ENSTO

Saves Your Energy

Basics of Atex

Contents

Basics of ATEX....4
Comparison of IEC with EN standards....5
Common principles of explosion and risk management....6
Explosion groups....7
Risk management....8
Ex area inspections and maintenance....9
Basics: Classification of zones....10
Equipment group....11
Equipment protection levels (EPL) for Ex equipment....12
Temperature....14
Types of protection....16
Marking....18
North American equipment certification
Requirements for hazardous locations....19
The road to conformity for ATEX....22
Selecting cable gland....23

Basics of ATEX

ATEX, Appareils destinés à être utilisés en ATmosphères EXplosibles, refers to possible hazardous environment where an explosive mixture of air and explosive material may be present in a room, a part of a room or a restricted indoor or outdoor space.

The ATEX Directive 99/92/EC classifies explosive atmospheres into area classes. This classification is applied to atmospheres where a combination of dusts, aerosols, vapors, gases, and air may form an explosive mixture. Areas where this standard must be applied are, for example, oil refineries, paint shops, biogas power plants and peat processing plants. Design aims to classify areas into groups and area classes, each of which has its own rules for applying protection methods and precautions. This is referred to as drawing up an explosion protection document, prepared according to Directive 99/92/EY. Area classification aims to save lives using cost-efficient and reasonable risk management principles.

Directive 94/9/EC refers to equipment and protection systems intended to be used in explosive atmospheres. Generally this Directive is referred to as: the ATEX Equipment Directive. Its purpose is to create a harmonized set of norms to unify the legislation of the member states.

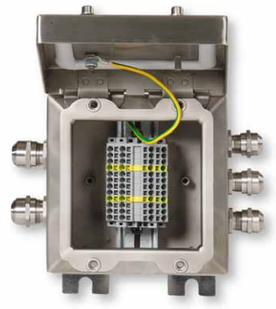
This Directive is applied to all equipment and components intended to be used in areas where explosive liquids, gases, or dusts are present. For example, the following equipment is classified as primary ATEX equipment: electrical and mechanical equipment, protection systems, safety and control systems, and the components of equipment protection systems. The Directive does not apply to medical equipment, household gas equipment or facilities for storing explosives. International standard IEC 60079-0 and the CENELEC EN 60079-0 standard contain more detailed specifications for equipment and requirements. The common goal is to provide a set of instructions to ensure that devices sold meet essential safety requirements.

The main principle in making the safety classification is to prevent the formation of an Ex atmosphere. This is done by eliminating sources of ignition and by minimizing the consequences of possible explosions (94/9/EC). The most important thing is to take all safety requirements into account. These may include all sources of ignition, faults, and potentially incorrect uses. The safety specifications also include safety, maintenance, and protection instructions and related markings. The previous guidelines primarily contained instructions on managing the current situation. Future technical developments must also be taken into account.

Comparison of IEC with EN standards

The table below compares the IEC standard to corresponding CENELEC standards. The purpose of the table is to help in the comparison of national requirements with international ones. Mainly these standards cover all general regulations for determining the classifications of groups, design parameters and regulation of systems, and also installation and operation, all in the areas where explosive gases, vapors and dust are present.

Title Contents	Document IEC	Document CENELEC	Date Year
Explosive atmospheres - Part 0: Equipment - General requirements	IEC 60079-0	EN 60079-0	2009
Explosive atmospheres - Part 1: Equipment protection by flameproof enclosures "d"	IEC 60079-1	EN 60079-1	2007
Explosive atmospheres - Part 2: Equipment protection by pressurized enclosure "p"	IEC 60079-2	EN 60079-2	2007
Electrical apparatus for explosive gas atmospheres - Part 4: Method of test for ignition temperature	IEC 60079-4	-	-
Explosive atmospheres - Part 5: Equipment protection by powder filling "q"	IEC 60079-5	EN 60079-5	2007
Explosive atmospheres - Part 6: Equipment protection by oil immersion "o"	IEC 60079-6	EN 60079-6	2007
Explosive atmospheres - Part 7: Equipment protection by increased safety "e"	IEC 60079-7	EN 60079-7	2007
Electrical apparatus for explosive gas atmospheres Part 10: Classification of hazardous areas	IEC 60079-10	EN 60079-10	2003
Explosive atmospheres - Part 11: Equipment protection by intrinsic safety "i"	IEC 60079-11	EN 60079-11	2007
Explosive atmospheres - Part 14: Electrical installation design, selection, and erection	IEC 60079-14	EN 60079-14	2003
Electrical apparatus for explosive gas atmospheres - Part 15: Construction, test and marking of type of protection "n" electrical apparatus	IEC 60079-15	EN 60079-15	2005
Explosive atmospheres - Part 17: Electrical installation inspection and maintenance	IEC 60079-17	EN 60079-17	2007
Electrical apparatus for explosive gas atmospheres - Part 18: Construction, testing, and marking of type of protection encapsulation "m" electrical apparatus	IEC 60079-18	EN 60079-18	2006
Electrical apparatus for explosive gas atmospheres - Part 25: Intrinsically safe systems	IEC 60079-25	EN 60079-25	2006
Explosive atmospheres - Part 26: Equipment with equipment protection level (EPL) Ga	IEC 60079-26	EN 60079-26	2007
Explosive atmospheres - Part 28: Protection of equipment and transmission systems using optical radiation	IEC 60079-28	EN 60079-28	2007
Explosive atmospheres - Part 30-1: Electrical resistance trace heating - General and testing requirements	IEC 60079-30-1	EN 60079-30-1	2007
Explosive Atmospheres - Part 31: Equipment dust ignition protection by enclosure "tD"	IEC 60079-31	EN 60079-31	-
Degrees of protection provided by enclosures (IP Code)	IEC 60529	EN 60529	1993



Common principles of explotion and risk management

An explosion is a sudden increase in volume and a release of energy in a harmful manner. Usually it involves the generation of high temperatures and the release of gases. An explosion causes pressure waves. Explosions are categorized as deflagrations if these waves are subsonic and detonations if they are supersonic (shock waves). A third type is a thermal explosion, which occurs with the rapid conversion of a highly exothermic reaction accompanied by a temperature rise. The disastrous property of an explosion comes with a rise in pressure and often with a high dose of heat radiation from the fireball, both occurring in a very short period of time. In ATEX areas, causes of explosion must be eliminated or minimized.

To generate the sudden chemical reaction of an oxygen and flammable substance compound, the mixture must be in an explosion range to release a high-energy explosion. Flammable substances normally occur in the form of a dust, mist, gas, or vapor. Normally an explosion occurs only if the three main factors react in a convenient mixture.

