SAE Aerospace
An SAE International Group

AEROSPACE STANDARD

SAE AS1130 | REV. G

Issued 1970-11
Revised 2002-02
Reaffirmed 2007-12
Stabilized 2013-01

Superseding AS1130F

Air and Air/Surface (Platform) Cargo Pallets

RATIONALE

This document has been determined to contain basic and stable technology which is not dynamic in nature.

STABILIZED NOTICE

This document has been declared "Stabilized" by the SAE AGE-2A Cargo Handling Committee and will no longer be subjected to periodic reviews for currency. Users are responsible for verifying references and continued suitability of technical requirements. Newer technology may exist.

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1. SCOPE:

This SAE Aerospace Standard (AS) establishes three classes of pallets:

a. Type A, Air only Pallet
b. Type B, Platform Pallet (Air/Surface Intermodal)
c. Type C, Adapter Pallet

Pallets will have nominal dimension of:

a. Size F pallet (10 ft) (NAS 3610-2F1P) - 2.44 m x 2.99 m (96 in x 117.75 in)
b. Size R pallet (16 ft) (NAS 3610-2R1P) - 2.44 m x 4.98 m (96 in x 196 in)
c. Size G pallet (20 ft) (NAS 3610-2G1P) - 2.44 m x 6.06 m (96 in x 238.5 in)
d. Size H pallet (30 ft) (NAS 3610-2H1P) - 2.44 m x 9.12 m (96 in x 359.25 in)
e. Size J pallet (40 ft) (NAS 3610-2J1P) - 2.44 m x 12.19 m (96 in x 480 in)

Type A, Air only pallets, will normally be on aircraft equivalent roller conveying systems and/or on similarly equipped ancillary ground handling devices.

Type B, Platform pallets, are suitable for air/surface handling and transport systems. Supplementary requirements for Type B version are found in Section 4.

Type C, Adapter pallets, are used to adapt 2.44 m x 2.44 m (8 ft x 8 ft) surface mode only containers for transport. Supplementary requirements for Type C version are found in Section 5.

NOTE: Use of the adapter pallet with surface mode only 2.44 m x 2.44 m (8 ft x 8 ft) containers may require uniform load distribution on the base cross members of these containers for carriage on certain aircraft. The aircraft approved Weight and Balance Manual should be referred to for loadability procedures or limitations, or both.

1.1 Purpose:

This Aerospace Standard (AS) provides dimensional, structural, and environmental requirements for 2.44 m (8 ft) wide pallets to be used in freighter versions of certificated aircraft equipped to provide restraint to pallets tested to the requirements of NAS 3610 Class II restraint system. It is also intended to be compatible with 2.44 m x 2.44 m (8 ft x 8 ft) cross section containers described in AS832. The Type C adapter pallet is intended to be compatible with 2.44 m x 2.44 m (8 ft x 8 ft) cross section containers described in ANSI MH 5.1, Cargo Containers and ISO 1496 Series 1, Freight Containers. Pallet nets used in conjunction with these pallets are described in AS1131. The minimum essential criteria are identified by use of the key word "shall". Recommended criteria are identified by use of 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 recommended criteria should occur only after careful consideration, extensive testing, and thorough service evaluation have shown alternate methods to be satisfactory.

2. REFERENCES:

2.1 Applicable Documents:

The following publications form a part of this document to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order. In the event of conflict between the text of this document and 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.

2.1.1 SAE Publications: Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

AS832	Air and Air/Surface (Intermodal) General Purpose Containers
AS1131	Air and Air/Surface (Platform) Cargo Pallet Nets

2.1.2 ISO Publications: Available from International Organization for Standardization, Case Postale 56, CH-1211, Geneve 20, Switzerland.

ISO 4115	Air Cargo Equipment - Air/Land Nets
ISO 4116	Air Cargo Equipment - Ground Equipment Requirements for Compatibility With Unit Load Devices
ISO 4117	Air and Air/Land Cargo Pallets - Specification and Testing
ISO 1496/1	Series 1 Freight Containers - Specification and Testing - Part 1: General Cargo Containers

2.1.3 FAR Publications: Available from Federal Aviation Administration, 800 Independence Avenue, SW, Washington, DC 20591.

Federal Aviation Regulation (FAR) Part 25, United States Department of Transportation Technical Standard Order TSO-C90

2.1.4 NAS Standards: Available from Aerospace Industries Association, 1250 Eye Street, NW, Washington, DC 20005.

NAS 3610 Cargo Unit Load Devices, Specification for

2.1.5 U.S. Government Publications: Available from DODSSP, Subscription Services Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

MS33601A Track and Stud Fitting for Cargo Transport Aircraft, Standard Dimensions for

Available from Specification Sales, Building 197, Washington Navy Yard, General Service Administration, Washington, DC 20407.

United States Federal Test Method Standard 406, Plastics - Methods of Testing

2.1.6 IATA Publications: Available from International Air Transport Association, 800 Place Victoria, P.O. Box 113, Montreal, Quebec, Canada H4Z 1M1.

IATA 50/9 16 ft or 20 Ft Pallet for NAS 3610 Class II Restraint System

2.1.7 ANSI Publications: Available from American National Standards Institute, 11 West 42nd Street, New York, NY 10036-8002.

ANSI MH5.1 Basic Requirements for Cargo Containers

3. BASIC REQUIREMENTS:

3.1 External dimensions and pallets shall be as specified in Table 1 and Figure 1. Diagonal tolerances shall be as specified in Table 2.

3.2 Construction:

3.2.1 Pallet construction shall be rugged, weatherproof, minimizing maintenance and original cost by having no moving parts.

3.2.2 All fittings and appurtenances shall be within the maximum outside dimensions of the pallet.

3.2.2.1 Mating devices that support, transfer position and secure pallets shall be provided by transportation carriers, transferring equipment or terminal facilities.

3.2.3 Pallet construction shall have sufficient structural strength to perform its intended function and to meet the structural design and test requirements of this document.

3.3 Pallet Surfaces:

3.3.1 The top and bottom surfaces of the pallet shall be parallel, flat, and continuous.

3.3.1.1 For the length of the pallet the bottom surface shall have a smooth to a flat plane within 1.6 mm (0.0625 in). This shall allow for a waviness factor of crest to crest at a pitch of 914 mm (36 in) minimum.

3.3.2 No structure shall protrude below the lower surface.

3.3.3 Construction:

3.3.3.1 The pallet edges (Length "L") shall have a nominal thickness of 50.8 mm (2 in) from the lower surface. This thickness may be varied when the design employed results in a lighter and more durable structure capable of accepting uniform loading of 1953 kg/m^2 (400 lb/ft^2) when supported on conveying system per 3.3.3.3.

TABLE 1 - Pallet Dimensions /1/

Pallet Code	Overall Length in	Overall Length mm	Overall Width in	Overall Width mm	Nominal Thickness	Dim. A in	Dim A mm	Dim B in	Dim. B mm	Dim C in	Dim C mm	Dim D in	Dim D mm
J	+0 480 -.375	+0 12 192 -9.5	+0 96 -.19	+0 2438 -4.8	/2/	9.42	239.27	15.43	391.92	9.37	238.00	16.47	418.34
H	+0 359.25 -.375	+0 9125 -9.5	+0 96 -.19	+0 2438 -4.8	/2/	9.42	239.27	15.43	391.92	9.37	238.00	17.02	432.31
G	+0 238.5 -.250	+0 6058 -6.4	+0 96 -.19	+0 2438 -4.8	/2/	9.42	239.27	15.43	391.92	9.37	238.00	16.90	429.26
R	+0 196 -.250	+0 4978 -6.4	+0 96 -.19	+0 2438 -4.8	/2/	9.42	239.27	15.43	391.92	9.37	238.00	16.11	409.19
F	+0 117.75 -.19	+0 2991 -4.8	+0 96 -.19	+0 2438 -4.8	/2/	9.42	239.27	15.43	391.92	9.37	238.00	16.50	419.10

/1/ See Figure 1 for dimension locations
/2/ For Type A: 50.8 mm (2.0 in)
For Type B: 139.7 mm (5.5 in)
For Type C: 57.2 mm (2.25 in)

