

Technical Article

Detention and Correctional Facilities - Misconceptions Regarding “Institutional Sprinklers”

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Detention and correctional facilities pose unique fire protection design and installation challenges. This type of building includes any facility where people are restrained by locks they do not control such as prisons, some mental health facilities and juvenile detention facilities. The fire protection design for these buildings is particularly difficult because most of the fires are incendiary or suspicious in nature.¹ Additional concerns exist because of the potential for vandalism to the fire protection equipment and specifically the automatic sprinkler systems, where installed.

Sprinklers and related components such as escutcheons have been and are being installed successfully within detention and correctional facilities throughout North America.² The sprinklers and escutcheons are located in areas that are accessible to those persons who are incarcerated, presenting several safety concerns and introducing a number of concepts unique to the operation and installation of automatic sprinklers. This has led to a number of misconceptions about the installation, operation and listings for “institutional” sprinklers.

What is an “institutional” sprinkler?

The name “institutional” sprinkler is used by sprinkler manufacturers and the fire protection industry simply to identify a type of sprinkler that has “tamper resistant” characteristics making them more suitable than other types of sprinklers for installation in environments where vandalism is a concern. They are also designed to reduce the likelihood of attaching heavy loads to the device prior to failure; an important feature in correctional or mental health facilities where there is the possibility exists for self inflicted injuries.³

The first misconception is in the term institutional sprinkler itself. A quick review of NFPA 13 2002, Installation of Sprinkler Systems and the Underwriters Laboratory Fire Protection Equipment Directory, shows that there is currently no definition or category for institutional sprinklers. There are, however, several proposals addressing this issue for the next edition of NFPA 13. The actions taken by the NFPA membership at the June 2006 meeting will determine if definition language for institutional sprinklers is added to the standard.

Presently however, the listing process for sprinklers referred to as “institutional” is no different than other sprinklers and, in the case of Underwriters Laboratory, conforms to test standard UL 199. The tamper resistant and breakaway features that make them suitable for institutional installations are not specifically tested by the approval agencies. Therefore, these sprinklers are tested to the existing categories used by the approval agencies. NFPA 13 2002 included institutional in its list of examples of light hazard occupancies in A.5.2⁴, requiring sprinklers marketed as institutional to be listed or approved as Quick Response Standard Coverage or Quick Response Extended Coverage sprinklers.

What makes an institutional sprinkler tamper resistant?

The second misconception is that institutional sprinklers are tamper proof. These sprinklers are not designed to be tamper-proof; they are designed to incorporate tamper resistant and breakaway features. Sprinklers installed in detention or correctional facilities pose two primary safety concerns. First, there is the potential for a part of the sprinkler to be broken off and fashioned into a weapon. Second, there is the potential that someone may use the sprinkler in a suicide attempt by hanging.

These two safety concerns are what make the construction of a tamper resistant sprinkler so difficult. The tamper resistant features are what generally cause the greatest confusion in the field among installing contractors and the operators of detention or correctional facilities. It is assumed by some that if a detained person tampers with the sprinkler there should be no way to break off parts or activate the sprinkler. This is only feasible for the body and escutcheon of the sprinkler. The basic operation of a sprinkler requires that the heat responsive element activate and separate from the sprinkler at the rated temperature, so it is simply not possible to design a tamper “proof” sprinkler. In addition, the fusible element, deflector and associated components can be a safety concern for potential suicides by hanging.

For institutional sprinklers, the heat responsive elements are actually designed to breakaway and fully release when a predetermined dynamic load is reached on the device. The dynamic loads range among the sprinklers manufacturers between 30 and 80 lbs. The dynamic load may also differ depending on whether the sprinkler is a pendent or horizontal sidewall, even if the sprinklers are made by the same manufacturer. This may become an important design consideration depending on what type of facility the sprinkler will be used in, adult or juvenile. Allowing the fusible element to breakaway and providing a special locking escutcheon helps reduce the potential for suicide by hanging and lessens the potential for parts being removed and fashioned into weapons.

Because many correctional facility employees are not familiar with the workings of sprinklers and how they operate, a high level of confusion exists when vandalism occurs and the sprinkler head operates. This can be a very difficult and frustrating situation given the frequency with which vandalism can occur. Sprinkler contractors, engineers and correctional facility staff must expect that if an incarcerated person attempts to break off a part of the heat responsive element or attempts to hang themselves or an object from these components, it may fully release the components and activate. For an industry that truly only wants sprinklers to activate in fire conditions, this can be a difficult concept to accept. Outside of detention and correctional facilities it is safe to say vandalism to sprinklers is a rare occurrence, making the safety concerns that exist in detention and correctional facilities not automatically considered by fire protection professionals.

