ELECTRICAL INSTALLATIONS IN HAZARDOUS AREAS pdf

1: UEE â€“ Certificate IV in Hazardous Areas - Electrical

Industrial electrical equipment for hazardous area has to conform to appropriate parts of standard IEC for gas hazards, and IEC for dust hazards, and in some cases, be certified as meeting that standard.

Industrial activities which use rechargeable batteries are more and more. Batteries usually used are with nickel-cadmium or lead and are divided into two groups: Traction batteries, mainly used in forklifts, machinery for the cleaning of large rooms etc These batteries are usually recharged in reserved areas or in ordinary indoor places. Of course, during the charging operation, they emit a certain quantity of gas hydrogen and oxygen. Thereby, these places must be classified in accordance to EN standard for the categorization of hazardous areas with presence of gas. Batteries lifetime and their gas emission depend on the recharge method. VRLA Valve Regulated Lead Acid batteries, defined in many ways on the commercial documentation recombination, sealed, airtight, maintenance free , are regulated with valves. There are two types of chargers: Chargers are commercially available with different charge profiles depending on the different recharge stages. As we wrote, during the activity of recharge, a battery emits a certain quantity of gas hydrogen and oxygen. The amount of gas emitted is very variable and depends on: A certain emission of gases is present also during the equalize charge. In order to understand the extension of this area you can refer to: EN standard relevant to stationary batteries. It depicts a method for the calculation of classified area extension. The extension is usually of some decimeters, based on the notion of hypothetical explosive volume. EN relevant to traction batteries. It indicates, conventionally, an extension of the area of 0. These assessments take account of any malfunction of the charging system or of battery cells. These two standards are useful, along with EN standard, to classify exactly the danger zone. In fact, the traction batteries, often of the type open cup, are discharged and recharged periodically typically every day and, hence, produce gas emission daily. The ventilation systems of batteries rooms can be realized with artificial ventilation or natural ventilation. A good solution is to realize a system of artificial air extraction in correspondence of each battery by means of a special hood. Normally, in stationary batteries rooms and in small locals for traction batteries charging is used a general room ventilation without the utilize of hoods. A ventilation of this type can be realized with an artificial extraction system or with a natural ventilation. In any case, the ventilation range should be sized on the basis of the total flow of gas emitted from all the batteries present.

2: Electrical Installation in Hazardous Areas | Electricians

In addition, electrical protection/isolation facilities, which isolate all phase conductors and the neutral conductor should be present in non-hazardous areas to permit isolation of circuits entering hazardous areas.

