SECTION VI

WEIGHT AND BALANCE/ EQUIPMENT LIST

TABLE OF CONTENTS

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INTRODUCTION TO WEIGHT AND BALANCE

The necessity for proper computation of the airplane's weight and balance cannot be overemphasized. In the basic design, it is planned that under normal loading the weight distribution of pilot, passengers, baggage, and fuel will balance the airplane for flight. Since these items are all variables, it is possible to concentrate weight in such a way as to make the airplane unsafe for flight. The factors which must be considered in the weight and balance of the airplane are the installation of equipment after the airplane has been weighed, trapped or unusable fuel, engine oil, usable fuel, pilot and passenger weights, and baggage or cargo.

In order to simplify the computation of the weight and balance, Beech Aircraft Corporation has devised a form called Basic Empty Weight and Balance. When the airplane is delivered from the factory it will first be weighed and the data recorded on this form. Provision has been made on the form for listing additions of items to be installed before the delivery or subtractions of items to be removed before delivery from the "as weighed" condition. This then represents the empty weight of the airplane.

When the airplane is first fueled, a certain amount of fuel is trapped in the fuel lines and cells which cannot be drained. Also, in some regimes of flight there are certain amounts of fuel that cannot be used. The combination of these fuel amounts is classified as unusable fuel. Also, it has been found that all operators bring the oil level near full before each flight. Thus, these items are computed along with the empty weight, giving a Basic Empty Weight as a starting point to the pilot for each flight computation.

Once the Basic Empty Weight for a given airplane has been established, the pilot is then only concerned with the

variable items which will comprise his useful load. These items which are of a changing nature are: Pilot and Passengers (computed on an individual weight and the seat occupied), Baggage and/or Cargo (computed on weight and location within the airplane), and Usable Fuel (the remaining fuel after subtracting the unusable fuel from the measured fuel on board).

WEIGHING INSTRUCTIONS

Periodic weighing of the airplane may be required to keep the Basic Empty Weight current. All changes to the airplane affecting weight and balance are the responsibility of the airplane's operator.

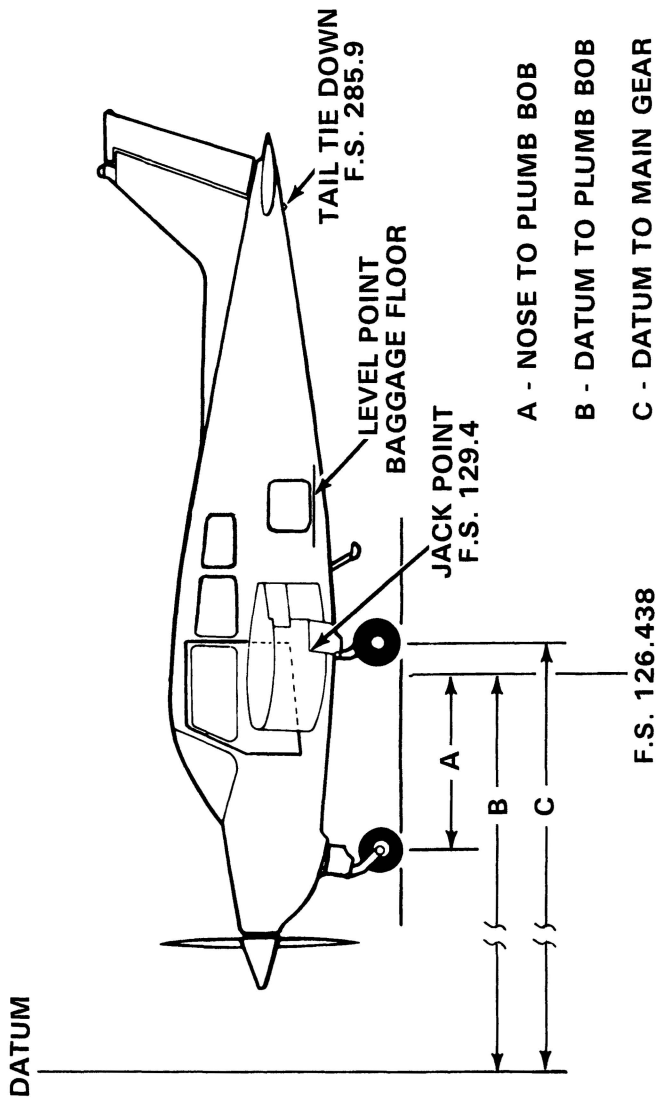
1. Provision for jack points are provided for weighing: two on the wing front spar at Fuselage Station 129.4 and one on the aft fuselage at Fuselage Station 285.9 (tail tie-down ring).
2. Fuel should be drained preparatory to weighing. Tanks are drained from the regular drain ports with the airplane in static ground attitude. The unusable fuel to be added to a Basic Empty Weight is: 6 lbs (M-1285 thru M-1516) at Fuselage Station 125.0. 45.6 lbs (M-1517 thru M-1879 except M-1875 or prior airplanes after compliance with Service Instructions No. 0624-281) at Fuselage Station 125.0. 15.6 lbs (M-1875, M-1880 & After) at Fuselage Station (125.0).
3. Engine oil must be at the full level or completely drained. Total engine oil when full is 15 pounds at Fuselage Station 48.
4. To determine airplane configuration at time of weighing, installed equipment is checked against the airplane equipment list or superseding forms. All installed equipment must be in its proper place during weighing.

