Falcon 10/100

Initial Pilot Training Manual

CAE SimuFlite

August 2010

NOTICE: This Falcon 10/100 Initial Pilot Training Manual is to be used for aircraft familiarization and training purposes only. It is not to be used as, nor considered a substitute for, the manufacturer's Pilot or Maintenance Manual.

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Our best wishes are with you for a most successful and rewarding training experience.

The Staff of SimuFlite

Using this Manual

This manual is a stand-alone document appropriate for various levels of training. Its purpose is to serve as an informational resource and study aid.

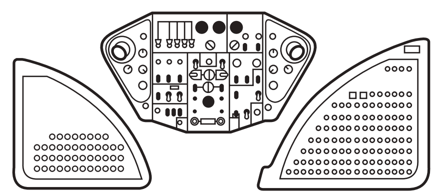
The **Quick Reference** section provides limitation and other data for quick review.

The **Operating Procedures** section contains chapters that provide a pictorial preflight inspection of the aircraft, normal procedures in an expanded format, standard operating procedures, maneuvers, and other information for day-to-day operations.

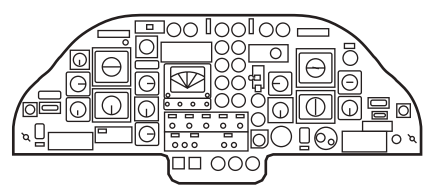
The **Flight Planning** chapter covers weight and balance and performance; a sample problem is included.

The **Systems** section is subdivided by aircraft system. Each system chapter contains a discussion of components, preflight and servicing procedures, and abnormal and emergency procedures. At the beginning of the Systems section, a list of systems is cross referenced to ATA codes to facilitate further self study, if desired, with the manufacturer's manuals.

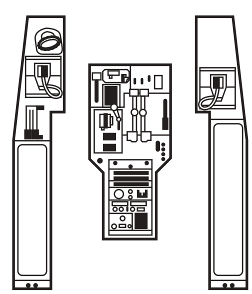
The graphics shown at the right direct your attention to a specific location in the cockpit. A shaded area locates various instruments or switches shown in the adjacent photographs.



The graphic at right (top) represents the overhead panel.



The graphic at right (middle) represents the cockpit forward panels.



The graphic at right (bottom) represents the center pedestal and side consoles.

Quick Reference

Chapter 2

This chapter contains the aircraft's operating limits and requirements as well as system by system charts summarizing power sources, distribution, controls, and monitors. All limitations are printed in gray.

It also contains sections on supplement-directed limitations and operations.

This chapter is intended to serve as a convenient reference.

Table of Contents

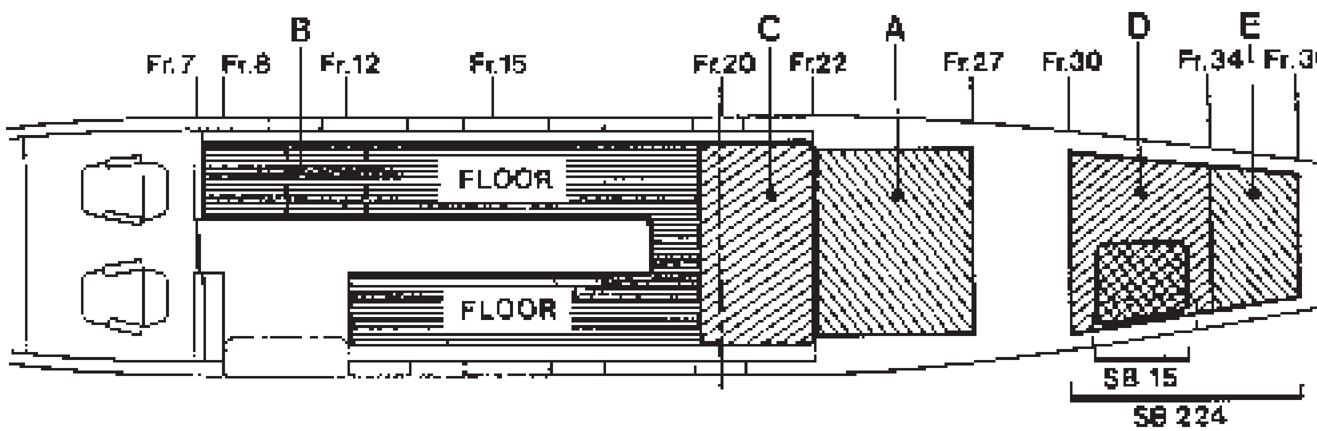
General Limitations

Authorized Operations

- The aircraft may be used for the following types of operation:
  - carriage of passengers
  - carriage of cargo and mail
  - icing conditions
  - extended overwater
  - ditching
  - day and night VFR
  - IFR.

Baggage and Cargo

- Do not use aft fuselage equipment bay as stowage for baggage and spare parts unless an approved installation is provided in this compartment. Refer to **Figure 2-1** and **Table 2-A**.



2-1

Aircraft Area		Maximum Load
Baggage Compartment A		500 lbs
Baggage Compartment B[1]		220 lbs
Baggage Compartment C		500 lbs
Baggage Compartments A and C Simultaneously		750 lbs
Baggage Compartment D **Aircraft with SB 0224**	Without Thrust Reversers	200 lbs
	With Thrust Reversers	150 lbs
Baggage Compartment E **Aircraft with SB 0224**	Without Thrust Reversers	100 lbs
	With Thrust Reversers	50 lbs
Ground Equipment Kit and Crew Baggage – **Aircraft with SB 0015**		55 lbs
Cabin Forward Zone (Frames 12 to 15)	Linear Load on Left or Right Side Floors and Center Aisle	33.6 lb/ft
	Maximum Total Weight for Left/Right Side Floors and Center Aisle	260.0 lbs
	Special Approved Installation[2]	1,078.0 lbs
Cabin Center Zone (Frames 15 to 20)		375.0 lbs
Cabin Aft Zone (Frames 20 to 22)		500.0 lbs

Table 2-A; Baggage, Cargo, and Cabin Load Limits

[1] Per change M7, resistance of coat compartment partition during emergency landing.

[2] Includes stowings and appropriate wing loads.

NOTE: SB 0015; Rear Bay – Container for Ground Equipment Kit and Crew Baggage.

SB 0224; Installation of Baggage Compartment in the Rear Bay.

Certification

- FAR 25 through Amendment 25-2D
- FAR 36 through Amendment 36-1
- FAA Special Conditions 25-49-EU-14, dated April 16, 1973

Maneuvers

- The following maneuvers are not authorized:
  - acrobatics
  - spins.

NOTE: SB 0067; Jump Seat: Utilization at Takeoff and Landing.

Maximum Number of Passenger Seats

- A maximum of nine seats is approved if the approved associated interior accomodation is installed.
- A maximum of eight seats is approved:
  - seven in the cabin if the approved associated interior accommodation is installed
  - one jump seat modified per SB 0067 for authorization at takeoff and landing.
- The jump seat occupant must be acknowledged by the pilot as able to use the jump seat and he must be instructed before the flight on its use and on the application of the safety instructions provided on the "Jump Seat" sheet.

Minimum Flight Crew

- Pilot and Copilot

Noise Levels

- In compliance with FAR 36, the measured noise levels are as shown in **Table 2-B**. No determination has been made by the FAA that the noise levels of this aircraft are or should be acceptable or unacceptable for operation at, into, or out of any airport.

NOTE: SB 0052; Upgrading of Weight Structural Limitations Allowing Takeoff with 18,740 lb.

SB 0238; Upgrading of Weight Structural Limitations Allowing Takeoff with 19,300 lb.

Measuring Point	Noise Level (EPNdB)	
	Aircraft Not Modified Aircraft with SB 0052	Aircraft With SB 0238
Flyover, Without Noise Reduction	83.4[1]	84.2[3]
Flyover, With Noise Reduction	80.6[1]	81.6[3]
Approach	95.4[2]	95.4
Sideline	86.4	86.2

Table 2-B; Effective Percevied Noise Levels

[1] Takeoff configuration for this noise level is slats + flaps 15° at 18,740 lbs.

[2] Approach configuration for this noise level is slats + flaps 52° at 17,640 lbs.

[3] Takeoff configuration for this noise level is slats + 15° flaps at 19,300 lbs.

Operational Limits

Weight Limits

Aircraft Not Modified:

Maximum Ramp Weight . . . . 18,300 LBS
Maximum Takeoff Weight . . . . 18,300 LBS
Maximum Landing Weight . . . . 17,200 LBS
Maximum Zero Fuel Weight . . . . 12,460 LBS
Minimum Flight Weight . . . . 9,920 LBS

Aircraft with SB 0052:

Maximum Ramp Weight . . . . 18,740 LBS
Maximum Takeoff Weight . . . . 18,740 LBS
Maximum Landing Weight . . . . 17,640 LBS
Maximum Zero Fuel Weight . . . . 13,560 LBS
Minimum Flight Weight . . . . 9,920 LBS

Aircraft with SB 0238:

Maximum Ramp Weight . . . . 19,400 LBS
Maximum Takeoff Weight . . . . 19,300 LBS
Maximum Landing Weight . . . . 17,640 LBS
Maximum Zero Fuel Weight . . . . 14,400 LBS
Minimum Flight Weight . . . . 9,920 LBS

- The takeoff weight is limited by the most restrictive of the following requirements:
  - climb gradients
  - balanced field length or distances connected to takeoff
  - landing weight at destination
  - maximum brake energy
  - maximum tire speed.
- The landing weight is limited by the more restrictive of the following requirements:
  - one-engine go-around climb gradient
  - landing distance.

NOTE: SB 0052; Upgrading of Weight Structural Limitations Allowing Takeoff with 18,740 lb.

SB 0238; Upgrading of Weight Structural Limitations Allowing Takeoff with 19,300 lb.

> **CAUTION**: Full application of rudder and aileron controls as well as maneuvers that involve angles-of-attack near the stall must be confined to speeds below V_A.

> **CAUTION**: Do not exceed the maximum operating speed (V_{MO}/M_{MO}) in any regime of flight (climb, cruise, or descent) unless a higher speed is authorized for flight tests or pilot training.

Speed Limits

V_A, Maneuvering . . . . 220 KTS

V_{FE}, High Lift Devices Extended:

- Slats Extended . . . . 200 KTS
- Slats + Flaps 15° . . . . 190 KTS
- Slats + Flaps 30° . . . . 165 KTS
- Slats + Flaps 52° . . . . 165 KTS

V_{LE}, Gear Extended . . . . 220 KTS

V_{LO}, Gear Operating . . . . 190 KTS

V_{MCA}, Minimum Control – Air . . . . 97 KTS

V_{MCA} was established with a maximum 5° bank angle.

V_{MCG}, Minimum Control – Ground . . . . 100 KTS

V_{MO}/M_{MO}, Maximum Operating:

- Sea Level to 10,000 Ft . . . . 350 KTS TO 370 KTS

  There is a straight line variation between altitudes.
- 10,000 Ft to 25,000 Ft . . . . 370 KTS
- Above 25,000 Ft . . . . 0.87 M

Maximum Copilot Pitot/Static
Pressure Abnormal . . . . 260 KTS/0.76 M

Maximum Cracked Windshield . . . . 230 KTS

Maximum Direct Vision Window Open . . . . 200 KTS

Maximum Flaps Extend:

- 15° . . . . 190 KTS
- 30° . . . . 165 KTS
- 52° . . . . 165 KTS

Maximum Hydraulic System 1 or 2 Failure . . . 260 KTS/0.76 M

Maximum Slats Extend . . . . 200 KTS

Maximum Tire Groundspeed:

- Tires **Approved for 180 MPH** . . . . 157 KTS
- Tires **Approved for 190 MPH** . . . . 165 KTS

Maximum Turbulent Air Penetration . . . . . . 250 KTS/0.75 M

Maximum Windshield Wiper Operation . . . . 190 KTS

Takeoff and Landing Operational Limits

Airbrakes

- The airbrakes must not deliberately be kept extended below a height of approximately 500 ft.

Altitudes

Airport Pressure Altitude . . . . -1,000 TO 10,000 FT

Ambient Temperature Limits

- Observe ambient temperature limits shown in **Figure 2-2**.

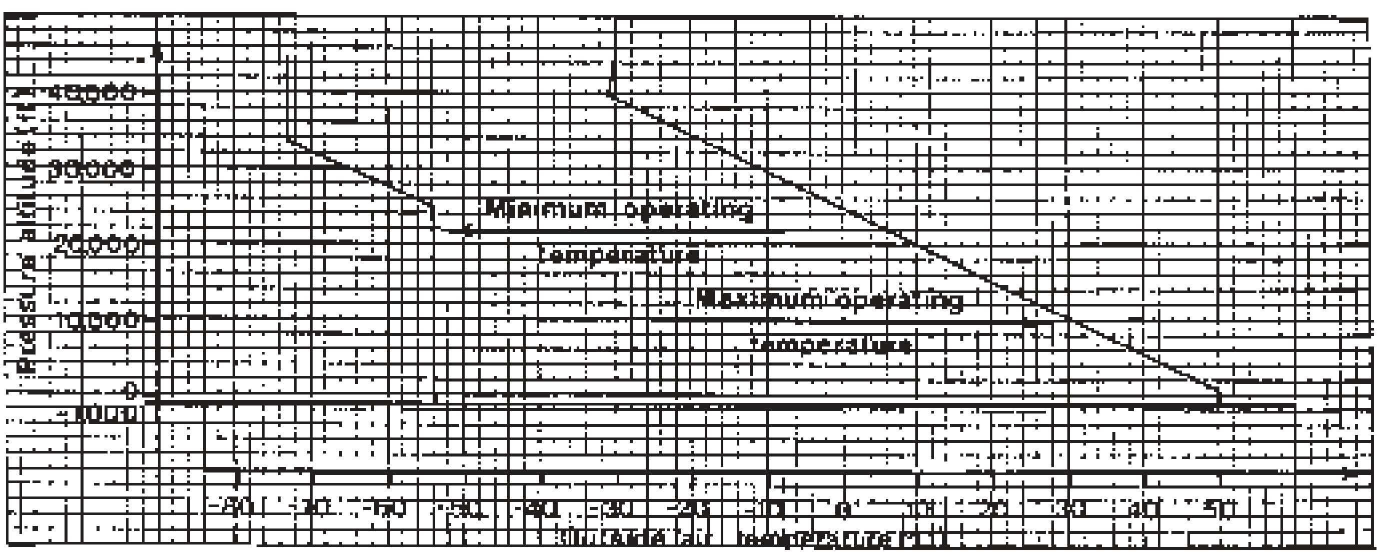
Autopilot (Collins AP 105/APS 80)

- Must not be used during takeoff.

Center of Gravity Limits

- Observe limits shown in **Table 2-C** and **Figures 2-3**, **2-4**, and **2-5**, following pages.

Ambient Temperature Limits



2-2

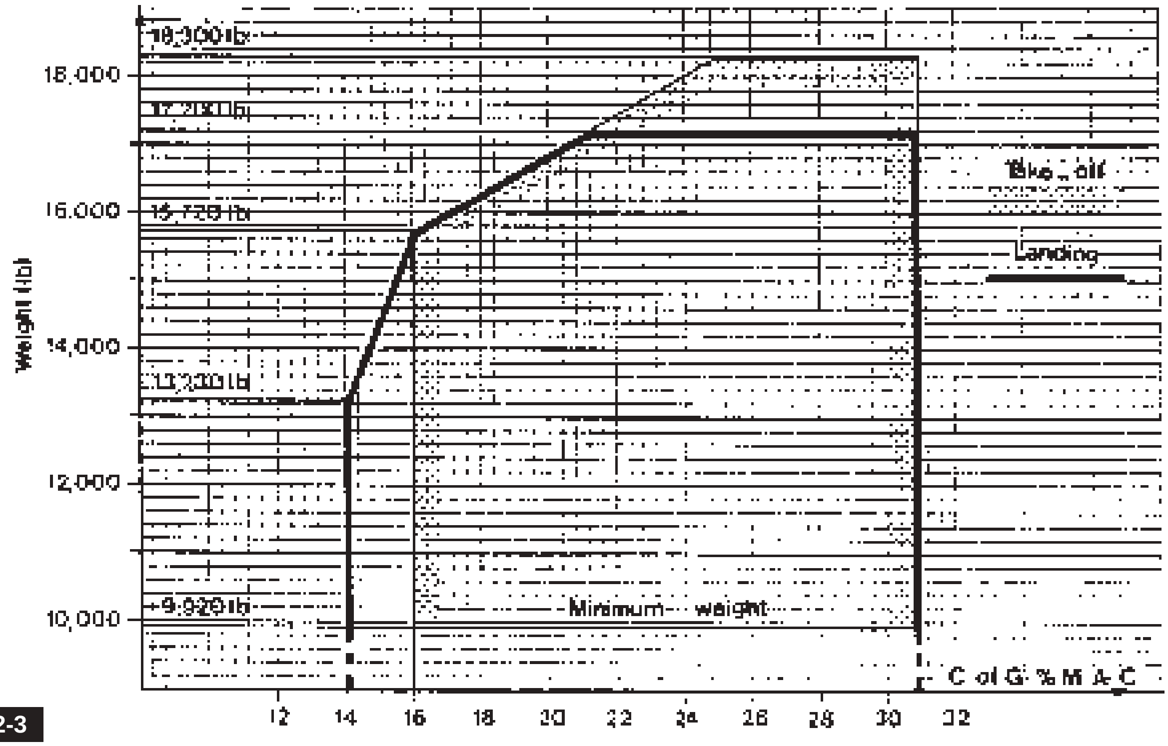
> **NOTE**: SB 0052; Upgrading of Weight Structural Limitations Allowing Takeoff with 18,740 lb.
>
> SB 0238; Upgrading of Weight Structural Limitations Allowing Takeoff with 19,300 lb.

Weight (lbs)			CG Limits (% MAC)	
			Forward	Aft
Aircraft Not Modified	Takeoff	15,720 18,300	16.0 25.0	31.0
	Cruise	13,230 15,720 18,300	14.0 16.0 25.0	31.0
	Landing	13,230 15,720 17,200	14.0 16.0 21.2	31.0
Aircraft With SB 0052	Takeoff	15,720 18,740	16.0 25.0	31.0
	Cruise	13,230 15,720 18,740	14.0 16.0 25.0	31.0
	Landing	13,230 15,720 17,640	14.0 16.0 21.8	31.0
Aircraft With SB 0238	Taxi	19,400	27.0	31.0
	Takeoff	15,720 19,300	16.0 26.6	31.0
	Cruise	13,230 15,720 19,300	14.0 16.0 26.6	31.0
	Landing	13,230 15,720 17,640	14.0 16.0 21.8	31.0

Table 2-C; Center of Gravity Limits

Center of Gravity Limits

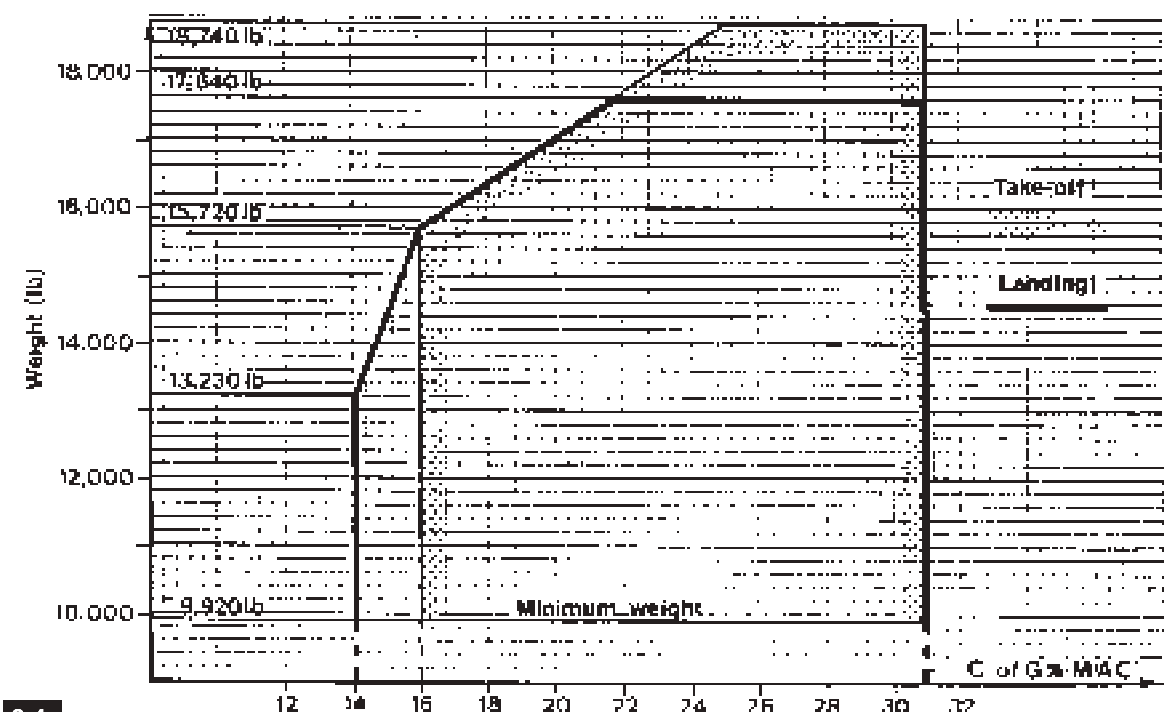
Basic Aircraft Without SB



2-3

Center of Gravity Limits

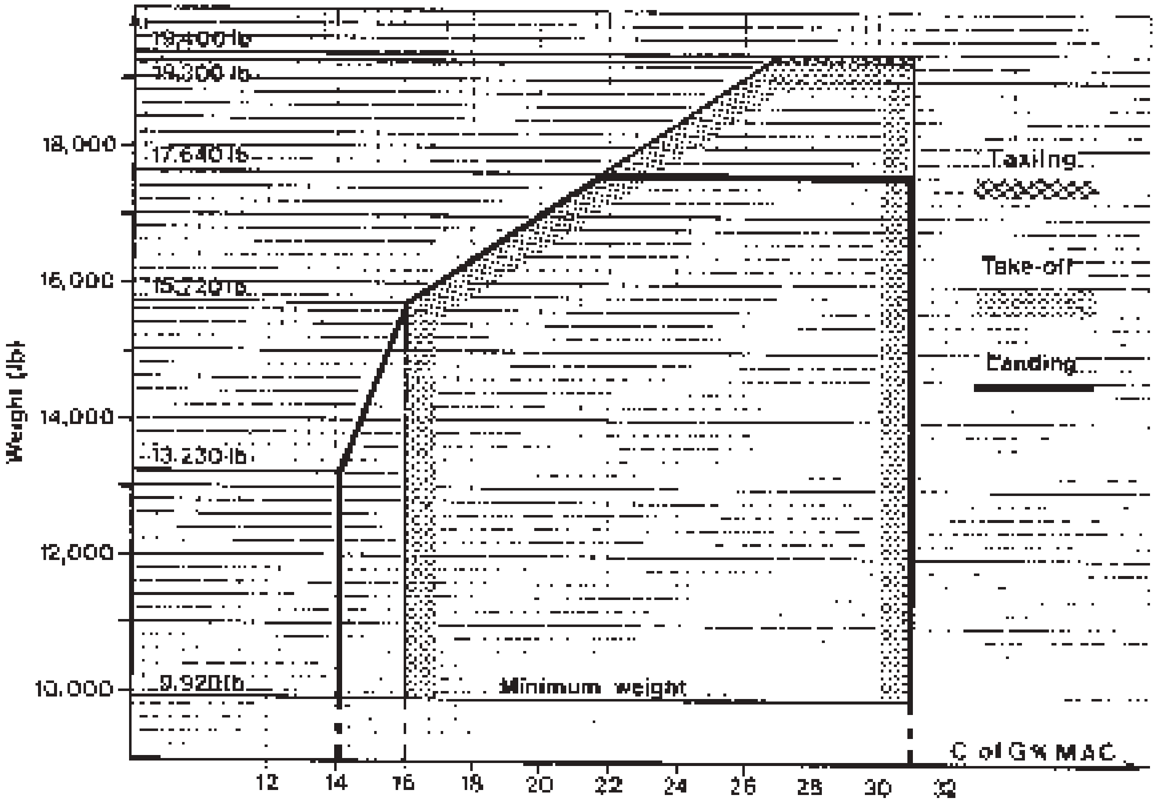
Basic Aircraft With SB 0052



2-4

Center of Gravity Limits

Aircraft With SB 0238



2-5

Demonstrated Crosswind

Maximum . . . . 90°/25 KTS

Elevation

Maximum Field Elevation for Takeoff
(Pressure Altitude) . . . . 10,000 FT MSL

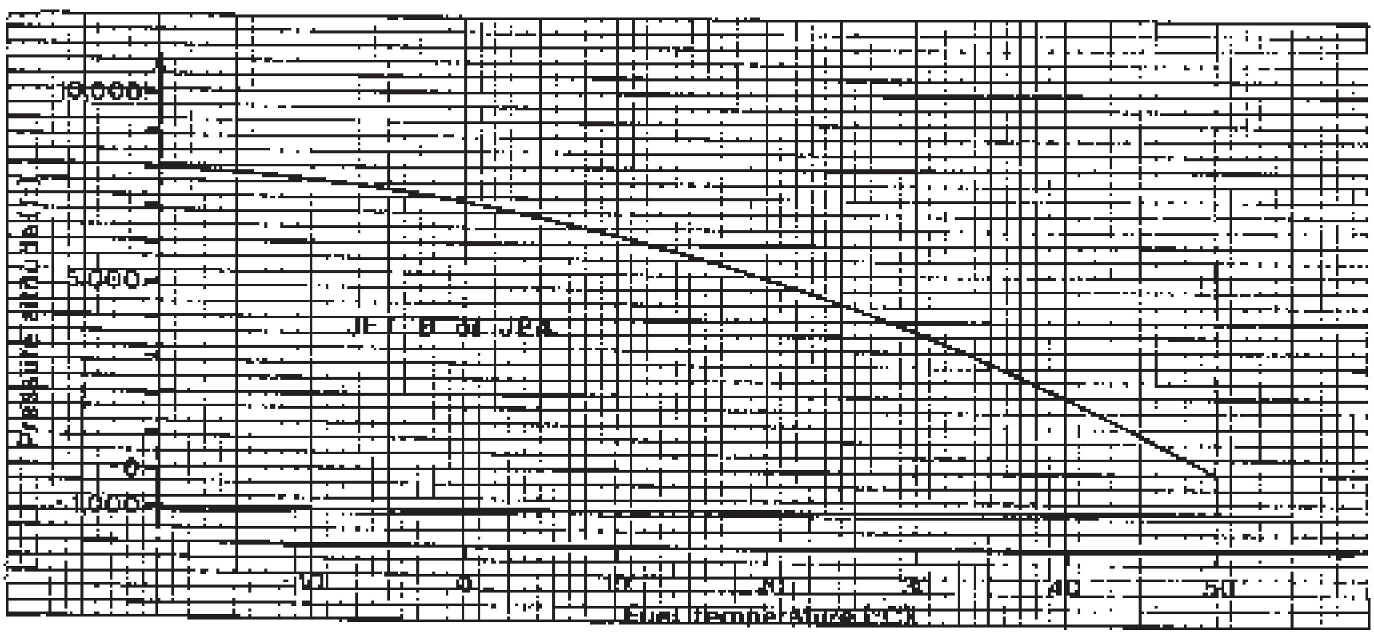
Fuel Computers

- Must be operative for takeoff.

Jet B or JP-4 Takeoff Envelope

- Observe fuel temperature limits in **Figure 2-6**.

Fuel Temperature Limits (Jet B or JP-4)



2-6

> **CAUTION**: If the emergency brake is used or the anti-skid system fails, the increase in the landing distance depends on the runway condition. Expect an increase of 2,000 ft on gravel or soil runways.

Operation on Unpaved (Dry) Runways – Supplement No. 1

- Aircraft authorized for a 19,300 lb maximum takeoff weight are limited to 18,740 lbs on an unpaved runway.
- Unpaved runways must be dry.
- The nosewheel must be equipped with a "wide-chine" tire.
- Anti-skid must be in good operable condition and on for takeoff and landing on grass runways.
- The runway bearing strengths are:
  - load classification number (LCN) not below 10.
  - California bearing ration (CBR) not below 10 for an aircraft weight of 11,023 lbs and 12 for an aircraft weight of 18,740 lbs (linear variation between the two weights).

Tailwind – Maximum

Velocity . . . . 10 KTS

Runway

Runway Slope . . . . . +2% (UPHILL) OR -2% (DOWNHILL)

- The runway must be smooth and hard-surfaced, except when operating in accordance with Supplement No. 1.

X-Feed and Rear Tank Intercom Valves

- These valves must be closed during takeoff.

Enroute Operational Limits

Airspeed Limits

- Observe limits depicted in **Figure 2-7** for flight envelope altitudes.

Altitudes

Maximum Flaps Extended . . . . 20,000 FT MSL

Maximum Gear Extended . . . . 20,000 FT MSL

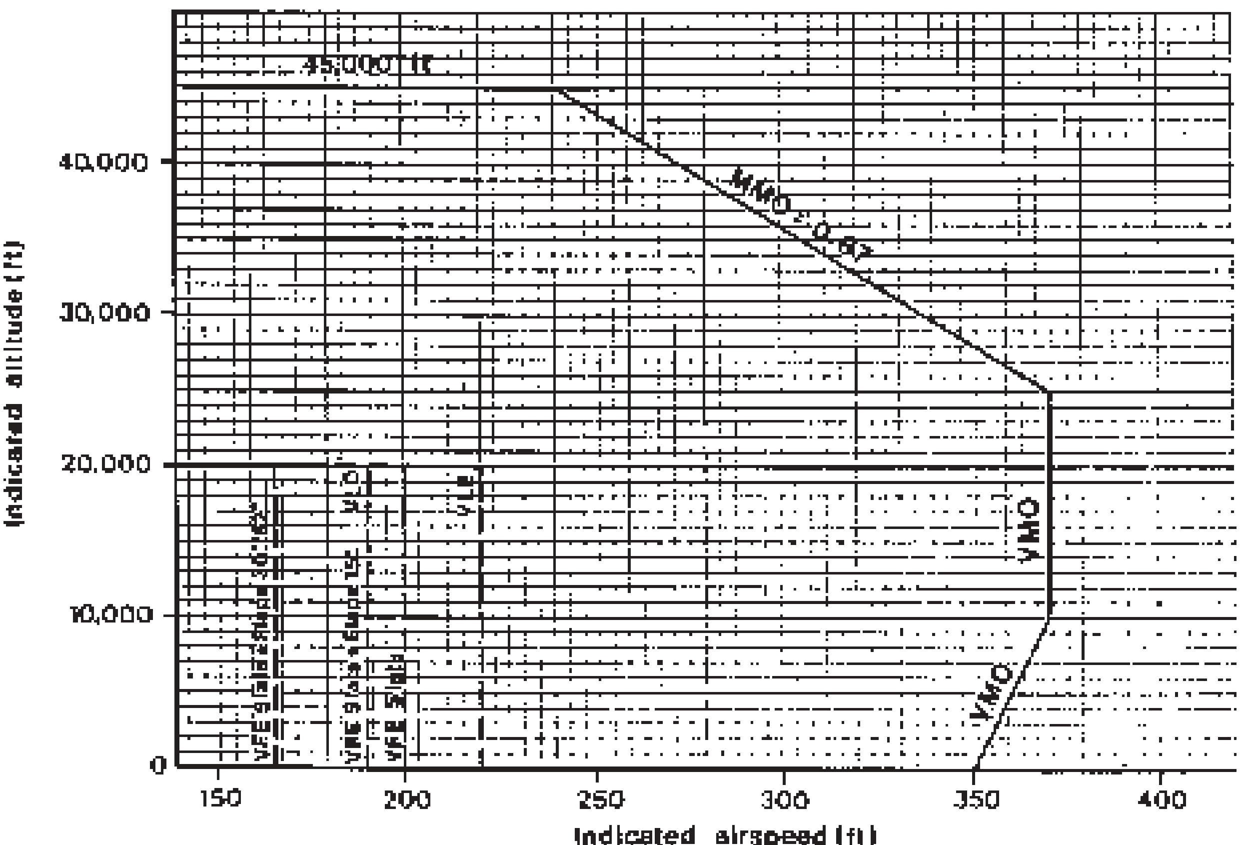
Maximum Operating . . . . 45,000 FT MSL

> **NOTE**: SB 0052; Upgrading of Weight Structural Limitations Allowing Takeoff with 18,740 lb.
>
> SB 0238; Upgrading of Weight Structural Limitations Allowing Takeoff with 19,300 lb.

Ambient Temperature Limits

- Observe the ambient temperature limits shown in **Figure 2-2**, page 2-11.

Airspeed Limits



2-7

Elevation

Maximum Elevation for Terrain Clearance . . . . . . 30,000 FT

Load Factors

Aircraft Without SB 0052 or 0238:

Flaps Retracted . . . . +3 TO -1

Flaps Extended . . . . +2 TO ZERO

Aircraft With SB 0052 or 0238:

Flaps Retracted . . . . +2.9 TO -1

Flaps Extended . . . . +2 TO ZERO

- These accelerations limit the angle of bank in turns and limit the severity of pull-up maneuvers.

Systems Limitations

Avionics and Communications

Autopilot – General

- Do not use the autopilot during takeoff.
- Hold the control wheel while commanding all autopilot disengagements.
- With single engine operation, the following apply.
  - After disengaging the autopilot, manually trim the aircraft before re-engaging the autopilot.
  - In consequence of thrust or speed changes, the aircraft must be manually trimmed with aileron and rudder trims.
  - Autopilot operation is authorized for single engine approach.
- When using the autopilot, one pilot must be in his seat with his belt and shoulder straps fastened so that if any malfunction of the autopilot occurs, he can recover control of the aircraft immediately.

Collins AP 105

Maximum Speed . . . . V_{MO}/M_{MO}

Minimum Height for Operation Enroute . . . . 1,000 FT

Minimum Height for Operation:

IMC Conditions . . . . 200 FT

VMC Conditions . . . . 80 FT

- The autopilot is authorized for Category I precision approaches.

Collins APS 80

Maximum Utilization Speed . . . . V_{MO}/M_{MO}

Minimum Height for Operation Enroute . . . . . 1,000 FT AGL

Minimum Height for Operation:

No Visual Reference . . . . 200 FT

No Radar Altimeter/With Visual Reference . . . . . . 100 FT

With Radar Altimeter/With Visual Reference . . . . . . 50 FT

Copilot Pitot/Static Pressure – Panel Only

Airspeed . . . . 260 KTS/0.76 M

GNS 1000

- The GNS 1000 (**if installed**) must not be used as the primary means of navigation during approach.

Electrical (and Lighting)

Maximum Battery Temperature for Start . . . . 120°F

Maximum Continuous Generator Output 300A

Maximum Generator Output . . . . 350A (5 MINUTES)

Maximum Voltage 31V

Recognition Light

- Limit the use of recognition lights on the ground to 5 minutes, followed by 15 minutes off to ensure sufficient cooling.

Flight Controls

> **CAUTION**: To maintain a sufficiently high engine setting in icing conditions, approach may be done in landing configuration with airbrakes extended to 500 ft above the ground. At 500 ft, the airbrakes must be retracted and the engine synchronizer, if installed, must be switched off.

Airbrakes

- The pilot must keep a hand on the airbrake control handle until the normal airbrakes extension or retraction is ascertained.
- Do not hesitate to use the airbrakes if the flight envelope limits (V_{MO}/M_{MO}) are accidentally exceeded.
- During approach and below 500 ft AGL, the airbrakes must not be deliberately kept extended.
- Do not use airbrakes below 500 ft AGL.
- In manual flight conditions, accompany airbrake extension with a nose-up maneuver of the pitch trim control to maintain longitudinal attitude. In automatic flight conditions, a momentary change of the longitudinal attitude in the nose-down direction appears upon airbrake extension.

Flaps

- In flight, limit each actuation of the flap control handle to the next detent position.

Yaw Damper/Q Unit

Q UNIT Annunciator Illuminated . . . . . 260 KIAS/0.76 M

On Approach If Q UNIT Annunciator Illuminates:

RUD Q . . . . 140 KTS MINIMUM UNTIL . . . . LANDING ASSURED, ADD 10 KTS TO V_{REF}

AIL Q . . . . ADD 10 KTS TO V_{REF}

- If aileron Q unit is not operating, limit speed to 260 KIAS (0.76 M).

Fuel

Approved Additives

- See **Table 2-D**, following page, for approved additives.
- Anti-icing additives are approved under the following circumstances:
  - conform to U.S. MIL-I-27686 specifications or equivalent
  - homogeneous mixture
  - concentration not in excess of 0.15% by volume.
- Shell ASA-3 anti-static additive, or equivalent, is approved in an amount to bring the fuel up to 300 conductivity units (300 picomhos per meter) if concentration does not exceed 1 mg by liter or 1 ppm.
- SOHIO Biobor JF biocide additive, or equivalent, is approved for use in the fuel at a concentration not to exceed 20 ppm of elemental Boron.

Approved Fuels

- See **Table 2-D**, following page, for approved fuels.

Fuel Asymmetry

- Do not deliberately fuel only one wing.

Fuel Pressure

Minimum Fuel Pressure Warning . . . . 4.5 PSIG

Jet B or JP-4 Takeoff Envelope

- See Takeoff and Landing Operational Limits, this chapter.

LO FUEL Light

- The LO FUEL annunciator illuminates when one feeder tank contains no more than 300 lbs of fuel.
- Do not attempt a go-around with feeder tank level below 100 lbs.
- If the wing tanks are empty, do not exceed 14° attitude for longer than 20 seconds.

Pressure Refueling

Maximum Pressure . . . . 50 PSI

Unusable Fuel

- The fuel remaining in the tanks when the fuel quantity indicators read zero is not usable in flight.
- The amber area of the fuel quantity indicators, 0 to 300 lbs, is a LO FUEL caution range.

X-Feed and Rear Tank Intercom Valves

- These valves must be closed during takeoff.
- If the type of fuel used is Jet B or JP-4, the X-FEED valve must be opened whenever the flight is made at an altitude for which the operation of the engine with a failed booster pump is not guaranteed.

Fuel Specification	Freezing Point (°C)	Additives		NATO Code
		Anti-Ice	Anti-Static	
EMS 53111 (Kerosene)				
ASTM D 1655 – Jet A	-40	*	*	–
CAN 2-3.23 – Jet A	-40	*	With	–
EMS 53112 (Kerosene)				
ASTM D 1655 – Jet A1	-47	*	*	–
CAN 2-3.23 – Jet A1	-47	*	With	–
DERD 2494 – AVTUR	-50	Without	*	F35
DERD 2453 – AVTUR/FSii	-50	With	*	F34
MIL-T-83133 – JP-8**	-50	With	*	F34
AIR 3405C	-50	Without	*	F35
AIR 2405C	-50	With	*	F34
CAN 3GP23	-50	*	*	–
EMS 53113 (Wide Cut Type)				
ASTM D 1655 – Jet B	-50	*	*	–
CAN 2-3.22 – Jet B	-50	*	With	–
MIL-T-5624 – JP-4**	-58	With	*	F40
AIR 2407B	-58	With	*	F40
DERD 2486 – AVTAG	-58	Without	*	–
DERD 2454 – AVTAG/FSii	-58	With	Without	F40
CAN 2-3.33	-58	With	With	F40
EMS 53116 (High Flash Point Type)				
AIR 3404C	-46	Without	*	F43
AIR 3404C	-46	With	*	F44
DERD 2497 – AVCAT	-46	Without	Without	F43
MIL-T-5624 – JP-5**	-46	With	Without	F44
DERD 2452 – AVCAT/FSii	-46	With	Without	F44
CAN 3GP24	-46	Without	*	F43
CAN 3GP24	-46	With	*	F44

Table 2-D; Approved Fuels

* Check information with the fuel supplier.

** JP-4 and JP-5 fuels are approved, but not recommended; if these fuels are in the system, the fuel heater may cause a vapor lock following a rapid power reduction. JP-4, JP-5, and JP-8 fuels have anti-icing additive preblended by the refinery. See the SimuFlite Technical Manual Fuel System chapter for more information.

Hydraulics

Airspeed Limitation

Hydraulic System 1 or 2 Failure . . . . 260 KTS/0.76 M

Approved Hydraulic Fluids

- The only hydraulic fluid approved for use must conform to the MIL-H-5606B/C specification.

Ice and Rain Protection

CAUTION: If ice has already started to accumulate, turn on the ignition system (start selector switches to AIRSTART) prior to selecting the engine anti-icing systems on; turn on the engine anti-ice systems one after the other with a time delay of no less than 30 seconds. Wing anti-icing can then be switched on.

Engine Anti-Ice (Ground or Flight)

- Engine anti-ice must be on when total air temperature is below +5°C and icing conditions are anticipated.
- Engine anti-ice must be off when total air temperature is above +10°C.

N_1 Settings

- For adequate performance of wing and engine anti-icing systems, the N_1 speed of the operative engines must not be lower than the minimum values shown in **Table 2-E**.

Phase of Flight	% N_1			
	at -30°C OAT	at -20°C OAT	at -10°C OAT	at -5°C OAT
In Flight – Minimum Recommended	76 78	73 75	67 69	62 64
Approach	69	69	69	64
One Engine	88	85	79	74

Table 2-E; Engine Settings for Anti-Ice

Windshield Electrical Heating

- The PILOT and COPILOT WINDSHIELD control switches must not be selected to the MAX position except in flight and then only if the NORM position is not sufficient in icing conditions.

Wing Anti-Ice (Flight Only)

- Must be on in flight when total temperature is below +5°C and when icing conditions are anticipated.
- Wing anti-ice must be off when total temperature is above +10°C.
- Do not operate on the ground.

> **CAUTION**: It is strictly forbidden to depress the brake pedals prior to touch-down.

> **CAUTION**: If red lights of main landing gear remain on when retracting during icing conditions, ice may hinder the up-latching of main landing gear. Attempt gear retraction three times to clear ice; if unsuccessful, speed must not exceed V_{LO} (190 kts) and fuel consumption can be increased by 33% at maximum.

> **NOTE**: The OIL 1 and OIL 2 annunciators illuminate for oil pressures below 25 PSI or if chips are detected.

> **CAUTION**: If a new type of fuel or a mixture of fuel is used, adjust the engine computer accordingly to preserve both the starting characteristics and the acceleration and deceleration performance characteristics of the engine.

Landing Gear

Brake Pedals

Observe the Caution at left.

Non-Latching of Gear in Icing Conditions

Observe the Caution at left.

Nosewheel Tire

- The nose wheel must be equipped with a chined tire.

Oxygen

- Above FL410, each passenger must wear an oxygen mask secured to the face and connected to the oxygen system.

Pneumatic and Pressurization

Maximum Cabin Pressure Altitude . . . . 8,000 FT

Maximum Differential Pressure . . . . 9.1 PSI

Powerplant

Approved Oils

- AiResearch Manufacturing Co. of Arizona EMS 53110, Type II.

Engine Synchronizer

- Engine synchronization, if installed, must not be used during take-off, go-around, and landing.

Fuel Computers

- Must be operative for takeoff.

Oil Consumption

Maximum . . . . 0.05 GPH

Oil Pressure Range (Minimum to Maximum)

Takeoff Thrust . . . . 38 TO 46 PSI

Maximum Continuous Thrust . . . . 38 TO 46 PSI

Idle . . . . 25 TO 46 PSI

Transient (Maximum) . . . . 55 PSI FOR 3 MINUTES

Oil Temperature

Maximum Sea Level to 30,000 Ft . . . . 113°C

Maximum Above 30,000 Ft . . . . 132°C

Maximum Transient (All Altitudes) . . 140°C FOR 2 MINUTES

Minimum for Start . . . . -54°C

Operating Limits

- Observe the limits shown in **Table 2-F**.

Condition	N_2 % RPM	N_1 % RPM	ITT (°C)	Time Limit
Starting	—	—	860	—
Takeoff	100	100	—	—
	—	—	860	5 Minutes
Maximum Continuous	100	100	832	30 Minutes
Transient	103	103	—	1 Minute
	105	105	—	5 Seconds
Ground Start/Starter Assist Airstart from 10% N_2 to Lightoff	—	—	—	10 Seconds
Ground Start from Lightoff to Idle	—	—	—	50 Seconds
Windmilling Airstart from Windmilling N_2 to 60% N_2	—	—	—	25 Seconds

Table 2-F; Powerplant Operating Limits

Thrust Ratings (Uninstalled, Sea Level, 86°F)

Takeoff . . . . 3,230 LBS

Maximum Continuous . . . . 2,966 LBS

Reduced Thrust Takeoff – Supplement No. 4

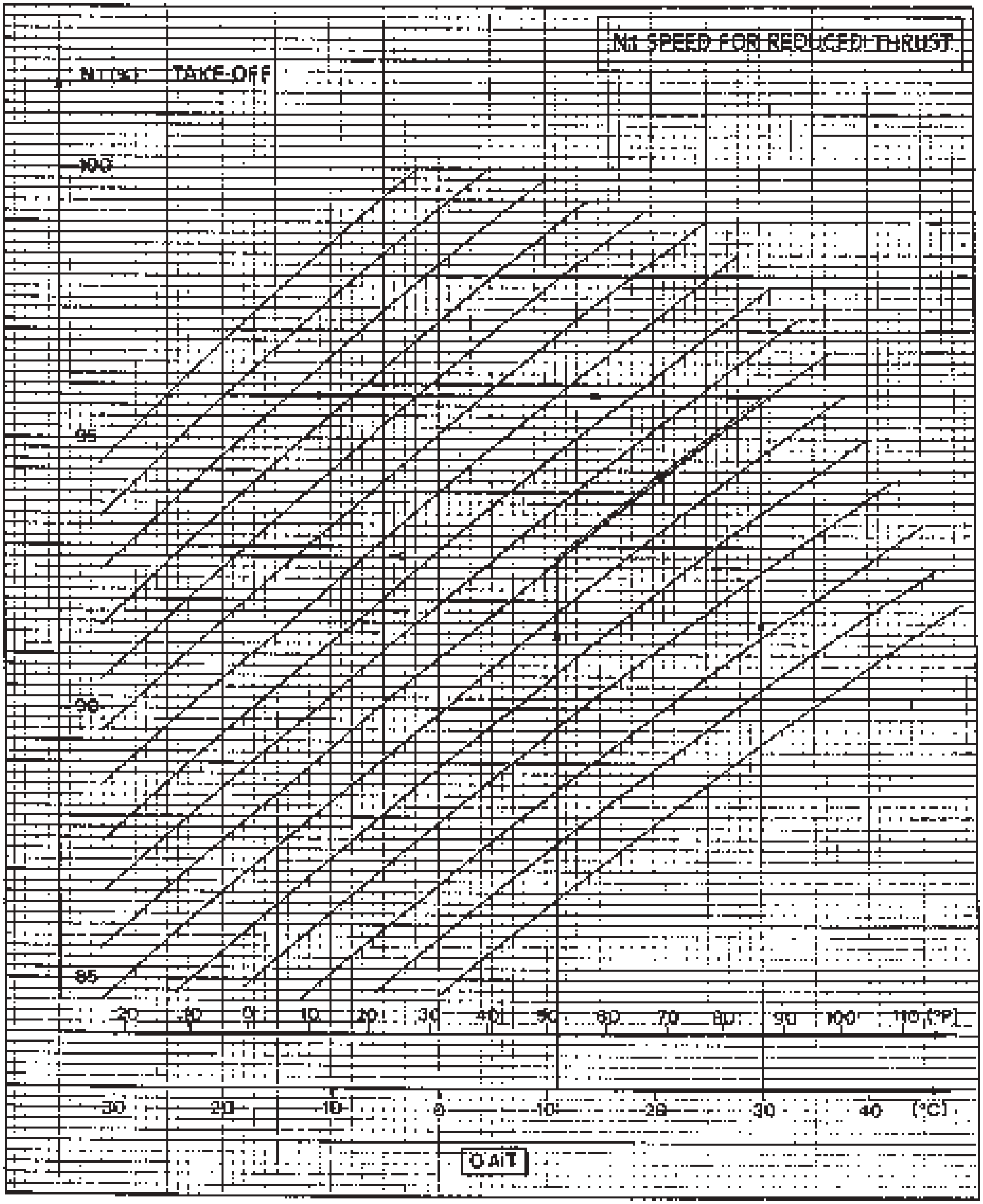
- Restrict the use of reduced thrust to those conditions where the actual takeoff weight is lower than the maximum takeoff weight limited by the maximum takeoff thrust performance.
- N_1 speed reduction must not exceed 5% below the rated takeoff thrust N_1 speed (such speed reduction corresponds to a thrust reduction of approximately 20%).
- The assumed temperature computed with this procedure must not exceed the upper limit normally observed and must not be less than the flat rating temperature of the takeoff thrust setting normally observed.
- Reduced thrust N_1 values must be based on the assumed temperatures (**Figure 2-8**).
- Use reduced thrust only on smooth, hard-surfaced runways, without snow, ice, slush, or water.
- Do not use reduced thrust if:
  - the anti-skid system is inoperative
  - the engine or engine and wing anti-icing system is on during takeoff
  - the aircraft is operated under an MEL or CDL condition related to powerplant installation or having an effect on performance.
- The use of clearways and stopways is not permitted.

Thrust Reversers

- Thrust reversers are approved for ground use only.
- The fuel computer must be on and operational for thrust reverser use.
- At power levels above idle, limit thrust reverser use to 30 seconds maximum with a 10-minute cooling period.
- Limit thrust reverser use to 60 seconds maximum in any 30-minute period.
- Asymmetric thrust reverse is limited to dry, hard-surfaced runways with operational steering.
- Do not use the thrust reversers to back up the aircraft.
- For a ground check of the throttle snatch mechanism, observe a maximum N_1 of 50%.
- If the throttle snatch mechanism is inoperative, the reverser must be bolted into the stowed position.
- Reverser life is limited to 20,000 hours.

Reduced Thrust Takeoff

Supplement No. 4



2-8

Electrical System

DC and AC Electrical Systems

Data Summaries

Power Source	Batteries (2) 24/26V DC, 23 amp hour (20-cell) 22/24V DC, 23 amp hour (19-cell) Engine generators (2) 28.5V DC, 350A, 10.5 kW Inverters (3) – 750VA 115V AC, 400Hz 26V AC, 400 Hz Ground power 28.5V, 1,000A maximum
Distribution	DC buses Battery Start Main A,B,C,D AC buses W bus (pilot) – 115V AC, 400 Hz Y bus (pilot) – 26V AC, 400 Hz X bus (copilot) – 115V AC, 400 Hz Z bus (copilot) – 26V AC, 400 Hz
Control	DC system switches Power selector Generator control Battery control Emergency power Auxiliary bus (load shed) Battery reset AC system switches Inverter control Standby inverter
Monitor	DC system Voltmeter/ammeter Battery temperature Annunciators GENE. 1/2 BATT HOT BAT AC system Voltmeter AC FAIL NO. 1/2 annunciators
Protection	Circuit breakers Current limiters Relays Generator control units

Fire Protection System

Engine Fire Protection System

Power Source	A bus Engine 1 detection circuit (FIRE 1 PULL light) B bus Engine 2 detection circuit (FIRE 2 PULL light) A bus Extinguisher shot 1 to either engine Battery bus Extinguisher shot 2 to either engine Teleforce cables on FIRE PULL handles Fuel shutoff valves
Distribution	Left and right engines
Control	TEST button HORN SILENCE button FIRE 1/2 PULL handles FIRE XTING 1/2 switches
Monitor	FIRE 1/2 PULL handles (red lights)
Protection	Fire warning test system Fuel firewall valves Fire bottle discharge device

Flight Controls

Primary Flight Controls

Power Source	Hydraulic System 1
	  Flight controls
	  Rudder Arthur Q
	Hydraulic System 2
	  Flight controls
	  Yaw damper
	Primary A bus
	  Aileron and elevator Arthur Q units
	  Normal stabilizer trim
	  Yaw damper
	C bus
	  Aileron trim
	  D bus
	    Emergency stabilizer trim
	    Rudder trim

Control	Control yoke Rudder pedals Trim switches Arthur Q low speed switch

Monitor	Annunciators
	  Q UNIT
	  RUD
	  AIL
	  STAB TRIM (takeoff warning)
	  GUST
	Hydraulic pressure gages
	Trim gages

Protection	Arthur Q system overstress protection Electric Arthur Q – automatic shutdown upon elevator/aileron Q failure Torque bar (secondary AFU) centers flight controls upon primary control linkage failure Yaw damp limiting to 1.5° at high speed Pitch trim limiting to 4° nose-up above 250 kts Rudder actuator pressure limiting (1,850 PSI permitted)

Secondary Flight Controls

Power Source	Primary A bus – normal trim Auxiliary D bus – emergency trim Load-Shed D bus – rudder trim
Control	Control yoke trim switches AP DISC switch on control yoke STAB EMG switch on pedestal
Monitor	Trim gage STAB TRIM annunciator Audio warning (clacker)
Protection	4° cruise stop Trim limit switches

Slats/Flaps System

Power Source	Hydraulic System 1 (normal mode) Inboard/outboard slats Hydraulic System 2 (emergency slats mode [standby]) Outboard slats extension only Hydraulic Systems 1/2 (stall protection mode [automatic] Outboard slats automatic extension Primary B bus Emergency slats Auxiliary C bus Flap position indicator system Auxiliary D bus FLAP CONTROL CB Flaps motor
Control	SLATS/FLAPS handle EMERG SLATS switch
Monitor	Slat/flap position indicators FLAP ASYM annunciator Flap overspeed aural warning Stall aural warning Slat configuration agreement lights (red/green)

Airbrakes

Power Source	Hydraulic System 1 Primary A bus
Control	Airbrake handle
Monitor	AIRBRAKE configuration light (amber) AIRBRAKE annunciator (red)

Fuel System

Power Source	A bus Left FUEL QTY gage No. 1 boost pump No. 1 jet pump B bus Right FUEL QTY gage No. 2 boost pump No. 2 jet pump C bus Intercom valve Crossfeed valve Fuel counter Fuel flow gages
Distribution	L/R wing tanks L/R feeder tanks NACA scoops (venting system) Boost pumps Jet pumps Intercom valve Crossfeed valve Gravity feed Suction feed Single point refueling system Gravity refueling Pylon valves
Control	TRANSFER switches REAR TANK INTERCOM knob BOOSTER PUMP switches X-FEED knob TOT/REAR TANK switch Feeder tank high/low level float switches Fueling valves/float valves Fueling test valve
Monitor	FUEL QTY gages FUEL □°C gage FUEL P1/P2 annunciators LO FUEL annunciator
Protection	Feeder tank high/low level switches NACA vents Transfer switches

Hydraulic Systems

Power Source	Engine-driven pumps (2) Main bus Standby electric pump power B bus Standby electric pump control HYDR QTY gages HYDR PSI gages Primary A bus System annunciators
Distribution	System 1 Rudder, elevator, and aileron servo-actuators Rudder Arthur Q unit Normal (inboard/outboard) slats Airbrakes Landing gear Normal braking System 2 Rudder, elevator, and aileron servo-actuators Yaw damper Emergency (outboard) slats Nosewheel steering Emergency and parking brakes Thrust reversers
Control	ST-BY PUMP switch (standby pump)
Monitor	HYDR QTY/PSI gages Annunciators HYD 1/2 HYD.TK1/TK2 ST-BY PUMP P.BRAKE Hydraulic reservoir sight gages Parking brake accumulator pressure switch
Protection	Circuit breakers Hydraulic system pressure relief valves Reservoir air pressure relief valves

Ice and Rain Protection

Engine/Wing Anti-Ice System

Power Source	Engine HP bleed air A bus – left engine $P_{t2}T_{t2}$ B bus – right engine $P_{t2}T_{t2}$ Wing HP/LP engine bleed air A bus – wing anti-ice valve
Distribution	HP bleed air Engine nacelle anti-ice valves Nacelle anti-ice valves Engine/nacelle pressure switches HP/LP bleed air Wing anti-ice valve Wing leading edges
Control	ENG 1/ENG 2 ANTI ICE switches WINGS ANTI ICE switch
Monitor	ENG 1/ENG 2 lights WINGS light
Protection	Circuit breakers

Pitot/Static and Windshield Anti-Ice System

Power Source	A bus L/R windshield wipers Pilot windshield heat Pilot pitot/static heat D bus Copilot windshield heat Copilot pitot/static heat
Distribution	Windshield temperature regulators
Control	PILOT/COPILOT PITOT switches A/A switch (**if installed**) PILOT/COPILOT WINDSHIELD switches Wiper switches
Monitor	Window heat X.FR light AMP meter PITOT 1/PITOT annunciators
Protection	Circuit breakers Windshield temperature regulators

Landing Gear/Brakes/Steering Systems

Landing Gear System

Power Source	A bus – gear selector and handle light B bus – position lights Hydraulic System 1 – landing gear actuators
Control	Landing gear selector Emergency gear T-handle Horn silence button Landing gear handle Override pushbutton (overrides ground down-lock device; its use is discouraged)
Monitor	Hydraulic System 1 pressure/quantity gages HYD.1 annunciator Down-and-locked lights (3 green) LDG GEAR MOVING lights (3 red) Gear handle light (blinking red) Warning horn
Protection	Mechanically controlled emergency gear valve Ground down-locking device Nose gear centering after takeoff Proximity (squat) switches

Proximity (Squat) Switches

Power Source	Primary A bus

Distribution	Nose gear switch
	  Gear retraction protection
	Left main switch
	  Airbrake warning
	  Battery blower
	  Gear retraction protection
	  Freon condenser blower
	  Pressurization controller
	  Stall system 1
	  Thrust reversers
	Right main switch
	  Conditioning valve
	  Hydraulic standby pump
	  STAB TRIM annunciator
	  Stall system 2

Control	Automatic via extension/compression of three landing gear struts

Brakes/Nosewheel Steering System

Power Source	A bus – nosewheel steering C bus – anti-skid Hydraulic System 1 – normal brakes Hydraulic System 2 Emergency brake Park brake Accumulator Nosewheel steering
Control	Brake pedals PARK BRAKE lever First detent – emergency brakes Second detent – parking brake Anti-skid switch Anti-skid test button Nosewheel steering handwheel
Monitor	Hydraulic Systems 1/2 pressure/quantity gages Annunciators HYD 1/2 (amber) ANTI-SKID BRAKE L/R (amber) BRAKE (red) P. BRAKE (amber)
Protection	Steering prevention via gear-extend microswitches

Lighting Systems

Power Source	28V DC A and B buses (non-shedding) C and D buses (load-shedding) 115V AC, 400 Hz W bus (non-shedding) X bus (load-shedding)
Control	Switches and rheostats Flight deck Passenger individual lights Entrance and cabin Exterior lights Gear handle (landing light)
Monitor	Warning and advisory lights
Protection	Circuit breakers

Oxygen System

Power Source	Oxygen cylinder (1,850 PSI at 70°F)
Distribution	Crew/passenger oxygen masks Passenger oxygen system Therapeutic oxygen mask (EROS)
Control	Oxygen cylinder shutoff valve Crew masks (N/100% PUSH) Passenger oxygen control unit AUTO/OFF/MANUAL (Robertshaw) NORMAL/OVERRIDE/FIRST AID/CLOSED (EROS)
Monitor	Bottle pressure gage Cockpit oxygen pressure gage Bottle safety discharge disc
Protection	Bottle safety valve (2,500 to 2,700 PSI)

Pneumatic Systems

Pneumatic System

Power Source	LP/HP bleed air – either engine
Distribution	Air conditioning via sidewall ducts and cockpit distributors Wingshield defog outlets Cockpit footwarmer Emergency pressurization Outflow valve control pressure and vacuum
Control	HP BLEED switch COND'G VALVE switch Emergency pressurization valve Cabin temperature regulator Footwarmer defog valves Anti-ice switches Engine power setting
Monitor	ENG 1/2 anti-ice lights WINGS anti-ice light Annunciators COND O'HEAT HYD. TK. 1/2 CABIN (cabin pressure over 10,000 ft) DEICING (some aircraft) Cabin temperature gage (**if installed**)
Protection	HP check valves LP check valves Check valves – aft pressure bulkheads

Pressurization Systems

Power Source	HP/LP bleed air from either or both engines W bus (115V AC) (**aircraft with IDC controller**) A bus (28.5V DC) (**aircraft with ABG-SEMCA controller**)
Distribtion	Pressurized fuselage area
Control	CABIN ALTITUDE controller RATE knob PULL FOR BARO knob AUTO/MAN/DUMP pressurization mode selector UP/DOWN manual pressurization knob (cherry picker) HP BLEED switch COND'G VALVE switch
Monitor	CABIN annunciator (10,000 ft) Indicators Cabin rate of climb Cabin altitude Cabin differential pressure
Protection	Overpressuration controller (9.1 PSI) Squat switch (landing depressurization)

Freon Air Conditioning System

Power Source	Main bus via operating generator or GPU
Distribution	Air conditioning ducts
Control	Switches Freon system Auxiliary bus Pressure Temp regulation valve Start buttons 30-second timer
Monitor	Generator ammeter Cabin temperature gage
Protection	Suction pressure switches Discharge pressure switches Starter button shutoff Generator/GPU power source relay

Powerplant

Power Source	A bus – left engine N_1, N_2, oil pressure, oil temperature, boost pump, ignition, fire detection, fuel computer, fire XTING switch position 1 B bus – right engine N_1, N_2, oil pressure, oil temperature, boost pump, ignition, fire detection, fuel computer Auxiliary buses Fuel flow indicators and totalizer Battery bus Ignition backup Fire XTING switch position 2 Generators Direct backup power for engine computers (GEN 1, GEN 2)
Control	Thrust lever PRESS TO START buttons Switches IGNITER ON SPR START/STOP AIR/GROUND/MOTOR-START Fuel computer ENGINE 1/ENGINE 2
Monitor	Engine operation Fuel computer Indicators N_1 N_2 Oil temperature Oil pressure Fuel flow Annunciators OIL 1/2 ENG. C1/C2 FUEL P1/P2 GENE. 1/2 IGNITER ON (2)
Protection	Computer ON Flat rating - 3,230 lbs thrust N_1, N_2, 100% EGT limiting 860° Ultimate overspeed protection N_1 – 109%; N_2 – 110% Mechanical Overspeed 105%

Thrust Reversers

Power Source	Hydraulic System 2 pressure **Aircraft without SB 0154** A bus (28V DC) No. 1 battery **Aircraft with SB 0154** A bus Main bus
Control	No. 1 battery switch (**aircraft without SB 0154**) HORN TEST button EMERGENCY STOW switch Main throttle lever Thrust reverser throttle lever
Monitor	Reverser warning horn Reverser TRANS/REV lights Hydraulic System 2 pressure gage Battery voltmeter (Main bus voltage)
Protection	Secondary latch Left main squat switch Throttle auto retard (Snatch) Reverser maximum RPM limit stop

Operating Procedures

This section presents four individual chapters of flight operations: preflight inspection, expanded normal procedures, standard operating procedures (SOP), and maneuvers. Although they are addressed individually in this manual, their smooth integration is critical to ensuring safe, efficient operations.

The **Preflight Inspection** chapter illustrates a step-by-step exterior inspection of the aircraft. Preflight cockpit and cabin checks are also discussed.

The **Expanded Normal Procedures** chapter presents checklists for normal phases of flight. Each item, when appropriate, is expanded to include limitations, cautions, warnings, and light indications.

The **Standard Operating Procedures** chapter details Pilot Flying/Pilot Not Flying callouts and verbal or physical responses.

The **Maneuvers** chapter pictorially illustrates common and emergency profiles. Additionally, written descriptions are included for most phases of flight with one or both engines operating.

Preflight Inspection

Chapter 3A

An essential part of the preparations made before any flight is the preflight inspection. During this inspection, the aircraft's flight readiness is verified. A thorough initial preflight is a later benefit in that subsequent inspections that day can be carried out in less time.

No detail should be overlooked during the first preflight of the day. Abnormal conditions (e.g., low tire pressure) must be corrected before flight. Even minor discrepancies should be fixed before flight to ensure safety.

The preflight inspection begins inside the aircraft where the initial cockpit setup and essential functions are verified. The actual exterior inspection follows; it begins at the left side of the nose, proceeds clockwise around the aircraft, and ends at the cabin door. Lastly, the pilot returns to the interior of the aircraft to check the passenger compartment, baggage area, and cockpit for flight readiness.

Table of Contents

Checklist Usage

Normal Procedures

Tasks are executed in one of two ways:

- as a sequence that uses the layout of the cockpit controls and indicators as cues i.e., “flow pattern”
- as a sequence of tasks organized by event rather than panel location; e.g., After Takeoff, Gear – RETRACT, Yaw Damper – ENGAGE.

Placing items in a flow pattern or series provides organization and serves as a memory aid.

A challenge-response review of the checklist follows execution of the tasks. The PNF calls the item, and the appropriate pilot responds by verifying its condition; e.g., Engine Anti-Ice (challenge) – ON (response).

Two elements are inherent in the execution of normal procedures:

- use of either the cockpit layout or event cues to prompt the correct switch and/or control positions
- use of normal checklists as done lists.

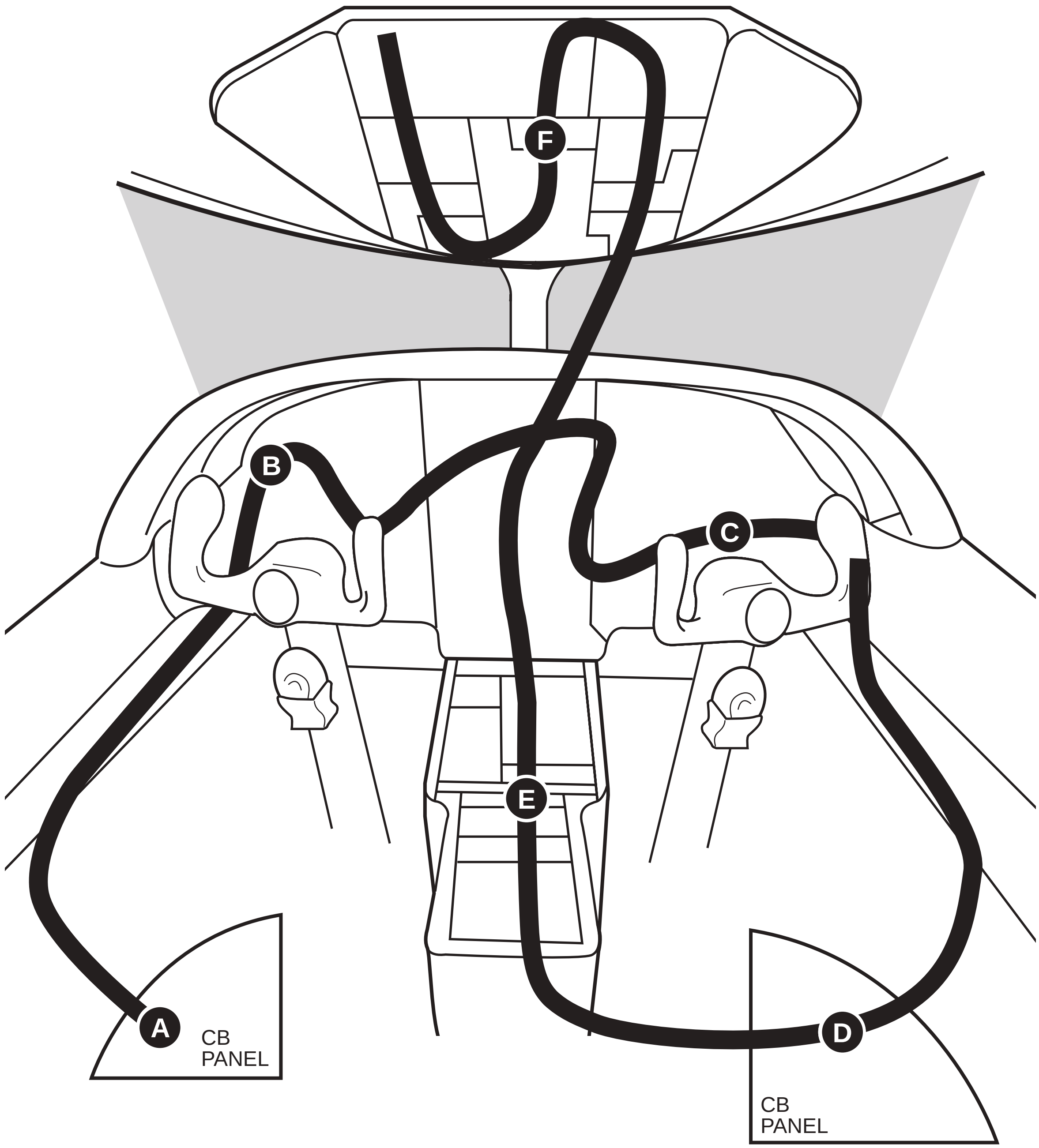
Abnormal and Emergency Procedures

Flow patterns will only be used for immediate recall items; the remaining tasks shall be done using a challenge-response (i.e., “do” list) method.

Cockpit Inspection and Setup

The cockpit inspection and setup is the first step in the preflight inspection. Except for the battery checks, the procedures in this checklist do not require the use of electrical power.

Cockpit Inspection and Setup



A Pilot's Circuit Breaker Panel and Side Console

Circuit Breakers . . . . CHECKED/IN

Verify that all circuit breakers are set. Reset any open circuit breakers after checking system status in the maintenance log.

Windshield Demist/Floor Heat . . . . COLD

Normally these controls are left in the cold position to reduce bleed air demands during engine start.

Oxygen Mask . . . . CHECKED/SET

Remove the mask from the box; perform an operational check of the harness inflating mechanism by squeezing the control plates. Push the red oxygen test button and listen for oxygen flow. Verify operation of the mask microphone.

B Pilot's Instrument Panel

Pitot/Static Selector . . . . NORMAL

Leave the pitot/static selector in NORMAL. In EMERGENCY, the system uses the static port in the nosecone.

Audio Panel . . . . SET

For normal use, verify that the VHF1 audio, VHF1 microphone, SPK (speaker), and ST (side tone) buttons are depressed. Select HAND or BOOM on the microphone selector (if installed). Set loudspeaker volume control to desired level.

Compass Switch . . . . GUARDED/MAG

Set the compass switch to MAG so the directional gyro synchronizes with magnetic heading.

Airspeed Bugs . . . . SET

Set the airspeed indicator bugs to the computed airspeeds on the TOLD card.

Course and Heading Knobs . . . . PUSHED IN

On aircraft **with Collins APS 105 system**, push the COURSE and HDG knobs on the course indicator in.

Altimeter(s) . . . . SET TO FIELD ELEVATION

Set the altimeter to field elevation. Also set the standby altimeter (if installed). The altimeters should agree within 75 ft.

Altitude Alerter(s) . . . . SET

Set the altitude preset/alerter to the initial departure altitude.

Standby Horizon . . . . TESTED/OFF

Test the horizon, then cage the unit to prevent damage when the aircraft is powered up.

Thrust Reverser Emergency Stow Switches . . . . DOWN/GUARDED

Verify that both switches are normal (down) and the guards cover the switches.

Fuel Quantity Selector . . . . TOTAL

Set the fuel quantity indicator selector to TOTAL.

Fire Handles . . . . IN

Verify that both fire handles are in. Pulling a handle closes the fuel shutoff valve. Exercise the handles periodically.

Fire Extinguisher Switches . . . . 0 POSITION

Verify that the switches are in the 0 position (down) and safety wired.

C Copilot's Instrument Panel and Side Console

Fuel Counter . . . . ZEROED

Zero out the fuel counter by rotating the knob on the lower edge of the indicator.

Gear Handle . . . . DOWN/LATCHED

Verify that the landing gear handle is down and the latch is in position.

Airspeed Bugs . . . . SET

Set the airspeed indicator bugs to the values on the TOLD card.

Pressure Controller . . . . SET

Set the pressure control knob to the center detent (-450 FPM) and the barometric pressure to 29.92. Set the altitude selector to the planned flight altitude.

Passenger Oxygen Controller . . . . AUTO

Set the passenger oxygen controller to AUTO. In AUTO, the system provides automatic operation based on cabin altitude. Check for a minimum of 965 PSI on oxygen gage (minimum for dispatch – ferry only). Pressure requirements vary depending on flight profile, passenger number, and flight duration.

Audio Panel . . . . SET

For normal use, verify that the VHF1 audio, VHF1 microphone, SPK (speaker), and ST (side tone) buttons are depressed. Select HAND or BOOM on the microphone selector (if installed). Set volume control to desired level.

Compass Switch . . . . GUARDED/MAG

Set the compass switch to MAG so the directional gyro synchronizes with magnetic heading.

Pitot/Static Selector . . . . NORMAL

Set the selector to NORMAL. In PANEL ONLY, pressure is supplied to the panel instruments only and all other supplied equipment is inoperative.

Oxygen Mask . . . . CHECKED/SET

Remove the mask from the box; perform an operational check of the harness inflating mechanism by squeezing the control plates. Push the red oxygen test button and listen for oxygen flow. Periodically verify operation of the mask microphone.

D Copilot's Circuit Breaker Panel

Circuit Breakers . . . . CHECKED/IN

Verify that all circuit breakers are in. Reset any open circuit breakers after checking system status in the maintenance log.

E Pedestal and Center Instrument Panel

Emergency Gear Handle . . . . STOWED

Verify that the emergency gear handle is stowed.

Autopilot/Yaw Damper . . . . DISENGAGED/OFF

Verify that the autopilot and yaw damper are disengaged.

Emergency Slats . . . . GUARDED

Check the emergency slat switch to verify that it is off and guarded.

Slat/Flap Handle . . . . CLEAN

Check the slat/flap handle to verify that it is in the full forward position (CLEAN) and locked in the detent.

Power Levers . . . . CUTOFF

Verify that the power levers are in the full aft (cutoff) position. A start cannot be initiated with the power levers out of cut-off.

Airbrake Handle . . . . IN

Check the airbrake handle to ensure that it is in the full forward (IN) position.

Trim Circuit Breaker . . . . IN

Verify that the trim circuit breaker is set.

Park Brake Handle . . . . SET

The handle is set to the middle detent to provide sufficient braking for 75% engine power settings. The handle contains a spring-loaded release that must be squeezed prior to moving from one detent to another.

Anti-Skid Switch . . . . ON

Verify that the anti-skid switch is on.

Standby Hydraulic Pump . . . . OFF

Turn the standby hydraulic pump off.

Freon/HP Bleed Switches . . . . OFF/CLOSED

Check that the Freon switch is OFF. Check that the HP bleed switch is in CLOSED to reduce engine bleed air requirements during engine start.

Pressurization Selector . . . . GUARDED/AUTO

Ensure that the pressurization selector switch is in AUTO and guarded.

Temperature Controller . . . . SET

Set the controller to the 12 o'clock position. This provides automatic temperature control with an approximate temperature of 72°F.

Radios . . . . OFF

Radar . . . . OFF

F Overhead Panel

Wiper . . . . OFF

Check that the copilot's windshield wiper switch is off.

Exterior Lights . . . . OFF

Verify that the anti-collision, nav, strobe, landing, taxi, wing ice, and other optional (logo, recognition, etc.) exterior lights are off.

Interior Lights . . . . OFF

Verify that the exit and cabin lights are off.

Seat Belts/No Smoking Switches . . . . PUSH

Push both switches so that the lights illuminate when power is connected.

Inverters (3) . . . . OFF

Check that the Standby, No. 1, and No. 2 inverters are off.

Volt/Ammeter Selectors . . . . BAT/STD BY

Set the DC volt/ammeter selector to BAT to read battery voltage. Set the inverter voltmeter selector to STD BY because it is the first inverter checked.

DC Power Selector . . . . NORMAL

The three position (LOW TEMP START/NORMAL/EXT POWER) switch is set to NORMAL for battery powered engine starts.

Fuel Computer Switches . . . . ON

The fuel computer switches are normally left on unless damage from an unreliable power source is anticipated (GPU).

Rear Tank Intercom/Crossfeed . . . . CLOSED

Verify that the rear tank intercom and crossfeed switches are in the closed (vertical) position.

Fuel Transfer Switches . . . . GUARDED

Verify that the fuel transfer switches are in the guarded position.

Booster Pumps . . . . OFF

Verify that both booster pump switches are off.

Start Selector Switches . . . . GRD START

Check that start selector switches are in the GRD START (middle) position. A start cannot be initiated in any other position.

Wiper . . . . OFF

Check that the pilot’s windshield wiper switch is off.

Pitot Heat/AOA . . . . OFF

Check that the pitot heat (pilot and copilot) and angle-of-attack (AOA) heat switches are off.

Side/Windshield Heat . . . . OFF

Check that the side, pilot, and copilot windshield heat switches are off.

Anti-Ice Switches . . . . OFF

Check that the ENG 1, ENG 2, and WINGS anti-ice switches are off. Significant damage can occur if wing anti-ice is activated on the ground.

Generators/Auxiliary Bus . . . . ON

Verify that the generator No. 1, No. 2, and auxiliary bus switches are on. A start cannot be initiated with the appropriate generator switch in the off position.

Batteries . . . . CHECKED/ON

- No. 1 battery ON, 23 volt minimum voltage checked. BATT annunciator check illuminated.
- No. 2 battery ON, BATT annunciator extinguished.
- No. 1 battery OFF, 23 volt minimum voltage on battery No. 2 checked. BATT annunciator illuminated.
- No. 1 battery ON, 23 volt minimum voltage with both batteries ON, BATT annunciator extinguished.

Do not attempt a normal battery start with less than 23 volts indicated.

Leave the battery switches on to complete the following checks.

Fuel Quantity . . . . CHECKED/SET REAR

Check that total fuel quantity is adequate for the planned flight or note the quantity to calculate the fuel order.

P Brake Annunciator . . . . EXTINGUISHED

Verify that the parking brake annunciator is extinguished. If not, motor the right engine to raise the accumulator pressure to extinguish the light or chock the aircraft prior to starting the right engine.

Engine Computer Lights . . . . EXTINGUISHED

Check that the two engine computer lights are extinguished. Illumination of a light indicates fuel computer malfunction.

Battery Switches . . . . OFF

Turn off the batteries.

Clock . . . . SET

Set and wind the clock (if installed) on the pilot's and copilot's control yokes.

Exterior Walkaround

Unfold the preflight inspection diagram on the following page for ease of reference. Note that each segment of the preflight inspection is identified by letters A through M. Subsequent pages provide sequenced checklists of each preflight inspection segment. Large locator photos identify the general location of each inspection. Adjacent photos detail the checklist items. Photos read left to right.

Limitations and specifications are noted if relevant to the checklist.

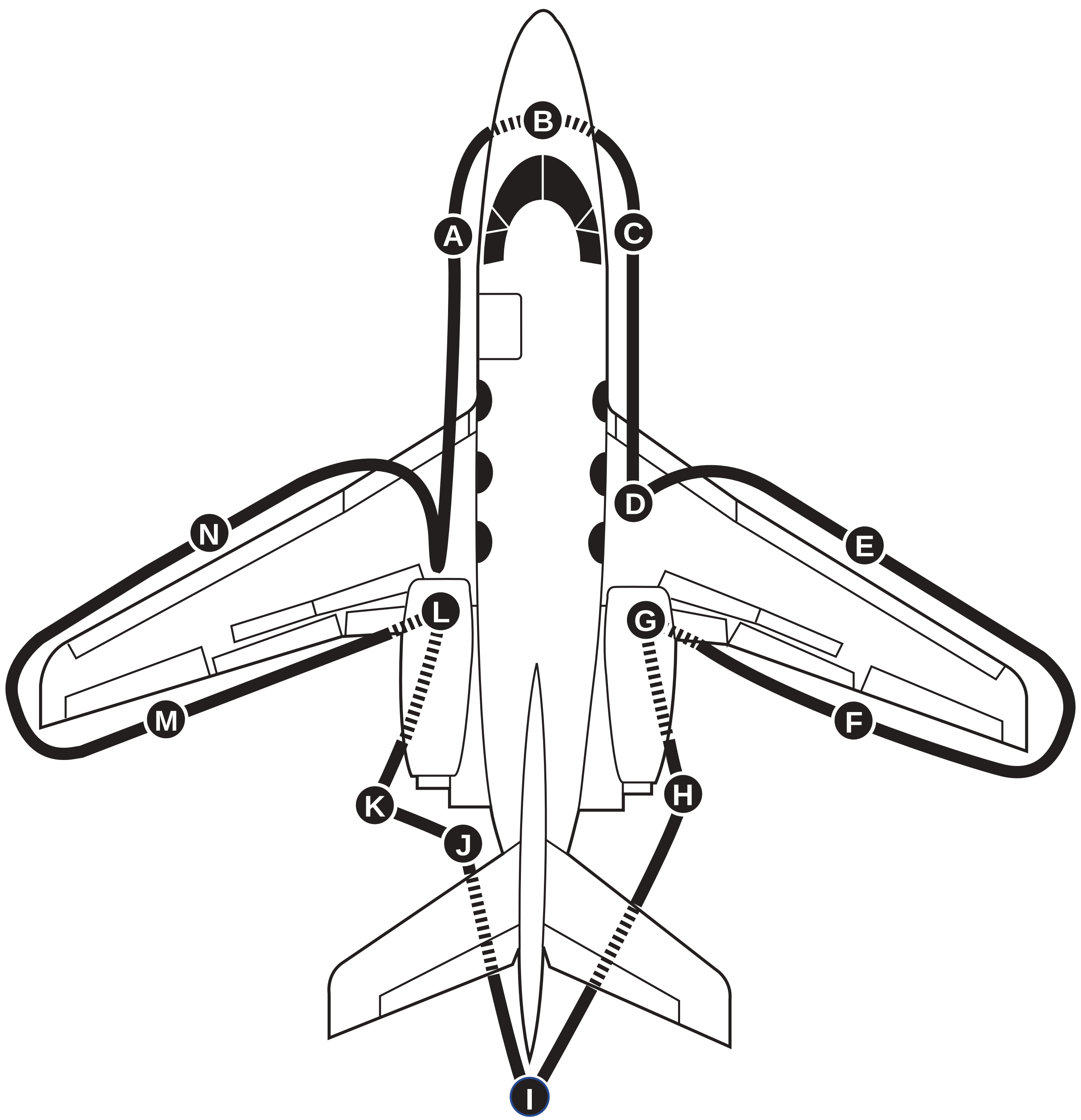
Before starting the exterior inspection of the aircraft, obtain a flashlight, screwdriver, and bucket or other suitable container for disposal of fuel samples.

Exterior (General)

Make a general check for security, condition, and cleanliness of the aircraft and components. Check particularly for damage, fluid leakage, security of access panels, and removal of keys from locks. Remove all covers from the pitot tubes, static ports, probes, and engine inlets and exhausts.

Preflight Inspection Walkaround Path

Preflight Inspection Walkaround Path

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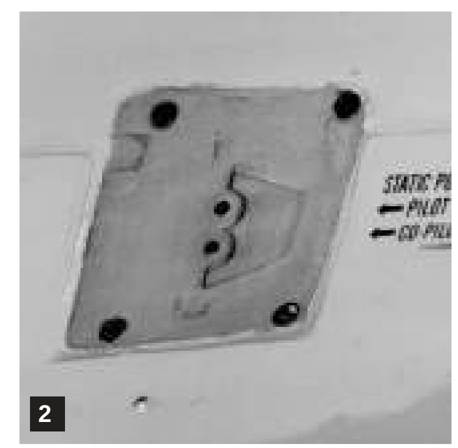

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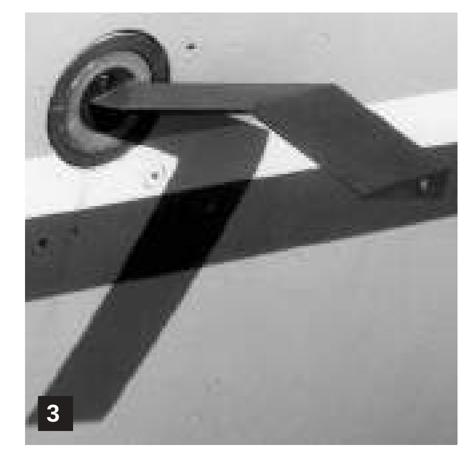
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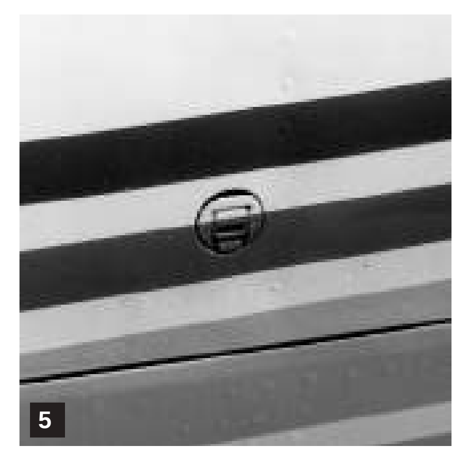
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Falcon 10/100
April 2000

A Left Forward Fuselage

1. Cabin Door: Check the condition of the cabin door seal for misalignment and pliability. Check the seal for cuts and tears.

2. Static Ports: Check the condition of the ports for cleanliness and freedom from obstructions.

3. Angle-of-Attack Vane: Check that the AOA vane moves freely and is free from obstructions. Leave the vane in the horizontal position.

4. Pilot's Windshield and Side Window: Check the general condition of the windshield and side window. Inspect for chips, cracks, and delamination.

5. Left Side Nosecone Latches: Check that the latches are secure and flush with the fuselage. Check that the nosecone is clean and free from damage.

6. Ram Air Temperature Sensor: Check that the sensor is clear and clean.

7. Left Pitot Tube: Remove the pitot cover and check the tube for cleanliness and freedom from obstructions.


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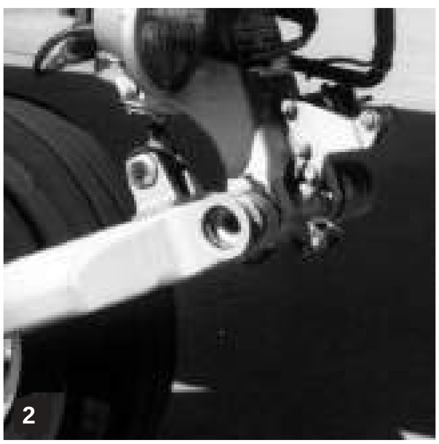
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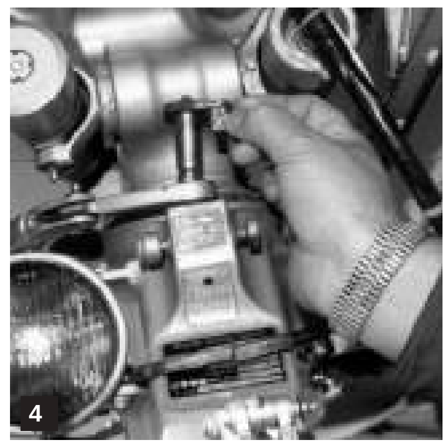
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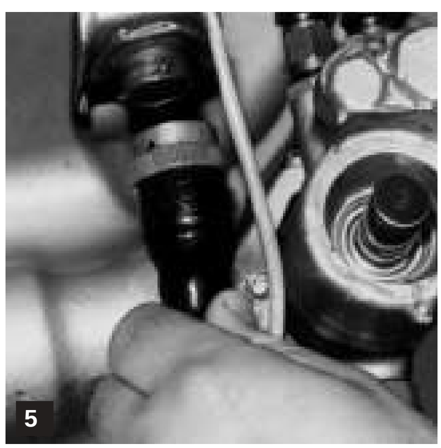
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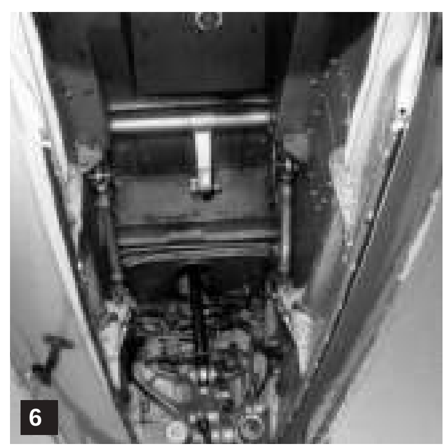
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B Nose Wheel and Wheel Well

1. Nose Gear Tire: Check for correct tire pressure. Inspect the tire for chine, irregular wear, delaminations, cuts or tears, and slip mark alignment. Inflate the tire with dry nitrogen only; never use oxygen or air. Normal tire pressure is 94 PSI.

2. Nose Strut: Examine the nose strut for normal extension. Strut extension height varies with ambient temperature. Normal strut extension at 68°F is approximately 2 $^1/_2$ inches. Consult the aircraft maintenance manual strut extension/temperature chart.

3. Taxi Light: Check the taxi light and cannon plug for general condition and security. Check the lens for any evidence of cracking or chipping. Check the condition of the bulb.

4. Nosewheel Steering Locking Pin: Verify that the nose-wheel steering locking pin is installed properly.

5. Nosewheel Steering Electrical Connection: Verify that the electrical connection is secure.

6. Nosewheel Well Doors: Check the overall condition of the doors and linkages.


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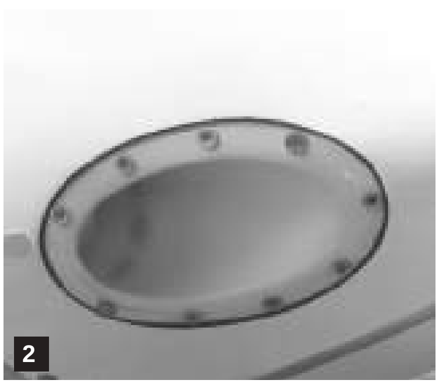
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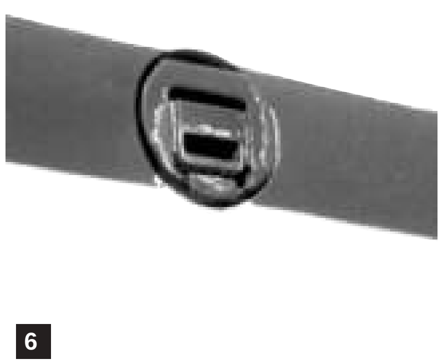
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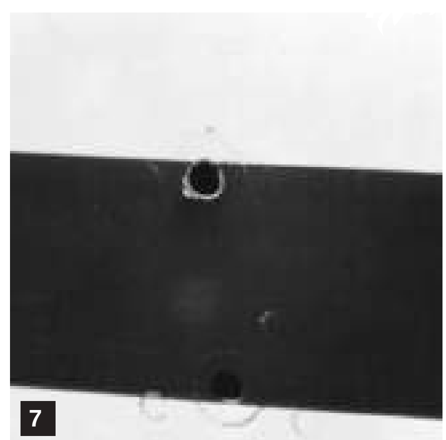
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C Right Forward Fuselage

1. Total Air Temperature Probe: Check the condition of the probe for cleanliness and freedom from obstruction.

2. Recognition Light: Check that the lens is not cracked or heat discolored. Check bulb condition.

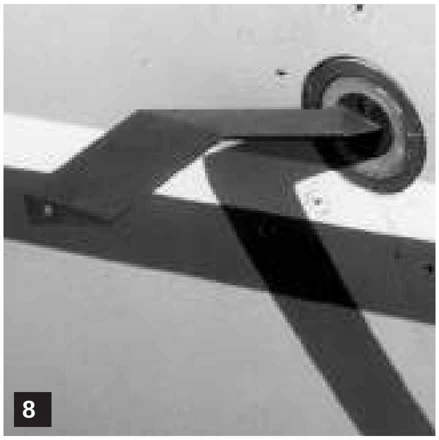
3. Right Pitot Tube: Remove the pitot cover and check the tube for cleanliness and freedom from obstructions.

4. Oxygen Filler Access Door: Verify that the oxygen valve is open, then open the door on the right side of the nose. Check the oxygen pressure gage for 1,850 PSI or minimum computed for flight. Close the door and verify that it is secure.

5. Oxygen Discharge Disc: Check that the oxygen discharge disc is present and intact.

6. Nosecone Latches: Verify that the latches are secure and flush with the fuselage.

7. Pressurization Static Port: Check that the static port cover is removed and that the port is clean and free from obstructions.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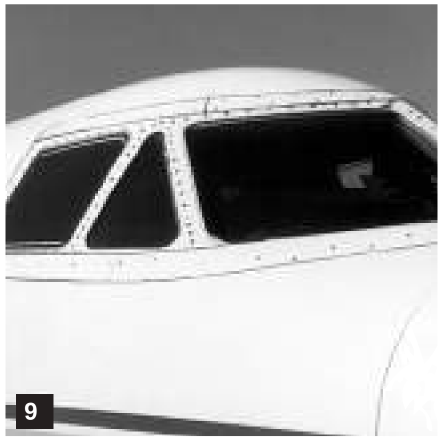
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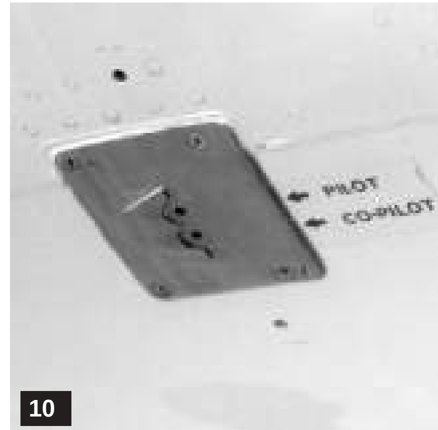
PILOT
CO-PILOT
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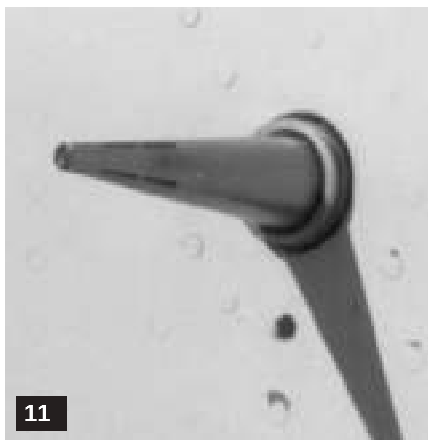
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C Right Forward Fuselage (continued)

8. Angle-of-Attack Vane: Verify that the AOA vane is unobstructed and free to move. Leave the vane in the horizontal position.

9. Windshield/Side Windows: Inspect the windshield and window for cleanliness. Check for cracking, chipping, and delamination.

10. Right Static Port: Check for condition, cleanliness, and freedom from obstruction.

11. Angle-of-Attack Probe (optional): Inspect the probe for cleanliness and freedom from obstructions. Verify that it moves freely.

12. Wing Leading Edge Light (optional): Check the light (wing ice light) for lens condition and bulb appearance.


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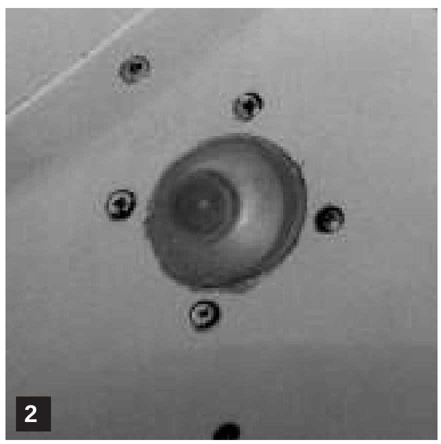
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D Right Fuselage and Engine Inlet

1. Bottom Fuselage, Antenna, and Anti-Collision Light: Check the fuselage underside for general condition and any sign of fluid leaks. Check the VHF 1 antenna for security, condition, and freedom from dents and cracks. Inspect the anti-collision light for security, lens condition, and bulb condition.

2. Emergency Exit Light: Check the emergency exit light on the bottom of the wing root for lens condition and bulb appearance.

3. Engine Inlet: Inspect the engine inlet for foreign objects and loose fasteners. Check the condition of the fan blades and inlet guides for nicks, cracks, and signs of damage. The P_{t2}/T_{t2} probe should be clean and undamaged.


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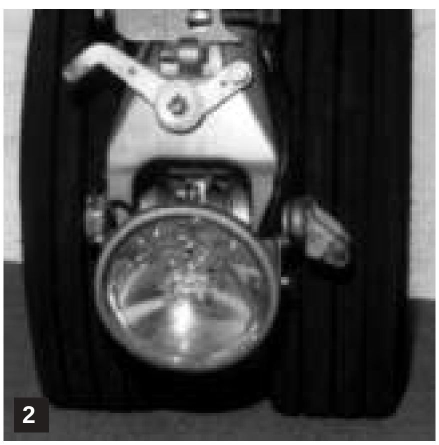
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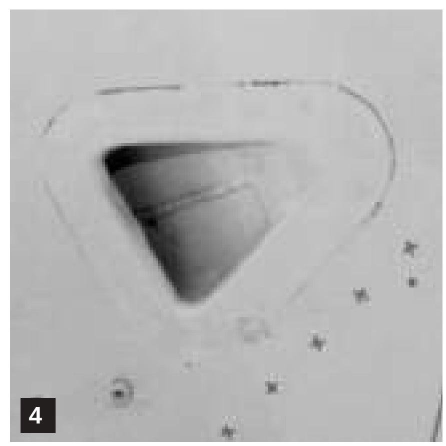
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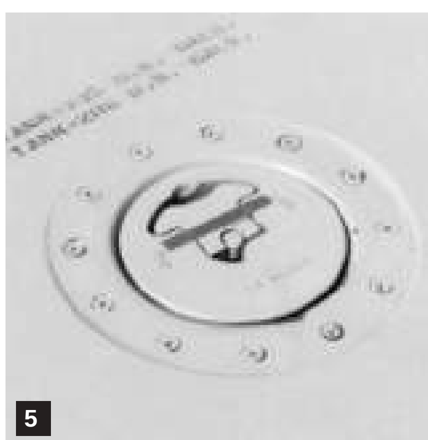
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E Right Wing

1. Emergency Exit: Ensure that the emergency exit is flush with the fuselage. Check that the red plexiglass cover over the emergency exit handle is in place.

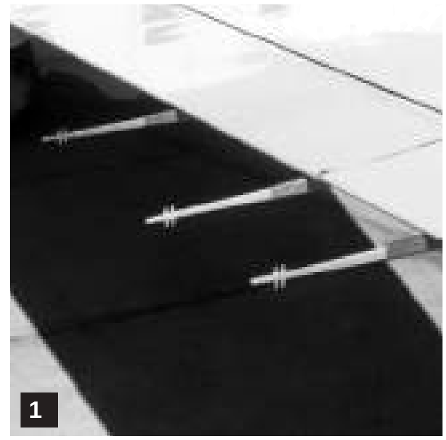
2. Landing Light: Check the light for security. Check the lens for cracks and signs of overheating. Check the condition of the bulb.

3. Leading Edge: Inspect the slats for general condition, security, as well as for dents or other damage. Check the wing fence for security, condition, and damage.

4. Wing Fuel Vent: Check the fuel vent on the underside of the wing for cleanliness, freedom from obstructions, and leaks.

5. Filler Fuel Cap: Check that the filler cap is properly secured and that the locking tab is facing aft with the tab flush with the wing surface.

6. Wing Tip and Navigation/Strobe Lights: Inspect the wing tip for damage. Check the navigation and strobe lights for lens damage, security, and any indication of a burned out bulb. If night flight is anticipated, perform an operational check of the navigation and strobe lights.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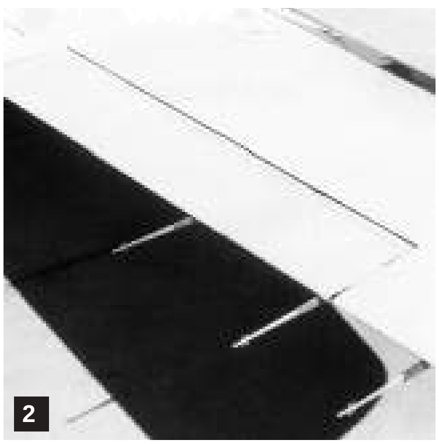
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F Right Wing Trailing Edge

1. Static Dischargers: Check that the static dischargers on the aileron and wing tip are present, secure, and undamaged and that the brushes are equal in length and fullness (if installed). Two different static dischargers are used on the Falcon 10/100. One consists of a three brush assembly; the other consists of a solid plastic unit with sharp points. The number of static dischargers used varies from aircraft to aircraft depending on modification status, operator preferences, and static discharger type.

2. Aileron: Inspect the aileron for damage and security.

3. Flaps: Check the condition and security of the flaps. Verify that the position of the flaps corresponds with flap handle position. Check the condition of all cables, actuators, and lines forward of the flaps, if extended.

4. Airbrakes: Check the condition and position of the airbrakes. Verify that the position of the airbrakes corresponds with airbrake handle position.

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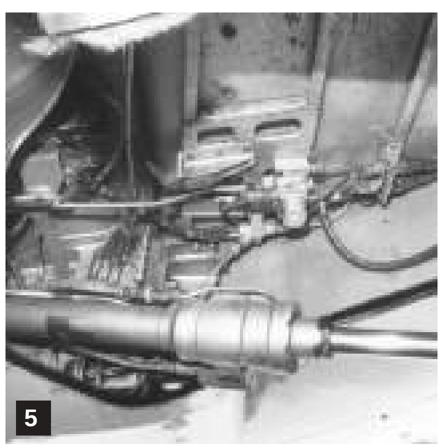

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G Right Main Gear

1. Wheel Embellisher: Check that no fasteners are missing from the embellisher.

2. Tires and Wheels: Check tires for proper inflation, abnormal wear, slip mark alignment, and other damage. Use only nitrogen to inflate the tires; never use dry air or oxygen. Inflation pressure depends on aircraft weight and service bulletin status. Check the wheel for dents, metal pickup on wheel surface, and other damage.

3. Brakes: Inspect the brakes for wear pin extension, leaks, damage, and signs of overheating. If the wear pin is recessed in the brake return box, excessive wear is indicated; maintenance is required before flight.

4. Strut: Check the strut for leaks and extension. Normal strut extension is 6 inches at 68°F; extension varies with ambient temperature. Consult the maintenance manual extension/temperature chart.

5. Wheel Well: Inspect the wheel well for general condition, security of hydraulic lines and cables. Check for indications of fluid leaks.

6. Fuselage Underside: Inspect the bottom of the fuselage for signs of leaks or damage.


PRESSURE REFUELING
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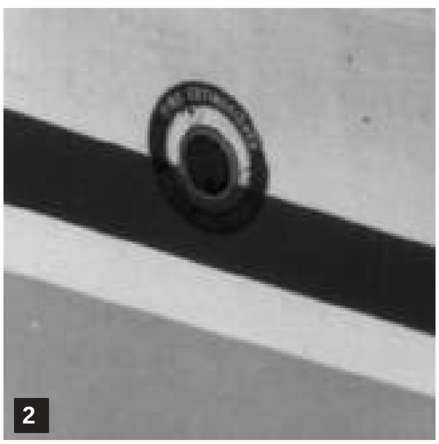
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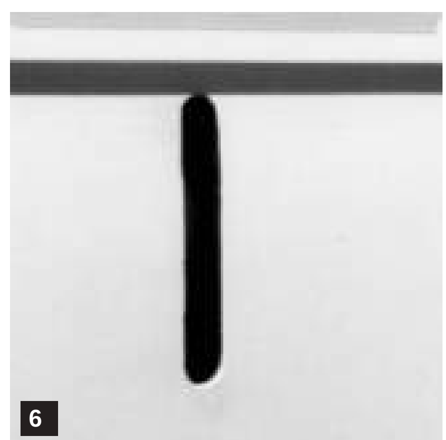
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H Right Aft Fuselage

1. Single Point Refueling Panel: Check for leaks. Verify that the panel is closed and secure.

2. Fire Extinguisher Discharge Disc: Check the red fire extinguisher disc to ensure that it is not absent (indicating bottle discharge).

3. Engine Fuel Filter Bypass: Check that the indicator is flush to indicate normal filter operation. If the indicator is protruding, the filter is bypassing; maintenance is required before flight.

4. Engine Cowl: Check that the cowling is properly latched and that there are no leaks on the underside of the cowl.

5. Engine Oil Filter Bypass: Check that the red indicator is flush to indicate normal filter operation. If the indicator is protruding, the filter is bypassing; maintenance is required before flight.

6. Oil Sight Gage: Push the spring-loaded access door to visually check engine oil quantity through the sight gage. Total engine oil tank capacity is approximately 1.5 gallons. Oil quantity should be checked within one hour after engine shutdown.

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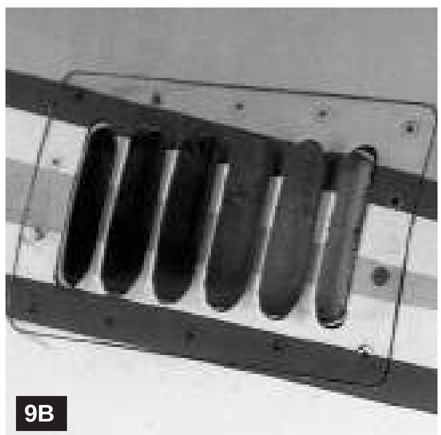

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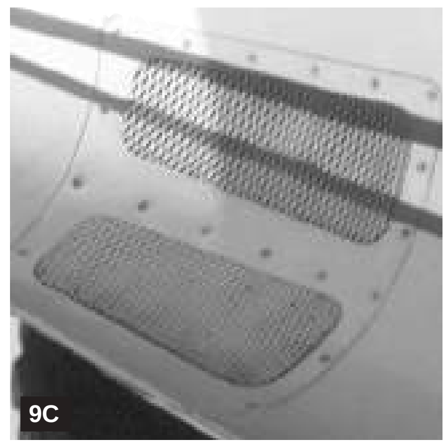


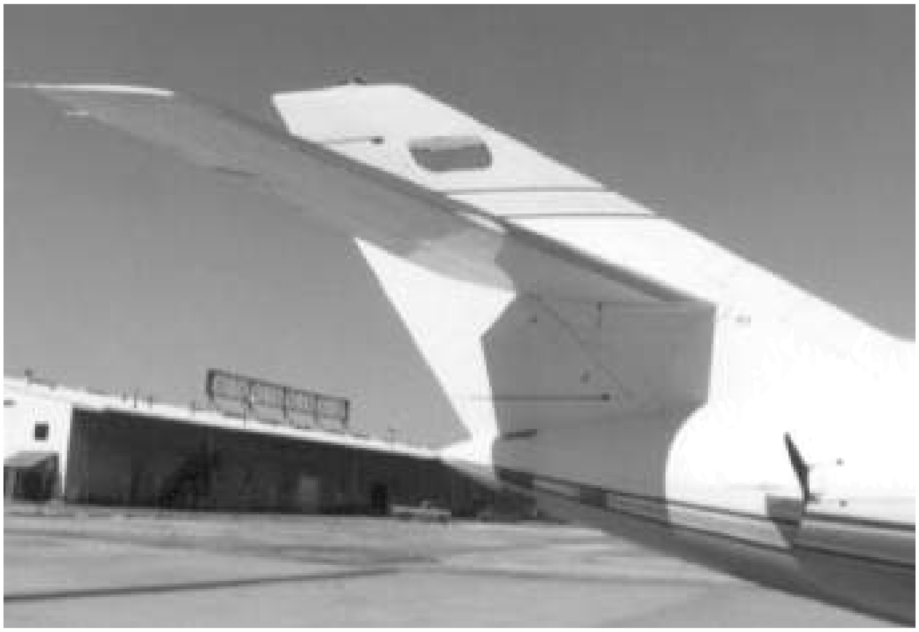
9C

H Right Aft Fuselage (continued)

7. Engine Tailpipe/Thrust Reverser: Inspect the engine turbine blades for nicks, cracks, or damage from foreign object ingestion. Confirm that the thrust reverser is stowed and that the exhaust duct is clear.

8. Engine Pylon and Static Discharger: Check the engine pylon for general condition and evidence of leaks. Ensure the inboard cowl latches are secure. One static discharger (solid type) is on the engine pylon trailing edge. Check for security and damage.

9. Rear Lower Side Fuselage: Check that the external power plug is properly connected (**9A**) or that the door is securely closed. Make sure the air conditioner heat exchanger inlet is unobstructed (**9B**). Check that the grates over the Freon condenser cooling outlets are clear (**9C**).



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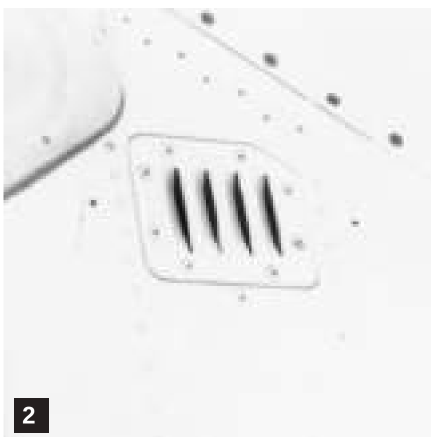

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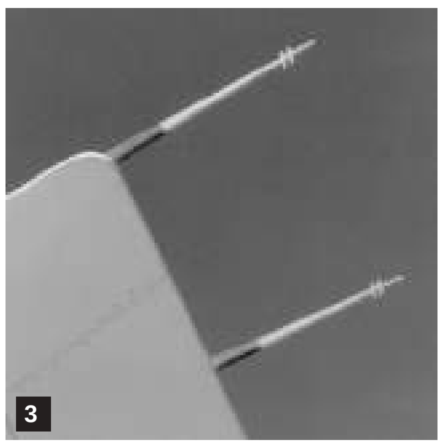

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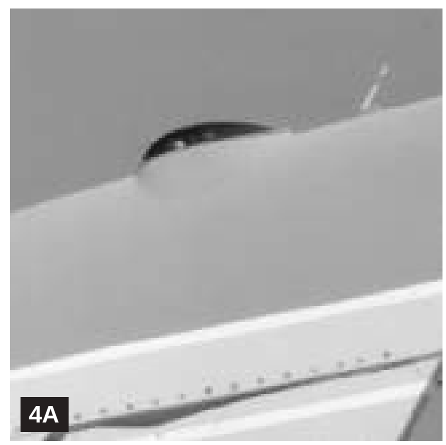

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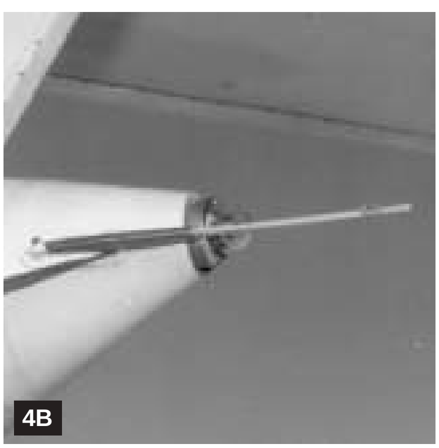

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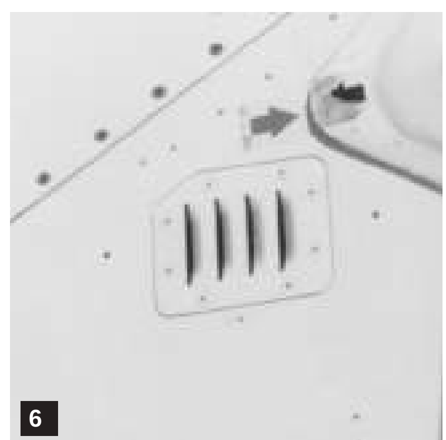

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Horizontal and Vertical Stabilizer

1. Right Horizontal and Vertical Stabilizer: Check the right horizontal and vertical stabilizer, elevator, and rudder for general condition, security, and damage.

2. Right Feeder Tank Vent: Inspect the tank vent for cleanliness and freedom from obstruction.

3. Static Dischargers: Check the static wicks for security and that all brushes are of equal length and fullness (brush type). Two types of static dischargers are used: a brush type and a solid plastic type. The number of dischargers varies depending on aircraft modification status, operator preference, and discharger type.

4. Anti-Collision and Strobe/Navigation Light: Visually inspect the lights on the vertical stabilizer top (**4A**). If night flight is anticipated, perform an operational check. Inspect the white navigation light on the tailcone for security, lens condition, and bulb condition (**4B**).

5. Left Horizontal and Vertical Stabilizer: Inspect the general condition of the left horizontal and vertical stabilizer, rudder, elevator, and static dischargers for general condition, security, and damage.

6. Stabilizer Alignment Mark and Left Feeder Tank Vent: Visually check that the horizontal stabilizer is aligned with the center or takeoff mark on the vertical stabilizer. Check that the tank vent is clean and free from obstructions.

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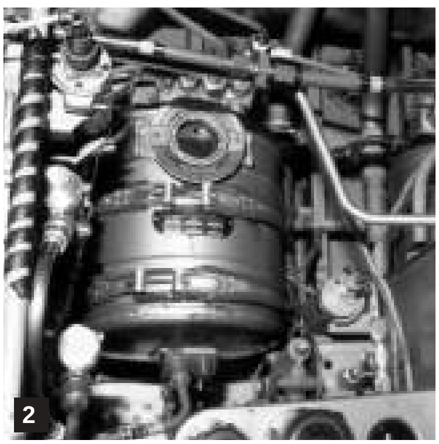

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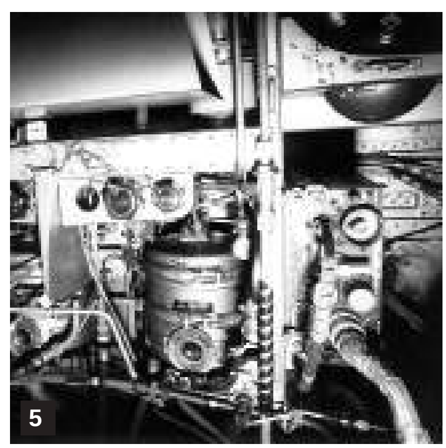

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J Rear Compartment

1. Rear Compartment Access Door: Open the door to gain access to the rear compartment.

2. Hydraulic Reservoirs: With the sight gage on the reservoir side, check the two hydraulic reservoirs for adequate fluid quantity. Fluid should be between the FILLING LEVEL and BELOW THIS LIMIT REFILL TO LEVEL indexes. Inspect all plumbing for security and loose fittings. Inspect the hydraulic system components and the general area for evidence of hydraulic leaks.

3. Circuit Breakers: Verify that all circuit breakers on the battery box are in, and that the battery charge switch is in the appropriate position.

4. Batteries: Inspect the battery cases and area surrounding them for evidence of leaks. Check both battery connectors for tightness by turning them clockwise.

5. Rear Compartment: Inspect all areas of the rear compartment for general condition, evidence of leaks, and equipment security. Close and secure the rear compartment access door.


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FIRE EXTINGUISHER
DISCH. INDICATOR
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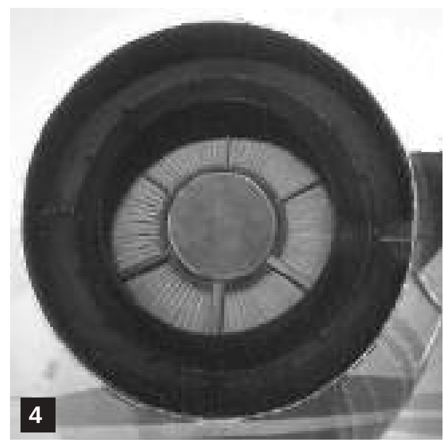
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K Left Aft Fuselage

1. Fuselage Underside: Check the underside of the fuselage for evidence of fluid leaks (streaks, etc.). Examine all antennas for security and damage.

2. Fire Extinguisher Discharge Disc: Check that the disc is intact. Absence of the disc indicates fire extinguisher bottle overpressurization and discharge; maintenance is required.

3. Engine Pylon and Static Discharger: Check the engine pylon for general condition and evidence of leaks. Ensure the inboard cowl latches are secure. One static discharger (solid type) is on the engine pylon trailing edge. Check for security and damage.

4. Engine Tailpipe/Thrust Reverser: Inspect the turbine exhaust blades for cracking, nicks, or damage from foreign object ingestion. Confirm that the thrust reverser is properly stowed and that the exhaust duct is clear.

5. Engine Cowl: Check the engine cowl for general condition, and ensure that it is secure and latched.


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K Left Aft Fuselage (continued)

6. Engine Fuel Filter Bypass: Check that the indicator is flush to signify normal filter operation. If the indicator is protruding, the filter is bypassing; maintenance is required before flight.

7. Oil Sight Gage: Push the spring-loaded access door to visually check oil quantity through the sight gage. Total engine oil tank capacity is approximately 1.5 gallons. Oil quantity should be checked within one hour after engine shutdown.

8. Engine Oil Filter Bypass: Check that the red indicator is flush to indicate normal filter operation. If the indicator is protruding, the filter is bypassing; maintenance is required before flight.


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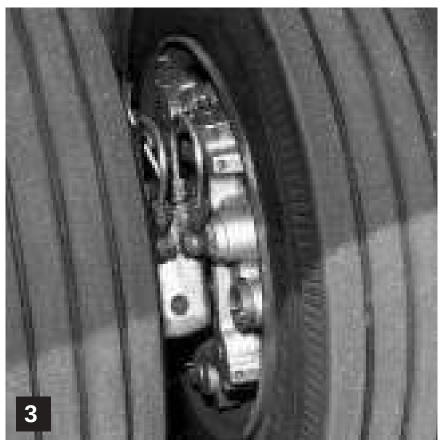
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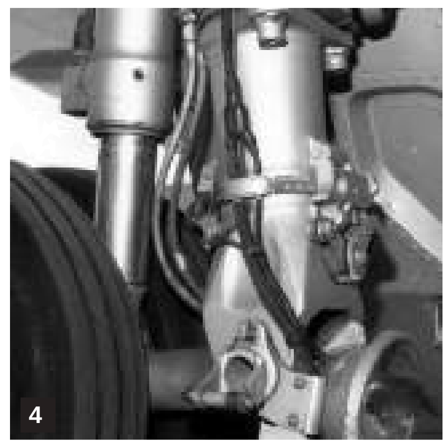
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L Left Main Gear

1. Wheel Embellisher: Check that no fasteners are missing from the embellisher.

2. Tires and Wheels: Check tires for proper inflation, abnormal wear, slip mark alignment, and other damage. Use only nitrogen to inflate the tires; never use dry air or oxygen. Inflation pressure depends on aircraft weight and service bulletin status. Check the wheel for dents, metal pickup on wheel surface, and other damage.

3. Brakes: Inspect the brakes for wear pin extension, leaks, damage, and signs of overheating. If the wear pin is recessed in the brake return box, excessive wear is indicated; maintenance is required before flight.

4. Strut: Check the strut for leaks and extension. Normal strut extension is 6 inches at 68°F; extension varies with ambient temperature. Consult the maintenance manual extension/temperature chart.

5. Wheel Well: Inspect the wheel well for general condition, and security of hydraulic lines and cables. Check for indication of fluid leaks.


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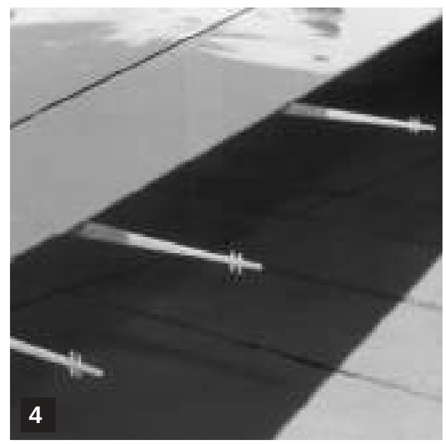
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M Left Wing Trailing Edge

1. Airbrakes: Check the condition and position of the airbrakes. Verify that the position of the airbrakes corresponds with airbrake handle position.

2. Flaps: Check the condition and security of the flaps. Verify that the position of the flaps corresponds with flap handle position. Check the condition of all cables, actuators, and lines forward of the flaps, if extended.

3. Aileron: Inspect the aileron for damage and security.

4. Static Dischargers: Check that the static dischargers on the aileron and wing tip are present, secure, and undamaged and that the brushes are equal in length and fullness (if installed). Two different static dischargers are used on the Falcon 10/100. One consists of a three brush assembly, the other consists of a solid plastic unit with sharp points. The number of static dischargers varies depending on aircraft modification status, owner preference, and discharger type.


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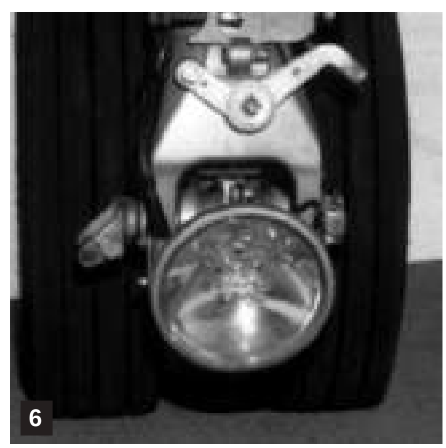
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N Left Wing and Engine Inlet

1. Wing Tip and Navigation/Strobe Lights: Inspect the wing tip for damage. Check the navigation and strobe lights for lens damage, security, and any indication of a burned out bulb. If night flight is anticipated, perform an operational check of the navigation and strobe lights.

2. Filler Fuel Cap: Check that the filler cap is properly secured and that the locking tab is facing aft with the tab flush with the wing surface.

3. Wing Fuel Vent: Check the fuel vent on the underside of the wing for cleanliness, freedom from obstructions, and fuel leaks.

4. Leading Edge: Inspect the slats for general condition, and security, as well as for dents or other damage. Check the wing fence for security, condition, and damage.

5. Engine Inlet: Inspect the engine inlet for foreign objects and loose fasteners. Check the condition of the fan blades and inlet guides for nicks, cracks, and signs of damage. The P_{t2}/T_{t2} probe should be clean and undamaged.

6. Landing Light: Check the light for security. Check the lens for cracks and signs of overheating. Check the condition of the bulb.

Cabin Inspection

The cabin inspection completes the preflight checklist for the Falcon 10/100.

First Aid Kit . . . . CHECKED

Check the first aid kit for adequate supplies.

Crash Axe . . . . CHECKED

If included on the aircraft equipment list, check for presence and proper storage.

Fire Extinguishers . . . . CHECKED

Check that the portable fire extinguishers are present and fully charged. Check for valid inspection.

Emergency Exit Safety Pin . . . . CHECKED

Remove the emergency exit safety pin.

Survival Equipment . . . . CHECKED

For overwater flight, there should be a life jacket stowed under each seat for the passenger and crew and life rafts (with sufficient capacity for crew and passengers).

Documents . . . . CHECKED

Ensure that the following documents are onboard the aircraft:

- registration certificate
- airworthiness certificate
- radio station license
- aircraft flight manual (AFM)
- operating manuals (for aircraft and avionics equipment)
- performance manual (with weight and balance information).

Seatbelts . . . . CHECKED

Check the passenger seatbelts for security and condition prior to passenger loading.

Passenger Oxygen Masks . . . . CHECKED

Ensure that the masks are secure within their panels.

Galley and Lavatory . . . . CHECKED

Check the galley for adequate supplies. Check the galley and lavatory for cleanliness.

Expanded Normal Procedures

Chapter 3B

This chapter outlines and expands normal operating procedures and includes applicable cautions and warnings. Also presented are cold and hot weather operations, as well as parking, mooring, and aircraft storage requirements.

Table of Contents

Before Starting Engines

Passenger Briefing . . . . COMPLETED

According to Part 91.519 requirements, the pilot-in-command or a crewmember briefs the passengers on smoking, use of safety belts, location and operation of the passenger entry door and emergency exits, location and use of survival equipment, and normal and emergency use of oxygen equipment. For flights over water, the briefing should include ditching procedures and use of flotation equipment. An exception to the oral briefing rule is if the pilot-in-command determines the passengers are familiar with the briefing content. A printed card with the above information should be available to each passenger to supplement the oral briefing.

Cockpit Check/Preflight . . . . COMPLETED

Standby Horizon . . . . TESTED/OFF

Generators 1/2 . . . . ON

Auxiliary Bus . . . . ON

Batteries . . . . CHECKED/ON

DC Power Selector . . . . SET

Set the DC power selector switch for the type of engine start to be accomplished.

Battery Start . . . . NORMAL

GPU Start . . . . EXT POWER

Cold Weather (below 5°C) . . . . LOW TEMP

Engine Computers . . . . ON/LIGHTS OUT

Cabin Signs . . . . ON

Overhead Warning Lights . . . . TESTED

Press to test the following lights:

- engine and wing anti-ice (three)
- windshield X.FR (one)
- left and right ignition (two)
- No. 1 and 2 inverters (two)
- optional cabin emergency (one).

Fuel Quantity . . . . CHECKED/REAR

Select TOTAL on the switch between the fuel quantity gages to check total fuel quantity. Select REAR to determine fuel quantity in the feeder tanks. Check for imbalance.

Annunciator Panel Lights . . . . TESTED

Press the TEST button on the center annunciator panel. Observe that all annunciators illuminate.

Fire Warnings . . . . TESTED

FIRE 1 System TEST Button . . . . PRESS

Observe that the light in the FIRE 1 PULL handle illuminates; the fire warning horn sounds.

Fire Warning Horn . . . . SILENCE

Observe that the light in the FIRE 1 PULL handle remains illuminated.

FIRE 1 System TEST Button . . . . RELEASE

Observe that the light in the FIRE 1 PULL handle extinguishes.

FIRE 2 System TEST Button . . . . PRESS

Observe that the light in the FIRE 2 PULL handle illuminates; the fire warning horn sounds.

Fire Warning Horn . . . . SILENCE

Observe that the light in the FIRE 2 PULL handle remains illuminated.

FIRE 2 System TEST Button . . . . RELEASE

Observe that the light in the FIRE 2 PULL handle extinguishes.

Landing Gear Panel . . . . TESTED

Landing Gear TEST Button . . . . PRESS

The gear warning horn sounds and the following illuminate:

- gear panel lights
- flight director annunciator panels
- thrust reverser lights
- anti-skid panel annunciator
- transfer panel lights.

Landing Gear Warning Horn . . . . SILENCE

Observe that the following lights remain illuminated:

- gear panel lights
- flight director annunciator panels
- thrust reverser lights
- anti-skid panel annunciator
- transfer panel lights.

Landing Gear TEST Button . . . . RELEASE

Observe that following lights extinguish:

- gear panel lights
- flight director annunciator panels
- thrust reverser lights
- anti-skid panel annunciator
- transfer panel lights.

Battery Temperature Warning . . . . TESTED

BATTERY TEST Button . . . . PRESS

Observe the temperature indicator needles rising. When the left needle indicates 120°, the amber warning light illuminates. When the right needle indicates 150°, the red warning light illuminates.

BATTERY TEST Button . . . . RELEASE

Hydraulic Quantity . . . . NORMAL

Parking Brake . . . . SET/P BRAKE LIGHT OUT

Cabin Altitude Warning . . . . TESTED

CABIN Test Button . . . . PRESS

The CABIN annunciator illuminates, and the cabin warning horn sounds.

Cabin Warning Horn . . . . SILENCE

Observe that the CABIN annunciator remains illuminated.

CABIN Test Button . . . . RELEASE

Observe that the CABIN annunciator extinguishes.

V_{MO} Warning . . . . TESTED

V_{MO}/M_{MO} Test Button . . . . PRESS

The overspeed warning horn sounds and cannot be silenced.

V_{MO}/M_{MO}/Test Button . . . . RELEASE

The warning horn silences.

Systems Checks – GPU Available

Inverters . . . . CHECKED/OFF

Both inverter lights illuminate to signify that the 115V AC buses are not powered.

AC Voltmeter Selector . . . . STD BY

Standby Inverter Switch . . . . NO. 1 AC BUS

Observe that the No.1 AC FAIL light extinguishes.

AC Voltmeter . . . . CHECK/115V AC

No. 1 Inverter . . . . ON

Standby Inverter Switch . . . . OFF

Observe that the No. 1 AC FAIL light remains extinguished and voltage reads zero.

Standby Inverter Switch . . . . NO. 2 AC BUS

Observe that the No. 2 AC FAIL light extinguishes and AC voltmeter reads 115V AC.

No. 2 Inverter . . . . ON

Standby Inverter Switch . . . . OFF

Observe that the voltmeter reads zero and No. 2 AC FAIL light remains extinguished.

AC voltmeter Selector . . . . NO. 2

Observe 115V AC.

AC Voltmeter Selector . . . . NO. 1

Observe 115V AC.

No. 1 and No. 2 Inverters . . . . OFF

No. 1 Power Lever . . . . ADVANCE

Hydraulic Standby Pump . . . . ON/NORMAL

Hydraulic Standby Pump . . . . ON

Observe that the hydraulic pressure in the No. 1 system rises to 2,150 PSI, then cycles between 1,600 and 2,150 PSI.

Hydraulic Standby Pump . . . . NORMAL

Observe that the hydraulic pressure in the No. 1 system rises to 2,150 PSI, then cycles between 1,600 and 2,150 PSI.

Trims . . . . CHECKED/SET

With the stabilizer trim in the green range and the No. 1 power lever advanced to takeoff, check the stabilizer trim.

Aircraft with Split Trim Switches:

Trim . . . . CHECK

No movement unless both switches are pressed.

One Stab Trim Switch on
Pilot's Control Wheel . . . . . . NOSE-DOWN/NOSE-UP

Check that normal trim does not move.

Other Stab Trim Switch on
Pilot's Control Wheel . . . . . . NOSE-DOWN/NOSE-UP

Check that normal trim does not move.

One Stab Trim Switch on
Copilot's Control Wheel . . . . . NOSE-DOWN/NOSE-UP

Check that normal trim does not move.

Other Stab Trim Switch on
Copilot's Control Wheel . . . . . NOSE-DOWN/NOSE-UP

Check that normal trim does not move.

Pilot's Stab Trim . . . . NOSE-DOWN

Observe movement nose-down.

Copilot's Stab Trim . . . . NOSE-UP

Check that movement of the stabilizer trim stops.

Stab Trim Switches . . . . RELEASE

Pilot's Stab Trim . . . . NOSE-DOWN UNTIL WARNING LIGHT ILLUMINATES

The red STAB TRIM annunciator illuminates at 4°.

Pilot's Stab Trim . . . . NOSE-UP

Observe movement nose-up. The STAB TRIM annunciator extinguishes.

Copilot's Stab Trim . . . . NOSE-DOWN

Check that movement of the stabilizer trim stops.

Stab Trim Switches . . . . RELEASE

Emergency Trim . . . . SELECT NOSE UP

Observe that the normal trim CB opens. Use emergency trim until red STAB TRIM annunciator illuminates which is at 8° nose-up.

Emergency Trim . . . . NOSE-DOWN UNTIL ANNUNCIATOR OUT

Stabilizer Normal Trim . . . . CB RESET

Stab Trim . . . . SET FOR TAKEOFF

Use the normal system.

CAUTION: Whenever the stabilizer trim is in motion, an aural warning sounds.

Airbrake Limitations

- The pilot must keep his hand on the airbrake control handle until the normal extension or retraction of the airbrakes is confirmed.
- Do not hesitate to use the airbrakes in the event the flight envelope limits (V_{MO}/M_{MO}) are accidentally exceeded.
- In approach and below a height of 500 ft AGL, the airbrakes must not deliberately be kept extended.
- Do not use below 500 ft AGL.
- In manual flight conditions, accompany airbrake extension with a nose-up maneuver of the pitch trim control to maintain longitudinal attitude. In automatic flight conditions, a momentary nose-down movement occurs on airbrake extension.

Aileron/Rudder Trim . . . . CHECKED/SET

Monitor the trim indicator, control wheel movement, and the rudder pedals for proper operation.

Airbrakes . . . . EXTEND

Observe the illumination of the amber AIRBRAKE annunciator on the landing gear panel and the red AIRBRAKE annunciator on the failure warning panel.

No. 1 Power Lever . . . . CUTOFF

Observe that the red AIRBRAKE annunciator extinguishes.

Airbrakes . . . . RETRACT

Observe that the amber AIRBRAKE annunciator extinguishes.

No. 1 Stall Warning . . . . TESTED

No. 1 STALL Test Button . . . . PUSH

The stall warning horn sounds and cannot be silenced. Observe that the slat indicator illuminates red, then green when the outboard slats are extended. Observe that the igniter lights on the overhead panel illuminate.

No. 1 STALL Test Button . . . . RELEASE

Observe that the slat indicator light illuminates red, then extinguishes when the outboard slats retract. The igniter lights extinguish after 10 seconds.

Slats/Flaps . . . . CYCLED

Slats Only . . . . SELECT

Observe that the slat indicator turns green when the slats are extended.

Flaps . . . . SELECT 15°/30°/52°

Observe that the flaps stop and indicate appropriately at each setting.

Slats/Flaps . . . . SELECT CLEAN

Observe that the red slat indicator does not extinguish before the flaps reach the clean position.

Hydraulic Standby Pump . . . . OFF

Batteries/External Power . . . . OFF

Engine Start – Part 1

Direct Vision Window . . . . OPEN

Batteries . . . . ON

DC Power Selector . . . . SET

Emergency Exit Lights . . . . TESTED/ARMED

Cabin Emergency Light Switch . . . . . . OFF/ARMED/ON

Observe that the exit lights illuminate in the cockpit dome fixture.

Cabin Emergency Light Switch . . . . ARMED

Cabin Lights . . . . ON

Anti-Collision Light . . . . ON

Freon/HP Bleed . . . . OFF/CLOSED

No. 1 Radio . . . . ON

At least one radio should be on for engine start.

Parking Brake . . . . . FULL AFT/P BRAKE LIGHT OUT

Verify that the parking brake handle is set full aft and that the P BRAKE annunciator is out.

No. 2 Booster Pump . . . . ON/LIGHT OUT

Turn the No. 2 booster pump on; confirm that the FUEL P2 annunciator extinguishes.

No. 2 Engine . . . . STARTED/PARAMETERS CHECKED

Abort the start if any of the following occurs:

- engine oil pressure does not rise within 10 seconds after lightoff
- EXH. TEMP. does not rise within 10 seconds with SPR switch energized
- EXH. TEMP. is rising rapidly and approaching the 860°C limit
- N_1 rotation is not observed by 20% N_2
- N_2 speed does not increase smoothly and rapidly to 24% after lightoff idle speed is not reached in time limit shown in **Table 3B-A**.

Condition	Time Limit
Ground Start/Starter Assist Airstart from 10% N_2 to Lightoff	10 seconds
Ground Start from Lightoff to Idle	50 seconds
Windmilling Airstart from Windmilling N_2 to 60% N_2	25 seconds

Table 3B-A; Start Limitations

Oil Limitation

See the Quick Reference chapter for oil consumption, pressure, and temperature limitations.

Powerplant Limitation

See the Quick Reference chapter for powerplant operating limits.

Generator Limitations

Maximum Continuous Amperage 300A

Maximum Output . . 350A (5 MINUTES)

Maximum Voltage 31V

No. 2 Start Button . . . . PRESS MOMENTARILY

Press the button for no more than two seconds. Check that N_2 rises.

At 10% N_2 and N_1 Rotation:

No. 2 Power Lever . . . . IDLE

Observe that:

- ignition light illuminates
- ITT rises
- N_2 increases
- N_1 rotates by 20% N_2
- oil pressure rises.

ITT . . . . MONITOR

At 50% N_2:

Igniter Light . . . . CHECK/OUT

The light extinguishes when the starter relay disengages.

Oil Pressure Annunciator . . . . CHECK/OUT

All Engine Instruments . . . . CHECK/STABILIZED

No. 2 Generator . . . . CHECKED

DC Voltmeter Selector . . . . GEN 2

Observe a positive ammeter reading and a voltage of 27V for three minutes.

No. 2 Stall . . . . TESTED

No. 2 STALL Test Button . . . . PUSH

The stall warning horn should sound and cannot be silenced. Observe that the slat indicator illuminates red, then green when the outboard slats are extended. Observe that the igniter lights on the overhead panel illuminate.

No. 2 STALL Test Button . . . . RELEASE

Observe that the slat indicator illuminates red and remains red. The igniter lights extinguish after 10 seconds.

Systems Not Previously Checked

> **CAUTION:** Whenever the stabilizer trim is in motion, an aural warning sounds.

No. 1 Power Lever . . . . ADVANCE

Hydraulic Standby Pump . . . . ON/NORMAL

Hydraulic Standby Pump . . . . ON

Observe that the hydraulic pressure in the No. 1 system rises to 2,150 PSI, then cycles between 1,600 and 2,150 PSI.

Hydraulic Standby Pump . . . . NORMAL

Observe that the hydraulic pressure in the No. 1 system rises to 2,150 PSI, then cycles between 1,600 and 2,150 PSI.

Slat Indicator . . . . CHECK

Indicator extinguishes after outboard slats retract.

Hydraulic pressure should cycle between 1,650 and 2,150 PSI.

No. 1 Stall . . . . TESTED

No. 1 STALL Test Button . . . . PUSH

The stall warning horn should sound and cannot be silenced. Observe that the slat indicator illuminates red, then green when the outboard slats are extended. Observe that the igniter lights on the overhead panel illuminate.

No. 1 STALL Test Button . . . . RELEASE

Observe that the slat indicator illuminates red, then extinguishes when the outboard slats retract. The igniter lights extinguish after 10 seconds.

Trims . . . . CHECKED/SET

With the stabilizer trim in the green range and the No. 1 power lever advanced to takeoff, check the stabilizer trim.

Aircraft with Split Trim Switches:

Trim . . . . CHECK

There is no movement unless both switches are pressed.

One Stab Trim Switch on
Pilot's Control Wheel . . . . NOSE-DOWN/NOSE-UP

Check that normal trim does not move.

Other Stab Trim Switch on
Pilot's Control Wheel . . . . NOSE-DOWN/NOSE-UP

Check that normal trim does not move.

One Stab Trim Switch on
Copilot's Control Wheel . . . . . . NOSE-DOWN/NOSE-UP

Check that normal trim does not move.

Other Stab Trim Switch on
Copilot's Control Wheel . . . . . . NOSE-DOWN/NOSE-UP

Check that normal trim does not move.

Airbrake Limitations

- The pilot must keep his hand on the airbrake control handle until the normal extension or retraction of the airbrakes is confirmed.
- Do not hesitate to use the airbrakes in the event the flight envelope limits (V_{MO}/M_{MO}) are accidentally exceeded.
- In approach and below a height of 500 ft AGL, the airbrakes must not deliberately be kept extended.
- Do not use below 500 ft AGL.
- In manual flight conditions, accompany airbrake extension with a nose-up maneuver of the pitch trim control to maintain longitudinal attitude. In automatic flight conditions, a momentary nose-down movement occurs on airbrake extension.

Pilot's Stab Trim . . . . NOSE-DOWN

Observe movement nose-down.

Copilot's Stab Trim . . . . NOSE-UP

Check that movement of the stabilizer trim stops.

Stab Trim Switches . . . . RELEASE

Pilot's Stab Trim . . . . NOSE-DOWN UNTIL WARNING LIGHT ILLUMINATES

The red STAB TRIM annunciator illuminates at 4°.

Pilot's Stab Trim . . . . NOSE-UP

Observe movement nose-up. The STAB TRIM annunciator extinguishes.

Copilot's Stab Trim . . . . NOSE-DOWN

Check that movement of the stabilizer trim stops.

Stab Trim Switches . . . . RELEASE

Emergency Trim . . . . SELECT NOSE UP

Observe that the normal trim CB opens. Use emergency trim until red STAB TRIM annunciator illuminates at 8°.

Emergency Trim . . . . NOSE-DOWN UNTIL WARNING LIGHT EXTINGUISHES

Normal Trim . . . . CB RESET

Stab Trim . . . . SET FOR TAKEOFF

Use the normal system.

Aileron/Rudder Trim . . . . CHECKED/SET

Monitor the trim indicator, control wheel movement, and the rudder pedals for proper operation.

Airbrakes . . . . EXTEND

Observe the illumination of the amber AIRBRAKE annunciator on the landing gear panel and the red AIRBRAKE annunciator on the failure warning panel.

No. 1 Power Lever . . . . CUTOFF

Observe that the red AIRBRAKE annunciator extinguishes.

Airbrakes . . . . RETRACT

Observe that the amber AIRBRAKE annunciator extinguishes.

Engine Start, Part 2

No. 1 Booster Pump . . . . ON/LIGHT OUT

No. 1 Booster Pump . . . . ON

Fuel P1 Annunciator . . . . CHECKED/OUT

No. 1 Engine . . . . STARTED/PARAMETERS CHECKED

Start the No. 1 engine using the same procedures for starting the No. 2 engine.

No. 1 Generator . . . . CHECKED

DC Voltmeter Selector . . . . GEN 1

Observe a positive ammeter reading and a voltage of 27V for three minutes.

DC Power Selector . . . . NORMAL

Ground Power . . . . REMOVED

If ground power was used for start, place the DC power selector switch to NORMAL prior to disconnecting the GPU. The GENE. 1/2 annunciators do not extinguish until the GPU is disconnected.

After Start

Inverters . . . . CHECKED/ON

Exterior Lights . . . . SET

Engine Computers/Anti-Ice . . . . CHECKED

Engine Anti-Ice Switches . . . . ON

No. 1 Engine Computer Switch . . . . OFF

Guard the No. 1 engine power lever at the same time; an engine runaway is possible. Engine RPM increases slightly.

No. 1 Power Lever . . . . ADVANCE SLIGHTLY

Engine RPM follows power lever movement. Check for illumination of the left engine's ANTI-ICE light as the power lever is advanced during the computer check.

If Engine Anti-Ice Is Not Required:

ENG 1 ANTI-ICE Switch . . . . OFF

Observe the ENG ANTI-ICE light extinguishes.

No. 1 Power Lever . . . . RETARD TO IDLE

No. 1 Engine Computer Switch . . . . ON

Guard the No. 1 engine power lever at the same time; an engine runaway is possible.

No. 2 Engine Computer Switch . . . . OFF

Guard the No. 2 engine power lever at the same time; an engine runaway is possible. Engine RPM increases slightly.

Generator Limitations

Maximum Continuous Amperage 300A

Maximum Output . . 350A (5 MINUTES)

Maximum Voltage 31V

Wing Anti-Ice Limitations

- Must be on in flight when total temperature is below +5°C and when icing conditions are anticipated.
- Must be off when total temperature is above +10°C.
- Do not operate on the ground.

Engine Anti-Ice Limitations

- Must be on when total air temperature is below +5°C and icing conditions are anticipated.
- Must be off when total air temperature is above +10°C.

Windshield Electrical Heating Limitation

The PILOT and COPILOT WINDSHIELD control switches must not be selected to the MAX position, except in flight and only if the NORM position is not sufficient in icing conditions.

Yaw Damper/Q Unit Limitations

Q UNIT Annunciator
ON . . . . . 260 KIAS/0.76 M

On Approach if Q UNIT Light On:

RUD Q . 140 KTS MINIMUM UNTIL LANDING ASSURED

AIL Q . . . ADD 10 KTS to V_{AP}

If Not Operating:

Airspeed . . 260 KIAS (0.76 M) MAXIMUM)

Battery Limitation

Maximum battery temperature for start is 120°F.

No. 2 Power Lever . . . . ADVANCE SLIGHTLY

Engine RPM follows power lever movement. Check for illumination of the right engine's ANTI-ICE annunciator as the power lever is advanced during the computer check.

If Engine Anti-Ice Is Not Required:

ENG 2 ANTI-ICE Switch . . . . OFF

Observe the ENG ANTI-ICE light extinguishes.

No. 2 Power Lever . . . . RETARD TO IDLE

No. 2 Engine Computer Switch . . . . ON

Guard the No. 2 engine power lever at the same time; an engine runaway is possible.

Engine Anti-Ice/Pitot Heat . . . . AS REQUIRED

Windshield Heat . . . . NORMAL

Emergency Power/Standby Horizon . . . . . ON/UNCAGED

Q Unit/Yaw Damper . . . . TESTED/ON

Yaw Damper . . . . ENGAGE

Annunciator Panel Test Button . . . . PRESS/HOLD

Observe that the yaw damper disengages with all annunciators, except the Q UNIT annunciator, which illuminates after several seconds along with the RUD/AIL lights on the copilot's CB panel.

Annunciator Panel Test Button . . . . RELEASE

Yaw Damper . . . . ENGAGE

Radios/Avionics . . . . ON

Battery Temperatures . . . . CHECKED

Standby Pump/Freon/HP Bleed . . . . . . ON/AUTO/OPEN

Circuit Breakers . . . . CHECKED

Galley Power . . . . ON

Direct Vision Windows . . . . CLOSED

TOLD Card/Bugs . . . . COMPUTED/SET

Taxi

Because nosewheel steering receives power from the right engine, taxiing with only the right engine operating is authorized. Taxiing with only the left engine operating is not recommended.

Normal Brakes/Steering . . . . CHECKED

Check operation of normal brakes and steering when leaving the parking area at a slow speed.

Anti-Skid . . . . TESTED

After clearing the ramp area, test the anti-skid for the left and right brakes individually.

While Holding Pressure on Left Brake:

Anti-Skid Test Button . . . . PRESS/RELEASE

Brake pressure is momentarily released (amber anti-skid light illuminates) and then restored (amber anti-skid light extinguishes).

While Holding Pressure on Right Brake:

Anti-Skid Test Button . . . . PRESS/RELEASE

Brake pressure is momentarily released (amber anti-skid light illuminates) and then restored (amber anti-skid light extinguishes).

Emergency Brakes . . . . CHECKED

Smoothly move the emergency brake handle aft.

Thrust Reversers (if installed) . . . . CHECKED

Reverse Levers . . . . IDLE REVERSE.

Observe the amber TRANS lights illuminate and then extinguish as the GREEN REV indicators illuminate.

Reverse Thrust . . . . INCREASE APPROXIMATELY 5% N_2 ABOVE IDLE

Emergency Stow Switches . . . . EMERG STOW

Observe that the power levers automatically return to reverse idle. Observe that the GREEN REV indicators extinguish, followed by the AMBER TRANS indicators extinguishing.

Reverse Levers . . . . STOW

Emergency Stow Switches . . . . NORM

T/R Test Button . . . . PRESS

This tests the warning horn, which sounds if a reverser door position does not agree with the respective power lever.

Thrust Reverser Limitation

- Thrust reversers are approved for ground use only.
- Maximum 50% N_1 for power lever retarder check.

Engine Synchronizer Limitation

Engine synchronization, if installed, must not be used during takeoff, go-around, and landing.

Fuel Computer Limitation

Fuel computers must be operative for takeoff.

X-Feed and Rear Tank Intercom Valves Limitation

These valves must be closed during takeoff.

Recognition Light Limitation

Use of recognition lights on the ground is limited to 5 minutes, followed by 15 minutes off to ensure sufficient cooling.

Flap Limitation

In flight, each actuation of the flap control handle must be limited to the next detent position.

Slats/Flaps . . . . CYCLED/SET FOR TAKEOFF

Slats Only . . . . SELECT

Observe that the slat indicator turns green when the slats are extended.

Flaps . . . . SELECT 15°/30°/52°

Observe that the flaps stop and indicate appropriately at each setting.

Slats/Flaps . . . . SELECT CLEAN

Observe that the red slat indicator does not extinguish before the flaps reach the clean position.

Slats/Flaps . . . . SET FOR TAKEOFF

Airbrakes . . . . RETRACTED

Trims . . . . THREE SET

Flight Controls/Hydraulic Systems . . . . FREE/CHECKED

Before Takeoff

In case of crosswind or tailwind, set takeoff N_1 speed progressively when reaching approximately 30 kts.

Flight Instruments . . . . NO FLAGS/SET

Pressurization . . . . SET

Set the pressure to 29.92, the altitude to the flight plan altitude, and the rate knob to the center detent.

Crew Briefing . . . . COMPLETED

Line Up

Parking Brake . . . . OFF/BRAKE LIGHT OUT

Radar/Transponder . . . . ON

Pitot/AOA Heats . . . . ON/LIGHTS OUT

Start Selectors . . . . AIRSTART

Strobes/Recognition Lights (if installed) . . . . ON

Warning Lights . . . . CLEAR

F.A.T.S. Check . . . . COMPLETED

Flaps, airbrakes, trims, and speeds are safety-checked for takeoff.

Climb

Landing Gear . . . . **UP**
Slats/Flaps . . . . **CLEAN**
Anti-Ice Panel . . . . **SET**
Start Selectors . . . . **GROUND START**
Landing/Taxi Lights . . . . **OFF**
Cabin Signs . . . . **AS REQUIRED**
Pressurization . . . . **CHECKED**
Standby Pump . . . . **NORMAL**
Altimeter (At Transition Altitude) . . . . **SET**
Recognition Lights . . . . **OFF**

Cruise

Electrical Systems . . . . **CHECKED**
Fuel Panel . . . . **CHECKED**
Engine Instruments . . . . **CHECKED**
Hydraulic Systems . . . . **CHECKED**
Pressurization . . . . **CHECKED**
Oxygen . . . . **CHECKED**

Descent

Pressurization . . . . **SET**
Fuel Quantity/Panel . . . . **CHECKED**
Anti-Ice Panel . . . . **SET**
TOLD Card . . . . **COMPUTED**
Crew Briefing . . . . **COMPLETED**
Altimeter (At Transition Level) . . . . **SET**
Recognition Lights (if installed) . . . . **ON**

Pressurization Limitations

Maximum Cabin
Pressure Altitude . . . 8,000 FT

Maximum
Differential Pressure . . 9.1 PSI

Oxygen Limitation

Above FL 410, all passengers must wear an oxygen mask secured to the face and connected to the oxygen system.

Operating Limitation

Maximum
Operating Altitude . . . FL 450

X-Feed Valve Limitation

In flight, if Jet B or JP-4 fuel is used, the X-FEED valve must be opened whenever the flight is made at an altitude for which the operation of the engine with a failed booster pump is not guaranteed.

Flap Limitation
In flight, each actuation of the flap control handle must be limited to the next detent position.

Engine Synchronizer Limitation
Engine synchronization, if installed, must not be used during takeoff, go-around, and landing.

Brakes Limitation
It is strictly forbidden to depress the brake pedals prior to touchdown.

