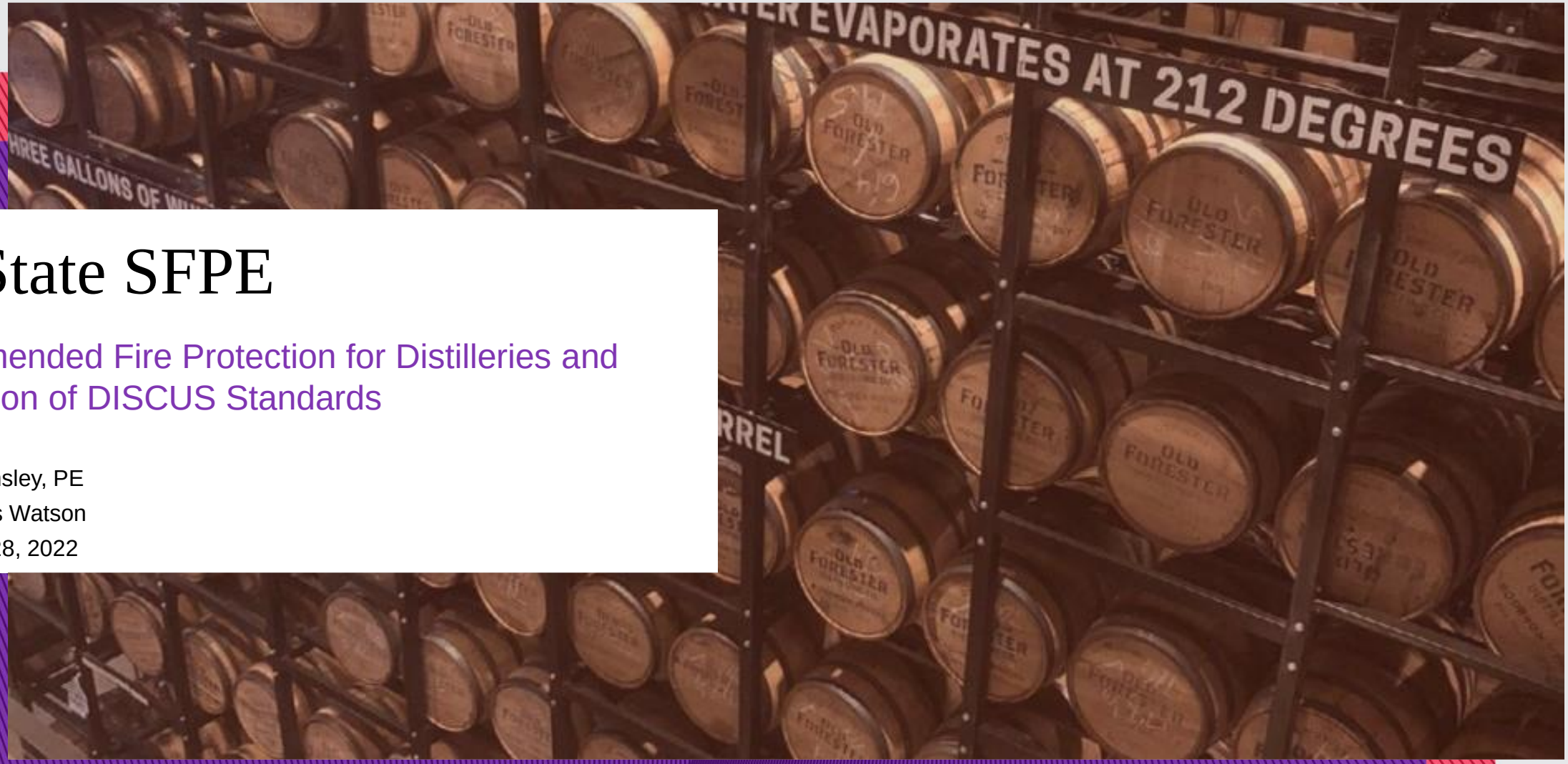


Tri-State SFPE

Recommended Fire Protection for Distilleries and Application of DISCUS Standards

Daniel R. Linsley, PE
Willis Towers Watson
September 28, 2022

Today's Agenda

- Distilleries
  - Principal Operations
  - Fire & Explosion Hazards
  - Protection Concepts
- Applicable Codes & Standards
- Distilled Spirits Council of the United States (DISCUS)
- Q&A

Your Speaker	
WTW 	**Daniel Linsley,** VP and Senior Property Risk Consultant (Nashville) Dan has over 35 years of experience in the property loss control field providing guidance to a wide range of clients on fire, life, and explosion safety and other property protection and property insurance matters, including project support for new construction and new fire system installations. Several of Dan's clients operate bourbon and whiskey distilleries in Kentucky and Tennessee including Buffalo Trace Distillery, Barton 1792 Distillery, Bulleit Distilling Company, Stitzel-Weller, Cascade Hollow Distilling Company (aka George Dickel), and several others in the US and Canada. Prior to joining WTW in 2013, Dan owned his consulting business; worked for an Atlanta-based Fire Protection Engineering Firm and for property insurance companies including Industrial Risk Insurers (IRI) and Allianz. Dan obtained his PE in fire protection while working in the state of Georgia. He is also a Certified Fire Protection Specialist and a member of NFPA.

Distillery Fires & Explosions

A Kentucky News Headline

1996 Heaven Hill Fire

Distillery Fires & Explosions

Distillery Fires & Explosions

The Distillery Industry reports 180 fire losses from 1933 to 2004.

Some of the notable fires include:

▪ 1935 Hiram Walker & Sons. Peoria, IL:	81,000 barrels ($54M)
▪ 1938 The Glenmore Distillery. Owensboro, KY	32,000 barrels ($42M)
▪ 1949 Hiram Walker & Sons. Peoria, IL:	Vapor Explosion, Two Deaths
▪ 1949 Kentucky River Distillery. Jessamine County, KY:	~18,000 barrels ($17M)
▪ 1954 American Distilling Co. Pekin, IL:	42,000 barrels & Six Deaths ($77.5M)
▪ 1960 Arbuckle Smith & Co. Glasgow, Scotland.	19 Firefighter Deaths ($75M)
▪ 1968 Waterfill & Frazier Distillery. Bardstown, KY:	7,000 barrels ($4.3M)
▪ 1979 America Distilling Co. Pekin, IL	Tank Room Fire. ($20M) Plus Significant Business Interruption
▪ 1996 Heaven Hill Fire. Bardstown, KY	90,000 barrels, 7.7M gallons ($60M)
▪ 2000 Wild Turkey Warehouse. Lawrenceburg, KY	17,000 barrels and est. 228,000 fish kill in Kentucky River
▪ 2003 Jim Beam Warehouse. Bardstown, KY	15,000 barrels. 800,000 gallons
▪ 2015 Silver Trail Distillery. Hardin, KY	Total Loss of Distillery. One Death.
▪ 2019 Jim Beam Distillery. Versailles, KY	45,000 barrels ($50M) Plus $712K EPD Fine & Other Costs

Principal Distillery Operations

How Bourbon is Made

Palletized Maturation Warehouses

Racked Maturation Warehouses

Fire & Explosion Hazards

Fire Hazards

The primary fire & explosion hazard within a distillery is the processing and storage of ***flammable liquids***, namely **ethyl alcohol.**

9. Physical and chemical properties	
Physical State	Liquid
Appearance	Clear
Odor	Alcohol-like
Odor Threshold	No information available
pH	Not applicable
Melting Point/Range	< -90 °C / -130 °F
Boiling Point/Range	77.1 °C / 170.8 °F
Flash Point	13.9 °C / 57 °F
Method -	Estimated
Evaporation Rate	3.6 (Butyl acetate = 1.0)
Flammability (solid,gas)	Not applicable
Flammability or explosive limits	
Upper	18.0 vol %
Lower	3.3 vol %
Vapor Pressure	48 mmHg
Vapor Density	1.5
Specific Gravity	0.785 - 0.792
Solubility	Soluble in water
Partition coefficient; n-octanol/water	No data available
Autoignition Temperature	362.8 °C / 685 °F
Decomposition Temperature	No information available
Viscosity	No information available
VOC Content(%)	100

Fire Hazards

Primary

The fire & explosion hazard from flammable alcohol is present from distillation through bottling including:

- Still house, including Distilled Spirit Bulk Tanks
- Barrel Filling
- Barrel Maturation Warehouses
- Barrel Dumping and Regauging
- Bulk Tank Farms and Tanker Loadout
- Bottling Tanks
- Bottling, limited to the filler & capper equipment

Fire Hazards

Ethyl alcohol is completely water miscible.

As water is added, the alcohol volume of the mixture declines, and the respective flash point and fire point temperatures increase.

At 55% ABV, the alcohol-water mixture is a Class 1C flammable liquid per NFPA 30 as its measured flash point temperature is greater than 73°F

At less than 20% ABV, the alcohol-water mixture is considered sufficiently diluted and can be treated as a noncombustible liquid.

Flash and Fire Points of Alcohol-Water Solutions[1]

Alcohol (Vol. %)	Tag Closed Cup Flash Point[2]	Tag Open Cup Flash Point[3]	Fire Point[4]
	Class IB liquids		
95%	63°F (17°C)	70°F (21°C)	70°F (21°C)
90%	65°F (18°C)	72°F (22°C)	72°F (22°C)
80%	68°F (20°C)	76°F (24°C)	76°F (24°C)
70%	70°F (21°C)	80°F (27°C)	80°F (27°C)
60%	72°F (22°C)	86°F (30°C)	87°F (30°C)
	Class IC liquids (below 55%)		
50%	75°F (24°C)	90°F (32°C)	94°F (34°C)
40%	79°F (26°C)	96°F (36°C)	102°F (39°C)
30%	85°F (29°C)	104°F (40°C)	113°F (45°C)
20%	97°F (36°C)	119°F (48°C)	136°F (58°C)
	Non-flammable liquid (below 20%)		
10%	120°F (49°C)	150°F (66°C)	---

Fire Hazards

Secondary

- Grain Handling Equipment (rubber belt conveyors and elevators)
- Combustible Dust
- Dry Goods & Packaging Storage
  - Glass & PET plastic containers
  - Corrugated Containers
  - Corks, Caps, and plastic film labels
  - Stretch Wrap
- Idle Pallets & Empty Barrels
- Combustible Construction
- Dried Grain Processing
- Finished Case Goods Storage
- Maintenance and Utility Areas

Explosion Hazards

Primary

- Collection of alcohol vapors with processing equipment and bulk storage tanks
- Accidents involving alcohol spills during processing and bulk storage.
- Alcohol vapors within barrel warehouses

Secondary

- Combustible dust can be generated during grain receiving, processing, and drying. Thus, combustible dust explosion hazards exist at all distilleries, large and small.
- Fuel gas fired equipment such as steam boilers

Protection Concepts

Protection Concepts - Detection

At a minimum, distilleries should be equipped with a Fire Alarm System meeting NFPA 72 Requirements.

