ELEVATORS AND SPRINKLERS

By Edward A. Donoghue, CPCA

HISTORY

A controversial issue of late has been the installation of sprinklers in elevator machine rooms and hoistways. Sprinklers in elevator machine rooms and hoistways have been recognized by the Safety Code for Elevators and Escalators, ASME A17.1 since the 1955 edition. Until recently they were not normally found in these areas. In the last ten years, building codes began to recognize sprinklers as one of the most effective means of controlling fires in buildings. The building codes at first did not require buildings to be sprinklered but encouraged their use by allowing "tradeoffs," which reduced the cost of construction by relaxing code requirements such as fire resistance ratings, distances to exits, area and height limitations, in exchange for full sprinkler protection. The theory being the cost of construction would be comparable for a fully sprinklered building vs. a non-sprinklered building and the level of fire protection would be equal. The payoff for a fully sprinklered building would be in a reduced premium for fire insurance throughout the life of the building, thus lowering operating cost. This has worked and today it is common for new buildings to be fully sprinklered. In the last few years, the building codes have gone one step further requiring fully sprinklered buildings for certain types of occupancies, such as high-rise office building, hotels and multiple-family dwellings.

In the early 1980's, the ASME A17 Safety Code for Elevators and Escalators Committee became aware of this trend and initiated a study of the hazards of water being discharged on elevator equipment. The possible effects of water on brakes, shorting of a safety circuit, motor, generator, or transformer, with the resulting hazards to people on the elevator is well known in the elevator industry. Some of the reported hazards include cars operating with car and/or hoistway doors opened, loss of brakes and loss of traction. One well documented accident was from a leak in a sprinkler system, which resulted in the elevator brake becoming wet. The wet brake could not stop the up traveling elevator. The result was an out of control up running elevator, which collided with the machine room floor at the top of the hoistway at a very high rate of speed. Luckily, there were no passengers on the elevator car though the building structure and elevator system sustained extensive damage. There are numerous cases of elevators leaving a floor with the doors open which have been traced back to wet interlocks and control circuits. We need only look at a recent fire in a Chicago skyscraper during which two firemen, groping their way through a darkened smoke filled hallway, fell through an open hoistway door. The ASME A17 Committee could not close its eyes and blindly prohibit sprinklers in elevator machine rooms and hoistways. In the real world if a building code or fire code required sprinklers in all areas of the building, that code would be enforced, regardless of any contrary requirement that would be in the elevator code. At one time the ASME A17 Committee did approach the building and fire code community with a proposal that sprinklers not be required in elevator spaces in fully sprinkled buildings because of the potential hazards to elevator users. This was rejected.

The ASME A17 Committee was aware of its responsibility to ensure that the safety of the elevator user is taken into account when sprinklers are installed in areas with elevator equipment. In early 1982 I, at the request of the ASME A17 Hoistway Committee, made contact with the National Fire Sprinkler Association (NFSA) then known as the National Automatic Sprinkler and Fire Control Association Inc., a trade association for the sprinkler industry. After reviewing the potential hazards they made three recommendations to the ASME A17 Committee.

The ASME A17 Hoistway Subcommittee reviewed the NFSA recommendations and felt that one recommendation, for shield and raintight covers, was impractical. Even if complied with at the time of installation, shields and raintight covers would, over a period of time, be removed or become ineffective, thus permitting the equipment to become wet from a discharged sprinkler. Verification testing is the cornerstone of elevator safety assurance; but a waterproof elevator cannot be operationally tested under the real conditions for which it is intended. Another recommendation, for a carbon dioxide or halon system after further discussion with NFSA, was also discarded as its ability to provide the required level of protection was questionable. Non-water automatic fire suppression systems such as carbon dioxide or halon must be used in areas with minimal air movement. Air movement resulting from the stack effect in the hoistway would make these systems impractical and ineffective. NFSA third recommendation to disconnect the main line power to the elevator before sprinkler activation, was acceptable, was reworded in performance language, balloted, approved by the ASME A17 Main Committee and published as Rule 102.2(c)(4) in ANSI/ASME A17.1-1984.

ELEVATOR OPERATION IN A FIRE

If a fire developed in an elevator machine room or hoistway the sequence of events would most likely follow this scenario:

(1) Smoke in the elevator machine room or hoistway during the initial stage of the fire will activate the smoke detector required by ASME Rule 211.3b, recalling all elevators to the designated level on firefighters' Phase I Service.

(2) As the intensity of the fire builds, the sprinkler system would be activated and the power to the elevator driving machine would be interrupted.