Approach

Slats/Flaps . . . . SET
Standby Pump . . . . ON
Anti-Ice Panel . . . . SET
Avionics . . . . SET
Cabin Signs . . . . ON

Before Landing

Landing Gear . . . . DOWN/3 GREEN/NO RED
Hydraulic Pressure/Quantity . . . . CHECKED
Anti-Skid . . . . TESTED
Start Selectors . . . . AIRSTART
Slats/Flaps . . . . SET FOR LANDING
Landing Lights . . . . SET

After Landing

Anti-Ice/Pitot/Windshield Heat . . . . OFF
Start Selectors . . . . GROUND START
Strobe/Recognition Lights . . . . OFF
Landing/Taxi Lights . . . . SET
Slats/Flaps . . . . CLEAN
Airbrakes . . . . RETRACTED
Trims . . . . SET FOR TAKEOFF
Radar/Transponder . . . . STANDBY

Shutdown

Emergency Power/Standby Horizon . . . . . . **OFF/CAGED**

Parking Brake . . . . **SET**

Standby Pump/Freon/HP Bleed . . . . . **OFF/OFF/CLOSED**

Power Levers . . . . **CUTOFF**

Operate engines at idle for two minutes after landing before shutdown.

Exterior/Emergency Exit Lights . . . . **OFF**

Inverters . . . . **OFF**

Booster Pumps . . . . **OFF**

Radios . . . . **ALL OFF**

Batteries . . . . **OFF**

Auxiliary Bus . . . . **OFF**

Chocks . . . . **IN**

Parking Brake . . . . **OFF**

Quick Turn

Batteries . . . . **ON**

DC Power Selector . . . . **SET**

Cabin Signs . . . . **ON**

Emergency Exit Lights . . . . **ARMED**

Anti-Collision/Navigation Lights . . . . **ON**

Fire Warning . . . . **TESTED**

No. 1 Radio . . . . **ON**

Parking Brake . . . . . **FULL AFT/P BRAKE LIGHT OUT**

No. 2 Booster Pump . . . . **ON**

No. 2 Engine . . . . **STARTED/PARAMETERS CHECKED**

No. 2 Generator . . . . **CHECKED**

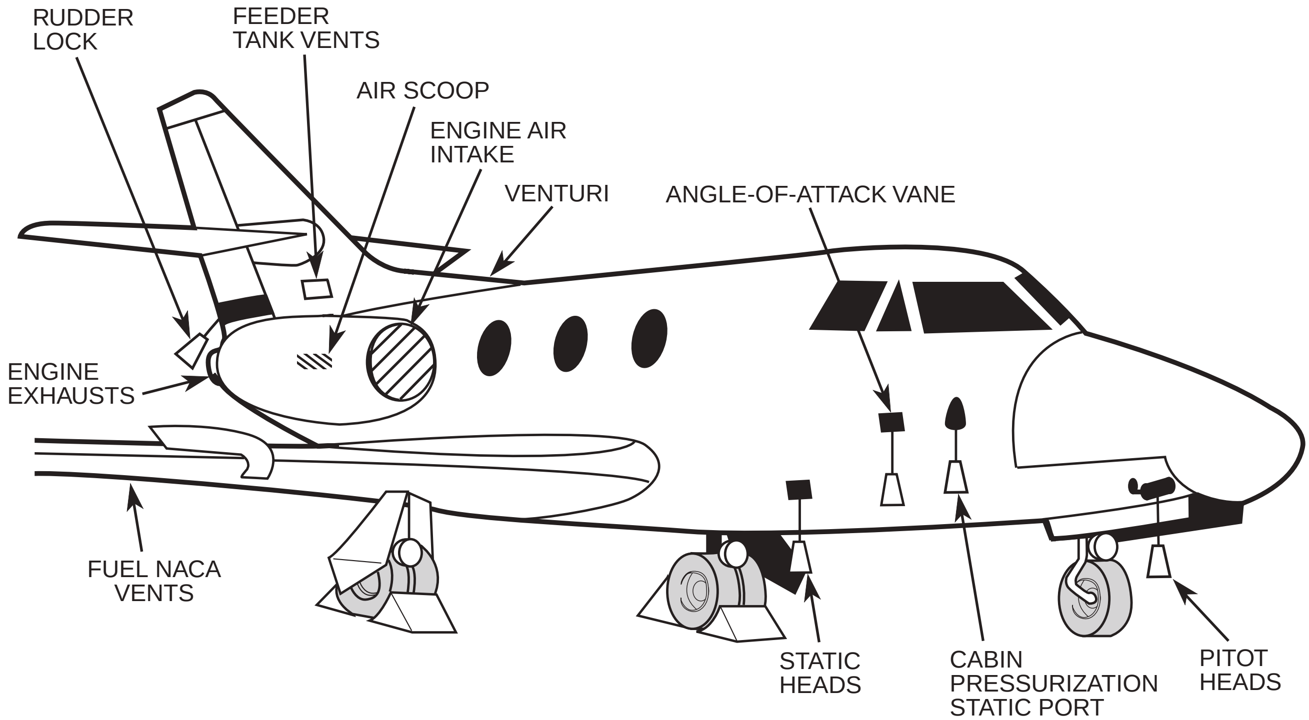
No. 1 Booster Pump . . . . **ON**

No. 1 Engine . . . . **STARTED/PARAMETERS CHECKED**

No. 1 Generator . . . . **CHECKED**

DC Power Selector . . . . **NORMAL**

Ground Power . . . . **REMOVED**


RUDDER
LOCK
FEEDER
TANK VENTS
AIR SCOOP
ENGINE AIR
INTAKE
VENTURI
ANGLE-OF-ATTACK VANE
ENGINE
EXHAUSTS
FUEL NACA
VENTS
STATIC
HEADS
CABIN
PRESSURIZATION
STATIC PORT
PITOT
HEADS

3B-1

Parking

Aircraft . . . . TURNED INTO THE WIND

Lower Fuselage/Tires . . . . CHECKED

Check that nothing can damage the airframe if a tire deflates or a shock strut is depressurized.

All Servicing Materials . . . . KEPT AT A DISTANCE FROM AIRCRAFT

Battery Switch . . . . OFF

Parking Brake . . . . CHECKED/NOT ENGAGED

Opening Windows . . CHECKED/CLOSED AND LOCKED

Wheel Chocks . . . . INSTALLED

Place in front and behind main landing gear wheels.

Protective Covers or Caps (Figure 3B-1) . . . . INSTALLED

Install covers and caps on the following elements:

- engine air intakes
- engine exhausts
- pitot heads
- static heads
- cabin pressurization static port
- air scoops
- wing air vents
- collector tank air vents
- pitch sensor.

Rudder Lock . . . . INSTALLED

Gear Safety Devices (Figure 3B-1) . . . . INSTALLED

Mooring

Aircraft . . . . PARKED

Main Gear Mooring Fitting Clamp . . . . INSTALLED

Use TF10A 10201 fittings.

Nose Gear Towing Spool/Locking Device . . . . INSTALLED

Use TF10A 10202 fittings.

Aircraft . . . . MOORED WITH RINGS (Figure 3B-2)

Mandatory Safety Precautions . . . . OBSERVED

If Snow is Anticipated:

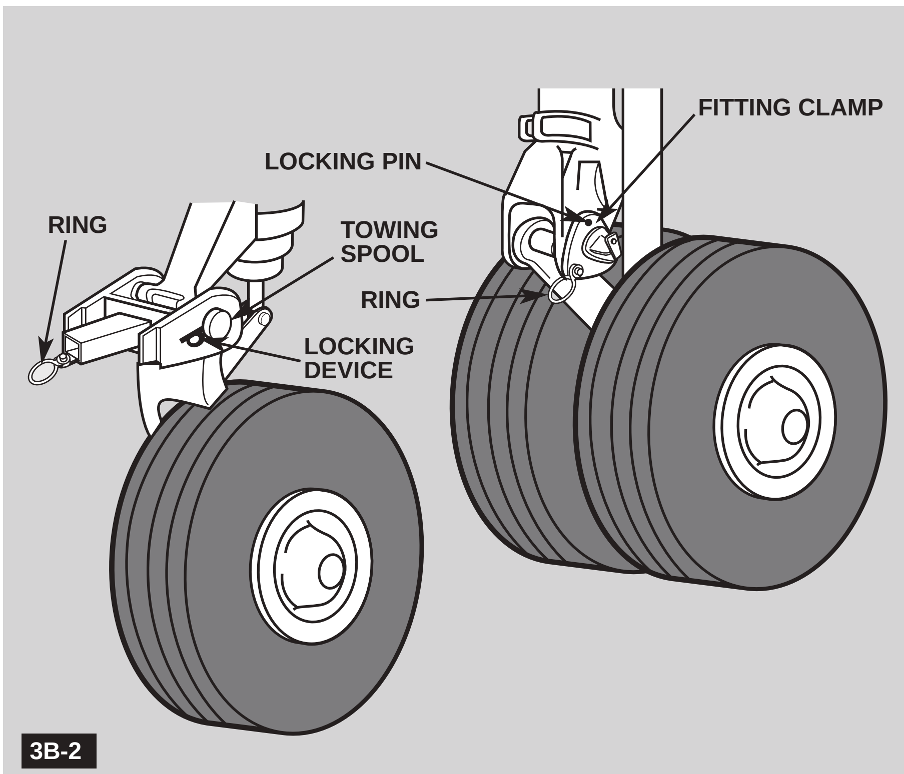
Snow Fittings . . . . INSTALLED

Use TF10A 07 106 fittings.

TF10A 07 107 Fitting . . . . TIGHTENED

1,000 KG Load . . . . INSTALLED ON TF10A 07 107 SHACKLE

Red Flag . . . . INSTALLED ON TF10A 07 107 SHACKLE



Towing/Taxiing

For all towing procedures, disconnect the steering control. During towing operations, check that wheel chocks have been removed; an assistant must be in the cockpit to release the emergency/parking brake.

Use the maneuvering fork to guide the aircraft on the ground over short distances; use the towing bar to pull or push the aircraft.

The nose wheel can rotate in the following arcs:

- 55° with steering control engaged
- 120° with steering control disengaged.

CAUTION: For operations requiring nosewheel to be turned by more than 120°, disconnect bonding braid and electrical connector (102). Use only the Falcon 10 towing bar with torque and tensile stress shear pins designed to prevent damage to the nose gear. Never use other towing bars (Falcon 20, etc.).

Towing – Hard Ground

Steering Control . . . . DISCONNECTED

Parking Brake . . . . CHECKED/RELEASED

Battery Switches . . . . BAT 1/BAT 2

Make sure the aircraft configuration green lights are illuminated.

Hydraulic System 1
Pressure . . . . CHECKED/2,465 PSI (170 BAR)

If pressure is less than 2,465 PSI (170 bar), use the electropump to pressurize the system.

If Maneuvering Fork Is Used:

Maneuvering Fork . . . . ASSEMBLED

Attach maneuvering fork to nose gear and guide aircraft with fork.

If Towing Aircraft:

Tow Bar . . . . ASSEMBLED

Attach tow bar to nose gear. Tow aircraft slowly; avoid jerking motions.

Close Up – Hard Ground

Aircraft . . . . STOPPED

Nose Wheel . . . . STRAIGHT AHEAD

Wheel Chocks . . . . INSTALLED

Maneuvering Fork or Towing Bar . . . . REMOVED

Steering Control . . . . CONNECTED

Towing – Soft Ground

The aircraft can be towed from soft ground forward or rearward using an assembly on the main gear; generally the aircraft is towed from the rear.

Gear Struts . . . . CHECKED/DOWNLOCKED

Steering Control . . . . DISCONNECTED

If Towing Rearward:

Nose Gear Strut Bonding Braid . . . . . . DISCONNECTED

Nose Gear Strut Electrical Connector . . . DISCONNECTED

Disconnecting the electrical cable and fitting prevents damage to these components due to nosewheel castering while towing rearward.

Angular limitation for rear towing is indicated by friction of cable on wheels. For rear towing, maneuvering fork can be used to guide nose wheel.

Parking Brake . . . . NEUTRAL

If the wheel brakes are operational, station an assistant in the cockpit to apply brakes as necessary. If the wheel brakes are not operational, take all precautions (e.g., clearing of areas, chocks) to prevent accidents.

Brake accumulator capacity permits 10 good braking applications performed by completely pulling out emergency/parking brake control handle.

Towing Apparatus . . . . ASSEMBLED

Attach to tow vehicle.

Aircraft . . . . TOWED SLOWLY

Avoid jerking motions. Tow along the longitudinal axis.

If Stress Shear Pin Breaks:

Stress Shear Pin . . . . REPLACED WITH SPARE

A stress shear pin breaks under a load of approximately 5,600 lbs (2,500 daN).

As Soon As Aircraft is on Hard Ground:

Towing Apparatus . . . . . . REMOVED FROM AIRCRAFT

Towing . . . . CONTINUED/NORMAL TOWING PROCEDURE USED

Close Up – Soft Ground

Wheels and Bearings . . . . REMOVED/INSPECTED/ SERVICED

Brake Units . . . . . . REMOVED/INSPECTED/SERVICED

Landing Gear and Doors . . . . . CLEANED/LUBRICATED/ PROTECTED

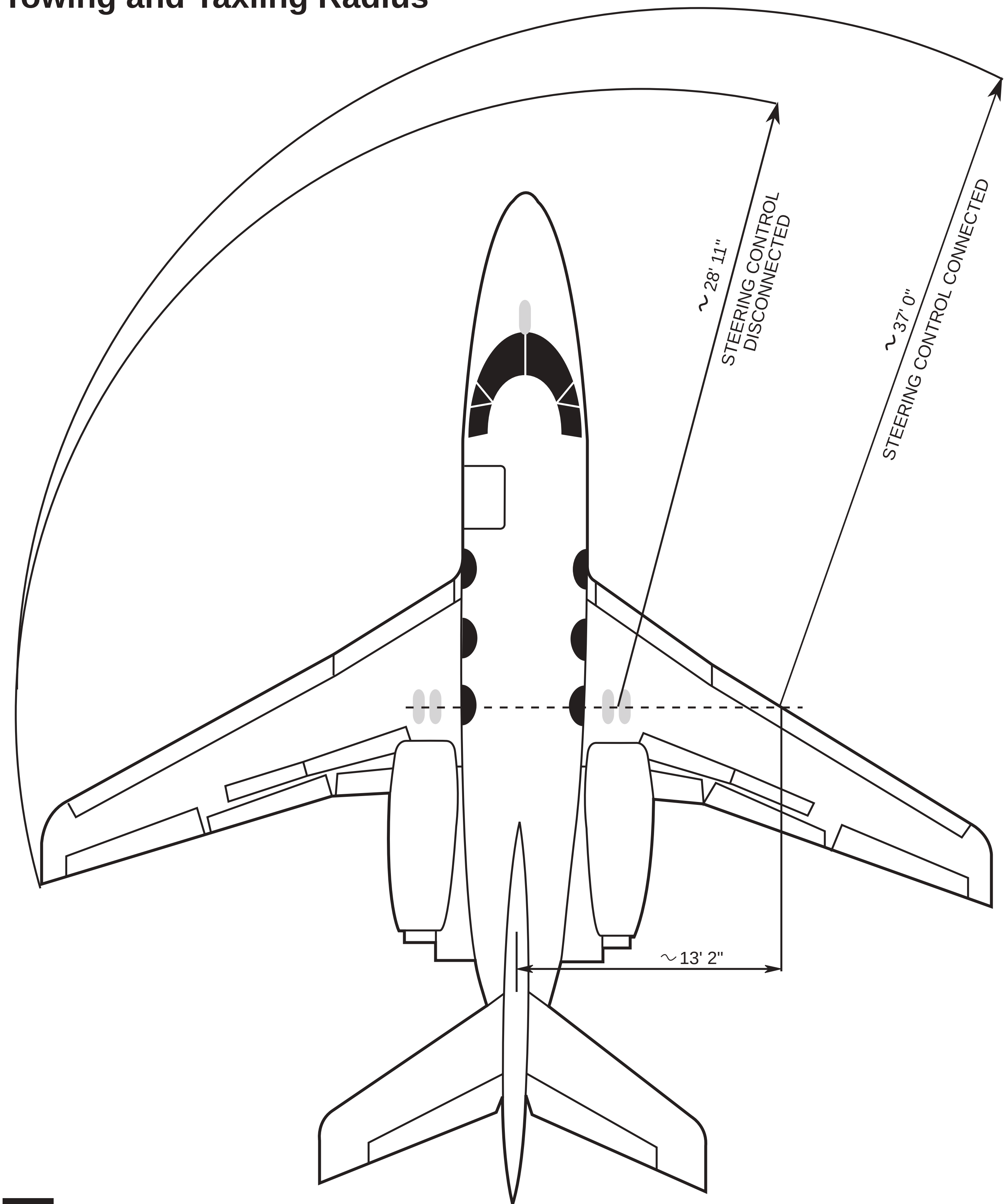
Aircraft . . . . CLEANED OF MUD

Landing Gear . . . . . . CHECKED/PENDULUM MOTION

Gear Struts . . . . CHECKED

Landing Gear Functional Test . . . . PERFORMED

Towing and Taxiing Radius



3B-3

Taxiing

The minimum turning radius (with steering control disengaged) is almost within the radius of the aircraft (**Figure 3B-3**); the nose wheel is able to turn 90°.

For rotation around the main landing gear, turning radius (with steering control disconnected) is approximately 28.7 ft (8.60 m).

For maximum nosewheel rotation, the turning radius is approximately 37 ft (11 m).

Storage and Restoring

The aircraft may be stored for up to eight months inside or outside of a hanger.

Storage

Aircraft Configuration, General

Aircraft . . . . **ON WHEELS**

Wheel Chocks (if outdoors) . . . . **INSTALLED/ FRONT AND BACK OF WHEELS**

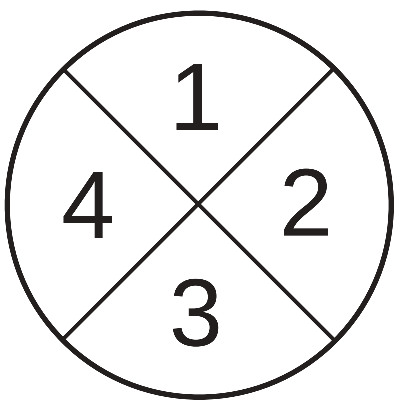
Aircraft . . . . **MOORED**

Front mooring should be accomplished if snow conditions are present.

Tire Pressure . . . . **CHECKED**

Parking Brake . . . . **RELEASED**

Wheel Positions (Figure 3B-4) . . . . **MARKED FOR MONTHLY ROTATION**



3B-4

Wheels . . . . **COVERED**

Passenger Door Seal/
Other Rubber Seals . . . . **POWDERED WITH TALC**

All Doors . . . . **CLOSED**

All Covers and Blanking Caps . . . . **INSTALLED**

Rudder . . . . **LOCKED**

Window Panes/Emergency Exit . . . . **TAPED**

Junctions Between Components . . . . **TAPED**

This prevents water seepage between different sections of slats, flaps, and boxes.

Wing Center Box . . . . **0°**

Visible Rod of Microswitch . . . . . . **LIGHTLY GREASED**

Use a low-temperature grease.

Aircraft Grounded for One Month, Aircraft Already Outdoors

All Water Drains . . . . **OPERATED**

All Airspeed Indicating Systems . . . . **BLEED**

Tank Drains . . . . **OPERATED**

Lift aircraft nose for satisfactory draining of wing center box.

Sound-Proofing Blankets . . . **CHECKED/NO MOISTURE**

Stub/Drain Compartment . . . **CHECKED/NO MOISTURE**

Rear Cargo Compartment . . **CHECKED/NO MOISTURE**

Wheels . . . . **REMOVED**

Axles and Bearings . . . . **LUBRICATED**

Wheels . . . . **INSTALLED**

Anti-Corrosion Varnish . . **APPLIED ON TIRE SIDEWALLS**

Tire Pressure . . . . **CHECKED**

Aircraft . . . . **GROUNDED**

Aircraft Cell . . . . PROTECTED

Corrosion Points . . . . TOUCH UP

Screw/Huck Rivet Heads . . CLEAN/TOUCH UP VARNISH

Unpainted Nuts/Pipe Ends . . . . CHECK/NO CORROSION

Pay particular attention to the wheel wells.

Electrical Connectors . . . . CHECK/NO CORROSION

Pay particular attention to open structures and wheel wells.

Greasing . . . . PERFORM

Do not remove excess grease from around tecalemit grease fittings.

Track Assembly . . . . INSPECT/CLEAN/GREASE

Slat Rollers . . . . INSPECT/CLEAN/GREASE

Microswitches . . . . INSPECT/CLEAN/GREASE

Cover Mechanisms . . . . INSPECT/CLEAN/GREASE

Flap Rollers and Rails . . . . . INSPECT/CLEAN/GREASE

Uplatch Olives/Catches/
Bolts/Latches/Visible Pin . . . . GREASE

Auxiliary Elevator Servo-Control AFS Pin . . . . . GREASE

Unpainted Aircraft . . . . . . PAINT WITH CELOPROTECT

Regardless of storage location, the entire cell skin including the leading edge should be covered with a coat of average green CELOPROTECT if unpainted.

Fuel System . . . . PREPARED

System . . . . INSPECT FOR LEAKS

Fuel Tanks . . . . DRAIN

Wing Fuel Tanks . . . . FILL TO CAPACITY OR HALF-CAPACITY

Collector Tanks . . . . FILL TO TRANSFER REGULATION LEVEL

Hydraulic System/Components . . . . PREPARED

Gas Chromatography Analysis
of Hydraulic Fluid . . . . PERFORM

If analysis shows contamination of hydraulic fluid, replace the fluid.

Hydraulic Reservoirs . . . . FILL

Slide Rods of Dampers/Lifting Jacks/
Door Mechanism/Strut . . . . CLEAN/MOISTEN

Use a dry cloth to clean the rods; lightly apply hydraulic fluid to the edges of each.

Damper Pressure . . . . CHECK

> **NOTE:** Bags of Silicagel must not contact sheet metal plate.

> **NOTE:** Refer to Maintenance Manual chapter 5-20 for equipment that have periodic maintenance procedures.

Equipment and Furnishings . . . . PREPARED

All Batteries . . . . REMOVE/STORE

This includes the DC generator starter, standby horizon, and emergency lighting batteries. Store batteries according to manufacturer directions. Clean battery areas.

Window Silicagel . . . . CHECK CONDITION

Rear Glass Panel
Demisting System . . . . CHECK CONDITION

Silicagel Bags . . . . HANG

Hang in radio and electrical racks of cockpit and nosecone. Also hang bags in the passenger compartment.

Oxygen Cylinder . . . . LOWER TO 100 PSI

Brake Fluid Level . . . . CHECK

Freon Compressor Oil Level . . . . CHECK

Periodic Checks of Storage Conditions, Each Month

Nosecone Condition . . . . . . CHECKED/NO MOISTURE

Visible Slide Rods of Dampers . . CLEANED/LUBRICATED

Use a dry cloth to clean the rods; lightly apply hydraulic fluid.

Outer Condition of Dampers . . . . CHECKED

Visible Slide Rods of Jacks . . . CLEANED/LUBRICATED

Use a dry cloth to clean the rods; lightly apply hydraulic fluid.

Aircraft Drains . . . . OPERATED

Tank Drains . . . . OPERATED

Silicagel . . . . CHANGED (IF BLUE)

Silicagel is pink when new and blue in humidity.

Skin and Wheel Wells . . . . INSPECTED/ CORROSION POINTS ELIMINATED

Engine Storage Conditions . . . . CHECKED

See manufacturer's directions for engine storage.

Aircraft Wheels . . . . ROTATED 1/4 TURN

Tire Pressure . . . . CHECKED

Fuel/Hydraulic Leaks . . . . CHECKED/NONE PRESENT

Freon System . . . . STARTED/RAN 5 MINUTES

Check reservoir indicator light for absence of bubbles; clean collection pan if necessary.

Periodic Checks of Storage Conditions, Every Two Months – Cranking of Dampers

Charging Pressure . . . . CHECKED

Aircraft . . . . PLACED ON HYDRAULIC JACKS

Operate very slowly so that rods move very slowly.

Visible Slide Rods of Dampers . CLEANED/LUBRICATED

Use a dry cloth to clean the rods; lightly apply hydraulic fluid.

Periodic Checks of Storage Conditions, Every Two Months – Cranking of Hydraulic Jacks

Visible Slide Rods . . . . CLEANED/LUBRICATED

Use a dry cloth to clean the rods; lightly apply hydraulic fluid.

Hydraulic Pressure . . . . RAISED

Raise the pressure progressively until there is no friction and there is a slow movement.

Gear/Airbrakes/Slats/Flaps . . . . EXERCISED

Visible Slide Rods . . . . CLEANED/LUBRICATED

Use a dry cloth to clean the rods; lightly apply hydraulic fluid.

Periodic Checks of Storage Conditions,Every Four/ Two Months (Depending on Engine Storage)

Extinguisher Cartridges . . . . CHECKED

Engines . . . . RESTORED

- Rudder . . . . UNLOCK
- Servo Control Slide Rods . . . APPLY HYDRAULIC FLUID
- Engine . . . . RUN UP
- Flight Servo Controls . . . . CHECK
- Pressurization . . . . CHECK
- Feeder Tank Drain and Wing Fuel Samples . . . . . OBTAIN/ CHECK/NO BACTERIA

Restoring

All Parking Protective Covers . . . . **REMOVED**

Unpainted Aircraft . . . . . . **CELOPROTECT REMOVED**

Aircraft . . . . **PLACED ON JACKS**

Nosewheel Bearings . . . . **CHECKED/LUBRICATED**

Engines . . . . **RESTORED**

Batteries . . . . **CAPACITY CHECKED/INSTALLED**

Hydraulic/Electric Rigs . . . . **CONNECTED**

Hydraulic System Tests . . . . **PERFORMED**

These include tests of the gear, airbrakes, flaps, slats, and servo controls. Perform the first tests very slowly to avoid hydraulic leakage.

All Hydraulic Equipment . . . . . **TIGHTNESS CHECKED/ NO CORROSION**

Extinguishers . . . . **MAINTENANCE PERFORMED**

Extinguisher Cartridges . . . . **CHECKED VALID**

Gage Insulation Measurements . . . . **PERFORMED**

Wing Collector Tank Expansion Valves . . . . . **CHECKED**

Hydraulic Reservoir Expansion Valves . . . . . . **CHECKED**

Yaw Damper . . . . **TESTED**

Brake System Pressure/Operation . . . . **CHECKED**

Accumulator Pressures . . . . **CHECKED**

Slat Tracks and Rollers/ Flap Rollers . . . . **CLEANED/LUBRICATED**

Aircraft . . . . **LUBRICATED**

Airspeed Indicating System . . . . **TESTED**

Radio Tests . . . . **PERFORMED**

Electrical Systems . . . . **TESTED**

Emergency Beacon (if installed) . . **CURE DATE CHECKED**

Oxygen . . . . **SERVICED/TESTED**

Fill the oxygen cylinder. Test the system for leakage; check mask operation.

Silicagel Bags . . . . REMOVED

Pressurization Valves . . . . . CHECKED/SATISFACTORY

Overpressure Valves . . . . CRANKED

Pressurized Refueling . . . . PERFORMED

Freon Motor-Compressor Belt . . . . STRETCHED

Freon Circuit . . . . REPLENISHED

Freon Level . . . . CHECKED/CORRECTED

Freon Compressor Oil Level . . . . CHECKED

Hot Weather and Desert Operations

Observe aircraft performance limitations computed from Section 5 of the AFM. Temperature affects engine thrust, braking, takeoff distance, and climb performance. In very dry areas, protect the aircraft from dust and sand.

Exterior Inspection

Preflight Inspection . . . . CONDUCTED

All Protective Covers . . . . REMOVED

Landing Gear Shock Struts . . . . CLEANED OF DUST AND SAND

Gear Doors, Position Switches, and Squat Switches . . . . CONDITION/ OPERATION CHECKED

Tires and Struts . . CHECKED FOR PROPER INFLATION

Engine Inlet/Exhaust Ducts and Thrust Reversers . . CLEANED OF DUST AND SAND

During the inspection, be particularly conscious of dust and sand accumulations on components that are lubricated with oily or greasy lubricants. Be careful of personnel and equipment behind the aircraft during engine starts.

Engine Start

ITT . . . . MONITORED

During engine starts at high outside temperatures, engine ITT is higher than normal but should remain within limits.

Taxi

If the airport surfaces are sandy or dust covered, avoid the exhaust wake and propwash of other aircraft.

Takeoff

Ensure takeoff performance is adequate for conditions and runway length.

Shutdown and Postflight

All Protective Covers . . . . INSTALLED

Sunscreens on Glareshield and Side Windows . . . . INSTALLED

This limits the sunlight entering the cockpit.

Window Shades in Cabin . . . . LOWERED

Cold Weather Operations

Preflight Inspection

Inspect areas where surface snow or frost could change or affect normal system operations. In addition, perform the following supplemental checks.

All Protection Covers . . . . REMOVED

Surface . . . . CHECKED FREE OF FROST, ICE, AND SNOW

The wing leading edges, all control surfaces, fuselage, wings, and horizontal stabilizer must be free of ice, frost, or snow.

Engine Inlets . . . . CLEARED OF INTERNAL ICE AND SNOW

Check that the inlet cowling is free of ice or snow and that the fan rotates freely.

Fuel Tank Vents . . CHECKED FREE OF ICE AND SNOW

Check the NACA vents. Remove all traces of ice or snow.

Pitot Heads and Static Ports . . . . CLEARED OF ICE

Water rundown resulting from snow removal may refreeze immediately forward of the static ports, causing an ice buildup that results in disturbed airflow over the static ports. Erroneous static readings occur even though the static ports themselves are clear.

Landing Gear and Gear Door Linkage . . . . . . CHECKED

Be sure the landing gear and door linkages are free of impacted ice or snow. Also, check the landing gear uplocks.

Aircraft Deicing . . . . COMPLETED

The times of protection (i.e., the holdover times) for different de-icing fluids vary considerably. Furthermore, these times depend to a large extent on the meteorological conditions and methods of application. When temperatures warrant, consider preheating the following equipment:

- engines (less than -35°C)
- batteries (less than -15°C)
- windshields (less than -15°C)
- interior and avionics.

Accomplish engine preheat by blowing heated air into the inlet and exhaust ducts.

CAUTION: Do not spray deicing fluid in areas where spray or fluid may enter the engine inlets. Deicing fluid may be used to clear these areas, providing they are thoroughly wiped clean before starting.

GPU Available

1,000 AMP Rating

For Engine Start:

Batteries . . . . PREHEAT IF NECESSARY

Thermal blankets may be used.

Windshield Heat . . . . NORMAL

DC Power Selector . . . . EXT POWER

Auxiliary heat (if installed) . . USE TO WARM INTERIOR

NOTE: It is highly recommended that the pressurization valve of each hydraulic reservoir be heated for several minutes.

GPU Not Available

Ambient Temperature -15° C to -35° C

Batteries . . . . PREHEAT

DC Power Selector . . . . LOW TEMP START

No. 2 Engine . . . . START

The No. 2 engine becomes a power source; 55% N_1 is required for cabin heating.

For Second Engine Start:

DC Power Selector . . . . NORMAL

After Engine Start

Instruments . . OBSERVED FOR NORMAL OPERATION

The engine instruments should indicate approximately normal shortly after reaching idle speed.

Engine Oil Pressure . . . . CHECKED

Power settings above idle are not recommended until engine oil temperature is 30°C or warmer. During cold starts, oil pressure transients up to 55 PSI for three minutes are allowed.

Flight Controls . . . . CHECKED

In extremely cold weather, the flight controls may be sluggish until the hydraulic fluid in the reservoir and lines warms. Operate the controls throughout their full range until the sluggishness disappears.

Verify that the stabilizer, slats, and flaps operate normally. At temperatures of -30°C, the FLAP MOTOR CB may open during flap retraction. As the aircraft warms, this situation should remedy itself.

Anti-Ice . . . . AS REQUIRED

During operation from snow-covered runways, turn on engine anti-ice during taxi and takeoff. Precede takeoff by a static engine run-up to as high a power level as practical to ensure stable engine operation prior to brake release.

If severe icing conditions are present, turn on engine anti-icing immediately after engine start. During prolonged ground operation, periodic engine run-up may be performed to reduce the possibility of ice buildup. However, be aware that ingestion of ice or hardened snow particles can cause engine damage.

Slats/Flaps . . . . RETRACTED

The slats and flaps should be retracted during taxi. Extend slats and/or flaps when the aircraft is on the runway and in takeoff position.

Brakes . . . . USE MINIMIZED

Using brakes on surfaces covered with snow or slush can result in moisture freezing in the brake assemblies that in turn can cause wheel jamming on the subsequent landing. This problem may be lessened by using the minimum practical braking force and by cycling the gear after takeoff.

> **CAUTION:** Flight test data has shown that engine flameout or compressor stalls can occur between 50 and 60 kts on takeoff in water or on snow.

Before Takeoff

Contaminated Runway Operations . . . . COMPUTED

Service Letter 34 presents formulas for computing recommended equivalent water depths, takeoff distances, and techniques. See Flight Planning chapter for details.

Slats/Flaps . . . . SET FOR TAKEOFF

Just prior to takeoff, extend the slats and/or flaps as planned.

Engine Operation During Acceleration . . . . . CHECKED

Ensure proper engine operation during takeoff roll. Abort takeoff if malfunctions or engine instrument variations are observed.

After Takeoff

Landing Gear . . . . CYCLED BELOW 190 KIAS

After takeoff in snow or slush, cycle the gear three times to remove snow and slush accumulations on the gear and brakes.

Slats . . . . CYCLED BELOW 190 KIAS

If Slats Fail to Fully Retract (red slat-in-transit light on):

Wing Anti-Ice . . . . ON

Slats . . . . CYCLE TO REMOVE ICE

If slats fail to fully retract, land as soon as possible.

Cruise/Descent

Satisfactory operation of the anti-icing system requires that the engine speed (N_1) be not less than shown in **Table 3B-B**.

Phase of Flight	% N_1			
	at -30°C OAT	at -20°C OAT	at -10°C OAT	at -5°C OAT
In Flight – Min.	76	73	67	62
Recommended	78	75	69	64
Approach	69	69	69	64
One Engine	88	85	79	74

Table 3B-B; Engine Settings for Anti-Ice

CAUTION: If ice has already formed, the ignition switches must be set to AIRSTART and anti-ice turned on as follows:
Ignition Switches – AIRSTART
Engine 1 Anti-Ice – ON
30 Seconds Later:
Engine 2 Anti-Ice – ON
30 Seconds Later:
WING ANTI-ICE – ON

Normal flight operations call for the airbrakes to be retracted at 500 ft AGL on the approach.

CAUTION: In order to maintain a sufficiently high engine setting in icing conditions, approach may be done in the landing configuration with airbrakes extended to 500 ft AGL. At 500 ft AGL, retract the airbrakes and turn off the engine synchronizer, if installed.

Landing

Contaminated Runway Operations . . . . COMPUTED

Service Letter 34 presents formulas for computing recommended equivalent water depths, landing distances, and techniques. See Flight Planning chapter for details.

Taxi-In and Park

Engine Anti-Ice . . . . AS REQUIRED

It may be necessary to leave the engine anti-ice on while taxiing in.

Wheel Chocks . . . . IN PLACE

Parking Brake . . . . OFF

Release the parking brake to eliminate the possibility of the brakes freezing.

Protective Covers . . . . INSTALLED

Water Storage Containers . . . . DRAINED

Toilet . . . . DRAINED

Batteries . . . . REMOVED

It is recommended that the batteries be removed and stored indoors at room temperature.

Standard Operating Procedures

Chapter 3C

SimuFlite strongly supports the premise that the disciplined use of well-developed Standard Operating Procedures (SOP) is central to safe, professional aircraft operations, especially in multi-crew, complex, or high performance aircraft.

If your flight department has an SOP, we encourage you to use it during your training. If your flight department does not already have one, we welcome your use of the SimuFlite SOP.

Corporate pilots carefully developed this SOP. A product of their experience, it is the way SimuFlite conducts its flight operations.

The procedures described herein are specific to the Falcon 10 and apply to specified phases of flight. The flight crew member designated for each step accomplishes it as indicated.

Table of Contents

General Information

Definitions

LH/RH – Pilot Station. Designation of seat position for accomplishing a given task because of proximity to the respective control/indicator. Regardless of PF or PNF role, the pilot in that seat performs tasks and responds to checklist challenges accordingly.

PF – Pilot Flying. The pilot responsible for controlling the flight of the aircraft.

PIC – Pilot-in-Command. The pilot responsible for the operation and safety of an aircraft during flight time.

PNF – Pilot Not Flying. The pilot who is not controlling the flight of the aircraft.

Flow Patterns

Flow patterns are an integral part of the SOP. Accomplish the cockpit setup for each phase of flight with a flow pattern, then refer to the checklist to verify the setup. Use normal checklists as "done lists" instead of "do lists."

Flow patterns are disciplined procedures; they require pilots who understand the aircraft systems/controls and who methodically accomplish the flow pattern.

A standardized flow pattern for the cockpit setup before starting engines appears in the Expanded Normals chapter.

Checklists

Use a challenge-response method to execute any checklist. After the PF initiates the checklist, the PNF challenges by reading the checklist item aloud. The PF is responsible for verifying that the items designated as PF or his seat position (i.e., LH or RH) are accomplished and for responding orally to the challenge. Items designated on the checklist as PNF or by his seat position are the PNF's responsibility. The PNF confirms the accomplishment of the item, then responds orally to his own challenge. In all cases, the response by either pilot is confirmed by the other and any disagreement is resolved prior to continuing the checklist.

After the completion of any checklist, the PNF states "____ checklist is complete." This allows the PF to maintain situational awareness during checklist phases and prompts the PF to continue to the next checklist, if required.

Effective checklists are pertinent and concise. Use them the way they are written: verbatim, smartly, and professionally.

Omission of Checklists

While the PF is responsible for initiating checklists, the PNF should ask the PF whether a checklist should be started if, in his opinion, a checklist is overlooked. As an expression of good flight deck management, such prompting is appropriate for any flight situation: training, operations, or checkrides.

Challenge/No Response

If the PNF observes and challenges a flight deviation or critical situation, the PF should respond immediately. If the PF does not respond by oral communication or action, the PNF must issue a second challenge that is loud and clear. If the PF does not respond after the second challenge, the PNF must ensure the safety of the aircraft. The PNF must announce that he is assuming control and then take the necessary actions to return the aircraft to a safe operating envelope.

> **NOTE:** "Control" means responsible for flight control of the aircraft, whether manual or automatic.

Abnormal/Emergency Procedures

When any crewmember recognizes an abnormal or emergency condition, the PIC designates who controls the aircraft, who performs the tasks, and any items to be monitored. Following these designations, the PIC calls for the appropriate checklist. The crewmember designated on the checklist accomplishes the checklist items with the appropriate challenge/response.

The pilot designated to fly the aircraft (i.e., PF) does not perform tasks that compromise this primary responsibility, regardless of whether he uses the autopilot or flies manually.

Both pilots must be able to respond to an emergency situation that requires immediate corrective action without reference to a checklist. The elements of an emergency procedure that must be performed without reference to the appropriate checklist are called memory or recall items. Accomplish all other abnormal and emergency procedures while referring to the printed checklist.

Accomplishing abnormal and emergency checklists differs from accomplishing normal procedure checklists in that the pilot reading the checklist states both the challenge and the response when challenging each item.

When a checklist procedure calls for the movement or manipulation of controls or switches critical to safety of flight (e.g., throttles, engine fire switches, fire bottle discharge switches), the pilot performing the action obtains verification from the other pilot that he is moving the correct control or switch prior to initiating the action.

Any checklist action pertaining to a specific control, switch, or equipment that is duplicated in the cockpit is read to include its relative position and the action required (e.g., "Left Throttle – OFF; Left Boost Pump – NORMAL").

Time Critical Situations

When the aircraft, passengers, and/or crew are in jeopardy, remember three things.

- FLY THE AIRCRAFT – Maintain aircraft control.
- RECOGNIZE CHALLENGE – Analyze the situation.
- RESPOND – Take appropriate action.

Aborted Takeoffs

The aborted takeoff procedure is a preplanned maneuver; both crewmembers must be aware of and briefed on the types of malfunctions that mandate an abort. Assuming the crew trains to a firmly established SOP, either crewmember may call for an abort.

The PF normally commands and executes the takeoff abort for directional control problems or catastrophic malfunctions. Additionally, any indication of the following malfunctions prior to V_1 is cause for an abort:

- engine failure
- engine fire
- thrust reverser deployment.

In addition to the above, the PF usually executes an abort prior to 80 KIAS for any abnormality observed.

When the PNF calls an abort, the PF announces "Abort." or "Continue." and executes the appropriate procedure.

Critical Malfunctions in Flight

In flight, the observing crewmember positively announces a malfunction. As time permits, the other crewmember makes every effort to confirm/identify the malfunction before initiating any emergency action.

If the PNF is the first to observe any indication of a critical failure, he announces it and simultaneously identifies the malfunction to the PF by pointing to the indicator/annunciator.

After verifying the malfunction, the PF announces his decision and commands accomplishment of any checklist memory items. The PF monitors the PNF during the accomplishment of those tasks assigned to him.

Non-Critical Malfunctions in Flight

Procedures for recognizing and verifying a non-critical malfunction or impending malfunction are the same as those used for time critical situations: use positive oral and graphic communication to identify and direct the proper response. Time, however, is not as critical and allows a more deliberate response to the malfunction. Always use the appropriate checklist to accomplish the corrective action.

Radio Tuning and Communication

The PNF accomplishes navigation and communication radio tuning, identification, and ground communication. For navigation radios, the PNF tunes and identifies all navigation aids. Before tuning the PF's radios, he announces the NAVAID to be set. In tuning the primary NAVAID, the PNF coordinates with the PF to ensure proper selection sequencing with the autopilot mode. After tuning and identifying the PF's NAVAID, the PNF announces "(Facility) tuned and identified."

Monitor NDB audio output anytime the NDB is in use as the NAVAID. Use the marker beacon audio as backup to visual annunciation for marker passage confirmation.

In tuning the VHF radios for ATC communication, the PNF places the newly assigned frequency in the head not in use (i.e., preselected) at the time of receipt. After contact on the new frequency, the PNF retains the previously assigned frequency for a reasonable time period.

Altitude Assignment

The PNF sets the assigned altitude in the altitude alerter and points to the alerter while orally repeating the altitude. The PNF continues to point to the altitude alerter until the PF confirms the altitude assignment and alerter setting.

Advising of Aircraft Configuration Change

If the PF is about to make an aircraft control or configuration change, he alerts the PNF to the forthcoming change (e.g., gear, speedbrake, and flap selections). If time permits, he also announces any abrupt flight path changes so there is always mutual understanding of the intended flight path.

Time permitting, a PA announcement to the passengers precedes maneuvers involving unusual deck or roll angles.

NOTE: The acronym AWARE stands for the following:

- aircraft status
- weather
- airport information
- route of flight
- extra.

Transitioning from Instrument to Visual Conditions

If visual meteorological conditions (VMC) are encountered during an instrument approach, the PNF normally continues to make callouts for the instrument approach being conducted. However, the PF may request a changeover to visual traffic pattern callouts.

Pre-Departure Briefings

The PIC should conduct a pre-departure briefing prior to each flight to address potential problems, weather delays, safety considerations, and operational issues. Pre-departure briefings should include all crewmembers to enhance team-building and set the tone for the flight. The briefing may be formal or informal, but should include some standard items. The acronym AWARE works well to ensure no points are missed. This is also an opportunity to brief any takeoff or departure deviations from the SOP due to weather or runway conditions.

Phase of Flight SOP

Holding Short

PF	PNF
CALL: "Before Takeoff checklist."	
	ACTION: Complete Before Takeoff checklist.
	CALL: "Before Takeoff checklist complete."

Takeoff Briefing

ACTION: Brief the following:

- Assigned Runway for Takeoff
- Initial Heading/Course
- Initial Altitude
- Airspeed Limit (If Applicable)
- Clearance Limit
- Emergency Return Plan
- SOP Deviations

Consider the following:

- Impaired Runway Conditions
- Weather
- Obstacle Clearance
- Instrument Departures Procedures
- Abort

Cleared for Takeoff

PF	PNF
	ACTION: Confirm assigned runway for takeoff and check heading indicator agreement
	CALL: "Assigned runway confirmed, heading checked"
ACTION: Confirm Assigned Runway for Takeoff and Check Heading Indicator Agreement	
CALL: "Assigned Runway Confirmed, Heading Checked"	
CALL: "Line-Up checklist"	
	ACTION: Complete Line-Up checklist
	CALL: "Line-Up checklist Complete

Takeoff Roll

PF	PNF
Setting Takeoff Power	
	CALL: "_____ set."
At 60 KCAS	
	CALL: "Airspeed alive." At 80 KIAS, **CALL:** "80 knots crosscheck."
ACTION: Move left hand to yoke. **CALL:** "My yoke."	**CALL:** "Your yoke."
At V_1	
	CALL: "V_1."
ACTION: Move hand from throttles to yoke.	
At V_R	
	CALL: "Rotate."
ACTION: Rotate to 16° pitch attitude or charted pitch attitude for takeoff.	

Climb

PF	PNF
At Positive Rate of Climb	
	CALL "Positive rate."
Only after PNF's call, **CALL** "Gear – UP."	
	CALL "Gear selected UP." When gear indicates UP, "Gear indicates UP."
After Gear Retraction	
	ACTION Immediately accomplish attitude correlation check. ▪ PF's and PNF's ADI displays agree. ▪ Pitch and bank angles are acceptable. **CALL** "Attitudes check." Or, if a fault exists, give a concise statement of the discrepancy.
At V_{FR} and 400 Ft Above Airport Surface (Minimum)	
	CALL "Clean wing speed."
CALL "Clean the wing."	
	CALL "Slats selected." When flaps indicate 0°, "Slats indicated." "Clean wing selected." When clean wing is indicated, "Clean wing indicated."

Climb (cont.)

PF	PNF
At V_{ENR} (Minimum)	
CALL "Climb power."	
	CALL "Climb power set."
At 15,000 FT (Minimum) Above Airport Surface and Workload Permitting	
CALL "Climb checklist."	
	ACTION Complete Climb checklist.
	CALL "Climb Checklist complete."
At Transition Altitude	
CALL "29.92 set."	**CALL** "29.92 set."
At 1,000 Ft Below Assigned Altitude	
	CALL "_____ (altitude) for _____ (altitude)." (e.g., "9,000 for 10,000.")
CALL "_____ (altitude) for _____ (altitude)." (e.g., "9,000 for 10,000.")	

Cruise

PF	PNF
CALL "Cruise checklist."	
	ACTION Complete Cruise checklist.
	CALL "Cruise checklist complete."
Altitude Deviation in Excess of 100 Ft	
	CALL "Altitude."
CALL "Correcting."	
Course Deviation in Excess of One Dot	
	CALL "Course."
CALL "Correcting."	

Descent

PF		PNF	
CALL	“Descent checklist.”		
		ACTION	Complete Descent checklist.
		CALL	“Descent checklist complete.”

At 1,000 Ft Above Assigned Altitude

PF		PNF	
		CALL	“_____ (altitude) for _____ (altitude).” (e.g., “10,000 for 9,000.”)
CALL	“_____ (altitude) for _____ (altitude).” (e.g., “10,000 for 9,000.”)		

At Transition Level

PF		PNF	
CALL	“Altimeter set _____ .”	**CALL**	“Altimeter set _____ .”

At 10,000 Ft

PF		PNF	
		CALL	“10,000 ft.”
CALL	“Check. Speed 250 kts.”		

Maintain sterile cockpit below 10,000 ft above airport surface.

Descent (cont.)

PF	PNF

At Appropriate Workload Time

PF	PNF
REVIEW	**REVIEW**

Review the following:

- approach to be executed
- field elevation
- appropriate minimum sector altitude(s)
- inbound leg to FAF, procedure turn direction and altitude
- final approach course heading and intercept altitude
- timing required
- DA/MDA
- MAP (non-precision)
- VDP
- special procedures (DME step-down, arc, etc.)
- type of approach lights in use (and radio keying procedures, if required)
- missed approach procedures
- runway conditions information

ACTION Brief the following:

- configuration
- approach speed
- minimum safe altitude
- approach course
- FAF altitude
- DA/MDA altitude
- field elevation
- VDP
- missed approach
  - heading
  - altitude
  - intentions
- abnormal implications.

Accomplish as many checklist items as possible. The Approach checklist must be completed prior to the initial approach fix.

Precision Approach

PF	PNF
Prior to Initial Approach Fix	
CALL "Slats."	
	CALL "Slats selected."
	When slats light green, "Slats indicated."
CALL "Flaps – 15." "Approach checklist."	
	CALL "Flaps selected 15."
	When flaps indicate 15°, "Flaps indicate 15."
	ACTION Complete Approach checklist.
	CALL "Approach checklist complete."
At Initial Convergence of Course Deviation Bar	
CALL "Localizer/ course alive."	**CALL** "Localizer/ course alive."
At Initial Downward Movement of Glideslope Raw Data Indicator	
CALL "Glideslope alive."	**CALL** "Glideslope alive."
CALL "Gear – DOWN." "Before Landing checklist."	
	CALL Gear selected DOWN.
	When gear indicates DOWN, "Gear indicates DOWN."
	ACTION Complete Before Landing checklist except for full flaps and autopilot.

Precision Approach (cont.)

PF	PNF
When Annunciators Indicate Localizer Capture	
CALL "Localizer captured."	**CALL** "Localizer captured."
At One Dot From Glideslope Intercept	
	CALL "One dot to go."
CALL "Flaps – 30."	
	CALL "Flaps selected 30."
	When flaps indicate 30°, "Flaps indicate 30."
When Annunciator Indicates Glideslope Capture	
CALL "Glideslope captured."	**CALL** "Glideslope captured."
CALL "Flaps – 52."	
	CALL "Flaps selected 52."
	When flaps indicate 52°, "Flaps indicate 52."

> If the VOR on the PNF's side is used for crosschecks on the intermediate segment, the PNF's localizer and glideslope status calls are accomplished at the time the PNF changes to the ILS frequency. This should be no later than at completion of the FAF crosscheck, if required. The PNF should tune and identify his NAV radios to the specific approach and monitor.

Precision Approach (cont.)

PF	PNF
At FAF	
CALL "Outer marker." or "Final fix."	
	ACTION ■ Start timing. ■ Visually crosscheck that both altimeters agree with crossing altitude. ■ Set missed approach altitude in altitude alerter. ■ Check PF and PNF instruments. ■ Call FAF inbound.
	CALL "Outer marker." or "Final fix." "Altitude checks."
At 1,000 Ft Above DA(H)	
	CALL "1,000 ft to minimums."
CALL "Check."	

Precision Approach (cont.)

PF	PNF
At 500 Ft Above DA(H)	
	CALL "500 ft to minimums."
CALL "Check."	

Approach Window

- Within one dot deflection, both LOC and GS
- IVSI less than 1,000 fpm
- IAS within V_{AP} ± 10 kts (no less than V_{REF})
- No flight instrument flags with the landing runway or visual references not in sight
- Landing configuration

When within 500 ft above touchdown, the aircraft must be within the "approach window." If the aircraft is not within this "window," a missed approach must be executed.

PF	PNF
At 200 Ft Above DA(H)	
	CALL "200 ft to minimums."
CALL "Check."	
At 100 Ft Above DA(H)	
	CALL "100 ft to minimums."
CALL "Check."	

Precision Approach (cont.)

PF		PNF	
At Point Where PNF Sights Runway or Visual References			
		CALL	"Runway (or visual reference) _____ o'clock."
CALL	"Going visual. Land," or "Missed approach."		
		ACTION	As PF goes visual, PNF transitions to instruments.
At DA(H)			
		CALL	"Minimums. Runway (or visual reference) ____ o'clock."
ACTION	Announce intentions.		
CALL	"Going visual. Land," or "Missed approach."		
		ACTION	As PF goes visual, PNF transitions to instruments.

Precision Missed Approach

PF	PNF
At DA(H)	
	CALL "Minimums. Missed approach."
CALL "Missed approach."	
ACTION Apply power firmly and positively. Activate go-around mode and initially rotate the nose to the flight director go-around attitude.	**ACTION** Assist PF in setting power for go-around.
CALL "Flaps – 15."	
	CALL "Flaps selected 30."
	When flaps indicate 30°, "Flaps indicate 30." "Flaps selected 15."
	When flaps indicate 15°, "Flaps indicate 15."
At Positive Rate of Climb	
	CALL "Positive rate."
CALL "Gear – UP."	
	CALL Gear selected UP.
	When gear indicates UP, "Gear indicates UP."
	ACTION Announce heading and altitude for missed approach.

Precision Approach Deviations

PF	PNF
± One Half Dot – Glideslope	
	CALL “One half dot *(high, low)* and *(increasing, holding, decreasing)*.”
CALL “Correcting.”	
± One Half Dot – Localizer	
	CALL “One half dot *(right, left)* and *(increasing, holding, decreasing)*.”
CALL “Correcting.”	
V_{AP} ± _____	
	CALL “Speed plus or minus ____ and *(increasing, holding, decreasing)*.”
CALL “Correcting.”	
At or Below V_{REF}	
	CALL “V_{REF}.” or “V_{REF} minus _____ (knots below V_{REF}).”
CALL “Correcting.”	
Rate of Descent Exceeds 1,000 FPM	
	CALL “Sink ____ (amount) hundred and (*increasing, holding, decreasing*).”
CALL “Correcting.”	

Non-Precision Approach

PF	PNF
Prior to Initial Approach Fix	
CALL "Slats."	
	CALL "Slats selected."
	When slats light green, "Slats indicated."
CALL "Flaps – 15." "Approach checklist."	
	CALL "Flaps selected 15."
	When flaps indicate 15°, "Flaps indicate 15."
	ACTION Complete Approach checklist.
	CALL "Approach checklist complete."
At Initial Convergence of Course Deviation Bar	
CALL "Localizer/ course alive."	**CALL** "Localizer/ course alive."
When Annunciators Indicate Course Capture	
CALL "Localizer/course captured."	**CALL** "Localizer/course captured."

Non-Precision Approach (cont.)

PF	PNF
Prior to FAF	
	CALL "One mile or 30 seconds from FAF."
CALL "Gear – DOWN." "Before Landing checklist."	
	CALL "Gear selected DOWN."
	When gear indicates DOWN, "Gear indicates DOWN."
	ACTION Complete Before Landing checklist except for full flaps and autopilot.
CALL "Flaps – 30."	
	CALL "Flaps selected 30."
	When flaps indicate 30°, "Flaps indicate 30."
	CALL "Altimeters check."

Non-Precision Approach (cont.)

PF	PNF
At FAF	
CALL "Outer marker." or "Final fix."	**CALL** "Outer marker." or "Final fix."
	ACTION ■ Start timing. ■ Visually crosscheck that both altimeters agree. ■ Set MDA (or nearest 100 ft above) in altitude alerter. ■ Check PF and PNF instruments. ■ Call FAF inbound.
At 1,000 Ft Above MDA	
	CALL "1,000 ft to minimums."
CALL "Check."	

Non-Precision Approach (cont.)

PF	PNF

At 500 Ft Above DA(H)

PF	PNF
	CALL "500 ft to minimums."
CALL "Check."	

Approach Window

- Within one dot CDI deflection or 5° bearing
- IVSI less than 1,000 fpm
- IAS within V_{AP} ± 10 kts (no less than V_{REF})
- No flight instrument flags with the landing runway or visual references not in sight
- Landing configuration, except for full flaps

When within 500 ft above touchdown, the aircraft must be within the "approach window." If the aircraft is not within this "window," a missed approach must be executed.

At 200 Ft Above MDA

PF	PNF
	CALL "200 ft to minimums."
CALL "Check."	

At 100 Ft Above MDA

PF	PNF
	CALL "100 ft to minimums."
CALL "Check."	

At MDA

PF	PNF
	CALL "Minimums. _____ ." (time) to go." or Minimums. _____ . (distance) to go."
CALL "Check."	

Non-Precision Approach (cont.)

PF	PNF
At Point Where PNF Sights Runway or Visual References	
	CALL "Runway (or visual reference) ______ o'clock."
CALL "Going visual. Land." or "Missed approach."	

Non-Precision Missed Approach

PF		PNF	
At MAP			
		CALL	"Missed approach point. Missed approach."
CALL	"Missed approach."		
ACTION	Apply power firmly and positively. Activate go-around mode and initially rotate the nose to the flight director go-around attitude.	**ACTION**	Assist PF in setting power for go-around.
CALL	"Flaps – 15."		
		CALL	"Flaps selected 15."
		When flaps indicate 15°,	"Flaps indicate 15."
At Positive Rate of Climb			
		CALL	"Positive rate."
CALL	"Gear – UP."		
		CALL	Gear selected UP.
		When gear indicates UP,	"Gear indicates UP."
		ACTION	Announce heading and altitude for missed approach.

Non-Precision Missed Approach (cont.)

PF	PNF
At V_{REF} + 35 and 400 Ft Above Airport Surface (Minimum)	
	CALL "Clean wing speed."
CALL "Clean the wing."	
	ACTION Slats selected."
	When slats indicate 0°, "Slats indicated." "Clean wing selected."
	When clean wing indicated, "Wing indicates clean."
At 1,500 Ft (Minimum) Above Airport Surface and Workload Permitting	
CALL "Climb checklist."	
	ACTION Complete Climb checklist.
	CALL "Climb checklist complete."

Non-Precision Approach Deviations

PF	PNF
± One Dot – Localizer/VOR	
	CALL "One dot *(right, left)* and *(increasing, holding, decreasing)*."
CALL "Correcting."	
± 5° At or Beyond Midpoint for NDB Approach	
	CALL "_____ degrees off course) (*right, left*) and *(increasing, holding, decreasing*)."
CALL "Correcting."	
V_{AP} ± _____	
	CALL "Speed plus or minus ____ and *(increasing, holding, decreasing)*."
CALL "Correcting."	
At or Below V_{REF}	
	CALL "V_{REF}." or "V_{REF} minus _____ (knots below V_{REF})."
CALL "Correcting."	
Rate of Descent Exceeds 1,000 FPM	
	CALL "Sink ____ (amount) hundred and (*increasing, holding, decreasing*)."
CALL "Correcting."	

Visual Traffic Patterns

PF	PNF
Before Pattern Entry/Downwind (1,500 Ft Above Airport Surface)	
CALL “Slats.”	
	CALL “Slats selected.”
	When slats light green, “Slats indicated.”
CALL “Flaps – 15.” “Approach checklist.”	
	CALL “Flaps selected 15.”
	When flaps indicate 15°, “Flaps indicate 15.”
	ACTION Complete Approach checklist.
	CALL “Approach checklist complete.”
Downwind	
CALL “Gear – DOWN. Before Landing checklist.”	
	CALL “Gear selected DOWN.”
	When gear indicates DOWN, “Gear indicates DOWN.”
CALL “Flaps – 30.”	
	CALL “Flaps selected 30.”
	When flaps indicate 30°, “Flaps indicate 30.”
	ACTION Complete Before Landing checklist except for full flaps.

Visual Traffic Patterns (cont.)

PF	PNF
At 1,000 Ft Above Airport Surface	
	CALL "1,000 AGL."
CALL "Check."	
At 500 Ft Above Airport Surface	
	CALL "500 AGL."
CALL "Check."	
At 200 Ft Above Airport Surface	
	CALL "200 AGL."
CALL "Check."	

Landing

PF	PNF
At Point on Approach When PF Sights Runway or Visual Reference (Landing Assured)	
CALL "Going visual. Land. Flaps – 52."	
	CALL "Flaps selected 52."
	When flaps indicate 52°, "Flaps indicate 52."
ACTION Push autopilot disconnect switch.	**ACTION** Continue with: ■ speed check ■ vertical speed check ■ callouts
CALL "Autopilot off."	■ gear down verification ■ flap verification.
	CALL "Final gear and flaps recheck." "Before Landing checklist complete."
At 100 Ft Above Touchdown	
	CALL "100 ft."
At 50 Ft Above Touchdown	
	CALL "50 ft."
At Touchdown	
CALL "Extend airbrakes."	
	ACTION Extend airbrakes.
	CALL "Airbrakes extended."

Landing (cont.)

PF	PNF
At Thrust Reverser Deployment	
	CALL "Two green lights."
At 80 Kts	
	CALL "80 kts."
At Thrust Reverser Idle Speed (60 KIAS)	
	CALL "60 kts."

Maneuvers

Chapter 3D

This chapter includes a written description of various maneuvers and techniques during normal operation and one-engine operation.

Table of Contents

Normal Operation

Taxiing

Prior to taxiing the Falcon 10/100, complete all items of the Before Taxi checklist. Obtain clearance from the appropriate control agency and ensure both pilots understand the taxi route prior to aircraft movement. Both pilots should visually check the area around the aircraft for ground equipment, other obstructions, and personnel.

Also, a visual check should be made of the passenger cabin to note that baggage and equipment are stowed, emergency exit access is clear, galley equipment and supplies are secure, and passengers are seated with seat belts fastened. If necessary, a verbal or PA announcement can be made that the aircraft is being taxied.

When ready to taxi, release the parking brake. Depress and hold the nose steering wheel while advancing the power levers. Remember that the nose steering wheel can be turned 120° in each direction, with the first 60° of rotation producing up to 6° of nosewheel turning, and the remaining 60° of rotation producing approximately 54° additional nosewheel turning.

Smoothly pressure the nose steering wheel into and out of each turn to produce a lurch-free ride. Releasing the downward pressure on the steering wheel allows the nosewheel to return to its center position rather abruptly; this can cause lurching while the aircraft is moving, especially in a turn.

When applying power to taxi, use care and good judgment to avoid exhaust blast to other aircraft, personnel, equipment, and buildings. Apply sufficient power to start the aircraft rolling; check proper operation of the wheel brakes and then reduce power to idle. At lighter weights and higher elevations, the aircraft may accelerate easily, even at idle power making it easy to generate taxi speeds much higher than desired.

If it is necessary to make a sharp turn after moving from the parking spot, maintain above idle power until sufficient speed is gained to complete the turn with idle thrust. The additional speed prevents the aircraft from stopping during the turn and then requiring excess thrust to get it moving again. If taxiing in a congested area and close to other aircraft, hangars, or other obstacles, use ground personnel to ensure adequate clearance.

When clear of other aircraft, check anti-skid operation by depressing one brake at a time and pushing and releasing the anti-skid test button. Ensure that the anti-skid lights illuminate and extinguish, and that the brake releases and engages. Repeat this procedure with the other brake pedal.

Both pilots should maintain good lookout discipline while taxiing. Avoid tests, checks, and paperwork activity that compromise necessary visual clearing. Taxi speed should be kept to the minimum practical for safety and for passenger comfort.

Items of the Taxi and Before Takeoff checklists should be accomplished by flow pattern, then verified by checklist reading and response when visual clearing is not compromised.

Whenever it is necessary to stop the aircraft movement with the engines running, hold firm pressure on the brake pedals until coming to a complete stop, then set the Park Brake handle in the aft detent. Plan ahead – be sure that the aircraft and its pilots and passengers are ready for flight before calling for takeoff clearance.

Before Takeoff

Prior to takeoff, consider the following:

- use of flight director
- thrust application
- brake release
- time to 100 kts
- runway alignment
- proper use of controls
- proper rotation
- gear retraction
- noise abatement procedures and thrust reduction to climb power
- adherence to airport area speed limits
- icing conditions.

The PF's takeoff briefing, in accordance with SOP, should be clear, concise, and pertinent to the specific takeoff. Set airspeed bugs according to the SOP. Navigation aids should be tuned and identified; the specific courses should be set. The altitude alerter should be set to the proper altitude. When cleared for takeoff, complete all items of the Takeoff/ Line Up checklist.

Takeoff (General)

The primary instruments for setting takeoff thrust are the N_1 gages. The required takeoff power settings are obtained from the manufacturer's AFM or from the SimuFlite Operating Handbook. The AFM and the Operating Manual state that for normal takeoffs, this power is set statically and the charted takeoff performance is based on such a setting.

With the fuel computers operating normally, advancing the power levers quickly full forward may produce momentary overshoots of the target values for N_1 and ITT; these should return to normal ranges within a short time. Both pilots should, however, monitor these indicators to ensure limiting values do not remain exceeded.

Normal Standing Takeoff

Hold the brakes firmly and advance the power levers to approximately 80% N_1. Allow the engines to spool up and stabilize at nearly equal N_1 indications before advancing the levers to the desired takeoff N_1. When power is set, check engine instruments and release the brakes smoothly.

To optimize coordination, the PNF should monitor the instruments and assist with the power levers to enable the PF to concentrate on directional control.

The PF should control direction initially with the nose steering wheel while maintaining power lever control with the right hand. The PNF initially maintains slight forward pressure on the control column while holding neutral ailerons.

At 80 KIAS, the PF's left hand releases the nose steering wheel and moves to the control yoke; directional control is then accomplished with the rudder pedals. At V_1, the PF's right hand moves to the yoke in preparation for takeoff rotation. Refer to the profile on page 3D-27.

Rolling Takeoff

A rolling takeoff may be accomplished when actual runway length adequately exceeds balanced field length and obstacle clearance is not a factor. Once the aircraft is aligned with the runway, the brakes are applied and power levers advanced to 80% N_1. The brakes are then released and power adjusted to the takeoff N_1 setting prior to 60 KIAS. Remember that AFM takeoff field length data and takeoff N_1 settings assume a standing start.

Crosswind Takeoff

When required, a crosswind takeoff may be combined with any other takeoff. Directional and lateral control throughout a crosswind takeoff are critical.

The PNF holds the yoke forward to keep the nosewheel firmly on the ground until takeoff rotation. The ailerons should remain in the neutral position, and a combination of rudder and nosewheel steering should be used until 80 kts when the rudder becomes effective enough to control direction. In strong/gusty crosswinds, apply full rudder in the downwind direction prior to starting the takeoff roll. During the takeoff roll, rudder displacement decreases as the rudder gains effectiveness.

Nosewheel steering use is restricted by speed; it should not be used above 80 KIAS.

Reduced Thrust Takeoff

The Falcon 10/100 AFM authorizes reduced thrust takeoffs at the pilot's discretion. The practice of using reduce thrust takeoffs has proven beneficial in improving engine service life because it sets the minimum required thrust to meet certification requirements for takeoff.

The assumed temperature method is used to calculate the takeoff performance requirements. When considering reduced thrust takeoffs:

- only dry, hard surface runways may be used
- use of clearways or stopways is not permitted
- use in icing conditions is not allowed
- the anti-skid must be working
- no outstanding mechanical problems affecting the engines or the aircraft's performance exist
- the maximum N_1 reduction cannot exceed 5% below the rated N_1 speed
- a rated (full power) thrust takeoff must have been made within the last 10 to 20 takeoffs.

The AFM has strict rules for reduced thrust takeoffs. Supplement 4 of the AFM provides the approved procedures for use of reduced thrust takeoffs.

Takeoff Rotation

Precisely at V_R, smoothly rotate to a takeoff attitude of 16° (if takeoff is made with slats + 15° flaps) or to the charted takeoff attitude (if takeoff is made with a speed increase or with slats-only, or if obstacle clearance is a factor).

Smooth rotation prevents a decrease in airspeed. Early or late rotation degrades takeoff performance.

Rejected Takeoff

For abort prior to V_1, immediately and simultaneously apply wheelbrakes, retard power levers to idle, move airbrake handle to EXTEND, and deploy the thrust reversers. When the thrust reversers are deployed, increase reverse thrust to slow the aircraft.

If necessary, use maximum reverse thrust to 60 KIAS, then reduce to idle. Use reverse thrust cautiously on wet or slippery runways. Use caution also during strong crosswind conditions because reverse thrust may aggravate any weather vaning tendency. Maintain directional control with differential braking and nosewheel steering to remain on the runway centerline. Thrust reverser operation is limited to 60 seconds in a 30 minute period.

Initial Climbout

Once a positive rate of climb is indicated by the altimeter and vertical speed indicator, move the landing gear lever to UP. Confirm gear retraction and monitor annunciators and engine instruments.

When the airspeed increases to a minimum of V_2 + 35 KIAS, clean the wing by retracting the leading edge slats and flaps in two separate motions.

After retraction of the slats and flaps, climb power should be set (860°C, five minutes maximum). The initial setting is made by reference to 795°C ITT (maximum 832°C) or the climb N_1.

After making the initial setting, consult the climb N_1 chart for the maximum allowable N_1; adjust power levers accordingly unless N_1 is below the recommended value and additional power is not required.

Noise Abatement Climbout

Section V of the AFM provides the Falcon 10/100 pilot with a noise abatement procedure which, if followed exactly, allows the aircraft to meet FAR 36 noise levels.

After gear retraction in the initial climb, maintain takeoff power and wing configuration. The aircraft climbs at V_2 + 10 KIAS until reaching 2,600 ft AGL in a 18,300 lb or 18,740 lb gross weight aircraft or 2,350 ft in a 19,300 lb gross weight aircraft. Reduce power to a charted value until clear of the noise-sensitive area, then increase power to the normal climb N_1 values.

Climb

After setting the climb power, and when clear of the airport traffic area, both pilots complete the climb checklist. Use a flow pattern with the PNF verifying completion and indications with the checklist.

Throughout the climb, the PNF compares the indicated N_1 with the climb N_1 chart. N_1 RPM increases with altitude; several power adjustments may be necessary during climb to maintain the specified setting required by the climb charts. If a temperature inversion is encountered during the climb, closely monitor the climb N_1 setting to stay within the climb N_1 limits.

Observe the differential pressure/ cabin altitude and cabin vertical speed gages for proper programming and comfort rate.

Cruise

Thrust Setting

Climb power is normally maintained upon level-off until acceleration to the desired cruise Mach, then adjusted to the appropriate setting. During the climb and acceleration to cruise speed, the ITT should not be between 795° and 832°C for more than 30 minutes.

Cabin Temperature

Monitor the temperature control panel to ensure proper comfort level for the passengers and crew. Normally, the temperature control selector is in AUTO at the 12 o'clock position.

Turbulent Air Penetration

Although the aircraft is not operationally restricted in rough air, do not fly into known severe turbulence.

Carefully plan turbulence avoidance strategy with an understanding of mountain wave dynamics, thunderstorm characteristics, and weight versus altitude buffet margins. When turbulence is encountered, the following steps are recommended:

1. Maintain 250 KIAS (0.75 M).

2. Set thrust to maintain target airspeed. Change thrust only for extreme airspeed variation.

3. With the autopilot not engaged, keep control movements moderate and smooth. Maintain wings level and desired pitch attitude. Use the attitude indicator as the primary instrument. In extreme drafts, large attitude changes may occur. Do not make sudden large control movements. After establishing the trim setting for penetration speed, do not change the trim.

4. Large altitude changes are possible in severe turbulence. Reduce altitude to increase the buffet boundary margin if necessary. Do not chase altitude or airspeed.

5. Ensure yaw damper is engaged to reduce yaw/roll oscillations.

6. If turbulence is penetrated with the autopilot on, engage the Turbulence (Soft Ride) mode.

7. If turbulence is known or suspected to be moderate or severe, the start selectors should be placed to AIR START and the FASTEN BELT sign illuminated.

Operation in Icing Conditions

The engine anti-ice systems and the wing anti-ice system prevent the accumulation of icing; they should be turned on prior to encountering such conditions.

Engine anti-ice should be used for taxi and takeoff when the ambient temperature is 5°C or below, and visible moisture, precipitation, or a wet runway exists. Engine anti-ice is used in flight when the total air temperature is 5°C or below with visible moisture, precipitation, or icing.

Wing anti-ice should be used under the same conditions, but must not be used on the ground. On takeoff, it should be turned on after gear retraction. During approach and landing, it should be turned off prior to touchdown.

If it becomes necessary to de-ice the aircraft in flight, use the following procedure.

1. Place engine start selectors to AIR START.

2. Turn on engine anti-ice to each engine, one at a time, pausing momentarily between each step.

3. Turn wing anti-ice on.

For proper anti-ice operation, ensure adherence to the minimum engine N_1 settings for the existing phase of flight (see the AFM or the SimuFlite Operating Handbook).

Inflight Procedures

Airbrake Deployment

Airbrakes may be used to expedite a descent or reduce airspeed. Buffeting is noticeable with airbrakes extended.

Airbrakes may be used at any speed up to the V_{MO}/M_{MO} and, if necessary, with the landing gear and/or wing slats/flaps extended. During approach, extension of the airbrakes is not permitted below 500 ft AGL.

Change of Airspeed

Airbrakes may be used in conjunction with thrust reduction when reducing airspeed quickly. Reduce thrust to the appropriate setting for the desired airspeed, then extend the airbrakes. Upon reaching the desired airspeed, retract the airbrakes.

Smoothly coordinate all power and flight control inputs to maintain desired heading, airspeed, and altitude. Airbrakes may also be used to control airspeed during inflight operation of the engine and airframe anti-icing systems when higher-than-normal engine power settings are required.

Steep Turns

Steep turns (45° bank) confirm the aerodynamic principle that increasing bank requires increased pitch and power to maintain altitude. Refer to the profile on page 3D-35.

At intermediate altitudes, approximately 10,000 ft MSL, practice steep turns at 250 KIAS. Start the maneuver on a cardinal heading and altitude.

CAUTION: The adjacent discussion is presented only in the context of recovery training. Stalls in high performance aircraft should not be deliberately executed unless they are part of a supervised pilot training program. Safety of flight considerations dictate that the utmost caution be employed during such exercises.

The initial engine power setting is about 78% N_1. When passing through 30° bank, increase power setting about 2% N1 and pitch attitude approximately 4°. Trim out back pressure as needed. Lead the roll-out heading approximately 15° and reduce thrust and pitch to the original settings.

Stall Recognition and Recovery

Approach to Stall

The approach to stall should be continued only to the first warning indication of a stall (audible stall warning or airframe buffet, whichever occurs first).

At the first warning indication, initiate an immediate recovery. Do not allow the aircraft to go into a full stall. Refer to the profile on page 3D-33.

Perform the approach to stall in clean, takeoff, and landing configurations. Practice altitude should be no higher than 20,000 ft MSL (AFM limitation), and no lower than 5,000 ft above terrain.

Before practicing approaches to stall, clear cockpit area of loose articles; visually clear the practice area, compute V_{REF}, and set airspeed indicator bugs to V_{REF}.

Clean Configuration – Flaps and Gear Up

While maintaining altitude and heading (wings level), retard power levers to 40% N_1. As the aircraft slows, maintain altitude with back pressure. Use trim to reduce stick force (but not below 160 KIAS).

Observe the angle-of-attack indicator information; stall warning occurs when the indicator approaches the red band. At the first indication of a stall (i.e., stall warning horn), perform the following.

1. Advance power levers to maximum power.
2. Maintain pitch attitude (approximately 11° nose-up) and wings level.
3. As airspeed increases, reduce pitch attitude to maintain altitude.
4. Accelerate to 180 KIAS, then reduce power to approximately 70% N_1 to maintain 180 KIAS.

Takeoff Configuration – Slats + 15° Flaps and Gear Down

Establish a level turn using 15 to 20° bank; retard power levers to 50% N_1. As the aircraft slows, maintain altitude with back pressure. Use trim to reduce stick forces; however, stop trimming at 130 KIAS.

Observe the angle-of-attack indicator information; stall warning occurs when the indicator approaches the red band. At the first indication of a stall (i.e., stall warning horn), perform the following.

1. Advance power levers to maximum power while rolling the wings level.
2. Maintain pitch attitude (approximately 13° nose-up) and wings level.
3. As the airspeed increases, reduce pitch attitude to maintain altitude.
4. Accelerate to 160 KIAS, then reduce power to approximately 70% N_1 to maintain 160 KIAS. If completing a stall series, maintain gear and flap configuration.

Landing Configuration – Full Flaps and Gear Down

While maintaining altitude and heading (wings level), retard power levers to 60% N_1. Trim to reduce stick forces, but do not trim below V_{REF}. At the first indication of a stall (i.e., stall warning horn), perform the following.

Monitor the warning lights for indication of malfunction. If the computer is not working properly, erroneous information may be presented.

Instrument Approach Considerations

Several factors should be considered prior to commencing an approach in a high performance jet aircraft. The pilot must have a thorough knowledge of the destination and alternate weather conditions before descending out of the high altitude structure. Many weather and traffic advisory sources are available, including:

- Flight Service Stations that may be used enroute any time to obtain the latest destination and alternate weather conditions
- ARTCC where controllers can obtain information (if requested) pertaining to traffic delays and whether aircraft are successfully completing approaches
- ATIS
- destination tower and/or Approach Control.

If weather is at or near minimums for the approaches available, review how much time and fuel is needed to go to an alternate.

To continue the approach to a landing after arrival at minimums, FAR 91.175 requires that:

(c) ***Operation below DH or MDA.*** *Where a DH or MDA is applicable, no pilot may operate an aircraft, except a military aircraft of the United States, at any airport below the authorized MDA or continue an approach below the authorized DH unless:*

(1) The aircraft is continuously in a position from which a descent to a landing on the intended runway can be made at a normal rate of descent using normal maneuvers, and for operations conducted under part 121 or part 135 unless that descent rate will allow touchdown to occur within the touchdown zone of the runway of intended landing;

(2) The flight visibility is not less than the visibility prescribed in the standard instrument approach being used; and

(3) Except for a Category II or Category III approach where any necessary visual reference requirements are specified by the Administrator, at least one of the following visual references for the intended runway is distinctly visible and identifiable to the pilot:

(i) The approach light system, except that the pilot may not descend below 100 ft above the touchdown zone elevation using the approach lights as a reference unless the red terminating bars or the red side row bars are also distinctly visible and identifiable.

(ii) The threshold.

(iii) The threshold markings.

(iv) The threshold lights.

(v) The runway end identifier lights.

(vi) The visual approach slope indicator.

(vii) The touchdown zone or touchdown zone markings.

(viii) The touchdown zone lights.

(ix) The runway or runway markings.

(x) The runway lights.

(d) ***Landing.*** *No pilot operating an aircraft, except a military aircraft of the United States, may land that aircraft when the flight visibility is less than the visibility prescribed in the standard instrument approach procedure being used.*

Additional Instrument Systems

The following additional equipment is available on most aircraft and should be set according to company SOP:

- radio altimeter
- terrain advisory voice encoding altimeter
- vertical navigation computer controller
- long-range navigation equipment.

Normal Descent

As descent is initiated, set the pressurization control for landing. The cabin pressure controller may initially be set to:

- QNH and true landing field altitude
- QFE of landing field and altitude 0
- 29.92 inches of Hg and QNE.

The manufacturer then permits setting the pressure controller to 300 ft below field elevation. The latter setting results in the aircraft landing slightly pressurized, but it depressurizes within 30 seconds after touchdown. Many operators, however, use a final setting slightly above field elevation to land depressurized.

Continue to monitor the differential pressure, cabin altitude, and cabin vertical speed throughout descent. The most comfortable condition occurs when cabin descent is distributed over the majority of the aircraft descent time.

The engine and wing anti-ice systems should be on when operating in visible moisture if the total air temperature is 5°C or below. The radar altimeter may be bugged to the decision height, the height above the airport, or as desired in VFR operation for terrain proximity warning.

Double-check landing field information and estimated arrival gross weight; check runway requirements and determine V_{REF} and V_{AP} (V_{AP} equals V_{REF} plus configuration correction, if there is any, plus wind factor; minimum is 10 kts, maximum is 20 kts). When descending through the transition altitude, set the altimeters to field pressure and check for agreement.

Emergency Descent

An emergency descent moves the aircraft rapidly from a high altitude to a lower altitude; it is most often used in conjunction with a loss of pressurization.

Put on oxygen masks, establish communications, disconnect autopilot, retard power levers to idle, extend airbrakes, illuminate the seat belt/no smoking signs, and roll into a moderate bank while lowering the nose (initially to approximately 20°) below the horizon.

Adjust pitch as necessary to approach, but do not exceed, V_{MO}/M_{MO} (approximately 10° below the horizon). If flying in turbulent air, or if structural integrity is questionable, make the descent at a lesser and more prudent speed. The PNF should set the transponder to 7700.

When conditions permit, the engine start selectors may be placed to AIR START, the condition of the passengers checked, and ATC contacted for assistance and instructions. The PNF should monitor the descent progress, and complete the appropriate checklists on command.

VFR Traffic Pattern

The traffic pattern altitude is normally at 1,500 ft AGL. At uncontrolled airports, comply with the prescribed traffic flow for that airport. Refer to profile on page 3D-45.

The specific power settings stated in the following paragraphs apply to a flight weight of about 16,000 lbs at a sea-level airport with standard day atmospheric conditions.

Before entering downwind leg, complete the Approach checklist. Set slats + 15° flaps and slow to 160 KIAS. Target power setting is approximately 63 to 65%. Abeam the end of the runway, select gear down and maintain airspeed. Complete the Before Landing checklist.

In the base turn, select flaps 30° and slow to 140 KIAS; power is set at about 63% N_1 and a descent rate of 500 to 600 FPM is maintained. Upon intercepting the glidepath, set landing flaps (52°). As airspeed approaches V_{AP}, set power to maintain V_{AP} (about 68% N_1). Cross the threshold at V_{REF} + wind factor.

Approaches

Checklist and Configuration

For instrument approaches where a procedure turn is flown, the Approach checklist should be completed and flaps set at 15°. The aircraft is slowed to 160 KIAS with power set to approximately 63 to 65% N_1 when passing the IAF outbound.

Configuration	Airspeed	Pitch	Power/PPH	
			2 Engines	1 Engine
Clean (Above 10,000 ft)	300 kts	3	85%/880	—
Clean (10,000 ft)	250 kts	4	78%/700	85%/1,100
Clean (Below 10,000 ft)	250 kts	4	68%/650	85%/1,100
Clean	180 kts	7	63%/600	80%/1,100
Slats + 15° Flaps	160 kts	4	65%/650	80%/1,100
Slats + 30° Flaps (Gear Down, Level Flight)	140 kts	4	72%/700	93%/1,300
Slats + 30° Flaps (Gear Down, Glideslope)	140 kts	4	65%/600	75%/900
Slats + 52° Flaps (Gear Down, Glideslope)	V_{REF} +10	4	68%/650	—
Slats + 30° Flaps (Gear Down, Non-Precision Descent	140 kts	1	58%/400	68%/600
Slats Only (Gear Down, Glideslope)	Bug +10	4	50%/300	—

Table 3D-A; Maneuvering Guidelines

If the aircraft is receiving radar vectors for an approach, the Approach checklist and aircraft configuration changes should be completed when abeam the FAF, or three to five miles before the FAF for a straight-in approach.

At uncontrolled airports, make all required position/intention reports on the appropriate Traffic Advisory frequency.

Power Settings

Table 3D-A depicts typical power settings and fuel burn rates during approach.

Typical Precision Approach

An ILS approach is considered normal when all engines, the appropriate ILS facilities, and the airborne equipment are operating normally. Refer to profile on page 3D-37.

1. When established on the localizer inbound to the FAF, ensure flaps are set to 15°.
2. Maintain airspeed at 160 KIAS with power set at approximately 63 to 65%.
3. When the glideslope indicates alive, lower the landing gear. Complete the Before Landing checklist.
4. When the glideslope indicates one dot prior to intercept, set flaps to 30°.
5. At glideslope intercept, begin descent and extend flaps to 52°.
6. Maintain airspeed at V_{AP} with power set at approximately 68% N_1.
7. At or before DA/DH, establish visual contact with the runway.
8. Reduce power slightly to ensure crossing the runway threshold at V_{REF} plus wind factor.

Typical Non-Precision Approach

Refer to the profile on page 3D-41.

When established on the inbound course to the FAF, perform the following.

1. Set slats + 15° flaps and complete the Approach checklist.
2. Adjust airspeed to 160 KIAS; the power setting should be about 63 to 65% N_1.
3. One mile outside of FAF, extend landing gear, select flaps to 30°, and complete the Before Landing checklist (except for final flap setting). Maintain 140 KIAS or V_{REF} + 20 minimum with the power approximately 72% N_1.
4. Upon crossing the FAF, start timing, notify ATC, and descend to the MDA while maintaining 140 KIAS with power at about 58% N_1. Vertical speed in descent should normally be 1,000 to 1,500 fpm.
5. After leveling off at MDA, increase power to approximately 72% N_1 to hold airspeed at 140 KIAS or V_{REF} + 20 minimum while proceeding to the VDP or the MAP.
6. With the runway landing environment in sight, set landing flaps (52°) and slow to V_{AP} while intercepting the proper visual glidepath for landing.

Slats-Only/Clean Wing Approach and Landing

Maintain a minimum airspeed of 180 KIAS while maneuvering with power set to about 63% N_1. Plan for a long final approach. Extend slats and maintain 160 KIAS minimum until glideslope alive.

If no slats are available, maintain 180 KIAS until glideslope alive. Lower landing gear early in the approach to help control airspeed. Complete the Before Landing checklist.

Once established on final, reduce to V_{REF} + 15 KIAS + wind factor (with slats extended) or V_{REF} + 35 KIAS + wind factor (with clean wing). The stabilized power settings on final should be about 50% N_1.

The aircraft has a tendency to float because of increased airspeed and low drag configuration; this can be countered by flying the aircraft onto the runway and using minimal flare to break the descent rate. Expect landing field length to be longer than normal. Refer to profiles on pages 3D-51 and 3D-53.

Go-Around/ Missed Approach/ Balked Landing

Accomplish the go-around/missed approach/balked landing at the DA/DH or MDA with time expired (if applicable) and runway visual reference either not in sight or not in a position from which a normal visual landing approach can be accomplished. Refer to the appropriate profile on page 3D-49.

Go-Around Procedure

Accomplish the following.

1. Apply go-around power.

2. Push the go-around button; rotate to the flight director go-around attitude (approximately 14° nose-up). Ensure airbrakes are retracted.

3. With airspeed at a minimum of V_{REF}, set flaps to 15°, one detent at a time. Retract gear at indication of a positive rate of climb.

4. When clear of obstacles (400 ft AGL minimum) and at a minimum airspeed of V_{REF} + 35 KIAS, clean the wing and accelerate. Adjust pitch attitude and power as necessary.

5. When clear of obstacles, reduce power to climb N_1. At the relatively light gross weight at which missed approaches are normally accomplished, the aircraft accelerates quickly. Pitch and power need to be adjusted accordingly.

6. Set the flight director as required. Use the heading bug and the heading mode to fly a desired heading, and a navigation mode and the course selector to capture a desired radial/track. After the initial fixed (14° nose-up) climb attitude is established, variable climb attitudes may be commanded with the pitch synch button on the control yoke. Desired climbs or altitudes may then be captured and maintained by using one of the vertical modes.

7. Confirm the level-off altitude and heading/course needed for the missed approach. Comply with the published missed approach instructions unless other directions are received from ATC.

After a Missed Approach – Proceeding for Another Approach

Accomplish the following.

1. After level-off, complete the Climb checklist and maintain 180 KIAS minimum.

2. Complete the Approach checklist. In the slats + 15° flap configuration, maintain 160 KIAS. Refer to the profile on page 3D-49.

After a Missed Approach – Departing Area

Accomplish the following.

1. Accelerate to normal climb speed.

2. Complete the Climb checklist.

3. Follow normal climbout procedures.

Circling Approach/ Circling Pattern

A circling approach is an instrument approach requiring a heading change of 30° or more to align the aircraft with the landing runway. Once visual conditions are reached, the circling approach is a modified version of the VFR traffic pattern. Refer to profile on page 3D-47.

Turbulence, strong winds, poor visibility, and low maneuvering altitude are factors that must be considered when planning a circling approach. Plan to use a minimum circling altitude and distance appropriate to the airspeed or approach category. At uncontrolled airports, observe local traffic direction and restrictions.

It is recommended that the approach be flown with gear down and flaps 30° until arriving at a position from which a normal descent for landing can be made. At that time, begin descent, select flaps 52°, and slow to V_{AP}.

While maneuvering during the circling approach, fly a minimum of 140 KIAS. When established on final in the landing configuration, fly at V_{AP} until reducing power slightly to cross the runway threshold at V_{REF} + wind factor.

Landing

With slats + 52° flaps, cross the threshold at 50 ft AGL with a speed of V_{REF} + wind factor. The aircraft pitch attitude is approximately 2° nose-up. Reduce thrust slightly. At about 30 ft AGL, gradually increase pitch to decrease the rate of descent (resulting in a pitch attitude of approximately 8° nose-up at touchdown), then reduce the thrust to idle.

For approach and landing with slats + 15° flaps, pitch attitudes are approximately 4° nose-up on approach and approximately 10° nose-up on touchdown. Thrust may be reduced to idle at 50 ft AGL and minimum flare used to reduce float.

Upon touchdown, lower the nosewheel smoothly to the runway, extend the airbrakes, and apply braking as necessary. Use rudder and differential braking to maintain directional control, and deploy the thrust reversers. Use nosewheel steering below 80 KIAS.

Thrust Reversers

If necessary, reverse thrust may be used to shorten the landing roll between touchdown and full stop. Pull the reverser levers up and aft; after the thrust reverser doors are fully deployed (as indicated by the green REV lights), smoothly pull the levers further aft to increase reverse thrust to maximum N_1.

Crosswind

The maximum demonstrated crosswind for the Falcon 10/100 is 25 kts. On the final approach in a crosswind, the crab approach or the wing-down method may be used.

Do not allow the aircraft to float with power off prior to touchdown. Fly to touchdown with little, if any, flare. Deploy airbrakes on touchdown. At nosewheel touchdown, neutralize the ailerons. Use rudder and differential braking for directional control. Nosewheel steering may be used below 80 KIAS after nosewheel touchdown.

Touch-and-Go Landings

If touch-and-go landings are to be practiced, they should be preplanned and briefed. The thrust reversers and airbrakes should not be used on landing. The PNF should reset the flaps to 15°, set the stabilizer trim in the takeoff range, and confirm these settings to the PF before the power levers are advanced to takeoff power.

Wet/Contaminated/ Very Slippery Runways

To assist the Falcon 10/100 pilot in identifying the many factors involved in operating on other than dry, hard surface runways, the manufacturer has provided Service Newsletter No. 34 (April 1987). A synopsis of the definitions and considerations from this document is provided below.

Definitions

Wet runway – Not covered to any extent with standing water; water depth is not measurable or less than 1/8 inch.

Contaminated runway – Covered by standing water, slush, wet snow, or loose dry snow. The depth of such matter is greater than 1/8 inch and covers at least 25% of the required length.

Compacted snow runway – The snow has been packed into a solid mass into which the aircraft's wheels do not sink.

Very slippery runway – Covered with ice or black ice; some parts of a runway can also be very slippery due to a mixture of oil, rubber, and water.

Hydroplaning speed (V_h) – The groundspeed at which the hydrodynamic pressure build-up between the aircraft's tires and the water film on the runway is sufficient to lift the tire surface off the ground.

In this situation, wheel braking and steering effectiveness are diminished. Manufacturer's tests have shown that the hydroplaning speed for the Falcon 10/100 can be approximated by the formula:

$$V_h = 6.4 \sqrt{\text{tire pressure (PSI)}}$$

At normal tire inflation pressures, V_h for the nose and main wheels is 62 kts and 75 kts, respectively.

When operating on runways contaminated by standing water,in addition to the aerodynamic drag, the aircraft is also subject to hydrodynamic drag and plume drag. The total (hydrodynamic plus plume) drag increases proportionally up to V_h, and reaches about 3,100 lbs for a 3/8 inch water depth, then decreases slowly at speeds above V_h.

If the runway is contaminated by slush, wet snow, or dry snow, the equivalent water depth should be determined before estimating the V_h. A chart for determining equivalent water depth is found in the Falcon 10/100 Performance Manual.

When braking on non-dry runways, the braking coefficient of friction may be reduced by 20% to 50% on wet runways, by up to 75% on contaminated runways, by 60% to 90% on snow-compacted runways, and by 90% on very slippery runways.

Recommendations

Wet Runways

Throughout the ground phase of operation on such runways, ensure that the start selectors are in the AIR START position. If a crosswind is present, maintain neutral ailerons and hold forward yoke pressure for better nosewheel steering.

For landing operations, increase landing distance and landing field length by 15%. For takeoff operations, do not use reduced thrust and add 15% of the landing distance to the takeoff distance.

Contaminated Runways

Operation on contaminated runways should be avoided whenever possible especially during and immediately after heavy rainfall. If the surface contaminant is slush or snow, use the Performance Manual charts to determine the equivalent water depth.

Maximum recommended equivalent water depth is 0.5 inch; the anti-skid system must be operable and maximum crosswind is limited to 15 kts.

In a crosswind, use the same control techniques as for a wet runway. Start selectors should be in the AIR START position.

For landing operations, multiply the normal landing distance by 2.3 for landing field length. Use thrust reversers as soon as possible; do not apply wheel brakes until below hydroplaning speed (75 kts on water, slightly more on snow), then apply them fully.

For takeoff operations, adopt $V_1 = V_R$ and do not use reduced thrust. Use the Performance Manual charts to determine the takeoff distance with the equivalent water depth, then add double the landing distance; this gives an accelerate/stop distance with a safety margin.

Select a landmark along side the runway at the expected takeoff distance. If not airborne shortly before this landmark, abort the takeoff.

In the event the takeoff is rejected, use the above landing recommended stopping procedures. Use neutral ailerons and nosewheel steering until V_h; above that speed, use the rudder.

After takeoff, delay gear retraction (to blow off contaminant accumulation) and then cycle the gear several times if necessary (to shake off any accumulation from the landing gear and brakes).

Compacted Snow or Icy Runways

When considering operation on compacted snow or icy runways, the manufacturer says: "It is safer to neither takeoff nor land."

Maximum crosswind is limited to five knots. If a landing on such a runway is contemplated, the landing distance is equal to the dry runway distance times 2 (compacted snow) to 3.4 (black ice). Add 15% to the result for the new landing field length.

Upon touchdown, apply brakes with anti-skid fully, and use the thrust reversers as soon as possible. Nosewheel steering is of little help. Takeoffs on such runways should be avoided if at all possible because directional control is poor to nil. Do not use reduced thrust.

The approximate distance is the normal balanced field length plus once (compacted snow) or twice (black ice) the landing distance under the same conditions. If the takeoff must be aborted, use stopping techniques as recommended for landing above.

After Landing

After clearing the runway, complete the After Landing checklist. The engines should be operated at idle for at least two minutes (taxi time may be included) prior to shutdown. After the aircraft is parked, complete the Shutdown checklist.

One Engine Inoperative Operation

Engine Failure After V_1 – Takeoff Continued

With an engine fire or failure indication after V_1, continue the takeoff. Refer to the profile on page 3D-31.

Maintain directional control using the rudder and accelerate to V_R/V_2. At V_R, rotate the aircraft to 16° nose-up (or the pre-computed pitch attitude), and climb at V_2 minimum. If the indication occurs after exceeding V_2, maintain the existing airspeed. Retract the landing gear when a positive rate of climb is established.

When clear of obstacles (minimum 400 ft AGL), accelerate to V_2 + 35 KIAS and clean the wing. Increase speed to V_{FS} and continue the climb to 1,500 ft (or required altitude) above the takeoff field elevation. Limit the maximum takeoff power to five minutes, then reduce to maximum continuous power.

When time and conditions permit, complete After V_1 Engine Fire and/or Engine Failure checklist(s).

Single Engine Precision Approach and Landing

A one-engine inoperative approach is flown essentially the same as an approach with all engines operating. Landings may be made with slats + 30° flaps or slats + 52° flaps. On final approach, however, flaps are not extended beyond 30° until landing is assured (normally 200 ft AGL). Refer to the profile on page 3D-39.

Up to the final descent point, the aircraft is configured normally with the previously recommended speeds flown for each configuration.

Single engine thrust settings are slightly higher than comparable normal engine settings. If adequate runway is available, a landing in the slats + 30° flap configuration avoids the large trim and power changes required by selection of slats + 52° flaps.

If rudder trim has been used during the approach to counter the asymmetric thrust, zero the rudder trim prior to or during the landing power reduction to prevent unwanted yaw. Thrust reduction and flare are similar to a normal landing. Thrust reduction should be slower than normal to counter roll due to yaw effect. Consequently, slightly less flare than normal is required to prevent floating.

After touchdown, lower the nose, extend the airbrakes, apply wheel braking, and keep the wings level. Use rudder as required. Reverse thrust may be used if the runway is dry and nosewheel steering is available.

Single Engine Go-Around/ Missed Approach/ Balked Landing

Refer to the profiles on page 3D-49.

Apply maximum power on the operating engine, check that the airbrakes are retracted, and push the flight director go-around button to select the Go-Around mode. Rotate to approximately 14° nose-up as commanded by the flight director and retract the flaps to 15°. As thrust is increased, apply rudder pressure as required to counter yaw.

Maintain the go-around pitch attitude and minimum airspeed of V_{AC}. Retract the landing gear when a positive rate of climb is established.

Climb to 400 ft AGL (minimum), then accelerate to V_{REF} + 35 and clean the wing. Continue accelerating to V_{FS}, set climb power, and continue climb on the published missed approach.

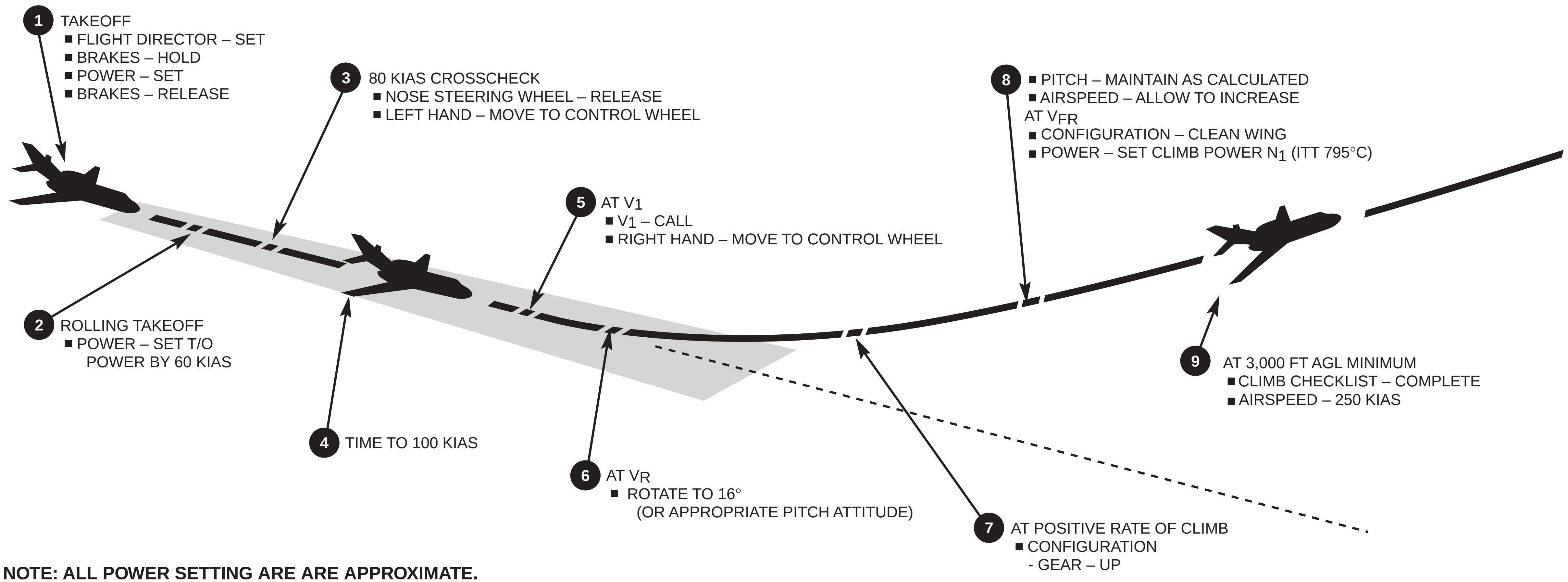
When time permits, the PNF sets the PF's heading bug on the missed approach heading and selects the requested modes on the flight director. At the appropriate time, advise ATC of the missed approach and request further clearance (another approach or a diversion to the alternate airport).

Profiles

The following flight profiles illustrate how selected maneuvers are performed. Each maneuver is broken down into sequential events that illustrate appropriate configurations.

- Takeoff
- Rejected Takeoff
- Engine Failure After V_1
- Stalls at Altitude
- Steep Turns
- Precision Approach and Landing
- Single Engine Precision Approach and Landing
- Non-Precision Approach and Landing
- Single-Engine Non-Precision Approach and Landing
- Visual Approach/Balked Landing
- Circling Approach
- Go-Around/Missed Approach
- Clean Wing Approach and Landing
- Slats-Only Approach and Landing

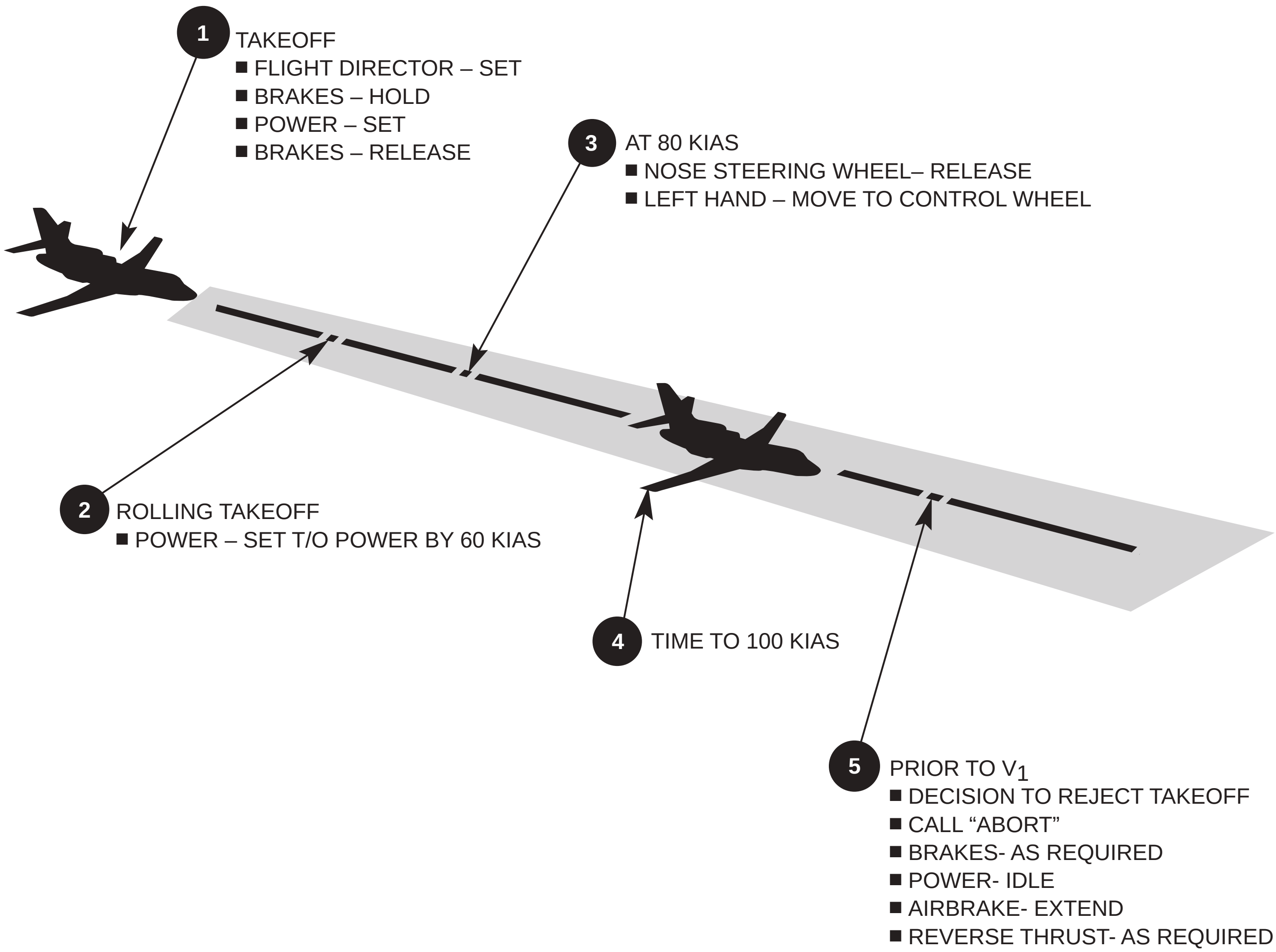
Takeoff



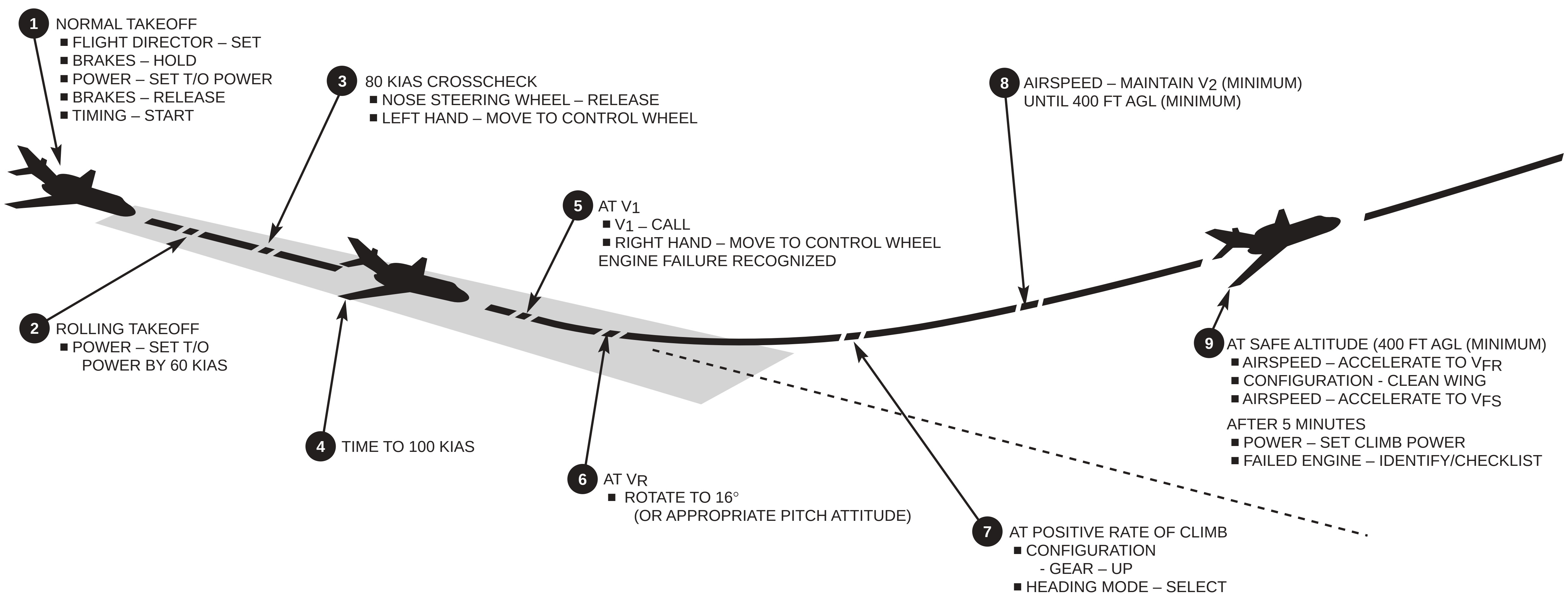
NOTE: ALL POWER SETTING ARE ARE APPROXIMATE.

Takeoff

Rejected Takeoff

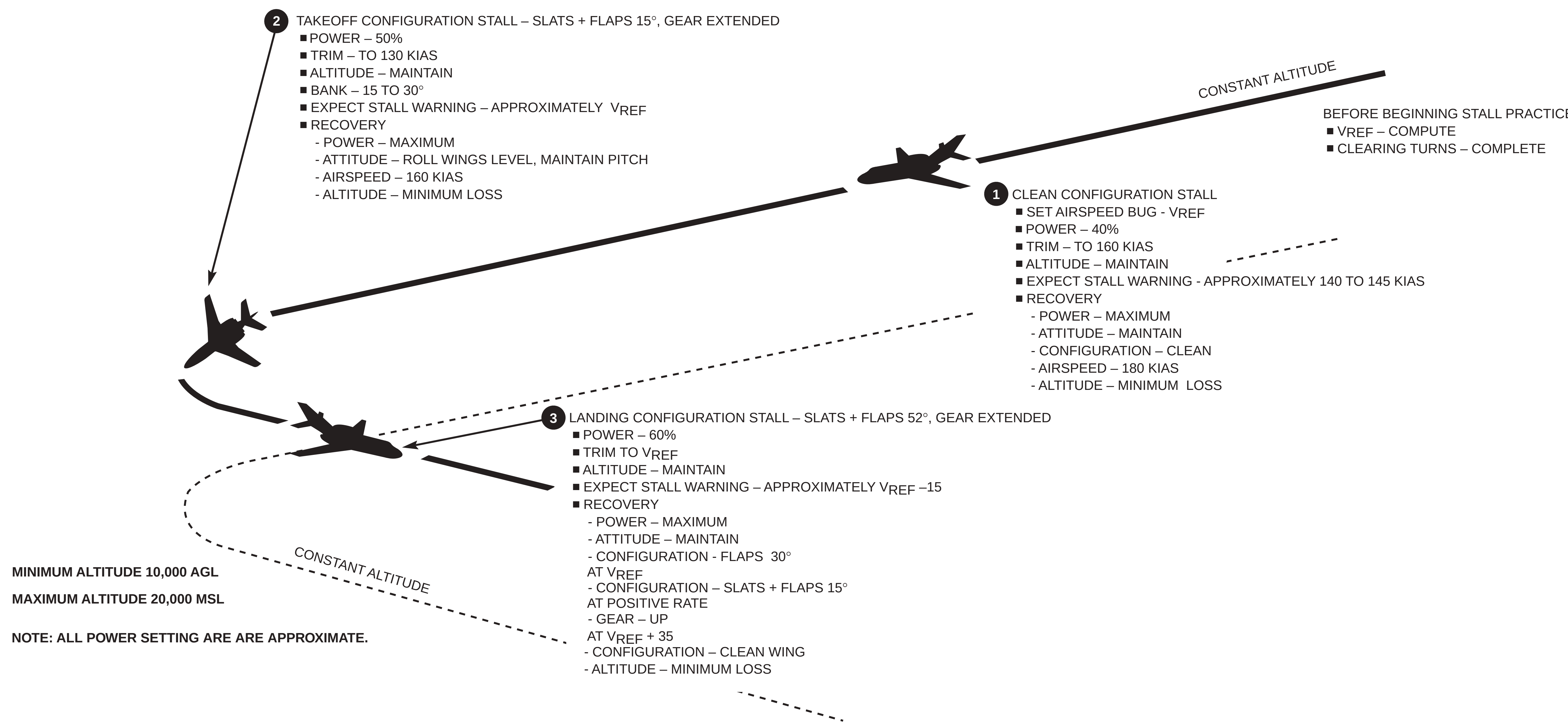


Engine Failure After V_1



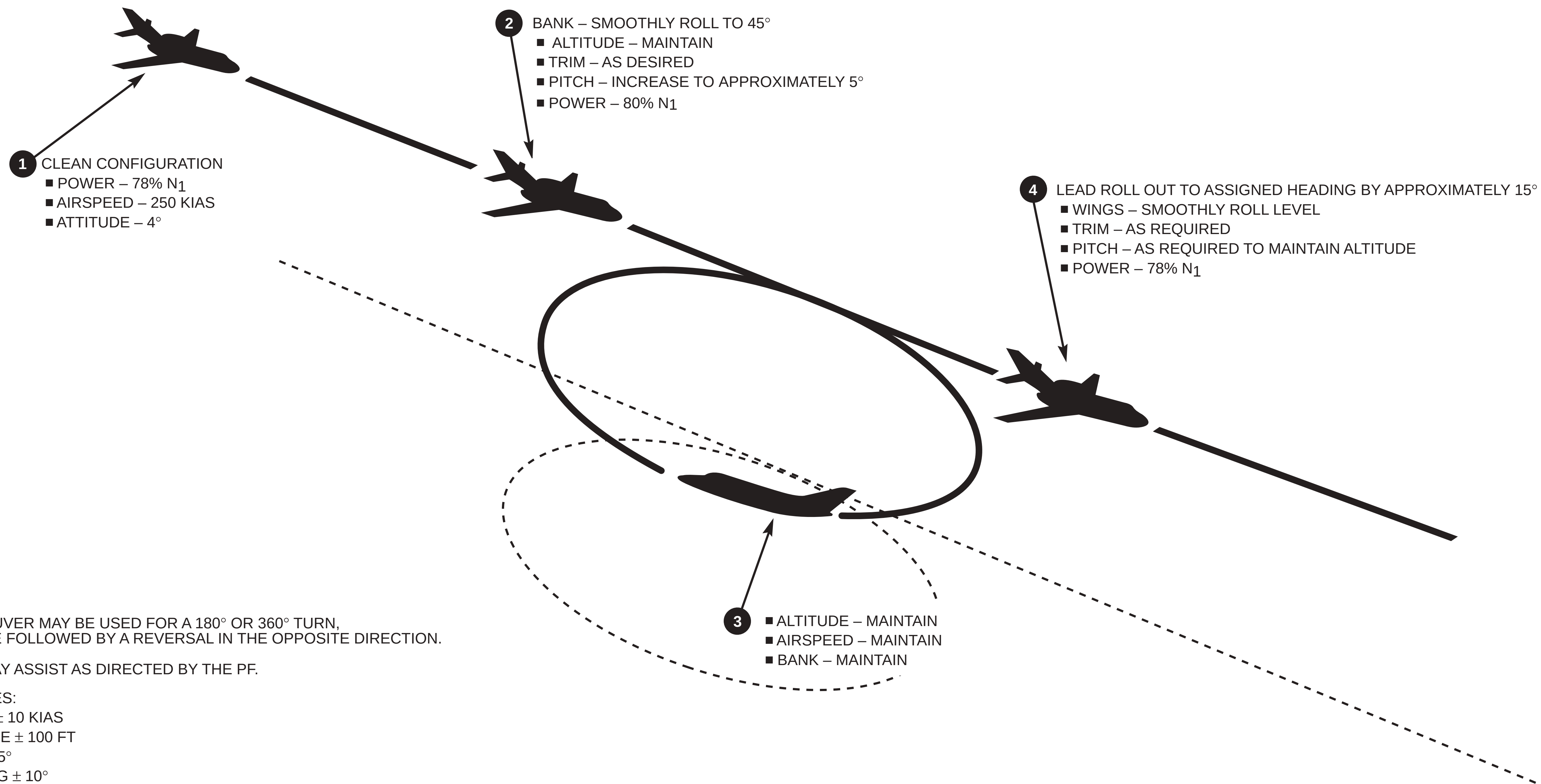
Engine Failure After V_1

Stalls At Altitude



Stalls At Altitude

Steep Turns



THIS MANEUVER MAY BE USED FOR A 180° OR 360° TURN, AND MAY BE FOLLOWED BY A REVERSAL IN THE OPPOSITE DIRECTION.

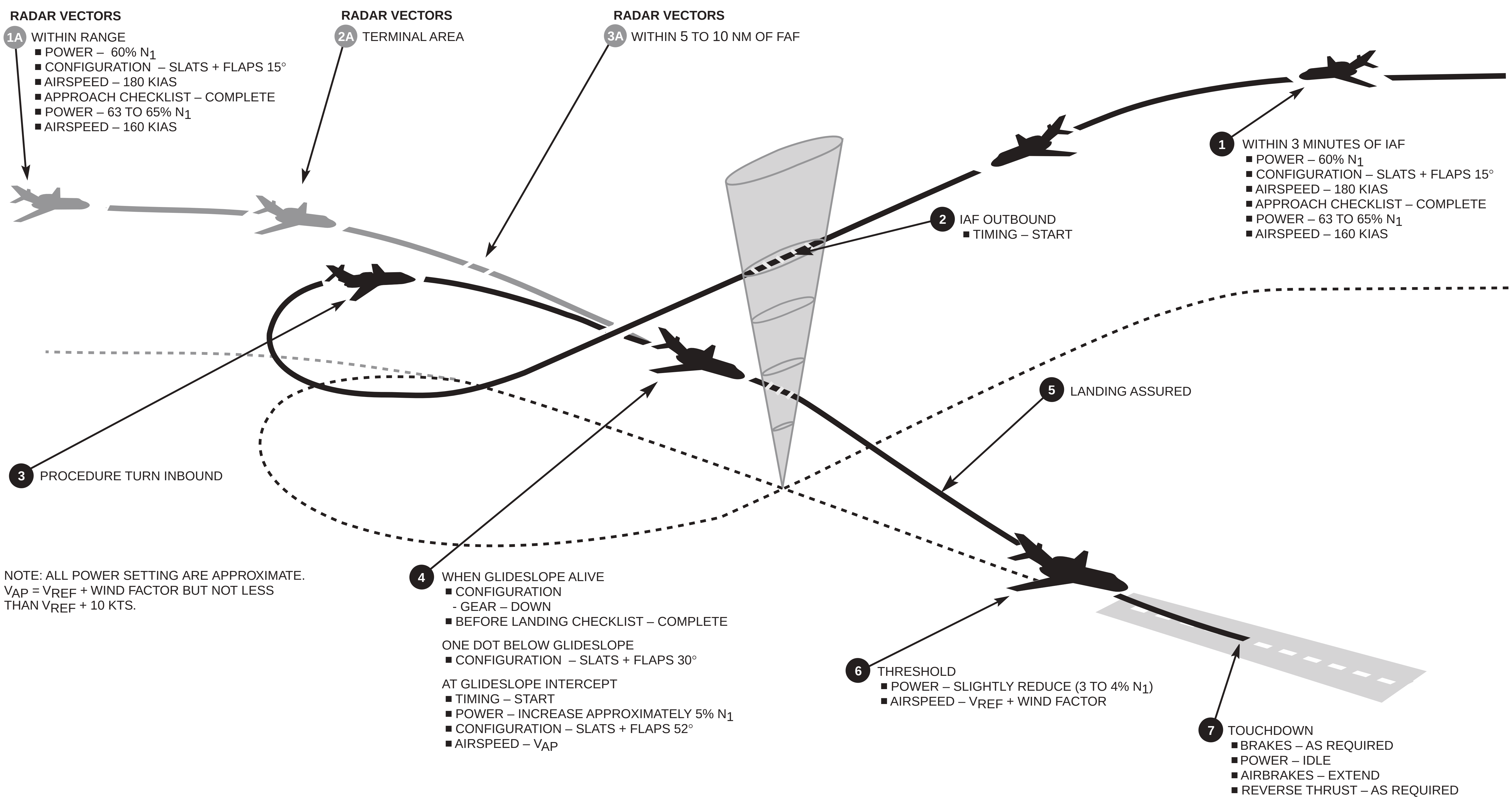
THE PNF MAY ASSIST AS DIRECTED BY THE PF.

TOLERANCES:
- SPEED ± 10 KIAS
- ALTITUDE ± 100 FT
- BANK ± 5°
- HEADING ± 10°

NOTE: ALL POWER SETTING ARE ARE APPROXIMATE.

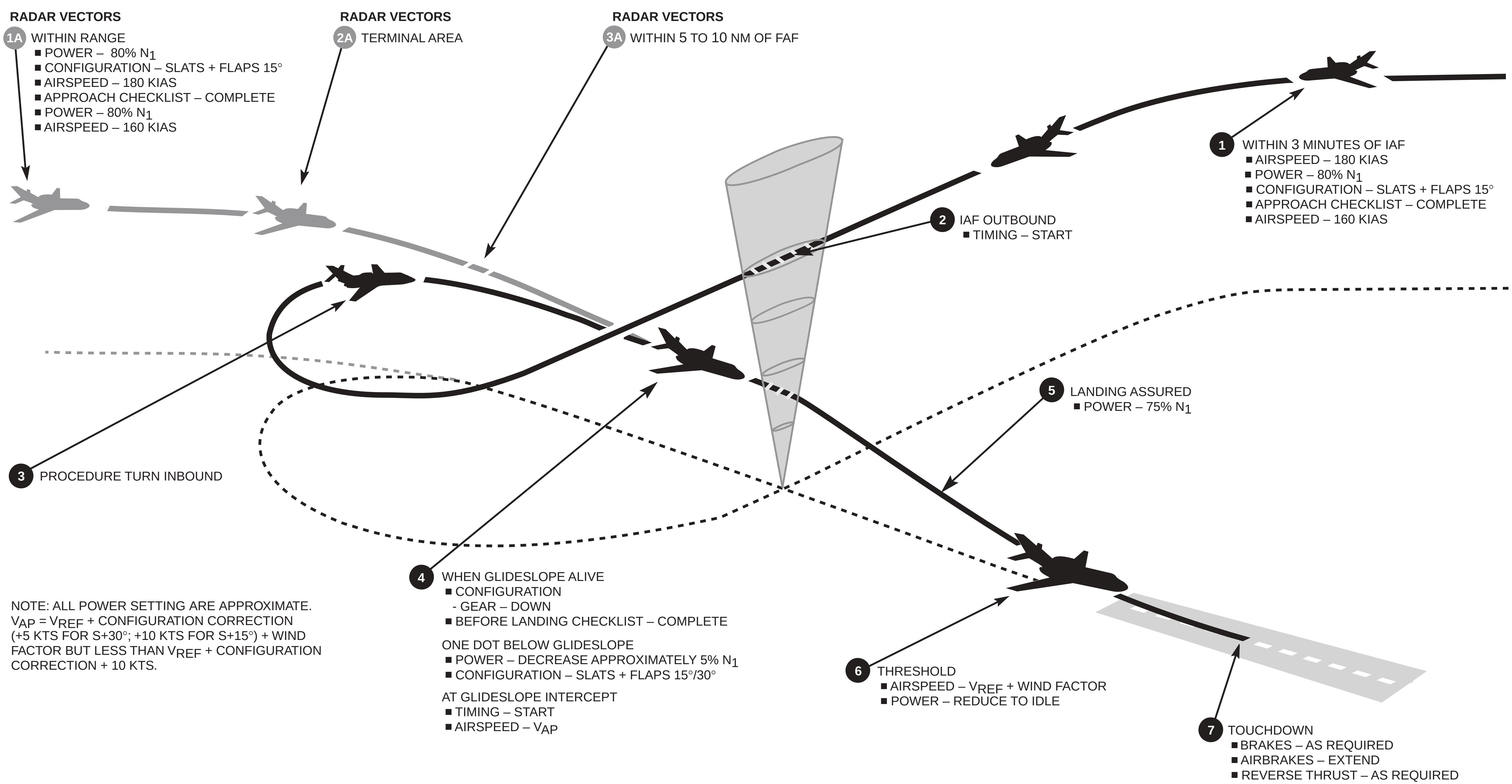
Steep Turns

Precision Approach and Landing



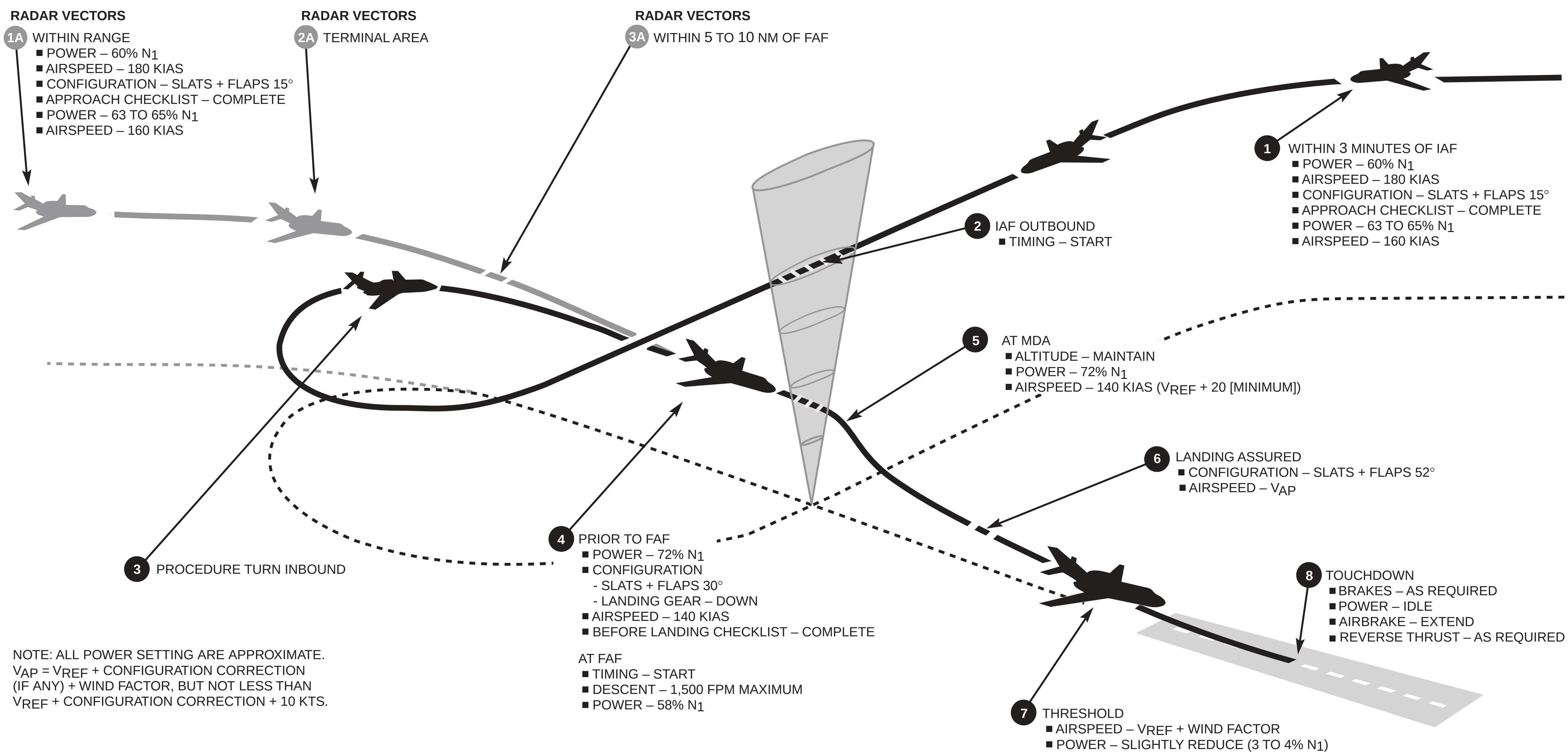
Precision Approach and Landing

Single Engine Precision Approach and Landing



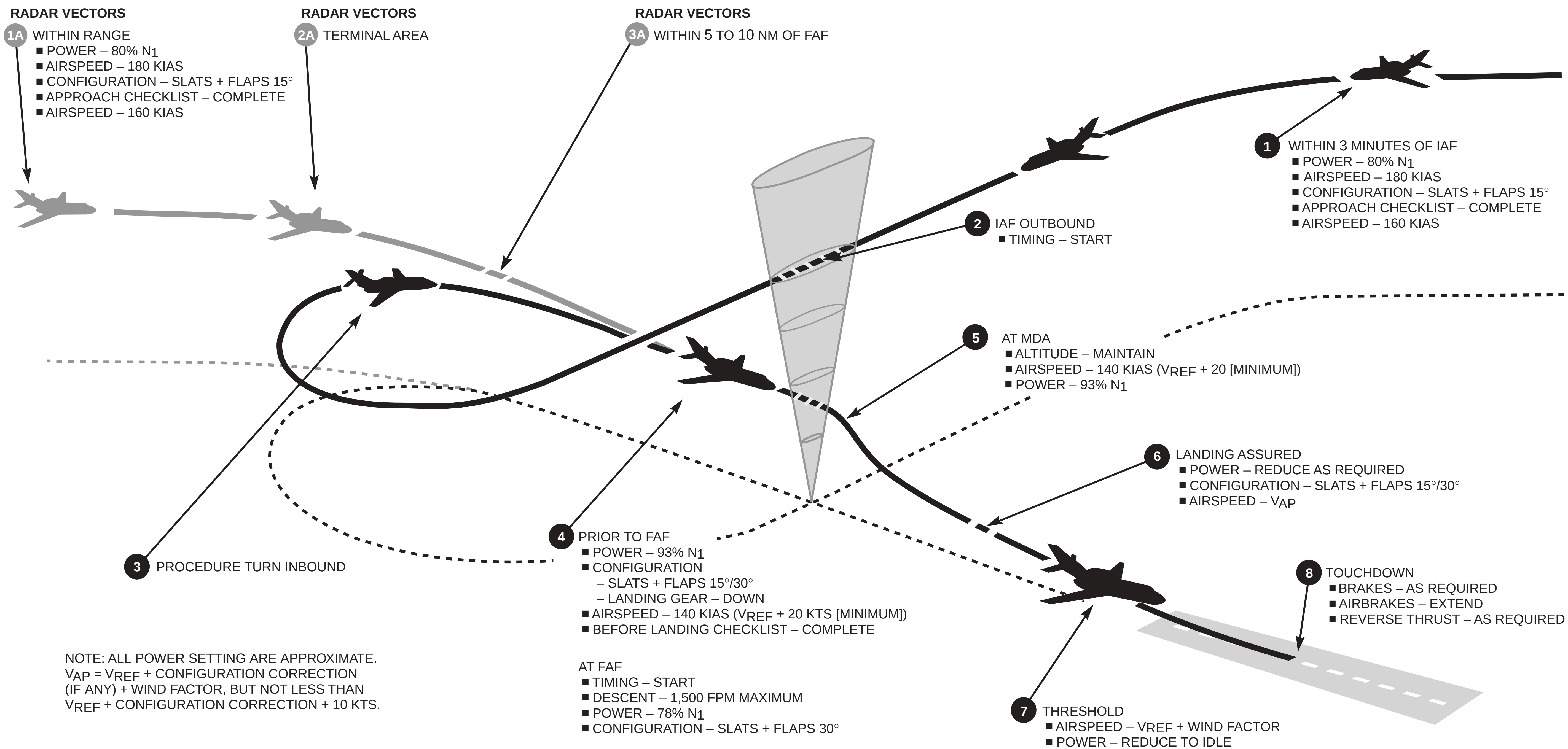
Single Engine Precision Approach and Landing

Non-Precision Approach and Landing



Non-Precision Approach and Landing

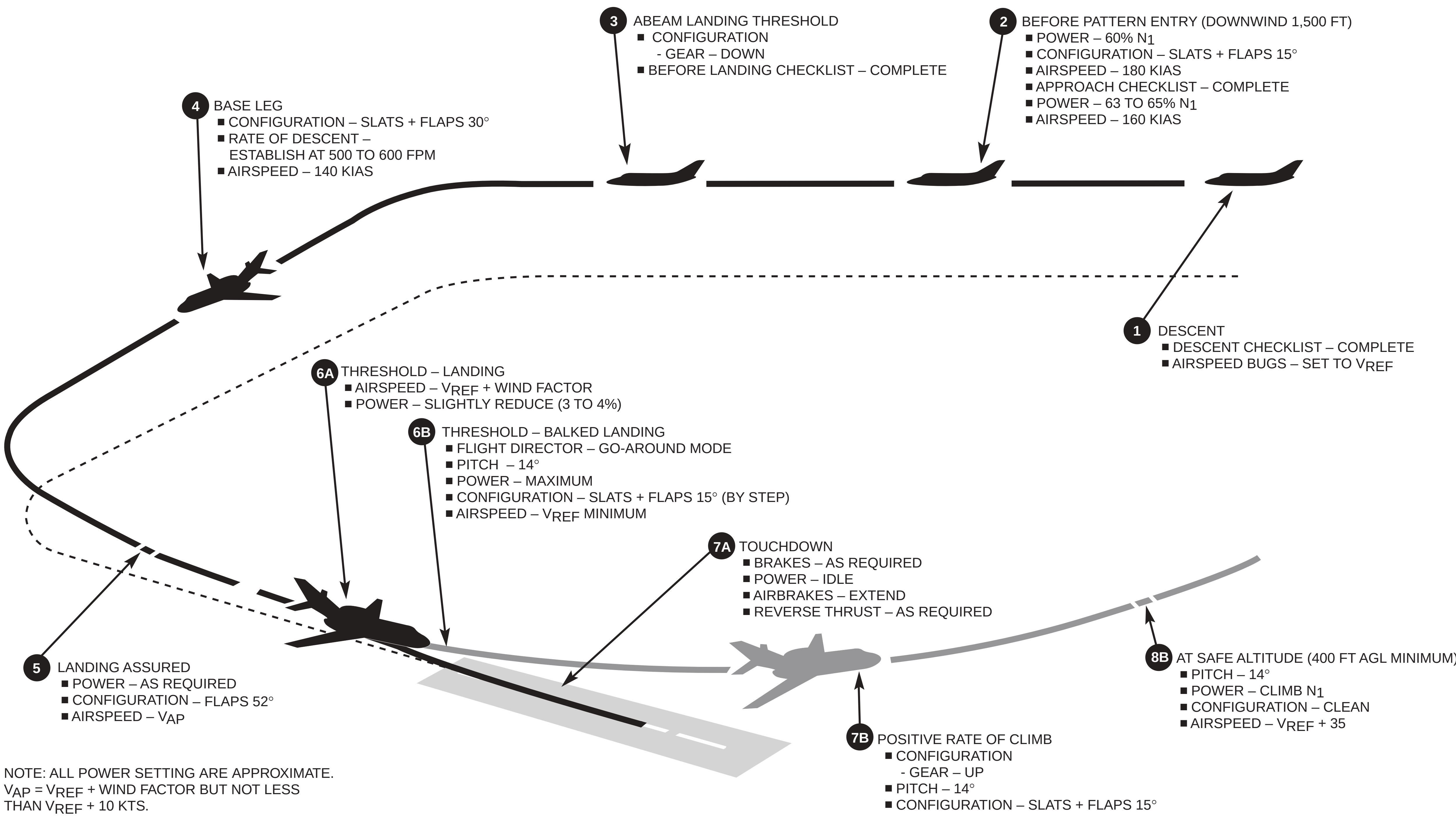
Single Engine Non-Precision Approach and Landing



NOTE: ALL POWER SETTING ARE APPROXIMATE.
$V_{AP} = V_{REF}$ + CONFIGURATION CORRECTION (IF ANY) + WIND FACTOR, BUT NOT LESS THAN V_{REF} + CONFIGURATION CORRECTION + 10 KTS.

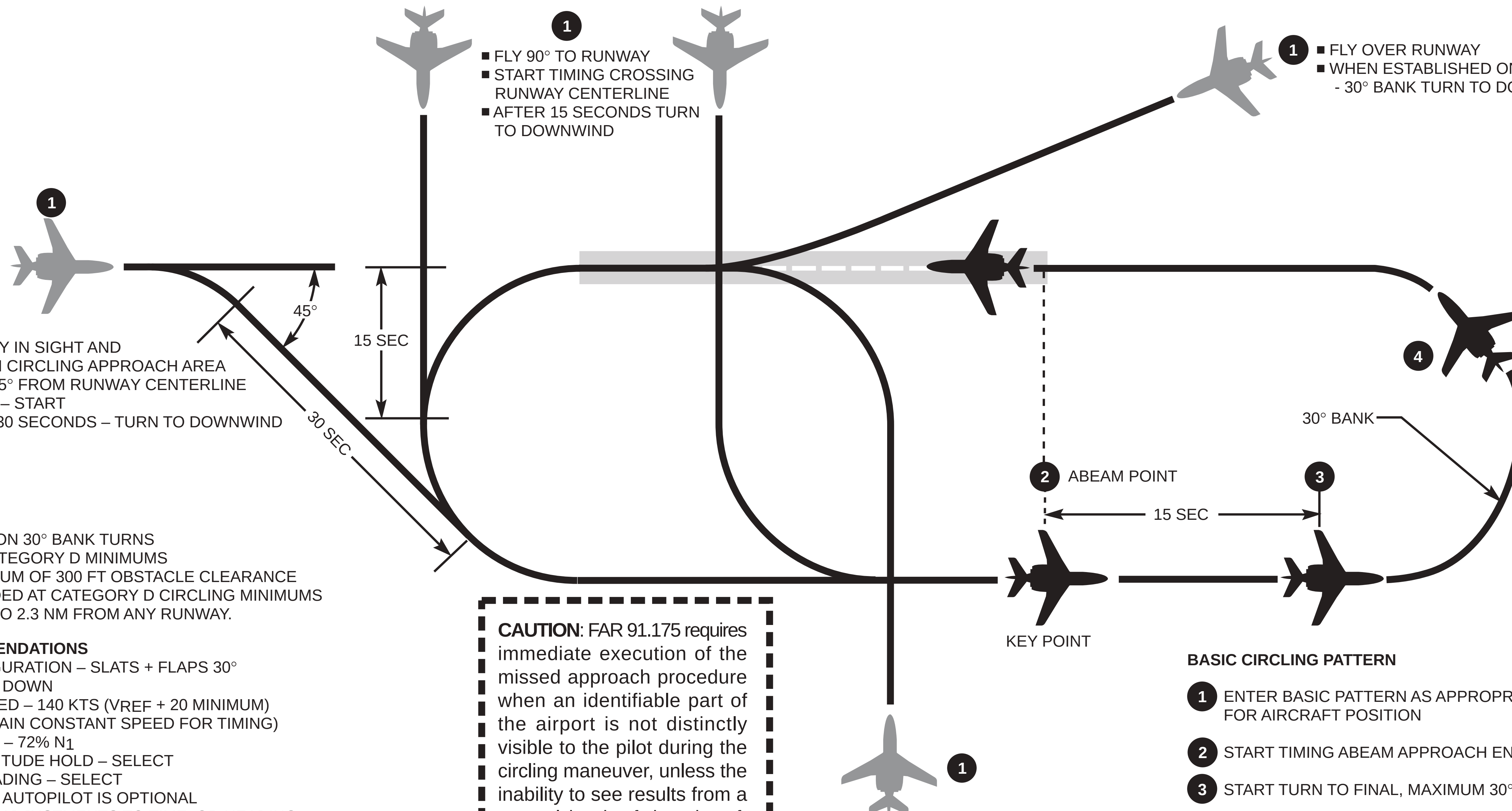
Single Engine Non-Precision Approach and Landing

Visual Approach/Balked Landing



Visual Approach/
Balked Landing

Circling Approach



NOTES

- BASED ON 30° BANK TURNS
- USE CATEGORY D MINIMUMS
- A MINIMUM OF 300 FT OBSTACLE CLEARANCE PROVIDED AT CATEGORY D CIRCLING MINIMUMS (MDA) TO 2.3 NM FROM ANY RUNWAY.

RECOMMENDATIONS

- CONFIGURATION – SLATS + FLAPS 30°
- GEAR – DOWN
- AIRSPEED – 140 KTS (V_{REF} + 20 MINIMUM) (MAINTAIN CONSTANT SPEED FOR TIMING)
- POWER – 72% N_1
- F/D ALTITUDE HOLD – SELECT
- F/D HEADING – SELECT
- USE OF AUTOPILOT IS OPTIONAL
- SLIGHT ADJUSTMENTS TO TIME OR HEADING MAY BE USED TO ADJUST FOR WIND

NOTE: ALL POWER SETTING ARE APPROXIMATE. V_{AP} = V_{REF} + CONFIGURATION CORRECTION (IF ANY) + WIND FACTOR, BUT NOT LESS THAN V_{REF} + CONFIGURATION CORRECTION + 10 KTS.

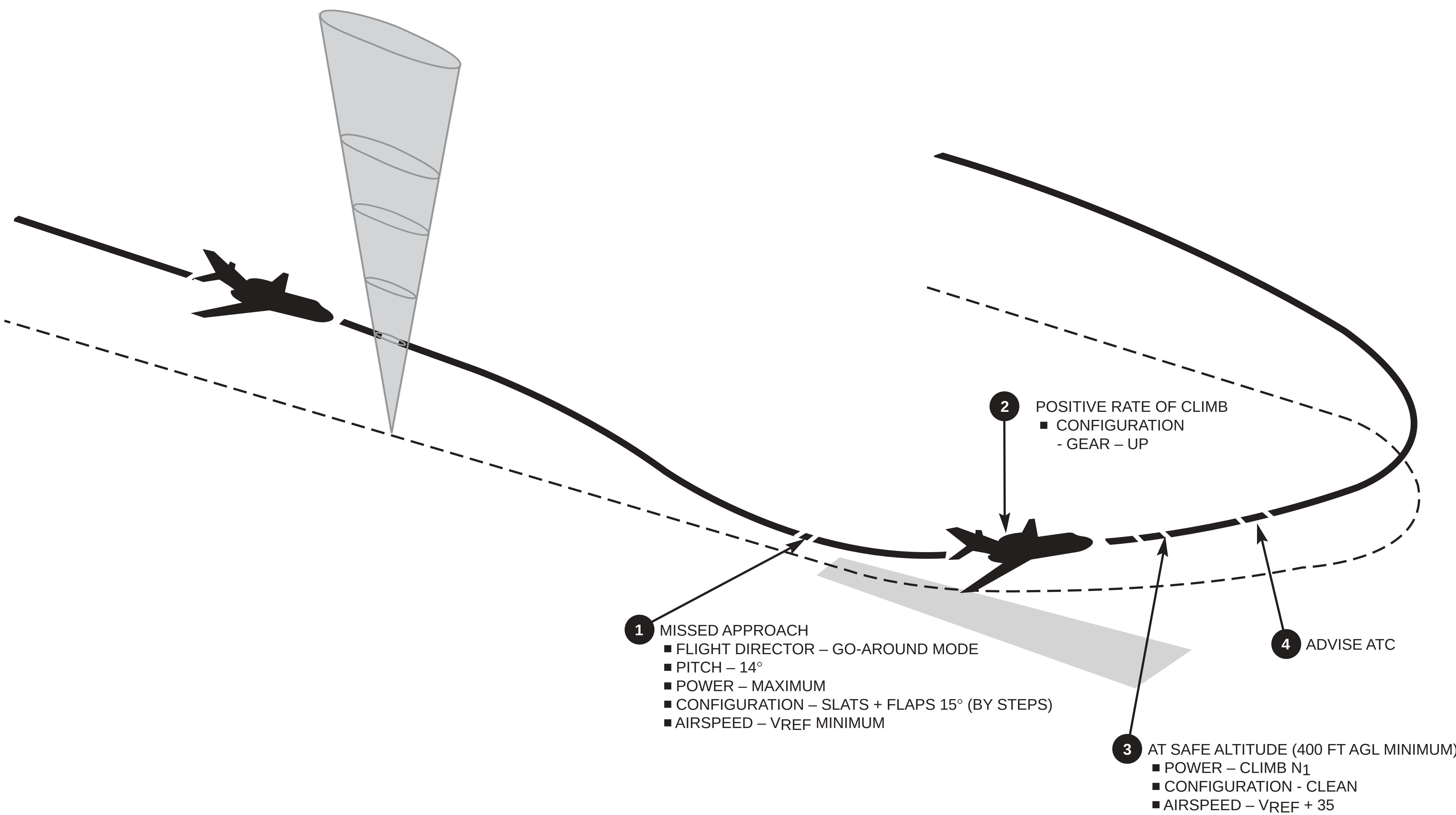
CAUTION: FAR 91.175 requires immediate execution of the missed approach procedure when an identifiable part of the airport is not distinctly visible to the pilot during the circling maneuver, unless the inability to see results from a normal bank of the aircraft during the approach.

BASIC CIRCLING PATTERN

1. ENTER BASIC PATTERN AS APPROPRIATE FOR AIRCRAFT POSITION
2. START TIMING ABEAM APPROACH END OF RUNWAY
3. START TURN TO FINAL, MAXIMUM 30° BANK
4. WITH RUNWAY IN SIGHT AND IN POSITION TO MAKE A NORMAL DESCENT TO LANDING
   - BEFORE LANDING CHECKLIST – COMPLETE
   - DESCENT FROM MDA – BEGIN
   - AIRSPEED – V_{AP}
   - IF NOT IN A POSITION TO MAKE A NORMAL LANDING
     - GO-AROUND – EXECUTE
   - AT THRESHOLD
     - AIRSPEED – V_{REF} + WIND FACTOR

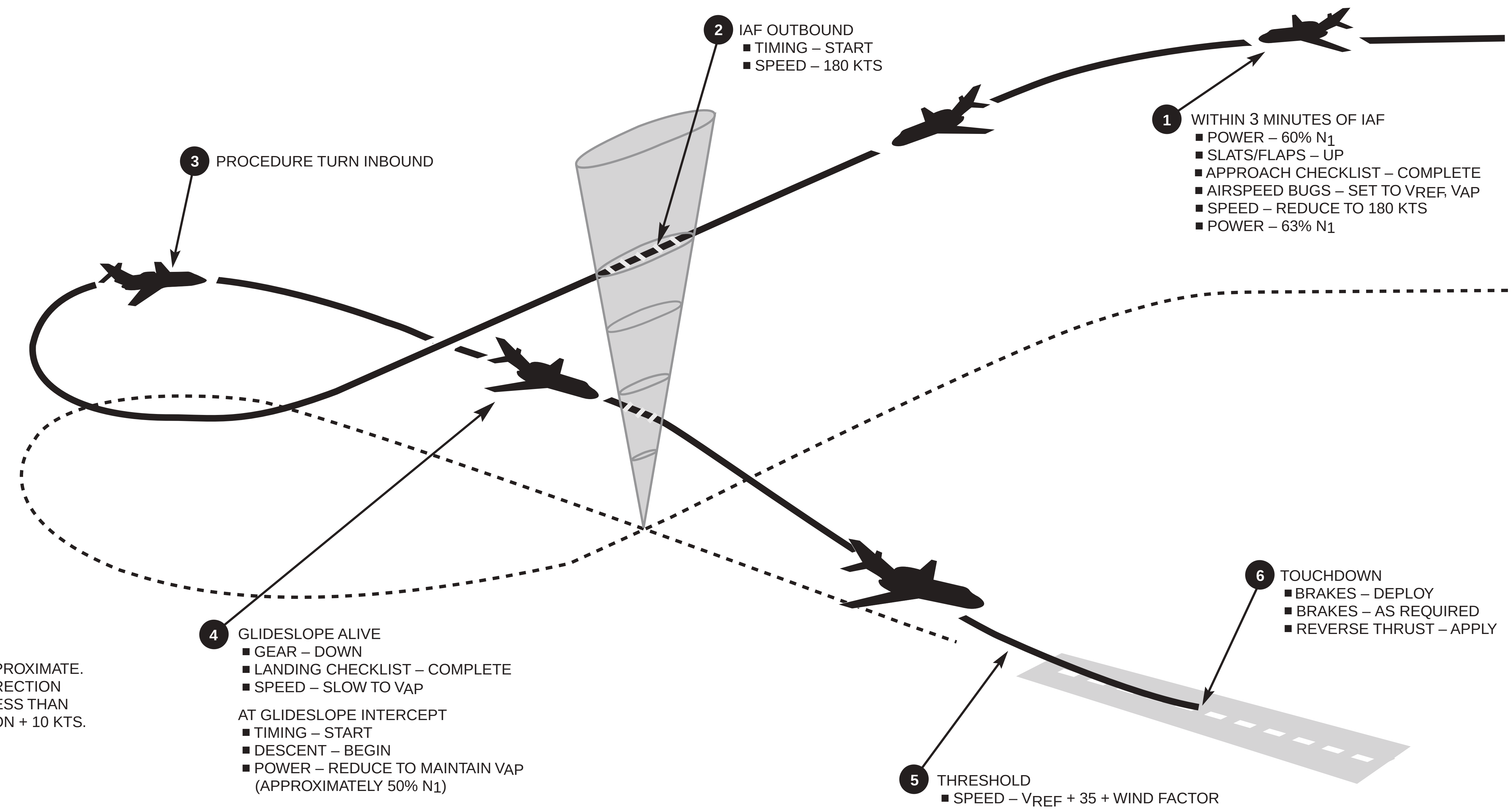
Circling Approach

Go-Around/Missed Approach



Go-Around/ Missed Approach

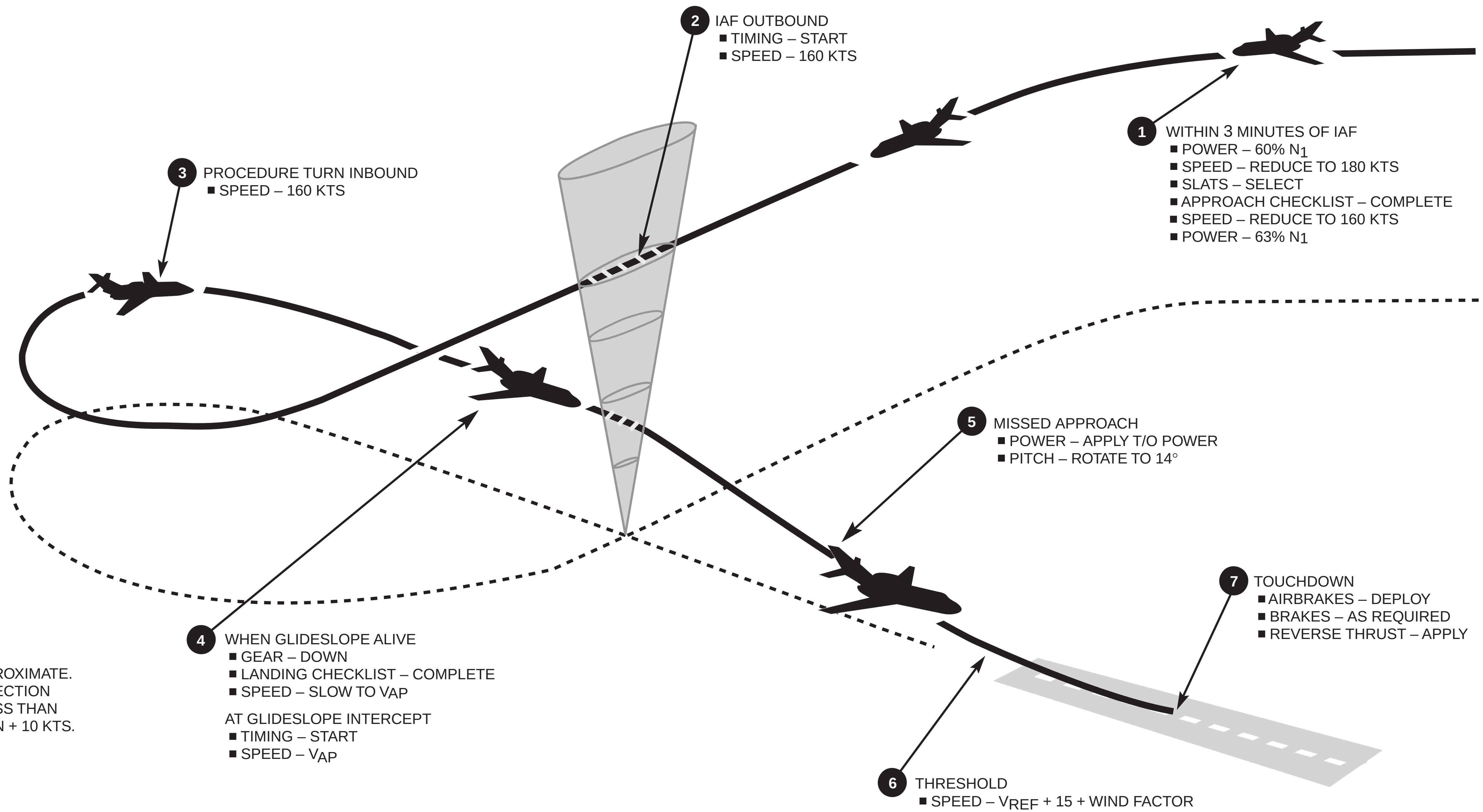
Clean Wing Approach and Landing



NOTE: ALL POWER SETTING ARE APPROXIMATE.
V_{AP} = V_{REF} + CONFIGURATION CORRECTION (IF ANY) + WIND FACTOR, BUT NOT LESS THAN V_{REF} + CONFIGURATION CORRECTION + 10 KTS.

