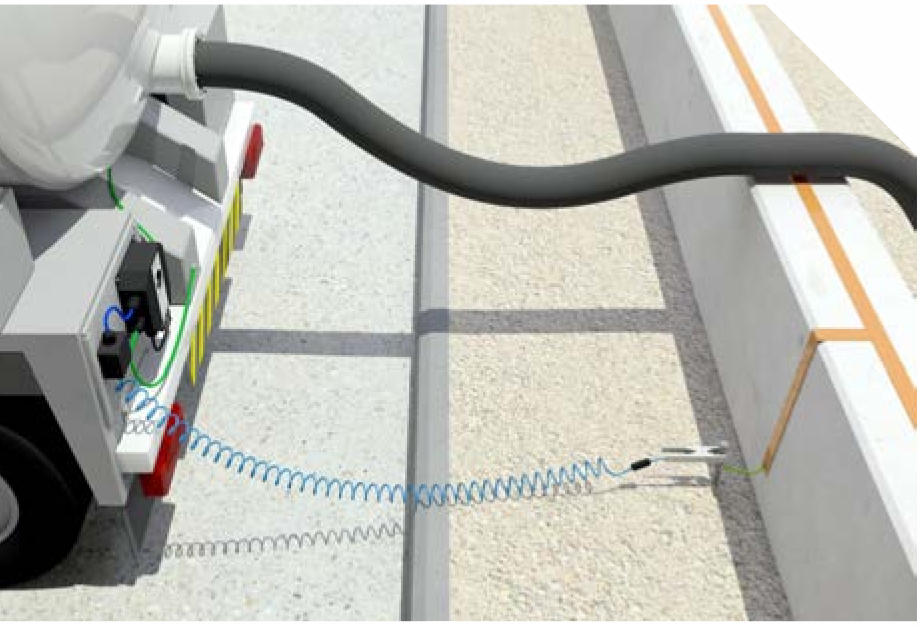
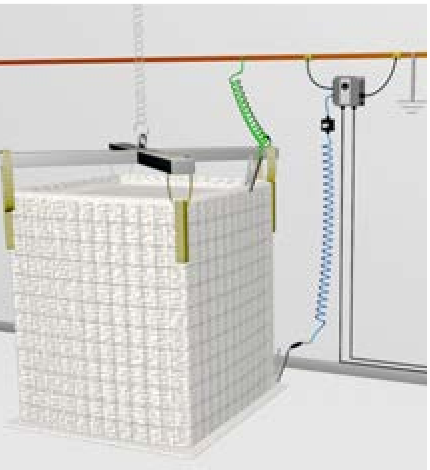
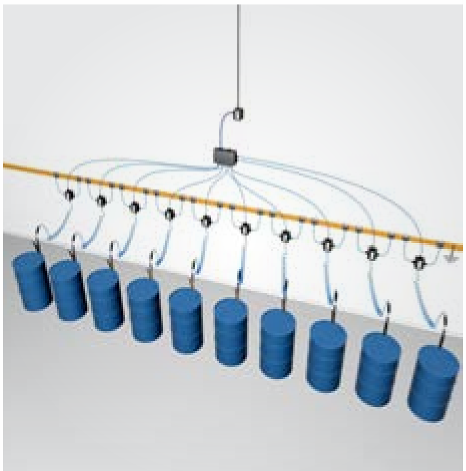
Newson Gale®







Issue 1

Grounding & Bonding Applications

Controlling
static electricity in
hazardous areas

Leading the way
in hazardous area
static control

www.newson-gale.co.uk

Newson Gale®

...your **Trusted Advisor In Static Control**

This Grounding and Bonding Application Handbook enables you to identify the processes carried out at your site that could pose a static ignition risk. As well as identifying the problem, this Handbook identifies the right solution.

If you want to discuss a particular application or product feel free to submit an enquiry via the enquiry buttons located in the PDF version or contact us via the telephone or e-mail details provided on the back cover.

Enquiry

Contents

< Back to Content

Newson Gale® is a company committed to eliminating the ignition hazards of static electricity.

Headquartered in Nottingham in the heart of the United Kingdom, we develop and manufacture a range of hardware solutions dedicated to ensuring static electricity is not an ignition source in potentially flammable and combustible atmospheres.

Ranging from the loading of road tanker trucks to emptying hand held cans, we have a solution for virtually every EX/HAZLOC process capable of generating static electricity. Because we are focussed on our customers, we understand the challenges your processes and installation options present you with. We know that static electricity is not something you deal with on a day-to-day basis and it's what separates us from other equipment suppliers.

With Newson Gale, you gain access to our extensive experience in static grounding and bonding that empowers you and your organisation to demonstrate compliance with the recommended practices of organisations like the International Electrotechnical Commission, the National Fire Protection Association and a wide range of industry specific codes of practice, that address the ignition hazards associated with static electricity.

Owing to the thousands of applications we have seen since the early 1980's two critical ingredients underpin the performance of our static control equipment: **Precision and Reliability**.

Precision.

- Our ground loop resistance monitoring circuits are developed based on the recommendations embedded in IEC, NFPA and other industry guidelines. We don't use arbitrary values of resistance. When our ground status indicators go green, your operators are working in compliance with industry codes of practice.
- Our grounding systems monitor the ground loop through the equipment requiring static grounding protection back to verified grounding points, not the grounding system itself. This guarantees the removal of static electricity from the process.
- We continue to develop products that are patented industry firsts. In 2012, the Earth-Rite® MGV won the "Technical Innovation of the Year" award at the HazardEx awards ceremony.

Reliability.

- Based on our extensive experience of a wide range of EX/HAZLOC sectors we develop and manufacture clamps, cables and grounding systems that can cope with the "industrial treatment" provided by process operators.
- In accordance with IEC 61508 our range of Earth-Rite® systems are approved for installation in Safety Integrity Level 2 rated environments.
- We can offer multiple layers of protection based on the scale of the static ignition hazards present at your site.

Static electricity as a hazard

Static electricity can be described in a number of different ways, but it is, essentially, electricity stuck in one place. In a normal electrical circuit, charges that form an electrical current move through a closed circuit in order to do something beneficial, like power a computer or the lighting in your house. In these circuits, the charge always returns to the source from which it has been supplied. Static electricity is different. Because it is not part of a closed circuit static electricity can accumulate on plant equipment ranging from road tankers to flexible intermediate bulk containers.

Although static electricity is generally regarded as a nuisance, in the hazardous process industries, its effects can be devastating. Discharges of static electricity have been identified as the ignition source for a broad range of processes that cut right across a wide selection of industry groups. It is as potent as sparks resulting from mechanical and electrical sources, and yet, it is often underestimated, either due to a lack of awareness of the risks it poses or because of neglect and/or complacency.

Legislation concerning static electricity in the hazardous process industries

The threat posed by static electricity as an ignition source is addressed in legislation in both European and North American occupational health and safety laws. In Europe, Article 4 "Assessment of explosion risks" of Directive 99/92/EC, otherwise known as the ATEX Workplace Directive, makes a clear reference to "electrostatic discharges" as a potential ignition source that must be considered as part of the explosion risk assessment.

In the U.S., the Code of Federal Regulations that addresses hazardous location activities, 29 CFR Part 1910 "Occupational Safety and Health Standards", states that all ignition sources potentially present in flammable atmospheres, including static electricity, shall be eliminated or controlled.

Section 10.12 of Canada's Occupational Health and Safety Regulations (SOR/86-304) states that if a substance is flammable and static electricity is a potential ignition source that the employer "shall implement the standards set out in the United States National Fire Protection Association, Inc. publication NFPA 77, Recommended Practice on Static Electricity."

Industry Codes of Practice

NFPA 77 "Recommended Practice on Static Electricity" is one of a number of industry codes of practice that addresses the ignition hazards of static electricity. In recognition of the ignition risks posed by static electricity these publications are produced and edited by committees of technical experts that participate in the hazardous process industries. The following publications are dedicated to helping QHSE professionals and plant engineers identify and control electrostatic ignition sources.

Publisher	Title	Metal Grounding Circuits	FIBC Type C
International Electrotechnical Commission	IEC 60079-32-1: Explosive Atmospheres, Electrostatic Hazards - Guidance (2013).	10 Ω	1 x 10^7 Ω
National Fire Protection Association	NFPA 77: Recommended Practice on Static Electricity (2014).	10 Ω	1 x 10^7 Ω
American Petroleum Institute	API RP 2003: Protection against Ignitions Arising out of Static, Lightning and Stray Currents (2008).	10 Ω*	N/A
American Petroleum Institute	API 2219: Safe Operation of Vacuum Trucks in Petroleum Service (2005).	10 Ω	N/A
International Electrotechnical Commission	IEC 61340-4-4: Electrostatic classification of Flexible Intermediate Bulk Containers (2012).	N/A	1 x 10^7 Ω

Table 1: List of industry codes of practice designed to prevent ignitions caused by static electricity.

* API RP 2003 States that 10 Ω is 'satisfactory'.

The basics of the hazard

When a high resistivity liquid, gas or powder is constantly electrostatically charged during processing operations it will charge electrically isolated conductive plant equipment and materials that it is direct contact with, or in close proximity to.

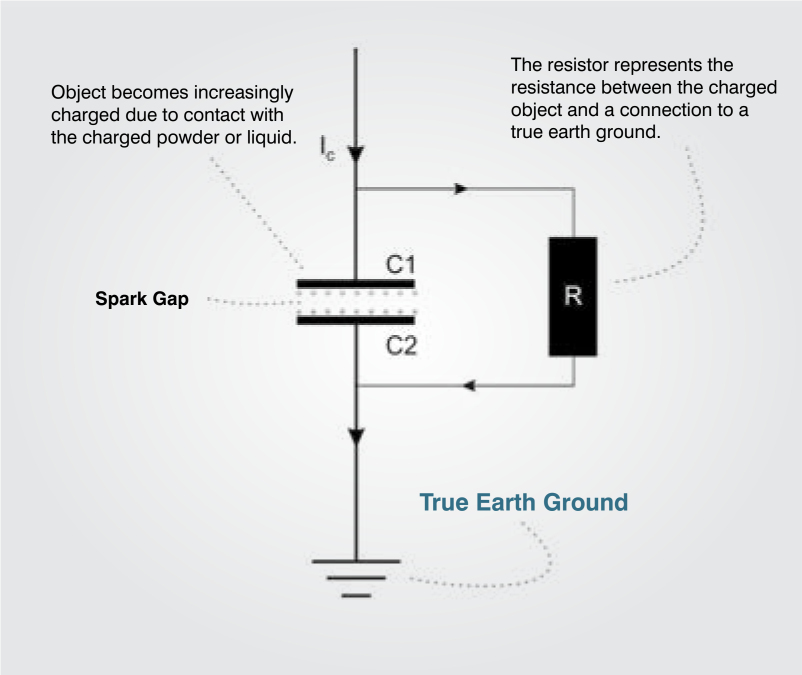


Figure 1: Basic model of why objects accumulate static electricity.

Although the diagram in Figure 1 is a simplified explanation of what can happen when objects are charged by static electricity, the primary contributors to an ignition by static discharges are addressed. "I_c" is the electrostatically charged powder or liquid that is making contact with the object, "C1". C1 could be a road tanker, a drum, a mixing vessel, an IBC or an FIBC. "C1", the object being charged, represents one plate of a capacitor. The other plate, "C2", represents the earth or an object in contact with the earth. "R" represents the electrical resistance between the charged object and the earth.

The object that is being charged, C1, is for some reason isolated from the earth and this isolation is caused by something that places a high resistance, R, between the object and the earth. If C1 had a low resistance connection to earth the charge would 'flow' directly to earth. This is because the general mass of the earth has an infinite capacity to balance electrical charges, which would result in no voltage being present on the object, C1.

If the resistance to earth is high, it will impede the flow of charge from the object to earth. The charge will, instead, rapidly accumulate on C1, the object. As more charge is deposited onto C1, its voltage will increase rapidly. Although the magnitude of the charging current, I_c, can be very small, typically no more than 100 micro-amps, the voltage on the object can be very high, easily entering the kilo-volt range. The relationship between voltage, charge and capacitance can be summed up in the equation:

$$V = \frac{Q}{C}$$

Where:

V = voltage of charged object (Volts).

Q = total quantity of charge on the object (Coulombs).

C = capacitance of charged object (Farad).

If we say the object being charged is a metal drum with a capacitance (*C*) of 100 pico-farads and it has 1.25 micro-coulombs of charge (*Q*) deposited onto it by an electrostatically charged liquid, its voltage (*V*) will be 12,500 volts. If more charge is deposited onto the drum, its voltage will continue to rise.

It is scenarios where the hidden increase in the voltage of the charged object presents the static ignition risk. This is because static sparks are caused by the rapid ionization of the atmosphere between the charged object and objects that are at a lower voltage. When the voltage of the object hits a critical level that exceeds the breakdown voltage of the medium present in the gap between the charged object, *C1*, and uncharged object, *C2*, ionisation occurs, which presents a conductive path for the charges to pass through the gap in the form of a spark. The spark gap is no different to an engine spark plug and can release sparks with energies far in excess of engine spark plugs. If the atmosphere in the spark gap is between its upper and lower flammable limits, ignition of the atmosphere will occur.

We can work out the total energy available for discharge based on the voltage (*V*) of the drum and its capacitance (*C*) based on the formula opposite:

$$Energy\ (joules) = \frac{1}{2}CV^2$$
$$= \frac{1}{2}(100x10^{-12})(12{,}500^2)$$
$$= 7.8\ mJ\ (spark\ energy)$$

This calculation demonstrates that if the drum was to discharge a spark at a voltage of 12.5 kV the energy of the spark would be higher than the minimum ignition energy of a vast range of liquids and gases.

The charge carried by non-conductive powders can be much higher than liquids and produce sparks with more than enough energy capable of igniting combustible dust atmospheres.

Liquid / Gas	MIE
Methanol	0.14 mJ
MEK	0.53 mJ
Ethyl Acetate	0.46 mJ
Acetone	1.15 mJ
Benzene	0.20 mJ
Toluene	0.24 mJ

Table 2: List of flammable liquids and gases and their corresponding Minimum Ignition Energies.

Powder	MIE
Magnesium Stearate	03 mJ
Polyethylene	10 mJ
Aluminium	50 mJ
Cellulose Acetate	15 mJ
Sulphur	15 mJ
Polypropylene	50 mJ

Table 3: List of combustible powders and their corresponding Minimum Ignition Energies.

Object	Capacitance
Trucks	Over 1000 pF
Plant Equipment	100 to 1000 pF
Medium Sized Containers	50 to 300 pF
Human Body	100 to 200 pF
Small Containers	10 to 100 pF
Small Scoops	10 to 20 pF

Table 4: Typical capacitance values of isolated objects. (Note: 1 pF 'pico-farad' is equivalent to 1 x 10^{-12} Farads).

