ATEX White Paper

Motors and the ATEX 137 Directive

Contents

1. Introduction

The ATEX Directives governing the use of equipment in potentially explosive atmospheres became mandatory in July 2003.

An acronym of the French *ATmosphères EXplosives*, ATEX is a European Directive, which amends and adds safety requirements for hazardous areas in the relevant national legislation in the member states of the European Union, bringing in a common standard.

1.1 Objectives of ATEX

Compliance with the ATEX Directives means reinforced safety aspects – safer design, more demanding testing procedures, and specific quality assurance measures for the design as well as the manufacturing process. It requires employers to protect both staff and the local community from the risk of an explosive atmosphere.

Minimum requirements is a key phrase of the directives - member states are free to introduce more stringent measures if they wish.

The origins of the ATEX directives can be found in the Treaty of Rome, which stipulates free movement of goods and services. The previous regulations would require a UK motor user to use a UK repair shop, which is a restriction of free movement. According to the Treaty of Rome, UK motor users are perfectly entitled to send their motors to a repair shop in, for instance, Ireland or France. Equally, a UK repair shop should be able to look for business in other countries of the European Union.

So although ATEX primarily increases safety levels, its roots are in the free movement of goods.

1.2 Geographical market

Harmonisation of standards will allow equipment to be sold across the European Union, without manufacturers having to satisfy different requirements for each national market.

ATEX also affects the countries of EFTA (European Free Trade Association), which includes Iceland, Liechtenstein, Norway and Switzerland.

1.3 Legal position

If a motor or another piece of equipment is to be used in potentially explosive atmospheres containing gas or combustible dust, it must comply with ATEX.

The ATEX directives supersede existing national legislation in the member states. The impact of ATEX will vary between the member states. In countries where previous national legislation was very detailed, ATEX can mean changes. This group of countries includes the UK, Germany, Switzerland, Finland, Norway and the Netherlands. In other countries, explosion protection was covered by general legislation. Here, adoption of ATEX will be straightforward as no specific rules were previously in existence. This group includes France, Belgium, Italy, Denmark, Sweden and Austria.

1.4 Difference between ATEX 95 and ATEX 137

ATEX consists of two parts: ATEX 95, which concentrates on the duties of the manufacturer; and ATEX 137, which focuses on the end user's obligations. This White Paper deals with issues and requirements of ATEX 137.

1.5 Fundamentals of ATEX 137

ATEX 137 is a new Directive for 'The Protection of Worker at Risk from Potentially Explosive Atmospheres' (1999/92/EC) - commonly known as the 'Use' directive. It requires that employers draw up documented evidence of risk analysis for their site

and that area classification and site inspections must be carried out where potentially explosive atmospheres may develop.

For the first time, atmospheres with potentially explosive dust must also conform to the requirements of the Directive. This includes locations like silos, flourmills, saw mills and milk powder production or transformation facilities.

The Directive ensures that only ATEX certified electrical, mechanical and safety related systems are installed in potentially explosive atmospheres.

ATEX 137 exists to protect the wider world from the risk of explosion, for instance staff, the public, contractors and the environment.

The objective is to ensure that all equipment is safe and is also operated safely.

1.6 New approach directives

ATEX belongs to the group of so-called *New Approach* directives. Under a New Approach directive, the route towards achieving the objective is not defined. The European Commission will not interfere with how a technical solution is reached, but gives all parties involved the freedom to define the best means, methods and procedures to meet the guidelines.

This gives rise to a division of responsibilities between the manufacturer and the end user. The less responsibility the manufacturer assumes for achieving the solution, the more the end user will have to take on, and vice versa.

1.7 Dates of enforcement

ATEX 137 enforcement has two critical dates. The first one applies to the “work equipment” such as the motors, and the second one to the “work place”, meaning the whole production unit.

According to Article 9 of the Worker Protection Directive, only one date applies to the “work equipment”, July 1st 2003. New “work equipment” in use after this date must be ATEX certified according to the Product Directive (ATEX 95) and the “work

equipment” already in use at this date must comply with the “minimum requirements” of the Worker Protection Directive (ATEX 137).

In practice, it means that all the equipment in use on July 1st 2003 must be safe at this date. This safety cannot be assumed but must be assessed and documented by an ATEX 95 certification for the new equipment, and through risks analysis and proven evidence that they comply with the “minimum requirements” of ATEX 137 for older units. By definition, the “work equipment” operates in a “work place”. For the “work places” two dates apply: the new “work place” starting after July 1st 2003 must fulfil these “minimum requirements” before starting. The old “work places” already in use at this date have a maximum of three years to comply with these “minimum requirements”.

