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Superseding AS36100

Air Cargo Unit Load Devices – Performance Requirements and Test Parameters

RATIONALE

After publication of AS36100 [2005-02], application studies evidenced ULD designs could be affected by cumulating the worst (main deck) ultimate load conditions with the worst (lower deck) testing restraint conditions, at a significant risk of needlessly increasing ULD weight. The present revision A, proposed for TSO C90d reference, remedies this difficulty by introducing two separate ULD configurations and testing restraint conditions for each of concerned sizes A, B and M, thus allowing for distinct approval of lower deck or main deck units, as was the case with the predecessor reference document NAS 3610 (TSO C90c).

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NOTE: In accordance with SAE Technical Standards Board Rules, successive document revisions are indicated by letters A, B, C, etc.

N = New / **R** = Renumbered without change

1. SCOPE

This SAE Aerospace Standard (AS) defines the minimum performance requirements and test parameters for air cargo unit load devices requiring approval of airworthiness for installation in an approved aircraft cargo compartment and restraint system that complies with the cargo restraint and occupant protection requirements of Title 14 CFR Part 25, except for the 9.0g forward ultimate inertia force of § 25.561 (b)(3)(ii).

1.1 Purpose

The purpose of this Aerospace Standard is to establish the minimum requirements for airworthiness approval of air cargo pallets, nets and containers, generally designated as air cargo unit load devices.

Other aspects that do not directly pertain to airworthiness approval and testing are defined in other Aerospace Standards and Aerospace Recommended Practices, e.g.:

- ULD design specifications,
- ULD in service damage limits,
- ULD restraint malfunction limitations,
- ULD test methods,
- ULD load distribution models,
- ULD maximum allowable contours,
- ULD CG location control means,
- ULD pressure equalization methods,
- ULD utilization guidelines.

1.2 Field of Application

This Aerospace Standard applies to all airworthiness approved air cargo unit load devices intended for carriage on board civil transport category airplanes type certificated under Federal Aviation Regulations Title 14 CFR Part 25, "Airworthiness Standards: Transport Category Airplanes".

It exclusively applies to unit load devices airworthiness approval and testing parameters. It does not apply to either aircraft design or aircraft operating requirements, which are provided by the approved Weight and Balance Manual for each aircraft type.

Air cargo unit load devices qualified prior to publication of this Aerospace Standard were TSO approved in accordance with the requirements of National Aerospace Standard NAS 3610 (latest published revision 10, 1st November 1990), "Cargo Unit Load Devices - Specification for -", internationally recognized under ISO 8097 (latest published revision: 4th edition, 2000).

Air cargo unit load devices the size or type of which is not covered in this Aerospace Standard are to be airworthiness approved in accordance with the requirements of NAS 3610 revision 10, if their size or type is contained therein, or other equivalent criteria, if not.

NOTE: The requirements for cargo covers are not defined in this Aerospace Standard, except insofar as net restraint is incorporated therein.

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 International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), www.sae.org

ARP1825 Methodology of Calculating Aircraft Cargo Volumes

AS33601 Track and Stud Fitting for Cargo Transport Aircraft, Standard Dimensions for

2.1.2 U.S. Government Publications

Available from U.S. Government Printing Office, Mail Stop SSOP, Washington DC 20402-9325, or its website <http://www.gpoaccess.gov/ecfr> and the FAA website www.airweb.faa.gov/rgl

Federal Aviation Regulations Title 14 CFR Part 21 - Certification Procedures for Products and Parts, Subpart O - Technical Standard Order Authorizations

Technical Standard Order TSO C90 - Cargo Pallets, Nets and Containers

Federal Aviation Regulations Title 14 CFR Part 25 - Airworthiness Standards: Transport Category Airplanes

2.1.3 AIA Publications

Available from Aerospace Industries Association, 1000 Wilson Boulevard, Suite 1700, Arlington, VA 22209-3928, Tel: 703-358-1000, www.aia-aerospace.org

NAS 3610 Cargo Unit Load Devices - Specification for - (Revision 10)

2.1.4 ISO Publications

Available from American National Standards Institute, 25 West 43rd Street, New York, NY 10036-8002, Tel: 212-642-4900, www.ansi.org

ISO 7166 Aircraft - Rail and stud configuration

ISO 8097 Aircraft - Minimum airworthiness requirements and test conditions for certified air cargo unit load devices

ISO 9788 Cast component of 22,250 N (5000 lb) double stud fittings

ISO 10046 Aircraft - Methodology of calculating cargo volumes

ISO 11242 Aircraft - Pressure equalization requirements for cargo containers

2.2 Definitions

CONTAINER (AIR CARGO -): A rigid structure which interfaces directly with the aircraft cargo handling and restraint system and alone performs all the functions of a unit load device.

COVER (CARGO -): A cover made of flexible material, used to protect cargo on a pallet. It may or may not incorporate a pallet net or be permanently attached to one. If a net is incorporated or permanently attached to the cover, the performance and testing requirements applicable to nets as shown in the present Aerospace Standard are applicable to the net / cover assembly.

NET (AIR CARGO PALLET -): A webbing or rope net for restraining load onto an air cargo pallet.

NUMERIC SIMULATION: Simulation of physical test condition and reaction of ULD employing numerical analysis, computational geometry and computer graphics to obtain proof support and design verification, validated by demonstration that parameters, algorithms and analytical methods used provide results of at least equivalent reliability to the outcome of a specified actual test.

PALLET (AIR CARGO -): A unit load device consisting of a flat platform with flat undersurface of standard dimensions, on which goods are assembled and secured by a net before being loaded as a unit onto the aircraft, and which interfaces directly with the aircraft handling and restraint system.

RESTRAINT SYSTEM: Equipment for supporting and restraining unit load devices in an aircraft against the ground/flight loads. It usually consists of such items as rollers, side guides and locks for securing unit load devices to the aircraft structure. It does not include unit load devices, barrier nets and tie-down straps.

UNIT LOAD DEVICE (ULD): Device for grouping, transferring and restraining cargo for transit. It may consist of a pallet with a net or it may be a container.

3. CLASSIFICATION

Unit load devices covered by this Aerospace Standard shall be of the following type, sizes, configurations and forms:

3.1 Type

Type 1 (Reference only): Unit load devices (ULDs) designed for use in an approved aircraft restraint system that conforms to all flight and ground cargo restraint and occupant protection requirements of Title 14 CFR Part 25, including the 9.0g forward ultimate inertia force of § 25.561 (b)(3)(ii).

NOTE: Type 1 Unit load devices (ULDs) are not shown in this Aerospace Standard. Refer to National Aerospace Standard NAS 3610 Revision 10.

Type 2: Unit load devices (ULDs) designed for use in an approved aircraft cargo compartment and restraint system that conforms to the flight and ground cargo restraint and occupant protection requirements of Title 14 CFR Part 25, except for the 9.0g forward ultimate inertia force of § 25.561 (b)(3)(ii), which is complied with either by supplementary installation of a barrier net or bulkhead, or by specifying an approved placement of the ULD in the aircraft.

3.2 Sizes

This Aerospace Standard provides for the following sizes of unit load devices, expressed as nominal dimensions in the overall plan form of a pallet or a container base, in mm (inches):

Size Code	Nominal Dimension
A	2235 X 3175 mm (88 x 125 in)
B	2235 x 2743 mm (88 x 108 in)
G	2438 x 6058 mm (96 x 238.5 in)
K	1534 x 1562 mm (60.4 x 61.5 in)
L	1534 x 3175 mm (60.4 x 125 in)
M	2438 x 3175 mm (96 x 125 in)
N	1562 x 2438 mm (61.5 x 96 in)
P	1198 x 1534 mm (47 x 60.4 in)
Q	1534 x 2438 mm (60.4 x 96 in)
R	2438 x 4978 mm (96 x 196 in)
S	1562 x 2235 mm (61.5 x 88 in)

NOTE: Size codes C, D, E, F, H, I, J, O have been intentionally omitted in this Aerospace Standard to be in agreement with IATA ULD Technical Manual coding (ULD ID codes).

3.3 Configurations

This Aerospace Standard provides for variations of configuration among pallets, nets and containers of the same type and size, specified in Section 7 and listed in Table 1 hereafter. Variations in pallet/net attachment and special interface requirements between components of unit load devices when affecting airworthiness are specified by the configuration drawings. Configurations are denoted by sequence number and are identified in accordance with 3.5 hereafter.

The applicable restraint conditions to be used for testing each unit load device configuration are specified in Section 8 and listed in Table 2 hereafter, based on testing of worst case analysis.

The ULD restraint conditions and ultimate loads included herein are intended to represent a worst case capability for the ULD. They are not intended to represent aircraft cargo handling system restraint designs. Actual aircraft implementations may vary from the ULD test parameters stated herein in such areas as number and spacing of restraints, among others, as long as they stay within the worst case ULD capabilities herein.

3.4 Forms

Form C = Container

Form N = Net

Form P = Pallet

3.5 Classification Identifier

The pallets, nets and containers described in this Aerospace Standard shall be identified by the numbers derived as shown. Types, sizes, configurations and forms shall be limited to those in configuration drawings; e.g.:

AS36100 - 2A7P = Type 2, Size A (2235 x 3175 mm, 88 x 125 in), Configuration sequence A7, Pallet.

4. PERFORMANCE REQUIREMENTS

4.1 Materials

The suitability and durability of materials used must be established on the basis of experience or tests. Materials must conform to approved industry specifications that ensure their having the strength and other properties specified in the design data.

4.2 Fabrication Methods and Workmanship

The methods of fabrication used must produce a consistently sound structure. If the fabrication processes (such as gluing or heat treatment) require close control to reach their objectives, the processes must be performed under an approved process specification. Workmanship shall be consistent with high-grade aircraft manufacturing practices.

4.3 Protection

All components of the unit load devices must be suitably 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. The unit load device must have provisions for ventilation or drainage where necessary for protection.

4.4 Construction

The unit load device shall be constructed to adequately encompass the cargo and shall provide for proper support and restraint of the cargo. All components shall be designed to withstand rough handling. The design shall minimize the possibility of improper installation. All pallet/net attachment devices shall conform with AS33601 track and stud configuration. ISO 7166 track and stud configuration, for single stud fittings, or ISO 9788 for double stud fittings, are acceptable alternatives.

4.5 Marking

Each pallet, net, and container must be legibly and permanently marked in an area clearly visible after the article is loaded with cargo, with the following information:

- (1) Name and address of the manufacturer.
- (2) The weight of the article to the nearest kilogram or pound, with the applicable unit.
- (3) The serial number and date of manufacture.
- (4) The part number of the article and its identification in the code system set out in 3.5.
- (5) If the article is not omni-directional, the words "FORWARD", "AFT", and "SIDE" must be conspicuously and appropriately placed.
- (6) The burning rate determined for the article under 4.7.
- (7) The applicable TSO number.
- (8) Any limitations or restrictions.

4.6 Inspection Provisions

There must be means to allow close examination of each part requiring inspection, adjustment, or lubrication.

4.7 Fire Protection

The materials used in the construction of pallets, nets, and containers shall meet the appropriate provisions set forth in Federal Aviation Regulations Title 14 CFR Part 25 Appendix F.

