
SECTION VI

WEIGHT AND BALANCE, EQUIPMENT LIST

INTRODUCTION

This section describes the procedure for airplane weight, moment and center of gravity determination. Examples for determination of weight, moment and center of gravity of different loading conditions are included.

A listing of the optional equipment installed in your aircraft is contained in the equipment list. This list provides weight and center of gravity arm of all optional equipment, which had been installed in your aircraft at the time of final inspection by the manufacturer.

Please note that specific information about weight, arm, and moment of this aircraft as well as the equipment installed can be seen from the weight and balance record only, which must be carried on board.

AIRPLANE WEIGHING

WEIGHING PROCEDURE

1. PREPARATION

- a) Inflate landing gear struts and tires to the recommended filling levels.
- b) Remove all drainable fuel from the wing tanks.
- c) Refill engine oil to 12 qts (11,4 l).
- d) Move front seats to most forward position and place seatbacks upright.
- e) Install control locking device in order to fix all controls in the neutral position.
- f) Retract wing flaps and close the cabin doors.

2. LEVELING

- a) Place a weighing scale below each wheel (Minimum capacity of the scales 882 lbs (400 kg) for each main wheel, 662 lbs (300 kg) for the nose wheel).
- b) Level the airplane by placing flat wooden sheets below the wheels or by deflating the respective tire.
- c) Leveling datum is the lower edge of the fuselage door frame.

CAUTION

After weighing has been completed, refill the tires to the prescribed levels (see Section II).

3. WEIGHING

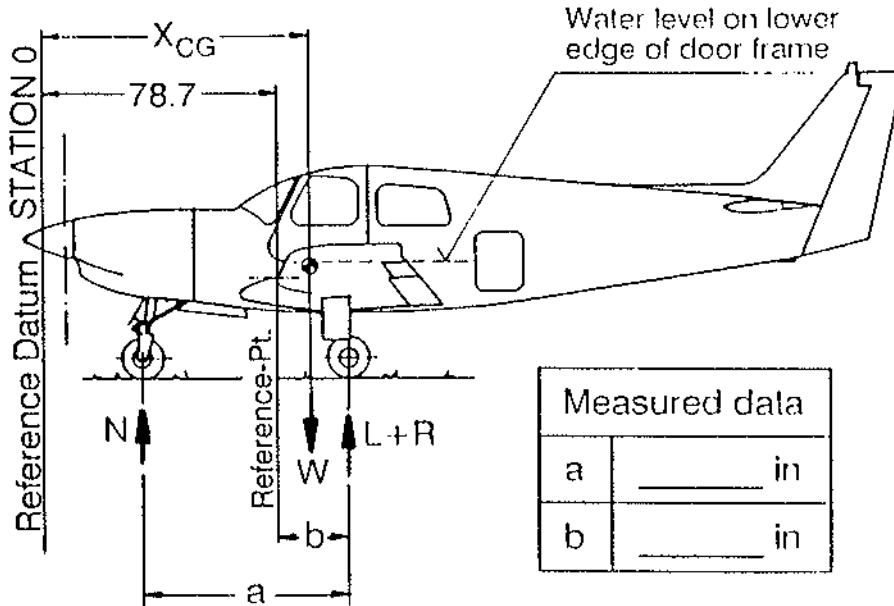
- a) With the airplane leveled and brakes released enter the weight indicated by each scale into the "Airplane Weighing Form" on page 6-6.

- b) Draw a (virtual) line between the axles of both main wheels. Measure the distance to the nose wheel axle parallel to the airplane centerline (distance "a"). Drop a perpendicular from the datum point - buckle of the wing leading edge - at both sides to the ground and measure the distance to the main landing gear (distance "b").

- c) Determine weight and respective center of gravity of the airplane by using the weights from 3a and distances from 3b.

- d) Use the table at the bottom of page 6-6 to determine the basic empty weight of the airplane.

