

How To Get Started In Hazardous Locations Design

Sean Costall, Sr. Certifications Engineer

Spark Institute, Calgary, AB, Canada

Abstract

Engineers and designers are often asked to design equipment to meet the requirements for hazardous locations. Often, designers have little to no experience, and the requirements are difficult to understand.

While there is a tremendous amount of publicly available information on hazardous locations, there is very little that describes the initial steps that are necessary in order to achieve a compliant design. This paper describes, in the most basic terms, the steps necessary to start the design process.

Step #1 – Know Your Terminology

The first thing that everyone runs in to is the terminology associated for hazardous locations. Typically, this comes in the form of the requested target certification, such as “Class I, Division 1, Groups A-D, T4” or “Zone 0, Group IIC, T4”. The first thing to do is to get to understanding what these mean.

Fortunately, this is not *too* hard. There are dozens, if not hundreds, of websites out there that define terms like Class, Division, Group, Zone and so forth. These will (usually) be enough to get you towards a basic understanding of what hazardous locations are all about.

Some people are able to figure out all they need to know from on-line resources, books, and the support of their colleagues. Others simply don’t have the necessary resources to really figure it out on their own.

If you want a better introduction, a training course may be in order. It is often not required, but can be faster and more comprehensive than self-study. If you are fortunate, you will be able to find an on-line course or a training venue close to your location; alternatively, it is possible to bring training to you.

Step #2 – Know Your Protection

The targets are *what* you want to achieve. After that, the question is *how*.

Unfortunately, there are many, many different ways to design equipment so it can be placed in hazardous locations. Worse, not all types are acceptable in all locations. This can make it confusing as to how to go about doing your design work.

Fortunately, the majority of hazardous location equipment is one of the following types:

Target	Protection method	Summary
Division 1 / Zone 0	Intrinsically safe	Limit current, capacitance and inductance
Division 1 / Zone 1	Explosion-proof / Flameproof	Use a heavy metal enclosure to contain an explosion
Division 2 / Zone 2	Non-incendive	Eliminate sparks and spark gaps

These methods do not work for all kinds of equipment, and are obviously limited. For example, portable equipment usually cannot be made explosion-proof (too heavy) and high-energy equipment cannot be made intrinsically safe. This usually makes it pretty obvious what design technique should be used.

There are also cases where none of the above techniques will work well, meaning a different technique is needed. Alternatives include the following:

- Purged/pressurized
- Encapsulated
- Increased safety
- Powder-filled
- Oil-filled
- Dust-tight

All of these have advantages and disadvantages, most of which are fairly obvious. Typically, there are only one or two protection techniques that are suitable for any given piece of equipment.

There are also special requirements concerning non-electrical equipment. If you are working on such equipment, it is a good idea to solicit expert advice.

Step #3: Find Your Standards

Hazardous locations safety is governed by standards. After you've picked your preferred protection method, you'll need to find your standards and ensure you meet all the requirements.

Historically, different countries and regions developed their own standards. International harmonization efforts have reduced the number of standards out there, but regional variations remain. This can mean that you will have to design to more than one standard in order to achieve your certification.

Very briefly, the standards necessary for the methods of protection noted above are as follows:

Protection	Region	Standard
Intrinsic safety	United States	UL 913 UL 60079-0 UL 60079-11
	Canada	CSA 60079-0 CSA 60079-11
	European Union	EN 60079-0 EN 60079-11
	Other countries	IEC 60079-0 IEC 60079-11
Explosion-proof / Flameproof	United States	UL 1203
	Canada	CSA C22.2 No. 30
	European Union	EN 60079-0 EN 60079-1
	Other countries	IEC 60079-0 IEC 60079-1
Non-incendive	United States	ANSI/ISA 12.12.01
	Canada	CSA C22.2 No. 213
	European Union	EN 60079-0 EN 60079-7 EN 60079-11
	Other countries	IEC 60079-0 IEC 60079-7 IEC 60079-11

Standards with similar names / numbers are harmonized, and can initially be assumed to be identical with each other. This is not entirely true, as regional variations ("national differences") can and do exist between different versions, but will suffice for a starting point.

Step #4: Meet Your Standards

When you ask an agency to give you a hazardous locations safety certification, they will check the design against the relevant standards. As compliance is mandatory, you must fulfill all of the applicable requirements.

Certainly some requirements may not apply. For example, there is no need for a product that has no batteries to comply with the requirements for battery-operated equipment. But you will not be allowed to skip or modify any requirements that do apply.

Hazardous locations standards are complex, and it is not possible for this paper – or, indeed, any paper – to fully describe how to apply the standards in every possible situation. If you are uncertain, you may want to obtain expert assistance in how to read, interpret and apply the standards to your particular design.

It is not at all unusual to find that the only protection method that is practical – such as intrinsic safety – is nevertheless very difficult to achieve. Trade-offs between compliance and performance are often required.

Summary

For simplicity, this paper describes only the initial steps towards getting started in hazardous locations design.

Additional work will certainly be required. These can include assembling the necessary documentation, choosing a certifications agency, and submitting the design for approval. However, none of these steps can occur without a compliant design.

Such compliance can only be achieved

- Understanding your targets;
- Choosing an appropriate protection technique;
- Correctly identifying the relevant standards; and
- Fully complying with all relevant requirements from the standards.

Without these, the probability of failing your agency certification is very high.

Hazardous locations design is often complicated. In cases where it is not obvious how to meet requirements, it may be worthwhile to obtain expert assistance.



About Spark Institute

Spark Institute is a full-service consultancy that specializes in intrinsically safe and hazardous locations design services. Our experience covers North American, ATEX, and IEC requirements.

Design Consulting

Know what you want, but don't know how? Put our years of experience to work for you. We can design hazardous locations products to your specifications.

Design Evaluation

Have an existing product, design, or concept? Spark Institute can help evaluate your design to the relevant standards to help ensure compliance. Take advantage of our experience to reduce your risks before making costly mistakes.

Training Services

Good designers aren't born - they're trained. Our training courses will drastically shorten the learning curve for both new and experienced designers. Courses can be tailored to your product lines on request.

Contact us today at: www.sparkinstitute.ca

