

N7972C

Piper

PA28-181

Weight and Balance (POH Excerpt)

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SECTION 6

WEIGHT AND BALANCE

6.1 GENERAL

In order to achieve the performance, safety and good flying characteristics which are designed into the airplane, it must be flown with the weight and center of gravity (C.G.) position within the approved operating range (envelope). Although the airplane offers a tremendous flexibility of loading, you cannot fill the airplane with the maximum number of adult passengers, full fuel tanks and maximum baggage. With the flexibility comes responsibility. The pilot must ensure that the airplane is loaded within the loading envelope before he makes a takeoff.

Misloading carries consequences for any aircraft. An overloaded airplane will not take off, climb or cruise as well as a properly loaded one. The heavier the airplane is loaded, the less climb performance it will have.

Center of gravity is a determining factor in flight characteristics. If the C.G. is too far forward in any airplane, it may be difficult to rotate for takeoff or landing. If the C.G. is too far aft, the airplane may rotate prematurely on takeoff or tend to pitch up during climb. Longitudinal stability will be reduced. This can lead to inadvertent stalls and even spins; and spin recovery becomes more difficult as the center of gravity moves aft of the approved limit.

A properly loaded airplane, however, will perform as intended. This airplane is designed to provide excellent performance and safety within the flight envelope. Before the airplane is delivered, it is weighed, and a basic empty weight and C.G. location is computed (basic empty weight consists of the standard empty weight of the airplane plus the optional equipment). Using the basic empty weight and C.G. location, the pilot can easily determine the weight and C.G. position for the loaded airplane by computing the total weight and moment and then determining whether they are within the approved envelope.

The basic empty weight and C.G. location are recorded in the Aircraft Log Book, or the Weight and Balance Data Form (Figure 6-5) and the Weight and Balance Record (Figure 6-7). The current values should always be used. Whenever new equipment is added or any modification work is done, the mechanic responsible for the work is required to compute a new basic empty weight and C.G. position and to write these in the Aircraft Log Book and the Weight and Balance Record. The owner should make sure that it is done.

A weight and balance calculation can be helpful in determining how much fuel or baggage can be boarded so as to keep the C.G. within allowable limits. If it is necessary to remove some of the fuel to stay within maximum allowable gross weight, the pilot should not hesitate to do so.

The following pages are forms used in weighing an airplane in production and in computing basic empty weight, C.G. position, and useful load. Note that the useful load includes usable fuel, baggage, cargo and passengers. Following this is the method for computing takeoff weight and C.G.

6.3 AIRPLANE WEIGHING PROCEDURE

At the time of delivery, Piper Aircraft Corporation provides each airplane with the basic empty weight and center of gravity location. This data is supplied by Figure 6-5.

The removal or addition of equipment or airplane modifications can affect the basic empty weight and center of gravity. The following is a weighing procedure to determine this basic empty weight and center of gravity location:

(a) Preparation

- (1) Be certain that all items checked in the airplane equipment list are installed in the proper location in the airplane.
- (2) Remove excessive dirt, grease, moisture, foreign items such as rags and tools from the airplane before weighing.
- (3) Defuel airplane. Then open all fuel drains until all remaining fuel is drained. Operate engine on each tank until all undrainable fuel is used and engine stops. Then add the unusable fuel (2.0 gallons total, 1.0 gallons each wing).
- (4) Fill with oil to full capacity.
- (5) Place pilot and copilot seats in fourth (4th) notch, aft of forward position. Put flaps in the fully retracted position and all control surfaces in the neutral position. Tow bar should be in the proper location and all entrance and baggage doors closed.
- (6) Weigh the airplane inside a closed building to prevent errors in scale readings due to wind.

(b) Leveling

- (1) With airplane on scales, block main gear oleo pistons in the fully extended position.
- (2) Level airplane (refer to Figure 6-3) deflating nose wheel tire, to center bubble on level.

(c) Weighing - Airplane Basic Empty Weight

- (1) With the airplane level and brakes released, record the weight shown on each scale. Deduct the tare, if any, from each reading.

