

INCH POUND
MIL-DTL-15011K
09 April 2013
<del>SUPERSEDING</del>
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DETAIL SPECIFICATION

PALLETS, MATERIAL HANDLING, WOOD  
POST CONSTRUCTION, 4-WAY ENTRY

Reactivated after 09Apr13 and may be used for new or existing design acquisitions.
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This specification is approved for use by all Departments and Agencies of the Department of Defense.

1. SCOPE.

1.1. Scope. This specification covers the design, materials, fabrication requirements, and examinations of 4-way entry, wood post construction pallets. The pallets shall comply with requirements given in this detailed specification as well as applicable drawings, standards and referenced specifications.

1.2. Classification. The pallets covered by this specification are classified into the following types and classes as specified (see 6.3).

Type I	- Assembled
Type II	- Unassembled
Class 1	- Seasoned lumber (specified moisture content see 3.2.1.4)
Class 2	- Unseasoned lumber (unspecified moisture content see 3.2.1.4)
Style 1	- General storage, Size - 40" L X 48" W
Style 1A	- General storage, Size - 35" L X 45-1/2" W
Style 1B	- General storage, Size - 42" L X 53" W

Comments, suggestions, or questions on this document should be addressed to: Commander, US Army ARDEC, ATTN: RDAR-QES-E, Picatinny Arsenal, New Jersey 07806-5000 or emailed to <a href="mailto:usarmy.picatinny.ardec.list.ardec-stdzn-branch@mail.mil">usarmy.picatinny.ardec.list.ardec-stdzn-branch@mail.mil</a> . Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at <a href="https://assist.dla.mil">https://assist.dla.mil</a> .
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ASTM D3953	– Standard Specification for Strapping, Flat Steel and Seals
ASTM D4442	– Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood- Base Materials
ASTM D6199	– Standard Practice for Quality of Wood Members of Containers and Pallets

(Copies of ASTM standards are available online from <http://www.asq.org/> and from American Society for Quality, P.O. Box 3005, Milwaukee, WI 53201-3005.)

## INTERNATIONAL PLANT PROTECTION CONVENTION

ISPM 15	– Regulation of Wood Packaging Material in International Trade
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(Copies of ASTM standards are available online from <http://www.ispm15.com/start.htm> and from International Standards for Phytosanitary Measures

2.4. Order of precedence. Unless otherwise specified herein or in the contract, in the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

### 3. REQUIREMENTS.

3.1. First article. When specified (see 6.3), a sample shall be subjected to first article inspection in accordance with 4.2.

3.2. Materials. The materials shall be as specified herein.

3.2.1. Wood. Unless otherwise specified, Style 1, Style 1A, or Style 1B pallets shall be constructed of any of the species of wood or combination thereof from Group IV of ASTM D6199.

3.2.1.1. Wood quality. Wood shall be free of decay which can be detected visually or by abnormal brashness (see 6.4) when picked with a sharp instrument. Lumber shall be free from insects, beetles, powder post beetle deterioration, and any other infestation at time of delivery that may result in subsequent pallet destruction. All hardwood and softwood component parts shall be absolutely free from bark. The quality of the wood selected for pallet construction shall also be free of defects set forth in 3.2.1.3.

3.2.1.2. Heat treatment. Unless otherwise specified, (see 6.3) pallets shall be fabricated from wood heat treated in accordance with Defense Ammunition Center Drawing ACV00831. This drawing satisfies the requirements of the International Standards for Phytosanitary Measures (ISPM 15).

3.2.1.3. Wood defects. The following defects shall apply to lumber as cut to size and assembled in the pallet.

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3.2.1.3.1. Splits. Splits (see 6.4) caused by the expansion of season checks, shakes, and the driving of fasteners during assembly shall be no longer than the width of the boards at time of manufacture; however, these splits will propagate over time. At Lot acceptance of the pallets, the boards shall have splits that are no longer than what is detailed in Table 1. If there are multiple splits in one board, then the longest split shall be compared with Table 1. Regardless of the cause of splitting, the split shall be straddled with additional fasteners when the split is more than 3 inches in length. Open splits with visible fastener shanks or legs shall be limited as follows. No more than one open split with a visible fastener shank or leg per connection shall be permitted and not more than one-third of the components per pallet shall contain open splits with visible fastener shanks or legs at the completion of manufacture.

Table 1. Allowable length of splits at time of lot acceptance

Pallet component	Component numbers from Figure 5, 6, or 7			Maximum allowable split length
	Style 1	Style 1A	Style 1B	
Outer top deckboards	1	1	1	W
Inner top deckboards	2,4	2	2,4	1/4 L
Outer stringer boards	7	6	7	W
Center stringer board	3	3	3	1/4 L
Outer bottom deckboards	8	7	8	W
Center bottom deckboard(s)	9	8	9	1/4 L
Outer posts	6	5	6	1/2 L, or 1/2 H, or 1/2 W
Center posts	5	4	5	1/2 L, or 1/2 H, or 1/2 W
Notes: L = Length of board, H = Height of board , W = Width of board				

3.2.1.3.2. Shakes. Shakes (see 6.4) shall be considered as splits (see 3.2.1.3.1) when the shake goes through the entire thickness of the board. Shakes running the full thickness of a component and longer than 3 inches shall be straddled with additional fasteners in the top and bottom deckboards.

3.2.1.3.3. Season checks. Season checks (see 6.4) which extend through the board shall be considered as splits (see 3.2.1.3.1). Season checks running the full thickness of a component and longer than 3 inches shall be straddled with additional fasteners in the top and bottom deckboards.

