

Honeywell
THE POWER OF **CONNECTED**

Gas Detection

GAS BOOK 3

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Typical applications for portable gas detectors

Confined spaces

Confined spaces can be found in a myriad of industries and applications and are one of the most prevalent applications for portable gas detection. A confined space is defined as being:

- 1 A space that has a limited or a restricted means of entry/exit
- 2 A space that is large enough for an operator to enter and perform certain tasks
- 3 A space that is not designed for constant worker occupancy
- 4 A space where ventilation may be poor, allowing gases to build up



There are two types of confined space:

- A normal confined space (no permit required)
- A permit-required confined space

In addition to the criteria defining a standard confined space, a permit-required confined space will also have one or more of the following attributes:

- Is known to contain (or has contained) a hazardous atmosphere
- Is known to contain a recognised safety hazard
- Is known to contain material with the potential for engulfment
- The design of the space itself has the potential to trap or asphyxiate the operator entering the space

Confined space application types

Confined spaces can be found in a wide diversity of industries and applications. Common types include:

Shafts



Trenches



Sewers and manholes



Tunnels



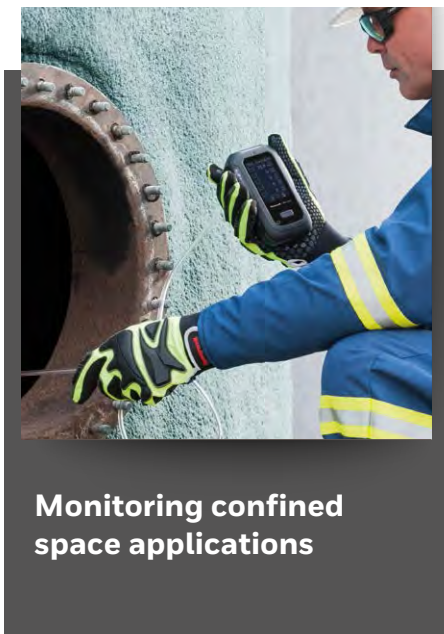
Tanks



Vessels



(including marine vessel tanks)



Monitoring confined space applications

Gas hazards in confined spaces



Depending on the application, numerous gases can be found in confined spaces. The atmosphere may contain a mix of flammable, toxic and Oxygen depletion gas hazard risks. The typical gases that may be encountered include but are not limited to:

- Oxygen
- Carbon Monoxide
- Hydrogen Sulphide
- Methane
- Ammonia
- Chlorine
- Nitrogen Dioxide
- Sulphur Dioxide
- Hydrogen Cyanide

Due to the dangerous nature of confined spaces, a two-step portable monitoring procedure needs to be employed. The area must first be tested and then continuous monitoring of the space must take place for the duration that the operator is working inside it.

Pits



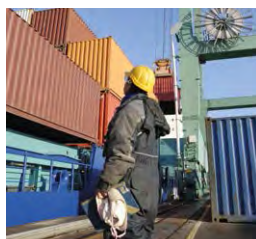
Boilers



Pipelines



Containers



Confined space stratified testing (Step 1)

Before entering the confined space, a portable gas detector combined with confined space entry accessories such as manual aspirator kits (if an integrated automatic sampling pump is not available), and a sample hose with probe should be used. This will allow the operator to be located outside of the confined space but be able to draw air from inside it so it can be tested by the portable gas detector. It's essential to sample the air at various levels from floor to ceiling - heavier-than-air gases will collect in low lying areas whilst lighter-than-air gases will collect at the highest levels.

- Pay special attention to uneven floors or ceilings that could allow high concentrations of gas to form
- Always sample at a distance from the opening; air can intrude into the confined space resulting in false readings and inaccurate Oxygen level data
- Once this full test has been conducted and no hazards have been found, a worker can enter the confined space



Subsequent continuous monitoring (Step 2)

Even if no dangers are identified whilst performing the stratified testing, it is essential to monitor the confined space continuously to ensure the atmosphere remains safe. Always remember that the atmosphere can change quickly in a confined space.

