



National Fire Protection Association

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MEMORANDUM

To: NFPA Technical Committee on Inspection, Testing, and Maintenance of Water-Based Systems

From: Elena Carroll, Administrator, Technical Projects

Date: May 31, 2012

Subject: NFPA 25 Proposed Tentative Interim Amendment (TIA) No 1068

The attached proposed Tentative Interim Amendment (TIA) is being submitted to you for letter ballot. This proposed TIA was submitted by Roland Huggins and endorsed by Gayle Pennel.

This proposed TIA will be published for public comment in the June 1, 2012 issue of *NFPA News* with a Public Comment Closing Date of July 2, 2012. Any public comments received will be circulated to the committee. The Standards Council will consider the issuance of this TIA at their August 7-9, 2012 meeting.

In addition to being balloted on the technical merits of the proposed TIA, the Committee is also being balloted on whether or not this matter is of an emergency nature. Please see Section 5 (copy enclosed) regarding the processing of TIAs from the *NFPA Regulations Governing Committee Projects*.

This TIA, if it is approved by the Committee, will supersede the previously balloted TIA Log 1046 to NFPA 25. If this TIA is not approved by the Committee in light of the current report issued by the Fire Protection Research Foundation Report: "Antifreeze Solutions Supplied Through Spray Sprinklers: Interim Report" released in February, 2012, we will reballot the previously balloted TIA Log 1046 to determine if the Committee still supports the TIA.

Please complete and return your ballot as soon as possible but no later than **June 14, 2012**. As noted on the ballot form, please return the ballot to Elena Carroll either via e-mail to ecarroll@nfpa.org or via fax to 617-984-7110. You may also mail your ballot to the attention of Elena Carroll at NFPA, 1 Batterymarch Park, Quincy, MA 02169.

Note: Please remember that the return of ballots and attendance at committee meetings are required in accordance with the NFPA Regulations Governing Committee Projects.

Attachments

Section 5 Tentative Interim Amendments.

5.1 Preliminary Determination of Compliance.

A Tentative Interim Amendment (TIA) to any Document may be processed if the Council Secretary determines, after a preliminary review, and consultation with the appropriate Chair, that the Amendment appears to be of an emergency nature requiring prompt action and has the endorsement of at least two Members of the involved TC or TCC. If processed, the question of emergency nature shall be considered by the TC and TCC. The text of a proposed Tentative Interim Amendment may be processed as submitted or may be changed, but only with the approval of the submitter.

5.2 Evaluation of Emergency Nature. Determination of an emergency nature shall include but not be limited to one or more of the following factors:

(a) The document contains an error or an omission that was overlooked during a regular revision process.

(b) The document contains a conflict within the document or with another NFPA document.

(c) The proposed TIA intends to correct a previously unknown existing hazard.

(d) The proposed TIA intends to offer to the public a benefit that would lessen a recognized (known) hazard or ameliorate a continuing dangerous condition or situation.

(e) The proposed TIA intends to accomplish a recognition of an advance in the art of safeguarding property or life where an alternative method is not in current use or is unavailable to the public.

(f) The proposed TIA intends to correct a circumstance in which the revised document has resulted in an adverse impact on a product or method that was inadvertently overlooked in the total revision process, or was without adequate technical (safety) justification for the action.

5.3 Publication of Proposed Tentative Interim Amendment.

A proposed Tentative Interim Amendment that meets the provisions of 5.1 shall be published by the Association in appropriate media with a notice that the proposed Tentative Interim Amendment has been forwarded to the responsible TC and TCC for processing and that anyone interested may comment on the proposed Tentative Interim Amendment within the time period established and published.

5.4 Technical Committee and Technical Correlating Committee Action.

(a) The proposed Tentative Interim Amendment shall be submitted for ballot and comment of the TC in accordance with 3.3.4. The TC shall be separately balloted on both the technical merits of the amendment and whether the amendment involves an issue of an emergency nature. Such balloting shall be completed concurrently with the public review period. Any public comments inconsistent with the vote of any TC Member shall be circulated to the TC to allow votes to be changed. A recommendation for approval shall be established if three-fourths of the voting Members calculated in accordance with 3.3.4.5 have voted in favor of the Tentative Interim Amendment.