4.8 Rapid Decompression

Unit load devices must be designed to protect the airplane structure and the occupants as result of a sudden release of pressure. The suitability of the design shall be established by analysis and/or tests or numeric simulation. See ISO 11242 for guidance as to possible methods.

4.9 Dimensions and Tolerances

Each pallet, net and container of a given configuration must conform to the requirements specified by the drawing for that configuration. General tolerances for all configuration drawings, unless otherwise noted, are ± 0.01 mm for two places decimals, ± 0.1 mm for one place decimals, ± 1 mm without a decimal (in inches: ± 0.01 for three place decimals, ± 0.03 for two place decimals, ± 0.1 for one place decimals).

4.10 Strength

4.10.1 Ultimate Load Criteria

Ultimate loads for each unit load device configuration are specified in the page defining that configuration. These loads shall be considered as acting separately, except as noted, and shall be applied in accordance with the specified center of gravity limits, which shall be taken into account simultaneously.

Longitudinal eccentricity is expressed in percentage of the longitudinal dimension of a pallet or container base, and it is measured from the lateral centerline of the pallet or container base. Longitudinal dimensions correspond to the forward and aft directions specified by the plan views in applicable figures.

Lateral eccentricity is expressed in percentage of the lateral dimension of a pallet or container base, and it is measured from its longitudinal centerline. Plus and minus signs indicate forward and aft directions from the lateral centerline, and right and left directions from the longitudinal centerline of the pallet or container base respectively.

Center of gravity height is expressed in mm (inches) above the bottom surface of a pallet or container base.

4.10.2 Restraint Criteria

Restraint system details for each restraint condition are specified by the figure referenced in restraint drawing. Tolerances for restraint system are the same as those specified in 4.9 for configuration drawings.

4.10.3 Pallets and Nets

4.10.3.1 If a pallet (or net) is to be substantiated individually, a qualified net (or pallet) of the same configuration code may be assumed for analysis or used for test. A qualified and compatible net (or pallet) of different configuration code may be used for testing, provided that it equals or exceeds ultimate strength requirements of the pallet (or net) being substantiated. For substantiating a net, any net tensioning devices shall be engaged; a pallet needs not be used for testing, provided that all net fittings are at the locations specified in the unit load device configuration.

4.10.3.2 Pallet edge tracks and net fittings shall conform to the geometric and tolerance requirements of AS33601 or ISO 7166 or, for double stud fittings, ISO 9788, or equivalent with at least equal ultimate strength.

4.10.3.3 All net fittings incorporating a single tie-down stud for attachment to pallets shall have a minimum ultimate load capacity of 8900 N (2000 pounds) in all directions, horizontal to vertical. Double stud tie-down fittings shall have a minimum ultimate load capacity of 17,800 N (4000 pounds) in all directions, horizontal to vertical. The load application point shall be 21 mm (0.83 inches) or less from the head end of the stud.

4.10.3.4 Except where otherwise stated, all track-type tie down receptacles incorporated in the pallet construction shall have a minimum ultimate load capacity of 8900 N (2000 pounds) in all directions, horizontal to vertical. The load application point shall be 23 mm (0.90 inches) or more from the bottom of the track groove.

4.10.3.5 Pallet/net tie down fittings, other than stud and track type fittings, shall have a minimum ultimate load capacity of 8900 N (2000 pounds) in all directions, horizontal to vertical.

4.10.4 Base Performance

Minimum base area loads for each unit load device configuration are specified in the page defining that configuration. These loads shall be applicable to any area representing at least 10% of the total base area, while the unit load device is supported by the aircraft system. All unit load device (container or pallet) bases shall have a minimum area load capacity of 10 kPa (209 lb/ft²).

All ULD base edges shall have a minimum vertical EI value of $5 \times 10^7 \text{ N.cm}^2$ ($1.75 \times 10^6 \text{ lb.in}^2$).

The base edge profiles shall be rounded or chamfered in order to ensure a smooth interface with aircraft unit load device conveyance and restraint systems.

4.11 Environmental Degradation

The materials used in the construction of pallets, nets and containers shall take into account the effects of environment conditions, such as temperature, humidity and U.V. degradation, expected in service.

5. TESTS

5.1 Test Requirements

Tests and/or analysis or numeric simulation shall be conducted as necessary to show compliance with this Aerospace Standard.

5.2 Test Parameters

Tests for any given ULD configuration shall be conducted using the maximum ultimate loads and center of gravity deviations shown in this Aerospace Standard for that ULD configuration, with the ULD being restrained in accordance with the indicated testing restraint condition(s). Analysis or numeric simulation, if used, shall use the same assumptions.

5.3 Test Methods

The method(s) used for testing any ULD configuration shall ensure conformity with the testing conditions and ultimate load parameters specified for that configuration in this Aerospace Standard. Ultimate load shall be applied in each specified direction for a minimum duration of 3 seconds, in accordance with Title 14 CFR Part 25 § 25.305 (b). Analysis or numeric simulation, if used, shall provide an equivalent assurance of conformity guarantee. A test and/or analysis report shall be established to record the details of the method(s) used and substantiate the results obtained.

NOTE: When two ULD sides (e.g., opposite ones) and the corresponding load and restraint conditions are identical, testing may be performed on one side only.

5.4 Test Results

Under ultimate load, the tested ULD or parts thereof may exhibit damage or permanent deformation, but shall not deform or rupture to the extent of discharging its contents. Analysis or numeric simulation, if used, shall confirm that the ULD would not deform or rupture to the extent its contents would be discharged under the test conditions.

6. NOTES

6.1 Intended Use

Type 2 nets, pallets, and containers (ULDs) described in this Aerospace Standard are intended for use only in an approved aircraft cargo compartment and restraint system where compliance with the 9.0 g forward ultimate inertia force of Title 14 CFR Part 25 § 25.561 (b)(3)(ii) is achieved either by supplementary installation of a barrier net or bulkhead, or by specified approved placement of the ULD in the aircraft.

NOTE: Type 1 unit load devices are not shown in this Aerospace Standard. Refer to National Aerospace Standard NAS 3610 Revision 10.

6.2 Unit Load Device Capacities

Maximum gross weight capacities are not shown for the unit load devices covered by this Aerospace Standard. Actual gross weight limits for a unit load device in a given airplane are determined in compliance with Federal Aviation Regulations Title 14 CFR Part 25 and listed in the Approved Weight and Balance Manual for that airplane.

6.3 Container Contours

Performance and testing parameters are independent from container contours, which hence are not shown in this Aerospace Standard. Maximum allowable container contours shall provide clearance from the relevant aircraft cargo compartment's inner envelope. Guidelines for this purpose are provided in ARP1825 (ISO 10046).

6.4 Pallet Configurations

Pallet configuration drawings indicate net attachment points. Continuous edge track is allowable all around the pallet's periphery, except where differently noted.

7. UNIT LOAD DEVICE CONFIGURATIONS

7.1 Unit load devices configurations, characteristics, and ultimate load capacities shall conform to the relevant ULD configuration page of this Aerospace Standard.

NOTE: The net attachment points shown on ULD configuration drawings may not, or not entirely, apply to containers.

7.2 ULD configuration pages are listed in Table 1 hereafter (configuration drawings are not on scale):

TABLE 1 - ULD CONFIGURATIONS

ULD Configuration (UC)	Type	Applicable to:			Nominal Base Dimensions mm (inches)	Min. Base Area Load kPa (lb/ft ²)	Page
		C	P	N			
A7	2	X	X	X	2235 x 3175 (88 x 125)	10 (209)	11
A8	2	X	X	X	2235 x 3175 (88 x 125)	10 (209)	12
B7	2	X	X	X	2235 x 2743 (88 x 108)	10 (209)	13
B8	2	X	X	X	2235 x 2743 (88 x 108)	10 (209)	14
G1	2	X	X	X	2438 x 6058 (96 x 238.5)	20 (418)	15
K4	2	X	X	X	1534 x 1562 (60.4 x 61.5)	10 (209)	16
L5	2	X	X	X	1534 x 3175 (60.4 x 125)	10 (209)	17
L6	2		X	X	1534 x 3175 (60.4 x 125)	10 (209)	18
M4	2	X	X	X	2438 x 3175 (96 x 125)	10 (209)	19
M5	2	X	X	X	2438 x 3175 (96 x 125)	10 (209)	20
N1	2	X	X	X	1562 x 2438 (61.5 x 96)	10 (209)	21
P1	2	X			1198 x 1534 (47 x 60.4)	10 (209)	22
Q1	2	X			1534 x 2438 (60.4 x 96)	10 (209)	23
R1	2	X	X	X	2438 x 4978 (96 x 196)	20 (418)	24
S1	2	X	X	X	1562 x 2235 (61.5 x 88)	10 (209)	25

NOTE: ULD configuration sequence codes A7, A8, B7, B8, K4, L5, L6, M4, M5 were assigned in order to differentiate from former NAS 3610 ULD configurations with non identical maximum C.G. eccentricities and/or non identical lateral ultimate load criteria.

ULD CONFIGURATION A7

Nominal base size 2235 x 3175 mm (88 x 125 in) - Type 2

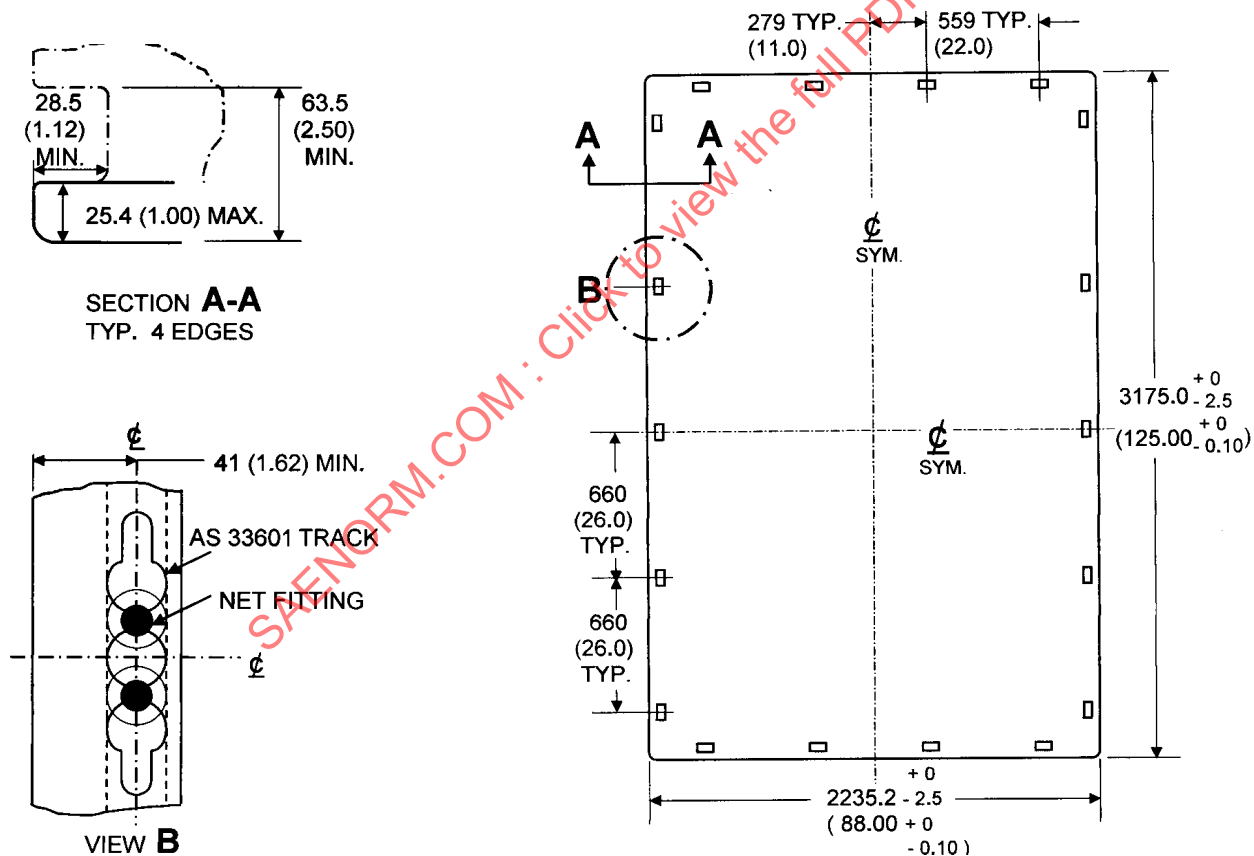
Applicable to: Containers, Pallets, Nets