- Use a 4-gas simultaneous portable gas monitoring solution - 5 or 6 gas devices can be used for additional hazard coverage including Photo Ionised Detection (PID) sensors for the detection of low-level Volatile Organic Compounds (VOCs).
- Choose a device with a robust crocodile clip/harness so hands are free to undertake the necessary work. Make sure the portable gas detector is always situated within the breathing zone (no more than 25 cm/10 inches from the mouth/nose)
- "Daisy chain" portable units together, allowing one worker to be inside the confined space, whilst a second is monitoring the entrant's data from a safe location on a second unit. This technique is particularly useful in the most potentially dangerous confined spaces



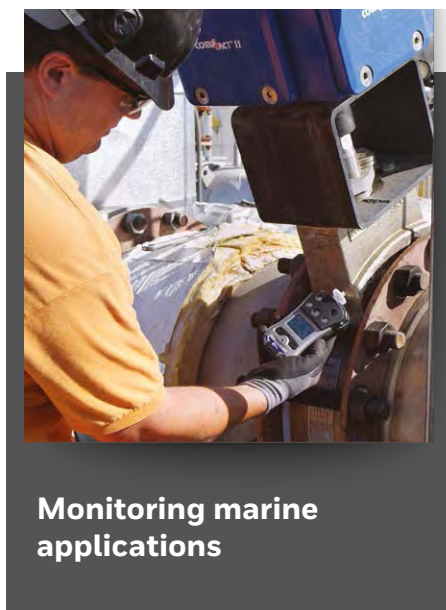
(Portable Gas Detectors Continued)

Marine

Marine gas hazards are numerous. Liquid gas, fuel, chemicals and other fossil fuels harbor a risk of explosion and there is a danger of suffocation from Oxygen displacement when using Nitrogen or other gases for inerting.

It is also important to be aware of dangers presented by toxic gases such as Carbon Monoxide from exhaust fumes, or Hydrogen Sulphide from the decomposition of organic compounds found in the briny water inside ballast tanks.

Due to the mobility of ships, portable gas detection is used predominantly as it affords flexibility and mobility.

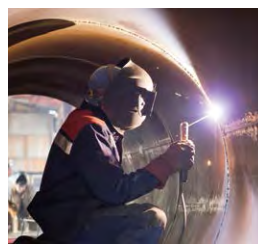


Monitoring marine applications

Marine applications requiring portable gas detection

Portable multi-gas monitoring solutions are an essential part of marine-based PPE, providing operator protection in a variety of applications and environments:

- Protection whilst carrying out clearance measurements of tanks and cargo bays
- Pre-entry check and subsequent monitoring for confined spaces
- Inerting and purging
- Leak detection
- Confined space entry including:
 - Cargo compressor room
 - Electric motor room
 - Cargo-control room (unless classified as gas-safe)
 - Enclosed spaces such as hold spaces and inter-barrier spaces (with the exception of hold spaces containing Type 'C' cargo tanks)
- Airlocks
- Burner platform vent hoods and engine room gas supply pipelines
- Hot work jobs



Gas hazards in marine applications



Marine regulations:

The marine industry is highly regulated due to the potential hazards that can be found, and legislation includes guidance on specific certifications that are required so portable devices can be used within marine applications:

- Within European Union (EU) Member States portable gas detectors need to be certified to the Marine Equipment Directive (MED)
- The ship's register may also require that gas detectors are approved to their Type Approval requirements, e.g. BV, DNV, Lloyds
- In some ports and countries across the World it is recommended that portable gas detectors are certified to the American Bureau of Shipping (ABS)

- Flammables (various flammable fuels are shipped via tanker including Liquid Petroleum Gas and Liquid Natural Gas)
- Carbon Monoxide
- Hydrogen Sulphide
- Oxygen depletion (from inerting via Nitrogen)

Water treatment

Water treatment is a large industry comprising many processes and aspects from the production and distribution of clean water to the collection, treatment and disposal of wastewater.



Aside from the domestic provision and treatment of clean water, industries such as chemical manufacture, steel and food processing may often have their own water treatment plants.

Gas hazards in water treatment applications



- Chlorine
- Sulphur Dioxide
- Carbon Dioxide
- Ammonia Flammable gases (Liquid Natural Gas and Liquid Petroleum Gas)
- Nitrogen Dioxide
- Oxygen

Water treatment regulations:

There are a variety of standards (international and national) governing the monitoring of toxic, flammable and corrosive substances used in the water industry. For detailed information on the compliance requirements for EU and Non-EU countries, please visit:

http://ec.europa.eu/environment/water/water-framework/index_en.html and http://osha.europa.eu/en/good_practice/topics/dangerous_substances/oel/nomembers.stm/members.stm.



Monitoring water treatment applications

Water treatment applications requiring portable gas detection

Portable multi-gas monitoring solutions are an essential part of marine-based PPE, providing operator protection in a variety of applications and environments:



• Purification plant monitoring

Various chemicals including Chlorine, Sulphur Dioxide and Ammonia are used to remove impurities from water. It's essential to use robust, multi-gas portable detectors during the purification process and also when entering or working in dosing rooms where chemicals like Ammonia may be used to "sweeten" the water. Carbon Dioxide may also be present, because it is used for PH correction to lower water acidity.



