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SECTION 5

PERFORMANCE

SECTION 5

PERFORMANCE

5.1 GENERAL

This section contains the required FAA performance information applicable to this aircraft. Additional information is provided for flight planning purposes.

Performance information associated with those optional systems and equipment which require handbook supplements is provided by Section 9 (Supplements).

5.3 INTRODUCTION - PERFORMANCE AND FLIGHT PLANNING

The performance information presented in this section is based on measured Flight Test Data corrected to I.C.A.O. standard day conditions and analytically expanded for the various parameters of weight, altitude, temperature, etc.

The performance charts are unfactored and do not make any allowance for varying degrees of pilot proficiency or mechanical deterioration of the aircraft. This performance, however, can be duplicated by following the stated procedures in a properly maintained airplane.

Effects of conditions not considered on the charts must be evaluated by the pilot, such as the effect of soft or grass runway surface on takeoff and landing performance, or the effect of winds aloft on cruise and range performance. Endurance can be grossly affected by improper leaning procedures, and inflight fuel flow and quantity checks are recommended.

REMEMBER! To get chart performance, follow the chart procedures.

The information provided by paragraph 5.5 (Flight Planning Example) outlines a detailed flight plan using the performance charts in this section. Each chart includes its own example to show how it is used.

WARNING

Performance information derived by extrapolation beyond the limits shown on the charts should not be used for flight planning purposes.

5.5 FLIGHT PLANNING EXAMPLE

(a) Aircraft Loading

The first step in planning the flight is to calculate the airplane weight and center of gravity by utilizing the information provided by Section 6 (Weight and Balance) of this handbook.

The basic empty weight for the airplane as licensed at the factory has been entered in Figure 6-5. If any alterations to the airplane have been made effecting weight and balance, reference to the aircraft logbook and Weight and Balance Record (Figure 6-7) should be made to determine the current basic empty weight of the airplane.

Make use of the Weight and Balance Loading Form (Figure 6-11) and C.G. Range and Weight graph (Figure 6-15) to determine the total weight of the airplane and the center of gravity position.

The landing weight cannot be determined until the weight of the fuel to be used has been established [refer to item (g)(1)].

(1)	Basic Empty Weight	3122 lbs.
(2)	Occupants (2 x 170 lbs.)	340 lbs.
(3)	Baggage and Cargo	27 lbs.
(4)	Fuel (6 lb./gal. x 80)	480 lbs.
(5)	Takeoff Weight	3969 lbs.
(6)	Landing Weight (a)(5) minus (g)(1), (3969 lbs. minus 314 lbs.)	3655 lbs.

The takeoff and landing weights are below the maximums and the weight and balance calculations have determined that the C.G. position is within the approved limits.

(b) Takeoff and Landing

Apply the departure airport conditions and takeoff weight to the appropriate Takeoff Performance and Accelerate and Stop Distance graphs (Figures 5-7 thru 5-15) to determine the length of runway necessary for the takeoff and/or the barrier distance.

The landing distance calculations are performed in the same manner using the existing conditions at the destination airport and, when established, the landing weight.

The conditions and calculations for the example flight are listed below. The takeoff and landing distances required for the example flight have fallen well below the available runway lengths.

	Departure Airport	Destination Airport
(1) Pressure Altitude	2000 ft.	3000 ft.
(2) Temperature	21°C	22°C
(3) Wind Component	9 KTS (Headwind)	10 KTS (Headwind)
(4) Runway Length Available	7400 ft.	9000 ft.
(5) Runway Required (Normal Procedure, Std. Brakes)		
Takeoff	1650 ft.*	
Accelerate and Stop	3260 ft.**	
Landing		2260 ft.***

NOTE

The remainder of the performance charts used in this flight plan example assume a no wind condition. The effect of winds aloft must be considered by the pilot when computing climb, cruise and descent performance.

(c) Climb

The desired cruise pressure altitude and corresponding cruise outside air temperature values are the first variables to be considered in determining the climb components from the Fuel, Time and Distance to Climb graph (Figure 5-23). After the fuel, time and distance for the cruise pressure altitude and outside air temperature values have been established, apply the existing conditions at the departure field to the graph (Figure 5-23). Now, subtract the values obtained from the graph for the field of departure conditions from those for the cruise pressure altitude.

*reference Figure 5-7
**reference Figure 5-13
***reference Figure 5-39

The remaining values are the true fuel, time and distance components for the climb segment of the flight plan corrected for field pressure altitude and temperature.

The following values were determined from the above instructions in the flight planning example.

(1) Cruise Pressure Altitude	16,500 ft.
(2) Cruise OAT	-13°C
(3) Time to Climb (15 min. minus 2 min.)	13 min.*
(4) Distance to Climb (27 naut. miles minus 3 naut. miles)	24 naut. miles*
(5) Fuel to Climb (12 gal. minus 1 gal.)	11 gal.*

(d) Descent

The descent data will be determined prior to the cruise data to provide the descent distance for establishing the total cruise distance.

Utilizing the cruise pressure altitude and OAT, determine the basic fuel, time and distance for descent (Figure 5-37). These figures must be adjusted for the field pressure altitude and temperature at the destination airport. To find the necessary adjustment values, use the existing pressure altitude and temperature conditions at the destination airport as variables to find the fuel, time and distance values from the graph (Figure 5-37). Now, subtract the values obtained from the field conditions from the values obtained from the cruise conditions to find the true fuel, time and distance values needed for the flight plan.

The values obtained by proper utilization of the graphs for the descent segment of the example are shown below.

(1) Time to Descend (16 min. minus 3 min.)	13 min.**
(2) Distance to Descend (44 naut. miles minus 7 naut. miles)	37 naut. miles**
(3) Fuel to Descend (6 gal. minus 1 gal.)	5 gal.**

*reference Figure 5-23
**reference Figure 5-37

(e) Cruise

Using the total distance to be traveled during the flight, subtract the previously calculated distance to climb and distance to descend to establish the total cruise distance. Refer to the Power Setting Tables when selecting the cruise power setting. The established pressure altitude and temperature values and the selected cruise power should now be utilized to determine the true airspeed from the Speed Power graph (Figure 5-27).

Calculate the cruise fuel for the cruise power setting from the information provided on Figure 5-25.

The cruise time is found by dividing the cruise distance by the cruise speed and the cruise fuel is found by multiplying the cruise fuel flow by the cruise time.

The cruise calculations established for the cruise segment of the flight planning example are as follows:

(1) Total Distance	394 miles
(2) Cruise Distance (e)(1) minus (c)(4) minus (d)(2), (394 naut. miles minus 24 naut. miles minus 37 naut. miles)	333 naut. miles
(3) Cruise Power	55% rated power
(4) Cruise Speed	172 KTS TAS*
(5) Cruise Fuel Consumption	18.7 GPH**
(6) Cruise Time (e)(2) divided by (e)(4). (333 naut. miles divided by 172 KTS)	1.94 hrs.
(7) Cruise Fuel (e)(5) multiplied by (e)(6). (18.7 GPH multiplied by 1.94 hrs.)	36.3 gal.

*reference Figure 5-27
**reference Figure 5-25

(f) Total Flight Time

The total flight time is determined by adding the time to climb, the time to descend and the cruise time. Remember! The time values taken from the climb and descent graphs are in minutes and must be converted to hours before adding them to the cruise time.

The following flight time is required for the flight planning example.

(1) Total Flight Time

(c)(3) plus (d)(1) plus (e)(6),	
(0.22 hrs. plus 0.22 hrs. plus 1.94 hrs.)	2.38 hrs.

(g) Total Fuel Required

Determine the total fuel required by adding the fuel to climb, the fuel to descend and the cruise fuel. When the total fuel (in gallons) is determined, multiply this value by 6 lb./gal. to determine the total fuel weight used for the flight.

The total fuel calculations for the example flight plan are shown below.

(1) Total Fuel Required

(c)(5) plus (d)(3) plus (e)(7),	
(11 gal. plus 5 gal. plus 36.3 gal.)	52.3 gal.
(52.3 gal. multiplied by 6 lb./gal.)	313.8 lbs.

