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Flammable and Combustible Liquid Storage and Handling

Quick Tips #179

Introduction

Since the advent of the industrial revolution, the use of non-water based chemicals has increased dramatically. Exposure to the hazards associated with these chemicals has also increased.

One potential hazard is flammability. To prevent fires, hazardous liquids require special precautions in storage, handling and use. The National Fire Protection Agency (NFPA) and the International Code Council (ICC) have developed guidelines for the safe storage and use of flammables under the Uniform Fire Code. These guidelines are not mandatory unless a federal, state or local authority chooses to use them.

Mandatory regulations have been developed, however, by the Occupational Safety and Health Administration (OSHA). OSHA has specified safe handling practices under three separate mandatory regulations for:

- General industry (29 CFR 1910.106)
- Construction industry (29 CFR 1926.152)
- Shipyard industry (29 CFR 1915.36)

For the purpose of this document, only the requirements of the general industry will be discussed.

Defining Flammables

To understand OSHA requirements for the safe storage of flammables, we must define flammable. The flashpoint and boiling point determine the category of a liquid.

A flammable liquid is any liquid having a flashpoint at or below 199.4°F. (93 °C)

- **Category 1:** Liquids with flashpoints below 73°F (22.8°C) and boiling point at or below 95° F (35°C) (1910.106(a)(19)(i)). Examples: acetaldehyde and ethyl ether.
- **Category 2:** Liquids with flashpoints below 73°F (22.8°C) and boiling points at or above 95°F (35°C) (1910.106(a)(19)(ii)). Examples: acetone, benzene and toluene.

- Category 3:** Liquids with flashpoints at or above 73°F (22.8°C) and at or below 140°F (60°C) When a Category 3 liquid with a flashpoint at or above 100°F (37.8°C) is heated for use to within 30°F (16.7°C) of its flashpoint, it shall be handled in accordance with the requirements for a Category 3 liquid with a flashpoint below 100°F (37.8 °C). (1910.106(a)(19)(iii)).
- Category 4:** shall include liquids having flashpoints above 140°F (60°C) and at or below 199.4°F (93°C). When a Category 4 flammable liquid is heated for use to within 30°F (16.7°C) of its flashpoint, it shall be handled in accordance with the requirements for a Category 3 liquid with a flashpoint at or above 100°F (37.8°C). 1910.106(a)(19)(iv)

*Note: term combustible liquid is no longer considered a class or category.

Whether liquids are Category 1 or 4 is not the only factor you should consider when determining your safe storage needs. You also need to consider ignition temperature, explosive limits (LEL or UEL), vapor pressure, specific gravity and vapor density if you want to design a truly safe storage system.

Flammable Safety Cans

One technique to reduce the hazards associated with flammables is the use of safety cans. OSHA defines a safety can as "an approved container, of not more than 5 gallons capacity, having a spring-closing lid and spout cover and so designed that it will safely relieve internal pressure when subjected to fire exposure" (1910.106(a)(29)).

This definition allows a wide variety of containers to be considered safety cans. However, many local laws and insurance carriers require safety cans to be Factory Mutual (FM) or Underwriter Laboratory (UL) approved. These two organizations are nationally recognized, independent testing laboratories to which manufacturers submit products for evaluation of their ability to meet safety requirements under intended use. Products that meet the requirements are given either a UL product or FM approved. Both laboratories are also recognized by OSHA. (For more information on these organizations, see [Quick Tips #100: Understanding ANSI, ASTM International, FM Global, NFPA, SEI and UL.](#))

In addition, 29 CFR 1910.106 limits the amount of liquid in a single [safety can](#). The following chart shows the allowable amounts for each class of liquid.

Maximum Allowable Size of Containers and Portable Tanks for Flammable Liquids				
Container Type	Category 1	Category 2	Category 3	Category 4
Glass or approved plastic	1 pint	1 quart	1 gallon	1 gallon
Metal (other than DOT drums)	1 gallon	5 gallon	5 gallon	5 gallon
Safety Cans	2 gallon	5 gallon	5 gallon	5 gallon
Metal Drum (DOT spec.)	60 gallon	60 gallon	60 gallon	60 gallon

There are exceptions to this rule, including: medicines, beverages, foodstuffs, cosmetics and other common consumer products when packaged according to commonly accepted practice.