The fire alarm system should monitor:

- Sprinkler System Waterflow Alarms
- Sprinkler Valve Tamper Switches
- Fire Pump signals
- When installed, Special Extinguishing System Discharge Alarms

Smoke detection is recommended within electrical rooms and IT spaces. Area smoke detection is not required.

At the client's option, manual fire alarm pull stations at emergency exit doors and an evacuation alarm system throughout can be installed.

Protection Concepts - Suppression

Tests and actual loss history proved that water is the most effective extinguishing agent for ethyl alcohol fires.

Protection Concepts - Suppression

Because most distilleries are in rural areas without strong public water supplies, fire pumps and water tanks are normally required.

Large distilleries may require two fire pumps and tanks for redundancy purposes.

Fire pumps and water tanks are sized for the largest water demand which is usually the Still House or Warehouses.

Protection Concepts - Suppression

Looped fire mains surrounding the distillery buildings and each warehouse is the most common approach.

Fire hydrants are provided and spaced according to local FD requirements.

Station Monitors can be provided for Barrel Warehouse and/or Bulk Tank Farm coverage

Protection Concepts - Suppression

Deluge Water Fire Suppression for Bulk Storage Tanks and Tanker Truck Loadout Stations may be required.

Protection Concepts - Suppression

Large, rotary driers are used to remove excess liquids from the spent grain.

Dryers are either equipped with a natural gas burner or are steam heated.

Fires within the dryer can occur and require fire protection.

High temperature monitoring and automatically activated steam smothering systems are considered best.

Occasionally, the steam fire suppression is manually activated.

Protection Concepts – Explosion Protection

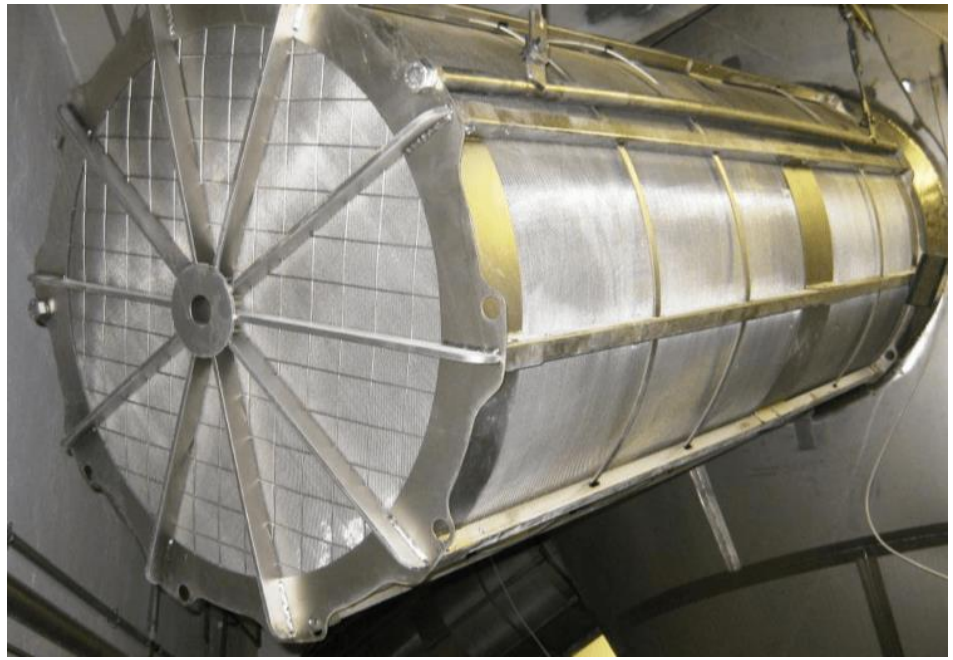
Combustible Dust Explosion Protection, Isolation, and Prevention Systems are required for the grain handling equipment and dust collectors associated with Grain Receiving, Milling and Dry House.

Explosion panels on dust collector.

Explosion Relief Panel - Silo

Explosion Suppression System

Protection Concepts – Explosion Protection



Flameless Explosion Vent

Explosion Isolation Valves

Protection Concepts – Ignition Control

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Class I rated electrical equipment are required in the following areas:

- Still House
- Tanker Loading/Unloading
- Bulk Tank Storage
- Barrel Fill and Barrel Dump Stations
- Barrel Warehouses
- Bottling (processing and filler equipment)
- Wastewater influent collection and impounding areas

Mashing and Fermenting areas and Finished Case Goods Storage Warehouses are generally unclassified.

Protection Concepts – Ignition Control

Class II rated electrical equipment are required for areas having the potential for appreciable combustible dust accumulations or releases such as:

- Grain Receiving
- Hammer Mill Room
- Dried Grain Processing Areas

Protection Concepts – Ignition Controls

Properly designed ventilation exhaust systems are needed to remove potential flammable vapors in the following areas:

- Still House
- Spirit Tank Rooms
- Bottling Processing Halls
- Barrel Warehouses

Design ventilation systems to limit any flammable vapor concentration to less than 25% LEL. Ventilation exhaust systems should be either constantly running or arranged to start based on LEL detection.

Barrel Warehouses are the highest emitters of flammable vapors. It may not be possible to run constantly running exhaust fans due to environmental concerns. Natural ventilation is often used and considered acceptable.

Protection Concepts – Other Ignition Controls

- Static protection through bonding and grounding
- Lightning protection for all buildings and warehouses handling high-proof alcohol
- Lightning protection for all exterior bulk storage tanks.
- Ignition control through spill containment and drainage

Applicable Codes and Standards

- International Code Council (ICC)
  - ICC Building Code
  - ICC Fire Code

2021 International Fire Code (IFC)

CHAPTER 9 FIRE PROTECTION AND LIFE SAFETY SYSTEMS

903.2.4.2 Group F-1 distilled spirits. P

An *automatic sprinkler system* shall be provided throughout a Group F-1 *fire area* used for the manufacture of distilled spirits.

903.2.9.3 Group S-1 distilled spirits or wine. P

An *automatic sprinkler system* shall be provided throughout a Group S-1 *fire area* used for the bulk storage of distilled spirits or wine.

Applicable Codes and Standards

- International Code Council (ICC)
  - ICC Building Code
  - ICC Fire Code

2021 International Fire Code (IFC)

CHAPTER 40 STORAGE OF DISTILLED SPIRITS AND WINES

4001.1 General.

The storage of distilled spirits and wines in barrels and casks shall comply with this chapter in addition to other applicable requirements of this code.

4001.1.1 Nonapplicability.

are not applicable to the storage of distilled spirits and wines in barrels and casks

Applicable Codes and Standards

National Fire Protection Association (NFPA)

- NFPA 13 – Installation of Sprinkler Systems
- NFPA 15 – Fixed Water Spray System
- NFPA 16 – Foam-Water Sprinkler & Water Spray Systems
- NFPA 20 – Fire Pumps
- NFPA 22 – Private Water Tanks for Fire Protection
- NFPA 24 – Private Fire Service Water Mains
- NFPA 30 – Flammable & Combustible Liquids
- NFPA 61 – Prevention of Fires & Dust Explosions in Agricultural & Food Processing
- NFPA 68 & 69 – Explosion Protection and Explosion Prevention Systems
- NFPA 70 – National Electric Code
- NFPA 72 – Fire Alarm
- NFPA 77 – Static Electricity
- NFPA 85 – Boilers and Combustion System Hazards
- NFPA 101 – Life Safety Code

Applicable Codes and Standards

Prior to the 2016 edition of NFPA 13, the commodity classification of liquors and spirits up to 100 proof (50% ABV) *in glass bottles* were considered as:

- Class III Commodities if stored in rack
- Class IV Commodities if stored palletized

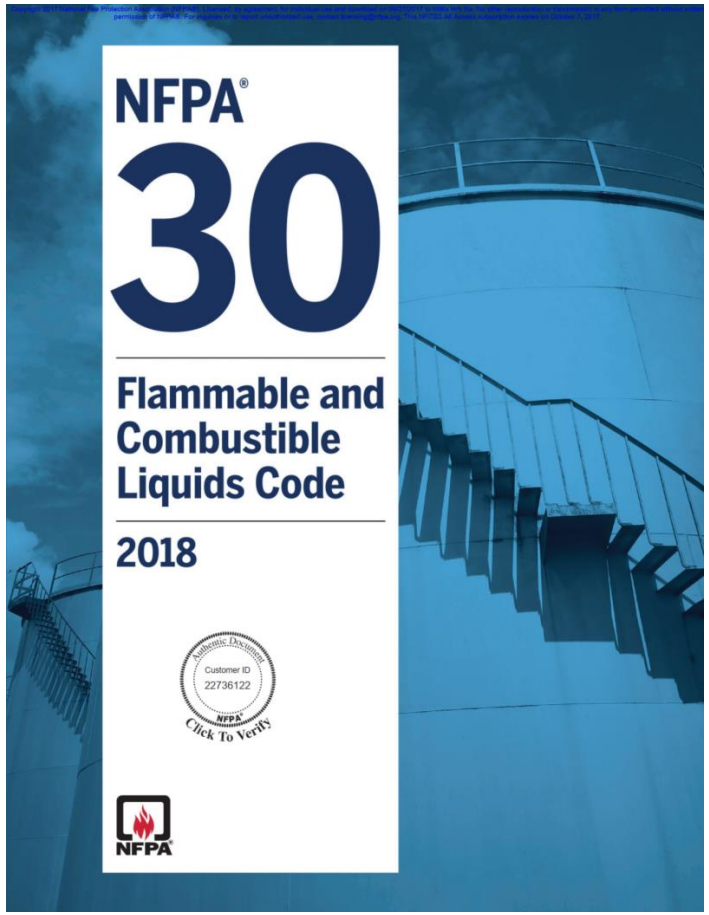
100 Proof spirits *in plastic bottles* were considered Class IV commodities whether palletized or rack storage.

