מקרי התלקחות במילוי מיכלים ניידים בתחנות דלק

רן שלף

כללי

- התלקחות של מיכל נוזל דליק נייד בכלל, ובתחנות דלק בפרט, הוא אירוע נדיר.
- למרות זאת, קיימים נהלים והוראות מחמירים ביותר לקביעת אופן הטיפול במיכלי נוזל נייד דליק.

- מה הסיבה לקונפליקט הזה?

דליקות בתחנת דלק

Flammable Liquids

OAR 437
Division 2/H

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General Information

The general industry standard, 1910.106, Flammable Liquids, is complex and covers many work environments and situations. This fact sheet covers only the basic storage, transfer, and transport requirements. Rules for heavier industrial applications; underground storage facilities; and for building tanks, containers, and other specialized items are in the standard. All references in this fact sheet are to 1910.106 unless stated otherwise. Contact the Oregon Office of State Fire Marshal or your local fire department for additional requirements.

Flammable liquids are divided into categories according to their flashpoints. The following table shows the categories for flammable liquids:

CATEGORY	CRITERIA
1	Flash point < 23°C (73.4°F) and initial boiling point ≤ 35°C (95°F)
2	Flash point < 23°C (73.4°F) and initial boiling point > 35°C (95°F)
3	Flash point ≥ 23°C (73.4°F) and ≤ 60°C (140°F)
4	Flash point > 60°C (140°F) and ≤ 93°C (199.4°F)

Knowing the category plays a role in how to store chemicals. This information may be on the safety data sheet (SDS).

Storage Requirements

Table H-12 in 1910.106 specifies maximum allowable sizes for various types of containers. Section 1910.106(d)(2)(iii) has provisions for glass or plastic containers of up to one-gallon capacity for a category 1 or 2 flammable liquid under specified conditions.

Container volume limits from 1910.106, Table H-12.

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 drums (DOT specifications)	60 gallon	60 gallon	60 gallon	60 gallon
Approved portable tanks	660 gallon	660 gallon	660 gallon	660 gallon

Safety cans: Use safety cans that have been approved by the U.S. Department of Transportation (DOT) or a nationally recognized testing laboratory. They may be either metal or plastic and in quantities of five gallons or less.

Cabinets: Do not store more than 60 gallons of category 1, 2, or 3 liquids or more than 120 gallons of category 4 liquids in a storage cabinet. This includes aerosol cans. See additional requirements in (d)(3) of the standard. You must label cabinets "Flammable, Keep Fire Away." Your state or local fire authority may limit you to three cabinets in each fire area. A fire area is a building or part of a building built with a fire rating of at least one hour and areas of pass-through to other parts of the building with fire ratings of at least one hour.

Inside buildings: Rules for storage of flammables inside buildings vary depending on the category of liquid, the type of building, type of occupancy, protection systems (fire sprinklers), types of containers, and other factors. See (d)(5).

INCIDENTAL INSIDE STORAGE	INSIDE STORAGE ROOMS
If you store or use flammable or combustible liquids that are incidental* to the work or process, the following quantities apply when the material (opened or unopened) is not in a specially built storage room or cabinet. See (e)(2).	An inside storage room permits the storage of larger quantities of flammable liquids than other methods. Paragraph (d)(4) has specific requirements for the design and construction of inside storage rooms. It references NFPA standards that you must follow and talks about wiring, ventilation, and the ways to configure stored containers.
Category 1: 25 total gallons in containers **Category 2, 3, or 4:** 120 total gallons in containers **Category 2, 3, or 4:** 660 total gallons in a single portable tank	

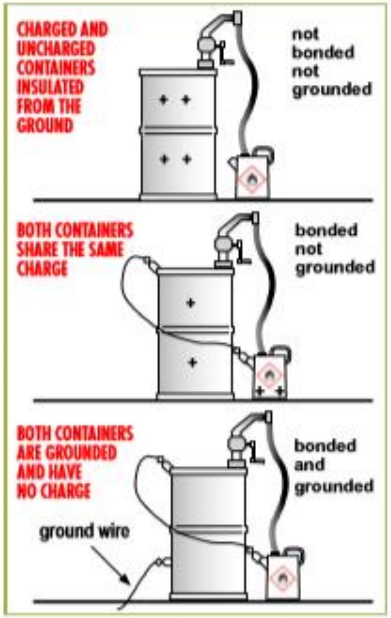
**An example of "incidental to the principal business" use or handling of flammable liquids is a tool manufacturer cleaning parts with flammable degreasing chemicals.*

Outside storage: Rules for storage of flammable liquids outside of buildings vary depending on the category of liquid, types of containers, amount stored, distance from streets and other property, and other factors. See (d)(6).

