NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

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Group Chairman's Factual Report

STRUCTURES

DCA13MA081

Attachment 2

Boeing 747-400BCF, Weight and Balance Control and Loading Manual, Boeing Sample Manual, Document Number D043U544-XXX1 Revision 2

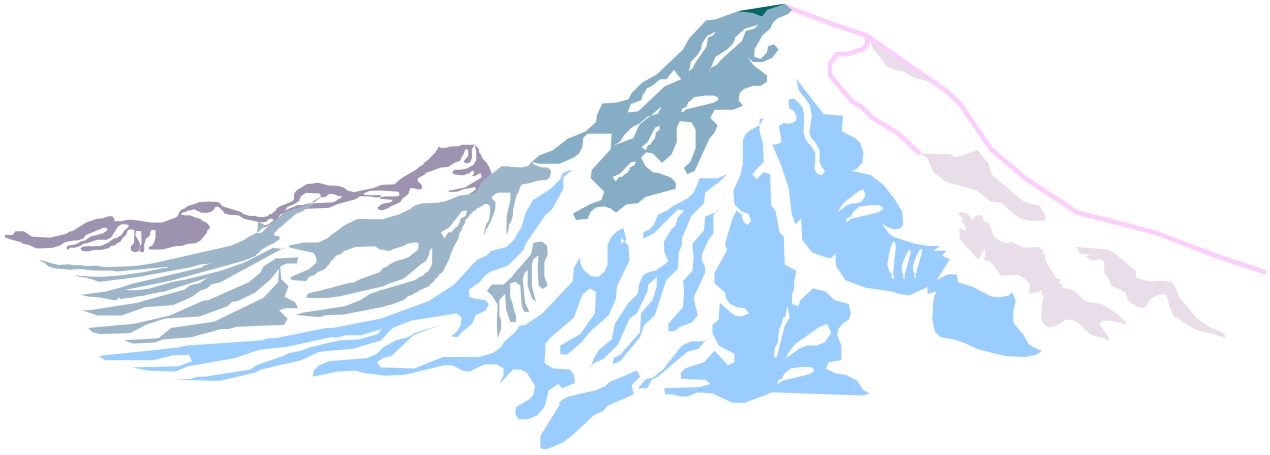
These are only selected pages needed for the purposes of conducting the accident investigation. This is not a complete manual and not approved for commercial use.

747-400BCF

SAMPLE MANUAL

WEIGHT AND BALANCE
CONTROL AND LOADING MANUAL

MODEL 747-440



Boeing Commercial Airplane Group
Weight Engineering Organization
P.O. Box 3707 Seattle, Washington 98124

Boeing Document No. D043U544-XXX1

INTRODUCTION

The data presented in this manual are in compliance with Federal Aviation Regulations Part 25, Paragraphs 25.29; 25.471 (b); 25.1519 and 25.1583 (c); and are provided for the purpose of establishing the Model 747-400BCF weight and balance requirements and allowables.

This manual presents all the weight and balance information necessary to ensure safe airplane operation. In addition, information is provided to allow the operator to efficiently plan loading procedures in such a manner that maximum payload capability is safely distributed for any type of operation.

The Weight and Balance Manual is organized following the guidelines of the Air Transport Association (ATA) Specification No. 100, “Specification for Manufacturers' Technical Data”. Accordingly, the weight and balance data is presented in two chapters.

CHAPTER 1 - CONTROL

Control contains all weight and balance data specifically related to the customer aircraft. The data presented in this chapter is modular, with groups of related information provided in discreet subject packages, each of which is uniquely identified by a three element Chapter-Section-Subject number (CHP-SEC-SUB). Major data groupings for the Chapter-Sections are as follows:

CHAPTER - SECTION	MAJOR DATA GROUPING
1- 00 through 1- 09	General
1- 20 through 1- 29	Fuel
1- 30 through 1- 39	Fluids
1- 40 through 1- 49	Personnel
1- 60 through 1- 69	Cargo
1- 80 through 1- 89	Ground Operations
1- 90 through 1- 99	Examples

The two digit section (SEC) element allows for ten distinct topics within each major group of data (e.g. 20 through 29 for Fuel). The subject (SUB) element is primarily used to uniquely identify topically identical data for varying aircraft configurations. However, in some cases the subject (SUB) element is used to further subdivide topical information.

The Chapter 1 document includes only those topics that apply to the airplanes called out in the “Airplane Configuration” section of the document. The CHP-SEC-SUB number, page numbering, revision date and document number appear on the lower outside corner of each page.

Changes within a revised CHP-SEC-SUB are identified with a solid bar in the outside margin, adjacent to the change. The date for the CHP-SEC-SUB will be revised and the changes will be noted in the revision highlights.

To determine if you have received a complete document, check each section listed in the “Table of Contents” and confirm that the section is included in this document. The total number of pages for each section is specified at the bottom of every page contained within it (e.g. “Page 1 of 4”, where “4” represents the total number of pages in the section).

APPLICABLE CONFIGURATIONS
All

INTRODUCTION (Continued)

MANAGING AIRCRAFT CONFIGURATIONS

The “Airplane Configuration” section of this document lists all aircraft covered in this document, along with the allowable configurations associated with each aircraft. Restrictions and limitations for each association of a configuration with a specific aircraft serial number are defined in the same section under the heading “Configuration Qualifications”.

The data presented within each CHP-SEC-SUB module apply to the aircraft configuration(s) listed in the “Applicable Configurations” box at the bottom of each page. The word “All” signifies that the data is applicable to all configurations listed in the “Airplane Configuration” section of this document, whereas data that is applicable to specific aircraft configurations will list only the appropriate configuration letter(s) in the “Applicable Configurations” box.

DOCUMENT NUMBERING

For all 747-400BCF Chapter 1 Manuals, document numbering will use the following convention:

D043U5[Y][Z]-[ccc][X]

where **[Y]** = Minor Model Designator (e.g. “4” for a -400 Minor Model)

[Z] = Derivative Designator (0=Passenger, 1=Combi, 2=Freighter, 3=Convertible, 4=Special Freighter)

[ccc] = Airline 3-Letter Designator (As per Boeing Standard Designators - CCID)

[X] = Document Serial Number (This will always be “1” unless an airline has multiple Weight & Balance Manuals for a given derivative model.)

CHAPTER 2 - AIRCRAFT REPORTS

The Aircraft Report (covered in a separate document) contains weight and balance data specifically related to each delivered aircraft of the customer's fleet. The data includes: make, model, serial number, registration identification, actual weighing data, and inventory list for the delivery configuration of each aircraft.

APPLICABLE CONFIGURATIONS
All

Highlights Revision No: 2

This revision makes miscellaneous changes to the manual. Detailed descriptions of the changes to each section are listed below.

TABLE OF CONTENTS

- Updated for this revision.

AIRPLANE CONFIGURATION

- Removed registry numbers.

INTERIOR EFFECTIVITY

- Updated for this revision.

1-02-011

- Adjusted shading to stay within the envelope on the kilogram graph.

1-09-001

- Added text for clarification when operating at alternate MTOWs (lower weights than basic certified MTOW).

1-22-001

- Revised “taxi” to “takeoff” in Fuel Loading Procedures list item.

1-24-001

- Revised fuel tables to equal the usable fuel quantities listed on page 3 of CHP-SEC 1-20-00x.

1-24-011

- Revised fuel tables to equal the usable fuel quantities listed on page 3 of CHP-SEC 1-20-00x.

1-24-021

- Revised fuel tables to equal the usable fuel quantities listed on page 3 of CHP-SEC 1-20-00x.

1-60-001

- Corrected kilogram value on page 6.
- Section number reference changed from “1-60-04x” to “1-60-40x” and “1-60-06x to 1-60-60x”.

1-60-201

- Section number changed from “1-60-021” to “1-60-201” and the section number reference changed from “1-60-04x” to “1-60-40x” and “1-60-06x to 1-60-60x”.

1-60-401

- Section number changed from “1-60-041” to “1-60-401”.

1-60-601

- Section number changed from “1-60-061” to “1-60-601”.

1-62-401

- Section number changed from “1-62-041” to “1-62-401”.

1-62-601

- Section number changed from “1-62-061” to “1-62-601”.

1-62-801

- Section number changed from “1-62-081” to “1-62-801”.

APPLICABLE CONFIGURATIONS
All

HIGHLIGHTS REVISION NO: 2 (Continued)

1-62-901

- Section number changed from “1-62-101” to “1-62-901” and the section number reference changed from “1-68-10x” to “1-68-90x”.

1-63-001

- Added data referencing TSO-C90.

1-63-021

- Added data referencing TSO-C90.

1-63-901

- Section number changed from “1-63-121” to “1-63-901” and the section number reference changed from “1-64-12x” to “1-64-9xx”.

1-64-201

- Section number changed from “1-64-021” to “1-64-201”.

1-64-601

- Section number changed from “1-64-061” to “1-64-601”.

1-64-801

- Section number changed from “1-64-081” to “1-64-801”.

1-64-901

- Section number changed from “1-64-121” to “1-64-901”.

1-66-201

- Section number changed from “1-66-021” to “1-66-201”.

1-66-601

- Section number changed from “1-66-061” to “1-66-601”.

1-66-801

- Section number changed from “1-66-081” to “1-66-801”.

1-66-901

- Section number changed from “1-66-121” to “1-66-901”.

1-68-001

- Changed page date - no data changed.
- Section number reference changed from “1-60-02x” to “1-60-20x”.
- Added list of requirements for tying down non-approved unit load devices.

1-68-901

- Corrected crew baggage tiedown fitting allowable loads for Up restraint direction.
- Section number changed from “1-68-101” to “1-68-901” and the section number reference changed from “1-68-12x” to “1-68-95x” and “1-68-1xx to 1-68-90x”.
- Updated General Information on page 1.

1-68-951

- Section number changed from “1-68-121” to “1-68-951”.

1-69-041

- Section number reference changed from “1-60-04x” to “1-60-40x” and “1-60-06x to 1-60-60x”.

APPLICABLE CONFIGURATIONS
All

HIGHLIGHTS REVISION NO: 2 (Continued)

1-84-001

- Added a note under towing and tipping considerations and added a bullet under tipping considerations.

1-90-001

- Revised ordering information.

APPLICABLE CONFIGURATIONS
All

Highlights Revision No: 1

This revision makes miscellaneous changes to the manual, with details of the changes listed below. In addition, the Boeing assigned model derivative is being updated from 747-400SF to 747-400BCF (Boeing Converted Freighter) and the title is being changed from Generic Customer to Sample Manual (for consistency with other models).

GENERAL

- Airline name changed from “Generic Customer” to “Sample Manual”.

TABLE OF CONTENTS

- Updated for this revision.

AIRPLANE CONFIGURATION

- Updated for this revision.

INTERIOR EFFECTIVITY

- Updated for this revision.

1-02-011

- Corrected typographical errors in labels and added additional labels to graphs.

1-05-001

- Corrected the graphic label from 19.2% to 19.1%.

1-09-001

- Added text for clarification.

1-22-001

- Added note concerning tankered fuel.

1-60-001

- Revised line types on graph and in legend for correlation.

1-62-001

- Revised bulk cargo compartment data.

1-62-081

- Revised bulk cargo compartment data.

1-63-121

- Added footnote for volume limitations based on position and orientation.

1-64-121

- Added profile limitations for Position 1A (A1) and Position 1(A).

1-68-081

- Revised bulk cargo compartment data.

1-69-121

- Added reduced volume data for Position 1(A), and revised sample problem calculations to reflect slight change in % Full for Position A1.

APPLICABLE CONFIGURATIONS
All

Highlights Revision No: Original Release

Original Release.

APPLICABLE CONFIGURATIONS
All

TABLE OF CONTENTS

APPLICABLE CONFIGURATIONS
All

TABLE OF CONTENTS (Continued)

APPLICABLE CONFIGURATIONS
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TABLE OF CONTENTS (Continued)

APPLICABLE CONFIGURATIONS
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TABLE OF CONTENTS (Continued)

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TABLE OF CONTENTS (Continued)

APPLICABLE CONFIGURATIONS
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TABLE OF CONTENTS (Continued)

APPLICABLE CONFIGURATIONS
All

TABLE OF CONTENTS (Continued)

APPLICABLE CONFIGURATIONS
All

AIRPLANE CONFIGURATION

The engineering data and FAA certification provided by this document are applicable and valid only for the airplane as defined in the Type Design at delivery, and as modified by the incorporation of any Boeing Supplemental Type Certificate (STC) or Service Bulletin. With respect to any third party STC configuration, either pre-delivery or post-delivery, it shall be the responsibility of the buyer to obtain the data and appropriate regulatory agency approval.

CONFIGURATION ASSIGNMENT

The table shown below correlates each airplane serial number to the currently allowed configuration(s) for that airplane. Each configuration is designated by a different letter. Configuration qualifications are listed following the table and indicate the change authorization involved for airplanes with mulitple allowable configurations. Because there may be multiple configuration letters applicable to any serial number, and also multiple configuration qualifications listed for any configuration letter, care should be exercised when determining the configuration letter which correctly reflects the applicable configuration of the airplane.

LINE NUMBER	SERIAL NUMBER	VARIABLE NUMBER	CONFIGURATION						
-444	94744	XX444	A						

CONFIGURATION QUALIFICATIONS

APPLICABLE CONFIGURATIONS
All

INTERIOR EFFECTIVITY

The tabular data shown below correlates each airplane serial number to the passenger arrangement(s) certified for that airplane. Each passenger arrangement is designated by drawing number and revision letter. To locate a particular passenger arrangement(s), refer to the interior section listed below. Drawing numbers are listed beside each interior drawing in the interior section.

UPPER CABIN

Weight and balance data for each drawing identified in the following table are provided in Section 1-42-003 of this manual.

SERIAL NUMBER	PASSENGER ARRANGEMENT EFFECTIVITY - UPPER CABIN							
	DRAWING #	REV	DRAWING #	REV	DRAWING #	REV	DRAWING #	REV
94744	LOPA-747SF-2700	-						

APPLICABLE CONFIGURATIONS
All

GENERAL INFORMATION

WEIGHT AND BALANCE DEFINITIONS

The following definitions are provided to assist operators in having a better understanding of the terms used throughout the Weight and Balance Manual.

General Terms and Acronyms

Balance Arm (B.A.)	A true measure of distance from foward to aft, in inches, from a fixed datum. The fixed datum is selected by the airplane manufacturer. Balance Arms are used in weight and balance calculations. To see the relationship between B.A. and B.S., refer to CHP-SEC-SUB 1-00-04x of this manual.
Body Station (B.S.)	A manufacturing location on the airplane. For first of an airplane model, B.S. are continuous from the front to the aft of the airplane. For later versions that are either stretched (i.e. fuselage inserts added) or shrunk (i.e. fuselage sections removed), B.S. becomes discontinuous, for manufacturing reasons. To see the relationship between B.A. and B.S., refer to CHP-SEC-SUB 1-00-04x of this manual.
Layout of Passenger Arrangement (LOPA)	A Boeing internal drawing the depicts the interior layout.
Layout of Passenger Systems (LOPS)	A Boeing internal drawing that depicts the interior layout.

Weight Terms

Basic Empty Weight (BEW)	Standard Basic Empty Weight plus or minus weight of standard item variations.
Delivery Empty Weight (DEW)	Manufacturer's Empty Weight, less any shortages, plus those standard items and operational items in aircraft at time of delivery.
Fleet Empty Weight (FEW)	Average Basic Empty Weight used for a fleet or group of aircraft of the same model and configuration. (The weight of any fleet member shall not vary more than the tolerance established by government regulations.)
Guaranteed Weight	Weight the manufacturer clearly defines and guarantees, subject to contractual tolerances and adjustments.
Manufacturer's Empty Weight (MEW)	Weight of structure, powerplant, furnishings, systems and other items of equipment that are an integral part of a particular aircraft configuration. (It is essentially a “dry” weight, including only those fluids contained in closed systems.)
Maximum Payload	Maximum Zero Fuel Weight minus Operational Empty Weight.
Operational Empty Weight (OEW)	Basic Empty Weight or Fleet Empty Weight plus operational items.

APPLICABLE CONFIGURATIONS
All

GENERAL INFORMATION (Continued)

Operational Items	Personnel, equipment and supplies necessary for a particular operation but not included in Basic Empty Weight. These items may vary for a particular aircraft and may include, but are not limited to, the following: ❑ Crew and Baggage ❑ Manuals and navigational equipment ❑ Removable service equipment for cabin and galley ❑ Food and beverage ❑ Usable fluids other than those in useful load ❑ Life rafts, life vests and emergency transmitters ❑ Aircraft unit load devices
Operational Landing Weight (OLW)	Maximum authorized weight for landing. (It is subject to airport, operational and related restrictions. It must not exceed maximum certified landing weight.)
Operational Takeoff Weight (OTOW)	Maximum authorized weight for takeoff. (It is subject to airport, operational and related restrictions. This is the weight at start of takeoff run and must not exceed maximum certified takeoff weight.)
Payload	Weight of the cargo.
Standard Basic Empty Weight (SBEW)	Manufacturer's Empty Weight plus standard items.
Standard Items	Equipment and fluids not considered an integral part of a particular aircraft and not a variation for the same type of aircraft. These items may include, but are not limited to, the following: ❑ Unusable fuel and other unusable fluids ❑ Engine oil ❑ Toilet fluid and chemical ❑ Fire extinguishers, pyrotechnics and emergency oxygen equipment ❑ Structure in galley ❑ Supplementary electronic equipment
Useful Load	Difference between takeoff weight and Operational Empty Weight. (It includes payload, usable fuel and other usable fluids not included as operational items.)
Zero Fuel Weight	Operational Empty Weight plus payload. (This weight must not exceed Maximum Zero Fuel Weight.)