Applicable Codes and Standards

sol; Level 1	Class III
ters; butane; blister-packed; cartoned	Group A Nonexpanded
ids; up to 20 percent alcohol (e.g. alcoholic beverages, flavoring extracts); greater than gal (20 L) plastic containers with wall thickness greater than ¼ in. (6 mm)	Group A Nonexpanded
ids; up to 20 percent alcohol (e.g., alcoholic beverages, flavoring extracts); metal, glass ceramic containers	Class I
ids; up to 20 percent alcohol (e.g., alcoholic beverages, flavoring extracts); plastic ntainers greater than 5 gal (20 L) and wall thickness up to ¼ in. (6 mm)	Class II
ids; up to 20 percent alcohol (e.g., alcoholic beverages, flavoring extracts); up to 5 gal 0 L) plastic bottles or jars	Class I
ids; up to 20 percent alcohol (e.g., alcoholic beverages, flavoring extracts); wood ntainers	Class II

Applicable Codes and Standards

Case Goods



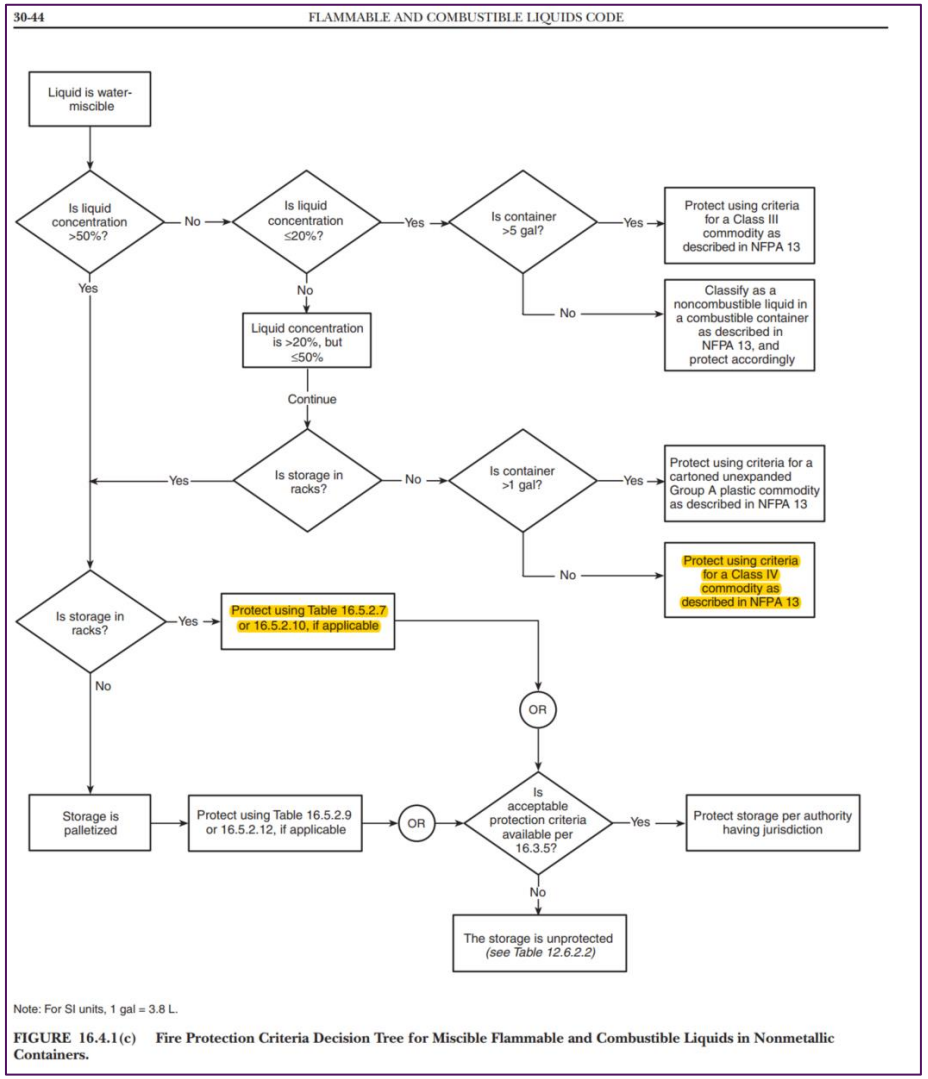
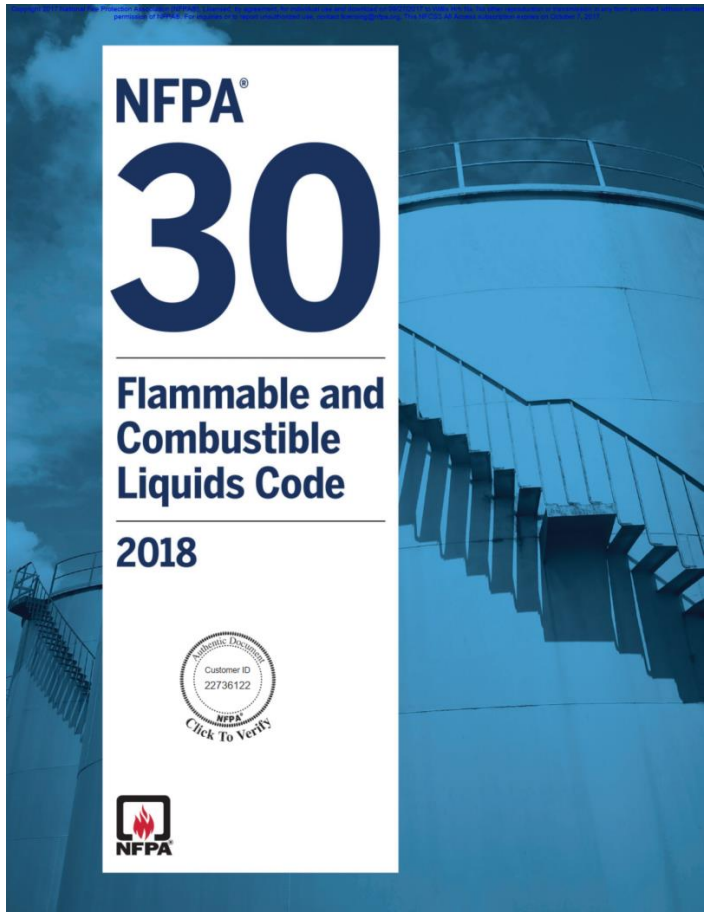


FIGURE 16.4.1(c) Fire Protection Criteria Decision Tree for Miscible Flammable and Combustible Liquids in Nonmetallic Containers.

Applicable Codes and Standards

Case Goods



16.6.2 Fire Protection System Design Scheme "B."

16.6.2.1 Horizontal barriers of plywood having a minimum thickness of ⅜ in. (10 mm) or of sheet metal of minimum 22 gauge thickness shall be installed in accordance with Figure 16.6.2.1(a), Figure 16.6.2.1(b), or Figure 16.6.2.1(c), whichever is applicable. All ignitible (flammable or combustible) liquid storage shall be located beneath a barrier.

16.6.2.2 In-rack sprinklers shall be installed in accordance with Figure 16.6.2.1(a), Figure 16.6.2.1(b), or Figure 16.6.2.1(c), whichever is applicable.

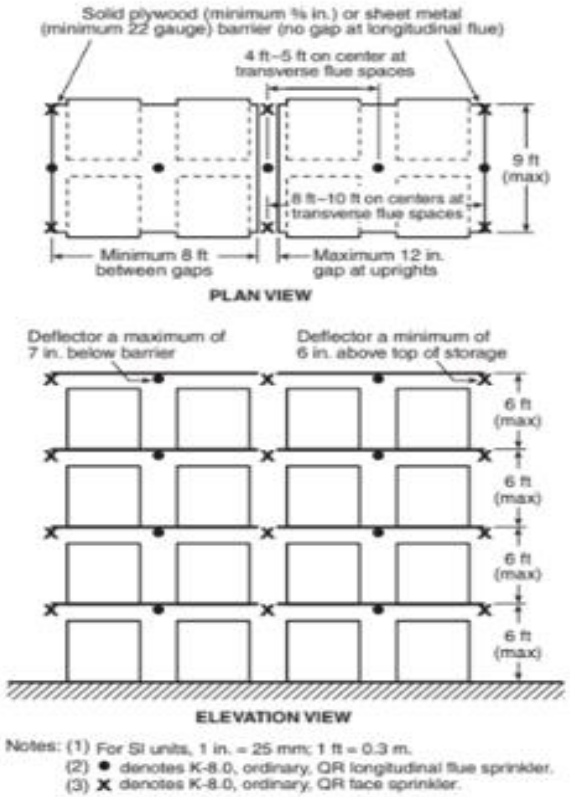
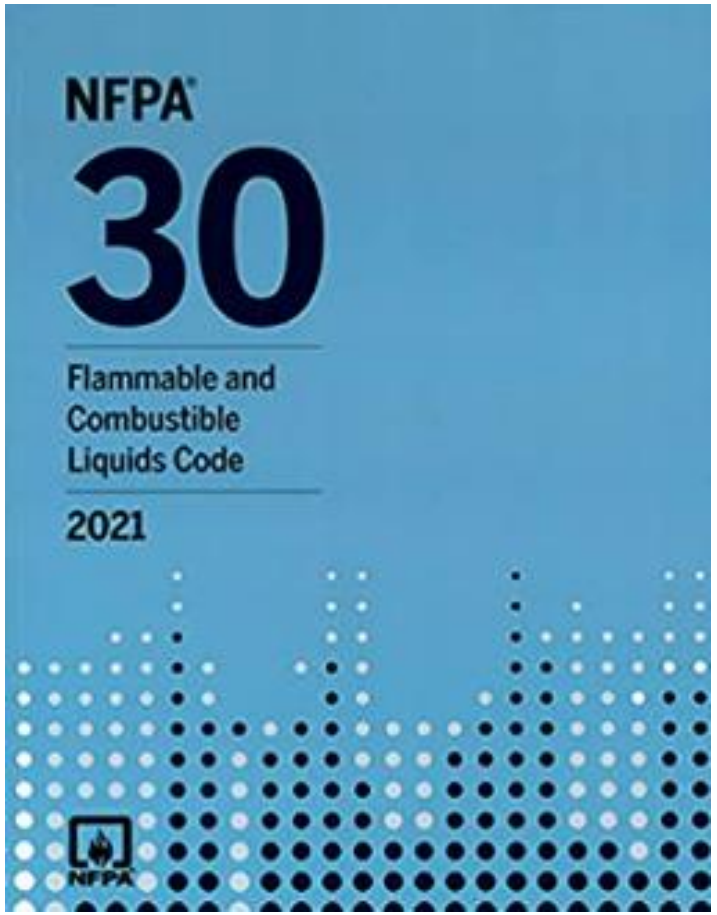


