BARREL STORAGE OF DISTILLED SPIRITS

INTRODUCTION

This section describes recommended protection for distilled spirits stored in wood barrels. PRC.17.23.3.2 describes recommended protection for the remaining operations that take place in distilleries.

POSITION

Management Programs

Implement management programs based on *OVERVIEW*. A total program of loss prevention and control is key to protecting facilities storing spirits in wood barrels. Include the following in these programs:

Hazardous Materials Evaluation

Identify the hazards of alcoholic beverages. This is the first and most important part of a hazardous material evaluation. A number of factors impact storage limitations and protection criteria. Management is responsible for identifying these factors and informing employees responsible for handling alcohol about the hazards.

Devise a system that ensures alcohol is stored in proper locations in a warehouse, i.e. not in the aisle or on the loading dock. Management should already have programs that evaluate and identify the hazardous properties of the finished products. Extend these programs to the storage hazards. Keep in mind the transportation hazards of alcohol may not be exactly the same as the storage hazards.

Employee Training

Train employees about the hazards associated with storing alcoholic beverages. Provide a Safety Data Sheet (SDS) to each employee, and use the SDS as the basis of employee training. Also, train employees how to safely handle, clean up, and safely dispose of alcohol.

Pre-Emergency Planning

Develop, train and equip an employee emergency brigade. Train members not only to respond to fires, but also to effectively and quickly handle alcohol spills.

Cutting, Welding and Other Hot Work

Control cutting, welding and other hot work in the warehouse. Remove alcohol from the areas of hot work operation, or if it cannot be removed, provide continuous combustible-vapor detectors to detect vapors from a spill or leak before ignition occurs. Follow other precautions outlined in *OVERVIEW*.

Smoking Regulations

Prohibit smoking throughout the warehouse and enforce nonsmoking regulations. Controlling smoking is vital in a warehouse storing alcohol. A small leak might be easily cleaned up before ignition occurs, but if smoking is allowed, ignition becomes more likely. Part of the task involves routinely surveying the warehouse and making sure the smoking prohibition is clearly marked and that there are no signs of this regulation being violated.

Spacing

Provide spacing between barrel warehouses and other buildings in accordance with PRC.2.0.5 and NFPA 80A.

Construction

Construct storage racks and warehouses of noncombustible materials. Fire resistive construction such as reinforced concrete, fireproofed steel or masonry is preferred for warehouses.

Ventilation

Provide mechanical ventilation throughout the warehouse on the basis of 1 cfm/ft^2 (0.3 m^3/min/m^2) of floor area. Locate air intakes within 6 in. (15 cm) of the floor using fans with blades of non-sparking material. Locate exhausts remote from any air intakes.

Drainage

Provide wall scuppers, trapped floor drains, or trapped trench drains terminating in a safe location. Size the drains to effectively handle the maximum calculated sprinkler and hose stream flows simultaneously.

Provide containment to prevent the flow of liquids into adjacent areas or buildings.

Electrical Systems

Use electrical systems suitable for Class I, Group D, Division 2 or Zone 2, Group IIA hazardous classified locations. Ordinary electrical systems may be used if installed at least 5 ft (1.5 m) above the top of the highest level of storage.

Locate the main circuit breaker or switch for the warehouse on the outside of an exterior wall. Shut off power to the interior of the warehouse except when personnel are working inside.

Lightning Protection

Provide lightning protection in accordance with NFPA 70 and NFPA 780.

Operations

Prohibit filling or emptying barrels within the warehouse.

Do not store empty wood barrels, idle wood pallets or other combustibles within the warehouse. Do not store alcohol in metal drums within the warehouse, unless the metal drums are provided with adequate pressure relief.

Use only DS, DY, GS, LPS, GS/LPS, ES, EE, or EX lift trucks within the warehouse.

Sprinklers

Install automatic sprinkler systems throughout per NFPA 13 and PRC.12.1.1.0. Use sprinklers equipped with water shields under all gratings. Dry systems are acceptable, but wet systems are preferred.