AIRPLANE WEIGHING FORM



Measured data	
a	_____ in
b	_____ in

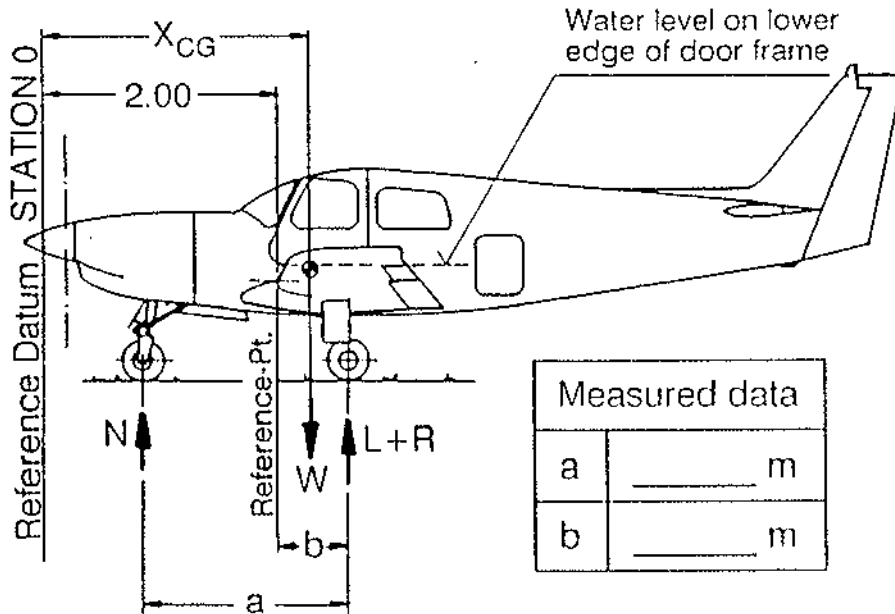
POSITION	SCALE READING	TARE	Symbol	Net Weight
LEFT WHEEL	lbs		L	lbs
RIGHT WHEEL	lbs		R	lbs
NOSE WHEEL	lbs		N	lbs
AIRPLANE TOTAL AS WEIGHED			W	lbs

$$X_{CG} = C. G. ARM = 78.7 + b - \frac{N \cdot a}{W} \text{ [in]}$$

$$X_{CG} = 78.7 + (\quad) - \frac{(\quad) \cdot (\quad)}{(\quad)} = \text{_____ in}$$

ITEM	WEIGHT [lbs]	ARM [in]	= MOMENT [in · lbs]
WEIGHT W (from table above)			
UNUSABLE FUEL (3.7 Gal · 6.0 lbs/Gal)	22.2	82.7	1836
EQUIPM. CHANGES			
BASIC EMPTY WEIGHT			

AIRPLANE WEIGHING FORM (Metric Measurement System)



POSITION	SCALE READING	TARE	Symbol	Net Weight
LEFT WHEEL	kg		L	kg
RIGHT WHEEL	kg		R	kg
NOSE WHEEL	kg		N	kg
AIRPLANE TOTAL AS WEIGHED			W	kg

$$X_{CG} = \text{C. G. ARM} = 2.00 + b - \frac{N \cdot a}{W} \text{ [m]}$$

$$X_{CG} = 2.00 + (\text{ }) - \frac{(\text{ }) \cdot (\text{ })}{(\text{ })} = \text{ } \text{ m}$$

ITEM	WEIGHT [kg]	ARM [m]	= MOMENT [m · kg]
WEIGHT W (from table above)			
UNUSABLE FUEL (14l · 0.72 kg/l)	10.0	2.1	21.0
EQUIPM. CHANGES			
BASIC EMPTY WEIGHT			

LOADING INSTRUCTIONS TO THE PILOT

The pilot bears the sole responsibility for proper loading of the airplane.

Flight safety and performance are affected by loading. The following information shall be used as a guideline for correct loading of your aircraft.

The maximum permissible flight weight of the R-90-230 RG under all approved operating conditions is 2977 lbs (1350 kg).

The maximum payload is determined by subtracting basic empty weight from max. takeoff weight. The airplane has to be operated strictly within the approved center of gravity range.

For correct loading of your aircraft proceed as follows:

Step 1 In order to make sure that you use the actual basic empty weight and center of gravity refer to the latest entry on page 6-7.

REMARK: It is assumed that the oil is always topped up to 12 qts (11.4 l) before each flight. The basic empty weight contains the weight of the oil and is considered to be constant for all calculations.

Enter the correct values for weight and moment/100 in the first line of the table on page 6-13.

Step 2 Determine pilot's weight and seating position. Enter the "Loading Diagram" on page 6-10 at takeoff weight (left side) and proceed horizontally right to the "Pilot and Copilot"-line. From the intersection proceed vertically down to obtain moment/100.

Repeat the same procedure for the copilot.

Enter the weight and moment/100 data in the appropriate line of the "Weight and Balance Determination" table.

Step 3 Proceed as described in step 2 to consider the rear seat passenger(s). Enter the determined values in the table.

Step 4 Repeat step 2 for the fuel on board. Enter weight and moment/100 in the appropriate line.

Step 5 Once again proceed according to step 2 to consider the baggage and enter the values in the table.

Step 6 Sum up all entries in the "Weight"-row. The sum may not exceed 2977 lbs (1350 kg). Then sum up all moment/100 values.

Step 7 Use the "Permissible Center of Gravity Moment Range" diagram (page 6-11).

