MICHIGAN MILLERS® INSURANCE
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Flammable & Combustible Liquids

SAFETY TALKS TOOLKIT

Flammable and combustible liquids are commonly used as paints, coatings, solvents, adhesives, hydraulic fluids, fuels and lubricants. They can present a severe fire and explosion hazard due to ease of ignition, rapid flame spread, and high heat release. Flammable and combustible liquid fires are difficult to extinguish. Because of these factors, these liquids require strict adherence to proper storage and handling practices.

Flash Point
These liquids emit flammable vapors that ignite or explode and sustain combustion when exposed to an ignition source. Only the vapors burn, the liquid itself does not. The temperature at which a liquid emits sufficient vapors to sustain combustion is referred to a flash point.

Flammable versus Combustible
Liquids with flash points less than 100°F are called flammable liquids.

Drums and shipping containers used to transport flammable liquids must display a distinctive red label in order to comply with Department of Transportation regulations. "Red Label" is sometimes used to mean flammable. However, a "Red Label" does not always appear on a flammable liquid container.

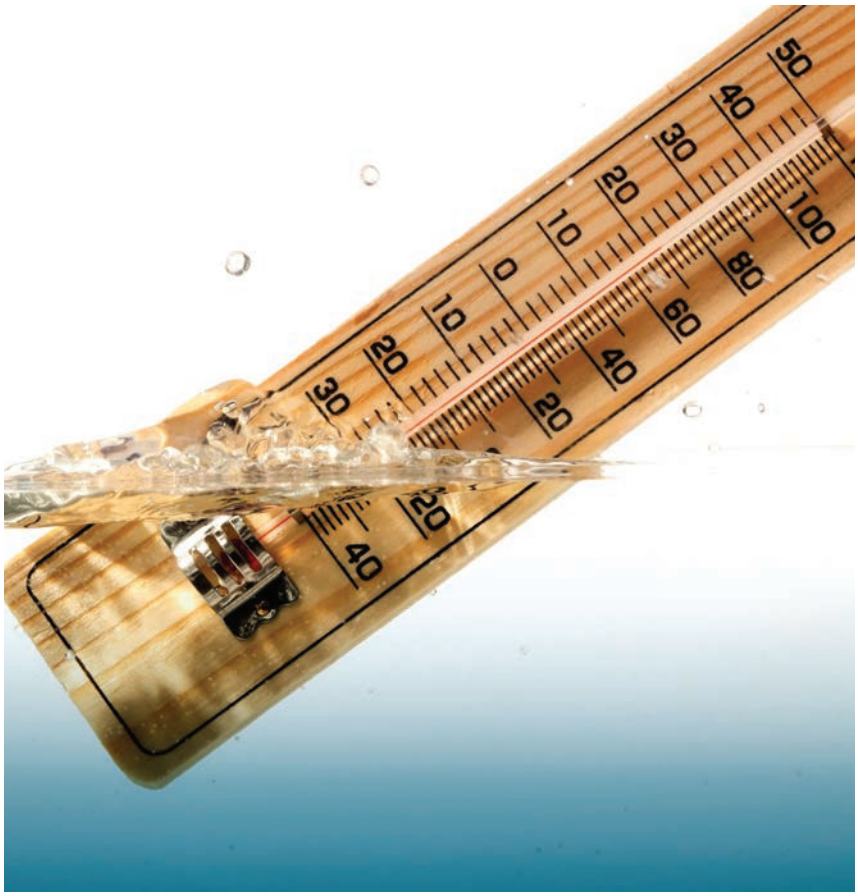
While the fire hazard of a combustible liquid may be less than a flammable liquid, it is still severe. Flash point is a measure of ignition temperature, not fuel loading. Combustible liquids burn vigorously also.

NFPA CLASSIFICATIONS

Flammable liquids are designated Class 1 by the National Fire Prevention Association, NFPA. They are subdivided by flash points above and below 73°F, and then boiling point, above and below 100°F, when the flash point is less than 73°F.

