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Airplane Recovery Document

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IMPORTANT MESSAGE TO USERS OF THIS DOCUMENT

The generalized recovery techniques and methods in this document are intended only for general planning purposes and procedures for model 767 airplanes.

The data presented in this document was calculated for hypothetical airplane conditions or for specific conditions which have occurred in the past. Because every situation requiring recovery is unique, the recovery method appropriate in a particular situation will depend upon the circumstances and the available recovery equipment.

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AIRPLANE RECOVERY DOCUMENT

Revision No. P
Sep 18/2002

To: All holders of this Boeing Document D623T001

Attached is the current revision to the Airplane Recovery Document. The Airplane Recovery Document (ARD) is available either as a printed manual, on microfilm, or digital products, or any combination of the three. This revision replaces all previous microfilm cartridges or digital products. All microfilm and digital products are reissued with all obsolete data deleted and all updated pages added.

For printed manuals, changes are indicated on the List of Effective Pages (LEP). The pages which are revised will be identified on the LEP by an R (Revised), A (Added), O (Overflow, i.e. changes to the document structure and/or page layout), or D (Deleted). Each page in the LEP is identified by Chapter-Section-Subject number, page number and page date. Pages replaced or deleted by this revision should be removed and destroyed.

All pages are included in this revision. Revision bars on the pages identify current revision changes.

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1 INTRODUCTION

1-00 GENERAL

1-00-1 General Data

1. This document provides information needed to recover a disabled Boeing 767 series airplane. As recommended in Air Transport Association (ATA) Specification 100, Section 2-11-0, "Aircraft Recovery Manual," this information describes equipment and procedures necessary to determine the Center of Gravity (CG), defuel, lift, shore, and move the airplane from abnormal conditions. This information is provided to effect recovery in a manner consistent with maintaining safety of recovery personnel and prevention of additional or secondary damage to the airplane.

   This document shows the procedures, equipment and special tools necessary to perform the recovery for all models of the 767 airplane. There are different procedures shown for different recovery conditions.
2. The Boeing Company supplies this data for the recovery of damaged airplanes from airport runways and adjacent areas.
3. The procedures in this document apply only after the applicable local authority releases the damaged airplane to the airline. In the United States (U.S.) the National Transportation and Safety Board (NTSB) releases the airplane. When you are outside of the U.S., a different local Authority releases the airplane. Make sure that you receive approval from the local authority for all the procedures that you use.

   This document is also published in a digital format. Digitally produced documents will, where applicable, be prepared in accordance with the provisions of ATA revision 2002.1, i spec 2200 Information Standards for Aviation Maintenance, dated March 2002.
4. Water recovery operations are not shown in this document. A water recovery does not occur very often. A water recovery may occur if an airplane accident has happened in the water and you must examine data from the accident. A water recovery may also occur if you need to remove an airplane from the path of boats (a navigable waterway). Another condition that may require a water recovery is for the removal of a damaged airplane from the view of an airport.

   A water recovery operation includes more careful decisions than other recovery operations. You must examine the effects of the items that follow:

   A. The depth of the water
   B. The location of the accident
   C. The possible effects on airport operations
   D. The possible effects on waterway operations
   E. The airplane condition and extent of salt water corrosion will determine recovery procedures
   F. The available equipment
   G. Environmental considerations
   H. Hazardous materials on board the airplane
5. The airplane data shown is for a serviceable airplane at a level attitude. You must adjust this data for the conditions at the accident location.
6. Recovery procedures shown in this document are only general procedures. The procedures that you use will possibly be different. They will change with the conditions you have at your accident location.
7. To move the airplane you must lift it. You can lift the airplane with jacks, pneumatic bags, cranes or other systems. After you lift the airplane, you must move it to a work area.
8. An airline can tell other airlines about data from its recovery operations (with the help of ATA, the International Air Transport Association [IATA] or other organizations). We recommend this procedure. All of this data will help all airlines make better recovery decisions and have better recovery procedures.

9. Make sure that only persons who are approved can go into the recovery location. This prevents or decreases problems in these areas:
   A. Decreases the danger to personnel for injury from contamination, debris, and sharp objects.
   B. Decreases the danger from any fires.
   C. Stops any removal of equipment and airplane components that is not approved.
   D. Prevents damage to important data that is necessary for the accident inspection.
   E. Controls the access of any media persons and other persons who are not approved.
   F. Controls the equipment persons and the other persons in the recovery operation.
10. This document shows recovery operations for all models of the 767.
   A. The basic model, 767-200.
   B. The basic model for longer distance, 767-200ER (Extended Range).
   C. The subsequent model, 767-300. This model is 253 in. (643 cm) longer than the basic model.
   D. The subsequent model for longer distance, 767-300ER (Extended Range).
   E. The subsequent model, for Freight only, 767-300F.
   F. The subsequent model, 767-400ER (Extended Range). This model is 253 in. (643 cm) longer than the 767-300 model.

      NOTE: The extended range models have more fuel tanks and the forward cargo door is wider. The Freighter model has the wide forward and wide aft cargo doors as standard. You can see some of the differences between the basic models and the subsequent models in Figure 1-5 through Figure 1-16.

      NOTE: Please note that any data that references applicability to the "767-200" and/or "767-300" airplane models also implies 767-200ER and/or 767-300ER applicability as well.
11. An airplane recovery is always the result of an accident. Thus, you must prepare for it before it occurs. To prepare for a recovery operation, make sure that you have persons available who have the correct instruction. Also, make sure that you have the correct recovery equipment available. Without good procedures and equipment, the airplane can receive secondary damage during the recovery operation.
   A. Persons for a Recovery Team - See SECTION 1-20
   B. Refer to SECTION 2-00 for recovery plan quick reference checklist.
   C. Tools and Equipment - See CHAPTER 5
12. You must have a satisfactory communications system that permits all recovery persons to speak to other recovery persons during the operation. Headphones and light (portable) transceivers are the best system you can use. Approval from the local authority may be necessary to operate them. Headphones with the correct transceivers are good equipment items for a recovery kit for all possible locations.

    Make sure you can speak with these important persons from your recovery control center:
   A. The control person at the airport.
   B. The local fire persons and the emergency persons.
   C. The security persons at the airport entrances.
   D. The local telephone system as it is necessary.
13. Make sure that you prevent more damage to the airplane from temperature, water, humidity, or some other possible problems.
   A. Collect and store deployed escape slides in a safe place.
   B. Prevent possible damage to the wire bundles and fabric surfaces from rodents.

14. Supply some temporary structures at the incident location for these functions:
    A. Special area to speak to other persons (telephone, fax) for the control of the operation.
    B. Special area for recovery persons (eat, drink, toilet).
    C. Special safe area for the location and the maintenance of tools and equipment.
15. Many different documents have the data that is possibly necessary for a good recovery operation. It is important to have these documents with you at the recovery location. See SUBJECT 1-00-3 for specific documents and numbers that apply to your model airplane and engines.

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1-00-2 Sequence of Document

1. General
   A. This document agrees with the instructions in ATA Specification 100 and ATA Specification 2100.
2. Sequence System
   A. The chapter sequence system uses a three element number (XX-XX-XX). This sequence system shows the Chapter, followed by the Section, followed by the Subject.
   B. The sequence of chapters in this document is similar to the sequence of steps used for an airplane recovery.
3. Contents of Chapters
   A. CHAPTER 1 - INTRODUCTION

   This chapter shows the general data available for an airplane recovery. Use this data with the procedures in the subsequent chapters. The basic items included in this chapter are:

   (1) A list of other documents with important data for this airplane.
   (2) Number Equivalents (English and Metric).
   (3) Glossary and Acronyms.
   (4) Airplane configuration and details.
   (5) Recovery Team Persons.

   B. CHAPTER 2 - SURVEY AND PREPARATION

   (1) You start the recovery with a first inspection. This chapter shows the first inspection of the airplane and of the adjacent area. The first inspection will help you prepare for the recovery. This chapter also shows a recommended recovery sequence.
   (2) You can change the CG of the airplane. If you change the CG, a stable airplane can move dangerously. The CG will change if you move, add or remove airplane weights. These weights can be the cargo, the fuel or large parts of the airplane. You will find more details on the change in the airplane's CG in this chapter.

   C. CHAPTER 3 - MAKE THE AIRPLANE STABLE TO LIFT

   (1) This chapter shows the procedures that make the airplane stable. This chapter also shows the procedures necessary to lift the airplane. The procedures include airplanes with landing gears that do not operate.

   D. CHAPTER 4 - MOVE THE AIRPLANE

   (1) This chapter shows the possible procedures for movement of the airplane. This includes the possible tether points and the permitted tow loads for different tow angles. This chapter also shows supports for damaged landing gears.

   E. CHAPTER 5 - TOOLS AND EQUIPMENT

   (1) This chapter shows the different groups of tools and equipment necessary for the airplane recovery.
       (a) General equipment and materials
       (b) Special tools and equipment
       (c) Special equipment (air transportable) that is available as a kit. Eleven airlines keep this equipment (at different locations around the world). It is available to airlines who are members of the International Air Transport Pool (IATP) and to other airlines (on a lease agreement).

(d) Three usual recovery items are available from the IATP (Worldwide Directory). The three items are pneumatic bags, recovery jacks and slings.

F. CHAPTER 6 - AIRPLANE RECOVERY INCIDENTS

(1) This chapter shows data from other recovery operations that occurred before. This airplane had only one recovery before January, 1991. This chapter describes that recovery. This chapter also refers to two documents that show data from the recovery of other airplanes.

1-00-3 Reference Documents

1. These documents show other airplane data. You can use these documents if the data is necessary. There are many other documents that you can use with this recovery document. The most important documents are the ones that follow:

Table 1-1 OTHER DOCUMENTS

D622T1XX	Maintenance Manual (last two digits designate customer airline)
D633T4XX	Baggage/Cargo Loading Manual (last two digits designate customer airline)
D634T201	Structural Repair Manual, 767-200
D634T210	Structural Repair Manual, 767-300
D634T215	Structural Repair Manual, 767-300F
D634T225	Structural Repair Manual, 767-400ER
D634T501	Illustrated Tool and Equipment Manual
D043T4XX	Weight and Balance Manual (last two digits designate customer airline)
D6-48646	Maintenance Facility and Equipment Planning Document
D621T001	JT9D-7R4 Engine Ground Handling Document
D621T005	PW4000 Series Engine Ground Handling Document
D621T002	CF6-80A Engine Ground Handling Document
D621T004	CF6-80C2 Engine Ground Handling Document
D621T006	RB211-524G/H Engine Ground Handling Document

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1-00-4 Other Data

1. Number Equivalents (English and Metric)
   A. The text of this document shows equivalents for numbers. This document shows the equivalent in brackets near the number. This chapter shows more equivalents in Figure 1-2. On the top of the charts you can see the formulas for these equivalents. You can use these formulas for more accurate values.
2. Other Equivalents
   A. The charts (Figure 1-2) do not show all equivalents. The formulas shown below give more equivalents.

ENGLISH AND METRIC EQUIVALENTS FORMULAS

To Obtain	Multiply	Factor
Gallons (U.S.)	Cubic Feet	7.48
Liters	Gallons (U.S.)	3.785
Miles per Hour	Knots	1.15
Liters/Min	Cubic Feet/Min	28.317

Weight of Fuel, Jet "A"	= 6.74 Lb/U.S. Gal.
Weight of Fuel, JP-8	= 6.55 Lb/U.S. Gal (2.97 Kg/L)
Weight of Water	= 8.345 Lb/U.S. Gal. at 62°F
	= 62.35 Lb/Cu Ft at 62°F

3. Glossary and Acronyms
   A. This document shows many Acronyms. These Acronyms in Figure 1-1 are the most usual Acronyms.

Figure 1-1 GLOSSARY AND ACRONYMS

APU	Auxiliary Power Unit
AZFW	Actual Zero Fuel Weight - The Operational Empty Weight plus payload
BEW	Basic Empty Weight - Standard basic empty weight plus or minus weight of standard item variations
CG	Center of Gravity
DLW	Design Landing Weight
ENP	Estimated Normal Payload - Total weight of passengers, cargo and baggage selection by the operator for statistical and related purposes
GSE	Ground Support Equipment
Kn	Knot - The speed of one nautical mile for each hour
MAC	Mean Aerodynamic Chord - The chord of the imaginary wing of constant section having same force vectors under all conditions as those of actual wing
MEW	Manufacturer’s Empty Weight - The weight of the structure, powerplant, furnishings, systems and other items of equipment that are an integral part of a particular airplane configuration
MTGW	Maximum Taxi Gross Weight - The maximum weight authorized for ground maneuver by the applicable government regulations and includes taxi and run-up fuel

Figure 1-1 GLOSSARY AND ACRONYMS (Continued)

MTOGW	Maximum Take Off Gross Weight - The maximum weight authorized at take off brake release by the applicable government regulations and excludes taxi and run-up fuel
MZFW	Maximum Zero Fuel Weight - The maximum weight allowed before usable fuel and other specified usable agents must be loaded in defined sections of the airplane as limited by strength and airworthiness requirements
NRW	Net Recoverable Weight - The Recoverable Empty Weight less the missing airplane equipment and components but including fuel, liquids and cargo
OEW	Operating Empty Weight - The weight of the structure, powerplant, furnishings, systems, unusable fuel and other unusable propulsion agents, and other items of equipment that are considered an integral part of a particular airplane configuration. Also included are certain standard items, personnel, equipment, and supplies necessary for full operation, excluding fuel and payload
REW	Recoverable Empty Weight - The Operating Empty Weight (OEW) less items torn from the airplane during landing or removed for the purpose of weight reduction
SBEW	Standard Basic Empty Weight - Manufacturer's Empty Weight plus standard items

Figure 1-2 ENGLISH AND METRIC EQUIVALENTS

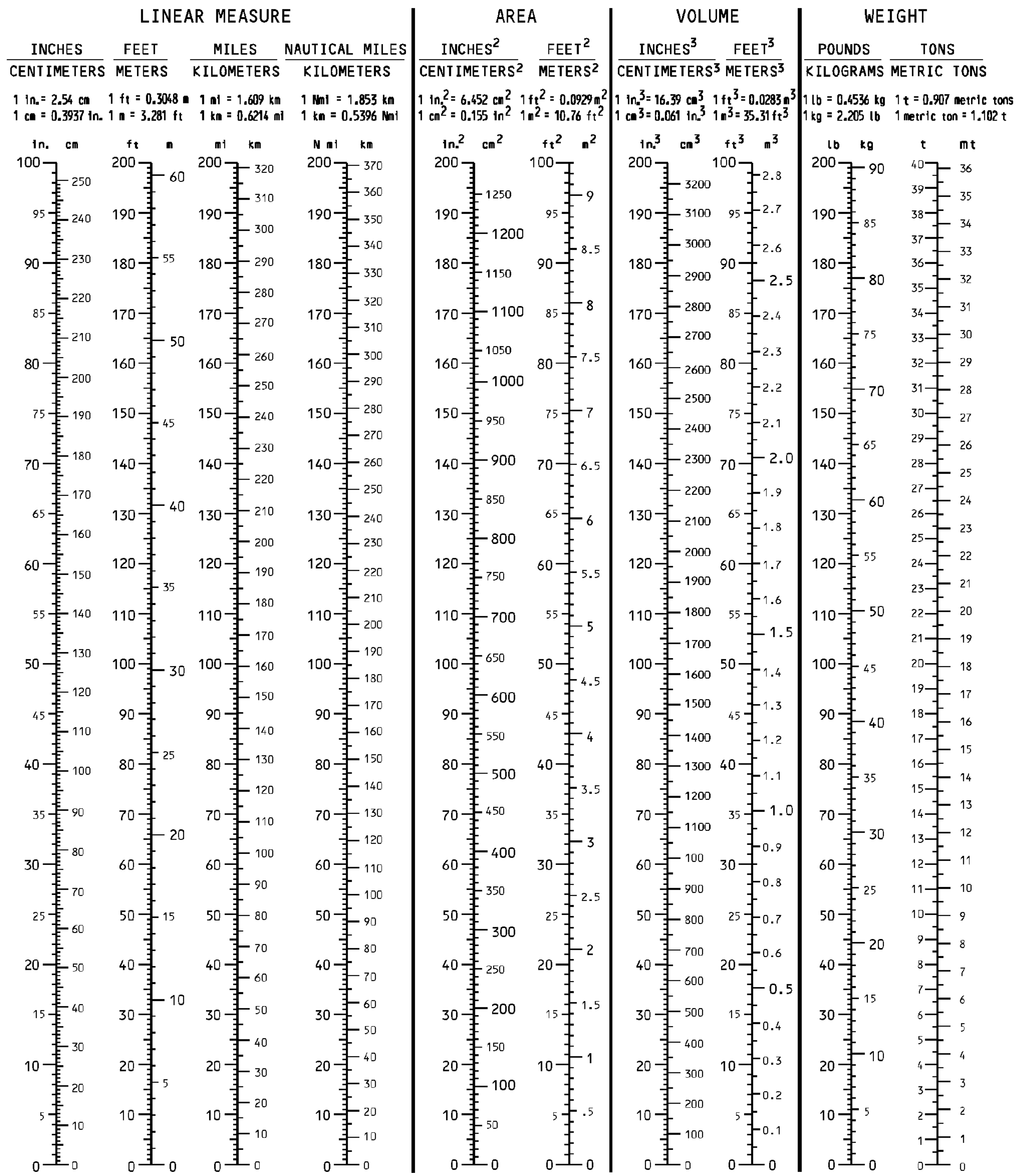
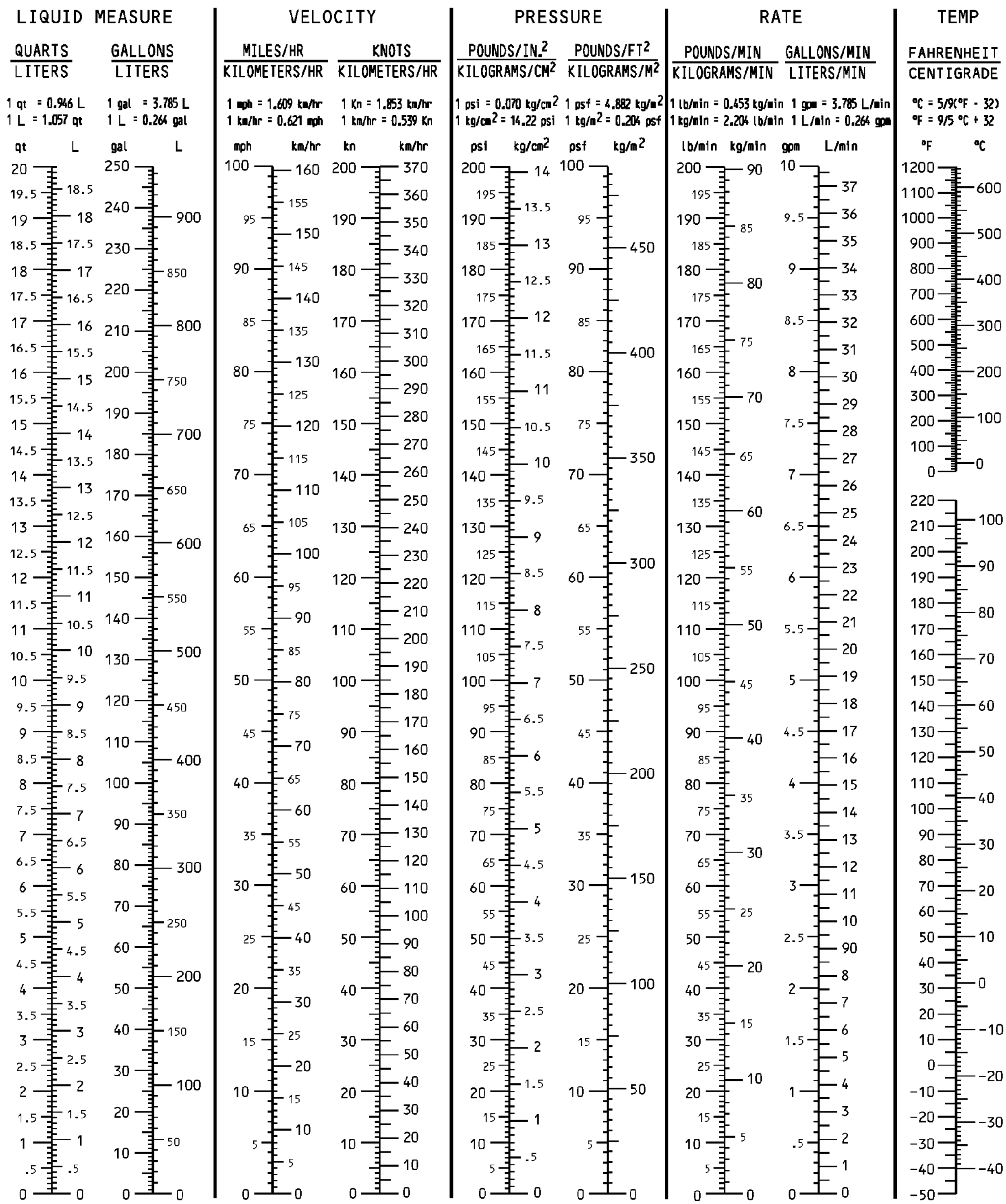


Figure 1-2 ENGLISH AND METRIC EQUIVALENTS (Continued)



1-10 AIRPLANE DETAILS

1-10-1 General Data

1. See Figure 1-5 through Figure 1-8) for the primary dimensions of the 767 series airplane.
   A. 767-200 Airplane
      (see Figure 1-10)
      (1) Wide body
      (2) Medium range
      (3) Twin engine (high bypass turbofans) with two possible engines
         (a) General Electric CF6-80A
         (b) Pratt and Whitney JT9D-7R4D
   B. 767-200ER Airplane
      (see Figure 1-10)
      (1) Basic 767-200 airplane
      (2) Wider forward cargo door
      (3) More fuel in the wing center section
   C. 767-300 Airplane
      (see Figure 1-11)
      (1) Longer than the 767-200 - 253 inches (643 cm)
      (2) Higher gross weights than the 767-200
      (3) Increased number of cargo containers (16 LD-2 Forward and 14 LD-2 Aft)
   D. 767-300ER Airplane
      (see Figure 1-11)
      (1) Longer than the 767-200 - 253 inches (643 cm)
      (2) Wider forward cargo door
      (3) More fuel in the wing center section
      (4) Higher gross weights than the 767-300
      (5) Three possible engines
         (a) General Electric CF6-80C2
         (b) Pratt and Whitney PW4000 Series
         (c) Rolls-Royce RB211-524H
   E. 767F Airplane
      (see Figure 1-12 and Figure 1-12)
      (1) Basic 767-300ER airplane
      (2) Main deck cargo door
      (3) Wider forward and aft lower lobe cargo doors standard
      (4) One passenger entry door on main deck
   F. 767-400ER Airplane
      (see Figure 1-8)
      (1) Twenty-one feet (6.4 m) longer than the 767-300

(2) Revised wing with new 8 foot (2.4 m) raked tip

(3) New, longer Main Landing Gear (MLG) with strengthened MLG beam and new rolling stock

(4) Higher gross weights than the 767-300

(5) Two engine choices

(a) General Electric CF6-80C2B7F (option B8F)

(b) Pratt and Whitney 4062

(6) Integrated Drive Generators and Auxiliary Power Unit are 120 KVA instead of 90 KVA as on the 767-200/300

G. Wings

(see Figure 1-15 (767-200/300) and Figure 1-16 (767-400ER))

(1) A usual low wing

(2) Six degree angle of dihedral

(3) Forward edge with a 34 degree rearward angle (sweep)

(4) Each wing has:

(a) Six leading edge slats (full span)

(b) Two trailing edge flaps

(c) Two ailerons

(d) Six spoilers

(5) Eight foot (2.4 m) raked tip (767-400ER only)

H. Horizontal Stabilizer

(see Figure 1-18)

(1) Seven degree angle of dihedral

(2) Forward edge with a 38 degree rearward angle

(3) A two-piece elevator

I. Vertical Stabilizer (see Figure 1-17)

(1) Forward edge with a 44.7 degree rearward angle

(2) Full height, one piece rudder

J. Hydraulic System

(1) Three systems that operate independently

(2) Left and right systems, two power sources

(a) Pumps energized by power from the engines

(b) Pumps energized by electrical power

(3) Center system, three power sources

(a) Two pumps energized by electrical power

(b) One pump energized by air power

(c) Ram air turbine (inflight only)

K. Conditioned Air

(1) Two power packs (same type)

(2) Packs installed forward of the wheel wells of the main gear

L. Nose Landing Gear (NLG)
   (1) A usual two-wheel gear
   (2) Sixty-five degree (approximate) tiller steering
   (3) Sixteen degree (approximate) pedal steering
   (4) Torsion links
      (a) Limit tow angle to 65 degrees
      (b) Can be disconnected to increase tow angle to 90 degrees
   (5) Strut assembly
      (a) Location of tow points
      (b) Location of jack points
   (6) Operation of doors
      (a) Aligned with gear operation (swing up and down)
      (b) Connected system (slave drive) operates the doors (open and close)

M. Main Landing Gear
   (1) A four-wheel truck (bogie)
   (2) Rotor brakes
   (3) Retraction to the center of the airplane
   (4) Gear doors that are the gear uplocks
   (5) A tow point at each end of the gear truck
   (6) A usual spherical jack point at each end of the gear truck

N. Electrical Power
   (1) For the 767-200/300 - Two 90 KVA integrated drive generators (one on each engine)
   For the 767-400ER - Two 120 KVA Integrated drive generators (one on each engine)
   (2) Auxiliary Power Unit (APU)
      (a) Installed on the aft end of the fuselage
      (b) Supplies pneumatic power and electrical power on the ground
      (c) Supplies inflight electrical power (backup)
      (d) Has an air inlet on the right side of the vertical stabilizer
      (e) Has an exhaust outlet contained in the airplane tailcone

O. Fuel System
   (1) Contained in the wings
   (2) Primary tanks
      (a) One tank in each wing
      (b) 6,070 U.S. gallons (22975 liters) capacity in each wing
   (3) Center tank is standard on the 767-200ER, 767-300ER, and 767-400ER, and is optional on the 767-200 and -300 models.
      (a) Auxiliary tank (usually dry)
      (b) 4,560 U.S. gallons (17260 liters) capacity
   (4) Center tank on the 767-200ER, the 767-300ER, 767F, and 767-400ER

(a) It is also a primary tank

(b) 8,310 U.S. gallons (31453 liters) capacity on the 767-200ER, 12,000 U.S. gallons (45420 liters) capacity on the 767-300ER, 767-300F, and 767-400ER.

(5) To fill the airplane with fuel

(a) The fuel point is on the forward spar of the left wing on all 767 airplane models.

P. New Airplane Materials

(1) Graphite epoxy (ailerons, spoilers, rudder and elevators)

(2) Kevlar/Graphite (engine cowls, doors for the main landing gears, wing and tail panels)

(3) Fiberglass/Graphite (doors for the nose landing gear)

(4) Kevlar (ECS ducts and other parts of the airplane)

Q. Airplane Structural Details (see Figure 1-9)

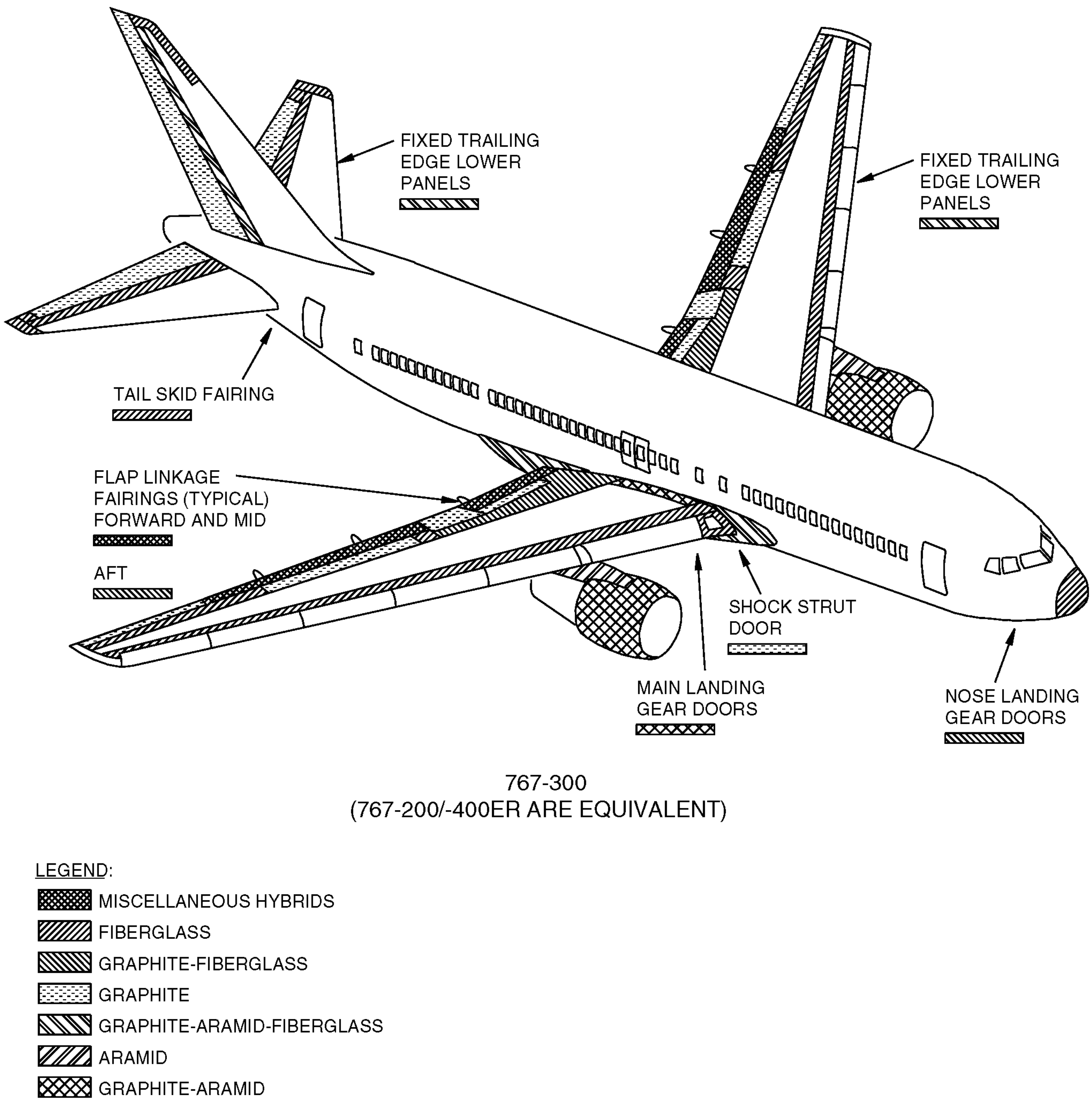
(1) Five fuselage sections (see Figure 1-10 through Figure 1-12)

(2) The wing attaches to the 45 Section with a wing torque box (see Wing Centerline Diagram, Figure 1-15)

(3) The horizontal and vertical stabilizers attach to the 48 Section (see Vertical Stabilizer Centerline Diagram, Figure 1-17, and Horizontal Stabilizer Centerline Diagram, Figure 1-18)

(4) Door locations and heights above ground (see Figure 1-19 through Figure 1-22)

Figure 1-3 COMPOSITE STRUCTURE



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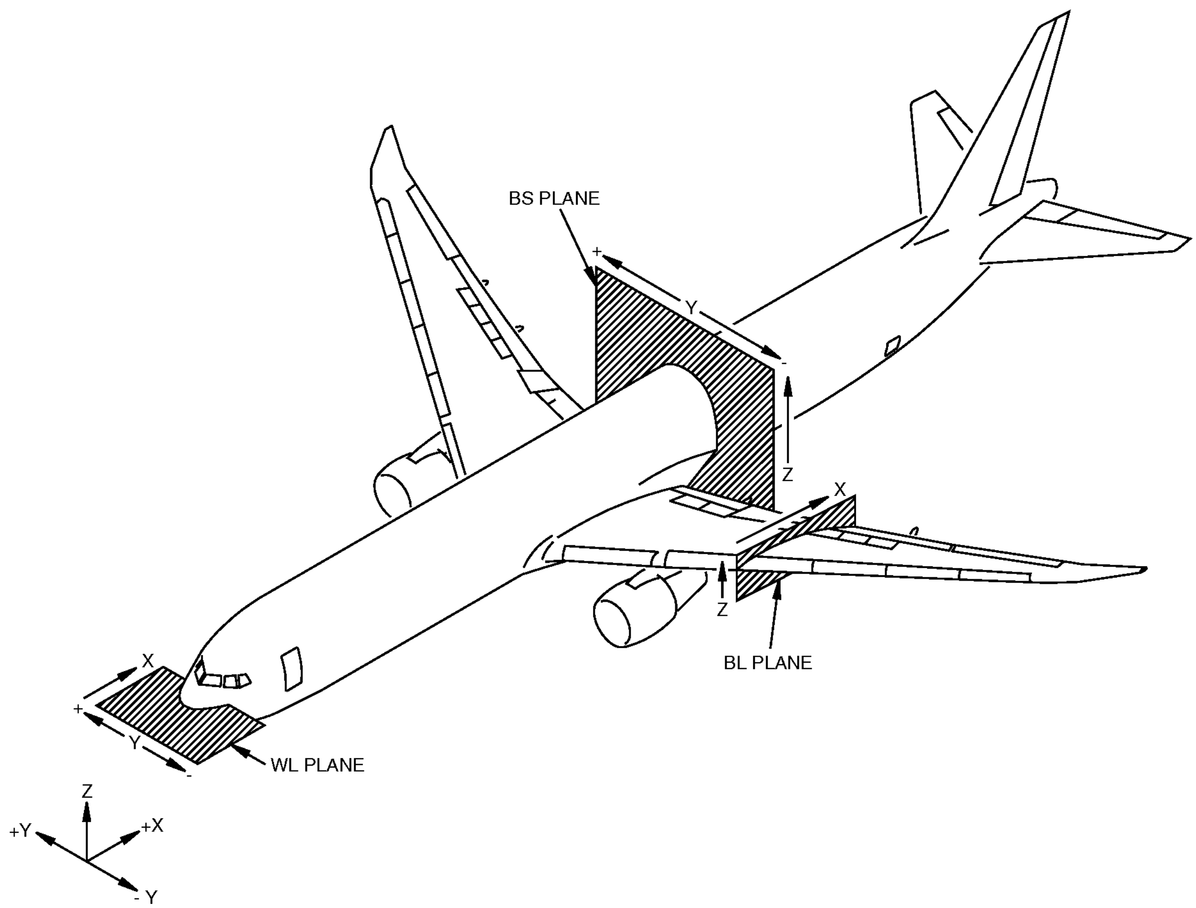
1-10-2 General Arrangement

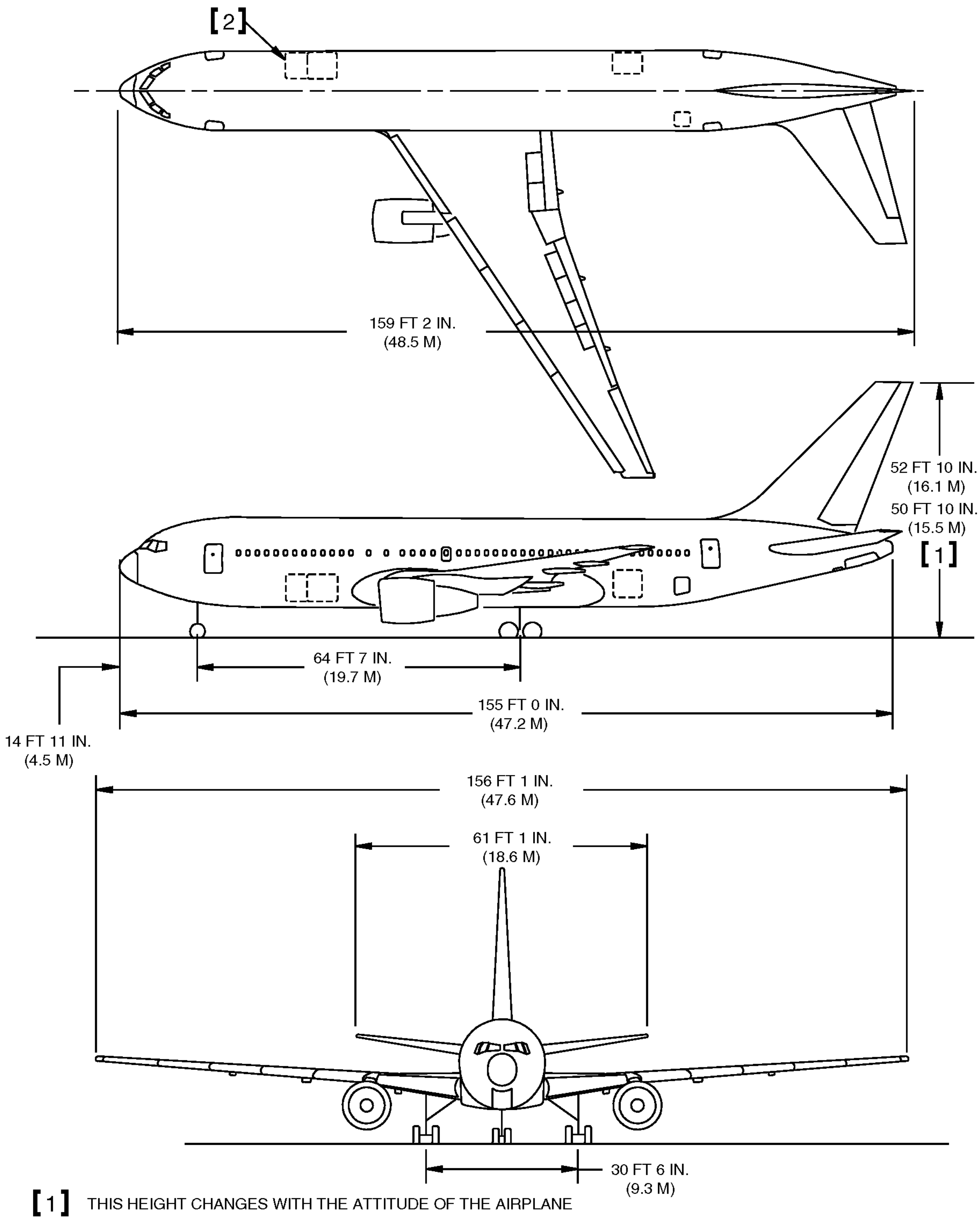
1. The general arrangement section subject contains general airplane dimensions. The dimensions are for the side, top and front views of the airplane.
2. The following illustrations, Figure 1-5, Figure 1-6, Figure 1-7, Figure 1-8, provide general arrangement drawings and primary airplane dimensions for the the 767-200, -200ER, -300ER and -400ER. The 767 Freighter has the same basic dimensions as for the 767-300ER.

Figure 1-4 AIRPLANE COORDINATE SYSTEM



AIRPLANE COORDINATE SYSTEM ABBREVIATIONS	
BS	Body Station: A vertical plane perpendicular to body centerline, located by its distance from point 90 inches forward of nose.
BL	Body Buttock Line: A vertical plane parallel to body vertical centerline plane, BL 0.00, located by its perpendicular distance from body centerline plane.
WL	Body Waterline: A horizontal plane located by its perpendicular distance from parallel, imaginary plane WL 0.00.

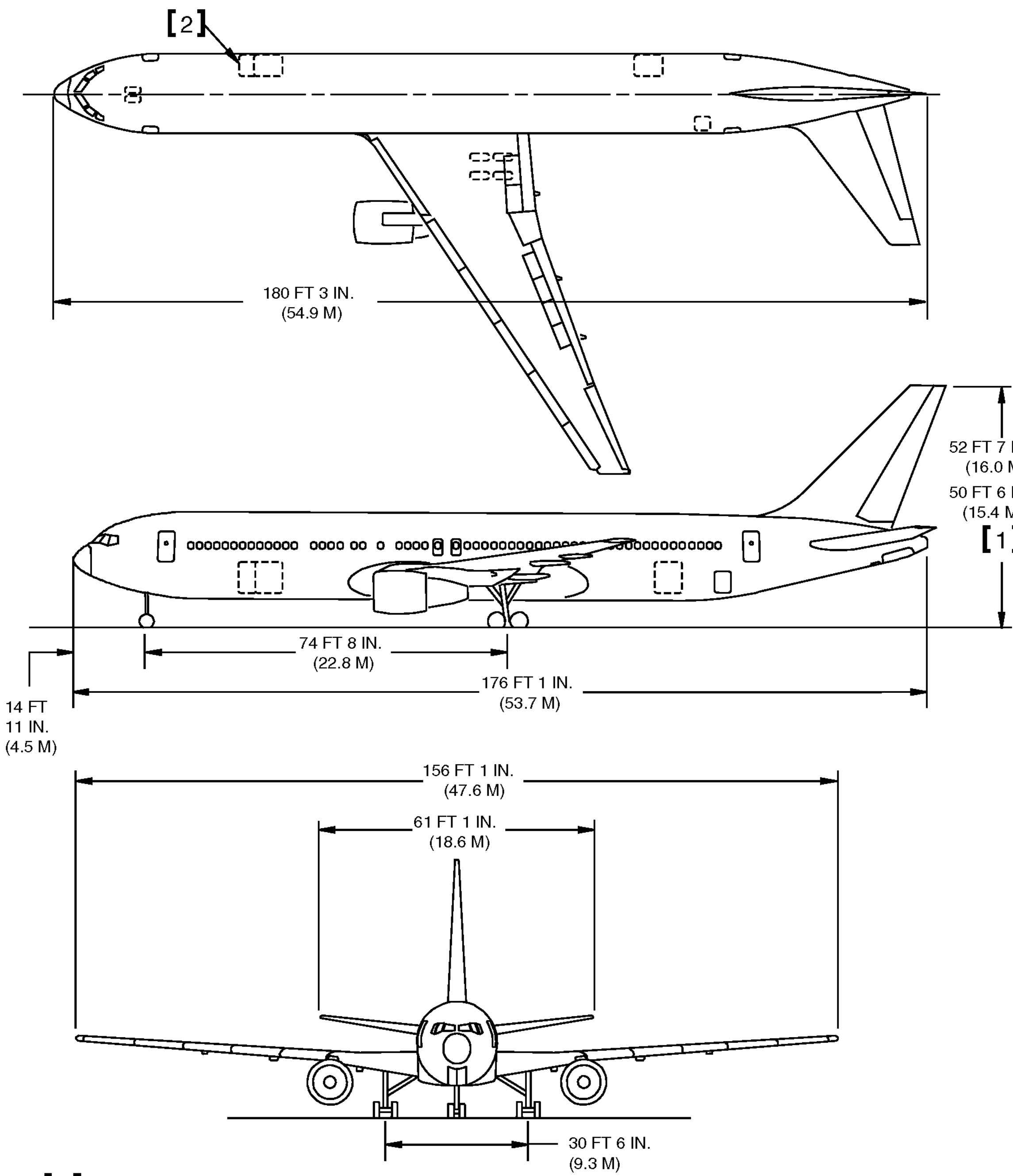
Figure 1-5 PRIMARY AIRPLANE DIMENSIONS - 767-200, -200ER



[1] THIS HEIGHT CHANGES WITH THE ATTITUDE OF THE AIRPLANE

[2] A LARGE CARGO DOOR IS BASIC ON THE 767-200ER

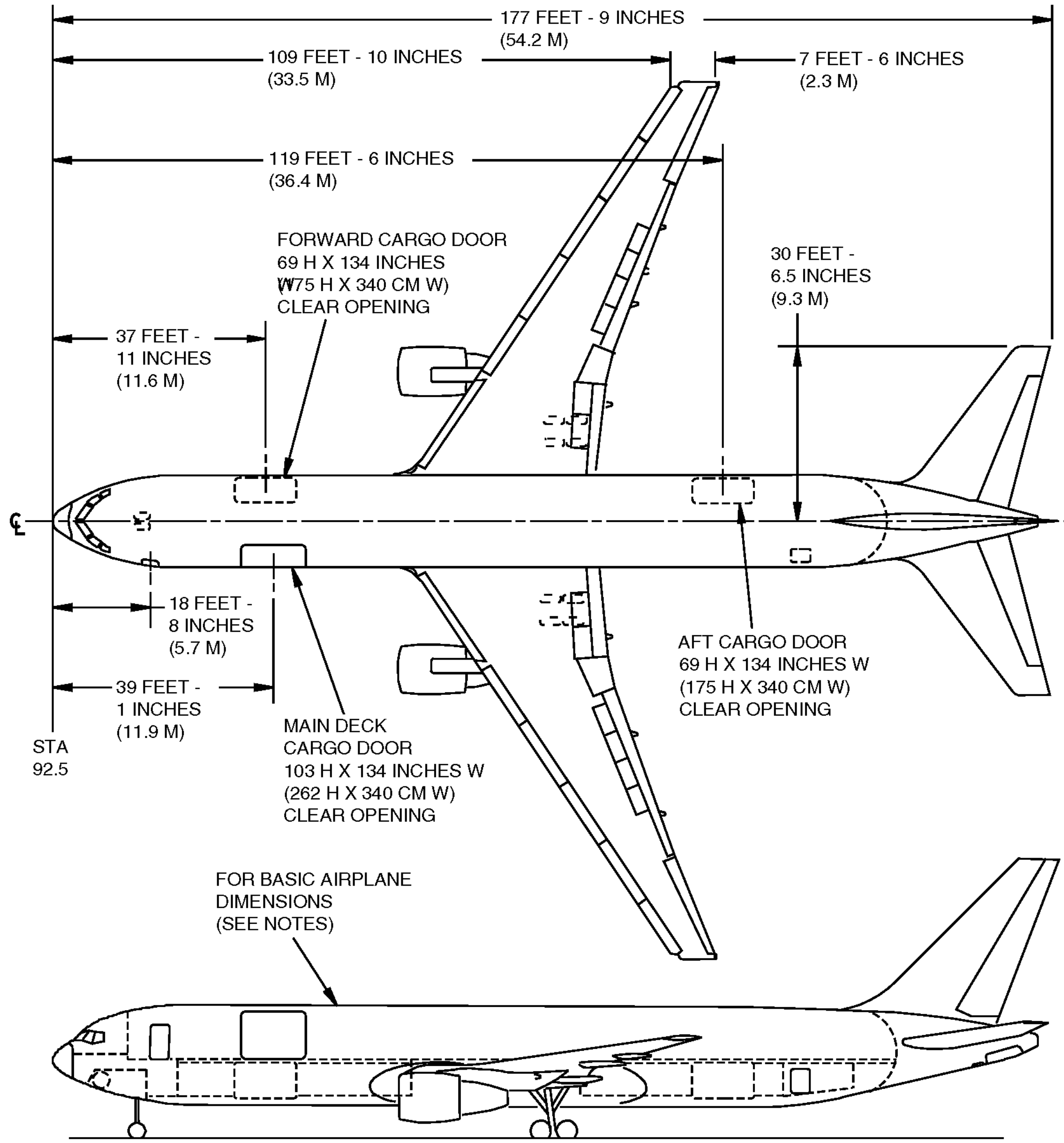
Figure 1-6 PRIMARY AIRPLANE DIMENSIONS - 767-300, -300ER



[1] THIS HEIGHT CHANGES WITH THE ATTITUDE OF THE AIRPLANE

[2] A LARGE CARGO DOOR IS BASIC ON THE 767-300ER

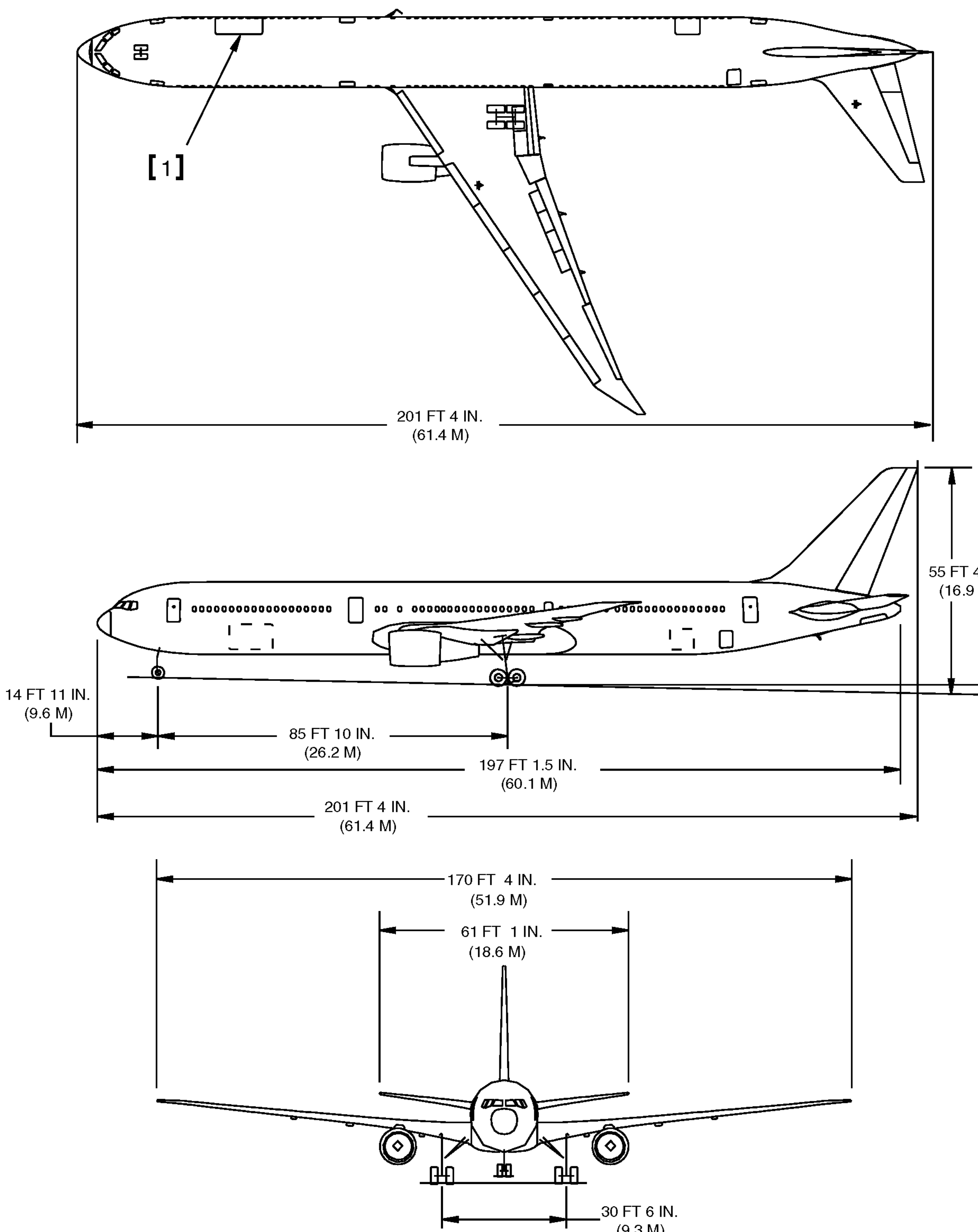
Figure 1-7 PRIMARY AIRPLANE DIMENSIONS - 767 FREIGHTER



NOTE: 1. The basic airplane dimensions of the freighter are the same as the -300/ER passenger model (see Figure 1-6)

2. For door locations, sizes and heights above ground see Figure 1-21

Figure 1-8 PRIMARY AIRPLANE DIMENSIONS - 767-400ER

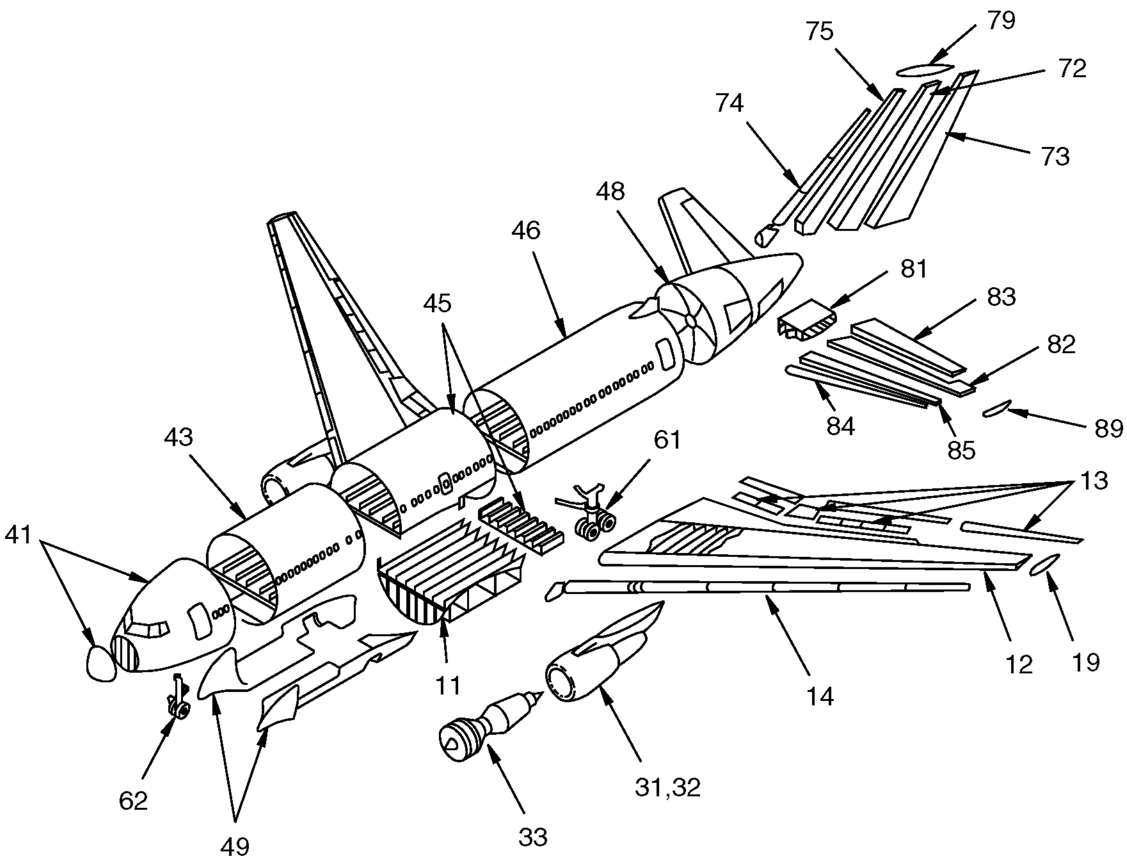


[1] A LARGE CARGO DOOR IS BASIC ON THE 767-400ER

1-10-3 Structural Sections

1. The general arrangement section subject depicts the structural sections of the airplane. The views are shown in an exploded view so the different sections can be better illustrated (see Figure 1-9).

Figure 1-9 STRUCTURAL SECTIONS



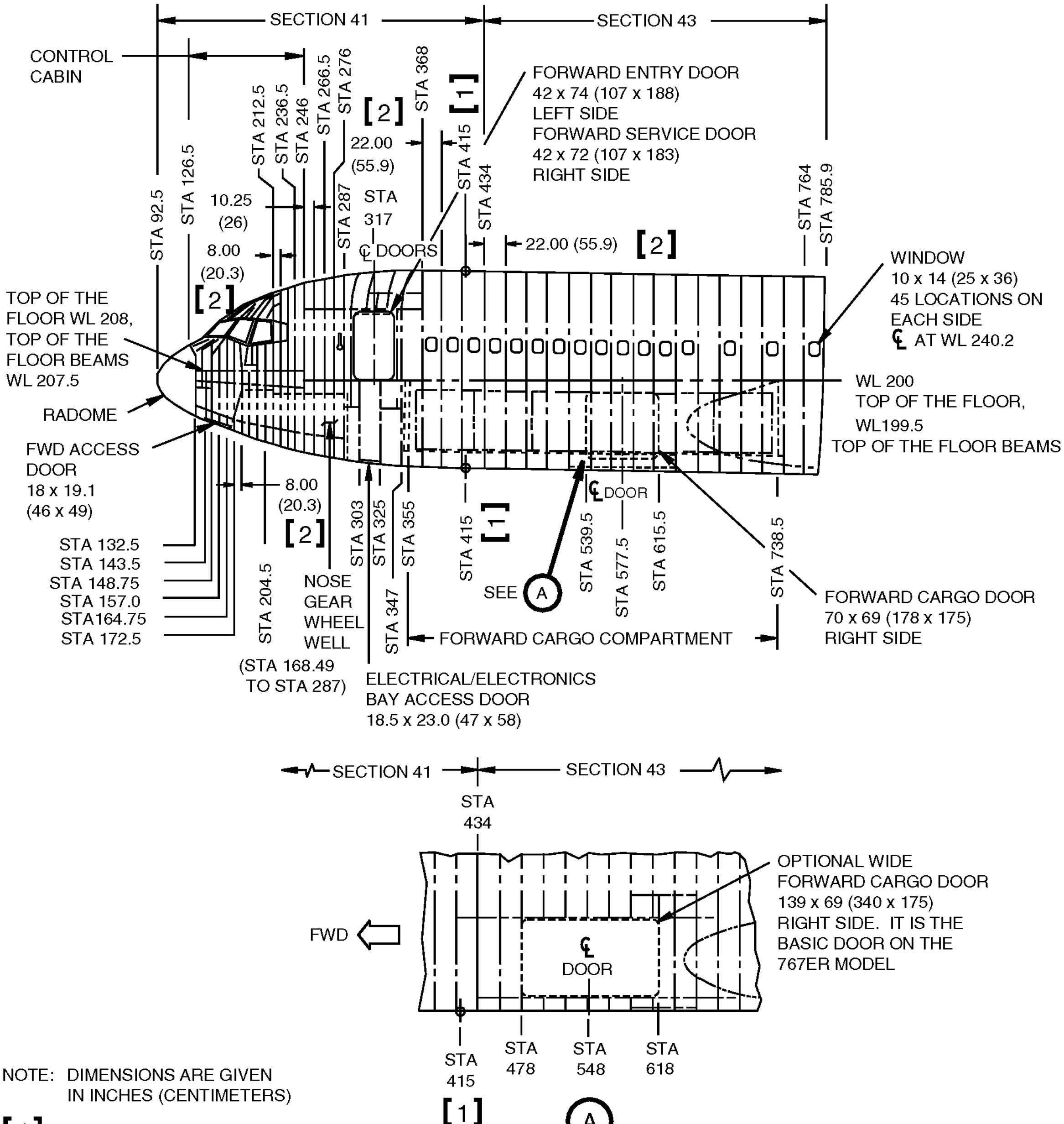
SECTION NUMBER	DESCRIPTION	SECTION NUMBER	DESCRIPTION
11	WING CENTER SECTION	49	MULTI-SECTION (WING AND BODY FAIRINGS)
12	WING OUTBOARD STRUCTURAL BOX	61	MAIN LANDING GEAR
13	WING TRAILING EDGE (INCLUDES AILERONS, FLAPS AND SPOILERS)	62	NOSE LANDING GEAR
14	WING LEADING EDGE (FIXED AND MOVEABLE)	72	VERTICAL TAIL, AFT TORQUE BOX
19	WINGTIP	73	VERTICAL TAIL, TRAILING EDGE (FIXED AND MOVEABLE)
31	PROPULSION, WING INSTALLATION (STRUT AND COWLING)	74	VERTICAL TAIL, LEADING EDGE
32	PROPULSION, CENTER INSTALLATION (MOUNT, INLET, DUCTING AND THRUST REVERSER)	75	VERTICAL TAIL, FORWARD TORQUE BOX
33	PROPULSION, BUILT-UP ENGINE	79	VERTICAL TAIL, TIP
41	FUSELAGE NOSE SECTION (INCLUDES RADOME)	81	HORIZONTAL TAIL, CENTER SECTION
43	FORWARD FUSELAGE SECTION	82	HORIZONTAL TAIL, AFT TORQUE BOX
45	FUSELAGE SECTION, WING JOIN	83	HORIZONTAL TAIL, TRAILING EDGE (FIXED AND MOVABLE)
46	AFT FUSELAGE SECTION	84	HORIZONTAL TAIL, LEADING EDGE
48	FUSELAGE TAIL SECTION	85	HORIZONTAL TAIL, FORWARD TORQUE BOX
		89	HORIZONTAL TAIL, TIP

NOTE: 767-200 SHOWN, OTHER MODELS SIMILAR

1-10-4 Centerline Diagrams

1. The centerline diagram section subject contains illustrations of the different fuselage body station and sections for the 767-200, -200ER, -300, -300ER, -400ER and -300F airplanes. Centerline diagrams of the wings, vertical stabilizer and the horizontal stabilizer are also provided in this section (see Figure 1-10 through Figure 1-18).

Figure 1-10 FUSELAGE CENTERLINE DIAGRAM - 767-200, -200ER

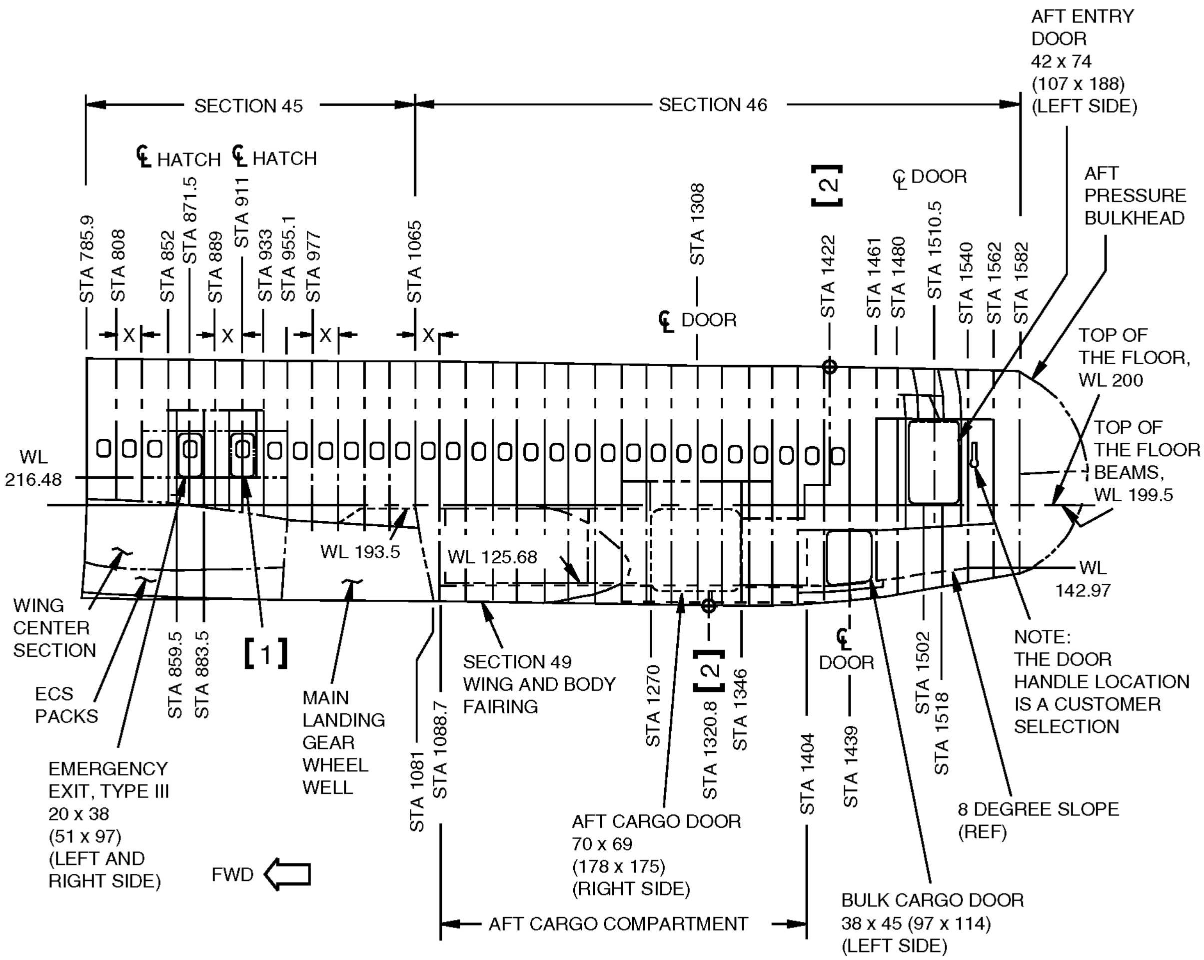


NOTE: DIMENSIONS ARE GIVEN IN INCHES (CENTIMETERS)

[1] THE CONSTANT SECTION BEGINS AT STATION 415 AND ENDS AT STATION 1422 (UPPER LOBE) AND AT STATION 1320.8 (LOWER LOBE)

[2] ALL FRAMES AFT EXCEPT AS SHOWN

Figure 1-10 FUSELAGE CENTERLINE DIAGRAM - 767-200, -200ER (Continued)



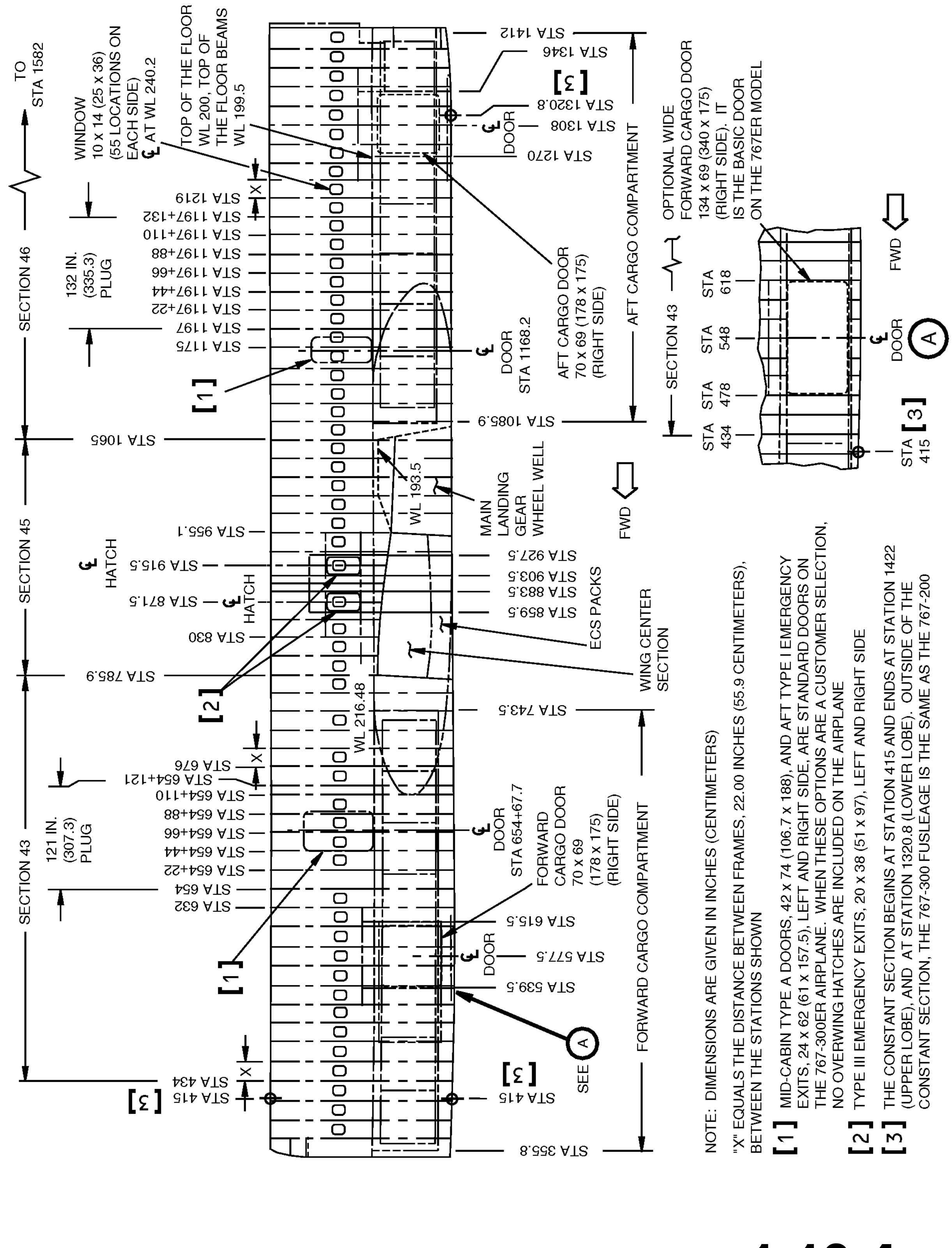
NOTE: DIMENSIONS ARE GIVEN IN INCHES (CENTIMETERS)

"X" EQUALS THE DISTANCE BETWEEN FRAMES, 22.00 INCHES (55.9 CENTIMETERS), BETWEEN THE STATIONS SHOWN

[1] OPTIONAL SECOND OVERWING EMERGENCY EXIT, TYPE III, 20 x 38 (51 x 97), LEFT AND RIGHT SIDE, IN THE SAME LOCATION AS THE 767-300 AIRPLANE

[2] THE CONSTANT SECTION BEGINS AT STATION 415 AND ENDS AT STATION 1422 (UPPER LOBE), AND AT STATION 1320.8 (LOWER LOBE)

Figure 1-11 FUSELAGE CENTERLINE DIAGRAM - 767-300, -300ER



NOTE: DIMENSIONS ARE GIVEN IN INCHES (CENTIMETERS)

"X" EQUALS THE DISTANCE BETWEEN FRAMES, 22.00 INCHES (55.9 CENTIMETERS), BETWEEN THE STATIONS SHOWN

[1] MID-CABIN TYPE A DOORS, 42 x 74 (106.7 x 188), AND AFT TYPE I EMERGENCY EXITS, 24 x 62 (61 x 157.5), LEFT AND RIGHT SIDE, ARE STANDARD DOORS ON THE 767-300ER AIRPLANE. WHEN THESE OPTIONS ARE A CUSTOMER SELECTION, NO OVERWING HATCHES ARE INCLUDED ON THE AIRPLANE

[2] TYPE III EMERGENCY EXITS, 20 x 38 (51 x 97), LEFT AND RIGHT SIDE

[3] THE CONSTANT SECTION BEGINS AT STATION 415 AND ENDS AT STATION 1422 (UPPER LOBE), AND AT STATION 1320.8 (LOWER LOBE). OUTSIDE OF THE CONSTANT SECTION, THE 767-300 FUSELAGE IS THE SAME AS THE 767-200

Figure 1-12 FUSELAGE CENTERLINE DIAGRAM - 767-300F

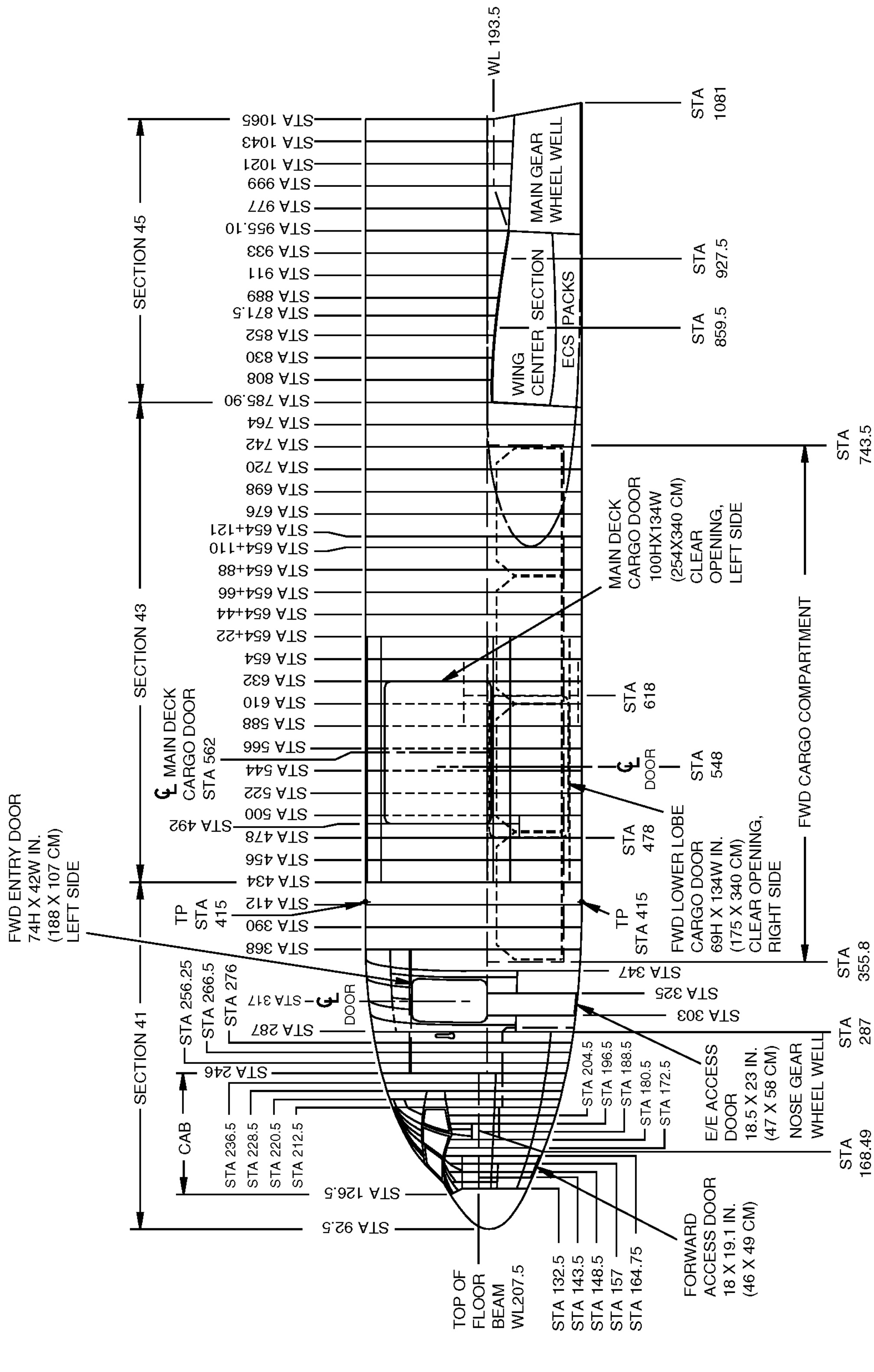


Figure 1-12 FUSELAGE CENTERLINE DIAGRAM - 767-300F (Continued)

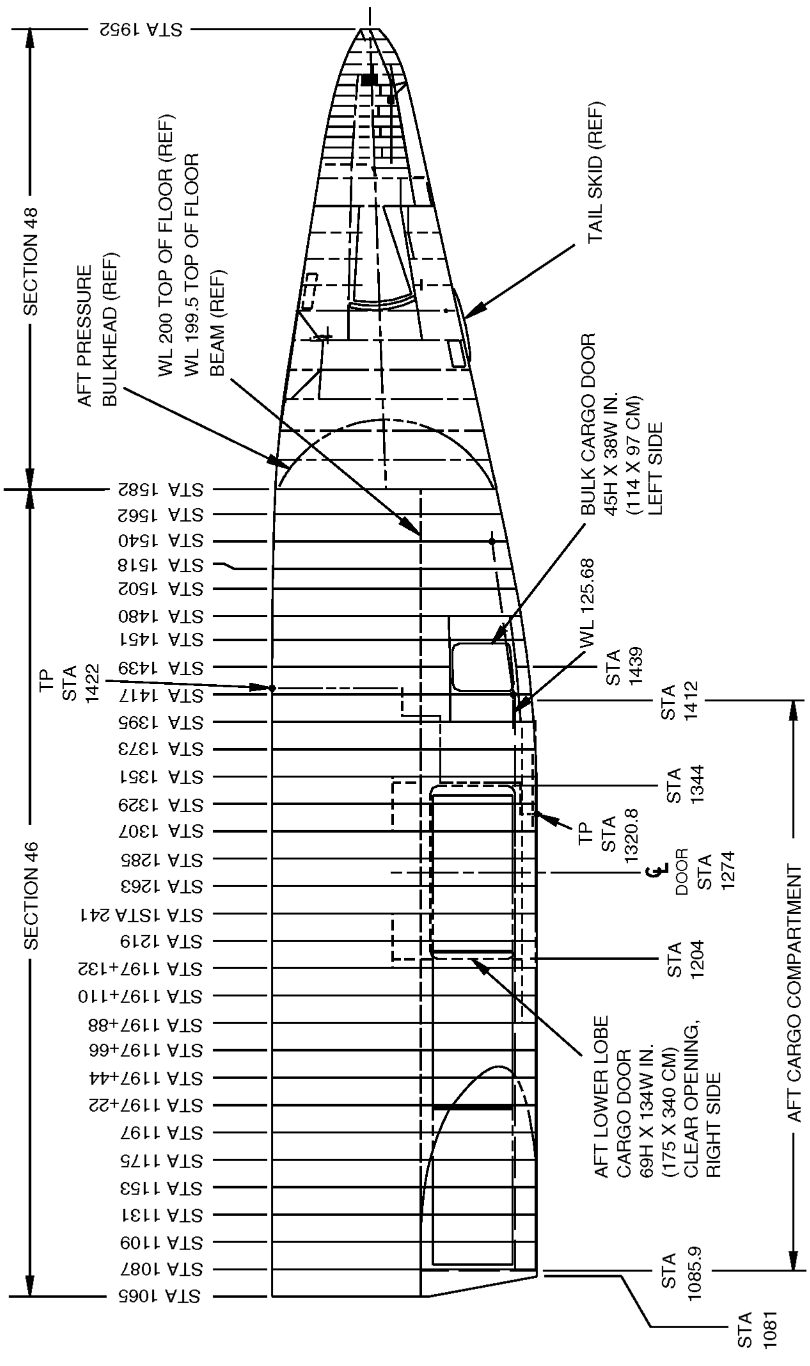


Figure 1-13 FUSELAGE CENTERLINE DIAGRAM - 767-400ER

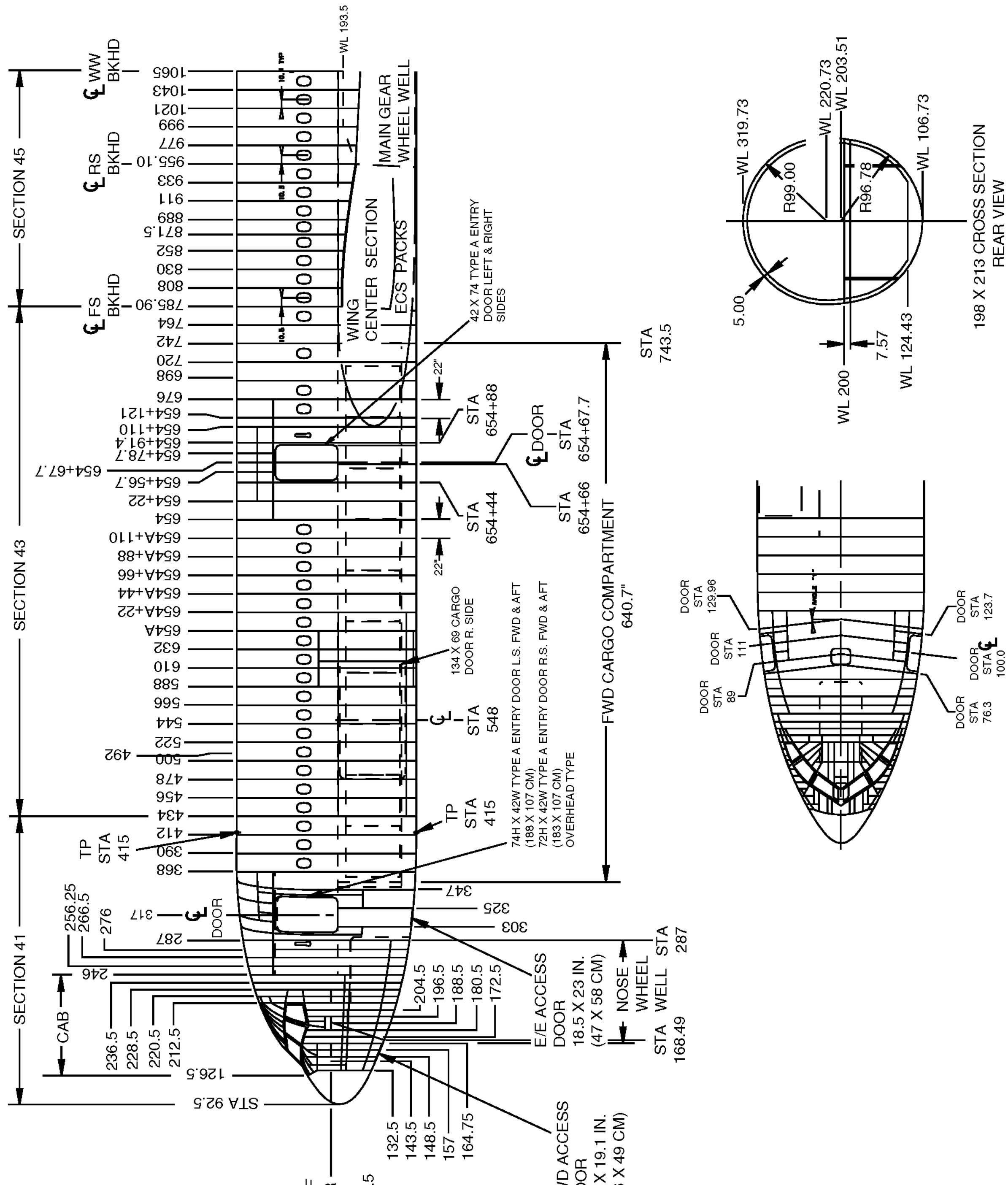


Figure 1-14 FUSELAGE CENTERLINE DIAGRAM - 767-400ER

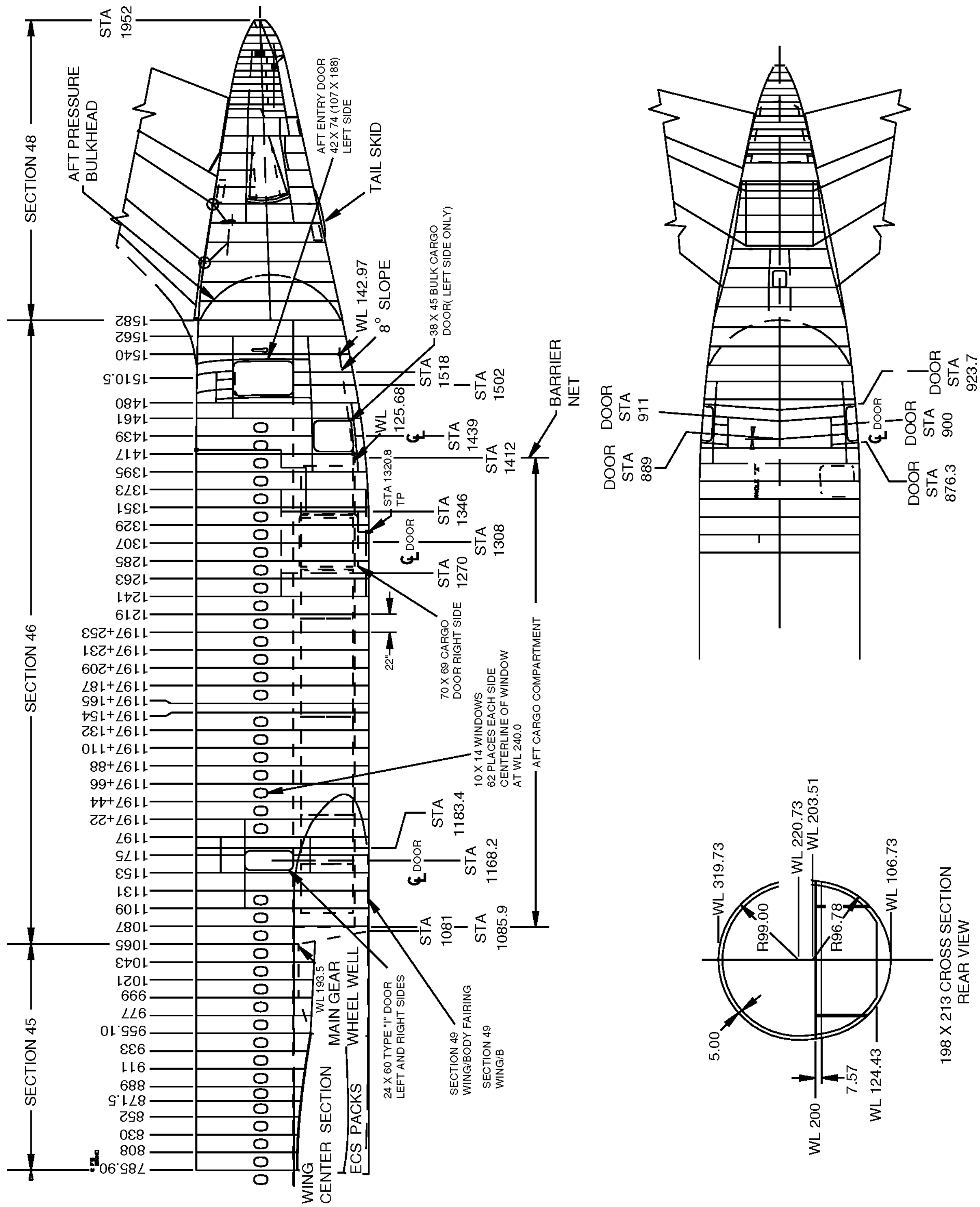
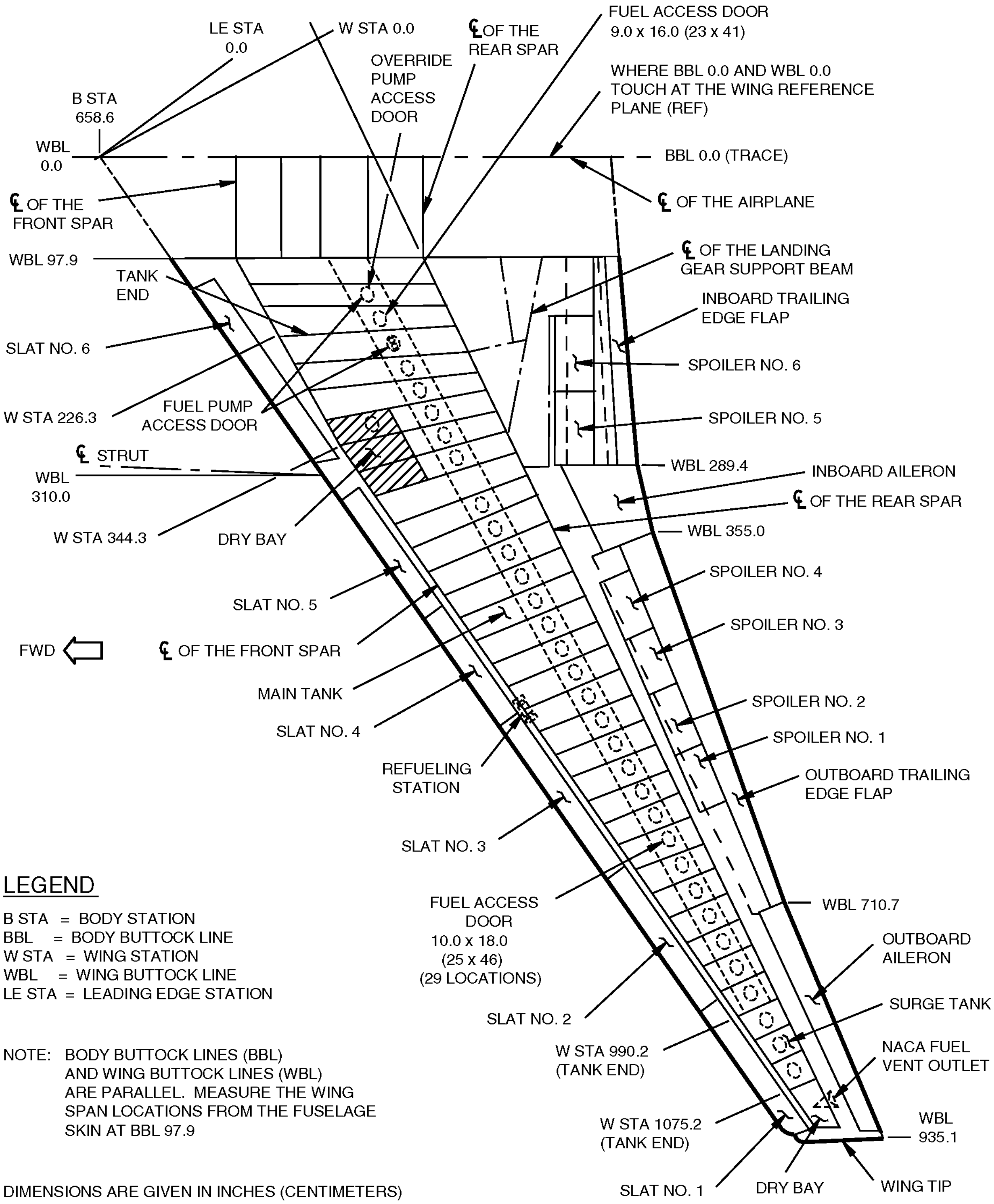


Figure 1-15 WING CENTERLINE DIAGRAM - 767-200, -300, -300ER



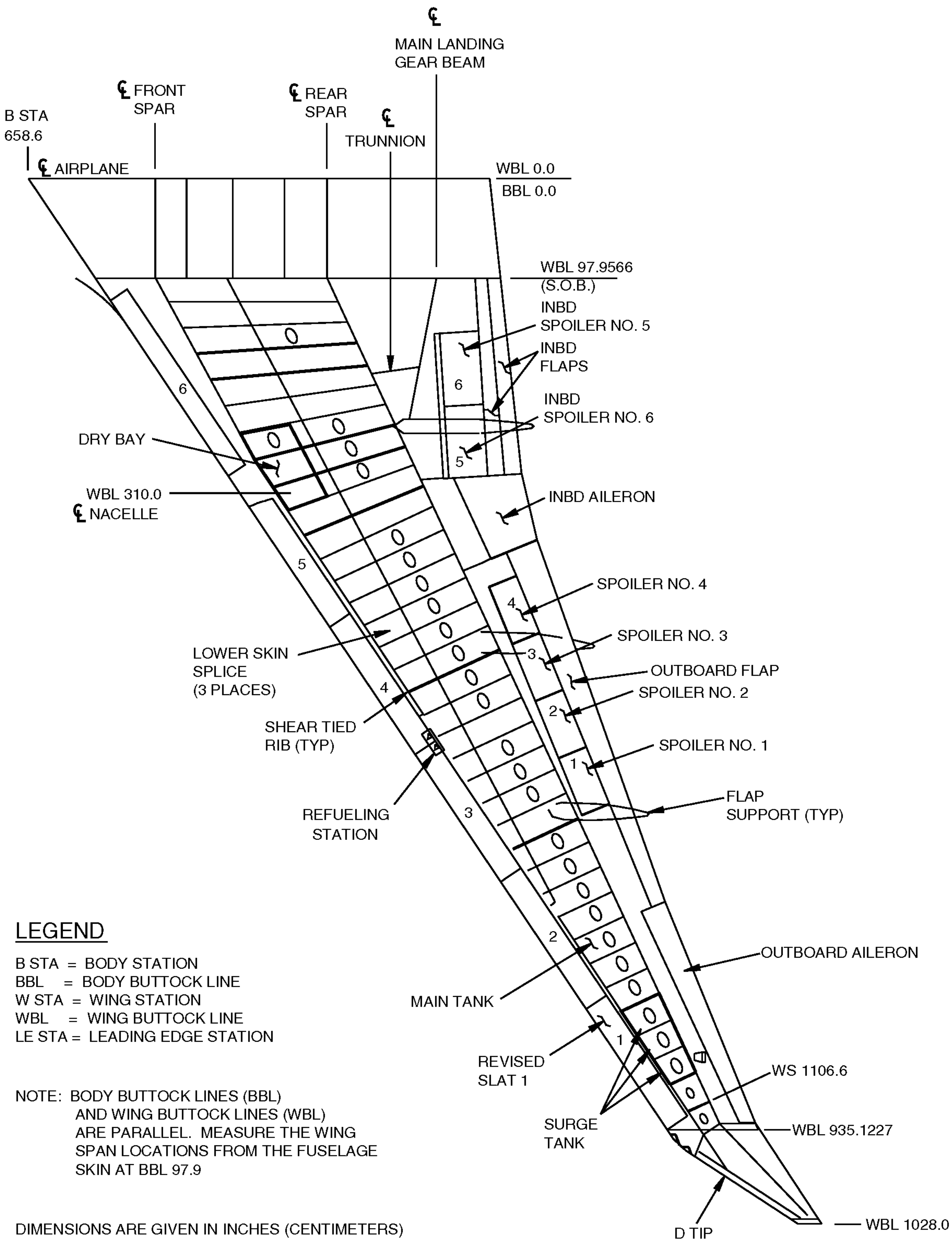
LEGEND

B STA = BODY STATION
BBL = BODY BUTTOCK LINE
W STA = WING STATION
WBL = WING BUTTOCK LINE
LE STA = LEADING EDGE STATION

NOTE: BODY BUTTOCK LINES (BBL) AND WING BUTTOCK LINES (WBL) ARE PARALLEL. MEASURE THE WING SPAN LOCATIONS FROM THE FUSELAGE SKIN AT BBL 97.9

DIMENSIONS ARE GIVEN IN INCHES (CENTIMETERS)

Figure 1-16 WING CENTERLINE DIAGRAM - 767-400ER



LEGEND

B STA = BODY STATION
BBL = BODY BUTTOCK LINE
W STA = WING STATION
WBL = WING BUTTOCK LINE
LE STA = LEADING EDGE STATION

NOTE: BODY BUTTOCK LINES (BBL) AND WING BUTTOCK LINES (WBL) ARE PARALLEL. MEASURE THE WING SPAN LOCATIONS FROM THE FUSELAGE SKIN AT BBL 97.9

DIMENSIONS ARE GIVEN IN INCHES (CENTIMETERS)

Figure 1-17 VERTICAL STABILIZER CENTERLINE DIAGRAM

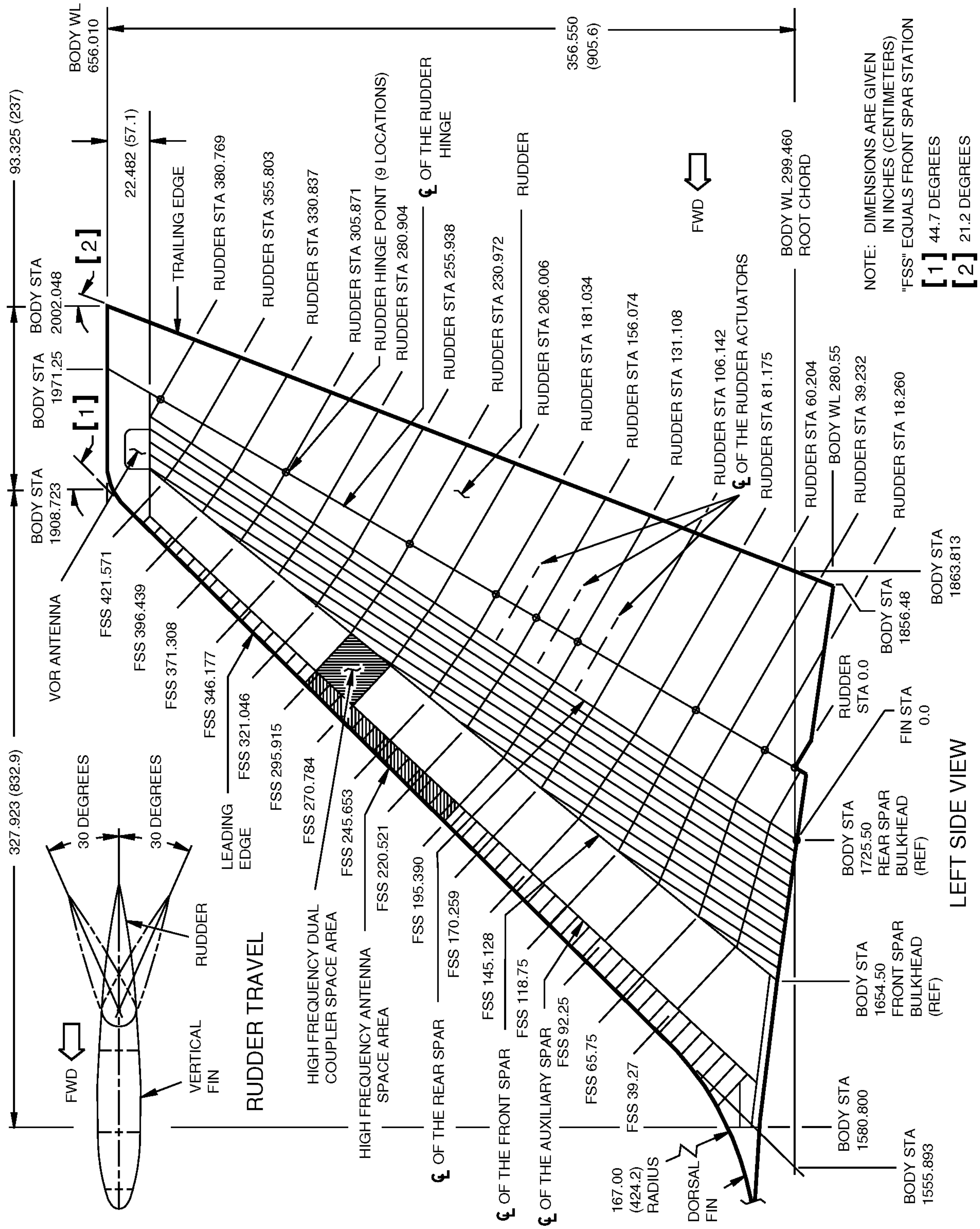
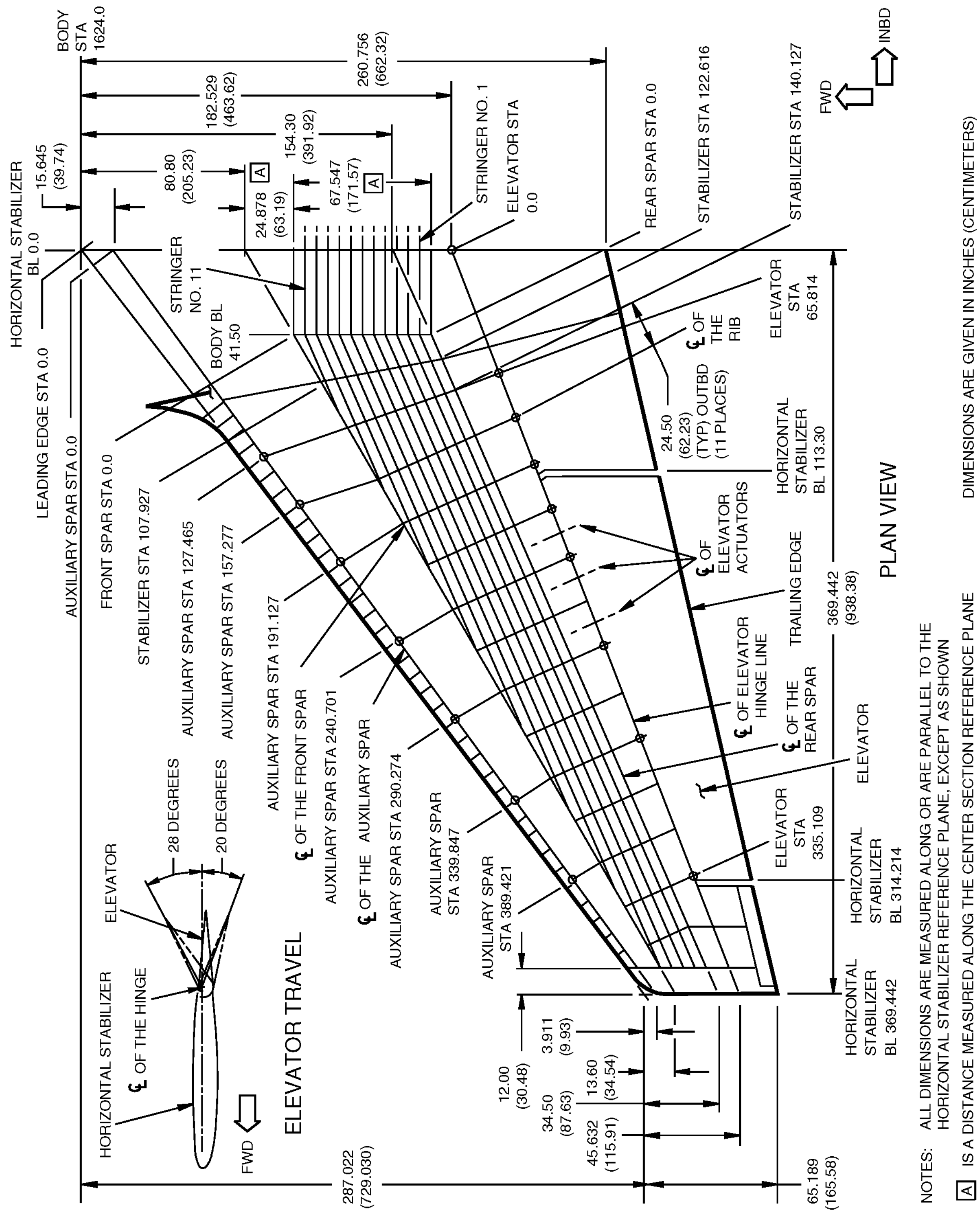


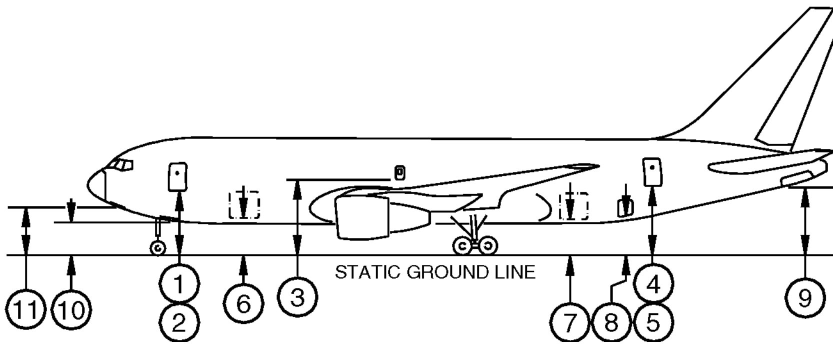
Figure 1-18 HORIZONTAL STABILIZER CENTERLINE DIAGRAM



1-10-5 Door Locations and Heights Above Ground

1. This section contains information about the dimensions and heights of the various doors and hatches from ground level on the 767 airplane. The following illustrations, Figure 1-19 through Figure 1-22, provide door locations and heights above ground. Ground clearance information is important to airplane recovery planning.

Figure 1-19 DOOR LOCATIONS AND HEIGHTS ABOVE GROUND - 767-200, -200ER



POINT	DESCRIPTION	SIZE (H x W) INCHES (CM)	BODY COORDINATES			HEIGHTS ABOVE GROUND, NORMAL LOADING	
			STA*[1]	BL	WL	MIN	MAX
1	Forward Entry Door	74 x 42 (188 x 107)	317	90L	200	161.0 (409)	175.5 (446)
2	Forward Service Door	72 x 42 (183 x 107)	317	90R	200	161.0 (409)	175.5 (446)
3	Mid Cabin Escape Hatch	38 x 20 (97 x 51)	871.5	98R,L	216.5	180.5 (458)	187.0 (475)
4	Aft Entry Door	74 x 42 (188 x 107)	1510.5	94L	200	160.4 (407)	174.1 (442)
5	Aft Service Door	72 x 42 (183 x 107)	1510.5	94R	200	160.4 (407)	174.1 (442)
6	Forward Lower Lobe Cargo Door	69 x 70 (175 x 178)	577.5	57R	126.4	88.6 (225)	99.1 (252)
	Wide Forward Lower Lobe Cargo Door *[2]	69 x 134 (175 x 340)	548	57R	126.4	88.6 (225)	99.1 (252)
7	Aft Lower Lobe Cargo Door	69 x 70 (175 x 178)	1308	57R	126.4	88.8 (226)	98.8 (251)
8	Bulk Cargo Door	48 x 38 (122 x 97)	1439	57L	128.8	90.2 (229)	102.2 (260)
9	Auxiliary Power Unit Service Door, Tapered	78 x 62 (198 x 157)	1832	0.0	194.2	153.3 (389)	171.4 (435)
10	Electrical/Electronic Bay Access Door	18.5 x 23 (47 x 58)	323.6	0.0	112.8	74.3 (189)	87.9 (223)

Figure 1-19 DOOR LOCATIONS AND HEIGHTS ABOVE GROUND - 767-200, -200ER (Continued)

POINT	DESCRIPTION	SIZE (H x W) INCHES (CM)	BODY COORDINATES			HEIGHTS ABOVE GROUND, NORMAL LOADING	
			STA*[1]	BL	WL	MIN	MAX
11	Fwd Access Door	18 x 19.1 (46 x 49)	164.8	0.0	151.3	111.3 (282.8)	118.4 (300.8)

*[1] AT THE CENTERLINE OF THE DOOR
*[2] STANDARD ON THE 767ER AND 767F, OPTIONAL ON ALL OTHER MODELS

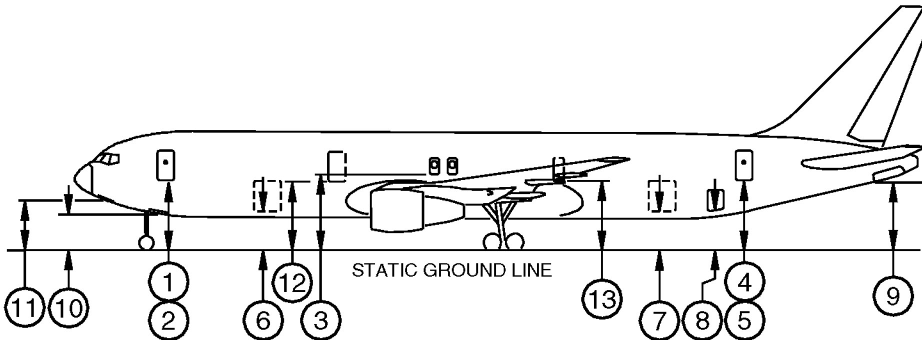
NOTE: 1. ‘‘Normal Loading’’ is loading in the limits of usual serviceable CG envelopes.

2. Dimensions are given in inches (centimeters).

3. ‘‘R’’ Equals a location on the right side.

4. ‘‘L’’ Equals a location on the left side.

Figure 1-20 DOOR LOCATIONS AND HEIGHTS ABOVE GROUND - 767-300, -300ER



POINT	DESCRIPTION	SIZE (H x W) INCHES (CM)	BODY COORDINATES			HEIGHTS ABOVE GROUND, NORMAL LOADING	
			STA*[1]	BL	WL	MIN	MAX
1	Forward Entry Door	74 x 42 (188 x 107)	317	90L	200	162.7 (413)	177.1 (450)
2	Forward Service Door	72 x 42 (183 x 107)	317	90R	200	162.7 (413)	177.1 (450)
3	Mid Cabin Escape Hatches Type III (2) *[2]	38 x 20 (97 x 51)	871.5 915.5	98R,L	216.5	180.9 (459) 181.0 (460)	187.6 (477) 187.1 (475)
4	Aft Entry Door	74 x 42 (188 x 107)	1510.5	94L	200	156.7 (398)	173.1 (440)
5	Aft Service Door	72 x 42 (183 x 107)	1510.5	94R	200	156.7 (398)	173.1 (440)
6	Fwd Lower Lobe Cargo Door	69 x 70 (175 x 178)	577.5	57R	126.4	89.9 (228)	100.7 (256)
	Wide Fwd Lower Lobe Cargo *[3]	69 x 134 (175 x 340)	548	57R	126.4	89.9 (228)	100.7 (256)
7	Aft Lower Lobe Cargo Door	69 x 70 (175 x 178)	1308	57R	126.4	86.0 (218)	98.6 (250)
8	Bulk Cargo Door	48 x 38 (122 x 97)	1439	57L	128.8	86.6 (220)	101.6 (258)
9	Auxiliary Power Unit Service Door, Tapered	78 x 62 (198 x 157)	1832	0.0	194.2	146.3 (372)	168.7 (428)
10	Electrical/Electronic Bay Access Door	18.5 x 23 (47 x 58)	323.6	0.0	112.8	75.5 (192)	89.2 (227)
11	Fwd Access Door	18 x 19.1 (46 x 49)	164.8	0.0	151.3	111.3 (282.8)	118.4 (301)

Figure 1-20 DOOR LOCATIONS AND HEIGHTS ABOVE GROUND - 767-300, -300ER (Continued)

POINT	DESCRIPTION	SIZE (H x W) INCHES (CM)	BODY COORDINATES			HEIGHTS ABOVE GROUND, NORMAL LOADING	
			STA *[1]	BL	WL	MIN	MAX
12	Mid Cabin Entry Door Type A *[4]	74 x 42 (188 x 107)	654 + 67.7	98R,L	200	161 (409)	176 (447)
13	Aft Cabin Escape Door Type I *[4]	62 x 24 (157.5 x 61)	1168.2	98R,L	200	158.7 (403)	174.4 (443)

*[1] AT THE CENTERLINE OF THE DOOR
*[2] OPTIONAL TO THE MID CABIN DOOR (POINT 12) AND THE AFT CABIN ESCAPE DOOR (POINT 13)
*[3] STANDARD ON THE 767ER AND 767F, OPTIONAL ON ALL OTHER MODELS
*[4] OPTIONAL TO THE ESCAPE HATCHES (POINT 3)

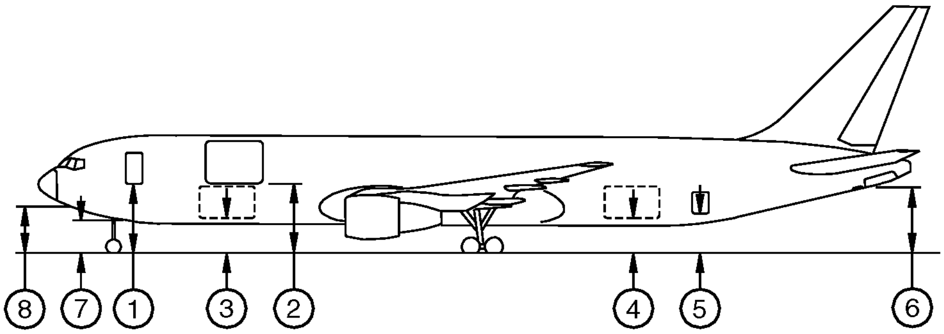
NOTE: 1. ‘‘Normal Loading’’ is loading in the limits of usual serviceable CG envelopes.

2. Dimensions are given in inches (centimeters).

3. ‘‘R’’ Equals a location on the right side.

4. ‘‘L’’ Equals a location on the left side.

Figure 1-21 DOOR LOCATIONS, SIZES AND HEIGHTS ABOVE GROUND - 767-300 FREIGHTER



POINT	DESCRIPTION	SIZE, (H x W) INCHES (CM)	BODY COORDINATES			HEIGHTS ABOVE GROUND, NORMAL LOADING	
			STA *[1]	BL	WL	MIN	MAX
1	Forward Entry Door	74 X 42 (188 X 107)	317	90L	200	161.8 (411.0)	176.7 (448.8)
2	Main Deck Cargo Door	103 X 134 (262 X 340)	562	94L	201.29*[2]	163.7 (415.8)	175.7 (446.3)
3	Fwd Lower Lobe Cargo Door *[3]	69 X 134 (175 X 340)	548	57R	126.4	89.2 (226.6)	100.8 (256.0)
4	Aft Lower Lobe Cargo Door	69 X 134 (175 X 340)	1274 + 253	57R	126.4	88.9 (225.8)	99.6 (253.0)
5	Bulk Cargo Door	45 X 38 (114 X 97)	1439 + 253	57L	128.8	88.6 (225.0)	103.3 (262.4)
6	APU Service Door, Tapered	78 X 62 (198 X 157)	1832 + 253	0.0	194.2	147.5 (374.7)	171.9 (436.6)
7	E/E Bay Access Door	18.5 X 23 (47 X 58)	323.6	0.0	112.8	74.6 (198.5)	89.4 (227.1)
8	Forward Access Door	18 X 19.1 (46 X 49)	164.8	0.0	151.3	112.4 (285.5)	129.5 (328.9)

*[1] AT THE CENTERLINE OF THE DOOR
*[2] THE WATERLINE FOR THE MANUAL CARGO HANDLING SYSTEM TRANSFER PLANE. THE GENERAL MARKET FREIGHTER WATERLINE IS 202. THE MINIMUM HEIGHT WILL BE 164.4 (417.6) AND THE MAXIMUM WILL BE 176.5 (448.3)
*[3] THE WIDE FORWARD LOWER LOBE CARGO DOOR IS STANDARD ON THE FREIGHTER MODEL.

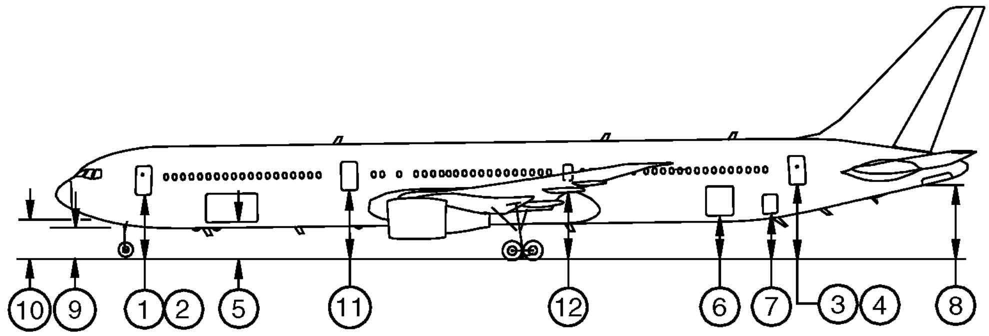
NOTE: 1. ‘‘Normal Loading’’ is loading in the limits of usual serviceable CG envelopes.

2. Dimensions are given in inches (centimeters).

3. ‘‘R’’ Equals a location on the right side.

4. ‘‘L’’ Equals a location on the left side.

Figure 1-22 DOOR LOCATIONS, SIZES, AND HEIGHTS ABOVE GROUND - 767-400ER



POINT	DESCRIPTION	SIZE (H x W) INCHES (CM)	BODY COORDINATES			HEIGHTS ABOVE GROUND, NORMAL LOADING	
			STA	BL	WL	MIN	MAX
1	Fwd Entry Door	74 x 42 (188 x 107)	317	90L	200	162.6 (413.0)	172.7 (438.7)
2	Fwd Service Door	72 x 42 (183 x 107)	317	90R	200	162.6 (413.0)	172.7 (438.7)
3	Aft Entry Door	74 x 42 (188 x 107)	1510.5	94L	200	193.2 (490.7)	203.9 (517.9)
4	Aft Service Door	72 x 42 (183 x 107)	1510.5	94R	200	193.2 (490.7)	203.9 (517.9)
5	Large Fwd Cargo Door	69 x 134 (175 x 340)	548	57R	126.4*[1]	93.7 (238.0)	102.6 (260.6)
6	Aft Cargo Door	69 x 70 (175 x 178)	1308	57R	126.4*[1]	116.4 (295.6)	125.8 (319.5)
7	Bulk Cargo Door	45 x 38 (114 x 97)	1439	57L	128.8	120.9 (307.1)	131.1 (333.0)
8	APU Service Door, Tapered	78 x 62 (198 x 157)	1832	0.0	194.2	192.4 (488.7)	205.3 (522.2)
9	E/E Bay Access Door	18.5 x 23 (47 x 58)	323.6	0.0	112.8	76.7 (194.8)	85.6 (217.4)
10	Forward Access Door	18.0 x 19.1 (46 x 49)	164.8	0.0	151.3	110.8 (281.4)	121.7 (309.1)
11	Mid Cabin, Type A Door	74 x 42 (188 x 107)	654 + 67.7	97R,L	200	173.5 (440.7)	180.8 (459.2)
12	Aft Of Wing, Type 1 Door	60 x 24 (152 x 61)	1168.2	97R,L	200	184.0 (467.4)	190.6 (484.1)

*[1] WL OF CARGO COMPARTMENT CONVEYOR PLANE

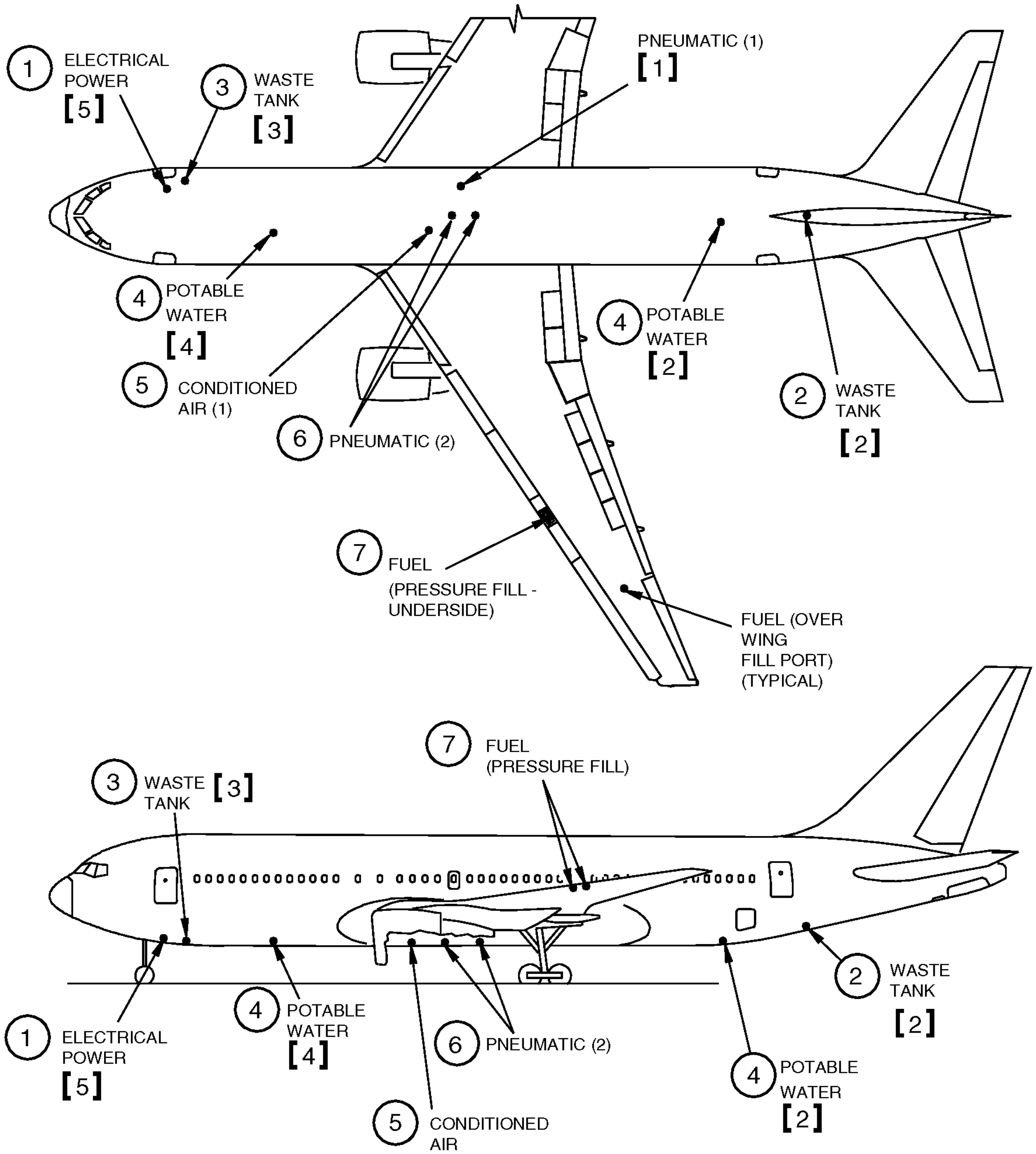
NOTE: 1. ''Normal Loading'' is loading in the limits of usual serviceable CG envelopes.

2. ''R'' Equals a location on the right side and ''L'' equals a location on the left side.

1-10-6 Ground Service Point Locations

1. This section subject provides information on the various ground servicing points on the 767 airplane. Knowing the locations of the ground service points for removal of various fluids is vital to reducing the weight of the airplane in a recovery scenario. Refer to the following illustrations, Figure 1-23 through Figure 1-25, for service point locations and capacities for the 767 airplane.