Real world scenarios

So what scenarios can give rise to situations where static charges accumulate on equipment used in EX/HAZLOC atmospheres?

As described in Figure 1 the objective is to ensure the equipment's voltage does not rise during operations. We know charge accumulation can only take place if there is a resistance present between the equipment and general mass of earth.

Connections to the mass of the earth should be provided by high integrity earth grounds present on the site. These high integrity earth grounds should be providing protection against lightning strikes and electrical faults with plant equipment, and will provide a satisfactory path for static electricity.

What we need to do is ensure any plant equipment, whether it is mobile or part of fixed plant, never becomes isolated from our designated earth grounding points.

But what can cause our equipment to become isolated? Table 5 provides examples of equipment that can become isolated and the reasons for it.

Objects	What causes capacitance?
Portable drums	Protective coatings, product deposits, rust.
Road Tankers	Rubber tyres.
Piping	Rubber and plastic seals, anti-vibration pads and gaskets.
Rail Tankers	Grease, vibration pads isolating tank from rails. Rails isolated from loading gantry.
People	Soles of footwear.
Scoops	Rubber gloves.
Hoses	Broken internal helixes and bonding connectors.
FIBC	Non-conductive fabric / damaged static dissipative threads.

Table 5: Equipment at risk of static charge accumulation and what can cause electrical isolation.

In all of the cases described above, our goal is to ensure that we minimise the resistance between the object at risk of charge accumulation and our designated earth grounding points during the operation. Referring back to Figure 1, we want the resistance 'R' to be below a certain threshold. As per the codes of practice listed in Table 1, by far the most commonly referenced resistance for objects that are made of metal, e.g. drums, trucks, IBCs, the maximum resistance in the ground path should be 10 ohms. For static dissipative equipment like Type C FIBC, the maximum resistance through the bag through to the designated earth grounding point should not exceed 1 x 10^7 ohm (10 meg-ohm).

Layers of Protection

Day to day responsibility for grounding and bonding will most likely rest with factory operators and drivers. Because static is not a visible or tangible hazard, a lack of understanding can lead to complacency or honest mistakes that result in electrostatic ignitions. Good static hazard awareness training combined with grounding equipment that displays compliance with the list of publications in Table 1 will go a long way to eliminating fires or explosions caused by static electricity.

The most optimum solution is to provide operators and drivers with a visual means of verifying that they have made a connection to the equipment at risk of static charge accumulation with a resistance of 10 ohms or less (Type C FIBC should be 10 meg-ohms or less). Static grounding equipment with a simple green light indicator can enable operators to take responsibility for ensuring the equipment does not pose a static ignition risk. Such a system should monitor the grounding of the equipment for the duration of the operation whether that is mixing, blending, drying, conveying, filling or dispensing.

If the grounding equipment indicates that grounding is not present during the operation, the operator can shut down the process to prevent the generation of static electricity. If it is not possible to stop the operation for product quality reasons, then other additional measures should be taken.

When operators and drivers are not in full sight of the ground status indicator for the period of time the operation is running, grounding systems with output contacts should be interlocked with the process to provide automatic shutdown should the system detect a compromised ground connection during the operation. Again, if a shutdown is not permissible, the grounding system should be interlocked with alternative attention grabbing measures like elevated strobe lights or audible alarms to draw attention to the hazard.

Figure 3 outlines the different Layers of Projection over electrostatic ignition risks provided by Newson Gale's comprehensive range of static grounding and bonding equipment. Ranging from levels 1 through to 5, each Product Application page that follows will highlight what protection characteristics are provided by each of our products.

Figure 2: Static grounding devices with visual references for operators and drivers with active ground loop monitoring circuits that demonstrate compliance with IEC 60079-23, NFPA 77 and API RP 2003.

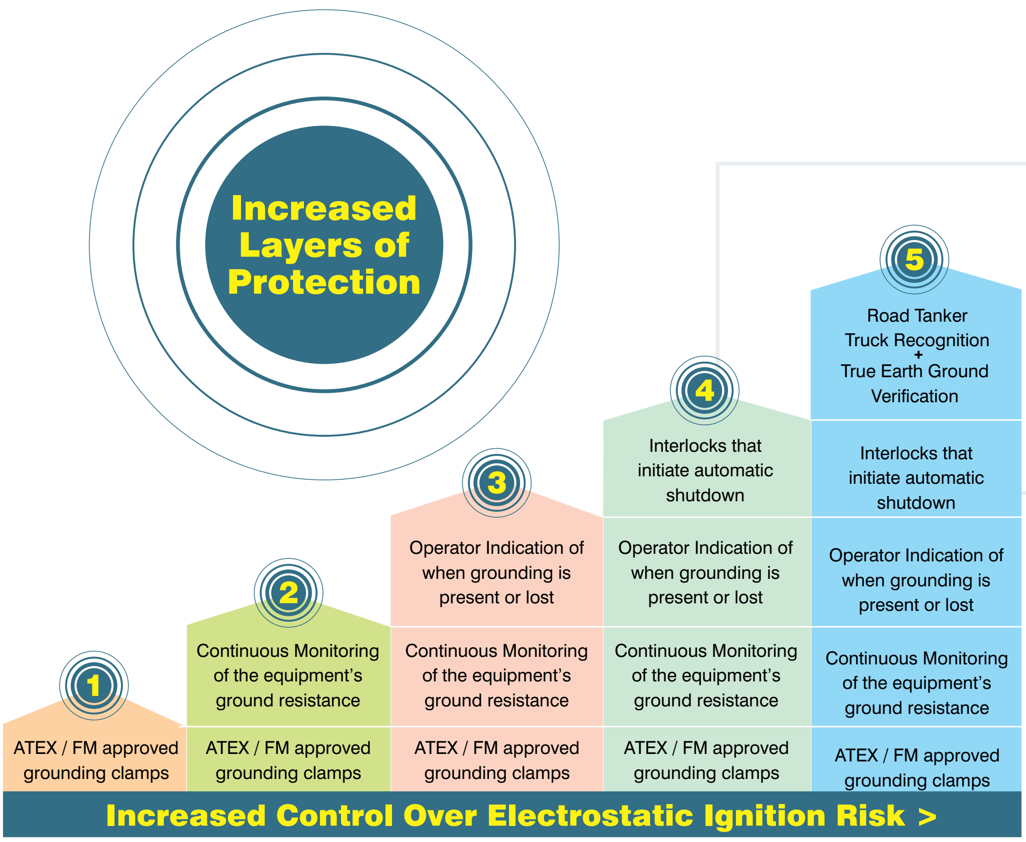


Figure 3: Layers of Protection provided by Newson Gale static grounding and bonding equipment.

ATEX IECEx SIL 2 INMETRO

Newson Gale®

Grounding and Bonding Applications

The following pages identify the most common processes that require static grounding and bonding protection. References from the various industry codes of practice listed on page 2 of this Handbook are provided alongside a brief explanation of the electrostatic ignition hazard behind individual processes.

In addition to identifying the hazard, these pages identify the right product solution.

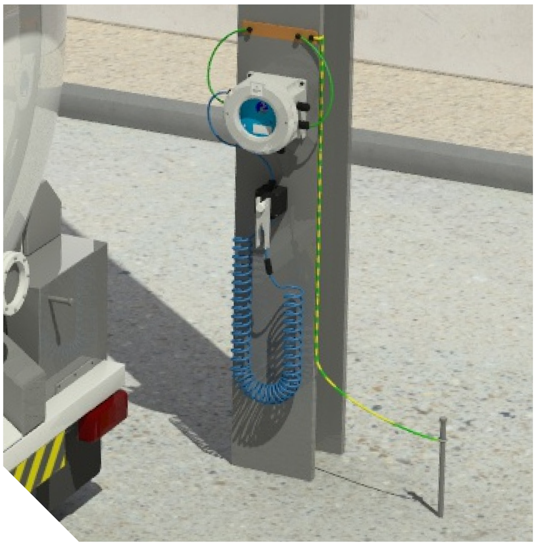
If you want to discuss a particular application or product feel free to submit an enquiry via the enquiry buttons located in the PDF version or contact us via the telephone or e-mail details provided on the back cover.

Enquiry

Newson Gale®

...your **Trusted Advisor In Static Control**

Grounding a road tanker truck with system interlocks and indication



When a road tanker is being filled with a liquid or powder at recommended flow rates, but is without static grounding protection, the road tanker could accumulate a voltage of between 10,000 volts and 30,000 volts within 15 to 50 seconds.

This voltage range is very capable of discharging a high energy electrostatic spark towards objects at a lower voltage potential, especially anything at earth potential. Examples of objects at earth potential could be operators working in the vicinity of the road tanker or the filling pipe situated in the hatch on top of the road tanker.

To counteract this risk, it is important to ensure that the road tanker does not have the capacity to accumulate static electricity. The most practical and comprehensive way of achieving this is to make sure that the road tanker is at earth potential, especially before the transfer process starts.

This is because the general mass of the Earth has an infinite capacity to pull static charges from the road tanker, which in turn eliminates the generation and presence of voltages on the road tanker.

The Earth-Rite® RTR performs three critical functions, via patented Tri-Mode technology circuits, which ensure the fire and explosion risk of an ignition caused by static electricity is eliminated.

IEC 60079-32-1, 7.3.2.3.3
"Precautions for road tankers" states:

1) Earthing and bonding

a) The bonding resistance between the chassis, the tank and the associated pipes and fittings on the truck should be less than 1 MΩ. For wholly metallic systems, the resistance should be 10 Ω or less and if a higher value is found further investigations should be made to check for possible problems of e.g. corrosion or loose connection.

b) An earthing cable should be connected to the truck before any operation (e.g. opening man lids, connecting pipes) is carried out. It should provide a resistance of less than 10 Ω between the truck and the gantry's designated earthing point and should not be removed until all operations have been completed.

c) It is recommended that the earth cable required in b) be part of a static earth monitoring system that continuously monitors the resistance between the truck and a designated earthing point on the gantry and activates interlocks to prevent loading when this resistance exceeds 10 Ω. It is further recommended that the static earth monitoring system should be capable of differentiating between connection to the truck's tank (or earth connection point) and other metal objects. This type of system will prevent operators from connecting the earthing system to objects (e.g. the mudguards) that may be electrically isolated from the truck's container.

Earth-Rite® RTR™

ATEX IECEx SIL 2 INMETRO

The **Earth-Rite® RTR** utilises patented electronics called **"Tri-Mode"** technology to establish three key inputs that must be in place before the loading/unloading operation can commence.

When the three key inputs are met, only then will the Earth-Rite® RTR go permissive and energise its pair of volt-free change-over contacts to engage the pump, or whatever equipment is interlocked with the system, to control the flow of product to or from the road tanker. Any static generated by the loading operation is transferred from the road tanker via the Earth-Rite® RTR to ground, eliminating static electricity as a potential source of ignition.

MODE 1 | In accordance with the recommendations of IEC 60079-32, the Earth-Rite® RTR determines if the grounding clamp is connected to a road tanker. This ensures the clamp is connected to the main body of the road tanker and cannot be bypassed by connecting the clamp to the loading gantry.

MODE 2 | The Earth-Rite® RTR ensures that it has a connection to the general mass of the earth. This is a critical input as a connection to earth is the only means by which the static electricity can be transferred from the road tanker, preventing the accumulation of static electricity.

MODE 3 | In accordance with the key recommendations of IEC 60079-32 and NFPA 77, the Earth-Rite® RTR ensures the resistance between the road tanker and the verified earthing point at the loading gantry never exceeds 10 ohms. The Earth-Rite® RTR achieves this by monitoring the resistance between the RTR clamp's connection to the road tanker and the RTR's connection to the verified grounding point for the duration of the transfer operation.

Earth-Rite RTR® In Ex(d)/XP enclosure.

Intrinsically Safe circuits delivered via **FM** / **ATEX** certified stainless steel grounding clamps.

Optional 15 m (50 ft.) 2 pole cable reel.

Europe / International:

IECEx
Ex d[ia] IIC T6 Gb(Ga) (gas & vapour).
Ex tb IIIC T80ºC IP66 Db (combustible dusts).
Ta = -40ºC to +55ºC.
IECEx SIR 09.0018
IECEx certifying body: SIRA.

ATEX
Ex II 2(1)GD
Ex d[ia] IIC T6 Gb(Ga)
Ex tb IIIC T80ºC IP66 Db
Ta = -40ºC to +55ºC.
Sira 09ATEX2047
ATEX Notified Body: SIRA.

North America:

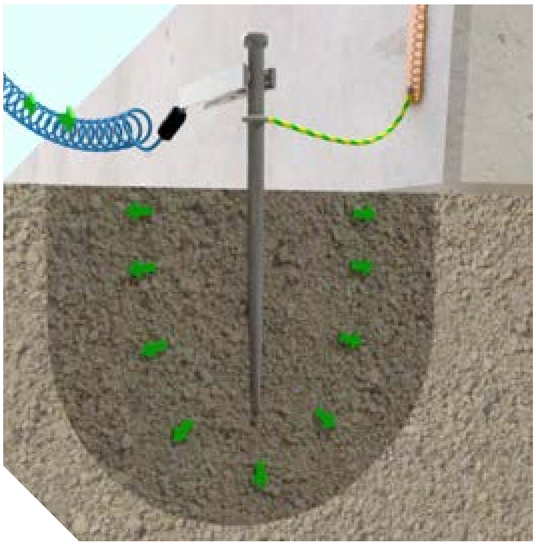
NEC 500 / CEC (Class & Division)
Associated Equipment [Ex ia] for use in
Class I, Div. 1, Groups A, B, C, D;
Class II, Div. 1, Groups E, F, G;
Class III, Div. 1,
Providing intrinsically safe circuits for
Class I, Div. 1, Groups A, B, C, D;
Class II, Div. 1, Groups E, F, G;
Class III, Div. 1,
When installed per Control Dwg;
ERII-Q-10110 cCSAus
Ta = -25°C to +50°C.
Ta = -13°F to +122°F.
OSHA recognised NRTL: CSA.

NEC 505 & 506 (Class & Zoning)
Class I, Zone 1 [0] AEx d[ia] IIC T6 Gb(Ga) (gas & vapour).
Class II, Zone 21 [20] AEx tD [iaD] 21 T80C (combustible dusts).

CEC Section 18 (Class & Zoning)
Class I, Zone 1[0] Ex d[ia] IIC T6 Gb(Ga)
DIP A21, IP66, T80ºC

Click here for more information

Truck mounted static ground verification with system interlocks and indication



Vacuum trucks and bulk chemical road tankers transferring flammable products require static grounding protection to prevent the build-up of static electricity on the truck or equipment, like hoses, that are connected to the truck. If static electricity is allowed to build up on the truck the discharge of a static spark becomes a very real, but unseen, ignition hazard.

