



Member of the FM Global Group



American National Standard for Classification of Pallets and Other Material Handling Products as Equivalent to Wood Pallets

ANSI/FM Approvals 4996-2019

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Foreword

NOTE: This foreword is introductory only and is not part of American National Standard/FM Approvals 4996.

This standard sets fire performance requirements for pallets and other material handling products so that they can be assigned a classification as equivalent to wood pallets in an effort to determine the demand on a sprinkler system in fire situations.

This American National Standard has been developed by the canvass method of standards development of the American National Standards Institute (ANSI). FM Approvals is an ANSI-accredited standards developing organization (SDO).

Approval of an American National Standard requires verification by ANSI that the principles of openness and due process have been followed and that a consensus of those directly and materially affected by the standard has been achieved. Consensus requires that all views and objections be considered, and that a concerted effort be made toward their resolution. Consensus is established when, in the judgment of the ANSI Board of Standards Review, substantial agreement has been reached.

The American National Standards Institute does not develop standards nor will it in any circumstances give an interpretation of any American National Standard. Requests for interpretations of this test standard should be addressed to FM Approvals.

ANSI regulations require that this American National Standard shall be revised, reaffirmed or withdrawn within five years of the date of publication.

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1. INTRODUCTION

1.1 Purpose

- 1.1.1 This standard states test requirements for the classification of pallets and other material handling products as equivalent to wood pallets.

1.2 Scope

- 1.2.1 This standard sets fire performance requirements for pallets and other material handling products so that they can be assigned a classification as equivalent to wood pallets.
- 1.2.2 This standard specifically addresses pallets and other material handling products. Totes, boxes and similar products are not included in the scope of this standard.
- A. The maximum size of the pallet or other material handling products is 16 ft² (1.5 m²) and the maximum aspect ratio of length to width is 1.35. “Half” and “quarter” size pallets may be tested by testing multiple stacks of pallets provided that the test area is less than or equal to the maximum allowed area or aspect ratio. For example, a half size pallet may be equal to ½ of the preferred overall size defined in B-2.1 (40 to 24 in. (1.02 to 0.61 m)).
- 1.2.3 Sprinkler protection requirements for pallets and other material handling products that are classified as equivalent to wood pallets are not included or determined in this standard.

1.3 Basis for Requirements

- 1.3.1 The requirements of this standard are based on experience, research and testing, and/or the standards of other organizations. The advice of manufacturers, users, trade associations, and loss control specialists was also considered.

1.4 System of Units

Units of measurement used in this standard are United States (U.S.) customary units. These are followed by their arithmetic equivalents in International System (SI) units, enclosed in parentheses. The first value stated shall be regarded as the requirement. The converted equivalent value may be approximate. Appendix A lists the selected units and conversions to SI units for measures appearing in this standard. Conversion of U.S. customary units is in accordance with the American National Standards Institute (ANSI)/American Society for Testing Materials (ASTM) SI 10-02, “Standard for Use of the International System of Units (SI): The Modern Metric System.”

1.5 Applicable Documents

The following standards, test methods, and practices are referenced in this standard:

ASTM D 1929 “Standard Test Method for Ignition Properties of Plastics”

ASTM E 2058 *Standard Test Method for Measurement of Synthetic Polymer Material Flammability Using Fire Propagation Apparatus (FPA)*

1.6 Definitions

For purposes of this standard, the following terms apply:

Flash-Ignition Temperature – the lowest initial temperature of air passing around the specimen at which a sufficient amount of combustible gas is evolved to be ignited by a small external pilot flame.

Nestable Pallet – pallet whose legs fit inside of the next pallet when in an idle configuration.

Open Deck Pallet – pallet allows air flow and water flow through the pallet vertically, this does not include openings for hand holds.

Other Material Handling Product – a portable device used for material handling that is not a pallet, i.e. skid.

Pallet – portable material handling product made from double deck or single deck usually with nine independent legs or various runner configurations designed for fork lift insertion.

