

Interline Air Cargo Pallets

RATIONALE

AS1491A has been reaffirmed to comply with the SAE five-year review policy.

1. **PURPOSE:** This Aerospace Standard establishes minimum requirements for pallets used to transport cargo in aircraft equipped with NAS 3610 restraint systems, except as noted, and using nets meeting the requirements of AS 1492. The minimum essential criteria are identified by the use of the key word "shall". Recommended criteria are identified by the key word "should" and while not mandatory are considered to be of primary importance in providing serviceable, economical, and practical air transport pallets. Deviation from the recommended criteria should occur only after careful consideration, extensive testing, and thorough service evaluation have shown alternate methods to be satisfactory.

1.1 Reference Documents:

- 1.1.1 SAE AS 1492, Interline Air Cargo Pallet Nets.
- 1.1.2 NAS 3610, Minimum Airworthiness Requirements & Test Conditions for Air Cargo Unit Load Devices. Aerospace Industries Association of America, Inc., 1725 De Sales Street N.W., Washington, D.C. 20046.
- 1.1.3 IATA Standard Specification Number 50/1, Pallet for NAS 3610 Class II Restraint Systems. International Air Transport Assoc., 2000 Peel Street, Montreal, Quebec, Canada H3A 2R4.
- 1.1.4 IATA Standard Specification Number 50/0, Condition Requirements for Interlining of ULDs, International Air Transport Assoc., 2000 Peel Street, Montreal, Quebec, Canada H3A 2R4.
- 1.1.5 MS 33601A, Track & Stud Fitting for Cargo Transport Aircraft, Standard Dimensions for.
- 1.1.6 United States Federal Test Method Standard 406, Plastics - Methods of Testing. Available from Specification Sales, Bldg. 197, Washington Navy Yard, General Services Administration, Washington, D.C. 20407

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1.1.7 Federal Aviation Regulation (FAR) Part 25, United States Department of Transportation.

2. SCOPE:

2.1 This document establishes dimensional, structural and environmental requirements for two types of interline pallets. Type II covers NAS 3610 code sizes and Type III covers other sizes not currently included in NAS 3610.

2.2 Type II Basic Pallet Sizes:

NAS 3610		
<u>Code Size</u>		<u>Dimension</u>
A	2235 x 3175 mm (88 x 125 in.)	Fig. 1
B	2235 x 2743 mm (88 x 108 in.)	Fig. 2
M	2438 x 3175 mm (96 x 125 in.)	Fig. 3 & 3A
L	1534 x 3175 mm (60.4 x 125 in.)	Fig. 4

2.2.1 Type II pallets will be transported in aircraft equipped with restraint systems defined in NAS 3610 Class II.

2.2.2 Type III Pallet Sizes:

<u>Size</u>	<u>Dimension</u>
III	1562 x 2438 mm (61.5 x 96 in.) Fig. 6

2.2.3 Type III pallets will be transported in aircraft equipped with restraint systems defined in Figures 8, 9, 10 and 11.

2.2.4 The cargo shall be restrained to the pallet by means of a net meeting the requirements of AS 1492.

2.3 Basic Pallet Configuration: The pallet consists of two basic components, core and edge rails, forming an essentially flat panel designed to transport cargo on aircraft systems. The aircraft systems are defined as follows:

a) Ball Mat:

ball diameter	25.4 mm (1 in.)
basic ball pitch	127 mm (5 in.)

2.3 (Continued):

b) Roller System:

pallet maximum overhang on major axis	362 mm (14.25 in.)
pallet maximum overhang on minor axis	254 mm (10 in.)
roller maximum pitch on major axis	673 mm (26.5 in.)
roller maximum pitch on minor axis	254 mm (10 in.)
minimum roller diameter	25.4 mm (1 in.)
minimum roller length	50.8 mm (2 in.)

c) Swivel Caster:

minimum wheel diameter	25.4 mm (1 in.)
minimum contact length	50.8 mm (2 in.)
maximum caster pitch	305 mm (12 in.)

2.4 Clearance Dimensions:

For Type II pallet lock and side vertical restraint overlap see NAS 3610.
For Type III pallet lock and vertical restraint overlap see Figures 9 and 11 as applicable.

3. PALLET CONSTRUCTION:3.1 General Construction:

- 3.1.1 The design, materials and construction of the pallet shall be of aircraft quality. Maintainability and repairability shall be a factor in the design to assure the minimum need for maintenance and to ease and minimize cost for maintenance and repair.
- 3.1.2 The pallet surfaces and edges shall present no rough or sharp edges potentially injurious to personnel or cargo.
- 3.1.3 Bottom surface of pallet shall be flat and continuous.
- 3.1.4 The pallet assembly shall comply with the applicable Design Loads in paragraph 4, the operational criteria in paragraph 5, and the performance requirements in paragraph 6.
- 3.1.5 The materials used in the construction of the Type III pallet shall meet the appropriate provisions of United States Federal Aviation Regulation (FAR) Part 25.

