**Raytheon** Aircraft

# Beech King Air® F90

(Serials LA-2 thru LA-204, except LA-202)

# Pilot's Operating Handbook and FAA Approved Airplane Flight Manual

FAA Approved in the Normal category based on 14 CFR Part 23. This document must be carried in the airplane at all times, and be kept within reach of the pilot during all flight operations. This handbook includes the material required to be furnished to the pilot by 14 CFR Part 23.

Airplane Serial Number: ______________________

Airplane Registration Number: ______________________

FAA Approved by: Dawn M Wingfield for
John Tigue
Raytheon Aircraft Company
DOA-230339-CE



P/N 109-590010-3
Issued: May, 1979

P/N 109-590010-3A12
Revised: October, 2001

Published By
**RAYTHEON AIRCRAFT COMPANY**
P.O. Box 85
Wichita, Kansas 67201
U.S.A

**NOTE**

Where Beech Aircraft Corporation is referred to in this publication, it will be taken to read Raytheon Aircraft Company.

**EXPORT STATEMENT**

Exported under the authority of license exception: TSU.
"These commodities, technology or software were exported from the United States in accordance with Export Administration Regulations. Diversion contrary to U.S. law prohibited."

Raytheon Aircraft Company

Member of GAMA

General Aviation Manufacturers Association

# Raytheon Aircraft

# LIST OF EFFECTIVE PAGES

*This listing contains all current pages with effective revision number or date. It should be used after posting changes to ensure the manual is complete and up-to-date. Always destroy superseded pages when you insert revised pages.*

**Beech King Air® F90**

**(Serials LA-2 thru LA-204, except LA-202)**

**Pilot's Operating Handbook**
**and**
**FAA Approved Airplane Flight Manual**

**P/N 109-590010-3**

**A12 Revision - October, 2001**

| | |
|---|---|
| Title Page | October, 2001 |
| Logo Page | Undated |
| List Of Effective Pages | October, 2001 |
| Log Of Revisions | |
| "A12" Revison | October, 2001 |
| "A11" Revision | June, 2001 |
| "A10" Revision | September, 1998 |
| "A9" Revision | January, 1996 |
| "A8" Revision | August, 1994 |
| "A7" Revision | October, 1990 |
| "A6" Revision | August, 1983 |
| "A5" Revision | March, 1981 |
| "A4" Revision | January, 1981 |
| "A3" Revision | August, 1980 |
| "A2" Revision | February, 1980 |
| "A1" Revision | October, 1979 |
| Original Issue | May, 1979 |

| | |
|---|---|
| 1-1 thru 1-5 | June, 2001 |
| 1-6 and 1-7 | May, 1979 |
| 1-8 | March, 1981 |
| 1-9 and 1-10 | August, 1983 |
| 1-11 | February, 1980 |
| 1-12 | May, 1979 |
| 1-13 thru 1-15 | February, 1980 |
| 2-1 and 2-2 | June, 2001 |
| Interim Addendum (1 of 1) | January, 1987 |
| 2-3 | May, 1979 |
| 2-4 | June, 2001 |
| 2-5 | August, 1983 |
| 2-6 | February, 1980 |
| 2-7 and 2-8 | August 1983 |
| 2-9 | May, 1979 |
| 2-10 and 2-11 | August, 1983 |
| 2-12 and 2-13 | June, 2001 |
| 2-14 thru 2-28 | August, 1983 |
| 3-1 and 3-2 | June, 2001 |
| 3-3 | January, 1981 |
| 3-4 and 3-5 | May, 1979 |
| 3-6 thru 3-11 | June, 2001 |
| 3-12 | September, 1998 |
| 3-13 and 3-14 | January, 1996 |
| 3-15 and 3-16 | September, 1998 |
| 4-1 and 4-2 | June, 2001 |
| 4-3 | May, 1979 |
| 4-4 | October, 1979 |
| 4-5 | January, 1981 |
| 4-6 | August, 1983 |
| 4-7 | January, 1981 |
| 4-8 and 4-9 | August, 1983 |
| 4-10 and 4-11 | June, 2001 |
| 4-12 and 4-13 | January, 1981 |
| 4-14 | August, 1983 |
| 4-15 and 4-16 | May, 1979 |
| 4-17 thru 4-22 | June, 2001 |
| 5-1 thru 5-9 | February, 1980 |
| 5-10 thru 5-16 | May, 1979 |
| 5-17 thru 5-21 | February, 1980 |
| 5-22 and 5-23 | May, 1979 |
| 5-24 and 5-25 | February, 1980 |
| 5-26 | January, 1981 |
| 5-27 thru 5-32 | February, 1980 |
| 5-33 | May, 1979 |
| 5-34 thru 5-56 | February, 1980 |
| 5-57 | August, 1983 |
| 5-58 | February, 1980 |