3.2.1.3.4. Knots and holes. Sound knots, loose knots, knot holes, and knot clusters shall be measured and restricted. The maximum allowable width of these knots shall be no more than 1/3 the width of the board in which contains them. The location of the knots shall be as close to the center of the board as possible. Deckboards and stringers shall not have knots, loose knots, knot holes, or knot clusters along their edges. Knots which occur in fastening areas shall not be used. For knot clusters, the sum of the width of the knots within a length equal to the width of the board in which they occur shall not exceed 1/3 the width of the board in which contains them.

3.2.1.3.5. Wane. Exposed wane (see 6.4) shall not be permitted on the outer edges of the outer deckboards, stringer boards, or posts. Wane is permissible on the surface or edge of the other components,

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but in no case shall fasteners be driven into or through this defect. The maximum allowable portion of the actual deckboard or stringer board with exposed wane shall not exceed one-quarter the width by two-thirds the thickness for the full length of the board. The maximum allowable portion of the actual post with exposed wane shall not exceed one-third the width by one-half the height for the full length of the post.

3.2.1.3.6. Warp. The bow in a member shall not exceed 1/16 inch per foot of length. The cup in a member shall not exceed 1/4 inch in an 8 inch width, or 1/8 inch in a 4 inch width, or a like proportion in other widths. The twist in a member shall not exceed 1/4 inch per foot of length in an 8 inch width, 1/8 inch per foot of length in 4 inch width, or a like proportion in other widths.

3.2.1.4. Moisture content. Unless otherwise specified, (see 6.3) the seasoned lumber used to construct Class 1 pallets at the time of manufacture and prior to the application of preservative treatment shall not be greater than 19 percent nor less than 12 percent of its oven dry weight as evidenced by the test specified in 4.4.1. For Class 2 pallets, the average moisture content for wood components is unrestricted.

3.2.2. Preservative treatments. Unless otherwise specified, (see 6.3) the constructed pallet or finished wood parts thereof shall be completely immersed or flooded as to inundate all interior and exterior surfaces for a minimum of one minute in a solution of one of the following wood preservatives:

- a. Copper-8-quinolinolate reduced with water down to 1.8% Copper-8-quinolinolate as metal (see 6.7).
- b. Zinc Naphthenate reduced with water down to 3% Zinc as metal (see 6.8).
- c. Copper Naphthenate reduced with water down to 2% Copper as metal (see 6.9).

3.2.2.1. Preservative application. Care shall be exercised to assure complete coverage of all wood products' surfaces. Immediately following the dip treatment, drain the treated wood products for a period of not less than five minutes. After the dip treatment, air dry the pallets for a period of 24 hours minimum providing through ventilation thus allowing full circulation around all surfaces of the wood products. Accelerated drying in an oven or kiln is permitted providing the oven or kiln dry does not exceed 160 degrees Fahrenheit.

3.2.2.2. EPA requirements. The preservative shall be registered with the Environmental Protection Agency (EPA) for the use intended. The pallet manufacturer shall provide a copy of the preservatives Material Safety Data Sheet (MSDS) with each shipment provided that the EPA registration number is annotated on the MSDS. Otherwise, the pallet manufacture shall provide a copy of the appropriate EPA approved preservative labels with each shipment.

3.2.2.3. Presence of Copper-8-quinolinolate preservative. When treated with Copper-8-quinolinolate, the wood shall show evidence of discoloration as specified in 4.4.2.

3.2.2.4. Presence of Zinc Naphthenate preservative. When treated with Zinc Naphthenate, the wood shall show evidence of discoloration as specified in 4.4.3.

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3.2.2.5. Presence of Copper Naphthenate preservative. When treated with Copper Naphthenate, the wood shall show evidence of discoloration as specified in 4.4.4.

3.2.2.6. Concentration level. The concentration of the applicable preservatives shall be checked as specified in 4.4.5 prior to utilization and every 8 hours of use thereafter.

3.2.3. Fasteners. The type, style, length, diameter and quantity per joint are dependent upon the location and width and of the boards to be fastened. Fasteners shall be made of hardened steel with a minimum Rockwell hardness of HRC 35. The fasteners shall be mechanically deformed (drive screw) type conforming to ASTM F1667, Type I, Style 18 – Pallet Nails (see 6.14). The fasteners shall be helically threaded with a minimum of 4 flutes. The fastener point may be diamond or chisel provided the width does not exceed the wire diameter. Length and size of fasteners shall be as specified in Table 2.

Table 2. Fastener schedule

Style of pallet	Size: <i>Length x Shank Diameter</i>	ASTM F1667 identification
1, 1A, 1B	3-1/4" x 0.135"	NL PL-10D
1, 1A, 1B	2-1/4" x 0.120"	NL PL-04D
1, 1A, 1B	1-5/8" x 0.120" <sup>1</sup>	NL PL-02D
Notes: <sup>1</sup> Alternative nails: 1-1/2" x 0.120", NL PL-01D, shall be used when 3/4" thick boards are utilized in construction.		

3.3. Construction. The construction of pallets shall be as specified herein.

3.3.1. Design and construction. The design and construction of pallets shall be as specified herein and in accordance with Figure 5, Figure 6, or Figure 7 as applicable.

3.3.2. Component details.

3.3.2.1. Deckboards. Deckboards shall be sized to a uniform thickness. Pre-drilling of deckboards of assembled pallets is at the option of the supplier. When specified in the contract or order, the top deckboards shall have strap slots and shall extend the length of the board. See Figure 5, Figure 6, or Figure 7 for strap slot locations and applicable sizes and tolerances.

