

American Fire Sprinkler Association

White Paper On Stand-Alone Residential Fire Sprinkler Systems

Background

As one- and two-family residential fire sprinkler systems (referred to hereafter as “residential systems”) become more common, due to consumer demand and/or code requirements, issues related to the type of installations need to be addressed. The NFPA 13D standard addresses residential sprinkler systems and concentrates on stand-alone fire sprinkler systems that have a separate water supply line within the home. However, NFPA 13D also has included provisions for multipurpose or “combination” systems for a number of years. Multipurpose systems are those in which the domestic water supply and sprinklers share common piping in the home.

Multipurpose systems can use PEX piping, CPVC or copper piping. Recently the International Residential Code (IRC) included a section on multipurpose residential systems under section P2904, and references compliance with requirements of NFPA 13D. NFPA has reviewed P2904 and agrees that as written it complies with the requirements of 13D. NFPA 13D is a more expansive standard and addresses a wider range of installation issues. IRC P2904 is a more limited standard that addresses only multipurpose systems in homes. Also the use of P2904 is applicable for tree type sprinkler systems, but no guidance is provided for use in a loop or grid system configuration. The P2904 may not be applicable for steeply pitched ceilings. The testing completed on steeply pitched ceilings indicated that more than two heads operate in these areas. The water demands, if additional sprinklers are calculated, could exceed the design tables in the IRC.

The 2009 edition of the International Residential Code (IRC) requires that effective January 1, 2011 all new one- and two-family dwellings must include an automatic fire sprinkler system that complies with NFPA 13D or IRC P2904. When requirements of P2904 cannot be met, NFPA13D would be the prevailing standard.

Installations

Under the existing standards, there are four general installation scenarios.

- A system using PEX-based piping system to supply water to the domestic plumbing and fire sprinkler system;
- A CPVC-based piping system to supply water to the domestic plumbing and fire sprinkler system;

- A CPVC-based plumbing system with outlets left to extend into a CPVC fire sprinkler system installed by a sprinkler contractor;
- A CPVC-based (stand-alone) fire sprinkler system.

Although the large majority of existing residential sprinkler systems are “stand-alone” systems, a misconception exists among many Authorities Having Jurisdiction that multipurpose systems will be installed to comply with IRC sprinkler requirements. However, the simple fact is, not all residential systems can or should be multipurpose systems. IRC P2904 provides requirements for a more limited residential system that cannot be met in many homes. Multipurpose systems as defined in NFPA 13D provide for a broader range of residential requirements, but many homes will not meet the criteria for a 13D multipurpose system. In addition, installation of any kind of multipurpose system may represent compromises and present concerns for expected performance. In many cases, stand-alone fire sprinkler systems will be the most effective, most cost effective and practical residential fire sprinkler system.

Potential drawbacks to multipurpose systems are:

- Some jurisdictions do not approve multipurpose systems.
- At this time, it has not been proven that multipurpose systems can be effectively monitored. Due to necessity of water flow for non life safety devices (sinks, toilets etc) the multipurpose piping network cannot be alarmed. Lack of monitoring can lead to significant and unnecessary damage from system activation.
- Vacation homes are often drained and left unheated for sustained periods of time. This is not an option for multipurpose systems.
- In areas where the water supply is known to be marginal, a multipurpose system may not be feasible due to the regular sustained demands from the domestic system.
- In homes that have large rooms the economical use of extended coverage sprinkler heads (20’x20’) may not be feasible due to hydraulic flow requirements and simultaneous domestic needs or a weak water supply.
- Some jurisdictions require dual outlet water meters with one outlet dedicated for fire sprinkler water service.

- Multipurpose systems do not allow the use of a fire department connection.
- In areas that have hard water where water softeners are used to condition the water. The water pressure loss through the water softener could prohibit adequate pressure to service the fire sprinkler system.
- Situations where the water purveyor requires the ability to turn off the domestic service without having to turn off the fire sprinkler system.
- Due to design considerations, multipurpose systems may not supply sufficient protection to steeply-pitched ceilings

Design issues that may make a stand-alone system a better choice:

- Increased water demands on domestic lines for a multipurpose system.
- A residential system supplied from a city water system can be impacted by the cost of the meter and the backflow. The stand-alone system allows the use of a tank and a small pump or a pressurized tank. This could be less than the cost of the increase in meter size and the backflow required on a city supplied system.
- The system can be fed before any pressure reducing devices and can benefit from the full pressure available to the residence, therefore reducing cost to the builder. With the availability of increased pressure, the issue of sloped ceilings and other pressure demanding scenarios are much easier to be dealt with.
- Stand-alone systems can use CPVC rather than PEX. CPVC has a larger inside diameter than the equivalent size in PEX therefore giving a better flow and pressure requirement when calculating the stand-alone systems. This allows for smaller pipe sizes and may allow the use of a smaller water meter.

We have not addressed Network Systems, which is a type of multipurpose system that often uses 1/2 in. piping to serve both domestic and fire protection needs. To accomplish this protection each sprinkler is supplied by water flowing to it from at least three separate paths. Network systems are usually a pre-engineered proprietary sprinkler system.