USING CPVC PIPING FOR Fire Sprinklers

by David Ostebo

In California, where I live, hundreds of towns and cities now mandate sprinklers in new residential construction. But this is not just another West Coast trend. Small towns across the country — like Gorham, Maine, for example — concerned about the distance to remote homes from fire stations and a lack of rural fire hydrants, are also requiring sprinkler systems. Occupants of a house with a sprinkler system and working smoke detector have a 76% chance of surviving a fire in their home (see Figure 1, next page).

While commercial sprinklers have been around for years, their response times are too slow for residential construction. It wasn't until 1979, as the result of full-scale fire tests in homes in Los Angeles and Charlotte, North Carolina, that the National Fire Protection Association (NFPA) stepped forward

An installer uses a special wrench to mount a sprinkler head.

Cut the cost of residential sprinkler systems with plastic pipe

Figure 1. Sprinklers make a difference. A fire that started in a bathroom wastebasket spread quickly, causing $75,000 in damage (above); no sprinkler was installed. By contrast fire in a kitchen exhaust hood (right) was doused with a single sprinkler head, leaving $600 in damages.

Figure 2. Residential sprinkler heads include pendant models (top) and recessed types (above) that are barely noticeable.

and established standards for residential sprinklers. The association mandated that sprinkler heads have a maximum 15-second response time, a maximum coverage of 144 square feet, and discharge 18 gallons per minute (gpm).

Just Say Plastic

While the sprinkler head (Figure 2) is the key component in a sprinkler system, it's the pipe that really affects the system's cost. Iron, steel, and copper are all acceptable piping materials, but chlorinated polyvinyl chloride (CPVC) is the pipe of choice because it's so easy to install. Two other features make CPVC attractive: Plastic pipe can never be an ignition source, and, as odd as it seems, CPVC, although it's plastic, won't support combustion.

Along with its non-combustible qualities, CPVC is installation-friendly by virtue of its light weight and flexibility. Pipe and fittings are easily assembled with one- or two-step glue. And, the pipe's smooth interior — unlike that of iron pipe — promotes water flow.

Although the cost of CPVC is comparable to that of copper and steel, the real savings with CPVC is in reduced installation time. Two semi-skilled workers can sprinkler an average 1,600-square-foot home in about four hours. (For more on typical sprinkler layout, see "Installing Sprinkler Systems," 8/96). Typically, no license is required by an installer and installer training is minimal. In my area, costs for a typical installation in a new house range from 85¢ to 95¢ per square foot. Prices run one-and-a-half to two times higher for retrofits.

Installation Details

CPVC has its limitations. It's restricted to wet pipe systems that are always charged with water — compared with a dry pipe system, which is filled with air until a sprinkler head is activated, causing water to rush in, replace the air, and disperse. And CPVC piping must be concealed or separated from the area it is protecting with a minimum barrier of either 1/2-inch plywood, 3/8-inch sheetrock or acoustical tile. An exception allows exposed installation below smooth, flat ceilings when used in conjunction with quick response heads and other spacing and clearance requirements. (In contrast,

Figure 3. CPVC pipe must be properly blocked and strapped to prevent deformation under pressure.

the peaks and valleys of irregular surfaces, such as textured ceilings, heat up at different rates and could delay sprinkler head activation.) CPVC can also be installed in walls, but the heads and their discharge rates are different.

Since CPVC isn't approved for installation in combustible concealed spaces requiring sprinklers, the installer must switch to metal piping in these areas. In the case of attic sprinklers, the bay in which the pipe is installed must be covered with code-specced plywood or drywall.

Proper support. CPVC piping must be supported by or from structural members in compliance with local plumbing codes. For most one-story installations, pipe is laid on top of the ceiling joists (Figure 3) and secured to the joists with pipe clamps spaced to prevent lateral movement and resist pipe uplift. Clamps must cover at least a 1/2-inch band on a pipe and are typically spaced 4 feet from a sprinkler head and within 12 inches of a 90-degree downward angle. In addition, no rough edges can come in contact with the pipe, nor can undersized hangers, "plumber's tape," or J-hooks be used. When suspended from above, CVPC is held in place with plumbers hanger bar.

Riser Plumbing

The system riser (Figure 4) is the vertical pipe that supplies the overhead lines and sprinkler heads. It contains the control and alarm features of the system, typically a control valve, check valve, pressure gauge, flow switch and a drain and test connection. These parts are all standard at plumbing supply houses.