FIGURE 16.6.2.1(c) Double-Row Rack Sprinkler Layout for Design Scheme "B."

Applicable Codes and Standards

Case Goods



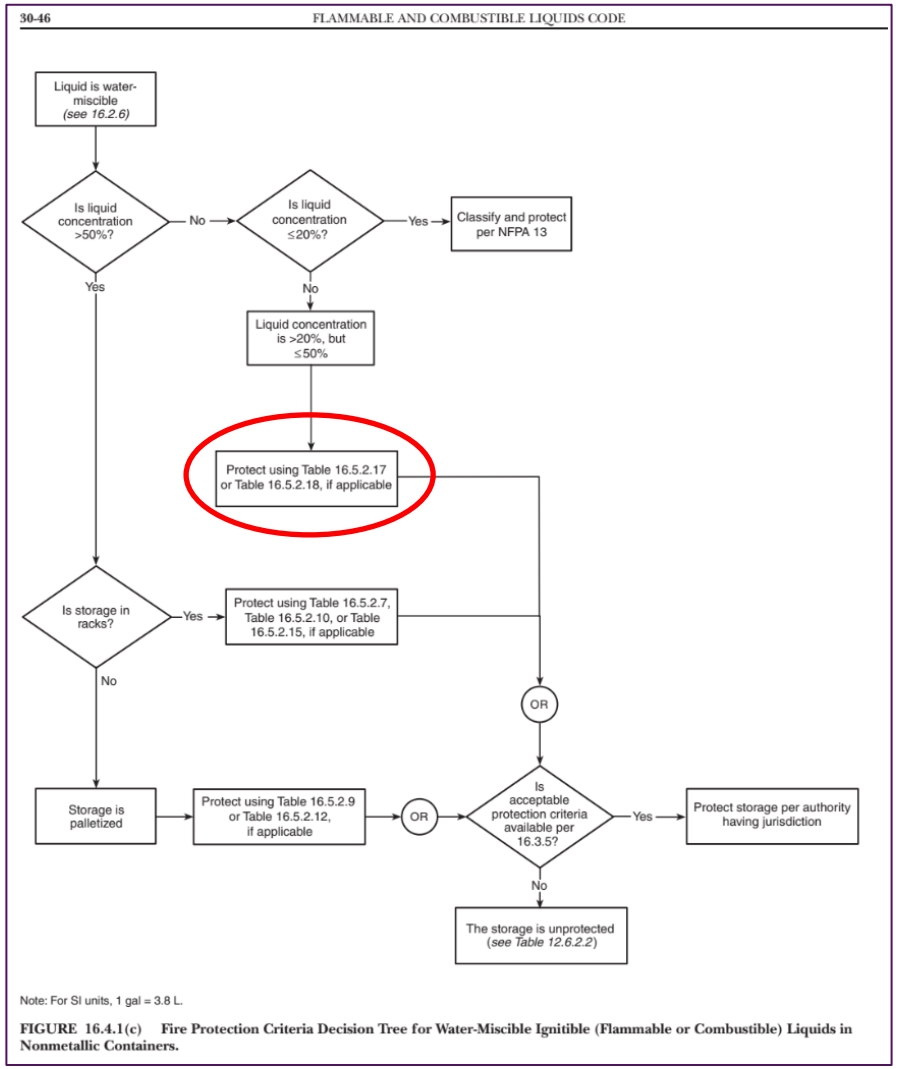


FIGURE 16.4.1(c) Fire Protection Criteria Decision Tree for Water-Miscible Ignitible (Flammable or Combustible) Liquids in Nonmetallic Containers.

Applicable Codes and Standards

Case Goods

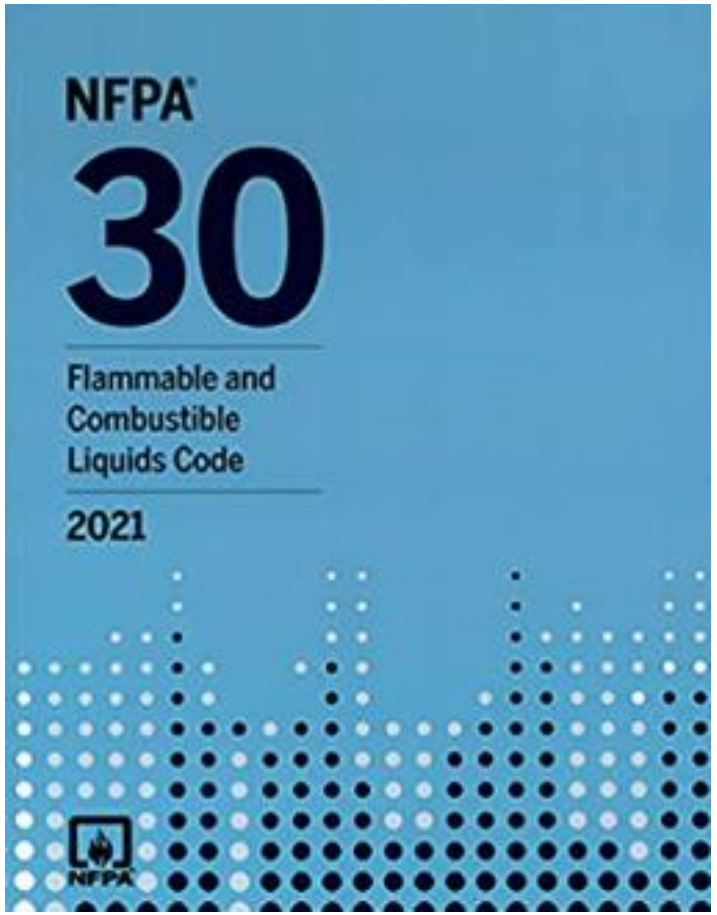


Table 16.5.2.17 Design Criteria for Sprinkler Protection of Rack Storage of 50 Percent/50 Percent Mixture of Ethanol/Propanol/Methanol/Water in Plastic or Glass Containers

						Ceiling Sprinkler Protection			In-Rack Sprinkler Protection			
Container Size	Maximum Ceiling Height ft (m)	Maximum Storage Height ft (m)	Packaging Type	Minimum Aisle Width ft (m)	Rack Type	Response/ Nominal Temperature Rating/ Orientation	K-factor gpm/psi$^{1/2}$ (L/min/bar$^{1/2}$)	Design, # of Sprinklers @ Pressure psi (bar)	Layout	Response/ Nominal Temperature Rating	K-factor gpm/psi$^{1/2}$ (L/min/bar$^{1/2}$)	Design Flow gpm (l/min)*
≤1 gal (≤4 L)	30 (9.1)	25 (7.6)	Cartoned only	8 (2.4)	DRR	QR/ordinary/ pendent	≥14.0 (≥202)	12 @ 75 (5.2)		None		
						SR/ ordinary/any	11.2 (161)	20 @ 29 (2.0)	See 16.6.7, Layout 9.	QR/ordinary	≥8.0 (≥115)	45 (170)
							14.0 (202)	20 @ 18 (1.2)				
							16.8 (235)	20 @ 13 (0.9)				
							25.2 (363)	20 @ 7 (0.5)				
<59 oz (<1.75 L)	Unlimited	Unlimited	Cartoned only	4 (1.2)	Any	SR/ ordinary/any	≥11.2 (≥161)	20 @ 7 (0.5)	See 16.6.6. <5 ft (<1.5 m) storage above top level of in-rack sprinklers			
						SR/ ordinary/any	≥11.2 (≥161)	20 @ 29 (2.0)	See 16.6.6. <10 ft (<3 m) storage above top level of in-rack sprinklers			