• Power plant monitoring

Water plants tend to feature their own power generation for the purposes of electricity generation and pumping. This creates the need for fuels like diesel and gas, creating the risk of flammable gas hazards from the fuel itself and also the exhaust fumes (where Carbon Dioxide is a by-product of combustion). A portable solution with %LEL flammable gas monitoring is essential in this application.



• Waste water plant intake and penstocks

As waste water enters the treatment plant, penstocks (a form of gate) halt/allow the flow of water into the plant. Flammable risks may be encountered because waste water may contain Hydrocarbons from spillages etc, so portable gas detection is often used to perform regular checks of water coming into the plant.



• Sewerage digester plant

The process of decomposition is accelerated in digesters, allowing filtered sludge to be converted into a safe form for disposal. Depending on the origin of the waste, digesters will promote either aerobic (in the presence of Oxygen) or anaerobic (without the presence of Oxygen) decomposition. Both Methane and Carbon Dioxide are by-products of these decomposition processes, creating the need for portable gas detection when working near digesters.

(Portable Gas Detectors Continued)

Military

Most militaries – regardless of the country they are located in – need to use gasoline, gas oil or kerosene to power their terrain vehicles, ships, submarines, aircraft and helicopters. Military fuel services contain numerous applications that require portable gas detection.

Militaries use dedicated fuel supply departments to manage and dispatch fuel to all army operatives and in reality, the World's militaries are one of the biggest volume users of these fuels.



Monitoring military applications

Military applications requiring portable gas detection

- Storage tanks
 - Storage tank cleaning
 - Storage tank inspections (in particular ballasts where Hydrogen Sulphide and Carbon Monoxide may build up)

Pumping



Storage tank filling



Transportation



All works linked fuel management



Confined space entry and inspection



Distribution



Aircraft tank inspection



Submarine



Ship monitoring



Maintenance of engines and pumps



(please see top right for more detailed information)

(please see top right for more detailed information)

In addition to the applications detailed right, particular care and attention should be given to the following marine-based military applications:

Submarine monitoring:

In a submarine the air is controlled by a dedicated analyser to ensure that the atmosphere is consistent and dangerous levels of Carbon Monoxide and Carbon Dioxide are not allowed to build up.

Hydrogen Sulphide is a real risk due to the fact that the batteries that power submarines may produce Hydrogen. Submarines may also feature flammable gases and other gases like Volatile Organic Compounds (VOCs), so it's important to monitor for these too. The septic tank onboard a submarine will also pose a risk for Hydrogen Sulphide.

Special considerations whilst undertaking submarine gas monitoring include the avoidance of using Carbon Monoxide sensors because there can be cross-sensitivity issues between Carbon Monoxide and Hydrogen Sulphide.



Ship Monitoring:

Hydrogen Sulphide is a risk near septic tanks and also where there are confined spaces so its essential to use a multi-gas portable when working in the vicinity of these locations. Carbon Monoxide poses a risk in engine rooms, kitchens and can also be found in confined spaces. Ballasts can pose a danger of Oxygen depletion, as can confined spaces. It's important to remember that Iron may be oxidised by Oxygen in ambient air, creating Iron Oxide (also known as rust). This means that Oxygen detection may also be required because the creation of rust can deplete Oxygen levels in the air creating deficiency risks. Both VOCs and flammable gas risks are likely in engine rooms, fuel storage locations and also where fuel is being used, replenished or re-located.

Monitoring military fuels

Robust multi-gas solutions that offer sensitive detection combined with useability are ideal for military fuel applications.

Historically, many military applications would specify 2, 3 or 4-gas portables (for the detection of flammables, Oxygen depletion, Hydrogen Sulphide and Carbon Monoxide), to monitor for fuel supply-related gas risks. In reality, a 5 or a 6-gas device is actually preferable, as it delivers total coverage against all gas hazards that can be found in fuel supply applications.



Gas hazards in military applications



- Flammable gases (various blends of Aviation Kerosene, Diesel and Gasoline)
- Carbon Monoxide
- Carbon Dioxide
- Hydrogen Sulphide
- Volatile Organic Compounds
- Oxygen

(Portable Gas Detectors Continued)

Hazardous Material (HAZMAT) emergency response

Accidents and releases involving Hazardous Materials (HAZMAT) can occur in a variety of locations including industry, on the roads or at sea during the transportation of materials.

Depending on the nature of the release itself, various emergency response teams may be involved in the isolation and clean-up of hazardous materials, including fire brigades.



