VOLPAR TURBOLINER II
D-109
PILOT'S OPERATING MANUAL
FAR PART 135

LIST OF EFFECTIVE PAGES

Listed below are the pages required for this publication, with effectivity current through the revision and/or reissue date shown on the lower left corner of this page. Each page is followed by an entry that denotes whether the page is still as originally issued or is part of some later revision or reissue.

ALWAYS DESTROY SUPERSEDED PAGES WHEN INSERTING REVISED PAGES

I	Revision No. 2, 10/18/72
II thru VII	Original
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1-9 & 1-10	Revision No. 3, 10/18/72
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8-1 & 8-2	Original

LOG OF REVISIONS
TURBOLINER II FAA FLIGHT MANUAL D-109

Revision Number	Revised Pages	Description of Revision	FAA Approved and Date
1	I	Revised Title Page	Keith D. Anderson 22 April 1971
	1-10	Changed max. altitude for takeoff and landing from 4000 ft. to 8000 ft.	
	4-14	Added performance data for operation up to 8000 ft. pressure altitude.	
	4-15		
	4-20	Added wind effect on performance	
2	I	Added ref. to operating limitations placard, added G-18S and H-18.	19 Oct 71
	1-6	Revised fuel pressures	
	1-10	Revised Oper. Limitations Placard	
	2-4	Spelling & Eng. Start Temp.	
	2-7	Remove note	
	2-8	Spelling	
	3-1	IAS and CAS speeds	
	3-2	Reworded Note	
	3-3	Spelling	
	6-4	Fuel Pressures	

A black bar on a revised page shows the current change

LOG OF REVISIONS
TURBOLINER II FAA FLIGHT MANUAL D-109

Revision Number	Revised Pages	Description of Revision	FAA Approved and Date
3	1-9 1-10 6-17 & 6-18	Revised Operating Limitations Revised Minimum Crew Equipment List	18 Oct 72

A black bar on a revised page shows the current change

VOLPAR DOCUMENT NO. D-109 FAR PART 135 OPERATIONS AND AS INDICATED BY THE OPERATING LIMITATIONS PLACARD.

F.A.A. APPROVED AIRPLANE FLIGHT MANUAL FOR THE VOLPAR TURBOLINER II

The Volpar Turboliner II is a Beech JRB-6, D-18C, D-18S, E-18S, E-18S-9700, C-45G, TC-45G, C-45H, TC-45H, TC-45J (SNB-5), G-18S, or H-18 aircraft modified in accordance with STC SA2204WE.

The certification basis for the Volpar Turboliner II is SFAR 23.

F.A.A. APPROVED

Keith D. Anderson
Acting Chief, Aircraft Engineering Division,
Western Region, F.A.A.

Approved 7/17/70

THIS MANUAL MUST BE KEPT IN THE AIRPLANE AT ALL TIMES WHEN REQUIRED BY THE OPERATING LIMITATIONS PLACARD.

Revision Approved

NOTICE TO AIRCRAFT OPERATOR

The Volpar Turboliner modification kit is manufactured by:

Volpar, Inc.
16300 Stagg St.
Van Nuys, California 91406

The current owners of the Volpar Turboliner aircraft should assure themselves of receiving the latest revisions to the Flight Manual, Service Bulletins and Service Letters by contacting Volpar at the above address, giving the registration number of the aircraft and the Volpar Turboliner serial number. The latter number should be found on a plate adjacent to the original aircraft identification plate.

ISSUED TO

DATE

AIRCRAFT NO.

COPY NO.

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FAA APPROVED FLIGHT MANUAL

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FAA APPROVED FLIGHT MANUAL

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The following sections are not F.A.A. approved

LIST OF ILLUSTRATIONS

SECTION 1 - OPERATING LIMITATIONS

SECTION 2 - NORMAL OPERATING PROCEDURES

SECTION 3 - EMERGENCY OPERATING PROCEDURES

SECTION 4 - PERFORMANCE

LIST OF ILLUSTRATIONS

AIRSPEED LIMITATIONS

1. Maximum Operating Speed, Vmo (red radial)
   242 MPH (210 Kts.) IAS
   240 MPH (208 Kts.) CAS
   The maximum operating speed shall not be exceeded.

2. Normal Operating Range (green arc)
   93 to 242 MPH (81 to 210 Kts.) IAS
   96 to 240 MPH (83 to 208 Kts.) CAS
   The normal operating range extends from the stalling speed, fully loaded, with the landing gear and wing flaps retracted, to the maximum operating speed.

3. Maximum Design Maneuvering Speed, Va
   152 MPH (132 Kts.) IAS
   153 MPH (133 Kts.) CAS
   The maximum design maneuvering speed is the maximum speed at which full deflection of the flight controls can be used without exceeding the structural limitations of the aircraft.

4. Maximum Flap Extension Speed, Vfe
   132 MPH (115 Kts.) IAS
   134 MPH (116 Kts.) CAS

5. Flap Operating Range (white arc)
   93 to 132 MPH (81 to 115 Kts.) IAS
   92 to 134 MPH (80 to 116 Kts.) CAS

   With Power Off, Flaps May Be Extended To:
   164 MPH (142 Kts.) IAS
   165 MPH (143 Kts.) CAS
   The operational speed range with the flaps down extends from the stall speed, fully loaded, with flaps and landing gear down to the structural limiting speed of the flaps in the extended position.

6. Maximum Speed For Landing Gear Extension and for Flight With The Landing Gear Extended, Vlo and Vle
   159 MPH (138 Kts.) IAS
   160 MPH (139 Kts.) CAS

7. Minimum Control Speed, Vmc
   97 MPH (84 Kts.) IAS
   100 MPH (87 Kts.) CAS

AIRSPEED INDICATOR DIAL MARKINGS

Red Line, Minimum Control Speed, Vmc
   97 MPH (84 Kts.) IAS
   100 MPH (87 Kts.) CAS

White Arc, Flap Operating Range
   93 to 132 MPH (81 to 115 Kts.) IAS
   92 to 134 MPH (80 to 116 Kts.) CAS

Blue Line, Single Engine Best Rate of Climb Speed
   128 MPH (111 Kts.) IAS
   130 MPH (113 Kts.) CAS

Green Arc, Normal Operating Range
   93 to 242 MPH (81 to 210 Kts.) IAS
   96 to 240 MPH (83 to 208 Kts.) CAS

Red Line, Maximum Operating Speed, Vmo
   242 MPH (210 Kts.) IAS
   240 MPH (208 Kts.) CAS

NOTE
IAS values are from the pilots airspeed indicator with zero instrument error.

CROSS WIND TAKEOFF AND LANDING

Cross wind limit not determined. Maximum cross wind tested is 26 MPH (23 Kts.), ref. section 4, page 4-9.

POWER PLANT LIMITATIONS

Engine: AiResearch TPE331-1-101B

NOTE

The takeoff horsepower rating of this engine is flat rated at 620 shaft horsepower at 41,730 RPM (2000 RPM, prop shaft) and 1620 foot pounds torque. In a cold atmosphere or at low altitude the engine must be held within this limit by retarding the power levers. In a hot atmosphere or at high altitude the power obtainable is reduced as the exhaust gas temperature (EGT) limits must not be exceeded.

Takeoff Power (Two (2) minutes ONLY)
Shaft Horsepower.....620
Propeller RPM.....100%, 2000
Exhaust Gas Temp.....Ref. page 1-4
Torque.....620 SHP; 56.65 PSI; 1620 Ft. Pounds

Observe Torque (SHP) or EGT limit, whichever is first reached.

Maximum Continuous Power
Shaft Horsepower in standard atmosphere at sea level (flat rated).....500
Propeller RPM.....100%. 2000
Exhaust Gas Temp.....Ref. page 1-4
Torque.....500 SHP; 48.00 PSI; 1313 Ft. Pounds

Observe Torque (SHP) or EGT limit, whichever is first reached.

Maximum Starting EGT
788 deg. C. for one second

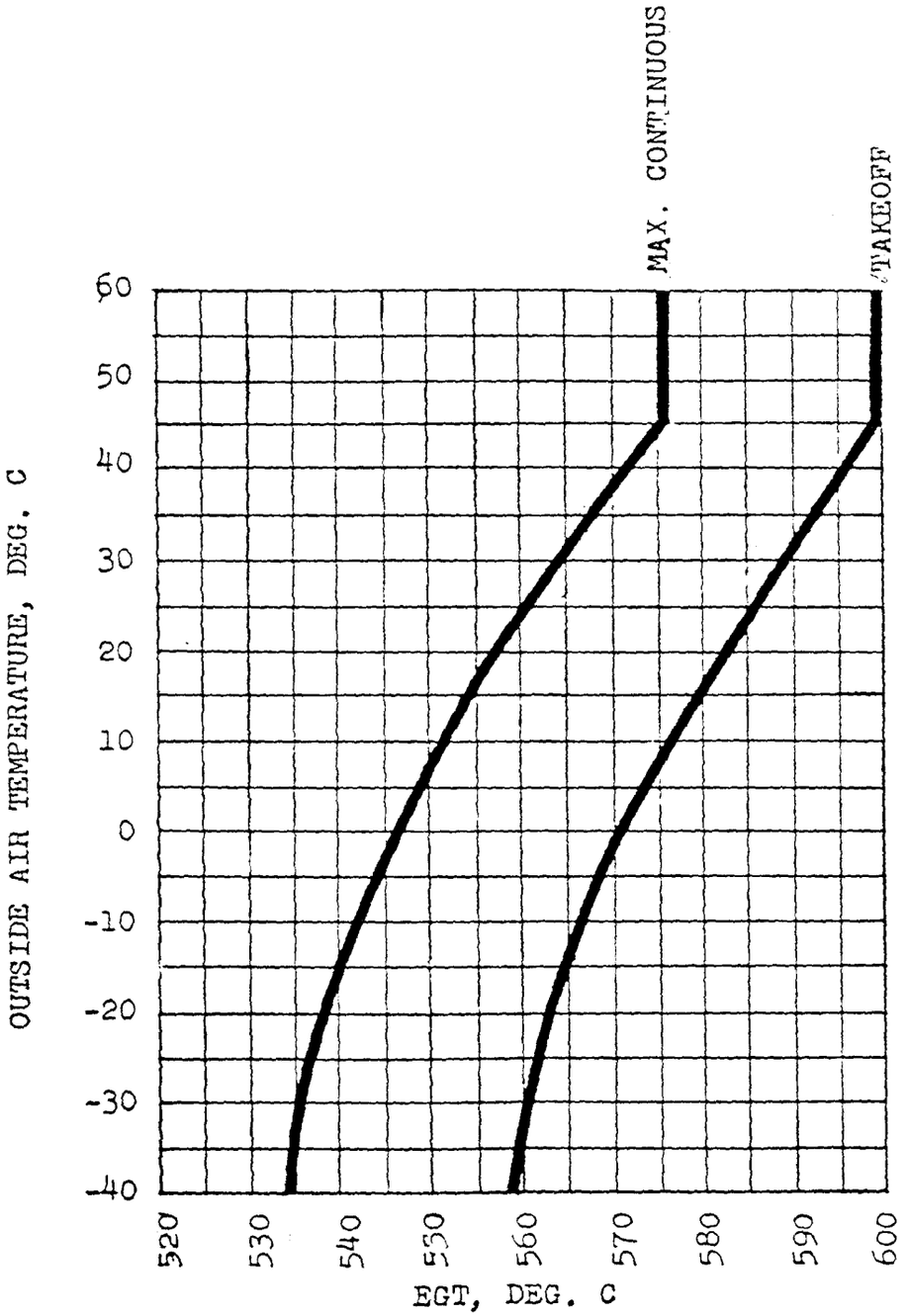
Engine Overspeed
2100 RPM for 5 seconds
2020 RPM for 5 minutes

NOTE

Engine overspeed governor check, as per page 2-5, shall be accomplished prior to any flight in which air starts are anticipated.

Minimum Outside Air Temperature Limit
-65 deg. F. (-55 deg. C.)

EGT LIMITS vs OAT
TPE331-1-101B ENGINE



NOTE

Induction deicing valve shall not be operated in flight when the outside air temperature is above 40 deg. F. (4.4 deg. C.)

Engine Oil

MIL-L-23699A; Mobil Jet Oil II, Aeroshell Turbine Oil, Enco/Esso 2380 Turbo Oil.

MIL-L-7808D and MIL-007808F These oils may only be used when the ambient air temperature is below 59 deg. F. (15 deg. C.) Texaco SATO 15, Sinclair Turbo S 15, Caltex SATO 15, British Petroleum Aero Turbine Oil 15, Brayco 880 Conojet, Continental Conojet, Regent SATO 15, Stauffer Jet I.

Rate of RPM Control Lever Movement

Not faster than full travel in one (1) second.

Fuel

Aviation Turbine Fuels, ASTM designations; Jet A, Jet A1, and Jet B.
Military Fuels, MIL-F-5616; JP-1. MIL-J-5624; JP-4 and JP-5.
Anti-Icing Additive, MIL-I-27686; Phillips PFA-55 MB jet fuel anti-icing additive is approved for use in fuels in amounts not to exceed .15% by volume.

NOTE

For emergency fuel refer to page 3-7.

Propellers

Hub: Hartzell Model HC-B3TN
Blades: Hartzell Model T10176
Diameter: 96.38 to 99.38 inches
Blade Angles at 30 inch station:

High (Feather).....	86.50 deg.	$\pm$ 0.25 deg.
Starting.....	3.25 deg.	$\pm$ 0.50 deg.
Flight Idle.....	11.00 deg.	$\pm$ 0.20 deg.
Reverse.....	-8.00 deg.	$\pm$ 0.50 deg.

Optional Propeller

Hub: Hartzell Model HC-B3TN
Blades: Hartzell Model T10178H
Diameter: 93.5 to 96 inches
Blade Angles at 30 inch station:

High (Feather).....	86.50 deg.	$\pm$ 0.25 deg.
Starting.....	2.50 deg.	$\pm$ 0.20 deg.
Flight Idle.....	10.50 deg.	$\pm$ 0.20 deg.
Reverse.....	-8.50 deg.	$\pm$ 0.20 deg.

NOTE

Maximum allowable variation between two propellers at Flight Idle blade angle is 0.40 deg.

ENGINE INSTRUMENT DIAL MARKINGS

Oil Temperature
- -40 deg.C. (-40 deg.F.) to 127 deg.C. (260 deg.F.)
- Green Arc
  - 0 to 127 deg.C. (32 to 260 deg.F.)
- Red Radial
  - 127 deg.C. (260 deg.F.)

Oil Pressure
- 70 to 120 PSIG
- Red Radial
  - 70 and 120 PSI
- Yellow Arc
  - 70 to 90 PSI
- Green Arc
  - 90 to 120 PSI

Fuel Pressure
- 15 to 80 PSIG
- Red Radial
  - 15 and 80 PSI
- Yellow Arc
  - 15 to 20 PSI
- Green Arc
  - 20 to 80 PSI

Tachometer
- Yellow Arc
  - 65 to 92% RPM
- Green Arc
  - 92 to 100% RPM
- Red Radial
  - 100% RPM

Torque Meter
- Green Arc
  - 0 to 500 SHP (10 to 48 PSI)
- Yellow Arc
  - 500 to 620 SHP (48 to 56.7 PSI)

ENGINE INSTRUMENT DIAL MARKINGS (cont.)

Exhaust Gas Temperature
- Green Arc
  - 200 to 575 deg.C.
- Yellow Arc
  - 575 to 600 deg.C.
- Red Radial
  - 600 deg.C.
- Red Dot
  - 788 deg.C. (Max. starting EGT for 1 second)

WEIGHT LIMITATIONS

Maximum Takeoff Weight may not exceed the most restrictive (lowest value) of:

1. 11,500 lbs. (structural limit)
2. The weight permitted by the single engine takeoff climb requirement (ref. page 4-13) for the existing airport altitude and temperature.
3. The weight permitted when the distance shown on page 4-14 is equal to or less than the available takeoff runway length for the existing airport altitude and temperature.

Maximum Structural Landing Weight.....11,000 lbs

Maximum Zero Fuel Weight.....10,500 lbs

Cargo

Cargo loading must not exceed the limits shown below and on page 1-8.

Location	Max. wt.
Sta. 52.5 to 74	264 lbs
Sta. 74.0 to 104	360 lbs
Sta. 104 to 136	761 lbs
Sta. 136 to 168	800 lbs
Sta. 168 to 199.5	787.5 lbs
Sta. 199.5 to 229.5	360 lbs
Sta. 229.5 to 259	354 lbs
Sta. 259 to 287	336 lbs
Sta. 287 to 315	200 lbs

WEIGHT LIMITATIONS (cont)

Maximum load concentration on one square foot of floor must not exceed the following:

1. 434 lbs for aircraft which have Rigicell sandwich floor.

2. 193 lbs for aircraft which have .125 inch thick magnesium floor.

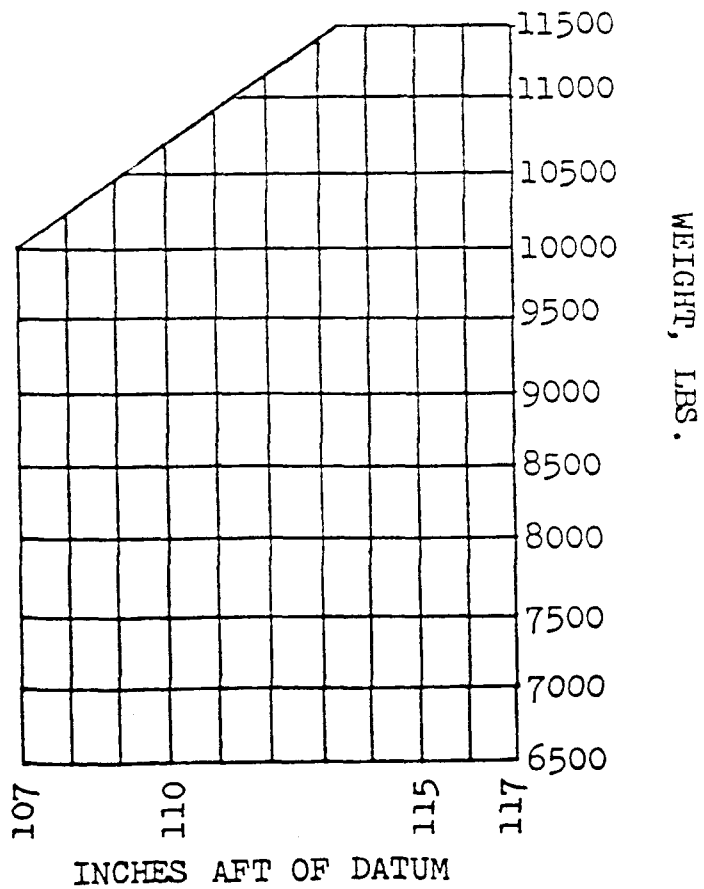
Cargo must be tied down per section 7 page 7-11.

Wing baggage must be loaded symmetrically.

Weight and C.G. Limits

Center of gravity, (aft of datum)
Aft limit.....117 in.
Forward limit at,
10,000 lbs or less.....107 in.
11,500 lbs.....113.3 in.

Variation between these points is shown by the following chart.



CAPACITIES

Oil 3 gal.

Fuel

Main Tanks	100 gal. total
Outboard Aux. Tanks	330 gal. total
Inboard Aux. Tanks	152 gal. total
Rear Aux. Tanks	50 gal. total

Optional outboard aux. tanks (replacing the 165 gal. each outboard aux. tanks)

60 gal. each (120 total)
100 gal. each (200 total)

NOTE

No assymmetric fuel loading is approved.

MANEUVERS

This is a Normal Category airplane. Acrobatic maneuvers, including spins, are unauthorized.

FLIGHT LOAD FACTORS

At 11,500 lbs. gross weight the positive limit load factor for this aircraft is 3.22 g's. Flap down positive limit load factor is 2.0 g's.

APPROVED OPERATIONS

This aircraft is approved for the following types of operation when the appropriate equipment listed in the Volpar Equipment List 2514 (section 6, page 6-17) is installed and operating:

1. VFR, day and night
2. IFR, day and night
3. FAR 135 operations when all pertinent limitations and performance considerations are complied with.
4. FAR 91 operations in compliance with the FAA Approved Flight Manual D-111.

Maximum authorized flight altitude of this aircraft is 16,500 feet.

Maximum altitude for takeoff and landing is 8000 feet.

Temperature limitation for takeoff and landing:
Maximum.....ISA +30 deg.C.
Minimum.....ISA -30 deg.C.

All engine bleed must be off during takeoff and critical one engine inoperative conditions.

Do not takeoff with an electrical load of more than 200 amps.

PLACARDS

In full view of the pilot: "This aircraft must be operated as a normal category airplane in compliance with the proper airplane flight manual. No acrobatic maneuvers, including spins approved.

In full view of the pilot: "AFM D-109 required for FAR 135 oper. on or after 1 June 72. AFM D-111 for FAR 135 oper. prior to 1 June 72. AFM D-109 or D-111 for FAR 91 oper.

Aft baggage compartment: "Baggage, 200 lbs. max."

MINIMUM CREW

VFR - One pilot
IFR - Pilot and Copilot

NORMAL OPERATING PROCEDURES

Only unconventional procedures are given in this section. Therefore all conventional procedures should be carried out regardless of their absence from these instructions.

PREFLIGHT INSPECTION

1. Inlet Sensors - Visual check for attachment and damage.
2. Oil vent circuit breaker located overhead in each wheel well. Push ON when starting at ambient temperatures of 15 deg.C. (59 deg.F.) or below.
3. External Starting Power - A 28 volt unit of 1000 amps capacity.

NOTE

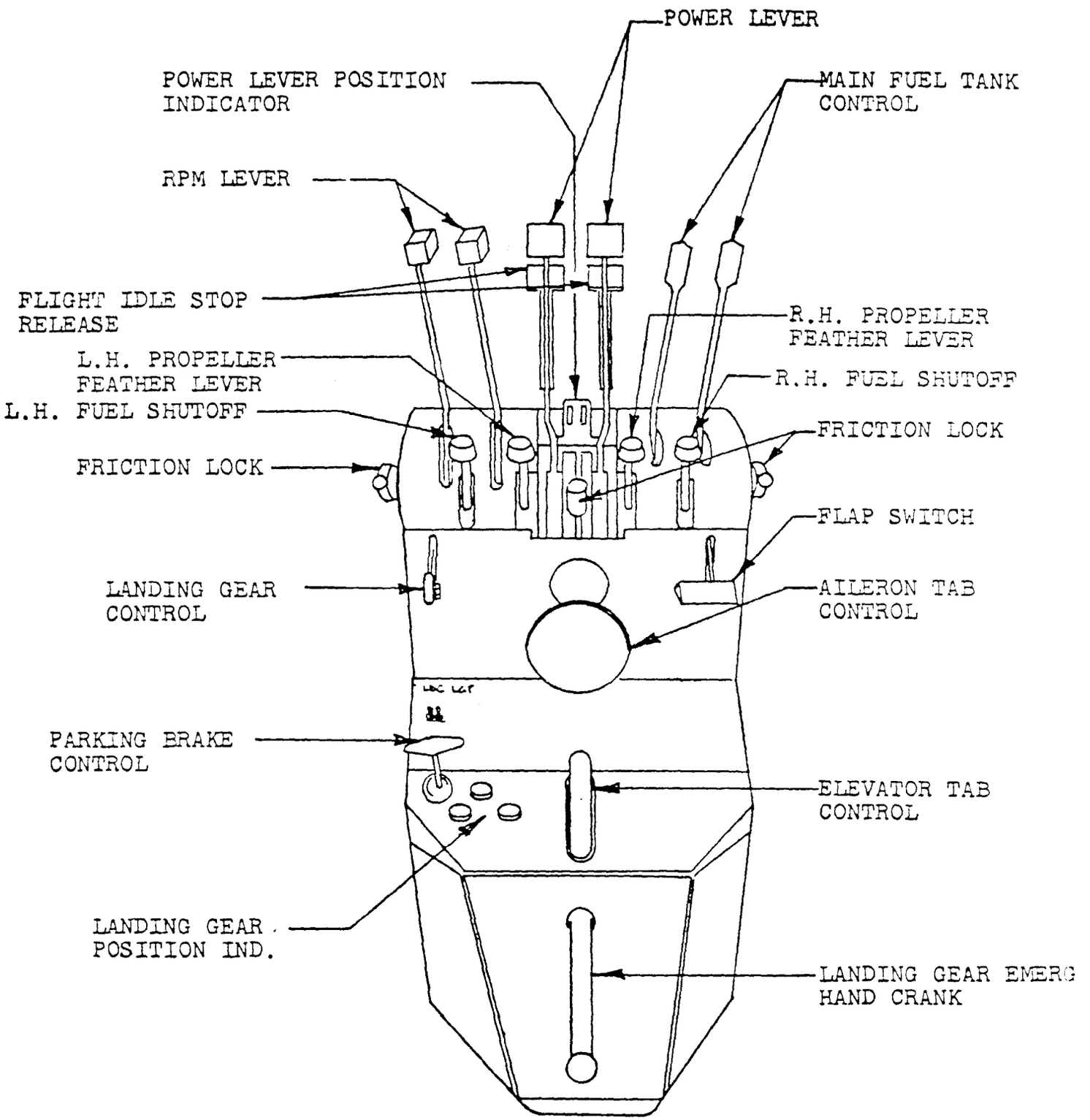
The battery, normally charged, will start an engine, making the external source optional. However, if external power is used it MUST BE OF AT LEAST 1000 AMPS CAPACITY. Use of an inadequate power source results in burned out starter/generators.

STALL WARNING CHECK

This check should be conducted prior to the first flight of each days operation.

1. Battery Switches - ON
2. Circuit Breaker - ON
3. Lift the stall warning vane on the leading edge of left wing and check the control column for desired oscillation.

CONTROL PEDESTAL



C A U T I O N

IF SUDDEN LOSS OR SIGNIFICANT FLUCTUATION OF TORQUE PRESSURE INDICATION OCCURS, THE ENGINE SHOULD BE PROMPTLY SHUT DOWN AND THE CAUSE DETERMINED BEFORE FURTHER OPERATION.

BEFORE STARTING ENGINES

Starting loads and engine temperatures are greatly increased by tail winds. Start facing into wind or cross wind.

1. Parking Brakes - SET
2. Switches - All OFF
3. Static Systems - NORMAL
4. Landing Gear Control - DOWN
5. Fuel Shutoffs - Pull up to ON
6. Cross Feed Valve - OFF
7. Aux Fuel Tanks and Gage - Check
8. Main Fuel Tank Control - ON (fwd)
9. Propellers - Check, unfeathered (if feathered, unfeather per page 2-11)
10. Feather Levers - UP (OFF)
11. Circuit Breakers - All IN or ON
12. Bus Tie - ON
13. Power Levers - Free and GROUND START
14. RPM Levers - Free and TAXI
15. Air Start/Ground Start Switch - GROUND START

NTS CHECK

This check should be conducted prior to the first flight of each days operation.

