Leading the way in hazardous area static control

Application Spotlight

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Grounding/Earthing Multiple Metal Containers in a Hazardous Atmosphere

Without suitable grounding provisions on site, electrostatic charges can accumulate on metal containers, such as drums and hazardous area suitable Ex IBCs during the handling of flammable liquids in Ex/HAZLOC. Once such handling operations begin, these metal containers can quickly generate enough voltage for an electrostatic discharge to occur. Implementing suitable electrostatic grounding & bonding measures is a critical step to mitigating against the risks posed to plant personnel and assets from ignitions caused by electrostatic discharges.

The storage and handling of flammable liquids is a necessity for many chemical companies' daily operations. Once a hazardous area classification has been assigned to the area(s) in question, attention should turn to the control of potential ignition sources in these areas.

When completing a risk assessment or hazard and operability (HAZOP) analysis of such operations, many can and will identify electrostatic discharges as a potential ignition source. Whilst best practice guidance such as *IEC TS 60079-32-1:2013+AMD1:2017 'Electrostatic hazards, guidance'* provides advice on the use of insulating and semi-conductive materials, a common challenge plant managers and personnel face is the grounding of potentially isolated metal plant equipment within a hazardous area.

If metal plant equipment is not suitably grounded prior to commencing work involving the handling of flammable liquids, electrostatic charges can quickly accumulate on the equipment once an operation begins. This causes voltage levels to increase, and once an object reaches a critical 'breakdown voltage' the risk of an electrostatic discharge is present. Provided the concentration of flammable gas and/or vapor is within the upper and lower explosion limits of the material(s) in question, and the energy level of the discharge exceeds the minimum ignition energy (MIE) of the surrounding hazardous atmosphere, an ignition can occur.

Target ≤ 10 Ω

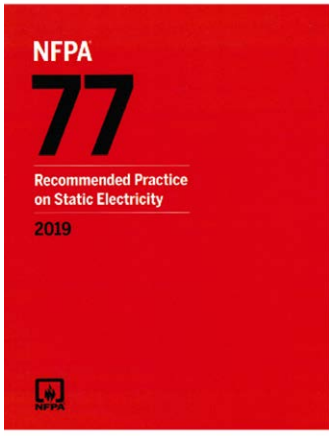
The immediate priority is to ensure the presence of a local plant ground point, typically a pre-verified ground bar capable of safely dissipating electrostatic charges to ground. Once verified, attention can turn to ensuring all metal plant equipment shares an equipotential bond to the nominated ground point, taking it to "earth/ground potential" for the safe dissipation of electrostatic charges.

Best practice guidance such as *IEC TS 60079-32-1:2013 +AMD1:2017 & NFPA 77 'Recommended Practice on Static Electricity, (2019 Edition)'* can be used to establish what constitutes a repeatable and reliable ground connection for metal plant equipment. Although, ≤ 1 megohm (1 x 10^6 Ω) is generally considered "adequate" (NFPA 77, 7.4.1.3) for the purpose of electrostatic charge dissipation, this should not be confused as being indicative of a repeatable and reliable connection to ground for all metal connections. In fact, both *IEC TS 60079-32-1 & NFPA 77* conclude that any ground connection exceeding 10 Ω for metal plant equipment can be a sign of "loose connections or corrosion" that requires further investigation.

Most fixed plant equipment will typically possess a structural ground connection that can be relied upon if properly maintained and tested. However, ensuring a ≤ 10 Ω ground connection for portable metal containers such as drums, hazardous area suitable Ex or stainless-steel IBCs, mixing pans and buckets can be far more of a challenge with several portable containers being used simultaneously.

Multiple Metal Containers

Many users will opt for a grounding system that continuously monitors the connection as far as the designated ground point in order to mitigate against loose or corroded connections. A system that monitors to a 10 Ω permissive threshold provides continuous indication of a connection that adheres to best practice recommendations.



Multi-Channel Ground-Monitoring System

When multiple electrostatic ground monitoring connections are required in a process area, the use of "traditional" single channel monitoring systems that would each require power in the 110/230 V AC range may not be the most cost effective, or flexible option in terms of installation requirements. Therefore, the use of a multi-channel ground monitoring system such as the **Earth-Rite® MULTIPOINT II** should be considered. This system allows for the simultaneous monitoring of up to eight items of process equipment to a 10 Ω permissive threshold from a single ATEX, IECEx, NEC & CEC certified monitoring control unit, and a 110/230 V AC power supply unit.