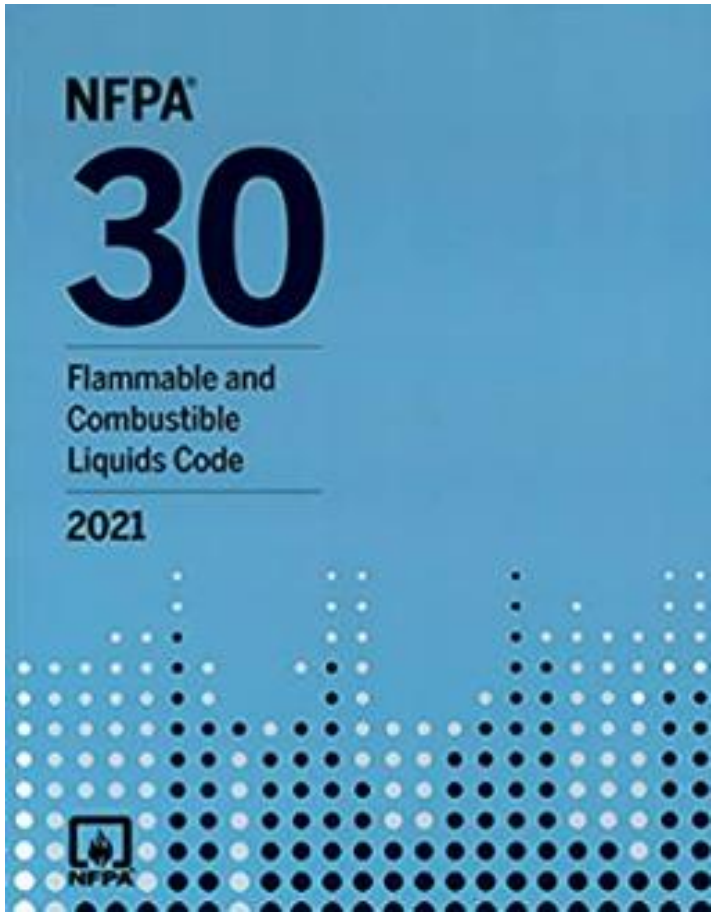
Table 16.5.2.18 Design Criteria for Sprinkler Protection of Palletized Storage of 50 Percent/50 Percent Mixture of Ethanol/Propanol/Methanol/Water in Plastic or Glass Containers

				Ceiling Sprinkler Protection		
Container Size/ Type	Packaging Type	Maximum Ceiling Height ft (m)	Maximum Storage Height ft (m)	Response/ Nominal Temperature Rating/ Orientation	K-factor gpm/ psi$^{1/2}$ (L/min/ bar$^{1/2}$)	Design, # of Sprinklers @ Pressure psi (bar)
<59 oz (<1.75 L)	Cartoned	30 (9)	17 (5.2)	QR/ ordinary/any	14.0 (202)	12 @ 50 (3.4)
			5 (1.5)	QR/ ordinary/any	14.0 (202)	20 @ 18 (1.2)
		40 (12)	17 (5.2)	QR/ ordinary/any	14.0 (202)	12 @ 75 (5.2)
			5 (1.5)	QR/ ordinary/any	14.0 (202)	20 @ 18 (1.2)

2021 Edition

Applicable Codes and Standards

Distilled Spirits in Barrels



9.1.4 This chapter shall not apply to the following:

(1) Containers, intermediate bulk containers, and portable tanks that are used in operations areas, as covered by Chapter 17

(2) Liquids in the fuel tanks of motor vehicles, aircraft, boats, or portable or stationary engines

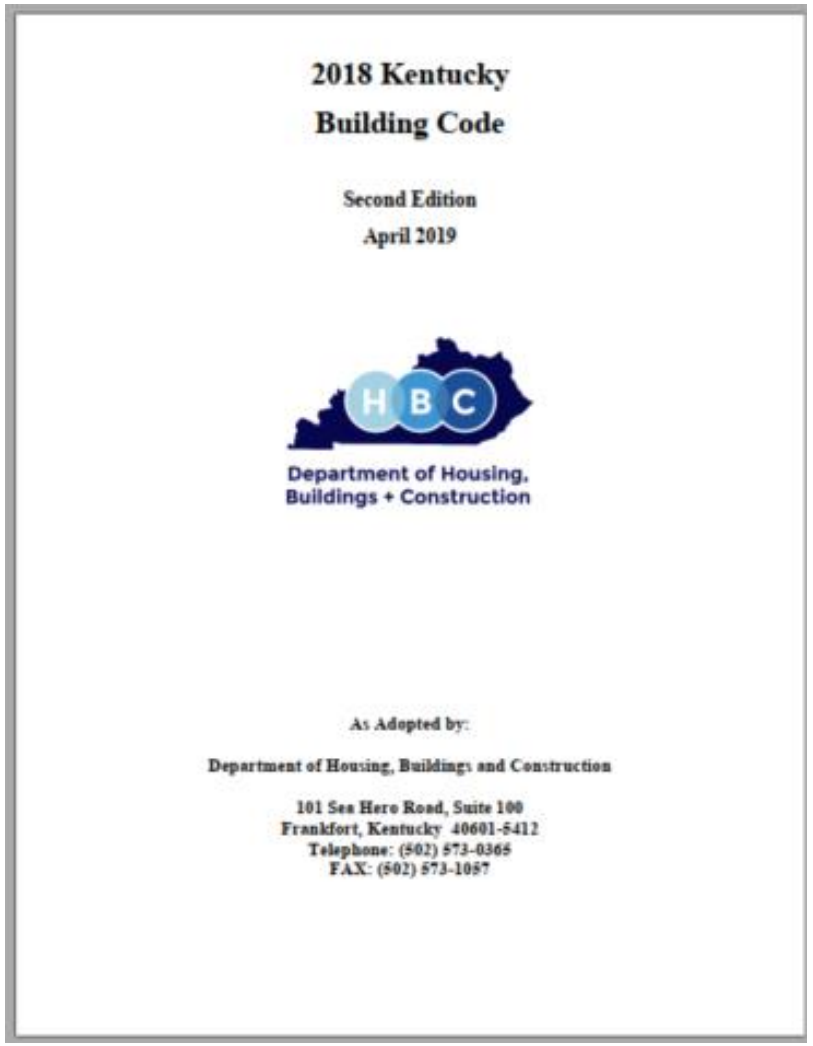
(3) Beverages, medicines, foodstuffs, cosmetics, and other products that do not contain more than 20 percent by volume of water-miscible ignitible (flammable or combustible) liquids, with the remainder of the product consisting of components that do not burn

(4) Liquids that have no fire point when tested in accordance with ASTM D92, *Standard Test Method for Flash and Fire Points by Cleveland Open Cup Tester*, up to the boiling point of the liquid or up to a temperature at which the liquid shows an obvious physical change

(5) Liquids with a flash point greater than 95°F (35°C) in a water-miscible solution or water-miscible dispersion with a water and noncombustible solids content of more than 80 percent by weight, and which does not sustain combustion when tested in accordance with "Method of Testing for Sustained Combustibility," in accordance with 49 CFR 173, Appendix H, or the UN publication, *Recommendations*

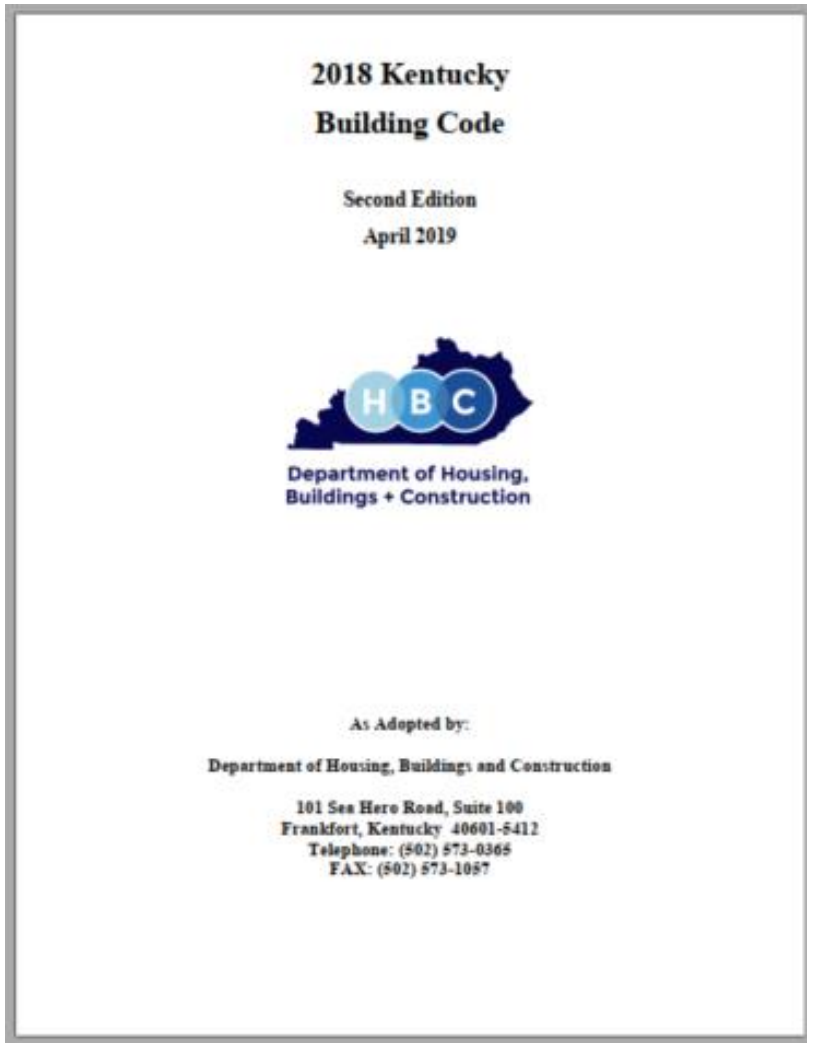
(6) Distilled spirits and wines in wooden barrels or casks

Applicable Codes and Standards



The Kentucky Building Code is based upon the 2015 International Building Code with Kentucky-specific amendments.

