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MILITARY SPECIFICATION

PANELS, FULL CLEATED, PARTIALLY CLEATED AND UNCLEATED: PLYWOOD, VENEER PAPER-OVERLAID AND SOLID FIBERBOARD FOR BOX, MODULAR SYSTEMS

This specification is approved for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers material and fabrication requirements for two types, three classes, and three styles of reusable box panels, designed for modular container systems for overseas and domestic shipments of military equipment and supplies (see 6.1).

1.2 Classification. Box panels covered by this specification shall be furnished in the following types, classes, and styles as specified in the contract or order (see 6.2).

Type I	Domestic Type
Type II	Overseas Type
Class 1	Plywood Panel
Class 2	Veneer, Paper-Overlaid Panel
Class 3	Solid Fiberboard Panel
Style A	Fully Cleated Panel
Style B	Partially Cleated Panel
Style C	Uncleated Panel

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Air Force Packaging Evaluation Agency (HQ AFLC/DSTZ), Wright-Patterson AFB OH 45433, by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

FSC 8115

2. APPLICABLE DOCUMENTS

2.1 Government Documents.

2.1.1 Specifications and Standards. Unless otherwise specified, the following specifications and standards of the issue listed in that issue of the Department of Defense Index of Specifications and Standards (DoDISS) specified in the solicitation form a part of this specification to the extent specified herein.

SPECIFICATIONS

FEDERAL

FF-F-133	Fasteners, Wood Joint, Corrugated (Saw Edge)
FF-N-105	Nails, Wire, Brads, and Staples
NN-P-530	Plywood, Flat Panel
QQ-S-781	Strapping, Steel, and Seals
TT-W-571	Wood-Preservation, Treating Practices
TT-W-572	Wood-Preservative, Water-Repellent
PPP-F-320	Fiberboard, Corrugated and Solid, Sheet Stock (Container Grade), and Cut Shapes
PPP-V-205	Veneer, Paper-Overlaid, Container Grade

STANDARDS

FEDERAL

FED-STD-101	Test Procedures for Packaging Materials

MILITARY

MIL-STD-105	Sampling Procedures and Tables for Inspection by Attributes
MIL-STD-129	Marking for Shipment and Storage
MIL-STD-731	Quality for Wood Members for Containers and Pallets
MIL-STD-147	Palletized and Containerized Unit Loads 40 Inch x 48 Inch Pallets, Skids Runners or Pallets Type Base

(Copies of specifications and standards required by suppliers in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

2.2 Other Publications. The following document(s) form a part of this specification to the extent specified herein. The issues of the documents which are indicated as DoD adopted shall be the issue listed in the current DoDISS and the supplement thereto, if applicable.

PS-51	Hardwood and Decorative Plywood
PS 1	Construction, and Industry Plywood

(Copies may be obtained from the Superintendent of Documents, U.S. Government Printing Office, Washington DC 20402.)

UNIFORM CLASSIFICATION COMMITTEE, AGENT:

Uniform Freight Classification

(Application for copies should be addressed to Uniform Classification Committee, Room 1106, 222 South Riverside Plaza, Chicago IL 60606.)

NATIONAL MOTOR FREIGHT TRAFFIC ASSOCIATION, INC.

National Motor Freight Classification

(Application for copies should be addressed to the American Trucking Association, Inc, 1616 "P" Street NW, Washington DC 20036.)

AMERICAN SOCIETY FOR TESTING MATERIALS STANDARDS

ASTM 3951-82 Standard Practice for Commercial Packaging

(Application for copies of this ASTM should be addressed to American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania 19103)

2.3 Order of Precedence. In the event of a conflict between the text of this specification and the references cited herein, the text of this specification shall take precedence.

3. REQUIREMENTS

3.1 Materials. Materials required to fabricate box panels shall conform to the requirements of this specification.

3.1.1 Lumber. Lumber used for cleats to fabricate styles A and B panels shall conform to all requirements of MIL-STD-731. Cleats, when specified (see 6.2), shall have the surface treated with water-repellent wood preservative conforming to Composition C or D of TT-W-572. When pressure treatment is specified, it shall be in accordance with TT-W-571. Type of treatment must be specified.

3.1.1.1 Cleats. Unless otherwise specified, cleats shall be made from groups of wood in thicknesses as outlined in Table I. Each cleat shall be a single piece of lumber without any joints in the width or length.

3.1.1.2 Cleat Dimensions and Tolerances. The thickness and width of cleats used to fabricate Style A panels of any type or class shall not be less than minimum thicknesses and widths specified in Table I. However, standard 3/4 or 25/32 inch thick cleat may be substituted for 13/16 inch cleat provided the cross-sectional area is equal to or greater than that specified. When cleats with dimensions exceeding those specified in Table I are required on panels to accommodate specific designs or types of mechanical fasteners (other than nails, staples, screws, etc), the manufacturer shall furnish the procuring activity or the contracting oficer the following information.

a. Actual dimensions (thickness and width) of cleats.

b. The type or design of mechanical fasteners, national stock numbers, and military or federal standards where applicable.

c. Maximum load (gross weight) and type of load for which the panels are designed and fabricated. Cleats used to fabricate Style B panels shall be of sufficient thickness and width to provide satisfactory performance when panels are assembled and tested in accordance with 4.4. The manufacturer shall furnish the procuring activity or the contracting officer the same type of information required for Style A panels as specified above. Maximum allowable tolerances for all cleats shall be as specified in MIL-STD-731 for sized lumber and box members.

