NOTE

Refer to Section 1.6 UNITS OF MEASUREMENT for conversion of SI units to US units and vice versa.

6.2 DATUM PLANE

The Datum Plane (DP) is a plane which is normal to the airplane's longitudinal axis and in front of the airplane as seen from the direction of flight. The airplane's longitudinal axis is parallel with the upper surface of a 600:31 wedge which is placed on top of the rear fuselage in front of the vertical stabilizer. When the upper surface of the wedge is aligned horizontally, the Datum Plane is vertical. The Datum Plane is located 2.194 meters (86.38 in) forward of the most forward point of the root rib on the stub wing.

6.3 MASS AND BALANCE REPORT

The empty mass and the corresponding CG position established before delivery are the first entries in the Mass and Balance Report. Every change in permanently installed equipment, and every repair to the airplane which affects the empty mass or the empty mass CG must be recorded in the Mass and Balance Report.

For the calculation of flight mass and corresponding CG position (or moment), the *current* empty mass and the corresponding CG position (or moment) in accordance with the Mass and Balance Report must always be used.

Condition of the airplane for establishing the empty mass:

- Equipment as per Equipment Inventory (see Section 6.5)
- Including brake fluid, lubricant (6.0 liters = 6.3 qts), coolant (6.0 liters = 6.3 qts), gearbox oil (0.9 liters = 0.95 qts), plus unusable fuel (2 US gal = approx. 7.6 liters).

MASS AND BALANCE REPORT

(Continuous report on structural or equipment changes)

DA 40 D				Serial No.: D4.285			Registration: PH-TIN			Page No.: 1		
				Changes in Mass								
				Addition (+)			Subtraction (-)			Current Empty Mass		
	Entry No.		Description of Part or	Mass	Moment Arm	Moment	Mass	Moment Arm	Moment	Mass	Moment Arm	Moment
Date	IN	OUT	Modification	[kg]	[m]	[kgm]	[kg]	[m]	[kgm]	[kg]	[m]	[kgm]
19.05.06	/	/	upon delivery	/	/	/	/	/	/	831	2.485	2048.3
07-06-2011	/	/	OSB-04-061/2	/	/	/	/	/	/	838	2.47	2069.2

6.4 FLIGHT MASS AND CENTER OF GRAVITY

The following information enables you to operate your DA 40 D within the permissible mass and balance limits. For the calculation of the flight mass and the corresponding CG position the following tables and diagrams are required:

6.4.1 - MOMENT ARMS
6.4.2 - LOADING DIAGRAM
6.4.3 - CALCULATION OF LOADING CONDITION
6.4.4 - PERMISSIBLE CENTER OF GRAVITY RANGE
6.4.5 - PERMISSIBLE MOMENT RANGE

The diagrams should be used as follows:

1. Take the empty mass and the empty mass moment of your airplane from the Mass and Balance Report, and enter the figures in the appropriate boxes under the column marked 'Your DA 40 D' in Table 6.4.3 - CALCULATION OF LOADING CONDITION.

2. Read the fuel quantity indicators to determine the fuel quantity. If an indicator shows 15 US gal, up to 19.5 US gal can be in the Long Range Tank. In this case, the exact quantity must be determined with the alternate mean for fuel quantity indication.

3. Multiply the individual masses by the moment arms quoted to obtain the moment for every item of loading and enter these moments in the appropriate boxes in Table 6.4.3 - CALCULATION OF LOADING CONDITION.

4. Add up the masses and moments in the respective columns. The total moments may be rounded to whole numbers. The CG position is calculated by dividing the total moment by the total mass (using row 5 for the condition with empty fuel tanks, and row 7 for the pre take-off condition). The resulting CG position must be inside the limits.

   As an illustration the total mass and the CG position are entered on Diagram 6.4.4 - PERMISSIBLE CENTER OF GRAVITY RANGE. This checks graphically that the current configuration of the airplane is within the permissible range.