1. Propellers - Clear
2. Battery Switches - ON
3. Air Start/Ground Start Switch - AIR START
4. Ignition Fuel Circuit Breaker - OFF
5. Stop/Start Switch - Hold in START until NTS light comes on.
6. Air Start/Ground Start Switch - GROUND START, NTS light should go out as starter begins to rotate propeller.
7. Stop/Start Switch - STOP and release
8. Battery Switches - OFF

ENGINE START

In temperatures below 10 deg.F. (-12 deg.C.) an auxiliary power unit will be required for starting.

1. Battery Switches - All ON (or Aux. power connected and Battery Switches to APU.)
2. Bus Tie - Check ON
3. Fire Warning Lights - Check
4. Fuel Boost Switches - Transfer ON; check fuel transfer pressure, positive and Transfer Lights ON, then switches OFF, check Transfer Lights OFF.
5. Fuel Boost Switches- ON Main
6. Fuel Pressure - Check, 10 to 20 PSI
7. Inverter Switches - Spare ON, check operation then OFF, Main ON, check operation.

NOTE
Start Right Engine First

8. Stop/Start Switch - START and release
9. Start Fuel Switch - ON at 10% RPM and release when ignition occurs.
10. Tachometer - Observe until 10 to 12% is reached.
11. Fuel Flow - Rising
12. EGT - Rising (at 14 to 20% RPM)

CAUTION
IF IGNITION HAS NOT OCCURED WITHIN 10 SECONDS OR AT 20% RPM, WHICHEVER IS FIRST REACHED, "STOP/START SWITCH" TO "STOP". Allow starter/generator to cool for 5 minutes before repeating starting procedure. If second attempt is unsuccessful, allow starter/generator to cool until a hand can be held on its surface.

13. EGT - Observe the rate of increase. If rate does not diminish before 715 deg. C. is reached, ABORT START.
14. RPM - Should stabilize at 65 to 75% RPM
15. EGT - Check, normal
16. Generator Switch - ON, if battery start, and charge battery until ammeter reads normal load, then OFF.

REPEAT STEPS "8" thru "15" FOR STARTING LEFT ENGINE

ABORTED GROUND START (due to no combustion attained)

1. Stop/Start Switch - STOP
2. Ignition Fuel Circuit Breaker - OFF
3. Allow starter to cool for 5 minutes
4. Stop/Start Switch - Hold in START position for 10 seconds to clear combustion chamber of fuel, then to STOP position and release.
5. Follow normal start procedure

PRE-TAXI

1. Auxiliary Power - Disconnect
2. Battery Switches - ON (if APU was used)
3. Generator Switches - ON
4. Radio Master - ON
5. Voltage - Check
6. Beacon - ON
7. Flight Instruments - ON
8. Fuel Boost Pump Switches - OFF
9. Air Start/Ground Start Switch - AIR START
10. Oil Temperature - Check
11. Oil Pressure - Check
12. Fuel Pressure - Check
13. Overspeed Governor Check - This check should be made whenever air starts are to be intentionally made, there is an indication of malfunction, or when any maintenance or adjustments involving the engine control system have been performed. (Start locks to remain engaged for this check)
    a. RPM Levers - Full Forward
    b. Power Levers - Advance until further movement causes no increase in fuel flow or RPM; RPM should be 103 to 104%. CAUTION: Do not allow RPM to exceed 105%.
14. Unlock Propeller Start Locks - Move Power Levers back from Ground Start position toward Reverse, a few degrees at a time, until BETA light goes out. When light comes on again, locks are released. Slowly return Power Levers to Ground Start position. (release of locks is also indicated by change in propeller sound and increase in fuel flow and EGT)
15. Ammeters - Check, load normal

16. No. 3 Battery Switch - OFF, check for no change on Ammeter, indicating a fully charged battery.

NOTE

The Emergency Bus is powered from No. 2 Battery Bus and No. 3 Battery. A failure of No. 2 Battery Bus power to the Emergency Bus with No. 3 Battery switch ON would not be detectable and result in depletion of the No. 3 Battery and loss of the Emergency Bus.

TAXI

1. Power Levers - Move forward from Ground Start towards Flight Idle or beyond as required.

NOTE

If more than idle reverse thrust is needed to slow down, move RPM Levers to flight position (full forward)

BEFORE TAKEOFF

1. Trim - Set
2. Flaps - UP
3. Boost Pump Switches - ON Main
4. RPM Levers - Flight (full forward)
5. Bleed, Anti-Ice Light - Out
6. Propeller Governor Check - Advance Power Levers toward Takeoff position until RPM does not increase with advancing Power Levers. RPM should be 99.5 to 101%.
7. Torque - 36 PSI (350 SHP)
8. High Side of Underspeed Fuel Governor Check - Retard Power Levers to the Flight Idle Stop, RPM should be 95.5 to 97%.
9. Engine Instruments - Check
10. Flight Instruments - Check
11. Flight Controls - Full and correct
12. RPM Levers - If takeoff will not be made immediately place in TAXI, to reduce fuel consumption.

TAKEOFF

1. RPM Levers - Flight (full forward)
2. Power Levers - Advance toward TAKEOFF, observe power limits as in Limitation Section.
3. Rotate - V_1, 105 mph (91 Kts) IAS
4. Climb - 113 mph (98 Kts) IAS at 50 ft.
5. Landing Gear - UP before 159 mph (138 Kts) IAS.

Do not retract the landing gear until reaching a point at which it would no longer be possible to make a landing on the remaining runway.

LANDING GEAR POSITION SWITCH LATCH

If landing gear position lever cannot be moved to UP when the airplane is airborne, insert finger through hole in left side of pedestal and push latch bar to right; the position lever then may be moved to UP.

NOTE

Rubber flight brake pads are installed in each wheel well to brake the wheels after retraction. Since these pads rub firmly against the tires for a short distance before complete retraction, wheel rotation assists in lifting the landing gear completely into place. DO NOT brake the wheels before retraction is completed since this will cause the flight brake pads to be tucked in backwards, making manual extension very difficult.

CLIMB

Maximum continuous or higher power requires the use of 100% RPM. Reduce EGT below 490 deg. C. before reducing RPM to 92%.

CRUISE

1. Engine Power - For normal cruise use cruise power (EGT limit 32 deg.C. below maximum continuous limit)
2. Main Fuel Tank Gages - Check that automatic leveling device is maintaining the Main Tanks between 35 and 40 gallons.
3. Aux. Fuel Tanks - When Aux. Tanks are empty pull transfer pump circuit breaker to OFF to prevent pump from running in dry condition.

COMPRESSOR STALL

"Lugging Down" by too high propeller blade angle or overloading withtoo much fuel can cause compressor stall. These conditions can occur from mismanagement of controls or from misrigging. Compressor stall is indicated by a loud popping noise from the engine and a rapid increase in EGT. If compressor stall occurs in flight, immediately retard Power Lever and advance RPM Lever. If compressor stall is allowed to continue the high temperatures will seriously damage the engine.

INTENTIONAL ENGINE SHUTDOWN IN FLIGHT

This procedure may be used as an alternate to the feathering procedures given under Emergency Procedures. If the emergency procedure is used, first reduce EGT below 500 deg.C.

1. Reduce total electrical load below 200 amps.
2. EGT - Reduce below 500 deg.C.
3. Stop/Start Switch - Stop and release
4. Power Lever - Full Forward
5. Generator Switch - OFF
6. Feather Lever - Push full down, to stop rotation when desired.

NOTE

When fuel is cut off a slight pulsing may be felt, in rhythm with an oil pressure fluctuation, as the engine rolls down. This is caused by the NTS system cycling the feather valve to reduce RPM and drag. At the stabilized windmill speed of 20 to 30% RPM, the system maintains a steady condition if not feathered. After feathering a rotation of 200 RPM max. in forward direction is permissible.

AIR START

1. Airspeed - 127 to 160 mph (110 to 139 Kts) IAS
2. Power Lever - Handle approx. one inch forward of the Flight Idle position.
3. RPM Levers - Taxi
4. Fuel Boost Pump Switch - ON Main
5. Ignition/Fuel Circuit Breaker - ON
6. Air Start/Ground Start Switch - Air Start
7. Propeller Feather Lever - Full UP
8. Fuel Shut-Off - Pull up to ON
9. Main Fuel Tank Control - Forward to ON
10. Generator Switch - OFF
11. Stop/Start Switch - Hold in Start
12. Start Fuel Switch - ON at 10% RPM, OFF at ignition
13. Propeller - Check unfeathering
14. EGT, Fuel Flow, & Tach - Monitor
15. Fuel Flow Indication - Should start at 10% RPM
16. EGT - Should indicate combustion at 15 to 20% RPM. If not indicated by 25%, abort start.
17. Start Fuel Switch - Release at ignition
18. Stop/Start Switch - Release at 60% RPM
19. RPM Levers - Flight or Cruise
20. Generator Switch - ON

ABORTED AIR START (due to no combustion attained)

1. Stop/Start and Start Fuel Switches - Release
2. Allow engine to windmill for at least one minute

Resume Start by:

3. Stop/Start Switch - Hold in Start
4. Start Fuel Switch - Hold ON
5. When combustion is attained proceed per Air Start procedures, step 14.
6. If combustion is not attained repeat above procedures

NOTE

If repeated attempts to start are unsuccessful reduce airspeed and altitude if possible. If this will take longer than 2 minutes, feather propeller by pushing feather lever full down.

BEFORE LANDING

1. Fuel System - Check valves and gages
2. Fuel Boost Pump Switches- ON Main
3. RPM Levers - Flight (full forward)
4. Landing Gear - Down at 159 mph (138 Kts.) IAS
5. Flaps - Down at 132 mph (115 Kts) IAS

APPROACH AND LANDING

Maintain approach speeds shown on page 4-10

1. Flight Idle Stop Release (on Power Levers) - After touchdown raise to release and move Power Levers back into the reverse range as required for deceleration.
2. RPM Levers - Move to Taxi when reverse thrust is no longer required.

BALKED LANDING CLIMB

1. Power Levers - Full Takeoff Power
2. Airspeed - 108 mph (94 Kts) IAS
3. Flaps - Retracted
4. Landing Gear - At positive climb rate retracted
5. Airspeed - As required

ENGINE SHUTDOWN

NOTE

To facilitate engine cooling, park headed into wind.

1. Fuel Boost Pump Switches - OFF
2. Power Levers - Ground Start
3. Inverter Switch - OFF
4. Radios - OFF
5. RPM Levers - 85% or higher
6. Start/Stop Switches - Stop and Release
7. Power Levers - Full Reverse thrust before RPM decays to 65% (to engage propeller blade start locks)

NOTE

If any doubt exists as to whether start locks are fully engaged, refer to Propeller Unfeathering Procedures below.

8. Generator Switches - OFF
9. Battery Switches - OFF
10. Power Levers - After propellers stop, Flight Idle
11. All Switches - OFF

NOTE

Do not plug intakes or tailpipes until engines have cooled for at least 10 minutes.

GROUND OPERATION WITH ONE ENGINE INOPERATIVE

DO NOT attempt to start to taxi from standing start.

TO FEATHER PROPELLERS AT ENGINE SHUTDOWN

Use normal engine shut down procedures except leave Power Levers in Ground Start position.

TO UNFEATHER PROPELLERS BEFORE ENGINE START

1. Ignition Fuel Circuit Breaker - OFF
2. Air Start/Ground Start Switch - Air Start
3. Power Levers - Reverse Thrust (full aft)
4. Stop/Start Switch - Start, hold in position. Listen for the propeller blade start locks to drop in place as the propeller blades go towards reverse.

NIGHT FLIGHT IN CLOUDS

1. Rotating Beacon - OFF

CIRCUIT BREAKERS

Push to reset, or pull then push to reset, except circuit breaker switches, which are reset by moving switch to OFF then to ON. Landing gear motor and generator circuit breakers are located in the main power distribution junction box under the floor between the pilot and co-pilot seats. Other infrequently used circuit breakers are also located in the main power distribution junction box. Landing gear and generator circuit breakers can not be pulled out to trip. The balance of manually reset circuit breakers are located on the instrument sub-panels. Battery bus circuit breakers are located under the pilot and co-pilot seats. A manually reset circuit breaker is located in each nacelle for the oil vent valve. The entrance light circuit breaker is located in the nose above the batteries.

DEICING PROCEDURES

NOTE

The performance of the deicing system in icing conditions has not been evaluated by the F.A.A.

1. Wing Deicing Switch - ON
2. Wing Deicer Pressure Gage - Observe, 15 psi for 10 seconds, zero psi for 170 seconds.
3. Engine Inlet Anti-ice Switches - ON, observe indicator lights ON when valves are open.

NOTE

Inlet deicing valves should not be open for more than 10 seconds when the ambient temperature is more than 40 deg.F.

4. Propeller Deicer Switches - ON, observe ammeter indication for a minimum of 2 minutes. A slight flicker will be noted at the end of each 30 second cycle that indicates the system is operating normally.

5. Stall Warning Heat - ON
6. Static Heat Switches - #1 and #2 ON, monitor load meter, should read .7 when both ON.

NOTE

Static heat may not be operated on ground for more than 5 seconds. Static heat may not be operated at temperatures above 50 deg.F.(10 deg.C.)

7. Pitot Heat Switches - #1 and #2 ON

NOTE

Prolonged use of pitot heat on the ground will damage the heating elements.

SINGLE ENGINE PROCEDURES

Minimum single engine control speed is 97 mph (84 Kts) IAS; 100 mph (87 Kts) CAS

Best single engine climb speed is 128 mph (111 Kts) IAS; 130 mph (113 Kts) CAS

The engines are equipped with an NTS (negative torque sensor) system which automatically moves the propeller blades toward their feathered position if negative torque is sensed, thus preventing excessive propeller drag. Although the drag is slightly higher than for a feathered propeller, it allows ample time to positively identify the dead engine for feathering.

ENGINE FAILURE DURING TAKEOFF

1. Before V_1 - Abort takeoff
   a. Power Levers - Flight Idle. When on ground Reverse Thrust, vary reverse thrust as required to maintain desired direction.
   b. Brakes - As required

2. After V_1 - Takeoff continued
   a. Rotate - 105 mph (91 Kts) IAS
   b. Climb - 113 mph (98 Kts) IAS
   c. Landing Gear - UP at positive rate of climb
   d. Accelerate to best single engine climb speed of 128 mph (111 Kts) IAS
   e. Establish which engine has lost power - Rudder pressure required to maintain direction will be on the side of the good engine. Check torque and EGT indicators.
   f. Feather Lever (inoperative engine) - Down
   g. Fuel Shut/Off (inoperative engine) - OFF
   h. Generator Switch (inoperative engine) - OFF
   i. On good engine recheck power setting and observe TWO MINUTE TAKEOFF POWER LIMIT

j. Airspeed - 128 mph (111 Kts) IAS

As time permits

k. Ignition/Fuel Circuit Breaker (inoperative engine) - OFF
l. Air Start/Ground Start Switch - Air Start
m. Fuel Boost Pump Switch (inoperative engine) - OFF
n. Follow fire procedures on page 3-3 if necessary.
o. Reduce electrical load as necessary - Monitor ammeter for excessive load.

NOTE
DO NOT ATTEMPT RESTART BELOW 500 ft. ABOVE THE TERRAIN AND BELOW 128 mph (111 Kts) IAS due to momentary high drag as the propeller comes out of the feathered position.

ENGINE FAILURE DURING CLIMB OR CRUISE

Procedure is the same as in Engine Failure During Takeoff except that full takeoff power may not be required and the landing gear may already be up. Climbs should be made at 100% RPM to insure proper cooling.

ENGINE FAILURE IN FLIGHT

1. RPM Levers - Both Full Forward
2. Power Levers - Max. Cont. Power
3. Establish Which Engine Has Lost Power
4. Feather Lever (inoperative engine) - Down
5. Fuel Shut/Off (inoperative engine) - OFF
6. Generator Switch (inoperative engine) - OFF
7. Ammeter - Monitor, not to exceed 300 amps for 5 min., or 200 amps continuously.
8. Power Levers - Recheck power setting
9. Ignition/Fuel Circuit Breaker (inoperative engine) - OFF

EMERGENCY LETDOWN

1. RPM Levers - Full forward
2. Power Levers - Flight Idle
3. Landing Gear - Down at 159 mph (138 Kts) IAS
4. Flaps - Down at 164 mph (142 Kts) IAS
5. Airspeed - Maintain 140 mph (122 Kts) IAS
6. Trim - As required

SINGLE ENGINE GO AROUND

1. RPM Levers - Full Forward
2. Power Levers - As required
3. Airspeed - 108 mph (94 Kts) IAS
4. Flaps - Retracted
5. Landing Gear - At positive rate of climb, retract
6. Airspeed - 128 mph (111 Kts) IAS

SINGLE ENGINE LANDING

Same as normal landing except as follows:
1. Flaps and landing gear down when landing assurred
2. After touchdown use reverse thrust commensurate with adequate directional control.

POWERPLANT CONTROL MALFUNCTION

Should there be an indication of improper operation of the fuel control or propeller control, it is recommended that the control action be checked by a simulated landing flare at altitude, before attempting landing. If excessive power or excessive drag be found, then the affected engine should be feathered and a single engine landing executed.

ENGINE FIRE IN FLIGHT

1. Feather Lever - Push Full Down
2. Fuel Shut/Off - Push Down to OFF
3. Fire Extinguisher Switch - Lift guard and hold switch ON for 5 seconds
4. Generator Switch - OFF

ENGINE FIRE ON GROUND

If fire is a rich exhaust mixture burning at the tail pipe at engine start, continue start and blow fire out.

ENGINE FIRE ON GROUND (CONT)

If fire is in the engine compartment of nacelle:

1. Fuel Shut/Off - Push down to OFF
2. Feather Lever - Push full Down
3. Fire Extiguisher Switch - Lift guard and hold switch ON for 5 seconds

LANDING GEAR MANUAL EXTENSION

Pull out the landing gear control circuit breaker. Place the position switch DOWN. Lift cover and depress landing gear clutch pedal, hold clutch pedal down and engage handcrank by pushing in. Crank gear full down, then release clutch pedal and rock hand crank until clutch pedal returns to engaged position.

NOTE

During the first 8 to 10 turns of the crank, (while the landing gear doors are being opened) the force required on the crank handle may be 35 to 40 pounds. The many positions of the handle may be used to maintain a favorable location for application of this force. After the doors are opened the crank will turn freely. 163 full turns of the crank are required for full extension of the landing gear. During manual extension, the landing gear position indicators are not an accurate indication of full extension, and will indicate a down position prematurely. Continue to crank until the crank can no longer be turned.

CABIN FIRE

Battery and generator master switches OFF.
Use portable fire extinguisher

CAUTION

Fumes from hand extinguisher are toxic. Discharge as little as possible to put out the fire completely. Open all ventilation outlets. If the fire is not electrical, battery and generator switches may be turned ON.

SMOKE EVACUATION

If only a small amount of smoke is present, or if the pilot is the only occupant of the aircraft the smoke can be removed by latching open the co-pilot side window.

If a large quantity of smoke is present, the most effective procedure for smoke evacuation from the cabin or cockpit is to open the rear entrance door, at or below 200 mph, to the limit of the snubber chain only (approx. 3 in.). Close and secure the door after the smoke has been removed.

FUEL SYSTEM EMERGENCY PROCEDURES

A study of section 6 and the fuel system diagram therein will indicate that the fuel system may be operated in many ways. Three of the basic operations are given below.

TO BYPASS MAIN TANK (ref. page 3-6)

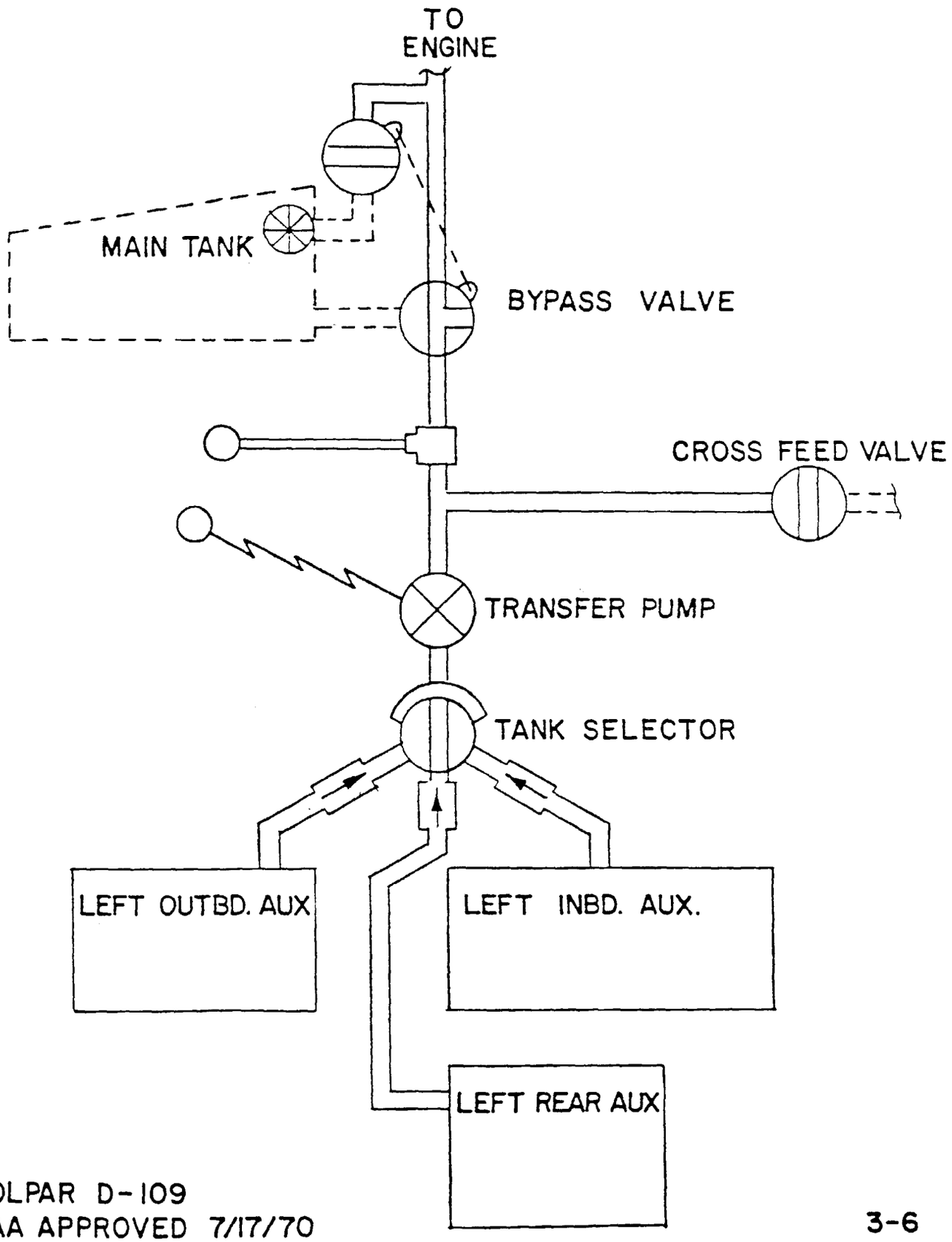
This procedure will feed fuel to the engine driven fuel pump under positive pressure and is used in case of failure of the main tank fuel boost pump. The procedure applies to the left or right system and feeds fuel from an auxiliary tank to the engine on the same side as the auxiliary tank.

1. Cross Feed Valve - OFF
2. Aux. Tank Gage - Check quantity
3. Fuel Boost Pump Switch - Aux. ON
4. Fuel Transfer Light - ON
5. Main Tank Control - BYPASS

TO MAKE FUEL FROM ONE AUX. TANK AVAILABLE TO BOTH ENGINES (ref. page 3-8)

1. Fuel Boost Pump Switches - Aux. on operative side, OFF on inoperative side
2. Main Fuel Tank Control - ON (fwd) on same side as Aux. tank to be used. BYPASS on side opposite to Aux. tank to be used.
3. Cross Feed Valve - ON

TO BYPASS MAIN TANK
(L.H. SHOWN R.H. OPPOSITE)



NOTE
When Aux. tank is empty turn Fuel Boost Pump Switch to OFF

TO FEED ENGINE FROM TANKS ON THE OPPOSITE SIDE WITH ONE ENGINE INOPERATIVE (ref. page 3-9)

This procedure is used if, after an engine has been shut down, it becomes necessary to make fuel on the opposite side of the aircraft available to the operating engine.

On Inoperative Engine Side

1. Fuel Shut/Off - Push down to OFF
2. Main Fuel Tank Control - BYPASS
3. Aux. Tank Gage - Check quantity
4. Fuel Boost Pump Switch - Aux. ON
5. Cross Feed Valve - ON

On Operating Engine Side

1. Main Fuel Tank Control - BYPASS
2. Fuel Boost Pump Switch - Aux. OFF

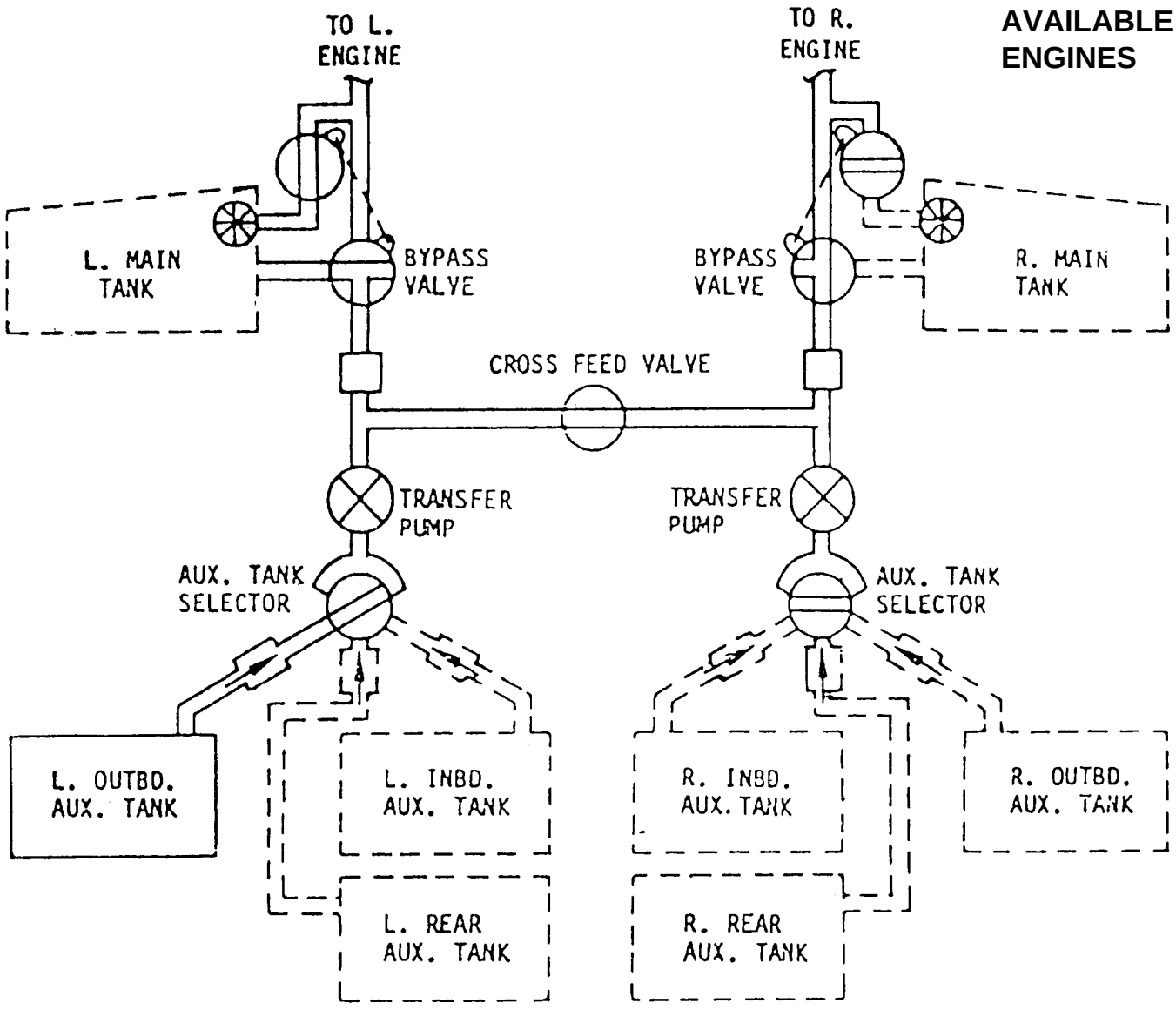
When the quantity of fuel in the aux. tank being used has been reduced to an amount insufficient to overflow the main tank of the operating engine, the Main Fuel Tank Control may be changed from BYPASS to ON, thus preventing engine stoppage due to running the aux. tank dry. Monitor the main and aux fuel gages to determine when the aux. tank is empty, and at that time switch the Fuel Boost Pump Switch to OFF to prevent running the pump while dry.

