Understanding the Risk

A high-volume low-speed (HVLS) fan is a type of mechanical fan used in commercial and industrial premises. HVLS fans are generally ceiling fans although some come as pole mounted fans. Unlike residential ceiling fans that are typically 36- to 52-inches (91 to 132 cm) in diameter, HVLS fans have very large diameters that start at 8 feet (2.4 m) and go up to 24 feet (7.3 m). Unlike standard high-speed fans, HVLS fans move very slowly. With very low rotational speed, HVLS fans move large amounts of air – hence the name, high volume, low speed.

HVLS ceiling fans can be found in warehouses, distribution centers, shopping malls, skating rinks and health clubs to name a few. Due to the rising costs of energy, HVLS fans are often used to supplement HVAC systems as they provide a stronger cooling effect while helping to maintain a constant temperature and humidity.

An HVLS fan has two requirements in order to be labeled as such:

1. The volume of air passing through the fan in one single revolution must be no less than 500 cubic feet. (14.2 cubic meter)
2. The tip speed of the fan’s blades must not be greater than 60 miles per hour (96.5 kilometer per hour).

How the HVLS Fans Work

HVLS fans work on the principle that a breeze moving across your skin on a very hot day feels good. The cool moving air breaks up the moisture-saturated boundary layer (also known as perspiration) surrounding the body and accelerates evaporation to produce a cooling effect.

No matter their size, ceiling fans produce a column of air as they turn. This column of air moves down and out along the floor. Called a horizontal floor jet, this deep wall of horizontal moving air is relative to the diameter of a fan, and to a lesser degree, the speed of a fan. Once the floor jet reaches its potential, it migrates outward until it meets a side wall or other vertical surface.

Under ideal conditions, an 8 foot (2.4 m) fan produces a floor jet of air approximately 36 inches (91 cm) deep. A 24 foot (7.3 m) fan produces a floor jet 108 inches (274 cm) deep, tall enough to engulf a human standing on the floor.

Air Flow of Typical HVLS Fan

This air flow effect can cause problems when it comes to fire protection and automatic sprinkler operation. The downward air-flow can delay the operation of sprinklers by not allowing the heat from a fire to rise through the air flow and operate the sprinkler heads in the required area over the seat of the fire. The fan itself can also create obstructions to the sprinkler water spray pattern. Both of these factors can have a negative impact on sprinkler operation and effective fire suppression.

Typical HVLS Fan in warehouse occupancy

Installation Requirements

Based on the findings through numerous large scale tests using both standard spray sprinklers and Early Suppression Fast Response (ESFR) sprinklers it was determined that the HVLS fans do have a negative impact on the effective operation of sprinkler systems. Consequently, the installation of HVLS fans in buildings equipped with sprinklers, including ESFR sprinklers, shall comply with the following:
1. The maximum fan diameter shall be 24 feet (7.3 m).
2. The HVLS fan shall be centered approximately between four adjacent sprinklers.
3. The vertical clearance from the HVLS fan to sprinkler deflector shall be a minimum of 3 feet (0.9 m).
4. At a minimum all HVLS fans shall be interlocked to shut down immediately upon receiving a waterflow signal from the automatic fire sprinkler system in accordance with the requirements of NFPA 72. Ideally, the fans should be interlocked to a fire alarm device such as a smoke or heat detector in addition to the waterflow device. A fire alarm device will likely respond much soon than the waterflow signal. This will help ensure that the fan is shut down immediately. Connection to multiple devices will also improve reliability of fan shut down.

Standards
The references are:
NFPA 13, Standard for Installation of Sprinkler Systems
NFPA 72, National Fire Alarm and Signaling Code

Additional Resources
For further information, contact your local GLP AIG Risk Engineer