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5.7 PERFORMANCE GRAPHS

LIST OF FIGURES

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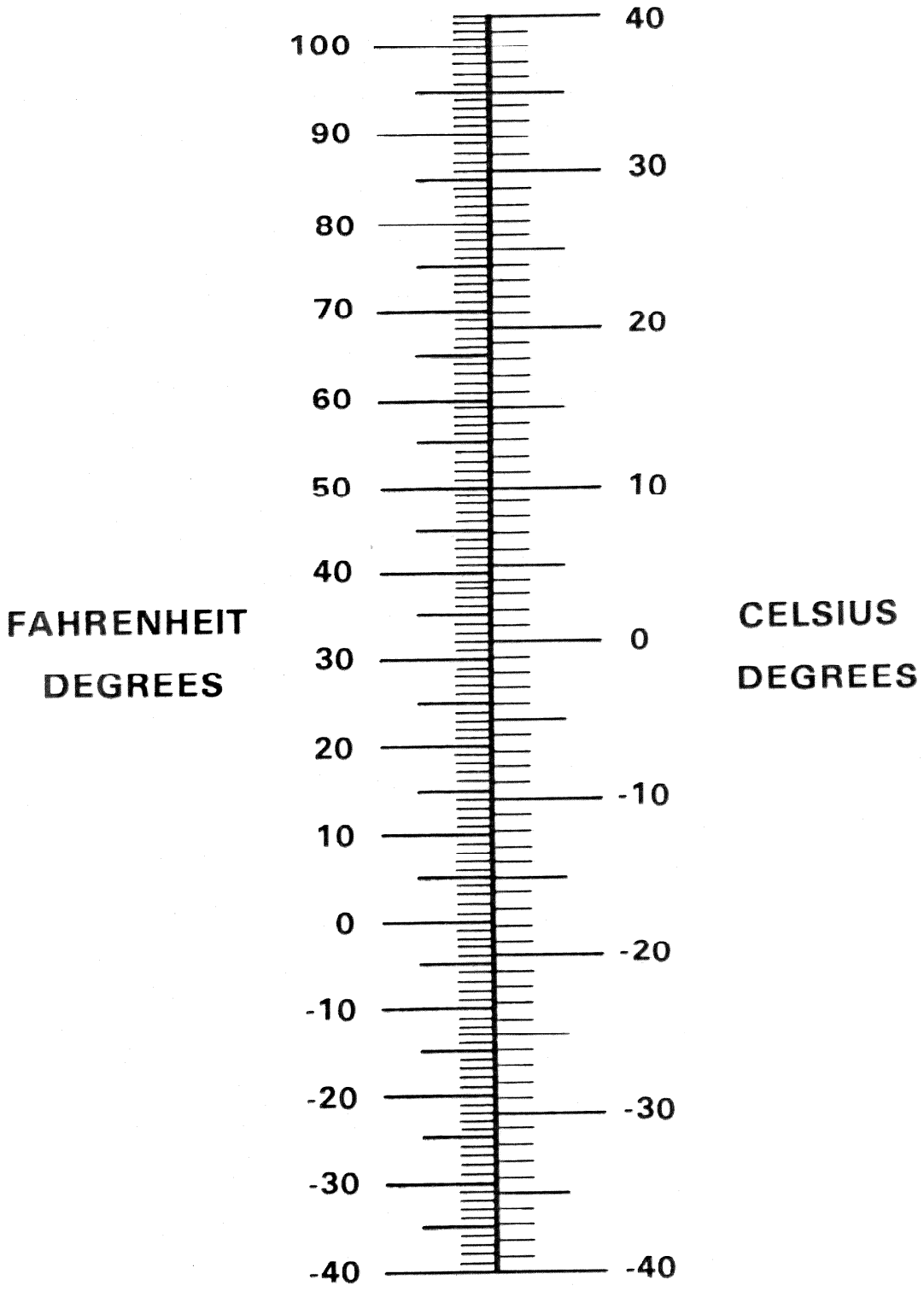
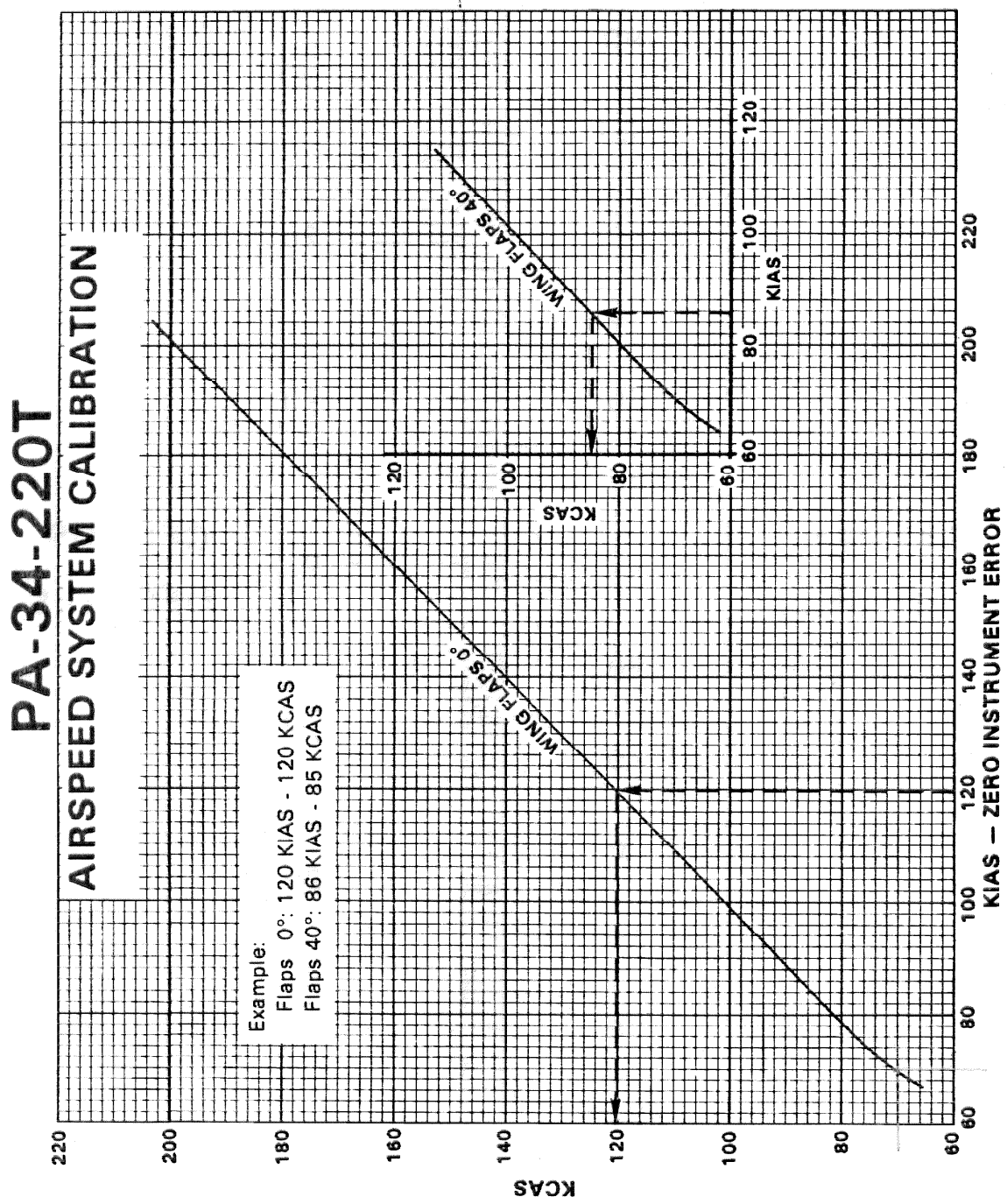
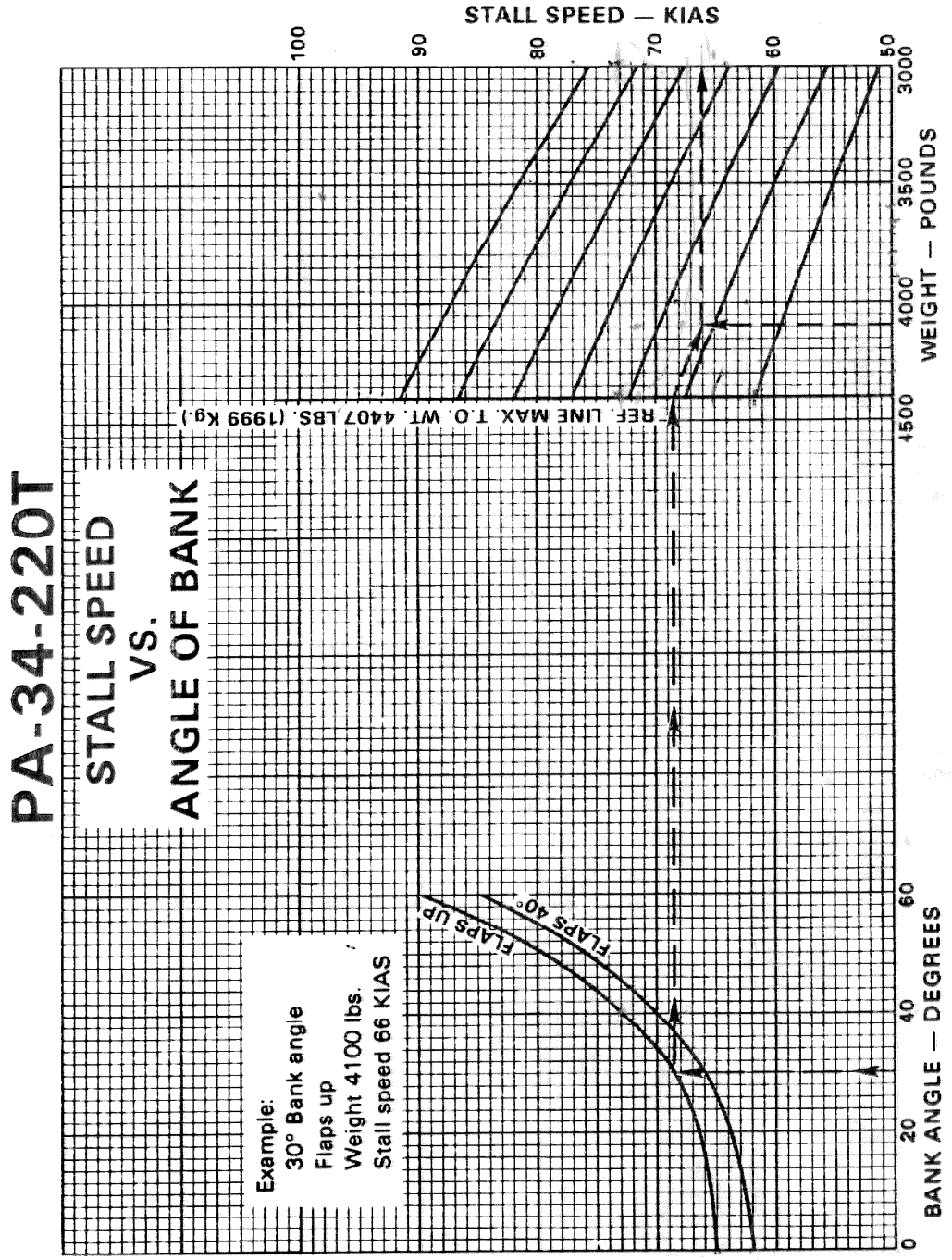


