

WEIGHT AND BALANCE

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WEIGHT AND BALANCE LOG OF REVISIONS

Revision	Revised Pages	Description and Revision	Approved Date
1	5-8 5-14 5-18 5-21 5-26 5-28 5-31 5-32	Revised Fuel Capacity on Sample Problem. Revised Battery and Voltage Regulator Weights and Moments. Revised Toe Brake Weight and Moment. Revised Battery Weights and Moment. Revised Selector Panel and Marker Beacon Weights, Arms and Moments. Revised -10 and -12 Microphones Weights, Arms and Moments. Revised Right and Left Vert. Adj. Front Seats' Weights, Arms and Moments. Revised Ground Vent. Blower; Added Corrosive Resistant Kit.	Oct. 29, 1973 <i>W. T. ...</i>
2	Title	Added PAC Approval Form. (NOTE: AIRCRAFT DELIVERED WITH MANUALS PRIOR TO THIS REVISION DO NOT REQUIRE THIS REVISION.)	March 25, 1974 <i>D. ...</i>
3	5-12 5-14 5-18 5-20 5-23 5-25 5-26 5-27 5-28 5-28a 5-28b	Added Oil Filters and footnote. Added Annunciator Light and footnote. Revised Inertia Safety Belts Weights, Arm, Moment and Part No. Added Oil Filter, Lycoming # LW-13743; added Vacuum Pump Model 211cc; added Low Vacuum Annunciator Light; added Vacuum Regulator # 133A4; added Vacuum Regulator 2H3-19; added footnotes. Added AutoControl IIIB; added footnotes; added ser. nos. to AutoControl III Console. Added footnotes; relocated Item. Added item relocated from Page 5-25; revised item entries; added footnote; re- located items; added Dual KNI-520. Added items relocated from Page 5-26; added footnote; relocated items. Added items relocated from Page 5-27; added footnote. Added page. Added page.	June 18, 1974 <i>J. G. Hamilton</i>

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Revision	Revised Pages	Description and Revision	Approved Date
3 (cont)	5-28c 5-28d 5-29 5-31 5-32	Added page. Added page. Added Encoding Altimeter. Revised Inertia Safety Belts' Weights, Arm, Moment and Part No.; revised Assist Strap and Coat Hook (62353-5); relocated info to page 5-32. Added info from page 5-31.	
4	5-12 5-14 5-18 5-21 5-29 5-30 5-31 5-32	Deleted Alternator. Revised Battery description. Added 79337-3 Right Front Seat. Revised Rotating Beacon description. Deleted Vacuum Regulator. Added Engine Hour Meter, Radar Altimeter and NSD Gyro; added footnote. Added 79337-18 Front Headrest; added 79337-18 Rear Headrest; added 79591-0 Left Front Seat; relocated Right Front Seat to page 5-32. Added Right Front Seat from page 5-31; added 79591-1 Right Front Seat; added 76304-11 and -12 Overhead Vent Systems; added Stainless Steel Control Cables; added footnote.	June 27, 1975 <i>C.E. Riehl</i>
5	5-22 5-27 5-28 5-29 5-30	Revised Electric Trim System to Piper Pitch Trim 67469-2; added Piper Pitch Trim 67469-3; added footnote. Added King KN61 DME and King KN65A DME. Added Dwg. No. to PAL Transmitter; added PAL Transmitter 79265-6. Deleted Dwg. No. from Clock. Added Narco OC-110 Converter and Mount.	Dec. 8, 1975 <i>George Tangel</i>
6	5-28	Added PAL Transmitter 79761-4.	July 22, 1976 <i>George Tangel</i>

WEIGHT AND BALANCE LOG OF REVISIONS (cont)

Revision	Revised Pages	Description and Revision	Approved Date
7	5-11	Added McCauley Propeller and Spinner; added footnotes.	<i>Jay Chazy</i> Feb. 28, 1977
	5-12	Added Lycoming IO-360-C1C6 Engine and footnotes.	
	5-15	Added Tachometer and footnotes.	
	5-29	Revised Attitude and Directional Gyro dash nos.	
8	5-1	Revised Weight and Balance info.	<i>Hal Fletcher</i> April 13, 1979
	5-3	Added Caution; relocated para. 2.6 to pg. 5-4.	
	5-4	Added para. 2.b. from pg. 5-3.	
9	5-1	Revised Weight and Balance info.	<i>Ward Erms</i> Feb 29, 1984
	5-3	Revised weighing procedures para.	
	5-7	Revised info.	