Many trucks recovering or transporting flammable products conduct transfer operations in locations where static grounding systems are not present. This is mostly due to the nature of the operation, which could range from cleaning out a storage tank to delivering product to sites where grounding systems are not installed at the product delivery point.

In situations where grounding systems are not present, grounding is usually achieved with a cable reel that bonds the truck to what is assumed to be a functional grounding point. However, it is impossible for a bonding reel to determine if the grounding point will in fact transfer electrostatic charges to ground.

It is also not possible to monitor the truck's connection to the grounding point for the duration of the transfer operation, which is risky as the driver will not know if the grounding clamp connection is compromised unless he has a visual confirmation of this.

A truck mounted system like the Earth-Rite® MGV removes any risk of "false" grounding points being mistakenly used by the driver. By simply connecting the MGV's clamp to the grounding point, the MGV automatically verifies if the grounding point has a connection to the general mass of the Earth that will prevent the build of static charges on the truck.

Not only does the Earth-Rite® MGV ensure the truck is connected to a verified true earth ground, it also monitors the truck's connection to the verified ground for the duration of the transfer operation.

API RP 2219 states:

5.4.2 Grounding:

Before starting transfer operations, vacuum trucks should be grounded directly to earth or bonded to another object that is inherently grounded such as a large storage tank or underground piping.

5.4.2 Grounding and bonding:

This system (grounding) should provide an electrical contact resistance of less than 10 ohms between the truck and a grounded structure.

IEC 60079-32-1, 8.8.4 "Vacuum trucks" states:

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 rods are required, or there is doubt regarding the quality of site earths, the resistance to earth should be verified prior to any operation. When the truck is connected to a verified earth, the connection resistance between the truck and verified earth should not exceed 10 Ω for pure metallic connections or 1 MΩ for all other connections.

Newson Gale®

Earth-Rite® MGV

ATEX IECEx SIL 2

The **Earth-Rite**® Mobile Ground Verification system (MGV) is a unique, patented technology designed to provide automatic confirmation of a positive electrostatic ground connection for trucks collecting and transferring flammable / combustible products.

The **Earth-Rite** MGV system performs two system checks which ensures the vehicle can dissipate static charges for the duration of the transfer process.

1. Static Ground Verification.

The MGV system ensures the connection resistance of the object that is identified as the ground source to earth, is low enough to safely dissipate static charges from the truck.

2. Continuous Ground Loop Monitoring.

When the Static Ground Verification process is confirmed, the MGV system continuously monitors the connection resistance of the truck to this verified grounding point for the duration of the transfer process. This connection resistance must be maintained at 10 ohms (or less) for the duration of the transfer process.

Two output contacts located in the control unit of the MGV system can interlock with pumps or other control devices to prevent transfer operations should a static ground connection fail to be established or maintained for the transfer process.

When the Static Ground Verification and Continuous Ground Loop Monitoring checks are positive, a cluster of attention grabbing green LEDs pulse continuously informing the operator that the truck is securely grounded.

The driver activates the system by simply connecting the system's grounding clamp to a site designated grounding point, buried metal structure (pipes, storage tanks) or temporary points like buried grounding rods.

Earth-Rite MGV®

Intrinsically Safe circuits delivered via **FM** / **ATEX** certified stainless steel grounding clamps.

Optional 15 m (50 ft.) 2 pole cable reel.

Europe / International:

IECEx
Ex nA nC [ia] IIC T4 Gc(Ga) (gas & vapour).
Ex tb IIIC T70ºC Db (combustible dusts).
Ta = -40ºC to +55ºC.
IECEx SIR 09.0097
IECEx certifying body: SIRA.

ATEX
Ex II 3(1) G
Ex II 2D
Ex nA nC [ia] IIC T4 Gc(Ga)
Ex tb IIIC T70ºC Db
Ta = -40ºC to +55ºC.
Sira 09ATEX2247
ATEX Notified Body: SIRA.

North America:

NEC 500 / CEC (Class & Division)
Associated Equipment [Ex ia] for use in
Class I, Div. 2, Groups A, B, C, D;
Class II, Div. 2, Groups E, F, G
Class III, Div. 2,
Providing Intrinsically Safe circuits for
Class I, Div. 1, Groups A, B, C, D;
Class II, Div. 1, Groups E, F, G;
Class III, Div. 1,
When installed per Control Dwg;
ERII-Q-10165 cCSAus
Ta = -25°C to +55°C.
Ta = -13°F to +131°F.
OSHA recognised NRTL: CSA.

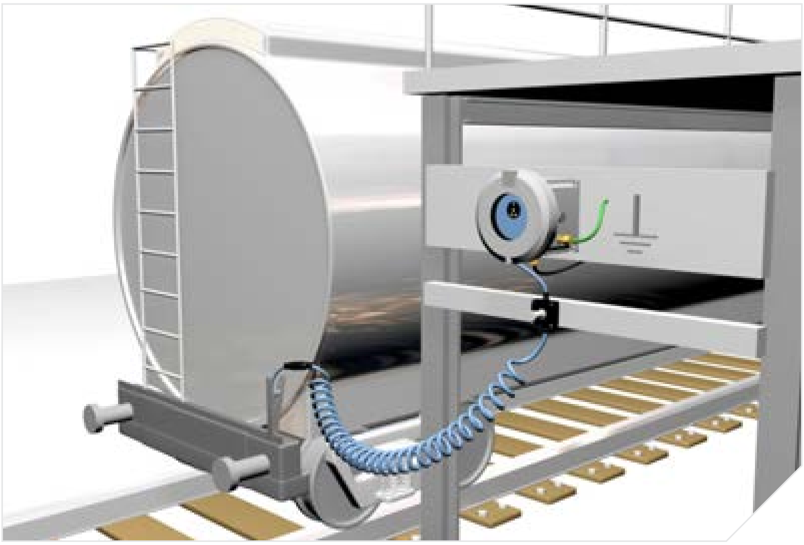
NEC 505 & 506 (Class & Zoning)
Class I, Zone 2, (Zone 0), AEx nA[ia] IIC T4 (gas & vapour).
Class II, Zone 21, AEx tD[iaD] 21, T70ºC, (combustible dusts).

CEC Section 18 (Class & Zoning)
Class I, Zone 2 (Zone 0) Ex nA[ia] IIC T4
DIP A21, IP66, T70ºC

Click here for more information

< Back to Content

Grounding railcars, IBC's and drums with system interlocks and indication



Conductive metal objects like railcars, LACT units, skids and IBCs that come into contact with electrostatically charged liquids can accumulate hazardous levels of electrostatic charge that could discharge static sparks with energies far in excess of the minimum ignition energies of a vast range of combustible gases and vapours.

If an ungrounded object is allowed to accumulate electrostatic charges, the voltage present on the object rises dramatically in a very short space of time. Because the object is at a high voltage, it is seeking to find ways of discharging this excess energy and the most efficient way of doing this is to discharge the excess charge in the form of a spark.

Grounded objects that are in close proximity to charged objects are good targets for electrostatic discharges. Permitting the uncontrolled accumulation of static electricity in an EX / HAZLOC atmosphere is no different to having an engine's spark plug exposed to a potentially flammable atmosphere.

If the transfer system is not grounded, the electrostatic voltage of objects like railcars can build up to hazardous levels in less than 20 seconds.

A grounding system that combines a simple visual "GO / NO GO" communication via indicators with interlock control capability is the most effective means of controlling the risk of ignitions caused by static electricity during operations involving railcars, IBCs and drums. Interlocking the transfer system with the grounding system is probably the ultimate layer of protection equipment specifiers and designers can take to ensure the equipment is grounded.

IEC 60079-32-1, 13.3.1.4
"Movable metal items" states:

Where such situations are expected, the object should be earthed by an alternative means (e.g. earthing cable). A connection resistance of 10 Ω between the cable and the item to be earthed is recommended. Earthing and bonding need to be continuous during the period that charge build-up could occur and cause electrostatic hazards.

NFPA 77, 12.4.1 & 12.4.2.
"Railroad Tank Cars" states:

In general, the precautions for railroad tank cars are similar to those for tank vehicles specified in **Section 12.2***.

Many tank cars are equipped with non conductive bearings and nonconductive wear pads located between the car itself and the trucks (wheel assemblies). Consequently, resistance to ground through the rails might not be low enough to prevent accumulation of a static charge on the tank car body. Therefore, bonding of the tank car body to the fill system piping is necessary to protect against charge accumulation.

***Section 12.2:**

Tank trucks should be bonded to the fill system, and all bonding and grounding should be in place prior to starting operations. Ground indicators, often interlocked with the filling system, frequently are used to ensure bonding is in place.

Newson Gale®

Earth-Rite® PLUS™

ATEX IECEx SIL 2 INMETRO

Precision and reliability is what the **Earth-Rite® PLUS™** provides to QHSE professionals and engineers who are tasked with protecting personnel and plant assets from the ignition hazards of static electricity during railcar, skid, and IBC loading/unloading operations.

The **Earth-Rite® PLUS** ensures that a continuously monitored 10 ohm, or less, connection is present between the grounded object and a designated true earth grounding point. This feature provides equipment specifiers with the ability to demonstrate compliance with the grounding and bonding recommendations of IEC 60079-32, NFPA 77 and API RP 2003.

Three green LEDs continuously pulse informing process operators that the object to be protected from static discharges is grounded. When the system is not in use, or when it detects the resistance in the static grounding path is higher than 10 ohms, a red LED illuminates the indicator panel located inside the enclosure.

The Continuous Ground Loop Monitoring feature monitors the resistance of the ground loop from the grounded object through to the site's verified true earth grounding point. If the Earth-Rite® PLUS detects that resistance in the ground loop is higher than 10 ohms, it engages a pair of volt free changeover contacts that can be interlocked with the product transfer system.

The primary volt free contact can be interlocked with electro-mechanical devices or PLC systems to shut down the flow of product. The secondary contact can interface with attention grabbing audible alarms or strobe lights to provide an extra layer of protection over the hazard.

Europe / International:

IECEx
Ex d[ia] IIC T6 Gb(Ga) (gas & vapour).
Ex tb IIIC T80°C IP66 Db (combustible dusts).
Ta = -40°C to +55°C.
IECEx SIR 09.0018
IECEx certifying body: SIRA.

ATEX
Ex II 2(1)GD
Ex d[ia] IIC T6 Gb(Ga)
Ex tb IIIC T80°C IP66 Db
Ta = -40°C to +55°C.
Sira 09ATEX2047
ATEX Notified Body: SIRA.

North America:

NEC 500 / CEC (Class & Division)
Associated Equipment [Ex ia] for use in
Class I, Div. 1, Groups A, B, C, D;
Class II, Div. 1, Groups E, F, G;
Class III, Div. 1,
Providing intrinsically safe circuits for
Class I, Div. 1, Groups A, B, C, D;
Class II, Div. 1, Groups E, F, G;
Class III, Div. 1,
When installed per Control Dwg;
ERII-Q-10110 cCSAus
Ta = -25°C to +50°C.
Ta = -13°F to +122°F.
OSHA recognised NRTL: CSA.

NEC 505 & 506 (Class & Zoning)
Class I, Zone 1 [0] AEx d[ia] IIC T6 Gb(Ga) (gas & vapour).
Class II, Zone 21 [20] AEx tD [iaD] 21 T80C (combustible dusts).

CEC Section 18 (Class & Zoning)
Class I, Zone 1 [0] Ex d[ia] IIC T6 Gb(Ga)
DIP A21, IP66, T80°C

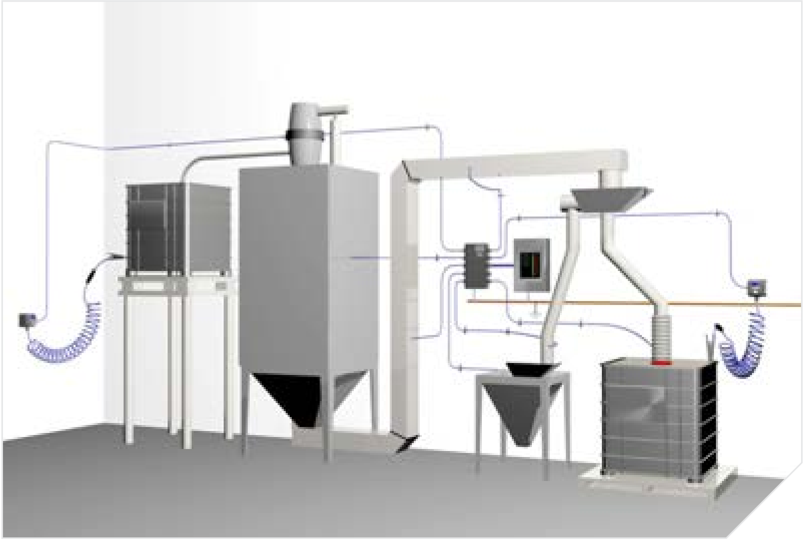
Earth-Rite® PLUS in Ex(d)/XP enclosure.

Intrinsically Safe circuits delivered via **FM** / **ATEX** certified stainless steel grounding clamps.

Optional 15 m (50 ft.) 2 pole cable reel.

Click here for more information

Grounding interconnected plant assemblies and piping with system interlocks and indication



Powder processing operations can generate vast quantities of electrostatic charge via the movement of powder. The most common cause behind the electrostatic charging of powder processing equipment is "tribo-electrification", which is the contact and separation of the powder with processing equipment, the powder itself or other factors that can cause charging, like surface contaminants.

In pharmaceutical operations, equipment like powder conveying systems, micronizers, blenders and sieve stacks all make up multiple component assemblies that can accumulate high levels of electrostatic charge should any of the components be isolated from a true earth ground.

Regular disassembly for cleaning and maintenance can result in bonding connections being missed or not being made correctly when the equipment is reassembled.

Regular flexing, vibration and corrosion can also degrade assembly connections so it is imperative to ensure that no parts in the assembly become isolated from a true earth ground source.

The most effective way of ensuring that equipment used in powder processing operations cannot accumulate static electricity is to provide a dedicated static grounding solution that will monitor the ground connection of components at risk of static charge accumulation and alert personnel to a potential hazard should a component lose its ground connection. This is especially important if the ground connection point to the equipment is not readily visible or easily accessible.

Powder processing equipment presents more of a challenge compared to standard applications as there are many metal parts that can make up larger assemblies that are electrically isolated from each other. It is therefore important to ensure that multiple components that come into contact with charged powders have a means of being monitored for static grounding protection purposes.

