

Recommended Fire Protection Practices

for Distilled Spirits Beverage Facilities



DISTILLED SPIRITS COUNCIL
OF THE UNITED STATES

A SUGGESTED GUIDE
Fourth Edition

The Distilled Spirits Council
of the United States, Inc.

1250 Eye Street, N.W. Suite 400
Washington, DC 20005

The Distilled Spirits Council of the United States, Inc. (DISCUS) is a national trade association representing producers and marketers of distilled spirits products sold in 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.

FOURTH EDITION

Library of Congress Control Number: 2020902004

ISBN: 978-0-578-63972-7

Copyright © 2020

Distilled Spirits Council Of The United States, Inc.

1250 Eye Street, NW, Suite 400

Washington, DC 20005

February 2020



FOREWORD



This publication is a suggested, voluntary guide for application primarily to new installations of distilled spirits production plants, including storage and warehouse facilities. It is not intended in any way to be an industry standard or code for regulatory purposes.

The information contained in this guide is not intended to apply retroactively to existing buildings or operations but any company, facility or operation may choose to apply the principles and practices within this guide at existing facilities. This guide also may be especially useful in designing significant alterations or extensions to existing facilities.

While the development of this document is based upon sound engineering principles, test data, and field experience, neither DISCUS or its member companies, accepts any responsibility or liability resulting from compliance or non-compliance with any of its provisions, for any restrictions imposed upon materials or processes, or for the completeness of the text.

DISCUS has no power or authority to require, police or enforce compliance with the contents of this document; and any certification of products stating compliance with the requirements of this document is made at the sole risk of the certifier.



DISCUS FIRE PROTECTION COMMITTEE

The DISCUS Fire Protection Committee 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.

This charge involves evaluating new fire protection technologies and developing and sharing non-proprietary technical data, procedures, and other relevant information with DISCUS member companies consistent with the antitrust laws and with the fire protection community.

The DISCUS Fire Protection Committee has prepared this document. The Committee is composed of the fire protection representatives of the respective DISCUS member companies as indicated on the following page.

LARRY COMBS (CHAIRMAN)

Senior Vice President, General Manager Jack Daniel's Global Supply Chain
Brown-Corporation Corporation

JULIO TORRUELLA

Global Sustainability Director
Bacardi U.S.A., Inc.

STEVE TUCKER

Global Health and Safety Director
Beam Suntory

JEFF SKILLERN

Manager, Environmental, Health & Safety
Brown-Forman Corporation

FRED ELLIOTT

Fire and Security Specialist
Brown-Forman Corporation

GARY MAIER

Director of Insurance
Brown-Forman Corporation

RICK ROBINSON

Vice President, U.S. Product Supply Chain
Campari America

KIMBERLY A. BUCEK

Manager, North America Health & Safety
Diageo

ANDREW JARRICK

Environment and Sustainability
Excellence Manager
Diageo

JOHN LONGO

Head of Facilities, North America
Diageo

JOHN MCKEE

Founder and Chief Technology Officer
Headframe Spirits

BRIAN BISSELL

Process Safety Manager
MGP Ingredients, Inc.

MONICA SWINGLE

Corporate Safety Innovation Manager
MGP Ingredients, Inc.

DALE HUFFMAN

Manager, Safety and Capital Projects
Ole Smoky Distillery

CATHY BEST

VP, Human Resources
Ole Smoky Distillery

SCOTT HORTON

Director, Environmental Health and Safety
Pernod Ricard USA

ROBERT CASSELL

Co-Founder
Millstone Spirits Group

COURTNEY ARMOUR (STAFF LIAISON)

Chief Legal Officer and Corporate Secretary
Distilled Spirits Council
of the United States, Inc.