3.2 Pallet Core:

The pallet core shall be enclosed on all four sides with an edge rail. Where the pallet core is of the sandwich type construction, the upper and lower skin shall be enclosed by the edge extrusion. In all cases, the design of the edge rail/core connection and the edge rail corner connection shall be adequate to ensure the integrity of the assembly under the impact and bridging loads expected in service.

3.3 Pallet Edge Rails and Corners:

3.3.1 Lower edge of pallet including corner sections shall be as shown in Figure 5.

3.3.2 The edge rail shall incorporate a continuous restraint track to MS 33601A dimensions as shown in Figures 1 through 4 and 6.

3.3.3 The pallet corners shall have a 63 mm (2.5 in.) $\pm$ 12.7 mm (.50) radius in plan view, or alternatively both edges at the corners shall be tapered off 9.5 mm (3/8 in.) over a 152.4 mm (6 in.) length and the intersection of the tapers blended with a 25.4 mm (1 in.) radius. Each type of corner shall meet the vertical dimensions shown in Figure 5.

4. DESIGN LOADS:

4.1 Table of Loads: The pallet will be used in conjunction with a net to restrain the loads listed below:

4.1.1 Type II Pallet:

NAS 3610 Code Sizes		<u>Dimensions</u>	<u>Max. Test Loads</u>
A		2235 x 3175 mm (88 x 125 in.)	6033 kg (13,300 lb)
B		2235 x 2743 mm (88 x 108 in.)	3629 kg (8,000 lb)
M		2438 x 3175 mm (96 x 125 in.)	6804 kg (15,000 lb)
L		1534 x 3175 mm (60.4 x 125 in.)	3175 kg (7,000 lb)

4.1.2 Type III Pallet:

<u>Size</u>	<u>Dimensions</u>	<u>Max. Test Loads</u>
III	1562 x 2438 mm (61.5 x 96 in.)	2510 kg (5,535 lb)

4.1.3 Ultimate Load Criteria:

4.1.3.1 For Type II pallets ultimate load criteria see NAS 3610 Table II.

4.1.3.2 For Type III pallet ultimate load criteria see Table I.

TABLE 1 - ULTIMATE LOAD CRITERIA - TYPE III PALLETS

ULTIMATE LOADS									
FORWARD (1)		AFT (1)		SIDE (1)		UP		DOWN	
daN	lb	daN	lb	daN	lb	daN	lb	daN	lb
3693	8303	3693	8303	3693	8303	6895	15500	12560	28230

NOTE: (1) In combination with a down load equal to the forward load.

CENTER OF GRAVITY			
Max. Height		Eccen.%	
mm	in.	Long.	Lat.
864	34	+10	+10

4.2 Pallet Net:

4.2.1 The net assembly required to react these loads shall be constructed so that it adequately encompasses the pallet load with all fittings attached to the pallet in locations shown in Figures 1 through 4 and 6 as appropriate. (See AS 1492)

4.3 Design and Test Requirements: The Type II pallet shall meet the critical performance, design and test requirements in accordance with NAS 3610 for Class II systems defined therein.

4.3.1 The Type III pallet shall meet the performance, design and test requirements as defined in this Aerospace Standard.

4.3.1 (Continued):

The Type III pallet and net (per AS 1492) shall be designed so that all up load is applied equally to the net attachments on the 1562 mm (61.5 in.) and 2438 mm (96 in.) sides when restrained as shown in Figure 8 and 10.

5. OPERATIONAL CRITERIA:

- 5.1 Impact Against Locks: The Type II pallet assembly shall withstand, without damage, an impact of a fully loaded pallet striking the locks as defined in NAS 3610, Figures 8 and 10 or Figures 34 and 35 as applicable. The Type III pallet shall withstand, without damage, an impact of a fully loaded pallet striking the locks as defined in Figures 8 and 10 of this Aerospace Standard.
- 5.2 Core Stiffness: The minimum core stiffness shall be 429 Nm^2 * per meter (3,800 lb. in² per inch) width/length of the core. The Type III pallet shall be capable of withstanding the compressive load of three fully loaded Type III pallets loaded directly behind the first pallet which is not loaded. See Figures 8.
- 5.3 Temperature Environment: The structural and operational integrity of the pallet assembly shall be maintained in a temperature environment from -54°C to $+71^\circ\text{C}$ (-65°F to $+160^\circ\text{F}$).
- 5.4 Deterioration: All components of the pallet shall be protected against deterioration or loss of strength in service due to weathering, corrosion, abrasion or other causes where the type of material used requires such protection.
- 5.5 Skin Hardness: Skin hardness shall be such that both upper and lower surfaces shall be capable of supporting a force of 1.33 kN * (300 lb) on a 25.4 mm (1 in) diameter steel ball.

6. LOCAL INDENTATION (PERFORMANCE):

6.1 Test Procedures:

- 6.1.1 Apply a force of 8.9 kN * (2,000 lb) by a steel roller, 50.8 mm (2.0 in) long by 25.4 mm (1.0 in) diameter per Figure 7.
- 6.1.2 Apply a force of 8.9 kN * (2,000 lb) parallel to the base over an area of 5.08 mm (0.2 in) long by 4.75 mm (0.187 in) wide.

- 6.2 Test Result: The maximum indentation (permanent set) allowed at any location of the base shall be 0.254 mm (0.01 in) for the above tests in accordance with Figure 5.

