

Transfer of Flammable Liquids

REFERENCE GUIDE

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This guide provides safety information and best practices for the transfer of flammable liquids. Large transfers of flammable liquids can lead to fire, explosion, and personal injury if not performed safely. Flammable liquids have low flash points and vapors can ignite easily, so it is necessary to follow proper procedures and precautions. The handling of flammable liquids is regulated by the California Fire Code (CFC) and Cal OSHA, specifically categorized by the Globally Harmonized System of Classification (GHS).



Definitions

Boiling Point: The temperature at which the vapor pressure of a liquid equals the atmospheric pressure of 14.7 pounds per square inch absolute (psia) (101 kPa) or 760 mm of mercury.

Bonding: The process of connecting two or more conductive objects together by means of a conductor so that they are on the same electrical potential.

Flammable Liquid: A liquid having a closed cup flash point below 100°F (38°C). Flammable liquids are further categorized into a group known as Class I liquids per CFC, and Categories 1-3 per GHS. The CFC Class I definition is subdivided as follows:

| Flashpoint | Boiling Point | CFC Classification | GHS Classification | Examples |
|--------------------------|---------------|--------------------|--------------------|--|
| <73°F(23°C) | <100°F (38°C) | Class 1A | Category 1 | Diethyl Ether, Pentane |
| <73°F(23°C) | ≥100°F (38°C) | Class 1B | Category 2 | Acetone, Ethanol, Isopropyl Alcohol, Methanol, Hexanes |
| 73°F(23°C) – 100°F(38°C) | N/A | Class 1C | Category 3* | 1-Pentanol, Xylene |

*Some Category 3 flammable liquids per GHS have flashpoints >100°F and are not Class 1C per CFC. They do not meet the criteria for the provisions of this guide unless the liquid is heated during transfer. Examples include diesel fuel and amyl acetate. Always verify the flashpoint of Category 3 flammable liquids and transfer conditions before initiating transfers.

Flash Point: The minimum temperature of a liquid or solid at which it gives off vapor sufficient to form an ignitable mixture with a gaseous oxidant (i.e., oxygen) near the surface of the liquid or solid under specified environmental conditions.

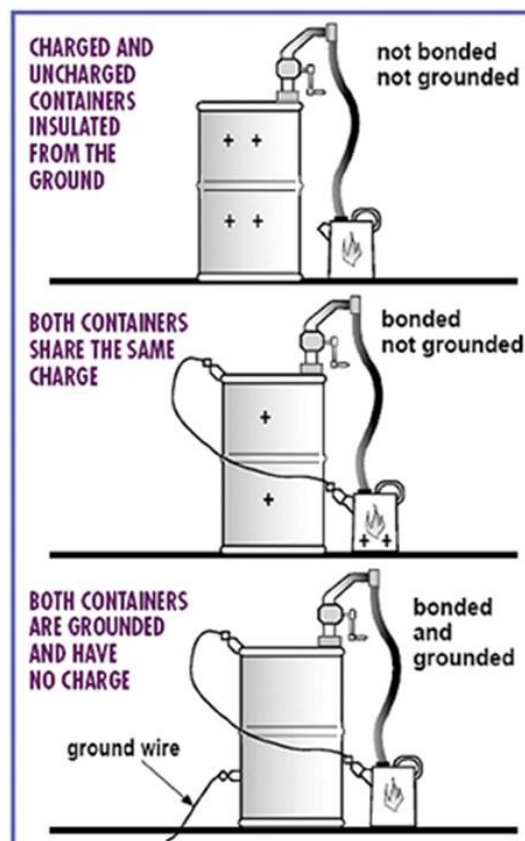
Grounding: The process of bonding one or more conductive objects to the ground so that all objects are at zero electrical potential.

General Guidelines

- All liquids with a flash point less than 100°F(38°C) have the potential to ignite under normal environmental conditions, especially during transfer, due to the potential buildup of static electricity or nearby heat and ignition sources. **Do not perform liquid transfers near heat or ignition sources.**
- **All liquids with a flashpoint below 100°F(38°C) in metallic or non-metallic containers >1 gallon (4 liters) must be bonded, grounded, and safely transferred in an adequately ventilated area.** When possible, using a fume hood is highly recommended.
- **Never pour flammable liquids directly from drums into other containers.** Always use a pump.
- Perform transfers using **secondary containment**. Metallic floorplates serve as secondary containment and are preferred to reduce the presence of non-conductive items during transfer.
- Wear appropriate PPE.
 - Flame-resistant Lab Coat
 - Safety Goggles
 - Closed Toe Shoes
 - Long Pants
 - Nitrile Gloves
 - Flame Resistant Outer Gloves (highly recommended)
 - Respirator (if applicable)
- Ensure the lab is equipped with an **adequate spill kit** and **clean any spills immediately**. Dispose of any debris as hazardous waste. For large spills, contact EHS for guidance or 911 if emergency.

