CLEAN AGENTS 2015

Updates to the NFPA 2001 Standard on Clean Agent Fire Extinguishing Systems 2015 Edition

APRIL 2015  MO-KAN SFPE CHAPTER MEETING
APRIL 6, 2015
PRESENTED BY C. DAVIS & D. O’DONNELL
Chapter 4 Components
Section 4.3.4 Control Equipment

• 4.3.4.1, 4.3.4.2 January 1, 2016 (also in 2015 edition)
  • “Removal of an electric actuator from the agent storage container discharge (4.3.4.2 Selector) valve that it controls shall result in an audible and visual indication of system impairment at the system releasing control panel”

• 4.3.4.1.2 & 4.3.4.2.2
  • Does not apply to Chapter 8 Marine Systems with exception of 8.6 (Class B >6000ft3 cylinder storage within hazard)
Chapter 2 Referenced Publications
Section 2.3 Other Publications

• NFPA 70 (NEC)
  • References 2014 edition

• NFPA 72 (Fire Alarm & Signaling)
  • References 2013 edition

• ASME Boiler and Pressure Vessel Code
  • References 2013 edition

• ASME B31.1 Power Piping Code
  • References 2012 edition

• ANSI/UL 2127 (Inert Gas) & 2166 (Halocarbon Gas)
  • 2012 Edition, UL aligned to ANSI to ease international efforts
Chapter 3 Definitions

Section 3.2 NFPA Official Definitions

• 3.2.6 Standard
  • “An NFPA Standard, the main text of which contains only mandatory provisions using the word “shall” to indicate requirements and that is in a form generally suitable for mandatory reference by another standard or code or for adoption into law. Nonmandatory provisions are not to be considered a part of the requirements of a standard and shall be located in an appendix, annex, footnote, informational note, or other means as permitted in the NFPA Manuals of Style. When used in a generic sense, such as in the phrase “standards development process” or “standards development activities,” the term “standards” includes all NFPA Standards, including Codes, Standards, Recommended Practices, and Guides.”
Section 3.3 General Definitions

- Two definitions have been added:
  - 3.3.28 Recovered Agent
    - Agent that has been removed from a system and kept for future use or until it is destroyed, without necessarily testing or processing it in any way.
  
  - 3.3.29 Recycle Agent
    - Agent that has been recovered, tested, and processed as necessary and found to be in compliance with the quality requirement of 4.1.2.
Chapter 4 Components

Section 4.1.4 Agent Storage Containers

• 4.1.4.4
  • Means to determine pressure in containers changed from…”refillable superpressurized containers” to …”containers of inert gas agents, superpressurized liquid agents, and superpressurized liquefied compressed gas agents.
    • More specific to pressurized containers

• 4.1.4.6
  • Took out wording on “external heating or cooling” of containers.
Chapter 4 Components
Section 4.2 Distribution

• 4.2.1 – Pipe
  • Updated reference requirements of B31.1
  • 4.2.1.1(3) Added – specifies inert gas piping shall use 4.2.1.1.1 and 4.2.1.1.2
  • 4.2.1.1.1 Updated to better reflect the common use of pressure reducers in inert gas piping. Highlighted section below added/updated:

> 4.2.1.1.1 In no case shall the value used for the minimum pipe design pressure be less than that specified in Table 4.2.1.1.1(a) and Table 4.2.1.1.1(b) for the conditions shown. For inert gas clean agents that employ the use of a pressure-reducing device, Table 4.2.1.1.1(a) shall be used for piping upstream of the pressure reducer, and 4.2.1.1.2 shall be used to determine minimum pipe design pressure for piping downstream of the pressure reducer. The pressure-reducing device shall be readily identifiable. For halocarbon clean agents, Table 4.2.1.1.1(b) shall be used. If different fill densities, pressurization levels, or higher storage temperatures from those shown in Table 4.2.1.1.1(a) or Table 4.2.1.1.1(b) are approved for a given system, the minimum design pressure for the piping shall be adjusted to the maximum pressure in the agent container at maximum temperature, using the basic design criteria specified in 4.2.1.1 and (2).
Chapter 4 Components
Section 4.2 Distribution continued

• Table 4.2.1.1(a) – New storage pressure added to Nitrogen (IG-01) and updated, reduced pressures for Inergen (IG-55). See Highlighted data below.

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<th>KPa</th>
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<td>32,778</td>
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• Added 4.2.1.1.2 – Further guidance on pressure reducing device: design pressure for piping based on flow calculation after the pressure reducing device.
Chapter 4 Components
Section 4.2 Distribution continued

- Added 4.2.1.1.3 – Piping for pre-engineered systems shall be designed in accordance with the manufacturers listed manual.

- 4.2.3.2 & 4.2.3.3, Simplifies and highlights that there is to be NO USE OF FITTINGS NOT RATED FOR PROPER Pressures!