NOTE: Lumber requirements (cleats) specified herein and outlined in Table I represent minimum requirements. Standard size lumber may be substituted provided the cross-sectional area of the substituted lumber is equal to or greater than the cross-sectional area of specified sizes and are within the exceptions permitted herein.

3.1.2 Plywood. Unless otherwise specified (see 6.2), plywood used shall conform to the product standards as outlined in Table II.

3.1.2.1 Thickness of Plywood for Type I and II, Class 1. Styles A and B panels thickness shall not be less than specified in Table I for the intended types and weights of loads and groups of wood to be used. Style C panels shall be of sufficient thickness to satisfactorily perform when panels are assembled into a completed box and tested in accordance with 4.4.

TABLE I
MINIMUM REQUIREMENTS FOR TYPE 1, CLASSES 1, 2, AND 3 STYLES A AND B PANELS

PANEL MATERIALS	WEIGHT OF CONTAINER CONTENTS IN POUNDS		CLEATS: WOOD GROUPS 1 & 2 DIMENSIONS ARE IN INCHES		CLEATS: WOOD GROUPS 3 & 4 DIMENSIONS ARE IN INCHES		PANEL MATERIAL MIN. STIFFNESS FOR POV FOR LOAD TYPES		PANEL MATERIAL MIN. THICKNESS FOR POV. INCHES FOR LOAD TYPES		PANEL MATERIAL THICKNESS: PLYWOOD, IN INCHES GROUP OF WOOD		PANEL MATERIAL GRADES: SOLID FIBERBOARD
	Exceeding	Not Exceeding	Min Thickness	Min Width	Min Thickness	Min Width	Types 1 & 2	Type 3	Types 1 & 2	Type 3	PS-1	PS-51	
Plywood	0	75	3/4	1-1/2	3/4	1-1/2	-	-	-	-	1/ 2/ 5/16	1/8	-
Solid Fiberboard	0	75	3/4	1-1/2	3/4	1-1/2	-	-	-	-	-	-	200
Paper-Overlaid Veneer	0	75	3/4	1-1/2	3/4	1-1/2	17	25	0.070	0.090	-	-	-
Plywood	75	150	3/4	1-3/4	3/4	1-3/4	-	-	-	-	1/ 2/ 5/16	1/8	-
Solid Fiberboard	75	150	3/4	1-3/4	3/4	1-3/4	-	-	-	-	-	-	275
Paper-Overlaid Veneer	75	150	3/4	1-3/4	3/4	1-3/4	42	70	0.115	0.140	-	-	-
Plywood	150	300	3/4	1-3/4	3/4	1-3/4	-	-	-	-	1/ 2/ 5/16	1/ 3/16	-
Solid Fiberboard	150	300	3/4	1-3/4	3/4	1-3/4	-	-	-	-	-	-	350
Pape-Overlaid Veneer	150	225	3/4	1-3/4	3/4	1-3/4	42	70	0.115	0.140	-	-	-
Paper-Overlaid Veneer	225	300	3/4	1-3/4	3/4	1-3/4	130	218	0.170	0.195	-	-	-
Plywood	300	500	3/4	1-3/4	3/4	1-3/4	-	-	-	-	2/ 5/16	5/16	-
Solid Fiberboard	300	400	3/4	1-3/4	3/4	1-3/4							375
Paper-Overlaid Veneer	300	400	3/4	1-3/4	3/4	1-3/4	400	-	0.225	-	-	-	-
Plywood	500	800	3/4	2-1/4	3/4	2-1/4	-	-	-	-	5/16	1/4	-
Plywood	800	1000	3/4	2-5/8	3/4	2-5/8	-	-	-	-	3/8	5/16	-

CONTINUE TABLE I
MINIMUM REQUIREMENTS FOR TYPE II, CLASSES 1, 2, AND 3 STYLES A AND B PANELS

PANEL MATERIALS	WEIGHT OF CONTAINER CONTENTS IN POUNDS		CLEATS: WOOD ALL GROUPS DIMENSIONS ARE IN INCHES		PANEL MATERIAL STIFFNESS FOR POV FOR LOAD TYPES		PANEL MATERIAL THICKNESS FOR POV, IN INCHES FOR LOAD TYPES		PANEL MATERIAL THICKNESS FOR PLYWOOD, INCHES TYPES 1&2 LOADS		PANEL MATERIAL THICKNESS FOR PLYWOOD, IN INCHES TYPE 3 LOADS		PANEL MATERIAL GRADES: SOLID FIBERBOARD
	Exceeding	Not Exceeding	Min Thickness	Min Width	Types 1 & 2	Type 3	Types 1 & 2	Type 3	PS-1	PS-51	PS-1	PS-51	
Plywood	0	100	3/4	1-3/4	-	-	-	-	2/ 5/16	3/ 3/16	2/ 5/16	3/ 3/16	-
Solid Fiberboard	0	200	3/4	1-3/4	-	-	-	-	-	-	-	-	V3s or V4s
Paper-Overlaid Veneer	0	100	3/4	1-3/4	17	48	0.070	0.120	-	-	-	-	-
Plywood	100	200	3/4	1-3/4	-	-	-	-	2/ 5/16	3/ 3/16	2/ 5/16	3/16	-
Paper-Overlaid Veneer	100	250	3/4	1-3/4	70	160	0.140	0.180	-	-	-	-	-
Plywood	200	300	3/4	1-3/4	-	-	-	-	2/ 5/16	3/16	5/16	1/4	-
Pape-Overlaid Veneer	250	350	3/4	1-3/4	400	-	0.225	-	-	-	-	-	-
Plywood	300	400	3/4	1-3/4	-	-	-	-	2/ 5/16	3/16	5/16	1/4	-
Plywood	400	500	3/4	2-1/4	-	-	-	-	2/ 5/16	3/16	5/16	1/4	-
Plywood	500	600	3/4	2-5/8	-	-	-	-	5/16	1/4	5/16	1/4	-
Plywood	600	800	3/4	3-1/4	-	-	-	-	3/8	5/16	3/8	5/16	-
Plywood	800	1000	3/4	3-1/4	-	-	-	-	3/8	5/16	1/2	3/8	-

