

ASPECTS REGARDING THE MAINTENANCE OF ELECTRICAL EQUIPMENT USED IN POTENTIALLY EXPLOSIVE ATMOSPHERE

FOTĂU DRAGOȘ¹, MAGYARI MIHAI², MOLDOVAN LUCIAN³, RAD
MARCEL⁴, COSMIN COLDA⁵

Abstract: The use of electrical equipment in potentially explosive atmospheres requires special attention, namely from the point of view of their construction and maintenance. Together with the technological developments, these objectives can easily be met, objectives which are defined by European standards concerning the construction, use and maintenance of explosive proof equipment. The purpose of this paper is to present the importance of the correct maintenance and repair of electrical equipment with type of protection flameproof enclosure „d” and type of protection increased safety „e” designed to be used in explosive atmosphere. Electrical equipment that operates in potentially explosive atmosphere, have characteristics specially designed for operation in this area. For security reasons, it is essential that the integrity of these special features be preserved in these areas throughout the life of the installation. To prevent an explosion it is very important that the maintenance and repair of electrical equipment is done correctly and is performed by trained personnel who know the principles of type of protection.

Keywords: electric equipment, increased safety, flameproof enclosure, repair, explosive atmosphere.

1. INTRODUCTION

Using electric equipment in potentially explosive atmospheres brings forward several particularities therefore the problems that appear during the design, construction and operation of electrical devices and installations brings forward numerous difficulties, their approach requiring special attention considering all the

¹ Sc. Res. IIIrd, PhD.Eng., INCD INSEMEX Petrosani, dragos.fotau@insemex.ro

² Sc. Res. Ist, PhD.Eng., INCD INSEMEX Petrosani, mihai.magyari@insemex.ro

³ Sc. Res. Ist, PhD.Eng., INCD INSEMEX Petrosani, lucian.moldovan@insemex.ro

⁴ Sc. Res. IIIrd, PhD.Eng., INCD INSEMEX Petrosani, marcel.rad@insemex.ro

⁵ Sc. Res. IInd, PhD.Eng., INCD INSEMEX Petrosani, cosmin.colda@insemex.ro

technical, economical and labor safety aspects. Due to this fact, it is very important that the equipment is properly inspected, maintained and repaired during the entire life of the equipment. The purpose of this paper is to identify improvements that can be made during the repair process of the equipment.[3]

2. MAINTENANCE OF ELECTRICAL EQUIPMENT USED IN POTENTIALLY EXPLOSIVE ATMOSPHERE

The electrical installations found in hazardous areas have especially designed characteristics in order to operate in such atmospheres. For safety reasons, it is essential that in these areas, during the entire lifespan of the installation, the integrity of these special characteristics to be maintained. [17], [18], [2]

When a electric equipment is installed in areas in the atmosphere of which there may be inflammable gases, vapors or mists in hazardous concentrations and quantities, protection measures for the reduction of the probability of an explosion due to spark ignitions, electric arks or incandescent surfaces during normal or specified malfunctioned operation, need to be applied. [1][19]

The general state of the whole equipment needs to be periodically checked, by applying the specified periodic inspections, and if necessary, measures to remedy them need to be undertaken. The current actions undertaken in order to maintain the state of full operation of the installed equipment is called maintenance. The maintenance of the integrity of the type of protection foreseen for the equipment has to be especially considered. Spare parts need to be according to the documentation for the safety protection and assurance.[7] [20]

The electric equipment found in a hazardous area may be negatively influenced by the environmental conditions where it is used. Some of the essential elements which need to be considered are: corrosion, environmental temperature, ultraviolet radiations, water penetration, dust or sand accumulation, mechanical effects and chemical aggression. [4][20]

If the case or one of the components is severely corroded, the part affected needs to be treated by covering it accordingly against corrosion, the frequency and the nature of such a treatment being determined by the nature of the environmental conditions. [21], [5]

If the flameproof enclosures are reassembled, all the joints need to be thoroughly cleaned and lubricated easily with a sort of Vaseline for the prevention of corrosion and to increase their weatherproofing. In order to clean the flanges a non metallic grater and noncorrosive cleaning products need to be used. The bolts and tenons and similar parts on which the type of protection depends, need to be replaced only with similar parts according to the design and recommendations of the producer. The deteriorated sealing gaskets need to be replaced. The condensation proof devices shall be verified to see if they work accordingly. [21], [6]

3. INSPECTION OF ELECTRICAL EQUIPMENT USED IN POTENTIALLY EXPLOSIVE ATMOSPHERE

Inspection - an action involving a thorough examination of an object carried out either without disassembly or with partial disassembly, as the case may be, supplemented by means such as measurements, in order to reach a definite conclusion on the condition of the object in question. [17], [20]

In order to carry out inspections and maintenance of electrical installations in optimal conditions, the following updated documents must be available.

- a) classification of hazardous areas;
- b) equipment group and the temperature class;
- c) sufficient records to allow explosion-protected equipment to be maintained in accordance with their types of protection.

The inspection and maintenance of electrical installations must be carried out only by experienced personnel whose training has included training on the different types of protection and practical methods of installation, all relevant rules and regulations, as well as the general principles of classification of hazardous areas. [10]

The main factors that cause damage to the equipment are: susceptibility to corrosion; exposure to chemicals and solvents; the possibility of accumulation of dust and dirt; the possibility of water penetration; exposure to excessive ambient temperatures; danger of mechanical damage; exposure to abnormal vibrations; staff training and experience; the possibility of unauthorized modifications and adjustments; the possibility of incorrect maintenance, for example not in accordance with the manufacturer's recommendations. [8], [9]

Inspections are classified into degrees and types of inspection.

