FLAMMABLE AND COMBUSTIBLE LIQUIDS CODE COMMITTEE

MEMORANDUM

TO: NFPA 30 Technical Committee on Storage and Warehousing of Containers and Portable Tanks

FROM: Janna Shapiro

DATE: August 13, 2015

SUBJECT: Agenda for NFPA 30 First Draft Meeting September 9, 2015 — 8:00 AM to 5:00 PM

Ladies and Gentlemen:

Attached is the Agenda for the NFPA 30, Flammable and Combustible Liquids Code, First Draft meeting of the NFPA 30 Technical Committee on Storage and Warehousing of Containers and Portable Tanks, to be held 8:00 AM to 5:00 PM, Wednesday, September 9, 2015, at the Crowne Plaza Hotel, Austin TX.

This Agenda will also be posted to the NFPA 30 Document Information Page at http://www.nfpa.org/30

If you have additional items for the Agenda, please bring them with you to the meeting.

rpb/

cc FLCC Meeting Folder
FLCSWC/NM
FLAMMABLE AND COMBUSTIBLE LIQUIDS CODE COMMITTEE

AGENDA — NFPA 30 First Draft Meeting

NFPA 30 Technical Committee on Storage and Warehousing of Containers and Portable Tanks
Crowne Plaza Hotel, Austin TX
Wednesday, September 9, 2015, 8:00 AM to 5:00 PM

1. Call to Order.

2. Introduction of Attendees. Update of Committee Roster. [Attachment № A1]

3. Approval of Minutes of Last Meeting. [June, 2013, San Antonio TX] [Attachment № A2]

4. Report of Committee Chair.

5. Report of Staff Liaison.
   - Technical Committee Scope. [See Attachment № A3 for Proposed New Scope]
   - Technical Committee Membership Status.

6. Member Reports on Current Issues. [As Necessary]

7. Review and Act on Public Inputs to Amend the 2015 edition of NFPA 30
   [Attachment № A5 – Public Inputs to Chapters 9, 10, 12, 14, and 16 and Annex D]
   [Attachment № A6 – Global Public Inputs: Low Pressure Containers; Reference Standards]

8. Old Business.
   - Need for New Definition – “Rack Section”?
   - New Committee Project for Low Pressure Containers.
   - Revisions to Table 9.4.3 – Correlation with DOT – Task Group Effort.

9. New Business. [NONE]

10. Schedule Next Meeting(s).

11. Adjournment.
### Storage and Warehousing of Containers and Portable Tanks

#### Flammable and Combustible Liquids

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<th>Name</th>
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<tr>
<td>John A. LeBlanc</td>
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<tr>
<td>Donald B. Hicks</td>
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<td>7/14/2004</td>
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#### Officers

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<tr>
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<tr>
<td>Peter R. Apostoluk</td>
<td>Principal</td>
<td>1/12/2000</td>
<td>Greif Inc. 366 Greif Parkway, Delaware, OH 43015</td>
</tr>
<tr>
<td>Glen A. Carter</td>
<td>Principal</td>
<td>1/10/2008</td>
<td>Justrite Manufacturing Company, LLC 14 Western Avenue Heights, Mattoon, IL 61938, Alternate: Arthur M. Stevens</td>
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<td>Tom de Nooij</td>
<td>Principal</td>
<td>04/08/2015</td>
<td>Riskonet B.V. Singel 540, Amsterdam, 1017 AZ The Netherlands, Alternate: William E. Koffel</td>
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<td>Keric M. Fitzgerald</td>
<td>Principal</td>
<td>08/11/2014</td>
<td>Roche Diagnostics 9115 Hague Road, W1 Facility, Indianapolis, IN 46256-1025</td>
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<tr>
<td>Dwight H. Havens</td>
<td>Principal</td>
<td>7/24/1997</td>
<td>Bechtel Marine Propulsion Corporation Knolls Atomic Power Laboratory, 20 Bellflower Road, Malta, NY 12020-4431</td>
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**Address List No Phone**

**Storage and Warehousing of Containers and Portable Tanks**

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<tr>
<td>David C. Kirby</td>
<td>Principal</td>
<td>Baker Engineering &amp; Risk Consultants, Inc. 1560 Clearview Heights Charleston, WV 25312</td>
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<td>Alternate: Duane L. Rehmeyer</td>
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<td>Jonathan Kulpit</td>
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<tr>
<td>Lee T. Rindfuss</td>
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<tr>
<td>George A. Seuss, Jr.</td>
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<td>The Hanover Insurance Group Verlan Fire Insurance Company 10480 Little Patuxent Parkway Suite 500 Columbia, MD 21044-3506</td>
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<tr>
<td>Peter J. Willese</td>
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<tr>
<td>Richard S. Kraus</td>
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<td>David C. Tabar</td>
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<tr>
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<td>The Viking Corporation 210 North Industrial Park Road Hastings, MI 49058</td>
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<td>Janna E. Shapiro</td>
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Flammable and Combustible Liquids

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Principal: Richard S. Kraus

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<tr>
<td></td>
<td>Principal: John A. LeBlanc</td>
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<tr>
<td>Jack Woycheese</td>
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<td>Quincy, MA 02169-7471</td>
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FLAMMABLE AND COMBUSTIBLE LIQUIDS CODE COMMITTEE

Minutes of NFPA 30 Second Draft Meeting

NFPA 30 Technical Committee on Storage & Warehousing of Containers & Portable Tanks
Doubletree Hotel – San Antonio Downtown
San Antonio TX
Thursday & Friday, June 20 & 21, 2013
*1:00 PM to 5:00 PM Joint with NFPA 30 Technical Committee on Storage and Warehousing of Containers and Portable Tanks

I. Participation

T. D. Bellamy, Telgian Corporation (Rep. The Home Depot)
J. D. Campbell, Telgian Corporation (Alternate to T. D. Bellamy, Rep. The Home Depot)
G. A. Carter, Justrite Manufacturing Company, LLC
C. V. De Taeye, Travelers, Insurance Company
J. J. Foley, The RJA Group, Inc.
D. H. Havens, Bechtel Marine Propulsion Corp. / Knowles Atomic Power Laboratories
D. C. Kirby, Baker Engineering & Risk Consultants
J. A. LeBlanc, FM Global, CHAIR
T. Lentz, AON Risk Management
J. P. Levin, Liberty Mutual Commercial Markets (Rep. Property Casualty Insurers Association of America)
R. A. Riegel, UL LLC
L. T. Rindfuss, Marsh Risk Consulting
D. A. Rivers, 3M Company
G. A. Seuss, Jr., Hanover Insurance Group / Verlan Fire Insurance Company
R. Stutzki, 3M Company
D. C. Tabar, The Sherwin-Williams Company
B. Tate, Office of the Fire Marshal – Ontario
C. J. Wieczorek, FM Global
J. Woycheese, Hughes Associates, Inc.

R. P. Benedetti, National Fire Protection Association, STAFF LIAISON

GUESTS: L. Arango, XL Global Asset Protection Services (NFPA 30 Correlating Committee)
S. Ayers, U. S. Consumer Product Safety Commission (Non-Voting Member – NFPA 30 Correlating Committee)
G. Brenneke, Liberty Mutual Insurance (NFPA 30 Technical Committee on Fundamentals)
R. Razawski, The Sherwin-Williams Company
II. Minutes

1. The meeting was called to order at 1:00 PM on Thursday, June 20, 2013 by Technical Committee Chair John LeBlanc.

2. Attendees introduced themselves. The Technical Committee roster was corrected as needed. An updated roster will be posted on the Technical Committee’s web page.

3. The Minutes of the previous meeting (August 2012, NFPA, Quincy MA) were unanimously approved as issued.

4. The Technical Committee Chair welcomed attendees and reviewed the Agenda.

5. The Staff Liaison reported on the following:
   - Technical Committee Scope Statement. The Technical Committee agreed to the need for a revised scope that accurately reflects the Technical Committee’s responsibilities. The Staff Liaison was directed to develop a revised scope statement for the committee’s review.
   - Membership Status. The Staff Liaison reported on recent changes to committee membership and on the balance of interests on the committees. At this time, there is no balance issue.

6. There were no reports on current issues.

7. The Technical Committee met jointly with the NFPA 30 Technical Committee on Fundamentals to review and act on a public comment to the definition of “safety can”. The committees came to a mutually agreed-upon action to resolve the comment.

8. The Technical Committee reviewed and acted on all other public comments to their First Draft report on NFPA 30.

9. There was no correspondence requiring the Technical Committee’s attention.

10. There was no old business requiring the Technical Committee’s attention.
11. The Technical Committee discussed the following new business items:

- **Pressurized Containers.** The Technical Committee determined that these new types of containers are beyond the scope of NFPA 30 and should be addressed in a separate dedicated standard.

- **Definition of “Rack Section”.** There seems to be a need for such a definition or a diagram to show a typical rack section.

- **Correlation between NFPA 30 and U. S. Department of Transportation RE: Container Types.** This is a Task Group effort.

12. The Technical Committee deferred action on scheduling future meetings.

13. The meeting adjourned at 2:15 PM, Thursday, June 20, 2013.
NFPA 30 Technical Committee on Storage and Warehousing of Containers and Portable Tanks

This Committee shall have primary responsibility for documents or portions of documents on safeguarding against the fire and explosion hazards associated with the storage, warehousing, and display merchandising of flammable and combustible liquids in containers whose capacity does not exceed 450 L (109 gallons), portable tanks whose capacity does not exceed 2500 L (660 gallons), and intermediate bulk containers whose capacity does not exceed 3000 L (793 gallons).

Responsible for Chapters 9 through 16 and Annexes D and E of NFPA 30, Flammable and Combustible Liquids Code.
# 2017 ANNUAL REVISION CYCLE

*Public Input Dates may vary according to standards and schedules for Revision Cycles may change. Please check the NFPA Website for the most up-to-date information on Public Input Closing Dates and schedules at www.nfpa.org/document # (i.e. www.nfpa.org/101) and click on the Next Edition tab.*

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<th>Process Step</th>
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<td>Public Input Closing Date*</td>
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<td>12/14/15</td>
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<td>Posting of First Draft and TC Ballot</td>
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<td>Post First Draft Report for Public Comment</td>
<td>3/7/16</td>
<td>3/7/16</td>
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</table>

| Comment Stage (Second Draft) | Public Comment closing date | 5/16/16 | 5/16/16 |
| | Final Date to Publish Notice of Consent Standards (Standards that received no Comments) | 5/30/16 | 5/30/16 |
| | Appeal Closing Date for Consent Standards (Standards that received no Comments) | 6/13/16 | 6/13/16 |
| | Final date for TC Second Draft Meeting | 10/31/16 | 7/25/16 |
| | Posting of Second Draft and TC Ballot | 12/12/16 | 9/5/16 |
| | Final date for Receipt of TC Second Draft ballot | 1/2/17 | 9/26/16 |
| | Final date for receipt of TC Second Draft ballot - recirc | 1/9/17 | 10/3/16 |
| | Posting of Second Draft for CC Meeting | | 10/10/16 |
| | Final date for CC Second Draft Meeting | | 11/21/16 |
| | Posting of Second Draft for CC Ballot | | 12/12/16 |
| | Final date for Receipt of CC Second Draft ballot | | 1/2/17 |
| | Final date for Receipt of CC Second Draft ballot - recirc | | 1/9/17 |
| | Post Second Draft Report for NITMAM Review | 1/16/17 | 1/16/17 |

| Tech Session Preparation | Notice of Intent to Make a Motion (NITMAM) Closing Date | 2/20/17 | 2/20/17 |
| & Issuance | Posting of Certified Amending Motions (CAMs) and Consent Standards | 4/17/17 | 4/17/17 |
| | Appeal Closing Date for Consent Standards | 5/2/17 | 5/2/17 |
| | SC Issuance Date for Consent Standards | 5/12/17 | 5/12/17 |

| Tech Session | Association Meeting for Standards with CAMs | 6/4-7/2017 | 6/4-7/2017 |

| Appeals and Issuance | Appeal Closing Date for Standards with CAMs | 6/27/17 | 6/27/17 |
| | SC Issuance Date for Standards with CAMs | 8/10/17 | 8/10/17 |

Approved: October 30, 2012

Revised: ___________________________
The maximum allowable size of a container, intermediate bulk container, or metal portable tank for Class I, Class II, and Class IIIA liquids shall not exceed that specified in Table 9.4.3.

