Aerolineas Argentinas

PAGE	DATE	CODE
CHAPTER 07 TAB LIFTING AND SHORING		
EFFECTIVE PAGES SEE LAST PAGE OF LIST FOR NUMBER OF PAGES		
7-CONTENTS		
1	AUG 01/05	ARG
2	BLANK	
07-10-0		
201	DEC 01/04	01
202	BLANK	
07-11-0		
201	DEC 01/04	01
202	BLANK	
07-11-11		
201	DEC 01/04	04
R 202	AUG 01/07	03.1
R 203	AUG 01/07	06.1
204	DEC 01/04	02
205	DEC 01/04	02
206	DEC 01/04	03
R 207	AUG 01/07	02.1
R 208	AUG 01/07	02.101
07-11-21		
R 201	AUG 01/07	01.1
R 202	AUG 01/07	04.101
R 203	AUG 01/07	01.1
204	BLANK	
07-11-31		
201	DEC 01/04	01
202	DEC 01/04	01
07-11-41		
201	DEC 01/04	01
202	BLANK	
07-12-0		
201	DEC 01/04	01
202	BLANK	
07-13-0		
201	AUG 01/05	01
202	DEC 01/04	01
203	AUG 01/05	01
204	AUG 01/05	02
205	DEC 01/04	02
206	AUG 01/06	02
207	DEC 01/04	02
208	DEC 01/04	02
209	DEC 01/04	02
07-13-0		CONT.
210	AUG 01/05	01
211	DEC 01/04	02
212	DEC 01/04	02
213	AUG 01/05	01
214	DEC 01/04	02
215	AUG 01/05	01
216	AUG 01/05	02
07-20-0		
201	DEC 01/04	01
202	BLANK	

CHAPTER 07 – LIFTING AND SHORING

TABLE OF CONTENTS

LIFTING - MAINTENANCE PRACTICES

1. General
   A. Two general types of airplane lifting will be covered in this chapter, airplane jacking for normal maintenance, and lifting damaged airplanes.
   B. When the airplane is jacked for normal maintenance, the main and auxiliary jacking points are used. The airplane is usually jacked for weighing, leveling, alignment checks, and gear retraction.
   C. Procedures for lifting and recovery of damaged aircraft are contained in the Boeing Document D6-40146, 707, 727, 737 AIRPLANE RECOVERY.
   D. When necessary to obtain additional tail clearance for positioning an airplane in a hangar or storage area, a nose lift dolly may be used to tilt the airplane. The nose lift dolly raises the airplane nose section, causing the airplane to rotate about the main gear.
   E. On Passenger/Cargo Convertible Airplanes, support assembly F80068 can be used to stabilize the airplane during loading or unloading operations when the center of gravity is in danger of shifting behind the aft limit. While airplane CG is within takeoff or landing limits, support assembly F80068 will clear the ground. A threaded stud on the support assembly fits the jacking pad at aft body jacking point C.

LIFTING AIRPLANE FOR MAINTENANCE

1. General
   A. Lifting the airplane for maintenance is accomplished by using conventional airplane jacks at jacking points provided on the wing, forward and aft body or at the nose and main landing gear. The jacking points on the wing and body are provided with receptacles for the attachment of removable ball-type jack adapters. The nose and main landing gear jacking points are integral with the landing gear.

JACK AIRPLANE

1. General
   A. The airplane is provided with three main jacking points and four auxiliary jacking points. The main jacking points are wing jacking point D and aft body jacking point G. The four auxiliary jacking points consist of one stabilizing and three landing gear jacking points. The stabilizing jacking point is forward body jacking point C. The three landing gear jacking points are points E-F at each main gear axle and points A-B under the nose gear axle. See Fig. 201 and 202 for jacking point locations, jacking point maximum loads, wing and body jack adapters and applicable jacks.
   B. The airplane may be jacked at any gross weight provided the maximum load of any jacking point is not exceeded. However, if the airplane is supported entirely by the three main jacks and the stabilizing jack, the maximum jacking weight of the airplane must not be exceeded (Fig. 202). At any weight, the airplane center of gravity must be within the forward and aft limits prior to jacking.
   C. The axle jacking points are designed to permit the changing of two flat tires on the same landing gear while the airplane is at maximum taxi weight. The maximum load on an axle jacking point must not be exceeded.
2. Equipment and Materials
   A. Main Landing Gear Oleo Lock Assembly - F80016 or F80234-1
   B. Nose Landing Gear Shock Strut Restrainer - 6ME65-73762 or F70263-1
   C. Wing and Fuselage Jacks, Axle Jacks and Jack Pad Adapters (Fig. 202)
      (1) Wing Jacks - Regent Model 986CT(or equivalent)
      (2) Body Jacks - Regent Model 8156 (or equivalent)
      (3) Axle Jacks - Regent Model 5923 (or equivalent)
   D. Nose and Main Landing Gear Ground Lockpins - F72735 (flyaway)
3. Raise Airplane

   CAUTION: DO NOT EXCEED ONE INCH CLEARANCE FROM JACK RAM LOCKNUT TO COLLAR AS JACK IS BEING RAISED OR LOWERED. EXCESSIVE CLEARANCE CAN RESULT IN DAMAGE TO AIRPLANE STRUCTURE IF JACK FAILS.

   A. Ensure that the maximum allowable jacking gross weight will not be exceeded and that C.G. conditions are such that airplane jack points allowable loads are not exceeded, and that all landing gear downlocks are in place.
   B. Set stabilizer, aileron and rudder trim controls to 0.
   C. Trip flight recorder circuit breakers before jacking so that recorded data is not lost while airplane is on jacks.

D. Head airplane into the wind if in an exposed area.

CAUTION: DO NOT JACK AIRPLANE AT JACK POINTS D, G, AND C IF WINDS EXCEED 35 MILES PER HOUR.

E. When airplane is being jacked for weighing, leveling, or for general requirements, the landing gear shock struts may be deflated and locked in the compressed position using oleo lock assemblies at the main gear and nose gear. The airplane does not have to be jacked as high with the shock struts locked in the compressed position.

F. Ground airplane to approved grounding attach point when airplane is on jacks (AMM 20-40-11/201).

NOTE: Ground airplane to jack pads when retracting landing gear.

CAUTION: DO NOT PERFORM THIS STEP IF AIRPLANE IS BEING RAISED TO PERMIT A GEAR RETRACTION TEST. SUCH A TEST REQUIRES THAT GEAR BE FULLY EXTENDED. IF SHOCK STRUT IS NOT COMPLETELY DEFLATED PRIOR TO OLEO LOCK ASSEMBLY INSTALLATION, OLEO LOCK ASSEMBLY MAY BE DAMAGED DURING JACKING OPERATION. TO AVOID SERIOUS DAMAGE TO SHOCK STRUT, DO NOT JACK AIRPLANE WEIGHT OFF WHEELS WITH SHOCK STRUTS INFLATED ABOVE NORMAL PRESSURE.

G. When airplane is being jacked for gear retraction test or when airplane is jacked and shock struts are not deflated and locked, it should be noted that the main gear shock strut is canted to trail 1.85 degrees aft of the vertical axis. When jacking the airplane, normal oleo extension on the 88.15-degree angle causes aft wheel movement on the ground up to a maximum of 0.55 inch. If wheels are chocked or parking brakes are set during the jacking or lowering operation, wheel movement will result in sliding of the chocks or scuffing of tires on the pavement.

CAUTION: HORIZONTAL REACTION LOADS DUE TO SCUFFING OR SLIDING WILL BE TRANSMITTED THROUGH STRUCTURE TO THE JACK PADS, RESULTING IN A TENDENCY TO TIP THE JACKS OVER.

H. Jacking the airplane for weighing, leveling, gear retraction test, or for general requirements open the following circuit breakers.
(1) Drain, Mast. Air.

I. Remove jack pad adapter recess fillers and fasteners at position D.

NOTE: Aft body jacking adapter F80000-7 is a threaded rod with a machined semiball on one end. The F80000-7 is inserted into a jack pad fitting that is an integral part of the airplane structure.

J. Use hand pump or air pressure to push jack post up to the jack pads and seat jacks on floor.

K. Install jack pad adapters and position jacks per Fig. 201 making sure that one leg of jack at position D points straight forward.

