

Engineering Rugged Industrial Devices to be used in hazardous areas: frequently asked questions

What are hazardous locations?

Hazardous locations are defined as areas where a fire or explosion risk may exist due to flammable gases, vapors, dusts, or ignitable fibers / flyings present in the air in quantities sufficient to produce an explosive or ignitable mixture. Such explosive atmospheres can be found in a variety of industrial sites: from oil fields, manufacturing plants, and petrochemical processing sites, to airports, distilleries, pharmaceutical production lines and beyond.

What is the value of ex certified devices over those built for heavy industrial sectors?

In recent years rugged mobile devices for industrial use - and the apps that run on them - have advanced markedly. They are critical in allowing mobile teams to access and record real-time data that's essential to provide continuous visibility across operations.

Take maintenance, for example. Based on real-time data captured from equipment, predictive algorithms can be used to proactively recommend maintenance. Engineers can be sent to check the equipment using their mobile computer to scan a barcode to ensure they are in the right place, and then access a wide range of helpful apps, from service manuals to service histories, with the option to video call colleagues for help. They can also report on their work, fill in timesheets and much more – all remotely.

However, rugged devices are unsafe for use in hazardous locations. And with safety being priority one for organizations we regularly come across sites where paper and pen are used to manage key workflow to avoid any chance of ignition caused by electronic equipment. But it doesn't have to be this way. The value of digitizing operations can be expanded across industrial sites by selecting devices that are certified for safe use in these areas: devices that can go wherever people go.

Bartec re-engineers and certifies a range of Zebra's rugged mobile handheld computers and scanners to work in areas where explosive materials may be present.

Our research and design efforts ensure that devices are incapable of releasing sufficient electrical or thermal energy, mitigating the risk of accidents happening in these particularly dangerous locations.

What are Ex standards?

Mobile devices used in hazardous locations must be certified and comply with local and global safety standards for hazardous areas. These standards provide guidelines for the classification of both potentially explosive areas and the devices that can be used in them. Hazardous locations are classified by the risk of a fire or explosion occurring: the higher the concentration of the flammable substance and time present in the atmosphere, the higher is the risk.

There are different classified systems (standards) for hazardous locations. The application of one standard over another varies from one country or region to another. These systems also determine the classification of electrical equipment that can be used in each type of hazardous area.

ATEX (European Union), IECEx (International) and NEC (North America) are the most widely used Ex standards. Further reading on these standards can be found at:

- ATEX: https://ec.europa.eu/growth/sectors/mechanical-engineering/atex_en
- IECExGlobal: <https://www.iecex.com/>
- NEC: <https://www.nfpa.org/ElectricalSolution>

Categorization hazardous areas (according to ATEX and IECEx)

Area classification for gas or fumes	
Equipment category	Definition
Zone 2	Where explosive gases or fumes are unlikely to be present under normal operating conditions – from 0% to 0.1%
Zone 1	An area where explosive gases or fumes may be present under normal operating conditions
Zone 0	An area where potentially explosive gases can be expected to be present for prolonged periods

Area classification for dust	
Equipment category	Definition
Zone 22	Under normal operation, the presence of explosive dust is unlikely to occur
Zone 21	An area where explosive dust may be present under normal operating conditions
Zone 20	An area where explosive dust are likely to be present for prolonged periods of time

Categorization hazardous areas (according to NEC)

Classification of hazardous materials	
Equipment category	Definition
Class I	Flammable vapours and gases may be present.
Class II	Combustible dust may be found.
Class III	Presence of easily ignitable fibres or flyings.

Area classification for hazardous materials	
Equipment category	Definition
Division 2	Ignitable concentrations of hazards are unlikely to be present under normal operations
Division 1	Ignitable concentrations of hazards exists under normal operation conditions and/or hazard is caused by frequent maintenance work

Summary of area classifications for ATEX, IECEx, and NEC

Europe (ATEX)		Global (IECEx)		North America (NEC 505)		North America (NEC 500)		
Gas	Dust	Gas	Dust	Gas (Class 1)	Dust (Class 1)	Gas (Class I)	Dust (Class II)	Fibres (Class III)
Zone 2	Zone 22	Zone 2	Zone 22	Zone 2	Zone 22	Div 2	Div 2	Div 2
Zone 1	Zone 21	Zone 1	Zone 21	Zone 1	Zone 21	Div 1	Div 1	Div 1
Zone 0	Zone 20	Zone 0	Zone 20	Zone 0	Zone 20			

What is an intrinsically safe device?

Devices certified to be used in hazardous locations are generally known in the industry as “intrinsically safe”, but not all ex-certified devices are made equal.

There are different types of protection techniques that enable the use of electrical devices in hazardous areas. The most common protection technique for mobile devices is “intrinsic safety” (marked as ex i). This technique restricts the electrical energy within the device and interconnecting wiring. The energy is so restricted that it cannot cause ignition by sparking or heating.