1/ 320 minimum inch thick plywood confroming to type III, grade 4 of PS-51, may be used in place of the 5/16 (3/20 inch thick plywood is not standard thickness in PS-51).

2/ At the option of the supplier, 1/4 inch sanded plywood may be furnished.

3/ Minimum 3/20 inch thick plywood conforming to type I, grade 4 of PS-51, may be used in place of the 3/16 inch thick plywood. (3/20 inch thick plywood is not a standard thickness in PS-51.

TABLE II, Plywood Flat Panel 1/, 2/, 3/

BOX TYPE	PS-51	PS 1
Type I, Class 1, Style A	Type II Grade 3-4	Standard Interior Grade C-D
Type II, Class 1, Style B and C	Type I Grade 3-4	Standard Interior with Ext. Glue
Type II, Class II, Style A, B, and C		Grade C-D

1/ Unless otherwise specified, plywood is furnished unsanded. Smooth finish or sanded panels, if required, must be specified in the contract or order.

2/ When specified (see 6.2), plywood shall have the surface treated with water repellent, wood-preservative conforming to TT-W-571 or composition C or D of TT-W-572. Type of treatment must be specified.

3/ Defects such as knot holes, worm holes, etc, that extend clear through the panel shall not be permitted.

3.1.3 Paper-Overlaid Veneer. Unless otherwise specified (see 6.2), paper-overlaid veneer panels shall confrom to Table III.

*TABLE III, Paper-Overlaid Veneer

BOX TYPE	Panel Material	Minimum Thickness and Stiffness
Type I, Class 2, Style A	PPP-V-205, Type I	See Table I
Type I, Class 2, Style B, C	PPP-V-205, Type II	See Table I
Type II, Class 2, Style A, B, C		

3.1.4 Fiberboard. Unless otherwise specified (see 6.2), fiberboard panels shall conform to Table IV.

*TABLE IV, Fiberboard

BOX TYPE	Panel Material
Type I, Class 3, Style A	PPP-F-320, Type SF Class Domestic, Grade (See Table 1)
Type II, Class 3, Style A	PPP-F-320, Type SF Class Weather Resistant, Grade (See Table 1)

3.1.5 Fasteners.

3.1.5.1 Nails. Nails used to fabricate panels specified herein shall be made of steel wire and shall conform to the requirements of FF-N-105.

3.1.5.1.1 Nails Sizes and Dimensions. Nails used to fabricate Type I panels intended for boxes to support loads up to 150 pounds shall have a shank diameter not less than 0.072 inch (15 gage) with a head diameter not less than 13/64 inch. Nails used to fabricate Type I panels intended for boxes to support loads over 150 pounds and all Type II panels shall have a shank diameter not less than 0.080 inch (14 gage) with a head diameter not less than 13/64 inch. Box nails that can be used are 4, 5, 6, and 7d. Nails used to fabricate any of the panels shall be of sufficient length to pass completely through the cleat and panel and provide a clinch not less than 1/8 inch.

3.1.5.2 Staples or Wire Stitches. Staples or wire stitches used to fabricate panels specified herein shall be made of steel wire of not less than 0.0625 inch diameter. If wire other than round wire is used for staples or stitching material, the cross-section area shall be equal to that of 16 gage, round wire. The bearing surface of the crown (underside) of staple or stitch shall not be less than 5/16 inch. Staples shall be of sufficient length to pass completely through the cleat and panel and provide a clinch not less than 1/8 inch.

3.1.5.3 Other Fasteners. Other fasteners, such as single legged fasteners preformed or formed from knurled wire, may be used to the extent specified under panel fabrication. Steel wire used to form these fasteners shall have a diameter not less than 0.0625 inch (16 gage). If wire, other than round wire, is used, the cross-section area shall be equal to that of 16 gage round wire. When these fasteners are used, the points and shanks shall be of a type which, when driven, shall not cause splitting of the wood cleats. These fasteners, when used, shall be driven with such equipment that will provide a clinch or hook on the machine end of not less than 1/8 inch or equal to the clinch requirements for staples and nails. These fasteners shall not be used with any of the applicable materials less than 1/4 inch in thickness.

3.1.6 Assembly Fasteners. Assembly fasteners (clamps, spring steel clips, plates and strapping, stays, etc) used by the panel manufacturer in performing the tests specified herein shall be identical to the fasteners that are readily available for purchase by any activity submitting orders for panels.