*Exception: As provided for in Section 9.1, 9.4.3.1, 9.4.3.2, and 9.4.3.3.*

<table>
<thead>
<tr>
<th>Container Type</th>
<th>Flammable Liquids</th>
<th>Combustible Liquids</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Class IA</td>
<td>Class IB</td>
</tr>
<tr>
<td>Glass</td>
<td>1 pt (0.5 L)</td>
<td>1 qt (1 L)</td>
</tr>
<tr>
<td>Metal (other than drums) or approved plastic</td>
<td>1.3 gal (5 L)</td>
<td>5.3 gal (20 L)</td>
</tr>
<tr>
<td>Safety cans</td>
<td>2.6 gal (10 L)</td>
<td>5.3 gal (20 L)</td>
</tr>
<tr>
<td>Metal drum (e.g., UN 1A1/1A2)</td>
<td>119 gal (450 L)</td>
<td>119 gal (450 L)</td>
</tr>
<tr>
<td>Approved metal portable tanks and IBCs</td>
<td>793 gal (3000 L)</td>
<td>793 gal (3000 L)</td>
</tr>
<tr>
<td>Rigid plastic IBCs (UN 31H1 or 31H2) and composite IBCs with rigid inner receptacle (UN31HZ1) that have been subjected to a standard fire test that demonstrates acceptable inside storage fire performance and shall be listed and labeled</td>
<td>NP</td>
<td>NP</td>
</tr>
<tr>
<td>Composite IBCs with flexible inner receptacle (UN31HZ2) and DOT/UN-approved flexible IBCs</td>
<td>NP</td>
<td>NP</td>
</tr>
<tr>
<td>Non-bulk Bag-in-Box</td>
<td>NP</td>
<td>NP</td>
</tr>
<tr>
<td>Polyethylene UN1H1 and UN1H2, or as authorized by DOT exemption</td>
<td>NP</td>
<td>NP</td>
</tr>
<tr>
<td>Fiber drum</td>
<td>NP</td>
<td>NP</td>
</tr>
<tr>
<td>NMFC or UFC Type 2A; Types 3A, 3B-H, or 3B-L; or Type 4A</td>
<td>1.3 gal (5 L)</td>
<td>5.3 gal (20 L)</td>
</tr>
</tbody>
</table>

NP: Not permitted for the container categories so classified unless a fire protection system is provided that is developed in accordance with 16.3.6 and is approved for the specific container and protection against static electricity is provided.

*See 9.4.3.1.*

**Additional Proposed Changes**

<table>
<thead>
<tr>
<th>File Name</th>
<th>Description</th>
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</tr>
</thead>
<tbody>
<tr>
<td>T29_Composite_IBCs__Slide_20_from_2015_NFPA_Conference.pdf</td>
<td>T29 Composite IBCs Slide</td>
<td></td>
</tr>
</tbody>
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**Statement of Problem and Substantiation for Public Input**

Non-listed Composite IBCs (Rigid nonmetallic intermediate bulk containers) that contain hydrocarbon liquids have been shown in laboratory testing to fail between 1 minute 12 second and 1 minute 56 seconds following fire exposure, and in large scale fire testing in the range of 2 minutes 30 seconds (UK HSE, 2007; Wieczorek & Yee, 2008). The catastrophic loss of hydrocarbon liquid creates an exposure pool fire in excess of 3000 square feet and can result in instantaneous heat release rates in excess of 588 Megawatts (George & Snyder, 2015). The subsequent exposure of other non-listed composite IBCs results in a rapidly expanding fire with catastrophic results (Fire Protection Research Foundation, 2014).

At present, the limitations for indoor unprotected storage are inadequate to manage the life safety and property risk presented by the rapidly released fuel load from non-listed composite IBCs involved in fire.

To adequately manage this risk, proposals are framed to do the following:
1. In Table 9.4.3, require that any Rigid Plastic IBCs (UN 31H1 or 31H2) and Composite IBCs with rigid inner receptacle (UN31HZ1) for storage of Class II and IIIA liquids be subjected to a standard fire test that demonstrates acceptable inside storage fire performance and shall be listed and labeled.

2. Remove the allowance for using non-listed composite IBCs in Class II and IIIA liquids for indoor, unprotected storage (Table 12.6.2.2), thereby limiting the indoor storage of composite IBCs to Protected Storage configurations.

References:


Related Public Inputs for This Document

<table>
<thead>
<tr>
<th>Related Input</th>
<th>Relationship</th>
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</thead>
<tbody>
<tr>
<td>Public Input No. 86-NFPA 30-2015 [Section No. 12.6.2.2]</td>
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<tr>
<td>Public Input No. 92-NFPA 30-2015 [Section No. 18.5.4.1]</td>
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</tr>
</tbody>
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Submitter Information Verification

Submitter Full Name: MICHAEL SNYDER
Organization: Dow Corning
Street Address:
City:
State:
Zip:
Submittal Date: Tue Jun 30 22:24:44 EDT 2015
CIBCs – Mitigation Strategy

- Pool Fires are the enemy!
- Consider a 275 gallon CIBC of Lube Oil:

<table>
<thead>
<tr>
<th>Depth of spill</th>
<th>0.125 in.</th>
<th>0.25 in.</th>
<th>0.5 in.</th>
<th>1 in.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area of spill</td>
<td>3,529 sq.ft.</td>
<td>1,765 sq.ft.</td>
<td>882 sq.ft.</td>
<td>441 sq.ft.</td>
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<td>Heat Release</td>
<td>557,480 BTU/sec</td>
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<td>139,221 BTU/sec</td>
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<td></td>
<td>588 MW</td>
<td>294 MW</td>
<td>147 MW</td>
<td>73 MW</td>
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<tr>
<td>Duration</td>
<td>1.03 min</td>
<td>2.06 min</td>
<td>4.13 min</td>
<td>8.25 min</td>
</tr>
<tr>
<td>Flame Height*</td>
<td>69 ft</td>
<td>54 ft</td>
<td>43 ft</td>
<td>34 ft</td>
</tr>
<tr>
<td># of Package Boilers**</td>
<td>803 boilers</td>
<td>401 boilers</td>
<td>200 boilers</td>
<td>100 boilers</td>
</tr>
</tbody>
</table>


** Assuming 2,500,000 BTU/hr Boiler

<table>
<thead>
<tr>
<th>Typical Package Boiler</th>
</tr>
</thead>
<tbody>
<tr>
<td>83 BTU/sec to 694 BTU/sec</td>
</tr>
<tr>
<td>300,000 BTU/h to 2,500,000 BTU/h</td>
</tr>
</tbody>
</table>
Leaking or damaged containers up to 60 gal (230 L) capacity shall be permitted to be stored temporarily in accordance with this chapter and Chapters 10 through 12, provided they are enclosed in approved overpack containers in accordance with section 9.4.3.3.1.

Statement of Problem and Substantiation for Public Input

directs user to requirements for overpace containers

Submitter Information Verification

Submitter Full Name: RICHARD KRAUS
Organization: APIPETROLEUM SAFETY CONSULTAN
Street Address:
City:
State:
Zip:
Submittal Date: Mon Jun 22 11:09:37 EDT 2015
9.5.3 Storage cabinets that meet at least one of the following sets of requirements shall be acceptable for storage of liquids:

(1) Storage cabinets designed and constructed to limit the internal temperature at the center of the cabinet and 1 in. (25 mm) from the top of the cabinet to not more than 325°F (163°C), when subjected to a 10-minute fire test that simulates the fire exposure of the standard time–temperature curve specified in ASTM E 119, *Standard Test Methods for Fire Tests of Building Construction and Materials*, shall be acceptable. All joints and seams shall remain tight and the door shall remain securely closed during the test.

(2) Metal storage cabinets constructed in the following manner shall be acceptable:
   (a) The bottom, top, door, and sides of the cabinet shall be at least No. 18 gauge sheet steel and shall be double-walled, with 1 1/2 in. (38 mm) air space.
   (b) Joints shall be riveted, welded, or made tight by some equally effective means.
   (c) The door shall be provided with a three-point latch arrangement, and the door sill shall be raised at least 2 in. (50 mm) above the bottom of the cabinet to retain spilled liquid within the cabinet.

(3) Wooden cabinets constructed in the following manner shall be acceptable:
   (a) The bottom, sides, and top shall be constructed of exterior grade plywood that is at least 1 in. (25 mm) thick and of a type that will not break down or delaminate under fire conditions.
   (b) All joints shall be rabbetted and shall be fastened in two directions with wood screws.
   (c) Where more than one door is used, there shall be a rabbetted overlap of not less than 1 in. (25 mm).
   (d) Doors shall be equipped with a means of latching, and hinges shall be constructed and mounted in such a manner as to not lose their holding capacity when subjected to fire exposure.
   (e) A raised sill or pan capable of containing a 2 in. (50 mm) depth of liquid shall be provided at the bottom of the cabinet to retain spilled liquid within the cabinet.

(4) Listed storage cabinets that have been constructed and tested in accordance with 9.5.3(1) shall be acceptable.

Additional Proposed Changes

<table>
<thead>
<tr>
<th>File Name</th>
<th>Description Approved</th>
</tr>
</thead>
<tbody>
<tr>
<td>NFPA_30_Section_9.5.3.docx</td>
<td></td>
</tr>
</tbody>
</table>

Statement of Problem and Substantiation for Public Input

This proposal is provided as a convenience for the code user. It is difficult for code users to determine if flammable liquid storage cabinets comply with the fire test criteria included in section 9.5.3 (1), and the detailed construction requirements in 9.5.3 (2). However it is easy for them to verify that storage cabinets are listed to UL 1275, which includes a fire test with all of the criteria noted in 9.5.3 (1). UL 1275 also includes construction requirements that comply with all four of the criteria included in Section 9.5.3 (2), including minimum metal thickness, double wall construction with 1-1/2 inch air space, joint construction, and door locking arrangement and minimum 2 inch sill height.

This proposed change allows two options for storage cabinets first (wood or metal) cabinets that are listed to UL 1275, or wood cabinets that meet the existing specifications. This approach is consistent with how other fire codes treat flammable liquid storage cabinets. With the addition of UL 1275 in item (1), item (4) is no longer necessary.

