SPRINKLERS IN ELEVATOR HOISTWAYS AND MACHINE ROOMS

by William E. Koffel, P.E.

Are sprinklers necessary in elevator machine rooms and elevator hoistways? The answer to that question is a definite maybe. The issue is a prime example of how our need to codify fire protection results in an overly simplistic solution that may not truly be a solution. The purpose of this paper is to address the issue from an engineering perspective.

PROBLEM DEFINITION

From a fire protection standpoint, the elevator machine rooms and elevator hoistways offer the following risks.

- Accumulation of trash and debris in the elevator shaft provides an easily ignited fuel source.
- Elevator machine rooms are not always used for the sole purpose of housing elevator machinery.
- Operational features of elevator shafts can facilitate vertical transport of fire and smoke.
- Elevators are often used to transport firefighters and the disabled during a fire emergency.
- A fire in any room can impact on the means of egress and structural integrity of the building.

Traditional fire protection solutions involving automatic sprinklers can result in a potential loss of control of the elevator. The elevator industry has indicated that the hazardous effects of water on brakes, shorting of a safety circuit, motor, generator or transformer are well know.[1] The elevator industry has also indicated that sprinkler protection is unwarranted since most modern elevator control systems will not operate in temperature above 100°F.

The latter argument concerning temperature is not germane to the issue. In fact, one could argue that the sensitivity of the equipment to such temperatures is an argument for utilizing quick response sprinklers. However, it must also be noted that the sprinklers are installed to protect more that just the elevator equipment. Besides, with an increasing desire to utilize elevators for egress by the disabled, the elevator industry may need to provide equipment capable of operating at higher temperatures.

TRASH AND DEBRIS

NFPA 13, Standard for the Installation of Sprinkler System[2], requires a sprinkler to be installed at the bottom of an elevator hoistway. The sprinkler is provided to control a fire within the shaft involving refuse which has collected at the bottom of the shaft. However, ASME A17.1 Safety Code for Elevators and Escalators requires that power be disconnected to the elevator prior to sprinkler discharge. For a fire at the bottom of the hoistway, this would most likely result in projected beam smoke detection and a pre-action sprinkler system. As an alternative, it would appear as if any water-sensitive equipment could be shielded from the water discharge. A flow switch could be installed on the branch line to activate a form of recall, possibly to the nearest floor, but not permit Phase II Operation.

If this problem is a real concern, sprinkler protection at the bottom of the hoistway should be provided for all elevator hoistways, regardless of whether the building is protected with sprinklers.

ELEVATOR HOISTWAYS

In addition to a sprinkler at the bottom of the shaft, NFPA 13 also requires a sprinkler at the top of the shaft. The effectiveness of this sprinkler has

been questioned based on the height of the shaft and the obstruction of the sprinkler discharge by the elevator car. The sprinkler does, however, have a role in reducing the effect of the accumulation of heated gases at the top of the shaft. The sprinkler will activate and provide a cooling effect when superheated gases accumulate at the top of the shaft.

This being the case, it would appear as if there are two potential solutions. First, a pre-action sprinkler system could be installed such that elevator recall and power disconnect would occur prior to sprinkler discharge. The use of an intermediate temperature sprinkler may be advisable to insure that the heat detector activates with sufficient time to recall the elevators. In this instance, elevators would not necessarily need to recall to the designated level for Phase I operation. While this would be desirable for fire service observation of the elevator car, it is more important to insure that the people are able to escape from the car. With respect to the fire service concerns, it should be noted that Phase II operation should not be permitted and that the location of the elevators in high-rise buildings is usually annunciated. The activation of the heat detector should also activate the building fire alarm system so that the occupants of the elevator car are aware of the fire emergency in the building.

The second alternative would be to provide emergency venting to prevent the accumulation of heated gases. While elevator hoistway pressurization is more desirable for emergency use and smoke management, if sufficient heat accumulates at the top of the shaft, the pressurization is not working and venting becomes necessary. Therefore, the emergency venting should be provided even if hoistway pressurization is provided. If adequate venting can be provided, sprinkler protection at the top of the shaft would be of minimal benefit except to suppress an elevator car fire.

If the concerns relative to fire spread in the shaft are real concerns, then sprinkler protection or emergency venting should be provided in all elevator hoistways.

ELEVATOR MACHINE ROOMS

Sprinkler protection in elevator machine rooms may be provided to address the following concerns: structural integrity, fire containment, maintaining tenable egress facilities and ease of suppression. It must be recognized that the installation of automatic sprinklers results in modifications to many building code requirements for fire resistance ratings. Therefore, the omission of sprinklers from a portion of the building may compromise the overall protection of the building. With this in mind, it would be reasonable to allow the omission of sprinklers from rooms used solely for elevator equipment provided such rooms are enclosed with construction having a fire resistance rating, are protected with automatic detection to initiate the building fire alarm system, are located no more than 75 feet above the level of the fire department access, and the room does not open into an exit stairway.

When the above conditions do not apply, a pre-action sprinkler system, with the permitted used of intermediate temperature sprinklers, should be installed. It should be noted that watertight enclosures of the elevator equipment could be provided thereby allowing the use of a wet-pipe sprinkler system. Sprinklers have been used for many years to protect areas with electrical equipment and therefore can be used in elevator machine rooms with the appropriate precautions. Sprinkler protection in elevator machine rooms should only be required if sprinkler protection is provided throughout the building.

OTHER ISSUES

The concerns relative to sprinklers in elevator hoistways and machine rooms are compounded by the existing provisions for emergency operation of elevators. The following recommendations should be considered.

(1) Traditional Phase I and Phase II emergency operation should be initiated by activation of the building fire alarm system by a reliable means. This will minimize the possibility that building occupants will become trapped in an elevator or exposed to the hazards discussed above.

(2) Traditional means to initiate Phase I recall should not allow Phase II operation. If the problem involves the elevator machine room or hoistway, even trained emergency personnel should not used the elevator. Phase II operation should only be permitted when elevator lobby detectors activate if a fire exposure to the call button will not compromise the reliability of Phase II operation.

If the above two recommendations are implemented, the installation of sprinklers in elevator machine rooms and hoistways will not pose the same hazard as currently identified by the elevator industry.

SUMMARY

The first step in resolving the conflict is to develop a better definition of the problem. For example, if fires involving rubbish at the bottom of the elevator hoistway is a problem which needs to be addressed, then the problem must resolved in both buildings with and without sprinkler protection. If it is not a real problem, why single out sprinklered buildings as requiring sprinklers at the bottom of the shaft provided the shaft enclosure requirements are not modified due to sprinkler protection in the building?

Likewise, if fire spread via the elevator hoistway is a problem, Why single out sprinklered building? Emergency venting has been proposed as a viable alternative to a sprinklers at the top of the hoistway.

The protection of elevator machine rooms is a more complex issue since a fire in such a room results in a fire risk similar to any room. Therefore, either protection features to prevent ignition and contain the fire must be implemented or sprinkler protection provided.

Once the problem has been qualified, if sprinkler protection is required or desired as a solution, proper design will result in safe elevator operations. In some instances, shielding of equipment or improved equipment enclosure may result in an acceptable level of protection without requiring the additional costs (initial and life-cycle) associated with pre-action sprinkler systems versus wet-pipe sprinkler systems.

NOTES

1 Donoghue, Edward. "Elevators & Sprinklers," *The Building Official and Code Administrator*, November/December, 1989, p. 26.

2 NFPA 13, *Standard for the Installation of Sprinkler Systems*, 1989.

3 ASME/ANSI A17.1, *Safety Code for Elevators and Escalators*, 1987.

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