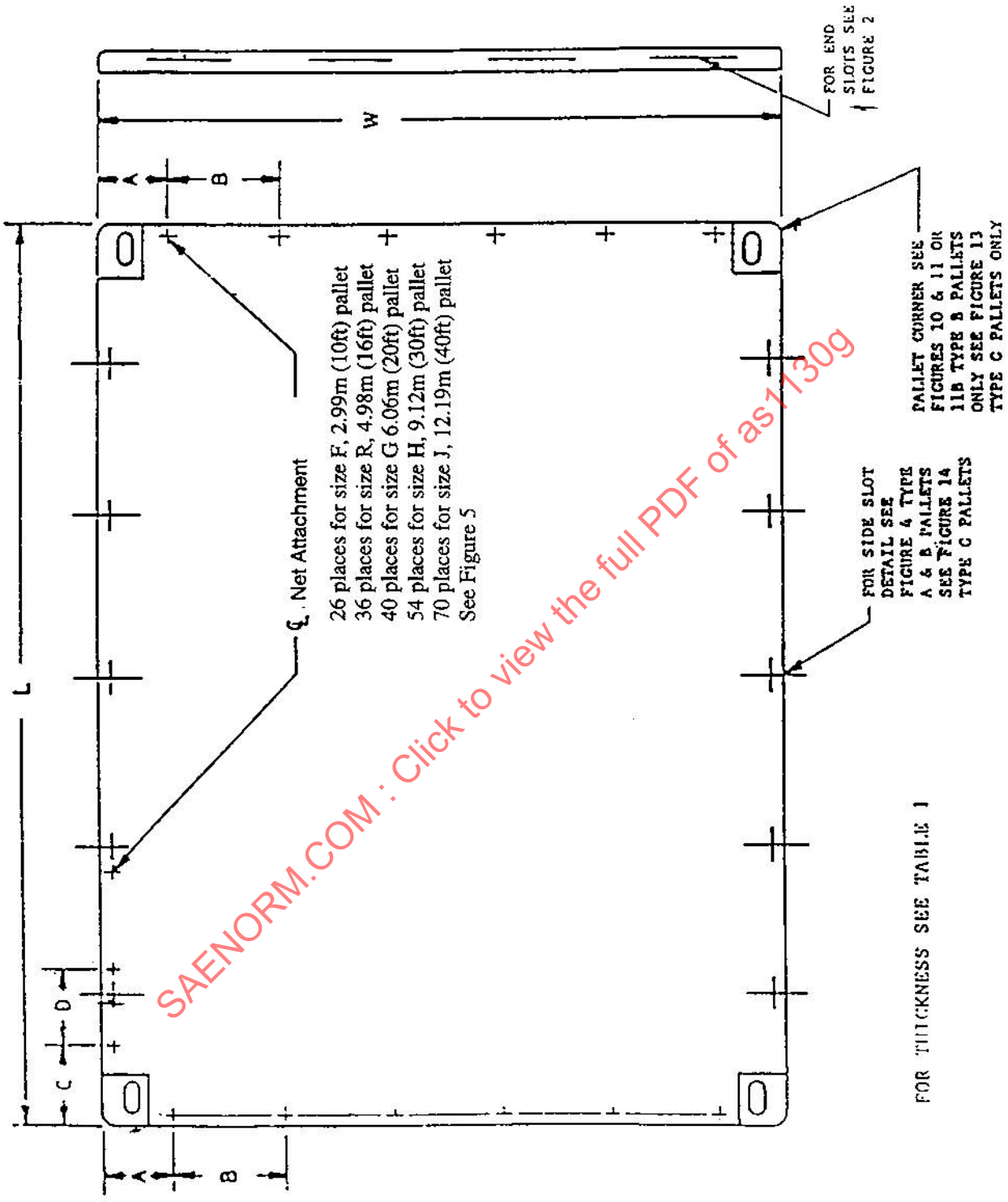


FIGURE 1

TABLE 2 - Diagonal Tolerances - Type B & C Pallets

Pallet Code	Overall Length in	Overall Length mm	S in	S mm	P in	P mm	K_1 Max in	K_1 Max mm
J	480	12 192	472	11,988.8	89	2260.6	3/4	19
H	359-1/4	9 125	351-1/4	8 921.7	89	2260.6	5/8	15.9
G	238-1/2	6 058	230-1/4	5 848.4	89	2260.6	1/2	12.7
R	196	4 978	188	4 775.2	89	2260.6	7/16	11.1
F	117-3/4	2 991	109-3/4	2 787.6	89	2260.6	3/8	9.5

NOTES:

For definitions of S, P, and D, see Figure 9
$K_1 = D_1 - D_2$

3.3.3.2 The pallet shall be enclosed on all four sides by an edge member conforming to Figures 2, 3, 4A and 4B. The vertical surface of the pallet edge between the restraint provisions shown in Figures 3, 4A, and 4B. Section A-A, Type A and B pallets, shall be smooth and continuous to provide automatically latching aircraft systems interface.

a. The pallet bottom skin shall be enclosed by its edge extrusion.
b. The bottom surface shall be flush with the edge member.
c. The lower edge of the edge members shall be as shown in Figure 4A and 4B.
d. The pallet corners shall have a 63.5 mm ± 12.7 mm (2.50 in ± 0.50 in) radius in the plane of the pallet.
e. Pallet corners should be readily replaceable when built as a separate bolted or riveted on part.

3.3.3.3 The pallet design shall provide for support and ease of movement at the rated distributed load on minimum conveyor systems as described in the following:

a. Four rows of rollers approximately equally spaced over a minimum width of 1930.4 mm (76 in) measured between centers with each row composed of 38 mm (1.5 in) diameter rollers 76.2 mm (3 in) long uncrowned with edge radius of 1.6 mm (0.06 in) R, spaced on 254 mm (10 in) centers. Pallet travels perpendicular to roller axis.

b. Swivel casters with 25 mm (1 in) diameter wheels having a contact length of 51 mm (2 in) located on a 305 mm x 305 mm (12 in x 12 in) grid pattern. Pallet travel is in all directions across grid.

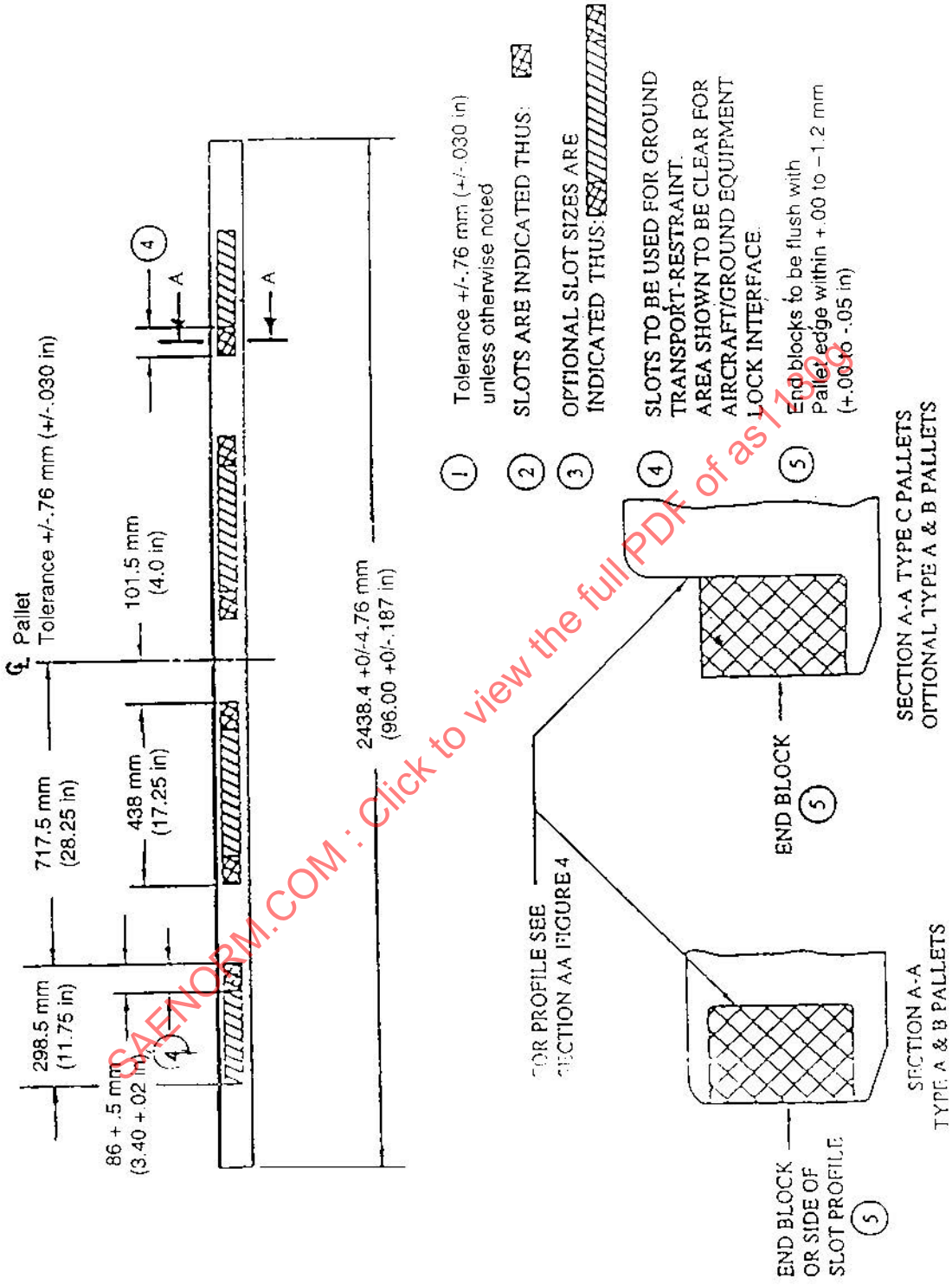


FIGURE 2 - End Slots or Blocks (Both Sides)

