White Paper

Earth-Rite® MGV
Mobile Grounding Verification

Author Details:

Mike O'Brien, Managing Director for Newson Gale

If you have any questions relating to the topics discussed in this article, please contact Newson Gale.

This article will explore the current methods used to provide static earthing protection for vehicles operating in locations that do not have installed, or correctly specified, static earth monitoring systems. Although primarily designed to provide all tankers with mobile ground (earth) verification capability, the **Earth-Rite® MGV** has proven to be a success for vacuum tankers used by contractors providing cleaning, spill and material recovery services to companies with classified hazardous areas. The MGV is also utilised on tankers that must collect from, or deliver product to, locations that do not have satisfactory static earthing protection for road tankers in place.

Vacuum tankers provide a wide range of services to the hazardous process industries ranging from storage tank cleaning to the recovery of combustible materials resulting from leaks and spills. A key feature of this type of service is the recovery of materials in locations with potentially combustible atmospheres.

Static electricity is a well known ignition source within the hazardous process industries and because the generation and accumulation of static electricity is not visible to the naked eye, this "below the radar" characteristic, makes it an exceptionally precarious and dangerous hazard. Normally, the only evidence of static electricity being present during a transfer operation is when somebody sees or hears a static spark discharge. By then it may be too late to prevent the ignition of the surrounding atmosphere if it is in its combustible range.

Earthing vacuum tankers operating in hazardous areas eliminates the threat posed by static electricity and is an action that effectively connects the tanker to the general mass of the Earth, which is sometimes called "True earth". The voltage induced on the tanker by the charged material is the key factor in a static spark discharge. Earthing ensures that no voltages are generated and permitted to accumulate on the tanker.

A solution that is appropriate to the potential hazard

For over twenty years dedicated static earth monitoring systems have replaced basic earthing reels on the road tanker loading gantries of petrochemical and chemical sites, pharmaceutical sites, tank farms and food and beverage manufacturing sites. Due to the combination of the large quantities of combustible material being processed, the amount of charge that can be induced on tankers and the potential outcome of the ignition of the atmosphere, bonding reels were replaced with earth monitoring systems that were designed to monitor the integrity of the road tanker's connection to earth so that electrostatic charge could not accumulate on the tank or chassis of the road tanker while product was being transferred. To enhance the safety of transfers at these locations, gantry mounted earth monitoring systems normally have an interlock function that stops the movement of product if the earthing system is disconnected from the road tanker.

Even though the potential and consequences of fires is, at the very least, the same for road tankers at dedicated loading gantries, vacuum tanker service providers have not been in a position to provide this level of safety and protection of their personnel and tankers, or for their customer's personnel and property.

Until now, vacuum tanker service providers have had to rely on very basic devices to earth their vehicles. This is simply because technology that is capable of verifying the quality of static earthing points in a mobile, quick and user-friendly way has not been available to drivers and operators. The method currently used consists of a simple earthing clamp attached to single core braided cable wound onto a reel.

Very often, vacuuming operations will be carried out on facilities and remote locations where "designated" earthing points may not be tested on a regular basis, are not accessible or do not exist. (*More detail on earthing points is provided at the end of this article*). Bulk transportation companies can also have the same difficulties when they deliver product to customer sites where earthing systems are not up to current specifications, or worse still, are not installed.

When compared to the performance and safety of static earth monitoring systems, single core bonding reels have several major drawbacks.

- Bonding reels cannot inform the driver that the clamp has penetrated through potential resistors to the flow of static electricity. Rust and paints coatings can prevent clamps from making a solid, low resistance connection to the metal of the object performing the earthing function.
- Bonding reels cannot monitor the tanker's connection to the earthing point for the duration of the transfer process. If the clamp's connection to the earthing point is compromised, the drivers and operators will have no way of knowing this as they will be concerned with the safe and secure transfer of material.
- When the driver needs to connect the reel to secondary earthing points (e.g. pipe or structural support beam), the bonding reel cannot verify that the earthing point actually has a verifiable connection to a True earth ground.
- On many customer sites electricians are required to perform resistance readings with multi-meters to verify that the tanker has a 10 ohm or less bonded connection to a designated earthing point, via the bonding reel. This method has several major drawbacks.
- The electrician needs to be taken off maintenance, repair and installation work to perform this test and may be delayed, even up to a few hours, in performing the resistance check. This has the knock on effect of delaying the vacuum tanker team in proceeding with the cleaning, spill recovery or tanker offloading operation.
- In an emergency situation, like a spill or leak, the vacuum tanker team may not have time to wait for an electrician to conduct a bond resistance test and will have to bond the tanker to points that have not been designated as verified earthing points. In that situation, they will be hoping that the object they have bonded to will have a connection to True earth.
- The resistance check is a one-time bond resistance check between the points the tanker is connected to. It does not verify if the structure the reel is connected to has a connection to a True earth ground.
- Because the resistance check is a one-time check, the drivers will not know if the clamp's connection is compromised during the transfer.

