SCHAEFER ENGINEERING

2005 Spring Newsletter

FEATURED

FORENSIC FEATURES

Drinkable Water, Rotten Pipes

Everyone expects chlorine to be in city water supplies. Chlorine, the same chemical in clothing bleach and swimming pools, is a potent oxidizer and chemical agent that keeps water drinkable and free from harmful bacteria. Due to federal statute, chlorine must be present in water and can chemically attack the plastic piping from the city reservoir to the tap in your kitchen. A recent trend in water purification and disinfection is a new chlorination process that uses both ammonia and bleach, the so called 'chloramine process'.

Chlorine has a relatively short lifetime in water. In fact, if allowed to stand for 48 hours in a container, all of the chlorine will dissipate. To extend the lifetime of chlorine in drinking water, municipal water systems recently started to use ammonia in conjunction with the chlorine, to form chloramines in city water. These chloramines, while not harmful to humans in potable water concentrations, kill bacteria. Unfortunately, they can also attack and degrade plastic much more quickly than the chlorine used in the past. Since plastic piping systems installed in the not so distant past were not designed to be resistant to chloramine attack, chloramine degradation of plastic plumbing can be rapid.

Pipe degradation occurs from the inside out. You cannot see, feel, smell or taste degradation. Merely looking at a pipe will not indicate if the pipe is nearing failure. A more in depth analysis is required.

Chloramines can swell and crack plastics that are not resistant. The degradation of the plastic will continue until failure. Plastics used in potable water supplies must be designed to be resistant to chlorine and chloramines or they will be prone to degradation by waterborne chemicals. Acetal plastic, used in toilet check valves, is prone to this type of degradation. Acetal fittings were also extensively used in polybutylene piping systems of the 1980-90's. These polybutylene systems had widespread failures resulting in large, class action, water damage lawsuits. If certain plastics are used in a water system that has recently switched to chloramine treatment, the ingredients of a ticking, water flooding time-bomb could exist.

What should you do? Perhaps nothing. Perhaps removal of all the suspect plumbing. Perhaps lobbying your municipal water district to alter their water treatment practices is in order. Inspection is a *required* first step.

Check if plastic plumbing or components are present. Inspect for plastic plumbing at fittings behind and inside toilets, under sinks and near hot water heaters. Look for drips. If any fittings or pipes are leaking, there is reason for concern. These fittings should be replaced and analyzed. Inspection for additional leaks, and ultimately determining the cause of the leaks, is recommended.

Plastic piping is under attack by the very water it is designed to transport. Check plumbing fittings and pipes at home and work. If there is reason for concern, contact Kevin Gaw, Ph.D., plastics engineer at Schaefer Engineering. Schaefer Engineering will send a sample collection and mailing kit. Dr. Gaw's analysis can reveal the causes and extent of degradation of your plumbing system. A course of action to avoid a major catastrophe can then be recommended.

Kevin Gaw, Ph.D., M.S. Mat. Sci., B.S. Mat. Sci, is a Senior Material Scientist/Plastics Engineer with Schaefer Engineering Corporation

Look for us at these events

Seattle Claims Adj Assn Golf Tournament
June 3 ❖ Trilogy Golf Course

Tacoma Claims Adj Assn Golf Tournament
June 10 ❖ Northshore Golf Course

CTLA / CDLA Golf Tournament
June 10 ❖ Saddlerock Golf Course

Denver Claims Assn Law Day
June 17 ❖ Denver, CO

Idaho Trial Lawyers Assn Annual Convention
June 17 & 18 ❖ Sun Valley, ID

Wyoming Trail Lawyers Assn Annual Convention
June 22 - 24 ❖ Cheyenne, WY

Denver Claims Assn Golf Tournament
July 29 ❖ Denver, CO

Colorado Defense Lawyers Assn Annual Seminar
August 4 - 7 ❖ Steamboat Springs, CO

