

Negotiating the maze of national and international rules and regulations can baffle a product manager.

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One of the new minefields for a product manager is the mandatory European Community (EC) Harmonized Safety Compliance Directives and Standards, with the most current being ATEX directive 94/9/EC. ATEX stands for "Atmosphere Explosive" (in French) and it is the law in the EU. Only EU certification agencies are allowed to certify products in accordance with the ATEX directive.

Despite the fact that ATEX compliance testing has been mandatory in Europe since July 1, 2003, many manufacturers are still not integrating the time, labor and cost implications of ATEX compliance into their R&D project planning and resource allocation.

It has become almost impossible to complete product design and secure its timed launching into the marketplace without considering all of the compliance issues necessary for the global marketplace. Clearly, a product should first and foremost be designed to conform to all the compliance requirements for all the targeted marketplaces, national and international. This may sound obvious, but many large and multi-national firms have lost huge contracts, big orders and even had to scrap designed products because they could not meet ATEX compliance requirements.

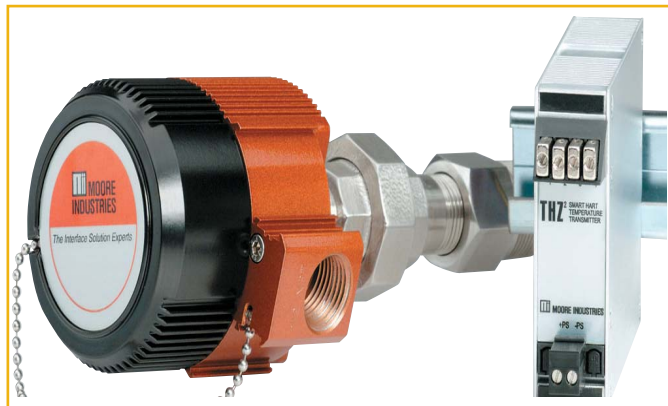
In some cases, the instrumentation was perfectly adequate for the task and met nearly every other safety directive; but, because it had not yet been ATEX-certified, it was unacceptable. In general, an instrument that can meet most international safety directives (Figure 1) can probably meet ATEX requirements, but it first must pass the ATEX certification process. The devil is in the details, though. Sometimes changes have to be made to meet ATEX requirements.

Compliance issues and legislation are becoming increasingly complex and detail-oriented, hence more of a burden to manufacturers. We cannot describe all the minor differences between ATEX and other requirements in this article, but we will review some of the fundamental differences between North American and European requirements.

Hazardous Area Classifications

Industrial operations often involve using, processing or storing hazardous (flammable) materials. Among the

Figure 1. If an instrument can meet most international safety requirements it can probably pass ATEX certification tests. The THZ² and TDZ² family of HART Temperature and Signal Transmitters from Moore Industries have Factory Mutual (FM), ATEX, cFMus (US/Canada), IECEx, CSA, CENELEC/ATEX 94/9/EC Directive and ANZEx (Australia and New Zealand) approvals for intrinsically-safe, non-incendive, explosion-proof and flame-proof operations in Class 1, Division 1, Groups A, B, C and D.



many protection techniques commonly used to annihilate, purge or drastically minimize the risks of explosion are Intrinsic Safety and Flame/Explosion-Proof apparatus, which are highly common in the process instrumentation industry. Such methods must be embedded in the initial engineering design and subsequent testing of electronic devices, and maintained through installation and commissioning.

There are a great number of potential ignition sources such as unauthorized smoking and use of naked flames, hot surfaces from the process itself, frictional sparking from rusty metals and static electricity, including problems from clothing. Most of these sources, at least to some extent, can be controlled and minimized, and this comes under the heading of sound engineering designs, good plant management and effective control systems. There is however, an additional problem.

The electrical apparatus necessary to operate the plant's pumps, lights, instrumentation, and other equipment is itself a potential source of ignition. Thus, the very apparatus which should be serving to provide better control over the plant and process may be making the site more, rather than less, dangerous.

The identification of Hazardous "Classified" Locations in a plant is usually carried out by experts or highly qualified personnel, such as process, industrial or chemical engineers. The possibility of a hazardous atmosphere being present and its condition and duration must be established. If an area is known to not contain hazardous materials or potentially explosive atmo-

Dealing With The ATEX Directive

spheres, then it is classified as a non-hazardous area or a safe location.

In the United States, the classification of hazardous locations is based on the National Electrical Code (NEC), while in Canada the Canadian Electric Code (CEC) applies. In Europe, Asia and Australia, the tendency is to follow the recommendations of the International Electro-technical Commission (IEC).