From its origins it has been developed in most industrialized countries with the United Kingdom, Germany and the United Sates of America being in the vanguard. As the world moves closer together this technology has, like all others, been coordinated so that its detail will be the same in all countries, principally to allow free marketing around the world. This has led to more detailed standard requirements particularly in the case of apparatus construction. In the UK the considerable standardization of technology is defined in more than 30 published standards some national, some European and some international. While this is basically good, in that it details what is necessary and thus makes the achievement of safety easier in principle, it has drawbacks in that there is considerable complication which can cause confusion. Despite the longevity of the technology I can find no serious attempt in the UK to produce a freely published volume, such as this, which brings together the entire technology under one roof, as it were. This fact, together with the pivotal role played by the UK in development through the British Standards Institution, which brought together all the necessary expertise to produce the necessary technical standards, the Safety in Mines Research Establishment now the Health and Safety Laboratory of the Health and Safety Executive and the Electrical Research Association now ERA Technology , organizations that carried out much of the research work necessary to permit the current standards to exist and the large contribution made by UK industry, led me to write this volume. The field can be divided into three facets: The determination of the likelihood and the areas contaminated or likely to be contaminated by explosive atmospheres produced by fuels such as gas, vapour, mist, dust or a combination of these. This is still the least researched of the areas of this technology, principally because there are so many variations, in particular circumstances occurring in practical locations. The construction of electrical equipment so that it is unlikely to become an ignition source. This has been heavily researched in many countries because, unlike area classification, it is relatively specific and lends itself more readily to specification. The installation, operation, maintenance and inspection of electrical equipment. This again is heavily influenced by the circumstances xviii Preface occurring at particular situations and is thus not as easily specified as equipment construction. It is, however, more specifiable than 1 above. In writing this book I have tied to address all three facets of the technology and, rather than reproducing all the content of standards and codes, I have been selective in discussing most of the principal requirements therein, while at the same time trying to explain the reasoning which led to their inclusion. Therefore, when applying the technology it will be necessary to address the appropriate standards and codes in all cases but this book will, by provision of the background reasoning, make those documents more understandable. In addition, by developing practical examples of their use, it will assist in their application. This field is not one for inexperienced engineers and technologists and thus must be approached with care. In addition there are many local conditions which can vary the advice given here and those involved need to be aware of this and have sufficient expertise to determine conditions under which additional requirements are necessary and those, much less common, where relaxations are possible. The contents here relate to the situation in the UK but differences in Europe and other counties are not great and its content should be useful elsewhere. Finally, unlike the situation historically existing, where this technology was often applied in isolation, it is now important to recognize that it can only be applied as a part of an overall safety strategy. That is not to say that its requirements can be ignored if they adversely affect other safety features but rather that, if such is the case, an alternative approach to achievement of its requirements should be sought. It should always be remembered that electrical installations in explosive atmospheres should only exist where necessary i. Alan McMillan 7 lntraduction Where combustible or flammable materials are stored or processed there is, in most circumstances, a possibility of their leaking or otherwise having the ability to produce what may be described as an explosive atmosphere in conjunction with the oxygen present in air. This is true for gases, vapours, mists and dusts and, as electricity is widely used in industries and other places where such explosive atmospheres can occur, the propensity of electrical energy to create sparking or hot surfaces presents a possibility that the explosive atmospheres may be ignited with resultant fire or explosion. This hazard has been recognized for many decades - almost since the use of electricity was introduced into mining and other industries - and the precautions taken to overcome this problem date back, in their basic inception, to the turn of the twentieth century and before. There is no way in which explosions can be totally prevented in industries where explosive atmospheres can occur as all human endeavour is fallible but it is necessary to develop our operations to a degree where such explosions are so rare that their risk is far outweighed by the benefits of the processes in which they may occur. It is true that the risks are minimized as far as possible but only to a level consistent with the need to win coal and accidents still occur. It remains true, however, that the risk of these accidents has been reduced to a level acceptable to our society and particularly those working in the industry. That is not to say that when a risk is identified by an incident nothing is done. We always learn from these and invariably they result in changes to our operating systems and equipment in order to minimize the risk of a repeat. Notwithstanding all of our efforts, however, accidents of significant proportion still occur with a degree of regularity which causes us all concern. I Examples of historic incidents The following are examples of the more significant incidents occurring in the UK and, although they were not necessarily caused by electricity, there is in at least one of the cases a suspicion of electrical initiation and electricity, as