3.3.2.2. Stringer boards. Stringer boards shall be sized to a uniform thickness. See Figure 5, Figure 6, or Figure 7 for applicable sizes and tolerances.

3.3.2.3. Posts. Posts shall be cut square with sides and shall be sized to a uniform thickness. See Figure 5, Figure 6, or Figure 7 for applicable sizes and tolerances.

3.3.3. Assembly.

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3.3.3.1. Component placement. All inner deckboards shall be parallel to the edges. All posts shall have the grain of the wood parallel to the length of the stringer boards and shall be positioned as shown on the applicable drawing. For construction details, see Figure 9 which illustrates the specific order of component placement and fasteners used for specific joints.

3.3.3.2. Assembly tolerances. Unless otherwise specified herein, tolerances for the assembled pallet shall be as specified in Figure 5, Figure 6, or Figure 7. Tolerances for the locations of fasteners shall be as specified in 3.3.3.3.

3.3.3.3. Fastener locations. Pallets shall be assembled with fasteners specified in 3.2.3. Fasteners shall be positioned not less than 3/4 inch from the ends or sides of deckboards, stringer boards, or posts. The remaining fasteners shall be uniformly spaced between them. Fasteners shall be driven in a staggered pattern. Staples shall be driven in two rows. Splits caused by fastening shall be supported by additional fasteners as specified in 3.2.1.3.1. All fasteners bent in driving shall be removed or broken off below the surface and replaced. The heads of fasteners shall be driven such that the head is flush to the surface of the board, or driven no more than 1/16 inch below the surface of the board.

3.4. Identification. Unless otherwise specified, (see 6.3) the pallets shall be marked by stamping, stenciling, branding, or roller coating with a material such that the markings are clearly visible, durable, contrasting, and legible. Markings that are not easily read shall be obliterated with a natural wood colored paint such as tan and the markings reapplied.

3.4.1. Manufacturer's mark. The pallet shall have the manufacturer's initials, month, and year of manufacture marked on at least one side of the center post for identification and reference for lot acceptance. The markings shall be 3/4 inch minimum in height (see Figure 5, Figure 6, or Figure 7).

3.4.2. Preservative treatment mark. The pallet shall have the letters that correspond to the type of preservative treatment utilized. The letters "PA" shall be annotated on all pallets subjected to the Copper-8-quinolinolate preservative treatment. The letters "PB" shall be annotated on all pallets subjected to the Zinc Naphthenate preservative treatment. The letters "PC" shall be annotated on all pallets subjected to the Copper Naphthenate preservative treatment. The marking shall be on the outside of the center post on both ends in letters one inch minimum in height (see Figure 5, Figure 6, or Figure 7).

3.4.3. ISPM 15 certification mark. The pallet shall be marked to show the conformance to the IPPC standard. The applicable ISPM 15 compliance marking shall be marked in accordance with the contract requirements or the locations specified in Defense Ammunition Center Drawing ACV00831.

3.5. Workmanship. Assembled pallets shall be free of dirt, grease, or oils. Assembled pallets shall be free of large splinters, exposed fastener points, or sharp edges that may cause injury when manually handled. The assembled pallet's fastener heads shall not be above flush as this will affect items being strapped to the decks of the pallet (see 3.3.3.3). In addition, unassembled pallets shall be free of defects which may affect field assembly.

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3.6. Transportability. The following requirements are for the Type II unassembled pallets. The Type II unassembled pallets shall be packed in accordance with Figure 8. The fasteners to be supplied with the pallet components shall be separated by type and placed into individual bags that conform to a MIL-DTL-117, Type I, Class E, Style 1, 2 or 3 bag. The individual bags shall be marked and labeled with a pressure-sensitive, water resistant label in accordance with MIL-STD-129 such that they identify the type of fastener. The strapping utilized to tie down the components shall be ASTM D3953, Flat strapping, Type 1, Heavy Duty, Finish B (Grade 2), size 1-1/4" x 0.035", or 0.031", or 0.029".

## 4. VERIFICATION.

Table 3. Requirement/verification cross-reference matrixMethod of verification

N/A – Not Applicable

1 – Analysis

2 – Demonstration

3 – Examination

4 – Test

Classes of verification

A – First Article

B – Acceptance

Section 3 Requirement		Verification Methods					Verification Class		Section 4 Verification
		N/A	1	2	3	4	A	B	
3.1	First Article				X	X	X		4.2 // 4.2.1
3.2	Materials	X							-
3.2.1	Wood				X		X	X	4.3.4
3.2.1.1	Wood quality				X		X	X	4.3.4
3.2.1.2	Heat treatment				X		X	X	4.3.4
3.2.1.3	Wood defects	X							-
3.2.1.3.1	Splits				X		X	X	4.3.4
3.2.1.3.2	Shakes				X		X	X	4.3.4
3.2.1.3.3	Season checks				X		X	X	4.3.4
3.2.1.3.4	Knots and holes				X		X	X	4.3.4
3.2.1.3.5	Wane				X		X	X	4.3.4
3.2.1.3.6	Warp				X		X	X	4.3.4
3.2.1.4	Moisture content				X	X	X	X	4.3.4 / 4.4.1
3.2.2	Preservative treatment				X		X	X	4.3.4
3.2.2.1	Preservative application				X		X	X	4.3.4
3.2.2.2	EPA registration				X		X	X	4.3.4
3.2.2.3	Presence of Copper-8-quinolinolate				X	X	X		4.3.4 / 4.4.2
3.2.2.4	Presence of Zinc Naphthenate				X	X	X		4.3.4 / 4.4.3
3.2.2.5	Presence of Copper Naphthenate				X	X	X		4.3.4 / 4.4.4
3.2.2.6	Concentration level				X	X	X	X	4.3.4 / 4.4.5