1. Flammable material
2. Oxygen
3. Ignition source

Flammable materials can be flammable gases, flammable liquids, and flammable solids. Of these, a flammable liquid can occur as a form of mist and also as a vapor. Some of the substances may need only very little energy to react. Normally gases and vapors are the most flammable. In flammable materials, solids can be in the form of dust, fiber, or flock. The reaction of flammable solids causes a rapid temperature rise and high pressure. Normally solids need more energy to react than gases but the energy of the reaction causes heavy explosions.

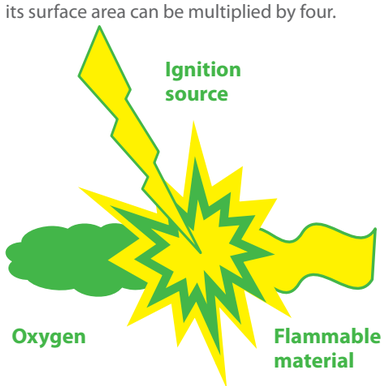
The ignition of an explosion can be started by several sources:

- Hot surfaces
- Flames and hot gases
- Mechanically generated sparks
- Electrical installations
- Equalizing currents
- Static electricity
- Lightning
- Electromagnetic waves
- Optical radiation
- Ionizing radiation
- Ultrasound
- Adiabatic compression and shock waves
- Exothermal reactions

Ensto recognizes this by taking all due caution to minimize the risk of ignition caused by materials or by the design of an enclosure. The structure must be designed to eliminate all electro-static charges. Generally charges are formed when two materials with different charges come into contact with each other. A larger contact area or greater distance between the surfaces of the materials touching each other increases the likelihood of a charge. Danger of an increasing charge in material increases when the resistivity of the other material decreases.

If the material has a charge, an electro-static discharge may occur. A charge can be discharged in many ways, but the most common ways are spark discharges and brush discharges. Both of these can cause a dangerous ignition, because the energy released can ignite gases and vapors. A spark discharge occurs when the charge between two conductors in different potentials increases to a sufficient level. In a brush discharge, energy is released when a charged object is approached by a round conductive object.

These charges can be eliminated effectively by using potential equalisation or grounding. Potential equalisation refers to the connection of two conductive objects to each other. Grounding refers to the connection of a conductive object to the ground potential. Discharging must be used when the protective structure is used in a space where explosion group IIC gases are present and the thickness of a non-conductive surface layer exceeds 0.2 mm or the surface resistivity exceeds 1 GΩ. In equipment class two it must be ensured that the projection surface area of non-conductive components, such as value plates and stickers, does not exceed 20 cm^2. If the non-conductive surface is surrounded by an grounded frame, its surface area can be multiplied by four.



Explosion groups

The specification contains three explosion groups. These groups are based on the measured ignition capabilities of gases and vapors at a certain temperature. The classification is split into sections I and II, and groups designated A, B, and C. For example, group A contains common alcohols with a low flash temperature and group C contains gaseous hydrogen with a relatively high flash temperature.

The table below shows examples of the ignition temperatures of gases and vapors in different temperature classes and explosion subdivisions.

CLASSIFICATION OF EXPLOSION GROUPS

Temperature class	Ignition temperature	IIA	IIB	IIC
T1	> 450 °C	Acetone Benzene Ethane Methanol Phenol Propane Toulene	Carbon monoxide	Hydrogen
T2	> 300 ... ≤ 450 °C	Ethyl Amyl asetate Butane Butyl Cyclohexane	Ethylene	Asetylene
T3	> 200 ... ≤ 300 °C	Petroleum Diesel fuel Jet fuel Hexane	Butyl acrylate Ethylene glycol	
T4	> 135 ... ≤ 200 °C	Acetaldehyde	Ethyl ether	Carbon bisulfide
T5	> 100 ... ≤ 135 °C			
T6	> 85 ... ≤ 100 °C			

Risk management

To ensure the safety of a product, such as a machine, it must be designed so that the use of the machine is as safe as possible. The end user must not be required to take their own protective measures. The end user must follow all general instructions provided in the designer's usage instructions. Two main phases must be met to make the product as safe as possible.

- Product design phase
- Situation of use

Risk assessment should always be carried out in every situation individually, in accordance with EN 1050. The element of risk assessment follows the steps given by the standard:

a) Identification of hazards such as flammable substances and the possibility of ignition
b) Identification of possible zones (hazardous atmospheres)
c) Identification of possible ignition sources and their capability for ignition
d) Identification of possible effects of an explosion
e) Risk management and evaluation
f) Actions to minimize the risks

An essential part of atmosphere classification is a truthful classification of emission sources. This classification is performed by classifying the emission source as continuous, primary, or secondary. When the emission source is continuous, such as an open liquid surface, emissions are released into the atmosphere continuously and the emission is either long-term or repeating. When the emission source is primary, such as leaking seals and ventilation openings, the probability for emission is temporary during normal use. Secondary emissions are not normally released, or if they are, they occur extremely rarely and are short-term. In this case the sources may be dry seals, pipe connectors, and flanges.

Reached product safety in design phase:

- Naturally safe structure and solutions
- The necessary security measures
- Safety markings and warnings

EC directives (94/9/EC)
IEC 60079-0, EN 60079-0

+

Reached safety in situations of use:

- Product usage according to instructions
- Knowledge of user
- Personal safety
- Work management

EC directives (99/92/EC)

=

The overall safety of the product:

Ex area inspections and maintenance

Electrical installations of Ex areas must be carried out according to IEC/EN 60079-17. Electrical installations in explosive areas are specifically designed to be suitable for Ex areas and the conditions of use. Taking the conditions of use into account, it must be ensured that the special properties designed are preserved for the entire lifecycle. This is the reason why the installations must be inspected and maintained regularly after the commissioning inspection by professional personnel.

The standard specifies that the item must be inspected visually, closely, and in detail, which refers to opening the enclosure and ensuring that the surrounding area is in a stabile state. A protocol must be kept of all inspections. The maximum inspection interval for Ex equipment is three years, but also in this case it must be evaluated how wearing the equipment use is. If the equipment is movable, the inspection must be performed every 12 months. Enclosures opened often must be inspected every 6 months. Ensto declares that the spare parts required to maintain the product classification will be kept available for all enclosures supplied by Ensto. It must be noted that all parts used must be approved by the original manufacturer and that they must be installed according to standard IEC/EN 60079-19 and the manufacturer's instructions. When Ex e equipment is repaired, the following must be noted:

- IP class must not change
- Temperature class must not change.
- Shock endurance must not change.
- Distance of movable and fixed parts must not change.
- Surface treatment must have no effect on the temperature class, e.g. product markings must not be covered.
- Transparent parts must be replaced, they must not be repaired.