In Europe, compliance with ATEX Directive 94/9/EC is mandatory when installing and commissioning electronic or mechanical devices in hazardous locations. Once an area is classified as potentially explosive, a risk analysis will normally dictate that only suitably certified electrical and qualified mechanical equipment can be installed.

These regulations force manufacturers to gain certification of electrical and/or mechanical products that can be used in a potentially explosive atmosphere. In many cases, legal requirements will not allow non-certified products to be placed in the field, whether mandated by the company, the end-user or by specific legislative requirements (i.e., ATEX in the European Union) and even possibly by insurance policy underwriters.

In Europe, hazardous areas are classified into three zones which are directly related to the predicted occurrence of when and the duration that an explosive atmosphere may be present in the area. These zones are:

ZONE 0: Where an explosive atmosphere is continuously present, or present for long periods of time.

ZONE 1: Where an explosive atmosphere is likely to occur in normal operation.

ZONE 2: Where an explosive atmosphere is not likely to occur in normal operation and if it does occur, it will exist only for a short time.

Furthermore, European standards require that apparatus be subdivided into two groups: I and II. Group I is for apparatus to be used in mines where the danger is represented by methane gas and coal dust. Group II is for apparatus to be used in surface industries where the danger is represented by gas and vapor that has been subdivided into three groups: A, B and C. The table

Hazard Type			
	Continuous	Intermittent	Abnormal
CEC/NEC	Division 1	Division 1	Division 2
IEC/Europe	Zone 0	Zone 1	Zone 2

shows the similarities or differences between the North American and European practices, regarding the classification of hazardous locations. It is important to note that in the table below, Zone 2 (IEC/Europe) and Division 2 (North America) are similar to a great extent but are not identical, while Division 1 includes the corresponding Zones 0 and 1. An instrument designed for Zone 1 cannot necessarily be directly used in Division 1, and no quantifications of the expressions "long period of time" for Zone 0, "can be present" for Zone 1 and Division 1, and "not normally present" for Zone 2, are given.

In common practice, for Zone 0, a level of probability of a dangerous mixture present more than 1% of the time is generally accepted. Locations classified as Zone 1 have a level of probability of a dangerous mixture between 0.01% and 1% (maximum 100 hours per year), while Zone 2 locations can be considered dangerous when said mixture is present for no more than one hour per year.

The main difference between the North American and the European classification of hazardous locations is that there is currently no direct equivalent to the European Zone 0 in the North American system; however, existing standards may be revised to allow an equivalent representation. Zone 0 is therefore the most dangerous. An instrument designed for Zone 0 must be incapable of generating or accumulating sufficient energy to ignite the fuel mixture.

Safety Methods

To minimize the risk of explosion, elimination of one or more of the components of the ignition triangle (Figure 2) is necessary. There are three basic methods of protection:

Explosion Containment: The only method that allows the explosion to occur but confines it to a well defined area, thus avoiding the propagation to the surrounding atmosphere. Explosion/Flame-Proof enclosures are based on this method.

Segregation: A method that attempts to physically separate or isolate the electrical parts or hot surfaces from the explosive mixture. This method includes several techniques such as pressurization and encapsulation.

Prevention: A method that limits energy, both electrical and thermal, to safe levels under both normal operation and fault conditions. Intrinsic Safety is the most representative technique of this method, it being a protection concept employed in potentially explosive atmospheres. It relies on the electrical apparatus being designed so that it is unable to release sufficient energy, by either

thermal or electrical means, to cause an ignition of a flammable gas. The energies required to ignite various gas groups have been proven by experimentation.

Electrical equipment that has been assessed, tested and found to be in compliance with the ATEX Directive and the relevant European Harmonized Standards must be marked with the certification coding as described in the standards. The product's ATEX label and markings should include information stating that it is:

- In compliance with the relevant and applicable safety standard/directive.
- Intended for use in hazardous or explosive atmospheres.
- Approved for certain gas groupings.
- Operational in a specific ambient temperature range.
- Assigned a certain temperature coding.

Meeting all the Directives

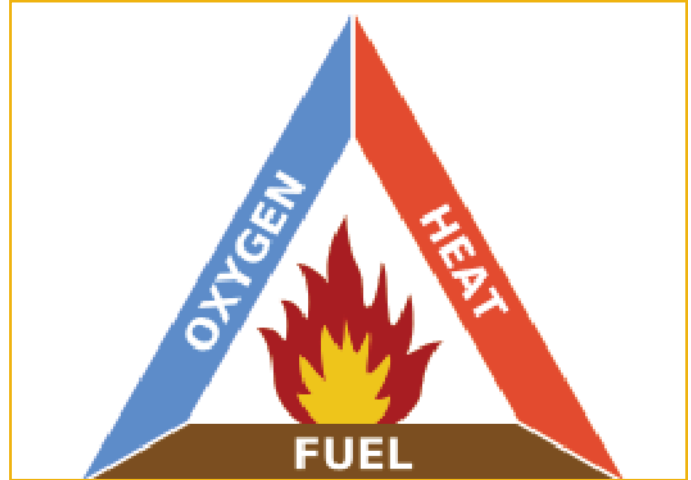
As a result of the combination of company installation policies, public legislation and safety requirements, many manufacturers and end-users must deal with issues with which they are somewhat unfamiliar. New directives and amended directives in the European Union can be introduced at any time. It is the manufacturer's sole responsibility to identify the mandatory directives and qualify their applicable products for full compliance.