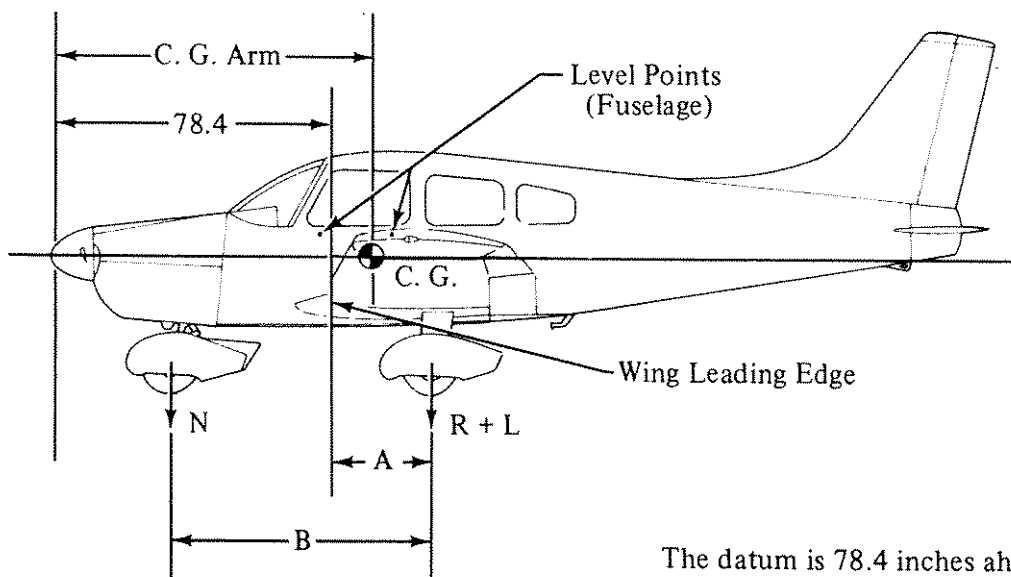
Scale Position and Symbol	Scale Reading	Tare	Net Weight
Nose Wheel (N)			
Right Main Wheel (R)			
Left Main Wheel (L)			
Basic Empty Weight, as Weighed (T)	—	—	

WEIGHING FORM

Figure 6-1

(d) Basic Empty Weight Center of Gravity

- (1) The following geometry applies to the PA-28-181 airplane when it is level. Refer to Leveling paragraph 6.3 (b).



The datum is 78.4 inches ahead of the wing leading edge at the intersection of the straight and tapered section.

A =

B =

LEVELING DIAGRAM

Figure 6-3

- (2) Obtain measurement "A" by measuring from a plumb bob dropped from the wing leading edge, at the intersection of the straight and tapered section, horizontally and parallel to the airplane centerline, to the main wheel centerline.
- (3) Obtain measurement "B" by measuring the distance from the main wheel centerline, horizontally and parallel to the airplane centerline, to each side of the nose wheel axle. Then average the measurements.
- (4) The basic empty weight center of gravity (as weighed including optional equipment, full oil and unusable fuel) can be determined by the following formula:

$$\text{C.G. Arm} = 78.4 + A - \frac{B(N)}{T}$$

$$\text{C.G. Arm} = 78.4 + (\quad) - \frac{(\quad) (\quad)}{(\quad)} = \quad \text{inches}$$

6.5 WEIGHT AND BALANCE DATA AND RECORD

The Basic Empty Weight, Center of Gravity Location and Useful Load listed in Figure 6-5 are for the airplane as delivered from the factory. These figures apply only to the specific airplane serial number and registration number shown.

The basic empty weight of the airplane as delivered from the factory has been entered in the Weight and Balance Record (Figure 6-7). This form is provided to present the current status of the airplane basic empty weight and a complete history of previous modifications. Any change to the permanently installed equipment or modification which affects weight or moment must be entered in the Weight and Balance Record.

MODEL PA-28-181 CHEROKEE ARCHER II

Airplane Serial Number 28-7690095

Registration Number N7972C

Date 12/10/75

AIRPLANE BASIC EMPTY WEIGHT

Item	Weight (Lbs)	x	C. G. Arm (Inches Aft of Datum)	=	Moment (In-Lbs)
Standard Empty Weight*	1416.0		85.2		120712
Optional Equipment	130.1		95.0		12363
Basic Empty Weight	1546.1		86.0		133075

*The standard empty weight includes full oil capacity and 2.0 gallons of unusable fuel.