Transferring Flammable Liquids

Transferring or dispensing flammable liquids often requires special preparation and caution. Moving liquid from one container to another can cause static electricity, increasing the chance of ignition or explosion caused by a spark.

When dispensing category 1, 2, or 3 liquids into portable containers, the containers must be electrically interconnected. **Spray Finishing, 437-002-0107**, also requires bonding and grounding of flammable liquids. The purpose of bonding is to eliminate a difference in the static-electrical charge potential between two or more objects. Use grounding to eliminate a potential difference between an object and the ground. Bonding and grounding are effective only when the bonding objects are conductive materials. Some materials, including some plastics, accumulate static but do not permit effective bonding or grounding because of the inability to disperse the charge. Special instructions for electrical bonding when loading and unloading tank vehicles are in (f)(3)(iv) through (vi) and, for processing plants, in (h)(7)(i).



Transportation and Filling Containers

These Oregon rules are located in Division 2/N, OAR 437-002-2224, Vehicle Drivers and Riders. Never transport flammable liquids in the same part of the vehicle in which people ride.

- For buses, vehicles that carry 16 or more, crew trucks, vans, and passenger cars, use only DOT or UL approved containers that hold five gallons or less and secure them in an area separate from passengers.
- For pickups, flatbeds and other vehicles not listed above, there is no container size limit as long it is not in an enclosed passenger area.

Never fill any container that is not bonded or grounded while it is inside the vehicle, in the pickup bed, or anyplace other than the ground.

Other Points

Fire extinguishers: Paragraph (d)(7) requires fire extinguishers where flammable liquids are stored. This section is a general requirement. Other sections have specific requirements for bulk plants, service stations, and other specialized situations. Find other directions for fire extinguishers in OAR 437-002-0187, Portable Fire Extinguishers.

Open flames and smoking: The standard prohibits smoking or open flames in flammable or combustible liquid storage areas. You must post "No Smoking" signs in service stations (filling areas) [(g)(8)] and bulk plants [(f)(6)].

Reactions with other substances: Read the labels, safety data sheets, or both before you store substances near or with flammable liquids. Some substances become unstable or explosive when mixed with flammable liquids. Always follow the manufacturers' instructions on storage compatibility.

Resources

Other standards containing requirements for flammable and combustible liquids include: 3/F, Construction; 4/H, Agriculture, and 7/F, Forest Activities.

Oregon OSHA Rules/Laws, Letters of Interpretations, and Program Directives

OAR 437-002-1910.106, Flammable Liquids

OAR 437-002-0187, Portable Fire Extinguishers

The Standards and Technical Resources Section of Oregon OSHA produced this fact sheet to highlight our programs, policies, or standards. The information is from the field staff, research by the technical resources staff, and published materials. We urge readers to consult the actual rules as this fact sheet information is not as detailed.

OR-OSHA FS-12 (6/17)

Oregon OSHA
A Division of the Department of Consumer and Business Services

Workplace Health and Safety
Bulletin
WORK SAFE ALBERTA

Handling and Storage of Flammable Materials at the Work Site

What are flammable materials

Flammable materials are substances that can ignite easily and burn rapidly. They can be common materials that are at most work sites in gas, liquid and solid forms. Some examples of flammable materials include:

Gases — Natural gas, propane, butane, methane, acetylene, carbon monoxide, hydrogen sulphide. Flammable gases are usually gases with a lower explosive limit of less than 13 percent in air, or have a flammable range in air of at least 12 percent. For example, butane is a flammable gas because its lower explosive limit in air is 20 percent. Carbon monoxide has a lower explosive limit of 13 percent and upper explosive limit of 74 percent in air, it is flammable over a range of 61 percent.