3.2 Panel Fabrication.

3.2.1 Fabrication of Plywood Panels, Types I and II.

3.2.1.1 Class 1, Styles A and B, Panels. The plywood shall be secured to the cleats by the use of nails, staples, wire stitches, or other fasteners as specified in 3.1.5 at the option of the contractor. Fasteners may be driven through the plywood and cleat in either sequence except that fasteners specified in 3.1.5.3 shall pass through the wood parts in the sequence of cleat to plywood only and the preformed staples or wire stitches (see 3.1.5.2) shall pass through the wood parts in the sequence of plywood to cleat only. All fasteners shall pass completely through the plywood and cleat and clinched not less than 1/8 inch. Shiners (protruding fastener points) shall not be permitted. Where plywood of 1/4 inch or less thickness is used, the staple, stitch crown, or nail head shall not be overdriven more than is necessary to prevent the fastener head or crown surface from extending above the surface of the plywood or cleat. Where plywood thicker than 1/4 inch is used, the bearing surface of the staple, stitch crown, or nail shall not be overdriven more than 1/32 inch or 10 percent of the plywood thickness whichever is the greater. Nails, staples, or knurled wire fasteners used lengthwise of the cleat shall be staggered in two parallel rows with the following exception: When crowned fasteners (staples, stitches, etc) with 7/16 inch or wider crowns are used, they may be driven in a straight line when cleats do not exceed 1-3/4 inches in width. The space between the two rows shall not be less than 3/8 inch nor more than a dimension equal to 50 percent of the cleat width. The distance between the nearest edge of the fastener and the edge of the cleat shall not be less than 3/8 inch nor more than a dimension equal to 25 percent of the cleat width. The spacing of nails or other single legged fasteners shall not exceed 6 inches within each row. The two rows of fasteners shall be evenly mismatched or staggered effecting a 3 inch spacing. The spacing of crown type fasteners (staples, wire stitches, etc) shall not exceed 7 inches within each row. With the exception as specified above, these two rows of fasteners shall be evenly mismatched or staggered effecting a 3-1/2 inch spacing.

3.2.1.1.1 Cleat Arrangement and Spacing for Class 1, Style A, Panels Each panel shall have a minimum of four cleats and shall be applied with a lap joint or butt joint at the corners of the panel. When the lap joint method is used, the lap cuts shall be of such accuracy that the combined thickness at the joint shall not be less nor

exceed the cleat thickness. When the panel cleats are butt joined, the through cleats shall be perpendicular to the grain of the face ply for plywood and to the grain of the veneer for paper-overlaid veneer and the filler cleats fitted in between the through cleats. When one or both dimensions of a panel when measured between the inside edges of the edge cleats (unframed area) exceeds 24 inches for Type I panels or 20 inches for Type II panels, one or more intermediate cleats shall be applied perpendicular to the length of the panel. The distance between intermediate cleats (unframed areas) shall not exceed 24 inches for Type I panels or 20 inches for Type II panels.

3.2.1.1.2 Cleat Arrangement and Spacing for Class 1, Style B, Panels. Style B panels shall be provided with a sufficient number of cleats, when assembled into a completed container, and closed as for shipment. Between cleats, there shall be no unframed area exceeding 24 inches in either dimension for Type I panels or 20 inches for Type II panels. Cleats arranged on the panels in accordance with the manufacturer's design shall be spaced and secured with such accuracy that the panels (ends, sides, top, and bottom), when assembled into a completed box, held together with fasteners or stays, and reinforced with steel strapping as for shipment, shall satisfactorily perform when tested in accordance with 4.4.

3.2.1.2 Class 1, Style C, Panels. Style C panels require no cleats and shall be made from weather-resistant plywood only. These panels shall be made from plywood of sufficient thickness to retain the fasteners for which they were designed, adequately protect the load intended for the completed box, and satisfactorily pass all applicable tests specified herein. All edges of these panels shall be cut in such manner or design or provided with metal plates, angles, etc, that the ends, sides, top, and bottom will interlock with each other when assembled into a complete box. The panels, when assembled into a complete box, fastened together with the fasteners (spring clips, clamps, stays, etc) and banded, if required, shall satisfactorily pass tests specified in 4.4 without the aid of internal supporting structure of loads.

3.2.1.3 Multi-Piece Panels. Unless otherwise specified, all panels not exceeding 96 inches in length by 48 inches in width shall be fabricated from one piece of panel material with the required number of cleats as specified herein. When the panel dimensions are of such magnitude that two or more pieces of panel material will be required, the adjacent edges of the panel material shall be butt joined with a joint cleat placed over the joined edges. The width of the joint cleat shall not be less than 2-3/8 inches or less than the edge cleats when they exceed 2-3/8 inches. Each piece of panel material shall be fastened to the joint cleat in accordance with the requirements specified for fastening of all other cleats. When two or more pieces of panel material are required to make Style C panels, the pieces of plywood shall be joined together in accordance with the requirements for scarf joints as specified in Commercial Standard PS 1.