Figure 1-23 LOCATION OF GROUND SERVICE POINTS



[1] A THIRD CONNECTOR IS AVAILABLE AS A CUSTOMER OPTION
[2] PASSENGER MODELS ONLY
[3] 767-300 FREIGHTER ONLY
[4] 767-400 ER ONLY
[5] TWO EXTERNAL POWER RECEPTACLES ON 767-400ER

Figure 1-24 GROUND SERVICE POINTS

767-200							
POINT	DESCRIPTION		BODY COORDINATES			HEIGHTS ABOVE GROUND, NORMAL LOADING IN (CM)	
			STA	BL	WL	MIN	MAX
1	Electrical Power		316.5	40.0R	120.0	81.5 (207)	95.3 (242)
2	Waste *[1]		1572.0	0.0	140.4	99.9 (254)	114.8 (292)
3	Waste *[2]		403.1	8.3R	110.0	N/A	N/A
4	Potable Water *[1]	Aft	1389.0	3.5L	110.0	68.8 (175)	79.5 (202)
		Fwd *[3]	639.7	3.5L	106.8	69.4 (176)	79.0 (201)
		Aft *[4]	1389.0	2.07L	111.9	N/A	N/A
		Fwd *[4]	654A +123	1.9L	109.3	N/A	N/A
5	Conditioned Air		792.0	53.6L	118.4	82.0 (208)	89.4 (227)
6	Pneumatic Air		820.5 832.5	36.0L	113.0	76.9 (195)	83.9 (213)
7	Fuel Connections		1048.0	537.0L	202.0	161.5 (410)	173.7 (441)
			1063.0	553.0L	204.0	163.2 (415)	175.9 (447)

*[1] PASSENGER MODELS ONLY
*[2] 767-300 FREIGHTER ONLY
*[3] DRAIN ONLY
*[4] 767-400ER ONLY

Figure 1-24 GROUND SERVICE POINTS (Continued)

767-300							
POINT	DESCRIPTION		BODY COORDINATES			HEIGHTS ABOVE GROUND, NORMAL LOADING IN (CM)	
			STA	BL	WL	MIN	MAX
1	Electrical Power		316.5	40.0R	120.0	83.0 (211)	96.9 (246)
2	Waste *[1]		1572.0	0.0	140.4	96.3 (245)	113.8 (289)
3	Waste *[2]		403.1	8.3R	110.0	N/A	N/A
4	Potable Water *[1]	Aft	1389.0	3.5L	110.0	65.3 (166)	79.3 (201)
		Fwd *[3]	639.7	3.5L	106.8	70.4 (179)	80.6 (205)
		Aft *[4]	1389.0	2.07L	111.9	N/A	N/A
		Fwd *[4]	654A +123	1.9L	109.3	N/A	N/A
5	Conditioned Air		792.0	53.6L	118.4	82.7 (210)	90.0 (229)
6	Pneumatic Air		820.5 832.5	36.0L	113.0	77.4 (197)	84.3 (214)
7	Fuel Connections		1048.0	537.0L	202.0	162.0 (411)	173.4 (440)
			1063.0	553.0L	204.0	163.7 (416)	175.4 (446)

*[1] PASSENGER MODELS ONLY
*[2] 767-300 FREIGHTER ONLY
*[3] DRAIN ONLY
*[4] 767-400ER ONLY

Figure 1-24 GROUND SERVICE POINTS (Continued)

767-300F							
POINT	DESCRIPTION		BODY COORDINATES			HEIGHTS ABOVE GROUND, NORMAL LOADING IN (CM)	
			STA	BL	WL	MIN	MAX
1	Electrical Power		316.5	40.0R	120.0	81.77 (208)	96.67 (246)
2	Waste *[1]		1572.0	0.0	140.4	N/A	N/A
3	Waste *[2]		403.1	8.3R	110.0	72.17 (183)	85.82 (218)
4	Potable Water *[1]	Aft	1389.0	3.5L	110.0	N/A	N/A
		Fwd *[3]	639.7	3.5L	106.8	N/A	N/A
		Aft *[4]	1389.0	2.07L	111.9	N/A	N/A
		Fwd *[4]	654A +123	1.9L	109.3	N/A	N/A
5	Conditioned Air		792.0	53.6L	118.4	82.92 (211)	89.2 (227)
6	Pneumatic Air		820.5 832.5	36.0L	113.0	77.65 (197)	83.52 (212)
7	Fuel Connections		1048.0	537.0L	202.0	162.0 (411)	173.4 (440)
			1063.0	553.0L	204.0	163.7 (416)	175.4 (446)

*[1] PASSENGER MODELS ONLY
*[2] 767-300 FREIGHTER ONLY
*[3] DRAIN ONLY
*[4] 767-400ER ONLY

Figure 1-24 GROUND SERVICE POINTS (Continued)

767-400ER							
POINT	DESCRIPTION		BODY COORDINATES			HEIGHTS ABOVE GROUND, NORMAL LOADING IN (CM)	
			STA	BL	WL	MIN	MAX
1	Electrical Power		316.5	40.0R	120.0	82.6 (209.8)	92.7 (235.4)
2	Waste *[1]		1572.0	0.0	140.4	134.1 (340.6)	145.3 (369.0)
3	Waste *[2]		403.1	8.3R	110.0	N/A	N/A
4	Potable Water *[1]	Aft	1389.0	3.5L	110.0	N/A	N/A
		Fwd *[3]	639.7	3.5L	106.8	N/A	N/A
		Aft *[4]	1389.0	2.07L	111.9	103.2 (262.1)	113.1 (287.3)
		Fwd *[4]	654A + 123	1.9L	109.3	81.2 (206.2)	88.9 (225.8)
5	Conditioned Air		792.0	53.6L	118.4	95.7 (243.1)	102.0 (259.1)
6	Pneumatic Air		820.5 832.5	36.0L	113.0	90.9 (230.9)	97.3 (247.1)
	(Optional Connector)		824.5	55.0R	114.0	92.0 (233.7)	98.1 (249.2)
7	Fuel Connections		1048.0	537.0L	202.0	181.1 (460.0)	189.2 (480.5)
			1063.0	553.0L	204.0	183.1 (465.1)	191.4 (486.1)

*[1] PASSENGER MODELS ONLY
*[2] 767-300 FREIGHTER ONLY
*[3] DRAIN ONLY
*[4] 767-400ER ONLY

Figure 1-25 SERVICING CAPACITIES

ITEM	CONNECTION (ON AIRPLANE)	CONNECTION (ON GSE)	LINE SIZE	CAPACITY	FLOW RATE	PRESSURE
PRECONDITIONED AIR	MS33562	AS REQUIRED	8 IN. (20 CM)	60 TONS (54.4 M TONS)	360 LB/MIN (163 KG/MIN)	48 IN. H_2O (122 CM) MAX
ELECTRICAL GROUND POWER	AN3114 - 1B OR MS90362-3	AN3430 OR MS25486	- - - -	90 KVA [6]	- - - -	- - - -
FUEL	S344T001-12 (2 STANDARD AND 4 OPTIONAL) OR 2790409-101 BY PARKER HANNIFIN	MS29520-1 OR F117 BY THIEM OR EQUIVALENT (2 STANDARD AND 4 OPTIONAL)	2-1/2 IN. (6.4 CM)	-200, -300 16,700 GAL (63216 L) -200ER 20,450 GAL (77411 L) -300ER, -400ER 24,140 GAL (91380 L)	800 GPM (3028 LPM) 800 GPM (3028 LPM) 1,000 GPM (3785 LPM)	
AIR START	KAISER/ROYLYN 4663-8 (2)	KAISER/ROYLYN 7950-54	3-1/2 IN. (8.9 CM)	- - - -	[1]	[2]
LAVATORIES [4]	KAISER/ROYLYN 2651-216 DRAIN KAISER/ROYLYN 4709-6 FLUSHING AND PRECHARGE (2)	KAISER/ROYLYN 2651-133 DRAIN KAISER/ROYLYN 0031-0118 FLUSHING AND PRECHARGE	4 IN. (10 CM) 1 IN. (2.5 CM)	WASTE -200/-300 116 GAL (439 L) -400ER 146 GAL (552 L) FLUSHING 50 GAL (189 L)	FLUSHING MINIMUM 10 GPM (38 LPM) PRECHARGE 12 GPM (45 LPM)	FLUSHING 30-75 PSIG (2.1-5.25 KG/SQ CM)
LAVATORIES [5]	SHAW AERO 1010/000C-M DRAIN KAISER/ROYLYN 0016-0015-5 FLUSHING AND PRECHARGE	KAISER/ROYLYN 2651-133 DRAIN KAISER/ROYLYN 0031-0118 FLUSHING AND PRECHARGE	4 IN. (10.2 CM) 1 IN. (2.5 CM)	11 GAL (41 L)	FLUSHING 10 GPM (38 LPM)	FLUSHING 30 PSIG (2.1 KG/SQ CM)
POTABLE WATER [4]	TA MFG CORP V4739J012C20 -400ER KAISER/ROYLYN 0016-0015-6	TA MFG CORP V1041J012A00 [3]	3/4 IN. (1.9 CM)	-200 109 GAL (413 L) ER & -300 149 GAL (564 L) -400ER 224 GAL (848 L)	15 GPM (57 LPM)	25-50 PSIG (1.75-3.50 KG/SQ CM)

NOTE: CONNECTORS ARE TO BE AS LISTED OR EQUIVALENT.

[1] JT9D - 228 LB/MIN (103 KG/MIN)
CF6 - 225 LB/MIN (102 KG/MIN)
RB211-524H - 238 LB/MIN (108 KG/MIN)

[2] JT9D - 49 PSIA (3.4 KG/SQ CM) AT CONNECTION
CF6 - 48 PSIA (3.4 KG/SQ CM) AT CONNECTION
RB211-524H - 50 PSIA (3.5 KG/SQ CM) AT CONNECTION;
STANDARD DAY, SEA LEVEL REQUIREMENT

[3] EQUIVALENT TO KAISER/ROYLYN 1041-12

[4] PASSENGER MODELS ONLY

[5] 767-300 FREIGHTER ONLY

[6] 767-400ER HAS 2 EXTERNAL POWER RECEPTACLES, EACH RATED AT 90 KVA

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1-20 RECOVERY TEAM PERSONS

1-20-1 Recovery Team Persons

1. Each airline can assemble a recovery team. We recommend this. Use persons who have instruction in airplane recovery procedures and operations. Also use persons who can operate recovery equipment. A good team includes the persons that follow:
   A. Head Recovery Person
      (1) Your functions:
         (a) Control the recovery teams (airline and contractors).
         (b) Help the Civil Aviation Authorities and Airport Authorities.
         (c) Coordinate with the News persons and Police persons.
      (2) Your record of work:
         (a) Know Civil Aviation procedures and operations.
         (b) Know Public Relations.
         (c) Know Airport functions.
         (d) You are a Production Manager or a Production Foreman.
   B. Structures Engineer
      (1) Your functions:
         (a) Make an analysis of damage to the airplane.
         (b) Make the decisions about the equipment and the procedures needed to lift the airplane.
         (c) Make the decisions about the equipment and the procedures needed to tow the airplane.
         (d) Make the approvals for the temporary repairs made to the airplane before the recovery operations are started.
      (2) Your record of work:
         (a) Know about strength of materials and metal inspection procedures.
         (b) Know about landing gears and their support structures.
         (c) Know about flap structures and engine support structures.
         (d) You make structural repairs.
   C. Planner of Equipment and Materials
      (1) Your functions:
         (a) Help the Structures Engineer with the equipment and the necessary materials.
         (b) Schedule and install a system that permits all recovery persons to speak to other recovery persons (communication system). This system also permits the recovery team to speak to the airport authority, the police persons and the other airlines. This system also includes a local telephone to permit the team to get materials and equipment.
         (c) Get ground support materials and ground covers when it is necessary.
         (d) Monitor each contractor’s equipment and persons. Monitor each contractor’s time and costs.
      (2) Your record of work:
         (a) Know the locations of airplane recovery equipment.
         (b) Know the name of the person you must speak to for each kit.
         (c) Know about heavy equipment for the movement of material.

(d) Know about equipment to lift the airplane and to tow the airplane.

(e) Know about temporary lease agreements for equipment.

(f) You have used and you know about communication system equipment.

D. Foreman at the Airplane Location

(1) Your functions:

(a) Control the operation, the contractors and the equipment.

(b) Schedule the recovery operation.

(c) Make sure the procedures to remove fuel from the airplane are correct.

(d) Make sure the procedures to seal other airplane systems are correct.

(e) Help the Structures Engineer schedule the procedures to lift and to tow the airplane.

(f) Monitor and control the operations to lift and to make supports for the airplane.

(g) Monitor and control the operations to prepare the ground surface.

(2) Your record of work:

(a) Know about the airplane systems.

(b) You know about and have worked on problems to make the soil stable.

(c) You know about the different parts and types of soil.

(d) You have used cranes, jacks and pneumatic bags.

E. Weight and Balance Engineer

(1) Your functions:

(a) Make an analysis of the airplane weight and balance system for each step of the recovery operation.

(b) Control the removal of the cargo and large components from the airplane.

(2) Your record of work:

(a) Know about the airplane weight and balance procedures.

(b) Know about the movement of cargo into the airplane and off the airplane.

(c) You know about Ground Support Equipment (GSE) tools for the removal of airplane components.

F. Environmental Engineer

(1) Your functions and record of work:

(a) Know about how airplane systems can effect the local environment. This includes fuel systems and cargo.

(b) Know how to work with environmental agencies.

(c) Know local and regional environmental laws and issues.

(d) Know how to apply current methods and technology to solve environmental problems.

2 SURVEY AND PREPARATION

2-00 QUICK REFERENCE GUIDE FOR AIRPLANE RECOVERY

2-00-1 General

1. Use these steps as an aid (guide or checklist) to prepare for an airplane recovery operation.
   A. Before you are on the site:
      (1) Get initial data about the incident.
      (2) Speak to an agent at the airport in the recovery area. Also speak to an agent of the local airline or to your agent.
      (3) Send a person to make a careful inspection of the recovery location.
      (4) Schedule persons, equipment, and manuals.
         (a) Necessary transportation to the location of the incident.
         (b) Necessary hotel rooms (through local agent).
         (c) Necessary documents (visas).
         (d) Necessary finances.
      (5) Make sure you can obtain access to a IATP kit if it is necessary.
   B. When you are on the site:
      (1) Speak to the local authorities (airport and the fire department). Make sure that only persons who are approved can go into the recovery location. Get a location map. Get these data:
         (a) Local environment or habitat (for example, poisionous snakes in high grass).
         (b) Climate (rain, wind, sun, thunderstorms, temperatures).
         (c) Soil (sand, dirt, gravel, clay, rock, moor peat).
         (d) Possible interfaces with primary airline station, airplane manufacturer.
         (e) Telephone
         (f) Telex
         (g) Fax
         (h) Radio
      (2) Make a careful program for airplane recovery.
      (3) Assess potential on-site hazards of the aircraft crash site before proceeding. Develop a plan to clear the hazards in question. Notify all personnel working in the area of these potential hazards and provide protective equipment to have these personnel work in these conditions.
      (4) Get necessary approval from local authorities to start recovery.
      (5) Supply these items:
         (a) Communication interfaces (phones, fax, internet, etc.).
         (b) Movement of persons and equipment.
         (c) Necessary protective portable structures and security fencing to protect equipment and assets.
      (6) Speak with the local airlines, airport authorities and local sources for this material and equipment:
         (a) Heavy equipment and cranes.
         (b) Roads, material for construction.

(c) Timber, gravel, sand, steel plates.

(d) Lights, generators.

(e) Portable shelters.

(7) Speak with local authorities about these problems:

(a) Doctors (First Aid).

(b) Movement of persons to hospitals.

(c) Local health risks.

(d) Protection from bloodborne pathogens.

(e) Environmental hazards and issues.

(8) Calculate the airplane weight and balance.

(9) Remove all possible weight from the airplane.

(a) Examine the manifests for dangerous cargo and hazardous materials.

(b) Use only approved procedures to remove dangerous cargo and to resolve environmental issues.

(c) Remove fuel, and liquids if it is possible.

(d) Remove baggage and cargo if it is possible.

(e) Remove all unwanted and discarded material from the galleys and lavatories (health risks, especially at warm sites).

(10) Monitor the recovery operation.

(a) Make sure that all areas of the recovery program are being worked satisfactorily.

(b) Make sure that all personnel follow all safety precautions.

(c) Make sure that all recovery personnel have been trained in areas such as hazardous materials and bloodborne pathogens.

(11) Remove all necessary airplane parts:

(a) To make the airplane lighter.

(b) To keep wind forces to a minimum.

(c) To obey instructions from local authority (vertical fin).

(12) Start these procedures:

(a) Install tethers.

(b) Lift the airplane.

(c) Move the airplane.

(13) Start these procedures:

(a) Park the airplane in a hangar or a repair area.

(b) Clean the airplane (externally and internally).

(c) Complete the damage report.

Table 2-1 AIRPLANE RECOVERY STEPS

1. SURVEY	2. PLAN	3. PREPARE	4. RECOVER
PRELIMINARY PLANNING ● Organization ● Persons on the recovery team ● Instructions for recovery team	QUICK RECOVERY ● Important ● Not Important	ASSEMBLE ● Equipment ● Manpower	STABILIZE/LIFTING ● Cables/Slings ● Jacks ● Airbags ● Shoring ● Inner communications
ASSESS ON-SITE HAZARDS ● Develop a plan ● Notify personnel ● Clean up hazards ● Provide protective clothing, equipment & training	WEIGHT AND BALANCE ● Calculate	DEFUEL ● Equipment operations ● Center of gravity ● Storage/disposal	TETHER THE AIRPLANE ● Attach tethers to the airplane ● Attach tethers to the ground or equivalent
AIRPLANE CONDITION ● Attitude ● Landing Gear ● Structural Damage ● Missing Items ● Unserviceable Items ● Cargo and Fuel ● Recover or Scrap	PLAN WEIGHT REDUCTION ● Unload Cargo ● Defuel ● Remove Engines ● Remove Components	WEIGHT AND CG MANAGEMENT ● Calculate CG ● Remove baggage ● Unload Cargo ● Move fuel to control the CG	LIFT ● Jack ● Lift with Air Bags ● Lift with Cranes
SITE ● Terrain ● Soil Characteristics ● Access Routes ● Environmental issues	SECURITY ● Fire ● Theft ● Control of persons ● Safety ● Protection from contaminants ● Equipment in/out of area	COMPONENT REMOVAL ● Ground support equipment ● Equipment to lift the airplane components	LANDING GEAR ● Operable ● Non-operable ● Extend
WEATHER ● Current ● Forecast	MEDIA ● Assign a media spokesperson ● Coordinate with headquarters ● Brief all team members on media relations	AIRPLANE REPAIRS ● As necessary for the lift and move	MOVE ● Tow on Gear ● Winch ● Carry on Trailer ● Transportation system ● Move by Crane ● Inner communications

Table 2-1 AIRPLANE RECOVERY STEPS (Continued)

1. SURVEY	2. PLAN	3. PREPARE	4. RECOVER
EQUIPMENT AVAILABILITY • Preparation • Lifting • Moving • Stabilizing • Provide protective equipment/clothing and training	RECOVERY PLAN • Remove Weight • Prepare Site • Necessary repairs • Lift • Move • Stabilize • Location to move airplane	PREPARE SITE • Temporary housing • Clear • Excavate/Fill • Access roads to support airplane movement • Stabilize • Environmental issues	PARKING • Support for repairs • Tiedowns • Temporary shelter or hanger for the airplane
MANPOWER • Organization • Availability • Number • Skills • Instructions	EQUIPMENT REQUIRED • Fly in equipment • Local equipment *[1] SCHEDULE REQUIRED • Personnel • Operation	PREPARE ROUTE • Clear • Excavate • Fill • Stabilize	
	COMMUNICATION • Radio • Telephone • Cellular phone • FAX • Computer links		
	COMPONENT PROTECTION • Remove and store deployed slides/rafts		

*[1] SEE CHAPTER 5

2-10 AIRPLANE DAMAGE AND TERRAIN CONDITIONS

2-10-1 Airplane Damage Analysis

1. Before you start the damage analysis or other work on the airplane, use the precautions that follow.

   NOTE: See the Maintenance Manual for the safe procedures.

   CAUTION: DISCUSS ANY ON-SITE HAZARDS WITH ALL PERSONNEL WORKING IN THOSE AREAS. CLEAR ON-SITE HAZARDS AND PROVIDE PERSONNEL WITH PROPER PROTECTIVE EQUIPMENT, CLOTHING AND ANY NECESSARY TRAINING.

   CAUTION: DISCONNECT THE AIRPLANE BATTERY. THEN REMOVE IT FROM THE AIRPLANE. DO THIS BEFORE YOU EXAMINE THE AIRPLANE OR START TO REPAIR IT. IF YOU CANNOT REMOVE THE BATTERY, YOU MUST CUT (AND TAPE) THE BATTERY GROUND CABLE AT A SATISFACTORY POINT. THIS POINT YOU MUST REMOVE THE POWER TO THE ELECTRICAL BUSSES.

   CAUTION: MAKE THE LANDING GEARS STABLE. INSTALL DOWNLOCKS IN ALL LANDING GEARS IN THE EXTENDED POSITION.

   CAUTION: MAKE THE AIRPLANE ELECTRICALLY SAFE. SUPPLY ELECTRICAL PROTECTION OR A GROUND TO THE AIRPLANE. YOU MUST USE THE CORRECT EQUIPMENT (A STEEL ROD THAT IS COPPER-PLATED AND A CABLE ASSEMBLY).

   CAUTION: MAKE THE HYDRAULIC SYSTEMS SAFE. REMOVE THE PRESSURE FROM THE HYDRAULIC SYSTEMS.

   CAUTION: MAKE THE AREA SAFE FROM AN OXYGEN EXPLOSION. REMOVE THE OXYGEN BOTTLES FROM THE AIRPLANE.

   CAUTION: CLEAN THE GROUND SURFACE. REMOVE ALL FUEL THAT IS ON THE GROUND NEAR THE AIRPLANE. REMOVE ALL OTHER FLAMMABLE LIQUIDS.
2. After a fire, make sure that there is a good flow of air through the airplane. Use air machines (blowers) and open all doors, windows and hatches.
3. An important first step is a full analysis of the condition of the airplane. You can look for the damage shown in the crew reports. You can also make a check of the damage shown on the incident report and other (insurance) reports. Then you have some indication of the necessary repairs you must make before you can start the recovery operation. You also know the type of procedures you must use in the operation.
4. After you see the apparent damage, examine the structure of the airplane. Try to make an estimate of the damage that extends to the other parts of the airplane.
5. Examine buckles or other skin changes in the wing or fuselage skin panels. Such changes at the structural joints or heavy fittings are indications of internal damage. Look for damaged rivets, bolts, or fasteners (tipped, sheared or loose). Look for damage on fairings and other parts that are not structural. These changes can show damage to internal structures.
6. In incidents where the landing gear is folded, it may be possible to use the gear again. After you lift the airplane, extend the gear if it is possible. Examine the gear structure carefully. Make sure that the gear structure can hold the airplane weight before you lower the airplane down on the gears.
   A. If the airplane has landing gear that are locked in the up position, you can possibly use them again. Then you can tow the airplane on its landing gear to the repair area.

B. If the gears folded after the landing, you possibly have a damaged side strut assembly (brace) or a damaged drag strut assembly (brace). Frequently, you can hold the gear with a temporary strut assembly (brace). Then you can tow the airplane to the repair area.

C. If there is no gear(s) attached to the airplane, you can possibly install the gear again with some temporary braces. You can install a new gear. Alternatively, you can use a flatbed trailer or equivalent to hold the body or the wing of the airplane. Then you can tow the airplane.

NOTE: Adequate support must be provided to prevent excessive loading on airplane wing and body skin panels and structure. Refer to chapter three for additional information on allowable skin pressures.

7. Find the best procedure to lift the airplane. SECTION 3-30 shows the procedures that are possible (jacking, pneumatic bags or mobile cranes).
8. Check landing gear fuse pins if the airplane moves along rough ground (off the runway), a fuse pin for the main landing gear can break. Make sure that all fuse pins are good. Replace the bad fuse pins. There are seven fuse pins for the main gear (see Figure 2-1):

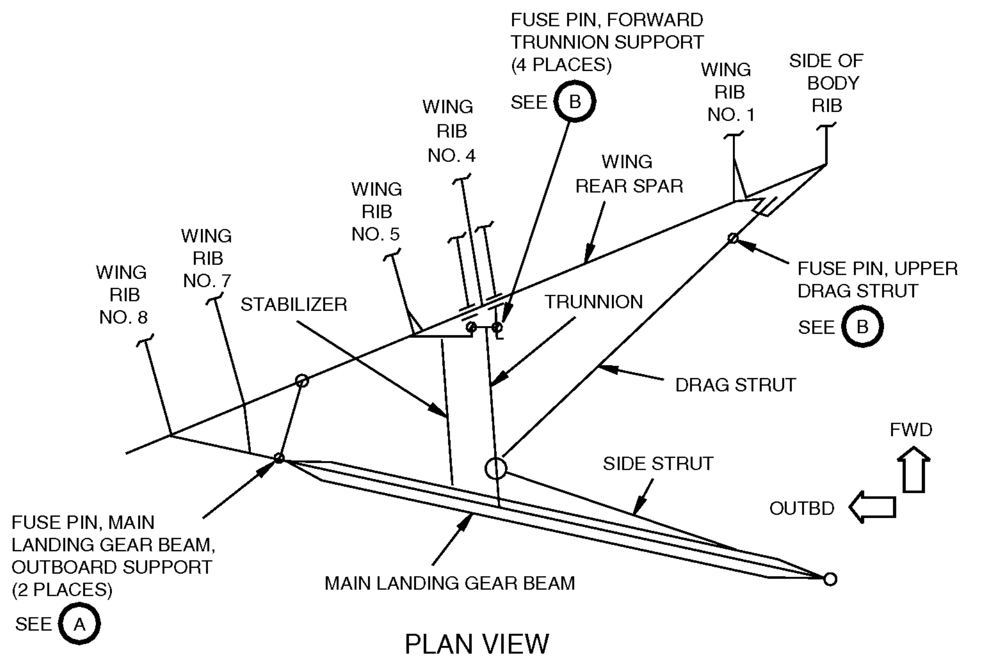
   A. One in the Upper Drag Strut.

   B. Four in the Forward Trunnion Bearing "H" Fitting.

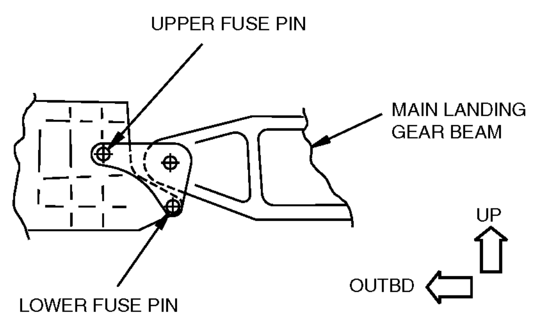
   C. Two in the outboard end of Gear Beam.
9. If the landing gear is damaged, the repair can be as easy as a component replacement. A new landing gear can also be necessary. You must complete all repairs for the landing gear before you apply the airplane loads. Do not tow the airplane before the gear repairs are completed.

   NOTE: Examine the Nose and Main Landing Gears for a hard landing (see the Maintenance Manual).
10. It can be possible that the airplane is too badly damaged to make a full recovery. You must make a decision about which of the components you can possibly keep. If you keep some components, you must do a different type of an operation (salvage operation). The procedures for that type of an operation are not included in this document.

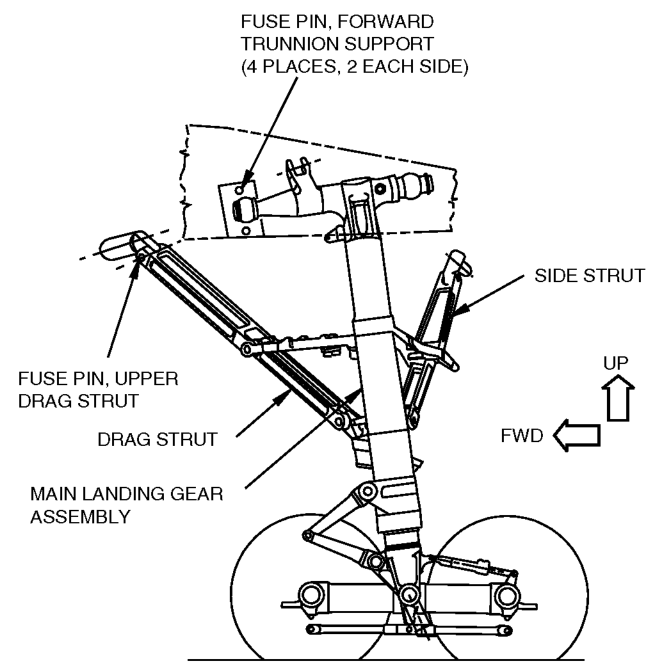
Figure 2-1 MAIN LANDING GEAR FUSE PIN LOCATION (767-200/300 SHOWN, -400ER SIMILAR)



PLAN VIEW
LEFT MAIN LANDING GEAR
INSTALLATION



A



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2-10-2 Examine the Terrain and Weather Conditions

1. Weather and terrain conditions are important. These conditions (plus any structural damage) help you in your selection of procedures to move the airplane.
2. Look at the terrain near the airplane. The surface of the ground must be almost level. This level surface becomes a temporary road to move the airplane. You must make (or grade) the road if it is necessary (see SUBJECT 2-10-4).
3. Weather conditions can cause problems for the recovery. In high winds, you must attach the airplane to the ground with tethers. In some locations, you must use irrigation pumps or drainage ditches to remove unwanted water.

   NOTE: Do not move the airplane in high winds (above 35 m.p.h. 30 knots or 56 km per hour).
4. It is necessary to know the ground strength properties to find the best equipment or materials for your operation. This can include the jacks, tow vehicles, winch vehicles, ground cable fasteners (anchors), supports (cribs), or cover materials for the ground.
5. Use an available special person (Civil Engineer or Ground Analyst) to find the necessary ground properties. Do this only if you have sufficient time.
6. If you cannot use a special person, you must make the decisions about the procedures. Can you tow (or winch) the airplane? Can you use jacks? Here are the most important items that you must know.
   A. The full damage to the landing gears.
   B. The vertical depth of the change in the ground surface at the wheels (wheel ruts).
7. Wheel Rut Depths
   A. You must measure the rut depth at approximately 12 in. (30 cm) behind the main landing gear.
   B. The tables in Figure 2-2 shows the maximum permitted depth that you can have to tow or winch the airplane. This table also gives the approximate weight of the airplane.
8. The following is the procedure for the wheel rut depth calculation:
   A. The load that you use to tow or winch the airplane is an important item. It cannot be more than the maximum permitted load on the tow fitting of the main gear. See Figure 4-11.
   B. You must first find the load on each main gear. If the airplane has a level attitude, have the same approximate load on each main gear. If the airplane attitude is not level, you must make an estimate of the different loads on each gear. You can use the pressure gage on each gear strut to do this.
   C. Use the largest gear load for the rut depth chart. The depth that you have at the airplane wheel cannot be more than the depth in the chart. If your depth is more than this, you must prepare the ground surface before you can tow the airplane. See CHAPTER 4 for the procedures to increase the load capacity of the ground.

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2-10-3 Soil Analysis

1. The supporting load capacity of the soil is very important when considering the planning of an airplane recovery. You must know the supporting capacity before towing, tethering or using supports with the airplane.

   NOTE: Stable soil conditions and adequate load bearing surfaces for the entire towing and or winching path is absolutely necessary to accomplish a safe and successful airplane movement.

2. We use a standard named the California Bearing Ratio (CBR) to compare the different soil conditions. This standard compares the soil strength to the strength of some (crushed) stone (shown as 100). Figure 2-6 shows the strength (CBR) for different soil conditions.
3. Examine the load capacity of the soil, including the following.
   A. The surface hardness and smoothness.
   B. The effect of rain.
   C. The safe bearing load and area (see Figure 2-6)
   D. The maximum rut depth (see Figure 2-2 and Figure 2-3)

   NOTE: If you have large depths (rut depths), you must use supports (ground cover, shoring or cribbing). These supports increase the load capacity of the soil (see Figure 2-4 and Figure 2-5).

4. If jack points on the airplane are lower than the soil, you must remove the necessary soil. If you must use supports, you must put the supports on a hard surface of the correct dimensions. The soil capacity gives you the dimensions of the support surface. The dimensions of the support surface (cribbing base) give you the depth of soil you must remove (see Figure 2-4 and Figure 2-5).
5. You must have soil of the same strength for a depth of 8 in. (20 cm).
6. If it is possible, we recommend you find a person who knows about ground capacities (Civil Engineer or Soil Analyst). This person can help you make the decisions about the load capacity of the ground at the incident location.
7. Make a check of the possible weather conditions that can occur (current and forecast weather). The terrain in the area can change with the weather.
   A. Cold weather (snow and ice) can make very hard conditions.
   B. High winds can blow airborne material (sand and dust) and make the operation slow.

Figure 2-2 TOWING, WINCHING AND WHEEL, TIRE DATA - 767-200, -300

SINGLE MAIN LANDING GEAR OLEO LOAD LB (KG) *[1]	767-200, -300			
	MAXIMUM RUT DEPTH FOR TOWING AND WINCHING			
	INFLATED TIRES		FLAT TIRES	
	TOWING BY TOW FITTING RUT DEPTH, IN. (CM)	TOWING BY OLEO RUT DEPTH, IN. (CM)	TOWING BY TOW FITTING RUT DEPTH, IN. (CM)	TOWING BY OLEO RUT DEPTH, IN. (CM)
150,000 (68040)	1.75 (4.4)	6.25 (15.8)	1.10 (2.8)	4.25 (10.8)
140,000 (63504)	2.00 (5)	7.00 (17.8)	1.25 (3.2)	4.75 (12.1)
130,000 (58968)	2.25 (5.7)	8.00 (20.3)	1.50 (3.8)	5.25 (13.3)
120,000 (54432)	2.50 (6.4)	9.00 (22.9)	1.75 (4.4)	6.00 (15.2)
110,000 (49896)	3.00 (7.6)	10.00 (25.4)	2.00 (5)	6.50 (16.5)
100,000 (45360)	3.75 (9.5)	11.50 (29.2)	2.25 (5.7)	7.50 (19.1)
90,000 (40824)	4.50 (11.4)	13.00 (33)	2.75 (7)	8.50 (21.6)

*[1] REFER TO Figure 4-10 AND Figure 4-11 (SECTION 4-20) FOR MAXIMUM TOW LOAD LIMITS

EXAMPLE: A GROSS AIRPLANE WEIGHT OF 260,000 LB (117,936 KG), APPROXIMATELY 130,000 LB (58,968 KG) FOR EACH MAIN LANDING GEAR STRUT, WITH A 6 INCH (15.2 CM) RUT DEPTH MEASURED IN THE VERTICAL, 12-18 INCHES (30.5-45.7 CM) BEHIND THE WHEEL AND TIRE ASSEMBLIES WHICH ARE INFLATED.

RESULT: TOW OR WINCH THE AIRPLANE WITH CABLES ATTACHED TO THE MAIN LANDING GEAR STRUTS

Figure 2-3 TOWING, WINCHING AND WHEEL, TIRE DATA - 767-400ER

SINGLE MAIN LANDING GEAR OLEO LOAD LB (KG) *[1]	767-400ER			
	MAXIMUM RUT DEPTH FOR TOWING AND WINCHING			
	INFLATED TIRES		FLAT TIRES	
	TOWING BY TOW FITTING RUT DEPTH IN. (CM)	TOWING BY OLEO RUT DEPTH IN. (CM)	TOWING BY TOW FITTING RUT DEPTH IN. (CM)	TOWING BY OLEO RUT DEPTH IN. (CM)
208,000 (94347)	1.5 (3.8)	3.2 (8.1)	1.1 (2.8)	2.4 (6.1)
202,000 (91626)	1.6 (4.1)	3.4 (8.6)	1.2 (3.0)	2.5 (6.4)
189,000 (85729)	1.9 (4.8)	3.8 (9.7)	1.4 (3.6)	2.8 (7.1)
179,000 (81193)	2.1 (5.3)	4.2 (10.7)	1.5 (3.8)	3.1 (7.9)
170,000 (77111)	2.3 (5.8)	4.6 (11.7)	1.6 (4.1)	3.3 (8.4)
161,000 (73028)	2.5 (6.4)	5.1 (13.0)	1.8 (4.6)	3.7 (9.4)
152,000 (68946)	2.9 (7.4)	5.7 (14.5)	2.0 (5.1)	4.0 (10.2)
143,000 (64864)	3.2 (8.1)	6.3 (16.0)	2.3 (5.8)	4.4 (11.2)
133,000 (60328)	3.7 (9.4)	7.0 (17.8)	2.5 (6.4)	4.9 (12.4)
124,000 (56245)	4.2 (10.7)	7.9 (20.1)	2.9 (7.4)	5.4 (13.7)
115,000 (52163)	4.8 (12.2)	8.8 (22.4)	3.3 (8.4)	6.1 (15.5)
106,000 (48081)	5.5 (14.0)	10.0 (25.4)	3.7 (9.4)	6.8 (17.3)

*[1] REFER TO Figure 4-10 AND Figure 4-11 (SECTION 4-20) FOR MAXIMUM TOW LOAD LIMITS

EXAMPLE: A GROSS AIRPLANE WEIGHT OF 260,000 LB (117,936 KG), APPROXIMATELY 130,000 LB (58,968 KG) FOR EACH MAIN LANDING GEAR STRUT, WITH A 6 INCH (15.2 CM) RUT DEPTH MEASURED IN THE VERTICAL, 12-18 INCHES (30.5-45.7 CM) BEHIND THE WHEEL AND TIRE ASSEMBLIES WHICH ARE INFLATED.

RESULT: TOW OR WINCH THE AIRPLANE WITH CABLES ATTACHED TO THE MAIN LANDING GEAR STRUTS

Figure 2-4 SOIL SURFACE CONDITIONS FOR SHORING (CRIBBING) REQUIREMENTS (ROLLING LOADS)

APPROX CALIFORNIA BEARING RATIO (CBR) RANGE *[1]	SURFACE MATERIAL	SHORING (CRIBBING) REQUIRED FOR ROLLING LOAD			
		MAX ALLOWABLE CONTACT PRESSURE		MINIMUM CONTACT AREA REQUIRED	
				FOR EA. 2K LB	FOR EA. 1K KG
		PSI	KG/SQ CM	SQ IN.	SQ CM
2 - 6	Soft Wet Clay or Wet Organic Soil	18	1.3	110	778
8 - 20	Loose Sand or Sandy Soil	65	4.6	30	212
15 - 30	Sand With Clay	100	7.0	20	141
20 - 60	Well-Graded Sand and Medium Clay	180	12.6	11	78
20 - 60	Sandy Gravel, Clayey Gravel or Dry Clay	300	21.1	6.5	46
50 and above	Compacted Sandy, Clayey Gravels	N/A	N/A	N/A	N/A

*[1] CBR DATA IS GIVEN FOR REFERENCE ONLY. THE LOAD-CARRYING CAPABILITY OF SURFACE SOIL CAN BE STATED IN TERMS OF CBR, BUT A WET MATERIAL HAVING A CBR OF 4 OR 5 CAN BE OF EQUAL BEARING STRENGTH TO A CBR 40 OR 50 MATERIAL, WHEN DRY

Figure 2-5 SOIL SURFACE CONDITIONS FOR SHORING (CRIBBING) REQUIREMENTS (JACKING LOADS)

APPROX CALIFORNIA BEARING RATIO (CBR) RANGE *[1]	SURFACE MATERIAL	SHORING (CRIBBING) REQUIRED FOR JACKING LOADS			
		MAX ALLOWABLE CONTACT PRESSURE		MINIMUM CONTACT AREA REQUIRED	
				FOR EA. 150K LB	FOR EA. 70K KG
		PSI	KG/SQ CM	SQ FT	SQ M
2 - 6	Soft Wet Clay or Wet Organic Soil	8	.6	130	12.4
8 - 20	Loose Sand or Sandy Soil	35	2.5	30	2.9
15 - 30	Sand With Clay	50	3.5	21	2.0
20 - 60	Well-Graded Sand and Medium Clay	85	6.0	12.5	1.2
20 - 60	Sandy Gravel, Clayey Gravel or Dry Clay	165	11.6	6.3	.6
50 and above	Compacted Sandy, Clayey Gravels	200	14.1	5.2	.5

*[1] CBR DATA IS GIVEN FOR REFERENCE ONLY. THE LOAD-CARRYING CAPABILITY OF SURFACE SOIL CAN BE STATED IN TERMS OF CBR, BUT A WET MATERIAL HAVING A CBR OF 4 OR 5 CAN BE OF EQUAL BEARING STRENGTH TO A CBR 40 OR 50 MATERIAL, WHEN DRY

Figure 2-6 CALIFORNIA BEARING RATIO (CBR) BEARING STRENGTH

SURFACE	SAFE BEARING LOAD LB/SQ IN. (KG/SQ CM)	APPROXIMATE BEARING AREA REQUIRED		
		10,000 LB		10000 KG
		SQ IN.	SQ FT.	SQ M
Slate or Rock	230 (16.1)	44	0.3	0.06
Concrete	156 (10.9)	64	0.4	0.09
Hard Pan And Compacted Gravel or Sand	138 (9.7)	73	0.5	0.10
Compact Sand and Gravel	100 (7)	100	0.7	0.14
Gravel, Coarse Sand or Medium Clay	62 (4.3)	161	1.1	0.23
Loose Sand-Gravel Mixture	42 (2.9)	238	1.7	0.34
Medium Stiff Clay	35 (2.5)	286	2.0	0.40
Loose Sand	30 (2.1)	333	2.3	0.47
Soft Clay or Earth	15.5 (1.1)	645	4.5	0.91

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2-10-4 Manufactured and Prepared Surfaces

1. If it is necessary, you can make a temporary road to tow the airplane. This road connects the area to a runway or a permanent road. If the load capacity of the soil is too low, you must increase it. (see Figure 2-7.) Make the road.
   A. Remove any unwanted water.
   B. Level the road area if necessary.
   C. Pour gravel or crushed rock on the road area.
   D. Pack down the gravel or crushed rock with a power tamper.
   E. The packed surface must have a good load capacity.
   F. Apply surface materials for a smooth road (see Figure 2-7).
      (1) Steel matting
      (2) Plywood
      (3) Railroad ties
      (4) Steel plate
      (5) Aluminum panels
      (6) Premanufactured portable road materials
      (7) Any combination of these materials on top of packed gravel or crushed rock.

      NOTE: Some of the premanufactured portable road materials may not require as much preparation work as outlined above. Consult the manufacturer of the portable road material for their recommendation.

Figure 2-7 EXAMPLES OF PREPARED SURFACES

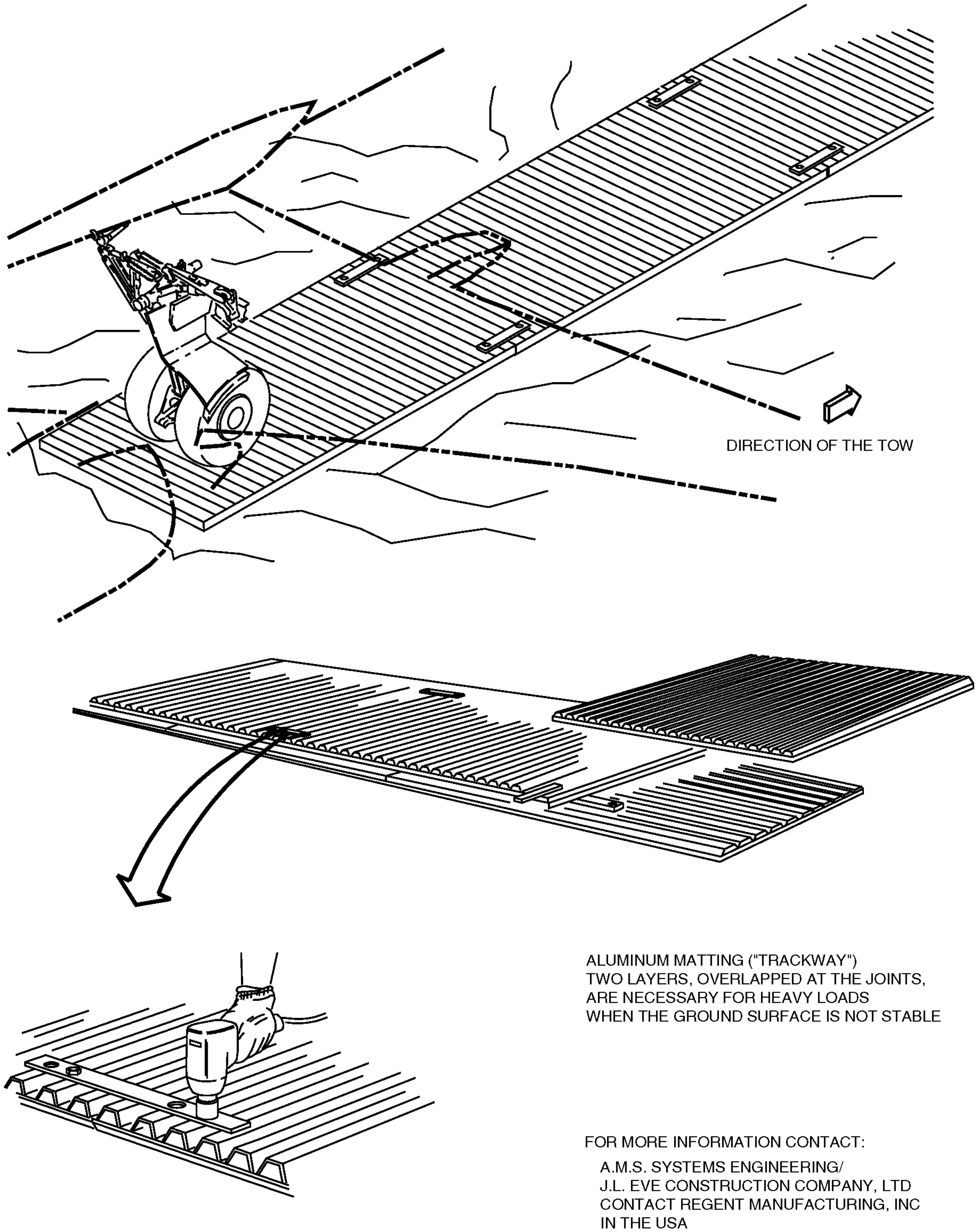
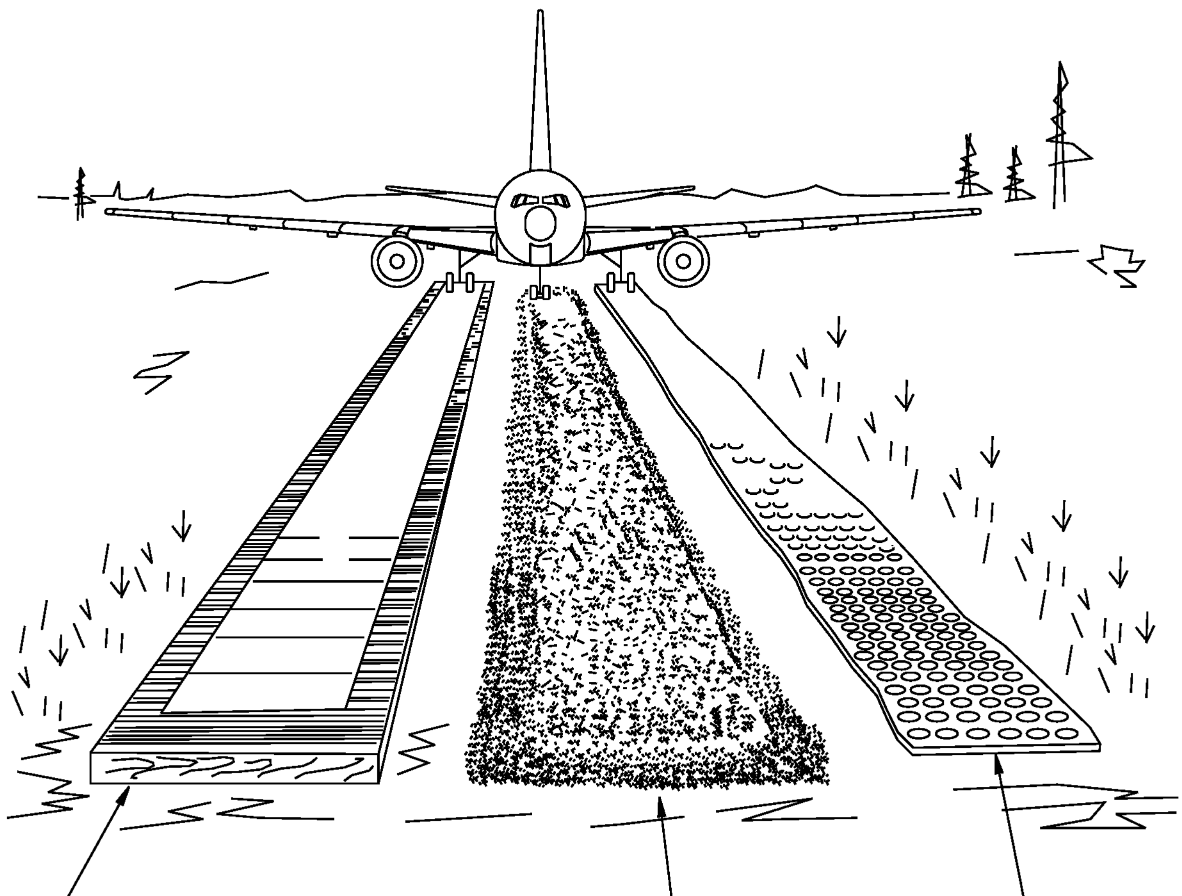


Figure 2-7 EXAMPLES OF PREPARED SURFACES (Continued)



NOTE: Other manufacturers of prepared surfaces include:

- For Aluminum Panels (Extruded) -
  Trackcess Panels- AMS Systems Engineering, Regent Manufacturing, Inc.
- For Metal Matting - Polypropylene fabric reinforced by steel wires
  Mammoth- Trackmat from Kunz GmbHF
- For Fabric- Woven Monofilament/Polyester
  Temp Trail from Deschamps Co.
- For Glass-Fibre Reinforced -
  SCOBOMAT from Manfred Vetter GmbH

NOTE: Make sure the ground surface is firm before you put steel plate, steelmatting, railroad ties or plywood directly on the ground.

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2-20 DAMAGE CONTROL AND SAFETY

2-20-1 Precautions

1. You must use precautions to prevent injury to persons. You must also use precautions for minimum damage to the airplane.

   A. When you defuel the airplane:

      (1) Make sure that only approved persons go into the recovery area.

      (2) Put electrical protection (ground) on the airplane, tanker trucks and power units.

      (3) Make sure that fire protection equipment and persons are in the recovery area. Make sure that they stay until the tanker trucks go from the recovery area.

      (4) Put (No Smoking) signs in the area.

   B. When you unload the cargo:

      NOTE: If you have hazardous materials onboard, make sure you use proper procedures and equipment for the removal.

      (1) Before you manually open a cargo door, make sure the door cannot hit you.

      (2) Make sure that you have good equipment. You can have better and faster movement of the cargo. You can also have better protection of persons.

      (3) If you cannot operate the cargo doors, you must go into the cargo area with a different procedure. You can cut through the airplane structure. Make sure that you have good structural data before you do this.

      (4) If the doors are not fully open and you cannot operate them, you can remove the doors. You can remove the doors if you remove the pins at the door hinges. Make sure that you do not cause damage to the fuselage skin when you remove the pins.

   C. When you lift the airplane:

      (1) Use good equipment with the necessary strength. You must have a minimum safety factor of five to lift the airplane from a point above the airplane.

      WARNING: FOR THE FREIGHTER AIRPLANE MODEL, DO NOT CHANGE THE POSITION OF THE MAIN CARGO DOOR. IF THE DOOR IS CLOSED, MAKE SURE THAT YOU LATCH IT. THE DOOR MUST STAY LATCHED WHILE YOU LIFT THE AIRPLANE ON JACKS. IF THE DOOR IS OPEN, IT MUST STAY OPEN WHILE YOU LIFT THE AIRPLANE ON JACKS. DO NOT OPERATE THE DOOR WHILE THE AIRPLANE IS ON JACKS.

      (2) Pneumatic bags are not always stable in the lateral direction. Use jacks and pneumatic bags together. Lift the airplane in small steps. This is a better procedure than if you use only the pneumatic bags.

      (3) You must always use tethers with the pneumatic bags. You must keep the tether lines tight and you must quickly make the lines loose when it is necessary. You must prevent structural damage (overstress) to the airplane at the tether points.

      (4) Do not lift the airplane on jacks in high winds (over 35 mph or 30 knots).

      (5) You must keep the airplane at a level attitude while you lift it. This keeps the airplane Center of Gravity (CG) in a safe range. If the CG moves from a safe range, there can be lateral loads on the airplane. The lateral loads can move the airplane off the pneumatic bags or the jacks.

      (6) The lift of the airplane can be a dangerous procedure. If the equipment is used for more than its strength, parts can break from their tether points. The failure of equipment because of a break can be dangerous to persons, the airplane and other equipment.

(7) Make sure a person monitors the load at each tether point. Then you can decrease a load before it becomes dangerous.

(8) Use a nose jack only to make the airplane stable. If the airplane is in a nose down position, lift the nose point first. You can use jacks, pneumatic bags, cranes and slings, or any combination of these to lift the nose. Lift the nose point until you have a level airplane. Make sure that you decrease the height of the tail jack correctly while you change the attitude of the airplane.

WARNING: FOR THE FREIGHTER AIRPLANE MODEL, DO NOT TOW THE AIRPLANE WHILE THE MAIN CARGO DOOR IS OPEN. THE DOOR MUST BE CLOSED AND LATCHED WHILE YOU TOW THE AIRPLANE.

D. When you tow the airplane:

(1) Do not use higher loads than those in Figure 4-10 and Figure 4-11.

(2) Make sure the equipment (cables, slings, shackles) has the correct dimensions. Also make sure the equipment has the correct capacity. The tow equipment must have a factor of safety (rated load to ultimate load) of five. Use load indicating devices to monitor the tow loads.

(3) If you use the landing gears, mechanically lock them in the DOWN position with DOWNLOCK PINS.

2-30 WEIGHT AND CENTER OF GRAVITY (CG) MANAGEMENT

2-30-1 General

1. It is important to accurately calculate the configuration that the airplane has for the full recovery operation. Then you must make an accurate weight and CG analysis of the airplane. This gives you the correct positions and capacity for the lifting and transporting equipment.
2. When it is possible, decrease the total airplane weight to the lowest quantity. You can remove the fuel, cargo, water and oil. Possibly, you can remove large airplane parts. It is possible to perform the recovery operation without these decreases in weight. This is a decision that is different for each incident.
3. In this document the Recoverable Empty Weight (REW) is the lowest possible airplane weight, and is the basic weight used for CG analysis. Finding the REW and its CG is discussed more in Calculating the REW (Recoverable Empty Weight) and the Center of Gravity/SUBJECT 2-30-5. This is the basic weight for CG analysis. Usually, you do not remove airplane equipment, large airplane parts or fluids that are in a closed system.

   NOTE: It is realized that in some instances recovery can be made with fuel and/or cargo aboard. For safety, we normally recommend that the airplane be defueled first. This determination must be made after a review of the conditions.
4. After you know the recovery configuration, you must calculate the airplane weight and it’s CG location. We recommend using the data and procedures shown in SUBJECT 2-30-2, SUBJECT 2-30-3, SUBJECT 2-30-4, SUBJECT 2-30-5 and SUBJECT 2-30-6 for this analysis.
5. If the REW configuration is not possible, you must keep accurate records of all the airplane components. These can be components that you cannot find on the airplane after the landing. Your records must show the weight of each component and its effect on the airplane CG. Then you must calculate the full airplane weight and CG location to find the load at each jack point. Also, you must make sure that the airplane CG location is in a safe range (see SUBJECT 2-30-6).

$$\text{CG SHIFT} = \frac{(\text{REW})\ (\text{ARM}_{\text{REW}}) + (W_1)\ \text{ARM}_1 \ldots\ldots + (W_N)\ \text{ARM}_N}{(\text{REW}) + (W_1 \ldots\ldots\ldots\ldots + W_N)} - \text{ARM}_{\text{REW}}$$

Where:

NRW = NET RECOVERABLE WEIGHT

REW = RECOVERABLE WEIGHT

W_1 ..... W_N = APPLICABLE WEIGHTS (FUEL, CARGO, EQUIPMENT ETC.)

ARM_{XXX} = THE DIMENSION FROM THE DATUM POINT TO CG OF THE ITEM

NOTE: The result is always in inches. A positive (+) result moves the CG rearward. A negative (-) result moves the CG forward. The W’s are the weights of the different items (fuel, cargo, water, etc.). The arms are the CG dimensions (moment arms) for each of the items. When you have more than one item, the full movement is the algebraic sum of all movements.

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2-30-2 Weight Definitions

1. Use these weight definitions and abbreviations for airplane recovery.

   A. The MTGW (Maximum Taxi Gross Weight) is the maximum airplane weight permitted when you operate the airplane on the ground. This weight is controlled by airplane strength limits and airworthiness limits (It includes the weight of taxi fuel and runup fuel).

   B. MTOW (Maximum Takeoff Weight) is the maximum weight for takeoff as limited by airplane structural strength and performance limitations.

   C. The DLW (Design Landing Weight) is the maximum weight permitted when you make a landing (by applicable government regulations).

   D. The MZFW (Maximum Zero Fuel Weight) is the maximum weight permitted before you install fuel and other specified agents to operate the airplane. These added weights are controlled by strength limits and airworthiness limits.

   E. The OEW (Operational Empty Weight) is the Manufacturer’s Empty Weight plus two more types of items (standard items and operational items).

      (1) These are the first type of items (standard items):

         (a) Fuel that cannot be used.

         (b) Engine oil.

         (c) Oxygen.

         (d) Equipment that is not attached (miscellaneous equipment).

         (e) Galley structure and fixed inserts.

      (2) These are the second type of items (operational items):

         (a) Crew and crew baggage.

         (b) Removable service equipment for cabin and galley.

         (c) Potable water.

         (d) Food and beverages.

         (e) Waste tank disinfectant.

         (f) Emergency equipment.

         (g) Cargo containers.

   F. The MEW (Manufacturer’s Empty Weight) is the weight of items that are a necessary part of the configuration of a specified airplane model. It is a basic DRY weight that includes those fluids contained in all closed systems.

   G. The REW (Recoverable Empty Weight) is the MEW plus the items that are necessary to operate the airplane and are part of it.

   H. The NRW (Net Recoverable Weight) is the REW with some adjustments. These adjustments are:

      (1) Minus the weight of the crew, the crew baggage, food and water.

      (2) The effect of the equipment and airplane components that are not there.

      (3) The effect of fuel or cargo on the airplane.

      (4) The effect of the positions of the landing gear and the flaps.

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2-30-3 Weight Removal, Increase or Movement to Change the Center of Gravity (CG) Location

1. It is very important to decrease the airplane weight to the lowest possible quantity before you start the recovery operation. It will be easier to lift and to tow or winch the airplane. The payload you can remove for a large change in the weight includes the passengers, the cargo and the baggage. The removal of fuel and large airplane components can also decrease a large quantity of the weight.
2. You can move or increase the weight on one side of the airplane. This will change the position of the airplane CG. Then you can easily lift the other side of the airplane. For example, if you have a damaged nose gear, you can move weight to the aft end of the airplane. Then you can easily lift the nose of the airplane.
3. You can transfer fuel to different locations in the airplane to change the airplane weight distribution and CG.
4. Be careful. The airplane can move suddenly when you move the weights or when you lift it. Make sure you do not cause injury to persons or more damage.

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2-30-4 Airplane Design Weights

1. Airplane weights (Design Weights) are shown in Figure 2-8 through Figure 2-11. Refer to the document (Weight and Balance Manual) for your model during the recovery.
2. Various model airplanes are certified for operation at different maximum gross weights, depending on engines, structural limitations and other configuration options. The tables that are shown on the following pages provide data to describe the range of operating weights presently offered for the 767-200, 767-200ER, 767-300, 767-300ER, 767-300F, and 767-400ER airplane models.

Figure 2-8 AIRPLANE DESIGN WEIGHTS FOR 767-200 PASSENGER AIRPLANES

CONDITIONS		767-200		767-200ER		767-200ER IGW	
		LB	KG	LB	KG	LB	KG
Maximum Taxi Weight (MTW)		302,000	136985	352,200	159755	388,000	175994
Maximum Takeoff Weight (MTOW)		300,000	136078	345,000	156489	387,000	175540
Maximum Landing Weight (MLW)		270,000	122470	278,000	126099	285,000	129274
Maximum Zero Fuel Weight (MZFW)		248,000	112491	253,000	114759	260,000	117934
Manufacturer's Empty Weight (MEW)	*[1]	163,700	74253	166,100	75342	166,400	75478
	*[2]	165,100	74888	167,500	75976	167,803	76114
	*[3]	164,000	74389	166,400	75478	166,700	75614
	*[4]	165,300	74979	167,700	76067	168,000	76204
Operating Empty Weight (OEW)	*[1]	176,419	80022	180,606	81922	180,959	82082
	*[2]	177,686	80597	181,838	82480	182,191	82640
	*[3]	176,719	80158	180,906	82058	181,259	82218
	*[4]	177,901	80694	182,053	82577	182,406	82738

*[1] WITH GE CF6-80A/-80A2 ENGINES (NO LONGER A STANDARD OPTION)
*[2] WITH GE CF6-80C2 ENGINES WITH FADEC
*[3] WITH P&W JT9D-7R4D/-7R4E ENGINES (NO LONGER A STANDARD OPTION)
*[4] WITH P&W PW4000 ENGINES

Figure 2-9 AIRPLANE DESIGN WEIGHTS FOR 767-300 PASSENGER AIRPLANES

CONDITIONS		767-300		767-300ER		767-300ER IGW	
		LB	KG	LB	KG	LB	KG
Maximum Taxi Weight (MTW)		347,000	157397	388,000	175993	409,000	185519
Maximum Takeoff Weight (MTOW)		345,000	156489	387,000	175539	408,000	185065
Maximum Landing Weight (MLW)		300,000	136078	300,000	136078	320,000	145150
Maximum Zero Fuel Weight (MZFW)		278,000	126099	278,000	126099	288,000	130636
Manufacturers Empty Weight (MEW)	*[1]	173,500	78698	176,000	79832	176,700	80150
	*[2]	174,900	79333	178,200	80830	178,890	81143
	*[3]	173,800	78834	176,300	79968	177,000	80286
	*[4]	175,100	79424	178,400	80921	179,090	81233
	*[5]	177,500	80512	180,800	82009	181,490	82322
Operating Empty Weight (OEW)	*[1]	189,124	85785	193,195	87632	193,885	87945
	*[2]	190,364	86347	195,205	88543	195,895	88856
	*[3]	189,424	85921	193,495	87768	194,185	88081
	*[4]	190,579	86445	195,420	88641	196,110	88954
	*[5]	192,928	87510	197,769	89706	198,459	90019

*[1] WITH GE CF6-80A/-80A2 ENGINES (NO LONGER A STANDARD OPTION)
*[2] WITH GE CF6-80C2 ENGINES WITH FADEC
*[3] WITH P&W JT9D-7R4D/-7R4E ENGINES (NO LONGER A STANDARD OPTION)
*[4] WITH P&W PW4000 ENGINES
*[5] WITH ROLLS-ROYCE RB211-524G/H ENGINES

Figure 2-10 AIRPLANE DESIGN WEIGHTS FOR THE 767-300 FREIGHTER MODEL

CONDITIONS		767-300 FREIGHTER	
		LB	KG
Maximum Taxi Weight (MTW)	*[1]	409,000	185519
Maximum Takeoff Weight (MTOW)	*[1]	408,000	185065
Maximum Landing Weight (MLW)		326,000	147871
Maximum Zero Fuel Weight (MZFW)		309,000	140160
Manufacturer’s Empty Weight (MEW)	*[2]	179,700	81510
	*[3]	179,800	81556
	*[4]	182,000	82554
Operating Empty Weight (OEW)	*[2]	187,200	84912
	*[3]	187,300	84958
	*[4]	189,500	85956

*[1] 413,000 LB (187337 KG) MTW WITH A CORRESPONDING 412,000 LB (186883 KG) MTOW IS A CUSTOMER OPTION
*[2] WITH GE CF6-80C2F SERIES ENGINES WITH FADEC
*[3] WITH P&W PW4000 SERIES ENGINES
*[4] WITH ROLLS-ROYCE RB211-524G/H ENGINES

Figure 2-11 AIRPLANE DESIGN WEIGHTS FOR 767-400ER PASSENGER AIRPLANES

CONDITIONS		767-400ER	
		LB	KG
Maximum Taxi Weight (MTW)		451,000	204570
Maximum Takeoff Weight (MTOW)		450,000	204116
Maximum Landing Weight (MLW)		350,000	158757
Maximum Zero Fuel Weight (MZFW)		330,000	149685
Manufacturers Empty Weight (MEW)	*[1]	204,700	91898
	*[2]	204,800	91943
Operating Empty Weight (OEW)	*[1]	227,400	103147
	*[2]	227,500	103192

*[1] WITH GECF6-80C2B7F1 ENGINES WITH FADEC
*[2] WITH P&W4062 ENGINES

NOTE: Weights do not include customer option allowance which averages approx. 1% of the MEW.

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2-30-5 Calculating the REW (Recoverable Empty Weight) and the Center of Gravity

1. Remove your data from Figure 2-13. (taken from the Weight and Balance Manual).
2. Subtract those items in Figure 2-13 that are not applicable.
3. Calculate the moment for those items that are applicable. (Each Moment = Weight x CG), (Pounds Inches).
4. Find the REW (Recoverable Empty Weight). (REW = Summation of All Weights), (Pounds)
5. Find the CG of the airplane in the REW condition. (The CG REW = the Summation of All Moments divided by the Summation of All Weights), (Lb In. / Lb).
6. Write the REW and CG REW in a format equivalent to the format (worksheet) shown (in Figure 2-12). Write these on line 1 of the format.
7. Write all equipment or assemblies damaged while the airplane made the landing. Write these items plus your removed items (to decrease weight) on line 2 of the worksheet. The weight and the moment of each component or each assembly is shown in the document (Weight and Balance Manual).
8. The CGCG REW applies to a specified airplane condition. In this condition, you must extend the landing gear and you must retract the Leading Edge (LE) slats and the Trailing Edge (TE) flaps. Find the effect on the CG when you have a different condition. (The gear or flaps or slats are not like this.) (The different conditions are shown in the airplane Weight and Balance Manual.) Write the effect on the CG on line 3 of the worksheet.
9. Find the quantity of fuel on the airplane and its effect on the CG. Write the effect on the CG on line 6 of the worksheet.
10. Find the weight and moment from OTHER FLUIDS on the airplane. The weight of oil in the engines and in closed systems is included in the airplane REW. There can be a change, if these oils are not on the airplane. You can ignore the engine oil but you must include all differences from other oils. You must include all differences from the potable water or the toilet fluids. Write these items on line 7 of the worksheet (The weights and arms are shown in the airplane's Weight and Balance Manual).
11. Find the weight and moment from CARGO on the airplane. You must include these items if they are on the airplane during the recovery. Write these items on line 8 of the worksheet (Refer to the cargo manifest for the cargo weight.).
12. Find the NRW (NET RECOVERABLE WEIGHT) of the airplane and the location of the CG (Arm) . The NRW is line 5 (REVISED REW) plus lines 6,7 and 8 (fuel, fluids and cargo). Write the results on line 9 of the worksheet.
13. There are incidents where the CG movement caused by one item is a better condition than the REW (or NRW). Find the change in the CG.

$$\text{CG SHIFT} = \frac{\text{(REW) (ARM)} + \text{(ITEM WEIGHT) (ARM)}}{\text{REW} + \text{ITEM WEIGHT}} - \text{ARM}_{\text{REW}}$$

NOTE: The result that is a positive (+) is a movement aft and the result that is a negative (-) is a movement forward. When you have more than one item, the full movement is the algebraic sum of all movements.

14. The NRW from line 9 plus the adjusted CG (if applicable) should be entered on line 10 of the worksheet.

Figure 2-12 WORK SHEET, WEIGHT AND CENTER OF GRAVITY CALCULATIONS

WORK SHEET FOR WEIGHT AND CENTER OF GRAVITY CALCULATIONS			WEIGHT	CG *[1]
1. Recoverable Empty Weight (REW) and CG				
2. Missing components (list items below)	Weight	Effect On CG		
3. Landing gear and flaps, effect on CG				
4. Total (lines 2 and 3)	-		-	
5. Revised REW and CG (lines 1 minus 4)				
6. Fuel				
7. Other fluids				
8. Cargo				
9. Total (lines 6 , 7 and 8)				
10. Net Recoverable Weight (NRW) and CG				

*[1] THE BASIS TO DECIDE THE CG LOCATION FOR THE AIRPLANE IN THE REW CONFIGURATION IS WITH THE LANDING GEAR EXTENDED AND THE FLAPS RETRACTED.

Figure 2-13 EXAMPLES OF RECOVERABLE EMPTY WEIGHT (REW) AIRPLANES - 767-200

767-200 AIRPLANE *[1]				
ITEM	GE		PW	
	WEIGHT LB	CG *[2]	WEIGHT LB	CG *[2]
Manufacturer's Empty Weight	164,300	971.3	164,100	969.7
Unuseable Fuel *[3]	240	935.1	240	935.1
Oil	140	789.1	140	789.1
Galley Structure and Installed Equipment (Includes Inserts)	1,814	1,278.0	1,814	1,278.0
Flight Crew, *[4]	340	175.8	340	175.8
Cabin Crew, (5) *[4]	700	906.0	700	906.0
Baggage, (7) *[4]	175	612.4	175	612.4
Carts That You Can Remove *[4]	1,200	1.098.0	1,200	1,098.0
Galley Contents *[4]	599	1,258.0	599	1,258.0
Passenger Service Equipment *[4]	660	947.0	660	947.0
Food And Beverage, (18 First Class) *[4]	440	275.0	440	275.0
Food And Beverage, (202 Tourist Class) *[4]	1,010	1,600.0	1,010	1,600.0
Potable Water For Drinking, (80 Gal) *[4]	666	1,572.0	666	1,572.0
Potable Water For Flushing, (22 Gal) *[4]	184	1,449.0	184	1,449.0
Waste Tank Disinfectant	100	1,570.0	100	1,570.0
Forward Escape Slides	290	317.0	290	317.0
Off-Wing Escape Slides	320	1,119.0	320	1,119.0
Aft Escape Slides	290	1,510.5	290	1,510.5
Cargo Container (22) LD-2	3,300	864.0	3,300	864.0
Miscellaneous (Oxygen, First Aid Kits)	80	608.0	80	608.0
Operational Empty Weight (OEW)	176,848	969.3	176,648	966.1

*[1] THE VALUES IN THIS TABLE ARE SHOWN AS EXAMPLES. REFER TO THE WEIGHT AND BALANCE AND SPECIFICATION DOCUMENTS FOR SPECIFIED AIRPLANES FOR CORRECT VALUES
*[2] BALANCE ARM
*[3] UNUSEABLE FUEL IS DRAINABLE. REFER TO THE WEIGHT AND BALANCE DOCUMENT
*[4] EXAMPLE OF ITEMS REMOVED DURING AIRPLANE RECOVERY

NOTE: 1 lb equals 0.4536 kg; 1 gallon equals 3.7854 liters; 1 in. equals 2.54 cm.

Figure 2-14 EXAMPLES OF RECOVERABLE EMPTY WEIGHT (REW) AIRPLANES - 767-300

ITEM	767-300 AIRPLANE*[1]					
	GE		PW		RR	
	WEIGHT LB	CG *[2]	WEIGHT LB	CG *[2]	WEIGHT LB	CG *[2]
Manufacturer's Empty Weight	174,600	973.4	174,400	971.8	177,700	972.0
Unuseable Fuel *[3]	240	932.6	240	932.6	240	932.6
Oil	140	789.1	140	789.1	140	789.1
Galley and Installed Equipment (Includes Inserts)	2,223	1,167.0	2,223	1,167.0	2,223	1,167.0
Flight Crew, (2) *[4]	340	60.0	340	60.0	340	60.0
Cabin Crew, (7) *[4]	840	798.0	840	798.0	840	798.0
Baggage, (9) *[4]	200	630.0	200	630.0	200	630.0
Carts That You Can Remove *[4]	1,500	1,172.0	1,500	1,172.0	1,500	1,172.0
Galley Contents *[4]	787	1,295.0	787	1,295.0	787	1,295.0
Passenger Service Equipment *[4]	607	956.0	607	956.0	607	956.0
Food And Beverage, (18 First Class) *[4]	440	154.0	440	154.0	440	154.0
Food And Beverage, (251 Tourist Class) *[4]	1,255	1,715.0	1,255	1,715 5	1,255	1,715.5
Potable Water, For Drinking, (122 Gal) *[4]	1,015	1,704.0	1,015	1,704.0	1,015	1,704.0
Potable Water, For Flushing, (27 Gal) *[4]	225	1,581.0	225	1,581.0	225	1,581.0
Waste Tank Disinfectant	100	1,702.0	100	1,702.0	100	1,702.0
Forward Escape Slides	290	196.0	290	196.0	290	196.0
Off-Wing Escape Slides	350	1,101.6	350	1,101.6	350	1,101.6
Aft Escape Slides	290	1,642.5	290	1,642.5	290	1,642.5
Cargo Container (30) LD-2	4,500	870.1	4,500	870.1	4,500	870.1
Miscellaneous (Oxygen, First Aid Kits)	100	616.0	100	616.0	100	616.0
Operational Empty Weight (OEW)	190,042	981.2	189,842	979.5	193.142	979.6

*[1] THE VALUES IN THIS TABLE ARE SHOWN AS EXAMPLES. REFER TO THE WEIGHT AND BALANCE AND SPECIFICATION DOCUMENTS FOR SPECIFIED AIRPLANES FOR CORRECT VALUES
*[2] BALANCE ARM
*[3] UNUSEABLE FUEL IS DRAINABLE. REFER TO THE WEIGHT AND BALANCE DOCUMENT
*[4] EXAMPLE OF ITEMS REMOVED DURING AIRPLANE RECOVERY

Figure 2-15 EXAMPLES OF RECOVERABLE EMPTY WEIGHT (REW) AIRPLANES - 767-200ER

767-200ER AIRPLANE *[1]				
ITEM	GE		PW	
	WEIGHT LB	CG *[2]	WEIGHT LB	CG *[2]
Manufacturer's Empty Weight	167,200	967.3	167,000	965.6
Unusable Fuel *[3]	270	929.8	270	929.8
Oil	140	789.1	140	789.1
Galley Structure and Installed Equipment (Includes Inserts)	2,637	1,128.0	2,63.7	1,128.0
Flight Crew, (2) *[4]	340	181.0	340	181.0
Cabin Crew, (4) *[4]	560	906.0	560	906.0
Baggage, (6) *[4]	150	725.6	150	725.6
Carts That You Can Remove *[4]	1,200	1,127.0	1,200	1,127.0
Galley Contents *[4]	848	1,235.0	848	1,235.0
Passenger Service Equipment *[4]	633	936.0	633	936.0
Food And Beverage, (18 First Class) *[4]	468	275.0	468	275.0
Food And Beverage, (193 Tourist Class) *[4]	1,930	1,586.0	1,930	1,586.0
Potable Water, For Drinking, (119 Gal) *[4]	990	1,572.0	990	1,572.0
Potable Water, For Flushing, (30 Gal) *[4]	250	1,449.0	250	1,449.0
Waste Tank Disinfectant	100	1,572.0	100	1,572.0
Forward Slide Rafts	430	317.0	430	317.0
Off-Wing Escape Slides	320	1,119.0	320	1,119.0
Aft Slide Rafts	320	1,510.0	320	1,510.0
Cargo Container (10) LD-2 *[4]	1,500	1,247.0	1,500	1,247.0
Cargo Pallets (3) 96 X 125 Inches	870	547.0	870	547.0
Miscellaneous *[5]	399	856.6	399	856.6
Operational Empty Weight (OEW)	181,555	978.6	181,355	977.0

*[1] THE VALUES IN THESE TABLES ARE SHOWN AS EXAMPLES. REFER TO THE WEIGHT AND BALANCE AND SPECIFICATION DOCUMENTS FOR SPECIFIED AIRPLANES FOR CORRECT VALUES
*[2] BALANCE ARM
*[3] UNSEABLE FUEL IS DRAINABLE. REFER TO THE WEIGHT AND BALANCE DOCUMENT
*[4] EXAMPLE OF ITEMS TO REMOVE DURING AN AIRPLANE RECOVERY
*[5] INCLUDES LIFE VESTS, 316 LB ON THE -200ER, 375 LB ON THE -300ER

Figure 2-16 EXAMPLES OF RECOVERABLE EMPTY WEIGHT (REW) AIRPLANES - 767-300ER

767-300ER AIRPLANE *[1]						
ITEM	GE		PW		RR	
	WT. LB	CG *[2]	WT. LB	CG *[2]	WT. LB	CG *[2]
Manufacturer's Empty Wt.	176,500	965.7	176,900	963.0	179,600	965.0
Unuseable Fuel *[3]	306	916.6	306	916.6	306	916.6
Oil	140	789.1	140	789.1	140	789.1
Galley and Installed Equipment (Includes Inserts)	3,064	1,250.0	3,064	1,250.0	3,064	1,250.0
Flight Crew, (2) *[4]	340	60.0	340	60.0	340	60.0
Cabin Crew, (5) *[4]	700	804.0	700	804.0	700	804.0
Baggage, (7) *[4]	175	638.0	175	638.0	175	638.0
Removeable Carts *[4]	1,025	1,252.0	1,025	1,252.0	1,025	1,252.0
Galley Contents *[4]	847	1,337.0	847	1,337.0	847	1,337.0
Pax Service Equipment *[4]	774	949.5	774	949.5	774	949.5
Food And Beverage, (24 First Class) *[4]	624	154.0	624	154.0	624	154.0
Food and Beverage, (234 Tourist Class) *[4]	2,340	1,731.0	2,340	1,731.0	2,340	1,731.0
Potable Water, Drinking, (113 Gal) *[4]	990	1,704.0	990	1,704.0	990	1,704.0
Potable Water, Flushing, (36 Gal) *[4]	250	1,581.1	250	1,581.1	250	1,581.1
Waste Tank Disinfectant	100	1,704.0	100	1,704.0	100	1,704.0
Forward Slide Rafts	860	196.0	860	196.0	860	196.0
Off-Wing Escape Slides	350	919.5	350	919.5	350	919.5
Aft Slide Rafts	320	1,642.6	320	1,642.6	320	1,642.6
Cargo Container (14) LD-2 *[4]	2,100	1,278.0	2,100	1,278.0	2,100	1,278.0
Cargo Pallets (4) 96 X 125 In.	1,160	484.0	1,160	484.0	1,160	484.0
Miscellaneous *[5]	578	727.5	578	727.5	578	727.5
Operational Empty Weight	193,543	979.6	193,943	977.1	196,643	978.7

*[1] THE VALUES IN THESE TABLES ARE SHOWN AS EXAMPLES. REFER TO THE WEIGHT AND BALANCE AND SPECIFICATION DOCUMENTS FOR SPECIFIED AIRPLANES FOR CORRECT VALUES
*[2] BALANCE ARM
*[3] UNSEABLE FUEL IS DRAINABLE. REFER TO THE WEIGHT AND BALANCE DOCUMENT
*[4] EXAMPLE OF ITEMS TO REMOVE DURING AN AIRPLANE RECOVERY
*[5] INCLUDES LIFE VESTS, 316 LB ON THE -200ER, 375 LB ON THE -300ER

Figure 2-17 EXAMPLES OF RECOVERABLE EMPTY WEIGHT (REW) AIRPLANES - 767-400ER

767-400ER AIRPLANE *[1]		
ITEM	GE	
	WEIGHT LB	CG *[2]
Manufacturer's Empty Weight	204,700	968.2
Unuseable Fuel *[3]	320	916.4
Oil	200	798.5
Galley Structure And Installed Equipment (Includes Inserts)	3,307	1,002.2
Flight Crew, (2) *[4]	360	-71.9
Cabin Crew, (7) *[4]	1120	899.6
Baggage, (7) *[4]	300	575.8
Carts That You Can Remove *[4]	2,140	1,009.6
Galley Contents *[4]	556	1,009.6
Passenger Service Equipment *[4]	735	1,060.7
Food And Beverage, (20 First Class) *[4]	1,480	25.4
Food And Beverage, (50 Business Class) *[4]	1,490	575.9
Food And Beverage, (175 Tourist Class) *[4]	2,584	1,819.8
Potable Water, For Drinking, (113 Gal) *[4]	411	1,825
Potable Water, For Flushing, (36 Gal) *[4]	1,455	1,702
Waste Tank Disinfectant	117	1,760
Forward Slide Rafts	838	328.4
Off-Wing Escape Slides	0	0
Aft Slide Rafts	661	1,551
Cargo Container (38) LD-2 *[4]	2,700	1,377.8
Cargo Pallets (5) 96 X 125 Inches	1,450	424.2
Miscellaneous (Oxygen, First Aid Kits, Etc.) *[5]	476	1,059
Operational Empty Weight (OEW)	227,400	975

*[1] THE VALUES IN THESE TABLES ARE SHOWN AS EXAMPLES. REFER TO THE WEIGHT AND BALANCE AND SPECIFICATION DOCUMENTS FOR SPECIFIED AIRPLANES FOR CORRECT VALUES
*[2] BALANCE ARM
*[3] UNUSEABLE FUEL IS DRAINABLE. REFER TO THE WEIGHT AND BALANCE DOCUMENT
*[4] EXAMPLE OF ITEMS TO REMOVE DURING AN AIRPLANE RECOVERY
*[5] INCLUDES LIFE VESTS, 316 LB ON THE -200ER, 375 LB ON THE -300ER

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2-30-6 Location of Center of Gravity (CG) in Percent of Mean Aerodynamic Chord (MAC)

1. You calculate the location of the CG in a relation to the Mean Aerodynamic Chord (MAC) as follows:

$$\text{Percent MAC} = \frac{\text{(ARM) CG Station - 913.2}}{237.5} \text{ X } 100$$

Where: Percent MAC = Location of CG in Percent of the MAC

CG Station = Station location of CG (inches)

273.5 = Length of MAC (inches)

913.2 = Distance of MAC leading edge to Station 0 (inches)

Figure 2-18 CG LIMITS (302,000 LB. MTW, 248,000 LB. MZFW), 767-200

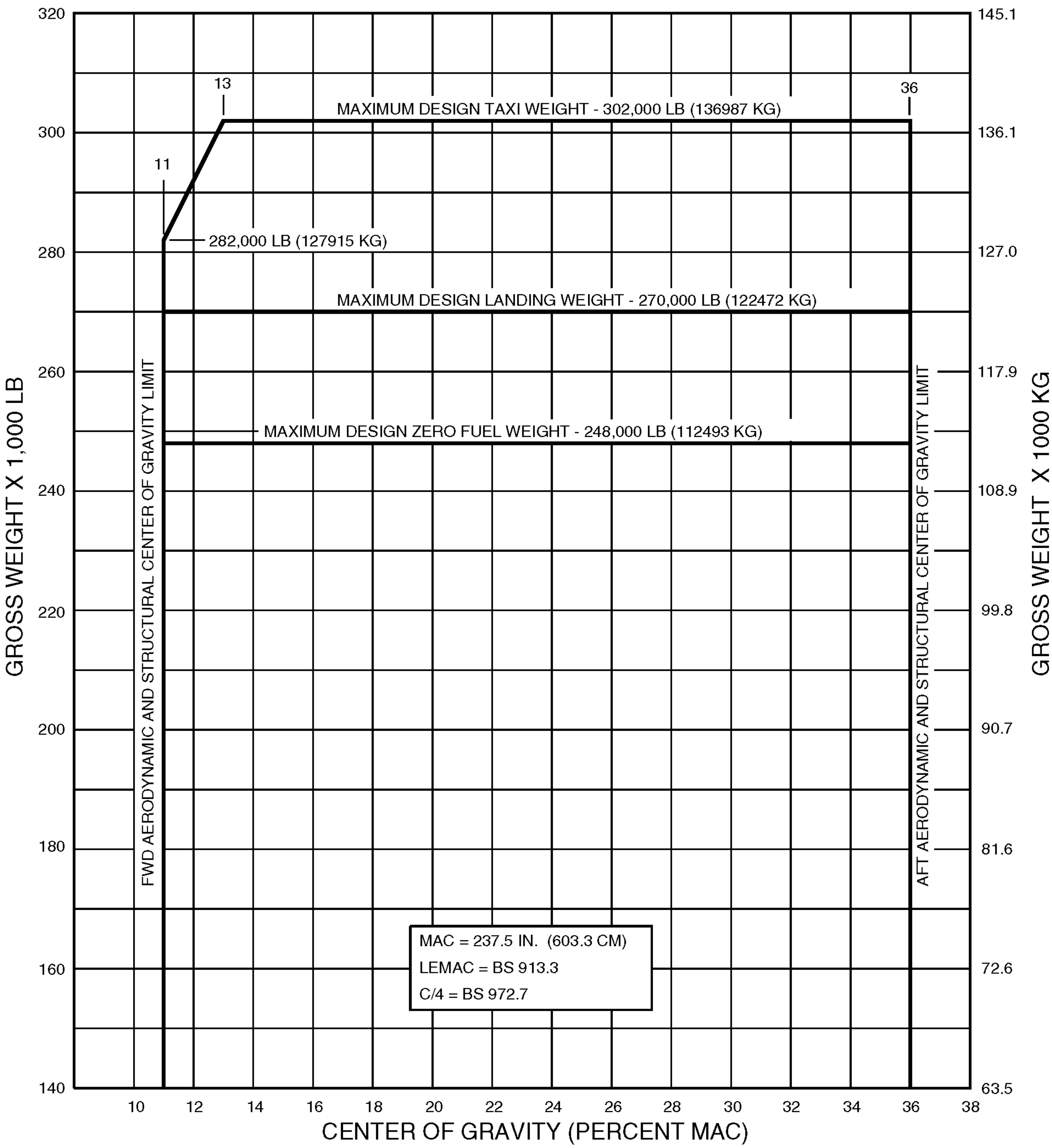
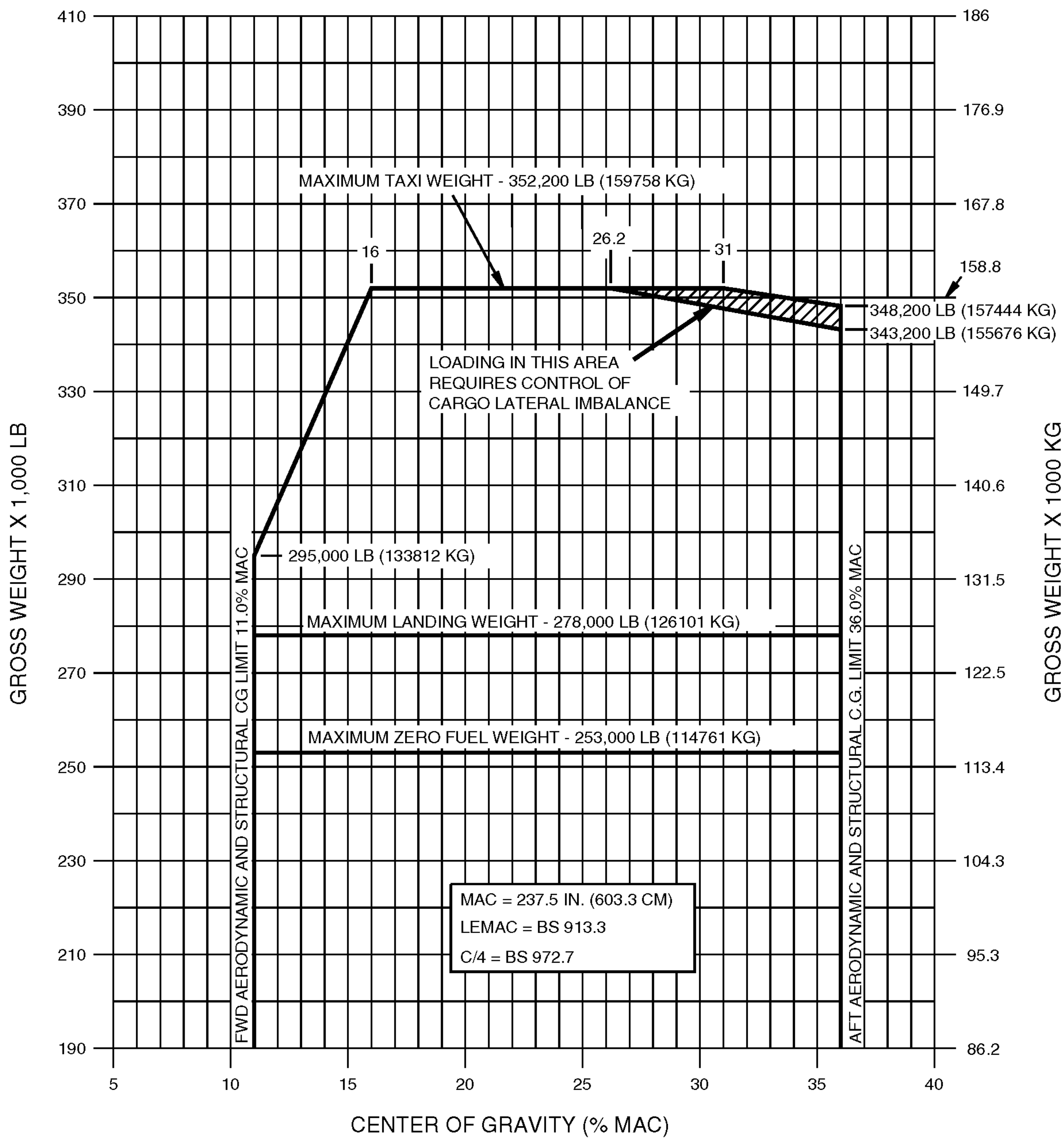


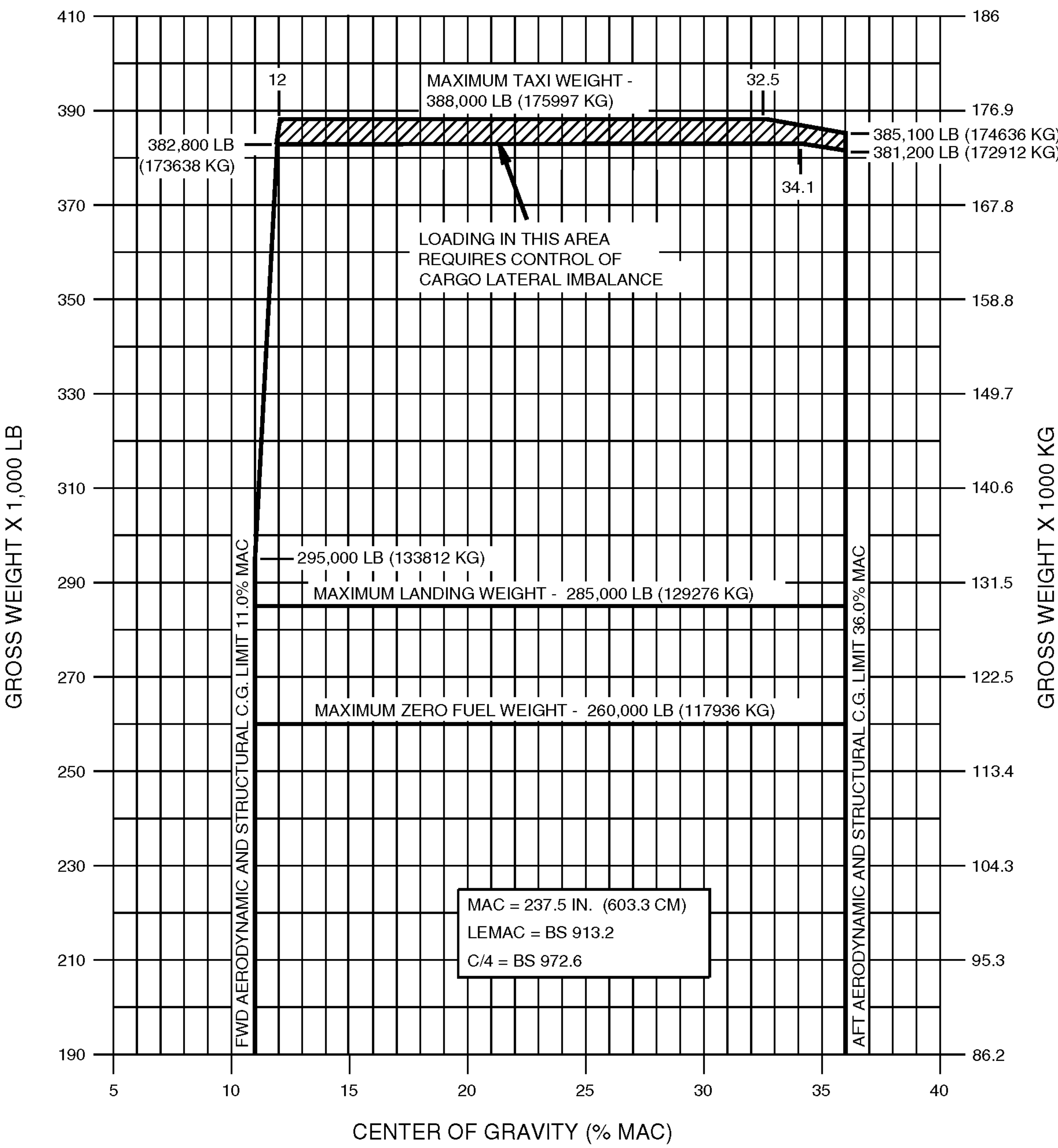
Figure 2-19 CG LIMITS (352,000 LB. MTW, 253,000 LB. MZFW), 767-200ER



MAIN GEAR: MINIMUM OF H46X18-20, 28 PR TIRE REQUIRED
NOSE GEAR: MINIMUM OF H37X14-15, 22 PR TIRE REQUIRED

GROSS WEIGHT CENTER OF GRAVITY GRID - 352,200 LB MTW, 253,000 LB MZFW

Figure 2-20 CG LIMITS (388,000 LB. MTW, 260,000 LB. MZFW), 767-200ER (IGW)



MAIN GEAR: MINIMUM OF H46X18-20, 32 PR TIRE REQUIRED
NOSE GEAR: MINIMUM OF H37X14-15, 24 PR TIRE REQUIRED

GROSS WEIGHT CENTER OF GRAVITY GRID - 388,000 LB MTW, 260,000 LB MZFW

Figure 2-21 CG LIMITS (347,000 LB. MTW, 278,000 LB. MZFW), 767-300

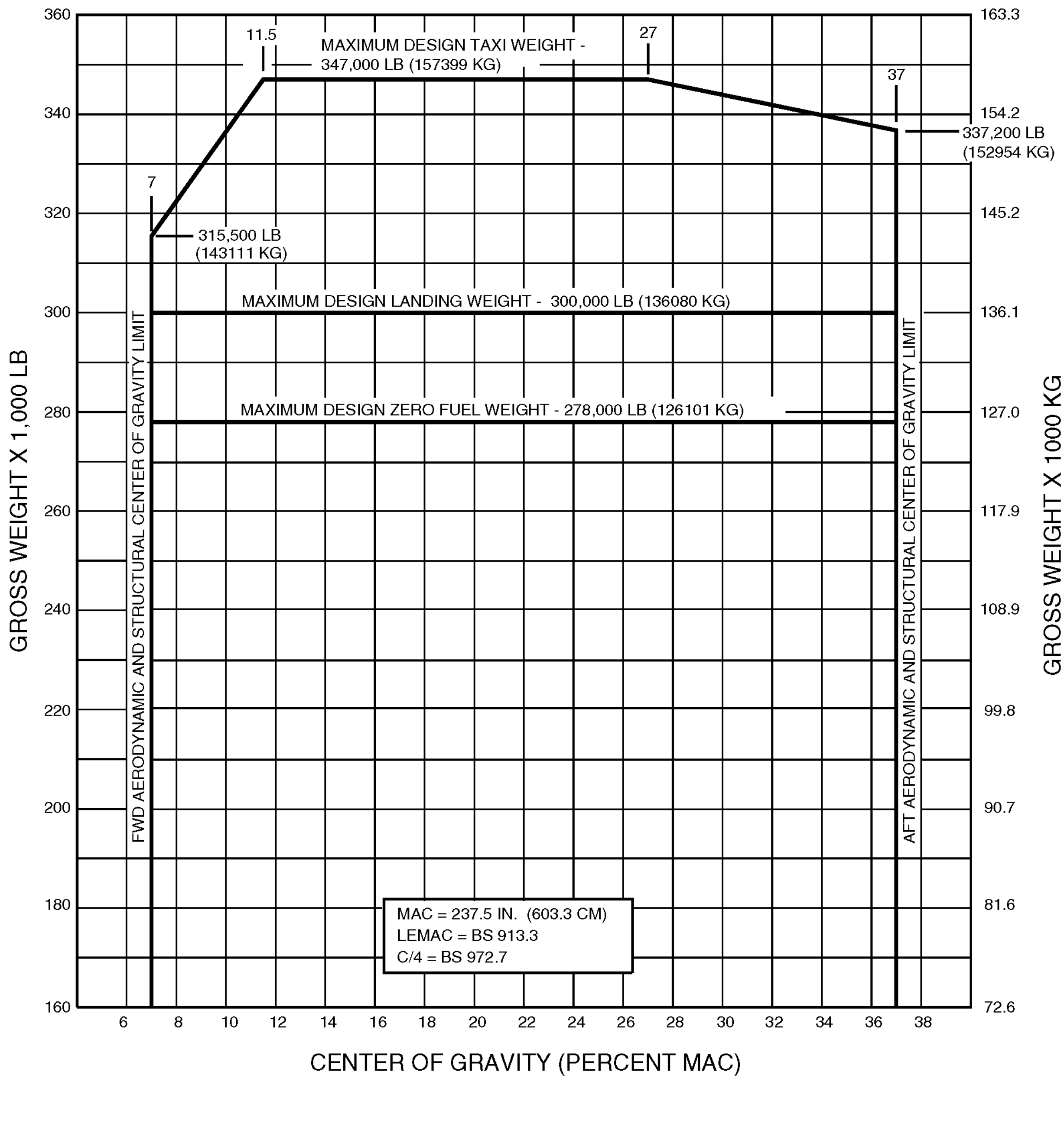
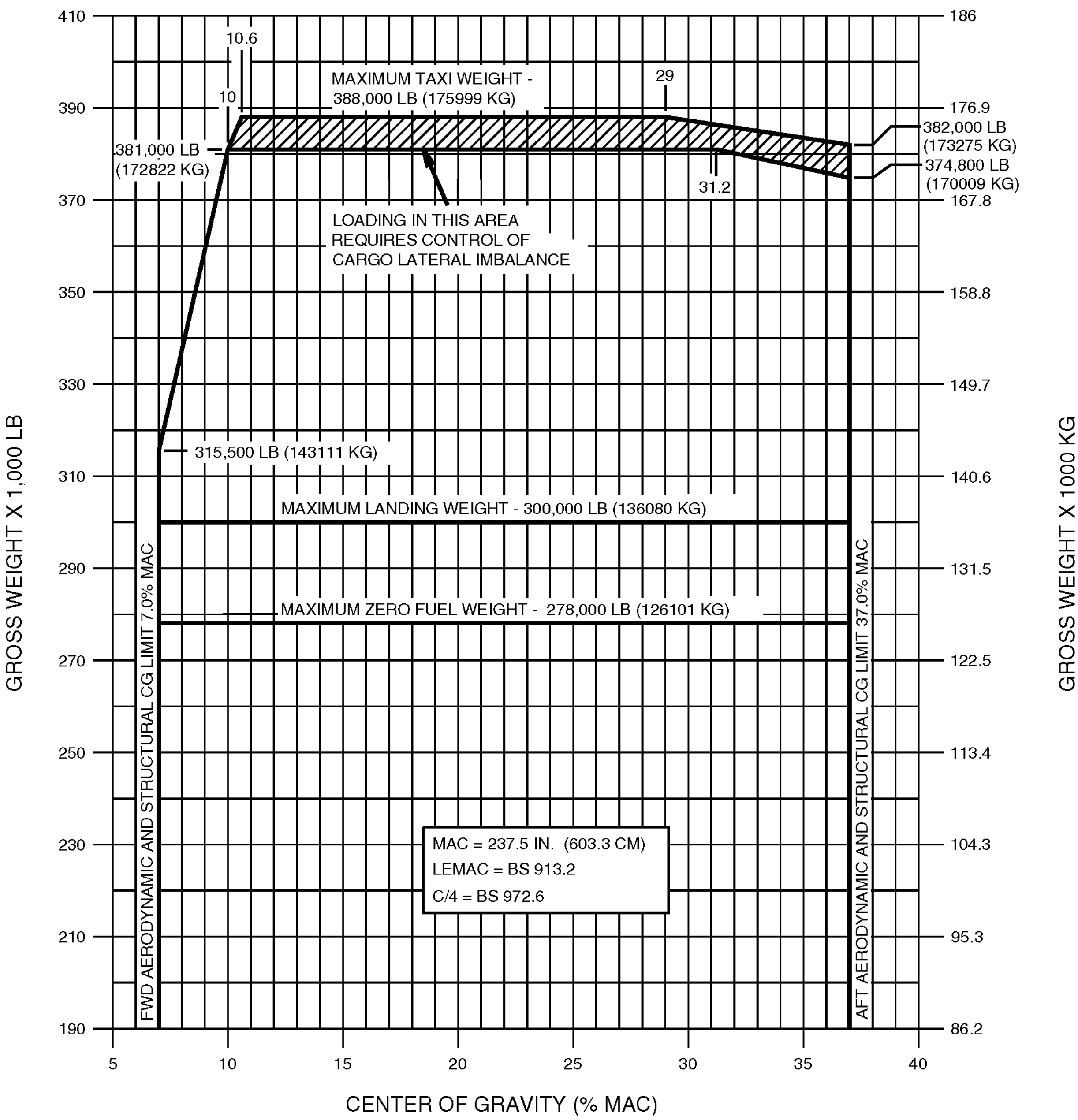


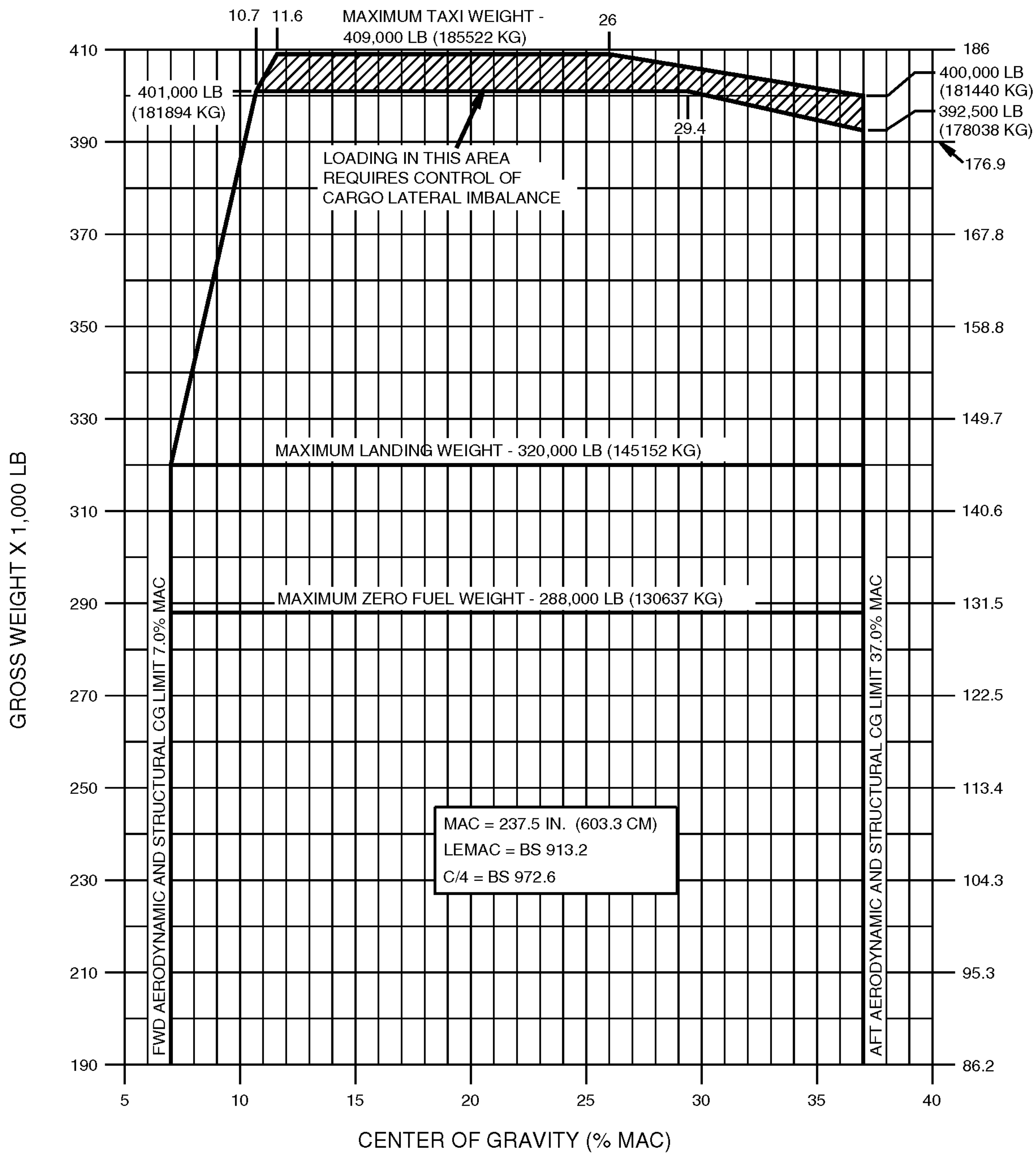
Figure 2-22 CG LIMITS (388,000 LB. MTW, 278,000 LB. MZFW), 767-300ER



MAIN GEAR: MINIMUM OF H46X18-20, 32 PR TIRE REQUIRED
NOSE GEAR: MINIMUM OF H37X14-15, 22 PR TIRE REQUIRED

GROSS WEIGHT CENTER OF GRAVITY GRID - 388,000 LB MTW, 278,000 LB MZFW

Figure 2-23 CG LIMITS (409,000 LB. MTW, 288,000 LB. MZFW), 767-300ER (IGW)



MAIN GEAR: MINIMUM OF H46X18-20, 32 PR TIRE REQUIRED
NOSE GEAR: MINIMUM OF H37X14-15, 22 PR TIRE REQUIRED

GROSS WEIGHT CENTER OF GRAVITY GRID - 409,000 LB MTW, 288,000 LB MZFW

Figure 2-24 CG LIMITS (409,000 LB. MTW, 309,000 LB. MZFW), 767-300 FREIGHTER

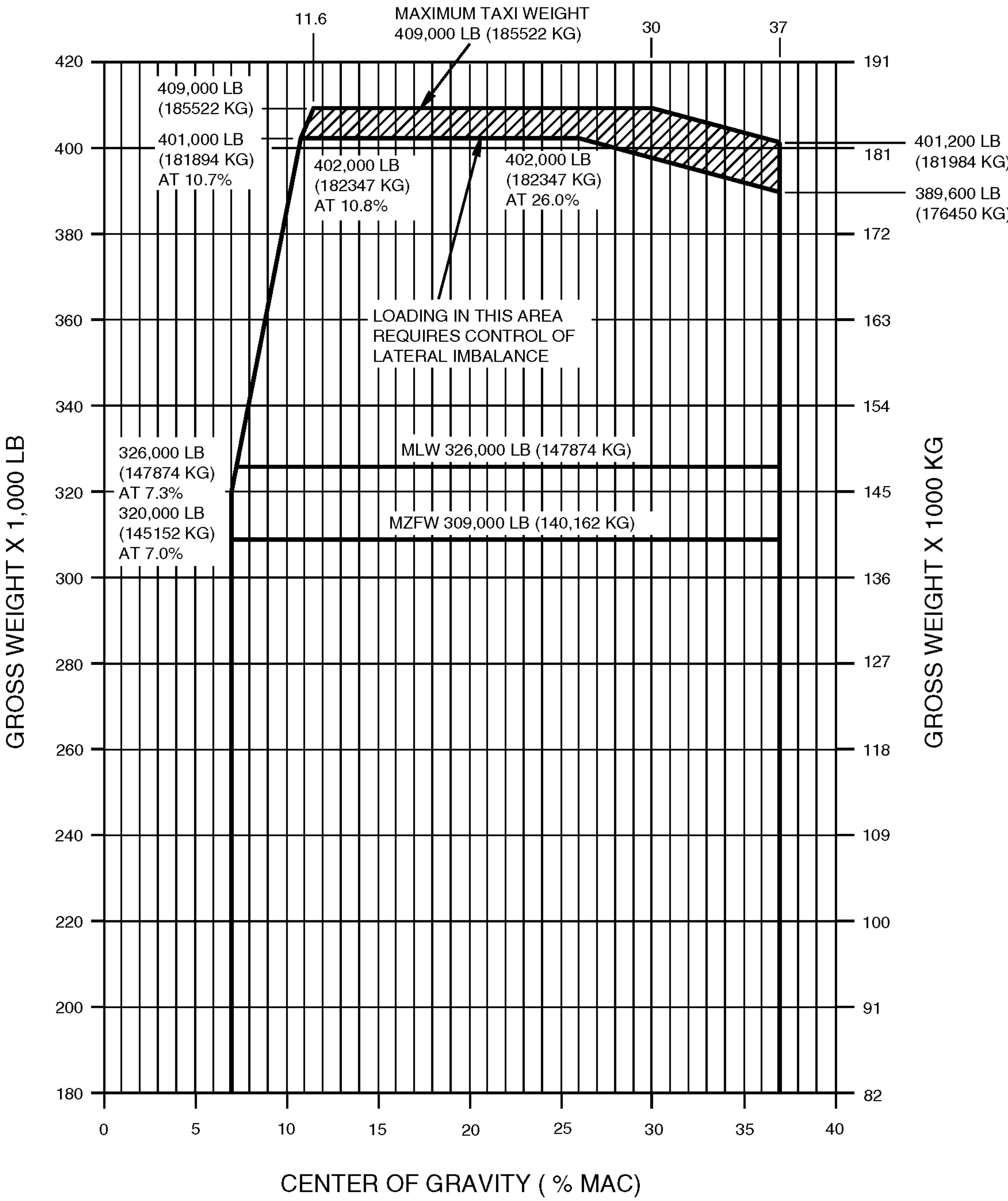


Figure 2-25 CG LIMITS (OPTIONAL) (413,000 LB. MTW, 309,000 LB. MZFW), 767-300 FREIGHTER

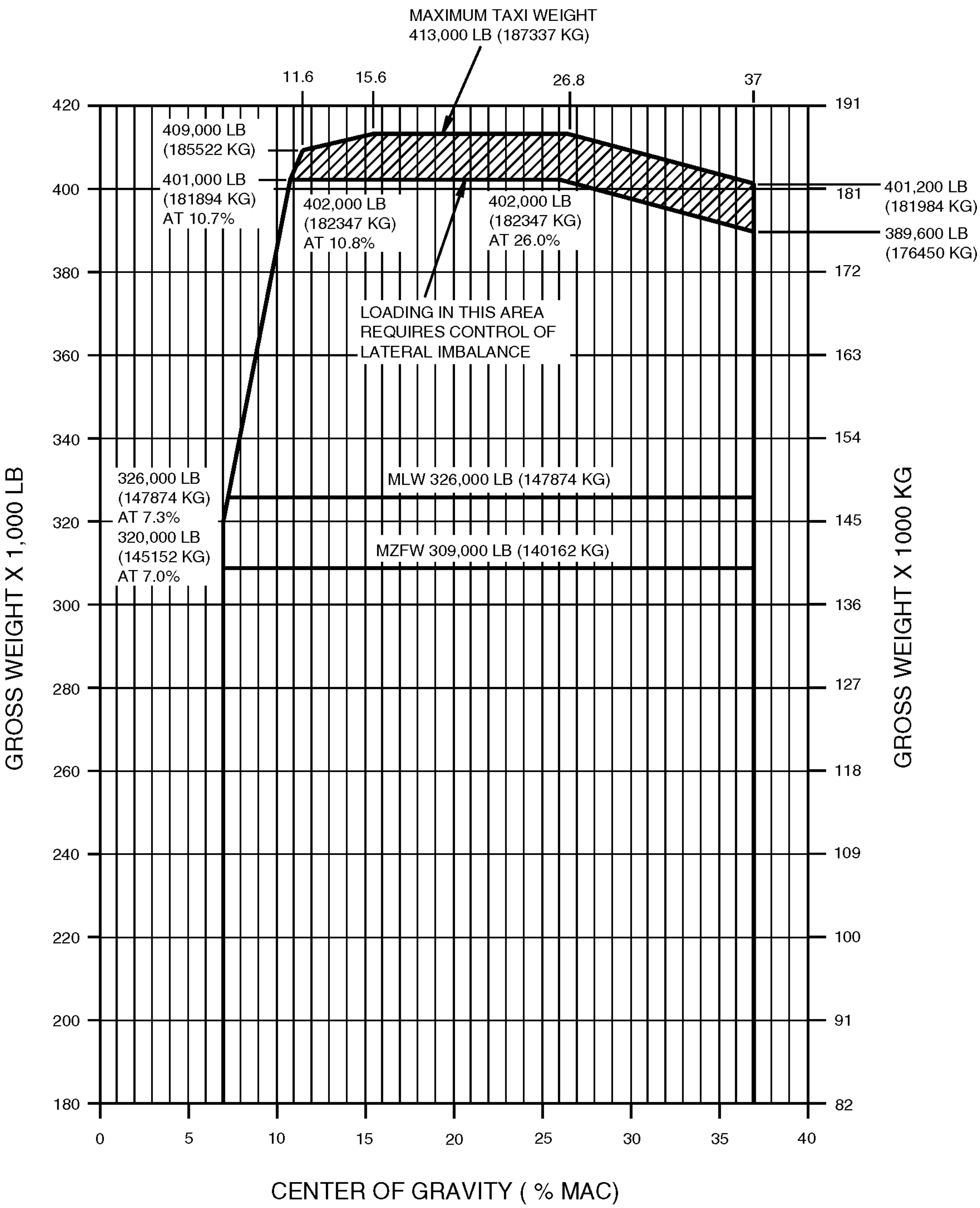
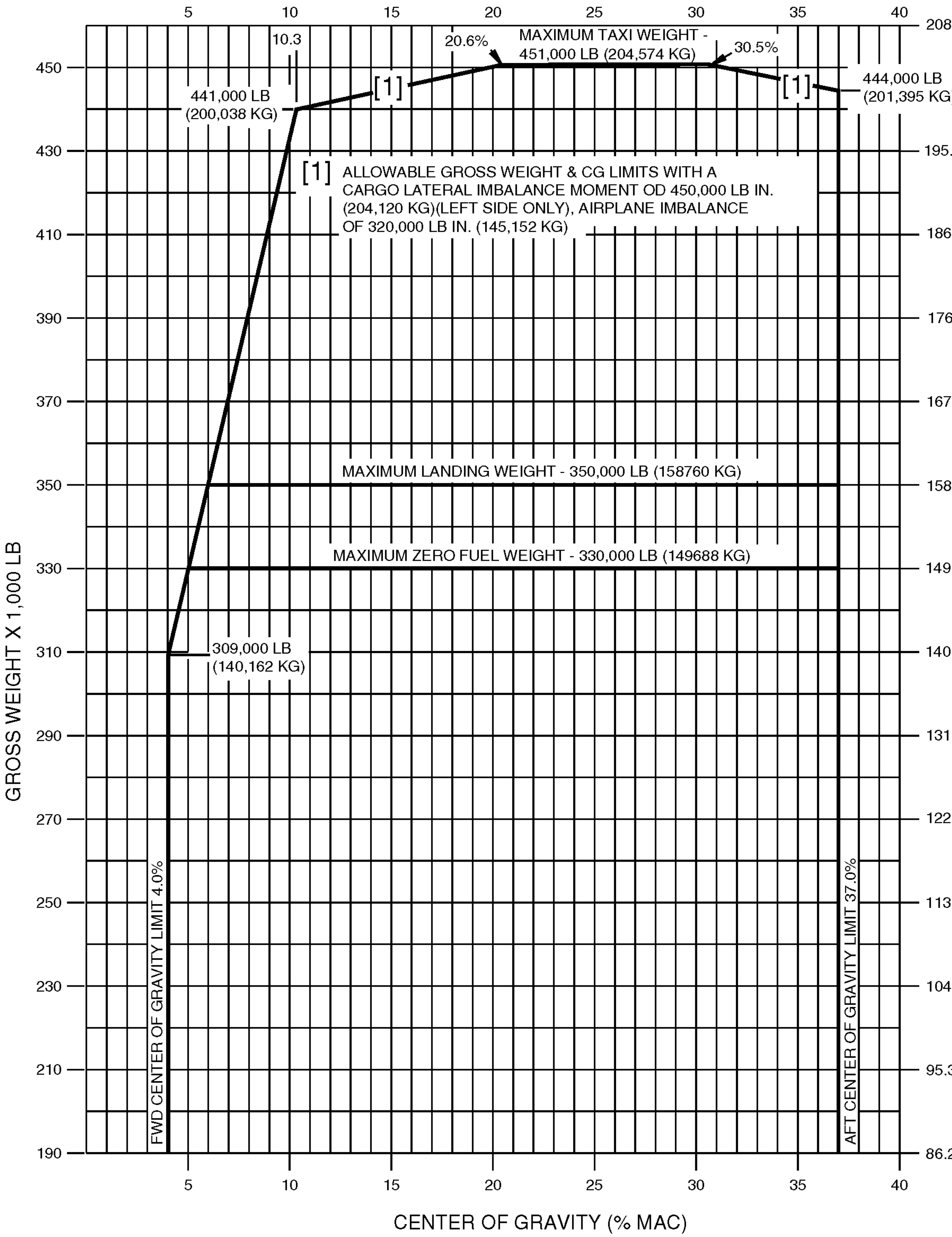


Figure 2-26 CG LIMITS (451,000 LB. MTW, 330,000 LB. MZFW), 767-400ER



2-40 REMOVAL OF PAYLOAD

2-40-1 General

1. The removal of the payload from the airplane is necessary to decrease the airplane weight. After passengers are off the airplane you can start the removal of all baggage and cargo from the cargo compartments. In this document, we recommend the removal of the fuel from the airplane as your first step. After the fuel is removed the cargo can also be removed.
2. The airplane will frequently be in an unusual attitude during the start of a recovery. Make sure you tell all the persons about the risks from a sudden load movement while you remove the payload.
3. You must prepare a procedure when you first examine the airplane. This procedure must show the relation between the payload removal and the defueling procedures for the CG control. Do not remove the payload until you calculate the CG of the airplane for the tow configuration.
4. If only one or two main landing gear (but no nose landing gear) are there, this may not be a stable condition during the payload removal operation. Persons should be aware. The airplane can suddenly shift down on its aft compartment while the payload is being removed. Provide adequate supports as necessary during the payload removal operation.
5. Remove cargo containers or pallets from the forward and aft lower lobe compartments and main deck (Freighter model). Also remove baggage from the bulk cargo compartments. Do this before the airplane is leveled and before lifting or moving.
6. The sill heights for the cargo doors are shown in Figure 1-19 through Figure 1-22. The sill heights are only good for an airplane at the correct attitude (normally parked on the ramp). When the airplane attitude is different from the parked condition (the gears are up or the fuselage is turned), the sill heights can change.
7. When removing the containers or pallets, you possibly will not have the aid of power equipment (or a conveyor system). Prepare for a change in the attitude of the airplane. The change can be sudden.
8. If the airplane is not on a hard surface, high flotation tires on the cargo handling equipment may be necessary. A very soft surface can also make other materials (mats, plywood) necessary. If you use a cargo loader, align the surface of the ground with the cargo floor.
9. See the Maintenance Facility and Equipment Planning Document (MFEPD) and the Weight and Balance Manual for your airplane (see SUBJECT 1-00-4 for applicable document number). These documents give you all the necessary data (the pallets, the containers, the interior configurations, the clearances and the loading data).
10. When you remove the cargo through the cargo door on the main deck, follow these precautions:
    A. The attitude of the airplane is usually not level. All persons must be careful. There can be a sudden movement of the cargo when you remove the restraints.
    B. You must schedule all changes in airplane loads for control of the CG. Thus, you must schedule the sequences that you use to remove the cargo and the fuel. Do not remove the cargo until you examine the CG of the last configuration of the airplane.
    C. Be careful if you have a main landing gear (or two of them) extended while you remove the cargo. The airplane can suddenly move down on its aft section. If it is possible, remove the cargo from the aft compartments (lower and main deck) first. You can also have the opposite condition where the load on the nose gear becomes too high.

    CAUTION: DO NOT OPERATE THE CARGO DOOR OR LET THE DOOR STAY OPEN IN WINDS MORE THAN 65 KNOTS. STRONG WINDS CAN CAUSE DAMAGE TO THE DOOR.

    D. You can use a movable crane to remove the cargo if the door is in the full open position. With the door in this position, there is sufficient floor area to permit a satisfactory cargo connection to the crane.

E. See the applicable documents (Weight and Balance Document, Baggage/Cargo Loading Manual, and the MFEPD) for the data that follows:

(1) Cargo removal operations

(2) Pallet and container descriptions

(3) Airplane interior arrangements and clearances

2-40-2 Forward and Aft Lower Lobe Cargo Doors, Main Deck Cargo Door and Controls

1. The centerline of the forward lower lobe cargo door is at Body Station 577.5. The centerline of the aft cargo door is at Body Station 1308 (See Fuselage Centerline Diagram, Figure 1-10 through Figure 1-13, for the 767-200, 767-300, 767F, and 767-400ER relationships). The two doors open away from the airplane. They are on the right side of the airplane and each door gives a clear 69 in. (175 cm) height and 70 in. (178 cm) width opening. On airplanes with the optional wide forward lower lobe cargo door, the door centerline is at Body Station 548. The door is of the plug type and opens away from the airplane to give a clear 69 in. (175 cm) height and 134 in. (340 cm) width opening.
2. The centerline of the main deck cargo door is at Body Station 562. This door also opens away from the airplane. It is located on the left side of the airplane and gives a clear 100 in. (254 cm) height and 134 in. (340 cm) width opening.
3. See Figure 1-19 through Figure 1-22 for exact door locations and heights above ground.
4. The forward and aft lower lobe and main deck cargo doors (not the bulk cargo door) use electricity (400 cycle, 3-phase AC). The forward and aft lower lobe doors open in 50 seconds and close in 40 seconds. The main deck cargo door opens in approximately 80 seconds and closes in approximately 80 seconds. The cargo door controls and cargo movement controls are shown in Figure 2-27, Figure 2-28 and Figure 2-30.
5. When electrical power is not available, you can open the doors with the manual (alternate) system.

CAUTION: DO NOT OPERATE THE CARGO DOOR OR LET THE DOOR STAY OPEN IN WINDS MORE THAN 65 KNOTS. STRONG WINDS CAN CAUSE DAMAGE TO THE DOOR.

CAUTION: IF YOU USE A POWER TOOL, DO NOT OPERATE IT AT A SPEED FASTER THAN 500 RPM OR A TORQUE MORE THAN 190 POUND-INCHES. INCORRECT OPERATION OF A POWER TOOL CAN CAUSE DAMAGE TO THE HINGE UNIT.

6. Use the following instructions to manually operate the standard forward lower lobe cargo door and the aft lower lobe cargo door (see Figure 2-27)
   A. Put a 3/8-inch square speed drive wrench into the lift/latch manual drive receptacle. Turn the wrench counterclockwise to lift the cargo door to the lifted position.

      NOTE: The door is in the lifted position when it is lifted vertically 2 in. (5 cm) from the latched position.

      It takes approximately 60 full turns of the wrench to move the door from the latched position to the lifted position.

CAUTION: IF YOU USE A POWER TOOL, DO NOT OPERATE IT AT A SPEED FASTER THAN 500 RPM OR A TORQUE MORE THAN 190 POUND-INCHES. INCORRECT OPERATION OF A POWER TOOL CAN CAUSE DAMAGE TO THE HINGE UNIT.

   B. Put a 3/8-inch square drive speed wrench in the open/close manual drive receptacle. Turn the wrench clockwise to open the cargo door to the fully open position.

      NOTE: It takes approximately 1150 full turns of the wrench to move the cargo door from the lifted position to the fully open position.

CAUTION: DO NOT OPERATE THE CARGO DOOR OR LET THE DOOR STAY OPEN IN WINDS MORE THAN 65 KNOTS. STRONG WINDS CAN CAUSE DAMAGE TO THE DOOR.

7. Use the following instructions to manually operate the wide forward lower lobe cargo door (see Figure 2-28).

CAUTION: DO NOT LET THE LATCH/HOOK ACTUATOR OPERATE WITH CLUTCH SLIPPAGE FOR MORE THAN A MAXIMUM OF 5 SECONDS. CLUTCH SLIPPAGE DURING THE OPERATION OF THE LATCH/HOOK ACTUATOR CAN CAUSE DAMAGE TO THE EQUIPMENT. IF YOU USE A POWER TOOL, DO NOT OPERATE AT A SPEED FASTER THAN 500 RPM OR A TORQUE MORE THAN 70 POUND-INCHES. INCORRECT OPERATION OF A POWER TOOL CAN CAUSE DAMAGE TO THE LATCH/HOOK ACTUATOR.