NFPA 77, 15.3.1 & 15.3.2
"Mechanisms of Static Electric Charging" states:

Contact static electric charging occurs extensively in the movement of powders, both by surface contact and separation between powders and surfaces and by contact and separation between individual powder particles.

Charging can be expected any time a powder comes into contact with another surface, such as in sieving, pouring, scrolling, grinding, micronizing, sliding and pneumatic conveying.

IEC 60079-32-1, 13.4.1
"The establishment and monitoring of earthing systems" states:

Where the bonding/earthing system is all metal, the resistance in continuous earth paths typically is less than 10 Ω. Such systems include those having multiple components. A greater resistance usually indicates that the metal path is not continuous, usually because of loose connections or corrosion. An earthing system that is acceptable for power circuits or for lightning protection is more than adequate for a static electricity earthing system.

< Back to Content

Earth-Rite® MULTIPOINT

ATEX

A specialised static grounding system, like the **Earth-Rite® MULTIPOINT**, provides the benefits of eight discrete static grounding systems rolled up into a single package, providing monitored static grounding protection for multiple components of powder processing assemblies through a discrete wall mounted monitoring unit with eight ground status indicators for each component being monitored.

The **Earth-Rite® MULTIPOINT** will continuously check that all components are connected to a reference earth grounding point, thus ensuring that the ground path resistance between the process equipment and the reference ground never exceeds 10 ohms. A monitored ground path resistance of 10 ohms or less is recommended in IEC 60079-32-1 and NFPA 77.

If the Earth-Rite® MULTIPOINT's monitoring unit detects that an assembly component is not grounded, it will send a signal to the controller which, if interlocked with the circuit powering the operation, can halt the process, thereby eliminating the electrostatic charging mechanism and potential charging of un-grounded equipment.

If such an event does occur, the plant's technicians can rapidly identify which connection needs to be investigated. They can do this by referencing the monitoring unit's ground status indicator panel which will indicate which channel needs to be checked. Once the connection to the equipment is re-established the Earth-Rite® MULTIPOINT controller will provide a permissive condition for the process to start again.

Earth-Rite® MULTIPOINT

Intrinsically Safe circuits delivered via **FM** / **ATEX** certified stainless steel grounding clamps.

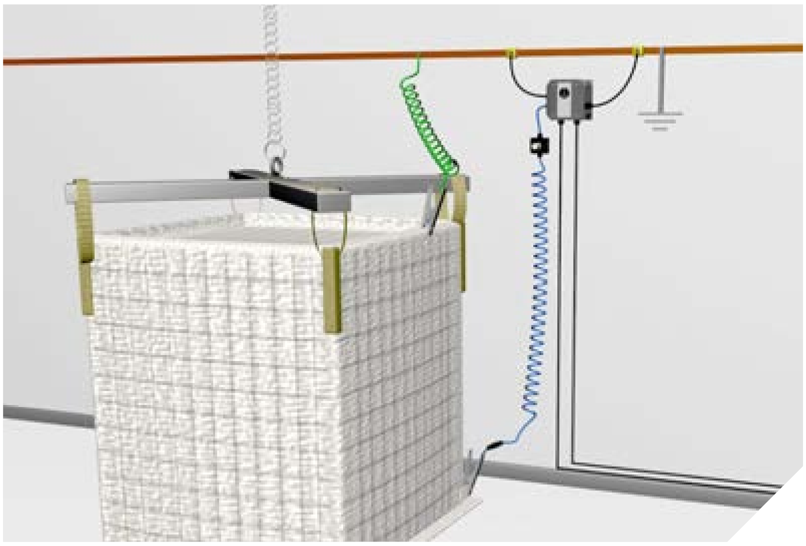
Intrinsically Safe circuits delivered via equipotential connectors.

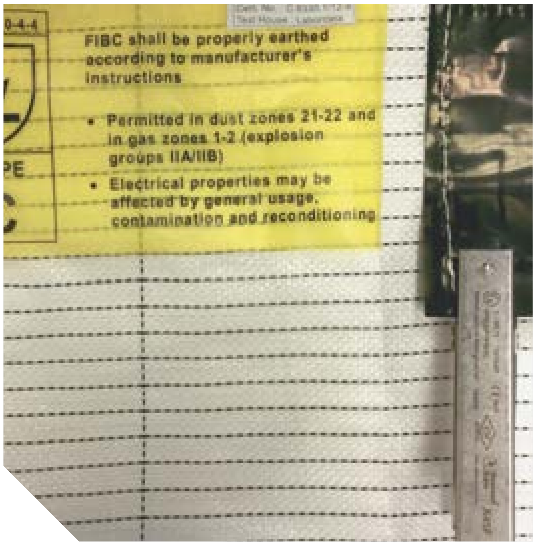
Europe

ATEX
II (1) GD [EEx ia] IIC
Ta = -20°C to +40°C
Sira 01ATEX2235
ATEX Notified Body: SIRA

Click here for more information

Grounding Type C FIBC with system interlocks and indication





Type C bags are designed to dissipate static electricity through static dissipative threads that are interwoven through the bag's material. Grounding tabs located on the bags are points where grounding systems can be connected to ensure static electricity does not accumulate on the bag. To ensure bags destined for use in hazardous areas will not accumulate static electricity there are several standards that provide guidance on the key parameters to which Type C bags must comply.

The primary standard for the electrostatic classification of Type C bags is IEC 61340-4-4, "Electrostatics – Part 4-4: Standard test methods for specific applications – Electrostatic classification of flexible intermediate bulk containers (FIBC)." This standard sets out the essential requirements of Type C bags in relation to eliminating the risk of charge accumulation on the bag. It states that the resistance through the bag should be less than 1×10^7 ohms (10 meg-ohm). NFPA 77, "Recommended Practice on Static Electricity", also recommends this value of resistance.

Grounding Type C bags can be achieved with either passive (single pole clamp and cable) or through active means (monitoring systems).

Given the magnitude of charge that can build up on bags an active grounding system is the better choice. This is because the system can determine whether or not the bag's construction complies with the relevant standards and will also ensure the bag is grounded for the duration of the filling / emptying operation. The primary benefit of checking the resistance through the bag is to ensure that after many cycles of repeated use, the static dissipative threads are functioning correctly and, more importantly, to ensure that bags not of Type C construction are not permitted to be used in the hazardous area.

Additional benefits with grounding systems are that they can control the movement of the powder through output contacts interlocked with valves or PLCs.

IEC 61340-4-4 "Electrostatics – Part 4-4: Standard test methods for specific applications – Electrostatic classification of flexible intermediate bulk containers (FIBC)" states:

7.3.1. Type C FIBC

A Type C FIBC intended for use in the presence of flammable vapours or gases, or combustible dusts with ignition energies of 3 mJ or less shall have a resistance to groundable point of less than 1×10^7 Ω when tested according to 9.3. Additionally, the FIBC shall be constructed entirely from conductive material or at least shall contain fully inter-connected conductive threads or tapes with a maximum spacing of 20 mm if the threads or tapes are in a stripe pattern, or 50 mm if they are in a grid pattern.

NFPA 77, 16.6.6.3, "Type C FIBC" states:

The recommendations for conductive IBCs given in 10.1.4 also apply to conductive FIBCs. A grounding tab that is electrically connected to the conductive material or threads is provided and is intended to be connected to a ground point when the FIBC is filled or emptied. The resistance between the conductive elements in the FIBC and the grounding tabs should be less than 1.0×10^7 ohms.

Earth-Rite® FIBC

ATEX IECEx SIL 2

The **Earth-Rite® FIBC™** system validates and monitors the resistance of Type C FIBC bags ensuring that the conductive elements of the bag are capable of dissipating electrostatic charges in compliance with IEC 61340-4-4 "Standard test methods for specific applications - Electrostatic classification of flexible intermediate bulk containers (FIBC)" and NFPA 77 "Recommended Practice on Static Electricity".

During the bag filling / emptying process the Earth-Rite® FIBC system continuously monitors the resistance of the bag so that if it rises above 1 x 10^7 ohms (10 meg-ohm) this dangerous situation can be indicated to operators and the process halted, either manually or via the system's pair of NO/NC volt free contacts.

When the Earth-Rite® FIBC detects that the resistance in the ground loop through the bag, through the plant's verified earth ground, back to the system is less than 1 x 10^7 ohms, it energises the volt free output contacts and three green LEDs continuously pulse informing operators that the FIBC bag to be protected from static discharges is securely grounded.

When the Earth-Rite® FIBC is not in use, or when it detects the resistance in the static dissipative loop is higher than 1 x 10^7 ohms, a red LED illuminates the indicator panel located inside the static dissipative GRP indicator station.

Newson Gale can also provide FIBC grounding systems that can validate and monitor Type C bags designed with an upper resistance threshold of 1 x 10^8 ohms (100 meg-ohm).

Europe / International:	North America:
IECEx Ex nA nC [ia] IIC T4 Gc(Ga) (gas & vapour). Ex tb IIIC T70°C Db (combustible dusts). Ta = -40°C to +55°C. IECEx SIR 09.0097 IECEx certifying body: SIRA. **ATEX** II 3(1) G Ex II 2D Ex nA nC [ia] IIC T4 Gc(Ga) Ex tb IIIC T70°C Db Ta = -40°C to +55°C. Sira 09ATEX2247 ATEX Notified Body: SIRA.	**NEC 500 / CEC (Class & Division)** Associated Equipment [Ex ia] for use in Class I, Div. 2, Groups A, B, C, D; Class II, Div. 2, Groups E, F, G Class III, Div. 2, Providing Intrinsically Safe circuits for Class I, Div. 1, Groups A, B, C, D; Class II, Div. 1, Groups E, F, G; Class III, Div. 1, When installed per Control Dwg; ERII-Q-10165 cCSAus Ta = -25°C to +55°C. Ta = -13°F to +131°F. OSHA recognised NRTL: CSA. **NEC 505 & 506 (Class & Zoning)** Class I, Zone 2, (Zone 0), AEx nA[ia] IIC T4 (gas & vapour). Class II, Zone 21, AEx tD[iaD] 21, T70°C, (combustible dusts). **CEC Section 18 (Class & Zoning)** Class I, Zone 2 (Zone 0) Ex nA[ia] IIC T4 DIP A21, IP66, T70°C

Earth-Rite® FIBC
housed in a static dissipative GRP enclosure

FM / ATEX aproved stainless steel monitoring clamp delivers intrinsically safe monitoring signal from the Earth-Rite® FIBC to the Type C bag (supplied with system).

FM / ATEX aproved stainless steel grounding clamp returns the intrinsically safe monitoring signal from the bag to the Earth-Rite® FIBC (recommended).

Click here for more information

< Back to Content

Panel mounted grounding with system interlocks

In limited circumstances electrical contractors may need to provide a static grounding solution as part of a specialised instrumentation/automation project. To satisfy the requirements of bespoke projects designers are often limited by standard "off-the-shelf" static grounding solutions that cannot be customised to provide a good "fit" for their specific application design requirements. A suitable design trade-off is to specify static grounding relays that can monitor a range of resistance values.

Although installations of this type are limited by not having ground status indication provided at the point of grounding, the normal application for such relays is to monitor the ground status of permanent fixed equipment connections or rotating machinery and using an internal relay to provide outputs to PLCs or customised HMI panels.

Ensuring that a rotating drum or impeller is correctly grounded to 10 ohms can be difficult as it is not always possible to rely on a consistent and smooth connection between the rotating shaft and the chassis of the machine.
Due to the design of bearings, etc. a good method of guaranteeing ground continuity is to use a non-hazardous area mounted ground monitoring relay to test the ground connection to the drum or impeller via a pair of carbon brushes or a slip ring, acting on the shaft.

Such relays may also be used to test the ground connection to key items of fixed plants, such as large storage vessels for flammable liquids.

Relays that have a range of resistance settings, like the Earth-Rite® OMEGA II are normally mounted on DIN rails inside electrical panels installed in non-hazardous areas.

< Back to Content

Earth-Rite® OMEGA

ATEX IECEx SIL 2

The **Earth-Rite® OMEGA II** is a compact panel mounted static grounding module that can monitor a range of resistance values, based on the grounding application and installation requirements of specific processes.

Earth-Rite® OMEGA

The **OMEGA II** monitors the resistance of the static grounding circuit for processes where a risk of static charge accumulation on the equipment could result in an incendive electrostatic spark within locations that have potentially flammable atmospheres present.

It is specified primarily for applications where an alternative means of ground status indication is provided, e.g. via panel mounted indicators or remote indicator stations, as opposed to more regular grounding solutions in the **Earth-Rite®** range.

The DIN rail mountable module can be located in an electrical panel mounted in a non-hazardous area or inside an Ex(d) certified enclosure located inside the hazardous area.

Two volt free changeover contacts can be used to switch power to additional ground status indicators or interlock with the process to shutdown product transfer when the OMEGA II detects an open circuit on the path to ground.

The OMEGA II is designed specifically for monitoring the static grounding of process equipment and has 4 resistance set points depending on the installation and operating characteristics of the application. It can also be installed to monitor the resistance of bonding circuits and lightning protection grounding points.

Up to four (4) OMEGAs can be powered by a single Newson Gale power supply.

Europe / International:

IECEx
[Ex ia Ga] IIC (gas & vapour).
[Ex ia Da] IIIC (combustible dusts).
Ta = -40ºC to +60ºC.
IECEx SIR 13.0003X
IECEx certifying body: SIRA.

ATEX
Ex II (1)GD
[Ex ia Ga] IIC (gas & vapour).
[Ex ia Da] IIIC (combustible dusts).
Ta = -40ºC to +60ºC.
Sira 13ATEX2009X
ATEX Notified Body: SIRA.

North America:

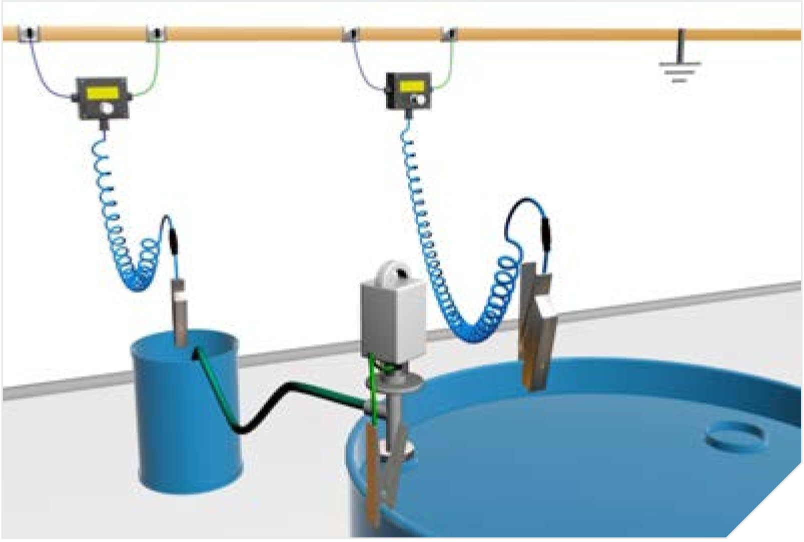
NEC 500 / CEC (Class & Division)
Intrinsically safe associated apparatus for supply to locations classified:
Class I, Div. 1, Groups A, B, C, D.
Class II, Div. 1, Groups E, F, G.
Class III, Div. 1.
Ta = -40°C to +60°C.
Ta = -40°F to +140°F
OSHA recognised NRTL: CSA.