Many chemicals and compounds are classified as HAZMAT, due to their associated risk and potential detrimental effect to organic life and the environment. This makes quick, enhanced-safety HAZMAT response and clean-up essential to minimise the impact of dangerous solids, liquids and gases and portable gas detection forms a key part of the Personal Protective Equipment (PPE) used by HAZMAT responders. Response teams can include various authorities, agencies and groups, including :

Fire departments



Police



Spill response teams



Air transport services



Monitoring HAZMAT response applications

Emergency response teams may hold a stock of various devices that can be used during specific incidents, owing to the large diversity of HAZMAT classified materials. 4, 5 or 6-gas portable detectors are ideal for emergency response because of their flexibility.

Gas hazards in HAZMAT applications



It's important to remember that incidents involving HAZMAT can occur anywhere, but the following examples are likely applications.

- Chemical spillages on highways
- Chemical spillages at sea
- Accidental releases at industrial plants
- Chemical releases into water ways
- Releases affecting commercial buildings or facilities
- Pipeline infrastructure issues resulting in spills

Gas hazards in HAZMAT applications



- Flammable gases including Liquid Natural Gas, Liquid Petroleum Gas, Crude and Methane
- Carbon Monoxide
- Carbon Dioxide
- Hydrogen Sulphide
- Sulphur Dioxide
- Chlorine
- Nitric Oxide
- Nitrogen Dioxide
- Ammonia
- Phosphine
- Hydrogen Cyanide
- Various Volatile Organic Compounds
- Oxygen

Oil and gas (offshore and onshore)

Safety-enhanced portable gas detection forms an integral part of mandatory Personal Protective Equipment (PPE) required for these challenging environments, owing to the abundance of potentially explosive atmospheres that can build up during crude extraction, transportation and subsequent refinement.

Floating Production Storage and Offloading (FPSO) and refineries are classified as “Top Tier” hazard installations and part of the risk reduction requirement includes the use of portable gas detectors.

Offshore applications are often hard to reach and accidents may require air rescue and air emergency response, creating the need for enhanced safety. Numerous flammable and toxic gas hazards exist, including Oxygen depletion risks from inerting with Nitrogen.

These locations may also be subject to severe adverse weather and sea spray, creating the need for the most robust solutions with enhanced Ingress Protection (IP).



Monitoring oil and gas treatment applications

Gas hazards in HAZMAT applications

- Flammable gases including Liquid Natural Gas, Liquid Petroleum Gas, Crude and Methane
- Carbon Monoxide
- Carbon Dioxide
- Hydrogen Sulphide
- Sulphur Dioxide
- Chlorine
- Nitric Oxide
- Nitrogen Dioxide
- Ammonia
- Phosphine
- Hydrogen Cyanide
- Various Volatile Organic Compounds
- Oxygen

Oil and gas applications requiring portable gas detection

A wide variety of applications require portable gas detection, but best practice guidance is that operators should always use a portable device to monitor for Hydrogen Sulphide.

- Confined space testing and entry
- Inerting of storage tanks
- Crude extraction from the sea bed
- When working near storage tank farms
- Loading and offloading flammable liquid/materials for transportation
- Working near refinery processes such as Hydrocarbon cracking
- During permit to work testing and when working in permit controlled areas



The aforementioned examples represent some of the key applications for portable gas detection but if you are interested to learn about additional applications, please visit:

www.honeywellsafety.com

North American Hazardous Area Standards and Approvals

The North American system for the certification, installation and inspection of hazardous locations equipment includes the following elements:

- 1 Installation Codes – E.g. NEC, CEC
- 2 Standard Developing Organisations (SDOs) – E.g. UL, CSA, FM
- 3 Nationally Recognised Testing Laboratories (NRTLs) – Third Party Certifiers e.g. ARL, CSA, ETI, FM, ITSNA, MET, UL
- 4 Inspection Authorities – E.g. OSHA, IAIEI, USCG



The installation codes used in North America are NEC 500 and NEC505 (National Electrical Codes) and CSA 22.1 (Canadian Electrical Code) for Canada. In both countries these guides are accepted and used by most authorities as the applicable standard on installation and use of electrical products. Details include equipment construction, performance and installation requirements, and area classification requirements. With the issuance of the new NEC these are now almost identical.

The Standards Developing Organisations (SDOs) work with industry to develop the appropriate overall equipment requirements. Certain SDOs also serve as members of the technical committees charged with the development and maintenance of the North American installation codes for hazardous locations.

The Nationally Recognised Testing Laboratories (NRTLs) are independent third party certifiers who assess the conformity of equipment with these requirements. The equipment tested and approved by these agencies is then suitable or use under the NEC or CEC installation standards.