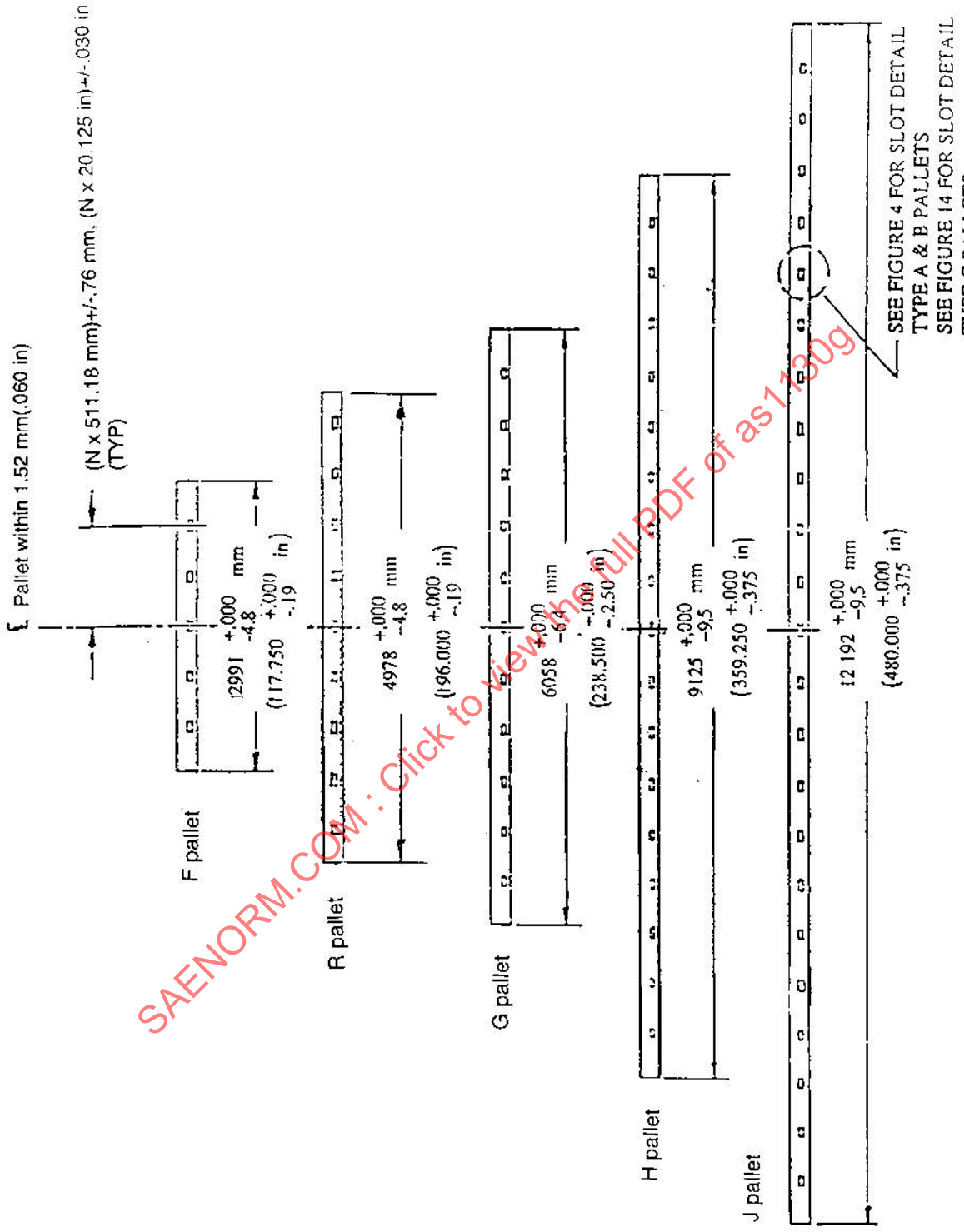


FIGURE 3 - Side Restraint Slots Location

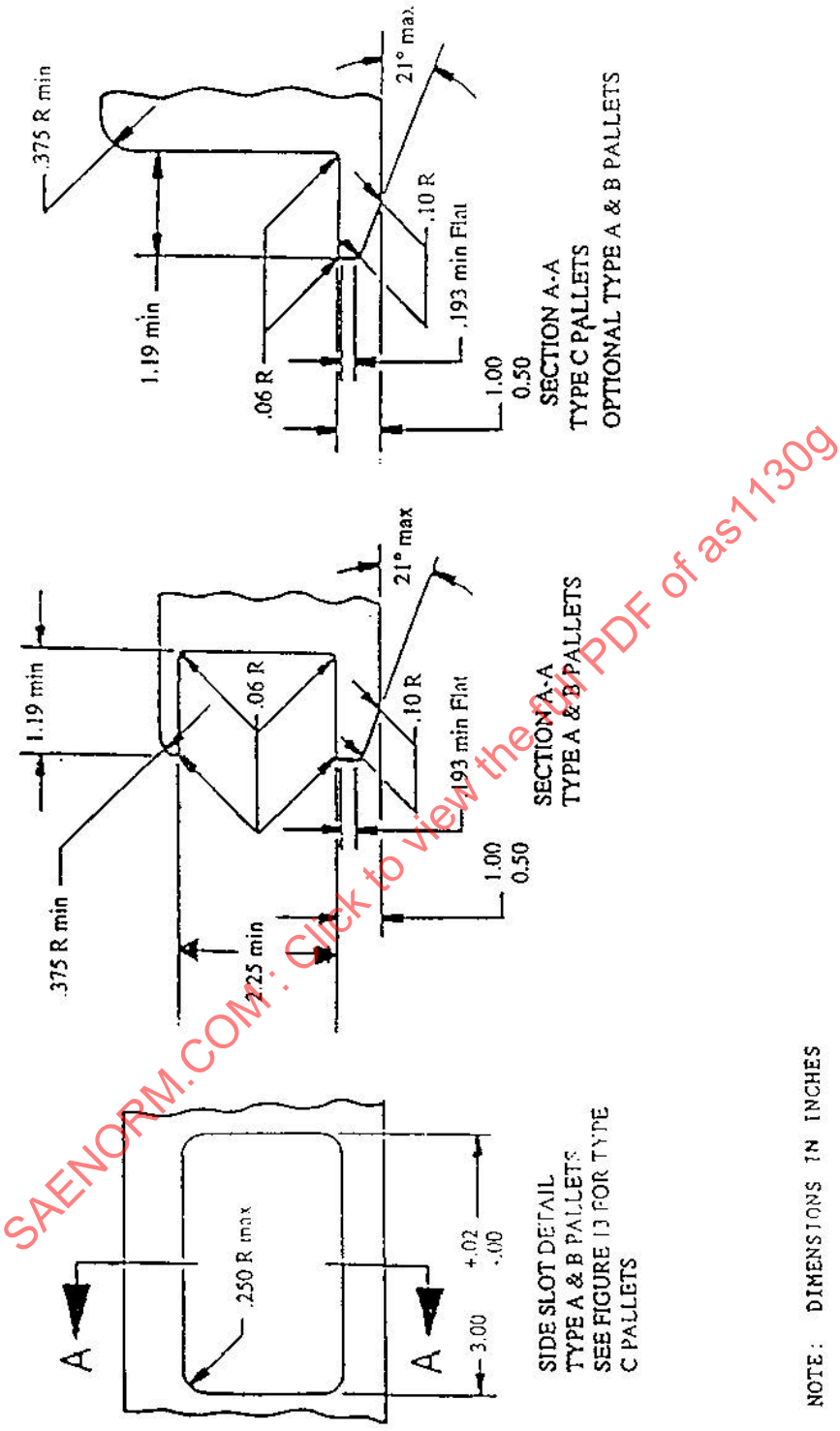


FIGURE 4A - Side Slot Detail

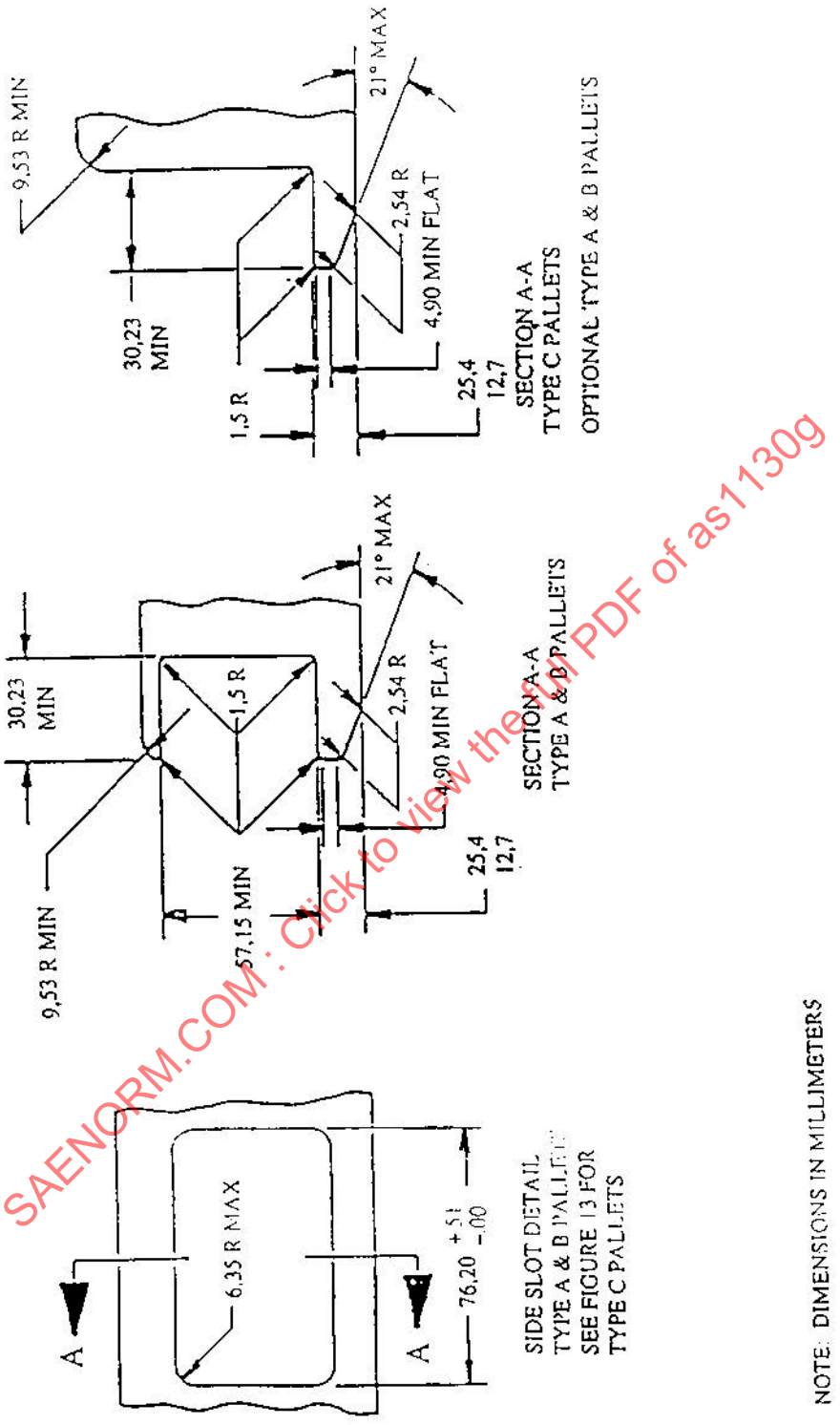


FIGURE 4B - Side Slot Detail

3.3.3.3 (Continued):

c. Ball transfer units with 25 mm (1 in) diameter balls located on a 127 mm x 127 mm (5 in x 5 in) grid pattern. Pallet travel is in all directions across grid.

3.3.3.4 The pallet lower surface shall comply with the following conditions:

a. Ball identation per 6.2
b. Ball casters per 6.3
c. Abrasion per 6.4

3.3.4 Net attachments shall be per MS33601A as shown in Figures 1, 5A, and 5B. As an option, a continuous seat track per MS33601A may be incorporated in the pallet upper surface for net or strap attachments.

3.4 Aircraft Restraint Provision:

Restraint provision as shown in Figures 2, 3, 4A, and 4B shall be provided.

3.5 Complete Assembly:

3.5.1 Pallet shall be capable of traversing a 0.035 rad (2°) crest or valley with no permanent deformation or damage.

3.5.1.1 To meet this condition pallets uniformly loaded to gross weight shall be capable of being supported at the cresting point through a roller contact of 2032 mm (80 in) minimum width with a roller of 38 mm (1.5 in) maximum diameter.

3.5.2 Pallet construction shall be free of any recesses or voids in which cargo (or other material) can be concealed. All pallet surfaces should be as free as possible of recesses and protuberances, where pests can hide, or where soil or other residues can accumulate.

3.5.3 The pallet shall withstand without permanent deformation a forklift wheel load of 2721.5 kg (6000 lb) on each of two wheels on 762 mm (30 in) centers anywhere on the pallet while resting on a surface of sufficient strength and continuity to adequately support the pallet.