ISSUED: FEBRUARY 28, 1977
 REVISED: FEBRUARY 29, 1984

REPORT: VB-549 PAGE 5-v
 MODEL: PA-28R-200

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WEIGHT AND BALANCE

In order to achieve the performance and flying characteristics which are designed into the aircraft, the Arrow must be flown with the weight and center of gravity (C.G.) position within the approved envelope. The aircraft offers flexibility of loading. However, you cannot fill the aircraft with four adults, full fuel tanks and maximum baggage. With the flexibility comes responsibility. The pilot must insure 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 when it is properly loaded. 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 try 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 aircraft, however, will perform as intended. Before the aircraft is licensed, the Arrow is weighed and a licensed empty weight and C.G. location computed. Using the licensed 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 licensed empty weight and C.G. location for a particular airplane are recorded in the weight and balance section of the Airplane Flight Manual. 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. The owner should make sure that it is done.

A weight and balance calculation is necessary in determining how much fuel or baggage can be boarded so as to keep within allowable limits. Check calculations prior to adding fuel to insure against improper loading.

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

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WEIGHT AND BALANCE DATA

WEIGHING PROCEDURE

At the time of licensing, Piper Aircraft Corporation provides each airplane with the licensed empty weight and center of gravity location. This data is on Page 5-7.

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

1. PREPARATION

- a. Be certain that all items checked in the airplane equipment list are installed in the proper location in the airplane.
- b. Remove excessive dirt, grease, moisture, foreign items such as rags and tools from the airplane before weighing.
- c. 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.

CAUTION

Whenever the fuel system is completely drained and fuel is replenished it will be necessary to run the engine for a minimum of 3 minutes at 1000 RPM on each tank to insure no air exists in the fuel supply lines.

- d. Drain all oil from the engine, by means of the oil drain, with the airplane in ground attitude. This will leave the undrainable oil still in the system. Engine oil temperature should be in the normal operating range before draining.
- e. 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.
- f. Weigh the airplane inside a closed building to prevent errors in scale readings due to wind.

2. LEVELING

- a. With airplane on scales, block main gear oleo pistons in the fully extended position.

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- b. Level airplane (see diagram) deflating nose wheel tire, to center bubble on level.