EMERGENCY FUELS

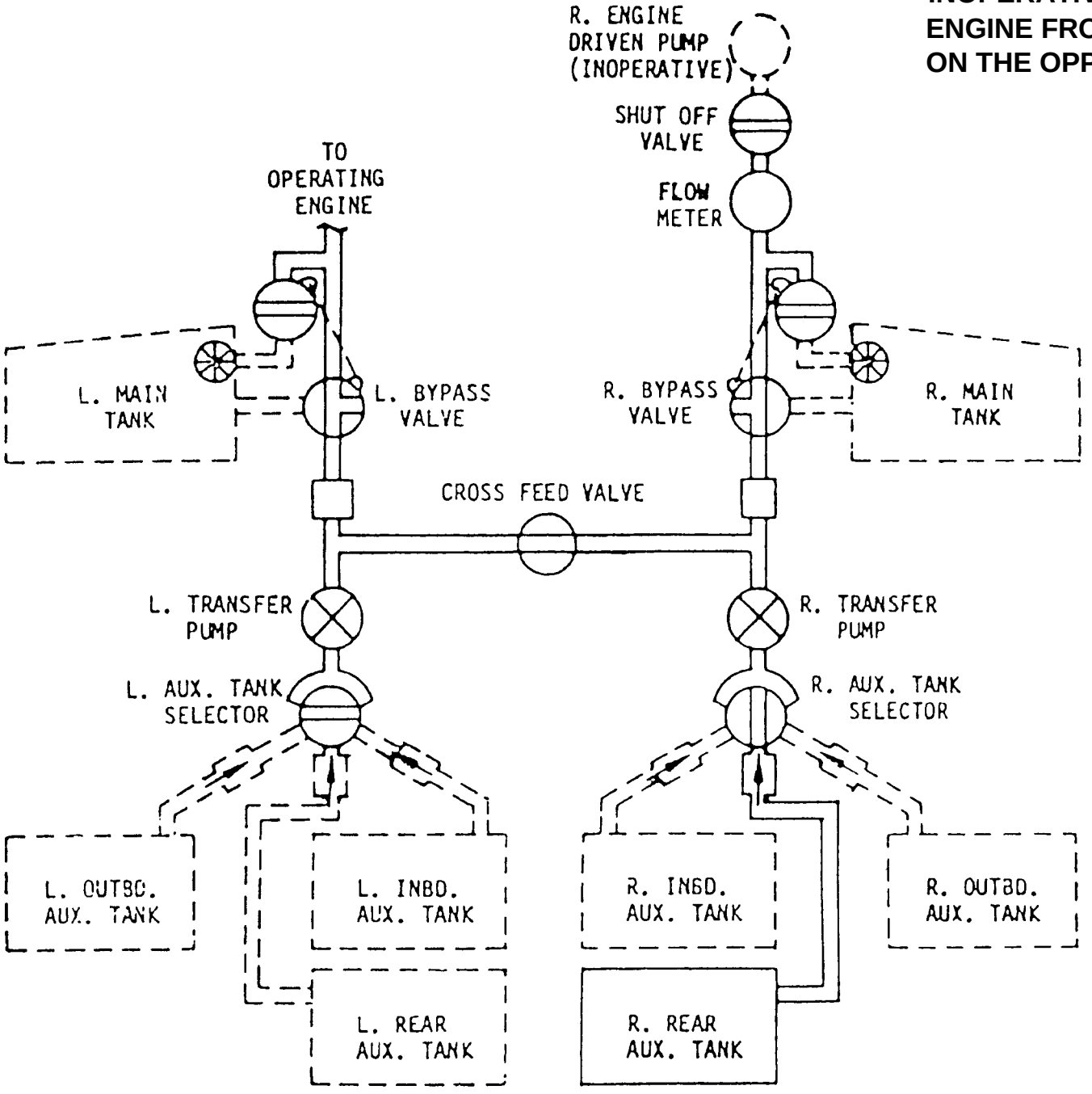
When fuels per Limitations Section are not available, grade 80/87 octane aviation gasoline or white gasoline may be used under the following limitations:

1. Do not exceed 1000 gallons per engine 100 hours of operation
2. The amount of gasoline used must be entered in the engine log book.
3. Use of the boost pumps on Main at takeoff (as per normal operating procedure) and at any time fuel pressure falls below 20 psi.

TO MAKE FUEL FROM L.H. AUX TANK AVAILABLE TO BOTH ENGINES



WITH R.H. ENGINE INOPERATIVE, TO FEED ENGINE FROM AUX. TANK ON THE OPPOSITE SIDE



ELECTRICAL SYSTEM FAILURE

Generator Inoperative (generator fail light ON)
1. Generator Switch - OFF
2. Generator Reset Switch (main dist. panel) - RESET
3. Generator Field Circuit Breaker (main dist. panel) - RESET
4. Generator Switch - ON
5. If generator fail light illuminates, Generator Switch - OFF
6. Operating Generator - Do Not exceed 200 amps

Bus Inoperative (bus fail light ON)
1. Bus Tie Switch - OFF
   (all systems will operate except failed bus)
2. All loads failed bus - OFF
3. Main Battery and Generator Circuit Breakers - Push to RESET
   (if circuit breaker trips again) - Do Not RESET
4. Reset all necessary equipment circuit breakers

Excessive Ammeter Indication (over 200 amps either gen.)
1. Bus Tie Switch - OFF
2. If ammeter indication still excessive:
   a. Generator Switch (high ammeter system) - OFF
   b. Generator Circuit Breaker (high ammeter system) - OFF
   c. Bus Tie Switch - ON

Inverter Inoperative (inverter light ON)
1. Main Inverter Switch - OFF
2. Spare Inverter Switch - ON
3. Check for Emergency Bus Failure

Emergency Bus Failure
1. No. 3 Battery Switch - ON
2. Non Required equipment switches - OFF

Electrical Smoke and or Fire
1. Generator Switches - OFF
2. Battery Switches - OFF
3. Emergency Bus Circuit Breaker - PULL
4. No. 3 Battery Switch - ON
5. Locate Fire
6. If emergency bus is faulted:
   a. Battery Switches - ON
   b. Generator Switches - ON
   c. No. 3 Battery Switch - OFF
7. If No. 1 or No. 2 or Essential Bus is Faulted:
   a. Bus Circuit Breaker (faulted bus) - PULL
   b. Generator Switches - ON
   c. Battery Switches - ON
   d. Bus Tie Switch - ON
   e. No. 3 Battery Switch - ON, if required

SECTION 4

PERFORMANCE

The performance information in this section is provided as part of the FAA Approved Flight Manual. Compliance with operating limitations in this section is mandatory for Part 135 operations.

MAXIMUM TAKEOFF WEIGHT

Maximum takeoff weight as limited by performance requirements is the most restrictive of:

1. The weight as permitted by the single engine takeoff climb requirements (ref. page 4-13) for the existing airport altitude and temperature

2. The weight permitted when the distance shown on page 4-14 (accelerate stop distance) is equal to or less than the available takeoff runway length for the existing altitude and temperature.

NOTE

The accelerate stop distances on page 4-14 were obtained using a 2.5 second pilot recognition time.

TAKEOFF DECISION SPEED (V_1)

The decision speed (V_1), as used in this Aircraft Flight Manual, is the airspeed on the ground at which, as a result of engine failure or other reasons, the pilot is assumed to have made a decision to continue or discontinue the takeoff.

This airspeed is: 105 mph (91 Kts) IAS
110 mph (96 Kts) CAS

NOTE

If an engine failure occurs at or above V_1 speed during a weight-limited takeoff considerable distance is required to accelerate to the best rate of climb speed while the propeller is NTS'ing and the gear has been retracted. The total distance from the start of the takeoff to accelerate to this speed is much greater than the accelerate stop field lengths as shown on page 4-14. This maneuver has been demonstrated as not requiring exceptional skill, but particular attention must be paid to airspeed control.

The procedures used to continue a single engine takeoff are those described on page 3-1.

NOTE

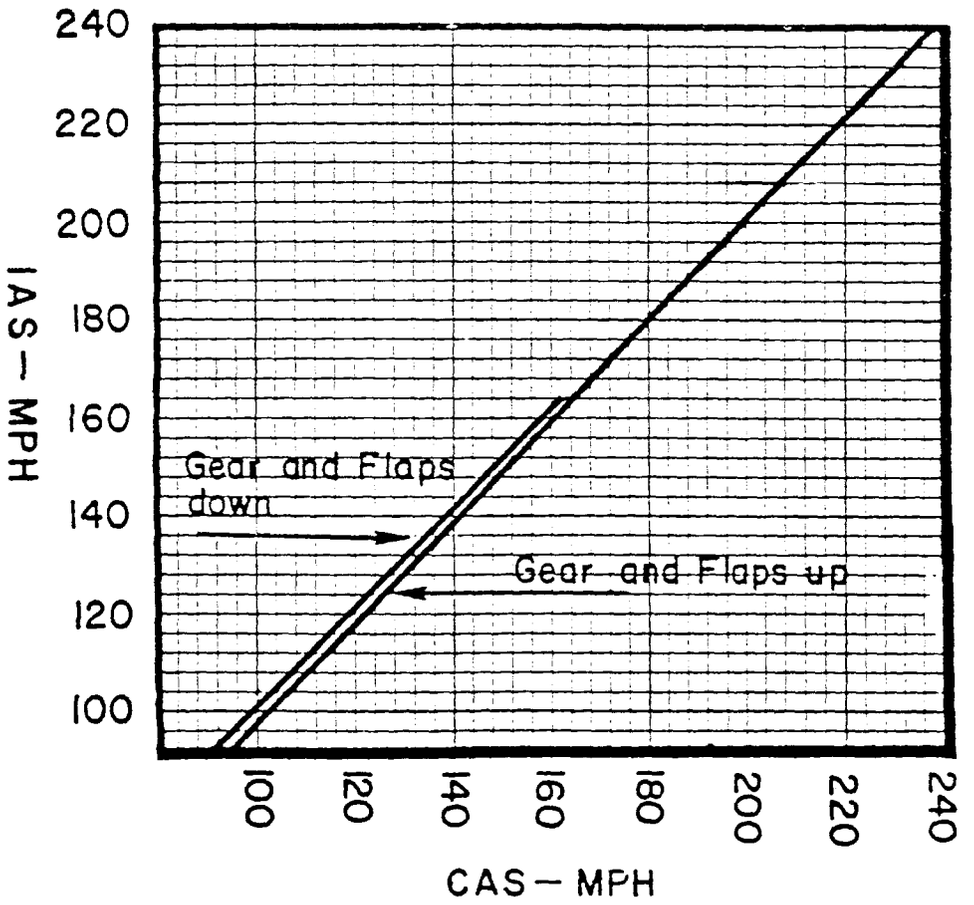
If an engine failure occurs at or above V_1 speed during a weight-limited takeoff considerable distance is required to accelerate to the best rate of climb speed while the propeller is NTS'ing and the gear has been retracted. The total distance from the start of the takeoff to accelerate to this speed is much greater than the accelerate stop field lengths as shown on page 4-14. This maneuver has been demonstrated as not requiring exceptional skill, but particular attention must be paid to airspeed control.

The procedures used to continue a single engine takeoff are those described on page 3-1.

AIRSPEED CALIBRATION
PILOTS AIRSPEED INDICATOR

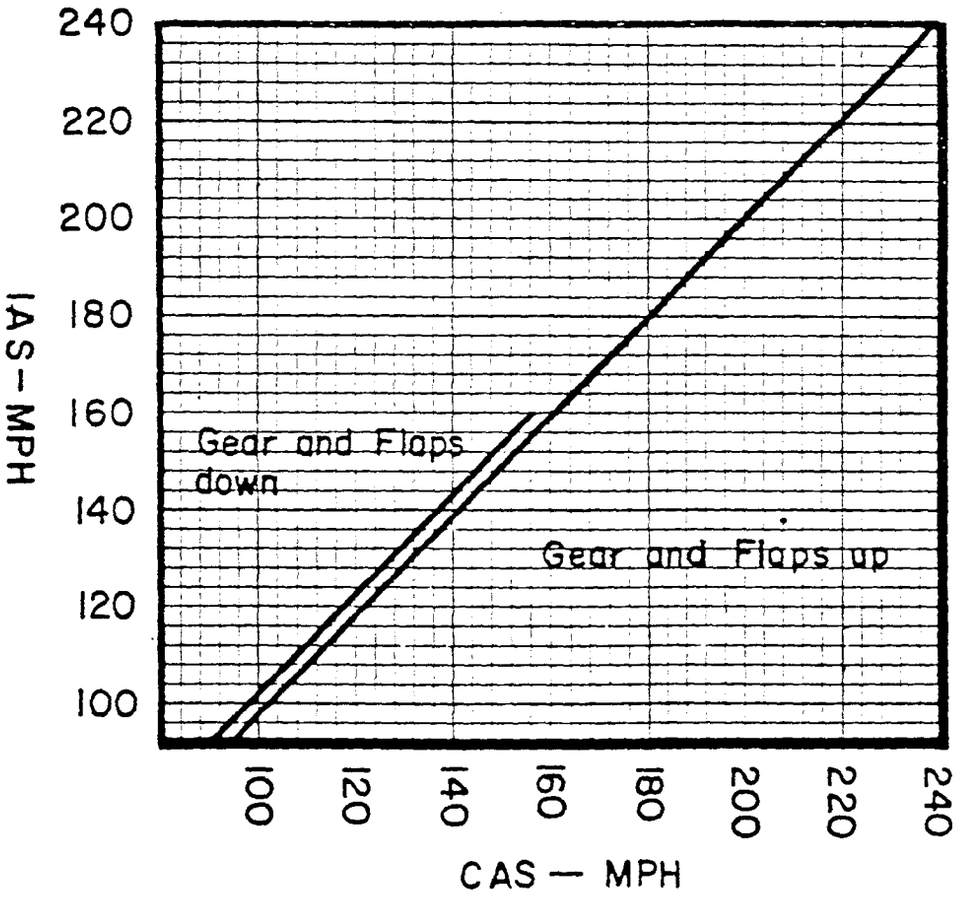
NOTE:

IAS assumes zero instrument error



AIRSPEED CALIBRATION
CO-PILOTS AIRSPEED INDICATOR

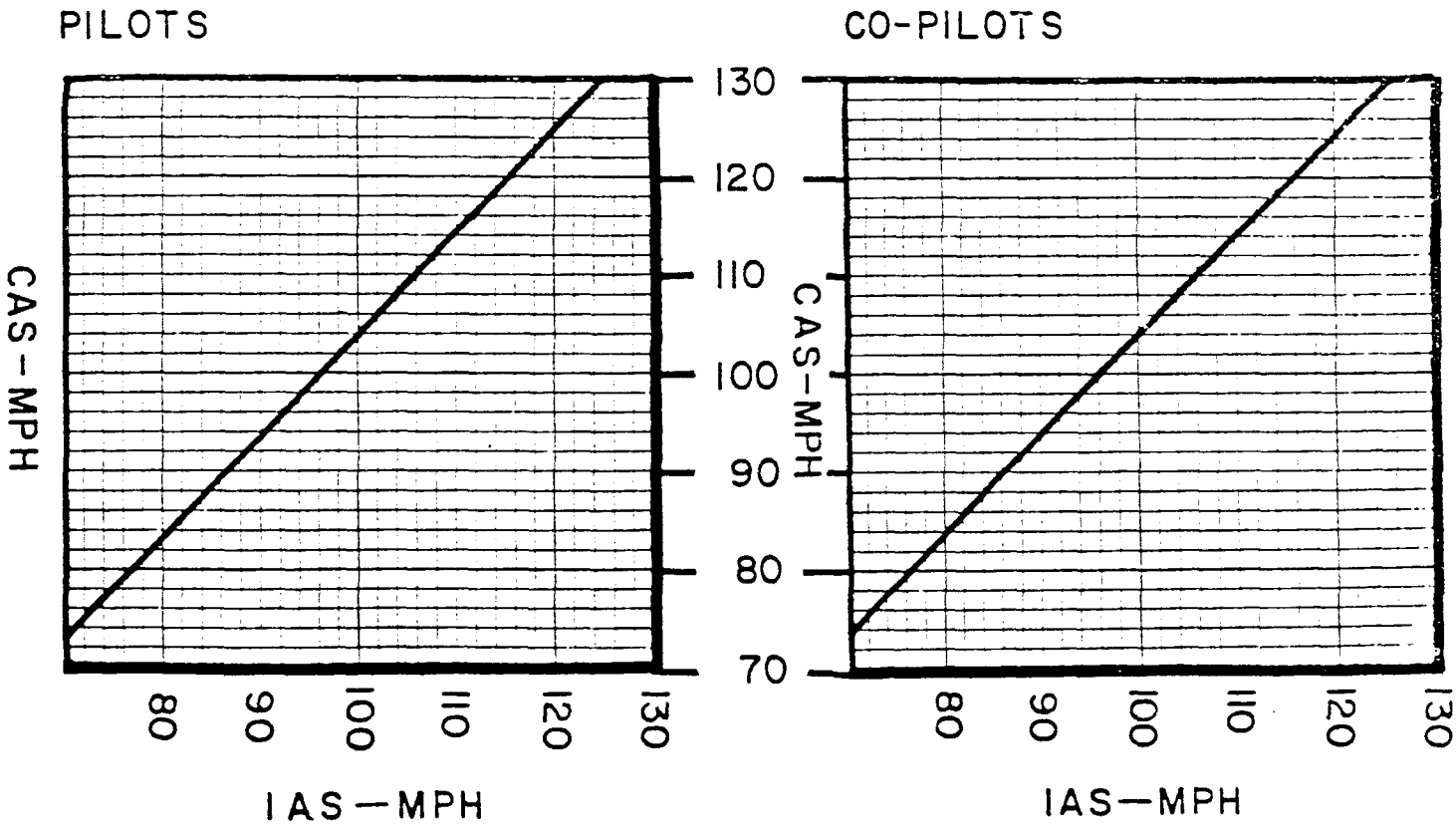
NOTE:
I A S assumes zero instrument error



GROUND AIRSPEED CALIBRATION

NOTE:

IAS assumes zero instrument error



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ADDITIONAL OPERATING SPEEDS

Vmc (minimum control speed)
97 mph (84 Kts) IAS
100 mph (87 Kts) CAS

V_1 (critical engine failure speed)
105 mph (91 Kts) IAS
110 mph (96 Kts) CAS

Vso (stall speed, gear and flaps down)
93 mph (81 Kts) IAS
92 mph (80 Kts) CAS

Vs1 (stall speed, gear and flaps up)
93 mph (81 Kts) IAS
96 mph (83 Kts) CAS

Vx (best angle of climb speed)
108 mph (94 Kts) IAS
110 mph (96 Kts) CAS

Vy (best rate of climb speed - two engines)
134 mph (117 Kts) IAS
135 mph (117 Kts) CAS

Vy (best rate of climb speed - one engine)
128 mph (111 Kts) IAS
130 mph (113 Kts) CAS

Vmo (max operating speed)
242 mph (210 Kts) IAS
240 mph (208 Kts) CAS

STALLING DATA

Stalling speed, power off, gear and flaps down, at zero angle of bank is 93 mph (81 Kts) IAS, 92 mph (80 Kts) CAS

Maximum altitude lost in a stall is 550 feet.

Maximum pitch angle below horizontal in a stall recovery is 22 deg.

The indication of a stall with power on is a strong rolling tendency.

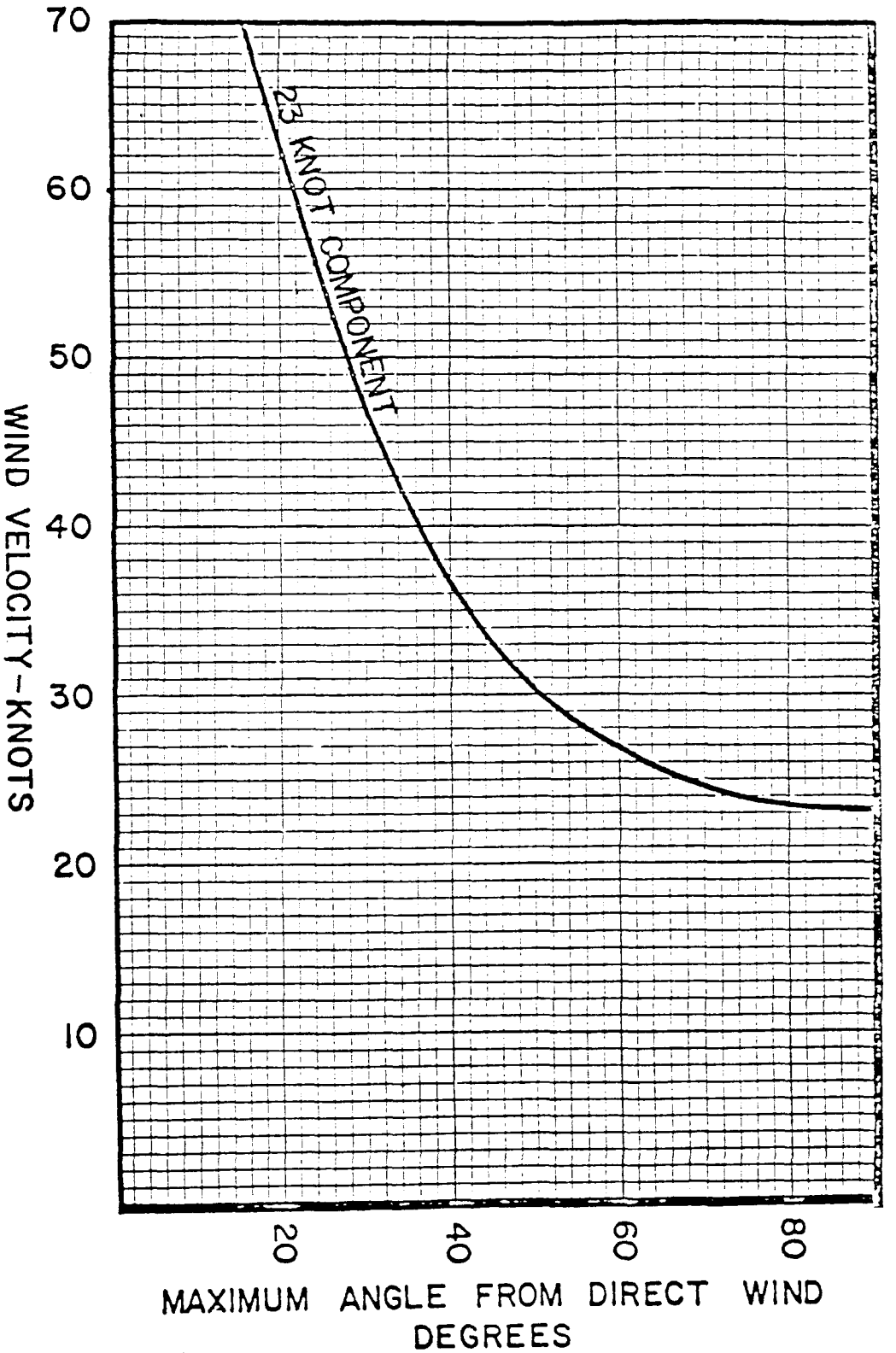
Stalling speed, power off, gear and flaps up, at zero angle of bank is 93 mph (81 Kts) IAS, 96 mph (83 Kts) CAS

STALL SPEEDS

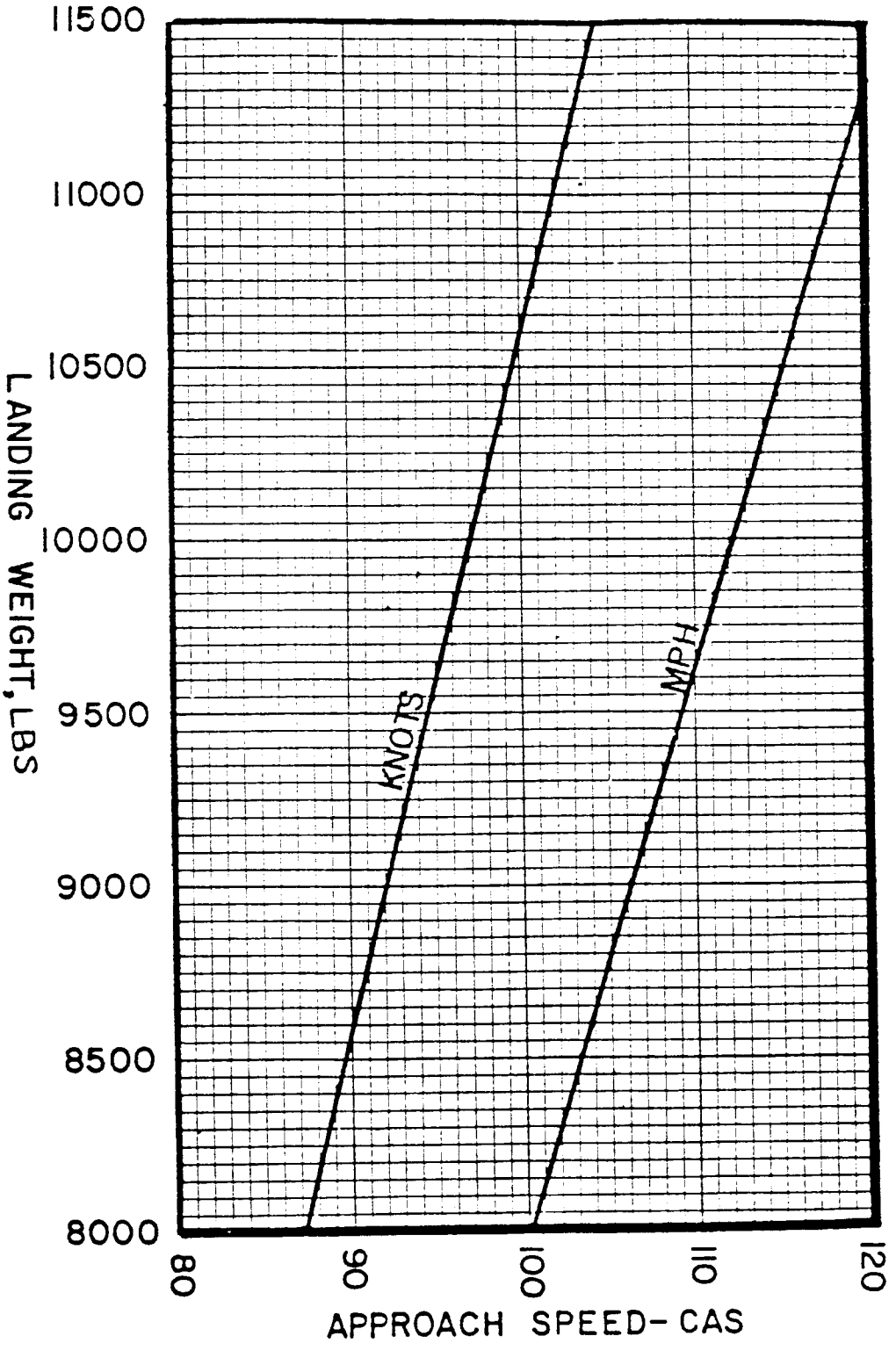
Configuration	Bank Angle, Deg. 0		20		40		60	
	IAS	CAS	IAS	CAS	IAS	CAS	IAS	CAS
Gear and Flaps Up	93	96	96	99	107	110	134	136
Gear and Flaps Down	93	92	96	95	106	105	132	130

Note: 1. IAS does not include instrument error.
2. All airspeeds given in MPH for power off and gross weight of 11,500 lbs.
3. Pilots airspeed system shown only.