It should also be pointed out that the Committee gave serious consideration to the possibility of a car stopping with passengers or even firefighters between floors. All types of recommendations were reviewed. Most proposals were along the lines of requiring a heat detector in the elevator machine room or hoistway to activate Phase I recall, and when completed then removing power and allowing sprinkler activation. In Committee deliberations, we came to the conclusion that if there was sufficient heat to activate the sprinkler, a fire was in progress and there was no way of assuring control of the elevator except by disconnecting the main line power supply. A fire in the hoistway or machine room would in all probability involve elevator equipment as this is the only equipment allowed in these spaces. The ASME A17 Committee also felt that requirements to delay sprinkler activation was not within its' scope. Additionally if the temperature is sufficient to activate a sprinkler, solid state elevator control systems cannot be relied on to continue to function as intended. Most modern elevator control systems cannot be relied on to operate as intended in temperatures above 100°F. Other papers presented at this symposium will address that issue in detail.

SYSTEM DESIGNS

Since the publication of ASME A17.1 Rule 102.2(c)(4) many questions have been raised about what type of system could be installed which would meet the intent of this requirement. The following are three methods; the first reportedly the most economical.

- Rate-of-rise/fixed-temperature heat detectors, in the elevator machine room and/or hoistway, would be arranged to automatically disconnect the main line power supply. These detectors would be placed near each sprinkler and the sprinkler rating would exceed the heat detector ratings. The detectors would be independent of the sprinkler system. In a fire the heat detector would trip first and cause a shunt trip circuit breaker to disconnect the main line power to the affected elevators before the application of water. This method was first proposed by a joint task force of NFPA and ASME A17. The ASME A17 Main Committee approved Inquiry 86-56, which stated that this design met the intent of the Code.
- The sprinkler system in the elevator machine room and the hoistway would be a pre-action system. A pre-action sprinkler system is a system employing automatic sprinklers attached to a piping system containing air that may or may not be under pressure, with a supplemental fire detection system installed in the same areas as the sprinklers. Actuation of a heat detector from a fire opens a valve which permits water to flow into the sprinkler piping system and to be discharged from any sprinkler head which may be open. The heat detector or flow valve in the sprinkler piping would cause a shunt trip circuit breaker to disconnect the main line power to the affected elevators at the time the valve opens to allow water flow into the sprinkler piping. The sprinkler system in the elevator machine room or hoistway should not be activated by a smoke detector, as this would shut the elevator down prematurely. A requirement in ASME A17.1 Rule 102.2(c)(5) prohibits sprinkler activation in elevator machine rooms and hoistways by smoke detectors for this very reason. If smoke

detector activation of sprinklers was permitted there would be no chance for Phase I recall as described earlier in the scenario of events during a fire in elevator spaces.

• The sprinkler system in the machine room or hoistway would be a dry pipe system. A dry pipe valve would be installed in the sprinkler piping where it enters the elevator machine room or hoistway. The pipe would contain air or nitrogen under pressure from the sprinkler head to the dry pipe valve and water to the opposite side of the dry pipe valve. The heat from a fire would open the sprinkler head allowing the air to escape and water to flow into the system. The dry pipe valve would open and cause a shunt trip circuit breaker to disconnect the main line power to the affected elevators. Water flow would have to be timed such that the elevator would be stopped before water was discharged from the sprinkler head.

ASME A17.1 AND NFPA NO. 70

A question that has also been raised is whether there is a discrepancy between the requirements in ASME A17.1 Rule 102.2(c)(4) and NFPA No. 70 Section 620-51(a) which states in part "....nor shall circuit breakers be opened automatically by a fire alarm system." It is the opinion of the A17 Committee that there is no discrepancy as a sprinkler system is not a fire alarm system; it is a fire suppression system. I do not believe it ever was the intent of NFPA No. 70 to prohibit elevator operation when a condition hazardous to life and limb exist.

THE FUTURE

The fire protection community and elevator industry must balance fire protection and the life safety of elevator users. A "fine line" must be drawn to balance two equally important life safety concerns. We must work together as neither concern outweighs the other and neither side has all the answers. Where do we go from here? I offer the following proposals for consideration:

Elevator Machine rooms

(1) All elevator equipment should be required to be in a rated fire resistive elevator machine room. No other building equipment or storage of non-elevator material should be allowed in elevator machine rooms. This will limit the fire loading.

(2) Elevator machine rooms above the roof should not be required to be sprinklered. The fire loading in this machine room would be controlled and any fire in same would not effect the remainder of the building.

Hoistways

(1) Modern elevator equipment does not present a serious potential for fires in hoistways. The hoistway is clean and free of grease and oil which was frequently found with older equipment. The car enclosure material is regulated by ASME A17.1 and presents minimal fire loading.

(2) The only location where a moderate potential exist for a fire is the pit, where trash may accumulate. Sprinklers in hoistways should be provided in this location only. The sprinkler discharge should be such that it will not spray the underside of the car platform. If this was the only sprinkler head in the hoistway the automatic disconnect of main line power could be eliminated if all pit electrical equipment, wiring, limits, etc. were waterproof.

If the above provisions were enacted the automatic disconnecting of electric power from elevators would not be required on the majority of elevators which are need for fire fighting in high-rise buildings. Yet, the area's needing sprinkler protection would be maintained.

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