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Table 3. Requirement/verification cross-reference matrix - Continued

Section 3 Requirement		Verification Methods					Verification Class		Section 4 Verification
		N/A	1	2	3	4	A	B	
3.2.3	Style 1, 1A, 1B pallet fasteners				X		X	X	4.3.4
3.3	Construction	X							-
3.3.1	Design and construction				X		X	X	4.3.4
3.3.2	Component details	X							-
3.3.2.1	Deck boards				X		X	X	4.3.4
3.3.2.2	Stringer boards				X		X	X	4.3.4
3.3.2.3	Posts				X		X	X	4.3.4
3.3.3	Assembly	X							-
3.3.3.1	Component placement				X		X	X	4.3.4
3.3.3.2	Assembly tolerances				X		X	X	4.3.4
3.3.3.3	Fastener locations				X		X	X	4.3.4
3.4	Identification				X		X	X	4.3.4
3.4.1	Manufacturers marking				X		X	X	4.3.4
3.4.2	Preservative marking				X		X	X	4.3.4
3.4.3	ISPM-15 marking				X		X	X	4.3.4
3.5	Workmanship				X		X	X	4.3.4
3.6	Transportability				X		X	X	4.3.4

4.1. Classification of inspections. The inspection requirements specified herein are classified as follows:

- a. First article inspection (see 4.2)
- b. Conformance inspection (see 4.3)

4.1.1. Verification conditions. Unless otherwise specified, all verifications shall be performed in accordance with the test methods and conditions specified in section 4.4.

4.1.2. Classification of characteristics. For examinations and tests cited herein or when required by contract; critical, major, and minor characteristics are defined in MIL-STD-1916.

4.2. First article inspections. When specified, (see 6.3) a first article inspection shall be performed when a first article sample is required (see 3.1). The first article sample shall consist of three consecutively produced pallets of one grade, type and style (see Figure 5, Figure 6, or Figure 7 as applicable) which has been produced using the same production processes, procedures and equipment as will be used in fulfilling the contract. These sample pallets shall be manufactured within 30 days of inspection. All materials shall be obtained from the same sources of supply as will be used in regular production.

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4.2.1. First article rejection. If any item of the sample fails to comply with any of the applicable requirements, the first article sample shall be rejected.

4.3. Conformance inspection. The sample pallets shall be subjected to conformance verification in accordance with 4.3.4. Sampling plans and procedures for Major and Minor defects shall be in accordance with MIL-STD-1916 except that continuous sampling plans may be used if approved by the procuring activity.

4.3.1. Lot formation. Lot formation shall be in accordance with the formation and identification of lots or batches in MIL-STD-1916.

4.3.2. Examination. Sampling plans and procedures for Major and Minor defects shall be in accordance with MIL-STD-1916 except that continuous sampling plans may be used if approved by the procuring activity. The attribute sampling plan required for the examination for defects in 4.3.4 shall be in accordance with MIL-STD-1916, using Verification Level IV for major characteristics and Level II for minor characteristics unless otherwise noted.

4.3.3. Conformance rejection. If any sample fails to comply with the conformance inspection requirements, the lot shall be rejected.

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4.3.4	Inspection by classification of characteristics			Inspection Method
Classification	Examination or Test	Conformance Criteria	Requirement Paragraph	
<u>Critical</u>	None defined			
<u>Major</u>				
101	Wood species not conforming to ASTM D6199	100%	3.2.1	Material Certificate of Conformance (COC)
102	Wood not free of decay	100%	3.2.1.1	Visual
103	Wood not free from bark	100%	3.2.1.1	Visual
104	Wood heat treatment lacking presence	100%	3.2.1.2	Visual
105	Concentration level not calculated and recorded	VL-IV	3.2.2.6	4.4.5
106	Fasteners not the correct size, diameter, or incorrect hardness value	VL-IV	3.2.3	COC
107	Overall opening for materials handling equipment not compliant	VL-IV	3.3.1	Gauge
108	Strap slots (if specified) missing in top deckboards	VL-IV	3.3.2.1	Visual
109	Preservative marking missing	VL-IV	3.4.2	Visual

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4.3.4 Continued				Inspection Method
Classification	Examination or Test	Conformance Criteria	Requirement Paragraph	
<u>Major (cont)</u>				
110	ISPM-15 marking missing	VL-IV	3.4.3	Visual
111	ISPM-15 marking not clearly visible, durable, contrasting or legible	VL-IV	3.4	Visual
112	Type II pallet components loose in bundled unitized load	VL-IV	3.6	Visual
113	Overall length and width of pallet within tolerance	VL-IV		Gauge
<u>Minor</u>				
201	Split in component not longer than specified	VL-II	3.2.1.3.1	Gauge
202	Knots, loose knots, knot holes, and knot clusters not within specified limits	VL-II	3.2.1.3.4	Gauge
203	Knots, loose knots, knot holes, and knot clusters located along edge of deckboards or stringers	VL-II	3.2.1.3.4	Visual
204	Wane along outer edges of outer deckboards, stringers, or posts not within specified limits	VL-II	3.2.1.3.5	Visual