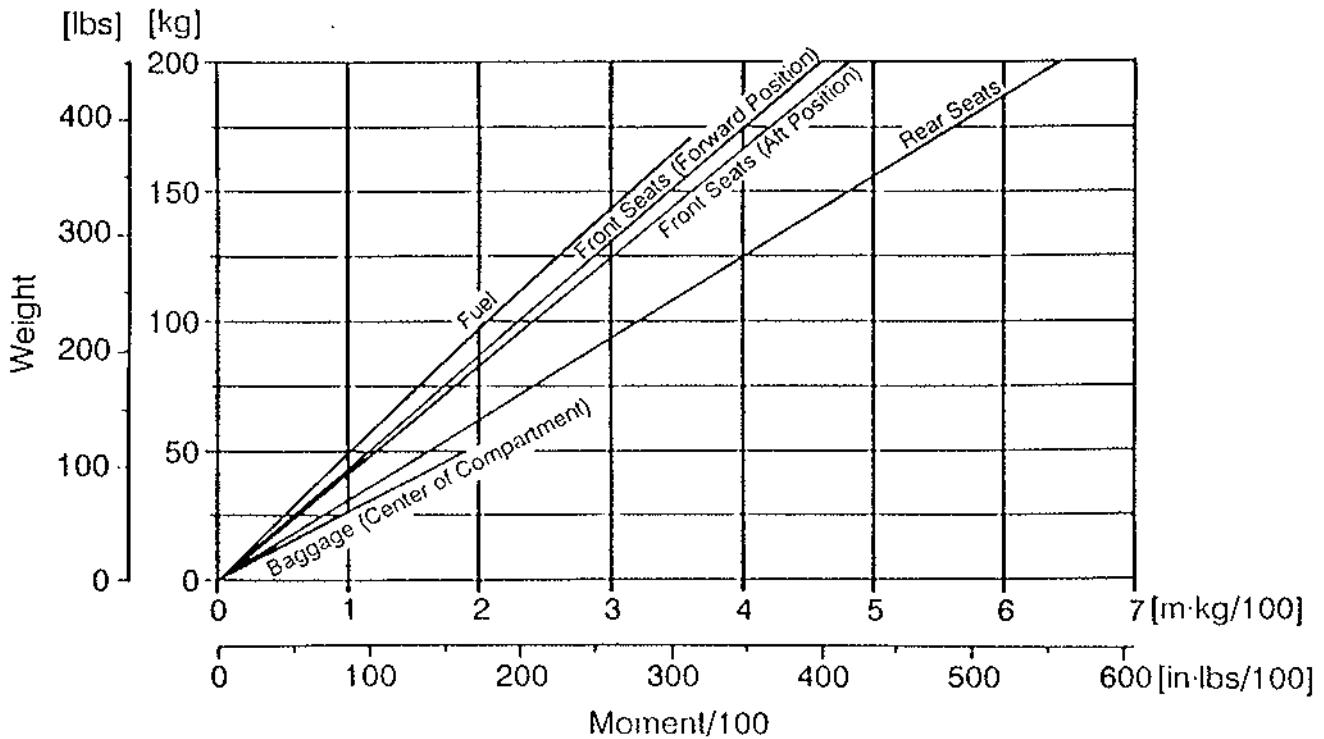
Enter the diagram at the determined weight of the loaded airplane (left vertical scale) and proceed horizontally to the right.

Enter the same diagram at the determined moment/100 value of the loaded airplane (bottom scale) and proceed vertically up to the intersection with the a.m. horizontal line. If the intersection of both lines is within the framed area the airplane is loaded correctly. In case the intersection is outside the framed area, the calculation has to be checked and the loading be changed if the values have found to be correct