Self-Ignition Temperature – the lowest initial temperature of air passing around the specimen at which, in the absence of an ignition source, the self-heating properties of the specimen approach ignition, or ignition occurs of itself, as indicated by an explosion, flame, or sustained glow.

Skid Pallet or Pallet Support Board – platform or single, thick panel used as a support base for material handling.

Solid Deck Pallet – pallet does not allow airflow or water flow through the pallet vertically. A pallet may still be solid deck pallet even if it includes openings for hand holds.

2 GENERAL INFORMATION

2.1 Product Information

Pallets and other material handling components are supplied in a typical idle stack arrangement. They are usually manufactured from a mixture of plastic polymer and resin containing a fire retardant chemical. The pallets may be supplied as double deck, nestable or skid (single deck) pallets. Other designs meeting the criteria of this standard may also be considered. Other material handling components are furnished in a variety of shapes, styles and sizes.

2.2 Classification

The fire test hazard classification used in this standard has been developed by FM Approvals and consists of monitoring the fire performance of the products. From this test, an assessment of performance determines if the product has met all requirements for fire hazard classification as equivalent to wood pallets. The fire performance criterion is the minimum water application rate at which the sample is controlled.

2.3 Selection of Test Designs

Due to the relatively large number of pallet and other material handling component designs produced by each manufacturer, an attempt shall be made to “envelope” designs in order to minimize the number of tests. Similar designs shall be grouped together and the particular design that is the most critical within that envelope shall be selected. If testing is successful on the selected design, the other designs within that envelope would not require additional full scale testing. The evaluation shall be conducted as follows:

2.3.1 A manufacturer submits designs for which recognition is desired.

2.3.2 The designs shall be reviewed and separated into envelopes such as solid deck, slatted, gridded, double decked, nestable, etc. based on their geometries, surface areas, volume of material and % of voids.

2.3.3 The selected design shall be tested under a Water Application Apparatus (WAA) for fire classification as equivalent to wood pallets (see Paragraph 4.1 for details). These results are then used as a benchmark for all other designs within the envelope by this manufacturer using the same resin. All other designs within the envelope shall receive the same recognition.

2.3.4 This process shall be repeated until all envelopes have been classified or disqualified.

3 GENERAL REQUIREMENTS

3.1 Review of Documentation

During the initial investigation, the manufacturer's specifications and details shall be reviewed.

3.2 Calibration

All examinations and tests performed in evaluation to this standard shall use calibrated measuring instruments traceable and certified to acceptable national standards.

3.3 Markings

3.3.1 Each resin container shall bear the following:

3.3.1.1 Marking on the product or, if not possible due to size, on its packaging or label accompanying the product, shall include the following information:

- name and address of the manufacturer or marking traceable to the manufacturer;
- date of manufacture or code traceable to date of manufacture or lot identification;
- trade name, model number, etc., as appropriate.

3.3.1.2 The model or type identification shall correspond with the manufacturer's catalog designation. The manufacturer shall not place this model or type identification on any other product unless covered by a separate agreement.

3.3.1.3 All markings shall be legible and durable.

3.3.2 Each pallet or other material handling product shall bear the following in a readily-visible location:

3.3.2.1 Marking on the product shall include the following information:

- name and address of the manufacturer or marking traceable to the manufacturer;
- date of manufacture or code traceable to date of manufacture or lot identification;
- trade name, model number, etc., as appropriate.

3.3.2.2 The model or type identification shall correspond with the manufacturer's catalog designation.

3.3.2.3 All markings shall be legible and durable, including hot stamps, or inclusive in the product mold. Stickers are not acceptable.

3.4 Drawings

Detailed drawings shall be submitted for each product design. As a minimum, the drawing shall show the product name/model number, length, width, height, thickness, size and location of all cut-outs and voids, volume, weight and surface area.

3.5 Required Samples

All products submitted for testing shall be representative of production run material.