* $1\text{N} = 0.225 \text{ lbf}$
1 kN = 10^3N

7. BRIDGING AND CRESTING (PERFORMANCE):

7.1 Test Procedures: Conduct these tests on an aircraft equivalent system meeting the requirement defined in Paragraph 2.3. Roller bed bridging and cresting points shall be located at least one pallet length apart. Load the pallet to its maximum uniformly distributed gross mass. Move the pallet on a roller bed across a stepped junction with another similar roller system with the height difference at the junction being not less than 152 mm (6 in.). At the point balance (cresting) position on the edge of the higher platform, hold the pallet for a minimum period of 5 seconds.

7.1.1 The rear end of the pallet shall then be allowed to drop from the higher platform onto the lower roller platform.

7.2 Test Result: Upon completion of the test the pallet shall show neither permanent deformation nor abnormality which will render it unsuitable for use and the dimensional requirements affecting handling, securing and interchange shall be satisfied.

8. IMPACT LOADS (PERFORMANCE):

8.1 Test Procedure: Load the pallet to its maximum uniformly distributed gross mass. Move the pallet on a roller bed to impact against solid stops with a velocity of 0.61 meters per second (2 feet per second). Do this for 250 impacts for each of the following test conditions. The size and position of the stops shall be as described in NAS 3610, Figures 8 and 10 or Figures 34 and 35 as applicable for the Type II pallet and as described in Figures 8 and 10 of this Aerospace Standard for the Type III pallet.

- a) Move parallel to major dimension of pallet and impact against base.
- b) Move parallel to minor dimension of pallet and impact against base.

8.2 Test Result: The maximum allowable permanent deformation after any series of 250 impact tests is 9.65 mm (0.38 in.).

9. BALL LOAD CAPACITY (PERFORMANCE):

9.1 Test Procedure: The pallet base surface or a representative portion thereof shall be subjected to a force of 4 kN* (900 lb) on a 25.4 mm (1 in) diameter steel ball.

9.2 Test Result: There shall not be permanent indentation in excess of 0.51 mm (0.020 in).

* 1N = 0.225 lbf
1 kN = 10³N

10. PERFORMANCE ON BALL UNITS:

10.1 Test Procedure: The base or representative portion thereof shall be subjected to a uniformly distributed load of 95.5 kg (210 lb) supported by four 25.4 mm (1 in) diameter steel ball units on a 127 mm (5 in) grid pattern. The base shall be moved over the units for a minimum of 5000 passes along a fixed line in each of two directions, 90 degrees to, and intersecting each other. The length of the stroke shall be approximately 305 mm (12 in).

10.2 Test Result: At the conclusion of the test, there shall be no evidence of deterioration of the base/ball unit interface surface.

11. ABRASION RESISTANCE (PERFORMANCE) FOR PLASTIC COATED OR MAGNESIUM BASE MATERIALS:

11.1 Test Procedure: Three samples of the pallet assembly material will be subjected to a test method equivalent to United States Federal Test Method Standard No. 406, Method 1091, except the abrasion wheel shall be used for all tests.

11.2 Test Results: The average of weight loss shall not exceed the following values:

After 1000 Revolutions:	0.015 grams
After 2000 Revolutions:	An additional 0.005 grams
After 5000 Revolutions:	An additional 0.030 grams
	Up to a TOTAL of 0.050 grams

12. ULTIMATE LOADS (PERFORMANCE - TYPE III PALLET):

12.1 Test Procedure: Load the pallet to each of the ultimate load values described in Table 1. These loads shall be considered as acting separately except as noted and shall be applied in accordance with the specified center of gravity limits. The load shall be restrained by an applicable pallet net specified in AS 1492. The pallet restraint system shall be as described in Figures 8, 9, 10, and 11, as applicable.

12.2 Test Results: At the conclusion of these tests the pallet and net may exhibit permanent deformation, but shall not rupture to the extent of discharging the load.

13. TESTS: The pallet shall be subjected to each of the following tests to show pallet compatibility with operational criteria and performance requirements:

Local Indentation	Para. 6 above
Bridging and Cresting	Para. 7 above
Impact Loads	Para. 8 above
Ball Load Capacity	Para. 9 above
Performance on Ball Units	Para. 10 above
Abrasion Resistance	Para. 11 above

*Ultimate loads (Type III pallet only), Para. 12 above.

NOTE: Any of the above tests need not be made if evidence can be shown that the subject unit is equivalent to other units where the above tests have been performed satisfactorily. The tests shall be made in the first instance in conjunction with the pallet net specified in AS 1492.

*NOTE: Analysis may be used as necessary in lieu of testing to show compliance with this requirement.

14. MARKING REQUIREMENTS:

- 14.1 Type II pallets covered by this specification shall be marked in accordance with the requirements of NAS 3610 Clause 3.5. Type III pallets covered by this specification shall be marked with the following information:

- (1) Name and address of the manufacturer.
- (2) The weight of the pallet to the nearest kilogram and pound.
- (3) The serial number or date of manufacture or both.
- (4) The burning rate determined for the pallet under paragraph 3.1.5.
- (5) The FAA Supplemental Type Certificate (STC) number.