Liquids — Gasoline, many solvents such as acetone, alcohols and toluene, paints and paint thinners, adhesives, degreasers, cleaners, waxes and polishes. Flammable liquids have a flashpoint below 37.8^0C (100^0F).

Portable storage containers for flammable liquids

When flammable liquids are transferred from their original container (one they were purchased in), or from bulk storage such as a drum or tank, it is important that the proper type of portable container be used. Containers that are approved for the use and storage of "portable quantities" are usually made of metal or plastic, are vapour-proof and have:

- welded seams,
- spark or flame arrestors,
- pressure release valves or spring closing lids with spout covers.

At Alberta work sites, portable storage containers for flammab liquids must meet one of these standards:

- Underwriter's Laboratories of Canada, ULC/ORD-C30-199 *Safety Containers*
- Canadian Standards Association, B376-M1980-R2003, *Portab Containers for Gasoline and Other Petroleum Fuels*

Container volume restrictions are summarized in Table 1.

Handling flammable materials

Fire prevention

To prevent fires, flammable materials must be properly managed in the workplace. There are three main ways to prevent fires:

(1) Limit the amounts of flammable and combustible materials
- Keep only what you need on-site
- Purchase materials in the smallest volumes necessary
- At work locations, keep only those chemicals that are needed for the present task
- Do not let hazardous wastes accumulate at the work site
- Store products, including wastes, used at the work site in proper containers
- Keep flammable materials separate from other processes and storage areas

(2) Provide proper ventilation to ensure flammable vapours do not accumulate
- Install properly designed ventilation in storage area
- Ensure that processes that use or make flammable materials do not exhaust back in the work site
- Ensure that equipment, such as spray booths, where flammable materials are used, are exhausted outside of the building, and away from air intakes
- Ventilation systems must be properly maintained and comply with the Alberta Building Code

Static electricity

Static electricity is an electric charge that cannot move. It is created when two objects or materials that are in contact with each other are separated. While the objects are in contact, the surface electricity charges try to balance each other. When the objects are separated, they are left with either an excess or shortage of electrons, causing them both to become electrically charged. If these charges do not have a path to the ground, they are unable to move and becomes "static". If static electricity is not quickly removed, the charge will build up. Eventually, it will develop enough energy to jump as a spark to some nearby less highly charged object. In an explosive or flammable atmosphere, the spark can set off an explosion or fire. The danger is greatest when flammable liquids are being poured or transferred.

Static electricity can be produced by:

- non-polar liquid flowing through a pipe or hose (e.g. hydrocarbons)
- spraying
- blending or mixing
- filling containers or tanks
- movement (and friction) between materials
- movement of dry powdered material through chutes or conveyors
- movement of non-conductive conveyor belts or drive belts
- appliances that are plugged into electrical outlets
- flipping a light switch on or off.

Static electricity can be controlled by:

- bonding and grounding
- humidification
- static collectors
- additives

אחסון נוזלים דליקים ובעירים

Storage of Flammable and Combustible Liquids

- *29 CFR 1910.106*

Code of Federal Regulations

מטרת הקוד של תקנות פדרליות

קביעת הטיפול, האחסון והשימוש בנוזלים דליקים ובעירים

Scope of the Standard

1910.106(j)

- **"Scope"**
  - This standard applies to the handling, storage, and use of flammable and combustible liquids with a ***flashpoint below 200 degrees F***.
  - The flash point of the liquid determines if it falls within the scope of the standard.

אירוע מספר 1: כניסה למושב בית גמליאל

מבט מצד ימין של הרכב

גופת אדם בתוך הרכב. האם רצח? האם אירוע פח"ע?

הדליקה בתוך תא הנוסעים

אירוע מספר 2: דליקה במהלך מילוי מיכלי טינר

הדליקה מצית כדי לבדוק את מיכל הדלק - ואת האש שפרצה ניסתה לכבות בידיים

לא ברור מה הנהגת הזאת ניסתה לעשות שכמעט פוצץ את תחנת הדלק, אבל היא חשבה שזה מעשה הגיוני לבדוק שמיכל הדלק שלה מלא בעזרת מצית

תגיות: שריפה, תחנת דלק, רוסיה

אסור לפספס
יום שלישי, 29 בנובמבר 2016, 08:07

א א א

מזג האוויר היבש במיוחד גורם לתופעות מעניינות וגם מסוכנות דוגמת החשמל הסטטי שנמצא באוויר וגורם לא רק ל"זצים" במגע עם מתכת כי אם גם לשריפות מסוכנות.