CAUTION: WHEN INSTALLING JACK PAD ADAPTERS, USE ATTACH BOLTS AS SPECIFIED IN FIG. 202 OR STRUCTURAL DAMAGE MAY RESULT. STABILIZING JACK MUST BE USED DURING WINDY CONDITIONS. STABILIZER JACK MUST BE PRELOADED TO A MAXIMUM OF 5000 POUNDS AT WINDS OF 35 MPH.

NOTE: Jacks must be equipped with pressure gages and a conversion table to give pounds of load at each jack point.

L. After jacks have been positioned and jacking is ready to proceed, ensure that wheel chocks are removed and that parking brakes have been released.

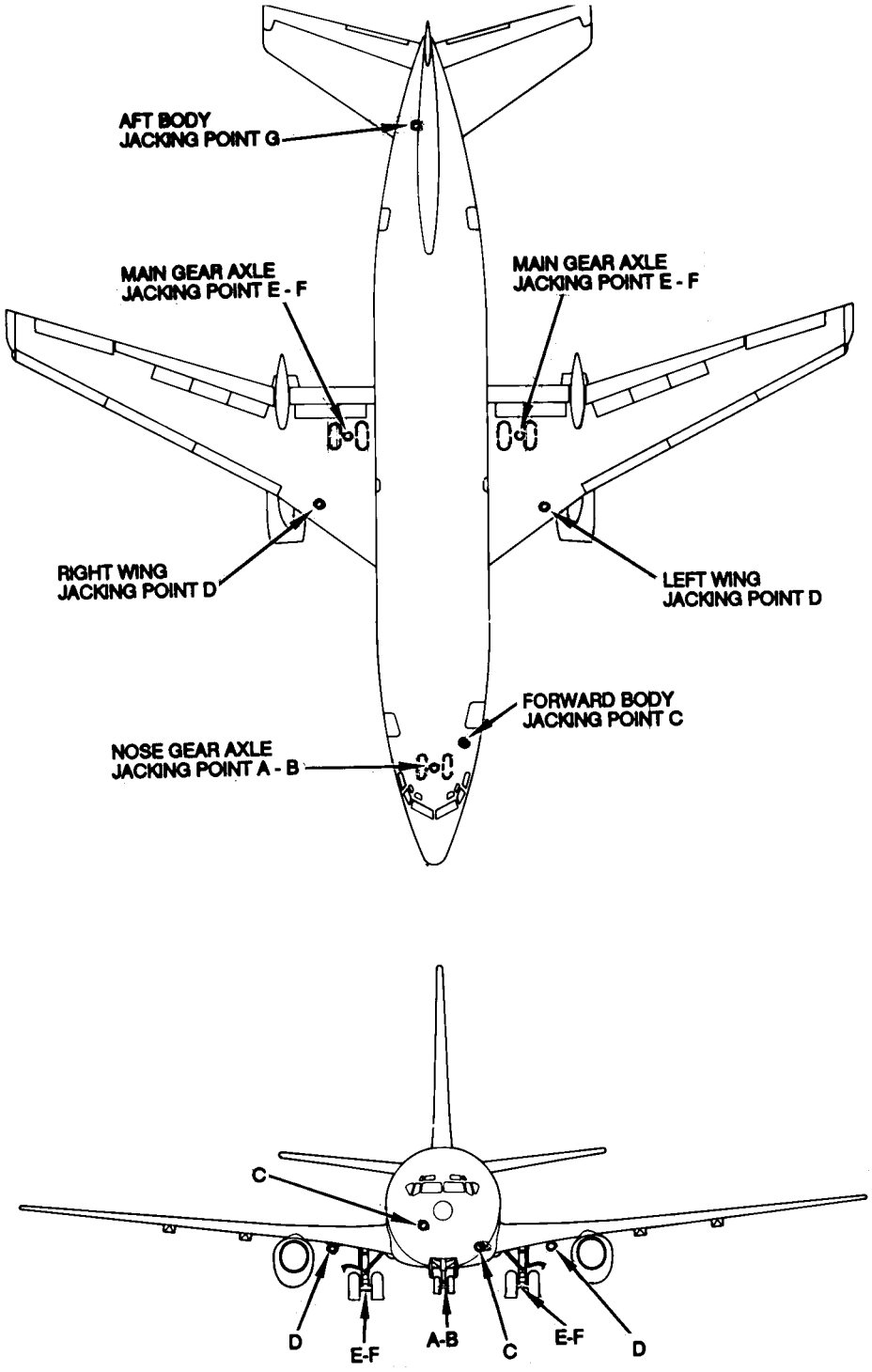
M. Use plumb bob and leveling scale in right wheel well to establish lateral level and longitudinal attitude while raising airplane.

NOTE: The plumb bob method is accurate enough for general jacking requirements, weighing, and gear retraction only. If more accurate leveling is required, refer to Chapter 8, Leveling.

N. Station one man at each jack to operate the jack and to ensure that the jack loads are not exceeded. Raise airplane in a level attitude, using jacks at wing jacking pad D and at aft fuselage jacking pad G, until landing gear clears the ground.

CAUTION: JACKS AT PAD D MUST BE RAISED PRIOR TO OR SIMULTANEOUSLY WITH JACK AT JACK PAD G. RAISING TAIL JACK AHEAD OF WING JACKS MAY OVERLOAD TAIL JACK POINT BY FORCING NOSE OF AIRPLANE DOWN ON NOSE GEAR, OR IT MAY OVERLOAD TAIL JACK POINT AND NOSE STABILIZING JACK POINT WHEN LATTER IS USED. JACK AIRPLANE IN A LEVEL ATTITUDE TO PREVENT INTRODUCING SIDE LOADS INTO THE JACK POINTS THAT COULD CAUSE JACKS TO SLIP OFF THE PADS OR OVERLOAD THE JACK POINTS AND DAMAGE STRUCTURE.

NOTE: When airplane is being jacked for gear retraction test, include 3 inches for tire arc sweep clearance plus 1 inch additional clearance.



Jacking Point Location
Figure 201

	LOCATION	BODY STA	BUTTOCK LINE	LANDING GEAR TIRES MINIMUM 1	LANDING GEAR TIRES MAXIMUM 2	MAX LOAD 3	JACKING ADAPTER	ATTACH BOLT
D	RIGHT WING	580	114.5R	68 IN.	85 IN.	SEE	F80060	NAS514P1032-24
D	LEFT WING	580	114.5L	68 IN.	85 IN.		-2 or -5	NAS514P1032-24
G	AFT BODY	1088	10R	103 IN.	116 IN.	CHART	F80000-7	NONE
C	FORWARD BODY	294.5	47.5L	57 IN.	77 IN.		F80000-7	AN5-11A
A	NOSE GEAR AXLE	286	0	SEE CHART BELOW		BELOW	NONE	NONE
F	MAIN GEAR AXLE	698	103				NONE	NONE

JACKING POINTS AND LOCATIONS

1 SHOCK STRUTS DEFLATED. WHEELS ON RIM

2 AIRPLANE ON JACKS WITH 2.5-INCH CLEARANCE UNDER MAIN GEAR

3 THE SUM OF THE JACKING LOADS AT POINTS C,D AND G MUST NOT EXCEED 75,000 LBS WHEN JACKING WHOLE AIRPLANE AT MAXIMUM TAXI GROSS WEIGHTS UP TO 110,000 POUNDS.

4 THE SUM OF THE JACKING LOADS AT POINTS C,D AND G MUST NOT EXCEED 93,000 LBS WHEN JACKING WHOLE AIRPLANE AT MAXIMUM TAXI GROSS WEIGHTS ABOVE 110,000 POUNDS.

