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The ATEX Directive–its effect on instrumentation in hazardous areas

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1. Introduction

The ATEX Directive has been under discussion for a number of years and was finally agreed by the European Commission and published in the official journal on 19 April 1994.

This commentary on the document is almost entirely the author's personal opinion. It is, however, based on a very large number of meetings—with UK government and EC officials and a number of CENELEC and other standards bodies—and several conferences on the subject. The existing flammable atmospheres directive (76/117/EEC 18 December 1975) is an optional directive with specific reference to CENELEC standards. This directive has worked reasonably well and despite its many imperfections it has considerably reduced the barriers to trade within the European Union.

The ATEX Directive is a 'New Approach Directive' which is a compulsory directive, beginning as an optional directive on 1 March 1996 and becoming mandatory on 30 June 2003. New approach directives are not intended to specify in detail any requirements but to specify essential safety requirements with which apparatus must comply. Compliance with the relevant CENELEC standards is generally thought to meet the essential safety requirements but is only one method of compliance.

The ATEX Directive should have been embodied in national law by 1 September 1995 but, with the exception of Luxembourg, this has not been done. There are some significant problems in this stage of the proceedings not least of which are known differences in the three languages of the official text. The differences are not trivial and hence some alignment will be necessary. The relevant departments in national governments and in Brussels are known to be struggling with intractable aspects of the EMC Directive which became compulsory on 1 January 1996 and hence this must have the higher priority in their scheme of things. The probability that certification to the new directive will be available by 1 March 1996 is rapidly receding. *(Since presentation, this prophesy has been fulfilled. Author)*

The ATEX Directive is intended to cover the design of all apparatus used in explosive atmospheres. This requirement to be all embracing means that the directive is quite difficult to interpret when applied to specific detailed problems. The directive attempts to embrace both electrical and mechanical hazards, dust and gas atmospheres and surface and mining industries. The logic of the all embracing argument has considerable appeal but it does fail to recognise that in some areas there is a long history of standards and certification while in others the solutions adopted have been based on experience in the particular industry and hazard.

Frequently, in meetings with representatives of the Commission, the response to detailed difficult questions has been that the 'intention' of the directive should be interpreted and that legalistic quibbles are not relevant. This concept of legal requirements, where an industrial designer has to anticipate the intention of the writer of the law, is difficult to understand. The only consolation is that it would become part of European culture for all engineers to be qualified in extra sensory perception of the way creators of directives think. The lessons learned in overcoming the deficiencies of the EMC Directive will form a sound basis for the approach to this directive. Commercial organisations which do not take a positive approach and liberally interpret the requirements—recognising that enforcement of the directive will be extremely difficult—will be at a considerable disadvantage.

The paper continues with a more detailed examination of how the author anticipates the design of instrumentation will be affected. It does not discuss in detail any aspects of coal mining [Group I] instrumentation since the author's knowledge of that industry is very limited. In the United Kingdom there has always been a considerable divergence between mining and surface industry practice and the existence of a common directive is not likely to influence that position.

2. Interaction with the 118a Directive

There has been active discussion on a complementary directive which would cover the safe use of the apparatus which complies with the ATEX Directive. Installation practice, maintenance, inspection and repair are all important aspects of the continued safety of correctly designed apparatus. At the time of writing this paper the status of this document seems to be in considerable doubt. A recent verbal statement from the Commission suggested that a revised document would appear in the near future (within a few weeks). However, a widespread industrial view is that codes of practice are guidance documents, best dealt with on a more local basis, and that this 118a Directive should be allowed to fade away.

For electrical equipment there is an IEC code of practice which could also become a CENELEC document and would solve some of the problems associated with the 'safe installation' directive. However, it is not unusual to deviate from existing electrical codes of practice in particular circumstances in order to achieve an adequate level of safety. If the 'safe installation' directive has to cover all conceivable mechanical and chemical hazards, then the code of practice would become an infinitely large book crystallising the experience of the last few decades.

It has to be recognised, however, that apparatus design does interact with how the equipment is used. Apparatus standards are separately written but they do make

assumptions about installation practice. This is particularly the case where intrinsically safe techniques are used, but flameproof designs make assumptions about equipment mounting and increased safety equipment designs have detailed bonding requirements. It is therefore inevitable that decentralised codes of practice will be cited as creating a restraint of trade. The impracticality of having a legally enforceable code of practice is however the stronger argument and may well prevail.

One of the difficulties which will arise, if certification to the essential safety requirements involves techniques which are a radical departure from the existing techniques, will be how the necessary instructions to ensure safe use will be accomplished.

The necessity to supply training for installation technicians and subsequent instructions for safe use will become a major issue. The assumption that the equipment is to be installed and used by personnel with some experience and knowledge will not be possible. This problem already arises with equipment which uses combined methods of protection where the installation and operation instructions have to be much more detailed so as to remove possible confusion.