In detention and correctional facilities the activation of a sprinkler, when vandalism occurs, actually has legitimate benefits. Of course, there can be many negatives aspects associated with sprinkler activation in non-fire conditions such as water damage, false alarms, and repair expense. No attempt is being made to suggest this is a desirable event. However, one potential benefit if a sprinkler operates due to vandalism or an attempted self-inflicted injury, the resulting water flow will immediately alert the staff and allow the opportunity to react and potentially save a life or prevent future injuries from material made into a weapon from the parts or pieces of the sprinkler. Alternatively, if the sprinkler did not activate the facility staff may be completely unaware of either situation.

Locking escutcheons

Sprinkler manufacturers design escutcheons for institutional sprinklers to be tamper resistant and use various methods to secure them in place after installation to prevent someone from removing it and fashioning a weapon (see Figure 1). The mechanical mechanism used to accomplish this could be locking rings or tamper resistant screws used in conjunction with retaining flanges to prevent "springing" of the pipe (see Figure 2).

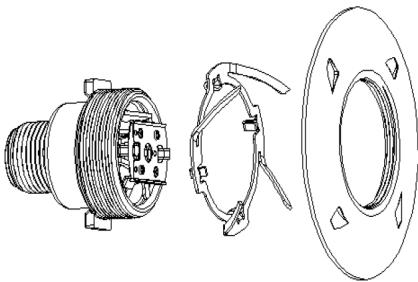


Figure 1- Institutional sprinkler with locking escutcheon ring.

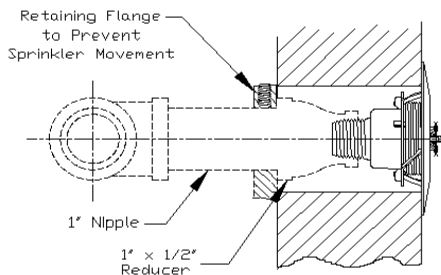


Figure 2- Institutional horizontal sidewall sprinkler installed with retaining flange.

In addition, the sprinkler escutcheons will either be designed for a flush-mounted installation or conical in shape. Both of the shapes used in conjunction with the locking mechanism help prevent an attempt to secure a rope or wire to the sprinkler body. These methods are only effective if the sprinkler is installed through a concrete slab or some locking steel ceilings. Some minimum-security facilities have areas with non-secure ceiling methods. In these cases, the use of a sprinkler with these tamper resistant features would be completely ineffective. If the incarcerated person can gain access above the ceiling, it is of little use to have a sprinkler with a locking escutcheon.

It is very important that the end-user of these sprinklers have a high degree of confidence in the installation, therefore the specifying engineer and sprinkler designer must understand that it is not possible for any manufacturer to anticipate all the possible vandalism methods which may be used by those incarcerated. The manufacturer’s technical literature will clearly state the sprinkler’s tamper resistant features and breakaway loads. If the installation has considerations in addition to those covered in the technical literature, additional features may be needed to supplement the institutional sprinklers.

Sprinkler system design considerations

In smaller jails and holding areas single interlock preaction sprinkler systems may be an option for use in conjunction with institutional sprinklers. By using a single interlock preaction sprinkler system, the design incorporates the same speed of water discharge as a wet pipe system in an actual fire condition. In the case of vandalism and a full release of the heat responsive element, the release panel will indicate a supervisory alarm from low air. This will allow the facility staff the notification of vandalism and the opportunity to retrieve any dislodged sprinkler material. Because the preaction system will only discharge air if the sprinklers are damaged, the issues inherent with a water discharge are eliminated.

Conclusion

The sprinkler system design for detection and correctional facilities takes on elements that challenge current sprinkler technology. The potential for vandalism and suicide attempts adds equipment considerations that can be easily overlooked by those unfamiliar with this environment. Understanding the features, listings and approvals for automatic sprinklers is always a primary element of a system design. Institutional sprinkler selection adds unique considerations and elements outside of the standards and building codes. Care must be taken to ensure all aspects of the design have been properly evaluated in order to ensure the safest sprinkler system installation possible.

References

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- ² Jaeger, Thomas W., “Detention and Correctional Facilities”, Fire Protection Handbook, Nineteenth Edition Volume 2, NFPA, Quincy, MA. p. 13 73.
- ³ Foster, Brian PE., and Cherkas, Grant,. “Impact of Unique Applications on Design Approaches”, in Gannon, G.M., ed., Designer’s Guide to Automatic Sprinkler Systems, SFPE, Bethesda, MD., NFPA, Quincy, MA, 2005., p 157.
- ⁴ “NFPA 13, Standard for the Installation of Sprinkler Systems”, 2002 Edition, NFPA, Quincy, MA, p. 13-209.