CL-350

CL-350 SUPPLEMENTAL MANUAL

WEIGHT & BALANCE 13

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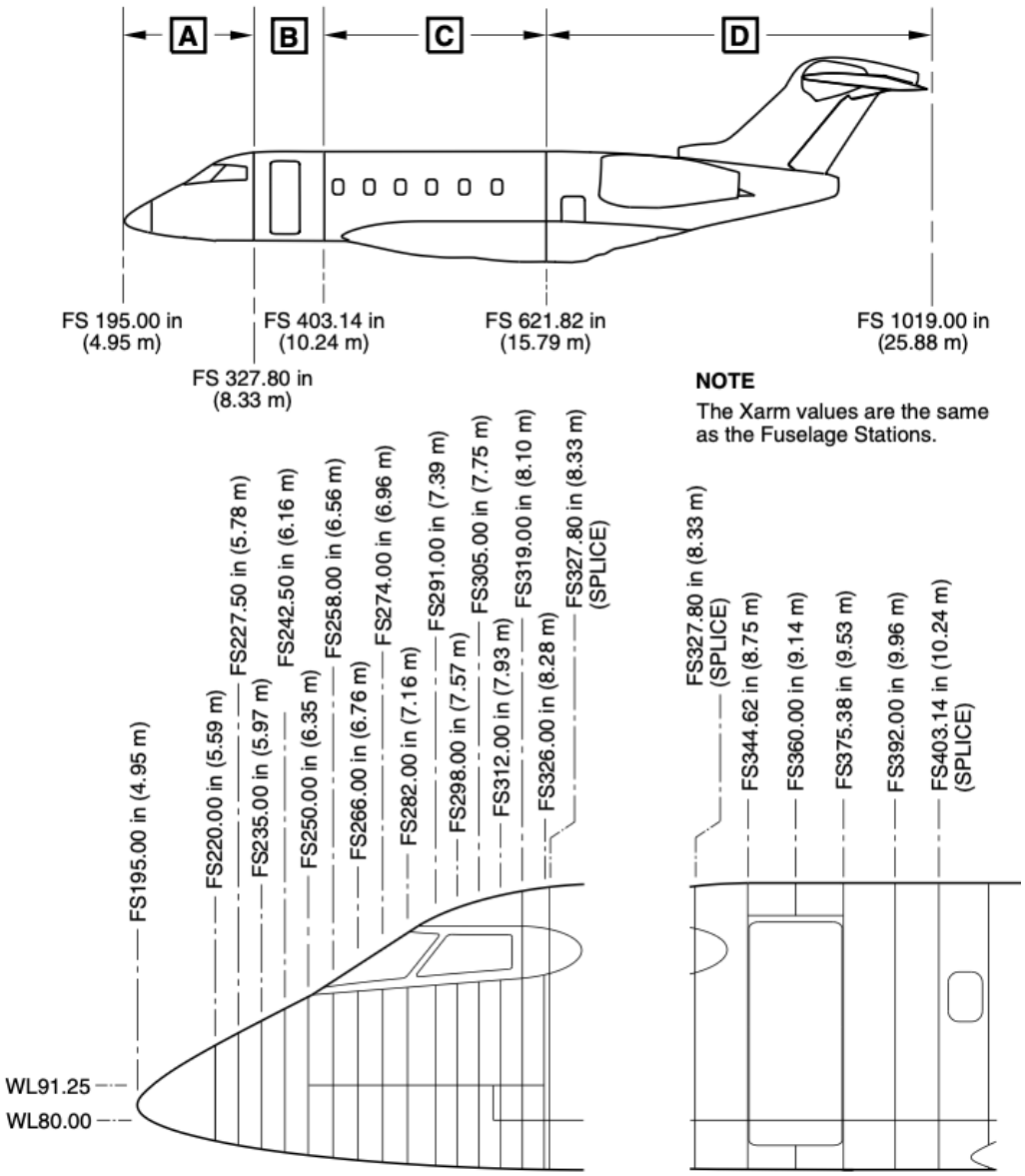
CHALLENGER 350

BD-100-1A10

WEIGHT AND BALANCE



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DEFINITIONS

This section provides definitions of key terms used throughout the Challenger 350 weight and balance calculations. Understanding these terms is essential for accurate weight and balance management.

Term	Definition
BEW	Basic Empty Weight - The weight of the aircraft as delivered from Bombardier, including structure, powerplant, systems, and interior provisions, plus engine oil and unusable fuel.
TEW	True Empty Weight - The actual weighed empty weight of the aircraft including all permanently installed equipment, engine oil, unusable fuel, and hydraulic fluid.
OWE	Operating Weight Empty - TEW plus operating items (crew, crew baggage, flight manuals, and standard cabin equipment). This is the starting point for flight weight calculations.
ZFW	Zero Fuel Weight - OWE plus payload (passengers and baggage). The aircraft weight before fuel is added.
MZFW	Maximum Zero Fuel Weight - 28,200 lb (12,791 kg). The maximum permitted aircraft weight before usable fuel is added.
RW	Ramp Weight - ZFW plus total fuel load. The weight of the aircraft ready for taxi.
MRW	Maximum Ramp Weight - 40,750 lb (18,484 kg). The maximum permitted weight for ground operations and taxi.
TOW	Takeoff Weight - Ramp weight minus taxi fuel burn. The actual weight at brake release.
MTOW	Maximum Takeoff Weight - 40,600 lb (18,416 kg). The maximum permitted weight for takeoff.
LW	Landing Weight - Takeoff weight minus enroute fuel burn. The projected weight at destination.
MLW	Maximum Landing Weight - 34,150 lb (15,490 kg). The maximum permitted weight for landing.
MFW	Minimum Flight Weight - 24,800 lb (11,249 kg). The minimum permitted weight for flight operations.
MAC	Mean Aerodynamic Chord - 112.22 inches. The chord of an imaginary wing with constant chord that has the same aerodynamic characteristics as the actual swept wing.
LEMAC	Leading Edge Mean Aerodynamic Chord - Located at Fuselage Station 556.675 inches.
%MAC	Percent Mean Aerodynamic Chord - The CG position expressed as a percentage of MAC measured from LEMAC. Calculated as: [(CG arm - 556.675) / 112.22] × 100
CG	Center of Gravity - The point at which the aircraft would balance if suspended. Expressed in inches from datum or as %MAC.
ARM	Moment Arm - The horizontal distance in inches from the datum (Zero Reference Datum) to the CG of an item.
MOMENT	The product of weight multiplied by arm. Expressed as moment/1000 (lb-in × 10^{-3}) for ease of calculation.
FCBP	Fuel Curve Boundary Points - Critical points on the fuel curve that define the CG path during fuel burn. Essential for verifying the aircraft remains within CG limits throughout flight.
ZRD	Zero Reference Datum - The reference point (FS 0.00) from which all horizontal measurements are made. Located 195.00 inches forward of the nose radome in the plane of symmetry of the aircraft at BL0.00 and WL0.00.
CDL	Configuration Deviation List - A list of secondary airframe components that may be missing with specific weight or performance penalties applied.

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WEIGHT AND BALANCE OVERVIEW

Aircraft Weighing Process

The Challenger 350 weight and balance process begins with periodic aircraft weighing to establish an accurate Basic Empty Weight (BEW) or True Empty Weight (TEW). While pilots do not perform the actual weighing procedure, understanding the process provides context for the weight data used in flight calculations.

Aircraft weighing is typically performed by qualified maintenance personnel in controlled conditions. The aircraft is placed on calibrated scales in a level attitude with all systems serviced to standard levels. The resulting weight and CG data are recorded on the Aircraft Weighing Report, which becomes the foundation for all subsequent weight and balance calculations.

NOTE: The weight data from the Aircraft Weighing Report should be verified against the actual aircraft documents. Any modifications or equipment changes since the last weighing may affect the aircraft's empty weight and CG.

Challenger 350 Design Weight Limits

The following table summarizes the certificated weight limits for the Challenger 350:

Weight Category	Pounds (lb)	Kilograms (kg)
Maximum Ramp Weight (MRW)	40,750	18,484
Maximum Takeoff Weight (MTOW)	40,600	18,416
Maximum Landing Weight (MLW)	34,150	15,490
Maximum Zero Fuel Weight (MZFW)	28,200	12,791
Minimum Flight Weight (MFW)	24,800	11,249

Maximum Loading

When loading the aircraft, the load must not be more than the maximum load permitted in each area. The following table gives the maximum loading for each aircraft area:

Description	Zone	Loading	Capacity
Avionics Area [1]	FS326.0 to FS344.6	250 lb/Longitudinal ft	400 lb
Galley Area [2]	FS344.6 to FS394.6	150 lb/Longitudinal ft	625 lb
Passenger Compartment Area [2]	FS394.6 to FS630.0	200 lb/Longitudinal ft	3,920 lb
Cargo Hold [3]	FS630.0 to FS668.7	400 lb/Longitudinal ft	750 lb
Flight Compartment Allowance [4]			250 lb
Aft Equipment Bay Allowance	Aft of FS668.7		300 lb

Floor Structure		75 lb/ft²	
Floor Panels		75 lb/ft²	

[1] Allowance in addition to type specification avionics.

[2] Allowance in addition to type specification interior and operating items.

[3] Maximum capacity = 750 lb.

[4] Allowance includes ballast. This ballast weight is in addition to type specification operating items.

Maximum Fuel Capacity

Tank	Volume (US gal)	Weight (lb)	ARM (in)
Main Tanks (Total)	2,096	14,150	573.0

Fuel weight calculated at standard density of 6.75 lb/US gal (0.809 kg/L).

NOTE: Standard fuel density of 6.75 lb/US gal is used for planning purposes. Actual fuel density varies with temperature and fuel type. Crews should use actual fuel density from fuel tickets when available for enhanced precision.

CG CONCEPTS FOR SWEPT WING AIRCRAFT

The Dynamic Nature of CG in Flight

Unlike straight-wing aircraft where fuel CG often coincides closely with the aircraft CG, the Challenger 350's swept wing configuration results in fuel being stored at varying distances from the aircraft's center of gravity. This creates a unique challenge: as fuel burns, the aircraft's CG shifts continuously throughout the flight.

In the Challenger 350, fuel is stored primarily in the wing tanks, with the fuel CG located forward of the aircraft's typical operating CG. As fuel burns from the wings, the overall aircraft CG tends to move aft. This aft shift must be accounted for in pre-flight planning to ensure the aircraft remains within CG limits throughout all phases of flight.

Understanding the Fuel Curve

The fuel curve is a graphical representation of how the aircraft's weight and CG change as fuel is consumed. For the Challenger 350, this curve is not a straight line but follows a specific path determined by the wing geometry and fuel tank configuration.

Key characteristics of the CL350 fuel curve include:

The fuel curve begins at Zero Fuel Weight (ZFW) at the bottom and extends upward as fuel is added. The path the curve takes represents the CG shift that occurs with different fuel loads. At maximum fuel capacity of 14,150 lb, the fuel CG is approximately 573.0 inches, which is forward of most loaded aircraft CG positions.

As fuel burns during flight, the aircraft's position on the fuel curve moves downward toward the ZFW point. The entire fuel curve from takeoff weight to landing weight must remain within the approved CG envelope.

WARNING: The entire applicable portion of the fuel curve must remain within the CG envelope limits throughout the flight. If any portion of the fuel curve exits the envelope, the aircraft loading must be adjusted before flight. If any part of the curve is out of the envelope limits, the aircraft is not safe for take-off, even if the TOW and ZFW points are within limits.

Fuel Curve Boundary Points (FCBP)

Fuel Curve Boundary Points are specific points on the fuel curve that define the extreme CG positions that will be encountered during fuel burn. The Challenger 350 uses two FCBPs to verify that the aircraft remains within limits:

Point	Fuel Weight	Purpose
FCBP1	11,660 lb at 566.1 in ARM	Represents the CG position at approximately 82% fuel capacity. This point typically defines the most forward CG position on the fuel curve for the specific fuel load.
FCBP2	9,310 lb at 562.0 in ARM	Represents the CG position at approximately 66% fuel capacity. This point helps define the fuel curve shape and verifies mid-flight CG positions.

When plotting weight and balance, plot four points on the CG envelope in sequence: TOW, FCBP1, FCBP2, and ZFW. Connect these points with lines to create the fuel curve. The entire curve must remain within the inner area of the CG envelope limits.

IMPORTANT — FCBP EXCLUSION RULE: Do not include a Fuel Curve Boundary Point if it is heavier than the Takeoff Weight (TOW). Specifically:• If FCBP1 is heavier than the TOW, omit FCBP1 and draw lines

connecting only TOW → FCBP2 → ZFW.• If both FCBP1 and FCBP2 are heavier than the TOW, omit both FCBPs and draw a line connecting only TOW → ZFW.This situation occurs when the aircraft departs with a fuel load less than the FCBP fuel quantity. Since those boundary points represent fuel states that will never exist during the flight, including them would plot an inaccurate fuel curve.

If the resulting curve is entirely within the envelope limits, the aircraft is safe for takeoff. If any part of the curve falls outside the envelope limits, the aircraft is not safe for takeoff. You must move, add, or remove payload or ballast until the weight and CG of the aircraft are within the envelope limits.

The CG Slide Method

The CG Slide Method provides a quick graphical means to verify that the aircraft will remain within CG limits throughout fuel burn. This method uses a transparent fuel curve overlay positioned on the CG envelope chart.

To use the CG Slide Method:

1. Calculate the ZFW and %MAC position.
2. Plot the ZFW point on the CG envelope chart.
3. Align the bottom of the transparent fuel curve with your ZFW point.
4. Verify that the entire fuel curve from ZFW to your planned fuel load remains within the envelope.
5. The aircraft is safe for flight only if the entire applicable portion of the fuel curve remains within the envelope.

WARNING: If any part of the curve is out of the envelope limits, the aircraft is not safe for take-off. This applies even if the individual TOW and ZFW points are within limits. The entire fuel curve path must be verified.

CENTER OF GRAVITY ENVELOPE

Longitudinal CG Limits

The Challenger 350's CG envelope defines the acceptable range of CG positions for various aircraft weights. The envelope is bounded by forward and aft limits that vary with aircraft weight.

The following table provides key reference points for the CG envelope:

Weight Condition	Forward Limit	Aft Limit	Weight (lb)
At MRW/MTOW	23% MAC	37% MAC	40,750
At MLW	23% MAC	41% MAC	34,150
At MZFW	25% MAC	43% MAC	28,200
At MFW	27% MAC	43% MAC	24,800

Calculating %MAC

The center of gravity position is expressed as a percentage of the Mean Aerodynamic Chord (%MAC). This standardized expression allows for quick verification against published limits.

%MAC FORMULA

$$\%MAC = [(CG\ ARM - 556.675) / 112.22] \times 100$$

Where: LEMAC = 556.675 inches, MAC = 112.22 inches

Example: If CG ARM = 598.71 inches:

%MAC = [(598.71 - 556.675) / 112.22] × 100 = 37.47%

WEIGHT AND BALANCE CALCULATION PROCEDURE

This section provides a comprehensive step-by-step procedure for calculating the Challenger 350 weight and balance from Operating Weight Empty through Landing Weight.

Step 0: Pre-Calculation CDL/MEL Check

Before beginning weight and balance calculations, review the aircraft's Configuration Deviation List (CDL) and Minimum Equipment List (MEL) for any items that impose weight penalties or performance restrictions.

> **IMPORTANT:** The AFM Appendices note that missing secondary airframe components (e.g., Wing-to-Aileron Side Seals) may require weight reductions (e.g., Takeoff Weight reduced by 30 lb per seal) or drag index adjustments in the Computerized Airplane Flight Manual (CAFM). Always verify CDL/MEL status before completing weight and balance calculations and apply any required weight penalties to the appropriate calculation step.

Step 1: Establish Operating Weight Empty (OWE)

The OWE is the foundation for all flight weight calculations. It includes the aircraft's True Empty Weight plus standard operating items.

Item	Weight (lb)	ARM (in)	Moment/100
True Empty Weight (TEW)	Per Aircraft	Per Rpt	Weight × ARM / 100
Flight Crew (Pilot + Copilot)	Actual	305.20	Weight × 3.052
Crew Baggage	Actual	385.00	Weight × 3.85
Flight Manuals	30	320.00	96.00
Operating Weight Empty (OWE)	**Sum**	—	**Sum**

Step 2: Calculate Zero Fuel Weight (ZFW)

Add all payload items to OWE to determine ZFW. Verify that ZFW does not exceed MZFW of 28,200 lb.

Item	Weight (lb)	ARM (in)	Moment/100
Operating Weight Empty (OWE)	From Step 1	—	From Step 1
Passengers (by seat position)	Actual	Per Seat	Calculate
Baggage (Cabin/Tailcone)	Actual	650.00	Calculate
Galley Supplies	Actual	366.30	Calculate
Zero Fuel Weight (ZFW)	**Sum ≤ 28,200**	Calculate	**Sum**

Calculate ZFW CG: CG = (Total Moment × 100) / Total Weight

Calculate ZFW %MAC: %MAC = [(CG - 556.675) / 112.22] × 100

NOTE: Verify ZFW does not exceed MZFW of 28,200 lb and that %MAC is within envelope limits (typically 25-43% at this weight).

IMPORTANT: Passenger seat arms and galley/baggage compartment arms are TAIL-NUMBER SPECIFIC and vary by interior configuration. The arms listed in this training manual are for sample exercise purposes only. For actual flight operations, always use the arm data from the specific aircraft's Weighing Report (Chapter 2, Aircraft Reports provided by the Completion Center).

Step 3: Calculate Ramp Weight (RW)

Add the planned fuel load to ZFW. Use the Fuel Loading Table to determine fuel moment. Verify RW does not exceed MRW of 40,750 lb.

Item	Weight (lb)	ARM (in)	Moment/100
Zero Fuel Weight (ZFW)	From Step 2	—	From Step 2
Fuel Loading	Per Plan	Variable	From Table
Ramp Weight (RW)	**Sum ≤ 40,750**	Calculate	**Sum**

WARNING — SNOW/ICE ACCUMULATION: When snow or ice has accumulated on the horizontal stabilizer, there is a risk of static stability degradation and potential tip-over during ground operations. Ensure the aircraft is properly de-iced before conducting weight and balance calculations. Snow accumulation on the tail can shift the actual CG aft of calculated values and may exceed the aft limit, creating a tip-over hazard.

Step 4: Calculate Takeoff Weight (TOW)

Subtract taxi fuel from Ramp Weight. A standard taxi fuel burn of 200-300 lb is typical for the CL350.

Item	Weight (lb)	ARM (in)	Moment/100
Ramp Weight (RW)	From Step 3	—	From Step 3
Less: Taxi Fuel	(200-300)	—	Interpolate
Takeoff Weight (TOW)	**Sum ≤ 40,600**	Calculate	**Sum**

WARNING: Calculate TOW CG and %MAC. Verify TOW does not exceed MTOW and that %MAC is within envelope limits (23-37% at maximum weight).

Step 5: Calculate Landing Weight (LW)

Subtract planned enroute fuel burn from Takeoff Weight. Verify LW does not exceed MLW of 34,150 lb.

Item	Weight (lb)	ARM (in)	Moment/100

Takeoff Weight (TOW)	From Step 4	—	From Step 4
Less: Enroute Fuel Burn	Per Plan	—	Interpolate
Landing Weight (LW)	**Sum ≤ 34,150**	Calculate	**Sum**

Step 6: Apply Landing Gear Retraction Moment

The official Weight and Balance Manual requires an adjustment for the balance effect caused by landing gear retraction. When the landing gear is retracted after takeoff, the change in gear position causes a moment change that must be accounted for in flight CG calculations.

BALANCE EFFECTS OF MAJOR OPERATIONS

The operation of certain aircraft systems changes the CG of the aircraft during flight, ground handling, takeoff, and landing operations. The Weight and Balance Manual requires that these moment changes be accounted for when calculating flight CG positions.

Configuration Change	Moment/1000 (lb in)	Moment/1000 (kg m)
Gears Up vs. Gears on Ground	-4.6	-0.053
Flaps Deployed vs. Flaps Stowed	-4.0	-0.046
Thrust Reversers Deployed vs. Stowed	Negligible (-0.06)	Negligible

LANDING GEAR RETRACTION MOMENT

Gear Retraction: Moment Change = -5.3 (Moment/1000)

Approximately -4,600 lb-in

Apply this adjustment to the ZFW (Gear Up) index and to each FCBP calculation. Subtract 5.3 from the Index (Moment/1000) when calculating flight CG positions.

WARNING: Failure to apply the landing gear retraction moment moves the calculated CG aft. On a critical loading scenario, this could lead a pilot to believe they are within the aft CG limit when they are actually outside of it once the gear is retracted. This adjustment is mandatory for all flight CG calculations.

Step 7: Verify Fuel Curve Boundary Points

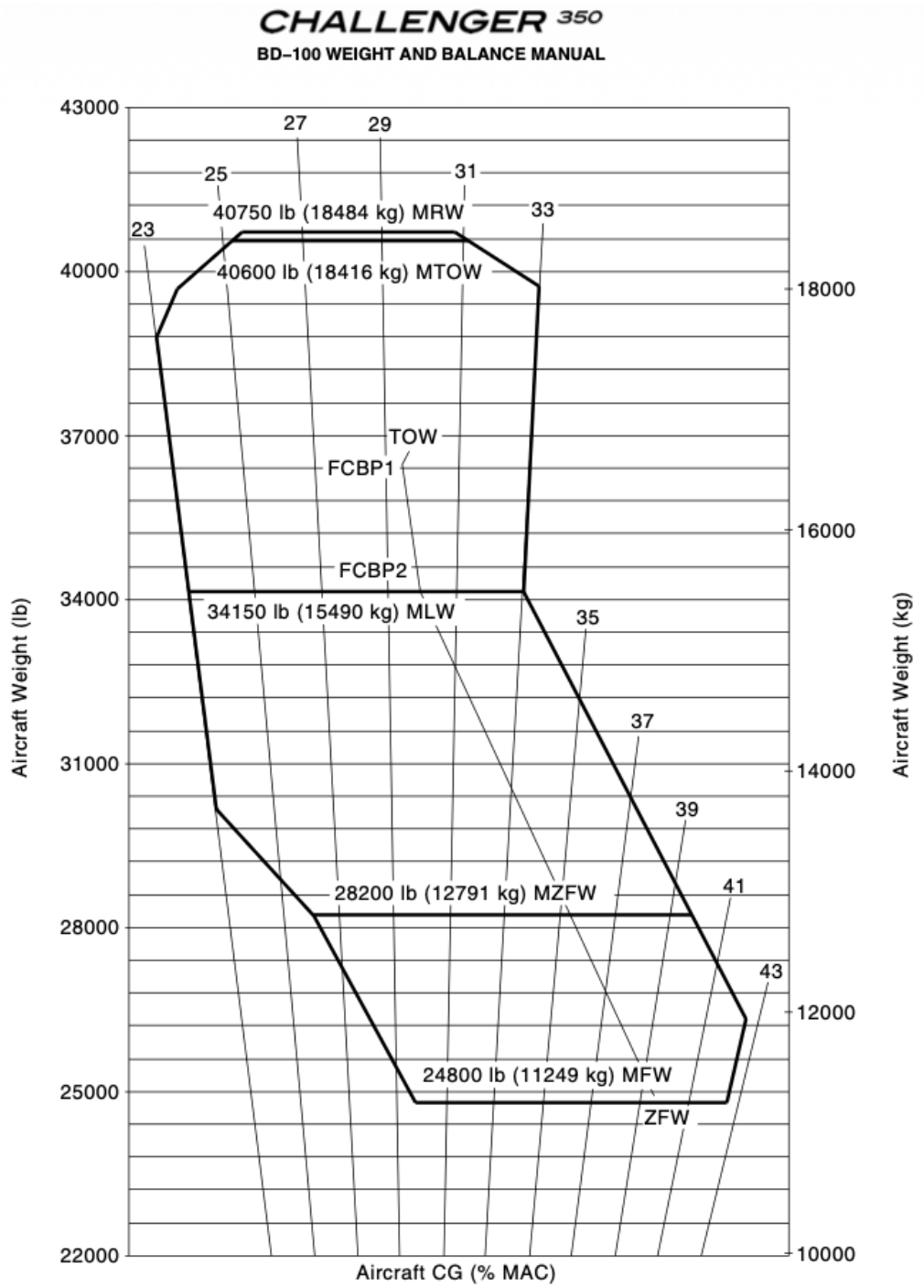
Calculate FCBP1 and FCBP2 to verify the aircraft remains within CG limits throughout fuel burn. Remember to apply the landing gear retraction moment (-5.3 Moment/1000) to each boundary point calculation.

Plot the following four points on the CG envelope and connect them with lines in this sequence: TOW → FCBP1 → FCBP2 → ZFW.

IMPORTANT — FCBP EXCLUSION RULE: Do not include a Fuel Curve Boundary Point if it is heavier than the Takeoff Weight (TOW):• If FCBP1 is heavier than TOW → plot only TOW → FCBP2 → ZFW.• If both FCBP1 and FCBP2 are heavier than TOW → plot only TOW → ZFW.This occurs when departing with less fuel

than the FCBP fuel quantity. Since those fuel states will never exist during the flight, they must be excluded from the fuel curve.

WARNING: If any part of the resulting curve is out of the envelope limits, the aircraft is not safe for takeoff. You must move, add, or remove payload or ballast until the weight and CG of the aircraft are within the envelope limits.



LOADING ARM REFERENCE DATA

IMPORTANT: The arm data listed below is representative of a typical Challenger 350 interior configuration and is provided for training purposes only. Passenger seat arms, galley arms, and baggage compartment arms are TAIL-NUMBER SPECIFIC and vary by aircraft. Always reference the specific aircraft's Weighing Report for actual operational data.

Flight Crew Stations

Station	ARM (in)	Moment/100 per lb
Pilot (LH Seat)	305.20	3.052
Copilot (RH Seat)	305.20	3.052

Passenger Seating Positions

Seat Position	ARM (in)	Seat Position	ARM (in)
Seat 1	422.70	Seat 6	520.70
Seat 2	422.70	Seat 7	565.30
Seat 3	469.30	Seat 8	568.30
Seat 4	471.30	Seat 9 (LAV)	613.00
Seat 5	518.70	—	—

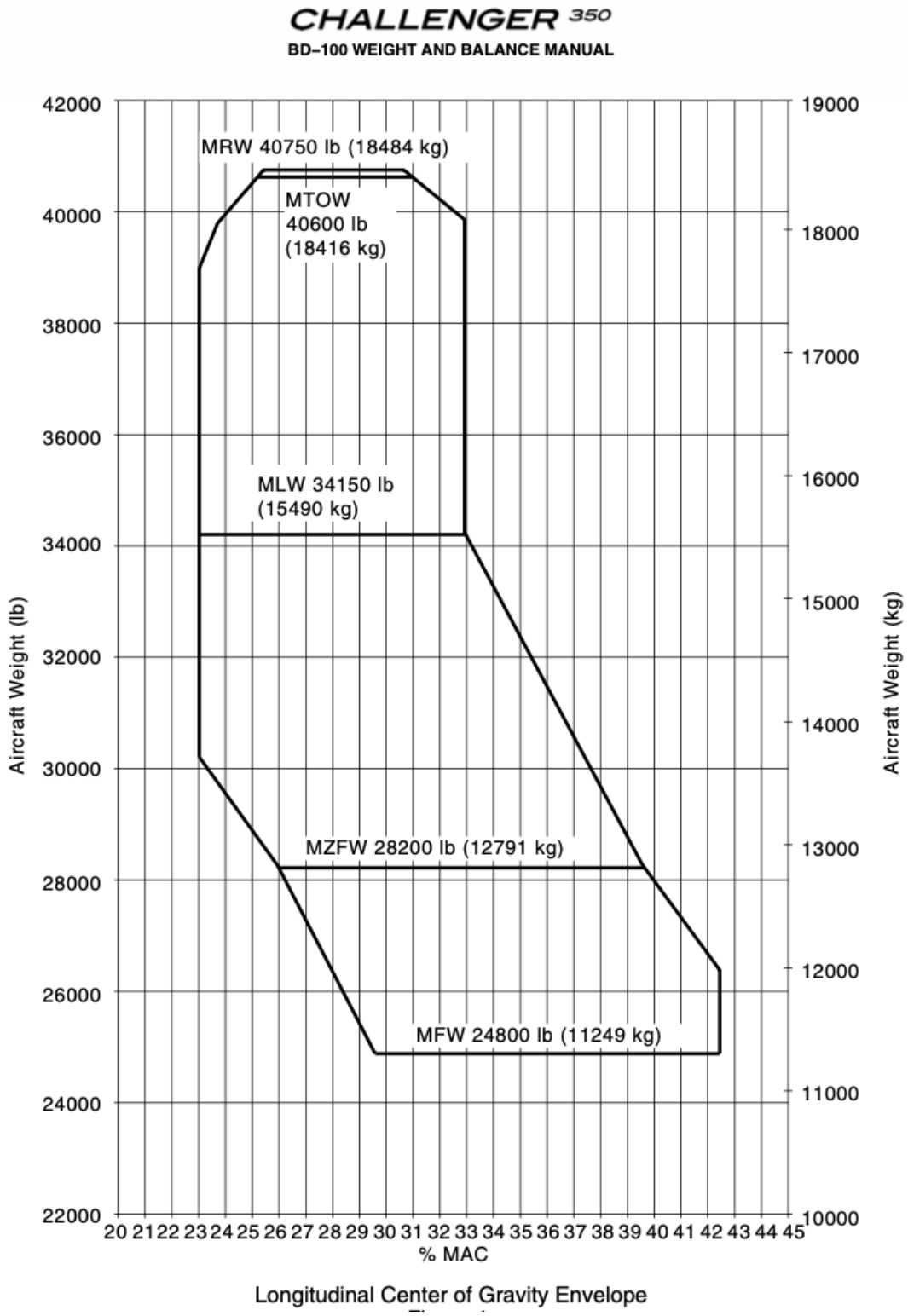
Baggage and Storage Compartments

Compartment	ARM (in)	Max Load (lb)
Crew Carry-On Baggage	385.00	Per Config
Crew Baggage Compartment	650.00	Per Config
Baggage Compartment (Aft)	650.00	Per Config

Standard Equipment Arms

Item	ARM (in)	Typical Weight (lb)
Flight Manuals	320.00	30
Galley Supplies	366.30	Variable
Aft Potable Water	636.00	Variable
Lavatory Chemicals	610.00	20

Lavatory Supplies	610.00	5
Aft Equipment Bay Ladder	737.10	9



Longitudinal Center of Gravity Envelope

FUEL LOADING TABLE

Use this table to determine fuel moment/100 based on fuel weight. For intermediate values, linear interpolation may be used.

NOTE: Fuel weight calculated at standard density of 6.75 lb/US gallon. Actual fuel density varies with temperature and fuel type. When available, use actual fuel density from fuel tickets for more accurate calculations.