AIRPLANE USEFUL LOAD

(Gross Weight) - (Basic Empty Weight) = Useful Load

Normal Category (2550 lbs) - (1546.1lbs) = 1003.9 lbs.

Utility Category (1950 lbs) - (1546.1lbs) = 403.9 lbs.

THIS BASIC EMPTY WEIGHT, C.G. AND USEFUL LOAD ARE FOR THE AIRPLANE AS DELIVERED FROM THE FACTORY. REFER TO APPROPRIATE AIRCRAFT RECORD WHEN ALTERATIONS HAVE BEEN MADE.

WEIGHT AND BALANCE DATA FORM

Figure 6-5

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

MAJOR REPAIR AND ALTERATION
(Airframe, Powerplant, Propeller, or Appliance)

Form Approved
Budget Bureau No. 04-R060.1

FOR FAA USE ONLY

OFFICE IDENTIFICATION
FAI FSDO
4-0-04

INSTRUCTIONS: Print or type all entries. See FAR 43.9, FAR 43 Appendix B, and AC 43.9-1 (or subsequent revision thereof) for instructions and disposition of this form.

1. AIRCRAFT	MAKE PIPER	MODEL PA-28-181
	SERIAL NO. 28-7690095	NATIONALITY AND REGISTRATION MARK N7972C
2. OWNER	NAME (As shown on registration certificate) BI-RITE AUTO TRANSPORT	ADDRESS (As shown on registration certificate) 1902 WEST NORTH GRAND PORTERVILLE, CA. 93257

3. FOR FAA USE ONLY

4. UNIT IDENTIFICATION

5. TYPE

UNIT	MAKE	MODEL	SERIAL NO.	REPAIR	ALTERATION
AIRFRAME	***** (As described in item 1 above) *****				X
POWERPLANT					
PROPELLER					
APPLIANCE	TYPE				
	MANUFACTURER				

6. CONFORMITY STATEMENT

A. AGENCY'S NAME AND ADDRESS AVIONICS PROFESSIONALS INC. 9500 AIRPORT DRIVE, SPACE 6 VISALIA, CA. 93277	B. KIND OF AGENCY	C. CERTIFICATE NO.
	☐ U.S. CERTIFICATED MECHANIC	CRS 404-50
	☐ FOREIGN CERTIFICATED MECHANIC	RADIO CLASS I, II, III
	☒ CERTIFICATED REPAIR STATION	LIMITED INSTRUMENT
	MANUFACTURER	LIMITED AIRFRAME

D. I certify that the repair and/or alteration made to the unit(s) identified in item 4 above and described on the reverse or attachments hereto have been made in accordance with the requirements of Part 43 of the U.S. Federal Aviation Regulations and that the information furnished herein is true and correct to the best of my knowledge.

DATE AUGUST 7, 1987	SIGNATURE OF AUTHORIZED INDIVIDUAL NICKOLAS KERN <i>Nickolas Kern</i>
------------------------	--

7. APPROVAL FOR RETURN TO SERVICE

Pursuant to the authority given persons specified below, the unit identified in item 4 was inspected in the manner prescribed by the Administrator of the Federal Aviation Administration and is ☒ APPROVED ☐ REJECTED

BY	FAA FLT. STANDARDS INSPECTOR	MANUFACTURER	INSPECTION AUTHORIZATION	OTHER (Specify)
	FAA DESIGNEE	XX REPAIR STATION	CANADIAN DEPARTMENT OF TRANSPORT INSPECTOR OF AIRCRAFT	
DATE OF APPROVAL OR REJECTION AUGUST 7, 1987	CERTIFICATE OR DESIGNATION NO. CRS 404-50	SIGNATURE OF AUTHORIZED INDIVIDUAL NICKOLAS KERN <i>Nickolas Kern</i>		

PIPER
PA 28-181
S/N 28-7690095
N7972C

REVISED
WEIGHT &
BALANCE

11-10-95

Original aircraft	1549.19	85.88	133038.83
Removed:			
DUAL KX 170	15.00	56.60	849.00
DUAL KI 201C	5.00	59.90	300.00
Installed:			
DUAL KX 155	10.45	56.60	591.50
DUAL IND KI 209			
KI 208	2.20	59.90	131.80
SIGTRONICS ICS	.50	62.00	31.00