MAXIMUM DEMONSTRATED CROSS WIND VELOCITY & ANGLE FOR TAKEOFF & LANDING



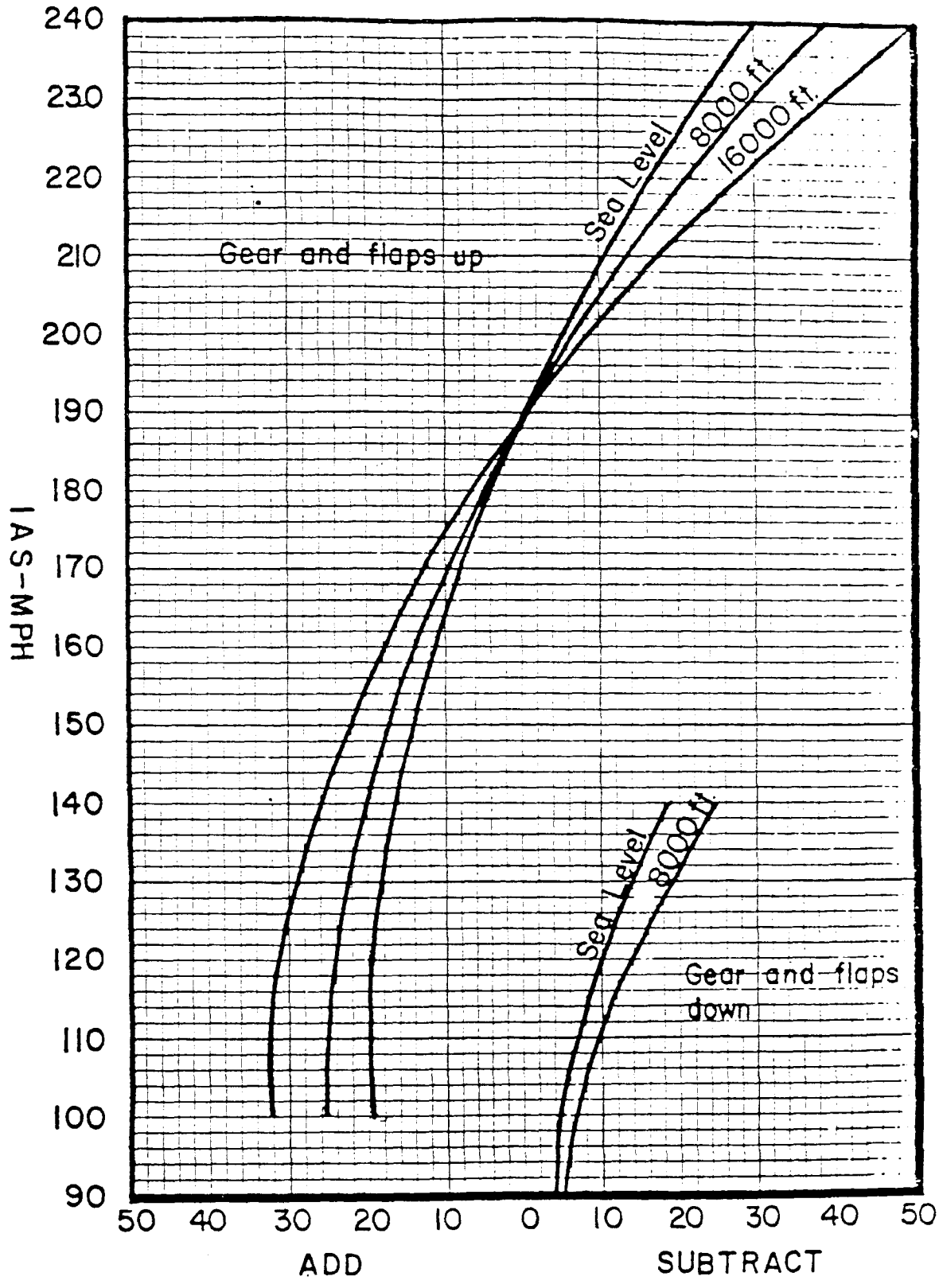
APPROACH SPEED AT 50ft. vs
LANDING WEIGHT



VOLPAR D-109

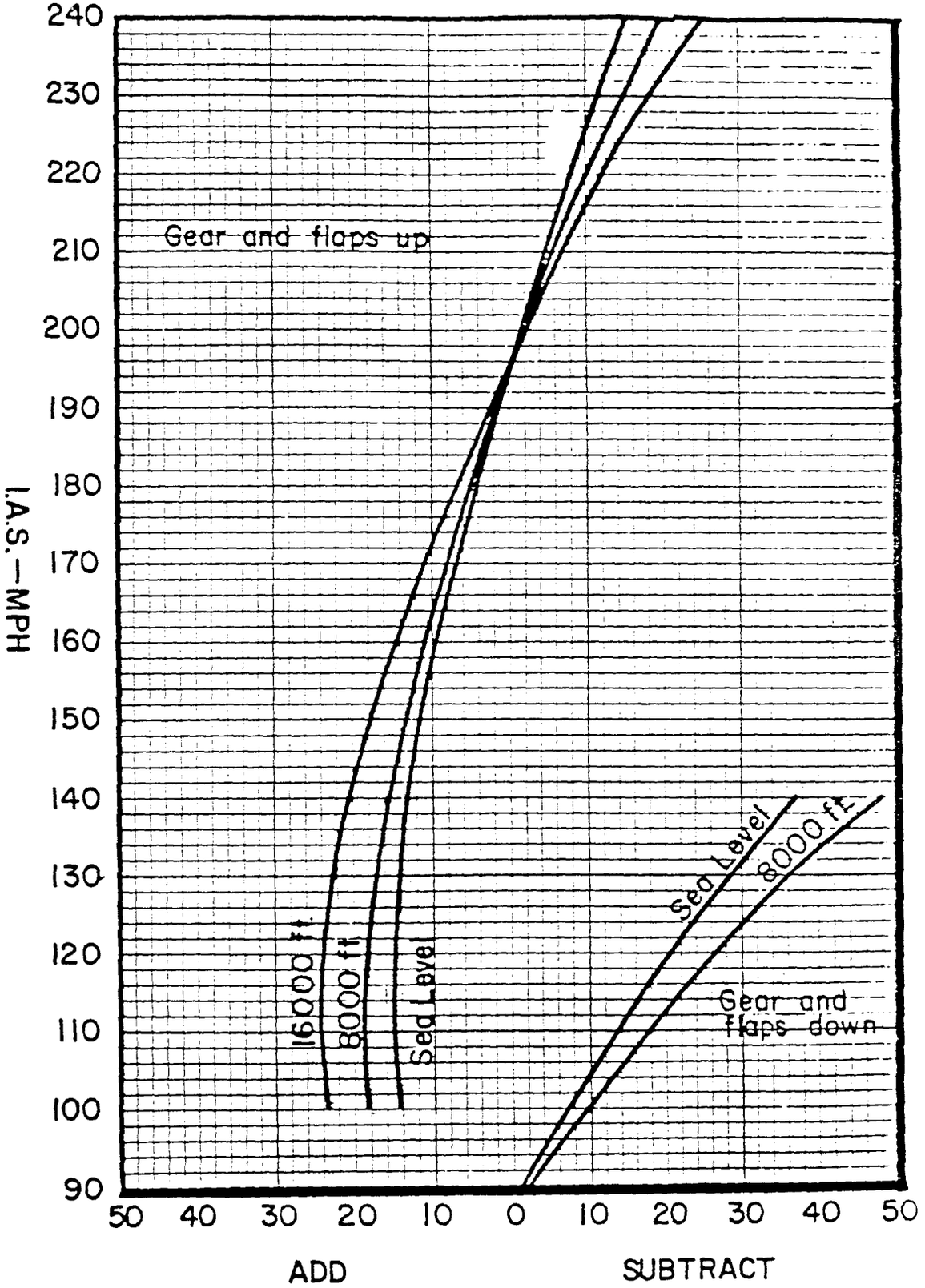
ALTIMETER CORRECTION, PILOTS SYSTEM

NOTE: IAS assumes zero instrument error



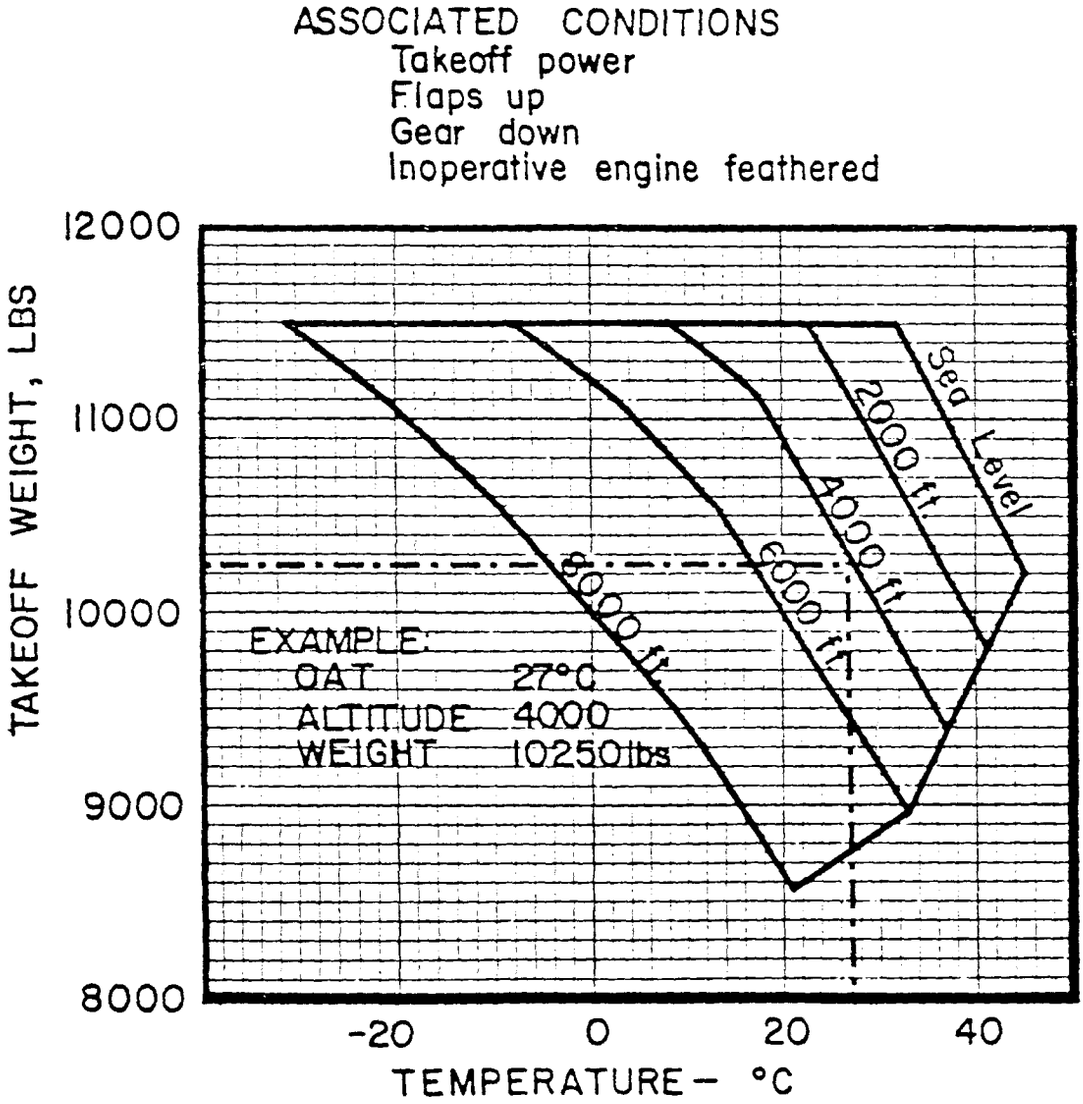
ALTIMETER CORRECTION, CO-PILOTS SYSTEM

NOTE: I A S assumes zero instrument error



ALTIMETER CORRECTION
FEET

MAXIMUM TAKEOFF WEIGHT PERMITTED BY SINGLE ENGINE TAKEOFF CLIMB REQUIREMENT. VARIATION WITH WEIGHT, ALTITUDE AND TEMPERATURE.



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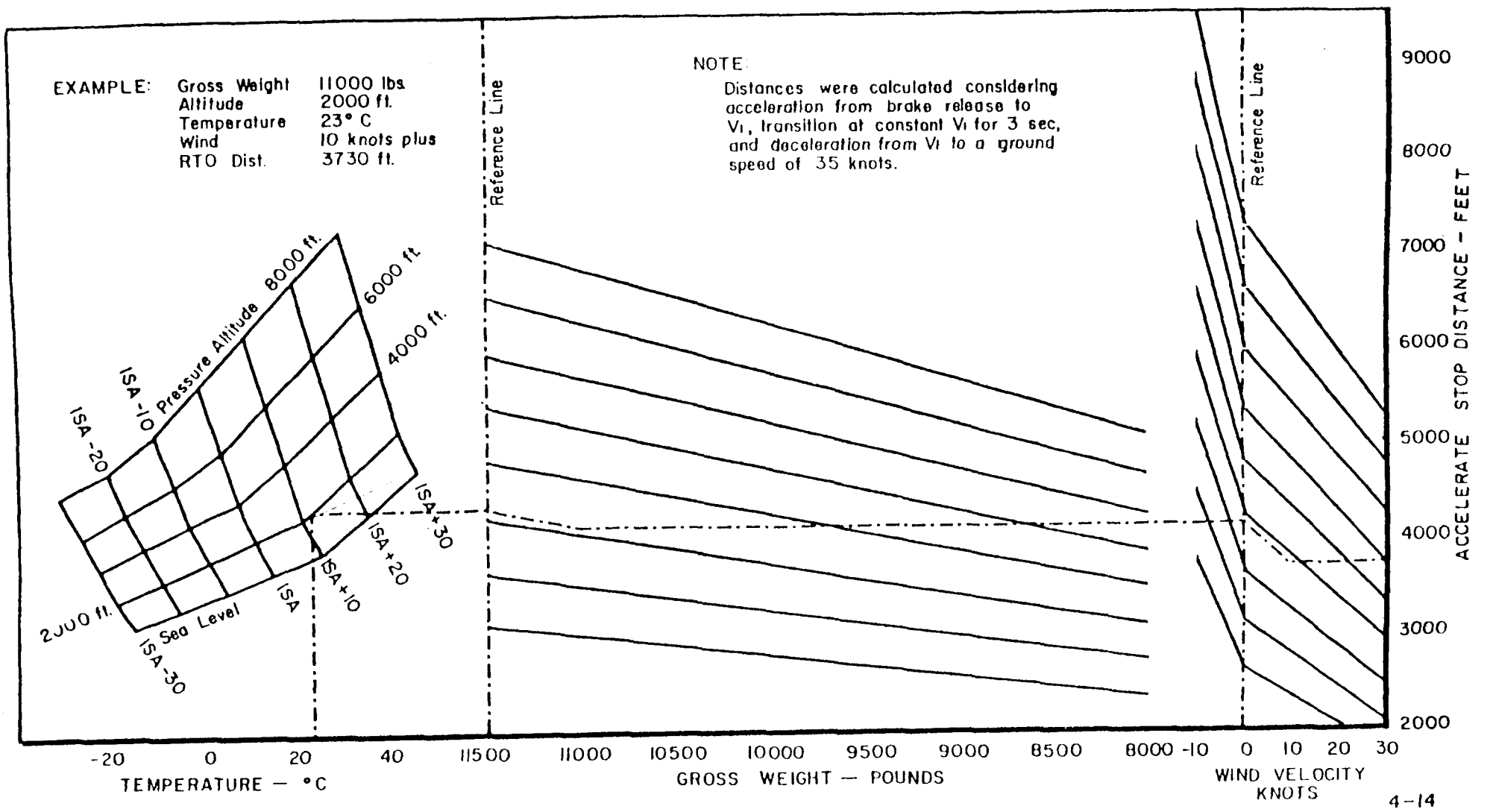
FAA APPROVED 7/17/70
REVISED 4/22/71

ACCELERATE STOP DISTANCE VARIATION WITH WEIGHT, ALTITUDE, TEMPERATURE AND WIND

ASSOCIATED CONDITIONS
Decision speed V_1, 110 mph CAS
Takoff configuration
Takoff power
One engine idle at decision speed
Maximum braking and reverse thrust
Hard surface level runway
Wind reported 6 ft. above runway



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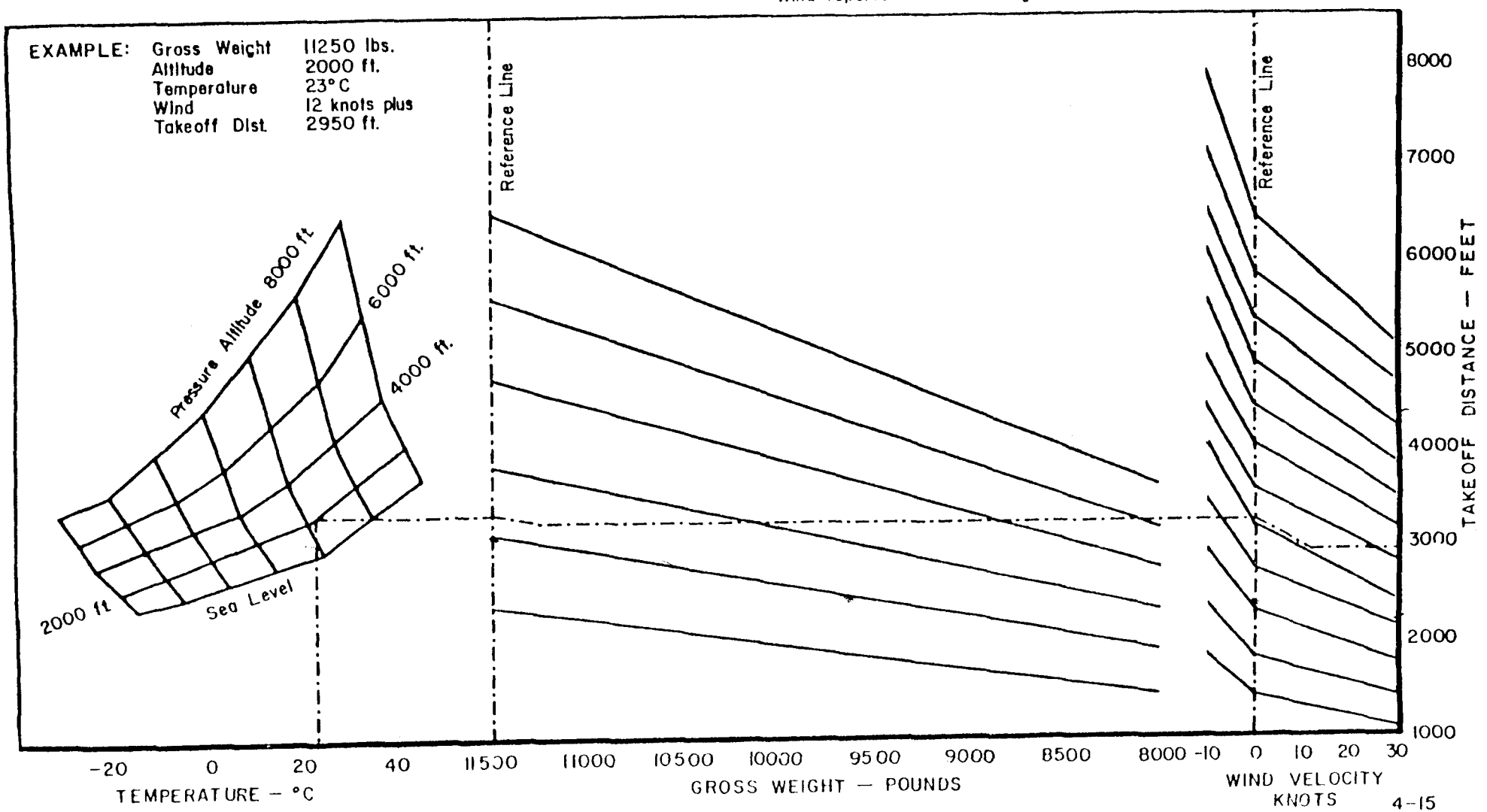
FAA APPROVED 7/17/70
REVISED 4/22/71

VARIATION OF TAKEOFF DISTANCE TO CLEAR A 50 FT. OBSTACLE, VARIATION WITH WEIGHT, ALTITUDE, TEMPERATURE AND WIND.

ASSOCIATED CONDITIONS
Takeoff configuration
Takeoff power
Liftoff speed, 110mph CAS
Climb speed at 50 ft. height, 115mph CAS
Hard surface level runway
Wind reported 6ft. above ground



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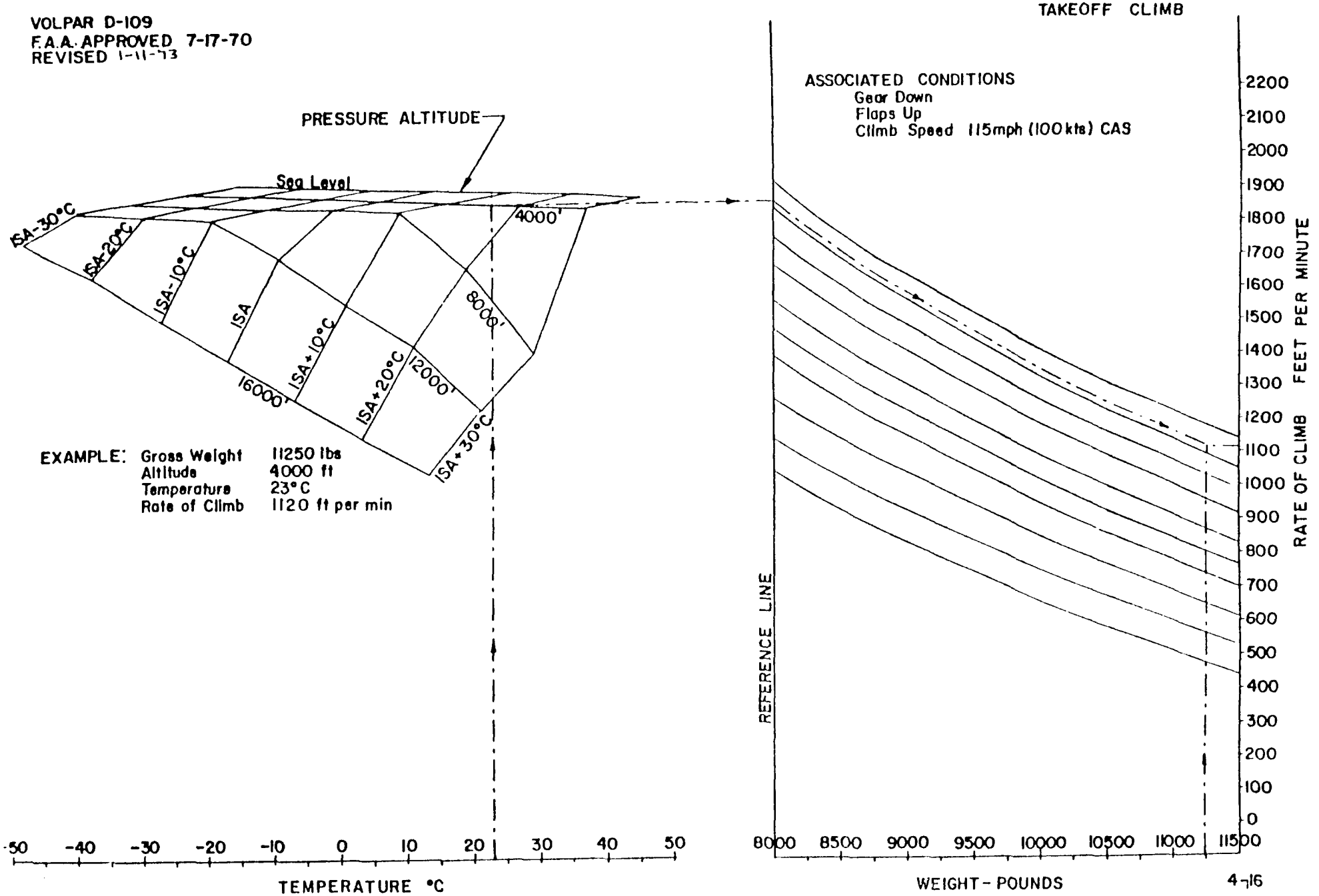
REVISED 1-11-73