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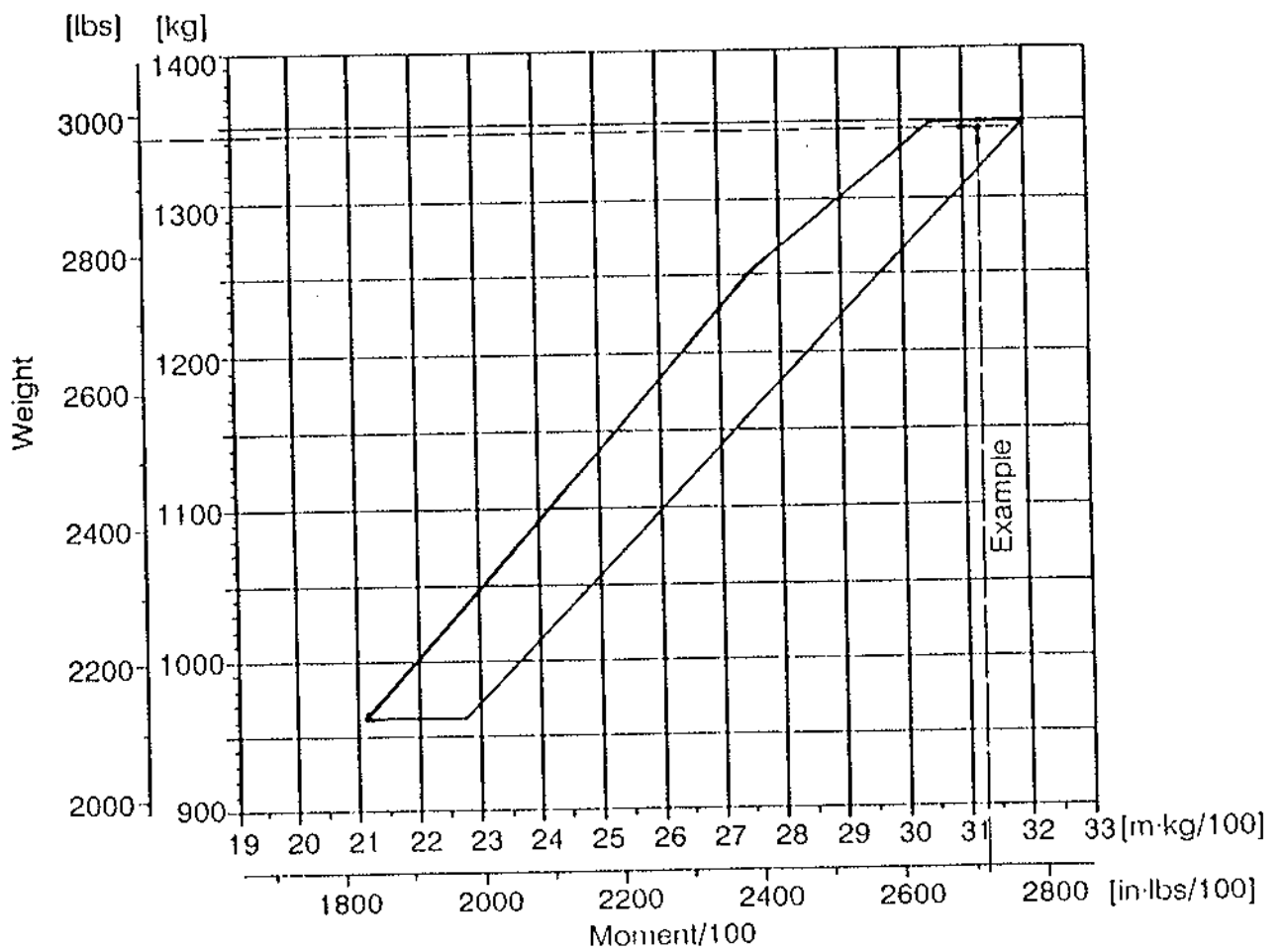
LOADING DIAGRAM

REMARK:

The moment/100 curve for baggage is related to the baggage compartment center. In case of baggage placed on the rear seats, the moment/100 curve for "Passengers, rear seats" has to be used.

In case of doubt, the arms have to be measured and the moment/100 values be determined by calculation. The rear bulkhead of the baggage compartment may be used as reference. Its position is 166.5 in (4.23 m) aft of the reference datum.