Earth-Rite® MULTIPOINT II features and benefits:

- **Monitors to a 10 Ω permissive threshold:** Demonstrates compliance with internationally recognized best practice guidance such as *IEC TS 60079-32-1 & NFPA 77.*

- **Continuous Monitoring:** Continually monitored connections with visual indication reduce the need for costly and time consuming electrical continuity checks. These checks should be undertaken by qualified hazardous area specialist personnel who may not always be accessible.

- **Application Flexibility:** A simple, easy-to-use dipswitch on the monitoring unit PCB allows the user to add/remove channels should their application requirements change.

- **Indication Flexibility:** Additional remote indicator stations can be positioned local to each monitoring connection, so the operator has an easily accessible indication as to a specific channel's current state via the red (non-permissive) and green (permissive) LEDs local to each process. This enables a single system to monitor multiple metal containers within a broad plant area.

- **Installation Flexibility:** The indicator stations are powered by intrinsically safe Ex ia circuits distributed from a single in-line marshalling junction box (supplied with the system). This can be advantageous for equipment installers who may otherwise face the prospect of installing several individually powered single-channel systems in an Ex/HAZLOC area. If you combine the installation flexibility afforded by the **Earth-Rite® MULTIPOINT II** system and the expected upfront saving of purchasing one multi-channel ground monitoring system over several individual units, the overall value differential can be favorable.

- **Process Interface Flexibility:** The voltage-free contacts located in the power supply unit enable the user to interface with process control devices such as pumps, PLCs and valves to inhibit their operation until a permissive output is obtained from the corresponding channel(s) (see Fig. 1). Each channel is allocated a single volt-free contact to enable complete segregation between distinct processes. Meanwhile, an additional group relay allows for several or all eight channels to be grouped using a simple dipswitch on the power supply unit, thus ensuring that all grouped channels must be permissive for the group relay to energize.

  Note – Process interface / interlock configurations should always be risk assessed by a suitably qualified entity, taking all process parameters into consideration.

- **Reliability:** The Earth-Rite® MULTIPOINT II uses secure and reliable software based on the MISRA C protocol. Watchdog circuits located on both the monitoring and power supply units can activate a fail-safe relay also located in the power supply unit.

Case Study

How a Newson Gale customer specializing in the production of resins, improved process safety and efficiency by installing the Earth-Rite® MULTIPOINT II.

When conducting a HAZOP analysis of its filling area, which is classified as a Zone 2 IIB T3 gas/vapor atmosphere, the customer identified a requirement to simultaneously monitor three electrostatic protected composite Ex IBCs prior to being filled with a solvent-based resin. The analysis also identified the metal funnels seated on top of the Ex IBCs as a potentially isolated conductor that required an independent monitoring connection. Due to this requirement, a total of six monitoring connections were used.