The following additional markings should also be included. The markings shall be permanently engraved onto the top surface not more than 25 mm (one inch) from the outer edge of the aircraft pallet. The engraving should be positioned on two sides diagonally opposite to one another within 305 mm (12 inches) from the corner. The letter size shall be large enough to ensure good readability.

I.D. Code _____

Mfg. Part No. _____ Date Mfd. _____

14.1 (Continued):

NOTE: The I.D. code is an international unit marking system consisting of:

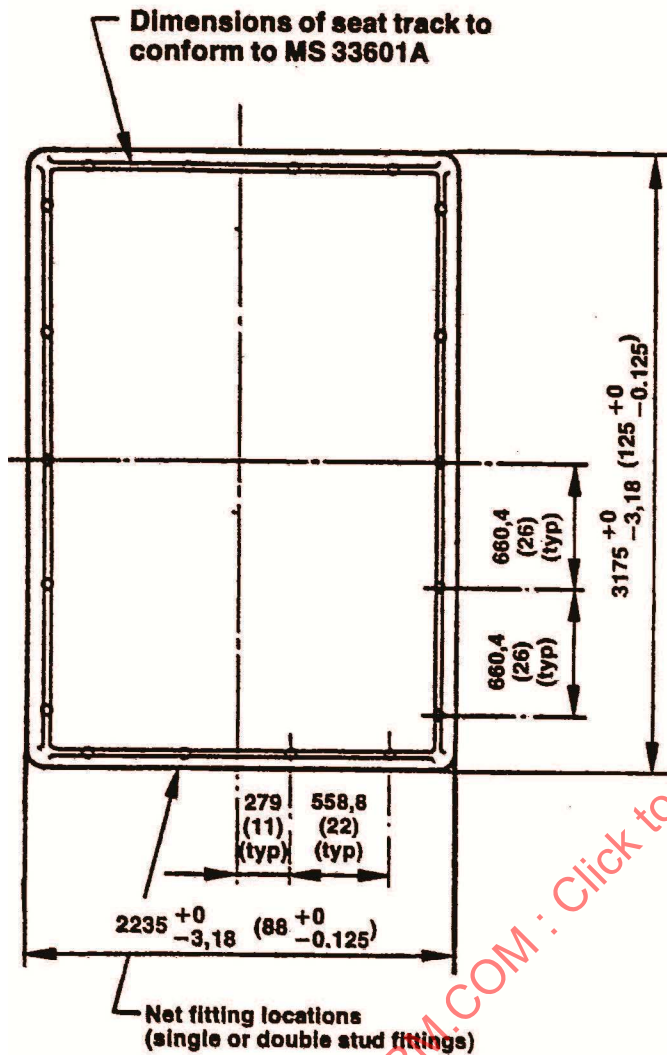
- 1) 3 digits (Alpha) for the type and code size.
- 2) 4 digits (Numeric) for individual serial number.
- 3) 2 digits (Alpha) for owner code (airline or non-airline)

I.D. codes are assigned by the U.L.D. Registrar, International Air Transport Association, 2000 Peel St., Montreal, Quebec, Canada, H3A 2R4.

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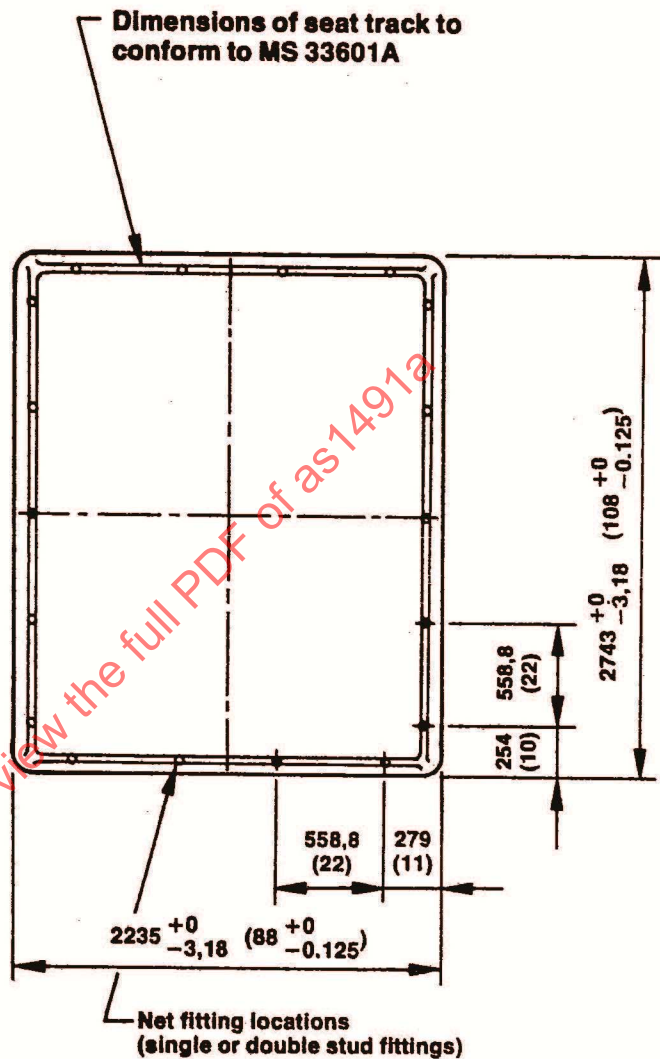
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Dimensions in millimetres
(inch values in parentheses)



