FPASA BULLETIN SF 02

STATIC ELECTRICITY AND THE FIRE HAZARD

According to fire reports received by the Fire Protection Association the number of fires caused through static electricity does not appear to be excessive. However, there is no doubt that many fires, the causes of which have been listed as unknown, could in fact have been initiated through this phenomenon.

Causes, Hazards, Preventive Measures

Static electricity is caused by the movement of electrons that occurs when dissimilar substances in contact with each other are separated. The electrons produce electrical charges on the objects separated. These charges, if they cannot escape are static; hence the term static electricity.

For example, a rapidly moving belt running over a pulley, or paper or cloth passing through machines over rollers take on static charges. Static is also produced when non-conducting liquids flow through the air in drops or as a spray, when they are agitated in tanks, or when air or other gases bubble through them. Petrol solvents, benzene, ether and carbon-disulphide are common materials that readily produce and accumulate static charges. Gases issuing from a nozzle at high velocity may generate static charges, especially if it carries liquid or solid particles.

Static electricity is also generated by the movement of stock in grain handling and storage plants; in processing plants for seed, feed, spices, sugar, starch, cocoa, resin or similar materials; and in metal powders. These charges of electricity are cause for concern when they cease to be static or at rest.

If static ele3ctricity is not neutralised or eliminated as rapidly as it is produced, the charge builds up. It will eventually develop energy enough to jump as a spark to some nearby grounded or less highly charged object. The spark can ignite nearby combustible materials or vapours.

Static electricity generation cannot be prevented, but conducting the electric charges away as fast as they are produced can prevent dangerous accumulations. Methods include bonding, grounding, ionisation and humidification. Such measures prevent a spark discharge by allowing separated positive and negative charges to recombine harmlessly. They may also be used in combination.

After a new process has been installed, sometime may be needed to find all the locations where dangerous static charges accumulate and to provide for their elimination. Periodic inspections of static neutralisers and bonding and grounding connections are necessary and are particularly important at locations where volatile flammable liquids are used to dispense.

Energy in a Static Discharge

Static electricity is a source of ignition when a spark discharge has sufficient energy to ignite nearby combustible materials or gases. The minimum amount of energy required to cause ignition varies for different combustible mixtures. Voltages on objects may vary from a few volts to several hundred thousand volts. A potential of 10 kV could be expected under many average conditions.

Static Generation by Personnel

The human body may frequently accumulate a dangerous static charge by contact of shoes with floor coverings or by working close to machinery that generates static electricity. However, the shoes and clothing of workers may be moist enough to drain away static charges as fast as they are generated.

In dry weather or in rooms where humidity is low, static charges may accumulate on the bodies of workers to a potential of several thousand volts. In hazardous vapour or dust locations, prevention of this accumulation of static charges is necessary. Workers should not wear rubbers, rubber boots, or rubber-soled shoes.

Under some conditions it is advisable to wear special conducting shoes and to stand on grounded metal plates or conductive floors. Care must be taken not to allow soles of shoes, metal floor plates or conductive floors to become covered by an insulating substance.

Some people have unusually dry skin and accumulate static charges more rapidly than others. Such people should not work with hazardous processes.

Increasing the relative humidity is helpful where conditions are not severe. In more hazardous locations, such as those where flammable anaesthetics are used, silk, wool, and synthetic textile materials, with the exception of rayon, should generally be avoided, unless the garment is in close contact with the body.

Bonding and Grounding

In hazardous locations, all metal parts of machines that may produce static electricity should be bonded and grounded. Bonding is the act of electrically connecting two or more conducting objects with a conductor. Grounding is the process of electrically connecting one or more conducting objects to ground potential.

The main purpose of bonding and grounding is to minimise potential differences between the metallic objects and between the objects and the ground. Bonding two objects keeps them both at the same potential, and thus no spark discharge can occur.

Grounding the conducting objects drains the static charges away as rapidly as they are produced. Thus, the threat of sparks is eliminated since there is no longer a difference in potential between the charged object and other nearby objects.

Although small wires or small metal strips make satisfactory bonding and grounding connections from an electrical standpoint, copper wire as large as 6 mm or 5 mm I.S.W.G. is advised because of its mechanical strength. Either bare or insulated wire may be used. Wires should be carefully maintained and examined regularly for continuity. Where exposed to damage, wires should be run in rigid metal conduit or pipe equivalent protection provided.

A grounding brush or wiper of carbon, brass or spring bronze is a practical method of making electrical contact between moving and stationary metal parts.

Conductive Floors

In some hazardous locations, an electrically conductive floor or floor covering may be needed to ground persons and conductive objects. Conductive floors are used in industrial plants, hospital operating rooms, and similar locations where it is necessary to prevent dangerous accumulations of electrostatic charges. The floor serves as a means of connecting the persons and objects together electrically to minimise the chance of a spark discharge.

References:

Factory Mutual Engineering Corporation of USA

Published by
Fire Protection Association of Southern Africa
(Incorporated Association not for Gain)
(Reg.No. 73/00022/08)
P O Box 15467
Impala Park
1472