Related Public Inputs for This Document

<table>
<thead>
<tr>
<th>Related Input</th>
<th>Relationship</th>
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<tbody>
<tr>
<td>Public Input No. 84-NFPA 30-2015 [Section No. 2.3.9]</td>
<td></td>
</tr>
</tbody>
</table>

Submitter Information Verification

Submitter Full Name: HOWARD HOPPER
Organization: UL LLC
Street Address:
Revise NFPA 30, Section 9.5.3 as follows:

9.5.3 Storage cabinets that meet at least one of the following sets of requirements shall be acceptable for storage of liquids:

(1) Storage cabinets shall be listed in accordance with UL 1275, the Standard for Flammable Liquid Storage Cabinets.

(1) Storage cabinets designed and constructed to limit the internal temperature at the center of the cabinet and 1 in. (25 mm) from the top of the cabinet to not more than 325°F (163°C), when subjected to a 10-minute fire test that simulates the fire exposure of the standard time-temperature curve specified in ASTM E 119, Standard Test Methods for Fire Tests of Building Construction and Materials, shall be acceptable. All joints and seams shall remain tight and the door shall remain securely closed during the test.

(2) Metal storage cabinets constructed in the following manner shall be acceptable:
(a) The bottom, top, door, and sides of the cabinet shall be at least No. 18 gauge sheet steel and shall be double-walled, with 1 1/2 in. (38 mm) air space.
(b) Joints shall be riveted, welded, or made tight by some equally effective means.
(c) The door shall be provided with a three-point latch arrangement, and the door sill shall be raised at least 2 in. (50 mm) above the bottom of the cabinet to retain spilled liquid within the cabinet.

(23) Wooden cabinets constructed in the following manner shall be acceptable:
(a) The bottom, sides, and top shall be constructed of exterior grade plywood that is at least 1 in. (25 mm) thick and of a type that will not break down or delaminate under fire conditions.
(b) All joints shall be rabbetted and shall be fastened in two directions with wood screws.
(c) Where more than one door is used, there shall be a rabbetted overlap of not less than 1 in. (25 mm).
(d) Doors shall be equipped with a means of latching, and hinges shall be constructed and mounted in such a manner as to not lose their holding capacity when subjected to fire exposure.
(e) A raised sill or pan capable of containing a 2 in. (50 mm) depth of liquid shall be provided at the bottom of the cabinet to retain spilled liquid within the cabinet.

(4) Listed storage cabinets that have been constructed and tested in accordance with 9.5.3(1) shall be acceptable.
10.10.3 Portable fire extinguishers in accordance with the requirements of NFPA 10, shall be provided where liquids are stored.

Statement of Problem and Substantiation for Public Input
changed in order to agree with the general requirement in 9.10.2.1

Submitter Information Verification

Submitter Full Name: RICHARD KRAUS
Organization: APIPETROLEUM SAFETY CONSULTANT
Street Address:
City:
State:
Zip:
Submittal Date: Mon Jun 22 11:18:19 EDT 2015
Storage of Empty Composite Intermediate Bulk Containers (IBCs) inside protected liquid storage areas

Storage of empty composite IBCs inside protected liquid storage areas shall be protected in buildings up to 30 ft (9 m) high as follows:

1. Protect up to 3 high composite IBCs with plastic pallets using K14.0 (K200), quick response, pendant sprinklers arranged to provide a discharge pressure of 32 psi (2.2 bar) over 12 sprinklers.

2. Protect up to 3 high composite IBCs with wooden or steel pallets using K14.0 (K200), quick response, pendant sprinklers arranged to provide a discharge pressure of 18 psi (1.2 bar) over 12 sprinklers.

Statement of Problem and Substantiation for Public Input

A study entitled "Fire Protection Requirements of Empty Intermediate Bulk Containers (IBCs)" was published by FM Global July 2012 (http://www.fmglobal.com/assets/pdf/IBCs.pdf)

The report concluded that empty plastic containers creates a fire hazard greater than what would be expected from an exposed unexpanded plastic. Section 2.4.5.4 of FM Global Datasheet 7-29 incorporate the results of these fire tests. This information is proposed for inclusion as a new sub-section of 12.3 that is proposed to expand coverage of this section to include fire protection requirements for storage of empty composite IBCs in protected liquid storage areas.

Related Public Inputs for This Document

<table>
<thead>
<tr>
<th>Related Input</th>
<th>Relationship</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public Input No. 88-NFPA 30-2015 [New Section after 12.3.10]</td>
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</tr>
</tbody>
</table>
Storage of empty Composite Intermediate Bulk Containers (IBCs) inside unprotected liquid storage areas shall be limited to a maximum pile size of 2500 ft\(^2\) (230 m\(^2\)) and to a maximum storage height of 4 ft (1.2 m).

Statement of Problem and Substantiation for Public Input

A study entitled "Fire Protection Requirements of Empty Intermediate Bulk Containers (IBCs)" was published by FM Global July 2012 (http://www.fmglobal.com/assets/pdf/IBCs.pdf)

The report concluded that empty plastic containers creates a fire hazard greater than what would be expected from an exposed unexpanded plastic. Due to the extreme fire loading presented by empty Composite IBC, this proposal suggests to allow the same floor area allowed for idle combustible pallets in an unprotected liquids warehouse but limits storage height to one level of container (4 feet).

Related Public Inputs for This Document

<table>
<thead>
<tr>
<th>Related Input</th>
<th>Relationship</th>
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<tr>
<td>Public Input No. 87-NFPA 30-2015 [New Section after 12.3.9]</td>
<td>Both proposals address storage and protection configurations for empty composite IBCs.</td>
</tr>
<tr>
<td>Public Input No. 89-NFPA 30-2015 [Section No. 13.3.7]</td>
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Submitter Information Verification

Submitter Full Name: MICHAEL SNYDER
Organization: Dow Corning
Street Address: City:
State:
Zip:
Submittal Date: Sun Jul 05 23:31:59 EDT 2015
12.6.2.2

Except as provided for in Chapter 9 and Chapter 13, unprotected liquid warehouses shall be as specified in Table 12.6.2.2.

Table 12.6.2.2 Quantity Limitations for Unprotected Liquid Warehouses

<table>
<thead>
<tr>
<th>Liquid Class</th>
<th>Maximum Storage Height (ft)</th>
<th>Containers</th>
<th>Metal Portable Tanks and Metal IBCs</th>
<th>Rigid Nonmetallic IBCs and Composite IBCs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Maximum Total Quantity per Pile or Rack Section (gal)</td>
<td>Maximum Total Quantity (gal)</td>
<td>Maximum Storage Height (ft)</td>
<td>Maximum Total Quantity per Pile or Rack Section (gal)</td>
</tr>
<tr>
<td>IA</td>
<td>5</td>
<td>660</td>
<td>660</td>
<td>NP</td>
</tr>
<tr>
<td>IB</td>
<td>5</td>
<td>1,375</td>
<td>1,375</td>
<td>7</td>
</tr>
<tr>
<td>IC</td>
<td>5</td>
<td>2,750</td>
<td>2,750</td>
<td>7</td>
</tr>
<tr>
<td>II</td>
<td>10</td>
<td>4.125</td>
<td>8,250</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>78,250</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>4,125</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IIA</td>
<td>15</td>
<td>13,750</td>
<td>27,500</td>
<td>7</td>
</tr>
<tr>
<td>IIIB</td>
<td>15</td>
<td>13,750</td>
<td>55,000</td>
<td>7</td>
</tr>
</tbody>
</table>

For SI units, 1 ft = 0.3 m; 1 gal = 3.8 L.
NP: Not permitted.

Additional Proposed Changes

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Statement of Problem and Substantiation for Public Input

Non-listed Composite IBCs (Rigid nonmetallic intermediate bulk containers) that contain hydrocarbon liquids have been shown in laboratory testing to fail between 1 minute 12 second and 1 minute 56 seconds following fire exposure, and in large scale fire testing in the range of 2 minutes 30 seconds (UK HSE, 2007; Wieczorek & Yee, 2008). The catastrophic loss of hydrocarbon liquid creates an exposure pool fire in excess of 3000 square feet and can result in instantaneous heat release rates in excess of 588 Megawatts (George & Snyder, 2015). The subsequent exposure of other non-listed composite IBCs results in a rapidly expanding fire with catastrophic results (Fire Protection Research Foundation, 2014).

At present, the limitations for indoor unprotected storage are inadequate to manage the life safety and property risk presented by the rapidly released fuel load from non-listed composite IBCs involved in fire.

To adequately manage this risk, proposals are framed to do the following:

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2. Remove the allowance for using non-listed composite IBCs in Class II and IIIA liquids for indoor, unprotected storage (Table 12.6.2.2), thereby limiting the indoor storage of composite IBCs to Protected Storage configurations.

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<tr>
<td>Public Input No. 76-NFPA 30-2015 [Section No. 9.4.3 [Excluding any Sub-Sections]]</td>
<td>Linkage between issue on non-listed Composite IBC</td>
</tr>
</tbody>
</table>

Submitter Information Verification

<table>
<thead>
<tr>
<th>Submitter Full Name: MICHAEL SNYDER</th>
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<tbody>
<tr>
<td>Organization: Dow Corning</td>
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<td>Street Address:</td>
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<tr>
<td>City:</td>
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<tr>
<td>State:</td>
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<tr>
<td>Zip:</td>
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<tr>
<td>Submittal Date: Sun Jul 05 10:44:25 EDT 2015</td>
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**CIBCs – Mitigation Strategy**

- Pool Fires are the enemy!
- Consider a 275 gallon CIBC of Lube Oil:

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<thead>
<tr>
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** Assuming 2,500,000 BTU/hr Boiler

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<tbody>
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</tr>
<tr>
<td>300,000 BTU/h to 2,500,000 BTU/h</td>
</tr>
</tbody>
</table>
12.8.1

Class IB and IC liquids in containers of 1.3 gal (5 L) or less capacity, Class II liquids in containers of 5.3 gal (20 L) or less capacity, Class IIIA liquids in containers of 60 gal (230 L) or less capacity, and Class IIIB liquids in containers, intermediate bulk containers, or portable tanks of 275 gal (1040 L) or less capacity shall be permitted to be stored in warehouses that handle combustible commodities, as defined in NFPA 13, Standard for the Installation of Sprinkler Systems, provided that the storage area for liquids is protected with automatic sprinklers in accordance with either of the following:

- The applicable provisions of NFPA 13 for 20 ft (6 m) high storage of Class IV commodities based on the storage configuration of the liquids
- The provisions of Chapter 16

Statement of Problem and Substantiation for Public Input

If it is the Committee’s consensus as reflected in A.12.8.1 is that providing protection based on NFPA 13 for this storage arrangement does not provide adequate protection then no such option should appear in NFPA 30.

A.12.8.1 The provision of automatic sprinklers designed to protect Class IV commodities to a height of 20 ft (6 m) for the liquid storage quantities and arrangements allowed in a general-purpose warehouse should not be construed as providing adequate protection. Fire tests utilizing such design criteria on the allowed storage arrangements have never been conducted, and other test results imply that control of a liquid pool fire might not be obtained. Examples of fire protection can be found in Chapter 16.