NEW AIRCRAFT EMPTY WEIGHT 1542.3

NEW AIRCRAFT MOMENT 132644.1

NEW AIRCRAFT C. G. 86.0

NEW AIRCRAFT USEFUL LOAD 1607.7

F. A. INC.
PO BOX 269
TULARE CA 93275

BF4R074M

6.7 WEIGHT AND BALANCE DETERMINATION FOR FLIGHT

- Add the weight of all items to be loaded to the basic empty weight.
- Use the Loading Graph (Figure 6-13) to determine the moment of all items to be carried in the airplane.
- Add the moment of all items to be loaded to the basic empty weight moment.
- Divide the total moment by the total weight to determine the C.G. location.
- By using the figures of item (a) and item (d) (above), locate a point on the C.G. range and weight graph (Figure 6-15). If the point falls within the C.G. envelope, the loading meets the weight and balance requirements.

	Weight (Lbs)	Arm Aft Datum (Inches)	Moment (In-Lbs)
Basic Empty Weight	1546.1	86.0	^{133166.5} 133075
Pilot and Front Passenger	340.0	80.5	27370
Passengers (Rear Seats)*	340.0	118.1	40154
Fuel (48 Gallon Maximum)	288.0	95.0	27360
Baggage*	35.9	142.8	5127
Total Loaded Airplane	2550	91.4	233086

The center of gravity (C.G.) of this sample loading problem is at 91.4 inches aft of the datum line. Locate this point (91.4) on the C.G. range and weight graph. Since this point falls within the weight - C.G. envelope, this loading meets the weight and balance requirements.

IT IS THE RESPONSIBILITY OF THE PILOT AND AIRCRAFT OWNER TO INSURE THAT THE AIRPLANE IS LOADED PROPERLY.

*Utility Category Operation - No baggage or rear passengers allowed.

SAMPLE LOADING PROBLEM (NORMAL CATEGORY)

Figure 6-9

SECTION 6
WEIGHT AND BALANCE

PIPER AIRCRAFT CORPORATION
PA-28-181, CHEROKEE ARCHER II

2550 ~~MTOW~~ MTOW

TABLE PARA VUELO PILOTO, COPILOTO FULL TANKS NO BAGGAGE	Weight (Lbs)	Arm Aft Datum (Inches)	Moment (In-Lbs)
Basic Empty Weight	1542.3	86.0	132644.1
Pilot and Front Passenger ^{170 lb each}	340	80.5	27370
Passengers (Rear Seats)*	000	118.1	
Fuel (48 Gallon Maximum) 6 Lbs X GAL	288	95.0	27360
Baggage*	000	142.8	
Total Loaded Airplane	2170.3	86.33	187374.1

1007.7 LBS USABLE LOAD

Totals must be within approved weight and C.G. limits. It is the responsibility of the airplane owner and the pilot to insure that the airplane is loaded properly. The Basic Empty Weight C.G. is noted on the Weight and Balance Data Form (Figure 6-00). If the airplane has been altered, refer to the Weight and Balance Record for this information.

*Utility Category Operation - No baggage or rear passengers allowed.

1007.7 USABLE

FUEL = 6 Lb X GAL.

WEIGHT AND BALANCE LOADING FORM

Figure 6-11

TOW = 2170.3

ELEV = 310.

TEMP = 83°F

ALT = 2999

	Weight (Lbs)	Arm Aft Datum (Inches)	Moment (In-Lbs)
Basic Empty Weight	1542.3	86.0	132644.1
Pilot and Front Passenger 170 x 2	340	80.5	27370
Passengers (Rear Seats)*		118.1	
Fuel (48 Gallon Maximum) 6 Lbs x 1 Gal	288	95.0	27360
Baggage*		142.8	
Total Loaded Airplane	2170.3	86.33	187374.1

1007.7 185 USABLE (0.1)

Totals must be within approved weight and C.G. limits. It is the responsibility of the airplane owner and the pilot to insure that the airplane is loaded properly. The Basic Empty Weight C.G. is noted on the Weight and Balance Data Form (Figure 6-00). If the airplane has been altered, refer to the Weight and Balance Record for this information.