How to Bond and Ground

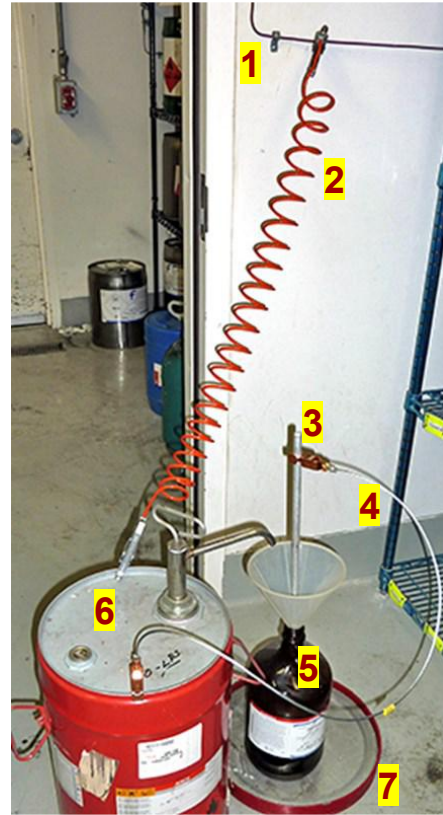
1. Identify a safe location with adequate ventilation away from heat and ignition sources, ideally within a fume hood, local exhaust system, or solvent dispensing room.
2. Obtain bonding and grounding wires.
 - a. Plastic coated grounding wire with clamps or loops on one or both ends, or a grounding plug.
 - b. Braided bonding wire with alligator clips or loops on one or both ends.
3. Connect the grounding wire to a metal ground source (e.g. copper rod connected to building, or grounding plug directly into electrical outlet). Do NOT use fire sprinkler lines.
4. Remove dirt, debris and paint from containers to ensure good metal to metal connections.
5. Connect the grounding wire to the metal dispensing container or metallic floorplate.
6. Connect the bonding wire from the receiving container to the metal dispensing container or metallic floorplate.
7. Non-metallic containers must also be bonded and grounded, which can be achieved using a grounding rod or metal funnel with long stem. Connect the dispensing container to ground and connect the bonding wire to the grounding rod or metal funnel placed directly into the receiving container.
8. Check connections for continuity with a multimeter or similar tool, ensure the configuration is correct, and touch the ground to discharge yourself before initiating transfer.



Bonding and Grounding Example Configurations and Equipment



1. Ground
2. Grounding Wire
3. Grounding Rod
4. Bonding Wire
5. Receiving Container
6. Dispensing Container
7. Metallic Floorplate/ Secondary Containment



| Grounding Wires and Plugs | Bonding Wires | Grounding Rods and Funnels* |
|---------------------------|---------------|-----------------------------|
| | | |

*Conductive metal funnels are preferred. If a plastic funnel must be used, or the metal funnel stem is not long enough to reach the bottom of the receiving container, ensure that a grounding rod is appropriately inserted into the receiving container and bonded to the dispensing container.

Dispensing Flammable Liquids

- Never pour from containers larger than 1 gallon (4 liters). Pouring flammable liquids from large containers can lead to spills, static buildup, exposure to hazardous vapors, and physical injury, so a **pump or syphoning technique must always be used**.
- Some flammable liquids have additional hazards such as toxicity. Ensure adequate ventilation and use a respirator if necessary. Contact EHS for guidance on respirator use. All respirator users must be fit tested and documented by EHS.
- There are several types of liquid dispensing pumps to choose from depending on your needs. Purchase liquid transfer equipment from a reputable science or industrial supplier.



- Not all pumps create a seal on containers. **Do not leave pumps in containers indefinitely**. They must be removed after each use or configured with appropriate equipment that creates a tight seal. Many drums and containers have screw-on adaptors that can support longer-term configurations.
- It is highly recommended to avoid transfers by purchasing smaller containers. If necessary, perform transfer operations strategically. One example is transferring all liquid from large drums/containers to smaller containers in a safe and controlled way all at once. This eliminates the need for frequent transfers from large containers.

References

- 2025 California Fire Code, Chapter 57: Flammable Liquids
- NFPA 30, Chapter 18: Dispensing, Handling, Transfer, and Use of Ignitable Liquids
- Prudent Practices in the Laboratory, Sections 6.F.1 & 6.F.2
- Globally Harmonized System of Classification and Labelling of Chemicals, 11th Edition

Contact EHS at (949) 824-6200 or safety@uci.edu for more information and questions regarding flammable liquid transfer.