has already been indicated, is seen as an obvious igniting agent. Most of them died from the resulting suffocation. Flixborough - A modification to a process plant, said by the accident report not to have been properly considered, was identified as causing a major release of flammable gas resulting in an immense aerial explosion. Loss of life on the plant was mercifully low probably because it was Saturday but damage to the plant and surrounding residential and other properties was significant. Piper Alpha - This oil platform was effectively destroyed by a gas explosion which resulted from a major release of gas suggested to be due to erroneous process operation. The initial and subsequent explosions and fire effectively prevented controlled evacuation of the platform and heavy loss of life was caused. Texaco Pembroke refinery - A major vapour explosion occurred leading to a major fire which was extremely difficult to extinguish. The refinery burned for a considerable time with consequent adverse effects on the local environment. Casualties were light but the refinery suffered considerable damage. The above examples clearly demonstrate the dangers present, particularly in locations where escape of personnel is difficult and it is essential, therefore, that all involved have an understanding of the technology used to minimize the risk of explosion. To have an explosion three elements are necessary - namely fuel, oxygen and a source of ignition see Fig. Oxygen is present in air to a sufficient extent to support combustion and cannot normally be excluded, which leaves only the fuel and ignition sources as elements to which influence can be applied. This has formed Introduction 3 Fuel Flammable gas, vapour, mist or dust Oxygen Air Ignition source Operation or maloperationof electrical equipment Fig. While in other areas of risk the approach is often based much more heavily on statistical analysis than is the case here, the approach in respect of explosive atmospheres is well established and accepted, having been in use since the early s. The presence of many subjective areas which make statistical analysis difficult have also limited the statistical approach although there have been many attempts to apply such an approach. Thus current and foreseeable future technology is based upon that currently used, and there is no indication of a radical change to readdress the technology on a statistical basis as is done, for example, in the nuclear industry. A typical attempt to analyse the statistical level of security achieved in relation to gas, vapour and mist releases is that in a paper by W. The technology is currently based upon the identification of the risk of an explosive atmosphere being present in a particular place coupled with the identification of the likelihood of electrical equipment within the explosive atmosphere malfunctioning in a way which would cause it to become a source of ignition coincident with the presence of that explosive atmosphere. The objectives are not just to identify these coincidences but to utilize the information so obtained to influence the design of particular process plants and similar operational situations in a way so as to minimize the risk of creation of an explosive atmosphere, and hence the risk of an explosion due to electrical installations. To this end, the generality of the approach is to seek out situations where an explosive atmosphere is normally present of necessity due to the process involved, situations where the likelihood of its presence is high and situations where the likelihood is of its presence is 4 Electrical installations in hazardous areas low but identifiable. In this scenario catastrophe does not play a part and although it is necessary to plan for catastrophe such plans are by and large outside the scope of this technology. In addition this technology should not be used in isolation but as part of an overall safety strategy for a location where the problem occurs. Having identified the possible presence of an Explosive Atmosphere it is then the part of technology to identify those electrical installations which really need to be present rather than those which convenience would make desirable, and ensure that these are protected in a way which makes the overall risk of an explosion sufficiently low. While the present approach is to minimize the chance of a release of flammable material, or where a release occurs to minimize the build up of the material in the atmosphere, it is probably somewhat surprising that in early coal production the method used to deal with releases of methane firedamp was to deliberately burn off the explosive atmosphere. The method used took advantage of the fact that methane is lighter than air relative density is around 0. Warning was given by changes in colour of the flames of the lamps used by miners and the workings were then cleared. A torch was inserted into the methane air cloud, igniting it and burning off the methane. The technique fell into disrepute for obvious reasons and was replaced by the introduction of the use of ventilation to restrict the possibility of explosive atmospheres forming and the employment of a safety lamp Fig. The introduction of electricity in the latter part of the nineteenth century and the early part of the twentieth century led to significant other risks being identified. Initially electricity was utilized for lighting and motive force. The lighting was typically provided by incandescent filament lamps, none of the more sophisticated lamps having been developed at the time, and the motive force usually by either dc or wound rotor ac machines which were initially typical of the motors available. Both lighting and machines required control equipment often as simple as a switch but this equipment also introduced risks associated with hot surfaces and sparks, together with the possibility of the presence of both methane and coal dust. The solutions to these problems in relation to gas, vapour and mist releases were developed in both the UK and Germany along very similar lines and in very similar time scales. In the UK a similar but governmental organization had significant involvement in similar developments. The initial technique for protection of electrical equipment was what we now know as flameproof enclosure and intended for high-power electrical equipment where the level of electrical energy necessary for equipment operation was always sufficient to initiate