(b) The proposed Tentative Interim Amendment shall be submitted for ballot and comment of the TCC, if any, which shall make a recommendation to the Council with respect to the disposition of the Tentative Interim Amendment. The TCC shall be separately balloted on both the merits of the amendment (as it relates to the TCC

authority and responsibilities in accordance with 3.4.2 and 3.4.3) and whether the amendment involves an issue of an emergency nature. Any public comments inconsistent with the vote of any TC or TCC Member shall be circulated to the 28 TCC to allow votes to be changed. A recommendation for approval shall be established if three-fourths of the voting Members calculated in accordance with 3.3.4.5 have voted in favor of the Tentative Interim Amendment.

(c) All public comments, ballots, and comments on ballot on the proposed Tentative Interim Amendment shall be summarized in a staff report and forwarded to the Council for action in accordance with 5.5.

5.5 Action of the Council. The Council shall review the material submitted in accordance with 5.4(c), together with the record on any Appeals (see 1.6, 1.6.1), and shall take one of the following actions:

(a) Issue the proposed Tentative Interim Amendment

(b) Issue the proposed Tentative Interim Amendment as amended by the Council

(c) Where acted on concurrently with the issuance of a new edition of the Document to which it relates, issue the Tentative Interim Amendment as part of the new edition;

(d) Reject the proposed Tentative Interim Amendment

(e) Return the proposed Tentative Interim Amendment to the TC with appropriate instruction

(f) Direct a different action

5.6 Effective Date of Amendment. Tentative Interim Amendments shall become effective 20 days after Council issuance unless the President determines, within his or her discretion, that the effective date shall be delayed pending the consideration of a Petition to the Board of Directors (see 1.7). The President may also, within his or her discretion, refer the matter of a delay in the effective date of the TIA to the Executive Committee of the Board of Directors or to the Board of Directors.

5.7 Publication of Amendment. The Association shall publish in one of its publications sent or accessible to all Members notice of the issuance of each Tentative Interim Amendment and may, as appropriate, issue a news release to applicable and interested technical journals. The notice and any news release shall indicate the tentative character of the Tentative Interim Amendment. In any subsequent distribution of the Document to which the Tentative Interim Amendment applies, the text of the Tentative Interim Amendment shall be included in a manner judged most feasible to accomplish the desired objectives.

5.8 Applicability. Tentative Interim Amendments shall apply to the document existing at the time of issuance. Tentative Interim Amendments issued after the proposal closing date shall also apply, where the text of the existing document remains unchanged, to the next edition of the Document. Tentative Interim Amendments issued concurrently with the issuance of a new edition shall apply to both the existing and new edition.

5.9 Subsequent Processing. TC responsible for the Document or part of the Document affected shall process the subject matter of any Tentative Interim Amendment as a proposal for the next edition of the Document (see 3.3).

5.10 Exception. When the Council authorizes other procedures for the processing and/or issuance of Tentative Interim Amendments, the provisions of this Section shall not apply.

NFPA® 25 - 2011

Standard for the Inspection Testing and Maintenance of Water-Based Fire Protection Systems

TIA Log No.: 1068

Reference: 5.3.4.2, A.5.3.4.2, Table A.5.3.4.2, A.5.3.4.2.1, and A.5.3.4.2.1(3)

Comment Closing Date: July 2, 2012

Submitter: Roland Huggins, American Fire Sprinkler Association, Inc.

1. *Delete 5.3.4.2 and subsections and add a new 5.3.4.2 and 5.3.4.2.1 as follows:*

~~5.3.4.2* Antifreeze solutions shall comply with one of the following:~~

- ~~(1) The concentration of a glycerin solution measured in an existing system shall be limited to 50% by volume.~~
- ~~(2) Newly introduced solutions shall be factory premixed antifreeze solutions of glycerin (chemically pure or United States Pharmacopoeia 96.5%) at a maximum concentration of 48% by volume.~~
- ~~(3) The concentration of a propylene glycol solution measured in an existing system shall be limited to 40% by volume.~~
- ~~(4) Newly introduced solutions shall be factory premixed antifreeze solutions of propylene glycol (chemically pure or United States Pharmacopoeia 96.5%) at a maximum concentration of 38% by volume.~~
- ~~(5) Other solutions listed specifically for use in fire protection systems.~~

5.3.4.2 Except as permitted by 5.3.4.2.1 and 5.3.4.2.2, all antifreeze systems shall utilize listed antifreeze solutions.