Parts of the protective enclosure, such as the grounding, door, base, seals, windows, locks, and threaded parts can be replaced by original parts supplied by the manufacturer. The original structure and intended use of the device must not change. The availability of critical spare parts for Ensto's Cubo X series should be ensured through discussion with Ensto's sales personnel or customer service.

Basics: Classification of zones

The protection principle must be selected in accordance with tables 4.2 and 4.3 to meet the requirements of area or equipment classification. The protection methods for Ex e and Ex i principles with No ignition sources and for Ex d and Ex t principles with Isolation from ignition sources are presented below. Requirements of standards IEC 60079-17 and IEC 60079-14 must be taken into account when servicing equipment with different protection principles.

Area classes are divided into two categories based on the material type. The categories are air/gas mixtures, vapor, particles and air/dust mixtures. Area classifications clarify the protection principles and levels for areas specified in the explosion protection document. This ensures correct selection of the protection principle and maintains cost-efficiency.

An explosion protection document is a document which the party responsible for operation must draw up concerning the production environment. This document contains the area classifications for all areas. Dangers caused by explosive mixtures of air and explosive materials must be investigated in determining area classification. The report describes how the formation of an explosive mixture or an ignition source, such as a spark, should be prevented. (1999/92/EC)

Dust atmospheres

Dust atmospheres, in accordance with IEC 60079-10-2 and IEC 60079-31, are classified in different zones. IEC 60079 gives guidance on how to identify and classify the areas where hazards from dust can occur. The area classification method evaluates the material's properties, emission sources, dust layers and formation probability of an explosive dust-air mixture.

Zone 20:

An area where combustible dust, as a cloud, is present continuously or frequently during normal operation. Areas, such as the inside parts of equipment, e.g. mixers, silos, filters, mills, transfer pipes, closed conveyors.

Zone 21:

An area where combustible dust, as a cloud, is likely to occur during normal operation. Areas, such as filling and emptying areas and places where dust accumulates and the probability for formation of an air-dust mixture is high.

Zone 22:

An area where combustible dust clouds may occur infrequently and persist for only short periods. Areas such as storage facilities of closed packages, outlet sides of air filters, surroundings of rarely opened equipment. And if the probability for formation of an air-dust mixture is high in abnormal conditions.

Gas atmospheres

Gas atmospheres are classified as follows according to IEC 60079-10-1 and IEC 60079-7.

Zone 0:

An area where an explosive mixture of air and flammable gas, vapor, or particles is present continuously, for long periods, or frequently.

Zone 1:

An area where the occasional occurrence of an explosive mixture of air and flammable gas, vapor, or particles is likely.

Zone 2:

An area where the occasional occurrence of an explosive mixture of air and flammable gas, vapor, or particles is not likely but rare and only short-term.

Equipment group

The Atex equipment groups and their classifications are divided into two groups and normal industrial use in accordance with 94/9/EC Equipment group II is divided into three categories by the equipment directive. Equipment in higher categories can be used in lower categories, but equipment in equipment group II cannot be used in equipment group I spaces. Equipment in equipment group I is intended for use in underground parts of mines.

Equipment grouping

Equipment group 1

Design and structure of the equipment ensure an extremely high level of safety when the operating conditions specified by the manufacturer are observed. The equipment must be able to ensure sufficient level of safety even in rare fault situations. The equipment must ensure two protection methods independent of each other and safety must be maintained even when two faults are present simultaneously. Equipment in this class is intended to be used in area classes 0 and 20 and Ga and Da.

Equipment group 2

Design and structure of the equipment ensure a high level of safety when the operating conditions specified by the manufacturer are observed. The equipment must be able to ensure a sufficient level of safety during repeated error situations and normal equipment fault situations. Equipment in this class is intended to be used in area classes 1 and 21 and Gb and Db.

Equipment group 3

Design and structure of the equipment ensure a normal level of safety when the operating conditions specified by the manufacturer are observed. The equipment must be able to ensure a sufficient level of safety during normal operation. Often the manufacturer's declaration of conformity is sufficient and third-party approval is not required. Equipment in this class is intended to be used in area classes 2 and 22, and Gc and Dc.

Equipment protection levels (EPL) for Ex equipment

IEC 60079-14 specifies an alternative way to describe zones. EPL uses risk evaluation in equipment selection and, when compared to CENELEC described above, is a better way to mark area classifications. It must also be noted that EPL aims for a uniform risk evaluation, not country-specific models.

Zone	EPL-marking
0	Ga
1	Ga or Gb
2	Ga, Gb or Gc
20	Da
21	Da or Db
22	Da, Db or Dc

Protection levels and Ex structures for flammable gases:

Type of protection	Code	Standards	EPL
Intrinsically safe	ia	IEC 60079-11	Ga
Encapsulation	ma	IEC 60079-18	
Two independent types of protection, each meeting EPL Gb		IEC 60079-26	
Flameproof enclosures	d	IEC 60079-1	Gb
Increased safety	e	IEC 60079-7	
Intrinsically safe	ib	IEC 60079-11	
Encapsulation	mb	IEC 60079-18	
Oil immersion	o	IEC 60079-6	
Pressurized enclosures	p	IEC 60079-26	
Powder filling	q	IEC 60079-5	
Intrinsically safe	ic	IEC 60079-11	Gc
Encapsulation	mc	IEC 60079-18	
Non-sparking	n	IEC 60079-15	
Restricted breathing	nR	IEC 60079-15	
Energy limitation	nL	IEC 60079-15	
Sparking equipment	nC	IEC 60079-2	

Protection levels and Ex structures for flammable dusts:

Type of protection	Code	Standards	EPL
Intrinsically safe	id	IEC 60079-11	Da
Encapsulation	mD	IEC 60079-18	
Increased safety	tD	IEC 60079-31	
Intrinsically safe	iD	IEC 60079-11	Db
Encapsulation	mD	IEC 60079-18	
Increased safety	tD	IEC 60079-31	
Pressurized enclosures	pD	IEC 60079-4	
Intrinsically safe	iD	IEC 60079-11	Dc
Encapsulation	mD	IEC 60079-18	
Increased safety	tD	IEC 60079-31	
Pressurized enclosures	pD	IEC 60079-4	

Temperature

Temperature groups or flammability groups refer to temperatures which the equipment or protective structure surface must not reach under any conditions. This temperature limit prevents the gas or vapor flash temperature from being reached. The temperature group and highest allowable surface temperature are usually determined by combined testing of the protective structure and the component.