ignition if released in a spark or as heat. This was well developed as early as and was rapidly followed by a second technique, now known as the intrinsically safe circuit. This second technique was developed for mine signalling systems and relied upon the fact that intelligence could be transmitted by very small amounts of electrical energy which, if released, was not sufficient to ignite any expected explosive atmosphere. The advantage of this latter technique was in the flexibility which it offered as large heavy protective enclosures were not necessary. Initially these two techniques were developed for the mining industry where methane was the most sensitive flammable material present but as the techniques began to be applied to surface industry two significant differences in approach became rapidly apparent. First it was recognized that releases of flammable material were normally from installed equipment 6 Electrical installations in hazardous areas and more predictable in quantity and frequency, and second the recognition that far from dealing with one gas and one dust, as in mining, surface industry was dealing with a myriad of different materials each with its own characteristics. This recognition led to development of the technique of area classification to define the risks of explosive atmospheres occurring in specific locations and the development of additional types of protection to more readily reflect the varying levels of hazard which could be identified. It is these two factors that led to the current UK and international industrial practice which this book seeks to describe. Regulation 27 of these regulations states: All conductors and apparatus exposed to the weather, wet, corrosion, inflammable surroundings or explosive atmosphere, or used in any process or for any special purpose other than for lighting or power, shall be so constructed or protected, and such special precautions shall be taken as may be necessary adequately to prevent danger in view of such exposure or use. This regulation clearly states the objective to be achieved but does not define the method of its achievement. While one may be concerned at this, its intent is to allow the widest possible range of approaches to the achievement of the required level of security and thus to give the maximum freedom of operation to industry, while at the same time, laying upon that industry the requirement to achieve an adequate level of security in its operation. Electrical equipment which may reasonably foreseeablybe exposed to: The tenor of this new regulation, now current, is very much the same as its predecessor. The objective to be achieved is specified and within that objective maximum freedom is given to industry in methods of its achievement. Introduction 7 The above method of legislating, while common in the UK, contrasts significantly with legislation in countries such as Germany where legislation tends to be more specific, giving much more detail in respect of the precautions to be adopted. There is, however, little or no evidence available to suggest that one or the other approach produces a better result as far as safety is concerned. Thus, the UK approach has much to commend it providing as it does maximum flexibility but, conversely, practitioners in the UK must be fully competent to deal with the flexibility permitted. In respect of dusts, a further regulation exists in the Factories Acts3which reflects the different nature of such materials, in that when a dust is released it does not disperse as is the case with gases, vapours and mists but settles and forms a layer which can be re-formed as a cloud at any time by any sort of physical intervention. The regulation in question is Regulation 31 1 which states: When, in connection with any grinding, sieving, or other process giving rise to dust, there may escape dust of such a character and to such an extent as to be liable to explode on ignition, all practicable steps shall be taken to prevent such an explosion by enclosure of the plant used in the process, and by removal or prevention of accumulation of any dust that may escape in spite of the enclosure, and by exclusion or effective enclosure of possible sources of ignition. While not specifically referring to electrical equipment, this regulation includes it as a possible source of ignition and identifies the method of protection as effective enclosure. This is possible as dust is nothing like as penetrative as gas, vapour or mist and can effectively be excluded with much less difficulty. To underpin these regulations and give guidance, many British Standards and Codes containing details of acceptable methods of compliance and third-party certification facilities have been developed to give purchasers of electrical equipment confidence. These certification schemes do not, however, extend to installation and use. In the past, when equipment construction Standards were limited and lacked detail, a great deal of expertise was necessary within the certification bodies as it was they who had to interpret what general statements within Standards actually meant. Thus, it was not surprising that the certification body in the UK was associated with the Health and Safety Executive and the Safety in Mines Research Establishment organizations which made great contributions to the more detailed technological base currently available. Now, with much more detailed requirements, this relationship, while remaining useful, is no longer necessary. The contribution of organizations such as the Safety in Mines Research Establishment, and the Electrical Research Association now ERA Technology Ltd , the latter through its industry sponsored project work, to the detail existing in current Standards and Codes cannot however be overstated. In addition to the above organizations, which were principally associated with the construction of equipment, a great deal of work was done by 8 Electrical installations in hazardous areas industry in general and organizations such as The Institute of Petroleum which produced a model code of safe practice6 for the oil industry. Industry, unlike the govenunental organizations, concentrated much of its work on the matters associated with how hazardous areas were formed and matters associated with installation and maintenance. This Directive was limited to equipment for gas, vapour and mist risks and was what is described as an optional Directive, solely concerned with barriers to trade.