3.6 Allowable Materials

All materials used in the manufacture of pallets or other material handling products shall be identical to those originally tested. Virgin material alone or regrind material may be used in conjunction with virgin material if the regrind material is included in the samples actually tested. The composition of the regrind material shall be identifiable and limited to the maximum percentage passing all criteria.

3.7 Formulations

All pallets or other material handling products shall be manufactured with identical resins, raw materials and additives as tested.

3.8 Design Changes

Subsequent new product designs, if any, shall be evaluated based on a comparison between the new design and the benchmark data obtained for the particular design envelope, as applicable, if possible.

3.9 Formulation Changes

- 3.9.1 Formulation changes involving a single major ingredient (e.g. resin, fire retardant, colorant) of a previously tested pallet or other material handling product shall be based on a favorable comparison (+/- 10% as applicable or show improvement) of the flammability characterization of the product produced from the proposed formulation with the flammability characterization of the originally tested product. The maximum number of changes using this method is limited to 5, for additional changes fire testing will be required.
- 3.9.2 For formulation changes where flammability characterizations of the proposed formulation do not compare favorably, classification shall be based on all requirements of this standard, including full scale fire testing.

4 PERFORMANCE REQUIREMENTS

4.1 Water Application Apparatus Fire Tests

4.1.1 In order to meet the requirement of this standard for pallet or other material handling component, a minimum of one fire test shall be conducted using a 20-MW calorimeter together with a water application apparatus to determine the quantities of water needed for fire control. Fire testing shall be in accordance with Test Procedure (see Appendix B).

A. Conditions for Acceptance of the Water Application Apparatus Fire Test:

The fire must be controlled when a water application density of 0.15 gpm/ft² (5.9 mm/min) is applied. The fire is controlled if it does not grow during the 10 minute test time frame which begins when the water is applied. Therefore the rate of heat release will plateau or continually decrease until the test is terminated.

4.1.2 Extensive research has been conducted utilizing wood pallets such that their relative fire hazard and the appropriate sprinkler design requirements have been determined. As such, recognition will be extended to pallets and other material handling products containing plastic that are determined to be no more critical than wood pallets.

4.1.3 Recognition shall not be extended to products that melt or drip excessively or form excessive pools of molten plastic that can readily spread to adjoining areas. Excessive melting, dripping or pooling shall be considered to have occurred if the molten material spreads and comes in contact with three sides of the barrier defined below.

A. 12 x 12 ft (3.66m x 3.66m) barrier, fabricated from steel angles, shall be placed on the floor and centered on the 2 x 2 x 2 core of the test array. The purpose of the barrier is to provide a means of quantifying the amount of molten plastic generated.

4.2 Flammability Characterization Tests

4.2.1 Flammability characterization tests shall be conducted as an aid in monitoring the quality controls exercised in the product manufacturing process in order to characterize the materials used in the formulation of the products. In addition, these tests are used as the basis for determining the anticipated performance characteristics of future changes in the resin formulation.

4.2.2 Ignition Properties — The flash-ignition and self-ignition temperatures shall be determined in accordance with ASTM D 1929 *Standard Test Method for Ignition Properties of Plastics*.

4.2.3 Ignition Characteristics and Fire Properties — conducted using the Fire Propagation Apparatus in accordance with ASTM E 2058 *Standard Test Method for Measurement of Synthetic Polymer Material Flammability Using Fire Propagation Apparatus (FPA)*.

A. Ignition Characteristics — Based on the ignition tests, a plot of times to ignition and external heat flux values shall be created. A minimum heat flux below which ignition is not expected to occur and the thermal response parameter (TRP) are determined for the sample.

B. Fire Properties — From the combustion test, fire properties, such as chemical heat release rate, mass loss rate, generation of CO, chemical heat of combustion and optical density of smoke are measured as a function of time. The peak values shall be reported.

