WHAT YOU NEED TO KNOW ABOUT THE ELECTRICAL SAFETY SYSTEM INSTALLATION CODES AND STANDARDS FOR HAZARDOUS LOCATIONS

It is critical to ensure that products used in hazardous environments meet requirements set forth by the Canadian Electrical Safety System – a system rooted in the harmonization between the product safety standards and the installation code. These installation codes and associated products must address the explosion hazard to maintain the safety of the specific installation.

HAZARDOUS (EXPLOSIVE) ENVIRONMENTS CODES

Following proper codes for your installation is critical to ensuring personnel safety and the protection of your facility. The Canadian Electrical Code (CE Code) has sections that define key elements required to make sure your personnel are safe and products and facilities are properly protected; in the U.S., the National Electric Code (NEC) includes chapters focused on installations in hazardous environments. These sections identify acceptable equipment and the wiring method(s) needed to maintain the safety of the equipment and prevent explosions.

ALIGNING INSTALLATION CODES WITH YOUR PRODUCT DESIGN

In order to make sure your product is safe in a hazardous environment, you must strictly follow the safety standards and installation code set forth. Your product design must allow for the interconnection (wiring methods) specified in the CE Code in Canada and the NEC in the U.S.

As an example, the installation code defines the conductor ampacity requirements for connection to equipment based on the power requirements of the product. The design of the terminations within your product must accept the conductors specified in the installation code. In some cases, sealing may be required in a hazardous location installation, and integral seals within the product must meet installation code requirements.

ZONES AND METHOD TO FOLLOW IN EXPLOSIVE ATMOSPHERES

Canada has adopted the IEC method for identifying (classifying) explosive atmospheres. The previous edition of our newsletter discusses IEC in greater detail,
including the IECEx scheme and related classification systems. The rules in Section 18 of the CE Code specify the wiring methods and equipment permitted in the various Zones.

Zones 0, 1 and 2 are used for explosive gas atmospheres, while Zones 20, 21 and 22 are used for explosive dust atmospheres. Zones 0 and 20 are the areas with the highest hazard level and Zones 2 and 22 are the lowest. The definitions from the CE Code are:

Zone 0 — a location in which explosive gas atmospheres are present continuously or are present for long periods.
Zone 1 — a location in which:
  (a) explosive gas atmospheres are likely to occur in normal operation; or
  (b) the location is adjacent to a Zone 0 location, from which explosive gas atmospheres could be communicated.
Zone 2 — a location in which:
  (a) explosive gas atmospheres are not likely to occur in normal operation and, if they do occur, they will exist for a short time only; or
  (b) the location is adjacent to a Zone 1 location, from which explosive gas atmospheres could be communicated, unless such communication is prevented by adequate positive-pressure ventilation from a source of clean air and effective safeguards against ventilation failure are provided.
Zone 20 — a location in which an explosive dust atmosphere, in the form of a cloud of dust in air, is present continuously, or for long periods, or frequently.
Zone 21 — a location in which an explosive dust atmosphere, in the form of a cloud of dust in air, is likely to occur in normal operation occasionally.
Zone 22 — location in which an explosive dust atmosphere, in the form of a cloud of dust in air, is not likely to occur in normal operation but, if it does occur, will persist for a short period only.

LEVELS OF PROTECTION AND PRODUCT MARKING
Industry standards for products in various hazardous environments must evolve to ensure the protection of personnel and the facility. This is achieved through continued evaluation of product standards and installation codes and methods.

When a product standard is updated, the Technical Sub-Committee developing the product standard considers what changes are needed for the installation rules. Then a proposal is sent to the appropriate CE Code Sub-Committee for review to make sure the installation code and product safety standards are aligned.