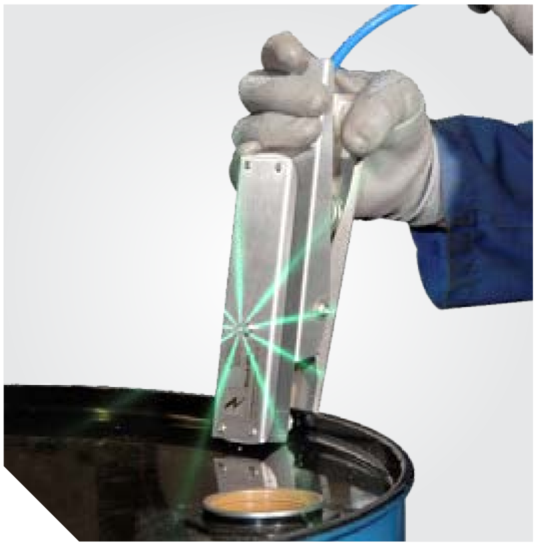
NEC 505 & 506 (Class & Zoning)
Class I, Zone 0, [AEx ia], IIC (gas & vapour).
Class II, Zone 20, [AEx iaD], IIIC (combustible dusts).

CEC Section 18 (Class & Zoning)
[Ex ia] IIC

Click here for more information

Grounding drums and containers with indication





Static grounding solutions that combine an extra layer of protection provided by interlocks may not be a feasible installation option for certain applications and locations. In most scenarios this will be because there is no means of interfacing the output contacts of **Earth-Rite**® systems with the systems or power source controlling equipment that is capable of generating static electricity.

Such restrictions do not mean that specifiers have to take a downward leap to passive grounding clamps (non-monitored). An intermediate layer of static grounding protection is possible through the specification of **Bond-Rite**® solutions that can continuously monitor and verify that the resistance between the equipment to be grounded and a true earth ground source is 10 ohms or less.

The Bond-Rite® CLAMP is one example of a grounding solution that not only continuously monitors the resistance in the ground path between the equipment to be grounded and a true earth ground source, it also provides process operators with a visual reference point to ensure the equipment is grounded.

This visual reference is provided by a green LED mounted in the body of the Bond-Rite® CLAMP. When the Bond-Rite® has a verified and continuous resistance of 10 ohms or less between the object at risk of discharging static sparks and a verified true earth ground source the green LED pulses continuously.

This patented feature enables process operators to take active responsibility for their own safety and that of their colleagues by repeatedly referring back to the status of the LED indicator. If the LED indicator is not pulsing, they can take action to halt the process to eliminate charge generation or sound an alarm to draw attention to the hazard.

Just because a particular installation or application does not lend itself to an inter-lockable grounding solution, specifying the Bond-Rite® CLAMP enables specifiers to maintain an effective layer of protection over the ignition risks of electrostatic discharges.

IEC 60079-32-1, 13.3.1.4 “Movable metal items” states:

Portable conductive items (e.g. trolleys equipped with conductive rollers, metal buckets etc.) are earthed through their contact with dissipative or conductive floors.

However, in the presence of contaminants like dirt, or paint on the contact surface of either the floor or the object the leakage resistance to earth may increase to an unacceptable value resulting in possible hazardous electrostatic charge on the object. Where such situations are expected, the object should be earthed by an alternative means (e.g. earthing cable). A connection resistance of 10 Ω between the cable and the item to be earthed is recommended.

NFPA 77, 7.4.1.3.1, “Bonding and Grounding” states:

Where the bonding/grounding system is all metal, resistance in continuous ground paths typically is less than 10 ohms. Such systems include those having multiple components. Greater resistance usually indicates that the metal path is not continuous, usually because of loose connections or corrosion.

< Back to Content

Bond-Rite® CLAMP

ATEX IECEx

The **Bond-Rite® CLAMP**, patented exclusively by Newson Gale, is the only static grounding clamp that provides operators with a visual reference that potentially charged equipment is connected to a verified static grounding point.

The **Bond-Rite® CLAMP** contains a bright green LED which pulses continuously when it detects that the resistance between the equipment to be grounded and the site's verified earth ground (e.g. copper tape) is 10 ohms or less.

Once connected the Bond-Rite® CLAMP continuously monitors the resistance of the circuit between the equipment and the verified ground point (e.g. wall-mounted bus bar).

The pulsing green LED provides process operators with a continuous visual reference point that enables them to monitor the ground status of equipment at risk of accumulating static electricity and discharging static sparks.

Highly visible LED housed in grounding clamp ensures operators know when low resistance connection is achieved with potentially charged equipment.

Tungsten carbide teeth bite through product deposit build up, rust & drum coatings to ensure proper bonding connections are made.

Stainless steel clamps designed to withstand use in tough chemical processing and industrial environments.

Quick Connect provides personnel with the flexibility of removing the clamp from zoned / classified areas for battery replacement.

10 ohms loop resistance monitoring compliant with international Recommended Practice*.

Junction box mounted stowage pin provides operators with location to return the clamp when the process is complete.

Europe / International:	North America:
IECEx Ex ia IIC T4 Ga (gas & vapour). Ex ia IIIC T135°C Da (combustible dusts). Ta = -40ºC to +60ºC. IECEx SIR11.0141 IECEx certifying body: SIRA. **ATEX** Ex II 1 GD Ex ia IIC T4 Ga (gas & vapour). Ex ia IIIC T135°C Da (combustible dusts). Ta = -40ºC to +60ºC. Sira 11ATEX2277 ATEX Notified Body: SIRA.	**NEC 500 / CEC (Class & Division)** Intrinsically safe equipment Exia for use in: Class I, Div. 1, Groups A, B, C, D. Class II, Div. 1, Groups E, F, G. Class III, Div. 1. Ta = -40°C to +60°C. Ta = -40°F to +140°F OSHA recognised NRTL: CSA.

Bond-Rite® CLAMP in rugged stainless steel housing

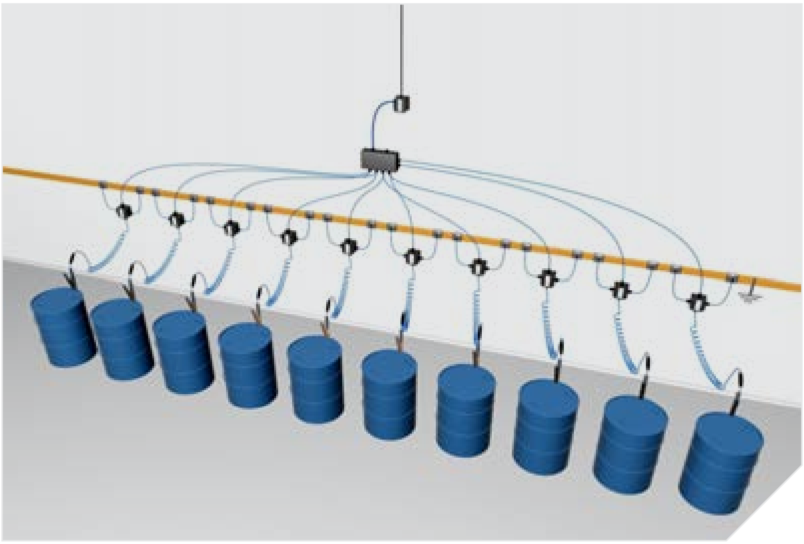
Tungsten carbide teeth set in a side by side configuration penetrate coatings, products deposits and rust to make a solid connection to equipment.

Equipment specifiers can order the Bond-Rite CLAMP with 2-pole Cen-Stat cable on standard spiral lengths of 3 m (10 ft.), 5 m (16 ft.) and 10 m (32 ft.) of cable. All cables supplied with universal quick connects for easy connection.

Click here for more information

< Back to Content

Grounding drums and containers with indication



Static grounding solutions that combine an extra layer of protection provided by interlocks may not be a feasible installation option for certain applications and locations. In most scenarios this will be because there is no means of interfacing the output contacts of **Earth-Rite®** systems with the systems or power source controlling equipment that is capable of generating static electricity.

Such restrictions do not mean that specifiers have to take a downward leap to passive grounding clamps (non-monitored). An intermediate layer of static grounding protection is possible through the specification of **Bond-Rite®** solutions that can continuously monitor and verify that the resistance between the equipment to be grounded and a true earth ground source is 10 ohms or less.

The Bond-Rite® REMOTE is one example of a grounding solution that continuously monitors the resistance in the ground path between the equipment to be grounded and a true earth ground source. It also provides process operators with a visual reference point to ensure the equipment is grounded.

This visual reference is provided by a green LED located on a wall mountable indicator station which houses the monitoring circuit PCB. When the Bond-Rite® REMOTE has verified the resistance between the object at risk of discharging static sparks and a verified true earth ground source is 10 ohms or less the green LED pulses continuously.

The Bond-Rite® REMOTE can be specified for installations where it is preferable to have the operator's visual reference located on a wall away from the clamp connection point to the equipment at risk of static charge accumulation.

Just because a particular installation or application does not lend itself to an inter-lockable grounding solution, specifying the Bond-Rite® REMOTE enables specifiers to maintain an effective layer of protection over the ignition risks of electrostatic discharges.

IEC 60079-32-1, 13.3.1.4 "Movable metal items" states:

Portable conductive items (e.g. trolleys equipped with conductive rollers, metal buckets etc.) are earthed through their contact with dissipative or conductive floors.

However, in the presence of contaminants like dirt, or paint on the contact surface of either the floor or the object the leakage resistance to earth may increase to an unacceptable value resulting in possible hazardous electrostatic charge on the object. Where such situations are expected, the object should be earthed by an alternative means (e.g. earthing cable). A connection resistance of 10 Ω between the cable and the item to be earthed is recommended.

NFPA 77, 7.4.1.3.1, "Bonding and Grounding" states:

Where the bonding/grounding system is all metal, resistance in continuous ground paths typically is less than 10 ohms. Such systems include those having multiple components. Greater resistance usually indicates that the metal path is not continuous, usually because of loose connections or corrosion.

< Back to Content

Bond-Rite® REMOTE

ATEX IECEx

The precision and reliability of the **Bond-Rite® REMOTE** provides enhanced safety and security by continuously testing the connection of the clamp to the container or other conductive item of plant in a complete loop made through the designated grounding point.

The **Bond-Rite® REMOTE** delivers a continuously monitored circuit between grounded equipment and verified ground points (e.g. wall-mounted bus bar).

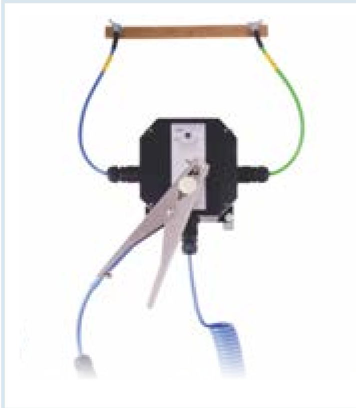
The pulsing green LED provides process operators with a continuous visual reference point that enables them to monitor the ground status of equipment at risk of accumulating static electricity and discharging static sparks.

The standard GRP enclosure is static dissipative and suitable for general processing environments. The stainless steel enclosure (SS 316) is designed to cater for hygienic or corrosive environment specifications.

Both enclosures provide a minimum IP 65 degree of ingress protection and are suitable for both indoor and outdoor installation.

The Bond-Rite® REMOTE can be powered with an intrinsically safe 9V battery (included). The **Bond-Rite® REMOTE EP** utilises an external 230/115 V AC power supply which can power up to 10 individual indicator stations.

The flexible external power supply can be located in both the 'hazardous' (Zone 2/22 - Div.2) and 'non-hazardous' areas, with the indicator stations mounted in the zoned / HAZLOC area (Zone 0 / Div.1) or lower.



Bond-Rite® REMOTE in static dissipative GRP enclosure.

Bond-Rite® REMOTE in stainless steel enclosure.

Bond-Rite® REMOTE EP external power supply can power up to 10 indicator stations.

Europe / International:

IECEx
Ex ia IIC T4 Ga (Gas & Vapour).
Ex ta IIIC T135ºC Da (Combustible Dusts).
Ta = -40ºC to +60ºC.
IECEx SIR 09.0023X
IECEx certifying body: SIRA.

ATEX
Ex II 1 GD
Ex ia IIC T4 Ga
Ex ta IIIC T135ºC Da
Ta = -40ºC to +60ºC.
Sira 09ATEX2158X
ATEX Notified Body: SIRA.

North America:

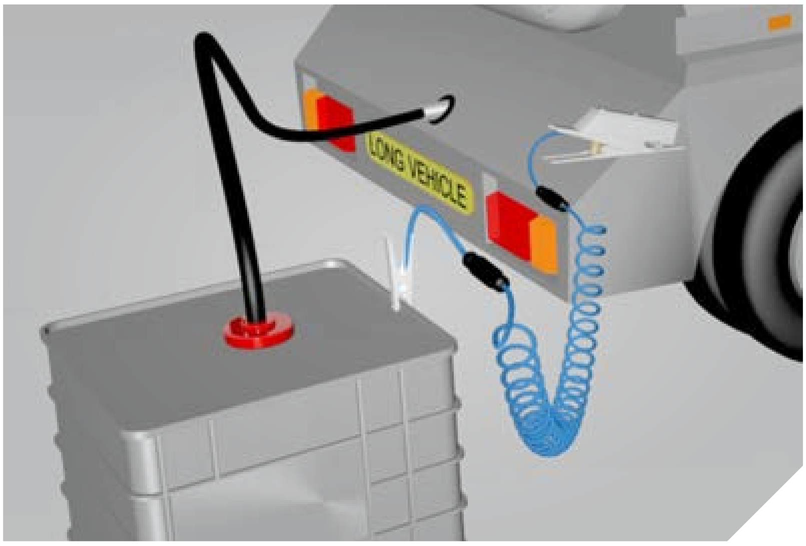
NEC 500 / CEC (Class & Division)
Intrinsically safe equipment Exia for use in:
Class I, Div. 1, Groups A, B, C, D.
Class II, Div. 1, Groups E, F, G.
Class III, Div. 1.
Ta = -40°C to +60°C.
Ta = -40°F to +140°F
BRR-Q-11185 cCSAus
OSHA recognised NRTL: CSA.

