

The Plastic Pallet And Fire Protection

Abstract

This paper attempts to identify some of the specifics of the process used to obtain approval for use of plastic pallets as equivalent to wood pallets for use in warehouse storage. This paper is written to look at the issue in general and is not intended to cover all storage situations. Your specific situation should be evaluated by a fire protection specialist.

Identifying the Issue

Most plastic pallets are molded out of polyolefin materials such as high density polyethylene or polypropylene. These materials are more flammable than the wood used to make pallets. Over the years the industry has argued with the fire protection establishment that plastic pallets, while they burn hotter than wood, are much more difficult to ignite. Fire protection people counter with the fact that most warehouse fires are arson and if an arsonist wants to start a fire they will do what ever they need to do to get a fire started.

Eventually the plastic pallet industry and the fire protection establishment came to some general agreements. The National Fire Protection Agency, NFPA, took the many documents that in any way referred to plastic pallets and included them in one document. This document, NFPA13, "Installation of Sprinkler Systems" identifies what warehouse owners need to do when using pallets, both wood and plastic, for storage in warehouses.

In general plastic pallets can be used in warehouse storage the same as wood pallets depending on certain situations.

Warehouses built since the mid-1990 are required to have sprinklers designated as K-17 or higher. Testing done to approve the K-17 sprinkler was done using plastic pallets because it was determined that plastic pallets afforded the most severe challenge for sprinklers to control. Since the K-17 sprinkler tested and approved for protection in a plastic pallet fire, it followed that plastic pallets could be used in warehouses with K-17 or higher sprinkler protection.

Warehouses built before the mid-1990's can be addressed in several different ways. One way is to upgrade the sprinkler system to present code. This can be done in some cases by simply replacing existing sprinkler heads with K-17 sprinkler heads as long as there is sufficient water volume and pressure, as described in NFPA 13.

In other cases the entire sprinkler system might need to be replaced. This is very expensive and in most cases impracticable. NFPA 13 addresses these cases by providing options in how the plastic pallets are handled and stored.

The following is taken from NFPA 13, 2007 edition for “Storage of idle plastic pallets” pages 13-121, 13-122 and 13-123.

“Plastic pallets shall be permitted to be stored in the following manners:

1. Plastic pallets shall be permitted to be stored outside.
2. Plastic pallets shall be permitted to be stored in a detached structure.
3. Plastic pallets shall be permitted to be stored indoors where arranged and protected in accordance with the requirements of indoor storage.
4. Indoor storage of plastic pallets shall be permitted to be protected in accordance with the following arrangements:
 - a. Maximum storage height of 10 ft.
 - b. Maximum ceiling height of 30 ft.
 - c. Sprinkler density 0.6 gpm/sq. ft. over 2000 sq. ft.
 - d. Minimum sprinkler K-factor of 16.8
5. Indoor storage of non-wood pallets having a demonstrated fire hazard that is equal to or less than idle wood pallets and is listed for such equivalency shall be permitted.
6. When specific test data is available, the data shall take precedence in determining the required protection of idle plastic pallets.

Plastic pallets where stored indoors shall be protected as follows:

1. Where stored in cutoff rooms the following shall apply:
 - a. The cutoff rooms shall have at least one exterior wall.
 - b. The plastic pallet storage shall be separated from the remainder of the building by 3 hour-rated fire walls.
 - c. Sprinkler protection by one of the following:
 - i. The storage shall be protected by sprinklers designed to deliver 0.6 gpm/sq.ft. for the entire room or by high-expansion foam and sprinklers with a density no less than 0.15 gpm/sq.ft.
 - ii. K-14 ESFR upright sprinklers when the storage is on the floor and the system is designed to supply all sprinklers in the room at 50 psi or a maximum of 30 ft. ceiling or 75 psi for a maximum 35 ft. ceiling.
 - d. The storage shall be piled no higher than 12 ft.
 - e. Any steel columns shall be protected by 1-hour fire-proofing or a sidewall sprinkler directed to on side of the column at the top or at the 15 ft. level, whichever is lower. Flow from these sprinklers shall be permitted to be omitted from the sprinkler system demand for hydraulic calculations.

2. Where stored without cutoffs from other storage the following shall apply:
 - a. Plastic pallet storage shall be piled no higher than 4 ft.
 - b. Sprinkler protection shall employ high temperature rated sprinklers.
 - c. Each pallet pile of no more than two stacks shall be separated from other pallet piles by at least 8 ft. of clear space or 25 ft. of stored commodity.”

In most cases when plastic pallets are substituted for wood pallets, the commodity stored on the pallet suffers a one class higher penalty. In other words, if one were storing a class II commodity, say bags of flour or sugar, the sprinkler protection required would have to be sufficient to protect a class III commodity.

In a lot of cases this would not be a problem. However, in cases where the stored product is a Class III commodity the jump to a class IV commodity requirement can prohibit the use of plastic pallets. The reason for this is that the increase in required sprinkler protection from classes is not equal. From Class I to Class II to Class III can be relatively easy to address. Going from Class III to Class IV is a very large jump.

