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Electrical installations in hazardous locations or "classified areas" need careful attention, because non-conformities can bring considerable risks not only to site, but also for other industries or even residential areas nearby

The importance of inspections in classified areas

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At industrial plants where flammable products are processed, e.g. plastics, varnishes, pharmaceuticals, oil refineries, etc., there are some locations where the possibility of an explosive atmosphere existing is identified. These locations are known as "classified areas", and need to be recorded on the "area classification drawings". These explosive mixtures occur mainly due to leaks from the process system. In UK, a recent survey indicated that more than 200 gas and liquid releases occur offshore every year. Of this total, 6% were ignited, and most were liquid fires on hot surfaces. These releases are significant, involving typically more than 25 kg of gas. Onshore data is not so readily available, but estimates are around 1 000 fires per year in UK industry, with 14 fatalities averaged over 10 years.

Maintenance responsibilities

Ex equipment is designed with such special characteristics that are unlikely to ignite an explosive atmosphere. To assure safe operation of the industrial plant, it is necessary not only that all Ex equipment is correctly specified and installed, but also adequately maintained, according to technical standards´ requirements. Safety at electric installations in hazardous areas depends on many actions from the design phase until the maintenance activities. In the UK survey, it was found that one plant was only four years old, but 35% of its faults were due to defective installation or maintenance activities. So a commitment from management is needed, together with sufficient resources for inspection and maintenance. A paper policy is no good without resources, staff, competence and commitment.

The main problems found in Ex maintenance activities are:

- Lack of management commitment to maintenance;
- No inventory of equipment (which may have been subject to un recorded modification, addition, or repair)
- Excessive corrosion, especially in salt-laden air.

Establishing an inspection plan

The following actions are recommended to perform an inspection plan in a facility.

- Obtain the area classification documentation;
- Train people to perform inspection;
- Gather data of all equipment inspected;
- Obtain the Conformity Certificates and check if any special conditions of use are being followed;
- Ensure that identified necessary repairs are carried out without delay.
- Area classification documentation

The area classification studies are developed using the IEC 60079-10 standard. Considering its recommendations, all data taken into consideration to define the extent of the classified areas must be recorded and kept available to plant employees. Linking the hazardous area classification drawings to inspection procedures is a good practice. By imposing a grid system on drawings, it enables better identification of inventory, making it easier to inspect.

Using trained people

Adequate training and related experience in hazardous areas are needed to keep industrial plants safe and to guarantee the integrity of Ex equipment.

Workers need to know not only what is to be done, but mainly how to do it in a safe way, keeping the integrity of Ex equipment. Many related non-conformities were attributed to the low qualification of maintenance professionals. It is worth noting that good workmanship is the result of competent people working within good systems of work. The whole inspection system is useless unless it is carried out by adequately trained personnel.

Gathering data

Vital information includes area classification drawings, records of installed equipment, apparatus type, gas group, T class and category. The location of records of previous inspections should be recorded. Maintenance requires more detailed knowledge than when the equipment is first installed. Problems of routine inspections can be reduced considerably if the documentation of each system is accurate and includes

Fig. 1: The sealing unit.

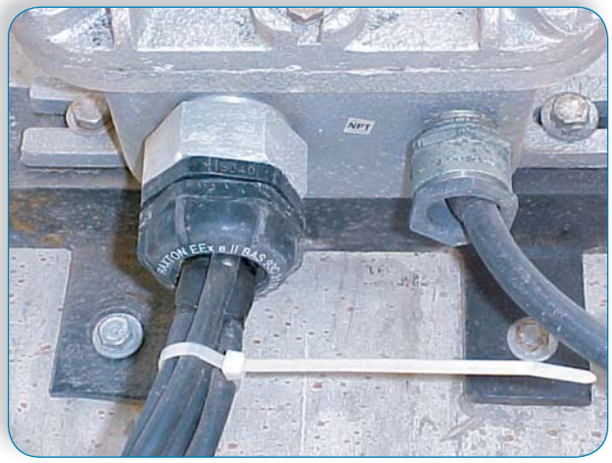

Fig. 2: The cable glands.

the points to be checked.

Knowing the conformity certificates

There is no real shortcut to identification of suitable equipment as the schedules issued with certificates of conformity and inspection certificates contain information that is necessary to the user. These should always be made available to the purchasers of certified equipment and there is a legal obligation on suppliers to do this as safety is dependent on such information. Special care needs to be taken when a letter suffix ("X" or "U") appears following the certificate number, as it means that specials conditions for use are applied.