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4.3.4 continued				Inspection Method
Classification	Examination or Test	Conformance Criteria	Requirement Paragraph	
<u>Minor (cont)</u>				
205	Warp in excess of specified limits	VL-II	3.2.1.3.6	Gauge
207	Preservative treatment lacking presence	VL-II	Note 1	Note 2
208	Top and bottom deckboard thicknesses not compliant	VL-II	3.3.2.1	Gauge
209	Stringer boards thickness not compliant	VL-II	3.3.2.2	Gauge
210	Posts not cut square	VL-II	3.3.2.3	Gauge
212	Spacing of the top deckboards not within specified limits	VL-II	3.3.3.1	Gauge
213	Fasteners driven into boards less than specified limit from the edges of the boards	VL-II	3.3.3.3	Gauge
214	Fasteners driven into boards less than specified limit from the ends of the boards	VL-II	3.3.3.3	Gauge
215	Fastener heads above flush	VL-II	3.3.3.3	Gauge
Note 1: Paragraph 3.2.2.3, or 3.2.2.4, or 3.2.2.5 as applicable for the type of preservative used. Note 2: Paragraph 4.4.2, or 4.4.3, or 4.4.4 as applicable for the type of preservative used.				

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4.3.4 continued				Inspection Method
Classification	Examination or Test	Conformance Criteria	Requirement Paragraph	
<u>Minor (cont)</u>				
216	Splits longer than specified limit not straddled by additional fasteners	VL-II	3.3.3.3	Gauge, Visual
218	Manufacturers marking missing	VL-II	3.4.1	Visual
219	Manufacturers marking not clearly visible, durable, contrasting or legible	VL-II	3.4	Visual
220	Preservative marking not clearly visible, durable, contrasting or legible	VL-II	3.4	Visual
221	Assembled pallet not free of dirt, grease, or oils	VL-II	3.5	Visual
222	Assembled pallet not free of large splinters, exposed fastener points, or sharp edges	VL-II	3.5	Visual
223	Strapping material for bundling Type II pallets not as specified	VL-II	3.6	COC
224	Deckboard width assembly not meeting dimensional tolerances	VL-II	Figure 5, 6, or 7	4.4.6
225	Overall pallet assembly out of square	VL-II	Figure 5, 6 or 7	4.4.7

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4.4. Methods of inspection. (See 6.6).

4.4.1. Moisture content prior to construction. One sample each of lumber blanks used for the top and bottom deckboards, stringer boards, and posts shall be tested to represent the material used in pallet construction. The moisture content shall be tested with an electric type moisture meter (see 6.15) or by one of the oven drying methods of ASTM D4442. If a moisture meter is used, the meter shall be capable of reading moisture contents as high as 30 percent with a minimum accuracy of plus or minus one percent of true moisture content. Three readings shall be taken from each blank, and if any one of the three measurements of moisture content fails to meet the requirements of 3.2.1.4, the lot shall be rejected.

4.4.2. Presence of Copper-8-quinolinolate preservative. An ordinary glass tube eye dropper shall be used to deliver two drops of PQ80 surface to the wood surface. An immediate dark brown coloration and the spreading of the drops shall indicate Copper-8-quinolinolate treatment. Alternatively, the PQ80 surface indicator may be substituted with a formulation containing 10 parts by weight, of Sodium diethyldithiocarbamate trihydrate (see 6.10) and 90 parts by weight of distilled water.

4.4.3. Presence of Zinc Naphthenate preservative. Dissolve 0.1 grams of dithizone (diphenylthiocarbazone) (see 6.11) in either 100 ml of Methyl ethyl ketone or 100 ml of Chloroform (Note: This solution may be stored for long periods of time.) An ordinary glass tube eye dropper shall be used to deliver five drops of the solution to the wood surface. The indicator turns red when zinc is present. The color green indicates that the preservative is not present. Both colors fade quickly in the presence of light.

4.4.4. Presence of Copper Naphthenate preservative. An ordinary glass tube eye dropper shall be used to deliver two drops of PQ80 surface indicator to the wood surface. The stain will turn a dark brown color and the spreading of the drops shall indicate Copper-8-quinolinolate treatment. Alternatively, the PQ80 surface indicator may be substituted with a formulation made by dissolving 0.5 grams Chrome azurol S concentrate (see 6.12) and 5.0 grams Sodium acetate in 80 ml of distilled water and then dilute further to 500 ml total with distilled water. Then a common manual (fly) type applicator shall be used to spray the solution over the surface of dried treated wood. The indicator turns a deep blue color when copper is present.

4.4.5. Concentration level. The concentration level of the applicable preservative shall be calculated and recorded prior to utilization and every 8 hours of use thereafter by following the preservative supplier's recommended ratio of product to water (see 6.13).

4.4.6. Deckboard width. Measurements for overall width of deckboards shall be performed by measuring across the fastener area with an ordinary tape measure. There is a potential of misrepresentation of the deckboard width if the measurements are taken at mid-span. The wood members tend to shrink due to wood cell moisture loss after construction which could cause boards to be nonconforming.

4.4.7. Pallet squareness. Measurements for overall pallet squareness shall be performed by measuring the diagonals from one corner to another with an ordinary tape measure.

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## 5. PACKAGING.

5.1. Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order. When packaging of materiel is to be performed by DOD or in-house contractor personnel, these personnel need to contact the responsible packaging activity to ascertain packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activities within the Military Service or Defense Agency, or within the military service's system commands. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

## 6. Notes.

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1. Parenthetical note. This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.

6.2. Intended use. Items covered by this specification are intended for use in the palletization of military items and it has no commercial application.