Minimum base area load: 10 kPa (209 lb/ft²)**Table A7 Ultimate load criteria**

Ultimate loads N (lb)					CG height mm (in) ¹	CG eccentricity %	
Forward ²	Aft ²	Side ²	Up	Down	Maximum	Longit.	Lateral
100,000 (22,500)	100,000 (22,500)	100,000 (22,500)	169,000 (38,000)	340,000 (76,500)	1219 (48)	± 10	± 10

¹ = for containers and nets, 55% of maximum height, limited to the maximum shown² = in combination with a download equal to the forward load**Configuration drawing**

Dimensions in mm (inches)



TYP. 18 PLACES (Continuous track optional)

Applicable testing restraint condition

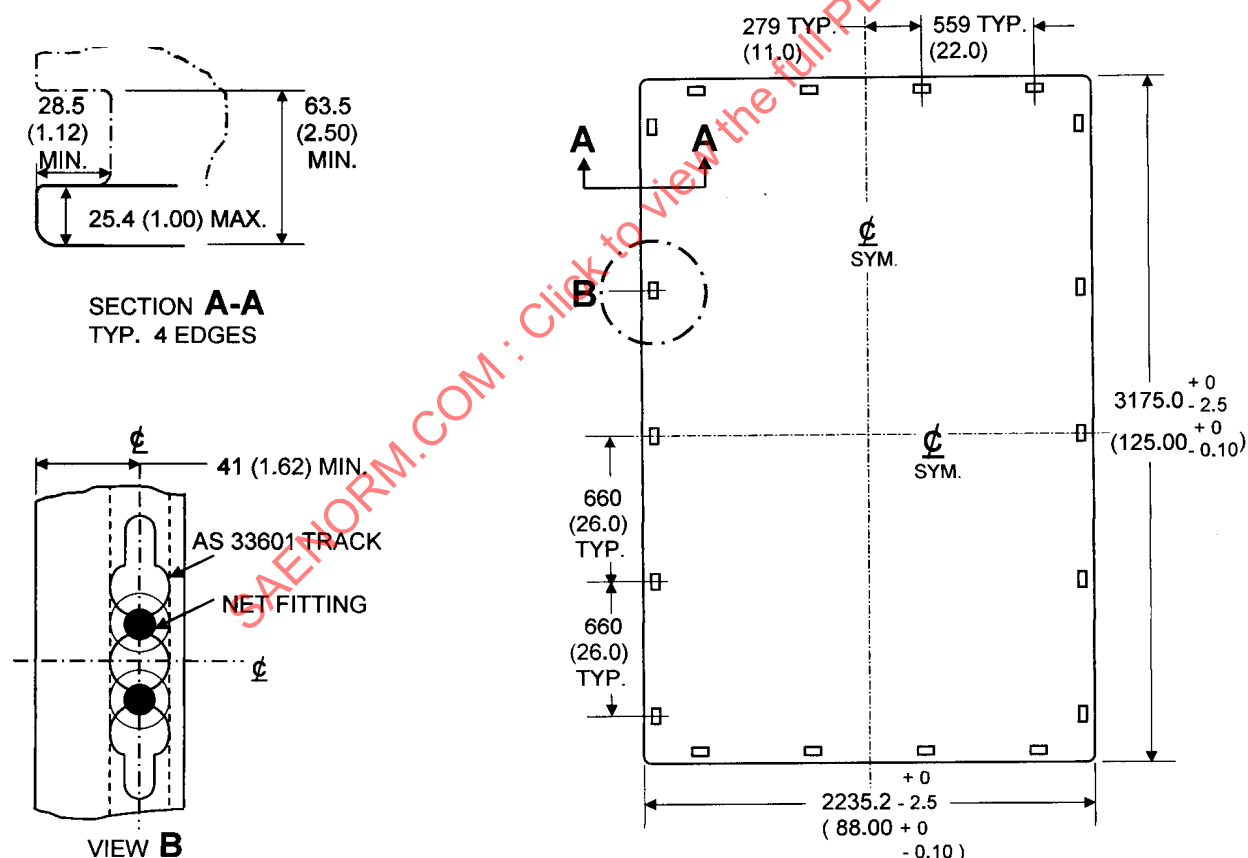
RC A1 (see section 8)

Minimum base area load: 10 kPa (209 lb/ft²)

Ultimate loads N (lb)					CG height mm (in) ¹	CG eccentricity %	
Forward ²	Aft ²	Side ²	Up	Down	Maximum	Longit.	Lateral
55,600 (12,500)	55,600 (12,500)	55,600 (12,500)	100,000 (22,500)	188,600 (42,400)	915 (36)	± 10	± 10

2 = in combination with a download equal to the forward load

Dimensions in mm (inches)

RC **A2** (see section 8)

ULD CONFIGURATION B7

Nominal base size 2235 x 2743 mm (88 x 108 in) - Type 2

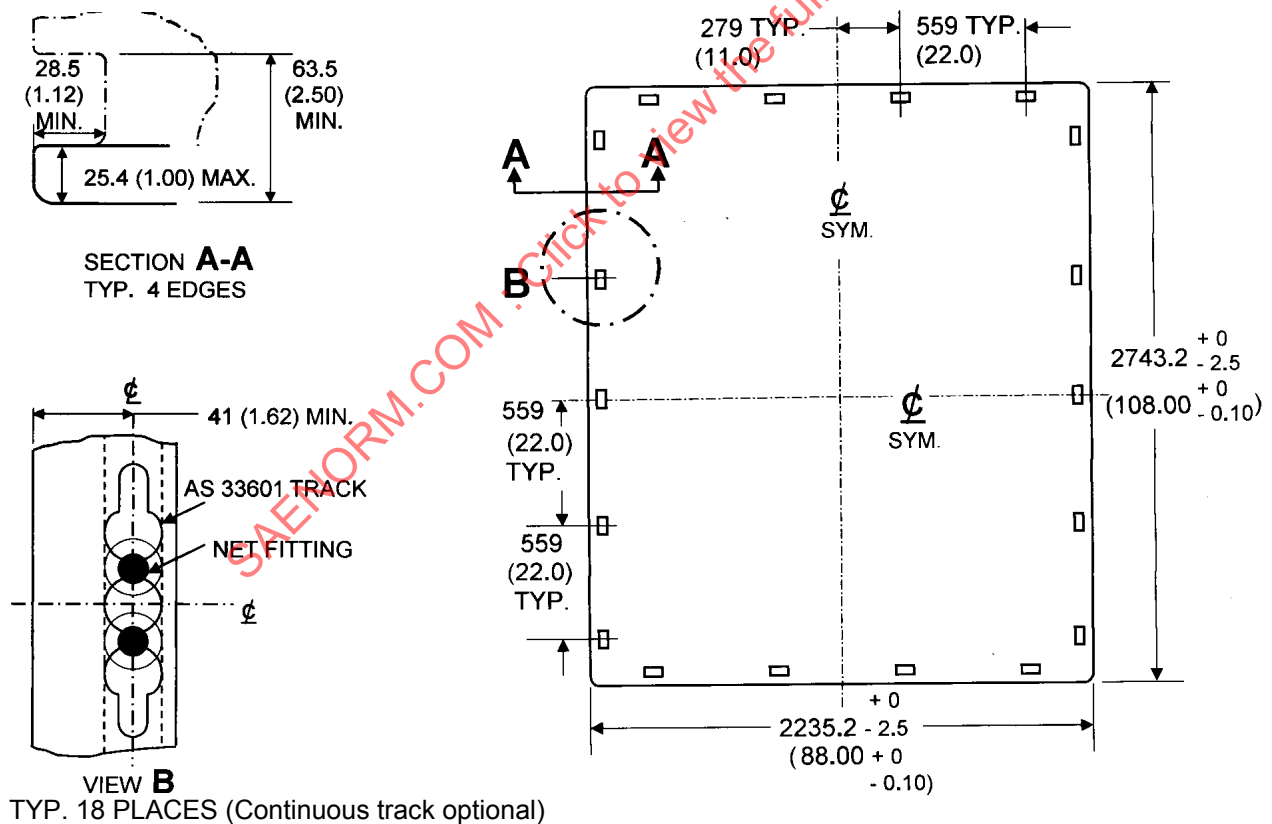
Applicable to: Containers, Pallets, Nets

Minimum base area load: 10 kPa (209 lb/ft²)**Table B7** Ultimate load criteria

Ultimate loads N (lb)					CG height mm (in) ¹	CG eccentricity %	
Forward ²	Aft ²	Side ²	Up	Down	Maximum	Longit.	Lateral
87,000 (19,500)	87,000 (19,500)	87,000 (19,500)	147,000 (33,000)	294,000 (66,000)	1219 (48)	± 10	± 10

¹ = for containers and nets, 55% of maximum height, limited to the maximum shown² = in combination with a download equal to the forward load**Configuration drawing**

Dimensions in mm (inches)

**Applicable testing restraint condition**

RC A1 (see section 8)