Colorado Trial Lawyers Assn Annual Convention
August 11 - 14 ❖ Snowmass, CO

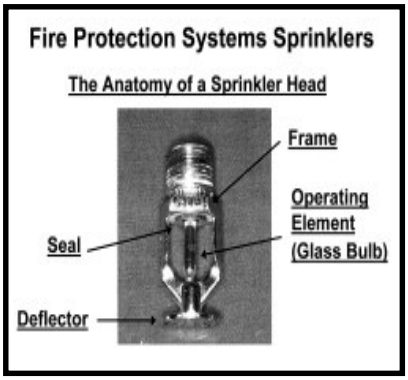
Fire Protection Systems: Fire Sprinkler Basics

Automatic sprinkler systems are an ever-present feature of modern life. Many public and private buildings are adorned with the telltale protrusions of automatic sprinklers. These seemingly simple devices, in use since the late 1800's, are a vital feature of the life safety systems in public and private structures. According to the National Fire Protection Association (NFPA), sprinkler systems reduce the risk of death in a fire by one-half to two-thirds, and similarly reduce the amount of property damage caused by fires. In fact, the NFPA has no record of more than two fatalities from any fire in a structure properly protected by sprinkler systems.[1] This article presents some of the basics of the design and operation of fire sprinklers.

Many commercial and residential properties are equipped with automatic sprinkler protection. This well recognized form of protection, when properly installed in residential properties, is expected to prevent flashover. Flashover is a transitional phase in the development of a fire in which surfaces exposed to thermal radiation reach ignition temperature, more or less simultaneously, and fire spreads rapidly throughout the space, resulting in full room involvement or total involvement of the compartment or enclosed space [2]. They also improve the chance for occupants to vacate a burning structure. Automatic sprinklers are also an effective property conservation measure in both commercial and residential properties.

A considerable amount of engineering, design, testing and research goes into developing a sprinkler head. Sprinkler head designs have expanded to address specific applications, however, the basic operating concepts remain unchanged.

A fire sprinkler is a fixed temperature heat sensing device that, under specific conditions, opens and releases water that sprays over a predetermined area. There are four primary components that make up a fire sprinkler; the frame, deflector, seal, and operating element.



The sprinkler frame is the bulk of the assembled product. The frame is usually a brass casting, occasionally factory painted or chrome plated, with an orifice. National Pipe Taper threads are machined into it and two flat faces are present to receive a wrench or socket for installation. The manufacturer name, sprinkler model, and year manufactured are often visible on the flat faces.

[1] NFPA's *U.S. Experience with Sprinklers* and NFPA's *Fire Loss in the United States*, November 2003, Kimberly D. Rohr

[2] *NFPA 921, Guide for Fire and Explosion Investigations*, 2004 Edition

The orifice that delivers the water to the sprinkler head is machined into the frame of the sprinkler. A watertight seal that holds back the water covers the orifice.

Attached to the frame is the sprinkler deflector. Water discharging through the round orifice, as a solid stream, contacts the deflector. The deflector converts the solid stream of water into a uniformly distributed spray pattern of fine water droplets. Teeth on the deflector aid in forming the water spray. Information pertaining to the sprinkler design, temperature rating, and agencies that tested and listed the sprinkler, is often stamped into the top of the deflector.

Sprinkler Deflector

Between the seal and the deflector is the operating element, which holds the seal in place over the orifice. The operating element is temperature sensitive and is designed to fail when exposed to an elevated temperature for a specific period of time. When the operating element fails, the pressure of the water in the sprinkler system pushes out the seal over the orifice.

The operating elements of earlier sprinklers were fusible solder link technology**.** This technology is still in use. The designs of the solder links vary dramatically, but all rely on metal parts positioned between the frame and the seal that covers the orifice. The metal parts are held in place by solder, specifically formulated to soften at a given temperature. When the solder softens, the link separates and releases the seal over the orifice. The temperature rating of the sprinkler is determined by the formulation of the solder used to construct the fusible link. The manufacturer may color code the frame to allow for easy identification of the temperature rating of the sprinkler.

An operating element more commonly seen in sprinklers is a liquid filled glass bulb. With this technology, a liquid is enclosed in a cylindrical, glass bulb. An air bubble is also present in the assembly. The glass bulb is positioned between the frame and seal of the sprinkler. When heated, the liquid expands or vaporizes and shatters the bulb thus releasing the seal. The size of the air bubble dictates how much liquid expansion is required, the amount of heat required, to produce sufficient pressure to fracture the bulb. The liquid is colored with dye to correspond with the temperature rating of the sprinkler.