If an old “work place” is upgraded, revamped, modified or extended, it must comply with the “minimum requirements” immediately.

2. Definitions and terms

Under the ATEX Directive, equipment is designated by the type of potentially explosive atmosphere in which the equipment may be used – Group 1 for underground mines and Group 2 for surface industries.

In Group 2, ATEX also defines categories of equipment, specified by their protection characteristics. It also designates the hazardous location zones they can be used in - zones 0, 1 and 2 for gases, vapours and mists and zones 20, 21 and 22 for dusts.

Category	Degree of Safety	Design Requirement	Application	Expected Zone of Use
1	Very high level of safety	Two independent means of protection or safe with two separate faults	Where explosive atmospheres are present continuously or for lengthy periods	Zone 0 Zone 20
2	High level of safety	Safe with frequently occurring disturbances or with one operating fault	Where explosive atmospheres are likely to occur	Zone 1 Zone 21
3	Normal level of safety	Safe in normal operation	Where explosive atmospheres are likely to occur infrequently and be of short duration	Zone 2 Zone 22

Figure 1: Zones and categories

2.1 Protection types for motors

Main protection types exist:

2.1.1 Non-sparking, Category 3 equipment for Zone 2

The lowest level of the protection types is non-sparking, so called because its design aims to prevent an internal malfunction from creating sparks in normal operation. It also aims to prevent excessive heating during starting, and the EHRS (Essential Health & Safety Requirements) introduced by ATEX 95 now make this design safer against the risk of sparks during starting.

This level of protection provides an economical compromise between high safety requirements and normal industrial standards. As Category 3 equipment they are for use in zone 2 only, i.e. for areas where explosive atmospheres occur occasionally, but not during normal duty.

Equipment in this category can be approved by self-certification carried out by the manufacturer.

2.1.2 Increased safety, Category 2 equipment for Zone 1

Increased safety motors prevent sparks, arcs or hot spots during service, including starting, by a number of constructional or dimensional provisions, and by the use of special protection devices, designed to trip within a specified time.

To reduce the temperature rise, this type of motor typically has a special winding that effectively derates the motor; for instance a motor that normally delivers 5.5 kW output may only deliver 5 kW in its increased safety design. When rewound, these motors must be rewound according to the original manufacturer's certified process.

2.1.3 Flameproof, Category 2 equipment for Zone 1

The enclosure of this motor type will prevent an internal explosion, or flame, from being transmitted to the explosive atmosphere surrounding the machine, hence the name flameproof. The enclosure must withstand any pressure levels caused by such an internal explosion.

Its design includes a flame path, a route for exploding gas to escape by whilst cooling off. The motor also has flameproof joints with long spigots that form part of the flame path. Every cast iron part must be pressure tested to ensure explosions will be contained.

2.1.4 Pressurised, Category 2 equipment for Zone 1

Mostly used for high voltage motors, the protection is provided by the injection of an inert gas into the frame of the motor.

The motor must be purged just before operation with inert gas to ensure that no hazardous gas is inside the enclosure before start. During operation, the over-pressure must be maintained slightly above the surrounding pressure. The over-pressure inside the enclosure prevents any explosive gas outside the motor to penetrate into the motor housing and becoming exposed to high temperatures or sparks.

This design is attractive for large sizes where the additional running costs of the inert gas supply are small compared to the total costs. These motors have a very heavy construction that does not require daily maintenance.

The use of a variable speed drive does not necessitate any additional protection measures with this motor type.

2.1.5 Dust Ignition Proof, Categories 2 and 3 for Zones 21 and 22

Motors for hazardous dust conditions are known as Dust Ignition Proof or DIP motors. Used in atmospheres where explosive dust surrounds the motor, or where dust settles under its own weight on the motor, typical applications include the handling of cereal, animal feed, chemicals and coal. These motors can also be used in the pharmaceuticals and cosmetics industries as well as in agriculture, food and beverage, sectors where the use of hazardous area motors until now has been limited.

DIP motors are marked similarly to Ex motors, except that equipment category 2 corresponds to Zone 21 or Zone 22 with conductive dust, and equipment category 3 corresponds to Zone 22 without conductive dust. The letter D following the equipment category indicates that the marking relates to dust. A product certified for both gas and dust is marked G-D.