Repairing Ex equipment

If the integrity of the Ex equipment is affected, the safety of the plant is at risk, so it is mandatory to perform the required repair without delay. Ideally, repair work on Ex equipment should only be carried out by the manufacturer. This rule can be waived in cases where the repairs are carried out by instructed and specially trained, skilled personnel, and only genuine spare parts are used, following the guidance given by IEC 60079-19 standard. Care must be taken to maintain the integrity of the type of protection provided for the apparatus. This may require consultation with the manufacturer. Defective parts should only be replaced by manufacturer authorised replacement parts, and modifications that might invalidate the certificate or other documents should not be made.

The following items are the most common non-conformities found at inspections on Ex equipment:

- Wrong equipment for the area classification;
- Bad installation practice in cable entry devices;
- Corrosion on Ex d enclosures.

Maintenance resources should be directed at eliminating these common failures that affect the safety of the plant. When maintaining Ex equipment, it is necessary that the certified components´ characteristics are respected. To keep the conformity certificate valid after a maintenance service, only spare parts recommended by the original manufacturer can replace defective parts. The quality of maintenance is a major factor affecting safety and operational costs.

Performing inspections

The following types of inspection are defined:

Initial inspections are used to check that the selected type of protection and its installation are appropriate.

Periodic inspections are carried out on a routine basis. They may be visual or close, but could lead to a further detailed inspection.

Sample inspections can be visual, close or detailed. The size and composition of all samples depends on the purpose of the inspection.

Continuous supervision is based on the frequent attendance, inspection, service, care and maintenance of the electrical installation by skilled personnel who have experience in the specific installation and its environment, in order to maintain the explosion protection features of the installation in satisfactory condition.

The grades of inspection are:

Visual inspections – identify, without the use of ladders or hand tools, those defects that are apparent to the eye, e.g. missing bolts on Ex d equipment;

Close inspections - include those aspects covered by visual inspections and, in addition, identify those defects which are only apparent by the use of access equipment and tools, e.g. loose bolts. Close inspections do not normally require the enclosure to be opened or the equipment to be de-energized;

Detailed inspections - include those aspects covered by close inspections and in addition identify those defects which are only apparent by opening the equipment and/or using tools and test equipment, e.g. loose terminals. Detailed inspections are carried out on completion of the installation when it has been handed over by the installation contractor, and prior to the equipment being put into service.

The frequency of routine inspections varies from site to site. On a stable site, with no corrosion problems, every two years could be adequate; on a site where frequent modifications are taking place, handling corrosive product, every six months could be the minimum. Obviously, if a routine inspection locates a significant number of problems, then the interval between inspections should be reduced.

Recalls

Despite observing the Ex conformity certification process, including evaluation of the manufacturer's ISO 9001 Quality Management System, some cases of recall of Ex equipment have been noted. This emphasises the importance of updated documentation about the Ex equipment inventory which would help the user to identify where in the plant the Ex equipment has been installed during the specified period of the recall.

Fig. 3: The sealing unit II.

Examples of non-conformities

Three examples of common non-conformities are presented here. All of them affect the integrity of the Ex equipment, putting the installation at risk.

Sealing units need to be installed in compliance with manufacturer instructions. Fig. 1 shows a sealing unit with its filling aperture pointing in the wrong direction.

Cable glands need special care, not only with the adequate specification, but also with respect to installation requirements.

Fig. 2 shows two cable glands not suitable for use with Ex d enclosures. For Ex d enclosures, only Ex d certified cable glands can be used.

Sealing units need to be filled with the recommended sealing compound. Without filling, the sealing unit is useless, allowing the propagation of an explosion throughout the conduit system.

Conclusions

Considering the specific characteristics of Ex equipment and the risks involved with electric installations in hazardous areas, it becomes necessary to invest in specialised training of maintenance and inspection teams, including contracted personnel. An inspection programme covering technical installation requirements applied to Ex installations would also contribute to provide effective plant safety in hazardous locations.

To keep the industrial plant in a safe conditions, the following actions should be implemented:

- Do training programs on Ex installations for maintenance, operation and purchasing teams;
- Request and analyse the conformity certificates before purchasing Ex equipment;
- Keep all data about Ex installations recorded;
- Perform periodic inspections following the schedule given by IEC 60079-17;
- Keep area classification drawings updated.

Inspections on installations in classified areas are essential and add value to safety and maintenance strategies.

References

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