TABLE OF CONTENTS

CHAPTER 1

Introduction **13**

1-1 Scope 14

1-2 Purpose 14

1-3 Definitions 14

1-4 Units/Conversion Factors 21

CHAPTER 2

Unique Characteristics of Alcohol-Water Solutions as Compared to Other Flammables **25**

2-1 Physical Properties of Alcohol-Water Solutions 26

2-2 Characteristics of Alcohol Vapors 27

CHAPTER 3

Processes **30**

3-1 General 31

3-2 Grain Handling 32

3-3 Mashing and Fermenting 38

3-4 Distillation 39

3-5 Drying 40

3-6 Alcohol Processing 46

3-7 Barrel Warehousing 48

3-8 Barrel Fill and Drain Operations 50

3-9 Empty Wooden Barrel Storage 53

3-10 Storage of Empty Bottles and Packaging Materials 54

3-11 Bottling 55

3-12 Storage of Finished Case Goods 56

3-13 Storage of Distilled Spirits in Metal and Plastic Drums or Totes 56

CHAPTER 4

Protection Practices 63

4-1 General	64
4-2 Sprinkler and Water Spray Protection	64
4-3 Explosion Protection	65
4-4 Water Supplies	65
4-5 Water Demand	67
4-6 Other Extinguishing Systems	67
4-7 Alarm Systems and Watch Service	67
4-8 Exposure Protection	68

CHAPTER 5

Alcohol Handling 79

5-1 General	80
5-2 Tank Design and Construction	80
5-3 Tank Venting	81
5-4 Tank Location	83
5-5 Overflow/Overfill Protection	84
5-6 Spill Control	84
5-7 Ventilation	85
5-8 Piping, Valves, and Fittings	86
5-9 Loading and Unloading Facilities	87
5-10 Protection	88

CHAPTER 6

Electrics 93

6-1 General 94

6-2 Area Classification 95

6-3 Static Electricity 96

6-4 Lightning Protection 96

6-5 Electronic Equipment 96

CHAPTER 7

Equipment 108

7-1 Mechanical Handling Equipment 109

7-2 Building Service Equipment 110

7-3 Process Equipment and Tools in Classified Areas 110

CHAPTER 8

Impairments, Maintenance and Inspections 111

8-1 Impairments 112

8-2 Maintenance 113

8-3 Inspections 116

CHAPTER 9

Emergency Planning 118

9-1 General 119

9-2 Emergency Action Planning 119

9-3 Pre-Incident Planning 121

9-4 Watch Service 121

APPENDIX A	
Characteristics of Flammable and Combustible Liquids	122
APPENDIX B	
Dust Properties	126
APPENDIX C	
Sample Self-Inspection Form Grain Storage Facilities	128
APPENDIX D	
National Electrical Code Criteria and Equipment Considerations	133
D-1 Scope	134
D-2 Class I Locations	134
D-3 Class II Locations	136
D-4 Non-Classified Area	136
D-5 Intrinsically Safe Electrical Equipment for Hazardous Locations	136
D-6 NEC Grouping of Atmospheric Mixtures with Similar Flammable Characteristics	137
APPENDIX E	
Sample Hot Work Permit	138
APPENDIX F	
Sample Self-Inspection Form for Fire Prevention	142
APPENDIX G	
Bibliography	150
APPENDIX H	
NFPA-FM-GE GAP Cross Reference	156

FIGURES

Figure 1-1	Single-Rack Barrel Warehouse	22
Figure 1-2	Double-Rack Barrel Warehouse	22
Figure 1-3	Multiple-Rack Barrel Warehouse	23
Figure 1-4	Typical Palletized Warehouse Floor Plan with Palletized Barrel Top View and Side View	24
Figure 2-1.2	Relative Rates of Burning	27
Figure 3-1.2	Sectional Diagram of a Terminal-Type Grain Elevator	58
Figure 3-1.4a	Example of a Column Distillery Process for Alcohol Distillation	59
Figure 3-1.4b	Example of Bourbon Whiskey Distillation with Doubler	60
Figure 3-4.2.1	Batch System	61
Figure 3-4.10.2	Example of a Pressure/Vacuum-Relieving Seal Pot	62
Figure 4-2.2a	Single-Row Racks. Location of In-Rack Sprinklers	75
Figure 4-2.2b	Double-Row Racks. Location of In-Rack Sprinklers	75
Figure 4-2.2c-1	Double-Row Racks. Location of Sprinklers Under Bottom Barrels (Jamieson or Burke System)	76
Figure 4-2.2c-2	Double-Row Racks. Location of Sprinklers Under Bottom Barrels (Jamieson or Burke System)	76
Figure 4-2.2d-1	Double-Row Racks. Location of In-Rack Sprinklers at Each Catwalk Level (Diamond Stagger System)	77
Figure 4-2.2d-2	Double-Row Racks. Location of In-Rack Sprinklers at Each Catwalk Level (Diamond Stagger System)	77
Figure 4-2.2e-1	Multiple-Row Racks. Location of In-Rack Sprinklers	78
Figure 4-2.2e-2	Multiple-Row Racks. Location of In-Rack Sprinklers	78
Figure 5-9.3.1a	Example of a Physical Grounding Connection for Tank Car Stations	91
Figure 5-9.3.1b	Example of a Physical Grounding Connection for Tank Truck Stations	92
Figure 6-2.1a	Example of Leakage Source Located Indoors, at Floor Level. Adequate Ventilation is Provided	99