Related Public Inputs for This Document

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Submitter Information Verification

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<th>Submitter Full Name:</th>
<th>ROBERT UPSON</th>
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<td>NATIONAL FIRE SPRINKLER ASSOCIATION</td>
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<tr>
<td>Affiliation:</td>
<td>National Fire Sprinkler Association</td>
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<td>City:</td>
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<tr>
<td>Submittal Date:</td>
<td>Mon Jul 06 12:56:38 EDT 2015</td>
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13.3.7 Storage of empty or idle combustible pallets, pallets, and empty composite Intermediate Bulk Containers (IBCs) shall be limited to a maximum pile size of 2500 ft² (230 m²) and to a maximum storage height of 6 ft (1.8 m).

13.3.7.1 Pallet and empty Composite IBC storage shall be separated from liquid storage by aisles that are at least 8 ft (2.4 m) wide.

Statement of Problem and Substantiation for Public Input

A study entitled "Fire Protection Requirements of Empty Intermediate Bulk Containers (IBCs)" was published by FM Global July 2012 (http://www.fmglobal.com/assets/pdf/IBCs.pdf)

The report concluded that empty plastic containers creates a fire hazard greater than what would be expected from an exposed unexpanded plastic. Due to the extreme fire loading presented by empty Composite IBC, this proposal suggests to allow the same floor area allowed for idle combustible pallets in an unprotected liquids warehouse but limits storage height to one level of container (less than 6 feet in height).

Related Public Inputs for This Document

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<td>Proposals both address storage controls for empty Composite IBCs in unprotected storage locations.</td>
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Submitter Information Verification

Submitter Full Name: MICHAEL SNYDER
Organization: Dow Corning
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Sun Jul 05 23:46:10 EDT 2015
Public Input No. 47-NFPA 30-2015 [Section No. 14.4.8 [Excluding any Sub-Sections]]

Lockers shall include a spill containment system to prevent the flow of liquids from the structure under locker under emergency conditions.

Statement of Problem and Substantiation for Public Input

see previous

Submitter Information Verification

Submitter Full Name: RICHARD KRAUS
Organization: APIPETROLEUM SAFETY CONSULTAN
Street Address:
City:
State:
Zip:
Submittal Date: Mon Jun 22 11:25:19 EDT 2015
14.6.1 Containers of liquid in their original shipping packages shall be permitted to be stored either palletized or solid piled within the locker.

Statement of Problem and Substantiation for Public Input
clarifies where pallets are allowed

Submitter Information Verification

Submitter Full Name: RICHARD KRAUS
Organization: APIPETROLEUM SAFETY CONSULTAN
Street Address:
City:
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Zip:
Submittal Date: Mon Jun 22 11:28:37 EDT 2015
Where automatic sprinkler systems or low-expansion foam-water sprinkler systems are used to protect storage of liquids, Figure 16.4.1(a), Figure 16.4.1(b), or Figure 16.4.1(c), whichever is applicable, and the appropriate table in Section 16.5 shall be used to determine protection criteria.

**Figure 16.4.1(a) Fire Protection Criteria Decision Tree for Miscible and Nonmiscible Flammable and Combustible Liquids in Metal Containers.**

**Figure 16.4.1(b) Fire Protection Criteria Decision Tree for Miscible and Nonmiscible Flammable and Combustible Liquids in Nonmetallic Containers.**

**Figure 16.4.1(c) Fire Protection Criteria Decision Tree for Miscible Flammable and Combustible Liquids in Nonmetallic Containers.**
Statement of Problem and Substantiation for Public Input

This is one of five Public Inputs (Nos. 66 through 70) intended to add a new sprinkler protection scheme for Class II and Class III Combustible Liquids stored in Metal Drums on Racks. See Public Input No. 66 for a complete substantiation.

Related Public Inputs for This Document

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<td>Public Input No. 69-NFPA 30-2015 [New Section after D.2]</td>
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</table>

Submitter Information Verification

Submitter Full Name: STEVEN WOLIN
Organization: RELIABLE AUTOMATIC SPRINKLER CO., INC.
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Fri Jun 26 15:21:48 EDT 2015
Revise Figure 16.4.1(a) as follows:

Protected using Table 16.5.2.1, 16.5.2.3, or 16.5.2.8, or 16.5.2.13
16.5.1 General.
Paragraphs 16.5.2.1 through 16.5.2.12, and their related tables, Table 16.5.2.1 through Table 16.5.2.12, shall be used to determine the protection criteria and storage arrangement for the applicable liquid class, container type, and storage configuration, as described in 16.5.2.1 through 16.5.2.12, and subject to the provisions of 16.5.1.

16.5.1.1 Table 16.5.2.1 through Table 16.5.2.12 shall apply only to stable liquids.

16.5.1.1.1 The protection criteria in Table 16.5.2.1 through Table 16.5.2.12 shall only be used with ceilings having a pitch of 2 in 12 or less.

16.5.1.2 When foam or foam-water fire protection systems are provided, discharge densities shall be determined based on the listing criteria of the foam discharge devices selected, the foam concentrate, the specific liquids to be protected, and the criteria in the appropriate table in this chapter. Where the discharge densities given in the tables differ from those in the listing criteria for the discharge devices, the greater of the two shall be used.

16.5.1.3 In-rack sprinklers shall be installed in accordance with the provisions of NFPA 13, *Standard for the Installation of Sprinkler Systems*. In addition, the following modifications shall apply:

1. In-rack sprinklers shall be laid out in accordance with 16.5.1.10 and Section 16.6, as applicable.
2. Sprinklers in multiple-level in-rack sprinkler systems shall be provided with water shields unless they are separated by horizontal barriers or are specifically listed for installation without water shields.
3. A vertical clear space of at least 6 in. (150 mm) shall be maintained between the sprinkler deflector and the top tier of storage.
4. Sprinkler discharge shall not be obstructed by horizontal rack structural members.
5. Where in-rack sprinklers are installed below horizontal barriers, the deflector shall be located a maximum of 7 in. (180 mm) below the barrier.
6. Longitudinal and transverse flue spaces of at least 6 in. (150 mm) shall be maintained between each rack load.

16.5.1.4 Ceiling sprinklers shall be installed in accordance with NFPA 13, *Standard for the Installation of Sprinkler Systems*, and shall be permitted to have the following maximum head spacing:

1. Classes I, II, and IIIA liquids: 100 ft² (9.3 m²) per sprinkler
2. Class IIIB liquids: 120 ft² (11.1 m²) per sprinkler

16.5.1.4.1 Ordinary or intermediate temperature–rated K-25 extended-coverage sprinklers shall be permitted to be used as standard response high-temperature sprinklers at greater than 144 ft² (13 m²) minimum spacing and a maximum coverage area of 196 ft² (18 m²) coverage.

16.5.1.5 The ceiling heights given in Table 16.5.2.1 through Table 16.5.2.12, excluding Table 16.5.2.8, shall be permitted to be increased by a maximum of 10 percent if an equivalent percent increase in ceiling sprinkler design density is provided.

16.5.1.6 Foam-water sprinkler systems shall be designed and installed in accordance with NFPA 16, *Standard for the Installation of Foam-Water Sprinkler and Foam-Water Spray Systems*.

16.5.1.6.1 Foam-water sprinkler systems shall have at least 15 minutes of foam concentrate, based on the required design flow rate.

16.5.1.6.2 Foam-water sprinkler systems shall provide foam solution at the minimum required concentration with as few as four sprinklers flowing.
16.5.1.7
When relieving-style containers are used, both \(\frac{3}{4}\) in. (20 mm) and 2 in. (50 mm) listed and labeled pressure-relieving mechanisms are required on containers greater than 6 gal (23 L) capacity.

16.5.1.8
For the purposes of Section 16.5, a rigid nonmetallic intermediate bulk container is one that meets the maximum allowable capacity criteria of Table 9.4.3 and has been listed and labeled in accordance with UL 2368, *Standard for Fire Exposure Testing of Intermediate Bulk Containers for Flammable and Combustible Liquids*, or equivalent.

16.5.1.9
For the purposes of Section 16.5, the following shall apply:

1. \(1 \text{ gal} = 3.8 \text{ L; } 1 \text{ ft} = 0.3 \text{ m; } 1 \text{ ft}^2 = 0.09 \text{ m}^2\)
2. \(1 \text{ gpm/ft}^2 \text{ is equivalent to } 40.7 \text{ L/min/m}^2 \text{ or } 40.7 \text{ mm/min}\)
3. A gauge pressure of 1 psi is equivalent to a gauge pressure of 6.9 kPa
4. SR = standard response sprinkler; QR = quick response sprinkler; ESFR = early suppression fast-response sprinkler; OT = ordinary temperature; HT = high temperature
5. Where an ordinary-temperature sprinkler is indicated, an intermediate-temperature sprinkler shall be used where ambient conditions require.

16.5.1.10
For the purposes of Section 16.5, the following shall apply to the in-rack sprinkler design layouts specified in Table 16.5.2.1 through Table 16.5.2.12:

1. Layout 1, as referenced in Table 16.5.2.1, shall mean one line of in-rack sprinklers 8 ft (2.4 m) above the floor in the longitudinal flue space, with sprinklers spaced not more than 10 ft (3 m) on center.
2. Layout 2, as referenced in Table 16.5.2.1, shall mean one line of in-rack sprinklers 6 ft (1.8 m) above the floor and one line of in-rack sprinklers 12 ft (3.6 m) above the floor in the longitudinal flue space, with sprinklers spaced not more than 10 ft (3 m) on center. Sprinklers shall be staggered vertically.
3. Layout 3, as referenced in Table 16.5.2.1 and Table 16.5.2.3, shall mean one line of in-rack sprinklers in the longitudinal flue space at every storage level above the floor except above the top tier, with sprinklers spaced not more than 10 ft (3 m) on center. Sprinklers shall be staggered vertically, where more than one level of in-rack sprinklers is installed.
4. Layout 4, as referenced in Table 16.5.2.1 and Table 16.5.2.3, shall mean one line of in-rack sprinklers in the longitudinal flue space at every other storage level, except above the top tier, beginning above the first storage level, with sprinklers spaced not more than 10 ft (3 m) on center. Sprinklers shall be staggered vertically, where more than one level of in-rack sprinklers is installed.
5. Layout 5, as referenced in Table 16.5.2.1, shall mean one line of in-rack sprinklers in the longitudinal flue space at every storage level above the floor except above the top tier and face sprinklers at the first storage level at each rack upright. In-rack sprinklers shall be spaced not more than 9 ft (2.7 m) on center and shall be staggered vertically, where more than one level of in-rack sprinklers is installed.
6. Layout 6, as referenced in Table 16.5.2.1, shall mean one line of in-rack sprinklers in the longitudinal flue space at every other storage level above the first storage level except the top tier and face sprinklers at the first storage level at each rack upright. In-rack sprinklers shall be spaced not more than 10 ft (3 m) on center and shall be staggered vertically, where more than one level of in-rack sprinklers is installed.
7. Layout 7, as referenced in Table 16.5.2.8, shall be as shown in Figure 16.6.4(a).
8. Layout 8, as referenced in Table 16.5.2.8, shall be as shown in Figure 16.6.4(b) or Figure 16.6.4(c).
9. Layout 9, as referenced in Table 16.5.2.8, shall be as shown in Figure 16.6.4(d) or Figure 16.6.4(e).