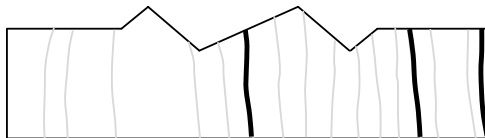
6.3. Procurement requirements. Acquisition documents should specify the following:

- a. Title, number and date of this specification and all reference documentation cited in this specification (see 2.2.1). The referenced documents will be those current at the time of solicitation or contract.
- b. Requirements for submission of first article sample (see 4.2).
- c. Type, class, style, and size of pallet (see 1.2).
- d. When moisture content is specified (see 3.2.1.4).
- e. When heat treatment is required (see 3.2.1.2).
- f. When preservative treatment is required (see 3.2.2).
- g. When pallets are to be marked (see 3.4).
- h. Requirements for acceptance inspection equipment designs (see 6.5).

6.4. Wood defect definitions.

*brash* – decay characteristic, which is the breaking of the grain without splintering.

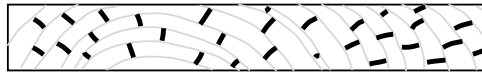
*season checks* – separations of the wood that normally occur across or through the annual rings, usually as a result of seasoning (see Figure 1).





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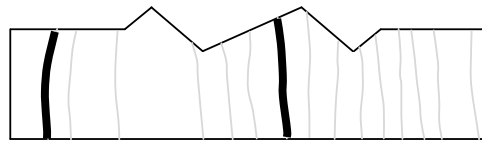
Top of board



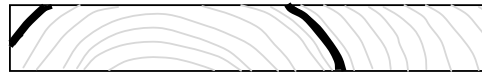
End of board

Figure 1. Depiction of season checks

*shake* – separation or a weakness of fiber bond, between or through the annual rings, that is presumed to extend lengthwise without limit (see Figure 2).



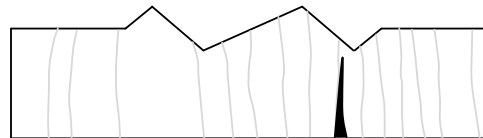
Top of board



End of board

Figure 2. Depiction of shakes

*split* – separation of the wood through the piece to the opposite surface or to an adjoining surface caused by tearing apart of the wood cells (see Figure 3).



Top of board

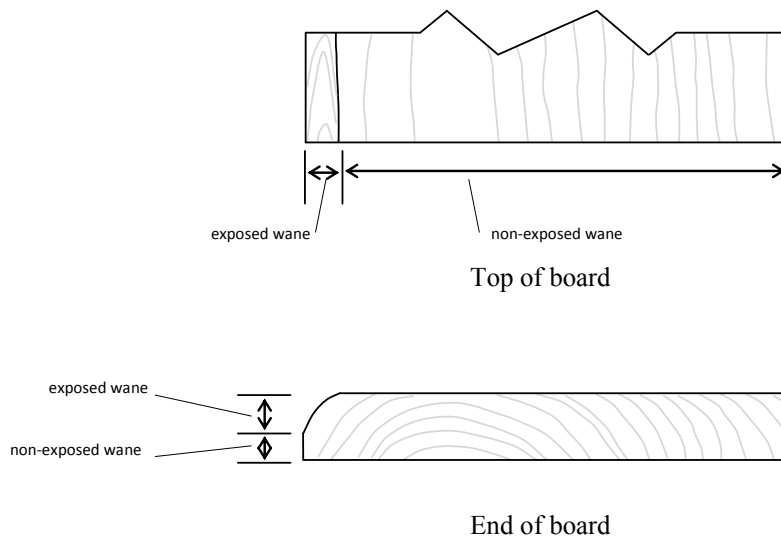


End of board

Figure 3. Depiction of splits

*wane* – bark or lack of wood on the edge or corner of a piece of lumber, regardless of cause; however, manufactured eased edges will not be considered as wane. (see Figure 4).

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Figure 4. Depiction of wane

6.5. Submission of contractor inspection designs for approval. Contractor should submit copies of designs as required to: Commander, U.S. Army Armament, Research, Development and Engineering Center (ARDEC), ATTN: RDAR-QEM, Picatinny, New Jersey 07806-5000.

6.6. Equivalent test method. Prior approval of the contracting officer is required for use of equivalent test methods. A description of the proposed method should be submitted through the Contracting Officer to: Commander, U.S. Army Armament, Research, Development and Engineering Center (ARDEC), ATTN: RDAR-QEM, Picatinny, New Jersey 07806-5000. This description should include but not be limited to the accuracy and precision of the method, test data demonstrating the accuracy and precision and drawings of any special equipment required.

6.7. Copper-8-quinolinolate. The Copper-8-quinolinolate may be obtained under the product name PQ-56 or PQ-80 from ISK Biocides, Inc. 416 E. Brooks Rd., Memphis, TN 38019 or equivalent facility.

6.8. Zinc Naphthenate. There are no known current EPA registered suppliers of Zinc Naphthenate.

6.9. Copper Naphthenate. The Copper Naphthenate may be obtained under the product name Cunapsol-5 from ISK Biocides, Inc. 416 E. Brooks Rd., Memphis, TN 38019 or equivalent facility.

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6.10. Sodium diethyldithiocarbamate trihydrate. The Sodium diethyldithiocarbamate trihydrate may be obtained from Mallinckrodt Baker Inc., 222 Red School Lane, Phillipsburg, NJ 08865 or equivalent facility.