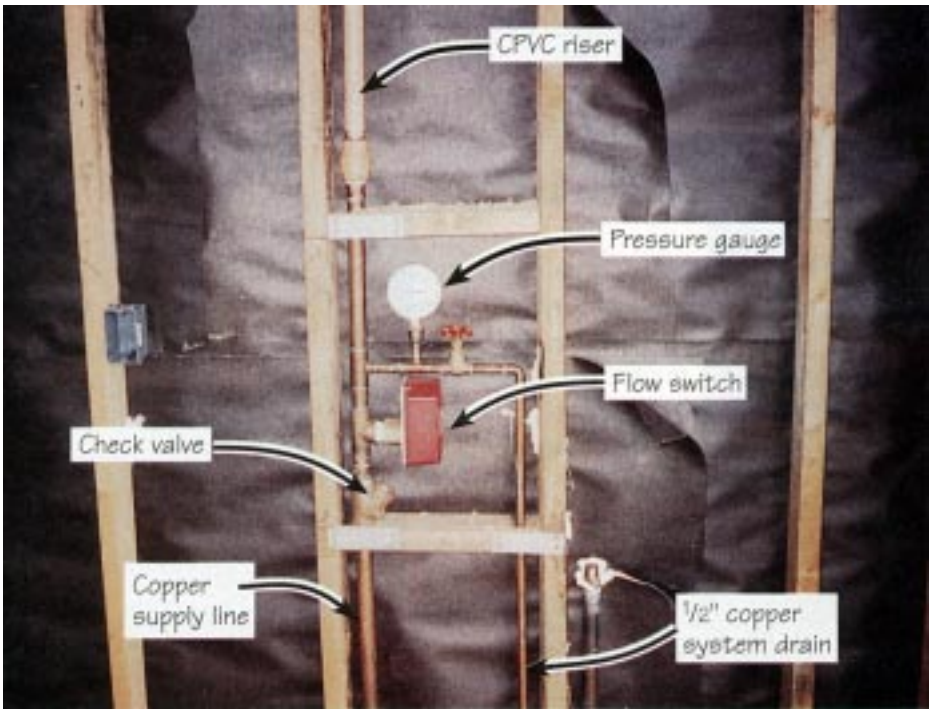

Figure 4. The sprinkler system riser controls are typically located near the point where the water supply enters the home, and are plumbed with copper. Note the transition from copper to CPVC in the upper half of the photo.

If the sprinkler heads and pipes are the nervous system of a residential sprinkler system, then the riser components are the system's brains. It's here that tests are conducted, alarms activated, and water routed. These devices are typically located just beyond the point where the water supply enters the house and are placed behind an access panel.

The shutoff valve shuts off both the domestic and sprinkler systems. However, individual shutoff valves — one for domestic water, another for the sprinkler — are allowed when the sprinkler control valve is locked in the open position or a stand-alone "tamper"

Sprinkler Facts

The objectives of residential sprinkler systems are simple: to prevent flashover, the rolling fireball that races across ceilings at temperatures approaching 600°F, and to keep room temperature to 150°F or less (human flesh burns at 154°F). By reducing heat, sprinklers also reduce the levels of toxic gases like carbon monoxide.

Where Sprinklers Are Exempt

The National Fire Protection Association (NFPA), through its research, has learned that 87% of all deaths from residential fires occurred in only nine areas of a residence. So it made sense to establish guidelines that would concentrate fire protection in those household areas of greatest incidence of fire, and to reduce or eliminate coverage in areas less likely to start a fire. Specifically, the association exempted these areas:

- Closets and pantries not over 24 square feet (provided that the walls were covered with sheetrock or comparable material).
- Garages, carports, or open attached porches. This standard applies to both detached and attached garages, although some municipalities require sprinklers in attached garages even when 5/8-inch fire code drywall is installed on the common wall with the living quarters.
- Attics, crawlspaces, and other concealed spaces not used or intended for living purposes or storage. If, however, a house is framed with a shed dormer, the dormer would need to be sprinklered even though the space is only intended for storage.

Sprinkler Head Guidelines

The NFPA stipulates that sprinkler heads must meet specific testing parameters and be listed by the Underwriters Laboratories (UL). Also, certain installation practices must be followed:

- Only factory-applied paint is allowed on the sprinkler head; if paint or textured ceiling overspray finds its way onto the head, it will have to be replaced.
- The proper UL-listed escutcheon, or seal ring, between the sprinkler head and ceiling must be correctly installed.
- Beams, light fixtures, and other obstructions must not interfere with the response time and discharge rate of the sprinkler head.
- In addition to a maximum spacing between sprinkler heads, there is also a minimum spacing requirement to prevent the discharge from one head from cooling down the head of an adjacent unit and preventing the second head from activating. Typically, this distance is 8 feet, although some models extend the distance to 9 feet.

As with any building code matter, check with your local code officer before proceeding with a sprinkler installation.

switch outside the building (usually located on a pedestal) ensures that water is available to the sprinkler system.

A check valve, although not required by the NFPA, is generally mandated by local code authorities. This valve closes if water flows backwards (away from the sprinkler pipes) and serves to eliminate unnecessary activation of any alarm bells.

A pressure gauge monitors water pressure to ensure that there's adequate pressure to power the system. The primary water source must be capable of delivering 30 gallons per minute at a pressure of 30 pounds per square inch (psi). City water systems typically meet this standard. But in rural areas, if the main water supply is incapable of delivering this flow rate, a second well dedicated to the sprinkler system may be needed. Alternatively, a 300-gallon (30 gpm multiplied by 10 minutes, the time usually needed to ensure safe egress from a house fire) stand-alone storage tank with a 1-hp motor capable of producing the required pressure can be tied into the sprinkler system.

The flow switch — a paddle-like device inside a switch housing that closes and makes electrical contact when water moves through the pipe — activates an outside alarm. Some code officers or fire departments also require that smoke detectors be linked to the exterior alarm bell so that the home's occupants will have another warning that their house is on fire. The homeowner may also choose to have the flow switch linked to a third party service that will report the alarm signal to the local fire company.

A drain valve between the flow switch and sprinkler system serves as a way to test the system, and provides a means to drain the system when work is performed. Homeowners should be instructed to perform monthly visual inspections of the system and to open the drain valve for 10 to 15 seconds to ascertain that the alarm system is working.

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