Weight (lb)	Moment/100	Weight (lb)	Moment/100	Weight (lb)	Moment/100
0	0.00	5,400	30,484.00	10,800	60,632.00
500	2,717.00	5,900	33,283.00	11,300	63,442.00
1,000	5,456.00	6,400	36,096.00	11,660	66,007.00
1,500	8,210.00	6,900	38,916.00	12,000	67,920.00
2,000	10,976.00	7,400	41,736.00	12,500	70,750.00
2,500	13,755.00	7,900	44,567.00	13,000	73,580.00
3,000	16,546.00	8,400	47,404.00	13,500	76,410.00
3,500	19,348.00	8,900	50,249.00	13,850	78,391.00
4,000	22,160.00	9,310	52,322.00	14,000	79,240.00
4,500	24,984.00	9,800	55,174.00	14,150	81,068.04
4,900	27,216.00	10,300	58,015.00		

NOTE: FCBP1 fuel weight: 11,660 lb at ARM 566.1 in. FCBP2 fuel weight: 9,310 lb at ARM 562.0 in. Maximum fuel capacity: 14,150 lb.

CHALLENGER 350 WEIGHT AND BALANCE COMPUTATION FORM

This form provides a comprehensive worksheet for calculating weight and balance for the Challenger 350. Complete all sections in order.

PRE-CHECK: Before completing this form, verify CDL/MEL status for any weight penalties. Also confirm that seat and baggage arms match the specific aircraft's Weighing Report.

Date:	**Flight #:**
Aircraft:	**Route:**
PIC:	**SIC:**

ITEM	WEIGHT (lb)	ARM (in)	MOMENT/100
AIRCRAFT BASIC DATA			
1. Basic Empty Weight			
OPERATING ITEMS			
2. Pilot		305.20	
3. Copilot		305.20	
4. Crew Carry-On Baggage		385.00	
5. Crew Baggage		650.00	
6. Flight Manuals	30	320.00	96.00
7. Galley Supplies		366.30	
8. Aft Potable Water		636.00	
9. Lav Chemicals		610.00	
10. Lav Supplies		610.00	
11. Aft Equip Bay Ladder		737.10	
PASSENGERS			
12. Seat 1		422.70	
13. Seat 2		422.70	
14. Seat 3		469.30	
15. Seat 4		471.30	
16. Seat 5		518.70	
17. Seat 6		520.70	
18. Seat 7		565.30	
19. Seat 8		568.30	
20. Seat 9 (LAV)		613.00	
BAGGAGE			

21. Baggage Compartment		650.00	
ZERO FUEL WEIGHT (ZFW)	**≤ 28,200**		

ZFW CG:_____ in %MAC:_____

FUEL			
22. Fuel Loading		Varies	
RAMP WEIGHT (RW)	**≤ 40,750**		

RW CG:_____ in %MAC:_____

23. Less: Taxi Fuel	( )	—	( )
TAKEOFF WEIGHT (TOW)	**≤ 40,600**		
LANDING WEIGHT (LW)	**≤ 34,150**		

TOW CG:_____ in %MAC:_____

24. Less: Enroute Fuel Burn	( )	—	( )
LANDING WEIGHT (LW)	**≤ 34,150**		

LW CG:_____ in %MAC:_____

25. Gear Retraction Moment	—	—	**-5.3 (M/1000)**

VERIFICATION: CG within limits for all phases of flight? □ YES □ NO

Prepared by: _____ Date/Time: _____

WEIGHT AND BALANCE EXERCISE

KSAN (San Diego) to KRFD (Rockford)

This exercise demonstrates a complete weight and balance calculation for a flight from San Diego International Airport (KSAN) to Chicago Rockford International Airport (KRFD) using actual aircraft data.

NOTE: The seat arms used in this exercise are for this specific sample aircraft configuration only. Actual seat arms are tail-number specific and must be obtained from the individual aircraft's Weighing Report.

Pilot: John Q. Public	**Copilot:** Jane E. Public
Aircraft: Trainer-1	**Route:** KSAN → KRFD

Step-by-Step Solution

Step 0: Pre-Calculation CDL/MEL Check

Before beginning calculations, verify the Configuration Deviation List (CDL) and Minimum Equipment List (MEL) status for the aircraft. For this exercise, no CDL/MEL items apply — the aircraft is in standard configuration with no weight penalties required.

Step 1: Establish Operating Weight Empty (OWE)

Begin with the Basic Empty Weight (BEW) from the aircraft's Weighing Report, then add all operating items (crew, crew equipment, and standard cabin provisions):

Item	Weight (lb)	ARM (in)	Moment/100
1. Basic Empty Weight	23,981	607.06	145,577.85
2. Pilot	199	305.20	607.35
3. Copilot	199	305.20	607.35
4. Crew Carry-On Baggage	40	385.00	154.00
5. Crew Baggage	60	650.00	390.00
6. Flight Manuals	30	320.00	96.00
7. Galley Supplies	109	366.30	399.27
8. Aft Potable Water	20	636.00	127.20
9. Lav Chemicals	20	610.00	122.00
10. Lav Supplies	5	610.00	30.50
11. Aft Equip Bay Ladder	9	737.10	66.34
Operating Weight Empty (OWE)	**24,672**	600.56 (%MAC: 39.11%)	**148,177.86**

Each moment is calculated as: Weight × ARM ÷ 100. For example, Pilot: 199 × 305.20 ÷ 100 = 607.35.

OWE CG ARM = 148,177.86 × 100 ÷ 24,672 = 600.56 inches. %MAC = [(600.56 − 556.675) ÷ 112.22] × 100 = 39.11%.

Step 2: Calculate Zero Fuel Weight (ZFW)

Add passengers and baggage to the OWE. Passenger weights include carry-on items. Use the seat arms from the specific aircraft's Weighing Report:

Item	Weight (lb)	ARM (in)	Moment/100
Operating Weight Empty (OWE)	24,672	600.56 (%MAC: 39.11%)	148,177.86
12. Seat 1	81	422.70	342.39
13. Seat 2	81	422.70	342.39
14. Seat 3	110	469.30	516.23
15. Seat 4	189	471.30	890.76
16–20. Seats 5–9	0	—	0.00
21. Baggage Compartment	400	650.00	2,600.00
Zero Fuel Weight (ZFW)	**25,533**	598.71 (%MAC: 37.47%)	**152,869.61**

ZFW CG ARM = Total Moment/100 × 100 ÷ Total Weight = 152,869.61 × 100 ÷ 25,533 = 598.71 inches.

%MAC = [(598.71 − 556.675) ÷ 112.22] × 100 = 37.47%

Verify: ZFW of 25,533 lb ≤ MZFW of 28,200 lb ✓. CG at 37.47% MAC is within limits (25–43% at this weight) ✓.

Step 3: Calculate Ramp Weight (RW)

Add the planned fuel load to ZFW. Use the Fuel Loading Table to look up the moment for the fuel weight:

Item	Weight (lb)	ARM (in)	Moment/100
Zero Fuel Weight (ZFW)	25,533	598.71 (%MAC: 37.47%)	152,869.61
22. Fuel Loading	14,150	Varies	81,068.04
Ramp Weight (RW)	**39,683**	589.52 (%MAC: 29.27%)	**233,937.65**

The fuel moment of 81,068.04 is obtained from the Fuel Loading Table for 14,150 lb. The fuel ARM varies with quantity because the fuel CG shifts as tanks fill.

RW CG ARM = 233,937.65 × 100 ÷ 39,683 = 589.52 inches. %MAC = 29.27%.

Verify: RW of 39,683 lb ≤ MRW of 40,750 lb ✓. CG at 29.27% MAC is within limits ✓.

Step 4: Calculate Takeoff Weight (TOW)

Subtract taxi fuel from Ramp Weight. A standard taxi burn of 300 lb is used for this flight. The taxi fuel moment is interpolated from the Fuel Loading Table:

Item	Weight (lb)	ARM (in)	Moment/100
Ramp Weight (RW)	39,683	589.52 (%MAC: 29.27%)	233,937.65
23. Less: Taxi Fuel	(300)	—	(1,857.02)
Takeoff Weight (TOW)	**39,383**	589.29 (%MAC: 29.07%)	**232,080.63**

The taxi fuel moment is determined by interpolating from the Fuel Loading Table for the marginal fuel burned during taxi.

TOW CG ARM = 232,080.63 × 100 ÷ 39,383 = 589.29 inches. %MAC = 29.07%.

Verify: TOW of 39,383 lb ≤ MTOW of 40,600 lb ✓. CG at 29.07% MAC is within limits ✓.

Step 5: Calculate Landing Weight (LW)

Subtract the planned enroute fuel burn from Takeoff Weight:

Item	Weight (lb)	ARM (in)	Moment/100
Takeoff Weight (TOW)	39,383	589.29 (%MAC: 29.07%)	232,080.63
24. Less: Enroute Fuel Burn	(6,151)	—	(36,149.55)
Landing Weight (LW)	**33,232**	589.59 (%MAC: 29.33%)	**195,931.08**

The enroute fuel moment is interpolated from the Fuel Loading Table based on the fuel quantity burned during the flight.

LW CG ARM = 195,931.08 × 100 ÷ 33,232 = 589.59 inches. %MAC = 29.33%.

Verify: LW of 33,232 lb ≤ MLW of 34,150 lb ✓. CG at 29.33% MAC is within limits ✓.

Step 6: Apply Landing Gear Retraction Moment

Apply the gear retraction moment adjustment of −5.3 (Moment/1000) to all gear-up flight CG calculations. This is a moment-only adjustment — it does not change the aircraft weight. Apply this correction to the ZFW, TOW, LW, and each FCBP when verifying CG positions against the gear-up CG envelope.

Step 7: Verify Fuel Curve Boundary Points

Calculate FCBP1 and FCBP2 by adding the boundary point fuel quantities to ZFW. Look up the fuel moment from the Fuel Loading Table for each FCBP fuel weight:

Point	Weight (lb)	ARM (in)	Moment/100
FCBP1 (ZFW + 11,660 lb fuel)	37,193	588.49 (%MAC: 28.35%)	218,876.61
FCBP2 (ZFW + 9,310 lb fuel)	34,843	588.90 (%MAC: 28.71%)	205,191.61

FCBP1: ZFW Moment (152,869.61) + Fuel Moment for 11,660 lb (66,007.00) = 218,876.61. ARM = 218,876.61 × 100 ÷ 37,193 = 588.49 in. %MAC = 28.35%.

FCBP2: ZFW Moment (152,869.61) + Fuel Moment for 9,310 lb (52,322.00) = 205,191.61. ARM = 205,191.61 × 100 ÷ 34,843 = 588.90 in. %MAC = 28.71%.

Both FCBP1 (37,193 lb) and FCBP2 (34,843 lb) are lighter than the TOW (39,383 lb), so both points are included in the fuel curve.

Plot all four points on the CG envelope in sequence: TOW → FCBP1 → FCBP2 → ZFW. The entire fuel curve must remain within the envelope. For this exercise, all points fall within the approved CG limits ✓.

Completed Weight and Balance Computation Form

The following form shows the completed calculation with all values filled in:

ITEM	WEIGHT (lb)	ARM (in)	MOMENT/100
AIRCRAFT BASIC DATA			
1. Basic Empty Weight	23,981	607.06	145,577.85

OPERATING ITEMS			
2. Pilot	199	305.20	607.35
3. Copilot	199	305.20	607.35
4. Crew Carry-On Baggage	40	385.00	154.00
5. Crew Baggage	60	650.00	390.00
6. Flight Manuals	30	320.00	96.00
7. Galley Supplies	109	366.30	399.27
8. Aft Potable Water	20	636.00	127.20
9. Lav Chemicals	20	610.00	122.00
10. Lav Supplies	5	610.00	30.50
11. Aft Equip Bay Ladder	9	737.10	66.34
PASSENGERS			
12. Seat 1	81	422.70	342.39
13. Seat 2	81	422.70	342.39
14. Seat 3	110	469.30	516.23
15. Seat 4	189	471.30	890.76
16-20. Seats 5-9	0	—	0.00
BAGGAGE			
21. Baggage Compartment	400	650.00	2,600.00
ZERO FUEL WEIGHT (ZFW)	**25,533**	598.71	**152,869.61**

ZFW CG: 598.71 in %MAC: 37.47% [MZFW = 28,200 lb ✓]

FUEL			
22. Fuel Loading	14,150	Varies	81,068.04
RAMP WEIGHT (RW)	**39,683**	589.52	**233,937.65**

RW CG: 589.52 in %MAC: 29.27% [MRW = 40,750 lb ✓]

23. Less: Taxi Fuel	(300)	—	(1,857.02)
TAKEOFF WEIGHT (TOW)	**39,383**	589.29	**232,080.63**

TOW CG: 589.29 in %MAC: 29.07% [MTOW = 40,600 lb ✓]

24. Less: Enroute Fuel Burn	(6,151)	—	(36,149.55)
LANDING WEIGHT (LW)	**33,232**	589.59	**195,931.08**

LW CG: 589.59 in %MAC: 29.33% [MLW = 34,150 lb ✓]

EXERCISE RESULTS SUMMARY

Zero Fuel Weight: 25,533 lb at 37.47% MAC — Within limits ✓
Ramp Weight: 39,683 lb at 29.27% MAC — Within limits ✓
Takeoff Weight: 39,383 lb at 29.07% MAC — Within limits ✓
Landing Weight: 33,232 lb at 29.33% MAC — Within limits ✓

ALL WEIGHTS AND CG POSITIONS WITHIN LIMITS — FLIGHT APPROVED

QUICK REFERENCE DATA

Weight Limits

Limit	Weight (lb)	Weight (kg)
Maximum Ramp Weight (MRW)	40,750	18,484
Maximum Takeoff Weight (MTOW)	40,600	18,416
Maximum Landing Weight (MLW)	34,150	15,490
Maximum Zero Fuel Weight (MZFW)	28,200	12,791
Minimum Flight Weight (MFW)	24,800	11,249
Maximum Fuel Capacity	14,150	6,418

CG Reference Data

Parameter	Value
Leading Edge MAC (LEMAC)	**556.675 inches**
Mean Aerodynamic Chord (MAC)	**112.22 inches**
%MAC Formula	**[(CG - 556.675) / 112.22] × 100**
Landing Gear Retraction Moment	**-5.3 (Moment/1000)**

Fuel Curve Boundary Points

Point	Fuel Weight	Fuel ARM
FCBP1	**11,660 lb**	566.1 in
FCBP2	**9,310 lb**	562.0 in

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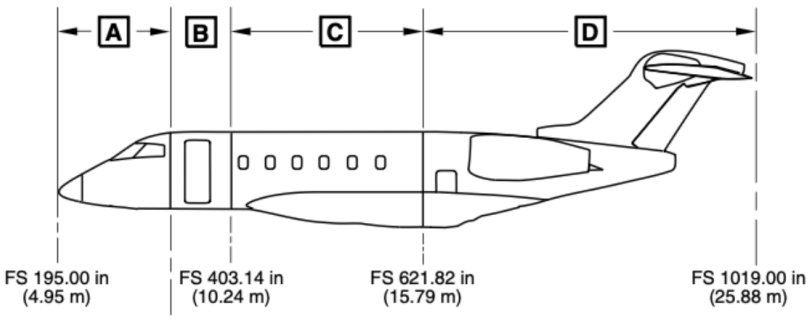
CHALLENGER 350

BD-100-1A10

WEIGHT AND BALANCE



17 March 2026 Revision: Original 1

Aircraft Standard Stations – Use the following ARMs for this exercise.

Aircraft & Baggage

	Weight (lb)	Arm (in)	Moment/100
Basic Empty Weight	23981	607.06	145579.06
Taxi Fuel	200	—	0.00
Crew Carry on Baggage	40	385.00	154.00
Crew Baggage	60	650.00	390.00
Baggage		650.00	0.00

Aircraft Items

	Weight (lb)	Arm (in)	Moment/100
Flight Manuals	30	320.00	96.00
Galley Supplies	109	366.30	399.27
Aft Potable Water	20	636.00	127.20
Lav Chemicals	20	610.00	122.00
Lav Supplies	5	610.00	30.50
Aft Equip Bay Ladder	9	737.10	66.34

Occupants

	Weight (lb)	Arm (in)	Moment/100
Pilot		305.20	0.00
Copilot		305.20	0.00
Seat 1		422.70	0.00
Seat 2		422.70	0.00
Seat 3		469.30	0.00
Seat 4		471.30	0.00
Seat 5		518.70	0.00
Seat 6		520.70	0.00
Seat 7		565.30	0.00
Seat 8		568.30	0.00
Seat 9 LAV		613.00	0.00

True Empty Weight (TEW/BEW) - The actual weighed empty weight of the aircraft including all permanently installed equipment, engine oil, unusable fuel, and hydraulic fluid.

For this example, we will use: 23,981 lbs., Arm: 607.06 Arm, Moment: 145577.85, %Mac: 41

Operating Weight Empty – TEW/BEW plus operating items (crew, crew baggage, flight manuals, and standard cabin equipment). This is the starting point for flight weight calculations.

Add the following:

Item	Weight (lb)	Arm (in)
Flight Manuals	30	320
Crew Baggage	40	385
Flight Crew	398	305.2

OWE CALCULATION FORM

ITEM	OP	WEIGHT lb (kg)	Xarm in (m)	MOMENT / 1 000 lb in (kg m)	%MAC	REFERENCE	NOTE
TRUE EMPTY WEIGHT (TEW)						LAST WEIGHING RESULT	[1] [2]
OPERATING ITEMS							
FLIGHT COMPARTMENT CREW	+					01–40–10	
CREW BAGGAGE	+					01–40–10	
FLIGHT MANUALS / MAGAZINES	+					01–40–10	
OPERATING WEIGHT EMPTY (OWE)	=						[1]

NOTES:
[1] %MAC (imperial) = [(Xarm – 556.675) / 112.22] x 100
%MAC (SI) = [(Xarm – 14.13) / 2.85] x 100
[2] Last weighing result for TEW given in Chapter 2, Aircraft Reports.

Payload Item Form - Use for the passengers and place the total in the "ADJUSTMENT" line in the ZFW buildup on the next page. Add the following standard items as well:

Item	Weight (lb)	Arm (in)
Galley Supplies	109	366.3
Aft Potable Water	20	636
Lav Chemicals	20	610
Lav Supplies	5	610
Aft Equip Bay Ladder	9	737.1
Passenger – Seat 1	81	422.7
Passenger – Seat 2	81	422.7
Passenger – Seat 3	110	469.30
Passenger – Seat 4	189	469.30

PAYLOAD ITEM FORM

ITEM	WEIGHT	Xarm	MOMENT / 1 000
	lb (kg)	in (m)	lb in (kg m)

Zero Fuel Weight - OWE plus payload (passengers and baggage). The aircraft weight before fuel is added. "ADJUSTMENT" is from the Payload Item Form.

Item	Weight (lb)	Arm (in)
Check-In Baggage	460	650

WEIGHT BUILD–UP – ZFW CALCULATION FORM

ITEM	OP	WEIGHT lb (kg)	Xarm in (m)	MOMENT 1000 lb in (kg m)	%MAC	REFERENCE	NOTE
OPERATING WEIGHT EMPTY (OWE)	=					01–90–10	[1] [2]
PAYLOAD ITEMS							
CHECK–IN BAGGAGE OR CARGO	+					01–60–00	
ADJUSTMENT							
ADJUSTMENT	+					01–40–10	[3]
ZERO FUEL WEIGHT – ZFW (GEAR DOWN)							
ZERO–FUEL–WEIGHT GEAR DOWN (ZFW GEAR DOWN)	=					01–00–50	[2]
GEAR UP	+			–4.6 (–0.053)		01–00–80	
ZERO FUEL WEIGHT – ZFW (GEAR UP)							
ZERO–FUEL–WEIGHT GEAR UP (ZFW GEAR UP)	=					01–00–50	[2]

Notes:
[1] Results from previous sum.
[2] %MAC (imperial) = [(Xarm $_{CG}$ – 556.675) / 112.22] x 100
%MAC (SI) = [(Xarm $_{CG}$ – 14.13) / 2.85] x 100
[3] To use when necessary.

Ramp Weight - ZFW plus total fuel load. The weight of the aircraft ready for taxi.

WEIGHT BUILD–UP – RW CALCULATION FORM							
ITEM	OP	WEIGHT lb (kg)	Xarm in (m)	MOMENT / 1 000 lb in (kg m)	%MAC	REFERENCE	NOTE
ZERO FUEL WEIGHT – ZFW (GEAR DOWN)							
ZERO–FUEL–WEIGHT GEAR DOWN (ZFW GEAR DOWN)	=					01–00–50	[1] [2]
FUEL							
FUEL TANK	+					01–20–10	
RAMP WEIGHT – RW (GEAR DOWN)							
RAMP–WEIGHT GEAR DOWN (RW GEAR DOWN)	=					01–00–50	[2]

Notes:
[1] Results from previous sum.
[2] %MAC (imperial) = $[(Xarm_{CG} - 556.675) / 112.22] \times 100$
%MAC (SI) = $[(Xarm_{CG} - 14.13) / 2.85] \times 100$

Takeoff Weight - Ramp weight minus taxi fuel burn. The actual weight at brake release.

WEIGHT BUILD–UP – TOW CALCULATION FORM							
ITEM	OP	WEIGHT lb (kg)	Xarm in (m)	MOMENT / 1 000 lb in (kg m)	%MAC	REFERENCE	NOTE
ZERO FUEL WEIGHT – ZFW (GEAR DOWN)							
ZERO–FUEL–WEIGHT GEAR DOWN (ZFW GEAR DOWN)	=					01–00–50	[1] [2]
FUEL							
REMAINING FUEL PRIOR TAKE–OFF	+					01–20–10	
TAKE–OFF WEIGHT – TOW (GEAR DOWN)							
TAKE–OFF–WEIGHT GEAR DOWN (TOW GEAR DOWN)	=					01–00–50	[2]

Notes:

[1] Results from previous sum.

[2] %MAC (imperial) = $[(Xarm_{CG} - 556.675) / 112.22] \times 100$

%MAC (SI) = $[(Xarm_{CG} - 14.13) / 2.85] \times 100$

Fuel Curve Boundary Points - Critical points on the fuel curve that define the CG path during fuel burn. Essential for verifying the aircraft remains within CG limits throughout flight.

WEIGHT BUILD–UP – FCBP1 CALCULATION FORM							
ITEM	OP	WEIGHT lb (kg)	Xarm in (m)	MOMENT / 1000 lb in (kg m)	%MAC	REFERENCE	NOTE
ZERO FUEL WEIGHT – ZFW (GEAR DOWN)							
ZERO–FUEL–WEIGHT GEAR DOWN (ZFW GEAR DOWN)	=					01–00–50	[1] [2]
FUEL							
FUEL QUANTITY FOR FUEL–CURVE BOUNDARY–POINT	+	11660 (5289)	566.1 (14.38)	6600.7 (76.049)		01–20–10	
FUEL–CURVE BOUNDARY–POINT 1 – FCBP1 (GEAR DOWN)							
FUEL–CURVE BOUNDARY–POINT 1 – FCBP1 (GEAR DOWN)	=						[2]
ADD GEAR RETRACTION MOMENT	+			–4.6 (–0.053)		01–00–80	[3]
FUEL–CURVE BOUNDARY–POINT 1 – FCBP1 (GEAR UP)							
FUEL–CURVE BOUNDARY–POINT 1 – FCBP1 (GEAR UP)	=					01–00–50	[2]

Notes:
[1] Results from previous sum.
[2] %MAC (imperial) = [(Xarm $_{CG}$ – 556.675) / 112.22] x 100
%MAC (SI) = [(Xarm $_{CG}$ – 14.13) / 2.85] x 100
[3] The total aircraft moment decreases by approximately 4600 lb in (53 kg m) when the landing gears are retracted.

WEIGHT BUILD–UP – FCBP2 CALCULATION FORM							
ITEM	OP	WEIGHT lb (kg)	Xarm in (m)	MOMENT / 1000 lb in (kg m)	%MAC	REFERENCE	NOTE
ZERO FUEL WEIGHT – ZFW (GEAR DOWN)							
ZERO–FUEL–WEIGHT GEAR DOWN (ZFW GEAR DOWN)	=					01–00–50	[1] [2]
FUEL							
FUEL QUANTITY FOR FUEL–CURVE BOUNDARY–POINT	+	9310 (4223)	562.0 (14.27)	5232.2 (60.282)		01–20–10	
FUEL–CURVE BOUNDARY–POINT 2 – FCBP2 (GEAR DOWN)							
FUEL–CURVE BOUNDARY–POINT 2 – FCBP2 (GEAR DOWN)	=						[2]
ADD GEAR RETRACTION MOMENT	+			–4.6 (–0.053)		01–00–80	[3]
FUEL–CURVE BOUNDARY–POINT 2 – FCBP2 (GEAR UP)							
FUEL–CURVE BOUNDARY–POINT 2 – FCBP2 (GEAR UP)	=					01–00–50	[2]

Notes:
[1] Results from previous sum.
[2] %MAC (imperial) = [(Xarm $_{CG}$ – 556.675) / 112.22] x 100
%MAC (SI) = [(Xarm $_{CG}$ – 14.13) / 2.85] x 100
[3] The total aircraft moment decreases by approximately 4600 lb in (53 kg m) when the landing gears are retracted.

Landing Weight - Takeoff weight minus enroute fuel burn. The projected weight at destination.

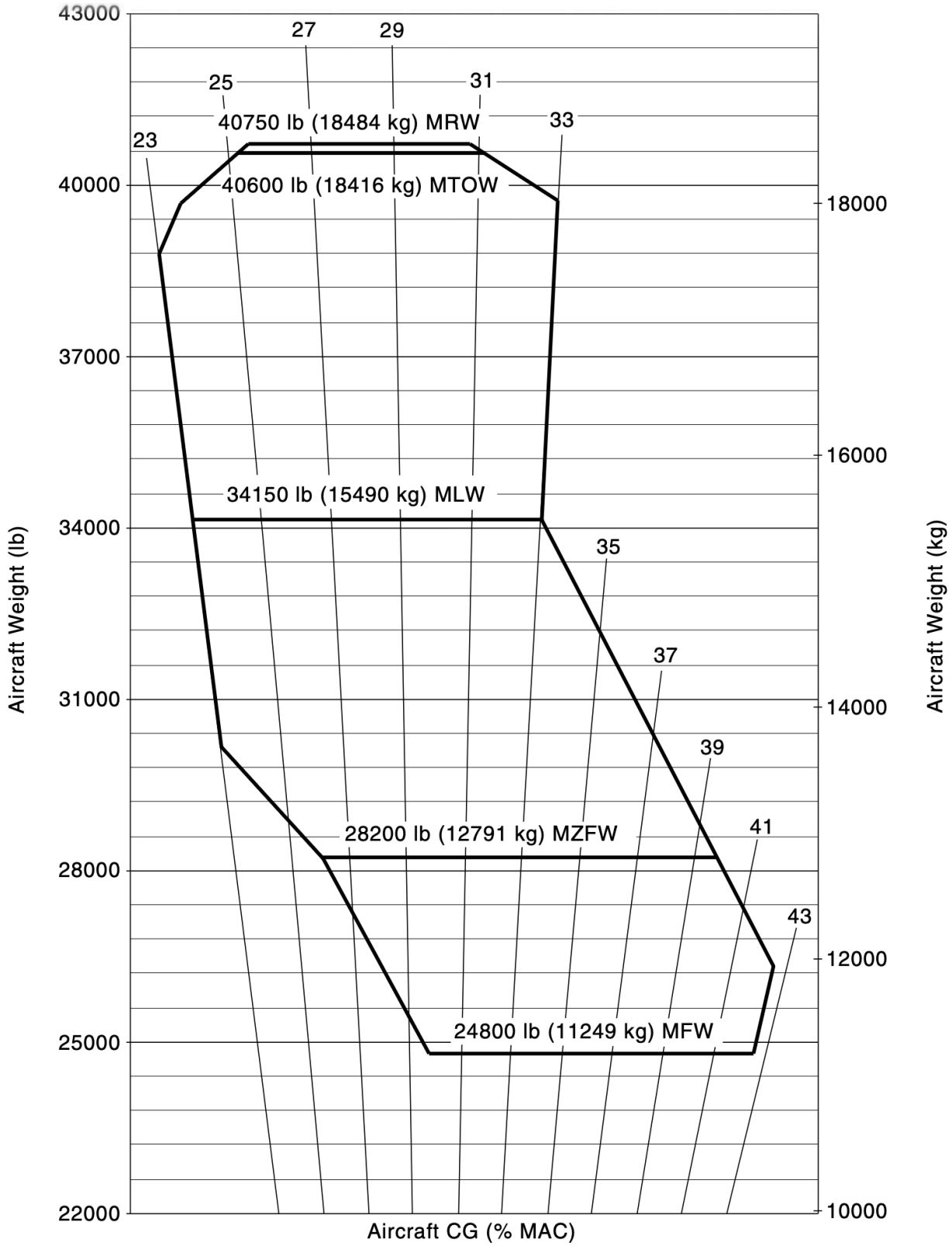
WEIGHT BUILD–UP – LW CALCULATION FORM							
ITEM	OP	WEIGHT lb (kg)	Xarm in (m)	MOMENT / 1 000 lb in (kg m)	%MAC	REFERENCE	NOTE
ZERO FUEL WEIGHT – ZFW (GEAR DOWN)							
ZERO–FUEL–WEIGHT GEAR DOWN (ZFW GEAR DOWN)	=					01–00–50	[1] [2]
FUEL							
REMAINING FUEL AT LANDING	+					01–20–10	
LANDING WEIGHT – LW (GEAR DOWN)							
LANDING–WEIGHT GEAR DOWN (LW GEAR DOWN)	=					01–00–50	[2]

Notes:

[1] Results from previous sum.

[2] %MAC (imperial) = $[(Xarm_{CG} - 556.675) / 112.22] \times 100$

%MAC (SI) = $[(Xarm_{CG} - 14.13) / 2.85] \times 100$


43000
40000
37000
34000
31000
28000
25000
22000
Aircraft Weight (lb)
18000
16000
14000
12000
10000
Aircraft Weight (kg)
23
25
27
29
31
33
35
37
39
41
43
40750 lb (18484 kg) MRW
40600 lb (18416 kg) MTOW
34150 lb (15490 kg) MLW
28200 lb (12791 kg) MZFW
24800 lb (11249 kg) MFW
Aircraft CG (% MAC)

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Weight and Balance Manual

MODEL	A/C EFFECTIVITY
BD-100-1A10 (CH-350)	20501-20999

CHALLENGER 350

Publication No. CH 350 WBM

BOMBARDIER CHALLENGER 350* (MODEL BD-100-1A10)

WEIGHT AND BALANCE MANUAL

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Montreal, Quebec, Canada H3C 3G9

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CHALLENGER 350

BD–100 WEIGHT AND BALANCE MANUAL

REVISION 4 – TRANSMITTAL LETTER

This package contains BD–100 WEIGHT AND BALANCE MANUAL, Revision 4, dated Sep 05/2018.

Record the incorporation of Revision 4 on the RECORD OF REVISIONS sheet at the front of your manual.

To bring your manual up to date, remove the old pages indicated below and insert the corresponding new pages, according to the following list.