5 CONSULT FLIGHT MANUAL FOR AIRPLANE WEIGHT

LOCATION	A NOSE GEAR JACK POINT	B NOSE GEAR WHEELS	C FORWARD BODY JACK POINT	D R & L WING JACK POINTS	E MAIN GEAR WHEELS	F MAIN GEAR JACK POINT	G AFT BODY JACK POINT
MAXIMUM TAXI GROSS WEIGHT OR GREATER - LB 5	MAXIMUM LOAD EACH JACK POINT - LB 4						
100,800	14,800	-	11,000	35,730	-	47,550	12,680
104,000	15,200	-	11,000	35,730	-	49,100	12,680
110,000	16,000		11,000	35,730	-	52,400	12,680
111,000	16,710	=	13,890	43,560	-	53,850	15,720
125,000	16,710	-	13,890	43,560	-	60,320	15,720

JACKING POINT DATA

Jacking Point and Landing Gear Tire Data
Figure 202 (Sheet 1)

GEAR	TIRE SIZE	CONDITION	DISTANCE FROM GROUND TO BOTTOM OF JACK PAD	CLEARANCE BETWEEN TIRES
MAIN GEAR	C40 X 18-17	NORMAL FLAT TO CHANGE TIRE	11.5 IN. 7.0 IN. 17.9 IN.*	10.5 IN. 6.0 IN. ---
NOSE GEAR	C24.5 X 8.5-12	NORMAL FLAT TO CHANGE TIRE	7.6 IN. 5.2 IN. 12.0 IN. *	6.2 IN. 4.0 IN. ---

* ASSUMES 2 INCHES TIRE CLEARANCE

LANDING GEAR TIRE DATA (LOW PRESSURE TIRES)
(IF INSTALLED)

GEAR	TIRE SIZE	CONDITION	DISTANCE FROM GROUND TO BOTTOM OF JACK PAD	CLEARANCE BETWEEN TIRES
MAIN GEAR	40 X 14-16	NORMAL FLAT TO CHANGE TIRE	12.4 IN. ** 12.0 IN. *** 7.3 IN. 17.5 IN. ** 17.9 IN. ***	16.5 IN. ** 14.4 IN. *** 10.5 IN. ** 10.0 IN. ***
	C40 X 14-21	NORMAL FLAT TO CHANGE TIRE	12.8 IN. 8.8 IN. 17.9 IN.*	15.3 IN. 14.0 IN. ---
NOSE GEAR	24 X 7.7-1.0	NORMAL FLAT TO CHANGE TIRE	7.7 IN. 4.7 IN. ** 4.6 IN. *** 11.0 IN. ** 12.0 IN. ***	7.0 IN. 4.0 IN. ---

* ASSUMES 2 INCHES TIRE CLEARANCE
** 737-100 AIRPLANES
*** 727-200 AIRPLANES

LANDING GEAR TIRE DATA

Jacking Point and Landing Gear Tire Data
Figure 202 (Sheet 2)

O. If conditions require that airplane be stabilized, raise forward fuselage jack pad C until sufficient weight is supported to steady airplane. Stabilizer jack must be preloaded to a maximum of 5000 pounds at winds of 35 mph.

NOTE: Whenever jacking the airplane, always lower all jack ram locknuts as jacks are raised. Maintain a clearance of one inch or less from nut to collar until jacking is complete, then snug up nut and tighten lockscrew.

4. Lower Airplane

CAUTION: DO NOT EXCEED ONE INCH CLEARANCE FROM JACK RAM LOCKNUT TO COLLAR AS JACK IS BEING RAISED OR LOWERED. EXCESSIVE CLEARANCE CAN RESULT IN DAMAGE TO AIRPLANE STRUCTURE IF JACK FAILS.

A. Ensure that the area immediately under the airplane is clear and that all landing gear downlocks are installed.
B. Ensure the landing gear handle is in the down position.
C. Loosen lockscrew in jack ram locknut at jack and adjust locknut up ram until it is no more that 1 inch from jack collar.

NOTE: If may be necessary to raise jack ram slightly to relieve load on locknut and allow locknut to be moved up ram.

D. Lower stabilizing jack at jacking point C (Fig. 201), maintaining 1 inch clearance between locknut and collar.

CAUTION: REMOVE STABILIZING JACK FROM BENEATH AIRPLANE TO PREVENT DAMAGE TO SKIN AND FRAME.

E. Station a man at each jack using plumb bob in right wheel well, lower jacks at jacking points D and G evenly and all together. Always maintaining 1 inch clearance between locknut and jack collar. If the nose and main gear oleo lock assemblies are not installed, be sure that there are no obstructions in front of the main gear wheels and that the parking brakes are not set. Due to the 1.85 degree cant of the shock strut, the wheels, due to oleo retraction, will move approximately 0.55 inch forward.

CAUTION: DO NOT ALLOW WING JACK D TO PRECEDE TAIL JACK G, OR NOSE GEAR WILL TOUCH FIRST AND OVERLOAD TAIL JACKING POINT G. A JACK "HANG UP" CONDITION MAY BE RELIEVED BY RAISING AND LOWERING JACK UNTIL RAM IS FREED. IF "HANG UP" CONTINUES, RAISE AND CRIB AIRPLANE UNTIL FAULTY JACK IS REPLACED.

F. Remove jacks and jacking adapters.

G. Replace jacking adapter fasteners at position D.

CAUTION: USE CORRECT FASTENERS (NAS514P1032-24) TO PREVENT STRUCTURAL DAMAGE.

H. Inflate landing gear shock struts (Ref Chapter 12, Landing Gear Shock Strut Servicing).
I. Close the following circuit breakers:
(1) Drain, Mast. Air

JACK AIRPLANE NOSE

1. Equipment and Materials
   A. Nose Landing Gear Shock Strut Retainer - 6ME65-73762 or F70263-1
   B. Body jack and jack pad adapter (Ref 7-11-11, Fig. 202)
   C. Nose and Main Landing Gear Ground Lockpins - F72735
2. Raise Airplane Nose

   CAUTION: DO NOT EXCEED ONE INCH CLEARANCE FROM JACK RAM LOCKNUT TO COLLAR AS JACK IS BEING RAISED OR LOWERED. EXCESSIVE CLEARANCE CAN RESULT IN DAMAGE TO AIRPLANE STRUCTURE IF JACK FAILS.

   A. Ensure that airplane weight and CG conditions are such that nose jacking point allowable loads will not be exceeded during the jacking operation.

      NOTE: Shifting of weight in the airplane is permissible, within allowable CG and weight limits, to ensure compliance with nose jack point load limit.

   B. Ensure that all gear ground lockpins are installed.
   C. Ensure nose gear steering lockout pin is installed.
   D. Set stabilizer, aileron and rudder trim controls to 0.
   E. Head airplane into wind if in an exposed area.

      CAUTION: DO NOT JACK AIRPLANE AT JACK POINT C IF WINDS EXCEED 35 MILES PER HOUR.

   F. Install nose jack pad adapter at jack position C (Ref 7-11-11, Fig. 201)

      CAUTION: FOR CARGO AIRPLANES DO NOT OPERATE THE MAIN CARGO DOOR WHILE JACKING FORCES ARE BEING APPLIED TO FORWARD BODY JACKING POINT "C". OPERATION OF THE DOOR CAN RESULT IN DAMAGE TO BOTH DOOR AND FUSELAGE.

   G. Retract Airstairs.

H. Position nose jack under jacking point C with jack rotated so that a line between aft two jack footpads is perpendicular to airplane centerline and jack is centered under jack pad (Ref 7-11-11, Fig. 201).

CAUTION: IF JACK IS NOT CENTERED UNDER JACK PAD, DAMAGE TO JACK OR AIRPLANE CAN OCCUR. AIRPLANE SHOULD BE ON LEVEL GROUND.

CAUTION: DO NOT DEFLATE THE SHOCK STRUTS IF YOU DO A GEAR RETRACTION TEST. THE SHOCK STRUTS MUST BE FILLED CORRECTLY AND NOT INFLATED ABOVE THE CORRECT PRESSURE. DAMAGE TO THE WHEEL WELL AND THE SHOCK STRUT WILL OCCUR.

NOTE: Jack must be equipped with pressure gage and a table converting pressure readings to load in pounds at jacking point.

I. Release airplane brakes, if applied, and move main gear forward wheel chocks forward about 2 inches from tires. Remove nose wheel chocks.
J. Raise nose jack maintaining a distance of one inch or less between jack ram locknut and the jack collar. To permit a nose landing gear retraction test, raise nose until nose wheels clear ground approximately three inches.

CAUTION: DO NOT EXCEED NOSE JACKING POINT ALLOWABLE LOAD.

K. Screw down jack ram locknut and tighten set screw when nose gear clears the ground by required amount.

3. Lower Airplane Nose

CAUTION: DO NOT EXCEED ONE INCH CLEARANCE FROM JACK RAM LOCKNUT TO COLLAR AS JACK IS BEING RAISED OR LOWERED. EXCESSIVE CLEARANCE CAN RESULT IN DAMAGE TO AIRPLANE STRUCTURE IF JACK FAILS.

A. Ensure that area immediately under airplane nose is clear and that all gear ground lockpins are installed.
B. Lower nose jacking point C, maintaining a distance of one inch or less between the jack ram locknut and the jack collar (Ref 7-11-11, Fig. 201).