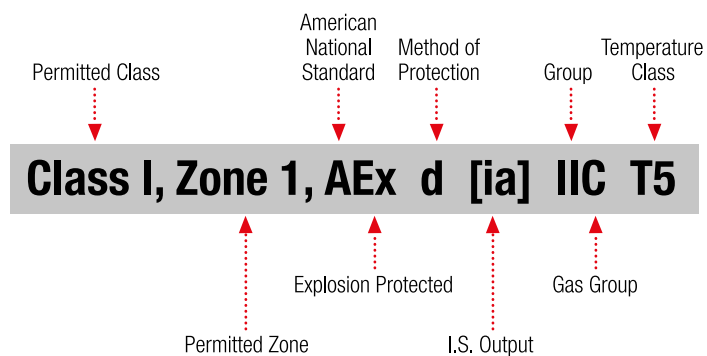
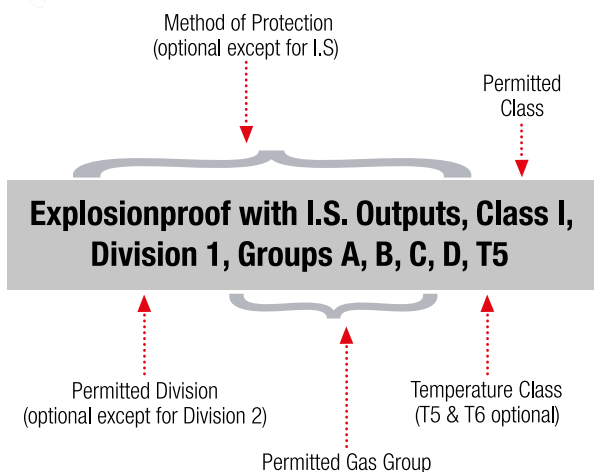
In the United States of America the inspection authority responsible is OSHA (Occupational Safety and Health Administration). In Canada, the inspection authority is the Standards Council of Canada. To confirm compliance to all applicable national standards both countries require an additional indication on products tested and approved.

For example, letters should be added to the NRTL's symbol as follows - cXXX for Canada, XXXus for the USA and cXXXus for both.



North American Ex Marking and Area Classification

Once approved, the equipment must be marked to indicate the details of the approval.



CLASS I – EXPLOSIVE GASES	
DIVISION 1	Gases normally present in explosive amounts
DIVISION 2	Gases not normally present in explosive amounts

GAS TYPES BY GROUP	
GROUP A	Acetylene
GROUP B	Hydrogen
GROUP C	Ethylene and related products
GROUP D	Propane and alcohol products

CLASS II – EXPLOSIVE DUSTS	
DIVISION 1	Dust normally present in explosive amounts
DIVISION 2	Dust not normally present in explosive amounts

DUST TYPES BY GROUP	
GROUP E	Metal dust
GROUP F	Coal dust
GROUP G	Grain and non-metallic dust



European Hazardous Area Standards and Approvals

The standards used in most countries outside of North America are IEC and ATEX. The IEC (International Electrotechnical Commission) has set detailed standards for equipment and classification of areas and is the standard that countries outside of both Europe and North America use.

IEC standards are virtually identical to the EN standards legislated by the ATEX Directive.

ATEX Certificates issued by European Notified Bodies are recognised in all EU Countries.