NEC 505 & 506 (Class & Zoning)
Class I, Zone 0, AEx ia IIC T4 Ga
(Gas & Vapour).
Class II, Zone 20, AEx iaD 20 T135ºC,
(Combustible Dusts).

CEC Section 18 (Class & Zoning)
Class I, Zone 0, Ex ia IIC T4 Ga
DIP A20, IP66, T135ºC

Click here for more information

Bonding equipment with a portable bonding device with indication



In scenarios where objects need to be bonded to prevent sparks from discharging between the objects, operators normally utilise bonding cables with basic clamps or alligator clips connected at both ends. Providing process operators with a visual indication of a verified bond ensures operators do not proceed with the transfer unless they know both objects are the same voltage.

Applications where bonding can be required ranges from trans-loading products from one mobile source to a mobile or fixed container. Such operations typically fall into two modes of product transfer.

One mode is called “trans-loading” which involves transferring product from a large, mobile bulk container, like a road tanker or railcar, into a smaller mobile object like an intermediate bulk container or a drum (and vice-versa).

Another common mode of product transfer is where a product is being manually deposited from a hand held container into another container or a process vessel. Bonding both the source container and receiving vessel ensures there can be no static sparks discharges between both objects, especially when they are in such close proximity.

It must be emphasised that bonding conductive objects ensures both objects are the same voltage, thereby eliminating the risk of sparking between both objects.

It does not mean that the bonded objects will not discharge sparks to objects at a lower voltage, particularly objects that are grounded (i.e. have no voltage as they are connected to the mass of earth).

The optimum solution is to provide operators with a visual verification of a secure and continuous bond between the objects and ensure that one of the objects is connected to a verified ground source.

Both IEC 60079-32-1, 13.1 “Earthing and bonding” and NFPA 77, 7.4. “Charge Dissipation” state:

Bonding is used to minimize the potential difference between conductive objects to an insignificant level, even where the resulting system is not earthed (grounded). Earthing, on the other hand, equalizes the potential difference between the objects and the earth.

API RP 2003, 3.2 “Bonding” states:

The practice of providing electrical connections between isolated conductive parts of a system to preclude voltage differences between the parts.

In field use, a strong wire resistant to physical damage may be needed, in which case a bond wire may be sized for physical or mechanical strength.

The process of connecting two or more conductive objects together by means of a conductor so that they are the same electrical potential does not necessarily mean they are the same potential the earth.

< Back to Content

Newson Gale®

Bond-Rite® EZ

ATEX IECEx CSA C US

The **Bond-Rite® EZ** is an easy to use hand-held portable static bonding device that can quickly and securely establish and verify an equipotential bond between equipment for operations conducted in EX areas.

The **Bond-Rite® EZ** is a flexible "go-anywhere" hazardous area certified static bonding device that verifies when two metal objects, that are at risk of discharging static sparks, are bonded together with a resistance of 10 ohms or less.

When the Bond-Rite® EZ detects that the resistance between the equipment is 10 ohms or less the green LED pulses continuously.

Once connected the Bond-Rite® EZ continuously monitors the resistance of the circuit between the bonded equipment.

The pulsing green LED provides process operators with a continuous visual reference point that enables them to monitor the bonding status of the equipment.

In addition to bonding, the Bond-Rite® EZ can be used by competent electrical personnel to ground objects at risk of electrostatic charging.

In such scenarios, the competent electrical person must be sure that the grounding point, e.g. wall mounted bus-bar, has a verified connection to the general mass of the earth.

The Bond-Rite® EZ houses the ground loop monitoring circuit and a bright green LED in a rugged stainless steel enclosure.

10 ohms is the benchmark resistance specified in IEC 60079-32-1 and NFPA 77.

Bond-Rite® EZ

Both standard and large heavy duty 2-pole clamps can be assembled to the Bond-Rite EZ.

Equipment specifiers can order the Bond-Rite EZ with 2-pole Cen-Stat cable on standard spiral lengths of 3 m (10 ft.), 5 m (16 ft.) and 10 m (32 ft.) of cable. All cables supplied with universal quick connects for easy connection.

Europe / International:

IECEx
Ex ia IIC T4 Ga (gas & vapour).
Ex ia IIIC T135°C Da (combustible dusts).
Ta = -40ºC to +60ºC.
IECEx SIR11.0141
IECEx certifying body: SIRA.

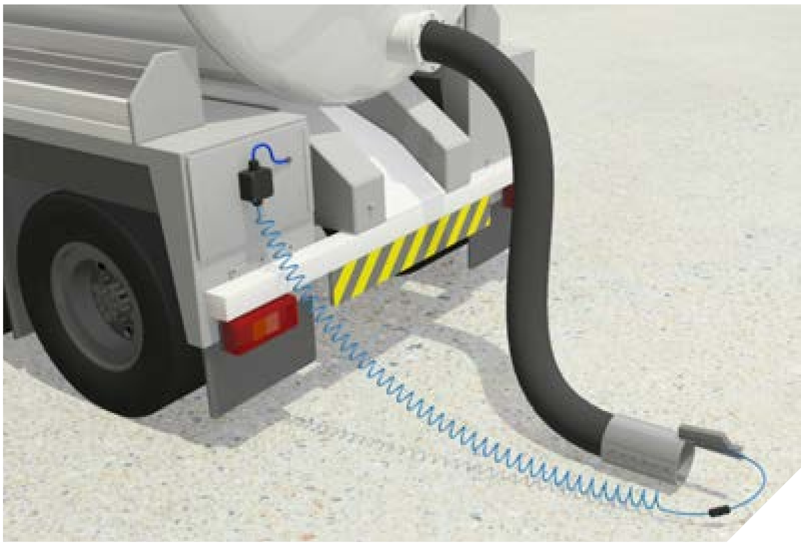
ATEX
Ex II 1 GD
Ex ia IIC T4 Ga (gas & vapour).
Ex ia IIIC T135°C Da (combustible dusts).
Ta = -40ºC to +60ºC.
Sira 11ATEX2277
ATEX Notified Body: SIRA.

North America:

NEC 500 / CEC (Class & Division)
Intrinsically safe equipment Exia for use in:
Class I, Div. 1, Groups A, B, C, D.
Class II, Div. 1, Groups E, F, G.
Class III, Div. 1.
Ta = -40°C to +60°C.
Ta = -40°F to +140°F
OSHA recognised NRTL: CSA.

Click here for more information

Hose testing and electrical continuity testing with visual indication



Hoses play an important role in hazardous area operations and owing to their direct interaction with moving liquids and powders are especially at risk of becoming electrostatically charged. At no point in its structure should the metal components of a hose be permitted to accumulate static electricity.

Examples of metal components that have a potential to accumulate hazardous levels of electrostatic charge are end couplings and metal wire helixes that run through the structure of the hose. If components like these become isolated they can accumulate static electricity and rapidly build up a voltage capable of discharging a static spark into the potentially combustible atmosphere in which the driver or operator is working.

Periodic resistance testing of hoses with multi-meters provides some level of comfort in terms of ensuring faulty hoses are taken out of service at the time of testing. However, there are plenty of operating environments that place a tremendous strain on the durability of hoses. For example, a metal wire helix that detaches from a coupling could go unnoticed by drivers or operators and be used continuously in the field until a scheduled test identifies the isolated components, or worse still, when the isolated components discharge a spark during operations.

Supplying drivers and operators with an easy to use hose continuity tester that provides an LED indicator to indicate a PASS or FAIL test of the hose(s) not only ensures the hoses are functioning correctly prior to every product transfer operation, it also ensures that the assembled hose sections a have low resistance electrical bond connection to the grounded truck.

This ensures that any static electricity generated by the product transfer process is transferred by the hoses to ground, via the truck's verified ground connection and ensures that the metal components of the hoses will not be a spark ignition risk during operations.

IEC 60079-32-1, 7.7.3.3.1 "End-to-end electrical bonding (continuity)."

End-to-end electrical bonding is usually provided by reinforcing helixes, wires embedded in the hose wall, or braided metal sheaths bonded to conductive end couplings. It is important that each bonding wire or reinforcing helix is securely connected to the end couplings.

Connections between bonding wires and couplings should be robust and the resistance between the end couplings should be tested periodically. The frequency and type of testing will depend on the application and should be determined in consultation with the manufacturer.

*IEC 60069-32-1, Table 16 of 7.7.3.4 "Practical hose classifications" recommends a maximum end-to-end resistance of 100 ohms for conductive hoses.

API RP 2219, 5.3. "Conductive and Non-conductive Hose" states:

Vacuum truck operators may use conductive or non-conductive hose (it is sometimes difficult to distinguish between the two). Petroleum industry experience indicates that electrostatic ignitions can present a significant hazard when using non-conductive transfer hose. Any isolated conductive object may accumulate a charge and provide spark gap. Even when using conductive hose, vacuum truck operators should both ground and bond their trucks when practical to reduce the possibility of electrostatic discharges.

< Back to Content

Newson Gale®

OhmGuard®

ATEX IECEx CSA C US

The **OhmGuard®** is an intrinsically safe electrical continuity tester designed to test hoses used on vacuum trucks and road tankers and prior to the transfer of flammable or combustible products. It can also be used to test the electrical continuity of plant equipment relative to verified static grounding points.

The **OhmGuard®** verifies that the electrical continuity of the hose is functioning correctly, thereby ensuring static electricity is not permitted to accumulate on the metal components of the hose and eliminating the risk of a fire or explosion caused by the discharge of a static spark.

The OhmGuard® is easy to operate, does not require any specialist driver training and will indicate, within seconds, if the hoses are safe to use.

The driver simply connects the OhmGuard's cable to a junction box situated on the truck and connects the OhmGuard® clamp to the last hose coupling as illustrated. The green LED housed in the OhmGuard® will pulse continuously if the hose has an electrical continuity of less than 100 ohms with the truck.

The OhmGuard® can also be used to conduct quick tests of the electrical continuity of fixed or semi-permanent plant equipment to ensure assemblies of parts, and items like hoses, have good electrical continuity with the site's verified true earth ground, thereby ensuring the presence of a static dissipative circuit through the plant equipment to ground.

OhmGuard® IS Continuity Tester

Rugged Stainless Steel housing with Tungsten Carbide Teeth.

Equipment specifiers can order the OhmGuard® with 2-pole Cen-Stat cable on standard spiral lengths of 3 m (10 ft.), 5 m (16 ft.) and 10 m (32 ft.) of cable. All cables supplied with universal quick connects for easy connection. Additional lengths available.

Europe / International:

IECEx
Ex ia IIC T4 Ga (gas & vapour).
Ex ia IIIC T135°C Da (combustible dusts).
Ta = -40ºC to +60ºC.
IECEx SIR11.0141
IECEx certifying body: SIRA.

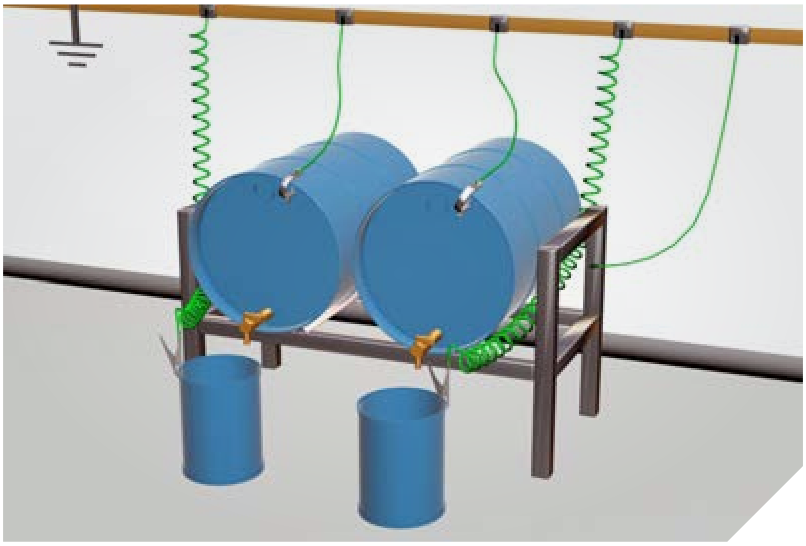
ATEX
Ex II 1 GD
Ex ia IIC T4 Ga (gas & vapour).
Ex ia IIIC T135°C Da (combustible dusts).
Ta = -40ºC to +60ºC.
Sira 11ATEX2277
ATEX Notified Body: SIRA.

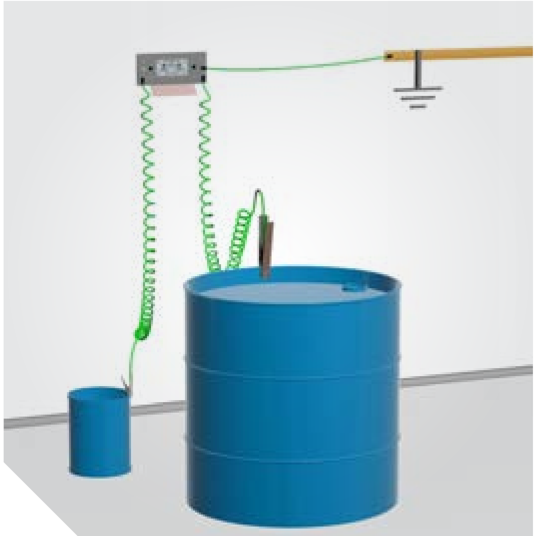
North America:

NEC 500 / CEC (Class & Division)
Intrinsically safe equipment Exia for use in:
Class I, Div. 1, Groups A, B, C, D.
Class II, Div. 1, Groups E, F, G.
Class III, Div. 1.
Ta = -40°C to +60°C.
Ta = -40°F to +140°F
OSHA recognised NRTL: CSA.

Click here for more information

Grounding drums and containers with Factory Mutual / ATEX approved clamps





Static grounding systems that combine interlock control and visual indication of a verified ground connection offer the highest levels of protection over electrostatic ignition risks. However, sites may elect to use passive devices, like single pole clamps, that do not have ground status monitoring capability.

If single pole clamps, or similar devices, are determined to be the solution required, it is important not to underestimate the function these clamps provide.

Product specifiers need to be sure that passive clamps used to ground equipment are capable of establishing and maintaining a solid mechanical and electrical connection to the equipment at risk of discharging static sparks.

Establishing a solid electrical connection can only be achieved by penetrating any connection inhibitors like coatings, product deposits and rust. Factors like this will impede the dissipation of static charges from the object to ground if the clamp is not capable of penetrating them and making a connection to the base metal of the container or vessel.

