Leading the way in hazardous area static control

Application Spotlight



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NewsonGale
HOERBIGER Safety Solutions

Don't Compromise on Safety, Clamp Down on Static

It is accepted that each day throughout Europe a static related incident causes a serious fire or explosion, whilst in the UK alone; HSE statistics suggest that some 50 such incidents occur each year. Apart from business interruption costs resulting from lost production, these incidents may also cause serious injury to people and damage to plant and the environment, as well as the possibility of legal action and the bad publicity for the organisation concerned.

Conductive (metal) plant items and equipment run the risk of accumulating dangerous levels of static charge if they are not properly earthed. Using purpose designed, Ex certified static grounding clamps is one of the safest and most cost effective methods of ensuring plant equipment and people are protected from static ignitions in potentially flammable or explosive atmospheres. Common mobile items of plant equipment such as drums, vessels, containers and even people have sufficient electrical capacitance to accumulate high levels of electrostatic charge. This stored energy can then be released in the form of a static spark with enough power to ignite numerous vapours and gases, as well as fine airborne powders and dusts. The greater the capacitance the higher the energy that can develop, so large objects like road tankers or IBCs pose even greater hazards.

Controlling the Risk

Static control systems designed to mitigate the risk of electrostatic discharge often have the capability to display visual indication, provide a continuous ground monitoring connection and the ability to execute automatic shutdown if interlocked with the process and a ground connection is compromised. However, the essence of a static protection system remains simple: a powerful clamp or some other reliable connection to the equipment to be protected, attached to an appropriate cable to conduct the electric charge to a designated grounding point.

A basic clamp and cable provides a low level of scrutiny when dissipating static, but as an introductory layer of protection is sufficient and must be considered a fundamental requirement. The functionality and durability of any clamp is much more important than the electronics and working mechanics of the system. Of course the system provides clear visual LED indication to the operator but this is determined by clamp behaviour. If the clamp and cable are ineffective then the capabilities of the system are virtually redundant.

In industry, batch processes can require many hundreds or even thousands of earth connections to be made and broken every day, it is essential that good ground contact is made each and every time. The effectiveness, reliability and durability of any grounding clamp and associated cabling is therefore key to keeping process operations safe from the dangers of a static discharge. The speed and scale of modern manufacturing processes coupled with changes to the nature and properties of many raw materials have increased the range and number of applications where electrostatic charge can accumulate.

Indeed, if an organisation stores, handles or processes flammable liquids, powders, gases or vapours, there is every likelihood that the company will be exposing plant personnel to the risk of static caused ignitions within hazardous atmospheres. Static electricity is a ubiquitous hazard in the production of coatings, resins, adhesives, paints, solvents, explosive or combustible powders and many other related processes. The common problem in these applications is that the processing equipment, as well as associated containers, drums and IBCs can build up layers of product or rust, or they have surface coatings. These layers can form an unpredictable insulating barrier that can easily defeat certain designs of clamps and other 'in house, jury-rigged' methods of making earth connections.



Regulatory Constraints

The importance of effective clamp design and its suitability for use in flammable atmospheres has not gone unnoticed by regulatory and approval bodies around the globe. Under ATEX, grounding clamps must meet specific criteria to be certified as suitable for use in hazardous areas. For example, a grounding clamp made of aluminum for use in Zone 0 or 20 must be coated with material that will not contribute to mechanical sparking under normal operating conditions. There are also limitations placed on the amount of plastic that may be used in the clamp body since this may allow surface-accumulation of static charge. The use of plastic also can introduce problems in terms of durability, resistance to chemical attack and thermal stability.

Clamp Approvals

The integrity of any item of equipment is always going to be scrutinised, however safety apparatus within a hazardous area facility is, and rightly so, subjected to various approvals. Clamps are assessed for sources of potentially stored energy and their ability to cause a spark if the energy is released in the hazardous area. One major energy source in grounding clamps is the spring. The spring has the potential to generate a mechanical spark through contact with other objects if it escapes the body of the clamp. Therefore, clamps are tested for their structural robustness to ensure any stored energy is reliably contained within the clamp. Combined with structural robustness testing, US approval bodies such as FM Global assess several other design criteria regarded as being essential for static grounding clamps. For use in hazardous locations, the electrical resistance across the clamp, including contacts and clamp body must not exceed 1 Ohm when attached to plant equipment. Additional tests ensure that the clamp is suitable for use in normal industrial conditions. The clamp must pass separation force testing, minimum-clamping force testing and vibration testing at varying frequencies to ensure that approved clamps guarantee positive and stable contact with mobile or portable plant equipment.



