Inspection, maintenance and repair of ATEX equipment

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Abstract - To apply the directive 1999/92/EC, the employer shall ensure that the work equipment, used in place where explosive atmosphere may occur, are maintained so as to reduce at most explosion risks.

The maintenance shall be realized in a permanent concern for keeping the protection level of work equipment in ATEX. This level shall never be either modified or deteriorated. That’s why this activity shall be carried out only by workers who have been trained to the specificity of the protection types and shall be the matter of specific follow-up and management.

The safety shall also be guaranteed if the maintenance and overhaul of equipment are sub-contracted.

We will establish technical and organizational recommendations to ensure a safe maintenance of ATEX equipment. On a technical point of view, the international standards IEC 60079-17 et IEC 60079-19 deal with inspection, maintenance, repair and overhaul of electrical apparatus for explosive gas atmospheres. With regard to the mechanical equipment, we will produce some elements of our referential ISMATEX and SAQRATEX.

To deal with the management of maintenance, we shall particularly watch over the identification of the ATEX equipment, the archiving of technical documentation, the establishment of maintenance planning, and to the traceability of the interventions.

We shall also be sure that the maintenance workers are correctly trained and experimented, either they are internal workers or sub-contractors.

Index Terms — Repair, Workshop, Spare parts, Maintenance, Inspection, Overhaul, Reclamation, Traceability, Training, Quality management system, Assessment, Competency,

I. INTRODUCTION

According to directive 1999/92/EC, all necessary measures must be taken to ensure that the workplace, work equipment and any associated connecting device made available to workers are maintained in such a way as to minimize the risks of an explosion. The methods and the rules to achieve this goal must be defined in the explosion protection document drawn up by the employer responsible for the workplace.

First, we will carry out a short inventory of the regulation requirements and applicable standards for maintenance and repair of equipment used in explosive atmospheres.

In a second time we will establish organizational and technical recommendations so as to maintain the level of protection of equipment and to fulfill the requirements of the directive 1999/92/EC.

It’s important to note that this article does not relate to technical measurements and/or of organization which must be applied in order to ensure the protection of workers during the actions of maintenance carried out in explosive atmospheres.

The following definitions will be used:

- Repair : Action to restore a faulty apparatus to its fully serviceable condition and in compliance with the relevant standard.
- Overhaul : Action to restore to a fully serviceable condition an apparatus which has been in use or in storage for a period of time but which is not faulty.
- Maintenance : Routine actions taken to preserve the fully serviceable condition of the installed apparatus.
- Reclamation : Means of repair involving, for example, the removal or addition of material to reclaim component parts which have sustained damage, in order to restore such parts to a serviceable condition in accordance with the relevant standard.
- Inspection : Action comprising careful scrutiny of an item carried out either without dismantling, or with the addition of partial dismantling as required, supplemented by means such as measurement, in order to arrive at a reliable conclusion as to the condition of an item.

II. INVENTORY OF REGULATION REQUIREMENTS AND APPLICABLE STANDARDS

A. European regulation

Although the user remains responsible for the maintenance and the repair of its equipment according to the directive 1999/92/EC, it is necessary to pay the attention to the requirements of directive 94/9/EC that could be connected to these activities.

1) Repaired equipment and modifications

Repaired equipment is product whose functionality has been restored following a defect without adding new features or any other modification. As this occurs after the product has been placed on the market and the product is not to be sold as a new product, the ATEX Directive 94/9/EC does not apply.

It is however important to note that directive 94/9/EC re-applies to a modified product where the modification is
considered to be substantial and if it is intended to be placed again on the EU market for distribution and/or use.
In the sense of directive 94/9/EC a substantial modification is any modification affecting one or more of the health and safety requirements (e.g. temperature) or the integrity of a type protection. In the case of the electrical equipment protected by a recognized protection type, the following modifications may be regarded as substantial:
  • Modification of the temperature class or temperature of surface of equipment following variation of dissipated power,
  • Motors supplied at varying frequency and voltage by a converter if this type of application is not specified by the instruction manual,
  • Luminaries: modification of power and type of lamp,
  • Electrical box: modification of the dissipated powers or the internal temperatures,
  • Intrinsic safety equipment: modification of the associated accumulators,
  • The drilling of holes in an explosion-proof enclosure,
  • Etc.