APPENDIX A: Units of Measurement

LENGTH:	in - "inches"; (mm - "millimeters") mm = in. × 25.4 ft - "feet"; (m- "meters") m=ft × 0.3048
AREA	in ² - "square inches"; (mm ² - "square millimeters") mm ² = in ² × 6.4516 × 10 ² ft ² - "square feet"; (m ² - "square meters") m ² =ft ² × 0.0929
HEAT:	Btu - "British thermal units"; (J - "joules") J = Btu x 1.0551 x 10 ³
HEAT RELEASE RATE:	Btu/min - "British thermal units per minute"; (kW - "kilowatts") kW = BTU/min x 0.0176
TEMPERATURE	°F - "degrees Fahrenheit"; (°C - "degrees Celsius") °C=(°F -32) × 0.556
LIQUID	gal - "gallons"; (L - "liter") L = gal × 3.785 L- "liter"; (dm ³ - "cubic decimeters") L= dm ³
FLOW RATE	gpm or gal/min - "gallon per minute"; (L/min - "liters per minute") L/min = gal/min × 3.785
DISCHARGE DENSITY	gpm/ft ² - "gallon per minute per square foot"; (L/min/m ² - "liters per minute per square meter") L/min/m ² = gpm/ft ² × 40.742

APPENDIX B: Test Procedure - Full Scale Fire Testing of Pallets and Other Material Handling Products

B-1 Introduction

This procedure is performed in an enclosed building and utilizes a test area under a 20-MW calorimeter used to monitor heat (energy) output in the test area. Measurements are made during the test by numerous pieces of data acquisition equipment used as part of the cone calorimeter equipment above the test set-up.

B-2 Test Set-up

B-2.1 The standard test set-up is as shown in Figure B-1 and consists of a two level, double row, open frame, steel rack segment located under the water application apparatus (WAA, see description below). The rack segment contains eight stacks of products placed into a 2 × 2 × 2 arrangement. Each stack of products is minimum 4 ft (1.2 m) high including a 42 x 42 x 4.38 in (1.07 x 1.07 x 0.11 m) hardwood stringer wood pallet, with an average moisture content between 4%-8% that is placed on the bottom of the stack. The exact number of products per stack is determined by dividing 48 in (1.2 m) -4.38 in (0.11 m) by the height of one product to be tested. The number of products is then rounded up to the nearest number. (Example: If the test products are 5 in. (127 mm) high, divide (48-4.38) by 5 and get 8.7 products, round up to 9 per stack for test purposes.) The preferred overall size range of each stack is 40 to 42 in. (1.02 to 1.07 m) by 40 to 48 in. (1.02 to 1.22 m); however, products of other sizes can also be considered for testing. If the dimensions of the product is less than or equal to one half of the preferred overall size range above in any one direction then two stacks of product may be used with the intention to fill the volume of 40-42 in. (1.02-1.07 m) by 40-48 in. (1.02-1.22 m) by minimum 48 in. (1.2 m) for each stack (height includes wood pallet on the bottom). Clearance from the top of the array to the WAA is approximately 8 in. (204 mm). WAA – Water Application Apparatus - consists of grid arrangement of 48 specialty spray nozzles installed on six jacketed, water-cooled steel pipes supplied by a dual header. The nozzles are in a 6x8 configuration with eight nozzles spaced on a single pipe. Pipes and nozzles are spaced 2 ft (0.6 m) apart in this configuration. WAA Nozzles have an operating pressure of 10 psi (68.95 kPa), (see Section B-2.5 for more details).

B-2.2 Ignition is provided by four standard igniters consisting of 6 × 3 in. (152 × 76 mm) cylinders of rolled cellucotton, each soaked in 8 oz. (0.24 L) of gasoline after being placed in a 12 × 12 × 3 in. (305 × 305 × 76 mm) steel pan. The pan is placed on the floor within the intersecting flues at the center of the test array at the start of the test.

B-2.3 The rack arrangement is placed on the load cell platform (shown in Figure B.1 below) centered on the floor below the inlet cone of the 20-MW calorimeter and the WAA. Eight stacks of products described above are arranged on the rack with 6 in. (0.15 m) vertical flue spacing and 8 in. (0.2 m) nozzle clearance. See Figure B.1.