5.3.4.2.1* For systems installed prior to September 30, 2012, listed antifreeze solutions shall not be required until September 30, 2022 where all of the following conditions are met:

(1)* The concentration of the antifreeze solution shall be limited to 50% glycerin by volume or 40% propylene glycol by volume.

(2) Newly introduced solutions shall be factory premixed antifreeze solutions (chemically pure or United States Pharmacopoeia 96.5%).

(3)* Antifreeze systems with concentrations in excess of 30% propylene glycol and 38% glycerine shall be permitted based upon an approved deterministic risk assessment, except where explicitly permitted under 5.3.4.2.1(4).

(4) A risk assessment shall not be required for the following applications:

a) Light hazard occupancies with ceilings heights not exceeding 20 ft (6.1m) where Quick Response sprinklers are installed

b) Dwelling Units where residential or other fast response sprinklers are installed

5.3.4.2.2 Premixed antifreeze solutions of propylene glycol exceeding 30% concentration by volume shall be permitted for use with ESFR sprinklers where the ESFR sprinklers are listed for such use in a specific application.

2. *Renumber A.5.3.4.2 and Table A.5.3.4.2 as A.5.3.4.2.1(1) and Table A.5.3.4.2.1(1).*

3. *Add new annex section to read as follows:*

A.5.3.4.2.1 It is assumed that all antifreeze systems installed after September 30, 2012 will meet the minimum requirements of NFPA 13(2013 Edition) or TIA XXX (2010 Edition).

Subject to the approval of the AHJ, small installations in normally unoccupied areas such as dust collectors and similar spaces may utilize concentrations in excess of the limits established in 5.3.4.2.1. Where concentrations in excess of 5.3.4.2.1 are desired for larger systems, an equivalency should be approved by the AHJ.

A.5.3.4.2.1(3) Propylene glycol and glycerin antifreeze solutions discharged from sprinklers have the potential to ignite under certain conditions. Research testing has indicated that several variables may influence the potential for large-scale ignition of the antifreeze solution discharged from a sprinkler. These variables include, but are not limited to, the

concentration of antifreeze solution, sprinkler discharge characteristics, inlet pressure at the sprinkler, ceiling height, and size of fire at the time of sprinkler discharge. All relevant data and information should be carefully reviewed and considered in the deterministic risk assessment.

In addition to the variables identified above, the deterministic risk assessment should include occupancy, quantity of solution, impact on life safety, and potential increase in heat release rate.

The following is a list of research reports that have been issued by the Fire Protection Research Foundation related to the use of antifreeze in sprinkler systems that should be considered in the development of the deterministic risk assessment:

1. *Antifreeze Systems in Home Fire Sprinkler Systems – Literature Review and Research Plan*, Fire Protection Research Foundation, June 2010.
2. *Antifreeze Systems in Home Fire Sprinkler Systems – Phase II Final Report*, Fire Protection Research Foundation, December 2010.
3. *Antifreeze Solutions Supplied through Spray Sprinklers – Interim Report*, Fire Protection Research Foundation, February 2012. **(UPDATE REFERENCE TO “FINAL REPORT” if available prior to issuance of TIA)**