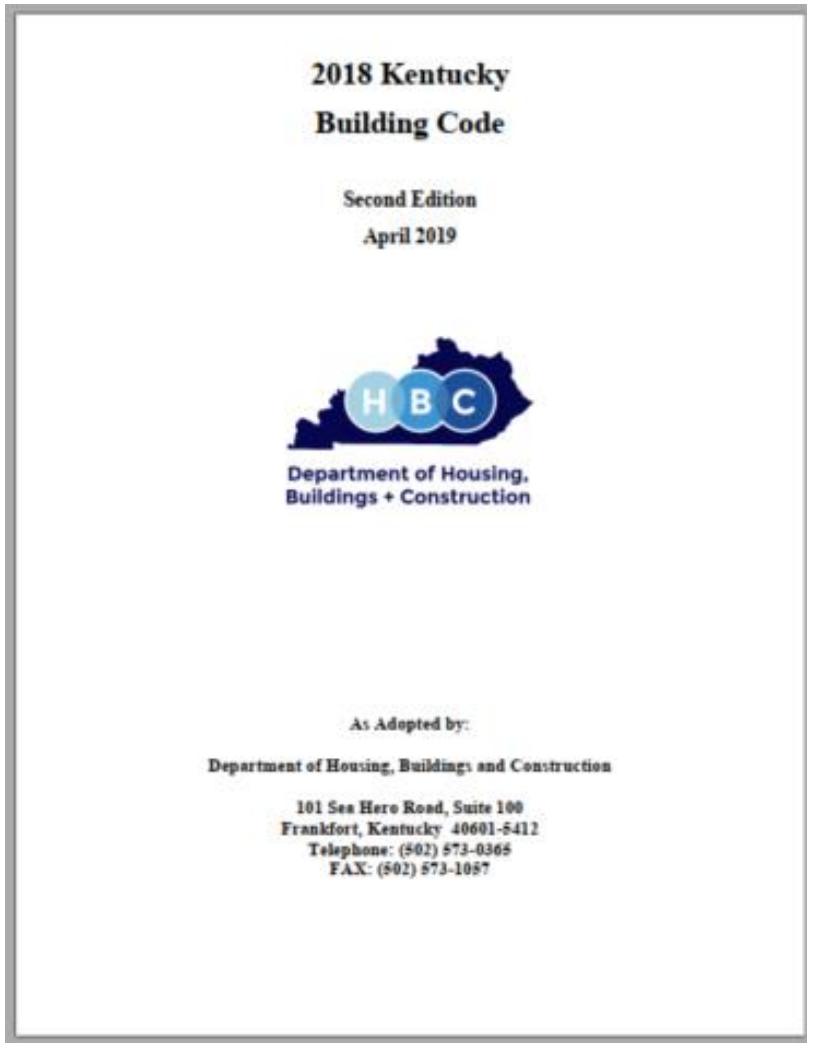
Applicable Codes and Standards



SECTION 430 BARRELED SPIRIT STORAGE BUILDINGS

430.1 Scope. The provisions of this section shall apply to *buildings* and *structure*s utilized solely for the purpose of storing barreled spirits after manufacture during the aging process.

Applicable Codes and Standards


2018 Kentucky
Building Code

Second Edition
April 2019

Department of Housing,
Buildings + Construction

As Adopted by:

Department of Housing, Buildings and Construction

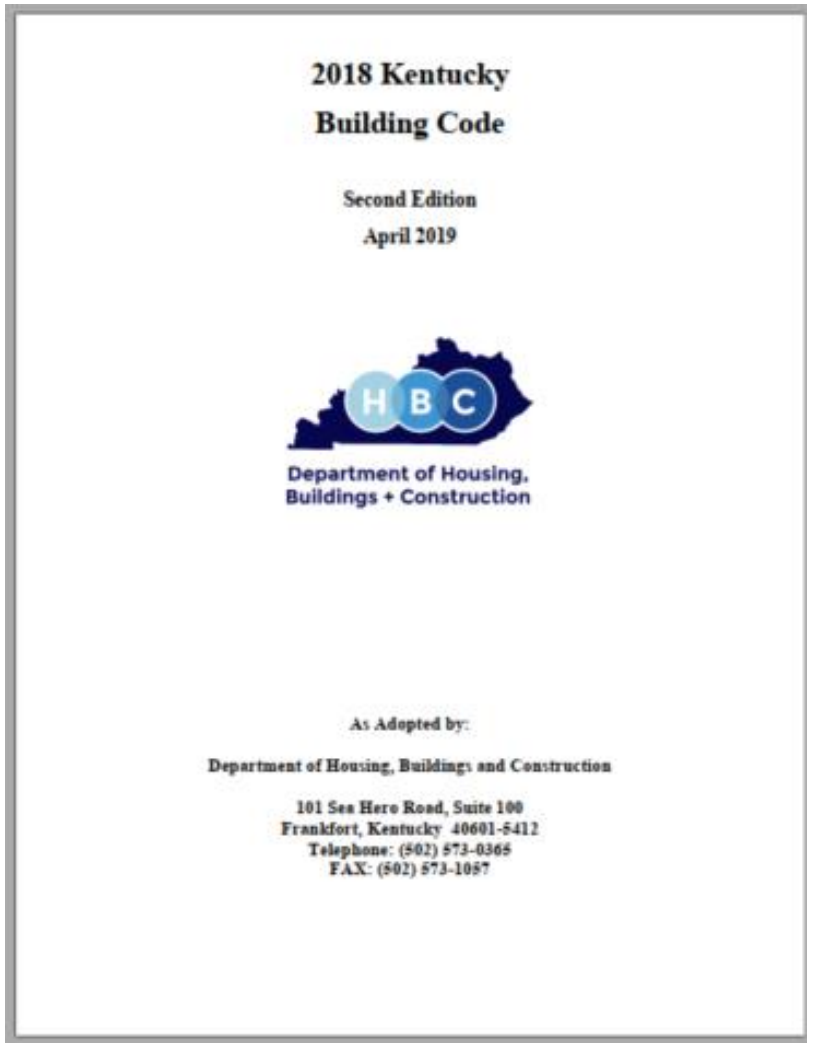
101 Sea Hero Road, Suite 100
Frankfort, Kentucky 40601-5412
Telephone: (502) 573-0365
FAX: (502) 573-1057

SECTION 430 BARRELED SPIRIT STORAGE BUILDINGS

430.3 Building area. Barreled spirit storage buildings shall not exceed the following areas:

1. Non-sprinklered rack supported structures shall not exceed 20,000 square feet.
2. Rack supported structures protected throughout by an automatic sprinkler system shall not exceed 40,000 square feet.
3. Non-sprinklered pallet storage buildings shall not exceed 20,000 square feet.
4. Pallet storage buildings protected throughout by an automatic sprinkler system shall not exceed 55,000 square feet and shall be constructed of Type IIB construction.

Applicable Codes and Standards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As Adopted by:

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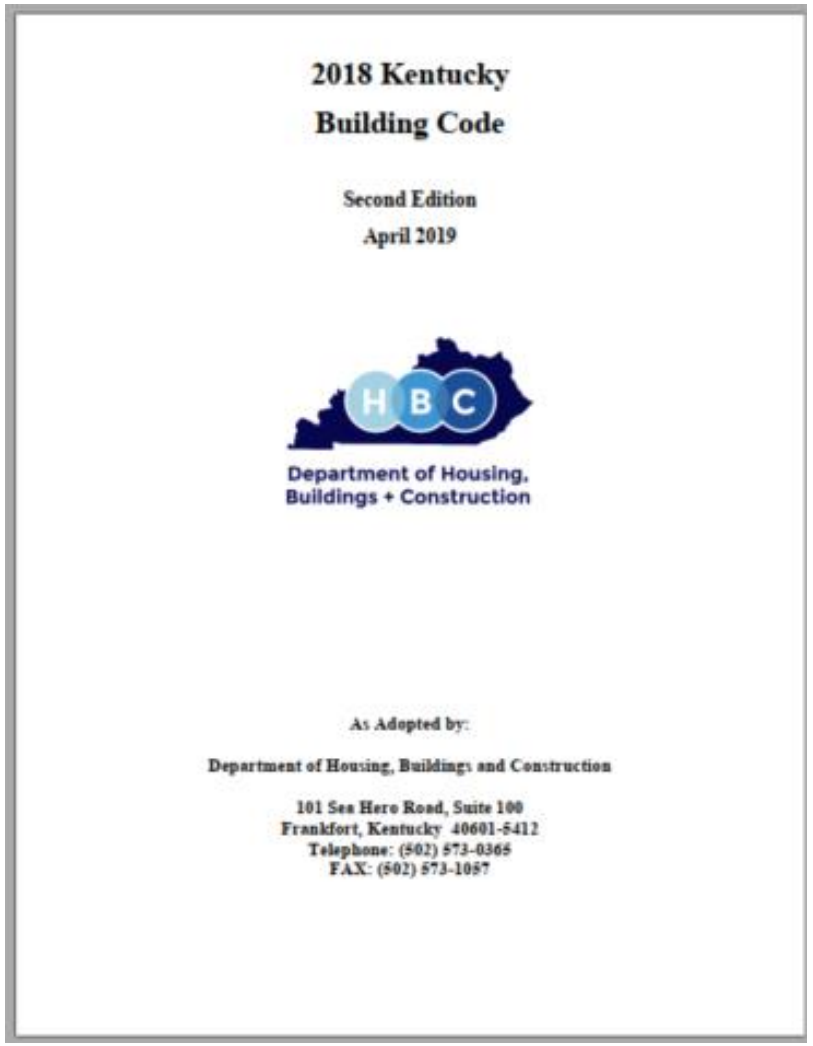
SECTION 430 BARRELED SPIRIT STORAGE BUILDINGS

430.4 Building height. Barreled spirit storage buildings shall be a one story, not to exceed the following heights:

1. Non- sprinklered rack supported structures shall not exceed 55 feet in height.
2. Sprinklered rack supported structures shall not exceed 60 feet in height.
3. Non-sprinklered and sprinklered pallet storage buildings shall not exceed 27 feet in height.

Applicable Codes and Standards



SECTION 430 BARRELED SPIRIT STORAGE BUILDINGS

430.5 Building location on property. Building location on property. The following fire separation distances shall be maintained between the barreled spirit storage buildings and any other buildings on the property and to the opposite edge of a street, alley, or other public way or property line.

1. Non-sprinklered pallet storage and non-sprinklered rack supported structures shall have a minimum separation distance of 200 feet.
2. Sprinklered pallet storage and sprinklered rack supported structures shall have a minimum separation distance of 100 feet.

   Exception: The *fire separation distance* may be reduced to not less than 100 feet to an adjacent sprinklered barreled spirit storage warehouse when the exposed exterior wall of the non-sprinklered barreled spirit storage warehouse is protected by an exterior water curtain.