TAKEOFF CLIMB



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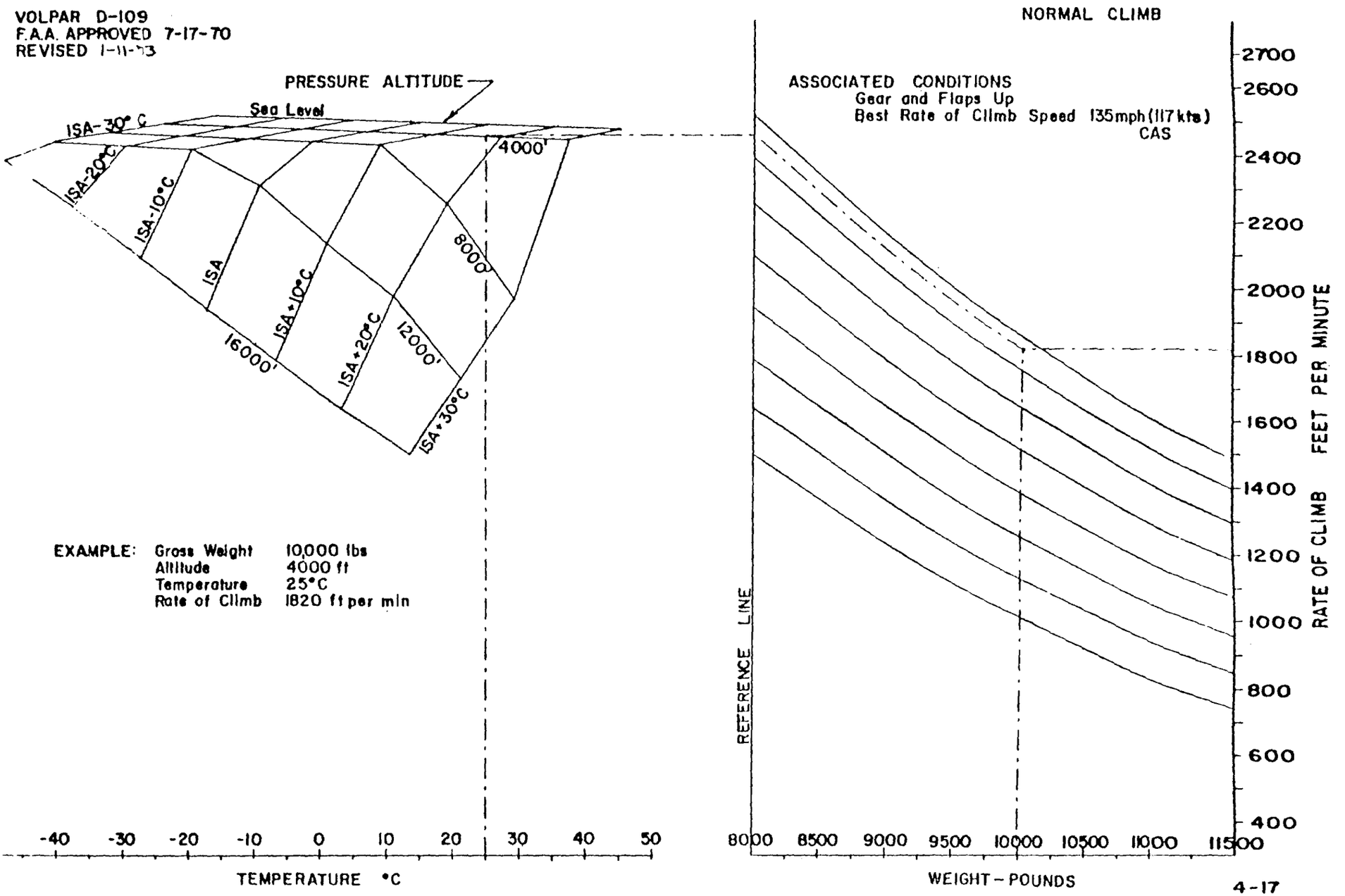
F.A.A. APPROVED 7-17-70
REVISED 1-11-73



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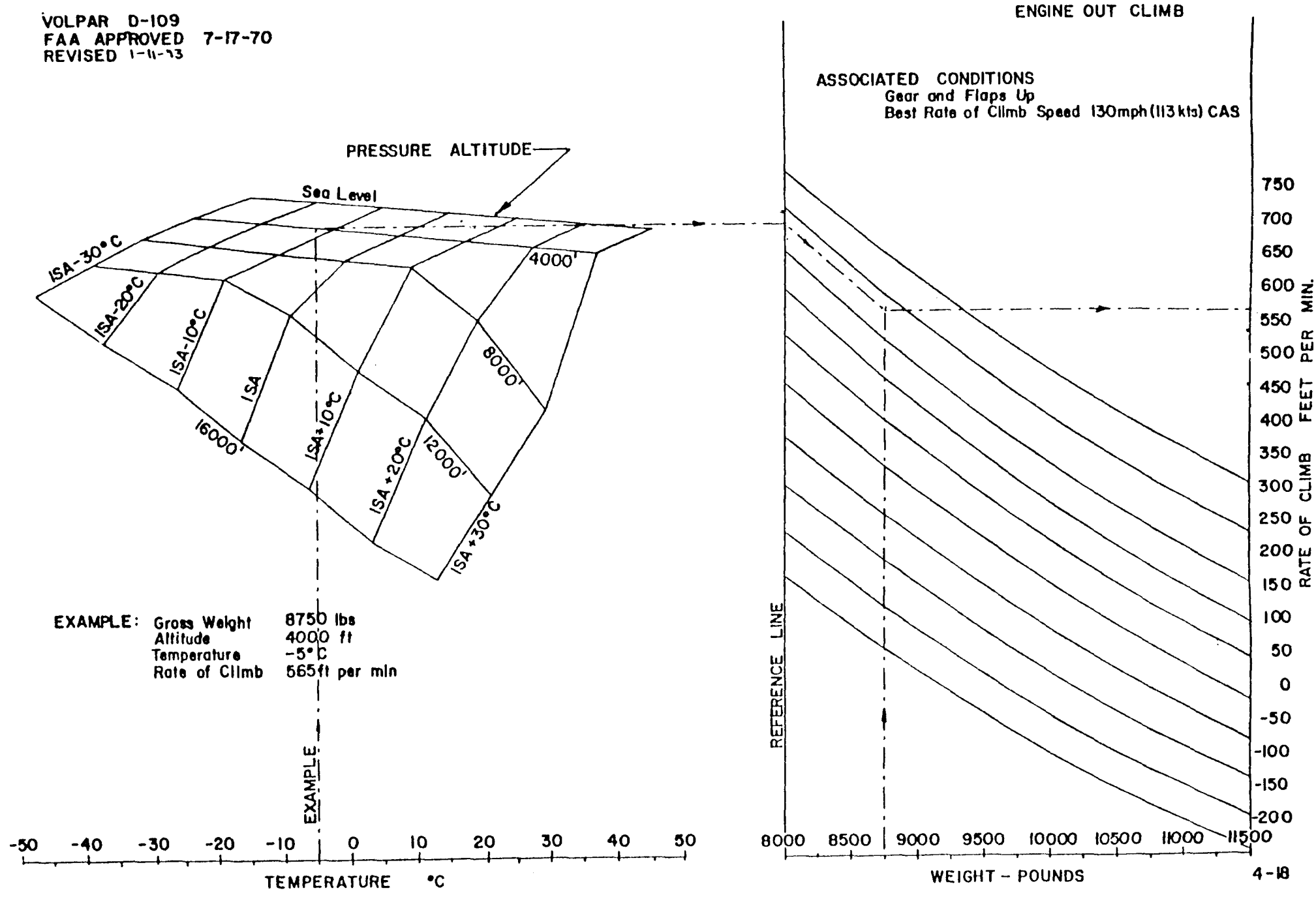
FAA APPROVED 7-17-70
REVISED 1-11-73



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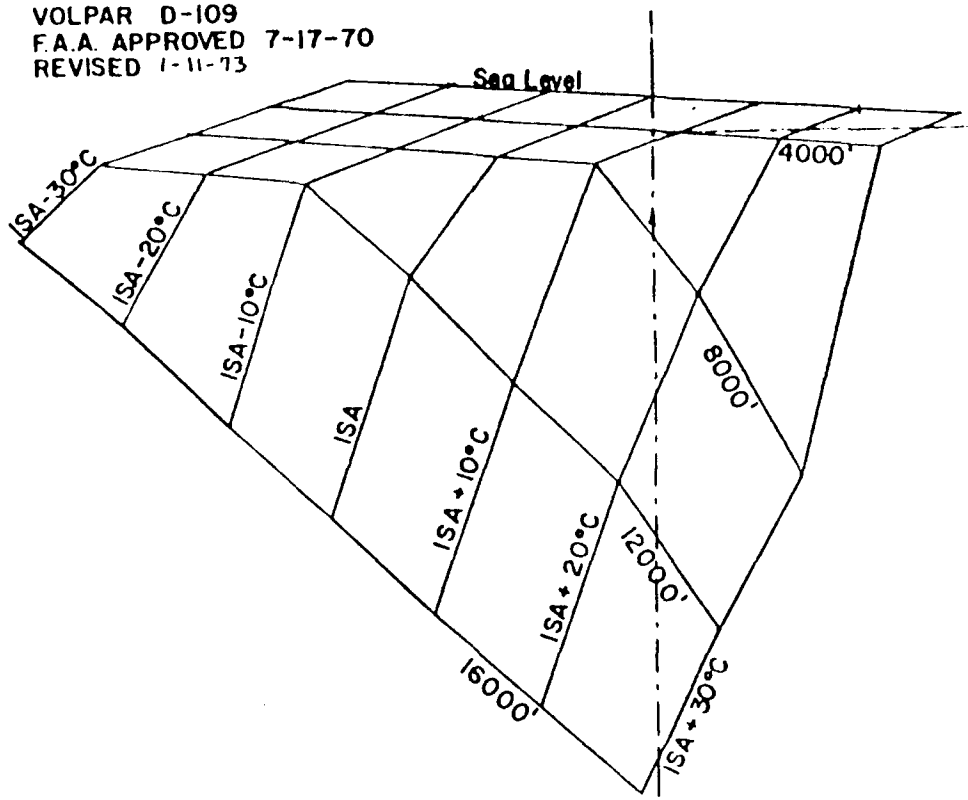
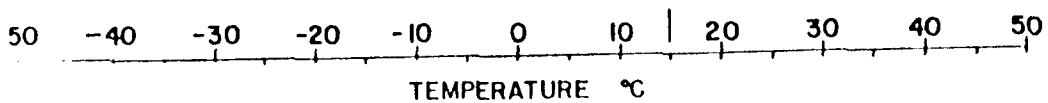
F.A.A. APPROVED 7-17-70
REVISED 1-11-73



EXAMPLE:

Gross Weight	10000 lbs
Altitude	4000 ft
Temperature	15° C
Rate of Climb	890 ft per min

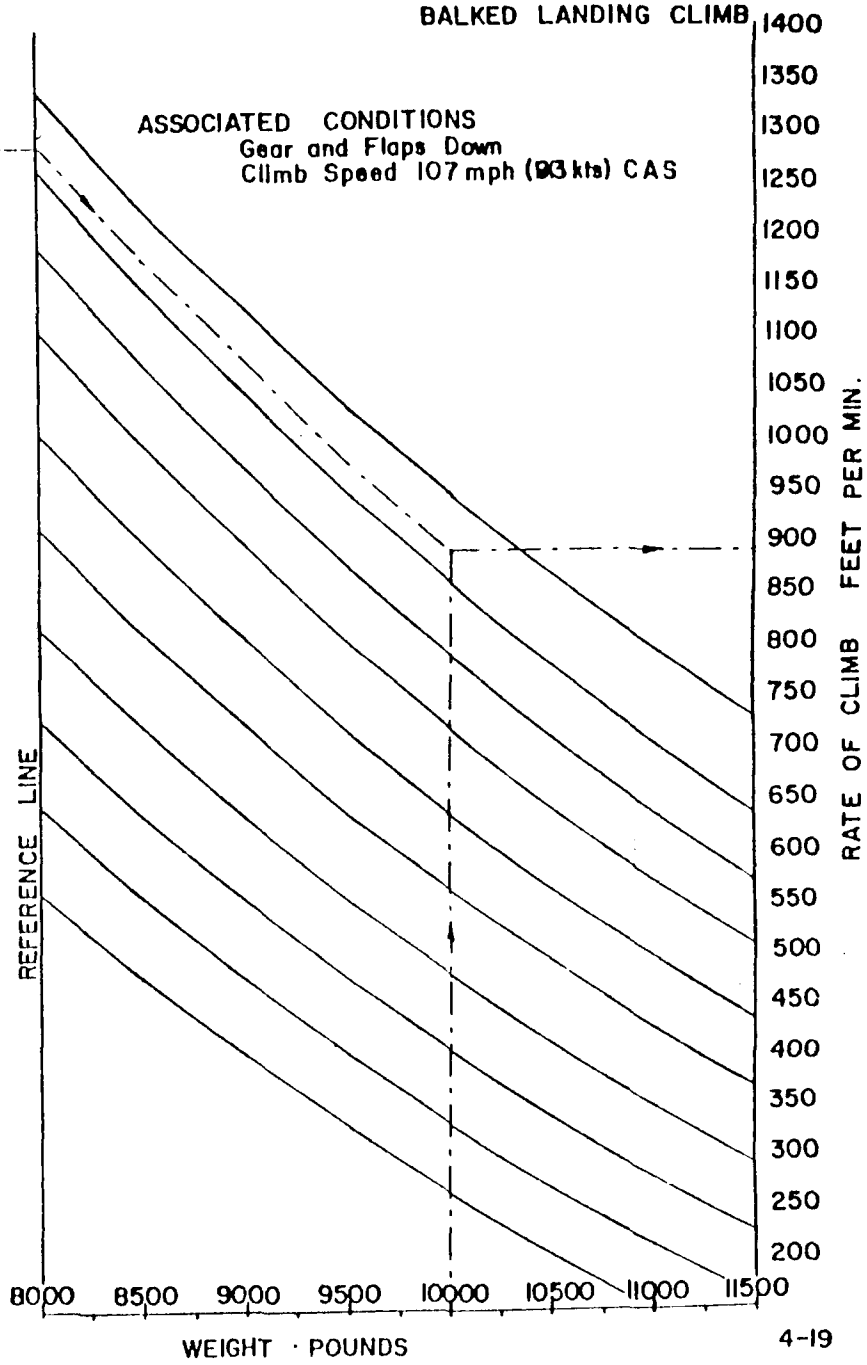


EXAMPLE

BALKED LANDING CLIMB

ASSOCIATED CONDITIONS
Gear and Flaps Down
Climb Speed 107 mph (93 kts) CAS

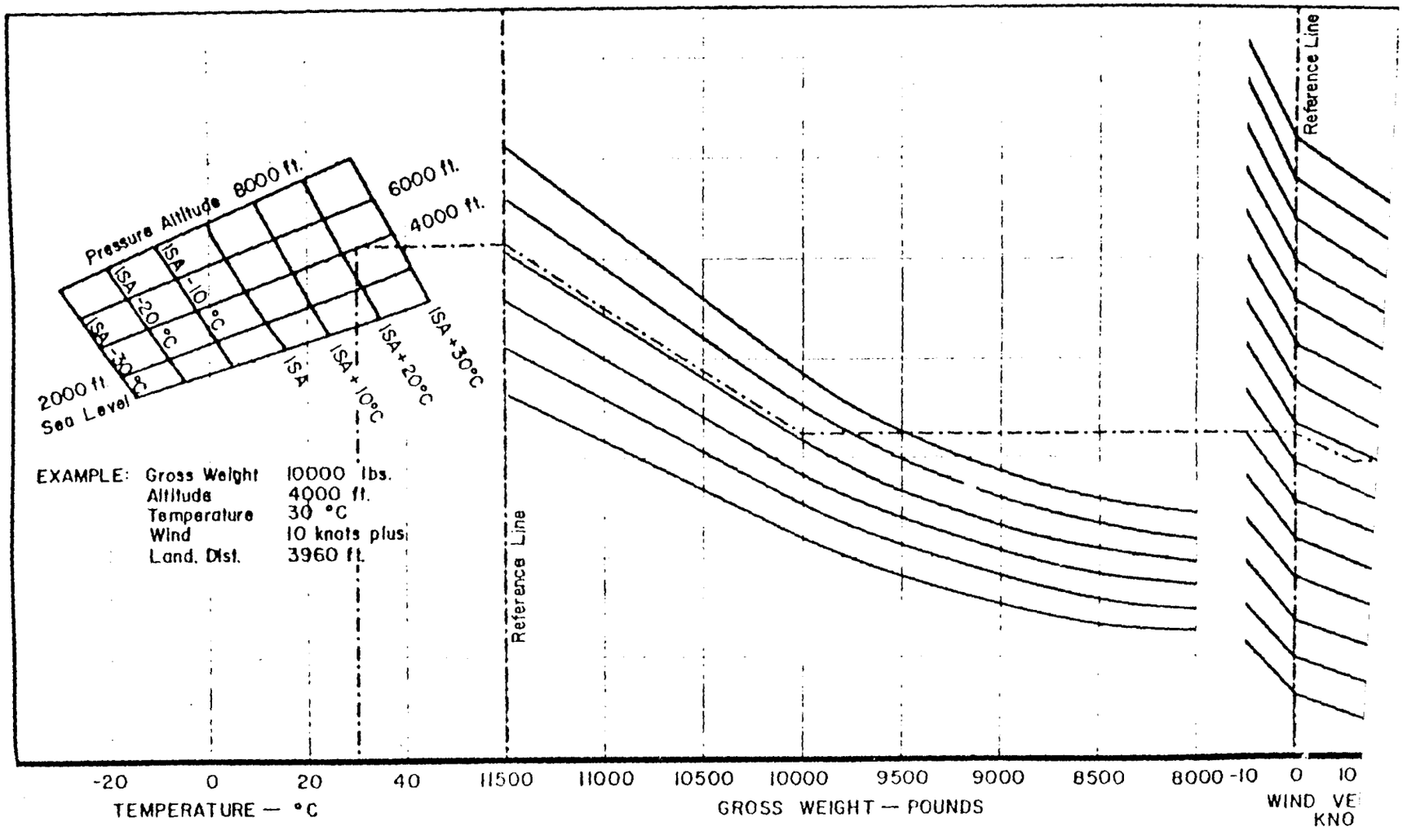
REFERENCE LINE

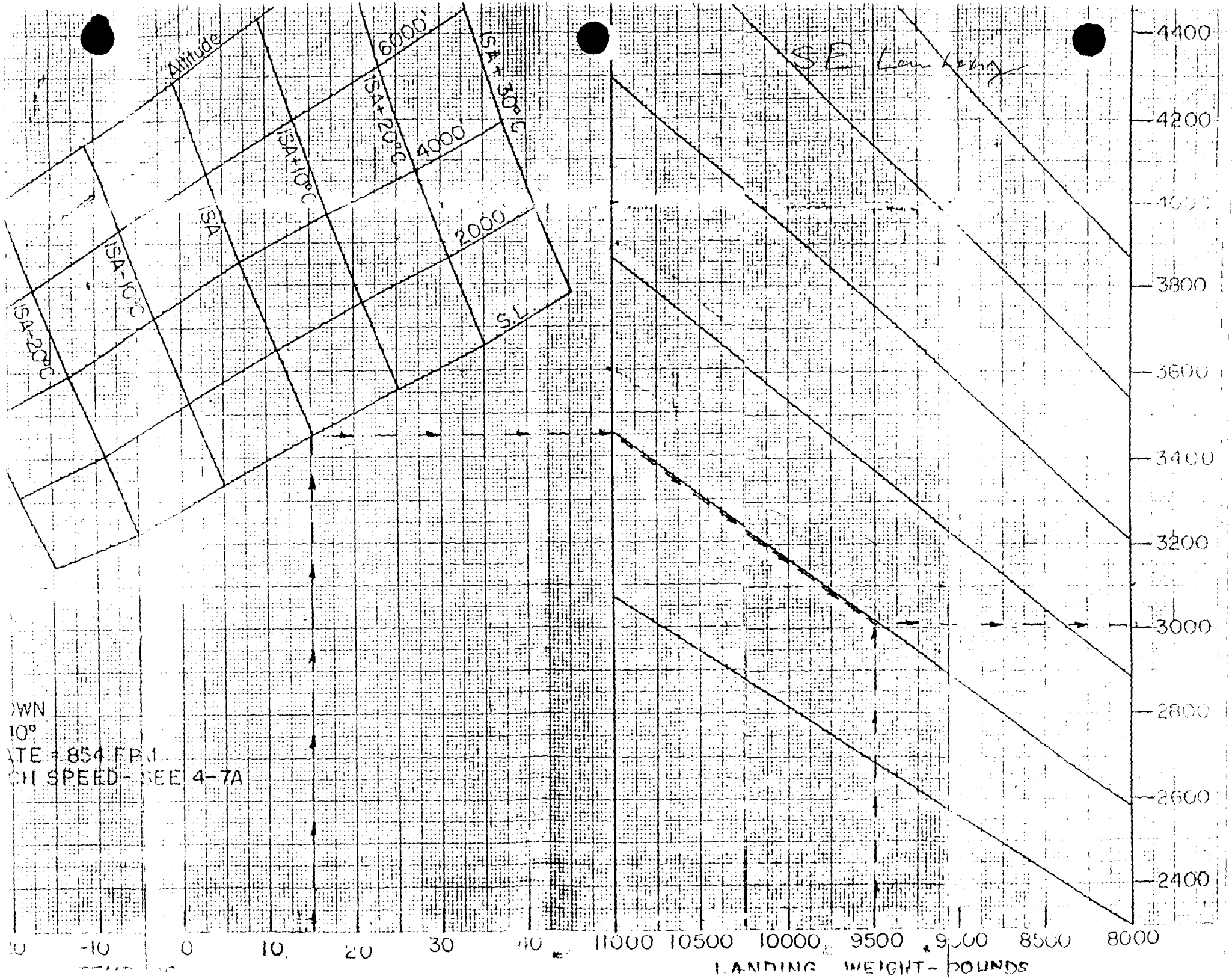


FEATHERED ENGINE LANDING DISTANCE
OVER A 50 FT. OBSTACLE, VARIATION WITH WEIGHT, ALTITUDE, TEMPERATURE AND WIND.

VOLPAR D-109
FAA APPROVED 7/
REVISED 4/22/71

ASSOCIATED CONDITIONS
Approach speed 1.3 Vso mph CAS
Power for 3 deg. sink rate
One engine feathered
Gear and flaps extended
Normal braking
Hard surface level runway



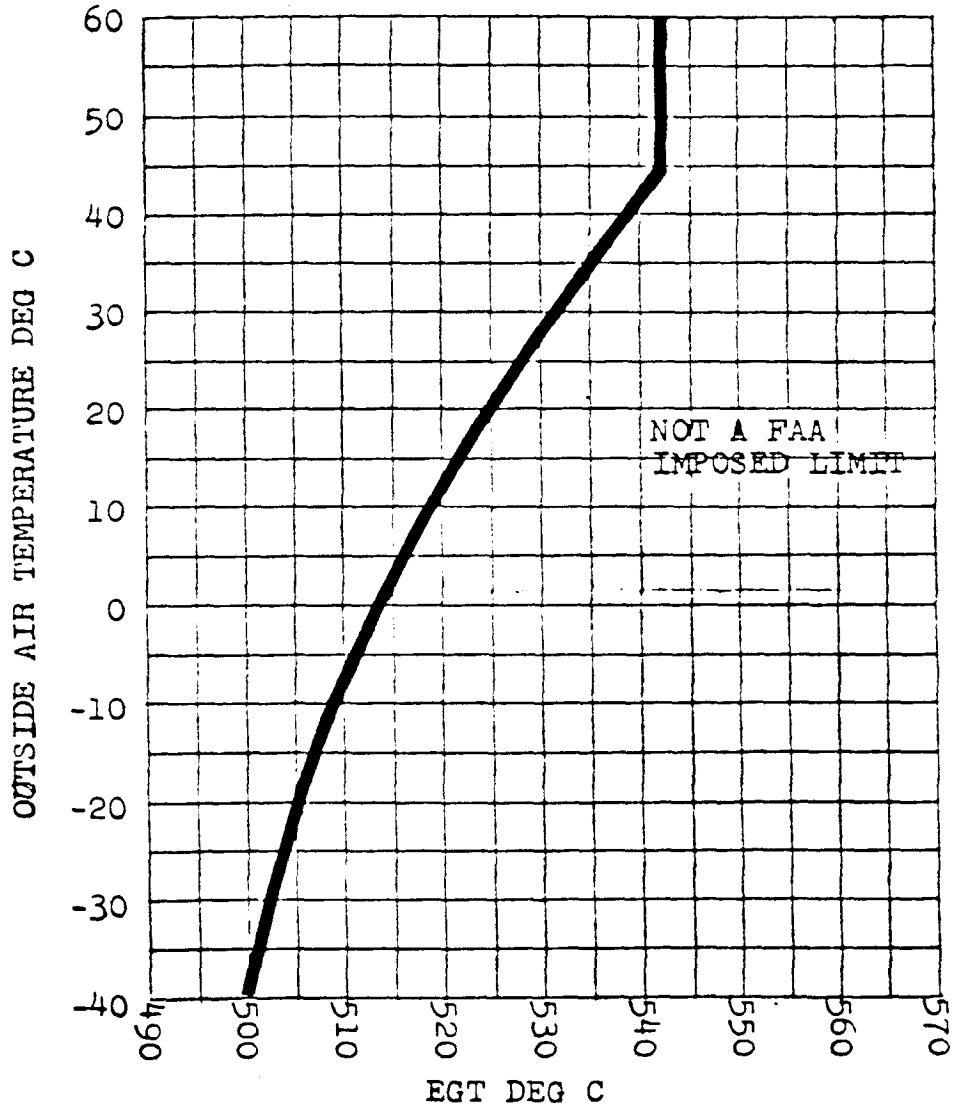

Altitude
6000'
4000
2000
S.L.
ISA+30°C
ISA+20°C
ISA+10°C
ISA
ISA-10°C
ISA-20°C
4400
4200
3800
3600
3400
3200
3000
2800
2600
2400
-10
0
10
20
30
40
11000
10500
10000
9500
8500
8000
LANDING WEIGHT - POUNDS

SECTION 5

OPERATION AND PERFORMANCE

The following pages of this manual are for information only and are not FAA approved.

EGT vs OAT
MANUFACTURER'S RECOMMENDED MAX CRUISE
TPE331-1-101B



FUEL SYSTEM

Refer to page 6-3 for a diagram of the system. The main tanks are leading edge tanks, located just outboard of the nacelles and feed their respective engines from a submerged booster pump in the tank outlet. The main tank is replenished from the selected auxiliary tank by an electrically driven vane type fuel transfer pump which is turned on and off by a float operated switch in the main tank. The switch is set to turn the pump on when the fuel level drops to 35 gallons and off when it reaches 40 gallons. With the Fuel Boost switches in AUX ON position the transfer pump is turned ON, regardless of the float operat- switch. Fuel transfer indicator lights on the instrument panel are turned on when there is flow through the transfer system.

CAUTION

The transfer pump should not be operated for extended periods when connected to an empty tank; therefore, when the auxiliary tank in use is emptied, the auxiliary tank selector should be changed to a tank containing fuel, or, when all auxiliary tanks are empty, to the OFF position. In addition to the auxiliary tank gauge, an empty auxiliary tank will be indicated by a drop in the MAIN TANK fuel level below the 35 gallons minimum which the automatic system is set to maintain.