ULD CONFIGURATION B8

Nominal base size 2235 x 2743 mm (88 x 108 in) - Type 2

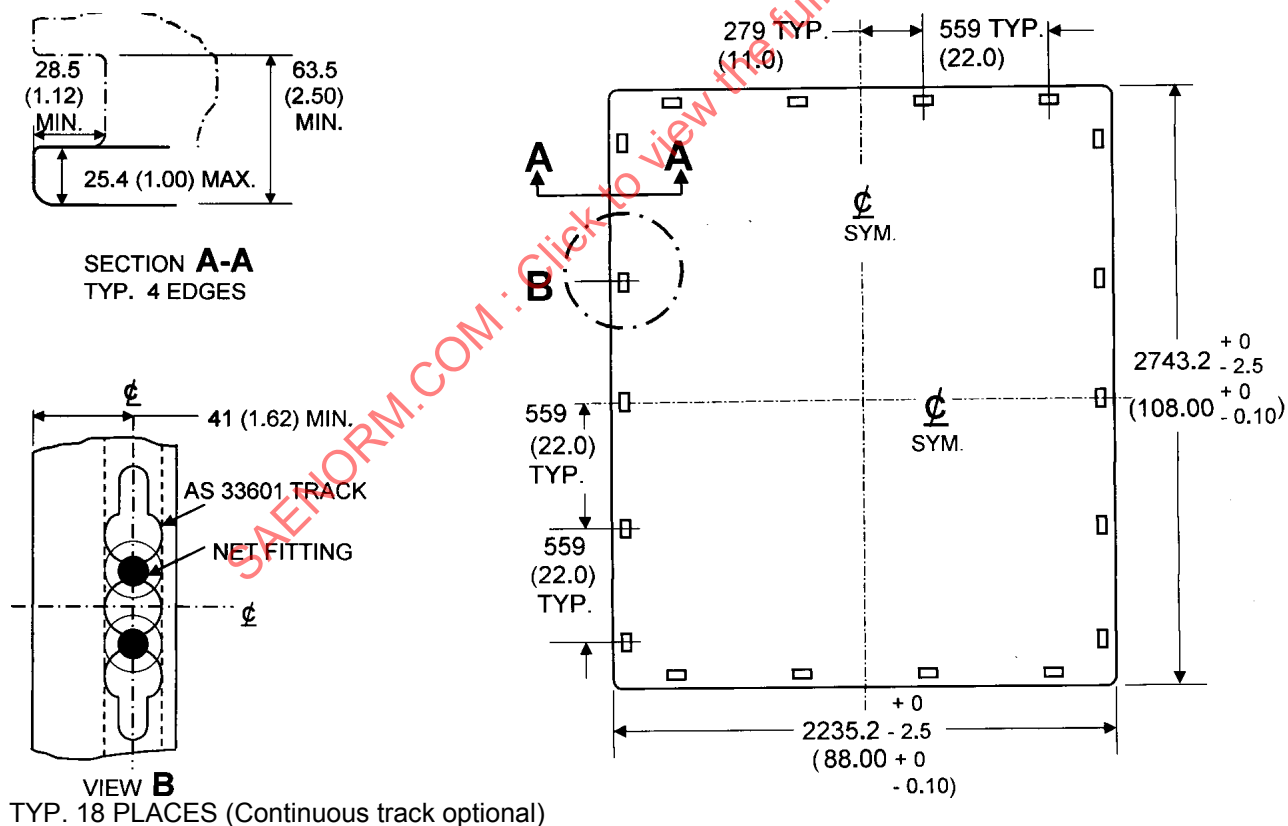
Applicable to: Containers, Pallets, Nets

Minimum base area load: 10 kPa (209 lb/ft²)**Table B8** Ultimate load criteria

Ultimate loads N (lb)					CG height mm (in) ¹	CG eccentricity %	
Forward ²	Aft ²	Side ²	Up	Down	Maximum	Longit.	Lateral
55,600 (12,500)	55,600 (12,500)	55,600 (12,500)	100,000 (25,200)	188,600 (42,400)	915 (36)	± 10	± 10

¹ = for containers and nets, 55% of maximum height, limited to the maximum shown² = in combination with a download equal to the forward load**Configuration drawing**

Dimensions in mm (inches)

**Applicable testing restraint condition**

RC A2 (see section 8)

ULD CONFIGURATION G1

Nominal base size 2438 x 6058 mm (96 x 238.5 in) - Type 2

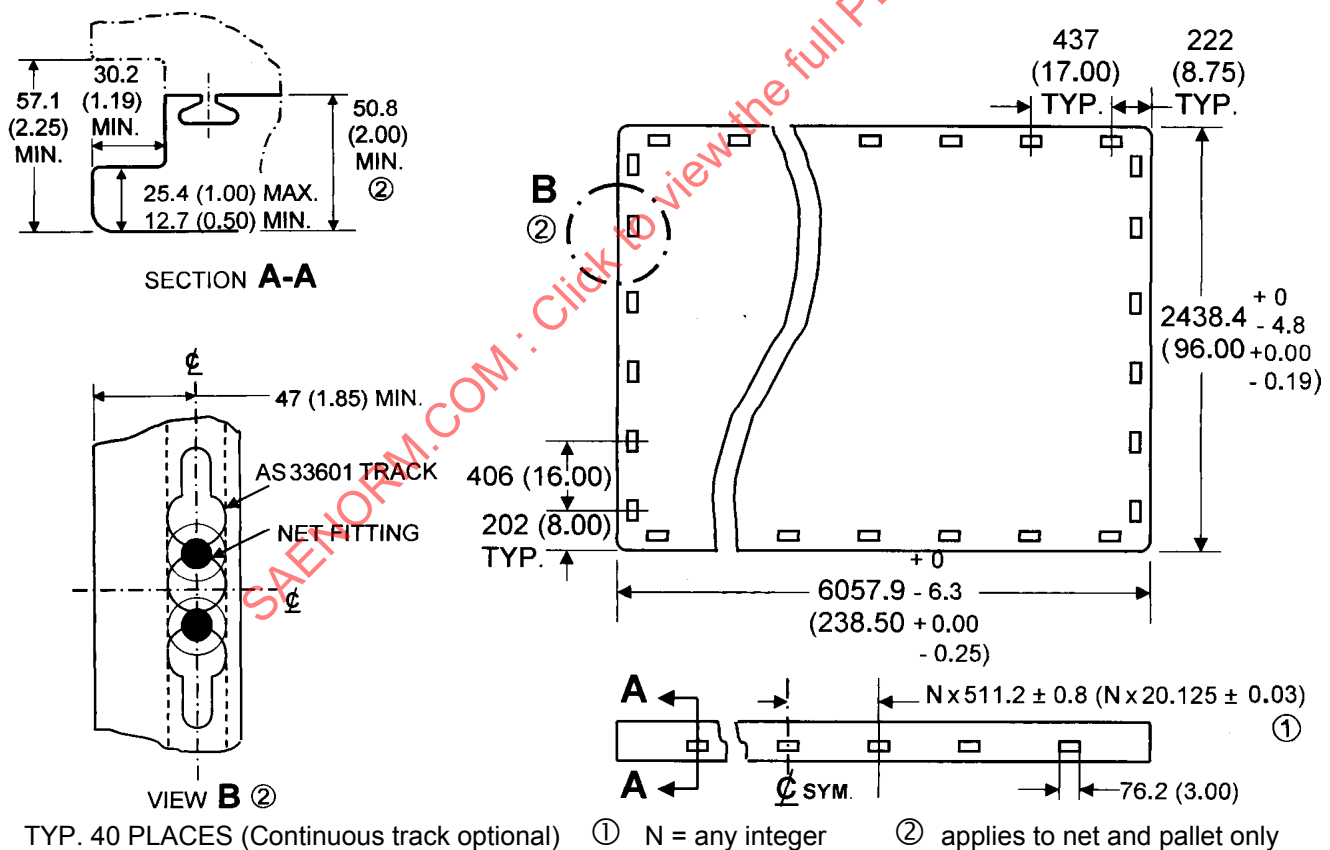
Applicable to: Containers, Pallets, Nets

Minimum base area load: 20 kPa (418 lb/ft²)**Table G1** Ultimate load criteria

Ultimate loads N (lb)					CG height mm (in)	CG eccentricity %	
Forward ¹	Aft ¹	Side ¹	Up	Down	Maximum	Longit.	Lateral
167,000 (37,500)	167,000 (37,500)	167,000 (37,500)	278,000 (62,500)	556,000 (125,000)	1219 (48)	± 5	± 10

¹ = in combination with a download equal to 2/3 of the forward load**Configuration drawing**

Dimensions in mm (inches)

**Applicable testing restraint condition**

RC G (see section 8)

ULD CONFIGURATION K4

Nominal base size 1534 x 1562 mm (60.4 x 61.5 in) - Type 2

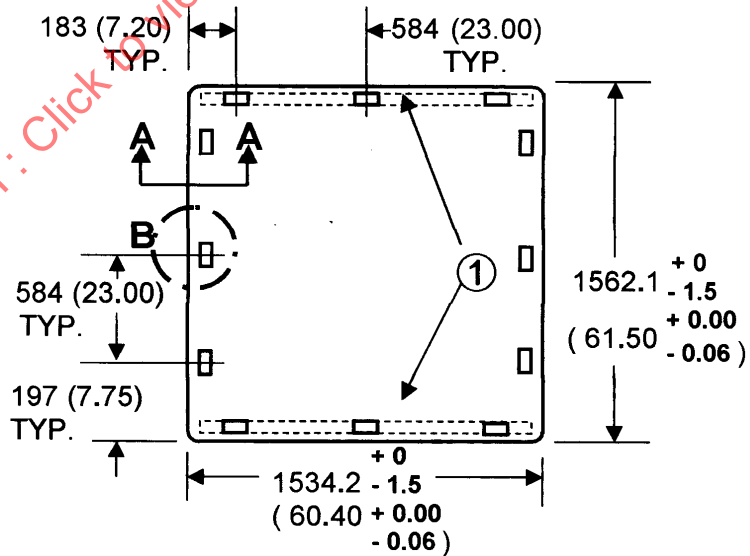
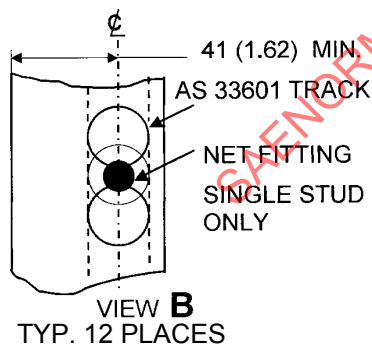
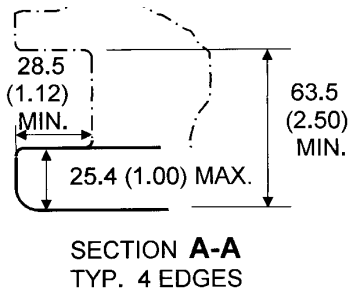
Applicable to: Containers, Pallets, Nets

Minimum base area load: 10 kPa (209 lb/ft²)**Table K4** Ultimate load criteria

Ultimate loads N (lb)					CG height mm (in) ¹	CG eccentricity %	
Forward ²	Aft ²	Side ²	Up	Down	Maximum	Longit.	Lateral
23,350 (5250)	23,350 (5250)	23,350 (5250)	43,600 (9800)	79,400 (17,850)	864 (34)	± 10	± 10

¹ = for containers, 55% of maximum height, limited to the maximum shown² = in combination with a download equal to the forward load**Configuration drawing**

Dimensions in mm (inches)

① Continuous track optional on these sides only**Applicable testing restraint condition**

RC K (see section 8)