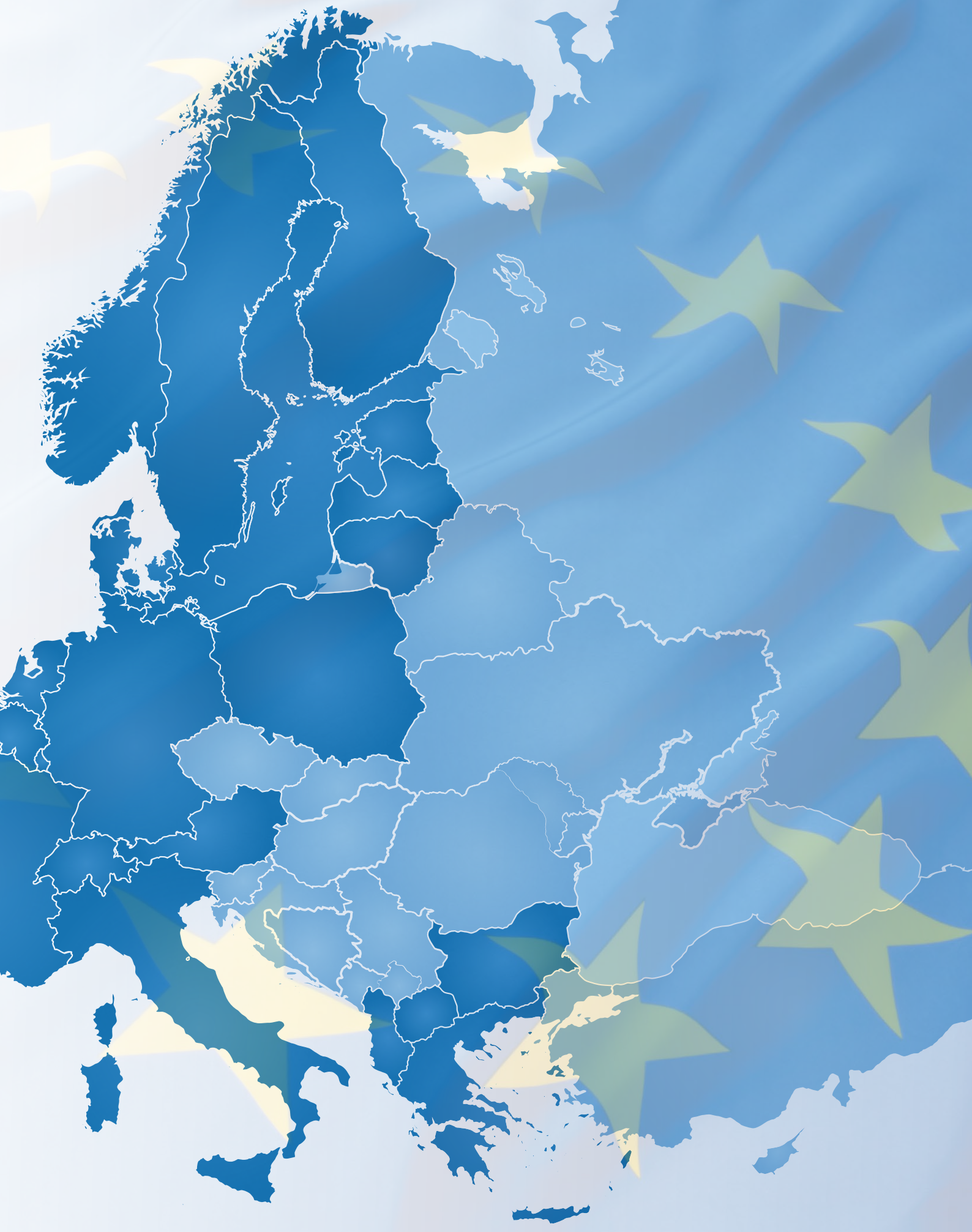
All countries within the EU also have governing bodies that set additional standards for products and wiring methods. Each member country of the EU has either government or third party laboratories that test and approve products to IEC and/or ATEX standards. Wiring methods change even under ATEX, this is primarily as to the use of cable, armoured cable, and type of armoured cable or conduit. Standards can change within a country “and referred as National Differences” depending on the location or who built a facility. Certified apparatus carries the ‘Ex’ mark. ■

Equipment approved by ATEX Notified Bodies may use the EU Distinctive Community Mark:



Note: This is not a Certification Mark





ATEX

ATEX = **A**Tmospheres **E**Xplosibles

There are two European Directives that have been enacted since July 2003 that list the manufacturers and users obligations regarding the design and use of apparatus in hazardous atmospheres.



RESPONSIBILITY	DIRECTIVE
MANUFACTURER	2014/34/EU
END USERS/EMPLOYERS	99/92/EC

The ATEX directives set the MINIMUM standards for both the employer and manufacturer regarding explosive atmospheres. It is the responsibility of the employer to conduct an assessment of explosive risk and to take necessary measures to eliminate or reduce the risk.

ATEX Directive 2014/34/EU

The Directive describes the manufacturer's responsibilities:

- The requirements of equipment and protective systems intended for use in potentially explosive atmospheres (e.g. Gas Detectors)
- The requirements of safety and controlling devices intended for use outside of potentially explosive atmospheres but required for the safe functioning of equipment and protective systems (e.g. Controllers)
- The Classification of Equipment Groups into Categories
- The Essential Health and Safety Requirements (EHSRs). Relating to the design and construction of the equipment/systems

In order to comply with the ATEX directive the equipment must:

- Display a CE mark
- Have the necessary hazardous area certification
- Meet a recognised performance standard, e.g. EN 60079-29-1 for flammable gas detectors (application specific)

GAS FACT

ATEX (an abbreviation of ATmospheres EXplosibles) sets the minimum safety standards for both the Employer and Manufacturer regarding explosive atmospheres.