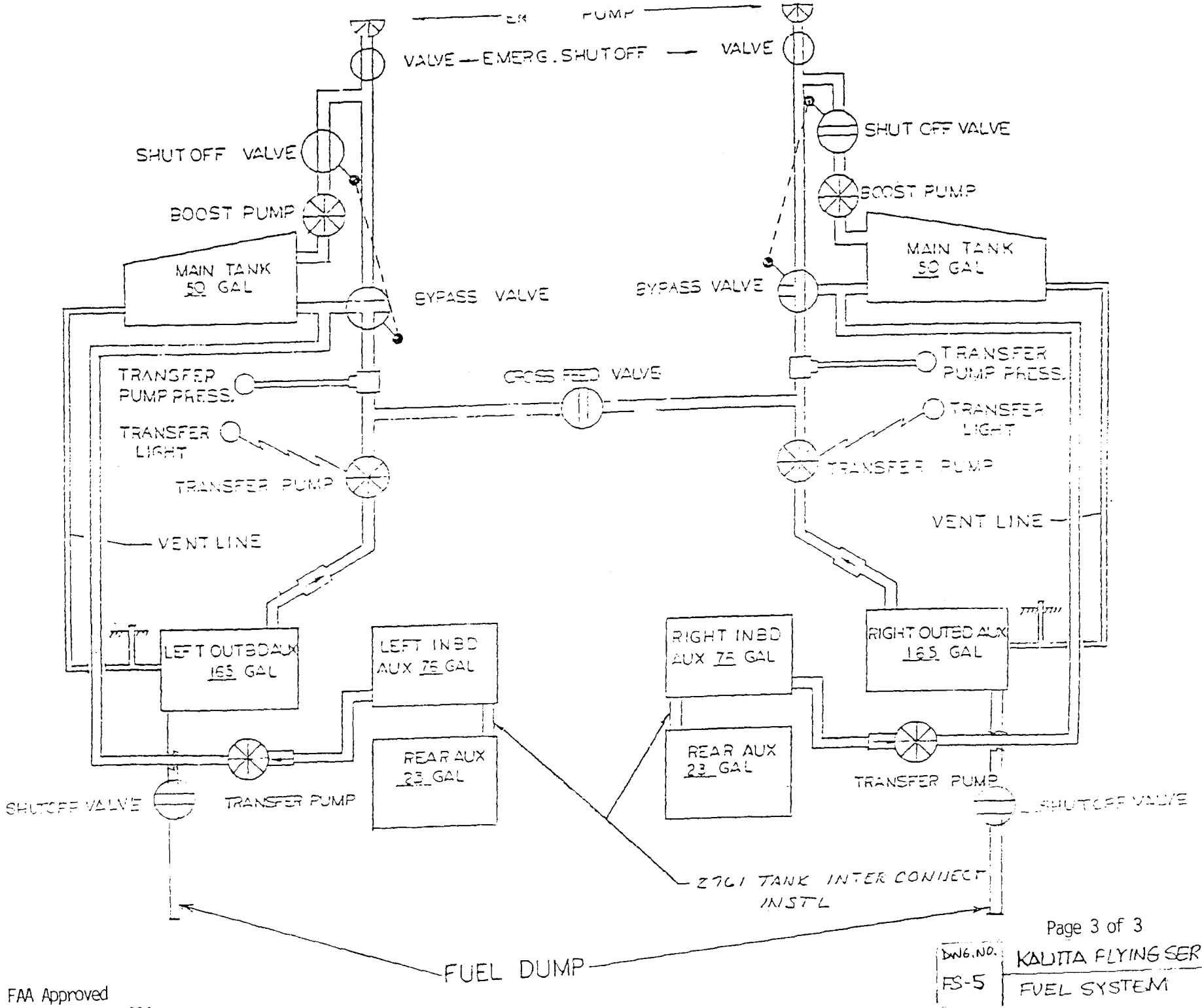
The main tank by-pass valves, operated by levers on the control pedestal, allow the fuel to be pumped directly from a selected auxiliary tank to the engine. Whit the cross feed valve turned on, this may be from a tank on the opposite side of the airplane. Use the transfer pump on the same side of the airplane as the tank being used.

Flow may be set up from an auxiliary tank to the main tank on the opposite side of the airplane. Fuel may not be pumped into an auxiliary tank by the transfer system, as check valves prevent back flow into these tanks.

FUEL TANK CAPACITIES

	LEFT		RIGHT		TOTAL	
	GAL	LBS**	GAL	LBS**	GAL	LBS**
MAIN	50	335	50	335	100	670.0
OUTBOARD AUXILIARY*	165	1105.5	165	1105.5	330	2211.0
INBOARD AUXILIARY*	76	509.2	76	509.2	152	1018.4
REAR AUXILIARY*	25	167.5	25	167.5	50	335.0
TOTAL						

*when installed
**at 6.7 pounds per gallon



FAA Approved
Date Aug 19 1994

DWG. NO.	KALITTA FLYING SERVICE
FS-5	FUEL SYSTEM

Although the engines will operate normally with fuel pressures in the yellow range (15 to 20 PSI), for periods of several hours, deleterious effects to the fuel control and combustion section of the engine may be prevented by maintaining the fuel pressure in the green range, (20 to 80 PSI); therefore. the 20 to 80 PSI range has been established by the engine manufacturer for warranty purposes. If operation with fuel boost pumps off results in fuel pressures below 20 PSI they may be raised to this figure or above by turning the Fuel Boost switches to the MAIN position.

See Emergency Procedures for exact instructions on abnormal usage of the system.

OIL SYSTEM

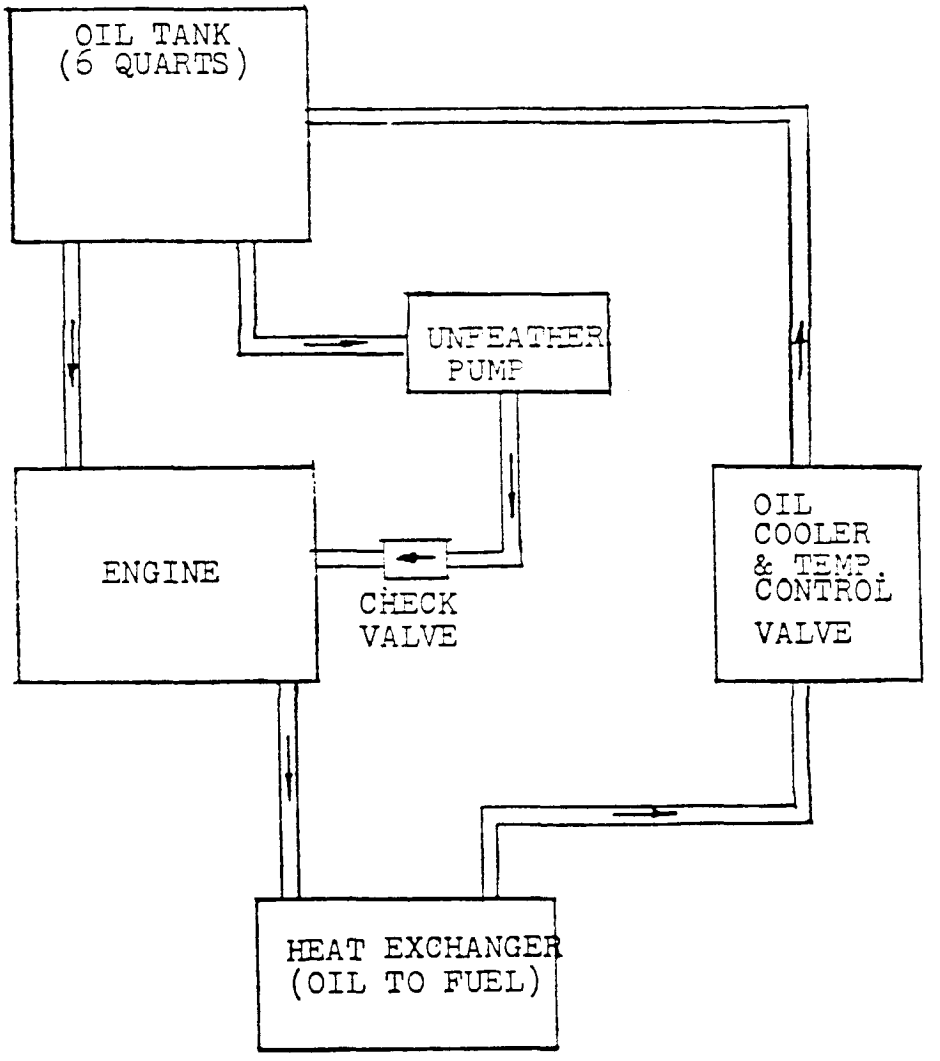
There are seperate systems for each engine, consisting of a 6 quart stainless steel tank located on the forward side of the firewall, a temperature control valve, oil cooler, oil to fuel heat exchanger and a propeller unfeathering pump.

An oil tank is on the right side of each nacelle. This tank supplies the lubricating oil for the engine as well as the oil to the propeller unfeathering pump. The unfeather pump is located adjacent to the oil tank. A dip stick is attached to each oil tank filler cap, and is calibrated to 6 quarts. The oil level should be a minimum of 5 quarts for flight, in order to provide proper cooling.

Oil flows from the engine to the thermostatic control valve which either directs it through the oil cooler & back through the valve, or directly to the oil to fuel heat exchanger (a comonent required for fuel anti-icing) and then to the oil tank. Flow from the oil tank is directly to the engine.

The oil system is automatic, requiring only monitoring of the oil temperature. Page 6-5 shows a schematic of the system for one engine.

OIL SYSTEM
SCHEMATIC



ELECTRICAL SYSTEM

The primary system is a 24 volt, direct current system in which two Sonotone CA-9 batteries are utilized in conjuction with two 200 ampere combination starter/ generators, one on each engine. A paralleling circuit balances the load between the two when acting as generators. A third battery, a Sonotone CA-31H, is used to supply 24 volt power to the fuel and ignition during the starting cycle.

The batteries are located in the nose compartment. When starting engines with the normal system, after the first engine is in the ON position to allow the generator to charge the batteries, monitor the ammeter until it reads a normal load before turning the generator to the OFF position, then proceed starting the second engine. The generator is turned off on the operating engine, (to prevent tripping the circuit breaker) until the second engine is started.

The aircraft electrical system is protected between the bus and the generator by a 200 amp. circuit breaker, located in the main power distribution junction box under the floor between the pilot and co-pilot seats.

Two inverters provide a source of 115 volts A.C. power and 26 volt A.C. power. It is recomended that the spare inverter be checked at engine start, but all normal operation be on the Main inverter; rather than equally dividing the time; thus preserving the capabilities of the second inverter for emergency use.

EQUIPMENT OPERATED BY D.C. POWER

Beta & NTS Indicator Lights
Beacon
Cockpit Lights
Engine Starting & Ignition
Fire Detectors
Fire Extinguisher System
Fuel Boost Pumps
Fuel Enrichment
Start Fuel
Fuel Tank Gages
Fuel Transfer Lights
Generator Failure Light
Inlet Anti-Icing Control
Certain Flight Instruments
Landing Gear
Landing Lights
Magnetic Chip Detector
Navigation Lights
Oil Temperature Indicator
Starter-Generator
Propeller Unfeathering Pumps
Wing Flaps
Oil Vent Valves
Wing and Prop De-Icer
Fuel Flow Indicators
Stall Warning

EQUIPMENT OPERATED BY A.C. POWER

Certain Flight Instruments
Torque Meters

PROPELLER DEICING (Optional Equipment)

Goodrich electrically heated, oil resistant, rubber boots are bonded to the propeller blades. The boot for each blade contains separate inner and outer heating elements, thus allowing electrical power to be conserved while maintaining propeller balance, by heating only the inner or outer elements of all blades of one propeller at one time.

The 24 volt D.C. power is supplied through a switch type circuit breaker and a special ammeter for the system, to a timer which switches the current between the various elements. The order of heatings is as follows:

1. Outer boots, right propeller
2. Inner boots, right propeller
3. Outer boots, left propeller
4. Inner boots, left propeller

GROUND CHECK (Engines running)

1. Circuit breaker switch, "ON".
2. Observe ammeter indication for a minimum of 2 minutes.
   A slight flicker will be noted at the end of each 30 second cycle. Reading should be in the normal range indicated on the ammeter.

INFLIGHT OPERATION

1. Circuit breaker switch, "ON"
2. Observe ammeter indication for a normal reading.
3. System may be operated continuously if needed.

IDUCTION DEICING

Anti-icing and deicing of the engine inlet in the nose cowl is accomplished by use of bleed-air from the engine, which enters a continuous duct built intergral with the intake lip. Exhaust from the duct is through a pattern of small holes spaced evenly around the lip, and through an internal orifice allowing a flow of hot air for deicing, even though all the external holes are closed with ice.

That section of the engine inlet which is integral with the engine is also deiced by bleed-air (on its lower surface), as well as the fuel control inlet probes. (The entire upper portion of the compressor air inlet integral with the engine is formed by the lower surface of the gear box and is kept free of ice by heat transfer from engine oil.)

An electric valve, furnished with the engine, controls the flow of bleed-air. This valve is turned ON or OFF by a switch, one for each engine, on the pilot's subpanel. An indicator light above each switch is turned ON when the valve is open.

The deicing valve should not be open for more than 10 seconds when the ambient temperature is higher then 40 F (4.4 C)

FIRE DETECTOR SYSTEM

A system of Fenwall fire detectors is located within each nacelle, forward of the firewall. One detector is located above the engine, just aft of the gearbox. Two more detectors are mounted on the firewall & another within the cylindrical firewall around the combustion section of the engine. All units are set to give warning at 450 F except the one within the cylindrical firewall, which is set for 600 F.

Each system contains a warning light on the center instrument panel. The light is turned on when one or more of the detectors reaches its set temperature. A double throw, momentary, test switch is located adjacent to the left warning light, allowing each system to be checked individually. Both systems receive power through the same 5 amp. circuit breaker.

FIRE EXTINGUISHING SYSTEM

Each nacelle contains an extinguishing system, consisting of a 1.37 lb. capacity container of Freon 1301 (Bromotrifluoromethane, $CBrF_3$), fireproof discharge tubes, and an electrical release system. The extinguishing agent is released above the engine just aft of the gearbox, and within the cylindrical firewall encompassing the hot section of the engine.

The guarded release switches are located, one for each system, at the aft center of the control pedestal. When actuating the system, the switch should be held on for 5 seconds. When fired, the entire contents of the extinguisher is released. Both release systems receive power from the same 10 amp. circuit breaker.

At pre-flight inspection, contents of the bottles may be checked by observing the gages on the bottles. A pressure correction table is on page 6-12.

ENGINE

The AiResearch Model TPE331 turboprop engine utilize two centrifugal compressors, an annular combustion chamber and three stages in the axial flow turbine. The compressors are directly connected to the turbine wheels, thus rotate at the same RPM, and are connected through a reduction gear to the propeller shaft. The gear ratio is 20.865 to 1, giving a propeller RPM of 2000 when the turbine speed is 41,730 RPM.

The structural limits of the engine are RPM, horsepower, and temperature. The temperature is most conveniently measured as Exhaust Gas Temperature, EGT.

Operation of the power plant controls should be smooth and deliberate.

FIRE EXTINGUISHER PRESSURE

PRESSURE CORRECTION TABLE,
FIRE EXTINGUISHER BOTTLE.

For a given temperature the pressure should be within the minimum and maximum shown.

deg.F.	-40	-20	0	20	40	60	80	100	120	140
deg.C.	-40	-29	-18	-7	4	16	27	38	49	60
MAX.	240	275	315	365	420	480	550	635	730	840
MIN.	190	220	250	290	340	390	455	525	605	700

ENGINE SPEED (RPM) CONTROL

The operating RPM range of the engine, as compared to reciprocating engines is very limited, being 65% of maximum continuous RPM and above for ground operation and 92% and above for flight operations. The RPM is maintained by governors, either the engine overspeed and underspeed governors in the fuel control, or the propeller governor which functions similarly to a constant speed propeller governor on a reciprocating engine. The relatively high operating RPM level of the engine provides one of the most attractive features; precise control of forward, reverse, or zero thrust in landing and taxiing operations.

The RPM control levers (sometimes referred to as Condition Levers) provide control of the engine speed through the propeller governors atspeeds of 92% and above. Below this point the levers control RPM by changing the setting of the governors in the fuel control.

POWER CONTROL

To the pilot the power control levers function as do the throttles of the conventional reciprocating engined aircraft. Like other aircraft providing reverse thrust, there are two ranges of operation, with a special action required to move the levers into the aft range. However, unlike most other aircraft, all normal ground operations in the Turboliner are conducted with the levers in the aft range.

When the power levers are brought back from their forward positions, they reach a stop at the Flight Idle position. A "finger-grip" is located below the knob on each power lever, an upward pull on these releases the stop and the lever to be moved on back into the aft or BETA range.

Pointers, connected to the power levers and extending forward, indicate the position at which the levers are set. Reading aft from the forward settings, positions indicated are Takeoff, Cruise, Flight Idle, Ground Start, and Reverse Thrust.

From the Flight Idle position forward to Takeoff, the power levers control the fuel flow to the engine, (while the propeller governors control the RPM), the pilot must monitor the torquemeters and EGT gages to establish the desired power. Fuel flow as indicated by the fuel flow

meters is also an indication of power, however the limits are those of torque and EGT.

The engine produces its greatest power at low altitude and in cold outside air temperature, (OAT). As OAT increases or air density decreases, as with altitude, the power of the engine drops off. In cold, dense air conditions the engine will be able to produce more than its rated 620 shaft horsepower for takeoff.

This power is limited to 2 (two) minutes maximum and must be obtained with 100% RPM.

With warmer than normal outside air temperature the engine will not be able to produce 620 shaft horsepower without exceeding the EGT limit; however the EGT limit is not constant, but increases with OAT. The aircraft has been equipped with a special OAT indicator which indicates the takeoff and maximum continuous power EGT limits for the existing OAT.

Maximum continuous power is likewise limited by torque or EGT, whichever is first reached: the EGT limit being shown by the OAT gage, as noted above. The torque limit for maximum continuous power is based upon 500 shaft horsepower at 100% RPM.

The power levers in the flight regime are set so as not to exceed the torque or EGT limit, whichever is first reached. As there is some lag between the positioning of the power levers and the stabilization of the EGT gage to the resultant reading, it is helpful to make the initial takeoff power lever setting by observing the fuel flow and then correcting this setting as necessary to obtain the desired EGT.

Access to the ground operating range of the power levers is by releasing the flight idle stops as previously described, and moving the levers aft. In this range, movement of the power levers directly controls the blade angle of the propellers while the engine fuel control varies fuel flow to maintain the RPM selected by the RPM control levers. This gives immediate control of forward, reverse or zero thrust as desired. Control in this range is known as BETA CONTROL. Indication that the propellers are being controlled in this manner is given by the greenlights on the instrument panel placarded L & R BETA WARNING.

NEGATIVE TORQUE SENSOR

A system is incorporated within the engine which automatically moves the propeller blades toward high pitch if negative torque is sensed, thus preventing excessive propeller drag. If negative torque is eliminated before combustion is lost, normal operation is automatically resumed. If not, the propeller moves to a pitch at which the engine will windmill at 20 to 30% RPM, without excessive drag. At any time during this sequence the pilot may elect to feather the propeller with the manual control. This NTS system removes the urgency from the feathering procedure in the event of engine failure, allowing ample time to be taken in identification of the malfunctioning engine.

PROPELLERS

Three-bladed Hartzell flange mounted propelllers are used. They are of the constant speed, full feathering, reversible pitch type. Blade angle changes are accomplished by oil pressure, spring and counterweight forces. Control in the flight regime is by a constant speed governor, however from the flight idle position of the power levers on back through the taxi and reverse range, the propeller blade angle is controlled directly by the pilot through a hydraulic servo system in the engine.

The propeller incorporates start locks which are normally engaged at engine shutdowns in order to provide low propeller drag for engine starting. Engagement is accomplished by moving the power levers to the reverse thrust setting as the engine is shut down. If this is not done the propellers will automatically feather, which in some cases may be desired. In this event the propellers must be unfeathered with the unfeathering pumps before starting the engines.

WING AND EMPENNAGE DEICING

B.F. Goodrich high pressure deicer boots of fabric reinforced rubber with spanwise deicing air tubes are bonded to the leading edge of the outer wing panels and stabilizers.

Air pressure is supplied by the compressor section of each engine to a distributor valve, which is controlled by an electric timer. The air pressure from the distributor is directed to the deicer boots of the outer wings for a six second interval, then to the stabilizers for a four second

interval. All deicer boots are deflated for a period of 170 seconds and then the cycle starts over. Total cycle time is three minutes.

Check valves are installed in each air supply line from the engines to prevent reverse air flow. A regulator relief valve maintains the air pressure at 15 psi with a relief pressure of 18 psi. An ejector valve located in the air line to the distrubutor supplies the vacuum necessary to deflate the deicer boots at the end of the cycle or when the system is not in use.

A switch and circuit breaker on the pilots panel supplies the 28 volts DC required to operate the timer. At any time the switch is returned to the "OFF" position the timer returns to the start of the cycle. By turning the switch off and then on the cycle time may be reduced to twenty seconds, this gives the system a manual as well as automatic operation feature. A pressure gage is located on the instrument panel, with an indicator light as an option, to monitor the operation of the system.

Ground Check (engines running):

1. Circuit Breaker - Push ON
2. Deicer Switch - ON
3. Deicer Pressure Gage - 15 psi for ten seconds. Zero psi for 170 seconds.
4. Visually observe deicer boot operation, all wing boots inflate in one sequence, and all stabilizer boots inflate in next sequence.

EQUIPMENT LIST

The equipment listed below is part of the Approved Type Design as reflected on Volpar Equipment List 2514. Further, if equipment is added or replacement of equipment listed below is accomplished, it must be evaluated by the FAA and found to serve its intended function.

DESCRIPTION	REQD.
Fuel Boost Pump	2
Fuel Transfer Pump	2
Fuel Flow Transmitter	2
Battery, CA 9	2
Battery, CA 31H	1
Starter/Generator	2
Inverter	2
Rotating Beacon	2
Fire Extinguishing System	2
Fire Detector	8
Airfoil Deicer System (optional)	1
Propeller Deicer Sytem (optional)	2
Static Air Anti-Icer	4
Stick Shaker System	1
EGT Limit Indicator	1
EGT Indicator	2
Horsepower Indicator	2
Tachometer	2
Fuel Pressure Indicator, Dual	1
Fuel Quanity Indicator, Main Tanks	1
Fuel Quanity Indicator, Aux Tanks	1
Engine Gage Unit	2
Fuel Flow Indicator	2
Deicer Pressure Indicator (optional)	1
Prop Deicer Ammeter (optional)	1
Volt/Amp Indicator	2
Vacuum Indicator	1
Compass	1
Directional Gyro	1
Horizon Reference Indicator, Vacuum	1
Horizon Reference Indicator, Electric	1
Turn and Bank Indicator	1
Turn and Slip Indicator	1
Altimeter	2
Rate of Climb Indicator	2
Airspeed Indicator	2
Clock	1
Elevator Tab Position Indicator	1
Flap Position Indicator	1
Oxygen Sytem (optional)	1

EQUIPMENT LIST (cont)

DESCRIPTION	REQD.
DME System	1*
Weather Radar	1*
ATC Transponder	1*
Marker Beacon	1*
ADF System	1*
VOR System	1*
ILS	1*

*As required by applicable Federal Air Regulation for specific type of operation.

SECTION 7

WEIGHT AND BALANCE

The maximum weights and center of gravity range are given on pages 1-7 and 1-8. The following procedures are given to enable the operator to keep the airplane within the prescribed limits.

The basic method of calculating C.G. is to mulitply each individual weight by its distance (in inches) from station zero (the datum) to obtain a "moment". All of the moments are then added to give a total moment. Dividing the total moment by the total weight gives the C.G. location in inches from station zero.

A tabular form of calculation is shown in the example, which will also gives the airplane empty weight and C.G. location, location of the pilots seats, and location of all fuel and oil tanks. The station diagram may be used to establish the location of other items in the aircraft.

SAMPLE WEIGHT AND BALANCE CALCULATION

ITEM	WEIGHT	ARM	MOMENT
Empty Wt.			
Oil	24	39.25	942
Pilots	340	35.50	12,070
Fuel, Main	670	103.00	69,010
Fuel, Inbd. Aux.	1018	126.00	128,268
Fuel, Rear Aux.	336	155.00	52,080
Fuel, Outbd. Aux.	2211	142.00	313,962
TOTAL			

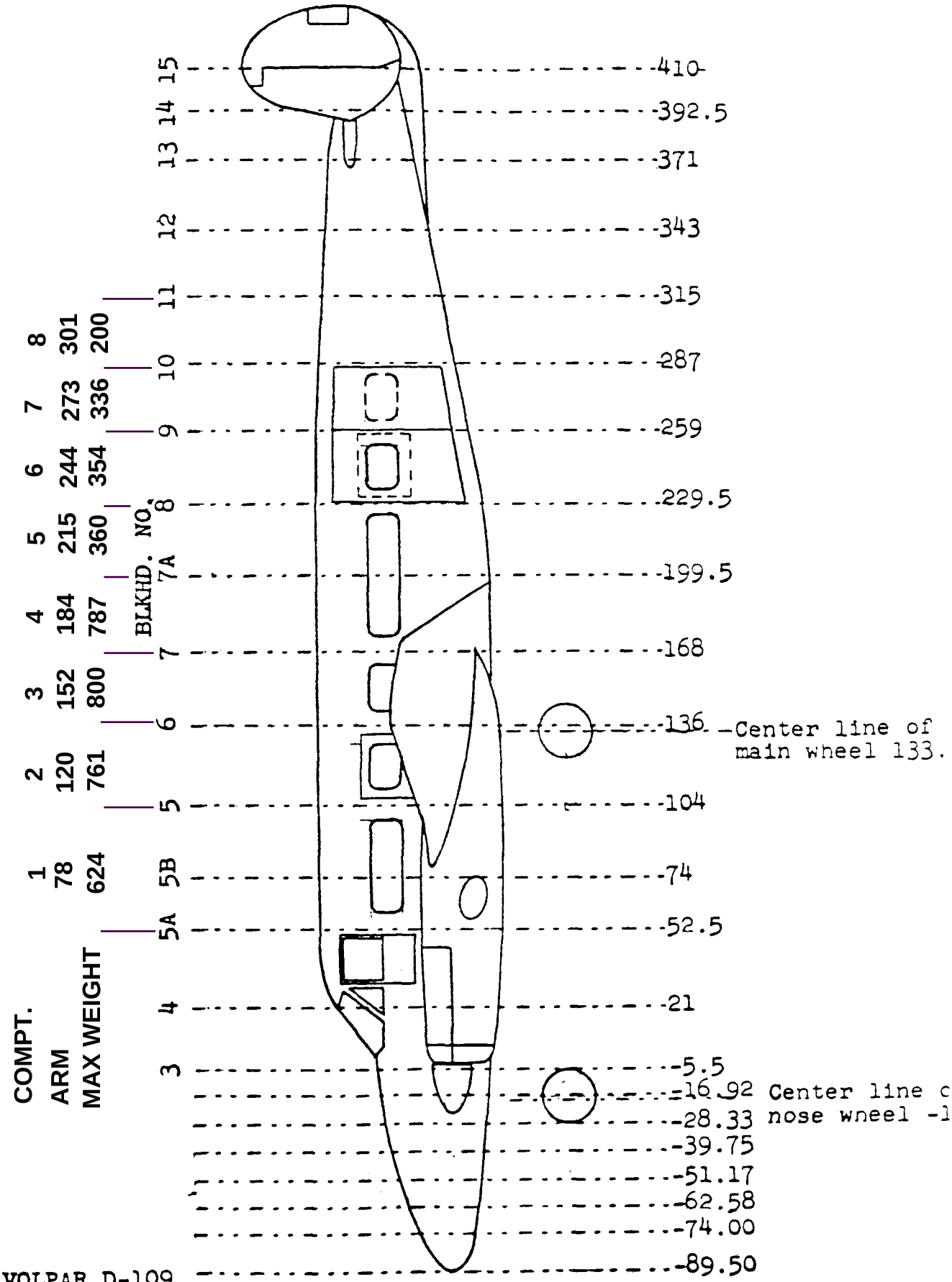
To simplify calculations the center of gravity table lists minimum ard maximum moments corresponding to the maximum approved forward and aft locations of the C.G. for various gross weights. These may be used in conjunction with the tables which give the moments for various fuel, passenger and baggage loadings. The appropriate weights and moments

should be added to the aircraft empty weight and moment and the totals compared to those in the center of gravity tables to determine that the moment is within the minimum and maximum for the gross weight.