- Added 4.2.4.2 Flanged valves require proper class of flange to connect.
Chapter 4 Components
Section 4.2 Distribution continued

• Added 4.2.5.5 provides guidance on distances from obstructions required to nozzle location. Also added annex material on this subject.

• Added 4.3.3.5.3 automatic type systems in non occupied spaces do not require manual release. This covers bulb and “Direct” type systems.
Chapter 5 System Design

• Added 5.4.2.1.1 Which requires calibration of cup burner method equipment and helps to keep the agent manufacturers testing consistent.

• 5.5 Total Flooding Quantity
  • 5.5.1.1 Added equation for minimum and maximum temperature concentration calculation per standard requirements
  • 5.5.1.2 Reference to Total Flooding quantities tables in Annex moved to 5.5.2.2, this information is still available in the annex.
  • Replaced with 5.5.1.2, new 5.5.1.2 now requires that the halocarbon agent concentration calculated at the highest and lowest temps shall be included on the system as-built drawings and flow calculations
  • 5.5.2 Equation updated for ease of use
Chapter 5 System Design Continued

- 5.5.1.2 now requires that agent concentration calculated at the highest and lowest temps shall be included on the system as-built drawings and flow calculations
- 5.6 – Duration of protection – 85% of adjusted minimum design “…shall be held at the highest level of combustibles…” has been changed to “…highest height of protected content…”
- 5.7.1.1 removed – elaborated on what rate of application is, unnecessary
Chapter 6 Local Application Systems

- 6.4.3.1 – Local App Discharge Time – added wording on mechanical rundown time for extended discharges
- 6.5.3 – Local App – Linear Detection Tubing – Direct type system now allowed.
Chapter 7 Inspection, Testing, Maintenance, and Training

• 7.1.2 – Inspection reports can be filed using electronic media (ie Building Reports)

• Added new 7.1.6 – Clarifies that recovered Clean Agents “shall not be released” into the atmosphere

• Old 7.1.6 became 7.1.7 (Inspection Tag)

• Added 7.7.2.1 & 7.7.2.2 Stating that installation acceptance testing shall be documented in a test report and maintained by the owner for the life of the system

• 7.7.2.4.12 through 7.7.2.4.12.2 Clarifies the pipe pressurization checkout method wording
## Clean Agent System Acceptance Test Report

**PROCEDURE**

Upon completion of work, an inspection and test shall be made by the contractor’s representative and witnessed by an owner’s representative. All defects shall be corrected and the system left in service before the contractor’s personnel leave the job. A certificate shall be filled out and signed by both representatives. Copies shall be prepared for approving authorities, owners, and contractor. It is understood the owner’s representative’s signature in no way prejudices any claim against the contractor for faulty material, poor workmanship, or failure to comply with approving authority’s requirements or local ordinances.

<table>
<thead>
<tr>
<th>Property name</th>
<th>Date</th>
</tr>
</thead>
</table>

### Plans

- Installation conforms to accepted plans [ ] Yes [ ] No
- Equipment used is approved [ ] Yes [ ] No

### Instructions

- Person in charge of the equipment has been instructed as to location of control valves and care and maintenance of this new equipment [ ] Yes [ ] No
- Copies of appropriate instructions and care and maintenance charts have been left on premises [ ] Yes [ ] No

### Enclosure

- Enclosure in conformance with construction documents [ ] Yes [ ] No
- Enclosure integrity report received and approved [ ] Yes [ ] No

### Mechanical equipment

- System type [ ] Total flooding [ ] Local app.
- Agent storage containers properly located (in accordance with approved system drawings) [ ] Yes [ ] No
- Storage containers and mounting brackets fastened securely [ ] Yes [ ] No
- Piping, equipment, and discharge nozzles proper size and location [ ] Yes [ ] No
- Pipe size reduction and tee fitting position in conformance with design drawings [ ] Yes [ ] No
- Piping joints, discharge nozzles, and pipe supports securely fastened [ ] Yes [ ] No
- Discharge nozzle orientation in conformance with approved design drawings [ ] Yes [ ] No
- Nozzle deflectors (if installed) orientation in conformance with approved design drawings [ ] Yes [ ] No
- Location of alarms and manual emergency releases acceptable [ ] Yes [ ] No
- Current hazard configuration comparable to original configuration [ ] Yes [ ] No
- Enclosure test report received [ ] Yes [ ] No
- All installed equipment listed for use [ ] Yes [ ] No

### Electrical equipment

- Proper operation verified for all auxiliary functions including alarm-sounding or displaying devices, remote annunciators, air-handling shutdown, and power shutdown [ ] Yes [ ] No
- Main/alternate transfer switch installed properly, readily accessible, and clearly identified [ ] Yes [ ] No
- Type and location of all detection devices verified [ ] Yes [ ] No
- Manual pull stations installed properly, readily accessible, accurately identified, and protected to prevent damage [ ] Yes [ ] No