3. Categorisation

The ATEX Directive introduces the concept of 'category of apparatus'. The suggestion in the directive is that the 'category' and 'Zone of use' are correlated in the way shown in Table 1. The directive is not as specific as the table but, for example, Group II category 1 equipment is specified as "Equipment in this category is intended for use in areas in which explosive atmospheres caused by mixtures of air and gases, vapours or mists or by air/dust mixtures are present continuously, for long periods or frequently". This, for gas hazards, is obviously a Zone 0. In a number of meetings, however, representatives of the Commission have stated that the categories are not to be directly identified with specific Zones.

There has been a suggestion that consequential damage should also be considered and there are very strong arguments for doing so. In practice this is a factor taken into account in the choice of equipment by the majority of engineers. There is however no mention of this factor in the directive and, if it has to be taken into consideration, then it should have been included. This subject is the fundamental one of the need for adequate risk analysis which is a fascinating subject with infinite possibilities.

CATEGORY	ZONE OF USE	FAULT COUNT
1	0	2
2	1	1
3	2	0

Table 1
Correlation of Category and Zone of use

4. Interaction with CENELEC standards

Third party certification of Group II category 1 and 2 electrical equipment appears to be a requirement of the directive. There is a 'let out' clause [Article 8, paragraph 5] which allows "the competent authorities" to permit the use of any type of equipment "in the interests of protection" within their own territory. The full implications of this clause have not been explained but, obviously, countries which have very flexible "competent authorities" will have considerable advantages. Except in the case of category 1 equipment, mechanical aspects of safety can be established as adequate by the manufacturer. This must be a pragmatic decision, based on the fact that there are no certifying authorities capable of examining all the mechanical problems, and not a reflection on the comparative integrity of mechanical and electrical engineers. The electrical industry has always been more disciplined than the other branches of engineering (possibly because it is easier and partly because of the 'electricity is dangerous' phobia) and consequently is penalised by this discrimination. Many pieces of equipment which need to comply with this directive will have a combination of both electrical and mechanical sources of ignition.

In the particular case of Group II category 1 equipment, equipment currently coded 'ia' and certified to the amended second edition of EN 50 020 should meet the requirements. There is a considerable amount of work proceeding within CENELEC which may permit a combination of existing methods of protection as category 1 apparatus. The majority of the relevant committee believes the task is relatively straightforward. The author's personal opinion is that there are a significant number of problems which will be difficult to overcome.

The certifying authority approved for the purposes of electrical safety may or may not have the capability to express an informed opinion on the mechanical aspects and, hence, some category 2 equipment will be third party certified for electrical purposes and manufacturers' assessments accepted for mechanical risks. The potential for misunderstanding the marking in these circumstances is significant.

Certification to the essential requirements has been stressed as a significant advance over the existing (1975) directive, which has been heavily criticised because the 'listed' standards were never up to date. The essential requirements are, however, so vague that certification to them is a lottery in which the choice of the certification authority may well be critical. There is no definition of fault and it is possible to think of faults which would destroy the integrity of all the currently acceptable techniques. For example, a fault which caused the 440V 3-phase system to become an 11kV 3-phase system would generate some interesting problems but is not considered in the existing systems. However the generally accepted interpretation is that the level of safety achieved by the existing CENELEC standards is that intended by the ATEX Directive. A result of this interpretation is that the work in CENELEC is concentrated on the "General Requirements" EN 50 014 and the major part of that work relates to the marking requirements.

It is possible that the recently produced second editions of the CENELEC apparatus standards will only need to be revised to refer to the amended EN 50 014. Then equipment certified to these standards will be acceptable to the ATEX Directive. If this situation emerges it is accepted that certification to these standards will be the normal approach.

The certifying authorities will be subject to scrutiny themselves and will have to satisfy some accreditation body that they are competent to certify. It is quite difficult to demonstrate competency when certifying to a standard, but to prove that an organisation is qualified to approve to the very loosely specified 'essential safety requirements' will be very difficult. Similarly, guidance on what will be acceptable will not be readily available to the manufacturer and, consequently, the probability of rejection will be high. It therefore seems almost certain that the majority of equipment will be certified to the

CENELEC standards and that manufacturers considering the 'essential requirements' route may well incur considerable delays and higher unpredictable costs.

There is a requirement in the ATEX Directive to take into account changes in 'technological knowledge' and these changes must be "utilised immediately". It is expected that the 'current' CENELEC standard will continue to be in step with the most recent 'technological knowledge'. If the standard fails to be the reference document then CENELEC will lose its credibility. It may be that some modification of CENELEC procedures, to speed up modifications to the standard or to provide interim solutions, will prove to be necessary. However, it must be recognised that the present standards of safety are acceptably high and that hasty decisions on changes to the standards frequently prove unsatisfactory in the long term.