Temperature class and maximum surface temperature

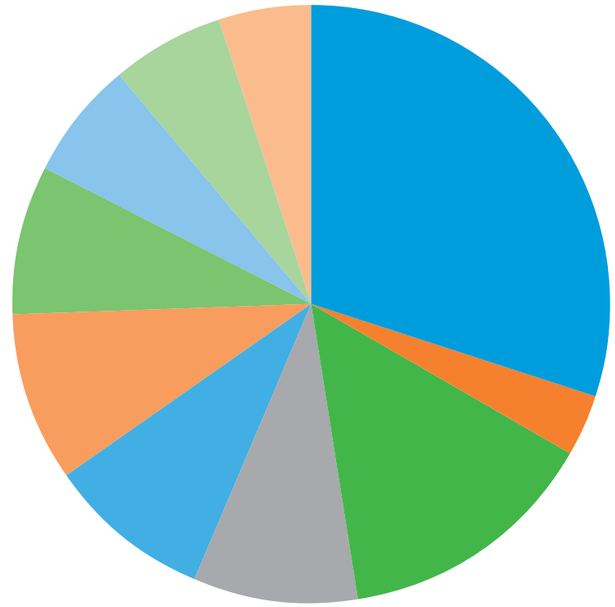
In accordance with IEC 60079-0, the temperature class specifies how high the surface temperature can rise without the gas, vapor, mist, or dust reaching its flash point and exploding. The relation between the surface temperature and the distance between the heat source and the protective structure is normally linear. This assumption cannot be relied on in all cases, so the surface temperature must be determined by tests and the temperature group selected accordingly. The flash temperature of gases and vapors is generally known to a high degree of accuracy. The highest allowable surface temperatures for each group are presented in the table below. These are the lowest allowable flash temperatures of gases, vapors, or dusts present in the environment:

Temperature classification of gas atmospheres.

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

A safety factor must be used when calculating the temperature of dust-air mixture and dust layers. For a dust-air mixture, the safety margin is calculated by multiplying the ignition temperature of the mixture by 0.67. When the dust layer thickness exceeds 5 mm, the safety margin is calculated by deducting 75K (Kelvin degrees) from the maximum tested temperature causing a dust explosion in the atmosphere. In most cases a shock or friction produces sparks, which cause the dust explosion as indicated in the table.

The most common causes of ignition



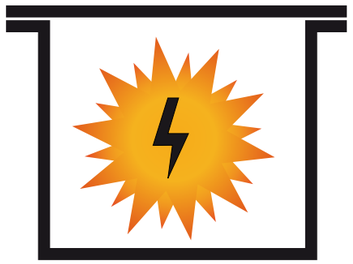
The ignition properties of the dust present must be known when evaluating dust atmospheres. Different types of dust mixtures are listed in the table below. T.ign-cl. is the lowest surface temperature required to ignite a dust cloud. T.ign-lay is the lowest surface temperature required to ignite a dust layer, and E.min is the lowest electric spark energy capable of igniting the most flammable dust-air mixture.

Examples of the ignition properties of dusts

Substance	T.ign-cl	T.ign-lay	E.min
Wood	≥410 °C	≥200 °C	≥100 *mJ*
Flour	≥380 °C	≥300 °C	≥30 *mJ*
Brown coal	≥380 °C	≥225 °C	-
Hard coal	≥500 °C	≥240 °C	≥1000 *mJ*
Aluminum	≥560 °C	≥340 °C	≥5 *mJ*
Sulfur	≥240 °C	≥250 °C	≥10 *mJ*

Types of protection

The protection principle must be selected in accordance with tables 4.2 and 4.3 to meet the requirements of area or equipment classification. The protection methods for Ex e and Ex i principles with No ignition sources and for Ex d and Ex t principles with Isolation from ignition sources are presented below. Requirements of standards IEC 60079-17 and IEC 60079-14 must be taken into account when servicing equipment with different protection principles.



Ex d

Ex d protection type refers to a protection type, which withstands the explosion pressure. The protection type must be in accordance with standard IEC/EN 60079-1, which makes it suitable for Zones 1 and 2. Spark-generating components, such as relays and switches, can be installed inside the enclosure. These components do not need to be approved for Ex areas. Enclosure protection is based on suffocating the explosion inside the enclosure through grooves in the enclosure so that flammable material is not released outside. The enclosure is always manufactured of metal and only metallic Ex d approved cable glands can be used.

Typical uses are Ex d motors, switch parts of safety switches, switch parts of control switches, Ex heaters, Ex connection boxes, and Ex lighting fixtures.

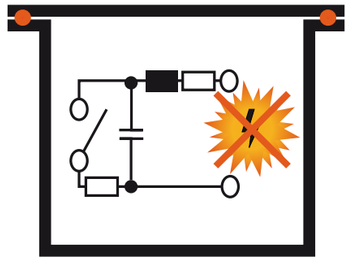
The enclosure can be repaired if the protection properties do not change and if the enclosure withstands the over-pressure test after the repair. It must be noted that seal materials must not be changed and extra holes must not be made in the enclosure. Transparent parts must not be repaired, and surface treatment must not cover the protective openings.

Ex e

Ex e protection type refers to an increased safety protection type. The protection type must be in accordance with standard IEC/EN 60079-7, making it suitable for Zones 1 and 2. Only intrinsically safe Ex approved components are allowed to be installed inside the enclosure. Suitability of this structure for the area class must be ensured through electrical design and technical solutions so that the equipment does not produce sparks and cannot overheat exceeding the temperature limits. An Ex e enclosure can be manufactured of either metal or plastic. Ex e or Ex d approved cable glands can be used in these enclosures.

Typical uses are Ex e motors, safety and control enclosures, Ex terminal blocks, Ex terminal block enclosures, enclosure parts of Ex lighting fixtures and Ex e bushes and sealing plugs.

The enclosure can be repaired if the sealing class and the temperature class do not change because of e.g. painting. Paragraph 2.4 contains more detailed specifications for service procedures.



Ex i

Ex i protection type refers to an intrinsically safe protection type. The protection type must be in accordance with standard IEC/EN 60079-11, making it suitable for area classes 0, 1, and 2. The equipment's electrical circuit energy must be below the dangerous minimum ignition energy (MIE) even in fault situations. In this case the power is restricted before it is transferred to the Ex area. Sparks are not generated even in short-circuit situations. An accurate specification for Ex i enclosures or markings does not exist, but Ensto recommends the use of Ex e enclosures and light-blue color coding of cables, cable glands, and equipment inside the enclosure. It is recommended that Ex i enclosures are visually different from normal enclosures. Additionally the circuits should be color-coded and visually different from other electrical circuits.

Typically Ex i equipment is used in automation systems. However, it is not suitable for large powers.