Clean Wing Approach and Landing

Slats-Only Approach and Landing



NOTE: ALL POWER SETTING ARE APPROXIMATE.
V_{AP} = V_{REF} + CONFIGURATION CORRECTION (IF ANY) + WIND FACTOR, BUT NOT LESS THAN V_{REF} + CONFIGURATION CORRECTION + 10 KTS.

Slats-Only Approach and Landing

Flight Planning

Chapter 4

Flight planning is critical to flight safety.

This section parallels groundschool instruction and provides instruction in and examples of flight planning procedures. A sample problem is used throughout the chapter with the appropriate chart opposite each lesson's procedural steps.

Problem examples and data drawn from the charts are italicized.

Table of Contents

General Information

Flight planning begins with data gathered on:

- payload
- airport data for departure, arrival, and alternate
- navigation information for departure, enroute, and arrival
- weather for departure, enroute, destination, and alternate
- NOTAMs.

The operator provides payload information. Airport data, such as elevation, available runways, and runway length, width, and lighting, is in Jeppesen or NOS charts. If runway bearing strength is questioned, other sources of airport information may be required. Navigation information is in Jeppesen or NOS charts. In some cases, additional information is needed (e.g., NAT tracks if crossing the North Atlantic).

Obtain weather conditions for departure, arrival, and alternate airports as well as enroute weather, winds, and temperatures aloft from the FAA Flight Service System by telephone, computer, or a flight planning vendor. The same sources provide NOTAMs.

Unless otherwise noted, the charts in this section are from the Falcon 10/100 Airplane Flight and Operational Instructions Manuals.

Limiting Factors

To initiate flight planning, first consider possible limiting factors such as structural, runway, and climb performance limits and trip fuel loads.

Structural Limits

Structural limits restrict heavy payloads. A dense load (e.g., gold bars) means weight is the primary planning concern; begin flight planning with weight and balance to determine payload restrictions requiring significant plan changes (e.g., two aircraft, load left at departure).

Runway and Climb Performance Limits

If takeoff, runway, or climb performance limits affect the maximum takeoff weight, fuel or payload may need adjustment. Determine the maximum takeoff weight, then adjust factors to accommodate it (e.g., an enroute refueling stop).

Trip Fuel Loads

The total capacity or the trip requirements limit the trip fuel load; carry no more than the required amount plus desired reserves. Determine weight and balance to find the zero fuel weight, then calculate the trip fuel, and add it to the zero fuel weight to determine the takeoff gross weight. Finally, examine takeoff performance.

Fuel Requirements

In practical operation, estimate fuel by rules of thumb relating to experience with aircraft operation. Large variances in fuel burn are based on factors such as gross weight, selected cruise altitude, and speed.

Reserve Fuel

Reserve fuel requirements vary with the destination location and traffic density as well as the weather. While a 1,200 lb reserve is adequate for a low traffic density and good VMC destination, anticipated traffic delay or IMC weather increases fuel reserves to 2,000 lbs or more. According to the FARs, 1,200 lbs of fuel at the destination is adequate to proceed to an alternate approximately 120 NM (still air) from the primary destination and arrive with the required reserves.

Fuel Burn Rates

Hourly fuel burn rates, **Table 4-A**, vary with takeoff weight, climb schedule, cruise altitude, and cruise Mach. For takeoffs near maximum takeoff gross weight, the following fuel burns occur if the cruise altitude is maintained at or near the highest possible.

Hour	Climb 260 kts/0.72 M Cruise 0.75 M (Lbs Fuel Burned)	Climb 300 kts/0.80 M Cruise 0.80 M (Lbs Fuel Burned)
1	1,628	1,701
2	1,320	1,250
3	1,240	1,130
4	1,200	1,130

Table 4-A; Fuel Burn Rates

For cruise at low altitudes, such as 15,000 feet MSL, a fuel flow of 600 lbs/hr per engine produces approximately 255 KIAS, decreasing to 220 KIAS at 1,000 ft MSL.

Takeoff and Landing Performance

In general, runway lengths are shorter for slats + flaps 15° than for slats-only takeoffs.

Slats + flaps with speed increase and slats-only takeoffs produce better climb performance than slats + flaps 15° takeoffs.

Slats + flaps 52° landings produce the shortest landing distances.

Trip Planning Data

Use the charts throughout this chapter to plan a long range trip on a hot day from Redbird Airport (RDB), Dallas, Texas, to Teterboro, New Jersey, with an alternate of Harrisburg, Pennsylvania.

The charts are appropriate for an aircraft **with SB F10-0052**. Assume a basic empty weight of 11,460 lbs and a moment of 400, which results in a typical operating weight of 11,800 lbs. The payload is three passengers, baggage, and supplies weighing 920 lbs.

This example uses the trip fuel load method of determining limiting factors.

NOTE: Most aircraft incorporate SB F10-0052, which increases the maximum takeoff weight (MTOW) to 18,740 lbs. The charts for an 18,740 lb aircraft are the same as for an 18,300 lb or 19,400 lb aircraft, except the values are commensurate with takeoff weights.

Although moment is recorded in pound-inches, the notation pounds-inches (lbs/in) is not used hereafter because it is understood. All numbers are positive unless otherwise noted.

Definitions

To understand flight planning, it is necessary to be thoroughly familiar with the terms involved. This section reviews the definitions for terms used throughout this chapter.

Accelerate-stop distance – Distance necessary to accelerate the aircraft to a given speed (V_1), and to come to a full stop, assuming one engine fails at V_1.

AGL – Above ground level.

Approach climb – The steady gradient of climb with one engine inoperative may not be less than 2.1%. Engine rating is takeoff thrust. The stabilized airspeed is V_{AC} for a slats + flaps 15° or slats + flaps 30° configuration as found in the AFM or the SimuFlite Operating Handbook.

Balanced field length – Distance obtained by choosing the engine failure speed V_1 so that takeoff distance and accelerate-stop distance are the same.

Basic empty weight – Weight of airframe, powerplant, interior accommodation, systems, and equipment that are an integral part of a given version (i.e., the weight without usable fuel, including all fluids contained in closed systems, the unusable and undrainable fuel and the engine oil).

Basic operating weight – Basic empty weight plus operational items and crew.

Clearway – Area beyond the runway:

- not less than 500 ft (152 m) wide
- centrally located on the extended centerline of the runway
- under the control of the airport authorities
- upward slope not exceeding 1.25%
- above which no object nor terrain protrudes (threshold lights should be at each side of the runway and not more than 26 inches (65 cm) high.

Configurations – The configurations referred to by name in the AFM charts correspond to the settings in **Table 4-B** on the following page (**Figure 4-1**, page 4-15).

Engine failure speed associated with balanced field length – Distance obtained by choosing the engine failure speed V_1 so that takeoff distance and accelerate-stop distance are the same. V_1 must be greater than V_1 MIN and less than V_{MBE} and V_R. If the determination of V_1 gives a value outside one of these limits, V_1 must be selected equal to the limit value. The field length found in the chart is the higher of either the takeoff distance or the accelerate-stop distance associated with this limit value of V_1.

Final segment – Segment extending from the end of the transition segment to a height no less than 1,500 ft AGL. The gradient of climb may not be less than 1.2%. Engine power is reduced from takeoff to maximum continuous.

First segment – Segment extended from the point at which the aircraft becomes airborne to the point at which gear retraction is achieved. The climb gradient without ground effect may not be less than 0.0% (positive). The speed increases from V_{LOF} to V_2, to be attained at a height not greater than 35 ft (10.7 m).

Gross climb gradient – Demonstrated ratio expressed in percent of change in height to horizontal distance travelled.

Height – Vertical distance from the lower point of the aircraft to the airport surface.

IAS – Indicated airspeed. Airspeed indicator reading, as installed in the aircraft.

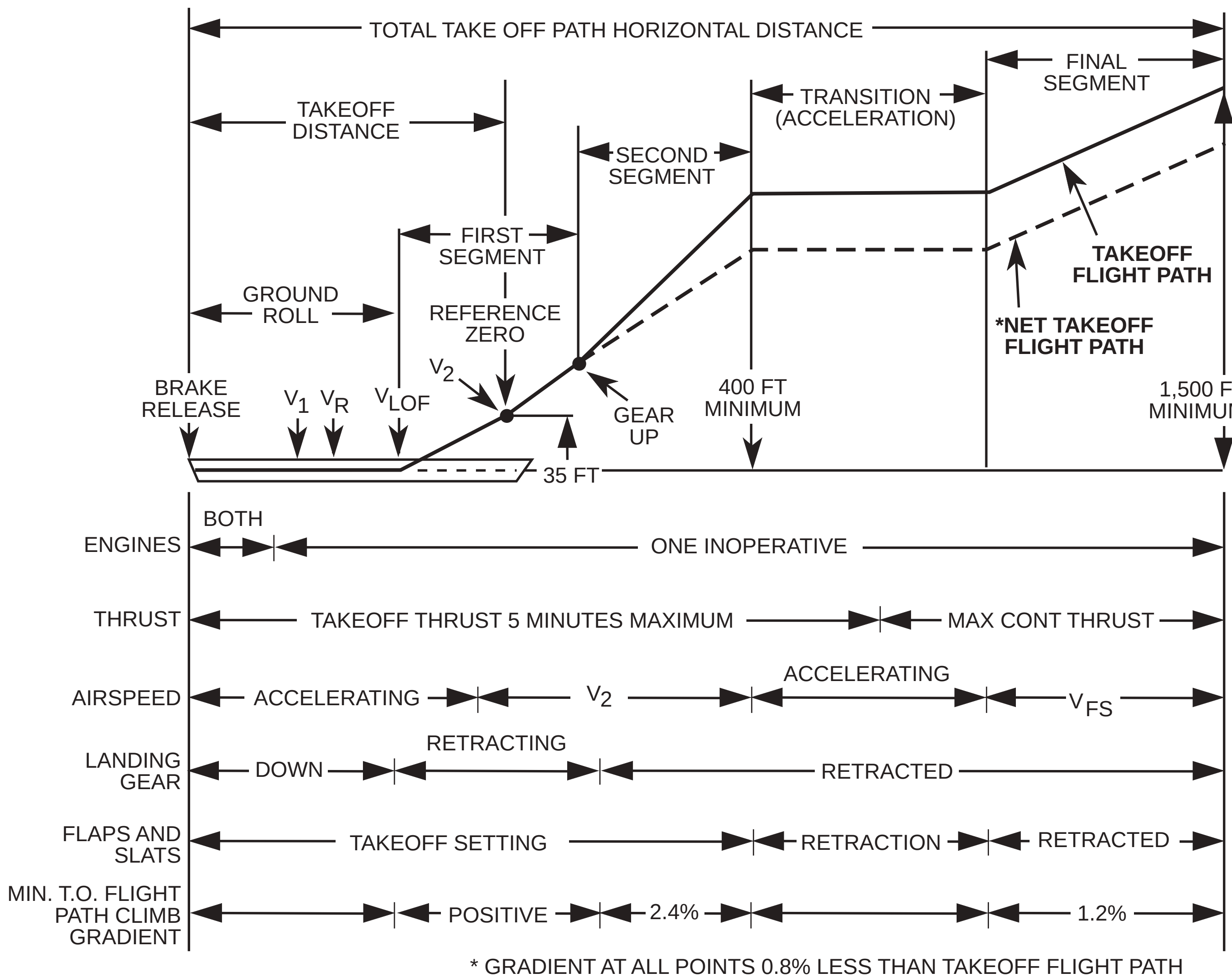
Landing climb – The steady gradient of climb in landing configuration with all engines operative may not be less than 3.2%. Engine rating is takeoff thrust. The stabilized airspeed is 1.3 V_{SO} (V_{REF}) for slats + flaps 52° landing configuration.

Flight Condition	Configuration			FAR Conditions			Effective Speed
	Engines		High Lift	Gear	Gross Climb	Speed	
	Power Setting	No.					
Takeoff	Takeoff	2	S + Flaps 15° or Slats	Down	0.0	0 to V_{LOF}	0 to V_{LOF}
First Segment	Takeoff	1	S + Flaps 15° or Slats	Down	0.0	V_{LOF} to V_2	V_{LOF} to V_2
Second Segment	Takeoff	1	S + Flaps 15° or Slats	Up	2.4	≥ V_2 Minimum	V_2
Transient Segment	Takeoff	1	In Retraction	Up	Available 1.2	0.0	In Acceleration
Final Takeoff	Maximum Continuous	1	Clean	Up	1.2	≥ 1.25 V_S	1.4 V_S
Enroute Climb	Maximum Continuous	1	Clean	Up	0.0	—	1.5 V_S
Approach Climb	Takeoff	1	S + Flaps 30°	Up	2.1	≤ 1.5 V_S	1.3 V_S
	Takeoff	1	S + Flaps 15°	Up	2.1	≤ 1.5 V_S	1.35 V_S
Landing Climb	Takeoff	2	S + Flaps 52°	Down	3.2	≤ 1.3 V_S	1.3 V_S
Landing	Idle	2	S + Flaps 52°	Down	0.0	≥ 1.3 V_S	1.3 V_S

Table 4-B; Configuration Settings

Minimum Climb/Obstacle Clearance

One Engine Inoperative



4-1

Landing distance – Horizontal distance required to land and come to a complete stop from a point at a height of 50 ft (15.2 m) above the landing surface. The stabilized airspeed is V_{REF} for slats + flaps 52° landing configuration.

Landing field length – The demonstrated landing distance multiplied by 1.67.

Landing weight – Maximum weight permissible at landing based on landing field limitations and other associated limitations. The landing weight must not exceed the maximum landing weight (MLW) defined by the structural weight limitations.

M – True Mach number. Indicated Machmeter, corrected for static and total pressure ports position error.

Maximum landing weight (MLW) – Maximum weight at landing, based on structural weight limitations.

MI – Indicated Mach number. Machmeter reading, as installed in the aircraft.

MSL – Mean sea level.

Net climb gradient – Gross climb gradient reduced by:

- 0.8% for takeoff flight path
- 1.1% for enroute flight path with one engine inoperative.

Operational takeoff weight – Maximum weight permissible for takeoff based on takeoff field or flight limitations, or other associated limitations. The operational takeoff weight must not exceed the maximum takeoff weight (MTOW) defined by structural weight limitations.

Payload – Weight of passengers, cargo, and baggage.

QFE – Field pressure. Actual atmospheric pressure at the elevation of the airport.

Second segment – Segment extending from the end of the first segment to a height of at least 400 ft. The gradient of climb may not be less than 2.4%. Aircraft speed is stabilized at V_2.

Stopway – Area beyond the runway:

- no less wide than the runway
- centrally located upon the extended centerline of the runway
- designated by the airport authorities for use in decelerating the aircraft during an aborted takeoff
- able to support the aircraft without causing structural damage.

Takeoff distance – Greater horizontal distance along the takeoff path from start of takeoff roll to the point at which the aircraft is 35 ft (10.7 m) high with either:

- one engine failure at V_1
- all engines operating (factored by 115%).

Takeoff run (takeoff with clearway) – Greater horizontal distance along the takeoff path from start of takeoff roll to a point equidistant between the point at which V_{LOF} is reached and the point at which the aircraft is 35 ft (10.7 m) high with either:

- one engine failure at V_1
- all engines operating (factored by 115%).

TAT – Total air temperature. Outside air temperature, including adiabatic compression rise; assumed recovery factor is 99%.

V_{LOF} – Liftoff speed. Speed at which the aircraft first becomes airborne.

V_{MBE} – Maximum brake energy speed. Maximum engine failure speed V_1 at which the maximum demonstrated brake energy is not exceeded. V_1 must not exceed V_{MBE}.

V_R – Rotation speed. Speed at which rotation is initiated.

V_{REF} – Reference speed. Minimum speed at the height of 50 ft (15.2 m) during a normal landing. V_{REF} should not be less than 1.3 V_S for landing configuration (slats + flaps 52°).

V_S – Stalling speed. Minimum speed obtained during the stall maneuver in the specific configuration.

V_{SO} – Stalling speed. Minimum speed obtained during the stall maneuver with gear and flaps fully extended.

V_1 – Engine failure speed. Speed at which one engine is assumed to become suddenly inoperative during takeoff, after which the takeoff must be continued. This speed is always greater than V_{MCG} (100 kts).

V_2 – Takeoff safety speed. Initial climb speed reached by the aircraft before it is 35 ft (10.7 m) above the takeoff surface with one engine inoperative.

Wind components – velocity and direction recorded at the height of 50 ft (15.25 m):

- headwind or tailwind – component parallel to the flight path
- crosswind – component perpendicular to the flight path.

Zero fuel weight (ZFW) – Certified empty weight plus payload. The zero fuel weight must not exceed the maximum zero fuel weight defined by structural weight limitations (i.e., ZFW MZFW).

Weight and Balance

Precise weight computations are required to operate the aircraft within limitations and for performance calculations. Balance computations are required to operate the aircraft within center of gravity limitations.

The Weight and Loading subsection of AFM Section 1, Limitations, states that maximum weight limits are determined by structural limitations that may in turn be reduced by performance limitations. The section states the center of gravity limits must stay within limits graphically indicated. This section then refers to Performance Manual Section 2, Loading, for weight and balance determinations.

Structural weight limitations are shown below in **Tables 4-C**, **4-D**, and **4-E**.

Weight	Pounds	Kilograms
Maximum Ramp Weight	18,300	8,300
Maximum Takeoff Weight	18,300	8,300
Maximum Landing Weight	17,200	7,800
Maximum Zero Fuel Weight	12,460	5,650
Minimum Flight Weight	9,920	4,500

Table 4-C; Aircraft with Minimum Takeoff Weight of 18,300 lbs (Basic without SB F10-0052)

Weight	Pounds	Kilograms
Maximum Ramp Weight	18,740	8,500
Maximum Takeoff Weight	18,740	8,500
Maximum Landing Weight	17,640	8,000
Maximum Zero Fuel Weight	13,560	6,150
Minimum Flight Weight	9,920	4,500

Table 4-D; Aircraft with Maximum Takeoff Weight of 18,740 lbs (Basic with SB F10-0052)

Weight	Pounds	Kilograms
Maximum Ramp Weight	19,400	8,800
Maximum Takeoff Weight	19,300	8,755
Maximum Landing Weight	17,640	8,000
Maximum Zero Fuel Weight	14,400	6,540
Minimum Flight Weight	9,920	4,500

Table 4-E; Aircraft with Maximum Takeoff Weight of 19,300 lbs (Basic with SB F10-0238)

Loading Manual Section 2, Balance Control, states that the center of gravity position is determined and checked by means of a weight and balance diagram. There are two steps to the procedure:

1. Determine that the zero fuel weight and moment are within the zero fuel weight limits.
2. Determine that the takeoff weight (ZFW + fuel weight) and moment are within the Weight and Balance Diagram limits, then determine the center of gravity position in percent MAC.

The Loading Manual provides the following to determine weight and center of gravity:

- definitions
- fuel moment graphs
- loading examples for various airplane configurations and blank loading forms for those configurations
- change in CG position for all configurations
- equipment lists
- weight and balance diagrams
- numerical weight and balance data tables.

The information is in both metric and U.S. units. The procedures used are exactly the same, whether in metric or U.S. units.

The pilot must use a configuration variation form that corresponds to a particular Falcon 10/100.

For this example, use Version 1 Weight and Balance form, U.S units, Three Windows on RH Side (**Figure 4-2**).

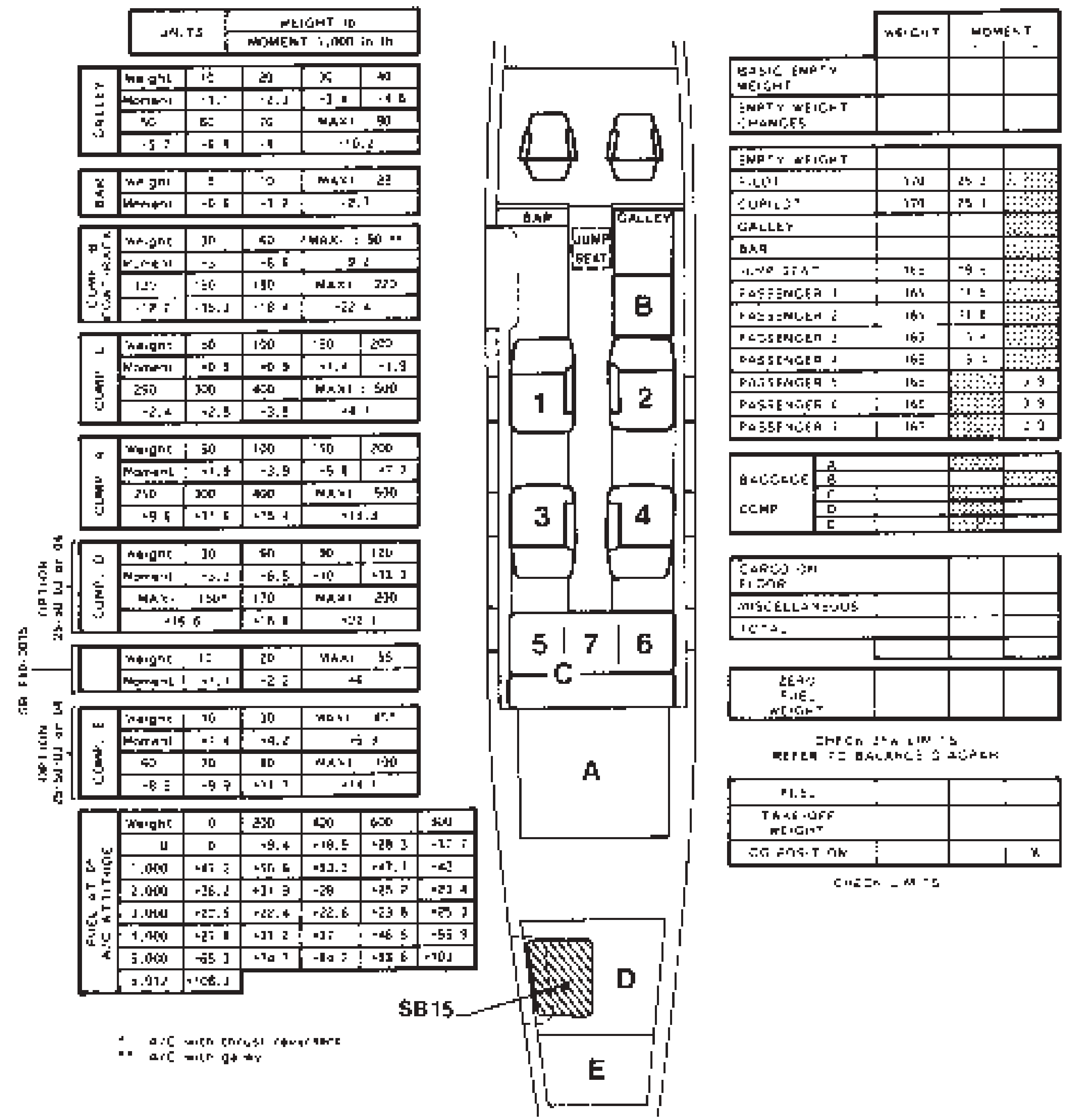
The form contains an illustration of the aircraft in the center; on the left are tables of moments for standard weights for specific locations; on the right is a loading schedule.

The loading schedule lists the location in the first column. The second column contains the weight for the area or item. The third and fourth columns contain the moments for the weights and express negative and positive, respectively. When a certain moment cannot have a negative or positive sign, that column for that row is shaded to prevent entry.

In this example, some of the specific locations are BAGGAGE COMP. A, COAT RACK (COMP. B), and GALLEY.

Weight and Balance

(Version No. 1, U.S. Units)



4-2

Weight and Balance

NOTE: Maintenance usually records changes to the basic empty weight and moment with an alteration form.

Basic Empty Weight and Moment

Obtain the basic empty weight and moment from the latest aircraft weighing form or from the latest weight and balance computation form after an aircraft alteration. Empty weight changes are made on the weight and balance form if added or removed equipment affects the basic empty weight.

1. Enter the basic weight and moment on the Determination of CG Location/Load Distribution form (**Figure 4-3**).

   For this example, the basic aircraft weight is 11,460 lbs with a corresponding moment of 400. Moments are entered in thousands. The figures 11,460 and 0.4 are entered in the BASIC EMPTY WEIGHT row in the WEIGHT column and the + MOMENTS column, respectively.

2. Record changes in empty weight and moment in the EMPTY WEIGHT CHANGES row, then add them to or subtract them from the BASIC EMPTY WEIGHT and MOMENT row. Record the results in the EMPTY WEIGHT row.

   For this example, there are no changes to the basic empty weight. The entry in the EMPTY WEIGHT row is the same as in the BASIC EMPTY WEIGHT row.

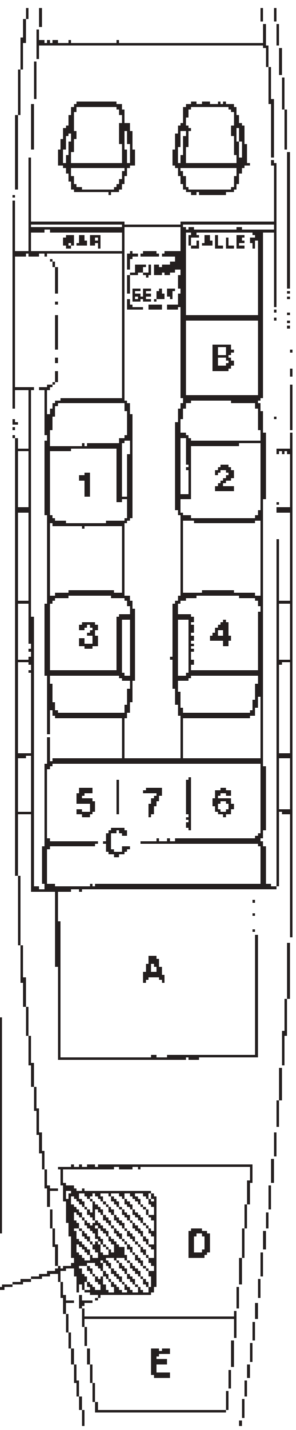
Weight and Balance
(Version No. 1, U.S. Units)

units	WEIGHT lb / MOMENT 1,000 in lb

Section					
GALLEY	Weight	10	20	30	40
	Moment	-1.1	-2.3	-3.4	-4.6
	50	60	70	MAXI. 90	
	-5.7	-6.8	-8	-10.2	
BAR	Weight	5	10	MAXI: 22	
	Moment	-0.6	-1.2	-2.7	
COMP. B COAT-RACK	Weight	30	60	MAXI. 90 **	
	Moment	-3	-6.6	-9.2	
	120	150	180	MAXI 220	
	-12.2	-15.3	-18.4	-22.4	
COMP. C	Weight	50	100	150	200
	Moment	+0.5	+0.9	+1.[illegible]	+1.9
	250	300	400	MAXI. 500	
	+2.4	+2.8	+3.[illegible]	+4.7	
COMP. A	Weight	50	100	150	200
	Moment	+1.9	+3.9	+5.8	+7.7
	250	300	400	MAXI. 500	
	+9.6	+11.6	+15.4	+19.3	
COMP. D (OPTION 25-50-03 M 04)	Weight	30	60	90	120
	Moment	+3.3	+6.6	+10	+13.3
	MAX 150*		170	MAXI. 200	
	+16.5		+18.4	+22.1	
SB F10-0015	Weight	10	20	Max 35	
	Moment	+1.1	+2.2	+4	
COMP. E (OPTION 25-50-03 M 04)	Weight	10	30	MAXI. 45*	
	Moment	+1.4	+4.2	+6.3	
	60	70	80	MAXI 100	
	+8.5	+9.9	+11.3	+14.1	

FUEL AT A/C ATTITUDE					
Weight	0	200	400	600	800
0	0	+9.4	+18.3	+28.3	+37.7
1,000	+47.2	+56.6	+59.6	+47.7	+42
2,000	+36.2	+31.9	+28	+25.2	+23.4
3,000	+32.6	+32.4	+22.8	+21.8	+25.3
4,000	+27.8	+31.2	+37	+46.5	+55.9
5,000	+65.3	+74.7	+84.2	+93.6	+103
5,914	+108.4				

* A/C with thrust reversers
** A/C with galley



	WEIGHT	MOMENT -	MOMENT +
BASIC EMPTY WEIGHT	11,460		.4
EMPTY WEIGHT CHANGES			

	WEIGHT	MOMENT -	MOMENT +
EMPTY WEIGHT	11,460		.4
PILOT	170	25.1	
COPILOT	170	25.1	
GALLEY			
BAR			
JUMP SEAT	165	[illegible]	
PASSENGER 1	165	11.6	
PASSENGER 2	165	11.6	
PASSENGER 3	165	5.4	
PASSENGER 4	165	5.4	
PASSENGER 5	165		0.5
PASSENGER 6	165		0.5
PASSENGER 7	165		[illegible]

BAGGAGE COMP		WEIGHT	MOMENT -	MOMENT +
	A			
	B			
	C			
	D			
	E			

	WEIGHT	MOMENT -	MOMENT +
CARGO ON FLOOR			
MISCELLANEOUS			
TOTAL			

	WEIGHT	MOMENT -	MOMENT +
ZERO FUEL WEIGHT			

CHECK ZFW LIMITS
REFER TO BALANCE DIAGRAM

	WEIGHT	MOMENT
FUEL		
TAKE-OFF WEIGHT		
CG POSITION		%

CHECK LIMITS

4-3

> **NOTE**: In rare cases, it is possible to exceed forward CG limits on some Falcon 10/100s if a very heavy individual sits on a forward seat.

Passenger and Crew Weights

The manufacturer assumes standard passenger and crew weights. The assumption is that variations in these weights from the actual weights are insufficient to significantly affect weight and balance.

Assume crew and passenger weights of 170 and 165 lbs, respectively.

1. On the weight and balance configuration form (**Figure 4-4**), line through the weight and moment areas of seats not occupied.

   For this example, the two crewmembers occupy the pilot and copilot seats; the jump seat is not occupied. Three passengers are in seats 1, 3, and 4. Corresponding weight and moment rows for unoccupied seats 2, 5, 6, and 7 are lined through.

Weight and Balance

(Version No. 1, U.S. Units)

units	WEIGHT lb / MOMENT 1,000 in lb

GALLEY

Weight	10	20	30	40
Moment	-1.1	-2.3	-3.4	-4.6
50	60	70	MAXI : 90	
-5.7	-6.8	-8	-10.2	

BAR

Weight	5	10	MAXI : 22
Moment	-0.6	-1.2	-2.7

COMP. D COAT-RACK

Weight	30	60	MAXI : 90 **
Moment	-3	-6.6	-9.2
120	150	180	MAXI : 220
-12.2	-15.3	-18.4	-22.4

COMP. C

Weight	50	100	150	200
Moment	+0.5	+0.9	+1.4	+1.9
250	300	400	MAXI : 500	
+2.4	+2.8	+3.8	+4.7	

COMP. A

Weight	50	100	150	200
Moment	+1.9	+3.9	+5.8	+7.7
250	300	400	MAXI : 500	
+9.6	+11.6	+15.4	+19.3	

OPTION 25-50-03 & 04

COMP. D

Weight	30	60	90	120
Moment	+3.3	+6.6	+10	+13.3
MAX 150*		170	MAXI : 200	
+16.5		+18.4	+22.1	

SB F10-0015

Weight	10	20	MAXI : 35
Moment	+1.1	+2.2	+4

OPTION 25-50-03 & 04

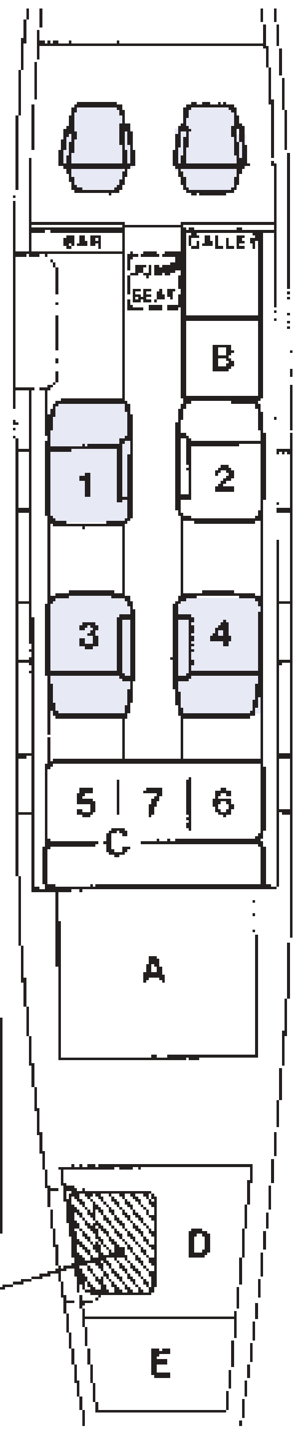
COMP. E

Weight	10	30	MAXI : 45*
Moment	+1.4	+4.2	+6.3
60	70	80	MAXI : 100
+8.5	+9.9	+11.3	+14.1

FUEL AT 0° A/C ATTITUDE

Weight	0	200	400	600	800
0	0	+9.4	+18.3	+28.3	+37.7
1,000	+47.2	+56.6	+54.2	+47.7	+42
2,000	+36.2	+31.9	+28	+25.2	+23.4
3,000	+22.6	+22.4	+22.8	+23.8	+25.3
4,000	+27.8	+31.3	+37	+46.5	+55.9
5,000	+65.3	+74.7	+84.2	+93.6	+103
5,914	+108.3				

* A/C with thrust reversers
** A/C with galley



	WEIGHT	MOMENT	
BASIC EMPTY WEIGHT	11,460		.4
EMPTY WEIGHT CHANGES			

	WEIGHT	MOMENT	
EMPTY WEIGHT	11,460		.4
PILOT	170	29.1	
COPILOT	170	29.1	
GALLEY			
BAR			
JUMP SEAT	~~165~~	~~14.5~~	
PASSENGER 1	165	11.6	
PASSENGER 2	~~165~~	~~11.6~~	
PASSENGER 3	165	5.4	
PASSENGER 4	165	5.4	
PASSENGER 5	~~165~~		~~0.3~~
PASSENGER 6	~~165~~		~~0.3~~
PASSENGER 7	~~165~~		~~2.5~~

BAGGAGE COMP				
	A			
	B			
	C			
	D			
	E			

CARGO ON FLOOR			
MISCELLANEOUS			
TOTAL			

ZERO FUEL WEIGHT			

CHECK ZFW LIMITS
REFER TO BALANCE DIAGRAM

FUEL			
TAKE-OFF WEIGHT			
CG POSITION			%

CHECK LIMITS

4-4

Miscellaneous Supplies and Baggage

The moments for loads in various areas are determined from the known weight of items placed in the areas.

Assume the following weights:

Galley (full stocks and aircraft documentation)	*70 lbs*
Bar (full stocks)	*20 lbs*
Baggage A	*275 lbs*
Baggage B	*30 lbs*
Baggage D	*30 lbs*

1. Locate the corresponding rows on the loading schedule on the right side of the weight and balance form and record the weights (**Figure 4-5**).
2. Find the corresponding weight/moment table on the left of the form. Interpolate if necessary.
3. Record the moment for the applicable weights in the rows provided on the loading schedule.

   The moments are:

Galley (full stocks and aircraft documentation)	*-8.0*
Bar (full stocks)	*-2.4*
Baggage A	*+10.6*
Baggage B	*-3.0*
Baggage D	*+3.3*

4. Record the values.

Configuration Form (Baggage)

(Version No. 1, U.S. Units)

UN. FS	WEIGHT lb / MOMENT 1,000 in lb

GALLEY

Weight	10	20	30	40
Moment	+1.1	+2.3	+3.4	+4.6
50	60	70	MAXI. 90	
+5.7	+6.8	+8	+10.2	

BAR

Weight	5	10	MAXI. 22
Moment	+0.6	+1.2	+2.7

COMP. B (COAT-RACK)

Weight	30	60	MAXI. 90 **
Moment	+3	+6.6	+9.2
120	150	180	MAXI. 220
+12.2	+15.3	+18.4	+22.4

COMP. C

Weight	50	100	150	200
Moment	+0.5	+0.3	+1.4	+1.9
250	300	400	MAXI: 500	
+2.4	+2.8	+3.4	+4.7	

COMP. A

Weight	50	100	150	200
Moment	+1.9	+3.9	+5.8	+7.7
250	300	400	MAXI: 500	
+9.6	+11.6	+15.4	+19.3	

OPTION 25-50-03 B 04

COMP. D

Weight	30	60	90	120
Moment	+3.3	+6.6	+10	+13.3
Max 150*		170	MAXI: 200	
+16.6		+18.4	+22.1	

SB F10-0015

Weight	10	20	Max 35
Moment	+1.1	+2.2	+6

OPTION 25-50-03 01 04

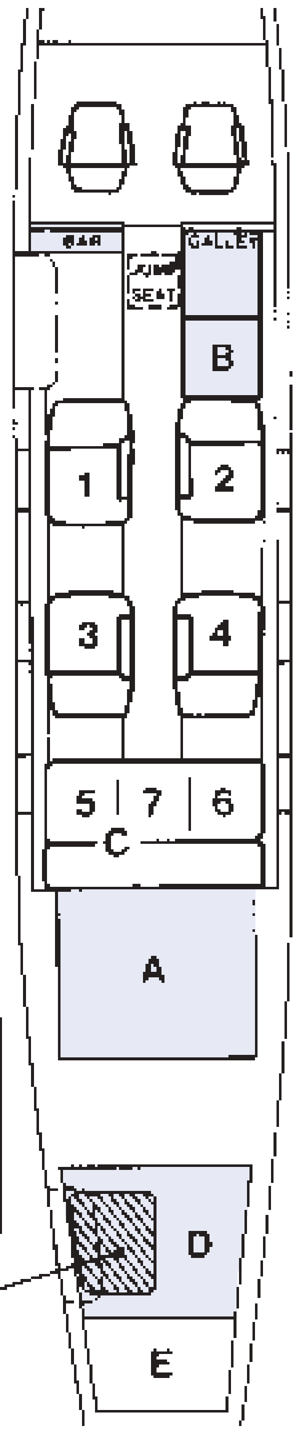
COMP. E

Weight	10	30	MAXI. 45*
Moment	+1.4	+4.2	+6.3
60	70	80	MAXI: 100
+8.5	+9.9	+11.3	+14.1

FUEL AT 0° A/C ATTITUDE

Weight	0	200	400	600	800
0	0	+9.4	+18.9	+28.3	+37.7
1,000	+47.2	+56.6	+51.2	+47.7	+42
2,000	+36.2	+31.9	+28	+25.2	+23.4
3,000	+22.6	+22.4	+22.6	+23.8	+25.3
4,000	+27.8	+31.2	+37	+46.5	+55.5
5,000	+65.3	+74.7	+84.2	+93.6	+103
5,912	+108.3				

* A/C with thrust reversers
** A/C with galley



	WEIGHT	MOMENT	
BASIC EMPTY WEIGHT	11,460		.4
EMPTY WEIGHT CHANGES			
EMPTY WEIGHT	11,460		.4
PILOT	170	25.5	
COPILOT	170	25.5	
GALLEY	70	8.0	
BAR	20	2.4	
JUMP SEAT	~~165~~	~~4.5~~	
PASSENGER 1	165	11.8	
PASSENGER 2	~~165~~	~~11.8~~	
PASSENGER 3	165	5.4	
PASSENGER 4	165	5.4	
PASSENGER 5	~~165~~		~~2.7~~
PASSENGER 6	~~165~~		~~2.5~~
PASSENGER 7	~~165~~		~~2.5~~
BAGGAGE COMP A	275		10.6
BAGGAGE COMP B	30	3.0	
BAGGAGE COMP C			
BAGGAGE COMP D	30		3.3
BAGGAGE COMP E			
CARGO ON FLOOR			
MISCELLANEOUS			
TOTAL			
ZERO FUEL WEIGHT			

CHECK ZFW LIMITS
REFER TO BALANCE DIAGRAM

FUEL			
TAKE-OFF WEIGHT			
CG POSITION			%

CHECK LIMITS

4-5

Baggage Weights and Adjustments

Baggage is loaded in the baggage compartment or in the interior.

If baggage loaded in the interior is stowed in one of the locations already calculated, the new weight is calculated and the new moment determined from the moment table. The revised values then replace the existing values in the corresponding row.

The following scenario is for illustration only, and the figures are not used in the example problem.

> *A passenger requests additional baggage weighing 60 lbs be stored in the coat rack (compartment B). Add that 60 lbs to the 30 lbs presently stored in compartment B for a total of 90 lbs, and determine a new moment from the chart on the left of the form. The revised baggage compartment B weight, 90 lbs, and the revised moment, -9.2, are recorded in the space (**) on the weight and balance form on the opposite page* (**Figure 4-6**).

Weight and Balance

(Version No. 1, U.S. Units)

UNITS	WEIGHT lb / MOMENT 1,000 in lb			

GALLEY

Weight	10	20	30	40
Moment	-1.1	-2.3	-3.4	-4.6
50	60	70	MAXI. 90	
-5.7	-6.8	-8	-10.2	

BAR

Weight	5	10	MAXI. 22
Moment	-0.6	-1.2	-2.7

COMP. B COAT-RACK

Weight	30	60	MAXI. 90**
Moment	-3	-6.6	-9.2
120	150	180	MAXI. 220
-12.2	-15.3	-18.4	-22.4

COMP. C

Weight	50	100	150	200
Moment	+0.5	+0.8	+1.4	-1.9
250	300	400	MAXI. 500	
+2.4	+2.8	+3.4	-4.7	

COMP. A

Weight	50	100	150	200
Moment	+1.9	+3.9	+5.8	+7.7
250	300	400	MAXI. 500	
+9.6	+11.6	+15.4	+19.3	

COMP. D (OPTION 25-50-02 or 04)

Weight	30	60	90	120
Moment	+3.3	+6.6	+10	+13.3
MAX 150*		170	MAXI. 200	
+16.5		+18.4	+22.1	

SB F10-0015

Weight	10	20	MAX. 35
Moment	+1.1	+2.2	+6

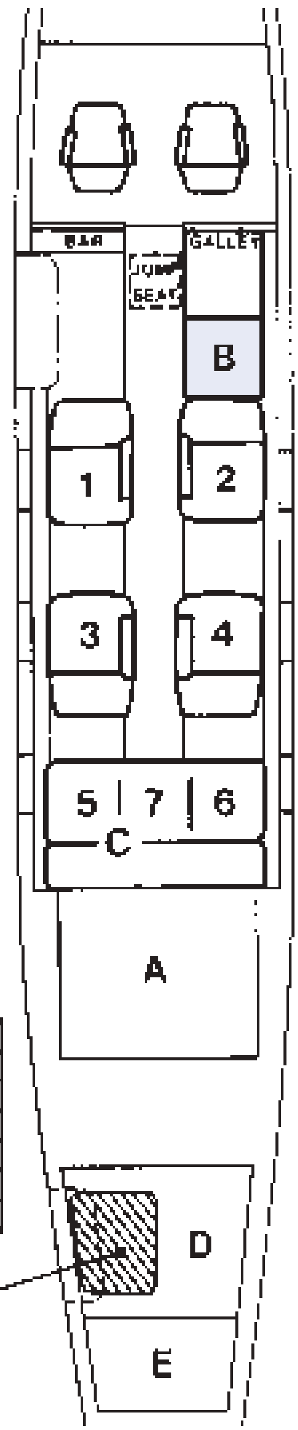
COMP. E (OPTION 25-50-03 or 04)

Weight	10	30	MAXI. 45*
Moment	-1.4	-4.2	-6.3
60	70	80	MAXI. 100
+8.5	+9.9	+11.3	+14.1

FUEL AT 0° A/C ATTITUDE

Weight	0	200	400	600	800
0	0	+9.4	+18.3	+28.3	+37.7
1,000	+47.2	+56.6	+57.2	+47.7	+42
2,000	+36.2	+31.9	+28	+25.2	+23.4
3,000	+22.6	+22.4	+22.6	+21.8	+25.3
4,000	+27.8	+31.2	+37	+49.5	+55.9
5,000	+65.3	+74.7	+84.2	+93.6	+103
5,912	+108.3				

* A/C with thrust reversers
** A/C with galley



	WEIGHT	MOMENT	
BASIC EMPTY WEIGHT	11,460	.4	
EMPTY WEIGHT CHANGES			
EMPTY WEIGHT	11,460		.4
PILOT	170	29.2	
COPILOT	170	29.5	
GALLEY	70	8.0	
BAR	20	2.4	
JUMP SEAT	~~165~~	~~1.5~~	
PASSENGER 1	165	11.6	
PASSENGER 2	~~165~~	~~11.8~~	
PASSENGER 3	165	5.4	
PASSENGER 4	165	5.4	
PASSENGER 5	~~165~~		~~4.1~~
PASSENGER 6	~~165~~		~~0.3~~
PASSENGER 7	~~165~~		~~2.2~~
BAGGAGE COMP A	275		10.6
B	30	3.0	
C			
D	30		3.3
E			
CARGO ON FLOOR			
MISCELLANEOUS			
TOTAL			
ZERO FUEL WEIGHT			

CHECK ZFW LIMITS
REFER TO BALANCE DIAGRAM

FUEL			
TAKE-OFF WEIGHT			
CG POSITION			%

CHECK LIMITS

1 REVISED WEIGHT IS 90 LBS., AND REVISED MOMENT IS -9.2

Zero Fuel Weight Computations

Complete the zero fuel weight computations. Record the results on the loading schedule (**Figure 4-7**).

1. Total the columns in the loading schedule, then enter the results in the TOTAL row.

   For this example, the weight column total is 12,720 lbs. The negative and positive moment columns total 86.6 and 14.3, respectively.

2. Subtract the total negative moment from the total positive moment. If the value is negative, enter the number without a sign in the left box below the TOTAL row; if the number is positive, enter the number without a sign in the right box below the TOTAL row.

   When -86.6 is subtracted from 14.3, the result is -72.3; enter this negative value in the left box below the TOTAL row.

3. Enter the weight from the TOTAL row into the ZERO FUEL WEIGHT row, then enter the combined moment result in the ZERO FUEL WEIGHT row in the corresponding column.

   Repeat the zero fuel weight (12,720 lbs) in the WEIGHT column of the ZERO FUEL WEIGHT row. Enter the combined moment of -72.3 in the left column of the ZERO FUEL WEIGHT row.

Weight and Balance

(Version No. 1, U.S. Units)

units	WEIGHT lb
	MOMENT 1,000 in lb

GALLEY				
Weight	10	20	30	40
Moment	+1.1	+2.3	+3.4	+4.6
50	60	70	MAXI. 90	
+5.7	+6.8	+8	+10.2	

BAR			
Weight	5	10	MAXI: 22
Moment	+0.6	+1.2	+2.7

COMP. B COAT-RACK			
Weight	30	60	MAXI. 90 **
Moment	+3	+6.6	+9.2
120	150	180	MAXI. 220
+12.2	+15.3	+18.4	+22.4

COMP. C				
Weight	50	100	150	200
Moment	+0.5	+0.9	+1.4	+1.9
250	300	400	MAXI. 500	
+2.4	+2.8	+3.8	+4.7	

COMP. A				
Weight	50	100	150	200
Moment	+1.9	+3.9	+5.8	+7.7
250	300	400	MAXI. 500	
+9.6	+11.6	+15.4	+19.3	

OPTION 25-50-03 M 04

COMP. D				
Weight	30	60	90	120
Moment	+3.3	+6.6	+10	+13.3
MAX. 150*		170	MAXI. 200	
+16.5		+18.8	+22.1	

SB F10-0015

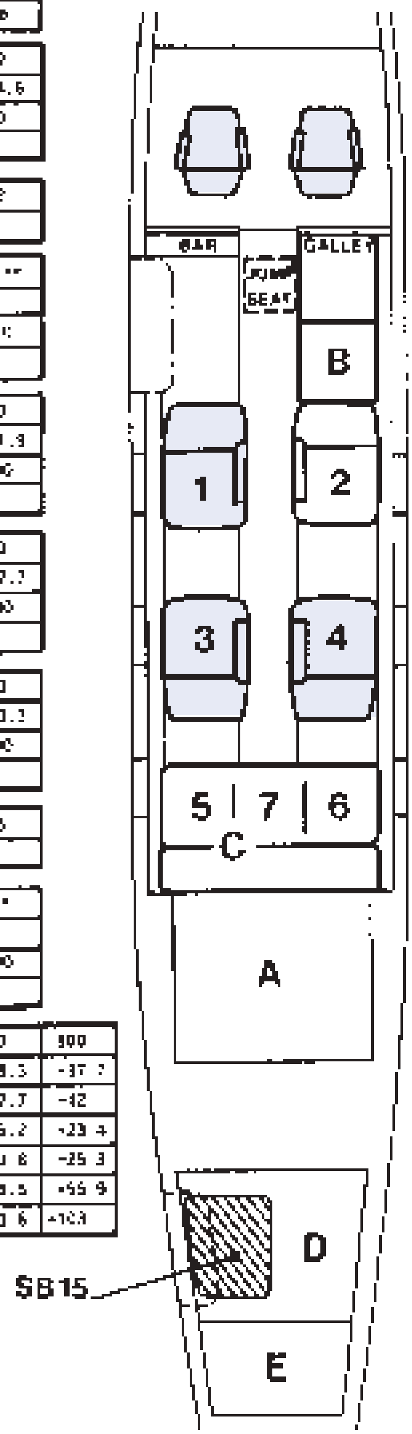
Weight	10	20	MAXI. 35
Moment	+1.1	+2.2	+8

OPTION 25-50-03 M 04

COMP. E			
Weight	10	30	MAXI. 45*
Moment	+1.4	+4.2	+6.3
60	70	80	MAXI. 100
+8.5	+9.9	+11.3	+14.1

FUEL AT 0° A/C ATTITUDE					
Weight	0	200	400	600	800
0	0	+9.4	+18.3	+28.3	+37.7
1,000	+47.2	+56.6	+52.2	+47.7	+42
2,000	+36.2	+31.9	+28	+25.2	+23.4
3,000	+22.6	+22.4	+22.8	+21.8	+25.3
4,000	+27.8	+31.3	+37	+48.5	+55.9
5,000	+65.3	+74.7	+84.2	+93.6	+103
5,914	+108.3				

* A/C with thrust reversers
** A/C with galley



	WEIGHT	MOMENT	
BASIC EMPTY WEIGHT	11,460		.4
EMPTY WEIGHT CHANGES			

EMPTY WEIGHT	11,460		.4
PILOT	170	21.[illegible]	
CO-PILOT	170	25.[illegible]	
GALLEY	70	8.0	
BAR	20	2.4	
JUMP SEAT	~~[illegible]~~	~~[illegible]~~	
PASSENGER 1	165	11.6	
PASSENGER 2	~~165~~	~~7.6~~	
PASSENGER 3	165	5.4	
PASSENGER 4	165	5.4	
PASSENGER 5	~~165~~		~~[illegible]~~
PASSENGER 6	~~165~~		~~[illegible]~~
PASSENGER 7	~~165~~		~~[illegible]~~

BAGGAGE COMP				
	A	275		10.6
	B	30	3.0	
	C			
	D	30		3.3
	E			

CARGO ON FLOOR			
MISCELLANEOUS			
TOTAL	12,720	86.6	14.3
		-72.3	

ZERO FUEL WEIGHT	12,720	-72.3	

CHECK ZFW LIMITS
REFER TO BALANCE DIAGRAM

FUEL			
TAKE-OFF WEIGHT			
CG POSITION			%

CHECK LIMITS

4-7

Zero Fuel Weight Limits

The Zero Fuel Weight and Balance diagram depicts an envelope for zero fuel weight (**Figure 4-8**). The zero fuel weight and moment must fall within the envelope to be within zero fuel weight limits.

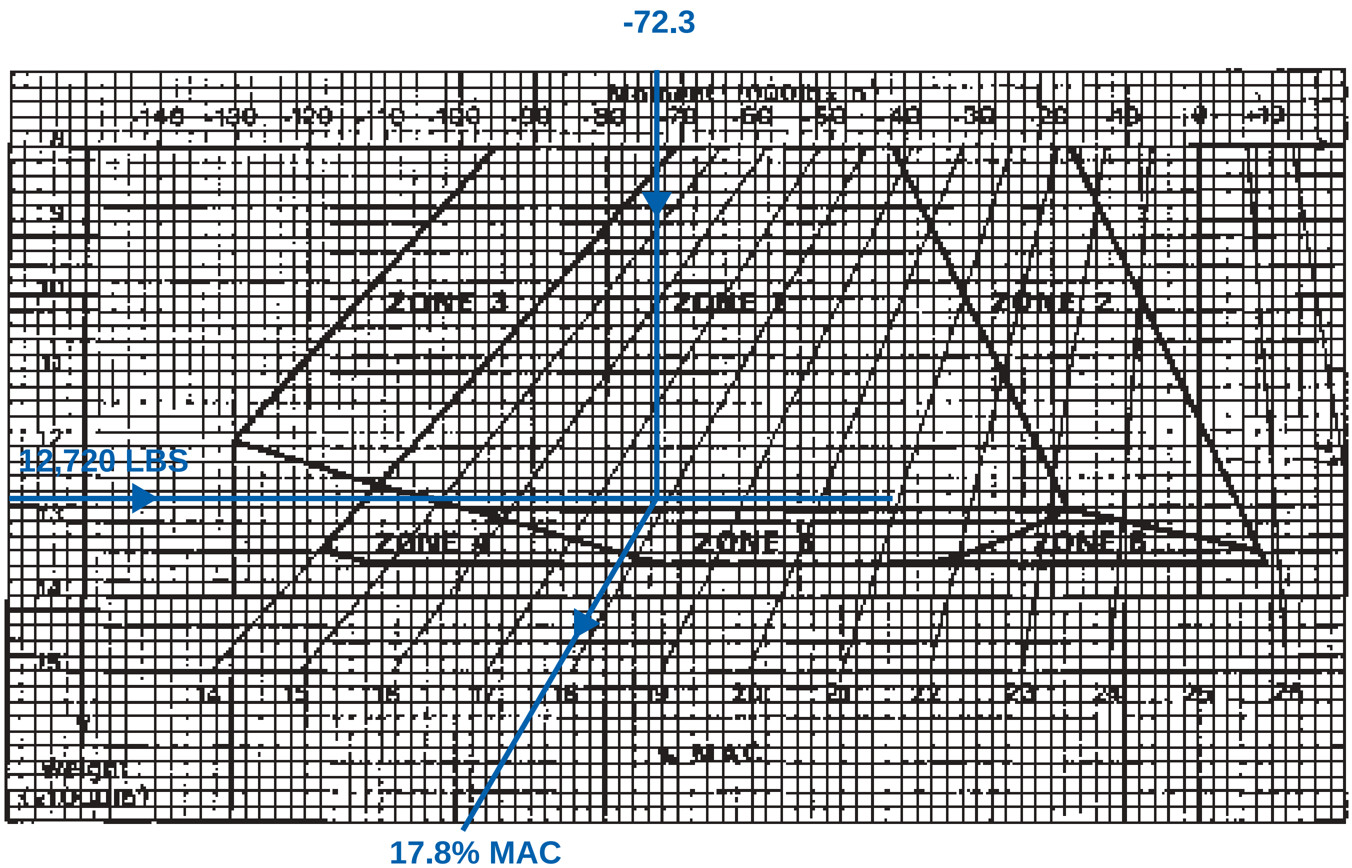
The envelope is subdivided into zones; the zone into which the zero fuel weight and moment falls determines possible fuel loading limitations. Zone limitations are defined below the diagram.

Zone 1 is the most desirable because there are no fuel loading limitations. If the zero fuel weight and moment is in Zone 1 and normal fuel management procedures occur, the aircraft remains within limits for aircraft attitudes between 0° and 11° nose-up pitch. If the zero fuel weight and moment fall within one of the other zones, there are limits on fuel loading.

1. Enter the chart from the left with the aircraft's weight (*12,720 lbs*). Move right to the general area of the applicable moment.
2. Enter the chart from the top at the aircraft moment (-*72.3*). Move down to intersect the aircraft weight.
3. Identify the limitations associated with the zone in which the intersection occurs.

   In this case, the intersection of the zero fuel weight is within Zone 1. There are no limitations.

Zero Fuel Weight Envelope



ZONE 1	No limitation of filling of feeder tanks if wing tanks are full.
ZONE 2	Filling of the feeder tanks is limited to regulation level 2 x 600 lb (2 x 272 kg), if the wing tanks are not full, or to 2 x 1,070 lb (2 x 485 kg), if the wing tanks are full.
ZONE 3	Emptying of the feeder tanks is limited to no less than 2 x 300 lb/ 2 x 136 kg (illumination of LO FUEL light).
ZONE 4	Filling of wing tanks is limited to 2 x 800 lb (2 x 362 kg).
ZONE 5	Limitation of filling of feeder tanks, and/or wing tanks.
ZONE 6	Filling of wing tanks to full and limitation of filling of feeder tanks.

4-8

Takeoff Weight and Moment

When the zero fuel weight and moment and the fuel weight and moment are combined, the result is the takeoff weight and moment. Use the FUEL table at the lower left of the weight and balance form (**Figure 4-9**) to obtain the moment for the fuel load.

The table is organized with moments for each 1,000 lbs and 200 lbs of fuel. Fuel moments are always positive. Use the fuel moment to the nearest 200 lb weight. The fuel moment chart provides moments for weights to the nearest 200 lbs from the left side of the weight and balance form.

1. Record the weight of the fuel loaded in the WEIGHT column of the FUEL row. Enter the fuel moment from the FUEL moment table in the positive column.

   Normally, the fuel load is calculated at this time, then that figure is used to complete the takeoff weight and CG exercise. For continuity, the fuel load for this example is 5,380 lbs. Using the FUEL moment table, determine the moment for 5,400 lbs of fuel (i.e., 84.2). Enter the values 5,380 and 84.2 in the WEIGHT and positive MOMENT columns of the FUEL row, respectively.

2. Add the zero fuel weight and the fuel weight, and record the result in the WEIGHT column of the TAKEOFF WEIGHT row.

   In this example, the total weight is 12,720 lbs plus 5,380 lbs, or 18,100 lbs. Enter this figure in the WEIGHT column of the TAKEOFF WEIGHT row.

3. Add the zero fuel weight moment and the fuel moment, then record the result (11.9) in the positive MOMENTS column in the TAKEOFF WEIGHT row.

   The zero fuel weight moment may be negative or positive, but the fuel moment is positive. Be sure to observe the positives and negatives when combining the zero fuel weight and fuel moments so that the final moment is entered into the correct column.

   The combined zero fuel weight moment, -72.3, and the fuel moment, 84.2, is 11.9; enter this value in the positive moment column of the TAKEOFF WEIGHT row.

Weight and Balance

(Version No. 1, U.S. Units)

units	WEIGHT lb / MOMENT 1,000 in lb

GALLEY

Weight	10	20	30	40
Moment	+1.1	+2.3	+3.4	+4.6
50	60	70	MAXI : 90	
+5.7	+6.8	+8	+10.2	

BAR

Weight	5	10	MAXI : 22
Moment	+0.6	+1.2	+2.7

COMP. B COAT-RACK

Weight	30	60	MAXI : 90 **
Moment	+3	+6.6	+9.2
120	150	180	MAXI : 220
+12.2	+15.3	+18.4	+22.4

COMP. C

Weight	50	100	150	200
Moment	+0.5	+0.9	+1.4	+1.9
250	300	400	MAXI : 500	
+2.4	+2.8	+3.4	+4.7	

COMP. A

Weight	50	100	150	200
Moment	+1.9	+3.9	+5.8	+7.7
250	300	400	MAXI : 500	
+9.6	+11.6	+15.4	+19.3	

OPTION 25-50-03 M 04 — COMP. D

Weight	30	60	90	120
Moment	+3.3	+6.6	+10	+13.2
MAX 150*		170	MAXI : 200	
+16.5		+18.4	+22.1	

SB F10-0015

Weight	10	20	MAX : 35
Moment	+1.1	+2.2	+8

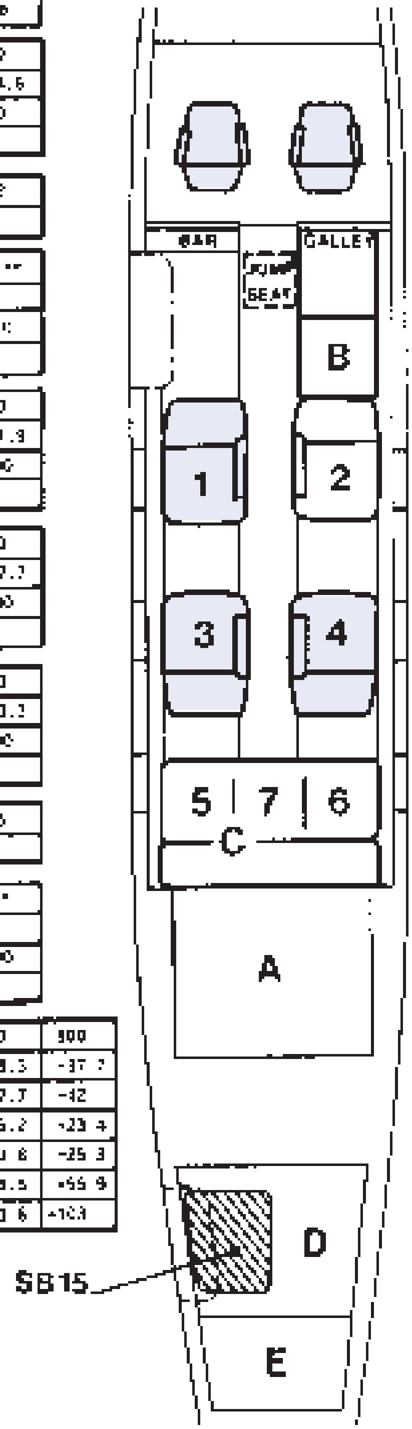
OPTION 25-50-03 M 04 — COMP. E

Weight	10	30	MAXI : 45*
Moment	+1.4	+4.2	+6.3
60	70	80	MAXI 100
+8.5	+9.9	+11.3	+14.1

FUEL AT 0° A/C ATTITUDE

Weight	0	200	400	600	800
0	0	+9.4	+18.3	+28.3	+37.7
1,000	+47.2	+56.6	+52.2	+47.7	+42
2,000	+36.2	+31.9	+28	+25.2	+23.4
3,000	+22.6	+22.4	+22.8	+23.8	+25.3
4,000	+27.8	+31.2	+37	+46.5	+55.9
5,000	+65.3	+74.7	+84.2	+93.6	+103
5,914	+108.4				

* A/C with thrust reversers
** A/C with galley



	WEIGHT	MOMENT -	MOMENT +
BASIC EMPTY WEIGHT	11,460		.4
EMPTY WEIGHT CHANGES			

EMPTY WEIGHT	11,460		.4
PILOT	170	21.1	
CO-PILOT	170	25.1	
GALLEY	70	8.0	
BAR	20	2.4	
JUMP SEAT	~~155~~	~~14.5~~	
PASSENGER 1	165	11.6	
PASSENGER 2	~~165~~	~~11.6~~	
PASSENGER 3	165	5.4	
PASSENGER 4	165	5.4	
PASSENGER 5	~~165~~		~~4.1~~
PASSENGER 6	~~165~~		~~4.1~~
PASSENGER 7	~~165~~		~~3.5~~

BAGGAGE COMP				
	A	275		10.6
	B	30	3.0	
	C			
	D	30		3.3
	E			

CARGO ON FLOOR			
MISCELLANEOUS			
TOTAL	12,720	86.6	14.3
		-72.3	

ZERO FUEL WEIGHT	12,720	-72.3	

CHECK ZFW LIMITS
REFER TO BALANCE DIAGRAM

FUEL	5,380		84.2
TAKE-OFF WEIGHT	18,100		11.9
CG POSITION			%

CHECK LIMITS

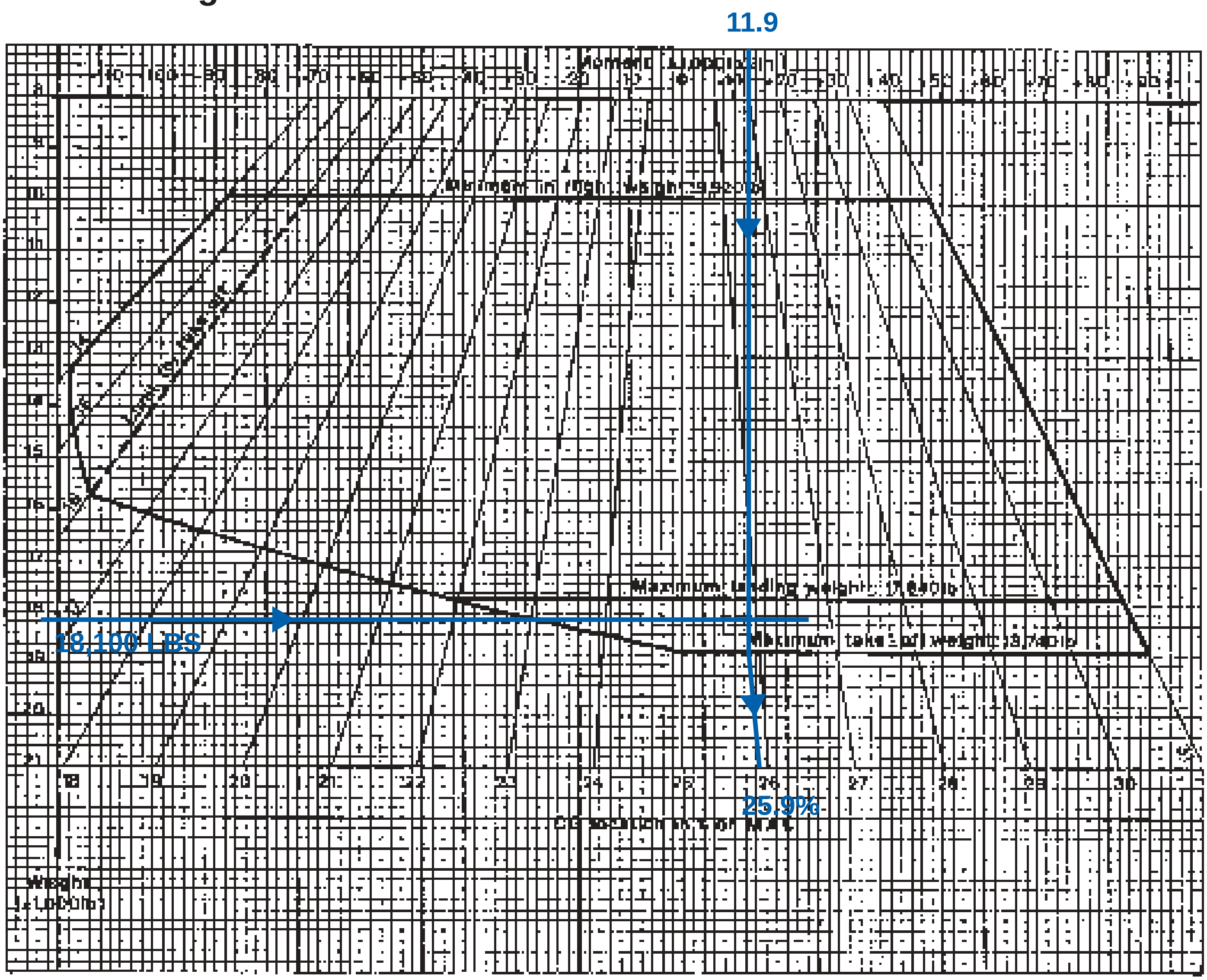
4-9

Center of Gravity

The computed takeoff weight and moment are plotted on the Balance Diagram (**Figure 4-10**) to determine whether the intersection is in the maximum takeoff weight envelope.

1. Enter the chart from the left with the aircraft's weight (*18,100 lbs*). Move right to the general area of the applicable moment.
2. Enter the chart from the top at the aircraft moment (*11.9*). Move down to intersect the aircraft weight.
3. From the intersection, parallel the guidelines down to the bottom of the chart. Read the % MAC CG for the plotted takeoff weight and moment (*25.9%*).
4. The CG derived from the Weight and Balance Diagram (*25.9*) is entered on the loading schedule on the CG POSITION row next to the "%" sign.

Balance Diagram



4-10

Trip Planning Data

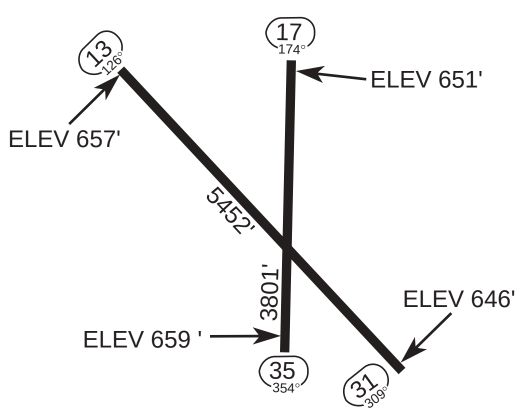
The Flight Planning section of the Performance Manual contains charts used to determine the initial cruising altitude, the highest cruise altitude as limited by maximum continuous thrust, the various cruise modes, and the reserve fuel requirement.

To use the Flight Planning section, the following information is required:

- distance from destination to alternate
- average head- or tailwind from departure to destination
- average head- or tailwind from destination to alternate
- expected or desired reserve time for holding or cruise
- Zero Fuel Weight (ZFW)
- selected cruise mode
- selected final cruise altitude
- selected climb profile
- distance from departure point to destination
- average temperature enroute.

This example plans a trip from Redbird Airport, Dallas, Texas, (**Figure 4-11**) *to Teterboro, New Jersey* (**Figure 4-12**, *following page*)*. The distance is 1,190 NM. The alternate, Harrisburg, Pennsylvania* (**Figure 4-13**, *following page*)*, is 143 NM from the destination.*

Redbird Airport, Dallas



4-11

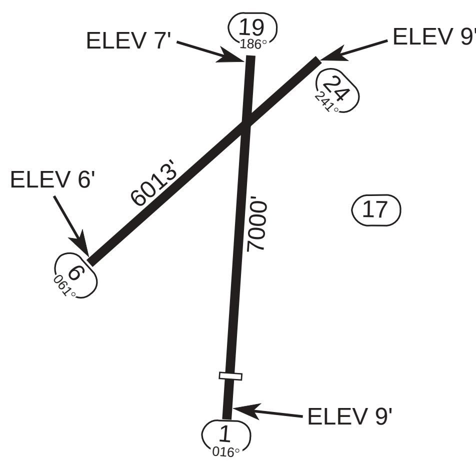
The weight information is the same derived during the preceding weight and balance discussion.

Assume the wind from departure to destination averages a 40 kt headwind. From the destination to the alternate, the wind averages a 30 kt headwind. The temperature enroute is ISA.

Using the 260 kt (0.72M) climb profile, calculate the initial cruise altitude by estimating a flight plan and takeoff weight.

Apply standard U.S. reserve fuel/time regulations, and calculate exact trip time and fuel by using the appropriate charts from the AFM and OIM.

Teterboro, New Jersey



4-12

Harrisburg, Pennsylvania

4-13

Estimated Trip Plan

Before accomplishing actual flight planning, calculate a trip estimate so that the maximum initial cruise altitude can be computed.

1. Carry over the zero fuel weight from the weight and balance chart. Then calculate the estimated time enroute by assuming the distance covered in the first hour of flight to be 370 NM, and subsequent distances at 460 NM per hour, plus estimated headwind or tailwind.
2. Calculate the hours or parts of hours needed to complete the trip.

   For example:

Planned Trip		*1,190 NM*
Hour 1	*370 NM - 40 kt wind =*	*330 NM*
Hour 2	*460 NM - 40 kt wind =*	*420 NM*
Hour 3	*460 NM - 40 kt wind =*	*420 NM*
Hour 4 (3 min or 0.05 hr)	*460 NM - 40 kt wind =*	*20 NM*

   The result is three hours and 3 minutes enroute.
3. Calculate the fuel needed by allowing 1,800 lbs for the first hour, 1,400 lbs for the second hour, 1,300 lbs for the third hour, and 1,200 lbs for every hour thereafter.

Hour 1	*1,800 lbs*
Hour 2	*1,400*
Hour 3	*1,300*
Hour 4 (1/20 hr X 1,200 lbs/hr)	*60*
Total trip fuel	*4,560 lbs*
4. Calculate fuel required for alternate and reserves.

   The alternate airport is 143 NM from the destination and there is an average 30 kt headwind enroute. At an approximate 300 kt average speed, the trip should take approximately 25 minutes. A first-hour fuel burn of 1,800 lbs per hour should use about 800 lbs of fuel. Add to that a holding time of 45 minutes at approximately 1,050 lbs per hour, or 790 lbs, to calculate an estimated 1,590 lbs required for alternate and reserves.

Zero Fuel Weight	*12,720 lbs*
Estimated Trip Fuel	*4,560*
Estimated Alternate and Reserve Fuel	*1,590*
Estimated T/O Gross Weight	*18,870 lbs*

5. Add the zero fuel weight, the estimated trip, alternate, and reserve fuel to derive the estimated takeoff weight (*18,870 lbs*).

   Because the estimated weight is more than the maximum takeoff weight allowed, assume a gross weight of 18,740 lbs, and continue the calculations.

Initial Cruise Altitude

To determine initial cruise altitude, use the Two Engine Flight Planning Maximum Initial Cruise Altitude chart for the type of climb performed. The chart is divided into groups by the climb mode considered and subdivided by climb rate values. Charts exist for each of the following conditions.

Climb Mode 260 kt/0.72M	**Climb Mode 300 kt/0.25M**
Rate of Climb 100 fpm	Rate of Climb 100 fpm
Rate of Climb 200 fpm	Rate of Climb 200 fpm
Rate of Climb 300 fpm	Rate of Climb 300 fpm

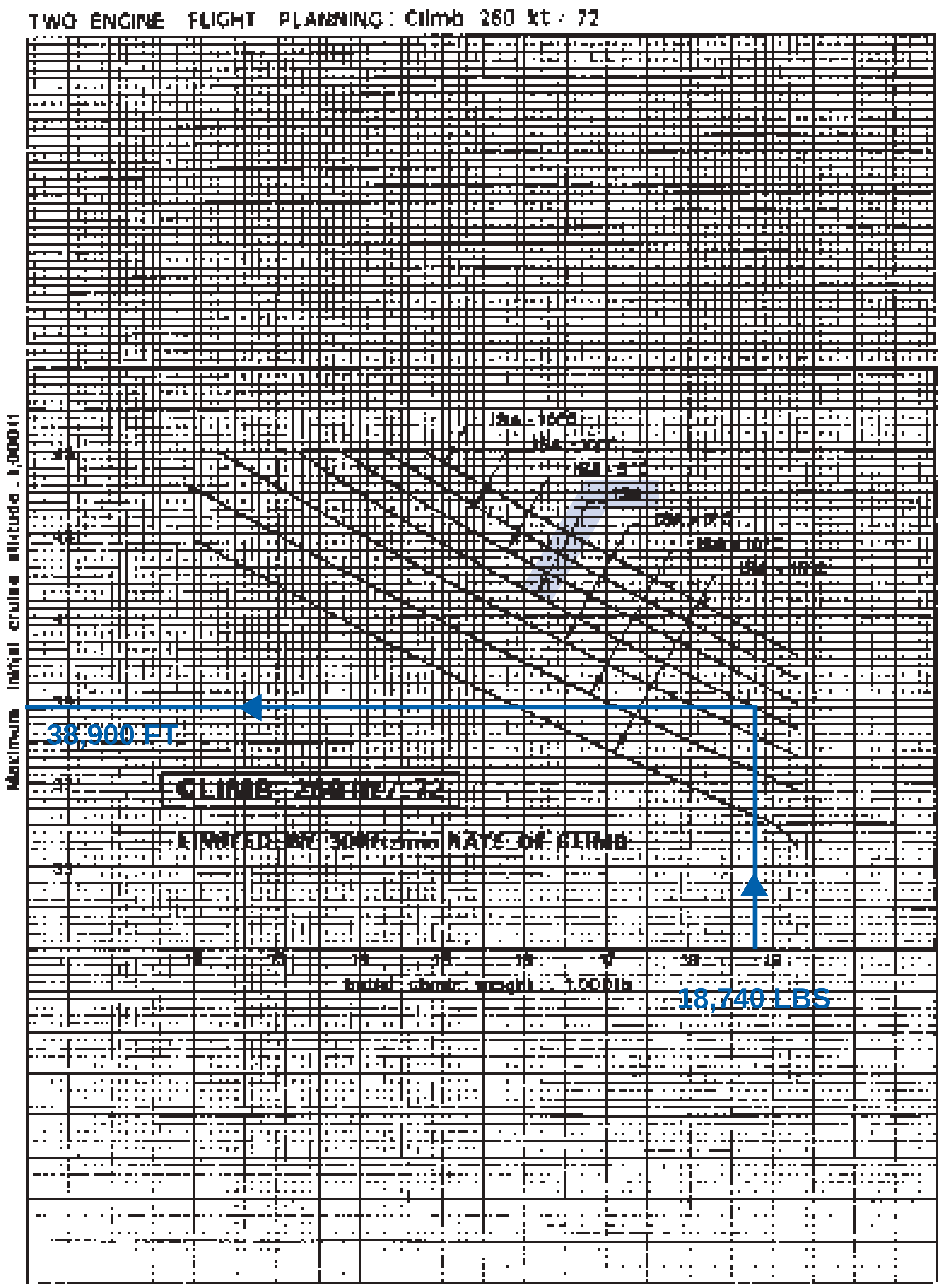
1. Use the Initial Cruise Altitude chart (**Figure 4-14**) to calculate the highest initial cruise altitude at the calculated gross takeoff weight at a climb speed (*260 kts/0.72M*).

   In the example, a weather service advises the temperature at high altitudes is ISA.

2. Enter the chart from the bottom with the takeoff weight (*estimated 18,740 lbs*).
3. Move up to intersect the cruise temperature (*ISA*).
4. Move left to the edge of the chart. Read the maximum initial cruise altitude (*38,900)*. Select the initial cruise altitude at or less than the maximum initial cruise altitude, as appropriate for direction of flight *(37,000 ft).*

Two Engine Flight Planning

Max Initial Cruise Altitude/Climb 260 kt/0.72M/ Limited by 300 ft/min Rate of Climb



4-14

> **NOTE**: For more convenient use, rotate the Reserve Fuel chart 90° clockwise, as shown on the opposite page.

Alternate and Reserve Fuel Requirement

(Landing Weight)

To determine the required fuel for the trip, calculate the aircraft weight at the destination by adding the reserve fuel to the zero fuel weight.

Use the Two Engine Operating Reserve Fuel chart (**Figure 4-15**) (referred to hereafter as Reserve Fuel chart) to determine the reserve fuel weight and landing weight at the destination.

U.S. FARs require the reserve fuel to the alternate be based on fuel consumption at normal cruising speed for both VFR and IFR operations; long range cruise is considered one of the four normal cruise modes. The FARs do not specify any altitude for the reserve cruise time.

Compute fuel to the alternate based on a missed approach at the destination, a climb to 25,000 ft, and long range cruise.

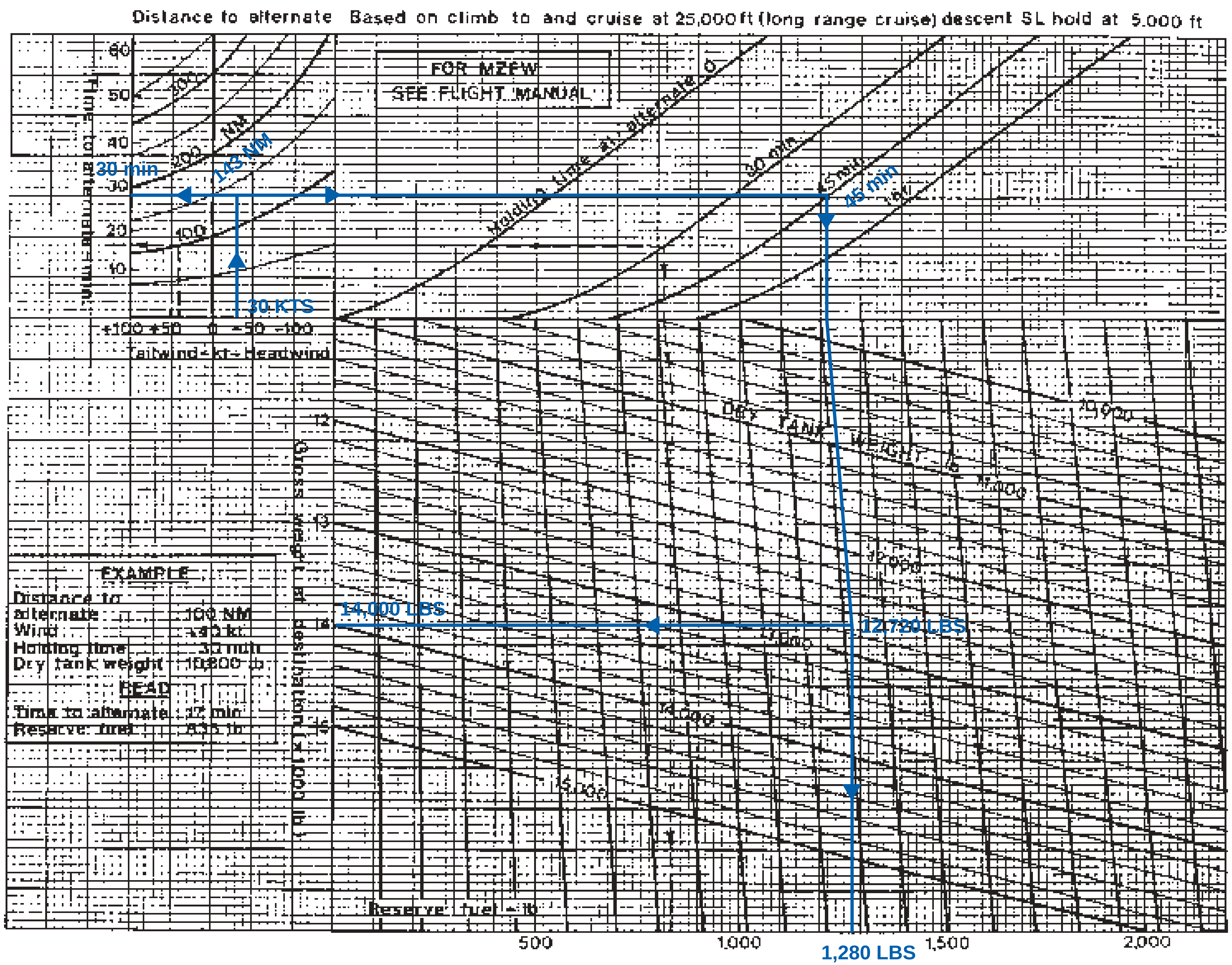
Time adjustments for reserve fuel are based on long range cruise at 25,000 ft to the alternate, holding at 5,000 ft for 45 minutes, and descent to sea level. The holding fuel burn rate at 5,000 ft is the same as the long range cruise fuel burn rate at approximately 15,000 ft.

1. Enter the Reserve Fuel chart at the Tailwind-kt-Headwind scale at the average wind value from destination to alternate (*30 kts headwind*).
2. Move up to the distance from the destination to the alternate (*143 NM*).
3. Move left crossing the Time to Alternate-min scale. Read the time to the alternate (*30 min*).
4. Move right to the appropriate Holding Time at Alternate line (*45 min*).
5. Move down from the reference line, following the guidelines, to intersect the planned zero fuel weight (*12,720 lbs*).
6. Move down to the bottom of the chart to derive the minimum reserve fuel (*1,280 lbs*).
7. Return to the zero fuel weight point (*12,720 lbs*). Move left to the edge of the chart and read the landing weight at destination (*14,000*).

   With the landing weight at destination computed, either re-address landing performance or continue flight planning.

Two Engine Flight Planning

Reserve Fuel Chart



4-15

Two Engine Flight Planning

Reserve Fuel Chart

Trip Fuel Requirement and Takeoff Weight

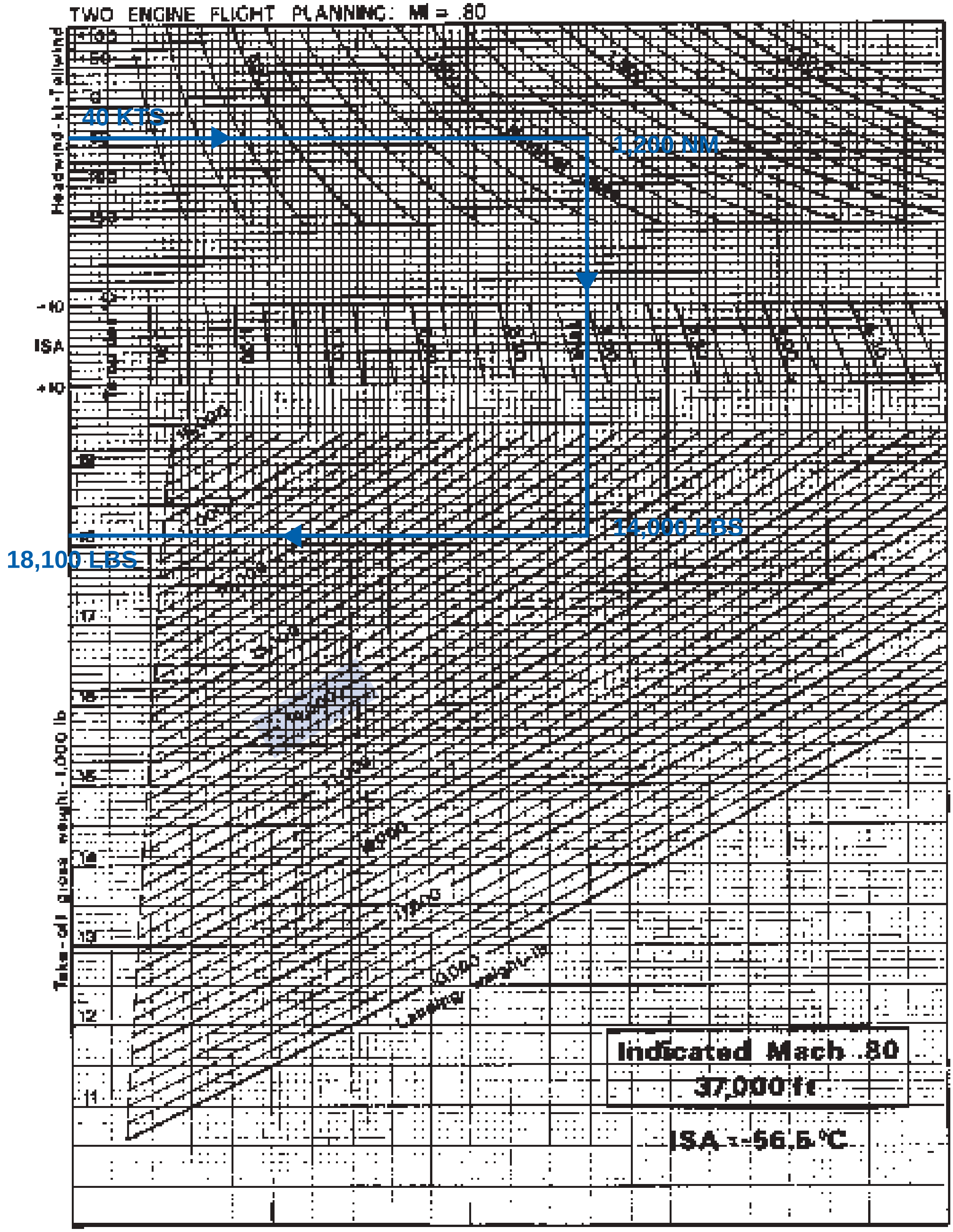
With cruise mode chosen and the final cruise altitude determined, select the Two Engine Flight Planning: Mi=.80 chart (**Figure 4-16**), hereafter referred to as the Mi chart.

1. Enter the chart from the upper left with the value of the average headwind or tailwind (*40 kts headwind*).
2. Move right to intersect the trip distance (*1,200 NM*).
3. Move down and read the trip time where the temperature (ISA) line crosses the trip line (*2:59*).
4. Continue down to intersect the landing weight at the destination (*14,000 lbs*).
5. Move left to the edge of the chart and read the takeoff weight (*18,100 lbs*).
6. Find trip fuel by subtracting the landing weight from the takeoff weight (*4,100 lbs*).
7. Add trip fuel to the alternate and reserve fuel to determine total fuel required. This total fuel does not include taxi fuel.
8. Record total fuel on the weight and balance form.

Final Fuel Calculation

The total fuel on board at takeoff is the takeoff weight (*18,100 lbs*) minus the zero fuel weight (*12,720 lbs*). Use this formula in the example to calculate fuel weight (*5,380 lbs*).

Mi Chart


TWO ENGINE FLIGHT PLANNING: MI = .80
Headwind - kt - Tailwind
40 KTS
1,200 NM
14,000 LBS
18,100 LBS
Take-off gross weight - 1,000 lb
Landing weight - lb
Indicated Mach .80
37,000 ft
ISA = -56.5 °C

4-16

Takeoff Performance

With the trip planned and the desired takeoff weight determined, compute takeoff and takeoff flight path performance. Review FAR 91.605(b) at this time.

FAR 91.605(b): No one may operate a turbine-engine-powered transport category airplane certificated after September 30, 1958, contrary to the AFM, or take off that airplane unless:

- *the takeoff weight does not exceed the takeoff weight specified in the AFM for the elevation of the airport and for the ambient temperature existing at the time of takeoff*
- *normal consumption of fuel and oil in flight to the airport of intended landing and to the alternate airports leaves an arrival weight not in excess of the landing weight specified in the AFM for the elevation of each of the airports involved and for the ambient temperatures expected at the time of landing*
- *the takeoff weight does not exceed the weight shown in the AFM to correspond with the minimum distances required for takeoff, considering the elevation of the airport, the runway to be used, the effective runway gradient, and the ambient wind and temperature component existing at the time of takeoff.*

The Falcon 10/100 is certified under FAR 25, which prescribes takeoff flight path limits and directs the manufacturer to present takeoff limits by weight or distance and takeoff climb performance limits by weight.

NOTE: See Quick Reference for weight limitations.

NOTE: SB F10-0052; Maximum Takeoff Weight of 18,740 Lbs (8,500 Kg) and Maximum Zero Fuel Weight of 13,560 Lbs (6,150 Kg).

SB F10-0238; Maximum Takeoff Weight of 19,300 Lbs (8,755 Kg) and Maximum Zero Fuel Weight of 14,400 Lbs (6,540 Kg).

Runway and Climb Weight Limits

The aircraft takeoff weight is limited by certified maximum gross takeoff weight, runway length, or climb requirements. Of these, only the maximum gross takeoff weight is fixed: 18,300 lbs (basic), 18,740 lbs on aircraft with **SB F10-0052**, or 19,300 lbs with **SB F10-0238**. Use charts in the AFM to determine if aircraft weight is limited by runway or climb requirements.

Acquire the following information to determine the maximum takeoff weight limited by runway and climb requirements and to determine runway requirements:

- departure airport elevation in pressure altitude
- length of runway in use
- runway slope
- field temperature
- runway wind
- desired takeoff weight if other than maximum
- any SID or obstacle climb requirement.

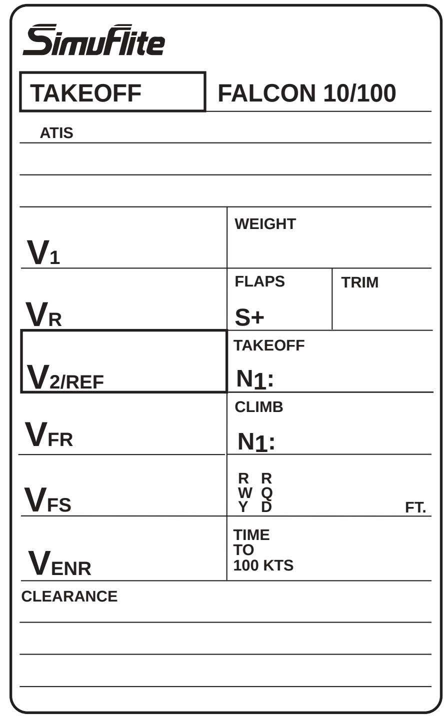
Dallas RBD is 660 ft MSL. Assume the conditions are 90°F, wind 210° at 5 kts, and altimeter 29.77 in/Hg. The pressure altitude for RBD is calculated as 510 ft. Runway 13, which is 5,452 ft long, is in use. The slope is not indicated; assume it is less than 2%. There is an 11 ft difference in elevation between runway ends, but that does not take runway rise or dip into consideration.

TOLD Card

A Takeoff and Landing Data (TOLD) card displays takeoff and landing data as a convenient reference aid in the cockpit.

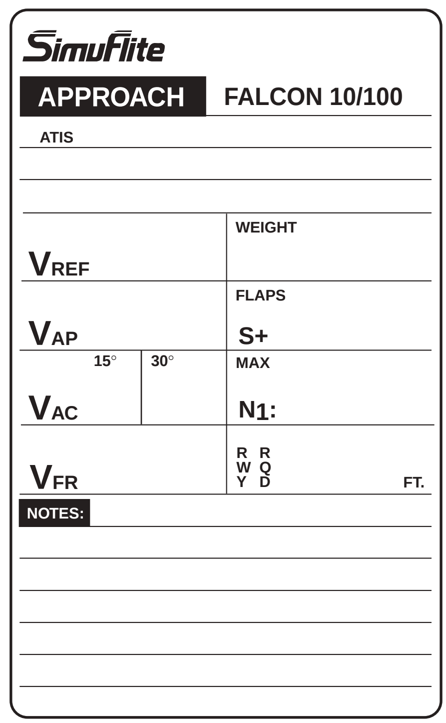
The takeoff side of the card provides spaces for the following information:

- ATIS
- V_1 – Takeoff Decision Speed
- V_R – Rotation Speed
- V_2/V_{REF} – Safety Speed/Emergency Return Landing Speed
- V_{FR} – Slat + Flap Retraction Speed
- V_{FS} – Final Segment Climb Speed
- V_{ENR} – Enroute Climb Speed
- Weight – Takeoff Weight
- Flaps – Configuration Flap Setting (15° or 0°)
- Pitch – Rotation Pitch Attitude
- Takeoff N_1
- Climb N_1
- Runway Required – Computed Takeoff Field Length
- Time to 100 kts.
- Clearance.



The approach side of the TOLD card provides spaces for the following information:

- ATIS
- V_{REF} – Landing Configuration Speed – 50 ft point.
- V_{AP} – Approach Target Speed
- V_{AC} – Single Engine Minimum Approach Speed for Flaps 15° or 30°
- V_{FR} – Slat + Flap Retraction Speed (Go Around)
- Weight – Computed Landing Weight
- S + Flaps – Required Landing Configuration
- Max N_1 – Maximum Go Around N_1
- RWY RQD – Computed Landing Distance or Landing Field Length
- Notes.



> **NOTE**: In addition to the information on the right, the aircraft is always limited as specified in the AFM, Limitations section (Structural).

Takeoff Gross Weight

Enter the takeoff weight determined by weight and balance in the WT block of the Takeoff side of the TOLD card *(18,100 lbs).*

Takeoff gross weight may be limited by any of the following:

- brake energy
- tire speed
- field length
- climb performance
- obstacle clearance
- approach climb gradients
- landing distance
- structural limits (maximum takeoff and maximum landing weight).

Evaluate the gross weight determined by weight and balance (*18,100 lbs*) against the manufacturer's guidelines for each of the limitations listed above.

Use performance charts in the AFM to determine the maximum takeoff gross weight permitted by FAR 25 and the associated speeds and flight paths. The aircraft may be limited in takeoff gross weight by field length, climb gradient, tire speed, obstacle clearance, or brake energy.

Takeoff Weight Limited by Climb Requirements

The takeoff weight may be limited by climb requirements, especially at high runway elevations or hot temperatures. The Maximum Takeoff Weight Limited by Climb Requirements chart (**Figure 4-17**) encompasses all the minimum climb requirements of certification for the takeoff flight path but may not include the first segment. If a takeoff weight is not limited by the chart, the takeoff flight path with an engine failure at that weight meets all FAR 25 minimum climb gradients.

The desired weight is 18,100 lbs. At Dallas RBD the conditions are:

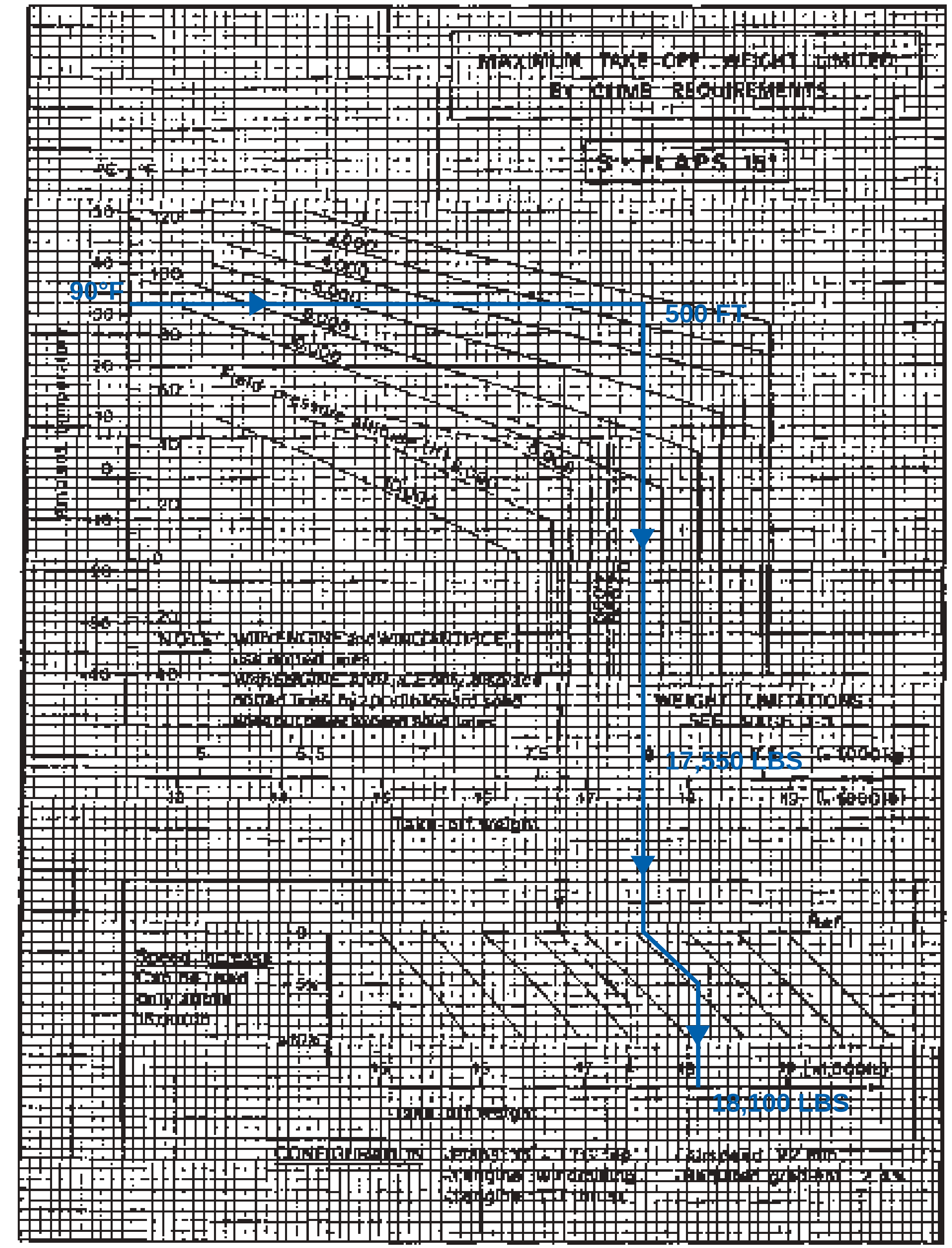
- *pressure altitude of 500 ft*
- *temperature of 90°F*
- *runway slope negligible*
- *0 headwind/tailwind components*.

1. Enter the chart from the left with the ambient temperature (*90°F*). Move right to intersect the airport pressure altitude (*500 ft*).
2. Move down to intersect the bottom of the chart and read the maximum weight allowable at takeoff to meet all minimum climb requirements. *(The result, 17,550 lbs, is not adequate for the planned trip.)*
3. If a slats + flaps 15° configuration does not meet climb requirements, a slats-only configuration may, although it is unlikely because the runway available is less than 6,000 ft. An alternative is to use up to a 10% speed increase, which uses more runway than the first configuration, but less runway than that needed for slats-only; speed can be adjusted to meet the need.
4. Move down to the speed increase reference line, then parallel the slant lines to the appropriate speed increase (*5%*). Move down to read the maximum weight allowed (*18,100 lbs*).

Ensure the runway required does not exceed the runway available. Address several charts if necessary to refine the calculations to fit the requirement. Work the chart in the same manner for all configurations.

NOTE: Use the Balanced Field Length chart to determine if the required speed increase is limited by runway length.

Maximum Takeoff Weight Limited by Climb Requirements



4-17

Maximum Takeoff Weight Limited by Climb Requirements

Balanced Field Length

The procedure specified by the manufacturer in the AFM utilizes the Balanced Field Length chart (**Figure 4-18**) to determine runway requirements and weight limits.

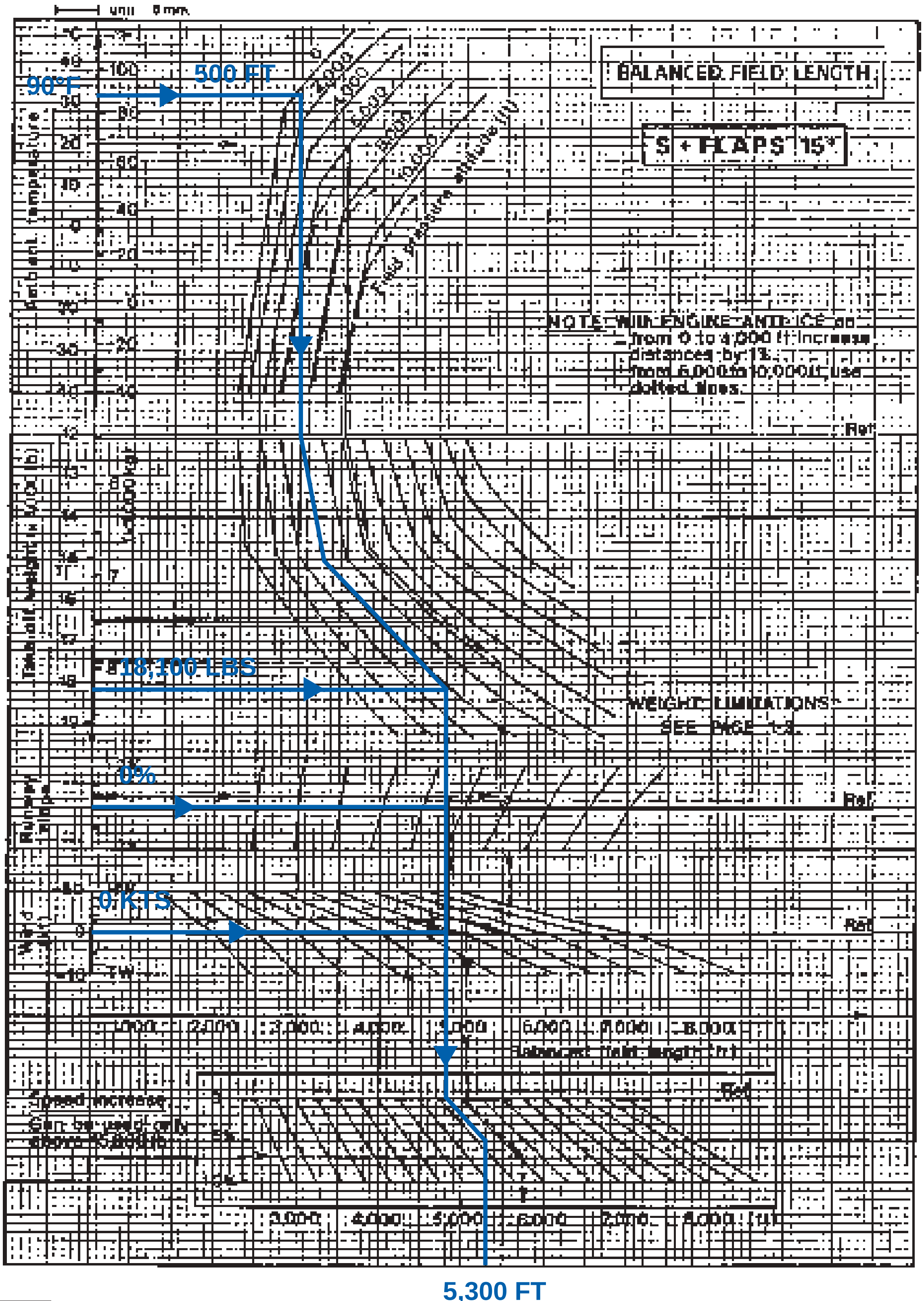
Assume the desired takeoff configuration is slats + flaps 15° with a 5% speed increase.

1. Enter the balanced field length chart from the upper left with the field temperature (*90°F*). Move right to intersect the departure field pressure altitude (*500 ft*).
2. Move down to the reference line and parallel the weight guidelines to intersect a line drawn from the takeoff weight at the left *(18,100 lbs)*.
3. To determine values for slope and wind:
   a. Move straight down to the slope reference line. Enter from the left at the slope (*0%*) and move right across the slope guidelines.
   b. Move up or down from the reference line and parallel the slope guidelines to intersect the slope value line (*0*), then down the wind reference line.

      Because the values are zero, there is no correction for slope.
   c. Enter from the left at the wind (*0*) and move right across the wind guidelines.
   d. Continue from the reference line and parallel the wind guidelines to intersect the wind value line and then down to read the value (*0*).

      Because the wind value is zero, there is no correction for wind.
4. Parallel the speed increase guidelines to the appropriate point (*5%*) and move straight down to read the balanced field length required (*5,300 ft*).

Balanced Field Length



4-18

NOTE: V_1 should never be greater than V_{MBE}.

V_{MBE} Speed Computations

Generally, maximum brake energy speed is not a limiting factor, particularly in the slats + flaps 15° configuration. A limiting speed may require a decrease in takeoff weight or a change in runway conditions (wind, slope, etc.).

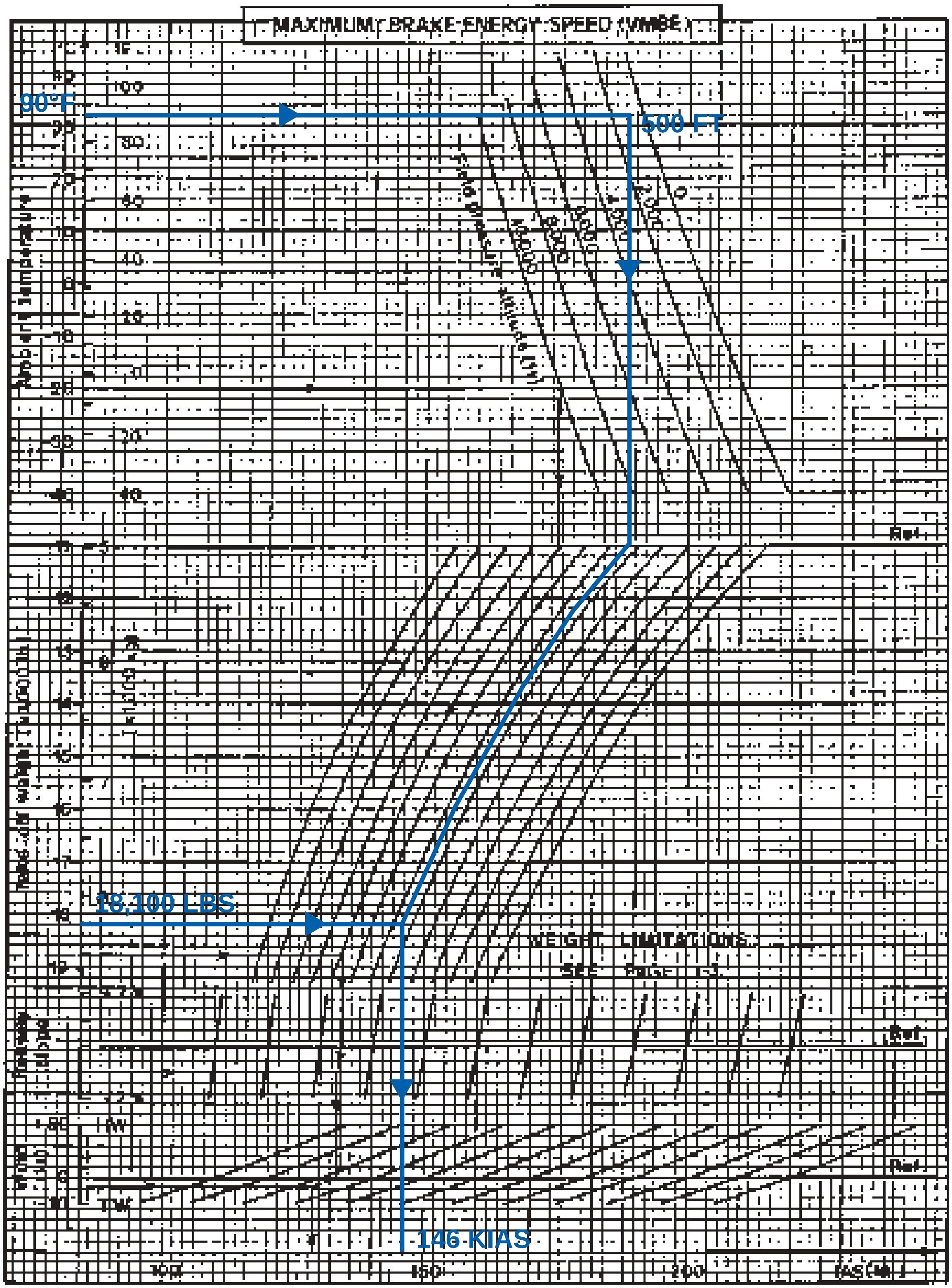
Determine V_{MBE} from the Maximum Brake Energy Speed (V_{MBE}) chart (**Figure 4-19**).

1. Enter the chart from the left at the ambient temperature (*90°F*). Move right to intersect the pressure altitude (*500 ft*). Move down to the reference line.
2. Enter left at the takeoff weight and move right, across the weight guidelines.
3. Return to the temperature-altitude reference line intersection and parallel the guidelines to intersect the takeoff weight line.
4. Move down to the runway slope reference line.

   Assume no slope.
5. Move down to the wind reference line.

   Assume no wind.
6. Move down to read the maximum brake energy speed (*146 KIAS*).

Maximum Brake Energy Speed (V_{MBE})



4-19

Tire Speed

Use the Maximum Allowable Takeoff Gross Weight Permitted by Tire Speed chart (**Figure 4-20**) to determine the maximum allowable takeoff gross weight based on tire speed.

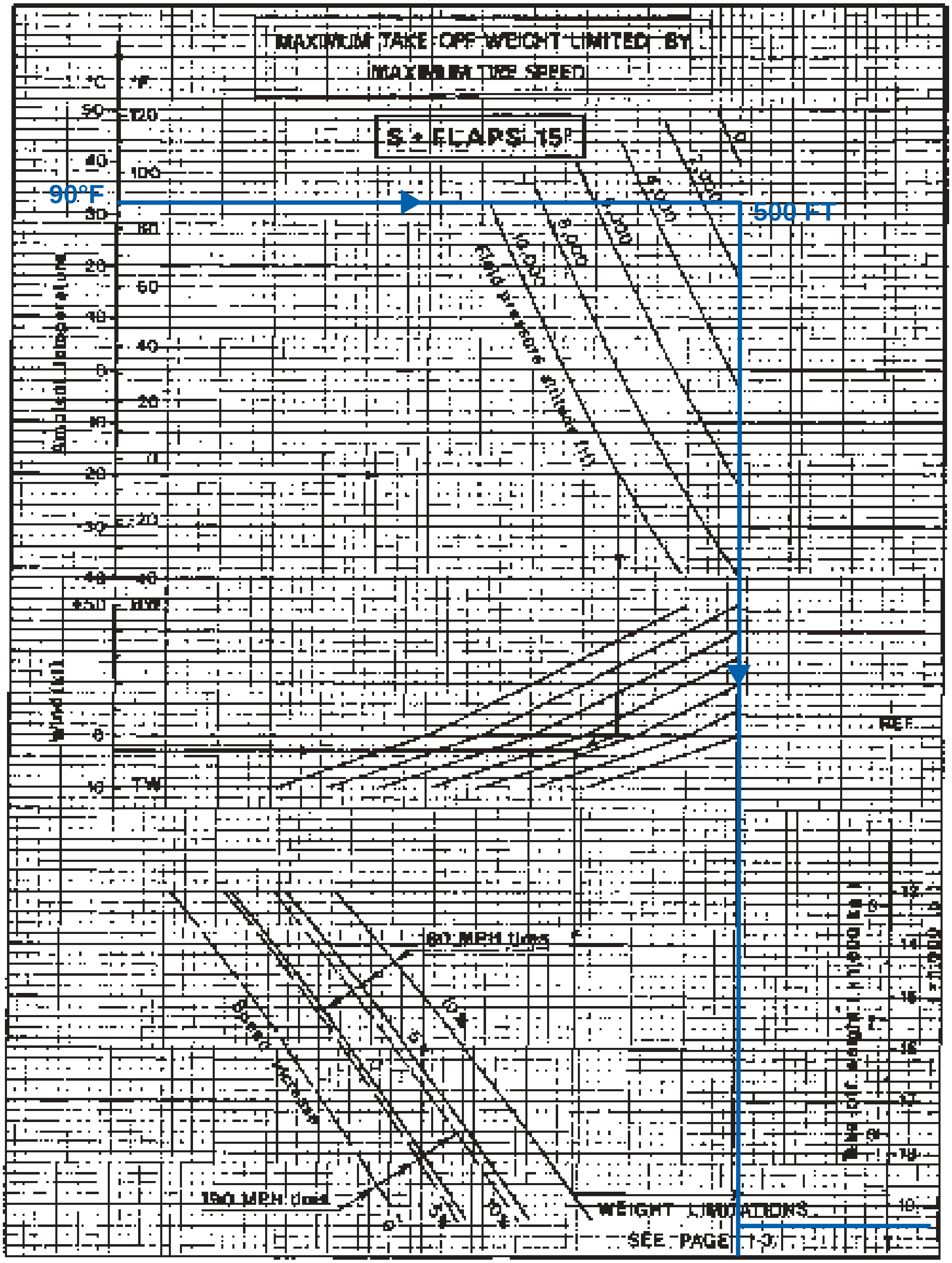
Generally the maximum takeoff weight is not limited by tire speed. It happens only at high gross weights, tailwind, high elevation, and hot temperatures; it most likely occurs in a slats + flaps 15° plus speed increase or in a slats-only configuration.

1. Enter the chart from the left at the ambient temperature (*90°F*). Move right to intersect the Field Pressure Altitude-Ft line (*500 ft*).
2. Move down to the wind reference line.

   Assume no wind.
3. Move down to intersect the tire speed limit/speed increase lines, then across to the maximum takeoff weight allowable.

   The vertical line did not intersect a tire speed line; therefore, tire speed is not limiting.

Max Allowable T/O Gross Wt Permitted by Tire Speed



4-20

SimuFlite

TAKEOFF	FALCON 10/100	
ATIS P. A. - 500'		
TEMP - 90°F		
V_1 118	WEIGHT 18,100	
V_R	FLAPS S+ 15	TRIM
$V_{2/REF}$	TAKEOFF N_1:	
V_{FR}	CLIMB N_1:	
V_{FS}	RWY RQD 5,300 FT.	
V_{ENR}	TIME TO 100 KTS	
CLEARANCE		

V_1 Speed Computations

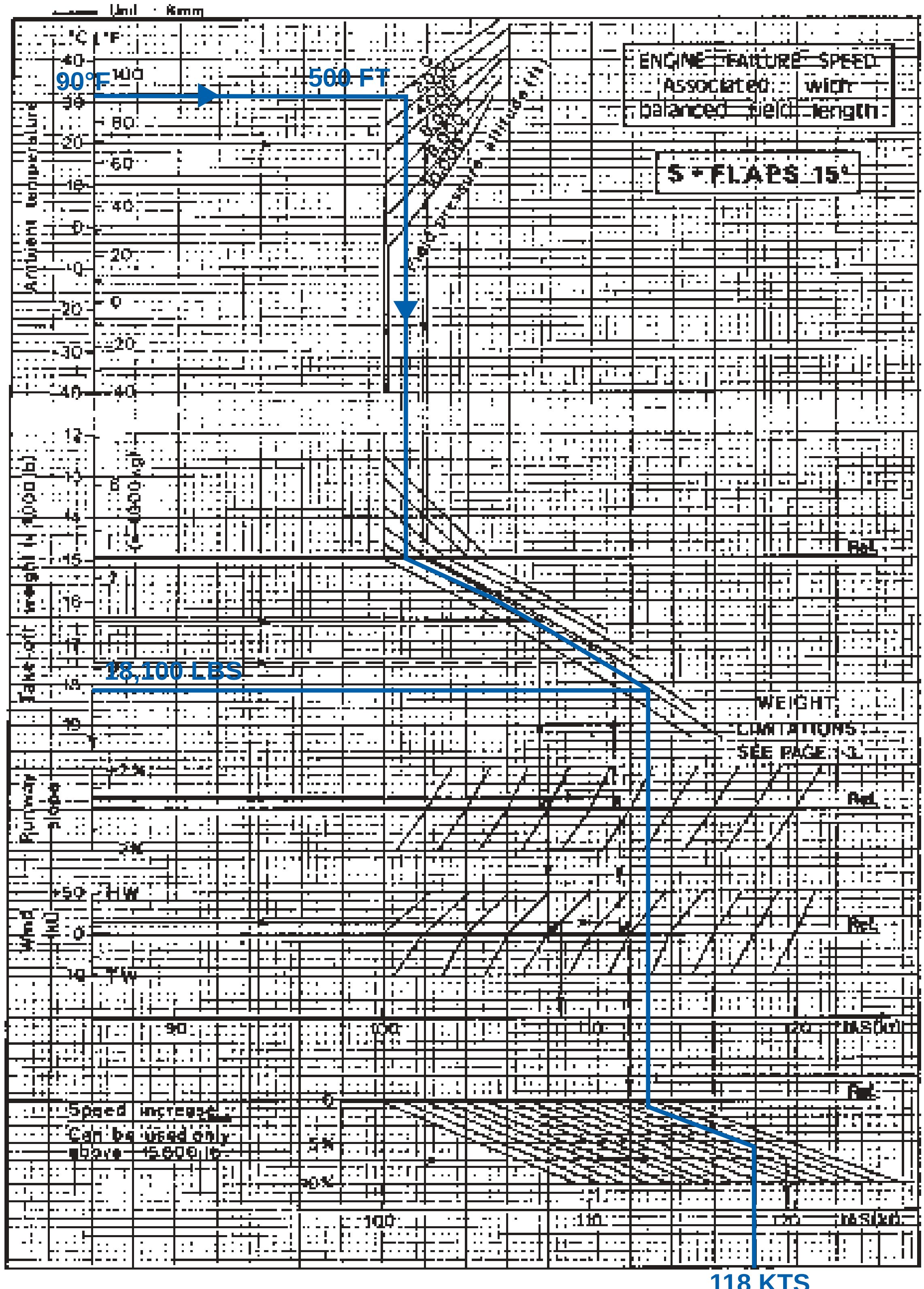
Once the runway and weight requirements are met, determine airspeeds for takeoff and climb. The first speed required is V_1. Use the Engine Failure Speed Associated with Balanced Field Length chart – Slats + Flaps 15° (**Figure 4-21**); the takeoff configuration determines which chart to use.

1. Enter the chart from the left at the ambient temperature (*90°F*). Move right to intersect the pressure altitude (*500 ft*). Move down to the weight reference line and parallel the weight guidelines.
2. Enter the chart from the left at the desired takeoff weight (*18,100 lbs*).
3. Move right across the weight guidelines to the intersection of the ambient temperature/pressure altitude line and the weight reference line. From this intersection, move down to the slope reference line.
4. Adjust V_1 for slope.

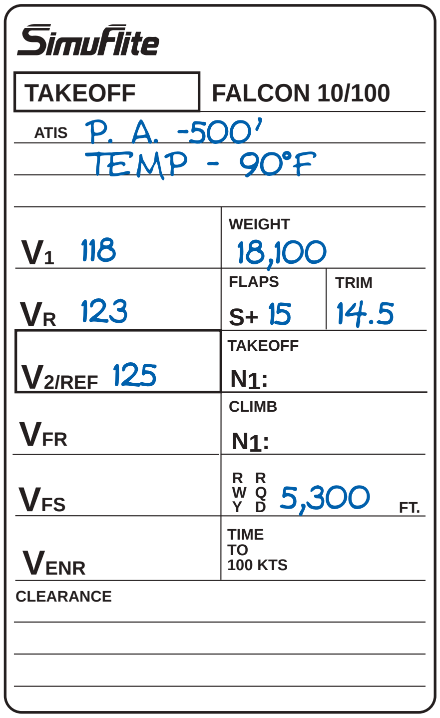
   Assume no slope. Continue to the wind reference line.
5. Adjust V_1 for wind.

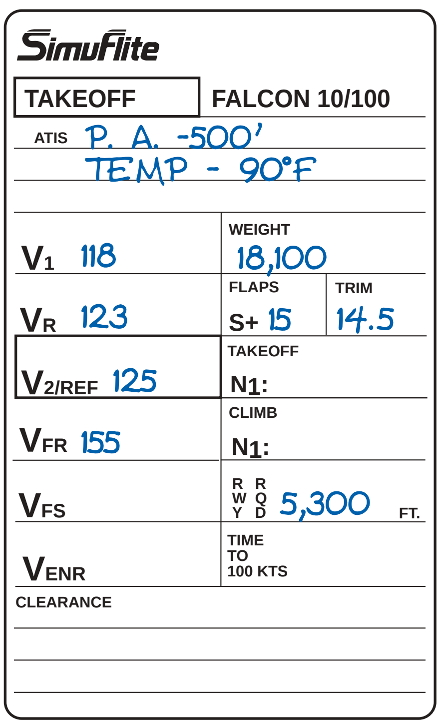
   Assume no wind. Continue to the speed increase reference line.
6. Adjust V_1 for speed increase.
   a. Enter the chart from the left at the speed increase (*5%*). Move to the right through the speed increase guidelines.
   b. Return to the temperature, altitude, and weight line, and follow the speed increase guidelines to the speed projection intersection.
   c. Move down to the bottom and read V_1 for a 5% speed increase (*118 kts*).

Engine Failure Speed Associated with Balanced Field Length



4-21





Takeoff Speed and Nose-Up Attitude (V_R, ATT, V_2, Slats + Flaps 15°)

To compute V_R, takeoff attitude and V_2, refer to the Takeoff Speeds and Nose-Up Attitude/ S + Flaps 15° chart for the takeoff configuration (**Figure 4-22**).

Compute V_R (top chart).

1. Enter the chart from the takeoff weight at the bottom of the chart (*18,100 lbs*), move up to the speed reference line, move left, and read the speed *(117 kts)*.
2. When, as in this case, a speed increase is used, move right from the speed reference line to the speed increase reference line, then parallel the speed increase guidelines to the 5% point and move right to read the rotation speed (*123 kts*).

Compute attitude.

1. Enter the chart from the takeoff weight at the bottom and move up to the pitch line. Read the pitch attitude left (*16°*).
2. With a speed increase, move right to the speed increase reference line and parallel the speed increase guidelines to the 5% point, then right to the takeoff pitch attitude (*14.5°*).

Compute V_2 takeoff safety speed.

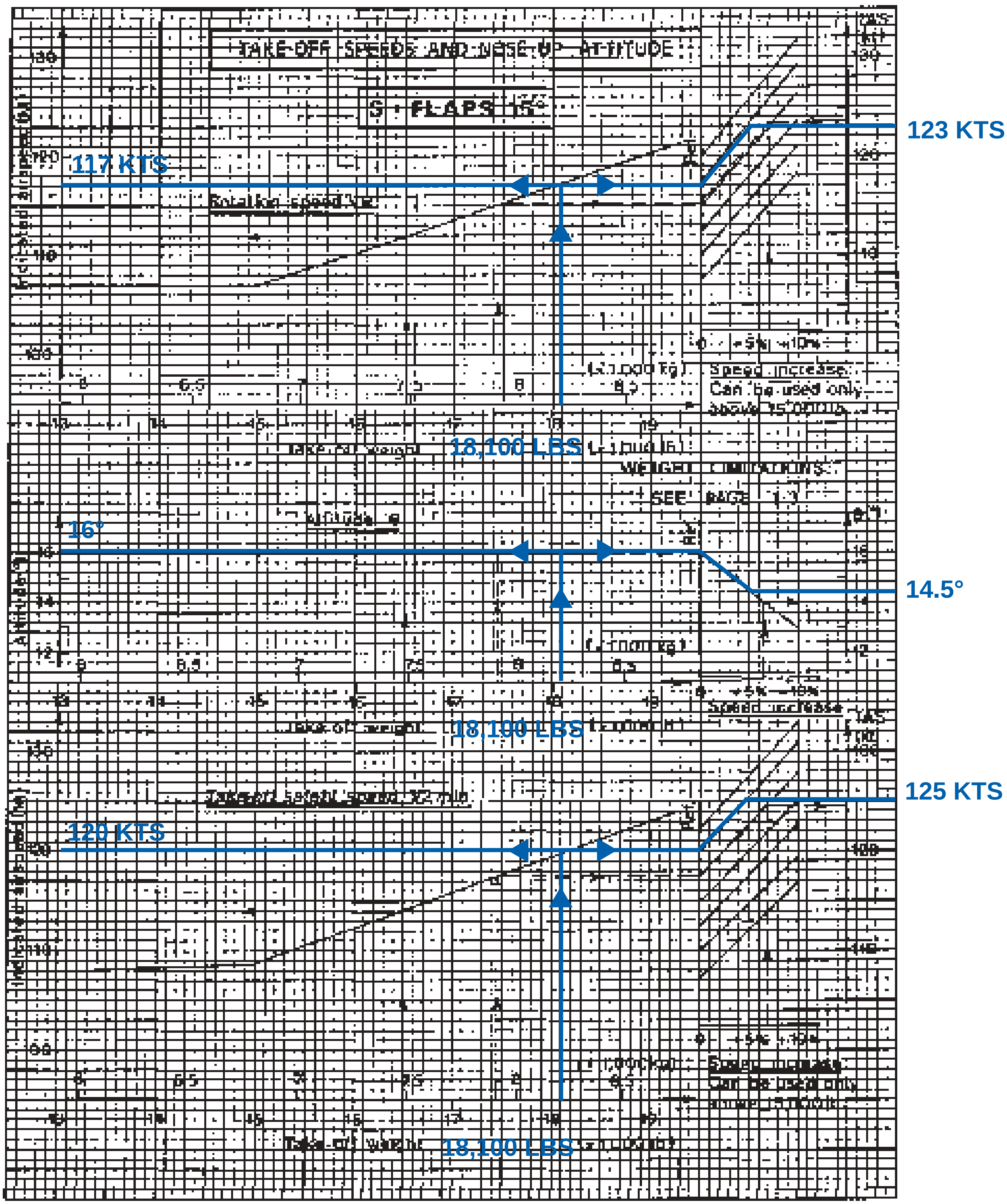
1. Enter the chart at the takeoff weight and move up to intersect the V_2 speed line. Read the speed at the left (*120 kts*).
2. Calculate the speed increase adjustment by moving from the V_2 speed line to the right to the speed increase reference line; parallel the speed increase guidelines to the 5% point, then move right to read V_2 (*125 kts*).

Takeoff Clean Wing Speed (V_{FR})

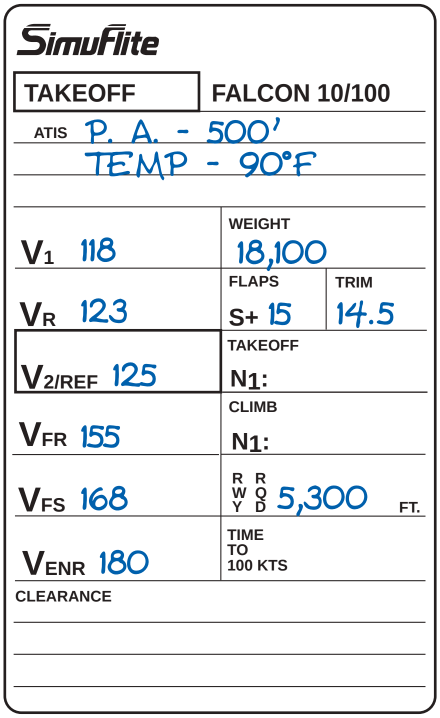
Clean wing speed is a weight-controlled number, regardless of configuration. To determine V_{FR} for any configuration, use the Takeoff Safety Speed (V_2) chart, Slats + Flaps 15° (refer to **Figure 4-22**).

To calculate clean wing speed, take V_2 previously calculated, speed increase not considered (*120 kts*), and add 35 kts *(120 kts + 35 kts = 155 kts V_{FR})*.

Takeoff Speeds and Nose-Up Attitude



4-22



Final Takeoff Climb Speed (V_{FS})

Determine V_{FS} speed using the Final Takeoff Climb Gradient chart (**Figure 4-23**).

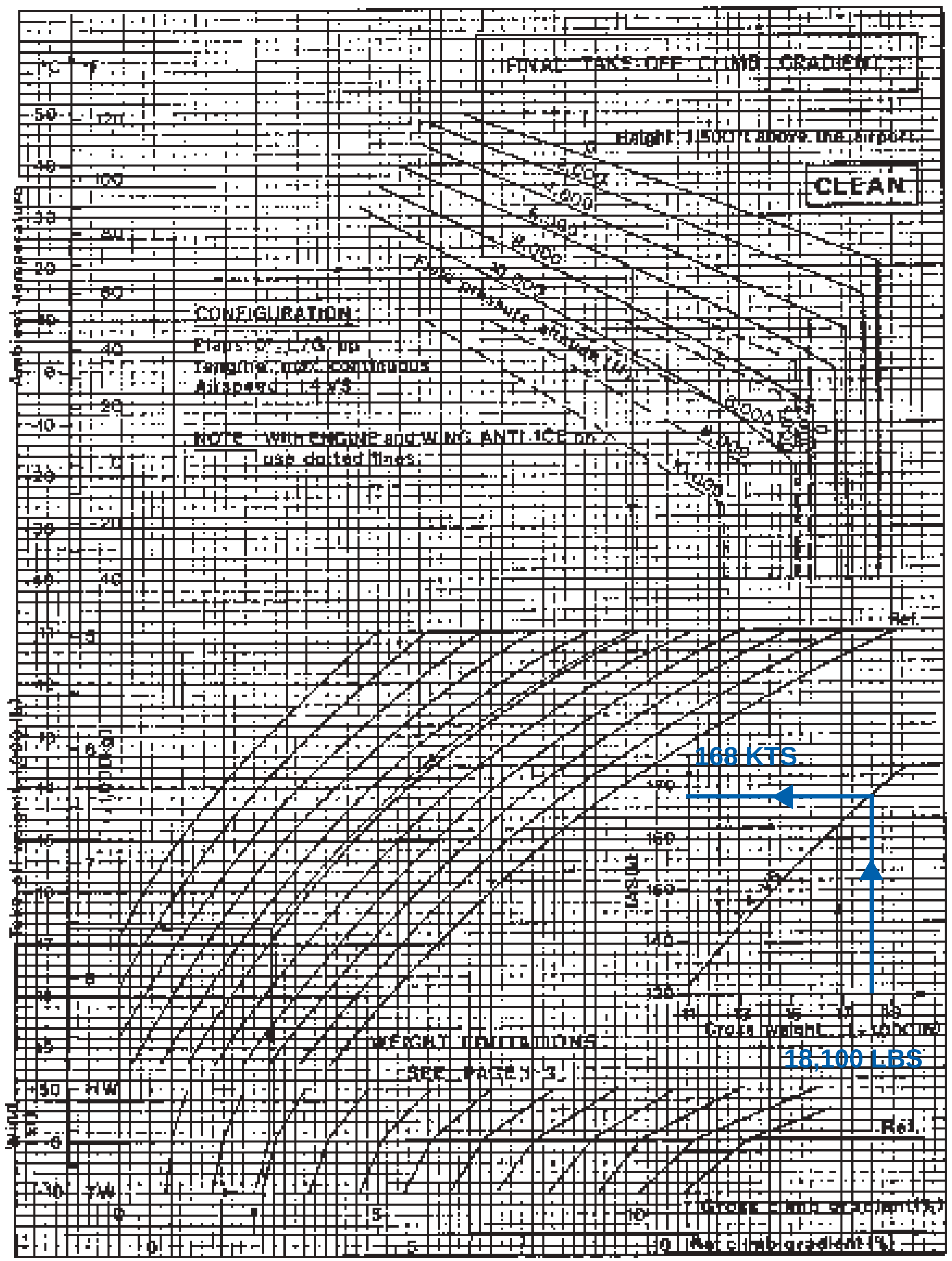
1. Find the 1.4 V_S speed chart in the lower right side of the above chart.
2. Enter gross weight at the bottom and move up to intersect the 1.4 V_S guideline.
3. Move left from that point to read the final segment climb speed (*168 kts*).

Enroute Climb Speed (V_{ENR})

Determine V_{ENR} using the Enroute Climb Gradient One-Engine Inop/Clean chart (**Figure 4-24**).

1. Find the 1.5 V_S speed chart on the lower right side of the above chart.
2. Enter gross weight at the bottom and move up to intersect the 1.5 V_S guideline.
3. Move left from that intersection to read the enroute climb speed (*180 kts*).

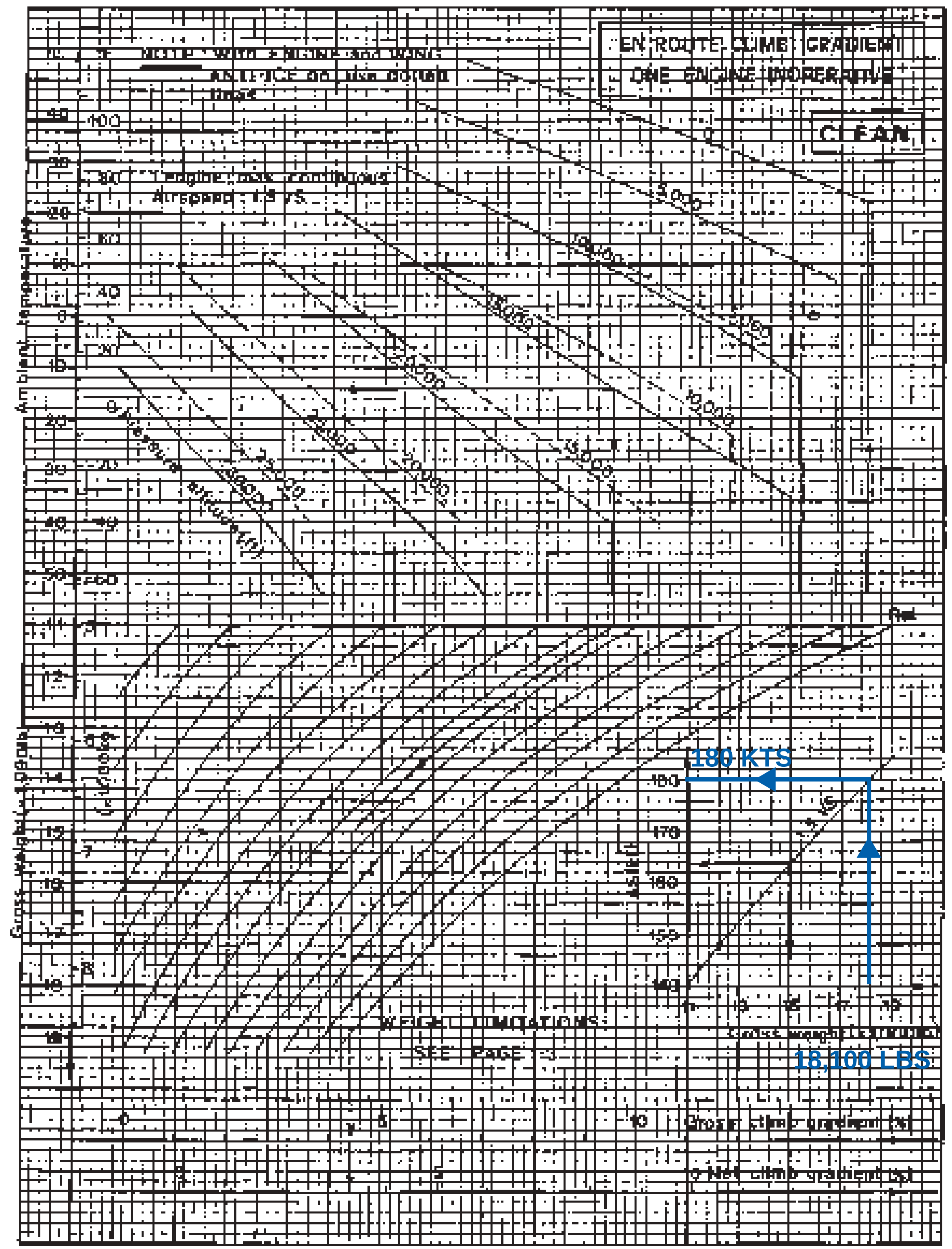
Final Takeoff Climb Gradient



4-23

Enroute Climb Gradient One Engine Inop

Clean



4-24

Enroute Climb Gradient One Engine Inop

SimuFlite

TAKEOFF	FALCON 10/100	
ATIS P. A. - 500' TEMP - 90°F		
V_1 118	WEIGHT 18,100	
V_R 123	FLAPS S+ 15	TRIM 14.5
$V_{2/REF}$ 125	TAKEOFF N_1: 95.3	
V_{FR} 155	CLIMB N_1: 93.4	
V_{FS} 168	RWY RQD 5,300 FT.	
V_{ENR} 180	TIME TO 100 KTS	
CLEARANCE		

N_1 Setting Computations – Takeoff Thrust

Use the Takeoff Thrust Setting chart (**Figure 4-25**) to calculate N_1 setting based on static air temperature and pressure altitude. This thrust begins the takeoff roll and achieves all takeoff performance values. Full advancement of the thrust levers should provide, as a minimum, the charted N_1 value for takeoff.

Assume ice protection is not required.

1. Enter the chart from the bottom with the OAT (*90°F*). Move up to intersect the pressure altitude (*500 ft*), or the limit line, whichever is first.
2. Move left from the intersection to the edge of the chart. Read the N_1 setting (*95.3%*).

Use a similar chart in the AFM in the same manner to calculate takeoffs with wing and/or engine anti-ice on. Wing anti-ice is prohibited during takeoff roll (on the ground).

N_1 Setting Computations – Climb Thrust

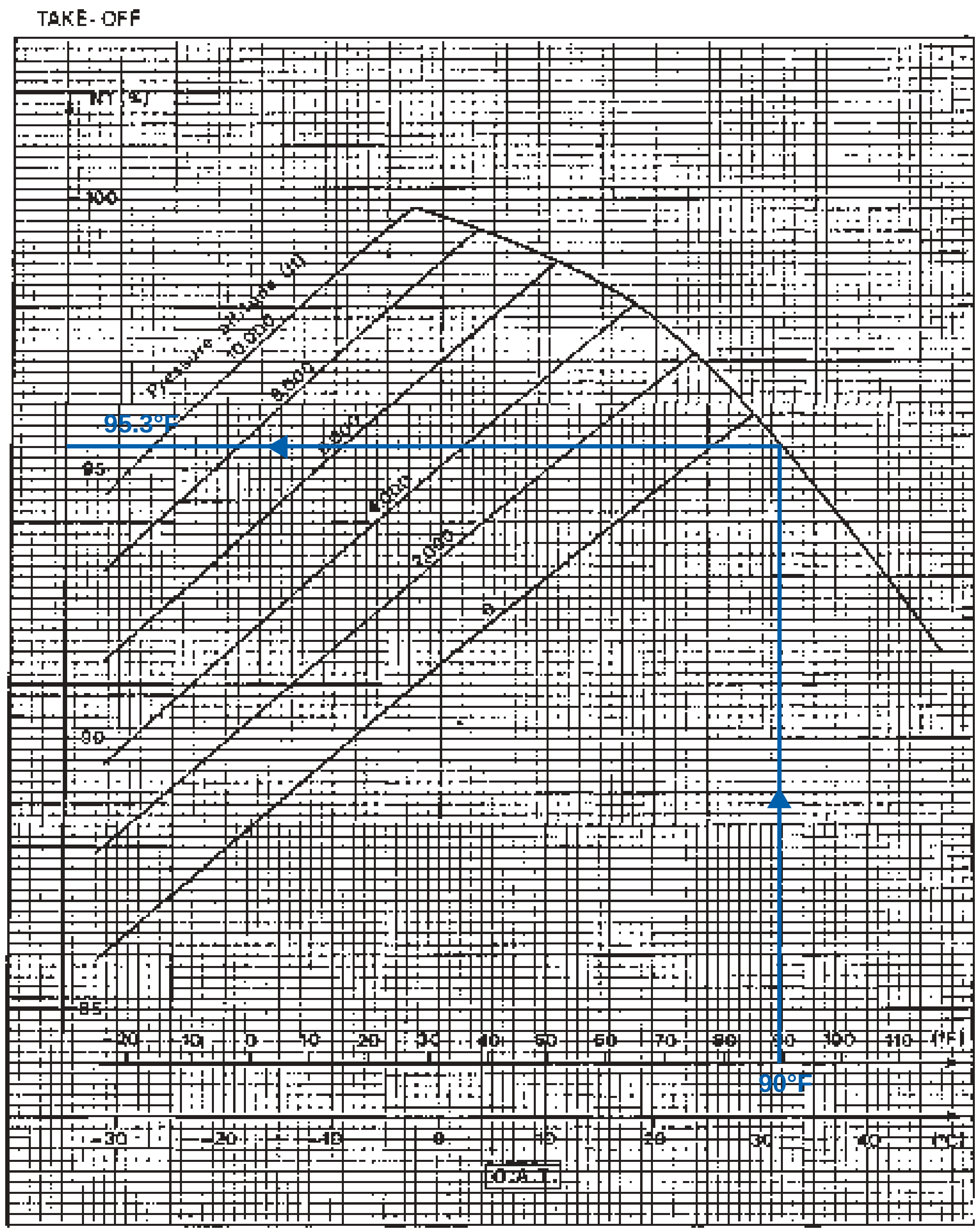
Use the Maximum Continuous Thrust – Final Takeoff and Enroute Climb chart (**Figure 4-26**) to determine climb N_1 at the maximum continuous thrust.

(The Maximum Continuous Thrust – Final Takeoff chart is used in the same manner for takeoff performance.)

Assume ice protection is not required.

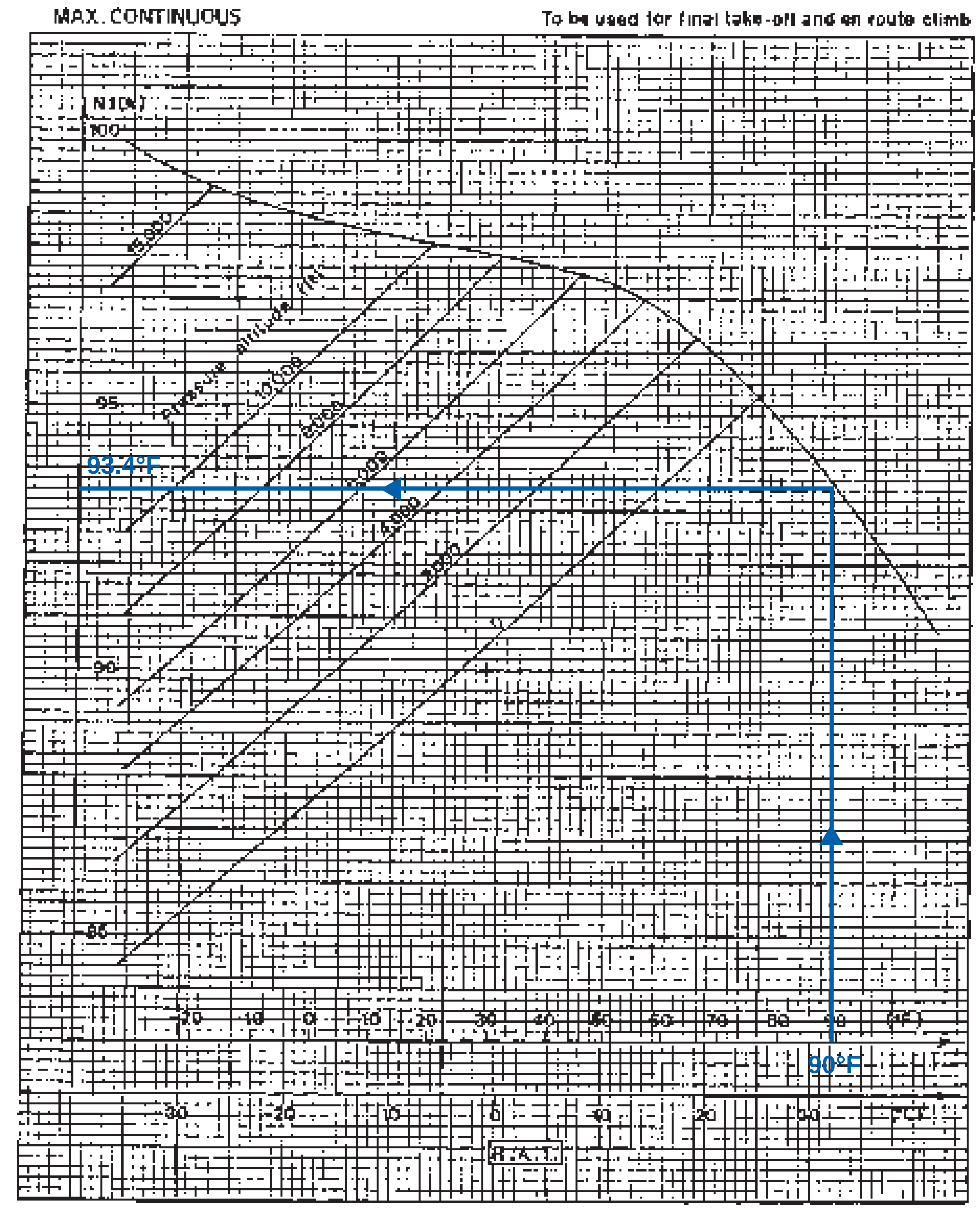
1. Enter the chart from the bottom with the RAT (*90°F*). Move up to intersect the pressure altitude (*500 ft*), or limit line, whichever is first.
2. Move left from the intersection to the edge of the chart. Read the N_1 setting (*93.4%*).

Thrust Setting/Takeoff



4-25

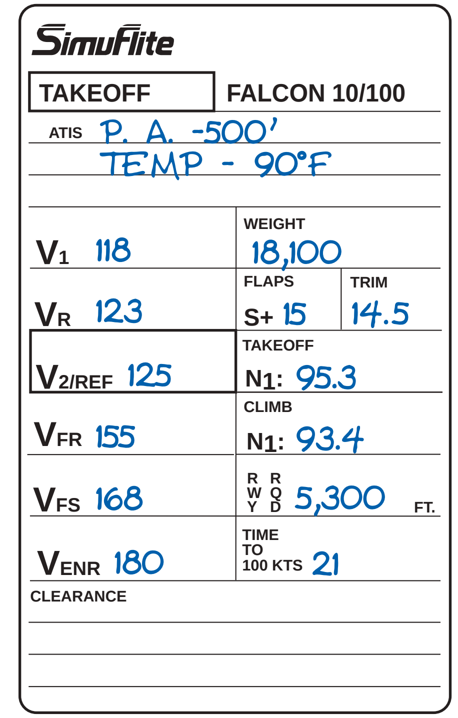
Thrust Setting/Maximum Continuous



4-26

Thrust Setting/ Takeoff

Thrust Setting/ Maximum Continuous


SimuFlite
TAKEOFF FALCON 10/100
ATIS P. A. -500'
TEMP - 90°F
V1 118 | WEIGHT 18,100
VR 123 | FLAPS S+ 15 | TRIM 14.5
V2/REF 125 | TAKEOFF N1: 95.3
VFR 155 | CLIMB N1: 93.4
VFS 168 | RWY RQD 5,300 FT.
VENR 180 | TIME TO 100 KTS 21
CLEARANCE

Time to 100 Knots

Use the Time To 100 Kts chart (**Figure 4-27**) to ensure the aircraft's operational performance is normal (e.g., that the thrust is appropriate, the brakes are not partially engaged, or the flaps are not extended more than required). The chart is valid for slats + flaps 15° or slats-only takeoffs.