REMOVE:			**INSERT:**		
Ch–Se–Su	**Effectivity**	**Page**	**Ch–Se–Su**	**Effectivity**	**Page**
Effective Pages		1–2	Effective Pages		1–2
01 – Effective Pages		1–2	01 – Effective Pages		1–2
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01–80–30	ALL	5–6, 16	01–80–30	ALL	5–6, 16
01–80–60	ALL	5	01–80–60	ALL	5
01–90–20	ALL	23	01–90–20	ALL	23

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RECORD OF REVISIONS

A signature in the "INSERTED BY" column shows that the publication holder has incorporated the revision.

REVISION NO.	ISSUE DATE	DATE INSERTED	INSERTED BY
Basic	Jun 11/2014	Jun 11/2014	Bombardier
1	Sep 15/2014	Sep 15/2014	Bombardier
2	Sep 28/2015	Sep 28/2015	Bombardier
3	Mar 09/2017	Mar 09/2017	Bombardier
4	Sep 05/2018	Sep 05/2018	Bombardier

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RECORD OF TEMPORARY REVISIONS

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01–1	01–80–30 Facing Page 1	Aug 18/2014	Aug 18/2014	Bombardier	Sep 15/2014	REV 1

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INTRODUCTION

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BD–100 WEIGHT AND BALANCE MANUAL

INTRODUCTION

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INTRODUCTION

1. Scope

The Weight and Balance Manual (WBM) prepared by Bombardier Business Aircraft agrees with specification No. 100 of the Air Transport Association of America (ATA–100), Revision 26, dated April 1987. The WBM contains data on the aircraft loads and aircraft operations for the Challenger 350 aircraft.

The weight and balance procedure is a necessary pre–flight check to make sure of the safe and satisfactory operation of the aircraft. Personnel must obey the procedures given in the WBM for the calculations of weight and balance. Only fully qualified and licensed personnel can do these procedures.

2. How to Use the Manual

The ATA–100 has a three–element number system to identify the different subjects contained in the WBM. The first element identifies the chapter (Ch), the second element identifies a section (Se) in the chapter and the third element identifies a subject (Su) in the section. The example that follows shows and briefly describes a typical three–element number:

“01–00–30”

The first element identifies Chapter 01 for CONTROL,

The second element identifies Section 00 for GENERAL,

The third element identifies Subject 30 for AIRCRAFT STATIONS.

3. Acronyms

Refer to the Subjects that follow for the technical definition of the acronyms found in the Weight and Balance Manual:

- DEFINITIONS (Subject 01–00–20)
- AIRCRAFT STATIONS (Subject 01–00–30)
- REFERENCE POINTS (Subject 01–00–40).

In the Weight and Balance Manual, terms are spelled out the first time they are used and the acronym is given in parentheses. Then only the acronym is given.

4. Warnings, Cautions and Notes

Warnings, cautions and notes added to the text are there to show important parts of the text when necessary. Their definitions are as follows:

A. Warning

A warning shows personnel how to use the materials. It also gives the limits and procedures that the personnel must obey to prevent injury to persons and damage to equipment.

B. Caution

A caution shows a procedure that personnel must obey to prevent damage to equipment.

C. Note

A note shows procedures that make the job easier.

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CHAPTER 01 – CONTROL

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01–20–00	ALL	1	Jun 11/2014
		2	Sep 28/2015
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		4	Mar 09/2017
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		7	Mar 09/2017
		8	Mar 09/2017
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		2	Sep 28/2015
01–30–20	ALL	1	Jun 11/2014
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		2	Sep 28/2015
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01–60–00	ALL	1	Jun 11/2014
		2	Sep 28/2015
01–60–10	ALL	1	Jun 11/2014
		2	Sep 28/2015
01–60–20	ALL	1	Jun 11/2014
		2	Sep 28/2015
01–80–00	ALL	1	Jun 11/2014
		2	Sep 28/2015
01–80–20	ALL	1	Sep 28/2015
		2	Sep 28/2015
		3	Sep 28/2015
		4	Sep 28/2015
01–80–30	ALL	1	Jun 11/2014
		2	Jun 11/2014
		3	Jun 11/2014
		4	Jun 11/2014
		5	Sep 05/2018
		6	Sep 05/2018
		7	Jun 11/2014
		8	Jun 11/2014
		9	Jun 11/2014
		10	Jun 11/2014
		11	Jun 11/2014
		12	Mar 09/2017
		13	Mar 09/2017
		14	Mar 09/2017
		15	Mar 09/2017
		16	Sep 05/2018
		17	Mar 09/2017
		18	Mar 09/2017
		19	Mar 09/2017
		20	Mar 09/2017
		21	Mar 09/2017
		22	Jun 11/2014
		23	Mar 09/2017
		24	Jun 11/2014
		25	Jun 11/2014
		26	Sep 28/2015
01–80–60	ALL	1	Mar 09/2017
		2	Mar 09/2017
		3	Jun 11/2014
		4	Mar 09/2017
		5	Sep 05/2018
		6	Mar 09/2017
01–90–00	ALL	1	Jun 11/2014
		2	Sep 28/2015
01–90–10	ALL	1	Jun 11/2014
		2	Jun 11/2014
		3	Jun 11/2014
		4	Jun 11/2014
		5	Mar 09/2017
		6	Sep 28/2015
01–90–20	ALL	1	Jun 11/2014
		2	Mar 09/2017
		3	Jun 11/2014
		4	Jun 11/2014
		5	Jun 11/2014
		6	Mar 09/2017
		7	Jun 11/2014
		8	Jun 11/2014
		9	Mar 09/2017
		10	Jun 11/2014
		11	Jun 11/2014
		12	Mar 09/2017
		13	Jun 11/2014
		14	Jun 11/2014
		15	Mar 09/2017
		16	Jun 11/2014
		17	Jun 11/2014
		18	Mar 09/2017
		19	Jun 11/2014
		20	Jun 11/2014
		21	Jun 11/2014
		22	Jun 11/2014
		23	Sep 05/2018
		24	Jun 11/2014
01–90–50	ALL	1	Jun 11/2014
		2	Sep 28/2015
		3	Jun 11/2014
		4	Jun 11/2014

CHALLENGER 350

BD–100 WEIGHT AND BALANCE MANUAL

CHAPTER 01 – CONTROL

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GENERAL

1. Description

This section gives general data applicable to the aircraft as follows:

- DIMENSIONS AND AREAS (Subject 01–00–10)
- DEFINITIONS (Subject 01–00–20)
- AIRCRAFT STATIONS (Subject 01–00–30)
- REFERENCE POINTS (Subject 01–00–40)
- DESIGN WEIGHT LIMITS (Subject 01–00–50)
- CENTER OF GRAVITY LIMITS (Subject 01–00–60)
- TAKE–OFF TRIM SETTINGS (Subject 01–00–70)
- BALANCE EFFECT CAUSED BY MAJOR OPERATION (Subject 01–00–80).

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DIMENSIONS AND AREAS

1. Dimensions

Refer to Figure 1.

This part of the manual shows the general external and primary dimensions of the aircraft. The dimensions are in imperial units. The equivalent values in SI units are also given.

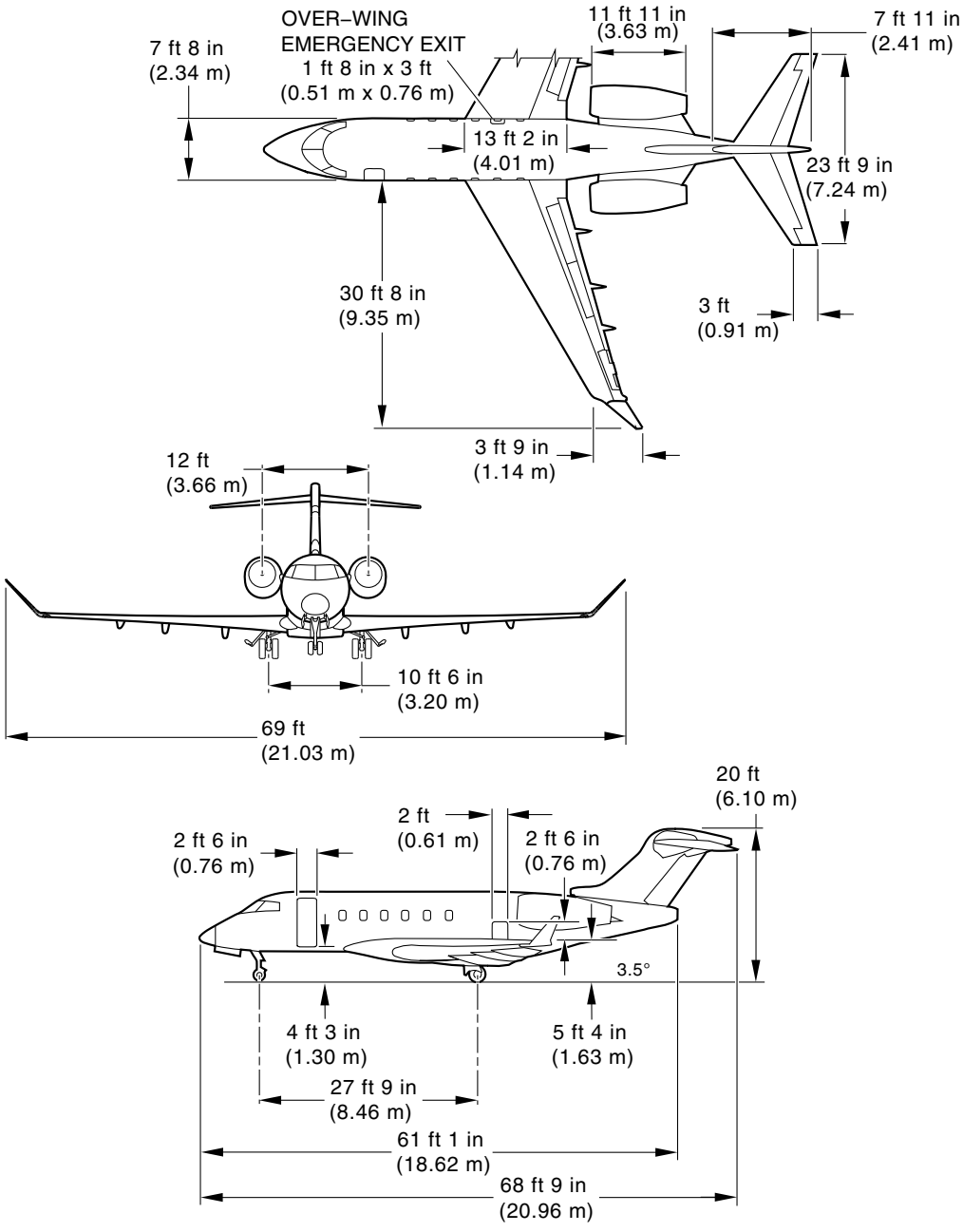
The Table 1 that follows shows the dimensions and areas of the primary aircraft assemblies.

NOTE: The values found in Table 1 are for general information only. Do not use them to do inspections or to reject assemblies.

Table 1 – General Dimensions and Areas of the Aircraft

Dimensions/Areas	Imperial (SI) Units
Aircraft	
Total Length	825.0 in (20.96 m)
Total Height	240.0 in (6.10 m)
Wing	
Span	827.9 in (21.03 m)
Mean Aerodynamic Chord (MAC)	112.22 in (2.85 m)
Leading Edge MAC (LEMAC)	556.675 in (14.14 m)
Horizontal Stabilizer	
Span	284.6 in (7.23 m)
Fuselage	
Diameter (external)	92.0 in (2.34 m)
Length	733.0 in (18.62 m)
Static Ground Angle (nominal)	–0.86 Degrees
Area	
Total Upper–Exposed Wing [1]	75 168.0 in^2 (48.50 m^2)
Total Upper–Exposed Horizontal–Stabilizer	17 640.0 in^2 (11.38 m^2)

Table 1 – General Dimensions and Areas of the Aircraft	
Dimensions/Areas	**Imperial (SI) Units**
Total Upper–Exposed Vertical–Stabilizer	11 980.8 in^2 (7.73 m^2)
Note: [1] Wing Area includes ailerons, flaps, spoilers and fuselage area.	
Landing Gear	
Track	126.0 in (3.20 m)
Wheel Base	333.0 in (8.46 m)
Minimum Turning Circle Diameter	754.0 in (19.15 m)
Main–Landing–Gear Tire Dimension	H26.5 x 8–14
Main–Landing–Gear Wheel Dimension	14.0 in (0.36 m)
Nose–Landing–Gear Tire Dimension	H18 x 5.5–8
Nose–Landing–Gear Wheel Dimension	8.0 in (0.20 m)



External Aircraft Dimensions
Figure 1

EFFECTIVITY: ALL

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BD–100 WEIGHT AND BALANCE MANUAL

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DEFINITIONS

1. General

This section contains a list of acronyms and the definitions of terms found in the Weight and Balance Manual (WBM). The list of acronyms also includes abbreviations.

2. Acronyms

Acronym	Term
ACM	Additional Crew Member
a/c	Aircraft
BL	Buttock Line
BWE	Basic Weight Empty
CG	Center of Gravity
CPLT	Copilot
DWE	Delivered Weight Empty
FCBP	Fuel Curve Boundary–Points
FLT#	Flight Number
FOB	Fuel On Board
FS	Fuselage Station
F/A	Flight Attendant
HSS	Horizontal Stabilizer Station
I/B	Inboard
LEMAC	Leading–Edge Mean–Aerodynamic–Chord
MAC	Mean Aerodynamic Chord
MFW	Minimum Flight Weight
MLG	Main Landing Gear
MLW	Maximum Landing Weight
MRW	Maximum Ramp Weight
MTOW	Maximum Take–Off Weight
MWE	Manufacturer's Weight Empty

Acronym	Term
MZFW	Maximum Zero–Fuel Weight
NLG	Nose Landing Gear
OWE	Operating Weight Empty
O/B	Outboard
PLT	Pilot
RW	Ramp Weight
SB	Service Bulletin
STGR	Stringer
TEW	True Empty Weight
TOW	Take–Off Weight
VSS	Vertical Stabilizer Station
WD	Weighing Datum
WGLTS	Winglet Station
WL	Water Line
WRP	Wing Reference Plane
WS	Wing Station
ZFW	Zero Fuel Weight
ZRD	Zero Reference Datum
3D	Three Dimensions

3. Definitions

Basic Weight Empty (BWE)

The BWE is defined as follows:

TEW + Temporary fixed equipment necessary for particular flights.

NOTE: Examples of temporary equipment are temporary ballast, flight test equipment or ferry kit.

Delivered Weight Empty (DWE)

The DWE includes the MWE, all fixed interior equipment (standard and optional) and the customer options.

Fuel Curve Boundary–Points (FCBP)

A group of points defined by the fuel curve and the longitudinal CG envelope. These FCBP define the area to use for the check of the aircraft longitudinal CG position, given a particular loading.

Manufacturer's Weight Empty (MWE)

The MWE includes the weight of the structure, power plant, systems and interior provisions. The MWE does not include the engine oil and the unusable fuel.

Maximum Landing Weight (MLW)

The MLW is the maximum aircraft weight permitted during a landing at the nominal descent velocity.

Maximum Ramp Weight (MRW)

The MRW is the maximum possible aircraft weight. An aircraft is permitted to have the MRW only during ground handling and taxiing.

Maximum Take–Off Weight (MTOW)

The MTOW is the maximum weight for the take–off operation.

Maximum Zero–Fuel Weight (MZFW)

The MZFW is the maximum permitted aircraft weight before the load of the usable fuel is added to the aircraft.

Mean Aerodynamic Chord (MAC)

The MAC is the chord of an imaginary wing with a constant chord that has the same aerodynamic characteristics as the aircraft wing.

Minimum Flight Weight (MFW)

The MFW is the minimum permitted aircraft weight for flight operations.

Operating Items

The operating items include the engine oil, unusable fuel, crew, crew equipment and passenger service items. Operating items also include other items necessary for the operation of the aircraft during usual flights.

Operating Weight Empty (OWE)

The OWE includes the TEW and operating items. The operating items do not include the engine oil and unusable fuel already included in the TEW.

Payload

The payload includes the passengers, baggage and cargo.

Ramp Weight (RW)

The RW includes the ZFW and usable fuel.

TakeOff Weight (TOW)

The TOW is the weight at the start of the take–off operation.

True Empty Weight (TEW)

The TEW is the weight of the aircraft in a condition where only the crew and fuel are necessary for the flight. The condition can change as follows:

1. TEW = MWE + Engine Oil + Unusable Fuel.
2. TEW = DWE + Engine Oil + Unusable Fuel.

Useful Load

The useful load is the difference between the RW and the OWE.

Xarm

The Xarm is the distance along the longitudinal axis of the aircraft from the Zero Reference Datum (ZRD) up to the CG of the item.

Zero Fuel Weight (ZFW)

The ZFW includes the OWE and payload.

AIRCRAFT STATIONS

1. General

Refer to Figure 1, Figure 2, Figure 3, Figure 4, Figure 5 and Figure 6.

To calculate the arm of a given component on the aircraft, aircraft coordinates are used. This section shows the six primary components of the aircraft in relation to their reference planes. The six primary components are shown, in the order that follows:

- Fuselage,
- Wing,
- Winglets,
- Vertical Stabilizer,
- Horizontal Stabilizer,
- Engine–Nacelles.

A. Buttock Line (BL)

The BL are vertical lines (planes in 3D) perpendicular to the Yarm axis. They are used to measure the distance in inches along the Yarm axis. The plane of symmetry of the aircraft at BL0.00 gives the ZRD. Refer to Figure 5 to see some BL.

B. Fuselage Station (FS)

The FS are vertical lines (planes in 3D) perpendicular to the Xarm axis. They are used to measure the distance in inches along the Xarm axis. The fuselage stations values start at the zero reference datum (ZRD) and increase thru the rear end of the aircraft, as shown. Refer to Figure 1 and Figure 6.

C. Horizontal Stabilizer Station (HSS)

The HSS are vertical lines (planes in 3D) parallel to the BL. They are measured from the symmetrical center line of the aircraft. Refer to Figure 5.

D. Vertical Stabilizer Station (VSS)

The VSS are lines (planes in 3D) related to the vertical–stabilizer reference axis. Refer to Figure 4.

E. Water Line (WL)

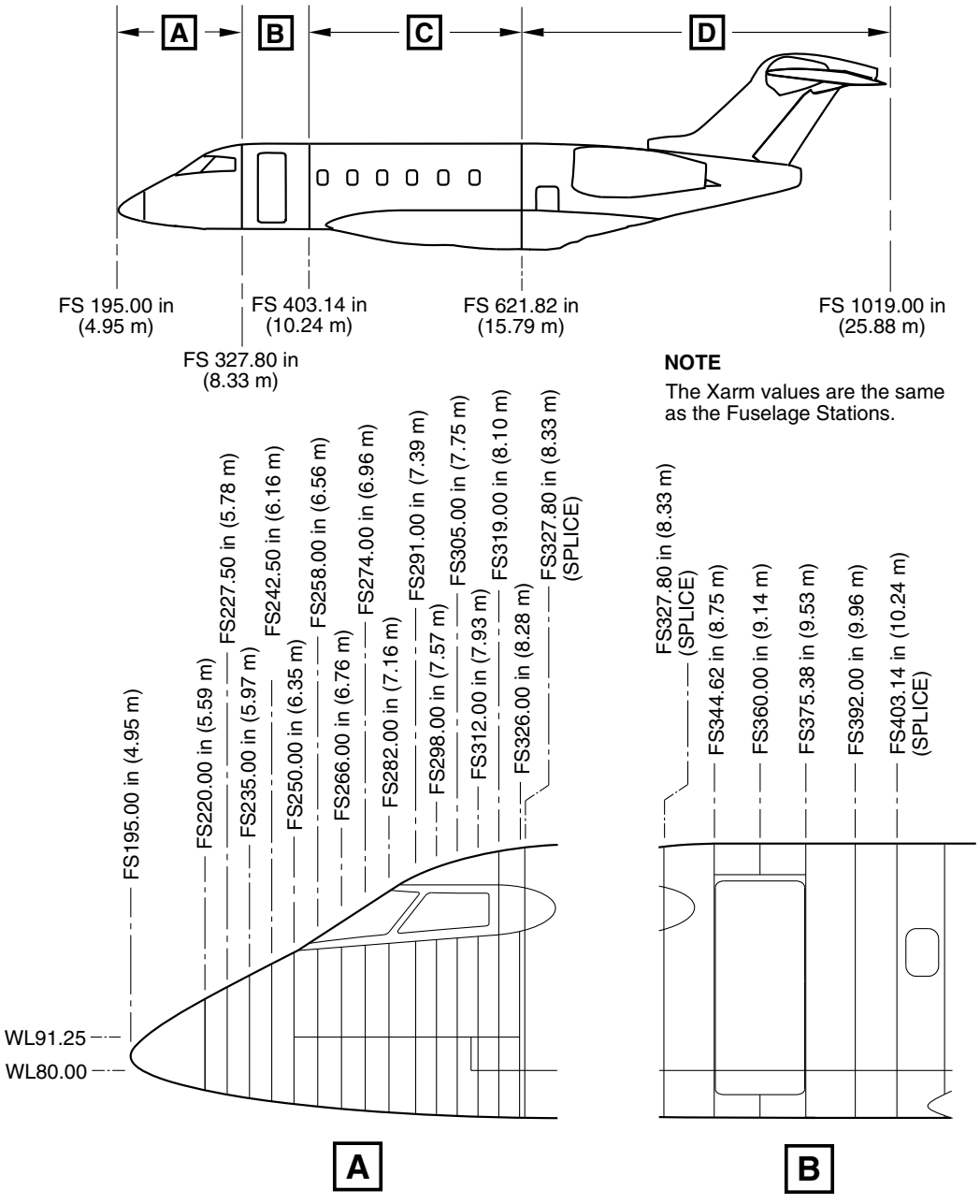
The WL are horizontal lines (planes in 3D) perpendicular to the Zarm axis and they are parallel to the fuselage center line. They are used to measure the distance in inches along the Zarm axis. Refer to Figure 4, Figure 5s to see the WL.

F. Wing Station (WS)

The WS are vertical lines (planes in 3D) perpendicular to the wing reference plane (WRP). Refer to Figure 2.

G. Winglet Station (WGLTS)

The WGLTS are horizontal lines parallel to the wing reference plane (WRP). Refer to Figure 3.



Fuselage Station Locations
Figure 1 (Sheet 1 of 2)

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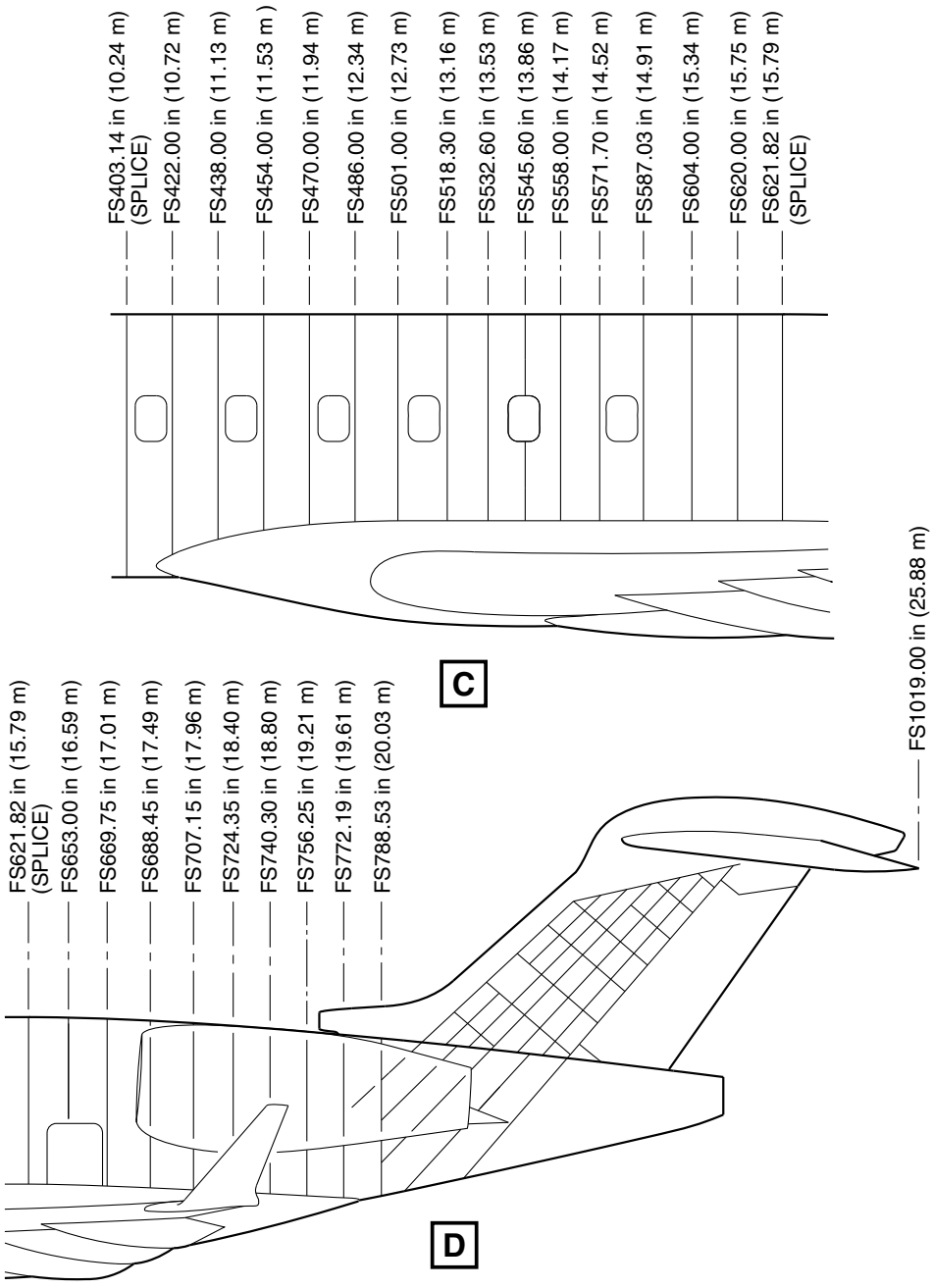
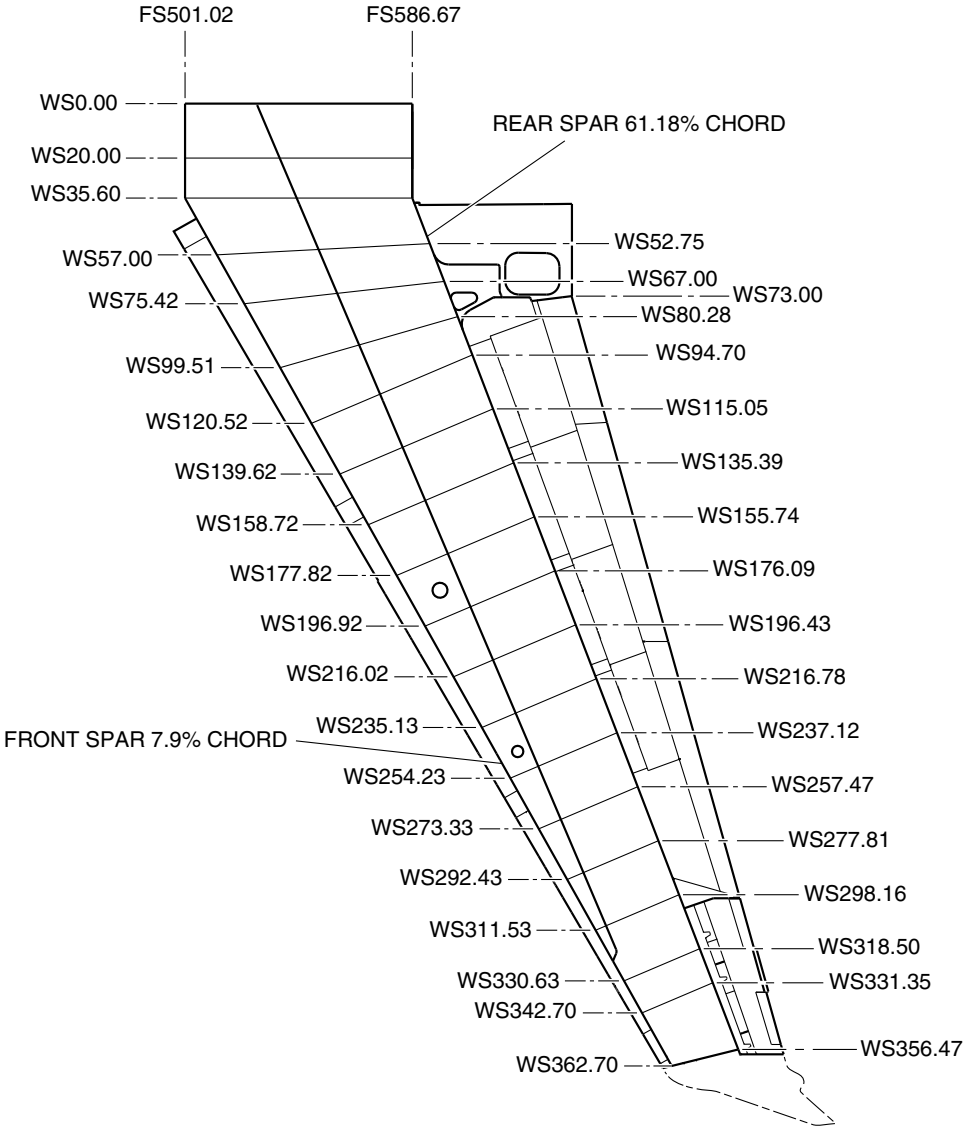


Fuselage Station Locations
Figure 1 (Sheet 2 of 2)