Design automatic sprinkler systems in accordance with Tables 1, 2 or 3. The sprinkler designs in these tables are from a guide published in *Recommended Fire Protection Practices For Distilled Spirits Beverage Facilities* by the Distilled Spirits Council of the United States (DISCUS). This guide is based on extensive testing that AXA XL Risk Consulting supported.

Water Supplies

Provide water supplies capable of meeting the ceiling and in-rack sprinkler demands and the hose stream requirements simultaneously for at least 4 h. Use a demand of 750 gpm (2840 L/min/m²) for outside hose and 150 gpm (570 L/min/m²) for inside hose. Also see PRC.14.0.1.

Manual Protection

Fire Extinguishers

Provide one 2AB rated, alcohol-compatible AFFF extinguisher unit for every 3000 ft² (279 m²). Use extinguishers listed by a nationally recognized testing laboratory. Travel distance to the nearest extinguisher should not exceed 75 ft (25 m). See NFPA 10.

Inside Hose Connections

Provide 1 in. (25 mm) hose connections, spaced so that any pile or rack section can be reached by at least two hose streams and equipped with 100 ft (30 m) of 1-½ in. (38 mm) woven jacketed, lined fire hose and adjustable spray nozzles. Supply hose connections from an adjacent ceiling sprinkler system. See NFPA 14.

Yard Hydrants

Provide two-way hydrants along the underground mains at approximately 150 ft (50 m) intervals around the barrel warehouses. Hose threads should be the same as those on existing equipment and those used by the local fire department. See NFPA 24.

Supervision

Provide complete alarm and supervisory service in accordance with PRC.11.0.1.

TABLE 1

Sprinkler Protection For Single Or Double Row Racked Storage Of Distilled Spirits In Barrels

	Sprinkler Design[1] (Sprinkler heads rated between 165-286°F wet or dry systems)							
	Ceiling Only		Ceiling with In-Racks One Level[2]		Ceiling with In-Racks under Bottom Barrel[3]		Ceiling with In-Racks at each Catwalk Level (Staggered Array)[4]	
Barrel Tiers between Floor and Ceiling	Density gpm/ft^2	Area of Application ft^2	Density gpm/ft^2	Area of Application ft^2	Density gpm/ft^2	Area of Application ft^2	Density gpm/ft^2	Area of Application ft^2
0-6	0.22[6]	4000						
7-9	0.30	4000						
10-12	0.40	3000						
13-15	0.50	3000	0.30	4000	0.35	3000	0.22	2000
16-18			0.40	3000	0.50	3000	0.22	2000
19-21			0.40	3000	0.50	3000	0.22	2000
22-24			0.40	3000	0.55	3000	0.22	2000

SI Units: gpm/ft^2 = 40.7 L/min/m^2; ft^2 = 0.093 m^2; °F = (°C × 1.8) + 32

NOTES

1. Where there is a sloping roof, the sprinkler head on each line closest to the eaves may have less than 18 in. clearance.
2. Design of in-rack sprinklers should be based on the simultaneous operation of the most hydraulically remote 6 sprinklers with a minimum operating pressure of 30 psi (2 bar).
3. Design of in-rack sprinklers under bottom barrels should be based on a discharge density of 0.15 gpm/ft^2 (6.1 L/min/m^2) over the hydraulically most remote 2500 ft.^{2}
4. Design of in-rack sprinklers should be based on the simultaneous operation of the most hydraulically remote 10 sprinklers (5 on each of the top two levels) with a minimum operating pressure of 30 psi (2 bar).
5. Where horizontal barriers are provided at every sixth tier, protection requirements for 0-6 barrels may be used.
6. It is permissible to have a sprinkler clearance less than 18 in. (46 cm) providing the discharge density is increased by 0.01 gpm/ft^2 for each inch reduction in sprinkler clearance.