5. At the time of weighing, the airplane must be level both longitudinally and laterally. Longitudinally and laterally level attitude is determined with a level on the baggage compartment floor.

6. Measurement of the reaction arms for a wheel weighing is made using a steel measuring tape. Measurements are taken, with the airplane level on the scales, from the reference (a plumb bob dropped from the centerline of airplane at F.S. 126.438, forward screw in spar access cover, approximately 8 to 10 inches forward of centerline drain hole) to the axle centerline of the main gear and then to the nose wheel axle centerline. The main wheel axle centerline is best located by stretching a string across from one main wheel to the other. All measurements are to be taken with the tape level with the hangar floor and parallel to the fuselage centerline. The locations of the wheel reactions will be approximately at Fuselage Station 134.0 for main wheels and Fuselage Station 58.5 for the nose wheel.

7. Jack point weighings are accomplished by placing scales at the jack points specified in step 1 above. Since the center of gravity of the airplane is forward of Fuselage Station 129.4, the tail reaction of the airplane will be in an up direction. This can be measured on regular scales by placing ballast of approximately 200 pounds on the scales to which the aft weighing point is attached by cable of adjustable length. The up reaction will then be total ballast weight minus the scale reading and is entered in the weighing form as a negative quantity.

8. Weighing should always be made in an enclosed area which is free from air currents. The scales used should be properly calibrated and certified.


TAIL TIE DOWN
F.S. 285.9
LEVEL POINT
BAGGAGE FLOOR
JACK POINT
F.S. 129.4
A - NOSE TO PLUMB BOB
B - DATUM TO PLUMB BOB
C - DATUM TO MAIN GEAR
F.S. 126.438
A
B
C
DATUM

BASIC EMPTY WEIGHT AND BALANCE

MODEL_____ SER. NO._____ REG. NO._____ DATE_____

JACK POINT LOCATION

FORWARD 129.4

AFT_____

PREPARED BY

Company_____

Signature_____

REACTION WHEEL - JACK POINTS	SCALE READING	TARE	NET WEIGHT	ARM	MOMENT
LEFT MAIN					
RIGHT MAIN					
NOSE OR TAIL					
TOTAL (AS WEIGHED)					
Space below provided for additions and subtractions to as weighed condition					
EMPTY WEIGHT (DRY)					
ENGINE OIL			15.0	48.0	720
UNUSABLE FUEL					
(M-1285 thru M-1516)			6.0	125.0	750
(M-1517 thru M-1879 except M-1875 or prior airplanes after compliance with S.I. No. 0624-281)			45.6	125.0	5700
(M-1875, M-1880 and after)			15.6	125.0	1950
BASIC EMPTY WEIGHT					

NOTE

Each new airplane is delivered with a completed sample loading, basic empty weight and center of gravity, and equipment list, all pertinent to that specific airplane. It is the owner's responsibility to ensure that changes in equipment are reflected in a new weight and balance and in an addendum to the equipment list. There are many ways of doing this; it is suggested that a running tally of equipment changes and their effect on basic empty weight and c.g. is a suitable means for meeting both requirements.

The current equipment list and empty weight and c.g. information must be retained with the airplane when it changes ownership. Beech Aircraft Corporation cannot maintain this information; the current status is known only to the owner. If these papers become lost, the FAA will require that the airplane be re-weighed to establish the empty weight and c.g. and that an inventory of installed equipment be conducted to create a new equipment list.

It is recommended that duplicate copies of the Basic Empty Weight and Balance sheet and the Equipment List be made and kept in an alternate location in the event the original handbook is misplaced.