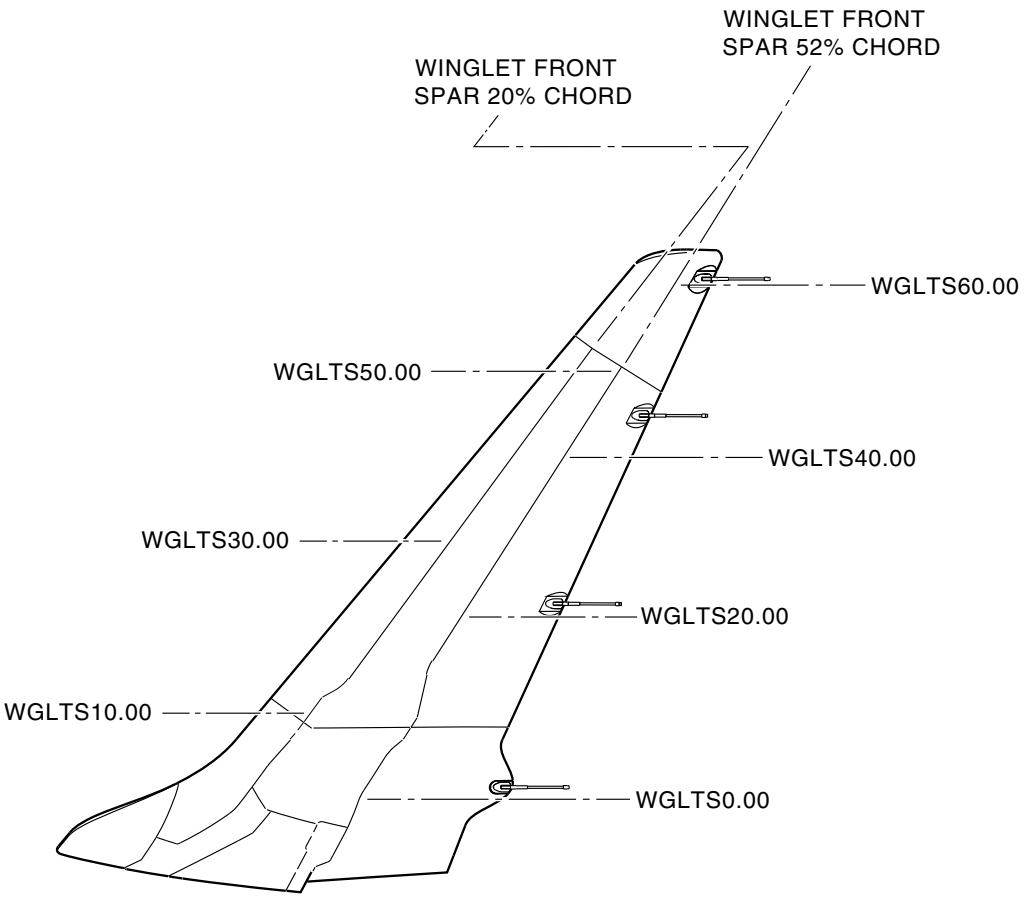
EFFECTIVITY: ALL



LH UPPER WING SURFACE SHOWN

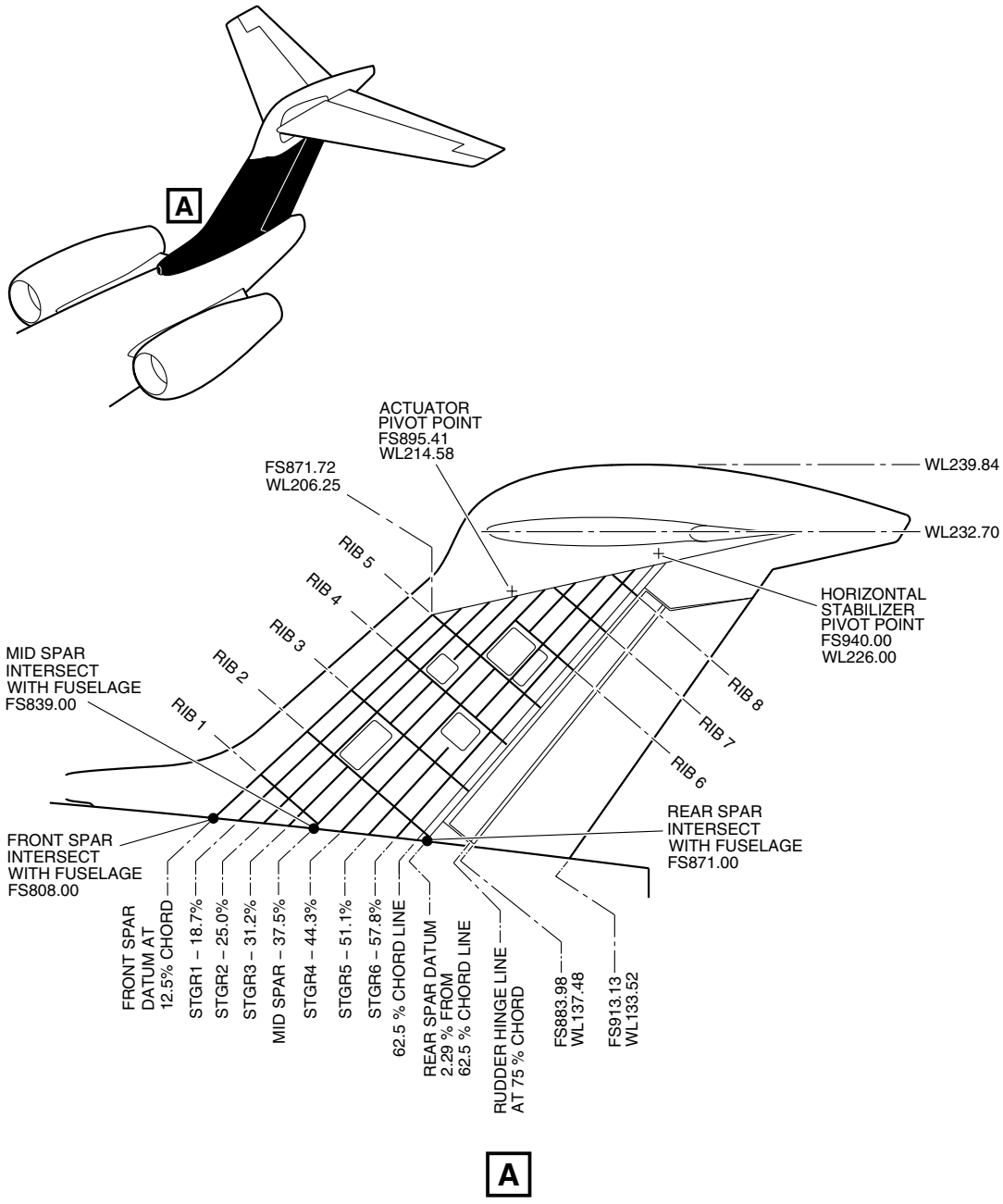
Wing Station Locations
Figure 2

EFFECTIVITY: ALL

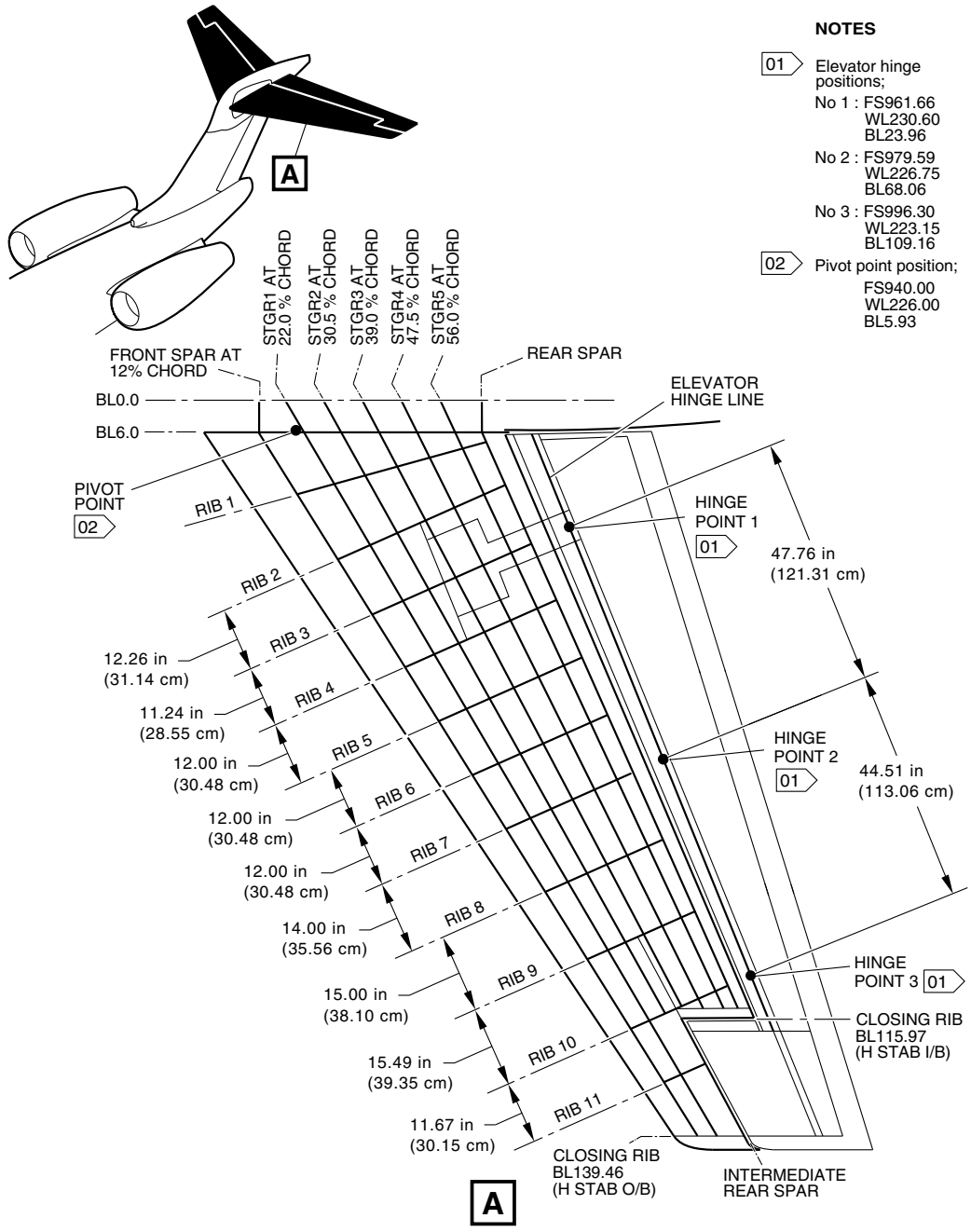


Winglet Station Locations
Figure 3

EFFECTIVITY: ALL

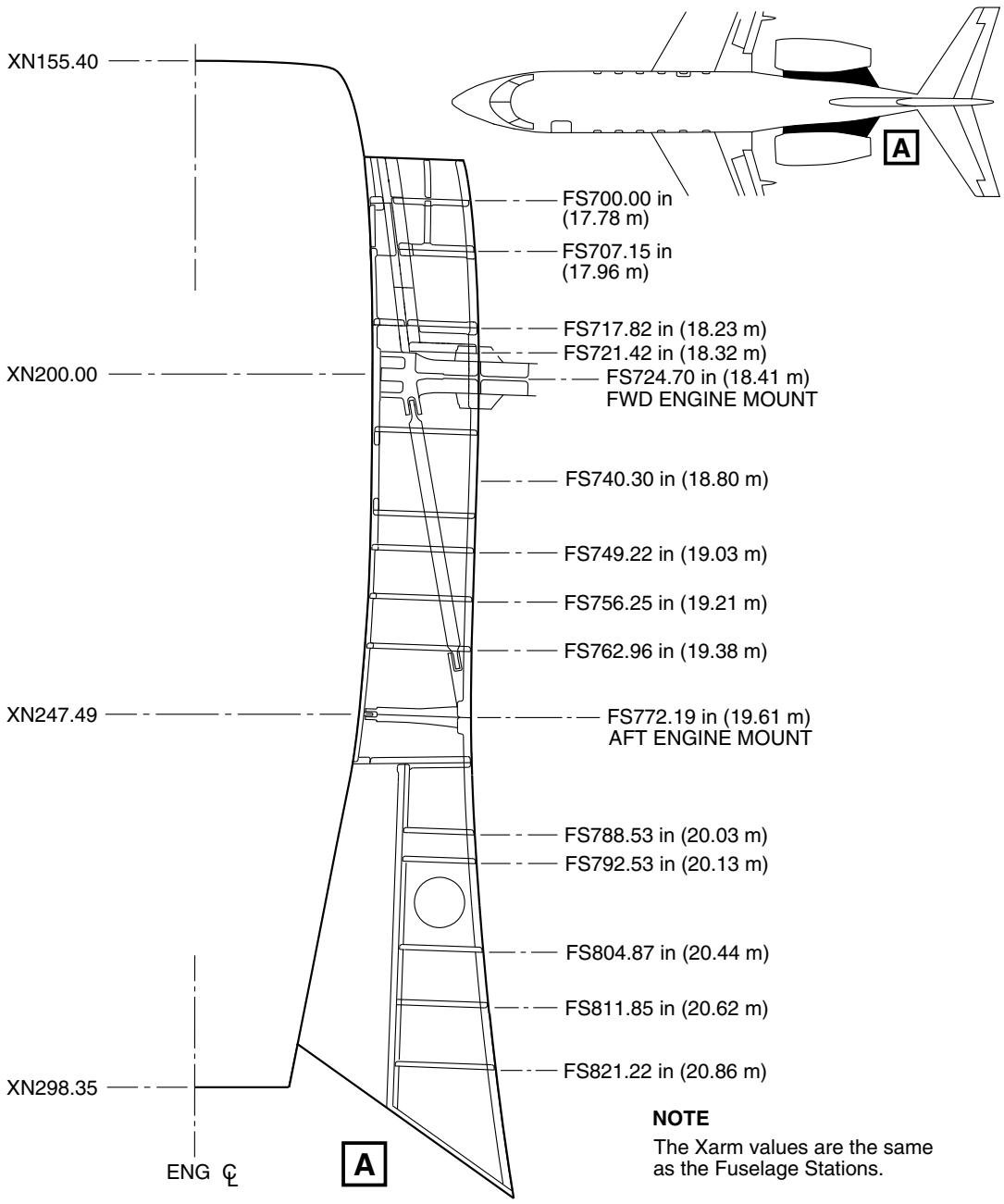


Vertical–Stabilizer Station locations
Figure 4



Horizontal–Stabilizer Station Locations
Figure 5

EFFECTIVITY: ALL



Engine–Nacelle Station Locations
Figure 6

EFFECTIVITY: ALL

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REFERENCE POINTS

1. General

This section gives data related to the reference points.

A. Leading–Edge Mean–Aerodynamic–Chord (LEMAC)

LEMAC is the distance along the Xarm axis from the ZRD to the leading edge, at the location where the wing chord is equal to the MAC.

B. Main–Landing–Gear (MLG) Axle Center–Line

The MLG axle center–line is the center of the MLG wheel. The MLG axle center–line can move forward or aft of its center position as a function of the MLG load and the shock strut pressure.

C. Mean Aerodynamic Chord (MAC)

The MAC is parallel to the fuselage center line. The location of the MAC is between the leading edge and trailing edge of the wing.

D. Nose–Landing–Gear (NLG) Axle Center–Line

The NLG axle center–line is the center of the nosewheel.

E. Weighing Datum (WD)

The WD is a reference point that is on the bottom of the aircraft fuselage.

F. Zero Reference Datum (ZRD)

The ZRD is a point that is in the plane of symmetry of the aircraft. The location of this point is at fuselage station FS0.00, forward of the nose radome at buttock line BL0.00, and at water line WL0.00. Refer to Figure 1 (Subject 01–80–30).

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DESIGN WEIGHT LIMITS

1. General

The Table that follows gives the maximum and minimum design weight limits of the aircraft:

– Refer to Table 1 for Aircraft 20501 and Subs.

EFFECTIVITY: ALL

Table 1 – Design Weight Limits (Aircraft with Maximum Ramp Weight of 40 750 lb (18 484kg))		
Description	**Weight**	
	lb	**kg**
Maximum Ramp Weight (MRW)	40 750	18 484
Maximum Take–Off Weight (MTOW)	40 600	18 416
Maximum Landing Weight (MLW)	34 150	15 490
Maximum Zero–Fuel Weight (MZFW)	28 200	12 791
Minimum Flight Weight (MFW)	24 800	11 249

EFFECTIVITY: ALL

CENTER OF GRAVITY LIMITS

1. General

This section contains the tables and chart related to the longitudinal CG envelope. The longitudinal CG envelope shows the weight and CG limits for the take–off, flight and landing conditions.

The balance limits are different for ground operations (Subject 01–80–60).

2. Longitudinal CG Envelope

Refer to Figure 1.

Use the Table 1A (imperial units) or Table 1B (SI units) that follows to quickly find the relation between the Xarm and the MAC (%MAC). This will make it easier to use the longitudinal CG envelope.

The formula to convert from Xarm to %MAC is:

%MAC = [(Xarm – LEMAC) / MAC] x 100

NOTE: The Weight and Balance Manual gives the definitions of LEMAC and MAC (Subject 01–00–40) . The values of LEMAC and MAC are in Table 1 (Subject 01–00–10) .

Table 1A – Xarm to %MAC (Imperial Units)

Xarm (in.)	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
580	20.79	20.87	20.96	21.05	21.14	21.23	21.32	21.41	21.50	21.59
581	21.68	21.77	21.85	21.94	22.03	22.12	22.21	22.30	22.39	22.48
582	22.57	22.66	22.75	22.83	22.92	23.01	23.10	23.19	23.28	23.37
583	23.46	23.55	23.64	23.73	23.81	23.90	23.99	24.08	24.17	24.26
584	24.35	24.44	24.53	24.62	24.71	24.80	24.88	24.97	25.06	25.15
585	25.24	25.33	25.42	25.51	25.60	25.69	25.78	25.86	25.95	26.04
586	26.13	26.22	26.31	26.40	26.49	26.58	26.67	26.76	26.84	26.93
587	27.02	27.11	27.20	27.29	27.38	27.47	27.56	27.65	27.74	27.82
588	27.91	28.00	28.09	28.18	28.27	28.36	28.45	28.54	28.63	28.72

EFFECTIVITY: ALL

Table 1A – Xarm to %MAC (Imperial Units)										
Xarm (in.)	**0.0**	**0.1**	**0.2**	**0.3**	**0.4**	**0.5**	**0.6**	**0.7**	**0.8**	**0.9**
589	28.81	28.89	28.98	29.07	29.16	29.25	29.34	29.43	29.52	29.61
590	29.70	29.79	29.87	29.96	30.05	30.14	30.23	30.32	30.41	30.50
591	30.59	30.68	30.77	30.85	30.94	31.03	31.12	31.21	31.30	31.39
592	31.48	31.57	31.66	31.75	31.83	31.92	32.01	32.10	32.19	32.28
593	32.37	32.46	32.55	32.64	32.73	32.82	32.90	32.99	33.08	33.17
594	33.26	33.35	33.44	33.53	33.62	33.71	33.80	33.88	33.97	34.06
595	34.15	34.24	34.33	34.42	34.51	34.60	34.69	34.78	34.86	34.95
596	35.04	35.13	35.22	35.31	35.40	35.49	35.58	35.67	35.76	35.84
597	35.93	36.02	36.11	36.20	36.29	36.38	36.47	36.56	36.65	36.74
598	36.82	36.91	37.00	37.09	37.18	37.27	37.36	37.45	37.54	37.63
599	37.72	37.81	37.89	37.98	38.07	38.16	38.25	38.34	38.43	38.52
600	38.61	38.70	38.79	38.87	38.96	39.05	39.14	39.23	39.32	39.41
601	39.50	39.59	39.68	39.77	39.85	39.94	40.03	40.12	40.21	40.30
602	40.39	40.48	40.57	40.66	40.75	40.83	40.92	41.01	41.10	41.19
603	41.28	41.37	41.46	41.55	41.64	41.73	41.82	41.90	41.99	42.08
604	42.17	42.26	42.35	42.44	42.53	42.62	42.71	42.80	42.88	42.97
605	43.06	43.15	43.24	43.33	43.42	43.51	43.60	43.69	43.78	43.86

Table 1B – Xarm to %MAC (SI Units)										
Xarm (m)	**0.00**	**0.01**	**0.02**	**0.03**	**0.04**	**0.05**	**0.06**	**0.07**	**0.08**	**0.09**
14.7	19.66	20.01	20.36	20.71	21.07	21.42	21.77	22.12	22.47	22.82
14.8	23.17	23.52	23.87	24.22	24.57	24.92	25.28	25.63	25.98	26.33
14.9	26.68	27.03	27.38	27.73	28.08	28.43	28.78	29.13	29.49	29.84

EFFECTIVITY: ALL

Table 1B – Xarm to %MAC (SI Units)										
Xarm (m)	**0.00**	**0.01**	**0.02**	**0.03**	**0.04**	**0.05**	**0.06**	**0.07**	**0.08**	**0.09**
15.0	30.19	30.54	30.89	31.24	31.59	31.94	32.29	32.64	32.99	33.34
15.1	33.70	34.05	34.40	34.75	35.10	35.45	35.80	36.15	36.50	36.85
15.2	37.20	37.55	37.91	38.26	38.61	38.96	39.31	39.66	40.01	40.36
15.3	40.71	41.06	41.41	41.76	42.12	42.47	42.82	43.17	43.52	43.87
15.4	44.22	44.57	44.92	45.27	45.62	45.97	46.33	46.68	47.03	47.38

The Tables 2A, 2B that follow give the center of gravity limits:

– Refer to Table 2A for Imperial units and Table 2B for SI units.

Table 2A – Center of Gravity Limits (Imperial Units)						
Weight	**Forward Limit**			**Aft Limit**		
	Xarm	**Moment/ 1 000**	**%MAC**	**Xarm**	**Moment/ 1 000**	**%MAC**
lb	**in.**	**lb in.**		**in.**	**lb in.**	
24 800	590.0	14631.0	29.66	604.4	14988.3	42.50
25 000	589.7	14 742.9	29.44	604.4	15 109.2	42.50
25 500	589.1	15 022.3	28.90	604.4	15 411.4	42.50
26 000	588.5	15 301.0	28.36	604.4	15 713.6	42.50
26 329	588.1	15 484.1	28.01	604.4	15 912.4	42.50
26 500	587.9	15 579.2	27.82	604.1	16 008.0	42.24
27 000	587.3	15 856.8	27.28	603.2	16 287.1	41.48
27 500	586.7	16 133.7	26.74	602.4	16 565.3	40.72
28 000	586.1	16 410.0	26.20	601.5	16 842.6	39.96
28 200	585.8	16 520.4	25.98	601.2	16 953.3	39.66
28 500	585.3	16 681.4	25.52	600.8	17 122.9	39.32

Table 2A – Center of Gravity Limits (Imperial Units)						
Weight	Forward Limit			Aft Limit		
	Xarm	Moment/ 1 000	%MAC	Xarm	Moment/ 1 000	%MAC
lb	in.	lb in.		in.	lb in.	
29 000	584.5	16 949.1	24.75	600.2	17 405.1	38.76
29 500	583.6	17 215.9	23.99	599.5	17 686.7	38.20
30 000	582.7	17 481.9	23.22	598.9	17 967.6	37.65
30 142	582.5	17 557.3	23.00	598.7	18 047.3	37.49
30 500	582.5	17 765.8	23.00	598.3	18 247.9	37.09
31 000	582.5	18 057.1	23.00	597.7	18 527.6	36.53
31 500	582.5	18 348.3	23.00	597.0	18 806.6	35.97
32 000	582.5	18 639.5	23.00	596.4	19 085.1	35.41
32 500	582.5	18 930.8	23.00	595.8	19 362.9	34.85
33 000	582.5	19 222.0	23.00	595.2	19 640.0	34.29
33 500	582.5	19 513.3	23.00	594.5	19 916.6	33.73
34 000	582.5	19 804.5	23.00	593.9	20 192.5	33.17
34 150	582.5	19 891.9	23.00	593.7	20 275.1	33.00
34 500	582.5	20 095.8	23.00	593.7	20 482.9	33.00
35 000	582.5	20 387.0	23.00	593.7	20 779.8	33.00
35 500	582.5	20 678.2	23.00	593.7	21 076.6	33.00
36 000	582.5	20 969.5	23.00	593.7	21 373.5	33.00
36 500	582.5	21 260.7	23.00	593.7	21 670.3	33.00
37 000	582.5	21 552.0	23.00	593.7	21 967.2	33.00
37 500	582.5	21 843.2	23.00	593.7	22 264.0	33.00
38 000	582.5	22 134.5	23.00	593.7	22 560.9	33.00

EFFECTIVITY: ALL

Table 2A – Center of Gravity Limits (Imperial Units)						
Weight	Forward Limit			Aft Limit		
	Xarm	Moment/ 1 000	%MAC	Xarm	Moment/ 1 000	%MAC
lb	in.	lb in.		in.	lb in.	
38 500	582.5	22 425.7	23.00	593.7	22 857.7	33.00
38 836	582.5	22 621.4	23.00	593.7	20 057.2	33.00
39 000	582.6	22 723.0	23.14	593.7	23 154.6	33.00
39 500	583.1	23 033.2	23.56	593.7	23 451.5	33.00
39 730	583.3	23 176.0	23.76	593.7	23 588.0	33.00
40 000	583.9	23 355.0	24.24	593.0	23 720.4	32.38
40 500	584.9	23 687.3	25.13	591.7	23 964.7	31.23
40 600	585.1	23 753.7	25.30	591.5	24 013.4	31.00
40 750	585.4	23 853.8	25.57	591.1	24 086.6	30.66

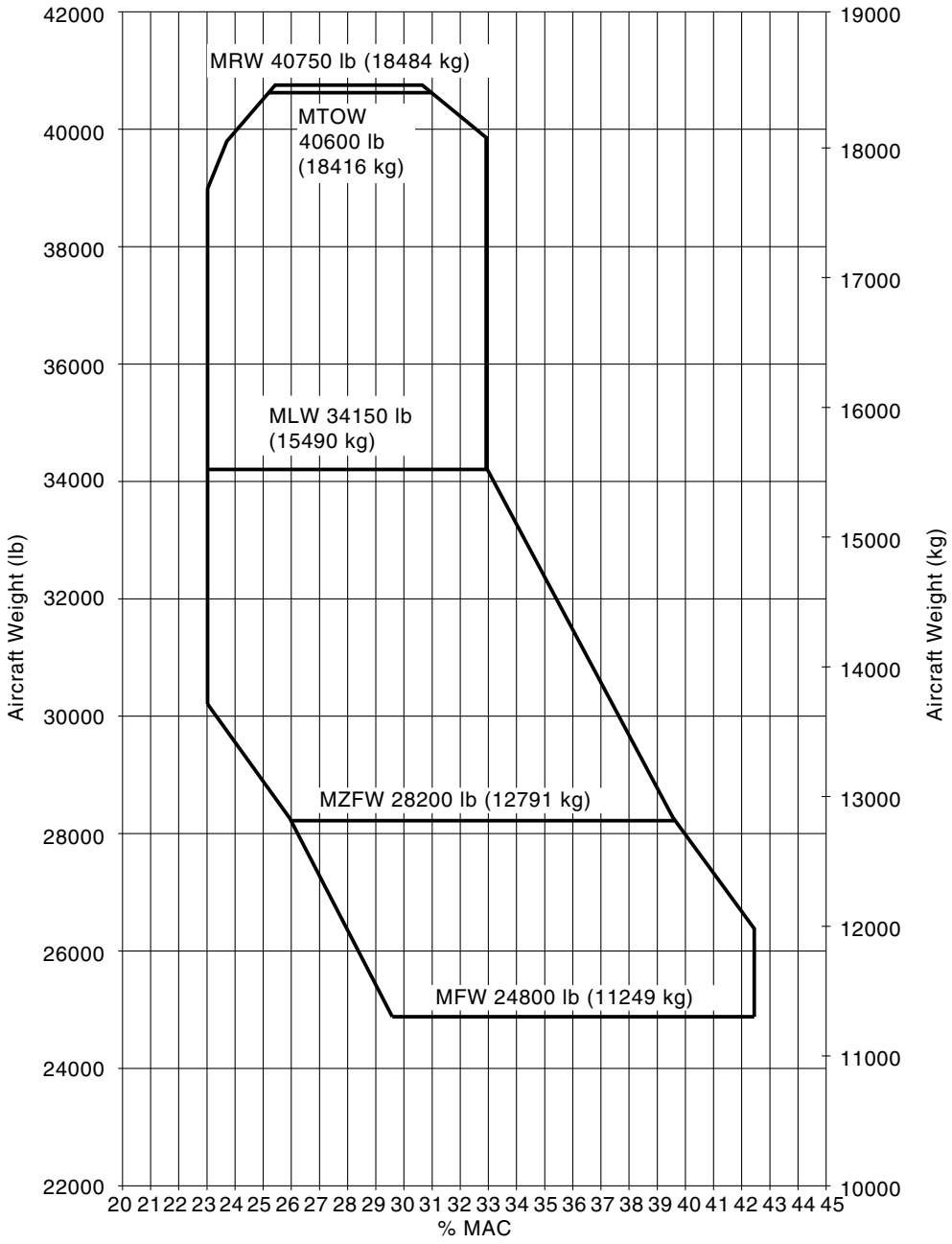
Table 2B – Center of Gravity Limits (SI Units)						
Weight	Forward Limit			Aft Limit		
	Xarm	Moment/ 1 000	%MAC	Xarm	Moment/ 1 000	%MAC
kg	m	kg m		m	kg m	
11 249	15.0	168.5	29.66	15.3	172.6	42.50
11 340	15.0	169.7	29.44	15.3	174.0	42.50
11 567	15.0	173.0	28.90	15.3	177.4	42.50
11 793	14.9	176.2	28.36	15.3	180.9	42.50
11 943	14.9	178.3	28.01	15.3	183.2	42.50
12 020	14.9	179.4	27.82	15.3	184.3	42.24
12 247	14.9	182.6	27.28	15.3	187.5	41.48

EFFECTIVITY: ALL

Table 2B – Center of Gravity Limits (SI Units)						
Weight	Forward Limit			Aft Limit		
	Xarm	Moment/ 1 000	%MAC	Xarm	Moment/ 1 000	%MAC
kg	m	kg m		m	kg m	
12 474	14.9	185.8	26.74	15.3	190.7	40.72
12 701	14.9	188.9	26.20	15.3	193.9	39.96
12 791	14.9	190.2	25.98	15.3	195.2	39.66
12 927	14.9	192.1	25.52	15.3	197.2	39.32
13 154	14.8	195.1	24.75	15.2	200.4	38.76
13 381	14.8	198.2	23.99	15.2	203.6	38.20
13 608	14.8	201.3	23.22	15.2	206.9	37.65
13 672	14.8	202.1	23.00	15.2	207.8	37.49
13 835	14.8	204.6	23.00	15.2	210.1	37.09
14 061	14.8	207.9	23.00	15.2	213.3	36.53
14 288	14.8	211.3	23.00	15.2	216.5	35.97
14 515	14.8	214.6	23.00	15.1	219.7	35.41
14 742	14.8	218.8	23.00	15.1	222.9	34.85
14 969	14.8	221.3	23.00	15.1	226.1	34.29
15 195	14.8	224.7	23.00	15.1	229.3	33.73
15 422	14.8	228.0	23.00	15.1	232.5	33.17
15 490	14.8	229.0	23.00	15.1	233.4	33.00
15 649	14.8	231.4	23.00	15.1	235.8	33.00
15 876	14.8	234.7	23.00	15.1	239.3	33.00
16 103	14.8	238.1	23.00	15.1	242.7	33.00
16 329	14.8	241.4	23.00	15.1	246.1	33.00

EFFECTIVITY: ALL

Table 2B – Center of Gravity Limits (SI Units)						
Weight	Forward Limit			Aft Limit		
	Xarm	Moment/ 1 000	%MAC	Xarm	Moment/ 1 000	%MAC
kg	m	kg m		m	kg m	
16 556	14.8	244.8	23.00	15.1	249.5	33.00
16 783	14.8	248.1	23.00	15.1	252.9	33.00
17 010	14.8	251.5	23.00	15.1	256.3	33.00
17 236	14.8	254.9	23.00	15.1	259.8	33.00
17 463	14.8	258.2	23.00	15.1	263.2	33.00
17 616	14.8	260.5	23.00	15.1	265.5	33.00
17 690	14.8	261.6	23.14	15.1	266.6	33.00
17 917	14.8	265.2	23.56	15.1	270.0	33.00
18 021	14.8	266.8	23.76	15.1	271.6	33.00
18 144	14.8	268.9	24.24	15.1	273.1	32.38
18 370	14.8	272.7	25.13	15.0	275.9	31.23
18 416	14.9	273.5	25.30	15.0	276.5	31.00
18 484	14.9	274.6	25.57	15.0	277.3	30.66



Longitudinal Center of Gravity Envelope
Figure 1

EFFECTIVITY: ALL

TAKE–OFF TRIM SETTINGS

1. General

The adjustment of stabilizer settings for take–off must agree with the related CG of the aircraft. Refer to Before Starting Engines subject in Chapter 4 of the Airplane Flight Manual to find the correct take–off trim settings.