APPLICABLE CONFIGURATIONS
All

GENERAL INFORMATION (Continued)

Weight Limitation Terms

Maximum Fuel Transfer Weight (MFTW)	The weight above which Reserve Tanks 2 and 3 must be full.
Maximum Landing Weight (MLW)	Maximum weight for landing as limited by aircraft strength and airworthiness requirements.
Maximum Takeoff Weight (MTOW)	Maximum weight at brake release as limited by aircraft strength and airworthiness requirements.
Maximum Taxi Weight (MTW)	Maximum weight for ground maneuver as limited by aircraft strength and airworthiness requirements. (It includes weight of taxi and runup fuel.)
Maximum Zero Fuel Weight (MZFW)	Maximum weight allowed before usable fuel must be loaded in the aircraft as limited by strength and airworthiness requirements.
Minimum Flight Weight (MFW)	Minimum weight for flight as limited by aircraft strength and airworthiness requirements.

Fuel Terms

Unusable Fuel	Fuel remaining after a fuel runout test has been completed in accordance with government regulations. (It includes drainable unusable fuel plus unusable portion of trapped fuel.)
Drainable Unusable Fuel	Unusable fuel minus unusable portion of trapped fuel.
Trapped Unusable Fuel	Unusable fuel remaining when aircraft is defueled by normal means using the procedures and attitudes specified for draining the tanks.
Usable Fuel	Fuel available for aircraft propulsion.
Drainable Usable Fuel	Usable fuel that can be drained from the aircraft by normal means using the procedures and attitudes specified for draining the tanks.
Trapped Usable Fuel	Usable fuel remaining in the fuel feed and engine lines after standard tank defueling.

Curtailments

Cargo Location Variation	Operational margin placed within the certified center of gravity limits to compensate for the effect of reasonable variations in cargo location when partially unrestricted cargo placement is permitted.
Fuel Density Variation	Operational margin placed within the certified center of gravity limits to compensate for the effect of fuel density variation.
Fuel Usage	Operational margin placed within the certified center of gravity limits to compensate for the effect of fuel management during the critical portions of flight.

APPLICABLE CONFIGURATIONS
All

GENERAL INFORMATION (Continued)

In-flight Movement	Operational margin placed within the certified center of gravity limits to compensate for the effect of reasonable crew movement during flight.
Loading Schedule	A hardcopy or computerized form used to record the aircraft's weight, load distribution and other appropriate information; to calculate and check the weight and balance conditions of the aircraft against operational limitations; and to establish the stabilizer trim setting for takeoff.
Operational Empty Weight Variation	Operational margin placed within the certified center of gravity limits to compensate for the known variations in the standard and operational items.
Seating Variation	Operational margin placed within the certified center of gravity limits to compensate for the effect of reasonable variations in crew center of gravity when unrestricted seating is permitted.

Balance Terms

Fleet Center-of-Gravity	Average Basic Empty Weight center of gravity used for a fleet or group of aircraft of the same model and configuration. (The center of gravity of any fleet member shall not vary more than the maximum tolerance established by government regulations.)
Lateral Imbalance	The offset of the airplane center of gravity from the airplane centerline. It is usually expressed as a moment (LB-IN. or KG-IN.) about the airplane centerline.

Cargo Terms and Definitions

Approved ULD	A unit load device that has been manufactured in accordance to and received approval by the appropriate governmental airworthiness authority indicating the airplane ULD meets their safety requirements.
Container	A rigid structure that performs the function of a ULD without the use of a restraining net.
Frangible Cargo	Cargo consisting of items which will progressively conform to the airplane contour when subjected to loads up to limit load.
g	The expression used to show the magnitude of a force in terms of the standard earth gravitational unit.
Igloo	A bottomless rigid shell made of fiberglass, metal or other suitable material. Its shape conforms to the contours of cargo aircraft envelopes. It covers the maximum usable area of an aircraft pallet to which it is secured during flight.

APPLICABLE CONFIGURATIONS
All

GENERAL INFORMATION (Continued)

Limit Loads	Limit loads are the maximum loads to be expected in service. Limit loads must be supported without detrimental permanent deformation or interference with safe operation.
NAS 3610	A document which defines test conditions for approval of ULDs per TSO-C90c.
Non-Approved ULD	A unit load device that has not received approval by the appropriate governmental airworthiness authority indicating the airplane ULD meets their safety requirements.
Pallet	An item of equipment consisting of a flat platform with a flat undersurface of standard dimensions on which goods are assembled and secured before being loaded as a unit onto the airplane.
Rigid Cargo	Cargo consisting of an item or items which will not progressively conform to the airplane contour when subjected to loads up to limit load. Examples include machine tools, pipes, large motors or generators, etc.
Tiedown Fitting	An attachment device designed to transfer forces between a load bearing device (typically a net, strap, rope or bar) and a cargo track.
TSO-C90c	Technical Standard Order for the approval of ULDs. NAS 3610 is the minimum performance standard.
ULD	Unit Load Device. An assembly of components comprising either of the following: aircraft pallet and pallet net, straps, igloo aircraft container The purpose of the unit load device is to enable individual pieces of cargo to be assembled into a standardized sized unit to facilitate rapid loading/unloading onto aircraft having compatible handling and restraint systems which interface directly with the unit.
ULD Position	A volume in the cargo compartment which is designated and equipped to be occupied, during flight, by a ULD of specified type.
Ultimate Load	Ultimate loads are limit loads multiplied by prescribed factors of safety.

GENERAL INFORMATION (Continued)

ABBREVIATIONS

The following terms, when necessary, will be abbreviated as shown below.

UNIT	ABBREVIATION	UNIT	ABBREVIATION
Pounds	LB	Inches	IN.
Kilograms	KG	Feet	FT
U. S. Gallons	U.S. GAL.	Square Feet	SQ FT
Liters	L	Cubic Feet	CU FT
Number	NO.	Inboard	INBD
Forward	FWD	Outboard	OUTBD
Balance Arm	B.A.	Mean Aerodynamic Chord	MAC
Body Buttock Line	B.B.L.	Leading Edge of the MAC	LEMAC
Water Line	W.L.	Center of Gravity	C.G.

CONVERSION FACTORS

The data in this manual is provided in both English and Metric units. Unless otherwise stated, the conversions listed below are used throughout this manual.

MULTIPLY	BY	TO OBTAIN
Pounds	0.45359237	Kilograms
U. S. Gallons	3.78541180	Liters

When totals or summations are required the English values are summed separately from the metric values. Differences may occur when comparing the English totals with the metric totals due to round off.

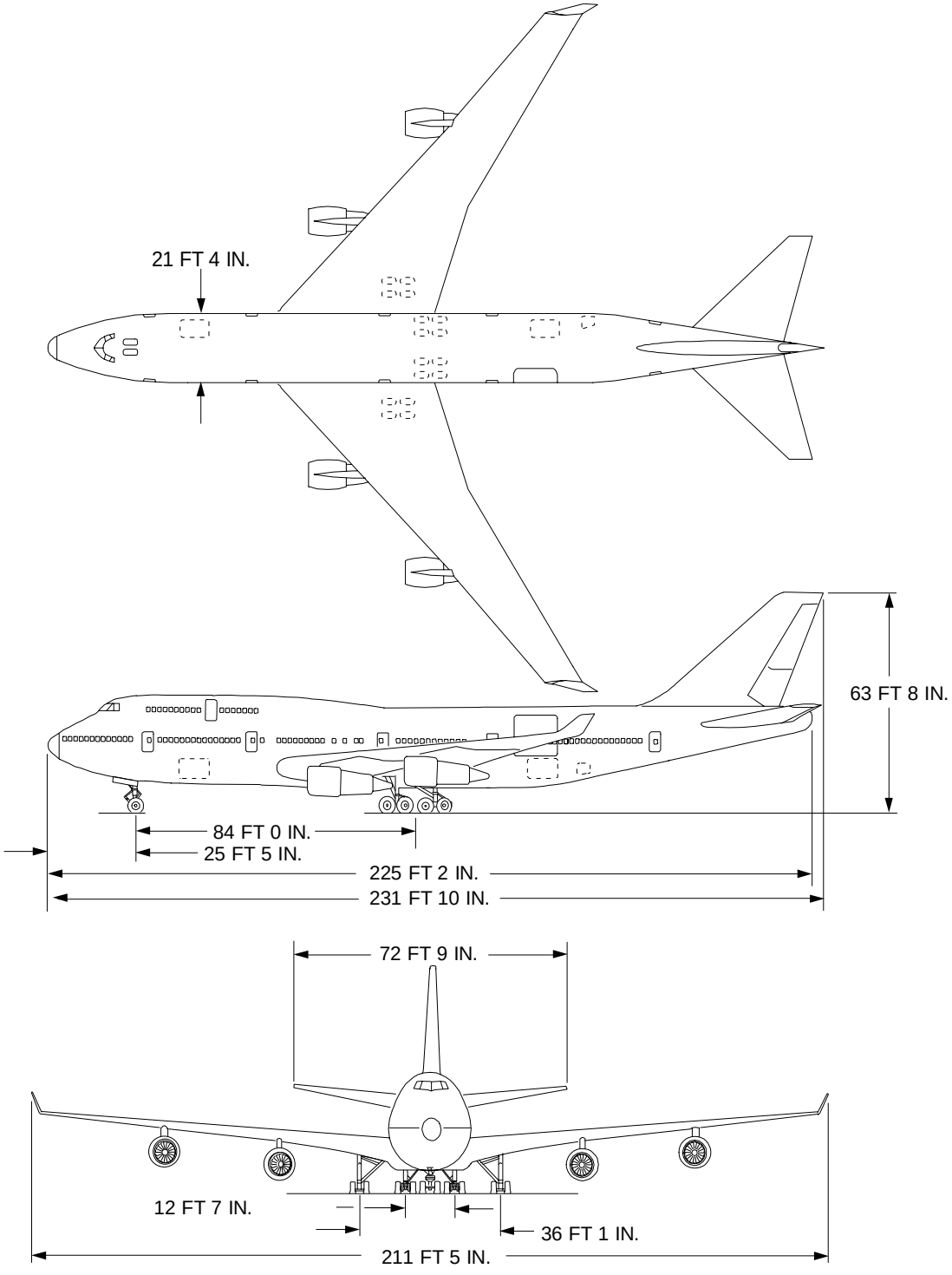
All metric values are converted from English values. When using the conversion factors in this manual, all resultants will be rounded except when the value is a weight limitation. For minimum or maximum weight limitations the resultant metric values will be rounded up or truncated, whichever is more conservative.

APPLICABLE CONFIGURATIONS
All

AIRPLANE DIMENSIONS

GENERAL ARRANGEMENT AND PRIMARY DIMENSIONS

The following figure shows the 747-400SF general arrangement and primary dimensions.

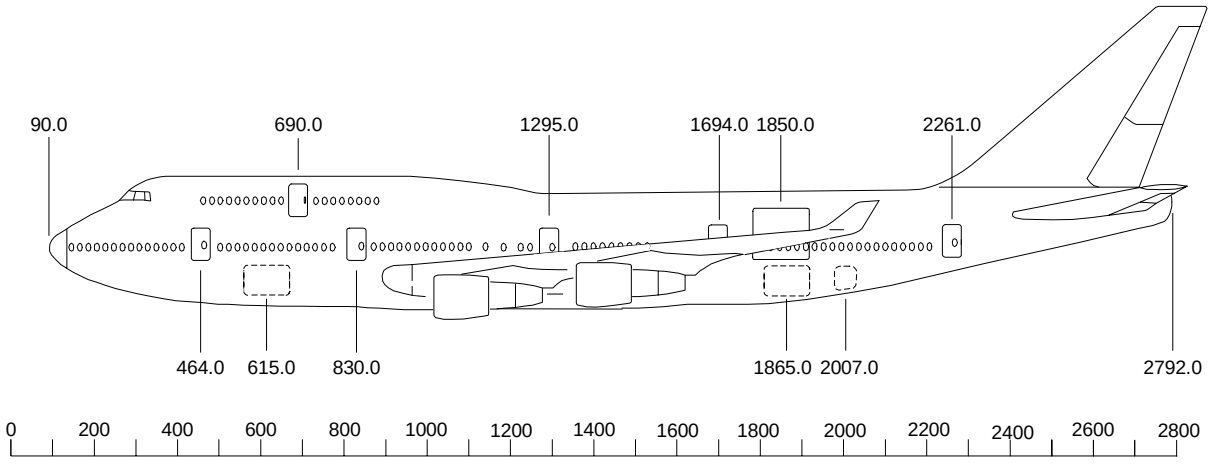


APPLICABLE CONFIGURATIONS
All

BALANCE REFERENCE SYSTEM

BALANCE ARMS / BODY STATIONS

Longitudinal location of all airplane component centers of gravity identified throughout this manual will be referred to as Balance Arms. The Balance Arm is a true measure in inches from the reference datum 90.0 IN. forward of the airplane nose. Balance Arms are equivalent to Body Stations (B.S.).



MEAN AERODYNAMIC CHORD

The Mean Aerodynamic Chord, as used in this manual, is a wing reference distance with a length of 327.8 IN. The Leading Edge of the Mean Aerodynamic Chord is at Balance Arm 1258.0 IN. Conversion of the airplane center of gravity from Balance Arm, in inches, to a percentage of Mean Aerodynamic Chord is derived using the following formula:

$$\%MAC = \frac{(B.A. - 1258.0) \times 100.0}{327.8}$$

The reverse conversion of the airplane center of gravity from a percentage of Mean Aerodynamic Chord to Balance Arm, in inches, is derived using the following formula:

$$B.A. = \frac{(327.8 \times \%MAC)}{100.0} + 1258.0$$

BODY BUTTOCK LINE

The Body Buttock Line is a vertical line or a vertical plane parallel to the centerline of the airplane used to locate points or planes to the left or right of the airplane centerline.

WATER LINE

The Water Line is a horizontal reference line or a horizontal plane parallel to the main deck floor used to locate points or planes vertically. The Water Line is measured from the reference datum 199.8 IN. below the top of the main deck floor.

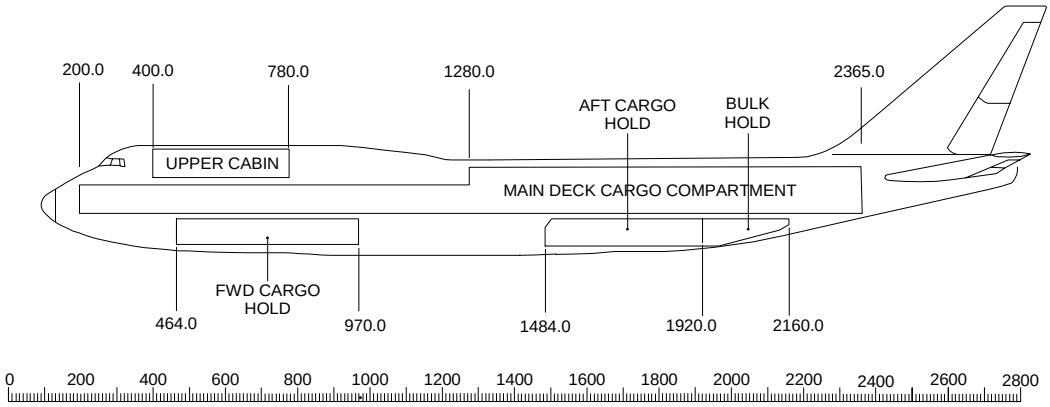
APPLICABLE CONFIGURATIONS
All

CARGO COMPARTMENT LOAD LIMITS

MAXIMUM ALLOWABLE WEIGHTS

This section provides upper deck, main deck, and lower deck cargo compartment loading. These values are the maximum allowable weights that can be sustained by the basic monocoque structure.

The following illustration shows the configuration of the cargo compartments.



BALANCE ARM - IN.

Five basic structural limitations that must be observed when loading payload are compartment, linear loading, floor loading, net loading and cumulative load limitations. Cumulative load limitations are discussed in CHP-SEC 1-60-40x (forward body) and CHP-SEC 1-60-60x (aft body).

APPLICABLE CONFIGURATIONS
All

CARGO COMPARTMENT LOAD LIMITS (Continued)

Maximum allowable compartment weights, and maximum allowable linear and floor loading are provided in the following table:

MAXIMUM ALLOWABLE WEIGHT						
COMPARTMENT	TOTAL WEIGHT		FLOOR LOADING			
	LB	KG	LB/IN.	KG/IN.	LB/SQ FT	KG/SQ FT
Upper Cabin B.A. 400.0 to B.A. 780.0			31.8[a]	14.4[a]	100.0	45.3
Main Deck Cargo[b]						
B.A. 200.0 to B.A. 525.0	19500	8845	60.0	27.2	100.0	45.3
B.A. 525.0 to B.A. 1000.0	71250	32318	150.0	68.0	200.0	90.7
B.A. 1000.0 to B.A. 1480.0	139200	63140	290.0	131.5	400.0	181.4
B.A. 1480.0 to B.A. 2218.0	125460	56907	170.0	77.1	400.0	181.4
B.A. 2218.0 to B.A. 2365.0	4500	2041	36.0	16.3	100.0	45.3
Forward Cargo Hold[c] B.A. 464.0 to B.A. 970.0	58400	26489	116.0	52.6	200.0	90.7
Aft Cargo Hold[c] B.A. 1484.0 to B.A. 1920.0	50570	22938	116.0	52.6	200.0	90.7
Bulk Hold B.A. 1920.0 to B.A. 2160.0	14880[d]	6749[d]	Varies[e]		150.0	68.0
Maximum Load Distribution Between Net Locations B.A. 1920.0 to 1980.0	5160	2340				
B.A. 1980.0 to 2060.0	5390	2444				
B.A. 2060.0 to 2160.0	4330	1964				

[a] The upper cabin allowable load includes the weight of supernumeraries, supernumeraries seats, and supernumeraries carry-on baggage stowed under the seats.

[b] The main deck limitations include the weight of cargo and the unit load devices (ULDs).