אישה שתדלקה את רכבה בתחנת הדלק בגינוסר במוצאי שבת יצאה מרכבה לקראת תום התדלוק, אך סוודר הצמר שלבשה גרם ככל הנראה לזיק של חשמל סטטי שהצית את פיית התדלוק.

האישה הצליחה לשחרר את הפיה מהרכב שהחל לבעור ונמלטה מהמקום. האירוע תועד כולו במצלמות האבטחה של תחנת הדלק.

חשמל סטטי גרם לדליקה בתחנת דלק. צפו

אשה שתדלקה את רכבה כשהיא לבושה בבגד צמר נגעה בפיית התדלוק שהחלה לבעור בעקבות זיק של חשמל סטטי. כיצד תשמרו מחשמל סטטי ומה יסייע לשחרר אותו? (מעניין)

כיכר השבת | כ"ז בחשון תשעז 09:33 28.11.16

חשמל סטטי גרם לדליקה בתחנת דלק

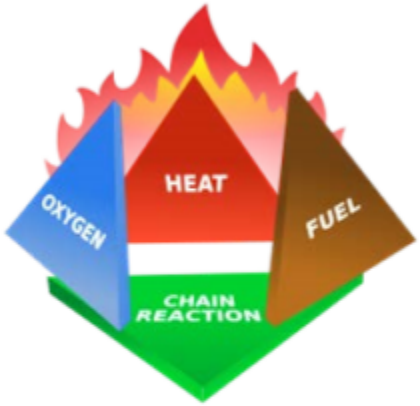
https://www.kikar.co.il/215358.html

חשמל סטטי בתחנת דלק

https://youtu.be/T6VKxmUPb3g

חשמל סטטי במילוי
מיכל נייד בתחנת דלק
https://youtu.be/Ru7bCQ0nQFc

Fire Tetrahedron and the Standard



Fuel

Heat Source

Oxygen

Sustained Combustion

Suitable Chemical Reaction

Combustible Flammable Liquid

Increased Surface Temperature

Production of Vapor

Flame Established

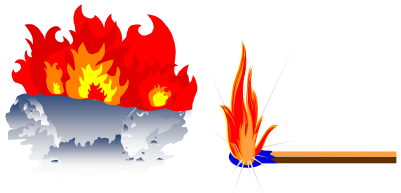
בעירה של נוזלים דליקים

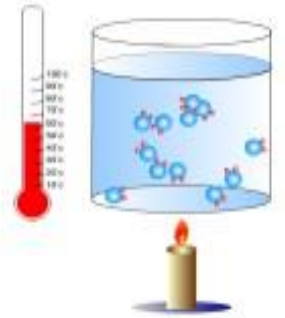
- נוזלים דליקים אינם בוערים לכשעצמם, אלא, האדים המתנדפים מעל פני הנוזל הם הבוערים.

- קצב הנידוף עולה עם טמפרטורת הסביבה.

נקודת הבזקה (Flash Point)

- הטמפרטורה המינימלית שבה תתנדף כמות אדים המספיקה ליצור בעירה ריגעית על ידי ניצוץ על פני הנוזל בתנאי לחץ של 760 מ"מ כספית.





- נקודת הבזקה קיימת גם לגבי מוצקים המתנדפים באיטיות בטמפרטורת החדר (נפטלין, קמפור).

מדידת נקודת הבזקה

Automatic Pensky-Martens closed cup tester with an integrated fire extinguisher

שלוש קבוצות חומרים (הגדרה לפי FP)

מבחינים בשלושה סוגים של חומרים דליקים:

- **נדלקים בקלות** – FP נמוך מ- 40 מעלות
- **נדלקים רגיל** – FP גבוה מ- 40 מעלות ומתחת ל- 100 מעלות
- **נדלקים בקושי** – FP מעל מ- 100 מעלות