WEIGHT AND BALANCE RECORD

SERIAL NO. _____ REGISTRATION NO. _____ PAGE NO. _____

DATE	ITEM NO.		DESCRIPTION OF ARTICLE OR CHANGE	WEIGHT CHANGE ADDED (+) OR REMOVED (-)			RUNNING BASIC EMPTY WEIGHT	
	IN	OUT		WT (LBS)	ARM (IN.)	$\frac{MOM}{100}$	WT (LBS)	$\frac{MOM}{100}$

WEIGHT AND BALANCE RECORD

SERIAL NO. _____ REGISTRATION NO. _____ PAGE NO. _____

DATE	ITEM NO. IN	ITEM NO. OUT	DESCRIPTION OF ARTICLE OR CHANGE	WEIGHT CHANGE ADDED (+) OR REMOVED (-) WT (LBS)	ARM (IN.)	MOM / 100	RUNNING BASIC EMPTY WEIGHT WT (LBS)	MOM / 100

WEIGHT AND BALANCE RESPONSIBILITIES

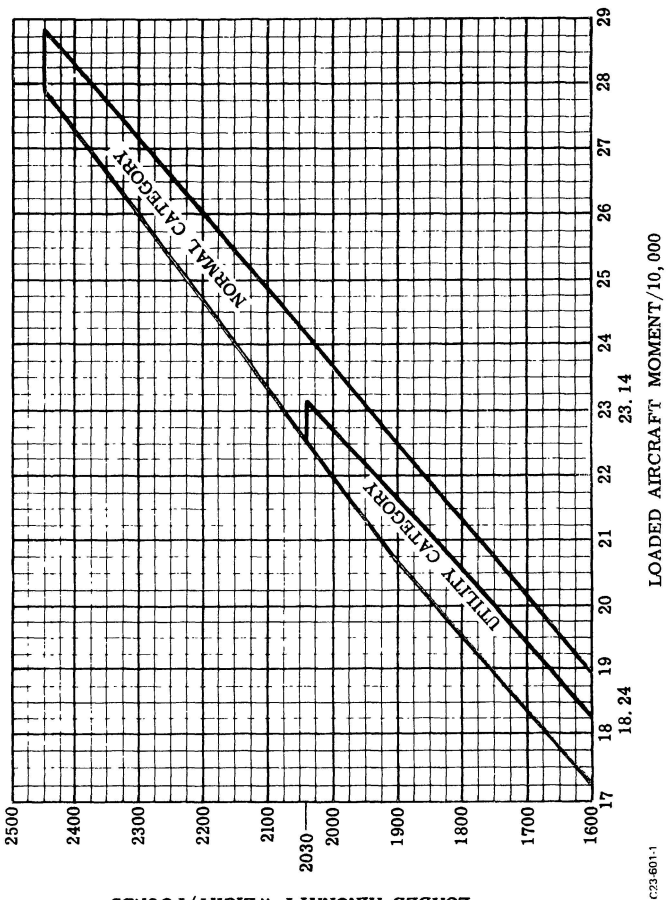
The Basic Empty Weight and Moment of the airplane at the time of delivery are shown on the airplane Basic Empty Weight and Balance form. Useful load items which may be loaded into the airplane are shown on the Useful Load Weights and Moments tables. The minimum and maximum moments are shown on the Moment Limits vs Weight table and can also be plotted on the Moment Limits vs Weight graph as visual indication that the limit is within the operational envelope. These moments correspond to the forward and aft center-of-gravity flight limits for a particular weight. The airplane must be loaded in such a manner to keep the center-of-gravity within these limits.

NOTE

THE FLOOR STRUCTURE LOAD LIMIT IS 100 POUNDS PER SQUARE FOOT.

ALL BAGGAGE/CARGO MUST BE SECURED.

GROSS WEIGHT MOMENT LIMITS GRAPH



GROSS WEIGHT MOMENT LIMITS

(NORMAL CATEGORY)