[c] The lower hold limitations include the weight of cargo and the unit load devices (ULDs).

[d] The bulk cargo net at B.A. 1920.0 must be installed or the maximum allowable weight is 0 LB (0 KG).

[e] 94.0 LB/IN. (42.6 KG/IN.) at B.A. 1920.0 decreasing linearly to 30.0 LB/IN. (13.6 KG/IN.) at B.A. 2160.0

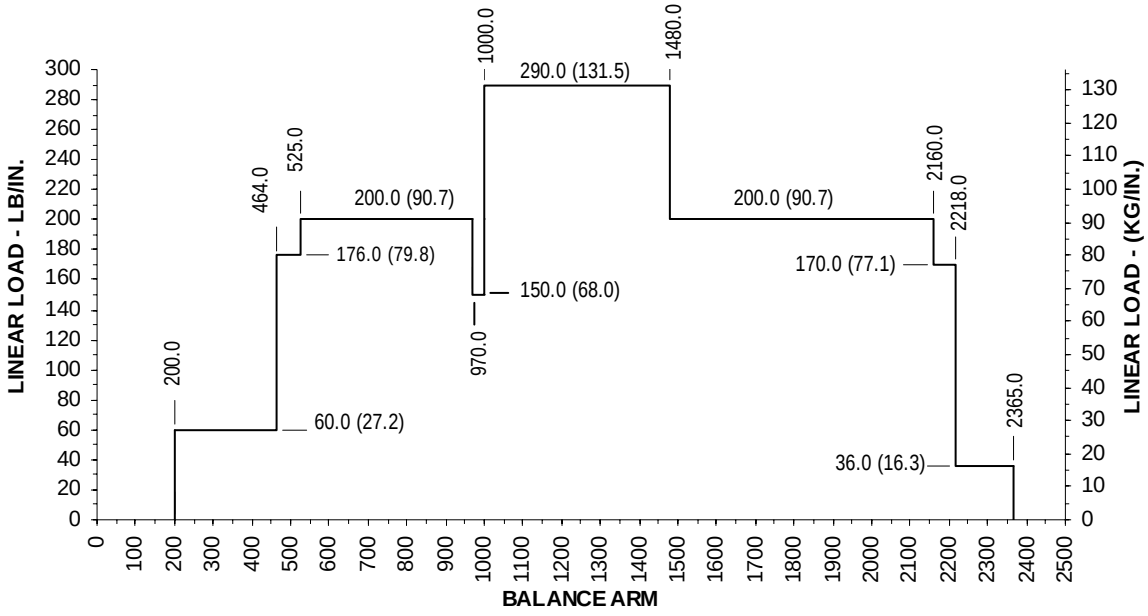
CAUTION THESE LOADS MAY BE FURTHER LIMITED BY CUMULATIVE LOAD LIMITATIONS.

APPLICABLE CONFIGURATIONS
All

CARGO COMPARTMENT LOAD LIMITS (Continued)

MAXIMUM COMBINED LINEAR LOAD LIMITS

Total loading for the main deck and lower deck cargo must not exceed the combined linear loading limits shown in the following diagram:



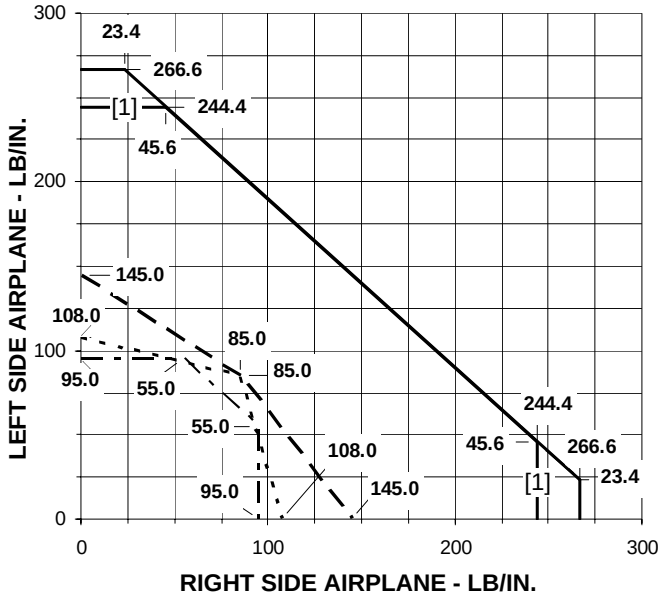
NOTE Cumulative loads are typically more restrictive than combined linear loads.

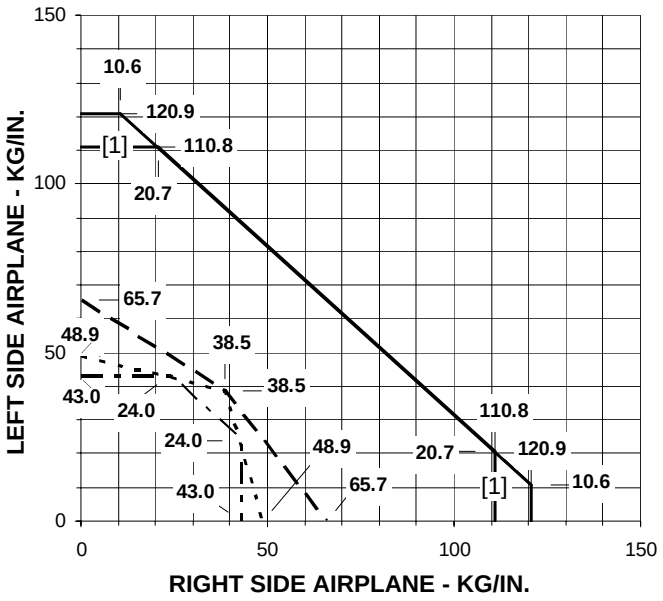
APPLICABLE CONFIGURATIONS
All

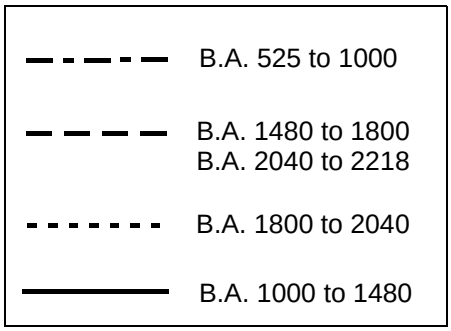
CARGO COMPARTMENT LOAD LIMITS (Continued)

MAIN DECK UNSYMMETRICAL PAYLOAD - LINEAR LOAD LIMITS

Unit load devices located side by side on the main deck must not exceed the unsymmetrical linear load limits shown below.







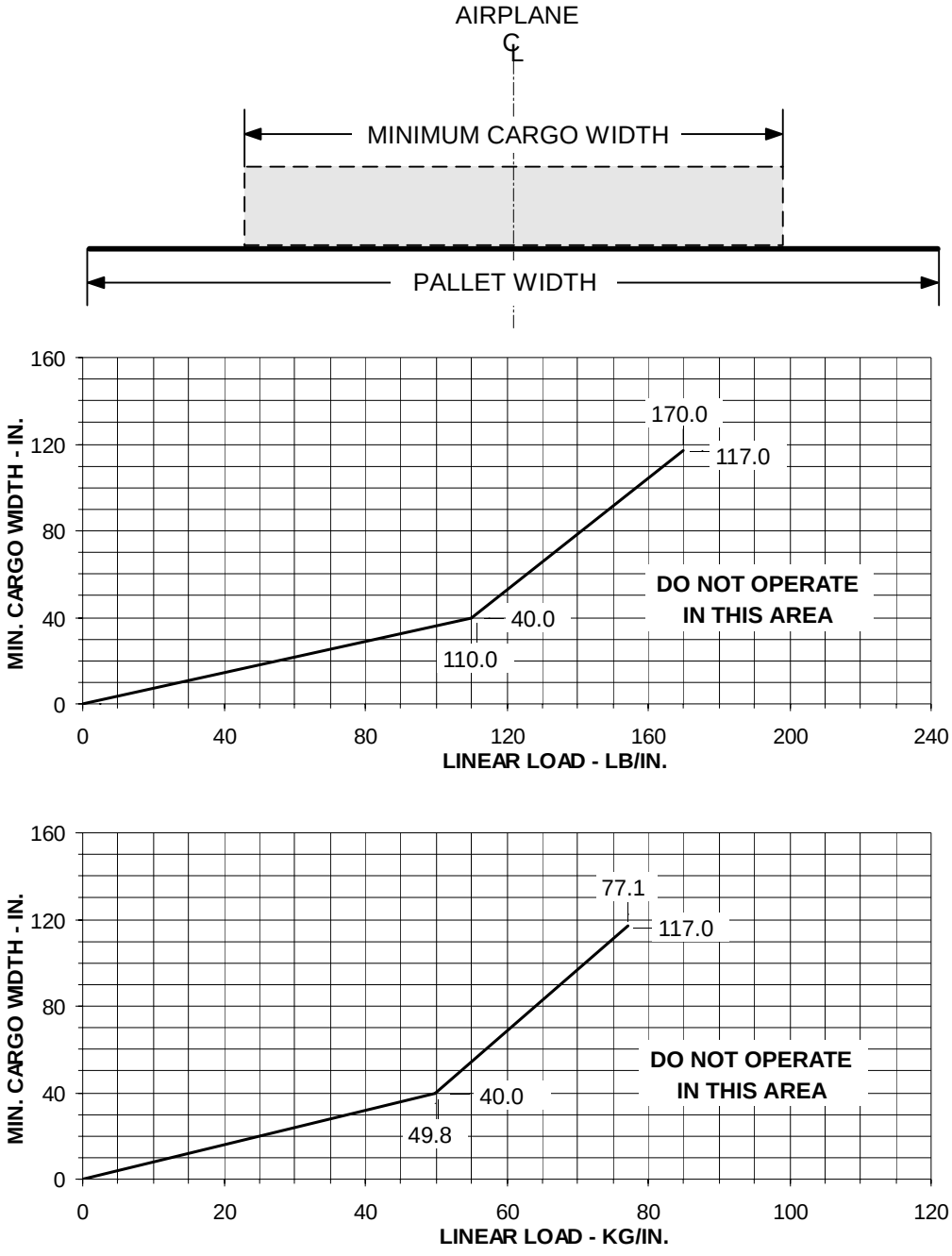
[1] Limit for 88 inch wide unit load devices to assure area load limit is not exceeded

APPLICABLE CONFIGURATIONS
All

CARGO COMPARTMENT LOAD LIMITS (Continued)

MAIN DECK CENTERLINE LOAD LIMITS

Cargo loaded on unit load devices located along the main deck centerline of the airplane between B.A. 525.0 to B.A. 1000.0 (Note that the floor loading rate in this region is 150 LB/IN (68KG/IN)) and B.A. 1480.0 to B.A. 2218.0 (Note that the floor loading rate in this region is 170 LB/IN (77.1KG/IN)) must meet the minimum cargo width requirements shown in the figure below. Between B.A. 1000.0 to B.A. 1480.0 the limitation is 290 LB/IN. (131.5 KG/IN.), provided the area load limit of 400 LB/SQ. FT. (181.4 KG/SQ. FT.) is not exceeded.

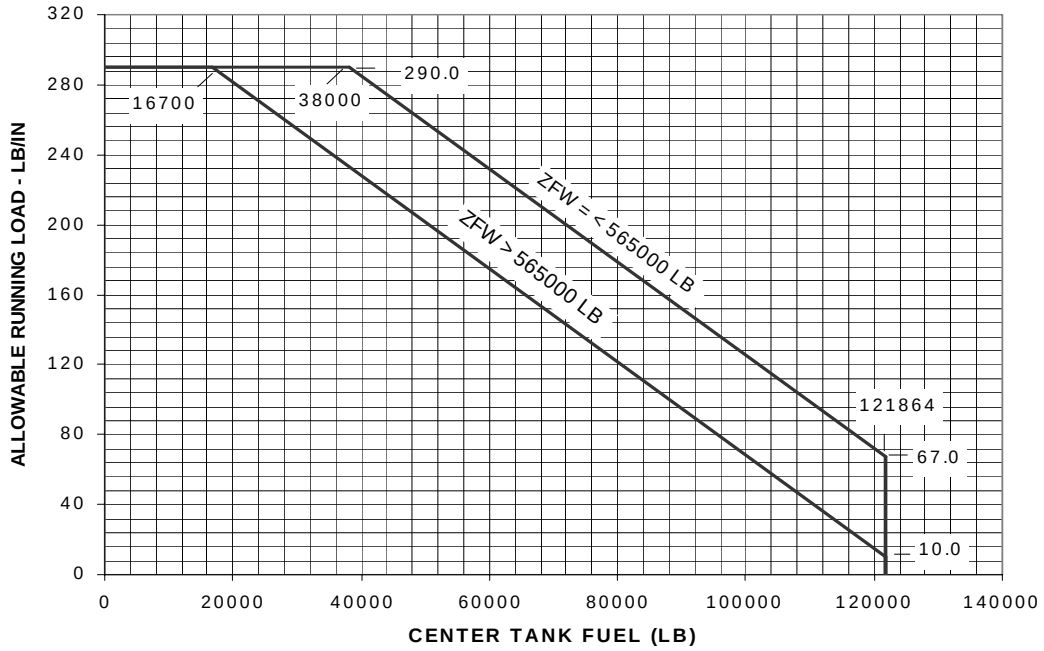


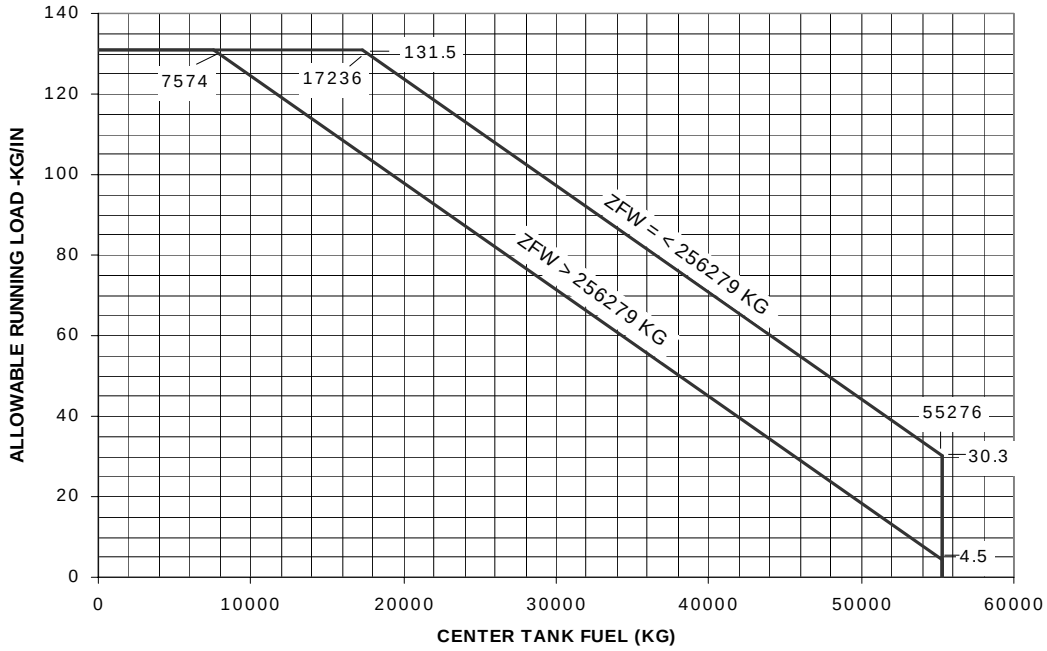
APPLICABLE CONFIGURATIONS
All

CARGO COMPARTMENT LOAD LIMITS (Continued)

ALLOWABLE MAIN DECK RUNNING LOAD VERSUS CENTER WING TANK FUEL

When the center wing tank contains more than 16700 LB (7574 KG), then the following reduction in allowable main deck running load from B.A. 1000 to 1265 is required.





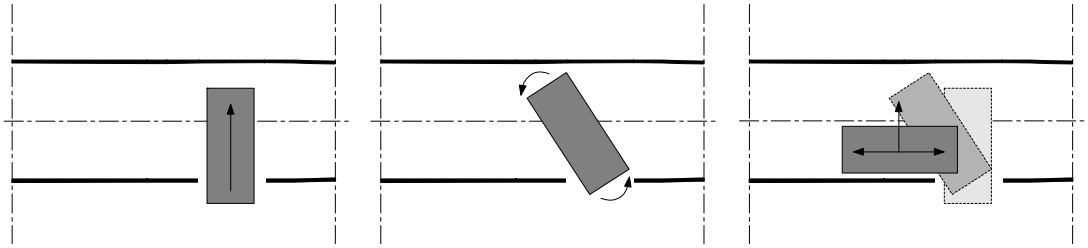
APPLICABLE CONFIGURATIONS
All

MAIN DECK UNIT LOAD DEVICE LOCATIONS

GENERAL

The following considerations should be observed when loading cargo on the main deck:

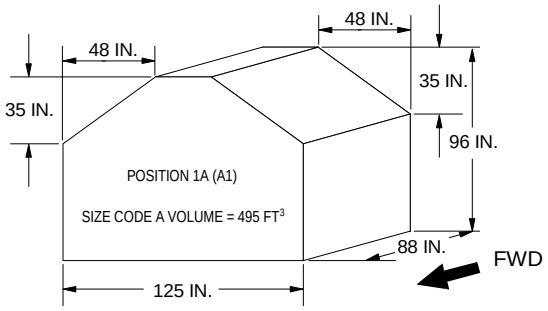
- Only Size Code A and M pallets can be loaded laterally forward of B.A. 525.
- Only Size Code A, B, and M pallets can be loaded longitudinally forward of B.A. 525.
- Only Size Code A, B, F, and M pallets can be loaded aft of B.A. 2218.
- Containers forward of B.A. 902 are limited to 96 inches in height to ensure at least a 2 inch clearance between the top of the ULD and the ceiling. This clearance is required to allow air flow around ULDs for decompression and smoke detection.
- Pallets forward of B.A. 902 are limited to 86 inches in height. A minimum of 10 inches of clearance must be maintained for netted pallets due to the upward deflection of the cargo in a negative “1G” load maneuver condition. The deflected pallet must not contact overhead structure to prevent damage to control cables and brackets.
- Aft of B.A. 902, ULDs are limited to 118 inches tall.
- The most forward position for tall rigid cargo that is 118 inches tall is B.A. 1220. The most forward position for tall rigid cargo that is 110 inches tall is B.A. 902. All cargo in excess of 110 inches tall between B.A. 902 and B.A. 1220 must be frangible cargo. See CHP-SEC 1-69-12X for limitations and sample problems for the loading of tall rigid cargo on the airplane. Tall rigid cargo is defined as cargo that is in excess of 96 inches tall and will not break apart during an emergency landing event (a 777 engine is an example of tall rigid cargo).
- ULDs longer than 240 inches (no larger than a Size Code G) cannot be loaded through the side cargo door because they cannot be rotated through the side cargo door.
- When positioned in the side cargo door area, ULDs are limited to 113 inches in height to allow for actuator movement.
- Size Codes G and R ULDs greater than 96 inches in height have profile restrictions to allow rotation through the side cargo door (see below).