Reasons to specify ATEX and FM approved clamps:

1. Clamp pressure testing
2. Electrical continuity testing
3. High frequency vibration testing
4. Mechanical pull testing
5. Source of mechanical sparking

Regulatory and approval bodies in Europe and North America emphasise the importance of using specially designed static grounding clamps that are fit for the purposes of dissipating electrostatic charges safely and are robust enough for use in industrial environments.

FM approved clamps are especially significant as they have been subjected to mechanical and electrical tests that validate their use as a static grounding clamp. For critical applications with extremely sensitive flammable/explosive atmospheres, where a low resistance bond to earth is absolutely vital, self-testing clamps and interlockable systems with visual indication are recommended.

These are the typical markings found on an ATEX and/or FM approved clamp:

FM APPROVED	Ex II 1 GD T6 SIRA 02ATEX 9381 CE 2804 Newson Gale Ltd Nottingham UK VESX90 YY/XXXXX	Newson Gale www.newson-gale.com X90

Clamps from Newson Gale

Hazardous area approved Newson Gale clamps of stainless steel construction provide optimum levels of mechanical protection whilst retaining a high level of chemical resistance. Any grounding clamp should have sufficient pressure to penetrate any protective coating. Layers of deposits can inhibit safe static dissipation and gripping the surface of any item of plant equipment securely with the ability to bite through any material deposits is imperative in order to provide a reliable earth connection.

In an effort to control the risk, Newson Gale's clamp tips are equipped with one of the hardest wearing materials in use in industry today, tungsten carbide. When used in combination with a well-designed clamp spring, the clamp has the capability to continuously bite through coatings, rust or product deposits that a basic alligator clamp, welding clamp and poorly manufactured clamp would struggle to penetrate. Tungsten carbide teeth penetrate connection inhibitors to ensure a reliable earth connection. Alternative tips made from copper are susceptible to corrosion in challenging atmospheres where sulphur is present, often in chemical processing operations. Naturally copper is a malleable material which will deform under compression. Deformed clamp tips will not be capable of biting through paints or contaminants. Likewise, carbonitrided steel tips can have poor impact quality, can suffer from internal stresses and can buckle due to unequal cooling effects.

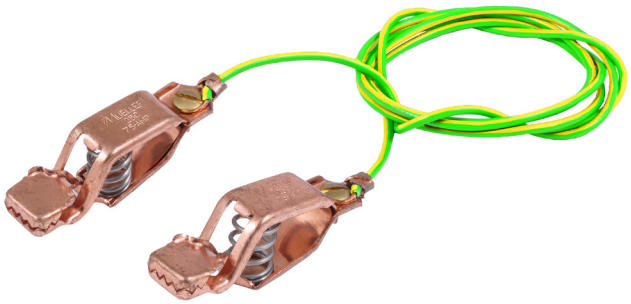
Tungsten Carbide Tips	Stainless Steel Teeth/Tips
Very sharp tips	Not sharp even when new
Hard wearing material	Hard material
Stays sharp for a long period of time	Teeth round and smooth over time
Capable of biting through various material deposits	Not always capable of biting through various material deposits

Drums and containers can have typical coating thicknesses of 675 micro-metres. Product deposits on drums and containers can result in thicknesses of up to several millimetres. The flat surface of basic welding clamps and battery clips are not designed to penetrate such coatings. It is of critical importance to specify clamps that can make regular and positive electrical contact with the conductive parts of the object.



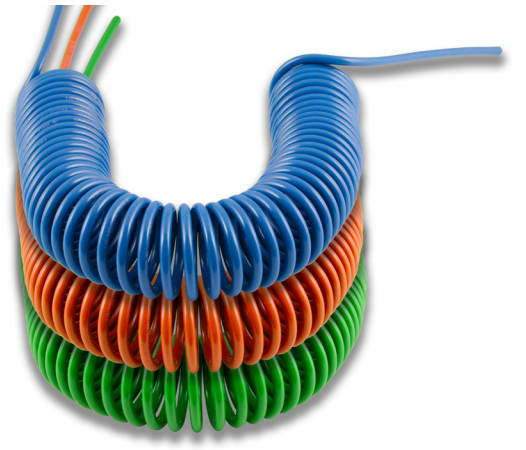
This ensures that every time a process capable of generating static charges is carried out the risk of an incendive static spark discharge is reduced to a safe and acceptable level. Studies of the effects of product accumulation, rust build up and protective coatings on the ability of grounding clamps to dissipate static effectively were conducted by engineers at Newson Gale. The tests looked at coatings and adhesives as inhibitors, as well as clamp resistance. In summary, they effectively demonstrated that product deposits can severely compromise accepted grounding methods. One particularly cautionary note; welding clamps, alligator clips and copper cables wound around plant equipment showed values of electrical resistance that exceeded generally accepted safe test levels for static electricity.