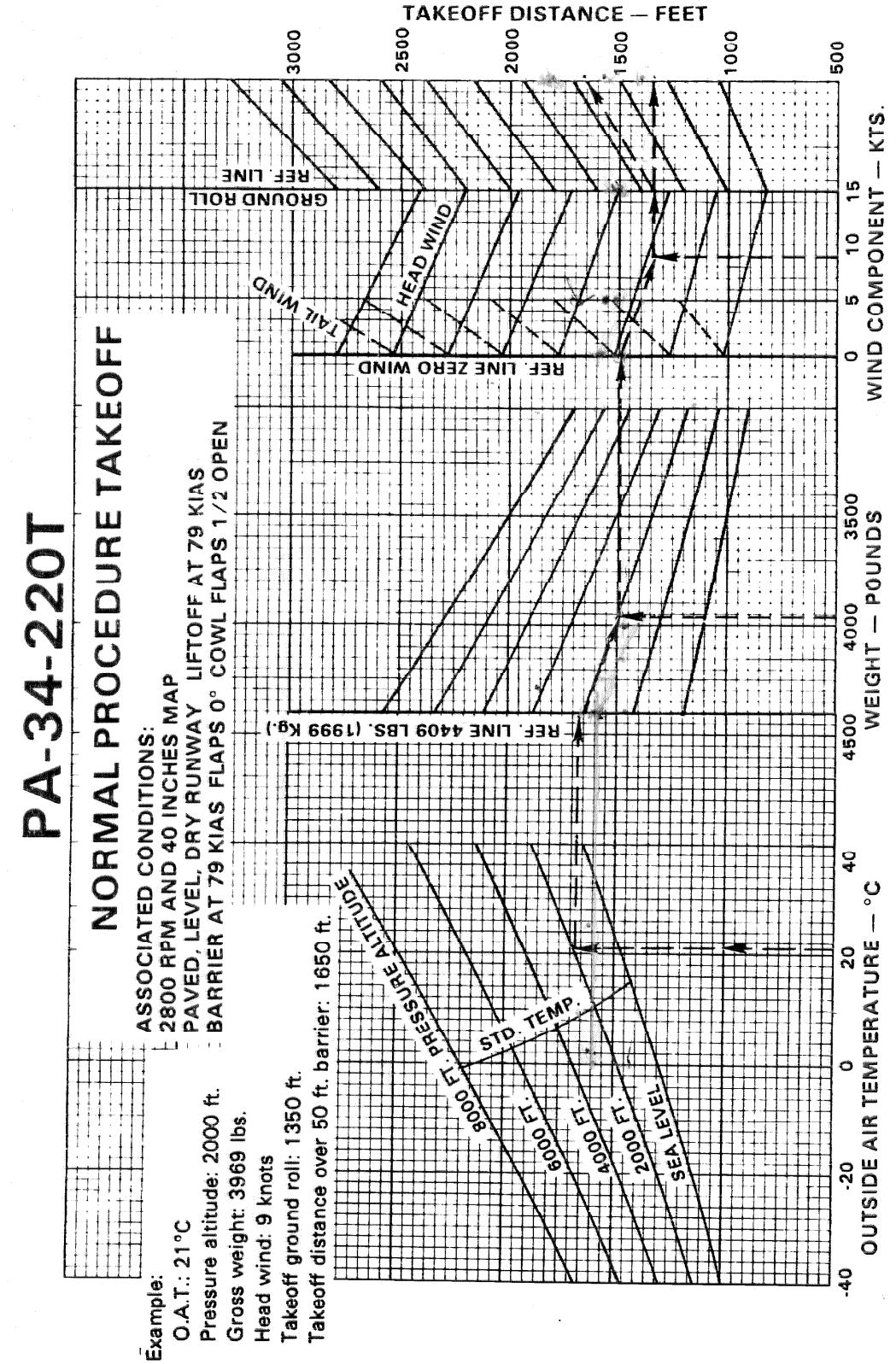
TEMPERATURE CONVERSION CHART
Figure 5-1



AIRSPEED SYSTEM CALIBRATION
Figure 5-3



STALL SPEED VS. ANGLE OF BANK
Figure 5-5



NORMAL PROCEDURE TAKEOFF
Figure 5-7

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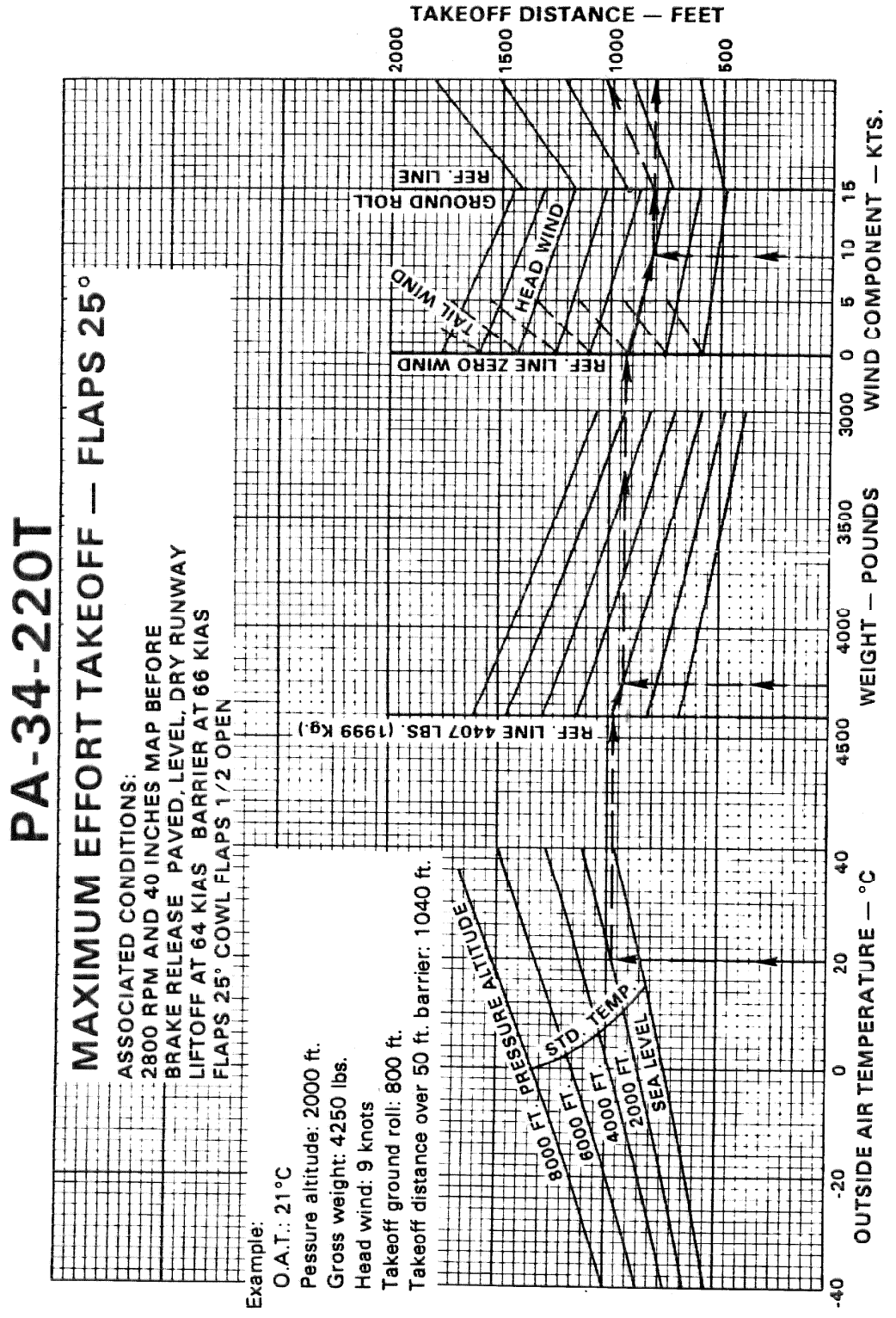
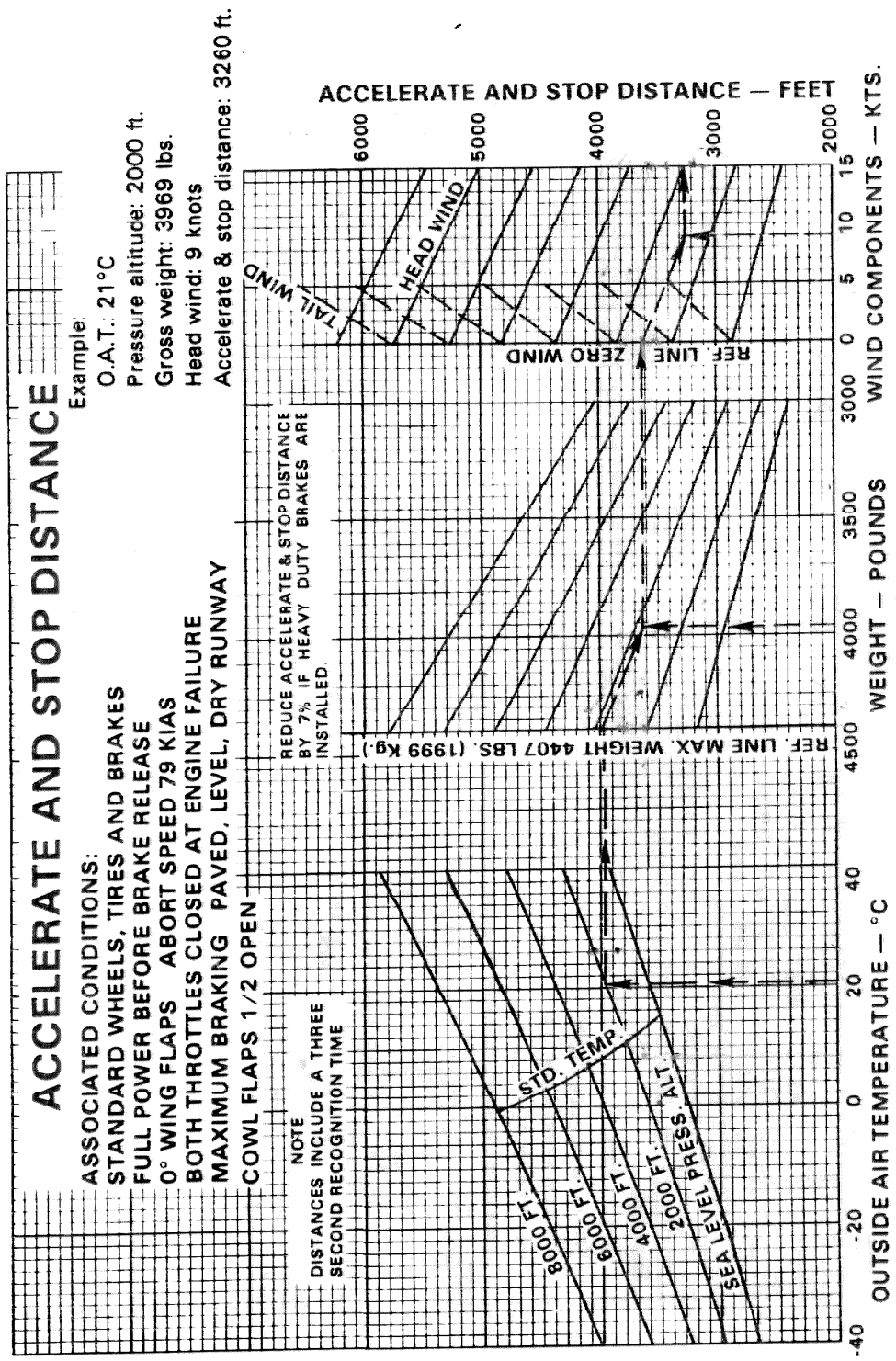
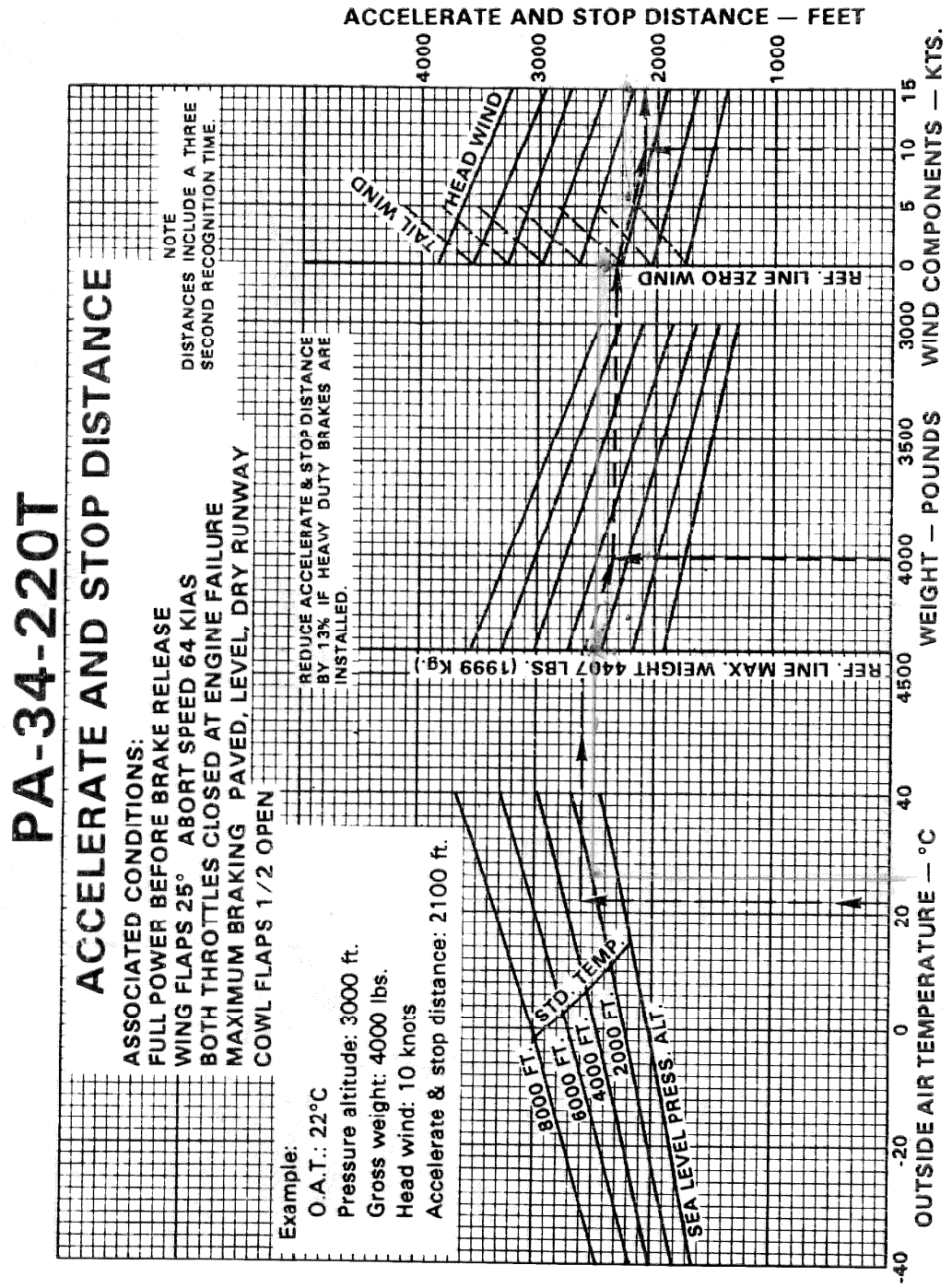
Figure 5-9



