

## Laboratory Safety Fact Sheet

### Flammable and Combustible Liquid Storage and Dispensing

#### DESCRIPTION

Fire and explosion hazards of flammable liquids exist in research laboratories throughout the University of Pennsylvania. Research experimentation in chemistry and medicine, for example, require dispensing significant quantities of flammable liquids for distillation and liquid chromatography. The safe handling of these materials requires a basic understanding of the hazards and the steps needed to minimize them.

#### FLAMMABLE & COMBUSTIBLE LIQUIDS IN THE LABORATORY

Flammable liquids are commonly divided into three classes

<u>Class</u>	<u>Flash Point</u>	<u>Boiling Point</u>	<u>Example</u>
IA	Below 73°F	Below 100 °F	Ethyl Ether
IB	Below 73 °F	At or above 100 °F	Acetone, Benzene, Toluene
IC	At or above 73°F and below 100°F		Hydrazine and Styrene

Combustible liquids are divided into three classes

<u>Class</u>	<u>Flash Point</u>	<u>Example</u>
II	100-139 °F	Acetic acid, naphtha and stoddard solvent
IIIA	140-199 °F	Cyclohexanol, formic acid and nitrobenzene
IIIB	200 °F or above	Formalin and picric acid

The **flashpoint** of a flammable liquid is the lowest temperature at which it can form an ignitable mixture with air and produce a flame when a source of ignition is present.

#### STATIC ELECTRICITY HAZARDS IN THE LABORATORY

The flow of flammable and combustible liquids can cause the buildup of static electricity. When enough of a charge is built up a spark can result and potentially cause a fire or explosion. The likelihood of this happening is dependent upon how well the liquid conducts electricity, the flash point and the capacity to generate static electricity.

Static electricity can be generated when liquid is transferred from one metal container to another. Liquids have the ability to generate static electricity when they move in contact with other materials during pouring, pumping or agitating. The build up of this static electricity can cause a spark to form where the solvent exits the container. This could result in a fire or explosion.

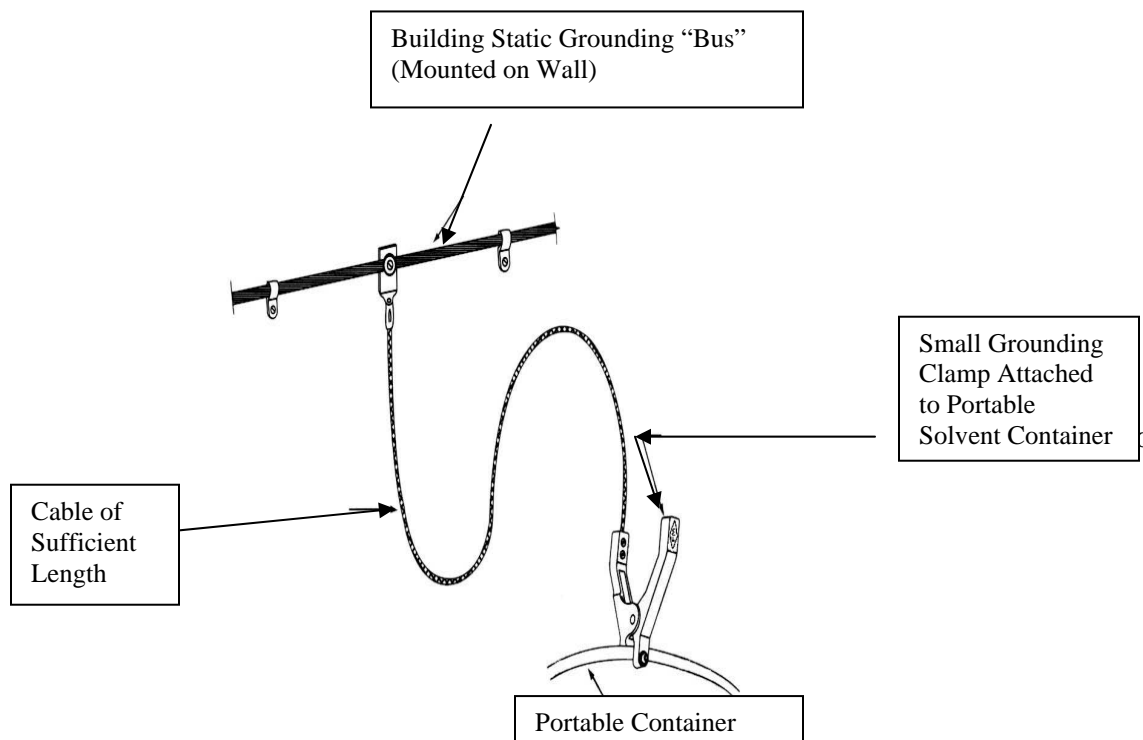
## PROCEDURES TO AVOID STATIC ELECTRICITY

To avoid the build up of static electricity that may cause a spark, it is important to bond and ground metal or special conductive plastic containers. **Bonding** eliminates the electrical potential between two containers therefore eliminating the likelihood of sparks. A bonding wire is connected to two conductive objects as seen in the drums pictured below.



Bonding wires between drums

**Grounding** eliminates the difference in static potential charge between the conductive object and ground. Grounding is accomplished by connecting the conductive object directly to the earth, usually using cold water copper pipes, building steel or grounding bus/bar.



Bonding and grounding require good electrical connections. Remove any dirt, paint or rust ensuring **metal to metal** contact.