1. Enter from the left at ambient temperature (*90°F*), move right to field pressure altitude (*500 ft*), then down to the gross weight reference line.
2. Enter from the left at the gross weight (*18,100 lbs*), and move right to the center of the chart.
3. Continue the temperature/altitude line at the weight reference line and parallel the weight guidelines to intersect the horizontal weight line drawn previously.
4. Continue down to the slope reference line.

   Assume no slope.
5. Continue down to the wind reference line.

   Assume no wind.
6. Continue down to read the time to 100 kts (*21 seconds*).

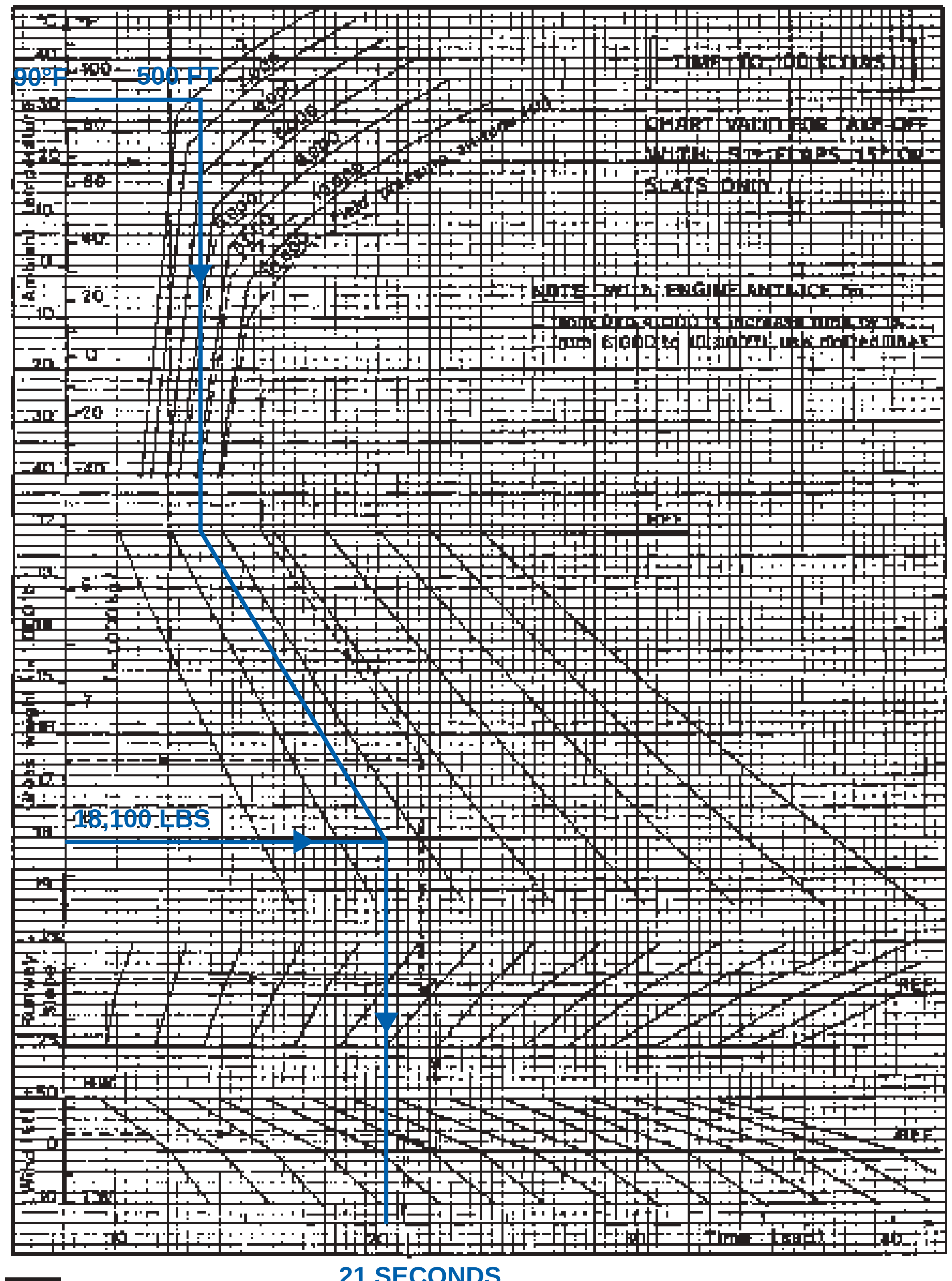
Cruise Climb N_1 Setting

Use the Thrust Setting Maximum Climb chart (**Figure 4-28**) to set climb power during normal climb to cruise altitude. Climb speed could be 260 kts/0.72M, or 300 kts/0.75M; ice protection is not a factor in calculating cruise climb N_1.

1. Enter from the top at pressure altitude (*10,000 ft*), and move down the vertical column. Intersect the horizontal row from the ram air temperature (*15°C*). The square at the intersection contains the appropriate maximum N_1 setting (*97.4%*).

Time to 100 Kts (IAS)

Valid for Takeoff with S + Flaps 15° or Slats Only



4-27

Thrust Setting/Maximum Climb

MAXIMUM CLIMB

Pressure altitude (ft)

Ram Air Temperature (°C)	0	5,000	10,000	15,000	20,000	25,000	30,000	36,000	41,000	45,000
45	92.0	92.4								
40	93.6	93.6	93.6							
35	94.7	94.7	94.7	94.7						
30	95.2	95.7	95.7	95.7	95.7					
25	94.2	96.4	96.4	96.4	96.4	96.4				
20	93.3	97.0	97.0	97.0	97.0	97.0				
15	92.4	96.8	97.4	97.4	97.4	97.4				
10	91.4	95.8	97.7	97.7	97.7	97.7	97.7			
5	90.5	95.0	97.9	97.9	97.9	97.9	97.9			
0	89.6	94.0	97.1	98.1	98.1	98.1	98.1	97.1		
-5	88.8	93.1	96.2	98.2	98.2	98.2	98.2	97.4		
-10	87.9	92.2	95.2	98.3	98.3	98.3	98.3	97.6	96.4	
-15	87.0	91.3	94.3	97.6	98.5	98.5	98.5	97.8	96.8	95.6
-20	86.2	90.4	93.4	96.6	98.7	98.7	98.7	98.0	97.0	95.9
-25	85.3	89.4	92.5	95.6	98.9	98.9	98.9	98.4	97.4	96.2
-30		88.5	91.6	94.7	99.3	99.3	99.3	98.7	97.7	96.6
-35			90.7	93.8	99.6	99.6	99.6	99.2	98.1	97.0
-40					100	100	100	99.5	98.5	97.5

If necessary, reduce N1 to avoid exceeding an EXH TEMP of 832°C.

NOTE

For recommended climb on standard day, use shaded area.

Example : Climb 300 kt i.e. M = 0.65 at 20,000 ft

RAT = − 6°C − N1 = 98.2 %

4-28

Time to 100 Kts (IAS)

Thrust Setting/ Maximum Climb

NOTE: The following slats-only exercises are for illustration only and do not relate to the main example for this chapter.

NOTE: SB F10-0077: Takeoff with Slats Extended and Flaps Retracted.

SimuFlite

TAKEOFF	FALCON 10/100
ATIS P. A. - 4,500' TEMP - 100°F	
V_1	WEIGHT 15,600
V_R	FLAPS S+ / TRIM
$V_{2/REF}$	TAKEOFF N_1:
V_{FR}	CLIMB N_1:
V_{FS}	RWY RQD FT.
V_{ENR}	TIME TO 100 KTS
CLEARANCE	

Takeoff – Slats-Only

Sometimes temperature and elevation severely limit the Falcon 10/100's load-carrying capabilities. In high density altitudes where the runway length is not a factor, loads may be increased by using speed increases discussed earlier or slats-only takeoffs.

Slats-only requires more runway than any other takeoff. If the runway length is less than 7,000 ft, slats-only may not improve load more than the speed increase technique.

The following example is for illustration only and is not related to previous problems:

Airport conditions:

- *Elevation: 4,500 ft*
- *Temperature: 100°F*
- *Runway: 11,000 ft*

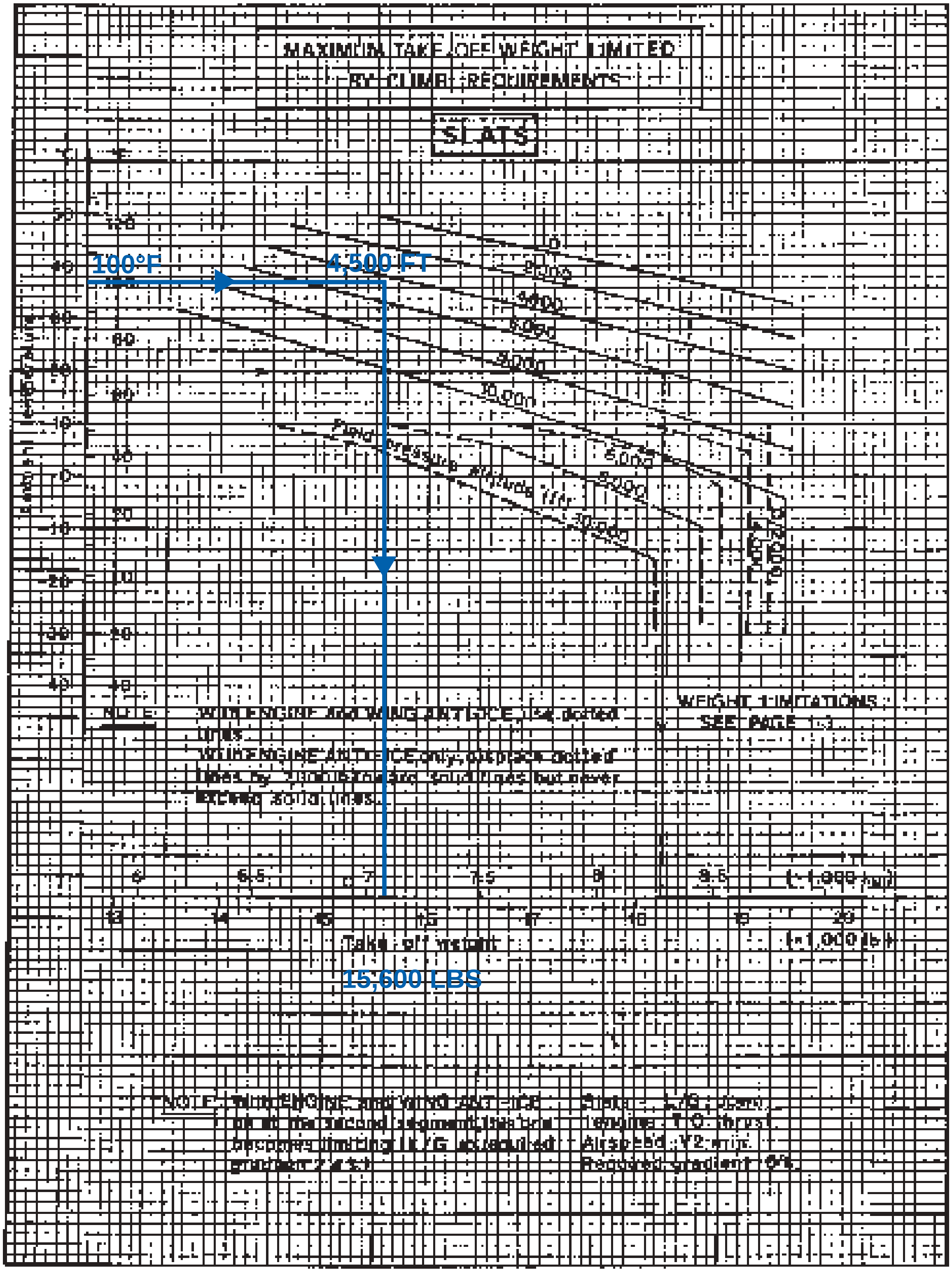
Find the maximum gross weight allowable under these conditions and calculate a TOLD card.

Maximum Takeoff Weight Limited By Climb Requirements – Slats-Only

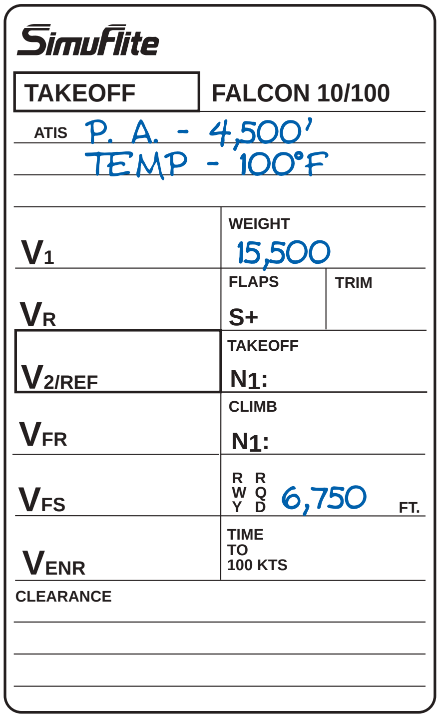
Use the Maximum Takeoff Weight Limited by Climb Requirements chart (**Figure 4-29**).

1. Enter from the left at the temperature (*100°F*).
2. Move right to the pressure altitude (*4,500 ft*).
3. Move down to read the maximum takeoff weight (*15,600 lb*).

Maximum Takeoff Weight Limited by Climb Requirements/Slats



4-29


SimuFlite

TAKEOFF | FALCON 10/100

ATIS P. A. - 4,500'
TEMP - 100°F

V_1 | WEIGHT 15,500
V_R | FLAPS S+ | TRIM
$V_{2/REF}$ | TAKEOFF N1:
V_{FR} | CLIMB N1:
V_{FS} | RWY RQD 6,750 FT.
V_{ENR} | TIME TO 100 KTS

CLEARANCE

Takeoff Climb: First Segment – Slats-Only

Slats-only takeoffs are limited by first segment, rather than second segment as slats + flaps 15° takeoffs. Use the Takeoff Climb-First Segment chart (**Figure 4-30**).

1. Enter from the left at the temperature (*100°F*).
2. Move right to the pressure altitude *(4,500 ft)*, then down the weight reference line.
3. Parallel the weight guidelines.
4. Enter from the left at the takeoff weight (*15,600 lbs*), then move across the weight guidelines to intersect the temperature/altitude line.
5. From the intersection, move down to read the gradient (-*.1%*).

The minimum gradient is 0% gross climb gradient. If the weight is more than what produces a positive gradient, then weight must be reduced (*15,500 lbs*), so that the gradient is positive (*0%*).

Balanced Field Length – Slats-Only

Use the Balanced Field Length chart (**Figure 4-31**).

New Gross Takeoff Weight: 15,500 lbs

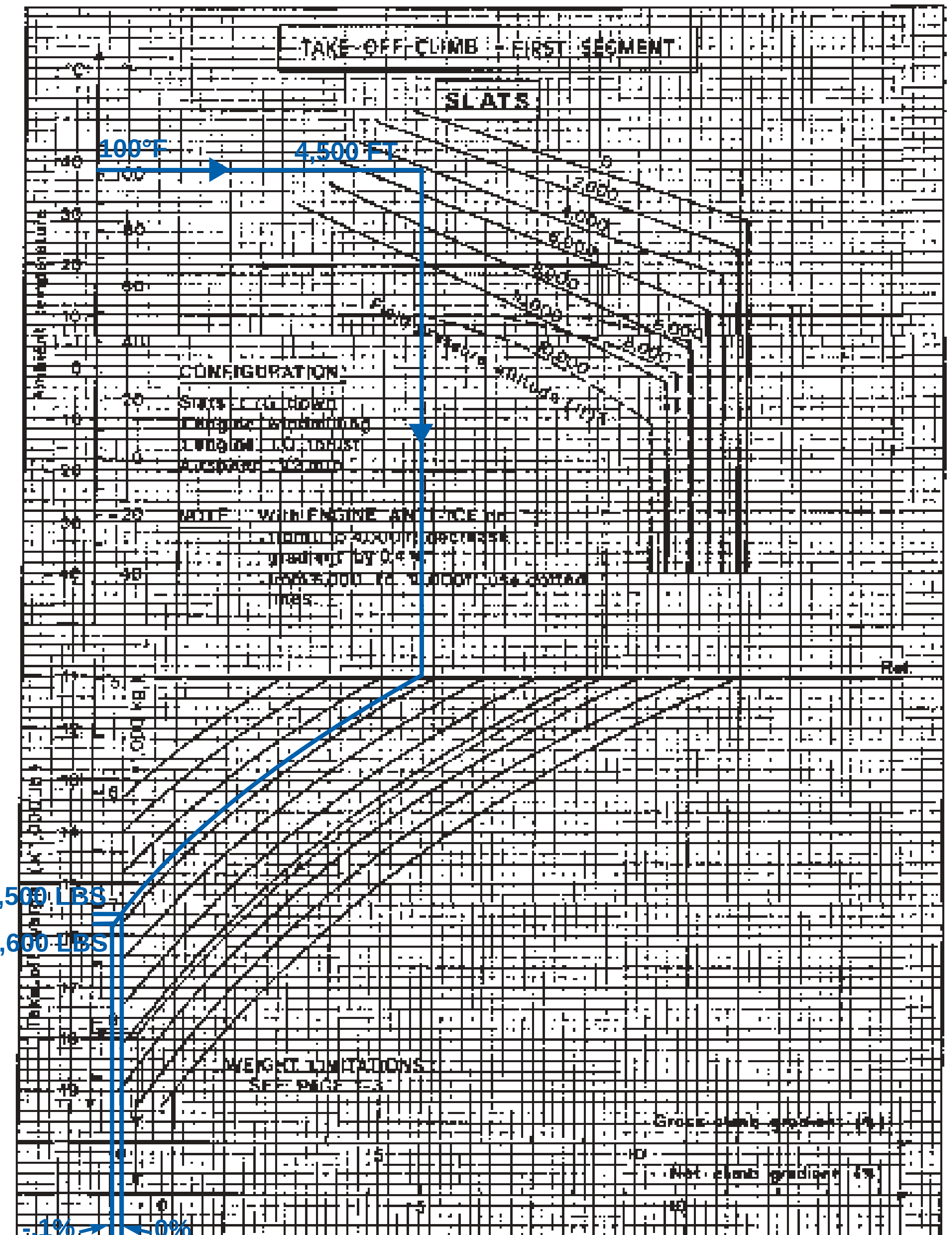
1. Enter from the left at the temperature (*100°F*).
2. Move right to the pressure altitude *(4,500 ft)*, then down to the weight reference line.
3. Enter from the left at the takeoff weight (*15,500 lbs*) and move right across the weight guidelines.
4. Continue the temperature/altitude line from the reference line and parallel the weight guidelines to intersect the weight line.
5. From the intersection move down to the slope reference line.

   Assume no slope.
6. Move down to the wind reference line.

   Assume no wind.
7. Move down to read the balanced field length (*6,750 ft*).

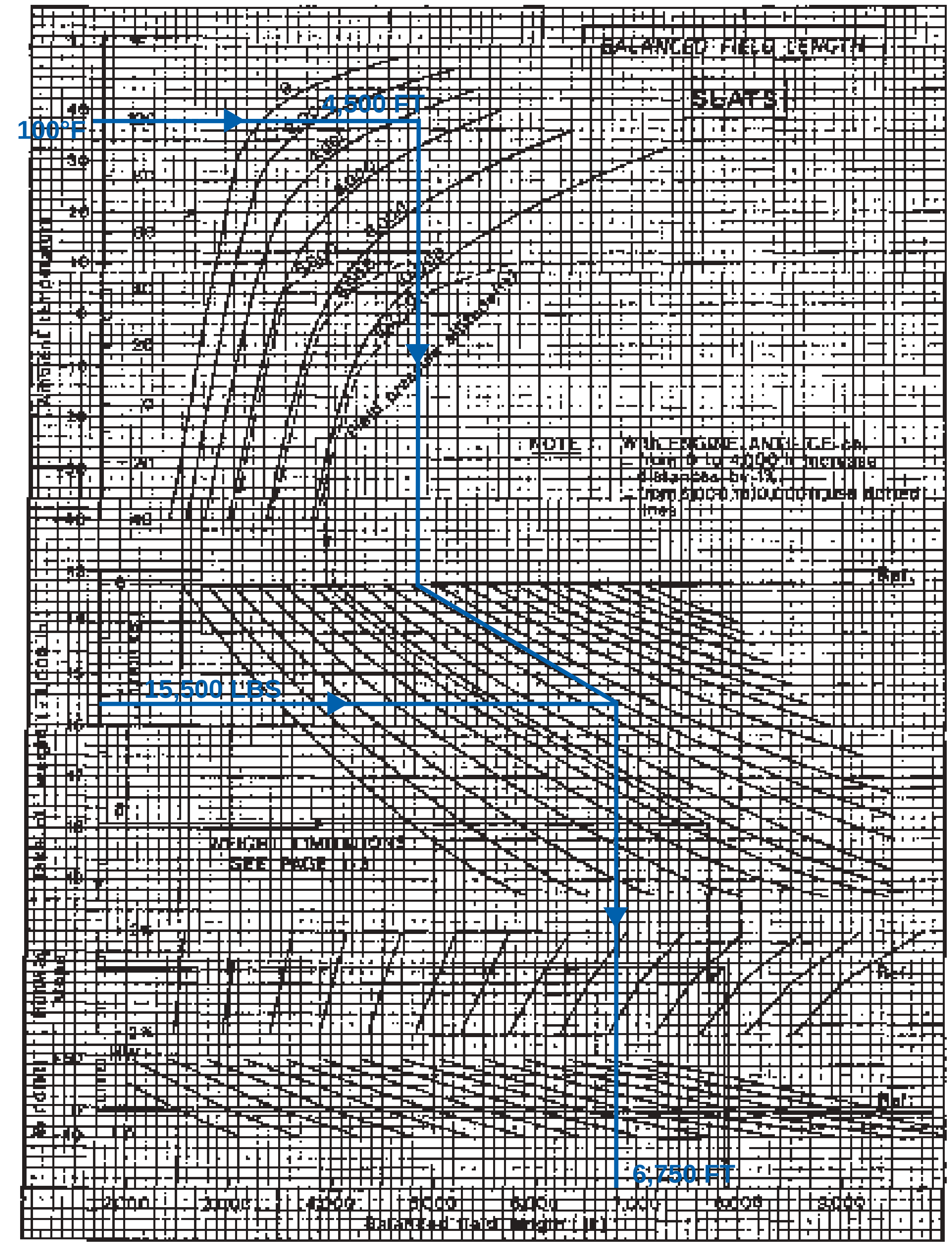
Takeoff Climb

First Segment/Slats



4-30

Balanced Field Length



4-31

Takeoff Climb

Balanced Field Length

Second Segment Climb – Slats-Only

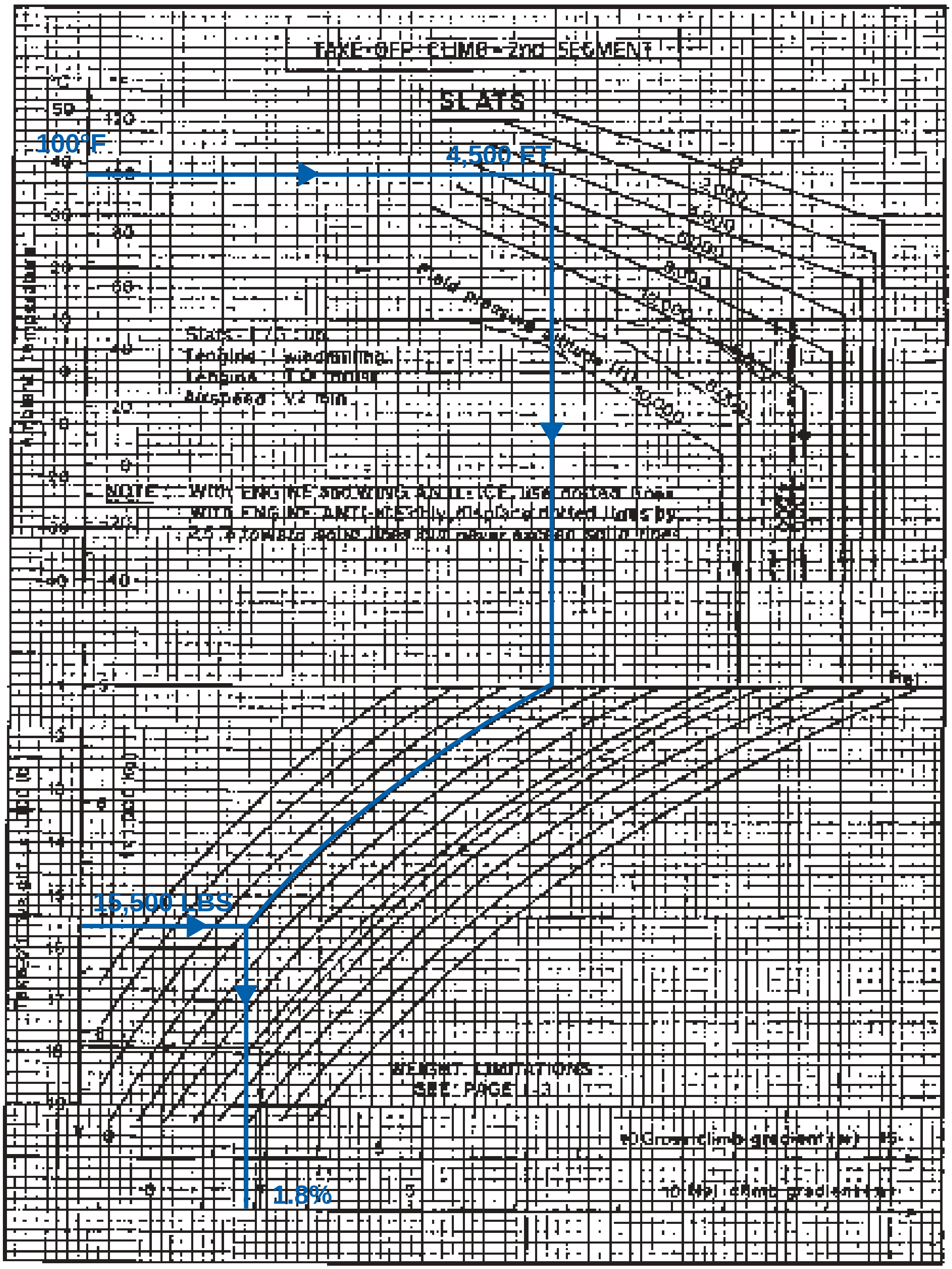
Use the Takeoff Climb – 2nd Segment chart (**Figure 4-32**) if obstacle clearance or minimum climb is a consideration. This gradient is also necessary in calculating the slats-only takeoff pitch attitude.

1. Enter from the left at the ambient temperature (*100°F*).
2. Move right to the pressue altitude (*4,500 ft*).
3. Move down to the weight reference line.
4. Enter from the left at the takeoff weight (*15,500 lbs*).
5. Move right across the weight guidelines.
6. Continue the temperature/altitude line from the reference line, paralleling the weight guidelines.
7. Intersect the weight line and move down to read the gradient (*1.8%*). A minimum of 1.6% is required.

   With a net climb gradient of 1.8%, a slats-only takeoff is not limited by second segment climb.

Takeoff Climb

Second Segment



4-32

SimuFlite

TAKEOFF	FALCON 10/100
ATIS P. A. - 4,500'	
TEMP - 100°F	
V_1 124	WEIGHT 15,500
V_R	FLAPS S+ / TRIM
$V_{2/REF}$	TAKEOFF N_1:
V_{FR}	CLIMB N_1:
V_{FS}	RWY RQD 6,750 FT.
V_{ENR}	TIME TO 100 KTS
CLEARANCE	

V_1 Safety Speed – Slats-Only

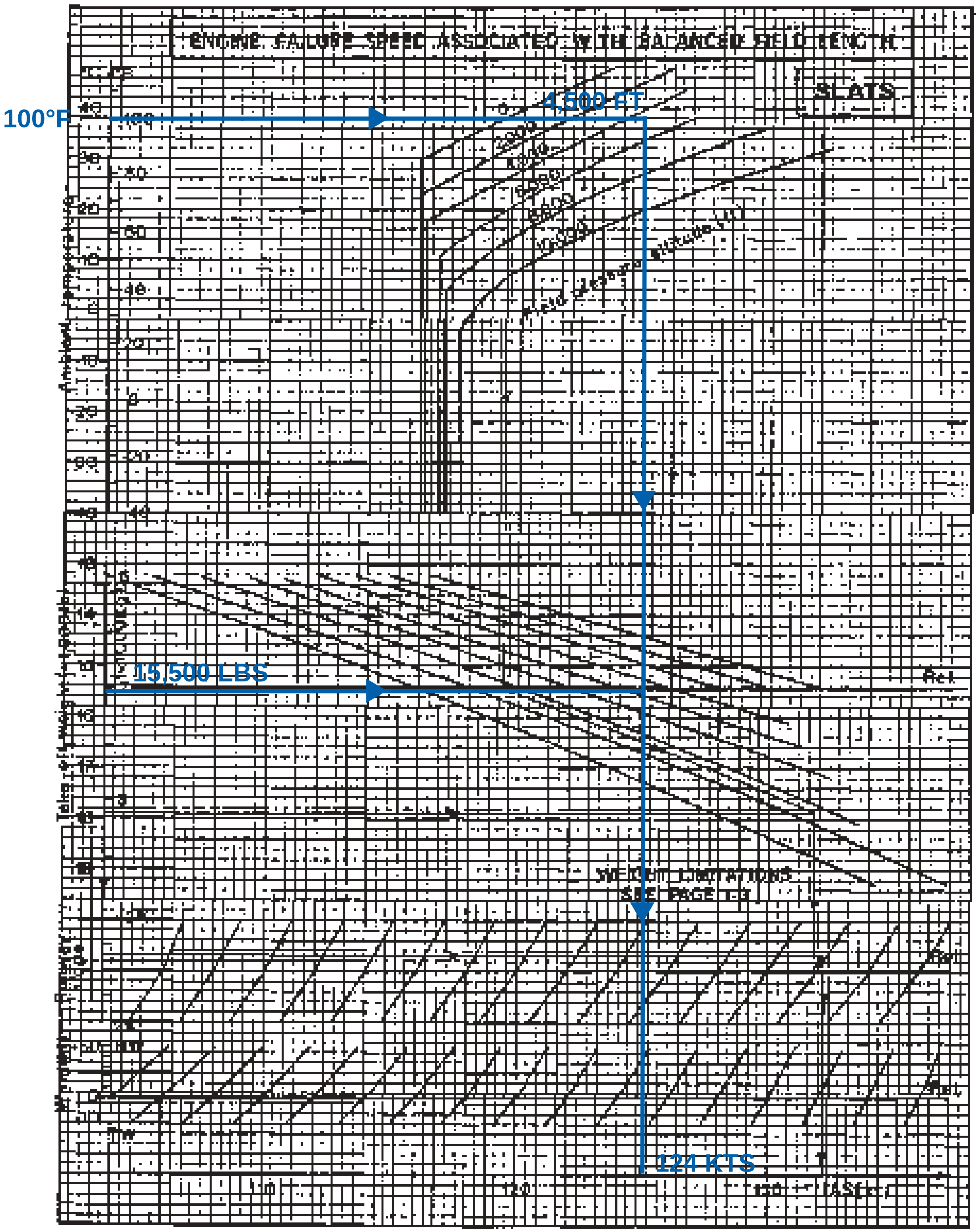
Use the Engine Failure Speed Associated with Balanced Field Length chart (**Figure 4-33**).

1. Enter from the left at the ambient temperature (*100°F*).
2. Move right to the pressure altitude *(4,500 ft)*.
3. Move down to the takeoff weight reference line.
4. Enter from the left at the takeoff weight (*15,500 lbs*).
5. Move right across the weight guidelines.
6. Continue from the weight reference line, paralleling the weight guidelines.
7. Intersect the weight line and move down to the slope reference line.

   Assume no slope.
8. Move down to the wind reference line.

   Assume no wind.
9. Move down to read the V_1 speed (*124 kts*).

Engine Failure Speed Associated with Balanced Field Length



4-33

SimuFlite

TAKEOFF	FALCON 10/100
ATIS P. A. - 4,500' TEMP - 100°F	
V_1 124	WEIGHT 15,500
V_R 126	FLAPS S+ / TRIM 13.4°
$V_{2/REF}$ 127	TAKEOFF N_1:
V_{FR}	CLIMB N_1:
V_{FS}	RWY RQD 6,750 FT.
V_{ENR}	TIME TO 100 KTS
CLEARANCE	

Takeoff Speeds and Nose-Up Attitude, V_R, Attitude, V_2 – Slats-Only

Use the Takeoff Speeds and Nose-Up Attitude chart (**Figure 4-34**) to calculate V_R, attitude, and V_2.

To determine V_R, perform the following.

1. Enter from the bottom of the Rotation speed V_R chart at the take-off weight (*15,500 lbs*).
2. Move up to the reference line.
3. Move left to read the rotation speed (*126 kts*).

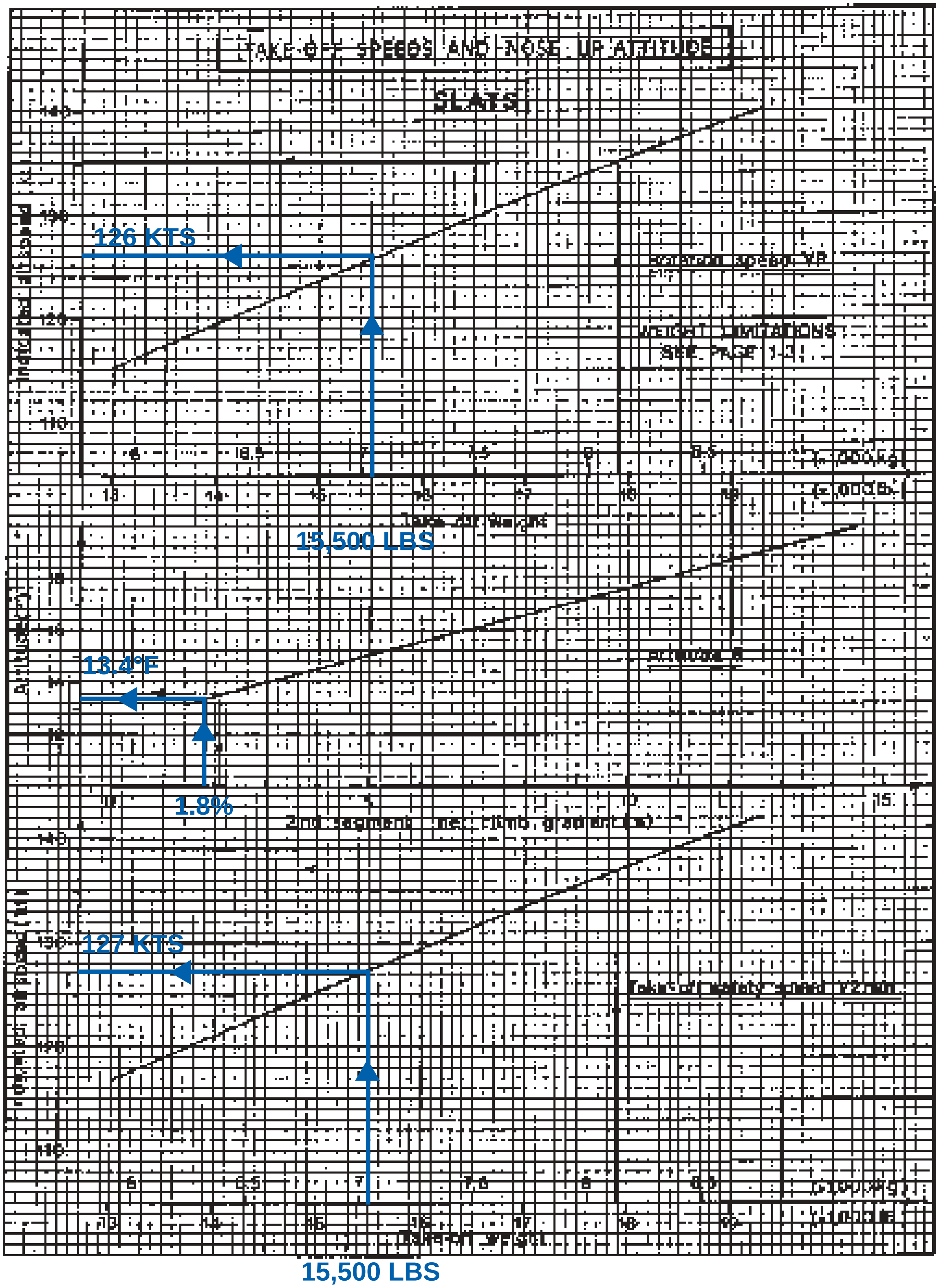
To determine attitude, perform the following.

1. Enter from the bottom of the Attitude chart at the second segment net climb gradient (*1.8%*).
2. Move up to the reference line.
3. Move left to read the Takeoff Pitch Attitude (*13.4°*).

To determine V_2, perform the following.

1. Enter from the bottom of the Take-off safety speed V_2 min chart at the takeoff weight (*15,500 lbs*).
2. Move up to the reference line.
3. Move left to read the takeoff safety speed (*127 kts*).

Takeoff Speeds and Nose-Up Attitude



4-33

> **NOTE**: Two types of tires are available, 190 kt and 180 kt.

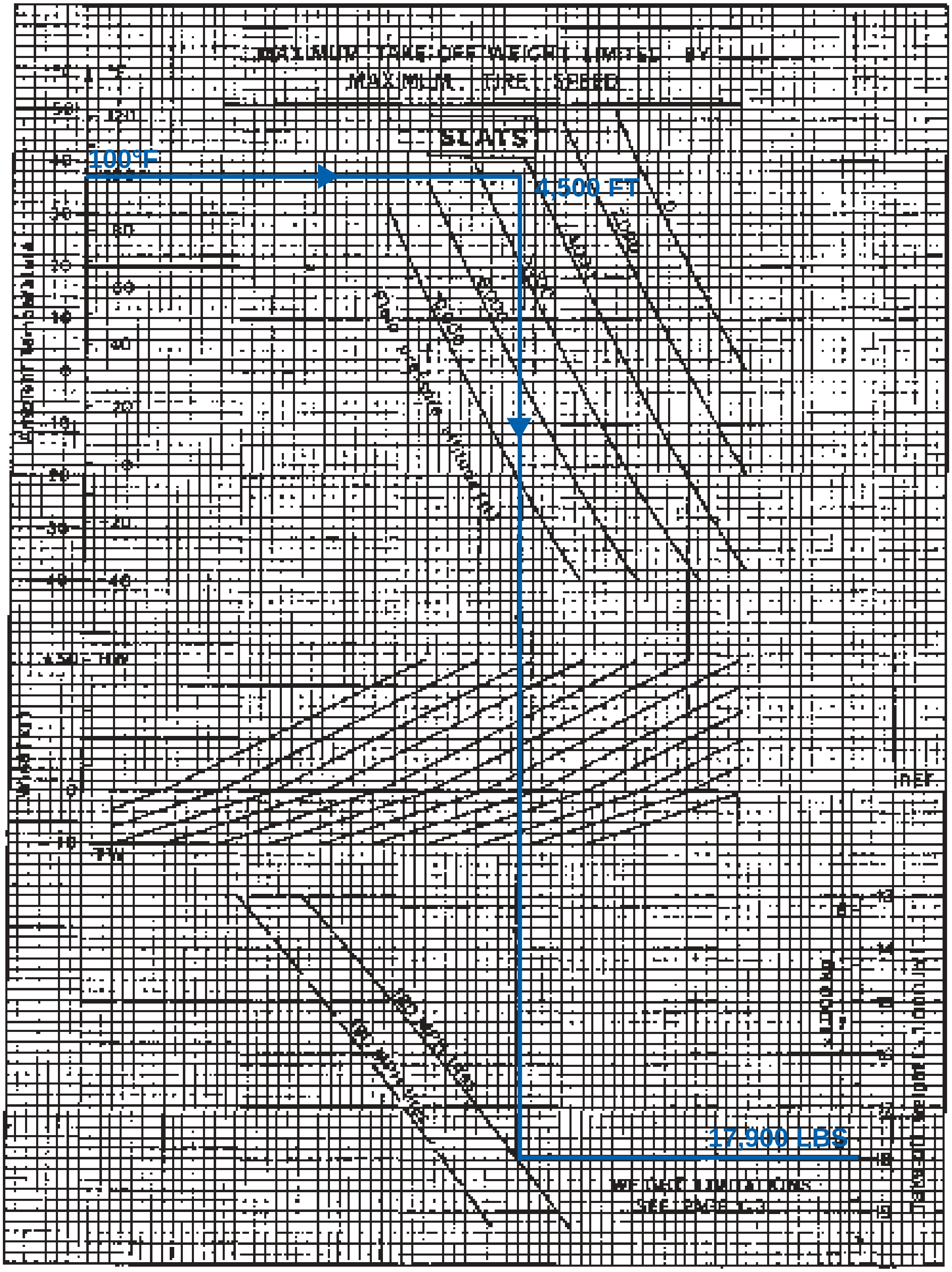
Maximum Tire Speed – Slats-Only

Under certain conditions, tire speed can be very high when using a slats-only takeoff. Use the Maximum Takeoff Weight Limited by Tire Speeds chart (**Figure 4-35**) to ensure these tire speed limits are not exceeded.

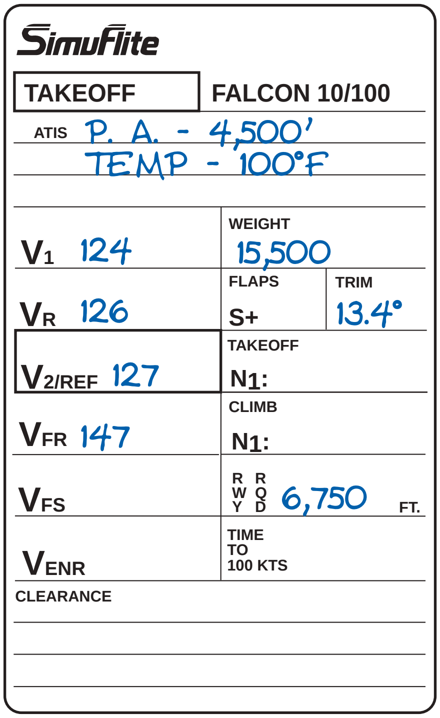
1. Enter from the left at the ambient temperature (*100°F*).
2. Move right to the pressure attitude (*4,500 ft*).
3. Move down to the wind reference line.

   Assume no wind.
4. Move down to the tire speed (*180 mph*) then right to read the maximum weight (*17,900 lbs*).

Maximum Takeoff Weight Limited by Maximum Tire Speed



4-35



SimuFlite

TAKEOFF | FALCON 10/100

ATIS P. A. - 4,500'
TEMP - 100°F

V_1 124 | WEIGHT 15,500

V_R 126 | FLAPS S+ | TRIM 13.4°

$V_{2/REF}$ 127 | TAKEOFF N1:

V_{FR} 147 | CLIMB N1:

V_{FS} | RWY RQD 6,750 FT.

V_{ENR} | TIME TO 100 KTS

CLEARANCE

Clean Wing Speed – Slats-Only

The clean wing speed is a speed at which it is safe to fly without high lift devices extended.

To calculate clean wing speed, take V_2 previously calculated (*127 kts*), and add 20 kts (*127 kts + 20 kts = 147 kts* V_{FR}).

Slats-Only TOLD Card Calculation

After calculating clean wing speed (V_{FR}), all following calculations are the same as for a slats + flaps 15° takeoff. Follow the same steps for:

- final takeoff climb gradient and speed
- enroute climb gradient and speed
- N_1 setting – takeoff thrust
- N_1 setting – climb thrust
- time to 100 kts
- maximum climb N_1 setting
- maximum brake energy speed.

Cruise and Landing Performance

Normal trip planning encompasses climb, cruise, and descent for total time and fuel used. It does not give specific climb, cruise, and descent information. Such information for all-engine climb, cruise, and descent is presented only in the Operating Manual.

Climb Data

Two Engine Flight Planning tables (**Figure 4-36**), one for climb at 260 kts/0.72M and one for climb at 300 kts/0.75M, are organized by altitude, weight, and temperature deviations from ISA.

1. Enter the appropriate chart (*260 kt/0.72M*) for the pressure altitude (*37,000 ft*) from the top with the aircraft weight (*18,000 lbs*).
2. Move down the column to the row of blocks directly across from the temperature (*ISA*) and read the values.

   For this example, the values are:

TAT	*-56.5°C*
RAT	*-37°C*
Time	*16 minutes*
Distance	*97 NM*
Fuel Used	*594 lbs*

Two Engine Flight Planning

Climb 260 kt/.72

NORMAL CLIMB FROM 1,500 ft : TIME (min) - DISTANCE (NM) - FUEL USED (lb)

Pressure Altitude ft	1,500	5,000	10,000	15,000	20,000	25,000	30,000	35,000	40,000	42,000
IAS kt	250	255	260	260	260	260	261	243	217	202

x 1,000 lb

Pressure altitude : 33,000 ft

WEIGHT / Temp	18.5	18	18	17	16	15	14	13	12
ISA + 15°C = -35.4°C RAT -19°C	21 / 140 / 847	21 / 143 / 776	20 / 124 / 647	18 / 108 / 414	16 / 97 / 501	15 / 86 / [illegible]	13 / 77 / 447	12 / 69 / 403	10 / 57 / 343
ISA + 10°C = -40.4°C RAT -18°C	20 / 119 / 690	19 / 114 / 677	17 / 102 / 600	15 / 91 / 560	14 / 82 / 488	13 / 73 / 453	11 / 64 / 408	10 / 55 / 370	9 / 51 / 314
ISA = -50.4°C RAT -30°C	15 / 88 / 573	14 / 82 / 557	13 / 74 / [illegible]	12 / 68 / 464	11 / 61 / 454	10 / 56 / 390	9 / 50 / 353	8 / 46 / 321	7 / 41 / 293
ISA -10°C = -60.4°C RAT -41°C	13 / 66 / 481	12 / 49 / 440	11 / 58 / [illegible]	10 / 54 / 414	9 / 49 / 381	8 / 45 / 356	7 / 41 / 326	7 / 37 / 303	6 / 34 / 284
ISA -15°C = -65.4°C RAT -47°C	11 / 61 / 429	11 / 59 / 457	10 / 49 / 431	9 / 49 / 387	8 / 46 / 366	8 / 42 / 330	7 / 38 / 300	6 / 35 / 282	6 / 32 / 254

35,000 ft

WEIGHT / Temp	18.5	18	18	17	16	15	14	13	12
ISA + 15°C = -39.3°C RAT -19°C	28 / 185 / 927	25 / 175 / 844	24 / 149 / 767	21 / 120 / 676	18 / 112 / 601	16 / 99 / 516	14 / 89 / 463	13 / 79 / 437	11 / 69 / 381
ISA + 10°C = -44.3°C RAT -24°C	23 / 146 / 770	22 / 136 / 758	19 / 119 / 467	17 / 104 / 594	15 / 93 / 530	14 / 83 / 494	12 / 74 / 439	11 / 67 / 400	10 / 49 / 354
ISA = -54.3°C RAT -35°C	16 / 97 / 621	16 / 94 / 604	14 / 89 / 548	13 / 76 / 500	12 / 69 / 455	11 / 62 / 416	10 / 56 / 370	9 / 51 / 348	8 / 45 / 310
ISA -10°C = -64.3°C RAT -45°C	13 / 75 / 557	13 / 79 / 526	13 / 66 / 488	11 / 60 / 441	10 / 53 / 404	9 / 50 / 371	8 / 44 / 330	7 / 41 / 300	7 / 37 / 280
ISA -15°C = -69.3°C RAT -51°C	12 / 68 / 511	12 / 64 / 480	11 / 60 / 480	10 / 55 / 423	9 / 51 / 390	8 / 46 / 310	8 / 42 / 334	7 / 39 / 307	6 / 35 / 270

Pressure altitude : 37,000 ft

WEIGHT / Temp	18.5	18	18	17	16	15	14	13	12
ISA + 15°C = -41.5°C RAT -20°C			30 / 183 / 827	26 / 155 / 754	21 / 135 / 642	18 / 114 / 584	16 / 100 / 530	14 / 88 / 480	13 / 77 / 410
ISA + 10°C = -46.5°C RAT -26°C	28 / 174 / 883	26 / 166 / 892	23 / 148 / 742	20 / 123 / 694	17 / 107 / 646	15 / 94 / 524	14 / 80 / 474	12 / 70 / 422	11 / 66 / 378
ISA = -56.5°C RAT -37°C	19 / 112 / 843	18 / 107 / 660	16 / 97 / 594	15 / 86 / 530	13 / 77 / 487	12 / 70 / 449	11 / 61 / 401	10 / 56 / 361	9 / 51 / 330
ISA -10°C = -66.5°C RAT -48°C	15 / 85 / 600	14 / 83 / 544	13 / 74 / 519	12 / 63 / 470	11 / 61 / 430	10 / 55 / 391	9 / 54 / 354	8 / 46 / 326	7 / 41 / 295
ISA -15°C = -71.5°C RAT -53°C	14 / 72 / 546	13 / 74 / 504	12 / 67 / 480	11 / 61 / 440	10 / 56 / 410	9 / 51 / 376	8 / 46 / 342	8 / 42 / 310	7 / 38 / 284

39,000 ft

WEIGHT / Temp	18.5	18	18	17	16	15	14	13	12
ISA + 15°C = -41.5°C RAT -21°C					26 / 169 / 744	22 / 148 / 550	19 / 118 / 574	16 / 143 / 500	14 / 88 / 457
ISA + 10°C = -46.5°C RAT -26°C			30 / 189 / 916	24 / 115 / 766	21 / 130 / 656	18 / 112 / 576	16 / 94 / 513	14 / 88 / 456	12 / 75 / 408
ISA = -56.5°C RAT -37°C	26 / 156 / 424	23 / 144 / 775	18 / 118 / 645	17 / 103 / 601	15 / 94 / 500	13 / 88 / 477	12 / 72 / 433	11 / 64 / 400	10 / 57 / 359
ISA -10°C = -66.5°C RAT -48°C	16 / 105 / 451	17 / 100 / 427	15 / 87 / 564	13 / 78 / 500	12 / 79 / 462	11 / 63 / 430	10 / 57 / 382	9 / 51 / 344	8 / 46 / 313
ISA -15°C = -71.5°C RAT -57°C	14 / 93 / 604	15 / 88 / 584	14 / 79 / 530	13 / 74 / 482	11 / 68 / 434	10 / 57 / 461	9 / 53 / 346	8 / 47 / 317	7 / 42 / 290

Colored area indicates abnormal operations, to be used for interpolation purpose only.

4-36

Cruise Data

Use data tables for detailed flight planning or enroute performance verification.

Data tables for all four normal cruise modes (i.e., long range, indicated 0.75M, indicated 0.80M, and maximum cruise thrust) are in the OIM.

The engine RPM, TAS, and RAT, and fuel flow are verified against indicated and trip planning values. Use the specific fuel consumption or fuel flow to estimate required fuel for the remaining cruise; specific fuel consumption provides more accurate information, but is more difficult to use.

Use the Two Engine Operating Chart: Mi = .80 (**Figure 4-37**) from the Operational Instructions Manual. Note that, as the trip progresses, the aircraft gross weight decreases to 15,000 lbs.

1. Enter the chart from the pressure altitude (*37,000 ft*) at the top with the aircraft weight (*15,000 lbs*).
2. Move down the column to the row of blocks directly across from the temperature and read the values.

   For this example, the values are:

TAT	*-56.5°C*
RAT	*-33°C*
TAS	*454 kts*
N_1 RPM	*94.1%*
Fuel Flow	*620 PPH*
NM per lb	*0.365*

Two Engine Operating

Indicated Mach .80

SPECIFIC RANGE (NM/lb) – TAS (kt) – RPM % – FUEL FLOW (lb/hr)

Pressure altitude : 31,000 ft

TEMP.	WEIGHT x1,000 lb	19	18	17	16	15	14	13	12
	NM/lb	.28[illegible]	.292	.29[illegible]	.30[illegible]	.309	.316	.320	.325
ISA – 10°C = –54.4°C RAT –33°C	TAS (kt) / RPM / F/F lb/hr	454 / 93.3 / 790	454 / 92.8 / 775	454 / 92.5 / 760	454 / 92.1 / 750	454 / 91.7 / 736	454 / 91.1 / 720	454 / 91.0 / 710	454 / 90.7 / 700
ISA = –44.4°C RAT –22°C	TAS (kt) / RPM / F/F lb/hr	464 / 95.[illegible] / 810	464 / 95.0 / 795	464 / 94.6 / 780	464 / 94.2 / 765	464 / 93.8 / 750	464 / 93.4 / 735	464 / 93.0 / 725	464 / 92.7 / 716
ISA + 10°C = –34.4°C RAT –11°C	TAS (kt) / RPM / F/F lb/hr	[illegible]	[illegible]	474 / 96.4 / 790	474 / 96.1 / 780	474 / 95.6 / 765	474 / 95.4 / 750	474 / 95.1 / 740	474 / 94.7 / 730

33,000 ft

TEMP.		19	18	17	16	15	14	13	12
	NM/lb	.300	.307	.314	.321	.328	.335	.342	.348
ISA – 10°C = –60.4°C RAT –53°C	TAS (kt) / RPM / F/F lb/hr	450 / 93.[illegible] / 750	450 / 92.9 / 730	450 / 91.4 / 715	450 / 92.0 / 700	450 / 91.5 / 685	450 / [illegible] / 670	450 / 90.7 / 655	450 / 90.3 / 645
ISA = –50.4°C RAT –30°C	TAS (kt) / RPM / F/F lb/hr	460 / 95.6 / 745	460 / 95.1 / 750	460 / 94.6 / 730	460 / 94.1 / 715	460 / 93.6 / 700	460 / 93.2 / 685	460 / 92.8 / 670	460 / 92.4 / 660
ISA + 10°C = –40.4°C RAT –18°C	TAS (kt) / RPM / F/F lb/hr	[illegible]	[illegible]	470 / 96.7 / 730	470 / 96.2 / 720	470 / 95.7 / 710	470 / 95.3 / 700	470 / 94.8 / 690	470 / 94.4 / 675

Pressure altitude : 35,000 ft

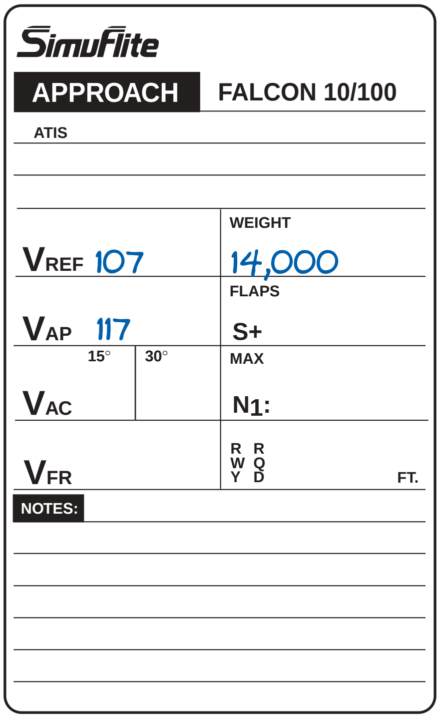
TEMP.		19	18	17	16	15	14	13	12
	NM/lb	.312	.321	.33[illegible]	.33[illegible]	.34[illegible]	.355	.365	.37[illegible]
ISA – 10°C = –64.3°C RAT –42°C	TAS (kt) / RPM / F/F lb/hr	445 / 93.6 / 715	445 / 93.4 / 695	445 / 92.5 / 675	445 / 91.8 / 660	445 / 91.4 / 650	445 / 90.9 / 635	445 / 90.4 / 620	445 / 89.8 / 605
ISA = –54.3°C RAT –31°C	TAS (kt) / RPM / F/F lb/hr	456 / 95.3 / 730	456 / 95.[illegible] / 710	456 / 95.1 / 690	456 / 94.1 / 670	456 / 94.6 / 655	456 / 93.0 / 640	456 / 93.6 / 625	456 / 92.[illegible] / 610
ISA + 10°C = –44.3°C RAT –19°C	TAS (kt) / RPM / F/F lb/hr	[illegible]	[illegible]	466 / 96.4 / 705	466 / 96.[illegible] / 685	466 / 95.[illegible] / 670	466 / 95.1 / 655	466 / 94.[illegible] / 640	466 / 94.[illegible] / 625

37,000 ft

TEMP.		19	18	17	16	15	14	13	12
	NM/lb	.332	.342	.34[illegible]	.354	.36[illegible]	.37[illegible]	.38[illegible]	.39[illegible]
ISA – 10°C = –66.5°C RAT –44°C	TAS (kt) / RPM / F/F lb/hr	443 / 94.5 / 680	443 / 93.9 / 665	443 / 93.1 / 650	443 / 92.5 / 635	443 / 91.9 / 620	443 / 91.[illegible] / 600	443 / 90.7 / 575	443 / 90.2 / 560
ISA = –56.5°C RAT –33°C	TAS (kt) / RPM / F/F lb/hr	[illegible]	454 / 95.[illegible] / 580	454 / 95.[illegible] / 560	454 / 94.[illegible] / 640	454 / 94.1 / 620	454 / 93.5 / 605	454 / 92.9 / 590	454 / 92.4 / 575
ISA + 10°C = –46.5°C RAT –22°C	TAS (kt) / RPM / F/F lb/hr	[illegible]	[illegible]	[illegible]	466 / 96.[illegible] / 655	466 / 95.7 / 635	466 / 95.6 / 620	466 / 95.0 / 600	466 / 94.5 / 585

Colored area indicates abnormal operations,
to be used for interpolation purpose only.

4-37



Descent Data

Use the Two-Engine Operating Normal Descent Mi .80/320 kt chart (**Figure 4-38**) for detailed flight planning and to verify the descent point in flight. The chart is based on descent at 85% N_1 and power settings that maintain a 500 lb/hr fuel flow for the remainder of descent.

Assume the flight weight is about 14,500 lbs near the descent point.

1. Enter the chart at aircraft weight (*14,500 lbs*).

   Use the columns for 14,000 and 15,000 lbs and interpolate.

2. Move down to the appropriate pressure altitude (*37,000 ft*). Interpolate between columns if necessary. Read the values at the intersection.

   The values for this example are:

	15,000 lbs	*14,000 lbs*	*Interpolation*
Time (Min)	*17*	*16*	*17*
Distance (NM)	*106*	*102*	*104*
Fuel Used (Lbs)	*259*	*250*	*255*

3. Compute the landing weight by subtracting the descent fuel from the weight at the beginning of descent (*14,500 - 255 = 14,245*).

V_{REF}/V_{AP} Speed Computations

Determine V_{REF} from the applicable Landing Speeds chart (**Figure 4-39**). The V_{AP} is equal to V_{REF} plus wind correction, with a minimum value of 10 kts.

1. Enter the chart from the bottom with the landing weight (*14,000 lbs*). Move up to intersect the diagonal reference line.

2. Move left to the edge of the chart and read the value for V_{REF} flaps 52° (*107 kts*).

   The wind is calm, thus V_{AP} is V_{REF} + 10 kts, or 117 kts.

Two Engine Operating

Normal Descent Mi .80/320 Kt

NORMAL DESCENT TO 1,500 ft • TIME (min) • DISTANCE (NM) • FUEL USED (lb)

DESCENT SPEED

Pressure Altitude ft	43,000	40,000	35,000	30,000	25,000	20,000	15,000	10,000	5,000	1,500
IAS kt	228	244	270	[illegible]	322	322	321	320	320	150

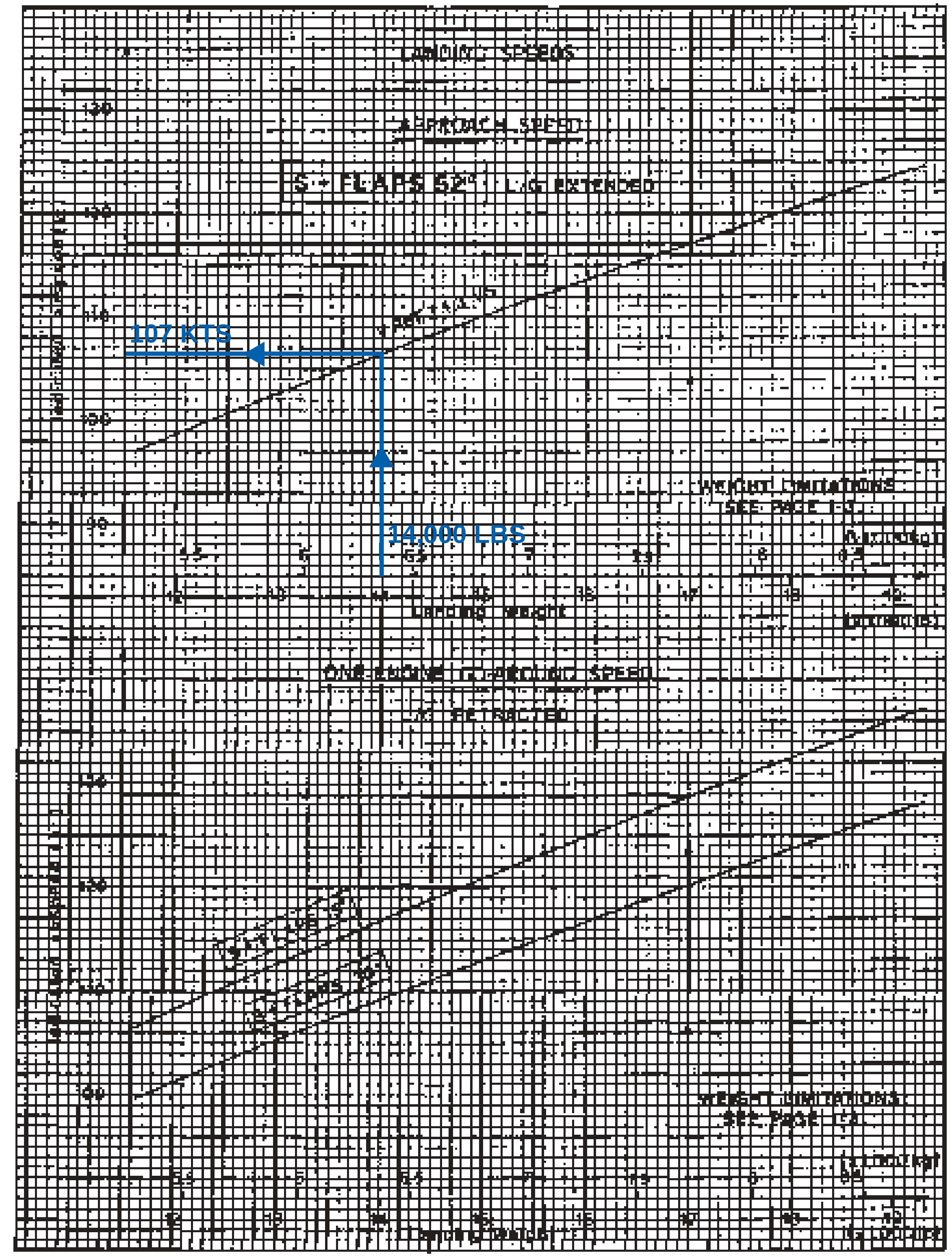
Thrust setting N1 = [illegible] %, F/F = 500 lb/hr below 20,000 ft

Weight x 1,000 lb / Altitude ft	19	18	17	16	15	14	13	12	11
43,000				20 136 308	21 127 292	15 120 282	15 119 273	15 115 261	17 109 248
41,000	[illegible] 131 308	[illegible] 128 305	[illegible] 126 298	19 124 290	15 120 282	15 117 273	16 112 263	17 107 250	16 102 237
39,000	19 124 298	17 122 293	19 118 287	18 117 279	18 113 271	17 109 262	17 106 251	14 100 239	15 96 227
37,000	16 [illegible] 287	16 [illegible] 282	16 [illegible] 276	17 [illegible] 268	[illegible] 104 259	16 102 250	16 98 240	15 93 228	14 88 216
35,000	16 111 276	[illegible] 109 271	[illegible] 106 265	17 103 257	[illegible] 100 248	14 98 239	15 92 228	14 87 218	[illegible] 82 205
33,000	17 105 268	17 103 260	16 100 252	16 97 248	15 94 237	15 90 233	14 86 219	13 82 207	13 77 193
31,000	15 98 253	12 97 248	17 98 242	15 91 234	[illegible] 88 226	16 85 217	13 85 208	13 76 197	12 72 185
29,000	15 93 241	15 91 236	15 88 230	15 86 233	14 82 216	13 79 207	13 76 198	12 72 185	12 67 176
27,000	15 88 228	15 86 225	14 83 219	14 81 212	13 79 205	13 75 197	12 71 188	12 67 178	11 63 168
25,000	14 81 217	16 79 214	15 77 205	13 75 199	13 73 192	12 69 184	12 66 177	11 63 167	10 58 157
23,000	13 78 200	15 73 196	13 71 191	12 68 188	[illegible] 68 179	11 61 172	[illegible] 60 165	10 57 156	10 54 147
21,000	13 68 187	[illegible] 66 181	12 64 177	11 67 171	[illegible] 60 165	11 58 158	10 55 152	10 52 144	9 48 138
19,000	11 61 178	11 60 164	[illegible] 58 162	10 56 157	10 54 152	13 53 146	5 50 140	9 47 133	8 44 125
17,000	10 55 155	10 54 152	10 52 148	10 51 144	5 48 138	9 47 134	3 46 128	8 45 122	4 40 115
15,000	5 49 140	5 48 138	3 47 135	4 45 130	9 44 126	8 42 122	6 40 117	8 38 111	[illegible] 34 109
13,000	8 43 125	8 42 123	8 41 121	8 40 117	8 39 113	8 37 109	7 36 105	7 34 100	[illegible] 32 95
11,000	3 37 110	[illegible] 37 109	[illegible] 36 107	7 35 103	7 34 100	[illegible] 33 97	[illegible] 31 94	6 30 88	4 28 85
9,000	[illegible] 32 95	[illegible] 31 94	6 31 93	4 30 90	6 29 87	6 28 85	6 27 83	5 26 78	5 26 74
7,000	6 26 79	6 25 78	[illegible] 25 78	6 25 76	5 24 76	5 24 72	5 23 70	5 22 67	5 21 64
5,000	5 21 68	5 20 64	5 20 63	5 20 62	5 21 61	3 19 60	4 19 59	4 18 56	4 17 55

4-38

Allowable chart for all conditions of temperature.

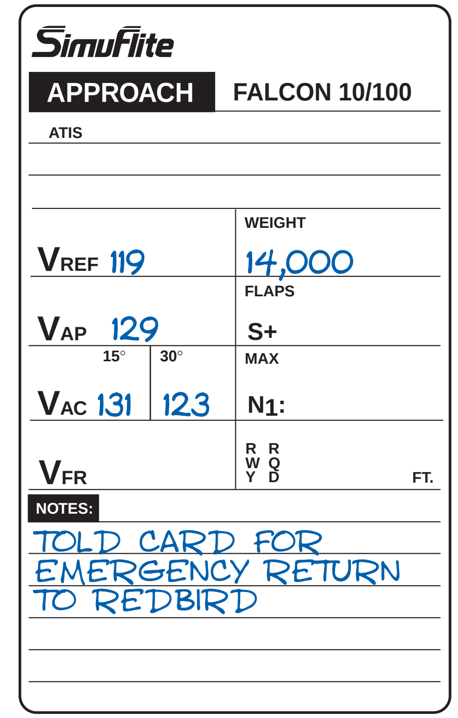
Landing Speeds



4-39

Two Engine Operating

Landing Speeds



Approach Climb Gradient/Speed

The following example is for illustration only and is not a part of the ongoing example.

Assume an engine fails after takeoff from Dallas Redbird Airport. The fuel used in returning to the airport is approximately 400 lbs, and the resulting landing weight is 17,700 lbs.

Using the One Engine Inoperative Approach Climb Gradient chart (**Figure 4-40**), determine the approach climb gradient slats + flaps 30°.

1. Enter the chart from the left at the ambient temperature (*90°F*). Move right to pressure altitude (*500 ft*), then down to the reference line.
2. Enter from the left at the aircraft weight (*17,700*) and move right across the weight guidelines.
3. Continue the temperature/altitude line from the reference line, paralleling the weight guidelines to intersect the weight line.
4. Move down to read the gross climb gradient (*1.2%*).

   The minimum gross climb gradient is 2.1%. The gradient at this weight and condition is insufficient to meet the minimum required; however, changing the configuration to slats + flaps 15° may increase performance.

Use the One Engine Inoperative Approach Climb Gradient/Slats + Flaps 15° chart (**Figure 4-41**) to determine the gradient and speed.

1. Enter the chart from the left at the ambient temperature *(90°F)* and move right to the pressure altitude (*500 ft)*. Then move down to the reference line.
2. Enter from the left at the gross weight (*17,700 lbs*), and move right across the weight guidelines.
3. Continue the temperature/altitude line from the reference line, paralleling the weight guidelines to intersect the gross weight line; move down to read the gross climb gradient (*3.6%*).

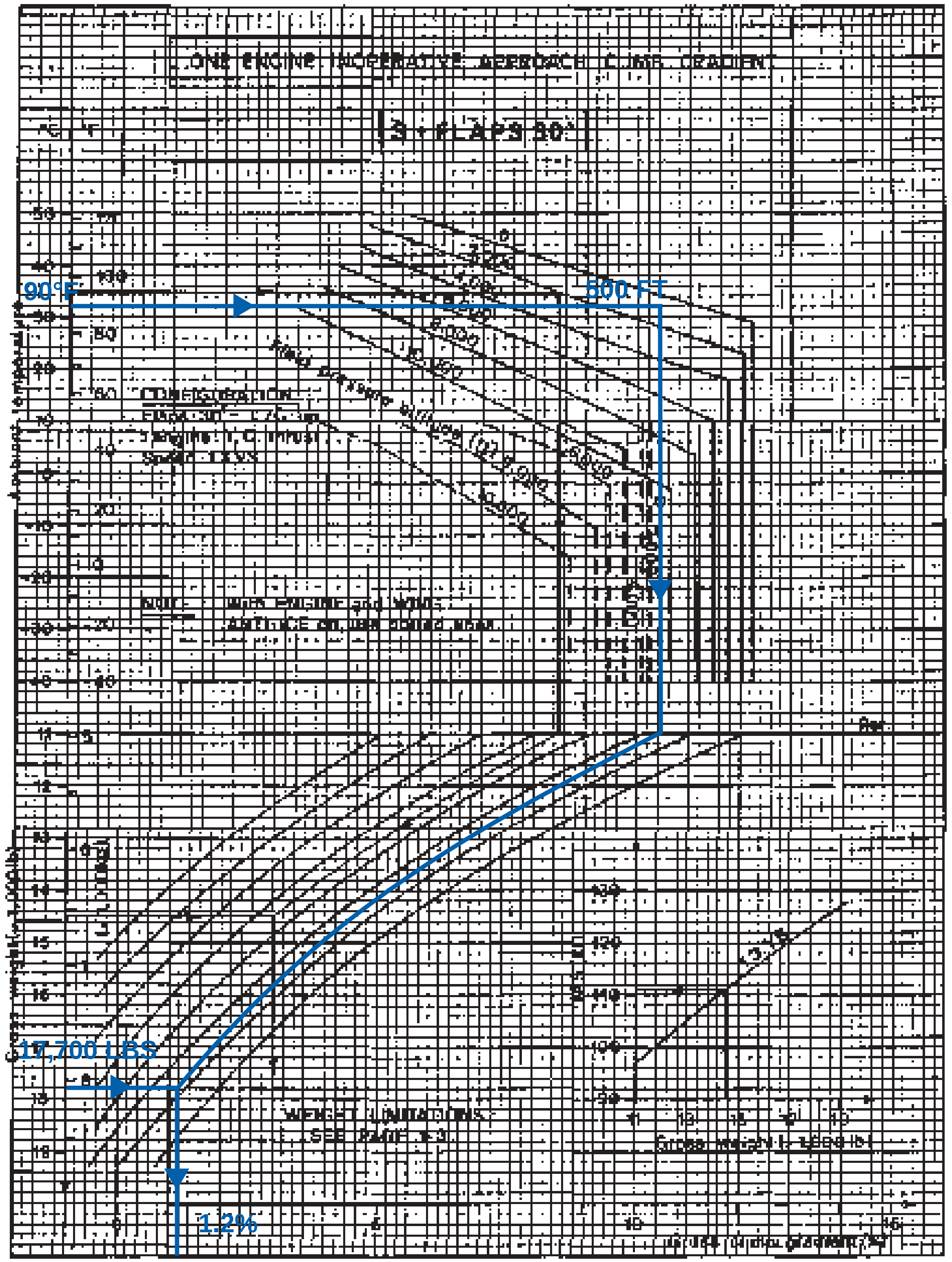
   By retracting the flaps from 30° to 15°, the climb gradient increases 2.4%, three times the climb gradient at 30° flaps or 1.2%.

Calculate the approach climb speed by using the small chart on the lower right side.

1. Enter from the bottom at the gross weight *(17,700 lbs)* and move up to the 1.35 V_S line, then left to read V_{AC}, slats + flaps 15° (*131 kts*).

One Engine Inoperative Approach Climb Gradient

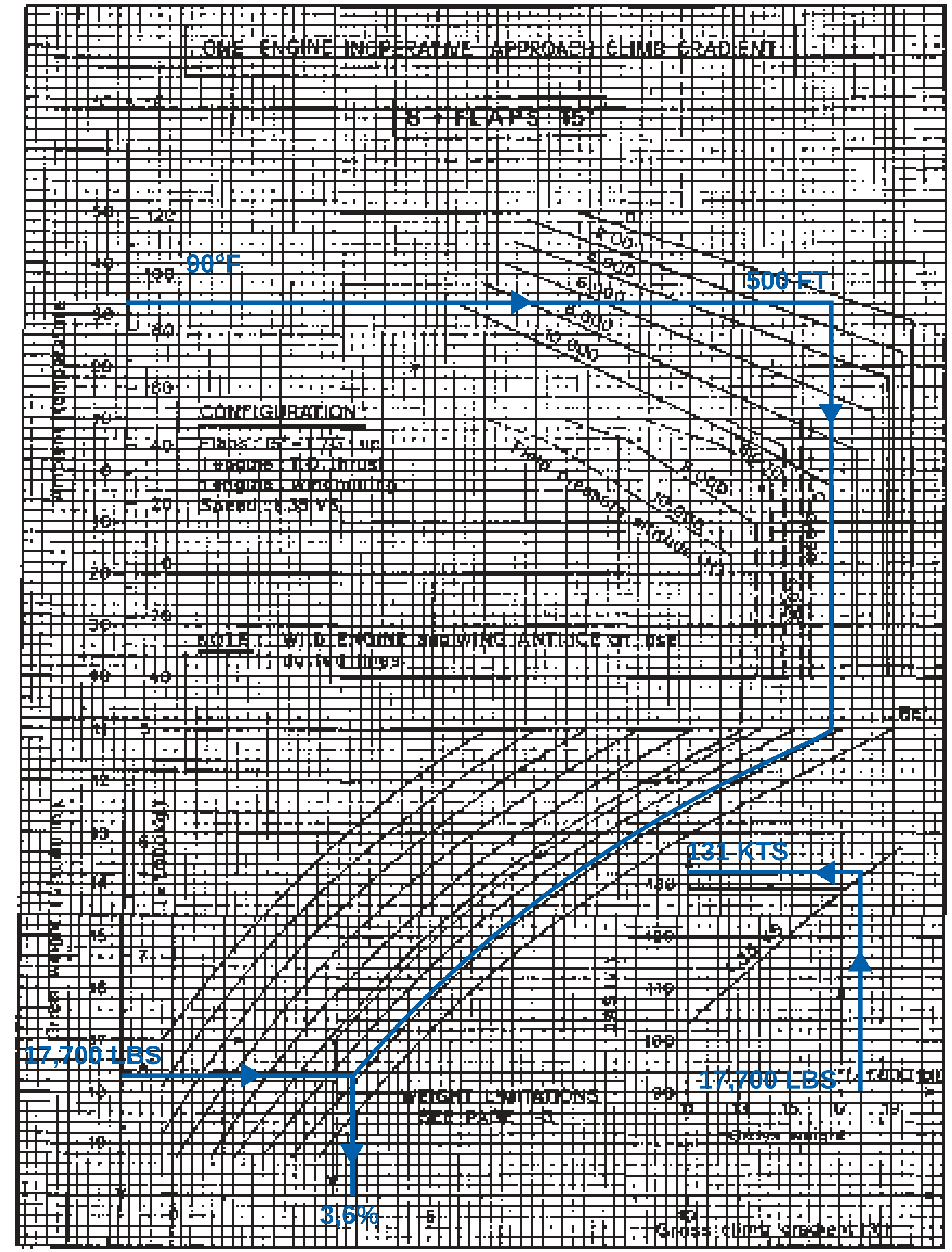
S + Flaps 30°



4-40

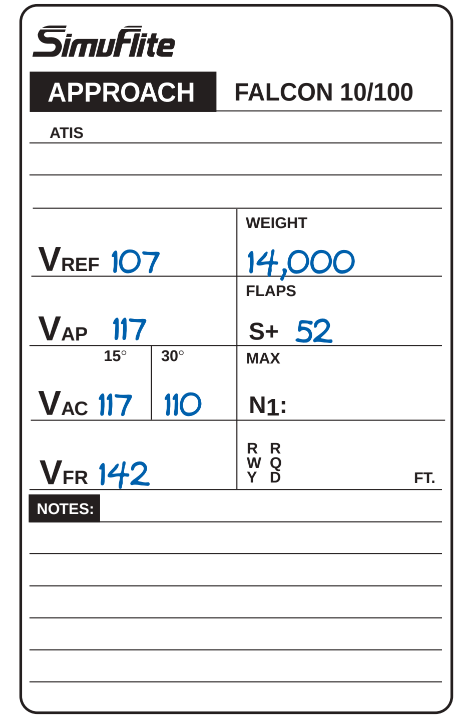
One Engine Inoperative Approach Climb Gradient

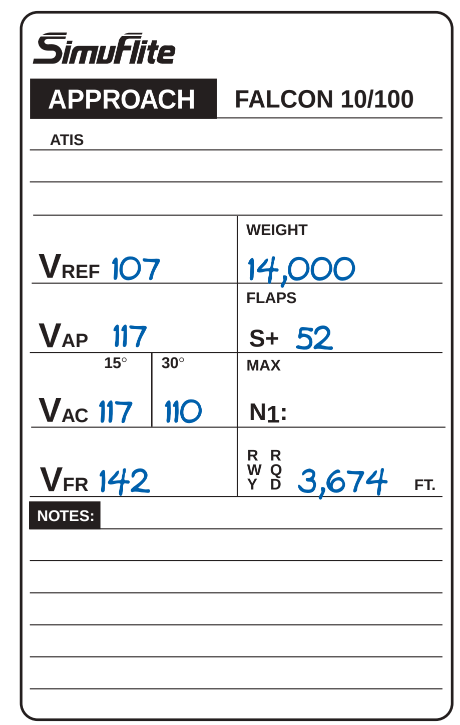
S + Flaps 15°



4-41

One Engine Inoperative Approach Climb Gradient





Missed Approach/Go Around Clean Wing Speed

Calculate, as previously discussed, the minimum speed at which the slats and flaps can be retracted after a missed approach or go-around maneuver.

V_2 *slats + flaps 15° + 35 kts =* V_{FR}. Generally, V_{REF} is within one or two knots of V_2 for the same condition; in this case, add 35 kts to V_{REF} to find V_{FR}.

V_2 - S+F 15 at 14,000 lbs = 108
V_{REF} at 14,000 lbs = 107
107 + 35 = 142 V_{FR}

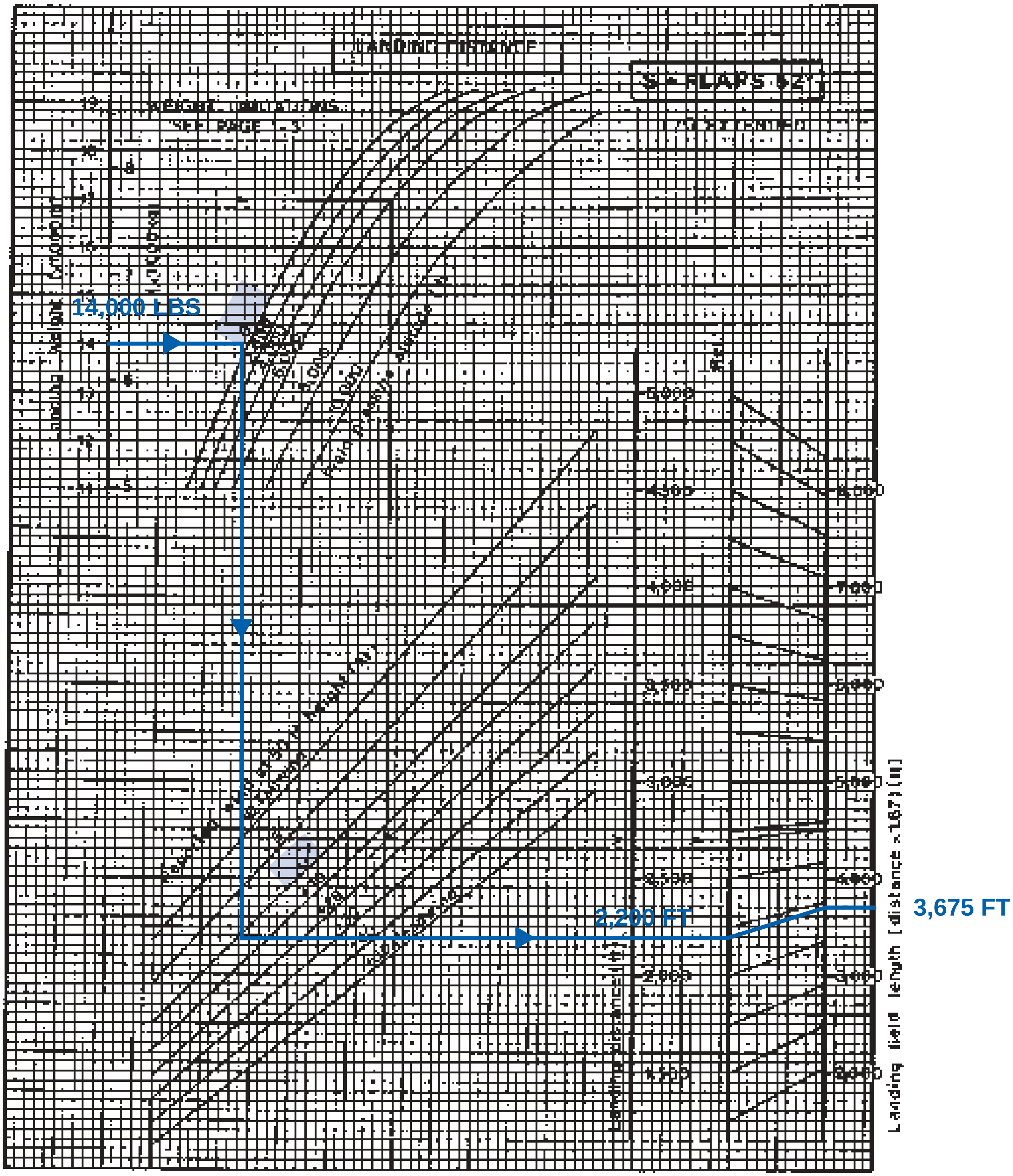
Landing Distance

To determine landing distance, use the Landing Distance S + Flaps 52° chart (**Figure 4-42**).

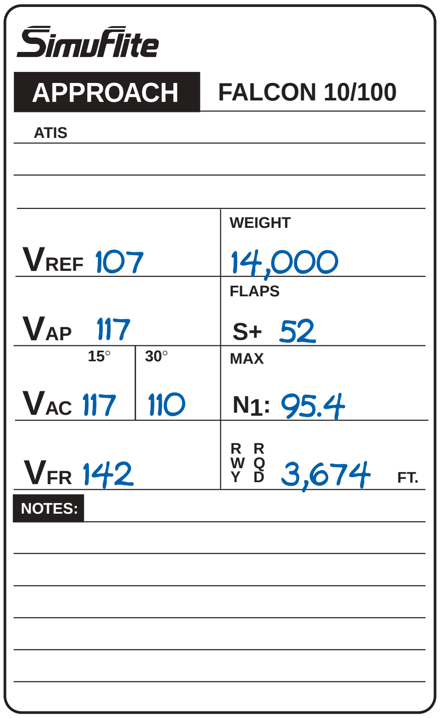
1. Enter the chart from the left with the landing weight (*14,000 lbs*). Move right to intersect the pressure altitude (*0 ft*).
2. Move down to intersect the wind (*0 kts*). From the intersection, move right to the landing distance scale. Read the landing distance (*2,200 ft*).
3. To convert the landing distance to landing field length, multiply landing distance by 1.67 (*2,200 ft X 1.67 = 3,674 ft*), or continue to move the line right to the reference line. Parallel the guidelines to the edge of the chart, and read the landing field length value (*3,675 ft*).

Landing Distance

S + Flaps 52°



4-42



N_1 Setting – Missed Approach or Go Around

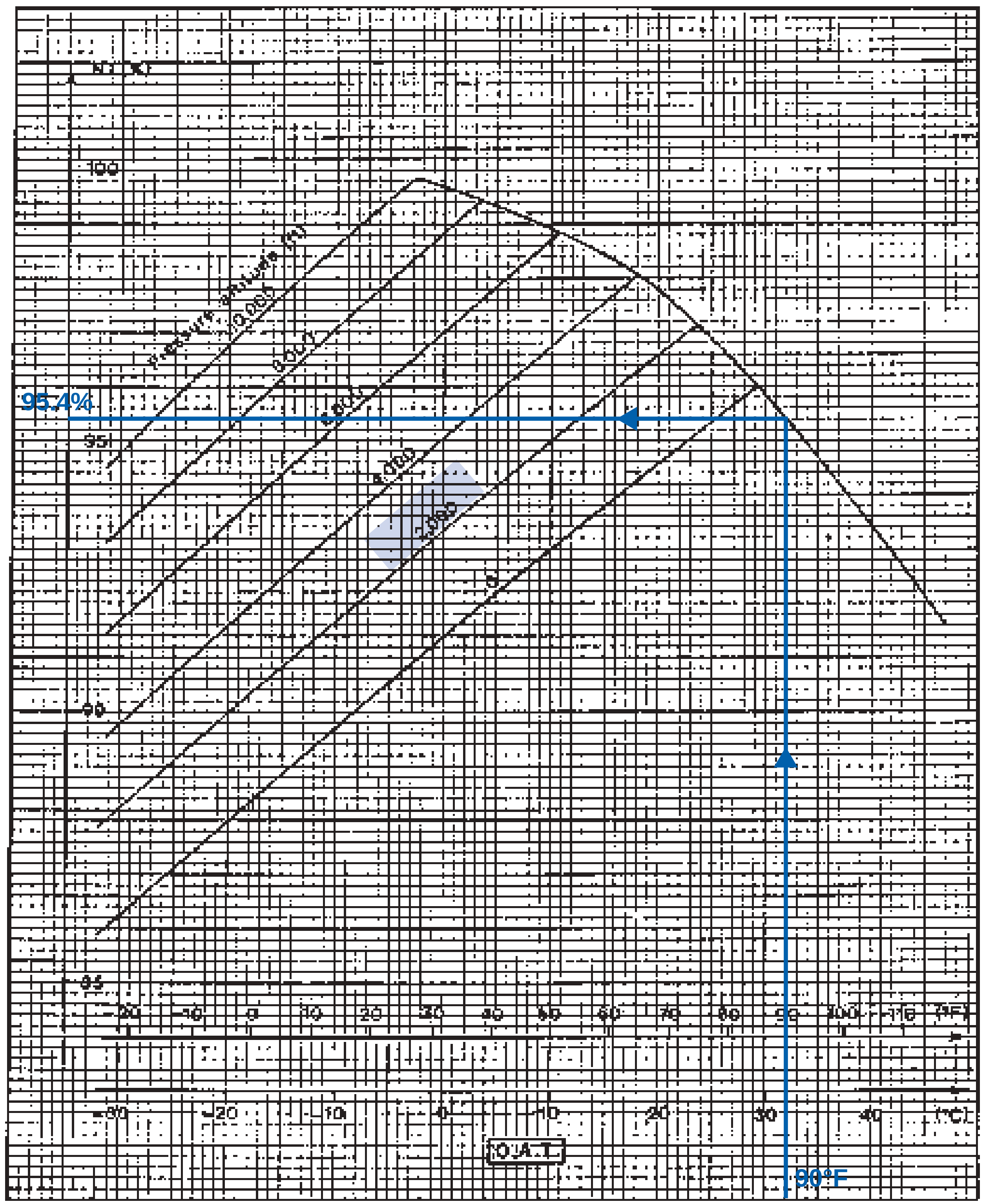
Find missed approach/go around thrust settings by using the Takeoff Thrust Setting chart (**Figure 4-43**) or Takeoff Thrust Setting with Wing and Engine Anti-Ice chart (**Figure 4-44**), depending on the condition.

1. For this example, anti-ice is not needed. Enter the chart (**Figure 4-43**) from the bottom at the OAT (*90°F*).
2. Move up to the pressure altitude or limit line, whichever is reached first.
3. Move left to read N_1 (*95.4%*).

   For illustration only, refer to **Figure 4-44**. *With 0°C and 2,000 ft pressure altitude given on the chart for thrust with wing and engine anti-ice, N_1 is 91.8%.*

Thrust Setting

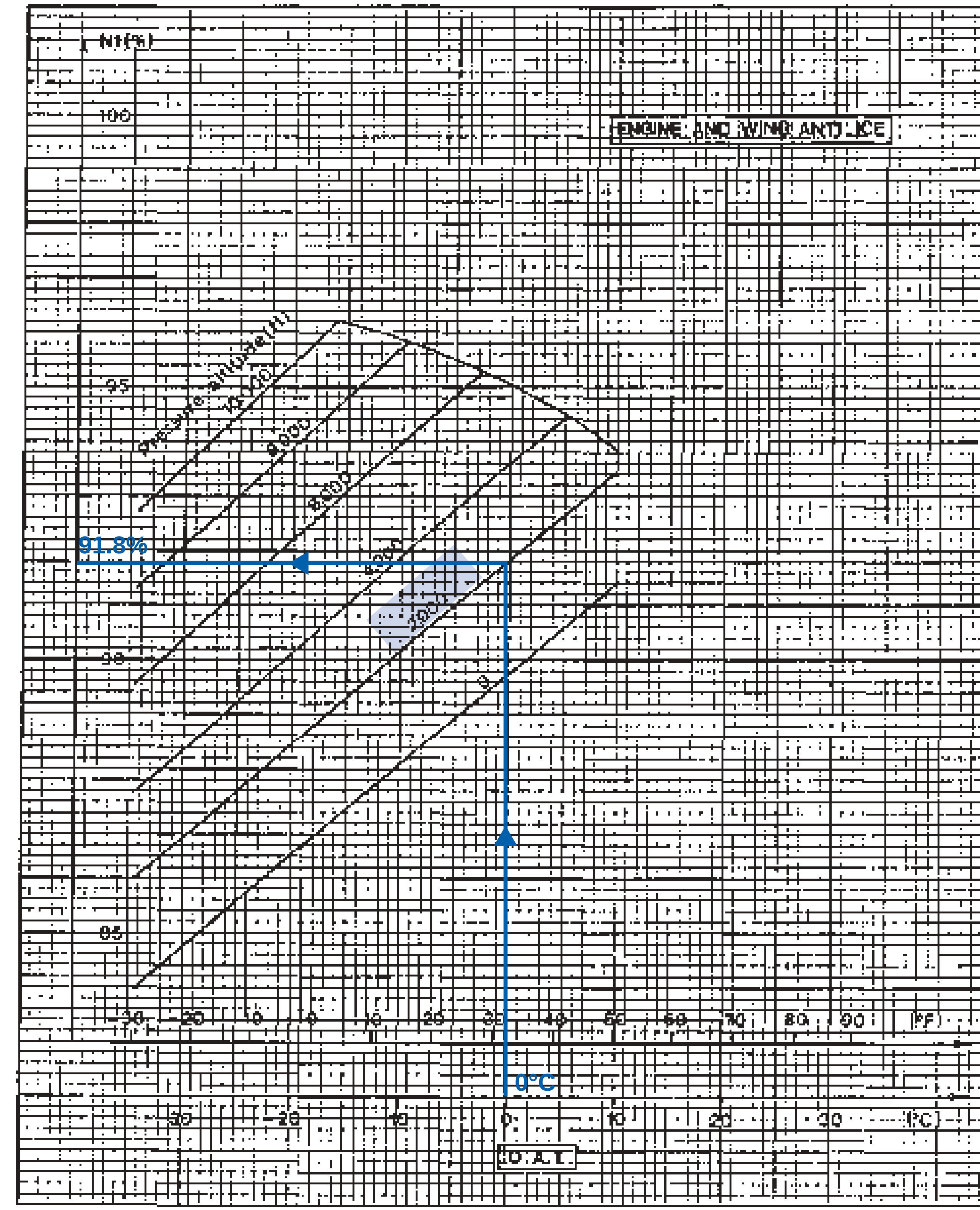
Takeoff



4-43

Thrust Setting

Takeoff/Engine and Wing Anti-Ice



4-44

Thrust Setting

Supplemental Information

The supplemental information section addresses specific situations other than normal routines presented elsewhere in this chapter. These procedures apply to unusual situations and should not be confused with normal performance procedures.

There is no relationship between the information computed in the previous example and the information exhibited on the following pages. Consider each subject independently, based on the data given.

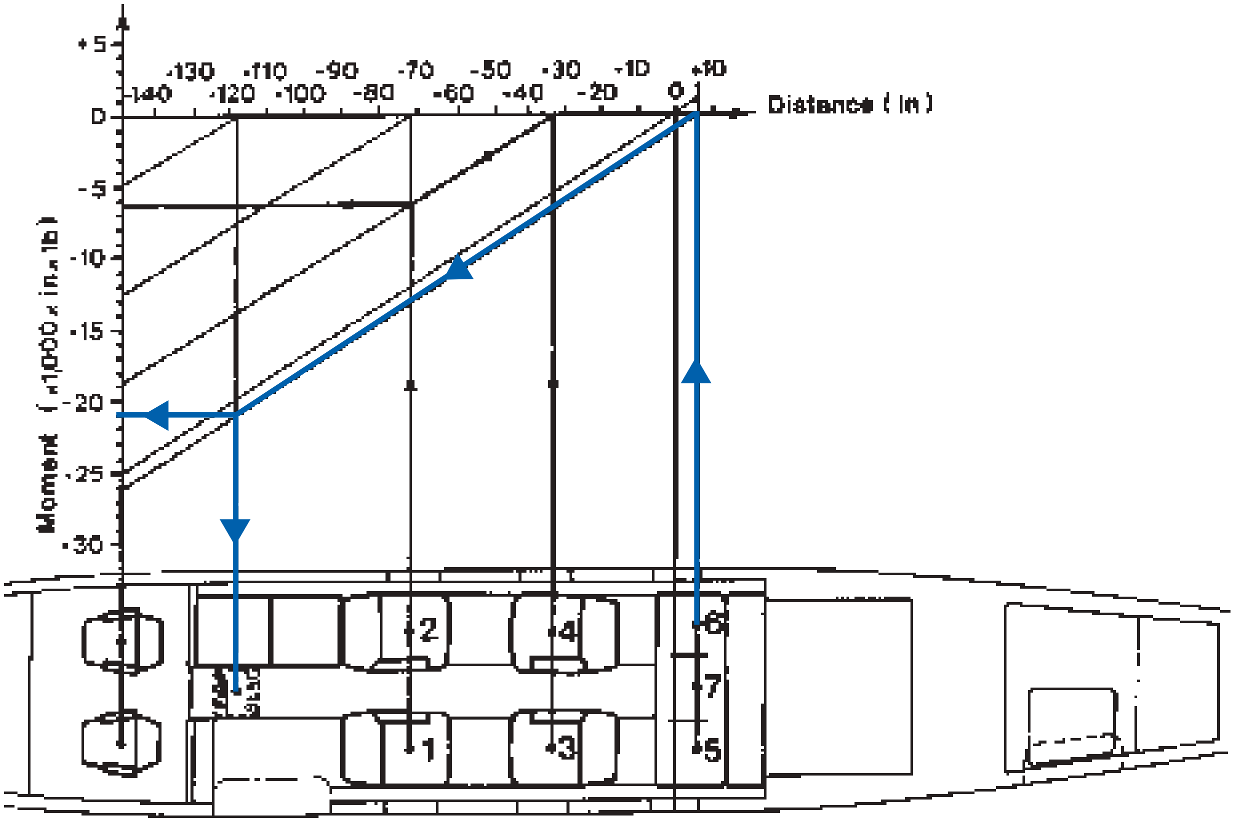
Adjustment of Weight and Balance

Sometimes it is necessary to adjust balance calculation when a passenger or cargo moves from the planned position to an alternate position.

*In the example, a passenger weighing 165 lbs moves from seat 6 to the jump seat. This forward movement causes the moment to become negative. Use the Moment Change chart (U.S. Units) (***Figure 4-45***):*

1. From the previous position (*seat 6*), move up to read the moment change (*+10 inches aft of datum*).
2. Follow, or parallel, the guidelines down and left to the vertical line extending from the new position (*jump seat*).
3. From that intersection move left and read the change in moment (*21,400 in/lb*).
4. Add the change (-*21,400*) to the initial moment and calculate the new CG.

Moment of Change



4-45

Obstacle Clearance

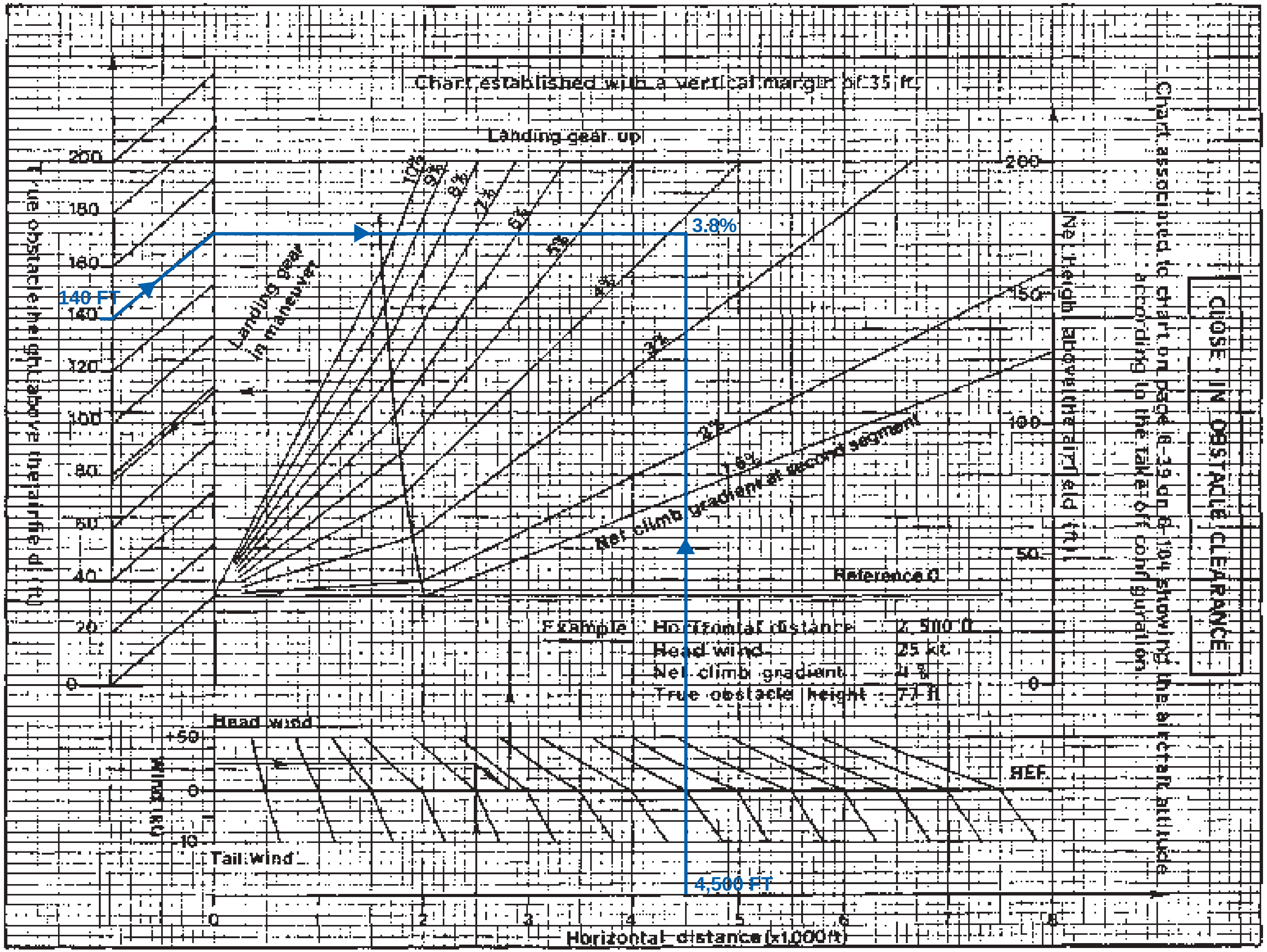
Obstacle clearance calculations depend on the distance from the point of liftoff to the top of the obstacle. Two charts, one for close-in obstacle and one for distant obstacle clearance, calculate in percentage the net climb gradient required to clear the obstacle by 35 ft. This percentage is used on a climb gradient chart to find the maximum weight for this climb under current airport conditions.

Use the Close-In Obstacle Clearance chart (**Figure 4-46**) to calculate the climb gradient necessary to clear the obstacle in the flight path.

1. Enter from the left at the obstacle's height (*140 ft*) and parallel the clearance guideline to the reference line, then continue right across the chart.
2. Enter the chart from the bottom at the obstacle's distance from reference zero (*4,500 ft*), and move up to the wind reference line.

   Assume no wind.
3. Continue up to intersect the height line and read the net climb gradient required (*3.8%*).
4. Go to the Takeoff Climb – 2nd Segment chart in the AFM to find the maximum gross weight.

Close-In Obstacle Clearance



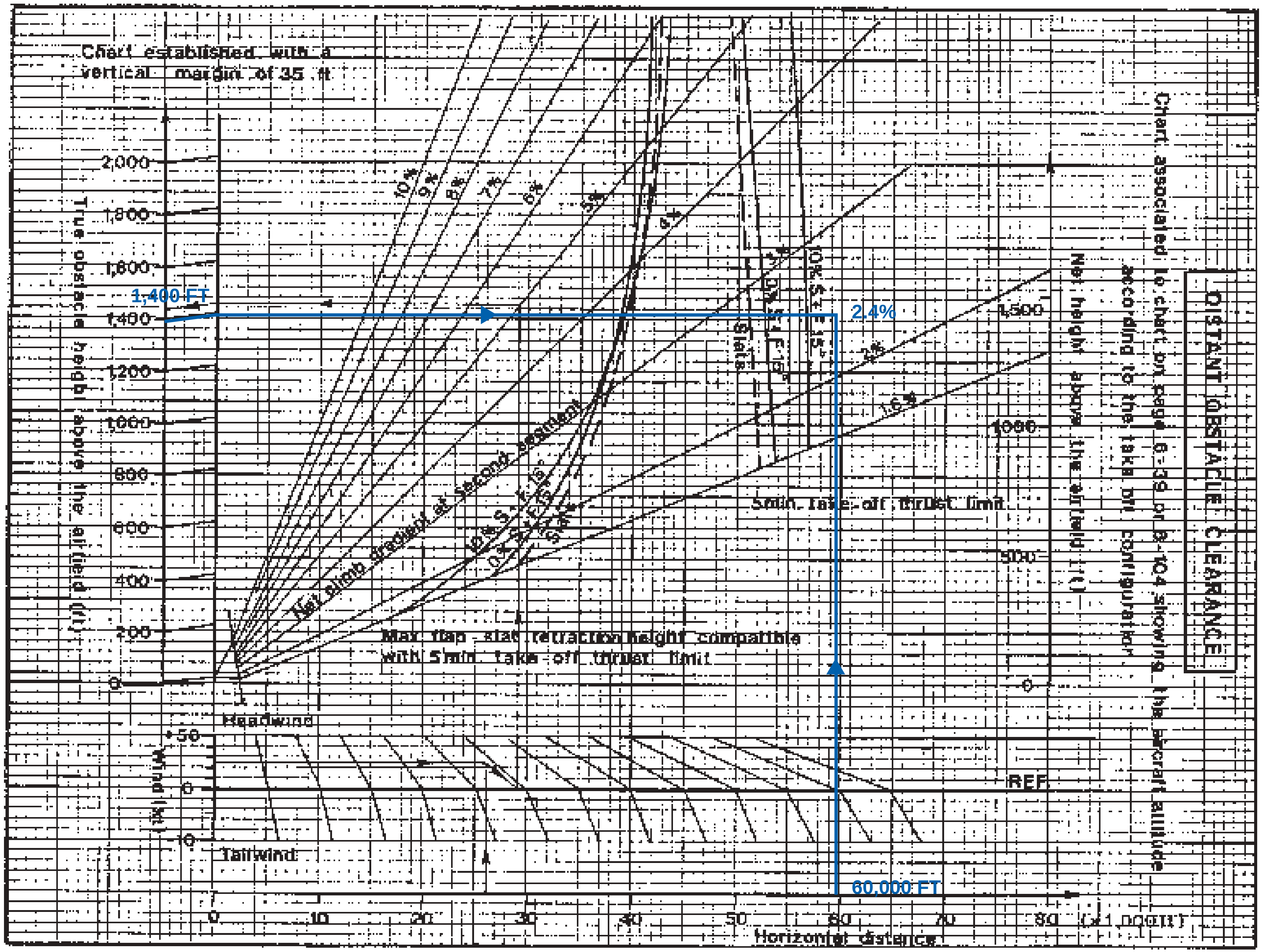
4-46

Close-In Obstacle Clearance

The example on the Distant Obstacle Clearance chart (**Figure 4-47**) is for illustration only. Use this chart if the obstacle is in the second segment or beyond.

The obstacle is 1,400 ft high, 10 NM (60,000 ft) from the lift-off point; the minimum gradient to clear it is 2.4% net.

Distant Obstacle Clearance



4-47

Distant Obstacle Clearance

NOTE: If a speed increase is not used, work the chart in the same manner; however, begin the gradient line at the net climb gradient (*3.8%*) reference above the speed increase box, and move up to intersect the temperature/altitude line, paralleling the weight guideline. From the intersection, move left to the maximum weight. Notice that the maximum weight is less than when a 5% speed increase is used (about 15,500 lbs).

Maximum Takeoff Weight Limited by Obstacle Clearance Requirement

To continue the obstacle clearance problem on the previous page, use the Takeoff Climb – 2nd Segment chart (**Figure 4-48**) because the obstacle height (*140 ft*) falls into the second segment of the takeoff profile.

1. Enter the chart from the left at the ambient temperature (*90°F*) and move right to the pressure altitude *(500 ft)*, then down to the reference line.
2. Enter from the bottom at the required climb gradient.

   In this case, use a 5% speed increase; a 3.8% net is equivalent to a 4.6% gross climb gradient, or 3.8% + .8% = 4.6%.
3. Move up to a line extending across from the speed increase *(5%)*, then parallel the speed increase guidelines to the reference line. Continue straight up through the weight guidelines.
4. Resume the temperature/altitude line at the reference line and parallel the weight guidelines to intersect the gradient line.
5. From the intersection, move left and read the maximum weight allowable to meet climb requirements (*15,800 lbs*).

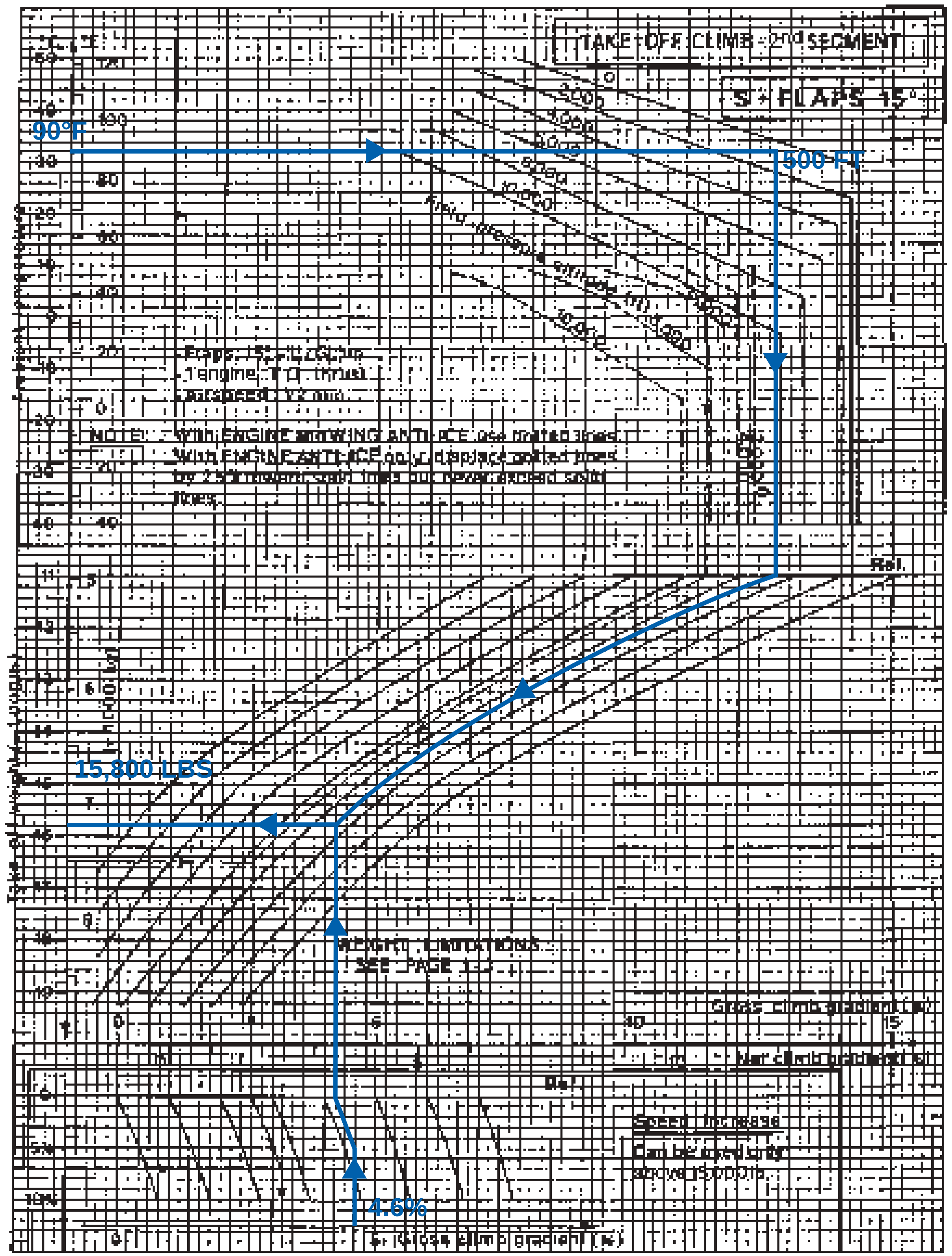
Use the Final Climb Gradient – One Engine Inoperative chart (**Figure 4-49**) to find the maximum gross takeoff weight limited by climb for obstacles in the final segment (illustration only).

The maximum weight allowed is 17,900 lbs, using the minimum climb gradient (2.4%).

If the obstacle in the enroute segment is higher than 1,500 ft, work the Final Segment Climb Gradient chart in the same manner.

Takeoff Climb

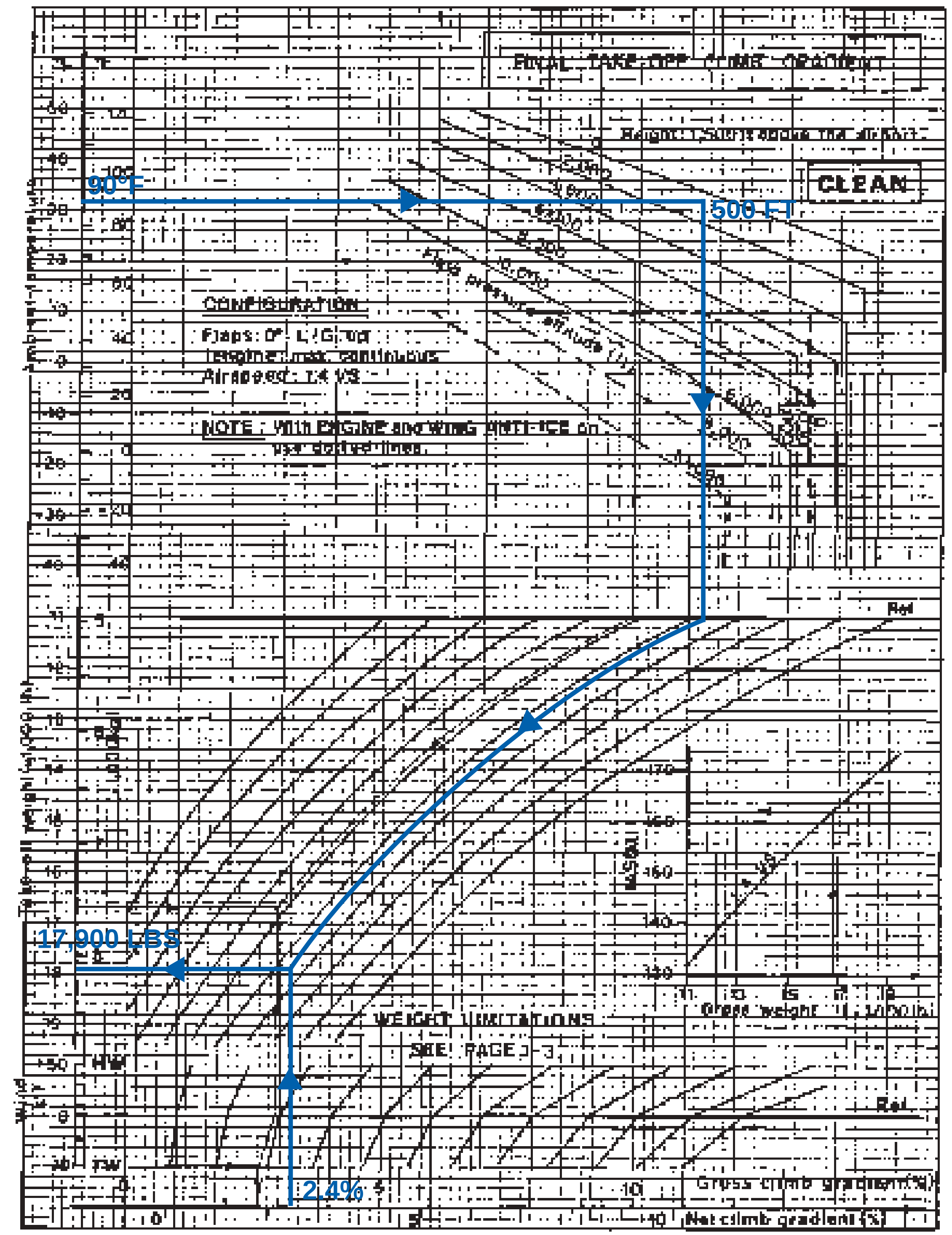
2nd Segment



4-48

Final Climb Gradient

One Engine Inoperative



4-49

Takeoff Climb

Final Climb Gradient

NOTE: See Quick Reference for noise reduction takeoff and approach configurations and slope diagrams.

Takeoff Noise Reduction Procedure – Maximum Takeoff Weight

(18,300 Lbs – Basic Without SB F10-0052), or (18,740 Lbs – Basic With SB F10-0052)

The following procedure reduces takeoff noise level at point A to a minimum after takeoff.

1. Maintain takeoff thrust up to 2,600 ft above the takeoff surface, with high lift devices in the takeoff configuration and maintaining a steady speed equal to V_2 + 10 kts.
2. At 2,600 ft, set the N_1 speed as defined on Takeoff Noise Reduction Procedure/N_1 Setting After Cutback chart (**Figure 4-50**) on the next page. This N_1 speed setting permits level flight with one engine inoperative.
3. As soon as possible, resume climb and increase thrust to maximum continuous power setting.

NOTE: See Quick Reference for noise reduction takeoff and approach configurations and slope diagrams.

Takeoff Noise Reduction Procedure – Maximum Takeoff Weight

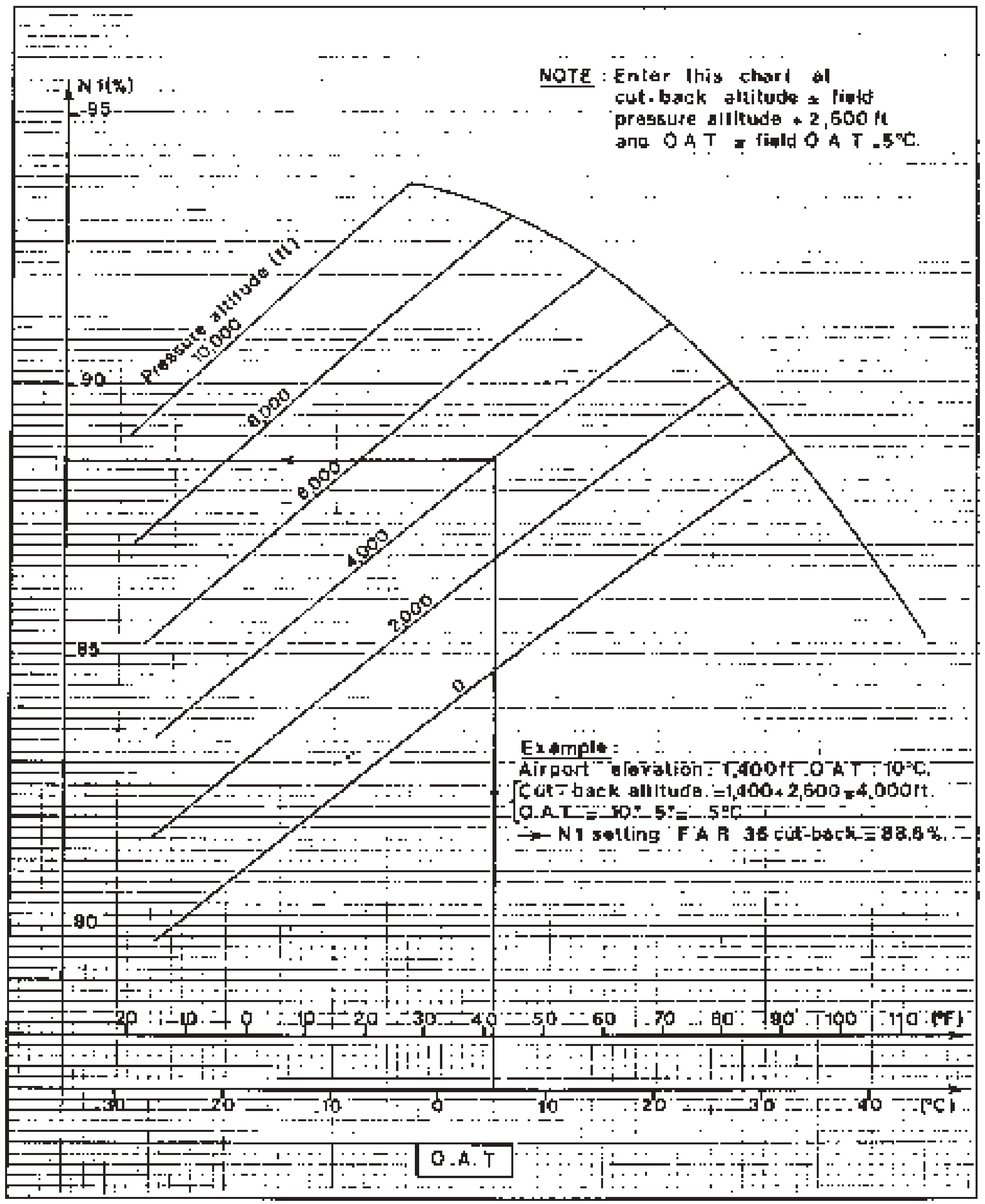
(19,300 Lbs – Basic With SB F10-0238)

The following procedure reduces takeoff noise level at point A to a minimum after takeoff.

1. With high lift devices in the takeoff configuration, maintain takeoff thrust to 2,350 ft above the takeoff surface and maintain a steady speed equal to V_2 + 10 kts.
2. At 2,350 ft, set the N_1 speed as defined on the Takeoff Noise Reduction Procedure/N_1 Setting After Cut Back chart (**Figure 4-51**). This N_1 speed setting permits level flight with one engine inoperative.
3. As soon as possible, resume climb and increase thrust to maximum continuous power setting.

N_1 Setting After Cut-Back

Maximum Takeoff Weight 18,300 Lbs (Basic, Without SB F10-0052) or 18,740 Lbs (Basic With SB F10-0052)



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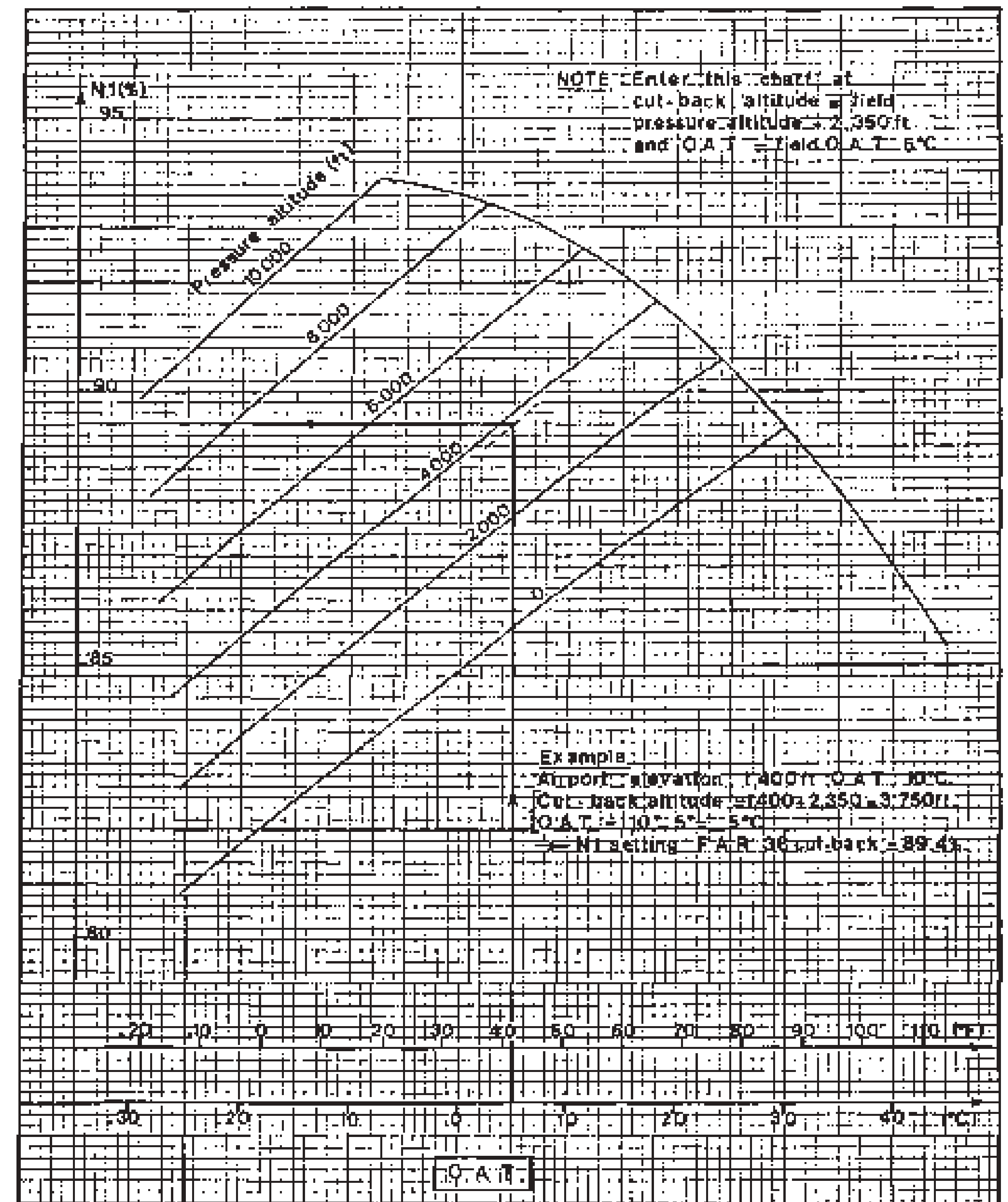
N_1 Setting After Cut-Back

Maximum Takeoff Weight 19,300 Lbs (With SB F10-0238)



4-51

Takeoff Noise Reduction Procedure

NOTE: See Maneuvers chapter for further discussion on contaminated runways.

Contaminated Runway Operations

The manufacturer, in its Service Newsletter 34, defines a wet runway as one with less than $^1/_8$ inch standing water and a contaminated runway as one with more than $^1/_8$ inch standing water, or equivalent water depth, on more than 25% of its length. Other runway-contaminating fluids include slush, wet snow, loose dry snow, compacted snow, ice, or black ice (a mixture of water, oil, and rubber).

Hydrodynamic Pressures

As a tire travels over a fluid-covered surface, hydrodynamic pressures increase with speed, creating both drag and lift under the tire. The force of the tire against the fluid produces drag, and as speed increases, the tire hydroplanes, or lifts clear of the runway surface. Tests show that at the moment the wheel lifts clear of the surface, wheel rotation diminishes rapidly and steering becomes less effective. When the main wheels slow to below 20 kts tire speed, the anti-skid system deactivates.

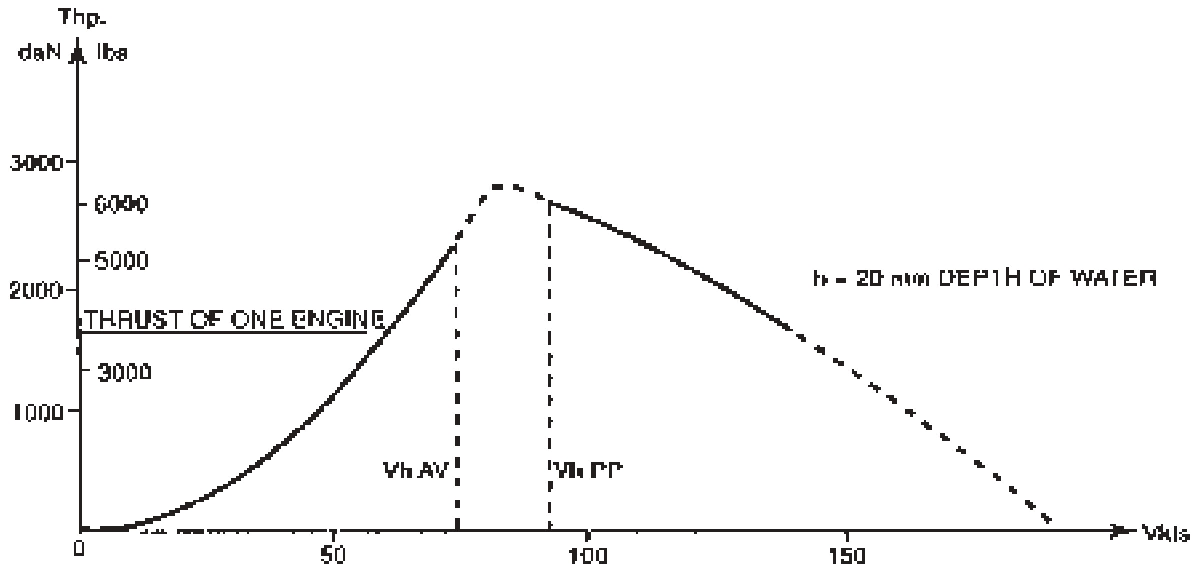
Hydroplaning

The manufacturer and other authorities support a recently developed formula to calculate hydroplaning speed: 6.4 times the square root of tire pressure ($V_H = 6.4\sqrt{P}$). Prior to Service Newsletter 34, the accepted formula was $V_H = 9\sqrt{P}$, which recent tests suggest was an overestimation. Calculated by the new formula, Falcon 10/100 nosewheel hydroplaning speed is 62 kts rather than 87 kts with the former formula, and main wheel hydroplaning speed is 75 kts rather than 106 kts. These speeds are, respectively, 25 and 27 kts less than previously believed.

Drag

Plume drag occurs when each wheel (especially the nose wheel) throws a water plume that strikes the aircraft. Plume drag, which is proportional to the speed squared, is greater for small aircraft than for large aircraft. Both hydrodynamic and plume drag can be extensive. For example, 0.4 inch water produces drag near the maximum power of one engine; above 0.5 inch water exceeds the force of one engine. The Speed-Drag-Thrust Chart (**Figure 4-52**) illustrates drag increase as speed increases in 0.79 inch (20 mm) water.

Speed-Drag Thrust



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Braking

Although braking measurement is difficult, authorities believe the following braking coefficients illustrate the use of anti-skid is indispensible.

Runway Condition	Braking Friction Coefficient	Decreased Braking Factor Relative to Dry Condition
Dry	0.5	– –
Wet	0.4 to 0.25	Up to 2 times
Contaminated	0.125	Up to 4 times
Very Slippery (e.g, Black Ice)	0.05	Up to 10 times

Summary: Contaminated Runway Operations

Conclusions

- Nosewheel hydroplaning speed is approximately 62 kts[1].
- Main wheel hydroplaning speed is approximately 75 kts[1].
- The tire lifts clear of runway surface.
- Steering is less effective and unpredictable.
- The wheels spin down rapidly.
- The anti-skid system deactivates below 20 kts wheel speed.
- Total drag can exceed power of one engine.
- Braking effectiveness is half or less.

[1] *Speed increases as fluid density decreases (e.g., slush = 12% increase).*

Recommendations

Landing on Wet Runway

- Increase landing distance by 15%.
- Increase factored landing distance by 67% for the landing field length.

Takeoff on Wet Runway

- Increase the balanced field length by adding 15% of the landing distance for the same conditions.

Contaminated Runway

If takeoff cannot be delayed, observe the following.

- Limit takeoff operations to less than:
  - 1/2 inch standing water
  - 3/4 inch slush
  - 1 inch wet snow
  - 2 inches dry snow.
- Adopt $V_1 = V_R$.
  - For new accelerate-stop distance, determine takeoff distance factored for equivalent water depth (Refer to OIM 2-60(1) and OIM 2-60(2)).
  - Add two times the landing distance for the same conditions.
- Limit crosswind to 15 kts for takeoff or landing.
- Multiply the landing distance required by 2.3.
- Ensure functional anti-skid availability.
- Delay braking action until below hydroplaning speed (75 kts).

If runways are very slippery (e.g., with compacted snow, ice, black ice), observe the following.

- Avoid if possible.
- Anticipate up to 1/10 braking effectiveness.
- Multiply the landing distance by at least 2.0 for compacted snow or at least 3.4 for ice.
- Use maximum reverse thrust.
- Limit crosswind to 5 kts for takeoff or landing.

NOTE: Although landing field length is normally calculated by dividing the landing distance by 0.6, the calculations used here have safety factors built in and only an additional 15% is necessary.

Landing – Contaminated Runway

1. Increase landing distance by at least 2.0.
2. Delay braking until below V_H.
3. Use maximum thrust reverse.
4. Ensure anti-skid operation.
5. LFL is landing distance (as above) plus 15%.

Takeoff – Contaminated Runway

1. Avoid. If the runway is covered with water, wait until the water flows away or is absorbed.
2. Calculate as previously discussed.
3. Pick a landmark alongside the runway as a go/stop point.
4. Above V_H, only the rudder is effective for steering.
5. Ailerons neutral.
6. If takeoff is aborted, proceed as for landing on contaminated runway.
7. After takeoff, cycle the gear several times to clear any accumulated snow or ice.

Landing – Slippery Runway

1. Landing distance is equal to landing distance times 2 for compacted snow, or times 3.4 for black ice.
2. LFL is landing distance as above plus 15%.
3. Apply maximum brakes at touchdown.
4. Use maximum thrust reverse.
5. Nose wheel may be of little use in steering.

Takeoff – Slippery Runway

1. Avoid if possible. Control is uncertain.
2. Required takeoff distance (same conditions):
   - for compacted snow: BFL plus the landing distance
   - for ice: BFL plus twice the landing distance.
3. Leave a safety margin.
4. If takeoff is aborted, proceed as for landing.

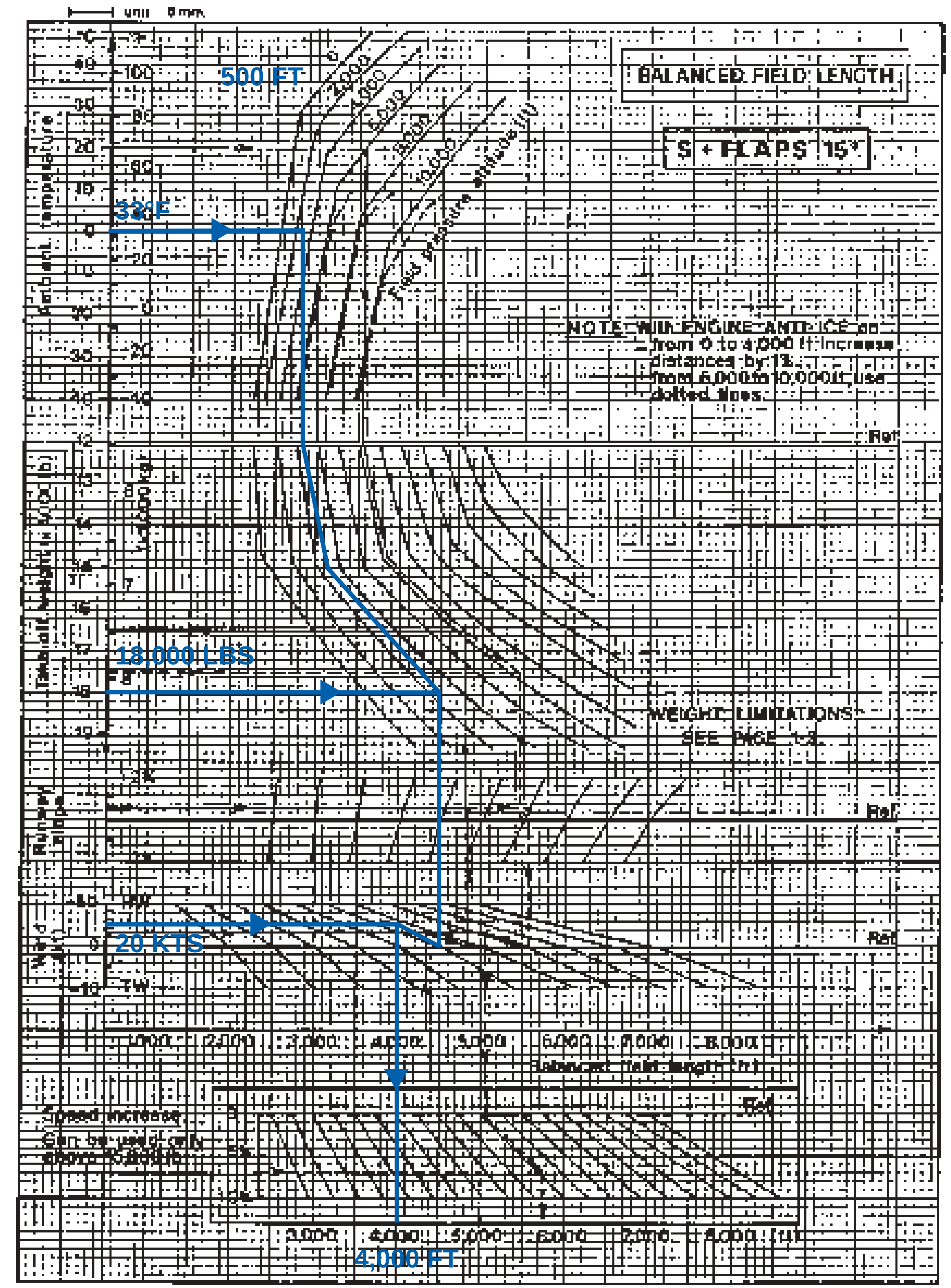
Contaminated Runway Calculations

The following example is for illustration only and is not related to previous problems.

Plan takeoff at an airport with:

- *0.75 inch slush on more than 25% of the runway*
- *3,000 ft pressure altitude*
- *temperature 33°F*
- *headwind 20 kts.*
- *takeoff weight 18,000 lbs*
- *balanced field length* (**Figure 4-53**) *4,000 ft.*

Balanced Field Length



4-53

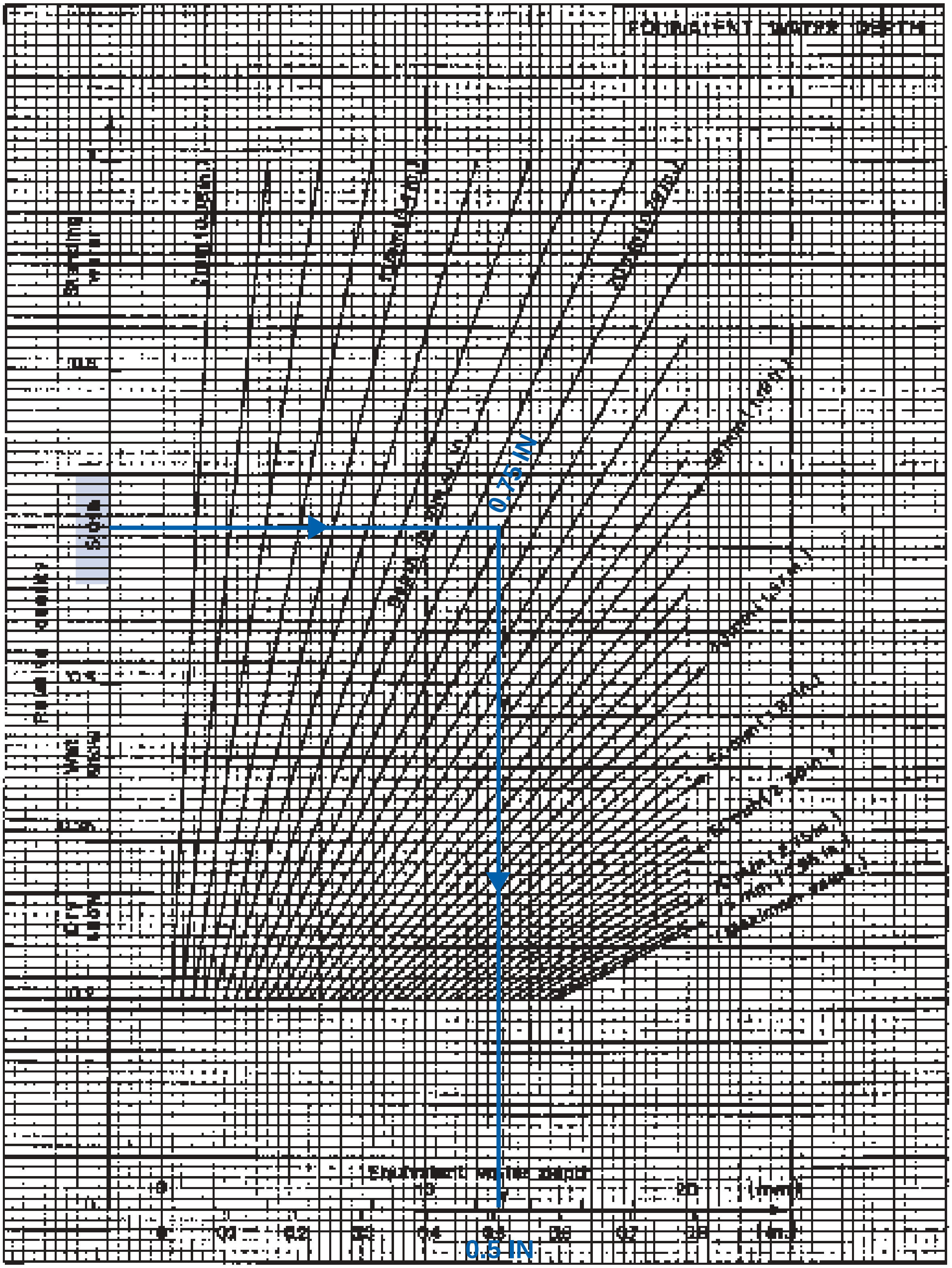
Balanced Field Length

Equivalent Water Depth

First find the equivalent water depth for slush. All other charts are calculated by the amount of standing water; go to the Equivalent Water Depth Chart (**Figure 4-54**) to determine how much water depth causes the same resistance as 0.75 inch slush.

1. Enter the chart from the left at relative density (*slush*).
2. Move right to equivalent water depth (*0.75 inch*).
3. Move down to read equivalent water depth (*0.5 inch water*).

Equivalent Water Depth



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Effect of Precipitation on Takeoff Distance

Use the Effect of Precipitation On Takeoff Distance For Slats/Flaps 15° chart (**Figure 4-55**) to determine runway length required.

1. Enter the chart from the left at the ambient temperature (*33°F*).
2. Move right to the pressure altitude (*3,000 ft*).
3. Move down to the weight reference line and parallel the weight guidelines.
4. Enter left at the takeoff weight (*18,000 lbs*) and move right to intersect the line paralleling the weight guidelines.
5. From the intersection move down to the equivalent water depth (EWD) reference line and parallel the EWD guidelines.
6. Enter left from the EWD (*0.5 inch*) and move right to intersect the line paralleling the guidelines.
7. Move down to the slope reference line.

   Assume no slope.
8. Move down to the wind reference line and parallel the wind guidelines.
9. Enter from the left at the wind (*20 kts*). Move right to intersect the line paralleling the guidelines.
10. From the intersection, move down to read the corrected takeoff field length (*5,700 ft*).

To complete the calculations, add two times the landing distance to the corrected takeoff distance for safety margin. Use the Landing Distance S + Flaps 52° chart (**Figure 4-56**).

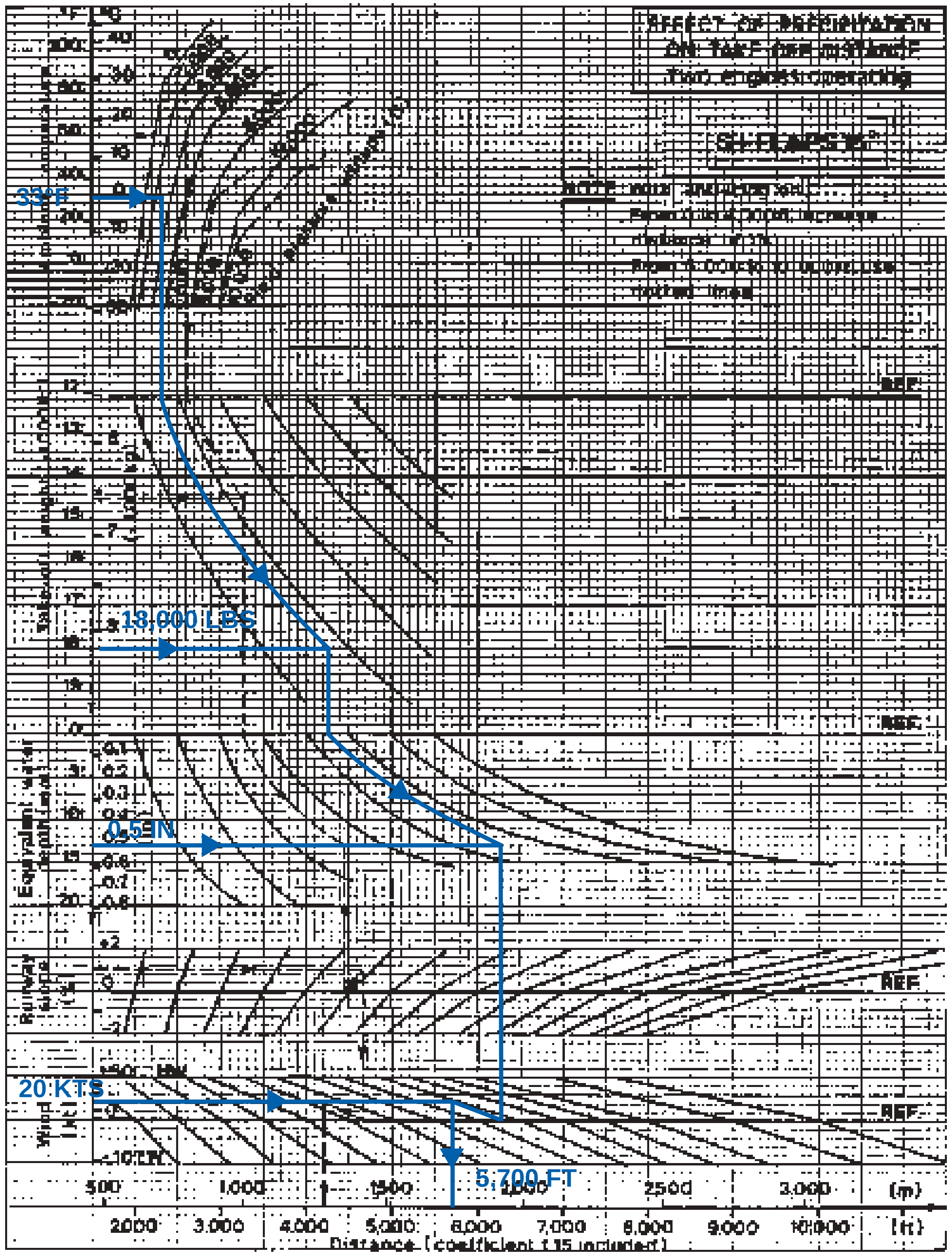
1. Enter from the left at the landing weight (*18,000 lbs)*
2. Move right to the pressure altitude (*3,000 ft*) and down to the headwind (*20 kts*).
3. Move right to read landing distance *(2,600 ft)*.

Takeoff Distance	*5,700 ft*
Landing Distance (2,600 X 2)	*5,200 ft*
Total runway required	*10,900 ft*

The total runway required (*10,900 ft*) is a considerable change from an uncorrected balanced field length (*4,000 ft*).

Effect of Precipitation on Takeoff Distance

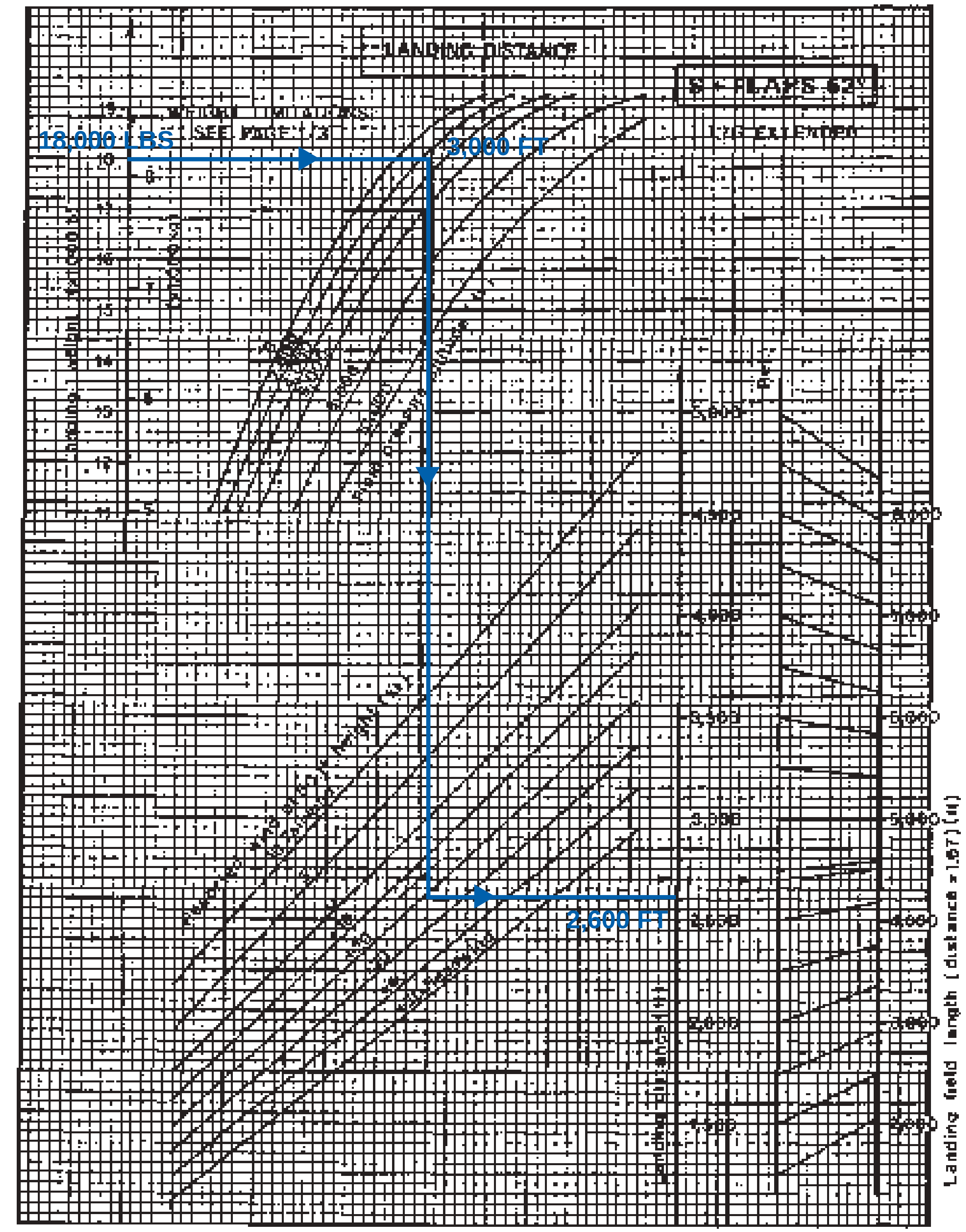
Flaps 15°/Two Engines Operating



4-55

Landing Distance

S + Flaps 52°



4-56

Effect of Precipitation on Takeoff Distance

Landing Distance

Effect of Precipitation on Landing Distance

To determine landing field length on wet or contaminated runway, use the Landing Distance/S + Flaps 52° chart (**Figure 4-57**).