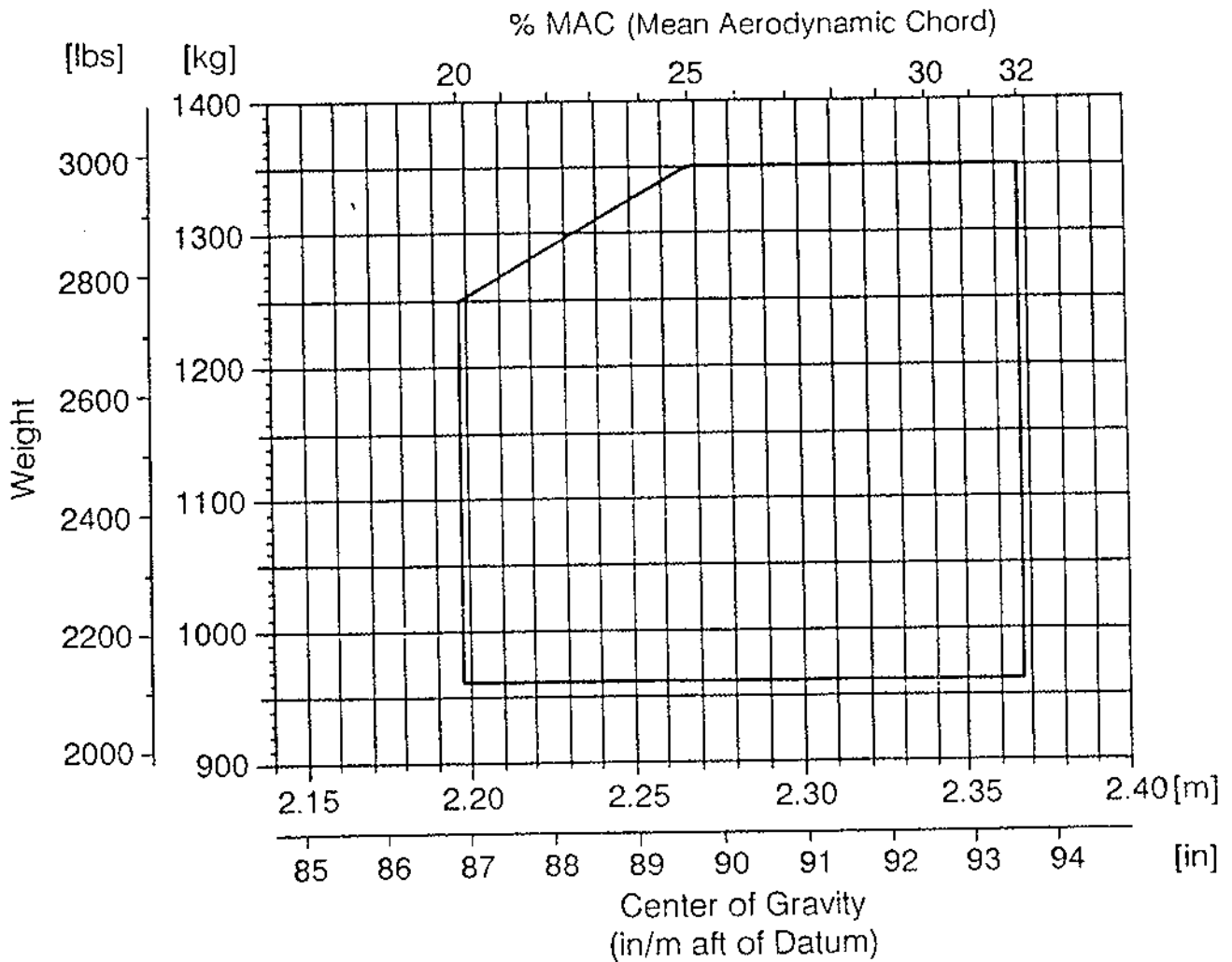
MOMENT LIMITS VS WEIGHT



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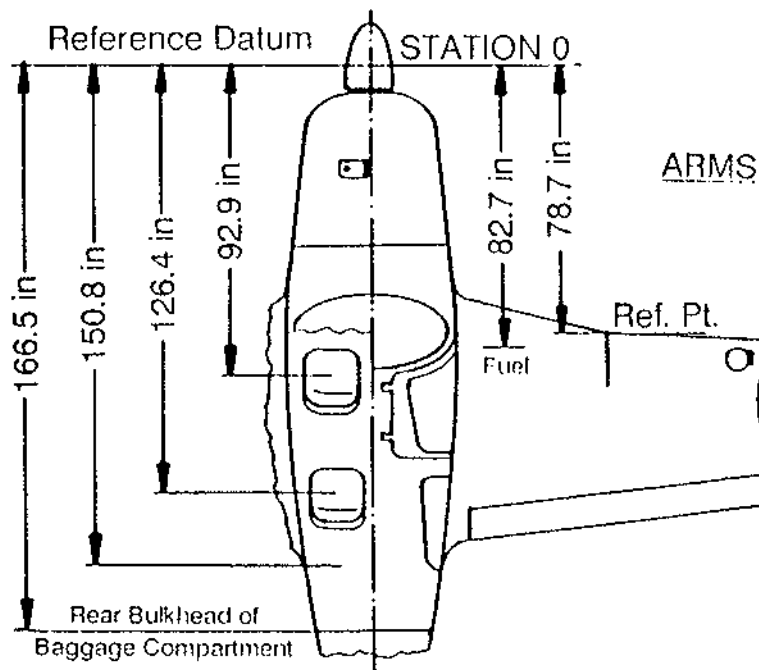
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CENTER OF GRAVITY LIMITS



The mean aerodynamic chord is: $l_{\mu} = 55.8$ in (1.418 m).
 It is located between stations 75.4 in (1.914 m) and 131.2 in (3.332 m) aft of reference datum.

WEIGHT AND BALANCE DETERMINATION FOR FLIGHT



Step	Weight and Balance Determination	Weight [lbs]	Moment/100 [in · lbs/100]
1	Basic empty weight from page 6-7 last entry (includes unusable fuel, full oil sump (12 qts) and hydraulic fluid.)		
2	Pilot Copilot		
3	Left rear seat Right rear seat		
4	Fuel (Max. usable fuel $62.3 \text{ Gal} \cdot 6.0 \text{ lbs/Gal} = 374 \text{ lbs}$)		
5	Baggage (Max. 110 lbs)		
6	Weight of loaded aircraft Sum 1 - 5 Sum of moment/100 (1 - 5)		
7	Enter weight and moment/100 values in the "Permissible Center of Gravity Moment Range" diagram (Page 6-11) in order to check for correct loading.		