The following tables provide an overview of the testing

Topic	Information
<u>Scope of Sprinklers Tested</u>	<p>The following sprinklers were used during the residential sprinkler research program described in the report dated December 2010:</p> <ul style="list-style-type: none"> • <u>Residential pendent style having nominal K-factors of 3.1, 4.9 and 7.4 gpm/psi^{1/2}</u> • <u>Residential concealed pendent style having a nominal K-factor of 4.9 gpm/psi^{1/2}</u> • <u>Residential sidewall style having nominal K-factors of 4.2 and 5.5 gpm/psi^{1/2}</u> <p>The following sprinklers were used during the spray sprinkler research program described in the report dated February 2012:</p> <ul style="list-style-type: none"> • <u>Residential pendent style having a nominal K-factor of 3.1 gpm/psi^{1/2}</u> • <u>Standard spray pendent style having nominal K-factors of 2.8, 4.2, 5.6 and 8.0 gpm/psi^{1/2}</u> • <u>Standard spray concealed pendent style having a nominal K-factor of 5.6 gpm/psi^{1/2}</u> • <u>Standard spray upright style having a nominal K-factor of 5.6 gpm/psi^{1/2}</u> • <u>Standard spray extended coverage pendent style having a nominal K-factor of 5.6 gpm/psi^{1/2}</u>
<u>Antifreeze Solution Concentration</u>	<p><50% Glycerine and <40% Propylene Glycol Antifreeze Solutions—Solutions were not tested.</p> <p>50% Glycerine and 40% Propylene Glycol Antifreeze Solutions—Large scale ignition of the sprinkler spray did not occur in tests with sprinkler discharge onto a fire having a nominal Heat Release Rate (HRR) of 1.4 MW. Large scale ignition of the sprinkler spray occurred in multiple tests with sprinkler discharge onto a fire having a nominal HRR of 3.0 MW.</p> <p>55% Glycerine and 45% Propylene Glycol Antifreeze Solutions – Large scale ignition of the sprinkler spray occurred in tests with sprinkler discharge onto a fire having a nominal HRR of 1.4 MW.</p> <p>>55% Glycerine and >45% Propylene Glycol Antifreeze Solutions -- Large scale ignition of the sprinkler spray occurred in tests with sprinkler discharge onto a fire having a HRR of less than 500 kW.</p> <p>70% Glycerine and 60% Propylene Glycol Antifreeze Solutions – Maximum antifreeze solution concentrations tested.</p>
<u>Sprinkler Inlet Pressure</u>	<p>Large scale ignition of the sprinkler discharge spray was not observed when the sprinkler inlet pressure was 50 psi or less for tests using 50% glycerine or 40% propylene glycol.</p>
<u>Ceiling Height</u>	<p>When discharging 50% glycerine and 40% propylene glycol antifreeze solutions onto fires having a HRR of 1.4 MW, no large scale ignition of the sprinkler spray was observed with ceiling heights up to 20 ft.</p> <p>When discharging 50% glycerine and 40% propylene glycol antifreeze solutions onto fires having a HRR of 3.0 MW, large scale ignition of the sprinkler spray was observed at a ceiling height of 20 ft.</p>
<u>Fire Control</u>	<p>The test results described in the test reports December 2010 and February 2012 indicated that discharging glycerine and propylene glycol antifreeze solutions onto a fire can temporarily increase the fire size until water is discharged.</p> <p>As a part of the residential sprinkler research described in report dated December 2010, tests were conducted to evaluate the effectiveness of residential sprinklers to control fires involving furniture and simulated furniture. The results of these tests indicated that 50% glycerine and 40% propylene glycol antifreeze solutions demonstrated the ability to control the furniture type fires in a manner similar to water.</p> <p>For standard spray type sprinklers, no tests were conducted to investigate the ability of these sprinklers to control the types and sizes of fires that these sprinklers are intended to protect.</p>

Submitter's Substantiation: The information provided in the Fire Protection Research Foundation report "Antifreeze Solutions Supplied through Spray Sprinklers: Interim Report" illustrates that under certain conditions (pressure, fire size, k-factor, ceiling height, deflector design...etc) a 50% glycerine solution is capable of igniting and causing a dramatic increase in heat release rate-with a stronger ignition source. In addition, sprinklers with larger orifices that require lower pressure than typical residential sprinklers and potentially a larger droplet distribution also ignited. After apparently successfully using antifreeze solutions for years, several changes in codes, sprinkler system materials, and industry practices have converged, resulting in an identifiable problem with past usage of antifreeze in sprinkler systems. Once the issue of ignition of antifreeze solutions became an apparent problem, code changes and research to determine appropriate code changes were needed. This TIA applies the research conducted by The Fire Protection Research Foundation to NFPA 25, for the testing, inspection and maintenance of existing antifreeze systems.

This TIA requires the use of Listed Antifreeze Solutions for systems installed after September 30, 2012. Using listed antifreeze solutions will ensure that the solution discharged from a sprinkler system will not ignite or cause a dramatic increase in heat release rate of a fire. The process for developing listed products will also allow for a continued improvement in fire and life safety in environments meeting the NFPA Codes and Standards.

This TIA allows the continued acceptance of currently listed ESFR Antifreeze Systems. The listing process has already shown that, in some cases, it is possible to use current antifreeze solutions to provide the level of protection prescribed by NFPA 13. For this reason, it is proposed to allow the continued use of propylene-glycol solutions in systems and in protection scenarios that have been thoroughly tested to demonstrate such results. There are ESFR systems currently available that have been specifically tested and listed with a specific model of sprinkler and solution delivery method that provide an appropriate level of protection as to be considered "Early Suppression".