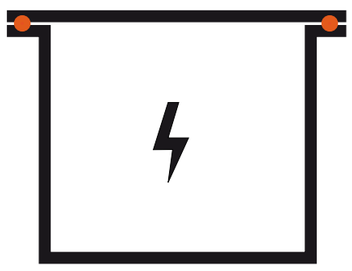
Protection class must not change when Ex i equipment is repaired. Also the surface and the air gaps must remain unchanged. Use of reserve fuses with the same value as the old ones is allowed in the equipment. Diode barriers must not be repaired but they must be replaced. Internal wiring must not be modified. Operation of the structure must be ensured after servicing by performing a one-minute voltage test with 500 V.

Ex t

Ex t protection type refers to a dust-proof enclosure. The protection type must be in accordance with standard IEC/EN 60079-31, making it suitable for area classes 0, 1, and 2. Spark-generating components, such as relays and switches, can be installed inside the enclosure. These components do not need to be approved for Ex areas. The protection type must prevent harmful amounts of dust from entering the enclosure. Entry of dust can also be completely prevented. Ensto recommends the use of Ex e enclosures.

Typically Ex tD equipment is used in many industrial applications, such as control and automation systems, and it is possible that some surfaces become hot.

The condition of enclosure seals must be inspected when repairing Ex t equipment. If a seal is damaged, the seal must be changed to a new original spare part manufactured of the same material. Enclosure shock resistance must not deteriorate. Distances of fixed parts must not change in repairs. If the item being repaired is a lighting fixture, all parts used must be approved by the manufacturer and the maximum power must not be exceeded.



Marking

Marking and documentation requirements of the ATEX Equipment Directive provide the user with information on the product's properties. The following information must be marked on the product:

- Manufacturer's name and address
- CE marking
- Serial or type marking
- Serial number, if applicable
- Year of manufacture
- Equipment group and class
- Marking of the gas (G) and/or dust class (D)
- Other markings related to safe use of the product

The manufacturer must have the required ATEX documents to be able to provide correct information on the product and to sell the product as suitable for Ex areas in the EU. These documents are the EU Declaration of Conformity for products or the Certificate of Conformity for components. The manufacturer must also produce installation, use, and maintenance instructions for the product. Figure 2.1 illustrates the marking of a protection principle, which must accompany the product. (94/9/EC)

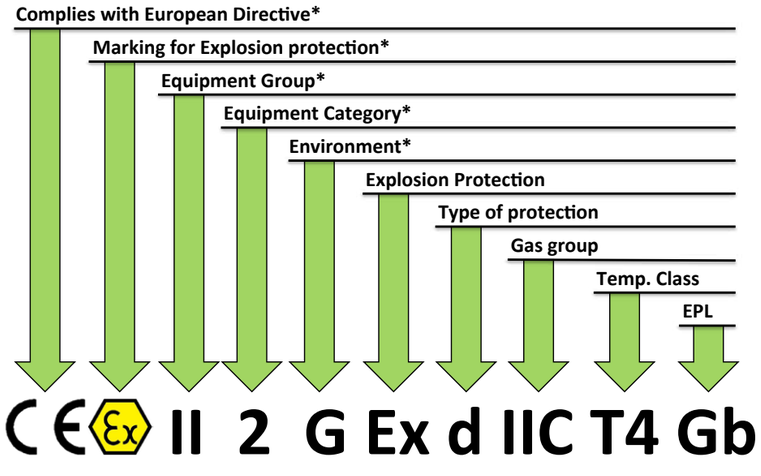


Figure Example of a protection principle marking according to the EN and IEC standards.

The Certificate of Conformity for products, components and products can only be issued by a testing facility accredited by the EU member states. These independent testing facilities evaluate conformity as specified by the Directive.

North American equipment certification requirements for hazardous locations

NORTH AMERICA

Typical North American Marking	
NEC® 500	NEC® 505
Class I, Division 1, Groups A&B T4	Class I, Zone 0, AEx ia IIC T4
Hazard Class; Area Classification; Gas Group; Temperature Class	Hazard Class; Area Classification; Protection Concept Code; Gas Group; Temperature Class
	Approved to US Standards

ATMOSPHERE GROUPS			
Substance	NEC 505	NEC 500	Hazard Class
Acetylene	IIC	Group A	Class I Flammable Gases
Hydrogen	IIC	Group B	
Ethylene	IIB	Group C	
Propane	IIA	Group D	
Methane (mining)		Group D	
Combustible Metal Dusts		Group E	Class II Combustible Dusts
Combustible Carbonaceous Dusts		Group F	
Combustible Dusts not in Group E or F (Flour, Grain, Wood, Plastics, Chemicals)		Group G	
Combustible Fibers and Flyings			Class III Fibers and Flyings

TEMPERATURE CLASSIFICATION			
Max. Surface Temperature	IEC - Group II	NEC® 505	NEC® 500 CEC®
450° C (842°F)	T1	T1	T1
300° C (572°F)	T2	T2	T2
280° C (536°F)			T2A
260° C (500°F)			T2B
230° C (446°F)			T2C
215° C (419°F)			T2D
200° C (392°F)	T3	T3	T3
180° C (356°F)			T3A
165° C (329°F)			T3B
160° C (320°F)			T3C
135° C (275°F)	T4	T4	T4
120° C (248°F)			T4A
100° C (212°F)	T5	T5	T5
85° C (185°F)	T6	T6	T6