ULD CONFIGURATION L5

Nominal base size 1534 x 3175 mm (60.4 x 125 in) - Type 2

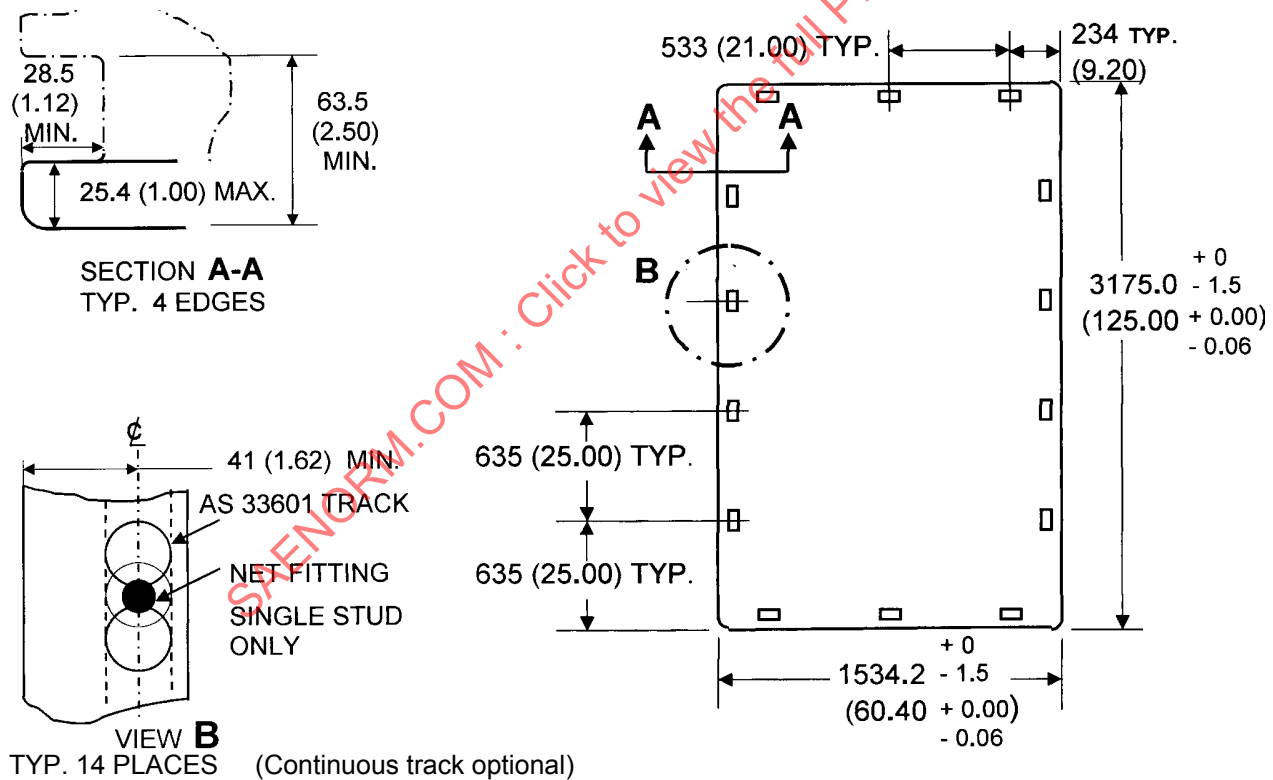
Applicable to: Containers, Pallets, Nets

Minimum base area load: 10 kPa (209 lb/ft²)**Table L5 Ultimate load criteria**

Ultimate loads N (lb)					CG height mm (in)	CG eccentricity %	
Forward ¹	Aft ¹	Side ¹	Up	Down	Maximum	Longit.	Lateral
46,700 (10,500)	46,700 (10,500)	46,700 (10,500)	87,200 (19,600)	158,800 (35,700)	864 (34)	± 10	± 10

¹ = in combination with a download equal to the forward load**Configuration drawing**

Dimensions in mm (inches)

**Applicable testing restraint condition**

RC L (see section 8)

ULD CONFIGURATION L6

Nominal base size 1534 x 3175 mm (60.4 x 125 in) - Type 2

Applicable to: Pallets, Nets

Minimum base area load: 10 kPa (209 lb/ft²)

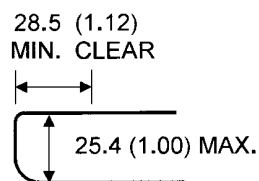
Table L6 **Ultimate load criteria**

Ultimate loads N (lb)					CG height mm (in)	CG eccentricity %	
Forward ¹	Aft ¹	Side ¹	Up	Down	Maximum	Longit.	Lateral
46,700 (10,500)	46,700 (10,500)	46,700 (10,500)	87,200 (19,600)	158,800 (35,700)	864 (34)	± 10	± 10

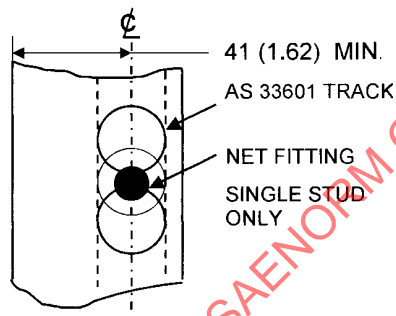
1 = in combination with a download equal to the forward load

Configuration drawing

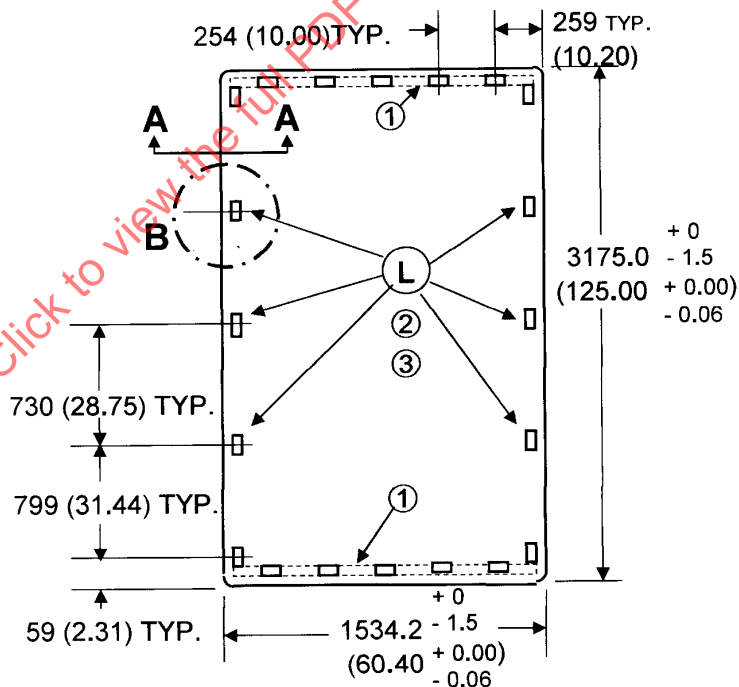
Dimensions in mm (inches)



SECTION **A-A**
TYP. 4 EDGES



VIEW **B**
TYP. 20 PLACES



- ① Continuous track optional on 1534 mm (60.4 in) sides only.
- ② Tie-down receptacles incorporated in the pallet construction at locations L shall have an ultimate load upward capacity of 3300 N (750 lb) maximum.
- ③ For the ultimate upward load condition, the 3300 N (750 lb) upward loads shall be considered acting simultaneously on all six locations L. Under this condition, the pallet shall not disengage from the aircraft restraints.

Applicable testing restraint condition

RC L (see section 8)

ULD CONFIGURATION M4

Nominal base size 2438 x 3175 mm (96 x 125 in) - Type 2

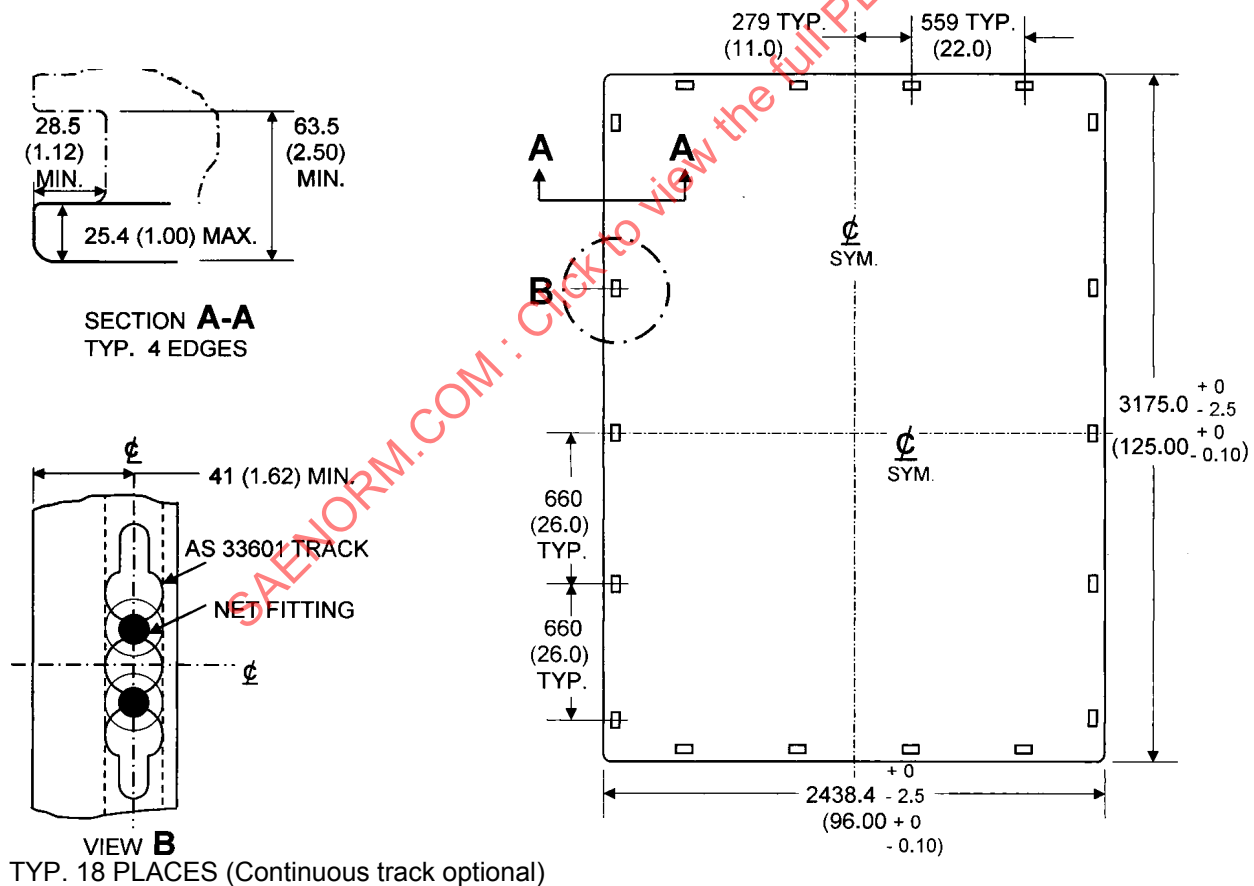
Applicable to: Containers, Pallets, Nets

Minimum base area load: 10 kPa (209 lb/ft²)**Table M4** Ultimate load criteria

Ultimate loads N (lb)					CG height mm (in) ¹	CG eccentricity %	
Forward ²	Aft ²	Side ²	Up	Down	Maximum	Longit.	Lateral
100,000 (22,500)	100,000 (22,500)	100,000 (22,500)	169,000 (38,000)	340,000 (76,500)	1219 (48)	± 10	± 10

¹ = for containers and nets, 55% of maximum height, limited to the maximum shown² = in combination with a download equal to the forward load**Configuration drawing**

Dimensions in mm (inches)

**Applicable testing restraint condition**

RC A1 (see section 8)