Unlike the security provided to road tanker drivers and loading gantry operators by gantry mounted earth monitoring systems, **the vacuum tanker team running the recovery or transfer operation has no way of knowing if their tanker is connected to a good earth.**

Contract service providers, and customers, have concerns due to such limitations because the teams are connecting reels to earthing points that have neither been tested nor verified as being connected to a True earth ground.

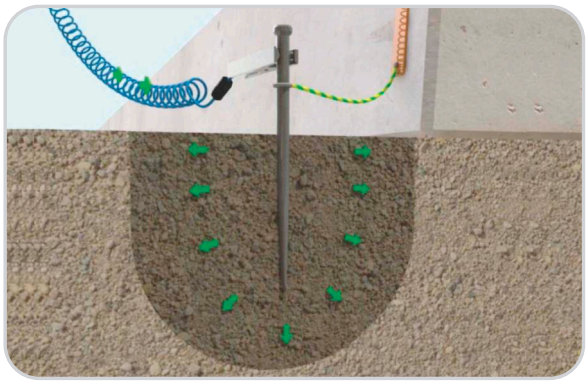
In order to remove this uncertainty and provide vacuum tanker service providers with the same level of protection that gantry mounted static earth monitoring systems provide, **Newson Gale developed the Earth Rite® MGV**, which is a vehicle mounted static grounding verification system. MGV stands for **M**obile **G**round **V**erification.

Newson Gale developed the Earth-Rite® MGV to give the providers and customers of vacuum tanker services the same level of safety and performance that a gantry mounted static earthing system can provide. The only difference between a gantry mounted system and the MGV is that the MGV is a permanent component of the tanker for which it is providing static earthing protection.

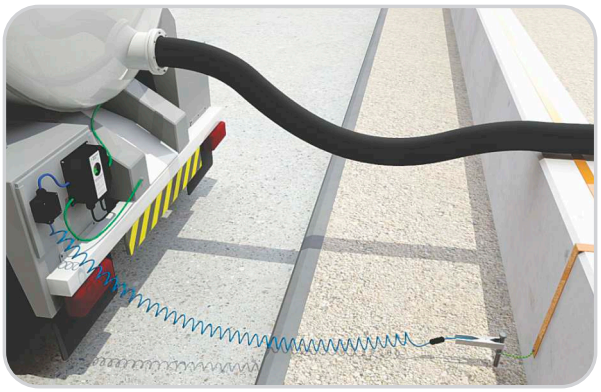
The MGV incorporates the recommendations of API RP 2219 "**Safe Operation of Vacuum Trucks in Petroleum Service**", which is the most relevant standard to address the precautions that should be put in place when vacuum tankers are being used to transfer combustible materials or are carrying out transfers in potentially combustible atmospheres.

When it comes to earthing vacuum tankers the recommendations in API RP 2219 are:

- To earth the truck before commencing with any operations, where a "designated, proven ground source is preferred."
- To ensure the electrical resistance between the truck and the grounding point does not exceed 10 ohms, "the continuity should be verified with an ohmmeter following connection and prior to operations."
- Focussing on the first requirement of the standard, it states that we need to establish that the earthing point we are connecting the tanker to, is a proven "**ground source**". The "ground source", in other words, is an object that has a direct electrical connection to a True earth ground. The MGV system matches this requirement by ensuring the earthing point to which it is connected, has a verifiable connection to True earth. **This function is called "Static Ground Verification" (SGV).**



To ensure the connection between the point the MGV has verified as having a connection to a True earth ground and the tanker is 10 ohms or less, the MGV will continuously monitor the tanker's connection to the now verified earthing point. In addition, the MGV monitors its own connection to the tanker. This is especially important as it ensures both the tank and chassis are connected to earth via the MGV system. This ensures that there is a continuously monitored circuit between the tanker and the verified earthing point which will enable static electricity flow off the tanker and into the ground. Because the MGV is now monitoring the circuit between the tanker and the verified earthing point, if the clamp's connection to the earthing point is compromised or removed while a transfer is underway, the MGV system detects this. **This function is called "Continuous Ground Loop Monitoring" (CGLM).**



Both the SGV and CGLM checks of the Earth-Rite® MGV must be positive in order for a static ground connection to be established. When both checks are positive three highly luminous green LEDs pulse to inform the drivers that the tanker is earthed. At this point, the transfer team can proceed with the next stage of the material transfer operation. Any static generated by the transfer process will immediately flow directly through the MGV to earth removing the risk of ignition of combustible atmospheres or shocks to operators caused by discharges of static electricity.