B-2.4 If the products to be tested contain cellulose material, the sample is kiln dried for at least 24 hours prior to testing to a maximum moisture percentage of 8.0%.

B-2.5 The nozzles installed in the WAA have a 120° discharge cone and are positioned 8 in. (203 mm) from the top surface of the product in the test array. Use a nozzle diameter that can achieve the water density of 0.15 gpm/ft² (5.9 mm/min) and average water droplet size of 0.07 in. (1.75 mm). Connect the WAA to a water supply with a discharge pressure can be controlled.

B-2.6 A 12 × 12 ft (3.66 × 3.66 m) barrier, fabricated from steel angles, shall be placed on the floor and centered on the 2 × 2 × 2 core of the test array. The purpose of the barrier is to provide a means of quantifying the amount of molten plastic generated.

B-3 Test Procedure

B-3.1 One test is conducted with each product to be evaluated.

B-3.2 After lighting the igniters, the fire is allowed to develop naturally. Water will be applied to the test array based on a real-time computer algorithm that simulated the response of a sprinkler installed 10 ft (3 m) above the center of the test array. The simulated sprinkler has a Response Time Index (RTI) of $276 \text{ (m-s)}^{1/2}$ ($500 \text{ ft-s}^{1/2}$) and 141°C (286°F) nominal temperature rating. The test will be allowed to continue for 10 minutes after the application of water.

B-3.3 Documentation for the test includes continuous video tape and still photographs along with visual observations of test events and fire damage. Measurements are recorded on a computerized data acquisition system.

B-3.4 The performance criteria is:

The fire must be controlled when a water application density of 0.15 gpm/ft^2 (5.9 mm/min) is applied within the 10 minute test time frame. The controlled fire will not continue to grow after the 10 minute test time frame, therefore the rate of heat release will decrease.

B-4 Performance Criteria

B-4.1 If the tested product meets or exceeds the performance criteria above, the fire hazard of the tested product would be designated as “equivalent to wood.”

B-4.2 Recognition shall not be extended to products, regardless of the test results, that exhibit excessive melting, dripping, or which form excessive pools of molten plastic. Excessive melting, dripping, or pooling shall be considered to have occurred if the molten material spreads and comes in contact with three sides of the barrier described in Paragraph B-2.6.

