

Highrise Building Smoke Removal Standard

Background

The City of Sacramento requires a mechanical smoke removal system for all new high rise buildings built in the city. Smoke removal is accomplished by the entrance of air at high volumes into the space, or spaces via the HVAC system (supply registers) and removed from the building through the air plenum above the ceiling via the return fan(s) and associated exhaust shaft. It is commonly combined with the building's main HVAC system to reduce the cost of engineering two separate systems for the building; one being the heat and air conditioning system, and the other being specifically for the smoke removal system.

The system may consist of fans installed in different areas throughout the building and interconnected by a common air shaft, one for the supply air and one for the return, or exhaust air. Another method is to provide a separate supply and return fan on each floor, serving only that floor. The requirement for the smoke removal system is to provide a tenable atmosphere for the tenants during a fire or other emergency and to remove and reduce the amount of smoke generated by the fire. It is also meant to prevent the spread of smoke throughout the remainder of the building. Controls are required for firefighters so that they can override the fans and/or dampers if the system is producing a negative environment for the tenants, or is exacerbating the fire.

The smoke is manipulated by creating a neutral pressure on the fire floor (6 air changes per hour) and creating a positive pressure (100% in and 0% out) on the floor above and below the fire floor by introducing supply air directly from the exterior and closing all exhaust dampers so that no air can leave the floor. The idea is to create an environment that will contain the smoke to a floor or area by creating a higher pressure above and below the fire floor so that smoke cannot migrate from floor to floor, and remove the smoke from the fire floor.

Once the smoke removal system has started, it will provide a minimum of 6 complete air changes per hour for the entire floor area. That equates to one complete air change every 10 minutes for the entire floor (in cubic feet). The theory is to be able to see clearly see any exit sign on the floor within 10 minutes of the start of the smoke removal process

Testing

Call fire dispatch prior to testing and advise them of the smoke test and that smoke will be exiting the building.

1. All initiating devices need to be tested to ensure they are working properly and reporting to the fire alarm panel as required.
2. The fire alarm panel needs to be free of any trouble or supervisory problems (*exception to the components associated with the test).
3. All smoke control switches are to be in the automatic position.
4. When the system is verified to be in proper working order, the smoke detection for the floor being tested will need to be temporarily disabled so that smoke can be introduced on to the floor. (If the smoke detection is not disabled prior to the introduction of smoke the smoke removal system will activate prematurely and not give the proper testing results.
5. While the smoke is being introduced onto the floor, check surrounding areas, corridors and the floors above and below for smoke migration. There may well be smoke entering other areas because the system has been temporarily disabled. This is not necessarily a failure, only an indication that the equipment installed has been disabled (and normally prevent or limit the spread of smoke) and allowing the some to migrate.
6. Corridors should be free of any smoke entering, as it is smoke/fire rated, although there may be some smoke dampers temporarily disabled through the alarm panel. If this is the case and the migration is not from another source such as a hole in the wall, request that the dampers be manually closed from the smoke control panel in the fire control room.
7. Once the floor or area has sufficiently filled with smoke, you should not be able to see any further than 8-10 feet in front of you in any direction. *If you over saturate the area with smoke, you will not be providing a reasonable representation of the smoke generated from a fire and the system will not be able to provide the necessary results.
8. Have the fire alarm representative place all of the initiating devices back in to “normal” and allow the smoke detection to initiate an alarm and start the smoke removal system.
9. Once the system has begun operation, you should hear an increase in air flow in the area. It may not be a dramatic change, but you will be able to see the smoke movement especially near any return or supply register.
10. Begin the 10 minute timing once the system has started.
11. During the testing, check all adjoining areas to ensure smoke is not migrating or being introduced in to other areas of the building. Check to see that all stair pressurization fans have started, and request from the fire control room the status of the fire alarm and the status of the fans/dampers for the smoke removal system.

12. At the end of the 10 minutes, the area should be very close to free of smoke and any exit sign should be clearly visible from ANY point on the area/floor. (Again, there may be a haze and residual smoke, but remember we are trying to verify the amount of air being removed as designed. The smoke allows us to “visibly” see the volume being removed. It also allows us to see if any smoke has migrated to other areas).

13. If the system has successfully removed the smoke as designed, the test has passed. Allow the system to remain in operation to remove all the smoke from the building. Ensure that all systems are placed back in to “normal” service.