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BALANCE EFFECT CAUSED BY MAJOR OPERATION

1. General

The operation of some systems changes the CG of the aircraft during flight, ground handling, take–off and landing operations. The Table 1 that follows shows the effect of these operations on the aircraft CG:

Table 1 – Balance Effect Caused by Major Operation

Items	Aircraft Delta Moment for Items Change from Fully Deployed to Fully Stowed Position	
	Moment/1000	
	lb in.	kg m
Gears Up Compared to Gears on Ground	–4.6	–0.053
Flaps Deployed Compared to Flaps Stowed	–4.0	–0.046
Thrust Reverser Deployed Compared to Thrust Reverser Stowed	Negligible (–0.06)	Negligible (–0.0007)

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FUEL

1. General

This section contains the subjects related to fuel that follow:

– Fuel Tanks Configuration and Capacities (Subject 01–20–10)

– Fuel Management (Subject 01–20–20).

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FUEL TANK CONFIGURATION AND CAPACITIES

1. Fuel Tank Configuration

Refer to Figure 1.

The fuel tanks configuration is as shown:

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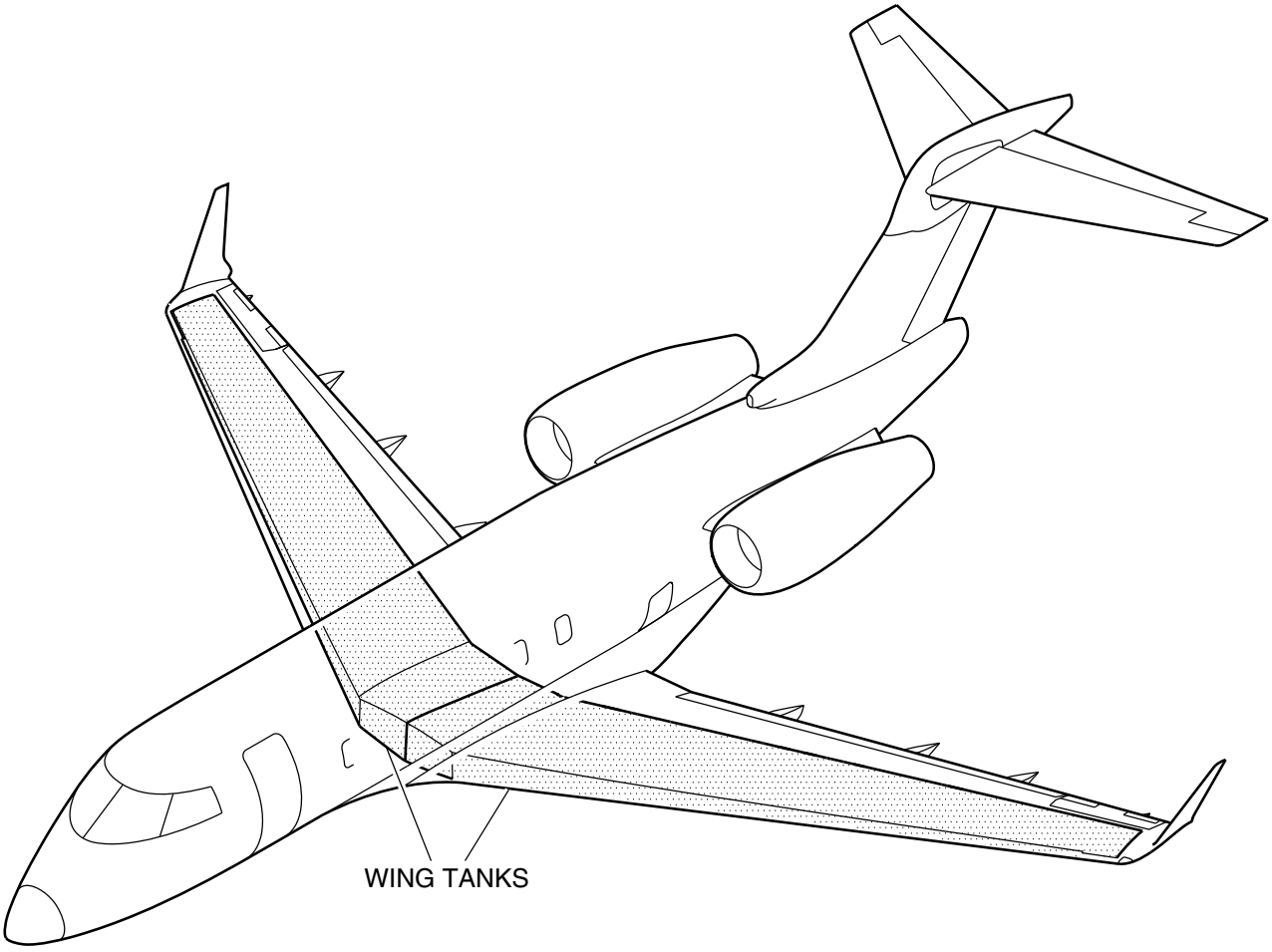

EFFECTIVITY: ALL

2. Fuel Tank Capacities

The Table 1 that follows shows the total volume, weight, center of gravity (CG) and moment for the two fuel tanks:

Table 1 – Fuel Tank Capacities

Description	Volume		Weight [1]		CG		Moment/1 000	
	U.S. gal	L	lb	kg	in.	m	lb in	kg m
Main Tank	2 096	7 934	14 150	6 418	573.0	14.55	8 107.25	93.406
[1] Weight is calculated with a fuel density = 6.75 lb/U.S. gal (0.809 kg/L)								

3. Unusable Fuel

The unusable fuel is the sum of the residual and trapped fuel in all the fuel system.

The residual fuel is the quantity of fuel that the engines cannot use under normal conditions in flight. It is possible to drain this residual fuel through the draining points with the aircraft in the level position.

The trapped fuel is the fuel caught in the aircraft fuel system after the residual fuel is drained.

The Table 2 that follows shows the volume, weight, CG and moment values for the unusable fuel:

Table 2 – Unusable Fuel								
Description	**Volume**		**Weight [1]**		**CG**		**Moment/1 000**	
	U.S. gal	**L**	**lb**	**kg**	**in.**	**m**	**lb in.**	**kg m**
Residual Fuel								
Main Tanks	7.5	28.2	50.4	22.85	543.2	13.80	27.4	0.315
Total Residual Fuel	7.5	28.2	50.4	22.85	543.2	13.80	27.4	0.315
Trapped Fuel								
Main Tanks	2.0	7.6	13.5	6.12	576.4	14.64	7.8	0.090
Engines	1.5	5.8	10.4	4.72	738.9	18.77	7.7	0.089
Fuel Lines	2.8	10.5	18.8	8.53	669.0	16.99	12.6	0.145
APU	0.1	0.4	0.70	0.32	870.2	22.10	0.6	0.007
Total Trapped Fuel	6.4	24.3	43.4	19.69	660.2	16.77	28.6	0.330
Total Unusable Fuel	13.9	52.6	93.7	42.50	597.3	15.17	56.0	0.645
Note: [1] Weight is calculated with a fuel density = 6.75 lb/U.S. gal (0.809 kg/L)								

EFFECTIVITY: ALL

4. Usable Fuel

The usable fuel is the fuel available to operate the aircraft engines. The Table 3A (imperial units) and Table 3B (SI units) that follow show the volume, weight, CG and moment values for the usable fuel:

Table 3A – Usable Fuel (Imperial Units)

Volume	Weight	Main Tank (per side)	
		CG	Moment/1 000
U.S. gal	lb	in.	lb in.
0	0	543.1	0.0
50	338	544.3	183.7
100	675	545.6	368.3
150	1 013	547.1	553.9
200	1 350	548.6	740.6
250	1 688	550.2	928.4
300	2 025	551.8	1 117.3
350	2 363	553.3	1 307.2
400	2 700	554.8	1 498.0
450	3 038	556.2	1 689.5
500	3 375	557.6	1 881.7
550	3 713	558.8	2 074.6
600	4 050	560.0	2 268.0
650	4 388	561.1	2 462.0
683	4 610	561.9	2 590.3
700	4 725	562.2	2 656.6
709	4 786	562.4	2 691.7
750	5 063	563.4	2 852.0

Table 3A – Usable Fuel (Imperial Units)			
Volume	Weight	Main Tank (per side)	
		CG	Moment/1 000
U.S. gal	lb	in.	lb in.
800	5 400	564.5	3 048.4
850	5 738	565.8	3 246.2
900	6 075	567.2	3 445.7
950	6 413	568.8	3 647.6
1 000	6 750	570.8	3 852.6
1 048	7 075	573.0	4 053.7

Table 3B – Usable Fuel (SI Units)			
Volume	Weight	Main Tank (per side)	
		CG	Moment/1 000
L	kg	m	kg m
100	81	13.81	1.12
200	162	13.83	2.24
300	243	13.84	3.36
400	324	13.86	4.49
500	404	13.88	5.62
600	485	13.90	6.75
700	566	13.92	7.88
800	647	13.94	9.02
900	728	13.96	10.17
1 000	809	13.99	11.31
1 100	890	14.01	12.47

EFFECTIVITY: ALL

Table 3B – Usable Fuel (SI Units)			
Volume	Weight	Main Tank (per side)	
		CG	Moment/1 000
L	kg	m	kg m
1 200	971	14.03	13.62
1 300	1 052	14.05	14.78
1 400	1 133	14.07	15.94
1 500	1 214	14.09	17.10
1 600	1 294	14.11	18.26
1 700	1 375	14.13	19.43
1 800	1 456	14.15	20.60
1 900	1 537	14.16	21.77
2 000	1 618	14.18	22.94
2 100	1 699	14.20	24.12
2 200	1 780	14.21	25.30
2 300	1 861	14.23	26.47
2 400	1 942	14.24	27.66
2 500	2 023	14.26	28.84
2 600	2 103	14.27	30.02
2 700	2 184	14.29	31.21
2 800	2 265	14.30	32.40
2 900	2 346	14.32	33.59
3 000	2 427	14.33	34.79
3 100	2 508	14.35	35.99
3 200	2 589	14.37	37.20

Table 3B – Usable Fuel (SI Units)			
Volume	Weight	Main Tank (per side)	
		CG	Moment/1 000
L	kg	m	kg m
3 300	2 670	14.39	38.41
3 400	2 751	14.41	39.62
3 500	2 832	14.43	40.85
3 600	2 912	14.45	42.08
3 700	2 993	14.47	43.33
3 800	3 074	14.50	44.58
3 900	3 155	14.53	45.85
3 967	3 209	14.55	46.71

FUEL MANAGEMENT

1. Fuel Transfer System

If a lateral imbalance of fuel load occurs, it is possible to use the standby boost pump to make the fuel flow from wing to wing. It is also possible to open the shutoff valve (SOV) to make the fuel flow by gravity. When the SOV is open, the higher fuel head in the heavy wing will cause fuel to flow to the light wing.

2. Fuel Replenishment

To refuel the aircraft, follow the procedures given in Chapter 12 of the Aircraft Maintenance Manual (AMM TASK 12–11–00).

3. Fuel Burn Sequence

The usual fuel flow in flight is from the left wing to the left engine and from the right wing to the right engine. The fuel burns equally on the left and right sides from 100% capacity to 0% capacity when the APU is not in operation.

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FLUIDS

1. General

This section contains the subjects related to fluids that follow:

- System Fluids (Subject 01–30–10)
- Service Fluids (Subject 01–30–20).

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SYSTEM FLUIDS

1. System Fluid Capacities

The Table 1 that follows gives the volume, weight, center of gravity (CG) and moment for the system fluids:

Table 1 – System Fluid Capacities

Description	Volume		Weight [1]		CG		Moment/1 000	
	U.S. gal	L	lb	kg	in.	m	lb in.	kg m
Engine Fluids								
Engines (2) Oil Tank at 60 °F	4.0	14.99	30.1	13.65	728.2	18.50	21.92	0.252
Total	4.0	14.99	30.1	13.65	728.2	18.50	21.92	0.252

[1] Assuming an oil density of 1.9 lb/qt.

[1] Total Oil Volume includes 6.0 qts (5.68 l) in Left Engine, 5.0 qts (4.73 l) in Right Engine, plus oil inside ATS and trapped in engine lines.

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SERVICE FLUIDS

1. Service Fluid Capacities

Refer to Chapter 2, Aircraft Reports provided by the Completion Center for data related to the service fluids.

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PERSONNEL

1. General

This section contains the subjects related to personnel that follow:

- Flight Compartment (Subject 01–40–10)
- Passenger Compartment (Subject 01–40–20)
- Balance Changes Due to Movement (Subject 01–40–40).

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FLIGHT COMPARTMENT

1. General

This section contains data on the personnel in the flight compartment.

2. Crew Arrangement

The crew seats are installed side by side on seat tracks in the flight compartment. The pilot sits on the left side and the copilot sits on the right side of the flight compartment.

3. Crew Weight and Balance Arms

The Table 1 that follows shows the weight, center of gravity (CG) and moment for the pilot and copilot with the seats in the fully vertical position:

Table 1 – Pilot and Copilot Weight and CG and Moment

Items	Weight		Xarm		Moment/1 000	
	lb	kg	in.	m	lb in.	kg m
Pilot	190	86.18	305.2	7.75	57.99	0.668
Copilot	190	86.18	305.2	7.75	57.99	0.668
Total	380	172.37	305.2	7.75	115.98	1.336

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PASSENGER COMPARTMENT

1. General

Refer to Chapter 2, Aircraft Reports provided by the Completion Center for the data related to the passenger compartment.

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BALANCE CHANGES DUE TO MOVEMENT

1. General

The operation of some systems, passenger or crew movement can change the center of gravity (CG) during flight, ground handling, take–off and landing operations. Refer to Chapter 2, Aircraft Reports provided by the Completion Center for the data related to the effect of these movements on the aircraft CG.

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CARGO

1. General

This section contains the subjects related to cargo that follow:

– Cargo Compartments (Subject 01–60–10)

– Passenger Compartment Storage (Subject 01–60–20).

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CARGO COMPARTMENTS

1. General

Refer to Chapter 2, Aircraft Reports provided by the Completion Center for the data related to the cargo compartments.

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PASSENGER COMPARTMENT STORAGE

1. General

Refer to Chapter 2, Aircraft Reports provided by the Completion Center for the data related to the passenger compartment storage.

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GROUND OPERATIONS

1. General

This section contains the subjects related to ground operations that follow:

- Static Loads (Subject 01–80–20)
- Weighing Procedures (Subject 01–80–30)
- Balance Limits (Subject 01–80–60).

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STATIC LOADS

1. Maximum Permitted Jacking Weight

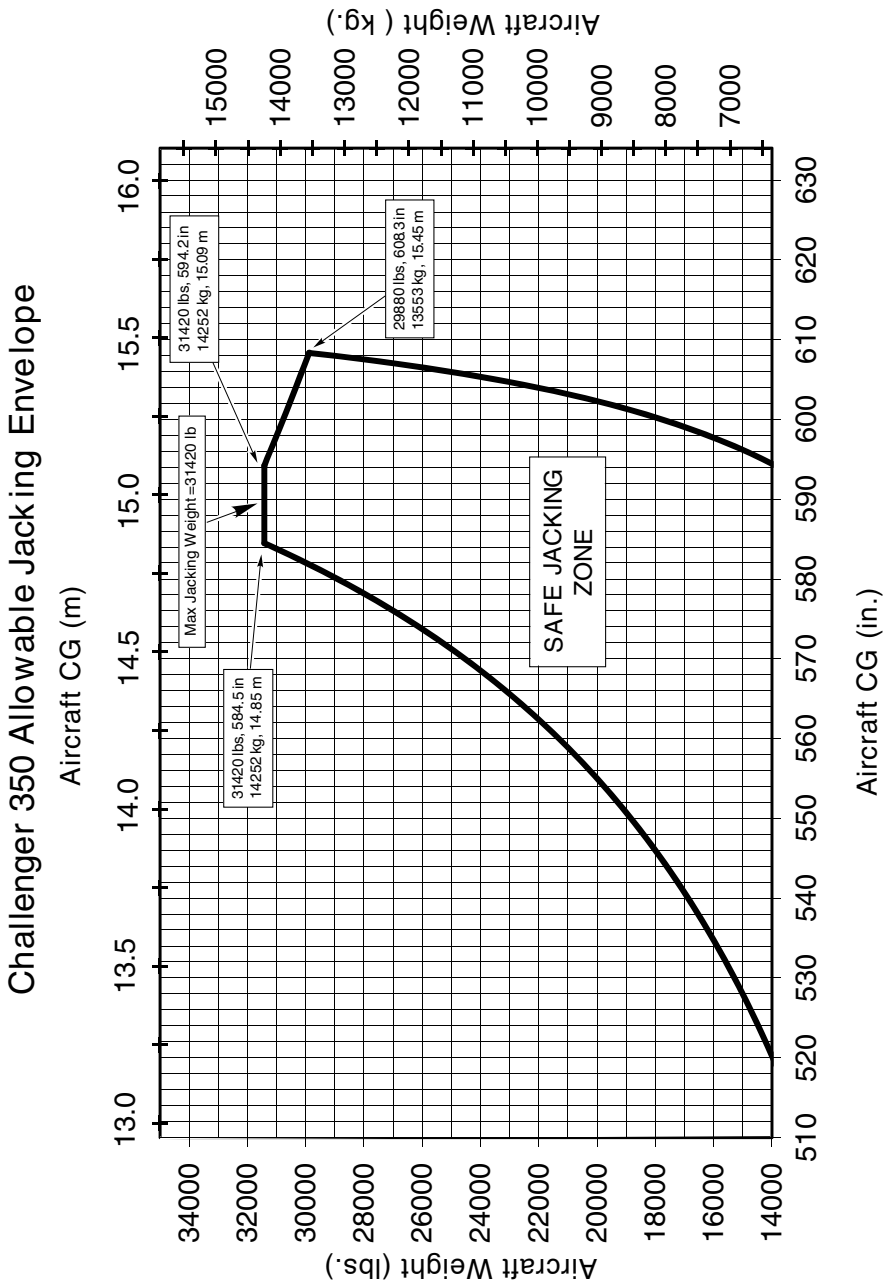
A. Jacking on Structure

The Table 1 that follows gives the maximum permitted aircraft jacking weight and the maximum permitted load for each structural jacking point.

Table 1 – Maximum Jacking Weight

Description	Maximum Static Load	
	lb	kg
Aircraft (Total Weight)	31 420	14 252
Nose Jacking Point	5 327	2 416
Wing (each side) Jacking Point	13 829	6 273

The following graph presents the safe jacking zone based on aircraft weight and CG when jacking on structure.



Allowable Jacking Envelope
Figure 1

EFFECTIVITY: ALL

B. Jacking on Landing Gear

The maximum aircraft weight when jacking on landing gear must not be more than the maximum ramp weight (MRW) (Subject 01–00–50).

2. Maximum Loading

When loading the aircraft, the load must not be more than the maximum load permitted in each area. The Table 2 that follows gives the maximum loading for each aircraft area:

Table 2 – Maximum Loading

Description	Zone	Loading	Capacity
Avionics Area [1]	FS326.0 to FS344.6	250 lb/Longitudinal ft (372 kg/Longitudinal m)	400 lb (181 kg)
Galley Area [2]	FS344.6 to FS394.6	150 lb/Longitudinal ft (223 kg/Longitudinal m)	625 lb (283 kg)
Passenger Compartment Area [2]	FS394.6 to FS630.0	200 lb/Longitudinal ft (297 kg/Longitudinal m)	3 920 lb (1 778 kg)
Cargo Hold [3]	FS630.0 to FS668.7	400 lb/Longitudinal ft (595 kg/Longitudinal m)	750 lb (340 kg)
Flight Compartment Allowance [4]			250 lb (113 kg)
Aft Equipment Bay Allowance	Aft of FS668.7		300 lb (136 kg)
Floor Structure		75 lb/ft² (366 kg/m²)	
Floor Panels		75 lb/ft² (366 kg/m²)	

Notes:

[1] Allowance in addition to type specification avionics.

[2] Allowance in addition to type specification interior and operating items.

[3] Maximum capacity = 750 lb (340 kg).

[4] Allowance includes ballast. This ballast weight is in addition to type specification operating items.

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WEIGHING PROCEDURES

1. General

This section gives the procedures to find the weight and the center of gravity (CG) of the aircraft.

The two different procedures to measure the weight of the aircraft are as follows:

– Weighing on Tripod Jacks Procedure
– Weighing on Platform Scales and Jack Procedure.

2. Job Set–Up Information

A. Tools and Equipment

Reference	Designation
GSE 07–10–01	Jacking Pads
GSE 07–10–02	Wing Jack
GSE 07–10–03	FWD Fuselage Jack
GSE 08–00–01	Leveling Kit
GSE 08–00–02	Aircraft Weighing Kit
GSE 09C–10–02	Aircraft Towbar
GSE 10–10–10	Wheel Chocks
Commercially Available	Platform Scale (50 000 lb (22 680 kg))

NOTE: For ground support equipment (GSE), refer to the ILLUSTRATED TOOL & EQUIPMENT MANUAL.

B. Reference Information

Reference	Designation
AMM TASK 12–00–00–867–803	Standard Aircraft Configuration for Maintenance
AMM TASK 12–11–09–650–801	Suction Defueling

Reference	Designation
AMM TASK 12–12–00–611–801	Servicing of the Hydraulic System Reservoirs
AMM TASK 12–14–01–612–801	Servicing of the Engine Oil Tank
AMM TASK 12–21–00–110–802	Cleaning of the Nontextile Floor Coverings
AMM TASK 12–21–00–110–803	Cleaning of the Textile Floor Coverings
AMM TASK 12–21–00–110–808	Cleaning of the External Surfaces of the Aircraft
AMM TASK 24–00–00–910–801	Electrical/Electronic Safety Precautions
AMM TASK 29–00–00–910–801	Hydraulic Safety Precautions
AMM TASK 29–00–00–910–802	Hydraulic Technical Precautions
AMM TASK 32–11–05–720–801	Functional Test of the Main Landing Gear (MLG) Shock–Strut Extension
AMM TASK 52–41–00–010–801	Opening of the Aft Equipment–Compartment Door (182GL)
AMM TASK 52–41–00–410–801	Closing of the Aft Equipment–Compartment Door (182GL)

C. Job Set–Up Procedure

CAUTION: WEIGH THE AIRCRAFT AND MAKE IT LEVEL IN A CLOSED HANGAR. IF YOU DO NOT DO THIS, AIR MOVEMENT CAN CAUSE INCORRECT RESULTS.

Do the steps that follow to prepare the aircraft for weighing:

(1) Do the suction defueling of the aircraft (AMM TASK 12–11–09–650–801).

(2) Park the aircraft in a closed hangar.

WARNING: OBEY THE PRECAUTIONS THAT FOLLOW WHEN YOU WEIGH THE AIRCRAFT ON JACKS:

- MAKE SURE THAT NO PERSONS OR TOOLS ARE ON OR IN THE AIRCRAFT.
- INSTALL THE LOCKPINS IN THE NOSE LANDING GEAR AND THE MAIN LANDING GEAR.
- REMOVE THE CHOCKS FROM THE WHEELS.
- RELEASE THE PARKING BRAKE.
- REMOVE THE REAR FUSELAGE SUPPORT.
- MAKE SURE THAT THE LOAD CELLS ARE INSTALLED CORRECTLY ON THE JACKS.
- MAKE SURE THAT THE JACKS ARE ALIGNED CORRECTLY BELOW THE JACKING PADS.
- MAKE SURE THAT THERE IS SUFFICIENT CLEARANCE AROUND THE AIRCRAFT.
- MAKE SURE THAT THERE IS NO SIDE LOAD ON THE LOAD CELLS.

THESE PRECAUTIONS CAN PREVENT INJURY TO PERSONS AND DAMAGE TO THE AIRCRAFT AND EQUIPMENT.

(3) Make sure that the hangar floor is hard, level and has no vibration.

(4) Obey the electrical/electronic safety precautions (AMM TASK 24–00–00–910–801).

(5) Obey the hydraulic safety precautions (AMM TASK 29–00–00–910–801).

(6) Obey the hydraulic technical precautions (AMM TASK 29–00–00–910–802).

(7) Open all fuel drain valves to let residual fuel drain during the weighing procedure.

(8) Make sure that the hydraulic system reservoirs are full (AMM TASK 12–12–00–611–801).

(9) Do the servicing of the engine oil tank (AMM TASK 12–14–01–612–801).

(10) Drain the water system.

(11) Drain the waste water system.

(12) Make sure that the aircraft is in the configuration that follows:

(a) The flaps and thrust reversers are retracted.

(b) All the flight controls are at the neutral position.

(c) All the doors, hatches, and access panels are closed.

(d) All the passenger seats are in take–off position.

(e) The internal surfaces of the aircraft are dry and clean (AMM TASK 12–21–00–110–802 and AMM TASK 12–21–00–110–803).

(f) The external surfaces of the aircraft are dry and clean (AMM TASK 12–21–00–110–808).

3. Weighing on Tripod Jacks Procedure

Do the steps that follow to weigh the aircraft on tripod jacks and calculate the center of gravity of the aircraft:

A. Weighing

Refer to Figure 1, Figure 2, Figure 3 and Figure 6.

Do the steps that follow to weigh the aircraft on tripod jacks:

(1) Do the Job Set–Up Procedure found in the Job Set–Up Information section.

(2) Remove the nylon plugs from the jacking points. Refer to Figure 2.

(3) Install the jack pads in the jacking points.

(4) Put the tripod jacks in position below the jacking points. Refer to Figure 1.

(5) Extend the jacks until they lightly touch the jack pads.

(6) Follow the manufacturer instructions to install the load cells between the jacks and the jacking points on the aircraft.

(7) Make sure that the load cell identification agrees with the related jacking point.

(8) Use a copy of the Aircraft Weighing Records – Tripod Jacks Method form to continue with this procedure. Refer to Figure 3.

(9) Record the load cell identification into the channel (Chn) column of the Aircraft Weighing Records – Tripod Jacks Method form.

CAUTION: DO NOT OPERATE THE ELECTRONIC WEIGHING KIT UNTIL IT IS SUFFICIENTLY WARM. IF THE ELECTRONIC WEIGHING KIT IS NOT SUFFICIENTLY WARM, YOU CAN GET INCORRECT INDICATIONS ON THE TEST EQUIPMENT.

(10) Let the load cells get warm for a minimum of 20 minutes.

(11) Follow the manufacturer instructions to calibrate the weighing kit to zero.

(12) Make sure that there is no weight on the load cells.

(13) Open the aft equipment–compartment door (182GL) (AMM TASK 52–41–00–010–801).

(14) Put the plumb line through the hole in the bracket at the top of the frame at FS755.50. Refer to Figure 6.

(15) Adjust the plumb line until the point of the plumb bob is approximately 0.5 in (1.27 cm) above the target.

NOTE: If the plumb bob is put higher than 0.5 in (1.27 cm) above the target, the result will not be accurate.

(16) Attach the end of the plumb line to the bracket.

CAUTION: LOWER/EXTEND THE JACKS EQUALLY TO PREVENT SIDE LOADS ON THE LOAD CELLS. THE EQUIPMENT CAN SHOW INCORRECT WEIGHTS, HAVE LOAD CELL FAILURE, OR YOU CAN CAUSE DAMAGE TO THE AIRCRAFT.

(17) Extend the jacks to lift the aircraft from 1.0 to 2.0 in (2.54 to 5.08 cm) until it is away from the ground.

(18) Make sure that the landing gears are fully extended.

(19) Make the aircraft level on the jacks.

(20) Fill the data in the form as follows:

(a) Find the weight at the nose jacking point as follows:

1 Get the indication from the load cell at the NLG tripod jack.

2 Record the value on your copy of the form in the Reading column.

(b) Find the weight at the left wing jacking point as follows:

1 Get the indication from the load cell at the left MLG tripod jack.

2 Record the value on your copy of the form in the Reading column.

(c) Find the weight at the right wing jacking point as follows:

1 Get the indication from the load cell at the right MLG tripod jack.

2 Record the value on your copy of the form in the Reading column.

(d) Find the weight of the aircraft as follows:

1 Do a sum of the three recorded values.

2 Record the result for Aircraft Total in the Reading Column.

CAUTION: LOWER/EXTEND THE JACKS EQUALLY TO PREVENT SIDE LOADS ON THE LOAD CELLS. THE EQUIPMENT CAN SHOW INCORRECT WEIGHTS, HAVE LOAD CELL FAILURE, OR YOU CAN CAUSE DAMAGE TO THE AIRCRAFT.

(21) Lower the aircraft until there is no load on the jacks and the load cells.

(22) Read the residual indication on each of the load cells.

(23) Record the residual load cell indications in the related field of the Zero column.

(24) Make sure that all of the recorded values are equal to zero:

(a) If the values are equal to zero, no change to the weight data is necessary. Copy the value recorded in the related Reading column into the Weight column.

(b) If the values are different than zero, change the weight data as follows:

1 If the value is more than zero, subtract it from the weight recorded in the related Reading column. Record the result in the related Weight column.

2 If the value is less than zero, add it to the weight recorded in the related Reading column. Record the result in the related Weight column.