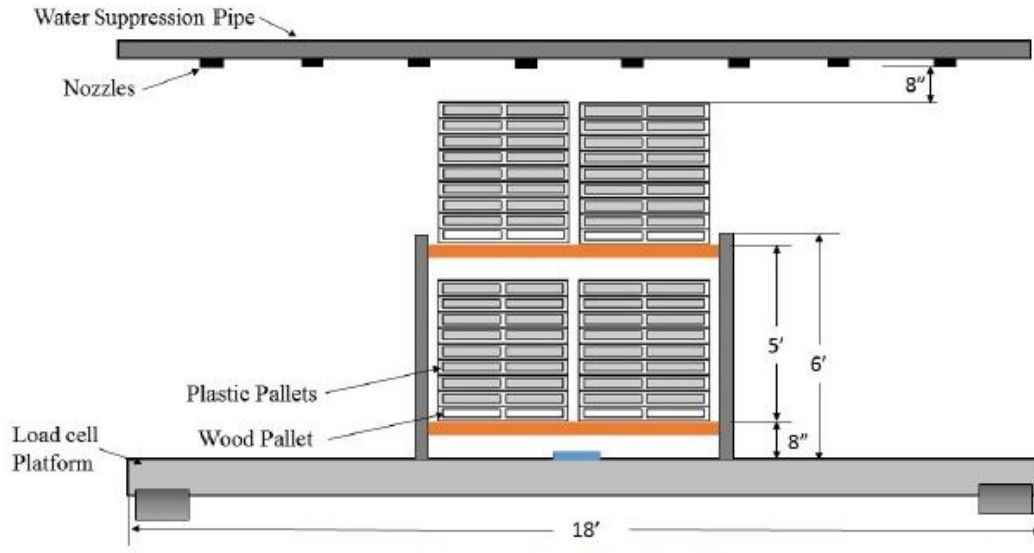


Figure 1 - Elevation View

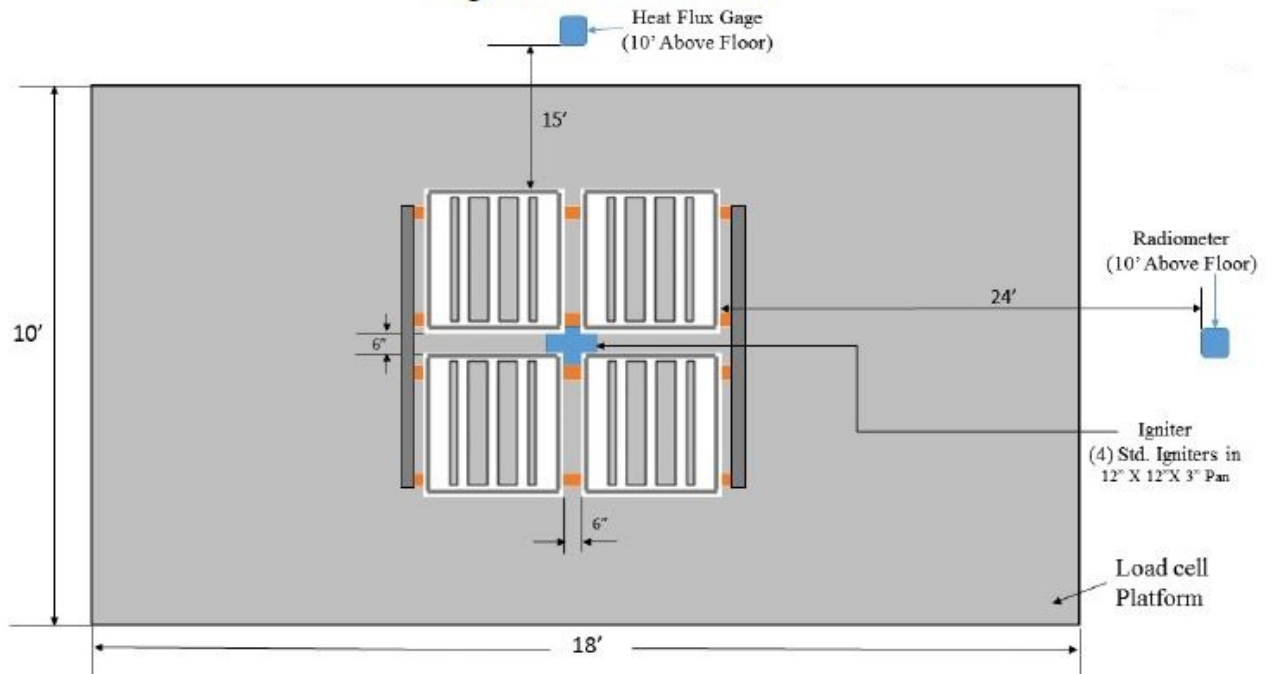


Figure B.1 - Test Setup

APPENDIX C: Informational Discussion

The purpose of this standard is to classify pallets and other material handling products as equivalent to wood pallets. Extensive research was performed on various wood pallets using the fire test methods outlined in this standard. Pallets containing plastic tested per this standard have demonstrated a fire performance that is either greater than or equivalent to wood pallets. Testing for commodity classification for pallets tested per this standard is not necessary because the fire performance of the pallets meeting these requirements is equivalent to wood pallets which were used in the initial evaluation of the commodity classification. Additionally, pallets tested per this standard are also considered equivalent to wood pallets when used in idle storage (rack or ground storage).