An example to consider is CAN/CSA-C22.2 No. 60079-11, which outlines the requirements and tests needed for equipment to receive a specific level of protection mark for intrinsic safety, or have an "i" mark. In this standard, "ia" is a mark defining the greatest level of protection, "ib" as middle level and so forth. The CE Code identifies that "ia" equipment is permitted to be installed in Zones 0 and 20, "ib" equipment can be installed in Zones 1 and 21 and "ic" equipment can be installed in Zones 2 and 22. Product standard CAN/CSA-C22.2 No. 60079-11 was developed and then the CE Code was updated to identify where products complying with the standard can be used.
IMPORTANT FACTORS TO REMEMBER

Installation codes and hazardous locations standards and methods are crucial components to follow when designing a product and its safe installation. When equipment is installed in an explosive environment, the protection methods of the product standards and the installation requirements for the environment must be met in order to prevent explosions. Adhering to the standards and understanding how they work are key factors in making sure you are aware and prepared to design and install products that protect workers from harm and are safe for the facility and its hazardous environment.

CSA C22.2 NO. 137 (SECOND EDITION) UPDATE FOR ELECTRIC LUMINAIRES

The CSA standard for electric luminaires for use in hazardous locations, a standard that has been in place since 1981, has been updated in the form of CSA C22.2 No. 137 (second edition). The update was made to more closely align with current technologies and general luminaire standard developments during the past few decades. By switching to the new standard, manufacturers will be able to:

- Use properly protected fuses within the construction of luminaires in hazardous locations
- Follow references to test requirements covered by other standards for products rather than adhere to full test requirements

AFFECTED USES AND LOCATIONS

CSA C22.2 No. 137 (second edition) applies to fixed and portable luminaires for installation and use in a variety of hazardous locations to reduce the risk of explosion to an acceptable level. Locations affected by the standard update include:

- Class I, Divisions 1 and 2, Groups A, B, C, D
- Class II, Divisions 1 and 2, Groups E, F, G
- Class III, Divisions 1 and 2 in accordance with the Rules of the Canadian Electrical Code, Part I

In addition, luminaires that meet the requirements of this standard may also be suitable for use in:

- Zones 1 and 2, Groups IIA, IIB, IIB+H2, and IIC
- Zone 20, 21, and 22 Groups IIIA, IIIB and IIIC as permitted in the Rules of the Canadian Electrical Code, Part I

WHAT MANUFACTURERS NEED TO KNOW

By adhering to the Canadian restriction, which better aligns the standard to U.S., European and international practices, manufacturers have more flexibility in product construction and manufacturing. Updated standard, CSA C22.2 No. 137 (second edition), also introduces a dedicated section with specific construction and test requirements for cord connected portable luminaires.
THE GROWTH IN DEMAND FOR FUNCTIONAL SAFETY PRODUCTS IN NORTH AMERICA

As industry continues to embrace advances in automation and the interconnectivity of devices, the need to assess the levels of safety in connected systems grows increasingly apparent. As site owners and system integrators in North America and across the globe continuously review levels of safety through safety analysis techniques such as risk assessment, HAZOP and LOPA studies, the need for functional safety evaluated equipment becomes evident as well.

Equipment that is required to perform a safety function, such as gas detectors, alarms or valve controllers, all need to comply with functional safety standards to mitigate the risk of injury or damage to the environment. With more of a burden on systems that operate with far less manual controls and intervention than before, functional safety becomes paramount.

WHAT IS FUNCTIONAL SAFETY?
Functional safety deals with operational safety, which is "part of the overall safety that depends on a system or equipment operating correctly in response to its inputs," according to the IEC. All products or systems that rely on electronics for safety, be it for commercial, household or industrial use, need to be evaluated and meet functional safety requirements to ensure safe operational functionality.

WHAT IS THE ROLE OF OPERATIONAL SAFETY?
Operational safety may in some cases depend on two or more functions occurring simultaneously. An example of this is an out of limit (combustible) gas detector signal causing an alarm. The functional safety assessment would need to verify the integrity and reliability of both the gas limit detection function and the alarm function.

A fault in either function needs to be detected in order to maintain a safe operation, including a possible shutdown and a maintenance alarm. Any fault in a critical component, such as an electrical short, should not result in the failure of the related safety critical function.

THE DRIVE FOR FUNCTIONAL SAFETY EVALUATION IN NORTH AMERICA
Product and application standards continue to increase with functional safety requirements to meet the new and more sophisticated control technologies now spanning a wide range of products and systems. These requirements are the same in both the U.S. and Canada.