However, there are two classifications of devices within this protection technique category – intrinsically safe (IS) and non-incendive (NI). The major difference between the two types of equipment is that NI circuits are evaluated for ignition capability under normal operating conditions, while IS circuits are evaluated under fault conditions.

- Intrinsically safe (IS): device is incapable of ignition even in the event of up to two independent faults and can be used throughout all hazardous area classifications.
- Non-Incendive (NI): device is incapable of ignition under normal operation conditions (no faults) and is restricted to use in Zone 2/22 and Div. 2 areas only.

Due to their higher degree of safety, IS devices go through extremely detailed and thorough product development and engineering processes. They must also pass demanding certification requirements. For these reasons they tend to have a higher price point than NI devices.

What changes do you make to Zebra's devices?

Re-engineering a rugged mobile device into one that can be used safely in hazardous locations is a complex process. These are some of the techniques we use:

- Modifying the device's main printed circuit board (PCBs) or adding PCBs on top of it to limit the current and voltage in the electrical circuits
- Potting – a process of encapsulating different electronic components with a solid or gelatinous compound to effectively seal them and prevent any interaction with the air/oxygen
- Filling the inside of the device with tiny glass pellets, which act as an energy dissipating medium in the case of an electrical fault

Take the BCS3600ex-IS, for example, which is certified for Zone 1 use. We've redesigned Zebra's ultra-rugged industrial handheld scanner to be even more robust to withstand the requirements of the toughest environments in hazardous areas. To do this, we used a combination of the above techniques including:

- Adding more PCBs to give us enough space to add the resistors and capacitors needed to limit the electrical power output of the scan engine and battery.
- Potting the device's scan engine to make components as airtight as possible to prevent the possibility of ignition. (We do this by wrapping the scan engine in an additional plastic housing and filling any space around it with special glues).
- Potting all electrical circuits. This ensures the devices are as airtight as possible.

Do accessories need to be modified to be used in hazardous locations, apart from the device itself?

To answer in short, Yes. We divide our accessories into two groups:

- Accessories that can be safely used in hazardous areas together with our mobile devices.
- Accessories that can only be used in industrial environments.



All accessories that are required in hazardous areas have to go through the same extensive testing and certification procedure as the device itself. Furthermore, the accessories are subject to the same norms and standards as the device. For example, the charging of batteries in hazardous areas and data transfer via USB connection is not permitted. Likewise, only accessories that meet the electrostatic requirements of the ex-zone and therefore do not pose a risk of transmitting electrostatic sparks can be used. Based on this have we developed our range of leather holsters and carry cases which are made of special leather. This prevents the build-up of electrostatic charge that could create a source of ignition as it rubs against items.

For us, the safety of our devices and therefore of our customers is always the highest priority and for this reason, we do not make any compromises when modifying our accessories. Let's take for example the MC92ex-IS battery. We modify the batteries, removing the cell and enclosing this in new housing. We also use potting with specialist glues to make sure no air gets in the enclosure, while also adding a limiting board to limit the power supply of the battery.

However, our modification measures are not limited to the accessories that may be used in hazardous areas. They extend further to the accessories that are used in industrial environments. For example, the base stations and four-slot battery charger are electronically modified to be perfectly adapted to the device.

Due to the extensive testing and certification processes that our accessories go through to be brought to market, they tend to have a higher price point than accessories offered by Zebra.

How are devices tested to attain Ex certifications?

Ex certifications are issued by notified bodies, who assess the conformity of products with different Ex standards. To assess standard conformity, these organizations perform a series and combinations of mechanical and electrical tests. These tests put the devices through a variety of stresses which may include, for example:

- Tumbling or dropping the devices several times onto different types of surfaces e.g. concrete
- Shooting ball bearings at the screen to test the strength of the glass
- Placing devices in a dust chamber
- Placing devices through extensive aging tests



- Rubbing devices with cotton cloths to test their ability to prevent a build-up of electrostatic charge
- Exposing the device to extreme low and high temperatures.

The extent to which the devices are tested by the notified body is not always clear to the manufacturer. Because of this, BARTEC runs its own set of rigorous and extensive mechanical and electrical tests, a process that can take several months, to ensure devices are fit to successfully pass testing in the certification process.

Can I buy a device from my standard Zebra partner channel and have it customized by BARTEC to be used in hazardous locations?

No, this is not possible. We use customized versions of standard Zebra devices as basis for the design and production of our own Ex certified devices. BARTEC Ex devices can only be bought through one of our 30+ commercial regional offices and their authorized local partners/distributors.

Please check our website to find the correct point of contact in your region. <https://www.bartec.de/en/contact/>

Can Bartec devices be repaired directly by Zebra?

No, because of the special Ex certification, only Bartec is authorized to repair and service the devices. Please get in touch with your local BARTEC commercial office or authorized partner/distributor if you need assistance in this sense.

For more information in The Netherlands:

Visit: www.bartec.nl

Call: [+31 180 610588](tel:+31180610588)

Email: info@bartec.nl

For more information other countries:

Visit: www.bartec.com

Call: [+49 7931 597 000](tel:+497931597000)

Email: info@bartec.com