When modifications are realized, it's necessary to ask to the manufacturers and/or to the authority in charge of certification, if the equipment can continue to be used in potentially explosive atmosphere.

2) **Spare parts**

A typical repair operation would be the replacement by a spare part. The spare part is normally not required to comply with directive 94/9/EC unless the spare part represents equipment or component as defined by the directive and it is placed for the first time on the EU market for distribution and/or use. In the case of the electrical equipment protected by a protection type recognized, the following spare parts can be regarded as equipment or component:
  • Separate cable glands (equipment or component),
  • Terminals,
  • Push button assemblies,
  • Relays,
  • Ballast for fluorescent lamps « EEx e »,
  • Etc.

1 In some cases, cable glands are fully with the enclosure or specific to the enclosure. They have been tested as part of the enclosure concerned and are not regarded as equipment or component.

Bearings, mechanical seals, screws, etc. are not usually placed on the market with the explicit intention to be incorporated into ATEX equipment but for general engineering purposes. In such case, their conformity has to be assessed in the course of the conformity assessment of the integral product and they don't represent equipment or components as defined by the directive.

It is preferable to obtain new parts from the manufacturer, and the repairer shall ensure that only appropriate spare parts are used in the repair or overhaul of certified apparatus. Depending on the nature of the apparatus, these spare parts may be identified by the manufacturer, the apparatus standard or the relevant certification documentation. If the manufacturer of the original spare part offers a new different one in its place (due to technical progress, discontinued production of the old part, etc.), and it is used for the repair, the repaired product (as long as no substantial modification of the repaired product takes place) does not need to be brought into conformity at this time with directive 94/9/EC as the repaired product is not then placed on the market and put into service.

When it is impossible to obtain spare parts coming from the manufacturer and if a new part, different from that which is in place must be used, this modification (as long as this modification cannot be regarded as substantial) must be realized under the responsibility of the user, within the framework of the 1999/92/EC directive. In this case, it seems necessary to formalize an assessment, showing that the modification doesn't affect one or more of the health and safety requirements or the integrity of a type protection. This analysis should be attached to the explosion protection document drawn up by the employer responsible for the workplace.

3) **Instructions for maintenance**

In addition, it is important to recall that all equipment must be accompanied by instructions for safe use (installation, operation and maintenance).

According to directive 94/9/EC, the instructions must contain the drawings and diagrams necessary for the putting into service, maintenance, inspection, checking of correct operation and, where appropriate, repair of the equipment or protective system, together with all useful instructions, in particular with regard to safety.

B. **Standards**

Although they are not imposed by the directives, standards may nevertheless be used like technical references for the activities of inspection, maintenance, repair and overhaul of electrical equipment used in explosive atmospheres. However, there is no equivalent for non-electrical equipment.

4) **Repair and overhaul for electrical apparatus used in explosive atmospheres**

The standard IEC 60079-19 gives instructions, principally of a technical nature, on the repair, overhaul and reclamion of a certified electrical apparatus designed for use in explosive atmospheres. It gives guidance on the practical means of maintaining the electrical safety and performance requirements of repaired apparatus, but also defines procedures for maintaining, after repair, compliance of the apparatus with the provisions of the certificate of conformity or with the provisions of the appropriate explosion protection standard where a certificate is not available.

Concerning electrical apparatus for explosive gas atmospheres, the standard provides instructions for the following types of protection:
  • Flameproof enclosures « d »,
  • Increased safety « e »,
  • Pressurized enclosure « p »,
  • Intrinsic safety « i »,
  • Types of protection « n »,
• Group II Zone 0 electrical apparatus.

Concerning electrical apparatus for use in the presence of combustible dust, the standard covers the following types of protection:
• Protection by enclosures « tD »,
• Pressurized enclosure « pD ».