Types of inspection: initial, periodic, survey.

Degrees of inspection: visual, rigorous, detailed.

Visual inspection - the inspection that identifies without the use of auxiliary equipment and tools, those defects that can be identified visually. [8]

Rigorous inspection - Inspection that includes the aspects covered by the visual inspection and, in addition, identifies those defects, for example loose screws, which can only be highlighted by using access equipment eg calibrated sills (if necessary) and tools. [11], [12]

Detailed inspection - the inspection that includes the aspects included in the RIGOROUS INSPECTION and in addition identifies those defects that can be highlighted only by opening the housing and / or when necessary using tools and test equipment. INITIAL INSPECTION - the inspection provided for all electrical appliances, systems and installations, before commissioning, in order to verify whether the type of protection chosen and its installation conditions are appropriate. [13]

The initial inspection must be carried out with a detailed degree of inspection. [8]

4. REPAIR OF ELECTRICAL EQUIPMENT USED IN POTENTIALLY EXPLOSIVE ATMOSPHERE

The general requirements for the repair and overhaul of an equipment are established by SR - EN 60079-19 which presents recommendations not only on the practical means of maintaining electrical safety and performance requirements for the repaired equipment, but also defines the procedures for maintaining after repairs, compliance of the equipment with the requirements of the certificate of conformity or with the provisions of the corresponding explosion protection standard. [15]

Users must use the most appropriate repair options for each piece of equipment that is provided by the manufacturer or a suitable, competent and equipped repairer. While some manufacturers recommend that certain equipment be returned for repair and others nominate repairers, there are also independent and competent repair organizations that have the means to carry out this type of work. [2][9]

Repair is the action by which a faulty appliance is restored to full operation and in accordance with the relevant standard (the standard according to which the appliance was originally designed). [9]

The overhaul is the action of restoring the state of operation of a device that has been in use or in storage for a certain period of time, but which is not defective. [6]

The repair organization must have adequate repair and overhaul capabilities, as well as the appropriate equipment required to perform the required checks and tests, taking into account the specific type of protection. [14]

The repairer must focus on the need to be informed and to comply with the relevant explosion protection standards and certification requirements applicable to the equipment to be repaired or overhauled. [9]

The repairer must ensure that the persons directly involved in the repair and / or overhaul of the certified equipment are trained and supervised for this type of work.

Data available for repair and / or overhaul must include details of:

- Technical specifications;
- performance and conditions of use;
- assembly and disassembly instructions;
- certification limitations, if specified;
- marking;
- indicated methods of repair / overhaul.

The data specified above must be obtained from the manufacturer or the beneficiary of the repair. These may include information related to previous repairs, overhauls or modifications. [9]

The repairer must provide the user with the following:

- details on the detected faults;
- complete details of repair and overhaul works;
- list of replaced or corrected parts;
- the results of all checks and tests.

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It is preferable to obtain spare parts from the manufacturer, and the repairer to ensure that only the appropriate spare parts are used for the repair or overhaul of the certified equipment.

The repairer must keep records with full details of the repair work performed. In order to identify the repair and overhaul, as well as the identity of the repairer, the repaired equipment must be marked. The marking may be provided on a separate label. It may be necessary to remove or complete the label in certain cases, as follows:

a) If after repair, overhaul or modification the equipment is changed so that it no longer conforms to the standard and certificate, the certification label must be removed unless an additional certificate has been obtained.

b) If the appliance is replaced during repair or overhaul so that it conforms to the standard, but compliance with the certificate is not required, the marking label shall not be removed and the equipment should be marked with the symbol seen in figure 1.

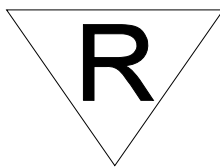


Fig.1. The equipment is in full compliance with the standard but compliance with the certificate is not required

c) If the appliance is replaced during repair or overhaul so that it conforms to the standard and the certificate, the marking label must not be removed and the equipment should be marked with the symbol seen in figure 2.

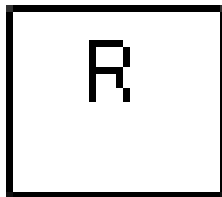


Fig.2. The equipment is in full compliance with the standard and certificate

Current maintenance and repair work which consists of simple replacement of worn parts with original spare parts, reconditioning of explosion-proof joints, reconditioning of simple spare parts such as axles, bushings, screws, etc. they can be executed in a regular workshop.

5. CONCLUSIONS

Flameproof enclosure electrical equipment has features specifically designed for operating in hazardous areas. For these reasons it is essential that equipment with

type of protection flameproof enclosure throughout their lifetime, need to be properly maintained so that the type of protection is not canceled.

For the proper functioning of electrical equipment used in potentially explosive atmosphere, the inspection, maintenance and proper repair of these is of great importance. These things must be done by personnel who know the principles of the types of protection, and also to have the necessary infrastructure for a proper repair.

The inspection and maintenance of the equipment is done according to the requirements of the standard EN 60079-17, and the revision and repair of the equipment is done according to the requirements specified in the standard EN 60079-19.

Over the years, research conducted at INSEMEX has shown that the maximum period of three years between two detailed inspections is often too long. Because of this, the equipment may suffer damage that may invalidate the type of protection, or high repair costs.

The most suitable is that users of electrical equipment used in potentially explosive atmospheres to reduce as much as possible the time between two detailed inspections, in order to be able to identify possible equipment failures in advance.

The electrical installations found in hazardous areas have especially designed characteristics in order to operate in such atmospheres. For safety reasons, it is essential that in these areas, during the entire lifespan of the installation, the integrity of these special characteristics to be maintained.

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