6.11. Dithizone. The Dithizone (Diphenylthiocarbazone) Sodium may be obtained from Mallinckrodt Baker Inc., 222 Red School Lane, Phillipsburg, NJ 08865 or Spectrum Laboratory Products Inc., 14422 S. San Pedro St., Gardena, CA 90248-2027 or equivalent facility.

6.12. Chrome azurol S. This reagent may be obtained from BOC Sciences, 45-16 Ramsey Road, Shirley, NY 11967 or equivalent facility.

6.13. Concentration level. For the Copper-8-quinolinolate, Copper Naphthenate or Zinc Naphthenate, a field test kit may be obtained for either product from ISK Biocides, Inc. 416 E. Brooks Rd., Memphis, TN 38019 or equivalent facility.

6.14. Fasteners. The ASTM F1667, Type I, Style 18 – Pallet Nails may be obtained from Maze Nails, 100 Church St., Peru, IL 61354 08865 or equivalent facility.

6.15. Moisture meter. Electric-type moisture meters may be either the resistance type or radio frequency power loss type except that only the resistance type may be used on rough sawn will be acceptable, except for discoloration that would interfere with marking on the outside of the container or the pallet.

6.16. The Styles 1, 1A, and 1B pallets comply with STANAG 2828 to include exceptions for the U.S. to weight and size, as applicable.

6.17. Subject term (key word) listing

Pallet  
Deckboard  
Stringer board  
Post  
Fastener  
Preservative  
Copper-8-quinolinolate  
Zinc Naphthenate  
Copper Naphthenate  
Moisture content

6.18. Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issues due to the extent of the changes.







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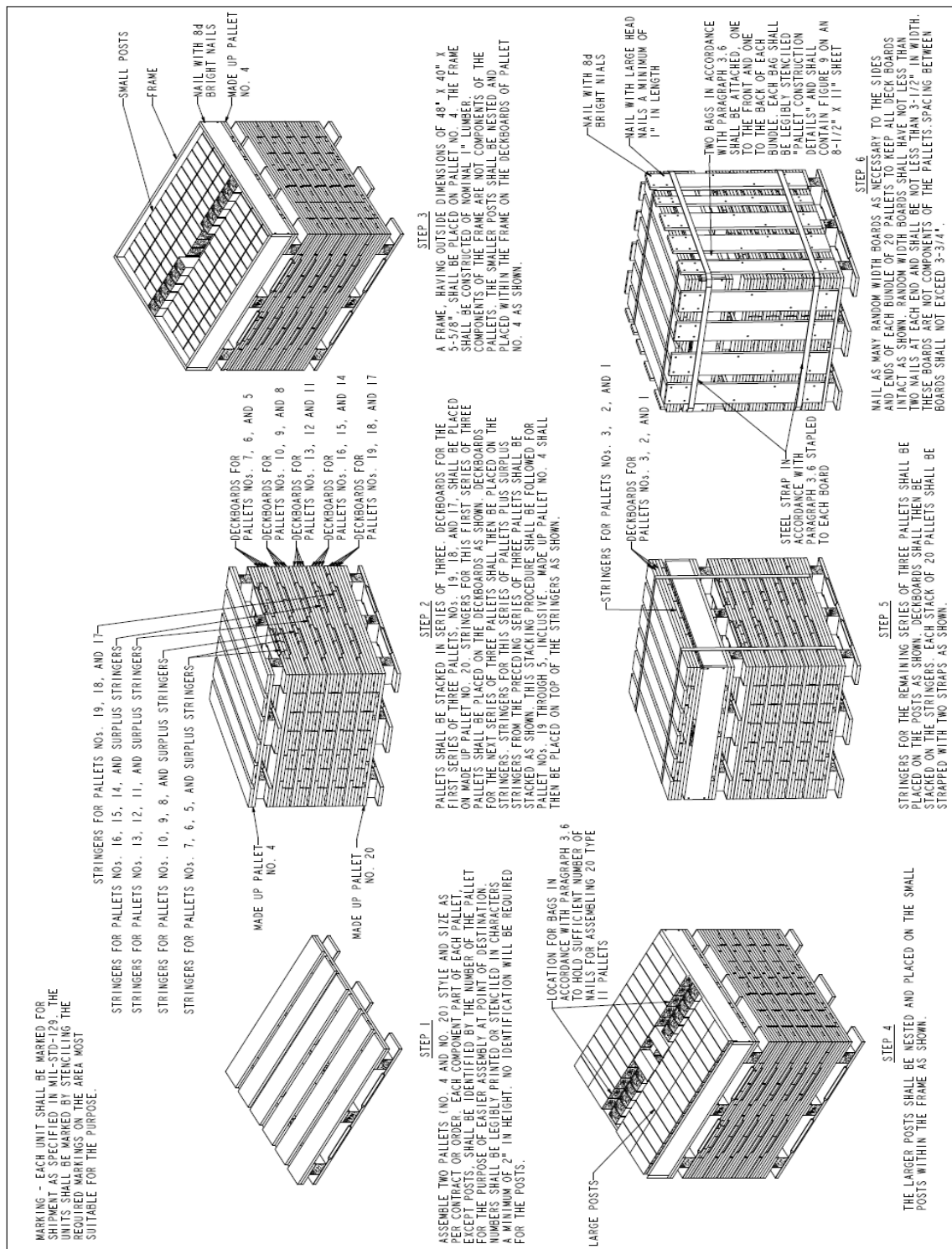


Figure 8. Type II Pallet, Method of unitizing 20 pallets for domestic and overseas shipments