SAMPLE WEIGHT AND BALANCE - PASSENGER CONFIGURATION

ITEM	WEIGHT	ARM	MOMENT
Aircraft Empty Weight	6990	99.86	698021.4
Oil	24	39.25	942.0
Crew	340	35.50	12070.0
sub total	7354	96.69	711033.4
Passengers			
Row 1, two Pax	340	64.00	21760.0
Row 2, two Pax	340	89.00	30260.0
Row 3, two Pax	340	124.00	42160.0
Row 4, two Pax	340	154.00	52360.0
Row 5, two Pax	340	184.00	62560.0
Row 6, two Pax	340	214.00	72760.0
Row 7, two Pax	340	244.00	82960.0
Row 8, one Pax	170	273.00	46410.0
sub total	9904	113.31	1122263.4
Baggage			
Wing Compartment	300	134.30	40290.0
Aft Fuselage Compartment	50	301.00	15050.0
sub total	10254	114.84	1177603.4
Fuel			
Main Tanks, 100 gal. total	670	103.00	69010.0
Outbd. Aux Tanks, 86 gal. total	576	142.00	81792.0
TOTAL	11500	115.51	1328405.4

STATION DIAGRAM



CENTER OF GRAVITY TABLE

GROSS WEIGHT	MINIMUM MOMENT	MAXIMUM MOMENT
6000	642000	702000
6050	647350	707850
6100	652700	713700
6150	658050	719550
6200	663400	725400
6250	668750	731250
6300	674100	737100
6350	679450	742950
6400	684800	748800
6450	690150	754650
6500	695500	760500
6550	700850	766350
6600	706200	772200
6650	711550	778050
6700	716900	783900
6750	722250	789750
6800	727600	795600
6850	732950	801450
6900	738300	807300
6950	743650	813150
7000	749000	819000
7050	754350	824850
7100	759700	830700
7150	765050	836550
7200	770400	842400
7250	775750	848250
7300	781100	854100
7350	786450	859950
7400	791800	865800
7450	797150	871650
7500	802500	877500
7550	807850	883350
7600	813200	889200
7650	818550	895050
7700	823900	900900
7750	829250	906750
7800	834600	912600
7850	839950	918450
7900	845300	924300
7950	850650	930150
8000	856000	936000
8050	861350	941850
8100	866700	947700
8150	872050	953550

CENTER OF GRAVITY TABLE (cont)

GROSS WEIGHT	MINIMUM MOMENT	MAXIMUM MOMENT
8200	877400	959400
8250	882750	965250
8300	888100	971100
8350	893450	976950
8400	898800	982800
8450	904150	988650
8500	909500	994500
8550	914850	1000350
8600	920200	1006200
8650	925550	1012050
8700	930900	1017900
8750	936250	1023750
8800	941600	1029600
8850	946950	1035450
8900	952300	1041300
8950	957650	1047150
9000	963000	1053000
9050	968350	1059950
9100	973700	1064700
9150	979050	1070550
9200	984400	1076400
9250	989750	1082250
9300	995100	1088100
9350	1000450	1093950
9400	1005800	1099800
9450	1011150	1105650
9500	1016500	1111500
9550	1021850	1117350
9600	1027200	1123200
9650	1032550	1129050
9700	1037900	1134900
9750	1043250	1140750
9800	1048600	1146600
9850	1053950	1152450
9900	1059300	1158300
9950	1064650	1164150
10000	1070000	1170000
10050	1077360	1178850
10100	1084740	1181700
10150	1092140	1187550
10200	1099560	1193400
10250	1107000	1199250
10300	1114460	1205100
10350	1121940	1210950
10400	1129440	1216800
10450	1136960	1222650
10500	1144500	1228500
10550	1152060	1234350
10600	1160700	1240200

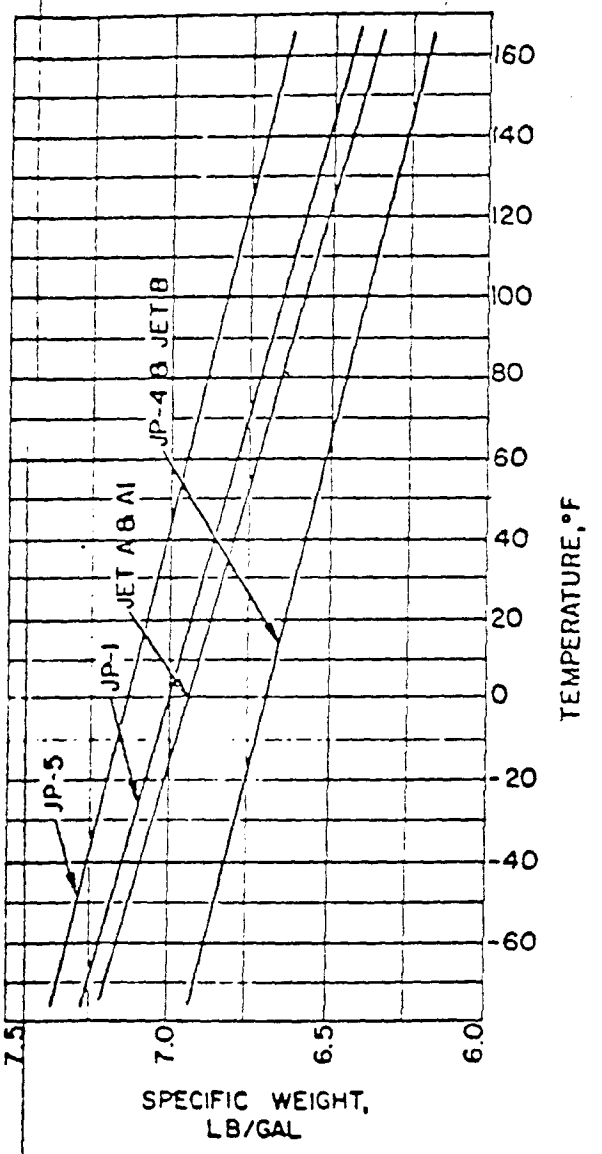
CENTER OF GRAVITY TABLE (cont)

GROSS WEIGHT	MINIMUM MOMENT	MAXIMUM MOMENT
10650	1169370	1246050
10700	1177000	1251900
10750	1184650	1257750
10800	1192320	1263600
10850	1200010	1269450
10900	1207720	1275300
10950	1215450	1281150
11000	1223200	1287000
11050	1230970	1292850
11100	1238760	1298700
11150	1246570	1304550
11200	1254400	1310400
11250	1262250	1316250
11300	1270120	1322100
11350	1279145	1327950
11400	1287060	1333800
11450	1294995	1339650
11500	1302950	1345500

NOTE

Arm for maximum moment is 117.0 inches to 11,500 pounds. Arm for minimum moment is 107.0 inches to 10,000 pounds, with a straight line variation to 113.3 inches at 11,500 pounds.

AVERAGE SPECIFIC WEIGHT VARIATION WITH TEMPERATURE - AVIATION FUELS.



VOLPAR D-109

ISSUED

MAIN TANKS (sta. 103.0)

Fuel at 6.75 pounds per gallon.

GALLONS	WEIGHT	MOMENT
5	34	3476
10	68	6953
15	101	10429
20	135	13905
25	169	17381
30	203	20858
35	236	24334
40	270	27810
45	304	31286
50	338	34763
55	371	38239
60	405	41715
65	439	45191
70	473	48668
75	506	52144
80	540	55620
85	574	59096
90	608	62573
95	641	66049
100	675	69525

OUTBOARD AUX. TANKS (sta. 142.0)

Fuel at 6.75 pounds per gallon.

GALLONS	WEIGHT	MOMENT
10	67.5	9585
20	135.0	19170
30	202.5	28755
40	270.0	38340
50	337.5	47925
60	405.0	57510
70	472.5	67095
80	540.0	76680
90	607.5	86265
100	675.0	95850
110	742.5	105435
120	810.0	115020
130	877.5	124605
140	945.0	134190
150	1012.5	143846
160	1080.0	153360
170	1148.5	163016
180	1215.0	172530
190	1283.5	182186
200	1350.0	191700
210	1417.5	201214
220	1485.0	210870
230	1552.5	220384
240	1620.0	230040
250	1687.5	239554
260	1755.0	249210
270	1822.5	258724
280	1890.0	268380
290	1957.5	277894
300	2025.0	287550
310	2092.5	297064
320	2160.0	306720
330	2227.5	316234

PASSENGER LOADING

STATION	WEIGHT	MOMENT
64	340	21760
89	340	30260
124	340	42160
154	340	52360
184	340	62560
214	340	72760
244	340	82960
273	170	46410

BAGGAGE COMPARTMENT LOADING (sta. 301.0)

WEIGHT	MOMENT	WEIGHT	MOMENT
10	3010	160	48160
20	6020	170	51170
30	9030	180	54180
40	12040	190	57190
50	15050	200	60200
60	18060	210	63210
70	21070	220	66220
80	24080	230	69230
90	27090	240	72240
100	30100	250	75250
110	33110	260	78260
120	36120	270	81270
130	39130	280	84280
140	42140	290	87290
150	45150	300	90300

CARGO LOADING

Cargo loading must not exceed the limits given on pages 1-7 and 1-8.

CARGO TIEDOWN

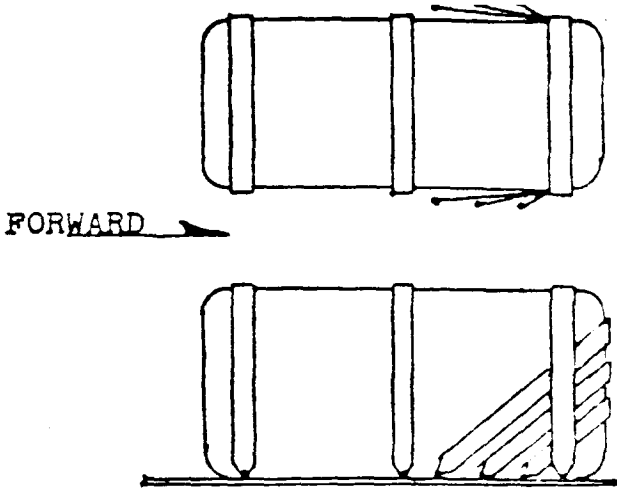
Cargo must be tied down in a suitable manner to resist movement in all directions. Tie down fittings must be Brownline Corp. fittings or equivalent for use with the tracks that are installed in the cabin floor.

Each tiedown strap and each fitting must have an ultimate strength of 1500 pounds or greater. Nets may be used in place of straps if the nets and their attachments are of equivalent strength.

For each item of cargo one or more tiedown fitting must be used to resist forward movement for every 10& pounds of weight.

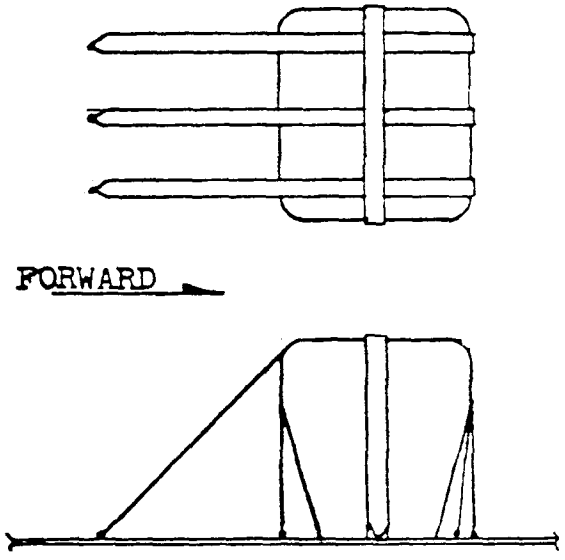
In this illustration, only the 6 fittings attached to the diagonal straps resist forward movement.

Therefore the item of cargo may weigh 600 lbs. or less



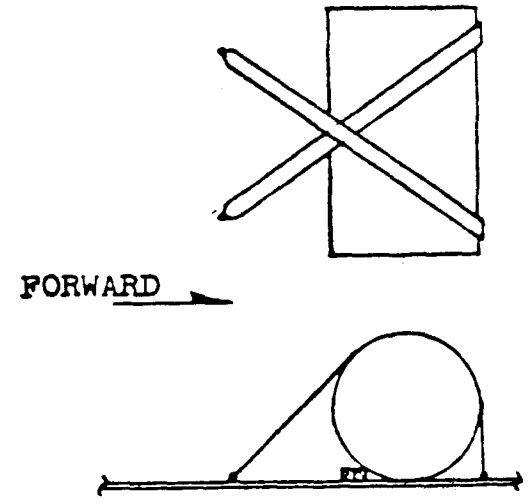
In this illustration, only the 3 most aft fittings resist forward movement.

Therefore the item of cargo may weigh 300 lbs. or less.



In this illustration, only the 2 aft fittings resist forward movement.

Therfore the item of cargo may weigh 200 lbs. or less.



GENERAL SPECIFICATIONS

Wing Span	46 ft.
Length	44 ft. 3 in.
Height	9 ft. 7 in.
Horizontal Tail Span	14 ft. 11.6 in.
Wing Area	373.9 sq. ft.
Gross Weight, Max.	11,500 lbs.
Landing Weight, Max.	11,000 lbs.
Empty Weight, Average	6,500 lbs.
Wing Loading, Max.	30.76 lbs/sq. ft.
Power Loading	10.0 lbs/SHP

VOLPAR INC.
16300 STAGG ST.
VAN NUYS, CALIF.

VI20-6A

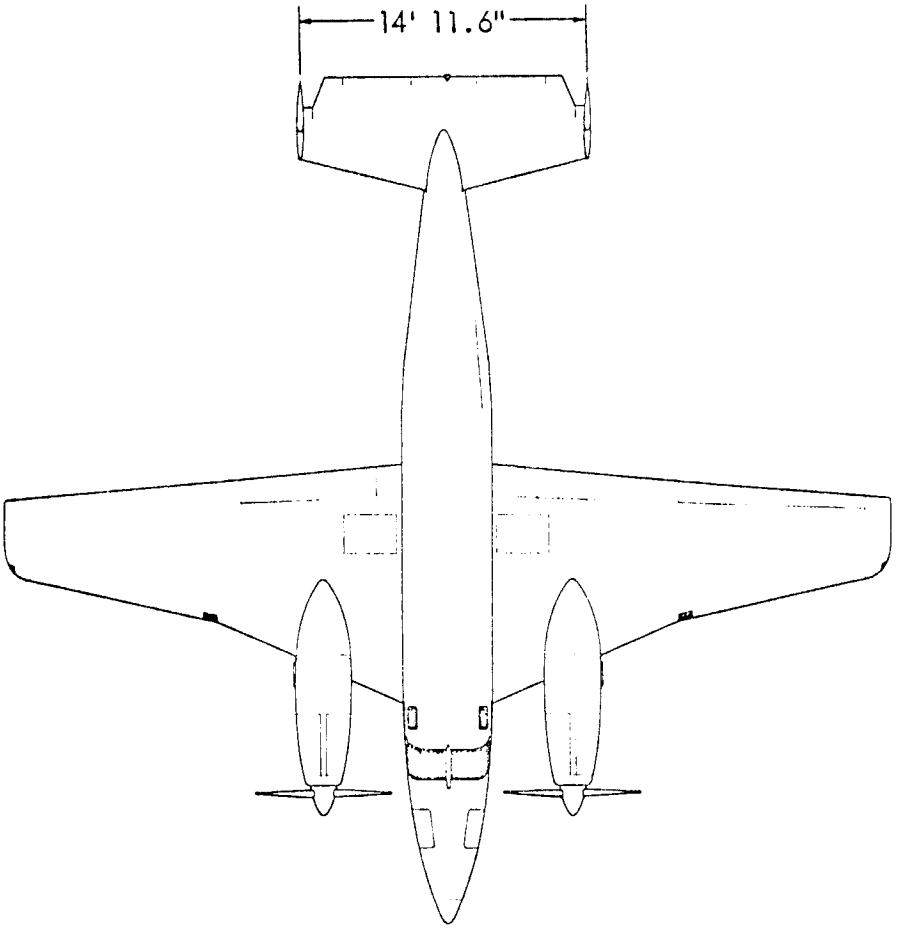
CREW & PASSENGER LOADING
TURBOLINER

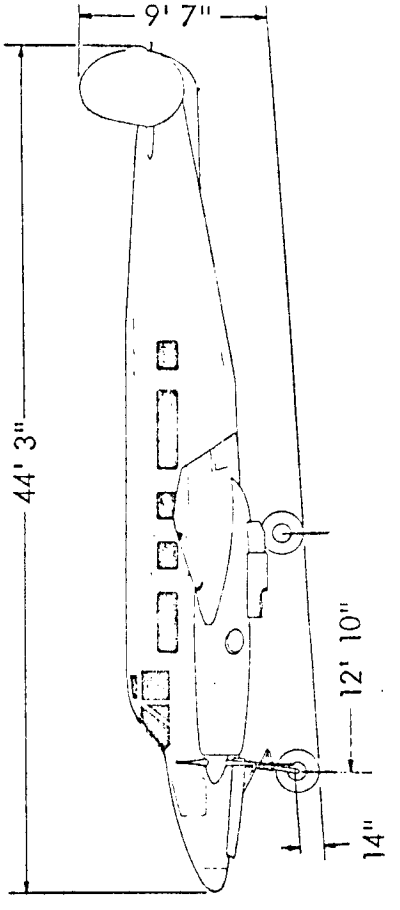
ITEM	WEIGHT	ARM	MOMENT
Pilot	170	35.5	6035.0
Co-pilot	170	35.5	6035.0
totals	340	35.5	12070.0

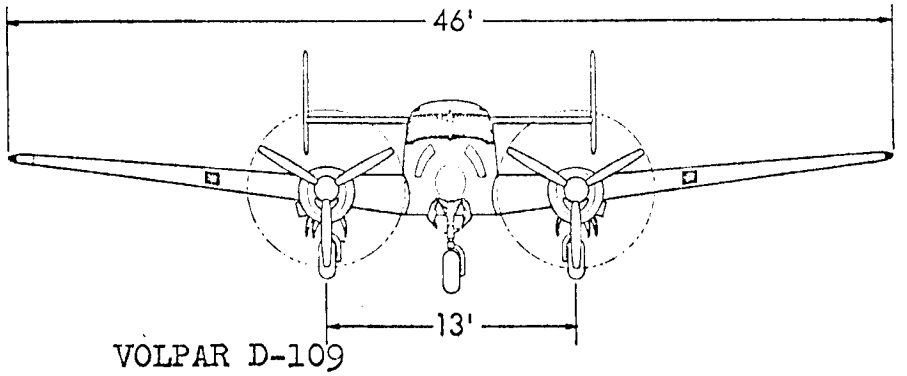
ITEM	ROW	WEIGHT	ARM	MOMENT
Passenger #1	1	170	64.0	10880.0
Passenger #2	1	170	64.0	10880.0
Passenger #3	2	170	89.0	15130.0
Passenger #4	2	170	89.0	15130.0
Passenger #5	3	170	124.0	21080.0
Passenger #6	3	170	124.0	21080.0
Passenger #7	4	170	154.0	26180.0
Passenger #8	4	170	154.0	26180.0
Passenger #9	5	170	184.0	31280.0
Passenger #10	5	170	184.0	31280.0
Passenger #11	6	170	214.0	36380.0
Passenger #12	6	170	214.0	36380.0
Passenger #13	7	170	244.0	41480.0
Passenger #14	7	170	244.0	41480.0
Passenger #15	8	170	273.0	46410.0
totals		2550	161.0	411230.0

NOTES:
1. Seats numbered front to rear

GENERAL DIMENSIONS







VOLPAR D-109
7/17/70

FAA APPROVED
AIRPLANE FLIGHT MANUAL SUPPLEMENT
FOR
BEECH MODEL G18S MODIFIED IN ACCORDANCE WITH STC SA220WE
(VOLPAR TURBOLINER II)

REGISTRATION NO. N404CK

SERIAL NO. AF297

This supplement must be attached to the FAA Approved Airplane Flight Manual dated 7/17/70 when passenger configuration is limited to nine passenger seats in accordance with STC SA457GL and FAA Form 337 dated 6/23/2003. The information contained herein supplements the information of the basic Airplane Flight Manual. For limitations, procedures, and performance information not contained in this supplement, consult the basic Airplane Flight Manual.

I. LIMITATIONS:

a. This aircraft is limited to nine passenger seats. Seat attachments are modified to prevent installation of more than nine seats.
b. Minimum crew will be one pilot or as specified in the applicable operational approval.

II. PROCEDURES:

Seats are removed and installed by rotating locks which secure each seal leg to the seat tracks. The position of each forward outboard leg is identified by red paint.

III. PERFORMANCE:

The aircraft performance is not changed by this modification.

IV. WEIGHT AND BALANCE:

An empty weight and balance with seats installed has been inserted in the Weight and Balance Section of the Airplane Flight Manual.

FAA APPROVED: Eugene L. Bollini
for Manager, ACE115A
Atlanta Aircraft Certification Office
Federal Aviation Administration
Atlanta, GA 30349

DATE: JUN 17 2003

United States of America

Department of Transportation — Federal Aviation Administration

Supplemental Type Certificate

Number SA2204WE

This certificate issued to VOLPAR, INC.

certifies that the change in the type design for the following product with the limitations and conditions thereof as specified hereon meets the airworthiness requirements of Part * of the Federal Aviation Regulations. * See continuation sheet 7 for certification basis.

Original Product — Type Certificate Number: 765

Make: Beech

Model: D18C, D18S, E18S-9700, C-45G, TC-45G, C-45H, TC-45H, TC-45J (SNB-5), JRB-6, E18S, G18S, H18

Description of Type Design Change:
Installation of 2 AiResearch TPE 331-1 series Turbo Prop engines with Hartzell HCB3TN propellers; eighty-one and one-half inches extension of fuselage and ventral fin, tricycle landing gear installation and related modifications in accordance with FAA sealed Volpar, Inc. drawing 2500.

Limitations and Conditions: The conditions and limitations of Aircraft Specification No. A-765 apply except as noted on continuation sheets 3 through 10.

This certificate and the supporting data which is the basis for approval shall remain in effect until surrendered, suspended, revoked, or a termination date is otherwise established by the Administrator of the Federal Aviation Administration.

Date of application: 5 May 1969

Date issued:

Date of issuance: 17 July 1970

Date amended: 27 August 1971

By direction of the Administrator

[signature]

Acting Chief, Aircraft Engineering Division

Title

Any alteration of this certificate is punishable by a fine of not exceeding $1,000, or imprisonment not exceeding 3 years, or both.

United States of America

Department of Transportation—Federal Aviation Administration

Supplemental Type Certificate

(Continuation Sheet)

Number SA2204WE

27 August 1971

I – Models: Beech D18S, D18C, E18S, E18S-9700, C-45G, G-45H, TC-45G, TC-45H, TC-45J (SNB-5), JRB-6, G18S, H18

Engines

2 AiResearch TPE 331-1-101B (turbo-prop) with 1:20.865 reduction gear ratio.

Fuel

Aviation Turbine Fuels ASTM Designation D1655-66T Type Jet A, Jet B and Jet A-1, Military Fuels MIL-J-5624G-1, Grades JP-4, JP-5 and MIL-F-5616-1, Grade JP-1 - See NOTES 5 and 6.

Oil

MIL-L-23699A (Mobil Jet II) required when operating in ambient temperatures above 60°F (15°C).

MIL-L-7808D and MIL-L-7808F may be used when operating in ambient temperature below 59°F (15°C).

Engine Ratings (Sea Level Static - See NOTE 3)

Take-Off (2 min)	Shaft Horsepower	620	
	Equivalent Shaft Horsepower	664	
	Propeller R.P.M.	2000	(100%)
	Torque	1620	ft. lbs. (56.65 psi)
Maximum Continuous	Shaft Horsepower	500	
	Equivalent Shaft Horsepower	529	
	Propeller R.P.M.	2000	(100%)
	Torque	1313	ft. lbs. (48.0 psi)

Maximum Allowable Power

Measured by the torquemeter for below standard inlet air temperature and/or ram conditions is 620 SHP for take-off (2 minutes) and 500 SHP for max. continuous while not exceeding EGT limits.

Temperature Limits

Exhaust gas temperature (standard sea level day)
Take-off (2 min.) 1112°F (600°C)
Maximum continuous 1065°F (574°C)
Starting Transient (one second) 1450°F (788°C)

NOTE: EGT limits vary with ambient temperature and pressure. Refer to the applicable FAA Approved Airplane Flight Manual for actual limits under non-standard conditions.

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27 August 1971

Oil Inlet Temperature	-40°F (-40°C) min. +260°F (+127°C) max. MIL-L-23699 (Mobil Jet II) oil required for operations above 60°F (15°C) ambient air temperature. MIL-L-7808F and MIL-L-7808D may be used when ambient air temperature is below 59°F (15°C).
Propeller and Propeller Limits (Option 1)	2 Hartzell HC-B3TN/T10176 Diameter: 99 3/8 in. Max., 96 3/8 in. Min. No further reduction in diameter is permitted. Pitch settings at 30-inch station: Low pitch stop (min. flt. idle) 11° ± 0.2° Start 3.25° ± .50° Reverse -8.0° ± .5° Feather 86.5° ± .25° Maximum allowable variation between two propellers at flight idle blade angle is 0.4°
(Option 2)	2 Hartzell HC-B3TN/T10178H Diameter: 96 in. max., 93 1/2 in. Min. No further reduction in diameter is permitted. Pitch settings at 30-inch station: Low pitch stop (min. flt. idle) 10.5 ± .2° Start 2.5° ± .2° Reverse -8.5° ± .2° Feather 86.5° ± .25° Maximum allowable variation between two propellers at flight idle blade angle is 0.4°
Airspeed Limits (CAS)	Max. operating speed 240 MPH (208 knots) Maneuvering speed 153 MPH (133 knots) Flaps extend speed a. Power off 165 MPH (143 knots) b. Power on 134 MPH (116 knots) Landing gear operating speed 160 MPH (139 knots)

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C. G. Range (Gear Extended)	+113.3 to +117 at 11,500 lbs. +107 to +117 at 10,000 lbs. or less Straight line variation between points given. Moment change due to gear retraction -8,931 in. lbs. See Volpar AFM D-109 or D-111.		
Max. Operating Altitude	16,500 feet		
Max. Weights	Take-off	11,500 lbs.	
	Landing	11,000 lbs.	
	* Empty Wing Weight	10,500 lbs.	