CAUTION: IF YOU USE A POWER TOOL, DO NOT OPERATE IT AT A SPEED FASTER THAN 500 RPM OR A TORQUE MORE THAN 190 POUND-INCHES. INCORRECT OPERATION OF A POWER TOOL CAN CAUSE DAMAGE TO THE HINGE UNIT.

A. Push the latch lock handle release button. Make sure the latch lock handle moves to the fully down position.

B. Put a 3/8-inch square drive speed wrench in the manual drive socket of the latch/hook actuator.

CAUTION: DO NOT LET THE HINGE POWER UNIT OPERATE WITH CLUTCH SLIPPAGE FOR MORE THAN A MAXIMUM OF 5 SECONDS. CLUTCH SLIPPAGE DURING THE OPERATION OF THE HINGE POWER UNIT CAN CAUSE DAMAGE TO THE EQUIPMENT. IF YOU USE A POWER TOOL, DO NOT OPERATE AT A SPEED FASTER THAN 500 RPM OR A TORQUE MORE THAN 190 POUND-INCHES. INCORRECT OPERATION OF A POWER TOOL CAN CAUSE DAMAGE TO THE HINGE POWER UNIT.

CAUTION: IF YOU USE A POWER TOOL, DO NOT OPERATE IT AT A SPEED FASTER THAN 500 RPM OR A TORQUE MORE THAN 190 POUND-INCHES. INCORRECT OPERATION OF A POWER TOOL CAN CAUSE DAMAGE TO THE HINGE UNIT.

C. Turn the speed wrench clockwise approximately 115 turns the fully not latched and not hooked position of the cargo door.

NOTE: The stops that prevent travel are touched when you feel or hear clutch slippage. The cargo door moves outboard approximately 2.6 in. (6.6 cm) when the stops are touched.

D. Put a 3/8-inch square drive speed wrench in the manual drive socket of the hinge power unit that is found on the external surface of the door near the forward side.

E. Turn the speed wrench counterclockwise until the lower part of the cargo door turns 6 ft (1.8 m) from the lower fuselage frame.

NOTE: It is usual for the door to stop at the lowest point of its travel.

F. Move the 3/8-inch square drive speed wrench to the manual drive socket of the hinge power unit that is found on the forward edge of the cargo door.

G. Turn the speed wrench counterclockwise until the cargo door is in the fully open position and you can feel or hear clutch slippage.

CAUTION: BEFORE YOU OPEN OR REMOVE A CARGO DOOR, MAKE SURE THAT THE FUSELAGE BY THE DOOR IS NOT DAMAGED. A DAMAGED FUSELAGE CAN STOP THE DOOR OPERATION OR REMOVAL.

8. If any of the cargo doors do not open when you use the manual procedure, you can remove the door. The door can be removed as a completed assembly from the external side of the airplane.

Figure 2-27 FORWARD AND AFT LOWER LOBE CARGO DOOR AND CONTROLS

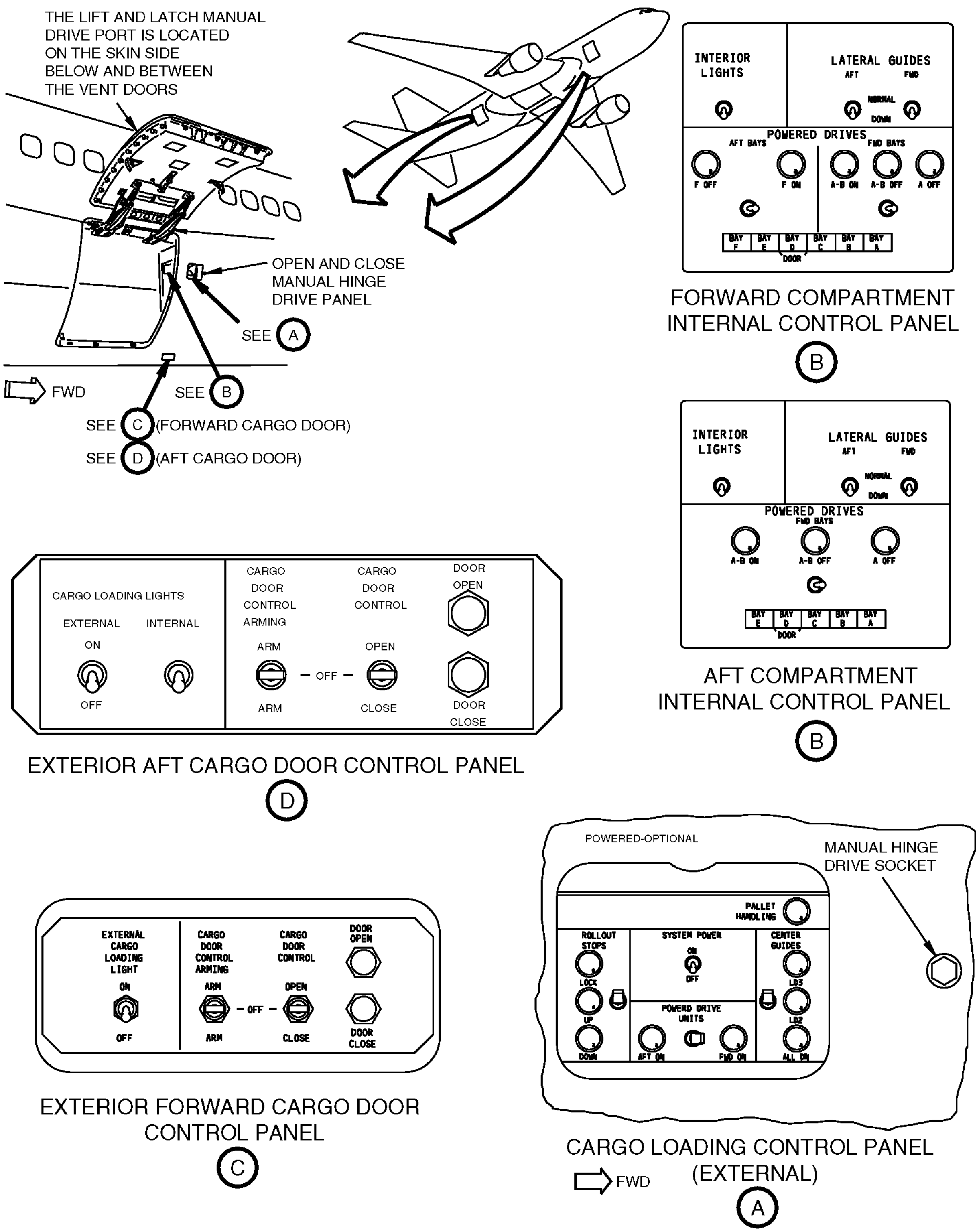


Figure 2-28 WIDE FORWARD LOWER LOBE CARGO DOOR AND CONTROLS

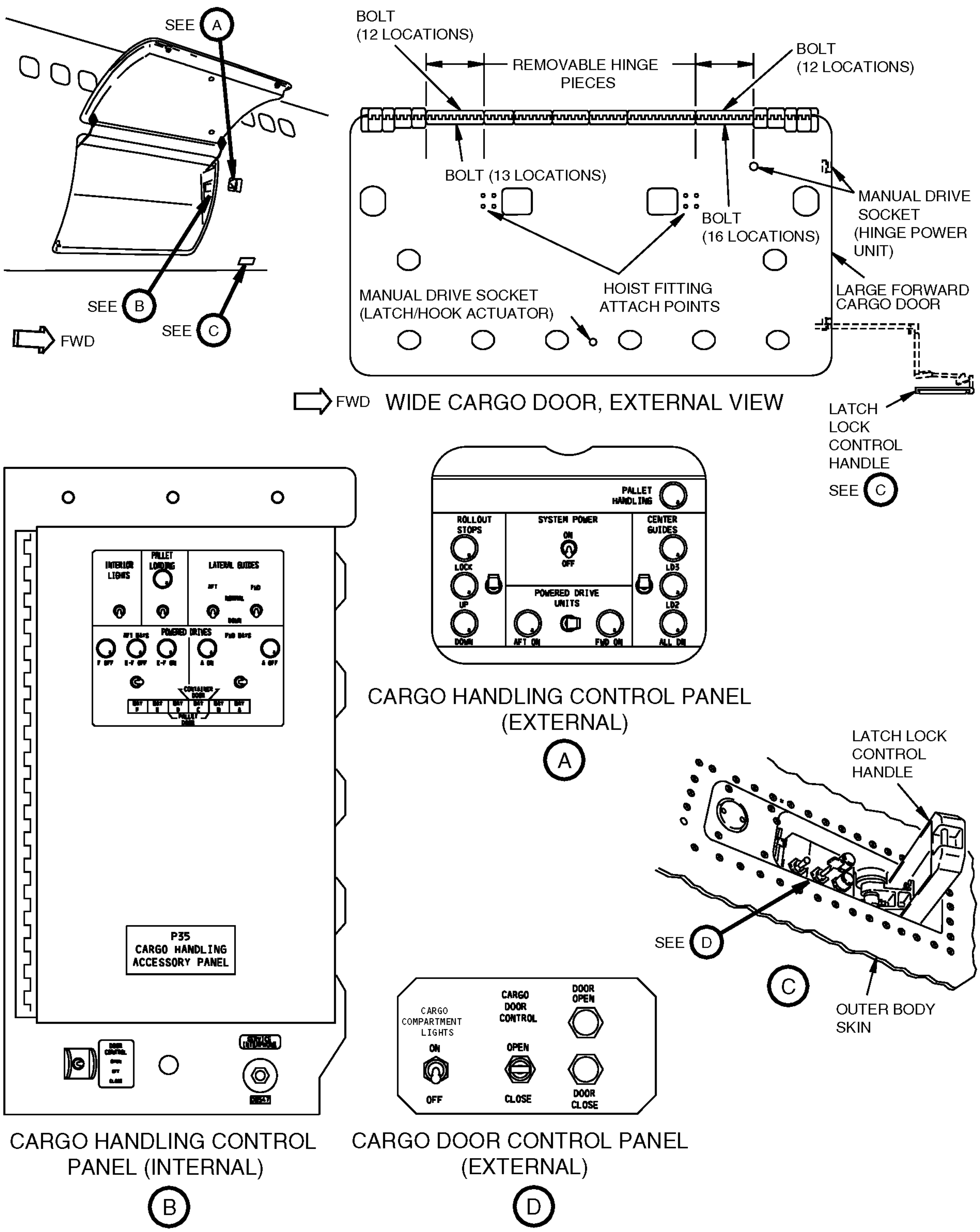


Figure 2-29 BULK CARGO DOOR

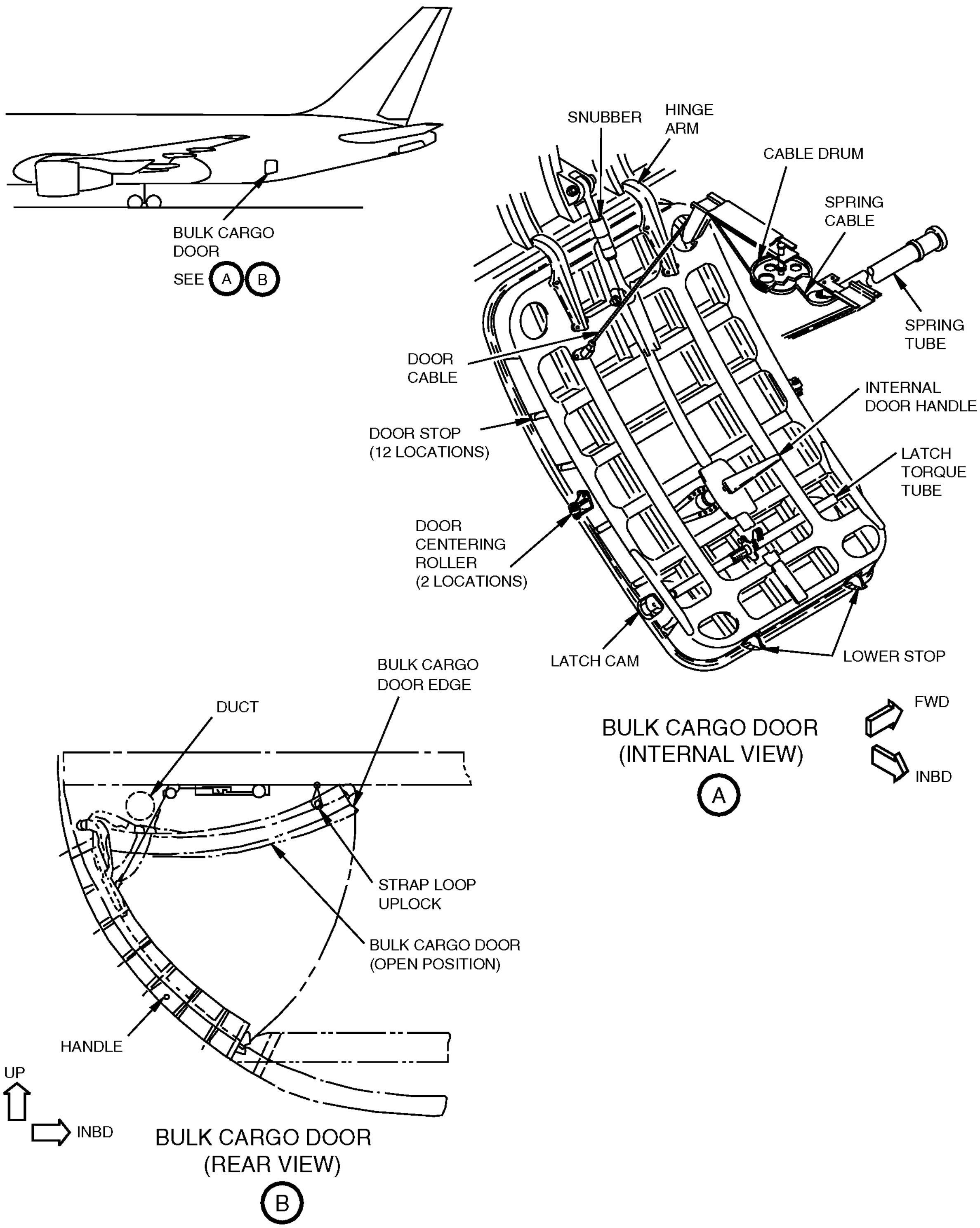
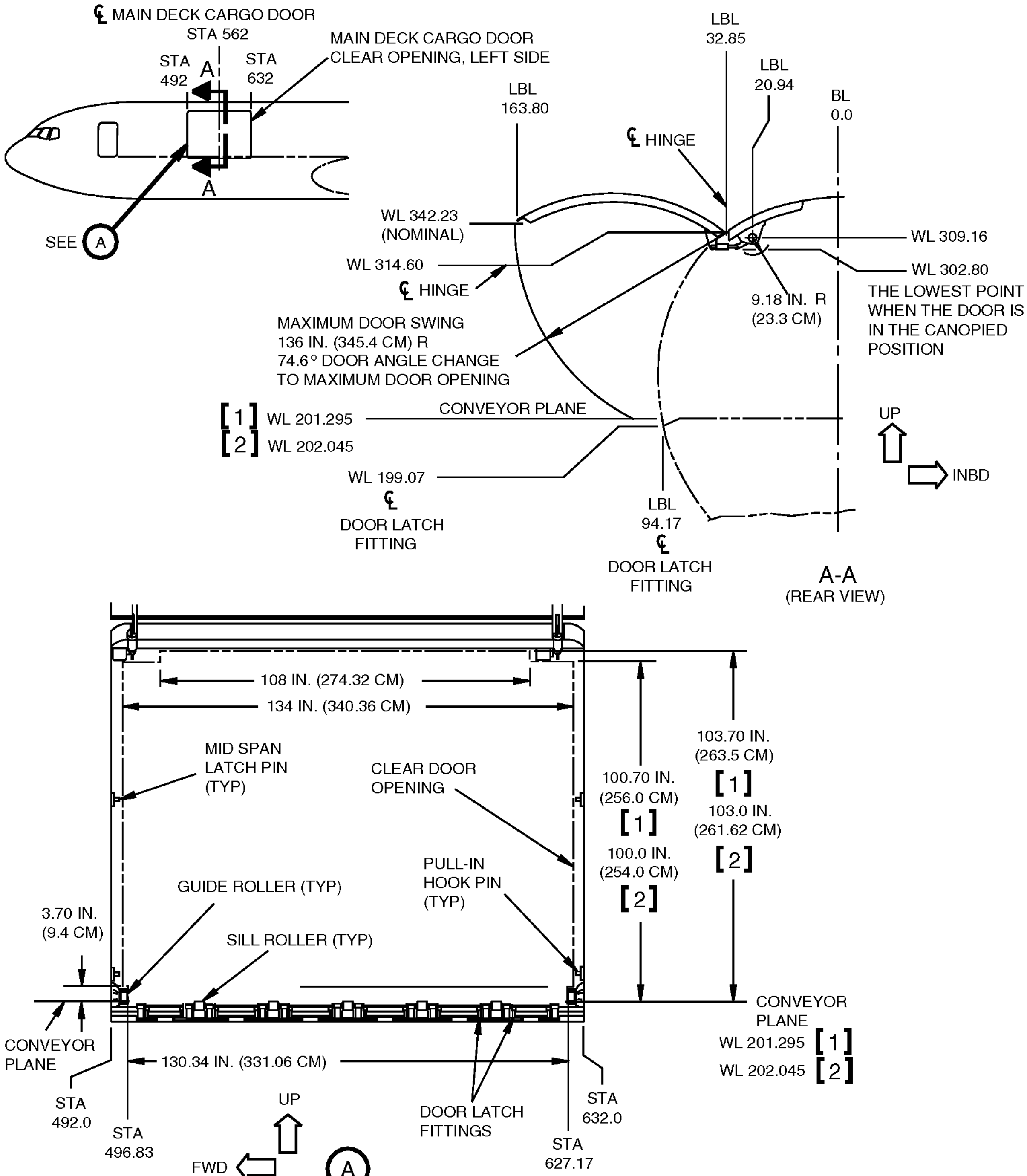


Figure 2-30 MAIN DECK CARGO DOOR (FREIGHTER)



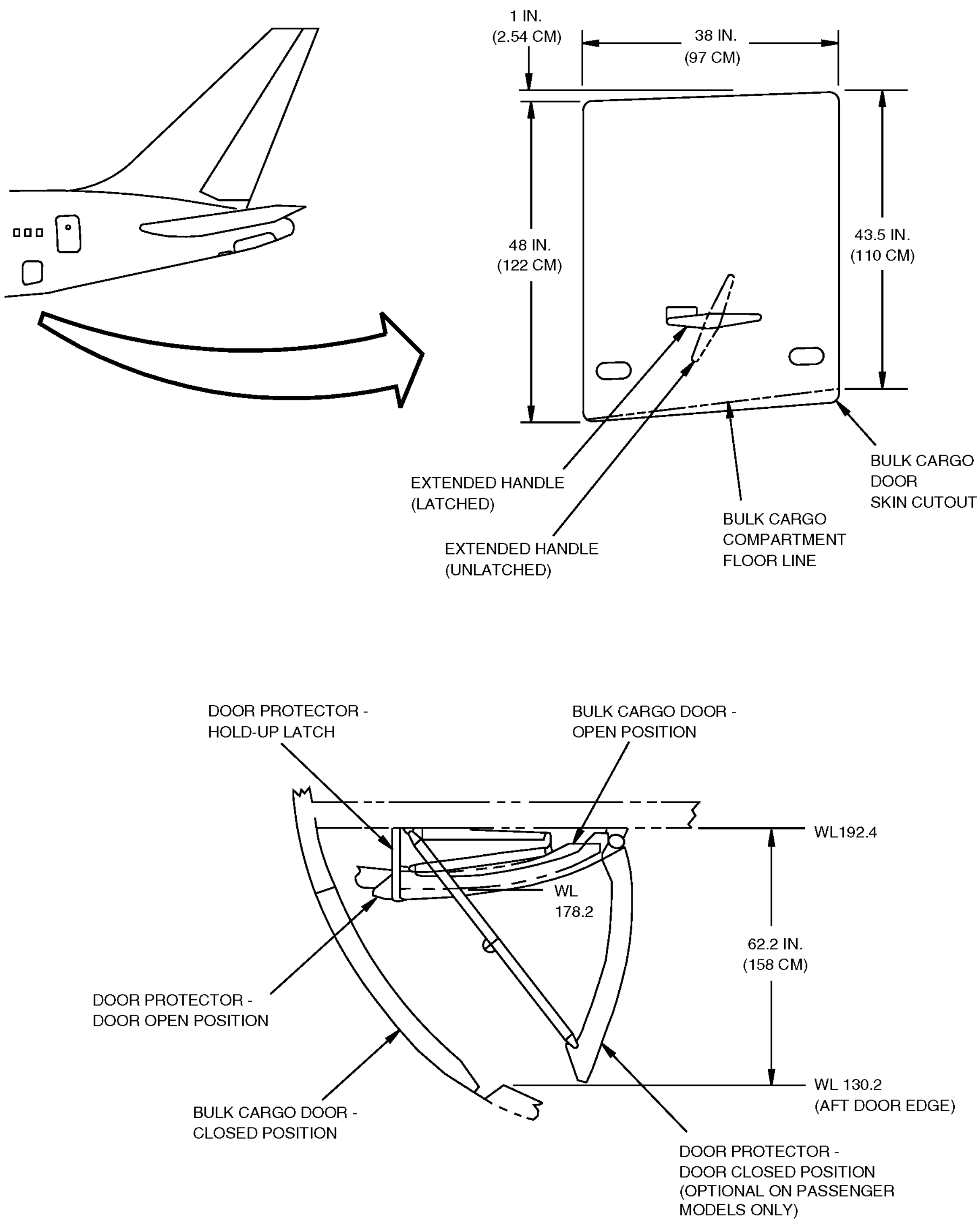
[1] FREIGHTERS WITH THE MANUAL CARGO HANDLING SYSTEM

[2] FREIGHTERS WITH THE POWERED CARGO HANDLING SYSTEM (GENERAL MARKET FREIGHTER)

2-40-3 Bulk Cargo Door

1. The centerline of the bulk cargo door is at Body Station 1439. It is a plug type door and it opens into the airplane. It is on the left side of the airplane and gives a clear 43½ in. (110.5 cm) height and 38 in. (96.5 cm) width opening.
2. You operate the bulk cargo door manually. You can not remove the door from the external side of the airplane. You can get access to the bulk cargo area if you go through the rear of the aft cargo compartment. An illustration of the internal surface of the bulk cargo door is shown in Figure 2-29.
3. Use these instructions to manually operate the bulk cargo door (see Figure 2-31):
   A. Turn the external handle 60 degrees counterclockwise.
   B. Turn the internal handle 60 degrees clockwise.

Figure 2-31 BULK CARGO DOOR OPERATION



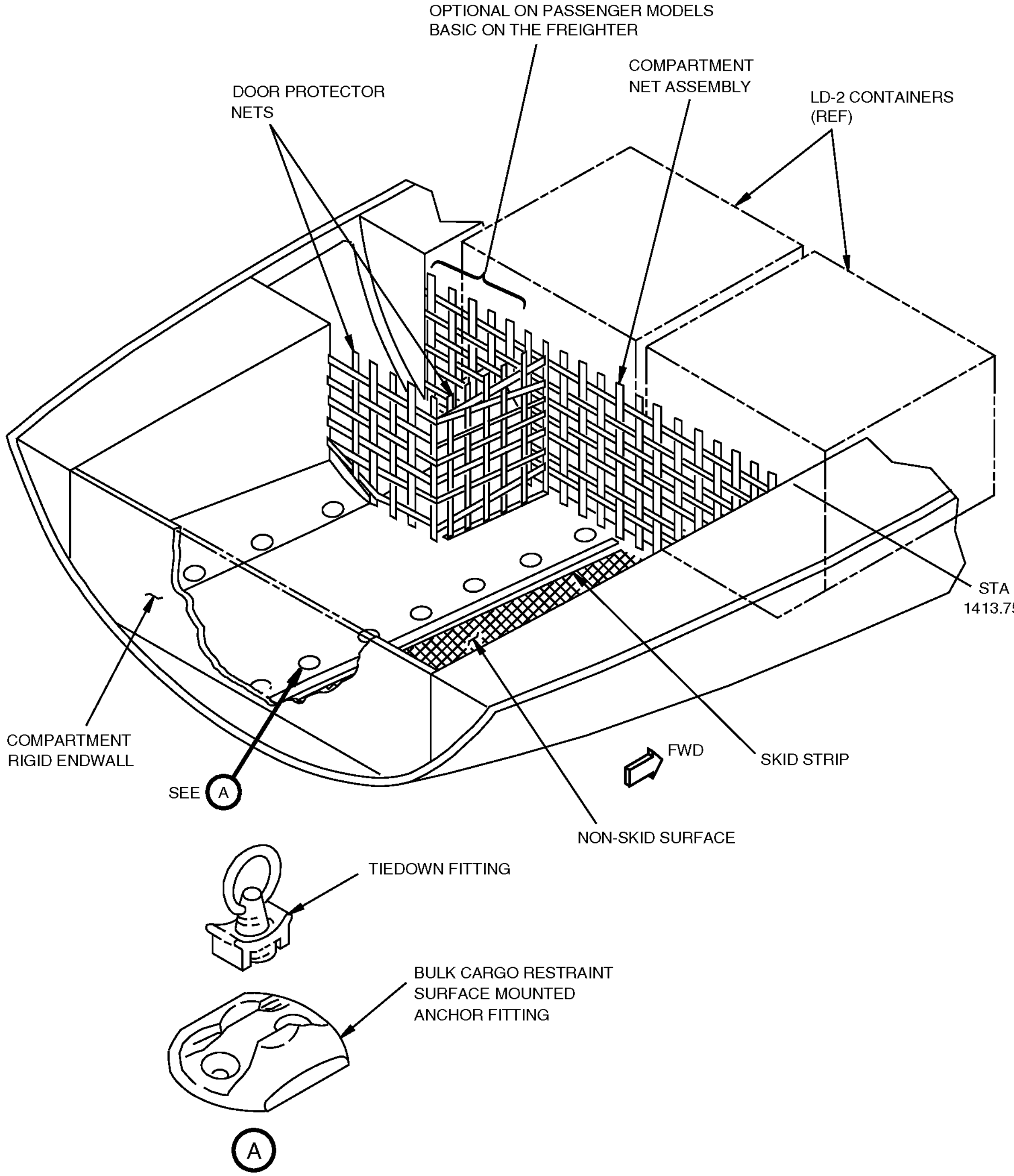
2-40-4 Unloading the Bulk Cargo Compartment

1. The removal sequence of the cargo is an important part of CG control. The defueling sequence is also important. Schedule these two sequences to keep the change in the CG at a minimum. Do not remove the cargo until you know the possible change in CG.

   WARNING: BE CAREFUL WHEN YOU RELEASE A CARGO RESTRAINT. A SUDDEN MOVEMENT OF LOADS CAN OCCUR. YOU MUST TELL ALL PERSONS OF THE DANGEROUS CONDITION.

2. Usually, you must remove the bulk cargo first because of its aft CG position. A net isolates the bulk cargo from the other (containerized) cargo (see Figure 2-32. You can remove the net quickly if it is necessary. This separation permits different removal sequences.

Figure 2-32 BULK CARGO COMPARTMENT



NOTE: TOTAL VOLUME (-200/-300): 430 CU FT (12.2 CU M);
TOTAL COMPARTMENT VOLUME WILL BE INCREASED
WITH THE ADDITION OF AN OPTIONAL NET ASSEMBLY
AT STA 1344, IN LIEU OF THE TWO LD-2 CONTAINERS SHOWN.

2-40-5 Main Deck Cargo (Freighter Model Only)

1. General

   A. The main deck cargo door is on the left side of the fuselage forward of the wing. Its correct fuselage position is Body Station 492 to Body Station 632. The hinges are at the top of the door and it opens away from the airplane. This permits the cargo to go into the airplane through a clear opening. The opening has a clear width of 134 in. (340 cm) and a clear height of 100 in. (254 cm); see Figure 2-30.

   B. The 767 Freighter airplane can accommodate several Unit Load Device (ULD) sizes depending on the loading configuration. The total capacity for the main deck is approximately 164,000 lb (74,389 kg). The main deck cargo compartment has either a powered transfer system (General Market Freighter (GMF) model) or a manual cargo handling system (non-powered).

   C. For the powered cargo handling system, Power Drive Units (PDUs) along with roller tray assemblies are installed to assist in transferring and positioning cargo Unit Load Devices (ULDs) within the cargo compartment. The main deck power drive system is primarily controlled by the Master Cargo Control Panel (MCCP). The panel is located on the outside of the airplane, immediately aft of the main deck cargo door. Three Local Cargo Control Panels (LCCPs) are also installed inside the main deck compartment, along the right sidewalls. The Local Cargo Control Panels are mainly used in making the final ULD movements to set the cargo locks, if necessary.

   D. For the manual cargo handling system, the main deck cargo compartment incorporates cargo tracks and structural hard points to accommodate installation of a non-powered cargo conveyor, guidance and restraint hardware. The main deck architecture will depend on the customer configuration.

2. When You Open the Main Deck Cargo Door

   A. Usually, you operate the door with electrical power. The P100 main deck cargo door control panel, for electric operation of the door, is located in the flight deck near the crew entry door (STA 348, LBL 69).

   B. If it is necessary, you can also operate the door with a manual (alternate) system. Placards located on and by the main deck cargo door describe the procedure for opening the door manually. Manual operation of the door is accomplished by using hand or power tools (500 rpm maximum) with 3/8 inch square male drive socket. The manual operation control ports are located on the door skin the lock and latch/hook system and on the body skin immediately aft of door cutout for the lift system.

   C. There are four mechanical mechanisms that operate independently to move the door. These mechanisms are the lift mechanism for raising and lowering the door, the latch/hook mechanism for latching and unlatching the door latches and for pulling the door out of the door cutout, and latch lock mechanism for locking the latches in the latched position. All of these mechanisms are controlled via the door operator station with power supplied by the airplane's 115-VAC and 28-VDC ground handling buses. The electrical sequence of these mechanisms will open or close the door in approximately 80 seconds.

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2-40-6 Unloading the Main Deck Cargo Compartment

1. General

   A. Document D633T4XX, 767 Baggage/Cargo Loading Manual shows the procedures for removing cargo from the main deck. However, an airplane recovery situation may require a change to the usual cargo unloading procedures due to unusual airplane attitudes.

   B. Make sure that you continuously monitor the airplane CG while you remove the cargo containers. Do not permit the cargo movements to cause a large change in the CG position. This can cause a sudden movement of the airplane. You can find the weight of the containers on each of the containers or on the cargo document (manifest).

   C. It is important to decrease the weight of the airplane to a permitted weight before you use some jacks. Figures Figure 3-35 and Figure 3-36 shows the permitted weight for an airplane when it is on jacks. If the airplane nose is not down, remove the most cargo containers that you can. When the airplane nose is down, you must use jacks or air bags to lift the airplane nose. Use jacks at the primary jack points (A or B in Figure 3-34) or bags below the forward fuselage. Then with the airplane at the correct height, you can repair (or replace) the nose gear.

   D. When the airplane nose is not down, its attitude will not be level. Then the removal of the cargo containers is not as easy. If you can make the airplane attitude level, the removal operation is easier.

   E. The recovery area or the airplane attitude can make the container removal not easy. Possibly, you cannot use the usual equipment for this removal. Possibly, you must use a large capacity (forklift) truck or a large crane. This alternative equipment has large diameter wheels. Thus, this equipment can be better for a soft ground surface. Also, it can be better for a surface that is not smooth. Frequently, you must use supports below the loader to align it with the door sill or the floor slope.

   F. If you have a folded nose gear, there can be structural damage in the main deck floor. Then you possibly cannot remove the cargo containers through the main deck door with the cargo system. If this occurs, you must remove each item of the cargo without the aid of the cargo system.

WARNING: MAKE SURE THE CARGO PERSONS STAY OUT OF THE PATH OF THE CARGO CONTAINERS. THERE CAN BE INJURIES IF A PERSON GOES BETWEEN THE CONTAINERS. ALSO, A CONTAINER CAN HIT A PERSON.

   G. When you move the cargo containers from the airplane to the loader, you must control the container movement. The attitude of the airplane floor can be different for each incident. It can be necessary to push the containers up the fuselage to the loader. It can also be necessary to hold them while they slowly go down to the loader. Frequently you must use cables or other equipment (winches, block and tackles, hand hoists, etc.) attached to the fuselage or an external structure.

   H. A large change in the airplane CG usually does not occur when you move the containers forward. After you move a container, make sure you lock it in the new position. This prevents the possible sudden movement of a container during the operation.

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2-40-7 Access to the Lower Lobe When the Cargo Doors Do Not Operate

1. Access to the lower lobe when the cargo doors do not operate.

   NOTE: The instructions for this section apply specifically to passenger models. However, the same cutout areas may be utilized to access lower lobe cargo on the freighter model when the lower lobe cannot be accessed using the lower lobe cargo doors.

2. Usually when the fuselage is damaged, the operation or removal of the cargo doors is not possible. You must go into the cargo lobe through the passenger floor or through the fuselage skin.

   WARNING: BE CAREFUL WHEN YOU CUT THE AIRPLANE. USE ONLY HAND TOOLS OR SAWS ENERGIZED BY AIR. DO NOT USE OTHER TYPES OF EQUIPMENT (SUCH AS FLAME OR ELECTRIC). DO NOT USE FUEL (GASOLINE) ENERGIZED EQUIPMENT.

3. Your best access to the containers in the lower lobe is shown in Figure 2-33. You must lift the carpet and panels in the floor of the aisle on the right side of the airplane. You can go through the floor beams and cut the cargo lining if it is necessary. You must also cut the top surface of the cargo containers to permit access to the contents.

   Use caution when you cut through the containers to prevent damage to the contents. Remove the contents through the floor beams. Before cutting any floor beams to gain additional access to cargo, consult a structural engineer for the estimated cost and extent of repair. The cost of repair may be too much if the floor beams are cut.

4. The usual access zones for an entrance through the fuselage skin are shown in Figure 2-34. Use caution when you cut through the fuselage skin. There is less heavy structure on the right side of the airplane and it is free of airplane systems. These are the access zones:

   A. In the forward cargo compartment, Body Station 434 through 500

   B. In the aft cargo compartment for the 767-200 and 767-200ER

      (1) Body Station 1153 through 1241

   C. In the aft cargo compartment for the 767-300 and the 767-300ER

      (1) Body Station 1153 through 1197+44

   D. In the aft cargo compartment for the 767-400ER

      (1) Body Station 1270 through 1346

Figure 2-33 ACCESS TO LOWER LOBE THROUGH FLOOR

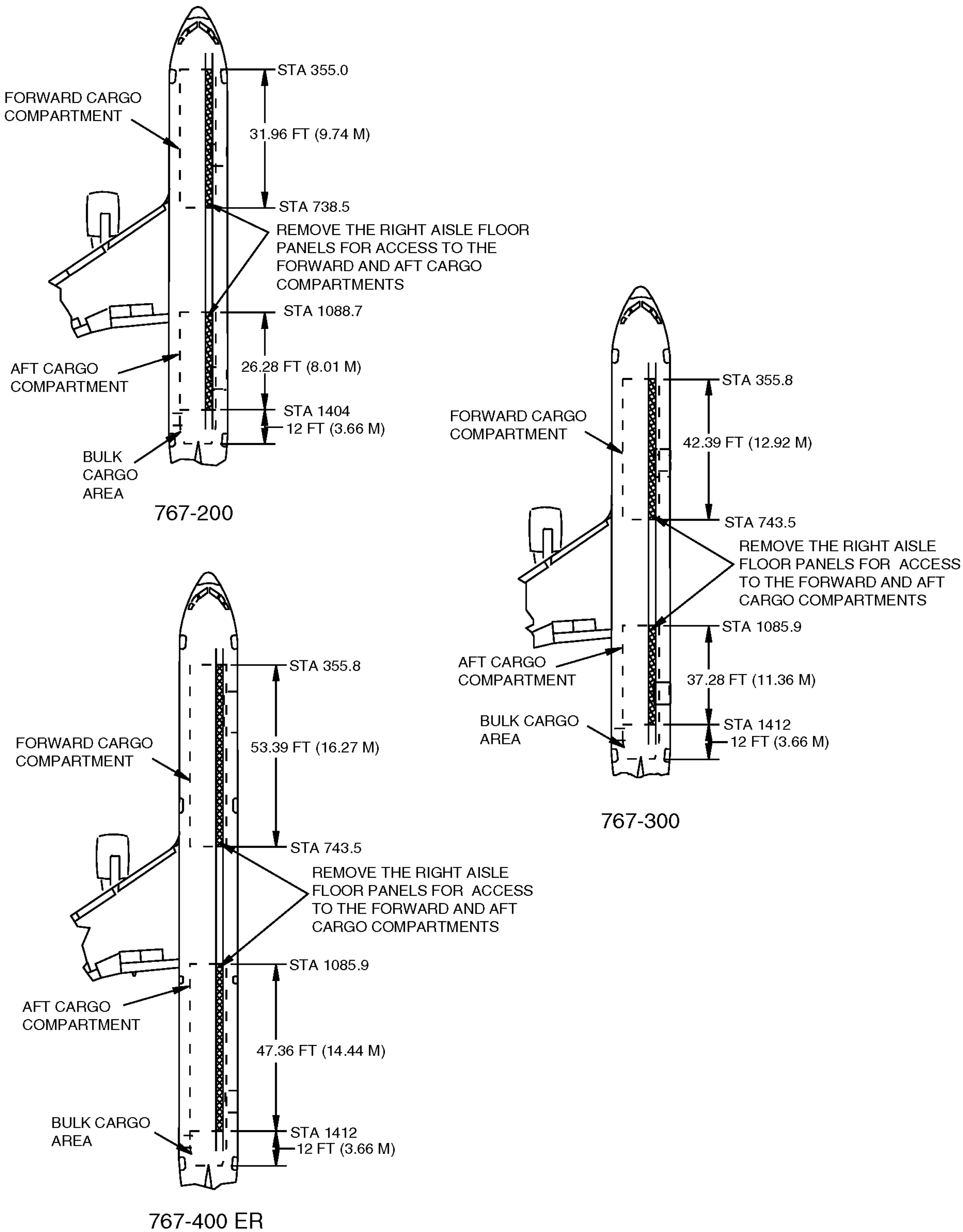
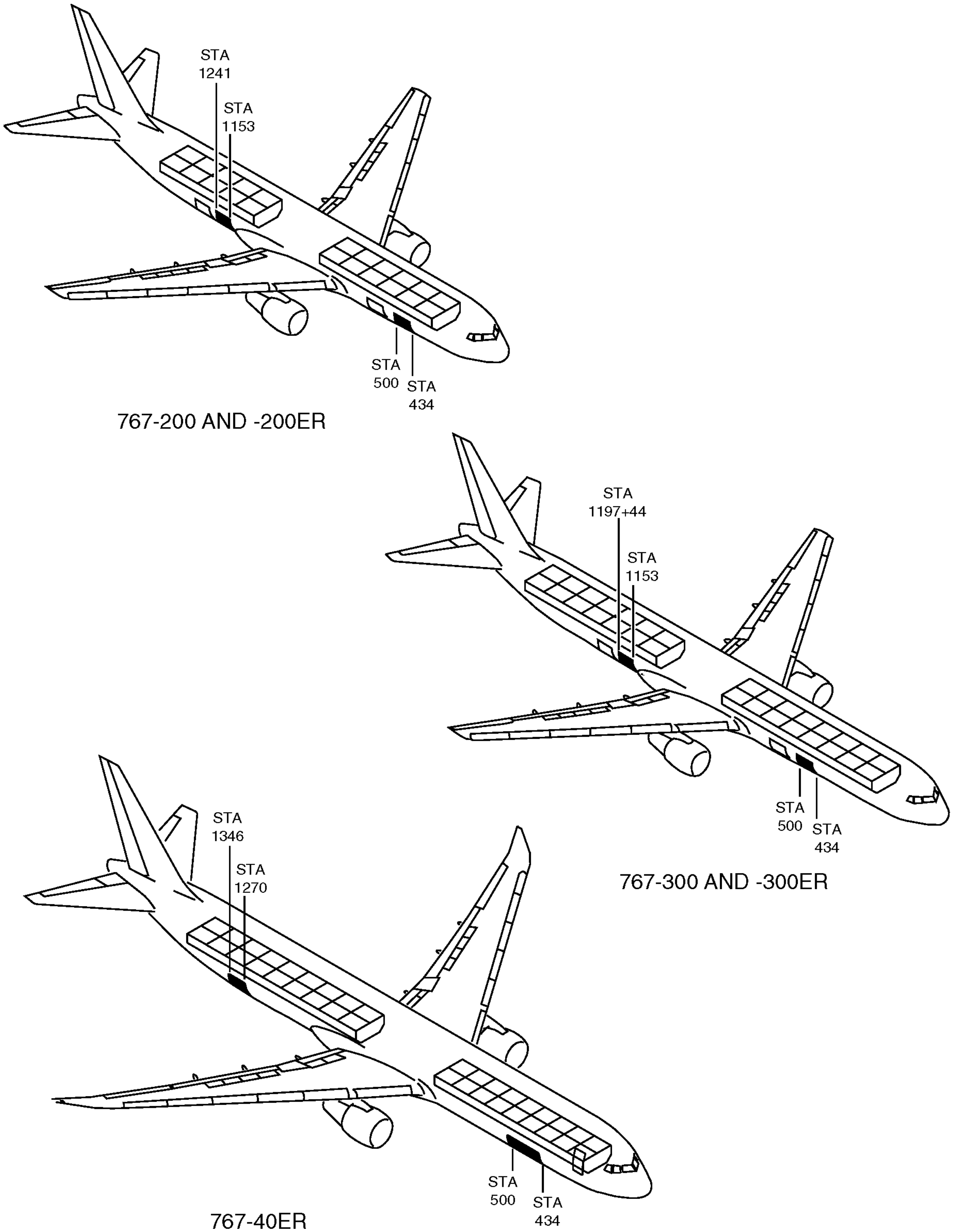


Figure 2-34 ACCESS TO CARGO COMPARTMENTS THROUGH THE BODY SKIN



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2-50 DEFUELING

2-50-1 General

1. The removal or movement of fuel is a primary problem. If a fire occurs, the fuel can be very dangerous. Removal or movement of fuel can also make a large change in the airplane CG. There can be a weight reduction if you remove some fuel. These are the total possible fuel tank capacities and weights:
2. Remove fuel to get the necessary CG position before you try to do the recovery. The condition of the airplane can increase the time that is necessary to remove the fuel. Use only persons who know the fuel system and the fuel removal operation.
3. When you schedule the recovery, you must make a decision about where you can keep the removed fuel. If the quantity of contamination of the fuel is very large, you can discard it. Speak to an oil manufacturer about these decisions.

   WARNING: DO NOT OPERATE ANY POWERED SYSTEMS OR DEFUEL THE AIRPLANE USING THE SYSTEM PUMPS UNLESS YOU ARE ABSOLUTELY SURE THERE ARE NO SYSTEM VOIDS THAT CAN CREATE A SPARK OR FLAME WHICH COULD ENDANGER PERSONNEL OR CAUSE ADDITIONAL DAMAGE TO THE AIRPLANE.

4. If you can repair the airplane power, use the approved procedures to remove the fuel from the airplane (detailed procedures are shown in Maintenance Manual Chapter 28-26-00). If you can not repair the electrical power, you can use one of two alternative procedures. The procedure you use is a function of the damage and the attitude of the airplane. These are the procedures you can use:
   A. Suction hose through the fill ports on the top of the wing.
   B. Hose adapter assembly for gravity drain through the boost pump housings on the bottom of the wing.

Figure 2-35 FUEL TANK CAPACITIES (USEABLE FUEL)

TANK	AIRCRAFT MODEL	U.S. GAL	LITERS	U.S. LB	KG
Left Main	all	6,070	22,975	40,669	18,447
Right Main	all	6,070	22,975	40,669	18,447
Center	-200 -300	4,560	17,260	30,552	13,858
Auxiliary	-200ER	8,310	31,453	56,677	25,709
	-300ER -300F -400ER	12,000	45,420	79,796	36,195
Total Capacity	-200 -300	16,700	63,210	111,890	50,752
	-200ER	20,450	77,403	138,015	62,602
	-300ER -300F -400ER	24,140	91,370	161,134	73,089

NOTE: The fueling (defueling) control panel is shown in Figure 2-40, view C. The fuel system diagram is shown in Figure 2-36.

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2-50-2 Defueling Procedures

1. This procedure contains four different procedures to defuel the fuel tank:
   - A. Pressure defueling
   - B. Suction defueling
   - C. Tank to tank transfer, and
   - D. Optional procedure to defuel without electrical power.

     NOTE: Pressure and suction defueling does not remove all of the fuel from the tank. A small quantity will remain in the tank.
2. Defueling the Airplane Using Pressure Defueling Method

   WARNING: DO NOT OPERATE HF COMMUNICATIONS SYSTEM OR WEATHER RADAR DURING THE DEFUELING OPERATIONS. THE HF COMMUNICATION SYSTEM OR WEATHER RADAR COULD CAUSE AN EXPLOSION TO OCCUR.

   CAUTION: DO NOT OPERATE THE HYDRAULIC SYSTEM IF THERE IS LESS THAN 600 US GALLONS OF FUEL IN EACH MAIN FUEL TANK. THE HYDRAULIC SYSTEM CAN BECOME TOO HOT IF THE HEAT EXCHANGER IS NOT IN FUEL.
   - A. Make sure that the airplane and the defueling truck are bonded and grounded.
   - B. Supply electrical power.
   - C. Make sure these circuit breakers on the main power distribution panel, P6, are closed:
     - (1) 6E7, DEFUELING VALVES
     - (2) 6G15, L AFT FUEL BOOST PUMP
     - (3) 6G18, R FWD FUEL BOOST PUMP
     - (4) 6G21, R AFT FUEL BOOST PUMP
     - (5) 6G24, L FWD FUEL BOOST PUMP
   - D. Make sure these circuit breakers on the overhead circuit breaker panel, P11, are closed:
     - (1) 11C34, FUEL QTY 1
     - (2) 11M15, FUEL PUMPS L CTR
     - (3) 11M16, FUEL PUMPS R FWD L AFT
     - (4) 11M19, FUEL QTY 2
     - (5) 11M24, FUEL PUMPS R CTR
     - (6) 11M25, FUEL PUMPS L FWD R AFT
   - E. Make sure the P34 circuit breaker on the Auxiliary Power Unit (APU) external power panel is closed:
     - (1) 34L4, DEFUELING VALVES
   - F. Open the fueling station door (521QB), located on the forward edge of the left wing (as shown in Figure 2-40, view A).

     NOTE: On some airplanes, there is a second optional fueling station panel located on the right wing. On these airplanes, you can defuel either from two control panels or from just the one on the right wing.
   - G. Make sure the fueling panel light comes on (see Figure 2-40, view A). This shows that there is 28V DC.
   - H. Remove the fueling adapter cap if one is installed on the fueling adapter.

I. Put cams of the fueling adapters to the DEFUEL position (see Figure 2-40, view B).

J. Connect the fueling nozzles to one or two of the fueling adapters.

K. Put the battery power switch on the fueling control panel to the BATT or POWER position (see Figure 2-40, view C).

L. Push the TEST IND switch on the fueling control panel to do a test on the load select indicators.

M. Make sure 88.8 shows on the top and bottom displays of the load select indicators.

N. Push and release each defuel valve light. Make sure each defuel valve light comes on and then goes off.

O. Put the auxiliary fuel tank in the configuration that follows for pressure defueling:

(1) Put the LEFT MAIN DEFUEL VALVES switch on the fueling control panel, P28, to the OPEN position.

(2) Make sure the LEFT MAIN DEFUEL VALVES OPEN light comes on.

WARNING: DO NOT OPERATE THE TWO OVERRIDE (C) PUMPS AT THE SAME TIME IF THE FUEL QUANTITY IN THE AUXILIARY TANK IS BELOW 1000 POUNDS (453 KILOGRAMS). DRY FUEL PUMP OPERATION MAY CAUSE FUEL VAPORS IN THE TANK TO IGNITE DUE TO THE GENERATION OF SPARKS CAUSED BY METAL TO METAL CONTACT WITHIN THE FUEL PUMPS.

(3) For 767-200/300 AIRPLANES WITHOUT A CENTER TANK SCAVENGE SYSTEM; Do these steps:

WARNING: OPERATE ONLY ONE OF THE TWO OVERRIDE (C) PUMPS IF THE FUEL QUANTITY IN THE AUXILIARY TANK IS BETWEEN 1000 POUNDS (453 KILOGRAMS) AND 400 POUNDS (200 KILOGRAMS). DRY FUEL PUMP OPERATIONS MAY CAUSE FUEL VAPORS IN THE TANK TO IGNITE DUE TO THE GENERATION OF SPARKS CAUSED BY METAL TO METAL CONTACT WITHIN FUEL PUMPS.

(a) Make sure that there is a minimum fuel quantity of 1000 lb (454 kg) in the auxiliary tank if you operate the two override pumps at the same time.

(b) Make sure there is a minimum fuel quantity of 400 lb (181 kg) in the auxiliary tank if you operate one of the two override pumps.

(c) If you operate one of the two override pumps between 1000 lb (454 kg) and 400 lb (181 kg), do these steps:

1) Make sure the pitch attitude of the airplane is between -1 and +2 degrees.

2) Record the pitch attitude of the airplane before you operate one of the two override pumps with less than 1000 lb (454 kg).

3) Turn the override pump switch OFF if the pump low press lights comes ON before the auxiliary tank quantity is at 400 lb (181 kg).

WARNING: DO NOT OPERATE THE TWO OVERRIDE (C) PUMPS AT THE SAME TIME IF THE FUEL QUANTITY IN THE AUXILIARY TANK IS BELOW 1000 POUNDS (453 KILOGRAMS). DRY FUEL PUMP OPERATION MAY CAUSE FUEL VAPORS IN THE TANK TO IGNITE DUE TO THE GENERATION OF SPARKS CAUSED BY METAL TO METAL CONTACT WITHIN THE FUEL PUMPS.

(4) For 767-200/300 AIRPLANES WITH A CENTER TANK SCAVENGE SYSTEM AND ALL 767-200ER/300ER/400ER AIRPLANES; Do these steps:

(a) Make sure that there is a minimum fuel quantity of 1000 lb (454 kg) in the auxiliary tank.

(5) Push the RIGHT C PUMP swich-light on the P5 panel to the ON position.

(6) Make sure the ON flowbar comes on.

P. Put the left main fuel tank in the configuration that follows for pressure defueling:

(1) Put the LEFT MAIN DEFUEL VALVES switch on the fueling control panel, P28, to the OPEN position (see Figure 2-40, view C).

(2) Make sure the LEFT MAIN DEFUEL VALVES OPEN light comes on.

(3) Push the AFT and FWD L PUMP switch-lights of the fuel management panel on the overhead panel, P5, to the ON position (see Figure 2-39, view A).

(4) Make sure the ON flowbars come on.

Q. Put the right main fuel tank in the configuration that follows for pressure defueling:

(1) Put the RIGHT MAIN DEFUEL VALVES switch on the fueling control panel, P28, to the OPEN position (see Figure 2-40, view C).

(2) Make sure the RIGHT MAIN DEFUEL VALVES OPEN light comes on.

(3) Push the AFT and FWD R PUMP switch-light of the fuel management panel on the overhead panel, P5, to the ON position (see Figure 2-39, view A).

(4) Make sure the ON flowbars come on.

R. Monitor the quantity of fuel in the fuel tanks on the load select indicators of the fueling control panel (see Figure 2-40, view C).

S. Put the applicable fuel boost pump, or override pump switch-light to the off position when the necessary quantity of fuel is defueled (see Figure 2-40, view C).

NOTE: You can stop the defueling operation when it is necessary, if you put the applicable defuel valves switch to the close position (see Figure 2-40, view C).

T. If the fuel tank must be fully defueled, drain the remaining fuel through the sump drain valve.

U. Put all the DEFUEL VALVES switches to the CLOSE position (see Figure 2-40, view C).

V. Disconnect the fueling nozzles from the fueling adapters (see Figure 2-40, view A).

CAUTION: MAKE SURE YOU REPLACE THE FUELING ADAPTER CAP. DAMAGE TO THE SLAT CONTROL MACHANISM CAN OCCUR.

W. Put the cams of the fueling adapters to the FUEL position (see Figure 2-40, view B).

X. Install the fueling adapter cap if you removed it to get access to the fueling adapter.

Y. Disconnect the cables that you used to bond the airplane to the fuel source.

Z. If the battery power switch is in the BATT position, put the battery power switch to the POWER position (see Figure 2-40, view C).

AA. Close the fueling station door, 521QB.

AB. Remove electrical power if it is not necessary.

WARNING: DO NOT OPERATE HF COMMUNICATIONS SYSTEM OR WEATHER RADAR DURING THE DEFUELING OPERATIONS. THE HF COMMUNICATION SYSTEM OR WEATHER RADAR COULD CAUSE AN EXPLOSION TO OCCUR.

CAUTION: DO NOT OPERATE THE HYDRAULIC SYSTEM IF THERE IS LESS THAN 600 US GALLONS OF FUEL IN EACH MAIN FUEL TANK. THE HYDRAULIC SYSTEM CAN BECOME TOO HOT IF THE HEAT EXCHANGER IS NOT IN FUEL.

3. Defueling the Airplane Using Suction Defueling Method

NOTE: You cannot suction defuel the auxiliary fuel tank. This procedure applies only to the main fuel tanks.

A. Make sure the airplane and defueling truck are bonded and grounded.

B. Supply electrical power.

C. Make sure the 6E7 DEFUEL VALVES circuit breaker on the main power distribution panel, P6, is closed.

D. Make sure the 34L4 DEFUELING VALVES circuit breaker on the main power distribution panel, P34, is closed.

E. Make sure these circuit breakers on the overhead circuit breaker panel, P11, are closed:

(1) 11C34, FUEL QTY 1

(2) 11M19, FUEL QTY 2

F. Open the fueling station door, 521QB.

G. Make sure the fueling panel light comes on (see Figure 2-39). This shows that there is 28V DC.

H. Connect the grounding cable at the fueling station.

NOTE: The grounding cable is not necessary if there is electrical continuity between the fueling nozzle and the receptacle.

I. Put the cams of the fueling adapters to the DEFUEL position (see Figure 2-40, view B).

J. Connect the fueling nozzles to one or two of the fueling adapters.

K. Put the battery power switch on the fueling control panel to the BATT or POWER position (see Figure 2-40, view C).

L. Push the TEST IND switch on the fueling control panel to do a test on the load select indicators.

M. Make sure 88.8 shows on the top and bottom displays of the load select indicators.

N. Push and release each defuel valve light. Make sure each defuel valve light comes on and then goes off.

O. Put the left main fuel tank in the configuration that follows for suction defueling:

(1) Put the LEFT MAIN DEFUEL VALVES switch on the fueling control panel, P28, to the OPEN position (see Figure 2-40, view C).

(2) Make sure the LEFT MAIN DEFUEL VALVES OPEN light comes on.

P. Put the right main fuel tank in the configuration that follows for suction defueling:

(1) Put the RIGHT MAIN DEFUEL VALVES switch on the fueling control panel, P28, to the OPEN position (see Figure 2-40, view C).

(2) Make sure the RIGHT MAIN DEFUEL VALVES OPEN light comes on.

Q. Start the defueling truck. This starts the suction defueling operation.

R. Monitor the quantity of fuel in the fuel tanks on the load select indicators of the fueling control panel, P28.

S. Put the applicable DEFUEL VALVES switch on the fueling control panel to the CLOSED position when the necessary quantity of fuel is defueled.

T. Stop the defueling truck.

U. If the fuel tank must be fully defueled, drain the remaining fuel through the sump drain valve.

V. Put all the DEFUEL VALVES switches to the CLOSE position.

W. Disconnect the fueling nozzles from the fueling adapters (see Figure 2-40, view A).

X. Put the cams of the fueling adapters to the FUEL position (see Figure 2-40, view B).

Y. Disconnect the cables that you used to bond the airplane to the fuel source.

Z. If the battery power switch is in the BAT position, put the battery power switch to the POWER position (see Figure 2-40, view C).

AA. Close the fueling station door, 521QB.

AB. Remove the electrical power if it is not necessary.

4. Procedure to Move Fuel Between Tanks (Tank to Tank Transfer)

WARNING: DO NOT OPERATE HF COMMUNICATIONS SYSTEM OR WEATHER RADAR DURING THE DEFUELING OPERATIONS. THE HF COMMUNICATION SYSTEM OR WEATHER RADAR COULD CAUSE AN EXPLOSION TO OCCUR.

CAUTION: DO NOT OPERATE THE HYDRAULIC SYSTEM IF THERE IS LESS THAN 600 US GALLONS OF FUEL IN EACH MAIN FUEL TANK. THE HYDRAULIC SYSTEM CAN BECOME TOO HOT IF THE HEAT EXCHANGER IS NOT IN FUEL.

A. Make sure the airplane is grounded.

B. Supply electrical power.

C. Make sure these circuit breakers on the main power distribution panel, P6, are closed:

(1) 6E5, FUELING CONTROL
(2) 6E6, FUELING VALVES
(3) 6E7, DEFUEL VALVES
(4) 6F15, L FUEL OVRD PUMP
(5) 6F21, R FUEL OVRD PUMP
(6) 6G15, L AFT FUEL BOOST PUMP
(7) 6G18, R FWD FUEL BOOST PUMP
(8) 6G21, R AFT FUEL BOOST PUMP
(9) 6G24, L FWD FUEL BOOST PUMP

D. Make sure these circuit breakers on the overhead circuit breaker panel, P11, are closed:

(1) 11C34, FUEL QTY 1
(2) 11M15, FUEL PUMPS L CTR
(3) 11M16, FUEL PUMPS R FWD L AFT
(4) 11M19, FUEL QTY 2
(5) 11M24, FUEL PUMPS R CTR
(6) 11M25, FUEL PUMPS L FWD R AFT

E. Make sure these circuit breakeers on the APU external power panel, P34, are closed:

(1) 34L3, FUELING CONTROL
(2) 34L4, DEFUEL VALVES
(3) 34L5, FUELING VALVES

F. Open the fueling station door, 521QB.

G. Make sure the fueling panel light comes on. This shows there is 28v dc.

H. Put the battery power switch on the fueling control panel, P28, to the BATT or POWER position (see Figure 2-40, view C).

I. Push the TEST IND switch on the fueling control panel to do a test on the load select indicators.

J. Make sure 88.8 shows on the top and bottom displays of the load select indicators.

K. Push and release each fueling valve light. Make sure each fueling valve light comes on the then goes off.

L. Push and release each defuel valve light. Make sure each defuel valve light comes on and then goes off.

M. For the fuel tank that gets the fuel, put the FUELING VALVE to the OPEN position.

N. Make sure the applicable FUELING VALVE lights come on.

O. For the fuel tank that gets the fuel, put the DEFUEL VALVES switch to the OPEN position.

P. Make sure the applicable DEFUEL VALVES OPEN light comes on.

Q. Push the FUEL CROSSFEED switch-light on the overhead panel, P5, when you move the fuel to the fuel tank on the opposite side of the airplane (see Figure 2-39).

WARNING: OPERATE ONLY ONE OF THE TWO OVERRIDE (C) PUMPS IF THE FUEL QUANTITY IN THE AUXILIARY TANK IS BETWEEN 1000 POUNDS (453 KILOGRAMS) AND 400 POUNDS (200 KILOGRAMS). DRY FUEL PUMP OPERATIONS MAY CAUSE FUEL VAPORS IN THE TANK TO IGNITE DUE TO THE GENERATION OF SPARKS CAUSED BY METAL TO METAL CONTACT WITHIN FUEL PUMPS.

R. Make sure the flowbar comes on.

S. Make sure there is a minimum fuel quantity of 1000 lb (454 kg) in the auxiliary tank.

T. For the fuel tank that supplies the fuel, push the applicable fuel boost pump or override pump switch-lights to the ON position.

NOTE: This starts the tank to tank transfer of fuel.

U. Make sure the ON flowbar comes on.

V. Monitor the quantity of fuel in the fuel tanks on the load select indicators (see Figure 2-40, view C).

W. Push the applicable fuel boost pump or override pump switch-light to the off position when the necessary quantity of fuel is moved (see Figure 2-40, view C).

X. Put the applicable DEFUEL VALVES switch on the fueling control panel, P28, to the CLOSE position (see Figure 2-40, view C).

Y. Put the applicable FUELING VALVE switch on the fueling control panel, P28, to the OFF position.

Z. If the fuel tank must be fully defueled, drain the remaining fuel through the sump drain valve.

AA. Close the fueling station door, 521QB.

AB. Remove electrical power if it is not necessary.

5. Procedure for Defueling without Electrical Power

(Figure 2-41)

A. To defuel the main fuel tank, remove a fuel boost pump.

B. To defuel the auxiliary fuel tank, remove an override pump.

C. Install the A28001-1 Main and Override Pump Defueling Hose Set to the applicable housing as follows:

(1) Make sure the valve on the hose set is closed.

(2) Lubricate the adapter on the hose set with fluorosilicone grease.

(3) Align the keyhole on the adapter of the hose set with the allen-head screws.

(4) Push the adapter up until the adapter touches the shutoff sleeve.

NOTE: Do not turn the adapter as you push it up.

(5) Make sure the allen-head screws go through the keyholes.

(6) Turn the adapter on the hose set approximately 12 degrees in the clockwise direction.

(7) Push the adapter and the shutoff sleeve up until the shutoff sleeve touches the housing.

(8) Install the phillips-head screw.

NOTE: The phillips-head screw attaches to the adapter.

(9) Tighten the phillips-head screw to 48-53 pound-inches.

D. Put the valve end of the hose set hose in the fuel receptacle.

E. Open the valve on the hose set to start the defueling.

F. When the necessary quantity of fuel is defueled, close the valve on the hose set.

WARNING: DO NOT TURN THE ADAPTER. MAKE SURE YOU PULL THE ADAPTER DOWN FULLY. FUEL LEAKAGE COULD OCCUR IF YOU TURN ADAPTER AND THE SHUTOFF SLEEVE IS NOT LATCHED.

G. Remove the phillips-head screw from the adapter.

NOTE: The phillips-head screw stays attached to the adapter.

H. Pull the adapter and shutoff sleeve down until the valve stop stops the movement (approximately 1.5 in. (38.1 mm)).

NOTE: Increased force is necessary during the last $\frac{1}{4}$ in. (6 mm) of movement.

WARNING: MAKE SURE THE DOG LATCH ON THE HOUSING ALIGNS WITH THE LOCKING SLOT ON THE SHUTOFF SLEEVE. FUEL LEAKAGE COULD OCCUR IF YOU TURN THE ADAPTER WITHOUT THE SHUTOFF SLEEVE LATCHED.

I. Make sure the locking slot and the dog latch align.

J. Turn the adapter approximately 12 degrees in the counterclockwise direction until it stops.

NOTE: This releases the adapter from the shutoff sleeve.

K. Make sure the dog latch on the housing engages with the locking slot on the shutoff sleeve.

(1) If the dog latch does not engage with the locking slot, do the steps that follow:

(a) Make sure the adapter and the shutoff sleeve touch.

(b) Turn the adapter in the clockwise direction.

(c) Pull the adapter down until the dog latch and locking slot align.

(d) Turn the adapter approximately 12 degrees in the counterclockwise direction until it stops.

NOTE: This releases the adapter from the shutoff sleeve.

(e) Make sure the dog latch engages with the locking slot.

L. Pull down to remove the adapter of the hose set from the shutoff sleeve.

M. For the main fuel tank install the fuel boost pump.

N. For the auxiliary fuel tank, install the override pump.

Figure 2-36 FUEL SYSTEM SCHEMATIC-LEFT WING

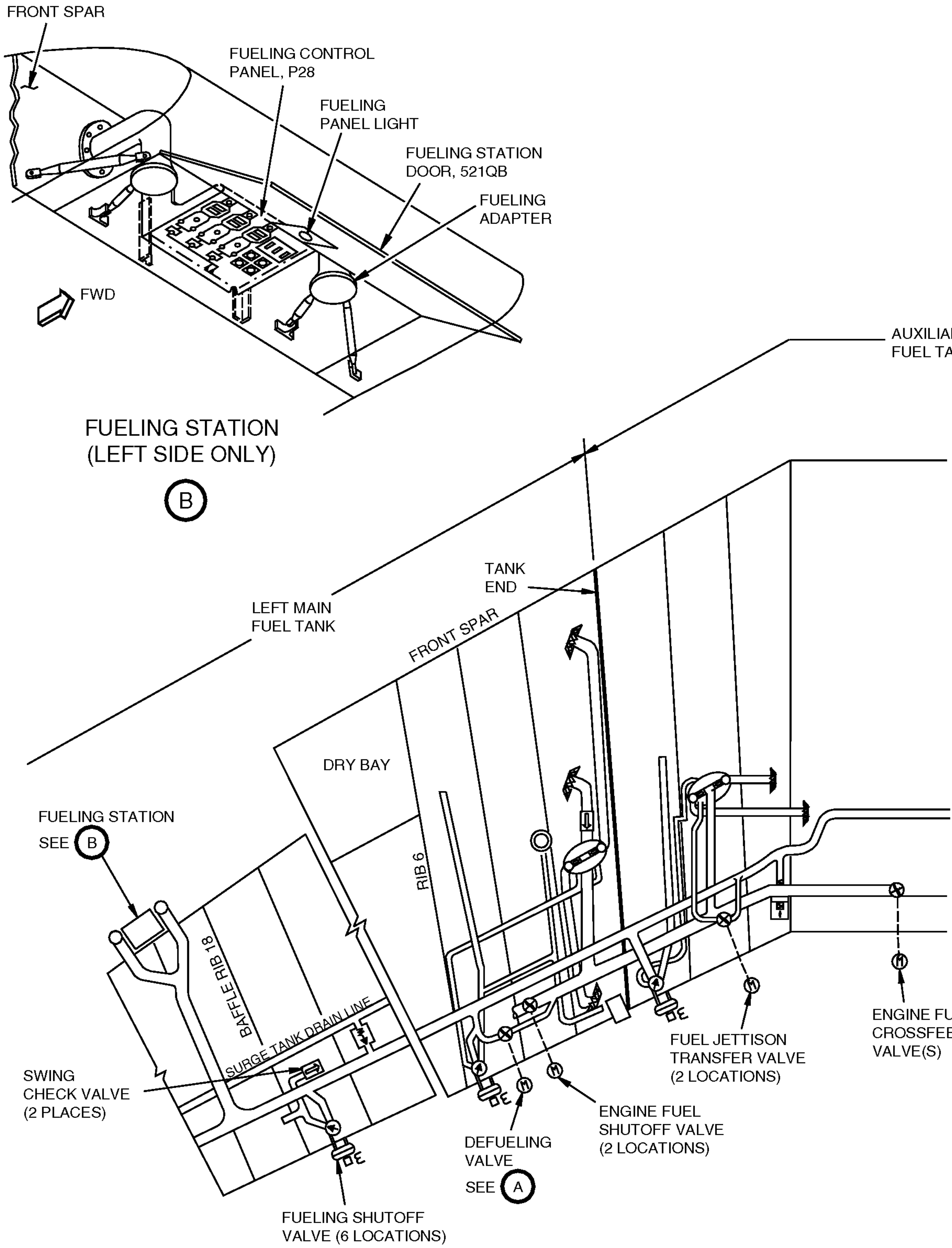


Figure 2-37 FUEL SYSTEM SCHEMATIC- RIGHT WING

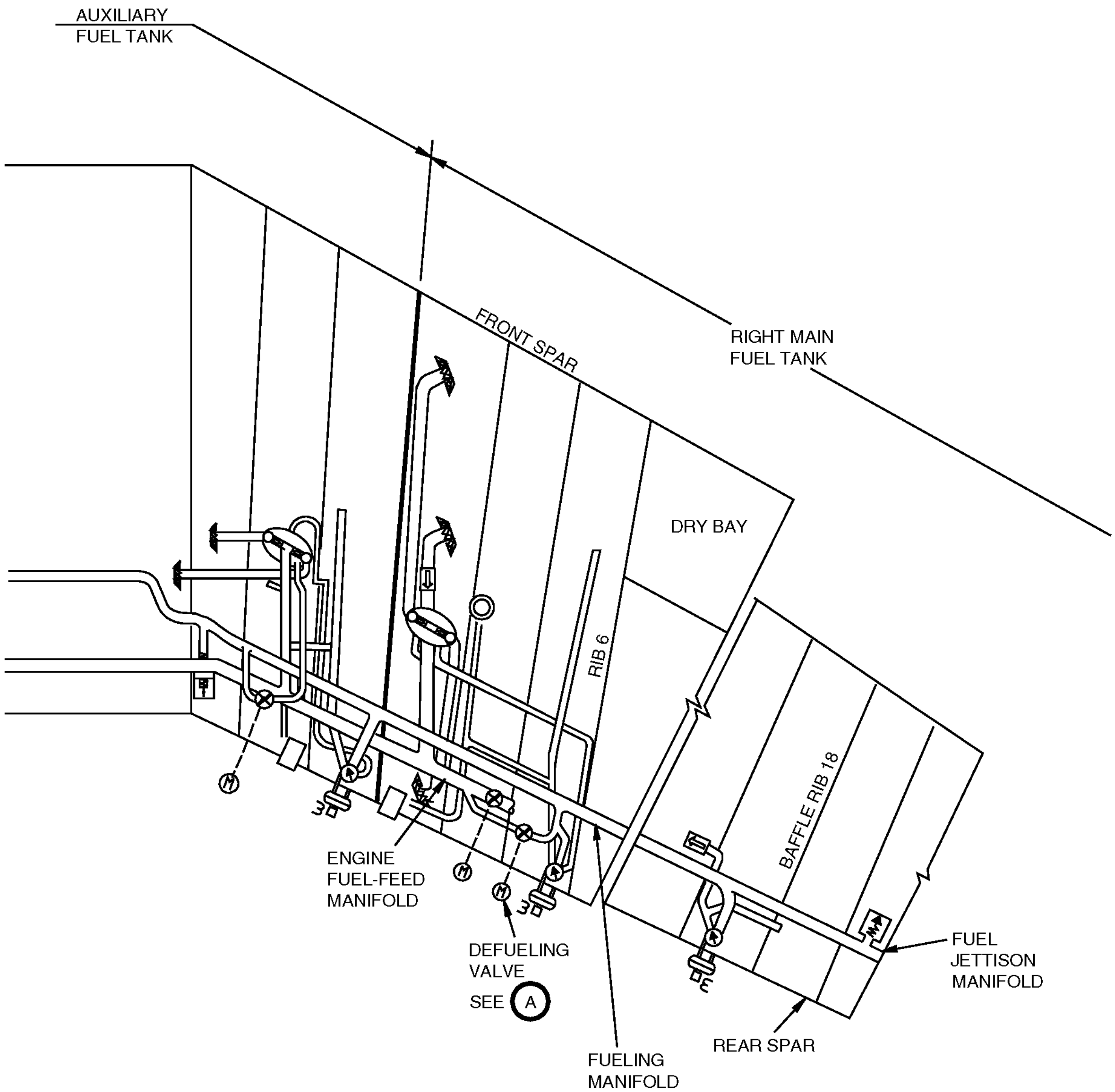


Figure 2-38 DEFUELING VALVE

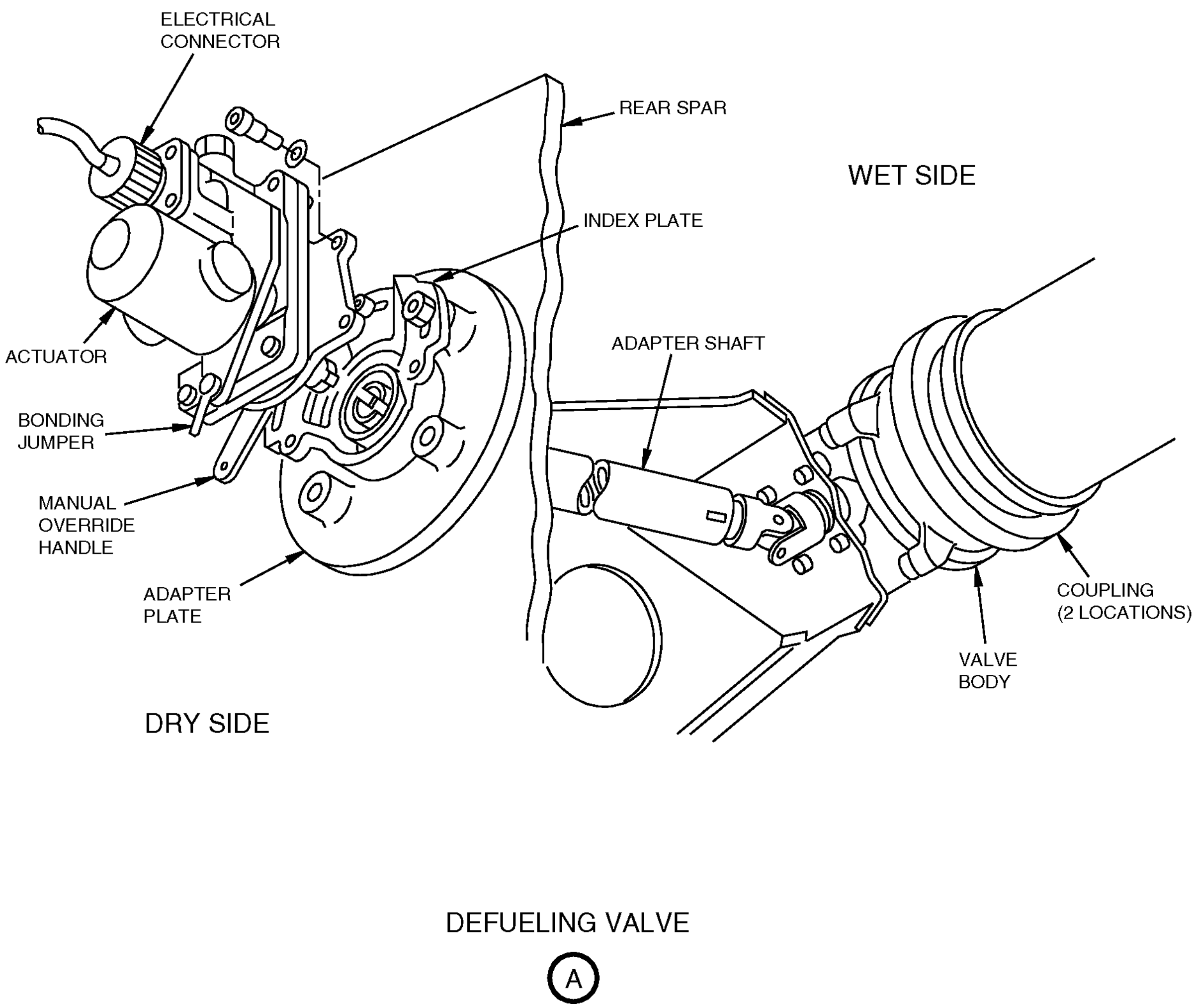
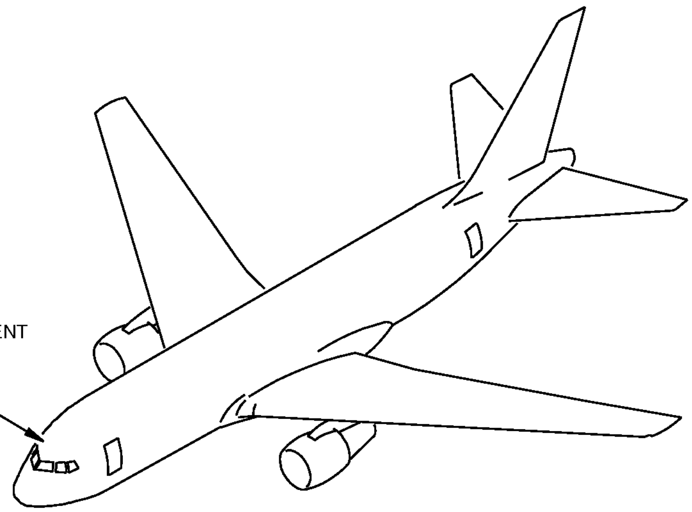
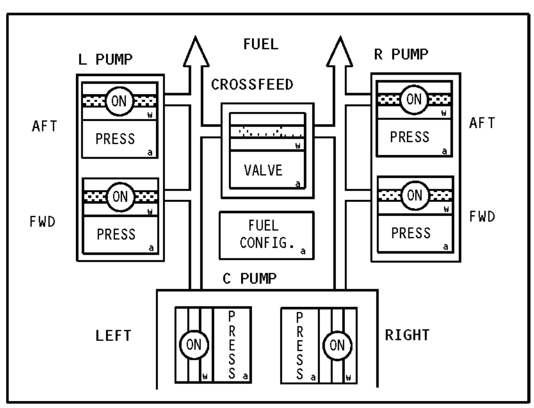


Figure 2-39 FUEL MANAGEMENT PANEL

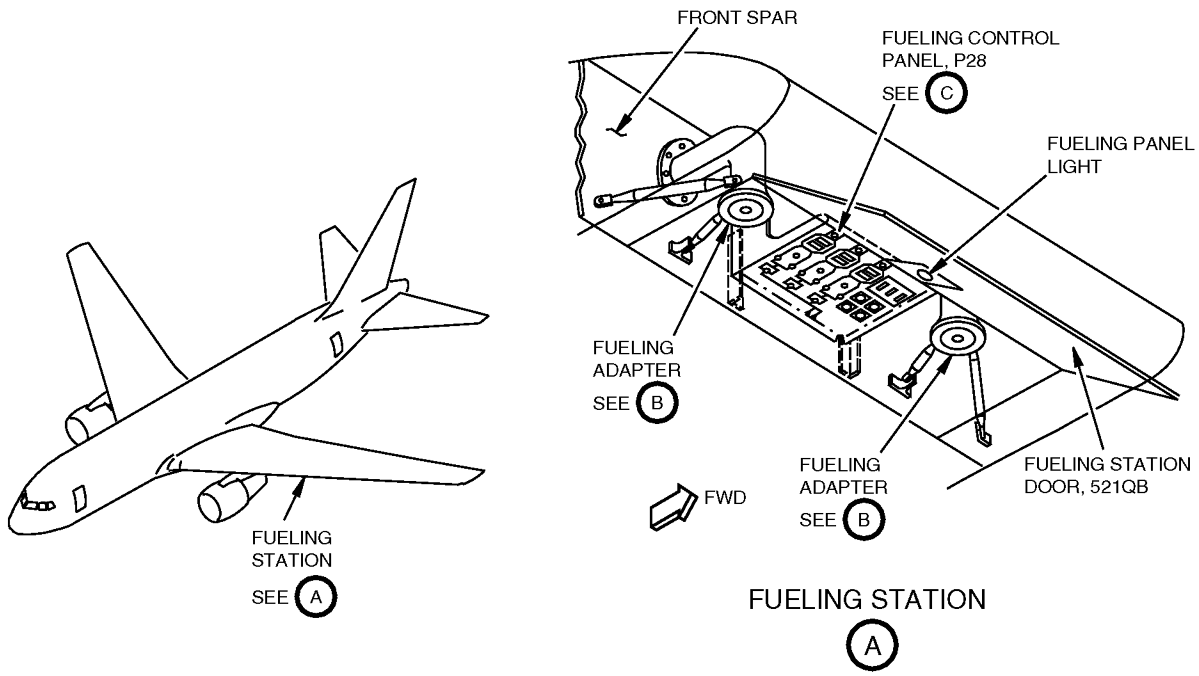


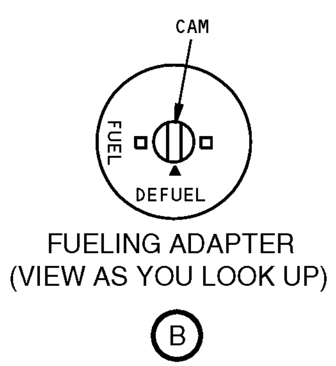


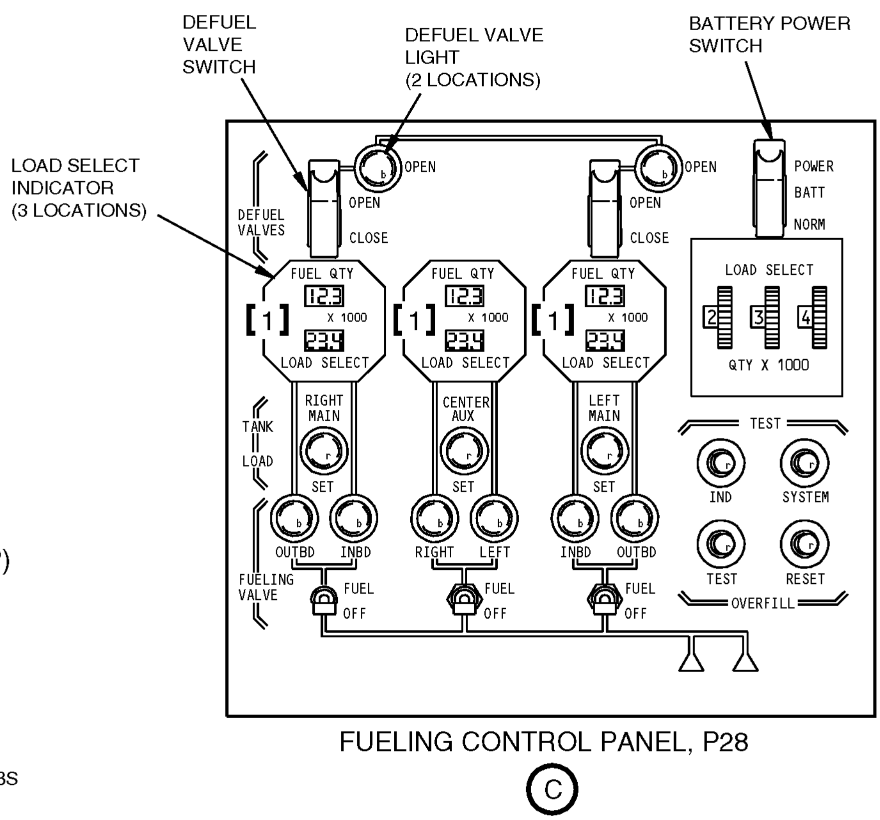
FUEL MANAGEMENT PANEL (ON THE P5 PANEL)

A

Figure 2-40 FUELING (DEFUELING) STATION AND CONTROL PANEL

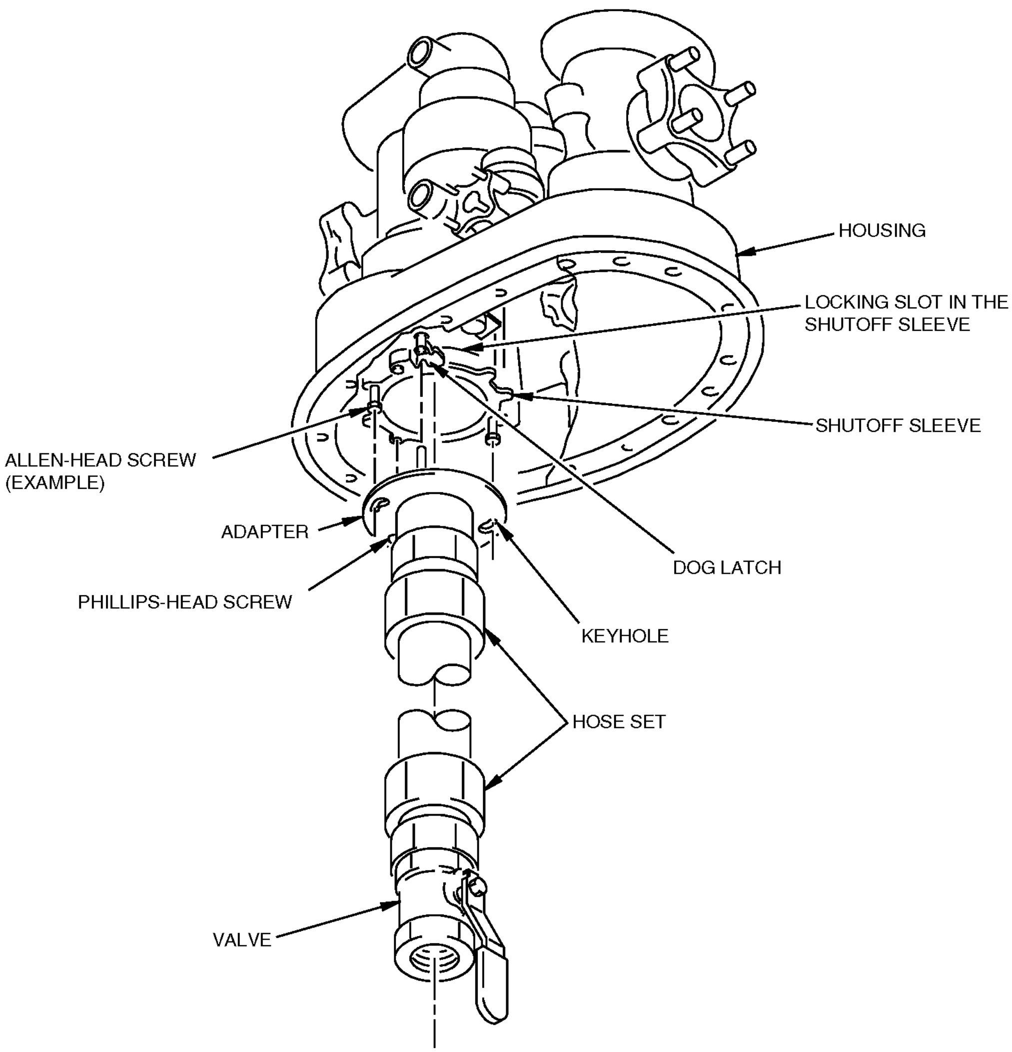






[1] THE UNITS ARE IN KGS OR LBS

Figure 2-41 A28001 MAIN AND OVERRIDE PUMP DEFUELING HOSE SET



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2-60 REMOVAL OF LARGE COMPONENTS FROM THE AIRPLANE

2-60-1 Component Removal - Basic

1. If you must remove a component (shown in Figure 2-44), the instructions are in the applicable Maintenance Manual. Figure 2-44 shows the approximate data (weight/ moment) to help you with the removal. Use the correct document (Weight and Balance Manual) for accurate component values.
2. Special tools (Ground Support Equipment (GSE)) for airplane recovery are shown in CHAPTER 5. All tools (GSE) are shown in a different document, the ITEM D634T501.
3. These documents show the engine removal tools (Engine Ground Handling):
   A. D621T001 - JT9D-7R4 engine
   B. D621T002 - CF6-80A engine
   C. D621T004 - CF6-80C2 engine
   D. D621T005 - PW4000 Series engine
   E. D621T006 - RB211-524H engine

Figure 2-42 MAJOR COMPONENTS, WEIGHT AND CENTER OF GRAVITY - 767-200/-200ER

ENGINE: PRATT & WHITNEY JT9D-7R4D/E				
COMPONENT	767-200		767-200ER	
	UNIT WT - LB	CG MOMENT ARM - IN.	UNIT WT - LB	CG MOMENT ARM - IN.
Bare Engine (with 30 lb of fluid)	8865	824.4	8865	824.4
Thrust Reverser	1499	812.6	1499	812.6
Thrust Reverser Sleeve	221	816.0	221	816.0
Inlet Cowl	542	737.7	542	737.7
Fan Cowl	119	779.5	119	779.5
Core Cowl	203	870.1	203	870.1
Primary Exhaust Plug	33	904.8	33	904.8
Primary Exhaust Sleeve	187	920.4	187	920.4
Engine Mounted Equipment *[1]	657	842.4	657	842.4
Mounts	180	849.1	180	849.1
Precooler	110	861.0	110	861.0

*[1] INCLUDES OIL WHICH CAN BE DRAINED

Figure 2-42 MAJOR COMPONENTS, WEIGHT AND CENTER OF GRAVITY - 767-200/-200ER (Continued)

ENGINE: GENERAL ELECTRIC CF6-80A/A2				
COMPONENT	767-200		767-200ER	
	UNIT WT - LB	CG MOMENT ARM - IN.	UNIT WT - LB	CG MOMENT ARM - IN.
Bare Engine (with 30 lb of fluid)	8766	832.9	8766	832.9
Thrust Reverser	1623	832.3	1623	832.3
Thrust Reverser Sleeve	236	824.0	236	824.0
Inlet Cowl	534	730.0	534	730.0
Fan Cowl	163	780.9	163	780.9
Core Cowl	129	880.8	129	880.8
Primary Exhaust Plug	33	927.2	33	927.2
Primary Exhaust Sleeve	161	935.9	161	935.9
Engine Mounted Equipment *[1]	580	828.5	580	828.5
Mounts	51	910.4	51	910.4
Precooler	106	862.0	106	862.0

*[1] INCLUDES OIL WHICH CAN BE DRAINED

Figure 2-43 MAJOR COMPONENTS, WEIGHT AND CG - 767-300,-300ER,-400ER

ENGINE: PRATT & WHITNEY JT9D-7R4D/E						
COMPONENT	767-300		767-300ER		767-400ER	
	UNIT WT - LB	CG MOMENT ARM - IN.	UNIT WT - LB	CG MOMENT ARM - IN.	UNIT WT - LB	CG MOMENT ARM - IN.
Bare Engine (30 lb of fluid)	8865	824.4	—	—	—	—
Thrust Reverser	1499	812.6	—	—	—	—
Thrust Reverser Sleeve	221	816.0	—	—	—	—
Inlet Cowl	542	737.7	—	—	—	—
Fan Cowl	119	779.5	—	—	—	—
Core Cowl	203	870.1	—	—	—	—
Primary Exhaust Plug	33	904.8	—	—	—	—
Primary Exhaust Sleeve	187	920.4	—	—	—	—
Engine Mounted Equip. *[1]	657	842.4	—	—	—	—
Mounts	180	849.1	—	—	—	—
Precooler	110	861.0	—	—	—	—

*[1] INCLUDES OIL WHICH CAN BE DRAINED

ENGINE: GENERAL ELECTRIC CF6-80A/A2						
COMPONENT	767-300		767-300ER		767-400ER	
	UNIT WT - LB	CG MOM ARM - IN.	UNIT WT - LB	CG MOM ARM - IN.	UNIT WT - LB	CG MOM ARM - IN.
Bare Engine (30 lb of Fluid)	8766	832.9	—	—	—	—
Thrust Reverser	1632	832.3	—	—	—	—
Thrust Reverser Sleeve	236	824.0	—	—	—	—
Inlet Cowl	534	730.0	—	—	—	—
Fan Cowl	163	780.9	—	—	—	—
Core Cowl	129	880.8	—	—	—	—
Primary Exhaust Plug	33	927.2	—	—	—	—
Primary Exhaust Sleeve	161	935.9	—	—	—	—
Engine Mounted Equip. *[1]	580	828.5	—	—	—	—
Mounts	51	910.4	—	—	—	—
Precooler	106	862.0	—	—	—	—

*[1] INCLUDES OIL WHICH CAN BE DRAINED

ENGINE: PRATT & WHITNEY 4000 SERIES						
COMPONENT	767-300		767-300ER *[1]		767-400ER	
	UNIT WT - LB	CG MOM ARM - IN.	UNIT WT - LB	CG MOM ARM - IN.	UNIT WT - LB	CG MOM ARM - IN.
Bare Engine (30 lb of fluid)	—	—	9294	824.1	—	—
Thrust Reverser	—	—	1493	813.4	—	—
Inlet Cowl	—	—	664	741.1	—	—
Fan Cowl	—	—	124	779.8	—	—
Core Cowl	—	—	237	870.2	—	—
Primary Exhaust Plug	—	—	44	911.0	—	—
Primary Exhaust Sleeve	—	—	190	920.0	—	—
Engine Mounted Equip *[2]	—	—	717	837.1	—	—
Mounts	—	—	172	850.0	—	—
Precooler	—	—	115	861.6	—	—

*[1] ALSO 767 FREIGHTER COMPONENTS AS APPLICABLE
*[2] INCLUDES OIL WHICH CAN BE DRAINED

Figure 2-43 MAJOR COMPONENTS, WEIGHT AND CG - 767-300,-300ER,-400ER (Continued)

ENGINE: GENERAL ELECTRIC CF6-80C2						
COMPONENT	767-300		767-300ER *[1]		767-400ER	
	UNIT WT - LB	CG MOM ARM - IN.	UNIT WT - LB	CG MOM ARM - IN.	UNIT WT - LB	CG MOM ARM - IN.
Bare Engine (30 lb of fluid)	—	—	9633	831.7	9704	831.7
Thrust Reverser	—	—	1414	824.6	1414	824.6
Inlet Cowl	—	—	489	724.7	489	724.7
Fan Cowl	—	—	240	777.6	240	777.6
Core Cowl	—	—	163	888.9	163	888.9
Primary Exhaust Plug	—	—	41	930.8	41	930.8
Primary Exhaust Sleeve	—	—	232	937.0	232	937.0
Engine Mounted Equip. *[2]	—	—	548	841.5	585	841.5
Mounts	—	—	138	860.6	138	860.6
Precooler	—	—	107	861.0	107	861.0

*[1] ALSO 767 FREIGHTER COMPONENTS AS APPLICABLE
*[2] INCLUDES OIL WHICH CAN BE DRAINED

ENGINE: ROLLS-ROYCE RB211-524H						
COMPONENT	767-300		767-300ER *[1]		767-400ER	
	UNIT WT - LB	CG MOM ARM - IN.	UNIT WT - LB	CG MOM ARM - IN.	UNIT WT - LB	CG MOM ARM - IN.
Bare Engine (30 lb of fluids)	—	—	9681	819.4	—	—
Thrust Reverser	—	—	1092	813.0	—	—
Inlet Cowl	—	—	661	743.7	—	—
Fan Cowl	—	—	157	790.4	—	—
Core Cowl	—	—	511	851.5	—	—
Primary Exhaust Plug	—	—	30	885.6	—	—
Primary Exhaust Sleeve	—	—	335	907.6	—	—
Engine Mounted Equip. *[2]	—	—	573	820.0	—	—
Mounts	—	—	205	857.1	—	—
Precooler	—	—	57	862.5	—	—

*[1] ALSO 767 FREIGHTER COMPONENTS AS APPLICABLE
*[2] INCLUDES OIL WHICH CAN BE DRAINED

Figure 2-44 MAJOR COMPONENTS, WEIGHT AND CENTER OF GRAVITY - 767-200/-200ER

AUXILIARY POWER UNIT (APU)				
COMPONENT	767-200		767-200ER	
	UNIT WT - LB	CG MOMENT ARM - IN.	UNIT WT - LB	CG MOMENT ARM - IN.
APU Assembly	570	1876.7	570	1876.7

LANDING GEARS, WHEELS AND BRAKES				
COMPONENT	767-200		767-200ER	
	UNIT WT - LB	CG MOM ARM - IN.	UNIT WT - LB	CG MOMENT ARM - IN.
Nose Gear Assembly Complete With Wheels and Tires But Without Drag Strut	1703	270.0	1703	270.0
Nose Gear Wheel and Tire Assembly	170.5	271.5	170.5	271.5
Main Gear Buildup Assembly Complete With Wheels and Tires But Without Drag Strut	4300	1046.0	4300	1046.0
Main Gear Wheel and Tire Assembly	405	1046.3	405	1046.3
Main Gear Brake Assembly	300 *[1]	1046.3	189 *[2] 300 *[1]	1046.3

*[1] STEEL
*[2] CARBON

CONTROL SURFACES					
COMPONENT		767-200		767-200ER	
		UNIT WT - LB	CG MOM ARM - IN.	UNIT WT - LB	CG MOMENT ARM - IN.
Rudder		435	1872.0	435	1872.0
Elevator,	Inboard	85	1864.0	85	1864.0
	Outboard	178	1901.0	178	1901.0
Aileron,	Inboard	130	1111.0	130	1111.0
	Outboard	124	1287.0	124	1304.0
Flap,	TE Inboard Main	385	1078.7	385	1087.0
	TE Inboard Aft	109	1117.0	109	1117.0
	TE Outboard	435	1178.0	435	1178.0

Figure 2-44 MAJOR COMPONENTS, WEIGHT AND CENTER OF GRAVITY - 767-200/-200ER (Continued)

CONTROL SURFACES					
COMPONENT		767-200		767-200ER	
		UNIT WT - LB	CG MOM ARM - IN.	UNIT WT - LB	CG MOMENT ARM - IN.
Slat,	LE Inboard No. 6 or 7	143	803.0	143	803.0
	LE Outboard No. 5 or 8	101	926.0	101	926.0
	LE Outboard No. 4 or 9	104	1006.0	104	1006.0
	LE Outboard No. 3 or 10	103	1091.0	103	1091.0
	LE Outboard No. 2 or 11	98	1175.0	98	1175.0
	LE Outboard No. 1 or 12	88	1257.0	88	1257.0
Spoiler,	Inboard No. 6 or 7	40	1078.0	40	1078.0
	Inboard No. 5 or 8	40	1083.0	40	1083.0
	Outboard No. 4 or 9	24	1133.0	24	1133.0
	Outboard No. 3 or 10	24	1156.0	24	1156.0
	Outboard No. 2 or 11	24	1179.0	24	1179.0
	Outboard No. 1 or 12	24	1202.2	24	1202.2

ACTUATORS					
COMPONENT		767-200		767-200ER	
		UNIT WT - LB	CG MOM ARM - IN.	UNIT WT - LB	CG MOMENT ARM - IN.
Rudder		30	1823.0	30	1823.0
Elevator		21	1857.0	21	1857.0
Horizontal Stabilizer		315	1658.0	315	1658.0
Aileron,	Inboard	26	1088.0	26	1088.0
	Outboard	15	1292.0	15	1292.0
Spoiler,	Inboard	21	1070.0	21	1070.0
	Outboard	12	1230.0	12	1230.0
Flap,	Positions 3, 6	81	1118.0	81	1118.0
	Positions 1, 2, 4, 5, 7, 8	59	1118.0	59	1118.0
Slat,	Inboard	15	824.0	15	824.0
	Outboard	9	1093.0	9	1093.0
Main Gear, Retract Actuator		185	1026.0	185	1026.0
Main Gear, Door Actuator		25	1025.0	25	1025.0
Nose Gear, Retract Actuator		92	271.0	92	271.0

MISCELLANEOUS					
COMPONENT		767-200		767-200ER	
		UNIT WT - LB	CG MOMENT ARM - IN.	UNIT WT - LB	CG MOMENT ARM - IN.
Raked Wing Tip		—	—	—	—
Radome		85	115.0	85	115.0
Fire Bottle,	APU (Full)	24	1824.0	24	1824.0
	Engine (Full)	19	760.0	19	760.0
Air Cycle Machine		42	916.0	42	916.0
Water Separator		5	895.0	5	895.0
Heat Exchanger,	Primary	37	936.0	37	936.0
	Secondary	50	936.0	50	936.0
Windshield,	No. 1	108	160.0	108	160.0
	No. 2	56	175.0	56	175.0
	No. 3	46	200.0	46	200.0
Integrated Drive Generator (IDG)		138	849.0	138	849.0
Generator (For The APU)		62	1850.0	62	1850.0
Hydraulic Pump	Air Driven	134	1121.0	134	1160.1
	Engine Driven	38	840.0	38	840.0
	Electric Driven	46	976.0	46	976.0
Drive Unit, Ram Air Turbine		130	1121.0	130	1121.0
Flap Drive Unit,	Trailing Edge	90	1067.0	90	1067.0
	LE Inboard	68	750.0	68	750.0
	LE Outboard	80	750.0	80	750.0
Entry Door,	Forward *[1]	210	317.0	210	317.0
	Mid Type A *[1]	—	—	—	—
	Aft *[1]	210	1511.0	210	1511.0
Service Door,	Forward *[1]	205	317.0	205	317.0
	Mid Type A	—	—	—	—
	Aft *[1]	205	1511.0	205	1511.0
Emergency Escape Door *[1]		58	872.0	58	872.0
Lower Cargo Door,	Forward *[1]	400	577.5	—	—
	Aft *[1]	400	1308.0	400	1308.0
	Bulk *[1]	100	1439.0	100	1439.0

Figure 2-44 MAJOR COMPONENTS, WEIGHT AND CENTER OF GRAVITY - 767-200/-200ER (Continued)

MISCELLANEOUS					
COMPONENT		767-200		767-200ER	
		UNIT WT - LB	CG MOMENT ARM - IN.	UNIT WT - LB	CG MOMENT ARM - IN.
Wide Forward (Passenger) *[1]		—	—	975	548.0
Wide Forward (Freighter) *[1]		—	—	—	—
Wide Aft (Freighter) *[1]		—	—	—	—
Main Deck Door (Freighter) *[1]		—	—	—	—
Access Door, Auxiliary Power Unit *[1]		30	1867.0	30	1867.00
E/E Bay Access Doors,	Aft *[1]	22	315.0	22	315.0
	Forward *[1]	19	140.5	19	140.5
Landing Gear Door,	Main Gear	266	1015.0	266	1015.0
	Forward Nose Gear	30	201.0	30	201.0
	Aft Nose Gear	24	253.0	24	253.0
Vertical Fin With Rudder (Includes Systems)		2730	1788.0	2730	1788.0
Forward Access (Electrical) *[1]		24	315.0	24	315.0
Escape Slides,	Fwd Door Slide/Raft	228	317.0	228	317.0
	Aft Door Slide/Raft	228	1510.5	228	1510.5
	Fwd Door Slide	146	317.0	146	317.0
	Aft Door Slide	146	1510.5	146	1510.5
	Mid Cabin Door Slide	—	—	—	—
	Mid Cabin Door Slide/Raft	185	—	185	—
	Type I Door Slide	—	—	—	—
	Overwing, Type III Slide, Single Lane	137.5	1099.0	137.5	1099.0
	Overwing, Type III Slide, Double Lane	141.3	1099.0	141.3	1099.0

*[1] INCLUDES STRUCTURES PLUS MECHANISM AND MISCELLANEOUS ITEMS

Figure 2-45 MAJOR COMPONENTS, WEIGHTS AND CENTER OF GRAVITY - 767-300,-300ER,-400ER

AUXILIARY POWER UNIT (APU)						
COMPONENT	767-300		767-300ER*[1]		767-400ER	
	UNIT WT - LB	CG MOMENT ARM - IN.	UNIT WT - LB	CG MOMENT ARM - IN.	UNIT WT - LB	CG MOMENT ARM - IN.
APU Assembly	570	2008.7	570	2008.7	651	2122.0

*[1] ALSO 767 FREIGHTER COMPONENTS AS APPLICABLE

LANDING GEARS, WHEELS AND BRAKES						
COMPONENT	767-300		767-300ER*[1]		767-400ER	
	UNIT WT - LB	CG MOMENT ARM - IN.	UNIT WT - LB	CG MOMENT ARM - IN.	UNIT WT - LB	CG MOMENT ARM - IN.
Nose Gear Assembly Complete With Wheels and Tires but Without Drag Strut	1724	148.0	1724	148.0	1724	148.0
Nose Gear Wheel and Tire Assembly	175	150.5	175	150.5	175	150.5
Main Gear Buildup Assembly Complete With Wheels and Tires but Without Drag Strut	4370	1046.1	4370	1044.7	4950	1046.5
Main Gear Wheel and Tire Assembly	432	1046.3	432	1046.3	446	1048.3
Main Gear Brake Assembly	194 *[2]	1046.3	197 *[2]	1046.3	446	1048.3
	300 *[3]	1046.3	300 *[3]	1046.3	224 *[2]	1048.3

*[1] ALSO 767 FREIGHTER COMPONENTS AS APPLICABLE
*[2] CARBON
*[3] STEEL

Figure 2-45 MAJOR COMPONENTS, WEIGHTS AND CENTER OF GRAVITY - 767-300,-300ER,-400ER (Continued)

CONTROL SURFACES							
COMPONENT		767-300		767-300ER*[1]		767-400ER	
		UNIT WT - LB	CG MOMENT ARM - IN.	UNIT WT - LB	CG MOMENT ARM - IN.	UNIT WT - LB	CG MOMENT ARM - IN.
Rudder		435	2004.0	435	2004.0	435	2122.5
Elevator,	Inboard	85	1996.0	85	1996.0	85	1996.0
	Outboard	182	2033.0	182	2033.0	176	2033.0
Aileron,	Inboard	130	1111.5	130	1111.0	130	1111.0
	Outboard	124	1304.0	124	1304.0	127	1304.0
Flap,	TE Inboard Main	385	1078.7	385	1078.7	395	1078.7
	TE Inboard Aft	109	1119.8	109	1119.8	109	1119.8
	TE Outboard	435	1193.5	435	1193.5	447	1193.5
Slat,	LE Inboard No. 6 or 7	143	803.0	143	803.0	144	803.0
	LE Outboard No. 5 or 8	101	926.0	101	926.0	102	926.0
	LE Outboard No. 4 or 9	104	1006.0	104	1006.0	105	1006.0
	LE Outboard No. 3 or 10	103	1091.0	103	1091.0	104	1091.0
	LE Outboard No. 2 or 11	98	1175.0	98	1175.0	99	1175.0
	LE Outboard No. 1 or 12	88	1257.0	88	1257.0	89	1257.0
Spoiler,	Inboard No. 6 or 7	40	1078.0	40	1078.0	15	1078.0
	Inboard No. 5 or 8	40	1083.0	40	1083.0	40	1083.0
	Outboard No. 4 or 9	24	1133.0	24	1133.0	24	1133.0
	Outboard No. 3 or 10	24	1156.0	24	1156.0	24	1156.0
	Outboard No. 2 or 11	24	1179.0	24	1179.0	24	1179.0
	Outboard No. 1 or 12	24	1202.2	24	1202.2	24	1202.2

*[1] ALSO 767 FREIGHTER COMPONENTS AS APPLICABLE

Figure 2-45 MAJOR COMPONENTS, WEIGHTS AND CENTER OF GRAVITY - 767-300,-300ER,-400ER (Continued)

ACTUATORS *[2]							
COMPONENT		767-300		767-300ER*[1]		767-400ER	
		UNIT WT - LB	CG MOM ARM - IN.	UNIT WT - LB	CG MOM ARM - IN.	UNIT WT - LB	CG MOM ARM - IN.
Rudder		30.0	1955.0	30.0	1955.0	30	2076.0
Elevator		21	1989.0	21	1989.0	21	2110.0
Horizontal Stabilizer		315	1790.0	315	1790.0	297	436.0
Aileron,	Inboard	26	1088.0	26	1088.0	26	1088.0
	Outboard	15	1292.0	15	1292.0	15	1292.0
Spoiler,	Inboard	21	1070.0	21	1070.0	21	1070.0
	Outboard	12	1230.0	12	1230.0	12	1230.0
Flap,	Positions 3, 6	81	1118.0	81	1118.0	90	1118.0
	Positions 1, 2, 4, 5, 7, 8	59	1118.0	59	1118.0	69	1118.0
Slat,	Inboard	15	824.0	15	824.0	15	824.0
	Outboard	9	1093.0	9	1093.0	10	1093.0
Main Gear,	Retract	185	1026.0	185	1026.0	205	1022.7
	Door	25	1025.0	25	1025.0	40	1025.0
Nose Gear	Retract	92	150.0	92	150.0	92	18.0

*[1] ALSO 767 FREIGHTER COMPONENTS AS APPLICABLE
*[2] UNIT WEIGHTS INCLUDE FLUIDS

MISCELLANEOUS							
COMPONENT		767-300		767-300ER*[1]		767-400ER	
		UNIT WT - LB	CG MOM ARM - IN.	UNIT WT - LB	CG MOM ARM - IN.	UNIT WT - LB	CG MOM ARM - IN.
Raked Wing Tip		—	—	—	—	141	1363.0
Radome		85	-6.0	85	-6.0	85	-143.0
Fire Bottle,	APU (Full)	24	1956.0	24	1956.0	24	2077.0
	Engine (Full)	19	760.0	19	760.0	19	760.0
Air Cycle Machine		42	916.0	42	916.0	112	916.0
Water Separator		5	895.0	5	895.0	10	895.0
Heat Exchanger,	Primary	37	936.0	38	936.0	127	936.0
	Secondary	50	936.0	50	936.0	—	—

Figure 2-45 MAJOR COMPONENTS, WEIGHTS AND CENTER OF GRAVITY - 767-300,-300ER,-400ER (Continued)

MISCELLANEOUS								
COMPONENT			767-300		767-300ER*[1]		767-400ER	
			UNIT WT - LB	CG MOM ARM - IN.	UNIT WT - LB	CG MOM ARM - IN.	UNIT WT - LB	CG MOM ARM - IN.
Windshield	No. 1		108	139.0	108	139.0	108	139.0
	No. 2		56	154.0	56	154.0	56	154.0
	No. 3		46	179.0	46	179.0	46	179.0
Integrated Drive Generator (IDG)			138	849.0	138	849.0	162	849.0
Generator (For The APU)			62	1982.0	62	1982.0	63	2103.0
Hydraulic Pump,	Air Driven		134	1160.1	134	1160.1	84	1160.0
	Engine Driven		38	840.0	38	840.0	34	840.0
	Electric Driven		46	976.0	46	976.0	31	976.0
Drive Unit, Ram Air Turbine			130	1121.0	130	1121.0	130	1121.0
Flap Drive Unit,	Trailing Edge		94	1067.0	90	1067.0	90	1067.0
	LE Inboard		69	750.0	68	750.0	60	750.0
	LE Outboard		80	750.0	80	750.0	75	750.0
Entry Door,	Forward	*[2]	210	196.0	210	196.0	210	64.0
	Mid Type A	*[2]	210	601.0	210	601.0	210	601.0
	Aft	*[2]	210	1643.0	210	1642.5	210	1763.5
Service Door,	Forward	*[2]	205	196.0	205	196.0	205	64.0
	Mid Type A	*[2]	210	601.0	210	601.0	210	601.0
	Aft	*[2]	205	1643.0	205	1643.0	205	1764.0
Emergency Escape Door		*[2]	58	872.0	—	—	—	—
Lower Cargo Door,	Forward	*[2]	400	456.5	—	—	—	—
	Aft	*[2]	400	1440.0	400	1440.0	400	1561.0
	Bulk	*[2]	100	1571.0	100	1571.0	100	1692.0
Wide Fwd (Passenger)		*[2]	—	—	975	427.0	975	295.0
Wide Fwd (Freighter)		*[2]	—	—	980	426.4	—	—
Wide Aft (Freighter)		*[2]	—	—	980	1405.4	—	—
Main Deck Door (Freighter)		*[2]	—	—	1,330	445.1	—	—
Access Door, APU		*[2]	30	1999.0	30	1999.0	—	2120.0
E/E Bay Access Doors,	Aft	*[2]	22	194.0	22	194.0	—	62.0
	Forward	*[2]	19	33.0	19	33.0	—	-99.0

Figure 2-45 MAJOR COMPONENTS, WEIGHTS AND CENTER OF GRAVITY - 767-300,-300ER,-400ER (Continued)

MISCELLANEOUS							
COMPONENT		767-300		767-300ER*[1]		767-400ER	
		UNIT WT - LB	CG MOM ARM - IN.	UNIT WT - LB	CG MOM ARM - IN.	UNIT WT - LB	CG MOM ARM - IN.
Landing Gear Door,	Main Gear	266	1015.0	266	1015.0	—	1015.0
	Fwd Nose Gear	30	86.0	30	80.0	—	-52.0
	Aft Nose Gear	24	141.0	24	141.0	—	9.0
Vertical Fin With Rudder (Includes Systems)		2730	1788.00	2730	1920.00	—	—
Forward Access (Electrical) *[2]		24	194	24	194	—	62.0
Escape Slides,	Fwd Door Slide/Raft	228	196.0	228	196.0	217	64.0
	Aft Door Slide/Raft	228	1642.5	228	1642.5	217	1763.5
	Fwd Door Slide	146	196.0	146	196.0	146	64.0
	Aft Door Slide	146	1642.5	146	1642.5	146	1763.5
	Mid Cabin Door Slide	185	600.7	185	600.7	185	600.7
	Mid Cabin Door Slide/Raft	185	—	185	—	—	600.7
	Type I Door Slide	118	1168	118	1168	—	1168.0
	Overwing, Type III Slide Single Lane	137.5	1099	137.5	1099	—	NA
	Overwing, Type III Slide Double Lane	141.3	1099	141.3	1099	—	NA

*[1] ALSO 767 FREIGHTER COMPONENTS AS APPLICABLE
*[2] INCLUDES STRUCTURES PLUS MECHANISM AND MISCELLANEOUS ITEMS

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2-60-2 Removal of the Vertical Fin

1. Possibly, you must remove the vertical fin. The runway (and possibly the airport) can close because the airplane stopped at the end of a runway. If the recovery is slow, a vertical fin removal is an important alternative. The removal opens the view (the glideslope pattern) and permits the runway to stay open. The fin removal is not a usual maintenance procedure for an airline. This is the procedure for the fin removal:

   A. Access to vertical fin components is necessary.

      (1) Hydraulic lines

      (2) Control cables

      (3) Wire bundles

      CAUTION: MAKE THE AIRPLANE STABLE BEFORE YOU REMOVE THE VERTICAL FIN. THIS WILL PREVENT MOVEMENT OF THE AIRPLANE. A MOVEMENT CAN CAUSE DAMAGE TO THE AIRPLANE OR TO PERSONS.

      CAUTION: BE CAREFUL IN HIGH WINDS. DO NOT REMOVE THE VERTICAL FIN IN VERY HIGH WINDS (ABOVE 15 MPH OR 13 KNOTS). THE WIND DIRECTION MAKES NO DIFFERENCE. THE VERTICAL FIN CAN MOVE DANGEROUSLY (WEATHERVANE) IN THE WIND.

      CAUTION: PUT THE AIRPLANE IN A CORRECT ATTITUDE BEFORE YOU START THE REMOVAL. IF YOU ARE IN AN EMERGENCY, YOU CAN START THE REMOVAL WITHOUT THIS STEP. ON LEVEL GROUND THE AIRPLANE USUALLY WILL NOT MOVE MORE THAN NINE DEGREES WHEN ONE LANDING GEAR IS BROKEN. MOVE SLOWLY AND BE VERY CAREFUL.

      (4) Mechanical fasteners

      Use the door (No. 312AR at Body Station 1690, WL 170, RBL 20). The components are approximately 130 in. (330 cm) above the door. There are many components in this area. Make sure you do not cause damage to a component. We recommend wood ladders or a wood platform (at approximately WL 215).

      Before you start, attach the removal equipment (slings and guide ropes). Also disconnect the control cables, hydraulic lines and electrical wire bundles.

   B. These are the special tools and other equipment that are necessary to remove the vertical fin:

      (1) A07007 Sling - Vertical Fin, Installation & Removal

      (2) A20005 Clamp - Control Cable

      (3) A07006 - Torque Multiplier and Adapter, Vertical Fin

      (4) Socket wrenches (as necessary)

      (5) Extension bars (as necessary)

      (6) Internal access platform or ladders

      (7) A cherry picker (the height of reach necessary must agree with the attitude and height of the damaged airplane in relation to the ground)

      (8) A boom crane (the crane must have the correct boom length and lifting capacity at the necessary boom angle)

      (9) Dunnage material (old tires, bed of timbers, mattresses, etc.)

      (10) Buckets to drain hydraulic fluid (as necessary)

(11) Some ropes for the lines (guy lines) approximately 100 ft (30 m) long with breaking strength no less than 100 lb (45 kg). A minimum of six is necessary

C. Install the Vertical Fin Sling (A07007) and use the instructions shown in Figure 2-47. Lift with a force that tightens the cables. If the airplane is in an incorrect attitude, the direction of the line of the force (applied by the crane) is very important. It must be vertical to the waterline (WL) of the fuselage and in a parallel location to the vertical fin. Attach a minimum of six ropes (guide ropes) and have sufficient persons to control the ropes.

CAUTION: BE CAREFUL WHEN YOU BEND THE WIRE BUNDLES. MAKE SURE THAT YOU DO NOT HAVE MORE THAN THE MINIMUM BEND RADII WHEN YOU MOVE (COIL AND STOW) THE WIRE (COAX) BUNDLES.

D. Disconnect and seal the electrical wire bundles (W/B) at panel A1501. The panel is on the main deck above the aft galley (at Body Station 1550, WL 300 and BL 0). See Figure 2-48 for more connector data.

Disconnect the necessary wire bundles (those that go through the vertical fin/body interface) from panel A1501. Remove the pressure seal at the pressure bulkhead (Body Station 1620, WL 300). Remove the wire bundles. Keep (coil and stow) the wire bundles in a safe location in the lower part of the vertical fin.

See Figure 2-48 for the connectors that you must remove from the A1501 panel.

2. Disconnect the cables (control cables RA and RB) at the turnbuckles (Body Station 1631.5, WL 289 and LBL 4.0). Use Cable Clamp A20005 to prevent damage to the cable parts on the fuselage side (see Maintenance Manual chapter 20-10-03). The clamp also keeps the cables tight. Remove the cables (from the fin side) and put (stow and coil) them in a safe location in the lower part of the vertical fin. See Figure 2-49 for the location of the cable turnbuckles.

3. Go through the door (access door No. 311AZ at Body Station 690, WL 403 and BL 0) to disconnect the hydraulic lines to the vertical fin. Disconnect and drain the fluid from the lines. Seal the lines (with leakproof caps and plugs). See Figure 2-50 for the tubes and their locations. See Figure 2-51 for more details.

4. Go through the main cabin (WL 318, Body Station 1533, 1540, 1562, and 1678) to find the fasteners (for the dorsal fin). These fasteners are directly above the aft galley. Remove the cabin insulation blankets on the right and left sides of the airplane. Remove the seven fasteners (BACB30NR). Remove the assembly (dorsal fin assembly No. 321A) to find the link assembly (side load link). Remove the link assembly (P/N 174T3302) from the vertical fin. See Figure 2-52.

5. Remove the panels (seal panels No. 323AL and 323AR) to find the fasteners (1 through 4). Remove the panel (No. 324 CLX) to find the fasteners (45 through 49 and 73 through 91). See Figure 2-52 for the location of the panel (seal panel). Remove the collars or nuts from the fasteners (1 through 49, 58 through 68, and 73 through 91) from the two sides of the airplane. Remove the fasteners with this tool (A07006, Torque Multiplier and Adapter). See Figure 2-55 and Figure 2-56 for the fastener locations.

6. Install bolts (3/8-inch diameter with the heads up) at the hole locations (No. 3, 4 and 42) on the two sides of the airplane. The bolts prevent movement of the vertical fin when the airplane is not level. If it is necessary, increase the No. 42 hole dimension (.388 to .391 inch diameter) to give sufficient clearance for the 3/8-inch diameter bolt. These bolts must be a minimum of 0.25 in. (6 mm) longer than the usual bolts for these holes.

7. All persons in the fin area (inside, outside, or between the fin and airplane body) must go into the 48 Section or get off the airplane at this time.

CAUTION: MAKE SURE THAT THE CABLE (HOIST CABLE OF THE CRANE) IS TIGHT. ALSO MAKE SURE THAT YOU HAVE SUFFICIENT PERSONS TO CONTROL THE LINES (A MINIMUM OF SIX LINES). DO THESE PROCEDURES BEFORE YOU REMOVE THE BOLTS FROM THE BARREL NUTS. THE VERTICAL STABILIZER MAY MOVE SUDDENLY WHEN THE LAST BOLTS ARE REMOVED AND POSSIBLY ENDANGER THE PERSONNEL.

8. From the inner side of the 48 Section, remove the fasteners (No. 50 through 57) from the two sides of the airplane. See Figure 2-53, Detail A, Figure 2-55 and Figure 2-56 for the fastener locations. Persons in the 48 Section must get off the airplane after they remove the last fastener. See Figure 2-57 for the possible side forces with different velocities of wind.
9. Lift the fin slowly to make sure that you do not cause damage to the top surface of the airplane. Make the fin stable with the lines (guy lines) after it is away from the airplane. Move the fin slowly to a satisfactory surface (prepared trailer or the ground with correct padding).

