Industry Standards & Guidelines
A comprehensive overview

For over 40 years, Newson Gale has been at the forefront of incorporating the static control measures of international associations, like National Fire Protection Association (NFPA), International Electrotechnical Commission (IEC), and CENELEC, and industry sector associations into the functional performance of its static grounding and bonding equipment.

While other manufacturers follow our lead or choose to incorporate arbitrary static control performance parameters into their solutions, Newson Gale has been, and continues to be, committed to providing our customers with hardware solutions that align with the control measures outlined in recommended practice in static grounding and bonding control product solutions.

Product standards for equipment operating in hazardous locations

Codes and standards developed by **NFPA** and regulations like the **ATEX Equipment Directive (2014/34/EU)** are aimed at providing workers and businesses with equipment that incorporate into their design equipment protection techniques which mitigate against the ignition of the surrounding hazardous locations if critical faults occur with the equipment, e.g., electrical sparks or arcs.

In the USA, Hazardous Location (HAZLOC) certification is the process for compliance of equipment used in explosive atmospheres and is overseen by **Nationally Recognized Testing Laboratories (NTRLs)**. Standards used for certifying equipment for hazardous locations in the USA are developed by **NFPA** which includes the **National Electrical Code (NFPA 70/NEC)**. The code uses a classification system for hazardous locations classifying them into Classes, Divisions, Groups and zones based on the hazardous process present and the likelihood of an explosive atmosphere. **NRTLs** can then assess equipment against standards by organizations like the American National Standards Institute **(ANSI), Underwriters Laboratories (UL), CSA Group (CSA)**, and other applicable standards which may be required for the equipment protection concepts and the environment it is designed for.

n countries that follow **ATEX, UKCA, IECEx** product certification and hazardous location zoning regulations, the equipment protection techniques that apply to equipment installed in hazardous locations can be found in the **IEC/BS/EN 60079 “Explosive atmospheres”** series of standards. To obtain a CE or UKCA mark, additional standards, like electromagnetic compatibility (RFI/EMC) and low voltage directive (LVD) must be complied with.

Grounding and bonding systems with active electronic monitoring circuits in hazardous locations also need to comply with such regulations. And although standards exist for the HAZLOC certification of static grounding and bonding systems, there are no formal product standards that govern the performance parameters of such equipment when used in the context of static grounding and bonding functionality.

Technical specifications addressing the ignition hazards associated with static electricity

Organizations like the **NFPA, IEC** and **CENELEC*** publish guidance (recommended practice) to support hazardous location operators with the proactive mitigation of static electricity as an ignition source. This guidance highlights the operations where static electricity could be present as a potential ignition source. Guidance on control measures and procedures that can be put in place to mitigate against such risk are also included in these publications.

**CENELEC adopts the IEC TS 60079-32-1 Technical specification and publishes it as a "Technical Report", which is listed as CLC/TR 60079-32-1 "EXPLOSIVE ATMOSPHERES – Part 32-1: Electrostatic hazards, guidance".*

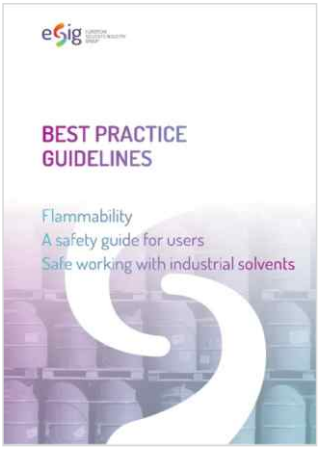
The purpose of the recommended practice **NFPA 77 2024ed** is to assist the user in controlling the hazards associated with the generation, accumulation, and discharge of static electricity by providing the following:

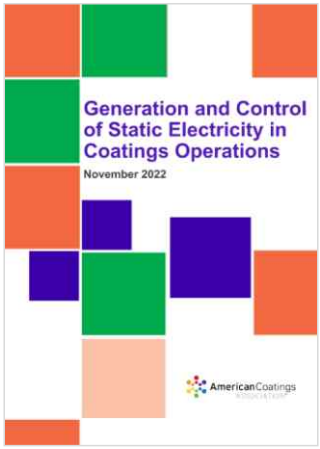
1. Basic understanding of the nature of static electricity.
2. Guidelines for identifying and assessing the hazards of static electricity.
3. Techniques for controlling the hazards of static electricity.
4. Guidelines for controlling static electricity in selected industrial applications.

Another publication is **PD CLC/TR 60079-32-1 "Explosive atmospheres – Part 32-1: Electrostatic hazards, guidance"**.

The goal of 60079-32-1 is:

"It gives the best available accepted state of the art guidance for the avoidance of hazards due to static electricity. This document is mainly written for designers and users of processes and equipment, manufacturers and test houses. It can also be used by suppliers of equipment (e.g. machines) and flooring or apparel when no product family or dedicated product standard exists or where the existing standard does not deal with electrostatic hazards."





In addition to globally recognized standards publishing organizations, there are also industry specific associations that publish guidance for their members. Organizations like the **European Solvents Industry Group (ESIG)**[1] and the **American Coatings Association (ACA)**[2] have guidelines and videos focused on processes and equipment that is of particular relevance to those industries. Both documents support their membership with the range of control measures that should be put in place to mitigate against the ignition risks associated with static electricity.

Incorporating Recommended Practice into grounding and bonding solutions like NFPA 77

In the absence of specific product standards (other than HAZLOC certification requirements), Newson Gale aligns, wherever possible, the performance parameters of its grounding and bonding solutions with the control measures specified in industry guidance documents.