3.5.4 The minimum pallet core stiffness shall be 225 kNm^2/m (2×10^6 $lbf\text{-}in^2/in$) width of the core.

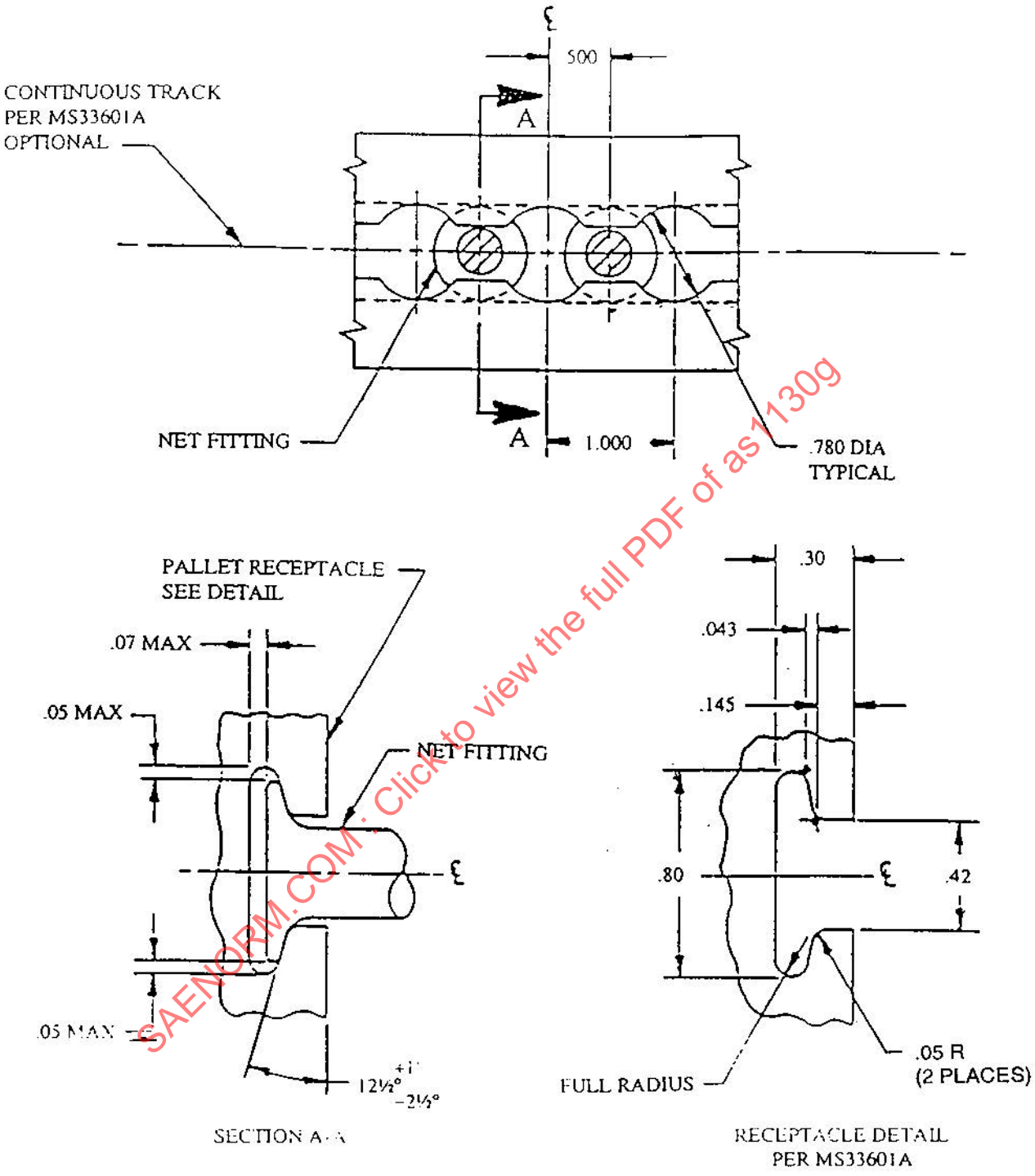
3.6 Ratings:

3.6.1 The pallet shall be designed for the following gross weights:

3.6.1.1 F pallet - 2.99 m (10 ft) - 5670 kg (12 500 lb)

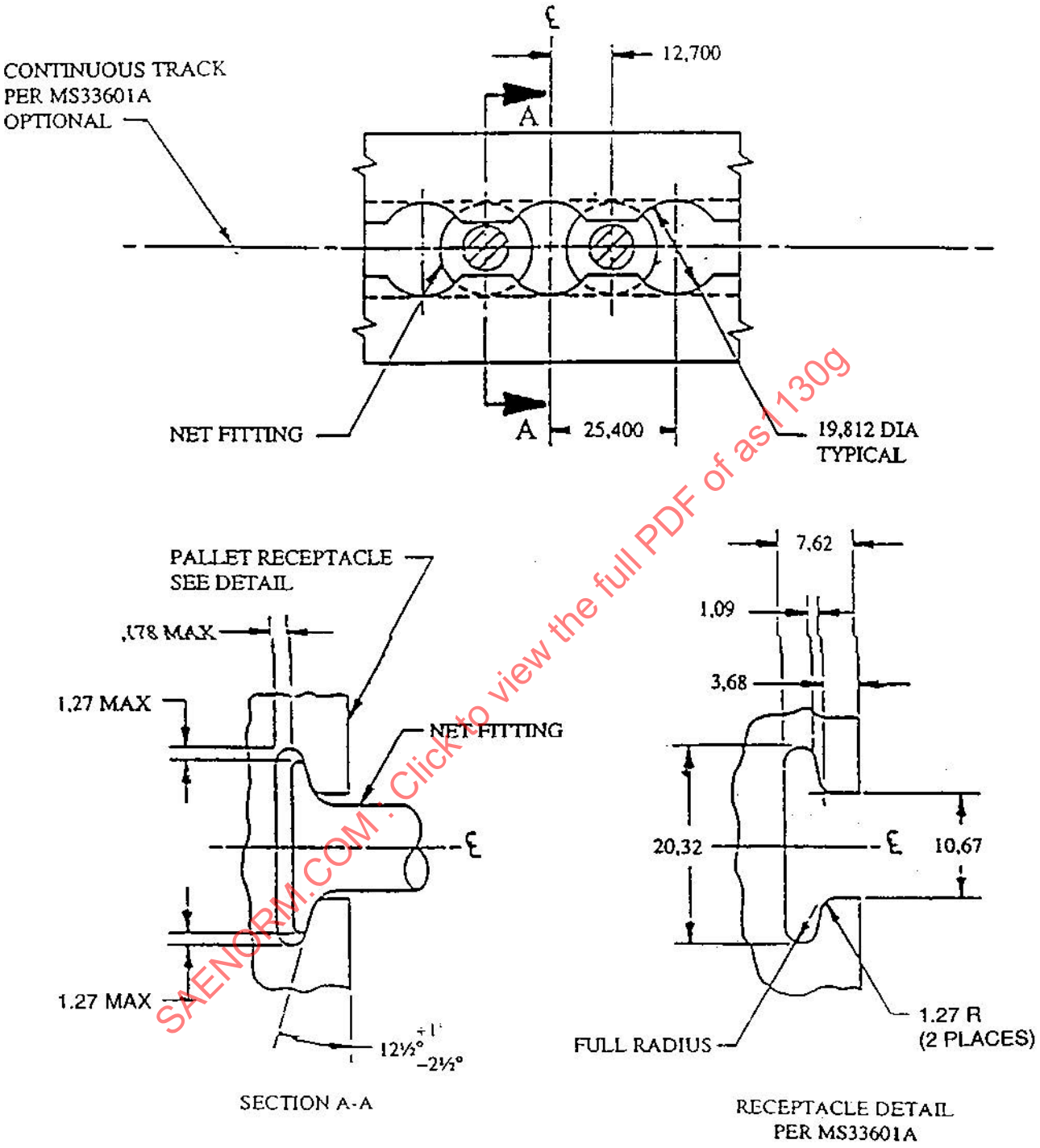
3.6.1.2 R pallet - 4.98 m (16 ft) - 11,340 kg (25 000 lb)

3.6.1.3 G pallet - 6.06 m (20 ft) - 13,608 kg (30 000 lb)



NOTE: DIMENSIONS IN INCHES

FIGURE 5A - Cargo Net Tie-Down Receptacle



NOTE: DIMENSIONS IN MILLIMETERS

FIGURE 5B - Cargo Net Tie-Down Receptacle

3.6.1.4 H pallet - 9.12 m (30 ft) - 15,876 kg (35 000 lb)

3.6.1.5 J pallet - 12.19 m (40 ft) - 20,412 kg (45 000 lb)

3.6.2 Pallets over 2.99 m (10 ft) length shall be designed for a gross weight of 6759 kg (14 900 lb) in any 2.99 m (10 ft) section of the pallet.

3.7 Design Loads:

3.7.1 Table of Loads: The pallet assembly will be used in conjunction with a net per AS1131 to restrain the loads listed in Table 3:

TABLE 3

Pallet Code	NAS 3610	Dimensions	Maximum Gross Loads
F	2F1P	2.44 m x 2.99 m (8 ft x 10 ft)	5 670 kg (12 500 lb)
R	2R1P	2.44 m x 4.98 m (8 ft x 16 ft)	11 340 kg (25 000 lb)
G	2G1P	2.44 m x 6.06 m (8 ft x 20 ft)	13 608 kg (30 000 lb)
H	2H1P	2.44 m x 9.12 m (8 ft x 30 ft)	15 876 kg (35 000 lb)
J	2J1P	2.44 m x 12.19 m (8 ft x 40 ft)	20 412 kg (45 000 lb)

3.7.2 Ultimate Loads: The pallet assembly shall be designed to the ultimate load per NAS 3610 while supported on a roller system in accordance with 3.3.3.3 with the cargo center of gravity located at any point in the range specified in 3.7.6. Under these loads the pallet may exhibit permanent deformation but shall not rupture to the extent of discharging cargo.

