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August 24, 2010

To: Mr. Joe Holland
Property Management Systems, Inc.
262 East 3900 South, Suite 200
Salt Lake City, UT 84107

From: Robert D. Fazzio, P.E.
RDF Engineering & Design, Inc.
3668 S. Eastwood Dr.
Salt Lake City, UT 84109

Re: Fire Sprinkler System Freezing Problem at Pinebrook Pointe Condominiums

Dear Joe,

The Development consists of many 8-plex type buildings with designations associated with the alphabet, i.e. Building A, Building B, etc. The recent history of the buildings indicate that there have been several incidents where freezing has occurred in the attic portions of some of the buildings and one incident (Building K only) of freezing in the crawl space (between the garage level and the first floor). We have been assigned the task of evaluating the systems for freezing potential and to recommend a cost effective corrective action to preclude additional freezing incidents.

On August 24, 2010, we visited the site and physically reviewed the installation in the attic and garage of Building J and looked at the exterior of the building crawl space at both Building J and Building K. The fire sprinkler systems consist of wet-pipe systems with a steel riser and CPVC piping in the remainder of the building. The crawl space appears very tight with the exception of the floor joists that extend over the foundation wall to support the deck. The joist penetration at this point appears to have some air gaps around the wood that would allow air infiltration into the space. The attic spaces appear to be insulated with blown in cellulose insulation that covers the sprinkler piping (supported on the top of the ceiling framing members). The depth of the insulation varies and in some cases the sprinkler pipes are exposed. We were informed that Property Management Systems, Inc. has added additional insulation to this unit and still had a freezing problem afterward.

We will express at this time that converting the systems to antifreeze is not an option at this time as there have been a couple of incidents where the antifreeze in the systems has exacerbated the problem in a fire condition. Due to this condition, the National Fire Protection Association (NFPA) has prohibited the use of antifreeze in new residential occupancies. See attached report from NFPA.

The systems will then have to be protected from freezing by eliminating the problems with the insulation and air infiltration into the piping spaces.

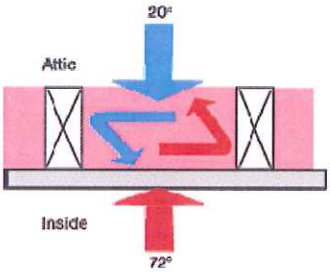
1. The joist openings into the crawl space of Building K have been sealed with expansion type foam which appears to be adequate. The maintenance man indicated that they have not had additional freezing problems in this space in Building K.

Recommendation:
We recommend that the joist penetrations be sealed in a similar fashion on the remainder of the buildings.

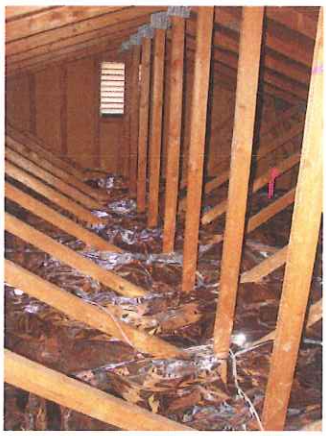
2. The CPVC sprinkler piping in the attic is supported on the top of the 2x6 or 2x8 ceiling framing members with the blown in insulation burying the piping. In most cases, there is more insulation below the

piping than there is above it and with the ceiling at the bottom of the framing member, there is the additional problem of an air barrier (the ceiling) between the heated space and the piping. A second problem exists with the loose fill cellulose insulation where the cold air drops and penetrates through the openings in the insulation while any heat will naturally rise. This is known as a Convective Loop.

Definition of Convective Loop



A convective loop, whether inside a wall cavity or in another part of the building structure, occurs when air rises along a warm surface and falls along a cold surface, creating a circular movement of warm and cold air. A convective loop transfers heat through the building assembly, requiring more energy to replace the lost heat in heating seasons and the lost cool air in cooling seasons.
Improper installation of conventional insulation, light density blown-in insulation and structural items such as a drop soffit in the kitchen can create a convective loop.



With the insulation and air barrier below the piping and the presence of a convective loop, the sprinkler piping will be subject to freezing temperatures and will freeze. I estimate that there have been many freezing incidents that didn't result in a broken pipe or sprinkler and then thawed when the temperature increased.

Recommendation:
We recommend that the insulation be removed from below the sprinkler piping and that plastic sheeting be laid over the pipe before re-installing the insulation. This will provide an air barrier and keep the insulation above the piping. The insulation should be a minimum of 12" above the piping to insure adequate insulation values. For added security, we also recommend the installation of a radiant barrier foil above the insulation to eliminate the formation of convective loops. Please note that the radiant barrier material for this application is the perforated style.

If you have any questions or comments, please call.

Sincerely,

Robert D. Fazzio, P.E.

attachment:

Updated August 2010

NFPA Safety Alert Regarding Antifreeze in Residential Fire Sprinkler Systems

Background

Automatic fire sprinkler systems with antifreeze solutions have more than 60 years of successful use in commercial applications and an equally successful experience since they have been in use in residential applications. Most fire fatalities occur in the home, and when home sprinklers are present, the risk of dying in a home fire decreases by 83%. NFPA supports and urges the expanded use of residential sprinkler systems as the most effective way to prevent fire injury and death in the home and other residential occupancies.