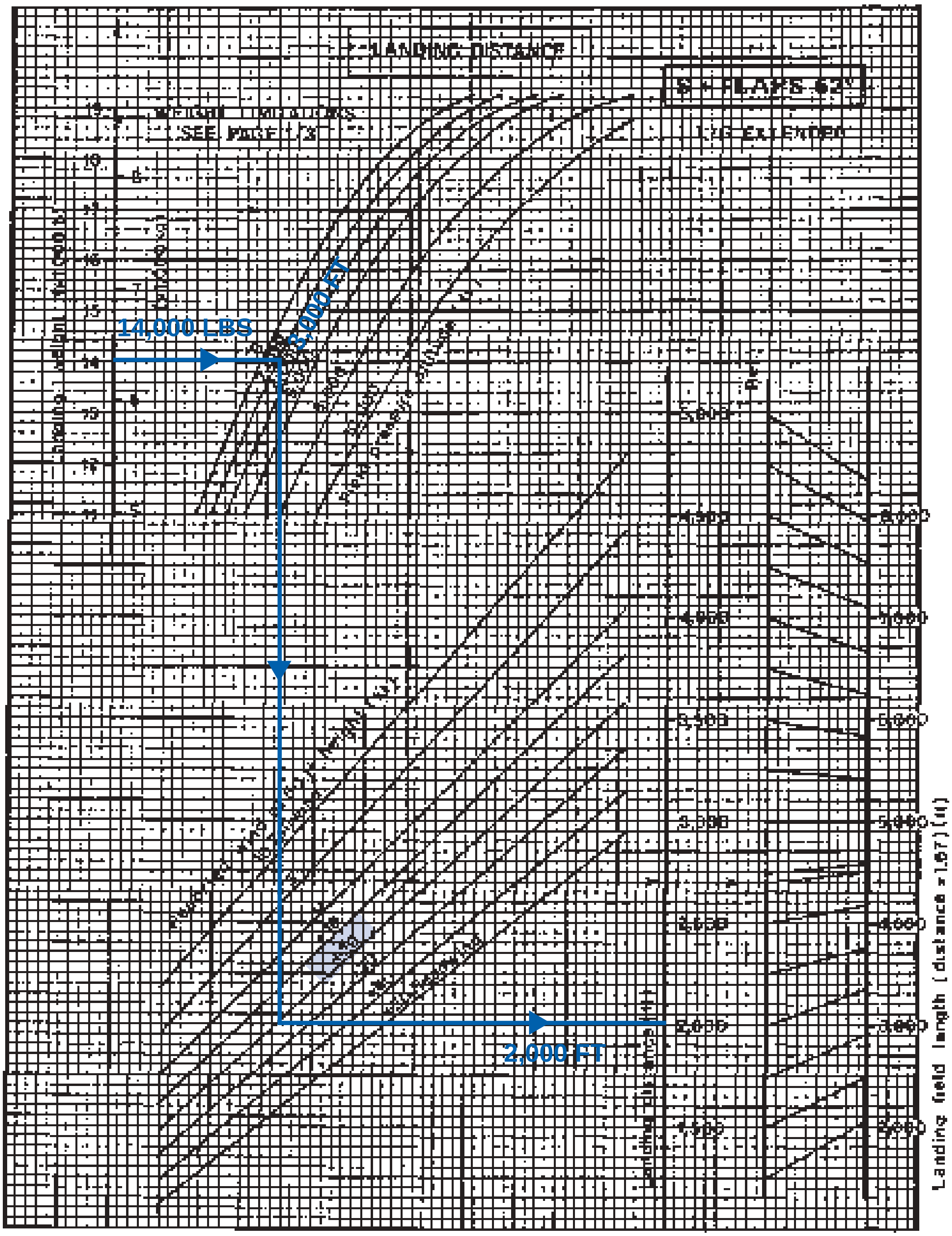
Assume a landing is to be made into an airport with:

- *3,000 ft elevation*
- *33°F temperature*
- *20 kt headwind*
- *14,000 lbs landing weight.*

1. Enter the chart from the left at the landing weight (*14,000 lbs*).
2. Move right to the pressure altitude (*3,000 ft*) and down to the headwind (*20 kts*).
3. Move right to read the landing distance (*2,000 ft*).
4. To determine landing distance, multiply the distance (*2,000 ft*) by the factors shown below.
   a. by 1.5 for wet runways (*2,300 ft*)
   b. by 2.0 for more than 1/8 inch equivalent water depth (*4,000 ft*)
   c. by 2 (compacted snow) to 3.4 (black ice) (*4,000 ft to 6,800 ft*).
5. To determine landing field length, perform the operations shown below.
   a. For wet runways, multiply the dry landing field length by 1.15.
   b. For contaminated runways, multiply the landing distance by 2, then multiply the result by 1.15.
   c. For very slippery runways (i.e., compacted snow or black ice), multiply the landing distance by 2 (compacted snow) to 3.4 (black ice) depending on conditions, then multiply the result by 1.15.

Landing Distance

S + Flaps 52°



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Systems

Several chapters contain multiple systems to facilitate a more coherent presentation of information. The systems covered are listed below in alphabetical order opposite the chapter in which they are located. ATA codes are noted in parentheses.

SYSTEM (ATA Code)	CHAPTER
Air Conditioning (21)	PNEUMATIC
Aircraft Structure (51)	AIRCRAFT OVERVIEW
Autopilot (22)	AVIONICS
Brakes (32)	LANDING GEAR
Communications (23)	AVIONICS
Dimensions and Areas (6)	AIRCRAFT OVERVIEW
Doors (52)	AIRCRAFT OVERVIEW
Electrical (24)	ELECTRICAL
Engine (71)	POWERPLANT
Engine Controls (76)	POWERPLANT
Engine Fuel and Control (73)	POWERPLANT
Engine Indicating (77)	POWERPLANT
Equipment/Furnishings (25)	AIRCRAFT OVERVIEW
Fire Protection (26)	FIRE
Flight Controls (27)	FLIGHT CONTROLS
Fuel (28)	FUEL
Fuselage (53)	AIRCRAFT OVERVIEW
Hydraulics (29)	HYDRAULICS
Ice and Rain Protection (30)	ICE AND RAIN
Ignition (74)	POWERPLANT
Landing Gear (32)	LANDING GEAR AND BRAKES
Lighting (33)	ELECTRICAL
Navigation (34)	AVIONICS
Oil (79)	POWERPLANT
Oxygen (35)	MISCELLANEOUS
Pitot/Static (34)	AVIONICS
Pneumatic (36)	PNEUMATIC
Pressurization (21)	PNEUMATIC
Stabilizers (55)	AIRCRAFT OVERVIEW
Stall Warning (27)	FLIGHT CONTROLS

Aircraft Overview

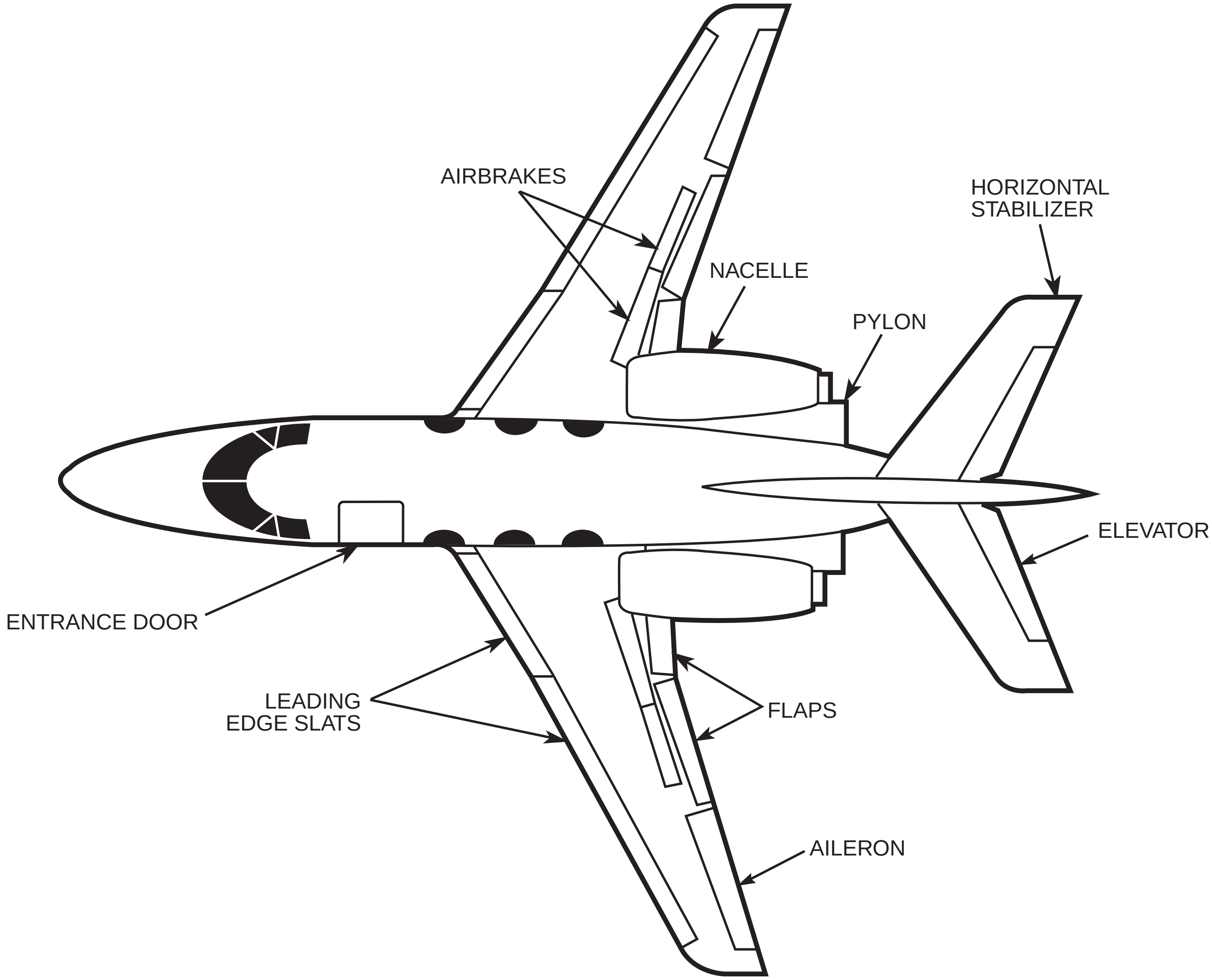
Chapter 5A

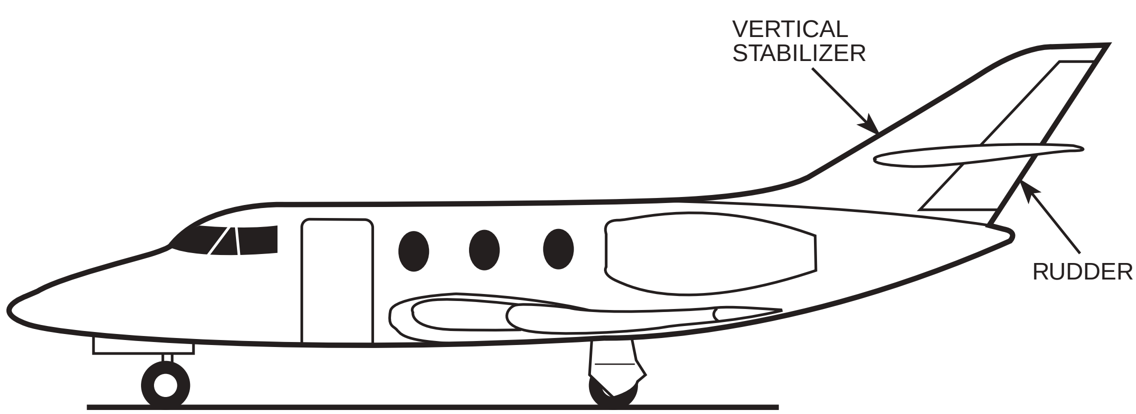
This section presents an overview of the Falcon 10 aircraft. It includes major features, aircraft structures, dimensions, and hazard areas as well as a summary of service bulletins (SBs).

This section references the manufacturer's serial number, and where system differences warrant, publishes separate data and schematics.

Table of Contents

Aircraft Features





Airframe Description

The two engine Falcon 10 aircraft is a medium range, swept wing, high speed aircraft. It is a transport category aircraft certified under FAR parts 25 and 36 and operates at altitudes up to 45,000 ft.

Failure design and construction guarantees aircraft life for 30,000 hours or 20,000 cycles (takeoffs).

Fuselage

Fuselage construction consists of aluminum frames and folded stringers with a riveted aluminum skin. Seven main frames carry the loads and stresses generated by the nose gear, cabin pressurization, wings, and the empennage. Forty-eight secondary frames brace the fuselage. The stringers together with the frames form a lattice structure to which the skin is attached. Additional fuselage structures include ribs, spars, and beams. Chemically milled skin panels utilize milled reinforcing structures for added strength around window, door, and access openings.

The fuselage consists of a main structure, auxiliary structure, and fairings.

The main structure consists of the nose gear box, pressurized section, center section wing box, main landing gear box, collector tank box, and fin stub (**Figure 5A-1**).

Nose Gear Box

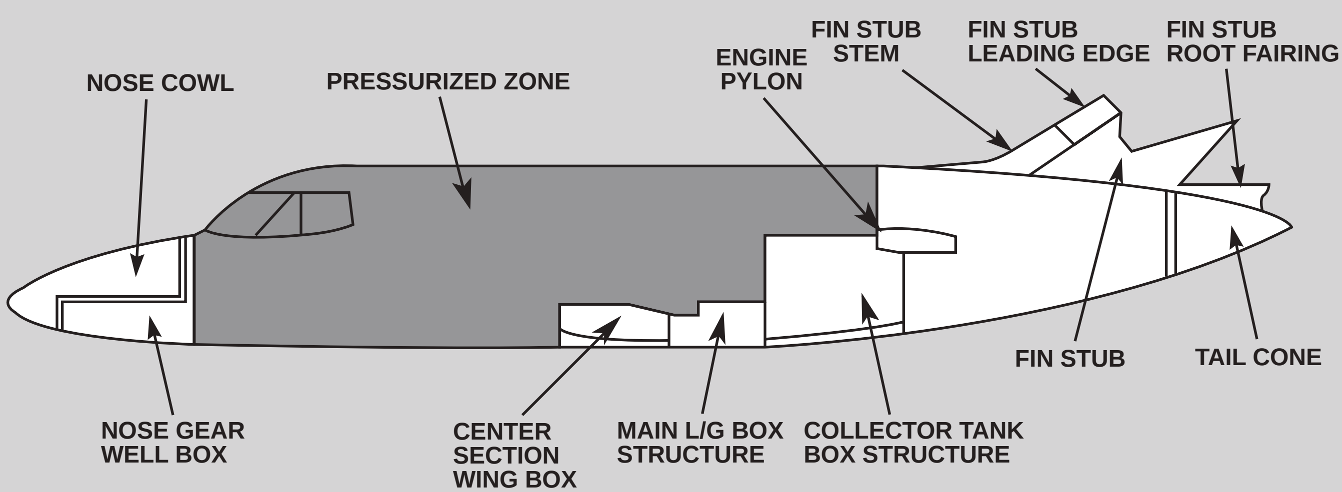
An auxiliary frame and a single main frame form the front and rear of the nose gear box. Beams on each side of the box and fittings on the main frame connect the nose gear to the aircraft fuselage. The main frame of the nose gear box also forms the forward pressure bulkhead.

Pressurized Section

The pressurized section contains the cockpit, entrance area, passenger cabin, and rear baggage area.

Cockpit

The two-crew cockpit is insulated from heat, cold, and noise (**Figure 5A-2**, following page). Each pilot has a flight station with a conventional control column and an instrument panel. A center instrument panel contains the engine instruments, fuel quantity and flow indicators, landing gear controls,



5A-1

weather radar/flight management displays, and communication and navigation control units. A pedestal between the pilot stations contains the power levers, secondary flight control selectors, and autopilot and flight director equipment controls.

Side consoles contain oxygen masks and microphone jacks. The pilot's console also has a nosewheel steering wheel. An overhead console contains engine starting, fuel, and electrical and lighting controls. Panels behind the crewmembers' heads contain most of the circuit breakers accessible in flight.

Six windshields/windows provide visibility from the cockpit. These consist of two curved windshields, two opening windows, and two fixed rear windows (**Figure 5A-3**).

Each windshield consists of four glass panes separated by three layers of butyryl plastic with a heating element for anti-icing.

Each triangular opening window consists of two panes of oroglass bonded to a metal frame. Air circulating between the two panes from two holes demists the window. An opening and latching mechanism allows each window to be opened inward at an angle for ventilation and direct viewing.

Depending on service bulletin status, the rear windows consist of either two panes of oroglass bonded to an orlon shim or three panes of oroglass bonded to a dacron shim. Air circulating through an airspace between the panes demists the windows. An electrical heating element demists the three-pane windows.


5A-2


5A-3


5A-4


5A-5

Passenger Cabin

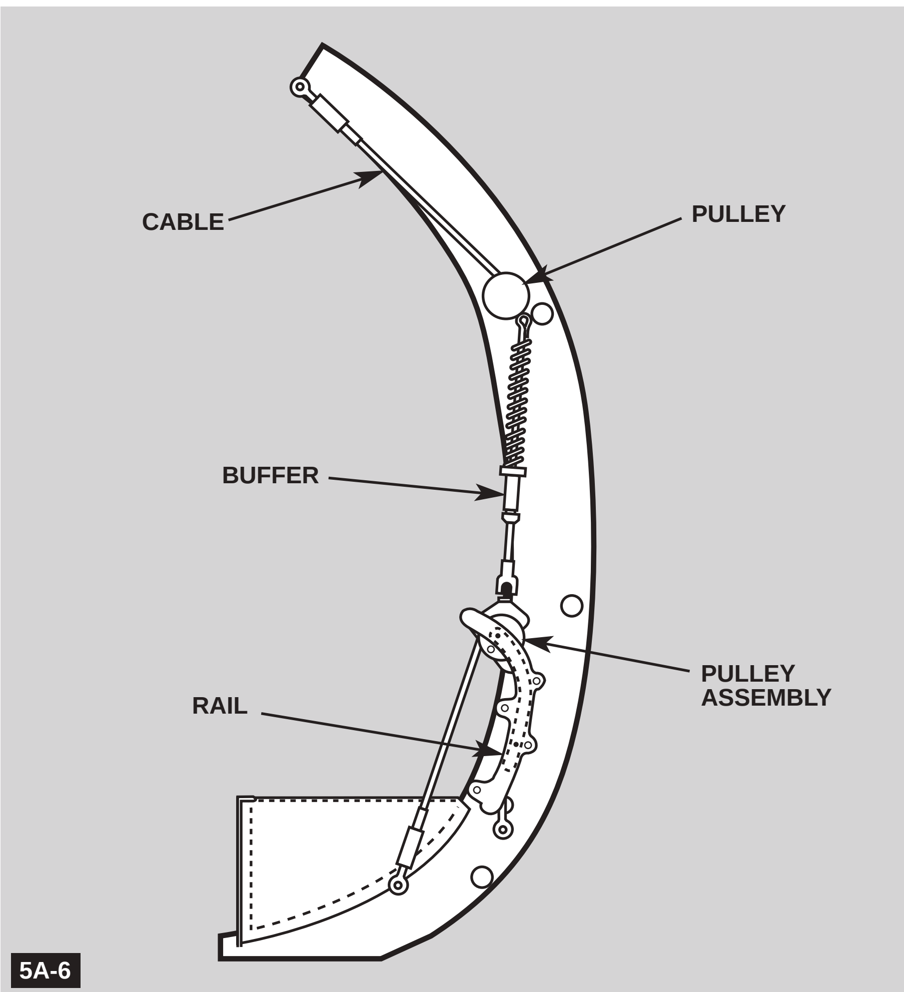
The pressurized, air conditioned passenger cabin is certified for eight passengers, though typical configurations comfortably seat seven (**Figure 5A-4**). Accommodations in the aircraft include a galley, lavatory, work tables, and a coat closet. The entrance door is on the left side of the fuselage. A single overwing emergency exit is on the right side.

The two piece (upper and lower) entrance door (**Figure 5A-5**) can be opened from either inside or outside; three steps are built into the lower panel. Hooks on the lower panel engage catches in the upper panel to secure the door halves. A counterbalance system assists door opening and closing (**Figure 5A-6**).

To open the door from the outside, unlock the door and remove the key. Push on the locktab to release the outer door control handle. Lift the handle. If the two halves catch, press on the lower half while lifting the top. The two door halves are interconnected through a counterbalance system. Restrain either half to control opening. To lock the doors in the open position, lift on the upper half.

To close the door from the outside, lift the lower door to drive the upper door down. Once the lower half is closed, push the upper half against the door frame. Push the door opening handle down until it is flush with the door. Lock the door with the key if necessary.

To open the door from the inside, depress the pushbutton to release the



5A-6

door locks and open the depressurization door. Lift up on the internal control handle to retract the side studs and release the door hooks. Push down on the handle to open the door halves. Once the doors are fully open, push the control handle up to engage the safety lock.

To close the door from the inside, depress the latch to release the door. Move the operating handle upwards to drive the upper and lower halves toward the closed position. Once the halves close, pull the door handle out and rotate it downwards to lock the door.

An emergency locking mechanism locks the lower door half for ditching purposes. The upper half can be opened for emergency egress in the event of ditching.

There are three passenger windows on each side (**Figure 5A-8**); the second window on the right is part of the emergency exit. Some aircraft have a seventh window opposite the entrance door (three left, four right); the third window on the right is part of the emergency exit. Each window consists of two panes of plastic with an airspace between each pane. Cabin air circulating between the panes demists the windows.

The emergency exit consists of a 20 by 36 inch panel with a window on the lower part and a locking mechanism on the upper part (**Figure 5A-7**). The exit is hinged on the bottom to ball joints. The exit opens from either the inside or outside; once unlatched, the exit opens inward.

Center Section Wing Box

The center section wing box, constructed of spars, ribs, skin panels, and plates, carries wing bending movement and transmits twist, lift, and drag from the wings to the fuselage. The center section wing box also forms the fuselage fuel tanks. The aft spar of this structure also contains fittings for the main landing gear side stays. Two main frames connect the structure to the fuselage. Dual skin construction isolates the wing box from the pressurized fuselage section. The airspace between the dual skins is drained and ventilated.

5A-7

5A-8

Main Landing Gear Box

The main landing gear box encloses the landing gear and protects the aircraft structure against tire burst.

Collector Tank Box

The collector tank box is aft of the center section wing box. The tank box contains two separate feeder tanks for the engines.

Fin Stub

The fin stub secures the empennage to the fuselage frame. It consists of a front spar, rear spar, oblique rib, ribs, and stiffeners. The horizontal stabilizer is hinged to the rear of the fin stub. The vertical stabilizer attaches directly to the stub.

Auxiliary Structures

The auxiliary structure consists of the floors and the engine pylons. The nosecone cowl, tailcone, fin stub root, wing-to-fuselage fillet, fin stub leading edge, and stem fairings provide aerodynamic smoothing of structures to each other.

Fixed and removable panels form the floor of the pressurized section. Removable panels allow access to control cables and equipment. Each panel is secured to beams that are supported by stringers.

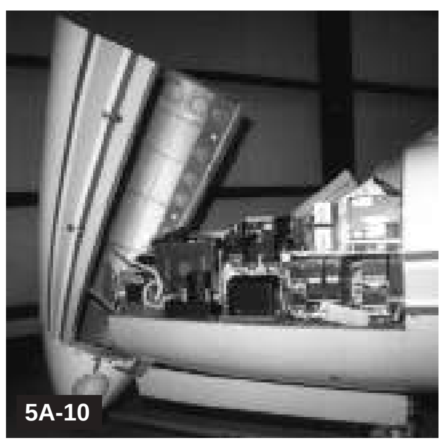
The engine pylons are box structures constructed of skin panels, ribs, stiffeners, and firewalls (**Figure 5A-9**). The structures transmit the forces produced by the engines to the fuselage. Each pylon also includes pylon-to-engine fittings and pylon-to-fuselage fittings.

Each pylon consists of a front section that forms the leading edge, a center box structure for engine electrical, fuel, hydraulic, and bleed air lines, and a rear section.

A hinged nosecone cowl (**Figure 5A-10**) allows easy access to avionics equipment forward of the cockpit. The cowl is constructed of frames braced by stringers, plates, and skin panels. A honeycomb structure covered by fiberglass forms the radome.

The tailcone is constructed of frames, stringers, skin panels, doors, and an end cap. The end cap contains the

5A-9



5A-10

Freon line condenser, air-conditioning lines, heat exchanger, and tail navigation light. Doors in the tailcone allow access to various equipment for maintenance purposes. An optional compartment provides 28.6 cubic feet for baggage storage.

The wing-to-fuselage fillet, constructed of beams, plates, stiffeners, and skin panels, aerodynamically fairs the wings to the fuselage structure. Removable fillets and doors allow access to various equipment and the center section fuel tank.

Tail Unit

The tail unit (**Figure 5A-11**) consists of the vertical stabilizer (fin), moveable horizontal stabilizer, elevators, and a rudder (see Flight Controls).

Vertical Stabilizer

The vertical stabilizer is a torsion-type box structure composed of a forward and aft spar connected with ribs and angles covered with aluminum skin panels (**Figure 5A-12**). The structure encloses the hinge and control systems for the rudder and the VOR antenna mounts. It is attached to the fin stub at two points. The stabilizer consists of a leading edge, box structure, upper fairing, and rudder. The rudder is hinged at three points. A spring-attached shroud seals the gap between the vertical stabilizer and the rudder.

The vertical stabilizer transmits the aerodynamic loads created by the stabilizer and rudder to the fuselage.

Horizontal Stabilizer

The horizontal stabilizer consists of a box structure that forms the main structure, two detachable leading edges, two detachable tips, and two elevators (**Figure 5A-13**). The stabilizer and elevators are constructed of spars, ribs, stiffeners, doublers, and skin panels. The moveable horizontal stabilizer provides elevator trim. Two spring-loaded ribs seal the gap between the moveable horizontal stabilizer and the vertical stabilizer.

A fixed hinge at the rear of the stabilizer connects the unit to the fin stub. A scissors attachment driven by an electric motor allows the horizontal stabilizer to be trimmed along the horizontal axis.

An elevator on each side of the vertical stabilizer is hinged to the horizontal stabilizer at three points. A coupling unit joins the left and right elevators.

Engines

Two Garrett Airesearch TFE-731-2-1C front fan engines power the aircraft. Each engine produces 3,230 lbs of thrust up to 86°F at sea level (see Powerplant chapter).

5A-11

5A-12

5A-13

The TFE-731 engine is of modular design that consists of a fan, planetary gearbox, compressor and high pressure turbine section, low pressure turbine section, and accessory gearbox module.

Wing

Each swept-back wing (**Figure 5A-14**) consists of a main frame wing center box structure with an auxiliary structure and moveable components. The auxiliary structure consists of inboard and outboard fixed leading edge boxes, flap and aileron baffle boxes, main landing gear wheel well ceiling, and wing tip fairing. The moveable components include aileron, inboard and outboard slats, inboard and outboard flaps, and inboard and outboard airbrakes.

The wing center box structure carries and transmits bending and torsion loads and stresses to the center box structure. The wing center box structure contains a front spar, rear spar No. 1, rear spar No. 2, 18 ribs, and skin panels.

The rear spars contain fittings for the main landing gear front hinge bearing and the wing flaps and ailerons. The front spar carries hinges for the inboard and outboard leading edge slats.

On the trailing edge of each wing are two flaps and a single aileron; each is hinged at three points (**Figure 5A-15**). These control surfaces are of conventional construction with aluminum skins, spars, and ribs. On the top of the wing, there are inboard and outboard airbrakes constructed of aluminum honeycomb with aluminum skins. The inboard and outboard slats are on the wing leading edge (**Figure 5A-14**). The slats consist of a fixed inboard box with a moveable outboard box. The inboard box provides a passageway for aileron control linkages, hydraulic lines, and electrical wires. All components are constructed of aluminum. Each slat rides on a roller and is driven by irreversible jacks.

Landing Gear

The aircraft is supported by a conventional tricycle landing gear that consists of a single wheel nose gear and dual wheel main landing gear (**Figure 5A-16**). An oleo-pneumatic (air-oil) shock absorber on each gear assembly absorbs landing forces (see Landing Gear chapter).

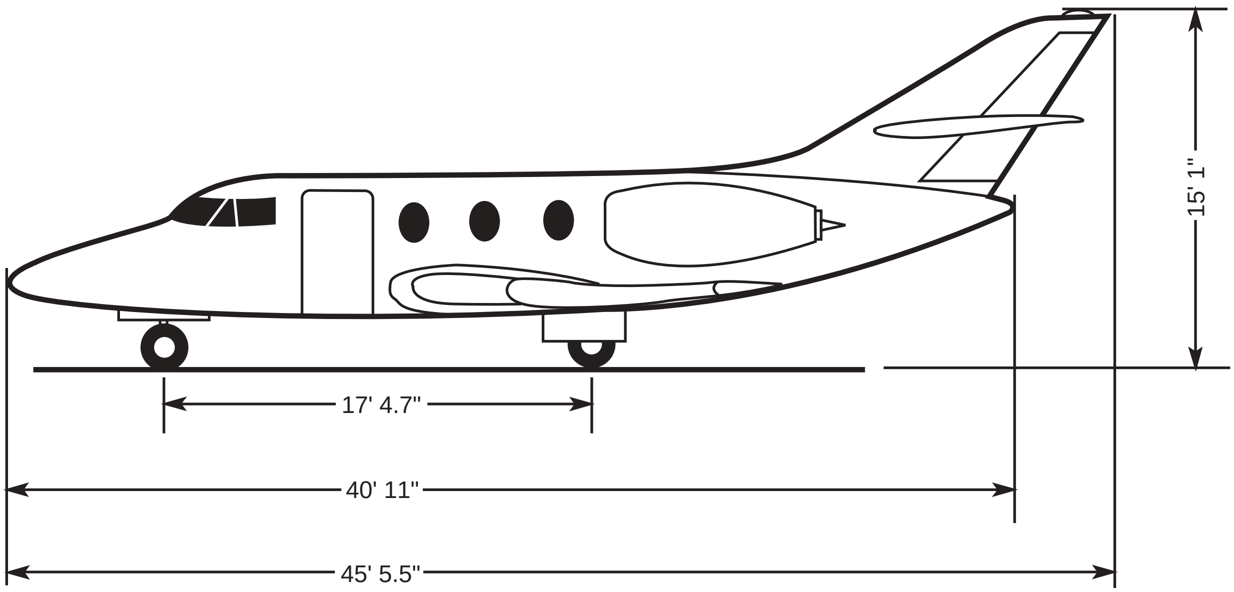
When retracted, the nose landing gear is completely covered by a pair of doors. Each main landing gear has a single strut-connected door that only covers the strut assembly. The outboard wheel on each main landing gear assembly has an embellisher (hub cap).

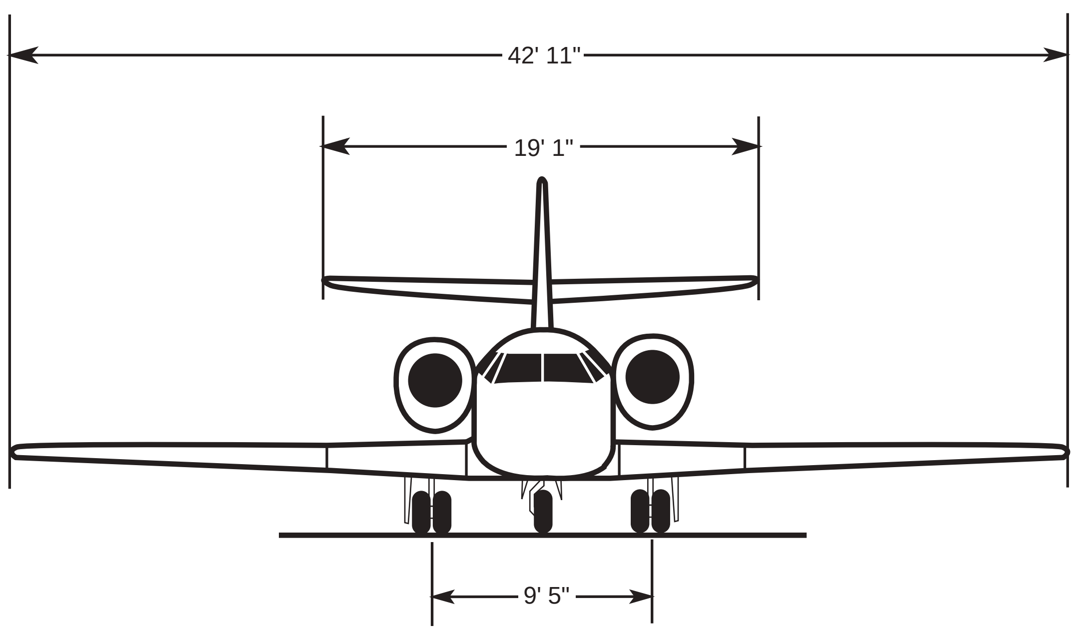
5A-14

5A-15

5A-16

Aircraft Dimensions

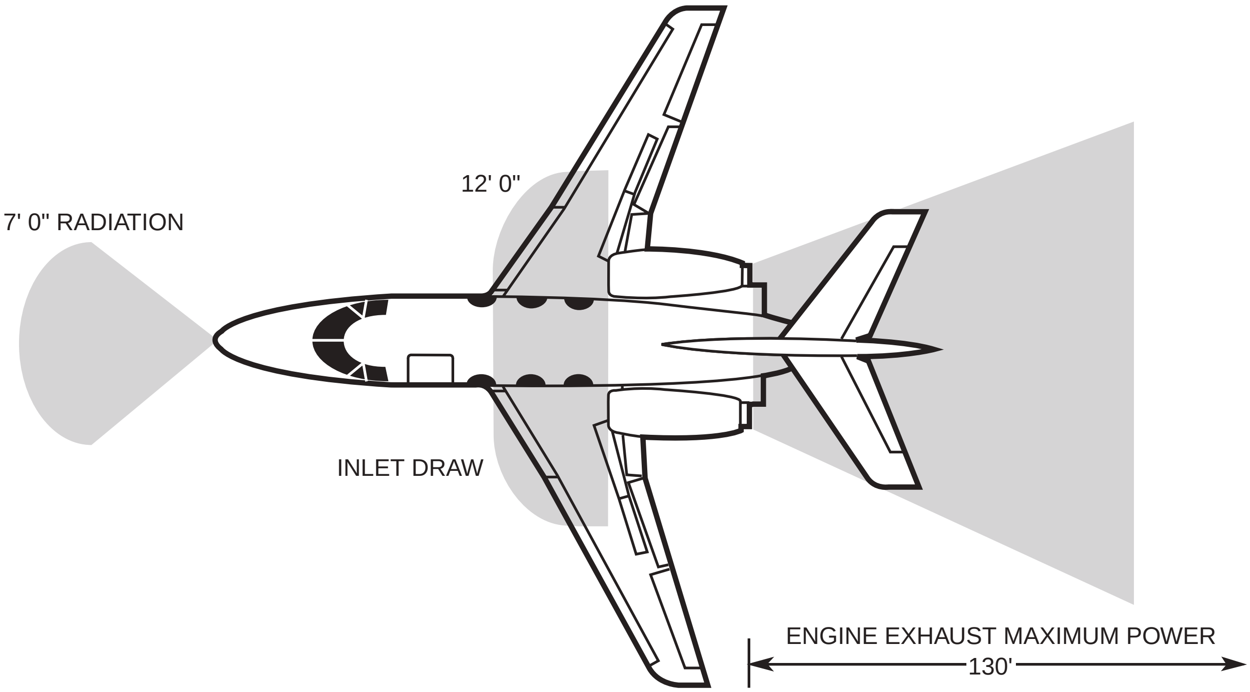


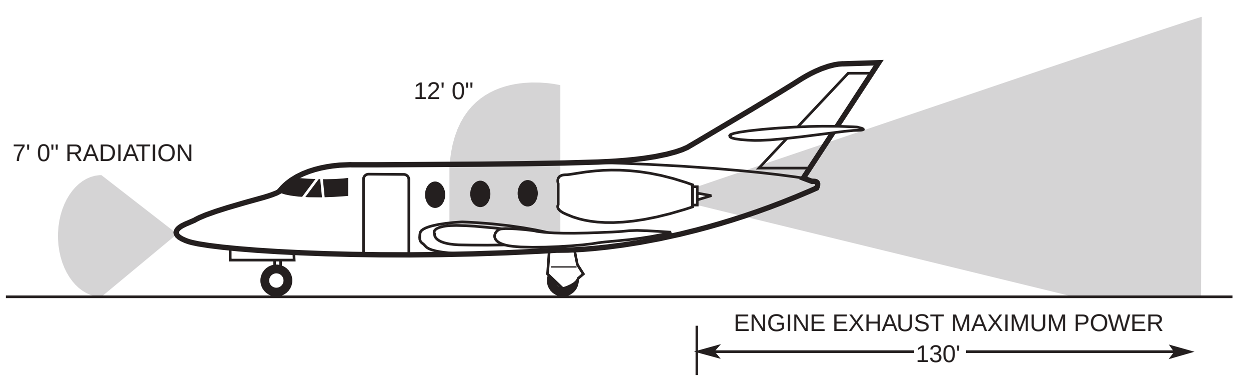


Aircraft Dimensions

Length	45´ 5.5˝
Height	15´ 1.0˝
Fuselage Length	40´ 11.0˝
Wing Span	42´ 11.0˝
Horizontal Stabilizer Span	19´ 1.0˝
Wheel Base	17´ 4.7˝
Wheel Track	9´ 5.0˝
Passenger Cabin:	
Length	16´ 3.0˝
Width (maximum)	4´ 9.0˝
Height (minimum)	4´ 7.0˝
Height (maximum)	4.´ 10.0˝
Cabin Windows:	
Height	1´ 3.7˝
Width	1´ 1.3˝
Emergency Exit:	
Height	3´ 0.0˝
Width	1´ 8.0˝
Entrance Door:	
Height	4´ 2.2˝
Width	2´ 5.5˝

Aircraft Hazard Areas





Hazard Areas

Radiation emissions from the weather radar, engine inlet draw, and engine exhaust are primary dangers during ground operations of the aircraft.

Radar

Hazards exist to personnel, equipment, and other aircraft when operating the weather radar on the ground. A potential fire ignition hazard exists within 300 ft of refueling aircraft. Radiation hazards to personnel exist within 7 ft forward of the aircraft in a 270° sector. Pointing the aircraft toward large obstructions, hangars, buildings, and other metallic objects within 300 ft can result in radar equipment damage.

Engine Inlet Draw

Engine inlet draw at full power is hazardous within 12 ft of the engine inlets. The draw increases as the distance to the inlet decreases.

Inlet draw at high power settings can cause the engine to ingest small objects (i.e., bolts, gravel) that can result in serious engine damage. Personnel hazards exist immediately forward of the inlet.

Engine Exhaust Plume

Hazards are present due to the high temperature, high velocity exhaust from the engines. Engine exhaust hazards exist within 130 ft of the nozzle.

Advise ground personnel of imminent engine starts. Do not start an engine without first verifying that the immediate area behind the aircraft is clear of personnel, small articles, or other aircraft and vehicles. Excessive thrust during taxi can result in serious damage to other aircraft, vehicles, structures, and personnel.

Service Bulletins

The Service Bulletins (SBs) addressed by the manual are listed below in numeric order.

SB 24-006 (0154); Electrical Power – DC Power – 22G Relay Supplied by the Main Bus Bar (**S/Ns 001 to 123, except 108, 113, 118, and 121**).

SB 27-013; Flight Controls – Dual Horizontal Stabilizer Trim Control Microswitch Equipped Control Wheels (**Optional – All**).

SB 29-007; Hydraulic Power – Intake Filter in the Reservoirs – Installation of a Paper Filter (**All**).

SB 29-009; Hydraulic Power – Engine-Driven Pumps – Replacement of ABEX Pumps by Vickers Pumps (**S/Ns 001 to 175 and 185**).

SB 30-001; Ice and Rain Protection – Cockpit Electrical Demisting of Rear Glass Panels (**S/Ns 002 to 019 except 005, 007, 014, and 017**).

SB 30-010 (0121); Ice and Rain Protection – Nacelle – Engine Anti-Icing (**S/Ns 001 to 085, except 071, 076, and 082**).

SB 30-012; Ice and Rain Protection – Passenger Cabin Windows – Installation of Dessicators (**S/Ns 001 to 119**).

SB 30-017; Ice and Rain Protection – Wing Leading Edge Slat Anti-Icing – Hot Air Leak Warning (**S/Ns 001 to 191**).

SB 72-001 (0180); Engines With Cone-Shaped Spinners and No Anti-Icing (**All**).

SB 77-003 (0074); N_1 and N_2 Tachometers – Doubled Voltage Supply With Battery Start on Low Temperature Start (**S/Ns 001 to 052**).

SB 78-001; Exhaust Grumman Tailpipes – Installation with a Backup Ring (**Aircraft with Tailpipes; F10A5B10-03-T**).

Avionics

Chapter 5B

Specific avionics systems vary with customer preference; many options are available. Therefore, this section provides only a brief introduction to some of the basic types of avionics equipment available on the Falcon 10/100.

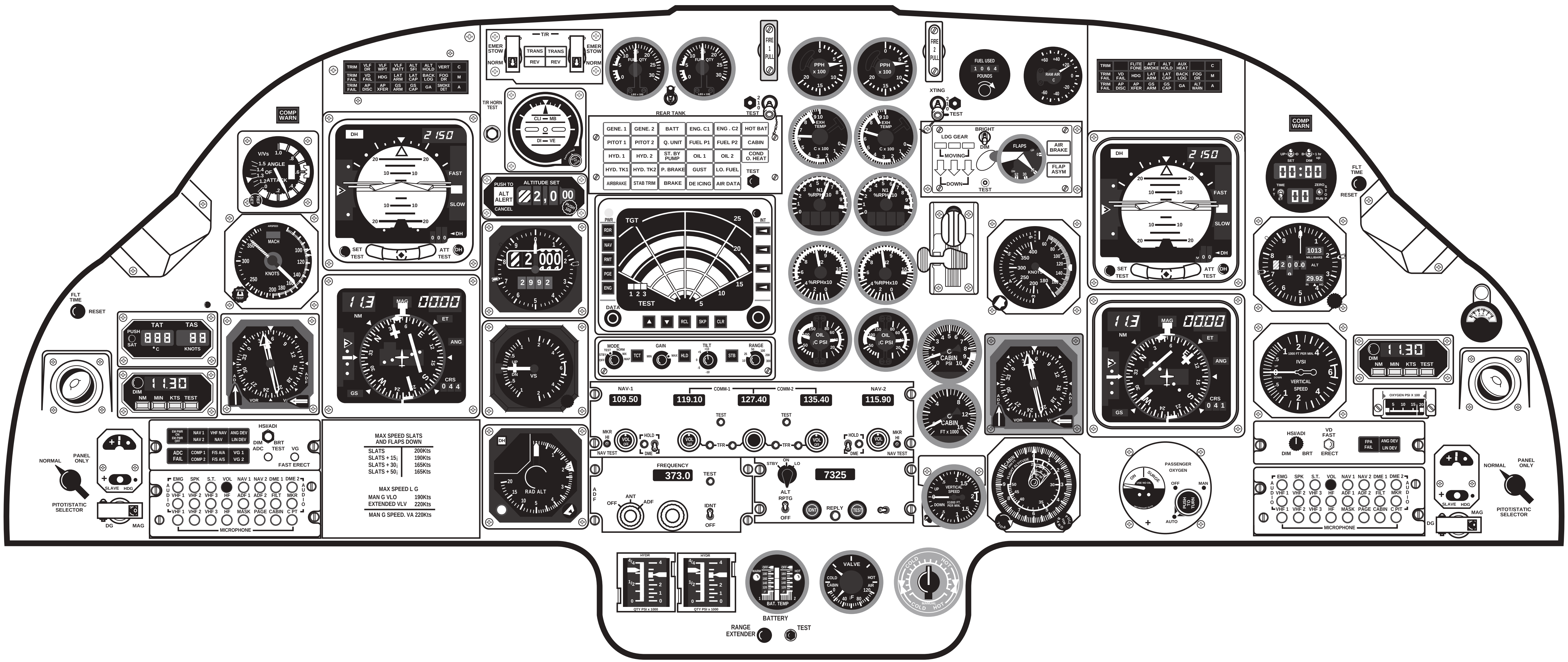
In addition, this chapter includes the pitot/static system and instrumentation not addressed in other chapters. The pitot/static system supplies dynamic and static air pressure for the air data computer and some flight instruments.

Cockpit panel art is provided to locate instruments.

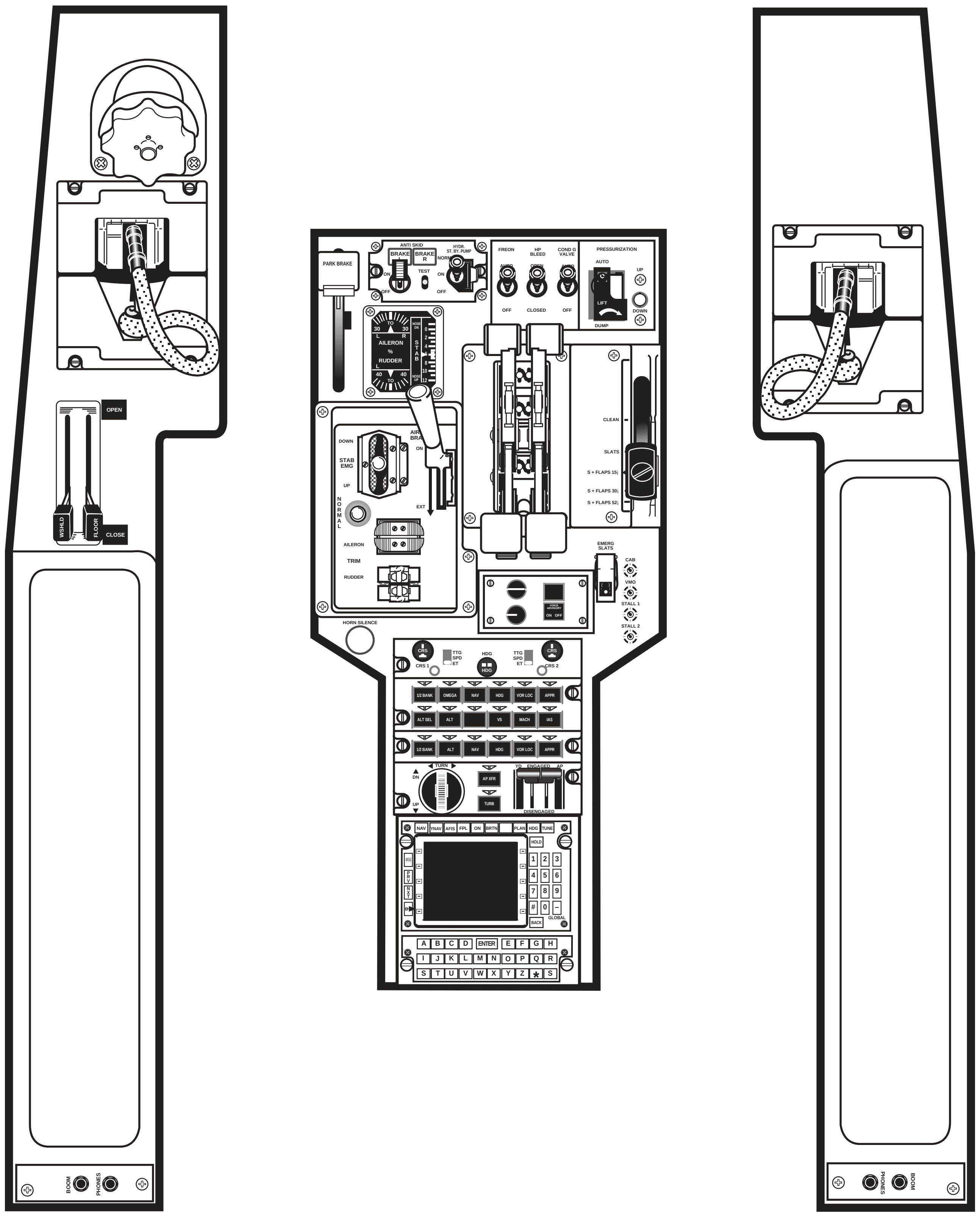
Table of Contents

Cockpit Instrument Panel

Cockpit Instrument Panel

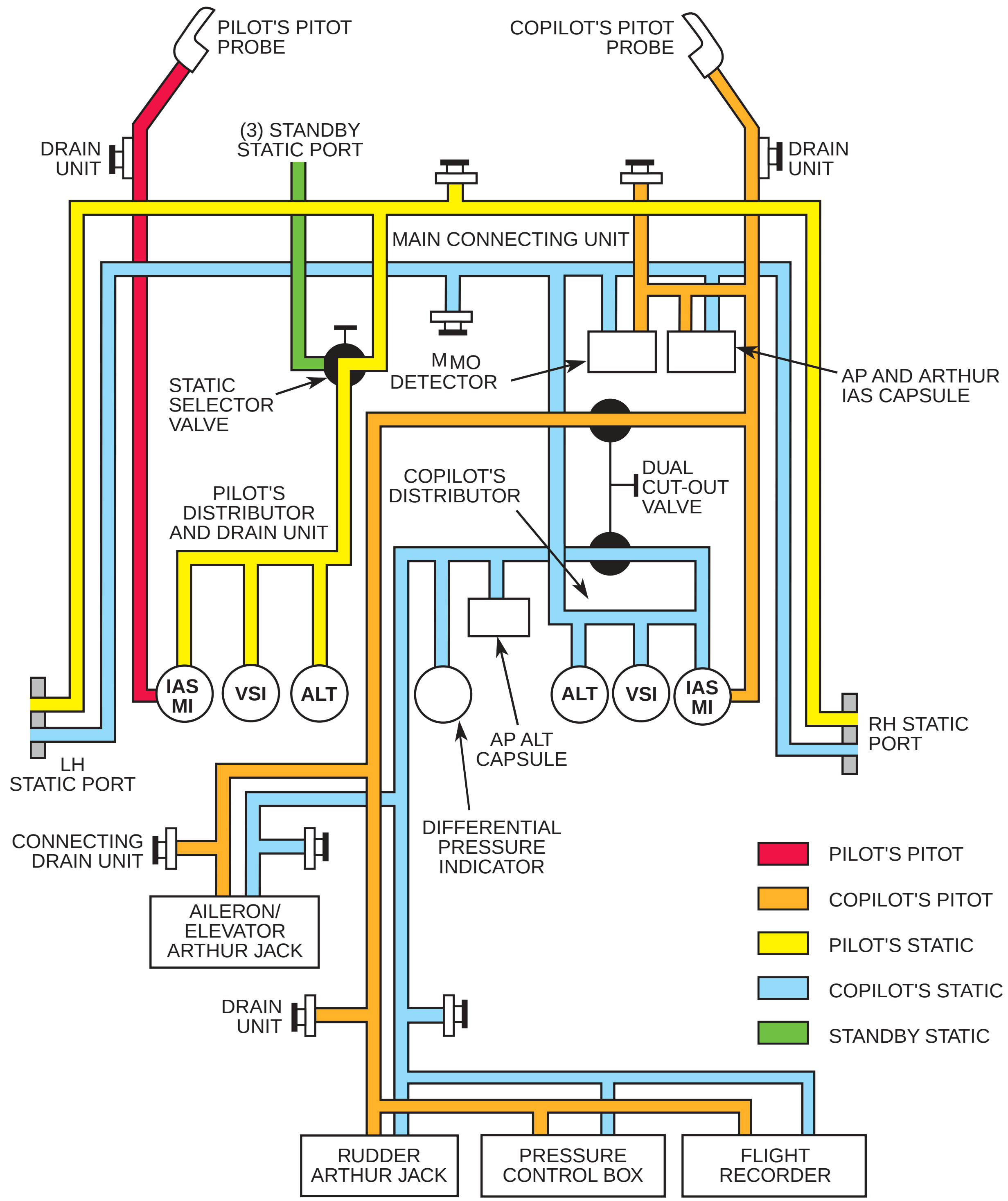


Pedestal Instrumentation

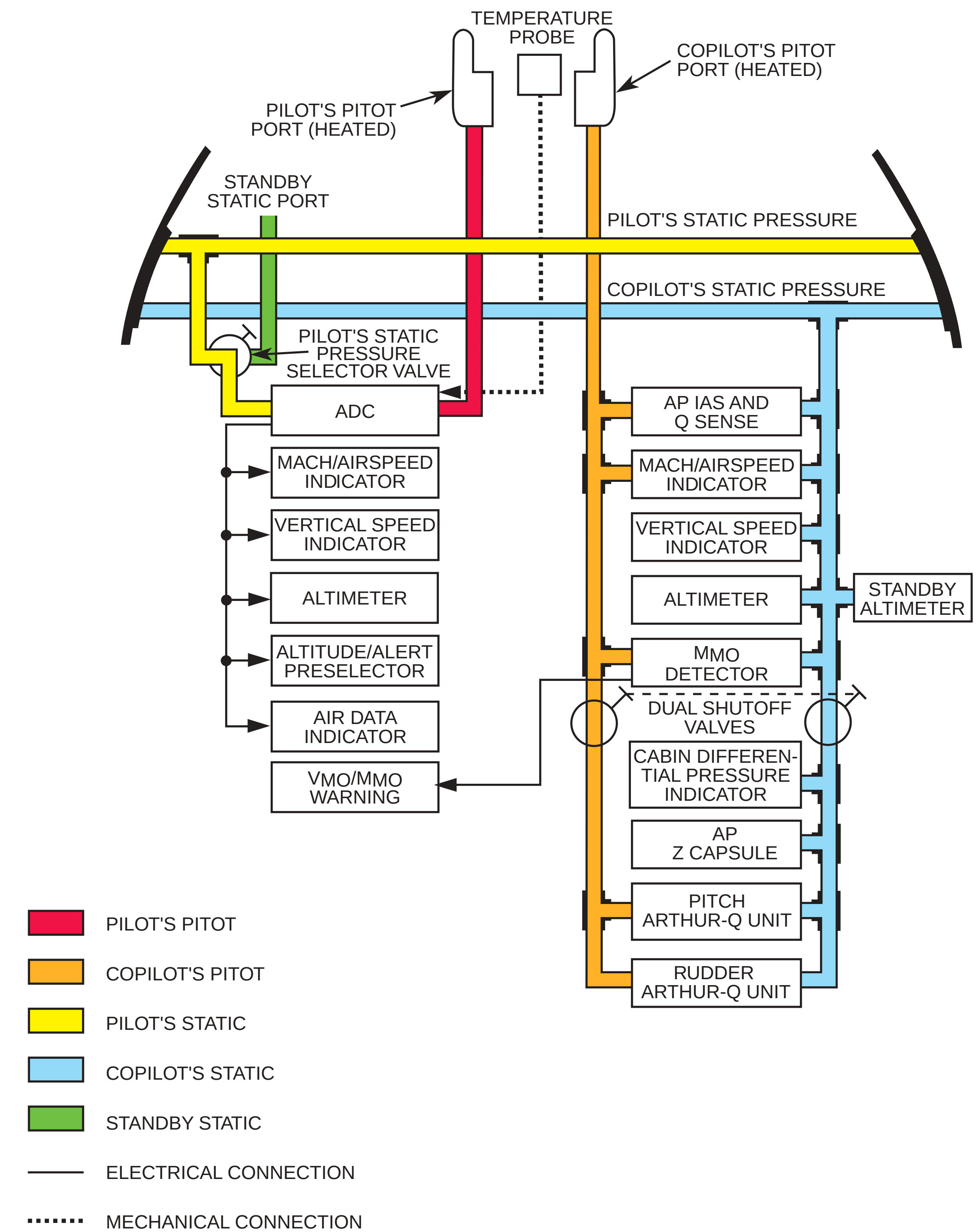


Pitot/Static Systems

Pitot/Static System
Without Air Data Computer



Pitot/Static System
With Air Data Computer



Air Data Systems

Air Data Systems include pitot probes, static ports, air temperature sensors, air data computers, and related instrumentation.

Pitot/Static System

The pitot/static system consists of two independent systems for the pilot and copilot. Each system consists of:

- two heated pitot probes
- two heated dual static ports
- one unheated standby static port.

A pitot probe (**Figure 5B-1**) on the lower fuselage on each side of the nose landing gear supplies pitot pressure to the pilot's and copilot's pitot/static systems.

A heated dual static port (**Figure 5B-2**) is on each side of the fuselage. One port on each side supplies the pilot's static system; one port on each side supplies the copilot's system. A selector valve on the pilot's instrument panel supplies static pressure from the standby static valve in the nosecone in the event of pilot's system malfunction.

The pilot's pitot/static system directly supplies the:

- Mach/airspeed indicator
- barometric altimeter
- vertical speed indicator.

Some aircraft use an air data computer (ADC) to supply pitot, static, and ram air temperature information to the pilot's instruments. The ADC supplies the:

- electric Mach/airspeed indicator
- electric vertical airspeed indicator
- electric altimeter
- altitude alerter
- temperature indicator.

The copilot's pitot/static system directly supplies the:

- Mach/airspeed indicator
- barometric altimeter
- vertical speed indicator
- Mach/airspeed warning switch
- Arthur and autopilot airspeed switches.

The copilot's system indirectly supplies through a shutoff valve the:

- cabin differential pressure indicator
- Arthur unit actuator for pitch and roll
- Arthur unit for rudder control
- autopilot altitude sensitive switch
- flight recorder (if installed)
- air data computer (if installed).

The copilot's pitot/static selector valve is a dual shutoff valve. In NORMAL,


5B-1

5B-2

both the instruments and auxiliary equipment are supplied with pitot/static pressure. In PANEL ONLY, the valve supplies the copilot's instruments and isolates the auxiliary equipment.

Drain traps within the system allow residual water removal from the pitot and static pressure lines. Plastic bowls within the drains indicate the presence of water at the traps.

Air Data Computer (ADC)

The ADC receives pitot and static pressure data from the pilot's pitot/static system and ram air temperature data from a probe. The ADC then computes altitude, corrected altitude, vertical speed component, indicated airspeed, Mach, maximum speed, and air temperature. This information is then fed to the pilot's instruments, autopilot, and flight director systems.

The ADC is in the nosecone and is supplied with 28V DC from the A bus through a circuit breaker.

A test button on the front of the ADC allows for system testing on the ground. The AIR DATA light illuminates for one-half second to indicate proper system operation. If the AIR DATA light illuminates steadily in flight, the system is malfunctioning.

Total Temperature System

An external total temperature probe on the forward right side of the fuselage provides ram air temperature data to the ADC. The ADC provides total air temperature (TAT) information to the total air temperature indicator on the pilot's instrument panel (**Figure 5B-3**). The indicator reads from -60°C to +60°C.

A heating element powered by 28V DC from the A bus provides anti-icing protection.

Altimeters

Two altimeters are on the Falcon 10/100 aircraft: pilot's and copilot's. A third standby altimeter is optional.

Pilot's Altimeter

On aircraft **without an ADC**, the pilot's altimeter is a barometric unit that receives data from the static ports. The unit displays altitude from -999 to +50,000 ft with a pointer that makes one revolution per 1,000 ft and a drum display. An adjustable pressure display allows the setting of local barometric pressure on the indicator.

On aircraft **with an ADC**, the pilot's electric altimeter receives data from the ADC. The altimeter (**Figure 5B-4**) displays altitude with a single point-

5B-3

5B-4

er that makes one revolution per 1,000 ft and a drum display. The drum display indicates aircraft altitude from -1,000 to +50,000 ft in 20-ft increments. A window indicates the barometric reference pressure in inches of mercury and millibars. A BARO knob on the lower right corner of the instrument allows for the adjustment of barometric pressure. Pushing the knob in adjusts for inches of mercury (In Hg); pulling it out adjusts for millibars.

The pilot's altimeter provides encoded altitude information to the transponder.

Pressing the TEST button on the altimeter displays a red flag and the altimeter indicates 750 ft. Absence of either indicates altimeter or servo-system failure.

Copilot's Altimeter

The copilot's altimeter (**Figure 5B-5**) is a barometric unit that displays altitude from -999 to +50,000 ft with a pointer that makes one revolution per 1,000 ft and a drum display. The unit receives static pressure data from the copilot's pitot/static system.

Two small windows display barometric pressure in inches of mercury (In Hg) and millibars. A knob on the lower right corner allows for the adjustment of barometric pressure.

On aircraft **with a second ADC**, the copilot's altimeter is similar to the pilot's electric altimeter.

Standby Altimeter

Some aircraft have a standby barometric altimeter on the copilot's instrument panel. The unit displays altitude from -1,000 to +60,000 ft with three concentric pointers. Barometric pressure is indicated in inches of mercury (In Hg) with a drum type display.

The unit receives static pressure data from the copilot's pitot/static system.

Mach/Airspeed Indicators

On aircraft **without an ADC**, the pilot and copilot Mach/airspeed indicators are identical (**Figure 5B-6**). Each unit receives pitot/static data from its respective pitot/static system. The units display accurate airspeed information from 60 to 400 kts and Mach number simultaneously.

A moving pointer indicates maximum airspeed (V_{MO}/M_{MO}). A moveable reference pointer (bug), controlled by a knob on the lower left corner of the instrument, allows the setting of a speed reference marker.

On aircraft **with an ADC**, the pilot's Mach/airspeed indicator is an electric unit that receives data from the ADC.

5B-5

5B-6

The unit displays airspeed from 60 to 420 kts with a pointer and Mach number from 0.30 to 0.99 on a drum display. If the power supply or indicator malfunctions, a red warning flag appears on the display.

Vertical Speed Indicators

On aircraft **without an ADC**, two identical vertical speed indicators (VSIs) indicate aircraft vertical speed from 0 to 6,000 feet per minute (FPM) up or down (**Figure 5B-7**). The graduations on the instrument indicate 100 FPM between 0 and 1,000 FPM and 500 FPM above 1,000 FPM.

On aircraft **with an ADC**, the pilot's vertical speed indicator is an electric unit that receives data from the ADC. The unit displays vertical speed from 0 to 6,000 FPM up or down. A red flag appears in the event of power failure or a system malfunction detected by the ADC monitoring circuits. A moveable reference marker, controlled by knob on the lower right corner of the indicator, allows the setting of a climb or descent speed marker.

Speed, Mach, and Altitude Warning

A Mach limit and overspeed warning system provides an aural warning when airspeed reaches 350 to 370 kts (depending on altitude) or Mach number reaches 0.87 above 25,000 ft. The system receives 28V DC power from the B bus.

An altitude alerting system provides a visual and aural signal whenever the aircraft is outside a preselected altitude. The ALT ALERT light illuminates and a 800 Hz tone sounds for two seconds when the aircraft is within 1,000 ft of the preselected altitude.

5B-7

The light extinguishes and remains extinguished as long as the aircraft flies within 300 ft of the selected altitude. If altitude varies more than 300 ft, the tone sounds and the ALT ALERT light illuminates.

The system has a built-in test feature that illuminates the light and displays a warning flag when the ALT ALERT button is pressed.

Additional Instrumentation

Additional flight instrumentation not related to the air data system includes digital clocks, a magnetic compass, and a standby gyro-horizon.

Digital Clock

A single digital clock provides time and elapsed time information in a 24-hour format (**Figure 5B-8**). The clock is capable of displaying elapsed time, flight time, and actual time.

Magnetic Compass

A standard liquid-filled compass (**Figure 5B-9**) is on the center windshield post. The unit has provisions for maintenance personnel to adjust the compass to compensate for magnetic fields generated by aircraft equipment. A compass correction card on the unit provides a written record of compass adjustments.

Standby Gyro-Horizon

The standby gyro-horizon (**Figure 5B-10**) provides roll and pitch attitude data in the event of a system failure. The unit operates on AC power supplied by an internal inverter from the A bus. The emergency battery supplies operating current if the aircraft electrical system fails.

5B-8

5B-9

5B-10

Avionics Equipment

Avionics equipment on the Falcon 10/100 aircraft includes communications and navigation equipment.

Depending upon customer preference and aircraft modifications, avionics systems can vary widely. This section provides a brief overview of the most common systems.

Communications

Communications equipment includes very high frequency (VHF), high frequency (HF), interphone and radio telephone systems, and static discharging systems.

VHF Communications

Very high frequency (VHF) transceivers provide air-to-air, air-to-ground, and ground-to-ground communications in the 116 to 151.975 MHz frequency range. Typical systems (118 to 135.975 MHz) provide 25 kHz frequency spacing with a possible 720 distinct frequencies. Extended frequency range systems provide 1,440 distinct frequencies in the 116 to 151.975 MHz range.

Each VHF communications system consists of a control unit, transceiver, and antenna. The No. 1 and No. 2 VHF transceivers are in the nose- cone. DC power from the A bus powers the No. 1 transceiver; the D bus powers the No. 2 transceiver. Control units (**Figure 5B-11**) on the center instrument panel provide frequency selection and display, volume control, transfer between two frequencies, power control (on/off), and system testing.

Each VHF transceiver has its own antenna. The No. 1 system antenna is on the lower fuselage; the No. 2 system antenna is on the vertical stabilizer.

HF Communications

Very long range, high frequency (HF) communication is provided by a single transceiver and control system. This system operates in the 2 to 30 MHz range with two transmission modes: amplitude modulation (AM) and single sideband (SSB). Frequency spacing of 100 Hz provides a possible 288,000 distinct frequencies.

The system consists of:

- transceiver
- control unit
- coupler-amplifier
- antenna.

The transceiver in the nosecone operates on 28V DC from the D bus. The HF control unit (**Figure 5B-12**) on the

5B-11


5B-12

right console contains controls for system mode, frequency selection and display, squelching, and volume.

A coupler-amplifier in the baggage compartment boosts transceiver output and balances the antenna load to the selected frequency. The wire HF antenna runs from a mast on the left wing to the left engine nacelle.

Interphone

A cabin address and external communications system allows the crew to communicate with the passengers through speakers and with ground personnel through jacks in the nose gear wheel well and in the baggage compartment.

When the crew communicates with the passengers, an attention tone precedes sounds in the cabin. The passenger address system also includes an input for a tape player or other audio source.

Audio Control Units

An audio control unit (**Figure 5B-13**) for each crewmember on the instrument panel allows audio source output and microphone input selection. Each unit has inputs for a handset, oxygen mask, and headset microphone and outputs for a cockpit loudspeaker and headset. The units use either toggle switches (**Figure 5B-14**) or pushbuttons for input and output selection.

A single potentiometer controls the volume of the selected audio channels. The volume control knobs on equipment control heads control individual receiver volume levels. Volume levels of the interphone, sidetone, marker receiver, and radio compass audio outputs are controlled by the volume control when they are filtered.

Multiple pushbuttons or toggle switches select audio sources from the communication and navigation receivers and microphone output to the communication transmitters, the public address system, and the interphone system.

On the pushbutton unit, an interlocking system for the VHF 1, VHF 2, VHF 3, and HF 1 microphone input switches prevents the selection of more than one input. Depressing the CABIN button overrides the VHF and HF microphone inputs.

5B-13

Selecting EMG or EMER (emergency) sends all selected audio outputs directly to the headset amplified by the receivers only. Depressing the SPK (speaker) button sends all selected outputs to the loudspeaker in the cockpit.

The system automatically mutes all audio outputs except cabin, aural warnings, and sidetone during VHF, HF, and cabin interphone transmissions.

Static Discharging

As an aircraft moves through the air, friction between the surface of the aircraft and air molecules creates static electricity. A static charge build up on the skin of the aircraft has an adverse effect on communication equipment; communication becomes unintelligible. Likewise, lightning strikes are destructive to the airframe, antennas, and avionics systems.

Static dischargers (**Figure 5B-15**) on the wings, stabilizers, and pylon trailing edges minimize the effect of static electricity and lightning strikes. The dischargers bleed off accumulated static charges to the atmosphere. They minimize static-induced noise in the communication systems.

During the preflight inspection, the security and presence of the dischargers should be checked.

The number of static dischargers varies with owner preference, type of discharger used, and modification status. Typical installations employ static dischargers on the wing tips, ailerons, pylon trailing edges, rudder, elevators, horizontal stabilizer trailing edge, and tailcone.

Navigation

Navigation equipment on the Falcon 10/100 includes VHF receivers, automatic direction finding (ADF), distance measuring (DME), radio altitude, attitude and heading gyros, and long range navigation equipment.

VHF Navigation

VHF navigation receivers provide very high frequency omni-range (VOR), localizer (LOC), glideslope (GS), and marker beacon navigation information to the flight crew through various indicating equipment.

5B-14


5B-15

Each receiver has 200 VHF frequencies from 108.00 to 117.95 MHz spaced at 50 kHz, 40 paired glide-slope frequencies from 329.15 to 335.00 MHz spaced at 150 kHz, and 40 LOC frequencies from 108.10 to 111.95 MHz. Automatic DME channeling is through the system control head. Multiple outputs from the receivers drive the flight director, radio magnetic indicators (RMIs), autopilot, course deviation indicators, and area navigation equipment (RNAV). Audio output from the receiver is supplied to the audio control units.

Receiver control, frequency selection, and display are controlled through heads on the center instrument panel (**Figure 5B-16**).

As part of the VHF navigation receiver, a marker beacon receiver provides visual and aural indications of beacon passage. The system receives on a single 75 MHz frequency and provides electrical outputs to two sets of three indicating lights on the instrument panel. The receiver also provides audio output to the audio control units for beacon passage notification.

The A bus and the pilot's inverter supply 28V DC and 26V AC, respectively, to the No. 1 VHF system. The C and D buses and pilot's inverter supply 28V DC and 26V AC to the No. 2 system.

Instrument Landing System

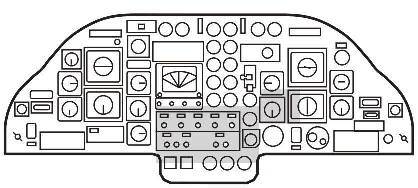
An instrument landing system (ILS) combines outputs from the VHF navigation receiver, a UHF glideslope receiver, and the marker beacon receiver to display ILS information on the attitude director indicator and the horizontal situation indicator.

The system consists of a glideslope receiver operating in the 329.15 to 335.00 MHz frequency range, the VHF receiver in LOC mode operating in the 111.95 to 118.10 MHz frequency range, a glideslope antenna in the nose, and a LOC antenna on each side of the vertical stabilizer.

Automatic Direction Finding

Automatic direction finding (ADF) systems consist of dual receivers, dual control heads (**Figure 5B-17**), and loop and sense antennas. They operate in the 190.0 to 1749.5 kHz frequency range with 0.5 kHz spacing to provide 3,120 distinct frequencies.

Typical ADF systems provide three basic modes of operation: antenna (ANT), automatic direction finding (ADF), and tone (TONE/BFO). In antenna mode, the RMI pointer parks and the system provides audio only. ADF mode provides RMI bearing to



5B-16

5B-17

the station and station audio. Tone/BFO mode provides a 1000 Hz tone for identification of morse code station identifiers.

The No. 1 ADF system receives 28V DC from the B bus and 26V AC from the Y bus. The No. 2 system receives power from the C bus and the Z bus.

The No. 1 and No. 2 system loop antennas are in the wing-to-fuselage fillets below the wing center section tank. The No. 1 sense antenna is in the fin stub root; the No. 2 sense antenna is the fuselage belly.

Distance Measuring

Distance measuring equipment (DME) provides slant range distance between the aircraft and a VORTAC facility. The system transmits in the 1025 to 1150 MHz range, and receives in the 962 to 1213 MHz range. Each DME channel is paired with a VHF navigation frequency between 108.00 and 117.95 MHz. DME channel selection is automatic through the VHF navigation receiver.

The DME system provides distance, speed, and time information to the horizontal situation indicators (HSIs), and DME displays.

The No. 1 DME receives 28V DC from the B bus, and the No. 2 system receives power from the C bus.

Transponder

Typical transponder systems with 4,096 individual Mode A/C code capability provide identification and altitude reporting to surveillance radar installations.

The system consists of dual transceivers that transmit on 1090 MHz and receive on 1030 MHz with a single source selectable control head on the center instrument panel (**Figure 5B-18**). Altitude information is from the pilot's encoded altimeter. A transmit/receive antenna for the transceiver is on the lower front fuselage.

Radio Magnetic Indicators

Two radio magnetic indicators (**Figure 5B-19**) display aircraft heading information on a calibrated servo-driven compass card. Bearing to either VOR or ADF stations is provided by pointers that are read against the card.

The radio magnetic indicators (RMIs) receive compass information from the HSIs, VOR bearing information from the VHF navigation receivers, and ADF bearing information from the ADF system.

Radio Altimeter

A single radio altimeter (**Figure 5B-20**) system provides precise altitude readings for approaches and landing.

5B-18

5B-19

5B-20

The system consists of a transceiver, indicator, transmit antenna, and receive antenna; the antennas are on the aft fuselage belly. The system transmits a 4250 to 4350 MHz (4.3 GHz ± 5 MHz) signal toward the ground, receives the bounced signal, and computes distance from the delay between transmission and reception. The system provides altitude information from -20 to +2,500 ft on an indicator on the pilot's instrument panel or on the ADI/EADI.

Vertical Gyros

Two vertical gyros provide pitch and roll data to the attitude director indicators, automatic flight control system, radar antenna pedestal, and yaw damper system. The No. 1 vertical gyro supplies the pilot's systems, and the No. 2 gyro supplies the copilot's systems and yaw damper.

The system consists of two vertical gyros in the nosecone. The W bus supplies 115V AC to the No. 1 gyro, and the X bus supplies 115V AC to the No. 2 gyro.

Directional Gyro

Two independent directional gyro systems provide 360° of magnetic heading information to the HSIs, RMIs, autopilot, and inertial navigation systems. Each system consists of a gyro, flux valve, compensator, and controller.

The flux valves measure the earth's magnetic field to act as a synchro transmitter for the directional gyros. A compensator for each flux valve counteracts magnetic disturbances affecting the flux valve.

The compass controllers on the pilot's and copilot's consoles allow the setting of a heading or course on the HSIs and RMIs.

The No. 1 system receives 28V DC from the A bus and 115V AC from the W bus. The No. 2 system receives 28V DC from the C bus and 115V AC from the X bus. The directional gyros supply their flux valves with 26V AC.

Avionics Switching Panel

A custom manufactured panel on the lower left and right sides of the instrument panel provides switching, transferring, and monitoring of instruments and navigation equipment. Panel onfiguration and operation varies on equipment installed and customer preference.

A typical panel (**Figure 5B-21**) for the pilot includes:

- EMERG ON-OFF. Arms and disarms the emergency battery. This system powers the emergency attitude indicator, altimeter, VSI, No. 1 COM and NAV radios, No. 1 transponder, and the lights for these instruments. With the switch off and the main batteries on, the light is yellow. When the switch is on, the light is green.
- NAV 1-NAV 2. Directs No. 1 NAV or No. 2 NAV information to the pilot's HSI; selected mode lights green.
- VHF NAV-Omega NAV. Directs VHF NAV or Omega NAV information to the pilot's HSI; selected mode lights green.
- ANG DEV-LIN DEV. Selects angular or linear deviation mode on the pilot's HSI. In angular deviation mode, each dot of course line displacement is measured in degrees. In

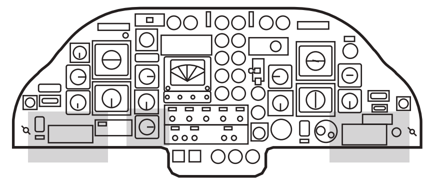
linear deviation mode, each dot of course line displacement is measured in actual distance.

- ADC FAIL. Illuminates if the ADC fails.
- COMP 1-COMP 2. Directs directional gyro (DG) information from DG No. 1 or DG No. 2 to the pilot's HSI; selected mode lights green.
- FS/AA-FS/AS. FS/AA directs fast/slow information to the AOA indexers and FS/AS directs airspeed information to the AOA indexers; selected mode lights green.
- VG 1-VG 2. Directs vertical gyro (VG) information from VG No. 1 or VG No. 2 to the pilot's ADI; selected mode lights green.

The copilot's panel (**Figure 5B-21**) contains switching for the angular and linear deviation displays. It includes:

- FPA FAIL. Illuminates if the flight path advisory system fails (FPA).
- ANG DEV-LIN DEV. Selects angular or linear deviation mode on the copilot's HSI. In angular deviation mode, each dot of course line displacement is measured in degrees. In linear deviation mode, each dot of course line displacement is measured in actual distance.

5B-21



Weather Radar System

Weather radar systems consist of an antenna, a receiver-transmitter, a display, and system controls (**Figure 5B-22**). The vertical gyro system provides attitude information to the radar system to stabilize the antenna. The system operates by transmitting a high frequency radio signal (X-Ray band), receiving the reflected signal, and displaying the reflected signals as echoes on the display. Controls on and below the indicator select system mode, scanning range, antenna tilt, and receiver gain (sensitivity).

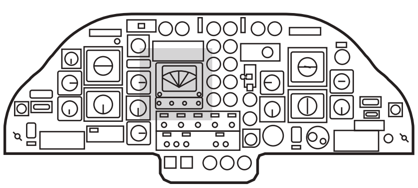
Typical systems provide:

- selectable scanning range
- ground mapping
- weather cell contouring
- adjustable antenna tilt and scan
- target alerting.

Some radar systems provide a moving map navigation display with the radar indicator. The navigation display includes VORTAC stations, waypoints, magnetic compass heading, station bearing, course lines, and other helpful navigation information with weather information.

When operating radar on the ground, precautions should be taken to avoid personnel injury, equipment damage, or fuel ignition. Avoid operating the radar during refueling or within 300 ft of refueling aircraft. Caution personnel to remain outside of an area within 270° and 7 ft forward of the radome. Direct the nose of the aircraft so that a 240° sector forward of the aircraft is free of large obstructions, hangars, and other buildings for a distance of 300 ft. Tilt the antenna up 15°.

For more information concerning radar hazards, refer to FAA Advisory Circular AC 2068B.



5B-22

Autopilot/ Flight Director System

Autopilot/flight director systems combine an autopilot, flight director, yaw damper, indicators, and controls to provide automatic flight control of high performance aircraft.

Autopilot

The autopilot provides stabilization of the aircraft around the pitch and roll axes. The system also provides:

- heading hold and commanded turns
- altitude capture and hold
- Mach/airspeed hold
- vertical speed hold
- VOR/LOC course capture and track
- Loran/LRN course capture and track
- ILS beam capture and track.

A typical autopilot system consists of:

- autopilot computer or shared autopilot/flight direcor computer
- autopilot amplifier
- servos
- autopilot controller
- controls and indicators.

Autopilot Computer

Each autopilot computer interprets commands from the vertical gyro, flight director computers, autopilot controller, magnetic heading reference system, and vertical accelerometers to command the autopilot amplifier to drive the aileron and elevator servos.

Autopilot Amplifier

The autopilot amplifier provides amplified steering commands from the flight director systems, vertical gyros, and directional gyro to the aileron and elevator servos. The servos in turn drive the control surfaces to the desired position.

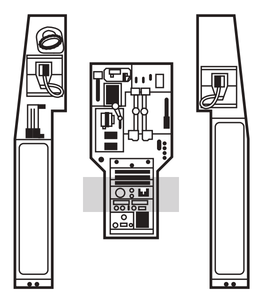
Servos

Servos for the elevator and ailerons consist of a DC torque motor, a tachometer-generator, and an electromagnetic clutch. Signals from the autopilot amplifier drive the servo motor to position the control surface through cables. A feedback signal produced by the tachometer-generator provides control surface position information to the amplifier. Once the control surface reaches the commanded position, the amplifier signals the servo to stop. The electromagnetic clutch connects the servo motor to its output shaft during autopilot engagement.

Autopilot Controller

A single autopilot controller on the pedestal (**Figure 5B-23**) contains an

5B-23



autopilot engage lever or pushbutton, yaw damper engage lever, pitch control wheel, turn control knob, and transfer and turbulence buttons. On some systems, the pitch and turn controls are spring-loaded to the center position. Engaging the autopilot also engages the yaw damper.

Manual control of the autopilot through the controller automatically disengages some functions of the system. Manually changing aircraft pitch through the pitch control knob automatically disengages all flight director vertical modes; using the turn control knob also disengages all flight director lateral modes.

The AP XFR button selects the flight director system supplying the autopilot. A mode coupler controls autopilot to flight director coupling; pushing the AP XFR button transfers the autopilot between flight director No. 1 or No. 2. In turbulent flight conditions, pressing the TURB button reduces autopilot commands to the servos to prevent the system from overreacting to rapid aircraft attitude changes.

Controls and Indicators

Controls and indicators for the autopilot are distributed throughout the cockpit. Pushbuttons on the control yoke disengage the autopilot and initiate a go-around command (**Figure 5B-25**). Pushing the disengage button disengages the autopilot, releases the autopilot engage lever, and illuminates the AUTOPILOT light on the instrument panel. Pushing the go-around button disengages the autopilot and initiates a fixed, nose-up pitch command for a missed approach maneuver (14°).

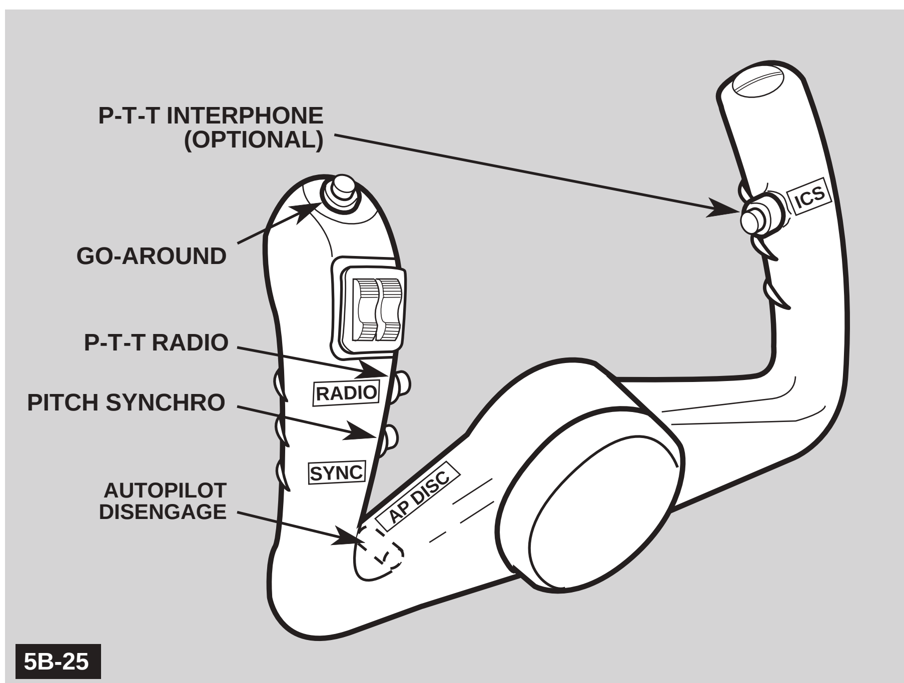
The aileron and elevator trim indicators on the pedestal allow the crew to verify autopilot operation. Signals from the autopilot amplifier and servos drive the indicators.

Flight Director

A typical flight director system consists of:

- flight director computer
- mode selector
- mode coupler
- attitude director indicator
- horizontal situation indicator.

5B-24



5B-25

Flight Director Computer

The flight director computers in the nosecone provide pitch and roll commands to the autopilot and the indicators. The navigation receivers, air data computer (**if installed**), gyros, and accelerometers supply data to the flight director computer. The flight director computer in turn provides pitch and roll commands to the autopilot and indicator command bars.

The mode coupler passes pitch and roll commands through the flight director to the autopilot, and from the autopilot to the aileron and elevator servos.

Mode Selector

A single mode selector on the pedestal allows the selection of flight director modes for the pilot's and copilot's flight directors. Pushbuttons allow:

- selection of altitude and heading hold
- capturing and tracking of a radio beam
- approach path (ILS)
- selection and coupling of the autopilot or autopilot/flight director computers to the autopilot amplifier.

In addition, pushbuttons allow the selection of vertical modes. These include:

- indicated airspeed
- Mach number hold
- vertical speed hold
- altitude selection.

Pressing a pushbutton selects the mode and illuminates the button to indicate mode activation.

Instrumentation

Depending on the system installed, the Falcon 10/100 uses mechanical or electronic flight instrumentation (EFIS).

Attitude Director Indicator

Depending on aircraft equipment, modification status, and customer preference, the attitude director indicator (ADI) is either a mechanical unit or an electronic unit (EADI). The ADI (**Figure 5B-24**) provides a three-dimensional representation of aircraft attitude and flight director generated roll and pitch commands.

The indicator displays:

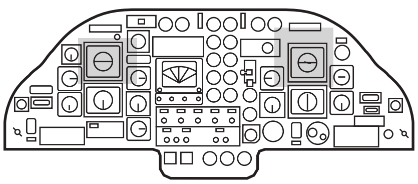
- attitude and steering commands
- localizer and glideslope deviation
- rate-of-turn
- radio altitude
- decision height
- speed deviation.

A rate-of-turn sensor detects aircraft lateral turn rate and drives the ADI display.

Aircraft attitude information is displayed by the relationship of a stationary aircraft symbol with respect to a moving horizon line. The horizon line is servo-driven through the pitch and roll axes. Degree lines above and below the horizon line indicate aircraft pitch angles in climb and descent. Aircraft roll angle is displayed by a scale at the top of the indicator.

Two bars flanking the aircraft symbol indicate flight director steering commands. The bars are servo-driven for combined roll and pitch commands. Numerous warning flags within the indicator alert the crew to failures.

The EADI provides the same information as its mechanical counterpart using a cathode ray tube (CRT).



Horizontal Situation Indicator

The horizontal situation indicator (HSI) (**Figure 5B-26**) can be either a mechanical unit or an electronic display. It displays:

- aircraft position and heading with respect to magnetic or true north
- selected heading and selected course
- DME slant range
- deviation from selected VOR, LOC, or other navigation aid
- vertical deviation from GS
- TO/FROM indication
- bearing/track information.

An aircraft symbol shows aircraft position and heading in relation to an azimuth card, lateral deviation bar, and selected heading. The azimuth card displays heading information from a gyro-stabilized magnetic compass. Heading is read on the card beneath the lubber line at the top center of the indicator.

The EHSI provides the same information as its mechanical counterpart using a CRT.

5B-26

Electronic Flight Instrument System

The Electronic Flight Instrument System (EFIS) reproduces information presented on the ADI, HSI, and weather radar on color CRTs. It replaces the standard mechanical ADI and HSI with an electronic attitude director indicator (EADI) and an electronic horizontal situation indicator (EHSI) that are high-resolution, black-matrix, shadow-mask color cathode ray tubes (CRT).

Additional information such as weather radar, navigation waypoint locations, and moving map displays are also available for display on the EADI and EHSI.

The weather radar indicator and control panel are replaced by a multifunction display that is capable of displaying radar and navigation information simultaneously.

The complete EFIS system includes:

- two display processor units
- one multifunction processor unit
- four identical CRTs for the EADIs and EHSIs
- two display control panels
- one multifunction display unit
- one course heading panel
- two reversionary switching panels.

Display Processor Unit

The display processor unit (DPU) receives data from the navigation equipment, flight director computer, vertical gyros, and directional gyros. The DPU processes this information for presentation on the EADI and EHSI. Each DPU controls a set of attitude and heading displays.

If a DPU fails, the multifunction processor unit (MPU) replaces the failed unit. If both DPUs fail, the MPU replaces both units to display identical data on both pair of EADIs and EHSIs.

Multifunction Processor Unit

The multifunction processor unit (MPU) receives data from the weather radar system and both pilot's navigation and attitude systems. The MPU processes radar information and/or navigation information for display on the multifunction display unit.

In the event of DPU failure, the MPU replaces the failed DPU. If both DPUs fail, the MPU replaces both DPUs. Each pair of displays (EADIs and EHSIs) displays the same information.

EADI and EHSI

The EADI (**Figure 5B-27**, following page) and EHSI (**Figure 5B-28**, following page) present displays similar to their mechanical counterparts. Each pair of units (EADI and EHSI) is driven by a separate DPU. In the event of EADI or EHSI failure, EADI is presented on the functional display and the EHSI is presented on the multifunction display unit. If both displays fail, a combined image of attitude and heading is displayed on the remaining display.

The EHSI can present information in three different modes: full compass rose, 60° compass rose, map, and combinations thereof. Full compass rose mode is similar to a mechanical HSI's display.

Display Control Panels

A display control panel (DPU) for each crewmember contains controls for each EADI and EHSI pair. Each DPU (**Figure 5B-29**) allows:

- selection of display modes on the EHSI
- display of navigation information on the EADI and EHSI
- brightness adjustment.

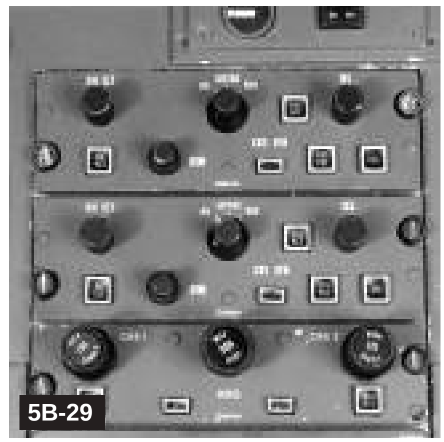
If one of the display control panels fails, the remaining panel operates both pairs of displays.

Multifunction Display Unit

The multifunction display unit (MFD) (**Figure 5B-30**) presents information in either radar, radar and navigation, or navigation only modes. In radar and navigation mode, navigation information (waypoints, course, etc.) is pre-


5B-27


5B-28


5B-29


5B-30

5B-31

sented with radar information. Mode selection is through pushbuttons on the unit's face. In the event of EADI or EHSI failure, the MFD presents the failed display's information.

MFD control is through a radar control panel below the display. This panel contains the normal controls found on a standard weather radar unit.

Reversionary Switching Panels

Two reversionary switching panels (RSP) control the operation of each EFIS display pair (**Figure 5B-31**). Each panel contains switches for:

- display transfer
- image transfer
- display of attitude and heading information from the INS or attitude and heading system
- replacement of a failed DPU by the MPU
- system testing.

Course Heading Panel

A single course heading panel (**Figure 5B-29**) for the entire system allows each crewmember to select a desired course through two knobs. A single knob allows a heading to be selected; it also allows the display of navigation data on the EHSIs.

Preflight and Procedures

Preflight

During the preflight inspection, remove the covers and verify that the pitot tubes and static ports are clear and free of obstructions. Check the condition and presence of the 17 or more static dischargers.

Abnormal Procedures

Abnormal procedures for the Falcon 10/100 concern the pitot/static and autopilot systems. Refer to Section 3 of the AFM for abnormal procedures concerning the electronic flight information system (EFIS).

Pilot's Pitot/Static Pressure

Inaccurate airspeed, altitude, or vertical airspeed indications on the pilot's instruments indicate pitot/static system malfunction, probe and static port clogging, or air data computer system failure. Set the pilot's pitot/static selector to EMERG to select the nose- cone static port. If indications are still inaccurate, continue the flight using the copilot's instruments.

Copilot's Pitot/Static Pressure

Inaccurate indications on the copilot's pitot/static instruments indicate pitot/static system failure. Set the copilot's pitot/static selector to PANEL ONLY. The copilot's pitot/static selector is a dual shutoff valve that acts on the pitot and static ports. PANEL ONLY isolates:

- cabin pressure differential indicator
- Arthur unit actuators for pitch, roll, and rudder control
- autopilot altitude sensitive switch
- flight recorder (**if installed**).

As the PANEL ONLY position isolates the Arthur units from the pitot/static system, the Q UNIT light illuminates and the artificial feel system no longer operates. Disengage the autopilot and reduce airspeed to 260 kt/Mach 0.76.

Landing Without Speed Information

If all airspeed indicators fail due to pitot/static system or instrument failure, maintain a normal glideslope and a N_1 speed 2% above normal approach speeds.

Abnormal Airspeed Indication at High Altitude

Abnormal or jammed Mach/airspeed indications at high altitudes due to complete pitot/static system failure or pitot port/static probe freezing is usually accompanied by the illumination of the AIR DATA and Q UNIT lights, sounding of the V_{MO}/M_{MO} warning horn, disengagement of the autopilot, and disagreement between the airspeed indicators and the standby airspeed indicator. If it is certain that the overspeed warning is false, do not change aircraft airspeed or attitude. Use the standby altimeter to maintain aircraft altitude.

Disengage the autopilot and avoid sudden or large control movements. Pull the V_{MO}/M_{MO} warning horn circuit breaker to silence it. Reset the circuit breaker at intervals and leave it reset if the horn stops. Refer to the AFM for climb, level flight, and descent procedures.

Air Data Computer Inoperative

Illumination of the AIR DATA light indicates failure of the air data computer. The pilot's altimeter, vertical speed indicator, and Mach/airspeed indicator is inoperative. Use the copilot's instruments and continue the flight. Disengage the autopilot because the ADC supplies the autopilot and the flight director system with data.

Compass System Failure

Failure of the compass system is indicated by the HDG flag on the RMI and course indicator or a disagreement between the pilot's and copilot's systems. The pilot's RMI receives compass information from the copilot's system and power from the pilot's inverter. The copilot's RMI receives information from the pilot's system and power from his own inverter. Failure of an inverter is correctable by using the standby inverter. Failure of a gyro renders the system inoperable.

Once a system fails, it is possible to restore heading information by switching the MAG-DG switch to DG. This allows the directional gyro to provide heading information to the malfunctioning system. Using the SLAVE HDG switch resets the secondary heading information.

If switching to the standby inverter or using the DG switch fails to correct the problem, the operating gyro and the standby compass can provide heading information.

Pitch Trim Failure

Depending on the autopilot installed in the aircraft, procedures for failure of the pitch trim system are similar; the only difference is in the failure indication. Illumination of the ELEV TR or AP TRIM light indicates failure of the pitch trim system.

If the pitch trim system fails, procedures require holding the control yoke firmly to maintain level flight, disengaging the autopilot, and retrimming the aircraft using normal stabilizer control. Do not re-engage the autopilot to prevent a reoccurrence of the problem.

Out-of-Trim Condition

Unusual readings on the trim indicators and illumination of the MISTRIM lights indicate an out-of-trim condition. Hold the control yoke firmly to maintain level flight and disengage the autopilot. Trim the airplane with normal stabilizer control and attempt to reconnect the autopilot. If the problem reoccurs, disengage the autopilot.

Emergency Procedure

A single emergency procedure concerns the autopilot system. Procedures for the Collins AP-105 and APS-80 and Sperry SPZ-500 autopilot systems are similar with the exception of altitude loss between failure recognition and recovery.

Pitch Servo-Actuator Runaway

A rapid nose-down movement of the aircraft with the autopilot engaged indicates a nose-down trim runaway. Procedures require the immediate disengagement of the autopilot and control yoke movement to bring the aircraft out of a dive. At cruise altitudes and speeds, demonstrated reaction time between recognition and recovery can result in an approximate altitude loss of 400 to 550 ft.

Electrical System

Chapter 5C

This section details the Electrical and Lighting Systems of the Falcon 10/100 aircraft.

The Falcon 10/100 Electrical System includes direct and alternating current.

Two engine-driven starter-generators provide direct current (DC) to their respective distribution buses for primary electrical power. Two nickel-cadmium (ni-cad) batteries provide supplementary DC for power buffering and engine starting.

Two primary inverters and one standby inverter provide alternating current (AC) by converting DC power to 115V, 400 Hz and 26V, 400 Hz AC power.

The Falcon 10/100; lighting system is divided into five major subsystems: flight deck, passenger compartment, emergency, rear commpartment, anad exterior lighting.

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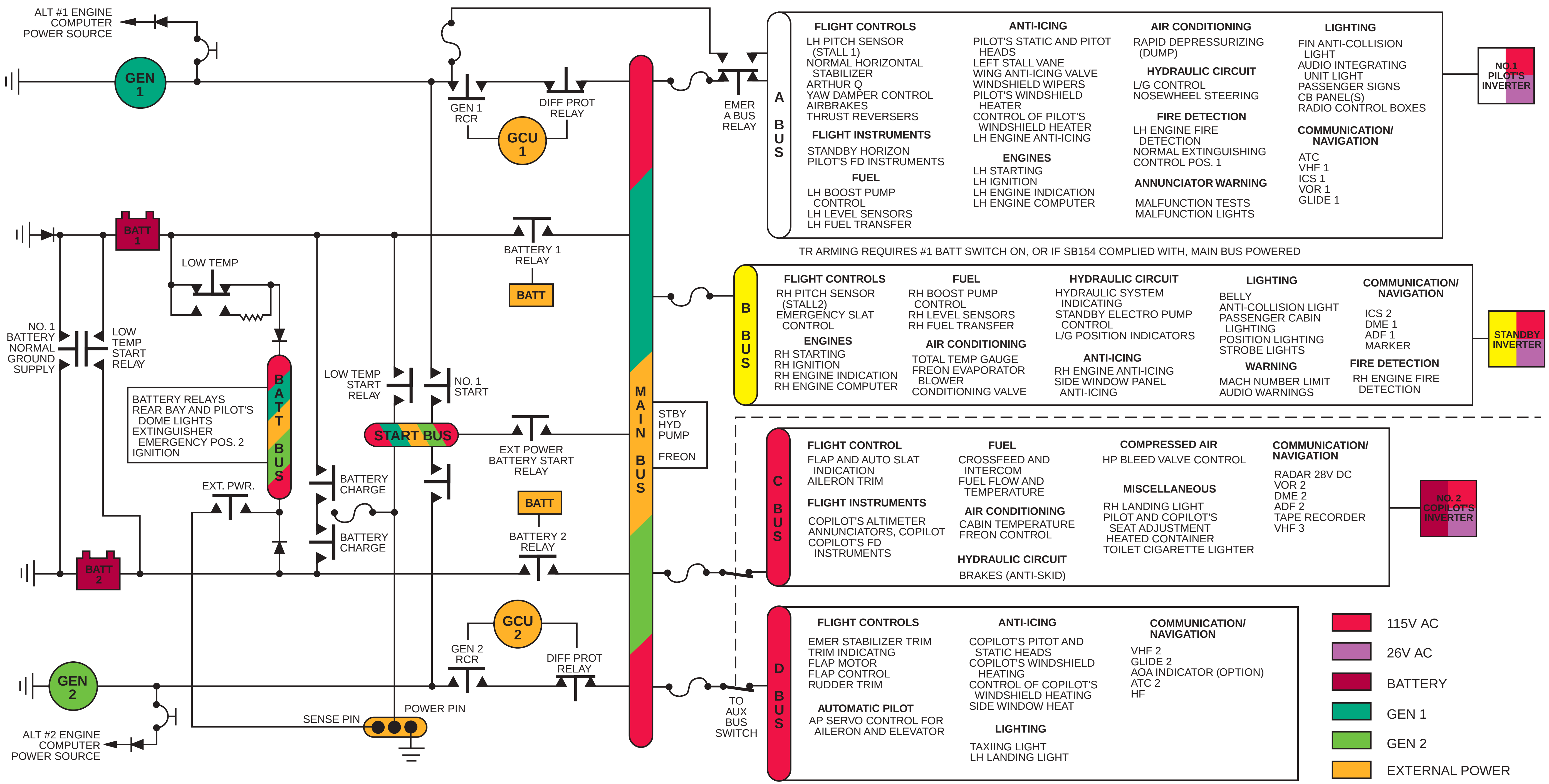
DC System

DC System


ALT #1 ENGINE COMPUTER POWER SOURCE
GEN 1
GEN 1 RCR
GCU 1
DIFF PROT RELAY
EMER A BUS RELAY
A BUS
FLIGHT CONTROLS
LH PITCH SENSOR (STALL 1)
NORMAL HORIZONTAL STABILIZER
ARTHUR Q
YAW DAMPER CONTROL
AIRBRAKES
THRUST REVERSERS
FLIGHT INSTRUMENTS
STANDBY HORIZON
PILOT'S FD INSTRUMENTS
FUEL
LH BOOST PUMP CONTROL
LH LEVEL SENSORS
LH FUEL TRANSFER
ANTI-ICING
PILOT'S STATIC AND PITOT HEADS
LEFT STALL VANE
WING ANTI-ICING VALVE
WINDSHIELD WIPERS
PILOT'S WINDSHIELD HEATER
CONTROL OF PILOT'S WINDSHIELD HEATER
LH ENGINE ANTI-ICING
ENGINES
LH STARTING
LH IGNITION
LH ENGINE INDICATION
LH ENGINE COMPUTER
AIR CONDITIONING
RAPID DEPRESSURIZING (DUMP)
HYDRAULIC CIRCUIT
L/G CONTROL
NOSEWHEEL STEERING
FIRE DETECTION
LH ENGINE FIRE DETECTION
NORMAL EXTINGUISHING CONTROL POS. 1
ANNUNCIATOR WARNING
MALFUNCTION TESTS
MALFUNCTION LIGHTS
LIGHTING
FIN ANTI-COLLISION LIGHT
AUDIO INTEGRATING UNIT LIGHT
PASSENGER SIGNS
CB PANEL(S)
RADIO CONTROL BOXES
COMMUNICATION/ NAVIGATION
ATC
VHF 1
ICS 1
VOR 1
GLIDE 1
NO.1 PILOT'S INVERTER
BATT 1
LOW TEMP
BATTERY 1 RELAY
BATT
NO. 1 BATTERY NORMAL GROUND SUPPLY
LOW TEMP START RELAY
BATTERY RELAYS
REAR BAY AND PILOT'S DOME LIGHTS
EXTINGUISHER EMERGENCY POS. 2
IGNITION
BATT BUS
LOW TEMP START RELAY
NO. 1 START
START BUS
EXT POWER BATTERY START RELAY
MAIN BUS
STBY HYD PUMP
FREON
TR ARMING REQUIRES #1 BATT SWITCH ON, OR IF SB154 COMPLIED WITH, MAIN BUS POWERED
B BUS
FLIGHT CONTROLS
RH PITCH SENSOR (STALL2)
EMERGENCY SLAT CONTROL
ENGINES
RH STARTING
RH IGNITION
RH ENGINE INDICATION
RH ENGINE COMPUTER
FUEL
RH BOOST PUMP CONTROL
RH LEVEL SENSORS
RH FUEL TRANSFER
AIR CONDITIONING
TOTAL TEMP GAUGE
FREON EVAPORATOR BLOWER
CONDITIONING VALVE
HYDRAULIC CIRCUIT
HYDRAULIC SYSTEM INDICATING
STANDBY ELECTRO PUMP CONTROL
L/G POSITION INDICATORS
ANTI-ICING
RH ENGINE ANTI-ICING
SIDE WINDOW PANEL ANTI-ICING
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COMMUNICATION/ NAVIGATION
ICS 2
DME 1
ADF 1
MARKER
FIRE DETECTION
RH ENGINE FIRE DETECTION
STANDBY INVERTER
EXT. PWR.
BATTERY CHARGE
BATTERY CHARGE
BATT
BATTERY 2 RELAY
BATT 2
C BUS
FLIGHT CONTROL
FLAP AND AUTO SLAT INDICATION
AILERON TRIM
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ANNUNCIATORS, COPILOT
COPILOT'S FD INSTRUMENTS
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BRAKES (ANTI-SKID)
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HP BLEED VALVE CONTROL
MISCELLANEOUS
RH LANDING LIGHT
PILOT AND COPILOT'S SEAT ADJUSTMENT
HEATED CONTAINER
TOILET CIGARETTE LIGHTER
COMMUNICATION/ NAVIGATION
RADAR 28V DC
VOR 2
DME 2
ADF 2
TAPE RECORDER
VHF 3
NO. 2 COPILOT'S INVERTER
GCU 2
GEN 2 RCR
DIFF PROT RELAY
GEN 2
ALT #2 ENGINE COMPUTER POWER SOURCE
SENSE PIN
POWER PIN
TO AUX BUS SWITCH
D BUS
FLIGHT CONTROLS
EMER STABILIZER TRIM
TRIM INDICATNG
FLAP MOTOR
FLAP CONTROL
RUDDER TRIM
AUTOMATIC PILOT
AP SERVO CONTROL FOR AILERON AND ELEVATOR
ANTI-ICING
COPILOT'S PITOT AND STATIC HEADS
COPILOT'S WINDSHIELD HEATING
CONTROL OF COPILOT'S WINDSHIELD HEATING
SIDE WINDOW HEAT
LIGHTING
TAXIING LIGHT
LH LANDING LIGHT
COMMUNICATION/ NAVIGATION
VHF 2
GLIDE 2
AOA INDICATOR (OPTION)
ATC 2
HF
115V AC
26V AC
BATTERY
GEN 1
GEN 2
EXTERNAL POWER

DC System

The Falcon 10/100 DC electrical system provides and distributes 28.5V DC power from various sources to buses for aircraft electrical systems.

Components

Direct current is provided by:

- two nickel-cadmium (ni-cad) batteries
- two engine-driven starter/generators
- external DC power
- various emergency batteries for subsystems, including emergency lighting, standby gyro, optional navigation equipment, and optional cockpit power.

The starter/generators are the primary source of electrical power when the engines are operating. Batteries provide engine starting power, buffer DC power for the electrical system, and supply emergency DC power if the generators are inoperative. An external power unit allows a ground power unit (GPU) to power the entire DC electrical system when the Main bus is connected.

The batteries, starter/generators, and external power unit supply power to the Main bus. The Main bus in turn supplies two primary (A and B) and two auxiliary (C and D) buses. A relay system allows the left starter/generator to directly supply the A bus if the Main DC bus fails.

In addition to the Main, A, B, C, and D buses, there is a Start bus supplied either by the Main bus or by a GPU as well as a Battery bus that is fully independent of the other buses. The batteries supply the Battery bus.

A load-shedding switch for the C and D buses allows both buses to be disconnected from the Main bus.

Batteries

Two 20 cell, 26V, 23 amp/hour, or two 19 cell, 24V, 23 amp/hour nickel-cadmium batteries are in the aft compartment. They are normally connected in parallel to the Main and Battery buses for power buffering, battery charging, and power supplying during emergencies. The batteries can be connected in series to the Start bus to provide additional power for cold weather engine starts.

During normal external power use, the batteries are disconnected from the DC system. Battery charging is also possible with external power.

If the generators fail, the batteries can provide essential power for up to 20 minutes.

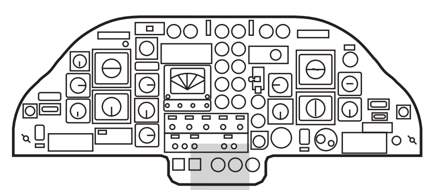
Battery Limitation

Minimum battery voltage for engine starting:

19 cell 22V

20 cell . . . . 23 V

5C-1



Cooling and Temperature

Air circulating in the rear compartment normally cools the batteries. A suction vent on the fuselage bottom connects to the battery vent to provide additional cooling air to the batteries. When the aircraft is on the ground, a blower directs air to cool the batteries. A microswitch on the landing gear controls power from the batteries or external power for the blower.

A temperature probe in each battery connects to a dual-reading battery temperature indicator on the instrument panel (**Figure 5C-1**, previous page) that provides battery temperature and overheat indications.

An amber WARM light on the indicator illuminates when either battery temperature exceeds 120°F. The red HOT light on the indicator illuminates when battery temperature exceeds 150°F.

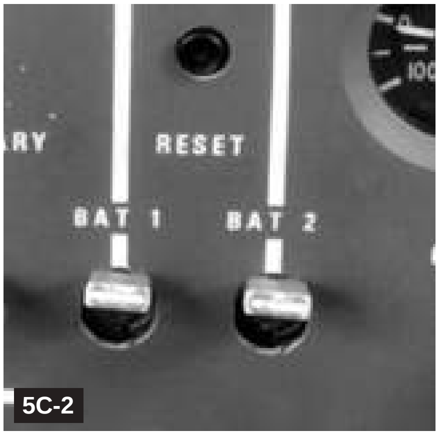
Because the indicator scale is limited, a button on the indicator provides a means to shift the display up when the indicator is off-scale. Pressing the RANGE EXTENDER button shifts the display up 50° from the actual temperature. Subtracting 50 from the indicated reading gives accurate battery temperature.

An amber HOT BAT light on the Failure Warning Panel illuminates when battery temperatures reach 160°F (71°C) for SAFT batteries or 135°F (57°C) for G.E. batteries. If the HOT BAT light illuminates, the batteries must be checked for damage.

Protection

Make-and-break relays in the DC supply box protect each battery. The make-and-break relays normally are closed when the battery switches are placed to ON, and thus connect the batteries to the Main DC bus. They also protect the batteries from excessive reverse current and the electrical system from low battery voltage (less than 16V). If reverse current or low battery voltage is detected, the make-and-break relay trips to isolate the battery from the bus.

A reverse current of approximately 250 amps causes the make-and-break relays to disconnect the affected battery. When the relay trips, the BAT light on the Failure Warning Panel illuminates, and the battery is disconnected from the Main bus.



5C-2

5C-3

5C-4

Battery Controls

The Battery bus always is powered when the batteries are connected. Individual battery switches on the overhead panel (**Figure 5C-2**) control the batteries.

If battery voltage is 18V or greater, placing the battery control switch on closes the make-and-break relays and connects the batteries to the Main bus; the BATT light on the Failure Warning Panel then extinguishes.

Pressing the RESET button above and between the BAT 1 and BAT 2 switches resets the battery make-and-break relays if an electrical fault causes one to open.

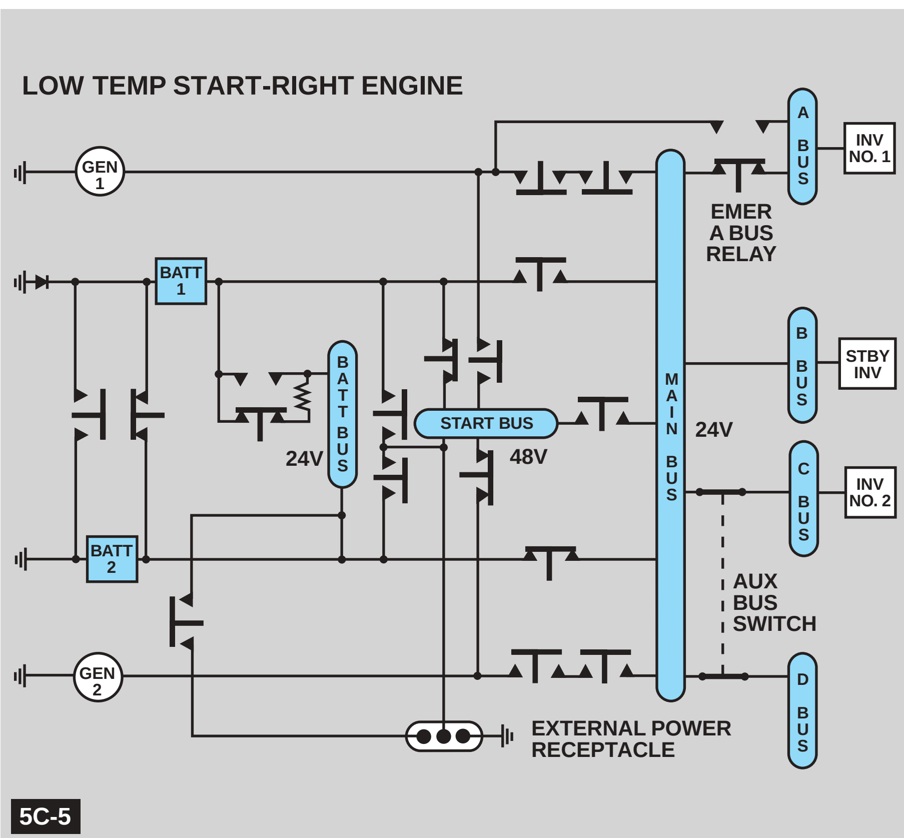
Setting the Auxiliary Bus switch to ON supplies battery power to the C and D buses when the Main bus is powered.

A source selectable voltmeter and ammeter on the overhead panel (**Figure 5C-3**) provide DC source voltage and current. Placing the voltmeter/ammeter selector switch to BAT displays Main bus voltage and current on the indicators.

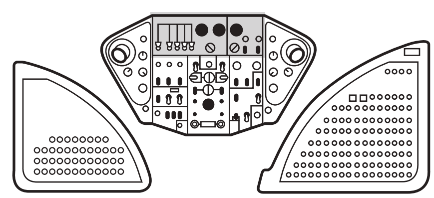
The power selector switch (**Figure 5C-4**) below the voltmeter/ammeter selector switch controls the connection of the batteries for engine starting purposes. The three position switch (EXT POWER/LOW TEMP START/NORMAL) selects the DC power source used for engine starting. NORMAL connects the batteries in parallel for normal engine starts, LOW TEMP START connects the batteries in series (**Figure 5C-5**) for additional power for engine starts in cold weather, and EXT POWER selects external power for ground operations or engine starts.

Battery Charging

An external power unit can charge the batteries with the electrical system



5C-5



Generator Limitation

Maximum . . . . . . 350 amps

powered or unpowered (**Figures 5C-6** and **5C-7**, respectively). A charging unit in the rear compartment controlled by a magnetically held Battery Charge switch on the main DC power supply box allows the batteries to be charged at voltages between 24V and 29V. If the charging voltage falls below 24V or exceeds 29V or if external power is disconnected, the unit trips off-line.

A BATTERY CHARGE light on the main DC power supply box illuminates when the batteries are being charged by an external power unit.

Starter/Generators

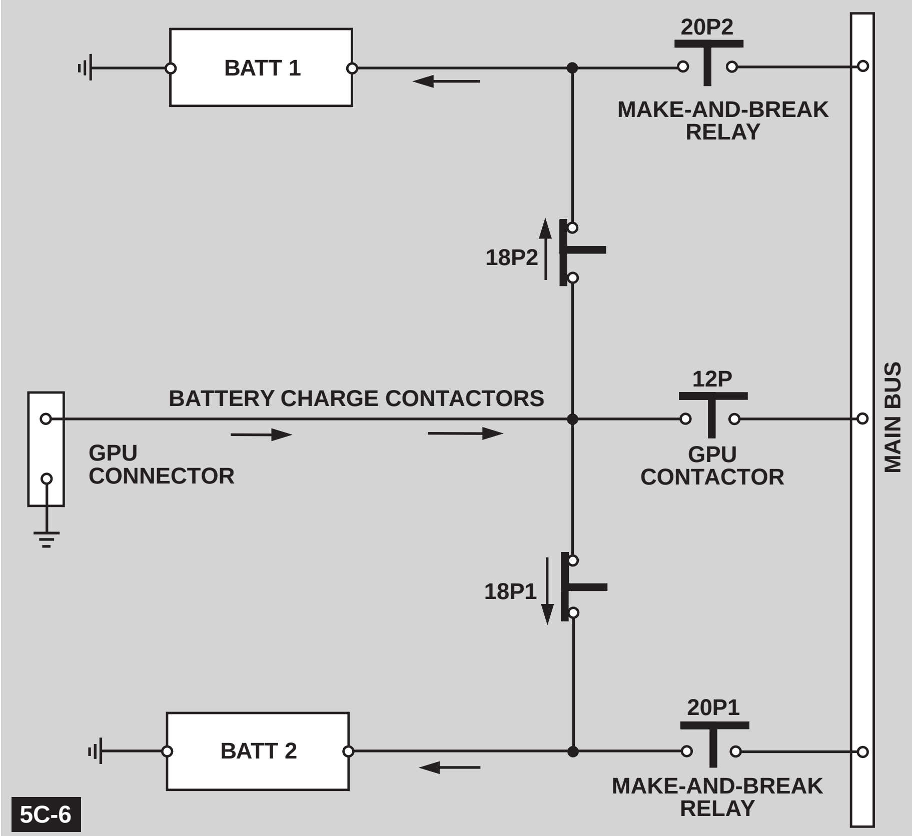
Two engine-driven starter/generators provide DC power for aircraft electrical needs. Each engine has a starter/generator on the accessory gearbox.

At normal operating speeds, each generator provides approximately 10.5 kilowatts of electrical power regulated at 28.5V DC. The maximum load of each starter/generator should not exceed 350 amps. Generator control units and reverse current relays regulate and protect the generators.

Protection

Generator control units (GCUs), make-and-break relays, and relays provide protection for the generators. A generator control unit (GCU) for each generator provides voltage regulation and protection. The GCUs in the cabin behind the right coat compartment:

- regulate generator voltage to 28.5V DC
- provide generator equalizing
- protect against overvoltage
- limit maximum generator current to 350 amps
- provide field weakening during engine start
- provide anti-runaway protection
- ensure voltage reduction to limit battery charging current to approximately 27V for three minutes after engine start.



5C-6

Overvoltage protection varies with voltage; as voltage increases, the cut-off time decreases. At 31V, overvoltage triggers a generator cut-off in seven seconds, 45V triggers a cut-off in three seconds, and a 60V condition causes an instantaneous cut-off. If an overvoltage condition is detected, the field shunt is cut, the make-and-break relay opens, the generator is cut off from the electrical system, a generator warning light illuminates, and the generator control switch automatically moves to OFF.

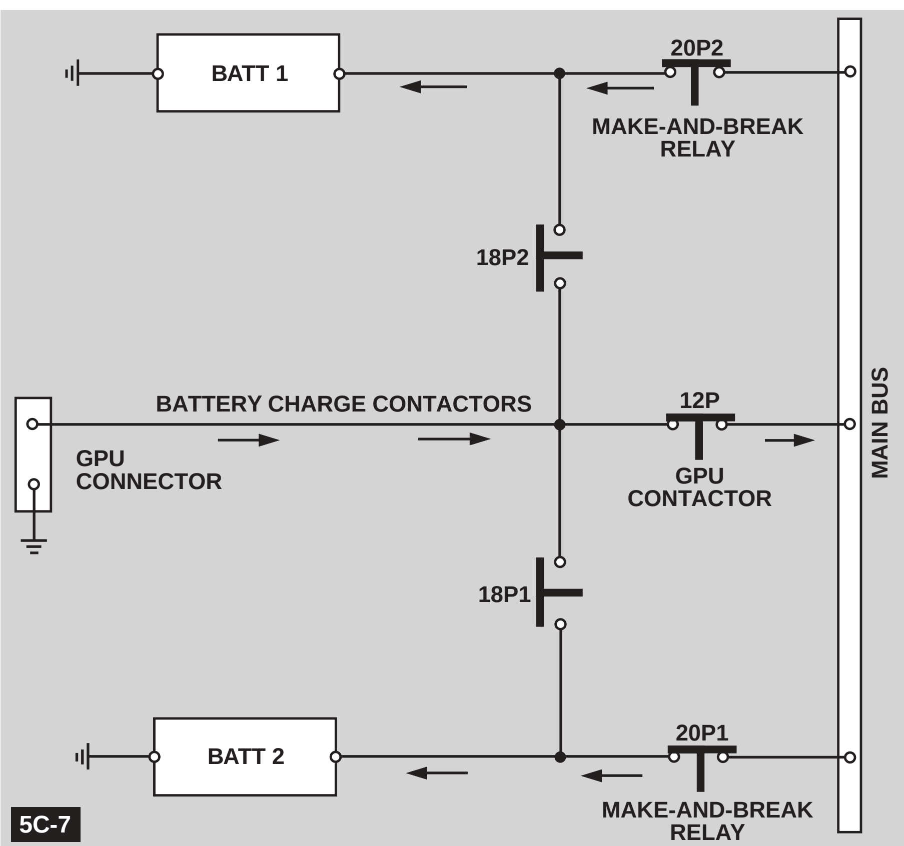
The make-and-break relays connect the generators to the electrical system when generator voltage exceeds the Main bus voltage by 0.6V. The relays also trip a generator off-line if a reverse current between the generators exists. If one generator produces a reverse current to the other generator of 0.6V or 25 amps or more, the make-and-break relay trips the generator producing the lower output off-line. If this occurs, the respective GENE light illuminates and the isolated generator switch remains on.

A differential protection relay for each generator protects against shorts between a generator and the Main bus. If a 150 amp short occurs, the relay energizes and isolates the generator, the respective generator warning light illuminates, and the generator control switch automatically moves to OFF. This failure requires system maintenance.

Engine Starting

During a battery start, the battery relays direct power from the batteries to the Main bus. Pushing a start button closes the external power/battery start relay to direct power to the Start bus. The start relay closes and the Start bus powers the respective starter.

With a GPU connected and providing power to the Start bus, selecting EXT POWER on the power selector switch closes the external power/battery start



5C-7

relay closes and provides power to the Main bus; the battery and generator relays open. Pushing a start button closes the start relay and directs power to the respective starter.

Selecting LOW TEMP START connects the batteries in series to provide approximately 48V DC to the Start bus and the selected starter. The No. 2 battery provides 24V DC to the Main bus and the No. 1 battery disconnects from the Main bus; the No. 1 battery supplies only the Start bus. During low temperature engine starts, start only one engine and perform a generator assisted start for the second engine.

Generator Controls

Controls and volt/amp meters for the generators are on the overhead panel. Two generator warning lights are on the Failure Warning Panel.

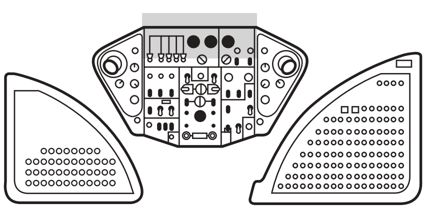
Separate generator control switches (**Figure 5C-8**) operate the No. 1 and No. 2 generators. Placing a control switch on with the engines operating energizes the generator make-and-break relay, connects the generator to the Main bus, and extinguishes the respective GENE light.

The generator control switches are normally in the ON position. Overvoltage and differential current (short) energize the magnet and allow the switch to move to the OFF position. Normally the switches are kept in the ON position for engine starting and generator excitation. The OFF position is only used during electrical emergencies, fire, or complete system failure.

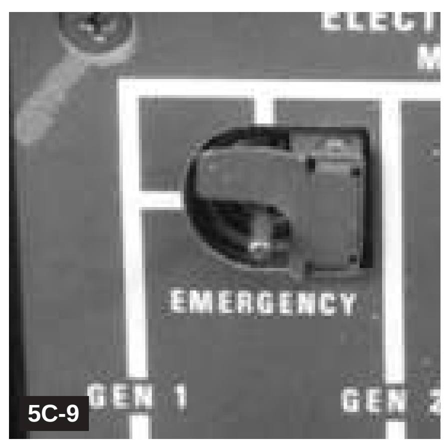
A guarded Emergency Generator switch (**Figure 5C-9**) allows the left (No. 1) generator to bypass the Main bus and supply the A bus directly.

A source selectable voltmeter and ammeter on the overhead panel (**Figure 5C-10**) provides generator output indications. Placing the switch in either GEN 1 or GEN 2 displays the respective generator's output voltage and amperage.

The GENE 1/GENE 2 lights illuminate when the respective generator is not connected. The lights also illuminate when external power is in use.



5C-8



5C-9

External DC Power

An external power receptacle on the right side of the aft fuselage allows the connection of a GPU. External power provides power for:

- aircraft electrical system
- battery charging
- engine starting.

The power selector switch on the overhead panel (**Figure 5C-11**) is the sole control for external power. Placing the switch in EXT POWER supplies power from the receptacle through the Start bus to the Main bus, de-energizes the battery make-and-break relays, and illuminates the BATT light.

With the engines operating and external power connected, the generator make-and-break switches do not close; the GENE 1/GENE 2 lights illuminate, and it is impossible to connect any of the generators regardless of power selector switch position.

External power voltage and amperage is read on the voltmeter and ammeter on the overhead panel by selecting the BAT position on the selector switch.

5C-10

Distribution and Protection

Direct current from the batteries, generators, or the external power system provide power to operate the majority of the aircraft systems. Power from these sources is supplied throughout the aircraft through distribution buses.

DC distribution buses in the Falcon 10/100 aircraft are either non-load shedding or load-shedding.

Distribution

The batteries and generators supply 28.5V DC power through circuit breakers and protection devices directly to the Main bus. External power from a GPU supplies the Start bus that in turn supplies the Main bus. The Main bus in turn supplies the A and B buses directly, and the C and D buses indirectly through the Auxiliary Bus control switch.

The Main, A, B, C, and D buses are in the main DC power supply box in the rear compartment. The power supply box is an insulated fiberglass-reinforced plastic box that also contains protective devices for the buses.

5C-11

External Power Limitation

GPU . . . . 1,000 AMPS, 28 V

NOTE: SB 77-003 (0074); N_1 and N_2 Tachometers – Double Voltage Supply with Battery Start on Low Temp Start (**S/N 001 to 052**).

A Battery bus in the battery box, independent of the other buses, connects the batteries together. The batteries connect to the Battery buses through diodes, and the batteries connect to the Main bus through separate make-and-break relays for each battery.

Distribution Buses

Normally, electrical power from the Main bus powers the A, B, C, and D buses through four 130 amp current limiters. The A and B buses supply power to the essential aircraft electrical loads (**Figure 5C-12**). The C and D buses carry non-essential loads and can be disconnected (load-shed) from the Main bus (**Figure 5C-13**). In the event of Main bus failure, the left generator can directly power the A bus through the emergency generator switch (**Figure 5C-14**, page 5C-17).

The Main bus powers:

- standby hydraulic pump
- Freon air conditioning compressor, right blower, and condenser blower
- A, B, C, and D buses.

The A bus supplies:

- left engine computer, starting, fire detection, anti-icing, and indication
- normal fire extinguishing system position No. 1
- left boost pump control, fuel level, and fuel transfer
- pilot's essential communication and navigation radios
- Failure Warning Panel lights
- No. 1 inverter
- landing gear control
- steering.

The A bus also supplies parts of the flight control, flight instrument, anti-icing, air conditioning, and lighting systems.

The B bus supplies:

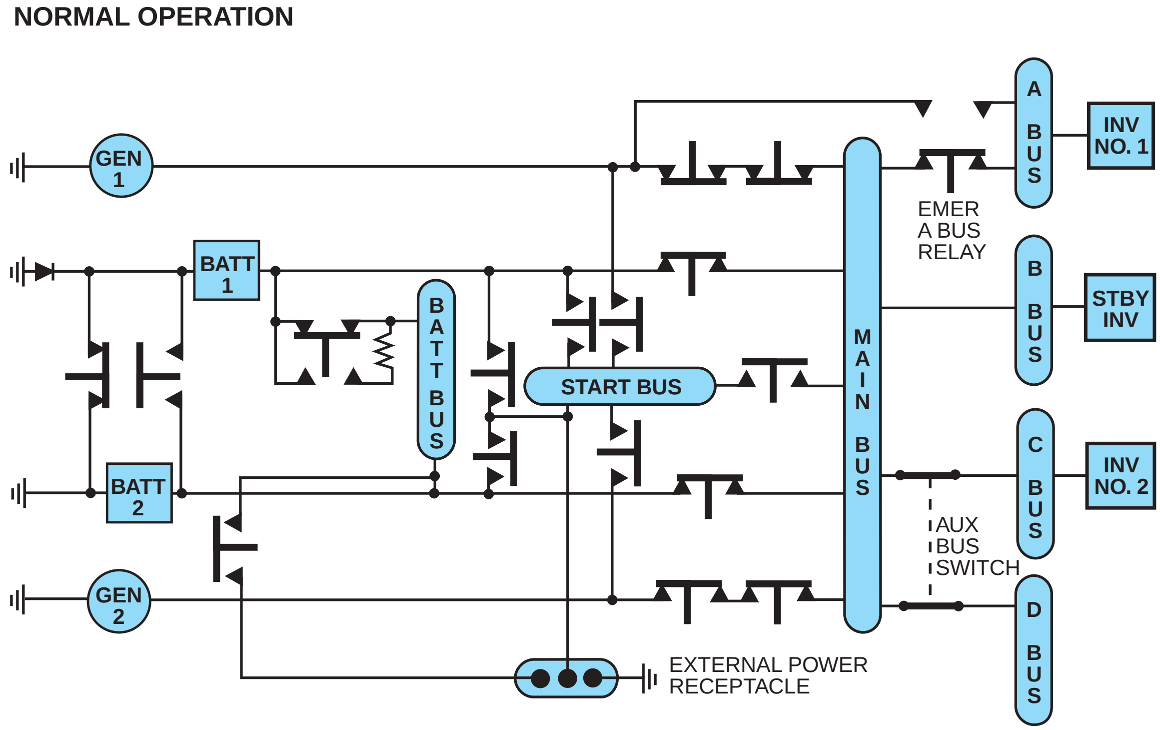
- right engine computer, starting, fire detection, anti-icing, and indication
- Mach number and audio warning systems
- right boost pump, fuel level, and fuel transfer
- hydraulic system indicating and standby electric pump control
- standby inverter
- landing gear position indicators.

The B bus also supplies parts of the flight control, air conditioning, lighting, communications equipment, and the standby inverter systems.

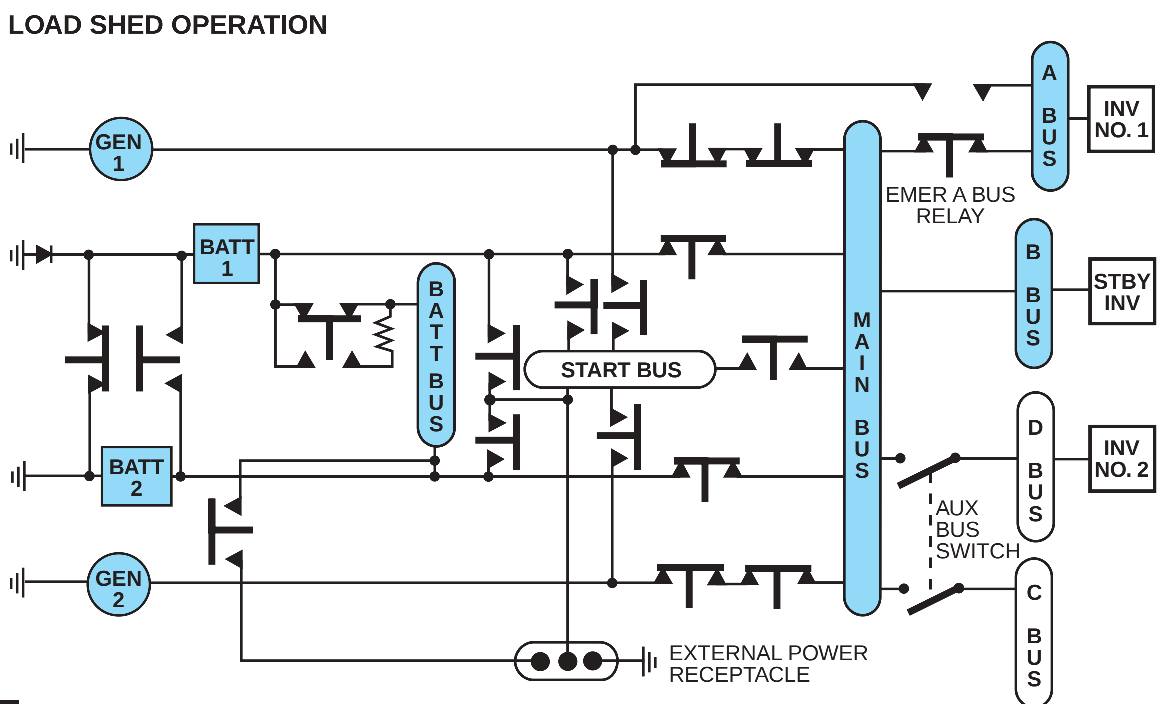
The C and D buses supply:

- No. 2 inverter
- brake anti-skid system
- flaps
- Freon air conditioning control
- HP bleed air.

The C and D buses, controlled by the Auxiliary Bus switch, also power the non-essential electrical loads on the aircraft. This includes No. 2 communication and navigation equipment and the copilot's instruments.


NORMAL OPERATION
GEN 1
BATT 1
BATT 2
GEN 2
B A T T B U S
START BUS
M A I N B U S
EMER A BUS RELAY
A BUS
B BUS
C BUS
D BUS
INV NO. 1
STBY INV
INV NO. 2
AUX BUS SWITCH
EXTERNAL POWER RECEPTACLE

5C-12


LOAD SHED OPERATION
GEN 1
BATT 1
BATT 2
GEN 2
B A T T B U S
START BUS
M A I N B U S
EMER A BUS RELAY
A BUS
B BUS
D BUS
C BUS
INV NO. 1
STBY INV
INV NO. 2
AUX BUS SWITCH
EXTERNAL POWER RECEPTACLE

5C-13

The Start bus supplies power necessary for engine starting. The bus is powered by:

- batteries in parallel during a normal battery start
- batteries in series during a low temperature start
- ground power receptacle during a GPU start
- batteries in parallel with one generator during a generator-assisted start.

The Battery bus, independent of the other buses, receives power directly from the batteries, the generators, or a GPU (**Figure 5C-15**). Normally, both batteries are connected in parallel to the bus. The bus powers:

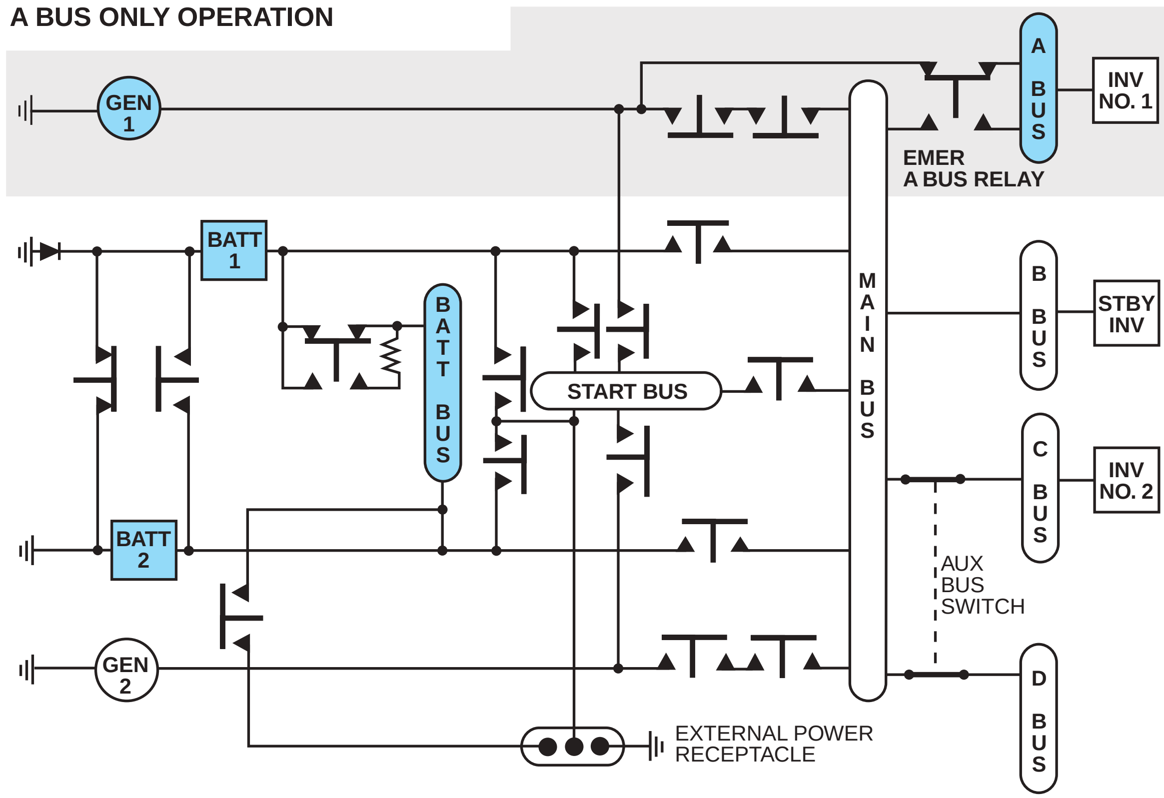
- battery relays
- rear compartment and pilot's dome lights
- fire extinguisher backup power control position No. 2
- engine ignition alternate source
- N_1 and N_2 indicators (**SB 77-003**).

Protection

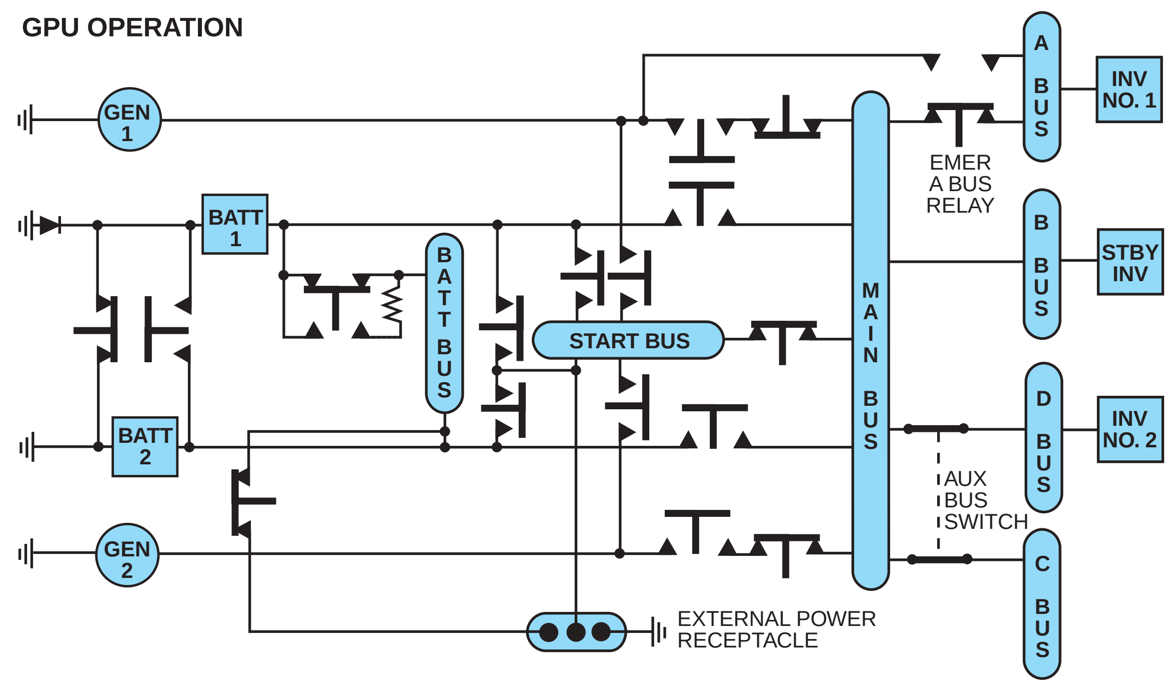
Circuit breakers, relays, and fuses protect the aircraft electrical system from overloads, shorts, and other electrical malfunctions. The circuit breaker (CB) panels are on either side of the cockpit.

The CB lettering is color coded: white labeled CBs protect circuits on the A bus, yellow labeled CBs protect circuits on the B bus, and red labeled CBs protect circuits on the C and D buses.

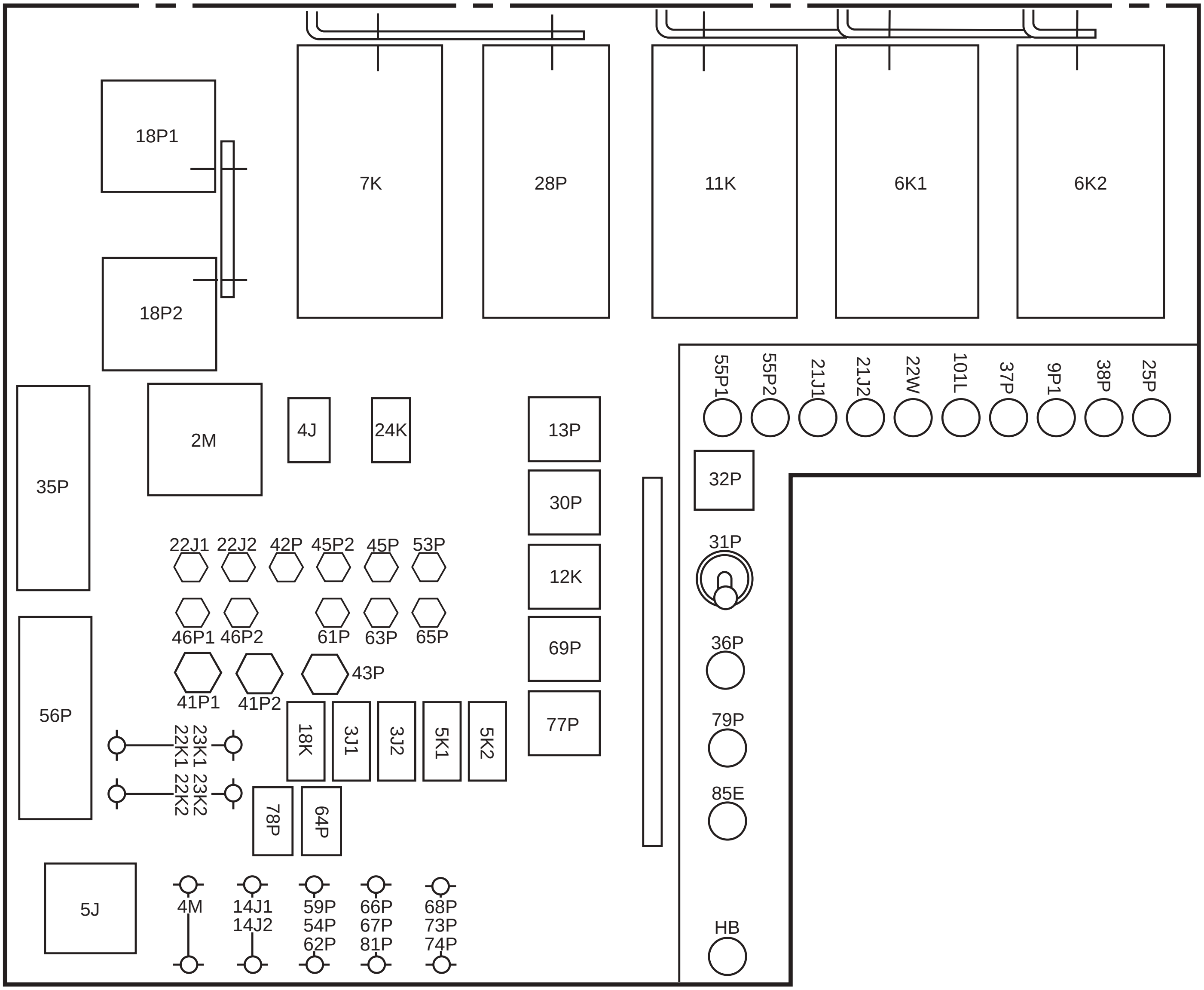
Additional CBs and fuses in the battery boxes (**Figure 5C-16**, page 5C-18, and **Table 5C-A**, page 5C-19) and main DC supply (**Figure 5C-17**, and **Table 5C-B**, page 5C-20) provide basic protection for the DC electrical system at the source.


A BUS ONLY OPERATION
GEN 1
BATT 1
BATT 2
GEN 2
BATT BUS
START BUS
MAIN BUS
EMER A BUS RELAY
A BUS
B BUS
C BUS
D BUS
INV NO. 1
STBY INV
INV NO. 2
AUX BUS SWITCH
EXTERNAL POWER RECEPTACLE

5C-14


GPU OPERATION
GEN 1
BATT 1
BATT 2
GEN 2
BATT BUS
START BUS
MAIN BUS
EMER A BUS RELAY
A BUS
B BUS
D BUS
C BUS
INV NO. 1
STBY INV
INV NO. 2
AUX BUS SWITCH
EXTERNAL POWER RECEPTACLE

5C-15

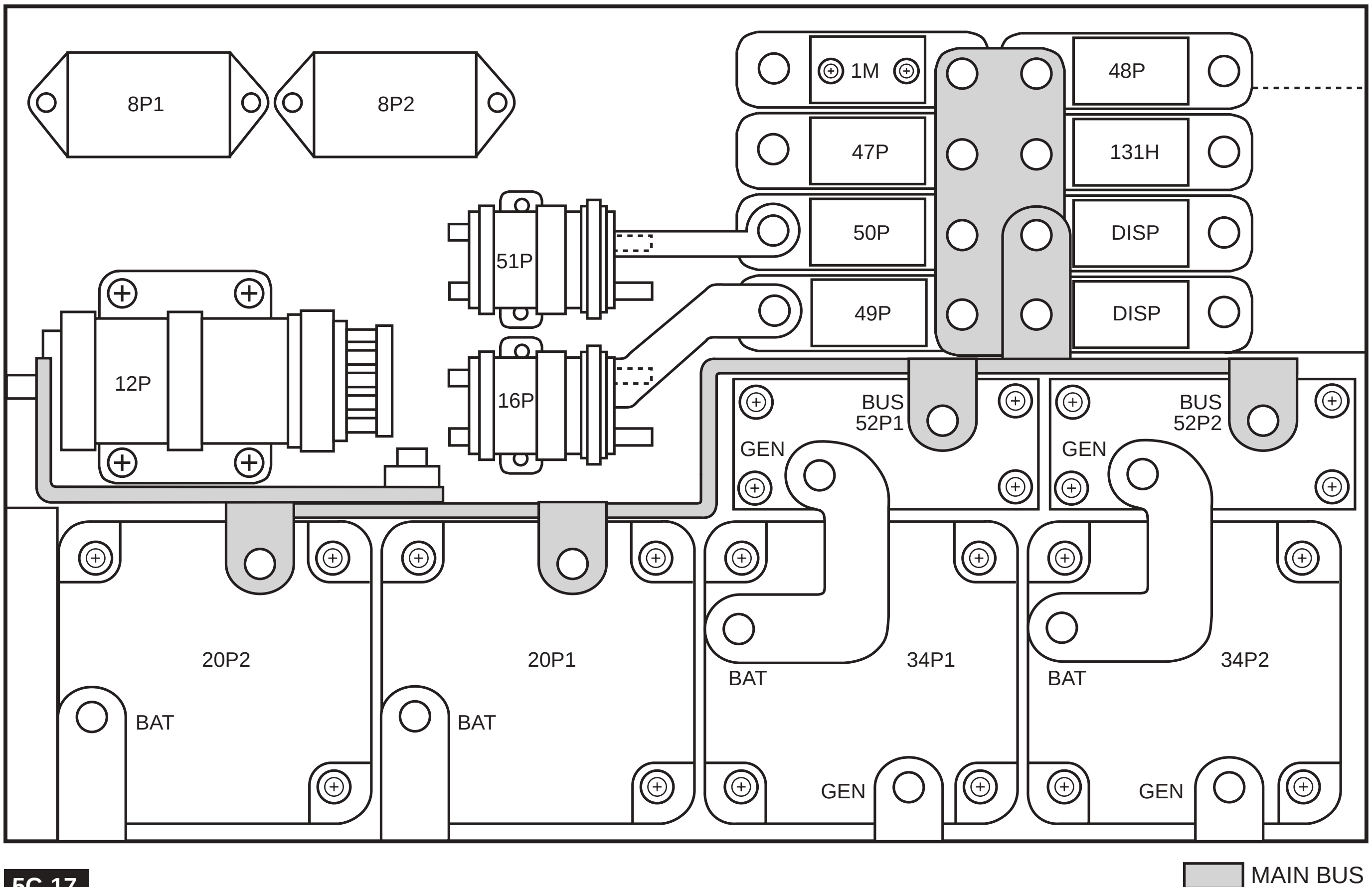


5C-16

NOTE: See **Table 5C-A** (opposite page) for battery box contents.

