

MONTHLY

UC SAFETY SPOTLIGHT

Poster of the Month

Practical Tips to Help You Keep Yourself, Your Co-workers and Your UC Campus Safe, Healthy and Secure

AUGUST 2017

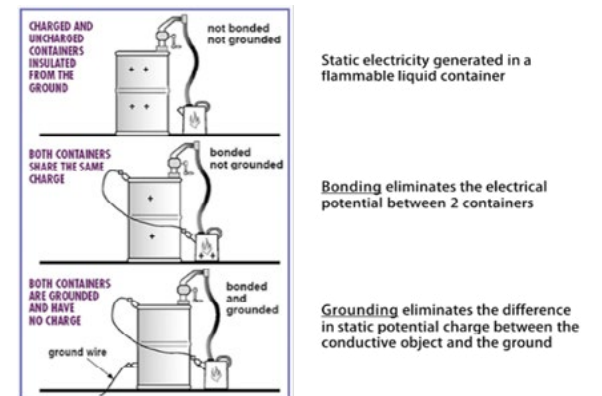
Safe Flammable Liquid and Gas Transfers in Lab-Scale Quantities

By Megan Hall, PhD. Assoc. Fire Marshal UCB; Mike Kumpf, Director Safety College of Chemistry, UCB; and Jim Gilson, PE, CPCC, OWSI, Center of Excellence Safety and Risk Engineering, UCB and UCOP

Several recent high-hazard lab fires or explosions have occurred in the past 24 months, at UC and other Universities. The ignition source for all of these was a static-electric spark. The cause of these fires was determined to be poorly installed flammable liquid or gas storage containers with piping and/or receiving containers that were not properly Bonded and Grounded. In several fires, there were also locations that had poor ventilation allowing for flammable fumes to accumulate.

Whenever transferring flammable liquids between a source/storage container and a use container, or a flammable gas from a storage bottle to research equipment through plastic piping or metal-fittings that have electrically-insulating pipe-thread sealants, there is potential for static-electric charges to build-up in the equipment components. These static-charges can occur from the movement of the liquid/gas through the piping, from storage of the source or receiver container in an electrically-isolated location, from friction within the pumping/distribution components, or from liquid falling through dry-air from a pump-nozzle to the receiving funnel and container. Also, personnel walking through dry-air, especially when wearing synthetic fabrics and athletic shoes, can develop their own static-electric charge different from their research equipment. In one particularly gruesome incident, the ignition source for an H₂ gas explosion was a static-electric discharge from the researcher's hand to their research equipment.

At UC Berkeley, a multi-departmental team formed from the College of Chemistry, EH&S Safety Engineering, Facilities and the campus Fire Marshal, to develop a universal approach to controlling static-electric charge build-up in all research equipment that uses flammable liquids and/or gases. It was first determined that all lab-buildings needed to be wired with an "earth ground" electrical-system that would potentially allow any lab-building electrical-outlet to be used as a grounding location for small scale research equipment and flammable liquid/gas transfers. In addition, the campus Fire Marshal determined that flammable liquid source-containers of 1-gallon and smaller were exempt from the need to ground and bond any flammable liquid transfers in a lab. However, flammable gas transfers from storage-tank to a research-use-location would need to all be bonded to the same building-ground system.



Testing and Labeling for High Quality Ground

The above criteria then allowed the College of Chemistry to develop their own in-house universally adaptable bonding and grounding equipment for all types of storage and receiving flammable liquid containers. In addition, flammable and oxidation gas storage containers could be physically separated and the metal-storage racks and piping distribution systems could all be bonded and grounded to the same building-ground system. All lab-equipment using the flammable gases are now grounded to the building-ground thus electrically-bonding the entire flammable gas distribution system together.

To use your building's ground to bond research equipment, Facility Services must first confirm that the building has an "earth ground" electrical system. Then, they can test for the presence of a high-quality ground on a specific outlet using a special outlet tester. Once it's confirmed a high-quality earth ground is present, a green "ground dot" is attached next to the receptacle alerting researchers that it's safe to use that receptacle for a grounding/bonding need.

EH&S Safety Engineering developed a set of test-protocols and sourced electrical test meters, continuity test equipment, pre-made grounding plugs and wires with alligator clips, and basic electrical-system outlet testers that are very low-cost and UL approved. This allows Lab Safety Managers to set up their own bonding and grounding equipment installations, and routinely test their own research equipment to confirm sound bonding and grounding of all their research.

For more information about adapting this grounding and bonding program to your lab operations and research equipment, or for a no-cost desk-top or on-site safety engineering consultation for grounding and bonding your research equipment, please contact Jim Gilson, PE, CPCC, OWSI, Center of Excellence Safety and Risk Engineering at 510-643-9575 (O) 415-710-7408 (C) email: j_gilson@berkeley.edu.

Safe Flammable Liquid Transfers

Bonding and grounding a 20L flammable liquid pail and glass, metal and plastic receiver cans.



GLASS

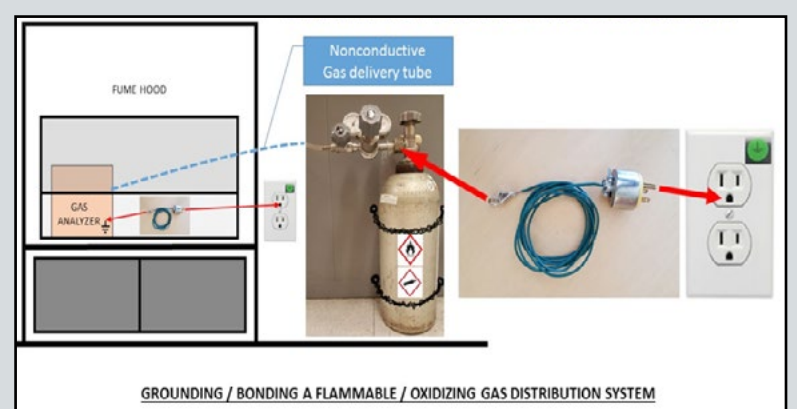


METAL



PLASTIC

Flammable Gas Distribution Safety



1. Use a grounding plug to electrically attach your supply piping and tank to the building's ground.
2. Use a separate grounding plug to electrically attach your gas analyzer to the building's ground. (Note, this may automatically occur if the analyzer has a 3-prong plug as standard equipment.)