While NFPA emphasizes that residential sprinkler systems are and remain reliable and effective, a recent fire incident involving a sprinkler system that contained a high concentration antifreeze solution has raised concerns about the combustibility of antifreeze solutions in residential sprinkler systems. The incident involved a grease fire in a kitchen where a sprinkler system with a reported 71.2% concentration of antifreeze deployed. The fire resulted in a single fatality and serious injury to another person. (Recently, NFPA received a report of another incident, this time in a living room, which may have been exacerbated by the presence of an antifreeze solution.)

Following the first incident, NFPA initiated a research project with the Fire Protection Research Foundation (Foundation) and an initial set of fire tests was also conducted by Underwriters Laboratories. Based on information learned from these efforts, NFPA issued an interim safety alert and recommendations in July 2010 and began additional research to gain further information on antifreeze solution performance under various fire scenarios.

The Foundation has completed this additional research in a report entitled "Antifreeze Solutions in Home Fire Sprinkler Systems: Phase II Research Interim Report" (2010), and NFPA is providing updated safety information and guidance based on the test results (see the box below).

Key findings of fire tests

- Antifreeze solutions with concentrations of propylene glycol exceeding 40% and concentrations of glycerin exceeding 50% have the potential to ignite when discharged through automatic sprinklers.
- Both the 40% propylene glycol and 50% glycerin solutions demonstrated similar performance to that of water alone for fire control throughout the series of tests.
- Based on the results of this research, antifreeze solutions of propylene glycol exceeding 40% and glycerin exceeding 50% are not appropriate for use in residential fire sprinkler systems.
- Consideration should be given to reducing the acceptable concentrations of these antifreeze solutions by an appropriate safety factor.

NFPA Standards Council Action

Based on the Foundation report, the NFPA Standards Council, the body that oversees the NFPA standards development process, issued tentative interim amendments (TIA) to NFPA 13, *Standard for the Installation of Sprinkler Systems*; NFPA 13D, *Standard for Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes*; and NFPA 13R, *Standard for Installation of Sprinkler Systems in Residential Occupancies Up To and Including Four Stories in Height* banning the use of antifreeze in sprinkler systems in new construction of residences and in the dwelling unit portions of other occupancies. (8/16/10)

For more information on this, topic visit http://www.nfpa.org/antifreeze.

Important safety information and NFPA guidance regarding antifreeze in residential fire sprinkler systems

New Systems

For now, and until any further action by NFPA consensus standards committees, NFPA sprinkler standards prohibit the use of antifreeze in new residential fire sprinkler systems.

NFPA standards prohibit the use of antifreeze in residential fire sprinkler systems in new construction following the August 16, 2010, issuance of tentative interim amendments (TIA) to NFPA 13, NFPA 13D, and NFPA 13R. If you are putting in a new residential fire sprinkler system (including all NFPA 13D applications and the dwelling-unit portions of NFPA 13 and NFPA 13R systems), refer to the latest editions of NFPA 13, NFPA 13D and NFPA 13R, as amended by TIAs 1000, 995, and 994.

Existing Systems

NFPA sprinkler standards are installation standards and do not currently address the problem of antifreeze in existing systems. NFPA, in its role as a safety advocate, believes that owners and contractors should take immediate steps to review the status of their existing residential sprinkler systems and take appropriate action. A complete ban on antifreeze is appropriate for new systems during the period that the NFPA standards committees review the Fire Protection Research Foundation reports and determine whether limited use of antifreeze in these systems is appropriate. A more difficult problem presents itself, however, with existing systems, some of which cannot be easily retrofitted or redesigned so as to avoid the need for antifreeze. Because of the lifesaving benefit of these systems, simply shutting down these systems should not be an option. For owners and contractors who now must determine how to handle these systems, NFPA is offering the following guidance regarding existing systems:

- Residential fire sprinklers are extremely effective fire protection devices, significantly reducing deaths, injuries, and property loss from fire. These systems should not be disconnected.
- Existing residential fire sprinkler systems, whenever possible, should not contain an antifreeze solution.
- If you have, or are responsible for, an existing residential occupancy with a fire sprinkler system, contact a sprinkler contractor to check and see if there is antifreeze solution in the system.
- If there is antifreeze solution in the system, determine if other means, such as insulation, can be used to provide adequate freeze protection.
- If there is no viable alternative to antifreeze solutions, NFPA recommends the following:
  - Use only propylene glycol or glycerin antifreeze solution.
  - The antifreeze solution should be the lowest possible concentration required for the needed freeze potential, but under no circumstance should the antifreeze solution exceed a maximum concentration of 40% of propylene glycol or a maximum concentration of 50% of glycerin. Consideration should be given to reducing these concentrations by an additional safety factor.
  - The antifreeze solution should only be a factory pre-mixed solution; use of factory pre-mixed solutions is essential to ensure the proper concentration level and solution integrity.
  - Antifreeze solutions should only be used with the approval of the local authority having jurisdiction.

For more information, including copies of the Foundation reports and the TIAs, and to stay up to date on any further guidance or information that NFPA may provide on this issue, regularly consult www.nfpa.org/antifreeze.

August 2010