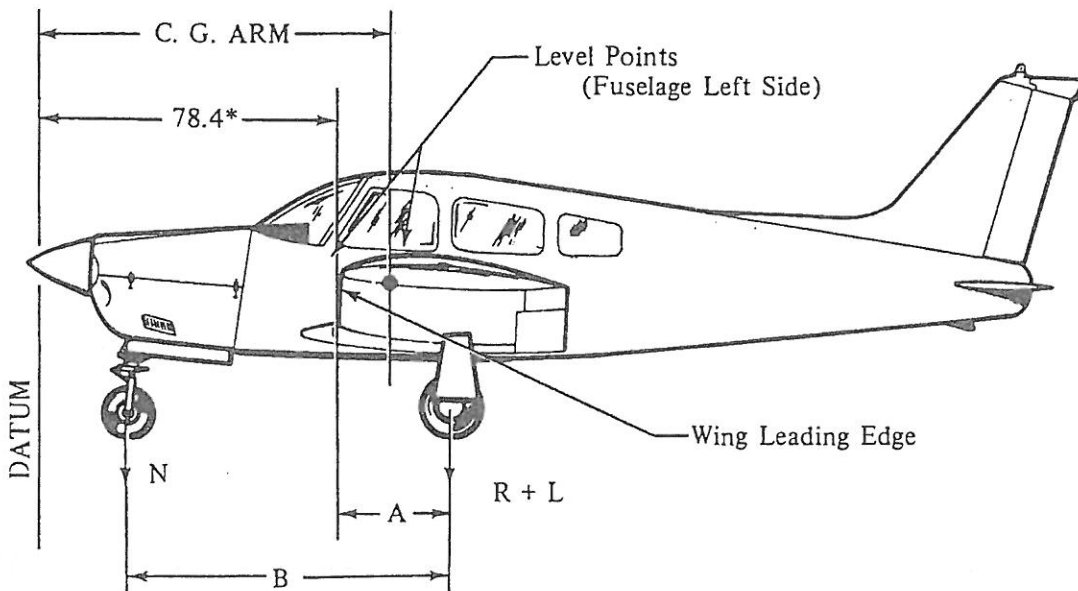
3. WEIGHING - AIRPLANE EMPTY WEIGHT

- a. 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	Weight
Nose Wheel (N)			
Right Main Wheel (R)			
Left Main Wheel (L)			
Airplane Empty Weight, as Weighed (T)			

4. EMPTY WEIGHT CENTER OF GRAVITY

- a. The following geometry applies to the PA-28R-200 airplane when airplane is level (See Item 2).



A =

B =

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

- b. 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.
- c. 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.
- d. The empty weight center of gravity (as weighed including optional equipment and undrainable oil) can be determined by the following formula:

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

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

5. LICENSED EMPTY WEIGHT AND EMPTY WEIGHT CENTER OF GRAVITY

	Weight	Arm	Moment
Empty Weight (as weighed)			
Unusable Fuel (13 1/3 Pints)	+10.0	103.0	+1030
Licensed Empty Weight			

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WEIGHT AND BALANCE DATA

MODEL PA-28R-200 CHEROKEE

Airplane Serial Number 28R-7535001Registration Number N44443Date 10/6/2005

AIRPLANE EMPTY WEIGHT

Item	Weight (Lbs)	C. G. Arm (Inches Aft of Datum)	Moment (In-Lbs)
*Empty Weight	Actual Computed		
Unusable Fuel (13-1/3 pints)	10.0	103.0	1030
Standard Empty Weight			
Optional Equipment			
Licensed Empty Weight	<u>1721.97</u>	<u>87.42</u>	<u>150,538.35</u>

*Empty weight is defined as dry empty weight (including paint and hydraulic fluid) plus 1.8 lbs undrainable engine oil.

AIRPLANE USEFUL LOAD - NORMAL CATEGORY OPERATION

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

(2650 lbs) - (lbs) = lbs

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

 C. G. RANGE AND WEIGHT INSTRUCTIONS

1. Add the weight of all items to be loaded to the licensed empty weight.
2. Use the loading graph to determine the moment of all items to be carried in the airplane.
3. Add the moment of all items to be loaded to the licensed empty weight moment.
4. Divide the total moment by the total weight to determine the C.G. location.
5. By using the figures of Item 1 and Item 4, locate a point on the C.G. range and weight graph. If the point falls within the C.G. envelope, the loading meets the weight and balance requirements.

 SAMPLE LOADING PROBLEM (Normal Category)

<i>Max Wt. = 2650#</i>	Weight (Lbs)	Arm Aft Datum (Inches)	Moment (In-Lbs)
Licensed Empty Weight	<i>1721.97</i>	<i>87.42</i>	<i>150,538.35</i>
Oil (8 quarts)	15	24.5	368
Pilot and Front Passenger		80.5	
Passengers, Aft (Rear Seat)		118.1	
Fuel (48 Gal. Maximum)		95.0	
*Baggage		142.8	
Moment due to Retracting of Landing Gear			819
Total Loaded Airplane			