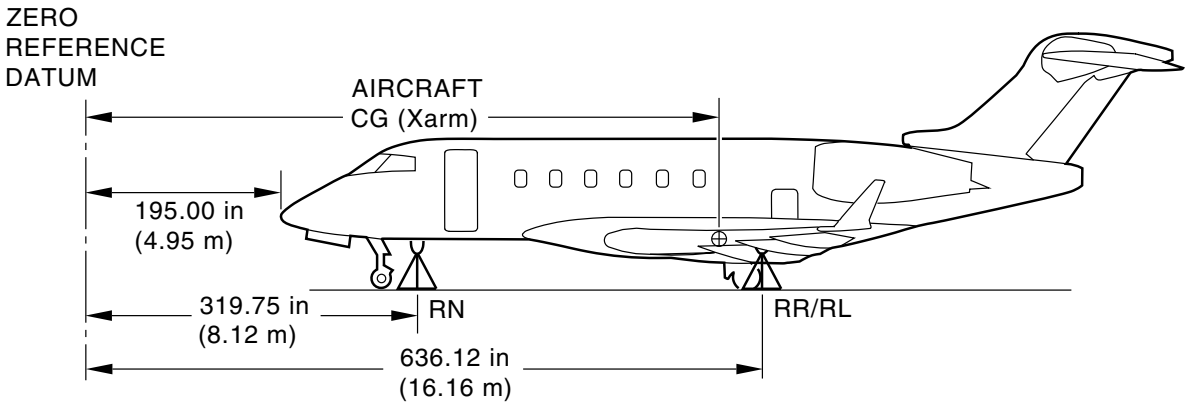
3 If the value is more than the permitted limit of the equipment, do as follows:

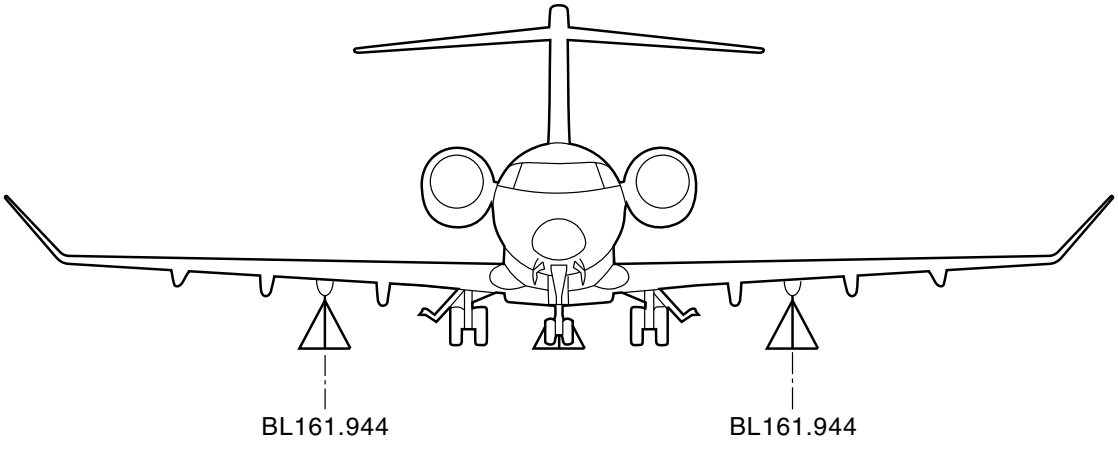
a Do the Weighing on Tripod Jacks Procedure again with load cells moved clockwise to the next jacking point.

b Do this until you get two indications, one after the other, that have the conditions that follow:

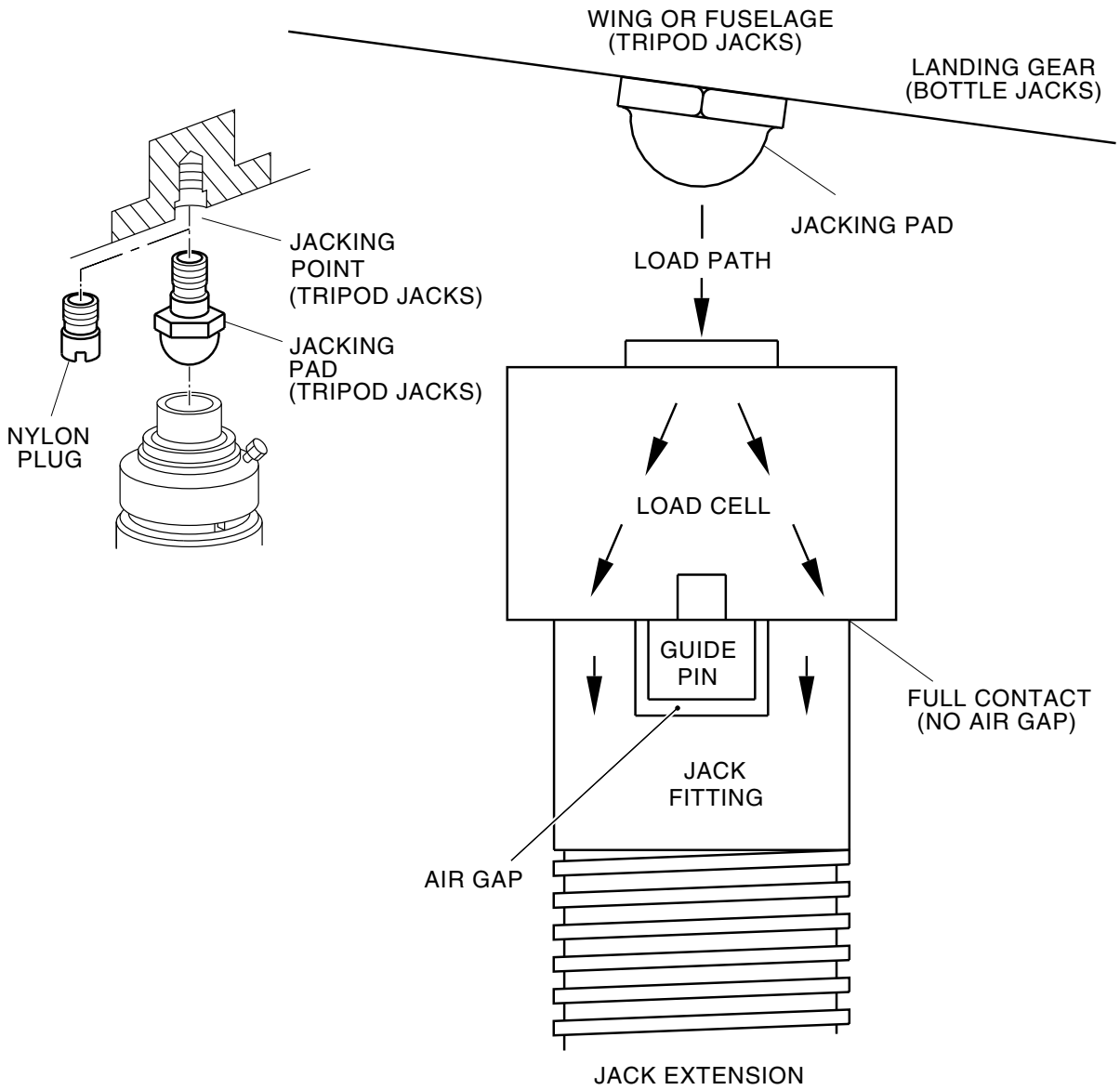
1) The residual indications are less than the permitted equipment limit.

2) The two indications that you get one after the other agree with the tolerance of the aircraft weighing kit.





EFFECTIVITY: ALL



Load Cell and Jacking Pad Arrangement
Figure 2

EFFECTIVITY: ALL

AIRCRAFT WEIGHING RECORDS – TRIPOD JACKS METHOD

DESCRIPTION		CHN	READING lb (kg)	ZERO lb (kg)	WEIGHT lb (kg)	Xarm in. (m)	MOMENT / 1 000 lb in. (kg m)
FIRST READING	LEFT MLG TRIPOD JACK						
	RIGHT MLG TRIPOD JACK						
	NLG TRIPOD JACK						
	AIRCRAFT TOTAL						
SECOND READING	LEFT MLG TRIPOD JACK						
	RIGHT MLG TRIPOD JACK						
	NLG TRIPOD JACK						
	AIRCRAFT TOTAL						
AVERAGE OF READINGS	LEFT MLG TRIPOD JACK						
	RIGHT MLG TRIPOD JACK						
	NLG TRIPOD JACK						
	AIRCRAFT TOTAL						

CG is calculated by equation: $Xarm_{CG}$ = [(Total Moment x 1 000) / Total Weight]

CG position measured in %MAC is calculated as follows:

%MAC = [($Xarm_{CG}$ – LEMAC) / MAC] x 100

Weighing Record Form – Tripod Jacks Method
Figure 3

EFFECTIVITY: ALL

B. Center of Gravity

Refer to Figure 1 and Figure 3.

Calculate the CG as follows:

NOTE: Do this procedure with the copy of the Aircraft Weighing Records – Tripod Jacks Method form used during the Weighing procedure. Refer to Figure 3.

(1) Record the CG of the nose and wing jacking points on the form in the related Xarm fields.

NOTE: The location of the jacking points is always the same unless specified differently.Refer to Figure 1.

(2) Calculate the moment for each jacking point with the formula:

Moment/1 000 = (Weight x Xarm) / 1 000

(3) Record the results on the form in the related Moment/1 000 fields.

(4) Add the weights from the Weight column and the moments from the Moment/1 000 column.

(5) Record the results on the form in the related Aircraft Total fields.

(6) Calculate the CG of the aircraft with the formula:

$Xarm_{CG}$ = [(Total Moment x 1 000) / Total Weight]

(7) Calculate the CG as a percentage of mean aerodynamic chord (%MAC) with the value of the CG of the aircraft calculated in the step above.

NOTE: The formula to calculate the CG position as a percentage of the MAC is:

%MAC (imperial) = [($Xarm_{CG}$ – 556.675) / 112.22] x 100

%MAC (SI) = [($Xarm_{CG}$ – 14.13) / 2.85] x 100

(8) Fill the Average of Readings section of the form as follows:

(a) In the Weight column, take the related jacking point values from the First Reading and the Second Reading sections.

(b) For each jacking point, divide the sum of the two values by two to find the average.

(c) Record the results in the related Average of Readings fields.

(d) Do the steps again for the Xarm column and Moment/1 000 column.

C. Example

The Table 1A (imperial units) and Table 1B (SI units) that follow give an example to calculate the aircraft weight and CG of the aircraft when you weigh it on tripod jacks:

Table 1A – Example to Calculate the Aircraft Weight and CG on Tripod Jacks (Imperial Units)

Description		Chn	Reading	Zero	Weight	Xarm	Moment/ 1 000
			lb	lb	lb	in.	lb in.
First Reading	Left MLG Tripod Jack	1	12 046	0	12 046	636.1	7 662.7
	Right MLG Tripod Jack	2	12 160	0	12 160	636.1	7 735.2
	NLG Tripod Jack	3	3 356	7	3 349	319.8	1 070.8
	Aircraft Total		27 562	7	27 555	597.7	16 468.7
Second Reading	Left MLG Tripod Jack	2	12 087	0	12 087	636.1	7 688.8
	Right MLG Tripod Jack	3	12 084	5	12 079	636.1	7 683.7
	NLG Tripod Jack	1	3 367	0	3 367	319.8	1 076.6
	Aircraft Total		27 538	5	27 533	597.4	16 449.1
Average (Avg) of Readings	Left MLG Tripod Jack				12 067	636.1	7 675.7
	Right MLG Tripod Jack				12 120	636.1	7 709.4
	NLG Tripod Jack				3 358	319.8	1 073.7
	Aircraft Total				27 544	597.5	16 458.9

CG is calculated by equation: $Xarm_{CG}$ = [(Total Moment x 1 000) / Total Weight]

First reading: $Xarm_{CG}$ = [(16 468.74 x 1 000) / 27 555] = 597.7 in.

Average reading: $Xarm_{CG}$ = [(16 458.89 x 1 000) / 27 544] = 597.5 in.

CG position measured in %MAC is calculated as follows:

%MAC = [($Xarm_{CG}$ – 556.675) / 112.22] x 100

Average %MAC = [(597.5 – 556.675) / 112.22] x 100 = 36.4%

Table 1B – Example to Calculate the Aircraft Weight and CG on Tripod Jacks (SI Units)							
Description		Chn	Reading	Zero	Weight	Xarm	Moment/ 1 000
			kg	kg	kg	m	kg m
First Reading	Left MLG Tripod Jack	1	5 464	0	5 464	16.16	88.299
	Right MLG Tripod Jack	2	5 516	0	5 516	16.16	89.134
	NLG Tripod Jack	3	1 522	3	1 519	8.12	12.335
	Aircraft Total		12 502	3	12 499	15.18	189.768
Second Reading	Left MLG Tripod Jack	2	5 483	0	5 483	16.16	88.599
	Right MLG Tripod Jack	3	5 481	2	5 479	16.16	88.541
	NLG Tripod Jack	1	1 527	0	1 527	8.12	12.401
	Aircraft Total		12 491	2	12 489	15.18	189.541
Average of Readings	Left MLG Tripod Jack				5 473	16.16	88.449
	Right MLG Tripod Jack				5 497	16.16	88.837
	NLG Tripod Jack				1 523	8.12	12.368
	Aircraft Total				12 494	15.18	189.655
CG is calculated by equation: $Xarm_{CG}$ = [(Total Moment x 1 000) / Total Weight] First reading: $Xarm_{CG}$ = [(189.8 x 1 000) / 12 499] = 15.18 m Average reading: $Xarm_{CG}$ = [(189.7 x 1 000) / 12 494] = 15.18 m CG position measured in %MAC is calculated as follows: %MAC = [($Xarm_{CG}$ – 14.13 / 2.85) x 100] Average %MAC = [(15.18 – 14.13 / 2.85) x 100] = 36.8%							

4. Weighing on Platform Scales and Jack Procedure

Do the steps that follow to weigh the aircraft on platform scales and jack and calculate the center of gravity of the aircraft:

A. Weighing

Refer to Figure 4, Figure 5 and Figure 6.

Do the steps that follow:

(1) Do the Job Set–Up Procedure from the Job Set–Up Information section.

(2) Align the three platform scales and ramps with the left and right main landing gears (MLG) and the nose landing gear (NLG).

(3) Make sure that the platform scales are leveled and on a level floor.

(4) Verify and record the platform scale identifications with the corresponding wheel location.

(5) Put the related wheel chocks on their platform scale and set the scales to zero.

(6) Remove the wheel chocks from the platform scales.

(7) Remove the rear fuselage support.

(8) Open the aft equipment–compartment door (182GL) (AMM TASK 52–41–00–010–801).

(9) Put the plumb line through the hole in the bracket at the top of the frame at FS755.50. Refer to Figure 6.

(10) Adjust the plumb line until the point of the plumb bob is approximately 0.5 in (1.27 cm) above the target.

NOTE: If the plumb bob is put higher than 0.5 in (1.27 cm) above the target, the result will not be accurate.

(11) Attach the end of the plumb line to the bracket.

(12) Attach the towbar to the aircraft.

(13) Move the aircraft slowly up the ramps and on the platform scales with a tow vehicle.

WARNING: MAKE SURE THAT THE WHEEL CHOCKS ARE PUT AT THE NOSE WHEEL/TIRE ASSEMBLIES. MOVEMENT OF THE AIRCRAFT CAN CAUSE INJURY TO PERSONS AND DAMAGE TO THE EQUIPMENT.

WARNING: MAKE SURE THAT THE WHEEL CHOCKS ARE PUT AT THE MAIN WHEEL/TIRE ASSEMBLIES. MOVEMENT OF THE AIRCRAFT CAN CAUSE INJURY TO PERSONS AND DAMAGE TO THE EQUIPMENT.

(14) Put the wheel chocks in front of and behind the MLG and NLG wheels. Use the same wheel chocks used to put the platform scales to zero and in the same locations.

(15) Disconnect the towbar from the aircraft.

(16) Do not set the parking brake.

(17) Use a copy of the Aircraft Weighing Records – Platform Scales and Jack Method form to continue with this procedure. Refer to Figure 5.

(18) Find the weight at the NLG platform scale as follows:

(a) Read the NLG weight data from the platform scale.

(b) Record the value on your copy of the form (see table 2A or 2B) in the “Scale Reading” column.

(19) Find the weight at the left and right MLG platform scales as follows:

(a) Read the weight data from each of the MLG platform scales.

(b) Record the related values on your copy of the form (see table 2A or 2B) in the Scale Reading column.

(20) Make the aircraft level as follows:

(a) Remove the nylon plug from the nose jacking point.

(b) Move the ramp away from the NLG platform scale.

(c) Install the jack pad in the nose jacking point.

(d) Put the jack below the nose jack pad.

(e) Extend the jack until it lightly touches the jack pad.

(f) Move the NLG wheel chocks away from the NLG wheels. Do not remove the NLG chocks from the platform scales.

(g) Extend the jack until the aircraft is level in the longitudinal direction.

NOTE: The NLG wheels may or may not be completely off the platform scale.

(h) Lock the jack extension locknut.

(i) Adjust the MLG shock struts to laterally make the aircraft level.

(21) Read the weight data from the left and right MLG platform scales and weight data from the NLG platform scale.

(22) Record the three related values on your copy of the form (see table 2A or 2B) in the “MLG/NLG Weight at Level” column.

(23) Calculate the sum of the left and right MLG readings from the “MLG/NLG Weight at Level” column and record the result on the “MLG Total” line under “MLG Weight Total at Level”.

(24) Calculate the Xarm value for the center line position of the MLG wheel axle as follows:

NOTE: The MLG Xarm position varies with a change in aircraft weight.

(a) Measure the exposed chrome length on each MLG schock strut.

(b) Take the average chrome length of the two measures. This value is called DIMX.

(c) Find the MLG center–line position Xarm with the formula:

Xarm (imp) = $(-0.00123\ DIMX^3 - 0.05209\ DIMX^2 + 0.05661\ DIMX + 620.609)$

Xarm (SI) = $(-0.00051\ DIMX^3 - 0.00854\ DIMX^2 + 0.00365\ DIMX + 15.76349)$

(25) Record the MLG Xarm value on the “MLG Total” line, under “Xarm”, on your copy of the form.

(26) Lift the aircraft sufficiently to release the jack extension locknuts.

(27) Release the jack extension locknuts.

(28) Lower the aircraft slowly until the NLG wheels are fully supported by the platform scale.

(29) Remove the jack from the jack pad and the aircraft.

(30) Remove the jack pad from the jacking point.

(31) Install the nylon plug in the jacking point.

(32) Do an extension check and adjustment of the shock strut as follows:

(a) Make sure that the shock struts of the MLG are set to the correct pressure (AMM TASK 32–11–05–720–801).

(33) Remove the chocks from the MLG wheels.

(34) Put the ramp in position against the platform scale.

(35) Attach the towbar to the aircraft.

(36) Tow the aircraft off the platform scales and down the ramps.

(37) Disconnect the towbar from the aircraft.

(38) Put the same wheel chocks on the same platform scales.

(39) Record the weight indications from all three platforms in the “Scale Residual” column on your copy of the form (see table 2A or 2B).

(40) Verify if all of the recorded “Scale Residual” values are equal to zero:

(a) If the values are equal to zero, no change to the weight data is necessary. Copy the value recorded in the related “Scale Reading” column into the “Weight” column.

(b) If the values are different than zero, change the weight data as follows:

1 If the value is less than zero, add it to the weight recorded in the related “Scale Reading” column. Record the result in the related “Weight” column.

2 If the value is more than zero, substract it from the weight recorded in the related “Scale Reading” column. Record the result in the related “Weight” column.

3 If the value is more than the permitted limit of the equipment, do as follows:

a Do the Weighing on Platform Scales and Jack Procedure again with platform scales turned clockwise to the next wheel location.

b Do this until you get two indications, one after the other, that have the conditions that follow:

1) The residual indications are less than the permitted equipment limit.

2) Consecutive readings are within the manufacturer’s tolerance of the weighing kit.

(41) Calculate the sum of the “Weight” column and record it on the “Aircraft Total” line on your copy of the form (see table 2A or 2B).

(42) Rotate each platform scale clockwise to the next wheel location and repeat the weighing procedure again by completing all pertinent steps between (2) and (41) above until you get two consecutive readings that satisfy the conditions that follow:

(a) The residual readings are less than permitted limit of the equipment.

(b) Consecutive readings are within the tolerance of the manufacturer’s weighing kit.

(43) Fill out the Average (Avg) of Readings section on your copy of the form as follows:

(a) In the “Weight” column, take the related values for the MLG and NLG from the First Reading and Second Reading fields.

(b) Calculate the average of these values.

(c) Record the result in the related “Average (Avg) of Readings” fields.

(d) Repeat the steps (a) to (c) for the related values in the “MLG/NLG Weight at Level” and the ”MLG Weight Total at Level” column.

(e) Calculate the average $Xarm_{MLG}$ with the formula below:

(f) $Xarm_{MLG} = \Sigma MLG_{Weight\ Total}(Level) \times X_{arm} / \Sigma MLG_{Weight\ Total}(Level)$

(g) Record the result on the “MLG Total” line, under the “Xarm” column.

(h) Go to “Section B –Center of Gravity” to calculate the Aircraft CG.

B. Center of Gravity

Refer to Figure 5.

Calculate the Aircraft CG position as follows:

(1) Use the values from the Total Weight and Total MLG Weight columns of the Average (Avg) of Readings fields to continue with this procedure.

(2) Find the Xarm with the formula below:

$Xarm_{(imp)} = 319.75 + [MLG_{Weight\ Total\ Avg}(Level) \times (MLG_{Xarm\ Total\ avg} - 319.75) - NLG_{Weight\ Avg}(Level)\ (32.65) / Total\ Avg\ Weight]$

$Xarm_{(SI)} = 8.12 + [MLG_{Weight\ Total\ Avg}(Level) \times (MLG_{Xarm\ Total\ Avg} - 8.12) - NLG_{Weight\ Avg}(Level)\ (0.83) / Total\ Avg\ Weight]$

(3) Record the Xarm value in the “Aircraft Weight and CG” line on your copy of the Aircraft Weighing Records – Platform Scales and Jack Method form.

C. Example

Table 2A (imperial units) and Table 2B (SI units) that follow give an example to calculate the weight and CG of the aircraft when using the platform scales and jack method.

Table 2A – Example to calculate the Aircraft Weight and CG on Platform Scales and Jack (Imperial Units)

Description		Chn	Scale Reading	Scale Residual	Weight	MLG/ NLG Weight at Level	MLG Weight Total at Level	Xarm
			lb	lb	lb	lb	lb	in.
First Reading	Left MLG Platform Scale	1	14 216	0	14 216	14 216	n/a	n/a
	Right MLG Platform Scale	2	14 790	0	14 790	14 780	n/a	n/a
	NLG Platform Scale	3	1 948	10	1 938	1802	n/a	n/a
	Aircraft Total		n/a	n/a	30 944	n/a	n/a	n/a
	MLG Total		n/a	n/a	n/a	n/a	28 996	620.6
Second Reading	Left MLG Platform Scale	1	14 200	0	14 200	14 200	n/a	n/a
	Right MLG Platform Scale	3	14 796	0	14 796	14 806	n/a	n/a
	NLG Platform Scale	2	1 938	0	1 938	1 798	n/a	n/a
	Aircraft Total		n/a	n/a	30 934	n/a	n/a	n/a
	MLG Total		n/a	n/a	n/a	n/a	29 006	620.6
Average (Avg) of Readings	Left MLG Platform Scale		n/a	n/a	14 208	n/a	n/a	n/a
	Right MLG Platform Scale		n/a	n/a	14 793	n/a	n/a	n/a
	NLG Platform Scale		n/a	n/a	1 938	1800	n/a	n/a
	MLG Total		n/a	n/a	n/a	n/a	29 001	620.6
	Aircraft Weight and CG		n/a	n/a	30 939	n/a	n/a	599.9

EFFECTIVITY: ALL

Table 2A – Example to calculate the Aircraft Weight and CG on Platform Scales and Jack (Imperial Units)							
Description	**Chn**	**Scale Reading**	**Scale Residual**	**Weight**	**MLG/ NLG Weight at Level**	**MLG Weight Total at Level**	**Xarm**
		lb	**lb**	**lb**	**lb**	**lb**	**in.**
Aircraft CG is calculated by equation as follows: Xarm = 319.75 + [(MLG Weight Total Avg at Level x (MLG Xarm Total Avg – 319.75) – NLG Weight Avg at Level x 32.65) / Total Avg Weight] Xarm = 319.75 + [(29 001 x (620.6 – 319.75) – 1 800 x 32.65) / 30 939] = 599.9 in.							
Conversion of CG position measured to %MAC is calculated as follows: %MAC = [((Xarm – 556.675) / 112.22) x 100] = [((599.9 – 556.675) / 112.22) x 100] = 38.5 Main Landing Centerline–Position is calculated as follows: Main Landing Centerline–Position Xarm = [–0.00123 $DIMX^3$ – 0.05209 $DIMX^2$ + 0.05661 DIMX + 620.609] Where DIMX = Average of the two MLG chrome lengths.							

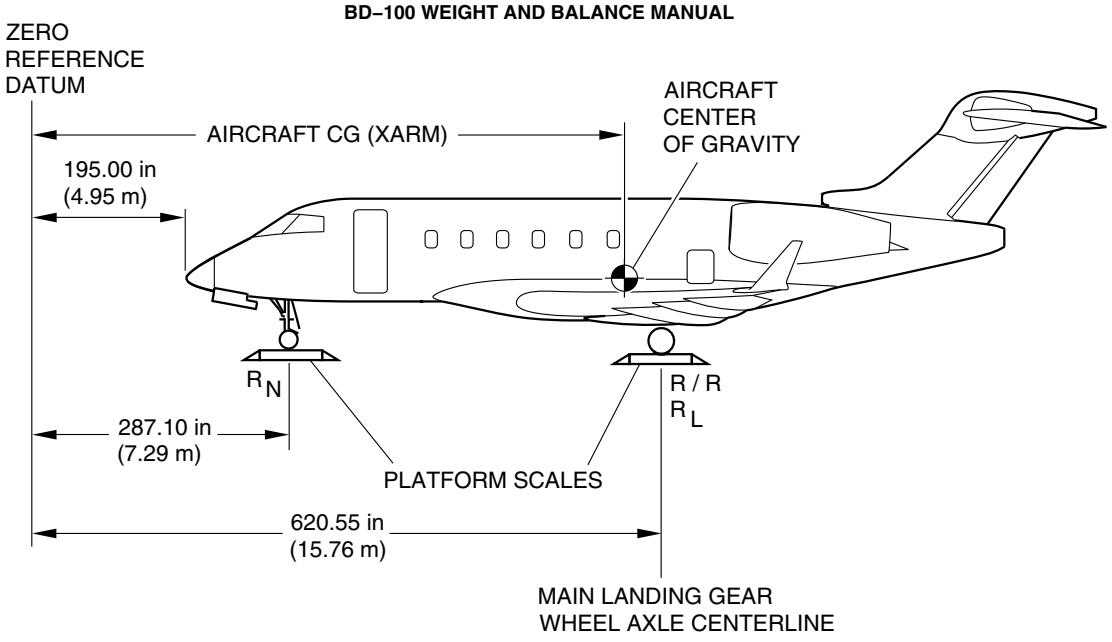
Table 2B – Example to calculate the Aircraft Weight and CG on Platform Scales and Jack (SI Units)

Description		Chn	Scale Reading	Scale Residual	Weight	MLG/ NLG Weight at Level	MLG Weight Total at Level	Xarm
			kg	kg	kg	kg	kg	m
First Reading	Left MLG Platform Scale	1	6 448	0	6 448	6 448	n/a	n/a
	Right MLG Platform Scale	2	6 708	0	6 708	6 704	n/a	n/a
	NLG Platform Scale	3	884	5	879	817	n/a	n/a
	Aircraft Total		n/a	n/a	14 035	n/a	n/a	n/a
	MLG Total		n/a	n/a	n/a	n/a	13 152	15.76
Second Reading	Left MLG Platform Scale	3	6442	0	6442	6 441	n/a	n/a
	Right MLG Platform Scale	2	6 712	0	6 712	6 716	n/a	n/a
	NLG Platform Scale	1	879	0	879	815	n/a	n/a
	Aircraft Total		n/a	n/a	14 033	n/a	n/a	n/a
	MLG Total		n/a	n/a	n/a	n/a	13 157	15.76
Average (Avg) of Readings	Left MLG Platform Scale		n/a	n/a	6 445	n/a	n/a	n/a
	Right MLG Platform Scale		n/a	n/a	6 710	n/a	n/a	n/a
	NLG Platform Scale		n/a	n/a	879	816	n/a	n/a
	MLG Total		n/a	n/a	n/a	n/a	13 155	15.76
	Aircraft Weight and CG		n/a	n/a	14 034	n/a	n/a	15.24

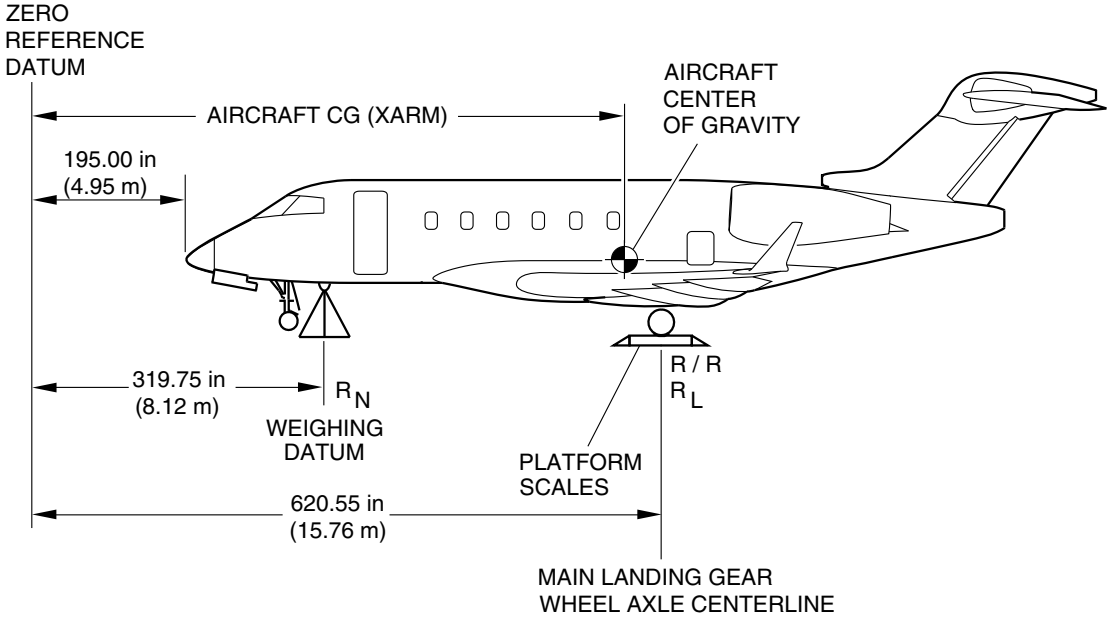
Aircraft CG is calculated by equation:

EFFECTIVITY: ALL

Table 2B – Example to calculate the Aircraft Weight and CG on Platform Scales and Jack (SI Units)							
Description	**Chn**	**Scale Reading**	**Scale Residual**	**Weight**	**MLG/ NLG Weight at Level**	**MLG Weight Total at Level**	**Xarm**
		kg	**kg**	**kg**	**kg**	**kg**	**m**
Xarm = 8.12 + [(MLG Weight Total Avg at level x (MLG Xarm Total Avg – 8.12) – NLG Weight Avg at level x 0.83) / Total Avg Weight] Xarm = 8.12 + [13 155 x (15.76 – 8.12) – 816 x (0.83) / 14 034] = 15.24 m Conversion of CG position measured to %MAC is calculated as follows: %MAC = [(Xarm – 14.13 / 2.85) x 100] = [(15.24 – 14.13 / 2.85) x 100] = 38.8 Main Landing Centerline Position is calculated as follows: Main Landing Position (m) = [–0.00051 $DIMX^3$ – 0.00854 $DIMX^2$ + 0.00365 DIMX + 15.76349] Where DIMX = Average of the two MLG chrome lengths (cm).							