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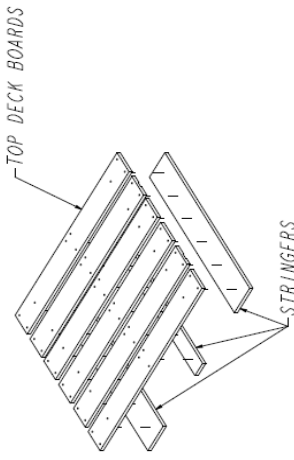
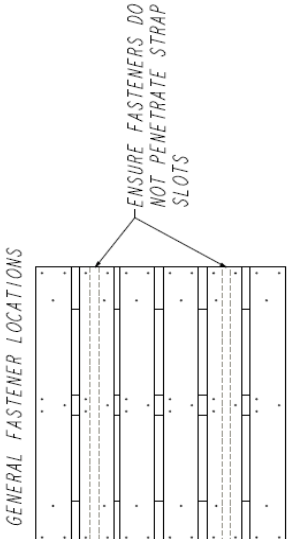
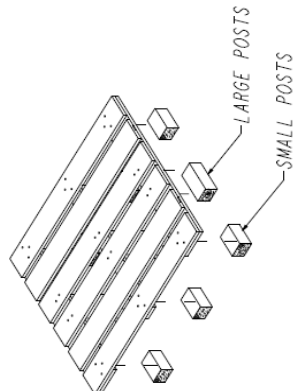
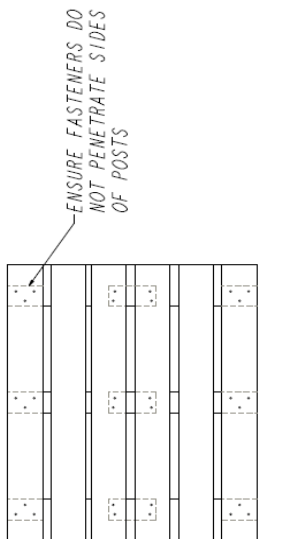
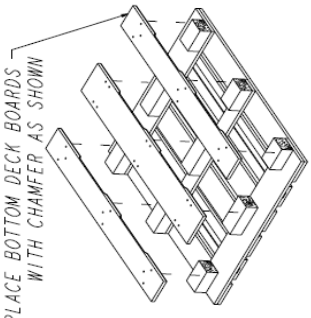
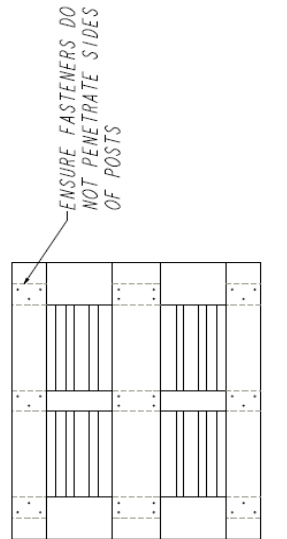
<b>PALLET CONSTRUCTION DETAILS (STYLE 1 SHOWN AS TYPICAL)</b>			
<p>ASSEMBLE TOP DECKBOARDS TO STRINGER BOARDS</p> <ul style="list-style-type: none"> <li>- USE 1-5/8" FASTENERS FOR BOARD THICKNESS GREATER THAN 13/16"</li> <li>- USE 1-1/2" FASTENERS FOR BOARD THICKNESS EQUAL TO OR LESS THAN 13/16"</li> <li>- TWO FASTENERS PER JOINT FOR CONNECTING DECK BOARDS WITH WIDTHS FROM 3-5/8" TO 4-7/8" TO STRINGERS</li> <li>- THREE FASTENERS PER JOINT FOR CONNECTING DECK BOARDS WITH WIDTHS FROM 5" TO 6-7/8" TO STRINGERS</li> <li>- FOUR FASTENERS PER JOINT FOR CONNECTING DECK BOARDS WITH WIDTHS FROM 7" TO 8-1/2" TO STRINGERS</li> </ul>		 <p>GENERAL FASTENER LOCATIONS</p> <p>ENSURE FASTENERS DO NOT PENETRATE STRAP SLOTS</p>	
<p>ASSEMBLE TOP DECKBOARD/STRINGER BOARD ASSEMBLY TO POSTS</p> <ul style="list-style-type: none"> <li>- THREE FASTENERS PER JOINT FOR CONNECTING POSTS WITH LENGTHS OF 5-5/8"</li> <li>- FOUR FASTENERS PER JOINT FOR CONNECTING DECK BOARDS TO POSTS WITH LENGTHS OF 7-5/8"</li> </ul>		 <p>ENSURE FASTENERS DO NOT PENETRATE SIDES OF POSTS</p>	
<p>ASSEMBLE BOTTOM DECKBOARDS TO POSTS</p> <ul style="list-style-type: none"> <li>- THREE FASTENERS PER JOINT FOR CONNECTING DECK BOARDS TO POSTS WITH LENGTHS OF 5-5/8"</li> <li>- FOUR FASTENERS PER JOINT FOR CONNECTING DECK BOARDS TO POSTS WITH LENGTHS OF 7-5/8"</li> </ul>		 <p>ENSURE FASTENERS DO NOT PENETRATE SIDES OF POSTS</p>	

Figure 9. Pallet construction details



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CONCLUDING MATERIAL

CUSTODIANS:

Army - AR  
Navy – OS  
Air Force - 99

Review Activities:

Army – EA, SM  
Navy – MC, SA  
Air Force – 69, 84

PREPARING ACTIVITY:

Army – AR  
Project 3990-2013-002

NOTE: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information above using the ASSIST Online database at <https://assist.dla.mil>.