48 gal = 288

36 gal = 216

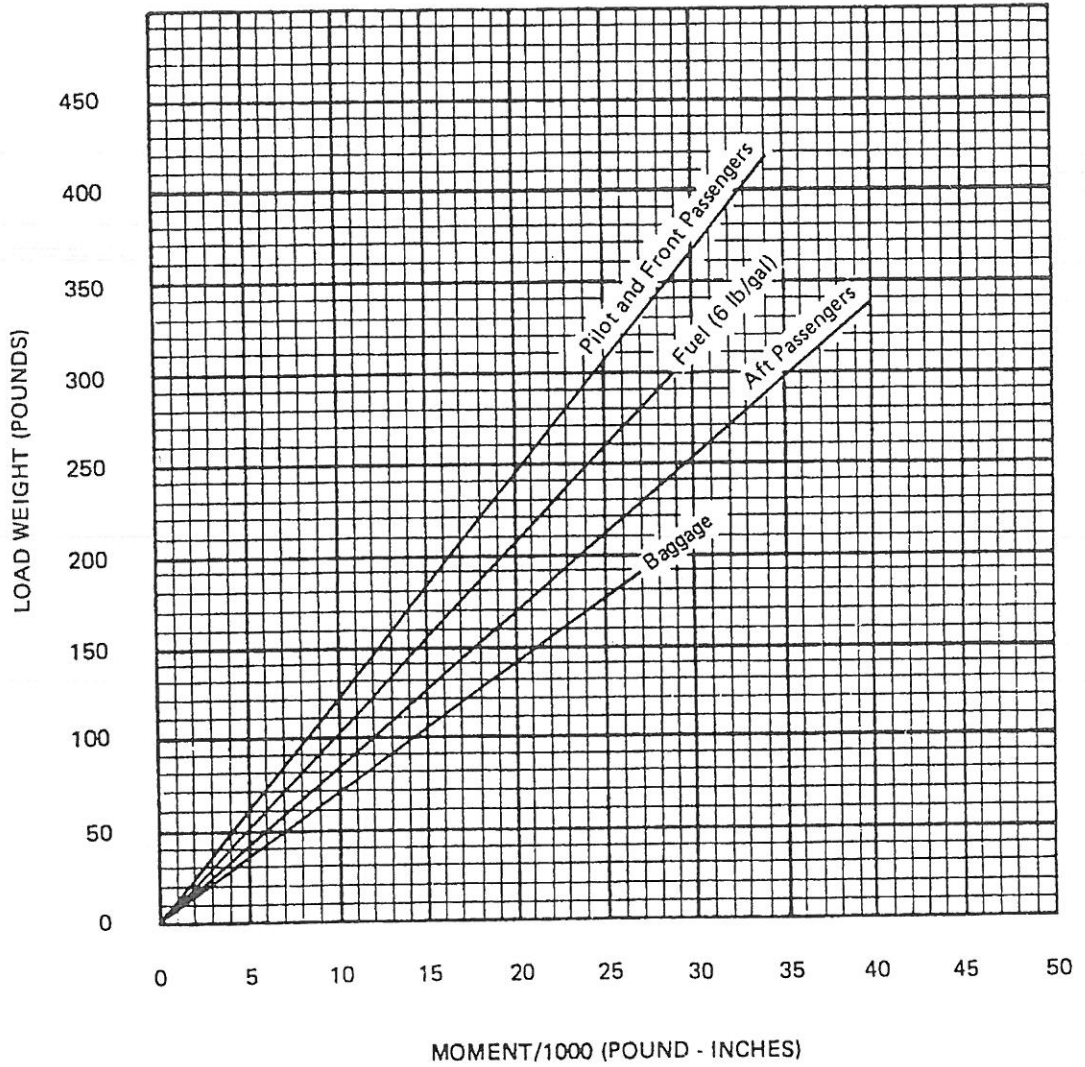
The center of gravity (C.G.) of this sample loading problem is at _____ inches aft of the datum line. Locate this point () on the C.G. range and weight graph. Since this point falls within the weight-C.G. envelope, this loading meets the weight and balance requirements.

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

*Check Aft C.G. between 150 lbs and 200 lbs.