NOTE: It may be necessary to raise jack ram slightly to relieve load on jack ram locknut and allow locknut to be moved up ram.

C. Remove jack, jack pad adapter, and nose gear shock strut retainer.

D. Set the parking brake and reposition the chocks.
E. Inflate nose gear shock strut (Ref Chapter 12, Nose Landing Gear Shock Strut Servicing).
F. Extend airstairs.

JACK AIRPLANE AXLES

1. General
   A. Jacking points are provided under each landing gear axle to remove wheel and tire or brake assembly without raising the entire airplane. For approximate axle jack pad heights and clearances between tires refer to 7-11-11, Fig. 202. The tables should be used as a guide only, as dimensions vary due to conditions.

      CAUTION: DO NOT ATTEMPT TO JACK AIRPLANE BY PLACING JACK UNDER ANY PART OF THE LANDING GEAR OTHER THAN THE AXLE JACK PADS. DAMAGE RESULTING FROM JACKING ELSEWHERE MAY RESULT IN LANDING GEAR FAILURE.

      NOTE: If it is possible, turn the airplane into the wind when it is out of the hangar for jacking the airplane axles.

2. Equipment and Materials
   A. Axle Jacks and Jacking Adapters (Ref 7-11-11, Fig. 202)
   B. Nose and Main Landing Gear Ground Lock Assembly - F72735
3. Jack Main Landing Gear Axles
   A. When both tires on the same main gear axle are flat, check that all landing gear downlocks are installed and raise the airplane with minimum height jacks. Refer to 7-11-11, Fig. 202, for jacks of suitable heights.
   B. If both tires on the same main gear axle are flat and suitable jacks are not available, it will be necessary to raise the axle initially by another means. The airplane may be raised as follows:
      (1) By reinflating the tires. At least one tire must be in good shape and well seated on its wheel. A source of high pressure air, such as air bottles, must be available. Refer to 12-15-51 for tire inflation.

         WARNING: ALWAYS USE A PRESSURE REGULATOR ON HIGH PRESSURE AIR SOURCE WHEN INFLATING TIRES. DO NOT INFLATE TIRES ABOVE THEIR STRUCTURAL LIMITATIONS.

      (2) By pushing or pulling the airplane so that the main gear is moved up an inclined block. The slope is not important except from the viewpoint of increased tow-bar load. The block should level out at a minimum height of 4 inches (assuming a jack with a collapsed height of 10 inches). If one block is used under each wheel there should be sufficient clearance between them to permit insertion of the axle jack base.

C. For one flat tire a procedure similar to those adapted in A may be applied. If an axle jack cannot be inserted at once an inclined block may be used. In using an inclined block, however, the block should be made of sufficient height to make subsequent use of an axle jack unnecessary. The good wheel would be run up inclined block.

4. Jack Nose Landing Gear Axle

A. For a nose gear axle with both tires flat, raise the airplane with minimum height jacks (Ref 7-11-11, Fig. 202). Prior to jacking the nose gear, disconnect the nose gear torsion link, and check that all landing gear downlocks are installed.

CAUTION: THE RUDDER PEDALS ARE DIRECTLY CONNECTED TO THE NOSE GEAR. STEERING AND ANY MOVEMENT WOULD HAVE A TENDENCY TO THROW THE NOSE GEAR OFF THE JACK IF THE TORSION LINKS ARE NOT DISCONNECTED.

B. If both tires on the nose gear axle are flat and suitable jacks are not available, it will be necessary to raise the axle initially by one of the following methods.

(1) By reinflating the tires. At least one tire must be in good shape and well seated on its wheel. A source of high pressure air, such as air bottles, must be available. Refer to 12-15-51 for tire inflation.

WARNING: ALWAYS USE A PRESSURE REGULATOR ON HIGH PRESSURE AIR SOURCE WHEN INFLATING TIRES. DO NOT INFLATE TIRES ABOVE THEIR STRUCTURAL LIMITATIONS.

(2) By pushing or pulling the airplane so that the nose gear is moved up an inclined block. The slope is not important except from the viewpoint of increased towbar load. The block should level out at a minimum height of 6 inches (assuming a jack with a collapsed height of 10 inches is available). If one block is used under each wheel there should be sufficient clearance between them to permit insertion of the axle jack base.

(3) By jacking the airplane at the nose jacking point D as described in Section 7-11-21, (Raise Airplane Nose), the use of an axle jack is unnecessary. (Refer to 7-11-11, figure 201.)

C. If one nose gear tire is flat, procedures similar to those adopted in A may be applied. If an axle jack cannot be inserted, the wheel with a good tire could be run up an inclined block. By using an inclined block of sufficient height, subsequent use of an axle jack would be unnecessary. The good wheel would be run up inclined block.

SUPPORT AIRPLANE WITH ENGINES REMOVED

1. General
   A. Normally, no airplane support will be required during engine removal on the 737 series airplane.

LIFTING DAMAGED AIRPLANE

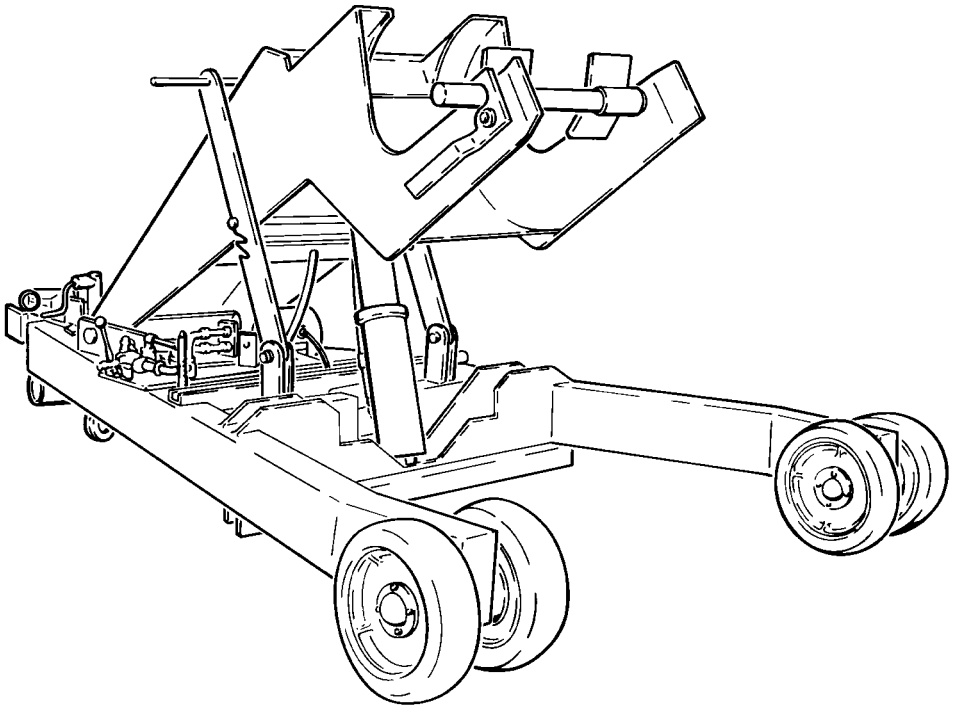
1. General
   A. Procedures for lifting and recovery of damaged aircraft are contained in the Boeing Document D6-40146, 707, 727, 737 AIRPLANE RECOVERY.