Bonding and Grounding wires come in a variety of styles and lengths. They can be purchased through [Fisher Scientific](#);, [Justrite Manufacturing](#); and through [Lab Safety Supply](#):



Hand Clamp



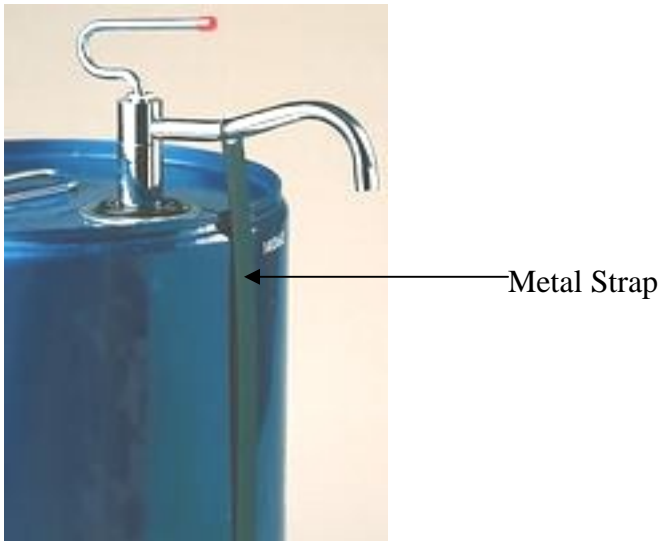
'C' Clamp and Alligator Clip

Static hazards may also exist in non-metallic plastic or glass containers that cannot be grounded. Static may be generated by the free fall and turbulence of the liquid being poured. To minimize this hazard, pour as slowly as possible and use a grounded nozzle extension that allows filling the container from the bottom.

#### DISPENSING FLAMMABLE LIQUIDS FROM 5 GALLON PAILS

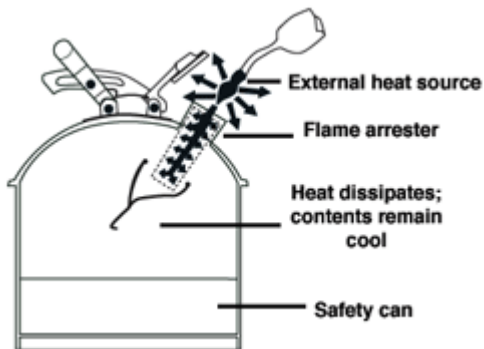
Manual dispensing pumps for 5-gallon pails/cans are available. These pumps are specifically designed to dispense liquids into small laboratory-size bottles without spilling. If you are pouring into a conductive container, a bonding wire should be attached from the 5-gallon pail to the container being filled. The 5-gallon pail should be grounded.

The dispenser shown in the picture below can be purchased through [Fisher Scientific](#). The metal strap in the picture hooks over the bottom of the pail and secures the dispenser while pumping.



## DISPENSING FLAMMABLES FROM SAFETY CANS

Safety cans have self-closing air tight lids and a flame arrester that protects the contents from an external ignition source. Bonding and grounding is still required on safety cans since static electricity generation is possible. The nozzle provides a bonding path to a receiving metallic vessel.



If either of the containers are non-metallic (conductive) it is still important to follow the limited velocity and grounded nozzle extension information given previously.



Safety cans do not offer protection from heat when exposed to fire and should be stored in a flammable liquids storage cabinet when not in use.

## FLAMMABLE LIQUIDS STORAGE CABINETS

In most university laboratories flammable liquids storage is provided under the chemical fume hood in specifically designed vented cabinets. These cabinets are clearly marked “Flammable Storage”. Flammable liquids storage cabinets are constructed to limit the internal temperature when exposed to fire. When additional storage is needed, NFPA 30-4.3.3 approved flammable liquids storage cabinet (FLSC) may be purchased. All containers of flammable liquids must be stored in a FLSC when not in use. The following requirements apply:

### General Requirements

Cabinets shall be no larger than 45 gallon capacity  
Cabinets should be located near fume hood alcoves  
Cabinets shall be marked “Flammable-Keep Fire Away”

### Biomedical Laboratories

Free standing cabinets in biomedical labs shall not be vented. Bungs shall be used to seal vent openings.

### Physical Science Laboratories

Free standing cabinets may be vented into the fume hood exhaust system or a dedicated system for hazardous materials exhaust if present. Replacement air shall be ducted into the cabinet in such a way as not to compromise the specified performance of the cabinet. Venting details shall be submitted to the offices of Environmental Health and Radiation Safety and University Architect for approval.

## Grounding of Flammable Liquids Storage Cabinets

Flammable liquids storage cabinets are equipped with a grounding system that can be connected to a building ground. If you are pouring from a container in the storage cabinet and if the container being poured to is conductive then a bonding strap should be attached between them as explained in ‘PROCEDURES TO AVOID STATIC ELECTRICITY’ found above.

[Fisher Scientific](#) and [Grainger](#) carry a wide variety of flammable liquids storage cabinets.



## PERSONAL PROTECTIVE EQUIPMENT

Splash proof goggles in addition to standard laboratory personal protective equipment (PPE) consisting of a lab coat, closed toe shoes and nitrile gloves should be worn while pouring flammable liquids. Pouring larger volumes may require additional PPE consisting of thicker gloves and an apron. Follow your laboratory Standard Operating Procedures (SOP).

## EMERGENCY PROCEDURES

In the case of a fire, call 511 from a university phone to reach Police/Fire, pull the fire alarm and leave the building. Make yourself available to the emergency responders. Follow your laboratory specific SOP for emergencies.

An eyewash/safety shower must be nearby when dispensing flammable liquids.