16.5.1.11
The "Fire Test Ref." number given for each entry in Table 16.5.2.1 through Table 16.5.2.12 shall be used to identify in Section D.2 the or D.3 the information on the fire tests on which the protection criteria for that entry are based.

16.5.1.12
The water supply shall be sufficient to meet the fixed fire protection demand plus a total of at least 500 gpm (1900 L/min) for inside and outside hose connections for at least 2 hours, unless otherwise specified in this chapter.

Statement of Problem and Substantiation for Public Input

This is the first of five Public Inputs (Nos. 66 through 70) intended to add a new sprinkler protection scheme for Class II and Class III Combustible Liquids stored in Metal Drums on Racks.
The proposed new sprinkler protection scheme for rack storage of Class II and Class III combustible liquids is based on a full scale fire test performed by Underwriters Laboratories, Inc. (UL). The test is documented in the report, “Class II Combustible Liquids in 55-gallon Steel Drums Stored in Racks with Continuous Combustible Horizontal Barriers Protected by K=25.2 EC In-rack Sprinklers,” dated June 13, 2014. A copy of the UL test report has been mailed to NFPA Standards Administration for distribution to the Technical Committee.

The test used racks of UN 1A1/X1.4/300 55-gallon steel drums filled with Ultra Low Sulfer Premium Diesel fuel on 48 by 48 inch pallets. The test was conducted with double-row racks and 6 ft wide aisles. A 2.5 gpm flow of heptane, up to a maximum of 55 gallons, at the second tier of the storage rack was ignited to simulate a leaking drum. The heptane supply was centered between two in-rack sprinklers.

Protection consisted of horizontal barriers and in-rack sprinklers as follows:

- K25.2 gpm/psi1/2 Intermediate Temperature (212°F) Control Mode Density Area Extended Coverage Pendent Storage Sprinklers used in the racks
- 30 psi operating pressure supplying nominally 138 gpm per sprinkler
- In-rack sprinklers located one per rack bay in the longitudinal flue, approximately 8 ft. 9 in. apart horizontally (centered between the rack uprights)
- Horizontal barriers, consisting of nom. 3/8 in. plywood, located directly above each level of in-rack sprinklers
- Horizontal barriers spaced 15 ft. apart vertically

The test used nominal 5 ft. tall tiers, with 3 tiers between horizontal barrier/in-rack sprinkler levels. A total storage height of 35 ft. was included in the test, with two levels of horizontal barriers/in-rack sprinklers. The fire did not progress beyond the lower level of horizontal barriers/in-rack sprinklers and did not activate the upper level of horizontal barriers/in-rack sprinklers. Thus, a single level of horizontal barriers/in-rack sprinklers was able to contain the fire.

As stated in the UL test report: “During the test, two in-rack sprinklers at the 15 ft. level operated at 00:06 after ignition of the heptanes spill. The horizontal fire travel within the double-row rack main test array was limited to the area of ignition only. There was no ignition of the target commodity nor any indication of fire damage.”

All test results showed successful control of the fire. Only 2 in-rack sprinklers operated. The temperature of a steel angle located near the ceiling level had only a 108°F maximum 1 minute average temperature, indicating relatively low ceiling temperatures and protection of structural steel at the ceiling.

This Public Input is intended to add the tested protection scheme. The proposed new scheme is suggested to be named Design Scheme “E” to avoid confusion with Design Scheme “D” currently in Annex D. The proposed new Section 16.6.4 is primarily based on the existing language in Section 16.6.3 adapted to the tested protection scheme.

Related Public Inputs for This Document

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Submitter Information Verification

Submitter Full Name: STEVEN WOLIN
Organization: RELIABLE AUTOMATIC SPRINKLER CO., Inc.
Street Address: 
City: 
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Zip: 
Submittal Date: Fri Jun 26 15:03:29 EDT 2015
16.5.2.13 Table 16.5.2.13 shall apply to the following:

1. Automatic sprinkler protection
2. Single- and double-row rack storage
3. Class II and Class III nonmiscible and Class II and Class III miscible liquids
4. Relieving-style metal containers

TABLE 16.5.2.13 Design Criteria for Sprinkler Protection of Single- and Double-Row Rack Storage of Class II and Class III Liquids in Metal Containers

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<th>Maximum Ceiling Height (ft)</th>
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<td>&gt;5 and &lt;60</td>
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<td>See 16.6.4 (new), Fire Protection System Design Scheme “E”</td>
<td>See Section D.3 (new)</td>
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For SI units, 1 gal = 3.8 L, 1 ft = 0.3 m.

Statement of Problem and Substantiation for Public Input

This is one of five Public Inputs (Nos. 66 through 70) intended to add a new sprinkler protection scheme for Class II and Class III Combustible Liquids stored in Metal Drums on Racks. See Public Input No. 66 for a complete substantiation.

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<td>Public Input No. 70-NFPA 30-2015 [Section No. 16.4.1 [Excluding any Sub-Sections]]</td>
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Submitter Information Verification

Submitter Full Name: STEVEN WOLIN
Organization: RELIABLE AUTOMATIC SPRINKLER CO., INC.
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Fri Jun 26 15:09:51 EDT 2015
16.6.2.4
In-rack sprinklers shall meet the following requirements:

1. In-rack sprinklers shall be ordinary temperature-rated quick-response sprinklers and shall have a nominal K-factor equal to or greater than 8.0. Intermediate-temperature sprinklers shall be used where ambient conditions require.

2. In-rack sprinklers shall be installed below each barrier level.

3. For containers that do not exceed 60 gal (230 L) capacity and where there is only one horizontal barrier, in-rack sprinklers shall provide a minimum discharge flow of 57 gpm out of each of the hydraulically most remote six sprinklers (three on two lines) if one barrier level is provided, or out of each of the hydraulically most remote eight sprinklers (four on two lines) if two or more barrier levels are provided. The minimum in-rack sprinkler discharge pressure shall not be less than a gauge pressure of 10 psi.

4. For containers that exceed 60 gal (230 L) capacity, but do not exceed 793 gal (3000 L), in-rack sprinklers shall provide a minimum discharge flow of 57 gpm out of each of the hydraulically most remote 12 sprinklers, six each on two lines. The minimum in-rack sprinkler discharge pressure shall not be less than a gauge pressure of 10 psi.

Statement of Problem and Substantiation for Public Input

This removes redundant and potentially confusing language from 16.6.2.4(3).

Submitter Information Verification

Submitter Full Name: ROBERT UPSON
Organization: NATIONAL FIRE SPRINKLER ASSOCIATION
Affiliation: National Fire Sprinkler Association
Street Address:
City:
State:
Zip:
Submittal Date: Mon Jul 06 12:54:03 EDT 2015
In-rack sprinklers shall meet the following requirements:

1. In-rack sprinklers shall be ordinary temperature–rated quick-response sprinklers and shall have a nominal K-factor equal to or greater than 8.0. Intermediate-temperature sprinklers shall be used where ambient conditions require.

2. In-rack sprinklers shall be installed below each barrier level.

3. For containers that do not exceed 60 gal (230 L) capacity and where there is only one horizontal barrier, in-rack sprinklers shall provide a minimum discharge flow of 57 gpm out of each of the hydraulically most remote six sprinklers (three on two lines) if one barrier level is provided, or out of each of the hydraulically most remote eight sprinklers (four on two lines) if two or more barrier levels are provided. The minimum in-rack sprinkler discharge pressure shall not be less than a gauge pressure of 10 psi.

4. For containers that exceed 60 gal (230 L) capacity, but do not exceed 793 gal (3000 L), in-rack sprinklers shall provide a minimum discharge flow of 57 gpm out of each of the hydraulically most remote 12 sprinklers, six each on two lines. The minimum in-rack sprinkler discharge pressure shall not be less than a gauge pressure of 10 psi.

Statement of Problem and Substantiation for Public Input

Add Annex comments to clarify the requirements for selecting remote sprinkler design areas.

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Submitter Information Verification

Submitter Full Name: ROBERT UPSON
Organization: NATIONAL FIRE SPRINKLER ASSOCIATION
Affiliation: National Fire Sprinkler Association
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Mon Jul 06 13:22:36 EDT 2015
16.6.4 (new) Fire Protection System Design Scheme “E.”

16.6.4.1 (new) Horizontal barriers of plywood having a minimum thickness of 3/8 in. (10 mm) or of sheet metal of minimum 22 gauge thickness shall be installed in accordance with Figure 16.6.4.1(a) or Figure 16.6.4.1(b), whichever is applicable. All liquid storage shall be located beneath a barrier.

16.6.4.2 (new) Vertical baffles shall not be installed between in-rack sprinklers.

16.6.4.3 (new) In-rack sprinklers shall meet the following requirements:

1. In-rack sprinklers shall be intermediate temperature–rated, pendent sprinklers with a nominal K-factor of 25.2 and shall be listed as extended coverage control mode density/area storage sprinklers.

2. In-rack sprinklers shall be installed below each barrier level.

3. In-rack sprinklers shall provide a minimum discharge flow of 138 gpm out of each of the hydraulically most remote three sprinklers (three on one line). The minimum in-rack sprinkler discharge pressure shall not be less than a gauge pressure of 30 psi.

16.6.4.4 (new) If there are adjacent bays of in-rack arrays that are not dedicated to storage of liquids, the barrier and in-rack sprinkler protection shall be extended at least 6 ft (1.8 m) beyond the area devoted to liquid storage.

16.6.4.5 (new) Ceiling sprinkler demand shall not be included in the hydraulic calculations for in-rack sprinklers.

16.6.4.6 (new) Water demand at point of supply shall be calculated separately for in-rack and ceiling sprinklers and shall be based on the greater demand.

16.6.4.7 (new) Ceiling sprinklers shall meet the following requirements:

1. Ceiling sprinkler protection shall be designed to protect the surrounding occupancy.

2. Any sprinkler type shall be acceptable.

3. If standard spray sprinklers are used, they shall be capable of providing not less than 0.20 gpm/ft² (8 mm/min over 270 m²).

4. If the liquid storage does not extend to the full height of the rack, protection for commodities stored above the top horizontal barrier shall meet the requirements of NFPA13, Standard for the Installation of Sprinkler Systems, for the commodities stored.

16.6.4.8 (new) A 500 gpm (1900 L/min) hose stream allowance shall be provided.

Additional Proposed Changes

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<td>Figure_16_6_4_1_b.pdf</td>
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Statement of Problem and Substantiation for Public Input

This is one of five Public Inputs (Nos. 66 through 70) intended to add a new sprinkler protection scheme for Class II and Class III Combustible Liquids stored in Metal Drums on Racks. See Public Input No. 66 for a complete substantiation.

