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APPENDIX

WEIGHT AND BALANCE

PART 1

This appendix, issued to supplement the information given in the Flight Manual, may be modified by specific amendments independent of those issued against the basic Flight Manual.



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APPENDIX WB 1

LIST OF EFFECTIVE PAGES

All the pages which constitute this document are listed below.

This list is re-issued with each amendment.

Page	Code	Page	Code
1	9-85 ✓		
2	9-85 ✓		
3	7.76 ✓		
4	7.76 ✓		
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1 - GENERAL

This document contains the information required to review a loading proposal or to compute the weight and balance of operational aircraft.

To this effect, the document states :

- Weight and c.g. location limits
- Location of loads specific to each mission

The forms, designed to follow the weight and balance variations of the empty aircraft, are included in Appendix "WB2".

For each individual aircraft, these data are given by the manufacturer (refer to the charts hereafter).

It is recommended to re-weigh the empty aircraft after general overhaul or after important modification to aircraft configuration.

Forward C.G. : 2,76 m (108.6 in)

Aft C.G. : 3,15 m (124 in)

When, for specific duties, the c.g. is close to either extreme limit, it is advisable to check that the c.g. will remain within permissible limits throughout the flight.

A plate secured to the cabin and marked with a cross is used as reference for longitudinal c.g. determinations. This reference is located 2 metres (78.74 in.) from the main rotor shaft center line.

CAUTION : CHART A "CONTINUOUS HISTORY OF CHANGES AFFECTING WEIGHT AND BALANCE" MUST BE KEPT UP TO DATE AT ALL TIMES.

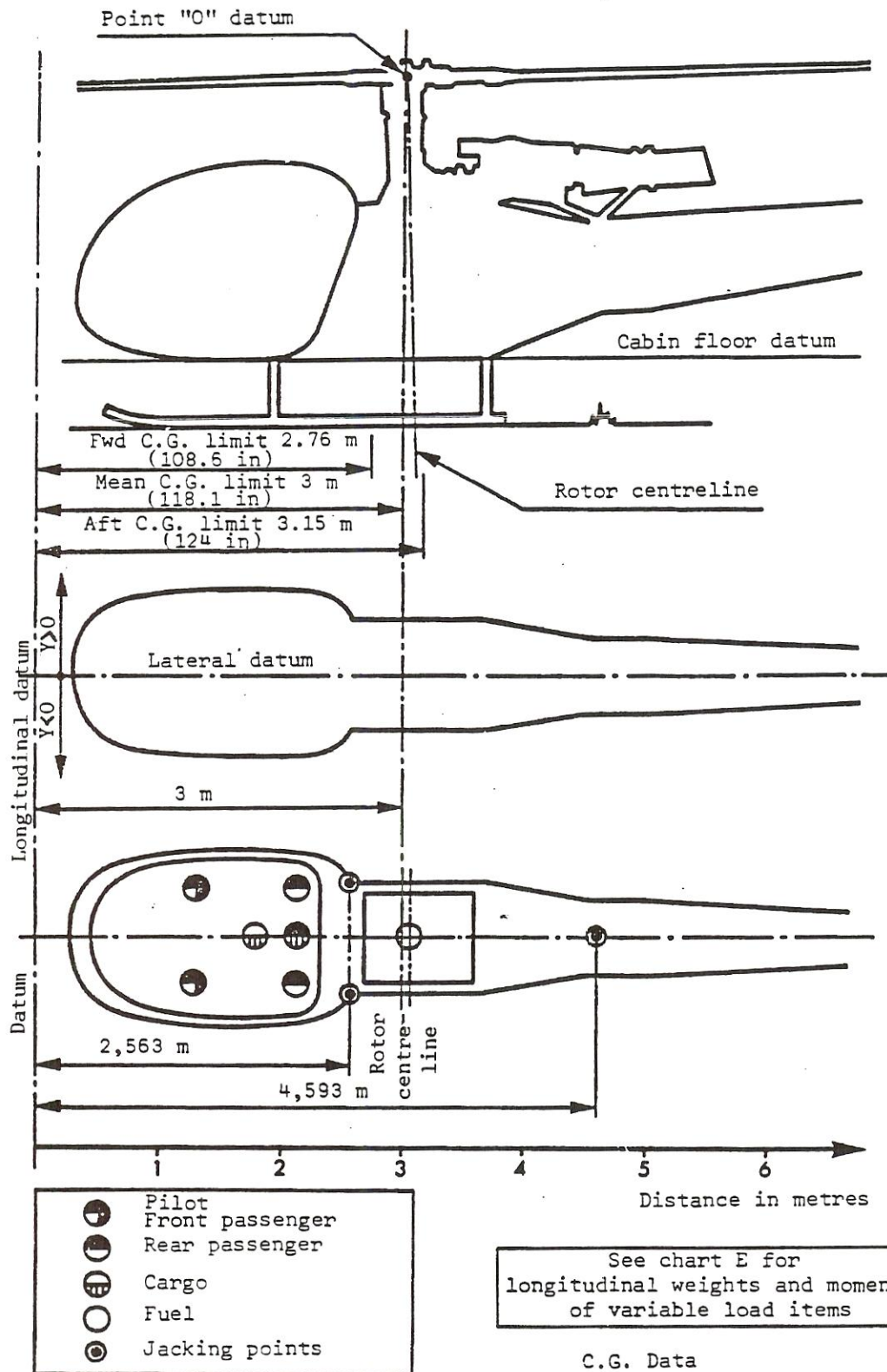
2 - DATUM PLANESA. DATUM PLANE OF LONGITUDINAL DIMENSIONS (X)

