Leading the way in hazardous area static control

Application Spotlight

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HOERBIGER Safety Solutions

Earth-Rite® MGV

The Ignition Hazards of Static Electricity Associated with Vacuum Trucks

Although vacuum trucks provide a fast and efficient method of removing industrial waste deposits, transferring chemicals and recovering hazardous materials, these operations are an inherently dangerous occupation. For those responsible in providing a safe working environment in the recovery of flammable and combustible products within hazardous process industries, one of the most potentially confusing aspects is determining susceptible areas that have the potential to discharge static sparks, and installing the right solution to mitigate these risks.

Earth-Rite® MGV The Ignition Hazards of Static Electricity Associated with Vacuum Trucks

Vacuum trucks and bulk chemical road tankers transferring flammable products require static grounding protection to mitigate the build-up of static electricity on the truck and equipment, like hoses, that are connected to the truck. If static electricity is allowed to accumulate, it will look to discharge at the earliest opportunity. Therefore, although often found in the vicinity of the incident with the objective to aid a clean-up or product transfer of hazardous materials, the vehicle itself should be seen as an ignition source too. Hazardous environments where static can accumulate is not exclusive to plant facilities and their processes, it is also a prevalent ignition source on vehicles. While many factors can contribute to the presence of a static hazard, the majority of processes at risk of static discharge will be controlled and accounted for if grounding and bonding protection measures are taken.

The majority of plant equipment at risk of static charge accumulation is made of metal. Metals are excellent conductors and the natural conductive properties of metals, ranging from copper through to steel, mean that electrical resistance to the transfer of charges from the metal body is low, provided that the body has good contact with the ground. However, this positive characteristic can quickly become a negative if the metal body is not grounded, as isolated metal conductors are the primary source of static spark ignition hazards. When dealing with metal objects such as a vacuum truck, because it is predominantly made of steel it will give the majority of its discharge energy in a single incendive spark.

The common factor that contributes to a spark discharge within vacuum truck incidents is that the rate of electrostatic charge generation on the components of the system were permitted to exceed the rate of charge dissipation, resulting in the accumulation of static charges on some part of the transfer system. Due to the movement of charged material from source to collection chamber, large charges can accumulate on the lance, hose, hose connections, components within the collecting chamber and the chassis of the truck itself. A range of deflagration incidents have been reported in vacuum truck operations, particularly in situations where areas of isolation have been allowed to develop and subsequently discharged a static spark into the surrounding atmosphere or within the vacuuming system itself. To remove the risk of an incendive static spark discharge causing a catastrophic accident, these components must be correctly grounded and bonded.

Protecting personnel and equipment in vacuum truck operations

Fig 1. – Large chemical processing refineries can have over 100+ designated static earth grounding points that electricians must check on a regular basis

Most chemical processing sites have designated grounding points to which trucks must be connected prior to transferring product. Typically, vacuum truck operations will be conducted on chemical facilities based in remote locations where "designated" grounding points may not be tested on a regular basis, are not accessible, or even do not exist. Of the many recommendations outlined in American Petroleum Institute (API) 2219 "Safe Operation of Vacuum Trucks", the most relevant instruction is to fully ground the truck by connecting it to "a designated, proven ground source" before commencing with transfer operations. The "ground source" describes an object with a low resistance connection to ground. The standard also states the importance of confirming that the connection resistance between the truck and designated grounding point is less than 10 Ohms and that this resistance should be verified with the use of an ohmmeter (or a multi-meter).

> "Vacuum trucks should be connected to a designated site earth before commencing any operations. In areas where site earths are not present, i.e. where portable earthing roads are required, or there is doubt regarding the quality of site earths, the resistance to earth should be verified prior to any operation"
> **IEC TS 60079-32-1, 8.8.4**

Refineries and other large chemical processing facilities typically include grounding stations that are certified to handle large electrical loads. If a grounding station is not available, vacuum truck operators have a number of alternative options to ensure electrical charges can be safely dissipated to earth.

In these situations, electricians are required to perform regular resistance readings with multi-meters to verify that the truck has a 10 Ohms or less bonded connection to ground, via the bonding reel. There are two major pitfalls:

1. Bonding reels cannot inform the truck driver, if the vehicle is connected to earth, or monitor the truck's connection, for the duration of the transfer process. If the connection were to be compromised the driver would be oblivious to the static charge that would be silently accumulating.