From the driver's perspective, earthing the vehicle with the MGV couldn't be simpler. When the LED behind the system's window is red, it means the tanker does not have an earth connection. All the driver needs to do is connect the earthing clamp to an object that he wishes to test. If the object to which the clamp is connected has a verifiable static earth connection and the clamps' connection resistance to the earthing point is 10 ohms or less, the LEDs will switch from red to pulsing green. The green pulsing LEDs inform the team that the MGV is continuously monitoring the health of their tanker's static earthing circuit.

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

And just like the levels of security provided by a gantry mounted static earthing system, the vacuum tanker provider has the option of interlocking a pair of volt free contacts with the pumping system. If the MGV detects a loose or broken connection in the earthing circuit when a transfer is underway it immediately shuts down transfer of material, which in turn, stops the generation and accumulation of static electricity on the tanker and the overall transfer system. Another interlock option is to mount a strobe light at an elevated position on the tanker to provide an additional indicator for the recovery team especially if they need to work in a position, or at a distance, that prohibits their view of the earth status indicators on the MGV system.

Primary earthing points and Secondary earthing points

The earth electrode, more commonly known as the "earthing point", can be any metal object ranging from a network of earthing rods protruding from concrete to standard installations such as building structures and pipes entering the ground.

The composition of the ground or soil surrounding the electrode is normally the component that presents the most resistance to the flow of static electricity. Different soils have varying levels of resistance due to soil type resistivities and moisture content which can vary dramatically throughout the seasons.

For example, soils with high moisture content levels can have very low values of resistance to a True earth ground, but in winter, this water and moisture can freeze, dramatically increasing the resistance between the electrode and True earth, which could rise to a level that would impede the flow of static electricity. In effect, the soil can be described as a resistor in a circuit and we want to know if this resistance is low enough to safely and reliably channel the static charges from the tanker to earth.

All sites with classified hazardous areas will have electrical fault and lightning protection systems that are connected to structures that will have been tested by engineers and will be defined as "designated" earthing points. These points can also be used to earth plant equipment and vehicles at risk of static charge accumulation. These **"primary"** earthing points should be regularly tested to ensure they will not only function as reliable paths to earth for stray currents and lightning strikes, but also protect against the accumulation of static electricity.

When looking at static electricity as distinct and separate from the hazards of lightning strikes and stray currents, higher values of resistance to a True earth ground are permitted. Although the hazardous voltages associated with static electricity are very high, when compared with the currents resulting from lightning strikes and electrical faults, the magnitude of static charging currents is very low.

Because the magnitude of static charging currents is low, **"secondary"** earthing points like pipes running beneath the ground, beams of building structures, storage tanks and temporary earthing rods can be tested by the MGV to determine if they have a resistance to a True earth ground that will easily channel static electricity off the tanker.

These are structures that will not be tested to verify their suitability for fault current protection and lightning protection, however, because of their inherent and permanent contact below the surface of the ground, they can be tested to determine if they have resistance values to True earth that would permit the safe transfer of static electricity.

Conclusion

Until now vacuum tanker service providers, and the customers of vacuum tanker services, have not had access to the levels of static earthing protection available to companies, who, for many years, have been operating tanker loading gantries with dedicated interlocking static earth monitoring systems. Additionally bulk transporters may be delivering combustible product to sites with out of date or non-existent static earthing protection measures.

With the **Earth-Rite® MGV** system vacuum tanker service providers and bulk transporters can now match the levels of control and safety that have been available to loading gantry operators ensuring their employees, tankers, customer employees and customer properties are fully protected from the ignition hazards associated with static electricity.

If the validity of primary earthing points is not fully known, or secondary earthing points must be used, they should be tested by a system like the MGV prior to their use. A verified resistance will safely allow the rapid transfer of static charging currents to True earth, ensuring the tanker, hoses and any other equipment used in the transfer process are protected from incendive static spark discharges within a potentially combustible atmosphere.

United Kingdom
Newson Gale Ltd
Omega House
Private Road 8
Colwick, Nottingham
NG4 2JX, UK
+44 (0)115 940 7500
groundit@newson-gale.co.uk

Deutschland
IEP Technologies GmbH
Kaiserswerther Str. 85C
40878 Ratingen
Germany
+49 (0)2102 5889 0
erdung@newson-gale.de

United States
IEP Technologies, LLC
417-1 South Street
Marlborough, MA 01752
USA
+1 732 961 7610
groundit@newson-gale.com

South East Asia
Newson Gale S.E.A. Pte Ltd
136 Joo Seng Road, #03-01
Singapore
368360
+65 6704 9461
ngsea@newson-gale.com

www.newson-gale.co.uk

NG UK White Paper 24 070918