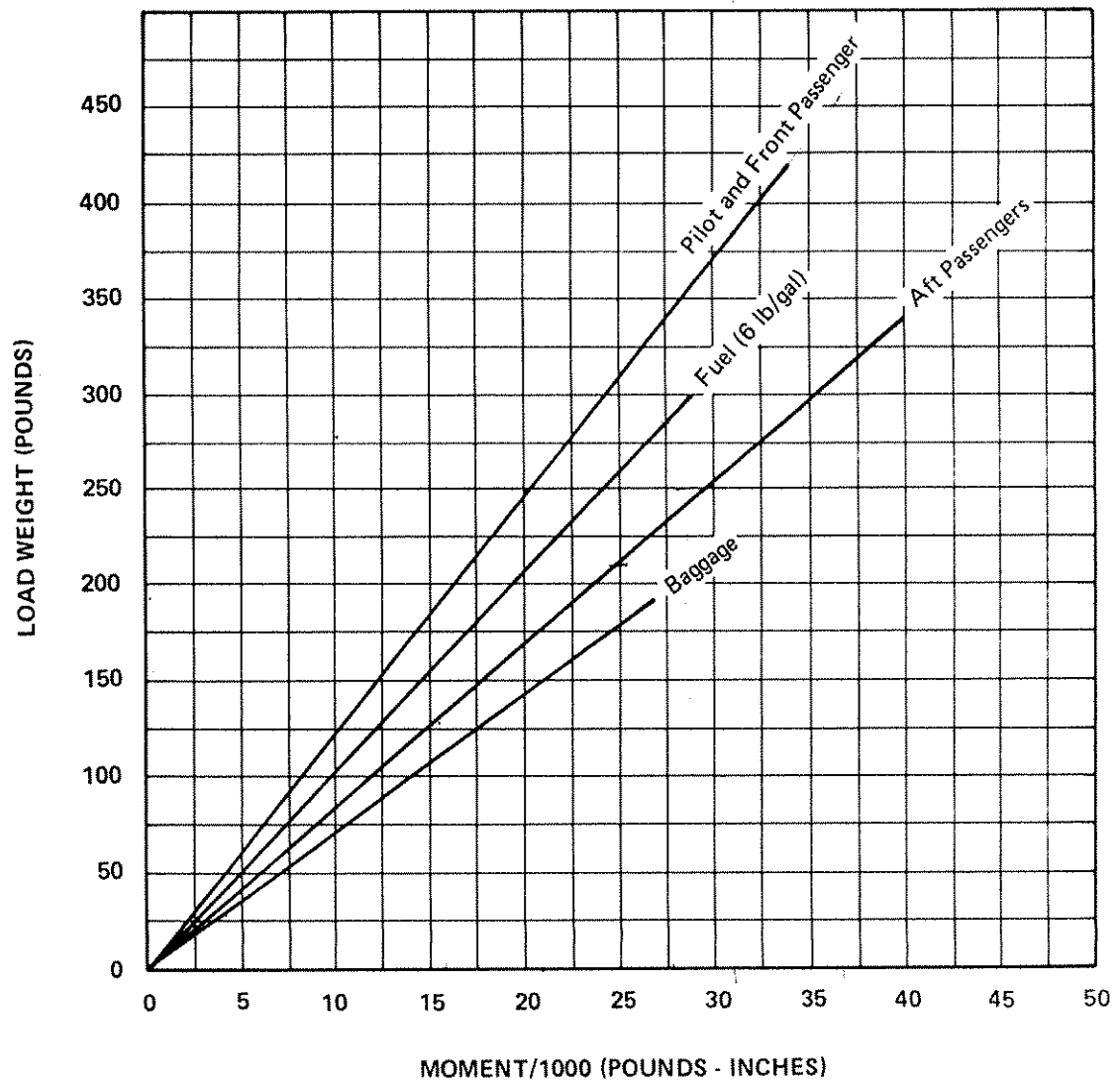
*Utility Category Operation - No baggage or rear passengers allowed.