3.7.3 Fore and aft loads shall be reacted by a latch per Figure 6 inserted in the restraint slots as shown in Figures 3, 4A, and 4B. The minimum latches required, either on one or both sides of the pallet, are as follows:

a. F pallet - 2.99 m (10 ft) pallet - 2 latches
b. R pallet - 4.98 m (16 ft) pallet - 4 latches
c. G pallet - 6.06 m (20 ft) pallet - 5 latches
d. H pallet - 9.12 m (30 ft) pallet - 8 latches
e. J pallet - 12.19 m (40 ft) pallet - 11 latches

3.7.3.1 The ultimate fore and aft load for any slot shall be 8340 daN (18 750 lb).

3.7.3.2 The fore and aft load bearing slots shall be considered to be either on one or both sides of the pallet.

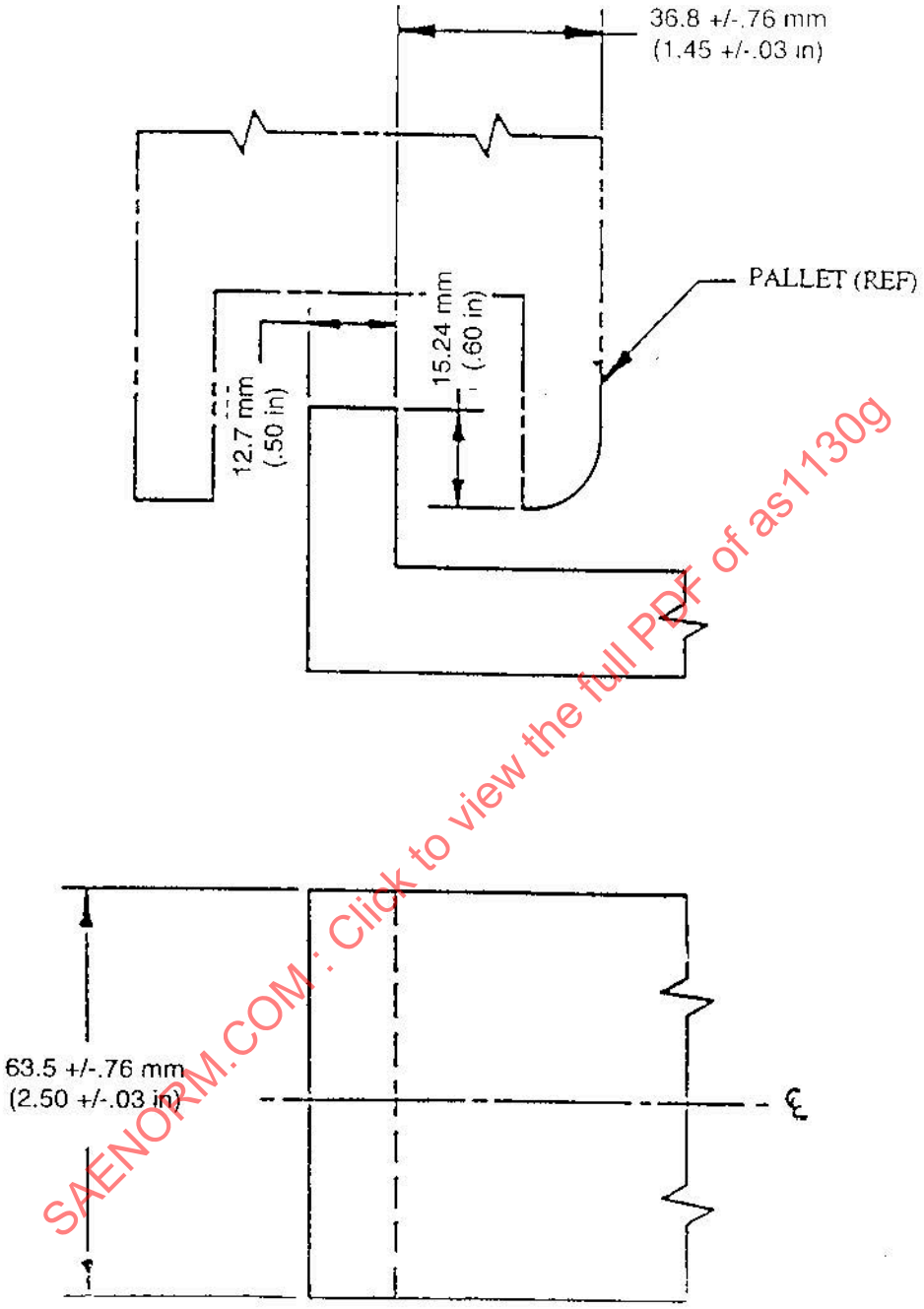


FIGURE 6 - Fore and Aft Restraint Latch Dimensions

3.7.4 Up load shall be reacted by a latch per Figure 7 inserted in the side restraint slots as shown in Figures 3, 4A, and 4B.

The minimum vertical restraint latches required, equally distributed on both sides and equally spaced along the full length of the pallet, are as follows. This includes the fore and aft restraint latches.

a. F pallet - 2.99 m (10 ft) pallet - 6 latches
b. R pallet - 4.98 m (16 ft) pallet - 10 latches
c. G pallet - 6.06 m (20 ft) pallet - 12 latches
d. H pallet - 9.12 m (30 ft) pallet - 18 latches
e. J pallet - 12.19 m (40 ft) pallet - 24 latches

3.7.5 End slots shall be provided in accordance with Figure 2.

3.7.5.1 Slots shall be designed to restrain a 2.99 m (10 ft) pallet for ultimate forward, aft, and vertical up loads when used in conjunction with restraint fittings in accordance with Figure 8.

3.7.5.2 Slots to be used for ground transport restraint on roller bed vehicles shall be provided as shown in Figure 2. The inner face of each outward slot (or block) shall be capable of restraining laterally 33% of the maximum unit gross weight. The pallet lower edge member shall be capable of restraining an upward load of 20% of the maximum unit gross weight in the slot area.

3.7.6 Center of gravity shall be assumed to vary up to:

a. ±10% of the pallet width measured from the centerline.
b. ±5% of the pallet length measured from the centerline.
c. 1219.2 mm (48 in) vertically measured from pallet bottom surface.
d. To achieve above asymmetric conditions, cargo density shall be assumed to vary linearly.

3.7.7 Each of the four base corners of the pallet shall be capable of reacting a 8340 daN (18 750 lb) in either the longitudinal or lateral direction.

3.7.8 The cargo net attachment fittings shall include the provision for attaching a cargo tie-down fitting, each capable of reacting a 2224 daN (5000 lb) ultimate load in any direction.

4. SUPPLEMENTAL REQUIREMENTS FOR AIR/LAND PALLETS (FIGURE 9):

4.1 Type B Pallet (Figure 10):

4.1.1 Type IB shall incorporate fittings at the four corners conforming to Figures 11A and 11B.

4.1.2 Type IIB are 10 and 20 ft pallets only and shall incorporate forklift tineways located per Figure 12 and fittings at the four corners conforming to Figures 11A and 11B.