The classification of hazardous areas is defined in the ATEX directive

HAZARDOUS AREA	DEFINITION	ATEX
ZONE 0	Areas in which explosive atmospheres caused by mixtures of air and gases, vapours, mists or dusts are present continuously or for long periods of time	Category 1
ZONE 1	Areas in which explosive atmospheres caused by mixtures of air and gases, vapours, mists or dusts are likely to occur	Category 2
ZONE 2	Areas in which explosive atmospheres caused by mixtures of air or gases, vapours, mists or dusts are likely to occur or only occur infrequently or for short periods of time	Category 3

ATEX CATEGORY	PERMITTED CERTIFICATION TYPE
CATEGORY 1	Ex ia, Ex da, Ex ma
CATEGORY 2	Ex ib, Ex db, Ex eb, Ex pb, Ex mb, Ex ob, Ex qb
CATEGORY 3	Ex ic, Ex dc, Ex ec, Ex pc, Ex mc, Ex oc, Ex qc, Ex nc



IEC Standards

IECEx (International Electrotechnical Commission) provides standards that are widely used by countries excluding Europe and North America. IECEx standards relate to area and equipment classification and provide similar guidance to ATEX.

ATEX Zones and IEC Equipment Groupings

ATEX HAZARD ZONE	EPL
ZONE 0 (GAS AND VAPOURS)	Ga
ZONE 1 (GAS AND VAPOURS) 2G	Gb
ZONE 2 (GAS AND VAPOURS) 3G	Gc
ZONE 20 (COMBUSTIBLE DUSTS)	Da
ZONE 21 (COMBUSTIBLE DUSTS)	Db
ZONE 22 (COMBUSTIBLE DUSTS)	Dc



IEC Equipment Categories and Method of Protection for Gas and Vapour Hazards

EPL	TYPE OF PROTECTION	CODE	IECEx REFERENCE
Ga	Intrinsically Safe	ia	EN/IEC 60079-11
Ga	Encapsulation	ma	EN/IEC 60079-18
Gb	Flameproof enclosure	db	EN/IEC 60079-1
Gb	Increased safety	e	EN/IEC 60079-7
Gb	Intrinsically Safe	ib	EN/IEC 60079-11
Gb	Encapsulation	mb	EN/IEC 60079-18
Gb	Oil immersion	ob	EN/IEC 60079-6
Gb	Pressurised enclosures	px / py / pz	EN/IEC 60079-2
Gb	Powder filling	qb	EN/IEC 60079-5
Gc	Intrinsically Safe	ic	EN/IEC 60079-11
Gc	Encapsulation	mc	EN/IEC 60079-18
Gc	Non-sparking	nA	EN/IEC 60079-15
Gc	Restricted breathing	nR	EN/IEC 60079-15
Gc	Energy limitation	nL	EN/IEC 60079-15
Gc	Sparking equipment	nC	EN/IEC 60079-15
Gc	Pressurised enclosures	pz	EN/IEC 60079-2



IEC Equipment Categories and Method of Protection for Combustible Dust Hazards



EPL	TYPE OF PROTECTION	CODE	IECEx REFERENCE
Da	Intrinsically Safe	ia	EN/IEC 60079-11
Da	Encapsulation	ma	EN/IEC 60079-18
Da	Enclosure	ta	EN/IEC 60079-31
Db	Intrinsically Safe	ib	EN/IEC 60079-11
Db	Encapsulation	mb	EN/IEC 60079-18
Db	Enclosure	tb	EN/IEC 60079-31
Db	Pressurised enclosures	pD	EN/IEC 61241-2
Dc	Intrinsically Safe	ic	EN/IEC 60079-11
Dc	Encapsulation	mc	EN/IEC 60079-18
Dc	Enclosure	tc	EN/IEC 60079-31
Dc	Pressurised enclosures	pD	EN/IEC 60079-2

Equipment Markings

ATEX DIRECTIVE 99/92/EC

ATEX 2014/34/EU Directive Nos describes the responsibilities of the employer/end user regarding the use of equipment designed for use in potentially explosive atmospheres.