The degree of expertise and specialized equipment required to meet all the various directives and requirements is beyond the reach of most companies. Indeed, it is often not cost effective to hire and retain a full-time in-house specialist to handle a task or a function that may be only called on several times a year. Moore Industries, which builds instrumentation for use worldwide, has such a full-time specialist because of the multitude of products it makes and the markets it serves.

Companies may prefer to concentrate on their core business rather than having to deal with the constantly changing legislative world of compliance, approvals and certifications. Instead, they outsource their compliance requirements.

Outsourcing is a long term relationship between the manufacturer and the compliance service. This sort of relationship is ideally suited for complex and ongoing

Figure 2. An explosion is any uncontrolled propagation of a combustion wave. To create an explosion there has to be fuel (i.e., an explosive gas such as hydrogen), an oxidizer (such as the oxygen in air) and a source of ignition energy (i.e., a hot surface or an electrical spark). Once the mechanism to mix the fuel and the oxidizer exists, the resulting explosion is commonly represented in 'the fire triangle' shown here.



problems of product design and safety compliance. Both outsourcing and subcontracting are costly, time-consuming and may require substantial material and human resources.

Design and compliance firms that provide such services must know products, marketplaces, and current and future compliance requirements so they can fully assist clients from the initial design specifications to the final listing or certification by a third party.

A third party is an independent certification agency neutral to both the consumer/end-user and the manufacturer. Some of the well-known and reputable testing approval agencies for ATEX compliance include ISSeP (Belgium), SIRA (UK), LCIE (France), KEMA (Holland) and Factory Mutual (USA & UK).

Certification is the process of assessing the design to the specification set down in an applicable Standard or Directive. Approval or certification agencies are generally not the standards-writing bodies (although they often have a strong presence on those bodies) but are rather independent services which give a third party attestation that a certain design complies with the requirements of a particular standard.

The Changing International Scene

Many countries publish their own National Standards concerning hazardous and electrical apparatus. Some of these standards still exist and others have become superseded.

Dealing With The ATEX Directive

There are differences from country to country in the way in which the standards and certification procedures are implemented. Within Europe, the Committee for Electrotechnical Standardization (CENELEC) produced a series of Standards aimed at harmonizing the technical approach of its member countries. On the other hand, North American approval agencies adhere to the guidelines and constraints stated by both the National Electric Code (USA) and the Canadian Electric Code (Canada).

Although Canada follows the classification of North America, it has close links with the IEC and CENELEC. In Australia, the Standards Association of Australia (SAA) produces National Standards, and offers a certification/approval service by which its main requirements are very similar to the European Standards. Also, there exist reciprocal arrangements assuring the acceptance of test results between European bodies and North America and Australia.

ATEX is required in Europe, of course, but because many countries follow Europe's standards, ATEX is being increasingly required across Asia and other regions.

In summary, the field of industrial safety is broad and very detail-oriented. Manufacturers are forced to adhere to numerous standards, regulations and directives in order to compete in the global marketplace and avoid liability and monetary losses caused by faulty designs and un-

safe products. Government agencies as well as insurance companies have strict guidelines on industrial facilities to integrate their procedures into the highest possible methods of protection.

The first and primary precaution to be used is to avoid placing electrical apparatus in hazardous locations. When designing a plant or a factory, this aspect needs to be considered and only when there is no other alternative should such applications be allowed. The size of the apparatus, the flexibility of the system, and its cost of operation and maintenance are secondary but also important facts that need to be considered.

Manufacturers of pneumatic and electrical/electronic devices that are intended for use in potentially explosive atmospheres must invest substantial monies in research and development, design and third party agency approvals in order to stay in business and compete.

Products designed and intended for installation and commissioning in hazardous locations in the European Community and many other regions must be tested and certified in accordance with the mandated ATEX Directive 94/9/EC, else they cannot be sold to the European marketplace. It is that simple: use ATEX-certified products for hazardous locations, else you'll break the law in the EU.

All product names are the property of their respective companies.



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