ULD CONFIGURATION M5

Nominal base size 2438 x 3175 mm (96 x 125 in) - Type 2

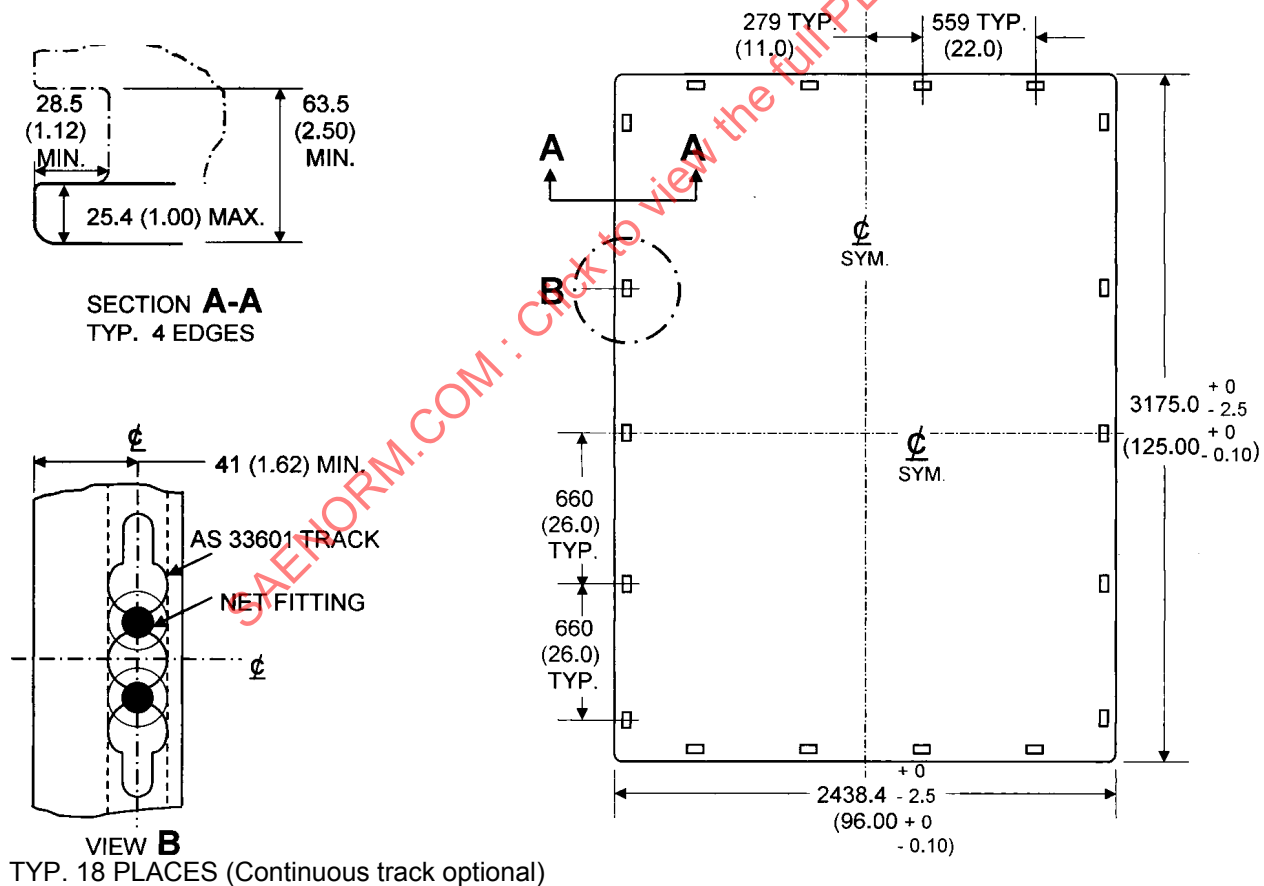
Applicable to: Containers, Pallets, Nets

Minimum base area load: 10 kPa (209 lb/ft²)**Table M5** Ultimate load criteria

Ultimate loads N (lb)					CG height mm (in) ¹	CG eccentricity %	
Forward ²	Aft ²	Side ²	Up	Down	Maximum	Longit.	Lateral
60,000 (13,500)	60,000 (13,500)	60,000 (13,500)	112,000 (25,200)	200,000 (45,900)	915 (36)	± 10	± 10

¹ = for containers and nets, 55% of maximum height, limited to the maximum shown² = in combination with a download equal to the forward load**Configuration drawing**

Dimensions in mm (inches)

**Applicable testing restraint condition**

RC A2 (see section 8)

ULD CONFIGURATION N1

Nominal base size 1562 x 2438 mm (61.5 x 96 in) - Type 2

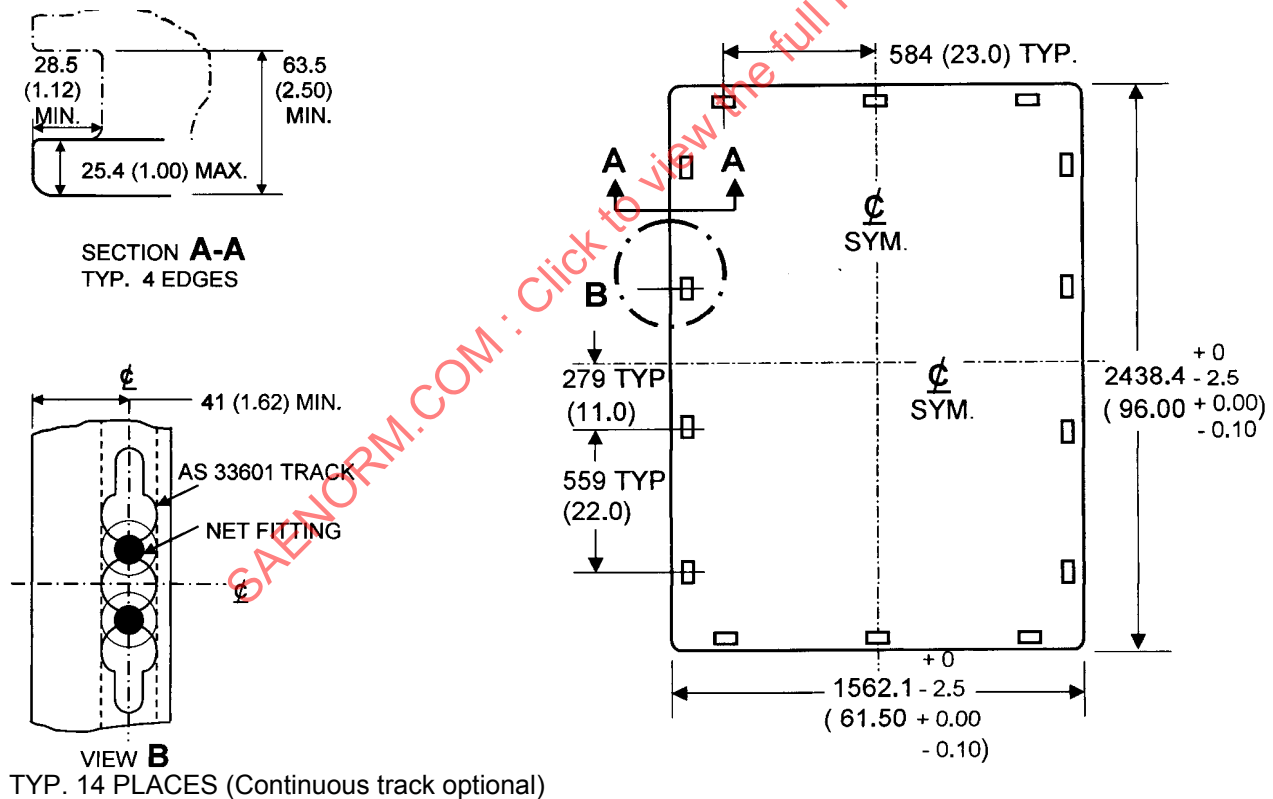
Applicable to: Containers, Pallets, Nets

Minimum base area load: 10 kPa (209 lb/ft²)**Table N1** Ultimate load criteria

Ultimate loads N (lb)					CG height mm (in) ¹	CG eccentricity %	
Forward ²	Aft ²	Side ²	Up	Down	Maximum	Longit.	Lateral
50,000 (11,250)	50,000 (11,250)	50,000 (11,250)	84,500 (19,000)	170,000 (38,250)	1219 (48)	± 10	± 10

¹ = for containers and nets, 55% of maximum height, limited to the maximum shown² = in combination with a download equal to the forward load**Configuration drawing**

Dimensions in mm (inches)

**Applicable testing restraint condition**

RC N (see section 8)

ULD CONFIGURATION **P1**

Nominal base size 1198 x 1534 mm (47 x 60.4 in) - Type 2

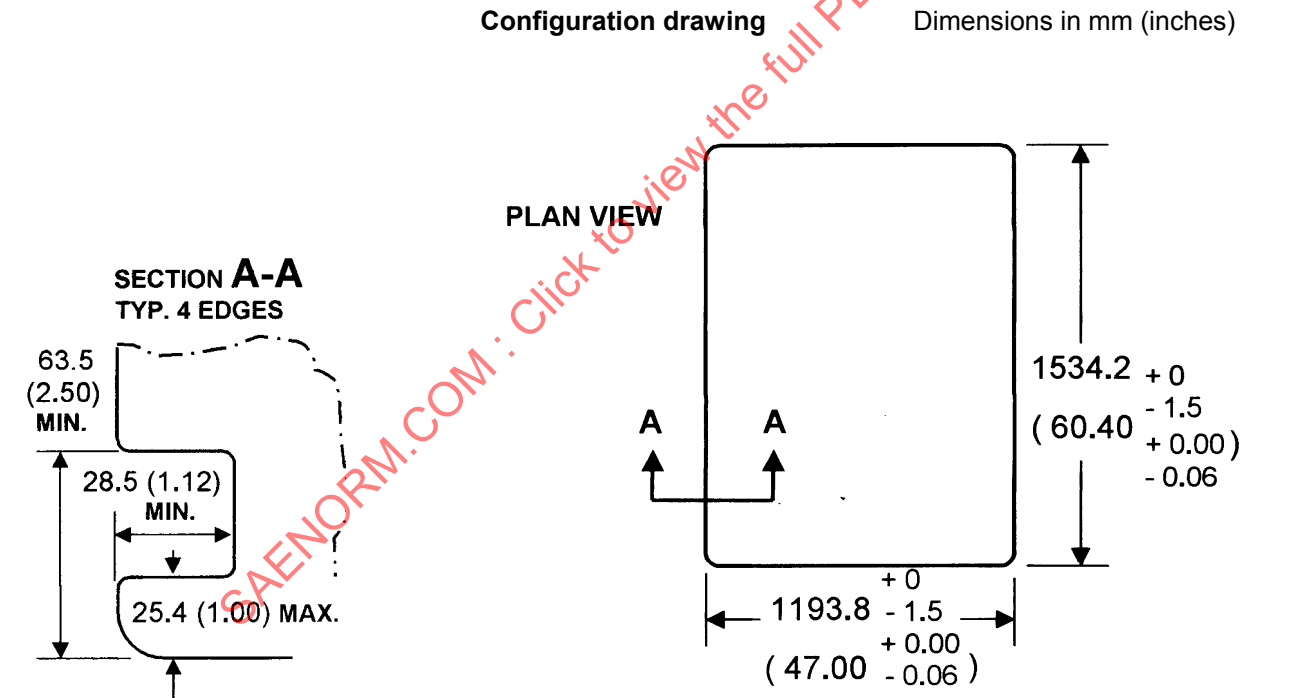
Applicable to: Containers

Minimum base area load: 10 kPa (209 lb/ft²)