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WEIGHT AND BALANCE DETERMINATION - EXAMPLE

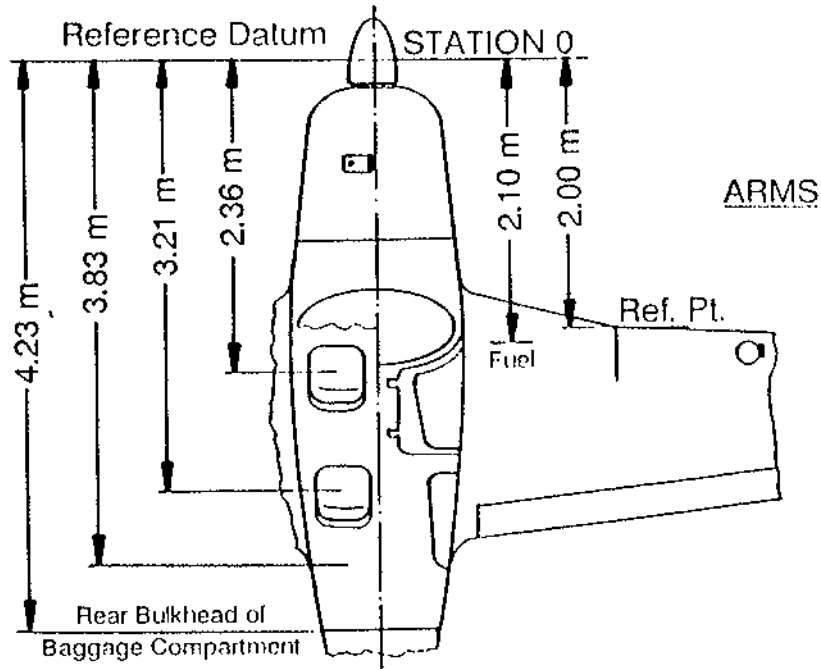
The following describes the entering of loading data of a sample airplane in the table on page 6-13.

The airplane is occupied by three persons and the tank is carrying 52.8 US Gal of fuel (52.8 Gal · 6.0 lbs/Gal = 317 lbs). 55 lbs of baggage are secured in the baggage compartment.

The weight of the loaded airplane is 2963 lbs. The total amount of the moment/100 values is 2708 in·lbs/100. The "Permissible Center of Gravity Moment Range" diagram (page 6-11) shows that the combination of both values is within the approved range.

Step	Weight and Balance Determination	Weight [lbs]	Moment/100 [in · lbs/100]
1	Basic empty weight from page 6-7 <u>last entry</u> (includes unusable fuel, full oil sump (12 qts) and hydraulic fluid.)	2062	1830
2	Pilot Copilot	181 161	163 145
3	Left rear seat Right rear seat	187 ---	232 ---
4	Fuel (Max. usable fuel 62.3 Gal · 6.0 lbs/Gal = 374 lbs (236 l · 0.72 kg/l = 170 kg))	317	257
5	Baggage (Max. 110 lbs (50 kg))	55	81
6	Weight of loaded aircraft Sum 1 - 5 Sum of moment/100 (1 - 5)	2963	2708
7	Enter weight and moment/100 values in the "Permissible Center of Gravity Moment Range" diagram (Page 6-11) in order to check for correct loading.		

WEIGHT AND BALANCE DETERMINATION FOR FLIGHT
(Metric Measurement System)



Step	Weight and Balance Determination	Weight [kg]	Moment/100 [m · kg/100]
1	Basic empty weight from page 6-7A <u>last entry</u> (includes unusable fuel, full oil sump (12 qts) and hydraulic fluid.)		
2	Pilot Copilot		
3	Left rear seat Right rear seat		
4	Fuel (Max. usable fuel $2361 \cdot 0.72 \text{ kg/l} = 170 \text{ kg}$)		
5	Baggage (Max. 50 kg)		
6	Weight of loaded aircraft Sum 1 - 5 Sum of moment/100 (1 - 5)		
7	Enter weight and moment/100 values in the "Permissible Center of Gravity Moment Range" diagram (Page 6-11) in order to check for correct loading.		

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WEIGHT AND BALANCE DETERMINATION - EXAMPLE (Metric Measurement System)

The following describes the entering of loading data of a sample airplane in the table on page 6-13A.

The airplane is occupied by three persons and the tank is carrying 200 l of fuel ($200 \text{ l} \cdot 0.72 \text{ kg/l} = 144 \text{ kg}$). 25 kg of baggage are secured in the baggage compartment.