Figure 2-46 WIRE BUNDLE CONNECTOR DATA

PANEL POSITION	WIRE BUNDLE	CONNECTOR
1	W0500	D05436J
4	W0593	D04519J
6	W0313	D04075J
8	W0599	D04527J
12	W0583	D04567J
15	W1413	D05801J
17	W0597	D04523J
18	W0243	D04003J
19	W0317	D04079J
21	W0775	D04827J
22	W1415	D05599J
25	W0579	D04559J
28	W0777	D04825J

Figure 2-47 CRANE AND SLING ATTACHMENT GEOMETRY

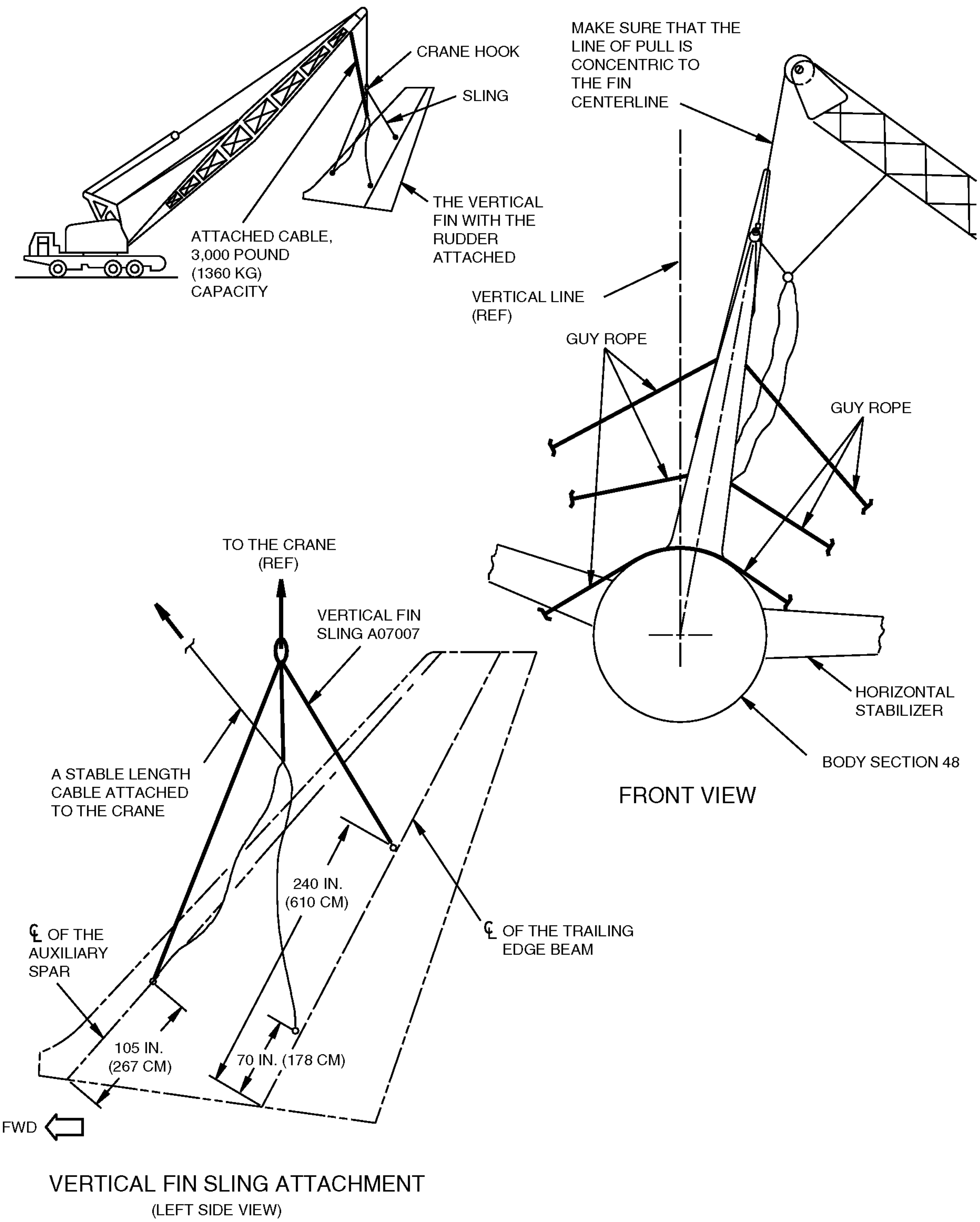


Figure 2-48 SECTION 46 WIRE PROVISION DISCONNECT PANEL AND SUPPORT INSTL

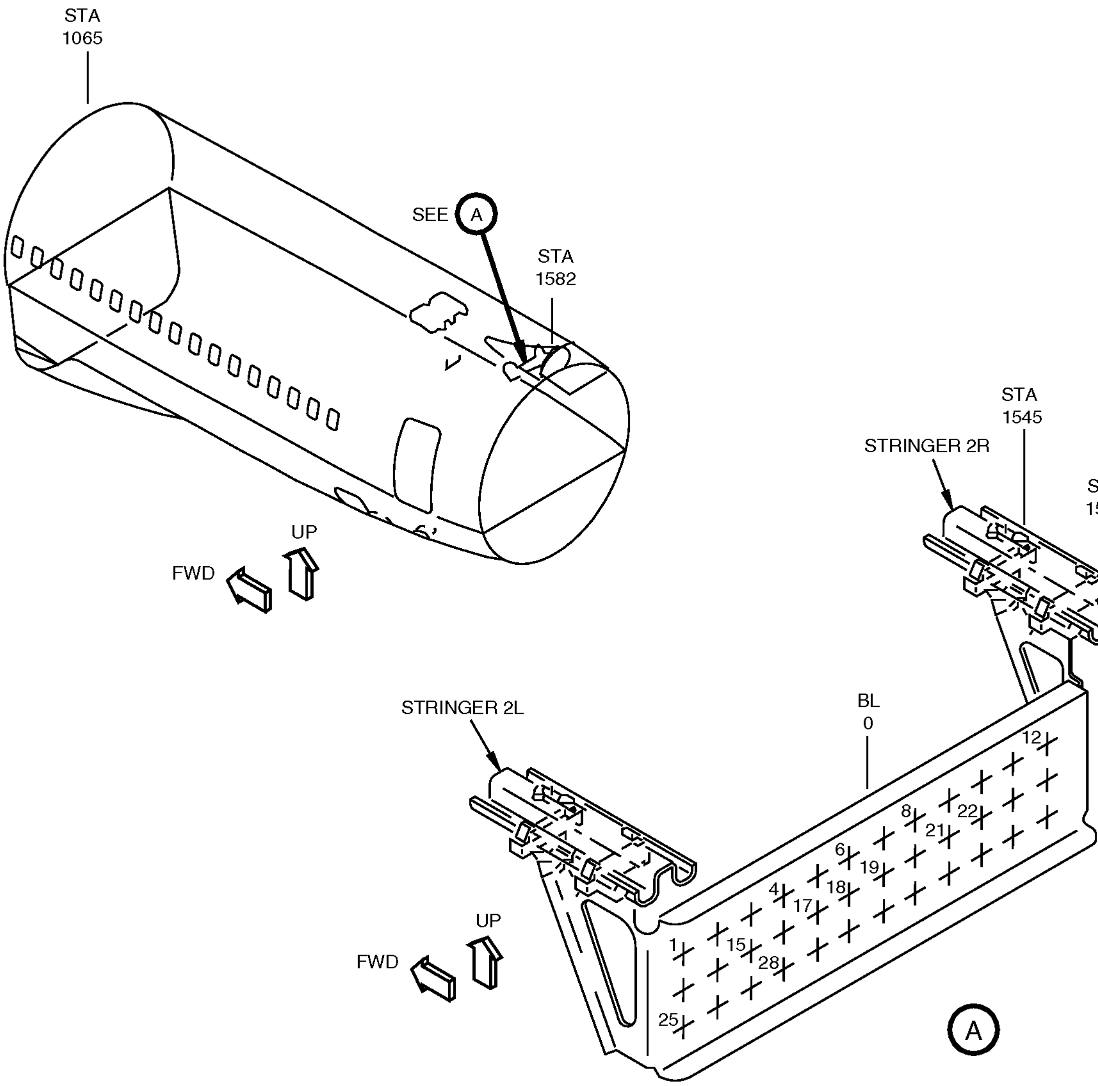


Figure 2-49 RUDDER CONTROL CABLES

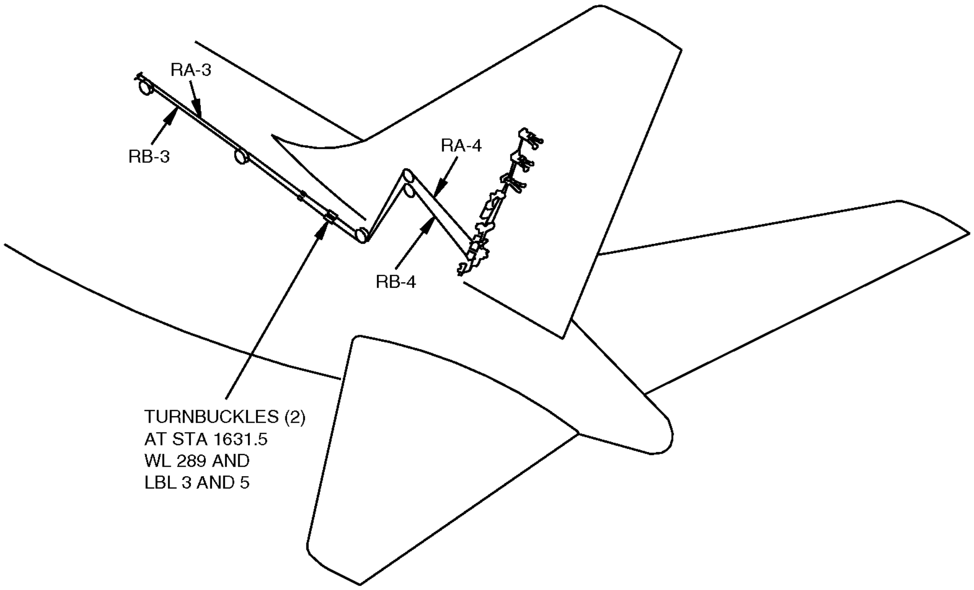


Figure 2-50 HYDRAULIC TUBES AND LOCATIONS

FUSELAGE TUBES	VERTICAL TUBES	LOCATIONS		
		STA	WL	BL
272T4800-126PC	272T7200-110PC	1664	314	0
272T4800-147PR	272T7200-131PR	1664	314	0
272T4800-324RC	272T7200-410RC	1664	314	0
272T4800-347RR	272T7200-431RR	1664	314	0
272T4800-111PL	272T7200-100PL	1712	306	0
272T4800-310RL	272T7200-400RL	1712	306	0

Figure 2-51 VERTICAL FIN HYDRAULIC LINES

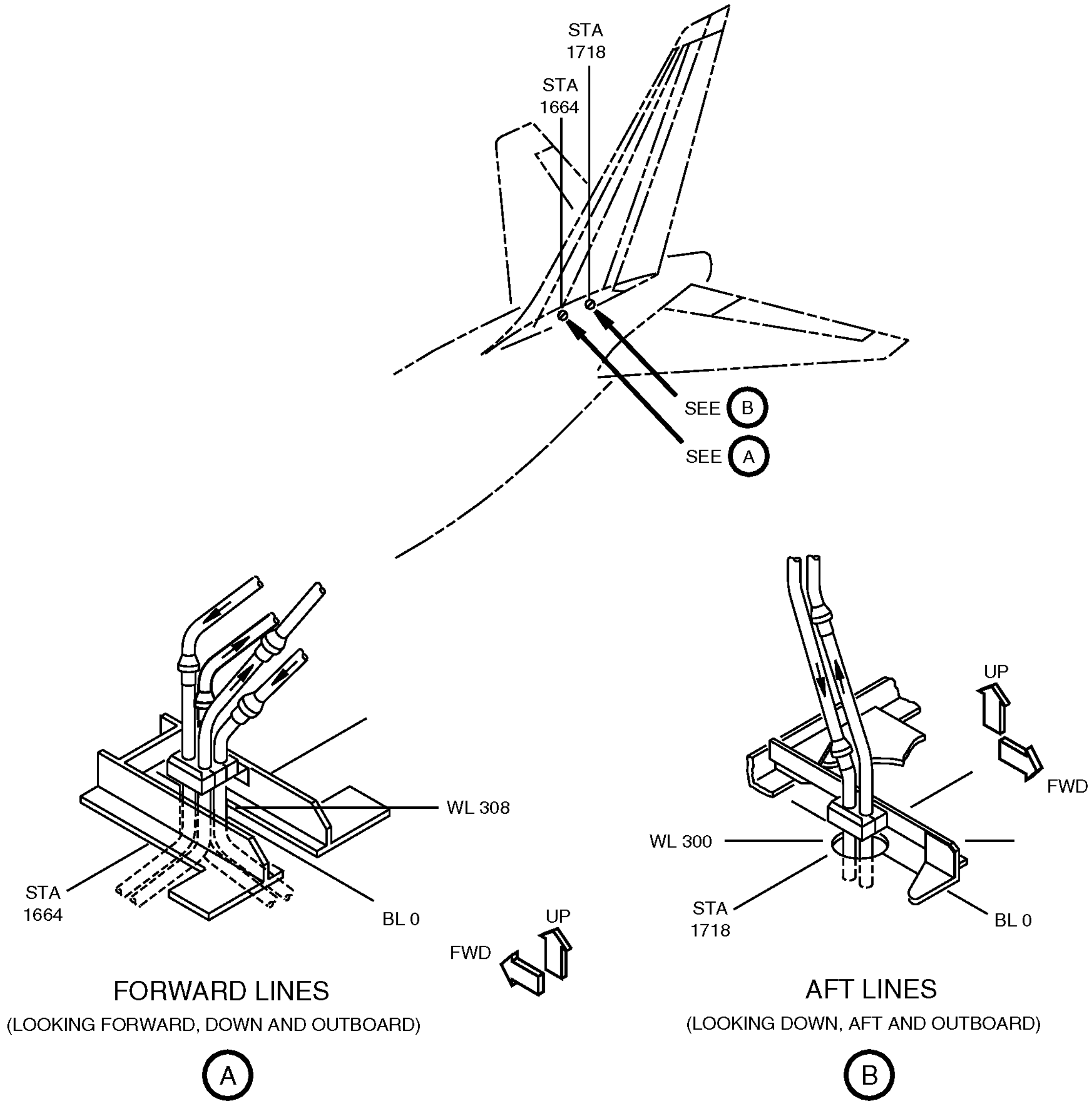


Figure 2-52 VERTICAL FIN SEAL PANELS

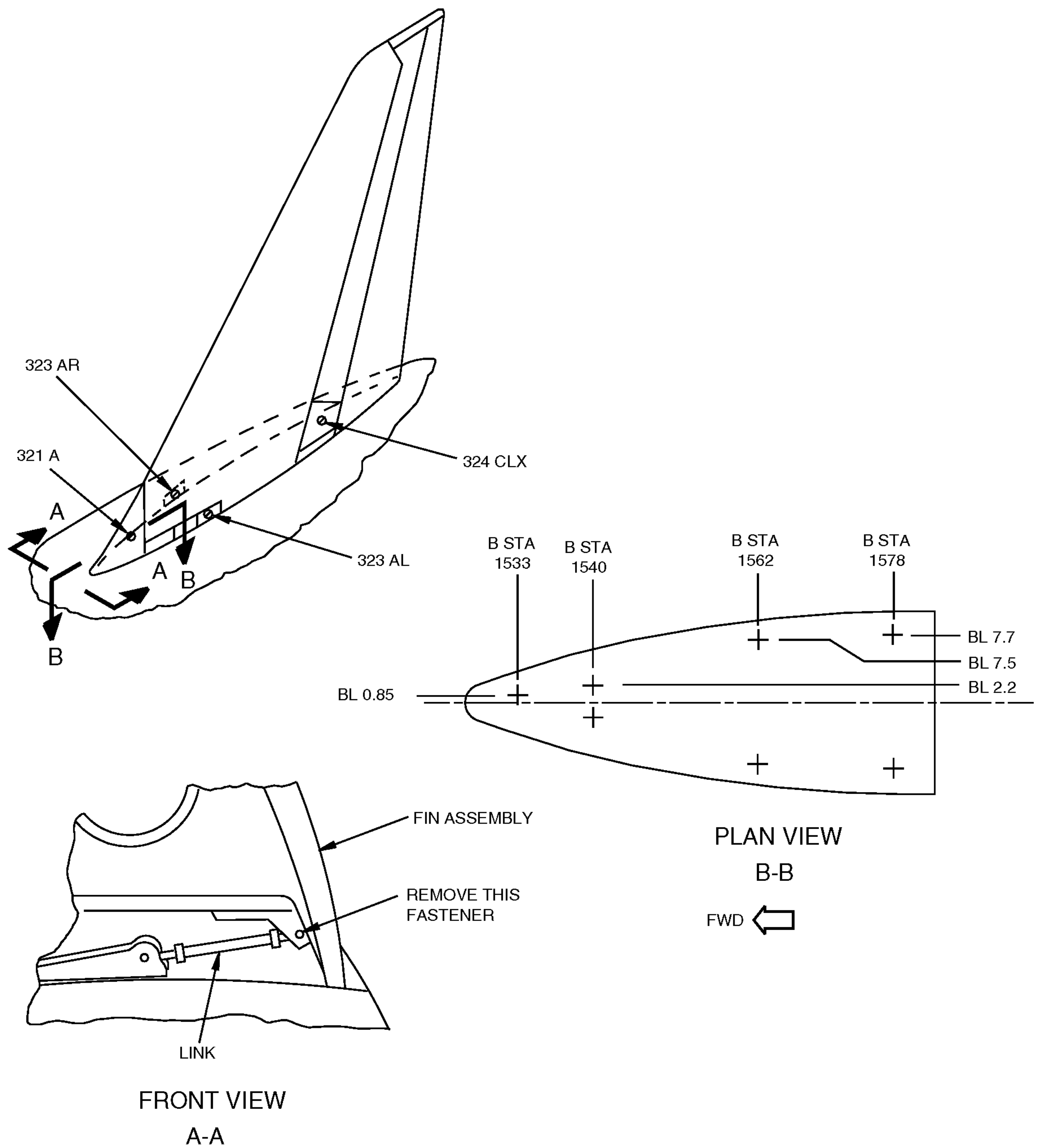
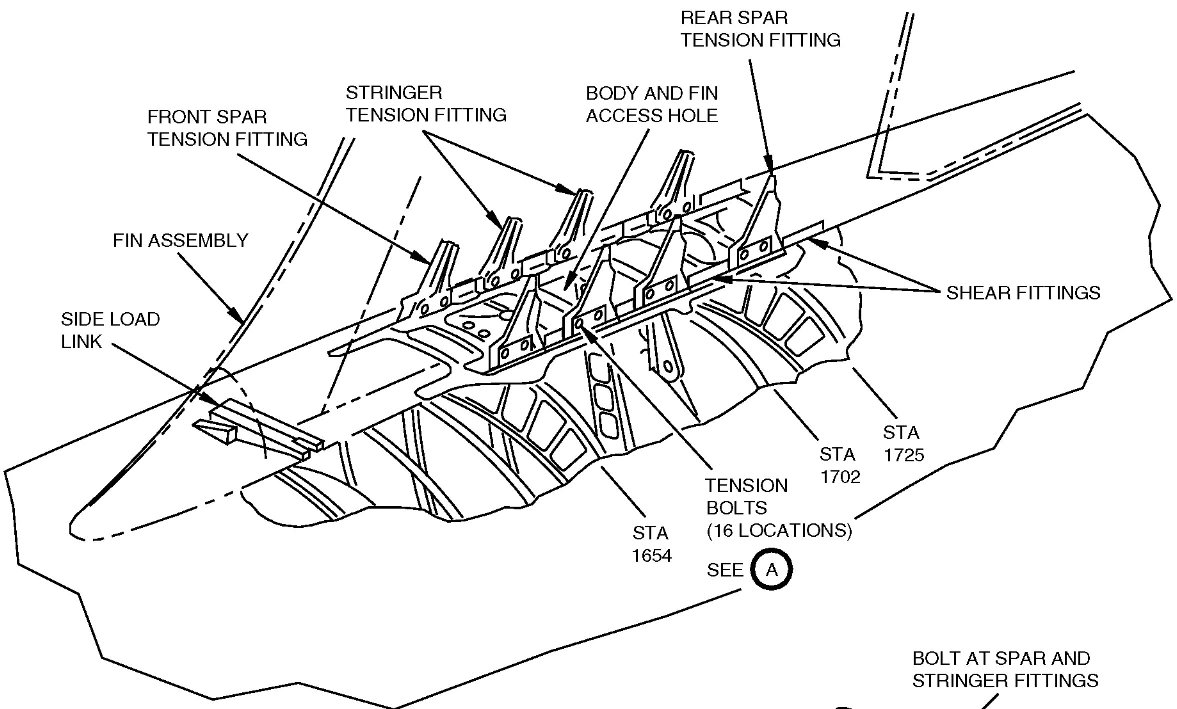
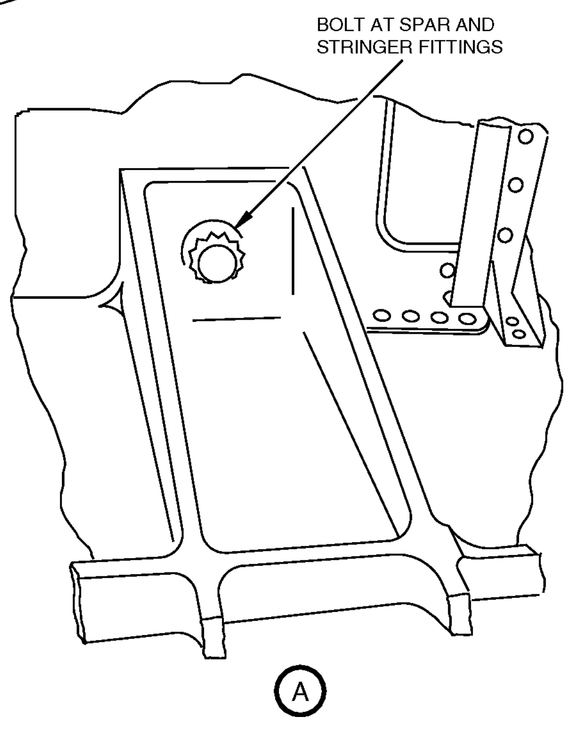


Figure 2-53 VERTICAL FIN TENSION BOLTS



VERTICAL FIN
ATTACHMENT



A

Figure 2-54 VERTICAL FIN REFERENCE DRAWINGS

DRAWING NUMBER	AREA
100T3480	SECTIONS 48 AND 72 INTEGRATION
140T1598	DRAWING INDEX - SECTION 48 FUSELAGE
146T0800	DORSAL FIN
148T6702	FIN ACCESS DOOR
170T1590	DRAWING DIAGRAM - VERTICAL STABILIZER, RUDDER
170T3100	HOISTING ATTACHMENT POINTS - VERTICAL STABILIZER
173T1215	RIB INSTALLATION - TRAILING EDGE
174T4000	SEAL PANEL INSTALLATION
251T3000	CONTROL INSTALLATION - RUDDER AND RUDDER TRIM
278T4860	TUBING INSTALLATION - PRODUCTION ILLUSTRATION
278T4861	TUBING INSTALLATION - PRODUCTION ILLUSTRATION
414T4301	MARKING INSTALLATION - INTERNAL IDENTIFICATION

Figure 2-55 MECHANICAL FASTENER LOCATIONS

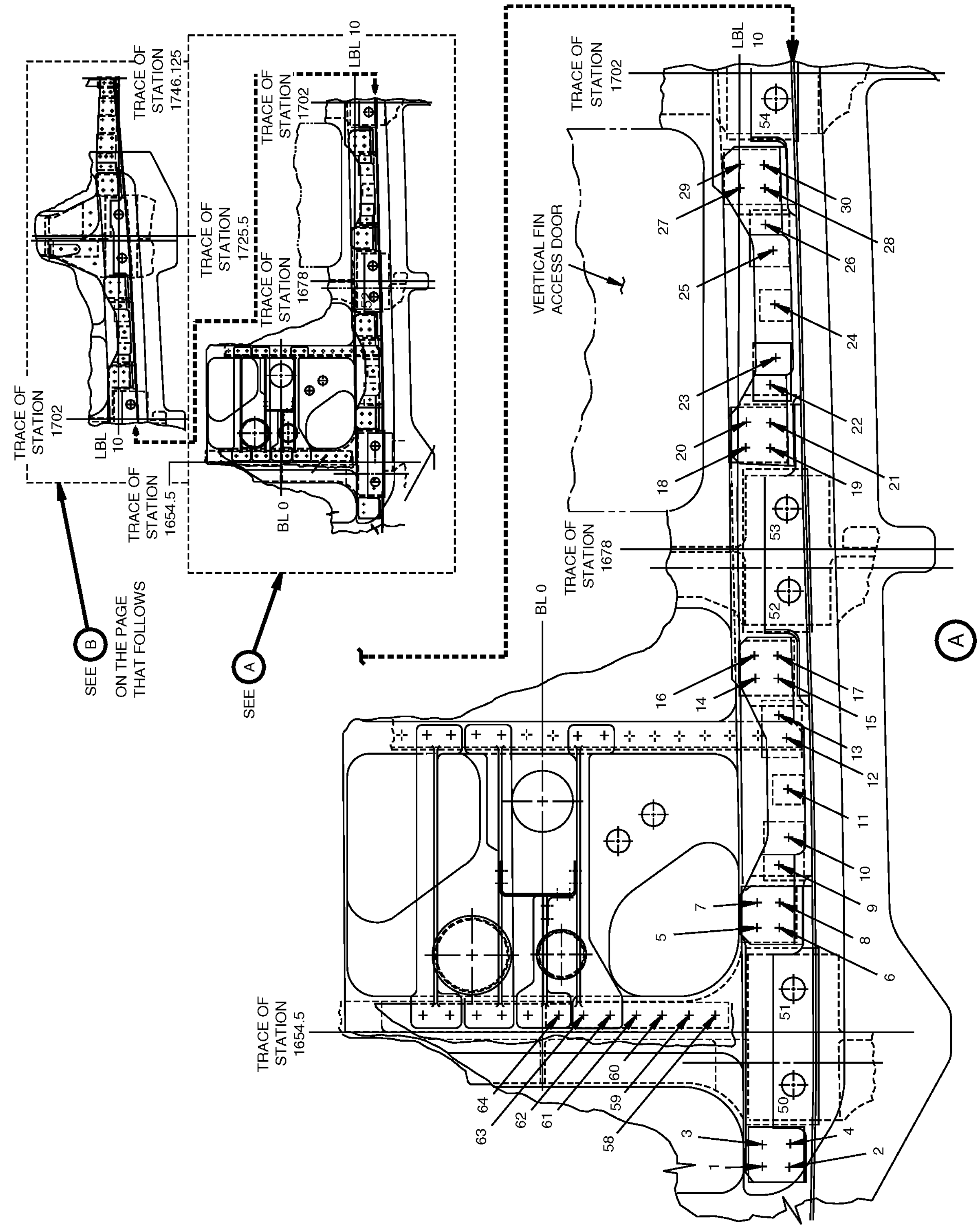


Figure 2-56 MECHANICAL FASTENER LOCATIONS

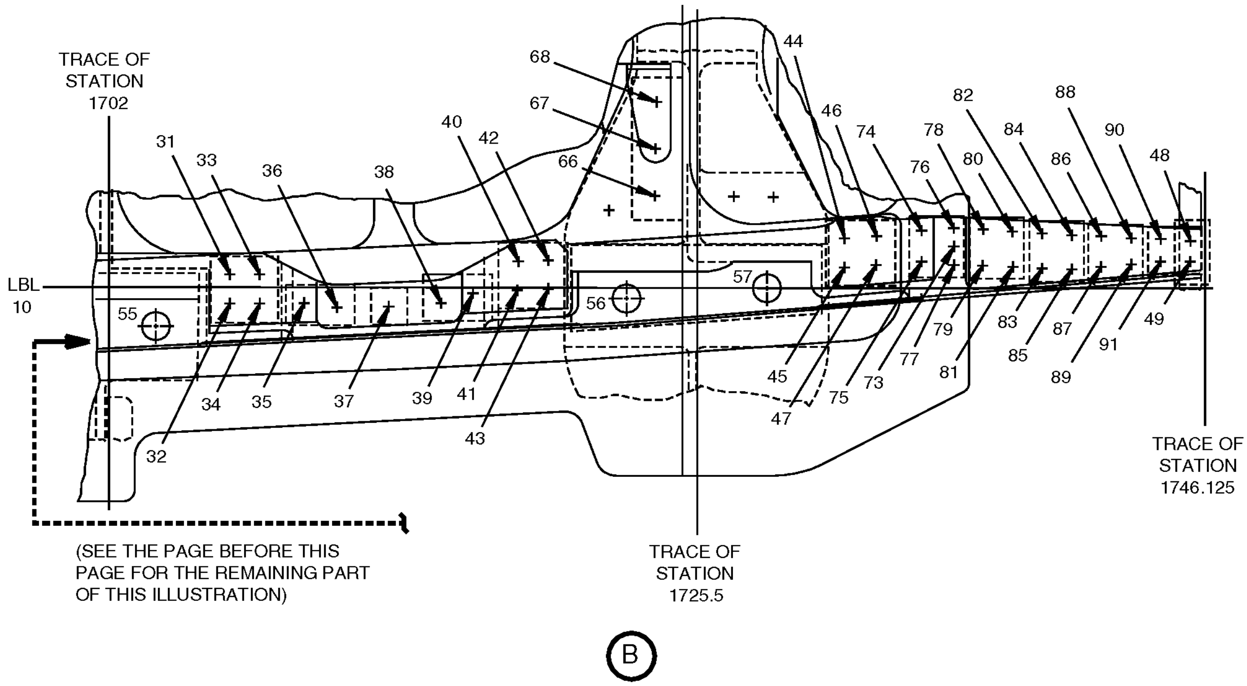


Figure 2-57 GUST LOADS ON THE 767 FIN DURING REMOVAL

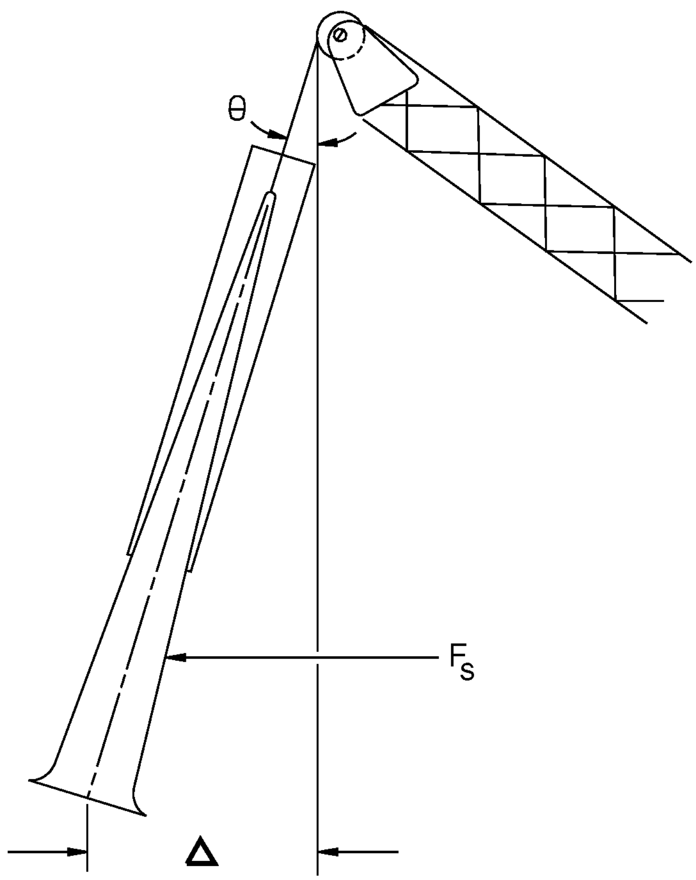


Figure 2-57 GUST LOADS ON THE 767 FIN DURING REMOVAL (Continued)

WIND VELOCITY MILES		F_S FIN SIDE LOAD BECAUSE OF WIND		Δ LATERAL DEFLECTION AT THE BOTTOM OF THE FIN		θ ANGULAR DEFLECTION FROM THE VERTICAL
PER HOUR	KNOTS	POUND	KILO	FEET	METERS	DEGREES
12	10	168	76	2	0.61	4
17	15	377	171	4	1.2	8
23	20	673	305	7	2.1	14
35	30	1517	688	16	4.9	30
CAUTION: THE BOEING COMPANY RECOMMENDS THAT YOU NOT REMOVE THE FIN IN WINDS OF MORE THAN 17 MILES/HOUR OR 15 KNOTS IN ANY DIRECTION. THE FIN CAN POSSIBLY WEATHERVANE IN CROSSWINDS						

NOTE:
- Fin deflection can change with the method of lift. Values shown are approximate only and are for reference only. The values are given as an indication of the intensity of the forces that occur.
- The fin must have a minimum of six guy lines attached during removal (install three on each side).
- Because of the effects of wind on the fin airfoil, winds of a specified speed in any direction from approximately a 15 degree to a 165 degree angle of incidence will cause side loads of almost equal intensity.

3 MAKE THE AIRPLANE STABLE TO LIFT

3-00 GENERAL

3-00-1 General Stabilizing Data

1. This section describes the techniques of tethering and stabilizing an airplane to prevent shifting during all phases of a recovery operation. This section also outlines the available methods and discusses different procedures to lift an airplane from various conditions.
2. Tethers are necessary to hold the airplane against the horizontal loads that can occur during a recovery. The horizontal loads are caused by the recovery equipment or by the wind. The horizontal loads can change for different recovery conditions. We do not give a full analysis of the possible load conditions in this document.
3. The persons who schedule the recovery must make the decisions about the tethers (number and locations). These decisions must be made at the location of the incident. There are many conditions that have an effect on these decisions:
   A. The type of airplane incident.
   B. The recovery method and procedures to be used.
   C. The equipment which will be used.
   D. The ground conditions in the area.
   E. Wind conditions.
4. The persons who schedule the recovery must know the data in this document. They must also know or have:
   A. Practical background of recovery experience.
   B. Specific recovery data for this airplane.
   C. Operation and limitations of recovery jacks, lifting bags, cranes or related recovery equipment.

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3-10 INTRODUCTION

3-10-1 Wind Loads

1. You can have very large loads from the wind on the airplane. These loads change with the wind direction and the wind velocity. When the airplane is on jacks, the wind forces must not cause large loads than the usual maintenance loads. Do not use jacks in wind speeds higher than 30 mph (26 knots) or 48 km/hour.
2. Do not use pneumatic bags in wind speeds higher than 23 mph (20 knots) or 37 km/hour.
3. Do not use movable cranes and slings in wind speeds higher than 30 mph (26 knots) or 48 km/hour.
4. Removal of the vertical fin can decrease the wind forces on the airplane when it is being lifted and when it is on the jacks. This also decreases the wind forces when the airplane is being towed.

   NOTE: The wind limits are for jacks that are fully extended.

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3-10-2 When You Use Jacks and Tethers

WARNING: BE CAREFUL IN HIGH WINDS. DO NOT LIFT THE AIRPLANE IN AN OPEN AREA IN VERY HIGH WINDS (ABOVE 40 MPH OR 35 KNOTS OR 64 KM/HR). FOR FREIGHTER AIRPLANES, IF THE MAIN CARGO DOOR IS CLOSED, MAKE SURE YOU LATCH IT WHILE YOU LIFT THE AIRPLANE ON JACKS. IF IT IS OPEN, IT MUST STAY OPEN FOR THE FULL OPERATION. DO NOT OPERATE THE MAIN DECK CARGO DOOR WHILE THE AIRPLANE IS ON JACKS.

1. When you lift the airplane with jacks, there can be large horizontal forces at the jack points. If a jack is not fully vertical on all sides, these forces can occur. They usually occur while the airplane turns to a level attitude because of the movement (arc travel) of the jack points.
2. There is a possible jack (the strut-type that has no mechanical lock ring for the vertical direction) that turns a large angle (through 8 degrees of arc). This jack turns while it aligns with the jack point and the airplane changes its position (to a level attitude). The force is the result of the multiplication of these factors:
   - A. The angularity of the jack ram (the sine of the jack angle)
   - B. The jack load
     - (1) The weight of the airplane on the ground at some point can decrease the horizontal forces on the jack. The horizontal forces can also be prevented by other jacks. These jacks must be in the correct position to be resistant to side loads.
     - (2) At a point where part of the airplane is on the ground, there is a horizontal force. This force decreases the horizontal force (side load) at the recovery jack point. The ground load force is the result of the multiplication of these factors:
       - (a) The coefficient of friction between the ground and the airplane
       - (b) The weight of the airplane at that point
     - (3) At the other jack position there is a horizontal force. This force is a minimum of 15 percent of the vertical load on the jack.
3. A different jack (the tripod type recovery jack) has a head that moves in the horizontal direction (by coordinated cylinder extension and retraction). The jack head and the jack point of the airplane align while the jack point moves (within limits through the arc). This prevents large horizontal loads.

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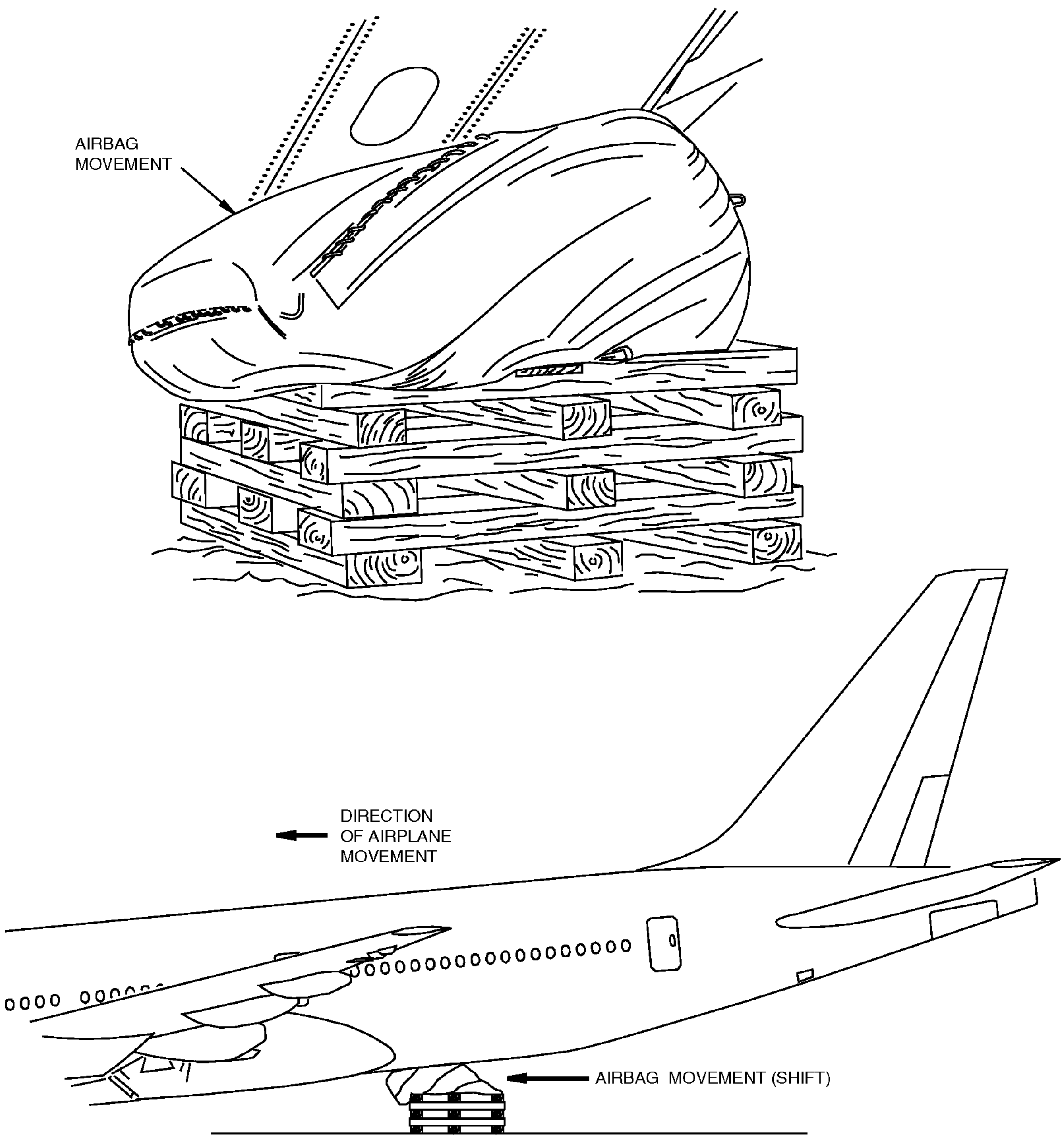
3-10-3 When You Use Pneumatic Bags and Tethers

1. If you use only pneumatic bags (elevators) to lift the airplane, you must use tethers. Your recovery configuration can be more or less stable with different types of pneumatic bags. Also, different tether configurations are necessary for a different bag height or a different type of pneumatic bag.
2. Newer style pneumatic bags are designed to give greater lifting power, more stability and safety to lifting damaged airplanes. They are multi-compartment, inflatable lifting elevators. Each elevator consists of compartments bonded together. The top two compartments are further divided into two separate and equal compartments; the top compartment is divided laterally and the compartment second from the top is divided horizontally in order to allow individual inflation to give better support under slanted surfaces.

   Older style pneumatic bags (first-design, balloon type) are more prone to lateral instability then the newer style pneumatic bags.
3. When you lift only one part of the airplane, the other airplane supports can help to keep it stable. The airplane parts that touch the ground have the same horizontal forces discussed before in SUBJECT 3-10-2. A pneumatic bag is not as stable as a jack and you must be more careful. Some tethers are always necessary.

Figure 3-1 AIRPLANE MOVEMENT ON FIRST-DESIGN (BALLOON TYPE) PNEUMATIC BAGS



3-10-4 When You Use Moveable Cranes and Slings with Tethers

1. Get an approved crane person to do a test of the load prior to the final airplane lifting. This person adjusts the crane until you can operate it safely. When you start lifting the low part of an airplane this will result in an inward movement of the lift point and shift of Center of Gravity (CG). This is not a stable condition. In this situation the airplane CG continues to change during the full operation.
2. For these operations you must use tethers at those points on the airplane that will help you make the operation stable and maintain a controlled lift.

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3-20 TETHERS (STABILIZE THE AIRPLANE)

3-20-1 Configurations for Tethers

1. General
   A. We show the recommended tether configurations for the 767 airplane in this section. You can make the airplane stable with a small number of correctly installed lines. It can be necessary to use more lines to prevent damage to the airplane from a sudden load. This load can be a wind load or the load from an attitude change during the movement of the airplane. Once you are at the site and determine the terrain and recovery procedures to be used, a decision about the number and position of tether lines can be made. Use sufficient lines to make the airplane stable for your airplane condition.
   B. Make sure that each tether line has an equal tether line that goes in the opposite direction. Each tether line must have an adjustment device (block and tackle, turnbuckle, hoist, etc) to permit small changes in the length of the line. This adjustment device also changes the load on the line and on the airplane. Make frequent changes to keep a positive load on the lines and to keep them tight. Use a dynamometer on each line. A person must monitor each dynamometer while you move the airplane. This person also makes sure that the loads at the airplane tether point are not too large.
   C. Do not make the selection of a tether line diameter until you know the necessary load. Refer to SUBJECT 3-20-2 for additional information on the selection and installation of tether lines. Refer to Figure 3-10 and Figure 3-12 for tethering line attachment hardware.
2. Tether Configurations
   A. You can use tethers on this airplane at the locations shown in Figure 3-4 and Figure 3-5.

3-20-2 When You Use Tether Lines

1. You must be careful in the selection and the installation of the tether lines. Use an adequate safety factor. This factor of safety is for the failure strength (breaking strength) of the line. See Figure 3-2 for the failure strength of some different material that you can use for a tether line.

   NOTE: Document all excessive tether loads that the structure has experienced during a recovery operation. Report all of these findings to your airlines Q.C./Q.A. Department immediately.

2. When you use a rope line, the end is an important part of the line strength. Here are two examples:
   A. An eye splice around a thimble in the end decreases the line strength to 90 percent of the maximum permitted load.
   B. A knot in the rope end decreases the line strength to 60 percent of the maximum permitted load.
3. Do not make the selection of a tether line (cable) diameter until you know the necessary load. Use an adequate safety factor. When the end of a cable is an eye splice, the (allowable) load is decreased by 10 percent. Thus, you must use a cable that is one increment larger (as shown in Figure 3-2). See Figure 3-13 for standard size shackles that are available.
4. Use pads if it is necessary to prevent damage to the lines from sharp edges.
5. Each tether line must have an adjustment device to permit small changes in the length of the line. Always apply a positive load to make the lines tight and to prevent movement of the airplane. Use a dynamometer on each line and have a person at each dynamometer. This person must make sure that the loads at the tether point are not too large for the airplane. The adjustment device can be used to change the load on the tether line.
6. Before you install the tether lines, you must examine all the lines for their safety. Do a check of the external surfaces. Look for the worn areas and the rust areas. Also, look for the cut strands or broken strands.
7. If you use a fiber rope, twist the strands open. Then examine the internal area. Look for some deterioration or broken strands. Do not use a rope that has kinks or knots from a heavy load.
8. Make a careful inspection of a steel cable that has some kinks.
9. In wet weather operations, the length of a manila line gets smaller. During such times, you must make a check that the lines are not too tight. You can easily put a high load into the structure of the airplane. Also, if a wet manila line is frozen, it can easily be broken.

Figure 3-2 TETHERING (STABILIZING) LINE MATERIALS DATA

NOMINAL DIAMETERS INCHES (MM)	TETHERING LINE MINIMUM BREAKING STRENGTH POUNDS (KILOGRAMS)			
	MANILA FED SPEC TR 605	DUPONT DACRON	NYLON	DOUBLE NYLON BRAID
1/2 (13)	2650 (1202)	6100 (2767)	6650 (3016)	7500 (3402)
5/8 (16)	4400 (1996)	9500 (4309)	10000 (4536)	12000 (5443)
3/4 (19)	5400 (2449)	13200 (5988)	14600 (6623)	17000 (7711)
7/8 (22)	7700 (3493)	17500 (7938)	19600 (8891)	23700 (10750)
1 (25)	9000 (4082)	22000 (9979)	25000 (11340)	28500 (12928)
1-1/4 (32)	13500 (6124)	30500 (13835)	37800 (17146)	44000 (19958)

NOTE: There is a 10 percent reduction in strength when the cable stops with an eye splice.

TETHERING LINE MINIMUM BREAKING STRENGTH POUNDS (KILOGRAMS)			
STEEL CABLE (6 X 19 WITH FIBER CORE)			
NOMINAL DIAMETERS IN. (MM)	LB (KG)	SMALLER DIAMETERS IN. (MM)	LB (KG)
1/2 (13)	21400 (9707)	3/16 (5)	3100 (1406)
5/8 (16)	33400 (15150)	1/4 (6)	5480 (2486)
3/4 (19)	47600 (21591)	5/16 (8)	8520 (3865)
7/8 (22)	64400 (29212)	3/8 (10)	12200 (5534)
1 (25)	83600 (37921)	7/16 (11)	16540 (7503)
1-1/4 (32)	129200 (58605)	—	—

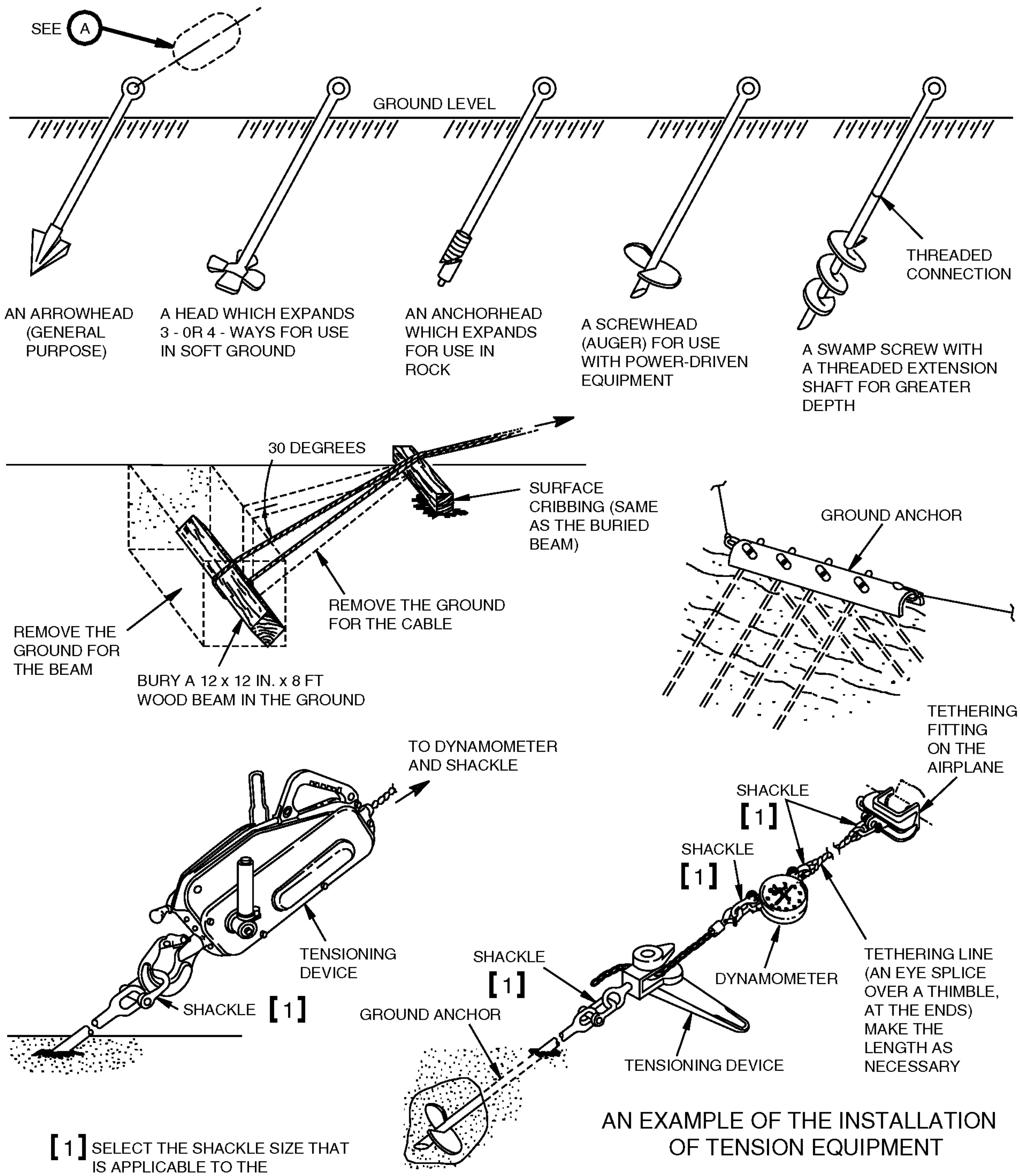
NOTE: There is a 10 percent reduction in strength when the cable stops with an eye splice.

3-20-3 Ground Anchors for Tethers

1. General
   A. Make the tether lines tight with a connection to a stable object (anchor). The objects can be large vehicles, wood beams (dead men) below the ground surface, ground fasteners (anchors) or other structures.
   B. Many different types of ground fasteners (anchors) are available. The type you use must agree with the strength of the soil at your location. Each fastener is used for a specified type of soil.
   C. See Figure 3-3 for some usual fastener (anchor) installations.
   D. Refer to the manufacturer's instructions for the correct installation of each fastener (anchor).
2. Types of Anchors
   A. Ground fasteners (anchors) are made of aluminum or steel (or malleable iron). They are made in different increments, weights and capacities. They are installed with different procedures:
      (1) Hand installed. Use a manual impact tool, a rod to drive the fastener and a handle to hold the fastener.
      (2) Screw type. Use a power drive machine.
      (3) Expandable type. Drill the hole, push the fastener into the hole, turn the fastener until it expands and fill the hole with soil (tamped) or concrete.
3. When You Prepare to Use Tethers (Stabilize the Airplane)
   A. When you use ground fasteners (anchors), make a decision about the fastener positions.
   B. Install the ground fasteners (anchors) after you refer to the manufacturer's instructions.
   C. Attach each tether line to a screw anchor or an equivalent fastener point on the ground (heavy truck, deadman, tractor).
   D. Make sure each position is sufficient for the applicable loads. Use a sufficient factor (margin) of safety.
   E. Each line must have an adjustment device (block and tackle, turnbuckle, hoist) to permit small changes in the line tension. Keep a constant, but not too much, tension on the line.
   F. Attach the tether lines to an adjustment device before you attach them to the ground fasteners or the vehicles.
4. Frequently, it is not easy to find the maximum permitted load you can use for a ground fastener. Thus, we recommend a special tool (Penetrometer or Soil Test Probe) to help you find the permitted load. See the Vendors shown in SUBJECT 5-20-1.

   NOTE: There is a special tool (the chance probe, model C3090032, made by the Chance Company, USA) that you can use to find the ground strength without the removal of ground material. The tool has a small diameter auger that has a length of 60 inches (152 cm). There is a torque fixture, attached to a ratchet handle, that moves along the auger. This torque fixture monitors the ground strength in inch-pounds. When you turn the auger into the ground, you can find an approximate strength value for the ground material.

Figure 3-3 EXAMPLES OF ANCHOR INSTALLATIONS



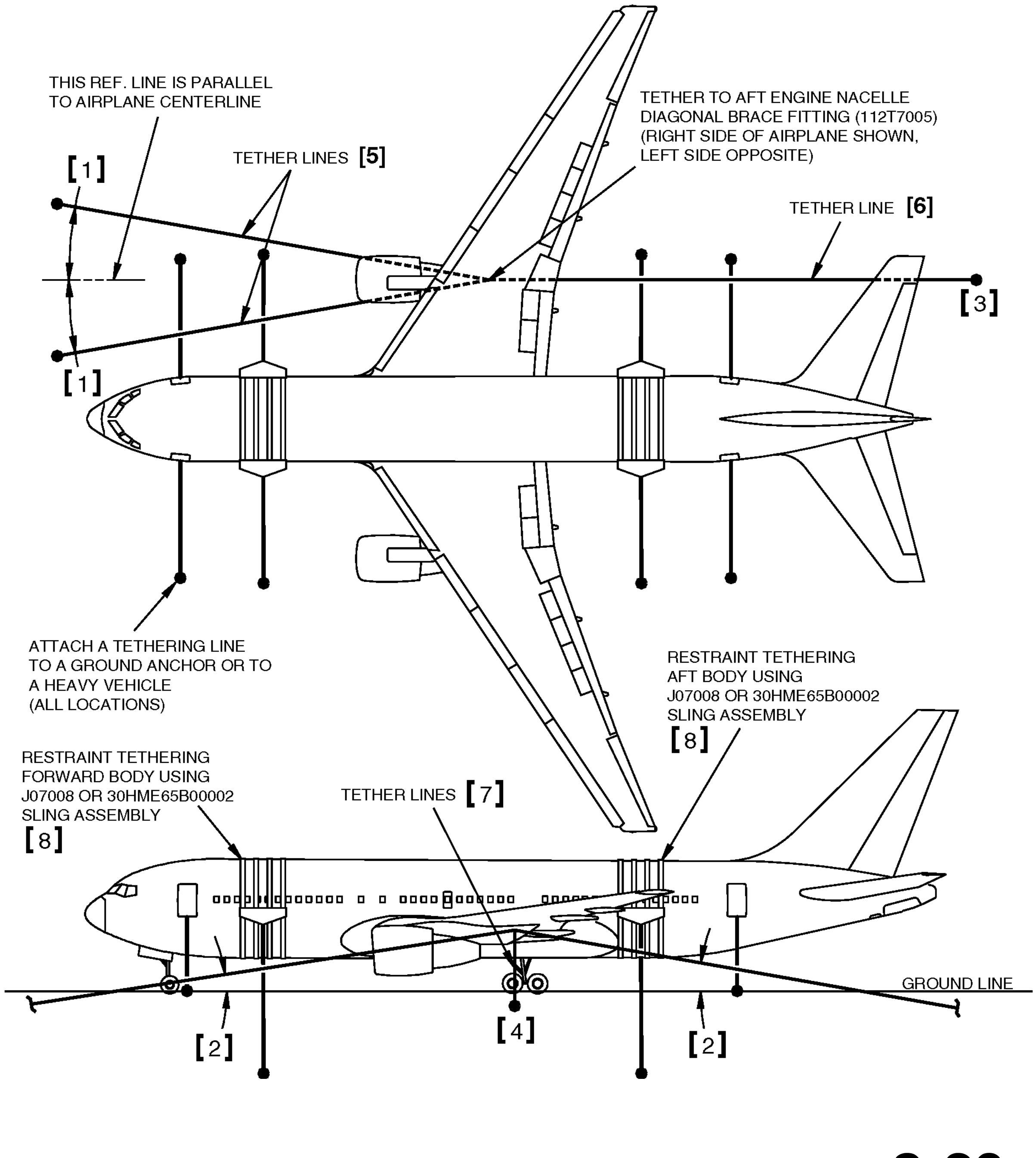
[1] SELECT THE SHACKLE SIZE THAT IS APPLICABLE TO THE IDENTIFIED LOADS

NOTE: SEE SECTION 5 VENDOR LIST FOR MANUFACTURERS OF TETHERING

3-20-4 Tethering and Stabilization of the 767

1. Figure 3-4 shows various options for tethering the 767 airplane. You must make sure that the maximum loads specified are not exceeded or you can damage the airplane.
2. Here are the instructions on how to make and install a tether fixture at the No. 1 and No. 4 passenger door locations:
   A. Make two sets of tether fixtures. The first set is for the No. 1 doors and the second set is for the No. 4 doors. Use material that is available from local sources and is the equivalent (in bending strength) of wood (fir). Make all surfaces smooth and all corners rounded.
   B. Where the fixture is on the airplane, or on the door frame, bond fabric to the fixture. The fabric (felt or a similar material) must have a minimum thickness of 1/4 in. (6 mm). Use 3/8 in. (10 mm) diameter bolts (through bolts) to complete the fixtures.
   C. Open the doors and install the tether fixtures by the door entrance near the sill. Connect and tighten the two opposite fixtures at each entrance with a rope. This rope keeps the fixtures attached. The rope also makes sure the fixtures do not disengage from the airplane if the tether line is not tight.
   D. Attach the tether cable to the horizontal part of the fixture. Two cables can connect to each fixture. Put the cable across the cabin, through the slot of the opposite fixture and to the ground surface. Make sure that the cable makes a 15 degree angle (minimum) at the ground. Do the same procedure with the opposite cable and fixture. See Figure 3-5 for a usual installation.

Figure 3-4 767 TETHERING AND STABILIZING DIAGRAM



[1] TETHER LINE ANGLE IS MAXIMUM 5-15 DEGREES FROM REFERENCE LINE SHOWN.

[2] TETHER LINE ANGLE IS MAXIMUM 5-10 DEGREES FROM GROUNDLINE.

[3] KEEP TETHER LINE PARALLEL TO FUSELAGE CENTERLINE PLUS OR MINUS 5 DEGREES.

[4] KEEP TETHER LINE PERPENDICULAR TO DIAGONAL BRACE FITTING CENTERLINE TO A MAXIMUM PLUS OR MINUS 5 DEGREES.

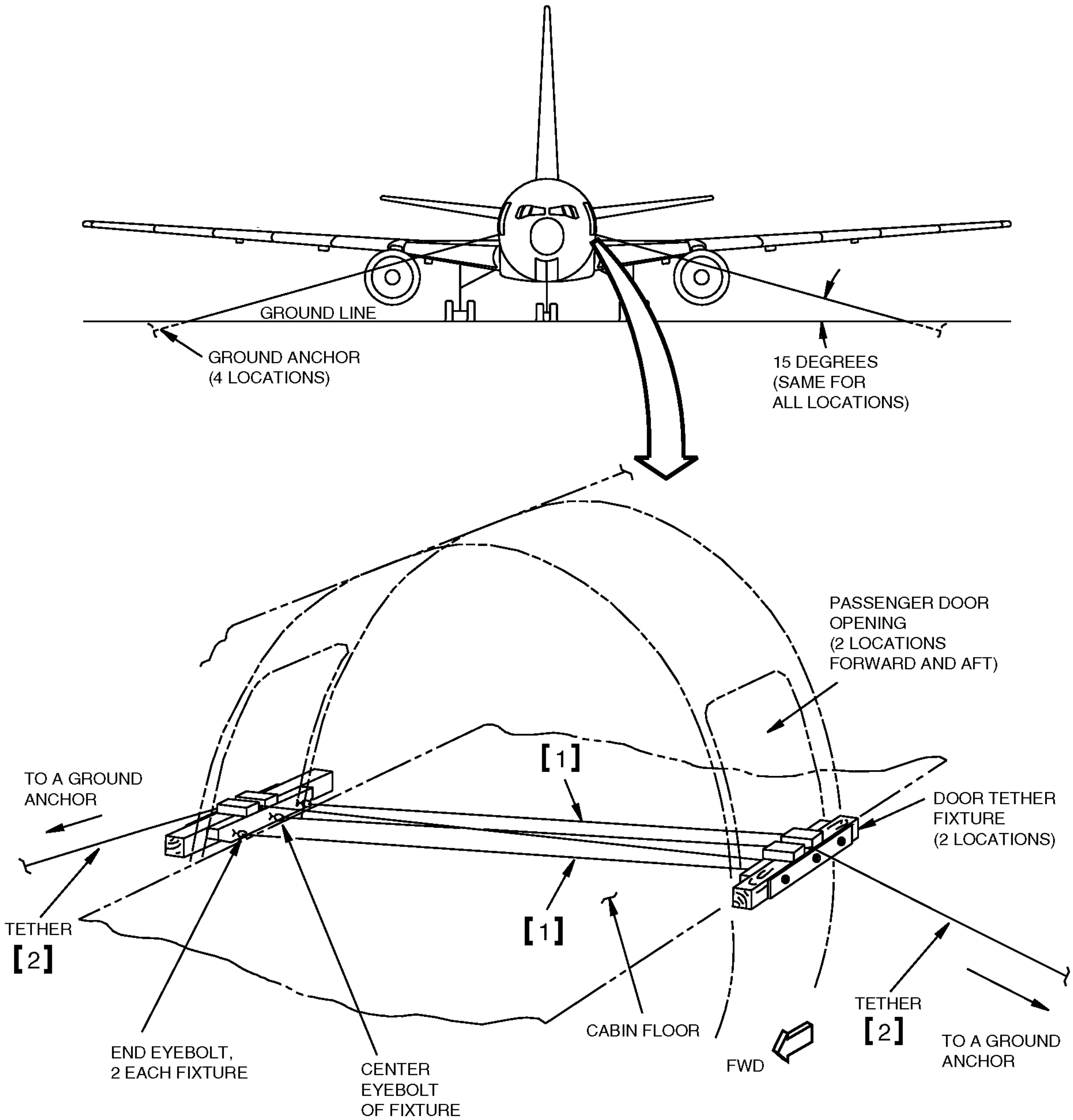
[5] MAXIMUM PERMITTED LOAD IS 15,000 LBS. (6803 KG) IN THE FORWARD DIRECTION. ONLY ONE OF THE TWO TETHER LINES SHOWN ARE TO BE USED AT ANY GIVEN TIME.

[6] MAXIMUM PERMITTED LOAD IS 15,000 LBS. (6803 KG) IN THE AFT DIRECTION.

[7] MAXIMUM PERMITTED LOAD IS 5000 LBS. (2268 KG) IN THE DOWNWARD DIRECTION.

[8] MAXIMUM ALLOWABLE TETHERING LOAD MUST NOT EXCEED 40,000 LBS. (18144 KILOGRAMS) FOR EITHER THE FORWARD OR AFT BODY FUSELAGE LOCATIONS. SEE Figure 3-71 FOR ACCEPTABLE FRAME STATIONS WHERE THIS SLING CAN BE PLACED.

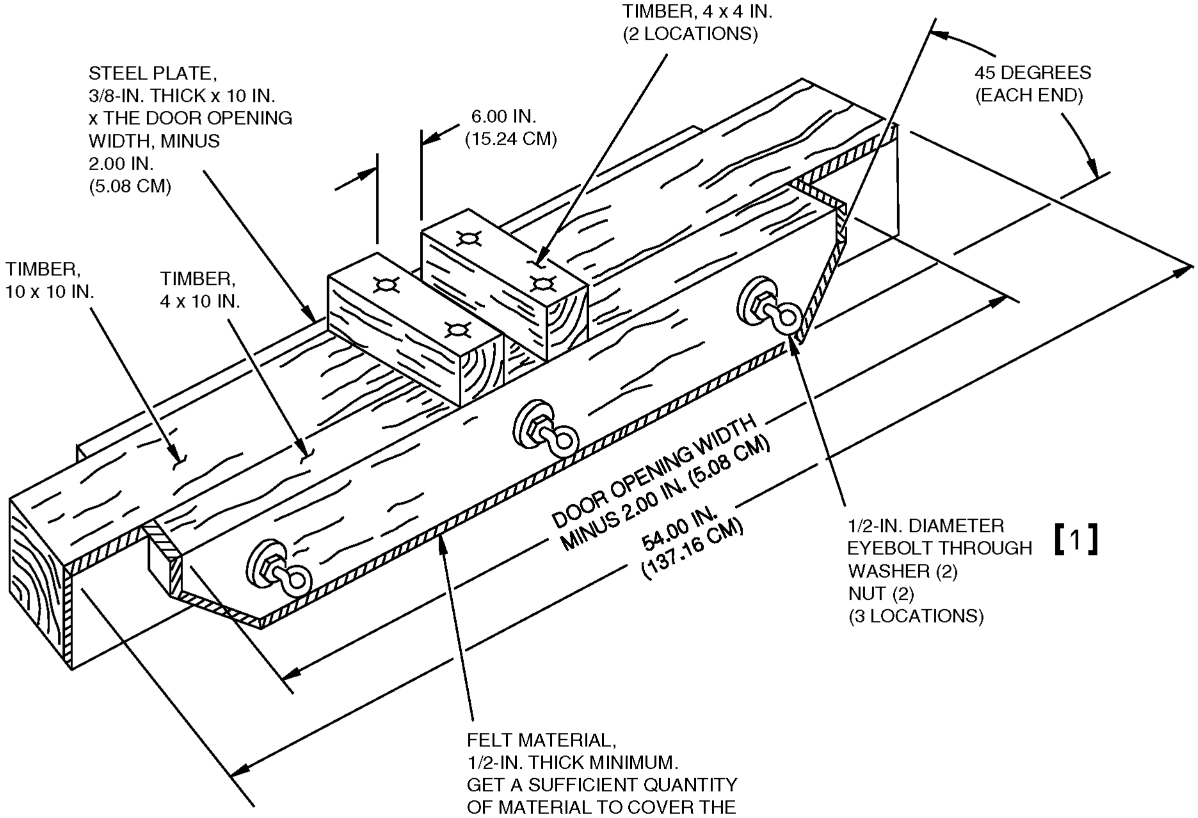
Figure 3-5 767 FUSELAGE TETHERING (STABILIZING) USING PASSENGER DOOR TETHER FIXTURE (PASSENGER MODELS ONLY)



[1] TO MAKE SURE THAT THE TETHER FIXTURES ARE TIGHT AGAINST THE DOOR FRAMES, TIE THEM TOGETHER WITH CORDS, ACROSS THE CABIN FLOOR, FROM END EYEBOLT TO END EYEBOLT

[2] PLACE THE TETHER LINE THROUGH THE FIXTURE, ACROSS THE CABIN FLOOR TO THE OPPOSITE FIXTURE, AND ATTACH IT TO THE CENTER EYEBOLT

Figure 3-6 767 FUSELAGE TETHERING (STABILIZING) USING PASSENGER DOOR TETHER FIXTURE (PASSENGER MODELS ONLY)



[1] MANUFACTURED AND SUPPLIED BY:
THE CROSBY GROUP
POST OFFICE BOX 3128
TULSA, OKLAHOMA 74101 USA
PHONE (918) 834-4611
(OR EQUIVALENT)

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3-20-5 Materials and Attachments

1. General

   You can use various materials to lift or pull the airplane. The paragraphs that follow discuss the usual materials that are available. Figure 3-7 and Figure 3-8 show the rated capacities or breaking strengths of these materials.

2. Straps

   A. Straps made from Nylon (or Dacron) material are the usual straps used to lift the airplane structure. They prevent damage to the fuselage surface. These straps are very resistant to a tear and they absorb less water. They also dry quickly and are resistant to the other problems caused by water (rot and mold).

   Nylon (and Dacron) straps can be damaged by a long (120 hours) time of high temperatures (125°F (52°C)) and dry air conditions. These straps will not hold their approved load with these conditions. You must then use straps made from a different (polypropylene) material.

   B. Usually, you must make sure that the straps agree with the conditions at your incident. They must have sufficient devices for protection and a large factor (20 or more) of safety. Some straps have some wire in their material for greater strength. See the manufacturer's documents (catalogs) for more data on a strap and its approved load. These documents will also recommend the correct straps for the conditions at your incident.

   C. We know from safety test data that sharp edges decrease the approved loads for Nylon slings. If the object that you lift has sharp edges (a radius less than 3/16 in. (5 mm)), you must decrease the load on the sling. Figure 3-7 shows these changes in the load capacity.

3. Manila Rope

   A. You can use manila rope for some conditions (tiedowns, power transmissions, etc.). You can also use it for hoist (block and tackle) operations. Do not use it at a connection point for a load or in other positions that can cut it (load droppers).

   B. When exposed to water or moisture, a rope will always absorbs water. If you have very cold temperatures, the water freezes and the rope has a lower load capacity. A rope can also decrease (shrink) in its length . A change in the length can be a change in the load. Make sure that you know the loads you have when you use a rope.

4. Chains

   A. Hoist chains are made from a good quality material (wrought iron) selected because of its properties (ductility and toughness). This material gives you a warning before it has a failure (it will bend or stretch). It is also easier to weld this material than it is to weld steel. The strength (tensile strength) is less than 46,000 psi (3234 kg/cm^2).

   B. Chain is good equipment to select when you lift a load. Chain has the qualities that follow:

      (1) Its components are smooth.

      (2) It will not cause injury to the hands of a person.

      (3) It is flexible and you can use it easily.

      (4) It will not get kinks.

      (5) It will not turn (twist or spin) the load.

      (6) Its capacity does not change when you have the usual conditions that follow:
      - Heavy loads
      - Hard hits
      - Heat

- Corrosion
- Abrasion

C. Be careful if you use chains near the surface of the airplane. It is flexible and it is heavy. It can easily cause airplane damage. We recommend some wire ropes if you are near the surface. Use wood pads to give protection to the surface if you must use chains.

5. Wire Rope

A. A wire rope is some wires around an element of a metal wire or a different material. A rope center element (hemp fiber) is frequently used for small loads. The center element holds the outer wires in their positions and it prevents damage (nicks) to them.

B. A good wire rope (improved plow steel) has the properties that follow:

(1) Strong

(2) Very flexible

(3) Wear resistant

(4) Distortion resistant

C. There are two numbers that you use to identify a wire rope: the first number shows the quantity of units, and the second number shows the quantity of wires in each unit (a 6 x 7 wire rope has 6 units with 7 wires in each unit). The diameter of a wire rope is that diameter that goes tightly around the rope.

D. The factor of safety for a wire rope can be a low number (5) or a high number (12). Use a rope with a higher number when the conditions are dangerous to persons.

E. Be careful with a rope that has some deterioration. The deterioration usually occurs first in the low areas between the units. If one of the wires in a unit breaks, there is possibly other deterioration that you cannot see. If you can see that more than one wire is broken, you must replace the rope.

F. A wire will usually break where the rope goes around a sheave or a drum. It will also break where mechanical equipment frequently hits the rope.

G. See Figure 3-10 through Figure 3-12 for information and dimensions of hardware used with wire rope.

6. Basic Sling Configurations

A. Some basic configurations of slings with vertical legs (within 5 degrees of vertical) are shown in Figure 3-9.

Figure 3-7 THE RATED CAPACITY OF NYLON ROPE SLINGS

EDGE RADIUS OF LOAD, INCHES (MILLIMETERS)	REDUCTION IN RATED CAPACITY, PERCENTAGE
3/16 (4.8)	NONE
5/32 (4.0)	5
1/8 (3.2)	15
3/32 (2.4)	25
1/16 (1.6)	40
1/32 (0.8)	55
0 (0)	85

Figure 3-7 THE RATED CAPACITY OF NYLON ROPE SLINGS (Continued)

NOMINAL ROPE DIA. IN (MM)	NOMINAL WT. LB/FT (KG/M)	MIN. BREAKING STRENGTH LB (KG)	EYE AND EYE SLING		
			VERTICAL HITCH	CHOKER HITCH	BASKET HITCH 0° ANGLE OF ROPE TO VERTICAL
1/2 (13)	0.065 (0.044)	6,080 (2758)	700 (318)	350 (159)	1,400 (635)
3/4 (19)	0.145 (0.098)	13,490 (6119)	1,500 (680)	750 (340)	3,000 (1361)
1 (25)	0.26 (0.175)	23,750 (10773)	2,600 (1179)	1,300 (590)	5,300 (2404)
1-1/2 (38)	0.55 (0.370)	50,350 (22839)	5,600 (2540)	2,800 (1270)	11,000 (4990)
1-3/4 (45)	0.83 (0.518)	74,100 (33612)	8,200 (3720)	4,100 (1860)	16,500 (7484)
2 (51)	0.95 (0.639)	87,400 (39645)	9,700 (4400)	4,900 (2223)	19,500 (8845)
2-1/4 (57)	1.29 (0.867)	118,750 (53865)	13,000 (5897)	6,600 (2994)	26,500 (12020)
2-1/2 (64)	1.49 (1.002)	133,000 (60329)	15,000 (6804)	7,400 (3357)	29,500 (13381)

NOMINAL ROPE DIA. IN (MM)	NOMINAL WT. LB/FT (KG/M)	MIN. BREAKING STRENGTH LB (KG)	ENDLESS SLING		
			VERTICAL HITCH	CHOKER HITCH	BASKET HITCH 0° ANGLE OF ROPE TO VERTICAL
1/2 (13)	0.065 (0.044)	6,080 (2758)	1,200 (544)	600 (272)	2,400 (1089)
3/4 (19)	0.145 (0.098)	13,490 (6119)	2,700 (1225)	1,400 (635)	5,400 (2449)
1 (25)	0.26 (0.175)	23,750 (10773)	4,800 (2177)	2,400 (1089)	9,500 (4309)
1-1/2 (38)	0.55 (0.370)	50,350 (22839)	10,000 (4536)	5,000 (2268)	20,000 (9072)
1-3/4 (45)	0.83 (0.518)	74,100 (33612)	15,000 (6804)	7,400 (3357)	29,500 (13381)
2 (51)	0.95 (0.639)	87,400 (39645)	17,500 (7938)	8,700 (3946)	35,000 (15876)
2-1/4 (57)	1.29 (0.867)	118,750 (53865)	24,000 (10886)	12,000 (5443)	47,500 (21546)

Figure 3-7 THE RATED CAPACITY OF NYLON ROPE SLINGS (Continued)

NOMINAL ROPE DIA. IN (MM)	NOMINAL WT. LB/FT (KG/M)	MIN. BREAKING STRENGTH LB (KG)	ENDLESS SLING		
			VERTICAL HITCH	CHOKER HITCH	BASKET HITCH 0° ANGLE OF ROPE TO VERTICAL
2-1/2 (64)	1.49 (1.002)	133,000 (60329)	26,500 (12020)	13,500 (6124)	53,000 (24041)

Figure 3-8 AVERAGE BREAKING STRENGTH OF SELECTED SLING MATERIALS

TRADE SIZE DIA. IN. (MM)	CHAIN				MANILA ROPE	
	WROUGHT IRON, DREDGE QUALITY		ALLOY STEEL, HEAT TREATED		THREE-STRAND	
	UNIT WT LB/FT (KG/M)	BREAKING STRENGTH LB (KG)	UNIT WT LB/FT (KG/M)	BREAKING STRENGTH LB (KG)	UNIT WT LB/FT (KG/M)	BREAKING STRENGTH LB (KG)
1/4 (6)	0.78 (1.16)	4,500 (2041)	0.73 (1.08)	10,500 (4763)	0.020 (0.03)	600 (272)
3/8 (10)	1.66 (2.47)	9,300 (4218)	1.59 (2.37)	22,500 (10206)	0.041 (0.061)	1,350 (612)
1/2 (13)	2.95 (4.39)	16,500 (7484)	2.77 (4.12)	40,000 (18144)	0.075 (0.011)	2,650 (1202)
5/8 (16)	4.30 (6.40)	25,000 (11340)	4.33 (6.44)	59,500 (26989)	0.133 (0.198)	4,400 (1996)
3/4 (19)	6.15 (9.15)	35,400 (16057)	6.36 (9.46)	77,500 (35154)	0.167 (0.248)	5,400 (2449)
7/8 (22)	8.20 (12.20)	48,000 (21773)	8.68 (12.90)	104,000 (47174)	0.225 (0.33)	7,700 (3493)
1 (25)	10.45 (15.55)	62,000 (28123)	11.23 (16.71)	135,000 (61236)	0.270 (0.402)	9,000 (4082)
1-1/8 (29)	13.10 (19.49)	78,000 (35381)	- - -	- - -	0.360 (0.536)	12,000 (5443)
1-1/4 (32)	16.00 (23.81)	96,000 (43546)	- - -	- - -	0.418 (0.62)	13,500 (6124)
1-3/8 (35)	19.30 (28.72)	115,000 (52164)	- - -	- - -	- - -	- - -
1-1/2 (38)	23.00 (34.22)	136,000 (61690)	- - -	- - -	0.600 (0.89)	18,500 (8392)

NOTE: 1. The breaking strength must be divided by an applicable factor of safety that is controlled by the amount of safety required for the work to be done.

2. See the manufacturer's catalogs for specific load ratings.

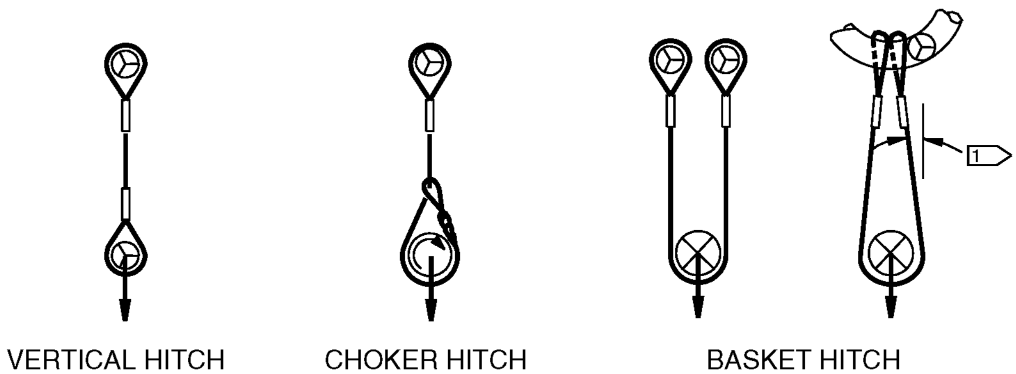
Figure 3-8 AVERAGE BREAKING STRENGTH OF SELECTED SLING MATERIALS (Continued)

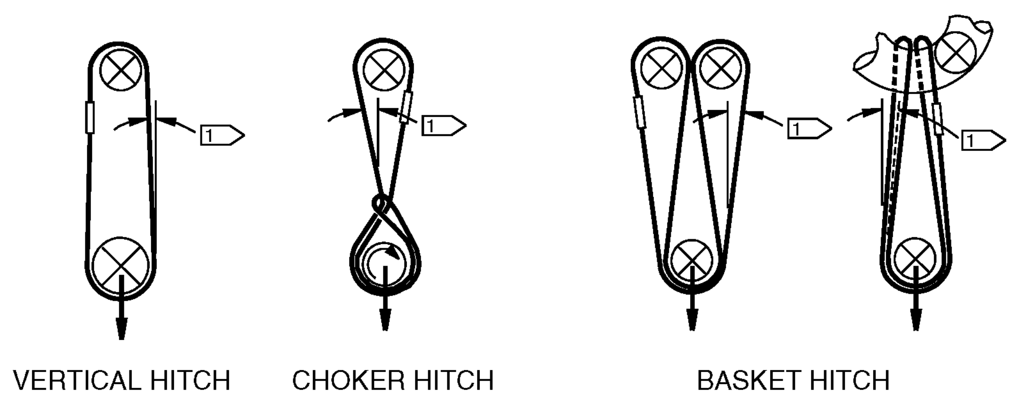
TRADE SIZE DIA. IN. (MM)	WIRE ROPE IMPROVED PLOW STEEL, HEMP CENTER					
	6 X 19 CONSTRUCTION		6 X 37 CONSTRUCTION		8 X 19 CONSTRUCTION	
	UNIT WT LB/FT (KG/M)	BREAKING STRENGTH LB (KG)	UNIT WT LB/FT (KG/M)	BREAKING STRENGTH LB (KG)	UNIT WT LB/FT (KG/M)	BREAKING STRENGTH LB (KG)
1/4 (6)	0.10 (0.15)	5,800 (2631)	0.10 (0.15)	5,600 (2540)	0.09 (0.13)	4,940 (2241)
3/8 (10)	0.23 (0.34)	12,600 (5715)	0.22 (0.33)	12,200 (5534)	0.20 (0.30)	10,900 (4944)
1/2 (13)	0.40 (0.60)	21,000 (9526)	0.39 (0.58)	21,200 (9616)	0.36 (0.54)	19,000 (8618)
5/8 (16)	0.63 (0.94)	33,200 (15060)	0.61 (0.91)	32,200 (14606)	0.57 (0.85)	28,800 (13064)
3/4 (19)	0.90 (1.34)	47,400 (21501)	0.87 (1.29)	45,600 (20684)	0.82 (1.22)	41,000 (18598)
7/8 (22)	1.23 (1.83)	64,400 (29212)	1.19 (1.77)	61,000 (27670)	1.11 (1.65)	55,200 (25039)
1 (25)	1.60 (2.38)	84,000 (38102)	1.55 (2.31)	79,000 (35834)	1.45 (2.16)	71,600 (32478)
1-1/8 (29)	2.03 (3.02)	106,000 (48082)	1.96 (2.92)	99,800 (45269)	1.84 (2.74)	90,400 (41005)
1-1/4 (32)	2.50 (3.72)	130,000 (58968)	2.42 (3.60)	123,000 (55793)	2.27 (3.38)	111,400 (50531)
1-3/8 (35)	3.03 (4.51)	157,000 (71215)	2.93 (4.36)	148,600 (67405)	2.74 (4.08)	134,000 (60782)
1-1/2 (38)	3.60 (5.36)	185,000 (83916)	3.49 (5.19)	176,400 (80015)	3.26 (4.85)	159,000 (72122)

NOTE: 1. The breaking strength must be divided by an applicable factor of safety that is controlled by the amount of safety required for the work to be done.

2. See the manufacturer's catalogs for specific load ratings.

Figure 3-9 SLING CONFIGURATIONS

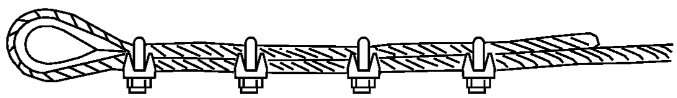




1 5 DEGREES MAXIMUM

Figure 3-10 WIRE ROPE CLIPS

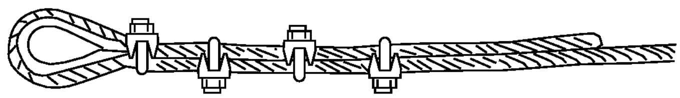
CORRECT PROCEDURE:



THIS ILLUSTRATES THE CORRECT APPLICATION OF WIRE CLIPS.
ALL THE SADDLES OF THE CLIPS ARE IN CONTACT WITH THE LOAD-END
OF THE ROPE AND THE CLIPS ARE THE CORRECT DISTANCE APART 1

METHOD OF ATTACHING WIRE ROPE CLIPS

INCORRECT PROCEDURE:



THIS ILLUSTRATES THE INCORRECT APPLICATION OF WIRE CLIPS.
THE CLIPS ARE TOO CLOSE TOGETHER AND CLIPS NO. 1 AND 3 HAVE
THE U-BOLTS IN CONTACT WITH THE LOAD END OF THE ROPE

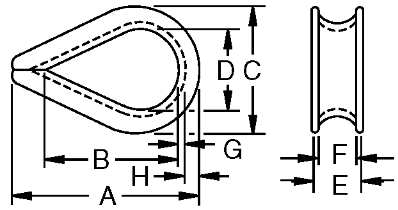
EFFICIENCY WITH USE OF CLIPS

THE CORRECT NUMBER OF CLIPS PROPERLY ATTACHED, WILL DEVELOP AN EFFICIENCY BETWEEN 75 AND 85 PERCENT OF THE ROPE BREAKING STRENGTH. THE DISTANCE BETWEEN CLIPS SHOULD NOT BE LESS THAN SIX TIMES (X) THE DIAMETER OF THE WIRE ROPE. AFTER THE ROPE HAS BEEN IN USE A SHORT TIME, ALL CLIPS SHOULD BE TIGHTENED AGAIN

1 FORMULA: THE DIAMETER OF THE WIRE ROPES, TIMES (X) SIX EQUALS THE DISTANCE IN INCHES BETWEEN THE CLIPS (1.00 INCH EQUALS 2.54 CENTIMETERS)

DIAMETER OF ROPE		NUMBER OF CLIPS	SPACE BETWEEN CLIPS	
INCHES	MM		INCHES	CM
1/4	6	2	1-1/2	3.81
5/16	8	2	1-7/8	4.76
3/8	10	2	2-1/4	5.72
7/16	11	2	2-5/8	6.67
1/2	13	3	3	7.62
9/16	14	3	3-3/8	8.57
5/8	16	3	3-3/4	9.53
3/4	19	4	4-1/2	11.43
7/8	22	4	5-1/4	13.34
1	25	4	6	15.24
1-1/8	29	5	6-3/4	17.15
1-1/4	32	5	7-1/2	19.05

Figure 3-11 TETHERING (STABILIZING) LINE THIMBLE DATA



EXTRA HEAVY WIRE ROPE THIMBLE
(MUST AGREE WITH FEDERAL SPECIFICATION FF-T-276a TYPE III)

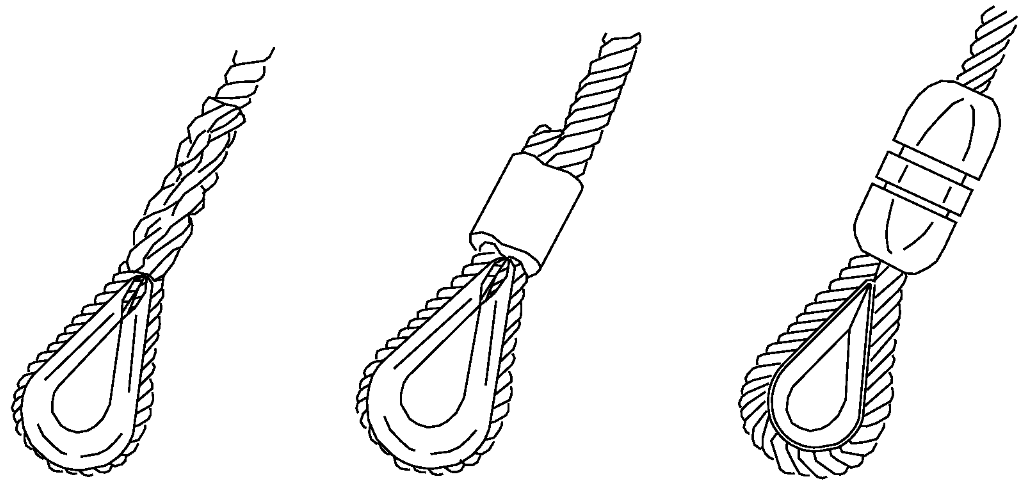
WIRE ROPE DIAMETER	DIMENSIONS IN INCHES								WT LB EACH
	A	B	C	D	E	F	G	H	
1/4	2.19	1.63	1.50	.88	0.41	0.28	0.06	0.23	0.075
5/16	2.50	1.88	1.81	1.06	0.50	0.34	0.08	0.28	0.14
3/8	2.88	2.13	2.13	1.13	0.63	0.41	0.11	0.34	0.25
7/16	3.25	2.38	2.38	1.25	0.72	0.47	0.13	0.38	0.36
1/2	3.63	2.75	2.75	1.50	0.81	0.53	0.14	0.41	0.51
9/16	3.63	2.75	2.69	1.50	0.88	0.59	0.14	0.41	0.51
5/8	4.25	3.25	3.13	1.75	0.97	0.66	0.16	0.50	0.75
3/4	5.00	3.75	3.81	2.00	1.22	0.78	0.22	0.66	1.47
7/8	5.50	4.25	4.25	2.25	1.38	0.94	0.22	0.75	1.85
1	6.13	4.50	4.94	2.50	1.56	1.06	0.25	0.88	2.91
1-1/8 - 1-1/4	7.00	5.13	5.88	2.88	1.81	1.31	0.25	1.13	3.83
1-1/4 - 1-3/8	9.06	6.50	6.81	3.50	2.19	1.44	0.38	1.13	8.16
1-3/8 - 1-1/2	9.00	6.25	7.13	3.50	2.56	1.56	0.50	1.13	11.66
1-5/8	11.25	8.00	8.13	4.00	2.72	1.72	0.50	1.38	16.25
1-3/4	12.19	9.00	8.50	4.50	2.84	1.84	0.50	1.31	18.37
1-7/8 - 2	15.13	12.00	10.38	6.00	3.09	2.09	0.50	1.50	25.75
2-1/4	17.13	14.00	11.88	7.00	3.63	2.38	0.63	1.63	38.50

NOTE: 1. Dimensions are given in inches.

2. 1 inch equals 2.54 centimeters.

3. 1 lb. equals 0.4536 kg.

Figure 3-12 LIFTING ATTACHMENTS

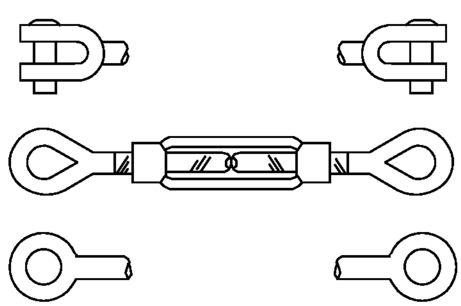


ADMIRALTY SPLICE

COPPER FERRULES OR SWAGGED ESCO SLEEVES

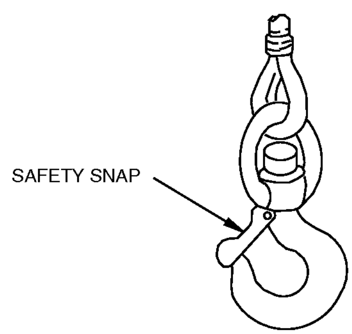
SCREW-WEDGE TYPE

THE ILLUSTRATIONS ABOVE SHOW PROCEDURES TO FORM A LOOP FROM THIMBLES OR OPEN ENDS OF WIRE ROPE. USE STAINLESS STEEL OR OTHER PERMITTED SWAGED FITTINGS FOR EYES IN WIRE ROPES



TURNBUCKLE

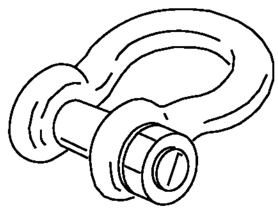
USE A TURNBUCKLE WITH PIN, OVAL OR ROUND EYE FITTINGS ON CHAIN OR WIRE ROPE SLINGS AND CABLES. TURNBUCKLES SUPPLY, AS NECESSARY, SLING AND CABLE LENGTH ADJUSTMENT



SWIVEL HOOK AND THIMBLE

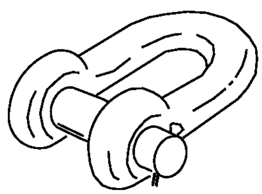
USE THIS CONFIGURATION FOR SLINGS AND CABLES WHEN THE ROTATION OF THE LOAD IS NECESSARY

Figure 3-12 LIFTING ATTACHMENTS (Continued)



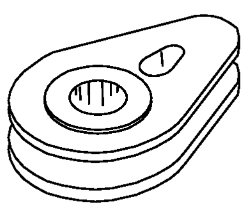
ANCHOR SHACKLE

THIS TYPE OF SHACKLE WITH A COTTER PIN BOLT, SCREW BOLT, OR BOLT-NUT COMBINATION IS USED TO CONNECT CHAIN LINKS OR WIRE ROPE ATTACHMENTS



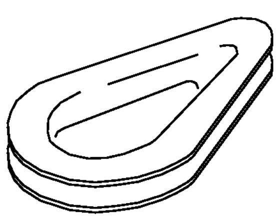
CHAIN PIN SHACKLE

THIS TYPE OF SHACKLE WITH A COTTER PIN BOLT, SCREW BOLT, OR BOLT-NUT COMBINATION IS USED TO CONNECT CHAIN LINKS OR WIRE ROPE ATTACHMENTS



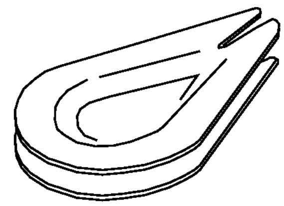
SOLID THIMBLE

THIS THIMBLE IS A VERY STRONG PART WHICH PROTECTS THE ROPE. USE IT WITH ATTACHMENTS THAT USE PINS OR BOLTS



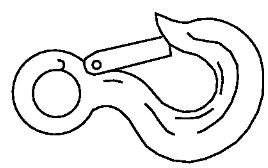
STANDARD THIMBLE

THIS THIMBLE IS USED WITH WIRE ROPE TO GIVE PROTECTION TO CABLE LOOPS



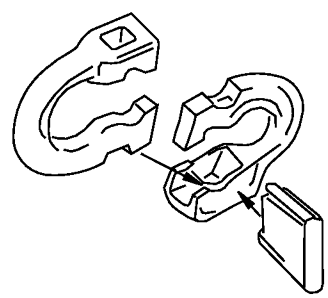
HAWSER THIMBLE

THIS IS A DURABLE THIMBLE FOR ROPE PROTECTION. IT IS RESISTANT TO DAMAGE AND WEAR AND WILL STAY IN THE LOOP



SAFETY SNAP EYE HOOK

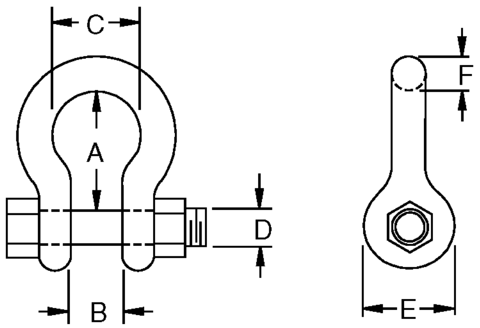
THIS HOOK CAN BE USED LIKE A STANDARD EYE HOOK. THE SAFETY SNAP PROPERTY OF THIS EYE HOOK PREVENTS THE LOAD FROM BEING DISENGAGED WHEN THE FORCE ON THE ROPE IS RELEASED



WEDGELOK LINK

THIS LINK IS A STRONG, FULLY SAFE PART USED TO REPAIR CHAIN. IT IS ALSO USED TO ATTACH A CHAIN TO MORE THAN ONE TYPE OF FITTING

Figure 3-13 TETHERING (STABILIZING) LINE SHACKLE DATA

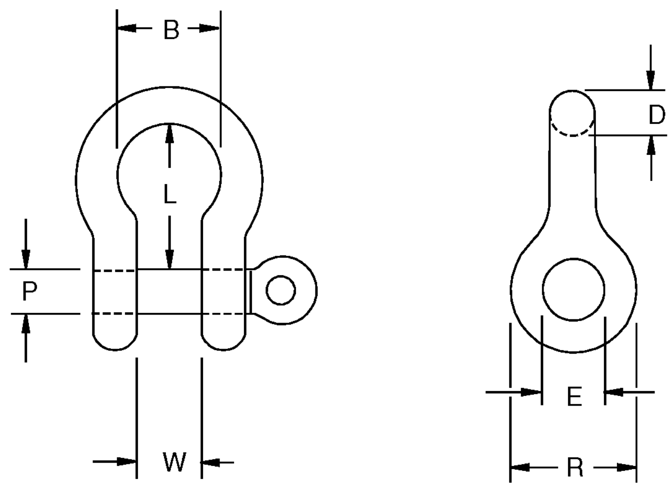


BOLT TYPE SHACKLES
MUST AGREE WITH FEDERAL
SPECIFICATION RR-C-271b

SHACKLE SIZE IN. (MM)	DIMENSIONS IN INCHES						WEIGHT EACH, LB (KG)	SAFE WORKING LOAD, TON (KG)
	A	B	C	D	E	F		
1/2 (13)	1-7/8	13/16	1-5/16	5/8	1-3/16	1/2	0.79 (0.36)	2 (1814)
5/8 (16)	2-3/8	1-1/16	1-11/16	3/4	1-9/16	5/8	1.60 (0.73)	3.25 (2948)
3/4 (19)	2-13/16	1-1/4	2	7/8	1-7/8	3/4	2.72 (1.23)	4.75 (4309)
7/8 (22)	3-5/16	1-7/16	2-9/32	1	2-1/8	7/8	3.95 (1.79)	6.5 (5897)
1 (25)	3-3/4	1-11/16	2-11/16	1-1/8	2-3/8	1	6.12 (2.78)	8.5 (7711)
1-1/8 (29)	4-1/4	1-13/16	2-29/32	1-1/4	2-5/8	1-1/8	8.27 (3.75)	9.5 (8618)
1-1/4 (32)	4-11/16	2-1/32	3-1/4	1-3/8	3	1-1/4	11.71 (5.31)	12 (10886)
1-3/8 (35)	5-1/4	2-1/4	3-5/8	1-1/2	3-5/16	1-3/8	15.83 (7.18)	13.5 (12247)
1-1/2 (38)	5-3/4	2-3/8	3-7/8	1-5/8	3-5/8	1-1/2	20.80 (9.43)	17 (15422)
1-3/4 (44)	7	2-7/8	5	2	4-5/16	1-3/4	33.91 (15.38)	25 (22680)
2 (51)	7-3/4	3-1/4	5-3/4	2-1/4	5	2	51.75 (23.47)	35 (31752)
2-1/2 (64)	10-1/2	4-1/8	7-1/4	2-3/4	6	2-1/2	101.6 (46.08)	55 (49896)
3 (76)	13	5	7-7/8	3-1/4	6-1/2	3	178.0 (80.74)	85 (77112)

NOTE: 1. The shackle must agree with Federal Specification RR-C-271B.

Figure 3-14 SCREW-PIN ANCHOR SHACKLES, TYPE IV, CLASS 1



DIMENSIONS IN INCHES								BREAKING LOADS MINIMUM LB (KG)
SIZE D	P MIN.	E MAX.	W	B MIN.	R MAX.	L	THREADED EYE MAJOR DIAMETER MAXIMUM	
1/4	5/16	13/32	15/32	3/4	7/8	1-1/8	11/32	3550 (1610)
5/16	3/8	15/32	17/32	13/16	1	1-1/4	13/32	5300 (2404)
3/8	7/16	17/32	21/32	15/16	1-1/8	1-7/16	15/32	7950 (3606)
7/16	1/2	19/32	23/32	1-1/16	1-1/4	1-11/16	17/32	10,850 (4922)
1/2	5/8	23/32	13/16	1-3/16	1-3/8	1-15/16	21/32	14,150 (6418)
9/16	5/8	23/32	7/8	1-3/8	1-5/8	2-1/8	21/32	17,900 (8119)
5/8	3/4	27/32	1-1/16	1-1/2	1-7/8	2-1/2	25/32	22,100 (10025)
3/4	7/8	31/32	1-1/4	1-3/4	2-1/4	3	29/32	31,800 (14424)
7/8	1	1-3/32	1-7/16	2	2-3/8	3-1/4	1-1/32	43,250 (19618)
1	1-1/8	1-7/32	1-11/16	2-5/16	2-5/8	3-3/4	1-5/32	56,550 (25651)
1-1/8	1-1/4	1-11/12	1-13/16	2-5/8	3	4-1/4	1-19/64	66,800 (30300)
1-1/4	1-3/8	1-15/32	2	2-7/8	3-1/4	4-1/2	1-27/64	82,500 (37422)
1-3/8	1-1/2	1-5/8	2-1/4	3-1/4	3-1/2	5-1/4	1-35/64	99,800 (45269)

Figure 3-14 SCREW-PIN ANCHOR SHACKLES, TYPE IV, CLASS 1 (Continued)

DIMENSIONS IN INCHES								BREAKING LOADS MINIMUM LB (KG)
SIZE D	P MIN.	E MAX.	W	B MIN.	R MAX.	L	THREADED EYE MAJOR DIAMETER MAXIMUM	
1-1/2	1-5/8	1-3/4	2-3/8	3-3/8	3-3/4	5-3/4	1-43/64	118,700 (53842)
1-5/8	1-3/4	1-7/8	2-5/8	4-1/8	4-1/8	6-1/4	1-51/64	139,500 (63277)
1-3/4	2	2-5/32	2-7/8	4-1/2	4-1/2	7	2-3/64	161,600 (73302)
2	2-1/4	2-13/32	3-1/4	5	5-1/8	7-3/4	2-19/64	211,100 (95755)
2-1/4	2-1/2	2-21/32	3-7/8	5-1/2	5-5/8	8-3/4	2-35/64	270,000 (122472)
2-1/2	2-3/4	2-29/32	4-1/8	6	5-7/8	10	2-51/64	338,000 (153317)

NOTE: 1. Anchor shackles must agree with Federal Specification RR-C-271B.

2. 1.00 inch equals 2.54 centimeters.

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3-30 WHEN YOU LIFT THE DAMAGED AIRPLANE

3-30-1 General

1. Because each incident is different, you must make an analysis of your special conditions. You can use jacks, pneumatic bags, cranes or slings to lift the damaged airplane.
2. Use caution when you use pneumatic bags. The initial (balloon-type) pneumatic bags are not stable but the newer design pneumatic bags with internal drop threads are more stable. A procedure that uses axle jacks (and cribbing) to lift the airplane in small increments can be considered as an alternative. If it is necessary to lift the fuselage, the use of cranes and slings (if available) is normally the preferred method to lift the fuselage.

WARNING: BE CAREFUL IN HIGH WINDS. DO NOT USE JACKS TO LIFT THE AIRPLANE IN VERY HIGH WINDS (MORE THAN 30 KNOTS/35 MPH/56 KM PER HOUR).

A. You can lift the airplane with recovery jacks (low profile) or pneumatic bags (25 t (23 metric tons) to 40 t (36 metric tons) ton multi-cell). You can also use a combination of jacks, bags, cranes and fuselage slings. See Figure 3-60 and Figure 3-61 for bag locations and limits (allowable surface bearing loads).

B. When you lift the airplane, keep it in a level attitude. This will make sure that the airplane CG stays in the correct range. The procedure that you use to lift the airplane makes no difference.

C. Make sure the CG is in the correct position. If you use jacks, calculate the forces on the jack points. Make sure you keep these same forces while you lift the airplane. This will prevent a dangerous movement of the airplane.

D. Remove all possible weight from the airplane. This will permit you to lift the airplane with an easier and a safer procedure. It is possible to lift the airplane with the fuel on it. When you lift a wing, it can be good to move the fuel to the opposite wing. To correct the CG of the airplane, you can add some ballast. You can put the ballast in the forward cargo compartment or the aft cargo compartment.

E. Lift the airplane with a procedure that prevents large horizontal forces at the jack points. The procedure must also prevent large forces that can cause movement of the pneumatic bags. Use tools (levels and plumb bobs) to move the airplane to the correct attitude (horizontal and vertical) when you lift the airplane. Use these tools to make sure the airplane keeps the correct attitude while you continue to lift the airplane.

F. If the airplane is on soft (or muddy) ground, it is best to use pneumatic bags. If the airplane is on hard ground, it is best to use movable cranes. If you have cranes of the correct capacity, you can quickly move (or walk) the airplane. It is possible that you can move it the full distance to a runway or a repair area.

WARNING: BE CAREFUL IN HIGH WINDS. DO NOT USE JACKS TO LIFT THE AIRPLANE IN VERY HIGH WINDS (MORE THAN 30 KNOTS/35 MPH/56 KM PER HOUR).

G. You must remove all possible fuel to decrease the airplane weight and to reduce the risk of a fuel fire.

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3-30-2 When You Prepare to Lift the Airplane

1. Examine the recovery procedure. Look at the terrain and examine the airplane structures that are scheduled for the procedure. Make sure the airplane structural points are sufficient for the procedure. Damaged airplane structures and unsatisfactory ground conditions can change the procedures you use to lift the airplane.
2. Install pins (downlock pins) on all the gears (in the extended position) immediately. This is mandatory safety precaution.

   WARNING: BE CAREFUL WHEN YOU CALCULATE THE CENTER OF GRAVITY OF THE AIRPLANE. USE THE MANUAL (WEIGHT AND BALANCE MANUAL) TO FIND THE CENTER OF GRAVITY AND THE WEIGHT. MAKE A MARK ON EACH SIDE OF THE FUSELAGE FOR THE LOCATION OF THE CENTER OF GRAVITY.

3. Find the location of the airplane center of gravity. If you remove all the fuel and all the payload from the airplane, you have a usual condition (Operating Empty Weight (OEW) and CG location). There are usually no problems.

   If some fuel or some payload stays on the airplane, you have a condition that is not usual. You must calculate the NRW (Net Recoverable Weight) and the location of the CG (Reference SECTION 2-30). You must also calculate these values if a large airplane part is not on the airplane. If the NRW is large and the CG makes a large movement (forward or aft), you must calculate other forces. These forces occur on the jack points, fuselage skin or other airplane points while you lift the airplane. These forces must not be too large.
4. Remove all the fuel and all the payload. This decreases the airplane weight to a minimum value.
5. Install all tethers before you lift the airplane (see SECTION 3-20).
6. If you lock the gear in the closed (collapsed oleo) position, you must decrease the air pressure in the landing gear struts.

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3-30-3 When You Lift the Airplane from Various Positions

1. The airplane can have many attitudes or different types of these attitudes at the time of the recovery. These are some of the attitudes:
   A. You have a folded nose gear.
   B. You have folded main gears.
   C. You have a folded main gear on one side of the airplane.
   D. You have a folded nose gear and a folded main gear on one side of the airplane.
   E. You have all folded gears.
   F. You have no folded gears. The airplane is in the usual attitude but it is off the runway (in mud or other material). You must lift the airplane before you can tow it.
2. If you have a folded gear, you must lift the part of the airplane near the gear. This permits you to do these tasks:
   A. You can open (extend) the gear if it is not damaged.
   B. You can repair or replace the gear if parts are available. You can also use a support system (dummy gear) as a temporary repair.
   C. You can move a truck (flat bed) or dolly below the gear area to permit movement of the airplane. This can occur when there is no possible repair or replacement. This can also occur when there is no support system available.
3. When You Lift the Airplane with a Folded Nose Gear (see Figure 3-15)
   A. The fastest procedure uses a movable crane and a sling to lift and hold the forward fuselage.
   B. You can use jacks at the primary (forward) jack points to lift the nose of the airplane.
   C. You can use a jack at the nose (auxiliary) jack point to lift the nose of the airplane. If you use this point, the jack load must not be more than 28,000 lb (12,701 kg) (all models).
   D. Pneumatic bags are an alternative to jacks. After you have a sufficient height with the bags, you must put the airplane on jacks (or cribs). Remove the bags after the airplane is on the jacks (or cribs). Bag locations and limits (allowable surface bearing loads) are shown in Figure 3-60 and Figure 3-61.
4. When You Lift the Airplane with a Two Main Gear Folded (see Figure 3-18 and Figure 3-30)
   A. Pneumatic bags must be your first alternative when you have this condition. It is necessary to have sufficient clearance and a level surface below the airplane. Remove material if it is necessary to get this clearance. Use supports (or cribs) as a safety precaution. Use tethers carefully.
   B. Cranes and slings are also an alternative when you have this condition. In this alternative, you lift the airplane in one of two ways:
      (1) By wrapping a sling (i.e. Lift-All Co. B6E1000 or SlingMax TPXC25000 braided round sling or equivalent) around the trunnion at the location where the trunnion and the outer cylinder meet (see Figure 3-68), or
      (2) By wrapping steel cables around the main landing gear beam. Make sure to use wood (spreader blocks) and other material (pads) to prevent damage to the support beam.

      In either case, you must remove the top panel on the wing directly above the main landing gear. You can also prevent damage to the support beam with a tool (hoist adapter A07005-1 or -2). After you install the cables or slings, use cranes to lift the airplane. Use one crane for each side of the airplane if necessary.
5. When You Lift the Airplane with a Folded Main Gear on One Side (see Figure 3-21)

A. Remove the fuel from the wing tanks on the side of the airplane that has the folded gear. This removes a large quantity of weight from that side. You can also move the fuel on this side to the tanks on the opposite side of the airplane. This moves the CG of the airplane in the direction of the opposite wing. This permits you to lift the airplane with a smaller force.

6. When You Lift the Airplane with a Folded Nose Gear and a Folded Main Gear on One Side (see Figure 3-24)

   A. Remove the fuel from the wing tanks on the side of the airplane that has the folded main gear. You can also move the fuel on this side to the tanks on the opposite side of the airplane. Each of these two procedures help you lift the airplane.

7. When You Lift the Airplane with All Gears Folded (see Figure 3-27)

   A. This condition is usually the hardest because your available clearance is at a minimum.

   B. It can be necessary to use pneumatic bags. Be very careful. You must use a full tether system because pneumatic bags may not be stable (see Figure 3-33).

   C. Jacks, cranes and slings are an alternative to pneumatic bags. They are safer and easier (see Figure 3-33).

8. When You lift the Airplane with No Gear Folded (see Figure 3-33)

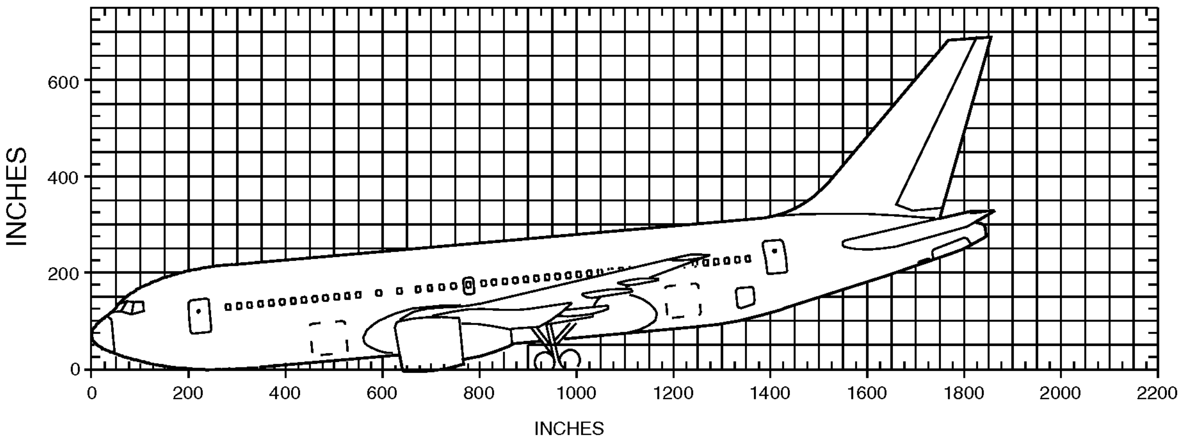
   A. You must lift an airplane in this condition if the gears are below the ground surface. You must lift the gears above the ground surface. This permits the airplane to be towed (or winched).

   B. You can use movable cranes with slings, to lift and hold the forward fuselage. Connect winches to the tow fitting on one or two main gears.

   C. You can use pneumatic bags with the cranes and slings. You can also use jacks at the primary jack points (wing and tail) to lift the gear above the ground surface.

   D. Hard surfaces (plywood, steel or other material) can be necessary to make a temporary road. This road permits the lifted airplane to be moved.

