



Workplace Safety

## Understanding Flammability Limits: How to Reduce Fire and Explosion Risks in Manufacturing

Matt Morgan | Jul 31, 2025

Flammable gases and liquids can pose a serious threat to worker safety in manufacturing facilities. Understanding the terms—such as lower flammability limit (LFL), lower explosive limit (LEL), upper flammability limit (UFL), upper explosive limit (UEL) and flashpoint—as well as applicable regulations is essential to reducing the risk of fires and explosions.

Fire! The word is enough to make anyone's hair stand on end. And in manufacturing, the threat of combustion is real. Due to the nature of the business—where solvents, compressed gases and other flammable chemicals are used all day, every day—the explosive potential of fire literally hangs in the air.

For a fire to occur, three elements must be present: fuel, such as a flammable liquid; oxygen, from the air; and an ignition source, such as an arc, spark or flame. These elements coexist in virtually every manufacturing business.

Ignition of flammable or combustible liquids caused an average of 262 manufacturing facility structure fires annually from 2017–21, costing \$30 million in direct property damage and resulting in two deaths and 38 injuries each year, according to a **2023 report** by the National Fire Protection Association.

**“Between the NFPA 30 and the IFC codes, you pretty much have it covered how you’re supposed to be doing stuff with flammable liquids.”**

Andy Brousseau  
FEMA

To minimize the risk of fire and avoid becoming a statistic, manufacturing companies should safely store and handle flammable liquids and gases.

## 3 Fire Safety Precautions for Manufacturing Facilities

Lowering your workplace's risk of fire from flammable and combustible liquids starts with these three steps from Andy Brousseau, a retired firefighter and paramedic.

- 1. Train and educate your employees.** Anyone whose job involves storing or handling flammable liquids should understand how to safely perform those tasks.
- 2. Develop standard operating procedures.** "You should have well-developed, documented, written processes on how you're going to transfer fluid, how you're going to add fluid to a machine," Brousseau says. "And people should be adhering to those processes."
- 3. Manage and audit the process.** "Somebody who knows what they're doing has to take a look and say, 'Is this training the correct training for what our folks are doing?'" he says. Periodically check to see that workers are completing the required paperwork and taking any necessary corrective actions.

### Flammability Basics

To protect your facility against fire risks from flammable liquids and gases, you must understand each product's flammability properties—and for that, you must start with the SDS, or safety data sheet.

"The SDS will give you what you need to get started. It won't give you any sound answers—you've got to do some investigation," says Andy Brousseau, a safety adviser with the Federal Emergency Management Agency and a retired firefighter and paramedic of 22 years.

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"It all depends on what the SDS is telling you," he adds. The SDS contains information about a product's physical and chemical properties that is used to determine the maximum allowable quantity of that product at the facility.

### What Are Flammability Limits and Explosive Limits?

Key characteristics of flammables and combustibles include:

#### Lower Flammability Limit

The lower flammability limit—also called the lower explosive limit—is the lowest percentage of a product's vapor or gas in the air that's capable of igniting when exposed to an ignition source, such as an arc, spark, heat or flame. Below the lower limit, the vapor in the air is considered too "lean" to ignite.

## Upper Flammability Limit

The upper flammability limit—also called the upper explosive limit—is the highest percentage of a product’s vapor or gas in the air that’s capable of catching fire. Above the upper limit, the vapor in the air is considered too “rich” to ignite, but conditions can become dangerous quickly: Adding air to a room, for example, can quickly bring the percentage of the product’s vapor down to within its flammability range, with potentially explosive consequences.

## Flashpoint

The flashpoint is the lowest temperature at which a chemical will release enough vapors to catch fire with an ignition source. The lower a chemical’s flashpoint, the more volatile it is and the tighter the restrictions are for storage.

## Boiling Point

The boiling point is the temperature at which a liquid changes to a gas or vapor under normal atmospheric pressure.

Once you know your product’s flammability properties and the many specific circumstances of your facility—down to building construction type, sprinkler system and occupancy rate—you can check your company’s compliance with the authoritative agencies.

## Flashpoint and Flammability Limits for Common Chemicals

Here are the flashpoint, lower flammability limit (LFL) and upper flammability limit (UFL) for a few common manufacturing chemicals. For precise numbers of the product in your facility, be sure to check the safety data sheet.