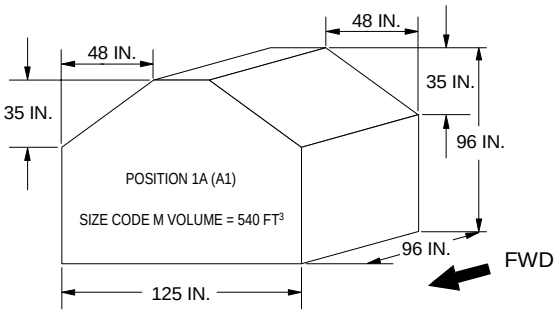
APPLICABLE CONFIGURATIONS
All

MAIN DECK UNIT LOAD DEVICE LOCATIONS (Continued)

- Position 1A (A1) require profiling as illustrated below.



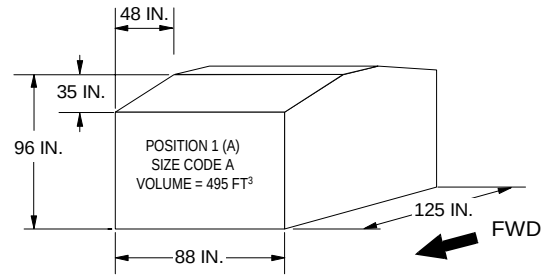
or



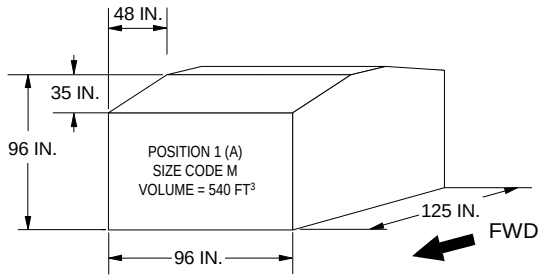
APPLICABLE CONFIGURATIONS
All

MAIN DECK UNIT LOAD DEVICE LOCATIONS (Continued)

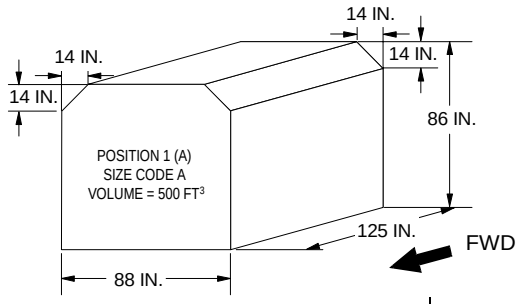
- Position 1 (A) require profiling as illustrated below.



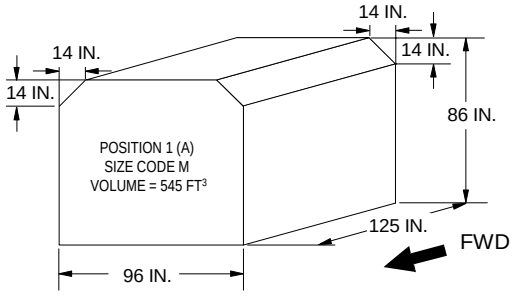
or



or



or

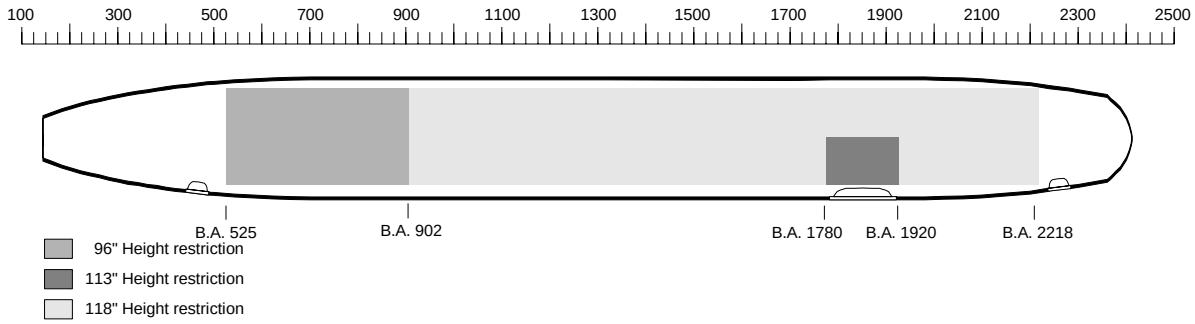


APPLICABLE CONFIGURATIONS
All

MAIN DECK UNIT LOAD DEVICE LOCATIONS (Continued)

MAIN DECK UNIT LOAD DEVICES

The illustration below shows the allowable region in the main deck compartment for main deck unit load devices. Location data for these or other ULD types is the responsibility of the STC holder of the cargo restraint system.



The following equation can be used to determine the center of gravity for each individual position.

$$\text{Position Center of Gravity} = \frac{\text{Forward Balance Arm} + \text{Aft Balance Arm}}{2}$$

APPLICABLE CONFIGURATIONS
All

MAIN DECK UNIT LOAD DEVICE LOAD LIMITS

CARGO RESTRAINT SYSTEM - SIZE CODES A, B & M

Data for the cargo restraint system (including load limit data) for these or other ULD types is the responsibility of the STC holder of the cargo restraint system.

APPLICABLE CONFIGURATIONS
All

CARGO TIEDOWNS - MAIN DECK

GENERAL INFORMATION

An approved unit load device will not require tiedowns unless one of the following conditions exist:

- The unit load device contains cargo of such shape and/or densities as to pose a hazard to the airplane structure or systems. If so, the entire weight of the ULD and its cargo must be tied down.
- The unit load device is limited either by restraint configurations or by missing / inoperative restraints. If so, the weight in excess of the ULD load limit data in CHP-SEC 1-66-xxx, must be tied down.
- The unit load device does not satisfy the center of gravity limitations in CHP-SEC 1-63-xxx. If so, the entire weight of the ULD and its cargo must be tied down.

A non-approved unit load device will always require tiedown.

Bulk cargo will always require tiedown.

Good judgment must be used in selecting the location and number of tiedowns to give sufficient safety margin for uneven strap and net stretch, strap and cargo slippage, and for varying allowables of rings used in combination. To prevent overloading of hardware, ring loops should be correctly oriented as closely as possible to the strap direction.

CAUTIONS

- DO NOT MIX DIFFERENT STIFFNESSES OF TIEDOWN STRAPS (FOR EXAMPLE, KEVLAR AND NYLON WEBS) WHEN RESTRAINING CARGO. MIXING STRAP STIFFNESSES MAY CAUSE PREMATURE FAILURE OF THE STIFFER STRAP. THE USE OF CHAINS FOR TIEDOWNS IS NOT RECOMMENDED.
- TIEDOWN ON THE MAIN DECK IS LIMITED TO THE TIEDOWN LOCATIONS IDENTIFIED IN CHP-SEC 1-68-95X. TIEDOWN TO ANY OTHER POINT IS NOT ALLOWED.

APPLICABLE CONFIGURATIONS
All

CARGO TIEDOWNS - MAIN DECK (Continued)

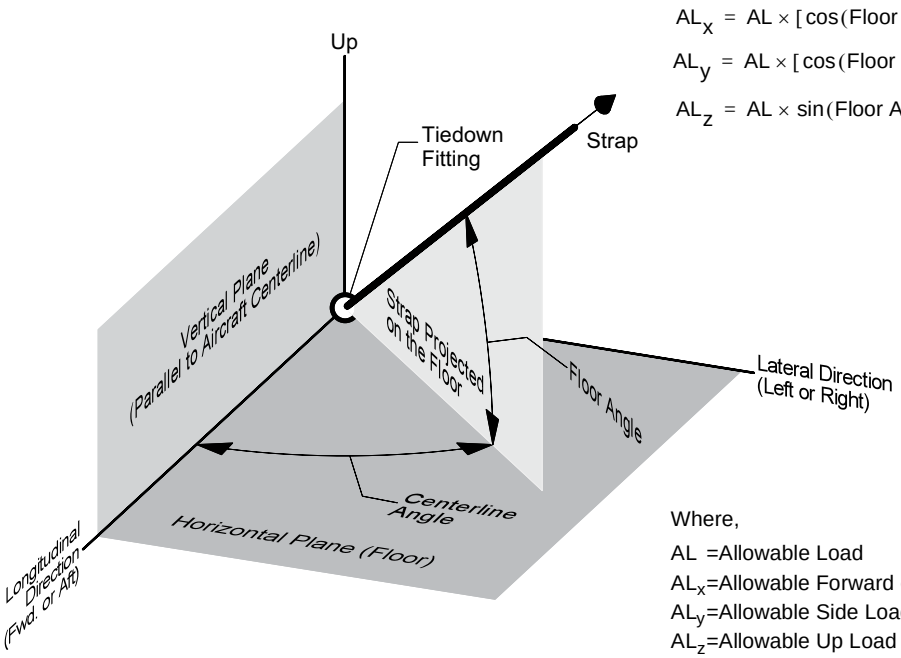
TIEDOWN ALLOWABLES

The following sections describe the basic tiedown requirements and provide the tiedown fitting allowables.

Tiedown Load Components

The allowables given in the tables on the following pages take into account the ring, hardware, local structure load carrying capability, floor and centerline strap angles and the load factors that can be experienced in the airplane.

The following diagram defines the floor and centerline angles used in the equations and tables.



$AL_x = AL \times [\cos(\text{Floor Angle}) \times \cos(\text{Centerline Angle})$

$AL_y = AL \times [\cos(\text{Floor Angle}) \times \sin(\text{Centerline Angle})]$

$AL_z = AL \times \sin(\text{Floor Angle})$

Where,

AL =Allowable Load

AL_x=Allowable Forward or Aft Load Component

AL_y=Allowable Side Load Component (either direction)

AL_z=Allowable Up Load Component

Tiedown Strap and Fitting Requirements

Each strap must have a minimum rating of 5000 LB (2268 KG).

Each single stud fitting must be a Brownline fitting P/N 10730 or P/N 11251 or equivalent or stronger.

Each double stud fitting must be a Brownline fitting P/N 21035-54 or equivalent or stronger. Fitting limited to single strap hook-up only.

APPLICABLE CONFIGURATIONS
All

CARGO TIEDOWNS - MAIN DECK (Continued)

Load Factors

The following table provides the load factors used in the creation of the tables of tiedown capability in this section.

LOCATION	BALANCE ARMs	LOAD FACTOR			
		FWD	AFT	SIDE	UP
Main Deck	BA 228 to BA 464	1.50	0.75	1.25	1.50
	BA 464 to BA 1480	1.50	0.75	0.75	1.50
	BA 1480 to BA 1520	1.50	0.75	0.77	1.50
	BA 1520 to BA 1920	1.50	0.75	1.16	1.86
	BA 1920 to BA 1980	1.50	0.75	1.22	1.91
	BA 1980 to BA 2160	1.50	0.75	1.39	2.08
	BA 2160 to BA 2218	1.50	0.75	1.45	2.13
	BA 2218 to BA 2365	1.50	0.75	1.77	2.27

Tiedown Fitting Allowables

The following tables describe the basic tiedown requirements and provide the tiedown fitting allowables for Boeing fittings installed at delivery. Data for other fittings is the responsibility of the STC holder.

DESCRIPTION	LOCATION[a]	MINIMUM SPACING BETWEEN TIEDOWNS IN.	TABLE PAGE NUMBER
Crew Baggage	Seat Tracks (LBL 34) B.A. 472 - 520 Seat Track (LBL 62.6) B.A. 445	N/A	4
Seat Tracks - Single Stud Fitting	B.A. 240 - 520 B.A. 520 - 1480 B.A. 1480 - 2300	20	5 7 9
Seat Tracks - Double Stud Fitting	B.A. 240 - 520 B.A. 520 - 1480 B.A. 1480 - 2300	20	6 8 10

[a] See CHP-SEC 1-68-95x for exact locations.

APPLICABLE CONFIGURATIONS
All

CARGO TIEDOWNS - MAIN DECK (Continued)

Crew Baggage - Seat Tracks at LBL 34 between B.A. 472 and 520, and the end of the Seat Track at LBL 62.6 and B.A. 445

The following table summarizes tiedown fitting allowable loads for crew baggage, including seat tracks at LBL 34 between B.A. 472 and 520, and the end of the seat track at LBL 62.6 and B.A. 445[1]. Data for other fittings is the responsibility of the STC holder.

RESTRAINT DIRECTION	FLOOR ANGLE (DEGREES)	CENTERLINE ANGLE (DEGREES)							
		0°		30°		60°		90°	
		ALLOWABLE LOAD							
		LB	KG	LB	KG	LB	KG	LB	KG
Forward	0° (Horizontal)	60	27	60	27	60	27	0	0
	30°	60	27	60	27	50	22	0	0
	60°	60	27	60	27	50	22	0	0
	90° (Vertical)	0	0	0	0	0	0	0	0
Side	0° (Horizontal)	0	0	0	0	0	0	0	0
	30°	70	31	70	31	60	27	0	0
	60°	210	95	200	90	180	81	0	0
	90° (Vertical)	1330	603	1150	521	660	299	0	0
Up	0° (Horizontal)	0	0	0	0	0	0	0	0
	30°	37	17	43	20	68	31	357	163
	60°	108	49	120	55	187	85	517	235
	90° (Vertical)	667	303	667	303	667	303	667	303
Aft	0° (Horizontal)	130	58	120	54	120	54	0	0
	30°	130	58	120	54	110	49	0	0
	60°	120	54	120	54	100	45	0	0
	90° (Vertical)	0	0	0	0	0	0	0	0

[1] See CHP-SEC 1-68-90x for exact locations.

APPLICABLE CONFIGURATIONS
All

CARGO TIEDOWNS - MAIN DECK (Continued)

Seat Tracks - B.A. 240-520 - Single Stud Fitting

The following table summarizes tiedown fitting allowable loads for seat tracks with single stud fittings between B.A. 240 and B.A. 520. Minimum spacing between tiedowns is 20 IN. Only seat tracks located in CHP-SEC 1-68-90x are available for tiedown using the data on this page.

RESTRAINT DIRECTION	FLOOR ANGLE (DEGREES)	CENTERLINE ANGLE (DEGREES)							
		0°		30°		60°		90°	
		ALLOWABLE LOAD							
		LB	KG	LB	KG	LB	KG	LB	KG
Forward	0° (Horizontal)	1300	589	1000	453	500	226	0	0
	30°	1100	498	700	317	400	181	0	0
	60°	600	272	400	181	200	90	0	0
	90° (Vertical)	0	0	0	0	0	0	0	0
Side	0° (Horizontal)	0	0	1100	498	1900	861	2400	1088
	30°	0	0	900	408	1500	680	1800	816
	60°	0	0	500	226	900	408	1200	544
	90° (Vertical)	0	0	0	0	0	0	0	0
Up	0° (Horizontal)	0	0	0	0	0	0	0	0
	30°	400	181	300	136	300	136	300	136
	60°	800	362	600	272	600	272	700	317
	90° (Vertical)	1300	589	1300	589	1300	589	1300	589
Aft	0° (Horizontal)	2600	1179	2000	907	1100	498	0	0
	30°	2300	1043	1500	680	800	362	0	0
	60°	1300	589	900	408	500	226	0	0
	90° (Vertical)	0	0	0	0	0	0	0	0

APPLICABLE CONFIGURATIONS
All

CARGO TIEDOWNS - MAIN DECK (Continued)

Seat Tracks - B.A. 240-520 - Double Stud Fitting

The following table summarizes tiedown fitting allowable loads for seat tracks with double stud fittings between B.A. 240 and B.A. 520. Minimum spacing between tiedowns is 20 IN. Only seat tracks located in CHP-SEC 1-68-95x are available for tiedown using the data on this page.