Gross Weight	Minimum Moment 100	Maximum Moment 100	Gross Weight	Minimum Moment 100	Maximum Moment 100	Gross Weight	Minimum Moment 100	Maximum Moment 100
1500	1617	1775	1900	2068	2248	2300	2599	2721
1510	1628	1786	1910	2081	2260	2310	2613	2733
1520	1639	1798	1920	2094	2271	2320	2626	2745
1530	1649	1810	1930	2107	2283	2330	2640	2756
1540	1660	1822	1940	2120	2295	2340	2654	2768
1550	1671	1834	1950	2133	2307	2350	2668	2780
1560	1682	1845	1960	2145	2319	2360	2681	2792
1570	1692	1857	1970	2158	2331	2370	2695	2804
1580	1703	1869	1980	2172	2342	2380	2708	2816
1590	1714	1881	1990	2185	2354	2390	2722	2827
1600	1725	1893	2000	2198	2366	2400	2736	2839
1610	1736	1905	2010	2211	2378	2410	2750	2851
1620	1746	1916	2020	2224	2390	2420	2764	2863
1630	1757	1928	2030	2237	2401	2430	2777	2875
1640	1768	1940	2040	2250	2413	2440	2791	2887
1650	1779	1952	2050	2263	2425	2450	2805	2898
1660	1789	1964	2060	2276	2437			
1670	1800	1976	2070	2290	2449			
1680	1811	1987	2080	2303	2461			
1690	1822	1999	2090	2316	2472			
1700	1833	2011	2100	2329	2484			
1710	1843	2023	2110	2343	2496			
1720	1854	2035	2120	2356	2508			
1730	1865	2047	2130	2369	2520			
1740	1876	2058	2140	2383	2532			
1750	1887	2070	2150	2396	2543			
1760	1897	2082	2160	2409	2555			
1770	1908	2094	2170	2423	2567			
1780	1919	2106	2180	2436	2579			
1790	1930	2118	2190	2450	2591			
1800	1940	2129	2200	2463	2603			
1810	1953	2141	2210	2477	2614			
1820	1966	2153	2220	2490	2626			
1830	1978	2165	2230	2504	2638			
1840	1991	2177	2240	2517	2650			
1850	2004	2189	2250	2531	2662			
1860	2017	2200	2260	2544	2674			
1870	2029	2212	2270	2558	2685			
1880	2042	2224	2280	2572	2697			
1890	2055	2236	2290	2585	2709			

The above weight and moment limits are based on the following weight and center of gravity limit data

NORMAL CATEGORY

WEIGHT CONDITION	FWD CG LIMIT	AFT CG LIMIT
2450 lbs (max take-off or landing)	114 5	118 3
1800 lbs or less	107 8	118.3

GROSS WEIGHT MOMENT LIMITS

(UTILITY CATEGORY & ACROBATIC CATEGORY)

Gross Weight	Minimum Moment 100	Maximum Moment 100	Gross Weight	Minimum Moment 100	Maximum Moment 100
1500	1617	1710	1800	1940	2052
1510	1628	1721	1810	1953	2063
1520	1639	1733	1820	1966	2075
1530	1649	1744	1830	1978	2086
1540	1660	1756	1840	1991	2098
1550	1671	1767	1850	2004	2109
1560	1682	1778	1860	2017	2120
1570	1692	1790	1870	2029	2132
1580	1703	1801	1880	2042	2143
1590	1714	1813	1890	2055	2155
1600	1725	1824	1900	2068	2166
1610	1736	1835	1910	2081	2177
1620	1746	1847	1920	2094	2189
1630	1757	1858	1930	2107	2200
1640	1768	1870	1940	2120	2212
1650	1779	1881	1950	2133	2223
1660	1789	1892	1960	2145	2234
1670	1800	1904	1970	2158	2246
1680	1811	1915	1980	2172	2257
1690	1822	1927	1990	2185	2269
1700	1833	1938	2000	2198	2280
1710	1843	1949	2010	2211	2291
1720	1854	1961	2020	2224	2303
1730	1865	1972	2030	2237	2314
1740	1876	1984			
1750	1887	1995			
1760	1897	2006			
1770	1908	2018			
1780	1919	2029			
1790	1930	2041			

The above weight and moment limits are based on the following weight and center of gravity limit data:

UTILITY CATEGORY & ACROBATIC CATEGORY

WEIGHT CONDITION	FWD CG LIMIT	AFT CG LIMIT
2030 lbs (max take-off or landing)	110.2	114.0
1800 lbs or less	107 8	114.0