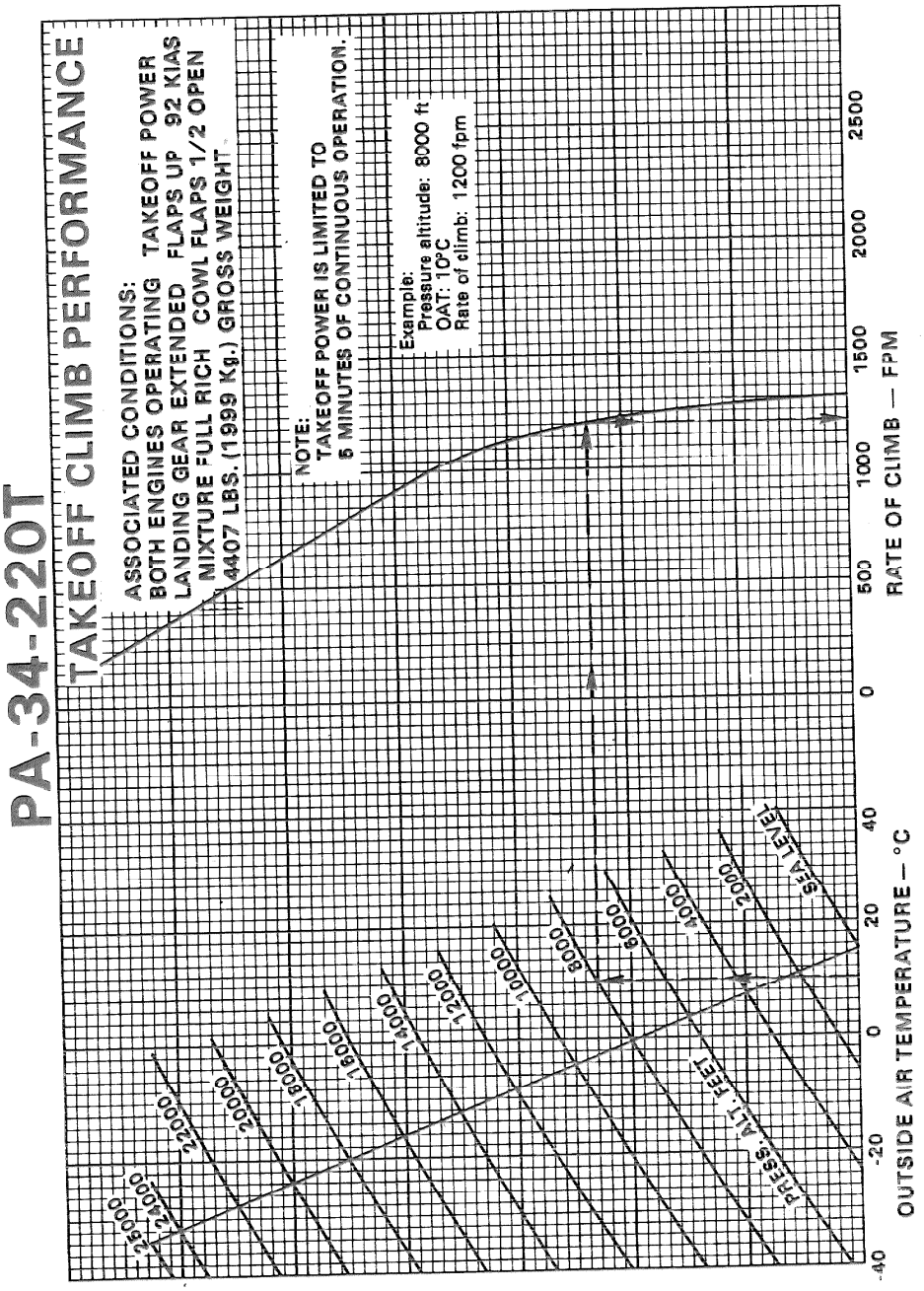
MAXIMUM EFFORT TAKEOFF - 25° FLAPS
Figure 5-11



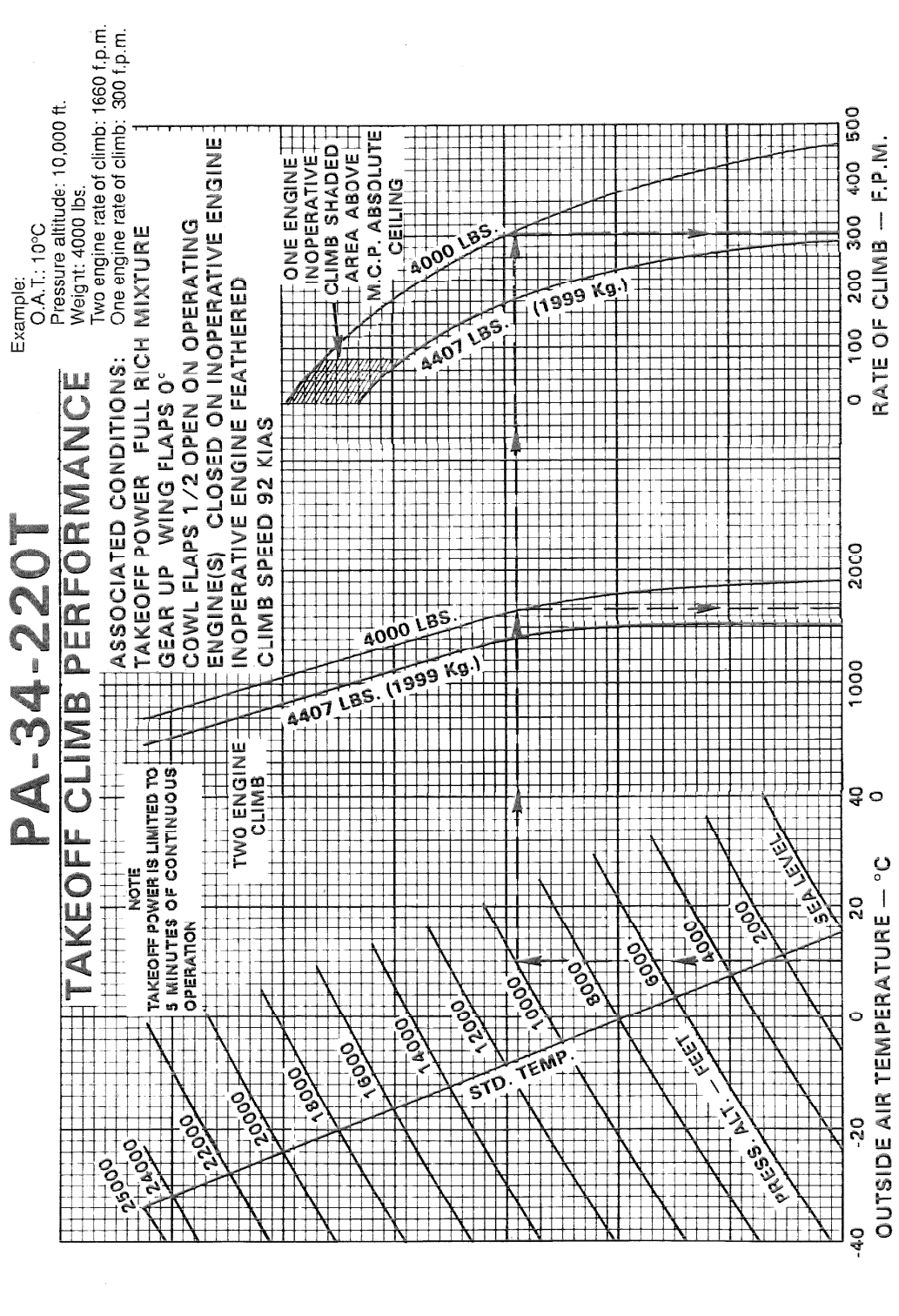
ACCELERATE AND STOP DISTANCE - 0° FLAPS
Figure 5-13



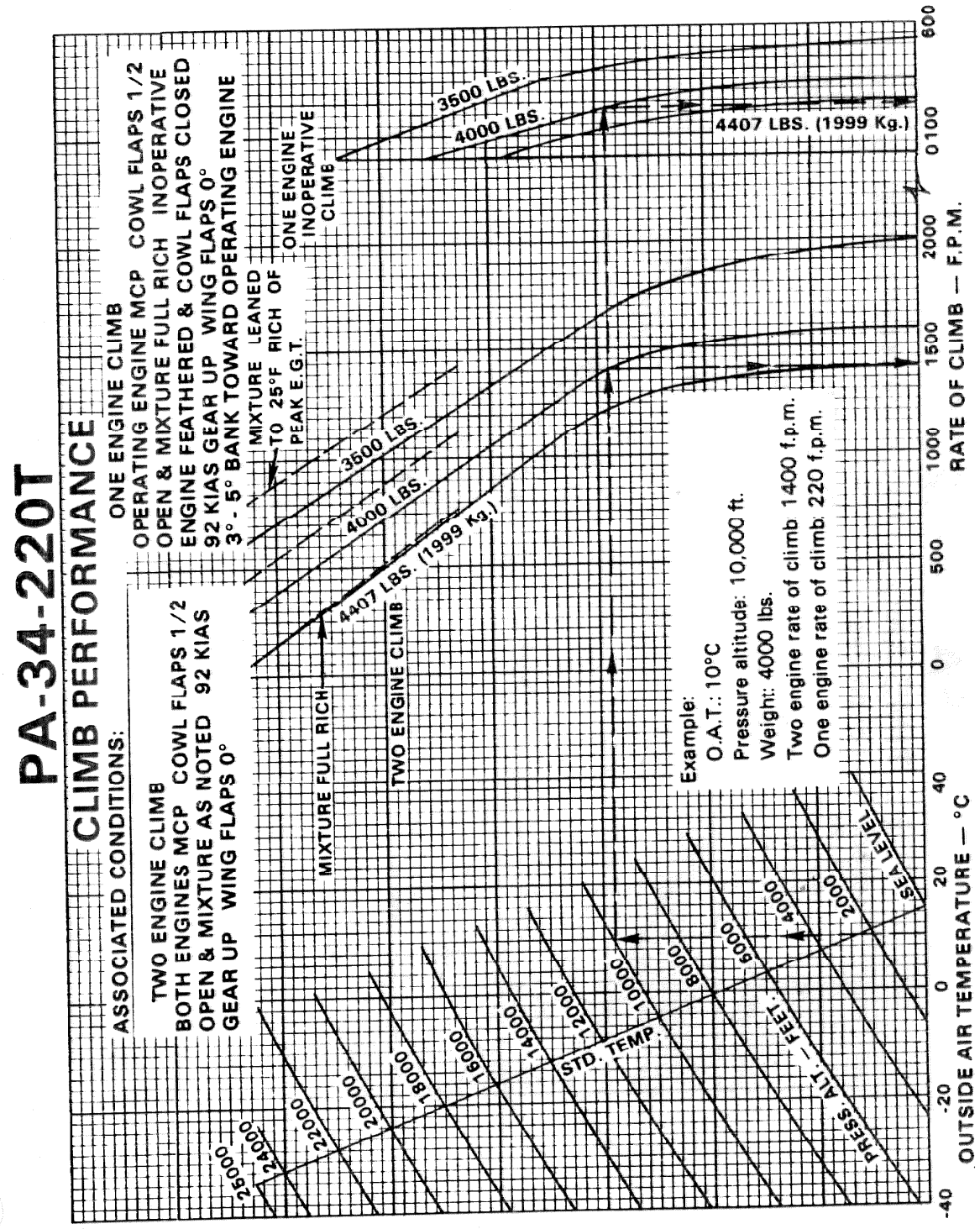
ACCELERATE AND STOP DISTANCE - 25° FLAPS
Figure 5-15