Current as of 06 May 2013 (MWT)

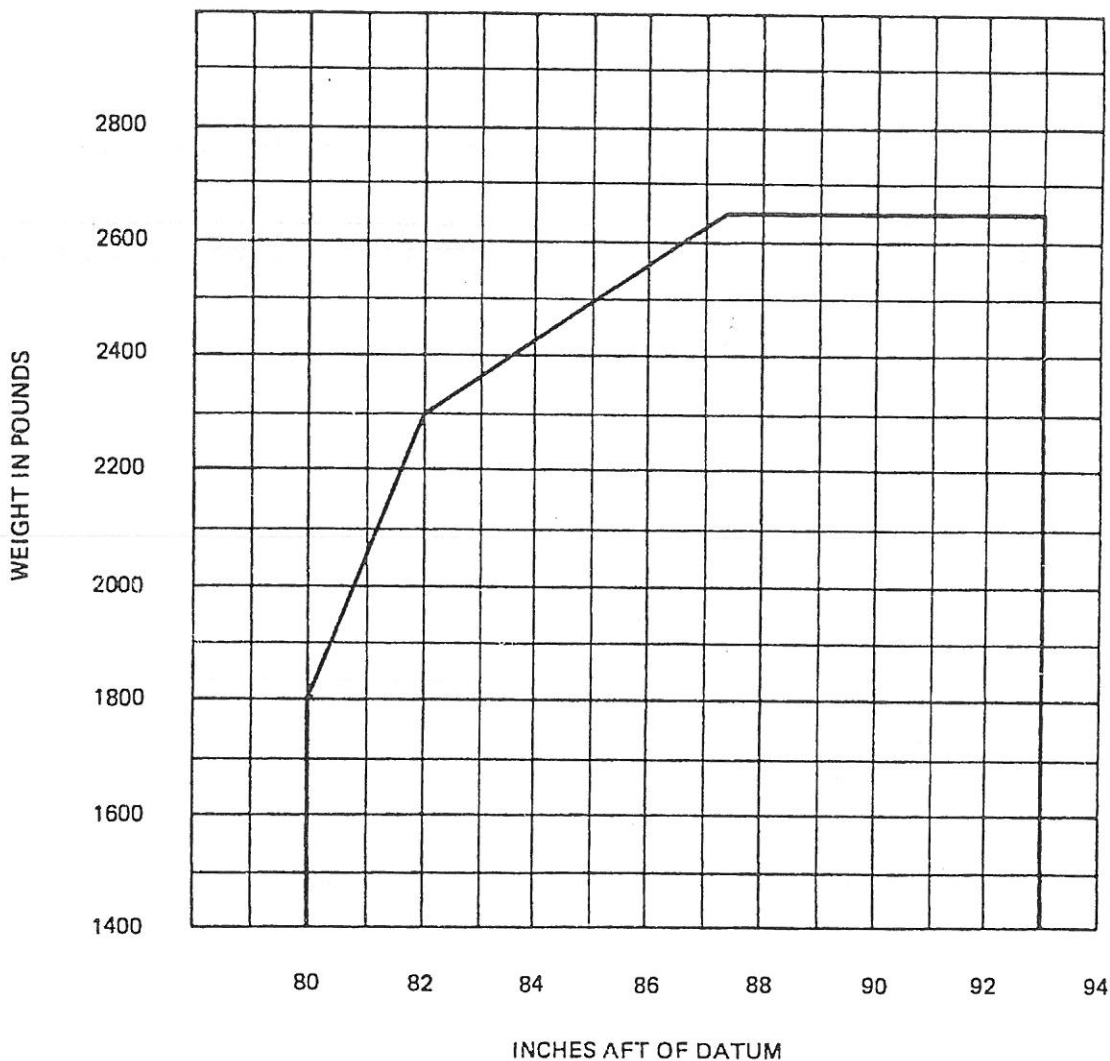
LOADING GRAPH



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IT IS THE RESPONSIBILITY OF THE OWNER AND PILOT TO ASCERTAIN THAT THE AIRPLANE ALWAYS REMAINS WITHIN THE ALLOWABLE WEIGHT VS. CENTER OF GRAVITY ENVELOPE WHILE IN FLIGHT.

C. G. RANGE AND WEIGHT



MOMENT DUE TO RETRACTING LANDING GEAR = +819 IN - LBS