RESTRAINT DIRECTION	FLOOR ANGLE (DEGREES)	CENTERLINE ANGLE (DEGREES)							
		0°		30°		60°		90°	
		ALLOWABLE LOAD							
		LB	KG	LB	KG	LB	KG	LB	KG
Forward	0° (Horizontal)	1300	589	1000	453	500	226	0	0
	30°	1100	498	700	317	400	181	0	0
	60°	700	317	500	226	300	136	0	0
	90° (Vertical)	0	0	0	0	0	0	0	0
Side	0° (Horizontal)	0	0	1100	498	1900	861	2400	1088
	30°	0	0	900	408	1500	680	1800	816
	60°	0	0	600	272	1000	453	1300	589
	90° (Vertical)	0	0	0	0	0	0	0	0
Up	0° (Horizontal)	0	0	0	0	0	0	0	0
	30°	400	181	300	136	300	136	300	136
	60°	900	408	700	317	700	317	800	362
	90° (Vertical)	1700	771	1700	771	1700	771	1700	771
Aft	0° (Horizontal)	2600	1179	2000	907	1100	498	0	0
	30°	2300	1043	1500	680	800	362	0	0
	60°	1400	635	1000	453	600	272	0	0
	90° (Vertical)	0	0	0	0	0	0	0	0

APPLICABLE CONFIGURATIONS
All

CARGO TIEDOWNS - MAIN DECK (Continued)

Seat Tracks - B.A. 520-1480 - Single Stud Fitting

The following table summarizes tiedown fitting allowable loads for seat tracks with single stud fitthings between B.A. 520 and B.A. 1480. Minimum spacing between tiedowns is 20 IN. Only seat tracks located in CHP-SEC 1-68-95x are available for tiedown using the data on this page.

RESTRAINT DIRECTION	FLOOR ANGLE (DEGREES)	CENTERLINE ANGLE (DEGREES)							
		0°		30°		60°		90°	
		ALLOWABLE LOAD							
		LB	KG	LB	KG	LB	KG	LB	KG
Forward	0° (Horizontal)	1300	589	1000	453	500	226	0	0
	30°	1300	589	800	362	400	181	0	0
	60°	1100	498	500	226	300	136	0	0
	90° (Vertical)	0	0	0	0	0	0	0	0
Side	0° (Horizontal)	0	0	1200	544	1900	861	2600	1179
	30°	0	0	1000	453	1600	725	2300	1043
	60°	0	0	500	226	800	362	1100	498
	90° (Vertical)	0	0	0	0	0	0	0	0
Up	0° (Horizontal)	0	0	0	0	0	0	0	0
	30°	400	181	400	181	300	136	400	181
	60°	900	408	600	272	600	272	700	317
	90° (Vertical)	1100	498	700	317	700	317	800	362
Aft	0° (Horizontal)	2600	1179	2100	952	1100	498	0	0
	30°	2300	1043	1800	816	900	408	0	0
	60°	1500	680	900	408	500	226	0	0
	90° (Vertical)	0	0	0	0	0	0	0	0

APPLICABLE CONFIGURATIONS
All

CARGO TIEDOWNS - MAIN DECK (Continued)

Seat Tracks - B.A. 520-1480 - Double Stud Fitting

The following table summarizes tiedown fitting allowable loads for seat tracks with double stud fittings between B.A. 520 and B.A. 1480. Minimum spacing between tiedowns is 20 IN. Only seat tracks located in CHP-SEC 1-68-95x are available for tiedown using the data on this page.

RESTRAINT DIRECTION	FLOOR ANGLE (DEGREES)	CENTERLINE ANGLE (DEGREES)							
		0°		30°		60°		90°	
		ALLOWABLE LOAD							
		LB	KG	LB	KG	LB	KG	LB	KG
Forward	0° (Horizontal)	1300	589	1000	453	500	226	0	0
	30°	1300	589	800	362	400	181	0	0
	60°	1300	589	500	226	300	136	0	0
	90° (Vertical)	0	0	0	0	0	0	0	0
Side	0° (Horizontal)	0	0	1200	544	1900	861	2600	1179
	30°	0	0	1000	453	1600	725	2300	1043
	60°	0	0	500	226	800	362	1100	498
	90° (Vertical)	0	0	0	0	0	0	0	0
Up	0° (Horizontal)	0	0	0	0	0	0	0	0
	30°	400	181	400	181	300	136	400	181
	60°	900	408	600	272	600	272	700	317
	90° (Vertical)	1100	498	700	317	700	317	800	362
Aft	0° (Horizontal)	2600	1179	2100	952	1100	498	0	0
	30°	2300	1043	1800	816	900	408	0	0
	60°	1500	680	900	408	500	226	0	0
	90° (Vertical)	0	0	0	0	0	0	0	0

APPLICABLE CONFIGURATIONS
All

CARGO TIEDOWNS - MAIN DECK (Continued)

Seat Tracks - B.A. 1480-2300 - Single Stud Fitting

The following table summarizes tiedown fitting allowable loads for seat tracks with single stud fittings between B.A. 1480 and B.A. 2300. Minimum spacing between tiedowns is 20 IN. Only seat tracks located in CHP-SEC 1-68-95x are available for tiedown using the data on this page.

RESTRAINT DIRECTION	FLOOR ANGLE (DEGREES)	CENTERLINE ANGLE (DEGREES)							
		0°		30°		60°		90°	
		ALLOWABLE LOAD							
		LB	KG	LB	KG	LB	KG	LB	KG
Forward	0° (Horizontal)	1200	544	700	317	400	181	0	0
	30°	1300	589	600	272	300	136	0	0
	60°	600	272	400	181	200	90	0	0
	90° (Vertical)	0	0	0	0	0	0	0	0
Side	0° (Horizontal)	0	0	400	181	700	317	1000	453
	30°	0	0	300	136	600	272	800	362
	60°	0	0	200	90	400	181	500	226
	90° (Vertical)	0	0	0	0	0	0	0	0
Up	0° (Horizontal)	0	0	0	0	0	0	0	0
	30°	500	226	200	90	200	90	300	136
	60°	800	362	500	226	500	226	600	272
	90° (Vertical)	800	362	800	362	800	362	800	362
Aft	0° (Horizontal)	2400	1088	1400	635	800	362	0	0
	30°	2600	1179	1200	544	700	317	0	0
	60°	1300	589	800	362	400	181	0	0
	90° (Vertical)	0	0	0	0	0	0	0	0

APPLICABLE CONFIGURATIONS
All

CARGO TIEDOWNS - MAIN DECK (Continued)

Seat Tracks - B.A. 1480-2300 - Double Stud Fitting

The following table summarizes tiedown fitting allowable loads for seat tracks with double stud fittings between B.A. 1480 and B.A. 2300. Minimum spacing between tiedowns is 20 IN. Only seat tracks located in CHP-SEC 1-68-95x are available for tiedown using the data on this page.

RESTRAINT DIRECTION	FLOOR ANGLE (DEGREES)	CENTERLINE ANGLE (DEGREES)							
		0°		30°		60°		90°	
		ALLOWABLE LOAD							
		LB	KG	LB	KG	LB	KG	LB	KG
Forward	0° (Horizontal)	1200	544	700	317	400	181	0	0
	30°	1300	589	600	272	300	136	0	0
	60°	900	408	400	181	200	90	0	0
	90° (Vertical)	0	0	0	0	0	0	0	0
Side	0° (Horizontal)	0	0	400	181	700	317	1000	453
	30°	0	0	300	136	600	272	800	362
	60°	0	0	200	90	400	181	500	226
	90° (Vertical)	0	0	0	0	0	0	0	0
Up	0° (Horizontal)	0	0	0	0	0	0	0	0
	30°	500	226	200	90	200	90	300	136
	60°	1100	498	500	226	500	226	600	272
	90° (Vertical)	1300	589	1300	589	1300	589	1300	589
Aft	0° (Horizontal)	2400	1088	1400	635	800	362	0	0
	30°	2600	1179	1200	544	700	317	0	0
	60°	1800	816	800	362	400	181	0	0
	90° (Vertical)	0	0	0	0	0	0	0	0

APPLICABLE CONFIGURATIONS
All

CARGO TIEDOWNS - MAIN DECK (Continued)

TIEDOWN CALCULATION

The following sections provide the methodology for determining the number of tiedown straps required for each of the basic restraint directions.

Calculation Procedure

The number of tiedowns required must be determined for each of the five basic restraint directions (forward, aft, side-left, side-right, and up). The operator is responsible to ensure that the strap tension rating and the strap attachment rating are each equal to or greater than the load limits of the airplane tiedown fittings used with the strap. Minimum allowable strap tension and strap attachment ratings of 5000 LB (2268 KG) are required.

The following steps outline the procedure for determining the number of tiedown straps required for a single restraint direction:

1.Determine the weight of the cargo to be restrained.

2. Create a table similar to the following worksheet:

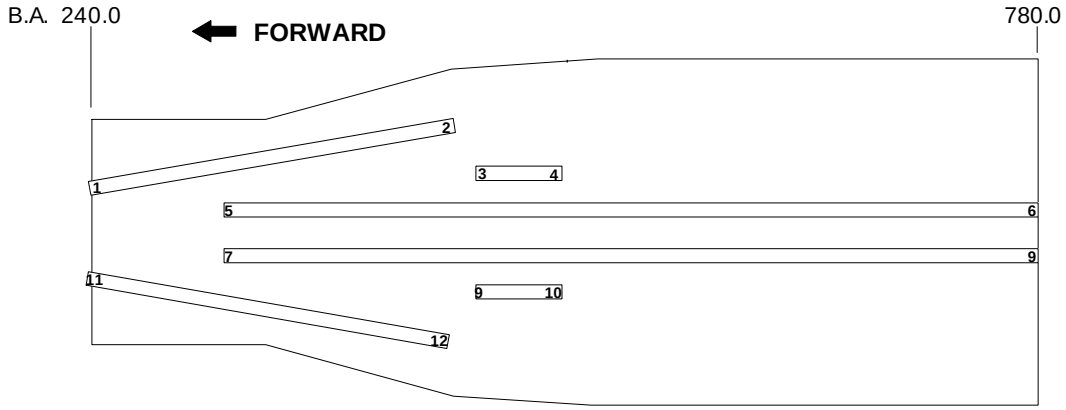
DIRECTION	TIEDOWN LOCATION	FLOOR ANGLE (DEGREES)	CENTERLINE ANGLE (DEGREES)	NUMBER OF TIEDOWN FITTINGS	TIEDOWN ALLOWABLE LB
Forward					
Aft					
Side-Left					
Side-Right					
Up					

3. Select the tiedown location to be used from the available tiedown locations on Page 3. The B.A., B.B.L., and W.L. of these tiedown locations are listed in CHP-SEC 1-68-90x. Only straps that contact the face of the cargo to be restrained are considered to restrain cargo in that direction (for example: a strap must contact the forward face to be considered effective in restraining the cargo in the forward direction. A strap over the top of the cargo does restrain in the up direction but yields no restraint in the forward, aft, or side directions).
4. Establish the floor and centerline angles (to the nearest 30 degree increment for each tiedown selected).
5. Use the tables on Pages 4 through 10 to determine the tiedown allowable.
6. Multiply the tiedown allowable by the number of tiedown fittings to get the total tiedown allowable.
7. If the total tiedown allowable is equal to or exceeds the weight of cargo to be restrained, then the tiedown scheme is acceptable in that direction. If the total tiedown down allowable is less than the weight of cargo to be restrained, then additional straps are required in that direction.

TIEDOWN FITTING LOCATIONS - MAIN DECK

FITTING LOCATIONS

The following illustration shows the layout of tiedown fittings on the main deck between B.A. 240.0 and B.A. 780.0. At delivery, no tiedown hardware was installed. Data for these locations is the responsibility of the STC holder.



The following tables provide the locations for each tiedown fitting on the main deck deck between B.A. 240.0 and B.A. 780.0.

	NO.	NODE[a]	B.A. IN.	B.B.L. IN.
Seat Tracks	1	First	240.0	+27.3
	2	Last	445.0	+62.6
	3	First	472.0	+34.0
	4	Last	520.0	+34.0
	5	First	320.0	+11.3
	6	Last	780.0	+11.3
	7	First	320.0	-11.3
	8	Last	780.0	-11.3
	9	First	472.0	-34.0
	10	Last	520.0	-34.0
	11	First	240.0	-27.3
	12	Last	445.0	-62.6

[a] Nodes are 1 IN. apart

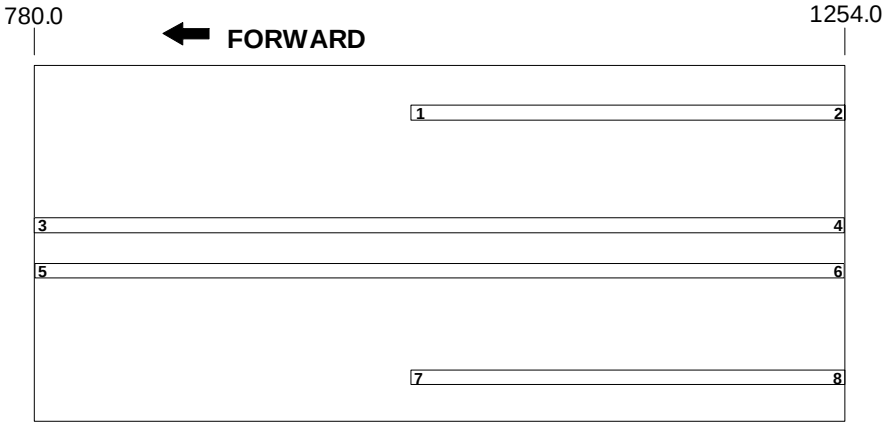
NOTE Crew Baggage tiedown locations are defined as follows:

- Seat tracks at BBL -34 between B.A. 472 and 520
- Seat track at BBL -62.6 and B.A. 445

APPLICABLE CONFIGURATIONS
All

TIEDOWN FITTING LOCATIONS - MAIN DECK (Continued)

The following illustration shows the layout of pivoting shackles and tiedown fittings on the main deck between B.A. 780.0 and B.A. 1254.0.



The following tables provide the locations for each tiedown fitting on the main deck deck between B.A. 780.0 and B.A. 1254.0.

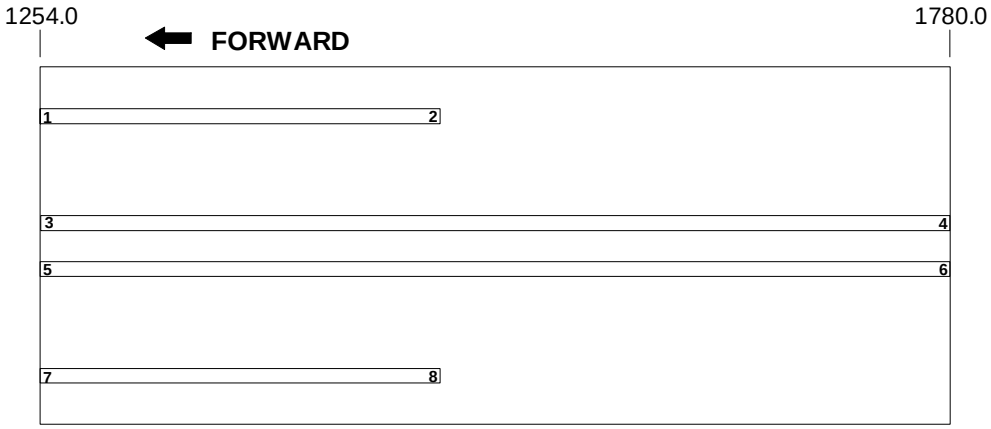
	NO.	NODE[a]	B.A. IN.	B.B.L. IN.	W.L. IN.
Seat Tracks	1	First	1000.0	+75.9	200.0
	2	Last	1254.0	+75.9	200.0
	3	First	780.0	+11.3	200.0
	4	Last	1254.0	+11.3	200.0
	5	First	780.0	-11.3	200.0
	6	Last	1254.0	-11.3	200.0
	7	First	1000.0	-75.9	200.0
	8	Last	1254.0	-75.9	200.0

[a] Nodes are 1 IN. apart

APPLICABLE CONFIGURATIONS
All

TIEDOWN FITTING LOCATIONS - MAIN DECK (Continued)

The following illustration shows the layout of pivoting shackles and tiedown fittings on the main deck between B.A. 1254.0 and B.A. 1780.0.



The following tables provide the locations for each tiedown fitting on the main deck deck between B.A. 1254.0 and B.A. 1780.0.

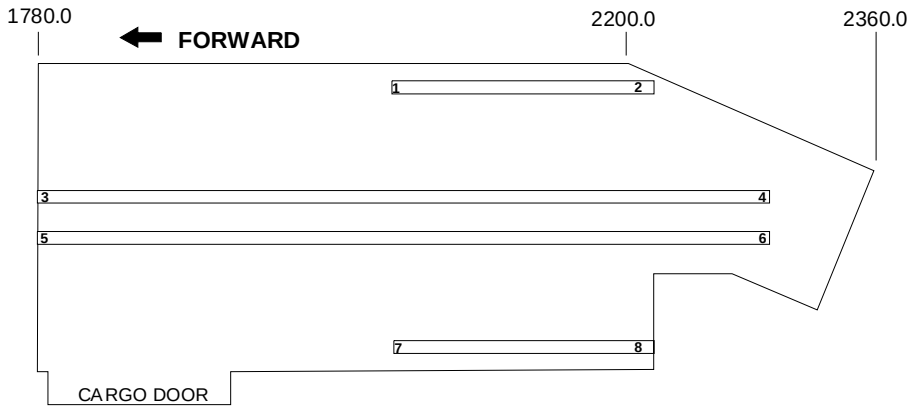
	NO.	NODE[a]	B.A. IN.	B.B.L. IN.	W.L. IN.
Seat Tracks	1	First	1254.0	+75.9	200.0
	2	Last	1480.0	+75.9	200.0
	3	First	1254.0	+11.3	200.0
	4	Last	1780.0	+11.3	200.0
	5	First	1254.0	-11.3	200.0
	6	Last	1780.0	-11.3	200.0
	7	First	1254.0	-75.9	200.0
	8	Last	1480.0	-75.9	200.0

[a] Nodes are 1 IN. apart

APPLICABLE CONFIGURATIONS
All

TIEDOWN FITTING LOCATIONS - MAIN DECK (Continued)

The following illustration shows the layout of pivoting shackles and tiedown fittings on the main deck between B.A. 1780.0 and B.A. 2360.0.



The following tables provide the locations for each tiedown fitting on the main deck deck between B.A. 1780.0 and B.A. 2360.0.