SPRINKLER TEMP. RATING COLOR CODE

Temperature Classification	Temperature Range (°F)	Solder Link Color Code	Glass Bulb Color Code
Ordinary	135-170	N/A	Red, Orange
Intermediate	175-225	White	Yellow, Green
High	250-300	Blue	Blue
Extra High	325-375	Red	Purple
Very Extra High	400-475	Green	Black
Ultra	500-650	Orange	Black

There are numerous types and styles of sprinkler heads, many designed for specific applications. The most common fire sprinklers fall into one of three categories:

1) Standard Spray Upright, 2) Standard Spray Pendent, 3) Horizontal Sidewall. The names describe their intended orientation. (PHOTO 1)

- ***Standard Spray Upright (SSU)*** sprinklers are intended to be installed below a relatively flat roof or ceiling. It should be positioned vertically, with its deflector in the upright position, parallel to the roof or ceiling above it. If installed under a pitched roof, the SSU should be installed at an angle, so that the deflector is parallel with the pitch of the roof. SSU sprinklers are usually installed in areas where the sprinkler pipe is visible, such as attics, mechanical rooms, and parking garages. An SSU sprinkler will discharge water in a circular pattern. (PHOTO 2)

- ***Standard Spray Pendent (SSP)*** sprinklers are intended to be positioned with the deflector facing down and parallel with the roof or ceiling above it. As with the SSU, a pendent sprinkler installed below a pitched ceiling should be positioned so that the sprinkler deflector is parallel to the ceiling. SSP sprinklers are frequently installed in occupied rooms where esthetics is important and sprinkler piping is concealed above a ceiling, such as in offices and living spaces in residential structures. An SSP sprinkler will also discharge water in a circular pattern. (PHOTO 3)

- ***Horizontal Sidewall Sprinklers*** are intended to be installed in the horizontal position, ideally near and below a flat ceiling. The flat portion of the deflector should be at the top. Horizontal sprinklers are often found in applications where overhead sprinklers are not practical. Unlike SSU and SSP sprinklers, the deflector of a horizontal sidewall sprinkler produces a fan shaped pattern. (PHOTO 4)

Dan Joyce, PE, CFEI, PI is a Fire Protection Engineer and Certified Fire and Explosion Investigator with Schaefer Engineering Corporation.

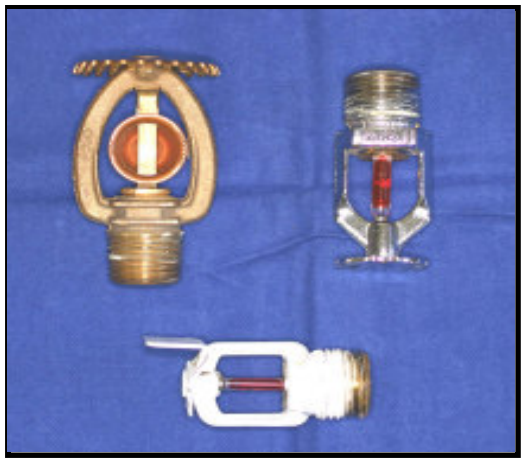


PHOTO 1

PHOTO 2

PHOTO 3

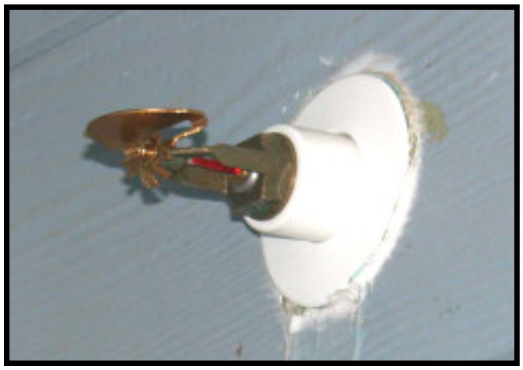


PHOTO 4