# List Of Effective Pages (Cont'd)
# P/N 109-590010-3
# A12 Revision - October, 2001

| Page | Date |
|---|---|
| 5-59 | May, 1979 |
| 5-60 and 5-61 | February, 1980 |
| 5-62 | January, 1981 |
| 5-63 | February, 1980 |
| 6-1 thru 6-26 | May, 1979 |
| 7-1 thru 7-3 | August, 1983 |
| 7-4 thru 7-7 | May, 1979 |
| 7-8 and 7-9 | February, 1980 |
| 7-10 | May, 1979 |
| 7-11 thru 7-14 | August, 1983 |
| 7-15 thru 7-18 | May, 1979 |
| 7-19 thru 7-21 | August, 1983 |
| 7-22 | May, 1979 |
| 7-23 thru 7-28 | August, 1983 |
| 7-29 | May, 1979 |
| 7-30 | August, 1983 |
| 7-31 | June, 2001 |
| 7-32 | May, 1979 |
| 7-33 | August, 1983 |
| 7-34 | June, 2001 |
| 7-35 | August, 1983 |
| 7-36 thru 7-40 | May, 1979 |
| 7-41 and 7-42 | August, 1983 |
| 7-43 | May, 1979 |
| 7-44 | March, 1981 |
| 7-45 | May, 1979 |
| 7-46 | March, 1981 |
| 7-47 and 7-48 | May, 1979 |
| 8-1 thru 8-14 | June, 2001 |
| 9-1 and 9-2 | May, 1979 |
| Supplements | See Log of Supplements |
| 10-1 thru 10-20 | May, 1994 |

Raytheon Aircraft

# LOG OF TEMPORARY CHANGES

**Beech King Air® F90**

**Pilot's Operating Handbook**
**and**
**FAA Approved Airplane Flight Manual**

**P/N 109-590010-3**

**June, 2001**

Temporary Changes to this manual must be in the airplane for all flight operations.

| PART NUMBER | SUBJECT | DATE |
|---|---|---|
| 109-590010-3TC1 | Emergency Electrical Fault Procedures - Incorporated into A11 Revision | June, 2001 |
| 109-590010-3TC2 | In-Flight Selection of Beta Range - Incorporated into A11 Revision | June, 2001 |

*NOTE: This page should be filed in the front of the manual immediately in front of the Log Of Revisions page. This page replaces any Log Of Temporary Changes page dated prior to the date of this Log.*

**Raytheon** Aircraft

# LOG OF REVISIONS

## Beech King Air® F90

**(Serials LA-2 thru LA-204, except LA-202)**

**Pilot's Operating Handbook**
**and**
**FAA Approved Airplane Flight Manual**

**P/N 109-590010-3**

**A12 Revision - October, 2001**

| PAGE | DESCRIPTION |
|---|---|
| Title Page | Updated |
| List Of Effective Pages | |
| 1 of 2 | New |
| 2 of 2 | New |
| Log Of Revisions | |
| 1 of 1 | New |

A12

**Raytheon** Aircraft

# LOG OF REVISIONS

## Beech King Air® F90

(Serials LA-2 thru LA-204, except LA-202)

## Pilot's Operating Handbook
## and
## FAA Approved Airplane Flight Manual

P/N 109-590010-3

**A11 Revision - June, 2001**

| PAGE | DESCRIPTION |
|---|---|
| Title Page | Updated |
| Logo Page | Updated |
| List Of Effective Pages | |
| 1 of 2 | New |
| 2 of 2 | New |
| Log of Temporary Changes | Updated |
| Log Of Revisions | |
| 1 of 2 | New |
| 2 of 2 | New |
| a and b | Deleted pages |
| 1-1 and 1-2 | Revised Table of Contents |
| 1-3 | Revised "Introduction" and "Important Notice" |
| 1-4 | Revised "Use of The Handbook", "Revising The Handbook", "Revision Service" and Shifted Data |
| 1-5 | Revised "Supplements" and "Airplane Flight Manual Supplements Revision Record" |
| 2-1 and 2-2 | Revised Table of Contents |
| 2-4 | Added "Power Levers" and Revised "Engine Manufacturer" |
| 2-12 and 2-13 | Added "Approved Airplane Deicing/Anti-Icing Fluids" and Shifted Data |
| 3-1 and 3-2 | Revised Table of Contents |
| 3-6 thru 3-8 | Added "Windshield Electrical Fault" and Revised "Glide", "Engine Oil System" and Shifted Data |
| 3-9 | Revised "Generator Inoperative (DC GEN annunciator)" and "Excessive Loadmeter Indication (Over 1.0)" |
| 3-10 and 3-11 | Added "Battery Charge Rate (BATTERY CHG annunciator)" and Shifted Data |
| 4-1 and 4-2 | Revised Table of Contents |
| 4-10 | Revised "Before Take-off (Runup) and Shifted Data |
| 4-11 | Shifted Data |
| 4-17 thru 4-19 | Revised "Nickel-Cadmium Battery Condition Check (Ground Operation Only)" and Added "Cold Weather Procedures (Snow, Slush, and Ice)" and Shifted Data |