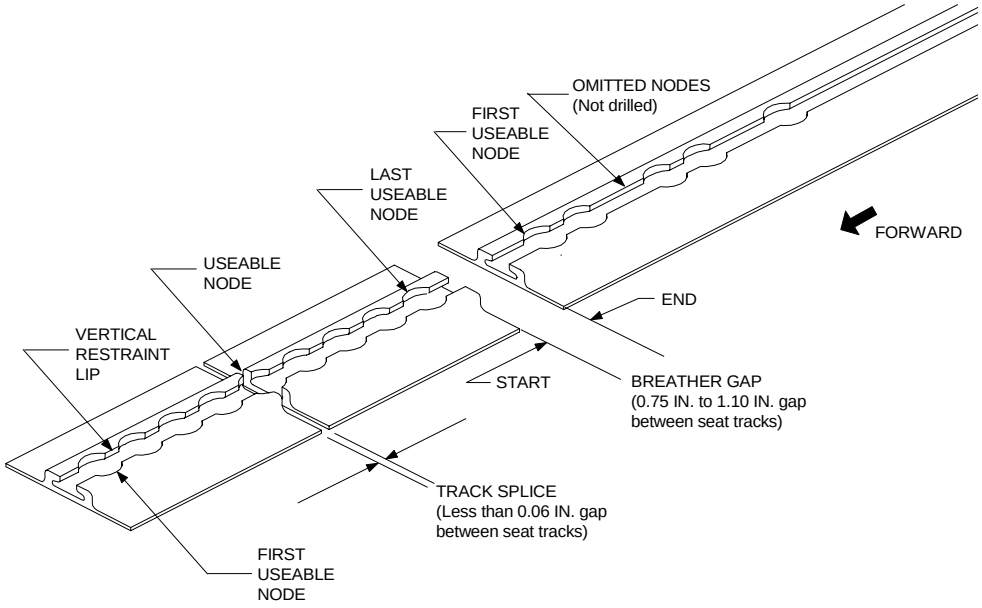
	NO.	NODE[a]	B.A. IN.	B.B.L. IN.	W.L. IN.
Seat Tracks	1	First	2040.0	+89.7	200.0
	2	Last	2220.0	+89.7	200.0
	3	First	1780.0	+11.3	200.0
	4	Last	2300.0	+11.3	200.0
	5	First	1780.0	-11.3	200.0
	6	Last	2300.0	-11.3	200.0
	7	First	2040.0	-89.7	200.0
	8	Last	2220.0	-89.7	200.0

[a] Nodes are 1 IN. apart

APPLICABLE CONFIGURATIONS
All

TIEDOWN FITTING LOCATIONS - MAIN DECK (Continued)

The following illustration shows a typical section of seat track located on the main deck.



NOTES
- Some locations may be unavailable due to cargo handling hardware, breather gaps between seat tracks, and ommited nodes.
- Do not use vertical restraint lips immediately adjacent to the breather gaps.

TALL RIGID CARGO

INTRODUCTION

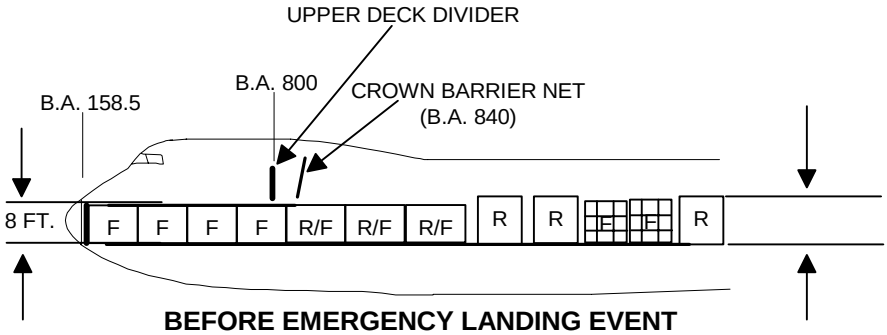
Tall rigid cargo is defined as cargo that is in excess of 96 inches tall and will not break apart during an emergency landing event (a 777 engine is an example of tall rigid cargo).

In an emergency landing event, tall rigid cargo must be stopped before it impacts the upper deck divider at B.A. 800. This will protect all of the upper deck occupants on the airplane.

To ensure this, a sufficient volume of cargo must be loaded forward of the tall rigid cargo. In an emergency landing event, this cargo will redistribute and fill up the main deck cargo volume between the B.A. 158.5 barrier and the tall rigid cargo. This volume of cargo will stop the tall rigid cargo impacting the upper deck divider at B.A. 800.

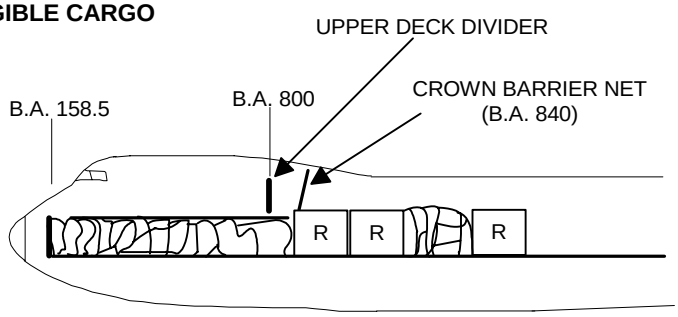
The most forward position for tall rigid cargo that is 118 inches tall is B.A. 1220. The most forward position for tall rigid cargo that is 110 inches tall is B.A. 902. All cargo in excess of 110 inches tall between B.A. 902 and B.A. 1220 must be frangible cargo. These height restrictions will ensure at least a 16 inch clearance between tha tall rigio cargo and the airplane structure overhead.

Note that all other cargo loading restrictions (compartment load limts, linear load limits, area load limits, combined load limits, and cumulative load limits) must be checked and the airplane must be within the airplane longitudinal C.G. limits (refer to CHP-SEC 1-02-xxx) and airplane lateral C.G. limits (refer to CHP-SEC 1-04-xxx).



BEFORE EMERGENCY LANDING EVENT

F = FRANGIBLE CARGO
R = RIGID CARGO
R/F = RIGID OR FRANGIBLE CARGO



AFTER EMERGENCY LANDING EVENT

APPLICABLE CONFIGURATIONS
All

TALL RIGID CARGO (Continued)

LOAD PLAN CALCULATION

To establish an acceptable load plan, the following steps must be taken:

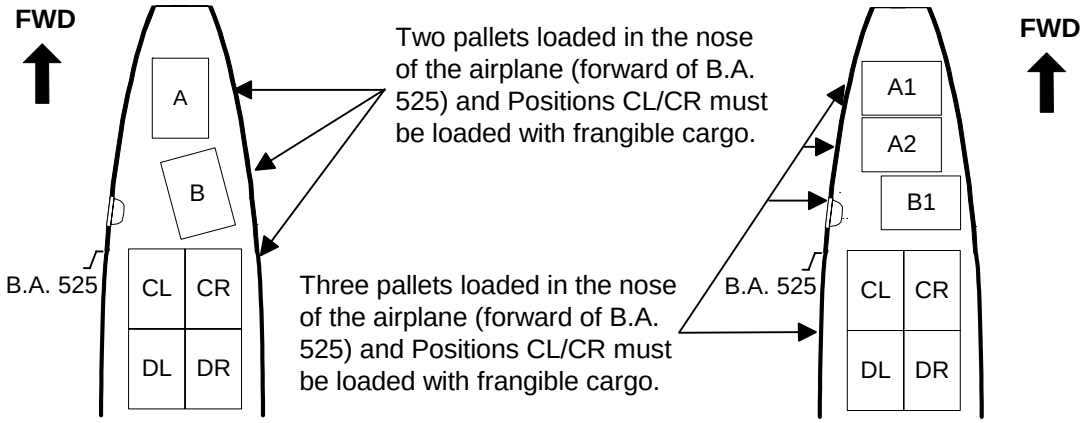
Step 1 - Define the Cargo Distribution

A. Determine the forward most balance arm (B.A.) location of the tall rigid cargo. Any cargo forward of this location will fill up the forward main deck in the event of an emergency landing event. Any cargo aft of this location will compress the cargo in the forward body.

B. ULDs are limited to 96 inches tall forward of B.A. 902. Aft of B.A. 902 they are limited to 118 inches tall. The most forward position for tall rigid cargo that is 118 inches tall is B.A. 1220. The most forward position for tall rigid cargo that is 110 inches tall is B.A. 902. All cargo in excess of 110 inches tall between B.A. 902 and B.A. 1220 must be frangible cargo.

C. When tall rigid cargo is loaded on the airplane centerline, all positions forward of the tall rigid cargo must be loaded with ULDs that are 96 inches wide (88 inches wide cargo is not allowed).

D. Frangible cargo must be loaded in the nose positions (Positions A & B or Positions A1 & A2 & B1) and in Positions CL/CR as shown below. Frangible cargo is cargo that will easily break apart on impact (a stack of boxes is an example of frangible cargo).



APPLICABLE CONFIGURATIONS
All

TALL RIGID CARGO (Continued)

Step 2 - Calculate the Volume of Cargo Forward of the Tall Rigid Cargo

A. Determine the gross volume of the ULDs forward of the tall rigid cargo (forward of the B.A. determined in Step 1A). Only that portion of the volume below 96 inches tall can be included in this determination (the portion of the volume above 96 inches tall will impact the crown barrier net and should not be considered). Use the volumes from the following table:

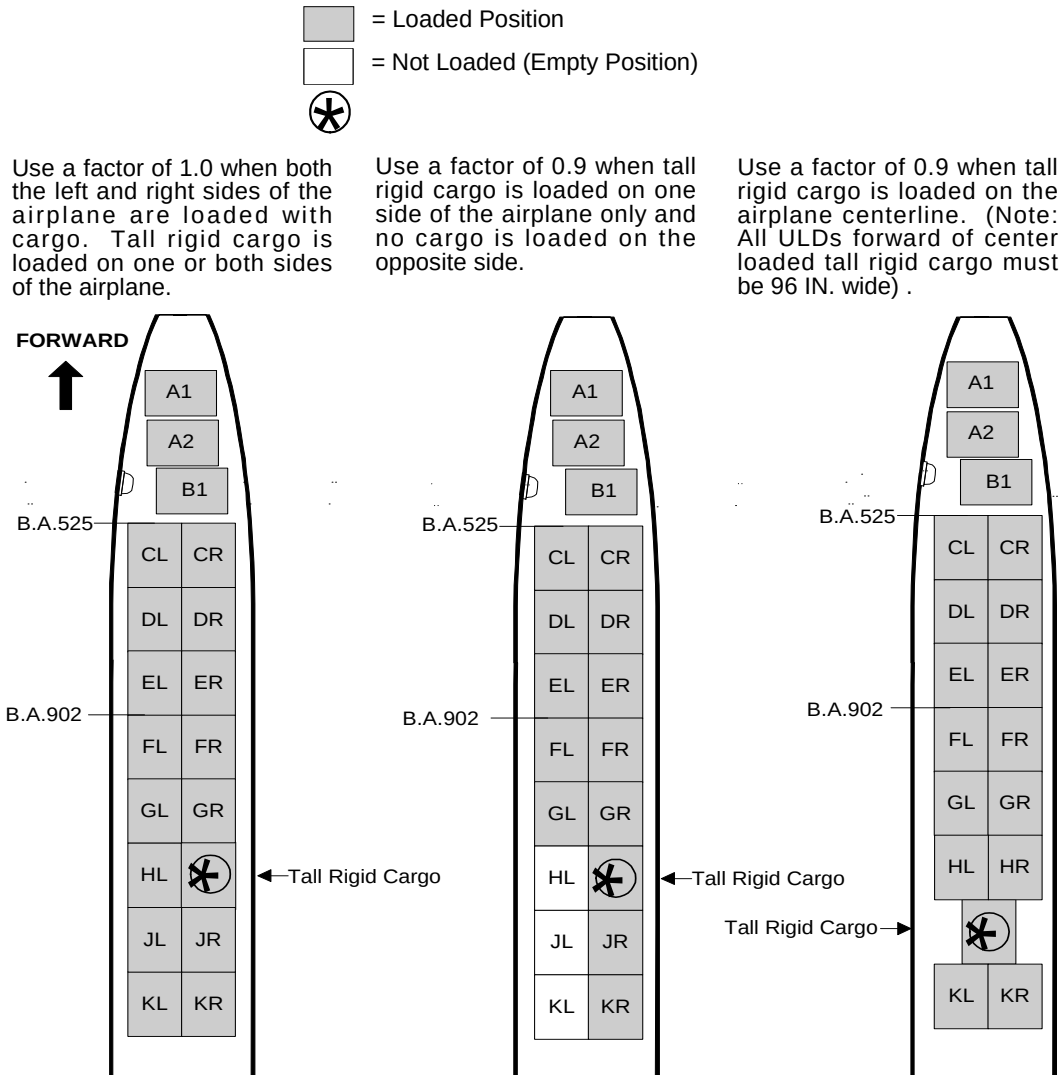
SIZE CODE	BASE DIMENSION IN.	VOLUME CU. FT.
A	88 X 125	572
		495 in Position A1 or Position A
B	88 X 108	482
F	96 X 117.8	572
G	96 X 238.5	1190
H	96 X 359.3	1801
J	96 X 480	2414
M	96 X 125	613
		540 in Position A1 or Position A
R	96 X 196	974

NOTE Only that portion of the volume below 96 inches tall can be included in this determiniation (the portion above 96 inches tall will impact the crown barrier net and should not be considered).

B. Determine the average percent full of the ULDs forward of the tall rigid cargo (forward of the B.A. determined in Step 1A). This percent full is based upon volume, not weight.

TALL RIGID CARGO (Continued)

C. Establish the configuration factor as 1.0 or 0.9 as follows:



D. Determine the effective volume of the ULDs forward of the tall rigid cargo (forward of the B.A. determined in Step 1A) by the following equation:

$$\text{Effective Volume} = [(\text{Gross Volume}) \times (\text{Percent Full} / 100)] \times (\text{Configuration Factor})$$

From Step 2A — From Step 2B — From Step 2C

APPLICABLE CONFIGURATIONS
All

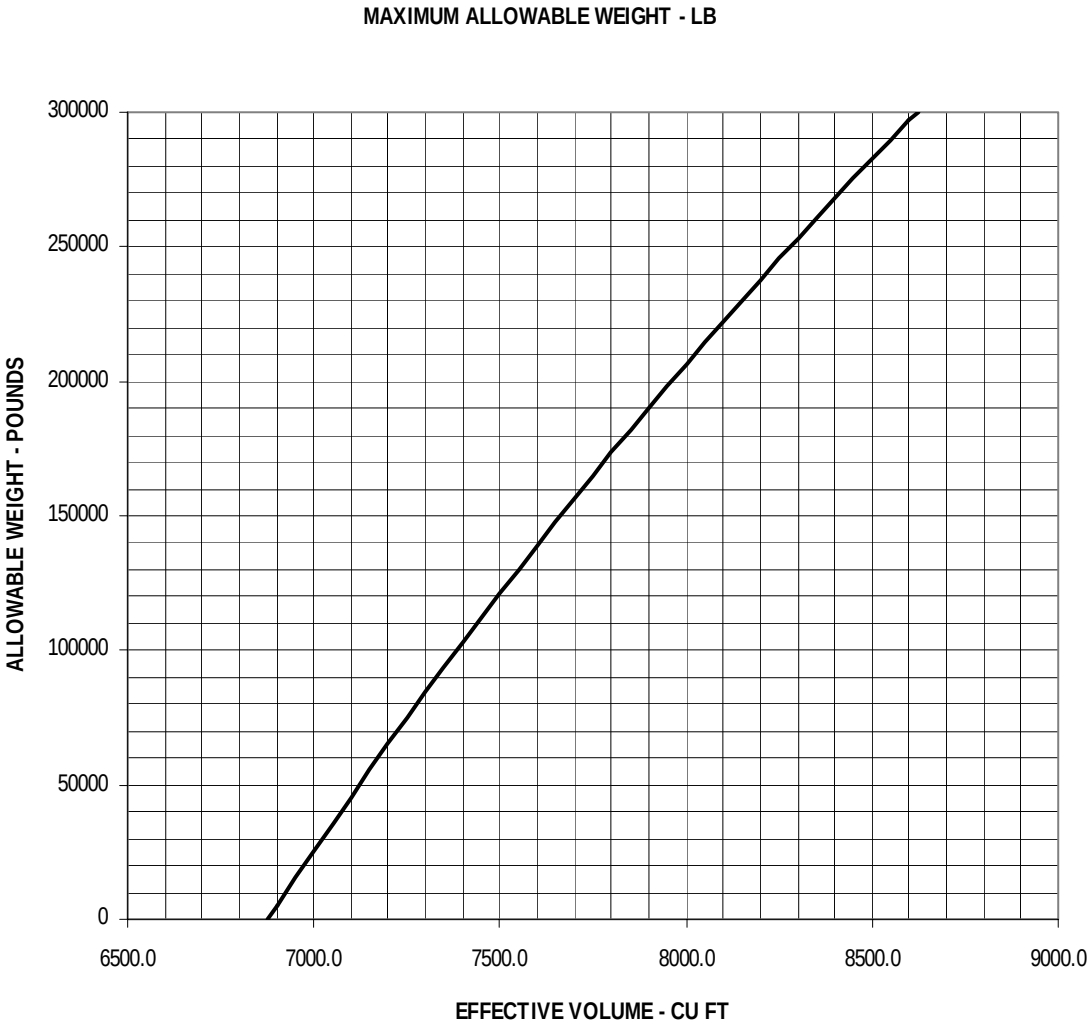
TALL RIGID CARGO (Continued)

Step 3 - Determine the Maximum Allowable Weight of Cargo that can be Stopped by the Effective Volume of Cargo Determined in Step 2

A. Use the graph below and on the following page to determine the maximum allowable weight of cargo that can be stopped by the volume of cargo determined in Step 1.