Variation in opposite diagonal dimensions across corners not to exceed 3,175 (0.125)

**Figure 1. 2235 x 3175 mm (88 x 125 in.)
Pallet**



Variation in opposite diagonal dimensions across corners not to exceed 3,175 (0.125)

**Figure 2. 2235 x 2743 mm (88 x 108 in.)
Pallet**

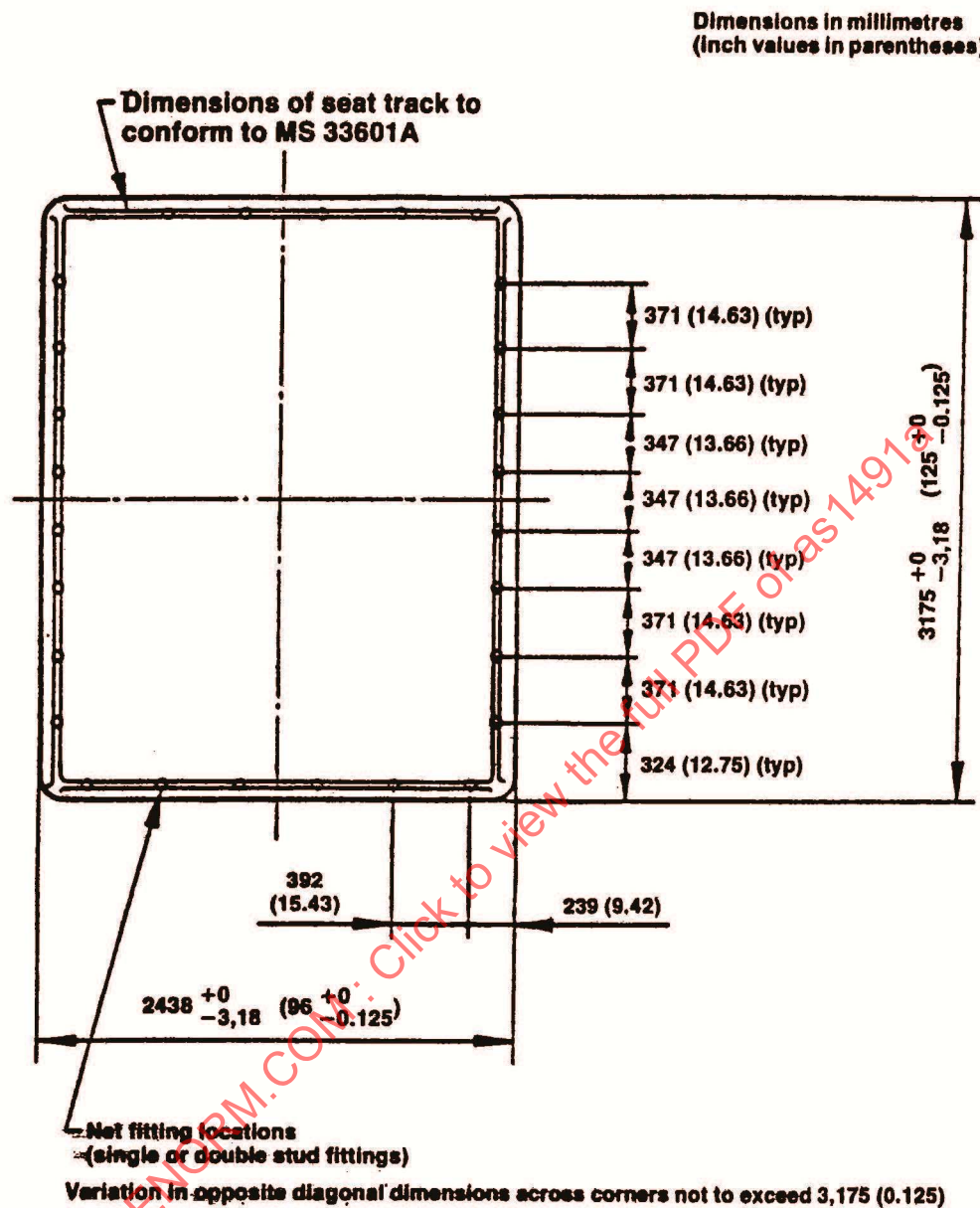
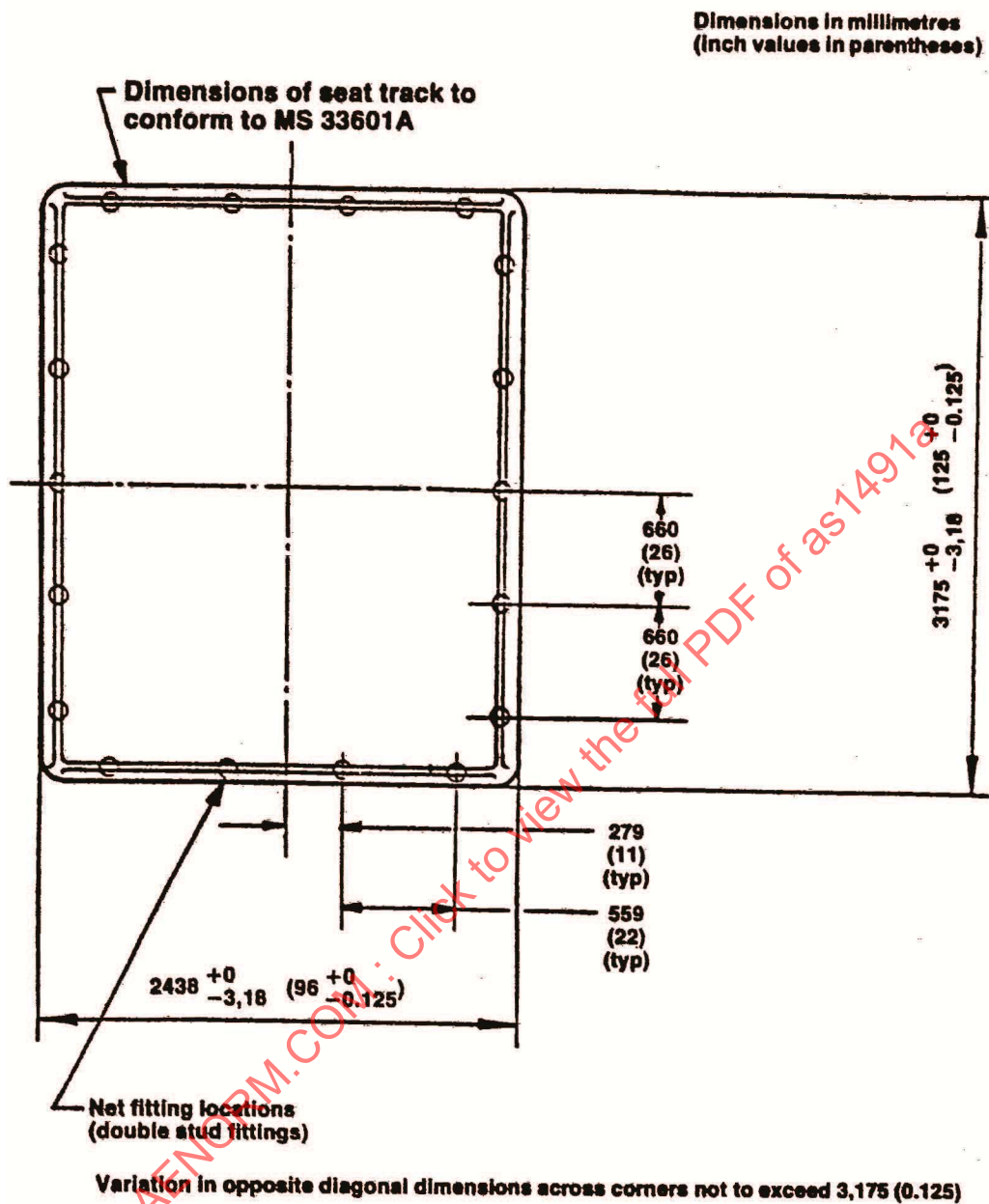