The 73°F subdivision is related to room temperature. Liquids with flash points less than 73°F are routinely exposed to temperatures in excess of their flash point. Boiling point is related to how rapidly the liquid evaporates and generates flammable vapors. A low boiling point indicates a highly volatile liquid that evaporates very rapidly.

Combustible liquids are designated Class II and Class III. Although combustible liquids require an outside heat source to heat them to their flash point, they are often used in situations that expose them to temperatures at or near their flash point. Atomized droplets produced in spray finishing are subject to rapid heating, and pressurized hydraulic fluids can be subjected to extremely high temperatures.



The complete listing of NFPA classifications is:

Class	Flash Point	Boiling Point
IA	< 73°F	< 100°F
IB	< 73°F	< 100°F
IC	73°F - < 100°F	
II	100°F - < 140°F	
IIIA	140°F - < 200°F	
IIIB	>200°F	

ISO CLASSIFICATIONS

ISO bases their classification system on NFPA classifications, but uses different groupings and replaces “class” with “type.”

The ISO Classifications are:

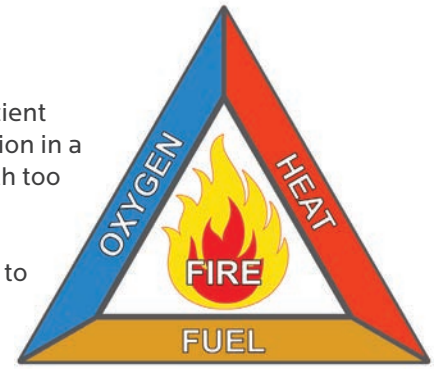
Class	Flash Point
I	< 100°F
II	100°F < 140°F
III	140°F < 200°F

ISO groups Class IC flammable liquids with Class II combustible liquids under Type II and ignores Class IIIB combustible liquids. Using this system, kerosene, mineral spirits thinner, turpentine, and most non-water based paints and coatings are classified Type II. Acetone, methyl ethyl Ketone, lacquer thinner, toluene and most alcohols and other common cleaning solvents are classified Type I.

LOSS CONTROL REPORTS USE NFPA CLASSIFICATIONS

Flammable Range

The fire triangle consists of fuel, oxygen (air) and heat. If any one of these is not present in sufficient quantity, combustion cannot take place. Flammable vapors will only ignite and sustain combustion in a limited range of fuel-air mixtures. With too much air and too little fuel, the mixture is to lean; with too little air and too much fuel, the mixture is too rich.



The range of vapor to air mixtures that will ignite or explode and support combustion is referred to as the flammable range or explosive range. Flammable and explosive are used interchangeably in this context, and the range will vary by substance.

The minimum concentration in the flammable range is the lower flammable (explosive) limit or LFL (LEL) and the maximum concentration is the upper flammable (explosive) limit or UFL (UEL). Ventilation is required in storage and processing areas to prevent vapor accumulations in excess of the LFL. Closed systems prevent vapor accumulations below the UFL.

Other Physical Properties

Certain other physical properties of flammable and combustible liquids can play an important role in the method of extinguishing fires involving them.

Liquids that are water soluble will be diluted by sprinklers and hose streams, increasing the flash point of the resulting diluted mixture. Water will also reduce the temperature and eventually extinguish the fire.

Liquids with a specific gravity less than one will float on top of water, while water will float on top of a liquid with a specific gravity greater than one.

If the liquid is not water soluble and has a specific gravity less than one, water applied to a fire will have some cooling effect, but will also provide a medium to spread the fire. If the liquid has a specific gravity greater than one, a surface layer of water will exclude the fire’s air supply.

Fire Prevention

Flammable and combustible liquid fires and explosions can be prevented by:

- exclusion of sources of ignition
- keeping liquids in closed containers or systems
- ventilation to prevent vapor accumulations inside the explosive range
- exclusion of air or use of an inert gas atmosphere

The most practical and effective means will usually be a combination of the first three methods.