In this case, as well as all cases, NFPA 13 allows for testing of plastic pallets and using the results from this testing to compare to known test results from commodity tests conducted with wood pallets. In other words, if the results from burning plastic pallets are equal to or better than results from burning wood pallets, they can be protected by the same sprinkler scheme as approved for wood pallets.

The following is taken from NFPA 13, 2007 edition for “Pallet Types” page 13-25.

“Pallet Types”:

1. When loads are palletized, the use of wooden or metal pallets shall be assumed in the classification of commodities.
2. For Class I through Class IV, when unreinforced polypropylene or high density polyethylene plastic pallets are used, the classification of the commodity unit shall be increased one class.
3. For Class I through Class IV, when reinforced polypropylene or high density polyethylene plastic pallets are used, the classification of the commodity unit shall be increased two classes. Reinforced polypropylene or reinforced high density polyethylene plastic pallets shall be marked with molded symbol to indicate that the pallet is reinforced.
4. For Class I through Class IV when other than polypropylene or high density polyethylene plastic pallets are used, the classification of the commodity unit shall be determined by specific testing conducted by a national testing laboratory or shall be increased two classes.

5. No increase in the commodity classification shall be required for Group A plastic commodities stored on plastic pallets.
6. For ceiling only sprinkler protection, the requirements of 2 and 3 shall not apply where plastic pallets are used and where the sprinkler system uses spray sprinklers with a K-factor of 16.8.
7. The requirements of 2 through 4 shall not apply to nonwood pallets that have demonstrated a fire hazard that is equal to or less than wood pallets and are listed as such.”

The Approval Process

There are a number of testing facilities that can do the burn tests. However, only two companies actually have documented approval processes. These laboratories are Factory Mutual Approvals in Norwood, MA. and Underwriters Laboratories in Chicago, IL.

Factory Mutual’s test is ANSI/FM4996 and involves testing idle plastic pallets as equivalent to wood pallets.

The fire test hazard classification used in this standard consists of monitoring several performance criteria during actual fire test conditions. The values obtained during the fire tests are then compared to predetermined limits for each criterion. From this comparison, an assessment of performance can be made to determine if the pallet has met all requirements for fire hazard classification as equivalent to wood pallets. The performance criteria are:

- Number of sprinkler operations
- Maximum one minute average ceiling level gas temperature
- Maximum five minute average ceiling level gas temperature
- Maximum one minute average ceiling level steel temperature
- Maximum five minute average ceiling level steel temperature
- Extent of fire damage
- Extent of melted plastic pooling

The number of sprinkler operations is useful in determining how quickly a fire can be controlled and/or extinguished by automatic sprinkler protection.

The maximum one and five minute average ceiling level gas and steel temperatures are the energy convected upward and are responsible for the heating of exposed steel and the operation of automatic sprinklers. Some fires are intense but short lived and may give a thermal impact less severe than a fire of lower intensity but longer duration. To assess fire severity, these measurements are averaged over the most severe one and five minute intervals.

The extent of fire damage is a measure of a fire’s potential for spreading horizontally and causing damage to adjacent products.

The extent of melted plastic pooling is a measure of the potential of the fire to spread along the floor to adjacent products located across an aisle space.

In addition to the above test criteria, quality control tests shall be conducted as an aid in monitoring the quality controls exercised in the resin and pallet manufacturing process in order to characterize the materials used in the make up of the pallets. These

tests can also be used as the basis for determining the anticipated performance characteristics of any future changes in the resin formulation.

Underwriters Laboratories' test is UL2335 and involves testing in both commodity classes and idle pallet storage conditions.

While UL2335 is very similar to the Factory Mutual test there are a couple of notable differences. In UL2335 there is a series of burn tests where a simulated Class II commodity is placed on the plastic pallet to be tested and the loaded pallets are placed in a steel rack configuration. The arrangement is then set on fire. There are three separate tests that differ in that the sprinkler water flow is set at three different volumes. The heat release, gas temperatures, steel temperatures and amount of damage is then compared to know results obtained from the same tests using wood pallets.

The idle pallet part of the tests are conducted similar to Factory Mutual except the pallets are stacked 20 ft. high in three rows with two of the rows back to back and the third with an 8 ft. aisle between it and the back to back rows. Here the heat release, gas temperatures, steel temperatures and the amount of damage is then compared to know results obtained from the same test using wood pallets.

Based on known data from testing wood pallets the plastic pallet is then approved or not.

While the two tests are somewhat different, NFPA accepts test results from both laboratories in the determination of acceptability as relates to fire protection and sprinkler installations. Passing either test establishes a particular plastic pallet as equivalent to a wood pallet.

As of this date only four companies have developed pallets which are approved by either/or Underwriters Laboratories or Factory Mutual Global. One of these companies is a resin company and achieved this by using a very expensive engineered resin. The other three companies are plastic pallet manufacturers and all achieved approval by changing the resin makeup of either high density polyethylene or polypropylene. This method helps keep the individual cost of the pallets much more affordable.

For those interested in contacting these companies, you can contact Factory Mutual Global or Underwriters Laboratories and they will give you the companies contact information.