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3: Electrical Installations in Hazardous Areas - Alan McMillan - Google Books

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Electrical considerations for Hazardous Area ATEX inspections 01 May Many companies do not give adequate consideration to the condition of their electrical installations in relation to potentially explosive atmospheres, especially within older plants. ATEX and explosive atmospheres. These may include a local, regional or national safety authority drive on achieving ATEX compliance; insurance requirements; organisational policy and safety processes, all of which may prioritise the requirement of ATEX inspections over electrical inspections. In fact, it is apparent within some industries and, particularly, within smaller companies that do not possess the resources to maintain awareness of legislative compliance requirements, that there is a clear lack of awareness about compliance for electrical systems. Organisations may conduct a hazardous area inspection and gain a satisfactory result as required by the BS EN standard even though the installation remains non-compliant with the required electrical inspection and verification standard BS due to outdated certification and condition reports. Moreover, in some situations, the installation and verification of electrical systems and overall safety considerations are carried out in-house by the maintenance workforce. The problem may arise that although the workforce is highly skilled and has knowledge of ATEX hazardous area requirements, it may not have complete clarity of the most recent UK amendments to the BS wiring standard â€" a valuable tool which is an essential consideration of the electrical risks to new installations, plant maintenance, modifications and for the employees or contractors who install or maintain electrical equipment. The standard provides guidance towards a compliant and a safe electrical installation in line with The Health and Safety at Work Act and Electricity at Work Regulations Furthermore, the capability of the inspectors completing the assessment should also be audited by a competent duty holder or third party organisation proficient in both hazardous areas and electrical inspection. Certified training, experience and tacit industrial knowledge of electrical and hazardous area inspection should all be included in the competency assessment BS EN Examples of possible problem areas Without taking adequate consideration of the risks for the electrical supplies, possible problem areas could give an overall unsatisfactory outcome. Electrical and Hazardous Area ATEX inspections The list of potential problem areas is non-exhaustive and experience can dictate that every installation creates a different challenge. However the requirements for non-hazardous areas are insufficient for installations in a hazardous area. For the electrical installation, an inspection should be carried out followed by an electrical installation condition report EICR , as required by BS part 6. The results of the electrical report are pertinent to the inspections required in BS , tables Both the hazardous area and electrical condition reports should be utilised to ensure that the installations are maintained to a satisfactory condition for continual use and for the identification of a pass, fail or non-applicable limitation noting that too many limitations will devalue the credibility and integrity of the information within the report Furthermore, issues with electrical installations outside hazardous areas can have a direct effect on systems within the hazardous areas which, in turn, could result in a catastrophic occurrence. There are a number of reasons which have led to this situation and although organisations may have completed their ATEX inspections accurately, the installations may still be non-compliant with the required electrical inspection and verification standard BS Organisations may conduct a hazardous area inspection and gain a satisfactory result as to the inspections required in the BS EN , although the installation may still be non-compliant. The proficiency of the inspectors conducting the inspections should also be assessed and audited accurately by a competent duty holder or third party. Certified training, experience and tacit industrial knowledge should all be included within such competency assessment. BS is the UK electrical installation industry standard and is a most valuable tool for the consideration of the electrical risks for new installations, plant maintenance, modifications and for the employees or contractors who install or maintain electrical equipment - the primary reason for ensuring that an electrical inspection is conducted is to ensure that the supplies into the hazardous ATEX area are adequate and safe for the application. Unsatisfactory electrical installation scenarios vary greatly as previously described where the list is non-exhaustive and experience dictates that every installation will pose a different challenge. Condition reports must be utilised to ensure electrical systems are installed and maintained to a satisfactory condition. Ultimately, whilst electrical installations in a hazardous area must comply with the appropriate standards for a non-hazardous area, the requirements for non-hazardous areas are technically insufficient for installations where potentially explosive atmospheres have been classified. Electrical and hazardous areas ATEX Inspections should be completed simultaneously in order to demonstrate that the risks have been suitably assessed and provide, as far as reasonably practicable, a safe installation. Conducting electrical and hazardous area ATEX inspections as part of any maintenance strategy will minimise the risk of a catastrophic occurrence. Electrical installations design, selection and erection. Electrical installations inspection and maintenance. The Electricity at Work Regulations, Retrieved February 20, , from legislation. Retrieved February 20, , from HSE: Dangerous Substances and Explosive Atmospheres Regulations Approved Code of Practice and guidance. Health and Safety at Work etc Act