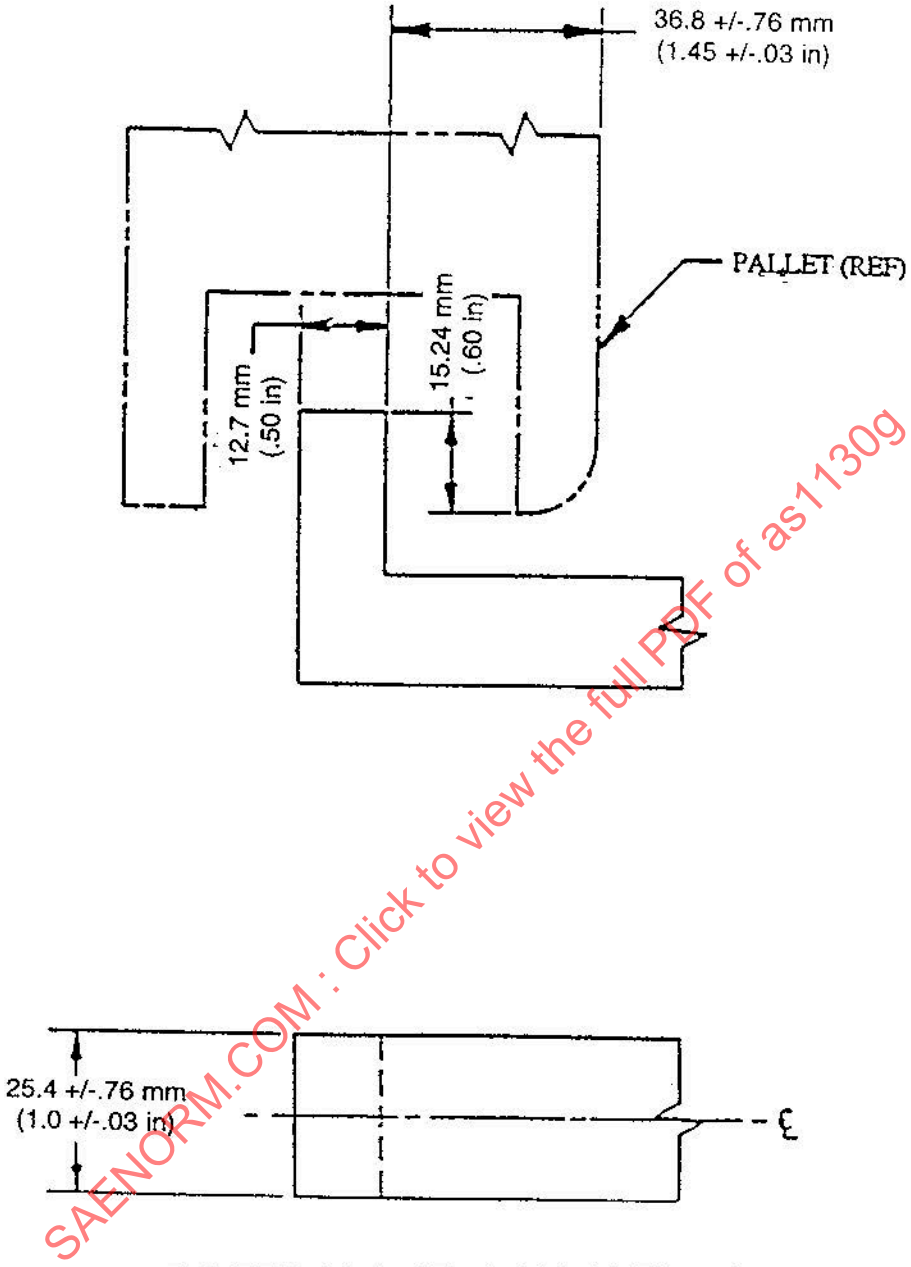


FIGURE 7 - Vertical Restraint Latch Dimensions

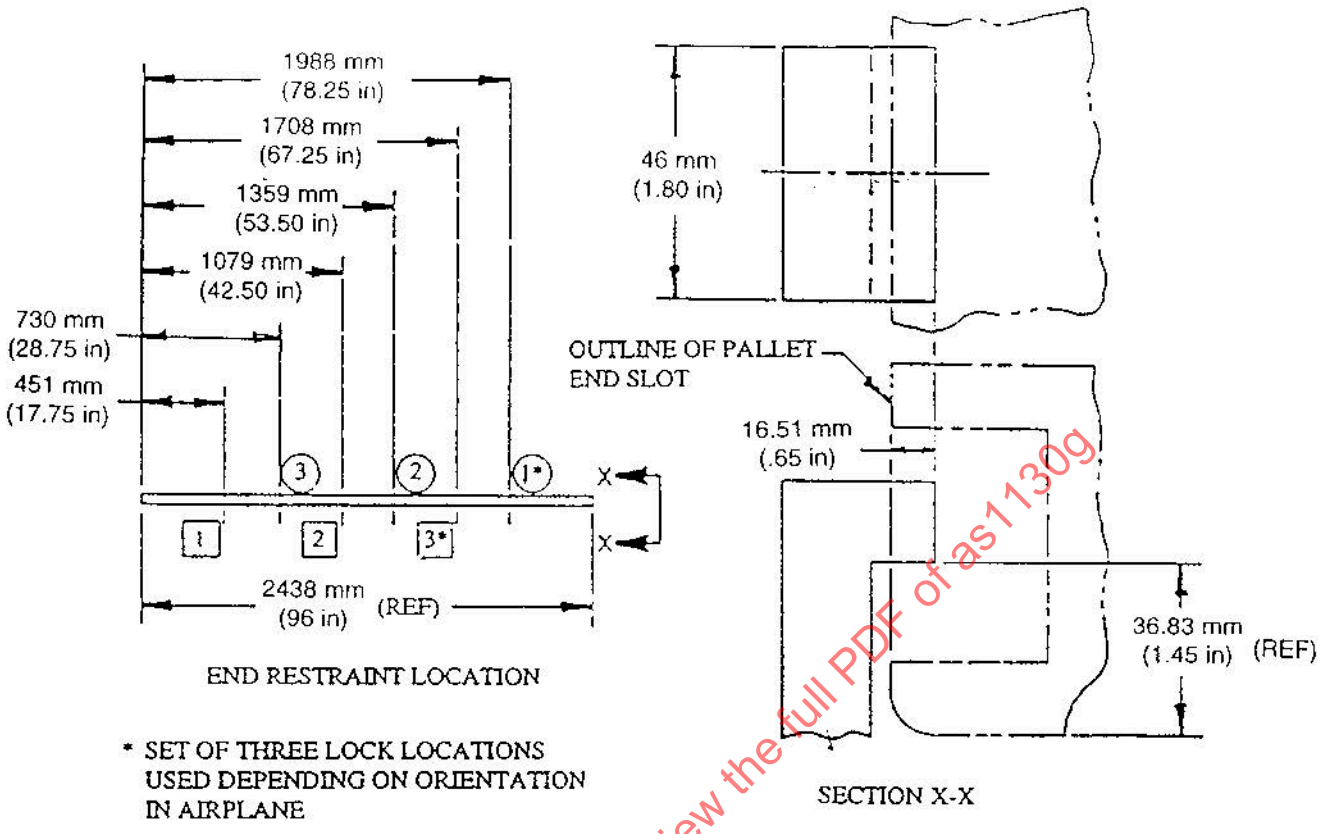


FIGURE 8 - End Restraint Fitting and Locations

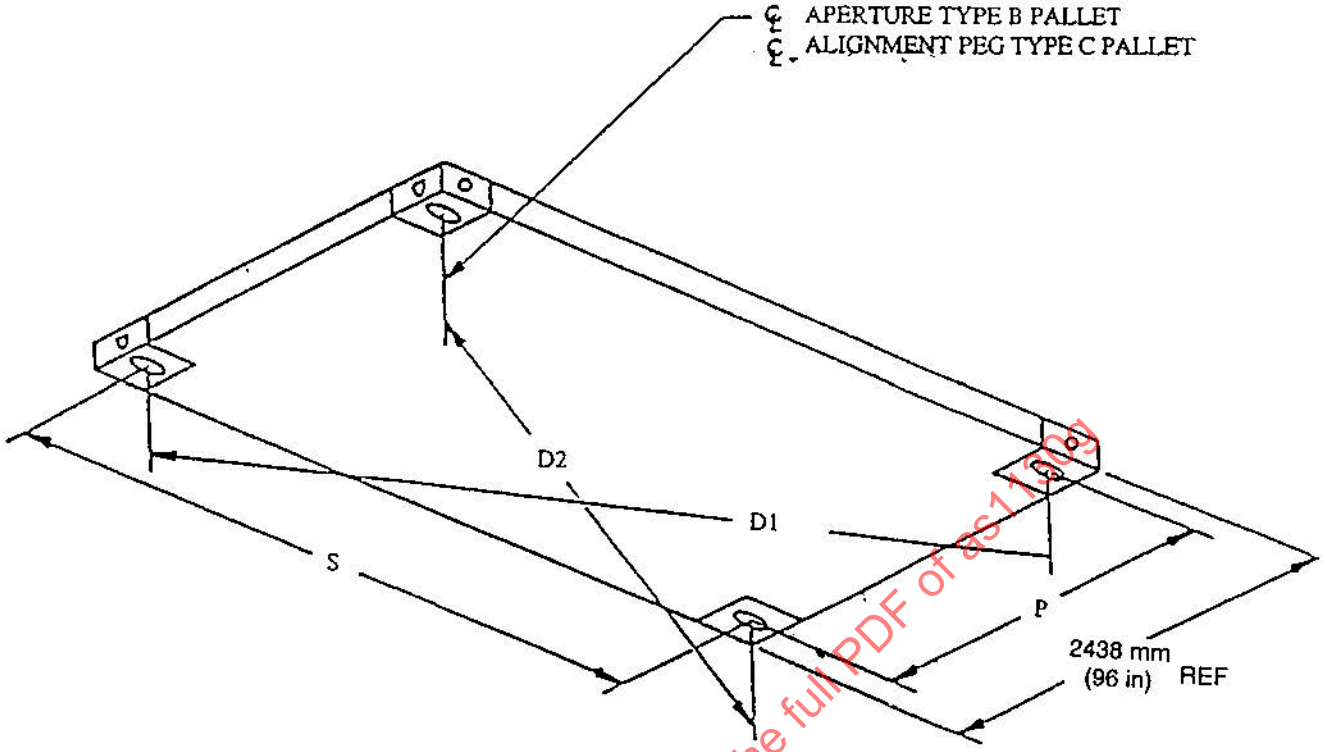


FIGURE 9 - Type B and C Pallet

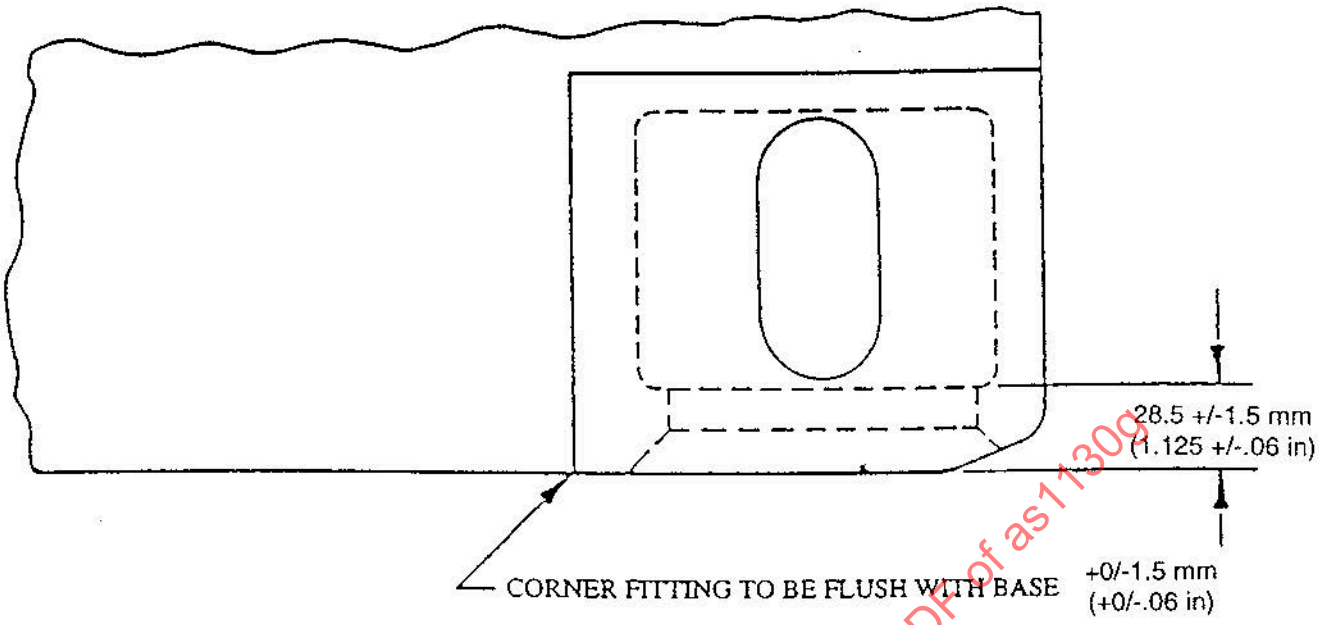


FIGURE 10 - Location of Bottom Corner Fitting Type B Pallet

Notes:

1. Solid and dotted lines (———and ------) show surfaces and contours which must be physically duplicated in the fitting.
2. Phantom lines (———) show optional walls which may be used to develop a boxed shaped fitting.
3. Outside and inside corners radii where sharp corners are shown must be 1/8in max except as noted.
4. Four fittings required per pallet, (2) left hand and (2) right hand.
5. Outside surfaces shall have a casting surface of C30 or better.