B. Locate the point on the curve intersecting the effective volume from Step 2D.

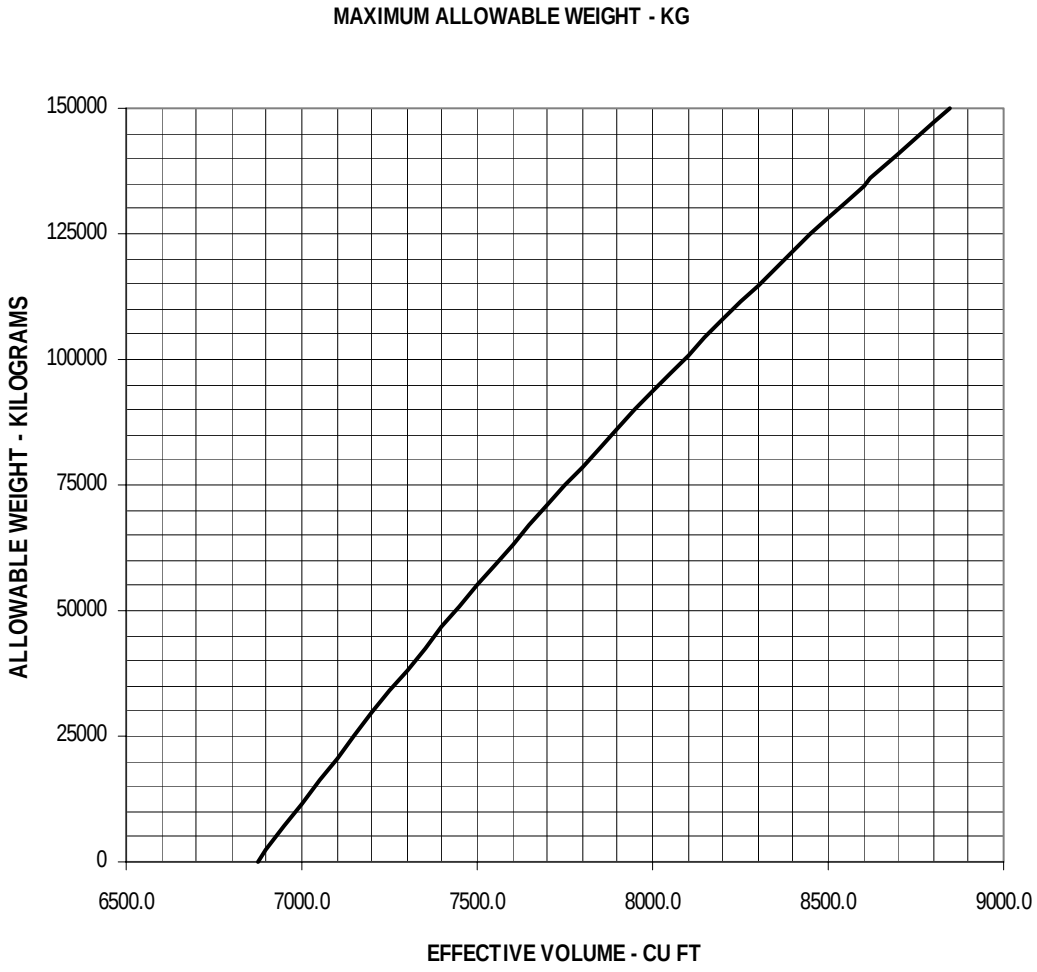
C. Determine the maximum allowable weight of cargo that can be stopped by the volume of cargo determined in Step 2.



$$\text{Allowable Weight} = \frac{(\text{Effective Volume} - 6876.0)}{[(5.98786 \times 10^{-7}) \times \text{Effective Volume} + (6.57375 \times 10^{-4})]}$$

APPLICABLE CONFIGURATIONS
All

TALL RIGID CARGO (Continued)



$$\text{Allowable Weight} = \frac{(\text{Effective Volume} - 6876.0) \times 0.45359237}{[(5.98786 \times 10^{-7}) \times \text{Effective Volume} + (6.57375 \times 10^{-4})]}$$

APPLICABLE CONFIGURATIONS
All

TALL RIGID CARGO (Continued)

Step 4 - Adjust the Main Deck Cargo Loading as Required

A. Determine total weight of loaded cargo aft of the forward most location of the tall rigid cargo (from Step 1A). This includes the weight of the tall rigid cargo.

B. Compare this weight to the maximum allowable weight determined in Step 3C.

C. If the loaded cargo (Step 4A) is **less** than the maximum allowable weight (Step 4B), then an acceptable loading scheme for the tall rigid cargo has been established.

D. If the loaded cargo (Step 4A) is **greater** than the maximum allowable weight (Step 4B), then an acceptable loading scheme for the tall rigid cargo has **not** been established. Adjust the main deck cargo loading as required. Possible changes to the main deck loading are:

- Move the tall rigid cargo
- Load the tall rigid cargo adjacent to other cargo and do not centerline load the tall rigid cargo.
- Ensure the cargo forward of the tall rigid cargo is volumetrically full.
- Load less cargo aft of the tall rigid cargo.

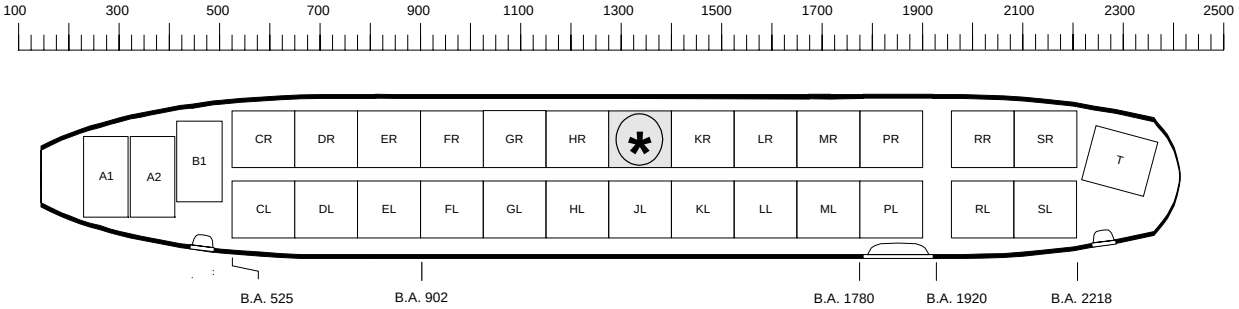
TALL RIGID CARGO (Continued)

SAMPLE PROBLEM NO. 1

Is the following load plan acceptable for loading 118 inch tall rigid cargo loaded in Position JR?

All positions are loaded with Size Code M pallets (96 inches X 125 inches).

Positions A1, A2, B1, CL, and CR are loaded with frangible cargo. The proposed loading is as follows:



The following table lists necessary data for determining an acceptable plan for carrying tall rigid cargo.

	DETAILS FOR CARGO LOADED ON LEFT SIDE				DETAILS FOR CARGO LOADED ON RIGHT SIDE			
IATA POSITIONS	WEIGHT (LB)	WEIGHT (KG)	LOADED VOLUME (% FULL)	HEIGHT OF CARGO	WEIGHT (LB)	WEIGHT (KG)	LOADED VOLUME (% FULL)	HEIGHT OF CARGO
A1	3000	1361	80	96	-	-		
A2	3200	1451	80	96	-	-		
B1	-	-			2800	1270	80	96
CL/CR	6400	2903	80	96	8000	3629	80	96
DL/DR	7400	3357	80	96	6400	2903	80	96
EL/ER	8000	3629	80	96	8200	3719	80	96
FL/FR	7000	3175	80	96	7800	3538	80	96
GL/GR	6800	3084	80	96	8000	3629	80	96
HL/HR	9600	4354	80	96	9400	4264	80	96
JL/JR	8400	3810	NA	NA	10000	4536	100	118
KL/KR	6400	2903	NA	NA	6000	2722	NA	NA
LL/LR	7000	3175	NA	NA	6800	3084	NA	NA
ML/MR	6200	2812	NA	NA	5600	2540	NA	NA
PL/PR	4000	1814	NA	NA	4400	1996	NA	NA
RL/RR	2500	1134	NA	NA	2700	1225	NA	NA
SL/SR	2900	1315	NA	NA	2800	1270	NA	NA
T	-	-			2000	907	NA	NA

Position JR is loaded with Tall Rigid Cargo

APPLICABLE CONFIGURATIONS
All

TALL RIGID CARGO (Continued)

Step 1 - Define the Cargo Distribution

A. For this sample problem, B.A. 1280 is the leading edge of the 118 inch tall rigid cargo loaded in Position JR.

B. For this sample problem, only Position JR is loaded with rigid cargo that exceeds 96 inches per the table on Page 8. The forward edge of Position JR is aft of B.A. 1280. B.A. 1220 is the forward most B.A. for tall rigid cargo that is 118 inches tall. This is an acceptable loading.

C. For this sample problem, the tall rigid cargo is not loaded on the airplane centerline and cargo is loaded on the left and right hand sides of the airplane. Therefore a factor of 1.0 is used.

D. For this sample problem, the required frangible cargo is loaded in Positions A1, A2, B1 and CL/CR.

Step 2 - Calculate the Volume of Cargo Forward of the Tall Rigid Cargo

A. For this sample problem, the total volume is per the table below (volume forward of B.A. 1280). Positions forward of B.A. 1280 are Positions A1, A2, B1, CL/CR, DL/DR, EL/ER, FL/FR, GL/GR, and HL/HR.

B. For this sample problem, all ULDs forward of B.A. 1280 are 80 percent full per the table on Page 8.

C. For this sample problem, a factor of 1.0 for tall rigid cargo will be used per Step 1C.

D. Determine the effective volume of the ULDs forward of the tall rigid cargo (forward of the B.A. determined in Step 1A) by the following table:

VOLUME OF CARGO FORWARD OF TALL RIGID CARGO						
IATA POSITIONS	DETAILS FOR CARGO LOADED ON LEFT SIDE			DETAILS FOR CARGO LOADED ON RIGHT SIDE		
	MAXIMUM VOLUME CU FT	PERCENT FULL %	LOADED VOLUME CU FT	MAXIMUM VOLUME CU FT	PERCENT FULL %	LOADED VOLUME CU FT
A1	540	80	432.0			
A2	613	80	490.4			
B1				613	80	490.4
CL/CR	613	80	490.4	613	80	490.4
DL/DR	613	80	490.4	613	80	490.4
EL/ER	613	80	490.4	613	80	490.4
FL/FR	613	80	490.4	613	80	490.4
GL/GR	613	80	490.4	613	80	490.4
HL/HR	613	80	490.4	613	80	490.4
JL/JR and Aft[a]	0	NA	0.0	0	NA	0.0
Total Loaded Volume per side			3864.8			3432.8

[a] Volume aft of B.A. 1280 (Positions JL/JR and aft) should not be included in this calculation.

Total Volume on Left Side		3864.8 CU FT
Total Volume on Right Side	+	3432.8 CU FT
Total Volume		7297.6 CU FT
Tall Rigid Cargo Factor	x	1.0
Effective Volume		7297.6 CU FT

APPLICABLE CONFIGURATIONS
All

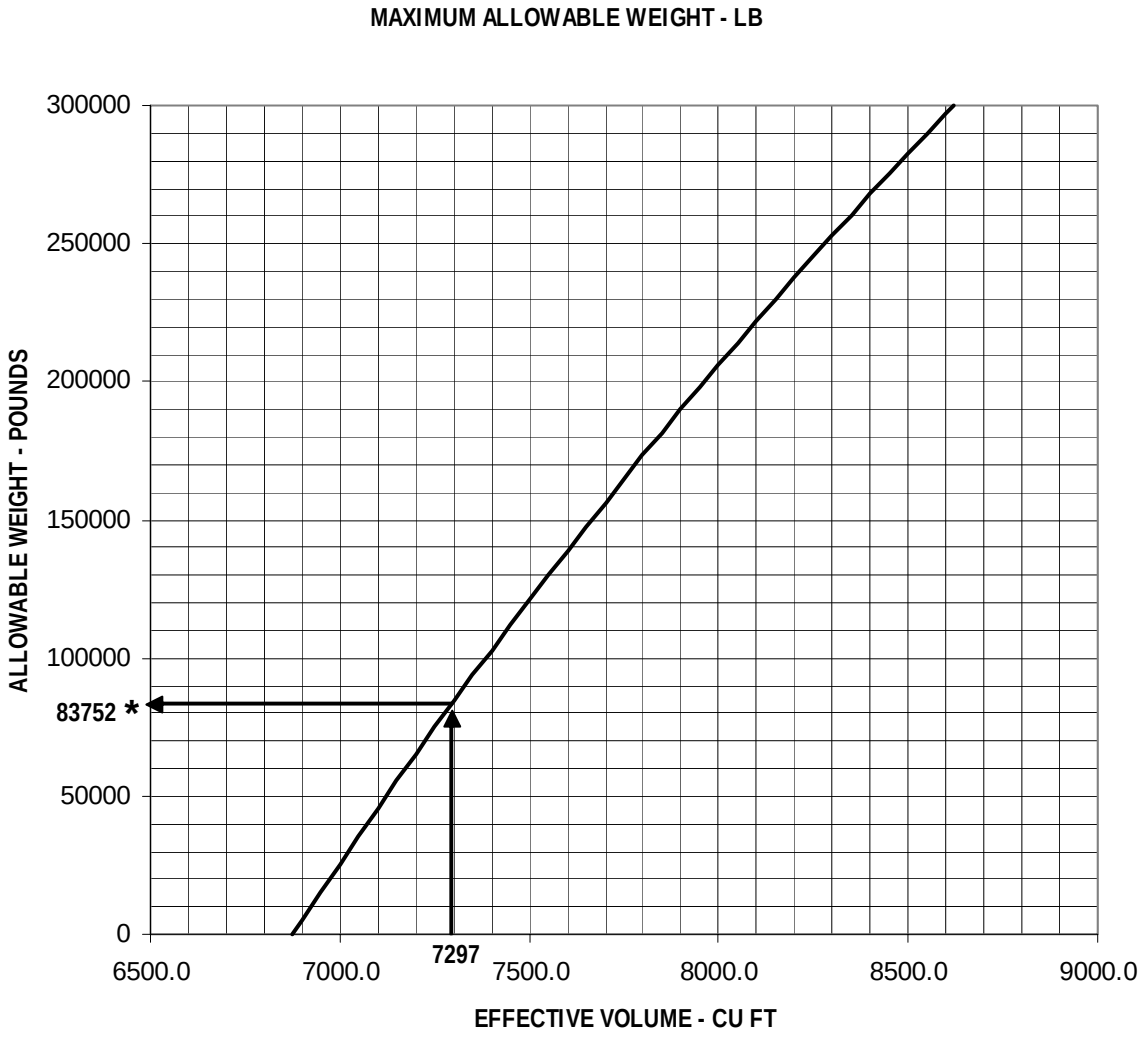
TALL RIGID CARGO (Continued)

Step 3 - Determine the Effective Maximum Allowable Weight of Cargo that can be Stopped by the Volume of Cargo Determined in Step 2

A. Use the graphs on Pages 5 and 6 to determine the maximum allowable weight of cargo that can be stopped by the volume of cargo determined in Step 1.

B. For this sample problem, use 7297 CU FT as calculated in Step 2D.

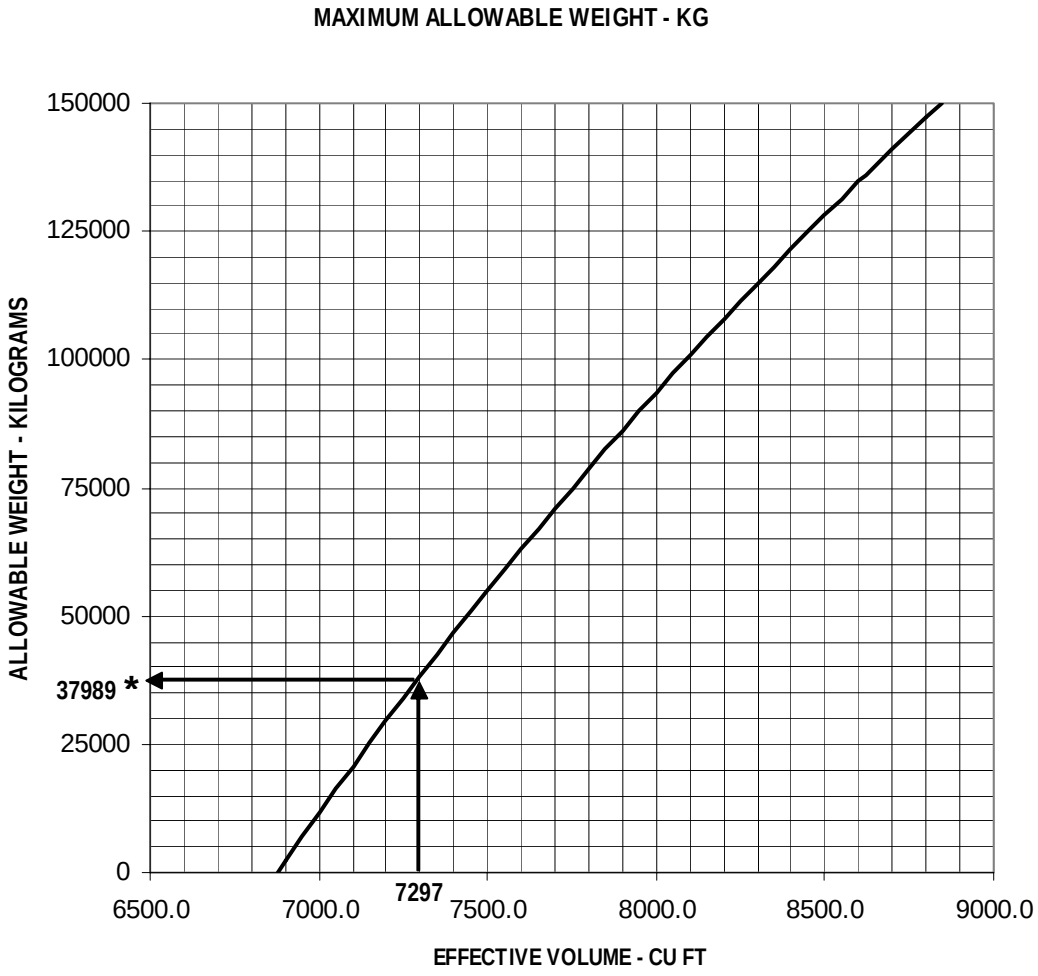
C. For this sample problem, a maximum allowable weight of cargo that can be stopped by a volume of 7297 CU FT is 83752 LB (37989 KG) as shown in the graph below and on the following page:



* Calculated using the equation on Page 5. Graphically shown here.