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<tr>
<td><strong>Submitter Full Name:</strong></td>
<td>STEVEN WOLIN</td>
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<td>-------------------------</td>
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</tr>
<tr>
<td><strong>Organization:</strong></td>
<td>RELIABLE AUTOMATIC SPRINKLER CO., INC.</td>
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<tr>
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Notes: (1) For SI Units, 1 in. = 25 mm; 1 ft = 0.3 m.
(2) * Denotes K25.2 Extended Coverage Pendent CMDA Storage Sprinkler

Figure 16.6.4.1(a) Single-Row Rack Sprinkler Layout for Design Scheme "E."
Notes: (1) For SI Units, 1 in. = 25 mm; 1 ft = 0.3 m.
(2) * Denotes K25.2 Extended Coverage Pendent CMDA Storage Sprinkler

Figure 16.6.4.1(b) Double-Row Rack Sprinkler Layout for Design Scheme "E."
A.12.8.1 — The provision of automatic sprinklers designed to protect Class IV commodities to a height of 20 ft (6 m) for the liquid storage quantities and arrangements allowed in a general-purpose warehouse should not be construed as providing adequate protection. Fire tests utilizing such design criteria on the allowed storage arrangements have never been conducted, and other test results imply that control of a liquid pool fire might not be obtained. Examples of fire protection can be found in Chapter 16.

Statement of Problem and Substantiation for Public Input

If it is the Committee’s consensus as reflected in A.12.8.1 is that providing protection based on NFPA 13 for this storage arrangement does not provide adequate protection then no such option should appear in NFPA 30.

12.8.1* Class IB and IC liquids in containers of 1.3 gal (5 L) or less capacity, Class II liquids in containers of 5.3 gal (20 L) or less capacity, Class IIIA liquids in containers of 60 gal (230 L) or less capacity, and Class IIIB liquids in containers, intermediate bulk containers, or portable tanks of 275 gal (1040 L) or less capacity shall be permitted to be stored in warehouses that handle combustible commodities, as defined in NFPA13, Standard for the Installation of Sprinkler Systems, provided that the storage area for liquids is protected with automatic sprinklers in accordance with either of the following:

(1) The applicable provisions of NFPA 13 for 20 ft (6 m) high storage of Class IV commodities based on the storage configuration of the liquids
(2) The provisions of Chapter 16

Related Public Inputs for This Document

<table>
<thead>
<tr>
<th>Related Input</th>
<th>Relationship</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public Input No. 94-NFPA 30-2015 [Section No. 12.8.1]</td>
<td>Main PI in body of standard</td>
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</tbody>
</table>

Submitter Information Verification

Submitter Full Name: ROBERT UPSON
Organization: NATIONAL FIRE SPRINKLER ASSOCIATION
Affiliation: National Fire Sprinkler Association
Street Address:
City:
State:
Zip:
Submittal Date: Mon Jul 06 13:07:08 EDT 2015
A.16.6.2.4(3) The design area requirements for containers that do not exceed 60 gal (230 L) in capacity specify using a set number of hydraulically remote sprinklers on "two lines". It is not always clear in the Design Scheme "B" options illustrated in FIGURE 16.6.2.1(a) through FIGURE 16.6.2.1(c) how this requirement should be applied. FIGURE A.16.6.2.4(a) through FIGURE A.16.6.2.4(c) illustrate permissible design areas for three sprinklers on two lines as required when one barrier level is provided. Similar configurations should be used for four sprinklers on two lines as required when two or more barrier levels are provided.

A.16.6.2.4(4) Design area configurations similar to those illustrated in A.16.6.2.4(4) should be used for six sprinklers on two lines as required when containers exceed 60 gal (230 L) but do not exceed 793 gal (3000 L).

Additional Proposed Changes

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<td>Public_Inputs_for_7-6-2015_Figure_A.pdf</td>
<td>FIGURE A.16.6.2.4(a) Design Area for Design Scheme &quot;B&quot; -- Sprinklers in Center of Rack (FIGURE 16.6.2.1(a)) and Containers ≤ 60 gal (230 L) Capacity with One Horizontal Barrier (16.6.2.4(3))</td>
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<td>Public_Inputs_for_7-6-2015_Figure_B.pdf</td>
<td>FIGURE A.16.6.2.4(b) Design Area for Design Scheme &quot;B&quot; -- Sprinklers in Center of Rack (FIGURE 16.6.2.1(b)) and Containers ≤ 60 gal (230 L) Capacity with One Horizontal Barrier (16.6.2.4(3))</td>
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<td>Public_Inputs_for_7-6-2015_Figure_C.pdf</td>
<td>FIGURE A.16.6.2.4(c) Design Area for Design Scheme &quot;B&quot; -- Double-Row Rack Sprinkler Layout (FIGURE 16.6.2.1(c)) and Containers ≤ 60 gal (230 L) Capacity with One Horizontal Barrier (16.6.2.4(3))</td>
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Statement of Problem and Substantiation for Public Input

This clarifies the requirements for selecting remote sprinkler design areas.

Related Public Inputs for This Document

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Submitter Information Verification

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<th>Submitter Full Name: ROBERT UPSON</th>
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<td>Organization: NATIONAL FIRE SPRINKLER ASSOCIATION</td>
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<tr>
<td>Affiliation: National Fire Sprinkler Association</td>
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FIGURE A.16.6.2.4(a) Design Area for Design Scheme “B” -- Sprinklers in Center of Rack (FIGURE 16.6.2.1(a)) and Containers ≤ 60 gal (230 L) Capacity with One Horizontal Barrier (16.6.2.4(3))
FIGURE A.16.6.2.4(b) Design Area for Design Scheme “B” -- Sprinklers on Face of Rack (FIGURE 16.6.2.1(b)) and Containers ≤ 60 gal (230 L) Capacity with One Horizontal Barrier (16.6.2.4(3))
FIGURE A.16.6.2.4(c) Design Area for Design Scheme “B” – Double-Row Rack Sprinkler Layout (FIGURE 16.6.2.1(c)) and Containers ≤ 60 gal (230 L) Capacity with One Horizontal Barrier (16.6.2.4(3))

Fire protection criteria in Section 16.5.2.13, Table 16.5.2.13, and 16.6.4 (new) is based on a full scale fire test documented in the report, "Class II Combustible Liquids in 55-gallons Steel Drums Stored in Racks with Continues Combustible Horizontal Barriers Protect by K=25.2 EC In-Rack Sprinklers", prepared by Underwriters Laboratories, Inc. dated June 13, 2014.

**Statement of Problem and Substantiation for Public Input**

This is one of five Public Inputs (Nos. 66 through 70) intended to add a new sprinkler protection scheme for Class II and Class III Combustible Liquids stored in Metal Drums on Racks. See Public Input No. 66 for a complete substantiation.

**Related Public Inputs for This Document**

<table>
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<td>Public Input No. 67-NFPA 30-2015 [New Section after 16.5.2.12]</td>
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<td>Public Input No. 68-NFPA 30-2015 [New Section after 16.6.3.8]</td>
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<td>Public Input No. 70-NFPA 30-2015 [Section No. 16.4.1 [Excluding any Sub-Sections]]</td>
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**Submitter Information Verification**

**Submitter Full Name:** STEVEN WOLIN  
**Organization:** RELIABLE AUTOMATIC SPRINKLER CO., INC.  
**Street Address:**  
**City:**  
**State:**  
**Zip:**  
**Submittal Date:** Fri Jun 26 15:19:22 EDT 2015
This Global Public Comment is a follow-up to Global Public Input No. 50 and a l l linked Public Inputs submitted to the First Draft, which proposed a change of containers from "containers, portable tanks, and intermediate bulk containers" to "containers, low pressure cylinders, portable tanks, and intermediate bulk containers". This simply added the designation of a 'low pressure cylinder' to the list of containers that were covered by NFPA 30.

The NFPA 30 Technical Committee was unsure whether this new designation of products should be listed in NFPA 30, NFPA 30B, NFPA 58, or a new section altogether. Due to only limited testing provided, it was decided that an inter-committee Task Group including members of NFPA 30, 30B, and 58 would determine the appropriate means to address this issue and make recommendations to the NFPA Standards Council. The test data supplied to NFPA was generated by 3rd parties (Intertek Group plc in conjunction with the University of Colorado) under contract by 3M.

Since the Technical Committee met to discuss the First Draft, new DOT legislation has been approved and put into place as of January 7, 2013 (See attached "Federal Register Vol. 78 No. 4"). Approved by the US DOT’s Pipeline and Hazardous Materials Safety Administration (PHMSA), this change echoes the changes in UN Classification on 'Chemical under pressure'. In the updated Federal Register, the Hazardous Materials Table (HMT) has been updated to include six specifications of "Chemical under pressure": UN3500-UN3505.

In the Register, PHMSA claims "The 'Chemical under pressure, n.o.s.' HMT entries are added to address shipments of liquids or solids (e.g. adhesives, coatings, and cleaners) combined with a gas or gas mixtures utilized to expel the contents from pressure vessels." Special Provision 362, which states that "classification of these materials is to be based on hazard characteristics of the components in the propellant, the liquid, or the solid forms", was amended to include the six new UN numbers that specify "Chemical under pressure".

Furthermore, Special Provision TP40 and T50 provide more detailed instruction for correct transportation of "Chemical under pressure" in various circumstances.

Along with this new support, all claims made in Global Public Input No. 50 should be considered as well.

Attached to this Global Public Comment is the Updated Federal Register as well as a list of the Public Inputs submitted to the First Draft Report that this Global Public Comment affects; a summary of results generated by 3rd party tests have been attached (video was unable to attach to this Public Comment; however, this video is now a public document following the First Draft Report).

It is recommended that any change pertaining to this Public Comment be applied to all past Public Inputs.

<table>
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Statement of Problem and Substantiation for Public Input

NOTE: The following Public Input appeared as "Reject but Hold" in Public Comment No. 16 of the A2014 Second Draft Report for NFPA 30 and per the Regs. at 4.4.8.3.1.

Classifying flammable liquids under low pressure.

Submitter Information Verification

Submitter Full Name: TC ON FLC-SWC
Organization: NFPA
This Global Public Comment is a follow-up to Global Public Input No. 50 and all linked Public Inputs submitted to the First Draft, which propsoed a change of containers from "containers, portable tanks, and intermediate bulk containers" to "containers, low pressure cylinders, portable tanks, and intermediate bulk containers". This simply added the designation of a 'low pressure cylinder' to the list of containers that were covered by NFPA 30.

The NFPA 30 Technical Committee was unsure whether this new designation of products should be listed in NFPA 30, NFPA 30B, NFPA 58, or a new section altogether. Due to only limited testing provided, it was decided that an inter-committee Task Group including members of NFPA 30, 30B, and 58 would determine the appropriate means to address this issue and make recommendations to the NFPA Standards Council. The test data supplied to NFPA was generated by 3rd parties (Intertek Group plc in conjunction with the University of Colorado) under contract by 3M.

Since the Technical Committee met to discuss the First Draft, new DOT legislation has been approved and put into place as of January 7, 2013 (See attached "Federal Register Vol. 78 No. 4"). Approved by the US DOT's Pipeline and Hazardous Materials Safety Administration (PHMSA), this change echoes the changes in UN Classification on 'Chemical under pressure'. In the updated Federal Register, the Hazardous Materials Table (HMT) has been updated to include six specifications of "Chemical under pressure": UN3500-UN3505.

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Furthermore, Special Provision TP40 and T50 provide more detailed instruction for correct transportation of "Chemical under pressure" in various circumstances.

Along with this new support, all claims made in Global Public Input No. 50 should be considered as well.