The weight of the loaded airplane is 1344 kg. The total amount of the moment/100 values is 31.21 m·kg/100. The "Permissible Center of Gravity Moment Range" diagram (page 6-11) shows that the combination of both values is within the approved range.

Step	Weight and Balance Determination	Weight [kg]	Moment/100 [m · kg/100]
1	Basic empty weight from page 6-7A <u>last entry</u> (includes unusable fuel, full oil sump (12 qts) and hydraulic fluid.)	935	21.1
2	Pilot Copilot	82 73	1.9 1.7
3	Left rear seat Right rear seat	85 ---	2.7 ---
4	Fuel (Max. usable fuel $62.3 \text{ Gal} \cdot 6.0 \text{ lbs/Gal} = 374 \text{ lbs}$ $(236 \text{ l} \cdot 0.72 \text{ kg/l} = 170 \text{ kg})$)	144	3.0
5	Baggage (Max. 110 lbs (50 kg))	25	0.9
6	Weight of loaded aircraft Sum 1 - 5 Sum of moment/100 (1 - 5)	1344	31.3
7	Enter weight and moment/100 values in the "Permissible Center of Gravity Moment Range" diagram (Page 6-11) in order to check for correct loading.		

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		Day				
		Month				
		Year				
Cons. No.	Item	Type	Weight [lbs (kg)]	Arm [in (m)]	Marked (x) if installed	
Electrical Equipment						
B-1	Flap actuator	SKF	2.87 (1.30)	111.4 (2.83)	x	
B-2	Electrohydraulic landing gear actuating unit	Oildyne	9.13 (4.14)	170.5 (4.33)	x	
B-3	Stall warning		1.04 (0.47)	69.7 (1.77)	x	
B-4	Landing gear indication incl. warning		0.55 (0.25)	72.8 (1.85)	x	
B-5	Annunciator panel, all systems		0.33 (0.15)	72.8 (1.85)	x	
B-6	Landing- and taxi lights, left (1 each)	General Electric	0.88 (0.40)	87.4 (2.22)	x	
B-7	Landing- and taxi lights, right (1 each)	General Electric	0.88 (0.40)	87.4 (2.22)		
B-8	Position- + Strobe-Lights, wing (2)	Hella	0.57 (0.26)	89.0 (2.26)	x	
B-9	Position light, rudder	Hella	0.11 (0.05)	301.2 (7.65)	x	
B-10	Anti collision light	Hella	0.29 (0.13)	282.7 (7.18)	x	
B-11	Instrument lighting	Wheelen	0.26 (0.12)	74.4 (1.89)		
B-12	Map lights (front)		0.26 (0.12)	89.4 (2.27)		
B-13	Cabin lighting		0.13 (0.06)	92.5 (2.35)		
B-14	Baggage compartment lighting		0.15 (0.07)	166.1 (4.22)		
B-15	Battery relay		0.99 (0.45)	51.2 (1.30)	x	

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Cons. No.	Item	Type	Weight [lbs (kg)]	Arm [in (m)]	Marked (x) if installed	Day		
						Month	Year	
Airframe Equipment								
D-1	Nose landing gear, cpl.		31.97 (14.50)	33.1 (0.84)	x			
D-2	Nose gear tire, incl. tube	5.00-5.06TT.FLS	5.73 (2.60)	29.9 (0.76)	x			
D-3	Main landing gear, cpl. (2 each)		93.84 (42.56)	103.1 (2.62)	x			
D-4	Main gear tire, incl. tube	15x600-6.06TT.FLC.1	18.90 (8.57)	106.7 (2.71)	x			
D-5	Heater, by heat exchanger		4.48 (2.03)	26.0 (0.66)	x			
D-6	Seat belts, front (2 each)	Gadringer	4.63 (2.10)	111.8 (2.84)	x			
D-7	Seat belts, rear (2 each)	Gadringer	4.63 (2.10)	145.3 (3.69)	x			
D-8	Seat, front (2 each)		31.97 (14.50)	100.4*(2.55)	x			
D-9	Seat, rear (2 each)		23.06 (10.46)	137.0 (3.48)	x			
D-10	Headrest, front (2 each)		2.98 (1.35)	106.3*(2.70)	x			
D-11	Headrest, rear (2 each)		2.98 (1.35)	145.7 (3.70)	x			
Note:						* Arm varies depending on seat position by ± 3.5 in (± 0.09 m)		