PART 1 OF THE PROCEDURE



PART 2 OF THE PROCEDURE

Weighing on Platform Scales and Jack
Figure 4

EFFECTIVITY: ALL

Aircraft Weighing Records - Platform Scales and Jack Method								
Description		Chn	Scale Reading	Scale Residual	Weight	MLG/NLG Weight at Level	MLG Weight Total at Level	Xarm
			lb (kg)	lb (kg)	lb (kg)	lb (kg)	lb (kg)	in (m)
First Reading	Left MLG Platform Scale						-	-
	Right MLG Platform Scale						-	-
	NLG Platform Scale						-	-
	Aircraft Total		-	-		-	-	-
	MLG Total		-	-	-	-		
Second Reading	Left MLG Platform Scale						-	-
	Right MLG Platform Scale						-	-
	NLG Platform Scale						-	-
	Aircraft Total		-	-		-	-	-
	MLG Total		-	-	-	-		
Average (Avg) of Readings	Left MLG Platform Scale		-	-		-	-	-
	Right MLG Platform Scale		-	-		-	-	-
	NLG Platform Scale		-	-			-	-
	MLG Total		-	-	-	-		
	Aircraft Weight and CG		-	-		-	-	

Aircraft CG is calculated by equation:

Xarm(imp) = 319.75 + [(MLG Weight Total Avg at level x (MLG Xarm Total Avg – 319.75) - NLG Weight Avg at level x 32.65) / Total Avg Weight]
Xarm(SI) = 8.12 + [(MLG Weight Total Avg at level x (MLG Xarm Total Avg – 8.12) - NLG Weight Avg at level x 0.83) / Total Avg Weight]

Conversion of CG position measured to %MAC is calculated as follows:

%MAC(imp) = [(Xarm – 556.675 / 112.22) x 100]

%MAC(SI) = [(Xarm – 14.14 / 2.85) x 100]

Main Landing Centerline Position is calculated as follows:

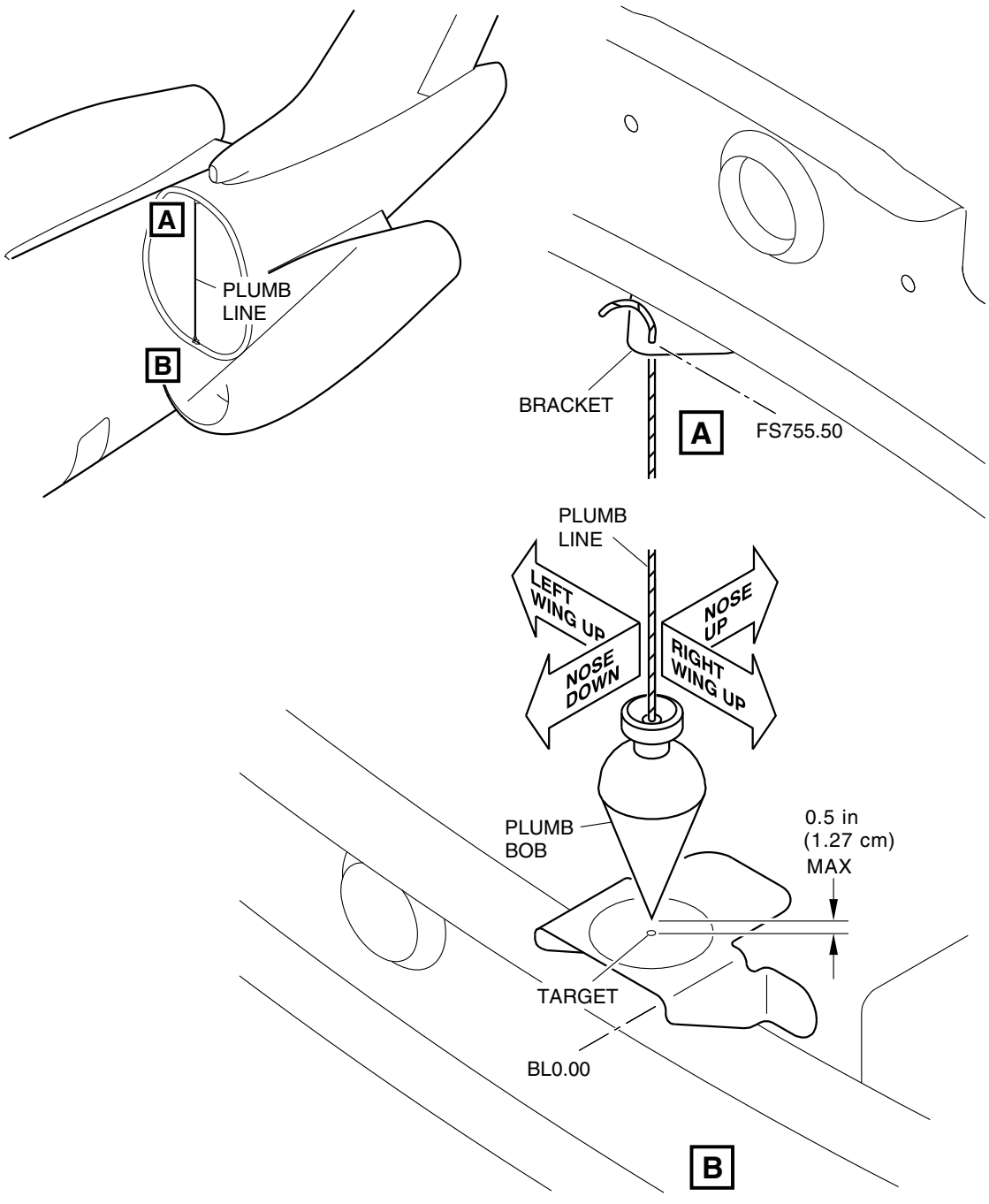
Main Landing Position(imp) = [-0.00123 $DIMX^3$ – 0.05209 $DIMX^2$ + 0.05661 DIMX + 620.609]

Main Landing Position(SI) = [-0.00051 $DIMX^3$ – 0.00854 $DIMX^2$ + 0.00365 DIMX + 15.76349]

Where DIMX = Average of the two MLG chrome lengths.

Weighing Record Form – Platform Scales and Jack Method
Figure 5

EFFECTIVITY: ALL



Weighing Procedures – Leveling with the Plumb Bob
Figure 6

EFFECTIVITY: ALL

5. Close Out

Refer to Figure 6.

A. Do the close out as follows:

(1) Remove the plumb bob from the aft equipment compartment.

(2) Close the aft equipment–compartment door (182GL) (AMM TASK 52–41–00–410–801).

(3) Remove all tools, equipment, and unwanted material from the work area.

(4) Make sure to close all the fuel drain valves.

(5) Put the aircraft back to the standard configuration for maintenance (AMM TASK 12–00–00–867–803).

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BALANCE LIMITS

1. Static Stability

Refer to Figure 1, Figure 3 and (AMM TASK 32–21–05–210–801).

A change in the configuration of the aircraft can cause the aircraft to be in a tip over condition. The changes can include one or more of those that follow:

- Added equipment
- Removal of equipment
- Moved equipment
- Unusual ground equipment
- Snow
- Wind
- Other conditions.

A. Before you complete a configuration change to the aircraft, do the steps that follow to make sure that the aircraft will stay stable:

(1) Make an analysis of the aircraft weight and balance moment impact due to the change in configuration.

(2) Do a check of the new weight and center of gravity of the aircraft as a result of the change in configuration (Subject 01–90–20).

(3) Make sure that the applicable configuration will stay in the safe region.

Refer to Figure 1.

(4) You must take more precautions when there is fresh fallen snow on the horizontal stabilizer and pylons (Refer to Table 1).

(5) You can use the Table 1 that follows for weight and balance calculations for static stability:

Table 1 – Snow Weight and Moment [1]

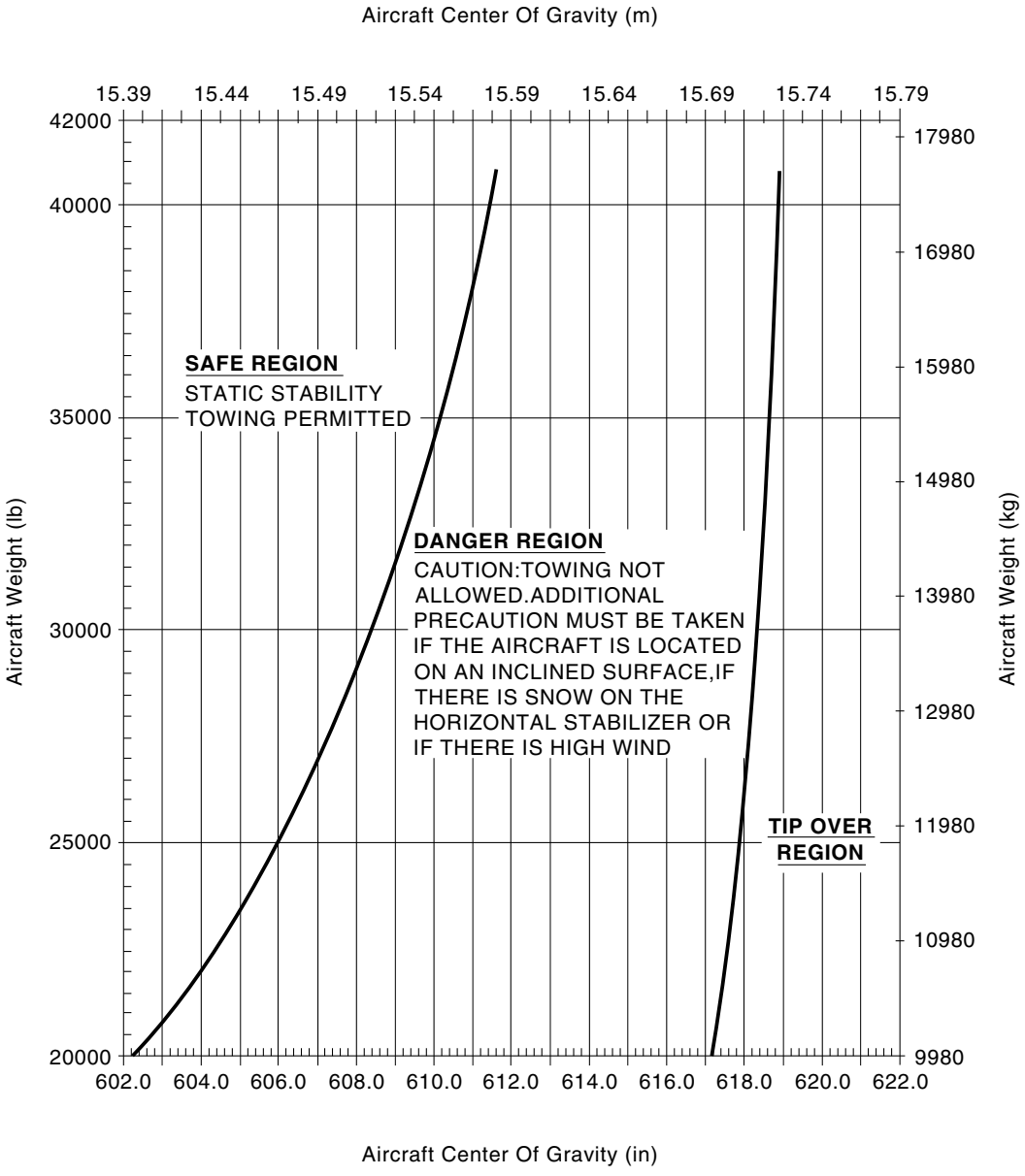
Depth		Weight [2]		Moment/1 000	
in.	m	lb	kg	lb in.	kg m
2	0.05	272	123	240	2.764
4	0.10	544	247	480	5.529
6	0.15	817	371	720	8.293

Table 1 – Snow Weight and Moment [1]					
Depth		Weight [2]		Moment/1 000	
in.	m	lb	kg	lb in.	kg m
8	0.20	1 089	494	960	11.057
10	0.25	1 361	617	1 200	13.821
12	0.30	1 633	741	1 440	16.586
14	0.36	1 906	865	1 679	19.350
16	0.41	2 178	988	1 919	22.114
18	0.46	2 450	1 111	2 159	24.879
20	0.51	2 722	1 235	2 399	27.643
Notes: [1] Fresh fallen snow on horizontal stabilizer and pylon. [2] Assuming snow density of 8 lb/ft³ (128 kg/m³)					

B. If the applicable configuration causes the aircraft to be in the tip over region, do as follows:

(1) Change the configuration in the flight compartment and passenger compartment until the CG is back to a permitted limit.

(2) Obey the load limits of the floor structure and floor panels of the flight compartment and passenger compartment, and the load limits of the fuselage. The values of the load limits are given in Table 2 (Subject 01–80–20).



Balance Limit
Figure 1

EFFECTIVITY: ALL

2. Towing

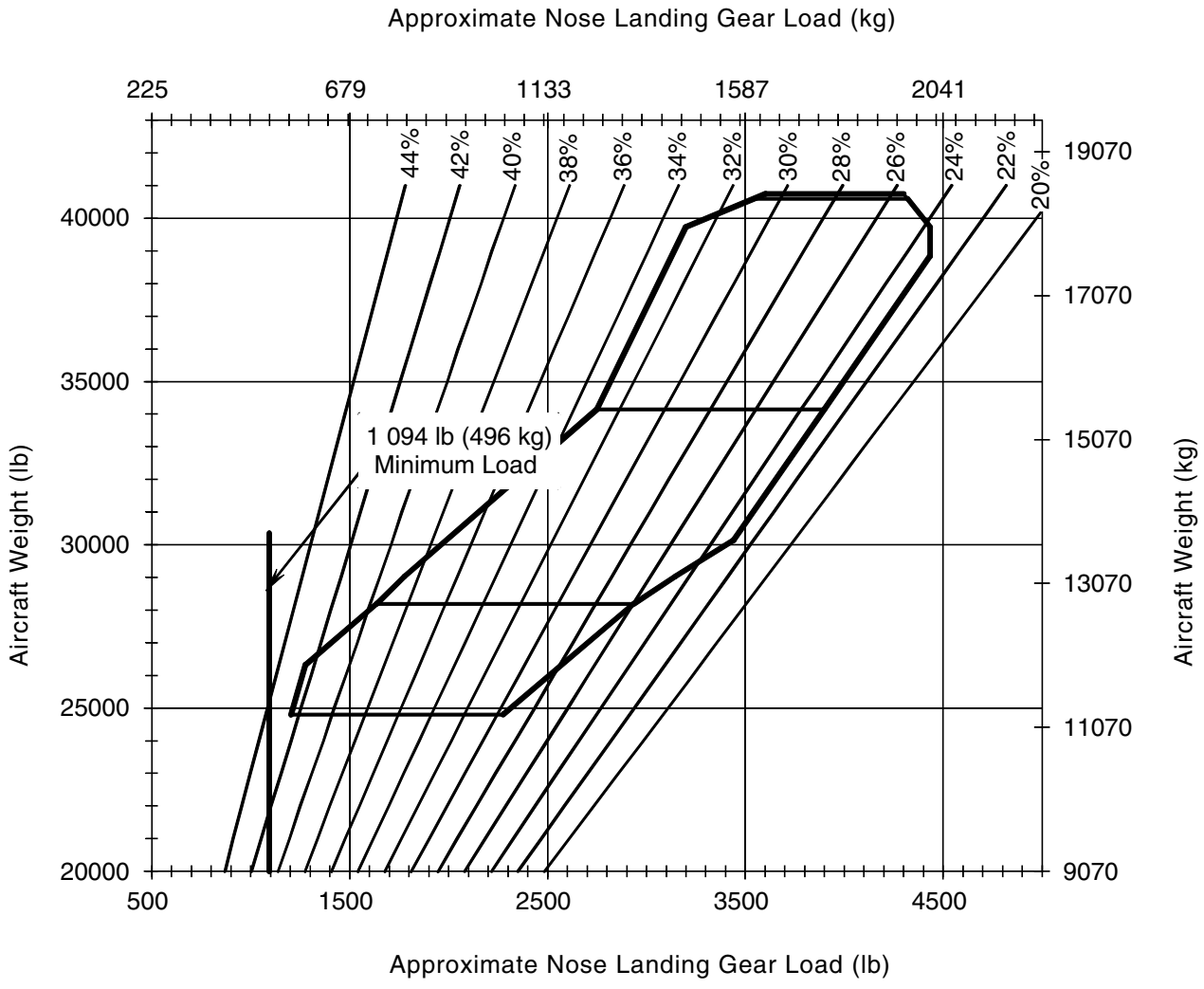
Refer to Figure 2 , Figure 3 and (AMM TASK 32–21–05–210–801).

When you tow the aircraft, you must keep a minimum load on the nose landing gear (NLG). Refer to the applicable ground static–load envelope to find the approximate NLG load related to the aircraft weight and CG.

A. Do the steps that follow when the NLG load is less than the minimum load:

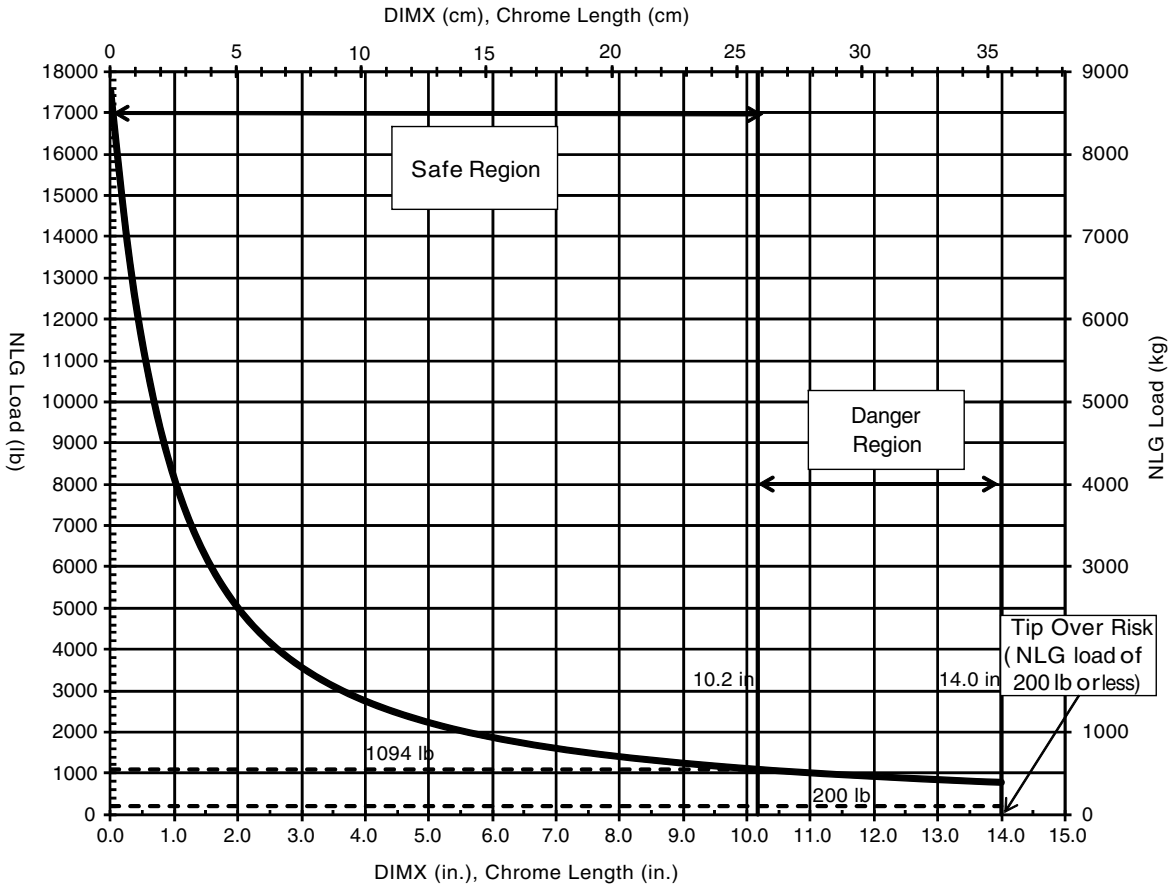
(1) Add ballast in the flight compartment and passenger compartment, as applicable.

(2) Obey the load limits of the floor structure and floor panels, of the flight compartment and passenger compartment, and the load limits of the fuselage. The values of the load limits are given in Table 2 (Subject 01–80–20).



Ground Static–Load Envelope
Figure 2

EFFECTIVITY: ALL



Chrome Length vs Nose–Landing–Gear Load
Figure 3

EFFECTIVITY: ALL

LOADING PROCEDURES AND EXAMPLES

1. General

This section contains the subjects that follow related to loading procedures and examples:

- Operating Weight Empty (Subject 01–90–10)
- Weight Build–Up (Subject 01–90–20)
- CG Slide Method (Subject 01–90–50).

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BD–100 WEIGHT AND BALANCE MANUAL

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OPERATING WEIGHT EMPTY

1. General

This section shows how to calculate the operating weight empty (OWE) and center of gravity (CG) of an aircraft for a given loading scenario. To find the OWE, it is necessary to add the values of the operating items to the true empty weight (TEW). It is necessary to know the value of the OWE to calculate the ramp weight (RW), take–off weight (TOW) and landing weight (LW) with the different procedures given (Subject 01–90–20).

2. Procedure

Refer to Figure 1 and Figure 2.

A. Do the steps that follow to calculate the OWE:

(1) Refer to the example in Table 1. Use a copy of the OWE Calculation Form to continue with this procedure. Refer to Figure 1.

(2) Find the values for the TEW in Chapter 2, Aircraft Reports.

(3) Record these values on the form in the related fields.

(4) Refer to the example in Table 2. Use a copy of the Multiple Item Form (Refer to Figure 2) to calculate the sums for multiple items.

(5) Record the sums of the multiple items on your copy of the OWE Calculation Form.

(6) Do the applicable operations (OP) as shown in Table 1.

OWE CALCULATION FORM							
ITEM	OP	WEIGHT lb (kg)	Xarm in (m)	MOMENT / 1 000 lb in (kg m)	%MAC	REFERENCE	NOTE
TRUE EMPTY WEIGHT (TEW)						LAST WEIGHING RESULT	[1] [2]
OPERATING ITEMS							
FLIGHT COMPARTMENT CREW	+					01–40–10	
CREW BAGGAGE	+					01–40–10	
FLIGHT MANUALS / MAGAZINES	+					01–40–10	
OPERATING WEIGHT EMPTY (OWE)	=						[1]

NOTES:
[1] %MAC (imperial) = [(Xarm – 556.675) / 112.22] x 100
%MAC (SI) = [(Xarm – 14.13) / 2.85] x 100
[2] Last weighing result for TEW given in Chapter 2, Aircraft Reports.

OWE Calculation Form
Figure 1

CWB0190100_001

EFFECTIVITY: ALL

MULTIPLE ITEM FORM			
ITEM	WEIGHT	Xarm	MOMENT / 1 000
	lb (kg)	in (m)	lb in (kg m)

CWB0190100_010

Multiple Item Form
Figure 2

EFFECTIVITY: ALL

3. Example

The example given in the Table 1 and Table 2 that follow shows how to calculate the OWE:

Table 1 – OWE Calculation (Example) [3]

Item	Op	Weight	Xarm	Moment/ 1 000	%MAC	Reference	Note
		lb (kg)	in (m)	lb in (kg m)			
True Empty Weight (TEW)		24 350 (11 045)	606.3 (15.40)	14 763.4 (170.093)	44.2	Last Weighing Result	[1] [2]
Operating Items							
Flight Compartment Crew	+	380 (172)	305.2 (7.75)	116.0 (1.336)		01–40–10	
Crew Baggage	+	40 (18)	383.1 (9.73)	15.3 (0.177)		01–40–10	
Flight Manuals / Magazines	+	30 (14)	320 (8.13)	9.6 (0.111)		01–40–10	
Operating Weight Empty (OWE)	=	24 800 (11 249)	601.0 (15.26)	14 904.3 (171.7)	39.5		[1]

Notes:

[1] %MAC (imperial) = [(Xarm – 556.675) / 112.22] x 100

%MAC (SI) = [(Xarm – 14.13) / 2.85] x 100

[2] Last weighing result for TEW given in Chapter 2, Aircraft Reports.

[3] Information found here is for example only.

Table 2 – Multiple Items (Example) [1]			
Item	**Weight**	**Xarm**	**Moment/1 000**
	lb (kg)	**in (m)**	**lb in (kg m)**
Pilot	190 (86.18)	305.2 (7.75)	58.0 (0.6681)
Copilot	190 (86.18)	305.2 (7.75)	58.0 (0.6681)
Total	380 (172.36)	305.2 (7.75)	116.0 (1.3362)
Pilot Baggage	20 (9.07)	383.1 (9.73)	7.7 (0.0883)
Copilot Baggage	20 (9.07)	383.1 (9.73)	7.7 (0.0883)
Total	40 (18.14)	383.1 (9.73)	15.3 (0.1766)
NOTE: [1] information found here is for example only.			

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BD–100 WEIGHT AND BALANCE MANUAL

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WEIGHT BUILD–UP

1. General

This section shows how to use the weight build–up procedure to calculate the weight and center of gravity (CG) for a given loading scenario. The weight of the passengers and baggage is added to the operating weight empty (OWE) to get the zero fuel weight (ZFW). Then the necessary fuel is added to calculate the ramp weight (RW), take–off weight (TOW), fuel–curve–boundary–points (FCBP) and landing weight (LW).

2. Procedure

Refer to Figure 1, Figure 2, Figure 3, Figure 4, Figure 5, Figure 6, Figure 7, Figure 8 and Figure 9.

A. ZFW Calculation

Refer to Figure 1, Figure 2, Figure 8 and Figure 9.

Do the steps that follow to calculate the ZFW:

(1) Refer to the example in the Table 1 that follows for the calculation of the ZFW:

Table 1 – Weight Build–Up – ZFW Calculation Example [4]

Item	Op	Weight	Xarm	Moment/ 1 000	%MAC	Reference	Note
		lb (kg)	in (m)	lb in (kg m)			
Operating Weight Empty (OWE)	=	24 800 (11 249)	601.0 (15.26)	14 904.3 (171.716)	39.5	01–90–10	[1] [2]
Payload Items							
Check–in Baggage or Cargo	+	80 (36)	650.0 (16.51)	52.0 (0.599)		01–60–00	
Adjustment							
Adjustment	+					01–40–10	[3]
Zero Fuel Weight – ZFW (Gear Down)							
Zero–Fuel–Weight Gear Down (ZFW Gear Down)	=	24 880 (11 285)	601.1 (15.27)	14 956.3 (172.315)	39.6	01–00–50	[2]

Table 1 – Weight Build–Up – ZFW Calculation Example [4]							
Item	**Op**	**Weight**	**Xarm**	**Moment/ 1 000**	**%MAC**	**Reference**	**Note**
		lb (kg)	**in (m)**	**lb in (kg m)**			
Gear Up	+			–4.6 (–0.053)		01–00–80	
Zero Fuel Weight – ZFW (Gear Up)							
Zero–Fuel–Weight Gear Up (ZFW Gear Up)	=	24 880 (11 285)	601.0 (15.26)	14 951.7 (172.262)	39.5	01–00–50	[2]
Notes: [1] Results from previous sum. [2] %MAC (imperial) = [($Xarm_{CG}$ – 556.675) / 112.22] x 100 %MAC (SI) = [($Xarm_{CG}$ – 14.14) / 2.85] x 100 [3] To use when necessary. [4] Information found here is for example only.							

(2) Use a copy of the Weight Build–Up – ZFW Calculation Form to continue with this procedure (Refer to Figure 2).

(3) Refer to the example in Table 1 (Subject 01–90–10).

(4) Take the values for OWE from your copy of the OWE Calculation Form (Figure 1 (Subject 01–90–10)).

(5) Record these values in the applicable fields of your Weight Build–Up – ZFW Calculation Form.

(6) Refer to the example in Table 7.

(7) Use a copy of the Payload Item Form to calculate the sum of payload items (Refer to Figure 8).

(8) Record the sums of the payload items on your Weight Build–Up – ZFW Calculation Form.

(9) Do the applicable operations (Op) as shown in Table 1.

(10) Use a copy of the Weight Build–Up Envelope to continue with this procedure:

– Refer to Figure 1.

(11) Make sure that the value of ZFW is not more than the maximum zero fuel weight (MZFW).

(12) Refer to the example:

– Refer to Figure 1.

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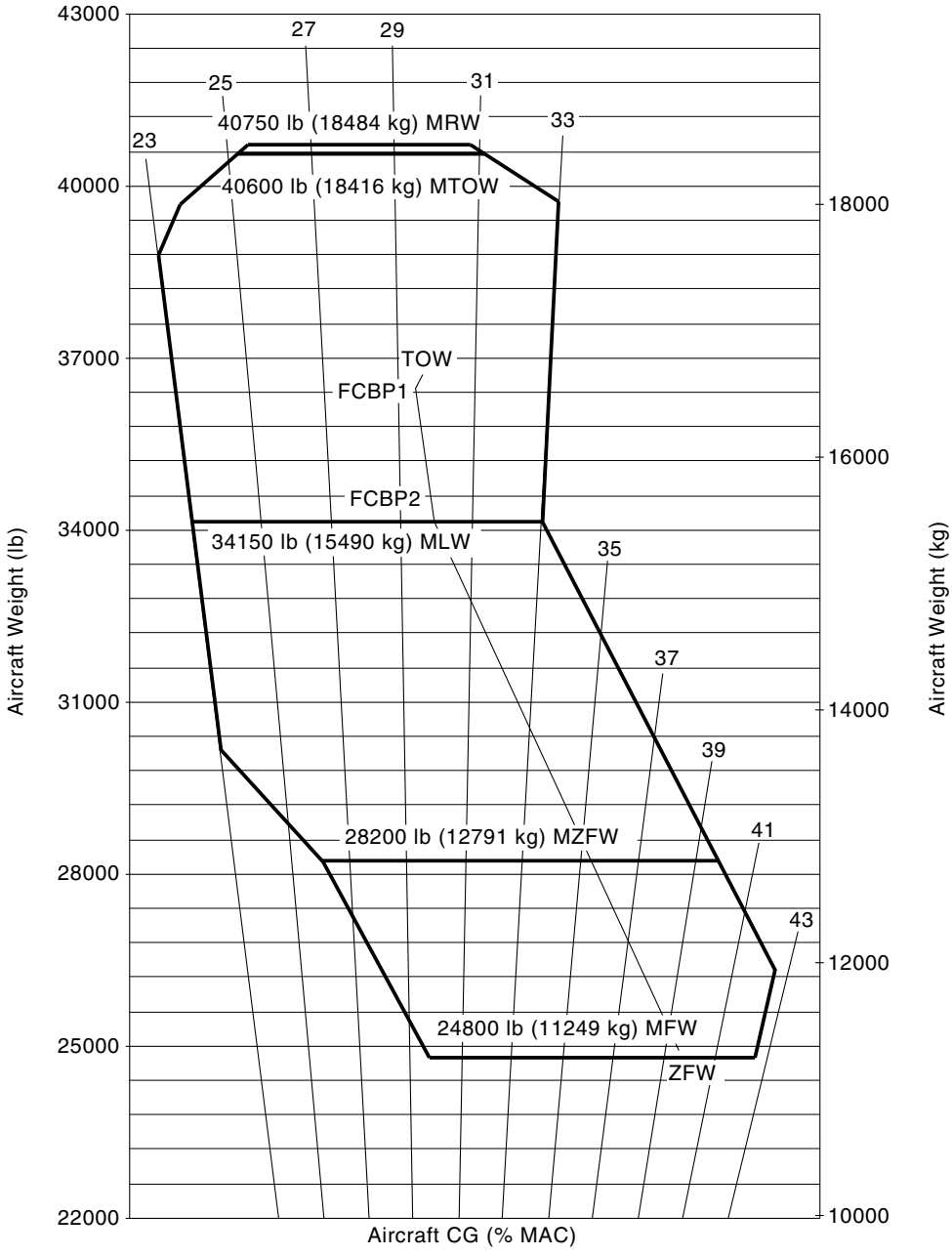

Weight Build–Up Envelope
Figure 1

EFFECTIVITY: ALL

01–90–20 Page 4 Jun 11/2014

WEIGHT BUILD–UP – ZFW CALCULATION FORM							
ITEM	OP	WEIGHT lb (kg)	Xarm in (m)	MOMENT / 1000 lb in (kg m)	%MAC	REFERENCE	NOTE
OPERATING WEIGHT EMPTY (OWE)	=					01–90–10	[1] [2]
PAYLOAD ITEMS							
CHECK–IN BAGGAGE OR CARGO	+					01–60–00	
ADJUSTMENT							
ADJUSTMENT	+					01–40–10	[3]
ZERO FUEL WEIGHT – ZFW (GEAR DOWN)							
ZERO–FUEL–WEIGHT GEAR DOWN (ZFW GEAR DOWN)	=					01–00–50	[2]
GEAR UP	+			–4.6 (–0.053)		01–00–80	
ZERO FUEL WEIGHT – ZFW (GEAR UP)							
ZERO–FUEL–WEIGHT GEAR UP (ZFW GEAR UP)	=					01–00–50	[2]

Notes:
[1] Results from previous sum.
[2] %MAC (imperial) = [(Xarm $_{CG}$ – 556.675) / 112.22] x 100
%MAC (SI) = [(Xarm $_{CG}$ – 14.13) / 2.85] x 100
[3] To use when necessary.