This is an imaginary plane at right angles to the helicopter centre line, and located 3 m (118.11 in.) ahead of the main rotor centre.

B. DATUM PLANE OF LATERAL DIMENSIONS (Y)

This is the aircraft's plane of symmetry.

- Positive dimensions to the RIGHT.
- Negative dimensions to the LEFT.



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3 - WEIGHTSA. EMPTY WEIGHT (E.W.)

This is the sum of the weights of the fixed assemblies and equipment :

- Of the airframe
- Of the engine
- Of the equipment common to all missions
- Of the lubricants for the M.G.B. - T.G.B. and engine
- Of the hydraulic fluids
- Of the non-usable fuel.

The empty weight is common to all missions of the concerned version and varies with each aircraft.

B. EQUIPPED EMPTY WEIGHT (E.E.W.)

This is the sum of :

- Empty weight (E.W.)
- Operational equipment items

The E.E.W. varies according to the scheduled mission.

C. ALL-UP WEIGHT (A.U.W.)

This is a sum of :

- The Equipped Empty Weight
- The crew
- The consumable fuel
- The payload

D. LIMIT WEIGHT

Maximum permissible weight on take-off : see Basic Manual.

4 - LOADING DATAA. CARGO

Loading limitations are stated on the "cargo loading" placard secured at the rear R.H. corner of cabin floor.

B. PASSENGERS

In general, the transport of passengers is not critical in relation to the permissible c.g. limits.

However, it is necessary to ensure that the c.g. forward limit is not exceed when the five seats are occupied by passengers of a high average weight.

It is also necessary to check that the c.g. rear limit is not exceed when a light weight pilot is flying alone. If this limit is exceeded, appropriate ballast should be added at the co-pilot's position.

Exceeding of the c.g. rear limit is most likely to occur when the pilot is flying alone in an aircraft stripped of its equipment.

C. CHART E

. Metric units

WEIGHT (kg)	PILOT AND FRONT PASSENGER (Lightened seat)	PILOT AND FRONT PASSENGER (Pan type seat)	REAR PASSENGERS	CARGO
	1.420 m from datum	1.426 m from datum	2.20 m from datum	2.0 m from datum
Longitudinal moments, in m.Kg				
1	1.42	1.42	2.20	2.0
2	2.84	2.85	4.40	4.0
5	7.10	7.13	11.00	10.0
10	14.20	14.26	22.00	20.0
25	35.50	35.65	55.00	50.0
50	71.00	71.30	110.00	100.0
75	106.50	106.95	165.00	150.0
100	142.00	142.60	220.00	200.0
125	177.50	178.25	275.00	250.0
150	213.00	213.90	330.00	300.0
175	248.50	249.55	385.00	350.0
200	284.00	285.20	440.00	400.0
225			495.00	450.0
250			550.00	500.0
275			605.00	550.0
300			660.00	600.0
325				650.0
350				700.0
375				750.0
400				800.0
425				850.0
450				900.0
475				950.0
500				1000.0
Moments (m.kg)				

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. British units

WEIGHT (lb)	PILOT AND FRONT PASSENGER (Lightened seat)	PILOT AND FRONT PASSENGER (Pan type seat)	REAR PASSENGERS	CARGO
	55.90 in from datum	56.14 in from datum	86.61 in from datum	78.74 in from datum
	Longitudinal moments, in in.lb			
2	111.80	112.28	173.22	157.48
4	223.60	224.56	346.44	315.16
10	559.00	561.40	866.10	787.40
20	1118.00	1122.80	1732.20	1574.80
50	2795.00	2807.00	4330.50	3937.00
100	5590.00	5614.00	8661.00	7874.00
150	8385.00	8421.00	12991.50	11811.00
200	11180.00	11228.00	17322.00	15748.00
250	13975.00	14035.00	21652.50	19685.00
300	16770.00	16842.00	25983.00	23622.00
350	19565.00	19649.00	30313.50	27559.00
400	22360.00	22456.00	34644.00	31496.00
450	25155.00	25263.00	38974.50	35433.00
500			43305.00	39370.00
550			47635.50	43307.00
600			51966.00	47244.00
650			56296.50	51181.00
700			60627.00	55118.00
750				59055.00
800				62992.00
850				66929.00
900				70866.00
1000				78740.00
1100				86614.00
Moments (in.lb)				