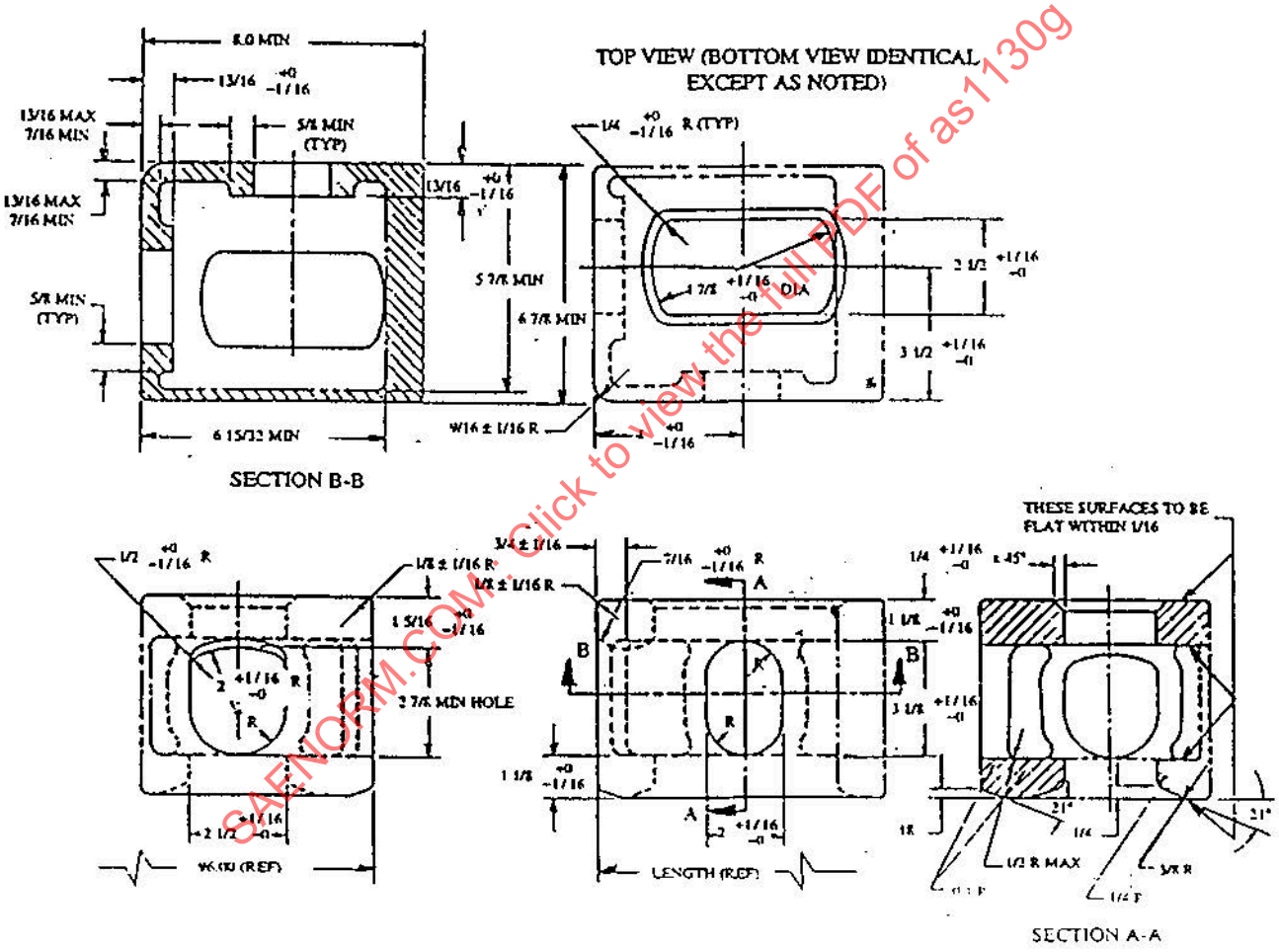
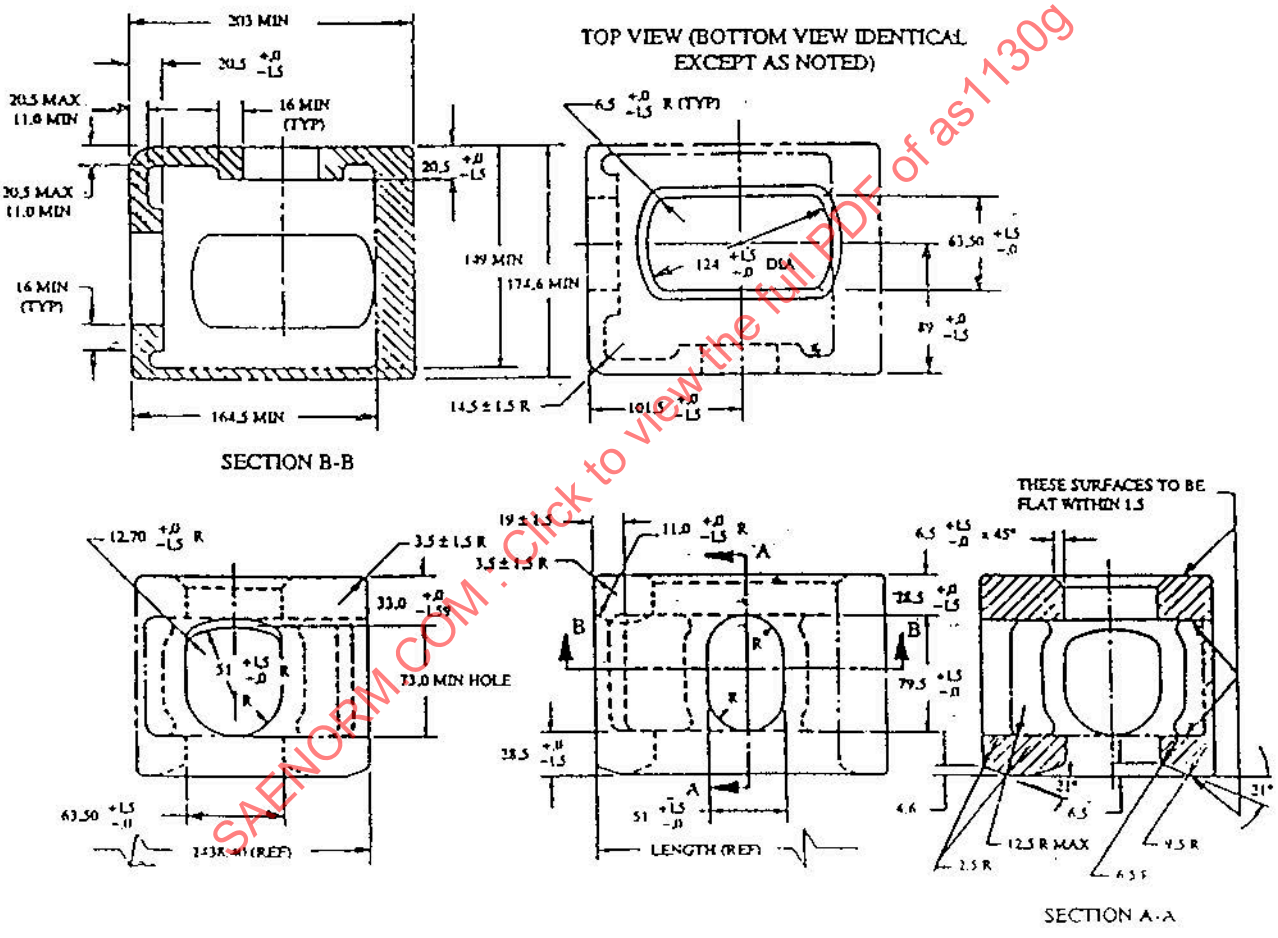


FIGURE 11A - Flush Mounted Corner Fitting (See Figure 10)

Notes

1. Solid and dotted lines (——and ------) show surfaces and contours which must be physically duplicated in the fitting.
2. Phantom lines (–––––) show optional walls which may be used to develop a boxed shaped fitting.
3. Outside and inside corners radii where sharp corners are shown must be 3mm max except as noted.
4. Four fittings required per pallet, (2) left hand and (2) right hand.
5. Outside surfaces shall have a casting surface of C30 or better.



NOTE: DIMENSIONS IN MILLIMETERS

FIGURE 11B - Flush Mounted Corner Fitting (See Figure 10)

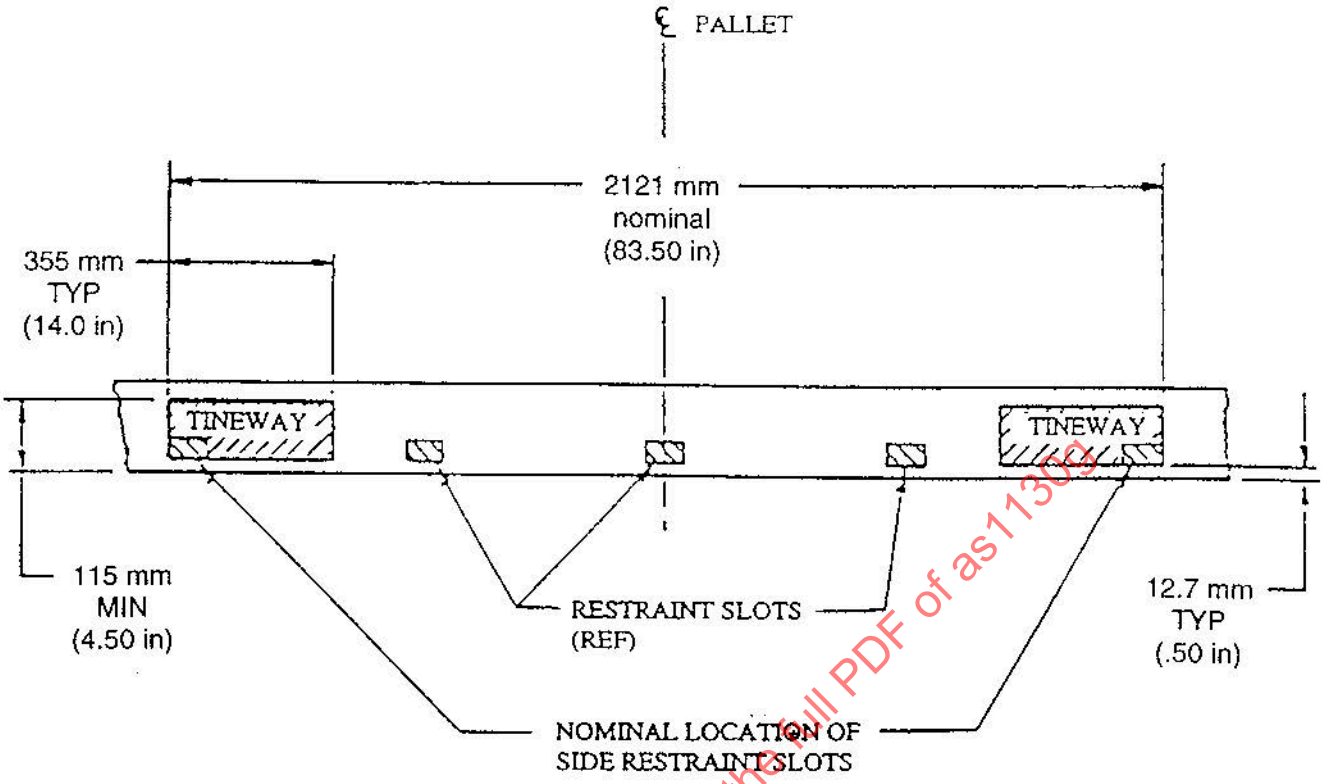


FIGURE 12 - Forklift Tineway Configuration

4.2 Ground Operational Loads:

4.2.1 The Type B pallets shall be capable of withstanding without permanent deformation a uniformly distributed down load equal to twice the maximum unit gross weight while supported by slings or frame connected to the four corner fittings.