The directive contains significant requirements for the provision of instructions and in particular requires them to be available in the languages of the country of use. It is not expected that the instruction manual will be part of the apparatus certification but its existence in at least one language will be checked. With some lower cost items, this requirement may lead to manufacturers not offering apparatus for sale in some countries where the market is small.

5. Intrinsic safety

Category 1 and 2 equipment will almost certainly continue to be certified intrinsically safe to the CENELEC standard which will be the revised second edition of EN 50 020. The second edition does not contain any fundamental changes except for the capacitive ignition curves which have reduced the permitted capacitance at some voltages. However, designers who are experienced in using the first edition of EN 50 020 together with its amendments and interpretation sheets are not likely to have significant problems. The second edition is thought to meet all the requirements for electrical safety of the new directive and the revised "General Requirements" EN 50 014 should cover the majority of the mechanical hazards.

Some instrumentation, such as level measuring equipment, has evolved over many years and adequate solutions to some of the extremely difficult compatibility problems between materials and measurement probes have been found. Presumably the certifying authorities will have to rely on this experience to satisfy themselves that the equipment is not likely to be dangerous. Any other approach would require very large testing resources and be extremely expensive.

Quite frequently apparatus which is not used in Zone 0 (e.g. solenoid valves) are certified 'ia' so that they can be used in 'ia' systems without further considerations. It may be that such equipment will become 'ia' category 2 equipment to avoid some of the restrictions placed on category 1 equipment. This classification could prove a nightmare for ardent label watchers.

It is generally accepted that associated electrical equipment intended for safe-area mounting is covered by Article 1, Clause 2 of the directive. This may or may not have been the intention, since its wording is more directly aimed at equipment required for operation with 'protective systems' which are intended to halt or limit incipient explosions. Fortunately, there are no special requirements for marking associated apparatus and this reinforces the author's belief that its inclusion in the directive was not intentional.

Intrinsically safe systems are not included in the directive, in the opinion of the majority of people consulted. Unfortunately, this has not been confirmed by Brussels and there has been a request for a revision of EN 50 039, but clarification should be available soon. Meanwhile the United Kingdom is proceeding on the assumption that intrinsically safe systems are not included. There is a long outstanding debate about whether a system standard is necessary or whether its contents should be in the code of practice. France requires that systems having part within a Zone 0 be certified and, hence, needs a standard. In general the United Kingdom prefers to have a system standard so that the option of having certified systems is available. Holland, emphatically, and possibly Germany are believed to prefer that the system requirements are embodied in the code of practice.

Intrinsically safe installations rely heavily on the use of uncertified 'simple apparatus' and one of the more useful inclusions in the second edition of EN 50 020 is a fuller definition of this type of apparatus. Fortunately, it is generally agreed that as this apparatus is considered to be passive and non energy storing it is not covered by the directive. This decision does raise an infinite number of very difficult questions, however, the proposed answer solves so many difficulties that it has been gratefully accepted and suitably recorded. There will however still be a marketing advantage in selling 'certified' simple apparatus and, hence, there will be a continued requirement for certifying authorities to issue certificates.

Intrinsically safe fieldbus systems are evolving and it seems probable that the rules for creating these systems will become easy to apply. They seem to be particularly amenable to being assessed using a simple computer programme, the printout from which solves the irritating problem of documentation.

6. Category 3 apparatus

The 'safe in normal operation' requirement normally associated with Zone 2 locations has the advantage that a manufacturer's declaration of compliance with the essential safety requirements is all that is required. However, third party certification of the more commonly used apparatus is normally a requirement by the end user and certainly makes the marketing of equipment for use in the petrochemical industry much easier. This flexibility of choice is the optimum and arguably should be permitted for all apparatus.

Unfortunately, the type 'n' standard does not adequately cater for light-current instrumentation which is only a diversion from the heavy-current practice enshrined in the standard. In particular the 'no live working' characteristic of type 'n' is not applicable to instrumentation. There is very little enthusiasm for the 'ic' concept (intrinsic safety with no faults) in the United Kingdom and the American 'non-incendive' standard is not comprehensive. Without an adequate standard and code of practice it is very difficult for certifying authorities to certify and end users to be assured of an adequate level of safety. It should be possible to reduce costs by utilising category 3 apparatus where this is appropriate but, at the present time, this does not seem to happen. The current position is therefore that neither manufacturer nor user sees sufficient economic benefit to warrant the creation of a new standard and code of practice and no one is prepared to do the necessary, boring work.

Even the proposed CENELEC type 'n' standard is not being promoted with much enthusiasm. The continued use of intrinsically safe apparatus for the majority of instrumentation seems probable and, as its safety record is high, this has much to commend it.

