



Worker Safety

## Justrite's Guide to Safety Grounding & Bonding Practices

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*Recommended practices for identification, assessment and control of static electricity to prevent fires and explosions.*

Most people are familiar with static electricity. They've heard the crackling when removing clinging fabrics from the dryer, or they've felt a slight electric shock when touching a door knob or other metal object after walking across a carpeted floor. During the winter or when the air is very dry, the effects of static electricity are more noticeable, and annoying. But, did you know static discharge is also a major cause of industrial fires and explosions?

In the United States, nearly 300 incidents are reported annually. In one such incident, a simple task of filling a bucket with toluene caused a significant fire. The operator hung a metal bucket with a wire bail and plastic handle on a globe valve during dispensing and stood back while the bucket filled. Suddenly, the toluene ignited, leaving the operator unable to extinguish the fire with a small handheld extinguisher. He left the scene to grab a larger fire extinguisher, but the fire was too large when he returned. He could no longer access the valve to shut off the toluene supply, providing the fuel for the large blaze. It resulted in major property damage.

Investigators identified a spark caused by static discharge started the fire. The ungrounded bucket's plastic handle insulated it from the piping system. This led to a difference in charge between the two.

Friction between different types of material creates static electricity. When contact is made, electrons may transfer from one material to the other. This creates an imbalance of electrical charges. Transferring or pouring flammable liquids also generates energy, increasing the risk of static electricity.

Electrical grounding and bonding are important safety practices for preventing static discharge and reducing the possibility of a fire. But the electrical principles on which we base grounding and bonding can be confusing. This guide answers some common questions about grounding and bonding, and will help you apply these principles and best practices in your workplace.



(Top) Use bonding wire while pouring liquids into other containers. (Bottom) Justrite cabinets feature grounding lugs that accept antistatic wires to safely ground cabinet to earth ground.

# Definitions

## **Grounding:**

The process of bonding one or more conductive objects to the ground, so that all objects are at the same static potential as earth; also referred to as "earthing."

## **Bonding:**

The process of connecting two or more conductive objects together by means of a conductor so that they are at the same static potential, but not necessarily at the same potential as the earth.

### **1. What is the Purpose of Grounding and Bonding?**

When working with flammable liquids, safety needs to always be top of mind. You must ground containers when dispensing Class I flammable liquids between containers. As an industry best practice, Class II and Class III liquids should be grounded when heated within 30°F from a storage or process condition. As the example above illustrates, it's easy for a spark of static to cause a flash fire. The purpose of grounding and bonding is to keep that from occurring, by providing a conductive pathway between transfer and dispensing containers and the ground.

Grounding all containers to an earth source is recommended to prevent the buildup of static electricity. Attach grounding cables on any drums in use to an earth source for as long as the drum is in use. This provides a pathway for the electric charge to the earth, where it safely dissipates.

When dispensing liquid into another container, use bonding wire to connect the dispensing container and the receiving container. This ensures both containers have the same static electric potential and prevents the formation of sparks.

For grounding or bonding to be effective, there must be a metal-to-metal connection. Even small amounts of paint, rust or dirt around the attachment may affect the quality of the connection.

### **2. Do I Need to Ground All Flammable Liquid Safety Cabinets?**

There are no regulations or codes that require grounding a safety cabinet. But, it is critical to do so if you are dispensing Class 1 flammable liquids from inside the cabinet. Not only could the inside of the cabinet rapidly fill with ignitable vapors, the cabinet also has a large metal surface and metal shelves to discharge static against.

All Justrite safety cabinets come with exterior grounding lugs in place to connect with a ground wire to a ground source. Connect a ground wire between all containers used to transfer liquids and someplace inside the cabinet, like a shelf hook or vent hole.

It is also an industry best practice to ground the cabinet otherwise.

### **3. Do I Need to Ground Hazardous Material Safety Cabinets?**

When conditions exist where ignitable vapors, flammable gases, combustible dusts can be ignited by static, static management should be utilized. Safety assessments should be made by a qualified individual to determine if grounding the cabinet is required.

### **4. Is Grounding and Bonding Required when Transferring Flammable Liquids Between Containers?**

Here is what OSHA 1910.106(e)(6)(ii) states regarding grounding:

Category 1 or 2 flammable liquids, or Category 3 flammable liquids with a flashpoint below 100 F (37.8 C), shall not be dispensed into containers unless the nozzle and container are electrically interconnected. Where the metallic floorplate on which the container stands while filling is electrically connected to the fill stem or where the fill stem is bonded to the container during filling operations by means of a bond wire, the provisions of this section shall be deemed to have been complied with.

In summation, you must ground and bond all containers of liquids with a flashpoint of 100°F or less.

**Note: The flexible nozzle of a Type II safety can is an effective bonding connection.**



Flame arresters prevent ignition of ignitable vapors.

## 5. What Part does a Flame Arrester Play in Bonding and Grounding?

Flame arresters are an important safety feature to prevent ignition of ignitable vapors inside a safety can. They are also integral to the bonding or grounding circuit when ground or bond wires are attached to the outside of safety cans.

## 6. What are the Requirements for a Bonding and Grounding Cable?

Ground/bond wires are not specified by the current-carrying capacity. Braided or stranded wires offer robust strength and dependability when frequently connected and disconnected. Justrite uses airplane cable. Use strong clamps with sharp bite or teeth to ensure a good metal-to-metal connection. When testing ground and bond circuits, a resistance of 1 megohm (10 to the 6th power) or less is considered adequate per NFPA 77. **Helpful Tip: For complete confidence in the connection, sand off all painted surfaces.**

## 7. How do I Ground and Bond Plastic Drums During Transfer?

Plastic drums do not conduct electricity, but static electricity may still build up on the surface of the plastic or in the flammable liquid itself.

Justrite discourages using plastic drums and containers for flammable and combustible liquids, unless provisions to manage static are incorporated into the design or the transfer process risks are fully assessed. Always consult NFPA 77: Recommended Practice on Static Electricity.

To manage static electricity when dispensing flammable liquids into plastic drums, use Justrite's Large Steel Drum Funnel with a 32-Inch Flame Arrester. The full-length brass flame arrester minimizes

splashing, friction, and the buildup of static in the fluid. When properly connected by grounding or bonding wires, the funnel keeps the fluid at the proper static potential. Sit plastic drums on a grounded metal plate to dissipate surface static on the outside of the plastic drum.

## 8. How do I Bond Plastic Safety Cans?

Plastic or polyethylene safety cans are popular because of their resistance to corrosion and chemical attack. They are also less susceptible to dents, punctures and chips than metal cans. Justrite's non-metallic safety cans feature a carbon impregnated insert creating a conductive path between the stainless-steel handle assembly and the stainless-steel flame arrester inside of the pour spout. A convenient place label on the handle is suitable for making a ground/bond wire connection between it and another container.

For a downloadable PDF of this Guide, click ***here***.

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