Engineer's Notebook

Hazardous Locations

Intrinsic Safety

Solutions for Electrical Safety

The use of electrical instruments and control devices in areas where explosion hazards are present carries with it the potential for disaster-unless specific preventative measures are taken. Hazards exist in the form of escaped flammable gases such as acetylene, hydrogen, propane and others. Metal, coal, flour and other dusts as well as some fibers suspended in air also are capable of being ignited with often very destructive consequences.

Plant locations within which specific hazards may be present because of the handling of flammable materials must be classified as outlined in Article 500 of the National Electrical Code. Table 1 indicates the classification scheme in abbreviated form. Attention is drawn particularly to Division 1 locations. There flammables may be handled openly and the risk of fire and/or explosion is ever present. Such locations require the ultimate in safety measures and practices.

Table 1
Classifications Of Hazardous Locations

CLASS	DIVISION	GROUP
I Flammable *gases* or *vapors* are or may be present in quantity to produce explosion.	1. Locations where flammables are openly handled, may be present continuously.	A. Acetylene B. Hydrogen, butadiene, ethylene oxide, propylene oxide, manufactured gas with more than 30% by volume hydorgen C. Ethyle-ether, ethylene, cyclopropane, etc. D. Gasoline, hexane, naptha benzine, etc.
II Flammable *dust* in suspension in quantity to produce explosion	2. Locations where flammables are normally contained or are in the form of deposits of dust. Applies also to locations adjacent to Division 1 areas.	E. Metal dust: aluminum, magnesium, their alloys and others F. Carbon black, coal, coke, dust G. Flour, starch, or grain dust
III Flammable *fibers* are present but are *NOT* likely to be in suspension to explode		

The recognition of safety hazards is not limited to the U.S.A. Other countries throughout the world have either originated or adopted location and hazard classifications. Noteworthy, many countries distinguish between locations which are continuously or predominantly hazardous and those which are intermittently hazardous.

Table 2
Hazardous Materials Classification

Test Gas Groups	USA & Canada Group:
Acetylene	A
Hydrogen	B
Ethylene	C
Propane	D
Methane	E

Table 2 gives the USA and Canadian hazard groupings. The test gas groups are made up of a number of gases with the most easily ignited of any given group furnishing the group name. The groupings are not quite the same for the different safety codes. Those who must deal professionally with classifications and groupings are well advised to resort to the code or standards documents applicable to their tasks.

Electricity in the form of a spark is an ideal agent to commence the ignition process. Sparks might be generated in the process of opening switches, at loose wires on terminal blocks and within any number of faulty electrical components.

Neither the avoidance of hazardous situations brought on by the open handling of flammables nor the use of electrical equipment is always practical or even desirable. The taking of precautionary measures, even though they may be expensive, is then indicated.

Purging, explosion proofing and intrinsic safety are the three dominant techniques used to guard against electrically induced explosion hazard.

PURGING

Purging is the act of surrounding the potential ignition causing electrical device within a housing and with a stream of uncontaminated air or inert gas such as nitrogen, at some pressure slightly above atmospheric, such that the clean air or inert gas leaks away from the electrical device. By this act the dust or vapors are prevented from getting to the potential ignition mechanisms and safety is promoted. The purging method requires interlocks between clean air or inert gas pressure and electrical power. In the event of failure of the former, the latter is turned off. This safety method while effective when working as intended can be easily defeated by unauthorized modification of the interlock circuit, and it is not always deemed acceptable.

EXPLOSION PROOFING

Explosion proofing requires that the electrical equipment and wiring be contained within substantial boxes, containers and pipes such that an explosion within any enclosure is contained therein and none of the resulting hot gases leak out at a temperature which would promote flame or explosion propagation. The method is effective but also very expensive. It requires the rigid adherence to codified installation and maintenance procedures to function as intended. It is the only method by which high power electrical and lighting equipment can be rendered safe in hazardous locations.

INTRINSIC SAFETY

Intrinsic safety can be applied to the characteristically low power needs of instrumentation and gain for the user significant economic benefits. Intrinsically safe equipment and wiring is designed and constructed to be incapable of releasing sufficient electrical or thermal energy under normal or abnormal conditions to cause ignition of hazardous atmospheric mixture in its most readily ignitable concentration. The concept of intrinsic safety recognizes that an energy discharge limit exists below which ignition can not be brought about. The concept also recognizes the possibility of failure within the electrical equipment and requires that safety not be impaired by the occurrence of faults within the equipment or protective mechanism.

TEST EQUIPMENT

Portable test equipment may only be transported into classified locations which have an equal or lower hazard rating than that which is plainly noted on the face of the equipment.

This article is not intended to be a substitute for the applicable codes and legislations which apply to hazardous location classification. Neither is this writing intended to substitute for the instructions and admonitions which must be supplied by equipment manufacturers in connection with instruments and testers which may be used in classified locations. Classifications and restrictions of use specifically enumerated in codes and instructions and on the labels of instruments or required by local safety authorities must be adhered to at all times.

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