TILT AIRPLANE FOR TAIL CLEARANCE - MAINTENANCE PRACTICES

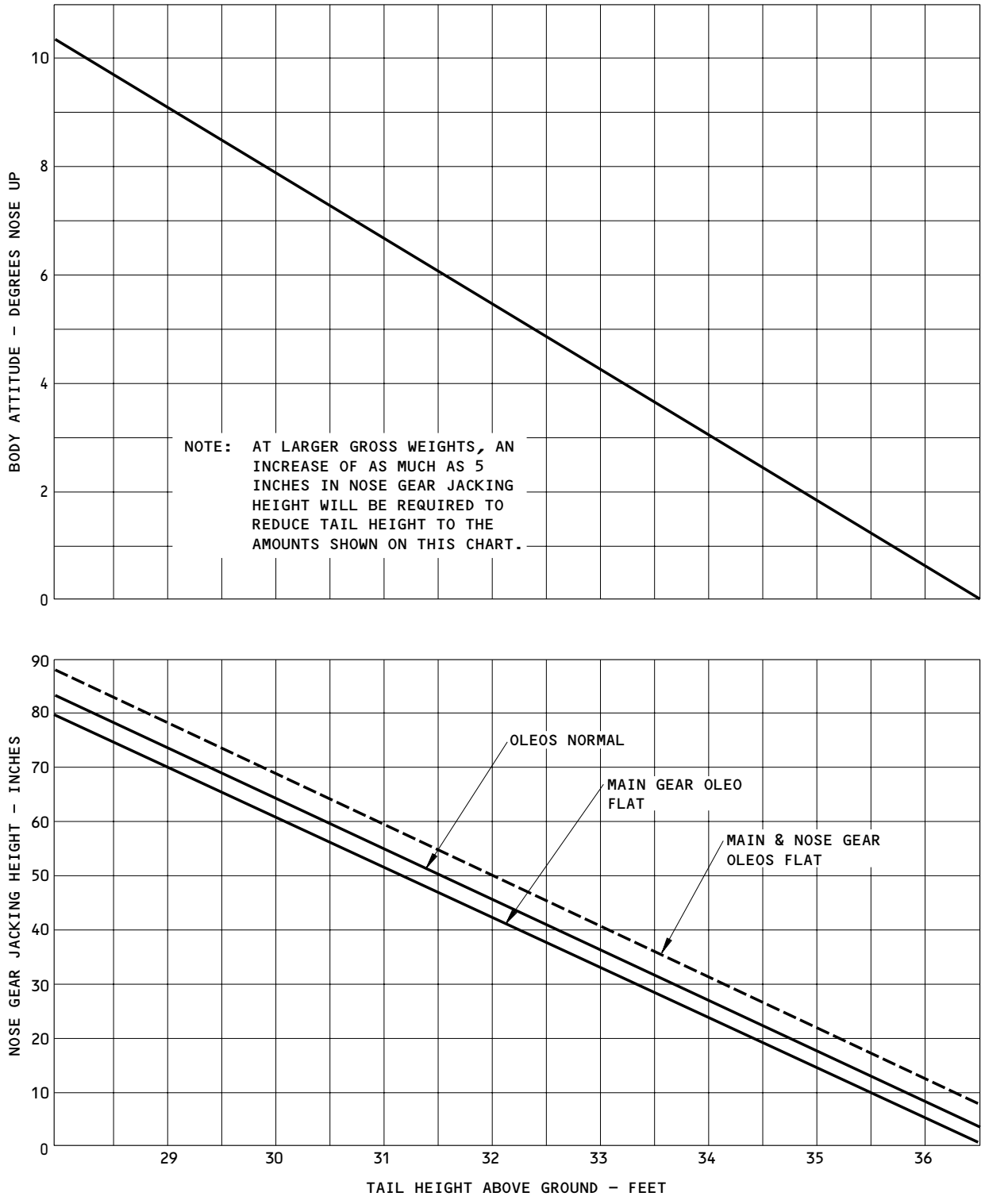
1. General
   A. The airplane nose is raised by means of a nose lift dolly. The nose is raised when it is necessary to lower the aft section of the airplane for clearance in hangar and storage areas. As the body attitude increases to a maximum of 10 degrees, 48 minutes, or the nose gear wheels raised 84 inches with maximum extension of nose strut limited to 22 inches, the tail height is reduced to approximately 28 feet, depending upon the nose lift dolly used.
   B. The airplane may require ballast.
      (1) Add ballast before tilting to prevent tipping.
         (a) See "Balance Check for Towing Tilted Airplane" paragraph.
      (2) See Fig. 210 when total airplane moment is below +900 for ballast requirements.
   C. Removal of the vertical fin tip antenna will reduce each of the ground clearance heights by 7 inches.
   D. A nose gear ramp may be employed so the vertical tail fin can pass under a hangar doorway.
2. Equipment and Materials
   A. Nose Lift Dolly - D100 Mercer Robinson, Div of Squibb Machine and Tool, Easton, Pennsylvania 18043 (used to lift 84 inches maximum)
   B. Nose Lift Dolly - G8950, Mercer Robinson, Div of Squibb Machine and Tool Co., Easton, Pennsylvania 18043 (used to lift 78 inches maximum)
   C. Nose and Main Landing Gear Ground Lockpins - F72735
3. Prepare to Tilt Airplane
   A. Defuel airplane to approximately 6000 pounds of fuel (Ref 12-11-0).
   B. Drain potable water and waste water tanks (Ref 12-14-0 and 12-7-0).
   C. Restrain nose shock strut with nylon strap, rope, sling or other suitable means so that dimension X, Fig. 203, is 22 inches maximum. Refer to 12-15-41 for inflation nose shock strut.
   D. Check that main gear shock struts are serviced to 1-1/2 +1/8 inch extension (Ref 12-15-31).
   E. Determine how high nose must be lifted to gain required tail clearance (Fig. 202).

      CAUTION: NOSE SHOULD NOT BE LIFTED MORE THAN 84 INCHES. FAILURE TO COMPLY COULD DAMAGE AIRPLANE.

   F. Center airplane nose landing gear.
   G. If using hose lift dolly D1000, install 4-inch collar around nose gear exposed inner cylinder to prevent excessive compression of nose gear inner cylinder. This will prevent damage to lower fuselage by contact with lift dolly.
   H. Remove rear lock bar from the dolly and roll dolly into position centered on the nose gear.
   I. Disconnect nose gear torque links and install dolly lock bar behind tires.



Nose Lift Dolly
Figure 201



(TYPICAL FOR AIRPLANES HAVING MGW 55–65,000 LBS AND CENTER OF GRAVITY BETWEEN 27% AND 29%)

Vertical Tail Height VS Nose Gear Jacking Height
Figure 202

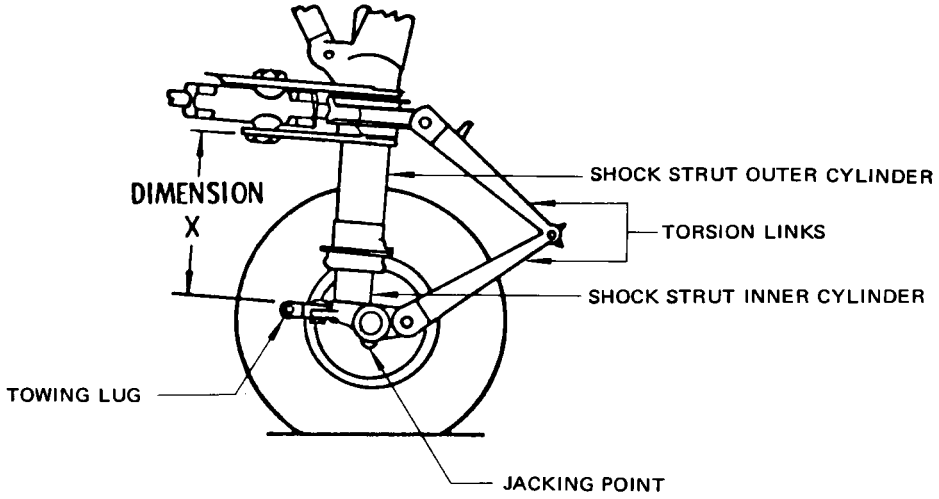
4. Tilt Airplane
   A. Check that all landing gear downlocks are installed.
   B. Loosely chock main landing gear wheels.
   C. Ensure that airplane brakes are released.
   D. Raise nose to the required uplock on the dolly. Operate gear scoop "down" to settle securely in the uplocks.
   E. Ensure that strut extension (dimension X) has not increased to more than 22 inches. If dimension X is exceeded release strut pressure until dimension X is 22 inches or less. Readjust restraints.

      CAUTION: IF STRUT EXTENSION (DIMENSION X) IS MORE THAN 22 INCHES DO NOT ATTEMPT TO TOW AIRPLANE. THE NOSE GEAR CENTERING CAMS CAN BE DAMAGED IF THIS CONDITION EXISTS.