Once a strong connection is established, it is vital that this connection remains constant for the duration of the process operation.

One way of trading off the use of active devices to ground equipment and establish reliable connections with passive grounding clamps is to specify Factory Mutual and ATEX approved clamps.

Factory Mutual approved clamps undergo a series of mechanical and electrical tests to ensure they can function as reliable static grounding clamps in EX / HAZLOC areas.

ATEX certification ensures there are no sources of mechanical sparking, such as thermite reactive materials like aluminium, or sources of stored energy, present in the construction of the clamp.

*the underlined wording is additional wording present in IEC 60079-32-1

Factory Mutual approvals / ATEX certification of passive static grounding devices.

Clamp Pressure Testing - ensures the grounding clamp is capable of establishing and maintaining low resistance electrical contact with equipment (FM approvals).

Electrical Continuity Testing - ensures the electrical continuity from the teeth throughout the grounding clamp is less than 1 ohm (FM approvals).

High Frequency Vibration Testing - ensures the grounding clamp is capable of maintaining positive contact when attached to vibrating equipment (FM approvals)

Mechanical Pull Testing - ensures the grounding clamp cannot be pulled off the equipment without an intentional application of force (FM approvals).

Sources of mechanical sparking - ensures no mechanical sparking sources are present in the clamp (ATEX certification).

Both IEC 60079-32-1,13.4.1 and NFPA 77, 7.4.1.6 & 7.4.1.4 state:

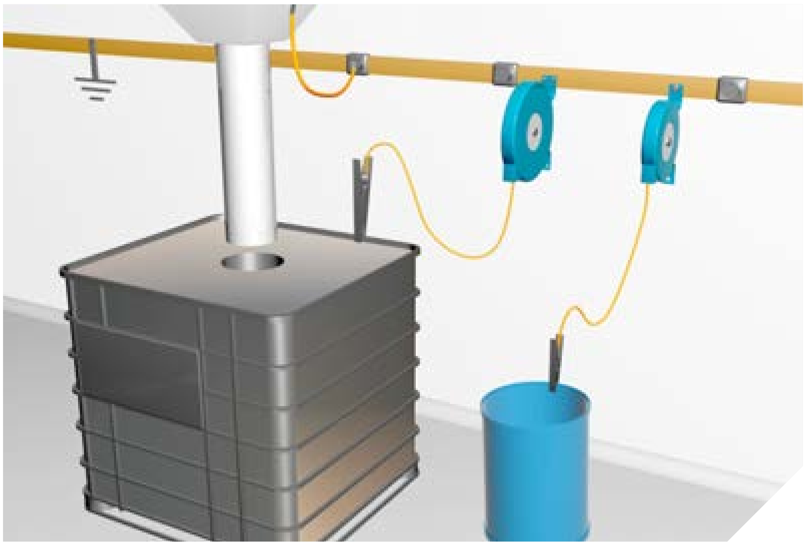
Temporary connections can be made using bolts, pressure-type earth (ground) clamps, or other special clamps. Pressure-type clamps should have sufficient pressure to penetrate any protective coating, rust, or spilled material to ensure contact with the base metal with an interface resistance of less than 10 Ω*****.

Where wire conductors are used, the minimum size of the bonding or earthing wire is dictated by mechanical strength, not by its current-carrying capacity. Stranded or braided wires should be used for bonding wires that will be connected and disconnected frequently.

< Back to Content

Cen-Stat™

ATEX FM APPROVED



VESX45 standard size heavy duty clamp

Stainless Steel single pole reels

Powder Coated single pole reels

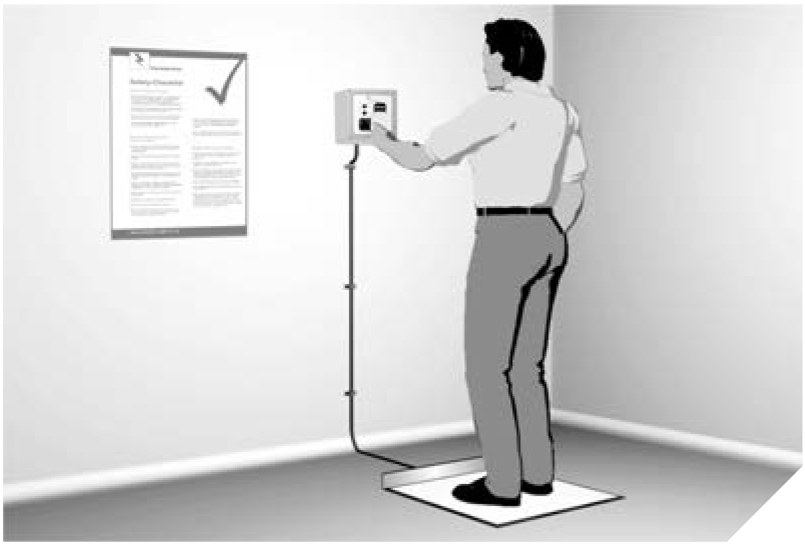
VESX90 large size heavy duty clamp

VESX45 doubled ended clamp assembly

Stainless Steel C-clamp

Click here for more information

Sole-Mate - Footwear Tester



Through their own movement people can generate large amounts of static charge if they are not grounded. Over 30,000 volts can be carried by people who are completely unaware that they themselves are the potential source of an electrostatic spark discharge that could ignite a flammable atmosphere.

To counteract this risk, it is important to ensure that the plant flooring is static dissipative with a connection to the earthing grid of the building.

The recommended range of resistance for static dissipative flooring in both IEC-60079-32-1 and NFPA 77 is 1 meg-ohm up to 100 meg-ohm ($1 \times 10^6\ \Omega$ up to $1 \times 10^8\ \Omega$).

Static charge accumulation on workers can be prevented by issuing them with footwear that is designed in accordance with safety standards or recommended practices that incorporate static dissipative properties in the structure of the footwear.

Standards like ASTM F2413 (2011) and recommended practice documents like IEC 60069-32-1 and NFPA 77 recommend a static dissipative range of 1 meg-ohm up to 100 meg-ohm through the shoe.

IEC EN 20345, which is another safety footwear standard, specifies a resistance range of 100 kilo-ohm up to 1000 meg-ohm ($100 \times 10^3\ \Omega$ up to $1 \times 10^9\ \Omega$).

When specifying footwear testers it is important to know what specification the shoes are manufactured to so that the applicable resistance range is tested on entry to the EX / HAZLOC area.

For example, if shoes manufactured in accordance with IEC EN 20345 are tested on a footwear tester designed to test shoes at ASTM F2413, IEC 60069-32-1 and NFPA 77 levels, there is a strong possibility that the tester will fail the shoes.

IEC 60079-32-1, 11.3 "Dissipative and conductive footwear" states:

Resistances can be measured with commercially available footwear conductivity testers which measure the resistance between a hand-held metal bar via body and feet to a metal plate on which the person stands. Alternatively, the resistance between a shoe filled with shot pellets and a steel plate on which the shoe is pressed can be measured according to IEC 61340-4-3.

The resistance of footwear can increase with the accumulation of debris on the footwear, use of orthopaedic insoles, and reduced floor contact area. The conductivity of footwear should be tested frequently to confirm functionality.

NFPA 77, 8.2.2.2
"Conductive and Static Dissipative Flooring and Footwear" states:

Static dissipative (SD) footwear used in conjunction with conductive or static dissipative flooring provides a means to control and dissipate static electric charges from the human body. Resistance to earth through static dissipative footwear and conductive or static dissipative flooring should be between 10^6 ohms and 10^8 ohms. For materials with very low ignition energies, the resistance to earth through footwear and flooring should be less than 10^6 ohms. Resistance should be measured with commercially available footwear conductivity testers.

< Back to Content

Sole-Mate™

The **Sole-Mate II** is a user friendly footwear tester designed to test the electrical continuity of static dissipative footwear prior to entering EX / HAZLOC areas exposed to potentially flammable and combustible atmospheres.

Regular testing of static dissipative footwear is recommended to ensure the static dissipative properties of the shoes do not change over the period of use.

The Sole-Mate II provide process operators with a quick and easy means of ensuring the shoes they are going to use in the EX / HAZLOC area are capable of preventing electrostatic charge accumulation on their bodies. The Sole-Mate II tests the condition of the shoes by measuring the resistance of the electrical loop through the operator and their footwear. If the resistance of the shoes is too high, the Sole-Mate II will indicate that the shoes have failed the test via a red lamp and buzzer alarm. If the shoes pass the test a green lamp will indicate to the operator that the shoes are fit for purpose.

Additionally, specifiers can interlock the tester with audible alarms or entry doors into hazardous areas so that personnel not wearing suitable footwear cannot enter the hazardous area.

All units are supplied with 3 m cable to connect to a mains electrical supply. The U.S. unit is supplied with 6 ft. cord and a standard U.S. 3 prong plug.

Please Note:
Equipment specifiers must ensure that the footwear tester resistance level selected is compatible with the static dissipative range the shoes are manufactured in accordance with.

Sole-Mate II

Stainless steel footplate included

Sole-Mate resistance tester ensures the Sole-Mate II footwear tester is operating within the correct range of resistance.

Click here for more information

Personnel grounding with grounding straps

Through their own movement people can generate large amounts of static charge if they are not grounded. Over 30,000 volts can be carried by people who are completely unaware that they themselves are the potential source for an electrostatic spark discharge that could ignite a flammable atmosphere.

The operating requirements of certain processes can cause the loss of direct contact between the operator's static dissipative safety shoes and the static dissipative flooring of the plant.

For example, an operator may need to stand on a ladder to tip powder into a large mixer and in the process of moving to the ladder loses contact with the static dissipative flooring of the plant.

Personnel grounding straps provide an added layer of protection to ensure process operators are grounded via the plant's verified grounding points.

By fastening a grounding strap to their wrist, static electricity cannot accumulate on the process operator and any charge generated by their movement can be dissipated to ground by direct contact to a verified ground connection.

Grounding straps may also be used to bond operators wearing insulating gloves to equipment like small hand held metal containers to prevent sparking between a grounded operator and the container or from the container to another grounded object.

It should be noted that grounding straps are not a substitute for static dissipative flooring or static dissipative footwear.

Grounding straps should only be used for rare occasions where process operators may lose contact between the soles of their static dissipative footwear and the plant floor.

IEC 60079-32-1, 11.4 "Supplementary devices for earthing of people" states:

The simplest type of commercial device is an earthing bracelet with a built-in resistor typically giving a resistance to ground of about 100 kΩ for shock protection. Wrist straps of this type have the greatest utility at ventilation hoods and at other locations where limitation on the operator's mobility can be tolerated. Breakaway wrist tether systems could be necessary where emergency egress is needed. A hood can be equipped with two external coiled earthing cords with cuff attachments that can be removed and kept by individual users.

NFPA 77, 8.2.3.2 "Personnel Grounding Devices" states:

Supplementary devices should be selected so that accumulation of hazardous static electrical charge is prevented, while the risk of electrocution is not increased. In most practical situations, grounding of personnel is achieved by ensuring that the resistance from the skin to ground is approximately 10^8 ohms or less. The need to protect against electrocution via a grounding device imposes a minimum resistance from skin to ground of 10^6 ohms. Based on skin contact and contact with the floor, especially during activities where the entire sole of the footwear is not in contact with the floor (e.g. kneeling) effectiveness can be compromised.

Personnel Grounding Strap

ATEX FM APPROVED

The **VESX45/PGS** personnel grounding strap is a heavy duty stainless steel grounding clamp and wrist strap assembly that provides operators working in hazardous areas with an additional layer of protection against fires or explosions caused by static electricity.

VESX45/PGS

FM & ATEX approved Heavy Duty stainless steel grounding clamp with:

Tungsten carbide teeth mounted in a side-by-side configuration to provide a high degree of clamp stability and to bite through rust, coatings and deposits of process material.

3.65 m (12 ft.) spiral cable fitted with a quick release connector enables operators to detach themselves in the event that they need to vacate the process area immediately.

1 meg-ohm safety resistor mounted in the cable to prevent stray electrical currents passing through the operator.

Adjustable anti-allergy wrist strap to fit a wide range of wrist sizes.

VESX45/PGS can bond operators to hand held containers when insulating gloves are required.

Click here for more information

< Back to Content

Guide to protection concepts and codes for electrical equipment operating in hazardous areas

Electrical Protection Method	Symbols	IECEx Code	IECEx Equipment Protection Level	Zone
Equipment protection by flameproof enclosures ‘d’	d	60079-1	Gb	1, 2
Equipment protection by pressurized enclosures ‘p’	px, py, pz	60079-2	Gb, Gc	1, 2
Equipment protection by powder filling ‘q’	q	60079-5	Gb	1, 2
Equipment protection by oil immersion ‘o’	o	60079-6	Gb	1, 2
Equipment protection by increased safety ‘e’	e	60079-7	Gb	1, 2
Equipment protection by intrinsic safety ‘i’	ia, ib, ic	60079-11	Ga, Gb, Gc	0, 1, 2
Equipment protection by type of protection ‘n’	nA, nC, nR, nZ	60079-15	Gc	2
Equipment protection by encapsulation ‘m’	ma, mb, mc	60079-18	Ga, Gb, Gc	0, 1, 2

Dust Protection Method (for electrical circuits)				
Enclosure	ta, tb, tc	60079-31	Da, Db, Dc	20, 21, 22
Intrinsic Safety	ia, ib, ic	60079-11	Da, Db, Dc	20, 21, 22
Encapsulation	ma, mb, mc	60079-18	Da, Db, Dc	20, 21, 22

NOTE: It is always important to ensure that electrical equipment specified for use in a hazardous area is certified to the requirements of current, and up to date, standards and codes. Specifiers must ensure that the location for which the equipment is specified matches the protection levels required for the particular zoned / classified area.

The codes used in the above table are based on IECEx standards of classification. However, the protection concepts are generally recognised by ATEX, the National Electrical Code and Canadian Electrical Code. Note that these standards are continuously updated, therefore, protection concepts or code descriptions may be revised or removed.

Temperature Classification of electrical equipment

Hazardous materials are classed by their auto-ignition temperature and the “T” rating is the maximum surface temperature that the certified equipment can reach.

Temperature Class
(IECEx, ATEX, NEC 505, CEC S.18)

T1	450°C
T2	300°C
T3	200°C
T4	135°C
T5	100°C
T6	85°C

Temperature Class
(NEC 500, CEC Annex J)

T1	450°C				
T2	300°C	T2A 280°C	T2B 260°C	T2C 230°C	T2D 215°C
T3	200°C	T3A 180°C	T3B 165°C	T3C 160°C	
T4	135°C	T4A 120°C			
T5	100°C				
T6	85°C				

Note that equipment approved for use in Gas or Gas and Dust zones usually has the temperature rating expressed as the T Class (e.g. T6), however equipment approved for use in Dust zones only, usually shows the actual temperature (e.g. T85°C).