### Acetone

Flashpoint: -17 C, 1.4 F

LFL: 2.2%

UFL: 13%

### Toluene

Flashpoint: 4 C, 39.2 F

LFL: 1.1%

UFL: 7.1%

### Ethanol

Flashpoint: 13 C, 55.4 F

LFL: 3.3%

UFL: 19.0%

## Regulations for Flammable Liquids and Gases

The primary source for regulation of flammable liquids in the United States is the National Fire Protection Association’s *Flammable and Combustible Liquids Code (NFPA 30)*. “Their document is the bible for flammables and combustibles,” Brousseau says.

Many companies that have international facilities follow the *International Fire Code*, whose regulations are similar. "Between the NFPA 30 and the IFC codes, you pretty much have it covered how you're supposed to be doing stuff with flammable liquids," he says.

When you've determined which guide to follow, "I recommend buying a copy and becoming familiar with it," he adds. "For any questions you have, contact your local jurisdiction having authority."

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Your local jurisdiction having authority is most likely your local fire department, which will have the final say in how your facility complies with flammable liquids regulations.

"As a former firefighter," Brousseau says, "I can tell you that their mindset is to help people, not to just issue citations. They will be glad to tell you, 'This is what you've got to do to be compliant.'"

## **OSHA and NFPA Requirements**

The Occupational Safety and Health Administration (OSHA) does not design rules and regulations for flammable liquids, Brousseau notes. Rather, it bases its *standards* on authoritative agencies such as the NFPA.

Beyond the authoritative agencies, it's a good idea to consult your insurance provider for any requirements it may have that are different from the NFPA, the IFC or the fire department. Failure to comply with your insurance company's regulations could affect your insurability.

## **Different Types of Fire Safety Products for Flammable Chemicals**

Given the looming danger of fire risk in manufacturing, safety products for storing, transferring and using flammable liquids are designed to meet exacting standards. Here are a few you might need at your facility:

**Flammable liquid storage cabinets** are required for any facility storing more than 25 gallons of flammable chemicals, such as solvents. These specially designed cabinets are certified by Underwriters Laboratories (UL) or Factory Mutual (FM), or both. "Almost all facilities will have a need for at least one flammable liquid storage cabinet," Brousseau says. "They can't just be metal cabinets that they used to keep their copy paper in."

**Compressed gas cages** are needed for facilities that use compressed gases, such as acetylene. Not to be confused with **flammable liquids storage lockers**, which have a sump for liquids at the bottom, cages are well-ventilated to let the gas safely dissipate.

**Safety dispensing cans** are good for transferring flammables from a large container (such as a drum) to smaller ones for use around the facility. "They burp and vent off gas when pressure builds up, which is what you want," Brousseau explains. "They have very tight-sealing lids. They're a certain thickness."

**Grounding and bonding equipment** is required to minimize static electricity sparks that could ignite a flammable liquid while it's being transferred from one container to another.

**Plunger cans** are useful for cleaning parts while keeping solvents contained. "You can't just be dipping your rag in an open container," Brousseau says. "You have to have the proper designed can, where you plunge down the rag and it gives you just enough solvent to do your job without releasing a lot of fumes."

**Drum faucets** have an auto-shutoff feature that prevents liquid from continuing to pour if a worker

suddenly isn't able to stop the flow. "We've seen people have strokes or heart attacks, or pass out or trip," he says, "and by the time it takes to get that person on his feet, you have literally gallons of flammables pouring out all over."

## **Frequently Asked Questions About Flammability Limits**

### **What's the difference between flashpoint and flammability limit?**

Flashpoint and flammability limit both relate to the flammability of a chemical substance but refer to different qualities. Flashpoint is the lowest temperature at which a substance will release enough vapors to catch fire with an ignition source. Flammability limit is the percentage range of a substance's vapor or gas concentration in the air that can catch fire with an ignition source.

### **How do you reduce explosion risk from flammable vapors?**

To reduce the explosion risk from flammable vapors, you need to keep flammable substances away from ignition sources by storing and handling them properly, and by complying with required maximum allowable quantities. Because flammable vapors also need oxygen to ignite, ensure the work area has proper ventilation.

***What questions do you have for managing flammable liquids and gases at your facility? Let us know in the comments.***