

Safety and Health

Management of Flammable and Combustible Materials

These guidelines apply to all Marshall University laboratories and departments storing or using flammable and/or combustible materials.

Definitions:

Combustible liquids - Those liquids having a flash point at or above 100 °F. Combustible liquids are classified as either Class II or Class III liquids and are subdivided as follows:

- Class II: Liquids with flash points at or above 100 °F and below 140 °F.
- Class IIIA: Liquids with flash points at or above 140 °F and below 200 °F.
- Class IIIB: Liquids with flash points above 200 °F.

Flammable liquids - Those liquids having a flash point below 100 °F. All flammable liquids are classified as Class I liquids and are subdivided as follows:

- Class IA: Liquids with flash points below 73 °F and boiling points below 100 °F.
- Class IB: Liquids with flash points below 73 °F and boiling points above 100 °F.
- Class IC: Liquids with flash points at or above 73 °F, but below 100 °F.

Safety can - A listed container of not more than 20 L (5.3 gal) capacity, having a spring-closing lid and spout cover, and designed so that it will relieve internal pressure when subjected to fire exposure.

Unstable liquids - Those liquids that will vigorously polymerize, decompose, undergo condensation reaction, or become self-reactive under conditions of shock, pressure, or temperature.

Storage Requirements:

- Flammable and combustible liquids stored outside of flammable storage cabinets shall be kept to the minimum necessary for the work being done.
- The maximum quantity of flammable and combustible liquids permitted outside of a flammable storage cabinet in any lab or work area is limited to a total of 10 gallons. This will be calculated as total container volume, not remaining liquid volume.
- Quantities stored in flammable storage cabinets shall be limited to 60 gallons of class I or II liquids, and the total of all classifications of liquids shall not exceed 120 gallons per cabinet.

- The size of containers of flammable and combustible materials shall be in compliance with the requirements listed in Table 1 – Maximum Container Size.
- Not more than three flammable storage cabinets shall be located in the same fire area.
- Flammable and combustible liquids shall not be stored near exit doorways, stairways, in exit corridors, or in a location that would impede egress from the building.
- Flammable aerosols and unstable liquids shall be treated as class IA liquids.
- Incompatible chemicals and oxidizers must be segregated from flammable and combustible liquids, and never stored in the same cabinet.

Handling and Dispensing:

- Class I liquids shall not be transferred from one vessel to another in any exit passageway.
- In laboratories, the transfer of flammable liquids from larger containers to smaller containers shall be done in a chemical fume hood.
- When dispensing flammable liquids from 5 gallon containers, the use of a manual dispensing pump designed to dispense liquids into small bottles without spilling is recommended.

Safety Cans:

Safety cans shall be used for all gasoline storage. Their use is recommended in laboratories for all Class I. They do not offer protection from heat when exposed to fire and should be stored in a flammable storage cabinet when not in use.

Personal Protective Equipment:

Splash proof goggles should be worn in addition to standard laboratory personal protective equipment (lab coat, closed toe shoes and nitrile gloves) 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, pull the building fire alarm, exit the building, and call the Marshall University Police Department at 696-4357 or the Huntington Fire Department (911) from a safe location. Make yourself available to the emergency responders. An eyewash/safety shower should be nearby when dispensing flammable liquids.

Flammable Storage Cabinets:

All containers of flammable and combustible liquids must be stored in a flammable storage cabinet when not in use. Flammable storage cabinets are constructed to limit the internal

temperature when exposed to fire. In most university laboratories flammable materials storage is provided under chemical fume hoods in specifically designed vented cabinets.

In non-laboratory work areas, and when additional storage is needed in labs, approved flammable storage cabinets may be purchased. All locations storing more than 10 gallons of flammable and/or combustible materials must have at least one cabinet. [Fisher Scientific](#), [Grainger Industrial Supply](#), and [Justrite Manufacturing](#) carry a wide variety.

Approved cabinets must be UL or Factory Mutual listed, and have self-closing and self-latching doors with a three-point latch. They shall be clearly marked “Flammable-Keep Fire Away.”