Weight Build–Up – ZFW Calculation Form
Figure 2

B. RW Calculation

Refer to Figure 1 and Figure 3.

Do the steps that follow to calculate the RW:

(1) Refer to the example in the Table 2 that follows for the calculation of the RW:

Table 2 – Weight Build–Up – RW Calculation Example [3]

Item	Op	Weight	Xarm	Moment/ 1 000	%MAC	Reference	Note
		lb (kg)	in (m)	lb in (kg m)			
Zero Fuel Weight – ZFW (Gear Down)							
Zero–Fuel–Weight Gear Down (ZFW Gear Down)	=	24 880 (11 285)	601.0 (15.26)	14 952.4 (172.270)	39.5	01–00–50	[1] [2]
Fuel							
Fuel Tank	+	12 000 (5 443)	566.9 (14.40)	6 802.8 (78.377)		01–20–10	
Ramp Weight – RW (Gear Down)							
Ramp–Weight Gear Down (RW Gear Down)	=	36 880 (16 728)	589.9 (14.98)	21 755.2 (250.647)	29.6	01–00–50	[2]

Notes:
[1] Results from previous sum.
[2] %MAC (imperial) = [($Xarm_{CG}$ – 556.675) / 112.22] x 100
%MAC (SI) = [($Xarm_{CG}$ – 14.14) / 2.85] x 100
[3] To use when necessary.

(2) Use a copy of the Weight Build–Up – RW Calculation Form to continue with this procedure (Refer to Figure 3).

(3) Record the values found for the ZFW gear down.

(4) Record the values for the fuel.

(5) Do the applicable operations as shown in Table 2.

(6) Make sure that the value of RW is not more than the maximum ramp weight (MRW) shown on your copy of the Weight Build–Up Envelope.

(7) Refer to the example:

– Refer to Figure 1.

WEIGHT BUILD–UP – RW CALCULATION FORM							
ITEM	OP	WEIGHT lb (kg)	Xarm in (m)	MOMENT / 1 000 lb in (kg m)	%MAC	REFERENCE	NOTE
ZERO FUEL WEIGHT – ZFW (GEAR DOWN)							
ZERO–FUEL–WEIGHT GEAR DOWN (ZFW GEAR DOWN)	=					01–00–50	[1] [2]
FUEL							
FUEL TANK	+					01–20–10	
RAMP WEIGHT – RW (GEAR DOWN)							
RAMP–WEIGHT GEAR DOWN (RW GEAR DOWN)	=					01–00–50	[2]

Notes:
[1] Results from previous sum.
[2] %MAC (imperial) = $[(Xarm_{CG} – 556.675) / 112.22] \times 100$
%MAC (SI) = $[(Xarm_{CG} – 14.13) / 2.85] \times 100$

Weight Build–Up – RW Calculation Form
Figure 3

EFFECTIVITY: ALL

C. TOW Calculation

Refer to Figure 1 and Figure 4.

Do the steps that follow to calculate the TOW:

(1) Refer to the example in the Table 3 that follows for the calculation of the TOW:

Table 3 Weight Build–Up – TOW Calculation Example [3]

Item	Op	Weight	Xarm	Moment/ 1 000	%MAC	Reference	Note
		lb (kg)	in (m)	lb in (kg m)			
Zero Fuel Weight – ZFW (Gear Down)							
Zero–Fuel–Weight Gear Down (ZFW Gear Down)	=	24 880 (11 285)	601.0 (15.26)	14 952.4 (172.270)	39.5	01–00–50	[1] [2]
Fuel							
Remaining Fuel Prior Take–Off	+	11 850 (5 375)	566.5 (14.39)	6 713.0 (77.342)		01–20–10	
Take–Off Weight – TOW (Gear Down)							
Take–Off–Weight Gear Down (TOW Gear Down)	=	36 730 (16 660)	589.9 (14.98)	21 665.4 (249.612)	29.6	01–00–50	[2]

Notes:
[1] Results from previous sum.
[2] %MAC (imperial) = [($Xarm_{CG}$ – 556.675) / 112.22] x 100
%MAC (SI) = [($Xarm_{CG}$ – 14.13) / 2.85] x 100
[3] To use when necessary.

(2) Use a copy of the Weight Build–Up – TOW Calculation Form to continue with this procedure (Refer to Figure 4).

(3) Record the values found for the ZFW gear down.

(4) Record the values for the fuel.

(5) Do the applicable operations (Op) as shown in Table 3.

(6) Make sure that the value of TOW is not more than the maximum take–off weight (MTOW) shown on your copy of the Weight Build–Up Envelope.

(7) Refer to the example:

– Refer to Figure 1.

WEIGHT BUILD–UP – TOW CALCULATION FORM							
ITEM	OP	WEIGHT lb (kg)	Xarm in (m)	MOMENT 1 000 lb in (kg m)	%MAC	REFERENCE	NOTE
ZERO FUEL WEIGHT – ZFW (GEAR DOWN)							
ZERO–FUEL–WEIGHT GEAR DOWN (ZFW GEAR DOWN)	=					01–00–50	[1] [2]
FUEL							
REMAINING FUEL PRIOR TAKE–OFF	+					01–20–10	
TAKE–OFF WEIGHT – TOW (GEAR DOWN)							
TAKE–OFF–WEIGHT GEAR DOWN (TOW GEAR DOWN)	=					01–00–50	[2]

Notes:

[1] Results from previous sum.

[2] %MAC (imperial) = $[(Xarm_{CG} - 556.675) / 112.22] \times 100$

%MAC (SI) = $[(Xarm_{CG} - 14.13) / 2.85] \times 100$

Weight Build–Up – TOW Calculation Form
Figure 4

D. FCBP1 Calculation

Refer to Figure 5.

Do the steps that follow to calculate the FCBP1:

(1) Refer to the example in the Table 4 that follows for the calculation of the FCBP1:

Table 4 – Weight Build–Up – FCBP1 Calculation Example [3]

Item	Op	Weight	Xarm	Moment/ 1 000	%MAC	Reference	Note
		lb (kg)	in (m)	lb in (kg m)			
Zero Fuel Weight – ZFW (Gear Down)							
Zero–Fuel–Weight Gear Down (ZFW Gear Down)	=	24 880 (11 285)	601.0 (15.26)	14 952.4 (172.270)	39.5	01–00–50	[1] [2]
Fuel							
Fuel Quantity for Fuel–Curve Boundary–Point	+	11 660 (5 289)	566.1 (14.38)	6 600.7 (76.049)		01–20–10	
Fuel–Curve Boundary–Point 1 – FCBP1 (Gear Down)							
Fuel–Curve Boundary–Point 1 – FCBP1 (Gear Down)	=	36 540 (16 574)	589.8 (14.98)	21 553.1 (248.318)	29.6		[2]
Add Gear Retraction Moment	+			–4.6 (–0.053)		01–00–80	[4]
Fuel–Curve Boundary–Point 1 – FCBP1 (Gear Up)							
Fuel–Curve Boundary–Point 1 – FCBP1 (Gear Up)	=	36 540 (16 574)	589.7 (14.98)	21 548.5 (248.265)	29.5	01–00–50	[2]

Notes:
[1] Results from previous sum.
[2] %MAC (imperial) = [($Xarm_{CG}$ – 556.675) / 112.22] x 100
%MAC (SI) = [($Xarm_{CG}$ – 14.14) / 2.85] x 100
[3] Information found here is for example only.
[4] The total aircraft moment decreases by approximately 4 600 lb in (53 kg m) when the landing gears are retracted.

(2) Use a copy of the Weight Build–Up – FCBP1 Calculation Form to continue with this procedure (Refer to Figure 5).

(3) Record the values found for the ZFW gear down.

(4) Do the applicable operations (Op) as shown in Table 4.

NOTE: The values found for the FCBP1 will be used to complete your weight build–up envelope (Refer to Figure 1).

WEIGHT BUILD–UP – FCBP1 CALCULATION FORM							
ITEM	OP	WEIGHT lb (kg)	Xarm in (m)	MOMENT / 1000 lb in (kg m)	%MAC	REFERENCE	NOTE
ZERO FUEL WEIGHT – ZFW (GEAR DOWN)							
ZERO–FUEL–WEIGHT GEAR DOWN (ZFW GEAR DOWN)	=					01–00–50	[1] [2]
FUEL							
FUEL QUANTITY FOR FUEL–CURVE BOUNDARY–POINT	+	11660 (5289)	566.1 (14.38)	6600.7 (76.049)		01–20–10	
FUEL–CURVE BOUNDARY–POINT 1 – FCBP1 (GEAR DOWN)							
FUEL–CURVE BOUNDARY–POINT 1 – FCBP1 (GEAR DOWN)	=						[2]
ADD GEAR RETRACTION MOMENT	+			–4.6 (–0.053)		01–00–80	[3]
FUEL–CURVE BOUNDARY–POINT 1 – FCBP1 (GEAR UP)							
FUEL–CURVE BOUNDARY–POINT 1 – FCBP1 (GEAR UP)	=					01–00–50	[2]

Notes:
[1] Results from previous sum.
[2] %MAC (imperial) = [(Xarm $_{CG}$ – 556.675) / 112.22] x 100
%MAC (SI) = [(Xarm $_{CG}$ – 14.13) / 2.85] x 100
[3] The total aircraft moment decreases by approximately 4600 lb in (53 kg m) when the landing gears are retracted.

Weight Build–Up – FCBP1 Calculation Form

EFFECTIVITY: ALL

E. FCBP2 Calculation

Refer to Figure 6.

Do the steps that follow to calculate the FCBP2:

(1) Refer to the example in the Table 5 that follows for the calculation of the FCBP2:

Table 5 Weight Build–Up – FCBP2 Calculation Example [3]

Item	Op	Weight	Xarm	Moment/ 1 000	%MAC	Reference	Note
		lb (kg)	in (m)	lb in (kg m)			
Zero Fuel Weight – ZFW (Gear Down)							
Zero–Fuel–Weight Gear Down (ZFW Gear Down)	=	24 880 (11 285)	601.0 (15.26)	14 952.4 (172.270)	39.5	01–00–50	[1] [2]
Fuel							
Fuel Quantity for Fuel–Curve Boundary–Point	+	9 310 (4 223)	562.0 (14.27)	5 232.2 (60.282)		01–20–10	
Fuel–Curve Boundary–Point 2 – FCBP2 (Gear Down)							
Fuel–Curve Boundary–Point 2 – FCBP2 (Gear Down)	=	34 190 (15 508)	590.4 (15.00)	20 184.6 (232.552)	30.0		[2]
Add Gear Retraction Moment	+			–4.6 (–0.053)		01–00–80	[4]
Fuel–Curve Boundary–Point 2 – FCBP2 (Gear Up)							
Fuel–Curve Boundary–Point 2 – FCBP2 (Gear Up)	=	34 190 (15 508)	590.2 (14.99)	20 180.0 (232.499)	29.9	01–00–50	[2]

Notes:
[1] Results from previous sum.
[2] %MAC (imperial) = [($Xarm_{CG}$ – 556.675) / 112.22] x 100
%MAC (SI) = [($Xarm_{CG}$ – 14.14) / 2.85] x 100
[3] Information found here is for example only.
[4] The total aircraft moment decreases by approximately 4 600 lb in (53 kg m) when the landing gears are retracted.

(2) Use a copy of the Weight Build–Up – FCBP2 Calculation Form to continue with this procedure (Refer to Figure 6).

(3) Record the values found for the ZFW gear down.

(4) Do the applicable operations (Op) as shown in Table 5.

NOTE: The values found for the FCBP2 will be used to complete your weight build–up envelope (Refer to Figure 1).

WEIGHT BUILD–UP – FCBP2 CALCULATION FORM							
ITEM	OP	WEIGHT lb (kg)	Xarm in (m)	MOMENT / 1000 lb in (kg m)	%MAC	REFERENCE	NOTE
ZERO FUEL WEIGHT – ZFW (GEAR DOWN)							
ZERO–FUEL–WEIGHT GEAR DOWN (ZFW GEAR DOWN)	=					01–00–50	[1] [2]
FUEL							
FUEL QUANTITY FOR FUEL–CURVE BOUNDARY–POINT	+	9310 (4223)	562.0 (14.27)	5232.2 (60.282)		01–20–10	
FUEL–CURVE BOUNDARY–POINT 2 – FCBP2 (GEAR DOWN)							
FUEL–CURVE BOUNDARY–POINT 2 – FCBP2 (GEAR DOWN)	=						[2]
ADD GEAR RETRACTION MOMENT	+			–4.6 (–0.053)		01–00–80	[3]
FUEL–CURVE BOUNDARY–POINT 2 – FCBP2 (GEAR UP)							
FUEL–CURVE BOUNDARY–POINT 2 – FCBP2 (GEAR UP)	=					01–00–50	[2]

Notes:
[1] Results from previous sum.
[2] %MAC (imperial) = [(Xarm $_{CG}$ – 556.675) / 112.22] x 100
%MAC (SI) = [(Xarm $_{CG}$ – 14.13) / 2.85] x 100
[3] The total aircraft moment decreases by approximately 4600 lb in (53 kg m) when the landing gears are retracted.

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Weight Build–Up – FCBP2 Calculation Form
Figure 6

F. LW Calculation

Refer to Figure 1 and Figure 7.

Do the steps that follow to calculate the LW:

(1) Refer to the example in the Table 6 that follows for the calculation of the LW:

Table 6 – Weight Build–Up – LW Calculation Example [3]

Item	Op	Weight	Xarm	Moment/ 1 000	%MAC	Reference	Note
		lb (kg)	in (m)	lb in (kg m)			
Zero Fuel Weight – ZFW (Gear Down)							
Zero–Fuel–Weight Gear Down (ZFW Gear Down)	=	24 880 (11 285)	601.0 (15.26)	14 952.4 (172.270)	39.5	01–00–50	[1] [2]
Fuel							
Remaining Fuel at Landing	+	2 200 (998)	547.4 (13.90)	1 204.3 (13.875)		01–20–10	
Landing Weight – LW (Gear Down)							
Landing–Weight Gear Down (LW Gear Down)	=	27 080 (12283)	596.6 (15.15)	16 156.7 (186.145)	35.6	01–00–50	[2]

Notes:
[1] Results from previous sum.
[2] %MAC (imperial) = [($Xarm_{CG}$ – 556.675) / 112.22] x 100
%MAC (SI) = [($Xarm_{CG}$ – 14.14) / 2.85] x 100
[3] Information found here is for example only.

(2) Use a copy of the Weight Build–Up – LW Calculation Form to continue with this procedure (Refer to Figure 7).

(3) Record the values found for the ZFW gear down.

(4) Record the values for the fuel.

(5) Do the applicable operations as shown in Table 6.

(6) Make sure that the value of LW is not more than the maximum landing weight (MLW) shown on your copy of the Weight Build–Up Envelope.

(7) Refer to the example:

– Refer to Figure 1.

WEIGHT BUILD–UP – LW CALCULATION FORM							
ITEM	OP	WEIGHT lb (kg)	Xarm in (m)	MOMENT / 1 000 lb in (kg m)	%MAC	REFERENCE	NOTE
ZERO FUEL WEIGHT – ZFW (GEAR DOWN)							
ZERO–FUEL–WEIGHT GEAR DOWN (ZFW GEAR DOWN)	=					01–00–50	[1] [2]
FUEL							
REMAINING FUEL AT LANDING	+					01–20–10	
LANDING WEIGHT – LW (GEAR DOWN)							
LANDING–WEIGHT GEAR DOWN (LW GEAR DOWN)	=					01–00–50	[2]

Notes:

[1] Results from previous sum.

[2] %MAC (imperial) = $[(Xarm_{CG} - 556.675) / 112.22] \times 100$

%MAC (SI) = $[(Xarm_{CG} - 14.13) / 2.85] \times 100$

Weight Build–Up – LW Calculation Form
Figure 7

EFFECTIVITY: ALL

G. Payload Item Calculation

Refer to Figure 8.

Do the steps that follow to calculate the payload items:

(1) Refer to the example in the Table 7 that follows for the calculation of the payload items:

Table 7 – Payload Item Calculation Example [1]

Item	Weight	Xarm	Moment/1 000
	lb (kg)	in (m)	lb in (kg m)
Cargo	80 (36)	650.0 (16.51)	52.0 (0.594)
Total	80 (36)	650.0 (16.51)	52.0 (0.594)

NOTE: [1] Information found here is for example only.

(2) Use a copy of the Payload Item Form to continue with this procedure (Refer to Figure 8).

(3) Record the applicable values for each of the payload items on your copy of the Payload Item Form.

(4) Calculate the sum of payload items as shown in Table 7.

NOTE: The sum of payload items is used for the calculation of the ZFW.

PAYLOAD ITEM FORM			
ITEM	WEIGHT	Xarm	MOMENT / 1 000
	lb (kg)	in (m)	lb in (kg m)

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Payload Item Form
Figure 8

EFFECTIVITY: ALL

H. Weight Build–Up Envelope

Refer to Figure 1 and Figure 9.

Do the steps that follow to complete the weight build–up envelope:

(1) Refer to the example:
- Refer to Figure 1.

(2) Use a copy of the Weight Build–Up Envelope to continue with this procedure.

Refer to Figure 9.

(3) Make four points on your copy of the Weight Build–Up Envelope to show the coordinates for the ZFW, TOW, FCBP1 and FCBP2.

(4) Make lines to attach the four points in sequence TOW, FCBP1, FCBP2 and ZFW.

(a) Do not include the fuel–curve boundary–points (FCBP) if they are heavier than the TOW:

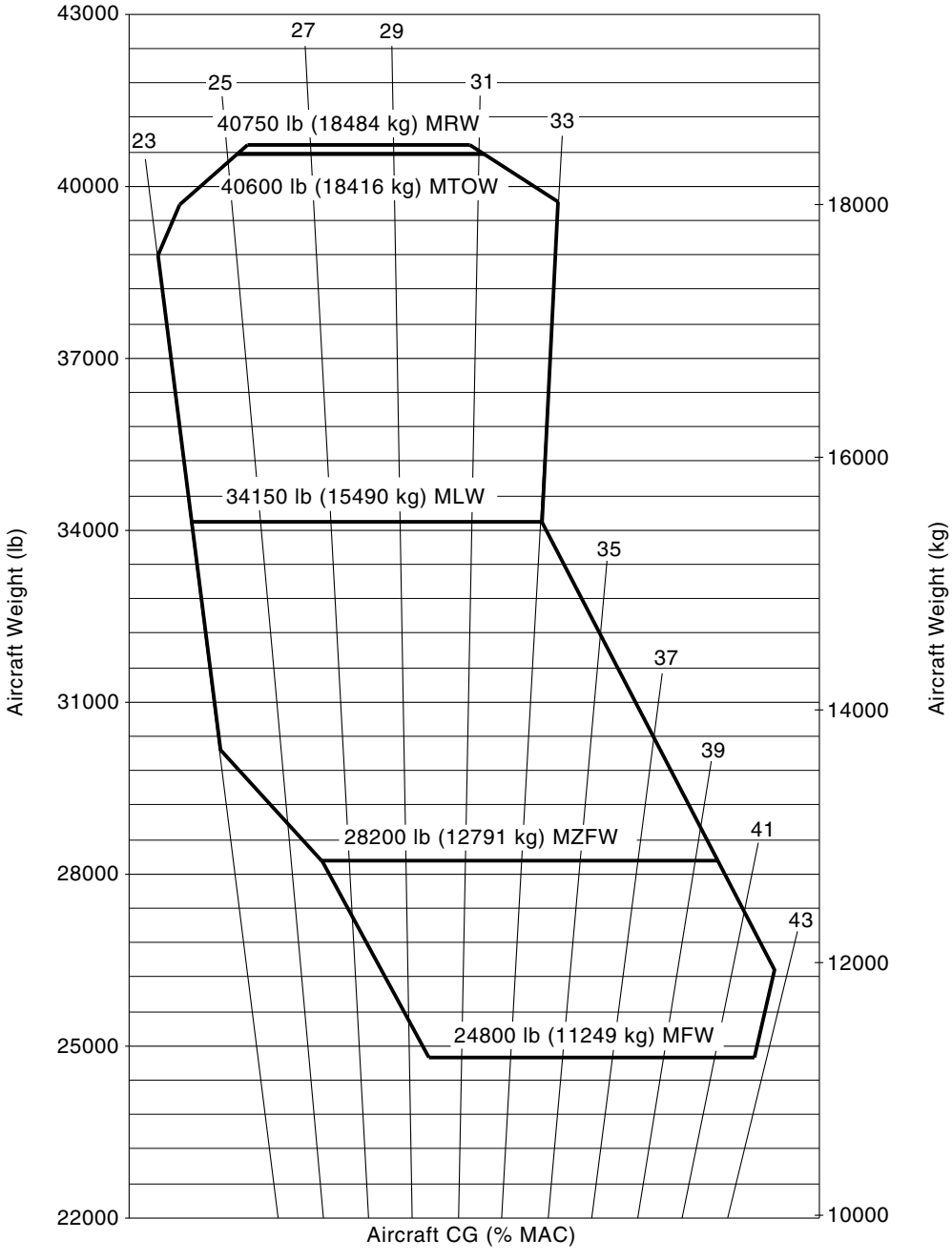
1 If FCBP1 is heavier than the TOW make only lines to attach the TOW, FCBP2 and ZFW points, in sequence.

2 If FCBP1 and FCBP2 are heavier than the TOW make only lines to attach the TOW and ZFW points.

(5) Make sure that the curve obtained is in the inner area of the envelope limits:

(a) If the curve is in the inner area of the envelope limits, the aircraft is safe for take–off.

(b) If a part of the curve is out of the envelope limits, the aircraft is not safe for take–off. You must move, add or remove payload or ballast until the weight and CG of the aircraft are into the envelope limits.



Weight Build–Up Envelope
Figure 9

EFFECTIVITY: ALL

CG SLIDE METHOD

1. Procedure

The SLIDE–A transparent charts are used as an alternative procedure to graphically get the approximate weight and longitudinal CG position during flight.

NOTE: The transparent SLIDE–A – Longitudinal Center of Gravity Envelope and SLIDE–A – Fuel Curve used for this procedure are at the end of this section.

A. Do the steps that follow to correctly use the CG Slide Method:

(1) Calculate the ZFW and longitudinal CG position (%MAC) (Refer to the ZFW Calculation procedure (Subject 01–90–20)).

(2) Make a copy of the applicable SLIDE–A – Longitudinal Center of Gravity Envelope. On your copy, make a point to record the coordinates for ZFW and %MAC.

(3) Put the transparent SLIDE–A – Fuel Curve squarely on top of the transparent SLIDE–A – Longitudinal Center of Gravity Envelope.

(4) Align the bottom point of the fuel curve with the point that you made on the SLIDE–A – Longitudinal Center of Gravity Envelope.

NOTE: The fuel curve that you get with this procedure shows the set of weight and longitudinal CG points along the fuel burn path. In other words, the highest point of the fuel curve shows an aircraft with full fuel tanks. During the flight, the point moves down the fuel curve as the fuel burns.

If the fuel tanks do not contain the maximum of fuel, it is necessary to use only the applicable part of the fuel curve. The applicable part goes from the ZFW point to the point equivalent to the RW of the aircraft for the flight.

(5) Find the weight and longitudinal CG position as a result of the fuel load for the flight.

WARNING: THERE MUST BE NO PART OF THE FUEL CURVE OUT OF THE LONGITUDINAL CG ENVELOPE LIMITS. IT IS NOT SAFE TO OPERATE THE AIRCRAFT IF PART OF THE FUEL CURVE IS OUT OF THE LONGITUDINAL CG ENVELOPE LIMITS. THIS COULD CAUSE INJURY TO PERSONS AND DAMAGE TO THE AIRCRAFT.

(6) Make sure that all of the applicable part of the fuel curve is in the inner area of the longitudinal CG envelope limits.

B. Example

This procedure shows an example of how to use the CG Slide Method. This example uses the values found in the ZFW Calculation procedure (Refer to Table 1 (Subject 01–90–20)). Do the steps that follow:

(1) The values for the example are ZFW=24 880 lb (11 285 kg) and %MAC=39.5.

(2) Make a copy of the applicable transparent SLIDE–A – Longitudinal Center of Gravity Envelope. On your copy, make a point to record the coordinates for ZFW and %MAC.

(3) The aircraft fuel tanks are full. The weight of the fuel load is 14 150 lb (6 418 kg). This fuel load added to the aircraft weight gives an approximate TOW of 39 030 lb (17 703 kg).

(4) From this TOW of 39 030 lb (17 703 kg) the CG Slide Method procedure is used to find that %MAC=30.5 approximately.

(5) It is safe to operate the aircraft because all of the applicable part of the fuel curve is in the inner area of the longitudinal CG envelope limits.

2. SLIDE–A Longitudinal Center of Gravity Envelope 40 750 lb (18 484 kg)

A. For the 40 750 lb (18 484 kg) SLIDE–A Longitudinal Center of Gravity Envelope, Refer to Figure 1.

3. SLIDE–A Fuel Curve Transparency

A. For the SLIDE–A fuel curve, refer to the transparency Refer to Figure 2.

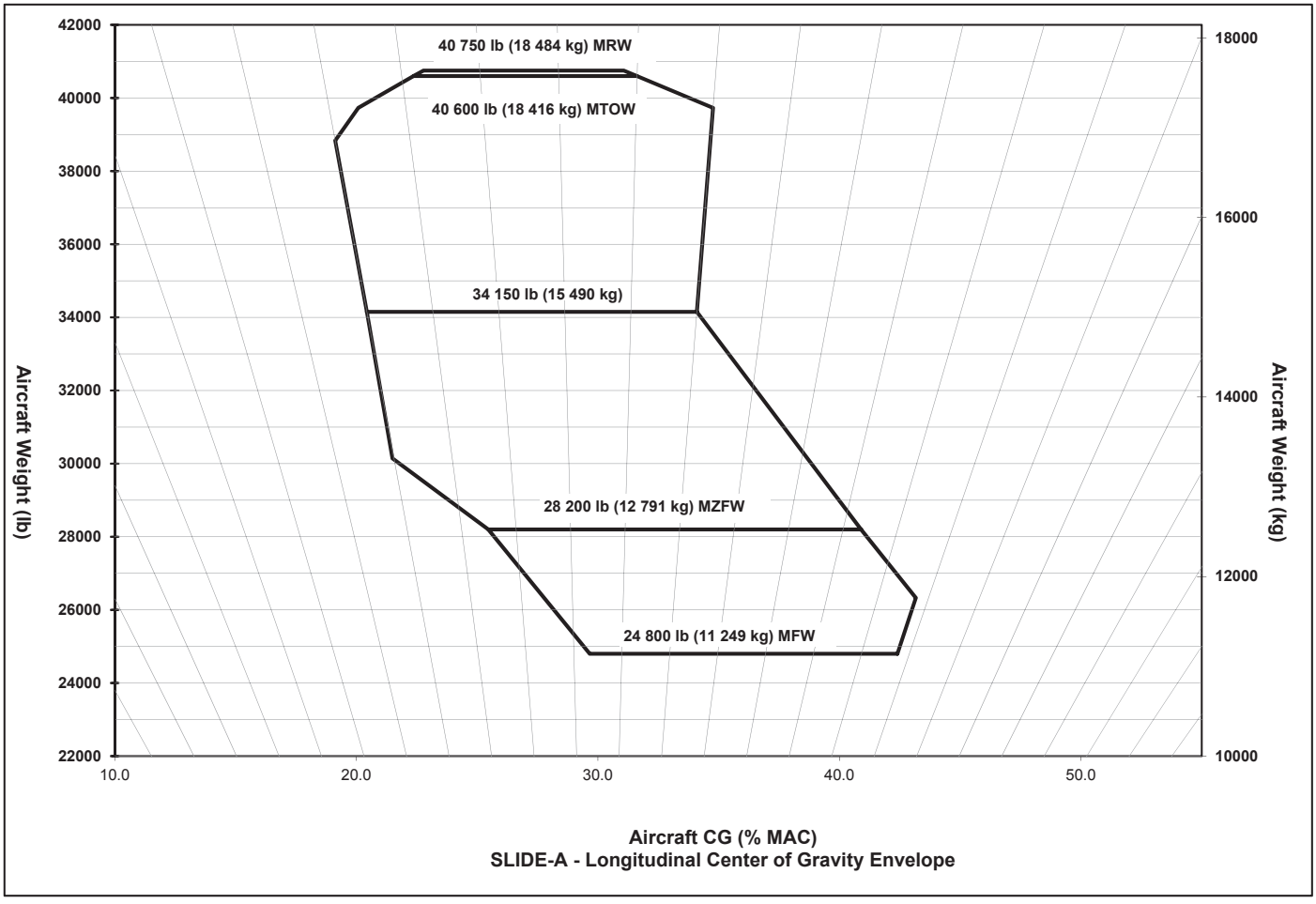

42000
40000
38000
36000
34000
32000
30000
28000
26000
24000
22000
Aircraft Weight (lb)
18000
16000
14000
12000
10000
Aircraft Weight (kg)
40 750 lb (18 484 kg) MRW
40 600 lb (18 416 kg) MTOW
34 150 lb (15 490 kg)
28 200 lb (12 791 kg) MZFW
24 800 lb (11 249 kg) MFW
10.0
20.0
30.0
40.0
50.0
Aircraft CG (% MAC)
SLIDE-A - Longitudinal Center of Gravity Envelope

Figure 1

BD-100 WEIGHT AND BALANCE MANUAL

Figure 2

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