Category 3 “DIP” motors will be IP55 or IP 65 protected depending on whether the dust is conductive or not. If the dust is conductive, it must not be allowed to penetrate inside the frame and so IP 65 protection is required. If the dust is not conductive, IP 55 will suffice.

IP65 protection brings a lot of regulatory constraints from a worker protection point of view, so the end user will no doubt use these motors only where necessary.

In both cases, the motor temperature class shall be selected according to the type of dust and whether it is in cloud or layer forms. These classes are normally different from gas. In addition, the thicker the dust layer, the more it will effect the cooling of the motor. This may cause selecting a bigger motor to ensure that the motor will not warm too much.

DIP motors can be operated with variable speed and ABB has ATEX certified its whole range of motors and variable speed drives for categories 2 and 3, see details in the variable speed drives chapter.

The decision on whether to employ DIP motors depends on the results of the risk assessment. The starting point for dusts is EN 50281, ‘Equipment for use in the presence of combustible dust’.

The most relevant part of this document is part 3, ‘Classification of areas where dust may be present’, which provides guidelines on classifying risk. Combustible dust hazards are not straightforward and depend on a host of factors, including particle size, moisture content and how the dust is formed.

Keeping working areas clean and dust free, particularly near potential ignition sources, will go a long way to reducing risks, but the best advice is to employ a professional consultant with experience in assessing dust risk and drawing up appropriate safety zones. He or she may be able to help reduce the hazardous areas even further, which will help cut costs in the long run.

With professional assistance, motor users will be able to risk assess the plant areas based on the release of hazardous dusts, work out the zones and draw up detailed design documentation and inspection schedules for the plant.

The next stage is to eliminate or reduce the risks from the use of these substances as much as possible, for instance reduce the inventory and replace substances with less dangerous alternatives. This could help make the hazardous area smaller, reducing safety risks as well as financial commitment.

3. Employers' responsibilities

The "Worker Protection Directive" 1999/92/EC, ATEX 137, describes the "minimum requirements" for improving the health and safety of workers potentially at risk. It classifies the environment into zones and outlines which category of equipment can be used in each zone.

The directive focuses on the analysis and description of the risks, the zone definitions and the maintenance practices in relation to site safety.

From July 1st 2003, an employer must assess all risks relating to hazardous atmospheres.

The safety of an installation in a hazardous area is the result of co-operation between the equipment manufacturer, the installer and the end user. Unless to have its own instructions fulfilling the "Minimum Requirements", the End user is obliged to follow manufacturer's instructions for how their equipment should be installed, maintained and repaired. All manufacturers are obliged to issue such instructions.

3.1 Responsibility for third parties

ATEX 137 concentrates on the duties of the end user. Workers should be trained on hazardous area issues by the employer. Authorization should be given to each employee working in a hazardous area. Explosion protection measures should be taken and an explosion protection document, EPD, has to be established. When equipment is to be repaired, the end user has the responsibility to select an appropriate repair shop.

Under ATEX, the only parties responsible for preventing accidents due to explosive atmosphere are the manufacturer and the end user. When it comes to the safety of the plant, the end user alone is responsible. Until now, a third party has often been used to provide expertise, as health and safety issues have frequently been contracted out. Even if the work is contracted out to a third party, the end user is

now responsible. ATEX does allow outsourcing, but the competence within many organisations may need to be reinforced to check the quality of such work.

Repair shops and other third parties have to conform either with ATEX 95 (the manufacturer's directive) or ATEX 137 (the end user directive). In practice, it means the repair shop needs to align itself with either a manufacturer or the end user, who will take final responsibility to check the work and assess the repair shop.

3.2 Responsibility for preventing an explosion

The employers' obligations in relation to ATEX include assessing the site's *Sources of Hazard* and likely sources of ignition, classification of the area into zones and marking all points of entry, as well as producing and maintaining documentation.

Essentially, the employer is required to take all reasonable measures to prevent the formation of an explosive atmosphere in the workplace. Where this is not possible, measures must be taken to avoid the ignition of any potentially explosive atmosphere. In addition, the effects of any explosion must be minimised in such a way that workers are not put at risk.

The main obligations on employers are to:

- Prepare an explosion protection document (EPD)
- Classify the workplace into Zones where applicable
- Select ATEX 95 certified products according to Zone
- Identify, using warning signs, locations where explosive atmospheres may occur

Existing motors, in use before July 1st 2003, need to conform to minimum requirements as a result of a risk analysis. The equipment history needs to be traced. Companies with good maintenance records should be in the clear. It is the end user's responsibility to show that the equipment used is safe.