NOTE: * The term "maximum zero fuel weight" is not utilized because of the possibility of operating the aircraft with either the wing baggage or auxiliary fuel tank configuration.

	Tank Location	No. of Tanks	Fuel Capacity/ 2 Tanks	Wt. of Fuel/ 2 Tanks
Fuel Capacity	Main Tanks	(2)	100 gallons	670 lbs. required
	Inboard Aux.	(2)	152 gallons	1018 lbs. optional
	Rear Inboard Aux.	(2)	50 gallons	335 lbs. optional
Option 1	Outboard Aux.	(2)	120 gallons	804 lbs. optional
Option 2	Outboard Aux.	(2)	200 gallons	1340 lbs. optional
Option 3	Outboard Aux.	(2)	330 gallons	2210 lbs. optional

Above weights based on 6.7 lbs./gallon
See NOTE I(a) and NOTE 2.
See Volpar Airplane Flight Manual D-109 or D-111 for fuel management procedures.

Oil Capacity: 3 gallons (23 lbs.) total per aircraft
Above based on 7.7 lbs./gallon
See NOTE I(b).

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27 August 1971

Control Surface			
	Wing flaps	--	Down 45°
	Aileron tab	up 22°	Down 19°
	Aileron	up 38.5°	Down 21°
	Elevator tab	up 12°	Down 19°
	Elevator	up 35°	Down 25°
	Rudder tab (double)	right 29°	Left 29°
	Rudder tab (single)	right 28-33°	Left 28-33°
	Rudder	right 19°	Left 19°

Aileron-Rudder Interconnect Rigging Table	Aileron Position	Rudder Travel
1.	Neutral	12° ± 1° Right, 12° ± 1° Left
2.	Left Aileron Full Up) Right Aileron Full Down)	4° ± ½° Right, 19° ± 1½° Left
3.	Left Aileron Full Down) Right Aileron Full Up)	19° ± 1½° Right, 4° ± ½° Left

Serial Nos. Eligible

All D18C, D18S, E18S, E18S-9700, C-45G, TC-45G, C-45H, TC-45H, TC-45J (SNB-5), G18S, H18, JRB-6 airplanes that are eligible for airworthiness certification under Type Certificate No. 765 and have been modified in accordance with FAA sealed VOLPAR, INC., Summary Drawing No. 2500, revision D or subsequent FAA sealed revisions.

NOTE: Wing spar modifications in accordance with Supplemental Type Certificate Nos. SA832SW and SA895SW are also required.

Data pertinent to all models.

Datum

Located 102 in. forward of centerline of wing main spar (Placard denoting datum installed on bottom of fuselage.)

Leveling Means

Models D18C, D18S, SNB-5, JRB-6, C-45 series leveling lugs on top of fuselage, forward of cabin door. Models E18S, E18S-9700, G18S, and H18 - Two extended screws on right side of airplanes at bulkhead No. 8, aft of emergency exit. Plumb bob is used to level.

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27 August 1971

Certification Basis

a. Part 03 of the Civil Air Regulation effective 13 November 1945.
b. CAR 3 dated 15 May 1956, plus Amendments 3-1 through 3-8 as applicable to the powerplant installation.
c. Those conditions listed in FAA letters to Volpar, Inc., dated 26 January 1965, and 2 June 1965.
d. SFAR 23 effective 7 January 1969.

Supplemental Type Certificate No. SA2204WE issued 17 July 1970. Date of application for Supplemental Type Certificate, 5 May 1969.

Production Basis

None

An inflight operational check must be conducted in accordance with FAR 91.167(a) for each airplane modified to incorporate this Supplemental Type Certificate. When original airworthiness certification has not previously been accomplished, the applicant must comply with FAR 21.130 and 21.183(d).

Equipment

The basic required equipment as prescribed in the applicable airworthiness regulations (See Certification Basis) and the additional items shown in Volpar Turboliner II Equipment List 2514 must be installed in the aircraft for airworthiness certification. In addition, Volpar Airplane Flight Manual D-109 or D-111 is required. See NOTE 9 for applicability.

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NOTE 1: Current weight and balance data including list of equipment included in the certificated empty weight, and loading instructions when necessary, must be provided for each aircraft at the time of original certification.

a. The certificated empty weight must include system fuel (unusable) of:

	Tank Location	No. of Tanks	Fuel Capacity/ 2 Tanks	Unusable Fuel/ 2 Tanks
	Main Tanks	(2)	100 gallons	1 gallon
	Inboard Aux.	(2)	152 gallons	½ gallon
	Rear Inboard Aux.	(2)	50 gallons	½ gallon
Option 1	Outboard Aux.	(2)	120 gallons	1 gallon
Option 2	Outboard Aux.	(2)	200 gallons	1½ gallons
Option 3	Outboard Aux.	(2)	330 gallons	2½ gallons

b. The certificated empty weight must include system oil (unusable) of 1 quart total per aircraft.

NOTE 2: Fuel weights in this data sheet are based on 6.7 lbs./gallon. For weight and balance calculations, fuel weights must be derived from the "Specific Weight vs. Temperature" chart in the Volpar Airplane Flight Manual D-109 or D-111.

NOTE 3: The engine ratings of this data sheet are based on static sea level conditions, compressor inlet air (dry) 15°C., 29.92 in. hg., no external accessory loads, no air bleed or anti-icing airflow. See Volpar AFM D-109 or D-111 for non-standard day.

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NOTE 4: CAUTION:

The approval of this change in Type Design applies basically to the Beech models JRB-6, D18C, D18S, E18S, E18S-9700, C-45G, TC-45G, C-45H, TC-45H, TC-45J (SNB-5), G18S, and H18 aircraft only. This approval should not be extended to other specific airplanes of these models on which other previously approved modifications are incorporated unless it is determined by the installer that the inter-relationship between this change and any of those other previously approved modifications will introduce no adverse effect upon the airworthiness of that airplane. This determination should include consideration of significant changes in weight distribution such as an increase in the fixed disposable weight in the fuselage. The above applies, as well, to modifications subsequently added to aircraft incorporating this change in Type Design.

NOTE 5: Phillips anti-icing fuel additive PFA-55 MB may be used if concentration delivered to airplane does not exceed 0.15% by volume. No fuel system anti-icing credit is allowed.

NOTE 6: Grade 80/87 octane aviation gasoline or white gasoline is approved for emergency use. Do not exceed 1000 gallons per engine per 100 hours of operation. The amount of gasoline used must be entered in the engine log book.

NOTE 7: Information essential to the proper maintenance of these airplanes is contained in Volpar Document D-110 which must be available at the time of delivery of the airplane.

NOTE 8: De-icer and/or anti-icing equipment items shown on OPTIONAL on Volpar Turboliner II Equipment List, Volpar Drawing No. 2514, revision E, or later FAA approved revisions, have been evaluated by FAA in accordance with SFAR 23 Section 59 only. No evaluation was accomplished in accordance with SFAR 23, Section 34. Compliance with SFAR 23, Section 48, has been shown.

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NOTE 9:

a. Volpar Airplane Flight Manual D-109 is required for FAR Part 135 operations on or after 1 June 1972.

b. Volpar Airplane Flight Manual D-111 may be used for FAR Part 135 operations in lieu of D-109 prior to 1 June 1972 only (reference FAR Part 135.144).

c. Volpar Airplane Flight Manual D-109 or D-111 may be used for FAR Part 91 operations.

d. The data presented in Airplane Flight Manual No. D-111 was prepared in accordance with paragraphs a, b, and c of the above Certification Basis, and that presented in Airplane Manual No. D-109 was prepared in accordance with paragraphs a, b, c, and d of the above Certification Basis. The latter manual contains additional operating limitations and performance information required by Sections 19 and 20 of SFAR 23.

Garmin AT 2345 Turner Rd. SE Salem, OR 97302	**Airplane Flight Manual Supplement** Garmin GNS 480 GPS/WAAS Nav Com	26 September 2006 Part #:560-0985-01 Rev D

FAA APPROVED
AIRPLANE FLIGHT MANUAL SUPPLEMENT
or
SUPPLEMENTAL AIRPLANE FLIGHT MANUAL
for
Garmin GNS 480 (CNX80) SYSTEM INSTALLATION
as installed in

BEECHCRAFT C45H

Make and Model Airplane

Registration Number N404CK

Serial Number AF297

This document serves as an Airplane Flight Manual Supplement or as a Supplemental Airplane Flight Manual when the aircraft is equipped with the Garmin GNS 480. This document must be carried in the airplane at all times when the Garmin GNS 480 is installed in accordance with Supplemental Type Certificate No. SA01229SE.

The information contained in this document supplements or supersedes the information made available to the operator by the manufacturer in the form of clearly stated placards, markings, or manuals or in the form of an FAA approved Airplane Flight Manual, only in those areas listed herein. For limitations, procedures, and performance information not contained in this document, consult the basic placards, markings, or manuals or the basic FAA approved Airplane Flight Manual.

FAA approved: Donald D. Wilson

for Manager, Aircraft Certification Office
Federal Aviation Administration
Seattle, Washington

Date: 3Oct06

FAA Approved Date:	OCT - 3 2006	Page 1 of 9

Revision Log

Rev	Rev. Date	Description	EN	By	FAA Approval	Date Approved
--	4/23/03	Original Release	7625	dfs	none	
A	5/30/03	Added clarification note of oceanic operations in paragraph 1.2, added Navigation subparagraph to Limitations.	7654	dfs	none	
B	6/5/03	Corrected typo of DR in paragraph 3.2.	7659	dfs	none	
C	6/25/03	Remove reference to CAR in cover statement, change GPS Approach statement (3.2.b). Add requirement for external annunciation check (2.5). Correct datacard part number (2.3). Correct typos.	7662	dfs pad mak	none	
D	6/26/03	Added limitation for backup CNX used to originate a flight plan	7662	pad	Steve O'Neal	6/27/03
E	10/27/03	Changed company name to Garmin AT, update mission planning tool (1.2.1), generalize sensors (1.2.1a), clarify Part 91 (1.2.1b), update for software version 1.2 (2.1, 2.2), clarify IFR installation status (2.1), clarify pilot action (2.5a), specify location of DR and LOI annunciations (3.2a, 3.2b), remove "transport aircraft" as FMS descriptor (4.).	7729	mak, pad	Donald Wilson	11/26/03
--	7/15/04	Changed model name to GNS 480, added Gamma 2, 3 precision approach capability and traffic sources for V2.0 software. Document major revision to -01 Rev-.	7971	pad	none	
A	8/26/04	Added wording regarding approaches with vertical guidance in section 4.1	7837	pad	Thomas E. Archer	9/15/04
B	8/11/05	Correct typo in STC number (cover, 1.2). Update Pilot's Guide revision to latest approved Rev B (2.1)	8253	mak	Donald Wilson	8/18/05
C	3/7/06	Updated Pilot's Guide revision; Application SW revision updated to 2.1 Added Section 2.7 GDL 90 Control	8326	msf	Donald Wilson	3/29/06
D	9/26/06	Update route planning software and manual (1.2.1). Add WAAS TSO deviation limitation (2.4). Add checkbox for GDL 90 control (2.7).		mak	Donald B. Wilson	30 Oct 06

TABLE OF CONTENTS

1. GENERAL

1.1 GARMIN GNS 480 GPS/WAAS NAV COM

The Garmin GNS 480 GPS/WAAS Nav Com is a panel-mounted product that contains a GPS/WAAS receiver for GPS approved primary navigation, VHF Com, and VHF Nav in an integrated unit with a moving map and color display. The GNS 480 can also control a remote transponder, and may display TIS-A traffic, or Skywatch traffic data. The previously approved Garmin CNX80 is an equivalent unit with only a bezel and model name change, and all data in this AFMS applies to both models.

The GNS 480 uses a high-resolution color display to provide information about the different functions. Information and "smart keys" unique for each mode of operation are displayed.

When you press the COM, VOR, or XPDR keys on the left side of the display, the display area for that function will be outlined and the information active for editing will be highlighted. The labels for the bottom row of smart keys will change for each function selected. Pressing the CDI key toggles between GPS and VOR/ILS/LOC. The operation of the smart keys across the bottom changes depending on the function selected.

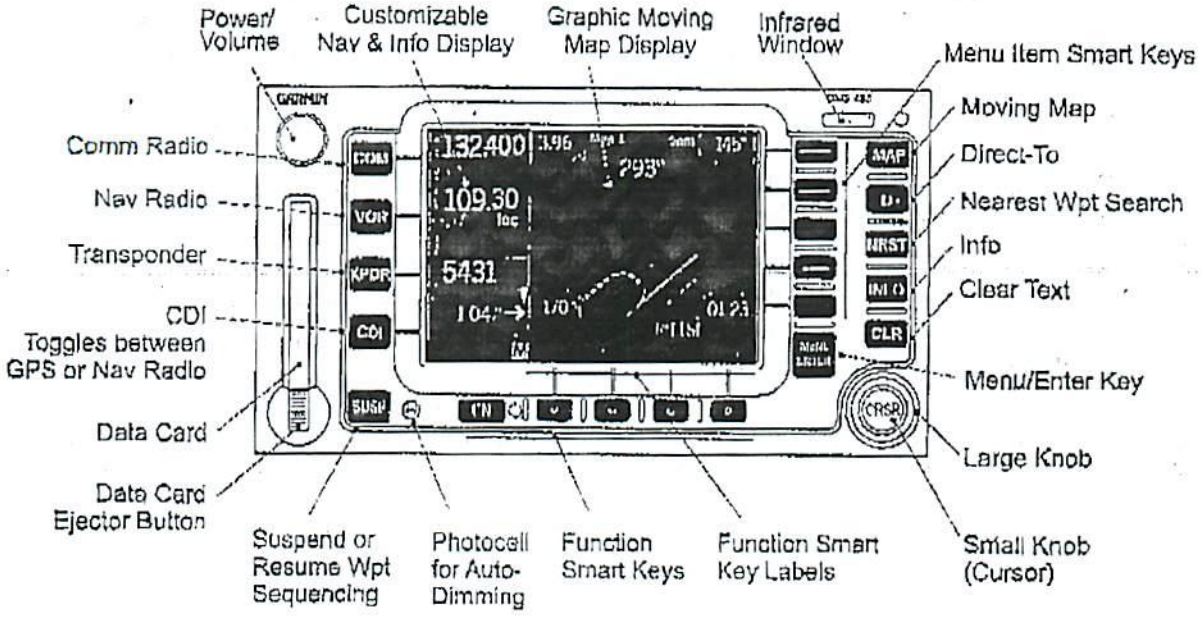

Figure 1 – GNS 480 Control and Display Layout

1.2 OPERATION

GPS/WAAS TSO-C146a Class 3: The Garmin GNS 480, when installed in accordance with STC SA01229SE, uses GPS and WAAS (within the coverage of a Space-Based Augmentation System complying with ICAO Annex 10) for en route, terminal area, precision and non-precision approach operations (including "GPS", "or GPS", and "RNAV" approaches).

Navigation information is referenced to WGS-84 reference system, and should only be used where the Aeronautical Information Publication (including electronic data and aeronautical charts) conform to WGS-84 or equivalent. Waypoints that are not compliant to WGS-84 are noted in the GNS 480 database, and annunciated if embedded in the system's flight plan.

1.2.1 Class II Oceanic, Remote, and other Operations

The Garmin GNS 480, as installed, has been found to comply with the requirements for GPS primary means of Class II navigation in oceanic and remote airspace, when used in conjunction with Garmin AT Route Planning Software, P/N 139-0370-020 (or later FAA approved Version, which is included with the Predictor Program P/N 006-A0154-02 or later FAA approved Version and the Route Planning User's Guide P/N 560-0180-01 or later FAA approved Revision on the P/N 140-0056-004 GNS 480 Product CD). Oceanic operations are supported when GNS 480 annunciates Enroute operations. This provides an alarm limit of 2 nm and a mask angle of 5° (degrees). The GNS 480 also has the ability to predict RAIM availability at any waypoint in the database if WAAS corrections are expected to be absent or disabled. This does not constitute an operational approval for Oceanic or remote area operations. Additional equipment installations or operational approvals may be required.

a) Use for oceanic navigation requires an additional approved long range oceanic and/or remote area navigation system with independent display, sensors, antenna, and power source.

b) Use of the GNS 480 for other than U.S. 14 CFR Part 91 operations requires redundant VHF Com and VHF Nav systems. Other limitations may be applicable for Canadian operations.

c) For FAR 91 operations, the RAIM prediction function may be used in lieu of the prediction software if WAAS corrections are unavailable.

d) Operations approval may be granted for the use of the GNS 480 RAIM prediction function in lieu of the Route Planning Software for operators requiring this capability. Refer to your appropriate civil aviation authorities for these authorizations.

2. LIMITATIONS

2.1 PILOT'S GUIDE

The Garmin GNS 480 Pilot's Guide, part number and revision listed below (or later FAA approved revisions), must be immediately available to the flight crew whenever navigation is predicted on the use of the Garmin GNS 480.

- Pilot's Guide P/N 560-0984-01 Rev. C or later approved for software version 2.1 or later

This AFM supplement does not grant approval for IFR operations to aircraft limited to VFR operations. Additional aircraft systems may be required for IFR operational approval, which is beyond the scope of this installation.

If a second redundant GNS 480 is installed outside the acceptable field of view, it should be utilized as a backup system and not the primary source of navigation, unless the primary unit fails. A backup system should not be utilized to originate a flight plan for navigation.

2.2 System Software

The system must utilize the software version listed below (or later FAA approved versions). The software version can be displayed in System Mode Screen on the display. This can be accessed, once the unit is initialized, by depressing the **FN** key twice and selecting **SYS**, followed by **VERS**. Software versions support different functions, check the GNS 480 Pilot's Guide for further information.

Table 1 – Approved Software Versions

Software Item	Approved Software Version *(or later FAA approved versions)*	
	SW Version	As displayed on GNS 480
Airborne SW	2.1	02.10

2.3 Database

The GNS 480 Database Card P/N 138-0329-051 Rev. -- (or later FAA approved version) must be installed.

a) IFR enroute and terminal navigation is prohibited, unless the pilot verifies the currency of the database or verifies each selected waypoint for accuracy by reference to current approved data.
b) Instrument approaches using the GNS 480 are prohibited, unless GNS 480 approach data is verified by the pilot or crew to be current. Instrument approaches must be accomplished in accordance with approved instrument approach procedures that are loaded from the GNS 480 database.

2.4 Navigation

No navigation is authorized north of 89° (degrees) latitude or south of 89° (degrees) latitude.

The equipment does not comply with US 14 CFR part 91, SFAR 97 requirements for TSO-C146a equipment. Until complete compliance is demonstrated and approved by the FAA, authorization to conduct any GPS or WAAS operation under Instrument Flight Rules (IFR) requires that:

a) Aircraft using the GPS or WAAS capability of the GNS 480 navigation equipment under IFR must be equipped with an approved and operational alternate means of navigation appropriate to the flight with the exception of oceanic and remote operations.
b) For flight planning purposes, if an alternate airport is required, it must have an approved instrument approach procedure other than GPS or RNAV that is anticipated to be operational and available at

the estimated time of arrival. All equipment required for this procedure must be installed and operational.

c) For flight planning purposes, Garmin Prediction Program part number 006-A0154-02 (with the installed antenna part number selected) should be used to confirm the availability of RAIM for the intended flight in accordance with the local aviation authority guidelines for TSO-C129a equipment. WAAS NOTAMs (or their absence) and generic prediction tools do not provide an acceptable indication of the availability for the GNS 480 equipment.

d) When flight planning an LNAV/VNAV or LPV approach, operators should use the Garmin Prediction Program part number 006-A0154-02 (with the installed antenna part number selected) in addition to any NOTAMs issued for the approach.

The antenna installed in this installation is (one antenna to be checked by installer):

☐ A-33 (575-9 / 590-1104) ☐ GA56A (011-01154-00) ☒ GA35 (013-0035-00)

☐ A-34 (575-93 / 590-1112) ☐ GA56W (011-01111-00) ☐ GA57 (011-01032-00)

2.5 APPROACHES

a) During GPS approaches, the pilot must verify the GNS 480 is operating in the approach mode.

b) When conducting approaches referenced to true North, a manual magnetic variation setting of zero degrees must be used.

c) Accomplishment of ILS, LOC, LOC-BC, LDA, SDF, MLS, VOR approach, or any other type of approach not approved for GPS overlay, is not authorized with GPS navigation guidance.

d) Use of the GNS 480 VOR/LOC/GS receiver to fly approaches not approved for GPS requires VOR/LOC/GS navigation data to be present on the external indicator.

e) For aircraft with remote source selection annunciation installed for the CDI/HSI, conducting IFR approaches is prohibited if the remote annunciation is found inoperative during pre-flight. (This limitation does not prohibit the conduct of an IFR approach if the required remote annunciation fails during flight, and the indicator provided on the GNS 480 display may be used as a backup).

f) Unless in emergency conditions, IFR approaches are prohibited whenever any physical or visual obstruction (such as a throw-over yoke) restricts pilot view and access to the GNS 480.

2.6 TRAFFIC DISPLAY

Traffic may be displayed on the GNS 480 when connected to an L-3 Avionics Systems Skywatch, or when the GNS 480 is connected to either a Garmin GTX 33 or GTX 330 series Mode S Transponder providing Traffic Information Services (TIS-A).

Both systems are capable of providing traffic monitoring and alerting to the pilot. The display of traffic is an aid to visual acquisition and may not be utilized for aircraft maneuvering. Operations and display of this traffic data is described in the GNS 480 Pilot's Guide.

2.7 GDL 90 CONTROL

The GNS 480 in this installation ☐ IS configured ☒ is NOT configured to control a GDL 90.
If the GNS 480 is configured to control a compatible transponder (SL70, SL70R, GTX 32, GTX 327, GTX 33, or GTX 330) and the transponder provides control to a GDL 90 UAT Datalink Sensor:

a) The GDL 90 does not replace any required equipment.

b) The GDL 90 UAT datalink is approved for Air Traffic Control (ATC) ADS-B Surveillance Services in the United States. For areas where ATC Surveillance Services are provided, the UAT equipment shall broadcast aircraft position, velocity, barometric altitude information, flight identification and/or a 4096 squawk code.

c) When directed by ATC to turn "off" the ADS-B transmission, pilots should use the GNS 480 transponder standby function (press XPDR, then STBY) to stop ADS-B transmissions while airborne or on the surface.

UAT datalink is also used to receive Traffic Information Services-Broadcast (TIS-B) and Flight Information Services-Broadcast (FIS-B) information. To receive TIS-B and FIS-B information, a display will be needed.

Not all areas of the United States have the capability to provide ATC services or TIS-B/FIS-B information on the UAT datalink. Refer to Notice to Airman for areas of coverage and operational applications, found on the FAA website: www.flyadsb.com.

3. EMERGENCY / ABNORMAL PROCEDURES

3.1 EMERGENCY PROCEDURES

No change.

3.2 ABNORMAL PROCEDURES

a) If the Garmin GNS 480 GPS navigation information is not available, or is invalid, internal VHF navigation function may be used, or utilize other remaining operational navigation equipment installed in the airplane as appropriate. If the GNS 480 loses GPS position and reverts to Dead Reckoning mode (indicated by the annunciation "DR" above the groundspeed indication on the moving map display), then the moving map will continue to be displayed. Aircraft position will be based upon the last valid GPS position and estimated by Dead Reckoning methods. Changes in airspeed or winds aloft can affect the estimated position substantially. Dead Reckoning mode terminates at the first Pilot Navigation leg in the flight plan.

b) If a "Loss of Integrity" (LOI) message is displayed (above the groundspeed indication on the moving map display) during:
   - Enroute/Terminal; continue to navigate using GPS equipment and periodically cross-check the GPS guidance to other approved means of navigation.
   - GPS Approach; GPS approaches are not authorized under LOI, revert to alternate means of navigation. This may be the internal VOR/LOC/GS or other remaining operational navigation equipment as appropriate.

c) If loss of the VHF Navigation radio message (NAV flag) is displayed, revert to an alternate means of navigation appropriate to the route and phase of flight. GPS position and VHF Comm radio functions are not affected unless annunciated as failed.

d) If the VHF Comm radio fails (as indicated by the display and associated message), then use another installed VHF Comm radio in the aircraft. GPS position and VHF Navigation radio functions are not affected unless annunciated as failed.

e) If the GNS 480 transponder control function fails at any time, the SL70 remote transponder will automatically revert to Mode S/C operation and squawk the last code assigned. A GTX 32 or 33 series transponder will retain the last mode of operation at the time of control function failure.

f) During a GPS LPV precision approach, or GPS LNAV/VNAV approaches, the GNS 480 will downgrade the approach if the Horizontal or Vertical Alarm Limits are exceeded. This will cause the vertical guidance to flag unavailable. The procedure may be continued using LNAV only minimums.

g) During any GPS approach in which precision and non-precision alarm limits are exceeded, the GNS 480 will revert to terminal operations alarm limits. The GNS 480 will indicate the approach must be aborted in this case. The GNS 480 may be utilized for terminal navigation or other means of primary navigation may be used.

4. NORMAL PROCEDURES

Refer to the GNS 480 Pilot's Guide defined in paragraph 2.1 on page 4 of this document for normal operating procedures.

GNS 480 functionality and user interface is similar to a Flight Management System (FMS). Although intuitive and user friendly, a reasonable degree of familiarity is required to use the GNS 480 without becoming too engrossed in GNS 480 operation at the expense of basic instrument flying in IMC and basic see-and-avoid in VMC. Pilot workload will be higher for pilots with limited familiarity in using the GNS 480 in an IFR environment, particularly without the autopilot engaged. Garmin AT provides excellent GNS 480 training tools with the Pilot's Guide, the Computer Based Training CD ROM with PC based GNS 480 simulator, and the GNS 480 Simulator Mode. Pilots should take full advantage of these training tools to enhance system familiarization. Use of autopilot is strongly encouraged when using the GNS 480 in IMC conditions.

4.1 APPROACHES WITH VERTICAL GUIDANCE

The GNS 480 supports three types of approaches with vertical guidance: LPV approaches, LNAV/VNAV approaches, and LNAV approaches with advisory vertical guidance. For LNAV approaches with advisory vertical guidance the GNS 480 will annunciate LNAV/VNAV indicating vertical guidance is available. LNAV minimums will be controlling in this case. For additional information on approaches with vertical guidance refer to the GNS 480 Pilot's Guide.

5. PERFORMANCE

No change.

6. WEIGHT AND BALANCE

See current weight and balance data.

7. AIRPLANE & SYSTEM DESCRIPTIONS

See Garmin GNS 480 Pilot's Guide for a complete description of the GNS 480 System.