Breakers	9P1	BATTERY 1 CONTROL	37P	BATTERIES COUPLING
	9P2	BATTERY 2 CONTROL	38P	BATTERY 1 CONTROL
	21J1	NO. 1 ENGINE IGNITION	55P1	NO. 1 GENERATOR VOLTMETER
	21J2	NO. 2 ENGINE IGNITION	55P2	NO. 2 GENERATOR VOLTMETER
	22W	EXTINGUISHERS CONTROL	79P	BATTERY (2 P2) STARTING
	25P	BATTERIES VOLTMETER	85E	TACHOMETERS SUPPLY
	36P	BATTERIES CHARGING	101L	LIGHTING
Diodes	4M	42P	54P	67P
	14J1	43P	59P	68P
	14J2	45P1	61P	73P
	22J1	45P2	62P	74P
	22J2	46P1	63P	81P
	41P1	46P2	65P	
	41P2	53P	66P	
Capacitors	23K1	STARTING RELAY SUPPLY		
	23K2	STARTING RELAY SUPPLY		
Fuses	35P	BATTERIES CHARGING		
	56P	BATTERY 1 CHARGING		
Relays	2M	SUPPLY – EMERGENCY	11K	BATTERIES IN SERIES STARTING
		HYDRAULIC PUMP	12K	BATTERIES IN SERIES STARTING
	3J1	IGNITION LEFT ENGINE	13P	GROUND POWER UNIT CONNECTION
	3J2	IGNITION RIGHT ENGINE	18K	CROSS START RELAY
	4J	AUTOMATIC IGNITION	18P1	NO. 1 BATTERY CHARGING
	5J	TIME RELAY FOR	18P2	NO. 2 BATTERY CHARGING
		AUTOMATIC IGNITION	24K	10 K RELAY CONTROL
	5K1	STARTING LEFT ENGINE	28P	BATTERY 1 RELAY
	5K2	STARTING RIGHT ENGINE	30P	BATTERIES CHARGING
	6K1	STARTING LEFT ENGINE	64P	GROUND POWER UNIT CONNECTION
	6K2	STARTING RIGHT ENGINE	69P	GROUND POWER UNIT CUT OUT
	7K	BATTERIES IN SERIES COUPLING	77P	BATTERY (2 P2) STARTING
		GENERATORS VOLTAGE		
	10K	REDUCTION TIME RELAY		
Resistors	22K1	STARTING RELAY SUPPLY		
	22K2	STARTING RELAY SUPPLY		
	78P	BATTERY BUS SUPPLY		

Table 5C-A; Battery Box Contents

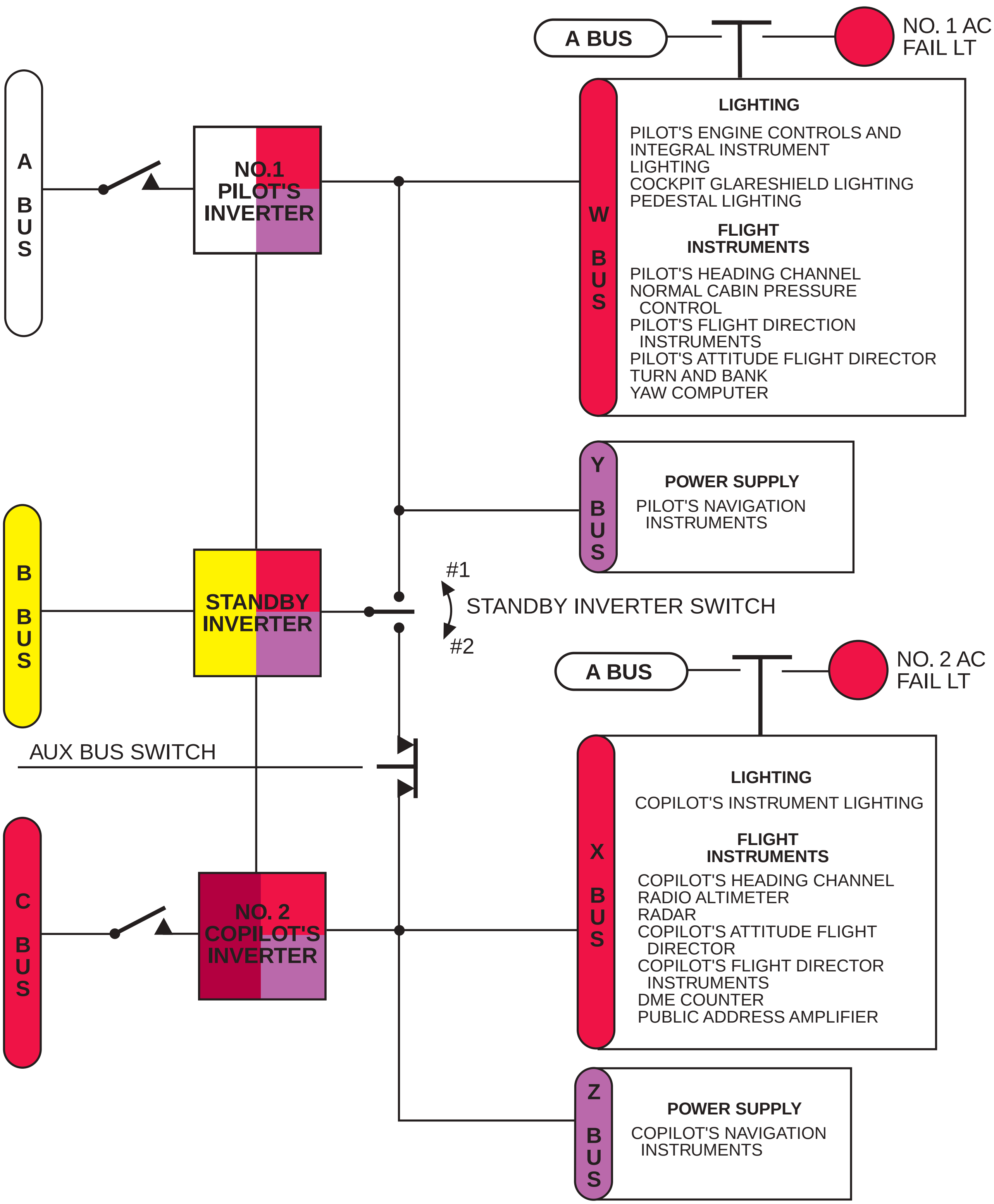


5C-17

Relays	1M	100 AMP HYDRAULIC STANDBY PUMP RELAY
	12P	GROUND POWER UNIT RELAY
	16P	C BUS SUPPLY RELAY
	20P1	BATTERY RELAYS
	20P2	BATTERY RELAYS
	8P1	NO. 1 GENERATOR EXCITATION
	8P2	NO. 2 GENERATOR EXCITATION
	51P	D BUS SUPPLY RELAY
	131H	200 AMP FREON PUMP RELAY
Switches	34P1	GEN TO MAIN BUS SWITCH
	34P2	GEN TO MAIN BUS SWITCH
	52P1	DIFFERENTIAL PROTECTION SWITCH
	52P2	DIFFERENTIAL PROTECTION SWITCH
Current Limiters	47P	135 AMP CURRENT LIMITERS (A BUS)
	48P	135 AMP CURRENT LIMITERS (B BUS)
	49P	135 AMP CURRENT LIMITERS (C BUS)
	50P	135 AMP CURRENT LIMITERS (D BUS)
	DISP	135 AMP CURRENT LIMITERS
	DISP	135 AMP CURRENT LIMITERS

Table 5C-B; Battery Box Contents

AC System


A BUS
NO. 1 AC FAIL LT
A BUS
NO.1 PILOT'S INVERTER
W BUS
LIGHTING
PILOT'S ENGINE CONTROLS AND INTEGRAL INSTRUMENT LIGHTING
COCKPIT GLARESHIELD LIGHTING
PEDESTAL LIGHTING
FLIGHT INSTRUMENTS
PILOT'S HEADING CHANNEL
NORMAL CABIN PRESSURE CONTROL
PILOT'S FLIGHT DIRECTION INSTRUMENTS
PILOT'S ATTITUDE FLIGHT DIRECTOR
TURN AND BANK
YAW COMPUTER
Y BUS
POWER SUPPLY
PILOT'S NAVIGATION INSTRUMENTS
B BUS
STANDBY INVERTER
#1
STANDBY INVERTER SWITCH
#2
A BUS
NO. 2 AC FAIL LT
AUX BUS SWITCH
X BUS
LIGHTING
COPILOT'S INSTRUMENT LIGHTING
FLIGHT INSTRUMENTS
COPILOT'S HEADING CHANNEL
RADIO ALTIMETER
RADAR
COPILOT'S ATTITUDE FLIGHT DIRECTOR
COPILOT'S FLIGHT DIRECTOR INSTRUMENTS
DME COUNTER
PUBLIC ADDRESS AMPLIFIER
C BUS
NO. 2 COPILOT'S INVERTER
Z BUS
POWER SUPPLY
COPILOT'S NAVIGATION INSTRUMENTS

AC System

The Falcon 10/100 AC electrical system provides and distributes 115V and 26V AC to buses to power various aircraft systems.

Alternating current is provided by:

- two primary inverters
- one standby inverter.

Two inverters supply the pilot's and copilot's separate AC electrical systems. A third standby inverter provides an alternate power source should one of the inverters fail. All three inverters are in the nose compartment.

Inverters

The single-phase 750 VA static inverters convert 28V DC into 115V and 26V, 400 Hz AC power for the pilot's (No. 1) standby, and copilot's (No. 2) systems. The batteries, external power, or the starter/generators provide 28V DC to the DC electrical system to power the three inverters. The pilot's inverter receives power from the A bus, the copilot's inverter receives power from the C bus, and the standby inverter receives power from the B bus.

Distribution

The inverters supply 115V, 400 Hz, and 26V AC power to their respective distribution buses. **Table 5C-C** lists the inverters, their power output, and the buses they power.

The standby inverter supplies either the pilot's system or the copilot's system through a three-position transfer standby inverter transfer switch.

AC Controls

Three switches on the overhead panel control the inverters (**Figure 5C-18**, following page). The left inverter switch controls the No. 1 inverter that receives power from the A bus. The right inverter switch controls the No. 2 inverter that receives power from the load-shed C bus. The three-position center inverter switch (**Figure 5C-18**, following page) controls the buses that the standby inverter powers. The standby inverter receives power from the B bus.

In the center position, the standby inverter control switch isolates the inverter from the AC electrical system. In NO. 1 AC BUS, the switch isolates the pilot's inverter from the AC electrical system and the standby inverter powers the W and Y buses. In NO. 2 AC BUS, the switch isolates the copilot's inverter and powers the X and Z buses.

Because the copilot's inverter receives DC power from the C bus, load shedding of the C bus results in the loss of the copilot's inverter and prevents the use of the standby inverter. The standby inverter cannot provide AC power to the copilot's AC buses if the auxiliary bus switch is off.

Inverter	Power	Bus or System
Pilot's	115V, 400 Hz AC 26V, 400 Hz AC	W bus Y bus
Copilot's	115V, 400 Hz AC 26V, 400 Hz AC	X bus Z bus
Standby	115V, 400 Hz AC 26V, 400 Hz AC	Pilot's or copilot's system

Table 5C-C; Inverter Power Supply Distribution

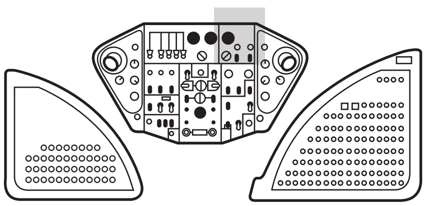
Indication

A single, source-selectable voltmeter (**Figure 5C-18**) on the overhead panel displays inverter voltage from 0 to 125 volts. Source selection is through the voltmeter supply switch below the voltmeter. The three position switch (NO. 1/STD BY/NO. 2) connects the voltmeter to a 115V AC output of the respective inverter.

Two warning lights on the overhead panel monitor the pilot's and copilot's inverters. Illumination of an AC FAIL light indicates the failure of the pilot's or copilot's inverter to power the 115V AC bus. Because DC power supplies the lights, the inverter failure relays control the illumination of the lights. The inverter failure relays controlled by the inverters are de-energized whenever the 115V AC output of an inverter fails or fails to reach the relay.

Protection

Circuit breakers protect the AC electrical system. The pilot's, copilot's, and standby inverters employ circuit breakers for DC input and AC output.



5C-18

Preflight and Procedures

Preflight

During the preflight inspection, verify that the No. 1 and No. 2 inverter control switches are in the off position. Verify that the standby inverter switch is in the center (off) position. Set the DC voltmeter/ammeter selector to BAT, and the inverter voltmeter selector to STD BY to check the output of the batteries and standby inverter. Verify that the generator and auxiliary bus switches are on because an engine start cannot be made with the generators off. Perform a battery check to verify that battery voltages are adequate for a normal battery start (23V minimum). When the initial cockpit inspection is finished, turn the batteries off.

Abnormal/ Emergency Procedures

The following section provides a brief discussion of what happens within the electrical system during abnormal and emergency procedures.

For a complete list of specific procedural steps for emergency and abnormal procedures for the Falcon 10/100 electrical system, please refer to the AFM or the SimuFlite Operating Handbook.

Illumination of the GENE 1/GENE 2 lights on the Failure Warning Panel indicate that the generator is not connected to the Main bus. A reverse current, overvoltage, short, or mechanical failure can cause a generator to go off-line. Depending on the condition, the generator control switch may or may not move to the off position.

A reverse current flowing from one generator to the other de-energizes the make-and-break relay of the lower output generator and removes the generator from the electrical system; the generator switch remains on.

An overvoltage condition de-energizes the make-and-break relay, removes the generator from the electrical system, and moves the generator switch to off. The voltmeter and ammeter indicate zero for the affected generator. Reset the generator by moving the switch to on.

A short between the generator and the Main bus opens the differential protection relay and removes the generator from the electrical system; the generator switch trips off. The voltmeter and ammeter indicate zero for the affected generator. The generator cannot be reset as maintenance is required to correct the short.

A mechanical failure, either internal or external, directly affects the output of the generator. The generator switch remains on and no voltage or amperage indicates on the meters. Maintenance is required to return the aircraft to service.

Abnormal Procedures

Abnormal procedures provide steps for dealing with single battery, generator, or inverter failures. They also include procedures for overheated batteries.

Failure of One Generator

Illumination of either GENE light indicates generator failure due to mechanical failure, overvoltage, reverse current, or electrical short between the generator and the Main bus. A short or overvoltage automatically moves the generator control switch to off; a mechanical failure or reverse current requires moving the switch to off. The associated voltmeter and ammeter indications are zero.

Attempt a maximum of two resets on the affected generator; if the generator fails to reset, remove non-essential equipment from the electrical system to reduce operating generator load to 300 amps.

A list of reasons why the GENE light illuminates and procedures to correct them is provided in **Table 5C-D**.

Battery Light On

Illumination of the BATT light on the Failure Warning Panel indicates that a battery reverse current relay is open. On the ground, verify that the power selector switch is not in EXT POWER or LOW TEMP START; either position illuminates the BATT light.

In the air, attempt a maximum of two resets of the battery system using the RESET button. If the light remains illuminated, it is difficult to identify the failed battery.

Battery Overheat

Illumination of the HOT BAT light indicates battery temperatures are 160°F (71°C) for SAFT batteries or 135°F (57°C) for G.E. batteries. A thermal runaway of the batteries that can cause aircraft structural damage is possible.

Turn both battery switches off and allow the batteries to cool. If the aircraft has a battery temperature monitor it is possible to identify the overheating battery; turn the unaffected battery on.

If the HOT BAT light remains illuminated, land as soon as possible.

Generator Switch OFF		Generator Switch ON Check Volts and Amps	
Differential Trip	**Overvoltage Trip**	**Reverse Current**	**Mechanical Failure**
Attempt reset (2 maximum). Non-resetable. If required, reduce load on operating generator to 300 amps maximum.	Attempt reset (2 maximum). Check volts and amps. Overvoltage generator switch OFF. If required, reduce load on operating generator to 300 amps maximum.	Check opposite generator volts and amps. Abnormal generator switch OFF. Normal generator AUTO reset. If required, reduce load on operating generator to 300 amps maximum.	Generator switch OFF.
Cause	**Cause**	**Cause**	**Cause**
▪ 150 amp differential between the generator output and Main bus.	▪ 31 to 33V for 7 seconds ▪ 65V spike	▪ 0.6V difference in generator output and Main bus voltage ▪ 25 amp reverse current flow	▪ sheared generator shaft ▪ G.C.U. ▪ broken wire ▪ other mechanical failure

Table 5C-D; Generator Light ON, Check Generator Switch Position

Failure of One Inverter

Illumination of either AC FAIL light, zero voltage readings, or the appearance of warning flags on flight instruments indicates inverter failure. The standby inverter can power either the pilot's or copilot's AC electrical buses. Move the standby inverter switch toward the failed inverter side. If the AC FAIL light extinguishes, the problem is a failed inverter.

If the light remains illuminated, the inverter is not at fault, and the problem exists elsewhere. Move the standby inverter switch to the center position, and reset the controlling CB if necessary. Turn the failed inverter off. Continue the flight using instruments powered by the other system.

Bus Failure

Failure of the A, B, C, or D bus can result in the loss of flight critical systems. Monitoring of certain systems assists in the identification of a bus failure. Please refer to **Table 5C-E**, page 5C-29, for lists of the key items to verify a bus failure and the affected systems critical to flight.

If only the A bus fails due to a short, or other electrical malfunction, key flight systems are rendered inoperative. Procedures require that the copilot fly the aircraft. Because the thrust reverser system is inoperative, airport field length and braking conditions are critical landing considerations. Loss of the left engine and wing anti-icing system prohibits flight into known icing conditions. Land as soon as possible.

Please refer to the AFM or the SimuFlite Operating Handbook for a complete list of systems affected and landing considerations with bus failures.

Emergency Procedures

Emergency procedures for the Falcon 10/100 electrical system concern electrical fire or smoke, complete failure of the DC and AC electrical distribution systems, and failure of both generators.

Electrical Fire or Smoke

If the source of smoke or electrical fire is known, isolate the fault by pulling circuit breakers or removing electrical sources.

If the source is unknown, procedures require the immediate donning of crew oxygen masks and verifying communication between the pilot and copilot. Procedures then require the isolation of the C and D buses through the auxiliary bus control switch and smoke evacuation by setting the WSHLD and FLOOR valves to full HOT. Use of the windshield and floor heating controls provides increased air flow to clear the cockpit of smoke.

Isolating the C and D buses renders all red labeled (load-shed) CB's unusable. If smoke decreases or stops, try to locate the source of the fire and isolate the circuit. If time permits, pull all red labeled CBs and reset one at a time.

Land the aircraft as soon as possible, refer to the Aux bus off landing considerations and proceed to a suitable airport. Aux bus off landing considerations include:

- no flap landing
- no anti-skid
- 8,000 ft minimum runway.

If the fire persists, perform an emergency descent and determine that oxygen use by the passengers does not increase the fire hazard.

Override the passenger oxygen control to provide oxygen to the passengers. Once the passengers are using oxygen, begin a complete shutdown of the electrical system by turning the generators and batteries off. Provide electrical power to the essential aircraft systems by turning the Emergency Generator switch ON. This bypasses the generator make-and-break relay and provides left generator output directly to the A bus.

If the fire decreases or stops, locate the source of the by pulling the affected system's CB; reset the other CBs. Land as soon as possible. Refer to the AFM or the SimuFlite Operating Handbook for landing considerations.

If all efforts fail to reduce the smoke or fire, pull and reset the white labeled (A bus) circuit breakers to try to isolate the electrical fault. Fight the fire and land as soon as possible. Refer to the AFM or the SimuFlite Operating Handbook for landing considerations.

Complete Electrical Distribution Failure

Indications of total electrical failure are:

- total loss of lighting
- appearance of warning flags on instruments
- activation of emergency lighting system.

Procedures for a complete distribution system failure require turning off the generators and batteries and turning on the Emergency Generator switch. Turning on the Emergency Generator switch bypasses the generator make-and-break relay and directly powers the A bus from the left generator. The A bus powers the minimum equipment required for IFR flight; this includes the pilot's flight instruments, the left engine indicators, the No. 1 VHF and VOR radios and all equipment protected by white labeled circuit breakers (A bus).

Check the condition of the batteries by turning the cockpit dome lights on. If the dome lights increase in brightness, the batteries are available. Land as soon as possible. Refer to the AFM or the SimuFlite Operating Handbook for A bus only landing considerations.

Failure of Two Generators

Illumination of the GENE 1 and GENE 2 lights indicate failure of both generators. Remove non-essential loads by setting the auxiliary bus switch off. Try resetting each generator switch; a maximum of two attempts is permissible for each generator.

If both lights remain illuminated, remove as many electrical loads from the system by pulling circuit breakers or shutting off equipment. The batteries are capable of providing power for up to 20 minutes; land as soon as possible. Refer to the AFM or the SimuFlite Operating Handbook for landing considerations with the Aux bus off.

Bus Failure Indication	Flight Critical Systems Affected
A Bus	
■ No. 1 inverter fails with no red light ■ Annunciation (warning) lights fail ■ Overhead lights fail	Left booster pump . . . . INOP Left fuel gage . . . . INOP Left fuel transfer . . . . JP FAILS OPEN Fuel level sensor . . . . INOP Left fire detection . . . . INOP No. 1 fire bottle . . . . INOP, No. 2 AVAILABLE Left engine indication . . . . INOP Wing anti-ice . . . . FAIL OFF Pilot pitot/static heat . . . . INOP Pilot windshield heat . . . . INOP
B Bus	
■ Right fuel P-2 fail ■ Right fuel gage fail ■ Landing gear annunciator fail ■ Right engine anti-ice – light on	Copilot audio panel . . . . INOP No. 1 ADF/DME/Markers . . . . INOP Right engine indications . . . . INOP Right fuel transfer . . . . JP FAILS OPEN Right fuel level sense . . . . INOP Right engine fire detection . . . . INOP A/C temperature control . . . . LAST POSITION Hydraulic STBY PUMP control . . . . INOP
C Bus	
■ No. 2 inverter fails ■ Fuel flow gages fail ■ No. 2 F/D fails ■ No. 2 VOR fails	VOR 2/DME2/VHF 2 . . . . INOP Radar/FD . . . . INOP Crossfeed valve . . . . LAST POSITION Intercom valve . . . . FAILS CLOSED Freon . . . . INOP Anti-skid . . . . INOP HP valve . . . . FAIL CLOSED Seat adjustment . . . . INOP Aileron trim . . . . INOP
D Bus	
■ No. 2 pitot heat fails ■ Trim indicators full deflection (3)	COM 2/GS 2 . . . . INOP Emergency stabilizer trim . . . . INOP Flaps . . . . INOP Rudder trim . . . . INOP Copilot pitot/static heat . . . . INOP Copilot windshield heat . . . . INOP

Table 5C-E; Bus Failures and Indications

Electrical System

DC and AC Electrical Systems

Data Summary

Power Source	Batteries (2) 24/26V DC, 23 amp hour (20-cell) 22/24V DC, 23 amp hour (19-cell) Engine generators (2) 28.5V DC, 350A, 10.5 kW Inverters (3) – 750VA 115V AC, 400Hz 26V AC, 400 Hz Ground power 28.5V, 1,000A maximum
Distribution	DC buses Battery Start Main A,B,C,D AC buses W bus (pilot) – 115V AC, 400 Hz Y bus (pilot) – 26V AC, 400 Hz X bus (copilot) – 115V AC, 400 Hz Z bus (copilot) – 26V AC, 400 Hz
Control	DC system switches Power selector Generator control Battery control Emergency power Auxiliary bus (load shed) Battery reset AC system switches Inverter control Standby inverter
Monitor	DC system Voltmeter/ammeter Battery temperature Annunciators GENE. 1/2 BATT HOT BAT AC SYSTEM Voltmeter AC FAIL NO. 1/2 annunciators
Protection	Circuit breakers Current limiters Relays Generator control units

Electrical System Distribution

DC Powered Electrical Systems

The following are partial listings of systems powered by the DC and AC electrical systems.

A Bus 28V DC (non-load shedding)	Aircraft configuration/failure warning/etc Aileron/elevator and rudder Arthur jacks Airbrake after SB 27-015 Anti-collision fin light Audio selector/CB panel/radio control lt Cabin pressurization dump valve Engine synchronization Flight recorder Landing gear control Left angle-of-attack sensor Left booster pump control Left engine anti-icing Left engine computer Left engine fire detection Left engine indication Left engine starting Left fuel tank indication and transfer Left pitot,static, and AOA anti-icing Normal fire extinguisher control Normal stabilizer control circuit Passenger warning lights Pilot’s interphone supply circuit Pilot’s inverter power supply Pilot’s windshield anti-ice and control Standby horizon Steering control No. 1 VHF, VOR, GS, and DME Windshield wipers Wing anti-icing Yaw damper servo-control

DC Powered Electrical Systems (cont.)

B Bus 28V DC (non-loading)	No. 1 ADF and DME Air conditioning valve control/total temperature Anti-collision (belly) and position light Audio warning device and Mach limit Copilot's interphone supply circuit Engine ignition Landing gear indication Left freon heat exchanger blower Marker beacon receiver Passenger cabin lighting Reservoir level/hydraulic pressure indication Right angle-of-attack sensor Right booster pump control Right engine anti-icing Right engine computer Right engine fire detection Right engine indication Right engine starting Right fuel tank indicaiton and transfer Standby electro-pump control Standby inverter power supply Standby inverter control Strobe lights
C Bus 28V DC (load-shedding)	No. 2 ADF, VOR, DME/VHF No. 3 Aileron trim Annunciator panels Anti-skid Cabin temperature regulation Cigarette lighter/toilet Crossfeed and intercom valves Copilot's altimeter Copilot's flight director instruments Copilot's inverter power supply Freon system control Fuel flow and temperature indication Heating container HP air bleed control Pilot's/copilot's seat adjustment Radar Right landing light Slat and flap indicator Tape recorder

DC Powered Electrical Systems (cont.)

D Bus 28V DC (load-shedding)	Airbrake prior to SB 27-015 Angle-of-attack indicator Autopilot aileron/elevator servo-motors Copilot's windshield heating Copilot's windshield heating control Flap control Flap gear reduction motor Glideslope No. 2 HF Communication receiver Lateral rear glass panel anti-icing Left landing light Razor light Right pitot/static/AOA anti-icing Rudder trim Standby stabilizer control circuit Taxi light Transponder (ATC) No. 2 Trim display panel VHF No. 2

AC Powered Electrical Systems

W Bus 115 V AC, 400 Hz	Automatic cabin pressurization indication Cockpit glareshield lighting Pilot's flight director instruments Pilot's heading channel Pilot's instrument/pedestal integral Rate-of-turn Yaw damper computer
X Bus 115V AC, 400 Hz	Copilot's flight director instruments Copilot's heading channel Copilot's instrument integral lighting DME No. 1 and No. 2 indicator supply Radar Radio altimeter
Y Bus 26V AC	Pilot's navigation instruments
Z Bus 26V AC	Copilot's navigation instruments

Lighting Systems

The Falcon 10/100 lighting system consists of interior, emergency, and exterior lighting. Interior lighting includes systems for the cockpit, passenger cabin, and the rear compartment. Exterior lighting includes the navigation, landing, and taxi lights. Optional exterior lighting includes an identification light in the nosecone, wing leading edge scanning lights (ice detection), anticollision, and strobe lights.

An emergency lighting system provides lighting in the event of complete power failure.

Interior Lighting

Interior lighting consists of:

- cockpit
- passenger cabin
- rear compartment.

Cockpit Lighting

Cockpit lighting consists of ambient, integral, and instrument panel lighting systems. The majority of the lighting controls are on either side of the overhead panel. The pilot's lighting panel (**Figure 5C-19**) controls the pilot's instrument integral, pedestal integral, and glareshield lighting, and a reading light. The copilot's lighting panel (**Figure 5C-20**) controls the overhead panel, radio control box, and copilot's integral instrument lighting, and a reading light.

Ambient

Ambient lights include a single cockpit dome light, circuit breaker flood light, and adjustable reading lamps for the pilot and copilot. The circuit breaker panel and reading lamps receive 28V DC power from the A bus. The dome light receives 28V DC power from the Battery bus with the auxiliary bus control switch on. The DOME switch on the side of the circuit breaker panel controls the dome light. The CIRCUIT BREAKER PANEL switch on the top of the circuit breaker panel controls the panel flood light. Separate READING LIGHT controls on either side of the overhead panel vary the intensity of the pilot's and copilot's reading lamps.

Instrument Integral

Instrument integral lighting consists of four separate systems for pilot, copilot, and pedestal instruments and radio control lighting. The pilot, copilot, and pedestal integral lighting systems use 115V AC from the inverters reduced to 5.5V AC by separate transformers. The radio control lighting system uses 28V DC from the A bus. Separate controls employ rheostats to vary the intensity of each of the lighting systems from off to full intensity (0 to 5.5V).


5C-19


5C-20

The pilot and pedestal integral instrument lights receive power from the 115V, 400 Hz W bus through separate transformers. The PILOT INSTRUMENTS rheostat controls the pilot's lights, and the PEDESTAL rheostat controls the pedestal instruments. The copilot's lighting system receives power from the X bus through a transformer controlled by the COPILOT INSTRUMENTS rheostat. Radio control lighting employs a rheostat to vary the voltage to the lights. The RADIO CONTROL BOX rheostat varies A bus power from 0V to 28V to adjust the lights from off to full intensity.

Glareshield Lighting

Glareshield lighting consists of a fluorescent tube under each side of the glareshield. The tubes shine down on the instruments to provide lighting if the integral instrument lighting system fails.

The 115V W bus supplies AC power to a power supply unit for glareshield lighting. The power supply together with the SHIELD rheostat varies the voltage from 380V to 450V to adjust the intensity of the lights from dim to full intensity.

Passenger Cabin

Passenger cabin lighting systems include entrance, bar, ambient, and passenger call signs (warning). As interior configurations vary from aircraft to aircraft, only a brief discussion of the cabin lighting systems is presented here.

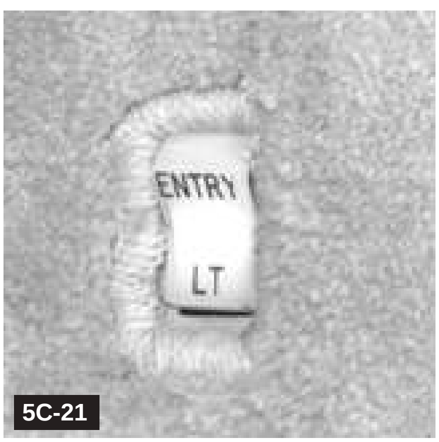
Typical cabin lighting systems employ 28V DC from the DC electrical system to power the lights. The primary controls for the cabin lighting systems are on the overhead panel below the inverter controls. Additional controls for the cabin and entrance lights are on the partition to the right of the entrance door.

Entrance and Bar Lighting

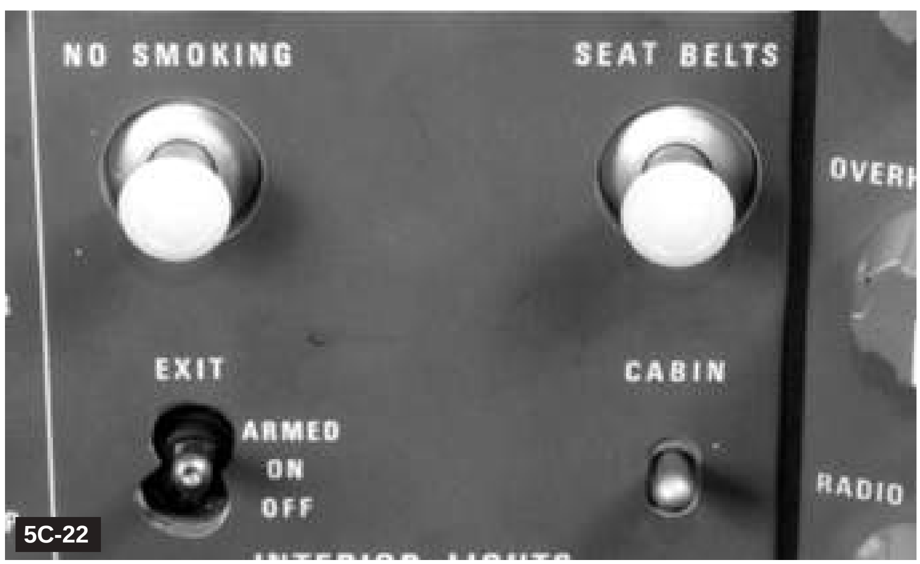
Entrance and bar lighting consists of fluorescent tubes on a partition to the right of the entrance door and fluorescent tubes in the ceiling above the luggage compartment. Luminous switches on the partition to the right of the entrance door control the lights. The ENTRANCE and CABIN switches (**Figure 5C-21**) illuminate once the entrance door is unlocked. Switches in the bar door and galley curtain control the lights for these areas. Opening the door or the curtain illuminates the lights.

Cabin Ambient Lighting

Cabin ambient lighting includes fluorescent tubes above each passenger window and above each table. The



5C-21



5C-22

CABIN switch (**Figure 5C-22**) in the cockpit controls the lights above each window; switches in the cabin may be available. Individual switches control the lights over the tables.

Passenger Call Signs

The passenger call sign consists of a single No Smoking/Fasten Seat Belts sign (**Figure 5C-23**). The NO SMOKING and SEAT BELTS luminous switches on the overhead panel control the operation of the sign (**Figure 5C-22**).

Rear Compartment

A single dome light provides illumination of the rear compartment. The light receives power from one of the 28V DC electrical buses. Light control is automatic through a microswitch on the rear compartment door and the Aux bus control switch.

Emergency Lighting

Two independent batteries supply DC to power emergency lighting systems in the event of complete electrical failure or intentional electrical system shut down. A three-position (OFF/ON/ARMED) switch on the overhead panel (**Figure 5C-22**) controls the arming and operation of the lights. The system consists of emergency exit handle lights, emergency exit spotlights, entrance door spotlights, exit sign lights, and cockpit dome lights.

During normal operations 115V, 400 Hz AC power from the W bus charges the batteries.

In ARMED, the emergency lighting system automatically provides power to the lights if the electrical system fails or is shut down. In ON, the lights illuminate for aircraft lighting during engine starting. The main batteries must be on to change switch positions.

Exterior Lighting

Exterior lighting consists of:

- navigation
- anticollision
- landing
- taxi.

Additional exterior lighting systems include optional nose cone identification (recognition), leading edge scanning (ice detection), anticollision, and strobe lights. The exterior lighting controls are on the lower right side of the overhead panel (**Figure 5C-24**).

Direct current from the A, B, C, and D buses provides power for the exterior lights.

5C-23

5C-24

Navigation and Strobe

Three navigation lights are on the aircraft: a green light on the right wing tip, a red light on the left wing tip, and a white light in the tailcone. Optional configurations combine the navigation lights with a strobe light (**Figure 5C-25**). The two-position (OFF/NAV) or three-position (OFF/NAV/NAV STROBE) on the overhead panel provides the navigation or combination navigation/strobe lights with 28V DC from the B bus.

Anticollision

The high intensity anticollision lights consist of red rotating beacons on the aircraft belly (**Figure 5C-26**) and fin tip fairing. The lights receive power from separate sources: the belly light from the B bus, and the fin tip light from the A bus.

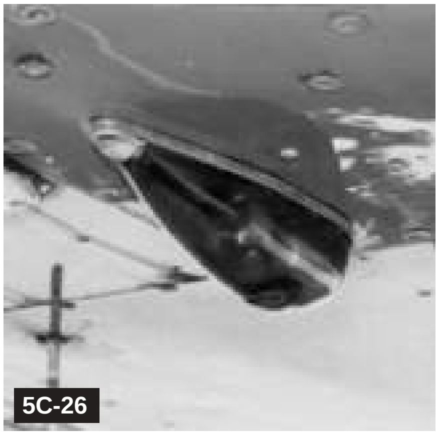
Landing Lights

A single 450 watt landing light (**Figure 5C-27**) is on each main landing gear strut. The Landing light switch in combination with the landing gear handle controls the operation of both lights. With the landing gear handle in the down position, the contacts of the landing light switch energize to provide power to the lights. Placing the switch ON provides 28V DC from the C and D buses. The right light receives power from the C bus, and the left light receives power from the D bus.

Taxi and Identification

A single, 150 watt taxi light (**Figure 5C-28**) is on the nose landing gear strut; the light rotates with the nose wheel. The two-position TAXI switch (OFF/TAXI) on the overhead panel controls the light with 28V DC from the D bus.


5C-25


5C-26


5C-27


5C-28


5C-29

The optional identification (recognition) lights in the nosecone consist of two 250 watt lights controlled by the TAXI/IDENT switch; they receive 28V DC power from the D bus.

Ice Detection

The ice detection (wing leading edge scanning) lights consist of 40 watt lights (**Figure 5C-29**) forward of the wing root that shine back on the wing leading edges. The A bus provides 28V DC for the lights through the WING ICE LIGHTS switch on the overhead panel.

Lighting Systems

Data Summary

Power Source	28V DC A and B buses (non-shedding) C and D buses (load-shedding) 115V AC, 400 Hz W bus (non-shedding) X bus (load-shedding)
Control	Switches and rheostats Flight deck Passenger individual lights Entrance and cabin Exterior lights Gear handle (landing light)
Monitor	Warning and advisory lights
Protection	Circuit breakers

Fire Protection

Chapter 5D

The Falcon 10/100 Fire Protection System consists of heat-sensitive, expanding gas detection systems and electrically powered extinguishers for the two engine fire zones.

Both aural and visual warnings in the cockpit activate in case of a fire or overheat condition in these areas.

The cabin and cockpit each have a portable fire extinguisher bottle.

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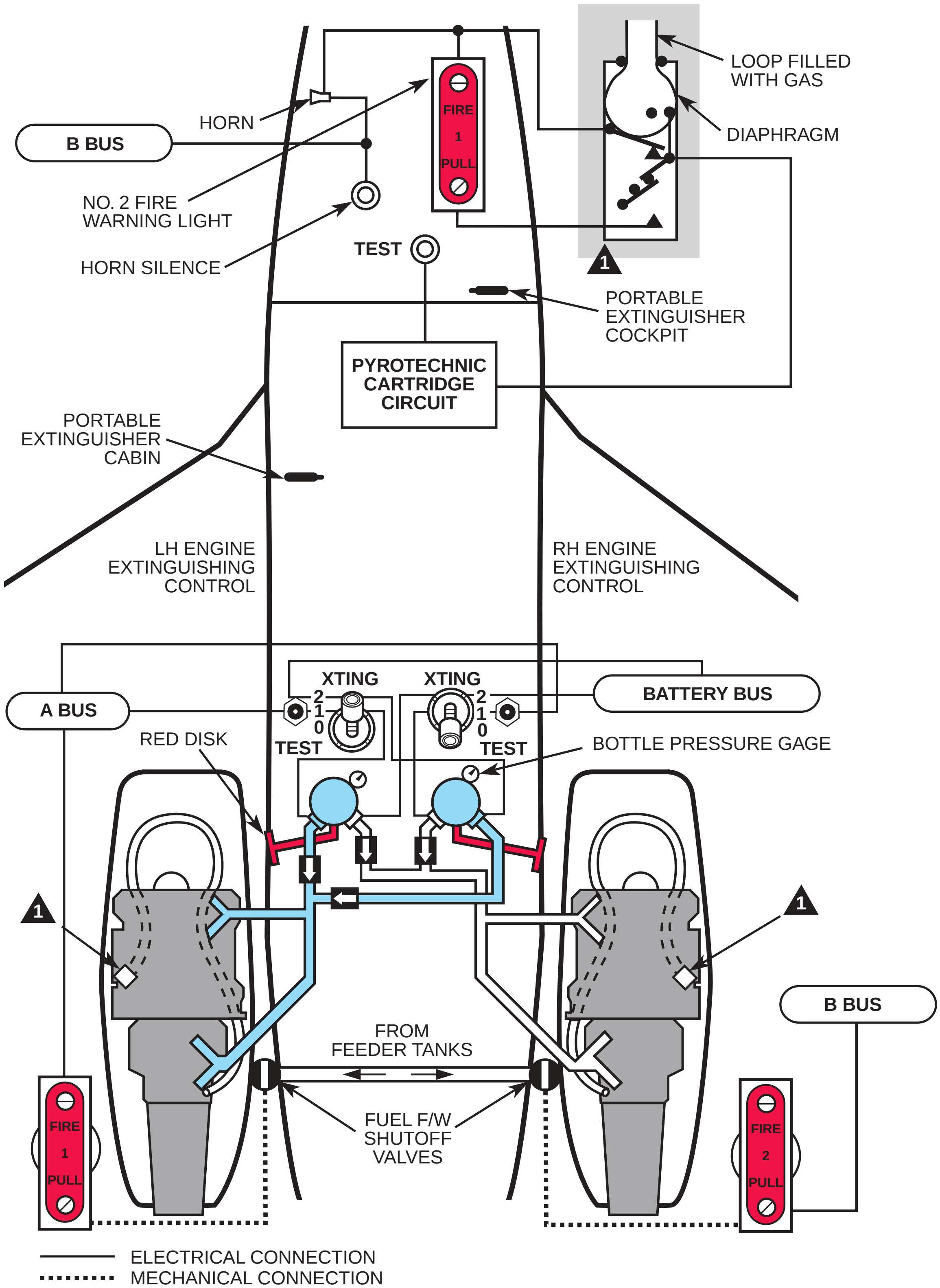
Fire Protection System



Fire Detection

Fire detectors in both of the engine nacelles are sensitive to ambient temperature rise or localized hot spots.

A stainless steel sensor tube (Lindberg Loop detector) in each of the high risk areas (engine nacelles) consists of a sensor element attached to a steel housing. The sensor element is protected by a stainless steel tube helically formed and attached to the steel housing. The tube contains an inert gas that expands when a relatively high temperature is sensed over the entire length of the tube. The expanding gas closes a normally open detection contact that triggers the appropriate fire warning circuits.

A discrete element in the detecting tube emits gas when a very hot temperature in a localized area occurs. This causes the pressure within the loop to increase and close the detection switch that triggers the appropriate fire warning circuits. Detection circuits are powered by the A and B buses.

When the temperature lowers, the element reabsorbs its contracting gas, and the detection contact reopens to rearm the detection system.

At one end of the tube is a box that houses:

- the alarm switch for the detection system
- the integrity switch for the test system.

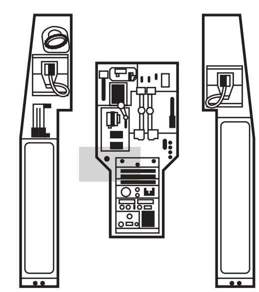
Engine Fire Detection

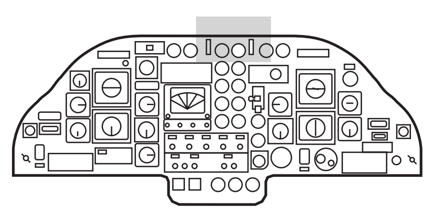
A 12 ft stainless steel detection tube is around each engine. Each 1.6 mm diameter tube contains the inert gas that triggers the fire warning circuits at 400°F (204°C). When a core element senses a local hot spot, it triggers the warning circuits at 800°F (427°C). The alarm switch housed in the detection box illuminates the appropriate FIRE PULL annunciator in the cockpit. A warning horn also sounds.

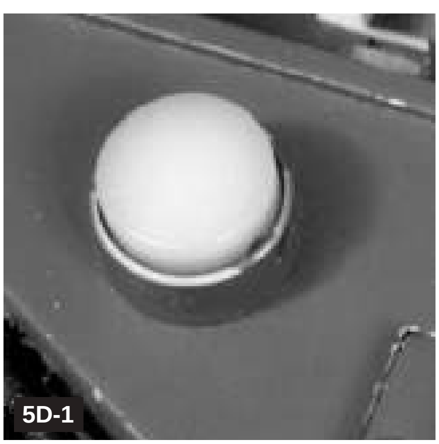
Warning Annunciators and Horn

In the event of fire or overheat condition in a nacelle, the corresponding warning annunciator on the fire panel illuminates and the fire warning horn sounds. The continuous two-tone sound silences when the pilot presses the HORN SILENCE pushbutton on the pedestal (**Figure 5D-1**).

Each of the fire panel warning annunciators contain two parallel-wired bulbs that test when the pilot presses the TEST pushbutton just below and outboard of each fire handle (**Figure 5D-2**). A self test of the fire detection loops and the squibs in the fire extinguisher bottles is also initiated. All components of the detection system must be intact to achieve a valid warning test.







5D-1

5D-2

Fire Extinguishers

Extinguishers

Two fire extinguisher bottles (**Figure 5D-3**) in the aft compartment, are cross-connected to permit both extinguishers to discharge into either engine nacelle through diffuser nozzles. The high pressure (600 PSI) bottles are filled with R13B1 Freon (European) or Halon 1301 (US) for fire suppression.

Each bottle incorporates two discharge outlets. One outlet is the first shot to an engine; the other is the second shot to the other engine. The extinguishing agent moves to the respective engine through check valves that are opened by the extinguishing agent pressure.

Because the discharge is not metered, each bottle empties its contents through the discharge nozzles in less than one second.

Extinguisher Power Supplies

Each engine extinguisher is controlled by a three-position (0/1/2) safety wired switch under its associated FIRE PULL handle. See **Table 5D-A**.

Portable Fire Extinguishers

The cockpit portable fire extinguisher must be of either the Halon 1211 or CO_2 variety; it can be used on Class A, B, or C fires. The passenger compartment portable extinguisher must be either water (suitable for Class A fires) or Halon (suitable for Class A, B, or C fires).

Switch	A Bus	Battery Bus[1]
ENG 1	Position 1	Position 2
ENG 2	Position 1	Position 2

Table 5D-A; Extinguisher Power Supplies

[1] Observe warning at right.

WARNING: Extinguishers are directly supplied by the Battery bus and may be fired with battery switches in the OFF position with batteries connected.


5D-3

FIRE PULL Handles/ Fuel Shutoff Valves

An illuminated FIRE PULL annunciator in the FIRE PULL HANDLE indicates engine fire or overheat. FIRE PULL handles attached to teleforce cables control the fuel shutoff valves in each pylon (**Figure 5D-5**). When pulled, the handle shuts off fuel to its respective engine.

Extinguisher System Protection

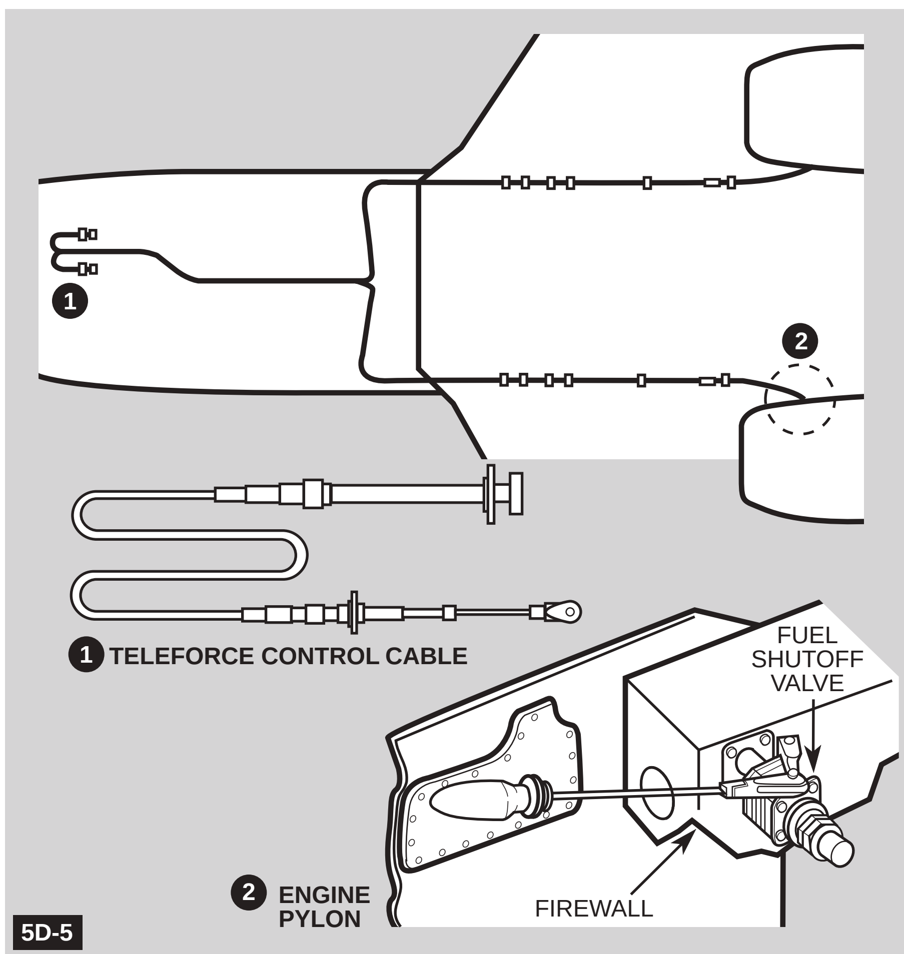
Each fire bottle has an overpressure discharge device. Excessive internal pressure buildup (from ambient temperature of 205°F or more) melts a thermal fuse to initiate a discharge through blowout discs on the aft fuselage under each engine pylon (**Figure 5D-4**). The red disc is knocked out by escaping pressure and uncovers the overpressure relief outlet. When an overboard discharge occurs, the bottle empties.

Engine Fire Extinguishing

Each engine fire extinguisher bottle incorporates two discharge frangible discs that are ruptured by independently controlled pyrotechnic squibs. The volume of each extinguisher is three pounds of Halon 1301 with an operating pressure of 600 PSI at 72°F (22°C).

The bottles are cross-connected so that both may be discharged into one engine. The A bus powers the first shot to engines 1 or 2. As a backup for possible primary bus failure, the battery bus powers the second shot to the engines. Refer to the Data Summary table in this chapter.

5D-4



5D-5

Preflight and Procedures

Preflight

During preflight, the crew checks in the cockpit that the extinguisher switches are set to the normal (0) position and safetied, and on the exterior inspection that the red extinguisher discharge indicators on the fuselage are intact.

A placard on each extinguisher body lists corresponding pressures and temperatures, which should be checked prior to each flight.

Fire Protection System Test

When pressed, the TEST button, just below the fire pull handle, activates a warning horn and illuminates the engine 1 and engine 2 FIRE PULL annunciators and checks:

- the integrity of the sensing elements (detector head and tube)
- the integrity of the bottle pyrotechnic cartridges (squibs)
- the horn and warning annunciators' operating condition
- that associated circuit breakers are engaged.

A system does not test if the detection tube or squibs are not working in one of the following situations:

- if the annunciator is out and no horn sounds, the corresponding system has failed (i.e., a detector head or tube is probably damaged or cut).
- if a annunciator is out and the horn does sound, there may be a warning annunciator malfunction or defective wires.
- if the horn fails to sound while the warning annunciator illuminates, this indicates a horn malfunction or defective wires.

Emergency Procedure

Engine Fire

A warning horn and an illuminated FIRE PULL handle annunciator indicate fire in the associated engine. The horn is silenced by pressing the HORN SILENCE button on the pedestal; do not silence the horn until the problem is identified.

When the problem is identified, silence the warning horn, and pull the illuminated FIRE PULL HANDLE, and retard the power lever to IDLE to reduce fuel to the engine at the fuel control. The fuel shutoff valve from the respective feeder tank is closed when the FIRE PULL handle is pulled and along with switching off the electric boost pump ensures fuel is no longer supplied to the engine. Closing the HP bleed air valves serves to decrease the chance of contaminated air entering the cockpit or cabin; turning off the Freon air system reduces the demand on the one remaining generator.

Reducing airspeed reduces airflow in the nacelle and helps in facilitating fire extinguishing.

Move the appropriate extinguisher switch to position 1 to discharge the contents of one fire bottle into the engine nacelle. If the condition persists, move the extinguisher switch to position 2 to discharge the contents of a second fire bottle into the nacelle.

WARNING: Do not attempt an engine relight after an engine fire or if the integrity of the engine is questioned.

Fire Protection System

Engine Fire Protection System

Data Summary

Power Source	A bus
	  Engine 1 detection circuit (FIRE 1 PULL light)
	B bus
	  Engine 2 detection circuit (FIRE 2 PULL light)
	A bus
	  Extinguisher shot 1 to either engine
	Battery bus
	  Extinguisher shot 2 to either engine
	Teleforce cables on FIRE PULL handles
	  Fuel shutoff valves

Distribution	Left and right engines
Control	TEST button Horn Silence button FIRE 1/2 PULL handles FIRE XTING 1/2 switches
Monitor	FIRE 1/2 PULL handles (red lights)
Protection	Fire warning test system Fuel firewall valves Fire bottle discharge device

Flight Controls

Chapter 5E

The Falcon 10/100 primary flight controls transmit pilot inputs through a mechanical linkage system to dual-barrelled, hydraulic servo actuators that move the ailerons, elevators, and rudder.

The secondary flight controls consist of a moveable horizontal stabilizer that provides pitch trim, trailing edge flaps, inboard and outboard leading edge slats, and airbrakes.

In addition to the primary and secondary flight controls, stall warning devices complete the flight controls system.

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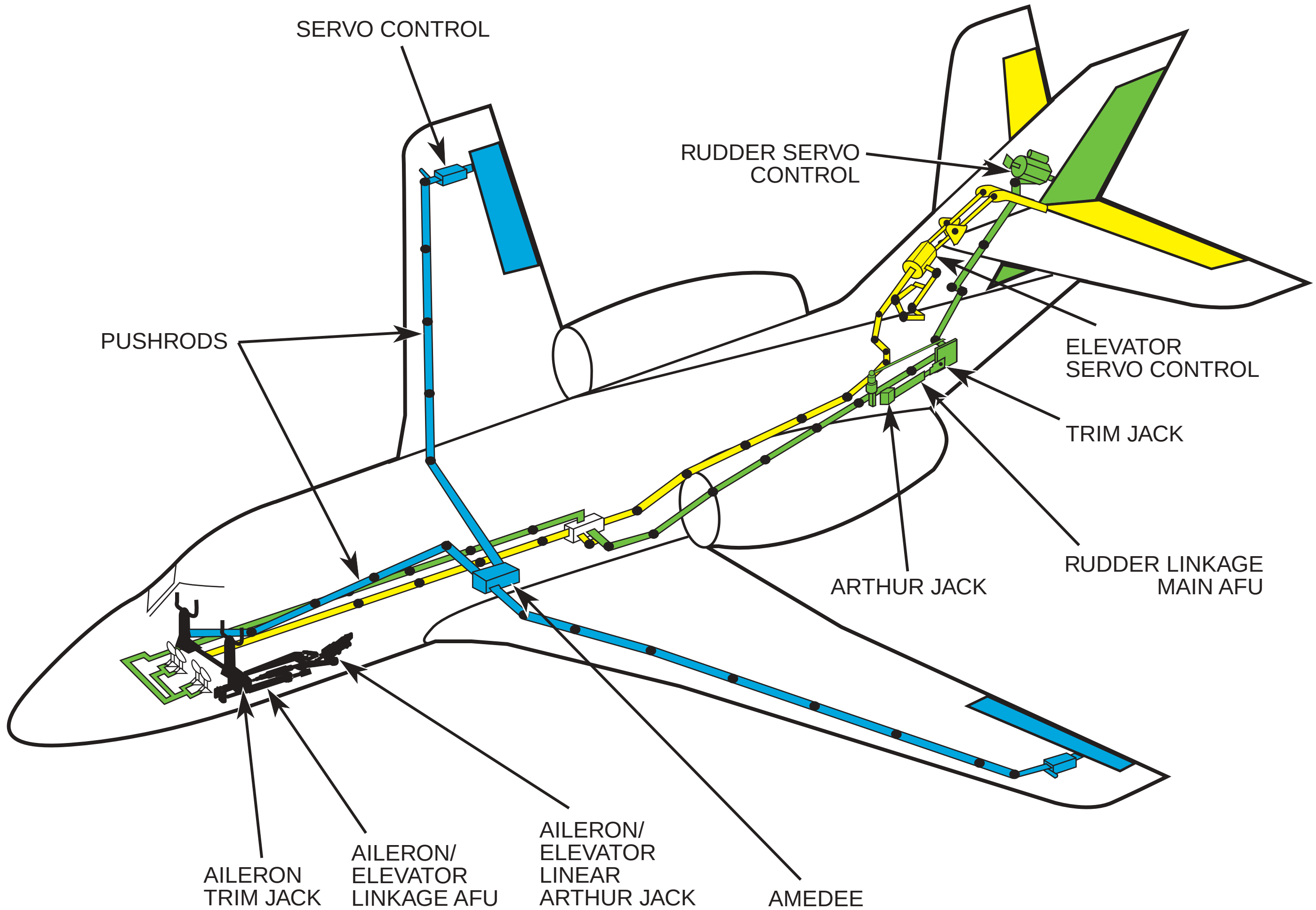
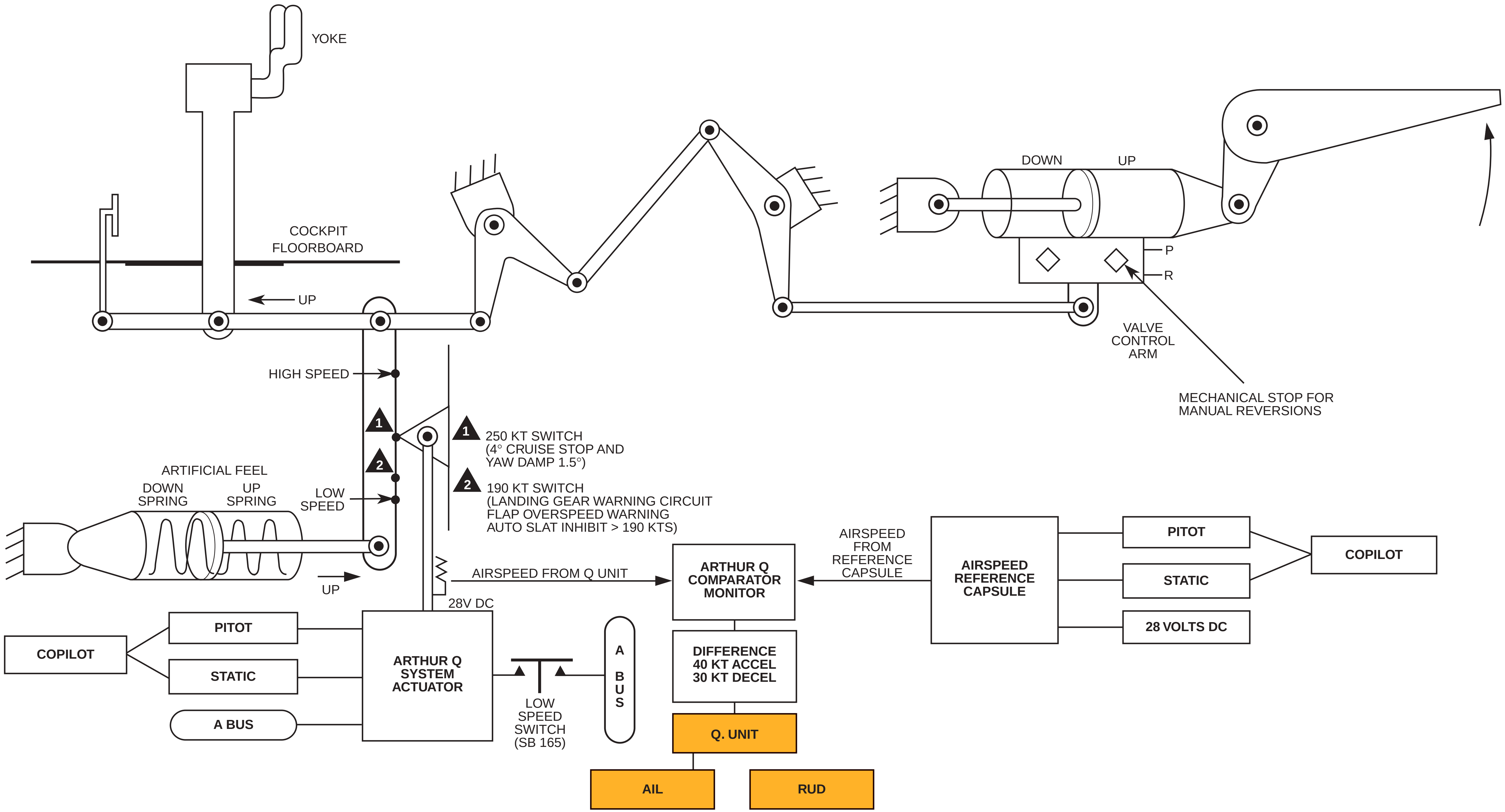
Elevator Control Linkage



Arthur Q Unit

Arthur Q Unit



Primary Flight Controls

The Falcon 10/100 hydraulically powered primary flight controls (**Figure 5E-1**) allow control of the aircraft through the roll, pitch, and yaw axes. Control inputs are transmitted through mechanical linkage systems to dual-barrelled, hydraulic servo actuators that move the following:

- ailerons
- elevators
- rudder.

Servo Control Actuators

Each control system's servo actuator comprises two barrels in one common block. One barrel of the servo actuator receives pressurized hydraulic fluid from Hydraulic System 1, which is powered by the left engine hydraulic pump. Hydraulic System 2, powered by the right engine hydraulic pump, supplies the second barrel. The yoke and rudder pedals move control valves to port hydraulic fluid to the appropriate side of each piston.

Once the surface moves to the selected position, the appropriate control valve closes, and trapped hydraulic pressure holds the surface in position with no pilot input pressure required.

In the event one hydraulic system fails, maximum allowable airspeed is 260 kts/0.76 M.

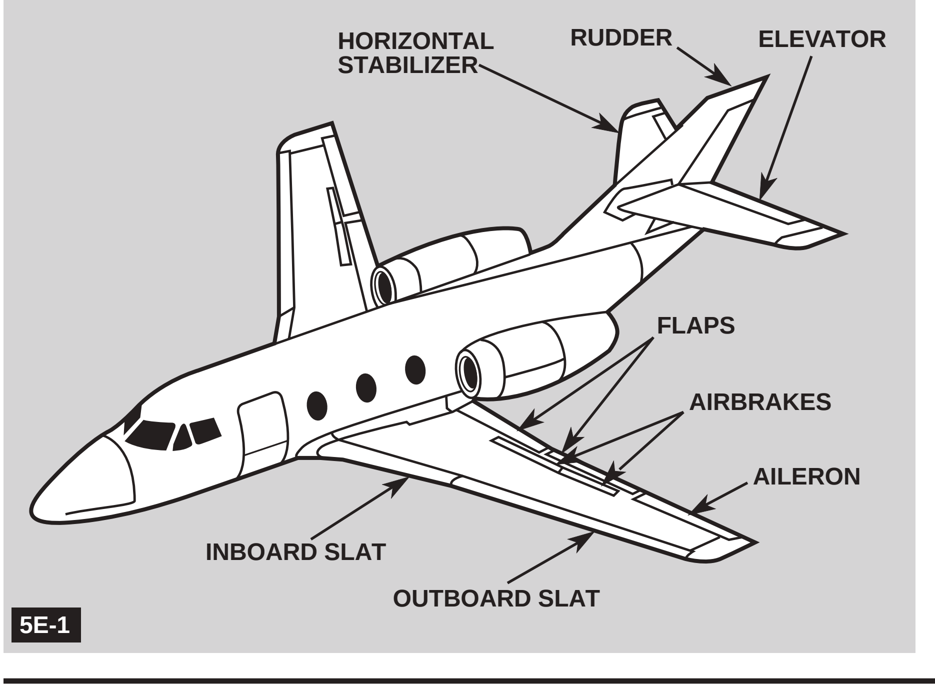
If both hydraulic systems fail, the flight controls revert to a conventional system. Because no pressure is available, manual control of the yoke moves the control valve arms to a mechanical stop; this moves the entire actuator and displaces the control surface. In this case, the maximum allowable airspeed is 260 kts/0.76 M, and the maximum recommended landing weight is 15,400 lbs. Because of control forces required, crosswind landings are more difficult without hydraulic pressure.

The primary control servo actuators incorporate the following protective devices:

- torque bar (secondary AFU)
- bypass valve
- mechanical stops
- irreversibility feature
- internal leakage.

NOTE: Because there is no feedback, or feel, to the pilot, the control system is called "irreversible" and requires the addition of an artificial feel device. See Artificial Feel Unit (AFU), this chapter.

CAUTION: In the event of complete hydraulic failure, expect extreme control forces because the pilot must overcome both the airloads and the artificial feel system.



5E-1

Torque Bar (Secondary AFU)

Each primary control linkage system incorporates a torque bar (secondary AFU) that acts as a centering device in the event of broken linkage or total hydraulic failure.

In the event of broken aileron linkage, the torque bar returns the servo actuator levers to neutral and fairs the control surfaces. The failed aileron hydraulically locks in neutral position, and the other aileron allows acceptable control of the aircraft.

If total hydraulic failure occurs, this secondary AFU causes control forces to become very heavy.

Bypass Valve

In case of hydraulic power failure to one actuator barrel, a bypass valve prevents the failed barrel from interfering with the normal function of the operating barrel.

There is no locking system for either the control surfaces or linkages other than active or stored hydraulic pressure. When the aircraft is parked and engines are shut down, the hydraulic accumulators progressively discharge, and the actuator barrels no longer receive pressure. Both bypass valves open when hydraulic pressure drops; friction resistance in the linkage holds control surfaces in a neutral position.

Mechanical Stops

The servo actuator actuating lever moves between two mechanical stops to provide the pilot with a mechanical means of flying the aircraft if all hydraulic systems fail completely. In this case, the forces of friction, secondary AFU, torque tube, and, especially, aerodynamic loads on the control surfaces reduce aircraft response and could overstress the airframe. Limit airspeed to 260 kts/0.76 M.

Irreversibility Feature

The check valve in the hydraulic supply line prevents displacement of the servo actuator in the reverse direction if the aerodynamic loads on the control surface exceed the force developed by the servo actuator.

Internal Leakage

Each servo actuator slide valve has a calibrated leakage that allows a flow of 600 cm^3 per minute to warm the power servo unit during prolonged flight at high altitude.

Artificial Feel Unit (AFU)

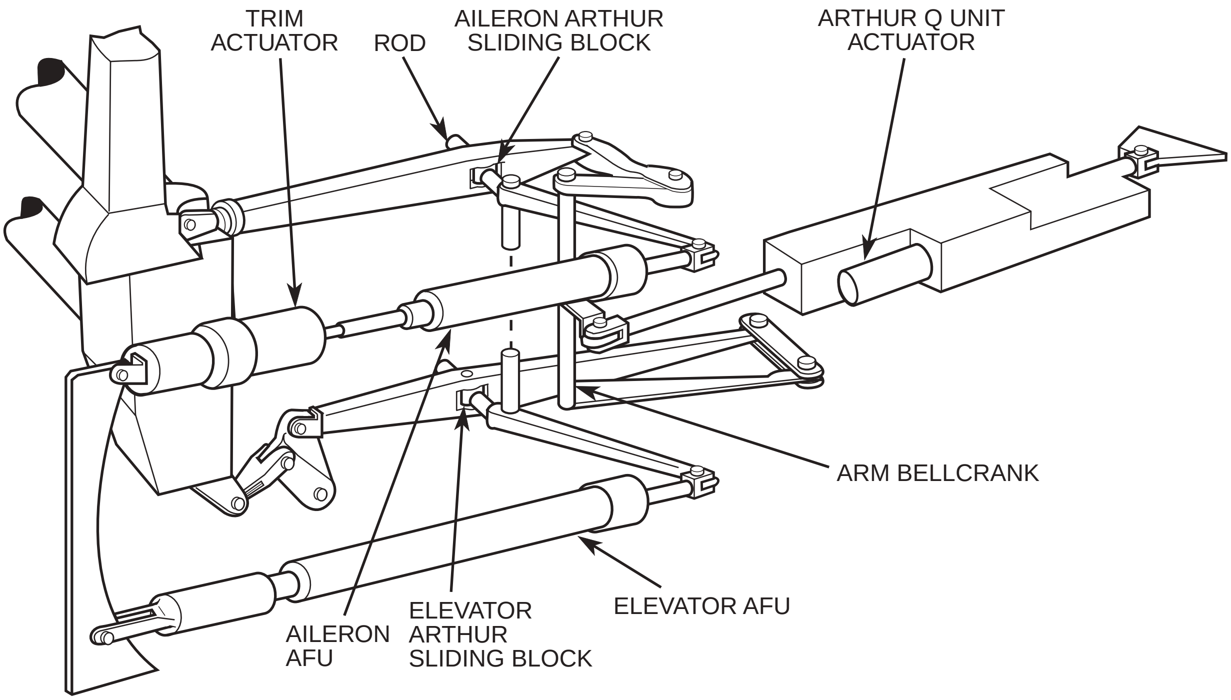
Because the primary controls are powered hydraulically, the only forces to overcome are the linkage component friction and resistance. Therefore, each control system incorporates an artificial feel unit (AFU) (**Figure 5E-2**) that gives the pilot a control force that increases with control deflection; the force varies as a piston moves against three preloaded springs within the AFU tube. An artificial feel unit is on each of the three primary flight control linkages:

- aileron
- elevator
- rudder.

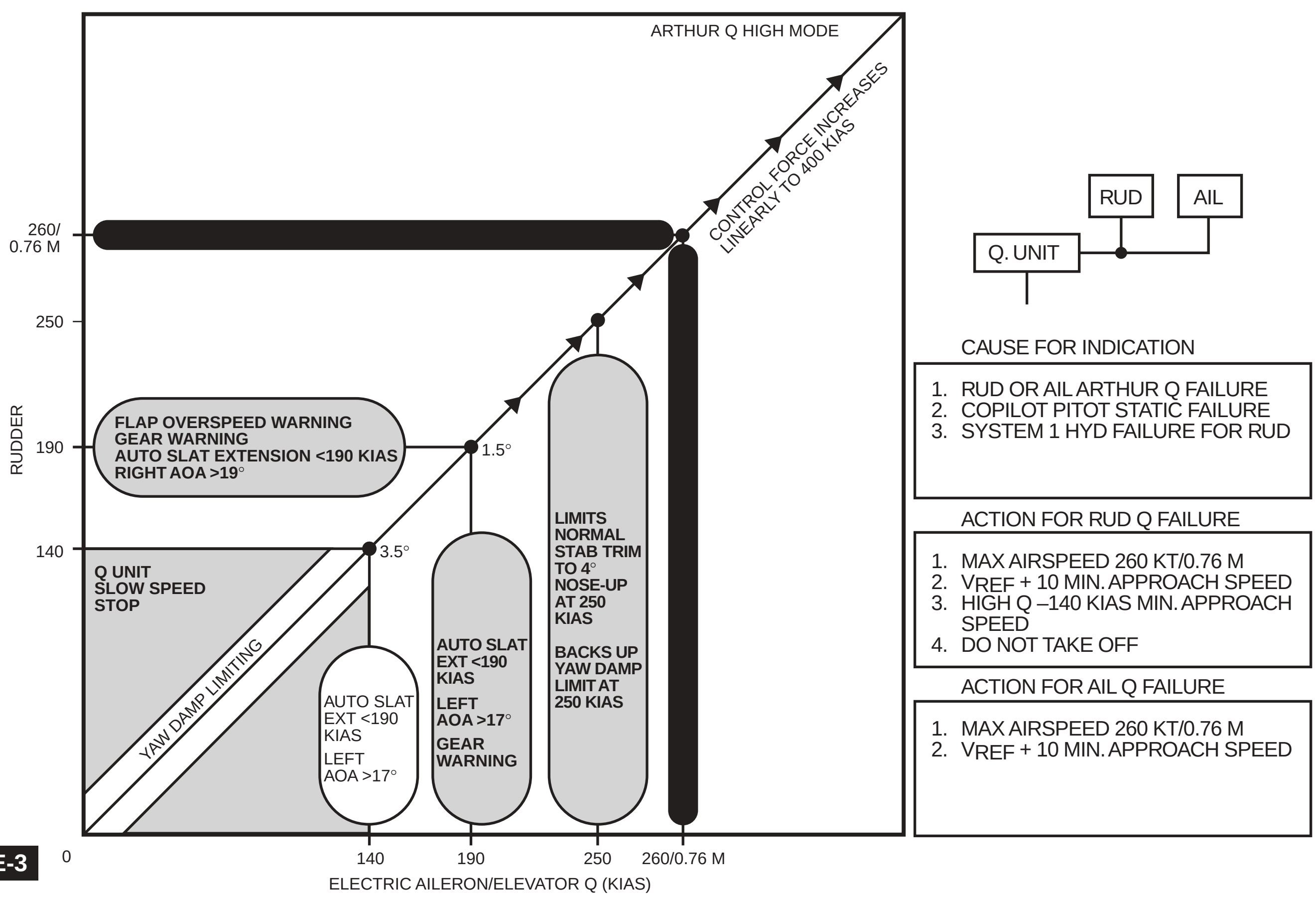
Arthur Q Unit

The faster the aircraft flies, the smaller the deflection required of control surface to get the same response (**Figure 5E-3**). To provide the necessary feel and response at higher airspeeds and to further refine the artificial feel system, each primary control linkage system incorporates an Arthur Q unit (**Figure 5E-2**).

Arthur means motion, and Q refers to dynamic pressure, or airspeed. Either of the two Falcon 10/100 Arthur Q


TRIM
ACTUATOR
ROD
AILERON ARTHUR
SLIDING BLOCK
ARTHUR Q UNIT
ACTUATOR
ARM BELLCRANK
ELEVATOR AFU
AILERON
AFU
ELEVATOR
ARTHUR
SLIDING BLOCK

5E-2


ARTHUR Q HIGH MODE
CONTROL FORCE INCREASES
LINEARLY TO 400 KIAS
260/
0.76 M
250
190
140
RUDDER
FLAP OVERSPEED WARNING
GEAR WARNING
AUTO SLAT EXTENSION <190 KIAS
RIGHT AOA >19°
1.5°
3.5°
Q UNIT
SLOW SPEED
STOP
YAW DAMP LIMITING
AUTO SLAT
EXT <190
KIAS
LEFT
AOA >17°
AUTO SLAT
EXT <190
KIAS
LEFT
AOA >17°
GEAR
WARNING
LIMITS
NORMAL
STAB TRIM
TO 4°
NOSE-UP
AT 250
KIAS
BACKS UP
YAW DAMP
LIMIT AT
250 KIAS
0
140
190
250
260/0.76 M
ELECTRIC AILERON/ELEVATOR Q (KIAS)
RUD
AIL
Q. UNIT
CAUSE FOR INDICATION
1. RUD OR AIL ARTHUR Q FAILURE
2. COPILOT PITOT STATIC FAILURE
3. SYSTEM 1 HYD FAILURE FOR RUD
ACTION FOR RUD Q FAILURE
1. MAX AIRSPEED 260 KT/0.76 M
2. VREF + 10 MIN. APPROACH SPEED
3. HIGH Q –140 KIAS MIN. APPROACH SPEED
4. DO NOT TAKE OFF
ACTION FOR AIL Q FAILURE
1. MAX AIRSPEED 260 KT/0.76 M
2. VREF + 10 MIN. APPROACH SPEED

5E-3

units (separate from the AFU) mechanically responds to changes in airspeed and varies the mechanical advantage of the yoke over the artificial feel system.

- The Primary A bus powers and actuates the aileron and elevator Arthur Q units.
- Hydraulic System 1 actuates the rudder Arthur Q unit.

Each Q unit, which is a variable length bell crank, drives its respective flight control system's main AFU. The unit's arm length varies with the aircraft's indicated airspeed input to control the AFU travel and the loads commensurate with indicated airspeed (i.e., light controls at low speed, heavy controls at high speed).

The rudder's hydraulic Q system utilizes a large spring to move toward low speed feel as the aircraft decelerates and hydraulic pressure to move toward high speed feel on acceleration. Therefore, if Hydraulic System 1 fails, the rudder Q system automatically goes to the low speed (140 kts) position. This is the reason for the 260 kts/0.76 M restriction during hydraulic failure; the resulting light feel forces could cause overcontrol and overstress of the empennage.

The electric Q system's motor positions the mechanical linkage through a jackscrew so that the linkage remains in its last position if the aileron/elevator Q system fails.

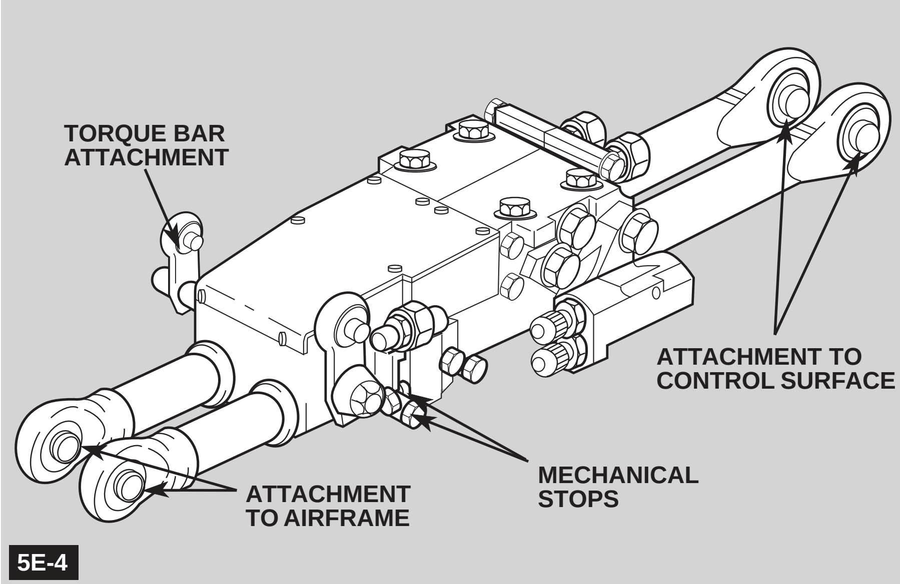
Q UNIT Light

In flight, an illuminated Q UNIT light (refer to Chapter 5J, Miscellaneous Annunciator Cross Reference) indicates there is a difference between Arthur Q position and aircraft speed. It does not mean system failure; it means a difference exists. Under rapid acceleration or deceleration, it is not uncommon for the Q UNIT light to flicker on and off to indicate the Q unit is not keeping up with the airspeed change.

Ailerons

The hydraulically actuated ailerons (**Figure 5E-5**) on the outboard trailing edge of each wing provide the primary roll control of the aircraft. The aileron linkage system routes through the fuselage and the wing leading edge to the aileron servo actuator (**Figure 5E-4**). See Servo Control Actuators, this chapter.

Control yoke rotation moves each aileron inversely to the other through a bell crank and torque bar system; the



5E-4

aileron on one wing moves up at the same time the aileron on the opposite wing moves down. Full travel range is 25°20´ up and 24°50´ down. Both aileron linkages are routed through a device called an Amedee.

Amedee Unit

The Amedee unit is a mechanical, variable ratio linkage between the yoke and the aileron servo. It reduces aileron travel at small control yoke displacements (in normal smooth flying conditions), but it gives proportionately greater displacement as control yoke travel increases. The Amedee's function is comparable to an automobile's variable rate power steering.

Roll Trim

The AILERON trim switch on the cockpit pedestal provides electrical aileron trim control with aileron deflection up to 30% of normal travel. The Auxiliary C bus powers the aileron trim actuator, which is just forward of the AFU.

Aileron Trim Switch

The aileron TRIM switch (**Figure 5E-6**) incorporates a cancelling device that prevents trim runaway. On **S/Ns 1 to 109**, the aileron trim is controlled with a single, dual action switch on the pedestal trim switch panel. A double, dual action switch is on **S/N 110 and subsequent.**

Elevators

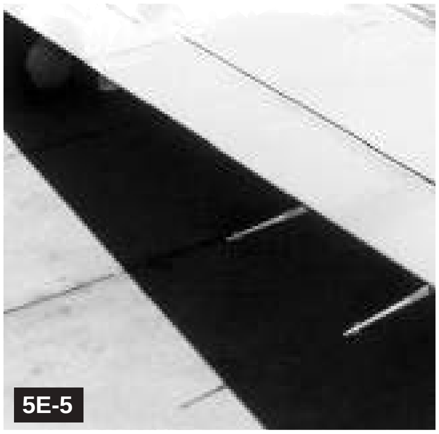
The elevators (**Figure 5E-7**), on the trailing edge of a moveable horizontal stabilizer, provide pitch control through fore and aft movement of the control column.

A dual-barrelled, hydraulically powered servo actuator drives the elevators. The pilot's column controls the actuator through linkage routed beneath the fuselage floor, aft, and upward to the hinged elevators. See Servo Control Actuators, this chapter.

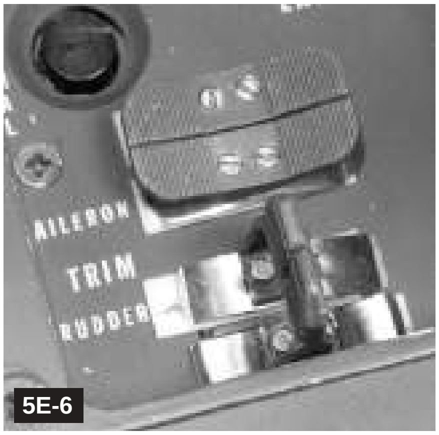
Horizontal Stabilizer/ Pitch Trim

The electrically driven horizontal stabilizer is an airfoil that provides longitudinal stability and replaces the need for trim tabs. The stabilizer is hinged at two points, fore and aft, to the vertical fin stub.

To provide pitch trim, the horizontal stabilizer pivots around the aft mount point. A scissors-type hinge anchored to the fin stub at the forward attach point provides lateral stability while the dual-motor electrical actuator drives a vertical shaft to provide trim motion. One motor is used for normal operation; the other is used for emergency operation. The Primary A bus powers the normal trim motor through the 10A NORMAL circuit breaker on the center pedestal, while the Load Shed D bus powers the emergency motor.



5E-5



5E-6

5E-7

Horizontal Stabilizer Actuator

The stabilizer actuator is a jackscrew mechanism that is driven through a reduction gearbox by either of two electric motors. Trim buttons on the control yokes (**Figure 5E-8**) control the motors. A switch on the pedestal controls the emergency trim motor.

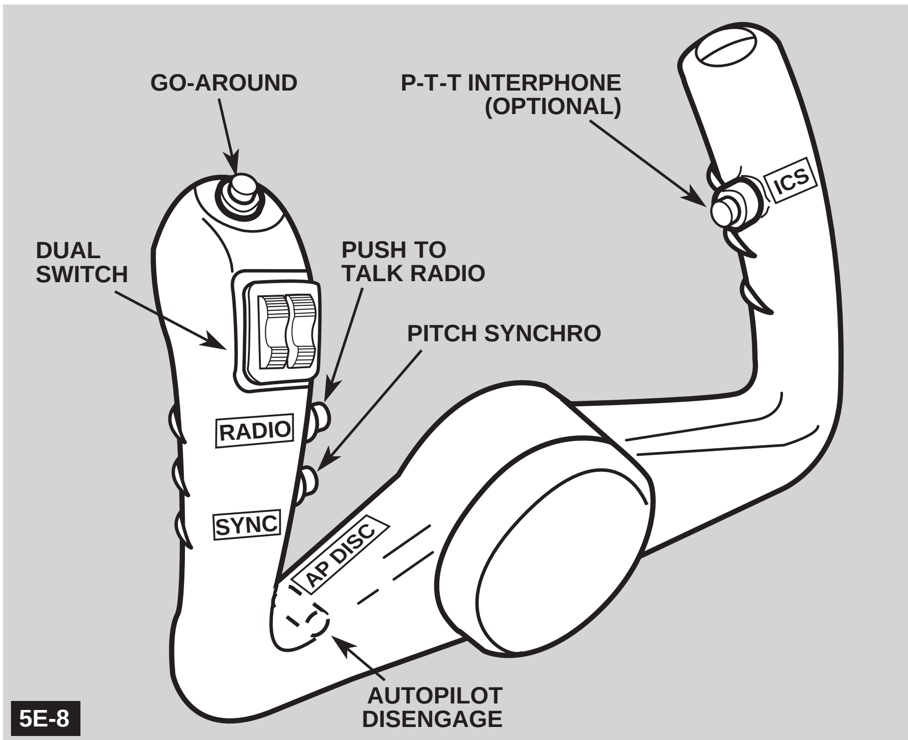
The actuator incorporates several microswitches.

- The limit microswitches stop the trim motion as it nears the end of its mechanical travel. These microswitches are available for both normal and emergency trim control systems. Should these microswitches fail, two mechanical stops limit travel prior to structural damage.
- Switches at the 4° and 8° trim positions actuate the STAB TRIM light on takeoff if trim is less than 4° or greater than 8°. A second 4° switch disables trim beyond 4° nose-up at airspeeds greater than 250 kts. This switch works in series with the 250 kts switch on the aileron/elevator electric Q unit to prevent a runaway nose-up trim from overstressing the aircraft. The second switch creates a small problem in the event of Q unit failure in the high speed position, because normal trim works only to the 4° microswitch. Emergency trim is required to complete trimming for landing.

On **S/N 99 and subsequent**, split switches on each control yoke (**Figure 5E-8**) activate the pitch trim; both switch halves must be pressed simultaneously in the same direction. On **S/Ns 1-98**, the switches are not split unless **SB-27-013** is installed. The autopilot activates the pitch trim as well.

Autopilot Stabilizer Control

When engaged, the autopilot issues pitch trim control signals if the 10A trim control circuit breaker is engaged. Deflection limits are the same as in manual control. Actuating manual pitch trim control automatically disengages the autopilot in most aircraft while leaving the yaw damper engaged.



5E-8

Horizontal Stabilizer Emergency Operation

The Auxiliary D bus powers the emergency horizontal stabilizer system, which controls the emergency motor of the electrical actuator. When activated, the STAB EMGY switch (**Figure 5E-9**) on the center pedestal actuates the emergency motor and mechanically trips the NORMAL TRIM circuit breaker.

Clacker

A motion detector inside the stabilizer trim actuator activates an audible cockpit clacker, which sounds to warn the crew of horizontal stabilizer motion.

Rudder

The rudder provides directional control of the aircraft about its vertical axis. Full range of motion is 35°. Like the aileron and elevator actuators, a dual-barrelled servo actuator drives the rudder. Both hydraulic systems supply the rudder actuator.

The rudder linkage routes beneath the fuselage floor, past the rear compartment, and upward through the vertical stabilizer. The rudder is mounted on three bearings with the center bearing connected to the servo actuator. A spring rod under the actuator returns the rudder to neutral.

Rudder Pedals

The pilot's and copilot's rudder pedal positions are separately adjustable. To adjust the pedals, turn the crank handle on the forward face of the control column until they reach the desired position.

Rudder Trim

The electrically actuated rudder trim activates when the pilot presses:

- a single rudder trim switch (**Figure 5E-10**) on center pedestal (**S/Ns 1-109**)
- both sides of a split switch (**Figure 5E-9**) on the center pedestal (**S/N 110 and subsequent**).

The Load Shed D bus powers rudder trim, which deflects the rudder 40%

5E-9


5E-10

of its maximum travel. The triple trim indicator reflects the amount of trim in percentage of travel left or right. Rudder trim deflection reaches from zero to full left or right within 15 seconds, or 30 seconds for full left to full right.

Yaw Damper

The electrically controlled and hydraulically actuated yaw damper system adjusts a mechanical yaw damper jack to control rapid oscillations about the vertical axis (Dutch roll) in all flight conditions. Controlled by the magnetically held YD switch (**Figure 5E-11**) on the center pedestal, the system also provides coordination in turns. The Primary A bus powers the yaw damper system, which does not affect pilot control of the rudder.

Gust Damper

In addition to standard servo actuator protection features discussed in this chapter, a gust damper with a calibrated bypass valve is in the rudder servo actuator. In the absence of System 1 hydraulic pressure, the bypass valve connects the two actuator chambers through a restrictor, which damps wind effects on the rudder. With System 2 pressure available, the pilot's rudder control is not affected, and the GUST light (see Miscellaneous Systems chapter, Miscellaneous Annunciator Cross Reference) is advisory only.

When both hydraulic systems are inoperative, the rudder controls are difficult to move; the pilot utilizes appropriate abnormal procedures.

Triple Trim Indicator

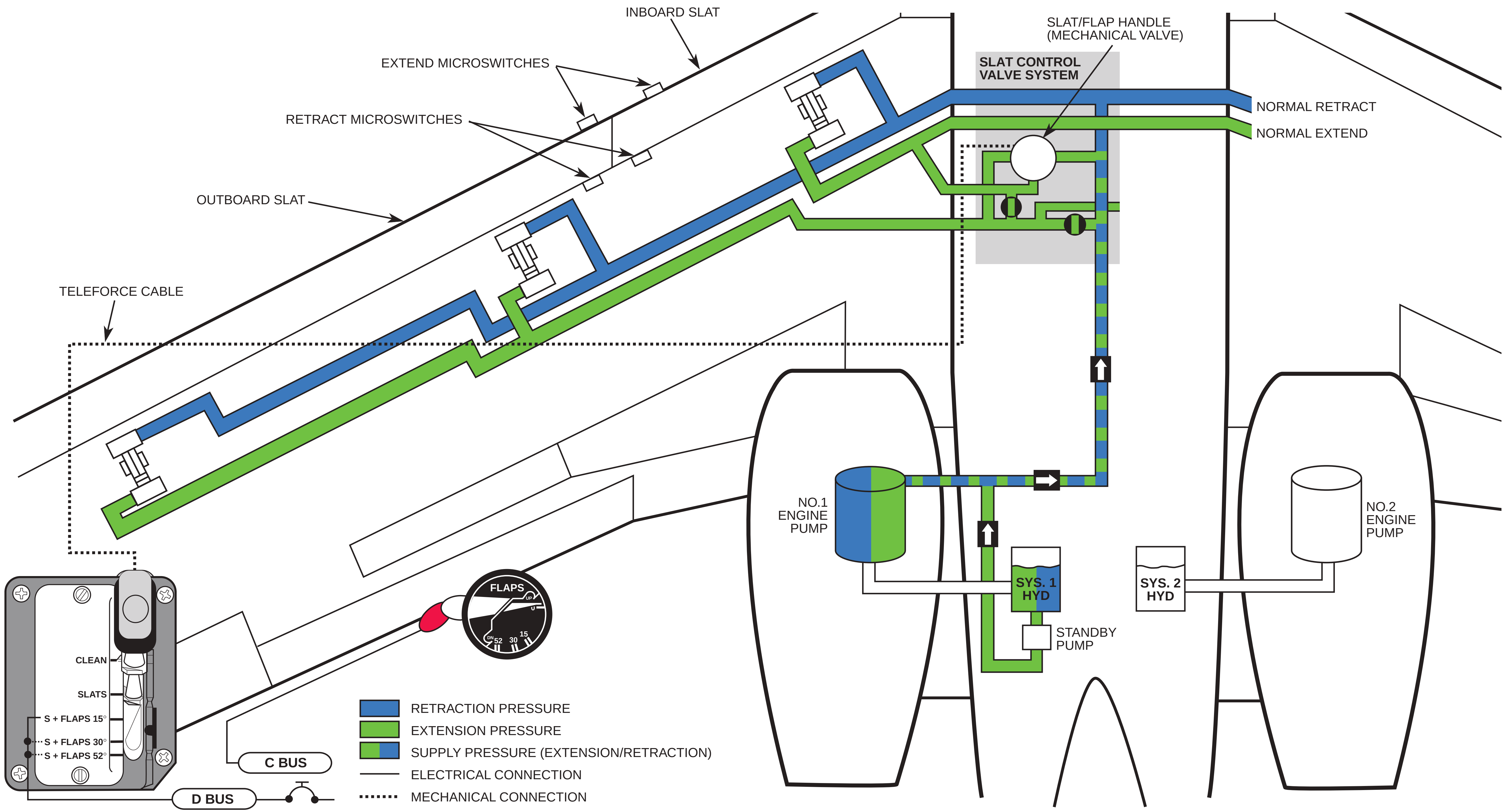
Roll, pitch, and yaw trim systems are electrically controlled. The triple trim indicator (**Figure 5E-12**) on the upper left center pedestal indicates percent of flight control deflection and calibrates stabilizer position in degrees from -2° NOSE DN to +12° NOSE UP. A green range between +5°30´ and +6°30´ shows the deflection range required for takeoff.

5E-11

5E-12

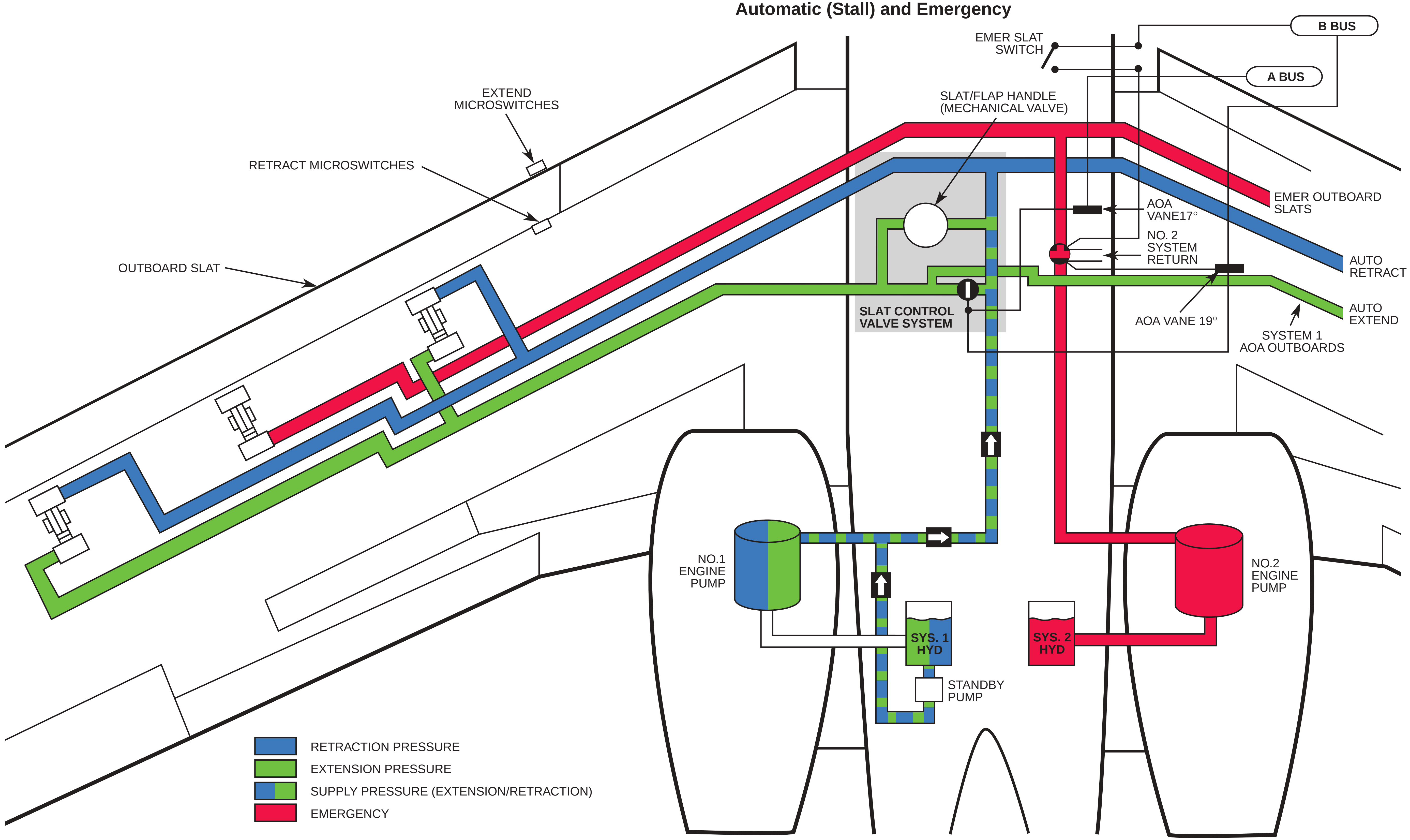
Normal
Slat Control

Normal Slat Control



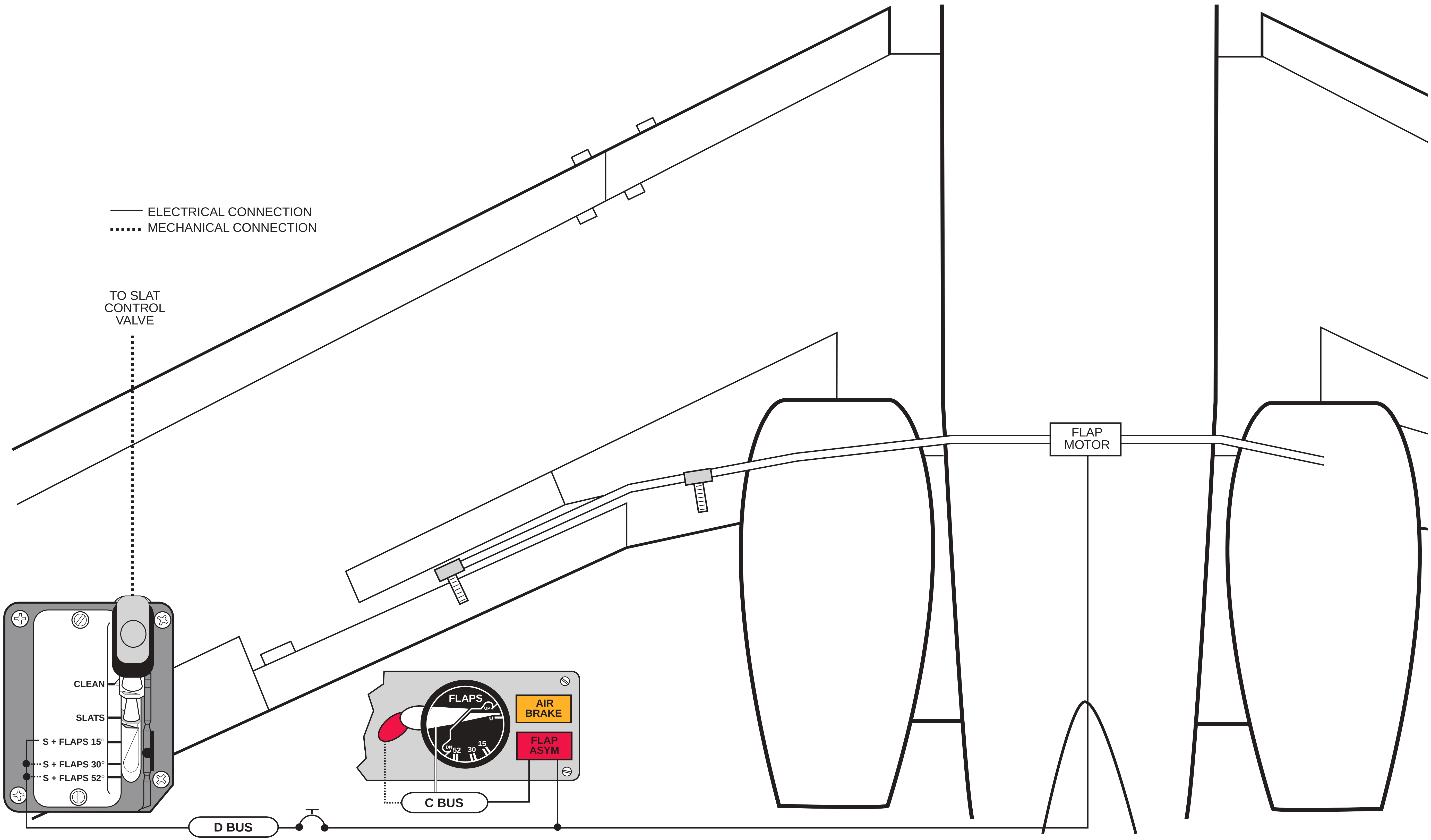
Slat Control
Automatic (Stall) and Emergency

Slat Control
Automatic (Stall) and Emergency



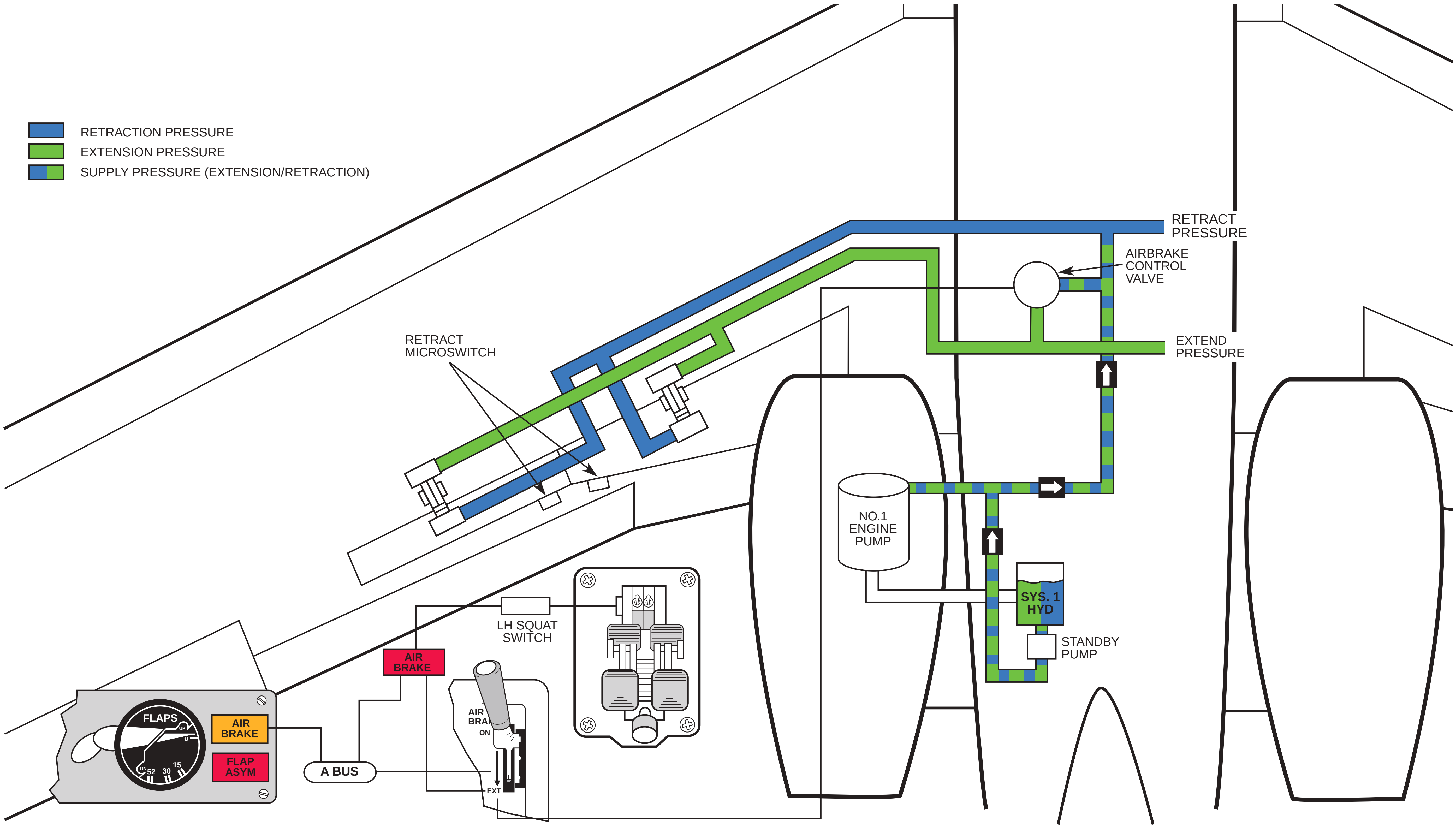
Flap Control System

Flap Control System



Airbrake Control System

Airbrake Control System



Secondary Flight Controls

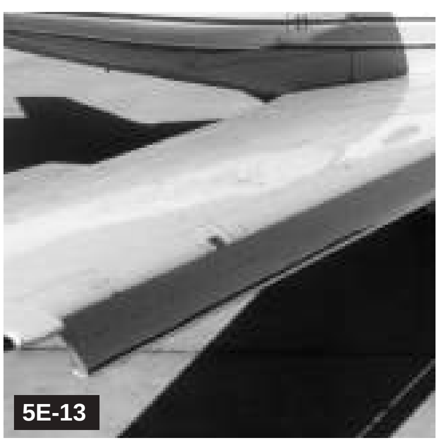
The secondary flight controls consist of:

- trailing edge flaps
- inboard and outboard leading edge slats
- airbrakes.

Slats

Each wing has two teleforce cable-controlled, hydraulically operated leading edge slats (**Figure 5E-13**): one inboard cuff-type slat and one outboard slotted-type. The slats change the wing's camber to allow very slow approach speeds relative to the cruise speed of the aircraft. Used alone, the slats provide a 20 kt reduction in the clean-wing approach speed and operate in three modes.

- In normal mode, Hydraulic System 1 powers the inboard and outboard slats; the outboard slats extend first while the inboard slats extend more slowly because of a restriction in the inboard slat hydraulic line.
- In emergency slats mode (standby), Hydraulic System 2 powers extension of the outboard slats only. This mode provides no retraction.
- In stall protection mode (automatic), either hydraulic system automatically powers extension of the outboard slats.



5E-13

Emergency Slats

The slats are normally mechanically controlled by the slat/flap handle, but in an abnormal condition or emergency, the outboard slats are electrically controlled by the EMERG SLAT switch (**Figure 5E-14**) on the pedestal. The Primary B bus powers the emergency slats switch.

If Hydraulic System 1 fails, System 2 powers the emergency slats extension, but provides no retraction.

Slats Indication

A red/green slat light on the configuration panel indicates disagreement/agreement.

The red light illuminates:

- following slat selection by the slat handle, emergency slats switch, or the stall warning system, and slats are in transit (when the requested slat configuration is complete, the green light replaces the red)
- when both emergency slats and flaps are selected (the slat/flap light remains red).

The green light illuminates:

- when all four units are fully extended (the slat/flap handle calls for both inboard and outboard slats)

5E-14

CAUTION: The emergency slats system does not provide retraction. Once selected, emergency slats should never be retracted.

NOTE: Angle-of-attack sensors automatically initiate slat extension. Stall sensors control both portions of the dual automatic (outboard only) slat extension system.

- if the slat/flap handle is in CLEAN position and outboard slats are fully extended as a result of either the selection of emergency slats or automatic activation by the stall warning system.

Either emergency or automatic slat extension calls for outboard slats only.

Slat/Flap Control Handle

The slat/flap control handle (Figure 5E-16) on the center pedestal mechanically controls the slats (**Figure 5E-15**) through a teleforce cable and electrically powers the flap motor. The handle stops at each of five detents:

- CLEAN (flaps and slats fully retracted)
- SLATS (extension of all the slats)
- S + FLAPS 15°
- S + FLAPS 30°
- S + FLAPS 52°.

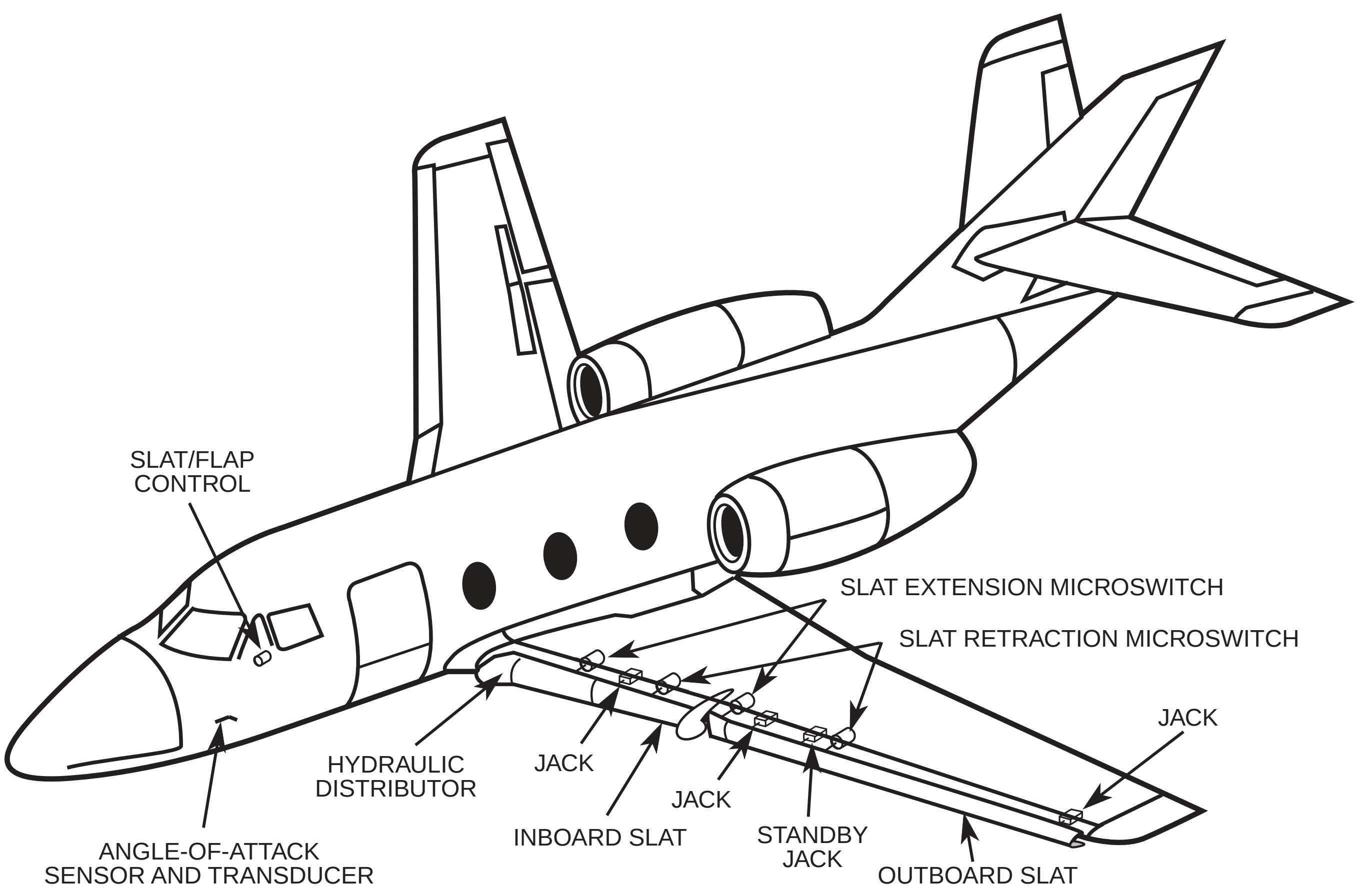
Microswitches at each flap position signal the flap motor, which runs until the flaps reach the corresponding position. The Auxiliary D bus powers the flap motor.

To move the handle from one detent to the other, pull it slightly upward to release the latch. If the slat/flap handle is moved from any flap position directly to CLEAN, the inboard slats retract immediately, but the outboard slats remain extended until the flaps are within 2° of fully retracted.

Stall Warning System

Two angle-of-attack sensing vanes (**Figure 5E-17**) one on each side of the aircraft nose, activate the stall warning system.

The A bus powers the left stall sensing vane, which controls Hydraulic System 1 pressure through solenoid valve A



5E-15

on the slats control valve to move the outboard slats through two primary actuators on each slat.

The B bus powers the right stall vane, which extends the outboard slats through either solenoid valve B on the normal slat control valve or, if Hydraulic System 1 is inoperative, through the emergency slat control valve. If System 1 is inoperative, emergency slats do not retract.

The left sensor switch is set at a 17° airflow angle and the right at 19°. The right vane serves as backup to the left. The switches provide stall protection for a clean (flaps and slats retracted) aircraft by:

- extending the outboard slats
- turning on the ignition system
- sounding a stall warning horn.

If the slats are already extended, the 17° and 19° switches are bypassed, and the stall warning horn sounds at a 27° airflow angle.

The horn continues to sound as long as either contact is maintained. To prevent engine flameout during a stall, the igniter plugs are automatically excited by the ignition boxes; both green IGNITER ON lights illuminate. The ignition remains on for 10 seconds after the two contacts are released. If IAS is below 190 kts, the same contacts cause the slats to extend automatically through electrical circuits independent of the stall warning circuits.

The stall system is tested on the ground using the STALL 1 and STALL 2 pushbuttons (**Figure 5E-18**), which do not function in flight. Refer to the AFM or the SimuFlite Operating Handbook for the stall system test checklist.

Flaps

The mechanically actuated and electrically driven, double-slotted Fowler flaps comprise four panels, two on each wing trailing edge. The panels, which are guided with rollers on rails, reduce approach speeds as much as 15 kts and produce high degrees of drag for short landing distances.

CAUTION: Do not use flaps unless outboard slats (at least) are extended.

5E-16

5E-17

5E-18

CAUTION: At altitudes above FL200, do not establish or maintain a configuration with the flaps or slats extended.

Slat Extension Limitation

Under all conditions, slat (at least outboard) extension must precede any flap extension. Upon retraction, if the handle is directly set to CLEAN, a flap position microswitch prevents the outboard slats from retracting before the flaps.

When the slat/flap handle is positioned, the twisting forces of mechanical drive shafts actuate irreversible, mechanical jackscrews that move the panels. A two-speed reversible electric motor in the right wheel well drives the jackscrews. The Auxiliary D bus powers the motor. A special tab on the slat/flap handle stops the handle at the S+FLAPS 15° position, regardless of which direction the handle is moved.

If a drive shaft breaks, the jackscrews' non-reversing devices prevent flap retraction from airload. Each inboard jackscrew has an adjustable retraction stop, and each outboard jackscrew has a fixed extension stop.

Four microswitches in a limit switch box near the motor control the flap stops at 0°, 15°, 30°, and 52°. Another microswitch in the wing root prevents the retraction of the outboard slats as long as the flaps are extended more than 2°.

A reduction gear box in the motor assembly transmits torque to the flap linkage and acts as a torque limiter. The 120° angle gear box also incorporates torque limit protection in case of linkage jamming downstream.

FLAP ASYM Warning

The left and right outboard flaps are each connected to a position potentiometer on the aft wing spar. In case of flap asymmetry, an electronic circuit powered by the Auxiliary C bus trips the FLAP CONTROL circuit breaker and causes the flaps to stop; this illuminates the FLAP ASYM light on the warning panel. The threshold is equal to or greater than 5° of asymmetry.

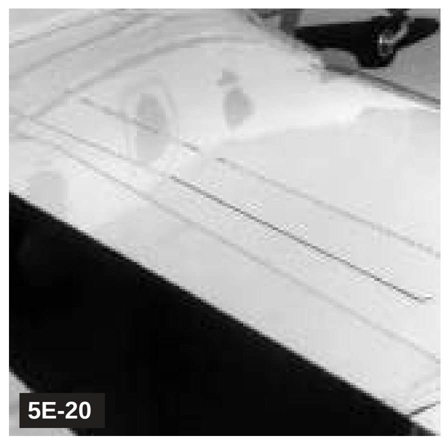
Flap Position Indicator

The left outboard flap potentiometer provides flap position (0°, 15°, 30°, 52°) on the slat/flap indicator (**Figure 5E-19**). The auxiliary D bus powers the indicator system.

Airbrakes

The airbrakes (**Figure 5E-20**), which are used for altitude loss and/or speed

5E-19


5E-20

reductions, comprise four panels: two hinged on the upper surface of each wing. Hydraulic System 1 powers the actuators that operate each panel. The maximum deflection of each airbrake panel is 50°. The airbrake panels have no synchronization system to operate simultaneously.

While there is no speed limit for operating the airbrakes, they must be retracted below 500 ft AGL.

In the event of System 1 failure, the airbrakes are held stowed by a pressure-holding valve in the airbrake system. Should the failure occur with the airbrakes extended, the airbrakes blow down, but do not stow.

Airbrake system electrical failure causes the airbrakes to stow (fail-safe) if System 1 is pressurized.

Airbrake Handle

The airbrake handle (**Figure 5E-21**) moves to two detents:

- IN (all four panels retracted)
- EXT (all panels extended).

When selecting a change in the airbrake position, grip the handle to allow a quick response if airbrake asymmetry develops.

Airbrake Indications

The amber AIRBRAKE light on the gear/slat/flap configuration panel illuminates when any panel is not in the retract position. Pressing the gear panel TEST pushbutton tests the amber AIRBRAKE light.

The red AIRBRAKE light illuminates (refer to the Miscellaneous chapter, 5J, Annunciator Cross Reference):

- on the ground if either throttle is advanced for takeoff with airbrakes not retracted
- in the air if airbrakes and slats are extended at the same time.
- on the ground or in the air when the main annunciator panel TEST pushbutton (**Figure 5E-22**) is pressed.

CAUTION: Airbrakes must be fully retracted by 500 ft AGL.

NOTE: In early aircraft, the red AIRBRAKE light is on the upper portion of the pilot's instrument panel; on later models, it is on the bottom row of the main annunciator panel.

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5E-22

Preflight and Procedures

Preflight

During the external preflight inspection, check all control surfaces for security and general condition.

During the cockpit inspection, ensure that the slat/flap lever agrees with the corresponding position indicator and that the stabilizer trim is within takeoff range. Refer to the Preflight chapter.

Abnormal Procedures

This section provides a brief discussion of flight controls abnormal procedures. For a list of specific procedural steps, refer to the AFM or the SimuFlite Operating Handbook.

Pitch Trim Malfunction

If a pitch trim malfunction occurs in flight, trim in the opposite direction, ensure the autopilot is disengaged, and use emergency trim as required. If an emergency trim runaway occurs, use the Auxiliary bus switch to stop the trim. If both trim systems are affected, consult the AFM or the SimuFlite Operating Handbook for jammed stabilizer procedures.

Aileron or Rudder Trim Malfunction

If aileron or rudder trim runaway occurs, trim the affected switch in the opposite direction to cancel the runaway. Maintain aircraft control and restore attitude with aileron or rudder. Pull the circuit breaker of the faulty system and ensure the autopilot is disengaged.

Yaw Damper Malfunction

The illuminated amber YD FAIL annunciator indicates a failure in the yaw damper function. If a malfunction occurs in flight, disengage the yaw damper.

Slats Only Approach and Landing

During a slats-only approach and landing, adjust landing distance and airspeed according to the AFM or SimuFlite Operating Handbook procedures.

Q Unit Failure

Abnormal feel force and an illuminated Q UNIT annunciator indicate failure of the rudder Q unit or aileron/elevator Q unit. To determine which system malfunctioned, check the RUD and AIL annunciators on the circuit breaker panel behind the copilot's head. If a failure occurs, disengage the autopilot/yaw damper; in the case of electric Q failure, also select emergency trim to trim nose-up past 4°. Using slow, smooth movements on the flight controls and cautious control force, adjust speed to no more than 260 kts/0.76 M.

Electric Q High-Speed (Cruise) Failure

The electric Arthur Q unit's most common malfunction is that of high-speed (cruise) failure due to cold soaking. Cold can cause the system lubricant to gel and stop the unit's motion. A comparator-monitor illuminates the ARTHUR Q annunciator, and the pilot lands the aircraft using the Arthur Q Jammed High-Speed procedure. After landing, actuation of the LOW SPEED/NORMAL switch to LOW SPEED drives the Q actuator to LOW to allow a ferry flight to the maintenance base. The LOW SPEED/NORMAL switch is normally in the forward right side of the passenger cabin.

CAUTION: Once emergency slats are selected, do not deselect because the emergency slat system does not provide retraction.

Slat Malfunction

Illumination of the red slat light indicates the slats are not in agreement with the slat/flap handle. With the slat/flap handle out of the CLEAN detent, select emergency slats. If the light turns green, the problem was with the outboard slats and has been resolved.

If the light remains red, select CLEAN with the slat/flap handle. If the light turns green, the problem is with the inboard slats; add 10 kts to V_{REF} and use flaps as necessary.

The light turns red and remains red when flaps are selected, which is a normal indication in this condition. Follow abnormal procedures in the AFM or the SimuFlite Operating Handbook.

If the slat light remains red after selecting CLEAN, follow the abnormal procedures for a clean wing landing in the AFM or the SimuFlite Operating Handbook.

Stabilizer Trim Light on Takeoff

The advisory STAB TRIM annunciator illuminates on the ground if the stabilizer is out of the 4° to 8° aircraft nose-up range and either power lever is in the takeoff range. Do not take off until the condition is corrected.

Flap Asymmetry

Illumination of the FLAP ASYM annunciator indicates a difference in flap positions, which causes asymetric lift. If flap asymmetry occurs, disengage the autopilot, control the aircraft with ailerons and aileron trim, add 10 kts to the approach speed, and land as soon as practical.

Data Summaries

Flight Controls

Primary Flight Controls

Power Source	Power Source, Hydraulic System 1 Flight controls Rudder Arthur Q Hydraulic System 2 Flight controls Yaw damper Primary A bus Aileron and elevator Arthur Q units Normal stabilizer trim Yaw damper C bus Aileron trim D bus Emergency stabilizer trim Rudder trim
Control	Control yoke Rudder pedals Trim switches Arthur Q low speed switch
Monitor	Annunciators Q UNIT RUD AIL STAB TRIM (takeoff warning) GUST Hydraulic pressure gages Trim gages
Protection	Arthur Q system overstress protection Electric Arthur Q – automatic shutdown upon elevator/aileron Q failure Torque bar (secondary AFU) centers flight controls upon primary control linkage failure Yaw damp limiting to 1.5° at high speed Pitch trim limiting to 4° nose-up above 250 kts Rudder actuator pressure limiting (1,850 PSI permitted)

Secondary Flight Controls

Power Source	Primary A bus – normal trim Auxiliary D bus – emergency trim Load-Shed D bus – rudder trim
Control	Control yoke trim switches AP DISC switch on control yoke STAB EMG switch on pedestal
Monitor	Trim gage STAB TRIM annunciator Audio warning (clacker)
Protection	4° cruise stop Trim limit switches

Slats/Flaps System

CAUTION: The emergency slats system does not provide retraction. Once selected, emergency slats should not be retracted.

CAUTION: Do not use flaps unless outboard slats (at least) are extended.

NOTE: Angle-of-attack sensors automatically initiate slat extension. Stall sensors control both portions of the dual automatic (outboard only) slat extension system.

Power Source	Hydraulic System 1 (normal mode) Inboard/outboard slats Hydraulic System 2 (emergency slats mode [standby]) Outboard slats extension only Hydraulic Systems 1/2 (stall protection mode [automatic] Outboard slats automatic extension Primary B bus Emergency slats Auxiliary C bus Flap position indicator system Auxiliary D bus FLAP CONTROL CB Flaps motor
Control	SLATS/FLAPS handle EMERG SLATS switch
Monitor	Slat/flap position indicators FLAP ASYM annunciator Flap overspeed aural warning Stall aural warning Slat configuration agreement lights (red/green)

Airbrakes

Power Source	Hydraulic System 1 Primary A bus
Control	Airbrake handle
Monitor	AIRBRAKE configuration light (amber) AIRBRAKE annunciator (red)

Fuel System

Chapter 5F

The Falcon 10/100 is equipped with two independent fuel systems; each supplies its respective engine. The Fuel Systems consist of the following major subsystems.

- A Fuel Storage System consisting of a tank in each wing as well as left and right feeder tanks in the fuselage. The fuel vent system is considered a part of the storage system.
- A Fuel Distribution System that includes the pumps, valves and plumbing required to transfer fuel through the aircraft to the engines. Fuel filttration is considered part of the distribution system.
- A Fuel Quantity Indication System that consists of fuel indicators and annunciators, and the probes and sensors that provide them with information.

Refueling of the aircraft is accomplished through single-point refueling or through overwing gravity refueling.

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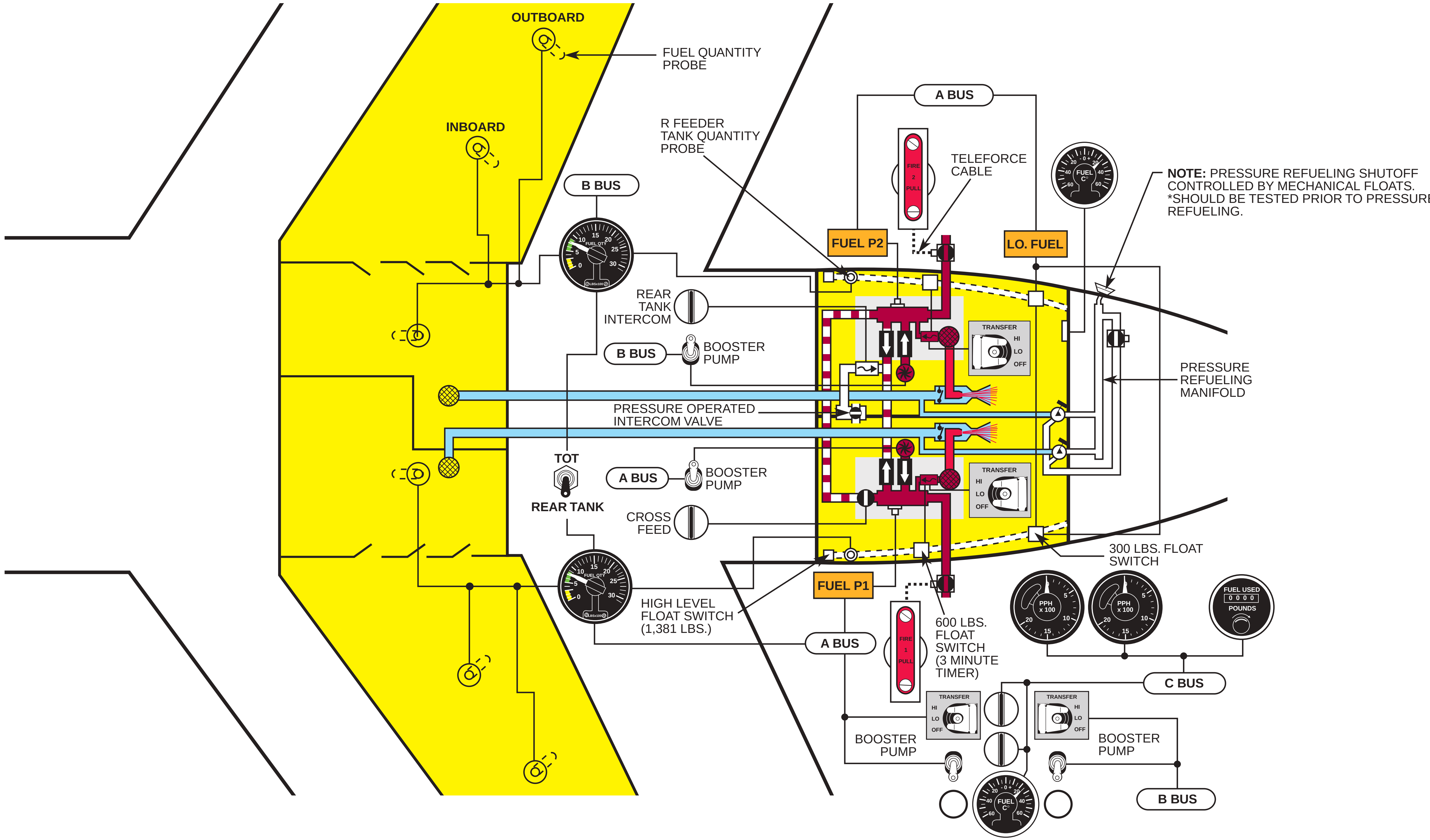
Fuel
System

Fuel System


OUTBOARD
FUEL QUANTITY PROBE
INBOARD
R FEEDER TANK QUANTITY PROBE
A BUS
TELEFORCE CABLE
B BUS
FUEL P2
LO. FUEL
NOTE: PRESSURE REFUELING SHUTOFF CONTROLLED BY MECHANICAL FLOATS. *SHOULD BE TESTED PRIOR TO PRESSURE REFUELING.
REAR TANK INTERCOM
B BUS
BOOSTER PUMP
TRANSFER
HI
LO
OFF
PRESSURE REFUELING MANIFOLD
PRESSURE OPERATED INTERCOM VALVE
TOT
A BUS
BOOSTER PUMP
REAR TANK
CROSS FEED
300 LBS. FLOAT SWITCH
FUEL P1
HIGH LEVEL FLOAT SWITCH (1,381 LBS.)
A BUS
600 LBS. FLOAT SWITCH (3 MINUTE TIMER)
FUEL USED
POUNDS
PPH x 100
C BUS
BOOSTER PUMP
BOOSTER PUMP
B BUS
FIRE 2 PULL
FIRE 1 PULL
FUEL

Fuel Storage

The fuel storage system consists of left and right (L/R) structural wing tanks with corresponding fuselage feeder tanks that supply the left and right engines, respectively. If one of the engine supply systems fails, cross-feeding from these tanks is possible.

Wing Tanks

The wing tanks are formed by sealing the wing structure to create integral chambers; each is divided into three individual tanks:

- a wing center section tank
- an inboard tank
- an outboard tank.

Access to each tank is provided through panels in the underside of the wing.

The tank in the wing center section is "L" shaped. Its outer limits are the wing junction plates, which are completely sealed with the exception of an orifice provided for air circulation. The junction plate is fitted with three flapper valves that prevent fuel from flowing outward away from the center section tanks.

The inboard tanks lie between the junction plate at the wing root and rib 5; the outboard tanks lie between ribs 5 and 13. Rib 5 is fitted with two one-way flapper valves to allow fuel to flow inward toward the center section tanks while restricting flow outward.

This particular design improves aircraft balance and response by restricting fuel movement within the tank and using outboard tank fuel first; this allows the aircraft to maintain a forward center of gravity.

5F-1

Feeder Tanks

Two integral feeder tanks are in the rear fuselage between the passenger cabin and the aft compartment. Basically one unit, the structure is divided into two tanks by a partition that runs along the centerline of the aircraft. A port in the upper forward area provides for interconnection of tank air venting and tank pressurization. Each feeder tank supplies its associated engine.

Access to the feeder tanks is via doors in the bottom of each feeder tank. Each feeder tank bottom is fitted with a drain valve (**Figure 5F-1**). Enclosed air spaces surrounding the fuel tanks are vented to prevent accumulation of fuel or fuel vapor.

Fuel Capacities

Fuel capacities are based on a fuel density of 6.7 lbs per US gallon at standard temperature 59°F. The wing tanks (left and right) have a capacity of 235

Usable Fuel Limitation

The total usable fuel quantity is 5,912 lbs (882 US gal).

Fuel Specification Limitation

Fuel used must conform to the specifications table in AFM Section 1, Limitations.

Fuel Adjustment Limitation

If the type fuel specified in the specifications table in AFM Section 1, Limitations, and used in the aircraft is changed, or if these fuels are mixed, the appropriate adjustment must be made at the fuel computer in conformance with instructions in the approved Maintenance Manual.

US gallons (1,575 lbs); left and right feeder tanks each have a capacity of 206 US gallons (1,381 lbs). The amount of fuel left in the tanks when fuel quantity indicators reach zero is not safely usable in all flight conditions.

Vent System

A fuel vent system provides continuous ram air pressure to the wing tanks and slightly negative pressure to the feeder tanks while the aircraft is in flight to ensure positive fuel transfer during all flight conditions. In addition, the vent system prevents negative pressure and overpressurization while the aircraft is on the ground.

Flush-mounted, NACA-type underwing ram airscoops admit air into the wing tanks through tubing (**Figure 5F-2**); the feeder tanks receive ventilation through slotted airscoops on either side of the vertical stabilizer (**Figure 5F-3**).

Wing Tank Vent Valves

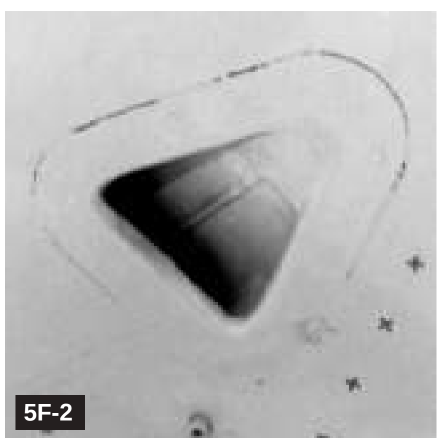
The wing center section tank and two wing tanks are vented through leakproof wing spar boxes in the wingtips. A fuel stopper valve controls venting. One valve, which is in the outboard wing tank at rib 13, is at the highest point in the wing tip end; it opens into the NACA vent compartment. The other valve, which is in the inboard wing tank between rib 0 and the junction plate, is the second high point of the wing; it is connected to the NACA vent compartment through a tube inside the wing.

Feeder Tank Vent Valve

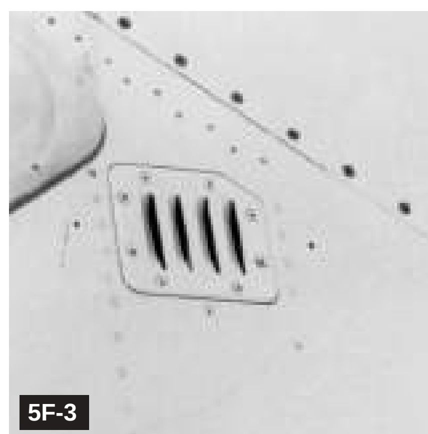
Each feeder tank is vented through a tube that departs the feeder tank at the front and opens into a vent box in the vertical stabilizer. Two reverse ram airscoops maintain a negative pressure to assist wing fuel transfer. The collector tank air vents also allow air to be vented during nose-up attitudes; the lowest points of the air vent tubes incorporate ball valves to prevent fuel from escaping.

Internal Venting

Air between the internal wing tanks is crossbled by apertures in the top edges of the junction plate and rib 5. Air crossbled between the feeder tanks is carried out through ports in the top edge of the dividing central wall.



5F-2



5F-3

Fuel Distribution

The fuel distribution system consists of two independent systems: one for each engine. Each system consists of the following components:

- jet pumps
- electric booster pump
- fuel filters
- fuel shutoff valve
- jet pump solenoid
- fuel manifold
- pressure switch.

Fuel distribution is managed by the fuel control panel on the overhead panel.

Fuel Pumps

Each of the two distribution systems contains two pumps: a jet pump and an electric booster pump. The pumps receive power from the following sources:

- No. 1 jet pump solenoid – A Bus
- No. 2 jet pump solenoid – B Bus
- No. 1 booster pump – A Bus
- No. 2 booster pump – B Bus.

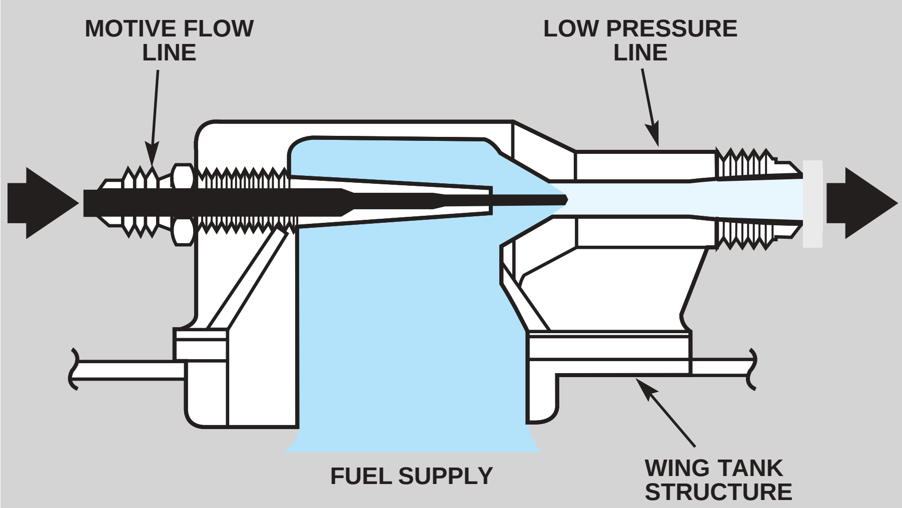
Jet Pumps

The jet pump inlet near the lowest point of the wing (in the center section tank) is submerged in fuel until the tanks are virtually empty. The jet pump has no moving parts and operates on the venturi principle (**Figure 5F-4**). Installed in the feeder tank, it uses motive flow from the booster pump to transfer fuel from the wing tanks to the feeder tanks.

Electric Booster Pump

An electric booster pump is in each distribution system; one is in the bottom of each feeder tank. The booster pump is a submerged type that is used to provide fuel under pressure to the fuel manifold. The booster pumps receive power from the associated (A or B) bus through the BOOSTER CBs.

A pressure drop in either booster pump system is indicated by illumination of a FUEL P1 or FUEL P2 annunciator on the Failure Warning Panel. See Fuel Control/Indicating System, this chapter, for details.



5F-4

Fuel Filters

Low pressure fuel filters between the manifold and the jet pump protect the jet pump from contamination. Replacement of the filters is considered a maintenance procedure. If either filter becomes clogged in flight, the associated jet pump can be shut off and fuel gravity feeds from the wing tanks to the feeder tank.

Fuel Valves

Fuel Shutoff Valve

Each distribution system incorporates a fuel shutoff valve in the engine feed line. The shutoff valves are two-position (open and closed) ball-and-seat type; they are mechanically operated. The valves allow the pilot to shut off the supply of fuel to the engine if an engine fire occurs. Each FIRE PULL T-handle on the center instrument panel (**Figure 5F-5**) closes its respective valve when the handle is pulled out; the valve opens when the handle is pushed in.

Fuel Manifold

A fuel manifold downstream of each booster pump inside the feeder tank incorporates a filter to protect the jet pump from contamination. Two check valves are also in the fuel manifold: one in the booster pump discharge line and the other in the feeder tank interconnection line.

A jet pump solenoid valve for wing-to-feeder tank fuel transfer and the fuel booster pump low pressure warning switch are on the fuel manifold. These items, in addition to the crossfeed valve actuator, can be removed from outside the aircraft without opening the feeder tanks.

The right fuel manifold connects the right booster pump discharge line to the:

- right engine feed line
- crossfeed valve and line
- right transfer jet pump nozzle
- feeder tank interconnection valve line.

The left fuel manifold connects the left booster pump discharge line to the:

- left engine feed line
- crossfeed valve and line
- left transfer jet pump nozzle
- feeder tank interconnection valve line.

Pressure Switch

A pressure drop in either booster pump system is indicated on the Failure Warning Panel by a FUEL P1 or FUEL P2 warning light; the light illuminates when the pump discharge pressure is below 4.6 ± 0.3 PSI. The pressure drop is sensed by two pressure switches on the fuel manifolds outside the feeder tanks.

5F-5

Fuel Filters

Low pressure fuel filters between the manifold and the jet pump protect the jet pump from contamination. Replacement of the filters is considered a maintenance procedure. If either filter becomes clogged in flight, the associated jet pump can be shut off and fuel gravity feeds from the wing tanks to the feeder tank.

Fuel Valves

Fuel Shutoff Valve

Each distribution system incorporates a fuel shutoff valve in the engine feed line. The shutoff valves are two-position (open and closed) ball-and-seat type; they are mechanically operated. The valves allow the pilot to shut off the supply of fuel to the engine if an engine fire occurs. Each FIRE PULL T-handle on the center instrument panel (**Figure 5F-5**) closes its respective valve when the handle is pulled out; the valve opens when the handle is pushed in.

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A jet pump solenoid valve for wing-to-feeder tank fuel transfer and the fuel booster pump low pressure warning switch are on the fuel manifold. These items, in addition to the crossfeed valve actuator, can be removed from outside the aircraft without opening the feeder tanks.

The right fuel manifold connects the right booster pump discharge line to the:

- right engine feed line
- crossfeed valve and line
- right transfer jet pump nozzle
- feeder tank interconnection valve line.

The left fuel manifold connects the left booster pump discharge line to the:

- left engine feed line
- crossfeed valve and line
- left transfer jet pump nozzle
- feeder tank interconnection valve line.

Pressure Switch

A pressure drop in either booster pump system is indicated on the Failure Warning Panel by a FUEL P1 or FUEL P2 warning light; the light illuminates when the pump discharge pressure is below 4.6 ± 0.3 PSI. The pressure drop is sensed by two pressure switches on the fuel manifolds outside the feeder tanks.

5F-5

Fuel Control/ Indicating System

Fuel Quantity System

Fuel quantity in the Falcon 10/100 is sensed by eight capacitance-type 28V DC probes, one in each outboard tank, inboard tank, center section tank, and rear feeder tank. Information is transmitted through a solid-state amplifier (bottom of rear feeder tank) to the two FUEL QTY indicators on the center instrument panel (**Figure 5F-6**). Each indicator is calibrated in pounds and reads up to 3,100 lbs.

The A and B buses supply DC power to the left and right quantity indicating systems, respectively.

Control

A two-position (TOT/REAR) fuel quantity selector switch under the fuel quantity indicators on the center instrument panel control fuel quantity indication. The switch is used to select the respective probes to determine either the overall weight of the fuel per tank group (TOT) or the weight of the fuel in each feeder tank (REAR). The TOT/REAR switch normally remains in the REAR position to monitor fuel transfer.

Feeder Tank Low-Level Warning

Float-type level switches provide low level warning for each of the feeder tanks; each switch controls a common annunciator on the Failure Warning Panel. Illumination of the LO FUEL annunciator indicates fuel remaining in at least one of the feeder tanks is less than 300 lbs.

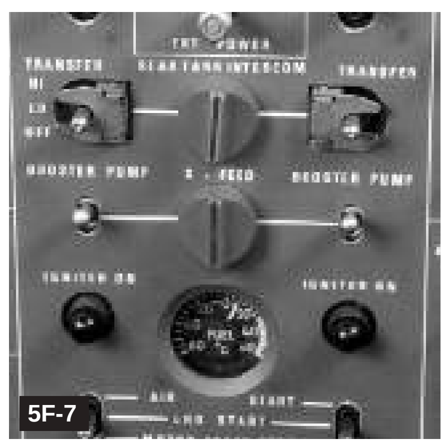
Booster Pumps

Two-position (ON/OFF) BOOSTER PUMPS switches on the engine and fuel control section of the overhead panel (**Figure 5F-7**) are turned on prior to engine starting to provide positive fuel pressure to the engine-driven fuel pumps. The BOOSTER PUMPS switches are turned off after engine shutdown.

Low Fuel Pressure

FUEL P1 or FUEL P2 annunciators on the Failure Warning Panel illuminate when the pump discharge pressure is below 4.6 ± 0.3 PSI. The annunciator illuminates when the pressure switch on the fuel manifold outside the feeder tank in either booster pump system detects low pressure, or when the associated booster pump is off.

5F-6



5F-7

Fuel Temperature Indicating System

A fuel temperature indicating system enables inflight monitoring via a temperature sensor inside the right feeder tank. The temperature indicator on the overhead panel (**Figure 5F-8**) indicates from -60°C to +60°C.

Fuel Flowmeters

Two fuel flowmeters on the center instrument panel, powered by loadshed C bus, display fuel flow for their respective engines (**Figure 5F-9**). The FUEL USED FLOWMETER (**Figure 5F-11**) indicates total fuel used. This system receives information from the fuel flowmeters.

Fire Pull T-Handles

In case of an emergency such as an engine fire, pulling the red FIRE PULL T-handle shuts off the fuel valve in the engine pylon line. This isolates the feeder tank from the engine.

Fuel Transfer System

The two guarded, three-position (HI/LO/OFF) TRANSFER switches (**Figure 5F-10**) function as follows.

- **OFF**. Solenoid valve is energized closed.
- **HI**. Jet pump solenoid valve is deenergized open until the fuel level in the affected feeder tank reaches 1,381 lbs of fuel; the HI float switch then energizes the jet pump solenoid valve to the closed position, and fuel transfer from the center wing to feeder tank terminates. This position is selected for overwing gravity fueling.
- **LO**. This position controls a three-minute time delay relay through the LO float switch to control the jet pump solenoid to maintain 600 lbs in the associated feeder tank. During each cycle (less than 600 lbs), the fuel level in the feeder tank decreases for three minutes. The time delay then de-energizes and opens the jet pump motive

5F-8

5F-9

flow solenoid; transfer from the center wing section to its feeder tank resumes until the 600 lbs level is reached. This position is used during flight. If an electrical failure should occur, the transfer jet pumps would fail open.

Rear Tank Intercom System

The two-position, rotary REAR TANK INTERCOM switch between the TRANSFER switches (**Figure 5F-10**) balances fuel between the feeder tanks. Rotating the REAR TANK INTERCOM switch 90° counterclockwise opens the solenoid valve and admits booster pump pressure to open the intercom valve. This action allows fuel to transfer between the feeder tanks. Booster pump pressure from either feeder tank is required to open the intercom valve; the valve fails closed.

Crossfeed System

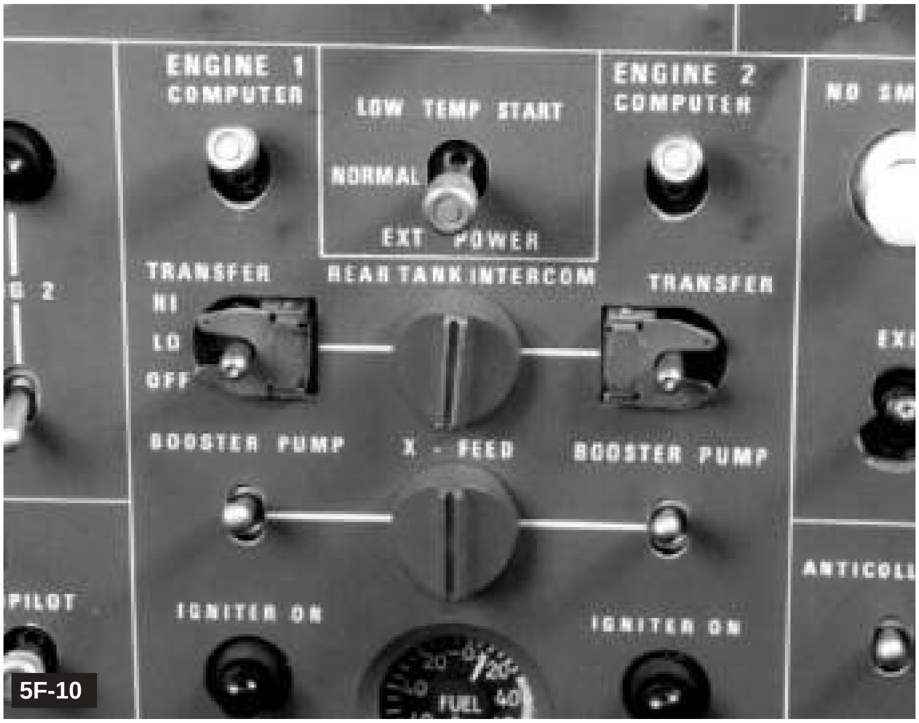
Rotating the two-position X-FEED switch between the booster pump switches (**Figure 5F-10**) 90° clockwise opens the crossfeed valve and permits either booster pump to supply pressurized fuel to both engines. This situation could arise if a booster pump fails or is turned off. Crossfeed also helps balance wing fuel loads. The switch and valve are powered by load-shed C bus. The valve remains in the last position selected in the event of failure.

Normal Feed

In the normal phase of fuel management, each engine is supplied fuel at booster pump pressure from its associated feeder tank. Fuel travels through the open fire shutoff valve in the pylon if the following configuration is established:

- TRANSFER switches in LO
- REAR TANK INTERCOM valve closed
- booster pumps on
- crossfeed valve closed.

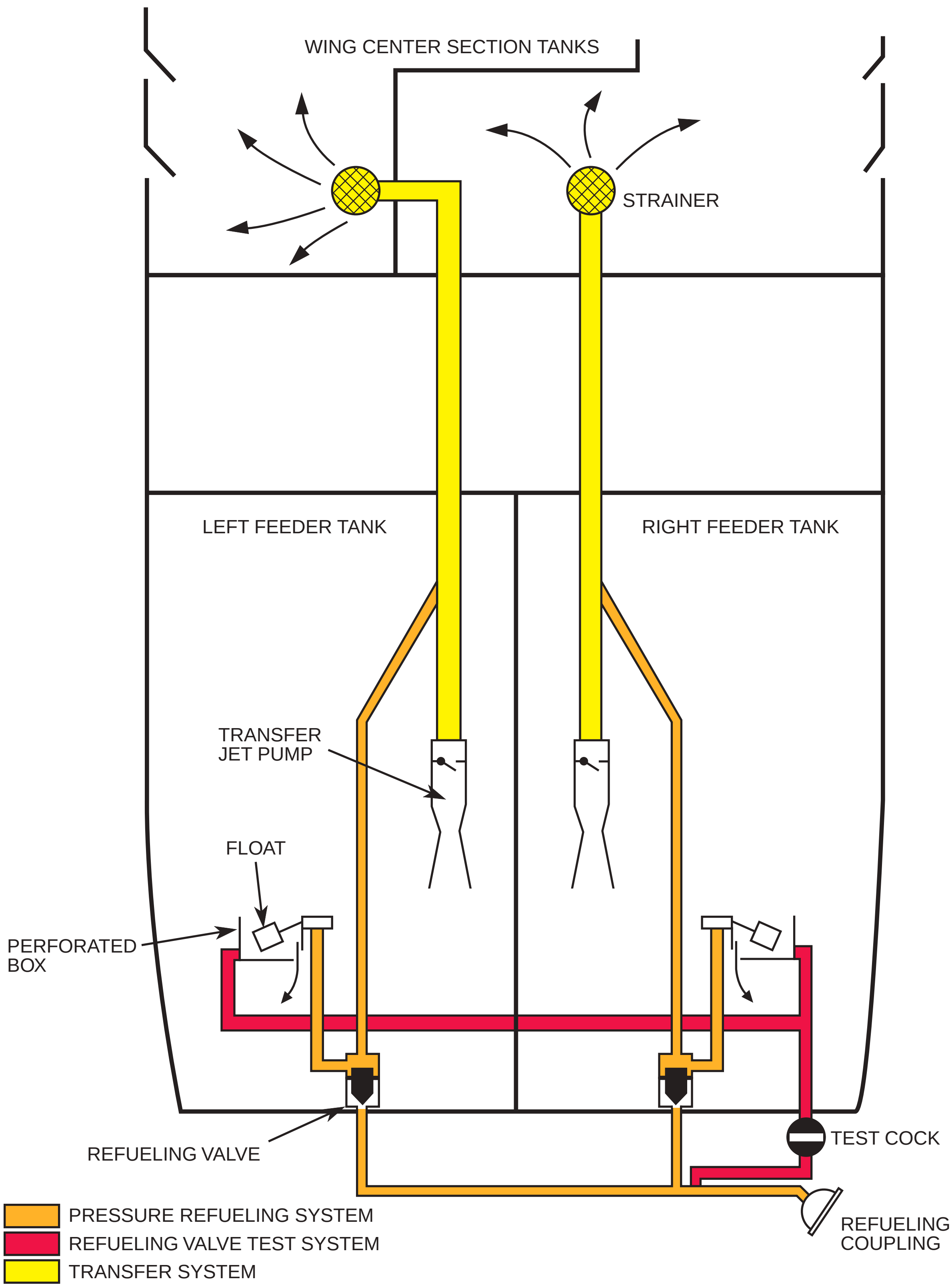
Float switches in the feeder tanks maintain automatic level control.



5F-10

5F-11

Pressure Fueling and Fuel Valve Test Systems



Servicing and Procedures

Preflight

During preflight, the following items are checked (See Preflight, Chapter 3A, for details):

- fuel quantity
- fuel sumps drained, closed, and not leaking
- gravity fueling ports caps secure; no evidence of tampering
- no fuel leaks or damage on wing underside
- all switches and the fuel tank vent control on single point fueling panel positioned properly
- single point fueling panel door closed; both latches secure.