### Pipe and fittings

- Piping pneumatically tested to 40 psi (276 kPa) for 10 minutes [ ] Yes [ ] No
- Pipe conforms to [ ] Standard [ ] Yes [ ] No
- Fittings conform to [ ] Standard [ ] Yes [ ] No
- If no, explain [ ]

### Pre-functional tests

- Each detector checked for proper response [ ] Yes [ ] No
- Polarity verified for all polarized alarm devices and auxiliary relays [ ] Yes [ ] No
- EOL resistors installed across all alarm and detection circuits (where required) [ ] Yes [ ] No
- Proper trouble response verified for all supervised circuits [ ] Yes [ ] No

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**Clean Agent System Acceptance Test Report (Continued)**

- puff test completed and continuous flow and unobstructed piping and nozzles verified [ ] Yes [ ] No
- Alarm functions verified following detection initiation [ ] Yes [ ] No
- Manual release functions according to design specifications [ ] Yes [ ] No
- Abort switch functions according to design specifications [ ] Yes [ ] No
- Automatic valves tested and operation verified [ ] Yes [ ] No
- All pneumatic equipment tested and verified [ ] Yes [ ] No
- Full operational test for single or multiple hazards [ ] Yes [ ] No
- Weight before and after discharge [ ]
  - lb [ ]
  - kg [ ]

**Operational test**

- For inert gas systems — pressure before and after discharge [ ] Yes [ ] No

**Remote Monitoring**

- Alarm signal from each input device on stand-alone verified [ ] Yes [ ] No
- Trouble signal verified for each alarm condition on each signal circuit [ ] Yes [ ] No

**Control panel primary power source**

- Control panel connected to a dedicated circuit [ ] Yes [ ] No
- Control panel supplied by other power source [ ] Yes [ ] No
- Control panel readily accessible [ ] Yes [ ] No
- Control panel secured from unauthorized access [ ]

- System returned to fully operational design condition [ ] Yes [ ] No

### Signatures

- Name of installing contractor: [ ]
- Tests witnessed by:
  - For property owner: Name [ ]
  - Title [ ]
  - Date [ ]
  - For contractor: Name [ ]
  - Title [ ]
  - Date [ ]

**Notes:**

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**FIGURE A.7.7.2.1** Sample Acceptance Test Report.
Changes to Appendix

• A.1.6 GWP & ODP Defined

GWP is a measure of how much a given mass of greenhouse gas is estimated to contribute to global warming. It is a relative scale that compares the gas in question to the same mass of carbon dioxide whose GWP is by convention equal to 1.

It is important to understand that the impact of a gas on climate change is a function of both the GWP of the gas and the amount of the gas emitted.

The ODP of an agent provides a relative comparison of the ability to react with ozone at altitudes within the stratosphere. ODP values are reported relative to the same mass CFC-11, which has an ODP equal to 1. When the environmental profile of a compound is considered, both the ODP and the GWP values should be considered to ensure that the agent selected complies with all local and regional regulations balanced with end user specifications. Good independent resources for environmental properties in terms of GWP and ODP of clean agent alternatives are available from the Montreal Protocol and the Intergovernmental Panel on Climate Change (IPCC).

<table>
<thead>
<tr>
<th>Agent</th>
<th>GWP (IPCC 2013)</th>
<th>ODP</th>
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<td>FIC-13II</td>
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</table>

Note: GWP is reported over a 100-year integrated time horizon. *Agent might have a nonzero ODP if released at altitudes high above ground level.
Changes to Appendix

• New Section Added
  • A.5.5.3 Considerations and Conditions Requiring Increased Design Factors
    • Unclosable Openings
    • Acid Gas Formation Considerations
    • Fuel Geometry Considerations
    • Enclosure Geometry
    • Obstructions Within the Enclosure
Changes to Appendix

- FSSA (Fire Suppression Systems Association) now referenced for multiple publications to assist designers.
  - A.4.3.1.1 Detection & Control Guide
  - A.5.1.2.2(28) Pressure Relief Estimating Document
  - A.7.1.2 Design Guide
  - A.7.2 Container Guide
Summary of Primary Changes

• Requirement of notification on electrical actuator removal
• Recovered/Recycled Agents now defined; recycled agents permitted
• Agent calculation requirement for low and high temperature of protected space
• No manual release required for automatic systems when unoccupiable & personnel not normally present
• Detection tubing permitted for use as nozzle in local app

• Annex Changes
  • Environmental definitions
  • FSSA references added
  • Addition of acceptance test report
  • Design factor considerations
Burning Questions?

- Upcoming Trends/Concerns within the Industry?
Thank You For Your Time

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