If the equipment does not meet the minimum requirements according to ATEX, it needs to be replaced, especially if proof cannot be provided, for instance if the nameplate or maintenance records are missing.

3.3 Explosion protection document

The employer must carry out an assessment of risks arising specifically from explosive atmospheres and produce an Explosion Protection Document that demonstrates that explosion risks have been assessed.

3.4 Classifying zones

3.4.1 Risk analysis

An initial risk assessment on the sources of ignition and types of explosive materials, both gas and dust, should be carried out, following the methodology suggested in EN 1127-1:1998 (Explosion prevention and protection). This will help identify the basic steps that need to be taken to reduce the risk of an explosion. The initial risk analysis is required by the ‘Use Directive’ and helps to determine what actions need to be taken, such as the elimination of ignition sources or an Area Classification exercise

Reducing the inventory and replacing substances with less dangerous alternatives could help make the hazardous area smaller, reducing safety risks as well as financial commitment.

3.4.2 Area classification

Where ignition sources cannot be eliminated, and a flammable gas or dust atmosphere may be present, it is important to determine the extent and duration of the risk for the purpose of the selection of the appropriately protected equipment. This is normally referred to as ‘Zoning’. See the entries on zones in Section 2, Definitions and Terms.

Dust must be included in the area classification assessment – there is more emphasis on this under ATEX than under previous legislation. Examples of combustible dust include substances such as sulphur, coal and lignite. Handling of bulk products such as cereal, milk powder or animal feed can also cause combustible dust.

The concept of a 'blanket zone', where the entire plant or site is specified as one type of zone, say zone 2, is a relatively simple approach, but will mean that more certified equipment than needed must be purchased, installed and inspected. It should be noted that the ATEX Directive now covers both electrical and non-electrical equipment.

3.5 Organisational consequences of ATEX 137

Under ATEX, the *safety manager* of the plant is personally responsible for the protection of the workers and thus the safety in relation to hazardous atmospheres. This was already the system in some countries, such as Germany. In other countries, for instance France and the UK, personal responsibility was only apportioned after investigation.

To bear his legal responsibility under ATEX, the *safety manager*, must have a proven competence and experience in the plant, therefore he is often selected from his position as *process manager.* In practice, this means imprisonment in severe cases following an accident, in waiting for further detailed investigations and proven faults. If no safety manager is formally nominated, the plant manager becomes personally responsible for explosion safety.

3.6 Inspections

ATEX 137 introduces a new inspection regime. In the past, equipment would have been inspected by engineers from a national authority on electrical items. Now, responsibility has shifted to the Labour Office, or equivalent authority, and the inspections are carried out by personnel responsible for health and safety or fire safety. These are not engineers and cannot make a judgment on whether a

particular piece of equipment is safe, only if it has the relevant paperwork and what the potential impact of an explosion could be.

The assessment aims to prevent the spread of an explosion from the source and assess how likely the equipment is to cause an explosion; in the event of an explosion, how can injury to workers in the immediate vicinity be avoided; and how can the spread of consequences to adjacent areas be prevented.

3.7 Motor marking

Once the plant is correctly divided into zones, the appropriate equipment must be selected for each zone. See the entries on motor types in Section 2, Definitions and Terms.

After commissioning, certain inspections and specified repair techniques must be applied to ensure the equipment retains its certificated status.

A user wishing to check that a motor is approved to the appropriate directive needs to look for the directive number, which appears in the EC Declaration of Conformity delivered with the motor. The EC Declaration of Conformity is the only document that has to be supplied with each delivery. The directive number can also be stamped on the rating plate along with the identification number of the Notified Body, given after the CE mark.

4. Conclusion

With the ATEX Directives, no areas where workers are operating can be assumed to be safe by default. The safety can only result from a consistent risks analysis proving that no explosion can occur in safe area because there is no source of risks and in hazardous area due to protective measures to prevent explosion in case of risks.

While many large companies will be accustomed to assessing hazards and will have a formal system in place to contain and control them, a large number of smaller companies may not. These may find it helpful to use professional

consultants well versed in European safety law, at least until they can put their own systems in place and have adapted their working methods to the new demands.

Whatever their size, all companies must remember that any measures taken must be reviewed regularly, particularly when any significant changes are made to the hazardous area workplace.

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