Refueling

Pressure Refueling

The normal refueling mode of the aircraft is through a single-point pressure refueling receptacle access on the right aft section of the aircraft (**Figure 5F-12**). Pressure from the refueling truck is not to exceed 50 PSI. At 50 PSI (see Refueling Pressure and Fuel Imbalance Limitations, next page), the aircraft is pressure refueled in approximately 13 minutes.

Refueling is through a $1^1/_4$ inch coupling connected to two fueling valves. The refueling valves are hydraulically-operated by a float valve in the top of the feeder tanks. The fueling valves close and pressure fueling is stopped as soon as the feeder tanks are filled or when the complete fueling is simulated by means of the test system.

Testing

During the initial stage of pressure refueling, the automatic shutoff system is tested by opening the test valve near the refueling adapter. The open valve directs fuel to the level control float valves to raise the floats, simulate a tank-full condition, and close the fueling valves. The refueler hose stiffens and the refueler flowmeter shows zero flow. The test valve is returned to normal and refueling is continued.

Pressure Refueling Procedures

When the amount of fuel required is determined and a fire extinguisher is available, the fuel truck is grounded to the ramp and then grounded to the aircraft's right main strut. Finally, the fueling nozzle is grounded to the aircraft connector. The truck should deliver fuel between 30 and 50 PSI.

5F-12

NOTE: The fuel remaining in the tanks when the fuel quantity indicators read zero is not usable in flight. The amber area of the fuel quantity indicators, 0 to 300 lbs, is a LO FUEL caution range.

NOTE: See Quick Reference for authorized fuel additives.

NOTE: The density of fuel or fuel mixture used is set on the engine computer by means of the 10-position adjusting knob covering densities from 0.61 to 0.85.

CAUTION: If a new type of fuel or a mixture of fuel is used, the engine computer must be adjusted accordingly to preserve both the starting characteristics and the acceleration and deceleration characteristics of the engine.

Refueling Pressure Limitation

Maximum pressure for single point refueling is 50 PSI; minimum pressure is 30 PSI.

Fuel Imbalance Limitation

No limit for fuel imbalance (do not deliberately fuel only one wing).

CAUTION: If testing is not satisfactory, stop refueling and troubleshoot as required.

Accomplish the refueling test by opening the test valve. If fueling stops, the test is good. Close the test valve and resume refueling. Fill to the desired number of gallons/pounds. The refueling stops automatically when the tanks are full.

Disconnect the refueling nozzle, and check that the sealing valve is seated and that there are no fuel drips. Disconnect the fueling nozzle, then close and latch the fueling access door. Disconnect the grounding wire.

Gravity Refueling (Standby Fueling)

Ground power is required for this procedure.

Refueling can also be accomplished through a gravity, over-wing system. Electrical power (GPU, if available) is required to operate the booster pumps and transfer switch (HI position). A qualified crewmember or maintenance person should be in the cockpit. Refueling is accomplished through the gravity refueling port in the top surface of each outboard wing tank.

During gravity refueling, the feeder tank is partially filled by direct communication (approximately 600 lbs in zero pitch attitude).

The aircraft can be partially or totally fueled by gravity. Connect the grounding connector (one per wing) near the filler port. Make sure that the tank to aircraft and refueling nozzle to aircraft static grounding connections are made.

Turn on aircraft electrical power and verify that the wing contains a minimum of 132 gallons (885 lbs). Turn the booster pumps switches to ON and turn the transfer pumps to HI. Confirm that the feeder tank level rises.

As fuel pumps into the wing tank, fuel transfers from both wing tanks to the feeder tanks. If the feeder tanks are not full prior to the wing tank indicating full, have the refueler stand by until the feeder tanks are full, and then top off the wing. Turn the booster pumps switches to OFF; turn the transfer pumps to LO.

Select TOT on the fuel quantity indicator to determine any imbalance of fuel; check the total fuel quantity and add fuel as required. The fueling time for each side is approximately 30 minutes.

If GPU power is not available, the following procedure is recommended to conserve batteries.

- Wing Tanks – FILL
- Refueling – DISCONTINUE
- One Engine – START
- Booster Pumps – ON
- Transfer Switch – HI
- Engine – OPERATE (until feeder tanks are full)
- Transfer Switches – LO
- Engine Shutdown
- Booster Pump – OFF
- Wing Tanks – TOP OFF

Defueling

Defueling is normally accomplished using the feeder tank drain valves after switching the transfer system on to transfer all wing tank fuel. Accomplish the proper grounding (tank-to-aircraft, coupling-to-aircraft) and drain fuel.

Abnormal Procedures

Following is a brief discussion of what happens in the fuel system during abnormal conditions. For a list of specific procedural steps in abnormal conditions, please refer to the AFM or the Simuflite Operating Handbook.

Low Fuel Pressure

Illumination of the amber FUEL P1 or FUEL P2 annunciator indicates one of the microswitches downstream of a booster pump detected a pressure drop (below 4.6 PSI); a booster pump may be inoperative.

The engines are supplied fuel pressure from the operative booster pump by positioning the X-FEED knob to OPEN and the inoperative boost pump switch to OFF.

If fuel pressure annunciator extinguishes, position the REAR TANK INTERCOM switch OPEN and monitor the fuel level in the feeder tanks (fuel level remains equal). If the fuel pressure annunciator remains illuminated, position the X-FEED knob to CLOSE and do not exceed Booster Pump Inoperative envelope outlined in the Falcon 10/100 AFM, Section 3. The cause may be a fuel leak that could rapidly result in an engine flameout.

High Feeder Tank Level

High feeder tank level indicates an inoperative or de-energized electrovalve, or a malfunctioning float switch associated with low fuel level position. Since jet pump-assisted fuel transfer is continuous, position the associated TRANSFER switch to OFF.

If the fuel level stops rising, the float switch is inoperative and fuel is transferred by gravity. If necessary, operate the TRANSFER switch to maintain adequate feeder tank fuel during high fuel usage periods.

If the fuel level continues to increase, the jet pump electrovalve has failed open. Position REAR TANK INTERCOM switch to OPEN to connect the left and right feeder tanks. Position the X-FEED knob to OPEN to ensure positive pressure to the engine-driven fuel pumps. Position the opposite side TRANSFER switch to OFF to ensure fuel is used from the malfunctioning side. Position the high side BOOSTER PUMP switch to OFF to lessen pressure to the malfunctioning transfer pump.

Low Feeder Tank Level

A low feeder tank level indicates an inoperative float switch associated with low fuel level position or an electrovalve stuck closed. Position the TRANSFER switch to HI to de-energize the electrovalve associated with the low level condition.

If the fuel level does not rise, compare the left and right gages after selecting the TOT position to make sure the fault is not a feeder tank leak. If there is no evidence of a leak, position the REAR TANK INTERCOM switch to OPEN and reduce airspeed to below MACH 0.80. If the transfer system fails, fuel is transferred by gravity.

Wing Tank Level Imbalance

Asymmetric fuel levels between the two wing tanks are indicated by asymmetric TOT gages and abnormal aileron trim position.

Position the X-FEED knob to OPEN to ensure positive pressure to the engine-driven fuel pumps. Position REAR TANK INTERCOM switch to OPEN to connect the left and right feeder tanks. Position the BOOSTER PUMP switch on the low TOT gage side to OFF to lessen pressure to the malfunctioning transfer pump. Position the TRANSFER switch on the low TOT gage side to OFF to ensure fuel usage from the high wing tank side. Monitor the fuel quantity gages and land normally.

Low Fuel

The amber LO. FUEL annunciator on the Failure Warning Panel illuminates when either feeder tank contains less than 300 lbs.

JP4/JP5 Limitation

JP4 and JP5 is approved but not recommended due to fuel heater possibly causing a vapor lock resulting from a rapid power reduction.

Overwing Refueling Limitation

Minimum 132 gallons in wing prior to transferring fuel to feeders.

CAUTION: 150 lbs of fuel are unusable on each side for a pitch attitude of approximately 5°.

Fuel System

Data Summary

Power Source	A bus Left FUEL QTY gage No. 1 boost pump No. 1 jet pump B bus Right FUEL QTY gage No. 2 boost pump No. 2 jet pump C bus Intercom valve Crossfeed valve Fuel counter Fuel flow gages
Distribution	L/R wing tanks L/R feeder tanks NACA scoops (venting system) Boost pumps Jet pumps Intercom valve Crossfeed valve Gravity feed Suction feed Single point refueling system Gravity refueling Pylon valves
Control	TRANSFER switches REAR TANK INTERCOM knob BOOSTER PUMP switches X-FEED knob TOT/REAR TANK switch Feeder tank high/low level float switches Fueling valves/float valves Fueling test valve
Monitor	FUEL QTY gages FUEL °C gage FUEL P1/P2 annunciators LO FUEL annunciator
Protection	Feeder tank high/low level switches NACA vents Transfer switches

Hydraulic System

Chapter 5G

Hydraulic power for the Falcon 10/100 is provided by two main hydraulic systems, henceforth referred to as System 1 and System 2.

System 1 is powered by the left engine-driven hydraulic pump and may be powered by the standby electric pump. System 1 supplies pressurized hydraulic fluid to:

- one barrel of each dual-barrel actuator for the rudder, elevators, and ailerons (see Flight Controls chapter)
- rudder Arthur Q-unit (see Flight Controls chapter)
- normal (inboard and outboard) slats (see Flight Controls chapter)
- automatic (outboard) slats (see Flight Controls chapter)
- landing gear operation (see Landing Gear chapter)
- normal braking system (see Landing Gear chapter)
- airbrakes (see Flight Controls chapter)
- gust damper (see Flight Controls chapter).

System 2 is powered by the right engine-driven hydraulic pump and does not incorporate a standby pump. System 2 supplies pressurized hydraulic fluid to:

- one barrel of each dual-barrel actuator for the rudder, elevators, and ailerons (see Flight Controls chapter)
- yaw damper (see Avionics chapter)
- outboard slat emergency system (see Flight Controls chapter)
- nosewheel steering (see Landing Gear chapter)
- emergency braking system (see Landing Gear chapter)
- thrust reversers (see Miscellaneous chapter).
- parking (emergency) brake system (see Landing Gear chapter).

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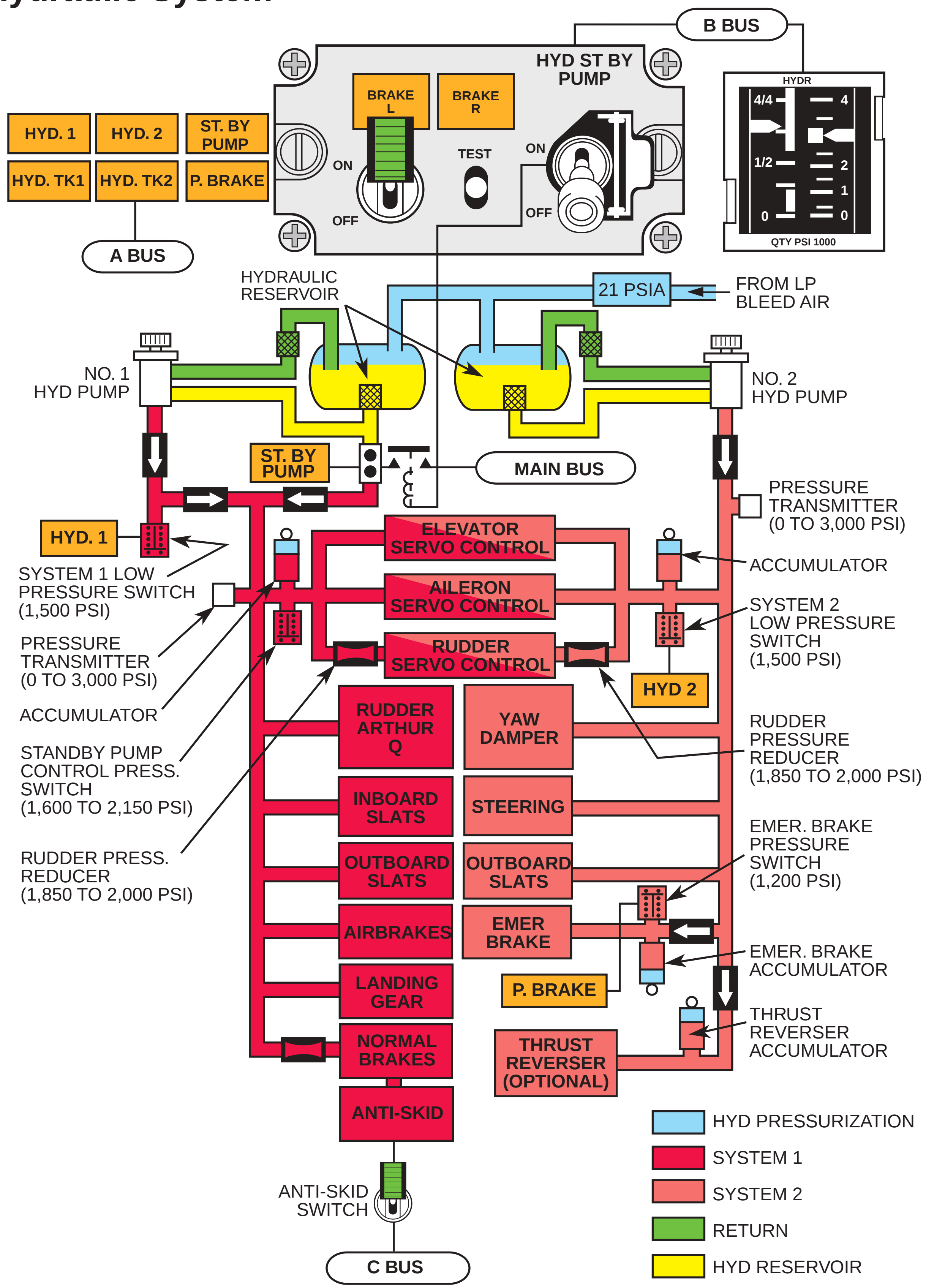
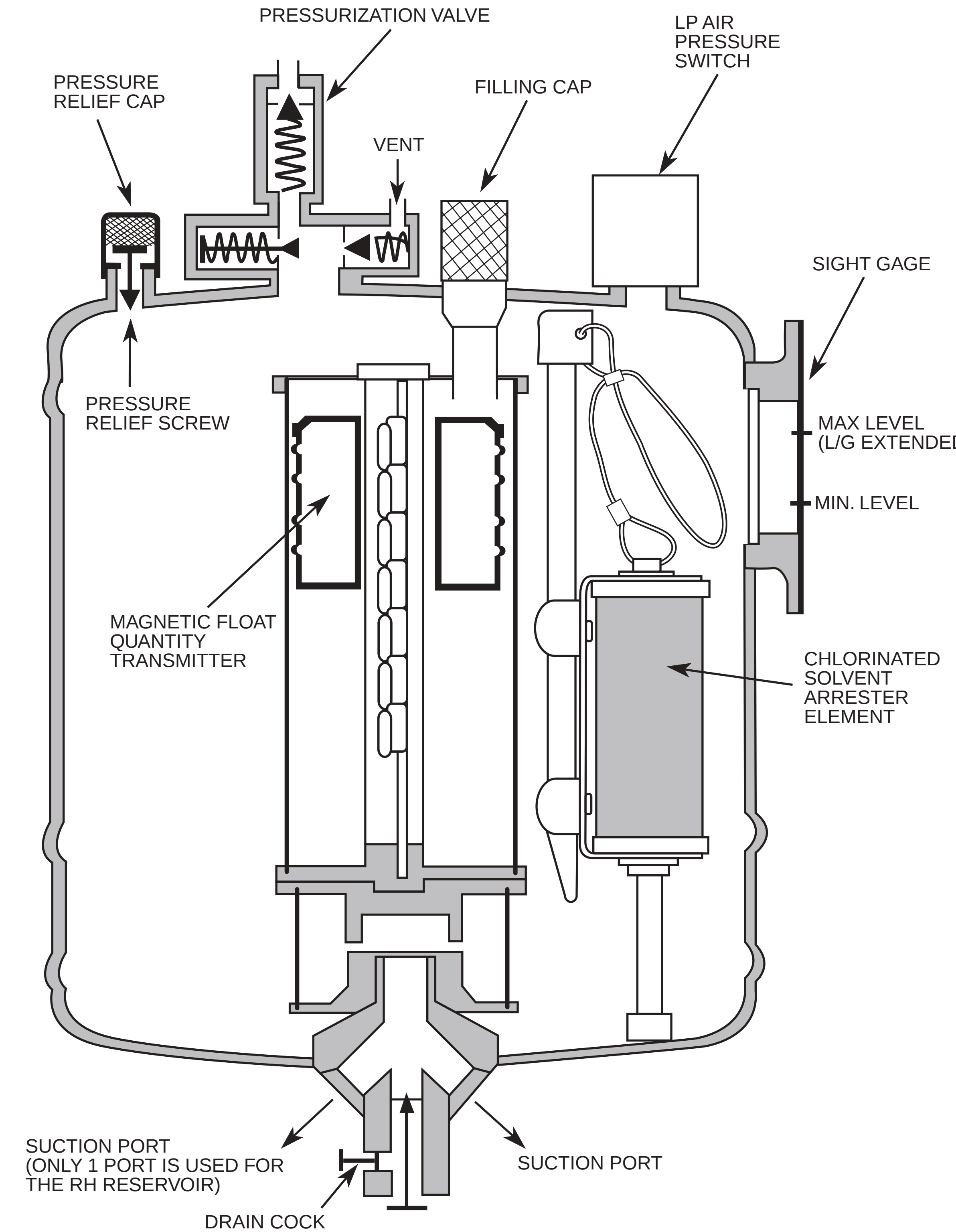
Hydraulic System and Reservoir

Hydraulic System



Hydraulic Reservoir



Hydraulic System Components

System 1 and System 2 hydraulic systems operate independently of each other using MIL-H-5606 B or C fluid. If the left engine-driven pump fails, System 1 incorporates an electric standby hydraulic pump to power all components of System 1.

Both systems are similar and include all components required for storage, filtering, pressurizing, and monitoring of the hydraulic fluid.

System 1 and System 2 hydraulic components include the following:

- control and indication panels
- reservoirs
- engine-driven pumps
- system filters
- pressure relief valves
- check valves
- accumulators
- pressure transmitters
- standby pump
- electric pump control pressure switches (System 1 only)
- ground service receptacles.

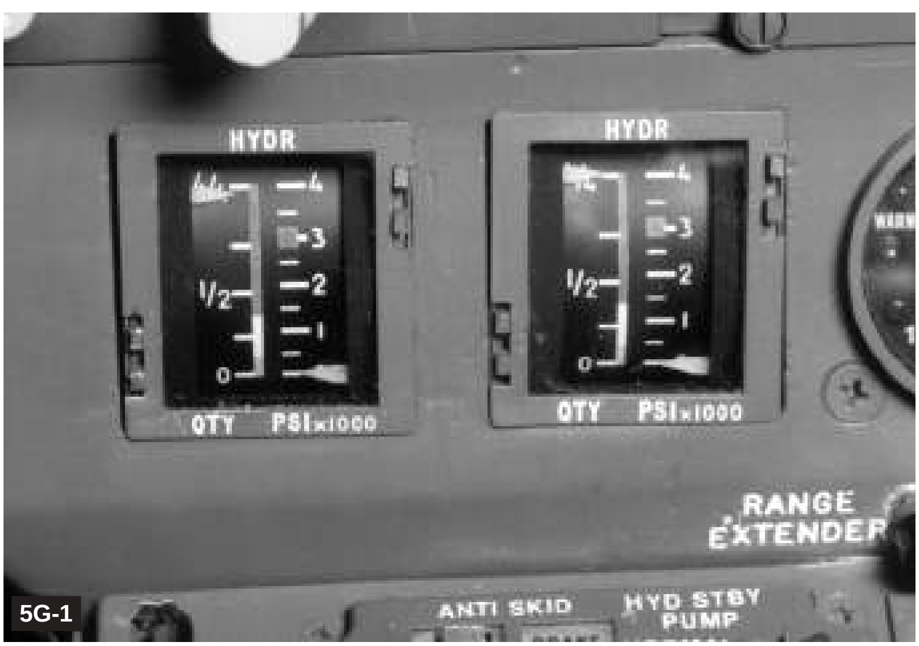
Control and Indication Panels

The fluid level (QTY) and pressure indicators (PSI x 1000) for System 1 and System 2 (**Figure 5G-1**) are on the pilot's side of the lower center instrument panel. The standby pump control (STBY PUMP) three-position toggle switch (NORM/ON/OFF) is on the pilot's side of the upper center pedestal.

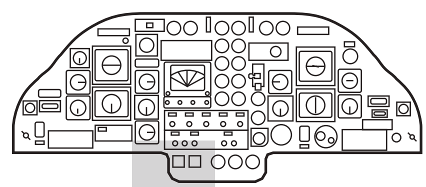
The amber hydraulic HYD 1, HYD 2, GUST, HYD. TK1, HYD. TK2, P. BRAKE, and ST.BY PUMP annunciators on the master warning panel are checked with the TEST pushbutton.

Power sources for illumination of the annunciators are as follows:

- P.BRAKE, HYD. TK1, HYD. TK2, HYD 1, HYD 2, GUST, and ST.BY PUMP – A bus
- System 1 hydraulic QTY indicator – B bus
- System 2 hydraulic QTY indicator – B bus
- System 1 pressure indicator – B bus
- System 2 pressure indicator – B bus.



5G-1



Reservoirs

System 1 (**Figure 5G-2**) and System 2 reservoirs in the aft compartment supply hydraulic fluid to their respective engine-driven pumps and receive system return fluid after utilization. The reservoirs have a capacity of 1.58 gallons and are pressurized automatically with engine low pressure (LP) air through a pressure reducing/ regulating valve when either or both engines are operated.

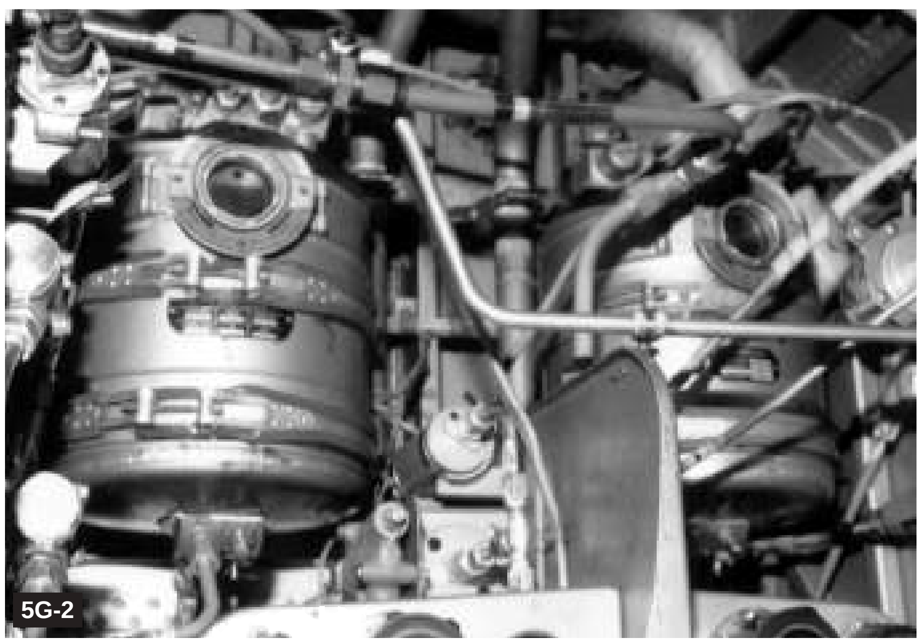
Normal tank pressurization is maintained at 21.0 PSIA. If pressure drops below 16 PSIA, a pressure switch in the upper section of the reservoir illuminates the respective HYD. TK1 (System 1) or HYD. TK2 (System 2) annunciator. Illumination of either annunciator requires the crew to monitor the fluid quantity/pressure indicators for fluctuation of system pressure. If pressure starts fluctuating, descend to an altitude below 20,000 ft as soon as conditions permit to avoid cavitation of the engine-driven pumps.

Additional components of the reservoirs include:

- a pressurization unit
- a sight glass on the side of the reservoir for visual checks of the fluid level
- a magnetic float and quantity transmitter for fluid level readings
- filters for the filling port and for the supply to the pumps.

The pressurization unit consists of:

- one check valve to prevent the return of fluid/air into the air supply line
- one pressure relief valve that prevents overpressure in the tank at 26.0 PSIA
- one pressure relief screw to relieve the pressure prior to removing the filling cap
- one vacuum valve set to prevent negative pressure in the tank at 0.38 PSI.



5G-2

Engine-Driven Pumps

Each engine drives a self-regulating variable displacement pump (**Figure 5G-3**) that produces approximately 3,000 PSI of pressure. The pumps draw fluid for distribution from their respective system reservoirs and return bypass fluid to the reservoir inlet. The left and right engines drive the pumps for System 1 and System 2 respectively.

Pump pressure output is monitored with a pressure switch downstream of the pump. This pressure switch illuminates a HYD 1 or HYD 2 annunciator when the pressure delivered by the associated pump drops below 1,500 PSI.

System Filters

Both hydraulic systems have the following additional filters:

- discharge line filter (each pump)
- reservoir filling filter
- pump supply filter (**aircraft with SB 29.007**)
- pump pressure line filter
- engine pump bypass filter.

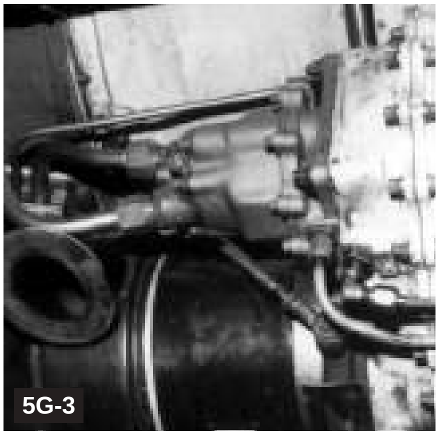
Pressure Relief Valves

The aft compartment contains three pressure relief valves. The valves protect the respective system in the event of overpressure caused by failure of the regulation system of the corresponding self-regulating pump. The valve opens at approximately 3,630 PSI.

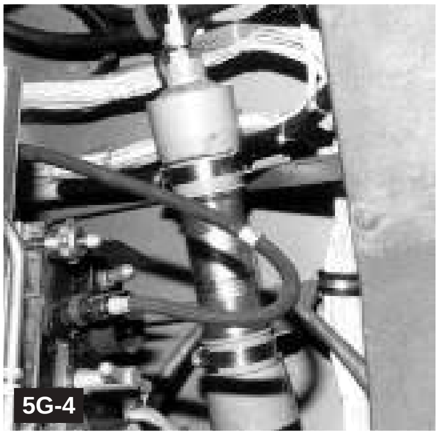
Accumulators

Each system includes a nitrogen-charged accumulator downstream of the engine-driven pumps (**Figure 5G-4**). The accumulators provide a power reserve for the hydraulic system and are preloaded with a charge of 1,450 PSI. The accumulators include an inflating valve (for servicing) and a pressure gage graduated in PSI.

NOTE: SB 29.007; Hydraulic Power – Intake Filter in the Reservoirs – Installation of a Paper Filter.



5G-3



5G-4

NOTE: SB 29.009; Replacement of ABEX Pumps by Vickers Pumps.

An additional accumulator on each pressure line dampens pressure surges; it is preloaded with a charge of 1,450 PSI. Aircraft **S/N 92 and subsequent or aircraft with SB 29.009** have a preload of 850 PSI.

System 2 includes an additional accumulator for the thrust reverser system (see Miscellaneous chapter) and an accumulator for the parking and emergency brake system (see Landing Gear Systems chapter).

Pressure Transmitters

Pressure transmitters in the aft compartment for each hydraulic system signal the pressure indicators to display respective system pressure.

Standby Pump

System 1 incorporates an electric standby hydraulic pump (**Figure 5G-5**) to power all components of the system if the left engine-driven pump fails.

Electric power for the standby pump is obtained from the Main bus through a current limiter and a power relay. The power relay is controlled by the standby pump switch using power from the B bus.

Switch position and system function for the standby pump are shown in **Table 5G-A**.

Ground Service Receptacle

The ground service receptacles for System 1 and System 2 are inside the aft compartment on the hydraulic equipment rack (**Figure 5G-6**). The ground receptacles are provided to supply the aircraft with hydraulic power from the hydraulic mule (cart). The receptacles are a self-sealing type and protected with dust covers.

5G-5

5G-6

Standby Switch Position	Aircraft Configuration	Function
ON or NORM	On the ground	If pressure drops below 1,600 PSI, standby pump cycles pressure between 1,600 PSI and 2,150 PSI.
NORM	In flight	If slat/flap control handle is set to a position other than clean or if the inboard slats are not retracted and pressure in System 1 falls below 1,600 PSI, standby pump cycles pressure between 1,600 PSI and 2,150 PSI.
ON	In flight	Standby pump cycles pressure between 1,600 PSI and 2,150 PSI if engine-driven pump pressure is less than 1,600 PSI.

Table 5G-A; Switch and Function

Preflight and Procedures

Servicing and Preflight

The fluid reservoirs are serviced with MIL-H-5606 B or C hydraulic fluid using a hydraulic mule through the ground service connections. The reservoirs can be serviced through the filler inlets on the reservoirs.

Both hydraulic system reservoir areas and all components in the aft compartment should be checked as part of the preflight inspection (see Preflight chapter).

Abnormal Procedures

Refer to the AFM or the SimuFlite Operating Handbook for specific procedures. The following is a discussion of general procedures and their effect on system operation.

Unwanted Operation of the Standby Pump

The standby pump operating time in a normal cycle is less than 30 seconds. If the ST. BY PUMP light illuminates, the pump must be turned OFF to prevent possible failure or fire.

Depressurization of Reservoir

If air pressure in a hydraulic reservoir drops below 16 PSIA, the associated HYD. TK1 or HYD. TK2 annunciator illuminates. If hydraulic pressure begins to fluctuate on the indicator panel, descend to 20,000 ft as soon as conditions permit to prevent pump cavitation.

Emergency Procedures

Loss of Left Engine Hydraulic Pump

The illumination of HYD 1 annunciator may indicate the loss of the No. 1 engine-driven pump. The pressure switch downstream of the pump senses a pressure of less than 1,500 PSI and signals the annunciator of a low pressure condition. Check System 1 QTY indicator.

With the left engine-driven pump failed and the standby pump operating, all System 1 components operate, but at a slower speed.

Loss of No. 1 Hydraulic System

The illumination of the HYD 1 annunciator along with the indicator panel fluid quantity reading empty (red range) indicates the loss of System 1 fluid. The pressure switch downstream of the pump senses a pressure of less than 1,500 PSI and signals the annunciator of a low pressure condition. With loss of system fluid, the standby pump is turned OFF to prevent unwanted pump operation. The Q UNIT annunciator may also illuminate.

With failure of System 1 pressure, a loss of the following occurs:

- System 1 flight control servo actuator barrel
- rudder Q unit
- normal slats
- normal (No. 1) braking system
- hydraulic operation of landing gear
- airbrakes.

WARNING: Paint damage may occur with hydraulic fluid contact.

CAUTION: Ensure that the hydraulic mule has not been contaminated by previous operations.

CAUTION: When servicing through the reservoir filler inlets, systems and air pressures should be completely relieved before complete removal of the caps.

CAUTION: The loss of both hydraulic systems requires higher stick forces; landing requires increased caution.

Airspeed Limitation

When Hydraulic System 1, System 2, or both fail, airspeed is limited to 260 KIAS/0.76 M_I.

Loss of No. 2 Hydraulic System

The illumination of the HYD 2 annunciator indicates the loss of the hydraulic pressure in System 2. The pressure switch downstream of the respective pumps senses a pressure of less than 1,500 PSI and signals the respective annunciator of a low pressure condition. A loss of System 2 results in the loss of the following:

- System 2 flight control servo actuator barrel
- yaw damper
- emergency slats
- emergency and parking brake system (still available with accumulator)
- thrust reversers (may be available with the accumulator)
- nosewheel steering.

Loss of Both Hydraulic Systems

Complete hydraulic system failure is indicated by the loss of hydraulic pressures and possible quantities as indicated on the panel. A pressure output of less than 1,500 PSI illuminates the HYD 1 and HYD 2 annunciators and requires a landing as soon as practical. Q UNIT annunciator may also illuminate.

Data Summary

Hydraulic Systems

Power Source	Engine-driven pumps (2) Main bus Standby electric pump power B bus Standby electric pump control HYDR QTY gages HYDR PSI gages Primary A bus System annunciators
Distribution	System 1 Rudder, elevator, and aileron servo-actuators Rudder Arthur Q unit Normal (inboard/outboard) slats Airbrakes Landing gear Normal braking System 2 Rudder, elevator, and aileron servo-actuators Yaw damper Emergency (outboard) slats Nosewheel steering Emergency and parking brakes Thrust reversers
Control	ST-BY PUMP switch (standby pump)
Monitor	HYDR QTY/PSI gages Annunciators HYD 1/2 HYD.TK1/TK2 ST-BY PUMP P.BRAKE Hydraulic reservoir sight gages Parking brake accumulator pressure switch
Protection	Circuit breakers Hydraulic system pressure relief valves Reservoir air pressure relief valves

Ice and Rain Protection

Chapter 5H

Engine bleed air and electrical heating elements provide most of the Ice and Rain Protection available on the Falcon 10/100.

Engine bleed air is used to anti-ice the following:

- wing leading edges
- nacelle air intake of each engine including the elliptical spinner, **if installed**.

Electrically powered heating elements provide anti-icing for the following:

- pitot probes
- static ports
- stall vane
- optional angle-of-attack probe
- P_{t2} and T_{t2} engine sensor
- total air temperature probe.

In addition, the pilot and copilot wipers are electrically driven and the front windshields are demisted. Each cabin window is demisted by an individual desiccant squib system.

A wing ice inspection light is also available.

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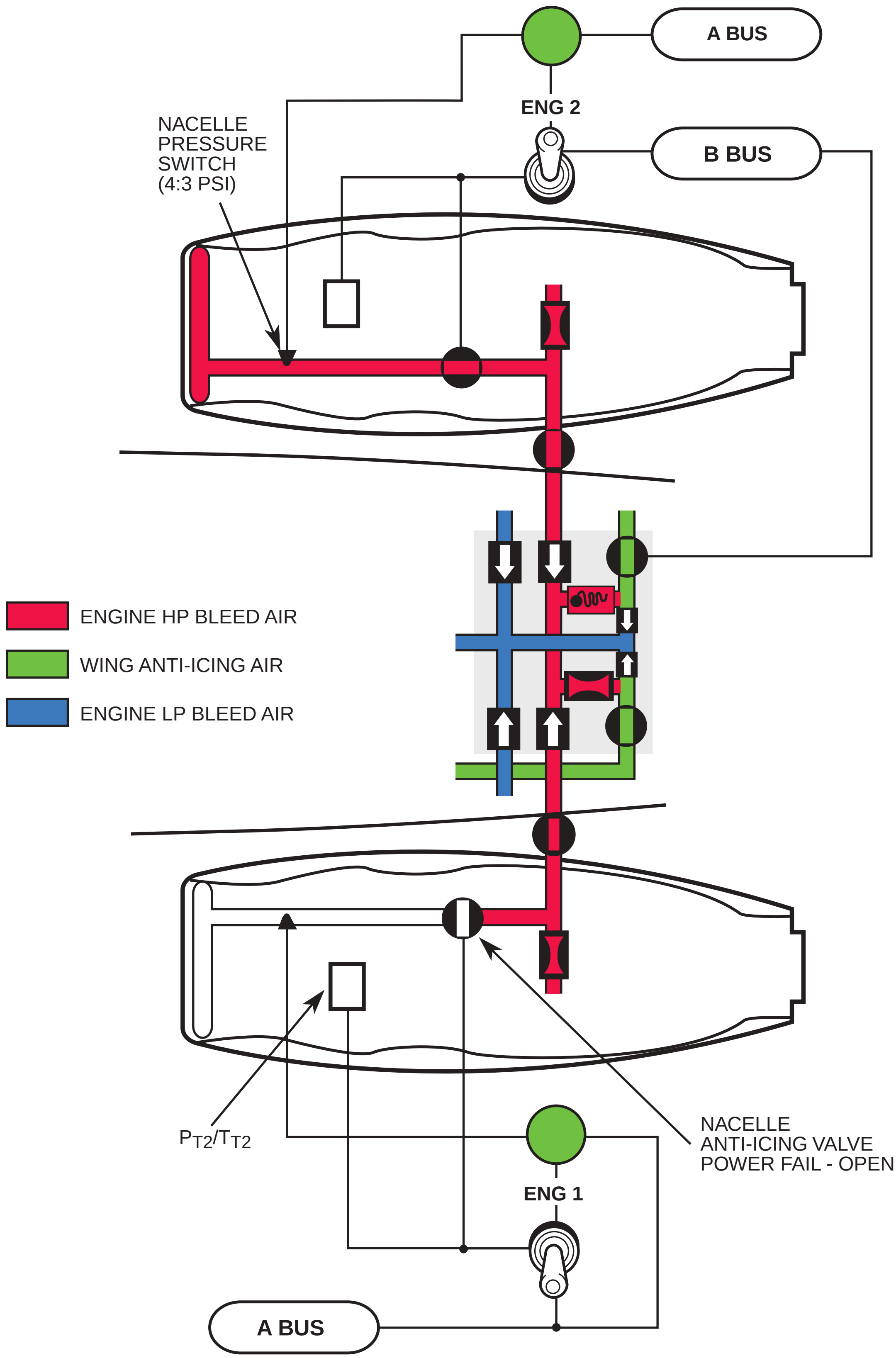
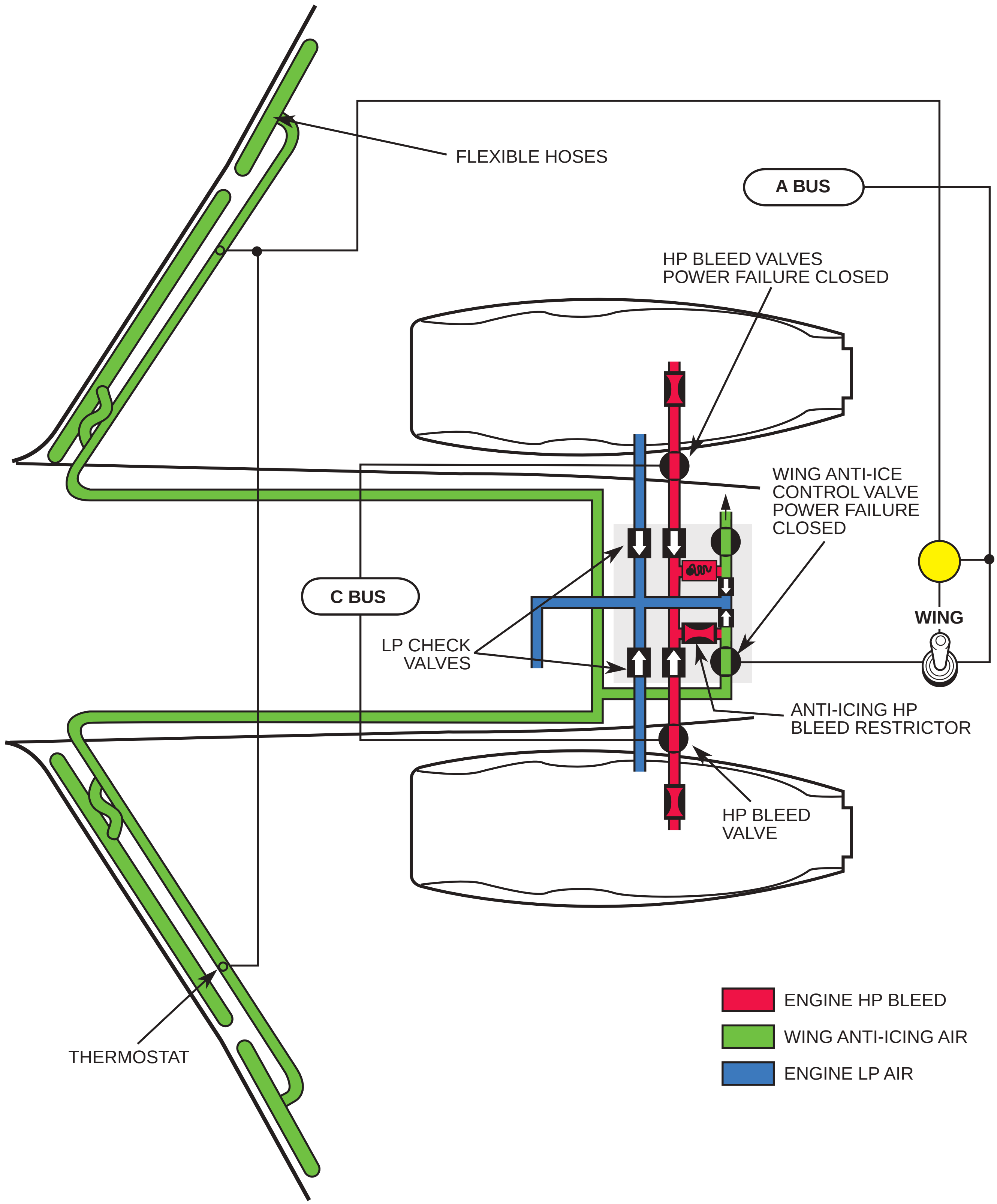
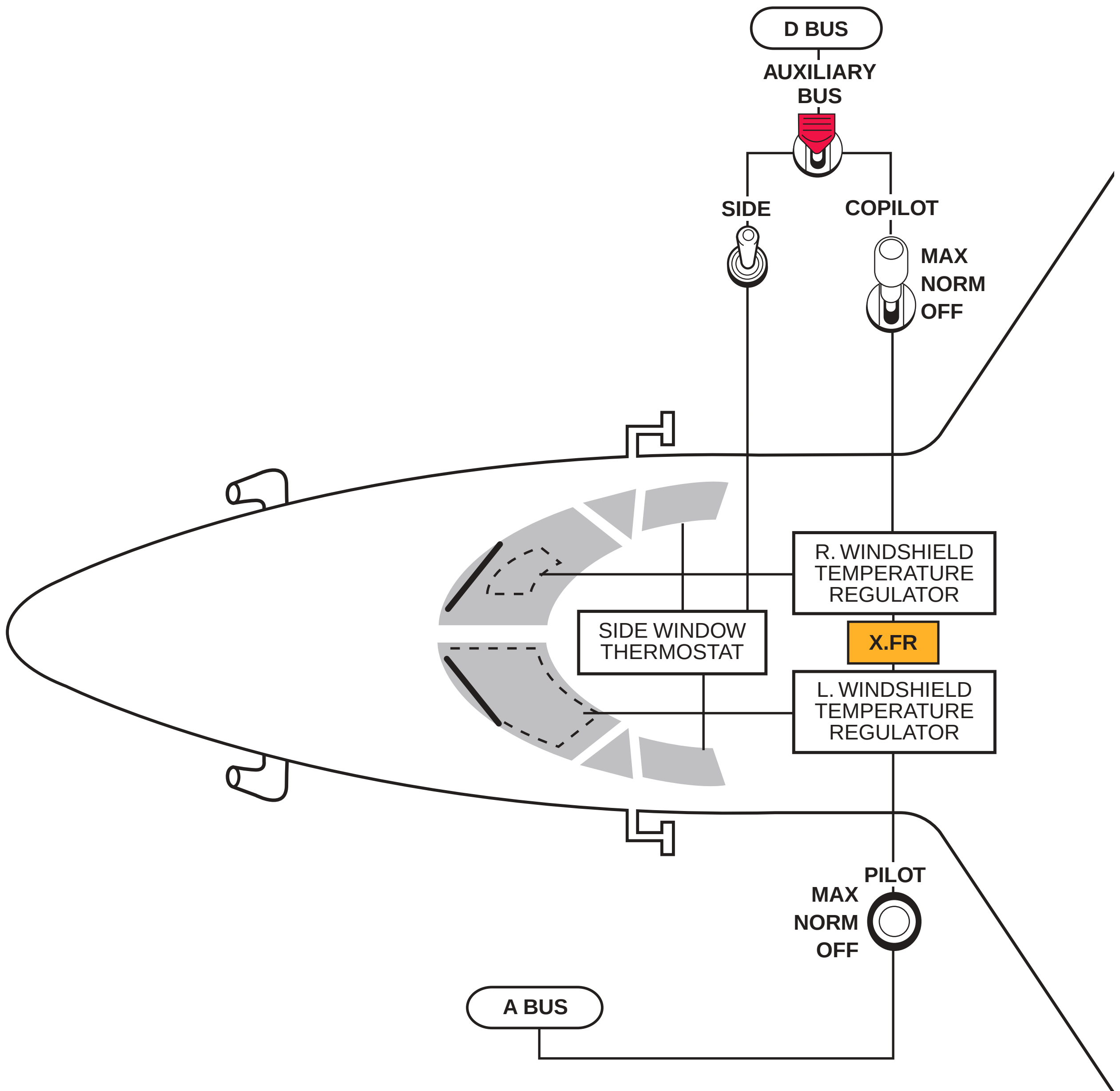
Engine Anti-Ice System



Wing Anti-Ice System



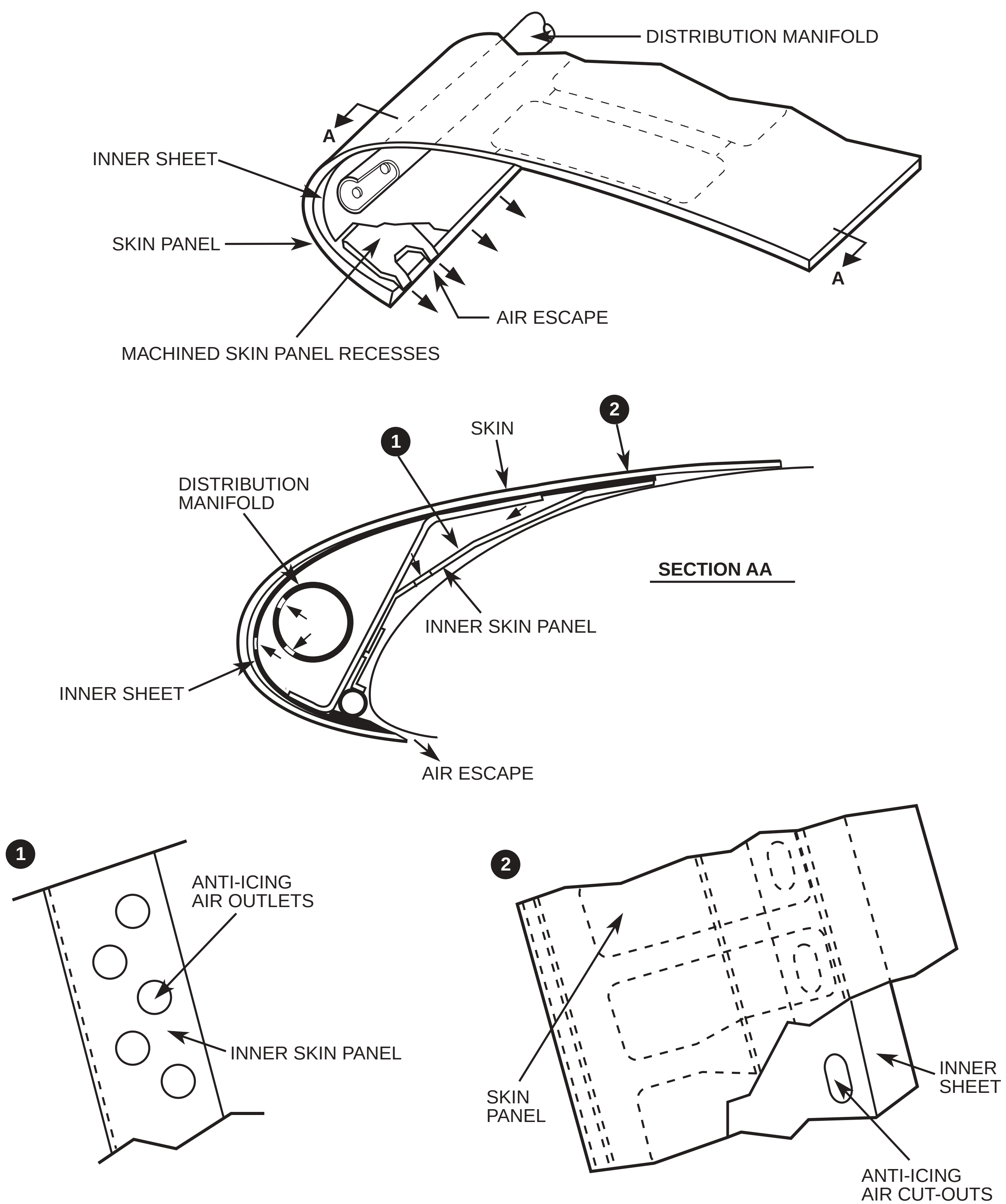
Windshield Heat System



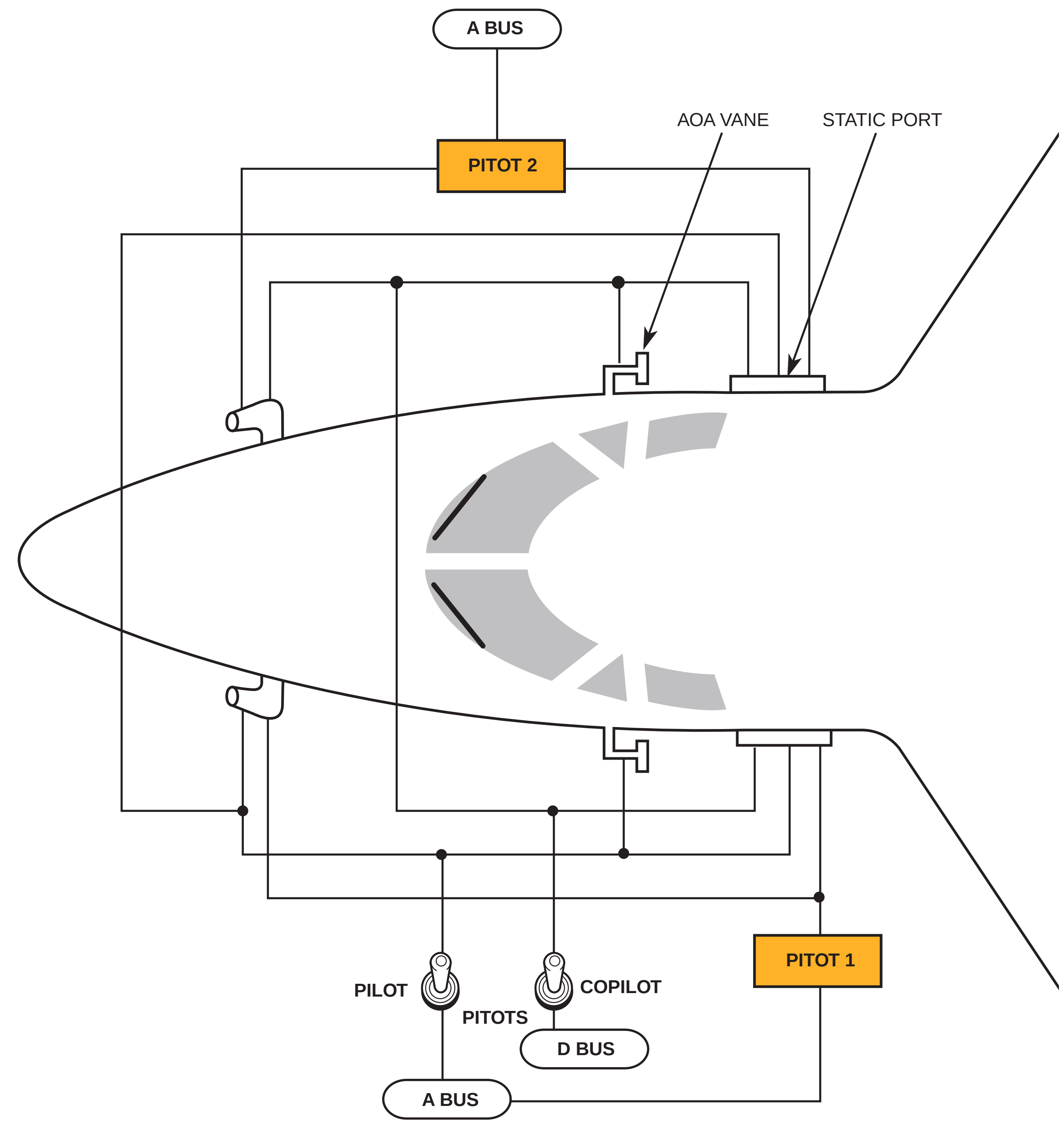
Slat Anti-Ice Distribution System

Pitot Heat System

Slat Anti-Ice Distribution System



Pitot Heat System



Bleed Air System

Pressurized bleed air for anti-icing is supplied as described below.

- Low pressure and high pressure air is bled from the engines and directed to the P2 unit. Air drawn from the P2 unit prevents ice formation on the slats and leading edges of the wing when slats are extended.
- Air drawn from the high pressure bleed (HP) air system of each engine prevents ice formation in its own nacelle air intake. HP bleed air also is used to anti-ice its own dome fan spinner (if installed). If engines are fitted with a conical-shaped fan spinner, no spinner anti-ice is required or installed.

Wing Anti-Ice System

Bleed air from the P2 unit anti-ices the wing leading edges, inboard and outboard slats, and wing roots (**Figure 5H-1**) with slats extended or retracted.

Components of the wing anti-icing system include the following:

- WINGS switch/indicator
- P2 unit (bleed air center)
- control valves
- supply duct
- distribution manifolds
- slat air distribution
- thermostats
- inboard leading edge anti-icing.

WINGS Switch/Indicator

The WINGS two-position ON/OFF switch in the ANTI-ICE zone on the overhead panel (**Figure 5H-2**) controls leading edge anti-icing.

In the OFF position, the wing anti-ice control valve is closed. In the ON position, the wing anti-ice control valve is energized open and the WINGS anti-ice (green) indicator light on the overhead panel illuminates and remains on if the wing supply duct thermostats are subjected to 176°F (80°C). See thermostat below.

On aircraft with SB 30 017, one of the thermal fuses melts and illuminates the amber DE-ICING annunciator if a hose is disconnected in the leading edge.

P2 Unit/Control Valves

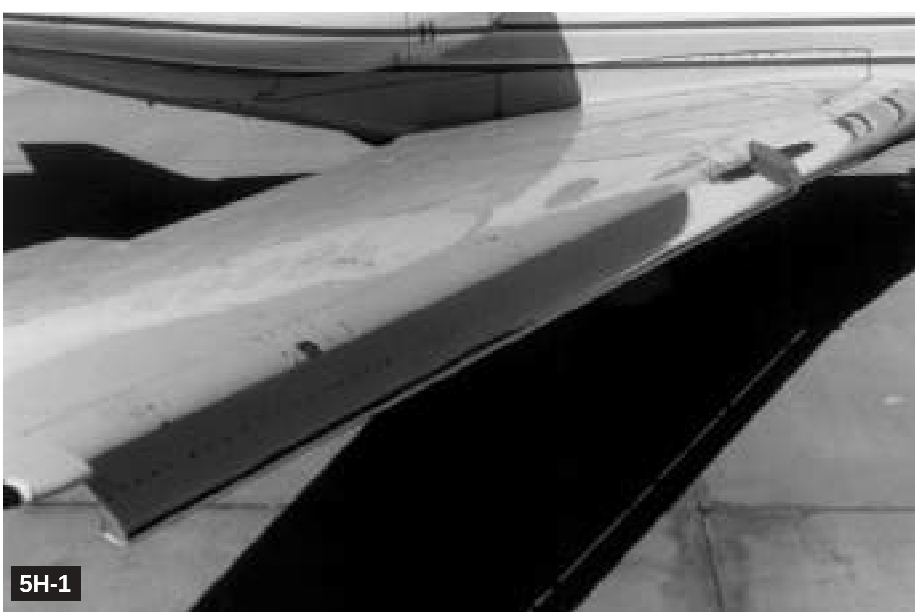
The P2 unit (bleed air center) receives low pressure bleed air continuously and high pressure bleed air through HP control valves in the pylon.

Anti-Icing Limitation

The anti-icing system is a preventive system and is not designed for eliminating ice. As a consequence, anti-icing must be turned on in flight as soon as TAT drops below +5°C in icing conditions, visible moisture, or if icing is anticipated.

Wing and Engine Anti-Icing Limitation

The engine and wing anti-ice systems must not be used with total air temperature in excess of +10°C. The wing anti-ice system must not be used on the ground except for maintenance checks.



5H-1

5H-2

Wing Anti-Ice Limitations

Do not perform ground checks of the wing anti-ice stystem without consulting the maintenance manual for procedures. With the aircraft on the ground, this can lead to overheating and subsequent damage to the slats.

WINGS anti-ice systems should be switched on in flight prior to entering visible moisture whenever the TAT is +5°C or below. Do not exceed the operational engine and wing anti-ice system limitations.

Wing anti-icing must not be used with total air temperature in excess of +10°C.

The wing anti-ice system receives a low pressure (LP) and high pressure (HP) bleed air mixture (approximately 70% low pressure and 30% high pressure) from both engines. Wing anti-ice air is tapped off the P2 unit and directed through the anti-ice control valve to the supply duct.

Supply Duct/ Distribution Manifolds

A single supply duct downstream from the P2 unit and wing anti-ice control valve splits so that each duct distributes bleed air to its respective wing leading edge distribution manifold. The distribution manifold along the front spars of the wing leading edge ducts bleed air to the inboard and outboard slats.

The supply duct is connected to the distribution manifolds through four flexible hoses (glass cloth reinforced silicone material) to permit extension of the slats.

Slat Anti-Ice Air Distribution

Inside the slats, the anti-icing air outlets distribute bleed air along the entire length of the slat leading edge through small, equally spaced holes. The air flows inside the area between the slat skin and the inner sheet through apertures cut in the inner sheet.

Recesses are machined in the inner surface of the skin panel to enable bleed air to circulate toward the top and bottom borders of slat skin panels.

Air escapes from the bottom border of the skin panel through small ducts in the skin panels opposite the inner sheet. Air escapes from the top border of the skin through apertures in the inner sheet and holes in the top skin panel.

Thermostats

Two thermostats connected in series in the supply duct sense the temperature of bleed air entering the slat leading edges. They provide positive indication of wing anti-ice. Although failure of a thermostat prevents a positive indication of anti-ice, wing heat is not affected.

Normal operation is confirmed by illumination of the green WINGS light on the overhead panel when the thermostats reach 176°F (80°C); because of thermal inertia, it takes one to two minutes to illuminate. The green WINGS light extinguishes if one of the thermostats senses a temperature of 158°F (70°C); this indicates inadequate anti-icing for one of the wings.

Inboard Leading Edge Anti-Icing

A tap off the supply duct supplies bleed air to the leading edge distribution manifold. A flexible tube connects the duct and manifold to provide inboard leading edge anti-ice protection.

Operations in Icing Conditions

Minimum N_1 speed

For adequate performance of the wing and engine anti-icing systems, the N_1 speed of the operative engines must not be lower than the minimum values shown in **Table 5H-A**.

The temperature correction chart in the AFM must be used to derive outside air temperature from ram air temperature.

Wing anti-icing must be switched on as a preventive measure in flight when the indicated total temperature is below +5°C (+41°F) in visible moisture and when icing conditions are anticipated.

The wing anti-icing system must not be operated on the ground, except for operational checks conducted at low power settings and under constant monitoring of the wing leading edge temperature.

Engine/Nacelle/ P_{t2}/T_{t2} Probe Anti-Ice System

Each engine provides its own high pressure bleed air to anti-ice the nacelle and the elliptical spinner (**if installed**). Additionally, when the engine anti-ice is selected, the P_{t2}/T_{t2} probes are electrically heated. (See Maneuvers chapter for operating requirements).

The engine nacelle anti-ice and P_{t2}/T_{t2} probe systems have a common control system for each engine.

Nacelle Anti-Ice System Components

Components of the engine nacelle air intake anti-ice systems include the following:

- nacelle anti-ice valve and pressure switch
- anti-ice supply line
- restrictor and expansion sleeves
- air intake circular distribution duct
- internal wall, shroud, and side louvers.

Distribution

The respective HP bleed air port of each engine supplies bleed air for the nacelle anti-ice system via the electrically-controlled nacelle anti-ice valve. This valve fails open in the event of a DC power failure.

HP bleed air from the engine is directed to the circular distribution duct that distributes it to the nacelle intake through expansion sleeves and a restrictor. The restrictor limits warm airflow to avoid excessively high temperatures through the anti-ice air supply line. Each line is fitted with a nacelle anti-ice solenoid valve that controls anti-ice air for each air intake. A 4.3 PSI nacelle pressure switch provides indication.

The bleed air in the air inlet circulates through the air intake box between the air intake internal wall and shroud. It is then evacuated outside through side louvers.

Dome Spinner Anti-Ice Valve (if installed)

The dome spinner anti-icing valve on the right side of each engine controls the engine bleed air to the spinner. HP bleed air is distributed into the internal face of the spinner by internal plumbing; it is then discharged into the air intake immediately upstream of the fan.

Engine Anti-Ice Limitation

The engine anti-ice must be used on the ground and in flight when the temperature is below +5°C and icing conditions exist or are anticipated.

CAUTION: Continuous operation of engine anti-ice in normal ambient conditions is not recommended because damage can result.

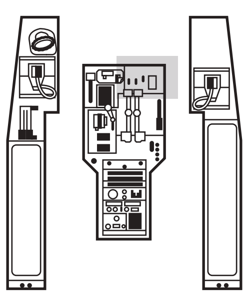
OAT	-30°C	-20°C	-10°C	-5°C
In flight, min. N_1 speed	76%	73%	67%	62%
In flight, recommended N_1 speed	78%	75%	69%	64%
In approach, min. N_1 speed	69%	69%	69%	64%
One engine	88%	85%	79%	74%

Table 5H-A; Minimum N_1 Speed

Engine Anti-Ice Limitation

Engine anti-icing must not be used with total air temperature in excess of +10°C.

CAUTION: In the event ice has already started to accumulate, the ignition system must be turned on (start selector switches to AIRSTART) prior to selecting the engine anti-icing systems. Select engine anti-ice ON, one at a time with a delay of no less than 30 seconds. Wing anti-icing can then be switched on.



Each engine has an electrically-controlled and pneumatically-operated dome spinner anti-icing valve normally held closed by a spring. The valve fails closed if DC power fails with an engine running.

HP bleed air always is available for engine anti-ice because the engine anti-ice valve is upstream of the associated HP bleed air shutoff valve.

The fan spinner anti-icing system is eliminated on aircraft with engines fitted with conical-shaped fan spinners.

P_{t2}/T_{t2} Probe

A P_{t2}/T_{t2} sensor (**Figure 5H-3**) on each engine provides pressure and temperature information to the fuel computer. Each engine's probes are heated electrically when the respective engine anti-ice control is in ON.

ANTI-ICE Switch

Each engine anti-ice system has a two-position (ON/OFF) ENG switch below the corresponding indicator light on the ANTI-ICE section of the overhead panel.

Engine anti-icing must be switched on as a preventive means when the total indicated temperature is below +5°C (+41°F) in visible moisture and when icing conditions are anticipated.

Each engine anti-ice switch opens or closes its engine nacelle anti-icing valve and elliptical spinner anti-icing valve (if installed). It also connects electrical power to its P_{t2}/T_{t2} probe heating element.

Anti-Ice Indicators

The ENG 1 and ENG 2 anti-ice systems each have a green indicator light above the corresponding switch on the ANTI-ICE section of the overhead panel. When an ENG 1 or ENG 2 anti-ice switch is on, the green light illuminates and remains on if the nacelle and spinner pressure switches are subjected to the proper pressure (nacelle air intake supply line 4 to 7 PSI and engine spinner supply line 6 PSI).

The indicator lights do not indicate proper P_{t2}/T_{t2} probe heat operation.

On aircraft with SB 30 010: When anti-ice control switches are placed in OFF, illumination of anti-ice lights indicates that one of the solenoid valves failed open and that bleed air from the respective engine continues even though anti-icing switch is off.

HP BLEED Switch

The HP bleed valves are electrically-controlled, air-operated, normally closed valves powered by the C Bus.

5H-3

5H-4

During the initial cockpit preflight, the two-position OPEN/CLOSED HP BLEED switch on the pedestal bleed air panel (**Figure 5H-4**) is set to CLOSED. With the HP bleed valves closed, HP bleed air is not available to the P2 unit.

Windshield Anti-Ice System

Electrical heating elements embedded between the windshield laminations prevent ice formation on the pilot/copilot windshields. Each windshield is separate and independent.

The two windshield anti-icing systems are identical and include the following components:

- controller
- probes/wires
- automatic transfer
- 3-position selector switches
- XFR signal light.

Controller

Each pilot's main windshield panel is heated electrically through a controller with heat sensing probes. The two probes in the pane (one a stand-by) and the controller automatically maintain the panes within a design temperature range. The regulation temperature is 30°C (86°F).

A sensing circuit between the windshield systems provides automatic transfer of control if either system fails or if a heat sensing probe short circuits.

Control and Indicating

The PILOT and COPILOT WINDSHIELD switches on the overhead panel, labeled OFF/NORM/MAX, control windshield anti-ice operation (**Figure 5H-5**). The NORM position provides normal heating intensity over a maximum area; the MAX position provides high heating intensity over a reduced area.

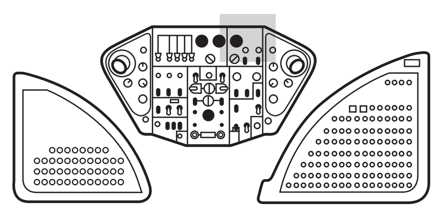
The NORM position is used in all normal operations; the MAX position is selected in flight only when the NORM position fails to maintain the windshields clear of ice. Selection of MAX allows current to bypass one heating element and thus increase current flow over a reduced area. This provides greater efficiency.

If one of the regulation systems is faulty (regulator or sensor failure), the regulator of the other system automatically takes over and annunciates the transfer by illuminating the amber X.FR light. Isolate the inoperative circuit immediately by setting the windshield ANTI-ICE switches to OFF; the switch that extinguishes the light indicates the faulty circuit.

Windshield Electrical Heating Limitation

The PILOT and COPILOT WINDSHIELD control switches must not be selected to the MAX position, except in flight, and only if the NORM position is not sufficient in icing conditions.

5H-5



Pitot Limitation

Pilot and copilot pitot heat on for flight.

Side Window Heat

The anti-icing system for the pilot's and copilot's OROGLASS panes (SB 30 001) is similar to the windshield anti-ice system except there is only one probe in each panel. The SIDE switch on the overhead panel controls the lateral rear panels heat. Normal heating temperature is 104°F (40°C).

A single controller with two overheat sensors is common to both side windows. If a failure occurs in one side window heat system, both sides automatically shut down to prevent overheating.

Windshield Defogging System

To maintain maximum visibility in the Falcon 10/100, unconditioned bleed air for defogging is supplied to the inner windshield surface through a duct running along the lower part of the windshield.

The WSHLD control lever on the pilot's console outboard of the floor heating lever regulates windshield defogging (**Figure 5H-6**). The lever has CLOSED and OPEN positions.

Pitot Heating System

The pitot probes, static ports, stall vanes, AOA probe, and total air temperature probe are anti-iced by 28V DC-powered, built-in heating elements.

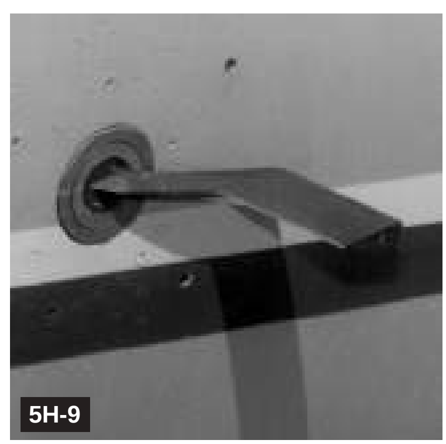
Components of the pitot/static anti-icing system include:

- pilot/copilot switches (**Figure 5H-12**)
- pitot probes (**Figure 5H-7**)


5H-6


5H-7


5H-8


5H-9

- static ports (**Figure 5H-8**)
- stall vanes (**Figure 5H-9**)
- AOA probe (**if installed**) (**Figure 5H-10**)
- total air temperature probe (**Figure 5H-11**).

PITOT Switches/ Indicators

The PILOT and COPILOT PITOT switches control anti-icing for the pitot/static system. The switches are in the PITOT area on the overhead panel (**Figure 5H-12**).

When the pilot's pitot system switch is in ON, the following heating elements are powered:

- left pitot probe
- left and right pilot static ports
- left stall vane.

When the copilot's pitot system switch is in ON, heating elements powered include:

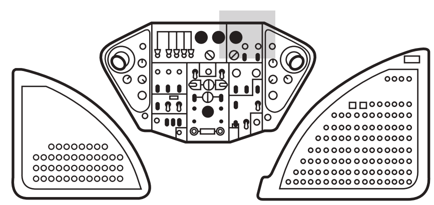
- left and right copilot static ports
- right pitot probe
- right stall vane

The AOA switch controls the heating element for the AOA probe.

Printed circuits monitor the electric current flowing through the heating elements of the pitot pressure probes and the static pressure ports. When the current in a monitored circuit becomes low or nonexistent, the corresponding printed circuit, acting as a current relay, grounds the amber PITOT 1 or PITOT 2 annunciator on the Failure Warning Panel. The 28V DC power applied to this panel then illuminates the warning light to indicate abnormal operating conditions.


5H-10


5H-11



5H-12

TAT probe and stall vane anti-icing are not monitored. A small ammeter, normally on the copilot's instrument panel, monitors the anti-icing current to the AOA probe (**if installed**).

The PILOT and COPILOT PITOT switches must be ON prior to takeoff; the amber PITOT 1 and PITOT 2 warning annunciators should extinguish.

When the PILOT and CO-PILOT PITOT switches are OFF, the pitot and static monitoring circuits sense no current and illuminate the PITOT 1 and PITOT 2 annunciators.

Electrical power for the pilot's pitot/static system anti-icing is provided by non-shed 28V DC; power for the copilot's pitot/static system anti-icing is provided by load-shed 28V DC.

Windshield Wipers

The pilot and copilot windshields are equipped with electric windshield wiper systems to provide clear visibility during takeoff, approach, and landing in rain or snow. The wipers are parked in a drained recess below the windshields when not in use to avoid any accumulation of ice or snow on the wipers.

Components of each windshield wiper system include:

- pilot/copilot wiper control switch
- motor/gearbox/drive shaft
- wiper arm assembly/wiper blade
- relay/resistor.

WIPER Switch

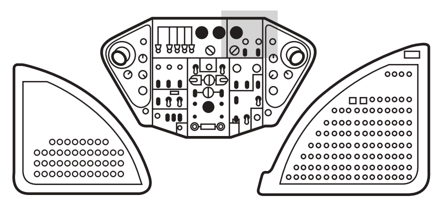
A three-position switch labeled ON/OFF/PARK on the overhead panel controls each wiper (**Figure 5H-14**). When either the PILOT WIPER or COPILOT WIPER control switch is set to ON, 28V DC is applied to the corresponding wiper motor.

Both pilot and copilot windshield wipers are powered from the A bus (**Figure 5H-13**). They have only one rate of motion of 170 cycles per minute. The wipers can be used up to a maximum speed of 190 kts. **SB 30 004** improves wiper return and storage to 150 kts.

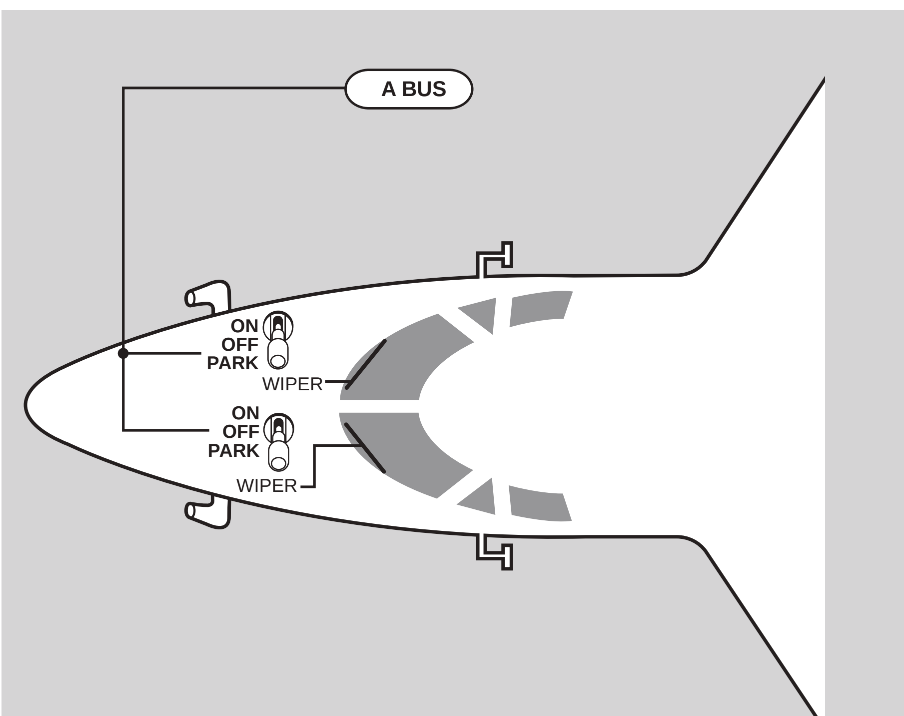
The revolving motor drives the windshield wiper via a flexible drive shaft. The gearbox reduces the drive speed and transforms the rotating movement into an oscillatory motion. This movement is transmitted to the wiper arm assembly that drives the windshield wiper blade. Either wiper switch automatically returns to OFF after the PARK position is selected.

When either wiper switch is held in PARK, 28V DC is applied to the corresponding parking position relay. Power is then applied to the associated windshield wiper motor via a resistor. The motor turns at a reduced speed. A ground connection is also provided for the parking position cam of the corresponding windshield wiper motor.

Miscellaneous



5H-14



5H-13

When the cam establishes end-of-travel contact (i.e., windshield wiper arm in the low sweep position and recessed), the cam cuts off the motor power supply. When the control switch is released, the switch returns to the spring-loaded OFF position.

Passenger/Cockpit Window Demisting Systems

Components of the demisting system include:

- the passenger window system
- rechargeable silicagel cartridge
- side port
- plastic cap
- the cockpit window system
- refillable silicagel cartridge
- layered windows with ports
- plastic plug.

With SB 30-012, each aft window of the flight compartment is dried by a separate system connected to a rechargeable cartridge of silicagel desiccant under the windows.

Without SB 30-012, a port is drilled in the inner window pane to vent the space between the two panes. **With SB 30-012**, this port is sealed and a silicone CAF4 canister is connected to the space at the bottom of the window. The canister is covered by a leather-covered plastic cap held in place by three locking tabs.

With SB 30-014, a refillable silicagel cartridge is included in front of frame six under the lower side of the trimming. A flexible hose connects the cartridge to the space between the two panes of the lateral glass panel.

A hole in the trimming for placement and inspection of the desiccant cartridge is fitted with a plastic plug held in place by three locking tabs.

Wing Ice Lights

The wing leading edges are illuminated by the wing ice lights in each side of the fuselage (**Figure 5H-15**). The WING ICE LIGHT switch on the overhead panel controls the wing ice lights (**Figure 5H-16**).

5H-15

5H-16

Preflight and Procedures

Preflight

During the exterior preflight inspection, accomplish the following checks of the ice and rain protection systems (refer to Preflight chapter).

Check that the left and right windshields are clean, in good condition, and have no delamination or discoloration. Check that the wipers are in good condition and in the park position.

Check the right and left wing leading edge slats condition.

Check the condition of the engine intake nacelle.

Ensure the wing ice inspection light(s) (if installed) are intact and in good condition.

Check the TAT probe, AOA sensor (if installed), P_{t2}/T_{t2} probes, pitot probes, static ports, and stall vanes for heat. Since the pitot probes and static ports are only monitored, heating of the other system components may occasionally be checked by touch.

If possible, perform check with a GPU connected to prevent battery drain.

Check for engine fan or spinner damage; verify that the P_{t2}/T_{t2} probe is intact.

Abnormal Procedures

The following section provides a brief discussion of what happens during abnormal anti-ice situations. For a list of specific procedural steps, refer to the AFM or the SimuFlite Operating Handbook.

Inoperative Engine Anti-Ice System

An inoperative engine anti-ice system is indicated when the ENG 1 or ENG 2 ANTI-ICE switch is on but the respective engine ANTI-ICE light remains extinguished. Because the two engine anti-icing pressure switches are series-connected, a malfunction of either can cause the associated ANTI-ICE light to remain extinguished.

With an engine anti-icing electrovalve jammed closed, select the ENG 1 or ENG 2 ANTI-ICE switch to OFF and avoid areas where icing conditions exist.

Unexpected Operation of Engine Anti-Ice Light

If an ENG 1 or ENG 2 ANTI-ICE light illuminates inadvertently, reduce the associated throttle to idle and shut down the associated engine as soon as possible after landing is completed.

This procedure is applicable to aircraft with conical spinners and no anti-icing per **SB F10-0180** or additional indicating system per **SB F10-0121**.

Inoperative Wings Anti-Ice System

If the WINGS anti-ice indicator light does not illuminate after the WINGS anti-ice system is activated, check that the HP BLEED switch is selected to OPEN. This switch may have been left in the CLOSED position.

An extinguished light may result from either a control thermostat malfunction or a failure of bleed air supply to the wing leading edges.

Select the WINGS ANTI-ICE switch to OFF to eliminate any risk of bleed air leakage downstream of the wing anti-icing electrovalve.

The most likely problem is that the wing anti-ice electro-valve is jammed closed. Avoid areas where icing conditions exist; maintain maximum speed to provide sufficient positive impact temperature.

CAUTION: When the HP BLEED switch is selected to CLOSED, wing anti-icing system efficiency is reduced. Avoid areas where icing conditions exist.

CAUTION: When pitot/static selector is selected to PANEL ONLY, the pilot feel force is no longer slaved to the airspeed and the cabin differential pressure indicator is disabled.

Wing Anti-Ice Light Illuminates Unexpectedly

If the WINGS green light illuminates unexpectedly with the WINGS ANTI-ICE switch in OFF, the wings anti-icing valve is jammed open.

A persistent wing anti-icing air bleed during the flight results in a slight loss of airplane performance (e.g. thrust, speed, consumption). There also exists a risk of overheating and damaging the leading edges when the aircraft is at a stop.

During the approach sequence, select the HP BLEED control to CLOSED to limit the risk of damage. Wing anti-icing is then supplied only with LP bleed air. Anti-icing efficiency is reduced; therefore, areas where icing conditions exist should be avoided.

To prevent overheating of the leading edges when the airplane is on the ground and outside air ventilation and cooling are not sufficient, shut down the engines as soon as landing is completed.

Leaking Wing Leading Edge Slat Hoses

Bleed air leakage is annunciated only if the aircraft is equipped with an amber DE-ICING annunciator as per **SB 30-017.** In S/Ns 1 to 4 and 6 to 151, this light is on the instrument panel; on S/N 152 and subsequent, it is on the warning panel.

Illumination of the DE-ICING annunciator indicates airframe bleed air is leaking in the area of the flexible hoses trigged by four thermal fuses. Set the WINGS ANTI-ICE switch to OFF and avoid icing conditions.

Front Pane Heating (Minimum Equipment List)

Illumination of the amber WINDSHIELD XFR light on the overhead panel indicates an automatic transfer of windshield heat regulation from the failed side to the operational side. Internal bleed air de-fogging provides for complementary heating. Its operation should be checked in flight.

If forward visibility is reduced, use the side window. The direct vision window can be removed for increased visibility.

Takeoff is authorized with a failure that only affects copilot pane.

Side Window Heating (Minimum Equipment List)

If side window heating fails, heating of both panes is immediately interrupted. A significant reduction in side visibility must be taken into consideration during operation in the traffic pattern and when maneuvering on the ground.

Failure of Pitot/Static Probe Heating System

The amber PITOT 1 or PITOT 2 annunciator illuminates when pitot or static probe heating fails to operate. It is not possible to mark the difference between a heating failure of the pitot or static probe in each circuit. Leave the pitot switch associated with the failed heating probe ON to continue heating the probe still operating.

If the pilot's flight instruments indications are false, use copilot's flight instruments and position the static selector to EMERGENCY.

If the copilot's flight instruments indications are also false, position the pitot/static selector to PANEL ONLY, position the autopilot to the DISENGAGED position, and reduce airspeed to 260 kts/MACH 0.76 MAX.

Ice and Rain Protection

Engine/Wing Anti-Ice System

Data Summaries

Power Source	Engine HP bleed air A bus – left engine $P_{t2}T_{t2}$ B bus – right engine $P_{t2}T_{t2}$ Wing HP/LP engine bleed air A bus – wing anti-ice valve
Distribution	HP bleed air Engine nacelle anti-ice valves Nacelle anti-ice valves Engine/nacelle pressure switches HP/LP bleed air Wing anti-ice valve Wing leading edges
Control	ENG 1/ENG 2 ANTI ICE switches WINGS ANTI ICE switch
Monitor	ENG 1/ENG 2 lights WINGS light
Protection	Circuit breakers

Pitot/Static and Windshield Anti-Ice System

Power Source	A bus L/R windshield wipers Pilot windshield heat Pilot pitot/static heat D bus Copilot windshield heat Copilot pitot/static heat
Distribution	Windshield temperature regulators
Control	PILOT/COPILOT PITOT switches A/A switch (**if installed**) PILOT/COPILOT WINDSHIELD switches Wiper switches
Monitor	Window heat X.FR light AMP meter PITOT 1/PITOT annunciators
Protection	Circuit breakers Windshield temperature regulators

Landing Gear Systems

Chapter 5I

The Landing Gear System on the Falcon 10/100 is a standard tricycle design electrically controlled and hydraulically actuated. The main gear utilizes dual wheel assemblies, while the nose gear uses a steerable single wheel with a chined tire for water and slush deflection.

In an emergency, landing gear extension is accomplished through mechanical unlocking of the gear.

The Brake System is mechanically controlled and hydraulically actuated by pressure from the hydraulic systems. The system has multiple disc brakes on the main gear wheels. An anti-skid system provides maximum braking efficiency on all runway surfaces.

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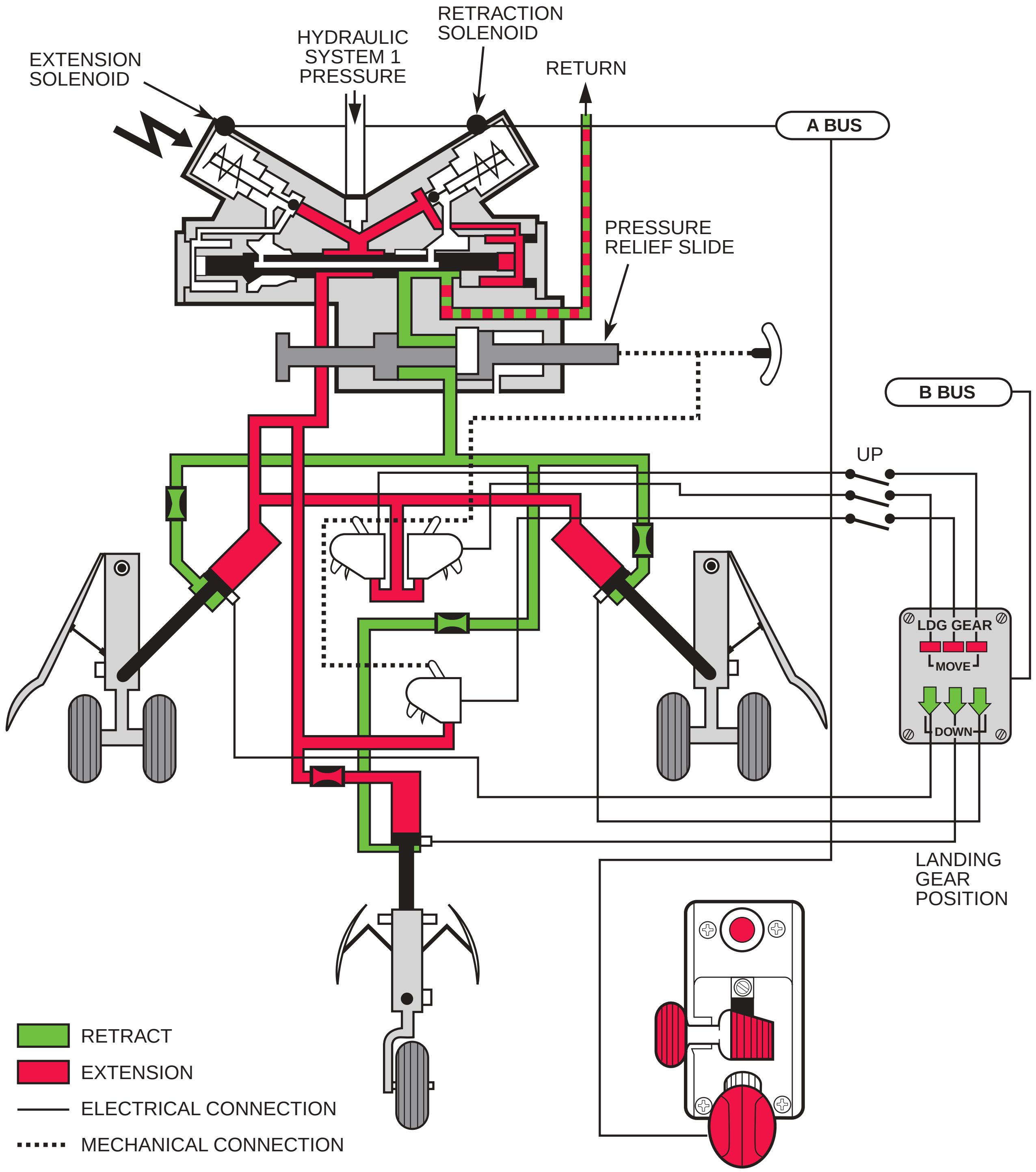
Landing Gear System



Landing Gear System

The Falcon 10/100 landing gear system is electrically controlled and hydraulically operated and includes dual-wheel main and single-wheel nose gear. When retracted, the nose gear is enclosed by mechanically actuated and linked doors (**Figure 5I-1**); the main gear is partially enclosed by a door attached to the main gear strut. The landing gear normally is actuated by hydraulic pressure from Hydraulic System 1 (see Hydraulics chapter for details). In the event of electrical and/or hydraulic problems with the landing gear, a manual emergency extension mode is available.

Ground/Flight Detection Proximity (Squat) Switches

An electrical proximity (i.e., squat) switch in each main gear and the nose gear sends signals to various aircraft systems indicating whether the aircraft is on the ground or airborne. The switches are on the fixed portion of each landing gear strut.

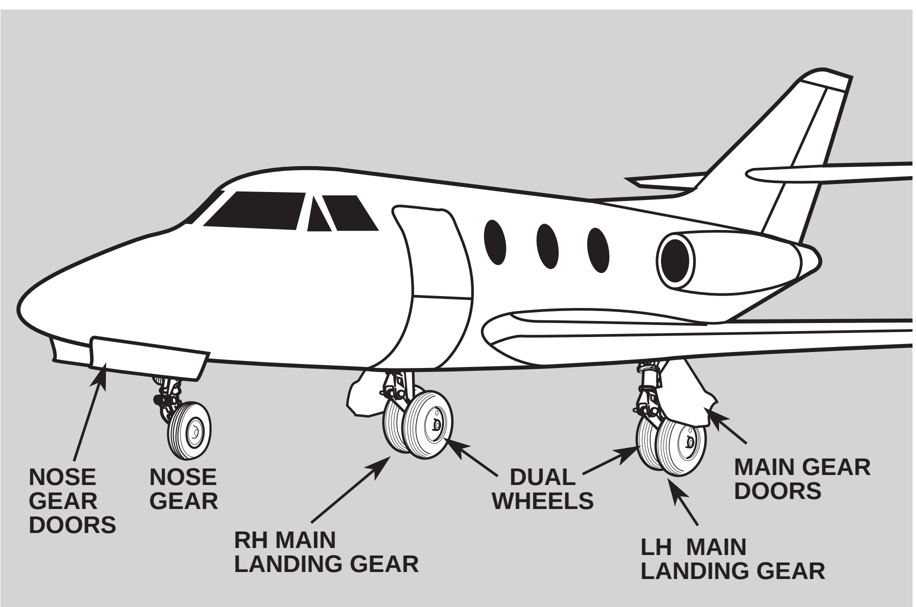
When the struts are extended, the switches are activated into the flight mode by movement of a flange against the proximity microswitch. When the struts are compressed, the switches are activated into the ground mode as the flange moves away from the microswitch.

The following systems receive inputs from the proximity switches:

- pressurization controller
- battery blower
- Freon air conditioning system
- Stall Systems 1 and 2
- gear retract protection
- airbrake warning
- thrust reversers
- conditioning valve
- hydraulic standby pump
- STAB TRIM annunciator
- nosewheel steering amplifier.

Main Gear

The main landing gear installation consists of right and left main landing gear assemblies of pneumatic/hydraulic shock struts with dual wheels (**Figure 5I-2**, following page). The gear is



5I-1

hydraulically retracted inward into the well under the wing and fuselage, and is locked in the up position by means of a lock assembly in each wheel well. When the gear is up, hydraulic pressure is removed from the landing gear system; each gear is held in place by its uplock.

In the down position, the gear is locked and braced by the landing gear extension unit (operating jack). Other components of the main gear include:

- trailer arm
- shock absorber barrel
- shock absorber (strut)
- door
- proximity switches
- uplock unit
- actuating cylinders
- brake assembly
- speed sensors.

The main gear includes the strut barrel, piston assembly, axle assembly, and associated parts (**Figure 5I-3**). The upper end of the strut main body is hinged between the forward and aft main gear supports within the wing structure by trunnion pins.

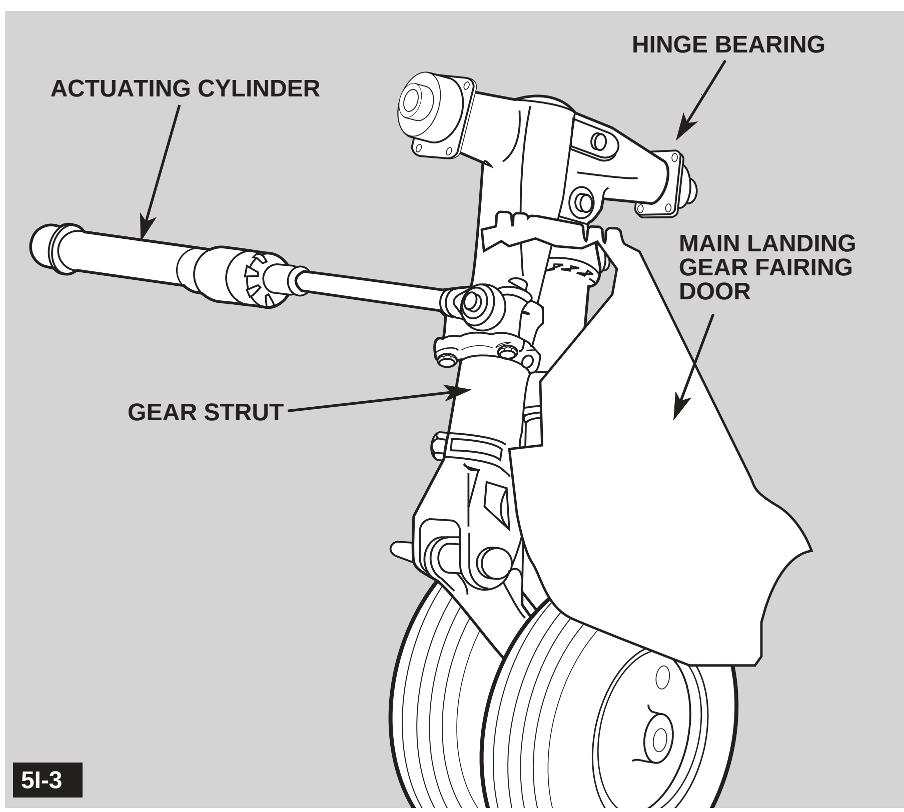
Main Gear Doors and Shock Strut

The main landing gear door assembly covers the landing gear well when the landing gear is retracted. The door is hinged on its outboard end to the wing structure; it is secured to the strut main body by an adjustable link that actuates the door during retraction and extension.

The main landing gear struts absorb shock forces generated during landing and taxiing. The lower portion of the strut is filled with MIL-H-5606 hydraulic fluid and the upper portion is serviced with nitrogen gas at 450 PSI.

During taxiing, shocks are absorbed largely by compression of the nitrogen gas within the strut; during landing, shock is absorbed by hydraulic action.

5I-2



5I-3

Main Gear Uplock

The main landing gear uplock assemblies contain mechanical link arms that retain the main gear in the up position (**Figure 5I-4**). During the landing gear retraction cycle, the spring loaded hydraulic uplock cylinder piston retracts to allow a roller to engage the latch and lock the gear in the up position.

When the landing gear extension cycle begins, the uplock cylinder piston rod extends to push the gear uplock roller away from the latch to the unlocked position. If hydraulic system pressure is lost, the uplock mechanism is unlocked by moving a mechanical lever on the uplock.

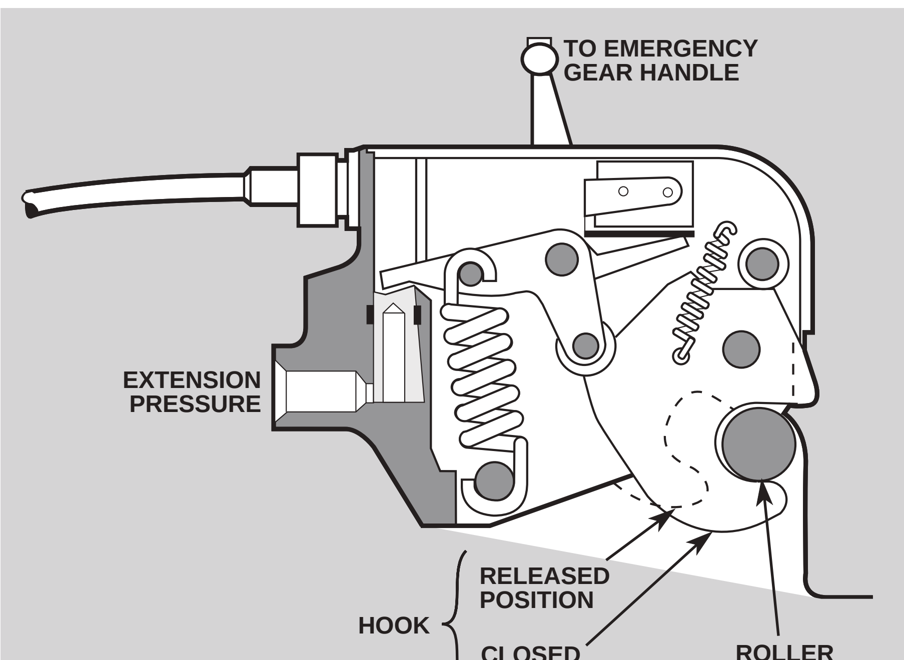
Main Gear Operation

The main landing gear is extended and retracted by two cylinder assemblies through the movement of the landing gear control handle on the forward instrument panel.

When the landing gear control is placed in the UP position, the landing gear selector solenoid is energized and main hydraulic pressure is applied to the gear up ports of the actuating cylinders to retract the main landing gear. The gear down ports of the actuating cylinders are connected to the hydraulic return line.

As the landing gear is driven to its upper limit, it actuates the link roller of the uplock mechanism and allows the rollers to latch the landing gear in the retracted position. The uplock arm actuates its uplock proximity switch on the uplock assembly, and the retraction sequence is ended. During landing gear retraction, the wheel brakes are automatically applied to stop wheel rotation.

When the landing gear handle is placed in DOWN, the landing gear selector solenoid valve opens and pressurizes the landing gear extension line. The uplatch boxes open and release the landing gear; the actuating cylinders control extension of the landing gear. Once the gear is fully down and locked, the solenoid remains energized



5I-4

to provide constant gear down line pressure. A claw type locking device in the gear actuator provides positive mechanical locking of the strut after engine shutdown.

Nose Gear

The nose gear installation consists of a nose gear assembly, a locking strut, an actuating cylinder assembly, a steering actuator assembly, a wheel assembly, a tire, and attaching hardware (**Figure 5I-6**). Other components include:

- piston assembly
- uplock roller
- doors
- proximity switch
- centering spring.

Nose Gear Doors and Shock Strut

Two doors enclose the nosewheel well when the landing gear assembly is retracted (**Figure 5I-5**). The doors are hinged to the aircraft structure and open to either side of the gear. The doors are mechanically actuated by movement of the gear and are attached by an adjustable linkage.

The doors open and close as the landing assembly is extended or retracted and are dependent upon the position of the landing gear strut. Actuation of the doors is accomplished by push rods and bellcranks linked to the outer body assembly and the aircraft structure.

Shock forces generated during landing and taxiing are cushioned with pneudraulics with the nose gear in the same manner as the main gear except that the nose gear shock strut is hinged by means of a trunnion supported by the shock strut in the nosewheel well.

Nose Gear Uplock

The nose gear uplock assembly is of the same construction and operation as the main gear uplock assembly except that it is smaller in size.

Nose Gear Centering

Springs within the nose gear centering device prevent the retraction of an off-center gear wheel assembly into the well. With nose gear extension after takeoff, the spring centers the lower strut and wheels and provides an inflight signal from a proximity switch. If centering does not occur, the landing gear does not retract.


5I-5

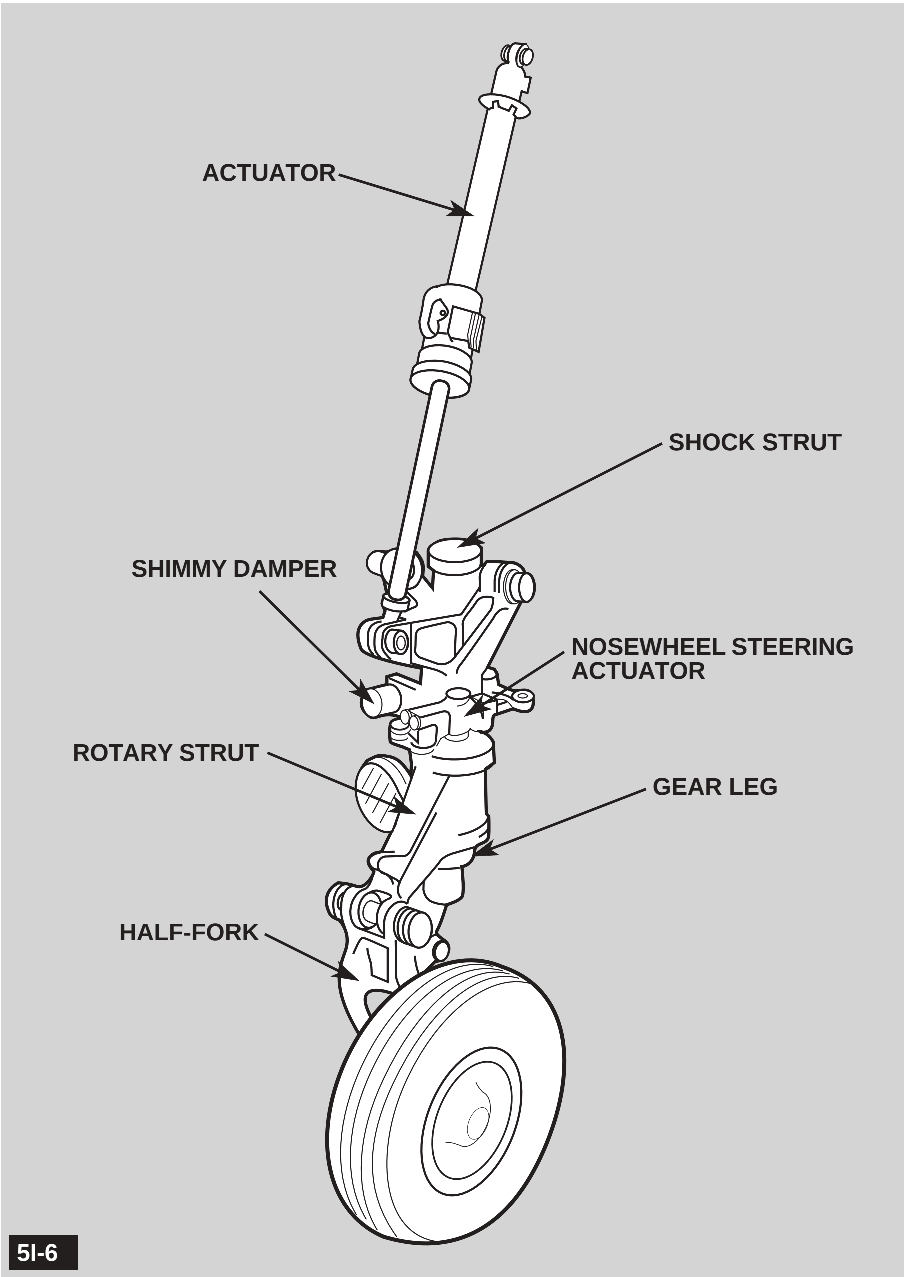
Nose Gear Operation

The nose landing gear is extended and retracted by a double-acting cylinder assembly similar to the main landing gear actuating cylinder assembly. In the retracted position, the nose landing gear assembly is latched by the uplock cylinder assembly in the wheel well. In the extended position, a telescoping locking strut mechanically locks the nose gear into position with a claw-type locking device.

When the landing gear control lever is placed in the DOWN position, hydraulic pressure is applied to the gear down port of the actuating cylinder and the gear up port is connected to the return line. The extension of the cylinder drives the landing gear to the down position, and the locking strut locks the gear in place.

When the landing gear control lever is placed in the UP position, hydraulic pressure is applied to the gear up port

NOTE: A red override button above the landing gear control lever allows overriding of the landing gear locking device. Its use is discouraged.



5I-6

of the nose gear actuating cylinder. The retraction of the cylinder drives the landing gear assembly to the fully retracted position. Gear retraction movement is slowed down by a one-way restrictor in the nose landing gear down line that restricts the return flow from the actuating cylinder.

During the last extension, hydraulic pressure unlocked the uplatch hook which is spring-loaded OPEN. This ensures the uplock accepts the gear uplock roller during retraction. The uplock roller on the nose gear joins the uplock hook, and the roller moves back into place to lock the gear in the UP position. The latch also actuates the uplock microswitch on the nose gear uplock assembly.

Landing Gear Control Lever

The gear control lever on the center instrument panel controls the landing gear (**Figure 5I-7**). The control lever electrically positions the gear selector solenoid valve to either retract or extend the gear. On the ground, a locking device holds the lever in the DOWN position to prevent inadvertent retraction. The landing gear electrical control circuit is powered from the Primary A bus. If the gear fails to retract, select gear down, verify that it is down and locked, and then return for landing.

Landing Gear Indication

The landing gear configuration lights above the landing gear control panel are powered by the B bus. Three lights and three arrows provide landing gear position information through the proximity switch on the mechanism that locks the actuating cylinders in the extended position.

In addition, a red light in the landing gear control handle blinks when at least one landing gear is not down and locked, either or both power levers are retarded, and the airspeed is lower than 190 knots. This light and the gear position indicator lights are tested together.

5I-7

5I-8

An aural warning sounds in either of the following conditions.

- If one or more gear is not down and locked when the power levers are retarded to idle and the airspeed is below 190 knots. This warning can be silenced by means of the horn-silence pushbutton.
- When one or more gear is not down and locked and the slat/flap control handle is selected past 30°. In this case, the gear control handle light does not blink; this warning cannot be silenced.

Illumination of the red gear panel lights indicates that the landing gear position does not agree with the selector handle. During extension or retraction, illumination of the red lights indicates that the gear is in operation. At the end of the sequence, the light extinguishes.

Illumination of the green lights for both main gear and the nose gear indicates that the associated gear is down and locked.

Emergency Operation

Emergency extension of the landing gear is accomplished through a mechanical emergency extension system; it requires neither hydraulic pressure nor electrical power to operate. The emergency gear extension handle connects to cables directly linked to all three uplock mechanisms and the landing gear control valve.

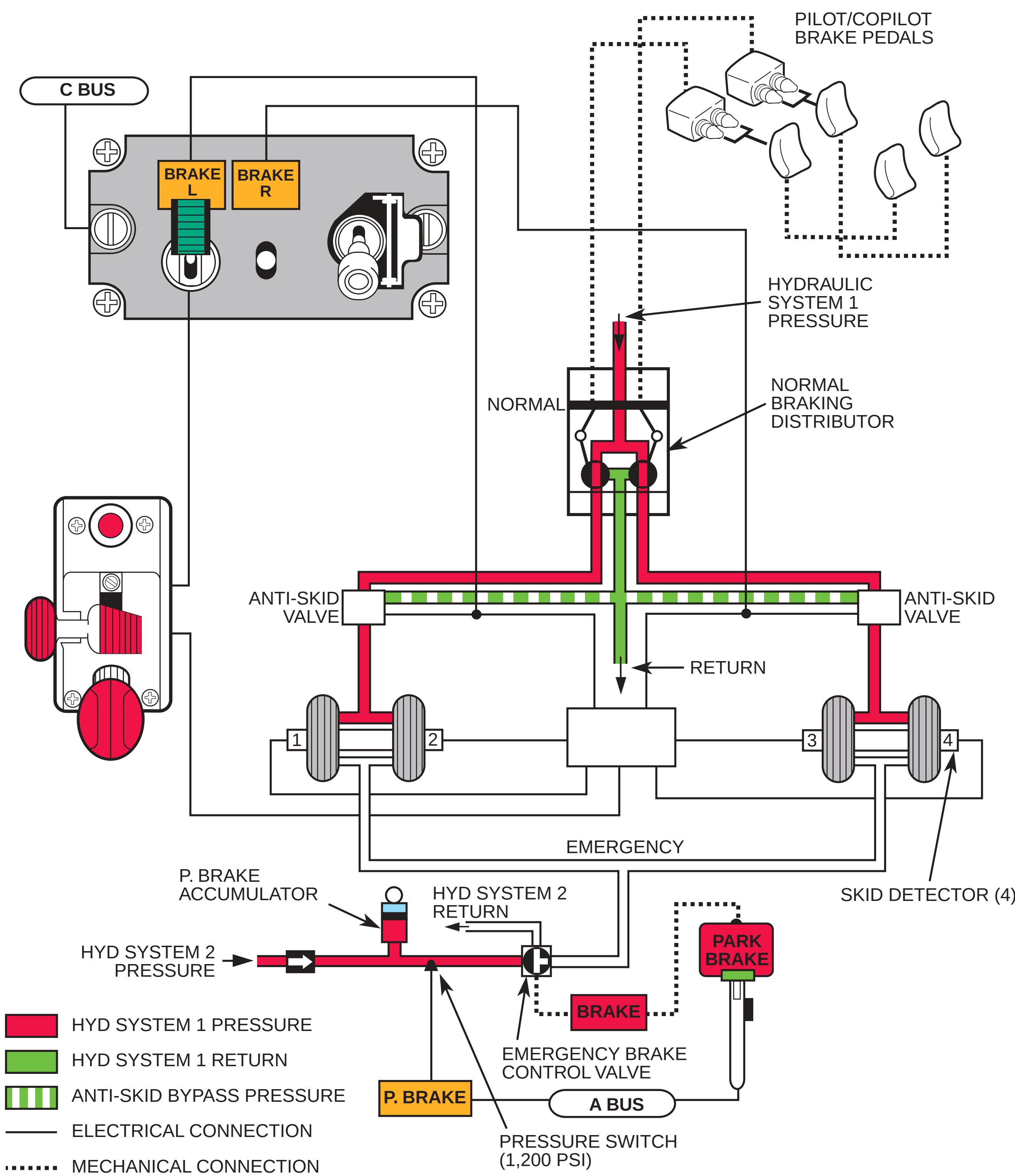
Emergency extension of the nose and main landing gear is accomplished by pulling the EMERG-L/G handle in a box aft of the center pedestal (**Figure 5I-8**). The gear then extends by gravity and is down-latched by the effect of its own weight and by aerodynamic forces acting on the gear. Placing the landing gear control lever in DOWN activates the anti-skid system and landing lights.

NOTE: In an emergency, sideslip may be required for extension of the main gear.

Brake System

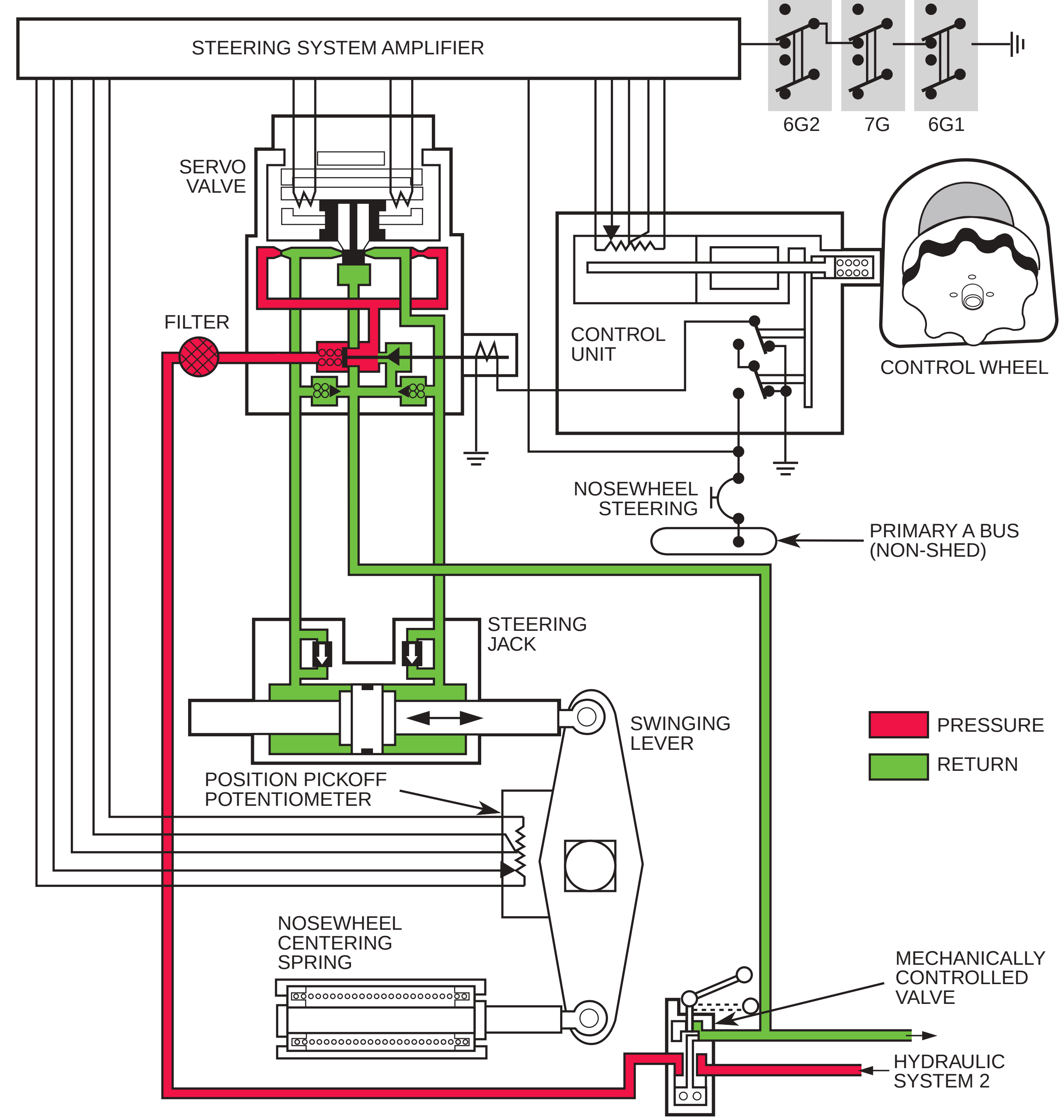
Nosewheel Steering System

Brake System



Nosewheel Steering System

STEERING WHEEL ROTATION	NOSEWHEEL STEERING
FROM 0 TO 60°	FROM 0 TO 6°
FROM 60 TO 120°	FROM 6 TO 55°



Brake System

The Falcon 10/100 is equipped with a multiple disc brake assembly on each of the four main wheels. Each assembly is independently actuated by the normal or the emergency braking systems and is controlled by the pilot or copilot brake pedals or emergency brake lever. Normal braking is progressive and differential. Inadvertent brake application is prevented by dead travel of the pedals.

An auxiliary system, supplied by landing gear retraction hydraulic pressure, causes the braking distributor to deliver pressure through Hydraulic System 1, thereby braking the wheels upon retraction.

The normal braking system, including the anti-skid system, is supplied by Hydraulic System 1 pressure. The maximum pressure available to the brakes with System 1 is 1,740 PSI.

Hydraulic System 2 provides pressure for the operation of the emergency braking system. This system, controlled by the PARK BRAKE lever on the left forward portion of the center pedestal, provides progressive but non-differential braking, and has no anti-skid protection. The intermediate position can apply regulated pressure to the brakes to produce drag without skidding for initial emergency braking at high speeds.

Lever positions aft of the intermediate detent provide progessively more braking. The full aft position provides maximum braking and locks the wheels in all conditions.

Components

Each brake assembly is hydraulically operated using Hydraulic System 1 or 2. The assembly is composed of a back plate subassembly, two rotating disks, one stationary disk, a pressure plate subassembly, brake holding plate, torque tube and two brake housings that each contain four pistons. Each brake assembly contains four normal pressure ports, four emergency pressure ports, and bleed screws.

Braking Distributor

A braking distributor transmits to the braking lines a pressure modulated by the compression of the brake pedal control push-rods. The control push-rods are actuated either by the pressure of the pedals or by the retraction pressure of the landing gear (automatic braking upon landing gear reaction). Hydraulic System 1 pressure is supplied to the distributor.

Brake System Operation

Hydraulic pressure forces the four pistons in a housing against the pressure plate to produce braking action. This in turn forces the disk stacks together to create a braking force between the rotating and stationary disks. When hydraulic pressure is released, the return assemblies pull the pressure plate and pistons to the off position to allow the disks to release and permit the wheel to rotate.

Parking/Emergency Brake

The parking brake system is used in two ways: to provide main wheel emergency braking and to provide main wheel braking when the aircraft is parked. Hydraulic System 2 provides pressure to the parking brake system through an accumulator. The accumulator provides pressure to operate the main wheel brakes with the parking brake handle when both hydraulic systems fail or when all engines are shut down.

The red PARK BRAKE handle on the center pedestal (**Figure 5I-9**) controls the parking brake. The handle has two detents; pulling it to the first stop locks the handle in the intermediate position and applies 550 PSI pressure to the brakes. The second detent is at the end of travel of the handle and supplies hydraulic pressure of 1,885 PSI for maximum braking.

Anti-Skid Brake System

The anti-skid system prevents wheels from locking by limiting the pressure applied to the brakes by the hydraulic system. Maximum braking efficiency is obtained when both wheels are in a slight skid or at maximum rate of deceleration short of skidding.

The system electronically controls two pressure control valves to continuously vary braking pressure in response to wheel rotation. There are separate anti-skid systems on the left and right main wheels; these are powered by the C bus. Each main wheel utilizes a tachometer generator for wheel speed information for the electronic control amplifier.

Servo Valves

The servo valves modulate braking pressure. The control amplifier creates a variable bypass pressure between braking pressure and return pressure by delivering electrical signals to the hydraulic distributor, which then signals the servo valves to modulate the braking pressure.

Control Box

The electronic control box separately controls the left and right servo valves. It develops commands from the signals provided by the tachometer generators relative to wheel speed. Wheel deceleration provides the skidding signal; at the beginning of a skid, the control box sends a signal to decrease braking pressure to both brakes on that gear and allow the wheel to accelerate.

Anti-Skid Operation

The anti-skid system provides fully modulated braking for the main wheels. The system consists of tachometer generators (one per wheel) and a signal receiving control amplifier. The amplifier interprets the electrical signals from the tachometer generators and sends corresponding signals to the servo valves, which hold or reduce brake pressure proportionally.

When the gear selector lever is in UP, the anti-skid system is deactivated. It is energized when the gear handle is down and the wheel speed sensors exceed 20 kts. The tachometer generator on each main wheel senses the beginning of a skid; through signals then provided to the servo valve on each main gear, braking is modulated to prevent main wheel skidding.

5I-9

5I-10


5I-11

The C bus supplies power to the electronic control amplifier through the anti-skid switch on the upper left of the center pedestal (**Figure 5I-10**).

A proximity switch on the nose landing gear provides a ground/flight signal to the control amplifier. When the control amplifier receives an inflight signal, it commands the servo valves to remain closed.

Nosewheel Steering

The lower nose gear strut can be hydraulically turned to steer the aircraft when taxiing. Steering is accomplished by action of the double actuating steering cylinder on the nose gear strut. Motion of the cylinder controls deflection of the wheel through the shock strut.

Steering can be operated only when the gear is extended. When the gear is retracted, steering is disabled and the wheel is centered for retraction. A quick uncoupling device is incorporated for towing. If the device is not disconnected for towing and the turning limits are exceeded, damage to the nosewheel steering occurs.

The electrically controlled and hydraulically operated nosewheel steering system receives electrical power from the A bus and hydraulic power from Hydraulic System 2. It consists of the following components:

- steering handwheel
- control potentiometer
- wheel position potentiometer
- control amplifier
- electro-distributor (solenoid valve)
- mechanically operated valve
- hydraulic servo system
- steering cylinder
- centering device.

The handwheel (**Figure 5I-11**) turns 120° left or right of center. The first 60° of handwheel movement in either direction results in 6° of nosewheel deflection. The subsequent 60° of handwheel deflection (full 120° travel) results in 55° of nosewheel deflection in the selected direction. The handwheel is depressed against a spring to initiate operation and, when released, returns to the up position.

A pair of potentiometers controls steering when the handwheel is pressed and rotated. The potentiometer on the control wheel senses the angular position of the steering wheel; the second potentiometer on the landing gear strut senses the deflection of the wheel assembly. The potentiometers provide inputs to a control amplifier.

The control amplifier compares the steering wheel position signal to the signal from the wheel assembly and delivers a signal to the servo valve to command the wheel to deflect according to the steering control commands.

Hydraulic System 2 pressure is initially supplied through an electrodistributor (solenoid) valve. The solenoid valve opens with:

- power from the A bus
- steering wheel pressed
- all gear actuators locked down.

Closing the solenoid valve ports hydraulic fluid to the return.

After leaving the solenoid valve, the hydraulic fluid enters the mechanical distributor that opens when the nose gear is downlocked. The distributor closes when the landing gear deflects 15° from the down-and-locked position and hydraulically disengages the steering system as the gear retracts. A rod on the shock strut controls this mechanical valve.

Hydraulic fluid from the mechanical valve next enters the hydraulic servo system. The servo system is on the nose landing gear strut next to the actuating cylinder and includes the steering servo valve. This two-stage valve converts electrical command signals from the control amplifier, through a torque motor and slider valve, to hydraulic pressures in the actuating cylinder. The servo system also includes an auxiliary system for hydraulic shimmy damping.

The steering cylinder, on the nose landing gear strut, is double-actuating. It contains a rack that engages a toothed gear integral to the shock absorber.

Nosewheel Steering Operation

When the aircraft is on the ground with A bus power and Hydraulic System 2 pressure available, the nosewheel steering system is armed for operation.

Holding the steering handwheel depressed and rotating it creates differential signals in the potentiometers that are sent to the control amplifier. Simultaneously, the electro-distributor opens to supply hydraulic fluid through the open mechanical valve to the hydraulic servo unit. The control amplifier commands the servo unit to hydraulically reposition the cylinder, thus turning the lower nose gear strut and wheel until the two potentiometers sense the same position. The nose wheel then holds the deflected position until the handwheel is again turned or released. If the handwheel is released, the nose gear wheel returns to center.

During takeoff when the steering handwheel is released, the electro-distributor closes and system hydraulic pressure is removed. Upon gear retraction, the mechanical valve closes, which also releases system pressure.

Servicing and Procedures

Preflight

During the exterior preflight inspection, accomplish the following checks of the landing gear and brake system (see Preflight chapter for details):

- Conduct visual inspection of nose gear assembly for fluid leaks, door condition and security, tire wear, nose gear wheel well condition, and tire pressure.
- Ensure the steering pin is installed and locked.
- Check main gear and doors for general security, fluid leaks, strut extension, brake condition, and main gear tire pressure.

During the cockpit preflight inspection, test the landing gear annunciators and aural warning with the landing gear TEST button on the landing gear control panel. Test the anti-skid annunciators with the same button.

Check that the landing gear control handle is down; check that three green “gear down” lights and no red lights are illuminated.

Anti-Skid Test

During taxiing and when clear of other aircraft, depress one brake pedal, then push and release the ANTI-SKID test button; observe that the brakes release and engage and that the anti-skid lights illuminate during release. Repeat for the other brake pedal.

Servicing

Inflation

Tire inflation should be accomplished according to the following:

- Nose Wheel – 94 PSI
- Main Gear Wheels –

  135 PSI (18,740 lbs GW)

  145 PSI (19,300 lbs GW)

Struts

The landing gear struts are filled with MIL-H-5606 hydraulic fluid and inflated with nitrogen. See Maintenance Manual for information on landing gear strut static extension and the following:

- Nose Strut – 1.48 to 2.56 IN
- Main Struts – 5.26 to 6.15 IN

Abnormal Procedures

The following is a brief discussion of various abnormal procedures for the landing gear systems. For a list of specific procedural steps, refer to the AFM or the SimuFlite Operating Handbook.

Landing Gear Does Not Extend

When all three green LOCKED DN lights fail to illuminate, hydraulic or electrical problems are interfering with gear extension. After ensuring that the control handle is correctly positioned in DOWN, that the CB is engaged, and the lights are operative, the landing gear can be extended using the following emergency gear extension procedure.

Pull the manual extension handle (in a box aft of the center pedestal) to mechanically unlock the gear. The gear units then extend by force of gravity and by aerodynamic forces. Once the gear is extended, verify their position by observing green lights on the landing gear panel and no gear handle light.

Abnormal Gear Retraction

If the landing gear fails to properly indicate UP after gear retraction on takeoff (gear handle UP), it is possible that ice or snow has accumulated on a proximity switch. If this is suspected, maintain speed below 190 KIAS and recycle the gear to shake or blow off the contaminants.

If the landing gear handle does not move up, it is possible that the nose gear did not center; therefore, retraction is not recommended. Return for landing.

Anti-Skid System Failure

If either of the ANTI-SKID lights fails to indicate properly during a test, or if the lights indicate a malfunction during brake application, ensure that the CBs are set and the ANTI SKID switch is ON. Use landing performance data adjusted for anti-skid off operations. Use caution when braking without anti-skid protection to prevent locking a wheel.

Low Parking Brake Accumulator Pressure

If the amber P BRAKE annunciator illuminates, parking brake accumulator pressure is less than 1,200 PSI. Under these conditions, the parking brake may not hold the aircraft in position. Hydraulic System 2 should be charged by starting or motoring the right engine. Chock the aircraft's wheels to prevent rolling before starting the right engine.

Brake System Failure

If the normal brake system fails, the No.2 (emergency) braking system, through the parking brake handle, can be used to stop the aircraft. During emergency braking, the anti-skid system is inoperative. Landing distance corrections must be determined with anti-skid system inoperative.

When using the parking brake handle, the first detent provides approximately 550 PSI to the brakes while the aft detent provides about 1,885 PSI. Use caution when pulling the handle aft of the first detent during landing since no anti-skid protection is available. Use the first detent for initial braking; when the aircraft has slowed sufficiently, increase braking by slowly moving the handle aft of the detent.

Landing Gear/Brakes/Steering Systems

Data Summaries

Landing Gear System

Power Source	A bus – gear selector and handle light B bus – position lights Hydraulic System 1 – landing gear actuators
Control	Landing gear selector Emergency gear T-handle Horn silence button Landing gear handle Override pushbutton (overrides ground down-lock device; its use is discouraged
Monitor	Hydraulic System 1 pressure/quantity gages HYD.1 annunciator Down-and-locked lights (3 green) LDG GEAR MOVING lights (3 red) Gear handle light (blinking red) Warning horn
Protection	Mechanically controlled emergency gear valve, Ground down-locking device Nose gear centering after takeoff Proximity (squat) switches

Proximity (Squat) Switches

Power Source	Primary A bus
Distribution	Nose gear switch Gear retraction protection Left main switch Airbrake warning Battery blower Gear retraction protection Freon condenser blower Pressurization controller Stall system 1 Thrust reversers Right main switch Conditioning valve Hydraulic standby pump STAB TRIM annunciator Stall system 2
Control	Automatic via extension/compression of three landing gear struts

Brakes/Nosewheel Steering System

CAUTION: Nosewheel steering control wheel deflection does not correspond to nosewheel deflections.

Power Source	A bus – nosewheel steering
	C bus – anti-skid
	Hydraulic System 1 – normal brakes
	Hydraulic System 2
	  Emergency brake
	  Park brake
	  Accumulator
	  Nosewheel steering

Control	Brake pedals
	PARK BRAKE lever
	  First detent – emergency brakes
	  Second detent – parking brake
	Anti-skid switch
	Anti-skid test button
	Nosewheel steering handwheel

Monitor	Hydraulic Systems 1/2 pressure/quantity gages
	Annunciators
	  HYD 1/2 (amber)
	  ANTI-SKID BRAKE L/R (amber)
	  BRAKE (red)
	  P. BRAKE (amber)

Protection	Steering prevention via gear-extend microswitches

Miscellaneous Systems

Chapter 5J

The Miscellaneous Systems chapter provides information in the following areas: Oxygen System, Thrust Reverser System, Emergency Equipment, and Warning System.

The Oxygen System provides supplementary oxygen for the crew and passengers.

The Thrust Reverser System provides additional deceleration force to assist braking.

The Emergency Equipment on the aircraft includes safety equipment, fire extinguishers, and life vests.

The Warning System provides warning of aircraft equipment malfunctions, indication of a condition requiring immediate attention, or indication that a system is operating.

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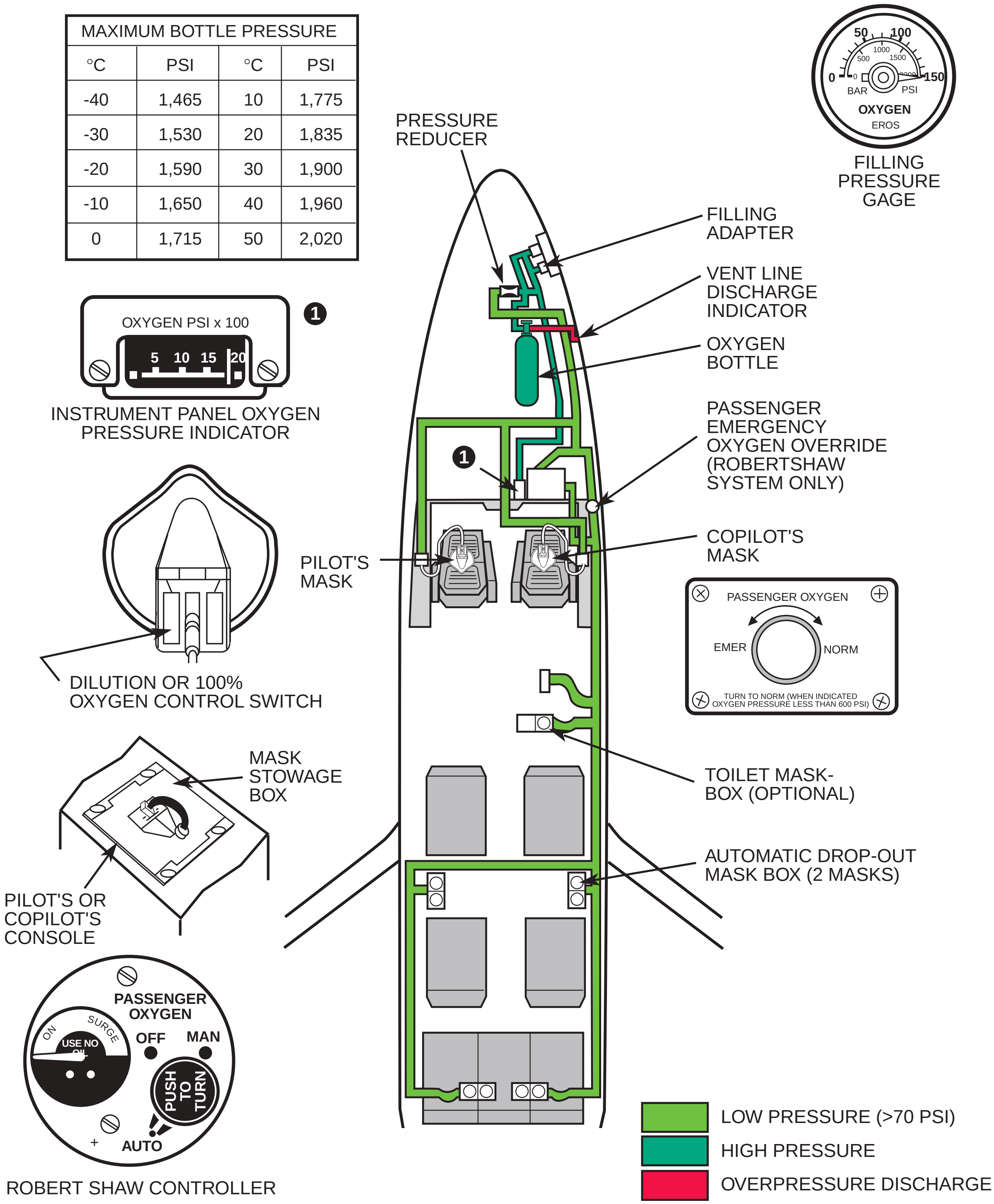
Oxygen System

MAXIMUM BOTTLE PRESSURE			
°C	PSI	°C	PSI
-40	1,465	10	1,775
-30	1,530	20	1,835
-20	1,590	30	1,900
-10	1,650	40	1,960
0	1,715	50	2,020



Oxygen System

Oxygen is available to the crew on demand anytime and is available to the passengers either manually through cockpit selection or automatically on cabin depressurization. The oxygen system meets requirements for oxygen during emergency descent due to pressurization loss or if smoke is in the cabin. The system permits oxygen to be used for therapeutic purposes.

Components

The oxygen system consists of:

- oxygen bottle
- brass filler valve/non-return valve
- servicing cap/filling pressure gage
- shutoff valve
- discharge indicator/ejection disc
- (HP) safety valve
- right instrument pressure gage
- reducer valve
- EROS masks/mask boxes
- passenger oxygen controller unit
- constant flow passenger masks
- therapeutic masks
- Robertshaw/EROS regulators.

Oxygen Bottle

A removable oxygen bottle on the right side of the nose cone (**Figure 5J-1**) supplies oxygen to the crew and passengers. The oxygen bottle has a capacity of 49.8 cubic feet with a normal operating pressure of 1,850 PSI at 21°C (70°F).

Two small holes in the oxygen bottle compartment provide moisture drainage and prevent pressurization by oxygen in the event of a leak. For servicing, an external access panel on the right side of the nose, forward of the bottle, provides access for inspection and shutoff valve operation.

Filling Adapter

Bottle servicing is accomplished through a brass filler valve (**Figure 5J-2**). The filler valve is fitted with a built-in non-return valve that ensures tightness of the oxygen bottle when the oxygen supply unit is disconnected. A servicing cap protects the filling adapter. A data plate adjacent to the filling adapter gives pressure vs. temperature information.

Filling Pressure Gage

Next to the filling adapter is a filling pressure gage that indicates bottle pressure when the high pressure shutoff valve is open. The pressure gage includes a circular dial with two ranges, the first being a white range with up to 2,176 PSI (150 bar) in 145 PSI (10 bar) graduations, and the second a green range in 500 PSI gradua-

5J-1

5J-2

tions to 2,200 PSI and expanded between 1,850 and 2,200 PSI.

Shutoff Valve

The oxygen bottle is fitted with a slow-opening shutoff valve which is normally in the open position and safety-wired; it is not accessible in flight.

Discharge Indicator

The discharge indicator (**Figure 5J-3**) has a green ejection disc connected to the high pressure (HP) safety valve on the oxygen bottle. When the safety valve cracks open for a thermal over-pressure exceeding 2,500 to 2,700 PSI, the disc is ejected when the pressure upstream of the indicator reaches 39 to 145 PSI.

Right Console Pressure Gage

A rectangular gage on the copilot's instrument panel (**Figure 5J-4**) is graduated from 0 to 2,000 PSI with two ranges: the red range (below 250 PSI) indicates a low oxygen content; the yellow range (above 2,000 PSI) indicates that the bottle is charged above the rated pressure.

A pressure of 1,850 PSI at 21°C (70°F) corresponds to 2,000 PSI at 118°F. This range is the maximum system pressure with the aircraft on the ground. Bottle pressure must therefore be checked and if necessary partially relieved to prevent the safety discharge disk from blowing out.

Pressure Reducer Valve

A 70 PSI piston-type HP reducer valve, fitted with a venturi device, between the oxygen bottle (HP) and the low pressure (LP) lines maintains constant pressure in the oxygen distribution system. The pressure reducer valve prevents high pressure within the bottle from reaching the crew or passenger masks.

Crew Masks

The crew system consists of two EROS masks inside the associated pilot/copilot mask boxes (**Figure 5J-5**) and the connecting lines from the pressure reducing valve. The mask boxes are on the left and right consoles.

Oxygen supply and mask microphone connections are in the bottom of the mask boxes. A portion of the face of the mask to protrudes from an opening in the mask box doors. Two red tabs allow the mask to be grasped and removed from the box while simultaneously inflating the harness for quick donning (**Figure 5J-6**).

5J-3

5J-4

After the mask is donned and the red tabs released, the inflated harness deflates. A miniature flow indicator in the mask oxygen line indicates a positive pressure with a green stripe.

A self-contained regulator on the face of the mask has a two-position selector control tab. When the control tab is pushed, the regulator supplies 100% oxygen on demand. When the control tab is pulled out (in the N position), the regulator supplies on demand oxygen mixed with cabin air proportional to the cabin altitude up to 30,000 ft, at which point either position provides 100% oxygen. Above approximately 33,000 ft, the regulator automatically provides pressure breathing of 100% oxygen. Oxygen consumption for flight above 41,000 ft is based on the control tabs being in the N position.

A red test button on the face of the mask allows a test of the pressure breathing feature. When it is pushed in, listen for oxygen flow hiss.

Oxygen is metered at 70 PSI to the crew at all altitudes. At higher altitudes, passenger oxygen is metered at 70 PSI. At lower altitudes, passenger oxygen is metered at 27.5 PSI.

Passenger Mask Box and Mask

A passenger mask box is above each seat position (**Figure 5J-7**); a magnetically latched cover normally conceals the box. When sufficient pressure is in the passenger oxygen distribution system, an actuator drives the cover clear of the box and releases an internal door to allow the mask to fall clear of the box. The lanyard attached to the mask must be pulled to make oxygen available at the mask. At high altitudes, oxygen is delivered at 70 PSI at 3.2 liters per minute. At low altitudes, oxygen is delivered at 27.5 PSI at 1.025 liters per minute.

Passenger Control and Distribution

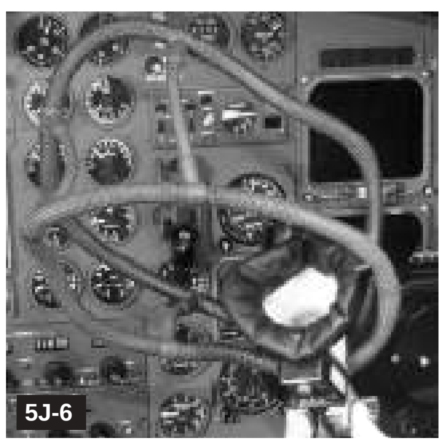
A typical installation of the oxygen control and distribution system is composed of:

- passenger oxygen controller unit
- seven constant flow passenger masks
- optional passenger mask with the retractable toilet
- optional therapeutic mask (EROS only).

Oxygen Limitation

When the aircraft altitude is above 41,000 ft, one pilot must wear his oxygen mask at all times.


5J-5


5J-6


5J-7

CAUTION: On **EROS regulators**, do not press the RESET button when the system is functioning because bleeding the control chamber immediately stops oxygen flow.

Oxygen Limitation

Above flight level 410, all passengers must wear an oxygen mask secured to the face, and connected to the oxygen system.

Passenger Oxygen Control Unit

The copilot controls oxygen delivery to the passenger masks through an oxygen controller on his instrument panel. With an oxygen pressure of 43 PSI or greater, the latch opens the internal door and the passenger masks fall, forcing the magnetic door to open.

Two brands of controllers are used for the Falcon 10/100: a Robertshaw or an EROS. Both deliver oxygen to the passenger masks, but pressures and flow rates differ slightly.

Robertshaw Regulator

Robertshaw type regulators (**Figure 5J-8**) are equipped with a mode select lever labeled AUTO/OFF/MANUAL and a pressure indicator, labeled SURGE SYSTEM ON.

Regulator function is based upon the cabin altitude of 10,700 ft and mode lever position. With the lever in AUTO, the mask boxes open and oxygen is delivered at a pressure depending upon cabin altitude (the pressure may range from 8 PSIG to 42 PSIG). With the lever in MAN, the masks deploy and the oxygen is delivered regardless of cabin altitude. Pressure schedule remains in effect.

EROS

EROS regulators have a four position mode lever labeled NORMAL/ OVERRIDE/FIRST AID/CLOSED and an ARMED and SUPPLY indicator. Operation/indications from the lever and indications are listed in **Table 5J-A**.

The RESET button enables the automatic circuit to be reset if the pressure sensitive valve is functioning (control switch on NORMAL). After any 70 PSI operation following a cabin depressurization, set the control switch to NORMAL and press the RESET button.

Delivery pressure is either 72.5 PSI above 18,000 ft cabin altitude or 27.5 PSI below 18,000 ft. The use of two pressure schedules and mechanical indicators enhances the simplicity and effectiveness of regulator operation.

Therapeutic Masks

On aircraft with the EROS system, a therapeutic mask and outlet are in the coat rack. The therapeutic mask may be connected to the therapeutic outlet without opening any doors or releasing any latches. When the controller selector is in FIRST AID, oxygen flows from the therapeutic mask at reduced pressure (27.5 PSI).

5J-8

Preflight

The high pressure valve is slowly opened (5 to 10 seconds) or checked open during preflight. Perform the complete test of the crew and passenger oxygen systems before the first flight of the day and the short test for subsequent flights.

Complete Test

Crew

Before the first flight of the day, perform the following procedures.

- Remove the crew masks from their boxes and don.
- Breathe oxygen with the regulator in N.
- Select 100%, then press the test button to provide a mask pressure of approximately 70 PSI above barometric.
- If pressure read by the gage drops abruptly during the test, check that the oxygen system shutoff valve is open, if closed, the oxygen consumed during the test comes from the high pressure circuit, which is soon emptied.
- Check the microphone; select MASK and C'PIT.
- Set the regulator to 100%.

Passenger

- Check that the passenger oxygen controller is in NORMAL or AUTO.
- Check the ARMED and SUPPLY indicators; if the ARMED indicator is visible, press the RESET button to black it out.

Short Test

Perform the procedures listed below to test the crew masks in their boxes.

- Switch the audio control panel to MASK and C'PIT and briefly press the red TEST button on the mask. Oxygen flow in the mask causes a hissing noise that can be heard in the headset or cockpit speakers.
- Check regulator is in 100%.

To avoid passenger mask deployment, do not perform a test of the passenger oxygen system prior to takeoff. When cabin altitude has decreased to less than 10,000 after takeoff, move the passenger oxygen selector to normal (counter-clockwise).

High Altitude Airports

Before landing on an airfield at an altitude of approximately 10,000 ft or higher, move the controller to CLOSED prior to decompressing the cabin to prevent automatic drop of the masks.

CAUTION: The bottle shutoff valve must always be opened very progressively (in at least 5 to 10 seconds).

WARNING: Personnel should always remember: Oxygen + Hydro carbons = Explosion.

MODE	Operation
CLOSED	Passenger supply is shut off.
OVERRIDE	Delivery circuit overrides NORMAL to supply masks.
NORMAL	Delivery circuit functions as a result of cabin decompression (over 10,700 ft). Masks deploy and oxygen is supplied automatically.
ARMED Indicator	Opens to show passenger masks are receiving oxygen.
SUPPLY Indicator	Opens to show passenger masks are receiving oxygen.
FIRST AID	Delivery circuit provides oxygen to the therapeutic masks if used; normal function for cabin remains active.

Table 5J-A; EROS Operation/Indications

WARNING: During oxygen filling, no one should be inside aircraft. Oxygen filling is to be performed in a well ventilated area. Aircraft-installed oxygen bottle shutoff valve should be opened slowly. Make sure that aircraft is ground-connected, aircraft power system is de-energized, and no refueling or defueling is under way.

CAUTION: Rated oxygen bottle pressurization depends on temperature. Refer to the Oxygen Cylinder Pressure as a Function of Temperature chart in the Maintenance Manual before refilling oxygen; the safety valve rupture disk will burst if pressure reaches range of 2,553 to 2,698 PSI.

WARNING: Filling valve cap must be closed properly to ensure tightness.

CAUTION: Excessive movement of oxygen controller may cause wear and leaks.

CAUTION: Do not use the RESET pushbutton in flight when oxygen system is operating. To stop the flow of oxygen: position the passenger oxygen selector to the CLOSED position.

Servicing

Certain safety precautions must be taken when servicing the oxygen system. No greasy substances should be in the vicinity. Check that the filling valve is clean. Set the oxygen bottle cart about 7 ft (2 meters) from aircraft oxygen filling valve.

The high pressure valve and the ground cart valve must be actuated slowly. Filling pressure is monitored with pressure gages. Pressure corrections for temperature must be taken into account and can be read on the placard on the oxygen bottle access door.

Unscrew the filling valve cap and connect the filling line and adapter to the filling valve. Slowly open the shutoff valve on the oxygen bottle on the cart. Then slowly open the shutoff valves on the oxygen bottles. Gradually increase bottle pressure by turning the pressure adjustment screw of the pressure reducing valve on the cart. Check and compare data given by the oxygen pressure indicator on the instrument panel (copilot side) and HP oxygen bottle pressure gage. Rated aircraft oxygen bottle pressurization is 1,850 PSI (127 bar) at 70°F (21°C).

When rated pressurization is reached, close the shutoff valve and oxygen cart bottle shutoff valves. Disconnect the oxygen filling line and replace the cap on the filling valve. Use a leak detector fluid to ensure there are no leaks. Close the access doors.

To comply with regulations for sufficient oxygen in case of cabin fire, a minimum pressure of 965 PSI is required to dispatch a flight below and above 10,000 ft MSL. For flights above 41,000 ft MSL, a chart or table is provided for minimum pressure in the system for dispatch.

Abnormal Procedures

The following section provides brief discussion of what happens to the oxygen system during abnormal conditions. For a list of specific procedural steps in abnormal conditions, please refer to your SimuFlite Operating Handbook.

Masks Do Not Drop Automatically

Position the passenger oxygen selector to OVERRIDE or MANUAL to override NORMAL/AUTO and deploy the passenger masks. After the passenger masks are deployed, ensure passengers don and check the masks for proper operation. Position the passenger oxygen selector to FIRST AID to deliver oxygen to the therapeutic outlet and to maintain normal delivery of oxygen to the cabin passenger masks.

With the Robertshaw system, oxygen does not flow if the cabin altitude is below approximately 10,000 ft unless the bypass valve on the copilot's side panel is opened (**Figure 5J-9**).

The AUTO/OFF/MANUAL selector selects passenger mask drop mode and a flow rate dependent on altitude. Open the bypass valve on the copilot's side panel to ensure maximum flow rate.

Air Conditioning Smoke/ Electrical Smoke

The initial steps for all procedures dealing with smoke start by neutralizing the life threatening situation. The crew dons oxygen masks and selects 100% to breathe 100% oxygen. The pilots then select MASK and C'PIT on the audio panel to ensure communication. With MASK and C'PIT selected, the microphone in the oxygen mask is activated to a hot interphone system; the hot interphone is heard over the speaker (if it is selected) or over the headset.

If there are no flames in the cabin, the passenger oxygen masks are deployed by selecting MANUAL or OVERRIDE on the oxygen control unit. This action directs 8 to 42 PSI (Robertshaw) or 28 to 72 PSI (EROS) to the passenger oxygen system for mask deployment and a maximum flow of up to 9.0 liters per minute. To ensure maximum flow, open the bypass on the copilot's side panel.

CAUTION: Oxygen must not be used when there are flames in the cabin or cockpit.

5J-9

Oxygen System

Power Source	Oxygen cylinder (1,850 PSI at 70°F)
Distribution	Crew/passenger oxygen masks Passenger oxygen system Therapeutic oxygen mask (EROS)
Control	Oxygen cylinder shutoff valve Crew masks (N/100% PUSH) Passenger oxygen control unit AUTO/OFF/MANUAL (Robertshaw) NORMAL/OVERRIDE/FIRST AID/CLOSED (EROS)
Monitor	Bottle pressure gage Cockpit oxygen pressure gage Bottle safety discharge disc
Protection	Bottle safety valve (2,500 to 2,700 PSI)

Data Summary

WARNING: During oxygen filling, no one should be inside aircraft. Perform oxygen filling in a well-ventilated area. Open bottle shutoff valve slowly, taking at least 5 to 10 seconds. Valve cap must be closed properly to ensure tightness. Ensure aircraft is ground-connected, aircraft power system is de-energized, and no refueling or defueling is underway.

WARNING: Oxygen contact with hydrocarbons causes an explosion.

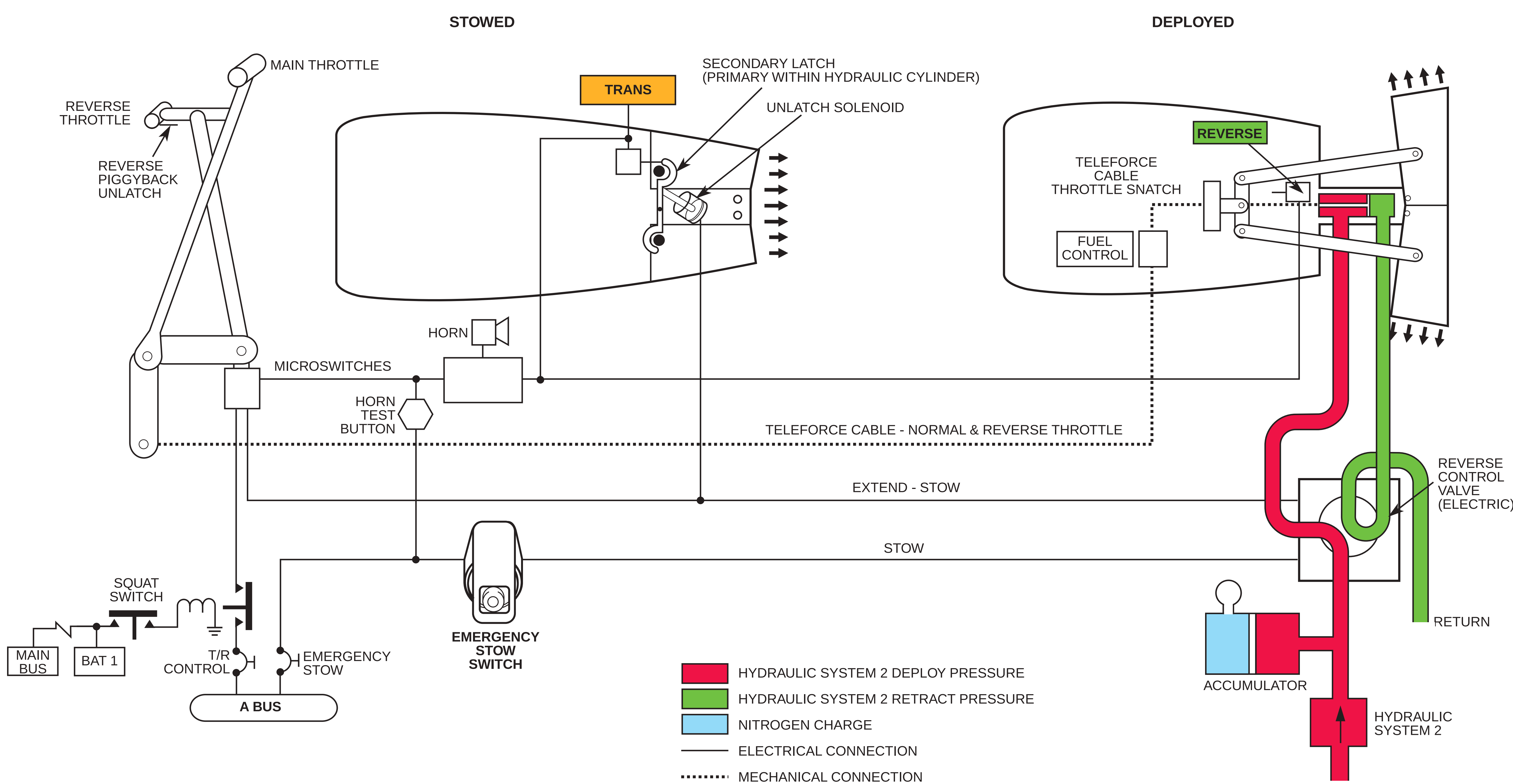
CAUTION: Excessive movement of oxygen controller may cause wear and leaks.

CAUTION: On EROS controller, do not use the RESET pushbutton in flight when oxygen system is operating. To stop the flow of oxygen, position the selector to the CLOSED position.

CAUTION: Rated oxygen bottle pressurization depends on temperature. Refer to the Oxygen Cylinder Pressure as A Function of Temperature Chart in the Maintenance Manual before refilling oxygen. The safety valve rupture disk can burst if pressure reaches range of 2,553 to 2,698 PSI.