Unlike the X45 and X90 clamps in the Cen-Stat range from Newson Gale, non-purpose built clamps (such as welding clamps and alligator clips) require a risk assessment before use in hazardous areas and are often constructed from mild steel, copper or alternative metals that are susceptible to chemical and mechanical attacks.



Most importantly, they often have flat contact edges that are not capable of reliably penetrating paints, rust and other deposits. If a clamp is not capable of providing direct contact to potentially charged equipment then as a result is unable to safely dissipate a potential electrostatic discharge.

Although Newson Gale's grounding clamps are constructed using stainless steel 304 there are alternative metals used in the production of other clamps. Aluminium is a widely used material, although it can lead to weak spots forming internally and more material is often needed to maintain structural strength which can make clamps bulky. It has been noted with zinc plated steel that applying an even layer to the base steel can often be met with difficulty leading to an uneven finish. This increases the clamps susceptibility to tough atmospheric conditions which are common in hazardous areas.



Cable Properties and Colours

Effective clamps need cables and connections that can stand up to the rigors of industrial use. Due to their mechanical strength multi-stranded steel cables provide much longer lifetime use than copper braids or cables which can easily harden with constant use. In manufacturing areas where corrosion is prevalent, multi-stranded stainless steel cabling is available.

Newson Gale's Cen-Stat range of clamps is provided with Hytrel® cables. The properties of Hytrel delivers cables with excellent resistance to chemical attacks and mechanical impacts, making it well suited to the operating environments they are subjected to. Any cable has to be durable enough that hazardous environments don't compromise the structural integrity of the cable itself. The static dissipative qualities and UV protection additives are part of the Hytrel compound.

Both IEC TS 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.

* Always check for and read the latest version of the International Standards, Guidance and/or Recommended Practices.

Trailing or taut grounding wires and cables can be a major trip hazard in the workplace. Use of brightly coloured, highly visible sheathed cable, in accordance with IEC TS 60446 "Basic and safety principles for man-machine interface, marking and identification" clearly identifies the cable is for static grounding as opposed to electrical earth use. Hytrel covered cable with proven resistance to abrasion, mechanical wear and most types of chemical corrosion when used in a retractable spiral, keeps earth cable handling simple, and options are available with a special anti-static treatment to even mitigate a surface charge accumulating on the cable coating.

Summary

It is no easy task being responsible for managing dangerous goods in hazardous environments and it is easy and somewhat naive to assume that the use of simple clamps will automatically mitigate the risk posed by static electricity. However, the complexity of dissipating static effectively requires careful planning and a sound approach to risk management. The primary mind set should be to source a grounding solution that provides the best fit for an organisation's objectives.

The more layers deployed to protect against an ignition source, the more likely static will be controlled in a safe, repeatable and reliable way, day in and day out. Ensuring that all process equipment and personnel involved in the transferring of hazardous materials are bonded and grounded to a verified earth is the main preventative cause of action.

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

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Providing a low resistance path to ground for the electrostatic charges to dissipate mitigates the threat. This can be achieved using clamps and cables, but integrity of the grounding network and sufficient ability of the verified earth to dissipate static charge is critically the responsibility of the operator.

Of course, recognition of the hazard is only the first step. Regular static hazard awareness training combined with grounding equipment that displays compliance with industry codes will go a long way to mitigating fires or explosions caused by static electricity.

A HAZOP risk assessment report will identify hazards, evaluate those associated risks and provide guidance on the subsequent control of the hazards.

To help control these risks, Newson Gale offers a wide range of static grounding and bonding equipment which is made to provide optimum safety in explosive atmospheres for a variety of process applications. The Newson Gale range mitigates static charge accumulation by using practical and innovative design, and ensures effective static control on three levels – grounding and bonding clamps, visual verification systems and interlockable control systems.

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