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This Special Edition of TechNotes is the third of a three-part series focused on freeze protection and winterization of sprinkler systems. This edition was co-authored by Kevin Hall, P.E., Manager of Engineering Research and Mark Hopkins, P.E., Vice President of Engineering. The first special edition was released on December 4, 2018 which focused on freeze protection options including current guidance regarding antifreeze and alternatives to antifreeze systems. The second special edition was released on December 11, 2018 which focused on maintenance considerations for dry pipe systems. This issue provides notification of the first listed/certified antifreeze on the market. All of these issues provide valuable information for contractors and building owners.

Over the past 8 years there have been restrictions applied to the use of antifreeze solutions in sprinkler systems. The sprinkler system installation standards, NFPA 13 and NFPA 13R have required a listed antifreeze solution since Tentative Interim Amendments (TIAs) were issued by NFPA applying to the 2010 editions of these standards. This requirement to have a listed (included in a list published by an organization that is acceptable to the AHJ) antifreeze solution has remained in all subsequent editions of these standards.

The changes made to NFPA 13D were a little different. The TIA and subsequent editions have required a listed antifreeze solution unless special conditions have been met. For existing systems, the use of a factory premixed solution of glycerine at a maximum concentration of 50 percent by volume, or a factory premixed propylene glycol at a maximum concentration of 40 percent by volume would be permitted. Additionally, the use of factory premixed glycerine or propylene glycol in these concentrations has also been permitted to protect piping which supplies sprinklers in a specific area of a dwelling unit, where acceptable to the authority having authority. NFPA 13D continues to allow these solutions in new construction because of the many residential systems being installed in areas subject to freezing, and the low pressures (80 psi) typically observed in these systems. Other NFPA 13D applications would only permit the use of a listed antifreeze solution.

NFPA 25, Standard for the Installation, Testing and Maintenance of Water-Based Fire Protection Systems has

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January 15, 2019

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14 with Some Common
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Presented by Bob
Upson, Manager of
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restricted the use of antifreeze solutions in existing NFPA 13 and NFPA 13R sprinkler systems since the 2011 edition. In order to issue a TIA in an NFPA document two requirements must be met: (1) The solution to the error/omission needs to have a strong technical basis and (2) needs to be of emergency nature as determined by the responsible technical and correlating committees. Four TIA's were issued for the 2011 edition of NFPA 25. Perhaps the most significant TIA was the one that imposed the sunset date of September 30, 2022 in NFPA 25 regarding the for continued use of propylene glycol and glycerin solutions in existing systems.

NFPA 25 is currently in revision cycle for the 2020 edition. The sunset provision will remain in effect as part of that document. However, the sunset provision will terminate before the next edition (2023 edition) will be developed and issued. As a result, there were many discussions at NFSA ITM and E&S Committee meetings, as well as, at the NFPA 25 first draft and second draft meetings about extending this date to allow the many existing antifreeze systems to be maintained. The discussions at these meetings swayed, but ultimately led to the conclusion that changing the date would remove the motivation for manufacturers to develop a listed antifreeze solution.

NFSA has received questions just about every month over the past several years about antifreeze solutions with the two most common questions being:

- 1) Is there any listed antifreeze solution available?
- 2) When will a listed antifreeze solution be available?

Our answer over the past several years has been consistent, "No, there are no listed antifreeze solutions, but there should be in the near future." This has been met with a long sigh and a retort of "We have heard that before." For the first time, we can answer these questions in a positive manner. The answer is now emphatically, "Yes!" JCI has given everyone a gift this holiday season by delivering the first and only "Listed Antifreeze Solution" for fire protection use in the market place. As for the answer to the question of when will a solution be available, answer is simple: the solution has been available for purchase since December 10, 2018.

The term listed as used in the context of NFPA 13, 13D and 13R is consistent. As an example, NFPA 13-2019 section 3.2.3 defines listed as,

"Equipment, materials, or services included in a list published by an organization that is acceptable to the authority having jurisdiction and concerned with evaluation of products or services, that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services, and whose listing states that either the equipment, material, or service meets appropriate designated standards or has been tested and found suitable for a specified purpose."