Figure 3-15 COLLAPSED NOSE GEAR - 767-200, -200ER



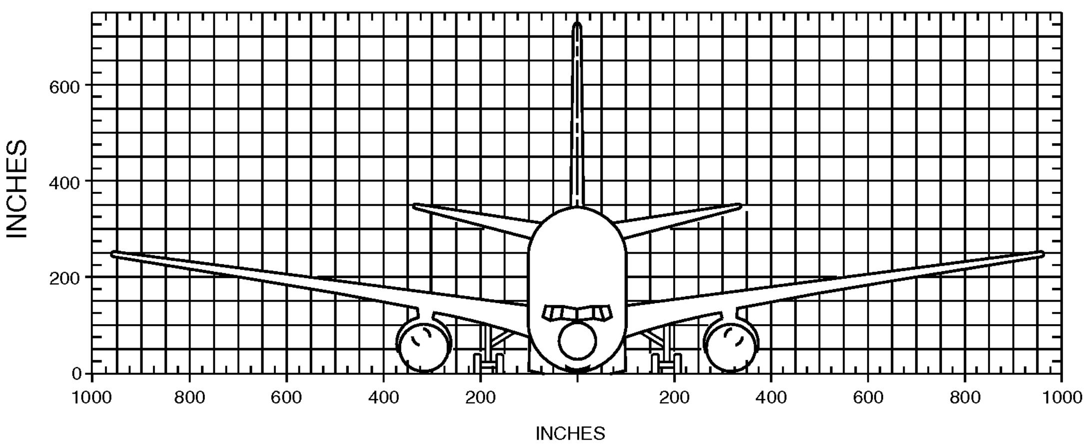


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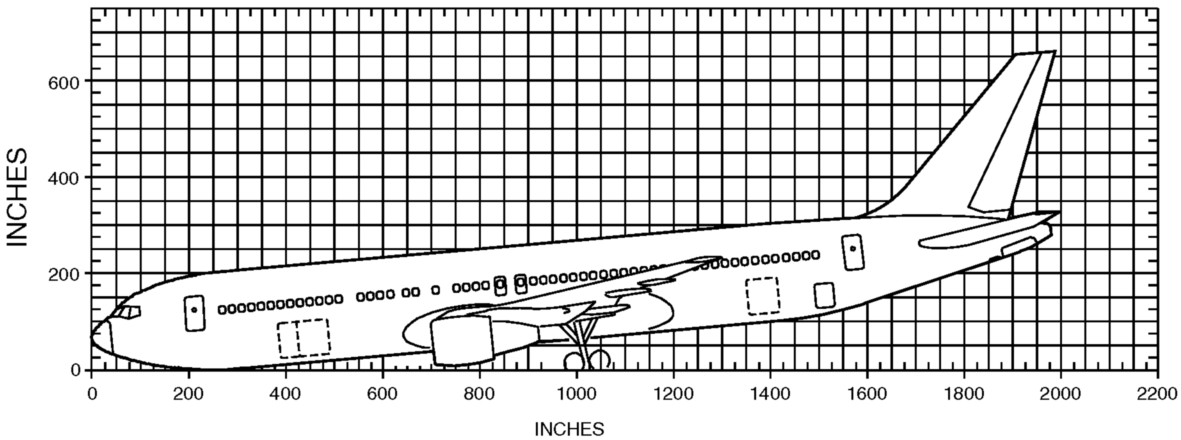
Figure 3-16 COLLAPSED NOSE GEAR - 767-300, -300ER



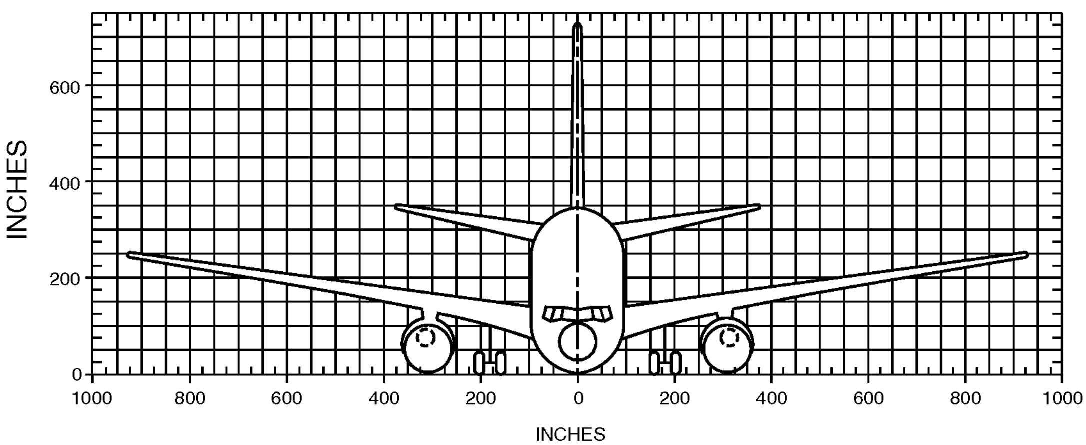


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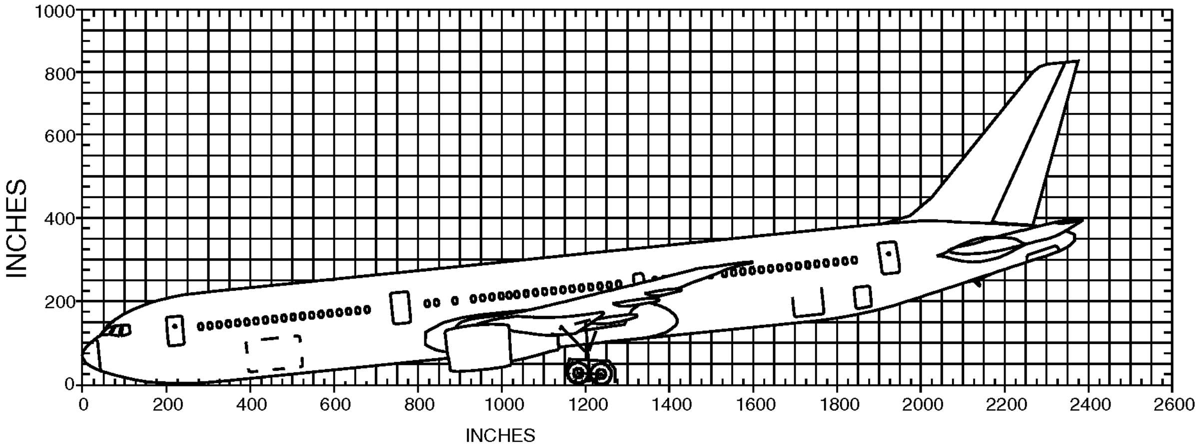
Figure 3-17 COLLAPSED NOSE GEAR - 767-400ER



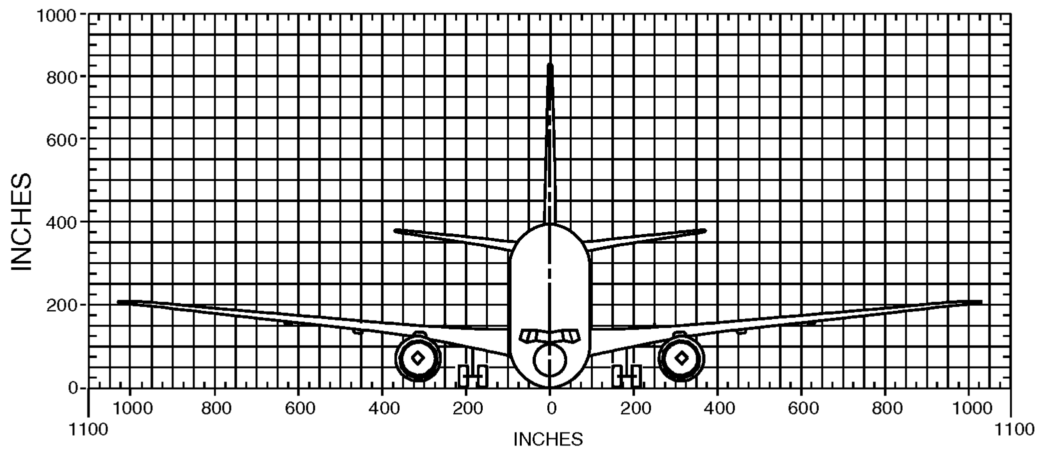


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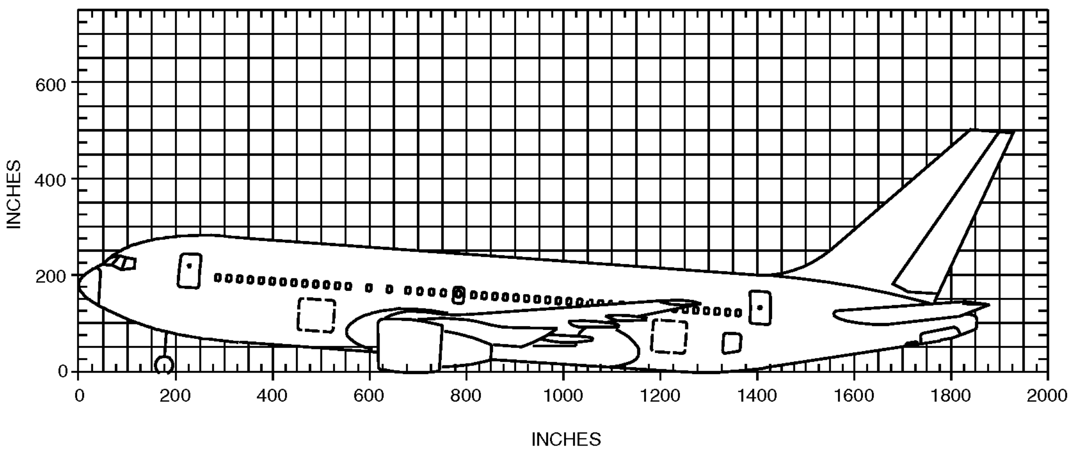
Figure 3-18 BOTH MAIN GEAR COLLAPSED - 767-200, -200ER



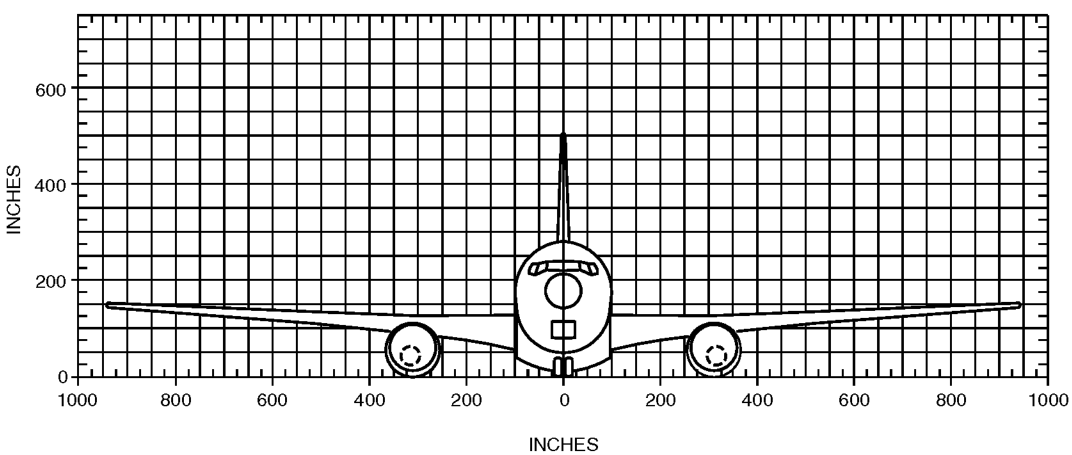


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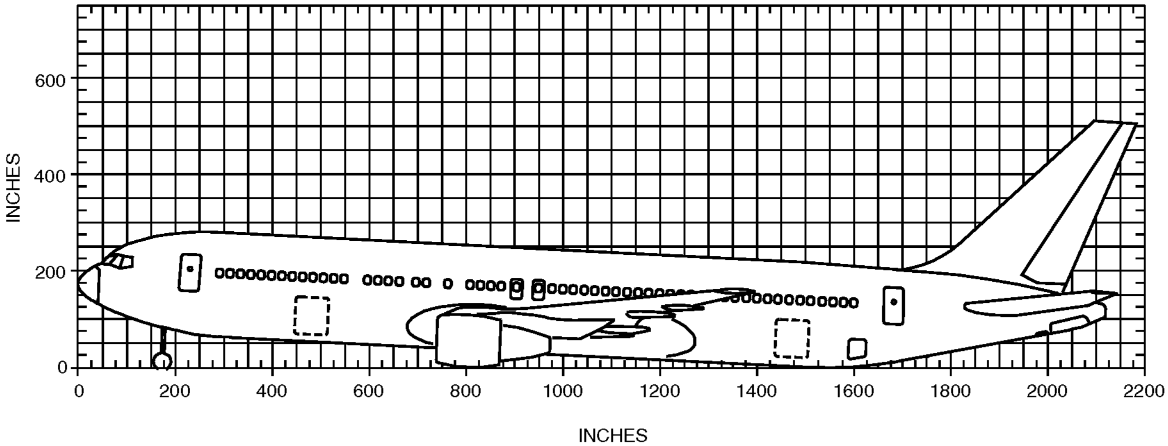
Figure 3-19 BOTH MAIN GEAR COLLAPSED - 767-300, -300ER



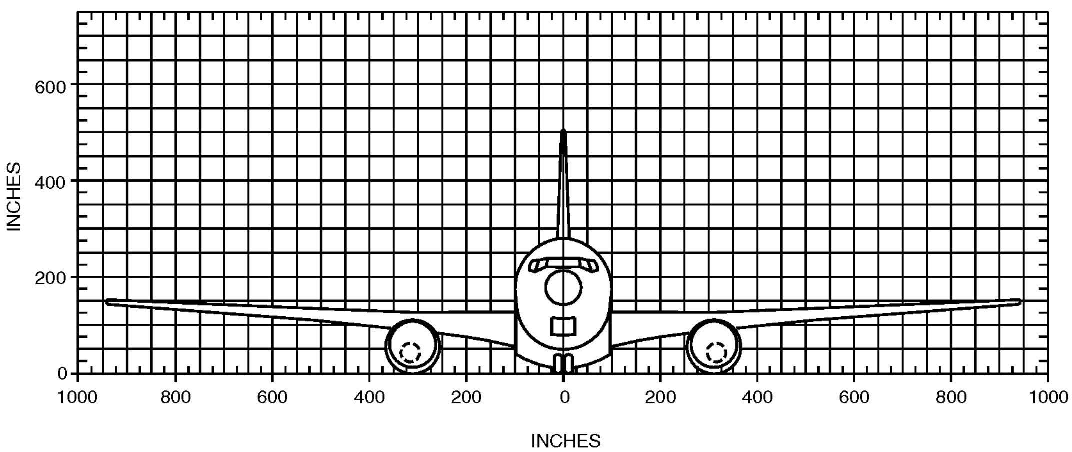


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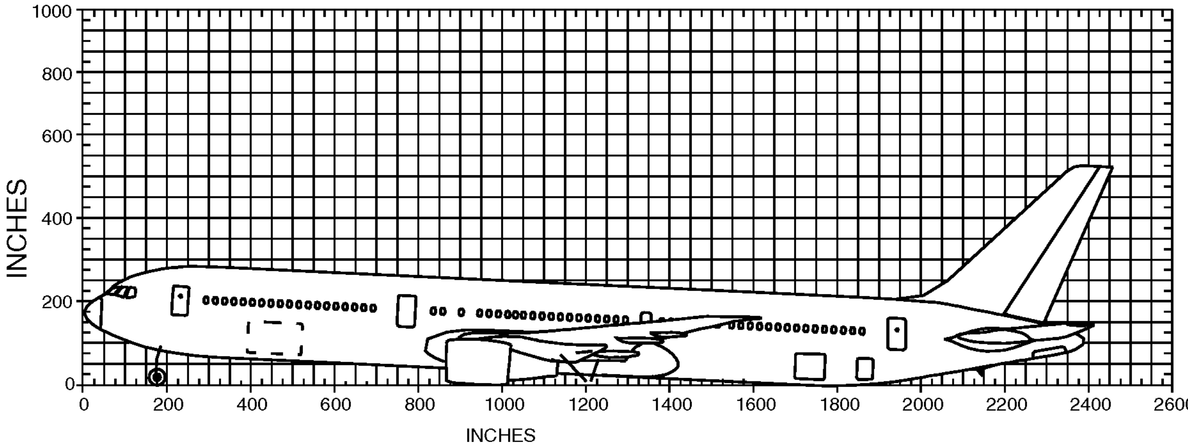
Figure 3-20 BOTH MAIN GEAR COLLAPSED - 767-400ER



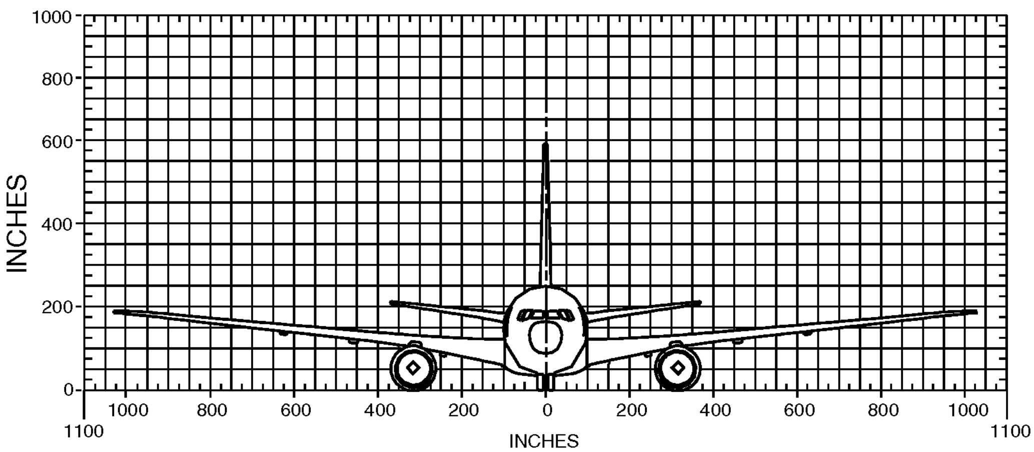


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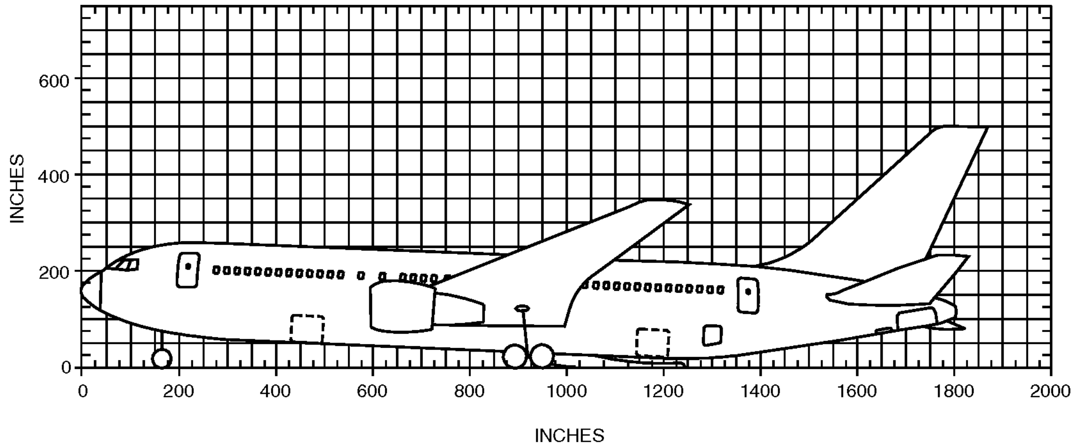
Figure 3-21 MAIN GEAR COLLAPSED ONE SIDE, ONE ENGINE SEVERED - 767-200, -200ER



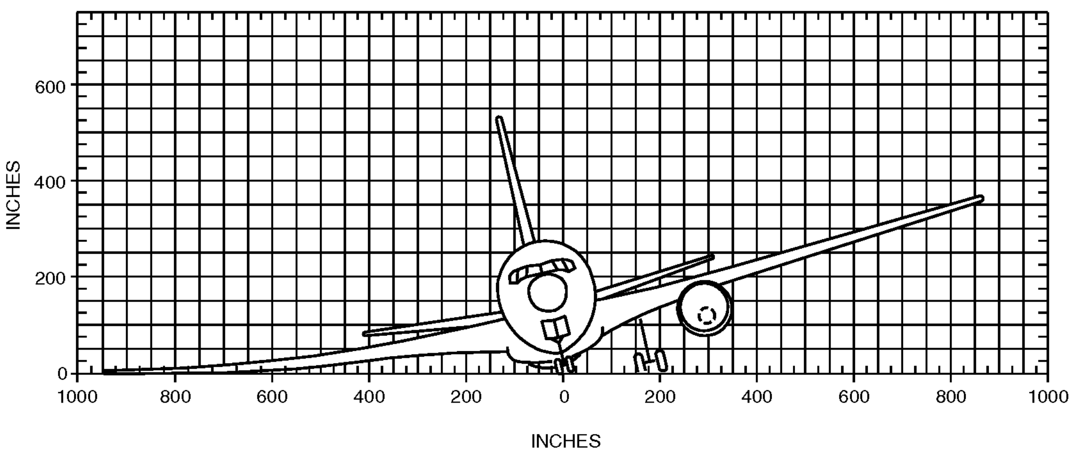


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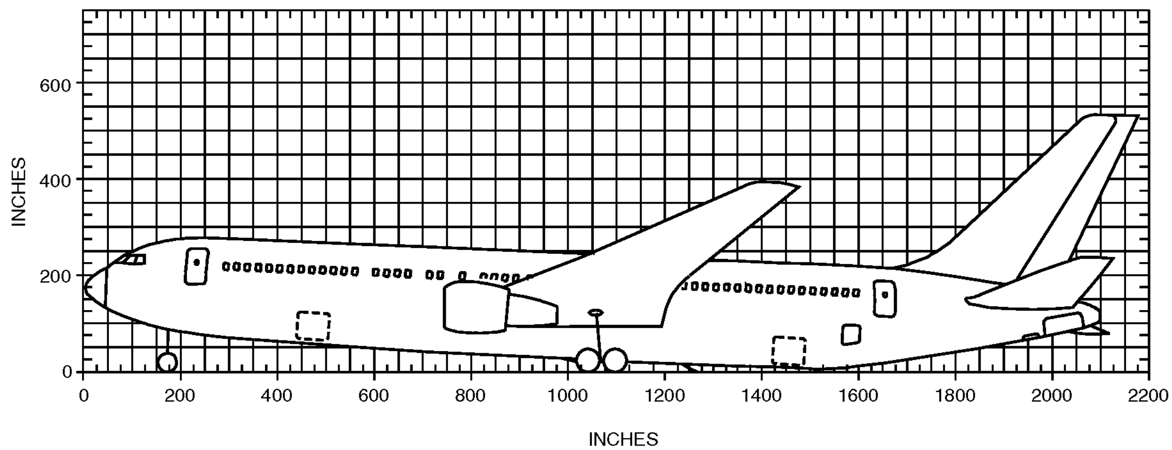
Figure 3-22 MAIN GEAR COLLAPSED ONE SIDE, ONE ENGINE SEVERED - 767-300, -300ER



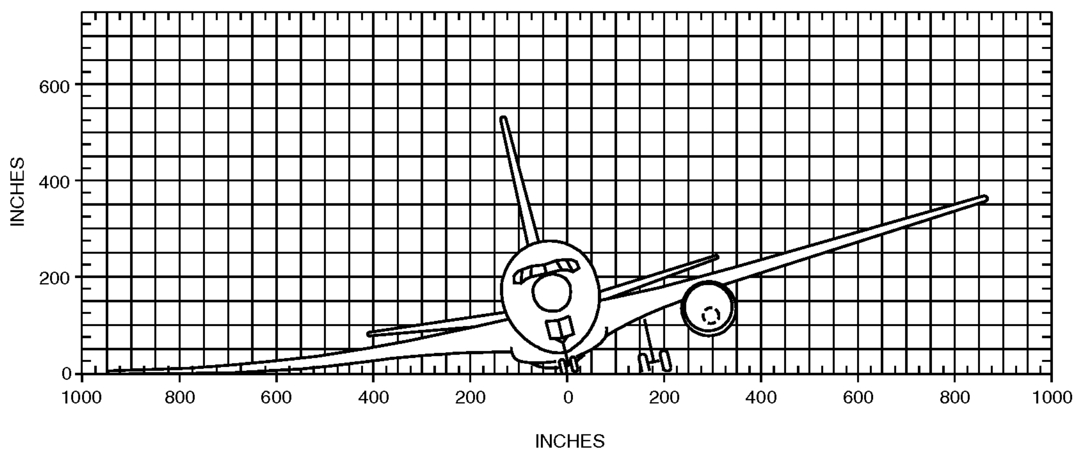


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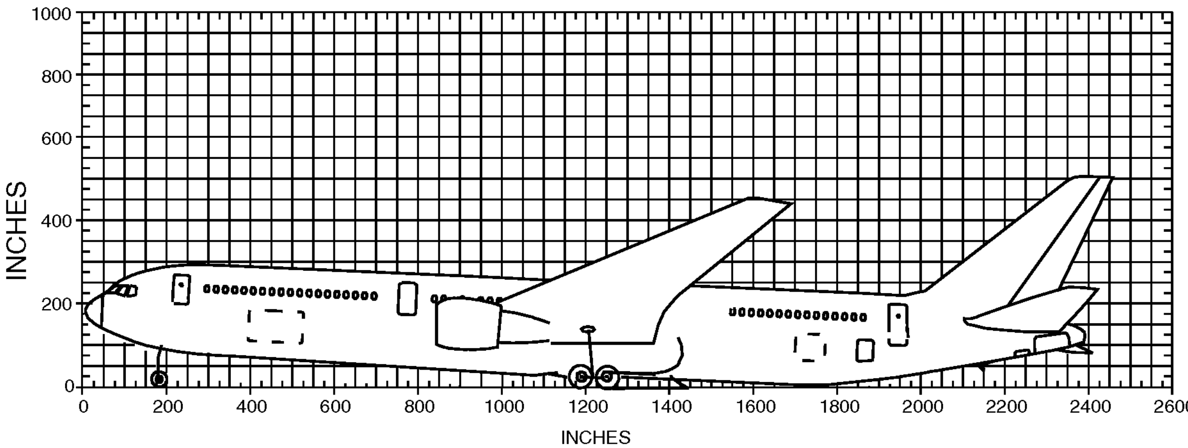
Figure 3-23 MAIN GEAR COLLAPSED ONE SIDE, ONE ENGINE SEVERED - 767-400ER



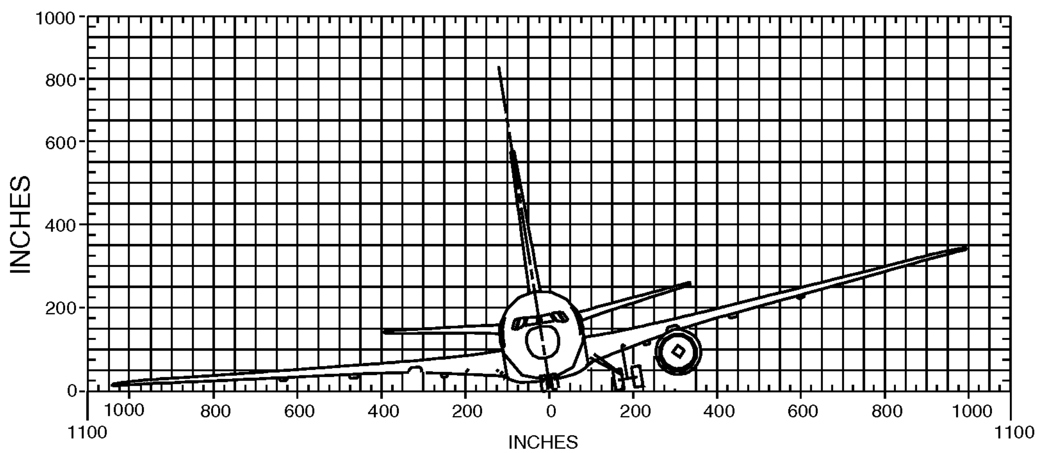


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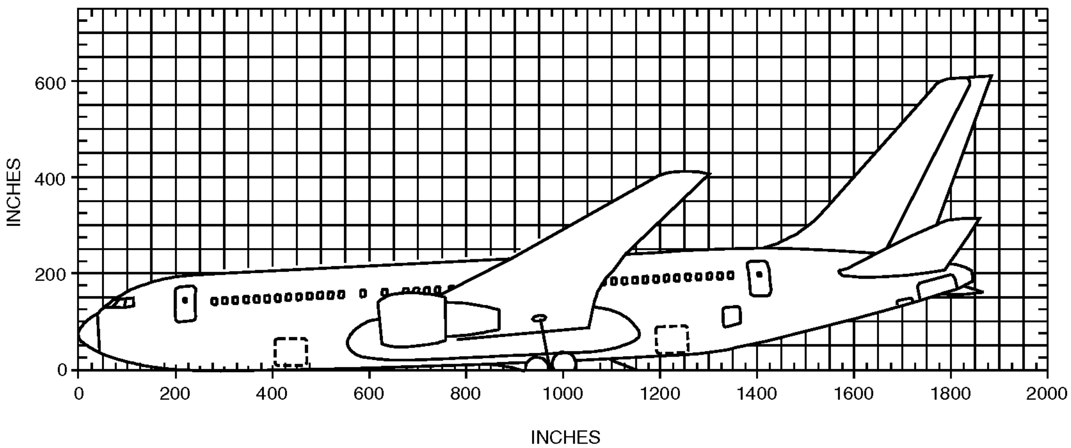
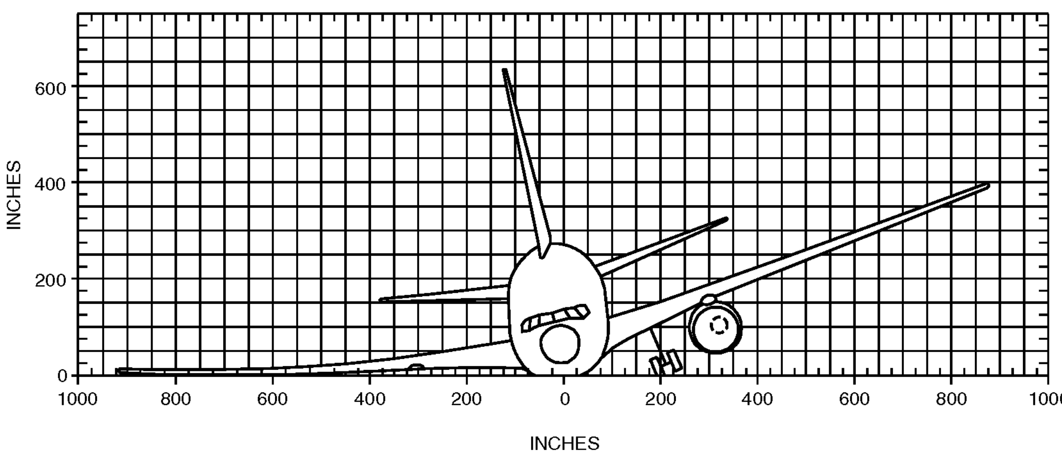
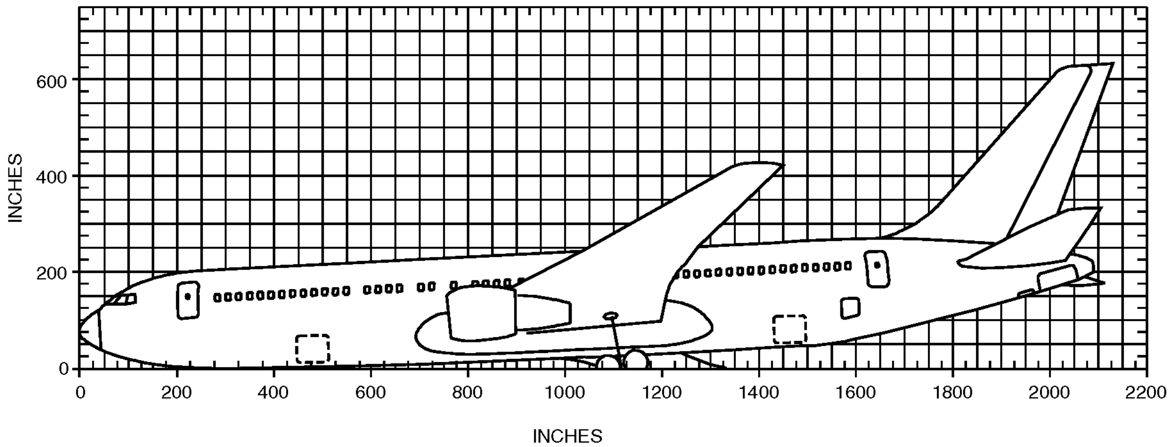
Figure 3-24 NOSE AND MAIN GEAR COLLAPSED ONE SIDE, ONE ENGINE SEVERED - 767-200, -200ER

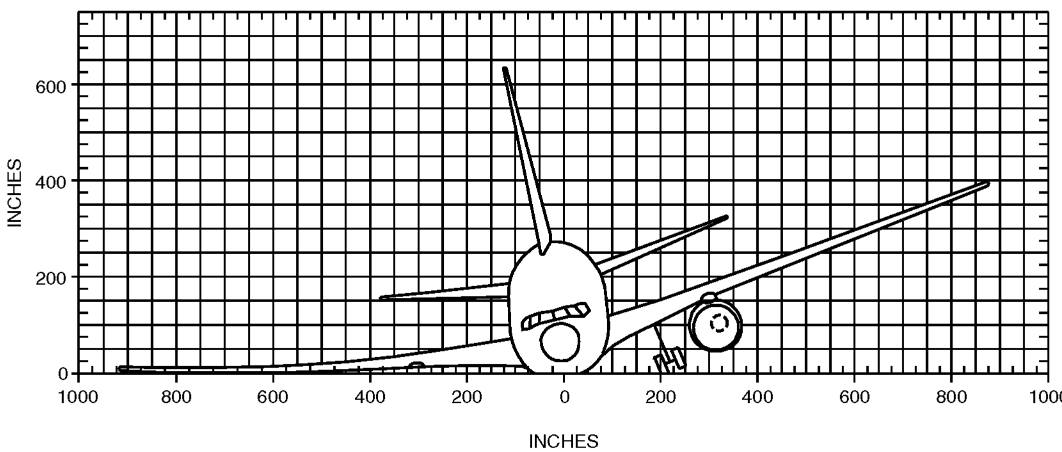




1 IN. EQUALS 2.54 CM

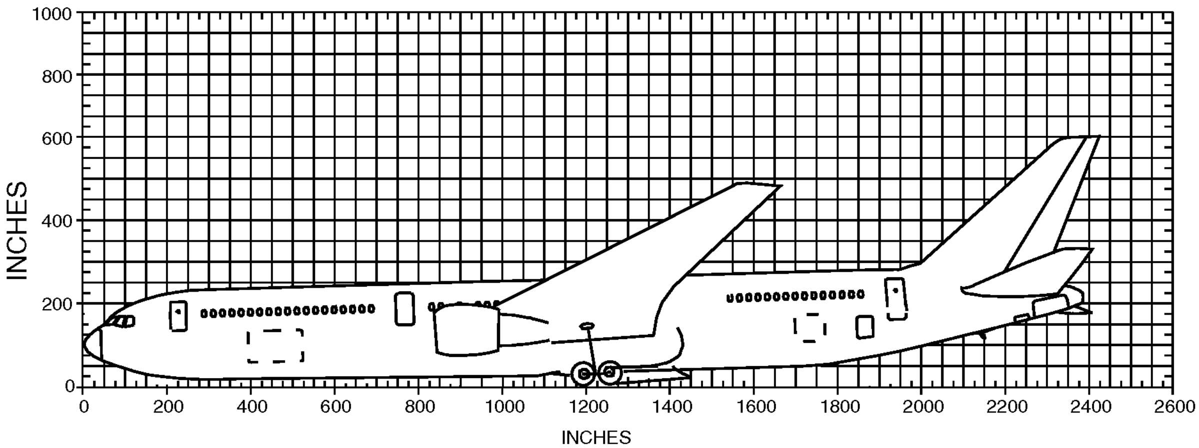
Figure 3-25 NOSE AND MAIN GEAR COLLAPSED ONE SIDE, ONE ENGINE SEVERED - 767-300, -300ER

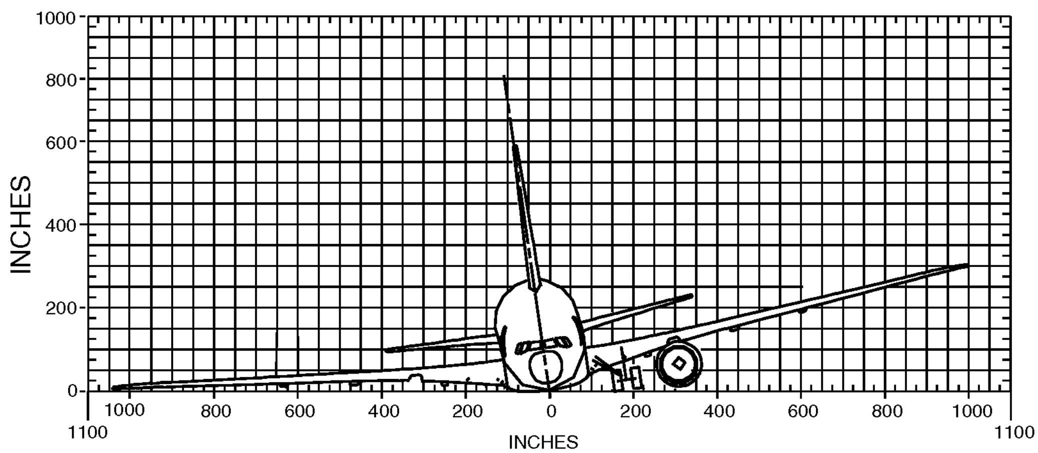




1 IN. EQUALS 2.54 CM

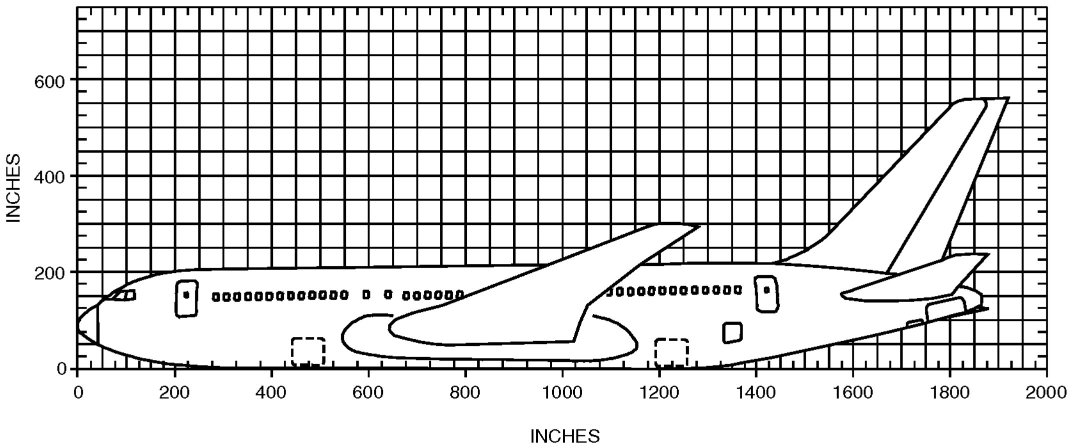
Figure 3-26 NOSE AND MAIN GEAR COLLAPSED ONE SIDE, ONE ENGINE SEVERED - 767-400ER

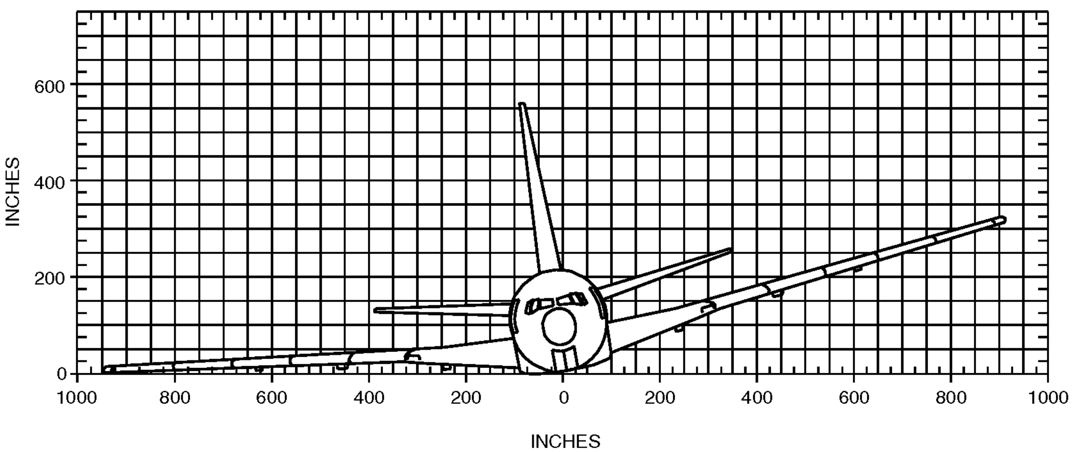




1 IN. EQUALS 2.54 CM

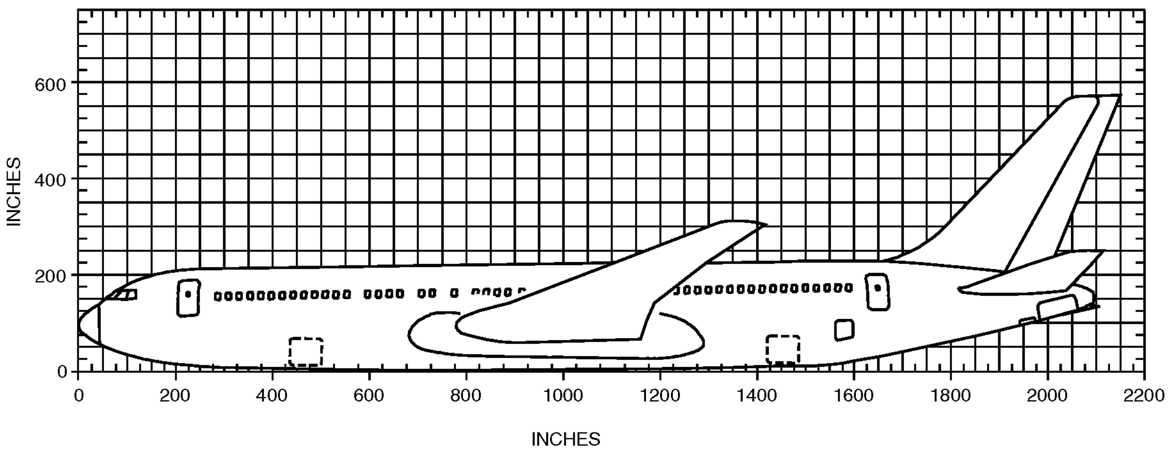
Figure 3-27 BOTH MAIN AND NOSE GEAR COLLAPSED, BOTH ENGINES SEVERED - 767-200, -200ER

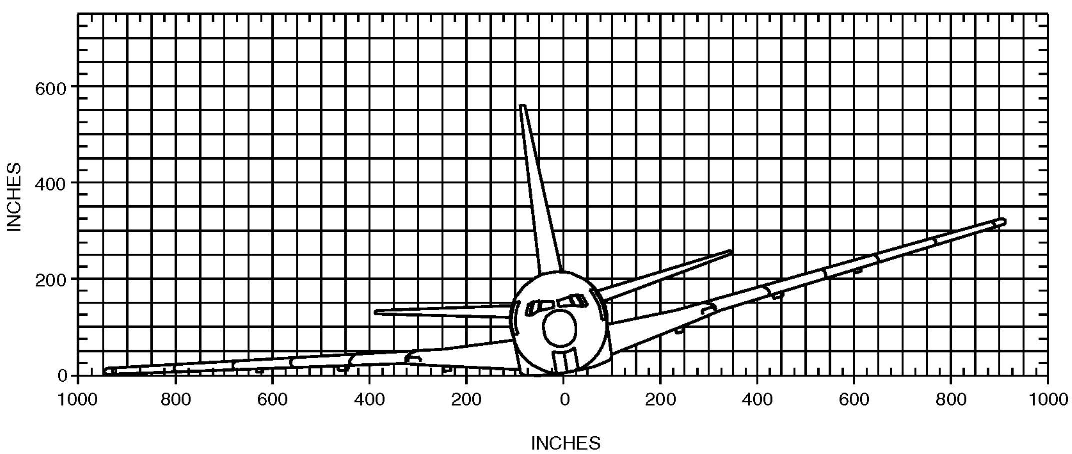




1 IN. EQUALS 2.54 CM

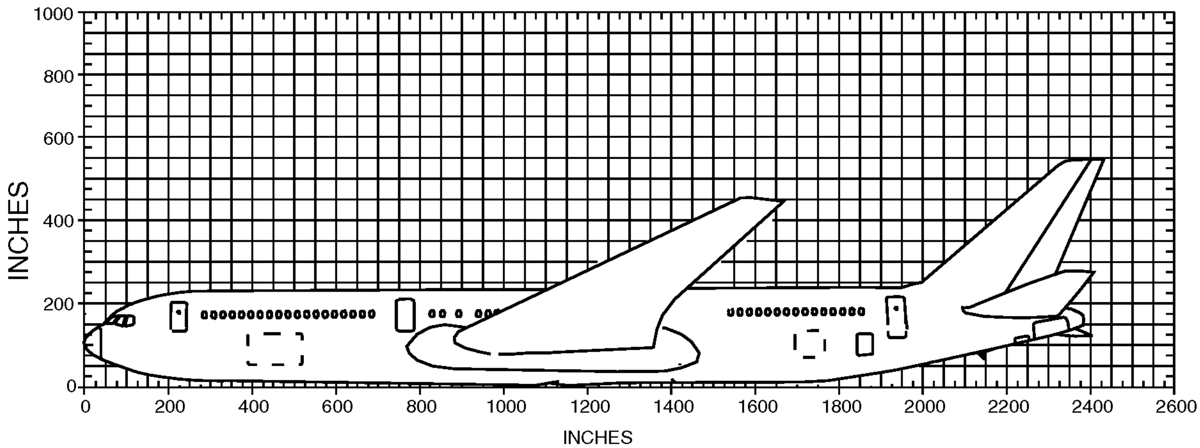
Figure 3-28 BOTH MAIN AND NOSE GEAR COLLAPSED, BOTH ENGINES SEVERED - 767-300, -300ER

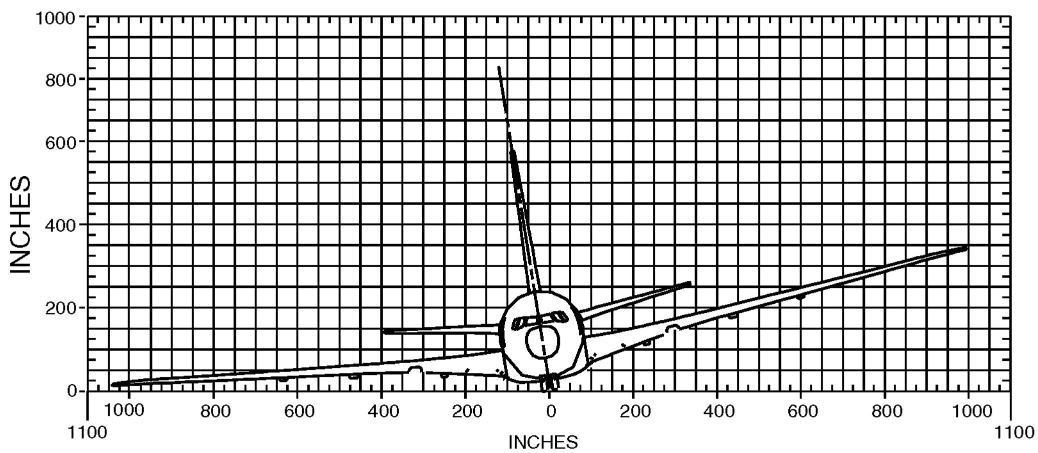




1 IN. EQUALS 2.54 CM

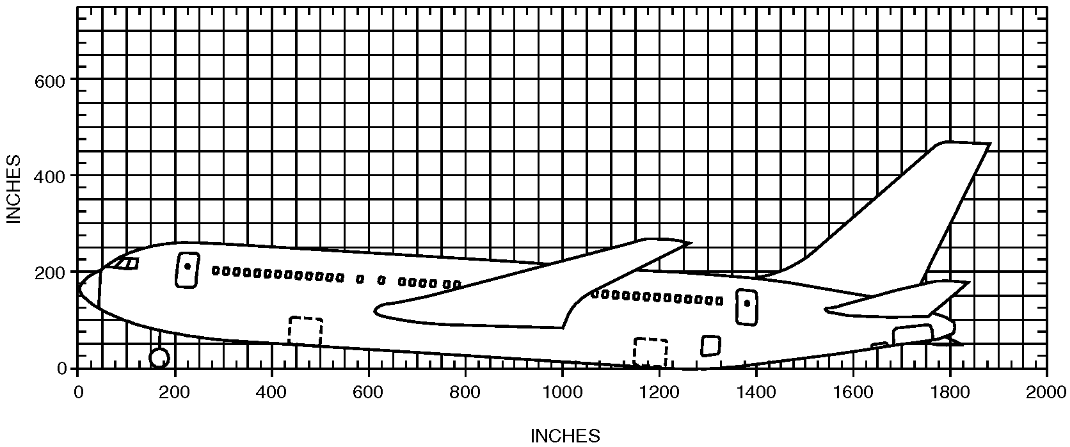
Figure 3-29 BOTH MAIN AND NOSE GEAR COLLAPSED, BOTH ENGINES SEVERED - 767-400ER

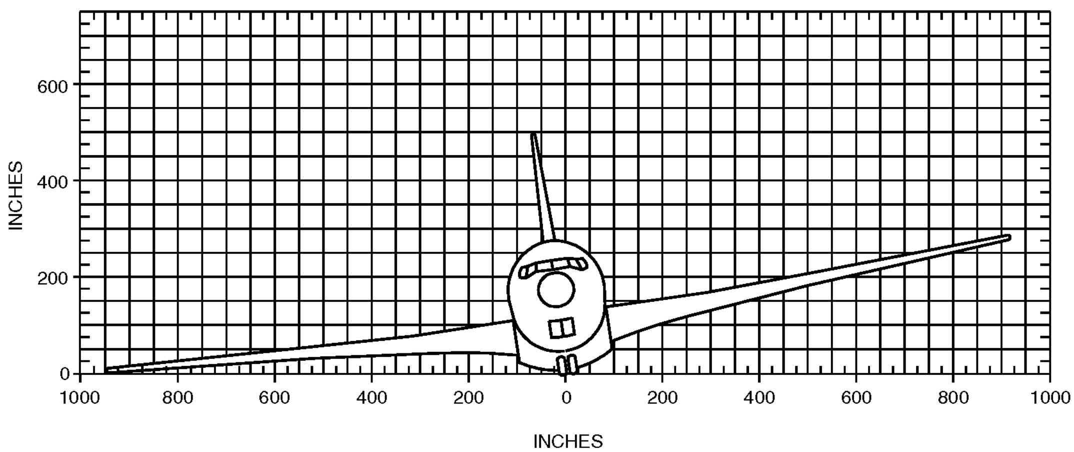




1 IN. EQUALS 2.54 CM

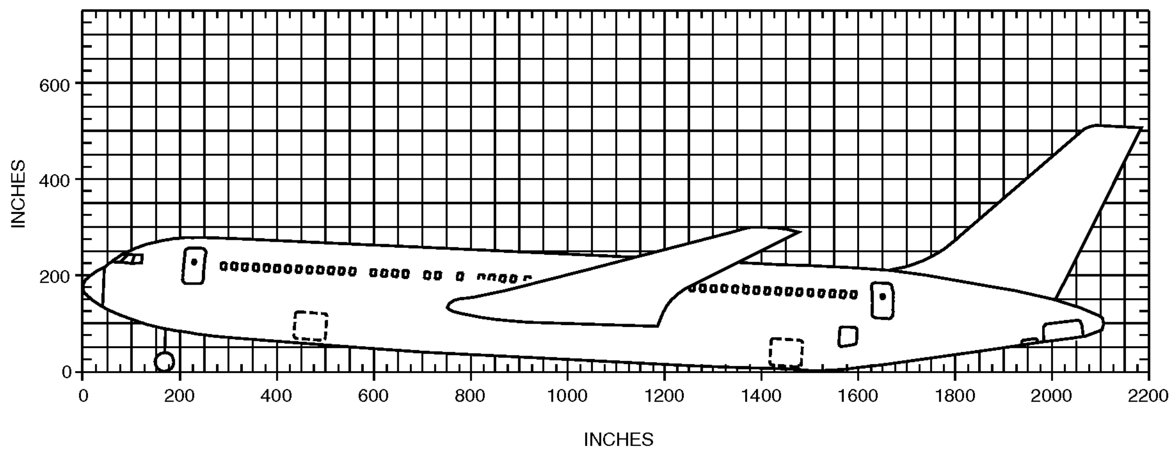
Figure 3-30 BOTH MAIN GEAR COLLAPSED, BOTH ENGINES SEVERED - 767-200, -200ER

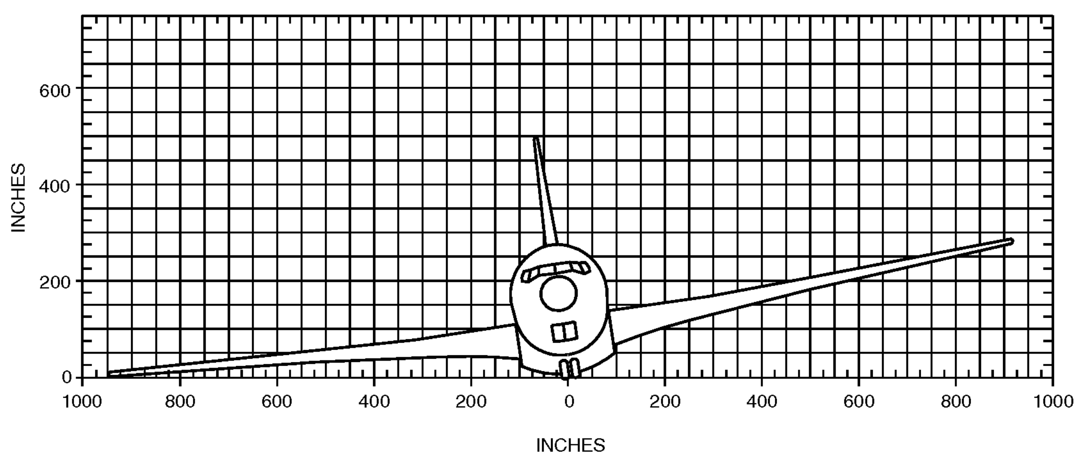




1 IN. EQUALS 2.54 CM

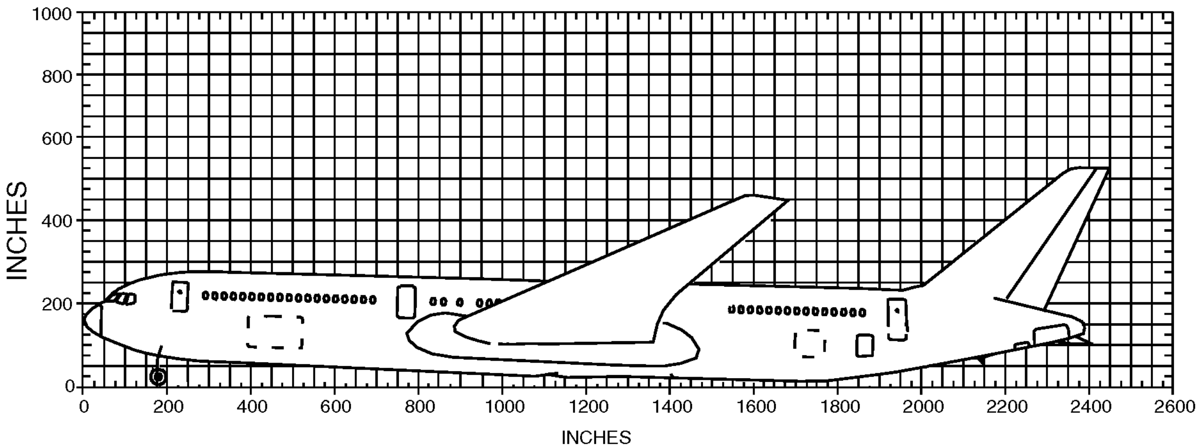
Figure 3-31 BOTH MAIN GEAR COLLAPSED, BOTH ENGINES SEVERED - 767-300, -300ER

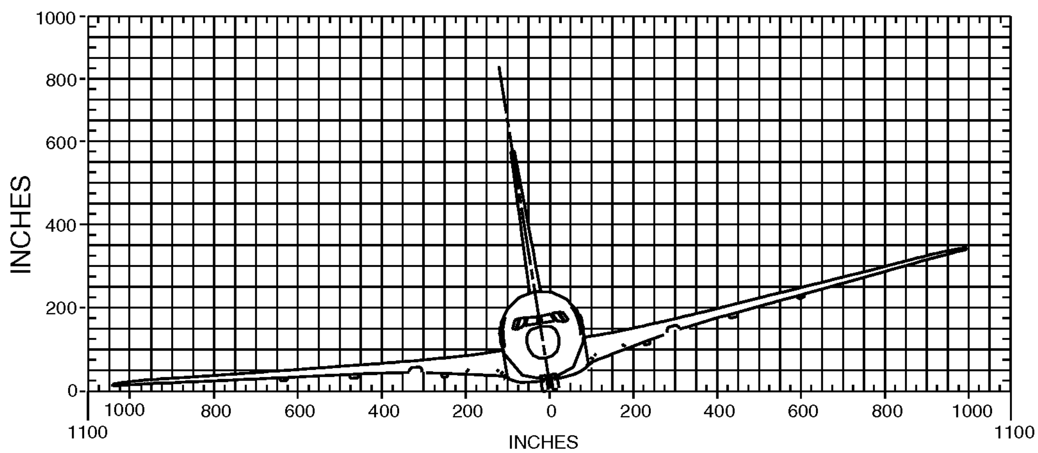




1 IN. EQUALS 2.54 CM

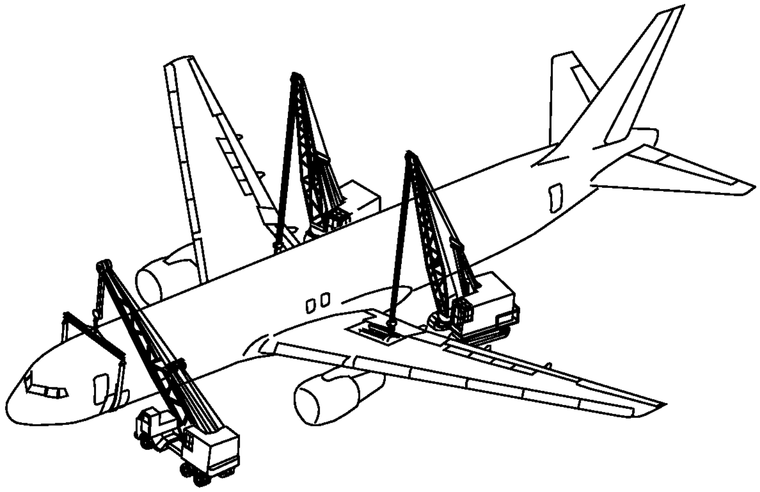
Figure 3-32 BOTH MAIN GEAR COLLAPSED, BOTH ENGINES SEVERED - 767-400ER





1 IN. EQUALS 2.54 CM

Figure 3-33 LIFTING ENTIRE AIRPLANE

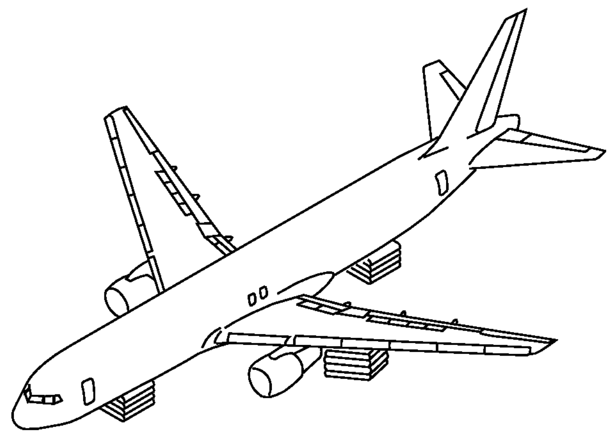


MOBILE LIFTING CRANES

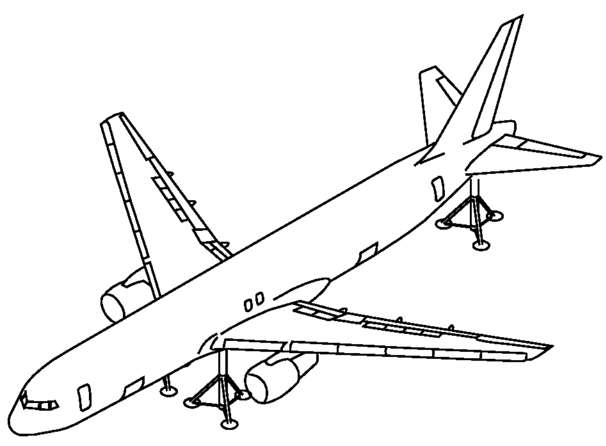
A CRANE WITH A SLING AT THE NOSE OF THE AIRPLANE LIFTS THE FORWARD FUSELAGE. A CRANE LIFTS THE AIRPLANE AT EACH MAIN LANDING GEAR SUPPORT BEAM OR AT EACH MAIN LANDING GEAR TRUNNION

25 TON TO 40 TON (23 M TON TO 36 M TON)
HIGH STABILITY PNEUMATIC BAGS

PLACE WING LIFT BAGS BETWEEN THE FRONT AND REAR SPARS ONLY. USE JACKS AND, IF IT IS NECESSARY, CRIBBING WITH PNEUMATIC BAGS



(JACKS AND CRIBBING NOT SHOWN)



75 TON TO 100 TON (68 M TON TO 90 M TON)
PRIMARY WING JACKS

1.25-INCH SPHERICAL RADIUS PRIMARY WING AND TAIL JACKS ARE USED TO CARRY THE LOAD. USE .75-INCH SPHERICAL RADIUS AUXILIARY OUTBOARD WING AND NOSE JACKS IF THE AIRPLANE NEEDS TO BE MORE STABLE

(AUXILIARY WING AND NOSE JACKS NOT SHOWN)

3-30-3

WHEN YOU LIFT THE AIRPLANE FROM VARIOUS POSITIONS

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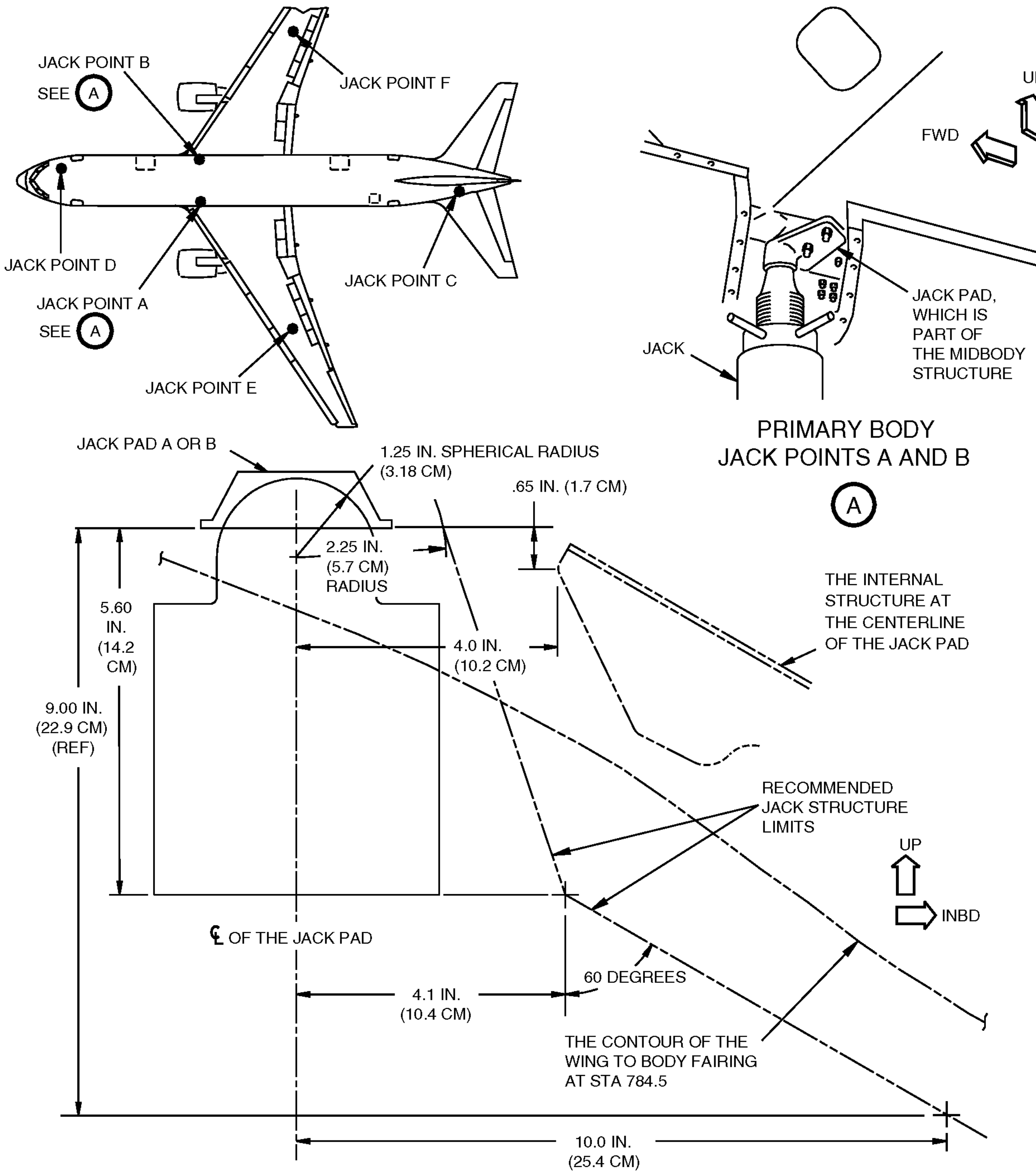
3-30-4 Jack Point Locations

1. The jack point locations are shown in Figure 3-34. You can use the three primary points (A, B and C) to lift the airplane when the clearance (roll-under height) is sufficient. You can also use these points if the terrain conditions are satisfactory.
2. These primary points are permanent fittings (female 1-1/4 inch spherical radius) that attach to the airplane structure. There are three auxiliary points (D, E and F). You can use these other points to make the airplane stable. These auxiliary points are temporary fittings (male 3/4-inch spherical radius) that you can attach to the airplane structure with bolts.
3. The maximum loads for the jack points (primary, auxiliary and axle) are shown in Figure 3-35 and Figure 3-36. Make sure the jack loads are not larger than the values shown in the table.
4. The bogie (truck) beam of the main landing gear has two points for axle jacks. These points are on the centerline of the truck beam. There is 56 in. (142 cm) between the two points on the 767-200, -300, -300ER models and 59.5 in. (151.1 cm) between the two points on the 767-400ER model. These points are pads (male 3/4-inch spherical radius) that are permanent parts of the truck beam (see Figure 3-34).
5. There is a point for axle jacks on the nose landing gear. This jack point is on the axle centerline of the gear. The jack point is a pad (male 3/4-inch spherical radius) that is a permanent part of the nose gear (see Figure 3-42).

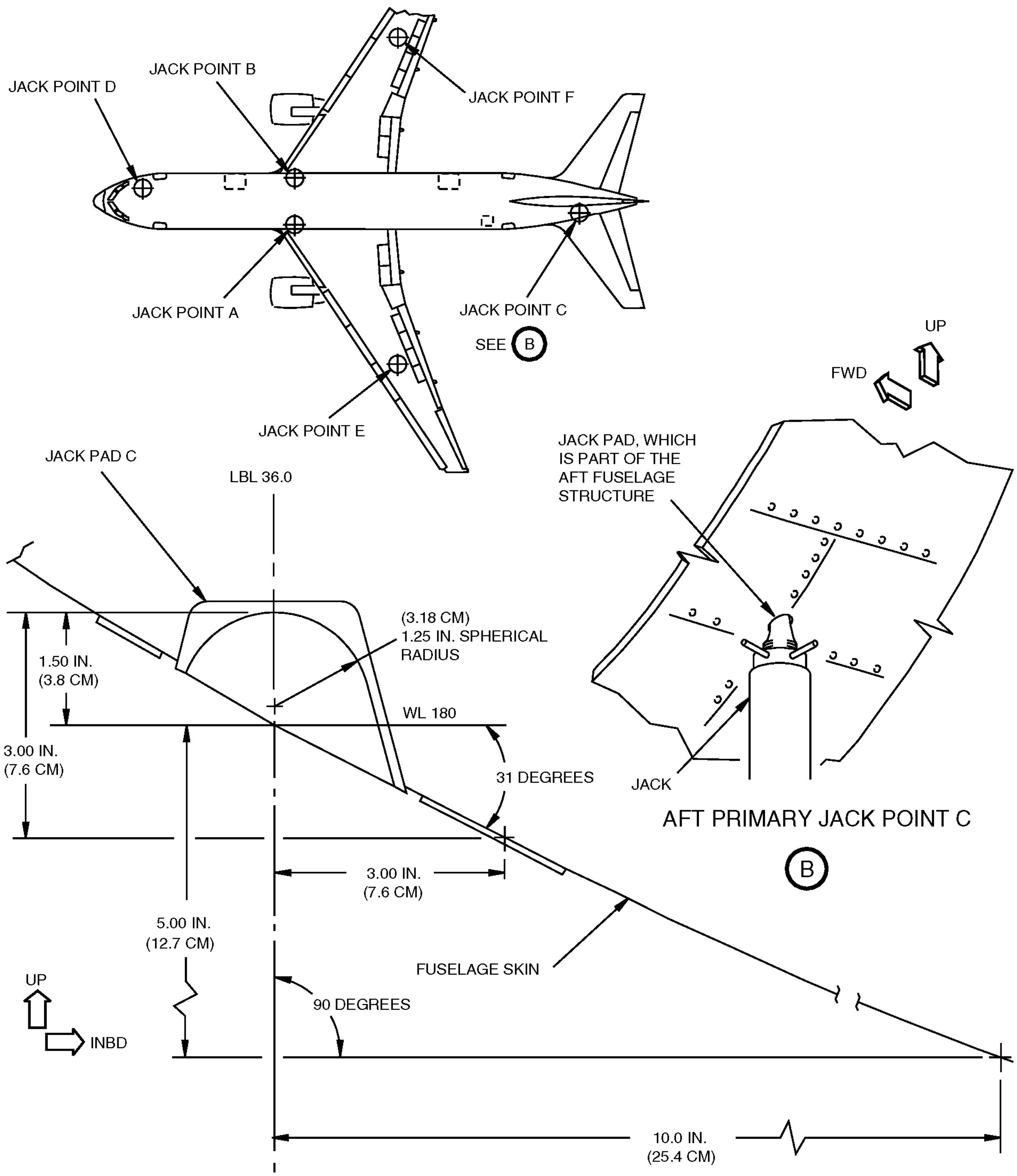
Figure 3-34 AIRPLANE JACKING POINTS AND JACK ADAPTERS



NOTE: THIS ILLUSTRATION IS A CROSS SECTION THROUGH BODY STATION 784.5 (THE CENTERLINE OF THE JACK PAD). IT SHOWS THE LOCATIONS OF THE INTERNAL STRUCTURE AND THE WING TO BODY FAIRING, AND GIVES THE MINIMUM DISTANCES THAT ARE NECESSARY FOR THE BODY OF THE JACK TO CLEAR THESE STRUCTURES

JACK POINTS "A" AND "B"
REAR VIEW

Figure 3-34 AIRPLANE JACKING POINTS AND JACK ADAPTERS (Continued)



NOTE: THIS ILLUSTRATION IS A CROSS SECTION THROUGH BODY STATION 1725.5 (THE CENTERLINE OF THE JACK PAD)

Figure 3-34 AIRPLANE JACKING POINTS AND JACK ADAPTERS (Continued)

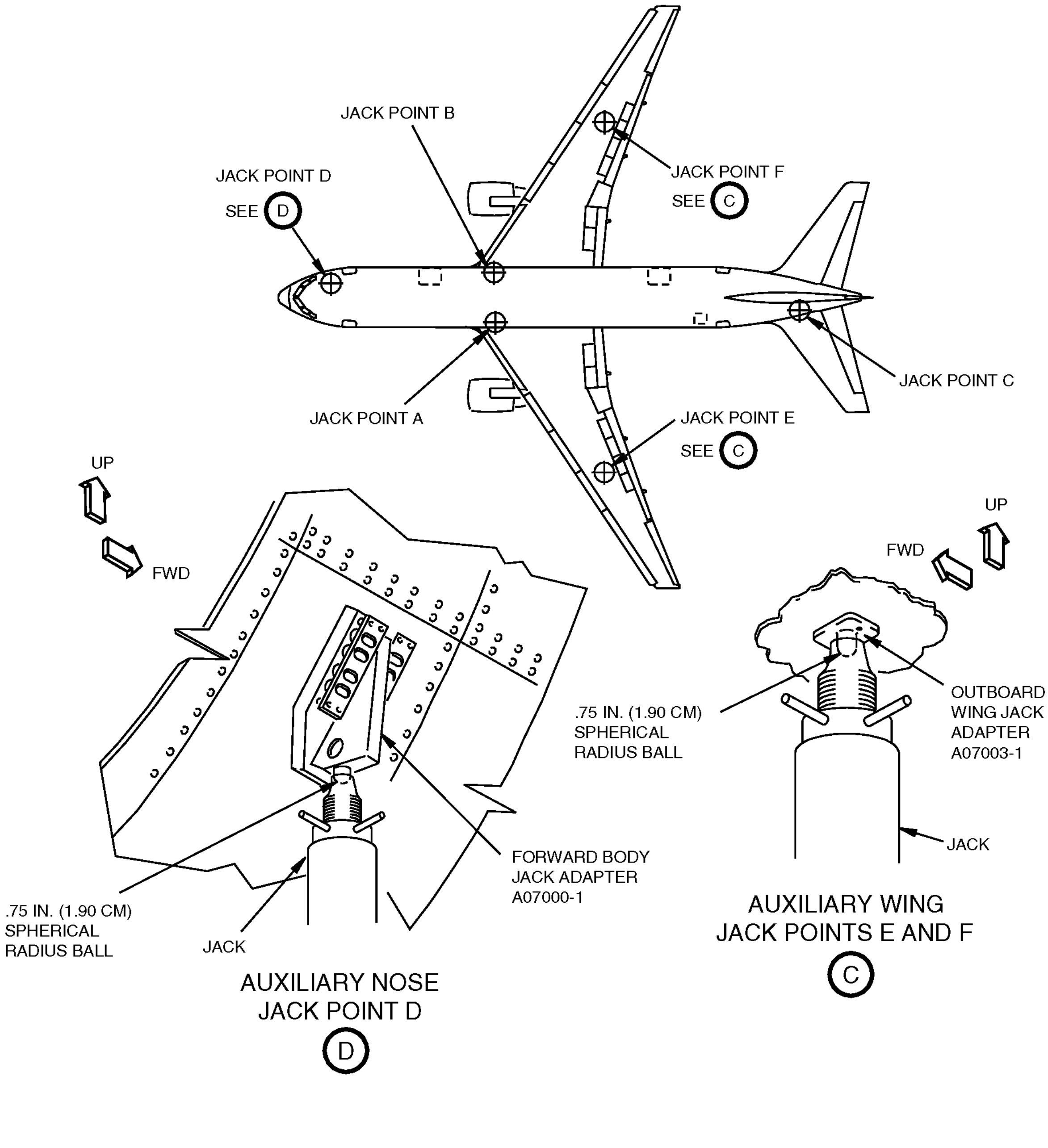
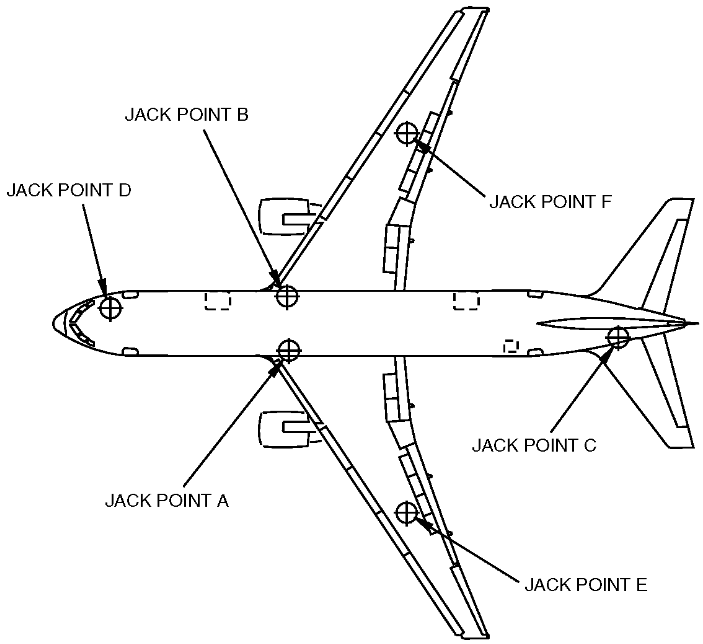


Figure 3-35 MAXIMUM JACKING LOADS- 767-200, -300



JACKING POINT		MAX JACK LOAD X 1,000 LB (KG)	LOCATION			JACKING POINT HEIGHT 767-200/767-300*[1]		ADAPTER FITTING
			B STA	BBL	WL	MINIMUM HEIGHT, IN. (CM)	EXTENDED HEIGHT, IN. (CM)*[2]	
Primary*[3]	A	150.0 (68.0)	784.5	97.4L	136.8	98.5 (250) *[4] *[5]	139.8 (355)*[6]	None
	B	150.0 (68.0)	784.5	97.4R	136.8	98.5 (250) *[4] *[5]	139.8 (355)*[6]	None
	C	67.0 (30.4)	1725.3	35.9L	181.4	148.6 (377) *[4] *[5]	184.3 (468)*[6]	None
Auxiliary	D	28.0 (12.7)	287.0	73.0R	145.5	105.0 (266)	149.4 (379)*[6]	Yes
	E	21.0 (9.5)	1157.0	530.5L	202.0	165.2 (420)	205.7 (522)*[6]	Yes
	F	21.0 (9.5)	1157.0	530.5R	202.0	165.2 (420)	205.7 (522)*[6]	Yes

Figure 3-35 MAXIMUM JACKING LOADS- 767-200, -300 (Continued)

JACKING POINT		MAX JACK LOAD X 1,000 LB (KG)	LOCATION			JACKING POINT HEIGHT 767-200/767-300*[1]		ADAPTER FITTING
			B STA	BBL	WL	MINIMUM HEIGHT, IN. (CM)	EXTENDED HEIGHT, IN. (CM)*[2]	
Axle*[7]	Main Gear	105.0 (47.6)*[8]	Wheel Axles (4) Total			6.5 (16.5)*[9]	17.5 (44)*[10]	None
						11.9 (30.2)*[11]	17.5 (44)*[10]	
	Nose Gear	50.0 (22.7)*[8]	Wheel Axle (1) Total			7.1 (18.0)*[9]	17.3 (43.9)*[10]	None
						12.5 (31.7)*[11]	17.3 (43.9)*[10]	

*[1] JACKING POINTS A, B, D, E AND F HEIGHTS WILL VARY LESS THAN 0.1 IN. (0.254 CM) FROM THE VALUES FOR THE 767-200. JACKING POINT C WILL BE APPROXIMATELY 0.7 IN. (1.78 CM) LOWER DUE TO ADDITIONAL AFT FUSELAGE DEFLECTION

*[2] EXTENDED JACK HEIGHT BASED ON:

1. AIRPLANE LEVEL
2. STRUT OLEOS EXTENDED
3. GROUND CLEARANCES
   a. GEAR DOWN & LOCKED 6.0 IN. (15.2 CM)
   b. DURING GEAR SWING 3.6 IN. (9.1 CM)

*[3] FOR MAXIMUM JACKING WEIGHT SEE DIAGRAMS ON Figure 3-37 AND Figure 3-38

*[4] FLAT MAIN TIRES JACKING POINT HEIGHT IS REDUCED BY 4.3 IN. (11 CM) AT POINTS A & B AND 12.2 IN. (31 CM) AT POINT C

*[5] JACKING POINT HEIGHT FOR JACKS BASED ON:

1. AIRPLANE WEIGHT 185,500 LB (84143 KG)
2. CG RANGE 11% TO 36%
3. STRUT OLEOS DEFLATED
4. MAIN TIRES 45 X 17-20
5. NOSE TIRES 37 X 14-15
6. NORMAL TIRE INFLATION

*[6] AN ADDITIONAL 26 IN. (66 CM) IS REQUIRED TO REMOVE MLG OLEO INNER CYLINDER FROM STRUT

*[7] FOR LANDING GEAR JACKING, OPERATIONS LIMITED TO 30 KN (56 KM/HR) WINDS FOR A SINGLE JACK AND 25 KN (46 KM/HR) WINDS FOR TWO OR MORE JACKS

*[8] MAXIMUM AXLE JACKING WEIGHT IS EQUAL TO THE MAXIMUM TAXI WEIGHT OF THE PARTICULAR AIRPLANE MODEL. SEE Figure 2-8, Figure 2-9 AND Figure 2-10.

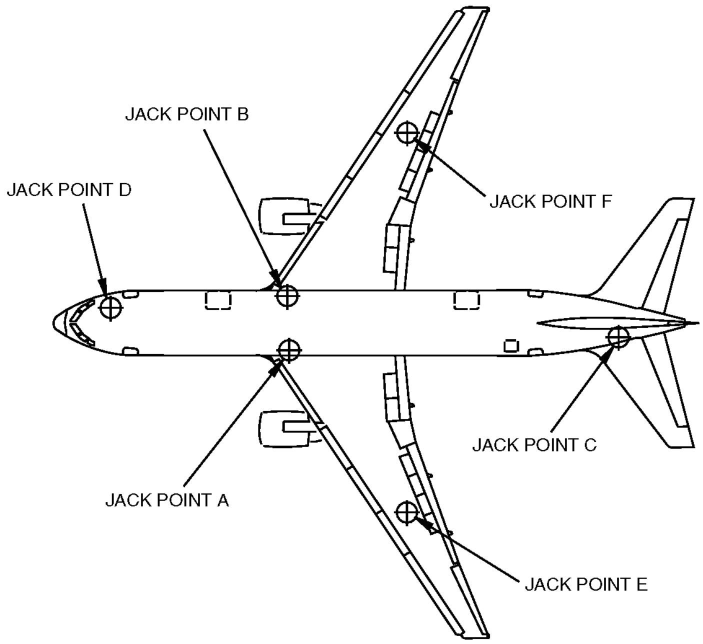
*[9] FLAT TIRES, AT MAX TAXI WEIGHT

*[10] EXTENDED HEIGHT ALLOWS 2 IN. (5 CM) GROUND CLEARANCE

*[11] NORMAL TIRE INFLATION, AT MAX TAXI WEIGHT

NOTE: Dimensions are in inches (centimeters)

Figure 3-36 MAXIMUM JACKING LOADS- 767-400ER



JACKING POINT		MAX JACK LOAD X 1,000 LB (KG)	LOCATION			JACKING POINT HEIGHT 767-400ER*[1]		ADAPTER FITTING
			B STA	BBL	WL	MINIMUM HEIGHT, IN. (CM)	EXTENDED HEIGHT, IN. (CM)*[2]	
Primary *[3]	A	150.0 (68)	784.5	97.4L	136.8	106 (269) *[4] *[5]	153.8 (391)*[6]	None
	B	150.0 (68.0)	784.5	97.4R	136.8	106 (269) *[4] *[5]	153.8 (391)*[6]	None
	C	67.0 (30.4)	1725.3	35.9L	181.4	178 (425) *[4] *[5]	198.4 (504)*[6]	None
Auxiliary	D	28.0 (12.7)	287.0	73.0R	145.5	105 (267)	162.5 (413)*[6]	Yes
	E	21.0 (9.5)	1157.0	530.5L	202.0	173 (439)	219 (556)*[6]	Yes
	F	21.0 (9.5)	1157.0	530.5R	202.0	173 (439)	219 (556)*[6]	Yes

Figure 3-36 MAXIMUM JACKING LOADS- 767-400ER (Continued)

<table>
<tr><th rowspan="2" colspan="2">JACKING POINT</th><th rowspan="2">MAX JACK LOAD X 1,000 LB (KG)</th><th colspan="3">LOCATION</th><th colspan="2">JACKING POINT HEIGHT 767-400ER*[1]</th><th rowspan="2">ADAPTER FITTING</th></tr>
<tr><th>B STA</th><th>BBL</th><th>WL</th><th>MINIMUM HEIGHT, IN. (CM)</th><th>EXTENDED HEIGHT, IN. (CM)*[2]</th></tr>
<tr><td rowspan="4">Axle *[7]</td><td rowspan="2">Main Gear</td><td rowspan="2">106.4 (48.4)*[8]</td><td rowspan="2" colspan="3">Wheel Axles (4) Total</td><td>6.6 (16.8)*[9]</td><td rowspan="2">21.6 (54.9)*[10]</td><td rowspan="2">None</td></tr>
<tr><td>14.2 (36.1)*[11]</td></tr>
<tr><td rowspan="2">Nose Gear</td><td rowspan="2">50.0 (22.7)*[8]</td><td rowspan="2" colspan="3">Wheel Axle (1) Total</td><td>7.1 (18.0)*[9]</td><td rowspan="2">17.3 (43.9)*[10]</td><td rowspan="2">None</td></tr>
<tr><td>12.5 (31.8)*[11]</td></tr>
</table>

*[1] JACKING POINTS A, B, D, E AND F HEIGHTS ARE PRELIMINARY. MINIMUM HEIGHT AT JACKING POINT C, E, AND F WILL BE LOWER DUE TO ADDITIONAL AFT FUSELAGE AND WING DEFLECTION. EXTENDED HEIGHTS AT JACKING POINTS E AND F WILL BE HIGHER DUE TO WING DEFLECTION.

*[2] EXTENDED JACK HEIGHT BASED ON:

1. AIRPLANE LEVEL
2. STRUT OLEOS EXTENDED
3. GROUND CLEARANCES
   a. GEAR DOWN & LOCKED 5.8 IN. (14.7CM)
   b. DURING GEAR SWING 4.5 IN. (11.4 CM)

*[3] FOR MAXIMUM JACKING WEIGHT SEE DIAGRAMS ON Figure 3-39

*[4] FLAT MAIN TIRES JACKING POINT HEIGHT IS REDUCED BY APPROXIMATELY 5.5 IN. (14.0 CM) AT POINTS A & B AND 14.3 IN. (36.3 CM) AT POINT C

*[5] JACKING POINT HEIGHT FOR JACKS BASED ON

1. AIRPLANE WEIGHT 225,000 LB (102273 KG)
2. CG RANGE 4% TO 37%
3. STRUT OLEOS DEFLATED
4. MAIN TIRES 50 X 20-R22
5. NOSE TIRES 37 X 14-15
6. NORMAL TIRE INFLATION

*[6] AN ADDITIONAL 25 IN. (63.5 CM) IS REQUIRED TO REMOVE MLG OLEO INNER CYLINDER FROM STRUT

*[7] FOR LANDING GEAR JACKING, OPERATIONS LIMITED TO 30 KN (56 KM/HR) WINDS FOR A SINGLE JACK AND 25 KN (46 KM/HR) WINDS FOR TWO OR MORE JACKS

*[8] MAXIMUM AXLE JACKING WEIGHT IS EQUAL TO THE MAXIMUM TAXI WEIGHT OF THE PARTICULAR AIRPLANE MODEL. SEE Figure 2-11

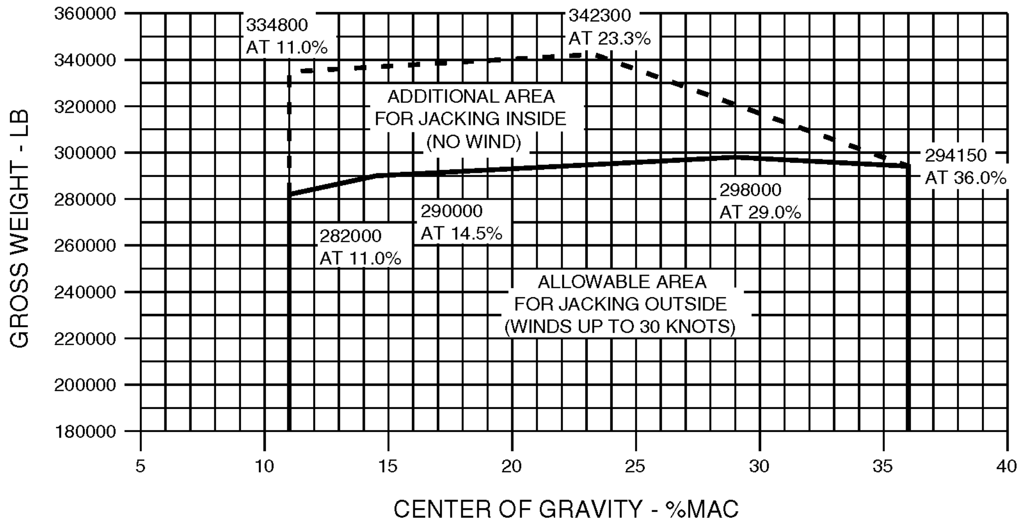
*[9] FLAT TIRES, AT MAX TAXI WEIGHT

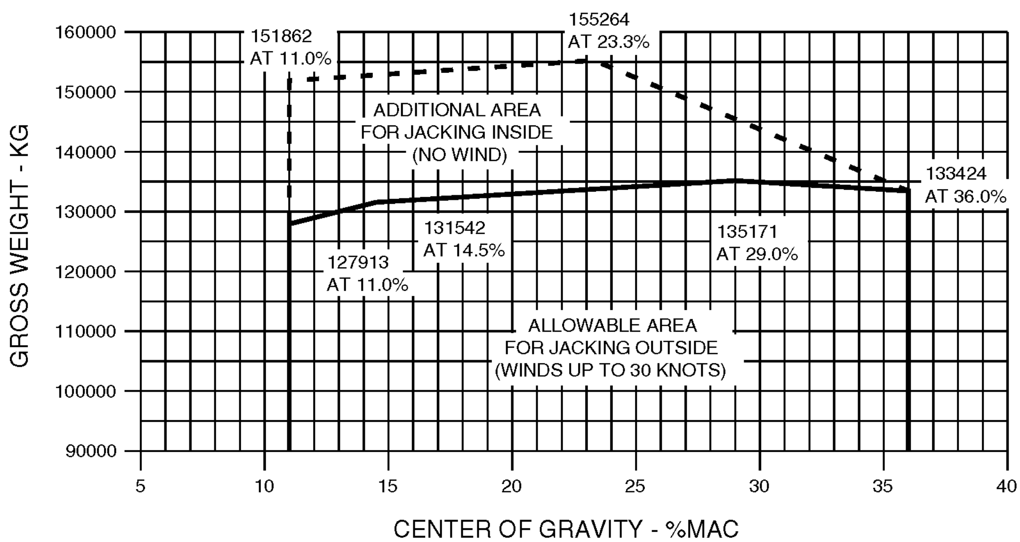
*[10] EXTENDED HEIGHT ALLOWS 2 IN. (5 CM) GROUND CLEARANCE

*[11] NORMAL TIRE INFLATION, AT MAX TAXI WEIGHT

NOTE: Dimensions are in inches (centimeters)

Figure 3-37 GROSS WEIGHT AND CENTER OF GRAVITY LIMITS FOR JACKING AT PRIMARY JACK POINTS-767-200

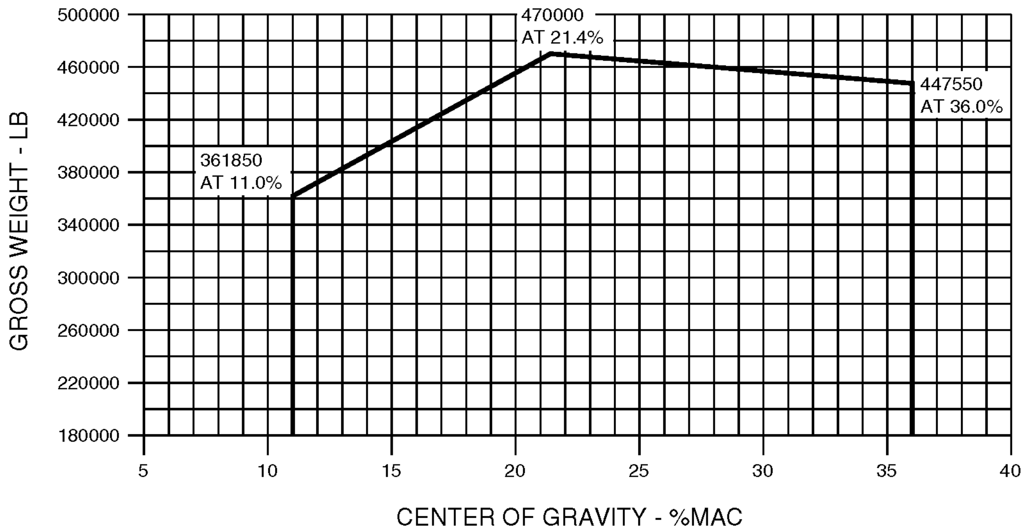


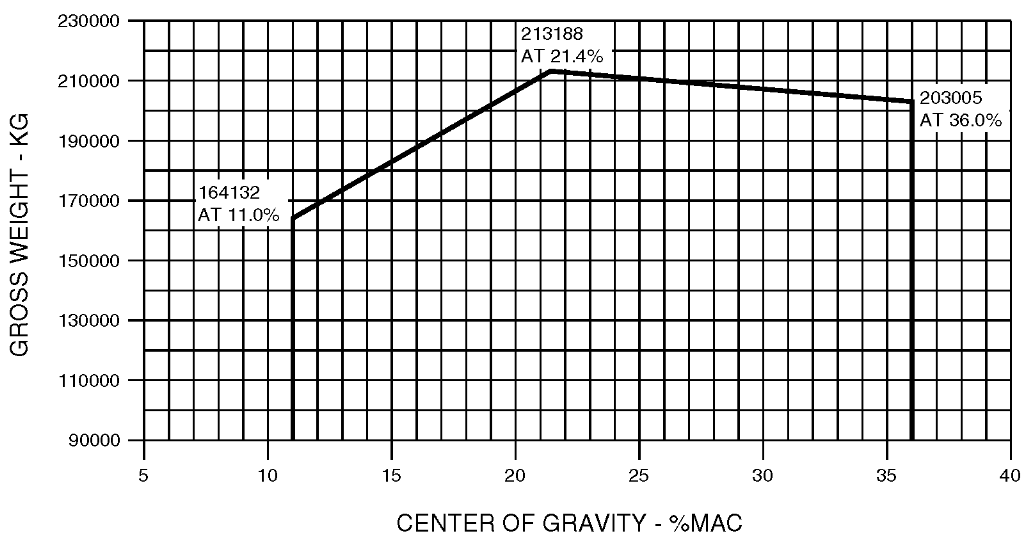


JACKING AT PRIMARY JACKING POINTS

NOTE: THE ABOVE JACKING LIMITS ARE BASED ON THE STRUCTURAL CAPABILITY OF THE AIRPLANE. THIS INFORMATION DOES NOT REFLECT AIRPLANE CERTIFICATION WEIGHT AND BALANCE LIMITS

Figure 3-37 GROSS WEIGHT AND CENTER OF GRAVITY LIMITS FOR JACKING AT PRIMARY JACK POINTS- 767-200 (Continued)

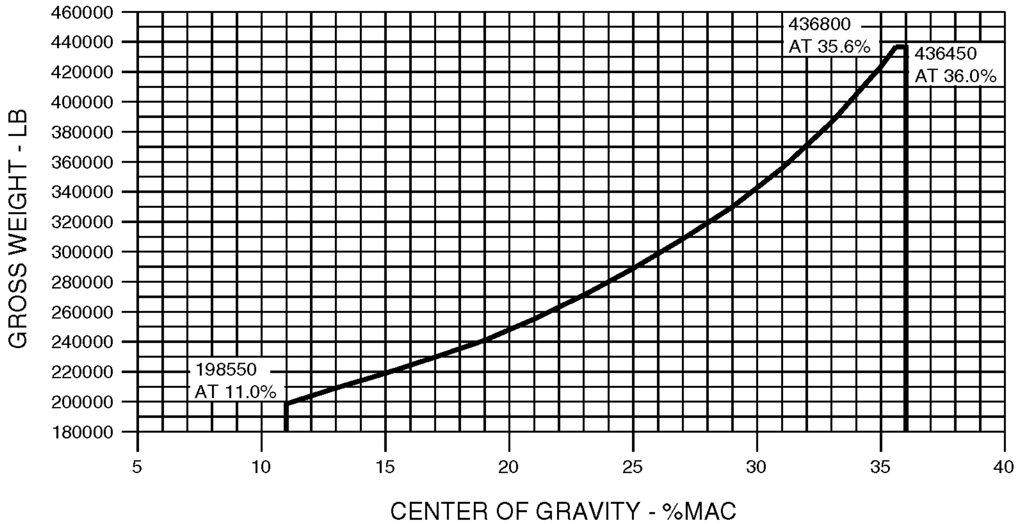


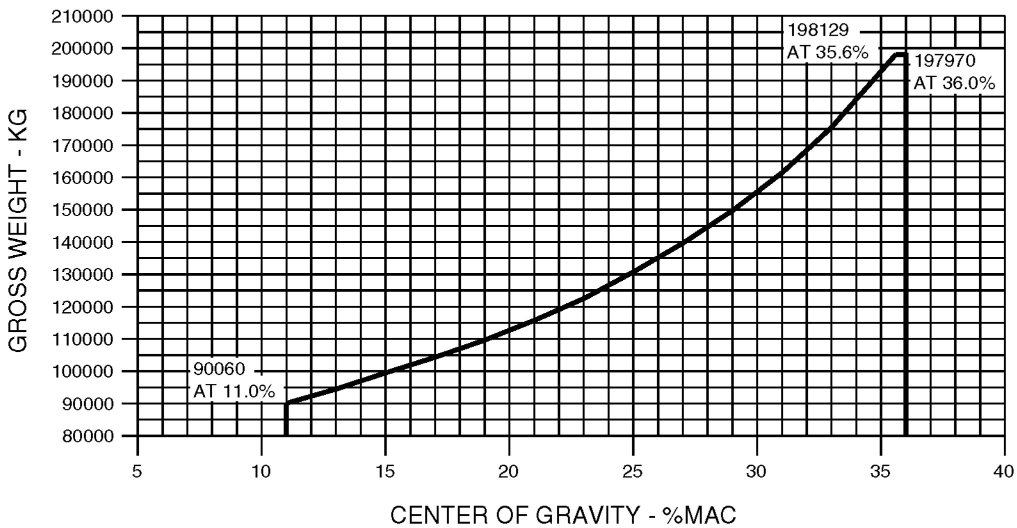


JACKING AT LANDING GEAR AXLES

NOTE: THE ABOVE JACKING LIMITS ARE BASED ON THE STRUCTURAL CAPABILITY OF THE AIRPLANE. THIS INFORMATION DOES NOT REFLECT AIRPLANE CERTIFICATION WEIGHT AND BALANCE LIMITS

Figure 3-37 GROSS WEIGHT AND CENTER OF GRAVITY LIMITS FOR JACKING AT PRIMARY JACK POINTS- 767-200 (Continued)

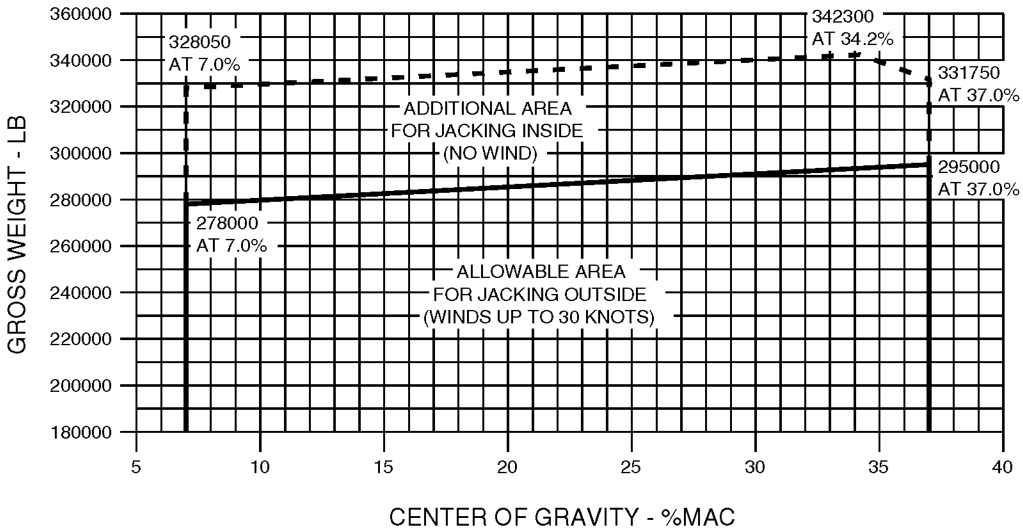


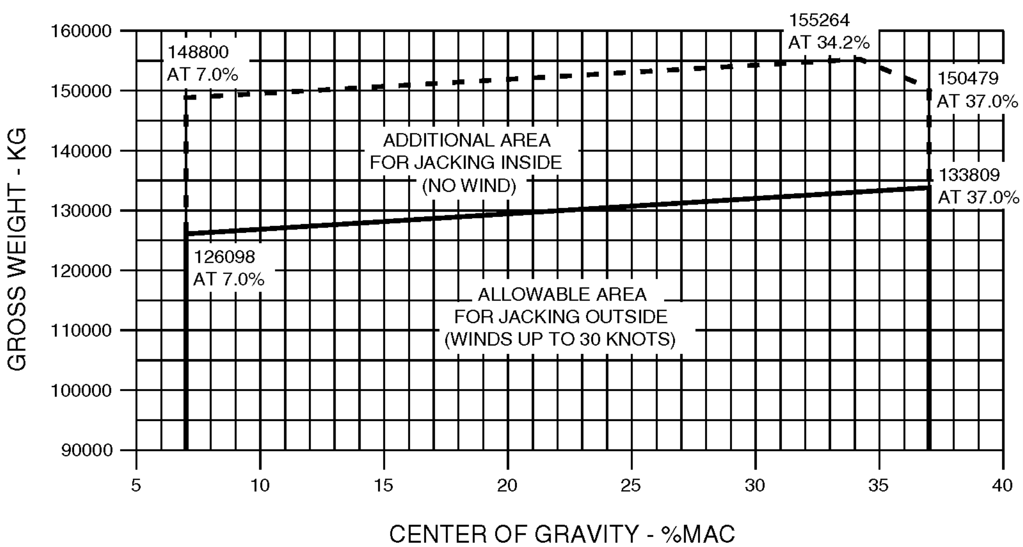


JACKING AT AIRPLANE NOSE

NOTE: THE ABOVE JACKING LIMITS ARE BASED ON THE STRUCTURAL CAPABILITY OF THE AIRPLANE. THIS INFORMATION DOES NOT REFLECT AIRPLANE CERTIFICATION WEIGHT AND BALANCE LIMITS

Figure 3-38 GROSS WEIGHT AND CENTER OF GRAVITY LIMITS FOR JACKING AT PRIMARY JACK POINTS-767-300

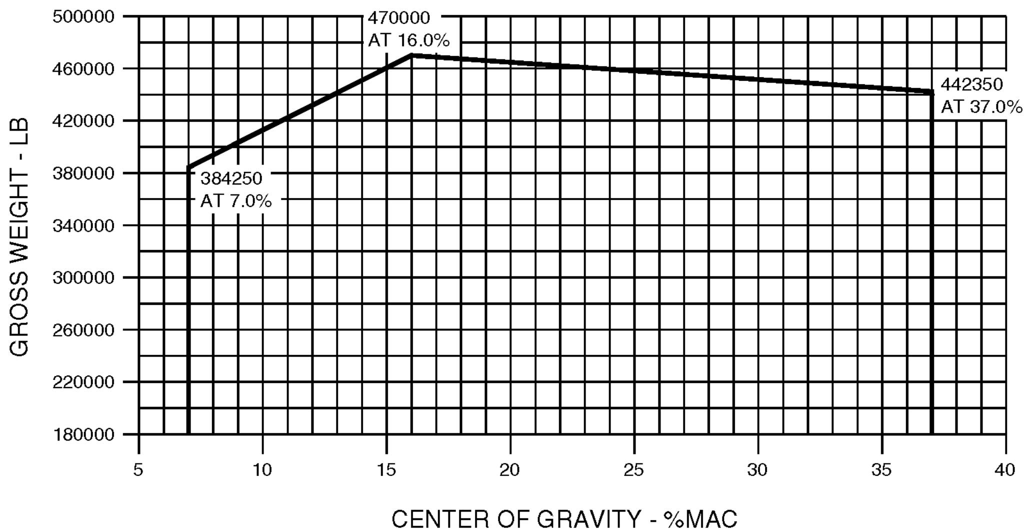


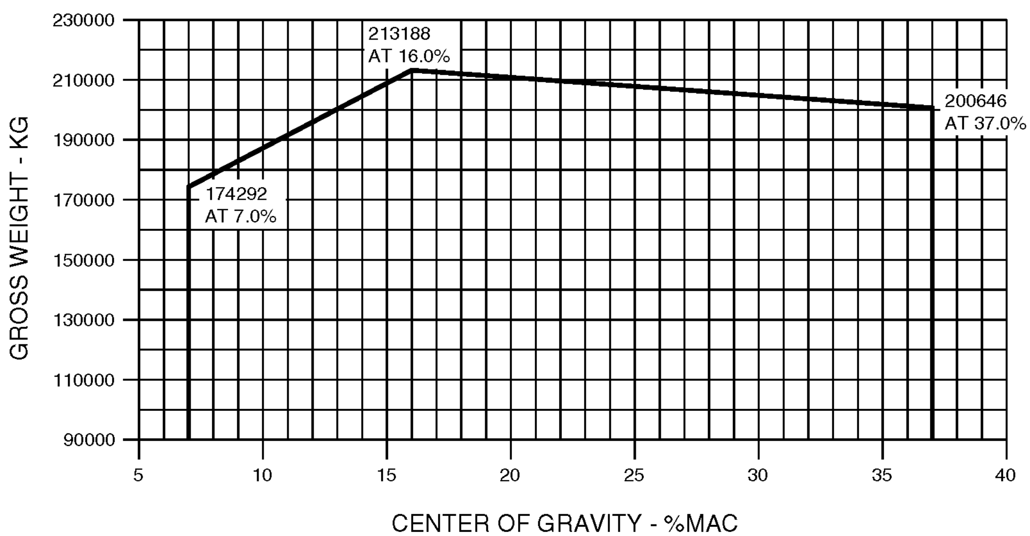


JACKING AT PRIMARY JACKING POINTS

NOTE: THE ABOVE JACKING LIMITS ARE BASED ON THE STRUCTURAL CAPABILITY OF THE AIRPLANE. THIS INFORMATION DOES NOT REFLECT AIRPLANE CERTIFICATION WEIGHT AND BALANCE LIMITS

Figure 3-38 GROSS WEIGHT AND CENTER OF GRAVITY LIMITS FOR JACKING AT PRIMARY JACK POINTS- 767-300 (Continued)

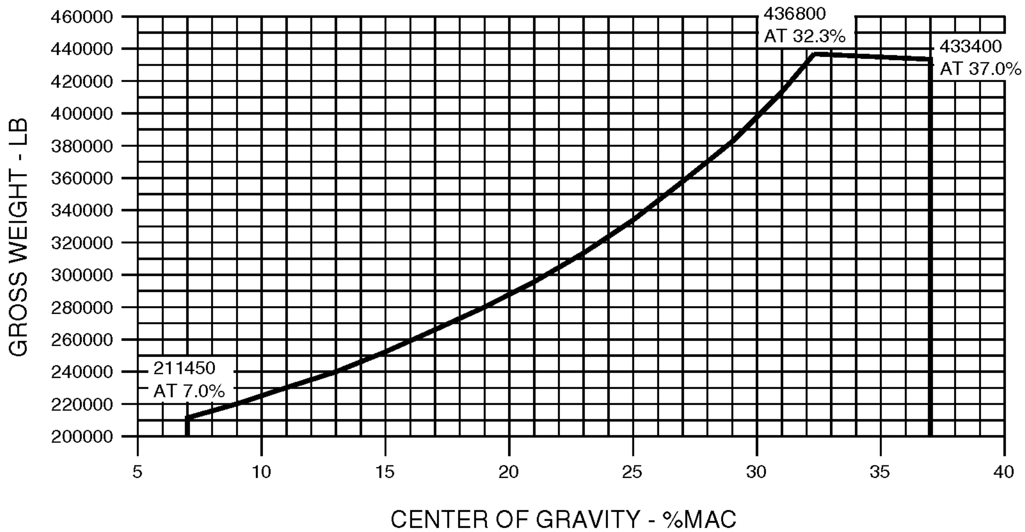


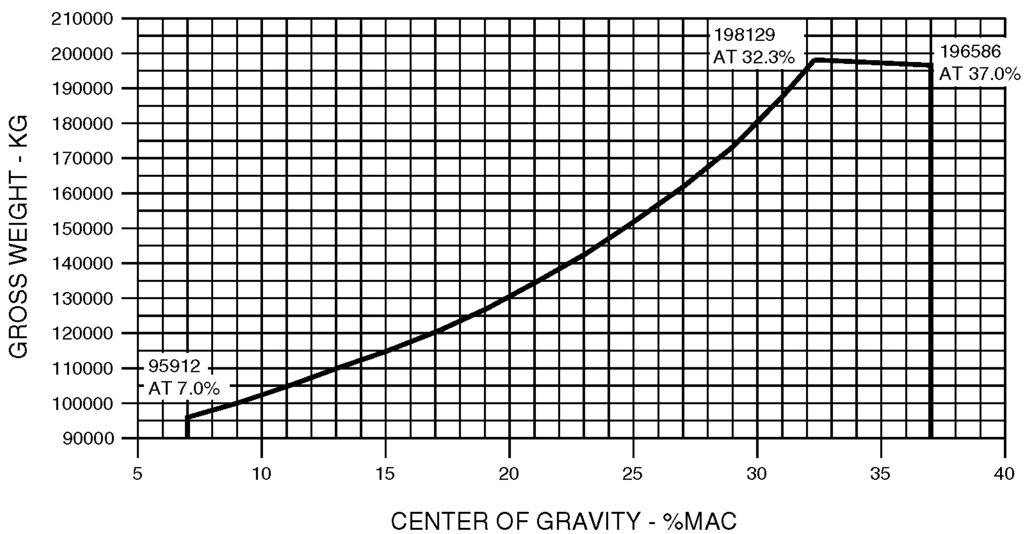


JACKING AT LANDING GEAR AXLES

NOTE: THE ABOVE JACKING LIMITS ARE BASED ON THE STRUCTURAL CAPABILITY OF THE AIRPLANE. THIS INFORMATION DOES NOT REFLECT AIRPLANE CERTIFICATION WEIGHT AND BALANCE LIMITS

Figure 3-38 GROSS WEIGHT AND CENTER OF GRAVITY LIMITS FOR JACKING AT PRIMARY JACK POINTS- 767-300 (Continued)

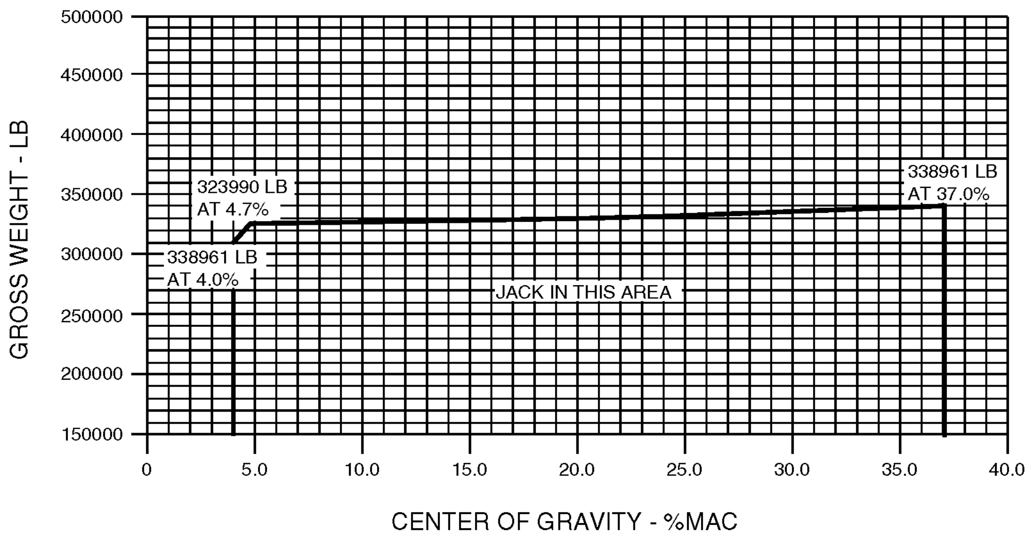




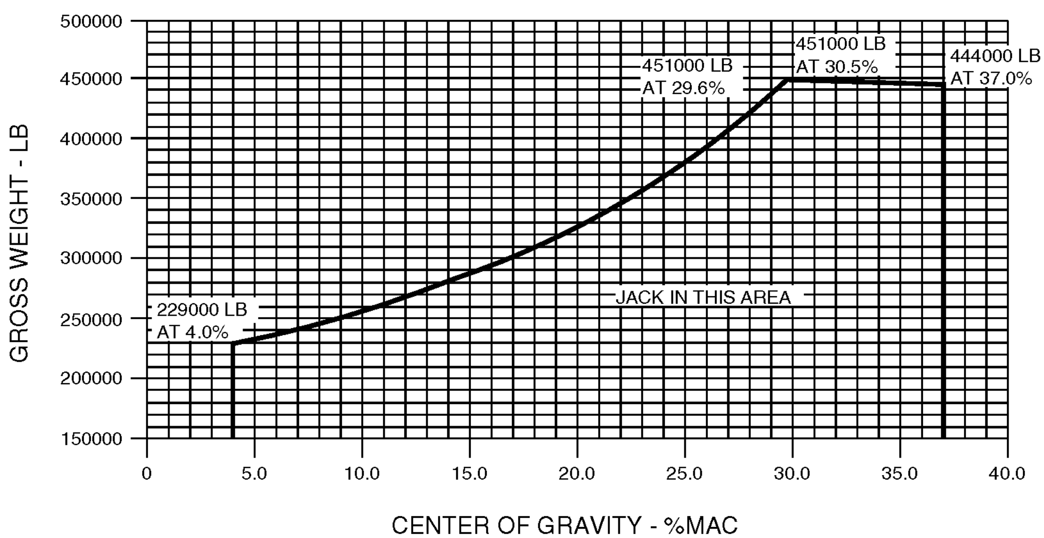
JACKING AT AIRPLANE NOSE

NOTE: THE ABOVE JACKING LIMITS ARE BASED ON THE STRUCTURAL CAPABILITY OF THE AIRPLANE.
THIS INFORMATION DOES NOT REFLECT AIRPLANE CERTIFICATION WEIGHT AND BALANCE LIMITS

Figure 3-39 GROSS WEIGHT AND CENTER OF GRAVITY LIMITS FOR JACKING AT PRIMARY JACK POINTS-767-400ER



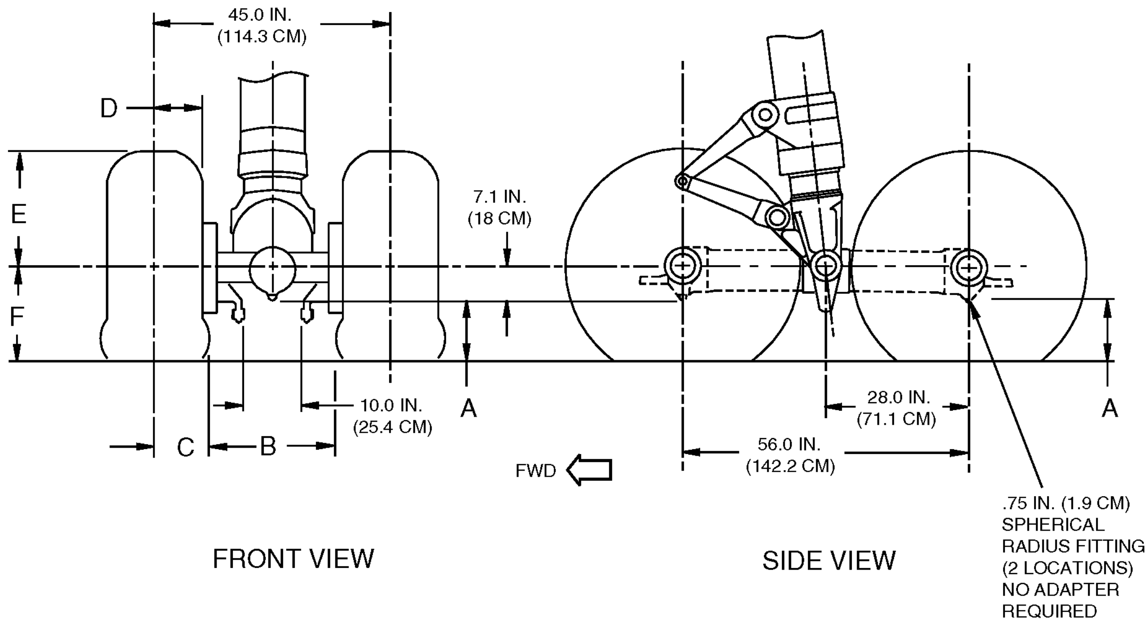
JACKING AT PRIMARY JACK POINTS



JACKING AT AIRPLANE NOSE

NOTE: THE ABOVE JACKING LIMITS ARE BASED ON THE STRUCTURAL CAPABILITY OF THE AIRPLANE. THIS INFORMATION DOES NOT REFLECT AIRPLANE CERTIFICATION WEIGHT AND BALANCE LIMITS

Figure 3-40 AXLE JACK POINTS - MAIN LANDING GEAR, 767-200, -300, -300ER



CONDITION	TIRE SIZE					
	H46 x 18-20 26, 28 OR 32 PLY 767-200ER/-300/-300ER					
	A	B	C	D	E	F
Max Taxi Weight, Normal Inflation 183 PSIG	12.5 (31.8)	26.6 (67.6)	9.2 (23.4)	9.0 (22.9)	23.0 (58.4)	19.6 (49.8)
The Two Tires Flat On The Wheels	6.5 (16.5)	19.0 (48.3)	—	—	—	—
One Tire Flat	9.8 (25)	23.0 (58.4)	—	—	—	—
On the Wheel Rims	4.5 (11.4)	31.5 (80)	—	—	—	—
On a Jack for a Tire Change, Tires Flat	17.9 (45.5)	27.0 (68.6)	—	—	—	—
On a Jack for a Tire Change, Tires Inflated, 2 in (5 cm) Ground Clearance	17.9 (45.5)	27.0 (68.6)	—	—	—	—

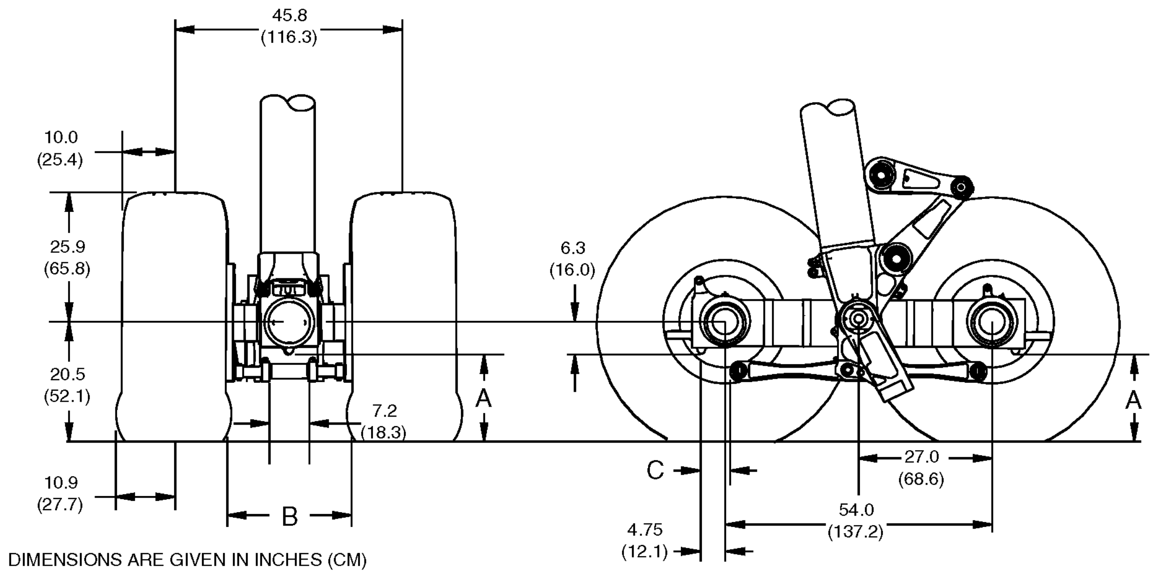
NOTE: Dimensions are given in inches (centimeters)

Figure 3-40 AXLE JACK POINTS - MAIN LANDING GEAR, 767-200, -300, -300ER (Continued)

CONDITION	TIRE SIZE H45 x 17-20 26 PLY 767-200					
	A	B	C	D	E	F
Max Taxi Weight, Normal Inflation 183 PSIG	11.9 (30.2)	26.2 (66.5)	8.7 (22.1)	8.5 (21.6)	22.5 (57.2)	19.0 (48.3)
The Two Tires Flat On The Wheels	6.5 (16.5)	20.0 (50.8)	—	—	—	—
One Tire Flat	9.05 (23)	24.0 (61)	—	—	—	—
On the Wheel Rims	4.5 (11.4)	31.5 (80)	—	—	—	—
On a Jack for a Tire Change, Tires Flat	17.4 (44.2)	28.0 (71.1)	—	—	—	—
On a Jack for a Tire Change, Tires Inflated, 2 in (5 cm) Ground Clearance	17.4 (44.2)	28.0 (71.1)	—	—	—	—

NOTE: Dimensions are given in inches (centimeters)

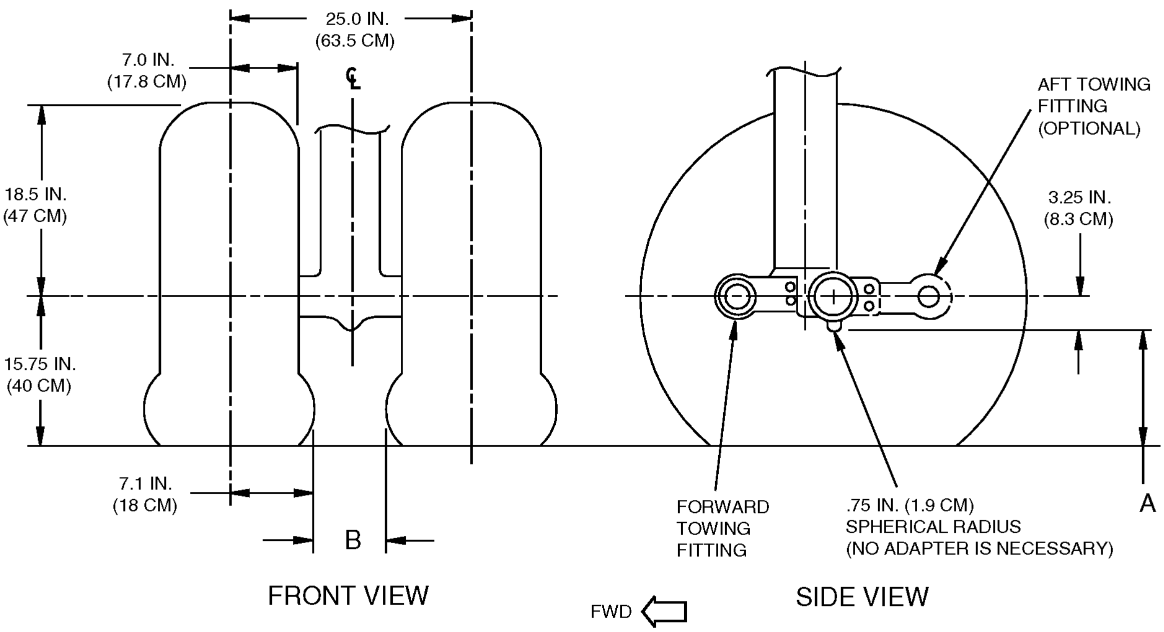
Figure 3-41 AXLE JACK POINTS- MAIN LANDING GEAR - 767-400ER



CONDITION	TIRE SIZE		
	50 x 20R22 32 PLY		
	A	B	C
Max Taxi Weight - Normal Inflation	14.2 (30.1)	24.0 (61.0)	5.8 (14.7)
Both Tires Flat On One Axle	5.9 (15.0)	15.6 (39.6)	4.5 (11.4)
One Tire Flat	10.6 (26.9)	20.3 (51.6)	5.4 (13.7)
On Wheel Rims	6.6 (16.8)	30.2 (76.7)	5.8 (14.7)
On Jacks for Tire Change - Tires Flat	21.6 (54.9)	25.0 (63.5)	5.8 (14.7)
On Jacks for Tire Change - Tires Inflated, 2 in (5 cm) Ground Clearance	21.6 (54.9)	25.0 (63.5)	5.8 (14.7)

NOTE: Dimensions are given in inches (centimeters)

Figure 3-42 AXLE JACK POINT - NOSE LANDING GEAR



CONDITION	TIRE SIZE H37 X 14-15 22 PLY RATING			
	A		B	
	IN.	CM	IN.	CM
Maximum Taxi Weight, Normal Inflation 145 PSIG	12.2	31.0	10.8	27.4
The Two Tires Flat on the Wheels	7.09	18.0	5.35	13.6
One Tire Flat	9.7	24.6	7.0	17.8
On Wheel Rims	5.55	14.1	14.1	35.8
On a Jack for a Tire Change, Tires Flat	17.25	43.8	11.0	27.9
On a Jack for a Tire Change, Tires Inflated	17.25	43.8	11.0	27.9

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3-30-5 Important Data about the Jacks

1. General

A. The usual jacks (axle, wing and body) are all applicable to some special phases of each airplane recovery. See Figure 3-44 for some frequently used jacks. The axle jacks are used the most when the clearances are at a minimum. You can use the usual tripod jacks when sufficient clearance is available.

B. There are two different types of recovery jacks available to lift the airplane. Each of the two types are hydraulic (low-profile, multi-stage) jacks. Their load capacity and their height ranges are equivalent. You can operate each of the two types by hand. You can also operate them with power from a different point (use a remote console).

(1) The first jack type (tripod-type) is shown in Figure 3-45. It is almost equivalent to the usual maintenance jack. There are two differences. The top part of the jack (the ram) becomes a solid head and each of the three legs have hydraulic cylinders (multi-stage). This permits horizontal movement of the jack head (within limits). This movement is the possible arc that the airplane moves through until it has a level attitude. It is possible with this jack to get only small horizontal loads on the jack head. Be careful. It is best if you know this jack from other incidents. The best performance (small horizontal loads) occurs when you use the jack frequently.

(2) The second jack type (strut-type) (shown in Figure 3-48) is a hydraulic jack (multi-stage, hydraulic ram) on a bottom plate. The bottom plate has a spring that aligns the jack automatically. This jack is easy to operate and it can align with the airplane through an arc of 8 degrees. A lock ring (vertical, mechanical) makes the jack more stable. This jack, with the lock ring removed, permits the head to move with the airplane (within limits).

NOTE: Both the tripod-type and strut-type recovery jacks may encounter clearance difficulties when being used at the wing to body primary jack points (A & B).

C. Using jacks at the primary jack points (see Figure 3-34), provides for a safe procedure to correct the airplane attitude. Use jacks at the auxiliary points (see Figure 3-34) only to make the airplane stable. Do not use loads that are more than the jack point loads shown in Figure 3-35 and Figure 3-36. Monitor load gages on the jacks to make sure that you do not use loads that are too large. Use the body nose jack only to make the airplane stable. When the airplane nose is down, lift the nose jack point first until you have a level airplane. Do not exceed the jacking loads specified for this area. You should lower the tail jack to the level position before the tail of the airplane moves down.

D. You can also use the jack points on the Main Landing Gear (MLG) and the Nose Landing Gear (NLG) to lift the airplane (see Figure 3-41 or Figure 3-42). If you do not have sufficient clearance for the usual axle jacks, you can use special equipment for this airplane. You install this special equipment (jack bar set) into the axle of each landing gear. The equipment (typical) for the MLG axle (A07004 or A07008 for 767-200, -300 models and A07009 for 767-400ER models) is shown in Figure 3-50. See Figure 3-43 for correct jacking bar equipment for the 767-200 and -300 models by MLG axle part number. The equipment for the NLG axle (A07002) is shown in Figure 3-51. The limits for jack loads are shown in Figure 3-35 and Figure 3-36.

(1) When you have a flat tire on the main gear, remove all internal hardware from the MLG axle. Put the emergency jack bar (A07004, A07008, or A07009) into the axle as shown in Figure 3-50. After you install the jack bar, you have a 9 in. (23 cm) height available. You can use this height to set the jack in and lift the main gear. When you have two flat tires on the main gear, install a jack bar into each end of the axle.

(2) When you have a flat tire on the nose gear, use the jack bar (A07002) shown in Figure 3-51. Install the jack bar into the inner diameter of the NLG axle. This gives you an available height of 9 in. (23 cm) to set the NLG jack in and lift the gear.

E. You can also use the wing spars (front and rear) or the support beam of the landing gear to lift the airplane. The correct locations for the jack points are shown in Figure 3-53. The maximum loads and a special tool (adapter) to divide the loads are also shown in Figure 3-53. Follow the maintenance manual procedures for jacking described in MM 07-11-03 for use of this jack.

2. Prepare to Use the Jacks

A. Make sure you complete the procedures shown in SECTION 3-20 of this Chapter.

B. Examine the available jacks. Make sure they are the correct type. Check manufacturers specifications for the jacks being used to determine the load limits of the jacks and the ground clearances.

C. Make sure that the ground surface below the jack has a sufficient strength for the jack loads. It is possible that you must remove the ground material and replace it with better material (rock or gravel). See SUBJECT 2-10-3 for more data.

D. Make sure the area below the jack is level and flat. Then the jack will have a correct vertical attitude. See SUBJECT 3-30-11 for jack surface preparation.

E. Install the jack pads (adapters).

F. Compress the jack to its minimum height.

NOTE: You can start to lift the airplane with axle jacks. Then when you have a sufficient height, you can use the usual tripod jacks.

G. Use supports (cribbing) if it is necessary below the jacks. Make the supports as level as possible with a large flat surface to correctly hold the jack. When you start, make the dimensions of the flat surface sufficient to permit changes in the jack positions. These changes will be necessary while you align the jack for each turn adjustment of the airplane. The turn adjustment can be very large (10 in. (25 cm) to 15 in. (38 cm)) when you lift only the lower wing.

H. You must monitor the horizontal movement of the airplane while you operate the jacks. You can tape plumb lines to the bottom centerline of the airplane. You can also attach plumb lines to some locations on the sides of the fuselage. Then put targets in the ground below each point to monitor the movement of the airplane.

I. Install load gages on all the jacks. Monitor the gages to make sure that you do not use loads that are too large. Write the maximum permitted load on the airplane by each jack pad.

J. Make sure that all recovery persons know the procedure. It must be possible for each person to speak with the other persons while you do the procedure. Then each person can adjust to the problems that occur. This permits you to prevent injury to each person and to prevent secondary damage to the airplane.

3. Lift the Airplane with Jacks

A. First you must change the airplane to a level attitude. Use an attitude gage or the plumb bob in the wheel well to monitor the movement of the airplane (see Section 8 of the Maintenance Manual). You can also use a different tool (carpenter's level). Put this tool on the ceiling of the wheel well or put this tool on the keel beam. If you cannot get access to these areas, put this tool on the floor of the airplane.

NOTE: Do not put the airplane on jacks when you have high winds (more than 40 m.p.h., 35 knots or 64 km/hour).

B. Apply an initial (preload) pressure of 1000 lb (454 kg) to each jack when you start to lift the airplane. Make sure that you have safe conditions at all of the jack points. Then apply pressure to all of the jacks at the same time until each jack has its calculated load. Do not apply a jack load that is more than the permitted load at a jack point. Usually, if you have the maximum permitted load, there is an error in your procedures. Examine the weight at that jack point, the airplane weight and the CG location.

C. Jack Procedures, Airplane Without a Level Attitude

(1) Lift the low point first. Because of the turn effect of the airplane, this jack point will move through an arc. Possibly, you will have horizontal movements as large as 10 in. (25 cm) to 15 in. (38 cm). These movements will cause a side load on the jacks that is too large.

(2) Make small vertical jack movements of approximately 6 in. (15 cm) to 8 in. (20 cm). Put supports (cribs) in the area of the jack points to hold the airplane after each jack movement. Then align the jacks. Also, put more supports below the jacks if it is necessary.

CAUTION: BE CAREFUL IF THE FUEL TANKS ARE NOT FULL. WHEN YOU CHANGE THE AIRPLANE TO A LEVEL ATTITUDE, THE MOVEMENT OF THE CENTER OF GRAVITY CAN BE LARGE.

(3) Do this small movement procedure until the airplane has a level attitude.

NOTE: Possibly you can deflate the struts (oleos) and the tires of the other landing gear. Then you can have a level airplane attitude more quickly.

4. Jack Procedures, Airplane With a Level Attitude

A. Use the jacks to lift the airplane in a procedure that keeps it in a level attitude. If you do not do this, you will put horizontal loads on the jacks. Frequently monitor the plumb bob, or other tools, for all dangerous movements of the airplane.

B. There are no alternative jack points on the wing where you can hold the airplane with jacks. If you must align the jacks, you must use other equipment to hold the airplane. Then you can also add more support below the jacks if it is necessary.

C. The wing rear spars and main landing gear beam area are the only available structures that can hold the jack load and correctly balance the airplane. Use a beam as shown in Figure 3-52 with two jacks below the rear spar of the wing. Do this on each side of the fuselage. This will hold the airplane while you remove the load from the main jack points.

D. Use padding between the beam and the wing to prevent local damage to the structure. Make sure that each beam is below the spar and not below a skin area that has no support.

E. Install load gages on each jack in the rear spar configurations. Monitor these gages while you apply the jack loads. A serviceable wing structure is flexible and you can apply slow and continuous loads. The inboard wing areas are less flexible than the outboard areas. Thus, a different jack extension is necessary at the outboard jack.

F. Do not lift the airplane with the rear spar configuration higher than it is necessary. Stop when you release the load on the primary wing jacks. If it is necessary, adjust the nose jack and the tail jack to keep a level airplane attitude. A level attitude keeps the jack loads to a minimum.

G. When the airplane is at a correct height, install more supports (cribbing) in the areas near the wing jack points. Then compress the axle jacks to their minimum height.

H. Use support tools (cradles) below the primary bulkheads or cargo doors. Put more support (cribbing) below the fuselage each time you put new supports (cribbing) below the body jacks. Adjust the vertical position of each body jack if it is necessary. Make sure you keep the airplane at a level attitude (see Figure 3-56 for jacking and contour shoring example).

I. After you add new supports (cribbing) below the jacks, you can use them to lift the airplane one more increment. Keep all stabilizer jacks at their specified (nominal) loads. Keep the airplane at a level attitude.

J. Continue these increments until you have a sufficient height to install the usual tripod jacks at the main jack points.

K. Use the main jacks to lift the airplane to the height that is necessary to do the recovery operation. Then extend the folded gear or replace it. Also, make sure that you lock the gear. Possibly, you must put a truck (flat bed) below the airplane to move it. See CHAPTER 4 for more data on the movement of the airplane.

NOTE: Extend the gear slowly because the ground below the gear is possibly not stable, or the landing gear is damaged. Use jacks, or cables or use a truck (forklift) to prevent a fast movement of the gear. Lock the extended gear. Then decrease the airplane height until the gear starts to hold the airplane. Remove the main wing jacks quickly when the airplane weight is all on the landing gear. This prevents damage to the airplane if the gear moves down into soft ground. Check the fuse pins on the gear, see SECTION 2-10.