Attached to this Global Public Comment is the Updated Federal Register as well as a list of the Public Inputs submitted to the First Draft Report that this Global Public Comment affects; a summary of results generated by 3rd party tests have been attached (video was unable to attach to this Public Comment; however, this video is now a public document following the First Draft Report).

It is recommended that any change pertaining to this Public Comment be applied to all past Public Inputs.

Additional Proposed Changes
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**Statement of Problem and Substantiation for Public Comment**

Classifying flammable liquids under low pressure.
Submitter Information Verification

Submitter Full Name: Michael Jacobs
Organization: 3M
Street Address:
City:
State:
Zip:
Submittal Date: Thu May 02 08:58:56 EDT 2013

Committee Statement
Committee Action: Rejected but held

http://submittals.nfpa.org/TerraViewWeb/ContentFetcher?commentParams=%28Comment...
Resolution: At the August 2012 NFPA 30 First Draft Meeting, the NFPA 30 Technical Committee on Storage and Warehousing of Containers and Portable Tanks reviewed a series of Public Inputs (PI No. 50 et al) to the 2012 edition of NFPA 30 that would have included requirements for storage, handling, and use of low pressure containers used to dispense flammable and combustible liquids (e.g., for adhesives application, coatings application and similar uses) by means of a compressed gas. These low pressure containers are currently not within the scope of NFPA 30. In the course of its deliberations, the Technical Committee considered whether these types of containers would be better addressed in NFPA 30B, Code for the Manufacture and Storage of Aerosol Products. However, the current scope of NFPA 30B is limited in its application to aerosol products in “…metal..containers ..up to a maximum of 1000ml…” Thus, neither document appears to address low pressure containers, as described in the original public inputs. At the time of the First Draft Meeting, the Technical Committee concluded that an intercommittee Task Group was needed to determine how best to address the subject. At the time, four options presented themselves: - Coverage under NFPA 30, Flammable and Combustible Liquids Code - Coverage under NFPA 30B, Code for the Manufacture and Storage of Aerosol Products - Coverage under NFPA 58, Liquefied Petroleum Gas Code - Establishing an entirely new code development project At the June 2013 Second Draft Meeting, the following product issues were discussed: The low pressure containers are typically significantly larger in size, and are now using U.S. Dept. of Transportation-approved containers. The products fall into four general categories: 1. Ignitable liquid – flammable propellant 2. Non-Ignitable liquid – flammable propellant These two categories are of most concern. There can be a substantial amount of flammable gas in one of these containers, creating a hazard similar to the filling operation of aerosols products. It may be appropriate to protect them that way. Currently, these containers are in storage at manufacturing sites, in warehouses, and at user locations, without clear guidance on the proper level of protection. 3. Ignitable liquid – non-flammable propellant. In this case, use of these containers appear to be no different than pressurized dispensing, which is already covered in NFPA 30. There is room for improvement for this category, but the bottom line is control of discharge, i.e., if container or piping vents, the result is limited to only discharge of the inert gas. 4. Non-ignitable liquid – non-flammable propellant. There appears to be no need of requirements from a fire protection standpoint for a product with a non-ignitable liquid and a non-flammable propellant. The Technical Committee on Storage and Warehousing of Containers and Portable Tanks has concluded that there are three options: 1. Amend the Scope of NFPA 30 to address low pressure containers. But, this would involve formation of a new Technical Committee (under the NFPA 30 project) to address the subject, because none of the current NFPA 30 technical committees have the appropriate expertise. Also, the new technical committee would need to include representation from the Technical Committee on Aerosol Products and representation by manufacturers of the containers and user industries. 2. Amend the Scope of NFPA 30B to include low pressure containers. It is not unlikely that NFPA 30B technical Committee has the appropriate expertise to deal with this issue, either. Likely, it, too, would have to create a new committee, ass described above. 3. Create a new project to develop a new code or standard that would deal strictly with low pressure containers exclusively. This might function under either of the above-named technical committees or might require formation of an entirely new committee, depending on subsequent review of NFPA's Standards Council. Therefore, the Technical Committee on Storage and Warehousing of Containers and Portable Tanks has decided to first seek guidance from the NFPA Standards Council as to their preferred direction and then proceed accordingly.
I, Michael Jacobs, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☑️ By checking this box I affirm that I am Michael Jacobs, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature.
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<th>Packaging (§ 173.***))</th>
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NFPA 30 First Draft Public Input #s with the related sections of NFPA 30 by Michael Jacobs of 3M Company:

- 48: Section 1.3.2
- 49: Section 1.3.3
- 50: Global
  - 63: Section 1.3.4
  - 66: Section 1.3.5
  - 67: Section 1.3.6
  - 68: Section 3.3.34
  - 69: Section 3.3.50
  - 70: Section 9.1.3
  - 71: Section 9.3.9
  - 72: Section 9.3.9.1
  - 73: Section 9.3.9.2
  - 74: Section 9.3.10
  - 75: Section 9.4.3
  - 76: Section 9.4.2
  - 77: Section 9.12.1
  - 78: Section 12.3.4
  - 79: Section 12.6.2.2
  - 80: Section 12.8.1
  - 81: Section A.16.1.1
  - 82: Section 13.1
  - 83: Section 13.3.8
  - 84: Section 14.1
  - 85: Section 15.1
  - 86: Section 15.3
  - 87: Section 15.3.2
  - 88: Section 15.4.1
  - 89: Section 16.1.1
  - 90: Section 16.2.3
  - 91: Section 16.4.1.1
Flammable and combustible liquids contained in a cylinder designed per DOT regulations and relief devices designed per CGA regulations at low internal working pressures (<260 psi @77°F) exhibit fire hazards at high temperatures that are no greater than currently accepted receptacles that contain flammable liquids or portable tanks.

Science and test data have shown that under fire conditions flammable liquids in well designed cylinders under low pressure can be safely stored under the same code as Flammable liquids.
A well designed cylinder is constructed and certified to Dept of Transportation (DOT) standards and has pressure relief devices installed to Compressed Gas Association (CGA) standards.

Testing has shown that a cylinder constructed to DOT 39 and DOT4BW240 has walls and welded seams that can withstand an internal pressure increase until the relief devices open to lower the pressure. By standards this is at a minimum of four times the working pressure. This is would be two times the pressure under fire conditions. This is a very adequate safety margin.

Testing has shown that the two styles of relief devices (frangible disk and spring loaded valve) installed per CGA specification open at a minimum of four times the working pressure and two times pressure under actual fire conditions. This is a very adequate safety margin.

Testing has shown that the relief device orifice per CGA regulations are wide to allow internal pressure to vent at a high enough rate in CFM (cubic feet per minute) to prevent any pressure increase past the designated relief pressure limit. The cylinder seams will not burst because the relief device is adequately sized.

Testing has shown that the volume of flammable vapor expelled through the relief device does not dislocate the cylinder. Relief valve discharges do not dangerously "rocket" the cylinder as can happen with unchained high pressure cylinders (3,000 psi).

Science has shown that the product formulations in the cylinder cannot autoignite or create a boiling liquid expanding vapor explosion (BLEVE).

**MORE TESTING REPORTS WILL BE SUBMITTED AS A HARD COPY TO SUPPLEMENT THIS CHANGE AND ALL CHANGES LINKED TO THIS GLOBAL INPUT**
Flammable Liquid in a Low Pressure Cylinder Flame Test Report
Reference: NFPA 30, Global Public Input #50

Norm Sato

Michael Jacobs

June 2012
ABSTRACT

In this experiment, the behavior of low pressure cylinders containing flammable liquids in extreme situations of heat and open flame was studied. Three different sizes of low pressure cylinders – 5, 25, and 50 gallon – were put in direct contact with open flame to emulate the situation wherein the storage area for low pressure cylinders catches fire. Through testing, it was determined that low pressure cylinders containing flammable liquids behave in a manner equal to or less hazardous in a fire than flammable liquids in currently approved containers. The resulting data within NFPA 30 Global Public Input 50 and all linked Public Inputs, related to inclusion of low pressure cylinders in NFPA 30: Flammable and Combustible Liquids.

BACKGROUND AND PURPOSE

Innovative new products frequently do not fit established regulatory templates, creating inconsistent warehousing or storage conditions – see FAQs in Appendix A. Current liquid based spray adhesives products (larger than aerosol) covered by this submission is unique and required testing under two NFPA test methods: (1) the design of the cylinder to DOT standards; and (2) the design of the pressure relief devices to CGA standards. The resulting cylinder designs function in manner equal to or less hazardous in a fire than flammable liquids in currently approved containers.

The purpose of the testing, report, and submission to NFPA is to support the inclusion of flammable liquid adhesives in low pressure cylinders into NFPA 30: Flammable and Combustible Liquids. Video and photographic data is available to support this submission.

TEST MATERIALS, EQUIPMENT, AND PROCEDURE

The basic setup for this experiment, as shown in Figure 1, included a low pressure cylinder that was heated through direct contact with an open flame provided by propane torches. A pressure gauge was attached to the main valve opening of the low pressure cylinder. This gauge reports pressure to the test operator, allowing testing to be shut down if internal pressure was to exceed the relief valve specifications. Above the low pressure cylinder was another open flame provided by a propane torch. This was used as a ‘flare’ or ‘pilot light’ to ignite any of the material that escapes through the relief valves.

In addition to the basic setup, extra precautions were taken by building concrete retaining walls around three sides of the experiment and each low pressure cylinder tested was chained to the ground. Cameras were set up to record video of the test from distance. All testing was done outside.
Three different sizes of cylinders, as described in Appendix B, were tested: 5 gallon, 25 gallon, and 50 gallon cylinders. The 5 gallon cylinder has a “frangible disk” relief valve found on the cylinder wall itself. When the frangible relief disk fails (breaks), a 0.12 in$^2$ orifice should be opened providing an escape route for contents inside the cylinder. The 5 gallon cylinder used in this test has manufacturer specifications claiming the relief valve will open between 360 and 520 psig. Both the 25 and 50 gallon cylinders have a spring loaded relief valve found on the back side of the main valve. When the gauge pressure of the cylinder reaches a certain level, the spring should be stretched enough to open an orifice and let some of the pressure escape from the cylinder. After a noticeable amount of gas has been released, the pressure inside the cylinder will decrease, causing the spring close the orifice. Both cylinders used in this test have manufacturer specifications claiming the relief valves will open between 360 and 480 psig.

All cylinders were heated by the propane torches until either a relief valve opened or the internal pressure exceeded relief valve specifications. For the 5 gallon containing a frangible disk relief valve, propane torches used for heating were extinguished following rupture of the frangible disk. The test was continued with a 10 minute observation and cool down period. Water was used to speed the cooling of the cylinder following the 10 minute observation. For the low pressure cylinders containing a spring relief valve, propane torches used for heating were
extinguished following the second opening of the relief valve. The test was continued until the pressure relief valve would not re-open, followed by a 10 minute observation and cool down period. Water was used to speed the cooling of the cylinder following the 10 minute observation.

**RESULTS**

**5 GALLON CYLINDER**

Pressure was recorded once every second during the test. Figure 2 shows the change in pressure over time for the testing of the 5 gallon cylinder.

![Figure 2](image_url)  
**FIGURE 2.** Internal Pressure (psig) vs Time Elapsed (sec) during the testing of the 5 gallon cylinder.