Thrust Reverser System

Thrust Reverser System



Thrust Reverser System

Many Falcon 10/100 aircraft have been equipped with the Grumman Aerospace conventional target-type design thrust reverser system (**Figure 5J-10**). The system is electrically controlled and hydraulically actuated. It provides effective braking force and can be used instead of brakes on longer runways. Since the reverser is quite loud in the cabin at higher power settings, full reverser power is rarely used.

The thrust reverser doors replace the aft cowling on the nacelle and form the upper and lower skins of the aft cowl when stowed. The doors open using Hydraulic System 2 pressure. The doors direct engine exhaust up, down, and forward.

Components

The thrust reverser system is composed of:

- thrust reverser levers
- reverser power levers
- SQUAT switch
- control valve and hydraulic actuator
- stowing latch and secondary latch solenoid
- warning horn
- hydraulic accumulator with pressure gage
- microswitches
- throttle snatch cable
- teleforce cable.

Thrust Reverser Levers

Thrust reverser levers (piggyback levers) on the engine power levers (**Figure 5J-11**) control the operation of the thrust reverser system. The thrust reverser release latches are below the thrust reverser levers.

The thrust reversers are enabled only when the main power levers are at idle. Lifting the latch and moving the levers up about 1/2 inch contacts a microswitch. If the left hand main squat switch is closed, power is routed to the deploy side of the reverser control valve. After the reverser is deployed, the power lever can be moved further aft to increase engine RPM and reverse thrust.

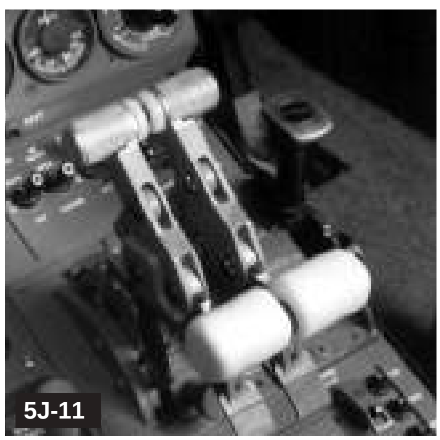
Hydraulic Actuator

A hydraulic actuator provides motion to the doors and contains the primary stowing latch. Deploy hydraulic pressure is required to unlatch, as well as extend the doors.

Thrust Reverser Limitation

Use of the thrust reversers is limited to ground operations only and may only be used for 60 seconds total within a 30 minute period. Using thrust reversers to back up is not permitted. Power must be retarded to idle at speeds lower than 60 knots. The power lever retarder must be operative.

5J-10



5J-11

> **CAUTION**: Do not move the thrust reverser levers beyond reverse idle until the REV light illuminates. If the horn sounds, do not add reverse thrust.

Secondary Latch Solenoid

As a backup to the hydraulic actuator, a solenoid-controlled latch is in each reverser; the latch consists of a hook to hold the doors closed and an electric solenoid that is energized to remove the hook. Unless the thrust reverser lever is in REVERSE and the reverser door is fully deployed, the amber TRANS light illuminates when this hook is not latched.

Indicating and Warning System

The thrust reverser indicator panel on the instrument panel includes an amber TRANS advisory light and green REV advisory light (**Figure 5J-12**). The TRANS light illuminates when the doors are unlocked but not fully deployed, and the green REV advisory light illuminates when the doors are fully deployed. The thrust reverser HORN TEST button next to the thrust reverser indicator panel powers the horn directly to verify operation.

Warning Horn

A non-silenceable independent warning horn in the thrust reverser system sounds whenever there is disagreement between power lever position and thrust reverser door position; the horn sounds if the main power levers are forward and the doors are deployed or if the thrust reverser levers are in the reverse power range with the doors stowed.

Accumulator and Control Valve

Hydraulic System 2 provides hydraulic pressure for thrust reverser actuation. The thrust reverser accumulator (part of Hydraulic System 2) in the aft compartment is fitted with a pressure gage and charged with nitrogen (1,200 PSI when hydraulic pressure is zero). The accumulator allows emergency stowage of the reverser doors if the Hydraulic System 2 pressure is not available. The reverser control valve is electrically controlled by microswitches in the power lever quadrant.

Operations

Deployment

Thrust reverser deployment requires the aircraft to be on the ground upon landing or before V_1 for an acceleration stop. Power levers must be set to idle. A mechanical latching system prevents operation of the thrust reverser when these conditions are not satisfied. To operate thrust reverser, move the main power levers to idle. Grasp reverse thrust power levers and the release latches and lift the latches to allow the reverser levers to be moved

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aft. The first 1/2 inch of travel contacts microswitches that deploy the reverser doors. Further aft movement of reverse power levers increases engine RPM and reverser thrust.

Stowage

The thrust reversers are stowed by moving the thrust reverser levers to the idle reverse position and lifting the latches to permit restow of the power levers and reverser doors.

Throttle Snatch

An automatic power lever retarding device, or throttle snatch, returns either main power lever or reverser lever to idle if the reverser doors move to the wrong position. If the main power lever is in forward thrust position and a door opens, the power lever moves to idle. If the reverser lever is in the reverse position and the doors close, the reverser lever moves to idle. Both are accomplished mechanically by a teleforce cable that connects the door and the power lever quadrant.

Emergency Stow Switches

The guarded red EMERGENCY STOW switches on the thrust reverser indicator panel bypass the power levers quadrant controls and normal thrust reverser control system to apply electrical power directly to the stow side of the reverser control valve and hydraulic pressure directly to the actuator to stow the respective thrust reverser.

An independent source of power is provided for these switches through separate circuit breakers on later thrust reverser systems or systems modified with **GAC F10 TR 78-019**.

Reverser Operating Characteristics

The aircraft weathercocks away from a crosswind on a slippery runway. The thrust reverser causes a noticeable pitch-up tendency when deployed. It is possible to scrape the tail and reversers on the runway if nose-down pressure is not applied.

Preflight

For a list of specific preflight procedural steps, refer to the SimuFlite Operating Handbook.

During the exterior inspection, check the general condition of the thrust reverser doors. Verify that the doors are fully stowed. Check for hydraulic leaks.

Emergency Procedures

For a list of specific emergency procedural steps, refer to the SimuFlite Operating Handbook.

Inadvertent Thrust Reverser Deployment During Takeoff

Take immediate action after V_1 to control the aircraft by positioning the nose full nose-down to counter the pitch-up tendency. Control roll and yaw. Activate the EMER STOW switch. If the thrust reverser stows, leave the emergency stow switch in EMER STOW and land. If the thrust reverser does not stow, leave emergency stow switch in EMER STOW and land as soon as possible.

Thrust Reverser Operational Limitations

Do not exceed: 60 seconds of continuous or accumulated operation within a 30 minute period; 87% N_1 for speeds exceeding 60 KIAS at idle; 40% N_1 for speeds below 60 KIAS; 50% N_1 for ground checks of the automatic power lever retarder.

Flight with the automatic power lever retarder inoperative is only authorized with the thrust reversers stowed and bolted.

Thrust Reverser Asymmetrical Operation Limitation

Use of the thrust reverser on one engine only is authorized on dry runways with the nosewheel steering system available. In this case, observe the same limitations and operational recommendations, with one control lever, as for normal use of the thrust reversers.

At higher gross weights with slats and flaps at 15°, it may not be possible to maintain level flight with the engine operating at idle reverse thrust.

Thrust Reverser Deployment – Climb or Cruise

During inflight deployment, the automatic power lever retarder on the respective lever automatically retards the affected lever to idle. The aircraft takes a nose-up attitude with possible wing roll, abnormal buffeting, and vibrations. Immediate action must be taken to control the rolling and yawing. Set the emergency stow switch to EMER STOW. Maintain airspeed below 190 KIAS, and ensure the affected engine is set to idle. If the thrust reverser stows, leave the emergency stow switch in EMER STOW and maintain engine thrust as required. Land as soon as possible.

If the thrust reverser does not stow, leave the emergency stow switch in EMER STOW and land as soon as possible. Shutdown of the affected engine is optional, but idle reverse decreases aircraft performance.

To silence the warning horn, pull the thrust reverser system L and R IND 5 CBs. This also deactivates the thrust reverser indicator lights. Do not use reverse thrust for landing under this condition.

Follow the procedures for approach and landing with one engine operative, with the following differences:

- V_{REF} – adjust + 20 KTS
- slats and flaps 15°
- delay landing gear extension until final approach
- when landing is assured, set slats and flaps 30°.

Data Summary

Thrust Reversers

Power Source	Hydraulic System 2 pressure **Aircraft without SB 0154** A bus (28V DC) No. 1 battery **Aircraft with SB 0154** A bus Main bus
Control	No. 1 battery switch (**aircraft without SB 0154**) HORN TEST button EMERGENCY STOW switch Main throttle lever Thrust reverser throttle lever
Monitor	Reverser warning horn Reverser TRANS/REV lights Hydraulic System 2 pressure gage Battery voltmeter (Main bus voltage)
Protection	Secondary latch Left main squat switch Throttle auto retard (Snatch) Reverser maximum RPM limit stop

Emergency Equipment

Emergency equipment on the aircraft includes safety equipment, fire extinguisher (see Fire Protection chapter), and life vests.

Safety Equipment

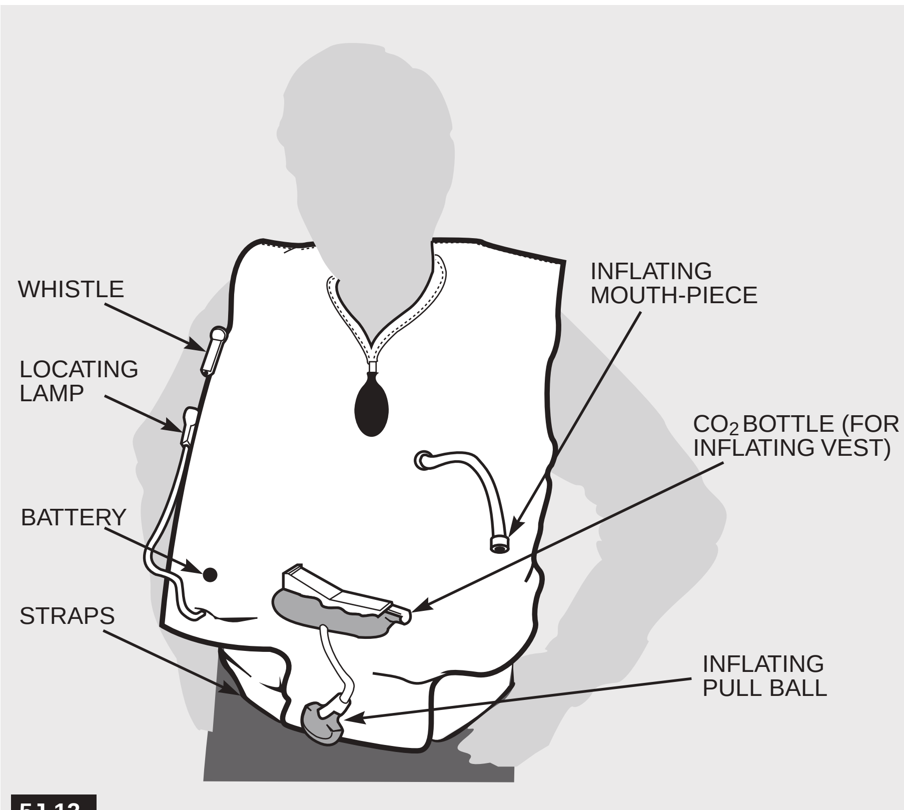
The following items of safety equipment are standard:

- axe (most aircraft)
- first-aid kit
- three pairs of smoke goggles in cockpit.

Overwater Equipment

A life vest (**Figure 5J-13**) is stored under each seat in the cabin. Pilot and copilot life vests are under each seat.

To make passenger evacuation through emergency exits easier, survival cords are included in the emergency equipment. They are stowed in the closet behind the copilot's seat. The cords are attached to the seat rails, then stretched to the wing leading edges where they can be attached to the anchor point.



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Warning Systems

Visual Warning Systems

The Failure Warning Panel alerts the crew of a configuration or operation malfunction in a system. Early aircraft were equipped with a 23-annunciator panel (22 amber, 1 red) and three other red annunciators on the instrument panel. The annunciators on later aircraft consist of 26 or 28 individual annunciators (24 amber, 4 red), each is illuminated by two bulbs. Engraved markings allow the corresponding system to be identified. For a list of annunciators, see end of chapter.

The Failure Warning Panel is equipped with a TEST pushbutton; when pressed all of the annunciators on the failure warning panel illuminate.

The T/O CONFIG warning is not directly testable. To check its operation, it is necessary to reproduce the conditions required for T/O CONFIG light illumination.

Altitude Alerter

The altitude alerter (**Figure 5J-14**) provides the pilot with visual and aural warnings when the aircraft deviates from a preselected altitude. The alerter is equipped with a warning light, an aural warning output, and a window in which altitude is set by means of a control knob.

The alerter receives corrected altitude information from the pilot's altimeter. When the aircraft comes within 1,000 ft of the indicator setting, the aural warning sounds for about one second and the warning light illuminates. The light extinguishes when the aircraft comes within 300 ft of the setting and remains off so long as the aircraft stays within 300 ft of the setting.

As soon as this tolerance is exceeded, the aural warning is heard for about one second and the warning light illuminates. The ALT ALERT light can be turned off at any time by pressing the light itself or by making a new altitude setting.

Aural Warning System

Components

The audio warning system consists of the following:

- buzzer unit
- loudspeaker/headsets
- potentiometer
- test pushbutton/horn silence button.

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Operation

The audio warning system alerts the crew to configuration anomalies or indicates certain operational conditions. The audio warnings are produced by an audio warning buzzer unit forward of the pedestal console. The audio warning buzzer unit receives failure information from the different systems and sends out discrete audio signals that correspond to the different type of failures. These discrete signals are transmitted to the crew through loudspeakers in the aircraft and through the crew's headsets. The audio warning system includes three potentiometers: one adjusts the audio warning unit loudspeaker output; one adjusts the pilot's headset audio output; and one adjusts the copilot's headset audio output. The HORN SILENCE pushbutton cannot silence the audio warning.

Horn Silence Cutoff Pushbutton

In a number of cases, the aural warning sound can be cancelled with the HORN SILENCE cutoff switch on the flight compartment control pedestal (**Figure 5J-15**).

Landing Gear Warning

The landing gear warning is a continuous, 285 Hz, low pitch sound while the landing control handle flashes red. The horn sounds when both of the following occur:

- airspeed lower than 190 kts
- either 1) one or more power levers in the reduced power position with the landing gear control handle in the up position, or 2) the landing gear control handle in the down position with one or more gear not downlocked.

Press the HORN SILENCE pushbutton to silence the audio warning. However, with the same conditions as above, and with flaps 52°, the HORN SILENCE pushbutton cannot silence the audio warning.

Cabin Pressure Warning

The cabin pressure warning is an intermittent, 250 Hz, low pitched sound that sounds for 600 msec, then is silent for 200 msec; the red CABIN annunciator on the Failure Warning Panel also illuminates.

The warning indicates the cabin altmeter reading is higher than 10,000 ft. The HORN SILENCE pushbutton can silence the audio warning.

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Fire Warning

The fire warning is a continuous, sharp, 500 to 550 Hz alternated sound that cycles on and off in 150 msec cycles with illumination of at least one FIRE light on the fuel shutoff handle when fire is detected.

The HORN SILENCE pushbutton can silence the audio warning.

Stall Warning

The stall warning is a fast, intermittent, sharp 1660 Hz (BIP-BIP) sound that is on for 100 msec and then off for 100 msec. There is simultaneous illumination of the two IGN lights and green slat light.

This warning is triggered by slats not extended and the left local AOA greater than 17° (which corresponds to an aircraft AOA greater than 11°) or the right local AOA greater than 19° (which corresponds to an aircraft AOA greater than 12°).

With the slats extended, warnings are activated when the left or right local AOA greater than 27° (which corresponds to an aircraft AOA greater than 17°). The HORN SILENCE pushbutton cannot silence the audio warning.

V_{MO}/M_{MO} Warning

The V_{MO}/M_{MO} warning is a continuous, sharp variable sound (modulated signal) between 660/3,330 Hz for 1 second. Both Mach-airspeed indicator readings are above the V_{MO}/M_{MO} red line and on the EADI (if installed). This situation is caused when the V_{MO}/M_{MO} limits are exceeded and the IAS is higher than 350 kts at sea level to 10,000 ft or 370 kts at 10,000 ft (indicated MACH higher than 0.87 at altitudes greater than 25,000 feet).

Altitude Deviation Warning

The altitude deviation warning is a sharp, continuous sound when flying through the preselected altitude. The two second warning occurs when the aircraft comes within 1,000 ft of the preselected altitude; the light on the indicator illuminates.

Once the preset altitude is reached, the audio warning sounds for two seconds; the light illuminate when the airplane deviates from the preselected altitude by more than 300 ft. The HORN SILENCE pushbutton cannot silence the audio warning.

Horizontal Stablizer Warning

The horizontal stablizer warning is a continuous rattle sound (clacker) in 12.5 Hz pulses to indicate the horizontal stabilizer actuator is moving. The warning sounds when the horizontal stabilizer moves in both normal and emergency operation.

Test

The audio warnings for the flaps and landing gear are tested by depressing the LANDING GEAR INDICATOR TEST pushbutton (**Figure 5J-16**); such action activates the audio warning and causes the landing gear control handle to flash red.

The audio warnings for the pedestal console (**Figure 5J-17**) are tested by pressing the appropriate pushbuttons.

Pressing the V_{MO}/M_{MO} pushbutton performs an operational test of the audio warning by air data computer; a continuous variable frequency sound is issued.

Pressing the CAB pushbutton activates the audio warning; the CABIN light on the overhead panel illuminates. Silence the warning with HORN SIL pushbutton).

Pressing the Stall 1 or 2 pushbuttons activates the audio warning; the IGN lights on the overhead panel illuminate.

The audio warnings for the fire panel are tested by pressing the appropriate TEST pushbutton to activate the fire audio warning (**Figure 5J-18**). All the red lights in the fire pull handle illuminate if the detection systems are operative. Silence the warning with the HORN SILENCE pushbutton.

Voice Advisory System

The FPA-80 flight profile advisory system is a solid-state aural advisory and warning system. The FPA-80 is completely automatic and requires no controls or visual displays. All advisory and warning information is conveyed to the pilot with a natural sounding voice. The FPA-80 flight profile advisory CPN 622-4730-001 uses a male voice; the FPA-80 CPN 622-4730-002 uses a female voice.

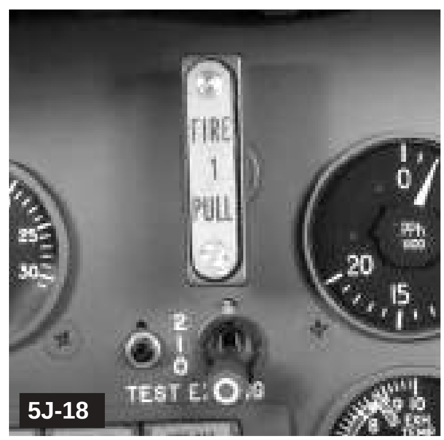
The FPA-80 is used with a radio altimeter system such as the Collins ALT-50/55 or equivalent, with an ARINC radio altimeter system such as the Collins AL-101, or any other system with ARINC analog output.

One of the main functions of the FPA-80 is to announce radio altitude and decision height. The FPA-80 informs the pilot when the aircraft enters the operating range of the radio altimeter system. At 1,000 ft and continuing to 100 ft, radio altitude is announced in 100 ft intervals. Decision height is announced when the aircraft reaches the selected altitude.

A second function of the FPA-80 is to announce messages of a warning or advisory nature. Such messages are repeated three times. Messages are included for glideslope and localizer deviations, trim failure, attitude and barometric altitude deviations, and landing gear.

Vocabulary

The FPA-80 callouts and conditions that cause an advisory are listed in **Table 5J-B**.



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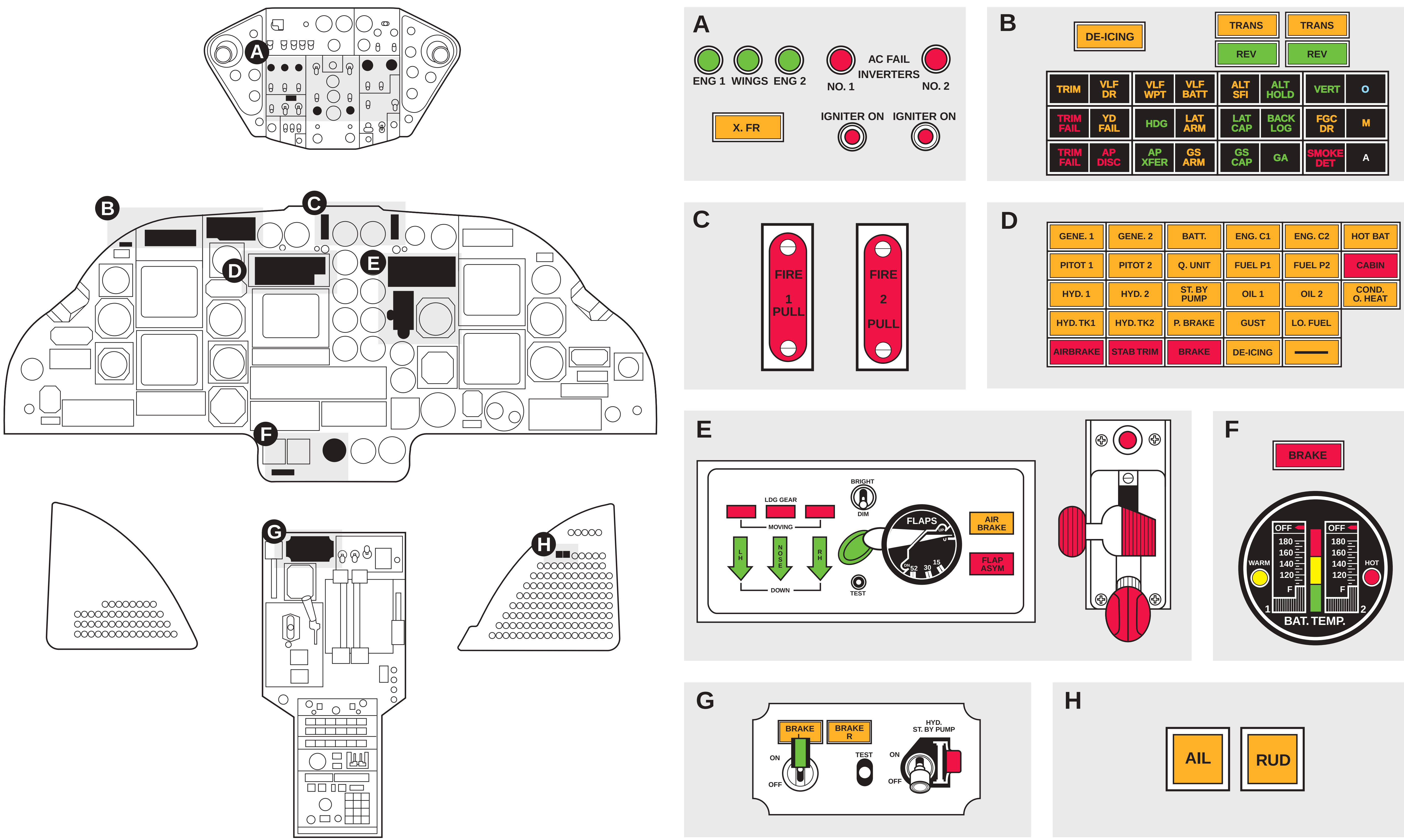
Announcement/ Condition	Reset
MINIMUM a. Radio altitude decreasing b. Decision height crossed	Radio altitude exceeds decision height
RADIO ALTITUDE and individual altitudes a. Radio altitude decreasing b. Specific altitude is crossed	Radio altitude exceeds that specific altitude
GLIDESLOPE a. Localizer frequency tuned b. Gear down c. Radio altitude between 200 and 700 ft d. One dot below glideslope e. Not in back localizer mode (difference between airplane heading and course arrow does not exceed 105°)	Correction of glideslope deviation
OR APA-80 of APS-80 a. Glideslope annunciator lamp lights	
LOCALIZER a. Localizer frequency tuned b. Gear down c. Radio altitude between 200 ft and 700 ft d. One dot below glideslope e. Not in Back Localizer mode (difference between airplanes heading and course arrow does not exceed 105°)	Correction of glideslope deviation
OR APA-80 of APS-80 a. Glideslope annunciator lamp lights	

Table 5J-B; Voice Advisory Vocabulary

Announcement/ Condition (continued)	Reset
CHECK TRIM a. Trim annunciator lamp lights	Correction of trim failure
CHECK ATTITUDE a. An attitude annunciator lamp lights	Correction of attitude deviation
CHECK BARO ALTITUDE a. PRE-80 aural warning sounds to indicate altitude deviation greater than 300 ft from preselected altitude b. Not in Approach mode (**optional**)	Automatically resets after completion of callout
CHECK GEAR a. Radio altitude decreasing b. Radio altitude between 500 and 100 ft c. Gear not down	Radio altitude exceeds 500 ft, the gear is down, or radio altitude increases more than 32 ft

Table 5J-B; Voice Advisory Vocabulary (continued)

Annunciators



Annunciator Cross Reference

Major annunciators, with brief explanations, are listed alphabetically to correspond with alphabetical designations on the illustration on page 5J-32. Specific information about what causes each annunciator to illuminate is in the appropriate system chapter.

A	
AC FAIL NO. 1 **AC FAIL NO. 2**	The illumination of a red AC FAIL light indicates failure of the respective 115V AC Inverter bus.
ENG 1 **ENG 2**	The green ENG 1/2 lights illuminate when HP bleed air is available to the engine inlet lip.
IGNITOR ON	The green advisory ignitor lights illuminate when power is available to the ignition box. A faulty ignitor does not prevent the light from illuminating.
WINGS	The green WINGS anti-ice light illuminates when both thermostats connected in series in the wings reach 80°C. It extinguishes when either thermostat senses less than 70°C.
X.FR	The amber windshield X.FR annunciator on the overhead panel illuminates when either windshield temperature control system fails. The windshield with the failed temperature control system is then controlled by the system of the opposite side.
B	
DE-ICING	**On S/Ns 001 to 151 with SB F10-208**, the amber DE-ICING annunciator illuminates to indicate airframe anti-ice air is leaking in the area of the flexible hoses. Four thermal fuses trigger the indication.
REV	The green REV lights in the thrust reverser panel on the instrument panel indicate the respective thrust reversers are in the deployed position.
TRANS	The two amber TRANS lights in the thrust reverser panel indicate their respective thrust reverser doors, actuator lock, and/or secondary latch are unlocked and the reverser is not fully deployed.
YD **FAIL**	Illumination of the amber YD FAIL light indicates yaw damper failure.
C	
FIRE 1 PULL **FIRE 2 PULL**	The red FIRE 1/2 PULL handles illuminate when the associated engine sensing element reaches an average temperature of 232°C or 427°C at a single point. Pulling a handle mechanically closes fuel valves in the associated engine pylon.

D	
AIRBRAKE	The red AIRBRAKE annunciator illuminates on the ground if the airbrakes are not retracted and either throttle is in the TAKEOFF position. In flight,, the annunciator comes on anytime the airbrakes are not retracted and the slats/flaps handle is out of the CLEAN position.
BATT.	Illumination of the amber BATT. annunciator indicates at least one of the two batteries is not connected to the Main bus.
CABIN	IIllumination of the red CABIN annunciator in the air accompanied by an aural warning horn indicates the cabin altitude pressure altitude is more than 10,000 ft. Illumination of the CABIN annunciator without the warning horn indicates the cabin access door, the rear compartment door, or the pressure-fueling door is not properly closed.
COND. O. HEAT	The COND. O. HEAT annunciator illuminates when the temperature of the air discharged into the air-conditioning system exceeds 250°C.
DE-ICING	**On S/N 152 and subsequent**, the amber DE-ICING annunciator illuminates to indicate airframe anti-ice air is leaking in the area of the flexible hoses. Four thermal fuses trigger the indication.
ENG.C1 ENG.C2	The amber ENG.C1/C2 annunciator illuminates when the associated engine computer switch is off, the associated engine computer fails, or power to the associated computer is lost.
FUEL P1 FUEL P2	Illumination of the amber FUEL P1/P2 annunciator indicates pressure below 4.6 PSI in the fuel manifold between the booster pump and the engine.
GENE. 1 GENE. 2	Illumination of an amber GENE.1/2 annunciator indicates the left or right generator is not connected to the Main bus. Possible faults are: differential/switch tripped, overvoltage/switch tripped, reverse current, mechanical.
GUST.	The amber GUST. annunciator illuminates when Hydraulic System No. 1 pressure is less than 400 PSI. Illumination of the amber GUST annunciator indicates closing of the automatic control valve to provide gust damping to the rudder.
HOT BAT	The HOT BAT annunciator illuminates when the internal temperature of one of the batteries reaches 135°F (160°F with SAFT batteries).
HYD. 1 HYD. 2	The amber HYD.1/2 annunciator illuminates whenever the associated hydraulic system is 1,500 PSI or less.
HYD. TK. 1 HYD. TK. 2	The amber HYD.TK.1/2 annunciator illuminates when the respective hydraulic reservoir tank LP air pressure is less than 16 PSIA.
LO. FUEL	The amber LO.FUEL annunciator illuminates when either feeder tank has less than 300 lbs of fuel.
OIL 1 OIL 2	Illumination of the amber OIL 1/2 annunciator with normal oil pressure indicates metal chips in the associated engine oil system. The amber OIL 1/2 annunciator illuminates when the oil pressure in the associated engine drops below 25 PSI.

P. BRAKE	The amber P. BRAKE annunciator illuminates when the pressure in the emergency/park brake accumulator is less than 1,200 PSI.
PITOT 1 PITOT 2	Illumination of the PITOT 1/2 annunciator indicates a power failure to either a pitot probe or static port.
Q. UNIT	Illumination of the Q. UNIT annunciator indicates a failure of rudder or aileron Arthur Q unit. When the annunciator illuminates, the malfunction can be further investigated by checking the copilot's circuit breaker panel for illumination of the aileron or rudder Q failure lights. Illumination while accelerating indicates the applicable Q Unit failed in Low Speed mode. Illumination while decelerating indicates the applicable Q Unit failed in High Speed mode.
ST.BY PUMP	The amber ST.BY PUMP annunciator illuminates when the hydraulic standby pump runs for more than 30 seconds consecutively.
STAB TRIM	The STAB TRIM annunciator illuminates on the ground if the stabilizer is out of the 4° to 8° aircraft nose-up range and either power lever is in the takeoff range.
E	
AIR BRAKE	Illumination of the amber AIR BRAKE annunciator indicates the airbrakes are not fully retracted.
FLAP ASYM	The red FLAP ASYM annunciator illuminates when a position difference of more than 5° exists between the flaps.
LDG GEAR LH/NOSE/RH	The three green LDG GEAR lights (LH, NOSE, and RH) on the configuration panel illuminate when the respective gear is in a locked down position.,
Gear Control Handle	The blinking red light in the control handle indicates that at least one gear is not down and locked, one or both throttles are retarded, and the airspeed is less than 190 kts.
LDG GEAR MOVING	The three red LDG GEAR lights on the configuration panel illuminate when the respective gear is not in a locked down or up position.
Slat Light	Illumination of the red slat light indicates the slats are not in agreement with the slats/flaps handle, stall input, or emergency slat extend switch. With emergency slats selected and the slat/flap handle out of the CLEAN detent, a red slat indication is normal.
F	
BRAKE	**On S/N 152 and subsequent**, the red BRAKE annunciator illuminates when the parking brake lever is moved from the OFF position (fully forward). It is on the main annunciator panel. **Prior to SN 152**, the annunciator is either on the center instrument panel forward of the emergency brake lever or above the main annunciator panel.
Battery Temperature Indicator	The amber light on the battery temperature indicator illuminates when a battery internal temperature reaches 120°F. The red light on the battery temperature indicator illuminates when a battery internal temperature reaches 150°F.

G	
ANTISKID BRAKE L/BRAKE R	The amber anti-skid lights illuminate any time the anti-skid system is functioning.
H	
AIL	The amber aileron/elevator Arthur signal failure light on the copilot's circuit breaker panel illuminates when accelerating and the aileron/elevator Q unit fails in the Low Speed mode or when decelerating and the aileron/elevator Q unit fails in the High Speed mode. Do not pull the warning horn CB until the landing gear is down and locked.
RUD	The amber rudder Arthur signal failure light on the copilot's circuit breaker panel illuminates when accelerating and the rudder Q unit fails in the Low Speed mode, or when decelerating and the rudder Q unit fails in the High Speed mode. If the rudder Q unit fails in high, the flap overspeed warning sounds when flaps are selected. Do not pull the warning horn CB until the landing gear is down and locked.

Pneumatic Systems

Chapter 5K

This chapter describes the systems that extract, distribute, and control engine bleed air (for anti-icing bleed air, see Ice and Rain Protection chapter). The Freon Air Conditioning System, Pneumatic Air Conditioning, and Pressurization Systems are combined in this chapter to present the flow of engine bleed air and its use throughout the aircraft.

The Pneumatic System extracts bleed air from the engines, collects it, and then transfers it to various other systems (i.e., air conditioning, ice and rain protection, and pressurization). The section covering the Pneumatic System begins on page 9.

The Air Conditioning System routes engine bleed air collected by the Pneumatic System through a conditioning valve for heating and cooling. The air conditioning section, which begins on page 13, discusses aircraft heating and cooling.

The Air Conditioning System also supplies conditioned air for the pressurized vessel. Pressurization is controlled by metering the outflow of conditioned air through the outflow valves. The operation of the outflow valves is controlled by the Pressurization System, which is discussed on page 21.

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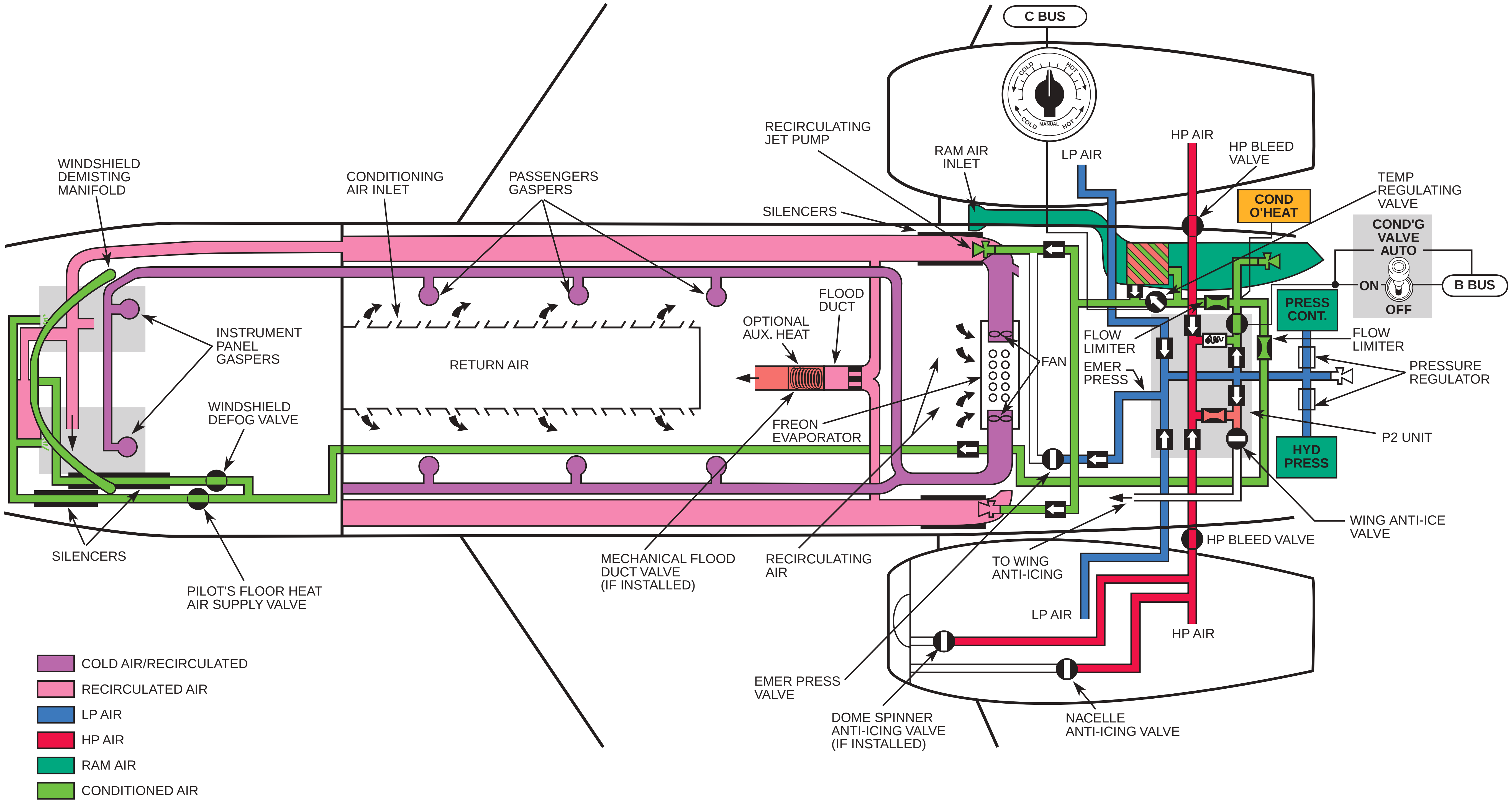
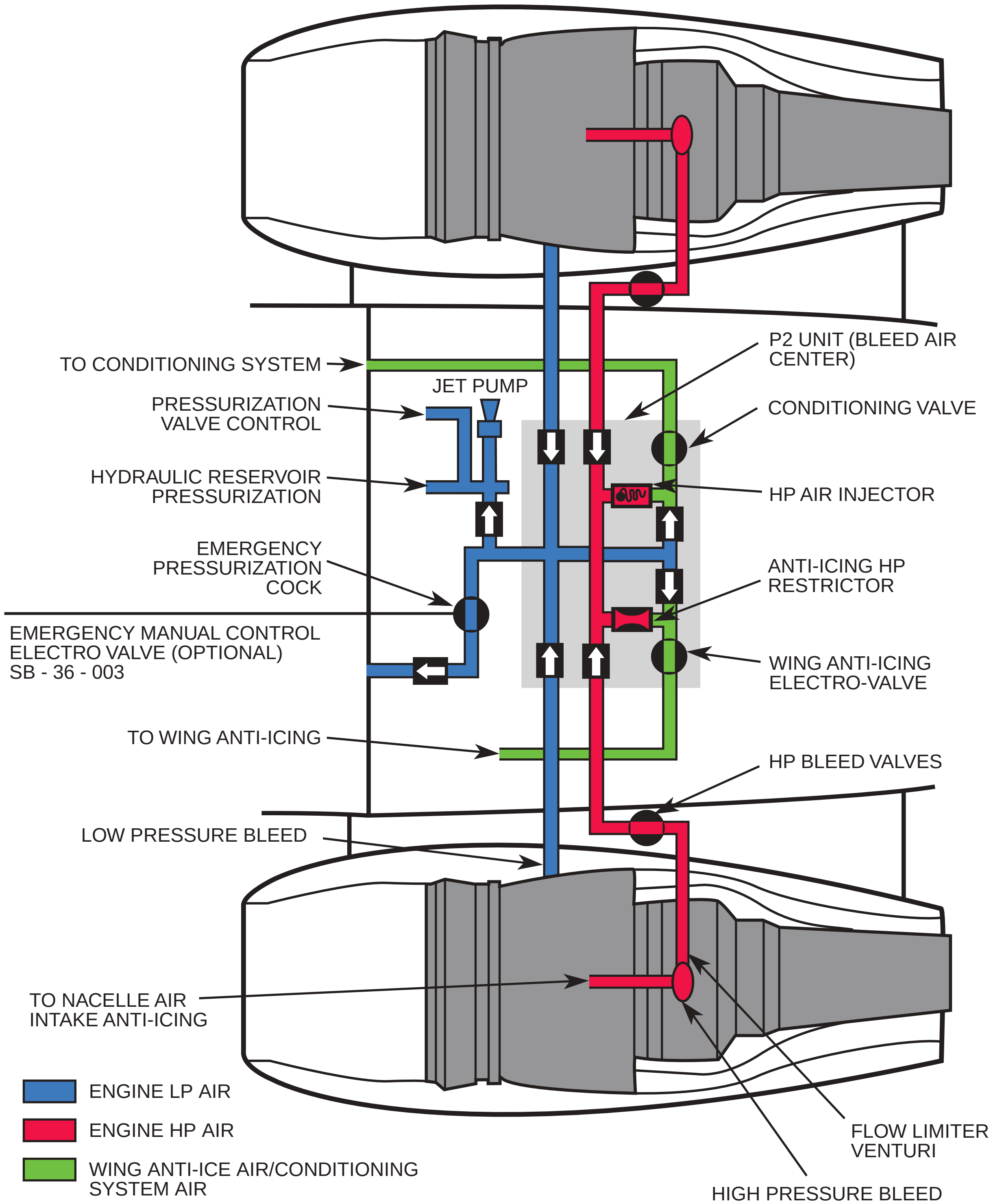
Bleed Air System

Bleed Air System



Pneumatic System Components



Pneumatic System

Distribution

Low pressure (LP) and high pressure (HP) bleed air from each engine supplies air through check valves to a P2 unit (bleed air center) in the rear compartment. HP bleed air is controlled by HP bleed control valves.

The P2 unit supplies bleed air to the following systems:

- air conditioning
- pressurization
- wing anti-ice
- emergency pressurization
- hydraulic reservoirs.

LP Bleed Air Supply

The left and right engines continuously supply LP bleed air. LP air is extracted through two bleed ports on the engine at the 3 and 9 o'clock positions. After exiting through the bleed ports, LP bleed air passes through one-way check valves, which block the path of bleed air trying to enter a non-operating engine.

LP bleed air is available through the bleed air center to all systems except:

- air conditioning and pressurization when the conditioning valve is closed
- wing anti-ice when the wing anti-ice control valve is closed.

HP Bleed Air Supply

High pressure (HP) air from the 12 o'clock HP port on the engine is drawn from both engines. HP bleed air flows from each engine through electrically controlled, air-operated shutoff valves in the pylons prior to the P2 unit. If LP bleed air is insufficient to pressurize or heat the cabin due to reduced engine power at altitude, HP bleed air flows into the P2 unit through a mixing valve (HP air injector). HP air is available for anti-ice through a restrictor and inlet hose.

Pneumatic System Components

Components of the pneumatic system that distribute and regulate the bleed air supply include the following:

- flow limiter venturis
- HP valves
- HP air injector (mixing valve)
- P2 unit (bleed air center)
- conditioning valve
- anti-icing electro-valves.

Flow Limiter Venturis

HP air passes through a flow limiter venturi that limits the amount of bleed air drawn from the HP port to 2.5% of the maximum engine compressor output. The venturi provides a safety feature that prevents excessive bleed air drawn from the compressor in the event of a ruptured HP line.

HP Valves

Each engine supplies HP bleed air through HP valves powered by the Load Shed C bus. These valves are electrically controlled and pneumatically operated. They fail closed with loss of electrical power.

Both HP valves are controlled with one switch labeled HP BLEED OPEN/CLOSED on the forward pedestal.

- In OPEN position, the valve allows HP bleed air to enter the P2 unit and mix with LP bleed air to support bleed air demand.
- In CLOSED position, HP valves close to shut off HP bleed air flow.

The P2 unit distributes bleed air for anti-icing and air conditioning.

P2 Unit (Bleed Air Center)

The P2 unit regulates the volume and pressure of air available for the air conditioning and wing anti-ice systems.

The P2 unit includes check valves for one-way airflow to prevent bleed air reversal during single engine operations (e.g. starting or engine failure).

The air conditioning system utilizes LP air only in normal operation. However, under conditions of high altitude and low power settings (beginning of descent), insufficient LP air is available. In this case, the HP injector valve injects HP air into the air conditioning system as required to maintain pressure. Because HP air is much hotter than LP air, a temperature sensor downstream of the conditioning valve monitors the duct temperature. If temperature exceeds 250°C, a COND O'HEAT annunciator illuminates on the Failure Warning Panel.

At takeoff power, LP air is approximately 230°C at 62 PSI; HP air is not injected until pressure drops to approximately 16 PSI. Above 16 PSI, HP air is restricted from entering the cabin air system.

The wing anti-ice system is provided air from both HP (30% by volume) and LP (70%) manifolds. Because HP air is much hotter than LP air, most of the heat required for airframe anti-icing is provided by HP air with additional volume being provided with LP air (see Chapter 5H, Ice and Rain).

HP Air Injector

The HP air injector infuses HP bleed air into the P2 unit to supplement the demand of bleed air to the cabin. The injector is an auto-adjusting orifice that senses upstream pressure changes. The pressure reducer starts opening at 15.83 PSI to permit the air conditioning system to be properly supplied in all flight conditions.

Conditioning Valve

The conditioning valve controls all airflow into the cabin except during emergency pressurization. The B bus powers the valve through the COND'G VALVE switch. The switch positions function as shown below:

- OFF – airflow is cut off.
- ON – the conditioning valve opens to allow bleed air flow.
- AUTO – the conditioning valve closes with weight on the gear and throttles advanced for takeoff. After takeoff, the valve automatically opens slowly to prevent pressure bumps. Approximately two minutes are required for complete opening.

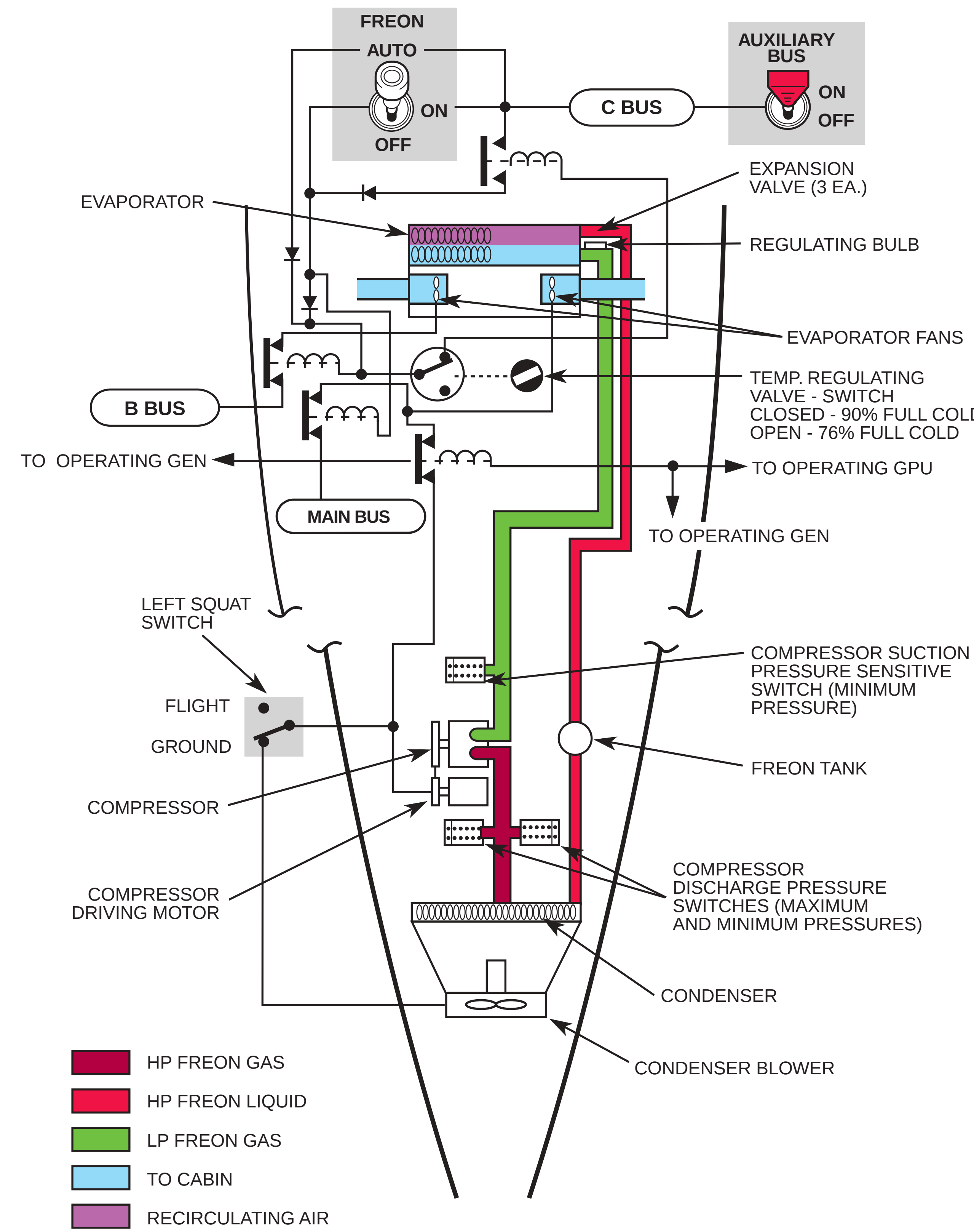
Anti-Icing Electro-Valve

For information on the anti-icing electro-valve, see Ice and Rain chapter.

Air Conditioning System

Power Supply		Freon Switch	Compressor Motor	Condenser Blower	Evaporator Fans	
AC System	Auxiliary Bus				LH	RH
	"OFF"	AUTO ON OFF	STOP	STOP	STOP	STOP
AC Batteries or During Starting Sequence	"ON"	AUTO	STOP	STOP	OPERATES	STOP
	"ON"	ON	STOP	STOP	OPERATES	OPERATES
	"ON"	OFF	STOP	STOP	STOP	STOP
GPU or At Least One Generator	"ON"	AUTO	Demand Operation: Temperature Regulating Valve in Full Cold Position within Safe Envelope	Demand Operation: on the Ground: Temperature Regulating Valve in Full Cold Position	OPERATES	OPERATES
	"ON"	ON	Operates if within Safe Envelope	Operates on the Ground	OPERATES	OPERATES
	"ON"	OFF	STOP	STOP	OPERATES	OPERATES

Air Conditioning System



Air Conditioning System

The air conditioning system provides conditioned air to the cabin and cockpit. The conditioning system is composed of the following systems:

- primary heating and cooling–engine bleed air system
- Freon system
- auxiliary heat (optional).

Primary Heating and Cooling System

The primary heating and cooling system provides conditioned air to be distributed through the aircraft's cabin and cockpit. Components are as follows:

- heat exchanger
- temperature regulating valve
- footwarmer/defog valves
- temperature regulation control box.

Heat Exchanger

The heat exchanger cools engine bleed air ducted directly from the engine venturis (flow limiters). Ram air, obtained with an outside ram air scoop on the top side of the right engine pylon, directs ambient air across the heat exchanger to cool the bleed air.

Temperature Regulating Valve

The gate-type temperature regulating valve is operated with a variable speed DC motor; it is controlled with an electronic cabin temperature control system. The regulating valve in line with the heat exchanger is automatically controlled with a electronic temperature regulator. Load Shed C bus distributes power for the regulating valve.

An electronic temperature controller determines the amount of hot engine bleed air routed through the heat exchanger to provide cooling air. The system may be operated automatically by the temperature controller or manually by the pilot.

To operate the system manually the pilot controls the system with the COLD/HOT switch selected to the 6 o'clock position, then rotating the switch clockwise for cooler selection or counterclockwise for a warmer selection. Some aircraft have a gage indicating the position of the temperature regulation valve.

In the automatic mode, the valve closes to pass a greater percentage of the air through the heat exchanger as the temperature in the cabin increases.

5K-1

If the Freon switch is in AUTO, the Freon system turns on when the valve reaches 90% full cold.

Windshield Defog and Pilot's Floor Heat

With the COND'G VALVE switch selected to ON or AUTO, the conditioning valve allows engine bleed air to flow directly from the P2 unit to the cockpit (**Figure 5K-1**, previous page). The bleed air passes through the following before reaching the cockpit:

- windshield defog valve (see Ice and Rain chapter)
- windshield demisting manifold (see Ice and Rain chapter)
- pilot's floor heat air supply valve.

The bleed air heats the floor and provides windshield demisting through the windshield defog valve air supply valves.

Footwarmer/Defog Valves

The footwarmer and defog valves on the pilot's side console provide unconditioned air (hot) to the cockpit for additional heat.

The air source of both valves is downstream of the conditioning valve and provides an excellent check after take-off to confirm that the conditioning valve is fully open.

The defog valve also directs unconditioned air to the windshield. The WSHLD lever on the pilot's left console next to the FLOOR lever controls the valve. In OPEN, the levers control windshield and foot warmers.

Temperature Regulation Control Box

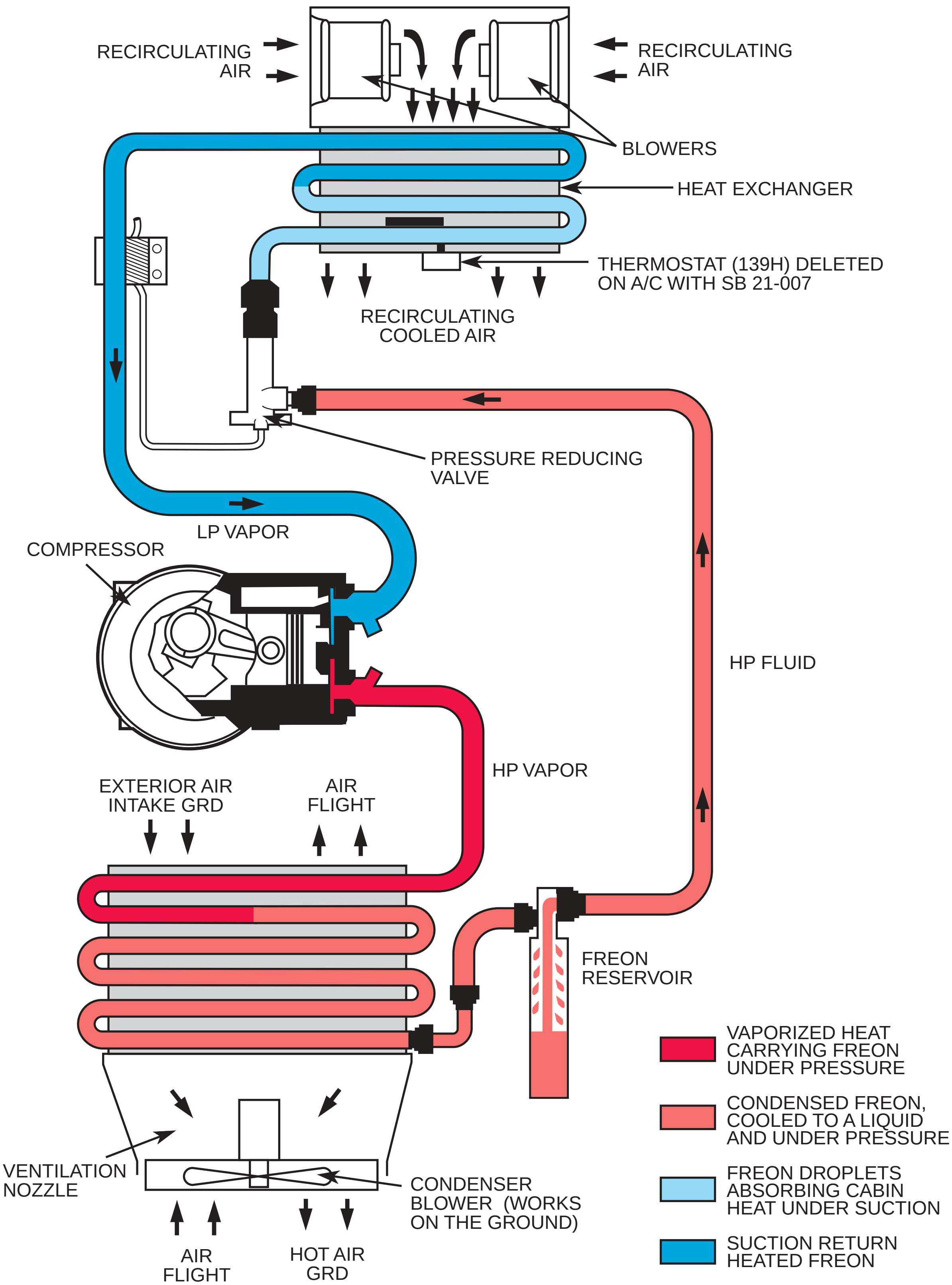
The temperature regulation control box at the bottom center section of the instrument panel consists of a rotating button and a circular stop (**Figure 5K-2**). Display on the upper scale indicates an automatic temperature regulation between 59°F (12°C) and 84°F (30°C).

The control box compares the temperature instructions preset on its dial with the cabin temperature sensed by probes; it then controls the opening and closing of the valve. The following probes send an electrical signal to the temperature control box:

- cabin temperature probe – (signal to temperature control box proportional to the cabin air temperature)
- duct air temperature probe – senses temperature in the air duct; (signal to the control box proportional to the air temperature in the duct).

5K-2

Freon System



Freon System

The self-contained air conditioning system uses Freon (refrigerant 12) to cool the cabin and cockpit on the ground and in the air. The temperature controller used to regulate conditioned air further controls the Freon system. The Freon system operates when the temperature regulating valve is more than 90% full cold with the system switch in AUTO (**Figure 5K-3**).

With the Freon system operating, recirculation fans draw warm cabin air across the evaporator to cool it and then deliver the cooler air back to the cabin and cockpit distribution system. Either external power or at least one generator must be powering the Main bus for the Freon compressor to operate. The compressor shuts down automatically when an engine start is initiated.

Components of the Freon system are:

- compressor motor
- compressor
- underpressure switches
- overpressure switches
- condenser
- condenser fan
- reservoir tank
- pressure reducing valves
- evaporator
- evaporator fans
- gasper air vents.

5K-3

Compressor Motor

A 28V DC electric motor receives power directly from the Main bus and drives the automotive-type two cylinder compressor.

The current consumption to drive the electric motor is between 150 and 170 AMPs, depending on ambient temperature. A three-position FREON switch powered through the Load Shed C bus controls power for the compressor (Main bus) and the Freon system components. The switch positions and functions are:

- OFF – removes electricity from the Freon system
- ON – actuates the Freon system by turning on the compressor motor after a 30 second delay
- AUTO – allows the temperature regulation valve to control the compressor motor, turning the system on when the temperature regulation valve reaches 90% full cold
- ON or AUTO – (on the ground with batteries only), Freon switch is a fan switch only.

Compressor

The Freon compressor is an automotive-type two-cylinder compressor. It compresses Freon drawn in as a gas from the evaporator. The compressor compresses the vapor and delivers it under pressure to the condenser where the gas returns to a liquid state.

The electric motor drives the compressor with a belt.

Underpressure Switches

A switch on the pressure discharge line of the compressor senses a low pressure condition of 26.1 ± 7.2 PSI. The switch stops the compressor motor with the opening of the control circuit of the compressor. These switches also protect against a Freon leak or operation in a cold environment.

The inlet (suction) line of the compressor incorporates a pressure switch set at 14.5 PSI, which shuts the compressor motor down if the following occurs:

- the intake line is clogged (the thermostatic expansion valve needle is jammed shut).
- the Freon system is set into operation when the temperature is too low.

Overpressure Switches

A switch on the discharge line of the compressor turns off the system if discharge pressure is 283 ± 14.5 PSI. The switch stops the compressor motor through opening of the control circuit. The switch protects against head pressure which is too high for the motor to overcome. This also protects against operation at an excessive temperature.

Condenser

The condenser in the tail of the aircraft converts high-pressure and temperature gaseous Freon into a liquid. A condenser fan draws air across the condenser on the ground consequently causing the Freon to give up its heat and cool to a liquid. When airborne, air is scooped into the tail opening by the tail screens and exits the aircraft through a screen on the aft compartment door.

Efficiency is improved on the ground with the opening of the aft compartment door to allow an increased air volume.

Condenser Fan

A condenser fan in the tail of the aircraft with the condenser unit is a 28V DC operated electric fan that pulls cooling air across the condenser fins to cool vaporized Freon back to a liquid. The fan operates only when:

- the aircraft is on the ground
- 28V DC aircraft system is supplied by one aircraft generator or with a GPU
- the FREON switch is in the ON or AUTO selection (in AUTO, the temperature control valve must also be in a position close to the full cold position, greater than 90% cold).

Reservoir Tank

A reservoir tank in the rear compartment has a capacity of 1/8 gallon. The reservoir incorporates a sight glass that allows maintenance to check for air in the system with the Freon system operating. The flow of bubbles across the sight glass indicate low Freon charge or air in the system.

The reservoir contains a desiccator that absorbs traces of water. This absorption prevents moisture damage of the system.

The maximum Freon pressure is 326 PSI at 80°C (176°F); normal operating pressure is 247 PSI at 38°C (100°F).

Pressure Reducing Valves

Freon pressure reducing valves incorporate jets in which the cross sectional area is variable. The jets:

- meter the flow of liquid Freon supplying the three bundles of tubes of the Freon evaporator
- spray the Freon in fine droplets to allow for faster evaporation in the evaporator.

Evaporator

The evaporator in the passenger cabin contains liquid Freon that boils after leaving the expansion valves. The Freon in the evaporator absorbs heat from the cabin as it passes through the evaporator core. This Freon heat absorption turns the boiled liquid into a vapor that carries the heat away from the aircraft cabin.

Cabin air is blown across the evaporator using jet pump action and Freon evaporator fans. The Freon enters each layer of the evaporator through a pressure relief valve and vaporizes due to the low pressure level established in the tubes by the compressor suction. Cabin air, brought in with the fans, circulates from top to bottom between fins brazed onto the tubes. This air cools by collecting cold units dissipated by Freon evaporation and transmitting them to the cabin.

Evaporator Fans

Two electric evaporator fans in the passenger cabin draw cabin air around the evaporator fins and distribute it into the air conditioning distribution system. The left fan supplies the gasper system and the right supplies the right conditioning air distribution duct.

Both fans operate automatically with the aircraft electrical system supplying 28V DC unless the engines are being started. If batteries only are on, the left fan that supplies air to the pilot's gaspers operates with the FREON switch placed in AUTO. If this switch is ON, both fans operate. The fans stop with the selection of AUX BUS switch to OFF.

Gasper Air

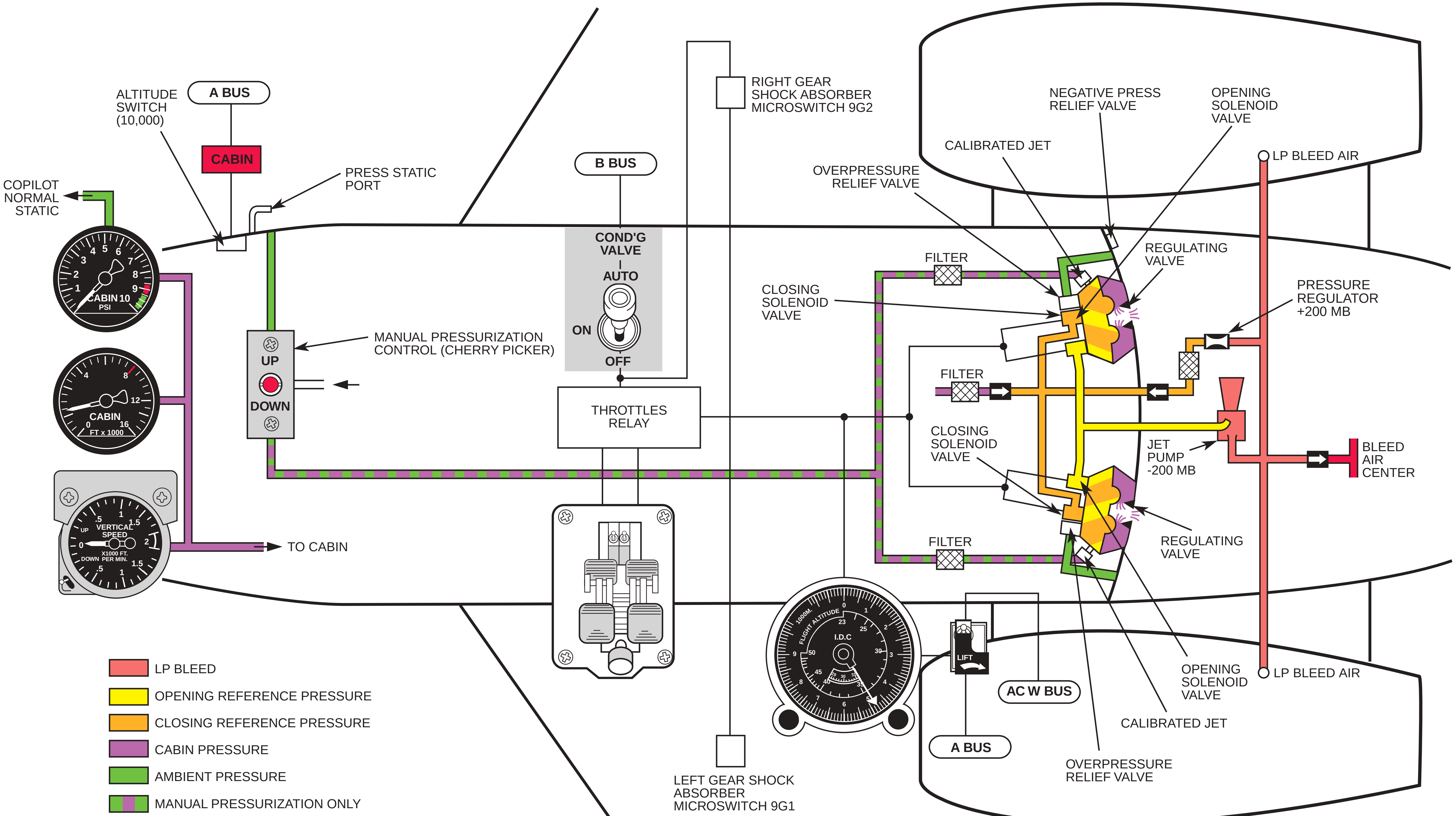
Each cold air duct divides into two ducts to supply the gasper manifold. The gasper manifold, at the top of the frame at the rear of the passenger cabin, supplies the distribution ducts.

Ducts are in the passenger cabin ceiling and supply adjustable outlets above the passenger seats (**Figure 5K-4**). The duct routed through the right cabin sidewall and into the cockpit supplies two adjustable outlets on the outboard edge of each pilot and copilot instrument panel.

5K-4

Pressurization System

Pressurization System



Pressurization Systems

Conditioned air entering the cabin through the air distribution ducts pressurizes the cabin. The amount of air exhausted from the cabin controls pressurization.

If cabin pressurization and air refreshing are not sufficient, an emergency hand-controlled or electrically operated valve permits emergency pressurization to supply the cabin with fresh air. Pressurization may be achieved, but cabin air temperature is not regulated.

IDC Pressurization System

In normal operation, the pressurization system maintains a cabin altitude of 8,000 ft at a flight altitude of 45,000 ft with maximum differential of 8.8 PSI. Pressure relief is set for 9.1 PSI.

The pressurization system has two operating modes:

- automatic – (outflow valves are controlled electropneumatically)
- manual – (outflow valves are controlled pneumatically).

Components for the IDC system are:

- cabin pressurization indicating system
- cabin pressurization failure warning system
- automatic pressure regulator
- pressurization mode selector
- electropneumatic outflow valves
- manual controller
- jet pump.

Cabin Pressurization Indicating System

The cabin pressurization indicating instruments at the bottom of the center instrument panel monitor operation of the cabin pressurization system (**Figure 5K-5**). The instruments indicate the following:

- cabin differential pressure indicator – indicates readings from 0 to 10 PSI; includes a green arc between 8.8 and 9.0 PSI and a red arc from 9.1 to 10 PSI
- cabin altitude indicator – indicates cabin altitude (inside cabin) in thousands of feet from -1,000 to +16,000 feet; the dial displays a red line at +10,000 ft
- cabin vertical speed indicator – indicates vertical speed of cabin climb or descent in FPM from -2,000 to +2,000 FPM.

5K-5

Cabin Pressurization Failure Warning System

A pressurization warning system alerts crew of cabin altitude of 10,000 ft. The system incorporates an altitude sensitive switch in the copilot's side console. The system responds as follows at 10,000 ft.

- a horn sounds (horn is silenced with the HORN SILENCE button on pilot's side of the center console) (**Figure 5K-6**)
- CABIN annunciator illuminates in the Failure Warning Panel.

Depress the test button on the pedestal to check operation of the pressurization failure warning system.

Pressurization Controller

The automatic pressure regulator (control box) transmits electrical altitude and rate of altitude change signals to the outflow valves (**Figure 5K-7**). It receives 115V AC from the pilot's AC bus. The regulator casing is tapped to receive ambient cabin pressure and contains:

- a cabin-altitude sensor – that senses altitude inside the cabin
- cabin-altitude variable-speed capsule – that detects cabin rate of altitude change
- rate-adjusting potentiometer – that adjusts the rate of cabin climbs and descends
- servo amplifier – that actuates the opening and closing of the solenoid valves of the outflow control valves.

The outer scale of the dial on the pressure regulator indicates cabin/altitude. The inner scale indicates aircraft/flight/altitude.

The PULL for BARO knob on the right side of the regulator enables the pilot to rotate the inner scale and select a flight altitude while concurrently setting a cabin altitude on the outer scale that results in a cabin altitude differential of 8.8 PSI.

Pulling the knob allows the altitude scales on the dial to reference barometric pressure in inches-of-mercury.

The RATE knob on the left side of the regulator adjusts the cabin altitude rate-of-change. The RATE knob is adjusted on the ground only. It should not be turned during flight.

The RATE knob position results in the following:

- setting of the RATE knob gives a +650 FPM climb and -450 FPM descent in the detent position.
- pulling the RATE knob and rotating it full counterclockwise accomplishes a +300 FPM climb and -200 FPM descent.

5K-6

5K-7

- pulling the RATE knob and rotating it full clockwise accomplishes a rate of +2,000 FPM climb and -1,300 FPM descent.

For a typical flight, the automatic pressure regulator is set as shown below:

- takeoff – displays cruise altitude on altitude selector and 29.92 on the baro window (IN.HG)
- landing – displays field elevation on altitude selector and field barometric pressure on the baro window (IN.HG).

Pressurization Mode Selector

The pressurization mode selector on the pressurization and conditioning control panel contains a three-position AUTO/MAN/DUMP toggle switch (**Figure 5K-8**). The positions function as shown below:

- AUTO – pressurization regulation of AC electrical commands sent to valves through the control valve amplifier
- MAN – valves are electrically isolated from the control bus and can only be controlled pneumatically by the manual control valve
- DUMP – the valve receives A bus DC electrical power to operate the solenoid and dump cabin pressure.

The toggle switch uses a guard to prevent inadvertent dumping of pressurization. The switch guard is first turned clockwise, which permits the switch to move from AUTO to MAN. To select DUMP from MAN, move the switch guard down.

5K-8

Electropneumatic Outflow Valves

Two electropneumatic outflow valves on the pressure bulkhead respond to signals from the automatic pressure regulator. The valves establish a metered flow of air from the cabin to maintain the selected cabin altitude or to establish a pressure rate of change corresponding to the aircraft's rate of climb or descent.

Each valve chamber contains a calibrated jet that communicates between the servo chamber and pressure source (closed by a solenoid-operated valve). Pressure sources are the cabin and the non-pressurized zone set at 3.6 PSI.

A second calibrated jet communicates between the servo chamber and the vacuum source (closed with a solenoid-operated valve). The vacuum source is a jet pump in the non-pressurized zone supplied with engine bleed air; this vacuum source provides air at below ambient air static pressure. With engines failed, the jet pump no longer supplies vacuum; instead, the suction pipe communicates with the outside for satisfactory performance.

> **NOTE:** The Freon system should be used to reduce cabin temperature when emergency pressurization is required.

The valve chamber also has a relief valve that communicates between the servo chamber and outside air as soon as an overpressure in cabin of 9.1 PSI is reached.

The chamber contains a fitting with a calibrated orifice that provides for interconnection of both exhaust control valves servo chambers and their connection with the three-way manual control valve.

In addition, the outflow valve has an anti-nicotine filter on the cabin air inlet that protects the valve against air contamination.

Manual Controller

Manual operation is required if the automatic pressure regulator malfunctions or AC power to the unit fails. Selecting the manual controller removes electrical power from the automatic pressure regulator and reverts the system to pneumatic control of the electropneumatic outflow valves. The cabin altitude (cherry picker) knob on the pedestal (**Figure 5K-8**, previous page) is used for manual control.

To initiate a cabin descent, cabin pressure is introduced into the control chamber of each outflow valve to move the valves toward the closed position. Admitting ambient pressure from a static port into the control chamber of each outflow valve moves the valves toward the open position. This results in a higher cabin altitude.

Jet Pump

The jet pump in the rear compartment uses motive flow from engine bleed air to establish a stable pressure in the control chamber of each outflow valve.

Automatic Mode

The automatic pressure controller regulates the outflow valves to maintain cabin pressure according to:

- commands set by the pilot
- cabin pressure
- rate of change in cabin pressure
- aircraft configuration (on ground or in flight).

The outflow valves are closed for takeoff when all of the following occur:

- the power levers reach 82%
- conditioning valve is closed
- weight is on the gear
- pressurization is in AUTO.

With power levers below 82% and microswitches in ground mode, the outflow valves are commanded to a +500 FPM cabin climb rate (pressure decrease) to relieve any pressure.

Dump Mode

In dump mode, DC power from the A bus is applied directly to the operating solenoid with the pressurization selector to DUMP. The power signals the outflow valves to open and dump the cabin to flight altitude.

Emergency Pressurization

The emergency pressurization system provides unconditioned warm air from the P2 unit directly to the cabin through the aft pressure bulkhead.

The emergency valve is controlled manually with a mechanical knob on the left-hand side of the aircraft above the couch. With **SB F10-0003**, an electric valve replaces the mechanical valve, and a switch on the console next to the pressurization controller controls the valve.

ABG – SEMCA Pressurization System

In normal operation, the ABG – SEMCA pressurization system maintains a cabin altitude of 8,000 ft at a flight altitude of 45,000 ft with maximum differential of 8.8 PSI. Pressure relief is set for 9.1 PSI.

Pressurization is maintained by two outflow valves. One is an electropneumatic valve controlled by the automatic (i.e., electric) pressure controller; the second is a pneumatic valve slaved to the electropneumatic valve. System components for the ABG – SEMCA are:

- cabin pressurization indicating system
- cabin pressurization failure warning system
- automatic pressurization regulator
- pressurization mode selector
- main regulating (electropneumatic) outflow valve
- pneumatic (emergency) outflow valve
- manual pressurization controller (UP/DN knob)
- jet pump.

Cabin Pressurization Indicating System

The cabin pressurization indicating instruments at the bottom of the center instrument panel monitor operation of the cabin pressurization system. The instruments provide the following indications:

- cabin differential pressure indicator – indicates readings from 0 to 10 PSI; includes a green arc between 8.8 and 9.0 PSI and a red arc from 9.1 to 10 PSI
- cabin altitude indicator – indicates cabin altitude (inside cabin) in thousands of feet from -1,000 to +16,000 ft; the dial displays a red line at +10,000 ft
- cabin vertical speed indicator – indicates vertical speed of cabin climb or descent in FPM from -2,000 to +2,000 FPM.

Cabin Pressurization Failure Warning System

A pressurization warning system alerts the crew of a cabin altitude of 10,000 ft. The system incorporates an altitude-sensitive switch in the copilot's side console. The system responds at 10,000 ft as follows:

- a warning horn sounds (horn is silenced with the HORN SILENCE button on pilot's side of center console)
- the CABIN annunciator illuminates in the Failure Warning Panel.

Depress test button on the pedestal to check operation of the pressurization failure warning system.

Pressurization Controller

The automatic pressurization regulator on the lower right portion of the center instrument panel generates electrical commands to the electropneumatic outflow valve. Pressurization control is accomplished with manipulation of the ALT, RATE, and BARO knobs.

The ALT knob allows for selection of cabin pressure altitude from -1,000 ft through 10,000 ft (an inner scale shows corresponding flight level).

The RATE knob allows for selection of rate-of-change for cabin climb and descent. The detent provides a +650 FPM rate-of-climb and a -450 FPM rate-of-descent for the cabin.

Movement of the RATE knob full counterclockwise allows a rate-of-climb of +200 FPM and a rate-of-descent of -150 FPM; full clockwise allows a rate-of-climb of +1,200 FPM and a rate-of-descent of -830 FPM.

The BARO knob rotates the altitude display ring to adjust for barometric pressure.

Following a comparison between actual vs. commanded cabin altitude and actual vs. commanded rate-of-change, the controller signals the electropneumatic valve torque motor to position the outflow valves as desired. For deviations between preset and true cabin altitude greater than 100 ft, the rate-of-change is set by the RATE knob. For deviations less than 100 ft, the rate-of-change decreases as the altitude deviation decreases.

Pressurization Mode Selector

The pressurization mode selector on the pressurization and conditioning control panel contains a three-position (AUTO/MAN/DUMP) toggle switch. The positions and functions are shown below:

- AUTO – pressurization regulation of DC electrical commands (A bus) are sent to valves through the control valve amplifier
- MAN – the valves are isolated electrically from the control bus and can only be controlled pneumatically by the manual control valve
- DUMP – the valve receive A bus DC electrical power to operate the solenoid to dump cabin pressure.

The toggle switch uses a guard to prevent inadvertent dumping of pressurization. The switch guard is first turned clockwise to permit the switch to move from AUTO to MAN. Next, the switch guard is moved down to select DUMP from MAN.

Main Regulating (Electropneumatic) Outflow Valve

The electropneumatic outflow valve on the top left side of the aft cabin bulkhead receives commands from the automatic pressurization controller.

The valve is spring-loaded toward the closed position. A combination of static, cabin, and negative pressures positions the outflow valves.

The outflow valve is protected against overpressure. A pressure sensor attached to the valve body senses cabin static pressure and relieves cabin pressure higher than 9.1 PSI. The outflow valve's negative pressure relief device on the valve assembly causes the valve to open when ambient pressure exceeds cabin pressure.

Finally, cabin altitude is limited with a sealed aneroid attached to the outflow valve assembly; this aneroid expands to open a port that allows cabin pressure to close the outflow valve when cabin altitude exceeds 12,500 ft.

In addition, the outflow valve has an anti-nicotine filter on the cabin air inlet that protects the valve against airborne contamination.

Pneumatic (Emergency) Outflow Valve

The pneumatic (emergency) outflow valve on the right side of the aft cabin bulkhead is identical to the electropneumatic valve except the torque motor is replaced by a pneumatic relay.

In AUTO mode with the manual pressurization controller in DN (full counterclockwise), the relay essentially is inoperative; the pneumatic valve slaves pressure equal to that of the electropneumatic valve because of a crossfeed pipe.

In MAN mode, the slaving pressure of the pneumatic outflow valve is controlled by the manual pressurization controller (UP/DN knob).

The slaving pressure in the electropneumatic outflow valve is equal to the other outflow valve because of the crossfeed pipe. Electric control of the electropneumatic outflow valve is disabled.

Manual Pressurization Controller (UP/DN Knob)

The manual pressurization controller on the right lower portion of the center instrument panel controls the operation of the pneumatic relay on the pneumatic outflow valve.

The controller is an adjustable orifice through which cabin pressure and jet pump negative pressure are combined to create a reference pressure at a pressure relay (bellow) which, in turn, causes operation of the outflow valve. At DN (full counterclockwise), a cabin rate-of-descent of -1,000 FPM is commanded. At UP (full clockwise), a cabin rate-of-climb of +2,500 FPM is commanded.

Jet Pump

The jet pump in the rear compartment uses motive flow from engine bleed air to establish a stable pressure in the control chamber of each outflow valve.

Automatic Mode

The automatic pressure controller regulates the outflow valves to maintain cabin pressure according to the following:

- commands set by the pilot
- cabin pressure
- rate of change in cabin pressure
- aircraft configuration (ground or in flight).

With the power levers forward of 92% and pressurization in automatic mode, the outflow valves close.

With power levers below 92% and flight/ground relays in ground mode, the outflow valves are commanded to a +450 FPM cabin climb rate (non-adjustable) to relieve any pressure.

Dump Mode

In dump mode, Primary A bus power is applied directly to the torque motor on the electropneumatic (left) outflow valve to drive it open. The pneumatic (right) outflow valve follows (opens) as a slave. If cabin altitude approaches 12,500 ft, a separate cabin altitude limiter on each outflow valve causes the outflow valves to close pneumatically.

Manual Mode

The pressurization manual mode consists of a manual (emergency) pressurization controller and a pneumatic outflow valve. The manual pressure regulator:

- sets the required climb or descent rate
- holds cabin altitude at a constant value.

The manual pressurization controller knob UP or DOWN position is used in relationship to cabin altitude. If a higher cabin altitude is desired, rotate the knob toward UP; if a lower altitude is desired, rotate toward DOWN. For a level cabin altitude, the knob should be near 12 o’clock.

Servicing and Procedures

Preflight

Preflight of the pneumatic, air conditioning, and pressurization systems is accomplished in accordance with the Preflight chapter of this manual. Normal operation of these systems is accomplished in accordance with the Expanded Normals and Maneuvers chapters of this manual.

Abnormal Procedures

This section discusses what happens within the pneumatic, pressurization, and air conditioning system during abnormal or situations. For a list of specific procedural steps, refer to the AFM or the SimuFlite Operating Handbook.

COND'G OVHT Warning

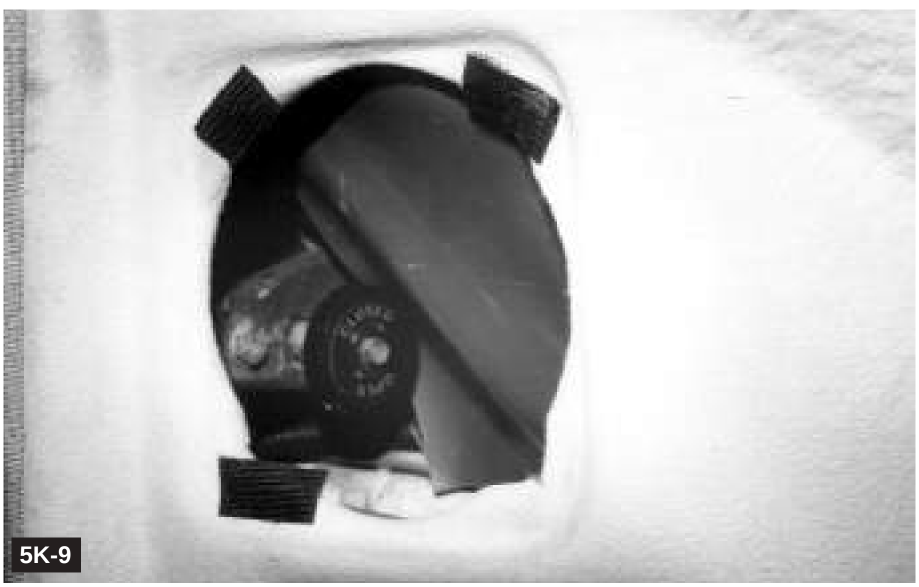
The COND'G OVHT annunciator on the Failure Warning Panel illuminates if a temperature of 250°C or greater is detected in the conditioned air supply duct.

The likely cause of a COND'G OVHT is a faulty HP injector. HP air is being added to LP air at too high an engine RPM so that the air in the duct between the conditioning valve and the heat exchanger is too hot. The maximum temperature of LP air is 230°C; therefore, the excess heat is coming from HP air. Turn the HP bleed OFF and the problem should be solved; the light should extinguish.

If annunciator remains illuminated, manipulate the throttles to see if one of the HP valves may be stuck open. If the annunciator remains on, land as soon as possible, open the emergency pressurization valve (**Figure 5K-9**), and close the conditioning valve. The Freon system may be used to cool the cabin while using emergency pressurization.

Conditioning Valve Fails to Open on Takeoff

The conditioning valve closes as power is advanced on takeoff (at 82°). Once airborne, a separate delayed timer circuit associated with the conditioning valve governs the progressive opening of the valve. The valve is fully open within two minutes following takeoff. Should a conditioning valve fail to open, conditioned air is not available to the cabin or cockpit. This condition may be due to a failure of the timer circuits. This condition happens shortly after takeoff. If bleed air cannot be restored, flight at high altitudes is not possible.



5K-9

If there is no bleed air directed to the cabin, select the conditioning valve to ON and monitor pressurization. If no change occurs, return for a landing.

Cabin Pressure Too High

Cabin pressure too high is recognized by referencing the cabin pressure and cabin vertical speed indicators.

Initially, select a higher altitude on the automatic pressurization controller to increase the cabin altitude reference for the pressurization system. This lowers the cabin pressure. If this action is successful, continue the flight with the higher altitude.

If the cabin pressure does not decrease, shift the pressurization from automatic control to manual control. Move the UP/DN knob using brief actuations to avoid a “bump” in pressurization. Control aircraft pressurization with the UP/DN knob.

Selection toward UP increases cabin altitude (by decreasing cabin pressure), and selection toward DN decreases cabin altitude. Monitor cabin vertical speed.

If manual pressurization does not solve the overpressure problem, return the pressurization switch to AUTO and move the UP/DN knob to UP as before. If the cabin pressurization remains too high, close the conditioning valve and use oxygen as required. Land as soon as practical.

Improper Cabin Vertical Speed

Improper cabin vertical speed is detected on the vertical speed needle of the cabin vertical speed indicator to the right of the center panel.

First, check that the pressurization controls are positioned properly. Adjust the rate knob on the automatic pressurization controller. If this solves the problem, continue the flight with increased surveillance of the vertical speed indicator.

If the problem is not solved, shift control of the pressurization system from automatic to manual. Move the UP/DN knob using brief actuations to avoid a “bump” in pressurization. Continue the flight controlling aircraft pressurization with the UP/DN knob. Selection toward UP increases cabin altitude (by decreasing cabin pressure), and selection toward DN decreases cabin altitude. Monitor the pressurization system with reference indicators.

If improper indications continue, select MANUAL on the pressurization switch and move the UP/DN knob as before.

Pressurization Loss (High Cabin Altitude)

A loss of cabin pressure is indicated by a high cabin altitude on the CABIN FT x 1000 indicator and/or illumination of the red CABIN annunciator on the Failure Warning Panel and sounding of the cabin altitude warning horn (which can be silenced with the HORN-SILENCE button on the pedestal).

Check that the COND’G VALVE switch is in the proper position. Attempt to gain control of the pressurization system by switching from automatic mode to manual. To lower the cabin altitude, move the UP/DN knob toward DN. Monitor the cabin vertical speed indicator.

Don oxygen masks, select cockpit communications, place the NO SMOKE switch to ON, and deploy the passenger oxygen masks by selecting MANUAL/OVERRIDE on the passenger oxygen controller.

If the condition continues, select AUTO on the pressurization switch and use the UP/DN knob again. If the altitude remains too high, open the emergency pressurization valve; if the cabin altitude is uncontrollable, continue the flight below 10,000 ft.

Emergency Procedures

This section discusses what happens within the pneumatic, pressurization, and air conditioning system during emergency situations. For a list of specific procedural steps, refer to the AFM or the SimuFlite Operating Handbook.

Air Conditioning Smoke

The Phase I (memory) procedures are designed to initially take care of a life threatening situation. Subsequent steps identify and eliminate the source of the smoke.

Air conditioning smoke normally is associated with oil entering the bleed air/conditioning system. Close the HP bleed valves and reduce engine thrust. Select WSHLD/FLOOR valves COLD and open pilot gaspers. Pull the Freon CB and bring either engine to idle.

If smoke continues, manipulate the power levers to identify the engine producing the smoke though the LP bleed air ducting. If smoke stops, leave that engine at idle. If smoke still continues, select passenger oxygen MANUAL/OVERRIDE, don masks, take the aircraft below 12,000 ft, and select the conditioning valve closed.

At less than 200 kts, open the DV window for smoke evacuation, turn off passenger oxygen when the cabin smoke clears.

Rapid Decompression/ Emergency Descent

The Phase I (memory) procedures designed to take care of life and death situations begin with the crew donning oxygen masks, selecting communications and executing a maximum performance descent.

Passenger oxygen masks are donned, ignition is turned on to prevent engine flameouts, ATC is advised, and the transponder is set to emergency squawk. The aircraft descent must be rapid to minimize the risk of losing consciousness at high altitude.

Smoke Removal

While no smoke removal procedure is published, several procedures in the Flight and Operating Manuals do give specific instructions dealing with this problem. The Electrical Fire or Smoke Procedure calls for opening the windshield and floor valves to move the smoke to the rear. Further ventilation is automatically ensured by the air conditioning system. The air conditioning Smoke and Odor Procedure suggests opening the DV window, however, the cabin must be completely depressurized. Smoke evacuation will occur while using the pressurization system to depressurize and will continue after opening the DV window. The airspeed must be below 200 kts to open the DV window and it can be removed for better vision.

Data Summaries

Pneumatic Systems

Pneumatic System

Power Source	LP/HP bleed air – either engine
Distribution	Air conditioning via sidewall ducts and cockpit distributors Wingshield defog outlets Cockpit footwarmer Emergency pressurization Outflow valve control pressure and vacuum
Control	HP BLEED switch COND'G VALVE switch Emergency pressurization valve Cabin temperature regulator Footwarmer defog valves Anti-ice switches Engine power setting
Monitor	ENG 1/2 anti-ice lights WINGS anti-ice light Annunciators COND O'HEAT HYD. TK. 1/2 CABIN (cabin pressure over 10,000 ft) DEICING (**some aircraft**) Cabin temperature gage (**if installed**)
Protection	HP check valves LP check valves Check valves – aft pressure bulkheads

Pressurization Systems

Power Source	HP/LP bleed air from either or both engines W bus (115V AC) (**aircraft with IDC controller**) A bus (28.5V DC) (**aircraft with ABG-SEMCA controller**)
Distribtion	Pressurized fuselage area
Control	CABIN ALTITUDE controller RATE knob PULL FOR BARO knob AUTO/MAN/DUMP pressurization mode selector UP/DOWN manual pressurization knob (cherry picker) HP BLEED switch COND'G VALVE switch
Monitor	CABIN annunciator (10,000 ft) Indicators Cabin rate of climb Cabin altitude Cabin differential pressure
Protection	Overpressuration controller (9.1 PSI) Squat switch (landing depressurization)

Freon Air Conditioning System

Power Source	Main bus via operating generator or GPU
Distribution	Air conditioning ducts
Control	Switches Freon system Auxiliary bus Pressure Temp regulation valve Start buttons 30-second timer
Monitor	Generator ammeter Cabin temperature gage
Protection	Suction pressure switches Discharge pressure switches Starter button shutoff Generator/GPU power source relay

Powerplant

Chapter 5L

The Powerplant chapter contains information on several areas:

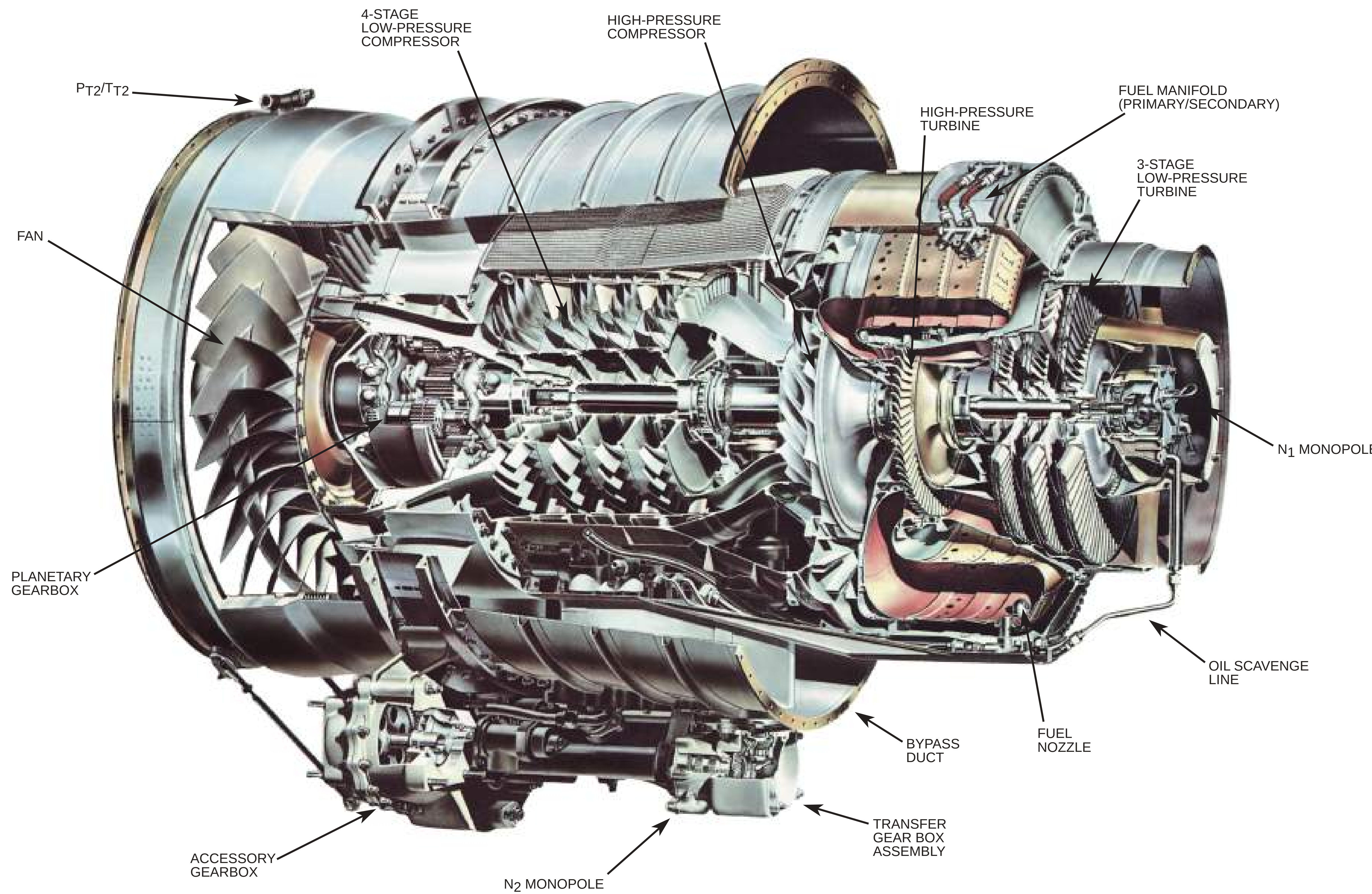
- the turbofan engine, including its components
- instrumentation and operation
- engine oil and lubrication
- ignition
- engine fuel and fuel control
- power control.

Two Garrett TFE731-2-1C turbofan engine power the Falcon 10/100. Each engine produces 3,230 lbs of static takeoff thrust at sea level. The TFE731 is a lightweight, low noise, two-spool, front fan engine with a medium bypass ratio. The engine's modular engine design allows for ease of maintenance and repair.

Table of Contents

Garrett TFE731-2-1C Engine

Garrett TFE731-2-1C Engine



Basic Operation

Turbofan Engines

Jet engines accelerate air to produce thrust. Thrust output can be generated two ways: a small volume of air accelerated to a high velocity or a large volume of air accelerated to a low velocity.

The turbofan engine utilizes both methods. Only a portion of the incoming air is compressed, mixed with fuel, combusted, and exhausted at a high velocity. The fan compresses and accelerates a large volume of air at a low velocity and bypasses it around the core of the engine without mixing it with fuel or using it for combustion.

The relation of the mass of bypassed air to the mass of air going through the combustion chamber is known as the bypass ratio. The TFE731-2-1C is considered a medium-bypass engine with a bypass ratio of 2.8 to 1, rated at 3,230 lbs static thrust.

Engine Components

The TFE731 engine consists of five major components:

- spinner and fan
- low pressure spool (N_1)
- high pressure spool (N_2)
- annular combustor
- transfer and accessory gearboxes.

5L-1

Fan

The fan is an axial flow fan that moves large quantities of air into the bypass stator and low pressure (core) inlet. Energy is translated into pressure by the rearward acceleration of air. Approximately 280% more air passes through the fan bypass duct than through the engine core. At sea level, the fan produces approximately 70% of the total thrust. The low pressure spool drives the fan through a planetary gear drive system.

Compressors

Axial and centrifugal compressors are used in the TFE731 engine. Axial flow compressors accelerate air rearward with increasing velocity through each stage where kinetic energy is translated into pressure. A stage is a consecutive pair of rotors (rotating blades) and stators (non-rotating blades).

Centrifugal compressors consist of an impeller (rotor), a diffuser, and a compressor manifold. Air picked up and accelerated outward toward the diffuser causes the accelerating air's kinetic energy to be translated into pressure. The diffuser maintains the maximum amount of energy imparted by the impeller.

Engine thrust on the Falcon 10/100 begins with the acceleration and compression of inlet air by the front axial fan (**Figure 5L-1**). Air is then split into two streams; one is passed around the engine core to the exhaust nozzle by the bypass duct, and the other is compressed by the four-stage LP compressor. The single-stage HP centrifugal compressor further compresses the air before it enters the combustion chamber.

Spools and Indicators

The two spools of the engine are the N_1 (or LP) spool and the N_2 (or HP) spool. The LP compressor and LP turbine are connected by a common shaft to form the N_1 spool. The center section of the N_1 shaft passes through the interior of a much shorter shaft. The outer, concentric shorter shaft connects the HP compressor and HP turbine to form the N_2 spool.

The HP spool compressor and turbine are between the LP compressor and LP turbine. The N_1 shaft rotates independently of the N_2 shaft. The most forward end of the N_1 shaft extends into and drives the planetary reduction gearbox. A tower shaft, perpendicular to and driven by the N_2 shaft, drives the transfer gearbox. A shaft from the transfer gearbox drives the accessory gearbox. During start, the starter drives the accessory section to rotate the N_2 spool through the transfer gearbox.

Low Pressure Spool (N_1)

The low pressure spool (N_1) consists of a four-stage, low pressure, axial flow compressor and a three-stage, low pressure turbine. Both low pressure compressor and turbine stages are mounted on a common shaft. Air is accelerated rearward through each stage (i.e., rotor and stator pair) with increasing pressure. Low pressure spool rotational speed is expressed as N_1. The N_1 shaft drives the fan through the planetary gears.

N1 Indicator

Low pressure compressor speed for each engine is measured by a pickup on the aft end of the low pressure rotor shaft. The pickup produces dual independent signals; one set of signals is used by the electronic engine control (EEC) for its operation.

The other set of signals is displayed as percent N_1 RPM (graduated from 0 to 100) on an analog/digital indicator on the center instrument panel (**Figure 5L-2**). Power for the indicating circuit is supplied through CBs from the associated A or B bus or, during low temperature starts, from the Battery bus.

5L-2

5L-3

High Pressure Spool (N_2)

The high pressure spool consists of a single stage centrifugal compressor driven by a single stage turbine through an outer concentric shaft. Air is accelerated outward by the impellers with increasing force; kinetic energy is translated into pressure by the action of the impeller and diffuser. The high pressure spool also drives the accessory section through a tower shaft and gear reduction system. High pressure spool rotational speed is expressed as N_2.

N_2 Indicator

HP compressor (N_2) speed is sensed from a pickup on the transfer gearbox that provides dual independent signals. One set of the speed signals is sent to the EEC for use in its operation. The other set of signals is sent to the cockpit indicator on the center instrument panel (**Figure 5L-3**). The indicator displays percent RPM (graduated from 0 to 100) on an analog/digital indicator. Power for the N_2 indicating circuit is supplied from either associated A or B bus or, during low temperature starts, from the Battery bus.

Annular Combustor

To decrease the length of the engine, a compact, reverse flow, annular combustor is used. In the combustion chamber, fuel is introduced into the reverse flow annular burner by 12 duplex fuel spray nozzles. The air and fuel are mixed, ignited, heated, and expanded. Hot gases pass through the high and low pressure turbines, drive both rotating compressor assemblies, and exit the exhaust nozzle with the bypassed air (**Figure 5L-4**). Fuel is introduced upstream of the primary ignition zone to allow premixing of air and vaporized fuel in the combustor.

Two igniter plugs at the six and seven o'clock positions in the combustion plenum provide a discharge spark of 18,000 to 24,000 volts at a rate of one to five sparks per second.

Interstage Turbine Temperature (ITT) Indicator

Ten Chromel-Alumel thermocouples in the gas path between the high pressure turbine and first stage of the low pressure turbine sections measure Interstage Turbine Temperature (ITT). An average temperature is presented in analog and digital format on a cockpit indicator on the center instrument panel (**Figure 5L-5**) and to the EEC. The indicator shows ITT in degrees

Engine Operating Limitations

Refer to the end of the chapter for engine operating limitations.

ITT Limits

Refer to the end of the chapter for ITT limits.

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5L-5

centigrade. Power for the analog ITT indicating system is from the thermocouple; digital-type gages receive power from the A or B bus.

Transfer and Accessory Gearboxes

The transfer and accessory gearboxes are mounted under the engine (**Figures 5L-6** and **5L-7**). The transfer gearbox, which powers the accessory gearbox, is driven by the high pressure spool (N_2) through a tower shaft. The N_2 monopole pickup, which senses HP rotor speed, is also mounted on the transfer gearbox.

A hydraulic pump and starter/generator are mounted on the forward side of the accessory gearbox; an engine fuel pump/control and oil pump are mounted on the aft side of the accessory gearbox.

Engine Bleed Air

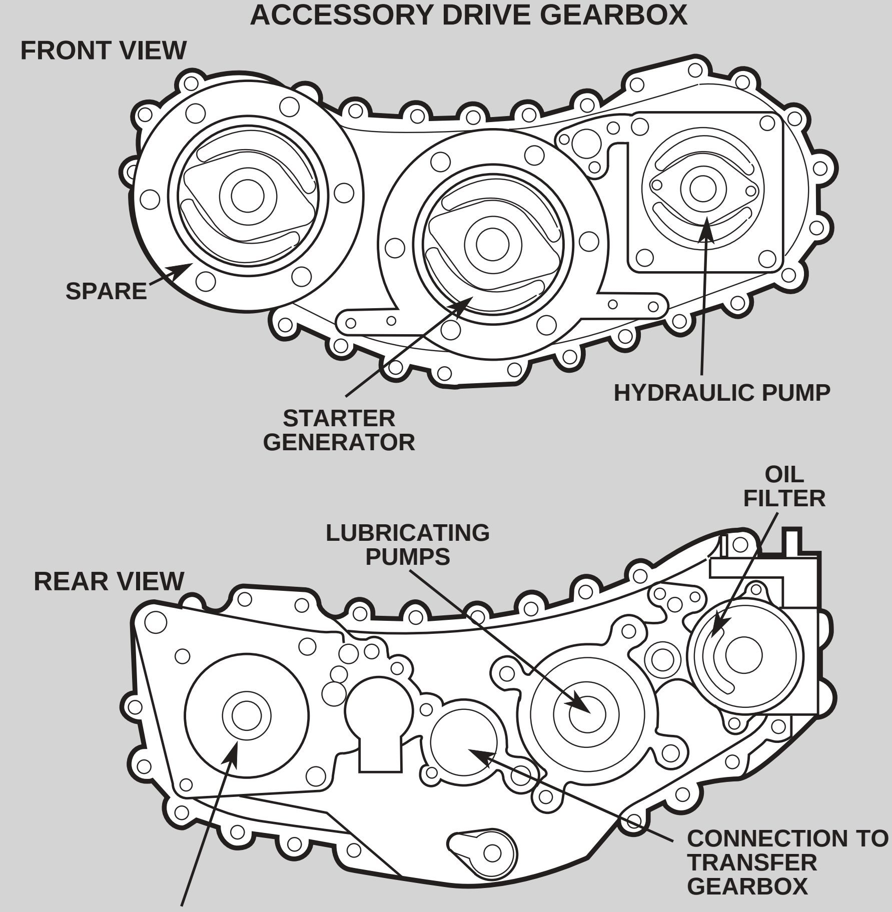
Each of the engines on the Falcon 10/100 has three bleed air ports. Two LP bleed ports at 3 o' clock and 9 o' clock take bleed air aft of the last stage of the axial compressor; one HP bleed port at 12 o' clock takes air from downstream of the centrifugal compressor.

Each bleed air system is equipped with check valves that prevent air from returning to the engines when they are shut off or running at low RPM.

All of the engine bleed ports provide the aircraft pneumatic system with air. In addition, each engine also has an internal HP bleed that is used for engine anti-icing. For more information on bleed air, see the Pneumatics chapter; for more information on engine anti-icing, see the Ice and Rain chapter.

5L-6

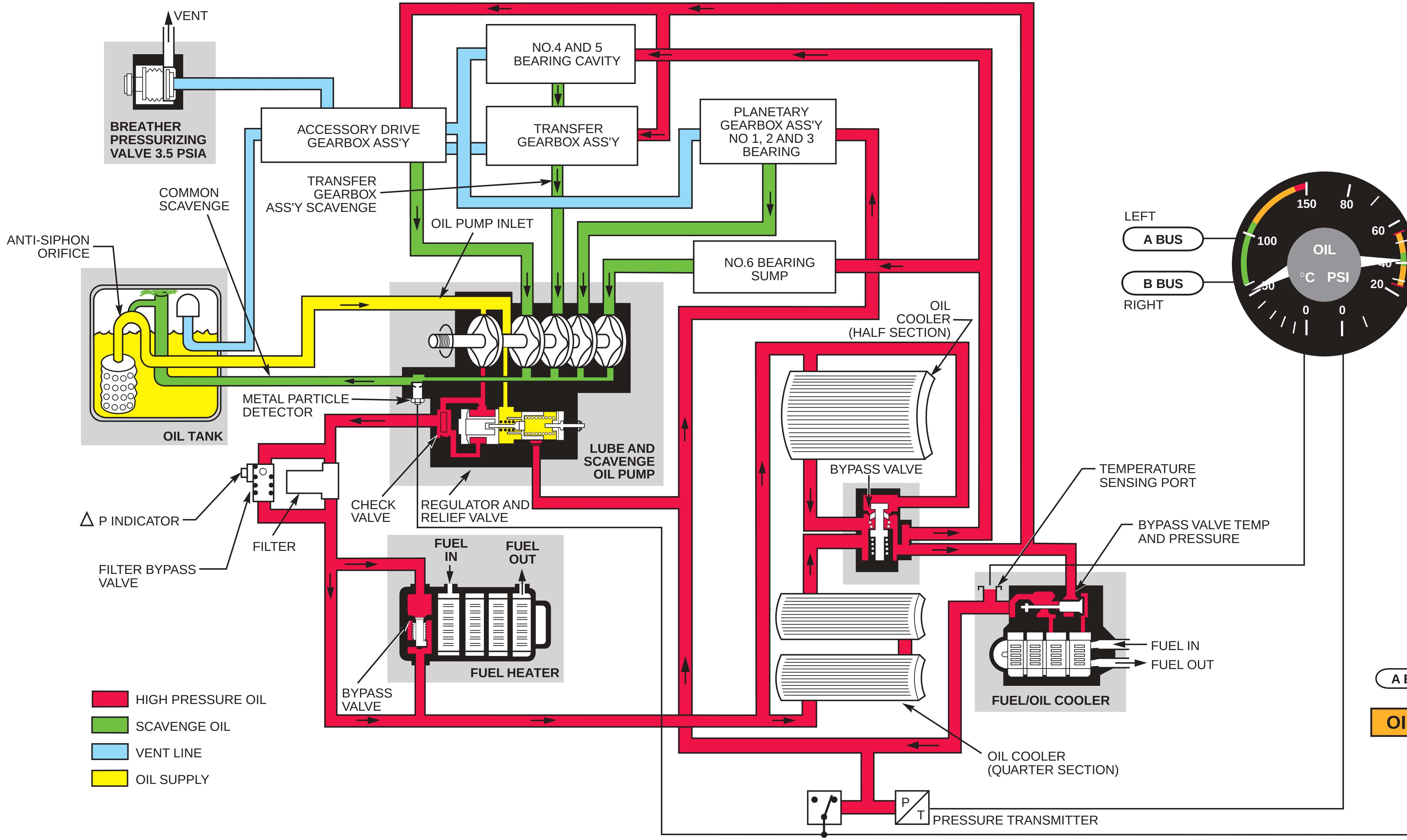
ACCESSORY DRIVE GEARBOX



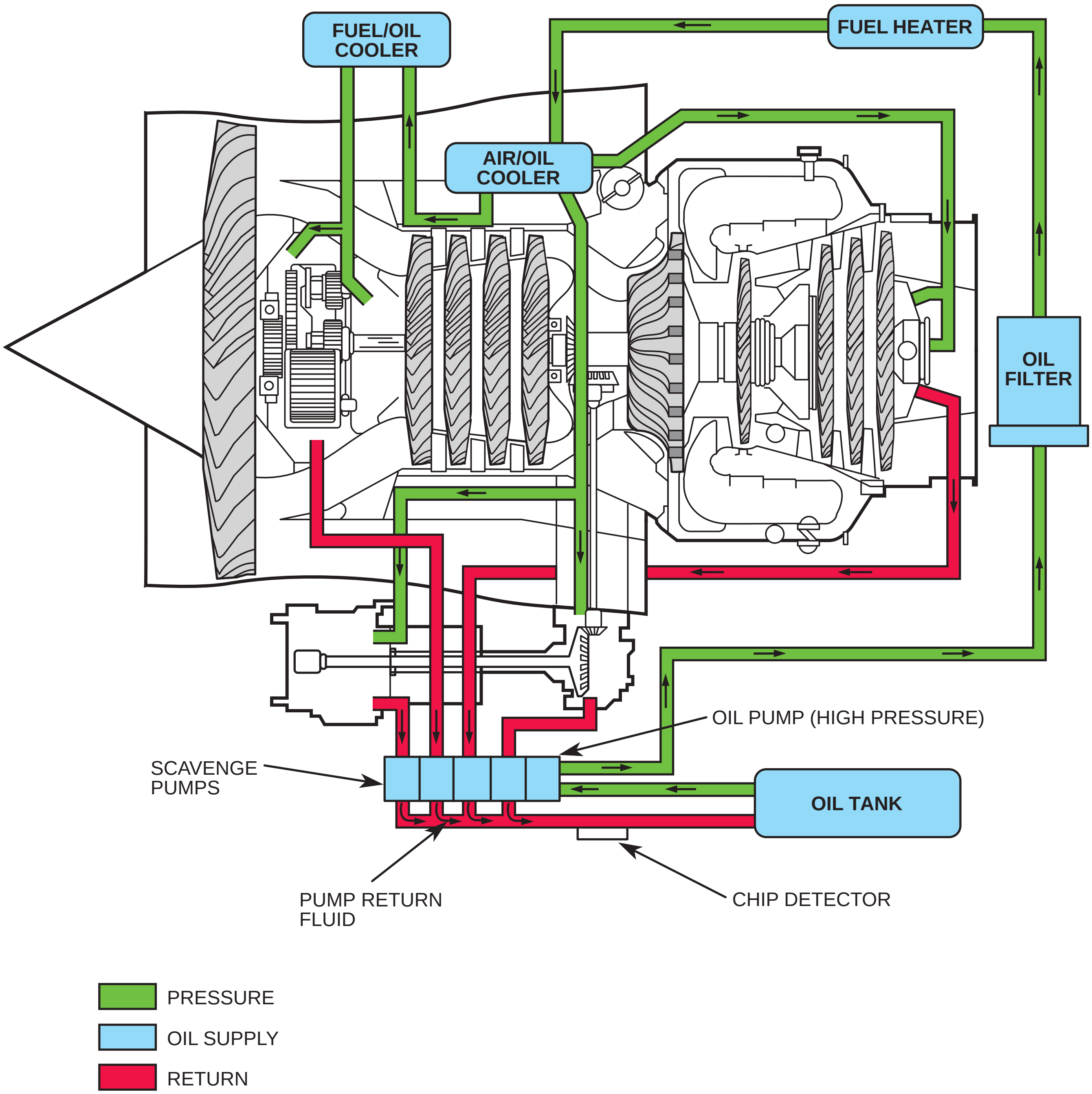
5L-7 FUEL PUMP AND HYDROMECHANICAL FUEL CONTROL REGULATOR

Engine Oil System

Engine Oil System



Oil Flow


FUEL/OIL COOLER
FUEL HEATER
AIR/OIL COOLER
OIL FILTER
OIL PUMP (HIGH PRESSURE)
SCAVENGE PUMPS
OIL TANK
PUMP RETURN FLUID
CHIP DETECTOR
PRESSURE
OIL SUPPLY
RETURN

Powerplant Systems

Engine Oil System

Oil is provided under pressure to the bearings, transfer, accessory, and planetary gearboxes. The system consists of:

- oil reservoir
- oil pump
- filter and housing
- filter bypass valve
- fuel/oil cooler and bypass valve
- three surface air/oil coolers
- oil temperature control and bypass valve
- breather pressurizing valve
- air/oil separator
- oil sight gage
- chip detector
- pressure and temperature transmitters.

Oil is drawn from the oil tank by the rotation of the engine oil pump on the bottom of each engine. Oil pump output is directed through a pressure regulator then through a paper cellulous filter before delivery to the engine bearings, the transfer gearbox, the accessory gearbox, and the fan reduction planetary gear assembly. The pressure regulator maintains oil pressure at 42 ± 4 PSIG.

Filter restriction of more than 25 PSID is indicated by projection of a red pin on the right side of the engine accessory gearbox. The indicator pin is visible through a small access hole in the engine cowling. Once the pin pops out, it remains out until reset. The pin provides no indication to the cockpit during flight; therefore, it should be checked on pre- and post-flight inspections. If the pin is observed to be protruding, an impending bypass is indicated; maintenance action is required.

In the event of filter blockage, engine oil lubrication is rerouted past the filter by a bypass valve when there is a pressure drop of 30 to 40 PSID across the filter, and the indicator pin pops out.

After oil leaves the filter, it passes through a fuel heater and oil-to-air heat exchangers in the fan bypass duct. A temperature control valve allows the oil to bypass the oil-to-air heat exchangers until oil temperature rises again. Oil at temperatures higher than 65°C passes through the three segmented oil-to-air heat exchangers. If the coolers become obstructed, the temperature control valve reroutes the oil around them.

Part of the oil is then distributed to the No. 6 bearing sump, No. 4 and No. 5 bearing sumps (HP rotor shaft), transfer gearbox bearings and gear meshes, and accessory gearbox and gear meshes. Oil is also routed through a temperature control valve at the fuel/oil cooler assembly. If oil temperature exceeds 99°C, the temperature control valve at the fuel/oil cooler opens to route oil through the cooler.

The oil then lubricates fan shaft bearings No. 1 and No. 2, front low pressure spool bearing No. 3, and all planetary gearbox bearings and meshes.

After traveling to all main sump areas, oil drains by gravity to the lowest point in each sump. The sumps are connected to four scavenge pumps in the pump pack. A magnetic particle chip detector is in the scavenge pump oil return line; if metallic particles collect on the detector, the OIL 1 or OIL 2 light illuminates.

Spectrometric oil analysis program (SOAP) and oil filter residue analyses are used as maintenance procedures to monitor the condition of the engine. This is done by determining the suspended particle content and composition in the lubrication system.

> **CAUTION:** Do not exceed idle RPM with oil temperature less than 30°C unless ambient temperature is so low as to prevent warmup, when slightly higher RPM may be used.

The condition of engine parts contacted by engine oil can be monitored, and impending failure of specific parts can be predicted from the amounts of metal in the oil.

Venting for the oil tank and lubricating system is via the accessory gearbox. The accessory gearbox is vented to the atmosphere through a normally open breather pressurization valve. As pressure altitude increases above 27,000 ft, the breather pressurization valve closes to maintain an engine case pressure of approximately 3.5 PSIA.

Oil Level Sight Gage

The sight gage for engine oil level is built into the oil tank on the right side of the engine (**Figure 5L-8**). The sight gage may be observed through small openings in the cowling for each engine. There is no oil level indication in the cockpit. Oil quantity indications are not accurate unless checked within one hour of engine operation; normally, the check is conducted during the post-flight inspection.

Dual Oil Pressure/ Oil Temperature Indicator

Dual oil pressure/oil temperature indicators display engine oil pressure and engine oil temperature for each engine (**Figure 5L-9**). An oil pressure transmitter in the oil line to the planetary gearbox transmits the operating pressure to the indicator. Normal operating pressure is 38 to 46 PSI, with a minimum (red line) of 25 PSI and a maximum (red line) of 55 PSI for 3 minutes or less.

Information for engine oil temperature indication consists of two resistance bulbs that provide a signal to the temperature side of the dual indicator on the instrument panel. Normal operating temperature is 30 to 113°C up to an altitude of 30,000 ft with a maximum operating temperature of 132°C above 30,000 ft. A transient limit of 140°C is permitted for a maximum of two minutes.

Power for the oil pressure and oil temperature indicating systems is provided through CBs from the A and B buses for their respective engines.

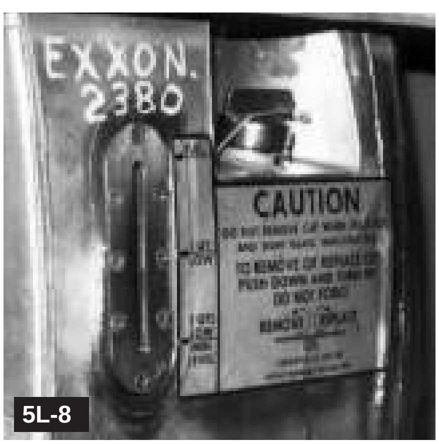
Oil Warning

OIL 1 and OIL 2 warning lights on the failure warning panel are operated by a pressure switch in the oil line to the planetary gearbox. The lights illuminate for an oil pressure less than 25 PSI, or if the metal particle detector in the oil return line detects metal chips. The lights serve as a backup to the oil pressure indicator.

Ignition System

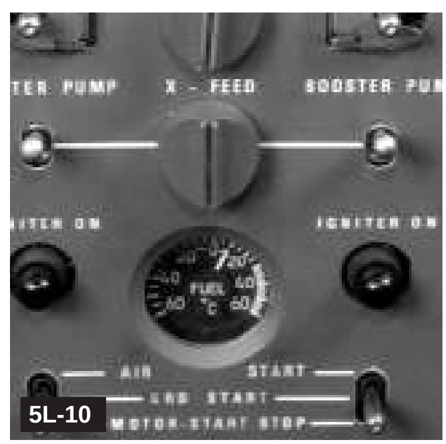
Each engine has an independent ignition system that consists of the following components:

- ignition exciter box
- ignition leads
- igniter plugs



5L-8

5L-9



5L-10

- ignition switch
- circuit breakers.

An ignition exciter box on the upper left side of the fan bypass housing is a high voltage, capacitance discharge, noise-suppressed, intermittent sparking-type unit utilizing 10 to 30V DC. It provides 18,000 to 24,000 volts to the igniter plugs. Continuous operation is possible when flight conditions require it.

The igniters, mounted at the six and seven o'clock positions on the annular combustor, operate independently of each other. Each plug fires at a rate of 1 to 5 sparks per second when triggered by the ignition unit.

The IGN lights on the overhead panel above the start selector switches illuminate when power is supplied to the exciter box; the lights do not indicate that the igniters are actually firing. Continuous ignition is recommended for all takeoffs and landings and in contaminated runway conditions.

Start Selector Switch

A three-position start selector switch for each engine is on the overhead panel (**Figure 5L-10**).

In the GND START position, the starting circuitry is armed for an engine start if the power lever is in the cutoff position. After the start pushbutton is pressed and the power lever is subsequently moved to idle, power is supplied to the ignition system as fuel is supplied to the combustion chamber. When the engine N_2 RPM exceeds 50%, the EEC terminates the start and turns the ignition off.

The MOTOR START-STOP position of the switches provides the control circuits to motor the engine without ignition system operation. This position can also be used to end a start sequence if the EEC fails to terminate the start. With the switch in MOTOR START-STOP, the start pushbutton can be pressed; the starter/generator motors the engine as long as the start pushbutton is held. The ignition system does not function with the switch in MOTOR START-STOP.

Continuous ignition is available in the AIR START position, which activates the ignition circuit. This position provides ignition for takeoffs, landings, and contaminated runway operations but does not provide power for starter operation.

Normally supplied by A and B buses respectively, engine ignition will also receive Battery bus power in the event of Main bus failure or generator failure while in flight.

Start Pushbutton

The momentary-type start pushbuttons for each engine are on the overhead panel. Momentarily pressing the start pushbutton for approximately one to two seconds begins the engine start sequence if the power lever is in the cutoff position, the respective generator switch is in ON, both battery switches are in ON, and the start selector switch is in GROUND-START. Once the start sequence begins, the start pushbutton need not remain pressed because the start circuit is a self-latching circuit. With the preceeding conditions, the ignition system automatically functions when the power lever is moved to the idle position.

Start Sequence

Normal engine start is accomplished with a DC-powered starter on the accessory section of the engine. The starter turns the high pressure spool through the tower shaft. The HP compressor provides enough airflow and fuel pressure for engine starting at 10% N_2. The pilot monitors the N_2 RPM and, when in excess of 10% N_2 and N_1 rotation is indicated, advances the power lever from cutoff to idle. With the power lever in idle, fuel is available from the fuel control unit (FCU). The EEC begins to meter the fuel flow

NOTE: Some very early aircraft may still have the early EEC (P/N 949572-5 or -8.

to the combustion section, and ignition is activated. Once the engine passes approximately 50% N_2, the EEC turns off the igniters and the starter.

Fuel Control System

The Falcon 10/100 fuel control system consists of:

- fuel pump assembly
- hydro-mechanical fuel control unit (FCU)
- electronic engine control (EEC)
- fuel flow divider assembly
- fuel nozzles
- engine FIRE PULL handles.

Fuel is pumped by the engine fuel pump, filtered by the fuel filter, metered by the hydro-mechanical fuel control, delivered by the fuel manifold, and atomized by the fuel nozzles.

Fuel Pump

The engine-driven fuel pump, mounted on the accessory gearbox, is actually two pumps: a centrifugal, low pressure boost pump and a vane-type, high pressure pump. The pump also contains a filter element, filter bypass valve, pressure relief valve, and differential pressure indicator.

The low pressure pump draws fuel from the aircraft fuel system, which then passes through a fuel filter and is delivered to the high pressure pump element. To ensure continuous engine operation if the filter clogs, the filter bypass valve opens to deliver fuel to the high pressure pump. If the filter starts to clog, a red indicator pin on the valve pops out (6 to 8 PSID) to warn of potential failure. Once the pin pops out, it remains out until reset. The pin provides no indication to the cockpit during flight; therefore, it should be checked on pre- and post-flight inspections. If the pin is observed to be protruding, maintenance action is required.

The high pressure pump supplies high pressure fuel to the fuel metering valves in the FCU. The FCU meters the fuel according to power lever position and EEC inputs when the EEC is functioning. When the EEC is functioning normally, the capacity of the fuel pump exceeds the needs of the engine; therefore, all of the excess fuel is returned to the high pressure pump inlet.

Hydro-Mechanical Fuel Control Unit

The fuel control unit (FCU) is attached to the rear of the fuel pump and is driven by the fuel pump shaft. It incorporates a metering valve, a fuel metering torque motor, pressure regulator valve, bypass valve, mechanical flyweight governor, compressor discharge limiter (P_3 air), shutoff valves, ultimate overspeed solenoid, and power lever potentiometer.

The FCU receives commands from the EEC in normal operation. In the MANUAL mode, the fuel flow is commanded by throttle control of P_3 pressure. To protect the engine from a malfunctioning EEC, a governor is built into the FCU. The governor, mounted on the main shaft, protects the engine from exceeding 105% RPM regardless of EEC commands; it does not shut the engine off, but limits the RPM to less than 105%.

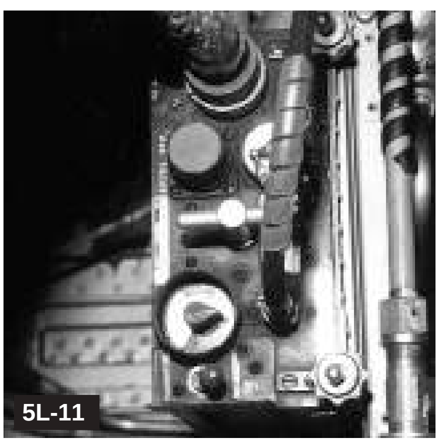
Two shutoff valves are in the FCU. One is the power lever actuated shutoff valve, and the other is a shutoff valve commanded by the EEC if ultimate overspeed is sensed.

Electronic Engine Control

The electronic engine control (EEC) (P/N 2101142) in the baggage compartment provides efficient fuel scheduling in addition to overspeed, surge, and temperature protection for the TFE731 engine (**Figure 5L-11**). The EEC receives inputs of engine inlet pressure and temperature, ITT, N_1 and N_2 RPM, and power lever position via a potentiometer on the FCU. With this information, the EEC provides start, idle through maximum thrust scheduling, acceleration, deceleration, and minimum fuel scheduling.

The ENGINE COMPUTER switch for each engine on the overhead panel controls power to the EEC. Power for the left engine EEC is available from the A bus; power for the right engine is from the B bus. Each receives power through CBs behind the copilot seat. If bus power fails, the power to the switch is supplied directly from the generator of the respective engine when the generator switch is on. CBs are connected to the starter/generator circuit at a point where, during start, power is supplied through an alternate source for the computer switches.

With the engine computer switch on, the EEC is on and the metering valve is held open by compressor discharge pressure (P_3 air) and regulated fuel pressure. The fuel control torque motor and bypass valve controls fuel delivery rate. The EEC determines the amount of fuel required for the power lever position and returns excess fuel to the high pressure pump inlet. Through normal metering of the fuel flow, the computer keeps the engine within its thrust, temperature, and RPM limits.


5L-11

If the engine exceeds normal RPM limits, the EEC provides an ultimate overspeed protection that shuts off fuel when N_1 exceeds 109% or N_2 exceeds 110%.

With the engine computer switch in OFF, the EEC is not powered. Control of the engine is maintained by power lever mechanical linkage to the FCU. With the EEC not powered:

- the surge bleed valve assumes an intermediate position of $^1/_3$ open
- engine acceleration is slower
- fuel consumption is approximately 5% higher
- idle thrust at low altitudes may be higher
- normal limit RPM governing and ITT limiting is not available.

Surge Bleed Valve

Under certain conditions, gas turbine engines have a tendency to surge and stall. For each compressor RPM, there is a relationship between its amount of airflow and its pressure increase. When this balance is disturbed, engine surges occur. A surge bleed valve provides protection against this problem.

The EEC controls the position of the surge bleed valve, which is between the LP compressor and the HP compressor. If the valve is open, it releases compressed air into the bypass duct. By controlling the surge bleed valve, the EEC prevents compressor stalls and surges. The EEC normally positions the surge bleed valve fully open for start and idle conditions and fully closed for high RPM conditions. For transient RPM conditions, however, the EEC modulates the surge bleed valve in response to impending stalls. With the fuel EEC OFF or failed, the surge bleed valve stays $^1/_3$ open.

Computer Failure

If a computer fails, the monitor system automatically switches to manual mode and disables the fuel metering function of the computer. An amber ENG C1 or ENG C2 warning light on the failure warning panel indicates that the associated EEC is inoperative. If either light illuminates and the engine instruments are within limits, reduce the power lever to idle, then cycle the engine computer switch for that engine to reset the EEC.

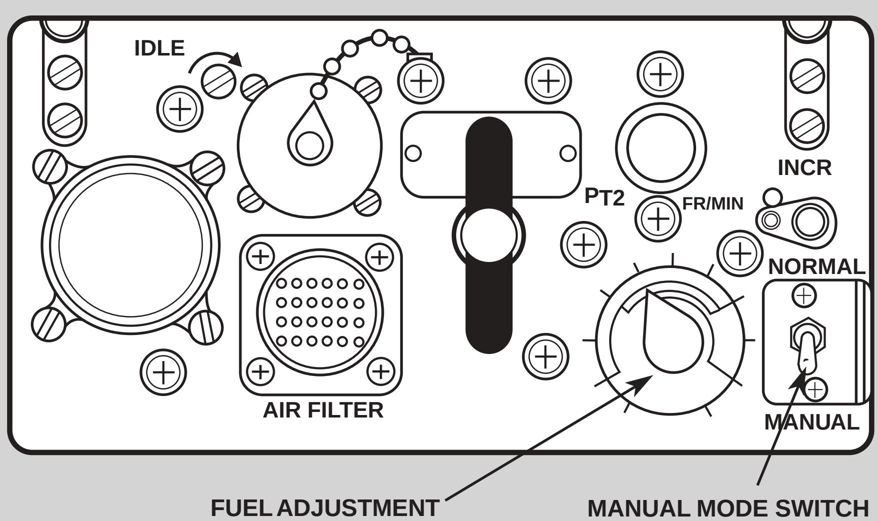
If reset is unsuccessful, the switch should be turned off. N_1 and N_2 ultimate overspeed protection (109% to 110%) is lost; the pilot must control engine operation to ensure that limits are not exceeded.

Both EECs must be ON for takeoff. If an EEC is inoperative, a ferry flight can be authorized by appropriate authorities.

When the aircraft is flown in accordance with the ferry flight procedure, a two-position switch on the face of the fuel computer is moved from NORMAL to MANUAL (**Figure 5L-12**). The cockpit fuel computer switch is then placed in ON. Ultimate overspeed protection for N_1 and N_2 is provided (N_1 and N_2 inputs must be functioning); however, all other functions of the fuel computer are disabled.

Fuel Density Adjustment

Engine operating parameters for different fuel types are compensated through the fuel computer. If fuel specific gravity adjustments are not adhered to, there is the possibility of engine surging and higher turbine temperatures in start, acceleration, and deceleration.



5L-12

The fuel density knob on the front of the EEC is calibrated for AV GAS, JET B, and JET A fuel (**Figure 5L-13**). The fuel adjustment knob may be rotated one "click" either side of the appropriate setting to compensate for individual engine characteristics or installation effects. Consult the Maintenance Manual for proper settings.

Fuel Flow Divider Assembly

The fuel flow divider is between the fuel control unit and the fuel nozzles. Fuel flow to the primary and secondary fuel nozzles is controlled during engine start, operation and shutdown. During engine start, the divider routes fuel at reduced pressure to the primary nozzles. As the start sequence continues, the fuel flow and pressure difference across the divider orifice increase; fuel is allowed to pass into the secondary lines that supply the fuel nozzles as RPM increases.

Fuel Nozzles

Each engine uses 12 duplex (primary and secondary) fuel atomizers that are mounted to two manifold assemblies; each manifold contains six duplex atomizers (**Figure 5L-16**, page 5L-22). Fuel swirls and breaks into microscopic droplets as it passes through the atomizer orifice into the combustor. The primary and secondary fuel atomizers provide a finely atomized fuel spray pattern.

Fuel Flow Indicators

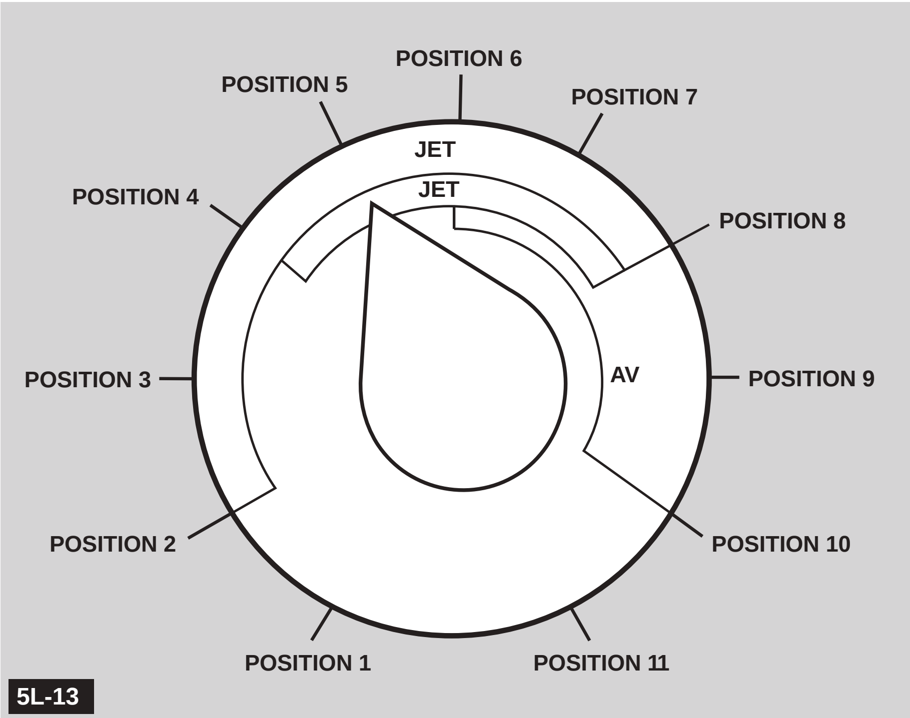
Engine fuel flow is indicated by a gage for each engine on the center of the instrument panel.

A signal proportional to the fuel flow of each engine is derived from a fuel flow transmitter in the fuel supply line of that engine. This signal is sent to the associated engine's fuel flow indicator, which is calibrated in pounds per hour times 100 (lbs/hr x 100) (**Figure 5L-14**).

The fuel flow indicating system requires power for operation from Auxiliary C bus.

Start Pressure Regulator

Two momentary-type start pressure regulator (SPR) switches are the over-



5L-13

5L-14

> **NOTE:** Some early aircraft may still have the early EEC installed. This early EEC does not have an automatic SPR (manual only).

head panel add extra fuel during start. During starts, the EEC normally adds extra fuel without the SPR switch being pressed up to an ITT of 200°C. During starts in cold ambient temperatures (-15°C or less), the SPR switch may be pressed and held up to an ITT of 400°C. Additional fuel is added as long as the switch is pressed.

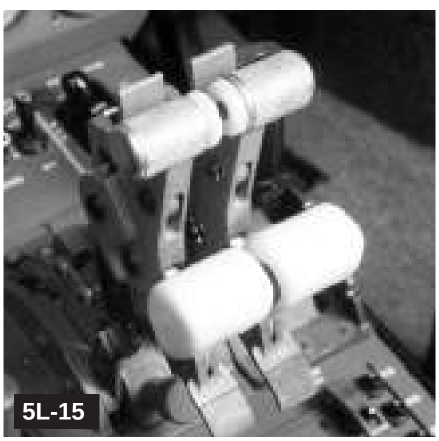
SPR is a function of the EEC; the SPR switch provides a signal to the EEC that responds by opening the torque motor metering valve more than it would in a normal start. The EEC provides fuel enrichment beyond 200° ITT as long as the SPR switch is held to ON. To avoid a hot start, the switch should not be held on longer than that required for the engine temperature to reach 400°C. An overheat condition is likely to occur if the switch is actuated while the engine is in operation. The SPR does not function if the EEC is off or failed.

Engine FIRE PULL Handles

Two engine FIRE PULL handles on the upper center of the instrument panel are mechanically linked to the fuel shutoff valves. Pulling an engine FIRE PULL handle cuts off fuel to the associated engine via a shutoff valve at the engine pylon. There is enough fuel in the fuel line between the shutoff valve and the engine-driven pump to allow the engine to continue to run at idle for approximately 20 seconds after an engine FIRE PULL handle is pulled. Information on engine fire detection and extinguishing is provided in the Fire Protection Chapter.

Power Control System

Engine power is regulated by the pilot with power levers on the center pedestal (**Figure 5L-15**). The power



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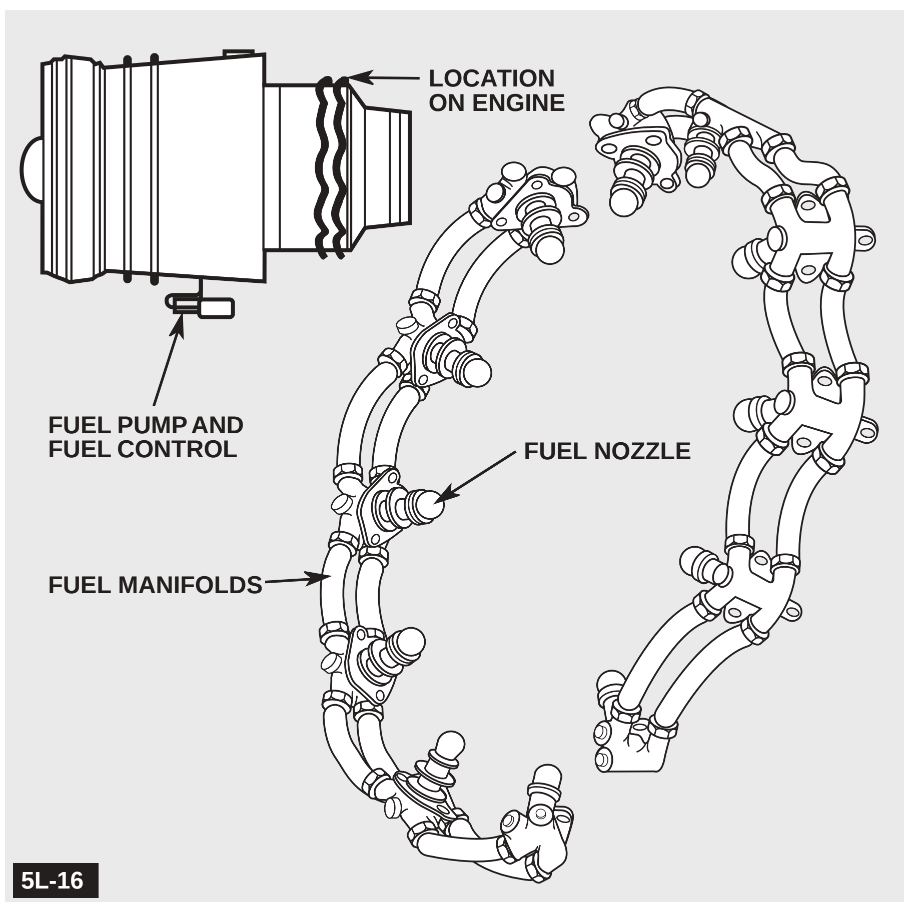

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levers are mechanically connected to the fuel control units. With the EEC functioning, the pilot's control of the engines is modified and there is linearity of thrust with power lever positions. If an EEC is not functioning, the pilot directly controls that engine.

The power lever positions are listed in relationship to the angle of rotation of the control shaft on the FCU. The full aft (0°) position is the engine fuel cutoff position. Forward at 20° FCU is the idle (or engine start) position. To move the power lever either from the idle to the cutoff position or from the cutoff to the idle position requires positioning a release lever forward or aft of the power lever. Forward movement from the idle position is unrestricted until reaching maximum limit of travel of the power lever.

During cold day conditions, required engine thrust is achieved by setting the N_1 RPM specified in the flight manual. This thrust is based on internal pressures, temperatures, and N_1 and N_2 RPM. Using N_1 RPM higher than design specifications can result in damage.

Under hot day conditions, operation of the engine at higher than specified settings can also cause excessive N_1 RPM This can reduce the life of or cause damage to the main shaft, planetary bearings, and combustor plenum.

NOTE: Power is normally set by moving the power levers forward to the maximum position; the EEC controls the engine and the pilot monitors N_1 and ITT for normal operation.

Preflight and Procedures

Preflight

During the external preflight, the engines are physically inspected to ensure that the engine inlets and exhausts are clear of foreign objects and the fan, turbine blades, and exhaust ducts are not bent, nicked, or cracked. The engine fuel bypass indicators should be checked; they should not be extended. Finally, nacelle condition should be checked; no fuel leaks should be evident.

Engine oil level should be checked within one hour after shutdown. Otherwise, start the engine and allow it to stabilize at idle before shutting down and checking oil level. Check that the oil bypass indicator is not protruding (right side of the engine) (**Figure 5L-17**).

The engine oil filler cap and access doors on each side should be checked for security (**Figure 5L-18**). Check engine cowlings for security.

Servicing

The oil system capacity is 12 quarts (11.36 liters); the oil tank holds 6 quarts (5.68 liters).

Maximum allowable engine oil consumption is 0.05 US gallons per hour. This is the equivalent of 1 quart per 5 hours of operation.

Approved engine oils conforming to Garrett EMS 53110, Type II, include the following and those listed in the AFM:

- Aeroshell/Royco Turbine Oil 500 (Type II)
- Castrol 5000 (Type II)
- Exxon/Esso 2380 Turbo Oil (Type II)
- Mobil Jet Oil II (Type II).

The listed brands of approved oil may be mixed. Other types of oil are not approved.

The following procedures should be used when adding oil.

1. Aircraft engine cowling must be opened. This is a maintenance procedure.
2. Remove oil tank filler plug by pushing down and rotating counterclockwise.
3. Fill tank with oil until sight gage or dipstick indicates full.
4. Install filler plug by pushing down and turning clockwise.
5. Close cowling.

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CAUTION: Synthetic lubricants used in this engine contain additives that are readily absorbed through the skin and are considered highly toxic. Prolonged exposure to these lubricants should be avoided.

NOTE: Access to the oil tank is difficult for No. 1 engine. Therefore, remove the cap at the end of the oil refill tube on the left side of the engine. This cap is fitted with a dipstick scaled in missing quarts. Do not use the dipstick for checking; use the sight glass on the tank.

NOTE: To prevent false indications, check the oil level within one hour after engine shutdown.

WARNING: Engine fire may result if airstart is attempted following engine failure accompanied by indications of internal engine damage.

Abnormal Procedures

The following is a brief discussion of abnormal procedures for the engines and their associated systems. For a list of specific procedural steps, refer to the AFM or the SimuFlite Operating Handbook.

Oil Pressure

The illumination of the amber OIL 1 (or 2) annunciator signals that either metal chips are detected in the oil scavenge line or the oil pressure is less than 25 PSI. If the indicated oil pressure exceeds 25 PSI, the most probable cause is metal chips. If possible, reduce thrust, monitor engine operation and land as soon as practical.

If the indicated oil pressure is less than 25 PSI, the crew action is to verify oil pressure in the associated engine and accomplish a precautionary engine shutdown.

Engine Computer Light ON

An engine computer light illuminates when one of the following indications occurs.

- The associated engine computer switch is OFF.
- Power to the associated computer is lost.
- The associated computer fails internally.

Cycle the computer switch to reset the computer. If the light remains on after cycling the computer, the exhaust temperature of the operating engine is used to determine proper setting for the engine with the inoperative computer. Avoid rapid power lever movements; maintain N_1 RPM at 70% above 20,000 ft. Thrust reversers are not authorized for landing.

Engine Overspeed

If N_1 or N_2 exceeds normal operating speeds, retard the power lever on the affected engine. Do not turn the affected engine EEC off because the EEC provides additional engine overspeed protection.

If the engine does not respond to power lever movement, shut it down using normal procedures.

Engine Airstarts

All engine airstarts should incorporate the following procedures.

- Do not attempt an airstart without indication of fan rotation.
- Do not attempt an airstart following an engine failure where the possibility of internal engine damage or fire exists.
- If ITT is approaching limits and rising rapidly, immediately abort the start by placing the power lever in CUTOFF.
- If a malfunction in the EEC is isolated, use the Computer Off Start procedure and continue the flight with fuel computer off.

One of two airstart procedures is implemented, depending on whether the EEC is on or off.

1. Maintain airspeed and altitude within airstart envelope (**Figure 5L-17**).
2. Abort airstart if any of the following situations occur.

- Oil pressure does not rise within 10 seconds of lightoff.
- ITT does not rise within 10 seconds of fuel introduction.
- ITT rise rapidly approaches 860°C limit.
- N_1 RPM remains near 0% when N_2 is 20%.
- N_2 RPM does not rise normally after lightoff.

- N_1 RPM exceeds 80% with power lever at IDLE.

With the fuel computer off, overspeed protection and temperature protection are not provided. Exercise care to prevent reaching engine temperature or speed limits.

Refer to the AFM or the SimuFlite Operating Handbook for the restart envelope and airstart procedures.

Engine Failure During Takeoff

If speed is below V_1, abort the takeoff by bringing power levers to IDLE, extending the airbrakes, applying brakes, and applying reverse thrust to slow aircraft. Accomplish Engine Shutdown procedure when clear of the runway.

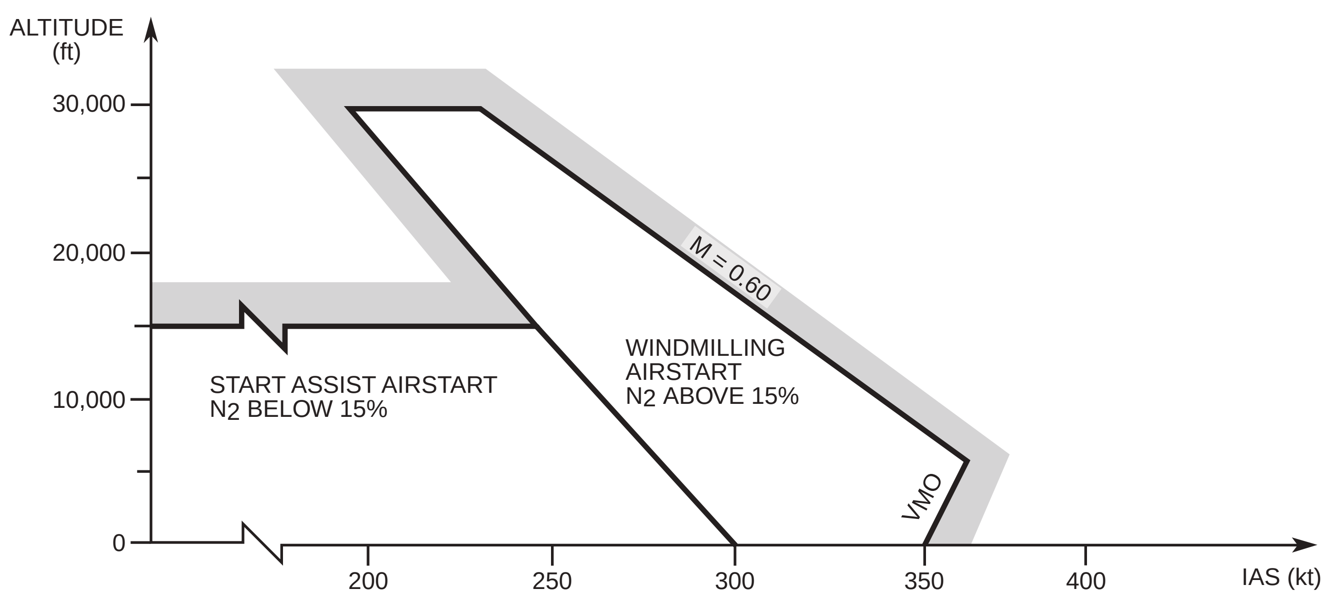
During braking, apply continuous maximum pressure to the brake pedals to obtain best performance from the anti-skid system. Takeoff field lengths assume application of maximum braking at scheduled V_1 speed during aborted takeoff and assume no thrust reversers are available. Refer to the Maneuvers chapter for specific procedure for engine failure after V_1.

After stabilizing the aircraft, perform Engine Shutdown procedure for failed engine.

Engine Failure – Shutdown in Flight

Several conditions (e.g., abnormally high or low oil pressure, rising or high ITT, engine vibration, fan/turbine RPM fluctuations, high oil temperature, or erratic fuel flow) could necessitate an engine shutdown. Usually the Engine Shutdown procedure is part of another abnormal or emergency procedure.

Shut down the affected engine by placing its power lever in CUTOFF and adjust power on the operating engine. Call for the Engine Failure/ Shutdown in Flight checklist.



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Emergency Procedures

The following is a brief discussion of emergency procedures for the engines and their associated systems. For a list of specific procedural steps, refer to the AFM or the SimuFlite Operating Handbook.

Engine Fire

A warning horn and an illuminated FIRE PULL handle light indicate fire in the associated engine. The horn is silenced by pressing the HORN SILENCE button on the pedestal.

When the problem is identified, silence the warning horn. Retard the power level to IDLE. The fire shutoff valve in the pylon is closed when the FIRE PULL handle is pulled. Reducing airspeed to 250 KIAS or below also reduces airflow to the nacelle.

Move the appropriate extinguisher switch to position 1 to discharge the contents of one fire bottle into the engine nacelle. If the condition persists, move the extinguisher switch to position 2 to discharge the contents of the second fire bottle into the nacelle.

Limitations

Temperature, RPM and Time Limits

	N_2% RPM	N_1% RPM	ITT (°C)	Time Limit
Starting			860	
Takeoff	100	100		
			860	5 minutes
Max. Continuous	100	100	832	30 minutes
Transient	103	103		1 minute
	105	105		5 seconds
Ground Start/ Starter Assist Airstart From 10% N_2 to Lightoff				10 seconds
Ground Start from Lightoff to Idle				50 seconds
Windmilling Airstart from Windmilling N_2 to 60% N_2				25 seconds

Data Summary

Powerplant System

Power Source	A bus – left engine N_1, N_2, oil pressure, oil temperature, boost pump, ignition, fire detection, fuel computer, fire XTING switch position 1 B bus – right engine N_1, N_2, oil pressure, oil temperature, boost pump, ignition, fire detection, fuel computer Auxiliary buses Fuel flow indicators and totalizer Battery bus Ignition backup Fire XTING switch position 2 Generators Direct backup power for engine computers (GEN 1, GEN 2)
Control	Thrust lever PRESS TO START buttons Switches IGNITER ON SPR START/STOP AIR/GROUND/MOTOR-START Fuel computer ENGINE 1/ENGINE 2
Monitor	Engine operation Fuel computer Indicators N_1 N_2 Oil temperature Oil pressure Fuel flow Annunciators OIL 1/2 ENG. C1/C2 FUEL P1/P2 GENE. 1/2 IGNITER ON (2)
Protection	Computer ON Flat rating - 3,230 lbs thrust N_1, N_2, 100% EGT limiting 860°C Ultimate overspeed protection N_1 – 109%; N_2 – 110% Mechanical Overspeed 105%