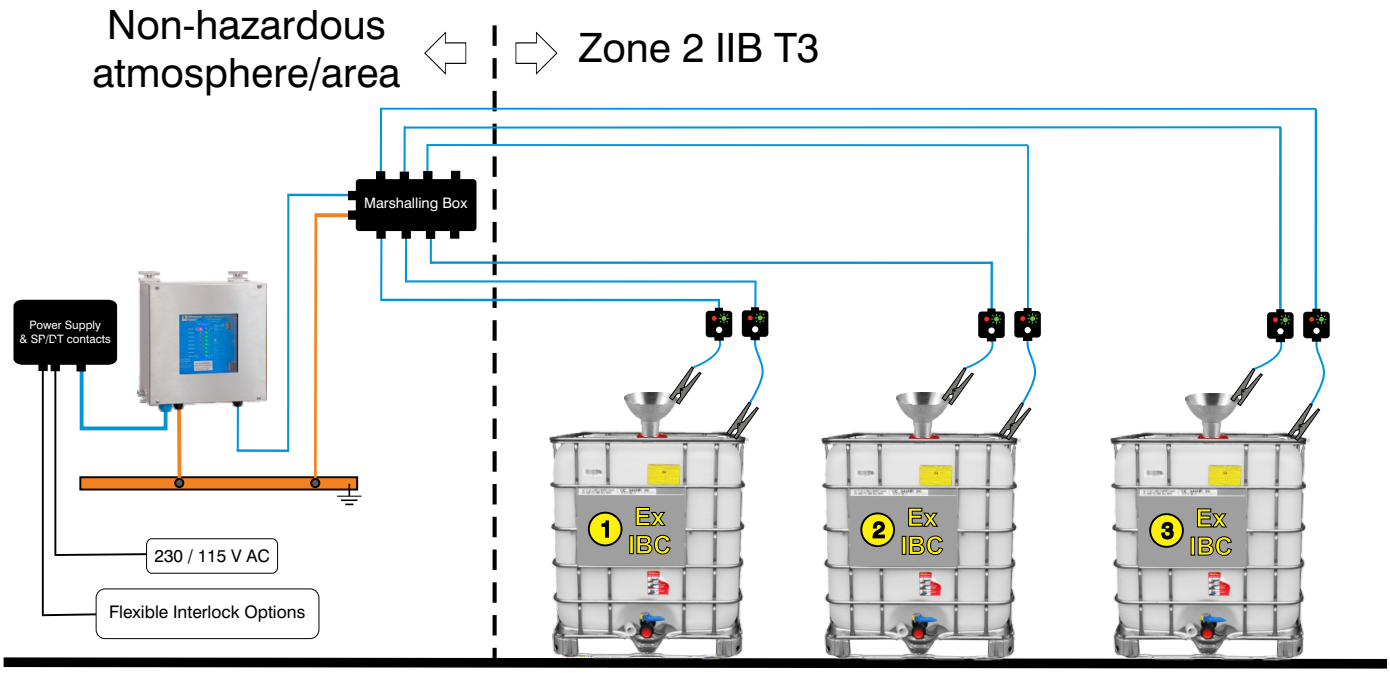


Fig. 1 - Process interface flexibility

Operating Environment

Adjacent to the filling room is the switch room, classified as a non-hazardous area. The switch room contains the PLC which controls the hazardous area certified pumps used to drive the flow of material from the mixing tanks (structurally grounded) to the Ex IBCs via metal pipework.

The CompEx accredited installer determined the most practical location for installation to be the switch room, positioning the power supply unit, monitoring control unit, and marshalling junction box next to the PLC - the latter two components being terminated to a common pre-verified ground bar. From there, intrinsically safe Ex ia monitoring circuits were routed via overhead cable trays to remote indicator stations positioned local to each filling station. Finally, two-pole clamps and cable assemblies were specified for each of the Ex IBCs and funnels, with all clamps possessing penetrative tungsten carbide tips to mitigate the potential for viscous product deposits preventing a $\leq 10\ \Omega$ connection from being achieved.

In this case, the benefits of selecting the **Earth-Rite® MULTIPOINT II** and installing in this manner included:

- The positioning of the monitoring control unit and remote indicator stations provides easily accessible **visual indication to operators inside the potentially hazardous atmosphere and those located remotely** in the switch room.
- **Minimized interlock control circuit runs** by positioning the power supply unit local to the PLC. The installer grouped the two channels allocated to each filling station in series and interfaced them with the PLC. The PLC was then programmed to ensure that the operation of the inline transfer pump was inhibited until the two channels allocated to that filling station obtained a permissive output. By "grouping" the channels in this manner, it avoided cross-interference between the respective filling operations at each station, thus outlining the **flexibility** afforded by the system.
- The two spare channels also **"future-proof"** the equipment against potential operational expansion or changes to process requirements.

This is one of many diverse hazardous area/EXLOC applications that the **Earth-Rite® MULTIPOINT II** *can be applied to. Should you have a potential application in mind, a Newson Gale Sales Engineer can be contacted to discuss your requirements in further detail.*

References:

International Electrotechnical Commission IEC TS 60079-32-1:2013+AMD1:2017 CSV, 'Amendment 1 - Explosive atmospheres - Part 32-1: Electrostatic hazards, guidance', [online], available at https://webstore.iec.ch/publication/26519 (accessed 31st Octboer 2022).

National Fire Protection Association NFPA® 77, Recommended Practice on Static Electricity, 2019 Edition, [online], https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=77 (accessed 31st October 2022)

Note – Please ensure you are always accessing the latest version of any applicable standard or guidance document.

If you have any questions relating to this article please e-mail Newson Gale.

If you would like to learn more about the Earth-Rite® MULTIPOINT II follow this link to the product webpage.

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