However, it is noteworthy to identify that UL has changed its



terminology regarding product listings although the meaning is the same. Moving forward products will be identified as being "UL Certified" rather than "UL Listed." This is one of the first products having this distinction. LFP Antifreeze is a listed product since it is included in the list of UL Certified products as required by the NFPA standards.

LFP™ Antifreeze for Fire Protection Systems manufactured by Tyco, a JCI brand, is now available and listed for fire protection use. According to JCI engineers, the process has taken over five years and previous variants could not pass either the rigorous UL fire or compatibility tests. The requirements of UL 2901 (the Outline of Investigation for Antifreeze Solutions for Use in Fire Sprinkler Systems)) were established in order to ensure the safe and effective use of an antifreeze in a fire sprinkler system and are difficult for any solution to pass. Fortunately, JCI engineers and UL's technical representatives were able to revise the requirements through research, testing, and data analysis, to finalize a protocol appropriate for public safety. This testing protocol includes fifteen performance objectives with high ambient temperature stability, corrosion rate, resistance to leakage, compatibility with materials used in fire sprinkler systems, exposure to fire, and firefighting effectiveness being a few key qualities that stand out. Without this collaboration, we might not have ever seen a listed antifreeze on the market

In addition to passing the UL 2901 test, the LFP™ Antifreeze solution has also gone through rigorous full-scale fire testing to ensure that, when installed per the manufacturer's instructions, this product will not present the same risk as some of its glycerin and propylene glycol predecessors. The following list highlights some of the products attributes and limitations:

- With a freezing point of -13 °F, the product is allowed to be used in environments having an ambient temperature as low as -10 °F
- The antifreeze can be used in environments having a maximum ambient temperature of 150 °F
- There are no system volume limits for use in NFPA 13D or 13R systems solely protecting dwelling units
- There is a 40-gallon limit for the following applications:
 - LH, OH1 and OH2 occupancies in 13 systems
 - Non-ESFR storage systems
 - Mixed use 13R systems
 - The antifreeze is prohibited from use in ESFR, Extra Hazard, and Flammable Liquids applications

For the layout technician, a K-factor adjustment is required. The new K-factor in an antifreeze system is determined with the following formula:

$$KA=7.94KwpA$$

Where,
KA is the adjusted K-factor
Kw is the K-factor of the sprinkler discharging water
ρA is the density of the antifreeze solution at the



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temperature used for testing

For systems or applications having a volume less than 40 gallons, the Hazen-Williams formula is permitted to be used in determining friction loss. However, for permitted applications having a volume greater than 40 gallons, the Darcy-Weisbach formula is required to be used in determining friction loss. This has been and will continue to be a requirement of NFPA 13 as well as part of the manufacturer's instructions. Refer to the NFPA 13, NFPA 13D, and NFPA 13R for additional information regarding volume limits and hydraulic calculation requirements.

Technicians and installers will also have to provide a fluid sampling valve to be installed at the top of each system riser. Thermal expansion based on expected temperature fluctuations should be calculated based on the tables provided in the product literature.

The intent of the sunset clause provided in the 2011 edition of NFPA 25 was always to promote innovation in the industry and bring a safe product to the market that provides more options when protecting sprinkler systems from freezing. JCI has achieved this with their listed LFP™ Antifreeze Solution for Fire Protection Systems. Additional information, including product flyers, safety data sheets, and template system inspection tags can be found on JCI's subsidiary site www.tyco-fire.com. See "LFP Antifreeze" under the "Products" tab.

NFPA 13, 13R, 13D Update

(2016 Edition)

January 23, 2019

Dover, DE

NFPA 13, 13D, 13R Update

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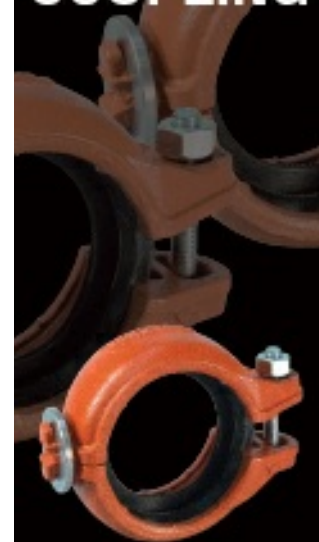
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