

## Flammable Liquids

Examples of flammable and combustible liquids frequently used in the workplace include gasoline, acetone, alcohols, solvents, cleaning fluids, paint and coatings. This bulletin provides an overview of flammable liquid properties, hazards and safety measures.

### PROPERTIES

A flammable liquid gives off vapors that will burn and can be explosive when mixed with air in certain proportions. The distinction between a flammable liquid and a combustible liquid is the rate or ease with which it give off flammable vapors. Any combustible liquid, heated sufficiently, will become flammable. It is the vapor, not the liquid, that burns.

The minimum temperature at which a liquid gives off vapors that can be ignited is its flash point. The flash point is the most commonly accepted hazard index of flammable and combustible liquids. The lower the flash point, the greater the hazard. When there is a lower flash point, the temperature necessary to produce vapors which may be ignited is lower. Liquids that have a flash point lower than room temperature (defined as 73° Fahrenheit) are particularly hazardous because they give off flammable vapors whenever they are exposed to air.

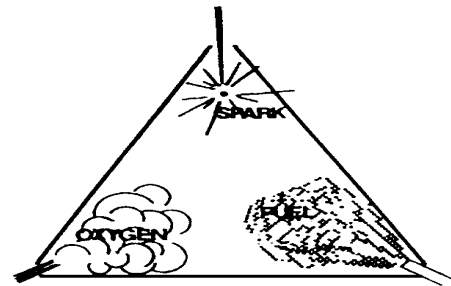
Flammable liquids evaporate and become gases as the temperature increases or the pressure decreases. Thus, the difference between the liquid state and the gas state for any substance is only a matter of temperature and pressure.

Vapors of flammable liquids are heavier than air and tend to settle on the floor or flow along the ground.

Vapors are likely to accumulate in basements and pits unless there is some way for the vapors to drain off at the bottom. Storage and use of any low flash point flammable liquid in a basement should be avoided unless you take special ventilation precautions.

### HAZARDS

The primary hazards of flammable liquids are fire or explosion. A fire requires heat (ignition source), oxygen and fuel.



Common sources of ignition include electricity, smoking, friction of equipment, overheated materials, hot surfaces and burned flames, sparks and embers, spontaneous ignition (e.g. oily rags), static discharges and lightning.

Flammable liquid fires can be prevented by applying one or more of the following:

- Eliminate ignition sources.
- Exclude air (oxygen).
- Keep liquids in closed containers or systems.
- Ventilate to prevent vapor accumulation.
- Replace air with an inert atmosphere.

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## GENERAL SAFETY MEASURES

### QUANTITY

Hazards depend to a certain extent on the quantity of flammable liquids exposed and the volume of the room or building where used. A general rule is to limit quantities used to the smallest possible amount. For specifics, check with your local fire department.

### CONTAINERS

Closed metal containers should be used to store and handle flammable liquids. There is ordinarily little hazard where liquids are stored in non-flammable tight tanks, containers or safety cans with no liquid exposed to the air.

Buckets or other open containers should never be used for storage or handling of flammable liquids.

### MIXTURES

Accidental mixing of flammable liquids must be prevented. A small amount of acetone accidentally put into a kerosene tank may lower the flash point of the entire contents. Gasoline mixed with fuel oil changes the flash point sufficiently to make the fuel oil hazardous in ordinary use. In each case, the lower flash point liquid acts as a fuse to ignite the higher flash point liquid. Piping and containers must be carefully labeled to prevent accidental mixture.

### SMOKING

Smoking is a very common source of ignition. Smoking must be carefully controlled through employee training, warning signs and prohibition in areas where flammables are used or stored.

### ELECTRICITY

Electricity is a major cause of industrial fires. Often, faulty or overloaded wiring in motors is involved. Electrical equipment with special safeguards must be used in hazardous locations and in areas where flammable and combustible materials are stored. For instance, "explosion proof" wiring physically separates electrical conductors from the atmosphere which may contain flammable vapors.

## HOT SURFACES

Hot surfaces and burner flames are found in boilers, furnaces, exhaust ducts, flues and lights. Use of flammables should be avoided in areas where hot surfaces exist, and flammables should never be stored in these areas.