Safety Cabinets

Another fundamental means of fire protection is the use of flammable storage cabinets. The NFPA, OSHA and Uniform Fire Code (UFC) require flammable cabinets to be designed and constructed to specific requirements. 1910.106(d)(3)(ii)(a) states that metal cabinets must be constructed in the following manner:

- Bottom, top and sides of cabinet shall be at least No. 18 ga. sheet steel
- Cabinet must be doubled walled with 1" airspace
- Joints shall be riveted, welded or made tight by some equally effective means
- Door shall have a three-point latch
- Door sill shall be raised at least 2" above the cabinet bottom to retain spilled liquid within the cabinet
- Cabinet shall have a "FLAMMABLE—KEEP FIRE AWAY" legend

These regulations also provide an option for wood cabinets. 1910.106(d)(3)(ii)(b) states that wood cabinets must be constructed in the following manner:

- Bottom, top and sides of cabinet shall be constructed of exterior grade plywood at least 1" thick
- Plywood shall not break down or delaminate under fire conditions
- Joints shall be rebuttet and fastened in two directions with flathead wood screws
- When more than one door is used, they should have a rebuttet overlap of not less than 1"
- Doors shall be equipped with latches and hinges that are mounted to not lose their holding capacity when subjected to fire
- Door sill or pan shall be raised at least 2" above the cabinet bottom to retain spilled liquid within the cabinet
- Cabinet must have a "FLAMMABLE—KEEP FIRE AWAY" legend

In addition to the requirements listed above, the UFC also requires self-closing doors. Most local authorities use one or more of these standards as a foundation for establishing local codes.

29 CFR 1910.106(e)(2)(ii)[b] limits the total amount of liquids kept outside a safety cabinet or storage room. These limits are only applicable to those portions of an industrial plant where the use and handling of flammables is only incidental to the principal business. The quantity of liquid that may be stored outside of an inside storage room or flammables storage cabinets in any one fire area of a building cannot exceed:

- 25 gallons of Category 1 liquids in containers
- 120 gallons of Category 2, 3, or 4 liquids in containers
- 660 gallons of Category 2, 3, or 4 liquids in a single portable tank

The amount of liquid storage and location of cabinets is regulated. 1910.106 (d)(3)(i) states, "Not more than 60 gallons of Category 1, 2, or 3 liquids, nor more than 120 gallons of Category 4 liquids may be stored in a storage cabinet." Also, according to NFPA 304.3.2, not more than three such cabinets may be located in a single fire area.

Fire Areas

OSHA does not provide a definition of a fire area in the standard. However, a fire area is defined by NFPA Code 30 (1.6.15) as, "An area of a building separated from the remainder of the building by construction having a fire resistance of at least 1 hour and having all communicating openings properly protected by an assembly having a fire resistance rating of at least 1 hour."

The NFPA also provides a special provision for the grouping of flammable cabinets in an industrial facility. Because most industrial settings do not have walls or barriers within a facility, "In an industrial occupancy, additional cabinets may be located in the same fire area if the additional cabinets, or the group of not more than three (3) cabinets, is separated from the other cabinets or group of cabinets by at least 100 feet (30 m)" (4.3.2 Exception 1).

Commonly Asked Questions

Q. When dispensing flammables, do I have to use bonding and grounding wires?

A. According to 1910.106(e)(6)(ii), Category 1 or 2 liquid or Category 3 liquids with a flashpoint below 100°F (37.8°C) are required to be bonded and grounded. However, for your own safety, bonding and grounding should always be used when dispensing

flammable liquids. For more information, see [Quick Tips #255: Bonding and Grounding](#).

Q. Am I required to have a flammables storage cabinet?

A. OSHA does not require the use of flammables storage cabinets unless the total amount of flammables reaches a given amount. Local authorities and insurance companies may require the use of flammables storage cabinets in quantities less than that of OSHA.

Q. What is the difference between type I and type II safety cans?

A. A Type I safety can has one spout for both pouring and filling. A Type II safety can has two openings: one for pouring and one for filling.

Q. What is a flame arrestor, and what purpose does it serve?

A. A flame arrestor is a mesh or perforated metal insert within a flammable storage container (safety can, cabinet) that protects its contents from external flames or ignition. It also dissipates heat. All Type I, Type II, disposal and specialty cans include a flame arrestor.

Q. Are flammable cabinets required to have mechanical ventilation?

A. OSHA does not normally require the use of mechanical ventilation. The NFPA recommends that cabinets not be mechanically ventilated, but if they are, they should

be ventilated in accordance to NFPA 91 Exhaust Systems for Air Conveying of Materials. For more information, see [Quick Tips #215: Flammable and Chemical Storage Cabinet Ventilation](#).

Sources

National Institute of Occupational Safety & Health, [Pocket Guide to Chemical Hazards](#). U.S. Department of Health and Human Services. Washington: GPO 2005.

National Fire Protection Association, [Flammable and Combustible Liquids Code Handbook](#). Sixth edition, ed. Robert Benedetti, 1996.

United States Office of the Federal Register National Archives and Records Administration, "29 Code of Federal Regulations Parts 1900 to 1910," Washington: GPO 1994.

[International Code Council](#)

[National Fire Protection Association](#)

[Occupational Safety and Health Administration \(OSHA\) 1910.106](#)

Related Articles:

- [Quick Tips #124, Hazardous Locations: Classes, Divisions and Groups](#)
- [Quick Tips #136, Gas Cylinder Storage and Handling](#)
- [Quick Tips #180, NFPA 30: A Guide to Flammable Liquids](#)
- [Quick Tips #181, Chemical Compatibility Concerns in Storage](#)
- [Quick Tips #215, Flammable and Chemical Storage Cabinet Ventilation](#)
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