3.2.2 Fabrication of Veneer, Paper-Overlaid Panels, Types I and II.

3.2.2.1 Class 2, Styles A and B, Panels. Paper-overlaid veneer panel material shall be secured to the cleats by the use of nails, staples, or wire stitches at the option of the contractor. Fasteners used in fabricating these panels shall pass through the panel board and cleat and clinch on the cleat side. Shiners shall not be permitted. Staple or stitch crowns or nail heads shall not be permitted to extend above the surface of the panel board nor shall they be overdriven more than is necessary to prevent the fastener crown or nail head surface from extending above the panel board surface. Nails, staples or wire stitches used lengthwise in the cleat shall be staggered in two parallel rows with the following exception: When crowned fasteners (staples, stitches, etc) with 7/16 inch or wider crowns are used, they may be driven in a straight line when cleats do not exceed 1-3/4 inches in width. The space between the two rows shall not be less than 3/8 inch nor more than a dimension equal to 50 percent of the cleat width. The distance between the nearest edge of the fastener and the edge of the cleat shall not be less than 3/8 inch nor more than a dimension equal to 25 percent of the cleat width. The spacing of nails, staples, or wire stitches shall not exceed 6 inches within each row. The two rows of fasteners shall be evenly mismatched or staggered effecting a 3 inch spacing along the cleat. When cleats are 2-3/8 inches or more in width, two nails or other authorized fasteners shall be used in each end of the cleat.

3.2.2.1.1 Cleat Arrangement and Spacing for Class 2, Style A, Panels. The cleat arrangement and spacing for these panels shall be as specified in 3.2.1.1.1.

3.2.2.1.2 Cleat Arrangement and Spacing for Class 2, Style B, Panels. The cleat arrangement and spacing for these panels shall be as specified in 3.2.1.1.2. Cleats arranged on the panels in accordance with the manufacturer's design shall be spaced and secured with such accuracy that the panels (ends, sides, top, and bottom) when assembled into a completed box, held together with fasteners or stays, and reinforced with steel strapping as for shipment, shall satisfactorily perform when tested in accordance with 4.4.

3.2.2.2 Class 2, Style C, Panels. These panels shall be fabricated in accordance with the requirements of 3.2.1.2 except material as specified in 3.1.3 shall apply,

3.2.2.3 Multi-Piece Panels. Two-piece panels fabricated from paper-overlaid veneer shall be as specified in 3.2.1.3.

3.2.3 Fabrication of Solid Fiberboard Panels, Types I and II.

3.2.3.1 Class 3, Style A, Panels. Solid fiberboard material used for these panels shall be secured to the cleats by the use of nails or staples. Nails and staples shall conform to requirements specified in 3.1.5 except the diameter of nail heads shall not be less than 7/32 inch and the crown of staples shall not be less than 1/2 inch.

Fasteners used to fabricate these panels shall be driven through the panel material, then the cleat, and clinched on the cleat side. Shiners shall not be permitted. Staple crowns or nail heads shall not be permitted to extend above the surface of the panel material nor shall they be overdriven to the extent that breaks in the outer liner are visible. The spacing and pattern used for nails or staples in manufacturing these panels shall be as specified in 3.2.2.1. The butt joint formed by two adjacent edge cleats on a panel or by an intermediate cleat and an edge cleat shall be reinforced by a staple or corrugated fastener. When corrugated fasteners are used, they shall conform to FF-F-133 and their depth shall not be less than 75 percent of the cleat thickness. When staples are used for joint reinforcing, they shall have a crown not less than one inch and be driven through the two adjacent cleats and clinched on the panel board side of the panel.

3.2.3.1.1 Cleat Arrangement and Spacing for Class 3, Style A, Panels. The cleat arrangement for these panels shall be as specified in 3.2.1.1.1. Type II, Class 3, Style A, panels shall not exceed dimensions that would be required to fabricate a box with inside dimensions Of 48 inches long by 36 inches wide by 36 inches deep.

3.2.3.2 Multi-Piece Panels. Two-piece panels fabricated from solid fiberboard shall be as specified in 3.2.1.3. The use of two or more pieces of panel board is permitted for Type I, Class 3, Style A, panels only.

3.3 Panel Design Features. The manufacturer shall not furnish or propose to furnish any box panels with such design features or cleat arrangements for which acceptable fasteners or stays required to assemble them into a complete box are not readily available.

3.3.1 Reusability. Panels shall be of such design that they can be repeatedly assembled into a complete box then disassembled without distortion or damage.

3.3.2 Assembly. Sets of panels (ends, sides, top, and bottom) within each classification combination (type, class, and style) furnished under this specification shall be capable of being assembled into a complete box suitable for the purpose intended. The panels shall also be capable of being assembled and disassembled by the use of common hand tools such as: a standard carpenter's claw hammer, mallet, screw driver, nail bar, etc. Each set of panels, when assembled into a completed box, shall conform to the inside length, width, and depth, plus or minus 1/8 inch, specified in the contract or order (see 6.2).

3.4 Panel Dimensions and Tolerances.

3.4.1 Dimensions. Dimensions of panels furnished under this specification shall be as specified in the contract or order (see 6.2).

3.4.1.1 Assembled Dimensions. When exact dimensions of panels are unknown, the procuring activity may specify that panels shall be of such dimensions that when assembled into a complete box, the inside dimensions of the box shall be as specified in the contract or order (see 6.2).

3.4.2 Tolerances. Panel board shall be cut with such accuracy that each corner will be a 90 degree angle with a tolerance not to exceed plus or minus 1/2 degree and at no point shall the panel board extend more than 1/16 inch beyond the cleats or more than 1/16 inch under the edges of the cleats. Tolerances not specified herein shall be as specified in the material specifications applicable to this document.