This, as well as greater significance being placed on functional safety within industry, has seen the rise of third-party certification organizations providing recognized safety approvals for products for use in North America. Not only does this provide confidence to the industry that the product has met rigorous assessment criteria, in many cases it provides the manufacturer with a competitive advantage when bidding on projects.

HOW DOES THIS AFFECT THE MANUFACTURER?
Manufacturers must be able to provide documentation required by the applicable functional safety standards in North America. These standards address everything from
safety design, software documentation, software requirements and software testing, among other elements.

NORTH AMERICAN STANDARDS FOR FUNCTIONAL SAFETY

When placing product in Canada, devices such as electronic components, assemblies, or systems including software that perform a safety function need to be assessed to the standard CSA C22.2 No. 0.8 (Safety functions incorporating electronic technology). There are also corresponding standards when U.S approval is required.

CSA C22.2 No. 0.8 covers the requirements of the safety control functions where the safety relies on either electronics or software or both. These functional safety requirements are in addition to the electrical safety requirements from the associated product standard. As an example, a product that has a critical temperature limit as a safety function will need assessment to CSA C22.2 No. 24 (Temperature-indicating and regulating equipment) and CSA 60730-1 (Automatic electrical controls).

In the case of a valve, assessment to CSA C22.2 No. 0.8 and CSA C22.2 No. 139 (Electrically operated valves) is required.

Ultimately, products that handle safety critical functions where the safety relies on an electronics-based design must be evaluated for functional safety to ensure the wellbeing of people, property and the surrounding environment.

WHAT MANUFACTURERS NEED TO KNOW ABOUT THE PLUGS AND SOCKETS STANDARD UPDATE (C22.2 NO. 159)

The CSA standard for C22.2 No. 159 (plugs, connectors, receptacles, and similar wiring devices for use in hazardous locations) has been updated to keep it in line with current practice in other standards, such as the ordinary location standards. The major changes to this edition are the addition of an informative annex and the addition of requirements for Division 2 and Class III products.

KEY UPDATES TO THE STANDARD

A key modification to C22.2 No. 159 includes an informative Annex that clarifies where requirements in this standard for hazardous locations vary from the ordinary location standard, while expanding the scope to include products for Division 2 and Class III areas. The Annex helps product designers more quickly identify where requirements for hazardous locations may be more stringent than ordinary location products. This Annex also aids certification agencies in developing certification programs.

Another change to the standard is the removal of duplicate requirements from other standards referenced by C22.2 No. 159. The redundant requirements are replaced by references to the appropriate standards. This will help ensure alignment between the Hazloc standard and the ordinary location standard, as well as allow the standard to automatically be kept up-to-date as changes are made to the referenced standards.

PRODUCTS AFFECTED BY STANDARD CHANGES

The addition of products for Division 2 and Class III areas is in support of new editions of standards like C22.2 No. 213 Nonincendive electrical equipment for use in Class I and

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II, Division 2 and Class III, Divisions 1 and 2 hazardous (classified) locations which now support these products. There are several products affected by the standard update and include:

- Receptacles with:
  - Attachment plugs
  - Attachment plugs interlocked with circuit breakers
  - Attachment plugs interlocked with switches

- Cable and cord connectors, couplers and flanged-equipment power inlets and flanged-equipment power outlets intended for connection to copper conductors only and for installation and use in the following hazardous locations in accordance with the Rules of Canadian Electrical Code, Part I and CSA M421 Use of electricity in mines:
  a) Class I, Division 1, Groups A, B, C, and D
  b) Class I, Division 2, Groups A, B, C, and D
  c) Class II, Groups F and G
  d) Class III

**IMPORTANCE OF STANDARD UPDATE FOR MANUFACTURERS**

The Hazloc standards are important in reducing the risk of explosion to an acceptable level for the products addressed by the standards and to comply with the requirements for installation and use in hazardous locations.

From the addition of an informative Annex designed to help product designers more quickly identify levels of severity in hazardous locations to removing redundant requirements by replacing references to the appropriate standards, manufacturers are now better able to identify the unique requirements needed to ensure safe operation of their products in hazardous environments.