Figure 6-2.1b	Example of Leakage Source Located Indoors, at Grade	99
Figure 6-2.1c	Example of Tank Truck and Rail Car Operations - Side View	100
Figure 6-2.1d	Example of Tank Truck and Rail Car Operations - End View	101
Figure 6-2.1e	Example of Outside Storage Tanks	102
Figure 6-2.1f	Example of Barrel Fill or Drain	103
Figure 6-2.1g	Example of Barrel Dump	103
Figure 6-2.1h	Example of Barrel Conveyor	104
Figure 6-2.1i	Example of Barrel Fill and Drain - Barrels in Vertical Position	104
Figure 6-2.1j	Example of Bottling Filler	105
Figure 6-2.1k	Example of Bottling Capper	105
Figure 6-2.1l	Example of Indoor Tank with Outdoor Vent	106
Figure 6-2.1m	Example of Plate & Frame Filter	106
Figure 6-2.1n	Palletized Barrel Warehouse Electrical Classification	107
Figure 6-2.1o	Rick Barrel Warehouse Electrical Classification	107
Figure A-1	Relationship Between Flash Point, Flammable Limits, Temperature, and Vapor Pressure for Acetone and Ethyl Alcohol. Liquid, Vapor, and Air in a Closed Container at Normal Atmospheric Pressure	123
Figure A-2	Variation of Lower Flammable Limits with Temperature and Pressure	124
Figure A-3	Variation of Upper Flammable Limits with Temperature and Pressure	125
Figure F-1	Palletized Barrel Warehouse Sprinkler Setup	145
Figure F-2	Rick Barrel Warehouse Sprinkler Setup	145

TABLES

Table 1-4.1a	SI Conversion Factors	21
Table 1-4.1b	Standardized Conversions	21
Table 2-1.1	Flash and Fire Points of Alcohol-Water Solutions	26
Table 2-1.2a	Physical Properties of Various Flammable Liquids	28
Table 2-1.2b	Heat Combustion and Flash Point for Gasoline and Various Ethyl Alcohol-Water Solutions	29
Table 4-2.2a	Process Occupancies	70
Table 4-2.2b	Storage Occupancies	71
Table 4-2.2c	Sprinkler Protection Design Requirements for Single-Row and Double-Row, Racked Storage of Distilled Spirits in Barrels	72
Table 4-2.2d	Sprinkler Protection Design Requirements for Multiple-Row, Racked Storage of Distilled Spirits in Barrels	73
Table 4-2.2e	Recommended Criteria in Automatic Sprinkler Design for up to Six-High, Palletized Barrel Storage of Spirits	74
Table 4-2.2f	Recommended Criteria in Automatic Sprinkler Design for up to Seven-High, Palletized Barrel Storage of Spirits	74
Table 5-3.3	Required Thermal Venting Capacity (Expressed in Cubic Feet per Hour of Air) Interpolation Permitted	89
Table 5-4.1.1	Outside Above Ground Tank Locations	90
Table 6-2.1	Area Classification	97
Table B-1	Dust Properties	127
Table H-1	Cross-Reference - NFPA Codes & Standards to FM Data Sheets and GE GAP Guidelines	157

Note: Tables are based upon industry best practices and are not meant to be exhaustive or definitive.