Figure 3. 2438 x 3175 mm (96 x 125 in.)
Pallet



**Figure 3A. 2438 x 3175 mm (96 x 125 in.)
Pallet**

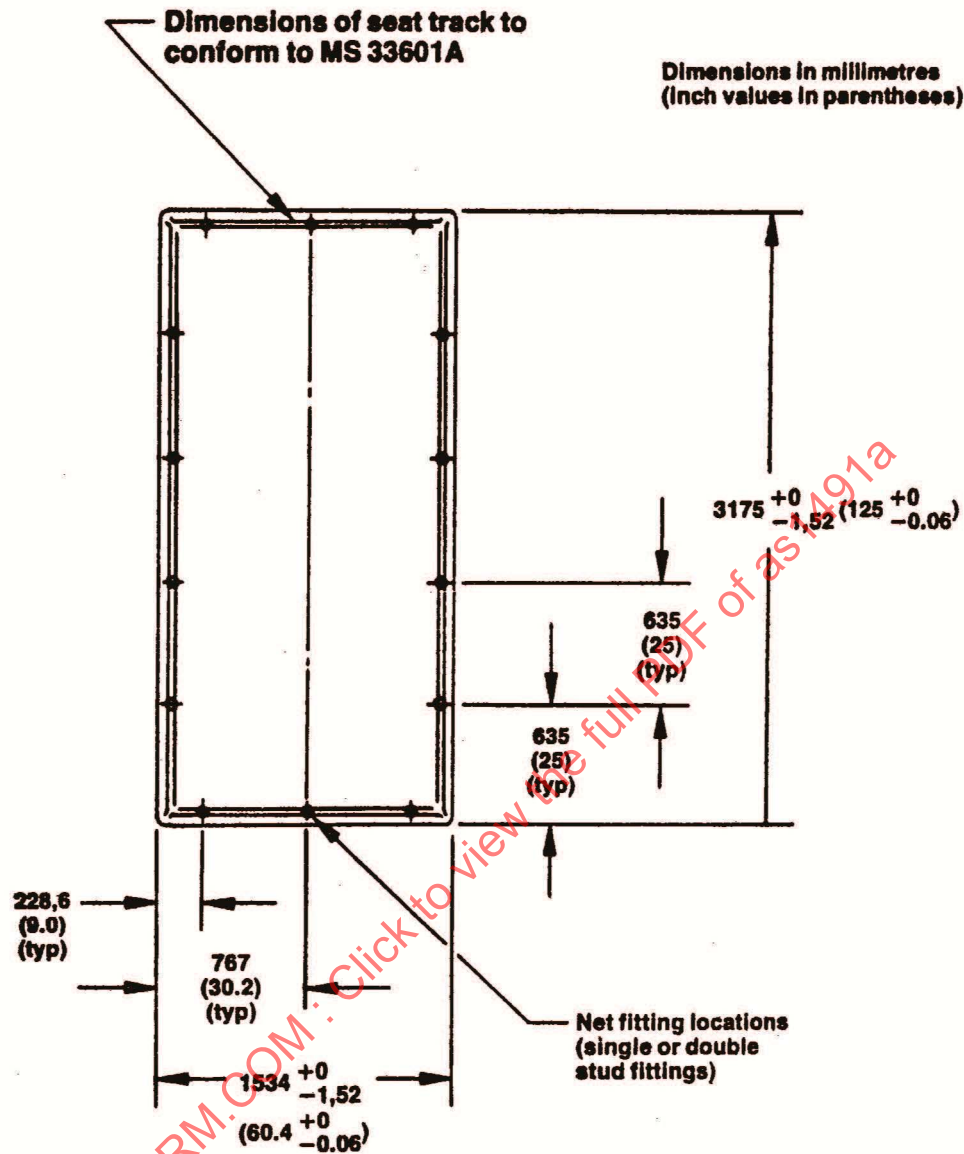


Figure 4. 1534 x 3175 mm (60.4 x 125 in.) Pallet

Dimensions in millimetres (inch values in parentheses)