Distilled Spirits Council of the United States, Inc. (DISCUS)

In 1973, three organizations – The Bourbon Institute, The Distilled Spirits Institute, and the Licensed Beverage Industries, Inc. merged to form the Distilled Spirits Council of the United States (DISCUS).

DISCUS is a national trade organization representing the interests of leading producers of distilled spirits in the United States.

DISTILLED SPIRITS COUNCIL
OF THE UNITED STATES

Agave Loco	Mast-Jägermeister
Bacardi U.S.A., Inc.	MHW, Ltd.
Beam Suntory	MGP Ingredients, Inc.
Brown-Forman Corporation	Moët Hennessy USA
Campari America	Ole Smoky Distillery
Constellation Brands	Pernod Ricard USA
Diageo	Rémy Cointreau
Edrington	

For a complete list of DISCUS Craft Members, please visit the DISCUS website.

Distilled Spirits Council of the United States, Inc. (DISCUS)

DISCUS has a Fire Protection Committee who is charged with evaluating and proactively engaging applicable regulatory agencies, insurance companies and other standards making organizations to ensure that the fire protection standards and guidelines affecting the distilled spirits industry are cost effective and appropriate.

The DISCUS Fire Protection Committee produces a voluntary guide, *Recommended Fire Protection Practices for Distilled Spirits Beverage Facilities* , which is periodically updated.

Distilled Spirits Council of the United States, Inc. (DISCUS)

Scope & Purpose:

- Voluntary application for new operations involved for the production, packaging and warehousing of distilled spirits.
- Used as an aid by engineers & architects for design and construction of new buildings or significant alterations.
- Often used by property insurance engineers for risk assessment and gap analysis
- Not intended to conflict with local regulations
- Not intended to provide Life Safety or Workplace Safety guidelines

Distilled Spirits Council of the United States, Inc. (DISCUS)

Content:

- General Process Descriptions
- Identification of Fire & Explosion Hazards
- Addresses best recommended advice for Construction for buildings and structures including separation advice
- Outlines fire protection design guidance

Distilled Spirits Council of the United States, Inc. (DISCUS)

Table 4-2.2a

Process Occupancies[1]

Occupancy	Type of Sprinkler System		Density gpm/ft² (mm/min)	Area of Demand ft² (m²)	Hose Stream Demand gpm (L/min)
Grain Handling (including drying)	Protect in accordance with NFPA 13 for Ordinary Hazard Group 2 occupancy (with a suggested minimum design area of 2000 ft² (186 m²).				
Mashing and Fermenting[2]	Wet		0.20 (8)	2000 (186)	250 (950)
	Dry		0.20 (8)	2600 (242)	250 (950)
Still House	Wet or Dry		0.20 (8)	5000 (465) first level 2000 (186) intermediate and ceiling levels	500 (1900)
Barrel Fill and Drain Areas	Wet or Dry		0.25 (10)	5000 (465)	500 (1900)
Barrel Warehousing	See Tables 4-2.2c, 4-2.2d and 4-2.2e				
Tanker Loading, Unloading Station	Deluge/Water Spray		0.25 (10)	Simultaneous operation of all sprinklers (see NFPA 15)	500 (1900)
Tank Rooms[3]	Wet or Dry	165°F	0.30 (12)	5000 (465)	500 (1900)
		286°F	0.30 (12)	4000 (372)	500 (1900)
Bottling Areas	Wet		0.20 (8)	3000 (279)	500 (1900)
	Dry		0.20 (8)	5000 (465)	500 (1900)
Cooperage	Protect in accordance with NFPA 13 for Ordinary Hazard Group 2 occupancy (with a suggested minimum design area of 2000 ft² (186 m²).				

Distilled Spirits Council of the United States, Inc. (DISCUS)

Table 4-2.2b

Storage Occupancies[1]

Occupancy	Container Type[2]	Storage Height	Type of Sprinkler System	Density gpm/ft² (mm/min)	Area of Demand ft² (m²)	Hose Stream Demand gpm (L/min)
Finished Case Goods						
1. Solid Pile / Palletized	Glass or PET Plastic	20 feet or less	Wet Dry	0.30 (12) 0.30 (12)	3000 (279) 4000 (372)	500 (1900) 500 (1900)
	Glass or PET Plastic	20 – 25 feet	Wet Dry	0.40 (16) 0.40 (16)	3000 (279) 4000 (372)	500 (1900) 500 (1900)
2. Racked	Glass	Any	- Protect in accordance with NFPA 13 for a Class III Commodity[3]			500 (1900)
	PET Plastic	Any	- Protect in accordance with NFPA 13 for a Class IV Commodity[3]			500 (1900)
Empty Bottles						
1. Solid Pile / Palletized	Glass	Any	- Protect in accordance with NFPA 13 for a Class I Commodity[3]			500 (1900)
	PET Plastic[5]	20 feet or less	Wet Dry	0.30 (12) 0.30 (12)	3000 (279) 4000 (372)	500 (1900) 500 (1900)
	PET Plastic[5]	20 – 25 feet	Wet Dry	0.40 (16) 0.40 (16)	3000 (279) 4000 (372)	500 (1900) 500 (1900)
2. Racked	Glass	Any	- Protect in accordance with NFPA 13 for a Class I Commodity[3]			500 (1900)
	PET Plastic[5]	Any	- Protect in accordance with NFPA 13 for a Class IV Commodity[3]			500 (1900)
Dry Goods[4,5]	- Protect in accordance with NFPA 13 as appropriate for the commodity[3]					500 (1900)
Empty Barrels and Idle Pallet Storage Exterior or Interior	- Protect in accordance with NFPA 13 as appropriate[3] for the commodity Treat empty NEW barrels as a Class III commodity Treat empty USED barrels as a Class IV commodity					Exterior: 1000 (3800) Interior: 500 (1900)

Distilled Spirits Council of the United States, Inc. (DISCUS)

Table 4-2.2c

Sprinkler Protection Design Requirements for Single-Row and Double-Row, Racked Storage of Distilled Spirits in Barrels

Number of Tiers of Barrels between Floor and Ceiling[3]	Sprinkler Design Criteria[1,2] (sprinkler temperature ratings between 165°F – 286°F [74°C – 141°C], both wet and dry systems)							
	Ceiling Only		Ceiling with In-Racks One Level[4]		Ceiling with Level Under Bottom Barrel (Jamieson or Burke System)[5,8]		Ceiling with In-Racks At Each Catwalk Level (Diamond Stagger System)[6,8]	
	Density gpm/ ft² (mm/min)	Area of Application ft² (m²)	Density gpm/ ft² (mm/min)	Area of Application ft² (m²)	Density gpm/ ft² (mm/min)	Area of Application ft² (m²)	Density gpm/ ft² (mm/min)	Area of Application ft² (m²)
0 – 6	0.22 (9)[7]	4000 (372)						
7 – 9	0.30 (12)	4000 (372)						
10 – 12	0.40 (16)	3000 (279)						
13 – 15	0.50 (20)	3000 (279)	0.30 (12)	4000 (372)	0.35 (14)	3000 (279)	0.22 (9)	2000 (186)
16 – 18			0.40 (16)	3000 (279)	0.50 (20)	3000 (279)	0.22 (9)	2000 (186)
19 – 21			0.40 (16)	3000 (279)	0.50 (20)	3000 (279)	0.22 (9)	2000 (186)
22 – 24			0.40 (16)	3000 (279)	0.55 (22)	3000 (279)	0.22 (9)	2000 (186)

Distilled Spirits Council of the United States, Inc. (DISCUS)

Table 4-2.2e

Recommended Criteria in Automatic Sprinkler Design for up to Six-High, Palletized Barrel Storage of Spirits[1]

	Units					
Temperature Rating of Sprinklers	°F (°C)	165 (74)		286 (141)		Hose Stream Demand ---
Type of System	---	Wet	Dry	Wet	Dry[2]	
Design Point 1 Density	gpm/ft² (mm/min)	0.35 (14)	*	0.35 (14)	0.35 (14)	500 gpm
Area of Application	ft² (m²)	7500 (697)		4000 (372)	4000 (372)	1900 L/min)
Design Point 2[3] Density	gpm/ft² (mm/min)	0.20 (8)	*	0.20 (8)	0.20 (8)	None Required
Area of Application	ft² (m²)	12500 (1,162)		10000 (929)	12500 (1,162)	
Duration of Demand	Hours	4	---	4	4	---

Distilled Spirits Council of the United States, Inc. (DISCUS)

Content:

- Addresses storage of high-proof alcohol in portable containers such as drums and Intermediate Bulk Containers (IBC).
- Outlines where emergency exhaust ventilation systems and spill containment and drainage systems are needed within the distillery and warehouses.
- Discusses water supply requirements for Distilleries and Warehouse

Distilled Spirits Council of the United States, Inc. (DISCUS)

Content:

- Pinpoints where Lightning Protection is required.
- Addresses explosion venting and explosion suppression systems for specific processes involving combustible dust including the Dry House.
- Outlines hazard controls for alcohol processing areas, including:
  - Bulk Tank location, design, construction, support and venting
  - Tank overflow/overfill protection and spill control
  - Ventilation, piping arrangements and valves
  - Grounding and bonding

Distilled Spirits Council of the United States, Inc. (DISCUS)