PROTECTION CONCEPTS

Type of Protection	Code	Cty	Class	Division/Zone	Standard	Basic Concept of Protection
Electrical Equipment for Flammable Gas, Vapors and Mist - Class I						
General Requirements		US	Class I	Division 1 & 2	FM 3600	
		CA	Class I	Division 1 & 2		
	AEx	US	Class I	Division 1 & 2	ISA 60079-0	
	Ex	CA	Class I	Division 1 & 2	CSA 60079-0	
Increased Safety	AEx e	US	Class I	Zone 1	ISA 60079-7	no arcs, sparcs or hot surfaces
	Ex e	CA	Class I	Zone 1	CSA E60079-7	
Non-Incendive	(NI)	US	Class I	Division 2	ISA 12.12.01/FM 3611	
	(NI)	CA	Class I	Division 2	C22.2 No. 213	
Non-Sparking	AEx nA	US	Class I	Zone 2	ISA 60079-15	
	EX nA	CA	Class I	Zone 2	CSA E60079-15	
Explosion Proof	(XP)	US	Class I	Division 1	UL 1203	Contain the explosion and extinguish the flame
	(XP)	CA	Class I	Division 1	C22.2 No. 30	
Flame Proof	AEx d	US	Class I	Zone 1	ISA 60079-1	
	Ex d	CA	Class I	Zone 1	CSA 60079-1	
Power Filled	AEx q	US	Class I	Zone 1	ISA 60079-5	
	Ex q	CA	Class I	Zone 1	CSA E60079-5	
Enclosed Break	AEx nC	US	Class I	Zone 2	ISA 60079-15	
	Ex nC	CA	Class I	Zone 2	CSA E60079-15	
Intrinsic Safety	(IS)	US	Class I	Division 1	UL 913 / FM 3610	Limit energy of sparks and surface temperature
	(IS)	CA	Class I	Division 1	C22.2 No. 157	
	AEx ia	US	Class I	Zone 0	ISA 60079-11	
	AEx ib	US	Class I	Zone 1	ISA 60079-11	
	EX ia	CA	Class I	Zone 0	CSA E60079-11	
	Ex ib	CA	Class I	Zone 1	CSA E60079-11	
Limited Energy	AEx nC	US	Class I	Zone 2	ISA 60079-15	
	Ex nL	CA	Class I	Zone 2	CSA E60079-15	
Pressurized	Type X	US	Class I	Division 1	NFPA 496 (FM 3620)	Keep flamable gas out
	Type X	CA	Class I	Division 1	NFPA 496	
	Type Y	US	Class I	Division 1	NFPA 496 (FM 3620)	
	Type Y	CA	Class I	Division 1	NFPA 496	
	Type Z	US	Class I	Division 2	NFPA 496 (FM 3620)	
	Type Z	CA	Class I	Division 2	NFPA 496	
	AEx px	US	Class I	Zone 1	ISA 60079-2	
	Ex px	CA	Class I	Zone 1	CSA E60079-2	
	AEx py	US	Class I	Zone 1	ISA 60079-2	
	Ex py	CA	Class I	Zone 1	CSA E60079-2	
	AEx pz	US	Class I	Zone 2	ISA 60079-2	
	Ex pz	CA	Class I	Zone 2	CSA E60079-2	
Restricted Breathing	AEx nR	US	Class I	Zone 2	ISA 60079-15	
	Ex nR	CA	Class I	Zone 2	CSA E60079-15	
Encapsulated	AEx ma	US	Class I	Zone 0	ISA 60079-18	
	AEx m	US	Class I	Zone 1	ISA 60079-18	
	Ex m	CA	Class I	Zone 1	CSA E60079-18	
	AEx mb	US	Class I	Zone 1	ISA 60079-18	
Oil Immersion	AEx o	US	Class I	Zone 1	ISA 60079-6	
	EX o	CA	Class I	Zone 1	CSA E60079-6	
Electrical Equipment for Combustible Dust - Class II & Class III						
General Requirements		US	Class II	Division 1 & 2	FM 3600	
		CA	Class II	Division 1 & 2		
		US	Class III	Division 1 & 2	FM 3600	
		CA	Class III	Division 1 & 2		
	Ex	US		Zone 20, 21, 22	ISA 60079-0	
Dust Ignition Proof	(DIP)	US	Class II	Division 1	UL 1203	Keep combustible dust out
		CA	Class II	Division 1	CSA C22.2 No. 25	
Dust Protected	(NI)	US	Class II	Division 2	ISA 12.12.01 / FM 3611	
		CA	Class II	Division 2	CSA C22.2 No. 25	
Protection by Enclosure	AEx tD	US		Zone 21	ISA 60079-31	
	(DIP) A21	CA	Class II	Division 1	CSA E61241-1-1	
	(DIP) A22	CA	Class II	Division 2	CSA E61241-1-1	
Fiber & Flying Protection		US	Class III	Division 1 & 2	UL 1203 / ISA 12.12.01	
		CA	Class III	Division 1 & 2	CSA C22.2 No. 25	
Encapsulation	AEx maD	US		Zone 20	ISA 61241-18	
	AEx mbD	US		Zone 21	ISA 61241-18	
Pressurization	(PX)	US	Class II	Division 1	NFPA 496 (FM 3620)	
	(PX)	CA	Class II	Division 1	NFPA 496	
	(PY)	US	Class II	Division 1	NFPA 496 (FM 3620)	
	(PY)	CA	Class II	Division 1	NFPA 496	
	(PZ)	US	Class II	Division 2	NFPA 496 (FM 3620)	
	(PZ)	CA	Class II	Division 2	NFPA 496	
	AEx pD	US		Zone 21	ISA 61241-2	
Intrinsic Safety	(IS)	US	Class II	Division 1	UL 913 / FM 3610	Limit energy of sparks and surface temperature
	(IS)	CA	Class II	Division 1	CSA C22.2 No. 157	
	AEx iaD	US		Zone 20	ISA 61241-11	
	AEx ibD	US		Zone 21	ISA 61241-11	
	(IS)	US	Class III	Division 1	UL 913 / FM 3610	
	(IS)	CA	Class III	Division 1	CSA C22.2 No. 157	