5. Jack Procedures, Airplane With a Folded Nose Gear

A. Use a jack at each of the primary jack pads on the wing and at the forward body jack point. See Figure 3-54 and Figure 3-55 for examples of jacking when minimum jack clearance is available and using the forward body jack point. See the data for an airplane that does not have a level attitude or that has a level attitude (SUBJECT 3-30-4).

B. Continue to put supports (cribbing) below the forward fuselage while you lift the airplane or you can use pneumatic elevators.

NOTE: You can also make a support cradle that has pads. This cradle must conform to the lower contour of the fuselage at each frame station. This cradle holds the nose of the airplane while you align the jacks or while you install more supports (cribbing) at the nose pad.

C. While you lift the nose of the airplane, you must make the aft fuselage stable with a tail jack. Then decrease the height of the tail jack while you lift the nose of the airplane above a level attitude. This keeps the airplane stable and prevents a movement to a tail-down position.

6. Jack Procedures, Airplane With a Folded Main Gear

A. Use a jack at the main jack point on the low wing. Do this while the airplane is held by the main gear on the opposite wing (see SUBJECT 3-30-4). If it is possible, remove the fuel from the low wing to decrease the load.

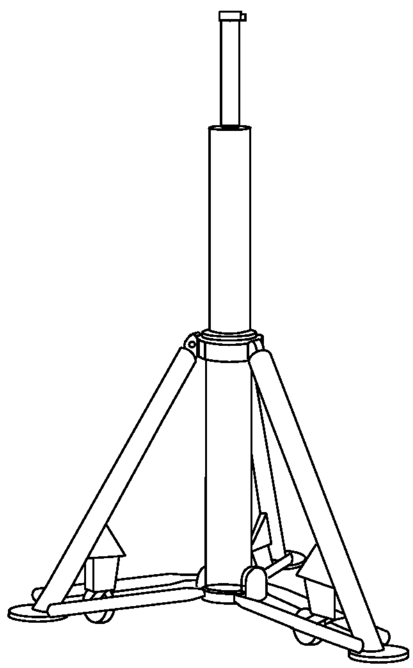
B. Lift the airplane to the height that is necessary to extend and lock the gear or to replace the gear. Possibly, you must put a truck (or some other equipment) below the airplane to move it. See CHAPTER 4 for more data on the movement of the airplane.

Figure 3-43 MAIN LANDING GEAR JACKING BAR EQUIPMENT- 767-200, -300

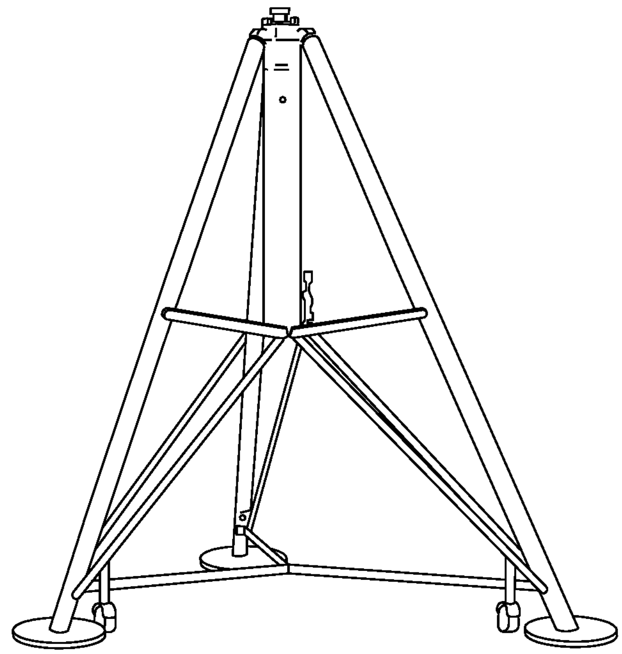
MAIN LANDING GEAR AXLE PART NUMBER	MLG JACKING BAR EQUIPMENT- 767-200, -300			
	A07004		A07008	
	-1	-8	-1	-19
161T1138-2	X	X	X	X
161T1138-4	—	X	X	X
161T1138-6	—	—	X	X
161T1138-8	—	—	X	X
161T1138-10	—	—	—	X
161T1138-12	—	—	—	X

NOTE: Note: The A07009-1 jacking bar equipment applies to the 767-400ER main landing gear axles.

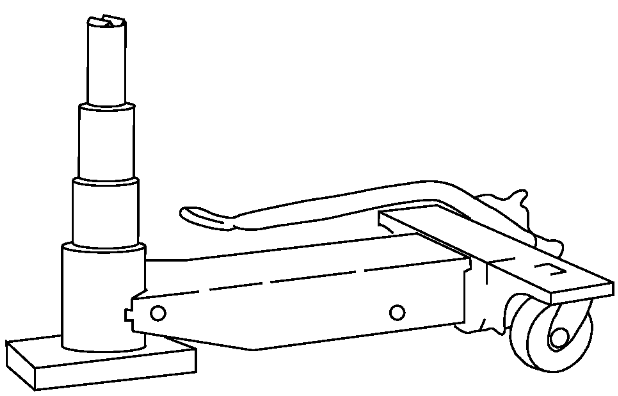
Figure 3-44 STANDARD AIRPLANE MAINTENANCE JACKS



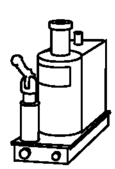
NOSE, WING AND TAIL TRIPOD JACK



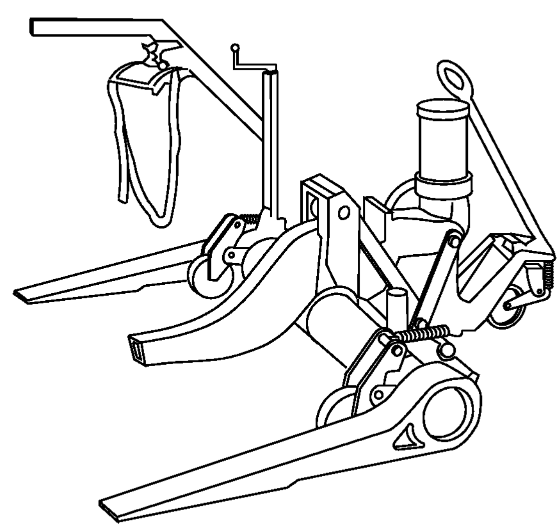
TAIL AND OUTBOARD WING TRIPOD JACK



AXLE JACK
(WHEELED, ALLIGATOR TYPE)

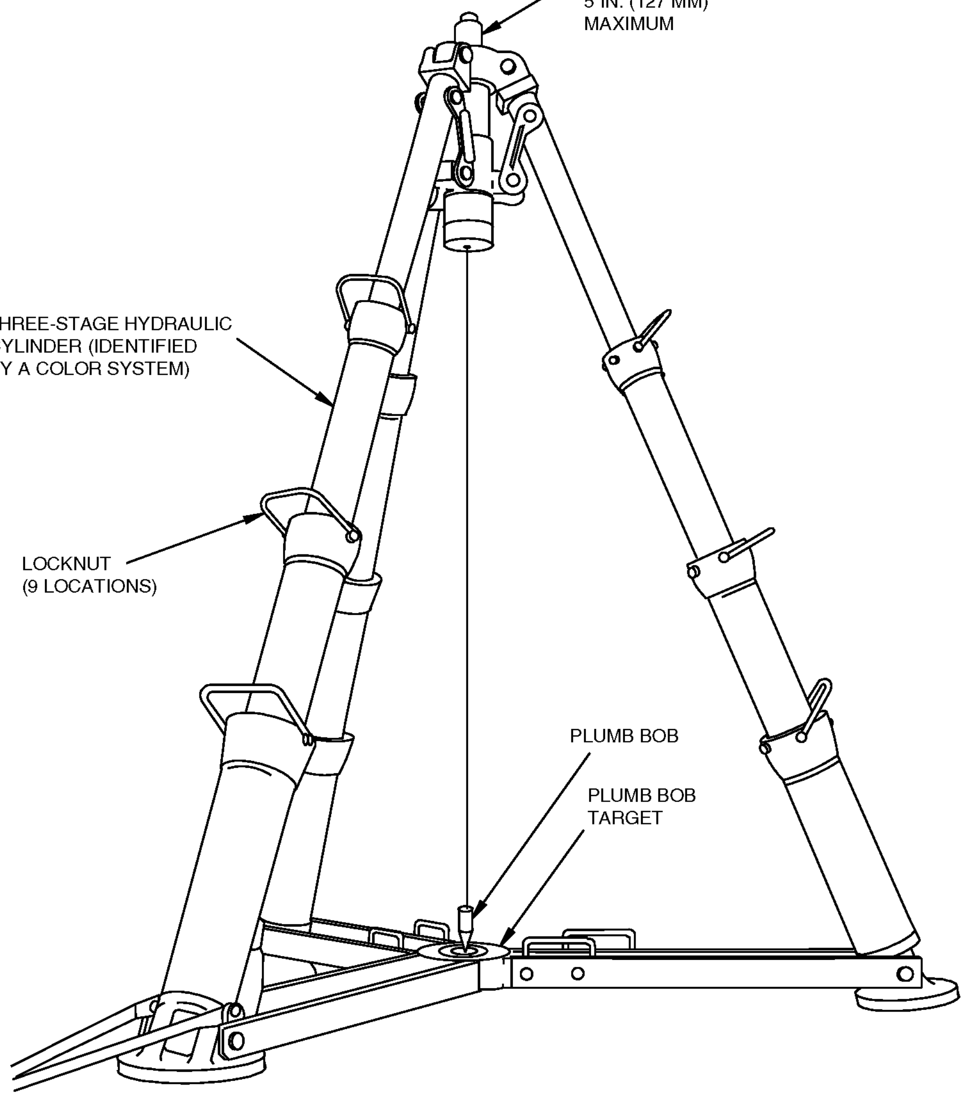


AXLE JACK
(HAND CARRY TYPE)



AXLE JACK
(CANTILEVER, RHINO TYPE)

Figure 3-45 LOW PROFILE RECOVERY JACK, TRIPOD TYPE



NOTES:

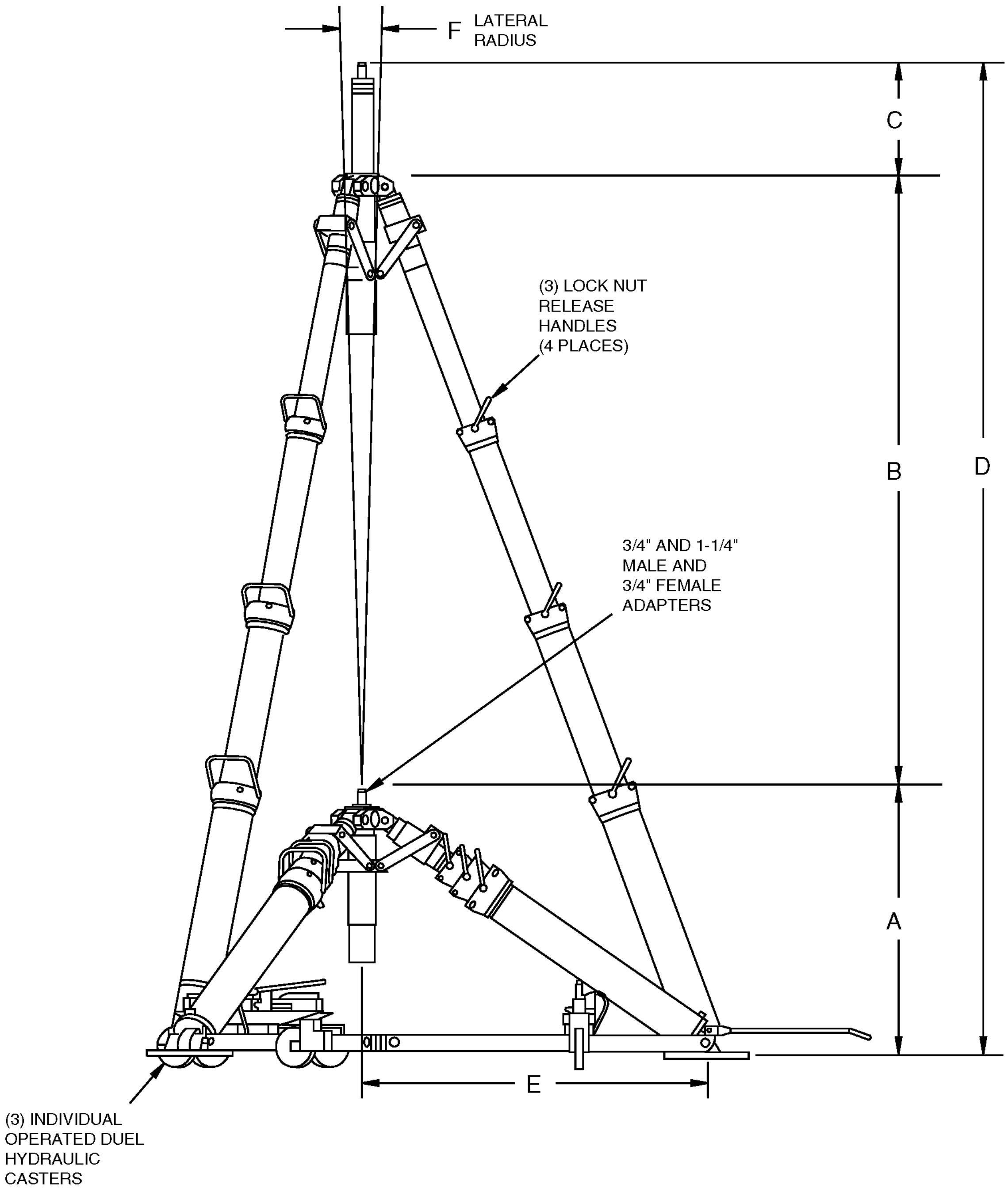
1. THE WHEEL ASSEMBLIES, THE THREE HYDRAULIC HOSES AND THE CONTROL CONSOLE ARE NOT SHOWN

2. THE JACK CAPACITY IS GIVEN BELOW:
   - FROM 20 TO 68 INCHES IT IS 80 TONS
   - FROM 68 TO 140 INCHES IT IS 100 TONS

3. THE ALLOWABLE DISTANCE THE LIFTING ADAPTER CAN MOVE FROM THE CENTER OF THE JACK, AS INDICATED BY THE PLUMB BOB, IS GIVEN BELOW:
   - BELOW 52 IN. IT IS 1.5 IN.
   - FROM 52 TO 76 IN. IT IS 2.0 IN.
   - FROM 76 TO 100 IN. IT IS 3.0 IN.
   - FROM 100 TO 124 IN. IT IS 4.0 IN.
   - FROM 124 TO 140 IN. IT IS 4.75 IN.

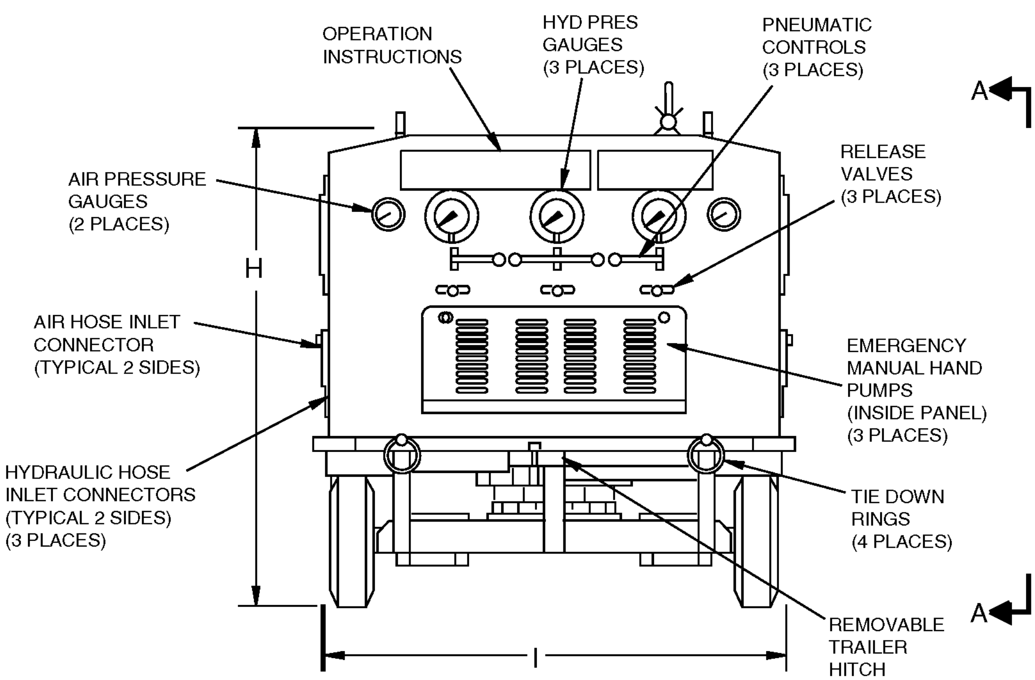
METRIC CONVERSION: 1 IN. EQUALS 2.54 CM
1 TON EQUALS 0.907 METRIC TONS

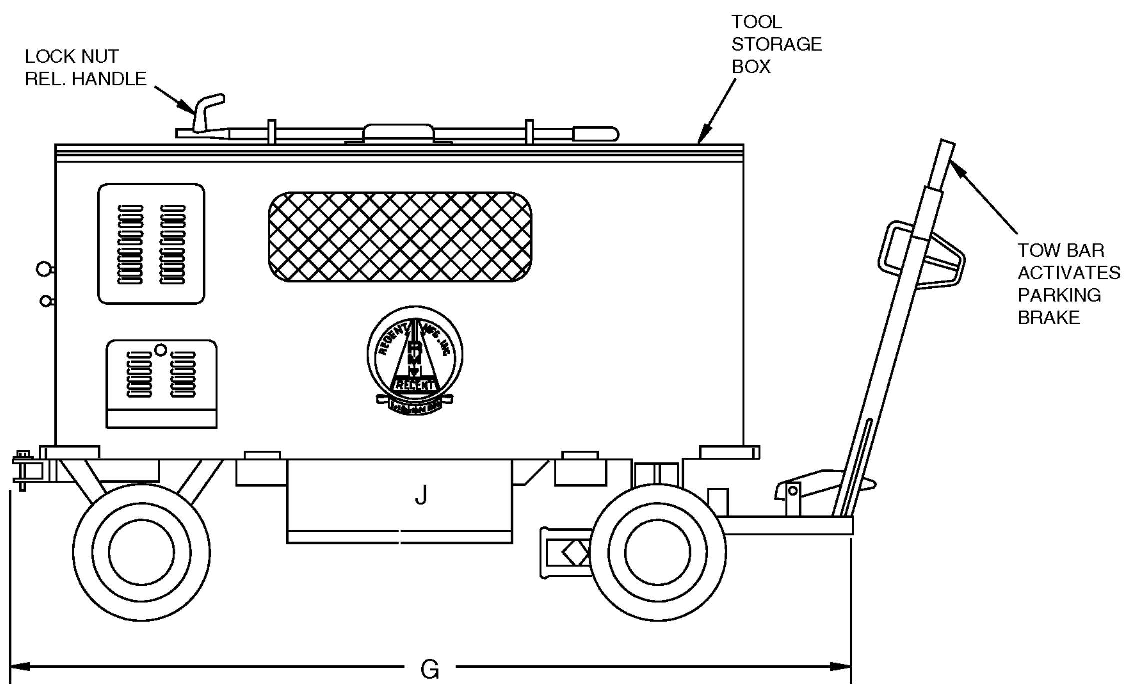
Figure 3-46 TRIPOD JACK RECOVERY SYSTEM- 110 TON CAPACITY



TRIPOD

Figure 3-46 TRIPOD JACK RECOVERY SYSTEM- 110 TON CAPACITY (Continued)





A-A

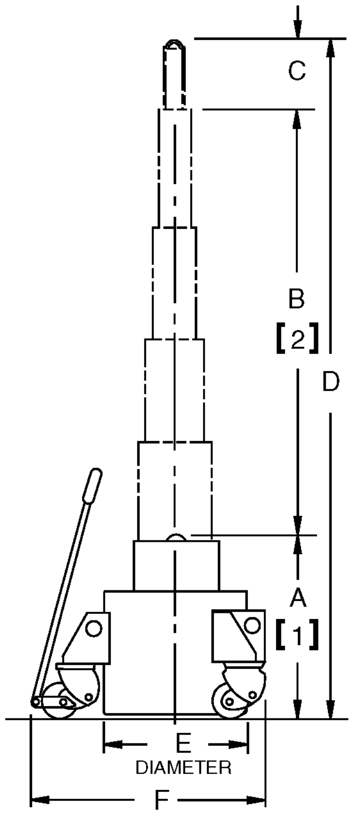
CONSOLE

Figure 3-47 TRIPOD 110 TON CAPACITY RECOVERY JACK AND CONSOLE DIMENSIONS

JACK MODEL NUMBER	VERTICAL CAPACITY (TONS)	A	B	C	D	E	F
		MIN. CLOSED HEIGHT (INCH)	HYD LIFT (INCH)	SCREW EXT. (INCH)	MAX EXT HEIGHT (INCH)	TRIPOD RADIUS (INCH)	LATERAL RADIUS (INCH)
9494-010	110.0	68.0	162.0	24.0	254.0	85.0	4.5
System	metric tons	mm	mm	mm	mm	mm	mm
9497-010	99.9	1,727	4,115	610	6,452	2,159	114

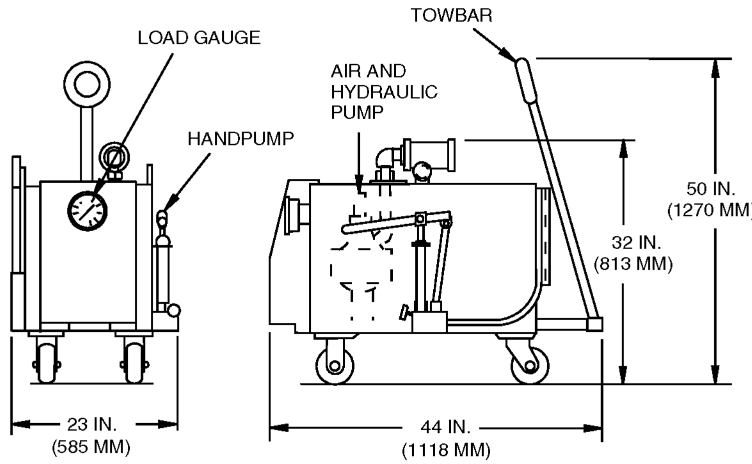
CONSOLE MODEL NUMBER	G	H	I	J	AIR PRESS. AT CONSOLE (PSI)	AIR FLOW AT CONSOLE (SCFM)	RES. CAP. (GAL)
	LENGTH (INCH)	HEIGHT (INCH)	WIDTH (INCH)	TINE WIDTH (INCH)			
9496-010	101.5	59.0	56.0	37.0	110	150	150
System	mm	mm	mm	mm	bars	dm3/s	liters
9497-010	2,578	1,499	1,422	940	7.6	70.8	568

Figure 3-48 LOW PROFILE RECOVERY JACKS, STRUT-TYPE



RECOVERY JACK ASSEMBLY
(STRUT TYPE)

A = MINIMUM HEIGHT
B = HYDRAULIC LIFT IN 4 STEPS
C = SCREW EXTENSION
D = MAXIMUM EXTENDED HEIGHT
E = BASE DIAMETER
F = MAXIMUM BASE DIMENSION



AIR-OPERATED HYDRAULIC POWER CART

NOTE: FOR STANDARD BASE FLOOR LOADING: 380 PSI AT 80 TONS (26.6 KG/ SQUARE CM AT 72.6 METRIC TONS) FOR MODELS 8207 AND 8272

[1] WITH OPTIONAL LOCKNUTS THIS DIMENSION IS 5.00 IN. (127 MM) MORE

[2] WITH OPTIONAL LOCKNUTS THIS DIMENSION IS 5.00 IN. (127 MM) LESS

[3] THE SWIVEL FEATURE MAY BE ELIMINATED WITH THE INSTALLATION OF AN OPTIONAL LOCKRING

[4] INCREASE THE JACK WEIGHT BY 500 LB (227 KG) IF A TRIPOD BASE IS NECESSARY

[5] REFER TO THE RECOVERY JACK BULLETIN FOR POWER CART DIMENSIONS

[6] MODEL 8294 IS AVAILABLE ONLY WITH AN OVERSIZE BASE OR AN OPTIONAL TRIPOD BASE

[7] MADE BY MALABAR INTERNATIONAL
PO BOX 367 220 WEST LOS ANGELES AVE
SIMI VALLEY, CA 93062 USA

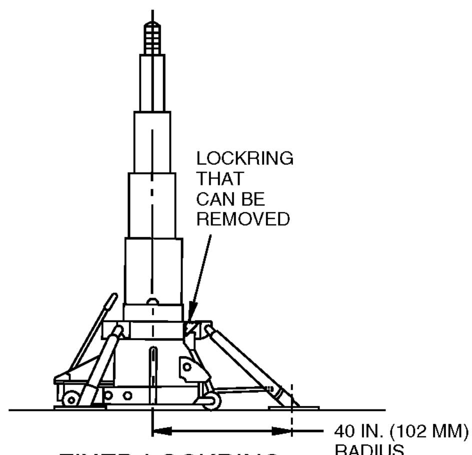
MODEL NUMBER [7]	CAPACITY TONS (METRIC TONS)	JACK DIMENSIONS, IN. (MM)						MAX RAM ANGLE, DEG. [3]	JACK WT. LB (KG) [4]	POWER CART WT. LB (KG) [5]
		A [1]	B [2]	C	D	E	F			
8207 Standard Base	80 (73)	30 (762)	76 (1930)	12 (305)	118 (2997)	24 (610)	42 (1067)	10	2,200 (998)	310 (141)
8207 Oversize Base	80 (73)	30 (762)	76 (1930)	12 (305)	118 (2997)	44 (1118)	45 (1143)	10	2,350 (1066)	310 (141)
8272 Standard Base	80 (73)	37 (940)	91 (2311)	12 (305)	140 (3556)	24 (610)	44 (1118)	8.3	2,350 (1066)	310 (141)

IMPORTANT DATA ABOUT THE JACKS

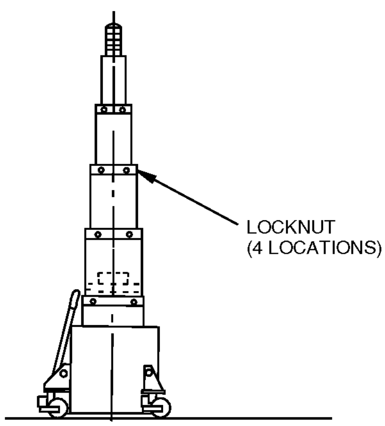
Figure 3-48 LOW PROFILE RECOVERY JACKS, STRUT-TYPE (Continued)

MODEL NUMBER [7]	CAPACITY TONS (METRIC TONS)	JACK DIMENSIONS, IN. (MM)						MAX RAM ANGLE, DEG. [3]	JACK WT. LB (KG) [4]	POWER CART WT. LB (KG) [5]
		A [1]	B [2]	C	D	E	F			
8272 Over-size Base	80 (73)	37 (940)	91 (2311)	12 (305)	140 (3556)	44 (1118)	52 (1321)	8.3	2,500 (1134)	310 (141)
8294 Over-size Base [6]	100 (91)	37 (940)	91 (2311)	12 (305)	140 (3556)	44 (1118)	52 (1321)	8.3	2,700 (1225)	310 (141)

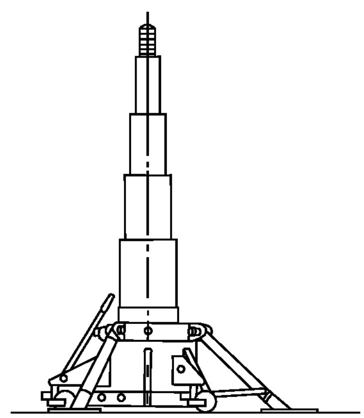
Figure 3-48 LOW PROFILE RECOVERY JACKS, STRUT-TYPE (Continued)



FIXED LOCKRING
(OPTIONAL)
THIS JACK HAS A MULTI-STAGE CYLINDER ASSEMBLY WHICH LOCKS IN A VERTICAL POSITION (A TRIPOD BASE IS NECESSARY)

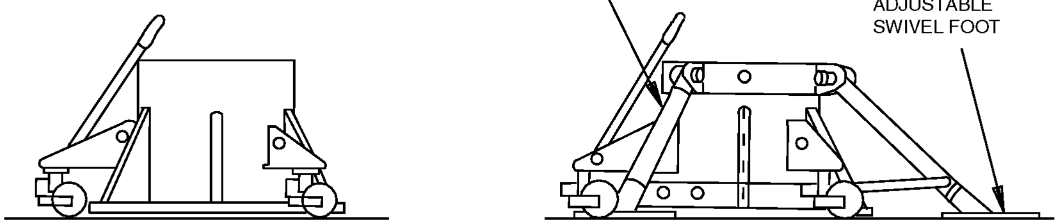


LOCKNUTS
(OPTIONAL)
THIS JACK GIVES A VERTICAL MECHANICAL LOCK WITH LOCKNUTS FOR EACH STEP



ADJUSTABLE LOCK ASSEMBLY
(OPTIONAL)
THIS JACK HAS A LOCK FOR THE MULTI-STAGE CYLINDER ASSEMBLY IN THE VERTICAL AND OFF-CENTER POSITION (A TRIPOD BASE IS NECESSARY)

Figure 3-48 LOW PROFILE RECOVERY JACKS, STRUT-TYPE (Continued)



OVERSIZE BASE
(OPTIONAL)

FLOOR LOADING:

116 PSI AT 80 TONS
(8.1 KG/SQUARE CM AT 72.6 METRIC TONS)

144 PSI AT 100 TONS
(10.1 KG/SQUARE CM AT 91 METRIC TONS)

THIS BASE GIVES A LOWER GROUND LOAD AND MAKES THE JACK MORE STABLE

FOR MODELS 8207, 8272 AND 8294

TRIPOD BASE
(OPTIONAL)

FLOOR LOADING:

116 PSI AT 80 TONS
(8.1 KG/SQUARE CM AT 72.6 METRIC TONS)

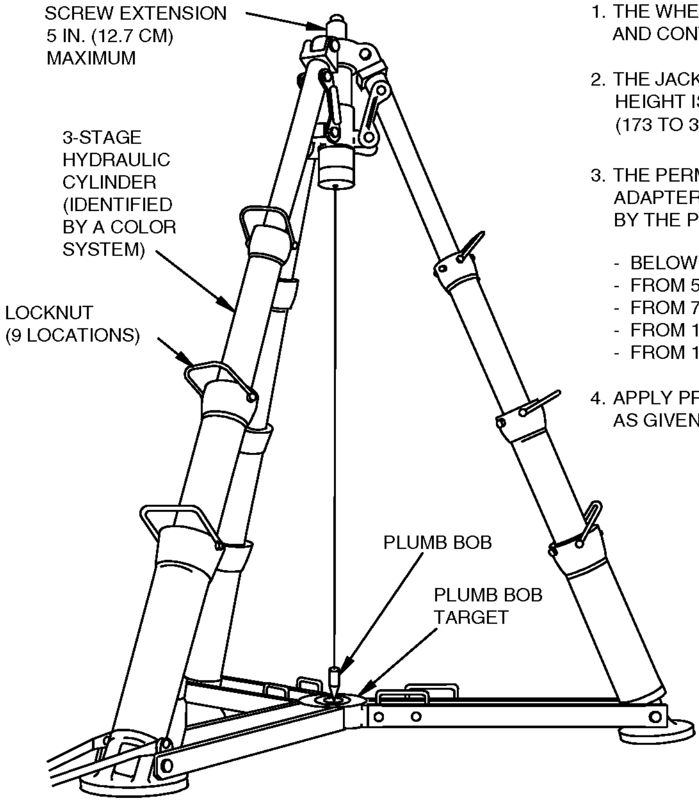
144 PSI AT 100 TONS
(10.1 KG/SQUARE CM AT 91 METRIC TONS)

THE JACK WITH THE TRIPOD BASE IS VERY STABLE AND CAN LIFT AN AIRPLANE THAT HAS ALL OF ITS LANDING GEARS DAMAGED AND FOLDED

THE JACK IS SUPPLIED WITH A LOCKRING WHICH CAN BE REMOVED

FOR MODELS 8207, 8272 AND 8294

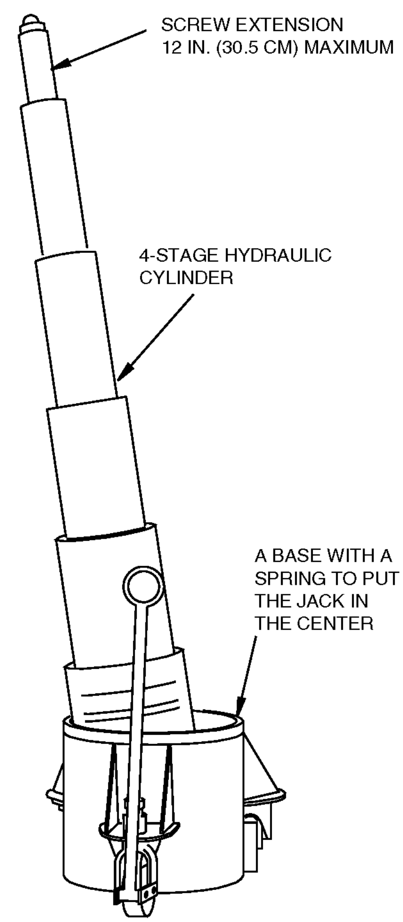
Figure 3-49 TRIPOD AND STRUT TYPE RECOVERY JACKS



A TRIPOD TYPE RECOVERY JACK

NOTES FOR A TRIPOD TYPE JACK:

1. THE WHEEL ASSEMBLIES, 3 HYDRAULIC HOSES AND CONTROL CONSOLE ARE NOT SHOWN
2. THE JACK CAPACITY AT A 28 TO 68 IN. (71.1 TO 173 CM) HEIGHT IS 80 TONS (72 M TONS) AND AT A 68 TO 140 IN. (173 TO 356 CM) HEIGHT IT IS 100 TONS (90 M TONS)
3. THE PERMITTED DISTANCES YOU CAN MOVE THE LIFT ADAPTER FROM THE CENTER OF THE JACK (AS SHOWN BY THE PLUMB BOB) ARE GIVEN BELOW:
   - BELOW 52 IN. (132 CM) IT IS 1.5 IN. (3.8 CM)
   - FROM 52 TO 76 IN. (132 TO 193 CM) IT IS 2.0 IN. (5 CM)
   - FROM 76 TO 100 IN. (193 TO 254 CM) IT IS 3.0 IN. (7.6 CM)
   - FROM 100 TO 124 IN. (254 TO 315 CM) IT IS 4.0 IN. (10 CM)
   - FROM 124 TO 140 IN. (315 TO 356 CM) IT IS 4.75 IN. (12.1 CM)
4. APPLY PRESSURE TO THE HYDRAULIC CYLINDERS AS GIVEN BY THE JACK MANUFACTURER

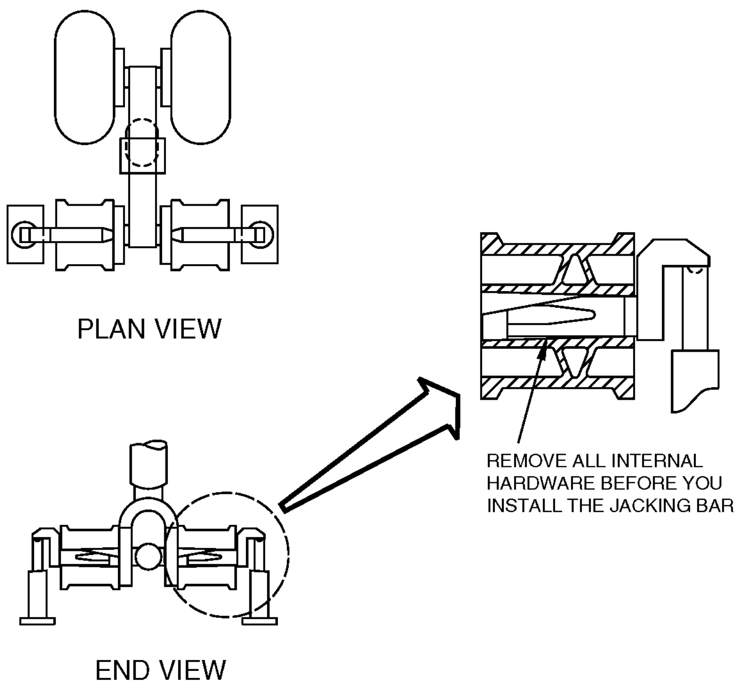


A STRUT TYPE RECOVERY JACK

NOTES FOR A STRUT TYPE JACK:

1. THE HYDRAULIC HOSE, LOCKING COLLARS AND THE CONTROL CONSOLE ARE NOT SHOWN
2. THE CAPACITY OF THE JACK IS 80 TONS (72 M TONS). THE OPTIONAL IS 100 TONS (90 M TONS)
3. THE LATERAL RAM MOVEMENT OF THE JACK IS 8.3 DEGREES
4. THE EXTENDED JACK HEIGHT IS 140 IN. (356 CM)

Figure 3-50 A07004 JACKING BAR SET - MLG AXLE (A07008 AND A07009 SIMILAR)



A07004
USAGE PICTURE

1. USE ONE JACKING BAR FOR A SINGLE FLAT TIRE CONDITION IF A STANDARD COMMERCIAL AXLE JACK CANNOT BE USED
2. TWO JACKING BARS ARE NECESSARY FOR A TWO FLAT TIRE CONDITION

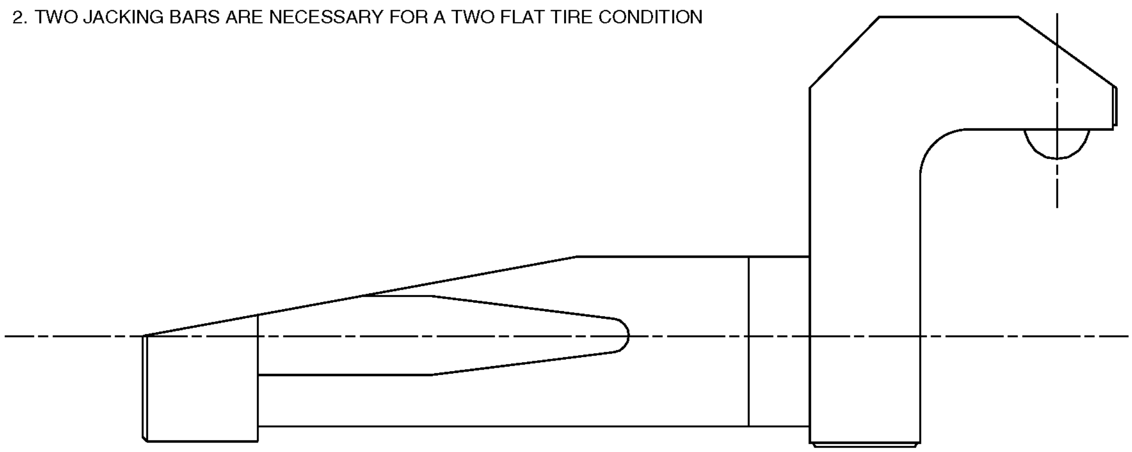
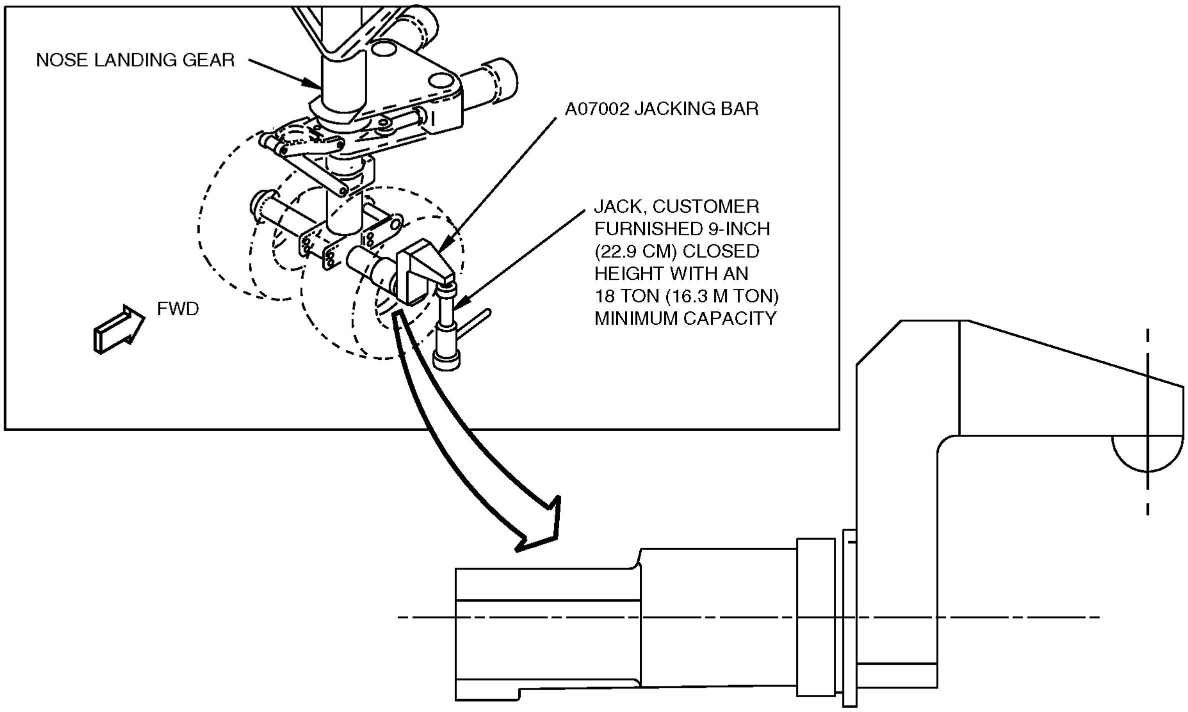
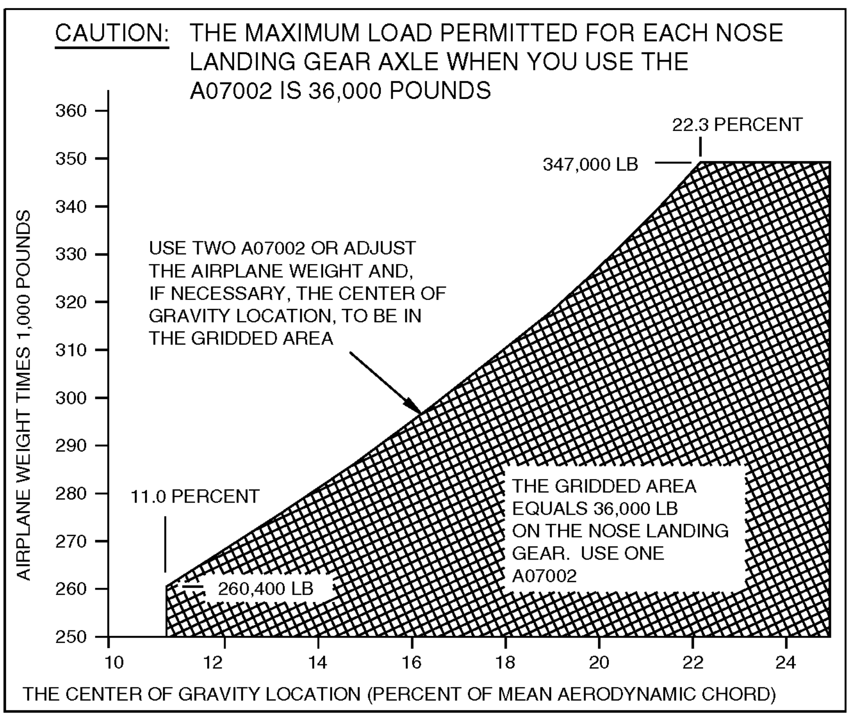


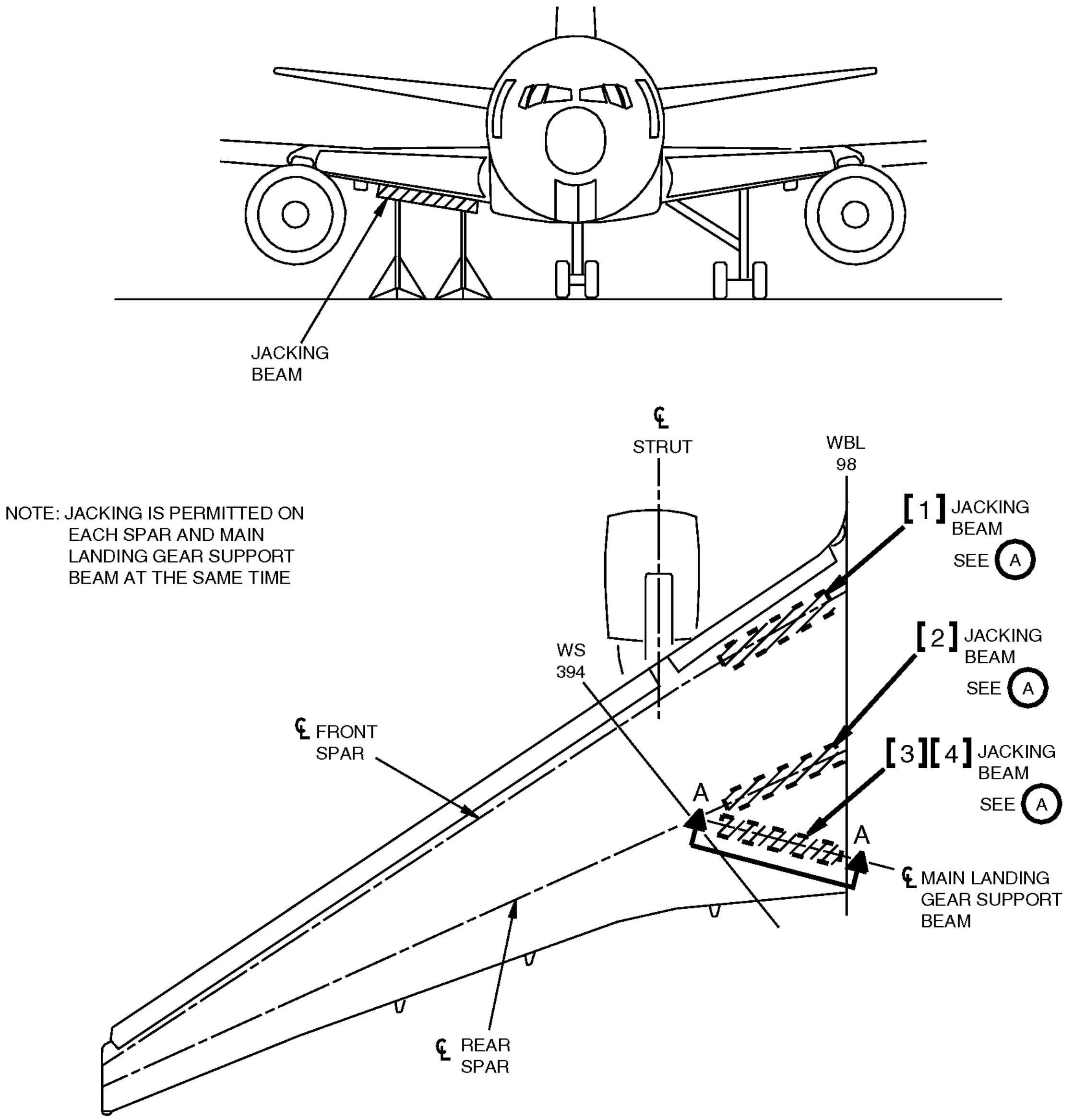
Figure 3-51 A07002 EMERGENCY JACKING EQUIPMENT - NLG





1 LB EQUALS 0.4536 KG

Figure 3-52 MAXIMUM ALLOWABLE JACKING LOADS, MLG BEAM AND WING SPARS- 767-200, -300, -400ER



767-200 WING SHOWN - OTHER MODELS SIMILAR

[1] AT THE FRONT SPAR THE LOAD IS:
767-200,-300: 7180 LB (3257 KG) FOR EACH FOOT
767-400ER: 7,900 LB (3583 KG) FOR EACH FOOT

[2] AT THE REAR SPAR THE LOAD IS:
767-200,-300: 10,800 LB (4899 KG) FOR EACH FOOT
767-400ER: 11,900 LB (5397 KG) FOR EACH FOOT

[3] AT THE MAIN LANDING GEAR SUPPORT BEAM LOAD IS:
767-200,-300: 15,000 LB (6804 KG) FOR EACH FOOT
767-400ER: 16,500 LB (7484 KG) FOR EACH FOOT

[4] 767-400ER ONLY,
FOR SPECIAL INSTRUCTIONS ON INSTALLING JACKING BEAM UNDER MAIN LANDING GEAR BEAM

Figure 3-53 MAXIMUM ALLOWABLE JACKING LOADS, MLG BEAM AND WING SPARS- 767-200, -300, -400ER

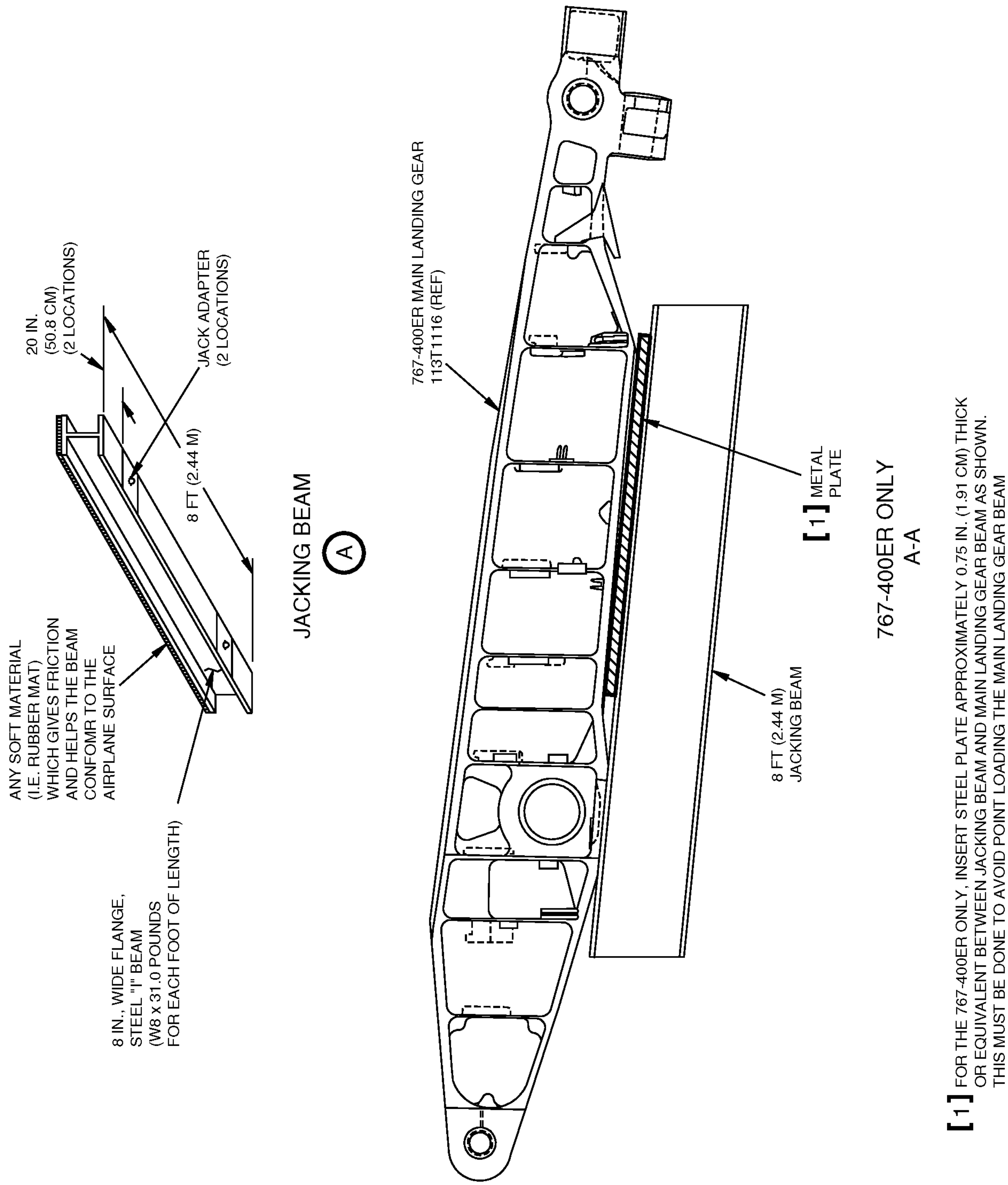
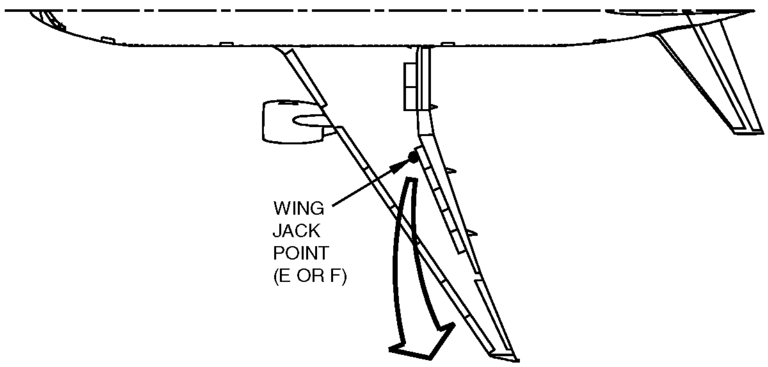


Figure 3-54 AN AXLE JACK USED AT THE MAIN WING JACK POINT



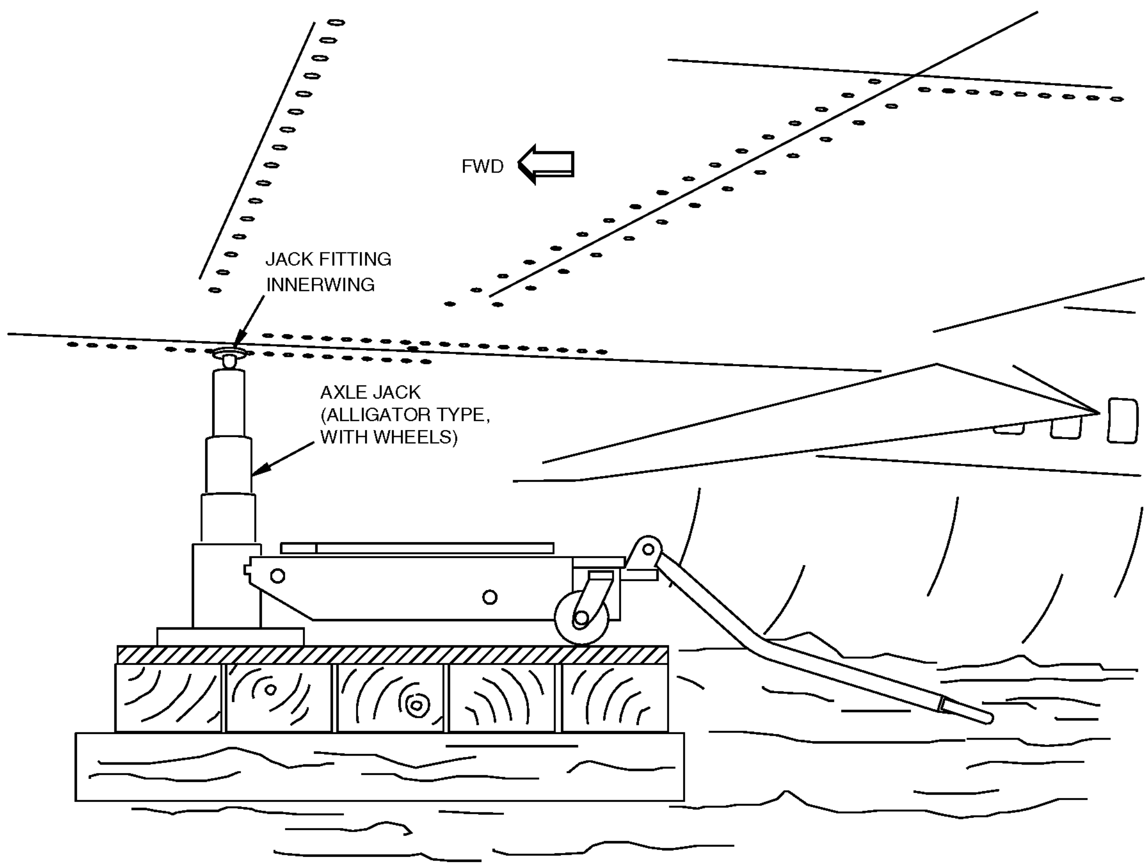


Figure 3-55 THE INITIAL LIFT WITH AXLE JACK AND PNEUMATIC ELEVATORS AT THE FORWARD AUXILIARY BODY JACK POINT

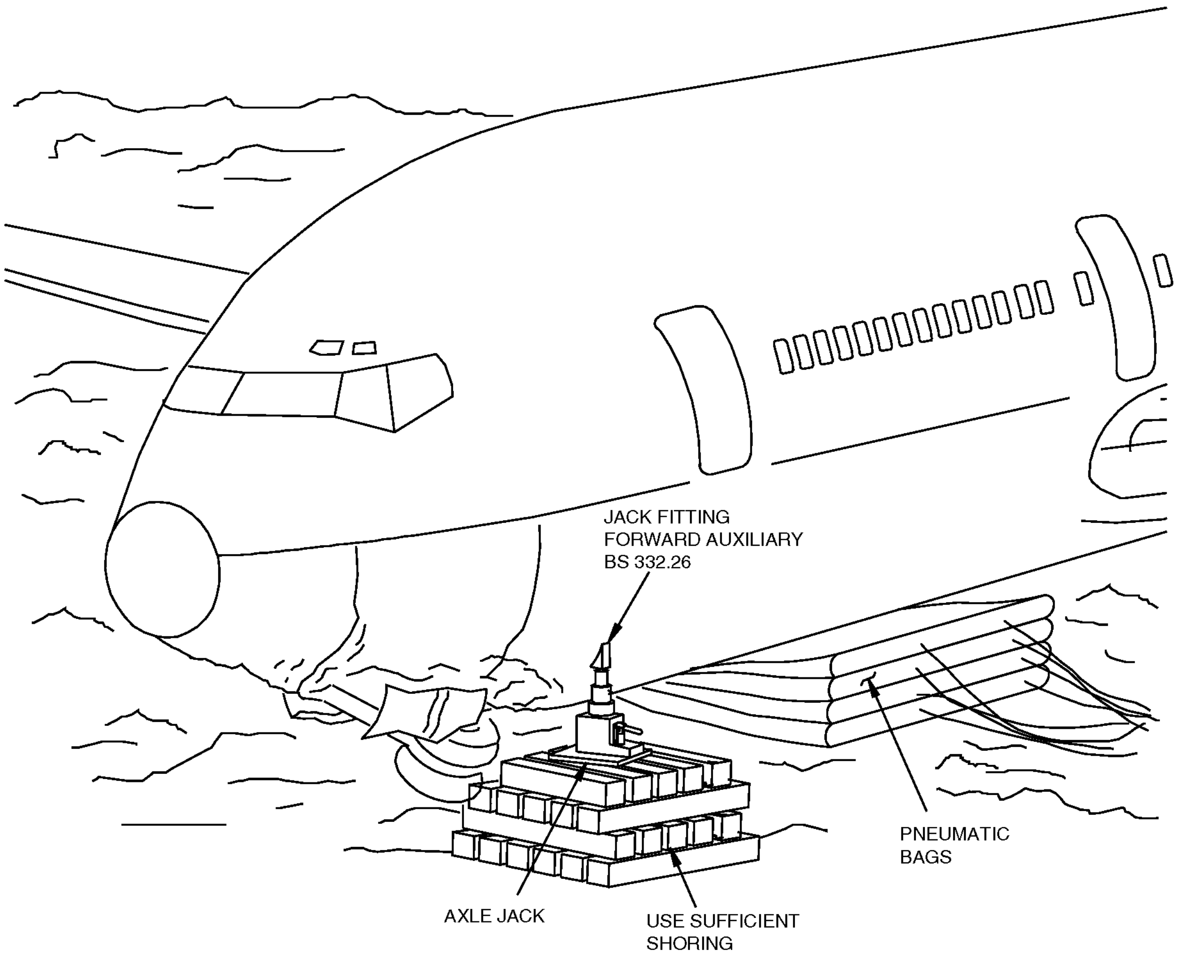
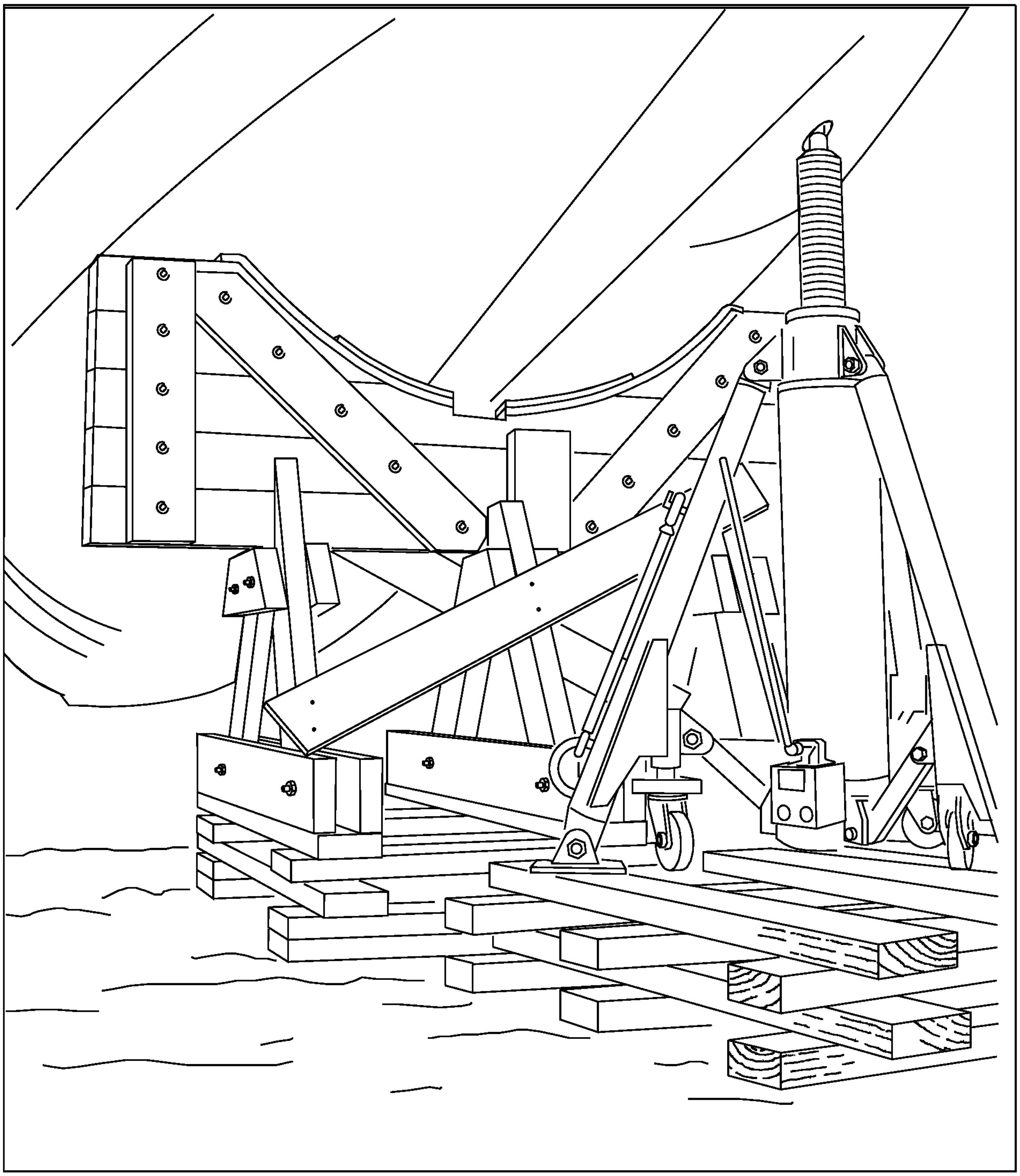


Figure 3-56 CONTOUR SHORING WHILE JACKING

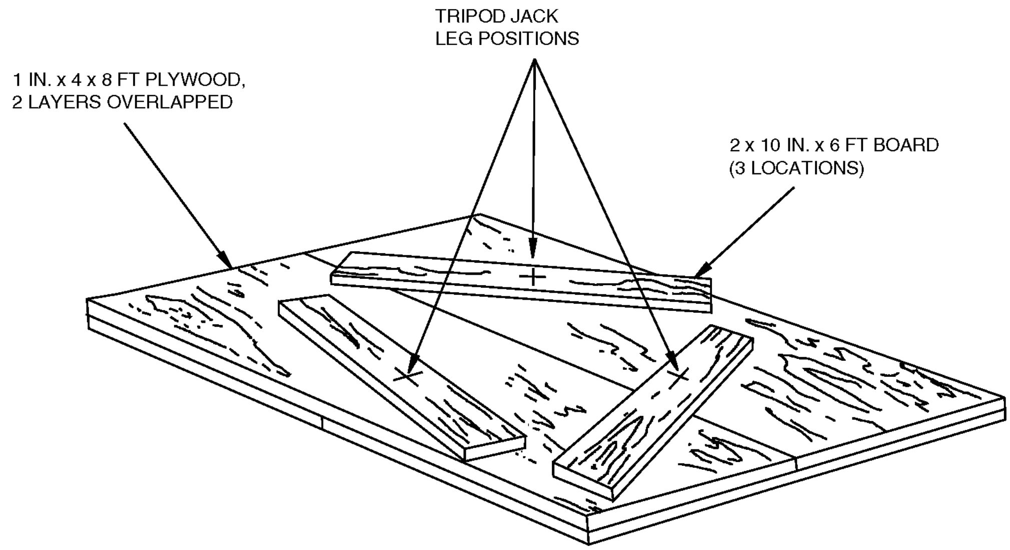


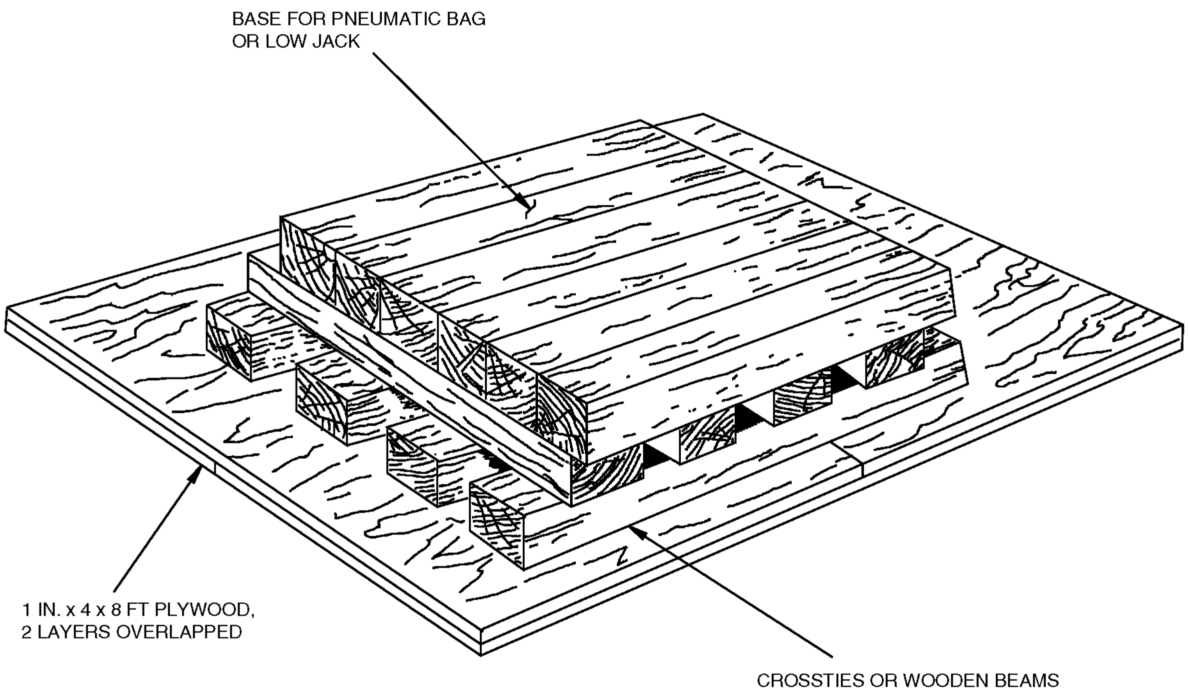
3-30-6 Important Data about the Surfaces Under the Jack

1. When you use a jack, it must be on a hard, prepared surface with a sufficient strength. You must have this strength to permit the usual jack loads. If you have a surface with a strength that is not sufficient, you must prepare the area. You can install steel plates ($\frac{1}{2}$ in. (13 mm) thick) or layers of wood (plywood sheets, $\frac{3}{4}$ in. (19 mm) thick) to make a surface for the jacks.

   Usual prepared surfaces for soft ground conditions are shown in Figure 3-57. If you have very soft ground, you must remove the material and put new material (crushed rock) into the area. This new material gives you a surface with a sufficient strength. Make sure that the surface below the jack is a level surface.
2. You must use supports (shoring) for jacks that can not lift the airplane to the correct height. This condition usually occurs when the jack point on the airplane is higher than the lowest height of the jack. Use available wood (timbers) for the supports. Put covers on the supports made of steel plates or layers of other wood ($\frac{3}{4}$ in. (19 mm) thick plywood sheets). Make sure that the supports are level for a stable condition.
3. You must have a procedure that monitors the horizontal movement of the airplane while you lift the airplane. We recommend a tool (plumb bob) attached to the bottom centerline of the fuselage. This tool is then aligned to a check point (target) on the ground surface.
4. You must have a system that permits all persons to speak with the other persons while they lift the airplane.

Figure 3-57 JACK SUPPORT BASES FOR SOFT GROUND





NOTE: 3/4-INCH THICK PLYWOOD IS OPTIONAL WHEN 1-INCH IS NOT AVAILABLE.
SHEETS OF STEEL PLATE ARE OPTIONAL IF PLYWOOD IS NOT AVAILABLE

3-30-7 Use These Precautions when You Use Jacks

1. When you lift the airplane with jacks, different jacks usually have different procedures. Make sure that you use the correct procedures for your type of a jack.
2. The persons who lift the airplane with jacks must include a person to monitor each jack. These persons must also include a person to monitor the movement tool (plumb bob) and a person to control the full operation. Adjust each jack only when the control person tells you to adjust it. Each jack person must monitor the jack gage continuously. Each jack person must immediately tell the control person of all problems in that jack area.
3. If the airplane moves horizontally (in an arc) while you lift the plane, you must be careful with the jacks. Make sure that the jack points move no more than the travel limits of the jacks. Each jack person must tell the control person when a jack is near its travel limit. When a jack point moves to the travel limit of a jack, a new jack position can be necessary. It can also be necessary to put some new supports in the area while you move the jack.

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3-30-8 General Procedures When You Use Recovery Jacks

1. Put the jack in a position below the airplane jack point.
2. Make the jack level with a tool (carpenter's level) on the head of the jack. Make sure the strength of the ground surface below the jack is sufficient for the usual jack loads. Use the higher heights (screw extensions) on the jack if it is necessary.
3. Connect the jack to its console with the hydraulic lines. On tripod type jacks, make sure you use the color code correctly. Connect each color line to the correct color jack leg. Connect the air line to the console.
4. Lift each jack point when the control person tells you to lift it. See the instructions from the manufacturer for correct jack procedures.

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3-30-9 When You Use the Equipment for Emergency Axle Jacks

1. When you have a flat tire on the NLG or the MLG, special equipment can be necessary. The ground clearance can be too small to permit you to use the usual axle jacks. See Figure 3-50 and Figure 3-51 for details on the jack equipment for this condition.
2. Before you use the jacks, make sure that you install the locks (downlock pins) in the landing gears. Use the applicable procedures from the maintenance manuals to lift the gears to the usual jack height. This height permits you to use a jack between the gear jack point and the ground. Install the usual gear axle jack. Lift the gear with the usual gear axle jack to a height that permits you to replace a wheel.

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3-30-10 When You Lift the Airplane with Pneumatic Bags

1. We recommend this type of a pneumatic bag:
   A. High stability (with internal drop threads)
   B. Multiple-element
   C. Small capacity - 25 ton (22 metric ton) (see Figure 3-58)
   D. Large capacity - 40 ton (36 metric ton) (see Figure 3-59)

   CAUTION: YOU MUST KNOW HOW THE BAGS OPERATE. MAKE SURE THAT YOU KNOW THE CAPACITY OF THE BAG AND THE MAXIMUM PERMITTED BAG PRESSURE ON THE AIRPLANE. THERE IS A DIFFERENCE.

   CAUTION: USE PNEUMATIC BAGS ONLY AS A TEMPORARY SOLUTION. YOU MUST REPLACE THEM WITH MORE POSITIVE SUPPORTS AFTER YOU LIFT THE AIRPLANE. SOME EXAMPLES OF MORE POSITIVE SUPPORTS ARE JACKS, STANDS, CRADLES, OR CRIBBING.

2. Usual bags of the small capacity are shown in Figure 3-57. Usual bags of the large capacity are shown in Figure 3-57. These figures show the bag pressure (inflation pressure). These figures also show the capacity that is available when you lift the airplane at that pressure. See Figure 3-60 and Figure 3-61 for bag locations and limits (allowable surface bearing loads).

   CAUTION: DO NOT LIFT THE AIRPLANE IN HIGH WINDS (MORE THAN 17 KNOTS/20 MPH/32 KM PER HOUR). IF THE TERRAIN IS SOFT (OR MARSHY), USE AVAILABLE MATERIALS TO MAKE THE SURFACE SATISFACTORY. MAKE SURE THAT THE BAGS ARE SAFE FROM SHARP OBJECTS ON THE GROUND OR ON THE AIRPLANE. WHEN YOU INFLATE THE BAGS, MAKE SURE THAT THE VALVES DO NOT CAUSE DAMAGE TO AN ADJACENT BAG.

   CAUTION: USE A TETHER SYSTEM WHEN YOU USE PNEUMATIC BAGS. THERE ARE LARGE HORIZONTAL FORCES IN ALL BAG PROCEDURES. WHEN YOU LIFT THE AIRPLANE, ADJUST THE TETHER LINES TO PREVENT AIRPLANE DAMAGE AT THE TETHER POINTS.

   CAUTION: MAKE ADDED SUPPORTS (CRIBS) WITH THE PNEUMATIC BAGS. THE BAGS CAN SUDDENLY OPEN (BURST). TO PREVENT DAMAGE OR INJURY, YOU MUST MAKE SUFFICIENT ADDED SUPPORTS TO HOLD THE WEIGHT OF THE AIRPLANE.

3. The manufacturers make the bags as stable as possible. This does not prevent large horizontal forces in all bag procedures. These forces make a condition that is not stable. Make sure that you use a tether system (see SECTION 3-20).
4. Lift the airplane from the lowest point first. Make sure that the airplane gets to a level attitude. Make sure that the airplane also stays as level as possible while you lift it. Attach a tool (plumb bob) to the nose or to the lower fuselage. This tool helps you to monitor the position of the airplane. This tool also helps you keep the horizontal forces (side loads) on the bags to a minimum.
5. Put the bags in positions that permit the center of their total force to align with the airplane CG. Install the bags very carefully. This prevents more damage to the airplane. The areas for the bag locations along the fuselage and wings are shown in Figure 3-60 and Figure 3-61.
6. The areas for the bag locations must be clear of all sharp objects. Remove all sharp objects (jagged edges or sharp protuberances) from the incident area. Prevent damage to the air bags. Put a layer of plywood that is 1 in. (25 mm) thick below the air bags. Put a cover (tarpaulin) on top of the air bags.

7. The airplane areas for the bags have special load limits (allowable surface bearing loads). The maximum loads for each area are shown in Figure 3-61. The top two bags in a location must not have pressures that are more than the maximum for that area. The lower bags in a location must have the pressures recommended by the manufacturer for the best stable condition.

CAUTION: DO NOT LIFT THE AIRPLANE IN HIGH WINDS (MORE THAN 20 MPH OR 17 KNOTS). IF THE TERRAIN IS SOFT (OR MARSHY), USE AVAILABLE MATERIALS TO MAKE THE SURFACE SATISFACTORY. MAKE SURE THAT THE BAGS ARE SAFE FROM SHARP OBJECTS ON THE GROUND OR ON THE AIRPLANE. WHEN YOU INFLATE THE BAGS, MAKE SURE THAT THE VALVES DO NOT CAUSE DAMAGE TO AN ADJACENT BAG.

CAUTION: BE CAREFUL WHEN YOU INFLATE THE BAGS. THE INFLATED PRESSURES OF THE TOP TWO ELEMENTS MUST BE LESS THAN THE PRESSURES LISTED IN THE TABLE IN FIGURE: 40 TON HIGH STABILITY PNEUMATIC LIFT BAG AND ITS LIFT CAPABILITY. THIS WILL MAKE SURE THAT THE SURFACE LOADS ARE NOT TOO LARGE. THEN THERE WILL BE NO DAMAGE TO THE AIRPLANE SURFACE.

8. Before you inflate the bags, examine the procedures and the safety precautions. Make sure that all the necessary equipment (jacks, cribs) is prepared and available. A level airplane attitude must be your primary task. You must get a level attitude and you must keep it while you lift the airplane. Use tools (plumb bobs and carpenter's levels) to help you keep a level attitude. Keep the tether lines tight while you lift the airplane.

9. Put each console in a position where the console person can clearly see and hear the control person (the person who controls all the procedures). This is very important while you lift the airplane. Prepare (flush) the console with air from the compressor.

10. When the protection pads are in their positions, inflate the lowest bag element. Inflate this element until you make a connection between the bags and the airplane. Inflate the second bag element from the top to tighten the connection (contour line). In this second bag element, start with the compartment that is nearest to the connection. Inflate all compartments of this bag element. Make sure that you make no deformations (folds or creases) while you inflate the bags.

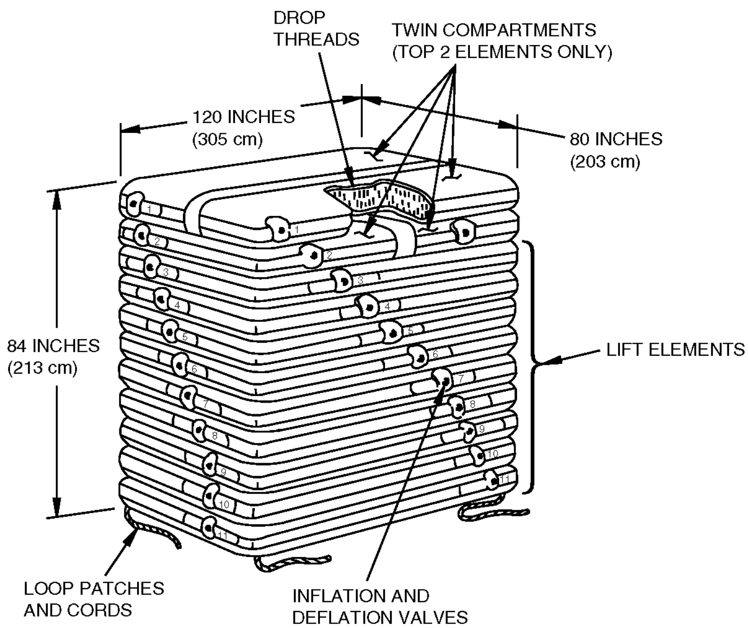
    Inflate the lower bag elements to the maximum pressures shown in Figure 3-58 and Figure 3-59. This will help to make the bags stable. The bag pressures shown in Figure 3-61 put a limit on the bag capacity available to lift the airplane.

11. Adjust the air bag supports (cribs) to permit the bags to follow the shape of the lower wing and body surfaces. It can be necessary to use jacks on the supports (cribs) to adjust them to the movement of the airplane.

    NOTE: Be careful when you use foam between the airplane and the pneumatic bags. The bags can put large horizontal loads into the foam. These loads can twist or break the foam block or the bag that holds the foam. For more data, see SUBJECT 3-30-11.

12. You can use air bags as high as 7 ft (2.13 m) without support (cribs) but we recommend a safer alternative. If the bags open (burst) or the winds change, the airplane can suddenly move. This can cause airplane damage and injury to persons. Thus, we recommend a height limit of 2 ft (0.61 m) above the supports (cribs). You must make the supports higher if it is necessary for the bags to go higher.

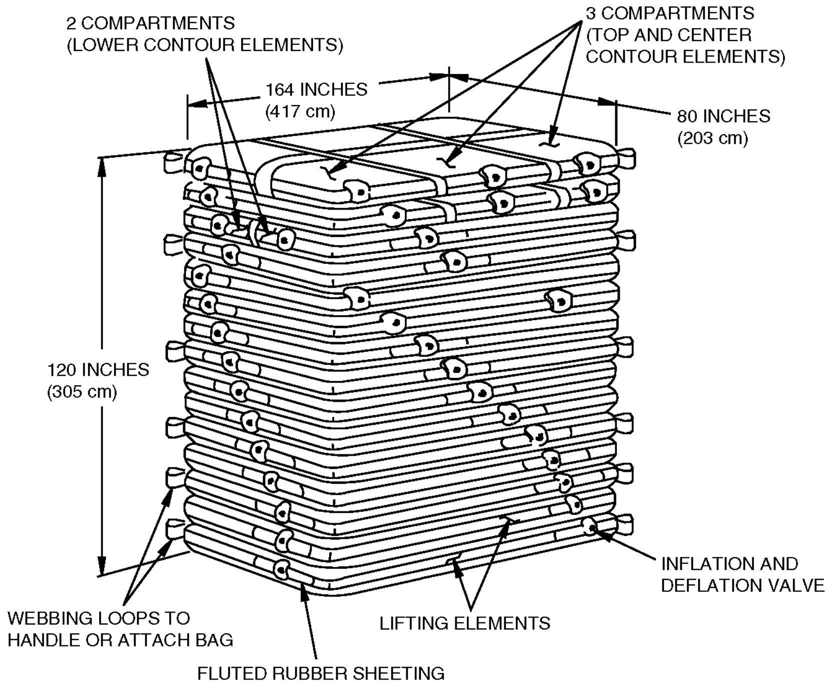
Figure 3-58 25 TON HIGH STABILITY PNEUMATIC LIFT BAG AND ITS LIFT CAPABILITY



NOTE: APPLY FABRIC TO VALVES TO PREVENT DAMAGE TO ADJACENT BAG WHEN INFLATING OR DEFLATING.

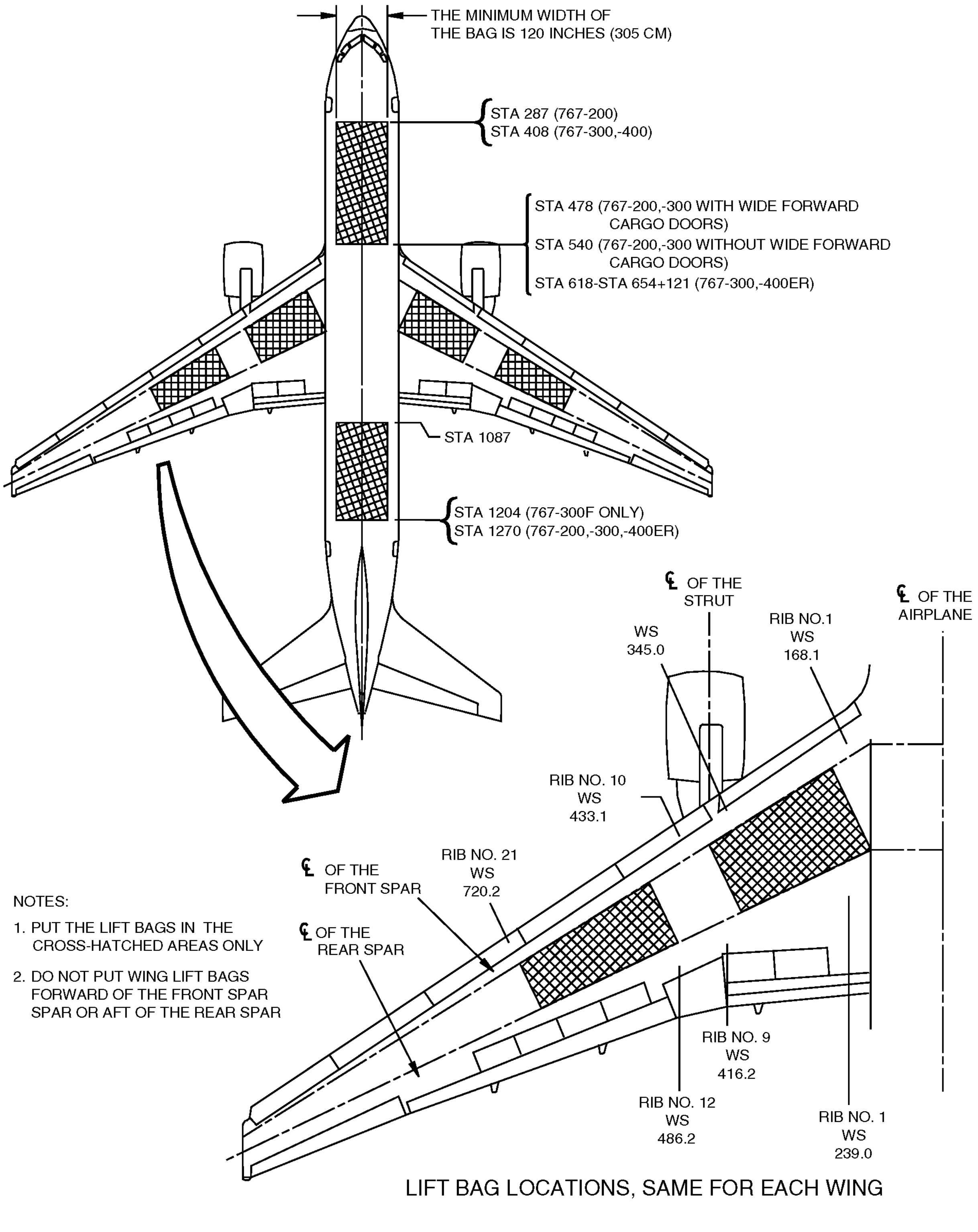
25 T (23 METRIC TONS) PNEUMATIC BAG LIFT CAPACITY IN POUNDS (KILOGRAMS)								
Pressure psi (kg/sq cm)	1 Bag	2 Bags	3 Bags	4 Bags	5 Bags	6 Bags	7 Bags	8 Bags
2.13 (0.15)	17,130 (7,770)	34,260 (15,540)	51,390 (23,310)	68,520 (31,081)	85,650 (38,850)	102,780 (46,621)	119,910 (54,391)	137,040 (62,161)
2.84 (0.20)	23,500 (10,660)	47,000 (21,319)	70,500 (31,979)	94,000 (42,638)	117,500 (53,298)	141,000 (63,958)	164,500 (74,617)	188,000 (85,277)
3.56 (0.25)	30,100 (13,653)	60,200 (27,307)	90,300 (40,960)	120,400 (54,613)	150,500 (68,267)	180,600 (81,920)	210,700 (95,574)	240,800 (109,227)
4.26 (0.30)	37,310 (16,924)	74,620 (33,848)	111,930 (50,771)	149,240 (67,635)	186,550 (84,619)	223,860 (101,543)	261,170 (118,467)	298,480 (135,391)
5.0 (0.35)	44,840 (20,339)	89,680 (40,679)	134,520 (61,018)	179,360 (81,358)	224,200 (101,697)	269,040 (122,037)	313,880 (142,376)	358,720 (162,715)
5.7 (0.40)	52,740 (23,923)	105,480 (47,846)	158,220 (71,769)	210,960 (95,691)	263,700 (119,614)	316,440 (143,537)	369,120 (167,434)	421,920 (191,383)
6.0 (0.42)	55,840 (25,329)	111,680 (50,658)	167,520 (75,987)	223,360 (101,316)	279,200 (126,645)	335,040 (151,974)	390,880 (177,303)	446,720 (202,632)

Figure 3-59 40 TON HIGH STABILITY PNEUMATIC LIFT BAG AND ITS LIFT CAPABILITY



40 T (36 METRIC TONS) PNEUMATIC BAG LIFT CAPACITY IN POUNDS (KILOGRAMS)						
Pressure psi (kg/sq cm)	**1 Bag**	**2 Bags**	**3 Bags**	**4 Bags**	**5 Bags**	**6 Bags**
1 (0.07)	12,600 (5715)	25,200 (11431)	37,800 (17146)	50,400 (22861)	63,000 (28577)	75,600 (34292)
2 (0.14)	25,250 (11453)	50,500 (22907)	75,750 (34360)	101,000 (45814)	126,250 (57267)	151,500 (68720)
3 (0.21)	37,900 (17191)	75,800 (34383)	113,700 (51574)	151,600 (68766)	189,500 (85957)	227,400 (103149)
4 (0.28)	50,560 (22934)	101,120 (45868)	151,680 (68802)	202,240 (91736)	252,800 (114670)	303,360 (137604)
5 (0.35)	63,200 (28668)	126,400 (57335)	189,600 (86003)	252,800 (114670)	316,000 (143338)	379,200 (172005)
6 (0.42)	75,800 (34383)	151,600 (68766)	227,400 (103149)	303,200 (137532)	379,000 (171914)	454,800 (206297)
7 (0.49)	88,450 (40121)	176,900 (80242)	265,350 (120363)	353,800 (160484)	442,250 (200605)	530,700 (240726)

Figure 3-60 PNEUMATIC BAG PLACEMENT LOCATION

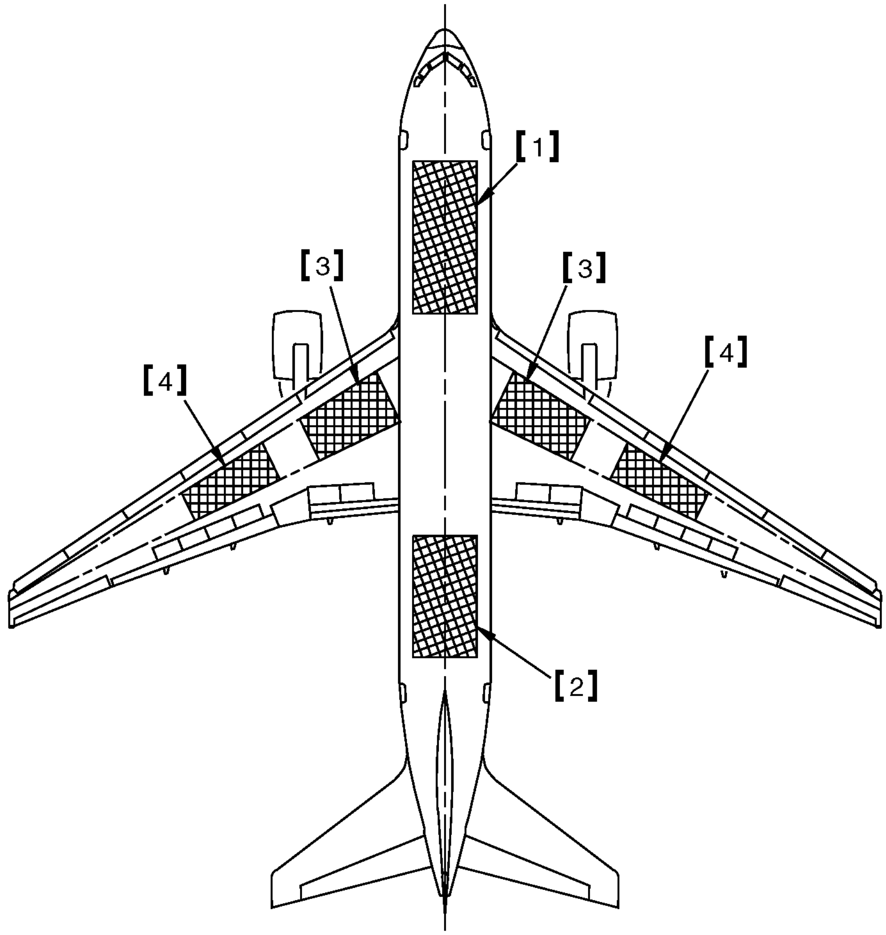


NOTES:

1. PUT THE LIFT BAGS IN THE CROSS-HATCHED AREAS ONLY
2. DO NOT PUT WING LIFT BAGS FORWARD OF THE FRONT SPAR SPAR OR AFT OF THE REAR SPAR

LIFT BAG LOCATIONS, SAME FOR EACH WING

Figure 3-61 MAXIMUM ALLOWABLE SURFACE BEARING LOADS



727-200 SHOWN
OTHER MODELS SIMILAR

[1] THE MAXIMUM PERMITTED BAG PRESSURE IS 6 PSI (.4218 KG/SQUARE CM). THE TOTAL PERMITTED LOAD IS 120,000 POUNDS (54432 KILOGRAMS)

[2] THE MAXIMUM PERMITTED BAG PRESSURE IS 6 PSI (.4218 KG/SQUARE CM). THE TOTAL PERMITTED LOAD IS 110,000 POUNDS (49896 KILOGRAMS)

[3] FOR THE 767-200,-300:
THE MAXIMUM PERMITTED BAG PRESSURE IS 6.0 PSI (.4218 KG/SQUARE CM). THE TOTAL PERMITTED LOAD IS 168,000 POUNDS (76205 KILOGRAMS)

FOR THE 767-400ER:
THE MAXIMUM PERMITTED BAG PRESSURE IS 6.6 PSI (.4640 KG/SQUARE CM). THE TOTAL PERMITTED LOAD IS 184,800 POUNDS (83824 KILOGRAMS)

[4] THE MAXIMUM PERMITTED BAG PRESSURE IS 4 PSI (.2812 KG/SQUARE CM). THE TOTAL PERMITTED LOAD IS 100,000 POUNDS (45360 KILOGRAMS)

NOTES:

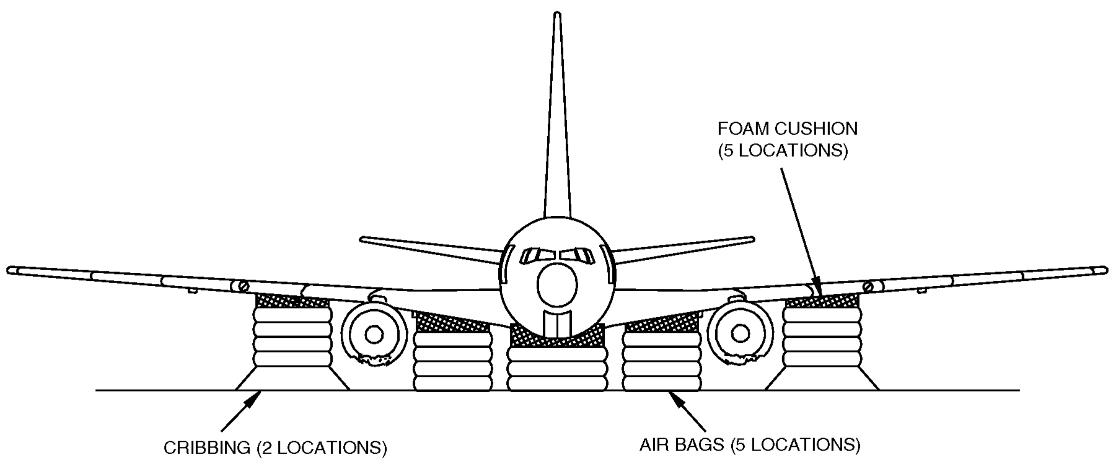
1. PUT THE LIFT BAGS IN THE CROSS-HATCHED AREAS ONLY
2. DO NOT PUT WING LIFT BAGS FORWARD OF THE FRONT SPAR OR AFT OF THE REAR SPAR

3-30-11 When You Use Filler Material (Foam) for Support (Contour Line)

1. Use filler material (foam) if it is necessary to give better support between the bags and the airplane. This permits the bag system to follow the shape of the airplane and to have a more stable condition. This is very important while you lift the airplane. The filler material is only permitted above the bag areas shown in Figure 3-62.
2. There are two different types of filler systems (foam) available to lift the airplane:
   A. The first type is a blown (polyurethane free-blown) system. You must make a wood perimeter around the top bags to contain the foam in the area above the bags. The clearance above the air bags must be a minimum of 6 in. (15 cm) before you use the foam.
   B. The second type uses a mixture of sodium silicate and isocyanate that you put into special glass fiber bags. The clearance above the air bags must be a minimum of 3 in. (7.6 cm) before you start.

   NOTE: Be careful with the special glass fiber bags. You can use the bags many times.

Figure 3-62 FOAM CUSHION FOR CONTOUR SHORING



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3-30-12 When You Lift the Airplane with Movable Cranes

1. General

   A. Large movable cranes with the correct slings are possibly the fastest procedure you can use to lift a damaged airplane. But the strength of the ground surface must be sufficient to hold the cranes.

   B. If you have a folded nose gear, a movable crane is the easiest equipment you can use. You can lift the forward fuselage in a one-step procedure (see Figure 3-63).

   C. You can use a three-point system to lift the airplane if the necessary structures are not damaged. You can go through the wings to the main landing gear trunnion. Then you lift the airplane from two wing points and a sling on the forward fuselage. This is the three-point system (see Figure 3-33). This system prevents many of the problems you can have if you lift the airplane with jacks or bags.

2. Prepare to Use Cranes and Slings

   A. Make sure that all the basic procedures in SECTION 3-20 of this Chapter are completed.

   B. Be very careful when you use a movable crane to prevent injury to persons and damage to equipment. We recommend these precautions:

   C. Use only persons (crane operators and hook tenders) who operate these cranes frequently.

   D. Each crane person must get only special signals. These signals only come from the crane hook person or from the control person for the full operation.

   E. Make a visual inspection of all slings. Look for worn or damaged areas. Install the slings carefully. Use pads or wood blocks for protection.

   F. Make sure the lines that prevent movement are always tight. Be careful. Release the lines if it is necessary, while you lift the airplane.

   G. Examine the scheduled procedure with all crane persons. Make sure all persons know the possible safety problems.

   H. When the strength of the ground surface is not sufficient for movable cranes, prepare the area. You can prepare the area with better material (gravel fill), steel plates or wood. You can use one or all of these alternatives (see SUBJECT 2-10-4).

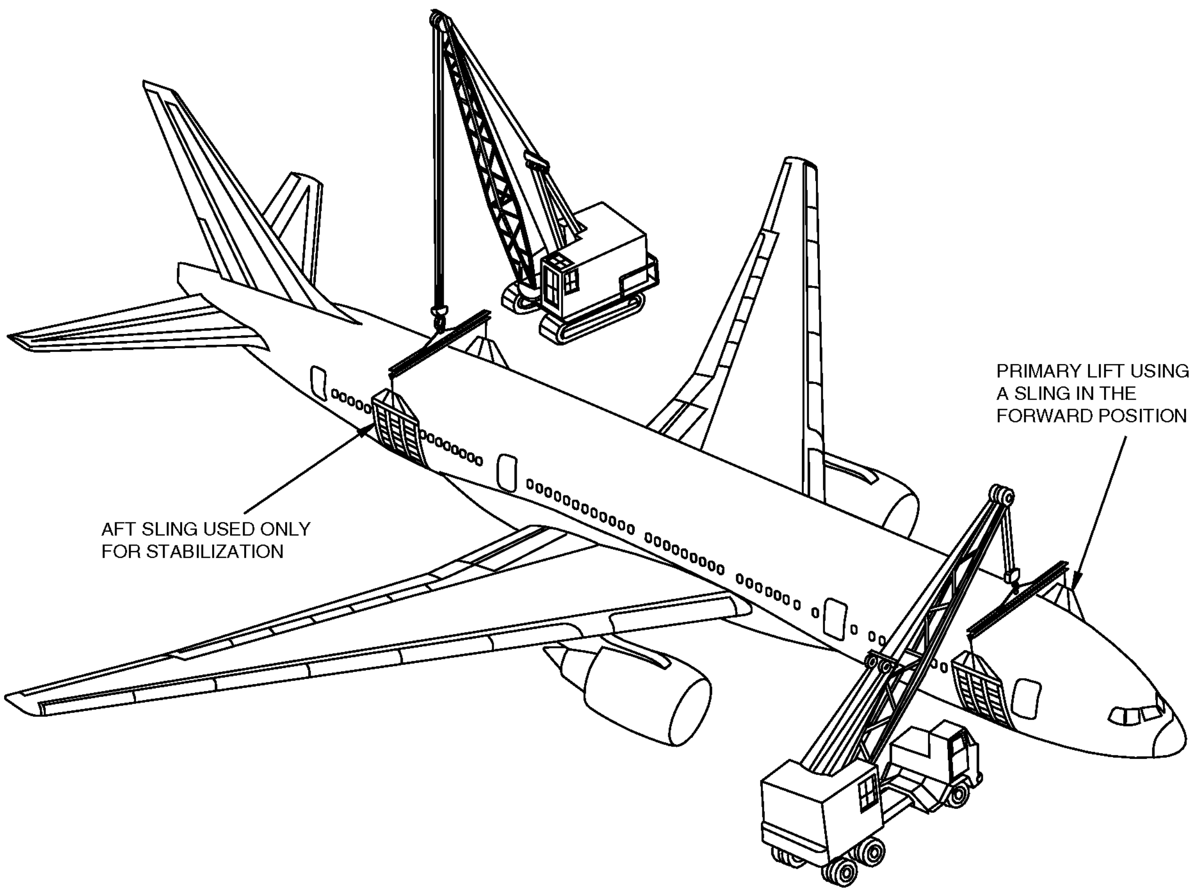
   WARNING: SEE THE SPECIFICATIONS OF THE MANUFACTURER FOR THE CRANE BOOM LIMITS (DESIGN OR OPERATION). THESE LIMITS HELP YOU FIND THE CAPACITY OF A CRANE THAT IS NECESSARY.

   I. Use cranes with a sufficient capacity. Do not operate the cranes at more than the specified loads. Know the relation between the specified loads and the boom angle. Use caution marks (warning indicators) if they are available. See Figure 3-65 thru Figure 3-67 for the values of a usual movable crane (75, 140 or 250 ton or 68, 127 or 227 metric ton capacity). The values are for the relation between specified loads and boom angles.

   CAUTION: THE AIRPLANE SHOULD NEVER BE LIFTED ENTIRELY WITH ONLY TWO CRANES.

   J. Figure 3-63 shows an example of using a crane to lift the forward fuselage section of an airplane in which the nose landing gear has sustained damage and cannot support the weight of the airplane. A crane is used at the aft portion of the airplane to prevent damage to the fuselage in case of sudden aft CG movement. See Figure 3-70 for maximum allowable lifting loads per frame.

Figure 3-63 THE LIFT OF THE NOSE WITH A MOBILE CRANE AND SLING - NOSE WHEEL



3-30-13 When You Lift the Airplane with Three Cranes

1. You can lift the total airplane with three cranes (140 t (127 metric tons) or (250 t (227 metric tons)). See Figure 3-33. Crane sizes will change based on the lifting weight of the airplane and the positions of the cranes. See SUBJECT 2-30-5 for airplane weights. See Figure 3-65, Figure 3-66 and Figure 3-67 for the usual boom crane ratings. These are the possible causes for requiring the use of three cranes:
   A. You do not have access to the area below the airplane.
   B. You must replace all of the landing gear before you move the airplane.
   C. You must lift the airplane to a trailer that permits you to remove the airplane from the runway.
2. You can lift the total airplane weight only with cranes at special locations. Put a crane and a recovery sling at the forward fuselage and two cranes, one on each side of the fuselage, behind the wing as shown on Figure 3-33. This arrangement is for lifting an airplane with a center of gravity that is forward of the main landing gear (i.e. forward CG). When an aft CG lifting situation is necessary, a crane used for stabilization must be placed at the aft fuselage instead of the forward fuselage.

   WARNING: DO NOT USE TETHER LINES ATTACHED TO THE LIFTING SLING TO MAKE THE AIRPLANE STABLE, WHILE YOU USE THE J07008, OHM65B00002 OR 3OHME65B0002 RECOVERY SLINGS TO LIFT THE AIRPLANE.
3. Put the cranes as near as possible to the airplane. Install the recovery sling to stabilize the airplane from the forward fuselage (forward CG situation) position.

   NOTE: The 747 recovery sling 3OHME65B00002 or OHME65B00002 can be used on the 767 airplane. The J07008 recovery sling replaces 3OHME65B00002 and OHME65B00002 for future procurement for 747, 767, and 777 airplanes. See Figure 3-70 for fuselage locations where recovery sling can be used and the maximum loads which can be applied at these positions.
4. The method that you choose to lift the airplane using the MLG will depend on the condition of the MLG and the MLG beam. The following provides the possible scenarios:
   A. The MLG is intact (folded or not folded), or
   B. The MLG is sheared/partially sheared from its support structure (the "support structure" includes the wing rear spar and/or the MLG beam).
5. If the MLG is intact, you can lift the airplane as follows:
   A. Remove the wing skin panels in the area above the MLG trunnion. Remove items in this area that prevent the necessary clearance. These items can be electrical wires or hydraulic lines. They can also be a part of the airplane structure.
   B. The following is applicable for the 767-200, -300 models only:

      CAUTION: THE USE OF THE A07005-2 HOIST ADAPTER REQUIRES THAT YOU MUST NOT EXCEED (IN ANY DIRECTION) A 2.5 DEGREE DEVIATION FROM AN IMAGINARY VERTICAL LINE WHEN LIFTING THE AIRPLANE. EXCEEDING THIS LIMIT COULD CAUSE OVERSTRESSING AND POSSIBLE FAILURE OF THE MLG OUTBOARD FITTING.

      (1) Install the tool (MLG trunnion sling or hoist adapter A07005-1 or -2). If you use the hoist tool (adapter, A07005-1 or -2), you must examine the quantity of damage to the landing gear structure. The procedure for this hoist tool applies to the landing gear on the left and the right wings. See Figure 3-68. One of the two part numbers of the tool (-1 or -2) is used for these conditions:
         - Use the A07002-1 when the spindle fitting of the drag strut is not damaged. You can remove the drag strut at the top end of the spindle.

- Use the A07002-2 when the fuse pins at the outboard fitting of the main MLG beam are damaged. You can move this beam to permit access to the fitting.

C. The following method is applicable for all 767 models:

CAUTION: WHEN USING A SLING WRAPPED AROUND THE TOP OF THE MLG TRUNNION, YOU MUST NOT EXCEED (IN ANY DIRECTION) AN EIGHT DEGREE DEVIATION FROM AN IMAGINARY VERTICAL LINE WHEN LIFTING THE AIRPLANE. EXCEEDING THIS LIMIT COULD CAUSE OVERSTRESSING AND POSSIBLE FAILURE OF THE MLG TRUNNION SUPPORT FITTINGS.

(1) Remove hydraulic hoses and fittings from around the upper part of the MLG trunnion. Then wrap a sling (such as Lift-All braided roundsling B6E1000 or SlingMax TPXC25000 or equivalent) around the trunnion as shown in Figure 3-68.

NOTE: Do an inspection of the MLG and its supporting structure to make sure that the forward and aft trunnion connect points to the wing rear spar and the MLG beam, respectively, have not been damaged before using a sling around the MLG trunnion to lift the airplane. Any significant damage to these interfaces will make it unsafe to lift the airplane using this lifting method. See alternate lifting tool p/n To Be Determined (TBD) when forward and/or aft trunnion connect interfaces are damaged.

6. If the MLG is sheared or partially sheared from its support structure, a different lifting method than the one in paragraph 5. must be used. There are two scenarios that are possible when the MLG is sheared or partially sheared from the airplane:

   A. There is no structural damage to the MLG beam, or

   B. There is structural damage to the MLG beam.

7. If the MLG is sheared or partially sheared from its support structure and there is no structural damage to the MLG beam, contact The Boeing Company for further instructions on lifting the airplane using this location on the airplane.

8. If the MLG beam has structural damage, contact The Boeing Company for further instructions on lifting the airplane using this location on the airplane.

9. Figure 3-64 summarizes the hoist equipment to use for each lifting scenario when you use three cranes picking up from the MLG and the MLG support structure.

10. Be careful when you lift the airplane. Make sure that you keep the airplane level and that you prevent a sudden movement of airplane loads. You must have a system that permits each person to speak with the other persons. This permits all three cranes to operate together. Tighten all the slings and cables before you start to lift the airplane. Start to lift the airplane slowly.

11. Stop regularly to examine the slings and the airplane attitude. Make the airplane level if it is necessary. When the airplane is at a satisfactory height, move it down to the necessary surface. The surface can be landing gears, jacks, supports (cribs) or trailers.

Figure 3-64 HOIST EQUIPMENT SUMMARY FOR 767 AIRPLANE LIFTING

MLG Condition	Hoist Equipment Required	
	No Structural Damage to MLG Beam	**Structural Damage Exists for MLG Beam**
Intact (with no damage to MLG trunnion to beam and/or trunnion to Rear Spar interface locations)	Lift-All Braided Roundsling B6E1000 or SlingMax TPXC25000 or equivalent (all 767 models) or A07005 Hoist Adapter (767-200, -300 only) (see paragraph 5.)	—
Sheared/Partially Sheared	P/N TBD: Contact The Boeing Company for further instructions. (see paragraph 7.)	P/N TBD: Contact The Boeing Company for further instructions. (see paragraph 8.)

Figure 3-65 THE USUAL MOBILE CRANE BOOM RATINGS (75 TON CRANE)

RADIUS IN FEET	LOAD RATINGS IN POUNDS — OVER SIDE AND OVER REAR WITH OUTRIGGERS — POWERED BOOM LENGTH, ALL POWERED SECTIONS EXTENDED EQUALLY														WITHOUT OUTRIGGERS	
	33 Feet		45 Feet		57 Feet		69 Feet		81 Feet		93 Feet		105 Feet			
	ANGLE	LB	ANGLE	LB	ANGLE	LB	ANGLE	LB	ANGLE	LB	ANGLE	LB	ANGLE	LB	OVER SIDE	OVER REAR
12	60	150,000	69	90,000	75	83,000									40,000	50,000
15	54	120,000	65	86,000	71	80,000	75	74,000	75	55,000 [1]					40,000	50,000
20	42	90,000	58	74,000	66	67,000	71	60,000	74	52,000	75	40,000 [1]			24,500	32,000
25	25	66,000	50	62,000	60	56,000	66	50,000	71	44,000	74	38,000	75	31,000 [1]	16,000	22,000
30			40	48,000	54	48,000	62	43,000	67	38,000	70	32,500	73	27,500	11,000	15,800
35			28	37,000	47	37,000	57	37,000	63	33,000	67	29.500	70	24,000	8,000	12,000
40					39	29,500	51	29,500	59	29,500	63	25,000	67	21,500	5,600	9,000
45					30	24,500	45	24,500	54	24,500	60	22,500	64	19,400	3,500	6,400
50							39	20,500	49	20,500	56	20,500	61	17,700	2,000	4,600
60									38	15,000	48	15,000	54	15,000	1,000	3,200
70											38	11,100	47	11,100	IF MORE THAN A 60 FOOT RADIUS, USE OUTRIGGERS	
80											25	8,000	38	8,000		
90													27	5,600		
100													1	4,200		

75 TON (68 M TON) HYDRAULIC TRUCK CRANE

NOTES:
1. RATINGS ABOVE THE THICK LINE ARE FOR THE SAFE STRUCTURAL AND HYDRAULIC CAPABILITIES OF THE CRANE. RATINGS BELOW THE THICK LINE ARE NOT AS SAFE; USE WITH CAUTION.
2. THE NUMBERS SHOWN ABOVE ARE FOR STANDARD CONDITIONS, SUCH AS A LEVEL GROUND LOAD LIFTED IN LINE WITH THE CRANE, THE USE OF OUTRIGGERS AND NO WIND EFFECT. THE OPERATING RADIUS IS THE DISTANCE FROM THE CENTER OF BOOM ROTATION TO THE CENTER OF GRAVITY OF THE LOAD.
3. 1 FT EQUALS 0.3048 METERS; 1 LB EQUALS 0.4536 KILOGRAMS.

[1] LOAD RATINGS FOR A MAXIMUM 75-DEGREE BOOM ELEVATION WILL BE AT A LONGER RADIUS THAN SHOWN.

Figure 3-66 THE USUAL MOBILE CRANE BOOM RATINGS (140 TON CRANE)

RATINGS IN POUNDS

OPER RAD FT	ANGLE	50 FT Boom		ANGLE	60 FT Boom		ANGLE	70 FT Boom		ANGLE	80 FT Boom		ANGLE	90 FT Boom		ANGLE	100 FT Boom	
		Boom PT EL	Rating LB		Boom PT EL	Rating LB		Boom PT EL	Rating LB		Boom PT EL	Rating LB		Boom PT EL	Rating LB		Boom PT EL	Rating LB
12	81	58.0	280,000															
15	78	57.5	220,800	80	67.6	196,000												
20	72	56.2	174,300	75	66.6	174,000	77	76.8	168,500									
25	66	54.3	128,000	70	65.1	129,400	73	75.6	129,100	75	85.8	128,800	77	96.3	128,500	78	106.5	128,200
30	60	52.0	103,900	65	63.1	104,600	69	74.1	104,300	71	84.2	104,000	73	94.6	103,700	75	104.2	103,400
35	53	48.6	85,200	59	60.1	85,900	64	71.6	85,600	67	82.2	85,300	70	93.1	85,000	72	103.8	84,700
40	45	44.0	73,600	54	57.1	74,300	59	68.6	74,000	64	80.6	73,700	67	91.5	73,400	69	102.1	73,100
45	36	37.0	62,700	47	52.5	63,400	55	66.0	63,100	59	77.2	62,800	63	88.8	62,500	66	100.1	62.200
50	24	28.0	54,050	40	48.2	54,750	49	61.4	54,450	55	74.1	54,150	60	86.6	53,850	63	97.7	53,550
60				22	30.9	42,750	37	50.6	42,450	46	66.1	42,150	52	79.6	41,850	56	91.5	41,550
70							20	33.4	35,200	35	54.4	34,900	43	70.0	34,600	49	84.1	34,300
80										19	34.4	29,350	32	58.0	29,050	41	74.1	28,750
90													17	35.8	24,750	31	59.9	24,450
100																17	37.5	20,000

140 TON (127 M TON) CRANE

NOTES:
1. RATINGS ABOVE THE THICK LINE ARE FOR THE SAFE STRUCTURAL AND HYDRAULIC CAPABILITIES OF THE CRANE. RATINGS BELOW THE THICK LINE ARE NOT AS SAFE; USE WITH CAUTION.
2. THE NUMBERS SHOWN ABOVE ARE FOR STANDARD CONDITIONS, SUCH AS A LEVEL GROUND LOAD LIFTED IN LINE WITH THE CRANE, THE USE OF OUTRIGGERS AND NO WIND EFFECT. THE OPERATING RADIUS IS THE DISTANCE FROM THE CENTER OF BOOM ROTATION TO THE CENTER OF GRAVITY OF THE LOAD.
3. 1 FT EQUALS 0.3048 METERS; 1 LB EQUALS 0.4536 KILOGRAMS.

Figure 3-67 THE USUAL MOBILE CRANE BOOM RATINGS (250 TON CRANE)

RATINGS IN POUNDS

OPER RAD FT	ANGLE	60 FT Boom		ANGLE	70 FT Boom		ANGLE	80 FT Boom		ANGLE	90 FT Boom		ANGLE	100 FT Boom	
		Boom PT EL	Rating LB		Boom PT EL	Rating LB		Boom PT EL	Rating LB		Boom PT EL	Rating LB		Boom PT EL	Rating LB
18	81	68.5	500,000	79	78.5	500,000									
20	78	68.0	456,000	78	78.5	455,000									
25	74	66.5	361,500	73	77.0	360,000	76	87.5	359,600	77	98.0	359,200			
30	68	64.5	265,500	69	75.5	264,700	72	86.0	264,700	74	96.5	264,600	76	107.0	264,600
35	63	61.5	207,000	65	73.5	212,700	68	84.5	212,400	71	95.0	212,000	73	105.5	211,500
40	57	58.5	168,200	60	71.0	173,300	64	82.0	272,900	67	93.0	172,500	70	104.0	172,000
45	51	54.0	141,100	55	67.5	145,900	60	79.5	145,500	64	91.0	144,900	66	102.0	144,400
50	45	49.0	121,200	50	64.0	125,700	56	76.5	125,200	60	88.1	124,700	63	99.5	124,100
60	27	33.0	94,000	38	53.5	98,000	47	68.0	97,400	52	81.5	96,800	57	93.5	96,200
70				22	36.0	74,000	36	56.5	79,300	44	72.5	78,700	49	86.0	78,000
80							20	37.5	63,200	34	59.5	65,900	41	76.0	65,200
90										19	39.5	52,200	32	62.5	55,700
100													18	41.0	46,400

250 TON (227 M TON) CRANE

NOTES:
1. RATINGS ABOVE THE THICK LINE ARE FOR THE SAFE STRUCTURAL AND HYDRAULIC CAPABILITIES OF THE CRANE. RATINGS BELOW THE THICK LINE ARE NOT AS SAFE; USE WITH CAUTION.
2. THE NUMBERS SHOWN ABOVE ARE FOR STANDARD CONDITIONS, SUCH AS A LEVEL GROUND LOAD LIFTED IN LINE WITH THE CRANE, THE USE OF OUTRIGGERS AND NO WIND EFFECT. THE OPERATING RADIUS IS THE DISTANCE FROM THE CENTER OF BOOM ROTATION TO THE CENTER OF GRAVITY OF THE LOAD.
3. 1 FT EQUALS 0.3048 METERS; 1 LB EQUALS 0.4536 KILOGRAMS.