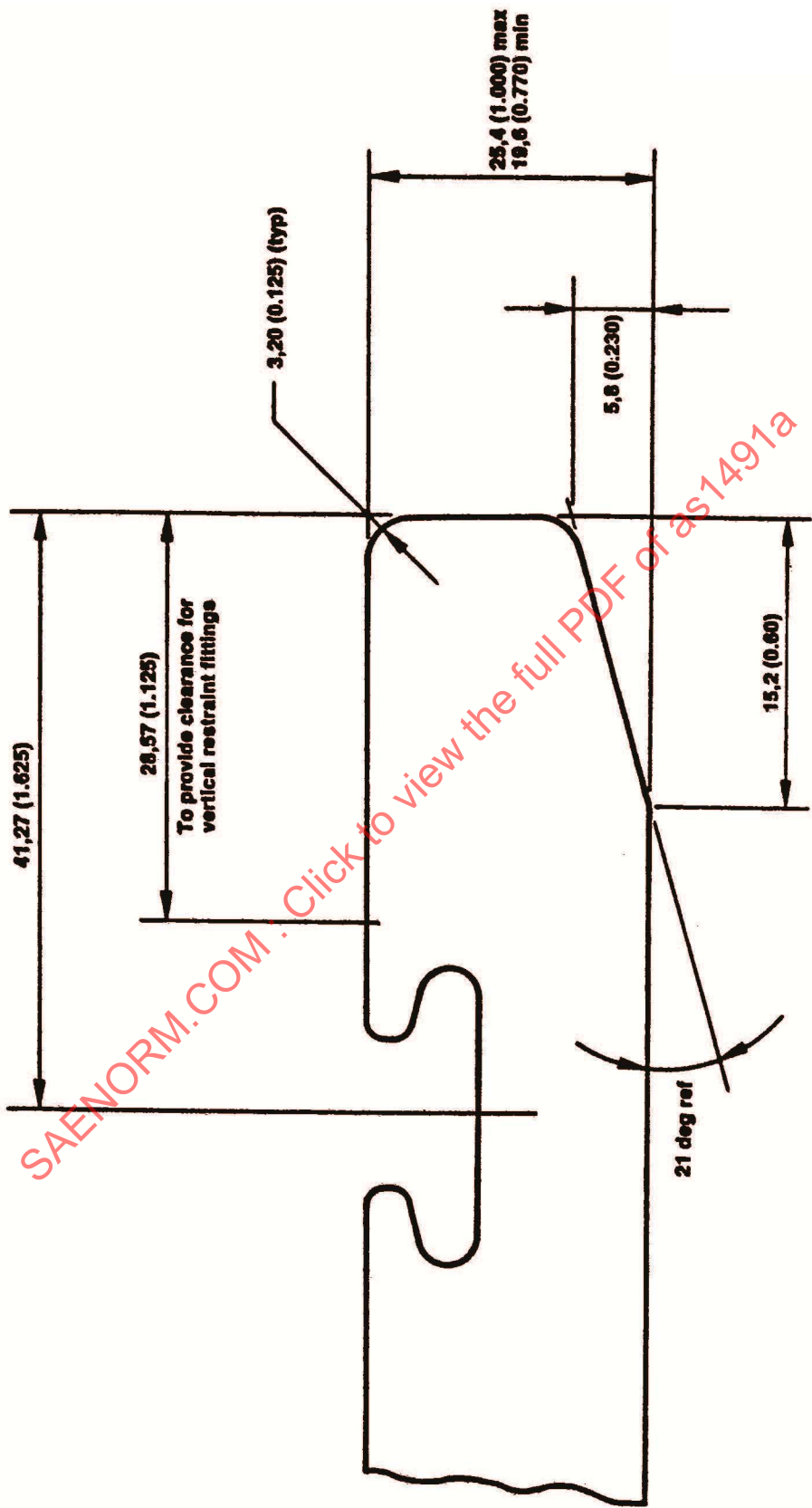


Figure 5. Pallet Edge

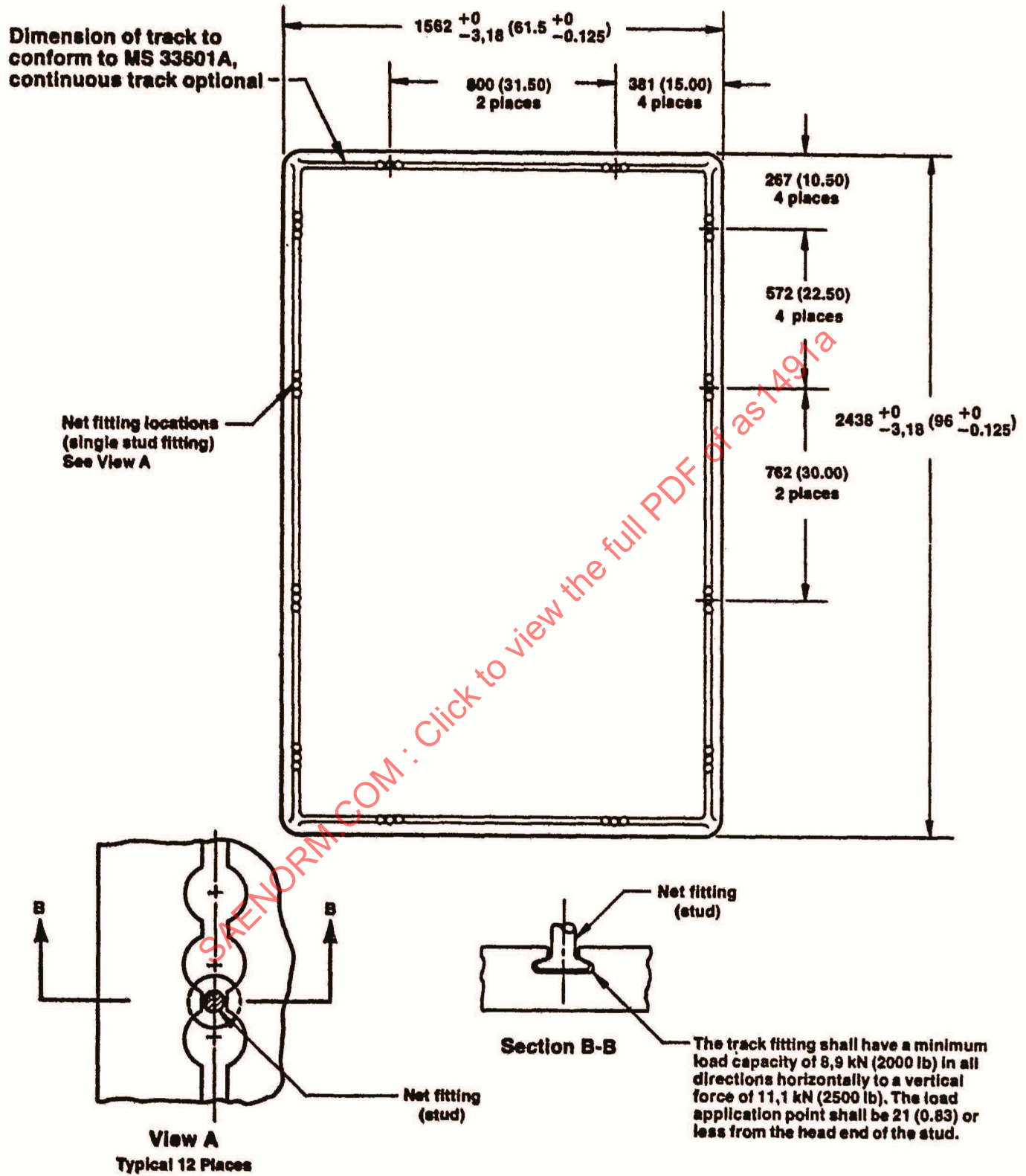


Figure 6. 1562 x 2438 mm (61.5 x 96 in.) Type III

Dimensions in millimetres (inch values in parentheses)