7. Production quality assurance

The existing directive contains some requirements for surveillance of quality control systems within manufacturers. The requirements are not well specified and, apart from the United Kingdom certifying authorities, has not been enforced within Europe. The present UK quality control system is based on the manufacturer having an ISO 9002 level of quality control plus some additional requirements necessary to ensure compliance with certified drawings and control of apparatus distribution. Routine checks on the manufacturer's system are carried out and corrective actions specified to maintain the required level of integrity.

It is expected that this system will continue to prove adequate, although it is being reviewed in the light of the new directive. This quality control system was introduced as a result of pressure from certain end users and government departments but whether it has increased safety or not has not been clearly demonstrated. Certainly it has not been translated into a procurement requirement by any major user in the United Kingdom.

The amount of work involved in setting up the regulation of the quality control systems by the notified body is considerable. The responsibility can presumably be seconded to other organisations (this is not clear) but there was no possibility of a notified body creating the necessary framework nor of approving manufacturers before March 1996—and much of the time to the year 2003 may well be absorbed in the learning process. It must be a real possibility that some of the smaller notified bodies currently recognised will not have the resources capable of performing this task.

It is certainly predictable that the interpretation of this requirement will vary considerably across Europe. It will be interesting to see if this requirement is enforced since no action was taken to enforce the requirement in the previous directive.

8. Marking

The marking requirements of the directive are best described as ludicrous. A detailed analysis of these requirements is pointless since they will be applied and there is nothing that can be done to change the requirement.

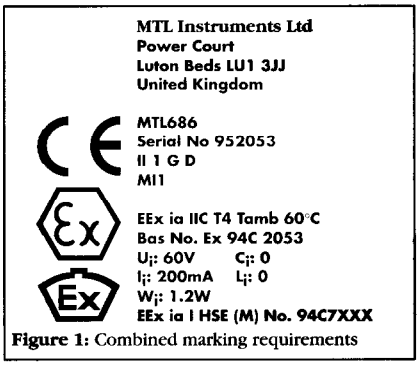


Figure 1: Combined marking requirements

It is perhaps sufficient to say that the requirements are that the marking will be comprehensive but meaningless because the personnel who are intended to use the marking cannot be expected to understand it. The example quoted (figure 1) is the marking requirements of an intrinsically safe indicator which, fortunately, has a relatively large flat space on which it is marked. However, when this requirement is combined with the marking requirements of other certifying authorities it becomes impossible to accommodate even on this relatively large piece of apparatus (figure 2). The problems which arise when marking apparatus such as small proximity detectors becomes obvious.

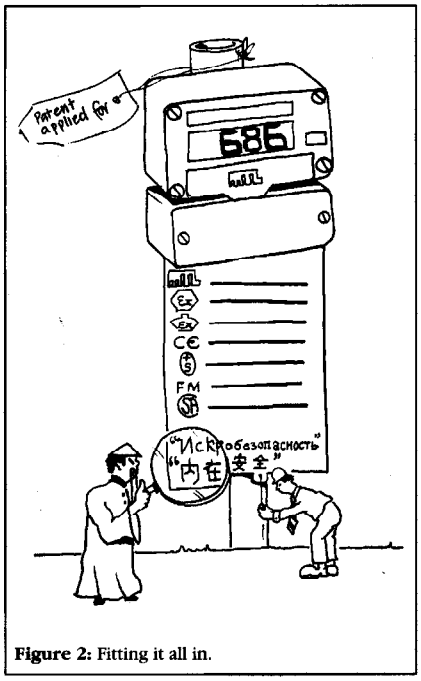


Figure 2: Fitting it all in.

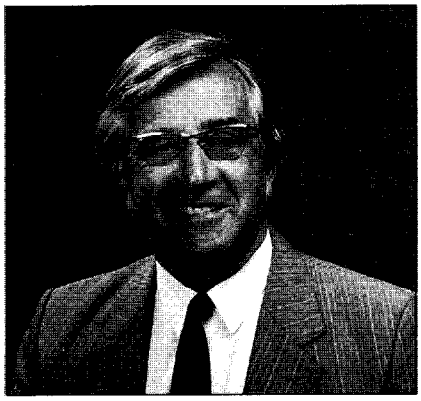
There must emerge some relaxation for these extremely small pieces of apparatus but there is no sign of sanity prevailing at the moment.

9. Conclusion

It is easy to believe that this directive will be completely unworkable. In practice, industry will carry on producing petrochemical products and a modus operandi will emerge. Those countries capable of bending with the wind will have a distinct advantage and the Brits will continue to moan about the "playing field not being level".

The rules will change and the 'flexible' will prosper.

The most unfortunate aspect of all this legislation is that it will be virtually impossible for a small company to participate in, or to start up in this industry. For the same reasons companies will be reluctant to develop products which have any element of commercial risk and some desirable, specialist, low-turnover products will be withdrawn from the market.



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