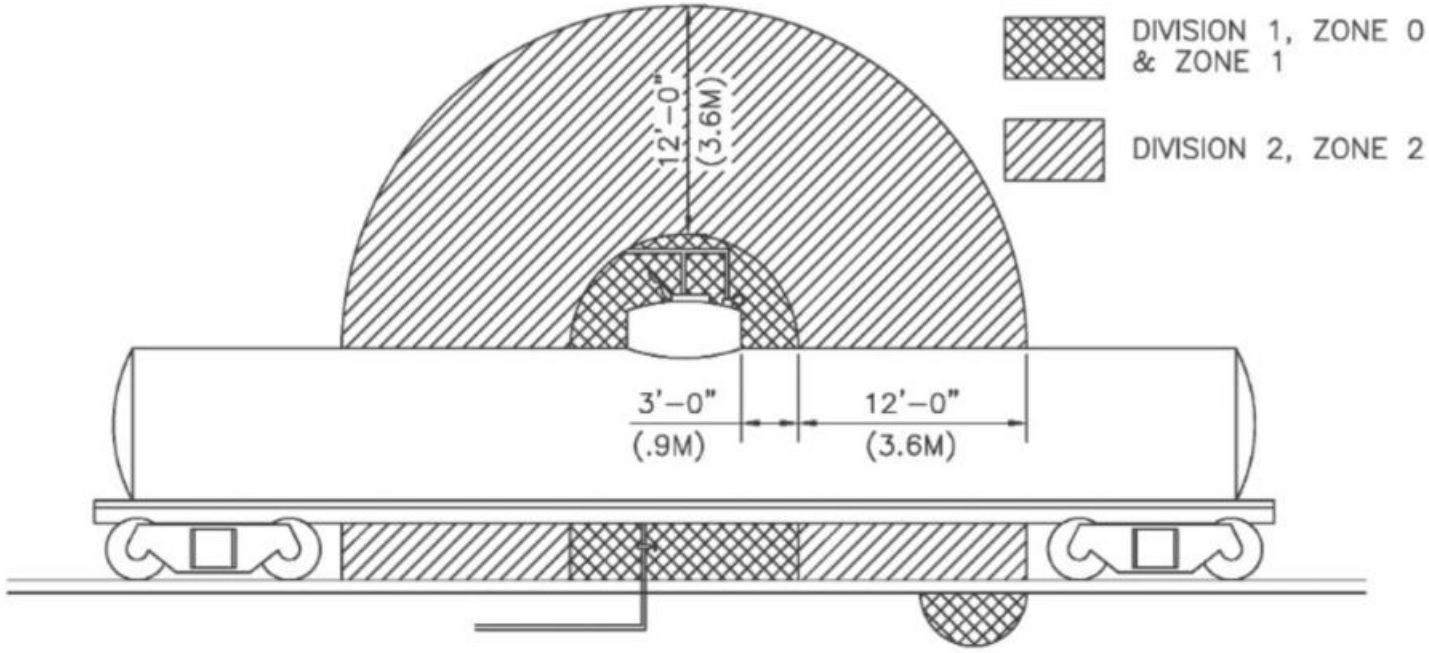
- Specifies Area Classification for suitable electrical equipment in hazardous areas.

Table 6-2.1
Area Classification

Building or Process	Class	Group	Division or Zone	Reference Figure	Explanation
Grain Handling	II	G	1		Equipment approved for use in Division 1 or Zone 1 hazardous location is needed in all areas where grain dust can form a potentially explosive cloud, except those rooms or enclosures that have been specially purged, pressurized, or in some method separated from the dust hazard.
Milling	II	G	1		See above.
Dried Grain	II	G	2		Dried grain is combustible, and the dust could be explosive although the potential for this hazard is not considered nearly as serious as it is in the handling of cereal grain.
Mashing and Fermenting	Generally unclassified				At this stage of production, the ethyl alcohol content is not high enough to constitute a flammable liquid. Therefore, this area may be an unclassified electrical area. However, if it is open to an area of higher ethyl alcohol content where the product is flammable liquid, such as in the still house, all or part of the area may be classified. Refer to Section 3-3.6, "Mashing and Fermenting."
Still House	I	D	1		The operation and equipment in this area are closed systems because the high temperatures that the alcohol is heated to and the fear that a break could cause a vapor cloud, the entire still area is classified as Division 1 or Zone 1. Exceptions may be made for pressurized or purged rooms if special care is taken to ensure that these rooms will remain so under all conditions, i.e., power failure.
Tanker Loading/ Unloading	I	D	0, 1 and 2 (see reference figures)	6-2.1c and 6-2.1d	Equipment approved for use in Division 1 or Zone 1 hazardous locations is needed in all areas where vapors may exist during loading/unloading operations or where a spill potential exists, either from over-fill or from rupture of flexible hoses. Distance requirements must be measured from the most remote anticipated loading/unloading point. It must be recognized that loading/unloading will not always take place at the same exact position. Equipment approved for use in Division 1 or Zone 0 hazardous locations is needed within tank interiors.

Distilled Spirits Council of the United States, Inc. (DISCUS)

- Provides electrical classification drawings



Distilled Spirits Council of the United States, Inc. (DISCUS)

- Provides electrical classification drawings

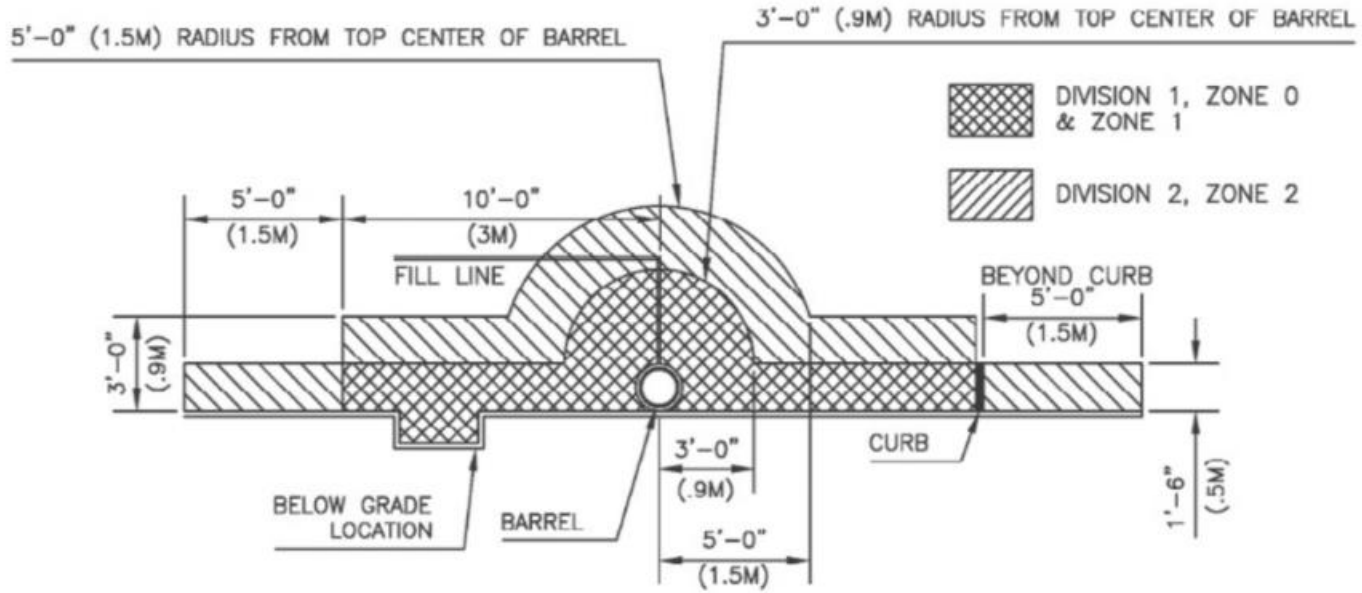


Figure 6-2.1f Example of Barrel Fill or Drain

Distilled Spirits Council of the United States, Inc. (DISCUS)

- Provides electrical classification drawings

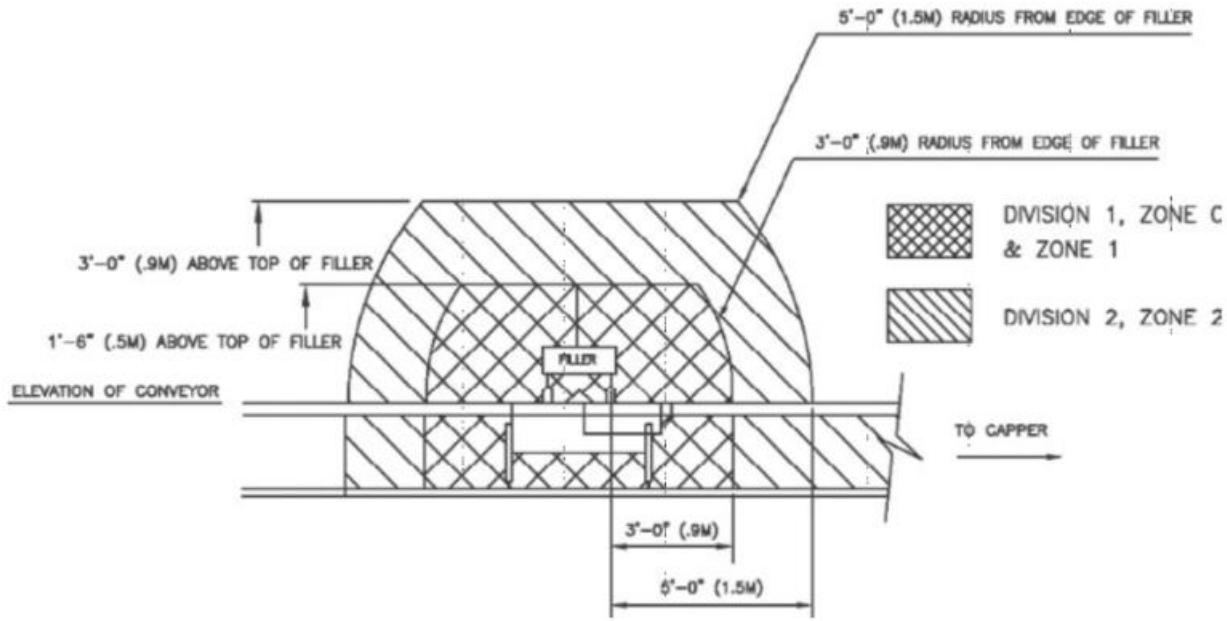


Figure 6-2.1j Example of Bottling Filler

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- Offers guidance on other property risk control topics such as:
  - Material Handling Equipment
  - Utilities
  - Inspections, Testing & Maintenance of Fire Protection Equipment
  - Fire System Impairment Handling
  - Equipment Maintenance including use of proper tools for Classified Areas
  - Hot Work Fire Safety
  - Emergency Planning
  - Security Service

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