Flammable Liquid Storage and Handling – Quick Tips



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 Association (NFPA) and the International Fire Code (IFC) have developed guidelines for the safe storage and use of flammables. These guidelines are not mandatory unless a federal, state or local authority chooses to adopt them. However, mandatory regulations have been developed by the Occupational Safety and Health Administration (OSHA) under separate 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 standard will be discussed.

Defining Flammables

To understand the OSHA requirements for the safe storage of flammables, we must first define flammable. The flashpoint and boiling point determine the category of a flammable liquid. Flashpoint is the minimum temperature at which a liquid gives off enough vapor to form an ignitable mixture with air near the surface of the liquid.

A flammable liquid is any liquid having a flashpoint at or below 199.4°F (93 °C). Flammable liquids are divided into four categories:

- **Category 1:**Liquids with flashpoints below 73.4°F (23°C) and boiling points at or below 95°F (35°C) (1910.106(a)(19)(i)). Examples: acetaldehyde and ethyl ether.
- **Category 2:**Liquids with flashpoints below 73.4°F (23°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 73.4°F (23°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 must 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:**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 must 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)). When a liquid with a flashpoint greater than 199.4 °F (93 °C) is heated for use to within 30 °F (16.7 °C) of its flashpoint, it must be handled in accordance with the requirements for a Category 4 flammable liquid (1910.106(a)(19)(v)).

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

Flammable Safety Cans

One tool to help 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 or FM approval. 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, UL and CSA Group.)

In addition, 1910.106 Table H-12 limits the maximum size of containers and portable tanks for flammable liquids. The following chart shows the allowable amounts for each category of liquid.

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 gallons	5 gallons	5 gallons
Safety Cans	2 gallons	5 gallons	5 gallons	5 gallons
Metal Drum (DOT specifications)	60 gallons	60 gallons	60 gallons	60 gallons
Approved portable tank	660 gallons	660 gallons	660 gallons	660 gallons

Medicines, beverages, foodstuffs, cosmetics and other common consumer products when packaged according to commonly accepted practice are exempted from these approved container and portable tank requirements.

Safety Cabinets

Another fundamental means of fire protection is the use of flammable storage cabinets. The NFPA and OSHA require flammable cabinets to be designed and constructed to specific requirements. Per 1910.106(d)(3)(ii), storage cabinets must be designed and constructed to limit the internal temperature to not more than 325°F when subjected to a 10-minute fire test and the cabinets must be labeled in conspicuous lettering, “Flammable – Keep Fire Away.” 1910.106(d)(3)(ii)(a) states that metal cabinets must be constructed in the following manner:

- Bottom, top and sides of cabinet must be at least No. 18-gauge sheet iron
- Cabinet must be double walled with one and one-half inch airspace
- Joints must be riveted, welded or made tight by some equally effective means
- Door must have a three-point latch
- Door sill must be raised at least two inches above the cabinet bottom to retain spilled liquid within the cabinet

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 must be constructed of exterior-grade plywood at least one inch thick
- Plywood must not break down or delaminate under fire conditions
- Joints shall be rabbetted and fastened in two directions with flathead wood

screws
- When more than one door is used, they must have a rabbetted overlap of not less than one inch
- Hinges must be mounted in such a manner as not to lose their holding capacity due to loosening or burning out of the screws when subjected to the fire test

In addition to the requirements listed above, in some areas of the country where the IFC is followed, well-fitted and self-closing doors are also required. Most local authorities use one or more of these standards as a foundation for establishing local codes—it's recommended that the authority having jurisdiction (AHJ) be contacted for specific guidance.

Safety cabinets are offered in single or two door styles with manual or self-closing doors. Manual doors open a full 180 degrees and require the user to physically shut the door(s). Self-closing, self-indexing doors incorporate a mechanism that automatically shuts the doors upon release. Fusible links hold the self-closing doors open during use, but if inadvertently left open, the links melt at 165°F in the event of a fire to automatically close the doors.

1910.106(e)(2)(ii)[b] limits the quantity of liquids that may be kept outside of an inside storage room or storage cabinet in a building or in any one fire area of a building. 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 storage cabinet in a building or 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 flammable liquid storage and location of cabinets are also regulated. 1910.106 (d)(3)(i) states, "Not more than 60 gallons of Category 1, 2 or 3 flammable liquids, nor more than 120 gallons of Category 4 flammable liquids may be stored in a storage cabinet."

Transfer and Use Areas

Areas in which flammable liquids are transferred from one container to another must be separated from other operations by adequate distance or by construction having adequate fire resistance (1910.106(e)(2)(iii)).

Category 1 or 2 flammable liquids, or Category 3 flammable liquids with a flashpoint below 100 °F (37.8°C), must be kept in covered containers when not actually in use (1910.106(e)(2)(iv)(a)). Category 1 or 2 flammable liquids, or Category 3 flammable liquids with a flashpoint below 100°F (37.8°C), may be used only where there are no open flames or other sources of ignition within the possible path of vapor travel (1910.106(e)(2)(iv)(c)).

Whenever handling flammable liquids always think of these eight basic tips:

1. Know your chemical –consult the safety data sheets (SDSs)
2. Remember it's not the liquid itself that burns, but rather, the invisible vapor
3. Maintain adequate ventilation, avoid confined areas where vapors can accumulate
4. Eliminate potential ignition sources
5. Think "covered" or "closed" for containers
6. Properly bond and ground containers when transferring
7. Keep liquids segregated by type and store according to governing codes

8. Use approved storage, transfer, use and disposal equipment, i.e., FM or UL listed

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 flammable liquids or Category 3 flammable 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 flammable storage cabinet?

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

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 for Occupational Safety and Health, Pocket Guide to Chemical Hazards

Occupational Safety and Health Administration (OSHA) 29 CFR 1910.106 Flammable Liquids

National Fire Protection Association (NFPA) Code 30 Flammable and Combustible Liquids Code, 2015 Edition

Related Articles

- Quick Tips #100: Understanding ANSI, ASTM International, FM Global, NFPA, SEI and UL
- 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
- Quick Tips #255, Bonding and Grounding
- Quick Tips #257, Outdoor Chemical Storage Buildings
- Quick Tips #304,What is NFPA 704?

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