Classifying Combustible Liquids

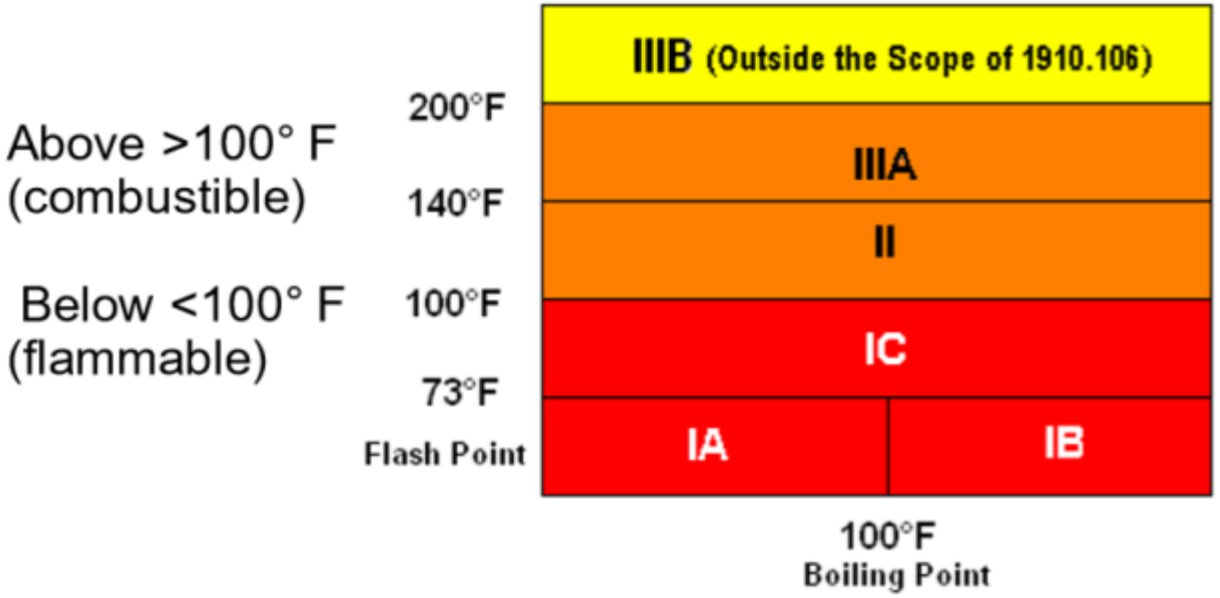
Class II	A flash point at or above 100°F but below 140°F.
Class IIIA	A flash point at or above 140°F but below 200°F.
Class IIIB	Liquids having a flash point at or above 200°F.

Note: Class IIIB liquids are not covered under the scope of §1910.106.

Flash Point

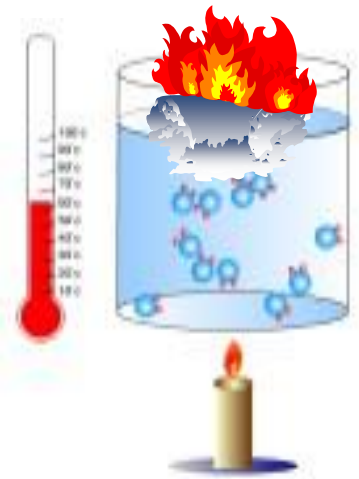
1910.106(j)

- As stated previously, the **flash point** determines if a substance falls within the scope of the standard.



טמפרטורת הצתה עצמית – (AutoIgnition Temperature)

הטמפרטורה המינימלית שבה יידלק חומר ספונטנית ללא ניצוץ.



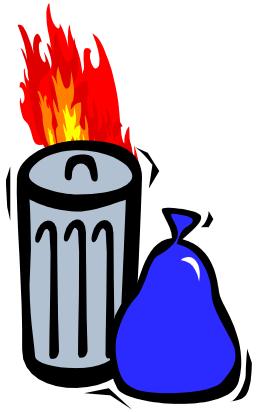
דוגמאות

Fuel	Flash point	Autoignition temperature
Ethanol (70%)	16.6 °C (61.9 °F)[2]	363 °C (685 °F)[2]
Gasoline (petrol)	−43 °C (−45 °F)[3]	280 °C (536 °F)[4]
Diesel (2-D)	>52 °C (126 °F)[3]	256 °C (493 °F)[4]
Jet fuel (A/A-1)	>38 °C (100 °F)	210 °C (410 °F)
Kerosene	>38–72 °C (100–162 °F)	220 °C (428 °F)
Vegetable oil (canola)	327 °C (621 °F)	
Biodiesel	>130 °C (266 °F)	