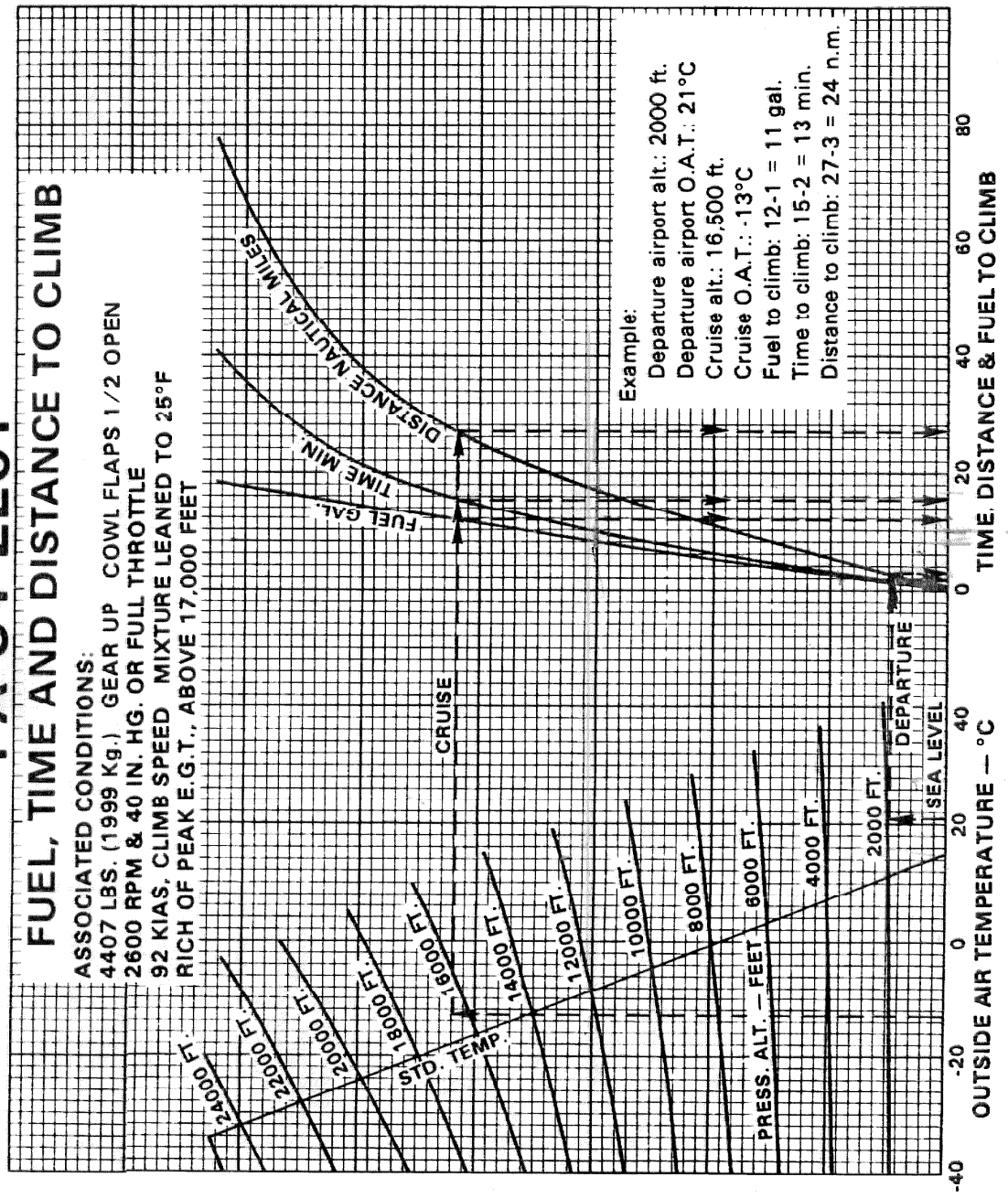
TAKEOFF CLIMB PERFORMANCE - GEAR EXTENDED
Figure 5-17



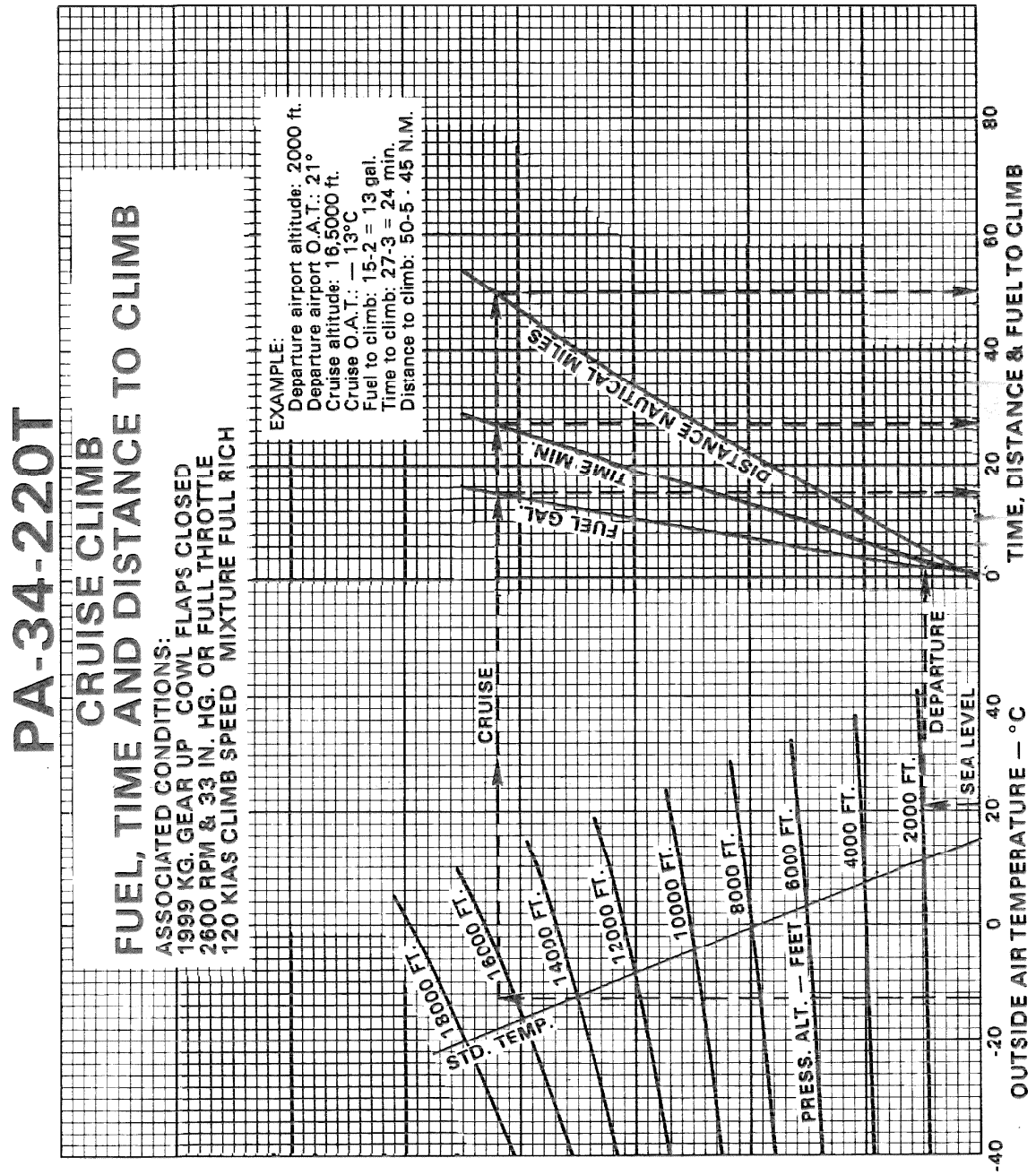
TAKEOFF CLIMB PERFORMANCE GEAR RETRACTED
Figure 5-19



CLIMB PERFORMANCE - GEAR RETRACTED - MAXIMUM CONTINUOUS POWER
Figure 5-21



FUEL, TIME AND DISTANCE TO CLIMB
Figure 5-23



FUEL, TIME AND DISTANCE TO CLIMB
Figure 5-24

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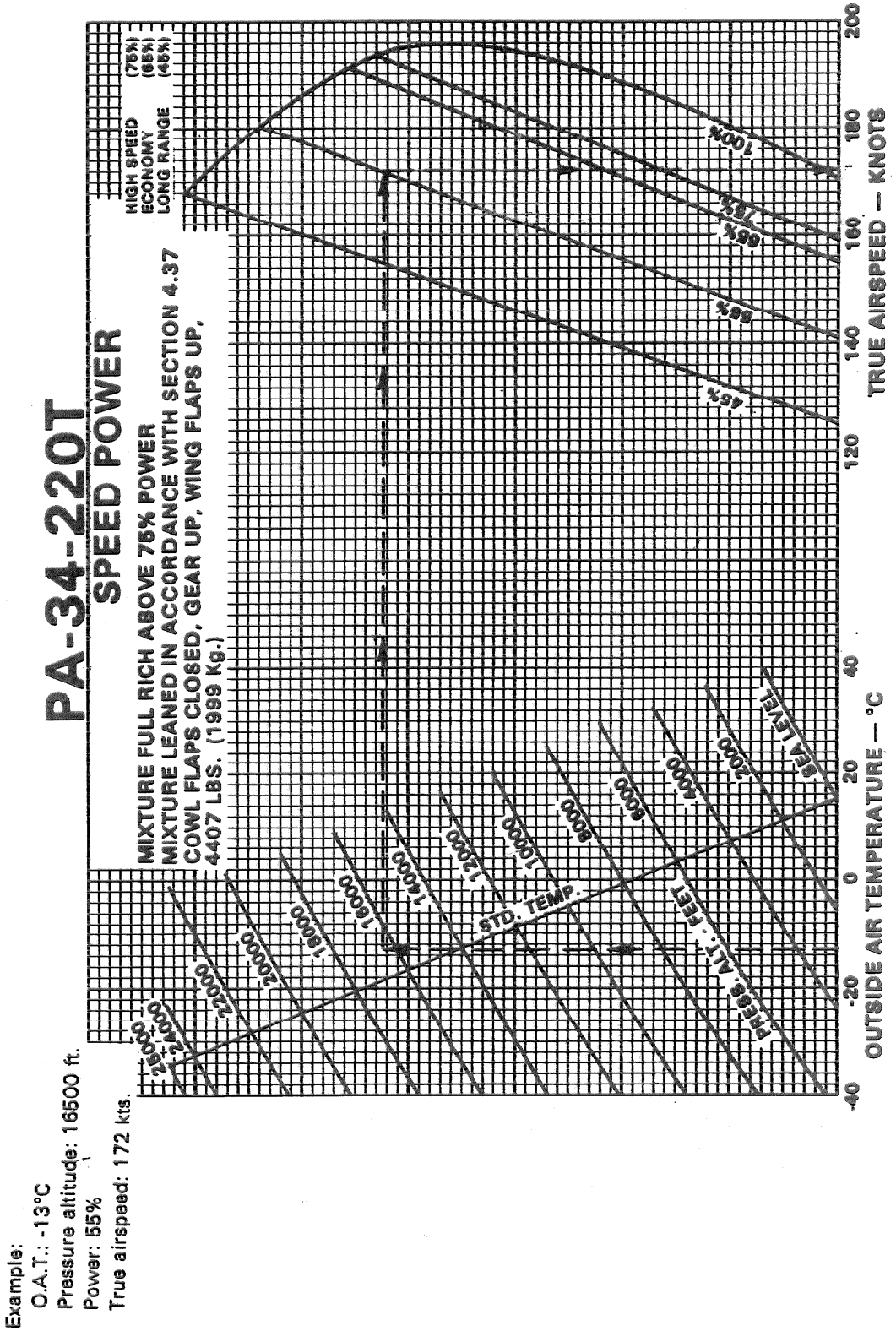
POWER SETTING TABLE - T.C.M. TSIO-360K SERIES PA-34-220T