## STATIC ELECTRICITY

Static electricity may be generated when a liquid flows through a pipe or from an orifice into a tank.

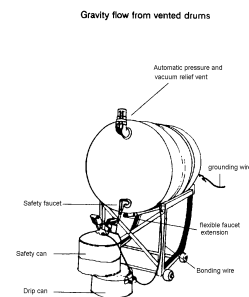
Static electricity may also be created by flammable liquid flowing through a dispensing hose, causing a spark discharge. The spark may contain sufficient energy to ignite flammable or explosive vapors. Grounding and bonding of flammable liquid containers is absolutely necessary to prevent static electricity from causing a spark.

## BONDING AND GROUNDING

The terms bonding and grounding often have been used interchangeably but are different. Bonding eliminates a difference in electrical potential between objects. Bonding is created by a flexible conductor, such as a bonding strap (wire connecting metal to metal) between the storage drum and the smaller receiving can. Grounding eliminates a difference in electrical potential between an object and ground (earth).

A common example is a gasoline fill pipe for autos. All gasoline fill pipes must make a metal to metal connection with the auto fuel tank spout. These gas nozzles are then electrically connected to ground. The auto tank and the gas nozzle are bonded and the underground storage tank is grounded.

Liquids can be safely handled with equipment similar to that shown below.

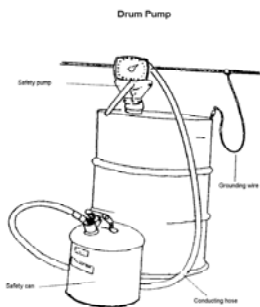


## HEALTH HAZARDS

Flammable liquids may create health hazards from absorption through skin contact and/or inhalation of vapors. The solvent action of many flammable liquids may also irritate skin tissue. It is important to control human exposure through standard industrial hygiene methods such as ventilation, separation or personal protective equipment. Flammable liquids should never be used to clean the skin.

## STORAGE

In many facilities, large drums are used for storage of flammable liquids. The best method of storage is a dedicated storage building. The next level of storage is an inside storage room with special protection. The least desirable method of storage is with no protection.



Inside tanks are undesirable and should not be permitted for low flash point liquids. Safety cans (maximum 5 gallons) approved by Underwriter's Laboratories (UL) should be used for storing and dispensing small quantities of flammable liquids in buildings.

UL-approved safety cans have a spring to close the spout, minimizing evaporation and the likelihood of accidental spillage. They also contain a spark arrestor in the spout.

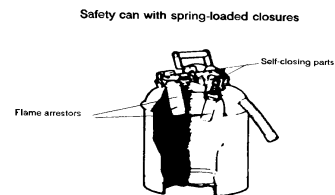
When small quantities of flammable liquids are not stored in storage rooms, they should be kept in specially designed, UL-approved, flammable liquid storage cabinets. Cabinets provide fire and heat enclosure, protect flammables against flash fires, prevent excessive internal temperatures if there is a fire in the building, contain spills and prevent theft when locked. Construction of cabinets should conform to OSHA and NFPA standards.

Empty tanks or drums may be dangerous when residual flammable liquid evaporates, forming an explosive mixture inside the tank. Empty tanks should be tightly closed or filled with water.

## FIRE EXTINGUISHERS

Flammable liquid fires generate a great amount of heat and smoke. For this reason, automatic extinguishing equipment, such as a sprinkler system, is highly desirable for operations where any quantity of flammable liquid is exposed indoors, such as in an open tank. The hotter a flammable liquid, the more rapidly vapors are given off. Extinguishment is more difficult after a fire has been burning long enough to heat the liquid and surroundings.

Before using a portable extinguisher, be sure it's the right type. Always look for the symbol "B" before using any extinguisher on a liquid fire. Never use water - it will only spread the flame, or cause it to flare up.



## CONCLUSION

While the subject of flammable liquids can be very complex, the basic prevention principles are simple.

1. Recognize hazards.
2. Control ignition sources.
3. Separate liquids from oxygen.
4. Store and use liquids properly.
5. Use adequate fire protection equipment.

For further information or assistance, contact your Zenith Safety & Health Consultant.