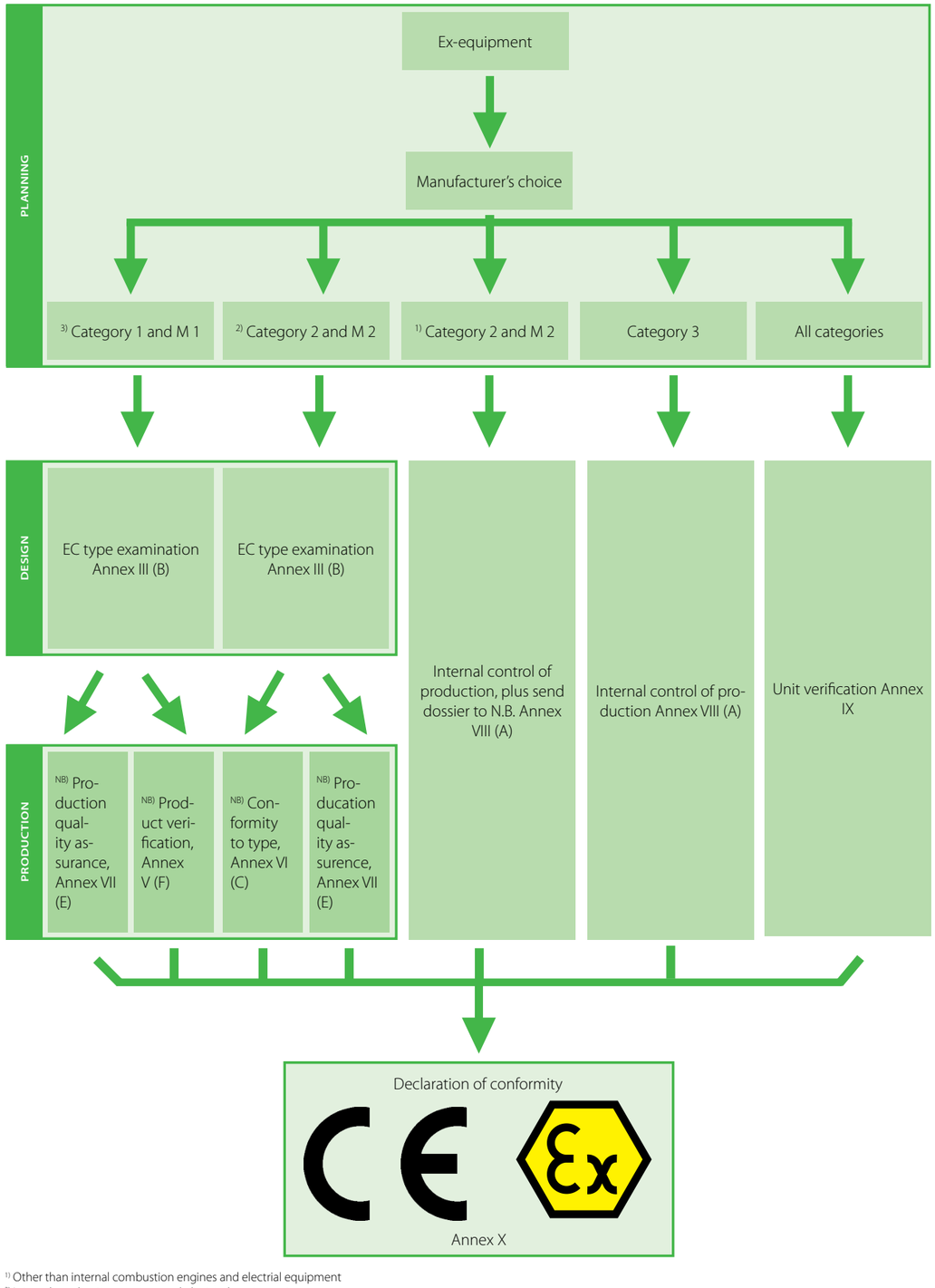
CLASSIFICATION OF DIVISIONS AND ZONES

Type of Area	NEC and CEC*	ATEX and IEC	Definitions
Continous hazard	Division 1	Zone 0 / Zone 20	A place in which an explosive atmosphere is continually present
Intermittent hazard	Division 1	Zone 1 / Zone 21	A place in which an explosive atmosphere is likely to occur in normal operation
Hazard under abnormal conditions	Division 2	Zone 2 / Zone 22	A place in which an explosive atmosphere is not likely to occur in normal operation, but may occur for short periods

ENCLOSURE TYPE RATINGS

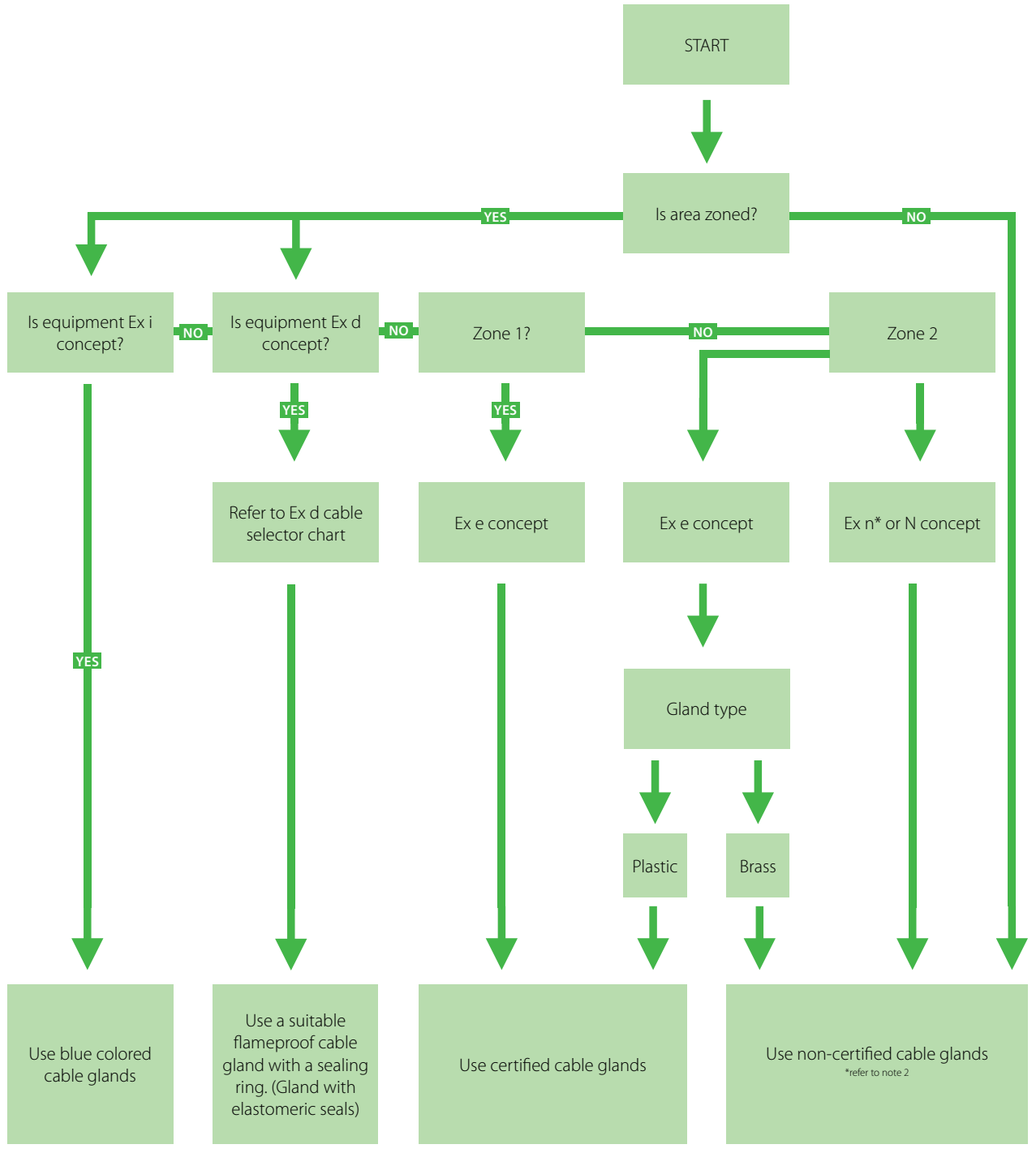
Type	Brief Definition	Area
1	General Purpose	Indoor
2	Protection against angled dripping water	Indoor
3, 3R, 3S	Protection against rain, snow	Indoor / Outdoor
4, 4X	Protection against rain, snow, hose directed water	Indoor / Outdoor
5	Protection against angled dripping water, dust, fibers, flyings	Indoor
6	Protection against temporary submersion	Indoor / Outdoor
6P	Protection against prolonged submersion	Indoor / Outdoor
12, 12K	Protection against circulating dust, fibers, flyings	Indoor
13	Protection against circulating dust, fibers, flyings, seepage	Indoor

