Hot Spots

A Fire Protection Newsletter

April 2006

GBA GEORGE BUTLER ASSOCIATES, INC.

Active Smoke Control Systems

Passive smoke control systems were discussed in the last issue of "Hot Spots". This issue will highlight the features and issues associated with active smoke control systems.

Active smoke control systems seek to limit smoke concentrations to tenable levels for a period of time long enough to allow safe egress and require interaction between multiple building systems. Due to the complexity, these systems have multiple points of possible failure, and require specific testing and maintenance for reliable operation. Active smoke control systems fall into three major categories.

Pressurization systems maintain a positive pressure within the smoke zone during a fire event to keep smoke from migrating into the zone. System components are typically fans, dampers and smoke doors, and emergency power systems operating in tandem with the fire alarm and detection system. The classic example is a stairwell pressurization system. Once a fire is detected in the building, fans operate to pump fresh air into the stairwell and maintain a positive pressure in the zone, while fire/smoke doors and fire/smoke dampers close to prevent smoke from entering the stairwell.

Smoke evacuation systems seek to eject smoke from the zone of origin and may also seek to keep smoke from entering other zones. Again, system components are typically fans, dampers and smoke doors, and emergency power systems operating in tandem with the fire alarm and detection system. The classic example would be an atrium. Once a fire is detected, fans and dampers actuate to isolate the atrium, evacuate smoke from the atrium, and supply fresh air to the atrium.

Hybrid systems combine elements of both, and are generally the most complicated. The classic example would be a high rise. In the event of fire detection, building HVAC systems may be utilized to maintain a negative pressure on the floor of origin by exhausting smoke from this floor to the outside. At the same time, the building HVAC systems maintain a positive pressure on the floors directly above and below the floor of origin to inhibit the migration of smoke into these areas.

Smoke control systems are required in areas not limited to, but including the following:

- Stages (NFPA 101, 2001, Section 13.4.5.5)
- Certain Underground Structures (NFPA 101, 2001, Section 11.7.4.4)
- High Rise Structures (IBC, 2003, Section 403.13)
- Atriums (IBC, 2003, Section 404.4)
- Certain Warehousing (IFC, 2003, Chapter 23)

The biggest issue with active smoke control systems is that they are complex systems, requiring interface between multiple building systems (fire alarm, HVAC, electrical). The more complex the system, the more likely systems may fail to communicate to each other correctly or that components will not operate as intended. Because of this, **there are strict requirements for acceptance and periodic testing, maintaining and commissioning smoke control systems**. These requirements are outlined in:

- NFPA 101, Section 9.3.1
- IBC, Section 909.18 and 909.19
- NFPA 92A(2000), Chapter 5
- NFPA 92B (2005), Chapter 8

Our own experience with commissioning these systems shows that it is common for 10-15% of critical components such as dampers and smoke doors to fail to operate. Usually, the failure to operate can be traced to mechanical problems with devices (improperly adjusted actuators, improper hardware on doors, etc.) and programming problems. Proper commissioning and maintenance of the systems identifies problems so they can be corrected.

GBA Fire Protection Contact:
David Lewis, P.E., FPE 913.577.8814
GBA Homepage: www.gbutler.com