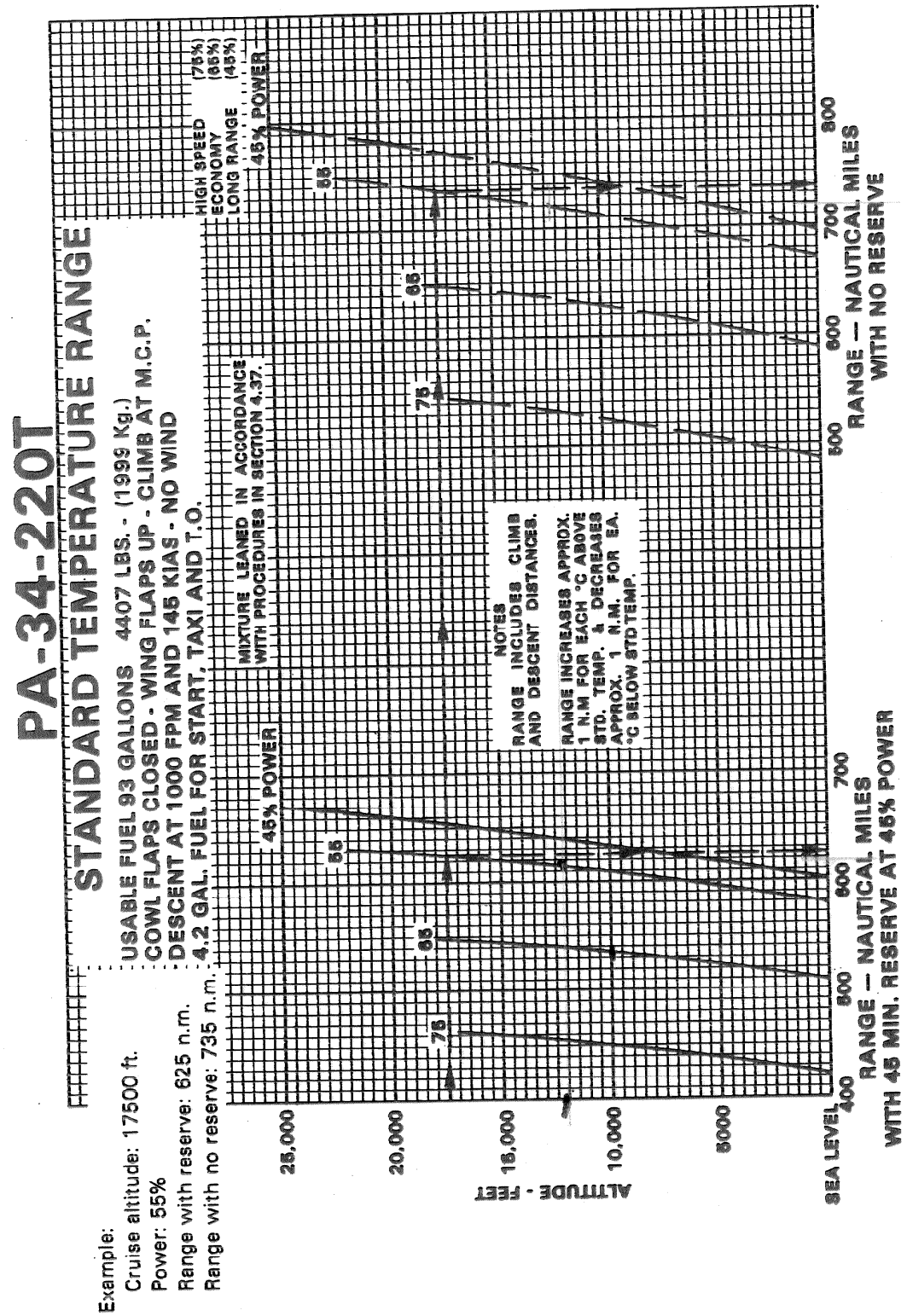
Press. Alt. Feet	Std. Alt. Temp. °C	45% Power Approx. Fuel 16 G.P.H. RPM AND MAN. PRESS.						55% Power Approx. Fuel 18.7 G.P.H. RPM AND MAN. PRESS.						65% Power Approx. Fuel 23.3 G.P.H. RPM AND MAN. PRESS.			75% Power Approx. Fuel 29.0 G.P.H. RPM AND MAN. PRESS.	
		2100	2200	2300	2400	2500	2600	2100	2200	2300	2400	2500	2600	2400	2500	2600	2500	2600
S.L.	15	27.1	26.4	25.5	24.3	23.3	22.5	31.2	30.3	29.4	28.2	27.2	26.3	33.8	32.0	31.0	34.0	33.0
2000	11	26.4	25.8	24.6	23.7	22.8	22.1	30.5	29.7	28.8	27.8	26.8	26.0	33.2	31.7	30.7	33.8	32.7
4000	7	25.8	25.0	24.0	23.2	22.3	21.8	30.0	29.2	28.3	27.4	26.4	25.6	32.8	31.5	30.5	33.6	32.4
6000	3	25.3	24.5	23.5	22.8	21.9	21.5	29.7	28.8	28.0	27.0	26.2	25.3	32.5	31.2	30.3	33.4	32.2
8000	-1	24.8	24.0	23.0	22.4	21.6	21.2	29.4	28.4	27.7	26.8	25.7	25.0	32.3	31.0	30.1	33.1	32.0
10000	-5	24.4	23.7	22.8	22.0	21.4	21.0		28.3	27.5	26.5	25.5	24.7	32.0	30.9	30.0	33.0	31.9
12000	-9	24.0	23.3	22.5	21.7	21.2	20.9		28.3	27.2	26.3	25.3	24.6	31.8	30.7	29.8	32.5	31.8
14000	-13		23.0	22.3	21.4	21.1	20.8			27.1	26.1	25.2	24.4		30.5	29.7		31.7
16000	-17			22.0	21.3	21.0	20.6				25.9	25.0	24.3		30.4	29.5		31.6
18000	-21				21.2	20.9	20.5					25.0	24.2			29.4		
20000	-25				21.2	20.8	20.4						24.2			29.3		
22000	-28						20.4						24.1					
		← 1650°F MAX E.G.T. (See P.O.H. Section 4) →															← 1525°F MAX E.G.T. → (See P.O.H. Section 4)	
24000	-33						20.4											
25000	-34						20.4											

To maintain constant power add approximately 1% for each 6°C above standard. Subtract approximately 1% for each 6°C below standard. Do not exceed 34" MAP in cruise.