5) Inspection and maintenance of electrical installations in explosive atmospheres

The standards IEC 60079-17 and IEC 61241-17 are intended to be applied by users and maintenance companies. They cover factors directly related to the inspection and maintenance of electrical installations within hazardous areas (respectively gas and combustible dusts). They give general requirements (documentation, qualifications of personnel, maintenance requirements, earthing and equipotential bonding, etc.) and additional inspection schedule requirements for electrical apparatus protected by:
• Flameproof enclosures « d »,
• Increased safety « e »,
• Pressurized enclosures « p » and « pD »,
• Intrinsic safety « i » and « ID »,
• Types of protection « n »,
• Protection by enclosures « tD ».

6) Specific standards

In addition, other standards give indications for maintenance of particular applications, such as:
• IEC 62086-2 : Electrical apparatus for explosive gas atmospheres - Electrical resistance trace heating - Part 2 : Application guide for design, installation and maintenance
• IEC 61779-6 : Electrical apparatus for the detection and measurement of flammable gases - Part 6 : Guide for the selection, installation, use and maintenance of apparatus for the detection and measurement of flammable gases

III. ORGANISATIONAL AND TECHNICAL RECOMMENDATIONS

7) Subcontractors selection

While the international standards and rules related to the electrical equipment for explosive atmospheres are very strong and binding for the construction and the installation of these appliances, there are few rules and international standards for the repair and maintenance. There are international standards relative to the repair, inspection and maintenance of the electrical apparatus for explosive atmospheres but they do not apply to the non-electrical equipment. Moreover, the use of a standard is not always sufficient to establish a reliable climate among the repairer and his customer and it is necessary to set up strict working procedures to establish this confidence. It can be one of the objectives of repair workshops (and/or maintenance companies) certification.

Regulation and standards recognize the necessity of a required level of competence for the repair and maintenance of an ATEX apparatus. Some manufacturers may recommend that the apparatus shall be repaired only by people whose competencies are established. Nevertheless, in some cases the manufacturer has either disappeared, or abandoned the manufacturing of this equipment, or stopped supplying spare parts.

There are also cases where the repair services of the manufacturers are completely separate and independent of the design and production units. In such cases, to utilize the manufacturer facilities does not completely exempt to check repairer competence.

Except specific local regulation, the certification of the companies of repair and maintenance is not obligatory but it remains a solution to guarantee a safe maintenance of ATEX products.

Users will utilize the most appropriate repair facilities for any particular item of equipment, whether they are the facilities of the manufacturer or a suitably competent and equipped repairer. Anyway, the user remains responsible for the maintenance and the repair of its work equipment.

8) Subcontractors certification

The purpose of such certification must be to guarantee that the operations are made according to the state of the art and that the level of safety of the repaired equipment stays the same that the one of the original equipment.

a) Quality management system:

It can be based on the quality management system of the repairer and/or maintenance company. An organization as a quality management system leads to a specific plan of organization to ensure the traceability and the quality of the works. This plan can be inspired by the arrangements taken within the framework of the European directive 94/9/EC relative to equipment for potentially explosive atmospheres as regards to product quality assurance and the survey of the manufacturer.

Therefore, such a company must:
• have the means and the professional skill necessary for the interventions to be realized (inspection, maintenance, repair, overhaul and/or reclamation),
• have the means required to realize the necessary tests and measurements,
• demonstrate the traceability of the interventions,
• put a marking plate on the equipment in case of repair, overhaul and/or reclamation,
• ensure the reporting to the user of interventions made on the equipment.

The quality management system must show that these requirements are fulfilled. The organization scheme of the company can be based on the following actors:
• "The authorized person " who is the final responsible for the operations. He is in charge of the quality assurance system, defines and organizes responsibilities in the field of ATEX equipment
• "The person responsible for final verification". He has the responsibility of final checking and marking in case of repair, overhaul and/or reclamation,
• "Operative persons" who are involved in the interventions on ATEX products.
IV. CONCLUSION

In conclusion, the need for a certification for the safety equipment is crucial to ensure the safety of the underground coal mines and mining industry. Indeed, this legislation reduces the interest of the investments in the same vein, the working units of French coal mines have no longer been the need to buy new equipment and are obliged to continue using the existing equipment. This policy leads to a decreasing of the investments and revenues of the French coal mines.