APPLICABLE CONFIGURATIONS
All

TALL RIGID CARGO (Continued)



* Calculated using the equation on Page 6. Graphically shown here.

Step 4 - Adjust the Main Deck Cargo Loading as Required

A. For this sample problem, the proposed loading has 77700 LB (35244 KG) as the weight aft of B.A. 1280. Positions aft of B.A.1280 are Positions JL/JR, KL/KR, LL/LR, ML/MR, PL/PR, RL/RR, SL/SR, and T.

B. For this sample problem, a maximum allowable weight of cargo that can be stopped by a volume of 7297 CU FT is 83752 LB (37989 KG).

C. For this sample problem, the loaded cargo 77700 LB (35244 KG) is **less** than the maximum allowable weight 83752 LB (37989 KG). This is an acceptable load plan.

The sample problem is OK for the carriage of tall rigid cargo.

APPLICABLE CONFIGURATIONS
All

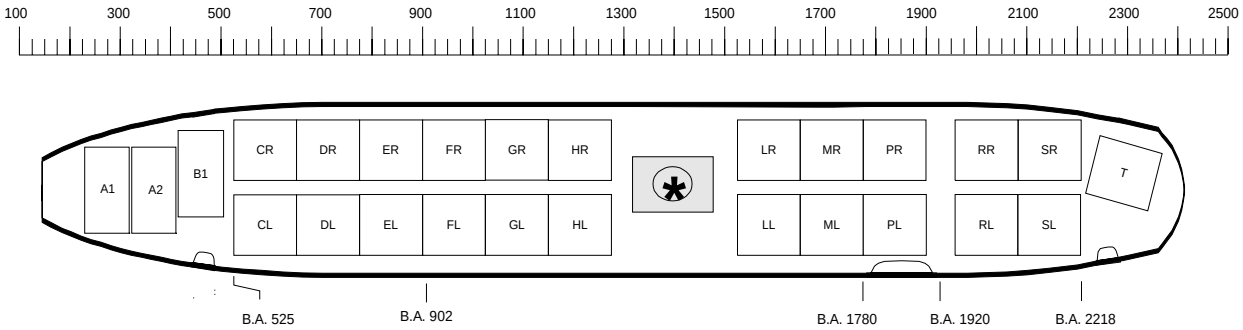
TALL RIGID CARGO (Continued)

SAMPLE PROBLEM NO. 2

Is the following load plan acceptable for loading 118 inch tall rigid cargo loaded in Positions J/K (loaded on the centerline on a Size Code R Pallet)?

All other positions are loaded with Size Code M pallets (96 inches X 125 inches).

Positions A1, A2, B1, CL, and CR are loaded with frangible cargo. The proposed loading is as follows:



The following table lists necessary data for determining an acceptable plan for carrying tall rigid cargo.

	DETAILS FOR CARGO LOADED ON LEFT SIDE				DETAILS FOR CARGO LOADED ON RIGHT SIDE			
IATA POSITIONS	WEIGHT (LB)	WEIGHT (KG)	LOADED VOLUME (% FULL)	HEIGHT OF CARGO	WEIGHT (LB)	WEIGHT (KG)	LOADED VOLUME (% FULL)	HEIGHT OF CARGO
A1	3000	1361	79	96	-	-		
A2	3200	1451	75	96	-	-		
B1	-	-			2800	1270	95	96
CL/CR	6400	2903	85	96	8000	3629	90	96
DL/DR	7400	3357	85	96	6400	2903	55	96
EL/ER	8000	3629	95	96	8200	3719	75	96
FL/FR	7000	3175	90	118	7800	3538	100	118
GL/GR	6800	3084	95	96	8000	3629	75	96
HL/HR	6400	2903	85	96	6000	2722	90	96
J/K					16000	7257	100	118
LL/LR	7000	3175	NA	NA	6800	3084	NA	NA
ML/MR	6200	2812	NA	NA	5600	2540	NA	NA
PL/PR	4000	1814	NA	NA	4400	1996	NA	NA
RL/RR	2500	1134	NA	NA	2700	1225	NA	NA
SL/SR	2900	1315	NA	NA	2800	1270	NA	NA
T	-	-			2000	907	NA	NA

Positions J/K are loaded with Tall Rigid Cargo

APPLICABLE CONFIGURATIONS
All

TALL RIGID CARGO (Continued)

Step 1 - Define the Cargo Distribution

A. For this sample problem, B.A. 1280 is the leading edge of the 118 inch tall rigid cargo loaded in Positions J/K

B. For this sample problem, Positions J/K are loaded with tall rigid cargo that exceeds 96 inches per the table on Page 12. This is aft of B.A. 1280. B.A. 1220 is the forward most B.A. for tall rigid cargo that is 118 inches tall. Position FL/FR is also loaded with cargo that exceeds 96 inches in height and is loaded forward of B.A. 1280, but is loaded with frangible cargo.

C. For this sample problem, the tall rigid cargo is loaded on the airplane centerline. Therefore, a factor of 0.9 is used.

D. For this sample problem, the required frangible cargo is loaded in Positions A1, A2, B1 and CL/CR.

Step 2 - Calculate the Volume of Cargo Forward of the Tall Rigid Cargo

A. For this sample problem, the total volume is per the table below (volume forward of B.A. 1280). Positions forward of B.A. 1280 are Positions A1, A2, B1, CL/CR, DL/DR, EL/DR, FL/FR, GL/GR and HL/HR.

B. For this sample problem, all ULDs forward of B.A. 1280 are between 55 and 100 percent full per the table on Page 12.

C. For this sample problem, a factor of 0.9 for tall rigid cargo will be used per Step 1C, because the tall rigid cargo is loaded on the airplane centerline.

D. Determine the effective volume of the ULDs forward of the tall rigid cargo (forward of the B.A. determined in Step 1A) by the following table:

VOLUME OF CARGO FORWARD OF TALL RIGID CARGO						
IATA POSITIONS	DETAILS FOR CARGO LOADED ON LEFT SIDE			DETAILS FOR CARGO LOADED ON RIGHT SIDE		
	MAXIMUM VOLUME CU FT	PERCENT FULL %	LOADED VOLUME CU FT	MAXIMUM VOLUME CU FT	PERCENT FULL %	LOADED VOLUME CU FT
A1	540	79	426.6			
A2	613	75	459.8			
B1				613	95	582.4
CL/CR	613	85	521.1	613	90	551.7
DL/DR	613	85	521.1	613	55	337.2
EL/ER	613	95	582.4	613	75	459.8
FL/FR	613	90	551.7	613	100[a]	613.0
GL/GR	613	95	582.4	613	75	459.8
HL/HR	613	85	521.1	613	90	551.7
J/K and Aft[b]	0	NA	0.0	0	NA	0.0
Total Loaded Volume per side			4165.9			3555.4

[a] Position FR is loaded with frangible cargo that is 118 inches tall. Per Step 2A, only that portion of the volume below 96 inches tall can be included in this volume calculation. Therefore, Position FR has a volume of 613 CU FT because it is 100% full up to a height of 96 inches.

[b] Volume aft of B.A. 1280 (Positions J/K and aft) should not be included in this calculation.

APPLICABLE CONFIGURATIONS
All

TALL RIGID CARGO (Continued)

Total Volume on Left Side		4165.9 CU FT
Total Volume on Right Side	+	3555.4 CU FT
Total Volume		7721.3 CU FT
Tall Rigid Cargo Factor	x	0.9
Effective Volume		6949.1 CU FT

APPLICABLE CONFIGURATIONS
All

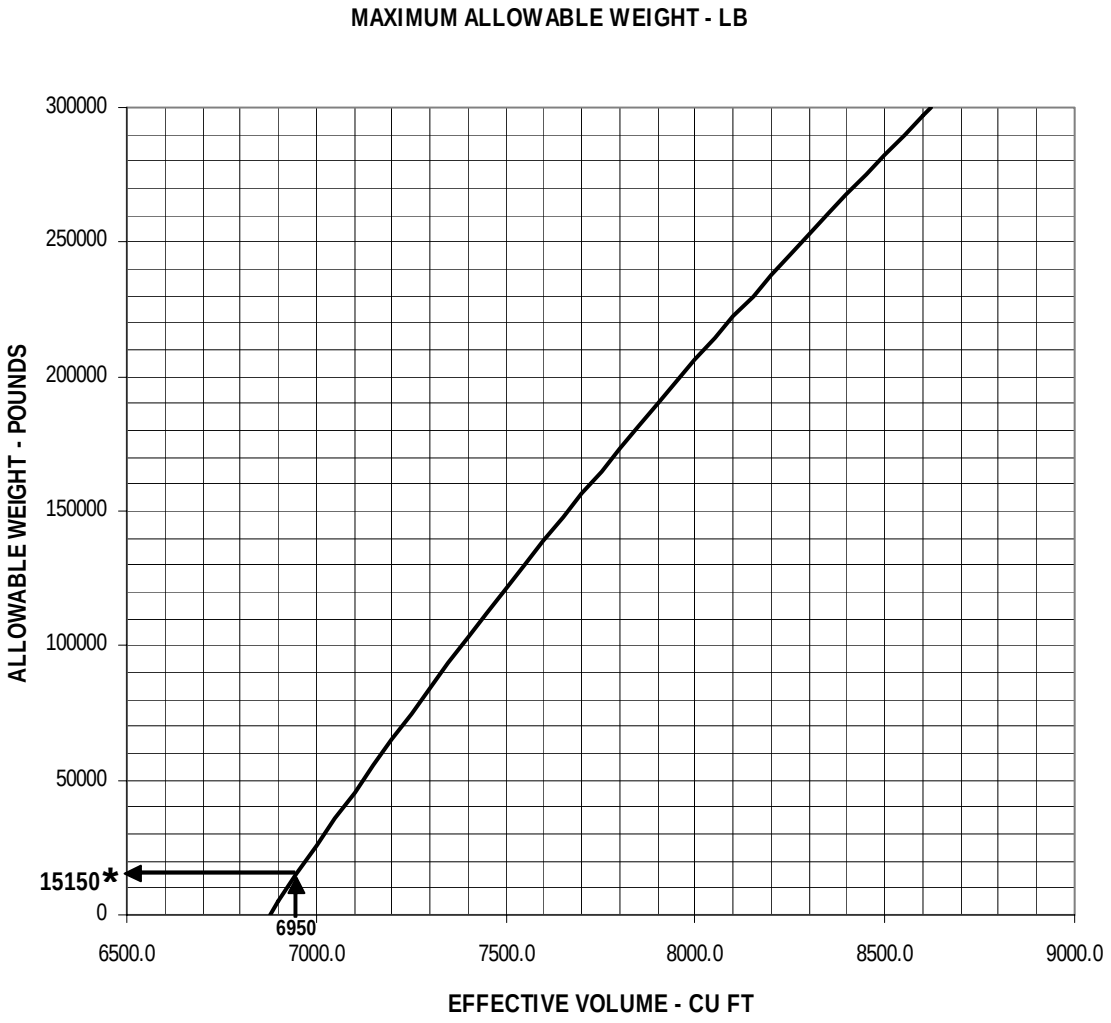
TALL RIGID CARGO (Continued)

Step 3 - Determine the Effective Maximum Allowable Weight of Cargo that can be Stopped by the Volume of Cargo Determined in Step 2

A. Use the graphs on Pages 5 and 6 to determine the maximum allowable weight of cargo that can be stopped by the volume of cargo determined in Step 1.

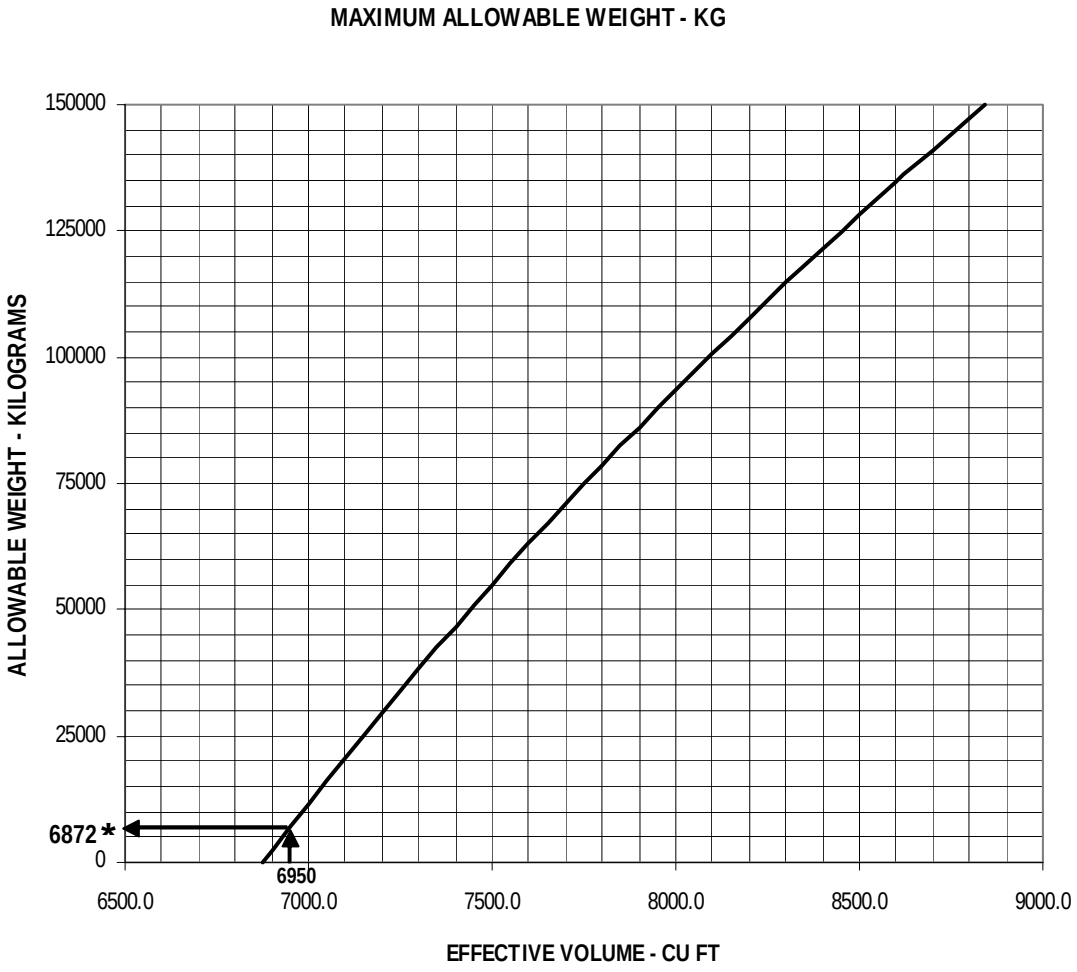
B. For this sample problem, use 6950 CU FT as calculated in Step 2D.

C. For this sample problem, a maximum allowable weight of cargo that can be stopped by a volume of 6950 CU FT is 15150 LB (6872 KG) as shown in the graph below and on the following page:



* Calculated using the equation on Page 5. Graphically shown here.

TALL RIGID CARGO (Continued)



* Calculated using the equation on Page 6. Graphically shown here.

APPLICABLE CONFIGURATIONS
All

TALL RIGID CARGO (Continued)

Step 4 - Adjust the Main Deck Cargo Loading as Required

A. For this sample problem, the proposed loading has 62900 LB (28530 KG) as the weight aft of B.A. 1280. Positions aft of B.A. 1280 are Positions J/K, LL/LR, ML/MR, PL/PR, RL/RR, SL/SR and T.

B. For this sample problem, a maximum allowable weight of cargo that can be stopped by a volume of 6950 CU FT is 15150 LB (6872 KG).

C. For this sample problem, the loaded cargo 62900 LB (28530) KG is **greater** than the maximum allowable weight 15150 LB (6872 KG). **This is not even close to an acceptable load plan.**

The sample problem is not OK for the carriage of tall rigid cargo.

Possible solutions are:

- Move the tall rigid cargo. (In this sample problem moving the tall rigid cargo to Positions J/K will increase the volume forward of the tall rigid cargo and reduce the weight aft of the tall rigid cargo. Both of these results are good.)
- Do not centerline load the tall rigid cargo. This will change the configuration factor from .90 to 1.0. (In this sample problem it is likely that cargo would hit the overhead airplane structure, so center loading is likely the only option).
- Ensure the cargo forward of the tall rigid cargo is volumetrically full. (In this sample problem the ULDs forward of B.A. 1280 are mostly full, but some positions like DR are only 55% full).
- Load less cargo aft of the tall rigid cargo. (For this sample problem removing cargo aft of the tall rigid cargo is a good solution, but this means some cargo may not make this flight. Also, removing cargo from the aft body may result in the airplane zero fuel weight moving forward, possibly outside of the C.G. limits (See CHP-SEC 1-02-xxx)).

APPLICABLE CONFIGURATIONS
All