5. Balance Check for Towing Tilted Airplane
   A. As the airplane is rotated into a tilted position the center of gravity moves aft with respect to the main gear axle. This aft movement, plus the adverse effects or wind, upgrades, and fuel movement due to tilting, could cause the airplane to tip and the aft fuselage settle on, or momentarily touch the ground. Therefore, a balance check form must be filled out to ensure that the airplane will not be overbalanced when tilted. If it is determined that the airplane will tip, either add forward ballast to counter the overbalance or restrain nose gear wheels to lift dolly so the dolly acts as ballast.
   B. The balance check consists of adding moments about the main gear due to airplane weight (Fig. 204), tilting airplane (Fig. 205), fuel shift (Fig. 206), wind (Fig. 207), tow vehicle acceleration (Fig. 207), and upgrades (Fig. 208). The sum of these moments is required to be more than +900,000 inch-pounds (+900 x 103 inch-pounds).
   C. Any accumulation of snow or ice on the empennage should be removed before tilting or accounted for in the balance check.
   D. Figure 211 presents the maximum nose gear load for tilted airplanes. The lift dolly must have capacity equal to maximum expected nose gear load.
   E. Table 201 provides a sample balance check for towing a tilted airplane, and Fig. 212 the tilt and clearance data.
6. Tow Airplane While Tilted

   CAUTION: WITH THE AIRPLANE IN THE NOSE-UP ATTITUDE, SUDDEN STARTS CAN DAMAGE THE NOSE GEAR OLEO. TOW AIRPLANE SMOOTHLY AVOIDING SUDDEN STARTS AND STOPS. DO NOT MAKE SHARP TURNS WHILE TOWING A TILTED AIRPLANE.

   A. Check that all landing gear downlocks are installed.
   B. Ensure that the dolly caster is fully retracted.
   C. Remove main gear chocks and tow airplane to desired location.



STRUT POSITION	DIMENSION X
FULLY COMPRESSED	12 INCHES
FULLY EXTENDED	24 INCHES

Nose Gear Shock Strut Extension
Figure 203

D. Check airplane main gear wheels if tilted airplane is to remain at location for a period of time.

7. Lower Airplane Nose
   A. Check that all landing gear downlocks are installed.
   B. Release airplane brakes, if applied.
   C. Remove main gear wheel chocks, if installed.
   D. Raise scoop to clear dolly uplocks. Release uplocks.
   E. Lower dolly smoothly and slowly.
   F. Chock airplane main gear wheels. The wheel chocks should be placed about 3 inches from the tires.
   G. Remove lock bar from behind tire and remove dolly.
   H. Connect nose gear torque links.

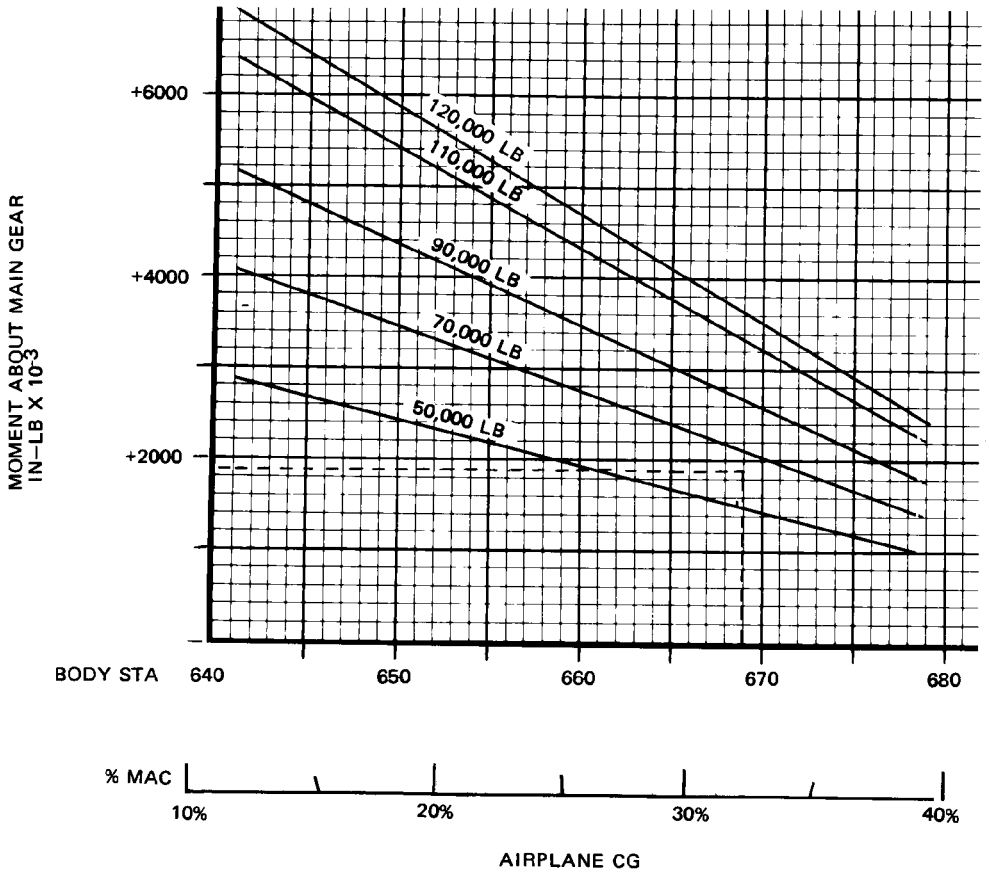
1. ENTER FIGURE WITH AIRPLANE CG
2. PROCEDE UPWARD TO AIRPLANE WEIGHT LINE
3. PROCEDE LEFT TO MOMENT
   NOTE: USE WEIGHT AND CG FOR AIRPLANE IN THE CONFIGURATION IT WILL BE IN AT TIME OF TILTING. CONSULT WEIGHT AND BALANCE MANUAL TO DETERMINE WEIGHT AND CG.

EXAMPLE:

CG = 30%

WEIGHT = 60,000 LB

MOMENT = +1900

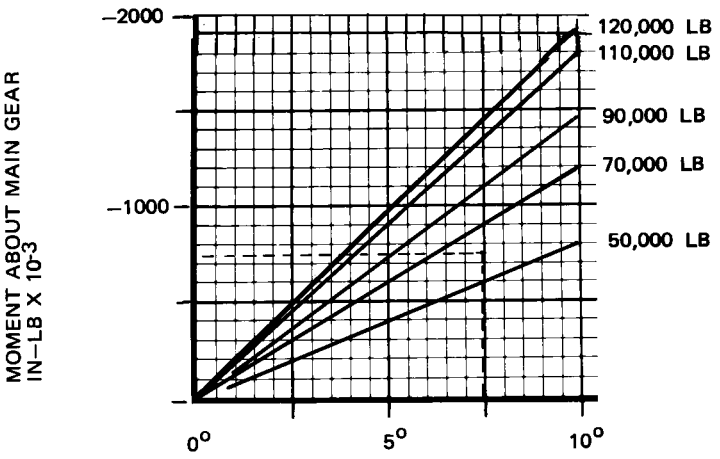


Moment Due to Airplane Weight
Figure 204

1. ENTER FIGURE WITH MAXIMUM ANGLE AIRPLANE IS TO BE TILTED.
2. PROCEDE UPWARD TO AIRPLANE WEIGHT.
3. PROCEDE LEFT TO MOMENT

EXAMPLE:

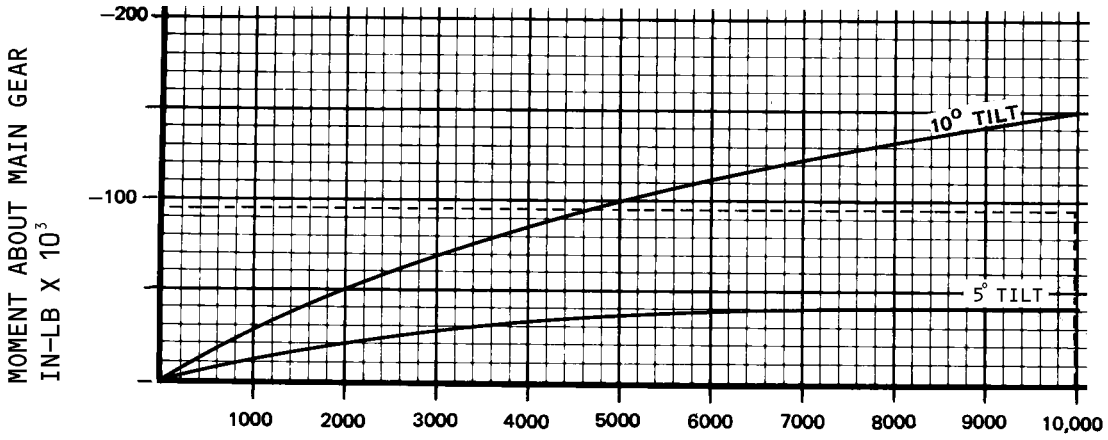
TILT = 7-1/2°
WEIGHT = 60,000 LB
MOMENT = −740