3.4.2.1 Assembled Tolerance. When panels are ordered to make up boxes of specific sizes, the allowable tolerances on the inside dimensions of the assembled box shall not exceed plus or minus 1/8 inch.

3.5 Fastener Information. The manufacturer shall furnish the procuring activity or the contracting officer with written information relative to the following:

a. Type of fasteners applicable to the panels that are furnished. Also federal stock numbers or procurement document covering the fasteners, if available, along with sources of supply.

b. Number of fasteners that are required per box of specific sizes to support the maximum load for which the panels were designed.

c. Instructions for application and removal of fasteners.

3.6 Panel Identification. Unless otherwise specified, each panel shall be permanently marked showing dimensions (length by width in inches), type, class, style, and maximum load (weight limitation) of complete box for which the panels were designed. The marking shall be in characters not less than 1/2 inch or more than 3/4 inch high. Marking shall be placed on the outside edge of the shortest edge cleat (normally the panel width) except on Style C panels. The marking for Style C panels shall be placed on the outside surface along the edge of the shortest dimension (width) and shall be placed as close to the edge as practicable. Marking shall consist of a series of numbers and symbols as follows:

a. First series of numbers to indicate the length and width of panel in inches, such as 28 x 14.

b. Second part of the identification will indicate the type of panel. Type I panels, for domestic boxes, will be identified by the letter "D". Type II panels, for overseas boxes, will be identified by the letter "O".

c. Third part of the identification will indicate the class of panel. Class I (plywood) will be identified by the number "1". Class 2 (paper-overlaid veneer) will be identified by the number "2". Class 3 (solid fiberboard) will be identified by the number "3".

d. Fourth part of the identification will indicate the style of panel. Style A panels will be identified by the letter "A". Style B panels will be identified by the letter "B". Style C panels will be identified by the letter "C".

e. Fifth part of the identification will indicate the maximum gross load of the assembled box for which the panels were designed. All weights shall be numerically indicated and shall be expressed in pounds to the nearest pound. Panel identification example: 28 X 14-0-1-A-300 is for a panel 28 inches long by 14 inches wide, Type II (overseas), Class 1 (plywood), Style A (fully cleated), and for a box to carry a gross load of 300 pounds.

3.6.1 Additional Marking for Style C Panels. Unless otherwise specified, each panel shall be permanently marked on one of the edge cleats or panel edge in the same manner as specified in 3.6 with the additional information "US Property-Reusable Panel" and "Designed for use with name and type of fasteners."

3.7 Workmanship. All panels shall be fabricated in accordance with the highest grade commercial practice for this type of work. Panels shall be free of any defects which might render them unserviceable or make them hazardous to employees assembling them into boxes. When panels are assembled into a complete box, they shall fit together with such accuracy that no joint or opening between adjacent panels exceeds 1/32 inch.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for Inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the government. The Government reserves the right to perform any of the inspections set forth in this specification where such inspections are deemed necessary to assure that supplies and services conform to prescribed requirements.

4.2 Sampling.

4.2.1 Lot. For the purpose of sampling, inspection, and testing, a lot shall consist of all panels of the same type, class, style, and size or combination of sizes, which are manufactured from the same materials and under essentially the same conditions and offered for delivery at any one time.

4.2.2 Sampling for Inspection. Sampling for inspection and examination for defects in material, construction, dimensions, appearance, and workmanship shall be in accordance with MIL-STD-105.

4.2.2.1 Inspection Levels and Acceptance Quality Levels for Examination. The inspection levels for the purpose of determining the sample size and Acceptable Quality Levels (AQLs) expressed in defects per hundred units shall be as follows:

EXAMINATION PARAGRAPH	INSPECTION LEVEL	AQL	
		MAJOR	TOTAL
4.3.1.1	S-4	2.5	6.5
4.3.1.2	S-2		4.0

4.2.3 Sampling for Assembly Inspection and Testing. The sample for assembly inspection and testing shall consist of one complete set of panels (ends, sides, top, and bottom) designed for assembling one complete box. One sample (set of panels as specified herein) shall be selected at random from the first 10 sets manufactured and one sample selected at random from each additional 200 sets or fraction thereof within each lot (see 4.2.1).

4.3 Inspection of the End Item.

4.3.1 Examination of the End Item. Examination of the end item shall be made in accordance with the classification of defects, inspection levels and Acceptance Quality Levels (AQLs) set forth in 4.2.2.1. The lot size and units for examination under 4.3.1.1 shall be as specified in 4.2.1 and the units for examination under 4.3.1.2 shall be bundles or crates of panels or knocked-down boxes as applicable.

4.3.1.1 Examination of the end item for defects in materials, construction, dimensions, appearance, and workmanship shall be in accordance with the following table of defects:

EXAMINE	DEFECTS	CATEGORY MAJOR	CATEGORY MINOR
Materials	Lumber used for cleats not in compliance with the quality specified in MIL-STD-731 (see 3.1.1 and 3.1.1.1).		101
	Cleats not in compliance with the dimensional requirements or exceed allowable tolerances (see 3.1.1.2).		102
	Plywood not in compliance with minimum quality (see 3.1.2).		103
	Plywood not conforming to minimum thickness (see 3.1.2.1).		104
	Veneer, paper-overlaid panel board not in compliance with requirements (see 3.1.3).		105
	Fiberboard panel board not in compliance with requirements (see 3.1.4).		106
	Fasteners (nails, staples, wire stitches, etc) not in compliance with requirements (see 3.1.5).		107
Panels	Panels not in conformance with type, class, or style as specified in contract or order (see 1.2 and 6.2).		108
	Panels not in conformance with sizes specified in contract or order or exceed allowable tolerances (see 3.4 and 6.2).		109
Fabrication (panels)	Fasteners not driven and clinched in accordance with minimum requirements applicable to type, class, and style of panel ordered (see 3.2.1.1, 3.2.2.1, and 3.2.3.1).		110
	Cleats not properly positioned in accordance with minimum requirements applicable to type, class, and style of panel ordered (see 3.2.1.1.1, 3.2.1.1.2, 3.2.2.1.1, 3.2.2.1.2, and 3.2.3.1.1).		111

EXAMINE	DEFECTS	CATEGORY MAJOR	CATEGORY MINOR
	Intermediate cleats missing or not spaced in accordance with minimum requirements (see 3.2.1.1.1, 3.2.1.1.2, 3.2.2.1.1, 3.2.2.1.2, and 3.2.3.1.1).	112	
	Assembly of panels not in true alignment or out of square (see 3.4.2).	113	
	Protruding fastener points (shiners), not permitted (see 3.2.1.1).	114	
	Two-piece panels not in accordance with minimum requirements (see 3.2.1.3).	115	
Accuracy of Assembly	Sets of panels (ends, sides, top, and bottom) when assembled into a complete box: dimensions not in accordance with contract or order or exceed allowable tolerances (see 3.4.1.1 and 3.4.2.1).		201
	Panels do not fit together properly leaving cracks in excess of minimum requirements (see 3.7).		202
Marking (Panel identification)	Panels not marked in accordance with requirements (see 3.6).		203

4.3.1.2 Examination of product for defects in preparation for delivery shall be in accordance with the following:

EXAMINE	DEFECTS	CATEGORY MAJOR	CATEGORY MINOR
Packing	Panels not in bundles and secured and ready for shipment as specified (see 5.1.1 and 5.1.2).		205

EXAMINE	DEFECTS	CATEGORY	
		MAJOR	MINOR
Marking	Marking of packages, bundles, etc, of panels not in accordance with 5.3.		206

4.4 Tests. Tests for acceptance shall consist of the examination of panels and sets of panels (ends, sides, top, and bottom) assembled into a complete box as specified under 4.3.1 and the applicable tests specified herein.

4.4.1 Assembly Test. Each sample conforming to 4.2.3 and selected in accordance with the provisions specified therein shall be assembled into a complete box. Only hand tools readily available on the commercial market or standard tools as specified in 3.3.2 shall be required to perform the assembling of panels into a complete box. The assembly time shall not exceed the time normally required to assemble a cleated panel box with nails.

4.4.2 Superimposed Load Test. A superimposed load test shall be conducted on boxes prior to the rough handling test. This test is to determine the ability of the panels assembled into a box to support superimposed loads. Except for conditions specified herein, the test shall be conducted in accordance with Method 5017 of Federal Standard No. 101. This test shall be conducted on an empty box without the use of struts, braces, dunnage or any other type of internal supporting structure. The loss of a panel or breakage of any panel component or permanent panel distortion after the load has been removed shall be considered as failure of the panels to pass this test.

4.4.3 Rough Handling Tests. The same box used for the superimposed load test shall be used for the rough handling tests, except it shall be loaded with a test or dummy load equal in weight to the load for which the panels were designed. The weight of test load and box, height of drops for free fall drop, edgewise drop, and cornerwise drop shall be as outlined in applicable test methods. The rough handling tests shall consist of the vibration test (4.4.3.1), one of the applicable drop test (4.4.3.2, 4.4.3.3, or 4.4.3.4) and if applicable, impact test (4.4.4). Tests shall be conducted in the sequence specified. Splitting, breaking or loss of cleats, shearing of fastenings (nails, staples, etc), panels failing to hold assembly fasteners, panel breakage, etc, shall be considered as a failure.

4.4.3.1 Vibration Test. Boxes shall be tested in accordance with Method 5019.1 of Federal Test Method Standard No. 101. The loss of a panel or distortion of the box components or fastenings after the load has been removed shall be considered as failure to pass the test.

4.4.3.2 Free-Fall Drop Test. Boxes shall be tested in accordance with Method 5007.1, procedure A of Federal Standard No. 101.

4.4.3.3 Edgewise Drop Test. Boxes shall be tested in accordance with Method 5008.1 of Federal Standard No. 101.

4.4.3.4 Cornerwise Drop Test. Boxes shall be tested in accordance with Method 5005.1 of Federal Standard No. 101.

4.4.4 Impact Tests. Boxes with any dimension exceeding 60 inches and not over 9.5 feet, closed as for shipment and with a gross weight exceeding 200 pounds, including a test load for which the panels were designed shall be subjected to one of the following impact tests.

4.4.4.1 Pendulum Impact. This test shall be in accordance with Method 5012 of Federal Standard No. 101.

4.4.4.2 Incline Impact. This test shall be in accordance with Method 5023 of Federal Standard No. 101.

4.4.5 Strength After Rough Handling and Impact Testing. After applicable rough handling and impact testing has been completed, boxes shall be capable of withstanding the superimposed load test of 4.4.2 except the required load per square foot shall be 50 percent of the load specified therein.