The certification process is a crucial step in the production of safer equipment. It guarantees that the equipment meets the necessary safety standards and regulations. This process involves a thorough examination of the equipment by independent third parties, ensuring that it meets the required safety standards.

At the conclusion of the evaluation, every person having acquired the level defined receives an individual certificate. The documents delivered during the training are also available, including technical manuals and training pamphlets. The training covers the application of the procedures and regulations relevant to the specific equipment and work environment.

In the event of intervention in hazardous areas, these persons are trained and certified to operate the equipment safely. The training includes the use of personal protective equipment, emergency procedures, and the handling of hazardous materials.

The certification process is a continuous one, and the equipment must be regularly inspected and maintained to ensure its continued safety. The certification process is a critical component of the overall safety and compliance program for the equipment used in hazardous environments.

The certification of equipment is a complex process that involves the cooperation of multiple parties, including manufacturers, government agencies, and independent testing laboratories. It requires a thorough understanding of the equipment's design, installation, and operation, as well as the specific safety regulations and standards that apply.

The certification process ensures that the equipment meets the necessary safety standards and regulations, reducing the risk of accidents and injuries. It is an essential component of the overall safety and compliance program for the equipment used in hazardous environments.
maintain existing equipment. Furthermore, because of the decrease of their manpower, the technical services or the maintenance units of coal mines can not ensure any more all the repairs.

In a lot of cases the manufacturers of mining equipment have either disappeared, or abandoned the manufacturing of these equipment, or stopped supplying spare parts. So it makes difficult the repair of the apparatus by the manufacturer or by his subcontractor.

The repairs should be made more and more by outside workshops not only informed about the requirements and the compulsory constraints for the electric equipment intended for mines susceptible to firedamp or for explosive atmospheres.

On another hand, more and more chemical and petrochemical companies outsource some facilities and services to external companies and they ask for a minimum quality of these services. This concern is reinforced by a requirement of the ATEX 1999/92/EC, which required that work equipment and work places are maintained in a such way to minimise the risk of explosion.

The aim of INERIS certifications for repair and maintenance companies is to become official national certifications. It ensures to users, the competency and the commitment of specialised subcontractors and a guaranty of safety, quality and traceability. It was designed by INERIS in order to cover:

- all type of equipment, electrical and non-electrical,
- all explosive atmospheres comprising flammable dust atmospheres,
- the need of all the users of equipment for explosive atmospheres (oil, chemical, food industries...)

It is hoped, to improve the safety, that such an approach should be used wherever there is a risk of an explosive atmosphere.

The number of certified companies and the interest of users companies show the usefulness of such a certifications.

V. REFERENCES


[3] IEC 60079-19, Ed. 2.0 : Electrical apparatus for explosive gas atmospheres - Part 19: Repair and overhaul for apparatus used in explosive atmospheres (other than explosives)

[4] IEC 60079-17 : Electrical apparatus for explosive gas atmospheres - Part 17: Inspection and maintenance of electrical installations in hazardous areas (other than mines)


[7] EN 1755 : Safety of Industrial trucks – Operation in potentially explosive atmospheres – Use in flammable gas, vapour, mist and dust

[8] IEC 62086-2 : Electrical apparatus for explosive gas atmospheres - Electrical resistance trace heating - Part 2 : Application guide for design, installation and maintenance

[9] IEC 61779-6 : Electrical apparatus for the detection and measurement of flammable gases - Part 6 : Guide for the selection, installation, use and maintenance of apparatus for the detection and measurement of flammable gases


VI. VITA

Olivier COTTIN is member of INERIS, person in charge for certifications of the companies of repair and maintenance in ATEX field (SAQRATEX and ISMATEX certifications)

He has developed the referential ISMATEX for the certification of companies involved in conception, realization and maintenance of electrical and non-electrical installations in hazardous areas.

He's also in charge, within the framework of the European directive 94/9/EC, of Quality Assurance Notifications of manufacturers.

He graduated in 1999 from ENSAM, a national college of engineering.

He is member of the IECEx Working Group ExMCWG12 - Personnel competency in the Ex field.

INERIS is notified for ATEX 94/9/CE European Directive.

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