4: Practical guidelines for determining electrical area classification

Electrical installations in hazardous areas involve high initial capital expenditure on methods of safeguarding and continuing high inspection and maintenance costs relative to comparable installations in non-hazardous areas. Therefore, electrical and instrument engineers have a special responsibility, if the need be, by influencing basic plant layout and design to ensure that the need for electrical apparatus in hazardous areas is kept to a minimum.

In an ordinary atmosphere this arc is of no concern, but if a flammable vapor is present, the arc might start an explosion. Electrical equipment intended for use in a chemical factory or refinery either is designed to contain any explosion within the device or is designed not to produce sparks with sufficient energy to trigger an explosion. Many strategies exist for safety in electrical installations. The simplest strategy is to minimize the amount of electrical equipment installed in a hazardous area, either by keeping the equipment out of the area altogether or by making the area less hazardous by process improvements or ventilation with clean air. Intrinsic safety , or non-incendive equipment and wiring methods, is a set of practices for apparatus designed with low power levels and low stored energy. Insufficient energy is available to produce an arc that can ignite the surrounding explosive mixture. Equipment enclosures can be pressurized with clean air or inert gas and designed with various controls to remove power or provide notification in case of supply or pressure loss of such gases. Arc-producing elements of the equipment can also be isolated from the surrounding atmosphere by encapsulation, immersion in oil, sand, etc. Heat producing elements such as motor winding, electrical heaters, including heat tracing and lighting fixtures are often designed to limit their maximum temperature below the autoignition temperature of the material involved. Both external and internal temperatures are taken into consideration. As in most fields of electrical installation, different countries have approached the standardization and testing of equipment for hazardous areas in different ways. As world trade becomes more important in distribution of electrical products, international standards are slowly converging so that a wider range of acceptable techniques can be approved by national regulatory agencies. Area classification is required by governmental bodies, for example by the U. Occupational Safety and Health Administration and compliance is enforced. Documentation requirements are varied. Often an area classification plan-view is provided to identify equipment ratings and installation techniques to be used for each classified plant area. The plan may contain the list of chemicals with their group and temperature rating, and elevation details shaded to indicate Class, Division Zone and group combination. The area classification process would require the participation of operations, maintenance, safety, electrical and instrumentation professionals, the use of process diagrams and material flows, MSDS and any pertinent documents, information and knowledge to determine the hazards and their extent and the countermeasures to be employed. Area classification documentations are reviewed and updated to reflect process changes. History[edit] Soon after the introduction of electric power into coal mines , it was discovered that lethal explosions could be initiated by electrical equipment such as lighting, signals, or motors. The hazard of fire damp or methane accumulation in mines was well known by the time electricity was introduced, along with the danger of suspended coal dust. At least two British mine explosions were attributed to an electric bell signal system. In this system, two bare wires were run along the length of a drift, and any miner desiring to signal the surface would momentarily touch the wires to each other or bridge the wires with a metal tool. The inductance of the signal bell coils, combined with breaking of contacts by exposed metal surfaces, resulted in sparks which could ignite methane, causing an explosion. In some cases the gas, ignitable vapor or dust is present all the time or for long periods. Other areas would have a dangerous concentration of flammable substances only during process upsets, equipment deterioration between maintenance periods, or during an incident. Refineries and chemical plants are then divided into areas of risk of release of gas, vapor or dust known as divisions or zones. The process of determining the type and size of these hazardous areas is called area classification. Guidance on assessing the extent of the hazard is given in the NFPA or NFPA standards published by the National Fire Protection Association for explosive gas or dust atmospheres respectively, or RP and RP standards published by the American Petroleum Institute for explosive gas or dust atmospheres respectively, and IEC or IEC standards published by the International Electrotechnical Commission for explosive gas or dust atmospheres respectively. The principles of the NEC Division and Zone classification systems are applied in countries around the globe, such as in the United States. The NEC Zone classification system was created to provide multinational companies with a system that could be harmonized with IEC classification system and therefore reduce the complexity of management. Canada has a similar system with the Canadian Electrical Code defining area classification and installation principles. Explosive gas area classifications[edit] Typical gas hazards are from hydrocarbon compounds, but hydrogen and ammonia are common industrial gases that are flammable. Class I, Division 1 classified locations An area where ignitable concentrations of flammable gases, vapors or liquids can exist all of the time or some of the time under normal operating conditions. Zone 0 classified locations An area where ignitable concentrations of flammable gases, vapors or liquids are present continuously or for long periods of time under normal operating conditions. An example of this would be the vapor space above the liquid in the top of a tank or drum. In this area the gas, vapor or liquids would only be present under abnormal conditions most often leaks under abnormal conditions. Such areas include a residence or office where the only risk of a release of explosive or flammable gas would be such things as the propellant in an aerosol spray. The only explosive or flammable liquid would be paint and brush cleaner. These are designated as very low risk of causing an explosion and are more of a fire risk although gas explosions in residential buildings do occur. Explosive dust area classifications[edit] An explosion of dust at this grain elevator in Kansas killed five workers in Flammable dusts when suspended in air can explode. An old system of area classification to a British standard used a system of letters to designate the zones. There must be a site plan drawn up of the factory with the divisions or zones marked on. Class II, Division 1 classified locations An area where ignitable concentrations of combustible dust can exist all of the time or some of the time under normal operating conditions. Class II, Division 2 classified locations An area where ignitable concentrations of combustible dust are not likely to exist under normal operating conditions. Class III, Division 1 classified locations An area where easily ignitable fibers or materials producing combustible flyings are handled, manufactured or used. Class III, Division 2 classified locations An area where easily ignitable fibers are stored or handled. Gas and dust groups[edit] Explosive atmospheres have different chemical properties that affect the likelihood and severity of an explosion. Such properties include flame temperature, minimum ignition energy, upper and lower explosive limits, and molecular weight. Empirical testing is done to determine parameters such as the maximum experimental safe gap MESG , minimum igniting current MIC ratio, explosion pressure and time to peak pressure, spontaneous ignition temperature, and maximum rate of pressure rise. Every substance has a differing combination of properties but it is found that they can be ranked into similar ranges, simplifying the selection of equipment for hazardous areas. The flash-point is the temperature at which the material will generate sufficient quantity of vapor to form an ignitable mixture. The flash point determines if an area needs to be classified. A material may have a relatively low autoignition temperature yet if its flash-point is above the ambient temperature, then the area may not need to be classified. Conversely if the same material is heated and handled above its flash-point, the area must be classified for proper electrical system design, as it will then form an ignitable mixture.