Cons. No.	Item	Type	Weight [lbs (kg)]	Arm [in (m)]	Marked (x) if installed	Day		
						Month	Year	
Special Equipment								
E-1	Audio system	King KMA 24	1.70 (0.77)	71.7 (1.82)				
E-2	Integrated NAV System	King KNS 81	4.41 (2.00)	68.9 (1.75)				
E-3	NAV/COM Transceiver	King KX 155	5.29 (2.40)	69.3 (1.76)				
E-3A	NAV/COM Transceiver	King KX 155	5.29 (2.40)	69.3 (1.76)				
E-4	Digital ADF	King KR 87	3.24 (1.47)	69.3 (1.76)				
E-5	Transponder	King KT 79	3.40 (1.54)	68.9 (1.75)				
E-6	DME Indicator	King KDI 572	0.79 (0.36)	73.2 (1.86)				
E-7	DME Rec./Transmit. unit	King KN 63	2.80 (1.27)	172.4 (4.38)				
E-8	Flux Valve	King KMT 112	0.31 (0.14)	167.7 (4.26)				
E-9	Gyro compass, remote	King KG 102 A	4.43 (2.01)	174.0 (4.42)				
E-10	Antenna VOR	1A 050	0.44 (0.20)	231.5 (5.88)				
E-11	Antenna DME	KING KA 60	0.22 (0.10)	196.9 (5.00)				
E-12	Antenna ADF	KING KA 44B	4.61 (2.09)	155.5 (3.95)				
E-13	Antenna COM 1	CI 102	0.57 (0.26)	181.9 (4.62)				
E-14	Antenna COM 2	C 70-4	0.66 (0.30)	185.0 (4.70)				

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Cons. No.	Item	Type	Weight [lbs (kg)]	Arm [in (m)]	Marked (x) if installed	Day		
						Month	Year	
Special Equipment (cont.)								
E-15	Antenna MKR	CI 1	0.44 (0.20)	81.1 (2.06)				
E-16	Antenna GS	N 25-3	0.42 (0.19)	85.8 (2.18)				
E-17	Antenna XPDR	King KA 60	0.22 (0.10)	104.7 (2.66)				
E-18	COM	King KY 196A	2.80 (1.27)	69.3 (1.76)				
E-19	Encoding altimeter	King KEA 129	1.90 (0.86)	71.7 (1.82)				
E-20	RMI	King KI 229	2.87 (1.30)	72.0 (1.83)				
E-21	VOR Indicator	King KI 204	1.70 (0.77)	71.7 (1.82)				
E-22	Slaving Accessory	King KA 51B	0.20 (0.09)	72.0 (1.83)				
E-23	Pict. Nav. Indicator	King KI 525A	3.95 (1.79)	70.5 (1.79)				
E-24	ELT	Pointer 3000	2.09 (0.95)	174.4 (4.43)				
E-25	COM	Becker AR 3201	1.98 (0.90)	71.7 (1.82)				
E-26	Voltage transformer	Becker	0.51 (0.23)	65.4 (1.66)				
E-27	DME	KING KN 62 A	2.60 (1.18)	69.3 (1.76)				
E-28	ADF-Indicator	KING KI 227	0.71 (0.32)	72.0 (1.83)				
E-29	NAV/COM Transceiver	King KX 165	5.64 (2.56)	69.3 (1.76)				

					Day		
					Month		
					Year		
Cons. No.	Item	Type	Weight [lbs (kg)]	Arm [in (m)]	Marked (x) if installed		
Special Equipment (cont.)							
E-29A	NAV/COM Transceiver	King KX 165	5.64 (2.56)	69.3 (1.76)			
E-30	VOR Indicator	King KI 206	1.70 (0.77)	71.7 (1.82)			
E-31	Intercom system	PS PM 1000	0.62 (0.28)	72.0 (1.83)			
E-32	Autopilot computer f. KAP 100	KING KC 190	1.90 (0.86)	69.3 (1.76)			
E-33	Autopilot roll servo, compl.	KING KS 271A/KM 275	3.70 (1.68)	96.1 (2.44)			
E-34	VOR Indicator	KING KI 202	1.70 (0.77)	71.7 (1.82)			
E-35	Demodulator	KING KA 118	0.37 (0.17)	76.8 (1.95)			
E-36	Intercom system	Telex ProCom 4	0.62 (0.28)	68.9 (1.75)			
E-37	Autopilot computer f. KAP 150	KING KC 191	2.29 (1.04)	67.3 (1.71)			
E-38	Autopilot computer f. KFC 150	KING KC 192	2.49 (1.13)	67.3 (1.71)			
E-39	Autopilot pitch servo, compl.	KING KAS 270A/KM 275	3.90 (1.77)	193.3 (4.91)			
E-40	Autopilot pitch trim servo, compl.	KING KAS 272A/KM 275	3.90 (1.77)	215.7 (5.48)			
E-41	Autopilot altitude preselect	KING KAS 297B	1.15 (0.52)	68.1 (1.73)			
E-42	Autopilot alerter	KING KAA 15	0.86 (0.39)	70.5 (1.79)			
E-43	Gyro compass	KING KG 107	2.69 (1.22)	70.5 (1.79)			