The road to conformity for ATEX



[1] Other than internal combustion engines and electrial equipment
[2] Internal combustion engines and electrical equipment
[3] And all autonomous protective systems
[NB] Notified body

Selecting cable gland



Extreme safety for extreme conditions

Ensto Cubo X ATEX enclosure

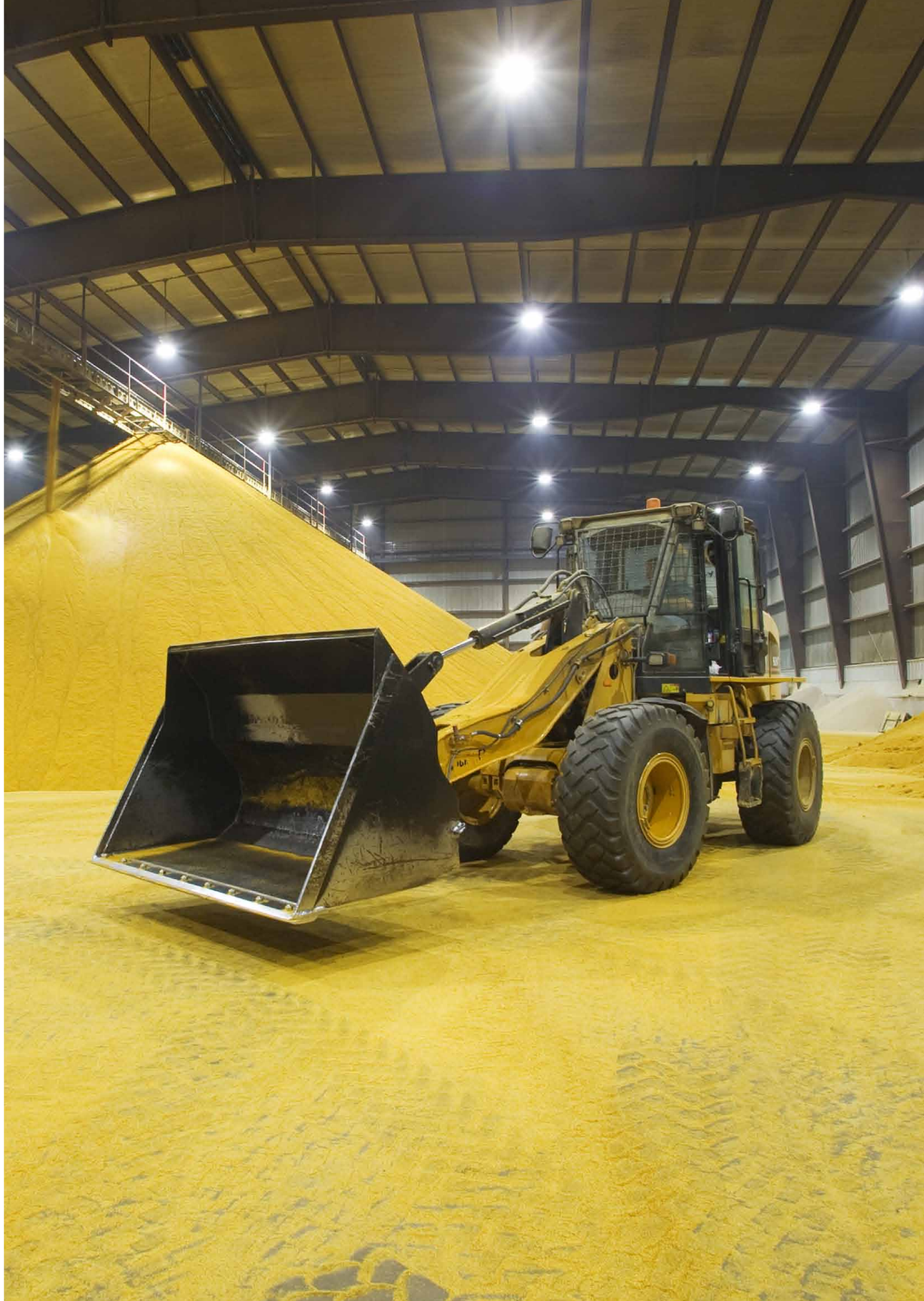
Ensto Cubo X is a new enclosure solution for the most demanding conditions. While Cubo X has been thoroughly tested to operate flawlessly in even the high-risk ATEX environment, its wide scalability ensures a perfect fit for every place and situation. It will ensure flawless operations and most of all, a safer working environment.

Ensto Cubo X is a new enclosure solution for the most demanding conditions. While Cubo X has been thoroughly tested to operate flawlessly in even the high-risk ATEX environment, its wide scalability ensures a perfect fit for every place and situation. It will ensure flawless operations and most of all, a safer working environment.

Ensto Cubo X combines seamlessly the features needed for optimum safety for electrical connections. Designed and manufactured by one of the world's leading industrial solutions company, it is packed with comprehensive understanding of the risks and opportunities of the widest variety of usage situations.

Ensto Cubo X efficiently keeps the danger outside, efficiently protecting the inside materials from dust, moisture, excessive heat and other elements present in the ATEX type working environments. The comprehensive enclosure solution provides reliability and continuity to operations, as well as improved safety to employees.

While Cubo X has been designed to survive the riskiest of situations, it can add operational safety and reliability everywhere electrical connections and systems exist. Provided by the worlds electricity expert, Cubo X reflects our thorough understanding and ability to create tailored, purposeful solutions for every need.



Download or order the Ensto Cubo X brochure from www.ensto.com/atex

Ensto – saves your energy
Ensto is a family business and an international electricity company specializing in the development, manufacture and marketing of electrical systems and supplies for the distribution of electrical power as well as electrical applications.

Legal notice
The information in this brochure is to the best of Ensto´s knowledge and belief correct and reliable. We reserve the right to make changes in the specifications, materials and production methods without further notice. Be aware of that you have to evaluate independently the suitability of each product for the intended application. Ensto does not give any assurance of any particular quality or performance. Our responsibilities for the products are set forth in the "Orgalime S 2000 General Conditions for the Supply of Mechanical, Electrical and Electronic Products". The products shall be installed only by a competent person having nationally required knowledge. Ensto is not responsible for its distributors or for any misuse, incorrect installation or ignored national safety or other national provisions.

Notes

IS6EN/06/2011/B9

Saves Your Energy

Ensto Finland oy
Ensio miettisen katu 2, P.o. box 77
Fin-06101 Porvoo, Finland
enclosure.solutions@ensto.com
www.ensto.com