5. Graphical method:

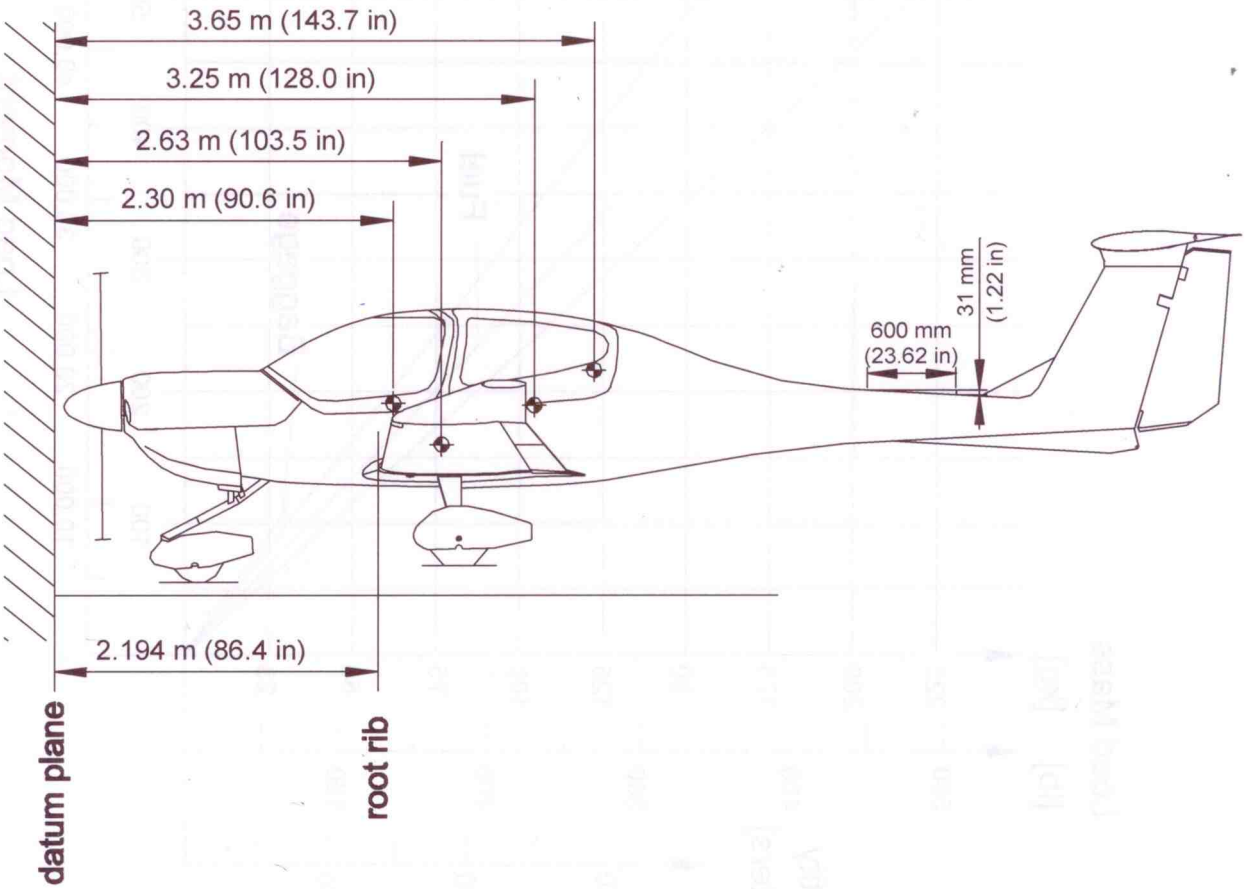
   Diagram 6.4.2 - LOADING DIAGRAM is used to determine the moments. The masses and moments for the individual items of loading are added. Then Diagram 6.4.5 - PERMISSIBLE MOMENT RANGE is used to check whether the total moment associated with the total mass is in the admissible range.