Venting Flammable Storage Cabinets:

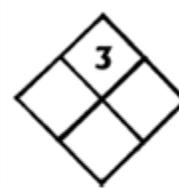
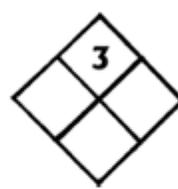
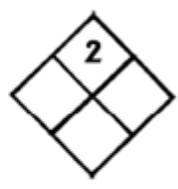
Venting of flammable storage cabinets is not recommended due to the fact that it could reduce the fire protection effectiveness of the cabinet. It is recognized that some individuals and departments may want to vent these cabinets to reduce odorous vapors emanating from the cabinet. This is particularly true when the cabinet is located in an occupied area. To minimize the affect on the fire resistance of the cabinet the following criteria should be followed:

- Mechanical exhaust ventilation shall be utilized. Exhaust shall be discharged above the roof using an existing lab exhaust system or as an independent system.
- The cabinet shall be vented from the bottom with fresh air being supplied from the top. The flame arrestor shall remain in both the lower and upper bung holes. The bung holes should be regularly inspected and cleaned to prevent them from becoming blocked.
- The exhaust duct provided shall be a material of equivalent strength (or better) as the material used for the cabinet's construction (a minimum of 18 gauge sheet steel). The exhaust duct shall also be a material compatible with the liquids stored inside the cabinet.
- The exhaust duct shall be welded. The use of stove pipe, dryer vent and PVC is prohibited.

Other considerations concerning Flammable Storage Cabinets:

- Never locate the flammable storage cabinet by an exit door, or sources of ignition.
- Materials stored inside of the Flammable Storage Cabinet should be compatible with the cabinet's design and construction.
- Acids should generally not be stored in a flammable storage cabinet due to the corrosion of the cabinet and incompatibility with organic solvents.
- When flammable or combustible liquids present multiple hazards, the laboratory design shall address the storage requirements for each hazard. For example, acetic acid is a corrosive and flammable material. Therefore, if stored in a flammable cabinet with other flammable materials, it must be segregated through the use of separate barriers (e.g., secondary containment).
- Incompatible materials, such as oxidizers, cannot be stored in the same cabinet. More information about chemical compatibility is available on the Safety and Health web site: <http://www.marshall.edu/safety/chemicals/>

Table 1. Flammable and Combustible Liquids Information

CLASS	IA	IB	IC	II
Flash point	less than 73°F	less than 73°F	73° - 100° F	100° - 140°F
Boiling point	less than 100°F	greater than 100°F		
Flammability Potential	Extremely High	Very High	High	Moderate
EXAMPLES OF COMMONLY USED MATERIALS	acetaldehyde benzoyl peroxide ethyl ether pentane methyl formate	acetone ethanol butylamine gasoline methanol isopropanol	amyl acetate butanol chlorobenzene turpentine xylene	formaldehyde hydrazine kerosene
NFPA 704 HAZARD RATINGS* 				
MAX CONTAINER SIZE				
Glass	1 pint (500 ml)	1 quart (1 liter)	1 gallon (4 liter)	1 gallon (4 liter)
Metal or approved plastic	1 gallon	5 gallon	5 gallon	5 gallon
Safety cans	2 gallon	5 gallon	5 gallon	5 gallon
Metal drums (DOT)	N/A	5 gallon	5 gallon	60 gallon

Please contact Safety and Health with questions concerning the use and/or limitations of flammable storage cabinets at 696-3432, or e-mail Brian Carrico at carrico8@marshall.edu.

References:

- National Fire Protection Association (2003), NFPA 30: Flammable and Combustible Liquids Code. Batterymarch, PA: NFPA
- National Fire Protection Association (2004), NFPA 45: Laboratories Using Chemicals. Batterymarch, PA: NFPA
- OSHA (2007). General Industry Safety and Health Standards 29CFR 1910.106. Washington D.C.: Bureau of National Affairs, Inc.