Figure 3-68 SUPPORT POINTS AND SLINGS FOR LIFTING AT MLG TRUNNION

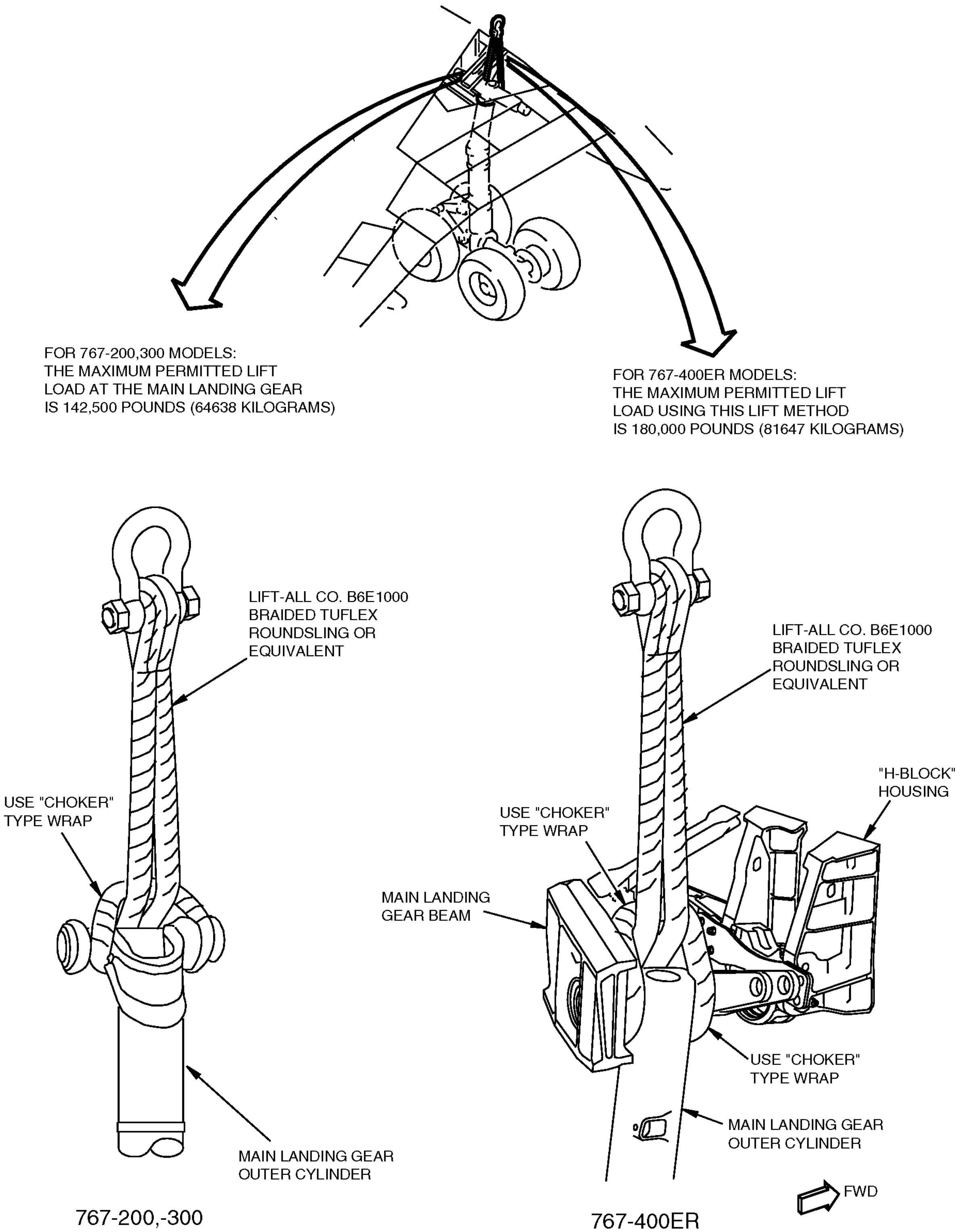
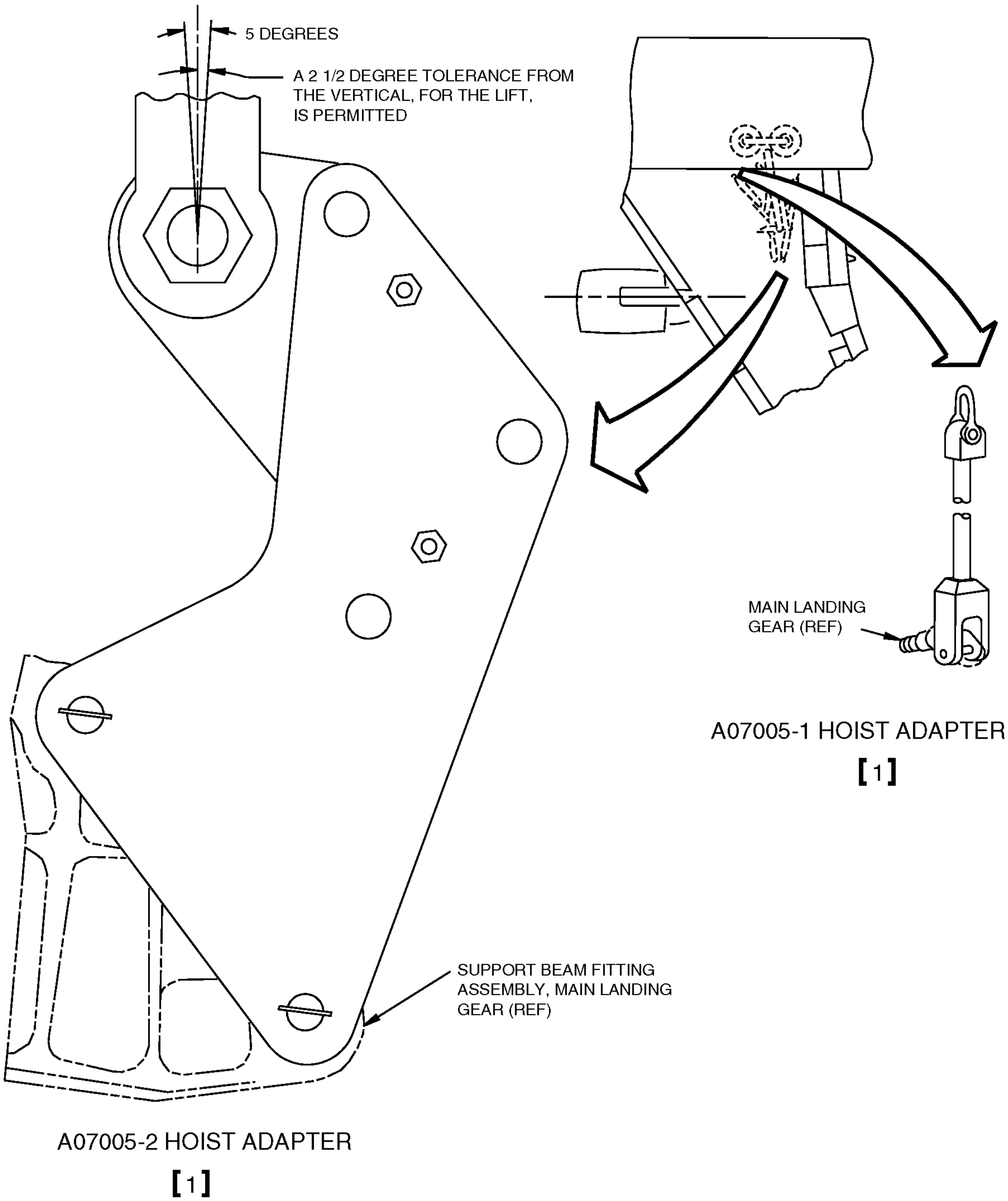
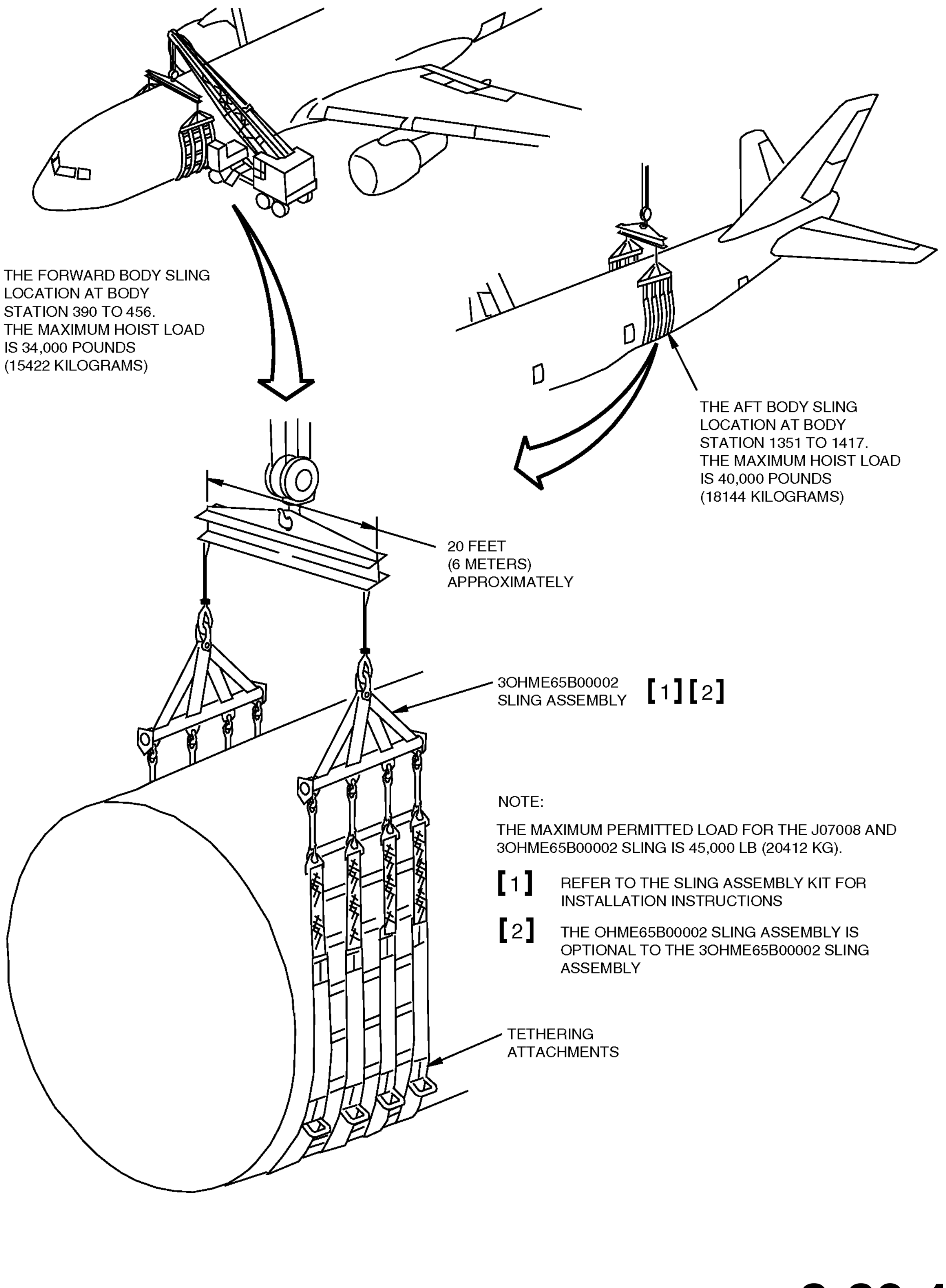


Figure 3-69 MAIN LANDING GEAR LIFT- 767-200, 300



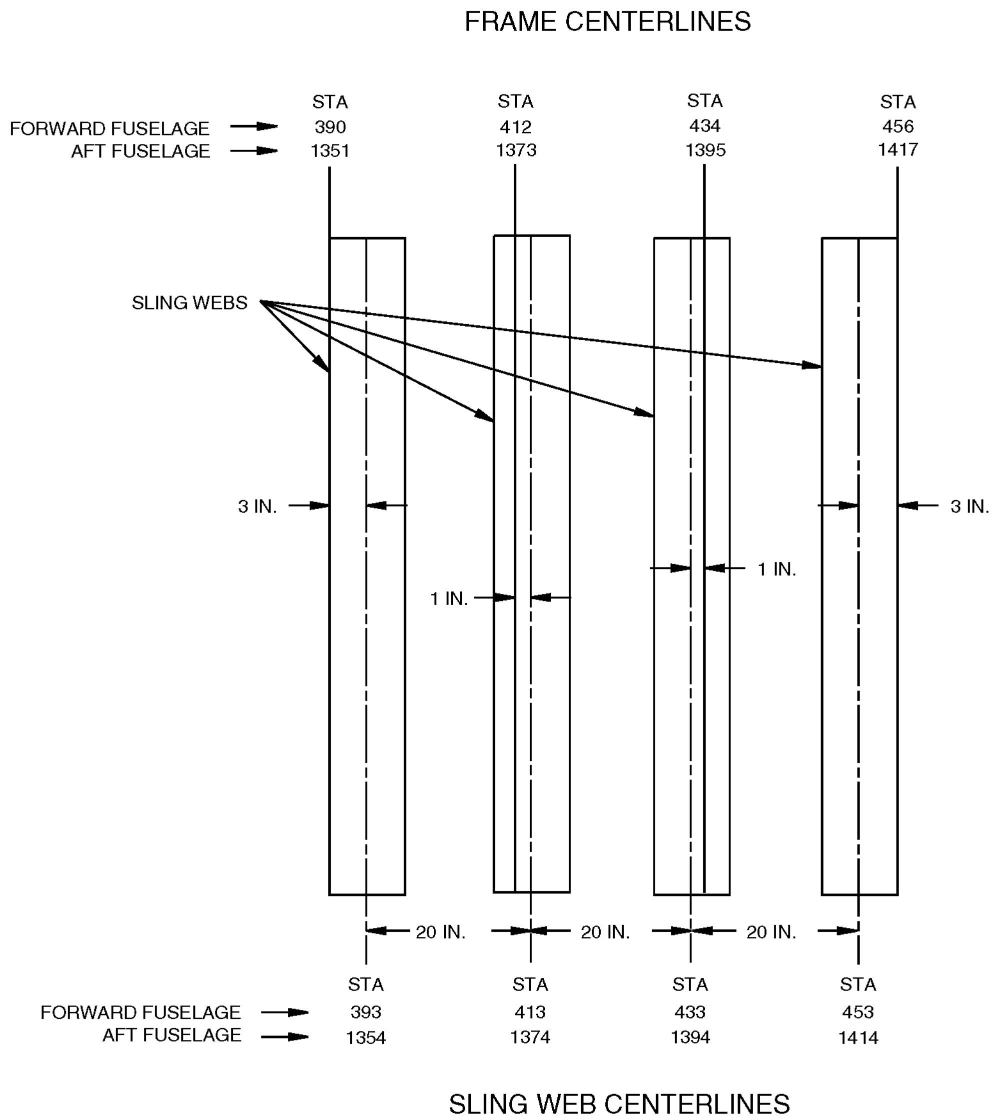
[1] THE MAXIMUM PERMITTED LOAD IS 142,500 POUNDS (64638 KILOGRAMS)

Figure 3-70 RECOVERY LIFTING SLING DATA



WHEN YOU LIFT THE AIRPLANE WITH THREE CRANES

Figure 3-71 RECOVERY LIFTING SLING DATA



NOTES:

1. THE MAXIMUM TOTAL HOIST LOAD MUST NOT BE MORE THAN 34,000 POUNDS (15422 KILOGRAMS) ON THE FORWARD BODY FUSELAGE, AND 40,000 POUNDS (18144 KILOGRAMS) ON THE AFT BODY FUSELAGE
2. PLACE THE CENTER OF EACH SLING WEB SO THAT THE DISTANCES FROM THE CENTERLINES OF THE OUTER SLING WEBS TO THEIR RELATED FRAMES ARE EACH 3 INCHES (7.62 CENTIMETERS), AS SHOWN
3. USE THE SLING ONLY TO LIFT THE AIRPLANE
4. THE USE OF TETHERING AND STABILIZING LINES IS NOT PERMITTED ON LIFTING SLINGS
5. 1 INCH EQUALS 2.54 CENTIMETERS

WHEN YOU LIFT THE AIRPLANE WITH THREE CRANES

3-30-14 Supports (Cradles/Cribs)

1. General
   A. It may be necessary to use supports (cradles/cribs) at set locations below the airplane during a recovery operation.
   B. You can use wood beams or sheets, sand bags, pads, rubber tires and other soft materials for these supports.
   C. We show the important qualities that you must have for good supports (cradles/cribs) below:
      - Make a surface area below the supports that has a sufficient strength to hold them.
      - Make the supports vertical or almost vertical.
      - Make sure that the support materials can hold the applied airplane loads.
      - Make sure that the interfaces between the supports and the airplane components are correct.
      - Make sure that the support installations are below the correct locations on the airplane.
   D. We show the necessary supports (cradles/cribs) for the jacks and the pneumatic bags in SUBJECT 3-30-6 and SUBJECT 3-30-8.
2. Wood Contour Supports
   A. When using wood contour supports (cradles) under the fuselage, make sure to place them such that the cradle is centered on the frame station centerline.
   B. When using cradles under the wings, make sure to place them only in the areas defined on Figure 3-52. The maximum allowable loads are also provided in Figure 3-52.
   C. The cradle supports must be fabricated to conform closely with the lower surfaces of the wings and the fuselage. This will eliminate the potential for excessive point loads which could damage the airplane. Make the supports with five laminations of 1 in. (25.4 mm) wood (plywood) and some ½ in. (13 mm) diameter bolts. Put four pads of ½ in. (13 mm) material (grey felt or rubber) with a 10-ounce cover (duck canvas or equivalent) on the airplane/cradle interface surfaces.
   D. Figure 3-72 provides data on construction of cradles and the support structures (cribs) below them. Figure 3-74 provides the specific fuselage "slope radius" required when constructing cradles for each fuselage frame station plus allowable loads for supporting the fuselage. See Figure 3-56 for an example of the use of cradle supports and associated cribbing to support the fuselage during a recovery operation.

Figure 3-72 BODY CRADLES AND CRIBBING

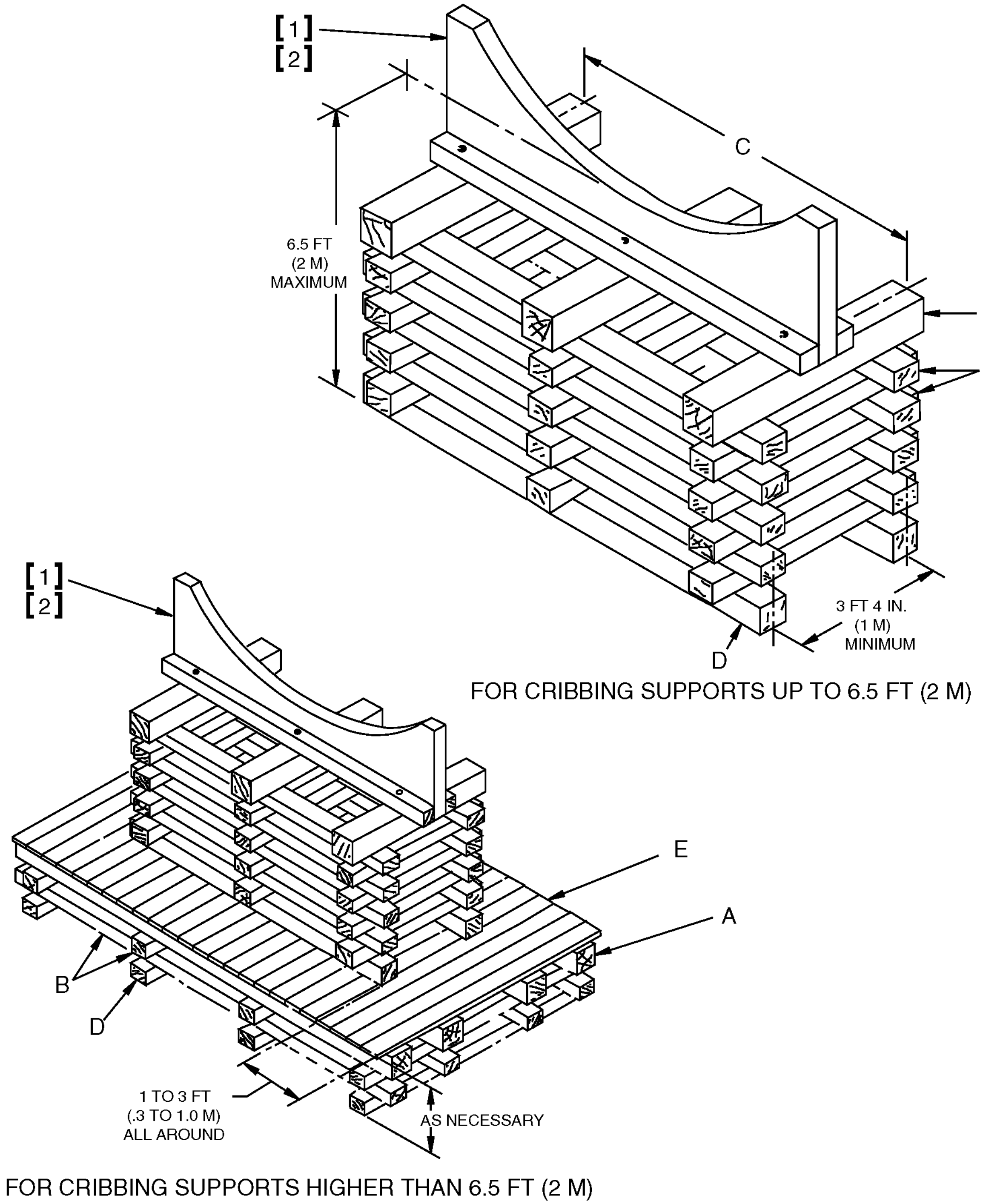
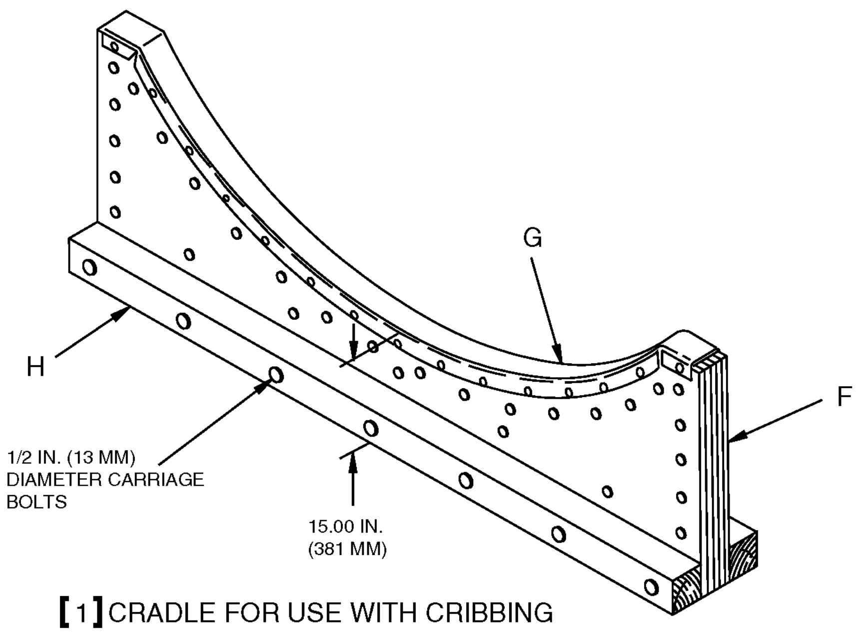


Figure 3-73 BODY CRADLES AND CRIBBING



[1] CRADLE FOR USE WITH CRIBBING

A = 8 X 10 IN. (20 X 25 CM) TIMBER, MINIMUM SIZE

B = ALL CRIBBING BELOW THE CROSS BEAMS CAN BE ANY AVAILABLE TIMBER NOT LESS THAN 6 X 6 IN. (15 X 15 CM)

C = THIS DIMENSION IS EQUAL TO THE WIDTH OF THE CONTOURED PART OF THE CRADLE

D = THE DISTANCE BETWEEN THE LOWEST TIMBERS DEPENDS ON THE BEARING STRENGTH OF THE SURFACE. IF THE SURFACE IS NOT CONCRETE, INSTALL SOLID ROWS OF TIMBERS THREE OR MORE LAYERS HIGH

E = 2 X 8 IN. (5 X 20 CM) LUMBER

F = FIVE PIECES OF 1.00 IN. (2.5 CM) A.B. GRADE OR BETTER EXTERIOR FIR PLYWOOD

G = CUSHION THE CONTOUR WITH FELT OR RUBBER

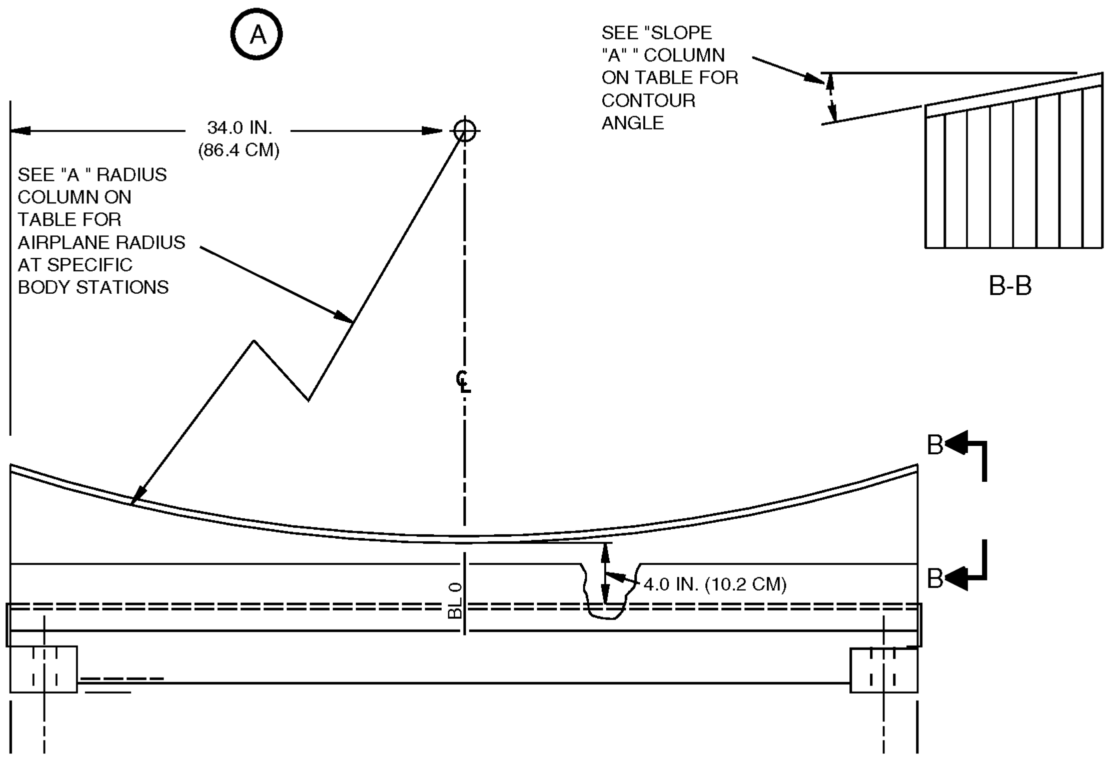
H = 6 X 6 IN. (15 X 15 CM) TIMBER

NOTE: GET QUALITY LUMBER WITHOUT DEFECTS WITH PHYSICAL PROPERTIES EQUIVALENT TO STRUCTURAL GRADE DOUGLAS FIR, WEST COAST REGION, USA

Figure 3-74 BODY CONTOUR SUPPORT CRADLE

AIRPLANE BODY STA	"A" RADIUS IN. (CM)	SLOPE "A" DEGREES
168	75.8 (192.53)	20.5 °
415-1320	97.4 (247.40)	0.00 °
287	101.7 (258.32)	8.05 °
303	101.3 (257.30)	6.67 °
325	100.9 (256.29)	5.04 °
368	98.5 (250.19)	2.49 °
1351	100.8 (256.03)	1.73 °
1395	107.8 (273.81)	4.26 °
1439	106.6 (270.76)	6.79 °
1540	95.0 (241.30)	11.5 °
1654.5	80.5 (204.47)	12.38 °
1725.5	74.3 (188.72)	12.38 °
1809	65.1 (241.30)	12.38 °

NOTE: THE MAXIMUM ALLOWABLE LOAD PER FUSELAGE FRAME IS 10,000 LBS. DO NOT EXCEED 40,000 LBS TOTAL LOAD FOR EITHER THE FORWARD FUSELAGE OR THE AFT FUSELAGE.



4 WHEN YOU MOVE THE AIRPLANE

4-00 GENERAL

4-00-1 General

1. When it is possible, make an inspection of the airplane damage. If the airplane damage is small, make a careful inspection of the landing gear. All the gear must be locked in the down position. All the gear must also be structurally safe for the support of the airplane. Install pins (downlock pins) in all the landing gear before you tow (or winch) the airplane (see Figure 4-1 and Figure 4-2).
2. You can have apparent damage to the airplane and a folded landing gear(s). When you have this condition, you must lift the airplane first. This permits you to examine the gear to see if it is serviceable. You can have a condition where you must replace the gear or install supports (dummy gear). You must do this before you tow (or winch) the airplane.
3. You can have a condition where you cannot extend or replace a gear. In this condition, you must use temporary supports (bracing) for the airplane. You can get this support from the equipment that follows:
   A. Low bed trailers
   B. Moveable cranes
   C. Transportation dollies

   WARNING: MAKE SURE THAT THERE ARE NO FUEL PROBLEMS (SPILLS OR VAPORS). IF YOU HAVE THIS CONDITION, YOU MUST IMMEDIATELY CORRECT IT TO PREVENT INJURY TO PERSONS OR DAMAGE TO THE AIRPLANE.

   D. Heavy duty commercial transporters

Figure 4-1 MAIN LANDING GEAR LOCKPIN INSTALLATION

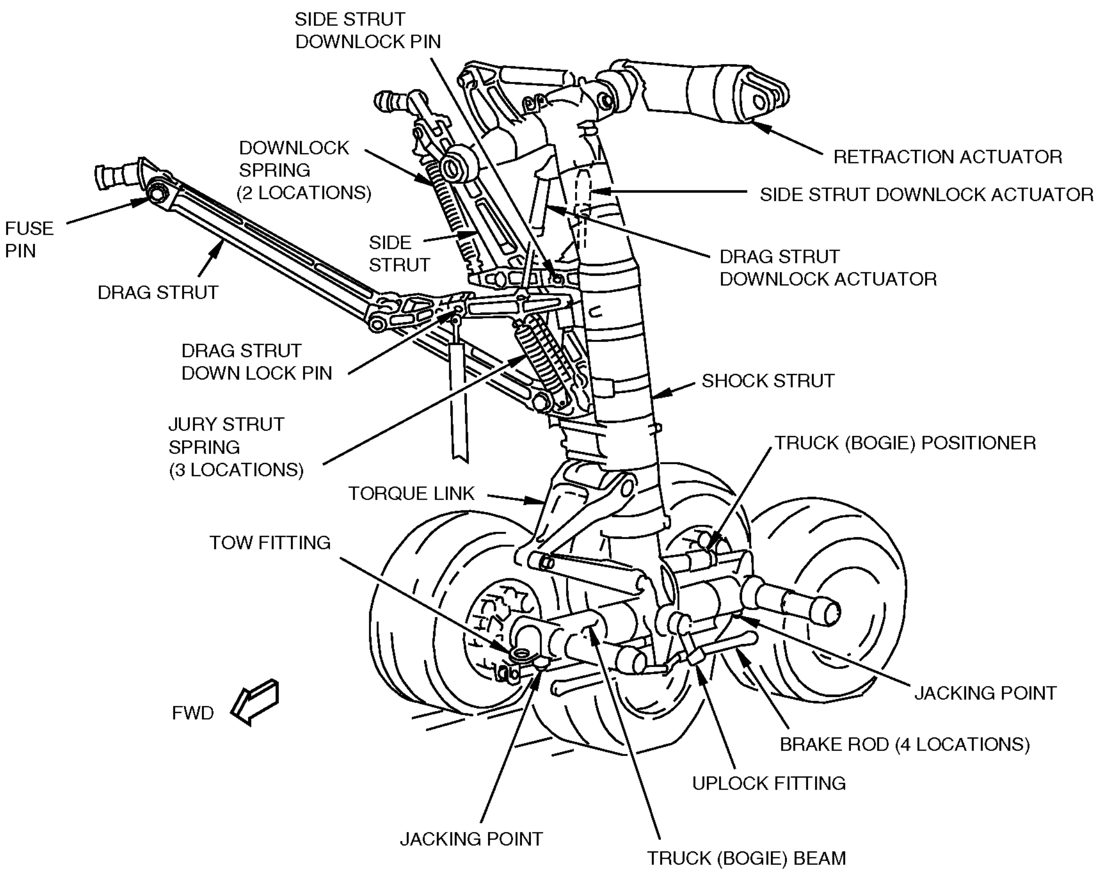
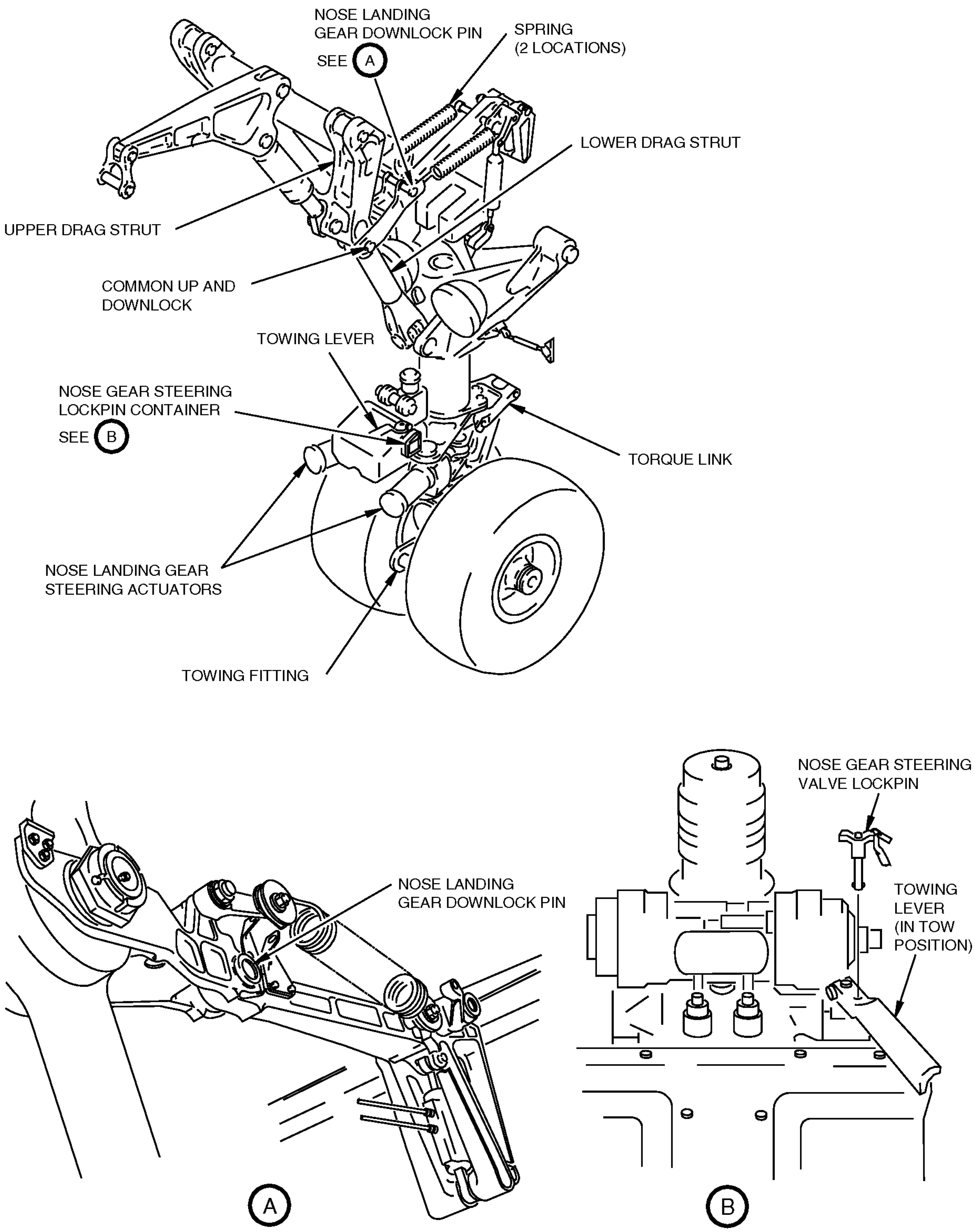


Figure 4-2 NOSE LANDING GEAR LOCK AND STEERING PIN INSTALLATION



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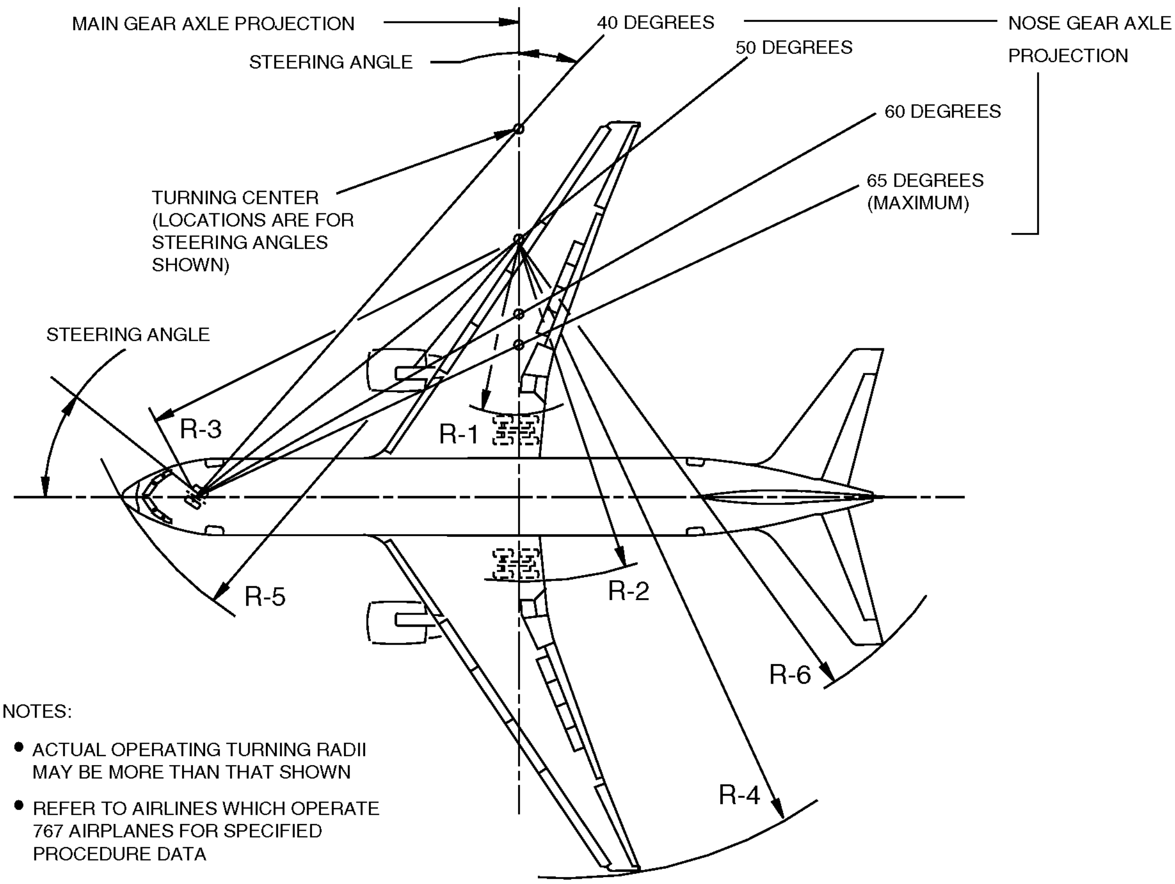
4-10 WHEN YOU MOVE AN AIRPLANE, THAT IS NOT DAMAGED, TO THE RUNWAY

4-10-1 General

1. You can have an airplane that moves off the runway and stops with its wheels below some soft surface material. In this condition, it is possible that there is no damage to the airplane. It is also possible that you cannot try a usual procedure to tow the airplane to the runway.
2. If only one main gear is off the runway, move all the fuel from that side of the airplane. Move the fuel from that wing tank and the middle tank or to the opposite wing tank. See the Maintenance Manual for the applicable procedures.
3. Decrease the airplane weight to make it as near as possible to the Operating Empty Weight (OEW). The fuel in Item 2. can stay on the airplane.
4. In most incidents, you must immediately move the airplane because the runway is blocked. You can have a faster recovery operation if you schedule it carefully before you start.
5. When you schedule the operation, include the items that follow:
   - The weight to be removed
   - The condition of the terrain
   - The type of support structure that you must make
   - The direction in which you must tow the airplane
   - Available construction equipment
   - The tow power of the vehicles
6. When you make the decisions for the operation, you must think about these conditions:
   A. You can lift the airplane wing and make a road on the ground surface.
   B. You can remove the necessary material below the wing and make a road to the ground surface.
   C. You must examine the brakes. The brakes can lock and they can cause the airplane to move off the runway. If the brakes are defective, you must make them serviceable before you start the operation.
   D. Examine the airplane structure in the area of the landing gears.
   E. Make sure the wheels turn sufficiently.
   F. Install downlocks on all the landing gears that are in the extended position.
   G. Attach tow lines to the tow points (lugs) on the main landing gears.
   H. Put the tow truck (or winch vehicle) on the runway. This gives you an added positive force (traction) for the tow operation.
   I. Make sure you do not try to turn the airplane less than the radius limits shown in Figure 4-3 and Figure 4-4.

Figure 4-3 STEERING ANGLES AND TURNING RADII- 767-200, -300



NOTES:

- ACTUAL OPERATING TURNING RADII MAY BE MORE THAN THAT SHOWN
- REFER TO AIRLINES WHICH OPERATE 767 AIRPLANES FOR SPECIFIED PROCEDURE DATA

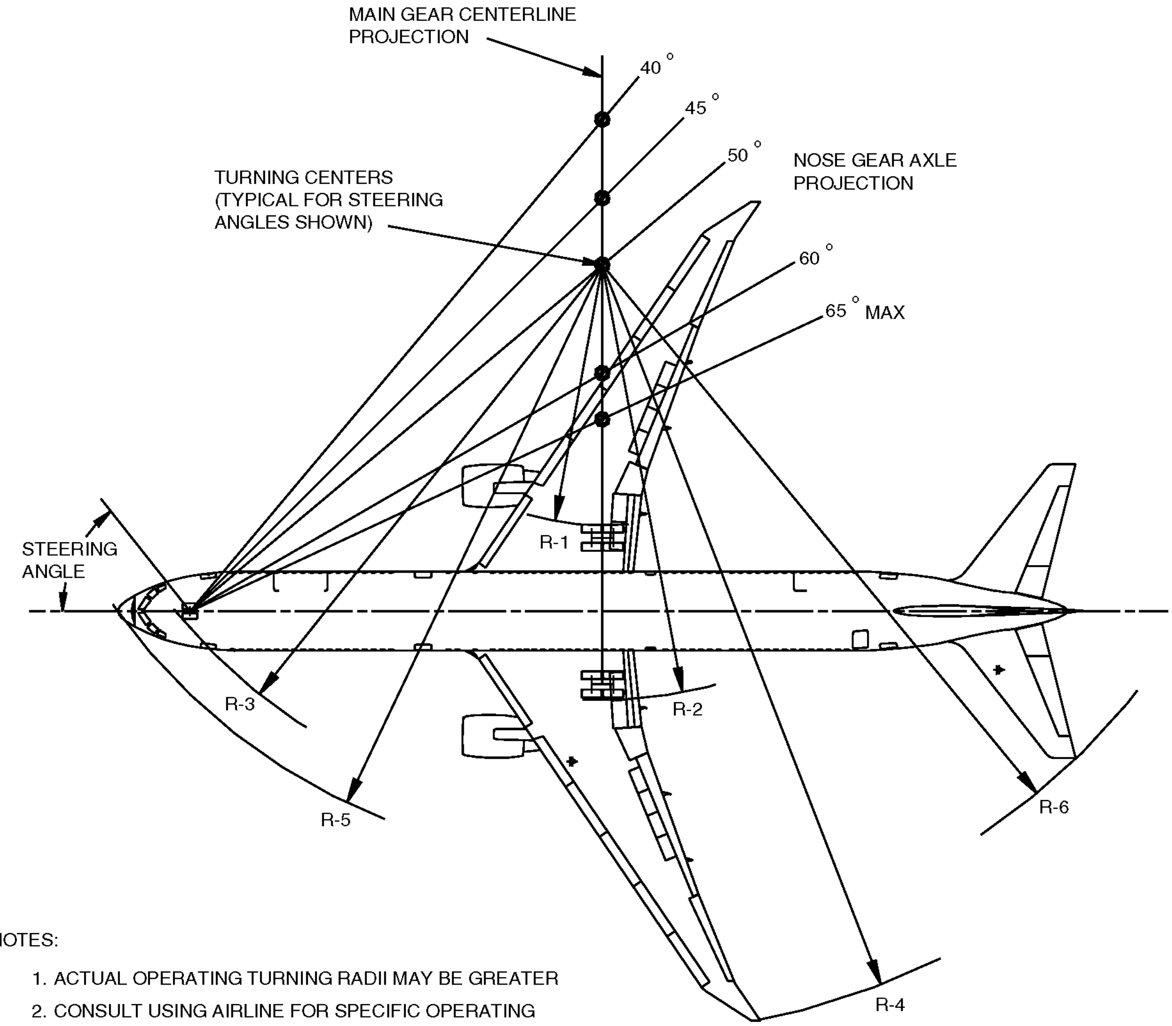
STEERING ANGLE (DEGREES)	R-1				R-2				R-3			
	INNER GEAR				OUTER GEAR				NOSE GEAR			
	-200		-300		-200		-300		-200		-300	
	FT	M	FT	M	FT	M	FT	M	FT	M	FT	M
30	94.0	28.7	111.5	34.0	129.7	39.5	147.3	44.9	131.4	40.1	151.0	46.0
35	74.4	22.7	88.8	27.1	110.1	33.6	124.6	38.0	114.8	35.0	131.8	40.2
40	59.1	18.0	71.1	21.7	94.8	28.9	106.9	32.6	102.7	31.3	117.8	35.9
45	47.7	14.5	56.8	17.3	82.4	25.1	92.6	28.2	93.5	28.5	107.2	32.7
50	36.3	11.1	44.8	13.7	72.1	22.0	80.6	24.6	86.5	26.4	99.1	30.2

Figure 4-3 STEERING ANGLES AND TURNING RADII- 767-200, -300 (Continued)

STEERING ANGLE (DEGREES)	R-1				R-2				R-3			
	INNER GEAR				OUTER GEAR				NOSE GEAR			
	-200		-300		-200		-300		-200		-300	
	FT	M	FT	M	FT	M	FT	M	FT	M	FT	M
55	27.3	8.3	34.4	10.5	63.1	19.2	70.2	21.4	81.1	24.7	92.8	28.3
60	19.4	5.9	25.2	7.7	55.2	16.8	61.0	18.6	76.8	23.4	87.8	26.8
65	12.3	3.7	16.9	5.2	48.0	14.6	52.7	16.1	73.5	22.4	84.0	25.6

STEERING ANGLE (DEGREES)	R-4				R-5				R-6			
	WING TIP				BODY NOSE				STABILIZER TIP			
	-200		-300		-200		-300		-200		-300	
	FT	M	FT	M	FT	M	FT	M	FT	M	FT	M
30	191.9	58.5	209.3	63.8	137.2	41.8	157.4	48.0	162.0	49.4	182.7	55.7
35	172.5	52.6	186.8	56.9	121.8	37.1	139.3	42.5	145.0	44.2	163.3	49.8
40	157.5	48.0	169.3	51.6	110.7	33.7	126.3	38.5	132.3	40.3	148.7	45.3
45	145.3	44.3	155.2	47.3	102.4	31.2	116.6	35.5	122.5	37.3	137.3	41.8
50	135.2	41.2	147.4	44.9	96.2	29.3	109.3	33.3	114.6	34.9	128.5	39.2
55	126.3	38.5	133.3	40.6	91.5	27.9	103.7	31.6	108.1	32.9	121.2	36.9
60	118.6	36.1	124.3	37.9	87.8	26.8	99.4	30.3	102.7	31.3	115.1	35.1
65	111.7	34.0	116.2	35.4	85.0	25.9	96.1	29.3	98.2	29.9	109.9	33.5

Figure 4-4 STEERING ANGLES AND TURNING RADII- 767-400ER



NOTES:

1. ACTUAL OPERATING TURNING RADII MAY BE GREATER
2. CONSULT USING AIRLINE FOR SPECIFIC OPERATING PROCEDURE DATA

STEERING ANGLE (DEGREES)	R-1		R-2		R-3		R-4		R-5		R-6	
	INNER GEAR		OUTER GEAR		NOSE GEAR		WING TIP		BODY NOSE		STABILIZER TIP	
	-400ER		-400ER		-400ER		-400ER		-400ER		-400ER	
	FT	M	FT	M	FT	M	FT	M	FT	M	FT	M
30	130.5	39.8	166.3	50.7	173.0	52.7	235.5	71.8	179.3	54.7	203.4	62.0
35	104.5	31.8	140.3	42.8	151.1	46.0	209.7	63.9	158.4	48.3	180.9	55.1
40	84.2	25.7	120.0	36.6	135.0	41.1	189.6	57.8	143.4	43.7	164.1	50.0
45	67.8	20.7	103.6	31.6	122.8	37.4	173.4	52.9	132.2	40.3	151.1	46.1

Figure 4-4 STEERING ANGLES AND TURNING RADII- 767-400ER (Continued)

STEERING ANGLE (DEGREES)	R-1 INNER GEAR -400ER		R-2 OUTER GEAR -400ER		R-3 NOSE GEAR -400ER		R-4 WING TIP -400ER		R-5 BODY NOSE -400ER		R-6 STABILIZER TIP -400ER	
	FT	M	FT	M	FT	M	FT	M	FT	M	FT	M
50	54.0	16.5	89.8	27.4	113.5	34.6	159.8	48.7	123.7	37.7	140.8	42.9
55	42.1	12.8	77.9	23.7	106.3	32.4	148.1	45.2	117.1	35.7	132.4	40.4
60	31.6	9.6	67.4	20.5	100.6	30.7	137.8	42.0	112.1	34.2	125.4	38.2
65	22.1	6.7	57.9	17.6	96.2	29.3	128.5	39.2	108.2	33.0	119.6	36.5

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4-10-2 When the Airplane is Off the Runway on Hard Ground

1. While the airplane moves off the runway, the wheels push down the soil and increase its strength in these locations. The soil is stronger for a depth of some inches. Be careful. Do not remove this layer of stronger soil in a removal operation. You can find the soil strength when you measure the wheel or tire depth (rut depth). See SECTION 2-10, Figure 2-2 and Figure 2-4.

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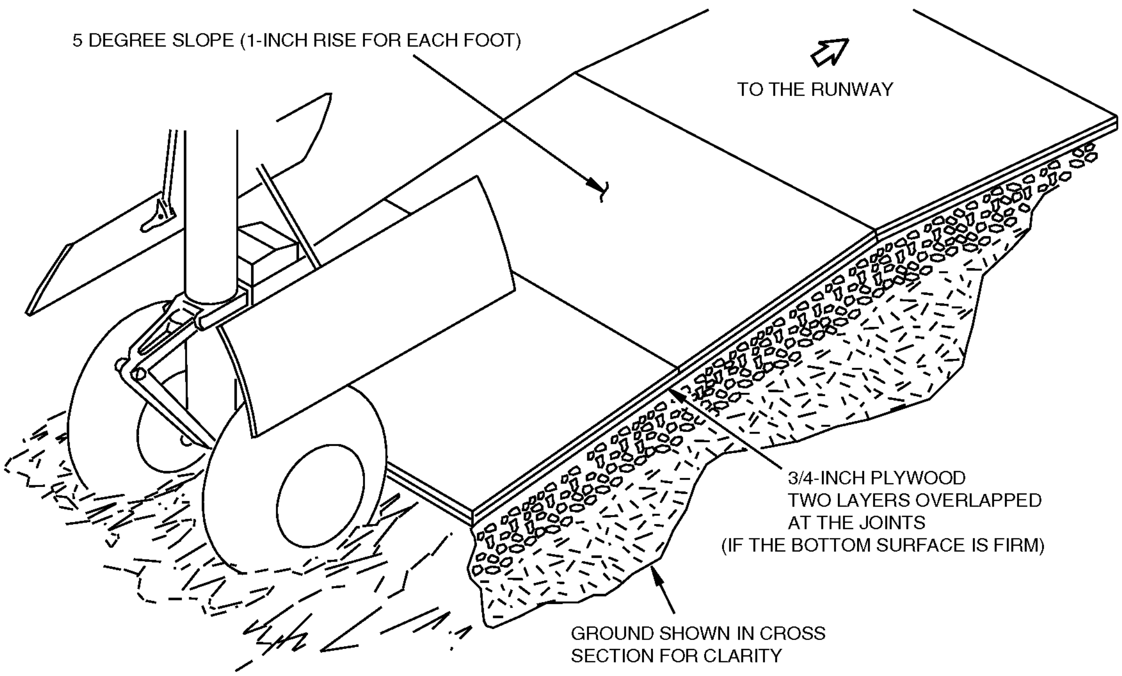
4-10-3 When the Airplane is Off the Runway on Soft Ground

1. The ground can also be soft after the movement of the airplane on it. You can find the soil strength when you measure the wheel or tire depth (rut depth); see SECTION 2-10, Figure 2-2 and Figure 2-4. Support structures (shoring or cribbing) can be necessary.
2. The removal area for bad material must have a minimum width of 8 feet (2.4 meters). This area must also extend in the tow direction to the nearest surface with a sufficient strength for the airplane. The slope must be 5 degrees maximum. If water comes into the removal area, use pumps to keep a minimum height of water. Put the pumps in areas where there are no gases (fuel vapors).
3. You must make the bottom of the removal area stronger. You must install a layer of some loose material (crushed rock) or some hard material (quick-set cement). If you use loose material, you must push it down (compact it) and put a cover on it. You can make the cover from some wood (plywood or cross ties), some steel or some other material (matting); see Figure 4-5.
4. It is possible to put a cover directly on the ground when you do not prepare the soil. Use the wheel depth (rut depth) to make sure that the soil strength is sufficient for this procedure. See SECTION 2-10, Figure 2-2 and Figure 2-4.
5. Be careful if you use wood beams (cross ties). You must use a layer of wood (plywood) or other material on top of the beams. This procedure divides the load of the airplane to many beams while the airplane moves. If you do not use this procedure, the large airplane load can push one beam down into the soil. This lower beam can cause a blockage and stop the movement of the airplane.
6. Put tow vehicles on the near edge of the runway. Put a vehicle of the other type (winch vehicle) on the far edge of the runway.
7. Tow the airplane from the main gears. See SECTION 4-20, for tow (and winch) procedures and for other limits (Figure 4-10 and Figure 4-11).

Figure 4-5 EXAMPLE OF A PREPARED SURFACE

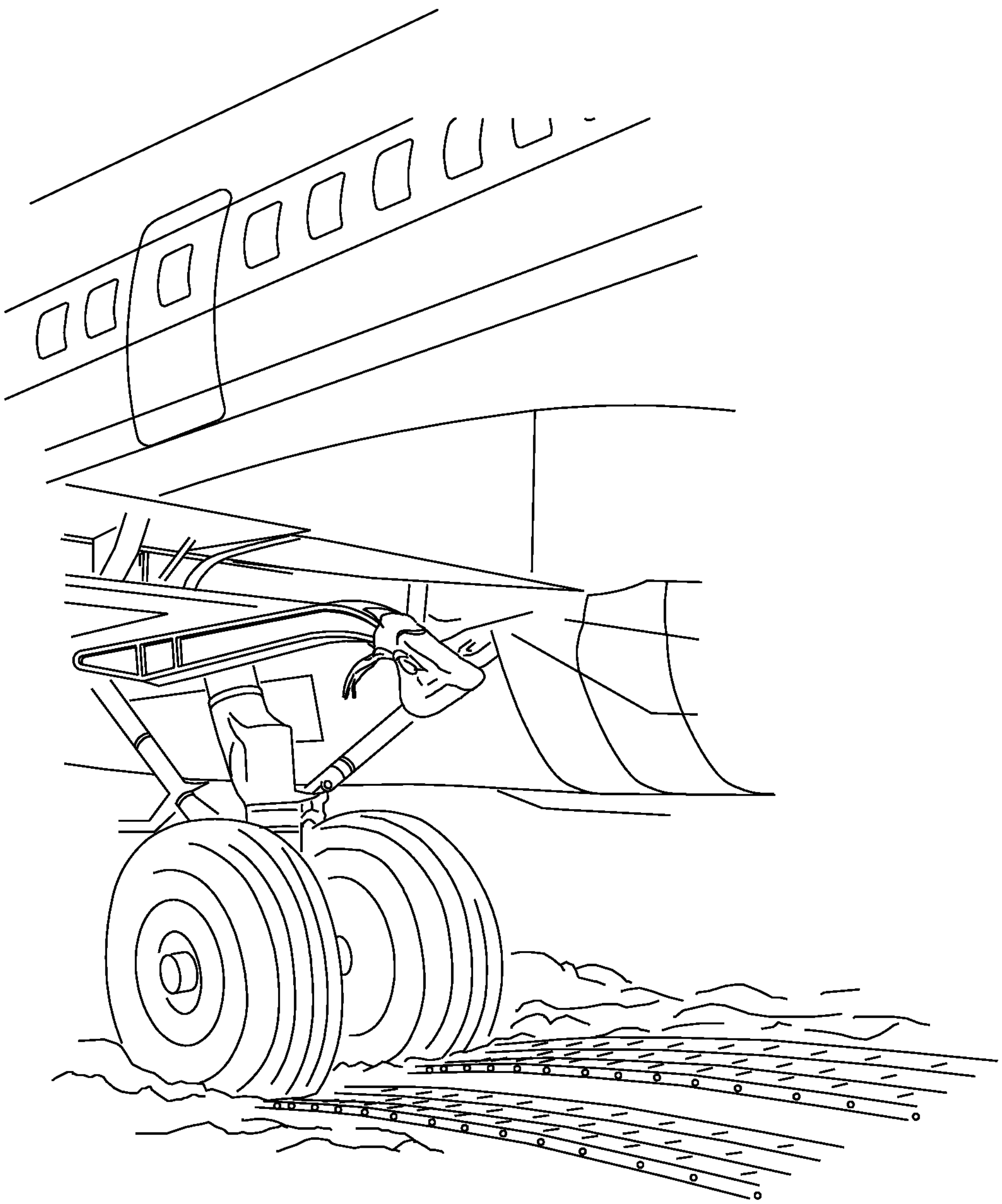


NOTE:

RAILROAD TIES, 1/4-IN. STEEL PLATE, OR OTHER APPLICABLE MATERIAL MAY BE USED

1 IN. EQUALS 2.54 CM

Figure 4-6 THE USE OF STEEL MAT STRIPS TO PREPARE A TREADWAY



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4-20 WHEN YOU TOW OR WINCH THE AIRPLANE

4-20-1 General

1. This section shows how you can tow (or winch) an airplane on wheels. A wheel can be a wheel on a landing gear or a wheel on a trailer (see Figure 4-7 and Figure 4-23). When you tow the airplane, it is easy to move. You can use many different movements.

   When you use the other procedure (winch the airplane), the movement is more controlled. You can also use a larger force to move the airplane (see Figure 4-18).

   When you tow the airplane on a trailer (see Figure 4-7 and Figure 4-23), you must have supports (cribbing) at specified positions below the airplane. These positions are usually hard points below the airplane. These positions can be areas where a fuselage section attaches to a second fuselage section. A position must not be a jack point. Some positions are possibly not available because of the damage to the airplane.

   While you tow the airplane, it can adjust (settle) on its supports (cribbing). Make sure that you use more than the minimum necessary supports. The added supports keep the airplane stable. The added supports are very important below the parts of the airplane that have damage. Make sure that the airplane is not too high off the ground to move below all possible blockages (bridges or others).

2. You can tow the airplane with a tow bar from the nose gear or the main gear. You can attach a tow bar to the tow eye on the front of the nose gear (see Figure 4-8). There is a tow eye on the front or the rear of the main gear (see Figure 4-9). See Figure 4-10 and Figure 4-11 for the approved tow loads.

   CAUTION: DO NOT TOW WITH A DAMAGED NOSE GEAR. IF THE NOSE GEAR IS DAMAGED, TOW THE AIRPLANE ONLY FROM THE MAIN GEAR.

3. Tow the airplane from the nose gear with a tow bar.

   CAUTION: BEFORE YOU TOW THE AIRPLANE, YOU MUST LOCK THE LEVER OF THE NOSE GEAR IN THE "TOW" POSITION. WHEN THE LEVER IS LOCKED, THE NOSE GEAR CAN TURN A MAXIMUM OF 65 DEGREES. THIS TURN IS PERMITTED WHEN THERE IS PRESSURE IN THE HYDRAULIC SYSTEM. WHEN YOU MAKE A TURN LARGER THEN 65 DEGREES, YOU MUST DISCONNECT THE TORSION LINKS. MAKE SURE YOU PUT THE LINKS IN A SAFE POSITION.

   A. Make sure that you install the pin (tow lockout pin) correctly (see Figure 4-1 and Figure 4-2). While you tow the airplane, make sure that it moves on all of the gears. This includes the nose gear and the two main gears.

   B. Make sure that you install pins (downlock pins) on all extended gears; see Figure 4-1 and Figure 4-2.

   CAUTION: BE CAREFUL WITH COMPRESSED STRUTS. DAMAGE TO A STRUT CAN OCCUR IF YOU TOW THE AIRPLANE WHEN A STRUT IS FULLY COMPRESSED.

   C. Make sure that the struts have the correct maintenance. Correctly inflate all the gear tires.

   D. Make sure that you cannot see more than 10 in. (25.4 cm) of the inner cylinder (chrome surface) of the nose gear.

   E. Do not use tow loads that are larger than the approved loads (see Figure 4-10 and Figure 4-11). While you tow the airplane, make sure that the airplane Center of Gravity (CG) does not move out of a safe range (see Figure 4-12).

   F. Attach the tow bar to the airplane. If the nose gear angle is larger than 65 degrees, disconnect the torsion links. Use a line (rope) to make sure the top link does not move down and cause damage to a different structure. Put the lower link on the tow fitting or on the tow bar.

   G. Make sure that you release the airplane brakes.

H. Tow the airplane when it is necessary. Make sure that you use the precautions and the procedures that are the standard for this airplane. See Figure 4-3 for the clearance limits.

I. Be careful when you complete the movement. Tow the airplane in a straight direction for a length of 6 ft (1.8 m) (minimum). This procedure permits the removal of the turn forces (torsional) applied to the gear while you towed the airplane.

4. Tow the airplane with lines (cables) attached to the main gear.

WARNING: MAKE HORIZONTAL CONNECTIONS WITH LINES (MANILA ROPE) AT FREQUENT SPACES. THIS PROCEDURE PREVENTS DAMAGE TO PERSONS OR TO EQUIPMENT FROM A BROKEN CABLE.

A. Attach a line (cable) to the tow eye of each landing gear or to the gear strut (hatched area of the strut). Attach the other end of the line (cable) to a vehicle (tow tractor). Use a load indicating device (load cell) between the gear and the cable to prevent damage to the gear from a dangerous load. See Figure 3-13 and Figure 3-14 for data about shackles and Figure 4-19 for load cell equipment. Put the lines in locations that permit you to divide the load equally between the main gears. The structural limits are shown in Figure 4-10 and Figure 4-11.

B. Make selections of equipment (cables, slings, shackles and others) that have the correct dimensions and capacity. You must use equipment that has a safety factor (rated load versus ultimate design load) of five.

C. Make sure that all vehicles move together. Increase the force slowly until the airplane starts to move. When the airplane starts to move, apply a constant force and move the airplane in a straight line. Prevent rearward (roll back) movements of the airplane with wheel chocks.

Figure 4-7 FORWARD FUSELAGE TRAILER SUPPORT AND TURNTABLE

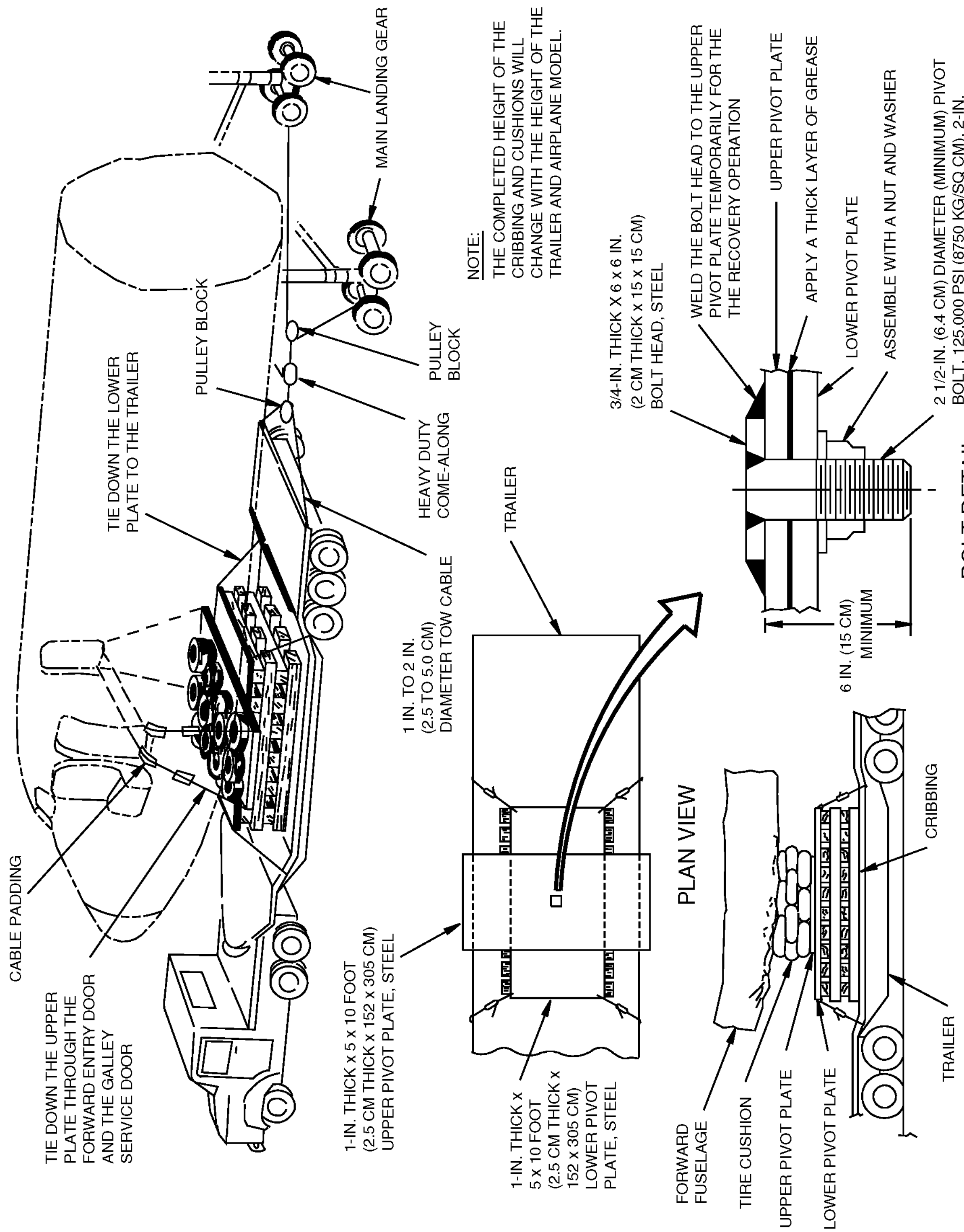


Figure 4-8 NOSE LANDING GEAR TOW FITTING

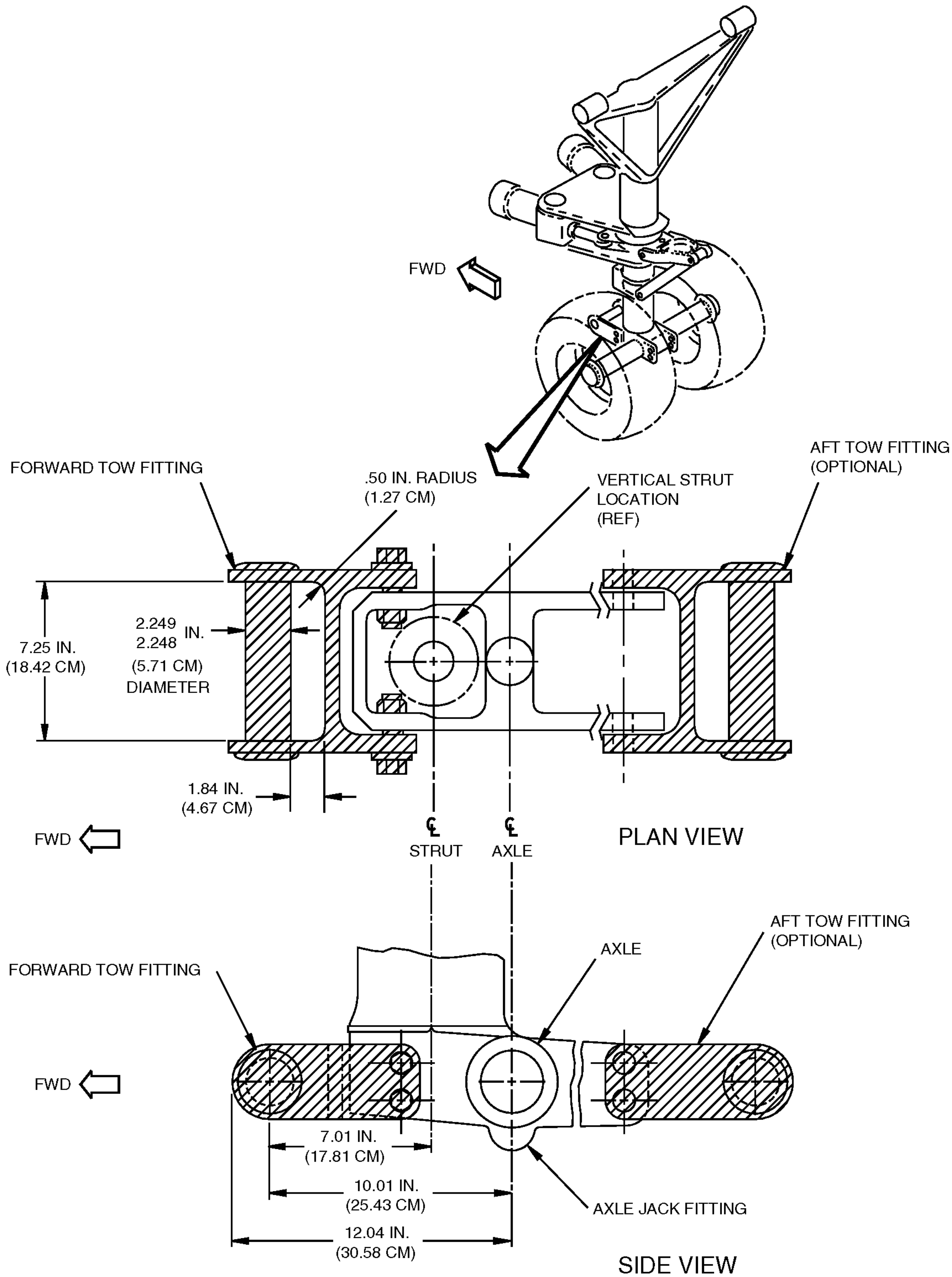
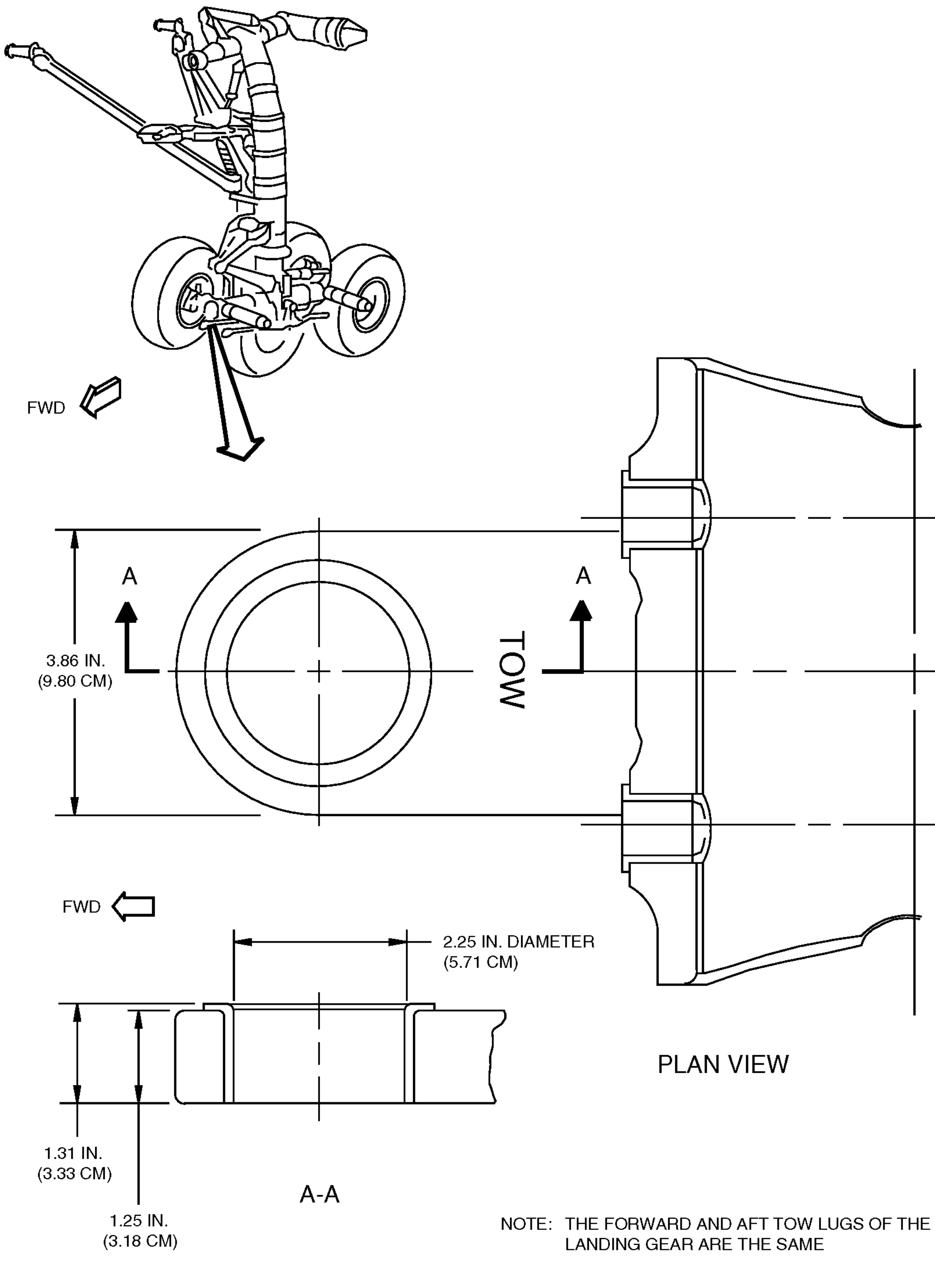


Figure 4-9 MAIN LANDING GEAR TOW FITTING



NOTE: THE FORWARD AND AFT TOW LUGS OF THE MAIN LANDING GEAR ARE THE SAME

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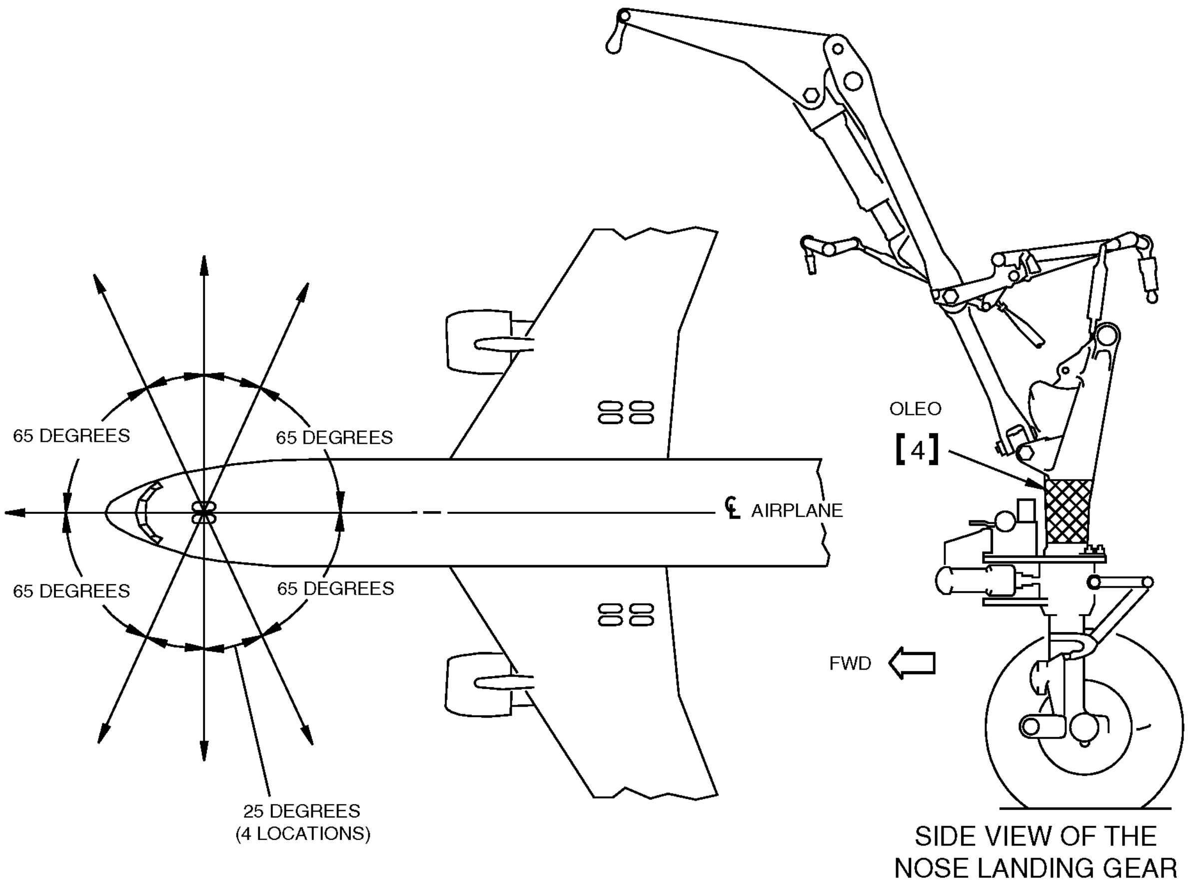
4-20-2 Load Limits and Tow Angles

1. When you tow the airplane (push or pull) from the nose gear, the allowable maximum towing load varies with the towing angle. See Figure 4-10 for the allowable load at different angles. There are also angular limits when you pull the airplane (forward or rearward) with tow lines on the main landing gears. The limits are 30 degrees to each side of the centerline as shown in Figure 4-11. Refer to Figure 4-10 and Figure 4-11 for maximum towing loads for the nose and main gear tow fittings and the maximum winching load which can be applied to the main landing gear oleo surface. Refer to Figure 4-12 for various airplane ground stability conditions.

Figure 4-10 MAXIMUM TOWING LOADS - NOSE GEAR



NOSE GEAR MAXIMUM TOWING LOADS	DESIGN LOAD LIMITS		ULTIMATE LOAD LIMITS	
	LB	KG	LB	KG
NLG Oleo (Cross Hatched Area) *[1]	80,000	36288 *[2]	120,000	54432 *[3]
Tow Fitting *[4]	62,000	28123 *[2]	105,000	47628 *[5]
Tow Fitting *[6]	31,000	14062 *[2]	46,000	20866 *[5]

*[1] INSTALL THE STRAP IN THE CROSS-HATCHED AREA. LIMIT ANGLE OF TURN TO NO MORE THAN 5 DEGREES FROM THE CENTERLINE.

*[2] IF THE APPLIED LOAD IS MORE THAN THE DESIGN LOAD LIMIT, YOU MUST MAKE A COMPLETE INSPECTION OF THE NOSE GEAR AND ALL RELATED OR ADJACENT STRUCTURE.

Figure 4-10 MAXIMUM TOWING LOADS - NOSE GEAR (Continued)

*[3] IF THE APPLIED LOAD EQUALS THE ULTIMATE LOAD, YOU MUST MAKE AN INSPECTION OF THE TRUNNION MOUNTS AND THE DRAG BRACE FOR STRUCTURAL DAMAGE

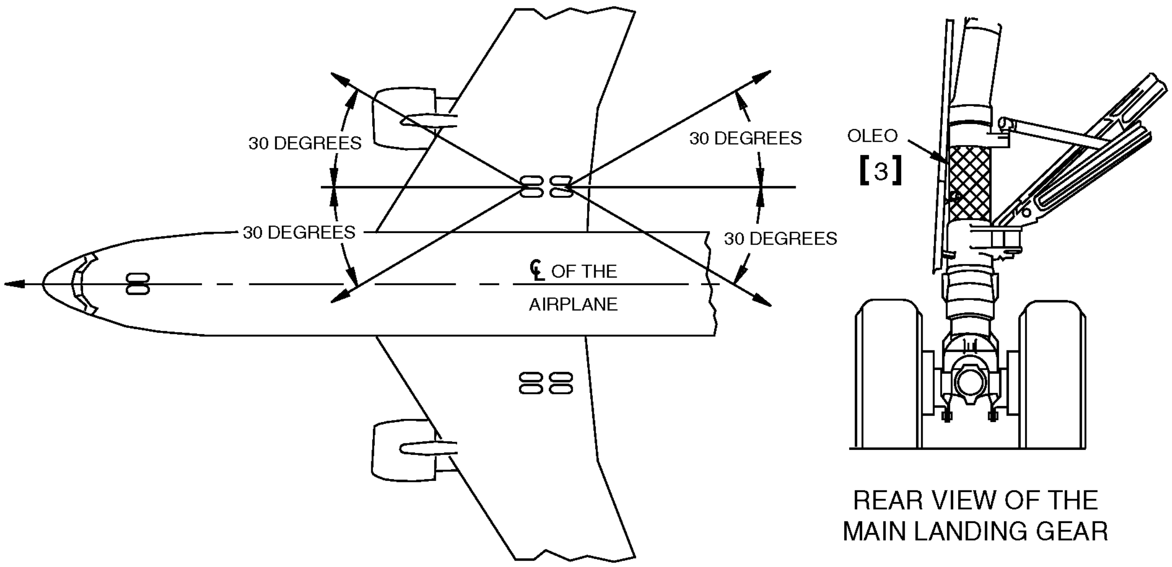
*[4] 0-65 DEGREES ANGLE OF TURN

*[5] IF YOU APPLY A LOAD EQUAL TO THE ULTIMATE LOAD, DAMAGE AND POSSIBLY FAILURE CAN OCCUR TO THE FOLLOWING COMPONENTS:

TOWING FITTING, DRAG BRACE, OLEO STRUT CYLINDER AND TRUNNION MOUNTS

*[6] 65-90 DEGREES ANGLE OF TURN

Figure 4-11 MAXIMUM TOWING LOADS - MAIN GEAR



MAIN GEAR MAXIMUM TOWING LOADS	DESIGN LOAD LIMITS		ULTIMATE LOAD LIMITS	
	LB	KG	LB	KG
Tow Fitting *[1]	47,000	21319 *[2]	70,500	31979 *[3]
MLG Oleo (Cross Hatched Area) *[4]	100,000	45360 *[2]	150,000	68040 *[5]

*[1] THE LOAD IS APPLIED EITHER FORWARD OR AFT, ± 30 DEGREES FROM THE CENTERLINE

*[2] IF THE APPLIED LOAD IS MORE THAN THE DESIGN LOAD LIMIT, YOU MUST MAKE A COMPLETE INSPECTION OF THE MAIN GEAR AND ALL RELATED OR ADJACENT STRUCTURE

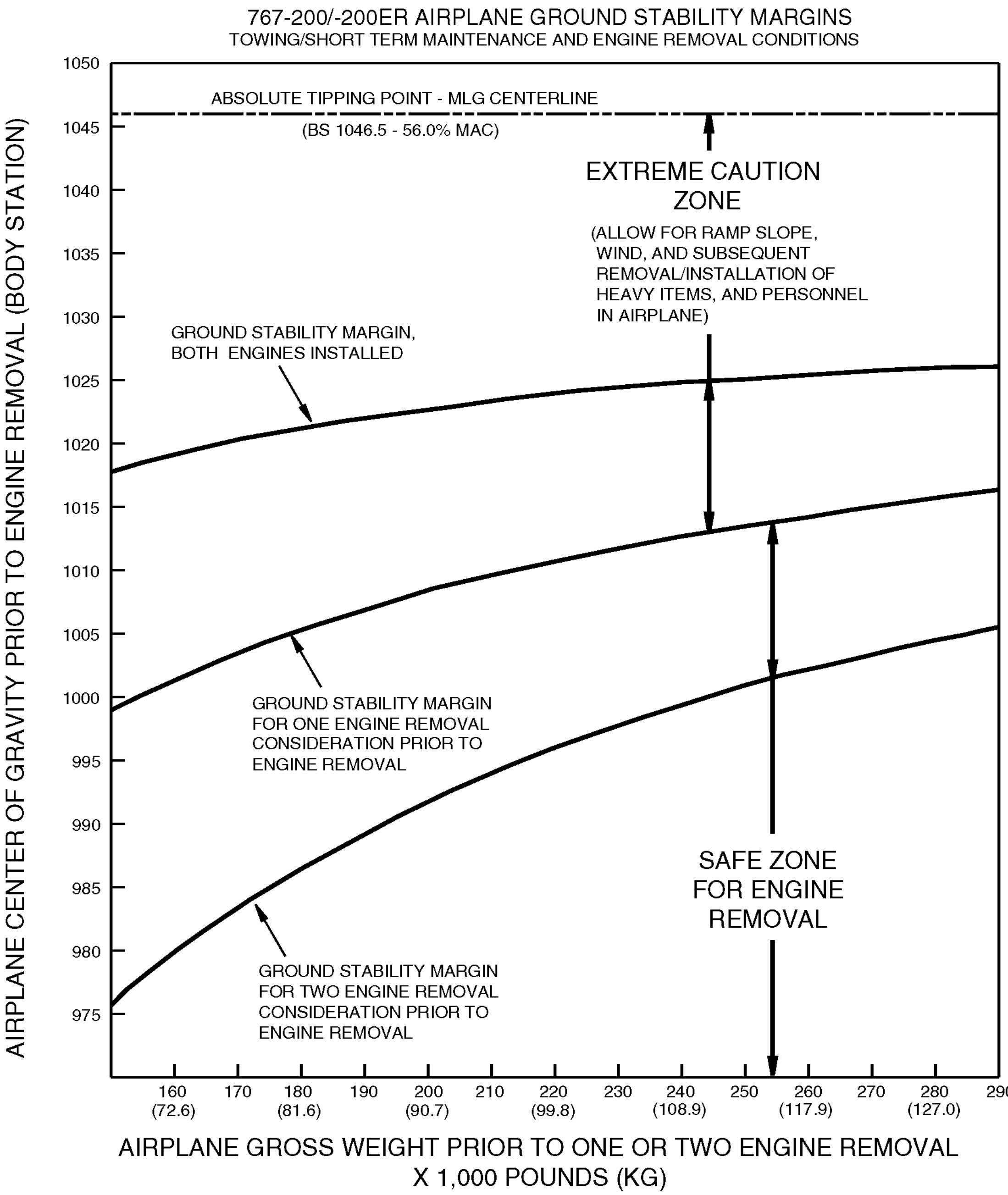
*[3] IF YOU APPLY A LOAD EQUAL TO THE ULTIMATE LOAD, DAMAGE AND POSSIBLY FAILURE CAN OCCUR TO THE FOLLOWING COMPONENTS:

TOWING FITTING, DRAG BRACE AND TRUNNION MOUNTS

*[4] THE LOADS ARE APPLIED EITHER FORWARD OR AFT ±30 DEGREES FROM THE CENTERLINE. INSTALL THE TOW STRAP IN THE CROSS-HATCHED AREA

*[5] IF THE APPLIED LOAD EQUALS THE ULTIMATE LOAD, YOU MUST MAKE AN INSPECTION OF THE FORWARD TRUNNION MOUNTS AND THE DRAG BRACE FOR STRUCTURAL DAMAGE

Figure 4-12 AIRPLANE GROUND STABILITY

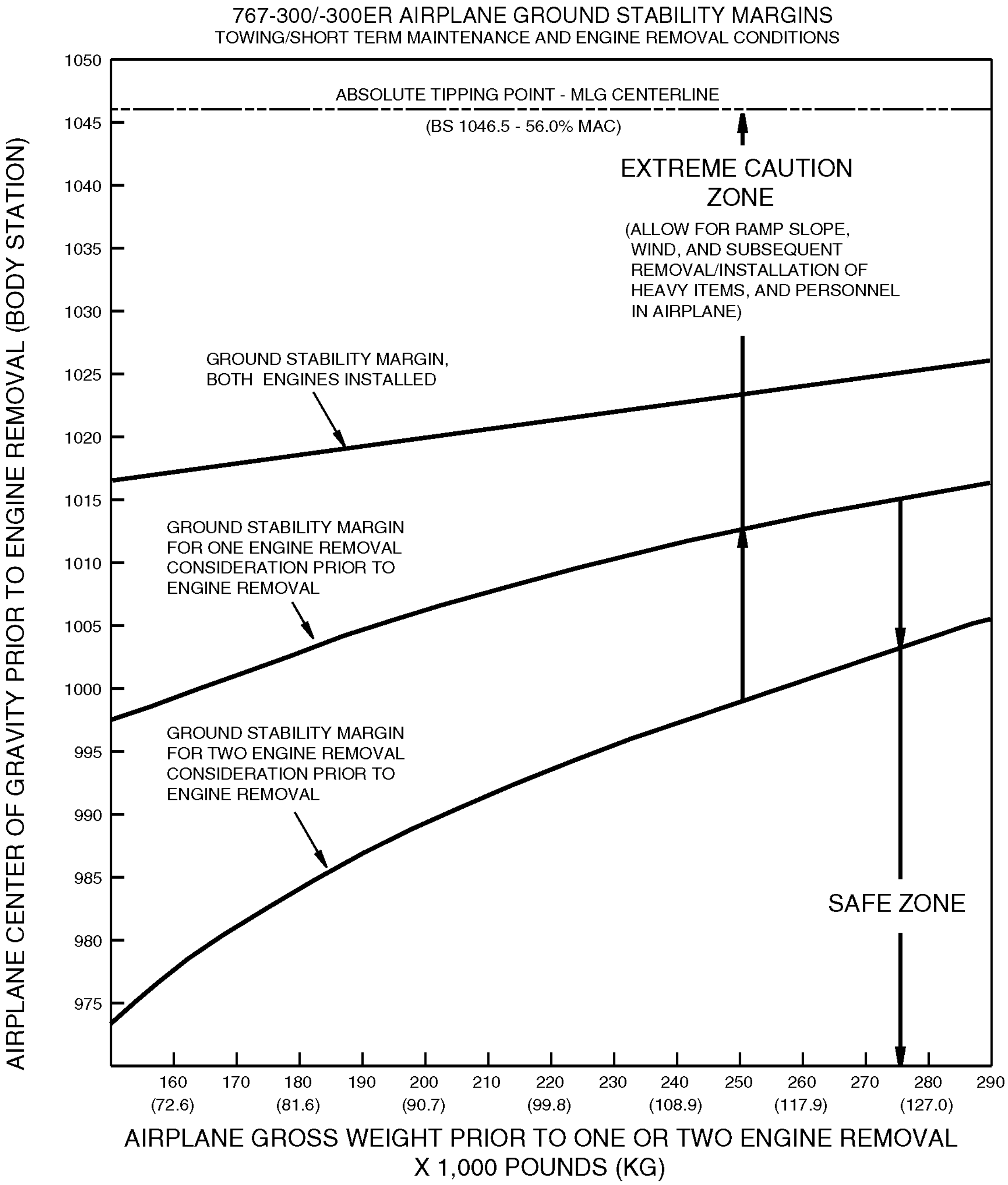


TIPPING OF 767 AIRPLANE:

THE CHART ABOVE SHOWS THE 767-200 TIPPING LIMITS. THE ABSOLUTE TIPPING LIMIT IS THE MLG CENTERLINE AT BS 1046.5. THE GROUND STABILITY MARGIN LINE REPRESENTS THE ABSLOULTE TIPPING LIMIT TO ACCOUNT FOR FACTORS SUCH AS TOWING FORCES, RAMP SLOPE AND WIND, BY ENSURING THAT THE AIRPLANE WEIGHTR AND CG DURING MAINTENANCE OPERATIONS IS BELOW THIS LINE, A TIPPING SITUATION WILL BE AVOIDED.

IT WILL BE SAFE TO REMOVE ENGINES, PERFORM MAINTENANCE, ETC, IF THE AIRPLANE CG AND WEIGHT CONDITION IS BELOW THE RESPECTIVE CURVE. IF THE CG IS ABOVE THE CURVE, ENGINE REMOVAL WOULD SHIFT THE CG AFT AND SAFETY WOULD NOT BE ENSURED.

Figure 4-13 AIRPLANE GROUND STABILITY

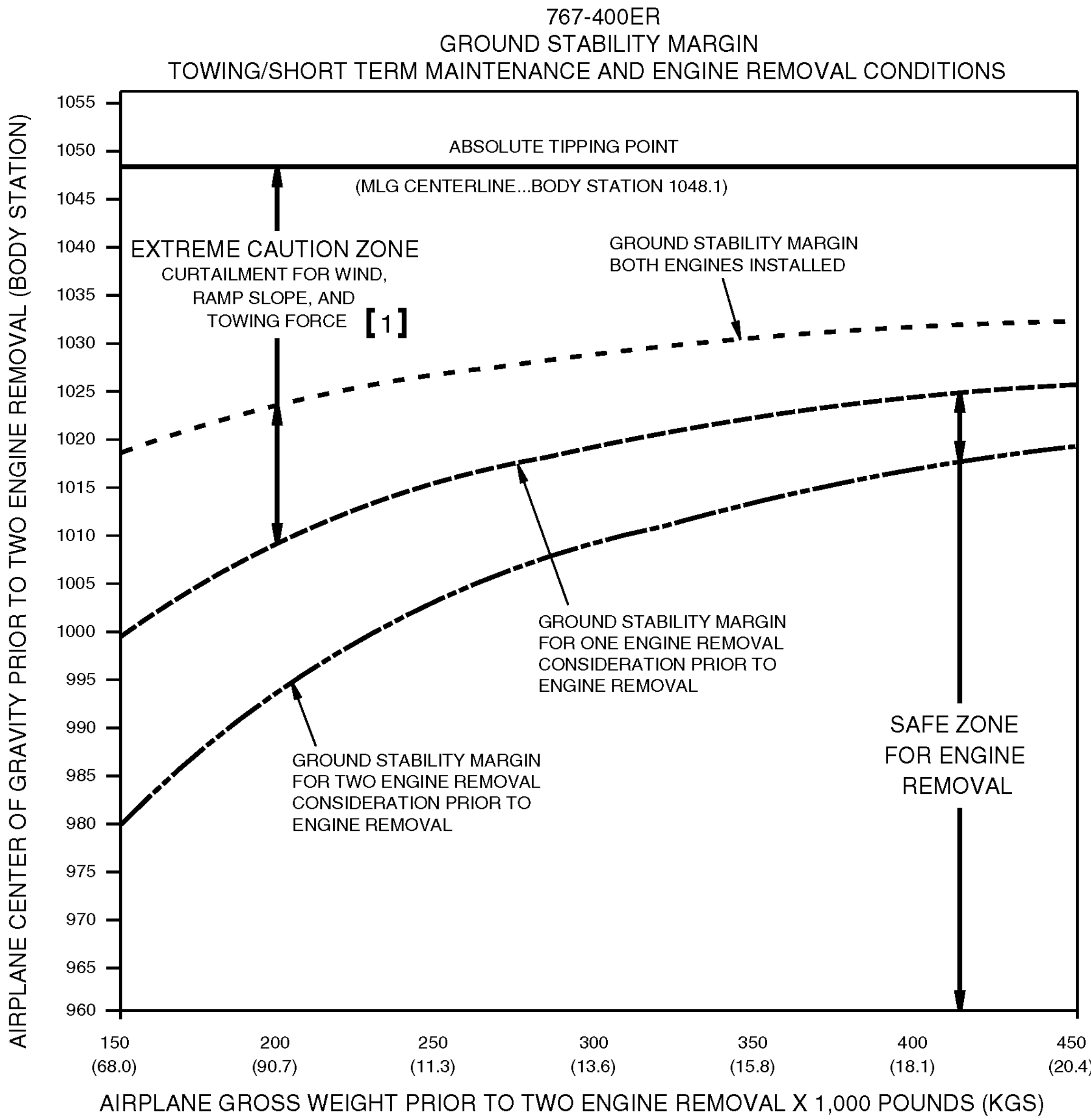


TIPPING OF 767 AIRPLANE:

THE CHART ABOVE SHOWS THE 767-200 TIPPING LIMITS. THE ABSOLUTE TIPPING LIMIT IS THE MLG CENTERLINE AT BS 1046.5. THE GROUND STABILITY MARGIN LINE REPRESENTS THE ABSLOULTE TIPPING LIMIT TO ACCOUNT FOR FACTORS SUCH AS TOWING FORCES, RAMP SLOPE AND WIND, BY ENSURING THAT THE AIRPLANE WEIGHTR AND CG DURING MAINTENANCE OPERATIONS IS BELOW THIS LINE, A TIPPING SITUATION WILL BE AVOIDED.

IT WILL BE SAFE TO REMOVE ENGINES, PERFORM MAINTENANCE, ETC, IF THE AIRPLANE CG AND WEIGHT CONDITION IS BELOW THE RESPECTIVE CURVE. IF THE CG IS ABOVE THE CURVE, ENGINE REMOVAL WOULD SHIFT THE CG AFT AND SAFETY WOULD NOT BE ENSURED.

Figure 4-14 AIRPLANE GROUND STABILITY



TIPPING OF 767 AIRPLANE;

THE CHART BELOW SHOWS THE 767-400ER TIPPING LIMITS. THE ABSOLUTE TIPPING LIMIT IS THE MLG CENTERLINE AT B.S. 1048.1 THE GROUND STABILITY MARGIN LINE REPRESENTS THE ABSOLUTE TIPPING LIMIT TO ACCOUNT FOR FACTORS SUCH AS TOWING FORCES, RAMP SLOPE AND WIND. BY ENSURING THAT THE AIRPLANE WEIGHT AND C.G. DURING MAINTENANCE OPERATIONS IS BELOW THIS LINE, A TIPPING SITUATION WILL BE AVOIDED

[1] ALLOW FOR RAMP SLOPE, WIND, AND SUBSEQUENT REMOVAL/INSTALLATION OF HEAVY ITEMS, AND PERSONNEL IN AIRPLANE

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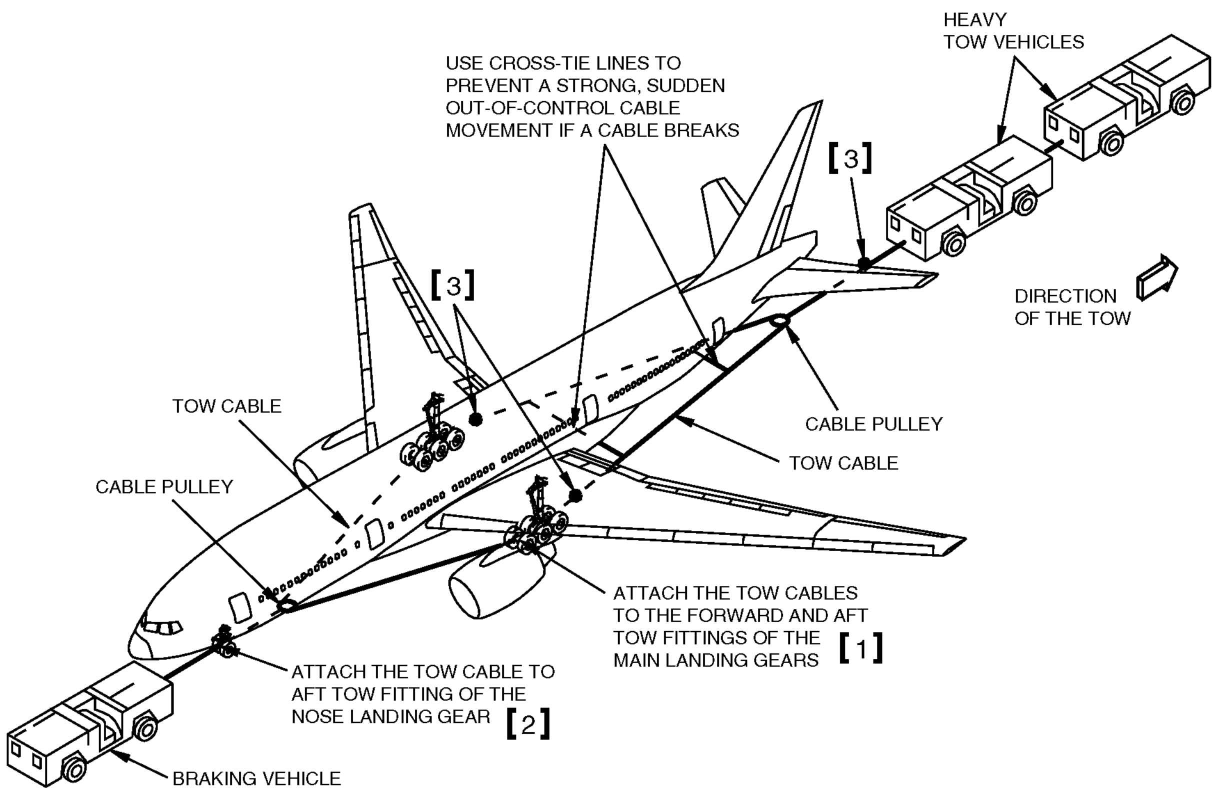
4-20-3 When You Tow or Winch the Airplane from the Main Gear

1. On the 767, there are tow lugs on the forward and the aft axles of the main gears. You can tow the airplane rearward from the rear tow fittings. For more data see Figure 4-15. Attach the nose gear to a vehicle with a towbar. This vehicle will move and stop (steer and brake) the airplane. For details on the nose gear fittings see Figure 4-8. See Figure 4-15 through Figure 4-18 for different towing and winching arrangements.

   NOTE: Do not tow the airplane from a gear that has damage. If you must use the gear, you must first repair it.

2. Use a wire rope cable between the airplane and the tow vehicle or the winch. The cable must have applicable fittings and cable diameters for the required load with sufficient safety factors. Use a load indicating device (see Figure 4-19) or equivalent between the gear and the cable to prevent damage to the gear from a dangerous load. See Figure 3-12, Figure 3-13 and Figure 3-14 for data about shackles.
3. Put a rope bridge between the cables each 15 ft (5 m). The bridge prevents sudden movements (whiplash) if a link or a cable breaks.
4. You can move the airplane forward or aft with a tow vehicle or a winch.
5. Control all the equipment to make sure it operates together as a system. Start the movement slowly. Increase the cable forces on the airplane slowly until it moves. Do not turn the gears more than the angular limits shown in Figure 4-10.
6. Use wheel chocks. Move the chocks continuously to prevent a possible opposite movement (rollback) of the airplane.
7. When the airplane starts to move, continue to keep a slow and a smooth force on it. Move the airplane in a straight line. If you must turn the airplane, make sure that you use the largest radius that you can.
8. Pull the airplane with a tow vehicle or a winch until all the gears are on the runway. Then you can use the usual tow procedures.
9. You must control the airplane when it is on a hard surface. The airplane can have a faster movement than the tow vehicle and hit it. Use a rear vehicle with a restraint cable. Then you can hold the airplane in a stable condition while it moves. The vehicle attached to the nose with a towbar will usually perform this function.
10. Be careful when you use more than one vehicle to pull the airplane. You must use them in the same straight line joined one behind the other (see Figure 4-16). This prevents a possible movement that is not symmetrical (see-saw) on the two landing gears.
11. If you use a trailer below the nose of the fuselage, it must have a turntable (swivel cradle) (see Figure 4-27). This permits the trailer to turn, if it is necessary, while you pull the airplane.

Figure 4-15 TOW CABLE ARRANGEMENT, REARWARD TOWING

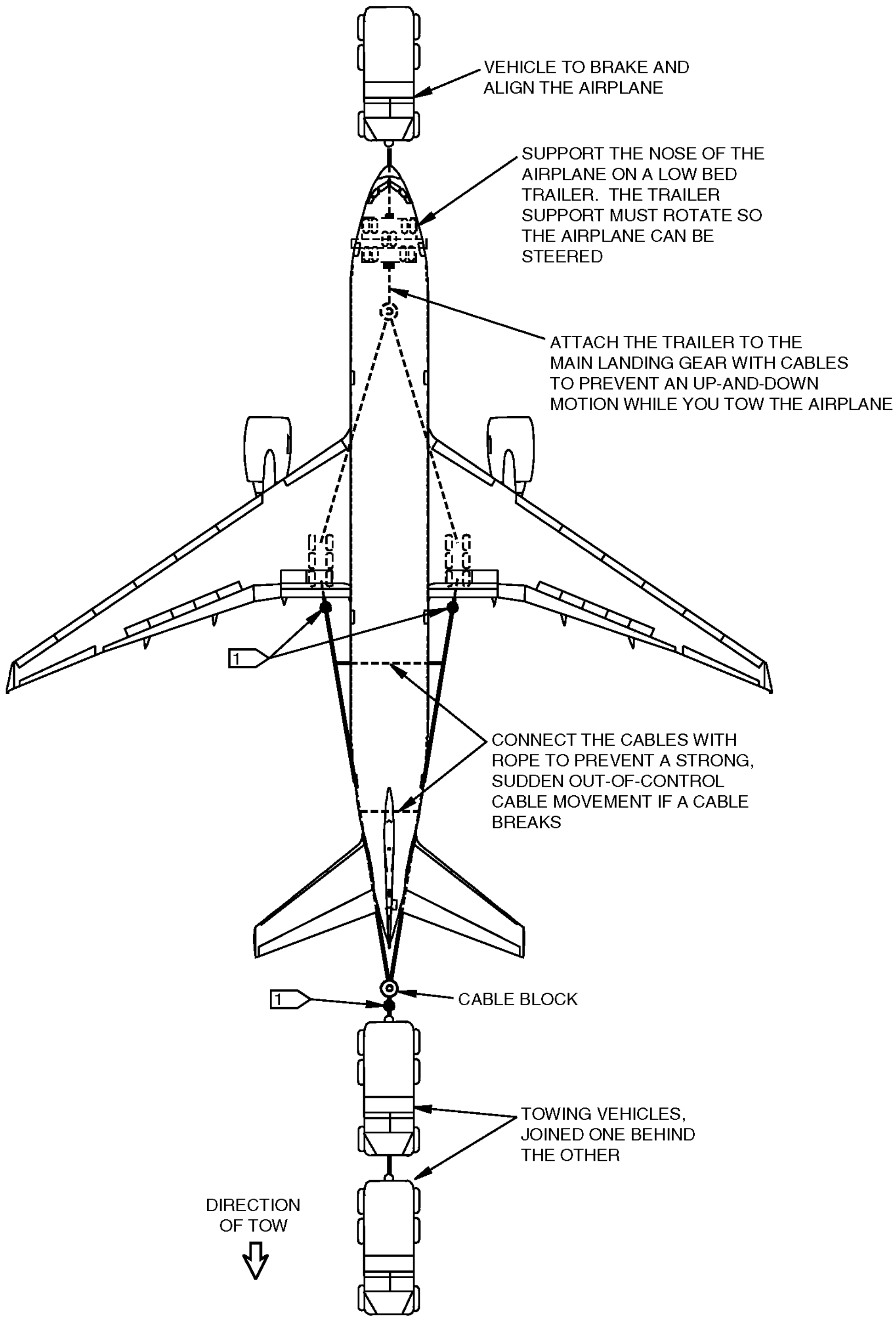


[1] SEE Figure 4-8

[2] SEE Figure 4-9

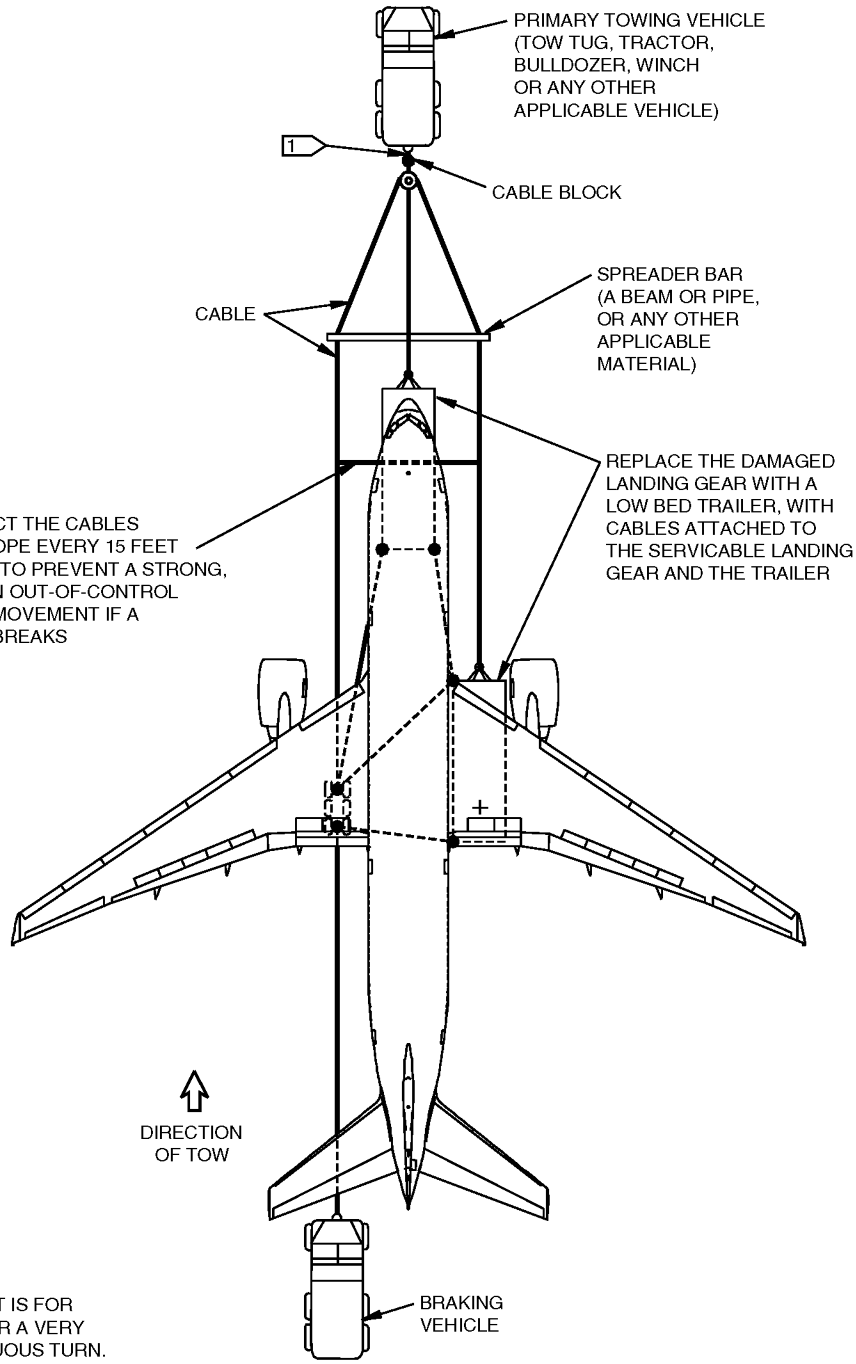
[3] LOAD INDICATING DEVICES SHOULD BE ATTACHED NEAR EACH MAIN GEAR OR ONE LOAD INDICATING DEVICE CAN BE ATTACHED TO THE CABLE BETWEEN THE AIRPLANE AND THE TOWING VEHICLE.

Figure 4-16 MULTI-VEHICLE TOWING ARRANGEMENT



1 LOAD INDICATING DEVICES SHOULD BE ATTACHED NEAR EACH MAIN GEAR OR ONE LOAD INDICATING DEVICE CAN BE ATTACHED TO THE CABLE BETWEEN THE AIRPLANE AND THE TOWING VEHICLE.

Figure 4-17 TOW CABLE ARRANGEMENT



NOTES: 1. THIS ARRANGEMENT IS FOR A STRAIGHT PULL OR A VERY SLOW AND CONTINUOUS TURN.

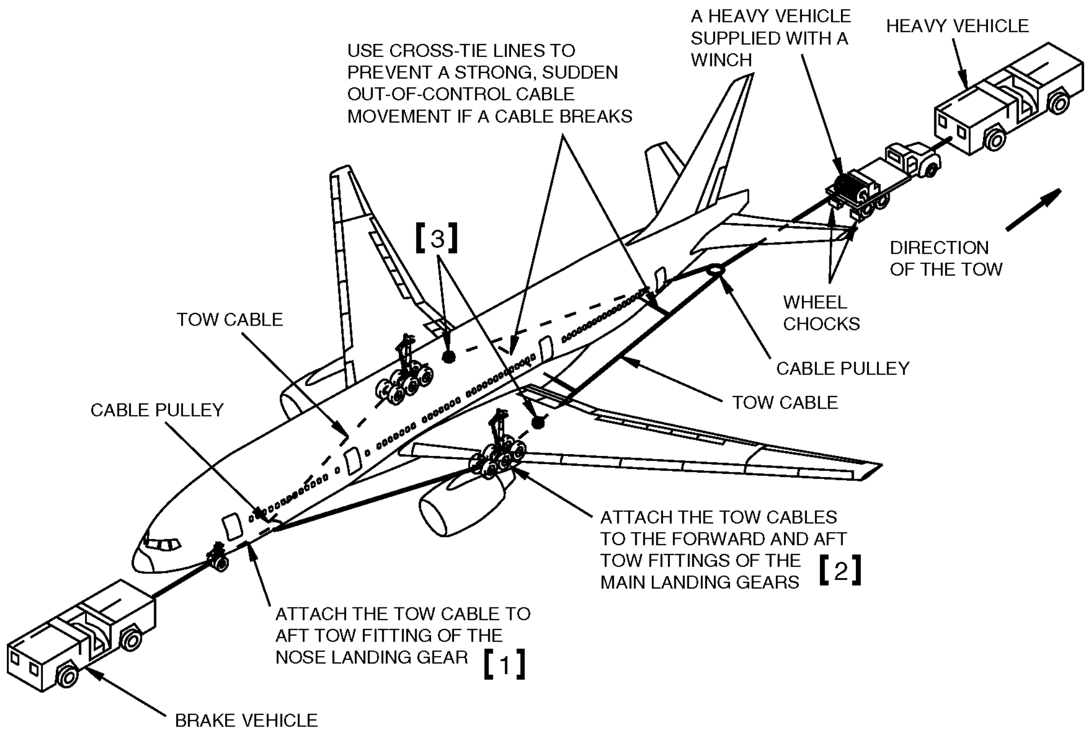
2. USE SHEAR LINKS WHEN YOU ATTACH CABLES TO THE LANDING GEAR.

1 LOAD INDICATING DEVICES SHOULD BE ATTACHED NEAR EACH MAIN GEAR OR ONE LOAD INDICATING DEVICE CAN BE ATTACHED TO THE CABLE BETWEEN THE AIRPLANE AND THE TOWING VEHICLE.

4-20-3

WHEN YOU TOW OR WINCH THE AIRPLANE FROM THE MAIN GEAR

Figure 4-18 MOVING THE AIRPLANE BY WINCHING

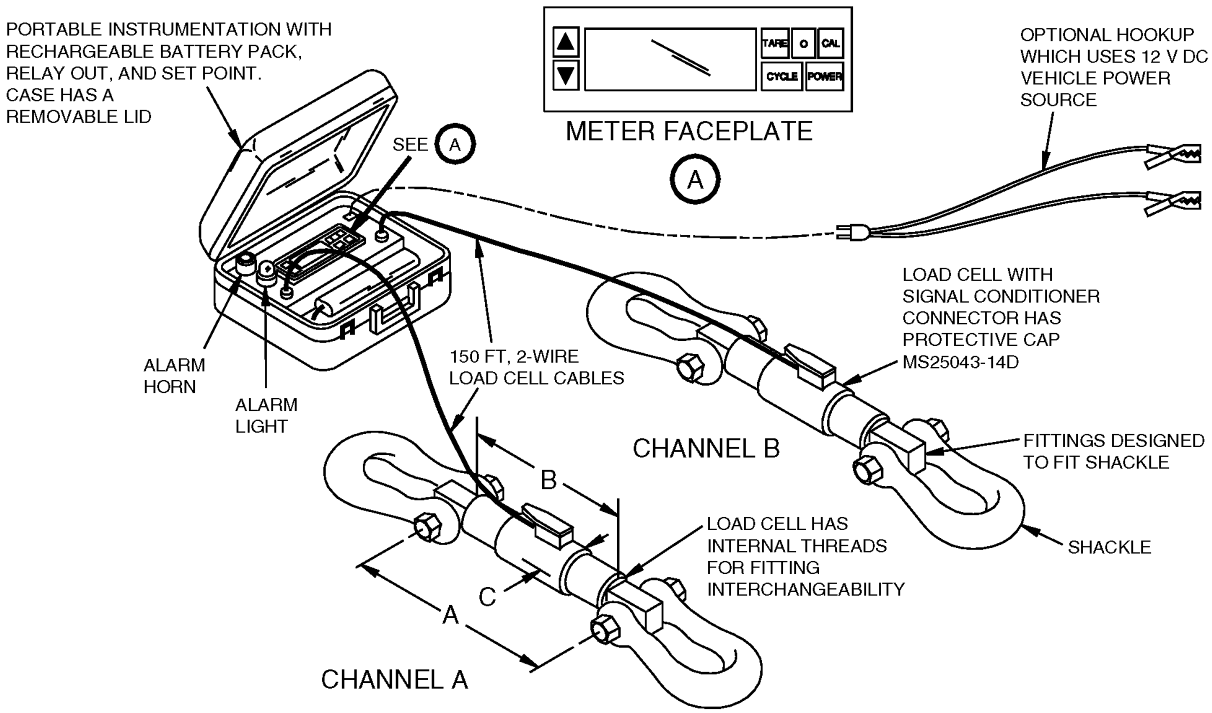


[1] SEE Figure 4-8

[2] SEE Figure 4-9

[3] LOAD INDICATING DEVICES SHOULD BE ATTACHED TO THE TOW CABLE NEAR EACH MAIN GEAR.

Figure 4-19 LOAD INDICATING DEVICE - TOWING/WINCHING



LOAD CELL CAPACITY IN KIPS	LOAD CELL CAPACITY WITH FITTINGS *[1]	APPROX DIMENSION (INCHES)			RECOMMENDED ALLOY SHACKLE	SHACKLE PIN DIA. (INCHES)	APPROX WEIGHT IN LB PER LOAD CELL
		A	B	C DIA			
150	A = 150 KIP	17.75	9.0	3.38	80 TON	2.75	60
150	B = 75 KIP	16.25	9.0	3.38	40 TON	2.25	57
150	C = 50 KIP	15.50	9.0	3.38	30 TON	2.00	57
150	D = 100 KIP	17.00	9.0	3.38	61 TON	2.50	60

*[1] COMMON LOAD CELL USES A VARIETY OF FITTINGS

NOTE: 1. Refer to SUBJECT 4-20-2 for towing load limits on main and nose gear.

2. Order by part number 63-010532-xx. The dash number is known when you find the required load capability.

3. 1.00 inch = 2.54 cm; 1 lb = 0.4536 kg; 1 ton = 907.2 kg; 1 kip = 70 kg/sq cm.

4-30 WHEN YOU MOVE A DAMAGED AIRPLANE

4-30-1 General

1. It is important for you to examine the folded landing gear for all possible damage. Do this during the initial airplane inspection. If this is not possible, you must do it after you lift the airplane to a sufficient height.
2. If it is possible, move the damaged airplane on its landing gears. If you use the landing gears, it can be necessary to do one of these procedures:
   - A. Repair the damaged gear.
   - B. Install a replacement gear.

   WARNING: YOU MUST BE VERY CAREFUL WHEN YOU MOVE THE AIRPLANE OR CHANGE ITS ATTITUDE. FUEL LEAKAGE WILL CAUSE DANGEROUS CONDITIONS. YOU MUST MONITOR THE OPERATION FOR LEAKAGES. THEN IMMEDIATELY DO THE CORRECT CONTROL PROCEDURES IF THEY ARE NECESSARY.

   - C. Install some temporary gear supports to hold the weight of the airplane.
3. If you cannot use the landing gear, you must use a different system to move the airplane. It can be necessary to use one or more of these items:
   - A. Trucks (low-bed trailers)
   - B. Movable cranes
   - C. Transportation dollies
   - D. House movement equipment
   - E. Commercial transportation equipment
4. It is possible that you must prepare the ground surface to tow the airplane (see SECTION 2-10 and SECTION 4-10).

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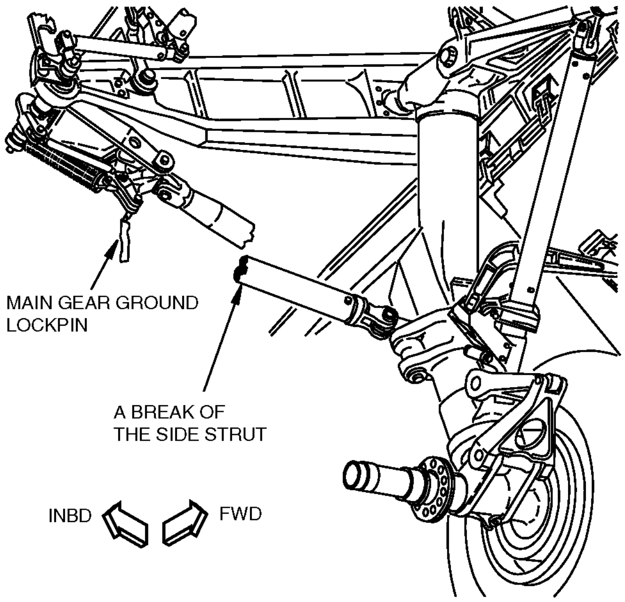
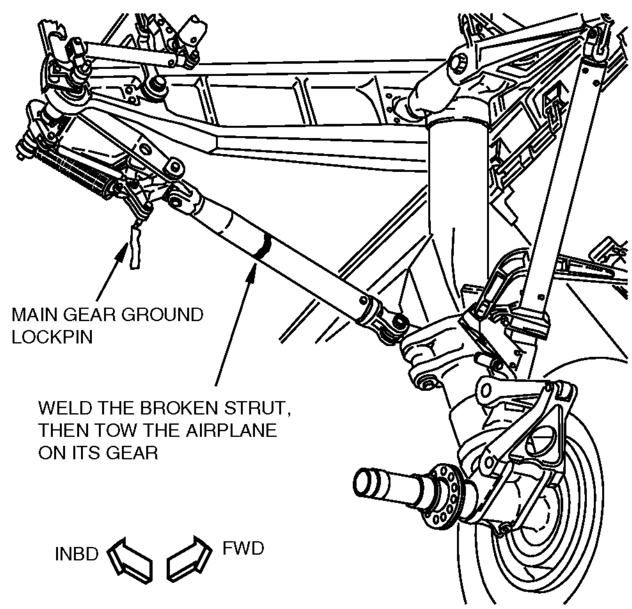
4-30-2 Repair or Replace the Damaged Gear

1. Initially, try to repair the damaged gear if the necessary parts and tools are available. Here are some examples of repaired gears. Similar procedures may be applicable to the 767 series airplane.
   A. Figure 4-20 shows a welded side strut on a 727 Main Landing Gear (MLG). The repaired MLG permits you to tow the airplane to the runway.
   B. In one example, the lower side strut on a 707 MLG was replaced to permit the airplane to be towed on its own landing gear.
   C. In a different incident, a 707 airplane makes a short landing before the runway. The landing causes damage to a MLG truck and its inner (oleo) cylinder. The damaged MLG is in the DOWN position. The recovery persons remove a length of the damaged inner cylinder. There is 12 in. (30 cm) to 14 in. (36 cm) of a good remaining cylinder. They put this remaining inner cylinder into the outer cylinder and tow the airplane to a repair area.
   D. Frequently, you can apply a temporary brace to a damaged side strut or a damaged drag strut. The landing gear must be in the extended position. Then these braces are a fast solution that permits you to tow the airplane to a repair area.
2. If a landing gear is available, a full replacement of the damaged gear is your best solution. Make sure that there is no structural damage to the gear support areas.

Figure 4-20 WELDED SIDE STRUT TO ALLOW TOWING ON THE MAIN LANDING GEAR





NOTE: THIS EXAMPLE SHOWS A 727
AIRPLANE LANDING GEAR REPAIR

4-30-3 Other Support Systems When You Cannot Use the Landing Gear

1. Movable Cranes
   A. When a landing gear is not a possible solution for you, a movable crane is your fastest solution. But you must have a ground surface with a sufficient strength. The other related conditions must also be sufficient. Then you can lift the wing and move the crane and the airplane together to a repair area.
   B. There are many different solutions that use a movable crane. See CHAPTER 3, SUBJECT 3-30-12, and SUBJECT 3-30-13 for more data on solutions that use movable cranes and slings.
2. Trucks (Low-Bed Trailers) or Dollies
   A. You can use trucks (low-bed trailers), dollies or other movable equipment to give support to a wing or the fuselage. Make sure you have a ground surface with sufficient strength for the wheels of the equipment (see SECTION 2-10 and SECTION 4-10).
   B. Use pads to prevent damage to the airplane surfaces. The pads can be foam, rubber (tires), pneumatic bags or other soft materials (mattresses) that give good protection. Make sure that the pad positions stay stable while you move the airplane. Foam and rubber pads (tires) are good because they have good friction against the airplane surface. Make sure that your pads always align with the contour of the airplane surfaces and there are no point loads. This keeps a constant pressure on all airplane surfaces that is less than the recommended maximum pressures of the manufacturer.
   C. You can fill the support areas with some foam when you use trucks or other commercial transportation equipment. You can use rubber supports (tires) to hold a wing or the fuselage (see the rubber tires in Figure 4-21 and Figure 4-22). You can use wood beams to align the rubber supports (tires) to the dihedral of the wing. You can also use wood supports (cribbing) on the movable equipment to hold landing gears that are not fully folded (see Figure 4-23).
3. Commercial Transportation Equipment
   A. Possibly, you can use the commercial equipment and procedures for the transportation of large structures. The structures can be transformers or other large items (houses, boilers or buildings). Examine these possible solutions if a usual airplane procedure is not easy for you.
   B. Speak with local persons who know this equipment. They can help you make a decision and they can also help you operate the equipment if it is necessary.

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4-30-4 Special Airplane Systems

1. Vehicle Systems

   A. The Aircraft Recovery Transportation System (ARTS) from Goldhoffer Trailers is shown in Figure 4-24 and Figure 4-25. This system was initially made to move a large width airplane (747 type) to the runway or along the runway. The system is made in modules. This permits you to change it to align with the configuration of a large airplane or a small one.

   B. There was one airplane recovery with this system that occurred before January 1992. In that recovery operation, the system moved a large width airplane (747). The damage to the airplane included no landing gear after a Rejected Takeoff (RTO) accident. There are three available ARTS systems at different locations that you can use. The manufacturer can give you more data on their location and their operation (see the Vendor List in SUBJECT 5-20-3 of this document).