Fuel or Chemical	Autoignition Temperature	
	(°C)	(°F)
Acetaldehyde	175	347
Acetic acid	427	801
Acetone, propanone	465	869
Acetylene	305	581
Anthracite - glow point	600	1112
Benzene	560	1040
Bituminous coal - glow point	454	850
Butane	405	761
Butyl acetate	421	790
Butyl alcohol	345	653
Butyl methyl ketone	423	793
Carbon	700	1292
Carbon disulfide, CS_2	90	194
Carbon monoxide	609	1128
Charcoal	349	660
Coal-tar oil	580	1076
Coke	700	1292
Cyclohexane	245	473
Cyclohexanol	300	572
Cyclohexanone	420	788
Dichloromethane	600	1112
Diethylamine	312	594
Diethylether	160	320
Diethanolamine	662	1224
Diesel, Jet A-1	210	410
Diisobutyl ketone	396	745
Diisopropyl ether	443	829
Dimethyl sulphoxide	215	419
Dodecane, dihexyl	203	397
Epichlorohydrin	416	781
Ethane	515	959
Ethylene. ethene	490	914
Ethyl acetate	410	770
Ethyl Alcohol, Ethanol	365	689
Fuel Oil No.1	210	410
Fuel Oil No.2	256	494
Fuel Oil No.4	262	505
Furfural	316	601
Heavy hydrocarbons	750	1382
Heptane	204	399
Hexane	223	433

התלקחות עצמית –חומרים המתלקחים כתוצאה מתגובה עם חמצן ושחרור חום.

מתרחש כאשר החום הנוצר, מצטבר במהירות העולה על קצב הפיזור שלו (לדוגמה - באשפה).



וההסבר:

- כאשר מדובר בכלי פתוח ובו נוזל דליק, האדים משתחררים מכל שטח הפנים.
- בכלי שבו פתח צר, האדים מצטברים והופכים למסוכנים יותר.
- בתנאים מסוימים, הסיכון גובר: לחות נמוכה, טמפרטורה גבוהה.

אחסון מיכלים ניידים

Container and Portable Tank Storage 1910.106(d)

- Only approved containers and portable tanks shall be used

רק מיכלים מאושרים ניתנים לשימוש

- Each portable tank shall be provided with one or more devices installed in the top with sufficient emergency venting capacity to limit internal pressure under fire exposure conditions

למיכלים יהיה מנגנון הפחתת לחץ בחלקם העליון

- Flammable and combustible liquid containers shall be in accordance with Table H-12

המיכלים יהיו בעלי דרישות כמפורט

Containers - Table H-12

Container Type	Flammable Liquids			Combustible Liquids	
	Class IA	Class IB	Class IC	Class II	Class III
Glass or approved plastic	1 pt.	1 qt.	1 gal.	1 gal.	1 gal.
Metal (other than DOT drums)	1 gal.	5 gal.	5 gal.	5 gal.	5 gal.
Safety cans	2 gal.	5 gal.	5 gal.	5 gal.	5 gal.
Metal drums (DOT specifications)	60 gal.	60 gal.	60 gal.	60 gal.	60 gal.
Approved portable tanks	660 gal.	660 gal.	660 gal.	660 gal.	660 gal.

Note: Container exemptions: (a) Medicines, beverages, foodstuffs, cosmetics, and other common consumer items, when packaged according to commonly accepted practices, shall be exempt from the requirements of §1910.106(d)(2)(i) and (ii).

המיכלים ישמרו במקומות מסומנים ותחת אמצעי בטיחות אש

Container and Portable Tank Storage 1910.106(d)(3)

- Storage cabinets
  - Cabinets shall be labeled in conspicuous lettering, "Flammable Keep Fire Away"
  - Must be fire resistant
  - Contain no more than 60 gallons of Class I or Class II nor contain no more than 120 gallons of Class III liquids
  - Specific requirements for metal and wood

ובכלל זה גם מערכת נידוף של הגזים ...