2. In an emergency situation, like a spill or a leak, the vacuum truck and emergency personnel may not have time to wait for an electrician to conduct a bond resistance test and will have to bond the truck to points that have not been designated as verified grounding points. In that situation, they will be hoping that the object they have bonded to will have a connection to a true earth ground.

Unlike the reassurance provided to vacuum truck operators by gantry-mounted ground monitoring systems such as the Earth-Rite® RTR, the vacuum truck operator running the recovery or transfer operation has no way of knowing if their truck is connected to a true earth ground. Newson Gale's Earth-Rite® Mobile Ground Verification (**MGV**) system removes this uncertainty and provides the same level of protection as mounted static ground monitoring systems.

The only difference between a gantry mounted grounding system and the MGV, is that the MGV system is a permanent addition secured to the truck for which it is providing static grounding protection. The system itself was designed in conjunction with hazardous material specialists and emergency response personnel who cannot justify the cost of having team members with the required level of electrical training, and for chemical manufacturing sites where limited access to busy electricians can delay transfer or cleaning operations.

Principles of operation

The Earth-Rite MGV system has a user-friendly operator interface which indicates when transfer operations are safe to begin. From the operator's perspective, this is identified visually (in the form of flashing green high intensity LED lights) and grounding the vehicle couldn't be simpler. The grounding system can be connected with a static grounding clamp to either buried structural metal work or to rods that are hammered into the ground. When the operator connects the clamp to the object believed to have a low resistance path to earth, the grounding system immediately verifies whether or not the contact resistance of the object to earth is sufficiently low enough to dissipate static charges that could build up on the truck's transfer system. This function is referred to as **"Static Ground Verification"**. Once this structure check is confirmed, the MGV continuously monitors the connection resistance of the truck to the verified grounding point for the duration of the transfer process; this is referred to as **"Continuous Ground Loop Monitoring"**. The connection resistance must be maintained at 10 Ohms or less for the duration of the transfer process.

Both the Static Ground Verification and Continuous Ground Loop Monitoring checks need to be positive in order for the ground status indicators to change from red to green.

An additional form of safety redundancy can be introduced by interlocking the pump with the grounding system, so that if the truck loses its ground connection, the transfer process is shut down automatically, thereby cancelling out the generation of electrostatic charges.

Fig 2. – Newson Gale's mounted Earth-Rite RTR static grounding system. Principally the same as an Earth-Rite MGV, which remains vehicle based

The Earth-Rite MGV's patented Tri-Mode technology performs capacitance and resistance monitoring. It is set to show permissive (flashing green high intensity LED lights) only when the system detects:

1. The presence of the tanker on which the system is mounted,
2. The presence of a connection to ground is less than 1000 Ohms
3. The resistance between the vac truck and the designated ground connection is less than 10 Ohms

Fig 3. – When the MGV system confirms the vacuum truck is fully grounded, three flashing green high intensity LEDs pulse to indicate that the truck has established a static dissipative ground connection

In summary

To mitigate electrostatic discharges igniting combustible and flammable atmospheres, companies should risk assess their processes and equipment to ensure any potential sources of ignition are identified and managed correctly. Incendive electrostatic sparks usually result from the lack of a thorough and detailed risk assessment, unintended changes to equipment during routine maintenance and unsafe operator working practices. All potential sources of internal and external static discharges from process equipment situated in zoned and classified areas must be accounted for and managed in the appropriate way.

Newson Gale has been supplying static grounding systems to the process industries for over 30 years. During that period, Newson Gale has developed cutting edge solutions tailored for applications and processes at risk of electrostatic discharges in potentially flammable and combustible environments.

The philosophy of product development within the organisation is two-fold; firstly; enable customers to demonstrate best practice compliance with the international standards for static control, and secondly; to fully understand the operating environment that products will be expected to perform in, such that they are user friendly and perform their intended safety function, along with being mechanically and electrically reliable.

The Newson Gale range mitigates static charge accumulation by using practical and innovative design, and ensures effective static control on three levels – grounding and bonding clamps, visual verification systems and interlockable control systems.

Fig 4. – The MGV system enclosure is bolted onto the side of the truck, in a locations where the LEDs are in the field view of the operators

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