   C. Figure 4-27 show a similar system called Disabled Aircraft Recovery Transport System (DARTS) which is manufactured by KAMAG of Germany. This system is available at Chep Lap Kok Airport in Hong Kong. The ARTS and DARTS systems have been used for airplane recovery operations.

2. Sledge Assembly Systems

   A. A recovery system (from A.M.S. Systems Engineering) is shown in Figure 4-29 and Figure 4-30. You use this system with other materials (aluminum panels, wood beams, etc) and vehicles to move the airplane. This is a good recovery solution if you have soft ground in your area.

   B. Figure 4-29 and Figure 4-30 show this system in a recovery operation that occurred before January, 1992. In that operation, the system moved an airplane that was 155 ft (47 m) long, which weighed 100 t (91 metric tons). The bad weather (heavy rains) caused a very soft ground surface in the area. Here are some more details:

      - The ground below the airplane had a 25 degree slope from the runway. The nose of the airplane was below the soft ground surface. The main gears were below the soft ground surface and the folded nose gear pushed up into the fuselage.
      - The recovery persons used special surface assemblies (brand name: Trakcess Aluminum Panels) below the main gears (see Figure 4-29). These assemblies permitted the main gears to move on the surface of the ground and to the runway. They used the primary system component (the sledge) below the nose of the airplane. This primary component prevented more damage to the airplane and made the recovery an easy operation.
      - Tow cables were the connection between the assembly system and two large recovery vehicles (winch tractors). Nine heavy loads, 30 t (27 metric tons) coal lorries were attached to the recovery vehicles to make them stable. Then the tow recovery vehicles pulled the airplane to the runway.

   C. Each recovery incident is different. If this equipment is a possible solution for your recovery incident, speak with the manufacturer for more data (see the Vendor List in SUBJECT 5-20-3 of this document).

Figure 4-21 THE SUPPORT OF THE WING WITH A LOW-BED TRAILER

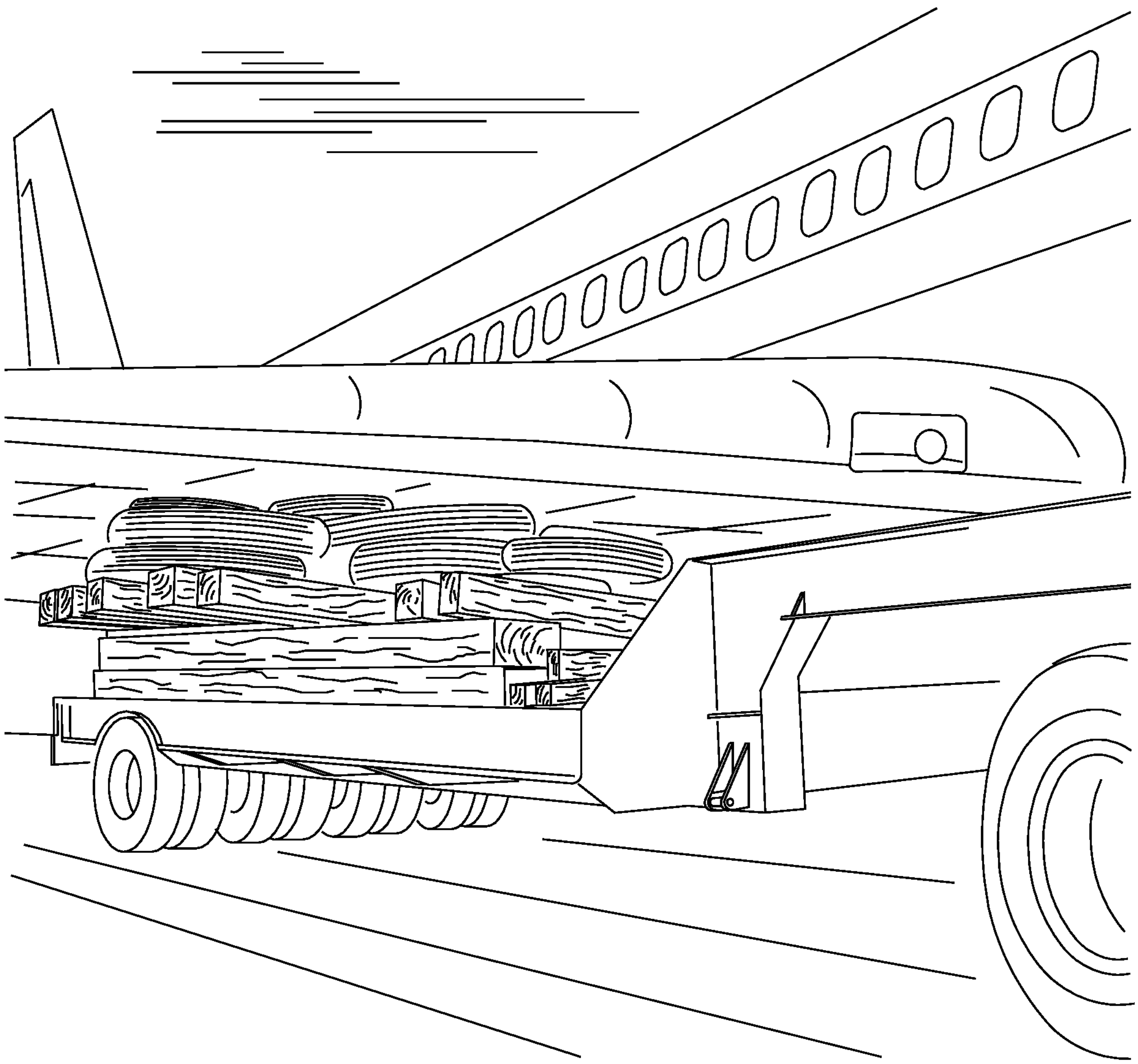
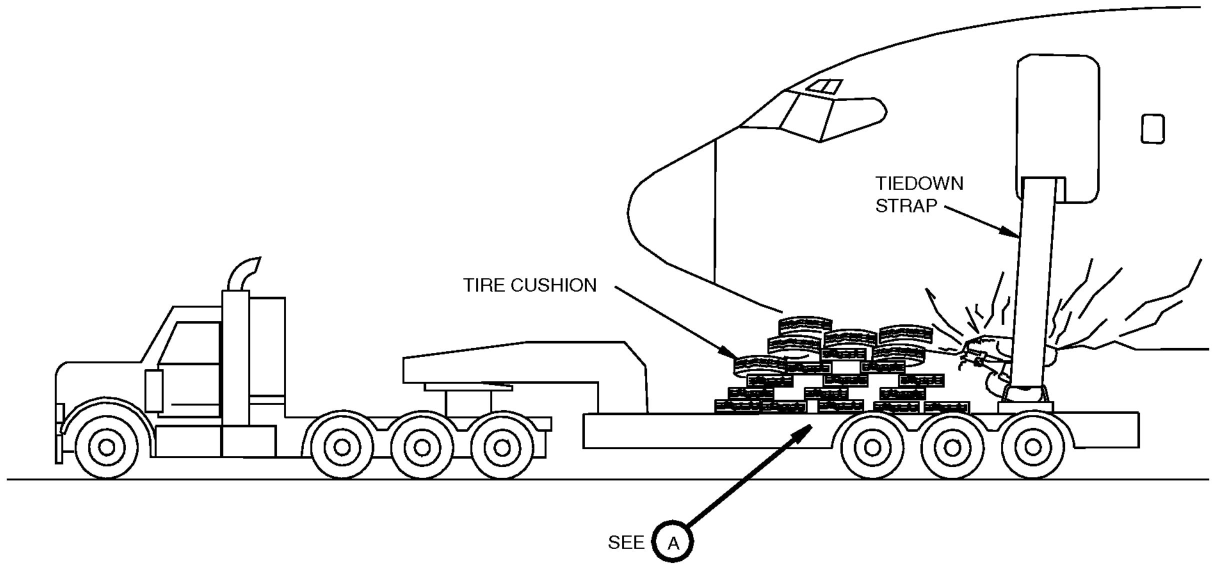
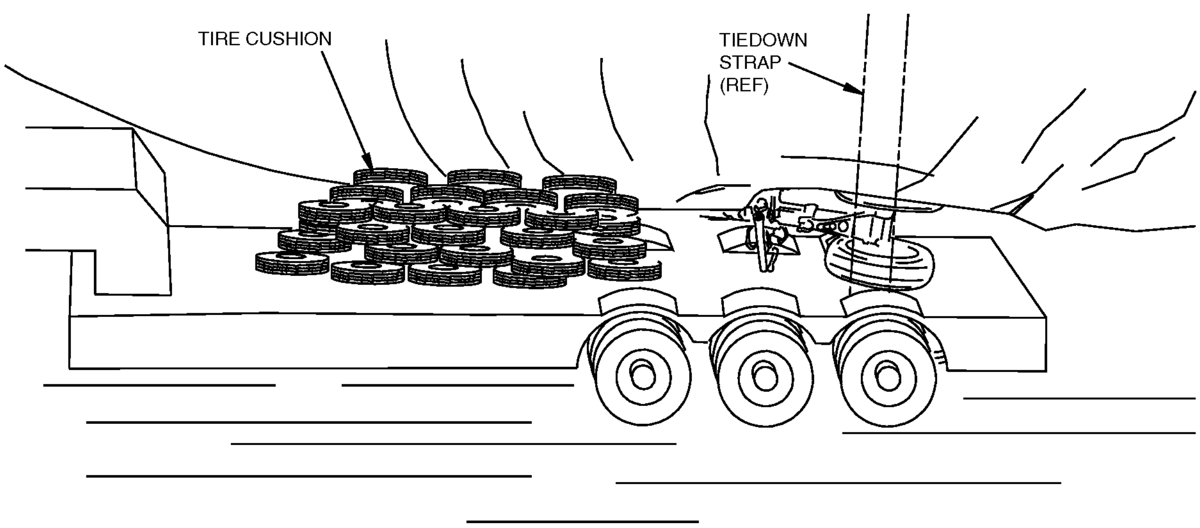


Figure 4-22 THE SUPPORT OF THE FORWARD FUSELAGE WITH A LOW-BED TRAILER





A

Figure 4-23 THE SUPPORT OF A NOT FULLY FOLDED NOSE GEAR ON A TRAILER (737 SHOWN)

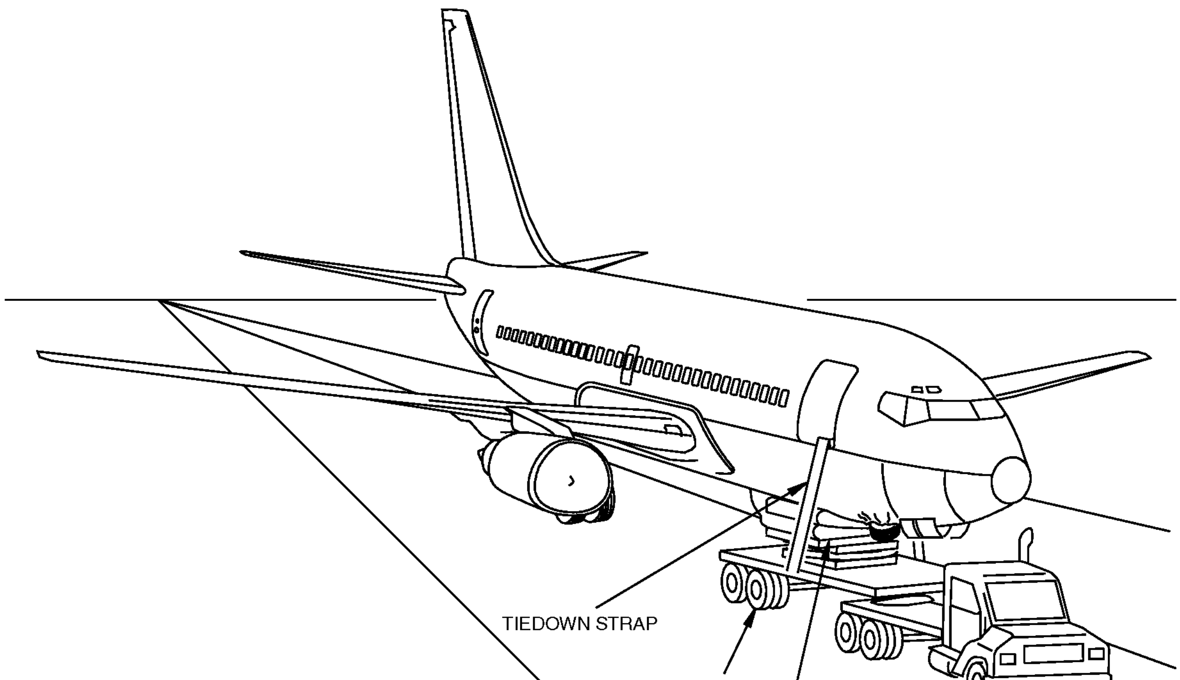
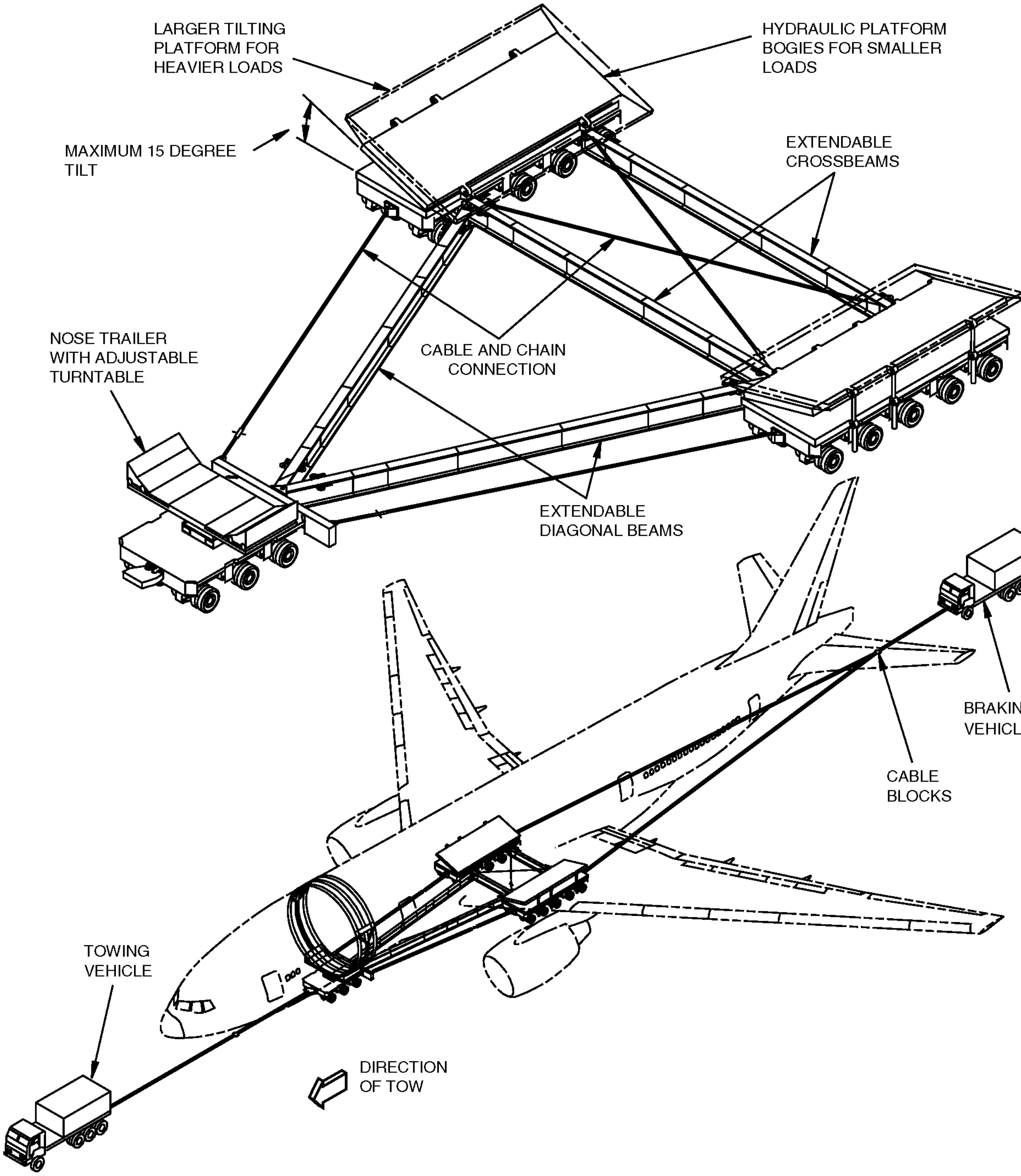
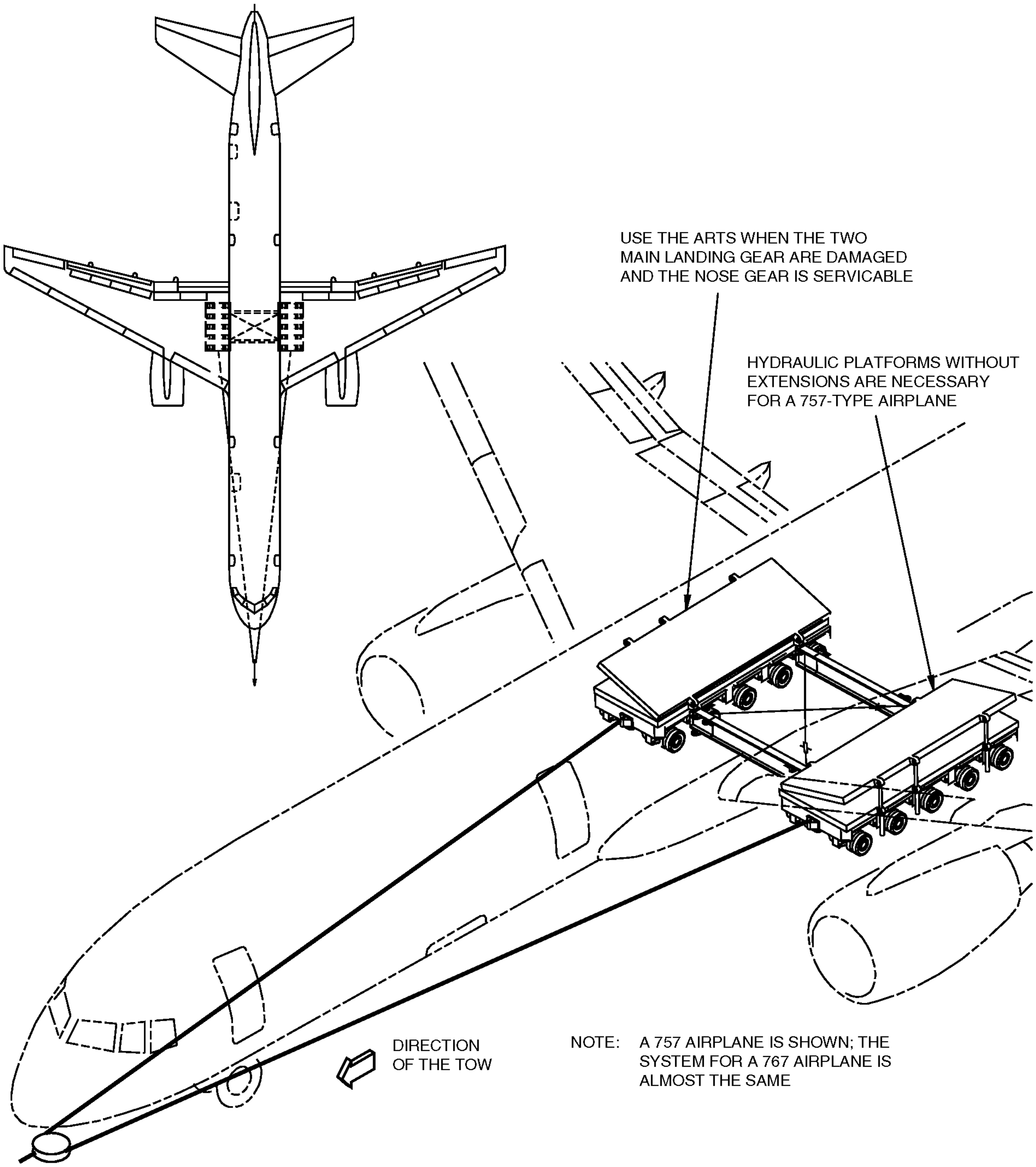


Figure 4-24 GOLDHOFFER AIRCRAFT RECOVERY TRANSPORTATION SYSTEM (ARTS)



NOTES:
1. THIS ILLUSTRATION SHOWS THE USE OF THE AIRCRAFT RECOVERY TRANSPORTATION SYSTEM (ARTS) CONTACT THE MANUFACTURER FOR THE CONFIGURATION YOU NEED FOR A SPECIFIED USE
2. FOR ADDITIONAL INFORMATION CONTACT: GOLDHOFFER, MEMMINGEN, GERMANY OR GOLDHOFFER TRAILERS, NEW YORK, USA
3. THIS SYSTEM IS GIVEN AS A GUIDE ONLY AND IS NOT ENDORSED BY THE BOEING COMPANY

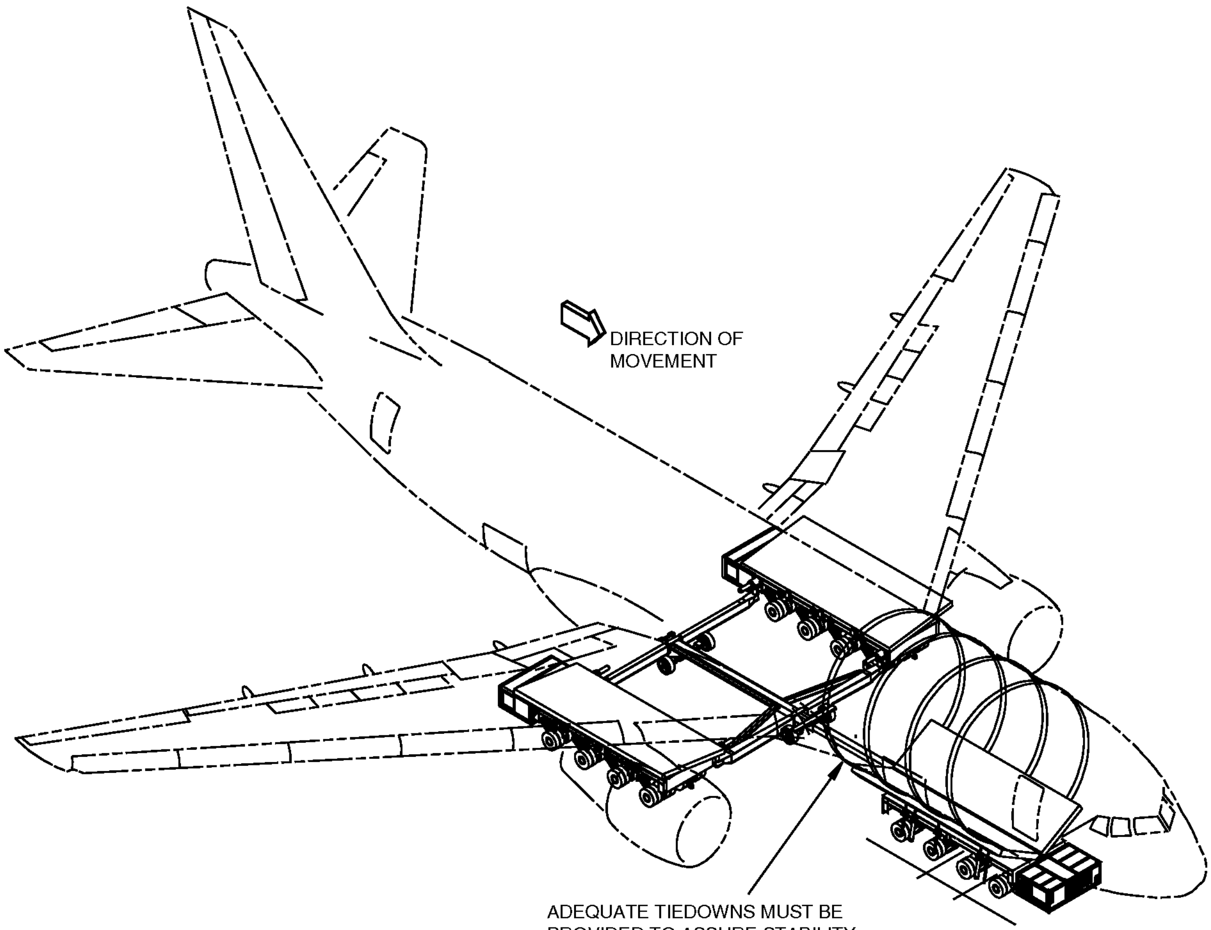
Figure 4-25 GOLDHOFFER AIRCRAFT RECOVERY TRANSPORTATION SYSTEM (ARTS)



NOTES: THE ILLUSTRATION SHOWS THE AIRCRAFT RECOVERY TRANSPORTATION SYSTEM (ARTS) USED FOR A 757 AIRPLANE. CONTACT THE MANUFACTURER FOR THE CONFIGURATION YOU NEED FOR A SPECIFIED USE

THIS SYSTEM IS GIVEN AS A GUIDE ONLY AND IS NOT SPECIFICALLY ENDORSED BY THE BOEING COMPANY

Figure 4-26 DISABLED AIRCRAFT RECOVERY AND TRANSPORT SYSTEM (DARTS)



NOTES: THIS ILLUSTRATION SHOWS THE USE OF DISABLED AIRCRAFT RECOVERY AND TRANSPORTATION SYSTEM (D.A.R.T.S.) FOR A 767 AIRPLANE RECOVERY. CONTACT MANUFACTURER FOR SPECIFIC APPLICATION USE.

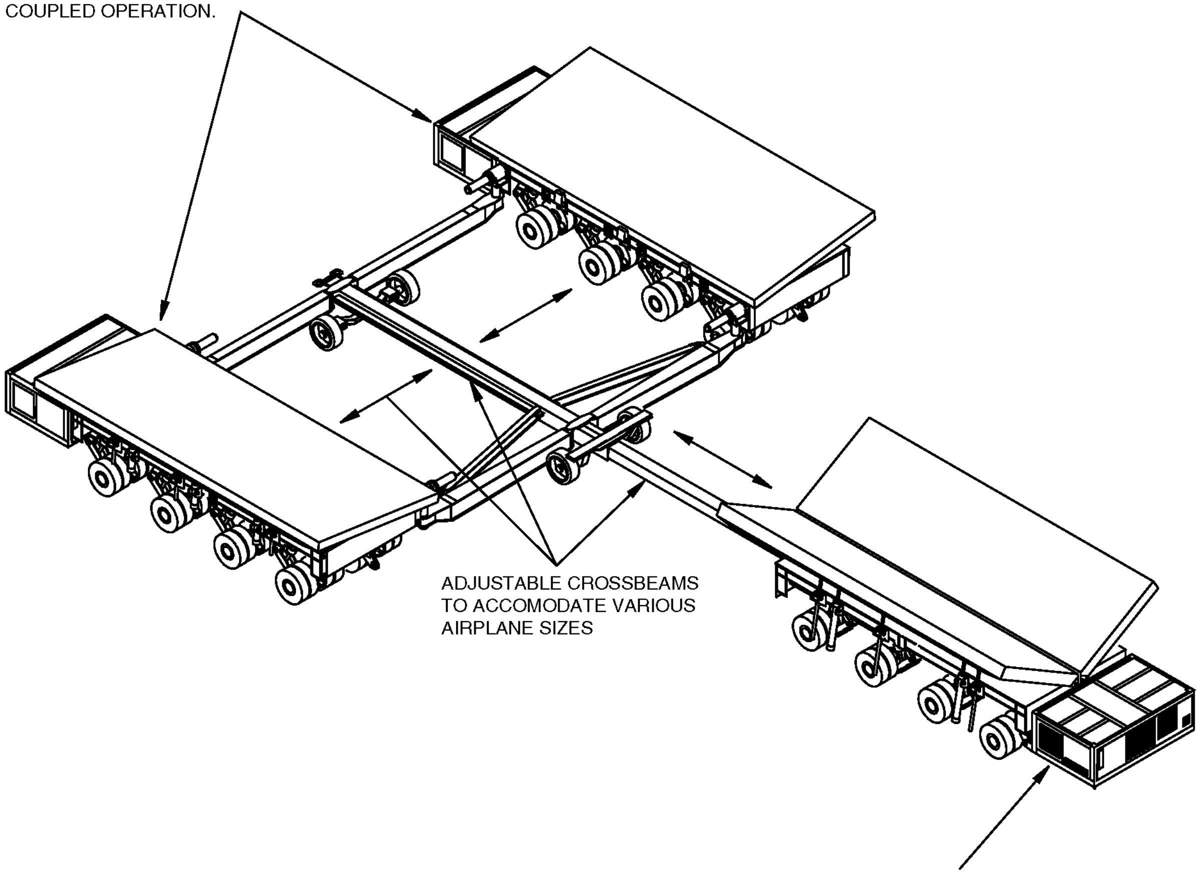
FOR ADDITIONAL INFORMATION CONTACT:
KAMAG TRANSPORTTECHNIK, GERMANY
OR KAMAG CORP. OF AMERICA
COCOA, FLORIDA, U.S.A.

THIS SYSTEM IS GIVEN AS A GUIDE ONLY AND IS NOT SPECIFICALLY ENDORSED BY THE BOEING COMPANY

Figure 4-27 KAMAG DISABLED AIRCRAFT RECOVERY AND TRANSPORT SYSTEM (D.A.R.T.S.)

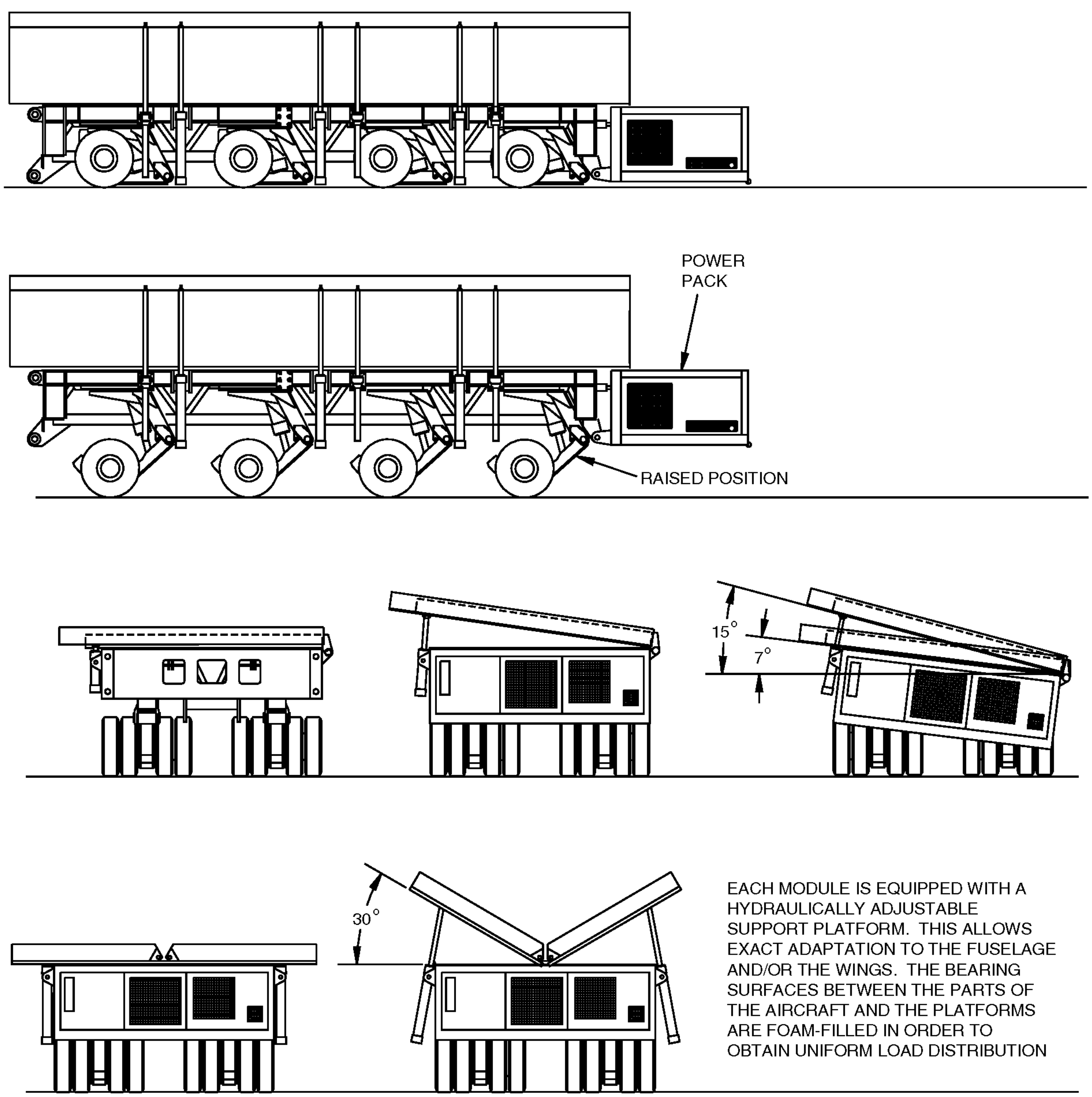
D.A.R.T.S. CAN BE USED IN A FLEXIBLE MANNER:

THE TRANSPORTER MODULES CAN BE OPERATED SEPARATELY OR COUPLED FOR USE AS A COLLECTIVE UNIT. THE FUNCTIONS OF THE ELECTRIC MULTIMODE STEERING ARE FULLY AVAILABLE FOR SINGLE OR COUPLED OPERATION.



THE INDIVIDUAL MODULES ARE PROVIDED WITH ELECTRONICALLY CONTROLLED MULTIMODE STEERING. IN COUPLED OPERATION ALL MODULES ARE SYNCHRONIZED BY A CENTRAL COMPUTER. THE WHOLE TRANSPORTER CONFIGURATION CAN BE SAFELY OPERATED BY ONLY ONE MAN.

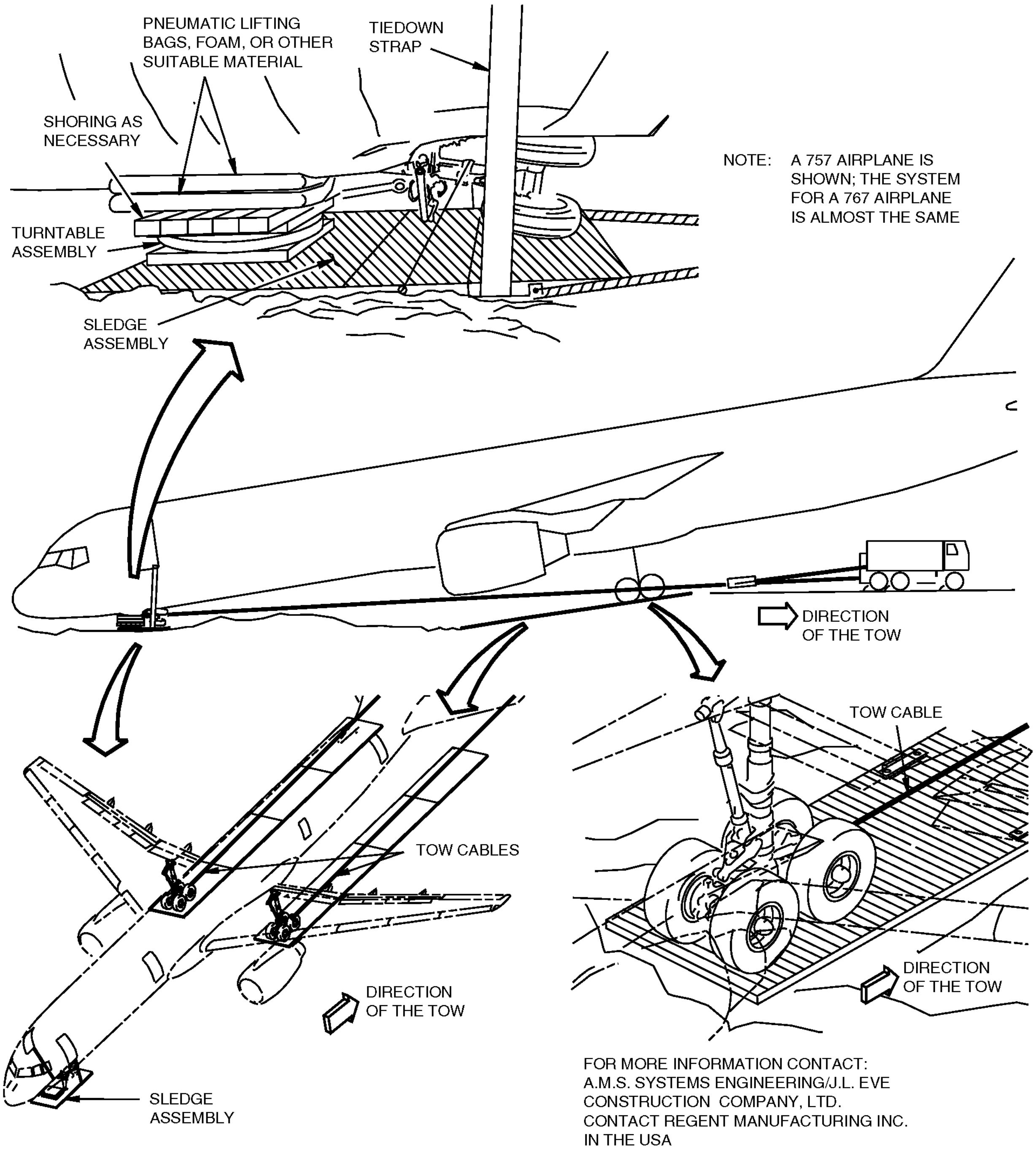
Figure 4-28 KAMAG DISABLED AIRCRAFT RECOVERY AND TRANSPORT SYSTEM (D.A.R.T.S.)



D.A.R.T.S. CONSISTS OF THREE TRANSPORTERS (MODULES) WHICH CAN BE USED EITHER COLLIECTIVELY IN COUPLED OR IN SINGLE OPERATION. EACH OF THE MODULES IS PROVIDED WITH A POWER PACK. THIS POWER PACK INCLUDES THE DIESEL ENGINE, HYDRAULIC PUMPS WHICH SUPPLY THE DRIVE SYSTEM, STEERING AND LIFTING SYSTEMS WITH PRESSURIZED HYDRAULIC OIL, AS WELL AS THE ENTIRE ELECTRONIC CONTROL SYSTEM.

IN COUPLED OPERATION THE FUNCTIONS OF THE INDIVIDUAL MODULES ARE SYNCHRONIZED WITH EACH OTHER. A CONNECTING FRAME BETWEEN THE FUSELAGE MODULE AND THE TWO WING MODULES ENSURES THAT THE DISTANCE BETWEEN THE TRANSPORTERS IS PROPERLY MAINTAINED.

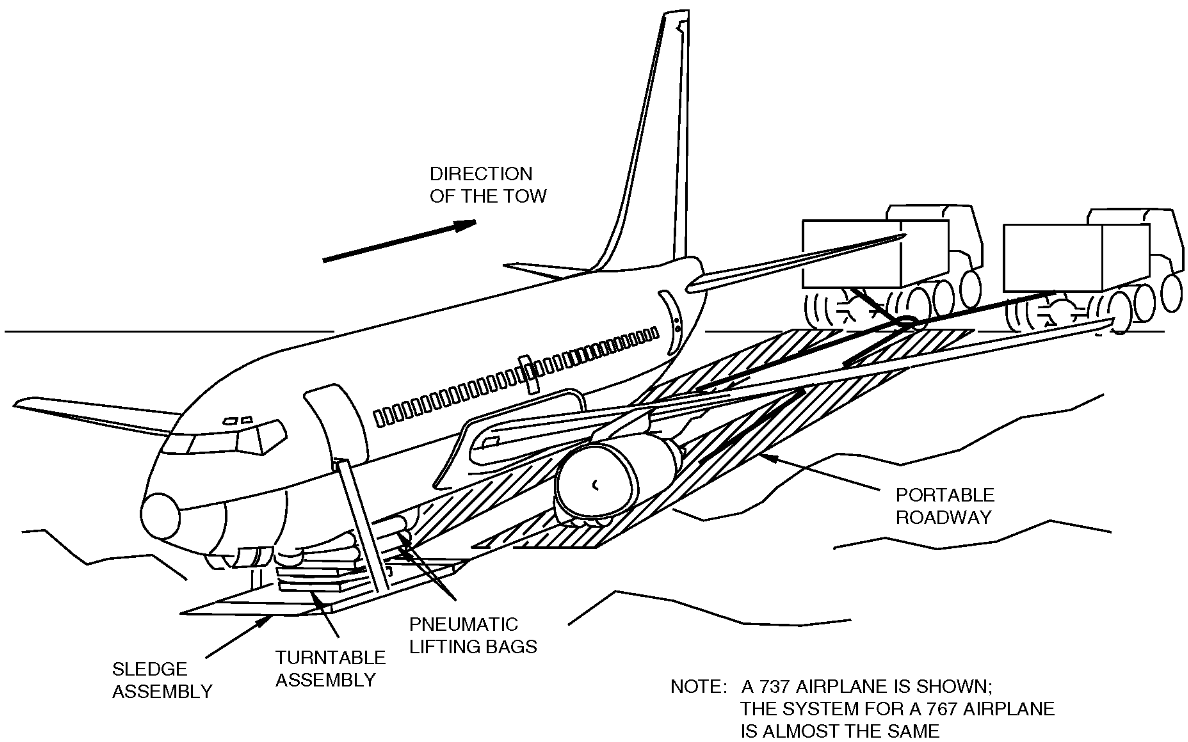
Figure 4-29 MOVING DISABLED AIRPLANE USING SLEDGE ASSEMBLY AND PORTABLE ROAD

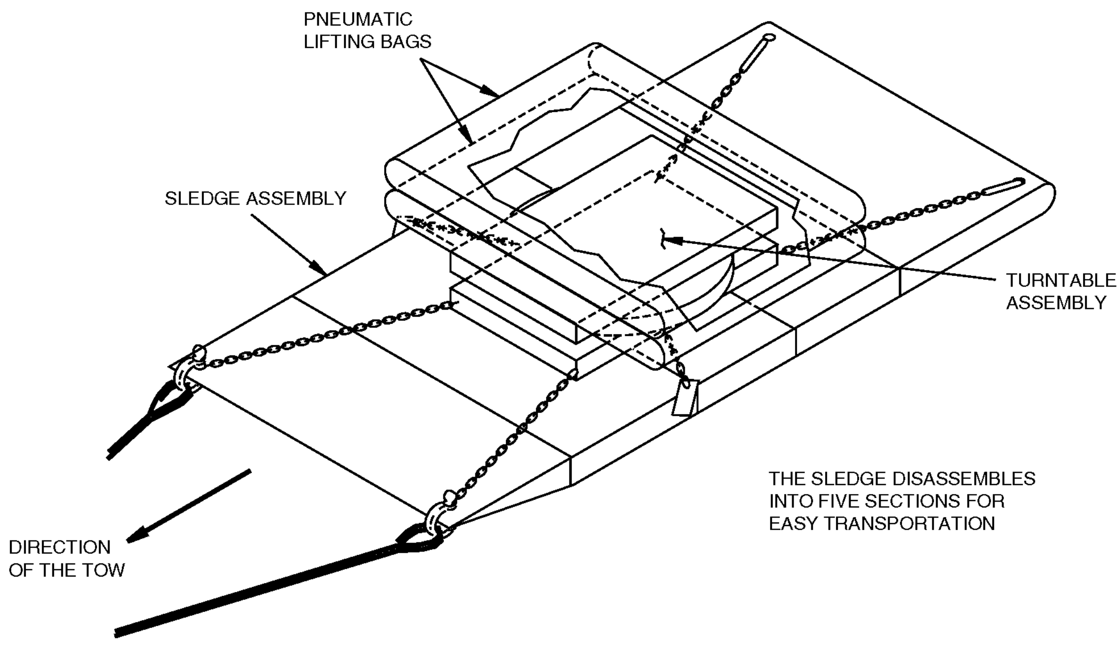


NOTES: THE ILLUSTRATIONS SHOW THE METHODS USED IN THE ACTUAL RECOVERY OF AN AIRPLANE (A BOEING 757 IS SHOWN HERE AS AN ILLUSTRATION EXAMPLE; THE ACTUAL AIRPLANE THAT WAS RECOVERED WAS A 155-FOOT LONG, 100 TON AIRPLANE). A COMBINATION OF PORTABLE ROADWAY MATERIAL AND A SLEDGE ASSEMBLY WAS USED TO RECOVER THE AIRPLANE FROM SOFT EARTH

THIS SYSTEM IS GIVEN AS A GUIDE ONLY AND IS NOT ENDORSED BY THE BOEING COMPANY

Figure 4-30 SLEDGE AND TURNTABLE ASSEMBLY





NOTE: THIS SYSTEM IS GIVEN AS A GUIDE ONLY AND IS NOT ENDORSED BY THE BOEING COMPANY

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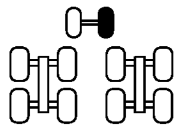
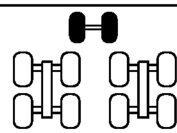
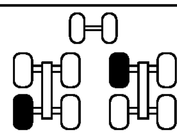
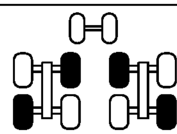
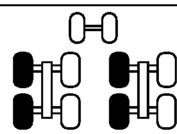
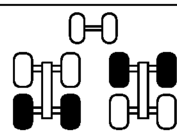
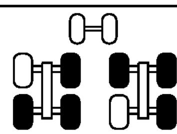
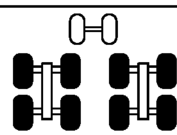
4-30-5 Towing Limits for an Airplane with Flat Tires

1. If you must move an airplane with flat tires to open a runway, you can do it. You must replace some of the tires but not all of them. The approved configurations and the limits are shown in Figure 4-31.

Figure 4-31 FLAT TIRE TOWING LIMITATIONS

SHOWS THE LOCATION OF AN INFLATED TIRE   SHOWS THE LOCATION OF A FLAT TIRE

CONDITION	TIRE POSITIONS	LIMITS
(1) ONE FLAT TIRE ON THE NOSE GEAR		NONE
(2) TWO FLAT TIRES ON THE NOSE GEAR		TOW THE AIRPLANE OFF THE RUNWAY, THEN INSTALL ONE SERVICEABLE TIRE AT THE MINIMUM
(3) ONE FLAT TIRE ON ONE OR THE TWO MAIN GEARS		NONE
(4) TWO FLAT TIRES ON DIAGONAL WHEELS, ON ONE OR THE TWO MAIN GEARS		NONE
(5) TWO FLAT TIRES, ONE BEHIND THE OTHER, ON ONE OR THE TWO MAIN MAIN GEARS		NONE
(6) TWO FLAT TIRES ON THE FRONT OR REAR WHEELS, ON ONE OR THE TWO MAIN GEARS		TOW THE AIRPLANE OFF THE RUNWAY IF THE RUNWAY MUST BE CLEAR, THEN REPLACE THE TIRES OR CHANGE THE TIRES TO AGREE WITH CONDITION (4)
(7) THREE FLAT TIRES ON ONE OR THE TWO MAIN GEARS		TOW THE AIRPLANE OFF THE RUNWAY IF THE RUNWAY MUST BE CLEAR, THEN INSTALL SERVICEABLE TIRES TO AGREE WITH CONDITION (4)
(8) FOUR FLAT TIRES ON ONE OR THE TWO MAIN GEARS		TOW THE AIRPLANE OFF THE RUNWAY IF THE RUNWAY MUST BE CLEAR. USE THE TWO MAIN GEARS FOR THE TOW, THEN INSTALL SERVICABLE TIRES TO AGREE WITH CONDITION (4)

GENERAL PROCEDURES FOR THE TOW OF AIRPLANES WITH FLAT TIRES

1. DO NOT TOW THE AIRPLANE WITH FLAT TIRES FOR A LONG TIME OR FOR A LONG DISTANCE. WHEN AN AIRPLANE IS TOWED WITH THESE CONDITIONS, AN OVERLOAD ON THE INFLATED TIRES CAN RESULT. THIS CAN CAUSE MORE TIRES TO BE REJECTED. ALSO, WHEELS, LANDING GEAR EQUIPMENT, AND STRUCTURE CAN BE DAMAGED.
2. TO CLEAR THE RUNWAY, YOU CAN TOW THE AIRPLANE IF YOU HAVE THESE CONDITIONS: (A) USE THE NOSE GEAR TO TO TOW THE AIRPLANE IF ONE NOSE GEAR TIRE AND NO MORE THAN FIVE MAIN GEAR TIRES ARE FLAT. (B) IF THERE ARE MORE THAN SIX FLAT TIRES TOTAL, A TOW AT THE TWO MAIN GEARS IS RECOMMENDED.
3. KEEP TOW SPEEDS TO A MINIMUM.
4. WHEN YOU TOW THE AIRPLANE MAKE SLOW AND CONTINUOUS, WIDE TURNS.
5. AFTER YOU TOW THE AIRPLANE WITH TWO FLAT TIRES ON AN AXLE, AS IN CONDITIONS (2) OR (6) THROUGH (8), SUBSEQUENT WHEEL MAINTENANCE MUST INCLUDE WHEEL AND TIRE INSPECTIONS AS GIVEN IN MAINTENANCE MANUAL (MM) CHAPTERS 32-45-03 AND 32-45-04. AFTER YOU TOW THE AIRPLANE WITH ONE FLAT TIRE ON AN AXLE, AS IN CONDITIONS (1) OR (3) THROUGH (5), REPLACE THE TWO TIRES ON THAT AXLE (REFER TO MM CHAPTER 12-15-03).
6. IF INCIDENTS RESULT IN FLAT GROUND WHEEL RIMS, DO NOT TOW THE AIRPLANE. A TOW ON FLAT SPOTTED WHEELS CAN CAUSE TOO MANY DRAG LOADS AND MORE DAMAGE. TOW ONLY IF THE RUNWAY MUST BE CLEAR. REPLACE FLAT SPOTTED WHEELS AND FLAT TIRES WITH SERVICEABLE EQUIPMENT BEFORE YOU START THE TOW.

5 TOOLS AND EQUIPMENT

5-00 GENERAL EQUIPMENT AND MATERIALS

5-00-1 General

1. In the pages that follow, we show three types of recovery equipment (and tools).
   - Type I, Special Recovery Equipment for all airplanes, air transportable.
   - Type II, General Recovery Equipment from local sources.
2. In SECTION 5-10 we list special recovery equipment that is specifically designed for use on the 767 series airplane for recovery operations.

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5-00-2 Type I, Special Recovery Equipment, Air Transportable

1. Some airlines in the International Air Transport Association (IATA) are identified as members of the International Airline Technical Pool (IATP). The IATP makes important equipment for airplane recovery available. You can move this equipment quickly (to all areas worldwide). The IATP identified the minimum equipment that is necessary for most recovery operations. This equipment is contained (in a kit) and installed in eleven (worldwide) locations. The locations are shown in Figure 5-1 through Figure 5-3 and are identified with an asterisk (*). This is airline equipment that is available to all airlines in the IATP. This equipment is available to airlines who are not in the IATP (on a rental basis). See for the airline persons who control this equipment (and other information).
2. A usual selection kit includes the following equipment (the airline can include additional equipment):

NO.	ITEM	QTY
1.	Pneumatic Bag, 25 ton (23 metric ton), 6 is the usual quantity, Repair Kit, and Supplemental Kit	8
2.	Movable Air Compressor, 50 cfm (1415 liters per min), 1 to 4 psi (0.07 to 0.28 kg/sq cm), Manifolds and Hoses	3
3.	Specialized Lifting Slings for Forward and Aft Body Lifting and Stabilizing	-
4.	Specialized Tether Slings	-
5.	Earth Screw Anchor	10
6.	Ratchet Hoist (Come-along), 2 ton (1.8 metric ton) capacity	4
7.	Wing jacks, 100 ton (91 metric ton) capacity, with consoles	2

NOTE: The airline that keeps the selection (kit) can possibly include other equipment.

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5-00-3 Type II, General Recovery Equipment from Local Sources

1. This equipment is frequently necessary for a recovery operation. It is possible that you can use less items or items with smaller capacities to do your operation. You can also use different equipment if it is necessary. All the equipment is usually available from local sources.
2. The IATP recommends locations for most of this equipment at the airports. It is better not to keep some equipment that has a high cost at the airports. If the equipment is not at the airport, you must speak to the local persons who have it. Then you can quickly get the equipment when it is necessary.
3. These items are different from the Special Recovery Equipment (Type I, Air Transportable).

NO.	ITEM	QTY.
1.	Wing/Body Jack 100 t (91 metric tons) capacity. Closed height 100 in. (254 cm). Extended height 169 in. (429 cm)	2
2.	Tail Jack 60 t (54 metric tons) capacity. Closed height 233 in. (592 cm). Extended height 302 in. (767 cm)	1
3.	Tail Jack 50 t (45 metric tons) capacity. Closed height 197 in. (500 cm). Extended height 266 in. (676 cm)	1
4.	Axle Jack, Cantilever Type 45 t (41 metric tons) capacity.	1
5.	Fencing with prohibitive signs	As necessary
6.	Steel Plate, 1 in. (25 mm) thick, 4 ft (122 cm) x 6 ft (183 cm)	12
7.	Steel Plate, 1 in. (25 mm) thick, 3 ft (91 cm) x 3 ft (91 cm)	12
8.	Manila Rope 3/4 in. (19 mm) diameter	500 ft (152 m)
9.	Pulley Block Double sheaves for 3/4 in. (19 mm) diameter rope	4
10.	Hardwood Beam 6 x 6 in. x 4 ft (15 x 15 x 122 cm)	2
11.	Felt padding or equivalent material	200 sq ft (19 sq m), approximately
12.	Mattress, Household-type	8
13.	Plywood Sheet, 3/4 in. (19 mm) thick, 4 ft (122 cm) x 8 ft (244 cm)	50
14.	Plywood Sheet, 1 in. (25 mm) thick, x 8 ft (244 cm)	125
15.	Shoring Timber, Hardwood, 6 x 3 in. x 8 ft (15 x 8 x 244 cm) and 12 x 12 in. x 10 ft (30 x 30 x 305 cm) approximately	500
16.	Mobile Electrical Power Unit, 5 kw or larger	1

NO.	ITEM	QTY.
17.	Floodlights with Stands Use with the above power unit which includes leads, junction box and 50 ft (15 m) extension cords	4
18.	Flashlight, Standard One for each person at night	As necessary
19.	Work Lights, Engine Driven	4
20.	Low-Height Flat Bed Trailer 150 t (136 metric tons) capacity. Height 4 ft (1.2 m) maximum	2
21.	Tow Tractor 60,000 lb (27,216 kg) drawbar pull or equivalent	1
22.	Tow Cable 20 t (18 metric tons) capacity wire rope. Length 100 ft (30 m), splice eyes at each end	4
22a.	Lifting Cable, Landing Gear Structure Assembly 50 t (45 metric tons) capacity. Length 20 ft (6 m), including splice eyes and thimbles	3
22b.	Tethering Cable or 3 in. (7.6 cm) diameter rope 20 t (18 metric tons) capacity. Length 80 ft (24 m), including splice eyes and thimbles	8
22c.	Ratchet Chain Hoist 3 t (2.7 metric tons) capacity, approximately	8
22d.	Ground Anchor 10 t (9 metric tons) capacity, approximately	8
23.	On-Site Communication Portable radios or interphone headsets	5
23a.	Telephone to Airport Operations	1
24.	Railroad Tie	Up to 1,500
25.	Crushed Rock, 1.5 in. (3.8 cm)	30 cubic yards (23 cubic meters) or equivalent
25a	Pit Run Gravel	50 cubic yards (38 cubic meters) or equivalent
26.	Planking or Steel, Aluminum or Epoxy Filament Cloth Ground Cover 2 x 8 in. x 8 ft (5 x 20 x 244 cm)	500
27.	Engine Removal Equipment: Tools, Slings, Hoists, etc	As necessary
28.	Mobile Crane 12 t (10.9 metric tons) capacity. Height 28 ft (8.5 m), 10 ft (3 m) reach for airplane component lifting including engines	1
29.	Bulldozers, Bucket Loaders, etc For excavation	As necessary

TYPE II, GENERAL RECOVERY EQUIPMENT FROM LOCAL SOURCES

NO.	ITEM	QTY.
30.	Winching Vehicles, Forklifts, Flat-bed Trucks, etc For tethering, moving, loading, unloading	As necessary
31.	Ladder At least 24 ft (7.3 m) extension	2
32.	Miscellaneous Tools: Shovels, picks, crowbars, sledge hammers, hoes, chainsaws, hammers, nails, handsaws, small hydraulic jacks, shackles, etc	As necessary
33.	Ballast: Sand bags, cement blocks, scrap iron, drums filled with water, iron ingots, railroad rails, livestock feed sacks	3000 lb (1361 kg)
34.	Trailers or Workshop Tent	As necessary
35.	Availability of Quick-Set Concrete	As necessary
36.	Availability of Large Mobile Cranes For wing and body lifting. Lift capacity to meet requirements of weight and balance computation	As necessary
37.	Used Rubber Tires	30
38.	Grounding Rod Coppertone-coated steel with 60 ft (18 m) cables and clips	10 ft (3 m)
39.	Off-load Fuel Capacity of 20,000 gal (75,708 l) Fixed mobile or bladder fuel tanks	As necessary
40.	Water Pump for Draining Ditches 2 in. (5 cm) diameter pump with a 50 gpm (189 l/min) to 100 gpm (379 l/min) capability. Pump power supply with 3 in. (7.6 cm) diameter, 100 ft (30 m) long suction hose so the pump may clear the fuel vapor area	2
41.	Penetrometer (See Boeing Document D6-24555 or the Vendor List of this document)	1

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5-10 SPECIAL RECOVERY EQUIPMENT

5-10-1 Special Tools

1. The items that follow apply to the 767. This equipment can be necessary in a recovery operation. More data about this equipment are shown in a different document, the ITEM D634T501.

Drawing #	Description
A07001	Jack Adapter - Forward Body
A07002	Emergency Jacking Equipment - Nose Landing Gear
A07003	Jack Adapter - Outboard Wing
A07004	Jacking Bar Set - Main Landing Gear Axle (-200, -300 only)
A07005	Hoist Adapter - Main Landing Gear Lift (-200, -300 only)
A07011	Hoist Equipment - Main Landing Gear Lift (-400ER only)
A07006	Torque Multiplier - Vertical Fin Tension Bolts
A07007	Sling - Vertical Fin, Installation and Removal
A07008	Jacking Bar Set - Main Landing Gear Axle (-200, -300 only)
A07009	Jacking Bar Set - Main Landing Gear Axle (-400ER only)
A09003	Lock Pin - Nose Gear Towing Lever
A20001	Boom Hoist - General
A20002	Safety Harness - Horizontal Stabilizer and Wing Attachment Attach Fitting
A20005	Clamp - Control Cable
A21001	Hoist Adapter - Air Conditioning Pack (-200, -300 only)
A21013	Hoist Adapter- Air Conditioning Pack (-400ER only)
A24001	Hoist - Airplane Battery
A25001	Replacement Equipment - Forward Galley Air Chiller
A27003	Lock Set - Rudder Power Control Actuator
A27004	Hoist Adapters - Leading Edge Slat Drive Units
A27005	Lock Assy - Outboard Aileron
A27006	Hoist - Horizontal Stabilizer Trim Act
A27007	Ground Locks - Inboard and Outboard Leading Edge Slats
A27008	Limiter - Elevator Motion
A27009	Lock Assembly - Inboard and Outboard Trailing Edge Flap
A27011	Lock Assembly - Spoiler
A27012	Sling - Inboard and Outboard Elevator
A27013	Lock Assembly - Inboard Aileron
A27015	Sling - Inboard and Outboard Aileron
A27016	Sling - Inboard Trailing Edge Flap
A27017	Sling - Leading Edge Slat, Inboard and Outboard

Drawing #	Description
A27022	Sling - Rudder
A27026	Equipment - Flap Power Drive Unit, Installation and Removal
A27027	Sling - Outboard Trailing Edge Flap
A27117	Sling- Outboard Slat PDU
A29001	Hoist Adapter - Air Driven Pump
A32002	Spring Extender Tool - Drag Strut, Main Landing Gear (-200 only)
A32003	Spring Compressor - Side Strut, Main Landing Gear
A32006	Sling - Retract Actuator, Main Landing Gear (-200, 300 only)
A32007	Protector - Axle, Main Landing Gear
A32008	Sling Equipment - Main Landing Gear Drag and Side Struts (-200, 300 only)
A32010	Puller - Retract Actuator Pin, Main Landing Gear (-200, 300 only)
A32011	Puller - Trunnion Pins, Nose Landing Gear
A32012	Wrench - Wheel Retaining Nut, Main Landing Gear
A32013	Puller - Upper Drag Brace Mounting Pins, Nose Landing Gear
A32014	Downlock - Nose Landing Gear and Main Landing Gear
A32015	Installation Tool - Lockpin, Main Landing Gear and Nose Landing Gear
A32016	Puller - Brake Rod Pin, Main Landing Gear (-200, 300 only)
A32017	Puller - Fuse Bolts, Forward Trunnion Support, Main Landing Gear (-200, 300 only)
A32020	Hoist Adapter - Drag Strut, Nose Landing Gear
A32022	Protector - Axle, Nose Landing Gear
A32023	Sling - Retract Actuator, Nose Landing Gear
A32025	Wrench - Axle Nut, Nose Landing Gear
A32026	Tools - Aft Trunnion Pin, Main Landing Gear, Installation and Removal (-200, 300 only)
A32027	Pump - Retraction and Extension Actuator, Main Landing Gear
A32028	Retention Strap - Inner Cylinder, Main Landing Gear and Nose Landing Gear
A32030	Ground Lock - Main Landing Gear Door
A32031	Turnbuckle - Truck Position Actuator, Main Landing Gear (-200, 300 only)
A32032	Overhead Sling - Main Landing Gear, Installation and Removal (-200, 300 only)
A32033	Sling - Main Landing Gear
A32036	Sling - Nose Landing Gear Assembly Handling
A32038	Transportation Dolly - Nose Landing Gear, 757/767
A32039	Tool - Removal, Main Landing Gear Bogie Pivot Pin (-200, 300 only)
A32045	Wrenches - Spanner (-200, 300 only)
A32046	Sling Equip - Main Landing Gear Drag and Side Strut (-200, 300 only)

Drawing #	Description
A32065	Restraint Wrench - Main Landing Gear Retract Actuator Support Pin
A32099	Spring Extender Tool - Drag Strut, Main Landing Gear (all models)
A32104	Puller - Fuse Bolts, Forward Trunnion Support, Main Landing Gear (-400ER only)
A32105	Sling Equipment - Main Landing Gear Drag and Side Struts (-400ER only)
A32108	Sling - Retract Actuator, Main Landing Gear (-400ER only)
A32109	Wrenches - Spanner (-400ER only)
A32110	Puller - Brake Rod Pin, Main Landing Gear (-400ER only)
A32113	Puller - Retract Actuator Pin, Main Landing Gear (-400ER only)
A32114	Turnbuckle - Truck Position Actuator, Main Landing Gear (-400ER)
A32115	Overhead Sling - Main Landing Gear, Installation and Removal (-400ER only)
A32116	Tool - Removal, Main Landing Gear Bogie Pivot Pin (-400ER only)
A32118	Sling Equip - Main Landing Gear Drag and Side Strut (-400ER)
A36001	Lift Device - Precooler
A49001	Cradle - Auxiliary Power Unit, Installation, Removal and Hoisting
A49002	Hoist Adapter - Auxiliary Power Unit Generator, Installation and Removal
A49004	Support Equipment - Auxiliary Power Unit, Installation and Removal
A49006	Track Assembly - Battery Hoist
A52004	Sling - Forward and Aft Cargo Doors
A52036	Sling - Main Deck Cargo Door
A52006	Sling - Bulk Cargo Door Replacement
A52019	Driver Set - Hinge Pin, Wide Cargo Door
A52035	Driver Set - Hinge Pin, Main Deck Cargo Door
A53001	Sling - Radome
A54003	Sling Equipment - Strut
A54004	Preload Equipment - Strut Installation
A55001	Lock Assembly - Horizontal Stabilizer
A71001	Hoist Assembly - Bootstrap, JT9D-7R4
A71002	Sling - Thrust Reverser, JT9D-7R4
A71003	Equipment - Torque, Forward Engine Mount
A71006	Cradle - 90 Inch, Rail Mounted, JT9D-7R4
A71009	Sling - Thrust Reverser, CF6-80A
A71011	Hoist Assembly - Bootstrap, CF6-80A
A71016	Sling - Core Cowl Lift, JT9D-7R4
A71017	Lift Sling - Core Cowl, CF6-80A

Drawing #	Description
A71023	Engine Cradle - 90 Inch, Rail Mounted
B20004	Leverage Adapter - Access Panel
F70312	Kit - Crowfoot Wrench
J07008	Sling - Fuselage Tethering and Lifting
OHME183T2000	Sling - Inboard and Outboard Elevator as Combined Unit
102028-767	Towbar
OHME65B00002	Sling - Fuselage Tethering and Lifting
3OHME65B00002	Sling - Fuselage Tethering and Lifting

5-20 SOURCES FOR RECOVERY EQUIPMENT

5-20-1 Local Sources of Heavy Equipment

1. The following is a list of possible sources for heavy equipment. Depending on the location of the recovery, there could be other sources for heavy equipment that we do not list here.

   A. Military Bases

   B. General and house moving contractors

   C. Large production companies

   D. Foundries

   E. Railroads

   F. Shipyards and loading docks

   G. Oil companies

   H. Lumber companies

   I. Electrical power companies

   J. Road construction companies

5-20-2 Worldwide Directory of Airplane Recovery Equipment

1. Figure 5-1 through Figure 5-3 show the recovery equipment available from the airlines in the International Airline Technical Pool (IATP) and from other airlines and airport authorities.
2. There are three items included in the data. The items are pneumatic bags, recovery jacks and slings to lift the airplane. The data do not include all the available equipment at each location. The data also does not include all possible equipment locations.

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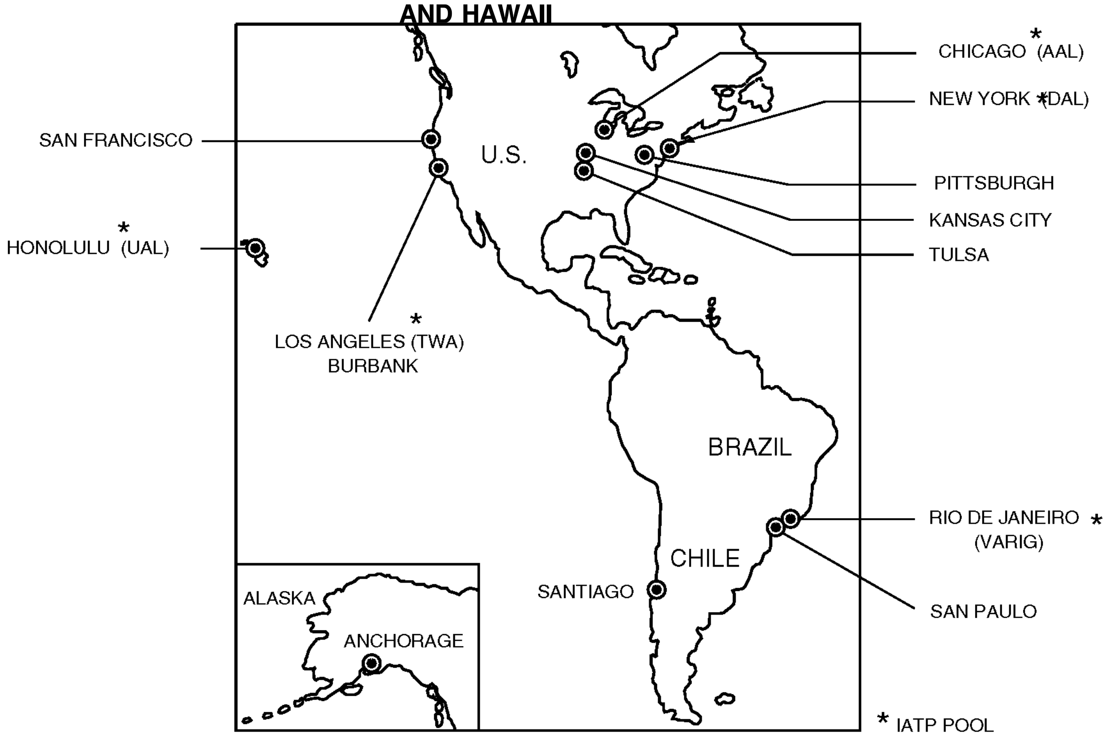
5-20-3 Special Equipment Manufacturers (Vendor List)

1. A list of known manufacturers of recovery equipment is shown in this section. The names of these manufacturers are included as an aid to you. We do not recommend these manufacturers more than other manufacturers.

Table 5-1 AIRLINE POOL RECOVERY KIT LOCATIONS AND CONTACTS

COUNTRY City/Airport	Provider Airline	Sita Code	Telephone	Contact
AUSTRALIA Sydney/Kingsford Smith International	Quantas (QF)	SYDEJQF SYDEDQF	61-2-6917829 61-2-6919119 61-2-6917271	Pooling Coordinator Base Maintenance Coordinator
BRAZIL Rio de Janeiro/Galeao	Varig Airlines (RG)	GIGMURG GIGMCRG	55-21-462-3830 55-21-468-2115 55-21-393-7625	Production Department Manager
FRANCE Paris/Orly	Air France (AF)	PARHUAF CDGGRAF	33-1-48-64-45-84	Ground Support Equipment Dept
INDIA Mumbai	Air India (AI)	BOMEBAI BOMEZAI BOMEMAI BOMELAI	91-22-836-6767 ext. 4382 91-22-836-6829	Shift in charge, Line Maintenance
JAPAN Tokyo/Narita Int'l Airport	Japan Airlines (JL)	NRTMNJL	81-476-32-4132	Assistant Director on duty
SOUTH AFRICA Johannesburg	South African Airways (SA)	JNBEWSA JNBTISA JNBMPSA	27-11-978-6175 27-11-978-6174 27-11-978-5312	Manager, IATP/ Line Station Control
UNITED KINGDOM London/Heathrow	British Airways (BA)	LHRKEBA	44-20-8513-0880	Maintenance Control Manager
UNITED STATES - 1 New York/ John F. Kennedy International	Delta Airlines (DL)	JFKMLDL ATLTEDL ATLJSDL	718-632-6701 718-632-6705	Shift Foreman
UNITED STATES - 2 Chicago/O'Hare	American Airlines (AA)	ORDMMAA	312-686-4400	Foreman
UNITED STATES - 3 Honolulu/ Honolulu Int'l	United Airlines (UA)	HNLMMUA SFOOWUA SFOMMUA SFOMSUA	808-831-5333 808-831-5334	Station Maintenance Controller
UNITED STATES - 4 Los Angeles/LAX Los Angeles Int'l	Trans World Airlines (TW)	LAXMFTW LAXMMTW	310-646-8908 310-646-3446 310-646-2410	Maintenance Manager or Supervisor on Duty

Figure 5-1 WORLDWIDE DIRECTORY OF AIRPLANE RECOVERY EQUIPMENT, NORTH AND SOUTH AMERICA AND HAWAII



LOCATION	CONTROLLING AGENCY	AIRBAGS			RECOVERY JACKS			LIFTING SLINGS		
		QTY	DESCRIPTION/ CAPACITY	MFR	QTY	DESCRIPTION/ CAPACITY	MFR	QTY	DESCRIPTION/ CAPACITY	MFR
ANCHORAGE, AK USA	NORTHWEST AIRLINES				1 SET	747 MAINT JACKS				
HONOLULU, HI USA	*UNITED AIRLINES	4	29 TON	B.F.GOODRICH	1 SET	747 AND DC10 MAINT JACKS				
		2	29 TON	VEPRO	2	100 TON RECOVERY 30-140 INCH LIFT	REGENT MODEL 8502			
		2	40 TON	VEPRO						
SAN FRANCISCO, CA USA	UNITED AIRLINES	6	25 TON	RFD/ B.F. GOODRICH	1	12 TON RECOVERY JACK		1	747 BODY SLING OHME 65B00002	
					1	50 TON RECOVERY JACK		2	727/737 MLG BEAM LIFT SLING	
						MAINTENANCE JACKS FOR 727, 737, 747, 757, 767, AND DC-10		1	NARROW BODY FUSE SLING	
								2	757 MLG BEAM LIFT SLING	
								1	DC-10 WING LIFT FITTING	
								2	767 WING LIFT FITTING	
LOS ANGELES, CA USA	*TRANSWORLD AIRLINES	6	25 TON 13 ELEMENT	RFD/ B.F. GOODRICH	1	100 TON RECOVERY 33-140 INCH LIFT	REGENT MODEL 8502	1	WIDE-BODY SLING 15 TON	TWA

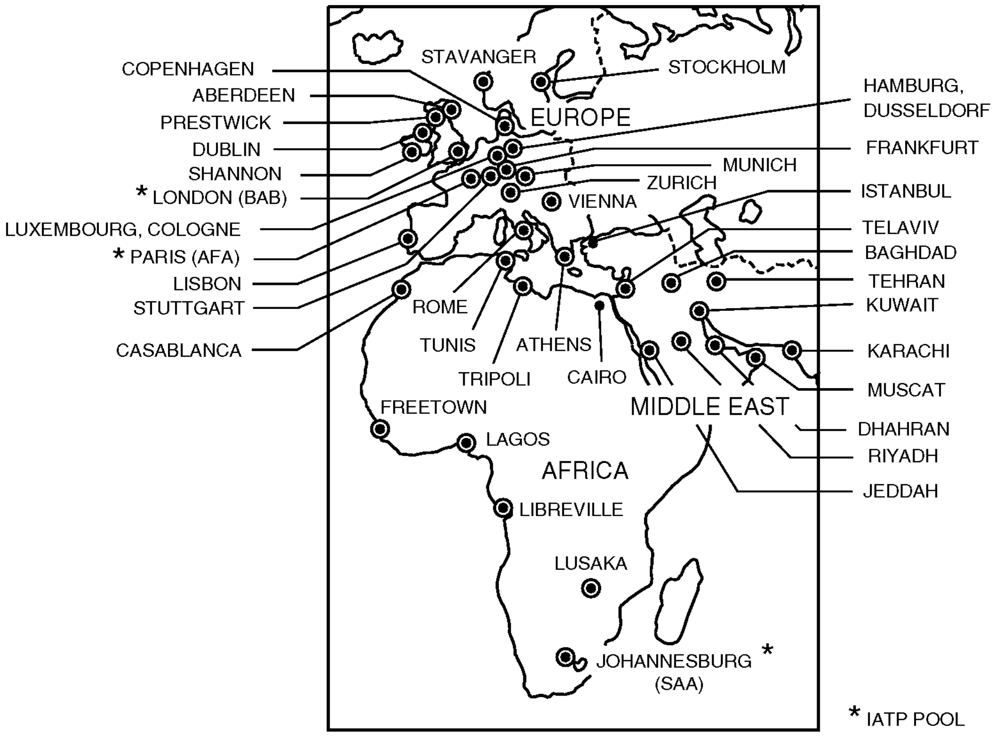
Figure 5-1 WORLDWIDE DIRECTORY OF AIRPLANE RECOVERY EQUIPMENT, NORTH AND SOUTH AMERICA AND HAWAII (Continued)

LOCATION	CONTROLLING AGENCY	AIRBAGS			RECOVERY JACKS			LIFTING SLINGS		
		QTY	DESCRIPTION/ CAPACITY	MFR	QTY	DESCRIPTION/ CAPACITY	MFR	QTY	DESCRIPTION/ CAPACITY	MFR
LOS ANGELES, CA USA (CONT.)					2	80 TON CRASH 20-140 LIFT INCH				
PITTSBURGH, PA USA	USAIR	4	29 M TON 305 CM	VEPRO				1	707/727/737 FUSELAGE F70244-17	
		2	29 M TON 245 CM	VEPRO						
BURBANK, CA USA	LOCKHEED AIRCRAFT CORP				1	80 TON RECOVERY 30-140 INCH LIFT	MALABAR MODEL 8207			
CHICAGO, USA IL	*AMERICAN AIRLINES	6	25 TON 13 ELEMENT	B.F. GOODRICH	2	80 TON RECOVERY 37-140 INCH LIFT	MALABAR MODEL SK-8272A	1	747 SLING ASSEMBLY 45 TON OHME 65B00002	
		2	40 TON 15 ELEMENT TYPES	RFD				1	707/727/737 FUSELAGE F70244-17	
	UNITED	25	12 TON		2	60 TON				
KANSAS CITY, MO USA	TRANSWORLD AIRLINES							2	707, 727 BODY, SLING, 15 TON	TWA
NEW YORK, NY USA	* DELTA AIRLINES	2	40 TON	RFD	1	80 TON CRASH JACK 30-118 LIFT INCH			UNIVERSAL 50,000 LB CAPACITY	
		6	30 TON	RFD	2	80 TON RECOVERY 30-118 INCH LIFT	MALABAR MODEL 8207			
	UNITED AIRLINES							1	727 BODY SLING	
								1	DC8 BODY SLING	
	AMERICAN AIRLINES	4	12 TON			707/727/737 MAINT. JACKS			707 BODY SLING	
	TRANSWORLD AIRLINES					747 MAINT JACKS		2	BODY SLINGS	
RIO DE JANEIRO, BRAZIL	* VARIG AIRLINES	5	25 M TON TYPE G	RFD	2	80 TON RECOVERY 30-118 INCH LIFT	MALABAR MODEL 8207	1	707/727/737 FUSELAGE F70244-17	
		2	40 M TON 15 ELEMENT TYPE F	RFD	2	50 TON 6-42 LIFT INCH	HYDRO-LITE MODEL 650	1	SLING 747 3OHME65B000 02	
		2	25 M TON TYPE H	RFD						
SAO PAULO, BRAZIL	VARIG AIR FORCE BASE					737 707, 727, MAINT JACKS				
SANTIAGO, CHILE	LAN CHILE				2	100 TON	REGENT 8517-101			
					1	30 TON	REGENT 8517-100			

Figure 5-1 WORLDWIDE DIRECTORY OF AIRPLANE RECOVERY EQUIPMENT, NORTH AND SOUTH AMERICA AND HAWAII (Continued)

LOCATION	CONTROLLING AGENCY	AIRBAGS			RECOVERY JACKS			LIFTING SLINGS		
		QTY	DESCRIPTION/ CAPACITY	MFR	QTY	DESCRIPTION/ CAPACITY	MFR	QTY	DESCRIPTION/ CAPACITY	MFR
SANTIAGO, CHILE (CONT.)					4	45 TON	COLUMBUS 5060-15			
					1	20 TON	MALABAR			
	LADECO				2	40 TON				
					1	25 TON				
	AIRPORT AUTHORTY S.E.I. DEPARTMENT	2	25 M TON TYPE G	RFD						
		4	25 M TON TYPE H	RFD						

Figure 5-2 WORLDWIDE DIRECTORY OF AIRPLANE RECOVERY EQUIPMENT, EUROPE, MIDDLE EAST AND AFRICA



LOCATION	CONTROLLING AGENCY	AIRBAGS			RECOVERY JACKS			LIFTING SLINGS		
		QTY	DESCRIPTION/ CAPACITY	MFR	QTY	DESCRIPTION/ CAPACITY	MFR	QTY	DESCRIPTION/ CAPACITY	MFR
LONDON- HEATHROW, ENGLAND	* BRITISH AIRWAYS	7	25 M TON 15 ELEMENT	RFD	2	100 TON LOW-PROFILE	REGENT	2	2BA-10053 ADJUSTABLE UP TO B747 30-35 TON	BA
		2	40 M TON 15 ELEMENT	RFD	1	50 TON LOW-PROFILE	REGENT			
	BRITISH AIRPORTS AUTHORITY	1	25 M TON 15 ELEMENT	RFD					MISC. SWR SLINGS	
		1	25 M TON TYPE D	RFD						
		2	40 M TON TYPE F	RFD						
		5	25 M TON TYPE G	RFD						
LONDON- GATWICK, ENGLAND	BRITISH AIRPORTS AUTHORITY	8	25 M TON 11 ELEMENT	RFD						
		5	25 M TON 15 ELEMENT	RFD						
		2	40 M TON 15 ELEMENT	RFD						
PRESTWICK, SCOTLAND	PRESTWICK INTERNATIONAL AIRPORT IS NOW OWNED BY PIK LTD. NO RECOVERY EQUIPMENT IS AVAILABLE.									

Figure 5-2 WORLDWIDE DIRECTORY OF AIRPLANE RECOVERY EQUIPMENT, EUROPE, MIDDLE EAST AND AFRICA (Continued)

LOCATION	CONTROLLING AGENCY	AIRBAGS			RECOVERY JACKS			LIFTING SLINGS		
		QTY	DESCRIPTION/ CAPACITY	MFR	QTY	DESCRIPTION/ CAPACITY	MFR	QTY	DESCRIPTION/ CAPACITY	MFR
DUBLIN, IRELAND	AER RIANTA (AIRPORT AUTHORITY)				1 1	2.5 TON TROLLEY JACK 2.5 TON TROLLEY JACK				
FRANKFURT, GERMANY	LUFTHANSA				2	100 TON RECOVERY	MALABAR MODEL 8294			
	CIVIL AIRPORT AUTHORITY	4 2	29 M TON 305 CM 40 M TON 305 CM	VEPRO				1	30 TON 15 TON B707 OR SMALLER	F.A. SCHELLENBERG
COPENHAGEN, DENMARK	FALCK CO	10 10	10 M TON 5 M TON	RFD RFD	1 2 3	50 TON 30 TON 20 TON				
	SAS	1 2	12 M TON 162 CM 29 M TON 245 CM	VEPRO VEPRO						
SHANNON, IRELAND	AER RIANTA (AIRPORT AUTHORITY)	6	25 M TON TYPE D	RFD	1	50 TON				
TUNIS, TUNISIA	TUNIS AIR				1 1 6 2 1	16 TON 57-108 INCH LIFT 14.8 TON 57-108 INCH LIFT 29.5 TON 58-121 INCH LIFT 49.2 TON MAIN LDG GEAR 39.3 TON NOSE LDG GEAR	S.A. PAYAN S.A. PAYAN S.A. PAYAN S.A. PAYAN HYDROGE-RATEBAU			
CASABLANCA, MOROCCO AEROPORT DE CASA-NOUVASSER	ROYAL AIR MOROC	6	12 M TON TYPE 120	AERAZUR FRANCE						
KARACHI, PAKISTAN	PAKISTAN INTL AIRLINES	2 5 2	40 M TON 25 M TON HIGH LIFT 25 M TON LOW LIFT	RFD						
ISTANBUL, TURKEY	CIVIL AIRPORT AUTHORITY	2 4	29 M TON 245 CM 29 M TON 305 CM	VEPRO						

Figure 5-2 WORLDWIDE DIRECTORY OF AIRPLANE RECOVERY EQUIPMENT, EUROPE, MIDDLE EAST AND AFRICA (Continued)

LOCATION	CONTROLLING AGENCY	AIRBAGS			RECOVERY JACKS			LIFTING SLINGS		
		QTY	DESCRIPTION/ CAPACITY	MFR	QTY	DESCRIPTION/ CAPACITY	MFR	QTY	DESCRIPTION/ CAPACITY	MFR
TEHRAN, IRAN	IRAN AIR	6	25 M TON 13 ELEMENT	RFD						
HAMBURG, GERMANY	CIVIL AIRPORT AUTHORITY	6	12 TON 6 X 6 FEET					2	25 TON 16 INCH WIDE X 49 FEET LONG	
		2	29 M TON 305 CM	VEPRO						
JOHANNES-BURG, JAN SMUTS, SOUTH AFRICA	*SOUTH AFRICAN AIRWAYS	6	25 M TON 13 ELEMENT	RFD	2	100 TON 30-140 INCH LIFT	SYNCROLIFT CORPORATION		COMPONENT SUPPORT SLINGS UP TO 11,000 LB (4990 KG)	
		2	40 M TON 20 ELEMENT TYPE F	RFD	1 SET	MAINT JACKS FOR 707, 727, 737, 747	GODFREY			
BAGHDAD, IRAQ	BAGHDAD CIVIL AIR AUTHORITY/ AIRPORT AND IRAQI AIRWAYS	6	25 M TON 11 ELEMENT	RFD		50 TON WING/BODY	REGENT			
						25 TON WING/BODY	REGENT			
						15 TON WING/BODY	REGENT			
						100 TON WING/BODY	MALABAR			
						60 TON WING/BODY	MALABAR			
						30 TON WING/BODY	MALABAR			
						25 TON WING/BODY	MALABAR			
						60 TON AXLE	MALABAR			
LUXEMBOURG	CIVIL AIRPORT	2	29 M TON 245 CM	VEPRO						
		2	29 M TON 309 CM	VEPRO						
		2	29 M TON 305 CM	VEPRO						
		2	40 M TON 305 CM	VEPRO						
STAVANGER, NORWAY	NORWEGIAN AIR FORCE HANGAR NO. 3	3	12 TON TYPE F2 6 FEET LIFT							
	BRAATHENS S.A.F.E				1	JACKING BEAM B2510-737	COLUMBUS			
					2	10 TON	COLUMBUS			
					2	COMPLETE SET FOR 737	COLUMBUS			
					1	45 TON RHINO PART NO. 5923	REGENT			

Figure 5-2 WORLDWIDE DIRECTORY OF AIRPLANE RECOVERY EQUIPMENT, EUROPE, MIDDLE EAST AND AFRICA (Continued)

LOCATION	CONTROLLING AGENCY	AIRBAGS			RECOVERY JACKS			LIFTING SLINGS		
		QTY	DESCRIPTION/ CAPACITY	MFR	QTY	DESCRIPTION/ CAPACITY	MFR	QTY	DESCRIPTION/ CAPACITY	MFR
ATHENS, GREECE	CIVIL AVIATION AUTHORITY					HYDRAULIC TRIPOD JACKS WT. CAP. RANGING 5-100 TONS				
						HYDRAULIC AXLE JACKS WT. CAP. RANGING 25-60 TONS				
TRIPOLI, LIBYA	LIBYAN ARAB AIRLINES	2	40 M TON 15 ELEMENT TYPE F	RFD	2	100 TON RAMJACKS				
		5	25 M TON 15 ELEMENT TYPE G	RFD						
		2	25 M TON 11 ELEMENT TYPE H	RFD		10 TON 53-88 INCH LIFT				
LIBREVILLE, GABON	AIR GABON				3	15 TON 45-125 INCH LIFT	KONI MODEL 3225			
					2	5 TON 40-90 INCH LIFT	HYDRO-GERA-TEBAU MODEL 1881			
					2	30 TON 60-110 INCH LIFT	HENGSTER MODEL FH-30			
					2	10 TON 90-150 INCH LIFT	SEFAH MODEL TRD10T			
					3	20 TON 50-100 INCH LIFT				
					2	25 TON 60-106 INCH LIFT	MALABAR 725A			
					1	10 TON 90-125 INCH LIFT	MALABAR 713A			
					1	10 TON 53-88 INCH LIFT	MALABAR 714A			
LAGOS, NIGERIA	NIGERIA DEPT OF CIVIL AVIATION	10	25 M TON 11 ELEMENT	RFD		1 SET UBM HOVERSY STEM MARK III				
FREETOWN, SIERRA LEONE	SIERRA LEONE AIRPORT AUTHORITY	6	25 M TON 11 ELEMENT	RFD						

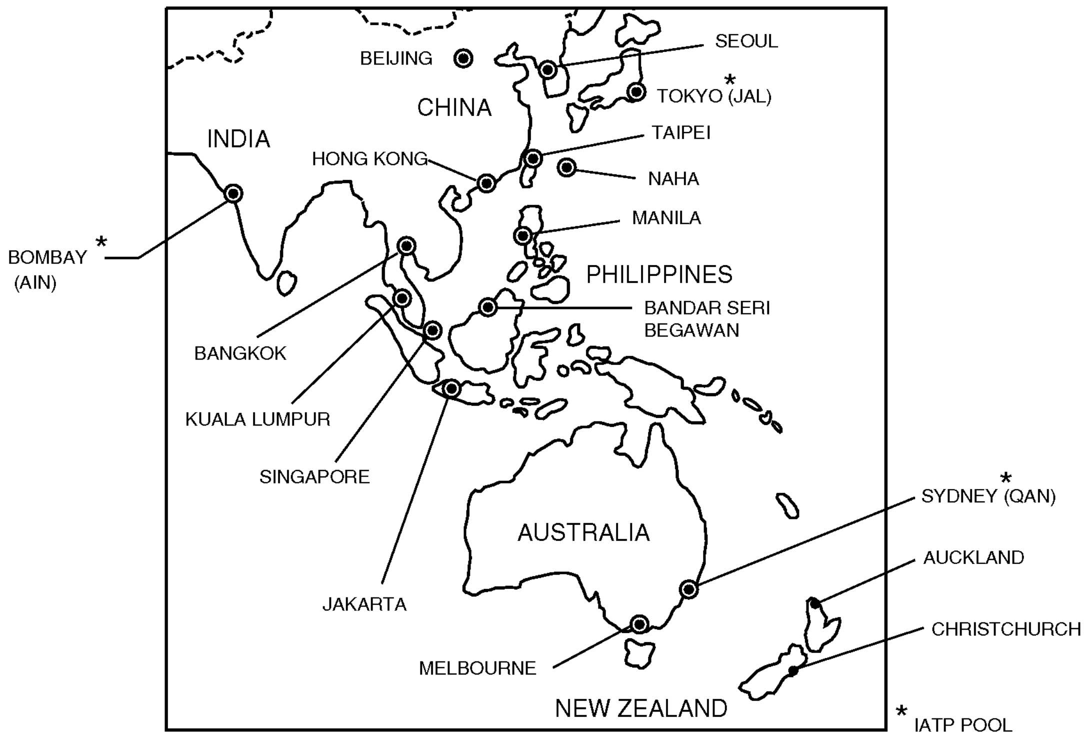
Figure 5-2 WORLDWIDE DIRECTORY OF AIRPLANE RECOVERY EQUIPMENT, EUROPE, MIDDLE EAST AND AFRICA (Continued)

LOCATION	CONTROLLING AGENCY	AIRBAGS			RECOVERY JACKS			LIFTING SLINGS		
		QTY	DESCRIPTION/ CAPACITY	MFR	QTY	DESCRIPTION/ CAPACITY	MFR	QTY	DESCRIPTION/ CAPACITY	MFR
LISBON, PORTUGAL	ANA EP/AERO PORTOS E NAVEGACAO AEREA EP	7	12 TON 8-20 INCH LIFT	ZODIAC		100 TON 97-193 INCH LIFT	REGENT MODEL 8356R			
		10	25 TON 20-147 INCH LIFT	PEREIRA E BRITO	1	50 TON 44 INCH LIFT	REGENT MODEL 2955			
	TRANSPORTERS AEROS PORTUGUESE				1	60 TON 221-321 INCH LIFT	REGENT MODEL 8357R			
					7	15 TON	REGENT MODEL 2958			
					1	30 TON 82-172 INCH LIFT	REGENT MODEL 8357R			
					2	25 TON 4O INCH LIFT	REGENT MODEL 986			
					2	15 TON 148-249 INCH LIFT	REGENT MODEL 8359			
					2	15 TON 183-297 INCH LIFT	REGENT MODEL 8330			
ROME, ITALY	FIUMICINO AIRPORT S.A.R.	2	30 M TON 14 ELEMENT	RLB				1	747 BODY SLING 24 TON	
		4	30 M TON 17 ELEMENT	RLB				2	55 TON SLING FOR MAIN GEAR TRUNNION	
		2	44 M TON 20 ELEMENT	RLB						
TEL AVIV, ISRAEL	BEN GURION INTL AIRPORT	4	12 M TON MODEL A3420	RFD	12	15 TON VARIOUS LIFTS	REGENT	1	747 BODY SLING 25 TON OHME 65B00002	PF INDUSTRIES
					2	25 TON 148-249 INCH LIFT	MALABAR			
					1	30 TON 87-188 INCH LIFT	MALABAR	2	10 TON	LIFT-ALL CO EM2806
					5	50 TON VARIOUS LIFTS	REGENT			
					3	60 TON VARIOUS LIFTS	REGENT AND MALABAR			
					6	100 TON VARIOUS LIFTS	REGENT AND MALABAR			
					2	110 TON 97-187 INCH LIFT	REGENT			

Figure 5-2 WORLDWIDE DIRECTORY OF AIRPLANE RECOVERY EQUIPMENT, EUROPE, MIDDLE EAST AND AFRICA (Continued)

LOCATION	CONTROLLING AGENCY	AIRBAGS			RECOVERY JACKS			LIFTING SLINGS		
		QTY	DESCRIPTION/ CAPACITY	MFR	QTY	DESCRIPTION/ CAPACITY	MFR	QTY	DESCRIPTION/ CAPACITY	MFR
ZURICH, SWITZERLAND	SWISSAIR AIRLINES	7	25 M TON	RFD		VARIOUS JACK CAPACITIES- USES RANGING FROM WING TO FUSELAGE		2	3 TON	
								2	3.5 TON	
		2	40 M TON	RFD				4	5.2 TON	
	CIVIL AIRPORT AUTHORITY	5	29 M TON 305 CM	VEPRO	3	100 TON	REGENT MODEL 8502	4	747 WING GEAR TRUNNION SLING 135 TON	
		2	40 M TON 305 CM	VEPRO	3	25 TON WING JACK		2	30 TON SLING OHME 65B00002	
		2	25 M TON TYPE H	RFD	1	20 TON FUSELAGE JACK		1	6 TON LIFTING SLING	
STOCKHOLM, SWEDEN	CIVIL AIRPORT AUTHORITY	2	29 M TON 305 CM	VEPRO						
		2	29 M TON 245 CM	VEPRO						
STUTTGART, GERMANY	STUTTGART AIRPORT AUTHORITY	2	25 M TON 11 ELEMENT	RFD						
		2	29 M TON 305 CM	VEPRO						
VIENNA, AUSTRIA	CIVIL AIRPORT AUTHORITY	2	25 M TON 11 ELEMENT	RFD						
		2	12 M TON 162 CM	VEPRO						
PARIS- ORLY, FRANCE	*AIR FRANCE	8	25 M TON 15 ELEMENT	RFD	2	747 FUSELAGE 100 TON				
		2	40/305 TON 300 CM	VEPRO	1	747 TAIL 80 TON				
LUSAKA, ZAMBIA	ZAMBIA AIRPORT AUTHORITY	6	25 M TON 15 ELEMENT	RFD						
MUSCAT, OMAN	MUSCAT DEFENSE DEPT.	4	25 M TON 11 ELEMENT	RFD						
MUNICH, GERMANY	CIVIL AIRPORT AUTHORITY	2	29 M TON 305 CM	VEPRO						
COLOGNE, GERMANY	CIVIL AIRPORT AUTHORITY	1	12 M TON 162 CM	VEPRO						
		1	29 M TON 305 CM							
DUSSELDORF, GERMANY	CIVIL AIRPORT AUTHORITY	3	12 M TON 162 CM	VEPRO						

Figure 5-3 WORLDWIDE DIRECTORY OF AIRPLANE RECOVERY EQUIPMENT, AUSTRALASIA AND FAR EAST



LOCATION	CONTROLLING AGENCY	AIRBAGS QTY	AIRBAGS DESCRIPTION/ CAPACITY	AIRBAGS MFR	RECOVERY JACKS QTY	RECOVERY JACKS DESCRIPTION/ CAPACITY	RECOVERY JACKS MFR	LIFTING SLINGS QTY	LIFTING SLINGS DESCRIPTION/ CAPACITY	LIFTING SLINGS MFR
TOKYO- NARITA, JAPAN	* JAPAN AIRLINES	2	40 M TON TYPE F	RFD	2	80 TON RECOVERY 30-118 LIFT INCH	MALABAR MODEL 8207	2	SC-250-214 45 TON, 747	JAL
		5	29 M TON 305 CM	VEPRO						
		2	29 M TON 245 CM	VEPRO						
SYDNEY, AUSTRALIA	* QANTAS AIRWAYS	6	25 M TON TYPE D	RFD		80 TON LOW-PROFILE	MALABAR MODEL 8207C			
		6	25 M TON 11 ELEMENT	RFD	2					
		6	40 M TON 15 ELEMENT	RFD						
		3	40 M TON TYPE F	RFD						
HONG KONG	CIVIL AVIATION DEPT HONG KONG AIRPORT	2	40 TON TYPE F	RFD	7	35 TON		1	HORIZONTAL STABILIZER SLING ASSEMBLY 2OHME65B00180	
		4	29 TON HEIGHT 3.05 M	VEPRO	7	40 TON		1	AFT FLAP SLING ASSEMBLY 12ME65B00116	

Figure 5-3 WORLDWIDE DIRECTORY OF AIRPLANE RECOVERY EQUIPMENT, AUSTRALASIA AND FAR EAST (Continued)

LOCATION	CONTROLLING AGENCY	AIRBAGS			RECOVERY JACKS			LIFTING SLINGS		
		QTY	DESCRIPTION/ CAPACITY	MFR	QTY	DESCRIPTION/ CAPACITY	MFR	QTY	DESCRIPTION/ CAPACITY	MFR
HONGKONG (CONTINUED)		2	29 TON HEIGHT M 2.45	VEPRO	2	100 TON		1	OVERHEAD SLING ASSEMBLY OHME65B90100	
		2	25 TON TYPE G	RFD				1	OVERHEAD SLING ASSEMBLY 2OHME65B89603	
								1	NOSE CARGO DOOR SLING ASSEMBLY 2OHME65B1305	
								4	ENGINE SLINGS	
								1	BODY SLING OHME65B00002	
								1	BODY SLING 3OHME65B00002	
KUALA LUMPUR, MALAYSIA	MALAYSIAN AIRLINES	3	12 TON		2	HYDRAULIC JACK		1	737 HORIZONTAL STABILIZER SLING ASSEMBLY F80006	
		4	40 TON TYPE F	RFD						
		10	25 TON TYPE G	RFD				1	737 SLING RUDDER ASSEMBLY F80025-1	
		4	25 TON TYPE H	RFD				1	737 SLING ASSEMBLY TRAILING EDGE FANS F80038-1	
TAIPEI, TAIWAN	CCAA CHINESE CIVIL AERONAUTIC AIRPORT ADMIN	3	40 M TON	RFD		AXLE JACKS				
		7	12 M TON		1	10 TON 11-31 INCHLIFT				
					1	17 TON 9-35 INCH LIFT				
					1	12 TON 8-23 INCH LIFT	REGENT			
					2	50 TON 10-22 INCH LIFT				
					3	20 TON 10-36 INCH LIFT				
					5	TRIPOD JACK 898R 40 TON 60-120 INCH LIFT				

Figure 5-3 WORLDWIDE DIRECTORY OF AIRPLANE RECOVERY EQUIPMENT, AUSTRALASIA AND FAR EAST (Continued)

LOCATION	CONTROLLING AGENCY	AIRBAGS			RECOVERY JACKS			LIFTING SLINGS		
		QTY	DESCRIPTION/ CAPACITY	MFR	QTY	DESCRIPTION/ CAPACITY	MFR	QTY	DESCRIPTION/ CAPACITY	MFR
JAKARTA, INDONESIA	PERTAMINA (PELITA AIR SERVICE)				3	AFT/BODY OUTBD WING 12 TON 120-174 INCH LIFT	MALABAR 713A			
					2	FWD BODY 20 TON 72-100 INCH LIFT	MALABAR 718A			
					2	INBD BODY 60 TON 66-122 INCH LIFT	MALABAR 767			
					1	EMERG JACK BEAM	MALABAR MODEL 60L4.5			
					2	GENERAL PURPOSE 20 TON	SKY-HI 52071			
BANGKOK, THAILAND	DIRECTOR OF CIVIL AVIATION, R.T.A.F.	2	40 M TON 15 ELEMENT	RFD						
		2	25 M TON 11 ELEMENT	RFD						
	THAI INTL AIRLINES	2	40 M TON 305 CM	VEPRO	2	747 MAINTENANCE JACK	HYDRO	1	747 BODY SLING	VEPRO
		2	29 M TON 245 CM	VEPRO	3	737 MAINTENANCE JACK	HYDRO	2	747 WING MAIN LANDING GEAR TRUNNION SLING	VEPRO
		5	29 M TON 305 CM	VEPRO				1	747 NOSE CARGO DOOR SLING	VEPRO
								1	747 SIDE CARGO DOOR SLING	VEPRO
BOMBAY, INDIA	*AIR INDIA	6	25 M TON 11 ELEMENT MODEL 32024-11	RFD	2	100 TON RECOVERY 28-140 INCH LIFT	REGENT	1	747 SLING ASSEMBLY OHME65B00002	
		2	40 M TON TYPE F	RFD	1	60 TON RECOVERY 88-309 LIFTINCH	REGENT			

Figure 5-3 WORLDWIDE DIRECTORY OF AIRPLANE RECOVERY EQUIPMENT, AUSTRALASIA AND FAR EAST (Continued)

LOCATION	CONTROLLING AGENCY	AIRBAGS			RECOVERY JACKS			LIFTING SLINGS		
		QTY	DESCRIPTION/ CAPACITY	MFR	QTY	DESCRIPTION/ CAPACITY	MFR	QTY	DESCRIPTION/ CAPACITY	MFR
SEOUL, KOREA	KOREAN AIRLINES	2	40 M TON TYPE F	RFD	2	100 TON RECOVERY 28-140 INCH LIFT	REGENT	2	747 SLING ASSEMBY 3OHME65B00002	
		5	25 M TON TYPE G		1	25 TON NOSE 87-142 INCH LIFT				
		2	25 M TON TYPE H		2	100 TON MAIN WING 100-211 INCH LIFT				
					1	50 TON TAIL 233-302 INCH LIFT				
					3	50 TON AXLE				
					1	15 TON NOSE 60-110 INCH LIFT				
					2	50 TON WING 60-110 INCH LIFT				
					2	15 TON OUTBD WING 124-172 INCH LIFT				
					1	50 TON TAIL 100-152 INCH LIFT				
SINGAPORE	SINGAPORE AIRLINES	2	25 M TON 15 ELEMENT TYPE G	RFD						
		4	25 M TON 11 ELEMENT TYPE D	RFD						
NAHA, OKINAWA	JAPAN TRANSOCEAN AIRLINES				2	20 TON ALLIGATOR				
					1	20 TON FWD BODY				
					1	20 TON AFT BODY				
					1	20 TON NOSE				
					1	25 TON TAIL				
					2	30 TON WING				
					2	50 TON MAIN				
MANILA, PHILIPPINES	CIVIL AVIATION ADMIN	4	25 M TON 15 ELEMENT	RFD	1	DRAGON JACK SYSTEM SET 707, 727, 737 CAPABILITY	RFD			
		2	25 M TON 11 ELEMENT							
BANDAR SERI BEGAWAN, BRUNEI	DEPT OF DEFENSE	5	25 M TON 15 ELEMENT	RFD						
		2	25 M TON 11 ELEMENT							

Figure 5-3 WORLDWIDE DIRECTORY OF AIRPLANE RECOVERY EQUIPMENT, AUSTRALASIA AND FAR EAST (Continued)

LOCATION	CONTROLLING AGENCY	AIRBAGS			RECOVERY JACKS			LIFTING SLINGS		
		QTY	DESCRIPTION/ CAPACITY	MFR	QTY	DESCRIPTION/ CAPACITY	MFR	QTY	DESCRIPTION/ CAPACITY	MFR
BEIJING, CHINA	CIVIL AVIATION AUTHORITY	2	40 M TON 305 CM	VEPRO						
		5	29 M TON 305 CM							
		2	29 M TON 245 CM							
		2	12 M TON 162 CM							

2. SUPPLIER LIST

NOTE: Known manufacturers of recover equipment are shown in this section. The names of these manufacturers are included only as an aid to you. We do not recommend these manufacturers more then other manufacturers.

PRODUCTS AND SERVICES

AIRPLANE RECOVERY SERVICES

AIRCRAFT RECOVERY INTERNATIONAL
AMS SYSTEMS ENGINEERING LIMITED
BOEING COMPANY

COMMUNICATIONS - HEADPHONE SYSTEMS

DAVID CLARK COMPANY, INC.
SOUND POWERED COMMUNICATIONS CORP.
WILLSON SAFETY PRODUCTS CO.

COMMUNICATIONS - PORTABLE RADIO

CON-SPACE COMMUNICATIONS INC
GENERAL ELECTRIC COMPANY
MOTOROLA COMMUNICATIONS GROUP PARTS DEPT.
RCA CORP.
TELEX COMMUNICATIONS INC.

CRANES - MOBILE

AMF INC.
BIGGE DRAYAGE CO.
HARNISCHFEGER CORP.

FISHPOLE HOIST

DIDSBURY ENGINEERING COMPANY, LTD.
MORGAN AERO PRODUCTS
PF FISHPOLE HOIST INC.

FOAM SYSTEMS

FOAM SYSTEMS, INC.
KUNZ GMBH

FORK LIFT TRUCKS/TOP LIFT EQUIPMENT

ALLIS CHALMERS CORP.
BIG JOE MANUFACTURING COMPANY
CAMET INDUSTRIES CO., INC.
CATERPILLAR INDUSTRIAL, INC.
CLARK MATERIAL SYSTEMS TECHNOLOGY CO.
HYSTER COMPANY CORP.
MI-JACK PRODUCTS INC.
NORDEQUIP, INC.
PETTIBONE MERCURY CORPORATION
SILENT HOIST AND CRANE COMPANY INC.
TAYLOR MACHINE WORKS INC.
WHITE MOTOR CORPORATION

GROUND ANCHORS

CHANCE, A. B. INDUSTRIES
LACONIA EARTH ANCHORS, INC.
RFD LTD.
TIRFOR LTD.

GROUND COVER - PORTABLE ROADWAY

AMS SYSTEMS ENGINEERING LIMITED
DESCHAMPS
KUNZ GMBH
MANFRED VETTER GMBH & CO.
REGENT MANUFACTURING INC.

INFLATABLE BUILDINGS & SHELTERS

AMS SYSTEMS ENGINEERING LIMITED
BACHMANN S. A.
RFD LTD.

JACKING/TAIL STANCHIONS

REGENT MANUFACTURING INC.
ZWICKY ENGINEERING LTD.

JACKS

COLUMBUS JACK CORPORATION
HYDRO-GERAETEBAU GMBH & CO. K.G.
MALABAR INTERNATIONAL
PAYAN S. A.
REGENT MANUFACTURING INC.
ZWICKY ENGINEERING LTD.

LANDING GEAR DOLLY

ADE-HML
CLYDE MACHINES, INC.
GROUND SUPPORT ENGINEERING, INC.
NORDEQUIP, INC.
UNITED FABRICATORS, INC.

LIFTING BAGS

AMS SYSTEMS ENGINEERING LIMITED
ENGINEERED FABRICS CORP.
KUNZ GMBH
MANFRED VETTER GMBH & CO.
PRONAL SA
REGENT MANUFACTURING INC.
RFD LTD.

LIFTING EQUIPMENT

PERMADUR INDUSTRIES INC
PRONAL SA

LIFTING SLINGS

AMS SYSTEMS ENGINEERING LIMITED
BOEING COMPANY
KUNZ GMBH
LIFT-ALL CO., INC.
LIFT-IT MANUFACTURING COMPANY, INC.
RASMUSSEN WIRE ROPE AND RIGGING CO
YARBROUGH CABLE SERVICE INC.

LOAD POSITIONER

PERMADUR INDUSTRIES INC

NOSE LIFT DOLLY

HYDRO-GERAETEBAU GMBH & CO. K.G.
PAYAN S. A.
SQUIBB MACHINE AND TOOL INC.

PENETROMETER

SOILTEST, INC.

PULLEYS

CROSBY GROUP INC., THE

PUMPS - WATER & HOSE

PEABODY BARNES INC.

SHELTERS - PORTABLE

BACHMANN S. A.
SPRUNG INSTANT STRUCTURES LTD.

SPECIAL TOOL FABRICATION - ELECTRICAL/ELECTRONIC

AIRCRAFT TOOL & MAINTENANCE EQUIPMENT, INC.
DEDIENNE CORP.
C & F MILLIER, LTD
FARWEST AIRCRAFT, INC.
INDUSTRIAL AUTOMATION, INC.
QUALITY AIRCRAFT TOOLING
SPEC TOOL CO
TECHMAN HEAD
TMH CANADA, INC.

SPECIAL TOOL FABRICATION - MECHANICAL

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C & F MILLIER, LTD
FRANK BROWN & SON LTD.
HYDRO USA, CO.
HYDRO-GERAETEBAU GMBH & CO. K.G.
INDUSTRIAL AUTOMATION, INC.
MENCHES TOOL AND DIE INC
QUALITY AIRCRAFT TOOLING
REGENT MANUFACTURING INC.
SPEC TOOL CO
TECHMAN HEAD
TIME AVIATION SERVICES INC.
TMH CANADA, INC.

TENSION MEASURING DEVICES

KUNZ GMBH
STRESS-TEK INC.

TENSIONING DEVICES

GRIPHOIST INC.
TIRFOR LTD.

TRANSPORTERS - DISABLED AIRPLANE

AERO-DOCKS LTD.
AIRCRAFT RECOVERY INTERNATIONAL
AMS SYSTEMS ENGINEERING LIMITED
GOLDHOFER FAHRZEUGWERK GMBH & CO.
KAMAG CORPORATION OF AMERICA
KAMAG TRANSPORTTECHNIK GMBH. & CO.
KUNZ GMBH
LISTAVIA LTD.

WINCHES

AMS SYSTEMS ENGINEETING LIMITED

ALPHABETICAL INDEX

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HAYES, - UB3 1EY
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FAX: 44.181-569 -1447
SUPPLIER CODE: 0F7A2

AERO-DOCKS LTD.
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LANDFORD, NA NA
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SUPPLIER CODE:

AIR SPARES INC
2617 E L ST
TACOMA, WA 98421
PHONE: 253-383-0800
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SUPPLIER CODE: 8M213

AIRCRAFT RECOVERY INTERNATIONAL
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ROCKVILLE CENTER, NY NA
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ALLIS CHALMERS CORP.
1126 S. 70TH ST.
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AMF INC.
WHITFORD AND EDEN ROADS
YORK, PA 17402
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FAX:
SUPPLIER CODE: 82983

ALPHABETICAL INDEX (Continued)

AMS SYSTEMS ENGINEERING LIMITED
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BIG JOE MANUFACTURING COMPANY
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PHONE: (312) 675-8700
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BIGGE DRAYAGE CO.
10700 BIGGE AVE.
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BOEING COMPANY
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C & F MILLIER, LTD
272 SOUTHMEAD ROAD
BRISTOL BS10 5EW, NA NA
PHONE: 44-117-9505252
TELEX:
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CAMET INDUSTRIES CO., INC.
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CATERPILLAR INDUSTRIAL, INC.
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CHANCE, A. B. INDUSTRIES
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CLARK MATERIAL SYSTEMS TECHNOLOGY CO.
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CLYDE MACHINES, INC.
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COLUMBUS JACK CORPORATION
1000 S. FRONT STREET
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CON-SPACE COMMUNICATIONS INC
1160 YEW AVE
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SUPPLIER CODE: 0V3X2

CROSBY GROUP INC., THE
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SUPPLIER CODE: 75535

ALPHABETICAL INDEX (Continued)

DAVID CLARK COMPANY, INC.
360 FRANKLIN STREET
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TELEX: 92-0982
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SUPPLIER CODE: 71483

DEDIENNE
17 RUE ARISTIDE BERGES
31270 CUGNAUX, NA NA
PHONE: 33-61-06-77-79
TELEX:
FAX: 33-61-06-81-13
SUPPLIER CODE:

DESCHAMPS
P.O.BOX 220 45 NB SCHOOL RD
NAT BRIDGE STATION, VA 24579
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DIDSBURY ENGINEERING COMPANY, LTD.
CLIFTON WORKS, MANOR RD.
MANCHESTER, LANCS., NA M19 3EJ
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TELEX: 667811
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ENGINEERED FABRICS CORP.
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FARWEST AIRCRAFT, INC.
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TELEX: 15-2220
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FOAM SYSTEMS, INC.
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ALPHABETICAL INDEX (Continued)

FRANK BROWN & SON LTD.
87-105 WINGATE ROAD
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GENERAL ELECTRIC COMPANY
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GOLDHOFER FAHRZEUGWERK GMBH & CO.
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D-87683 MEMMINGEN, - 1364
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TELEX: 54547
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GRIPHOIST INC.
331 LITTLEFIELD AVENUE
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PHONE: (415) 583-4008
TELEX:
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GROUND SUPPORT ENGINEERING, INC.
2401 N.W. 33RD AVE.
MIAMI, FL 33142-6923
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TELEX:
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SUPPLIER CODE: 16387

HARNISCHFEGER CORP.
2860 ROOT RIVER PKWY
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HYDRO USA, CO.
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ALPHABETICAL INDEX (Continued)

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TELEX: 7-525524
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KAMAG TRANSPORTTECHNIK GMBH. & CO.
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89079 ULM, NA D-7900
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TELEX: (17) 731 164
FAX: 00 49 73 1/94 54 - 707
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LIFT-ALL CO., INC.
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LIFT-IT MANUFACTURING COMPANY, INC.
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LISTAVIA LTD.
13 WOODMANCOURT
GODALMING, SURREY, NA GU7 2BT
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SUPPLIER CODE: 94861

MANFRED VETTER GMBH & CO.
POSTFACH 1355
D-53909 ZULPICH, NA NA
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TELEX:
FAX: 49 (0) 2252 300870
SUPPLIER CODE: C1774

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MI-JACK PRODUCTS INC.
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NORDEQUIP, INC.
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ST. PAUL, MN 55101
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TELEX: 256649
FAX: (651) 292-8341
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PAYAN S. A.
CENTREDA
F-31700 BLAGNAC, NA NA
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TELEX:
FAX: 33-61300115
SUPPLIER CODE:

PEABODY BARNES INC.
420 E. 3RD ST.
PIQUA, OH 45355
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SUPPLIER CODE: 05748

PERMADUR INDUSTRIES INC
186 ROUTE 206 SOUTH
SOMERVILLE, NJ 08876
PHONE: (908) 359-9767
TELEX:
FAX: (908) 359-9773
SUPPLIER CODE: 49035

PETTIBONE MERCURY CORPORATION
5501 W. GRAND AVE.
CHICAGO, IL 60639
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PF FISHPOLE HOIST INC.
151 SOUTH MICHIGAN
SEATTLE, WA 98108
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FAX: (206) 767-4006
SUPPLIER CODE: 06714

PRONAL SA
Z.I. ROUBAIX EST - B.P. 18
59115 LEERS, NA NA
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TELEX:
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SUPPLIER CODE: F5444

QUALITY AIRCRAFT TOOLING
1048 KING INDUSTRIAL DRIVE
MARIETTA, GA 30062
PHONE: 770-429-8157
TELEX: 80-4558
FAX: 770-423-9807
SUPPLIER CODE: 0AHE0

RASMUSSEN WIRE ROPE AND RIGGING CO
8727 5TH AVE S
SEATTLE, WA 98108
PHONE: 206-762-3700
TELEX:
FAX:
SUPPLIER CODE: 0AE82

RCA CORP.
8500 BALBOA BLVD.
VAN NUYS, CA 91409
PHONE: 213-894-8111
TELEX:
FAX:
SUPPLIER CODE: 05371

REGENT MANUFACTURING INC.
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DOWNEY, CA 90241-9013
PHONE: (562) 862-1174
TELEX: 910-583-1942
FAX: (562) 861-9624
SUPPLIER CODE: 02708

RFD LTD.
KINGSWAY, DUNMURRY
BT 17 9AF BELFAST, NA NA
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TELEX:
FAX: 28 (0) 9062 1765
SUPPLIER CODE:

ALPHABETICAL INDEX (Continued)

SILENT HOIST AND CRANE COMPANY INC.
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SOILTEST, INC.
86 ALBRECHT DR.
LAKE BLUFF, IL 60044-8004
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TELEX: 687-1537
FAX: (312) 295-9414
SUPPLIER CODE: 98773

SOUND POWERED COMMUNICATIONS CORP.
335 ROBBINS AVE.
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SUPPLIER CODE: 56093

SPEC TOOL CO
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TELEX: 69-8468
FAX: 310-945-3359
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SQUIBB MACHINE AND TOOL INC.
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TAYLOR MACHINE WORKS INC.
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TELEX:
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HOLBROOK INDUSTRIAL ESTATE
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TMH CANADA, INC.
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WHITE MOTOR CORPORATION
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HOPKINS, MN 55343
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SUPPLIER CODE: 1E973

WILLSON SAFETY PRODUCTS CO.
2ND AND WASHINGTON ST.
READING, PA 19603-0622
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TELEX: 510-651-0380
FAX: (610) 371-7725
SUPPLIER CODE: 79687

YARBROUGH CABLE SERVICE INC.
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ALERSHOT HAMPSHIRE, NA GU12 4QH
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FAX: 01252-336811
SUPPLIER CODE: U2041

6 DATA FROM OTHER RECOVERY OPERATIONS

6-00 DATA FROM OTHER RECOVERY OPERATIONS

6-00-1 General

1. General

   A. One recovery of this airplane occurred before January, 1991. Also, an additional airplane recovery from a 767-300F airplane occurred in September, 1998. This chapter shows the details of those recovery incidents.

   B. Different recovery operations occurred on other Boeing airplanes. Some of the incident conditions are as follows:

      (1) An aborted take-off

      (2) Airplane is damaged while it makes a landing

      (3) Tire has a blowout while airplane makes a landing

      (4) Airplane overruns the runway while it makes a landing

      (5) Airplane moves off icy runway or taxiway

      (6) Accidental nose gear retraction

      (7) Accidental main gear retraction

      These recoveries are not 767 airplanes. We do not show them in this document, but they are important sources of data.

   C. You can examine these incidents in Boeing Documents D6-30114, 747 Airplane Recovery Document and D6-40146, 707/727/737 Airplane Recovery Document.

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6-10 AIRPLANE INCIDENTS

6-10-1 General

1. The pilot of a 767 made this report about a flight to St. Louis, Missouri. There was a problem with the main landing gear. The right gear did not extend. The pilot flew the airplane in an emergency to a different airport (Scott Air Force Base in Belleville, Illinois).

   The airplane stopped 6 ft (2 m) off the runway on soft ground. The nose gear was off the ground and the right engine was on the ground. It was necessary to replace two flat tires. The cargo was removed from the rear cargo compartment. The airplane nose moved down until there was support from the nose gear.

   Tethers were subsequently applied to the nose of the airplane. A pneumatic bag was used for support only below the aft end of the fuselage. This was the only function of the bag in the recovery operation. The end of the right wing did not hit the ground. It was approximately 3 ft (1 m) off the ground when the airplane stopped.

   A 83 t (75 metric tons) crane was supplied by a local person who operated heavy equipment. The crane was at the recovery area when the recovery persons came. An inspection showed that a brake rod (No. 3 brake reaction rod) was loose. The rod was caught on a heavy bracket in the center of the wheel well.

   The right landing gear was lifted with a wheel jack (Malabar). The gear released when a recovery person turned the rod outboard. With the removal of the jack, the gear moved down to the ground.

   The recovery persons made the soft ground surface, near the forward cargo door, stronger with steel material (perforated steel planking). After they prepared the ground surface, they removed the cargo in the forward cargo compartment. They also removed approximately 2000 lb (907 kg) of fuel from the right fuel tank. They used a suction hose, at the fuel port on the top of the wing, to remove the fuel. They did not use the airplane electrical power because the airplane still had 7000 lb (3175 kg) of fuel on board after landing.

   They removed the wing plate directly above the right landing gear and used wood filler blocks taped into position to prevent damage to the opening that could have occurred when lines (cables) were used to lift the airplane.

   They removed the hydraulic manifold at the top of the gear. They put layers of protection (layers of aluminum tape, heavy grease, ¾ in. (19 mm) felt, layers of aluminum tape, heavy grease) around the trunnion. This protection decreased friction and permitted the lines to turn during the lift of the airplane. The friction occurred with the movement of the airplane. This movement turned the landing gear around the trunnion while the airplane was lifted.

   The recovery persons put the crane in a position behind the wing. They also released the air in the shock strut of the landing gear.

   The most important part of the operation was the possible movement of the right engine. The damaged engine turned clockwise while the airplane made the landing. This brokepart of the outboard engine mount. This also locked the flaps on the inboard forward edge in the inboard position. When the recovery persons started to lift the airplane, the engine turned counterclockwise. This released the locked flaps and the engine did not have to be removed.

   While they continued to lift the airplane, the landing gear moved smoothly down. With the airplane at a level attitude, they attached straps between the landing gear strut and the truck assembly. With the straps attached, they released the strut until the downlock was in its position. They removed the crane and they inflated the strut. They moved the airplane off the ground to the runway surface.

   They removed the airplane from the runway and towed it to a repair (remote) area.

2. The following describes a recovery of a 767-300 Freighter airplane that ran off of the runway in September, 1998 at Ellington Field Airport near Houston, Texas.

The aircraft departed the runway in heavy rain. This resulted in the right Main Landing Gear (MLG) strut fracturing during the off-runway excursion and the wheel truck beam penetrating the airframe. The left MLG remained intact and embedded into soft soil.

In addition, the right engine separated from the pylon when impacting the ground. This left the right wing tip coming to rest partially on the runway. The nose wheel also was imbedded in the mud.

Major equipment used to recover this airplane included a 150 t (136 metric tons) capacity mobile crane, a tow tractor with tow bar, and a 80 t (73 metric tons) capacity flat bed truck. Other miscellaneous equipment used included jacks, jack pads, tires, steel plates, slings, winches, cables, chains, beams, cross ties, manlifts and forklifts.

Every precaution was taken to prevent injury to personnel and minimize secondary damage to the airplane. The weight of the airplane was decreased by removal of cargo and defueling of the airpcraft without the use of airplane power.

In addition, the right MLG was secured to the fuselage with atraps and come-alongs, the number 2 pylon was secured to the wing through the forward pylon mount and the number 2 engine was secured to the pylon. The right MLG was inspected to determine if overhead lifting can be accomplished using the right MLG.

Gravel and steel plates were brought in to prepare a temporary roadway to transport the airplane back onto the runway. Mud was removed from around the partially submerged Nose Landing Gear (NLG) and MLG so that steel plates could be placed under them. Gravel and steel plates were distrubuted over the soft ground to prepare a solid surface for transportation of the airplane.

The crane was positioned behind the right wing and a sling was wrapped around the right MLG trunnion. The airplane was lifted in small increments from this side of the airplane while the relationship between the loads and the boom angle was continuously monitored. The left MLG was mechanically locked in the down position and landing gear attachments were checked for integrity.

After the airplane was lifted to a sufficient height, a low-boy trailer was positioned under the right wing. The low-boy had planking stacked on top several feet high with tires used as a buffer between the planks and the underside of the airplane wing. Wood planking was used as a portable roadway to support the trailer during transportation.

The airplane was towed to the runway with use of a tow tractor attached to the left MLG and the low-boy trailer moving carefully in tandem. Airplane was subsequently repaired by Boeing Aircraft On Ground (AOG) and returned to revenue service.