Table P1 Ultimate load criteria

Ultimate loads N (lb)					CG height mm (in)	CG eccentricity %	
Forward ¹	Aft ¹	Side ¹	Up	Down	Maximum	Longit.	Lateral
18,000 (4050)	18,000 (4050)	18,000 (4050)	33,600 (7550)	61,250 (13,750)	864 (34)	± 10	± 10

¹ = in combination with a download equal to the forward load



Applicable testing restraint condition

RC **P** (see section 8)

ULD CONFIGURATION **Q1**

Nominal base size 1534 x 2438 mm (60.4 x 96 in) - Type 2

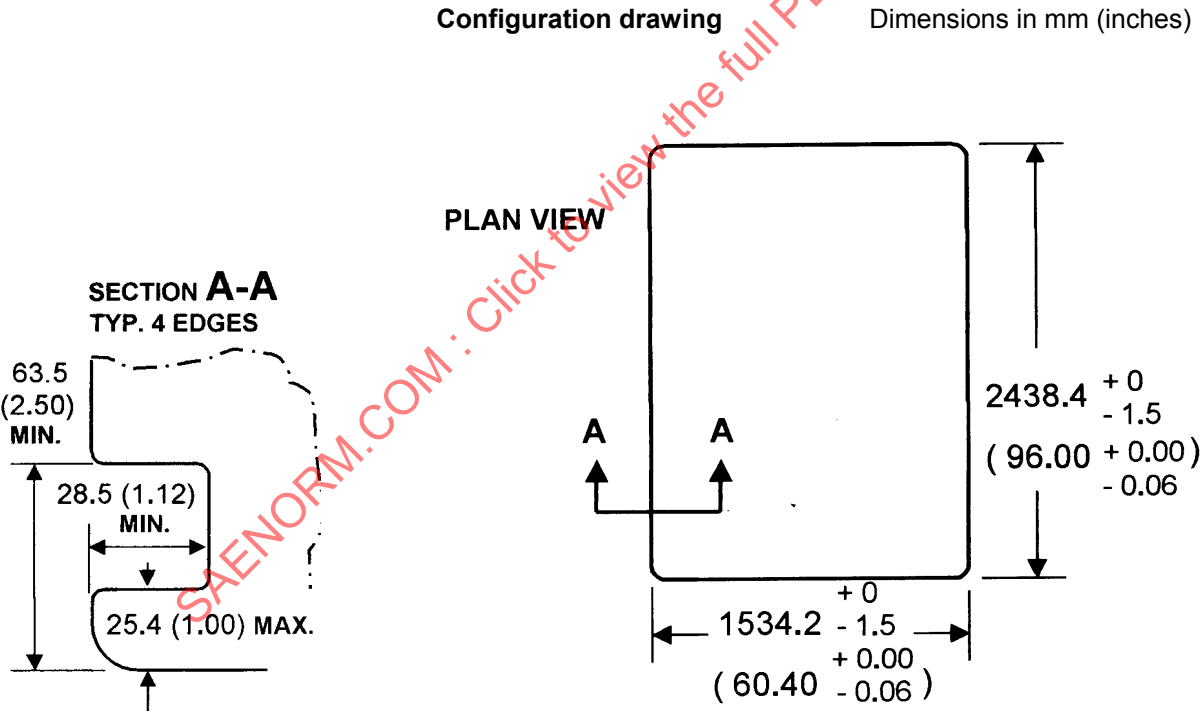
Applicable to: Containers

Minimum base area load: 10 kPa (209 lb/ft²)

Table Q1 Ultimate load criteria

Ultimate loads N (lb)					CG height mm (in)	CG eccentricity %	
Forward ¹	Aft ¹	Side ¹	Up	Down	Maximum	Longit.	Lateral
36,000 (8100)	36,000 (8100)	36,000 (8100)	67,200 (15,100)	122,500 (27,500)	864 (34)	± 10	± 10

¹ = in combination with a download equal to the forward load



Applicable testing restraint condition

RC **Q** (see section 8)

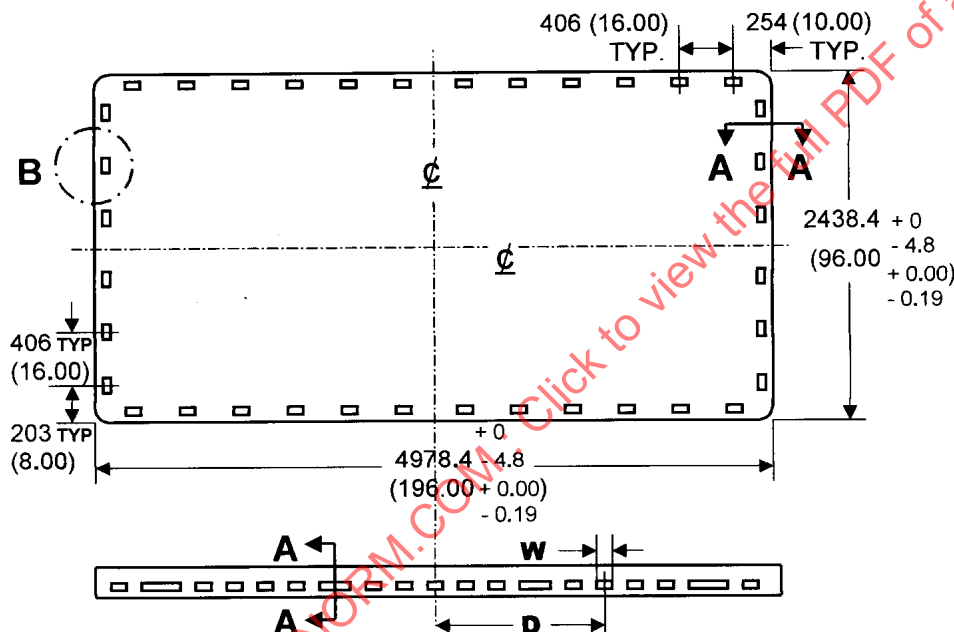
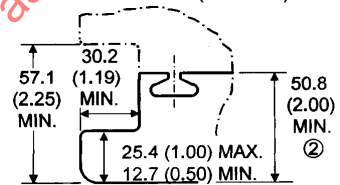
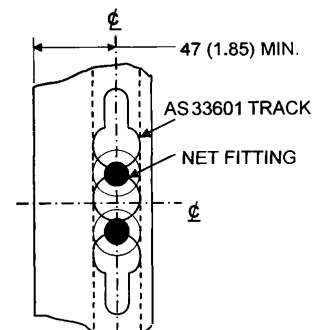
ULD CONFIGURATION R1

Nominal base size 2438 x 4978 mm (96 x 196 in) - Type 2

Applicable to: Containers, Pallets, Nets

Minimum base area load: 20 kPa (418 lb/ft²)**Table R1 Ultimate load criteria**

Ultimate loads N (lb)					CG height mm (in)	CG eccentricity %	
Forward ¹	Aft ¹	Side ¹	Up	Down	Maximum	Longit.	Lateral
167,000 (37,500)	167,000 (37,500)	167,000 (37,500)	278,000 (62,500)	556,000 (125,000)	1219 (48)	± 5	± 10

¹ = in combination with a download equal to 2/3 of the forward load**Configuration drawing****Dimensions in mm (inches)****SECTION A-A****VIEW B 2**

TYP. 36 PLACES

D ULD C/L	mm	0	215.9	511.2	733.4	1022.3	1206.5	1409.7	1533.5	1832.0	2044.7
to slot C/L	(in)	0.000	8.500	20.125	28.875	40.250	47.500	55.500	60.375	72.125	80.500

W width	mm	76.2*	101.6**	76.2*	171.4**	76.2*	101.6**	76.2**	76.2*	260.3**	76.2*
of slot	(in)	3.00*	4.00**	3.00*	6.75**	3.00*	4.00**	3.00**	3.00*	10.25**	3.00*

Load carrying blocks: both neither both neither both neither neither both neither both

* + 0.5 / - 0 (+ .02 / - .00)

** MIN. only

Applicable testing restraint condition

RC G and R (see section 8)

ULD CONFIGURATION S1

Nominal base size 1562 x 2235 mm (61.5 x 88 in) - Type 2

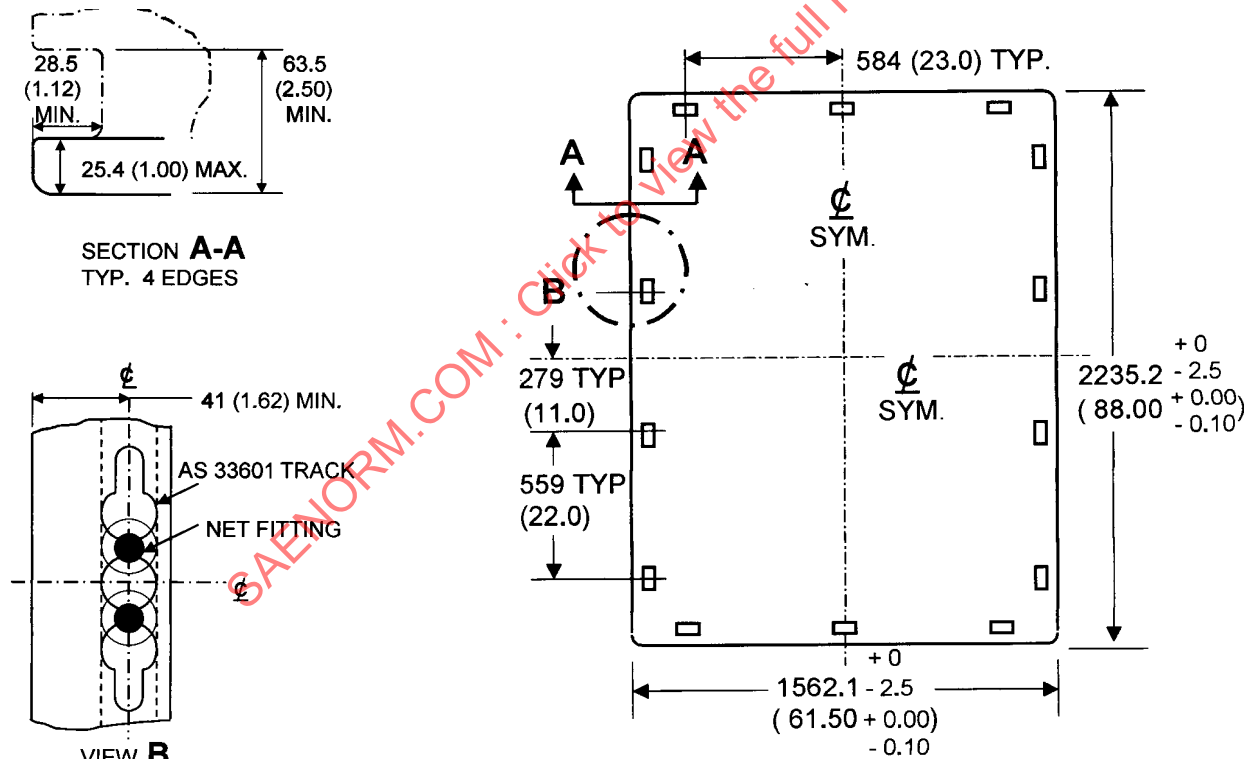
Applicable to: Containers, Pallets, Nets

Minimum base area load: 10 kPa (209 lb/ft²)**Table S1** Ultimate load criteria

Ultimate loads N (lb)					CG height mm (in) ¹	CG eccentricity %	
Forward ²	Aft ²	Side ²	Up	Down	Maximum	Longit.	Lateral
50,000 (11,250)	50,000 (11,250)	50,000 (11,250)	84,500 (19,000)	170,000 (38,250)	1219 (48)	± 10	± 10

¹ = for containers and nets, 55% of maximum height, limited to the maximum shown² = in combination with a download equal to the forward load**Configuration drawing**

Dimensions in mm (inches)



TYP. 14 PLACES (Continuous track optional)

Applicable testing restraint condition

RC N (see section 8)

8. TESTING RESTRAINT CONDITIONS

8.1 The typical testing restraint conditions specified in this Aerospace Standard were selected based on worst testing case analysis. They shall be used for testing the corresponding unit load devices configurations, and analysis or numeric simulation, if used, shall use the same assumptions.

