Warehouse fires have proven to be a great challenge for automatic fire sprinkler systems, due to the high density of combustible materials and significant storage heights.

Sprinkler system designs are based on specific details regarding the type of commodity being stored, the method of storage (rack or floor), storage height, configuration of the loads, packaging types and materials, ceiling height and others. Because each system is designed for a specific storage arrangement, changing any aspect of the storage may alter the effectiveness of the automatic fire sprinkler system. The following storage practices can severely impact the effectiveness of your fire protection.

**Vertical Clearance**
Sprinkler performance is dependent on several factors, but one of the most critical factors is the water spray pattern. Obstructions that prevent a proper water spray pattern are the leading cause of sprinkler system ineffectiveness. In order for the proper spray pattern to develop, sufficient vertical clearance must be maintained between the sprinkler deflector and the highest storage. The minimum vertical clearance for standard spray sprinklers is 18 inches, and 36 inches for Early Suppression Fast Response (ESFR) sprinklers.

**Rack Storage**
Flue spaces—Maintaining flue spaces in rack storage arrangements allows for sprinkler water from the ceiling sprinkler system to penetrate the rack system and reach fires imbedded below. Both longitudinal and transverse flue spaces should be maintained at no less than 6 inches.

**Solid shelving**—Solid shelving should be avoided whenever possible in a rack storage system. Solid shelving, or slats occupying 50 percent or more of the surface of the unit rack shelf area, should be replaced with an open shelf system, limited slats or expanded metal shelving. This will allow sprinkler water to penetrate the rack system and reach fires imbedded below. If solid shelving is necessary, properly designed and located “in-rack” sprinklers may be necessary.
Inside Idle Wood Pallet Storage
Idle pallets can be at the root of some of the most challenging fires to control. Typical pallets consist of dry wood, considerable air spaces and a large area of shielded combustible surfaces. NFPA® has developed guidelines for the inside storage of idle pallets. Pallet stacks should be limited to 6 feet in height. A maximum of four stacks should be grouped together, and each group should be separated from other groups by 8 feet or from other commodities by 25 feet clear space. For idle pallet storage above these guidelines, sprinkler systems must be specifically designed. Idle pallets should never be placed in storage racks.

Encapsulation
Encapsulation is a packaging method where a pallet load of combustible material is plastic-wrapped on all four sides and top. Encapsulation can contribute to increased rate of fire growth because the plastic inhibits the “pre-wetting” process. Pre-wetting occurs when sprinkler water contacts the commodity adjacent to the fire. This process slows fire growth because water-soaked commodities must absorb more thermal energy prior to ignition. If possible, plastic should not cover the top of the pallet load. If encapsulation is necessary, the fire sprinkler system should be specifically designed for this type of storage.

If there is any question as to the adequacy of your fire sprinkler system or designing a new system, contact EMC’s Risk Improvement Department for assistance.

For Additional Information
National Fire Protection Association: www.nfpa.org
  • NFPA 13® – Installation of Sprinkler Systems
U.S. Fire Administration: www.usfa.dhs.gov
  • Coffee break downloads
Canadian Centre for Occupational Safety & Health: www.ccohs.ca
EMC Insurance Companies: www.emcins.com
  • Tech Sheets