5. PACKAGING

5.1 Packing. Packing shall be Level A, C or Commercial as specified (see 6.2).

5.1.1 Level A.

5.1.1.1 Style A Panels. Unless otherwise specified, Style A, panels of like type, class, and size shall be bundled in 5s, 10s, or multiples of 10s, but in no case shall the bundles exceed 200 pounds. Each bundle shall be securely banded with steel strapping conforming to QQ-S-781. Panels shall be protected from water by covering them with a flexible waterproof shroud.

5.1.1.2 Styles B or C Panels. Unless otherwise specified, Styles B or C panels shall be in sets (ends, sides, top, and bottom) of like types, classes, and sizes. These sets shall be securely fastened together with twine, pressure sensitive reinforced tape, etc. These sets of panels shall be securely bundled in 5s, or multiples of 5s, except no bundle shall exceed 200 pounds. Each bundle shall be securely banded with steel strapping conforming to QQ-S-781. Type I panels shall be protected from water by covering them with a flexible waterproof shroud.

5.1.2 Level C. All panels shall be prepared for delivery as specified for Level A, except units (bundles, etc) shall not exceed 250 pounds without being palletized or placed on a skidded platform. All units prepared for delivery shall be in accordance with Uniform Freight Classification Rules or National Motor Freight Classification Rules, as applicable.

5.1.3 Commercial. Panels shall be packed in accordance with requirements of ASTM D-3951-82

5.2 Palletization. When specified (see 6.2), panels packed as specified in 5.1 shall be palletized in accordancee with load Type I of MIL-STD-147.

5.3 Marking.

5.3.1 Marking Level A or C. Each unit (bundle, pallet, etc) prepared for shipment shall be marked in accordance with MIL-STD-129.

5.3.2 Commercial. Each unit (bundle, pallet, etc) prepared for shipment shall be marked in accordance with ASTM D-3951-82

5.4 Preservation. Not applicable to this specification.

6. NOTES

6.1 Intended Uses. Panels furnished under the provisions of this specification are primarily intended for use in assembling demountable and reusable boxes assembled with fasteners other than nails and screws. They may also be used in establishing modular box systems of various sizes. Style A panels may be used in assembling non-demountable reusable boxes when requirements for such boxes exist. Class 3 panels (solid fiberboard) should not be expected to have reusability qualities equal to plywood or paper-overlaid veneer.

6.1.1 Interior types and grades of plywood conforming to commercial and product standards should not be directly exposed to excessive amounts of water nor be treated with water-borne fire-retardant or water-borne preservative chemicals. Hardwood plywood conforming to NN-P-530 should not be used in panel fabrication unless specifically directed or when economy dictates its use.

6.2 Ordering Data. Procurement documents should specify the following:

a. Title, number, and date of this specification.

b. Type, class, and style of panels required (see 1.2). Type, grade, or standard of plywood covered under the provisions of NN-P-530 and applicable commercial and product standards (see 3.1.2 and Table II).

c. Cleat size (width, thickness, etc) required if other than specified in Table I.

d. Thickness, type, class, grade, strength, stiffness, etc, of panel material if known (see Table I).

e. Wood preservative and type (see 3.1.1 and Table II).

f. Maximum weight and type of load to be packed in box for which panels are required when panel material requirements are not known (see Table I).

g. Dimensions of panels (length by width) if known (see 3.4.1).

h. Inside dimensions (length by width by depth) of box for which panels are being procured, when exact panel dimensions are not known (see 3.4.1.1).

i. Panel identification marking (see 3.6).

j. Applicable level of packing (Level A, C, or commercial) (see 5.1).

k. Marking (see 5.3.1 and 5.3.2).

l. Specify if palletizing is required (see 5.2).

6.3 Environmental. Environmental pollution prevention measures may be contained in the material documents referenced herein. Refer to material document or preparing activity for recommended disposability methods.

6.4 Recycled material It is encouraged that recycled material be used when practical, provided that it meets the requirements of this document (see 3.1).

6.5 Changes from previous issue. Asterisks are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes.

Custodians:

Air Force - 69
Army - GL
Navy - AS

Review Activities:

Air Force - 82, 84, 99
Army - MI, SM, AR, ME
Navy -

User Activities:

Air Force - 70, 71
Army - AV
Navy - SA

Preparing Activity:

Air Force - 69

Project No. 8115- 0468

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STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions - Reverse Side)

1. DOCUMENT NUMBER	2. DOCUMENT TITLE
MIL-P-9902C	Panels, Full Cleated, Partially Cleated and Uncleated, Plywood, Veneer Paper Overlaid and Solid Fiberboard for Box Modular Systems

3a. NAME OF SUBMITTING ORGANIZATION	4. TYPE OF ORGANIZATION *(Mark one)*
	☐ VENDOR
	☐ USER
b. ADDRESS *(Street, City, State, ZIP Code)*	☐ MANUFACTURER
	☐ OTHER *(Specify)* _____

5. PROBLEM AREAS

a. Paragraph Number and Wording:

b. Recommended Wording:

c. Reason/Rationale for Recommendation:

6. REMARKS

7a. NAME OF SUBMITTER *(Last, First, MI)* - Optional	b. WORK TELEPHONE NUMBER *(Include Area Code)* - Optional
c. MAILING ADDRESS *(Street, City, State, ZIP Code)* - Optional	8. DATE OF SUBMISSION *(YYMMDD)*

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