8.2 Testing restraint condition pages are listed in Table 2 hereafter:

TABLE 2 - TESTING RESTRAINT CONDITIONS

Restraint Condition (RC)	ULD Base Nominal Dimensions (UC)	mm (inches)	Upper Deck	Main Deck	Lower Deck	Length Wise ¹	Cross Wise ²	Page
RC A1	A	2235 X 3175 (88 X 125)	X	X		X	X	27
RC A1	B	2235 X 2743 (88 X 108)	X	X		X	X	27
RC A1	M	2438 X 3175 (96 X 125)	X	X		X	X	27
RC A2	A	2235 X 3175 (88 X 125)			X	X	X	28
RC A2	B	2235 X 2743 (88 X 108)			X	X	X	28
RC A2	M	2438 X 3175 (96 X 125)			X	X	X	28
RC G	G	2438 X 6058 (96 X 238.5)		X		X		29
RC G	R	2438 X 4978 (96 X 196)	X	X		X		29
RC K	K	1534 X 1562 (60.4 X 61.5)			X		X	30
RC L	L	1534 X 3175 (60.4 X 125)			X		X	31
RC N	N	1562 X 2438 (61.5 X 96)	X	X	X	X	X	32
RC N	S	1562 X 2235 (61.5 X 88)	X	X	X	X	X	32
RC P	P	1194 X 1534 (47 X 60.4)			X		X	33
RC Q	Q	1534 X 2436 (60.4 X 96)			X		X	34
RC R	R	2438 X 4978 (96 X 196)		X			X	35

1 = with longest dimension parallel to aircraft centerline.

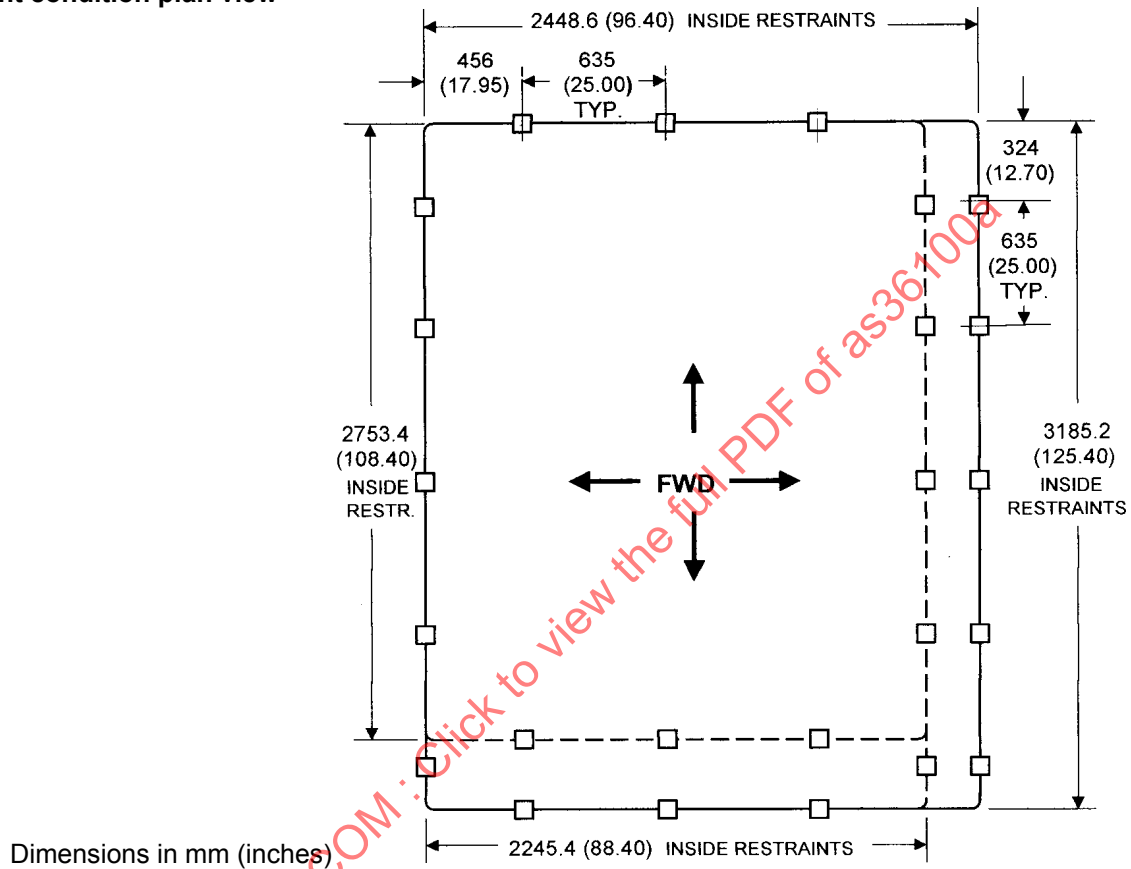
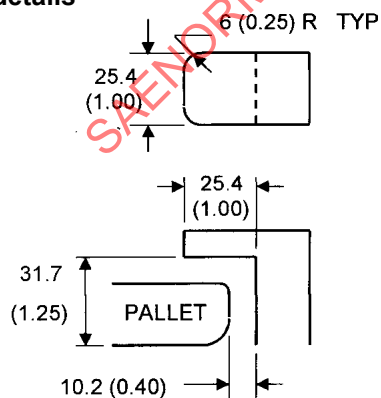
2 = with longest dimension perpendicular to aircraft centerline.

RESTRAINT CONDITION (RC) A1

Applicable to ULD configurations: A7, B7, M4

Applicable to: Containers, Pallets

Orientation: omni-directional

Restraint condition plan view**Restraint details****Other testing conditions**

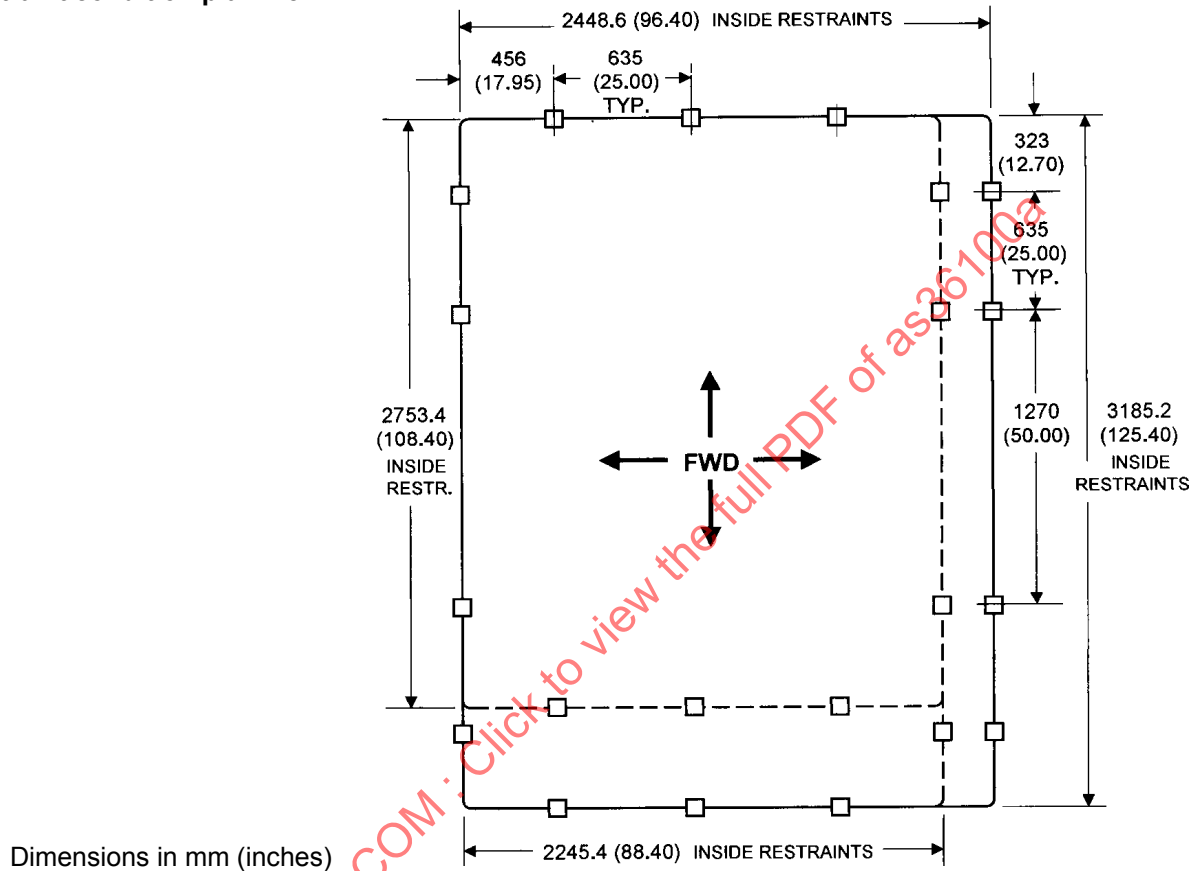
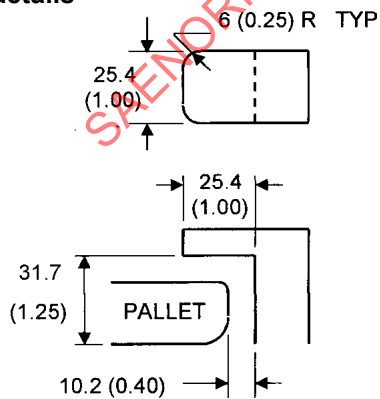
Maximum ultimate loads, CG height and CG longitudinal and lateral eccentricities of ULD configuration.

RESTRAINT CONDITION (RC) A2

Applicable to ULD configurations: A8, B8, M5

Applicable to: Containers, Pallets

Orientation: omni-directional

Restraint condition plan view**Restraint details****Other testing conditions**

Maximum ultimate loads, CG height and CG longitudinal and lateral eccentricities of ULD configuration.