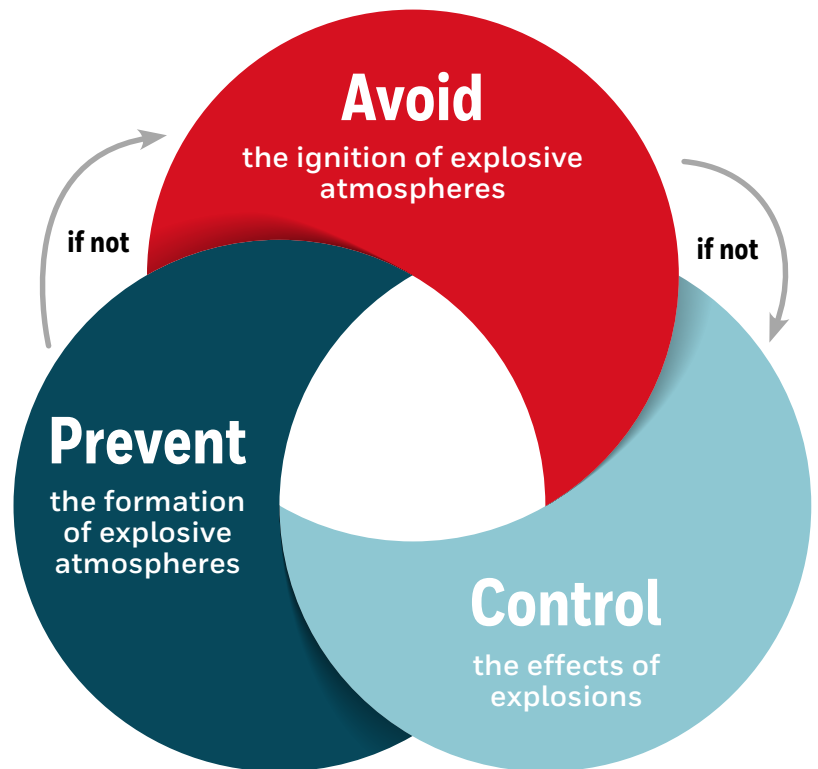
Unlike other directives, which are advisory in nature, ATEX is part of the New Approach Directives issued by the European Union (EU) and is mandatory.

For further information about this directive, please visit:

https://ec.europa.eu/growth/sectors/mechanical-engineering/atex_en

Member States use this information to frame their own legislation. For example, in the UK, this legislation is implemented by the Health and Safety Executive (HSE) as the Dangerous Substances and Explosive Atmospheres Regulations 2002 (DSEAR).

It sets out to:



Assessment of Explosion Risks

The employer must conduct a risk assessment including:

1 Probability of explosive atmosphere

Zone Area classification

2 Probability of ignition source

Equipment Categories

3 Nature of flammable materials

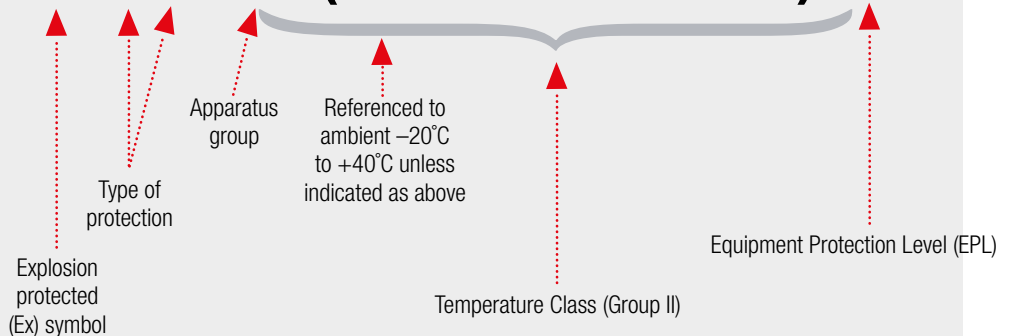
Gas groups, ignition temperature (T rating), gas, vapour, mists and dusts

4 Scale of effect of explosion

Equipment Protection Level

60079 Series

Ex d IIC T5 (T_{amb} -40°C to +55°C) Gb



Explosive Atmospheres Warning Sign

The employer must mark points of entry to places where explosive atmospheres may occur with distinctive signs:

In carrying out the assessment of explosion risk the employer shall draw up an Explosion Protection Document that demonstrates:

- explosion risks have been determined and assessed
- measures will be taken to attain the aims of the directive
- those places that have been classified into zones
- those places where the minimum requirements will apply
- that workplace and equipment are designed, operated and maintained with due regard for safety

The employer may combine existing explosion risk assessments, documents or equivalent reports produced under other community acts. This document must be revised with significant changes, extensions or conversions.



ATEX Markings

CE 0999

CE Mark Notified body number



EU Explosive atmosphere symbol

II 2 G

Equipment group
I : Mining
II : Other areas (Ex)

Type of explosive atmosphere

G : Gas, mist, vapour
D : Dust

Equipment category

Gas	Dust	Mining
1 : Zone 0	1 : Zone 20	M1 : Energised
2 : Zone 1	2 : Zone 21	M2 : De-energised
3 : Zone 2	3 : Zone 22	