This TIA allows the continued use of propylene glycol up to 30% and glycerine up to 38%. Factory Mutual testing reported in *FM Technical Report J.L.0003004619 K-25 Suppression Mode Sprinkler Protection for Areas Subject to Freezing* has identified that a concentration up to 30% propylene glycol will not increase the heat release rate. Additionally, the MSDS sheets on propylene glycol identifies that a concentration of 30% does not have a flash point (as would be present with a combustible liquid). Prior testing of the residential sprinklers and antifreeze has shown that 50% glycerine has a similar response to fire as 40% propylene glycol. Based on the concentrations from the residential sprinkler tests, a concentration of 38% glycerine was considered to be equivalent to 30% propylene glycol.

This TIA allows the continued uses of propylene glycol between 30% and 40% and of glycerin between 38% and 50% for the following:

- 1) Dwelling units with residential or fast response sprinklers, and
- 2) Light hazard occupancies with quick response sprinklers and a ceiling no higher than 20 ft.

The fuel load for dwellings units does not create a large enough fire before the activation of quick response sprinklers in ceilings up to 20 ft to present a hazard for either residential sprinklers or spray sprinklers as depicted by the reports. The previous research program on residential sprinklers assigned an adequately conservative fire size of 1.4 MW that was based on a ceiling height of 19 ft. The latest report on spray sprinklers shows that with a 1.4 MW fire, there is no difference in outcome between a residential sprinkler and a spray sprinkler (see Figure 2 of Antifreeze Solutions Supplied through Spray Sprinklers – Interim Report). Thus, dwelling units do not present a significant risk when concentrations do not exceed 40% for propylene glycol and 50% for glycerine.

Light Hazard occupancies typically have a fuel load that has a lower rate of heat release than dwellings units but it is not unusual to encounter office settings with similar levels of furnishing. Thus, the higher rate of heat release was used for the evaluation. For ceilings up to 20 ft, the evaluation for dwelling units is applicable and the use of antifreeze at the currently allowed concentrations does not pose a hazard. In order to evaluate the potential risk when the ceilings are greater than 20 ft, DETACT was used to determine the fire size at the time of activation of the sprinkler system. The same variables as used in the Antifreeze Solutions in Home Fire Sprinkler Systems report were applied. Additionally, the report - Performance of Residential Sprinkler Systems with Sloped Ceilings and Beamed Ceilings determined that the same fire growth curve was appropriate for dwelling units. It was determined that a 3 MW fire occurs with a 33 ft ceiling. It is not well understood how the antifreeze discharge will react at ceiling heights above 20 ft nor at what size fire significant involvement of the antifreeze discharge could occur at such ceiling heights. Thus, the ceiling height for light hazard occupancies is limited to a maximum of 20 ft.

In many cases, replacing existing antifreeze systems is a significant financial and /or operational burden for the owner. It is appropriate to provide time to plan and budget for the antifreeze systems identified above that have a minimal life safety and property loss risk. It is recognized that some existing antifreeze systems that are not readily grouped and identified above do not pose a risk, however, the variables affecting the hazard requires specific analysis. The results obtained from the Antifreeze Systems in Home Fire Sprinkler Systems report clearly indicated that a 1.4 MW fire does not present a threat for 40% propylene glycol and 50% glycerine. The results from the Antifreeze Solutions Supplied through Spray Sprinklers – Interim Report clearly show that a larger fire (3.0 MW) when combined with a 20 ft ceiling can create a problem. This presented the only two failures. However, significant increases in heat release rate were noted with a 3 MW fire and an 8-ft ceiling with smaller orifice sprinklers.

This TIA allows continued uses of propylene glycol between 30% and 40% and of glycerin between 38% and 50% for conditions not identified above, only when they are approved based upon a deterministic risk assessment.

Emergency Nature: The latest testing from The Fire Protection Research Foundation titled *Antifreeze Solutions Supplied through Spray Sprinklers Interim Report* (dated February 2012) shows that anti-freeze concentrations currently allowed in new NFPA 13 and 13R sprinkler systems, that are inspected, tested and maintained in accordance with NFPA 25, may support combustion and increase the size of the fire. This is a safety issue that requires changes in the standard.