Ingress Protection

It is generally accepted that ingress protection for Ex equipment starts at IP54:

IP54	protection against dust and water splashed from any direction (inc. rain)
IP55	protection against dust and low pressure water jets / hosing
IP65	completely dust tight and protected against low pressure water jets / hosing
IP66	completely dust tight and protected against heavy seas
IP67	completely dust tight and protected against periods of immersion in water

The American NEMA ingress ratings are difficult to equate to the IEC IP ratings, but the commonly specified NEMA 4 and 4X ratings cover Ingress Protection levels up to IP 66. NEMA 4X enclosures have additional protection against corrosion.

Comparison of European (ATEX), North American (NEC & CEC) and International (IECEx) Hazardous Area Classification Systems.

	Combustible atmospheres present continuously, for long periods or frequently	Combustible atmospheres are likely to occur in normal operation	Combustible atmospheres are unlikely to occur, be present infrequently or for short periods only
IECEx / ATEX (Gas & Vapour) IECEx / ATEX (Dust)	ZONE 0 ZONE 20	ZONE 1 ZONE 21	ZONE 2 ZONE 22
NEC 505 / CEC S.18 Class I NEC 506 Class II (Dust)	ZONE 0 ZONE 20	ZONE 1 ZONE 21	ZONE 2 ZONE 22
	Combustible atmospheres can exist all of the time or some of the time under normal operating conditions		Combustible atmospheres are not likely to exist under normal operating conditions
NEC 500 / CEC Annex J Class I (Gas) Class II (Dust) Class III (Fibres)	Division 1		Division 2

Two classification systems are used in the U.S. and Canada. For the U.S. NEC 500 (Class / Division) and NEC 505 / NEC 506 (Class / Zone) apply.
In Canada, CEC Section 18 describes the Class / Zoning system (Class I only) and CEC Annex J describes the Class / Division method.
The zoning system of the NEC and CEC standards is similar to the IECEx / ATEX method of zoning.

Comparison of European and North American Gas (and Dust) Groups

Groups according to IECEx, ATEX, NEC 505, CEC S.18

Gas Group	Representative Gas
I (Mining)	Methane
IIA	Propane
IIB	Ethylene
IIC	Hydrogen

Groups according to NEC 500 & CEC Annex J

Group		Representative Gas	Group		Representative Dust / Fibre
Class I	Group A	Acetylene	Class II	Group E	Metal Dust
Class I	Group B	Hydrogen	Class II	Group F	Coal Dust
Class I	Group C	Ethylene	Class II	Group G	Grain Dust
Class I	Group D	Propane	Class III		Fibres

< Back to Content

Interpreting certification and approval codes for hazardous area electrical equipment

The codes provided below are examples of the wide range of approvals / certifications required for hazardous area electrical equipment. The codes reflect current **ATEX, IECEx, NEC** and **CEC** methods of certification and approval.

The hazardous area codes for the **Earth-Rite RTR** are used to illustrate the differences and similarities between these methods.

North American approvals to NEC 500 & CEC Annex J requirements for the Earth-Rite RTR

"Class I": Combustible liquid, gas and vapour atmosphere

"Div.1": Division 1 defined as a location where combustible atmospheres can exist under normal operation, during maintenance, due to leaks or when equipment is faulty.

Class I, Div. 1, Groups A, B, C, D.

"Groups A, B, C, D": Indicates which gas groups the grounding system can be installed in. Gases, vapours, liquids are grouped according to their Minimum Experimental Safety Gap and Minimum Ignition Current ratio characteristics.
Higher Groups (e.g. A and B) require high levels of flameproof protection and low energy current.

"Class II": Combustible Dust atmospheres.

"Div.1": Division 1 defined as a location where ignitable dusts are normally suspended in air at a potentially combustible value under normal operating conditions.

Class II, Div. 1, Groups E, F, G.

"Groups E, F, G": Group E represents conductive metal dusts (e.g. aluminium). Group F represents carbonaceous dusts (e.g. coal dust). Group G represents other dust types not included in E and F, including the likes of grain, starch, flour, plastics and chemicals (pharmaceutical).

Class III, Div. 1

Hazardous locations where easily ignitable fibres and flyings are present around machinery but are not likely to be suspended in the atmosphere. Examples include saw dust from cutting operations and textile mills

Please note that NEC 505 & NEC 506 and CEC Section 18 describe the Class and Zoning system of hazardous location classification. If you require more information on grounding and bonding systems that must be approved to this method of classification please contact Newson Gale or your local Newson Gale supplier who can provide you with appropriate Certificates of Compliance.

Newson Gale®

ATEX certification for the Earth-Rite RTR

"II": Equipment group classification. Group II applies to electrical equipment used above ground. Group I applies to mining equipment.

"GD": RTR certification applies for both Gas and Dust atmospheres.

ATEX symbol for ATEX certified product. The ATEX certified product must also display the CE mark of conformity.

Ex II 2 (1) GD

"2": Electrical equipment protection method certified as Category 2, installation permitted for Zone 1, Zone 21.

"(1)": 2 pole grounding clamp monitoring circuit certified as Category 1, permitted for use in Zone 0, Zone 20 atmospheres.

IECEx certification (Gas & Vapour atmospheres) for the Earth-Rite RTR

"d[ia]": flameproof enclosure protection method combined with intrinsically safe current.

"IIC": Enclosure can be installed in IIC, IIB and IIA gas and vapour atmospheres.

"Ex": IECEx designation for hazardous area certified product.

Ex d[ia] IIC T6 Gb(Ga)

"Gb(Ga)": Equipment protection level "Gb", means enclosure can be mounted in Zone 1. Equipment level "Ga" means 2-pole clamp can be used in Zone 0.

"T6": Max surface temperature rating of T6 (85°C / 185°F)

IECEx certification (Dust atmospheres) for the Earth-Rite RTR

"tb": Dust Ingress protection method "tb" applied.

"T80°C": the surface temperature of the enclosure will not rise above 80°C (176°F).

"Ex": IECEx designation for hazardous area certified product.

Ex tb IIIC T80°C IP66 Db

"Db": Equipment protection level "Db" means system can be installed in Zone 21.

"IIIC": installation in dust groups up to IIIC (conductive dusts) permitted. This indicates installation in IIIA (fibres & flyings) and IIIB (carbonaceous & non-conductive) atmospheres is also permitted.

"IP 66": Enclosure rating IP 66. Dust tight and protected from heavy seas.

< Back to Content

On-Going Maintenance of Static Control Procedures and Equipment

Once appropriate static control procedures and equipment have been put in place, it is vital that a high level of static awareness is maintained. The three principles of a successful, on-going static control policy are:

I. Regular testing of the equipment used including logging of results.
ii. Frequent awareness training for operators and staff, particularly new employees.
iii. Reference to the standards when changes take place, such as the introduction of new types of plant or materials.

Generally, there are two main elements to the physical side of the static grounding system. These are firstly, the fixed grounding network. This may take the form of a copper strip or bar running along the walls and connected to a number of grounding rods, pits or grids, driven into the ground. This network should be tested periodically, with respect to ground, to ensure that it is maintaining a low (typically less than 10 ohm) resistance to ground. These tests are fairly specialist, and may be carried out by an outside contractor, often in conjunction with tests on lightning protection equipment. A typical test period would be every 11 or 13 months (so that over a period of time, the tests cycle through the seasons). A main point to look out for when testing the network, is any significant variation with previous tests, which could show deterioration. This also highlights the need for keeping good records. If the grounding network meets the necessary low resistance, then any metal object connected to it will also be grounded.

The second part of the physical system is the devices used to connect plant and equipment to the grounding network. If a piece of plant is fixed, such as the body of a mixing machine, then a simple strong bonding cable can be used to permanently attach it to the grounding network. However, movable plant, such as the mixer's product bowl, or a 200 litre drum is harder to ground, and the standards recommend that a cable with strong mechanical strength and a “designed for purpose” clamp are used to make a temporary connection when the item is in use.

These connections can be tested using an intrinsically safe ground lead tester or ohm meter and the results for each lead recorded. The tester or meter will be used to complete a circuit between the grounding point and the plant item to be grounded; for the purpose of testing clamps and their cables or reels, this may take the form of a clean piece of metal placed in the clamp jaw. The tester or meter leads may then be connected between the piece of metal and the grounding point in order to complete the circuit and obtain a reading.

These types of flexible connector should be tested more frequently than fixed ones; typically once every three months in the case of ground leads and after every re-assembly, in the case of bonds on removable ducting sections. A bond to a fixed piece of plant may be tested on an annual or six-monthly basis.

The on-going training of personnel may be more difficult to maintain, partly because of disruption to production, and also, as it can be difficult to keep things interesting. Training today need not just take the form of a classroom lecture; new learning media such as interactive CD-ROM provides flexible training solutions to accommodate the varying needs of production schedules, shifts and locations. Team leaders can quickly assess the knowledge level of existing or new operators and programme one or two hours per week to bring knowledge levels up.

Today, it is common for companies to use continuous monitoring of ground connections and systems incorporating interlocks that prevent a static-generating operation from taking place unless the ground is made. Such systems mean that the frequency of lead testing can be reduced, as the systems are providing a continuous test to a pre-determined resistance level. They also mean that the grounding measures are more likely to be remembered during operation, as a visual indication of ground condition, such as the LED in a self-testing clamp, act as a strong reminder to use the device.

Newson Gale®

Earth-Safe™

Equipment commissioning and maintenance service

Our equipment commissioning and maintenance service ensures your Newson Gale static grounding and bonding equipment is installed and maintained in accordance with our system operating and installation requirements.

Our CompEx certified engineers commission and service all Newson Gale static grounding and bonding equipment installed at your site.

Our CompEx® certfied engineers will ensure your Newson Gale equipment is installed and maintained in accordance with the equipment's instruction manual.

This is critical to ensuring the equipment has been installed in accordance with the ATEX and IECEx requirements laid down in EN and IEC standards for the safe installation and operation of electrical equipment in EX zoned areas.

In addition to ensuring the equipment is installed in accordance to ATEX / IECEx standards, our engineers will test the functionality of the installed equipment to ensure they are performing at the benchmarked parameters reflected in international guidelines including IEC 60079-32-1: "Electrostatic Hazards - Guidance".

To ask more about this service contact us on:

Telephone: +44 115 940 7500

e-mail: groundit@newson-gale.co.uk

CompEx Supporter

Click here for more information

Leading the way in hazardous area static control

Safety-Checklist

Newson Gale®

Maximise Safety in the Area

- Ensure all operators and managers are trained in safe working with flammable products. It is vital that they understand the characteristics and dangers of flammable products and the principles of static control.
- Ensure all electrical equipment is appropriate for use in the designated flammable atmosphere.
- Ensure lift trucks and other vehicles used in the vicinity are explosion protected to the appropriate standard.
- Ensure **"No Smoking"**, **"Static Hazard"** and **"Ex"** warning signs are clearly posted.

Minimise Charge Generation and Accumulation

- Ensure operators are supplied with static-dissipative (S.D.) footwear. Gloves, if worn, should also be static-dissipative.
- Ensure floors are adequately conductive and are well grounded.
- Ensure static-dissipative footwear is always worn and remains in good condition by use of resistance testing before entry into the combustible area.
- Ensure all containers, pipework, hoses, plant, etc., are conductive or static-dissipative, bonded together and grounded.
- Ensure that sufficient, suitable grounding leads and clamps are provided to enable movable containers to be grounded prior to product transfer or mixing.
- Where practical, pipe liquids directly from storage to the point of use.
- Eliminate or minimise product free-fall distances.
- Where practical, keep pumping speeds low.
- When using plastic materials, such as drums, kegs, liners and hoses in combustible areas, they should be static-dissipative and suitably grounded.
- When using FIBCs (Big Bags) in combustible areas or with potentially combustible dusts or powders, they should be "Type C" static-dissipative and suitably grounded.
- The use of anti-static additives should be considered in low conductivity liquids if they do not harm the product.

Maintain Safe Working Practices

- Ensure all new operators, managers and maintenance staff are trained in safe working with flammable products.
- Develop a written "safe system of working" for the handling of flammable products.
- Ensure all grounding straps, clamps, wires and monitoring systems are regularly inspected and maintained. The results of inspections should be recorded. Intrinsically safe equipment should be used to test continuity.
- Ensure static-dissipative floors remain non-insulating.
- Ensure all contractors are controlled by strict "permit-to-work" systems.
- Where large, conductive, movable equipment, such as stainless steel IBCs, road tankers or "Type C" FIBCs could become isolated from ground, the use of ground monitoring systems, with suitable interlocks to process equipment, pumps or valves is recommended, to ensure that they cannot pose a static hazard.

Examples of how different operations can result in discharges of static electricity

It's worth noting that the common denominator in these incidents was that the operator(s) did not have a visual reference point for a verified ground connection.

www.news.bbc.co.uk

www.csb.gov

Newson Gale®

Static electricity is an ever-present and significant hazard for operations taking place in flammable, combustible or potentially explosive atmospheres. The uncontrolled build up and discharge of electrostatic charge must be avoided in these environments to protect people, plant, processes and the environment.

Newson Gale's wide range of static grounding solutions can control and mitigate these risks, creating a safer and more productive working environment.

www.newson-gale.co.uk

5 Good Reasons

To specify FM & ATEX approved clamps

Clamp Pressure Testing

Ensures the clamp is capable of establishing and maintaining low resistance electrical contact with equipment.

Electrical Continuity Testing

Ensuring the continuity from the tip throughout the clamp is less than 1 ohm.

High Frequency Vibration Testing

Ensures the clamp is capable of maintaining positive contact when attached to vibrating equipment.

Mechanical Pull Testing

Ensures the clamp cannot be pulled off the equipment without an intentional application of force.

No sources of Mechanical sparking

Ensures no mechanical sparking sources are present in the clamp.

United States
Newson Gale Inc
460 Faraday Avenue
Bldg C
Jackson, NJ 08527
USA
+1 732 961 7610
groundit@newson-gale.com

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
Newson Gale GmbH
Ruhrallee 185
45136 Essen
Deutschland
+49 (0)201 89 45 245
erdung@newson-gale.de

South East Asia
Newson Gale S.E.A. Pte Ltd
136 Joo Seng Road
#03-01
Singapore
368360
+65 6420 0443
ngsea@newson-gale.com

Newson Gale®

www.newson-gale.co.uk

NG UK G&B Catalogue 050615 R1