Container and Portable Tank Storage 1910.106(d)(4)

- Inside storage rooms
  - Shall be constructed to meet the required fire-resistive rating for their use
  - If used for Class I liquids, electrical wiring and equipment ***in*** "inside storage" rooms shall be approved for Class I, Division 2 Hazardous Locations
  - Provided with either a gravity or a mechanical exhaust ventilation system

ועם כללים לאחסון

Container and Portable Tank Storage 1910.106(d)(4)

- In "inside" storage rooms
  - Maintain one clear aisle at least 3 feet wide
  - Containers over 30 gallons capacity shall not be stacked one upon the other
  - Dispensing shall be by approved pump or self-closing faucet only
  - Storage shall comply with Table H-13

Storage Inside Rooms - Table H-13

Fire Protection (1) Provided	Fire Resistance	Maximum Size	Total Allowable Quantities – gals./sq. ft/floor area
Yes	2 hours	500 Sq. Ft.	10
No	2 hours	500 Sq. Ft.	4*
Yes	1 hour	150 Sq. Ft.	5*
No	1 hour	150 Sq. Ft.	2

Footnote(1) Fire protection system shall be sprinkler, water spray, carbon dioxide, or other system.
***Note:** These numbers are shown incorrectly in 29 CFR 1910.106.

כללי בטיחות אש ואמצעים נדרשים

Container and Portable Tank Storage 1910.106(d)(7)

- Fire control
  - Fire control devices shall be available at locations where flammable or combustible liquids are stored.
  - Open flames and smoking shall not be permitted in flammable or combustible liquid storage areas.
  - Water reactive materials shall not be stored in the same room with flammable or combustible liquids.

הוראות למילוי מיכלים בנוזל דליק

Industrial Plants

1910.106(e)

- Class I liquids shall not be dispensed into containers unless the nozzle and container are electrically interconnected (grounding).
- Spills shall be cleaned up promptly.

סיכום

Summarizing Storage Requirements

- The flash point determines if a substance falls within the scope of the standard.

נקודת ההבזקה קובעת את הסיכון של חומר

- The flash point and boiling point together, determine how substances are stored:
  - Container capacity and spacing
  - Maximum amount per location

נקודת ההבזקה וטמפרטורת הרתיחה, קובעות את צורת האחסון הנדרשת

- The H-Tables help you determine storage limits, venting capacities, allowable sizes of containers and more...

נקבעו כללים בהתאם לסיכון

Flammable Liquids Storage and Handling

1. Purpose

This policy establishes requirements to minimize the [illegible] associated with flammable liquids in containers and portable tanks.

דרישות מינימום לטיפול ואחסנה של נוזלים דליקים במיכלים

2. Scope

This policy contains storage and handling requirements for flammable liquids and applies to all personnel in the workplace who may handle flammable liquids.

The following sections of the safety manual contain related policies and should be consulted for additional requirements and guidance:

- Electrical Safety
- Fire Protection
- Hazard Communication
- Safety Signs and Color Coding
- Personal Protective Equipment
- Hot Work
- Cold Work
- Quality Control Test Room Safety

3. Minimum Requirements

	Minimum Requirements	Supporting Documentation
1.	Containers and portable tanks used to store flammable liquids shall be approved or listed by a nationally recognized testing laboratory.	Section 6.1
2.	The use of plastic buckets to collect, store, or transfer flammable liquids is prohibited unless the liquid would react with metal.	Section 6.1
3.	Flammable liquids shall not be dispensed into containers unless the nozzle and container are electrically interconnected.	Section 8
4.	Storage in general purpose warehouses or in portions of such buildings cut off by standard firewalls shall be in accordance with Table I, Indoor Container Storage, or Table II, Indoor Portable Tank Storage, in Appendix I.	Appendix I

דרישות מינימום

נקבעו כללי בטיחות אש לאחסון מיכלים בבניינים

שימוש במיכלים ניידים לאחסון נוזלים דליקים, יאושרו על פי התקינה

3. Minimum Requirements

	Minimum Requirements	Supporting Documentation
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2.	The use of plastic buckets to collect, store, or transfer flammable liquids is prohibited unless the liquid would react with metal.	Section 6.1
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מילוי מיכלים יעשה תוך שימוש בהארקה

שימוש במיכלי פלסטיק אסורר למעט מיקרים שהנוזל מגיב עם מתכת