TABLE 2

Sprinkler Protection For Multi-Row Racked Storage Of Distilled Spirits In Barrels

	Sprinkler Design[1] (Sprinkler heads rated between 165-286°F wet or dry systems)			
	Ceiling with In-Racks for Every Six Barrel Tiers[2]		Ceiling with In-Racks under Bottom Barrel[3]	
Barrel Tiers between Floor and Ceiling	Density gpm/ft^2	Area of Application ft^2	Density gpm/ft^2	Area of Application ft^2
0-6	0.30	4000		
7-24	0.35	3000		
7-15			0.50	4000

SI Units: gpm/ft^2 = 40.7 L/min/m^2; ft^2 = 0.093 m^2; °F = (°C × 1.8) + 32

NOTES

1. Where there is a sloping roof, the sprinkler head on each line closest to the eaves may have less than 18 in. (46 cm) clearance.
2. Design of in-rack sprinklers should be based on the simultaneous operation of the most hydraulically remote:
3. 8 sprinklers when only one level is installed.
4. 14 (7 on each of the two top levels) when more than one level is installed.
5. A minimum operating pressure of 30 psi shall be provided at any sprinkler in the racks.
6. Design of in-rack sprinklers under bottom barrels should be based on a discharge density of 0.15 gpm/ft^2 over the hydraulically most remote 2500 ft.^{2}

TABLE 3
Sprinkler Protection For Palletized Barrels Of Distilled Spirits Up To Six High[1]

Type of System	Units	Temperature Rating of Sprinklers 165°F Wet	165°F Dry	286°F Wet	286°F Dry[2]	Hose Stream Demand
Design Point 1 Density/ Area of Application	gpm/ft^2	0.35/ 7500	N/R[5]	0.35/ 4000	0.35/ 4000[4]	150 gpm inside hoses
Design Point 2 Density/ Area of Application	gpm/ft^2	0.20[3]/ 12,500	N/R[5]	0.20[3]/ 10,000	0.20/ 12,500	750 gpm outside hoses
Duration of Demand	Hours	4	N/R[5]	4		

SI Units: gpm/ft^2 = 40.7 L/min/m^2; ft^2 = 0.093 m^2; gpm = 3.79 L/min; °F = (°C × 1.8) + 32

NOTES

1. Densities based on clearance of 18 in. to 10 ft with area per head coverage from 80 to 100 ft.^{2}
2. Minimum of one quick opening device (QOD) required. Second QOD suggested.
3. This second design point is not required when storage is four or less pallet levels in height (wet systems only).
4. This table is based on 6 barrels/pallet. Tests indicate that for 9 barrels/pallet, protection should be 0.35 gpm/ft^2 over 5000 ft.^{2}
5. N/R: Not recommended.

DISCUSSION

Alcohol used in beverages is actually ethyl alcohol, also known as ethanol or grain alcohol. It is a flammable liquid that burns with a blue flame that is hard to see. The heat of combustion is about 62% of that of gasoline. Alcohol vapors are 1.6 times the density of air so they tend to travel along the floor.

Alcohol-water solutions with an alcohol concentration of 20% or more support combustion and have flash points low enough to qualify as flammable liquids. Because alcohol is completely water miscible, water is a good fire-fighting agent. In addition to cooling the fire, water can dilute the alcohol to a point where it cannot support combustion. On the other hand, foam-water extinguishing systems must use special alcohol-compatible foam concentrates to prevent the alcohol from destroying the foam.

After distillation, alcoholic beverages still contain some bad-tasting impurities that must be removed by adsorption (or aging) in activated carbon (charred wood). Since this is a slow process, it is necessary to age raw spirits, having an ethanol content of 55 to 80%, for several years in charred oak barrels.

Barrels are usually stored inside buildings, either on their sides in steel or wood racks, or on end on wood pallets. These racks can be single, double or multi-row. In multi-story structures, racks are usually 6 to 9 barrels high per floor. If stored on end on pallets, storage is usually 6 high per floor.

Due to the massive quantities of alcohol and wood present in such a warehouse, a fire that is not promptly controlled will destroy the entire structure and all its contents. If spacing and drainage are inadequate, it is possible that several warehouses could be lost.

Since each warehouse represents the output of the distillery for some period of time, and the value of the finished product grows as time passes, both the property damage and business interruption components of a loss can be massive. Such a loss potential justifies a large investment in loss control.

The Distilled Spirits Council ran tests to determine the sprinkler designs needed to control fires in various distillery occupancies, including barrel storage warehouses. AXA XL Risk Consulting helped sponsor the tests. The DISCUS fire protection guide referenced by this section reflects the results of these tests.