D - FUEL C.G. CHART

. Metric units

STANDARD FUEL TANK or FOUR LOBE FUEL TANK		
QUANTITY (l)	WEIGHT (kg) density = 0.79	MOMENT (m. kg)
50	39.50	121.498
100	79.00	242.763
150	118.50	364.305
200	158.00	486.202
250	197.50	608.499
300	237.00	731.102
350	276.50	854.105
400	316.00	977.503
450	355.50	1101.256
500	395.00	1225.365
550	434.50	1349.379
565	446.35	1386.417
575	454.25	1411.016

. British units

STANDARD FUEL TANK or FOUR LOBE FUEL TANK		
QUANTITY (US gal)	WEIGHT (lb)	MOMENT (in. lb)
10	65.92	7282.9
20	131.84	15952.6
30	197.76	23929.0
40	263.68	31905.3
50	329.61	39915.8
80	527.37	64075.5
90	593.29	72144.1
100	659.21	80225.9
110	725.13	88393.3
120	791.05	96508.1
130	856.97	104636.0
140	922.89	112777.2
149	981.91	120116.0
151.9	1001.02	121003.6

E. LATERAL C.G.1. General

If longitudinal c.g. is correct, LATERAL c.g. is also correct provided, that non uneven distribution of external loads exists.

In the event of uneven distribution of external loads, make sure that c.g. location is between the limits given in Section 1, paragraph 3.

2. Hoisting role

For a hoisting mission, the lateral c.g. location remains within the limitations laid down, as these limitations can only be reached in the severest case of flight corresponding to the following conditions :

- Wind velocity of 20 knots.
- Fuel quantity below 60 litres (15.8 US gal).
- Light pilot and heavy hoist operator.

3. Spray equipment

When using only one half of the spray boom, the maximum permissible difference between the two spray tanks is half the capacity of either L.H. or R.H. tank, with the pilot flying alone.



1 st example



2nd example

5 - EXAMPLE OF C.G. DETERMINATIONA. BEFORE TAKE-OFF

- 1) Determine the maximum permissible take-off weight depending on ambient conditions.
- 2) Note the equipped empty weight (E.E.W.) determined on the latest weighing (Form C).
- 3) With reference to the tables given in paragraph "LOADING DATA", add the weights and moments as shown in the following table.
- 4) Compute the C.G. location or use the C.G. chart (page 12) which avoids calculation.
- 5) Check that the C.G. falls within the permissible limits.

	WEIGHT (Kg) (lb)	MOMENT (m.Kg) (lb.in)	REMARKS
Equipped empty weight (E.E.W.)	1000 2204	3200 277660	Shown in form "C"
Pilot + 1 passenger	150 330	213 18447	See pages 6 and 7
3 rear passengers	200 440	440 38195	See pages 6 and 7
Fuel	454 1000	1411 121003	See page 8
All-up weight (A.U.W.)	1804 3996	5264 455305	

Computation gives : $\frac{5264}{1804} = 2.91$ m or, in British units : $\frac{455305}{3996} = 113.9$ in.,
i.e. a C.G. location falling within the permissible limits (2.76 and 3.15 m)
(108.6 and 124 in.).

B. IN FLIGHT OR ON LANDING

Follow the same procedure, as previously described, taking into account the weight and moment of the remaining fuel.

NOTE : In general, C.G. determination is made only before take-off.

6 - C.G. LIMITSA. DEFINITIONS1) Longitudinal C.G.

The longitudinal C.G. location is defined by the distance from the centre of gravity to the datum plane.

<u>FORWARD limit</u>	: 2.76 m (108.6 in)
<u>REARWARD limit</u>	: 3.00 m (118.1 in)
	3.15 m (124 in) with weight and speed limitation
	3.09 m (121.6 in) with underslung load

2) Lateral C.G.

The lateral C.G. location is defined by the distance from the centre of gravity to the aircraft plane of symmetry.

<u>R.H. limit</u>	: + 0.043 m (1.7 in)
<u>L.H. limit</u>	: - 0.135 m (5.3 in)

NOTE :

The lateral c.g. limits are given for reference.
These limits are not reached in normal use.