5: HazardEx - Electrical considerations for Hazardous Area ATEX inspections

This GLOMACS Electrical Installations in Hazardous Areas training course is a legal obligation in the countries of the European Union, but is optional rather than mandatory in the counties of the GCC. By providing this training for their employees, companies in the GCC will be aware of latest international standards for Hazardous Area training.

6: Electrical installations in hazardous areas | Hazardous Area Solutions

Hazardous Area Classification for Flammable Gases and Vapours Area classification may be carried out by direct analogy with typical installations described in established codes, or by more quantitative methods that require a more detailed knowledge of the plant.

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7: Electrical installations in hazardous areas | Cortem Group

The Health and Safety at Work Act, together with current and impending EU Directives, obliges those responsible for hazardous areas, those who work in such areas and those who supply equipment for use in such areas to demonstrate that they have taken all necessary and reasonable steps to prevent fires and explosions.

8: Electrical Installations in Hazardous Areas - PDF Free Download

It will be not only very helpful to engineers from the UK and European countries involved with electrical installations in hazardous areas, but especially to US engineers who are not as conversant with the approach taken in the UK and Europe.

9: Hazardous Areas Classification and Design - Competency Training

Hazardous Area Solutions are experts when it comes to electrical installations in hazardous locations, including explosion proof lighting & junction boxes.

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