Equipment regularly used in industrial operations can be subjected to “heavy duty treatment” by operators and the materials that are being handled or processed. In such environments grounding and bonding solutions should be capable of establishing and maintaining a stable connection to the object that needs to be grounded for the period of time the process generating static charge is underway. Central to the operating parameters of any grounding or bonding solution is the electrical resistance present between the object and a plant verified grounding point. For the electrostatic charge to be transferred from the object to the verified grounding point, we need to know what the electrical resistance is between both points. This is what we normally refer to as the “ground loop”.

Temporary “ground loop” connection made to metal drum prior to a filling or blending operation. The copper tape is connected to the plant’s verified earth.

<u>This ground loop encompasses the:</u>

- Capability of the connection device (e.g., grounding clamp) to bite through connection inhibitors like paint, coatings, rust, product and grime build-up to the base metal of the object;
- The cable, and its connections, between the grounding clamp and the ground monitoring system;
- The ground path for static charges via the grounding system itself and finally;
- The ground loop connection(s) to the verified grounding point.

Most of the equipment at risk of accumulating electrostatic charge in manufacturing and distribution operations is made of metal and the common denominator in the guidance/ recommended practice documents listed above is to benchmark the total resistance present in the ground loop circuit to an electrical resistance threshold of 10 ohms or less.

Why 10 ohms or less?

While a theoretical resistance to earth of 1 meg-ohm is generally considered as capable of

dissipating static electricity, the current carrying value of the ground loop is not the primary concern for mitigating against the accumulation of static electricity. The primary concern is the physical integrity of the temporary or semi-permanent circuit that is made between the object that requires grounding and its connection to the verified grounding point.

The guidance listed above states that if there is a resistance in the circuit higher than 10 ohms it is likely that there are loose or corroded connections somewhere in the circuit. Scenarios like this should be addressed immediately as the path for removal of the static charge could be impeded. Setting a benchmark self-monitoring resistance of 10 ohms or less provides early indication of such situations. Given that the objective of the grounding system is to mitigate against the accumulation of static electricity, accompanied by the risk of a potentially incendive static spark discharge, setting a benchmark resistance threshold of 10 ohms or less makes practical sense.

To actively monitor ground loop circuits to a benchmark threshold resistance of 10 ohms or less requires electronic monitoring systems that have a high degree of precision and repeatability. With the exception of the Earth-Rite® FIBC ground monitoring system built to monitor Type C FIBC bags, all Newson Gale products, with active ground loop monitoring circuits, incorporate a 10 ohms or less threshold resistance level.

What follows are examples of the control measures outlined in the documents listed in this article.

NFPA 77

7.3.1.6.1
"Where the bonding/grounding system is all metal, resistance in continuous ground paths is measured to verify mechanical integrity. (See A.3.3.2) 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. A permanent or fixed grounding system that is acceptable for power circuits or for lightning protection is more than adequate for a static electricity grounding system. Static grounds should be made to the building steel, if possible. Grounding to power grounds or lightning protection systems is not recommended."

A.3.3.2 Bonding
"A resistance not exceeding 10 ohms for copper wire or 25 ohms for stainless steel or other metals is typically found in practice. Higher resistances could indicate a lack of mechanical integrity."

ACA Guidance Section 6.2.6

6.2.6 Grounding and bonding connections and devices should be routinely tested to confirm continuity and integrity.

"Maximum resistance to ground should be 10 ohms or less (check state and local codes). With all-metal systems and tight connections, it should be easy to achieve this level of resistance to ground. While a resistance of up to 1 megohm (1,000,000 ohms) is generally low enough for static charge removal (2, 4, 10, 11, 14, 16) resistance this high in all-metal systems with tight connections usually indicate problems such as corrosion, loose or broken connections or a buildup or coating of poorly conducting materials somewhere in the system. If the grounding path includes non-metallic components, such as conductive or static dissipating polymers as are found in many "conductive" FIBCs, a ground resistance of approximately 100 megohms may be normal."

IEC 60079-32-1 / PD CLC/TR 60079-32-1

13.3.4. Moveable metal items.
"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.

Earthing and bonding need to be continuous during the period that charge build-up could occur and cause electrostatic hazards. Making or breaking an earth or bond connection in the presence of an electrostatic field could cause electrostatic charging by induction, thus being hazardous."

13.4 The establishment and monitoring of earthing systems.

13.4.1 Design
"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.

Permanent bonding or earthing connections should be made in a way to provide low resistance during its lifetime, e.g., by brazing or welding. Temporary connections can be made using bolts, pressure-type earth 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."

ESIG Safety Guide Section 3.3.5.2 Filling IBCs

"The first step in loading all IBCs should be to attach a temporary earth connection with a maximum resistance of 10 Ω to the frame or earth point. The final step should be the removal of this earth connection."

ESIG Safety Guide Section 3.3.5.1 Earthing

"The resistance to earth of a tanker truck or ISO container vehicle with pneumatic tyres standing on a dry surface could exceed 1 MΩ. Therefore, the first step in loading these vehicles Ref 13, Ref 27 Part 2 Sec 7.2.1 should be to attach a temporary earth connection with a maximum resistance of 10 Ω to the earthing pin of the truck or container. This connection should not be detached until all other operations have been completed. Automatic earth checking systems are available, and their use is recommended."

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WEB01-030325-R2