B. CALCULATION

Form "B", in Appendix WB2, specifies the weight and C.G. location of the aircraft.

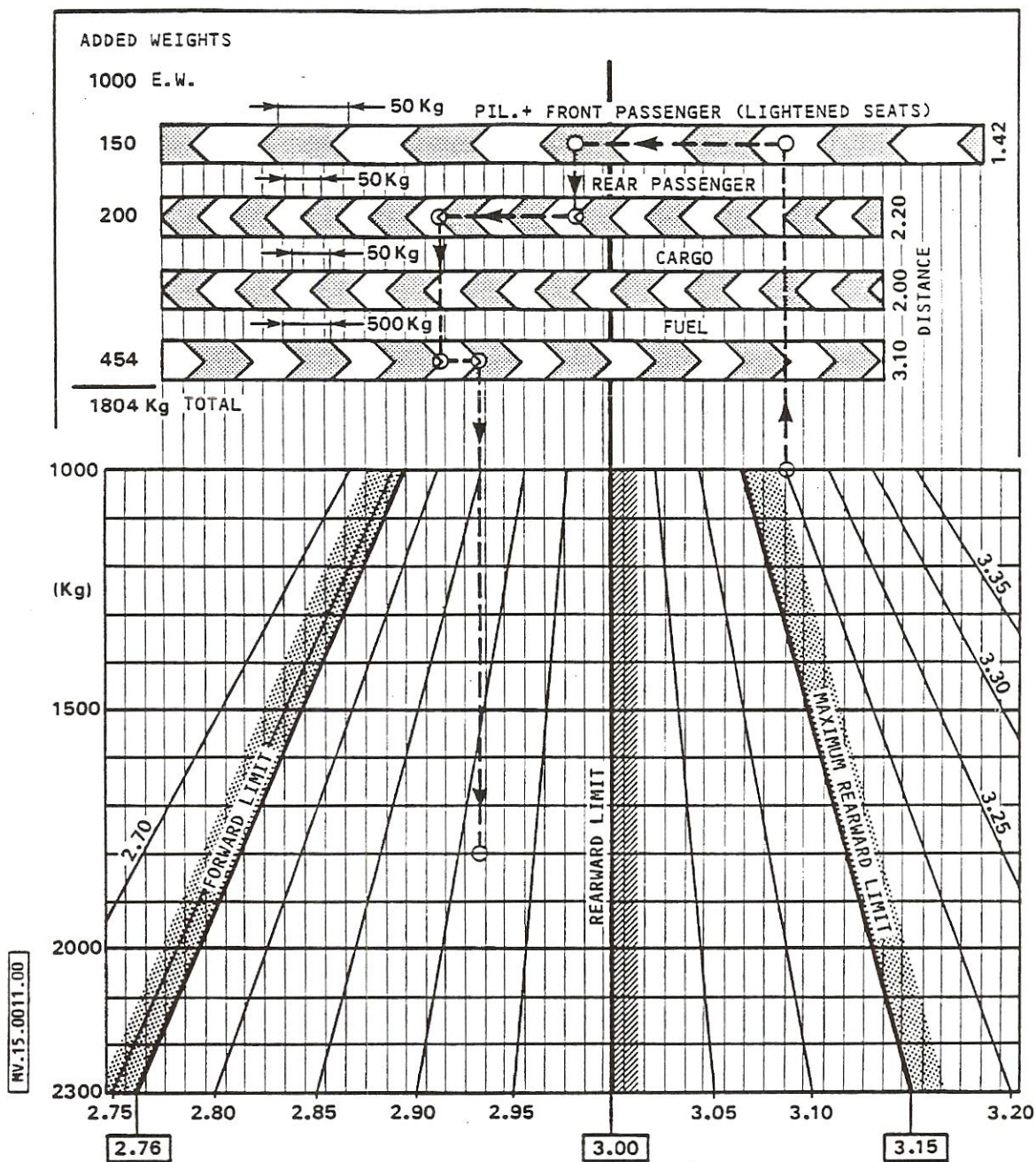
Form "A", in appendix WB2, specifies the weight and moment of the equipment items installed.

The tables given on page 6 and subsequent pages show the location and moment of loads corresponding to the various roles.

Using these data, the distance between the C.G. of the considered weights and the datum plane can be determined by means of the following formula :

$\frac{\text{Sum of moments}}{\text{Sum of weights}} = \text{C.G. location}$
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In practice, the following c.g. chart may be used to determine if the C.G. location remains within the permissible limits.



NOTE : During external load carrying missions the load variations on the hook move the centre of gravity vertically.

C.G. Chart