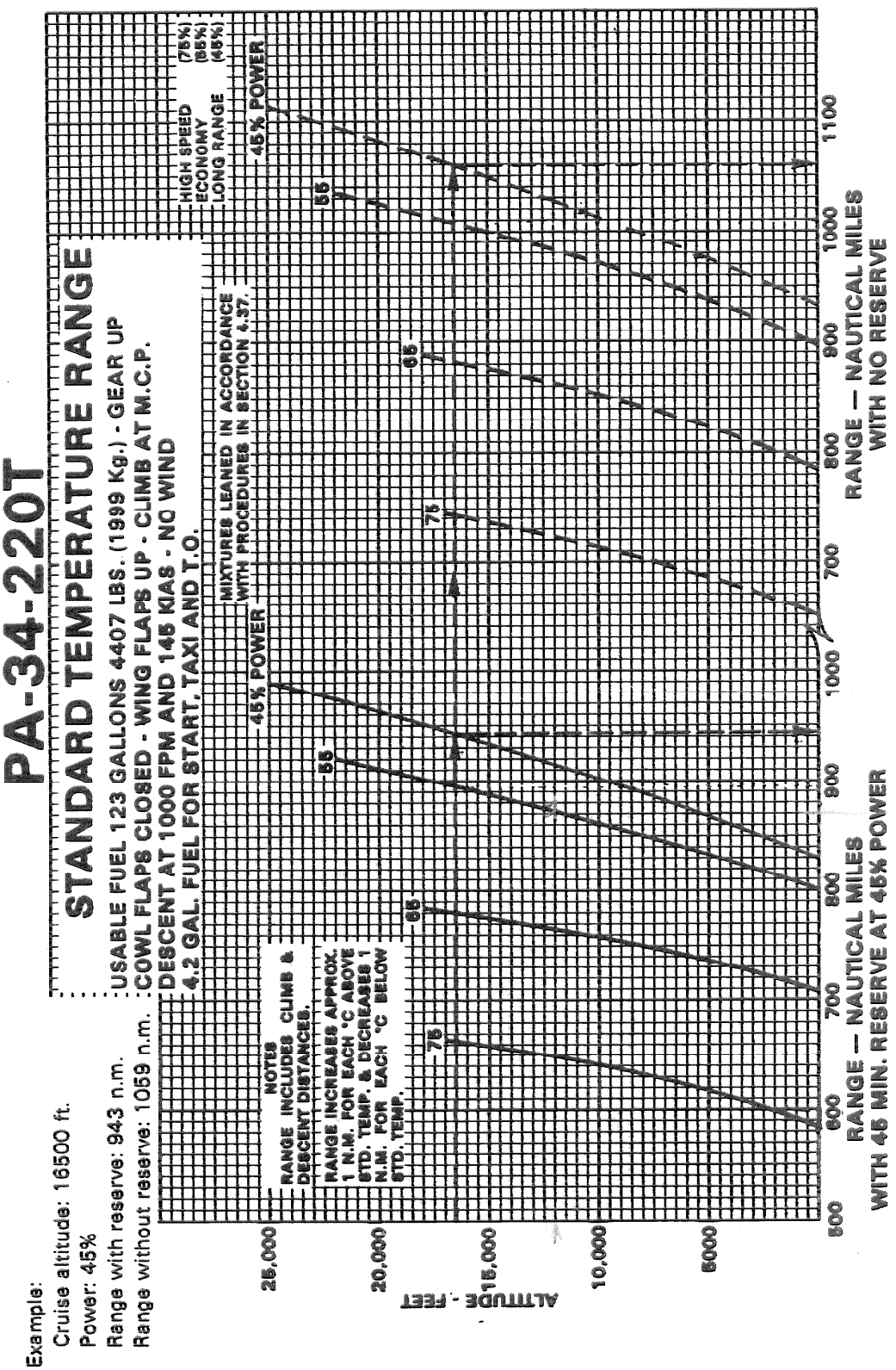
POWER SETTING TABLE
Figure 5-25



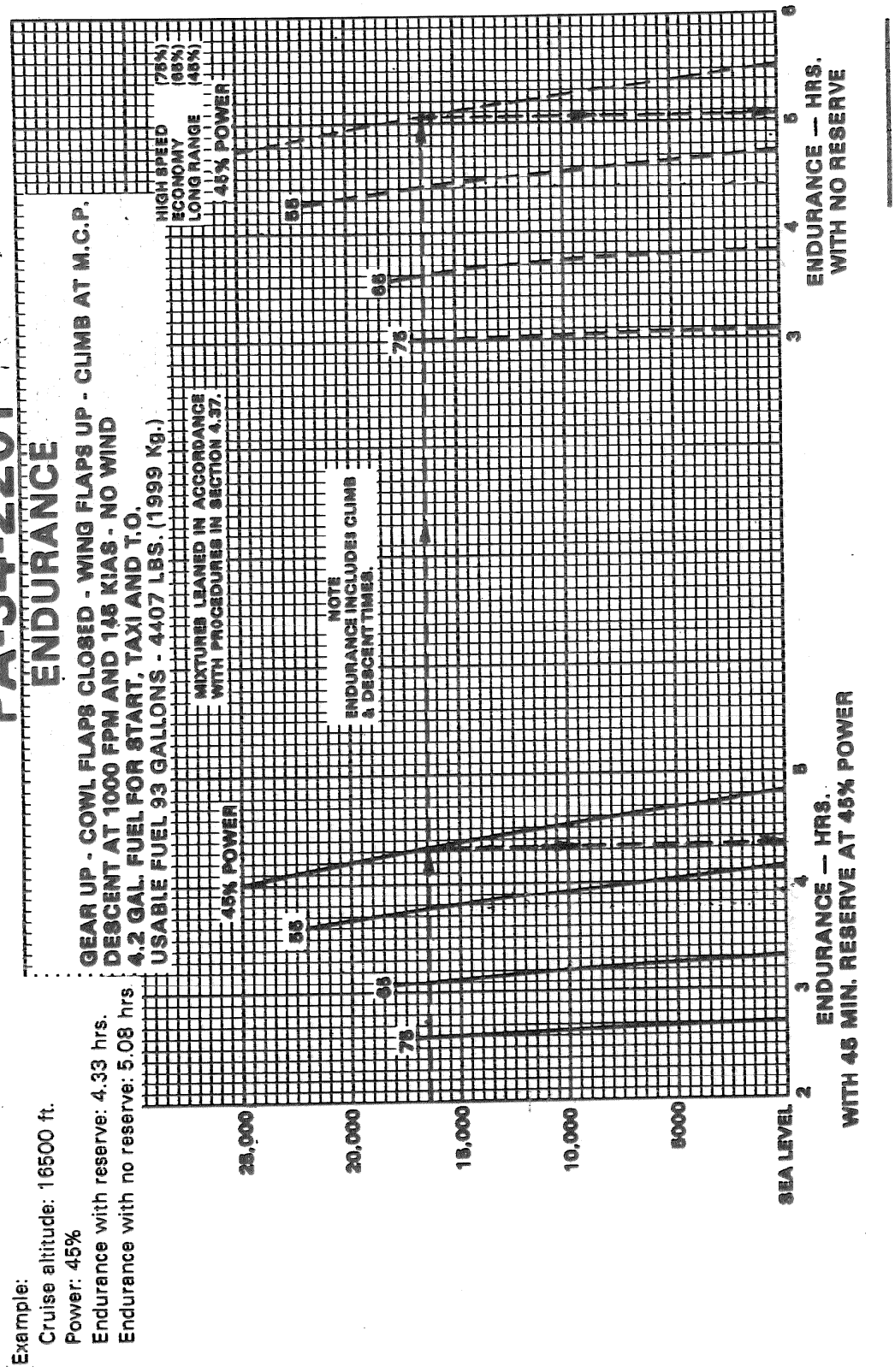
SPEED POWER
Figure 5-27



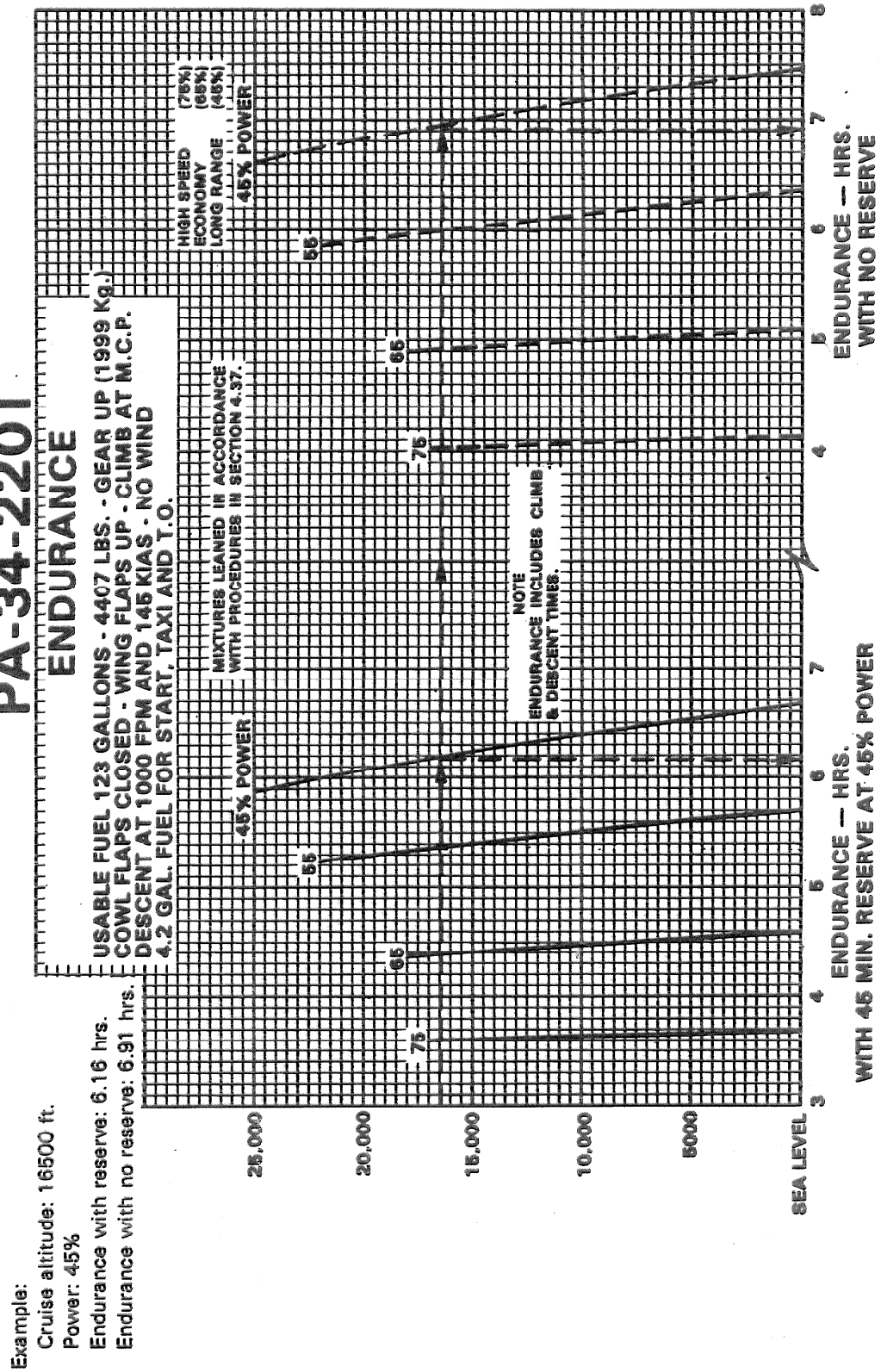
STANDARD TEMPERATURE RANGE - 93 GALLONS USABLE
Figure 5-29



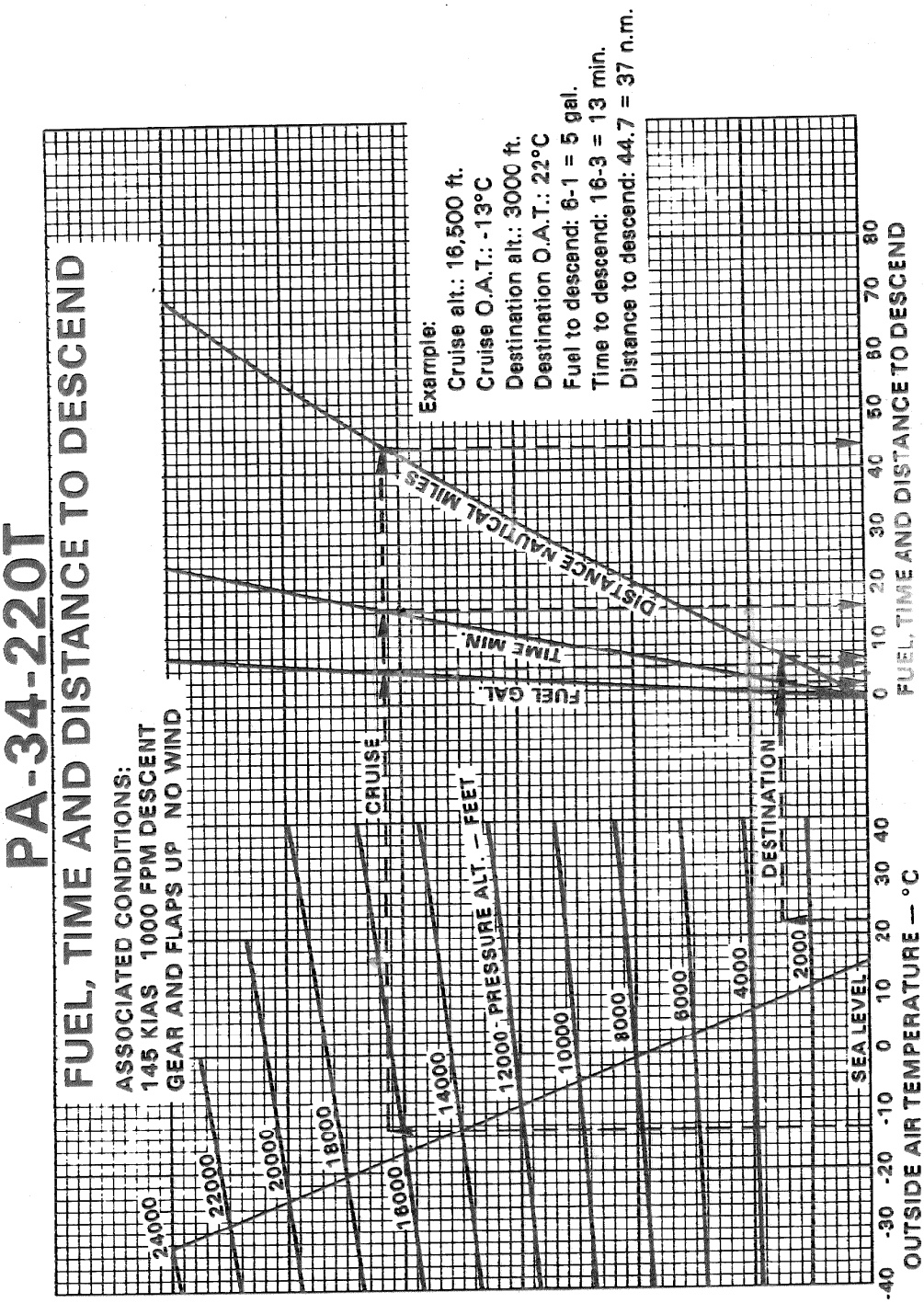
STANDARD TEMPERATURE RANGE - 123 GALLONS USABLE
Figure 5-31