1007.7 USABLE

WEIGHT AND BALANCE LOADING FORM

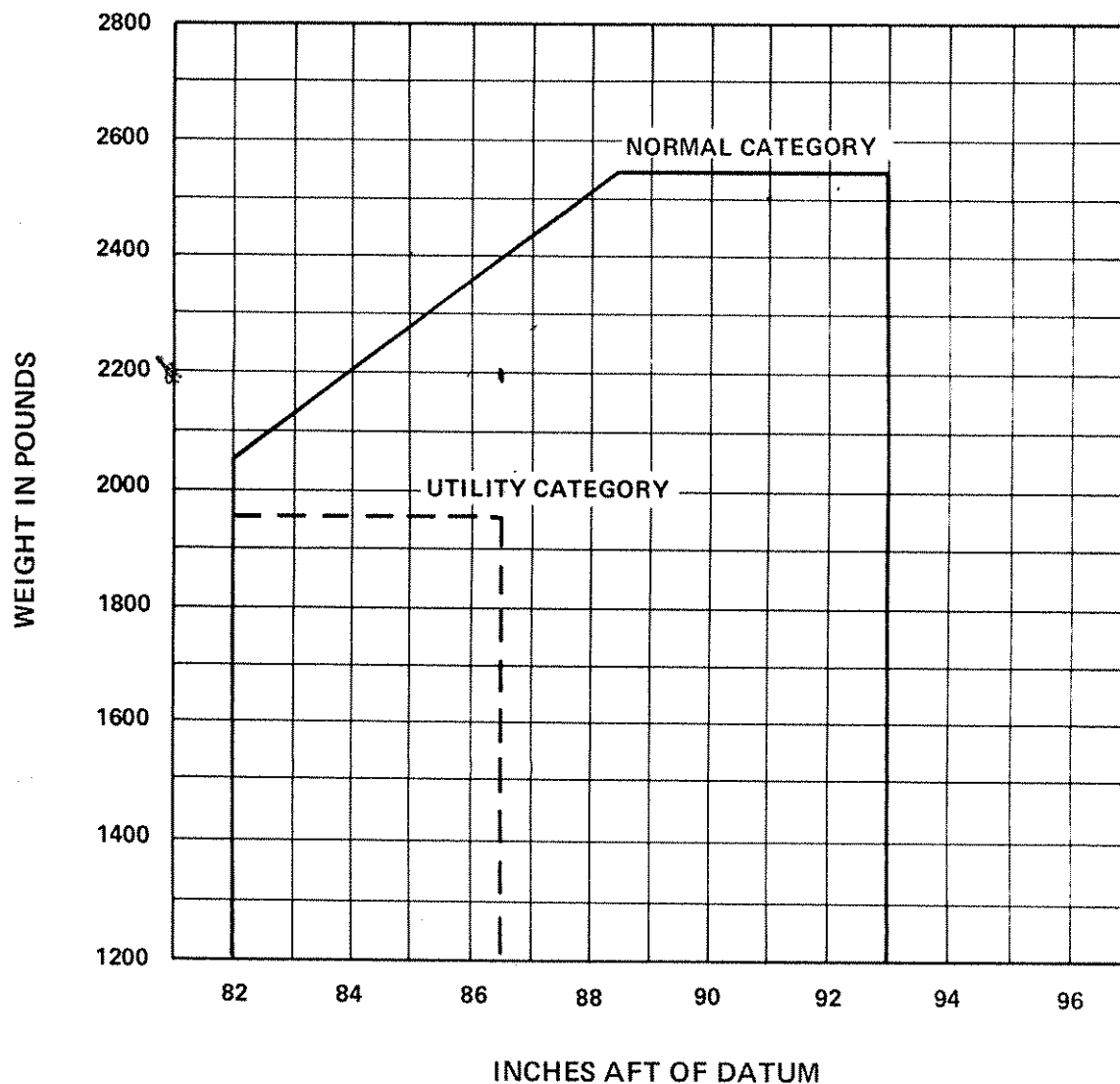
Figure 6-11

C.G. NORMAL CATEGORY
15 + 82.0 TO + 93.0 AT 2050 Lbs OR LESS
+ 88.6 TO + 93.0 AT 2550 Lbs



LOADING GRAPH

Figure 6-13



C. G. RANGE AND WEIGHT

Figure 6-15