Moment Due to Tilting
Figure 205

1. ENTER FIGURE TOTAL FUEL WEIGHT
2. PROCEDE UPWARD TO LINE
3. PROCEDE LEFT TO MOMENT

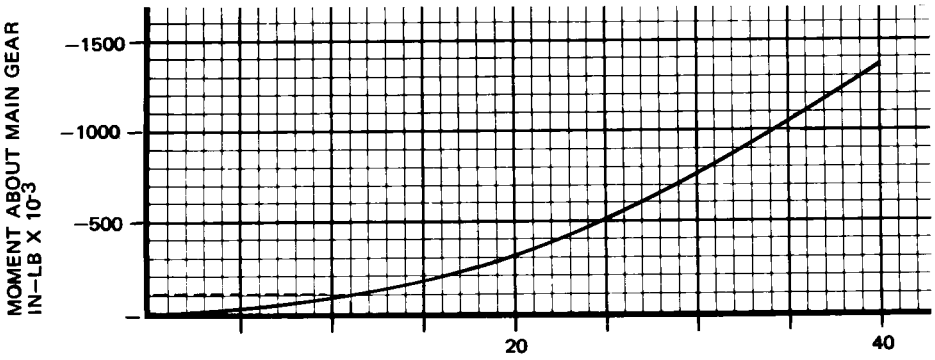
EXAMPLE:
7.5° TILT
FUEL WEIGHT = 10,000 LB
MOMENT = –95



Moment Due to Fuel Movement
Figure 206

1. ENTER FIGURE WITH MAXIMUM WIND VELOCITY
2. PROCEED UPWARD TO LINE
3. PROCEED LEFT TO MOMENT

EXAMPLE:
WIND = 11 KNOTS
MOMENT = −100



CAUTION: TOWING AIRPLANE TILTED IN HIGH WINDS IS NOT RECOMMENDED.

Moment Due to Wind

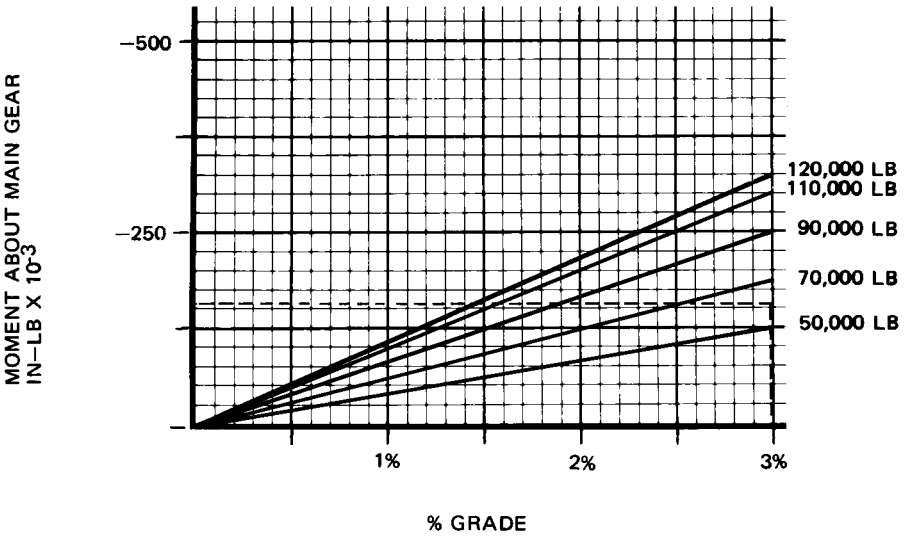
AIRPLANE WEIGHT	50,000	60,000	70,000	80,000	OVER 90,000
MOMENT ABOUT MAIN GEAR IN−LB X 10^3	−130	−160	−190	−220	−250

MOMENT DUE TO TOW VEHICLE ACCELERATION

Moment Due to Tow Vehicle Accelation, and Due to Wind
Figure 207

1. ENTER FIGURE WITH % GRADE
   (1% GRADE EQUALS 1–FOOT RISE PER 100 FEET)
2. PROCEDE UP TO AIRPLANE WEIGHT
3. PROCEDE LEFT TO MOMENT

EXAMPLE:
GRADE = 3%
WEIGHT = 60,000 LB
MOMENT =-160

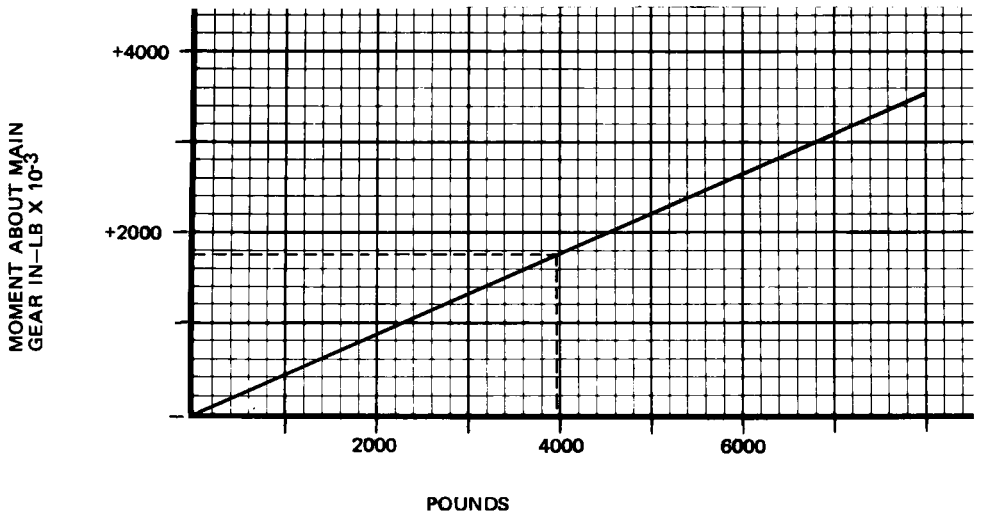


Moment Due to Towing Upgrade
Figure 208

1. ENTER MAXIMUM DOWN LOAD THAT DOLLY CAN SAFELY APPLY TO NOSE GEAR
2. PROCEDE UPWARD TO LINE
3. PROCEDE LEFT TO MOMENT

EXAMPLE:

MAX RESTRAINT LOAD = 3950 LB
MOMENT = 1780

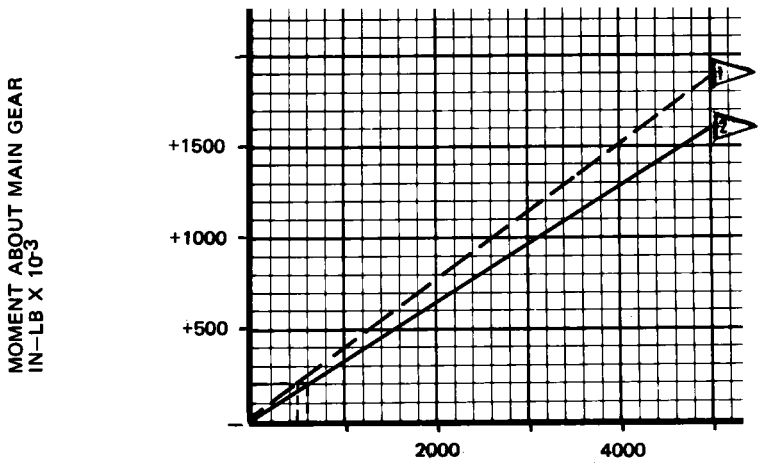


Moment Due to Dolly Restraint
Figure 209

1. IF BALLAST IS REQUIRED, READ MOMENT EFFECT FROM TABLE 201

EXAMPLE:

1. + MOMENT REQUIRED FROM TABLE 201 = +200
2. +200 = 600 LB BALLAST AT 2
   OR
   550 LB BALLAST AT 1

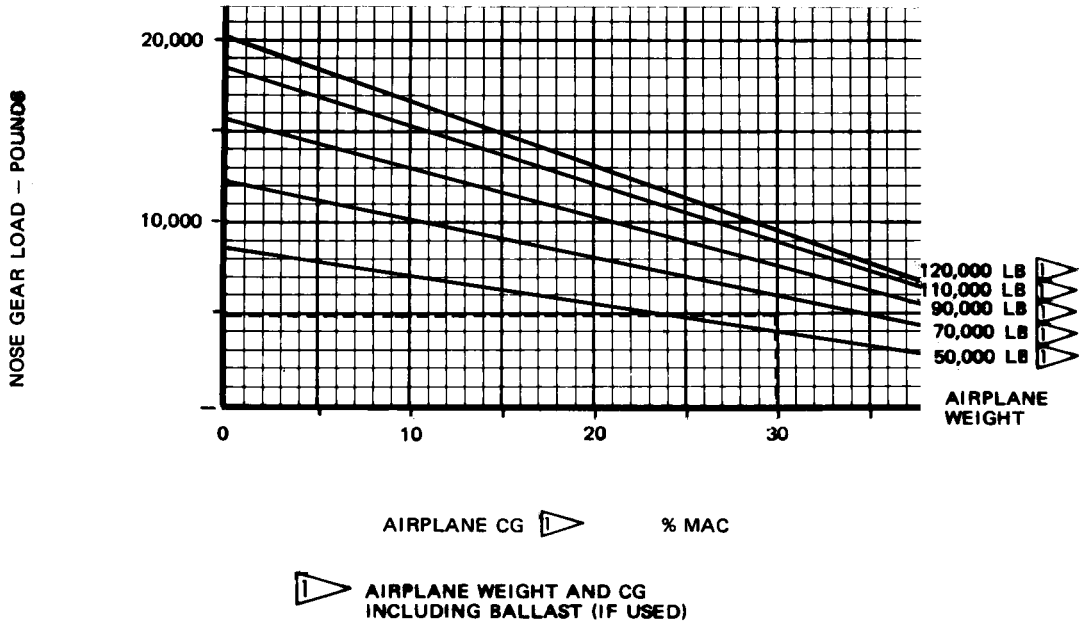


1 BALLAST LOCATED ON UPPER DECK FLOOR JUST AFT OF FORWARD ENTRY DOOR

2 BALLAST LOCATED IN FORWARD CARGO COMPARTMENT FORWARD OF DOOR

Moment Due to Ballast
Figure 210

EXAMPLE: AIRPLANE TOTAL WEIGHT = 60,000 LB
% MAC = 30%
MAXIMUM NOSE GEAR LOAD = 4900 LB

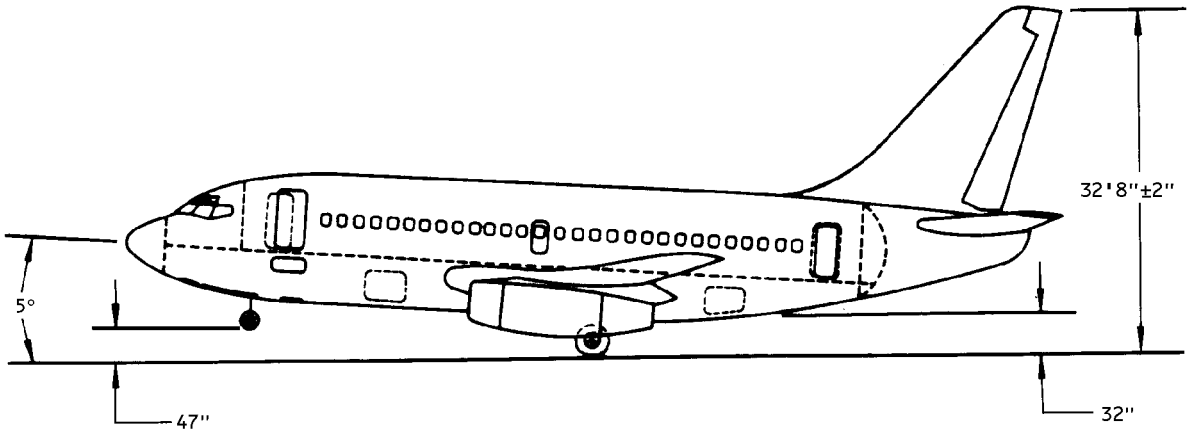


Maximum Nose Gear Load
Figure 211

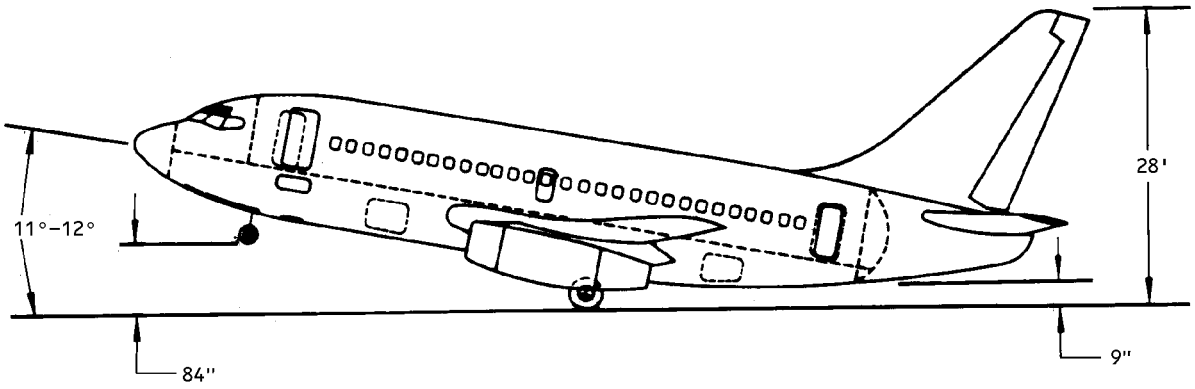
Table 201
BALANCE CHECK FOR TOWING AIRPLANE

AIRPLANE WEIGHT AND	_____	LB
CG AT TIME OF TILTING *[1]	_____	% MAC
TOTAL FUEL ON BOARD	_____	LB
ANGLE OF TILT *[2]	_____	°
MAXIMUM GRADE AIRPLANE IS TO BE TOWED UP	_____	%
MAXIMUM DOWN RESTRAINT DOLLY IS CAPABLE OF	_____	LB
	MOMENT IN-LB X 10	
1. MOMENT DUE TO AIRPLANE WEIGHT (FROM FIG. 204)	+_____	
2. MOMENT DUE TO TILTING AIRPLANE (FROM FIG. 205)	-_____	
3. MOMENT DUE TO FUEL MOVEMENT (FROM FIG. 206)	-_____	
4. MOMENT DUE TO TOW VEHICLE ACCELERATION (FIG. 207)	-_____	
5. MOMENT DUE TOWING UPGRADE (FROM FIG. 208)	-_____	
6. MOMENT DUE TO TOW DOLLY RESTRAINT (FROM FIG. 209)	+_____	
7. MOMENT DUE TO WIND (FROM FIG. 207)	_____	
TOTAL ITEMS 1 THROUGH 7	+_____	
IF TOTAL IS LESS THAN +900, BALLAST MUST BE ADDED		
8. MOMENT DUE TO BALLAST (FROM FIG. 210)	+_____	
TOTAL ITEMS 1 THROUGH 8	+_____	
MUST BE GREATER THAN +900		

*[1] SEE WEIGHT AND BALANCE MANUAL FOR WEIGHT AND CG INFORMATION
*[2] SEE FIGURE 212 FOR TILT AND CLEARANCE DATA



NOTE: 1. 40 X 14 TIRES ON MAIN GEAR
2. 65,000 POUNDS GROSS WEIGHT 28% MAC



Tilting 737-200 for Hangar Door Clearance
Figure 212

SHORING

1. General
   A. Shoring can be accomplished by using contour boards that conform to the lower wing and body surfaces. Contour boards should be made from four thicknesses of 1-inch plywood, laminated together and secured by bolts. The contour surfaces should be padded with 1/2-inch gray felt and covered with 10-ounce canvas duck.
   B. Wing and aft body jacks should be used with wing and/or body shoring. All landing gear downlocks should be installed prior to shoring. The body should be supported at aft body jacking point during shoring of wing or body. Maximum loads at jacking points are tabulated below.

JACKING POINT	MAXIMUM LOAD LBS	
	97,800 GW *[1] to 108,000	108,000 GW *[1] or Higher
RIGHT WING	35,250	43,900
LEFT WING	35,250	43,900
AFT BODY	13,700	15,950

*[1] GW is gross weight of airplane.

   C. Contour shoring should be restricted to areas near the forward and aft cargo doors on the fuselage and to interspar areas on each wing between WBL 92.5 and WBL 151.0 and between WBL 254.0 and WBL 355.0.