4.2.2 Type IIB pallets shall be capable of withstanding a down load equal to 1.25 the maximum unit gross weight while supported by a forklift truck.

4.2.3 Each of the four corners shall be capable of reacting at least an 8340 daN (18 750 lb) load in either the longitudinal or latitudinal direction.

4.3 The pallet edges (length "L") shall have a minimum thickness of 139.7 mm (5.5 in) from the lower surface.

5. SUPPLEMENTAL REQUIREMENTS FOR AIR ADAPTER PALLETS:

5.1 Type C Pallet:

5.1.1 The pallet shall incorporate alignment pegs at the four corners conforming to Figure 13. Each of the alignment pegs shall be capable of reacting at least an 8340 daN (18 750 lb) load in the longitudinal, lateral, and vertical (down only) direction.

5.1.2 The pallet shall incorporate side slots and strap receptacles conforming to Figure 14. See Figure 15 for typical usage of restraint straps to secure a surface mode container to adapter pallet.

5.1.2.1 The strap receptacle fitting shall include the provision for attaching a tie-down fitting, each capable of reacting a 2224 daN (5000 lb) ultimate load in the longitudinal and vertical direction.

5.1.3 The pallet edges shall have a nominal thickness of 57 mm (2.25 in) from the lower surface.

5.1.4 The pallet shall be enclosed on all four sides by an edge member conforming to Figures 2, 3, 4A, 4B and 13.

5.1.5 The pallet corners shall have a 14.5 mm (0.56 in) radius.

5.1.6 Aircraft restraint provisions as shown in Figures 2, 3, 4A, 4B, and 13 shall be provided.

5.1.7 Up, fore, and aft loads shall be reacted by a fitting inserted in the restraint slots shown in Figures 3, 4A, 4B, and 13.

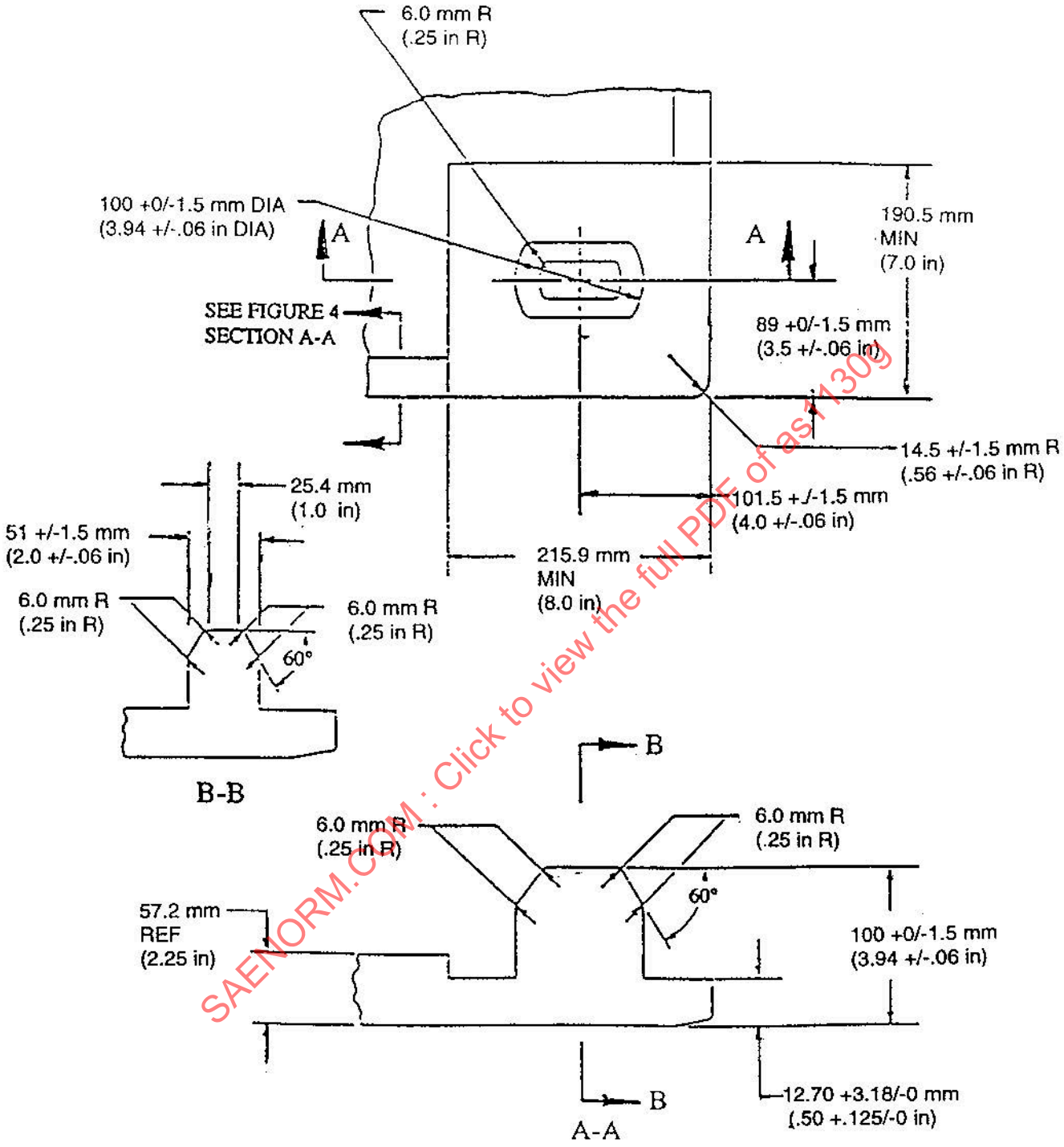


FIGURE 13 - Pallet Corner (Type C Pallet)

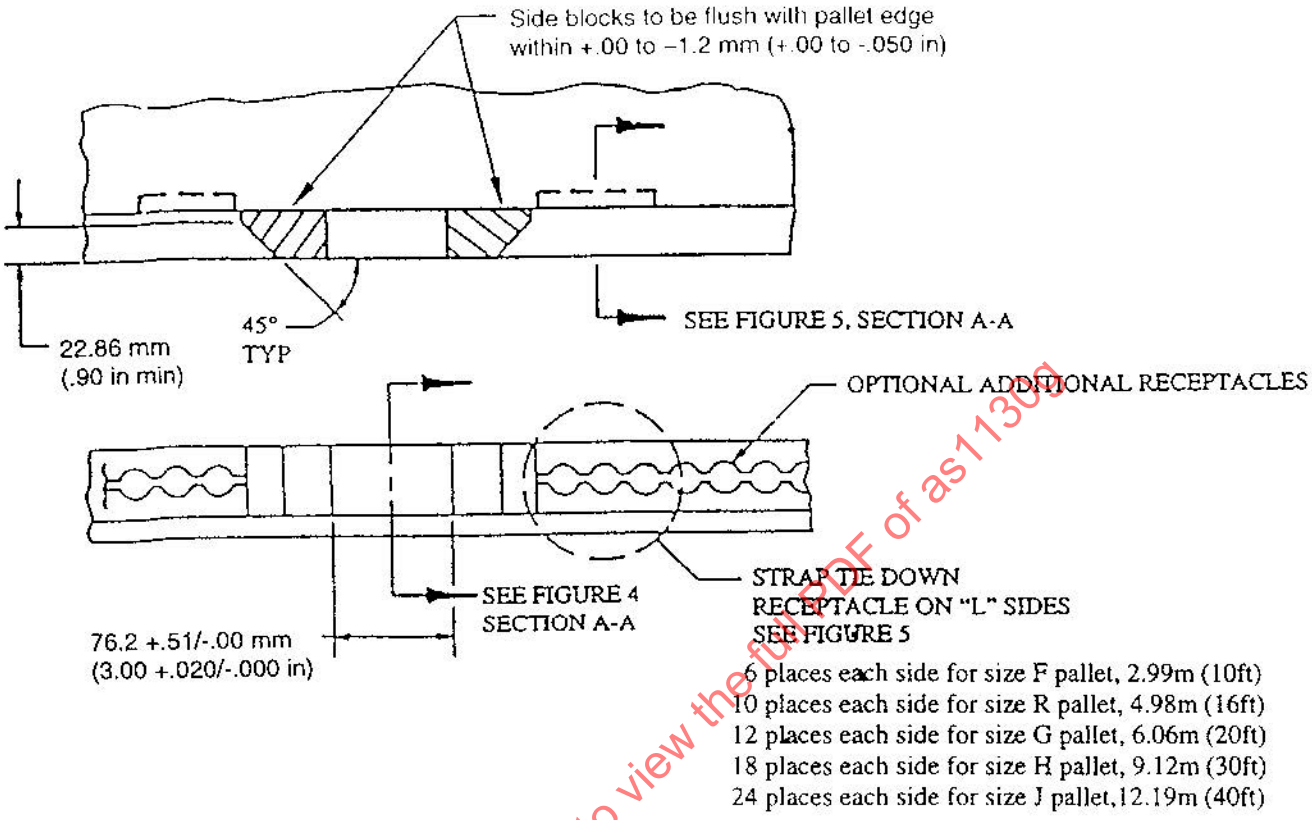


FIGURE 14 - Side Slot and Strap Receptacle Detail (Type C Pallet)