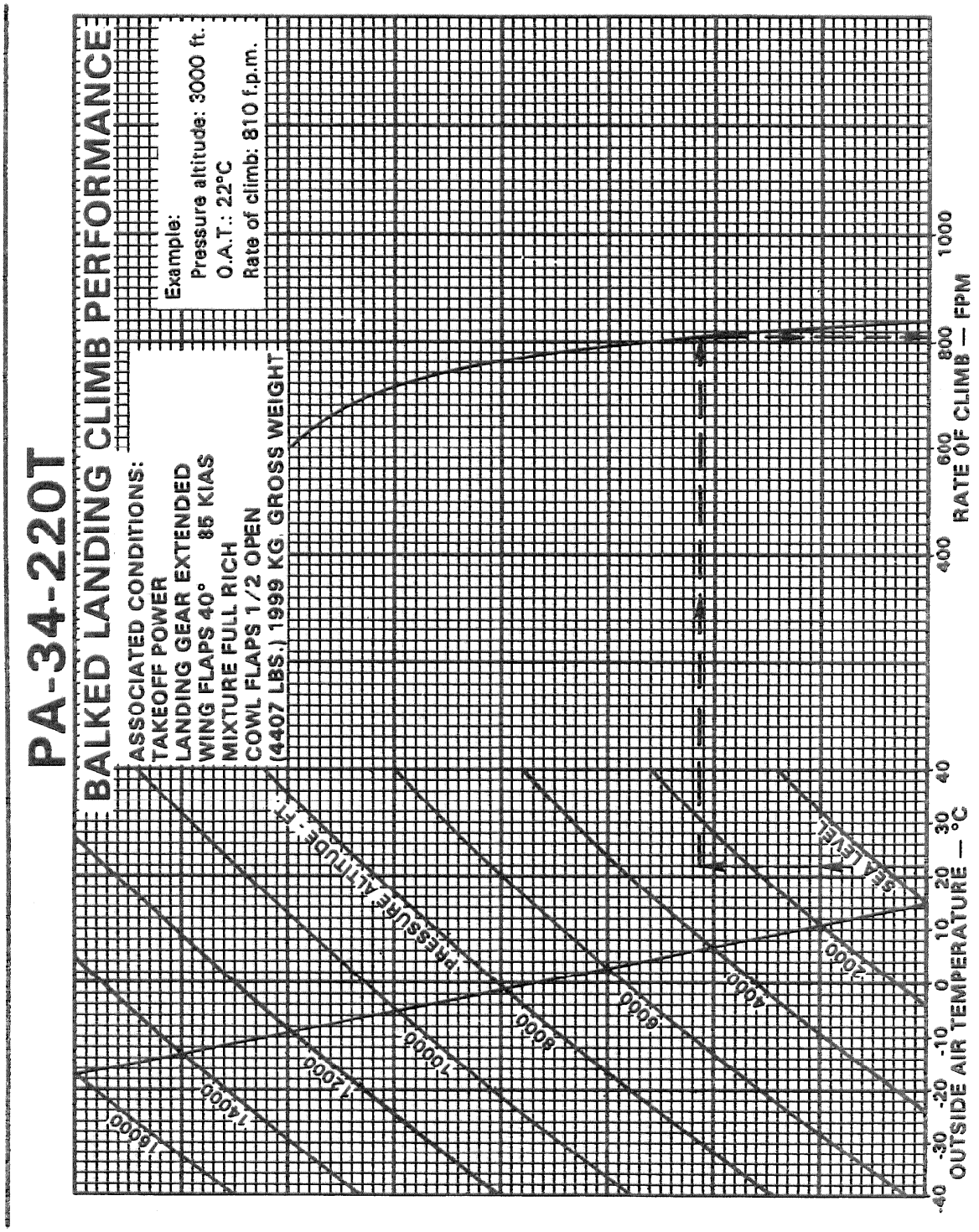
ENDURANCE - 93 GALLONS USABLE
Figure 5-33



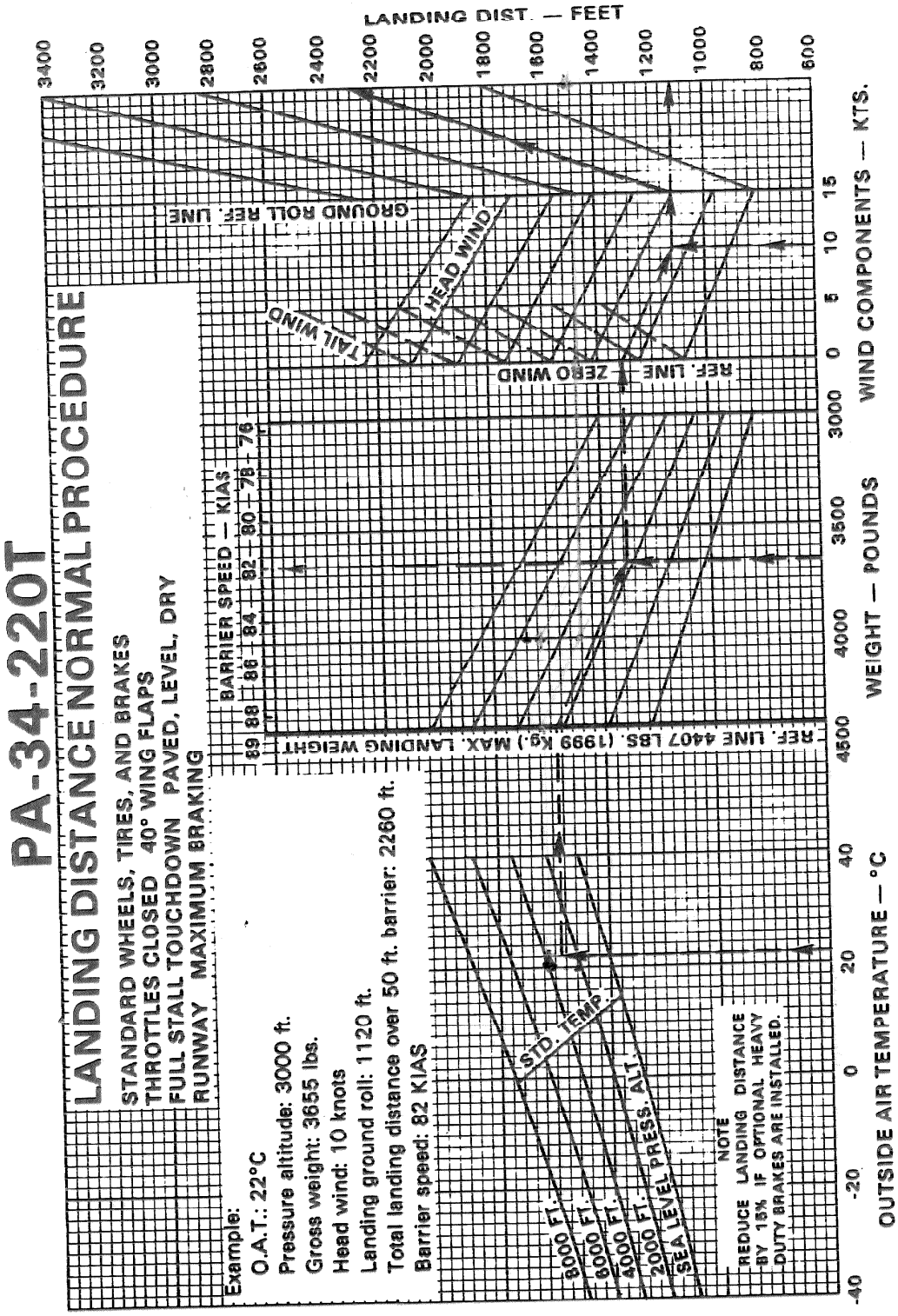
ENDURANCE - 123 GALLONS USABLE
Figure 5-35



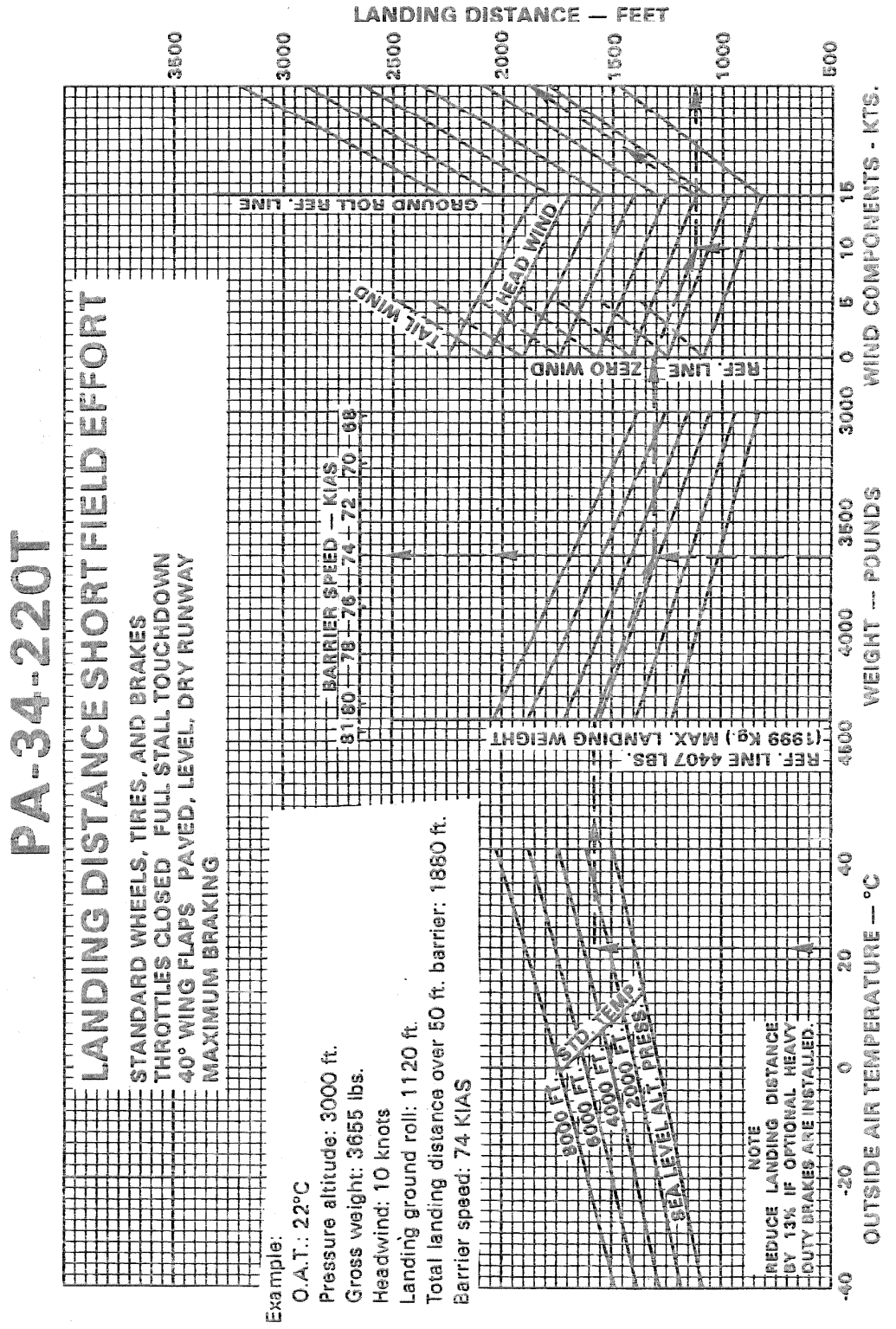
FUEL, TIME AND DISTANCE TO DESCEND
Figure 5-37



BALKED LANDING CLIMB PERFORMANCE
Figure 5-39



LANDING DISTANCE - NORMAL PROCEDURE
Figure 5-41



LANDING DISTANCE - SHORT FIELD EFFORT
Figure 5-43