COMPUTING PROCEDURE

1. Record the Basic Empty Weight and Moment from the Basic Empty Weight and Balance form (or from the latest superseding form) under the Basic Empty Condition block. The moment must be divided by 100 to correspond to Useful Load Weights and Moments tables.
2. Record the weight and corresponding moment from the appropriate table of each of the useful load items (except fuel) to be carried in the airplane.
3. Total the weight column and moment column. The SUB-TOTAL is the Zero Fuel Condition.
4. Determine the weight and corresponding moment for the fuel loading to be used. This fuel loading includes fuel for the flight, plus that required for start, taxi, and take-off. Add the Fuel to Zero Fuel Condition to obtain the SUB-TOTAL Ramp Condition.
5. Subtract the fuel to be used for start, taxi, and take-off to arrive at the SUB-TOTAL Take-off Condition.
6. Subtract the weight and moment of the fuel in the incremental sequence in which it is to be used from the take-off weight and moment. The Zero Fuel Condition, the Take-Off Condition, and the Landing Condition moment must be within the minimum and maximum moments shown on the Moment Limit vs Weight graph for that weight. If the total moment is less than the minimum moment allowed, useful load items must be shifted aft or forward load items reduced. If the total moment is greater than the maximum moment allowed, useful load items must be shifted forward or aft load items reduced. If the quantity or location of load items is changed, the calculations must be revised and the moments rechecked.

The following Sample Loading chart is presented to depict the sample method of computing a load. Weights used DO NOT reflect an actual airplane loading.

WEIGHT AND BALANCE LOADING FORM

MODEL C23 DATE _____

SERIAL NO. M-XXXX REG NO. NXXX

ITEM	WEIGHT	MOM/100
1. BASIC EMPTY CONDITION	1500	1650
2. FRONT SEAT OCCUPANTS	340	374
3. 3rd & 4th SEAT OCCUPANTS	340	482
4. BAGGAGE OR CARGO	40	67
5. **SUB TOTAL** ZERO FUEL CONDITION	2220	2573
6. FUEL LOADING (37 GAL)	222	259
7. **SUB TOTAL** RAMP CONDITION	2442	2832
8. *LESS FUEL F..., TAXI, AND TAK...OFF	-5	-6
9. **SUB TOTAL** TAKE-OFF CONDITION	2437	2826
10. LESS FUEL TO DESTINATION (25 GAL)	-150	-176
11. **LANDING CONDITION**	2287	2650

SAMPLE

*Fuel for start, taxi and take-off is normally 5 lbs at an average mom/100 of 6.

WEIGHT AND BALANCE LOADING FORM

MODEL _____ DATE _____

SERIAL NO. _____ REG NO. NXXX

ITEM	WEIGHT	MOM/100
1. BASIC EMPTY CONDITION		
2. FRONT SEAT OCCUPANTS		
3. 3rd & 4th SEAT OCCUPANTS		
4. BAGGAGE OR CARGO		
5. **SUB TOTAL ZERO FUEL CONDITION**		
6. FUEL LOADING (GAL)		
7. **SUB TOTAL** RAMP CONDITION		
8. *LESS FUEL FOR START, TAXI, AND TAKE-OFF		
9. **SUB TOTAL** TAKE-OFF CONDITION		
10. LESS FUEL TO DESTINATION (GAL)		
11. **LANDING CONDITION**		

*Fuel for start, taxi and take-off is normally 5 lbs at an average mom/100 of 6.

USEFUL LOAD WEIGHTS AND MOMENTS

OCCUPANTS

WEIGHT	FRONT SEATS				3RD AND 4TH SEATS	
	*FWD POS.		*AFT POS.		BENCH SEAT	SPLIT SEAT
	††ARM **104	†ARM **105	ARM **112		ARM **142	ARM **144
	MOM / 100	MOM / 100	MOM / 100		MOM / 100	MOM / 100
120	125	126	134		170	173
130	135	137	146		185	187
140	146	147	157		199	202
150	156	158	168		213	216
160	166	168	179		227	230
170	177	179	190		241	245
180	187	189	202		256	259
190	198	200	213		270	274
200	208	210	224		284	288

†Effective M-1285 thru M-2006
††Effective M-2007 and after
*Reclining seat with back in full-up position
**Values computed from a C.G. criterion based on a 170 pound male. Differences in physical characteristics can cause variation in center of gravity location.

USEFUL LOAD WEIGHTS AND MOMENTS

OIL

(Included in Basic Empty Weight)

ARM 48		
QTS	WT	MOMENT/100
8	15	7

USABLE FUEL

ARM 117		
GALLONS	WEIGHT	MOMENT/100
5	30	35
10	60	70
15	90	105
20	120	140
22	132	154
25	150	176
27	162	189
30	180	211
32	192	225
35	210	246
37	222	259
40	240	281
45	270	316
50	300	351
52	312	365
55	330	386
57	342	400
58	348	407

USEFUL LOAD WEIGHTS AND MOMENTS

BAGGAGE

ARM 167	
WEIGHT	MOMENT 100
10	17
20	33
30	50
40	67
50	84
60	100
70	117
80	134
90	150
100	167
110	184
120	200
130	217
140	234