The maximum pressure reached during the testing was 360.1 psig, 193 seconds into the test. At this point, the frangible disk broke and a rush of gas escaped from the cylinder immediately, dropping the pressure to 181.7 psi, at 200 seconds. From then on, pressure gradually decreased as the liquefied propellant (dimethyl ether in this case) vaporized and escaped through the orifice under the frangible disk. Vapors that escaped from the relief valve caught on fire from the flare above.

**25 GALLON CYLINDER**

Pressure was recorded once every second during the test. Figure 3 shows the change in pressure over time for the testing of the 25 gallon cylinder.
The maximum pressure reached during testing was 410.0 psig, 283 seconds into the test. This was the first time the pressure relief valve opened. Propane torches were left on while gas escaped from the cylinder. Within two seconds of the relief valve opening, the spring loaded valve closed at a pressure of 352.2 psi. The cylinder continued heating and pressure increased again until the relief valve opened the second time at 397.7 psig, 302 seconds into the test. Following the second relief valve closure, propane torches were extinguished. Due to thermodynamic interia, the spring relief valve opened two more times to relieve pressure. Figure 4 shows, in more detail, change in pressure over time during with the spring relief valve opened and closed. Vapors that escaped from the relief valve caught on fire from the flare above.
Pressure was recorded once every second during the test. Figure 5 shows the change in pressure over time for the testing of the 50 gallon cylinder.

The maximum pressure reaching during testing was 446.3 psig, 361 seconds into the test. This was the first time the pressure relief valve opened. Propane torches were left on while gas escaped from the cylinder. Within two seconds of the relief valve opening, the spring loaded
valve closed at a pressure of 387.9 psi. The cylinder continued heating and pressure increased again until the relief valve opened the second time at 441.8 psig, 398 seconds into the test. Following the second relief valve closure, propane torches were extinguished. Despite this, the spring relief valve opened two more times to relieve pressure. Figure 6 shows, in more detail, change in pressure over time during with the spring relief valve opened and closed. Vapors that escaped from the relief valve caught on fire from the flare above.

FIGURE 6. Internal Pressure (psig) vs. Time Elapsed (sec) during the testing of the 50 gallon cylinder.

**DISCUSSION AND CONCLUSIONS**

The pressure of the escaping vapor was determined to be low enough that the safety chains used are not needed.

Safety of the relief valves is confirmed; the data presented shows that relief devices specified by CGA open at 50% of the burst strength (see Appendix B) of the cylinders, allowing a very large safety margin.

Testing shows that the DOT cylinder construction is more than adequate in design to withstand fire situations listed under NFPA 30: Flammable and Combustible Liquids.
APPENDIX A: FAQs

1. Q: Why do existing regulations not clearly apply to cylinder spray adhesives?
A: Cylinder spray adhesives consist of a spray gun connected by a flexible rubber hose to a metal tank that is filled with dissolved resin in a solvent, under gas pressure. This innovative product does not exactly fit into current UN and DOT transportation regulations or current NFPA warehouse and storage fire codes, causing confusion and questions as fire marshals, inspectors and insurance agents evaluate the underlying science. Understanding the product and revising current regulations is key to establishing safe and consistent storage conditions.

2. Q: Are all cylinder spray adhesives Flammable?
A: No, flammability varies according to the product ingredients. Our products that contain both flammable and non-flammable solvents and propellants:

<table>
<thead>
<tr>
<th>Adhesive</th>
<th>Solvent</th>
<th>Propellant</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Non Flammable</td>
<td>Flammable</td>
</tr>
<tr>
<td>2</td>
<td>Non Flammable</td>
<td>Non Flammable</td>
</tr>
<tr>
<td>3</td>
<td>Non Flammable</td>
<td>Flammable</td>
</tr>
<tr>
<td>4</td>
<td>Non Flammable</td>
<td>Non Flammable</td>
</tr>
</tbody>
</table>

3. Q: The final product is a solid glue, why not store it as a solid?
A: This product, as stored, does not fit the definition of a solid. The solvents and propellant have dissolved the solid raw materials into a liquid mixture, so it can be sprayed. The 20-30% non flammable solid adhesive remains only after the carrier solvents and propellants have dissipated. The viscous mixture does lower the flammability characteristics of the pure solvent and the propellant gases.

4. Q: Could this product be covered under the Aerosol codes per NFPA 30B?
A: This product has been described as a cost effective alternative to the aerosol spray can for the high volume user. This product does not exactly fit the definition of an aerosol container as the size is too large.

“NFPA 30B 3.3.2 Aerosol Container: A metal can or plastic container, up to a maximum size of 1000 ml (33.8 fl oz).”

5. Q: Could this product be covered as a Gas, as the cylinders resemble my backyard BBQ liquid propane tanks?
A: The tanks we use are very similar because the US Department of Transportation (DOT) regulates the construction, shipment, inspection and storage during transport of pressurized metal cylinders. All of our non-refillable cylinders are certified to DOT 39 construction requirements per 49 CFR 173. This includes the materials and burst strength of the cylinder
wall, the main valve and the pressure relief disks and valves. Our cylinders are shipped and stored during transport as a GAS under current DOT regulations as this is the most expeditious.

6. Q: If it is shipped as a Flammable Liquified Gas, why not store it as a gas under NFPA 55?

A: We believe that DOT shipping regulations and NFPA storage codes for Gas cylinders are too restrictive and inappropriate for this product line. This product does not exactly fit the definition of a Liquefied Gas. The gas propellant is usually in the formula at less than 15% by weight. Gas is present in the small “headspace” above the liquid resin. 85% of the container is the non-volatile solid adhesive dissolved in a flammable liquid solvent. The small amount of gas propellant is at a low pressure of about 200 psi as it does not take much pressure to force the liquid out of the container. Some of the gas has mixed with the liquid, much like a carbonated soda can.

7. Q: If DOT shipping regulations are inappropriate for this product line is DOT considering amendments to those regulations?

A: Europe has already rewritten its regulations to contain new United Nation (UN) shipping codes which very closely fit our product line (UN3501). We hope that DOT will accept the UN codes and rewrite applicable DOT regulations in the near future. The UN3501 shipping codes are already included in the 2012 Emergency response guidebook.

8. Q: Is this product a flammable liquid?

A: This product does not exactly fit the definition of a liquid but it is close as 85% of the container volume is liquid. The remaining 15% headspace allows the propellants to come to equilibrium with the solution. The headspace allows for a safety margin in the event of a fire which can cause the internal pressure to increase.

“NFPA 30 4.3.1 Flammable liquids, (1) Class IA Liquid —Any liquid that has a flash point below 73°F (22.8°C) and a boiling point below 100°F (37.8°C)”

9. Q: Could this product be covered under the NFPA 30 Flammable Liquid regulations?

A: Yes, we believe our product is a stable Class 1A flammable liquid under low pressure and this might be the current best fit. There is precedent. Aerosol spray cans were stored as Flammable liquids under this code before NFPA 30B was created in 1990.

“Prior to 1990 the storage of flammable aerosols were set forth in NFPA 30, Flammable and Combustible Liquids Code, where they were treated as Class IA flammable liquids. NFPA 30 2011 pp4”

10. Q: Is this product a viscous flammable liquid?
A. The primary product is a viscous liquid with a viscosity over 100 cps. A viscous mixture does lower the flammability characteristics of the pure solvents as acknowledged in NFPA 30 16.2.5.

11. Q: Does NFPA 30 allow the storage of US-DOT approved Metal containers?

A: Yes, storage of US-DOT approved Metal containers is allowed, "NFPA-30 Chapter 9.4.1 Only the following approved containers, intermediate bulk containers, and portable tanks shall be used for Class I, Class II, and Class IIIA liquids:

(1) Metal containers, metal intermediate bulk containers, and metal portable tanks meeting the requirements of and containing products authorized by the U.S. Department of Transportation Hazardous Materials Regulations in Title 49, Code of Federal Regulations, Parts 100–199, or by Part 6 of the UN Recommendations on the Transport of Dangerous Goods"

12. Q: Does NFPA 30 or DOT consider this product a Portable tank?

A: We do not believe our cylinders fit the definition of a Portable Tank because our product has a capacity less than 1,000 lbs and less than 60 gallons. "NFPA-30 Chapter 9 Definitions, Cylinder means a pressure vessel designed for pressures higher than 40 psia and having a circular cross section. It does not include a portable tank,"

"NFPA 30 3.3.47.5 Portable Tank. Any vessel having a liquid capacity over 60 gal (230 L) intended for storing liquids and not intended for fixed installation."

"DOT-49CFR171.8 Portable tank means a bulk packaging (except a cylinder having a water capacity of 1,000 pounds or less)"

13. Q: Would this product qualify as Bulk Packaging under NFPA 30?

A: We do not believe our cylinders fit the definition of Bulk Packaging as tanks are too small. "Table 9.4.3 Maximum Allowable Size: bulk packaging has a maximum capacity greater than 450 L (119 gallons) as a receptacle for a liquid. "Non-bulk packaging means a packaging which has: (1) A maximum capacity of 450 L (119 gallons) or less as a receptacle for a liquid."
### APPENDIX B: Cylinder Specifications

Table 2. Cylinder Specifications

<table>
<thead>
<tr>
<th>Cylinder Characteristic</th>
<th>5 Gallon</th>
<th>25 Gallon</th>
<th>50 Gallon</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacity (lbs H2O)</td>
<td>48.77</td>
<td>238</td>
<td>476</td>
</tr>
<tr>
<td>Volume (cf)</td>
<td>0.78125</td>
<td>3.81</td>
<td>7.63</td>
</tr>
<tr>
<td>Working Pressure (psig)</td>
<td>200</td>
<td>200</td>
<td>200</td>
</tr>
<tr>
<td>Burst Pressure (psig)</td>
<td>650</td>
<td>960</td>
<td>960</td>
</tr>
<tr>
<td>Relief Type</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Relief Pressure (psig)</td>
<td>Frangible Disk 360-520</td>
<td>Spring Relief 360-480</td>
<td>Spring Relief 360-480</td>
</tr>
<tr>
<td>Relief Area (orifice)</td>
<td>0.120&quot; +/- 0.005&quot;</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Relief Capacity (CFM Air)</td>
<td>n/a</td>
<td>240</td>
<td>240</td>
</tr>
<tr>
<td>CGA Relief Requirement (CFM Air)</td>
<td>80.32</td>
<td>362.63</td>
<td>725.27</td>
</tr>
<tr>
<td>Estimated or Known CGA Relief Capacity</td>
<td>67.913</td>
<td>240</td>
<td>240</td>
</tr>
</tbody>
</table>
Throughout standard remove references to the following and replace with the following:

1. ANSI/UL and replace with UL.
2. API Specification and replace with API SPEC.
3. API Standard and replace with API STD.
4. ANSI/ASME B31.3 and replace with ASME B31.3.
5. ANSI Z129.1 and replace with ANSI Z400.1/Z129.1.
6. API # and so on and replace API STD # or API RP #.

Statement of Problem and Substantiation for Public Input

Recommended updates to correlate with PI-5 and PI-7.

Related Public Inputs for This Document

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<td>Referenced current SDO names, addresses, standard names, and years.</td>
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<tr>
<td>Public Input No. 33-NFPA 30-2015 [Section No. I.1.2]</td>
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