   The result found with the graphical method is however inaccurate. In doubtful cases the result must be verified using the exact method given above.

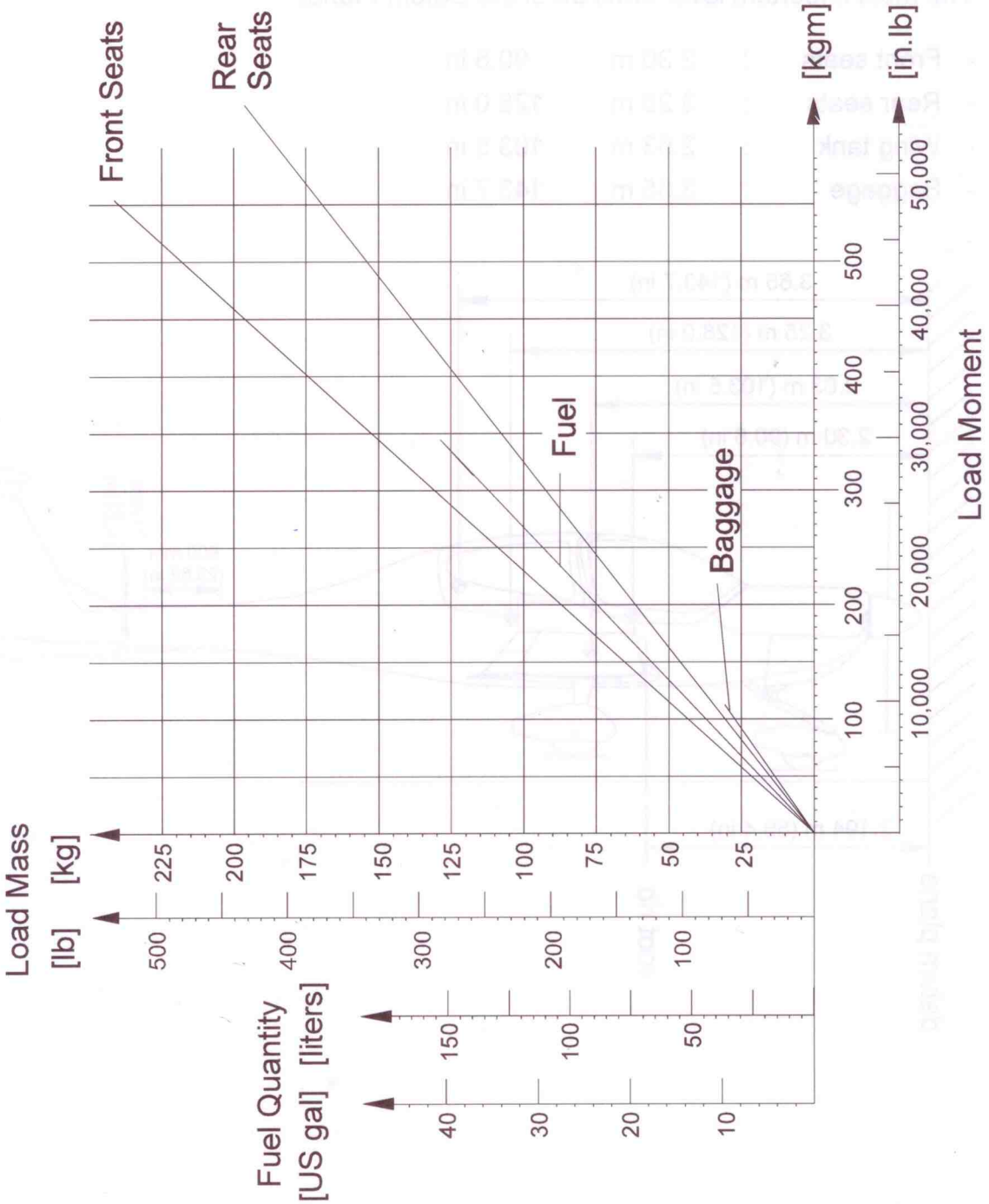
6.4.1 MOMENT ARMS

The most important lever arms aft of the Datum Plane:

- Front seats : 2.30 m 90.6 in
- Rear seats : 3.25 m 128.0 in
- Wing tank : 2.63 m 103.5 in
- Baggage : 3.65 m 143.7 in



6.4.2 LOADING DIAGRAM



6.4.3 CALCULATION OF LOADING CONDITION

a) Standard tank

CALCULATION OF LOADING CONDITION	DA 40 D (Example)		Your DA 40 D	
	Mass [kg] [lb]	Moment [kgm] [in.lb]	Mass [kg] [lb]	Moment [kgm] [in.lb]
1. Empty mass (from Mass and Balance Report)	735 1620	1820 158,000	838	2069.1
2. Front seats Lever arm: 2.30 m (90.6 in)	150 331	345 29,989		
3. Rear seats Lever arm: 3.25 m (128.0 in)	150 331	487.5 42,368		
4. Baggage Lever arm: 3.65 m (143.7 in)	0 0	0 0		
5. Total mass and total moment with empty fuel tanks (Total of 1.-4.)	1035 2282	2652.5 230,357		
6. On-board usable fuel (0.84 kg/liter) (7.01 lb/US gal) Lever arm: 2.63 m (103.5 in)	100.8 222	265.10 23,001		
7. Total mass and total moment with full fuel tanks (Total 5. plus 6.)	1135.8 2504	2917.60 253,357		

8. The total moments from rows 5 and 7 (2652.5 and 2917.6 kgm (30,357 and 53,357 in.lb)) must be divided by the related total mass (1035 and 1135.8 kg (2282 and 2504 lb) respectively) and then located in Diagram 6.4.4 - PERMISSIBLE CENTER OF GRAVITY RANGE.

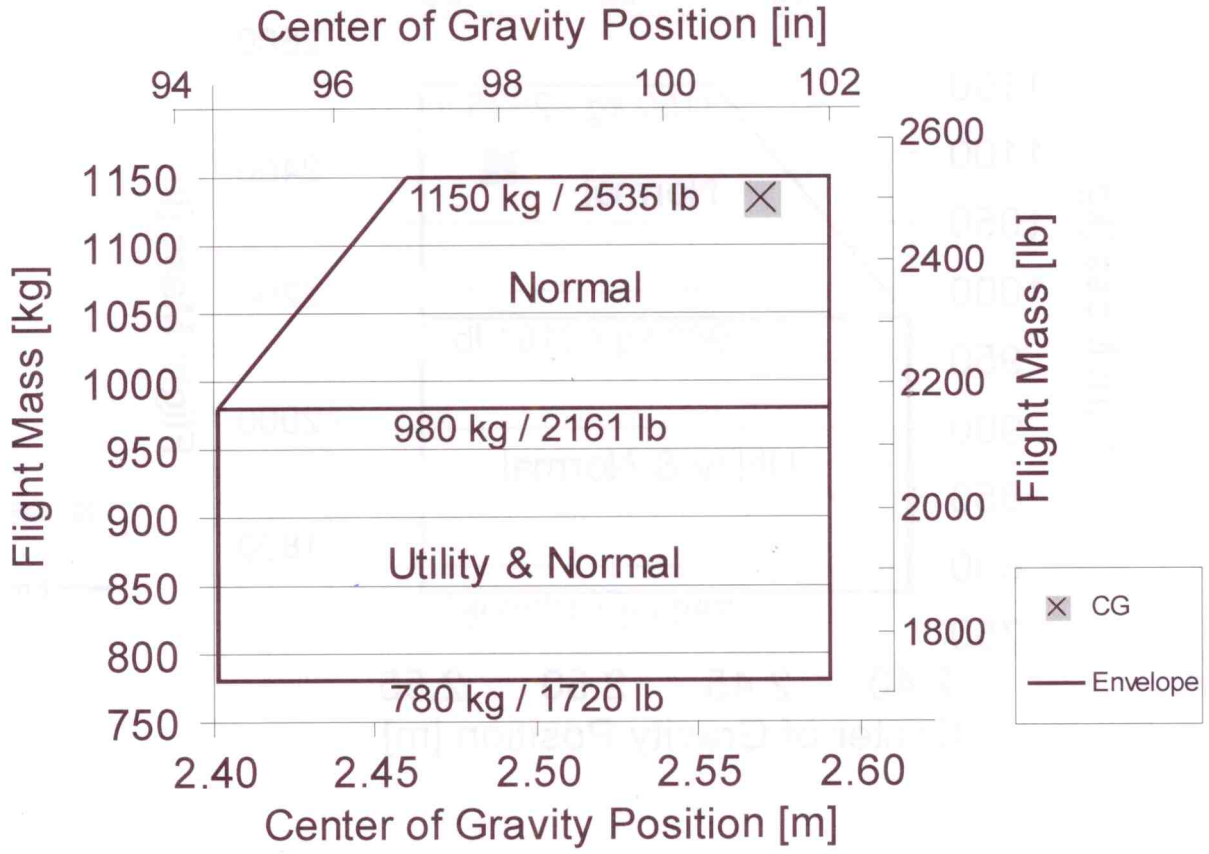
   As in our example CG positions (2.562 m and 2.569 m (100.95 and 101.18 in) respectively) and masses fall into the permitted area, this loading condition is allowable.

b) Long Range Tank

CALCULATION OF LOADING CONDITION	DA 40 D (Example)		Your DA 40 D	
	Mass [kg] [lb]	Moment [kgm] [in.lb]	Mass [kg] [lb]	Moment [kgm] [in.lb]
1. Empty mass (from Mass and Balance Report)	735 *1620*	1820 *158,000*		
2. Front seats Lever arm: 2.30 m *(90.6 in)*	150 *331*	345 *29,989*		
3. Rear seats Lever arm: 3.25 m *(128.0 in)*	80 *176*	260 *22,528*		
4. Baggage Lever arm: 3.65 m *(143.7 in)*	0 *0*	0 *0*		
5. Total mass and total moment with empty fuel tanks (Total of 1.-4.)	965 *2127*	2425 *210,517*		
6. On-board usable fuel (0.84 kg/liter) *(7.01 lb/US gal)* Lever arm: 2.63 m *(103.5 in)*	100.8 *222*	265.10 *22,977*		
7. Total mass and total moment with full fuel tanks (Total 5. plus 6.)	1065.8 *2349*	2690.10 *233,494*		
8. The total moments from rows 5 and 7 (2425 and 2690.1 kgm *(210,517 and 233,494 in.lb)*) must be divided by the related total mass (965 and 1065.8 kg *(2127 and 2349 lb)* respectively) and then located in Diagram 6.4.4 - PERMISSIBLE CENTER OF GRAVITY RANGE. As in our example CG positions (2.513 m and 2.524 m *(98.97 and 99.40 in)* respectively) and masses fall into the permitted area, this loading condition is allowable.				

6.4.4 PERMISSIBLE CENTER OF GRAVITY RANGE

a) Standard tank:



The CG shown in the diagram is that from the example in Table 6.4.3 (a) CALCULATION OF LOADING CONDITION, row 7 (pre take-off condition).

The flight CG position must be within the following limits:

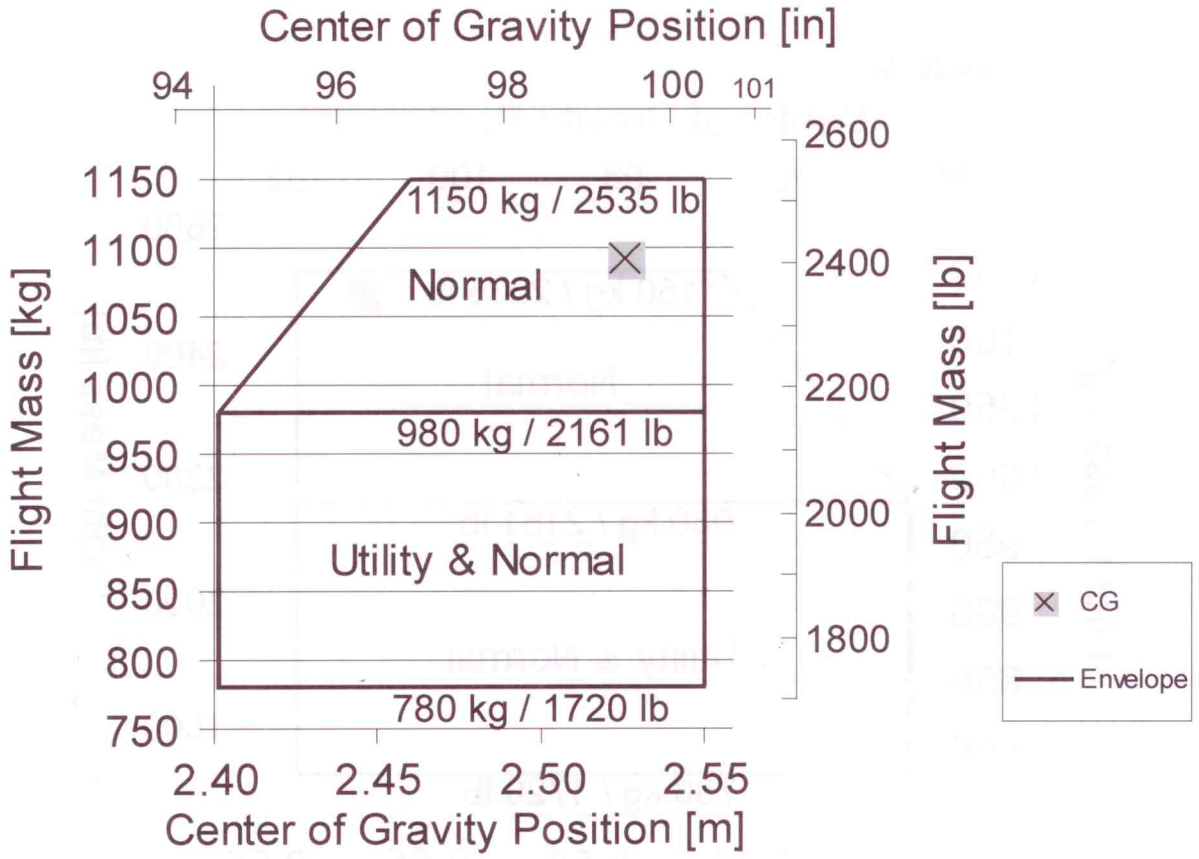
Most forward flight CG:

2.40 m (94.5 in) aft of Datum Plane at 780 to 980 kg (1720 to 2161 lb)
2.46 m (96.9 in) aft of Datum Plane at 1150 kg (2535 lb)
linear variation between these values

Most rearward flight CG:

2.59 m (102.0 in) aft of Datum Plane

b) Long Range Tank



The CG shown in the diagram is that from the example in Table 6.4.3 (b) CALCULATION OF LOADING CONDITION, row 7 (pre take-off condition).

The flight CG position must be within the following limits:

Most forward flight CG:

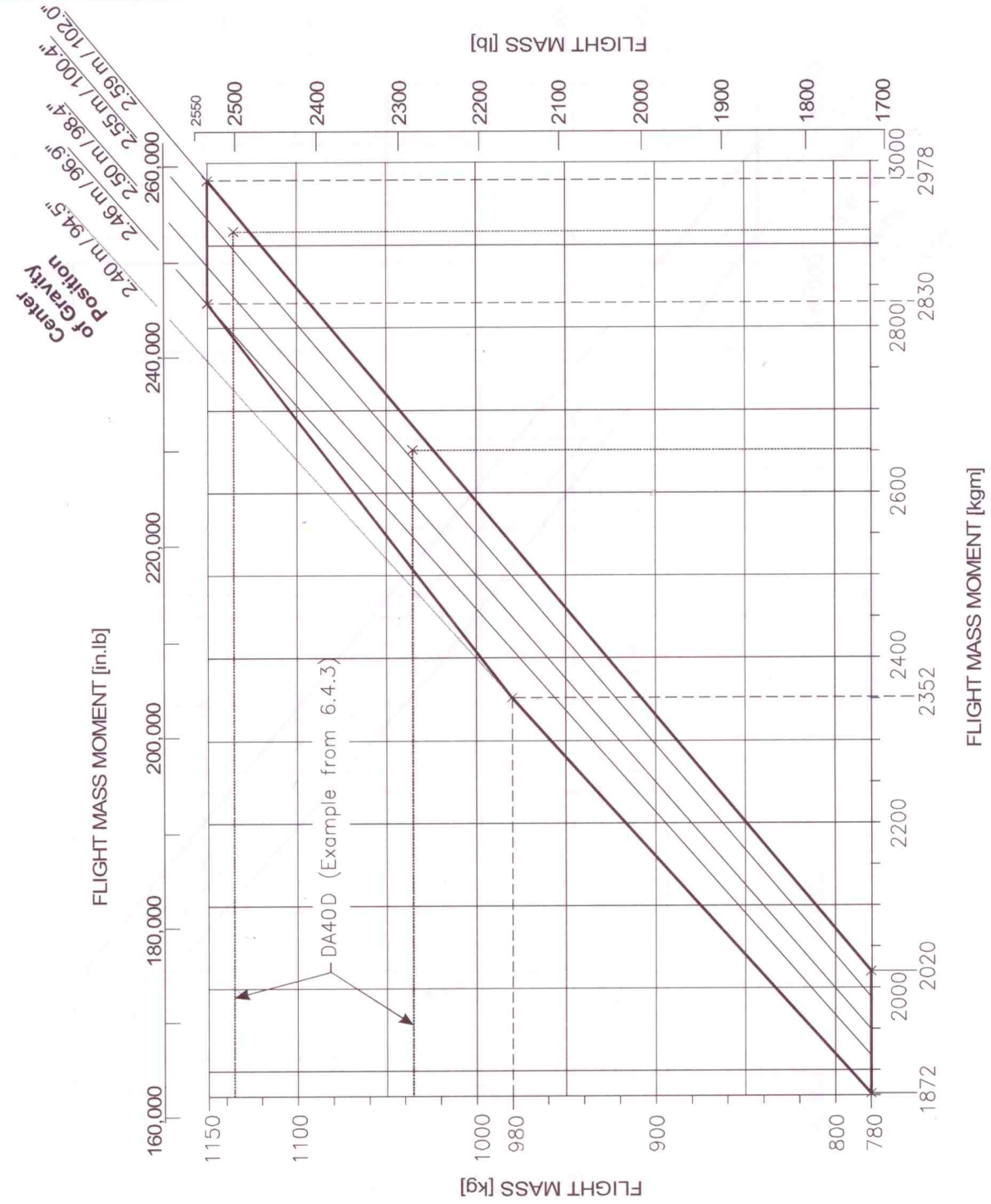
2.40 m (94.5 in) aft of Datum Plane at 780 to 980 kg (1720 to 2161 lb)
2.46 m (96.9 in) aft of Datum Plane at 1150 kg (2535 lb)
linear variation between these values

Most rearward flight CG:

2.55 m (102.0 in) aft of Datum Plane

6.4.5 PERMISSIBLE MOMENT RANGE

a) Standard tank



b) Long Range Tank