A11

| PAGE | DESCRIPTION |
|---|---|
| 4-20 | Revised "Icing Flight" |
| 4-21 | Reformatted Page |
| 7-31 | Revised "Electrical System" |
| 7-34 | Revised "External Power" and Shifted Data |
| 8-1 and 8-2 | Revised Table of Contents |
| 8-3 | Revised "Introduction to Servicing", "Publications" and "Airplane Inspection Periods" |
| 8-4 | Revised "Preventive Maintenance That May Be Accomplished By A Certificated Pilot", "Alterations or Repairs to Airplane", "Ground Handling" and "Towing" |
| 8-5 | Revised "Parking", "Tie-Down", "Jacking and Leveling", "Engine Care in Salty Environments", "Fuel System" and "Fuel Handling Practices" |
| 8-6 | Revised "Filling The Tanks", and "Fuel Grades and Types" and Added "Fuel Additives" and "Draining Fuel System" |
| 8-7 | Added "Engine Fuel Filters and Screens", "Cleaning Firewall Fuel Filters", Cleaning Engine-Driven Fuel Pump Filter and Screen" and Revised "Oil System" and "Servicing the Oxygen System" |
| 8-8 | Revised "Filling the Oxygen System" and "Air Conditioning System" |
| 8-9 | Revised "External Power" and "Tires" |
| 8-10 | Revised "Brake System", "Instrument Vacuum Air" and "Shock Struts" and Added "Deicing and Anti-Icing of Airplanes On The Ground" |
| 8-11 | Revised "Cleaning and Care" and Added "Exterior Painted Surfaces" |
| 8-12 | Added "Landing Gear" and Revised "Windows and Windshields" |
| 8-13 | Revised "Interior Care" and "Consumable Materials" |
| 8-14 | Revised "Lamp Replacement Guide" |
| 8-15 thru 8-47 | Deleted Pages and Deleted Data |

A11

# Raytheon Aircraft

# Beech® King Air F90

**(Serials LA-2 thru LA-204, except LA-202)**

**Pilot's Operating Handbook**
**and**
**FAA Approved Airplane Flight Manual**

**P/N 109-590010-3**

**LOG OF REVISIONS**

"A10" Revision .......................................................... September, 1998

| Page | Description |
|---|---|
| Title Page | Updated |
| Page A (A10) | New |
| 2-1, 2-2 | Revised Table of Contents |
| 2-13 | Added "Limitations When Encountering Severe Icing Conditions (Required By FAA AD 98-04-24)" |
| 3-1, 3-2 | Revised Table of Contents |
| 3-12 | Deleted "Operations Outside The FAR 25, Appendix C, Icing Envelope" |
| 3-15, 3-16 | Added "Severe Icing Conditions (Alternate Method Of Compliance With FAA AD 98-04-24)" |
| 4-18 | Revised "Icing Flight" |

A10

**BEECHCRAFT KING AIR F90**
**(LA-2 THRU LA-204, EXCEPT LA-202)**
**PILOT'S OPERATING HANDBOOK**
**AND**
**FAA APPROVED AIRPLANE FLIGHT MANUAL**
**P/N 109-590010-3**

# LOG OF REVISIONS

"A9" Revision .......... January, 1996

| Page | Description |
|---|---|
| Title Page | Updated |
| Page A (A9) | New |
| 2-1, 2-2 | Revised Table of Contents |
| 2-12 | Revised Data (ICING LIMITATIONS, STRUCTURAL LIMITATIONS) |
| 3-1, 3-2 | Revised Table of Contents |
| 3-11 | Revised Data (LOSS OF PRESSURIZATION) |
| 3-12 | Revised Heading, Added Procedure (ICE PROTECTION SYSTEMS) |
| 3-13 | Revised Procedure (SPINS) |
| 3-14 | Shifted Data |
| 4-1, 4-2 | Revised Table of Contents |
| 4-18 | Revised Data (ICING FLIGHT) |
| | A9 |

**KING AIR F90**
**(LA-2 THRU LA-204, EXCEPT LA-202)**
**PILOT'S OPERATING HANDBOOK**
**AND**
**FAA APPROVED AIRPLANE FLIGHT MANUAL**

## LOG OF REVISIONS

**A8 Revision** . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . **August, 1994**

| Page | Description |
|---|---|
| Title Page | Updated |
| Page A (A8) | New |
| 10-1 thru 10-20 | Revised Section X, Safety Information (May, 1994) |

A8

**KING AIR F90**
**(LA-2 THRU LA-204, EXCEPT LA-202)**
**PILOT'S OPERATING HANDBOOK**
**AND**
**FAA APPROVED AIRPLANE FLIGHT MANUAL**

## LOG OF REVISIONS

A7 Revision . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . October, 1990

| Page | Description |
|---|---|
| Title Page | Updated |
| Page A (A7) | New |
| 10-1 thru 10-22 | Revised Section X, Safety Information (October, 1990) |
| | A7 |

**BEECHCRAFT KING AIR F90**
**(Serials LA-2 thru LA-204, except LA-202)**
**PILOT'S OPERATING HANDBOOK**
**AND**
**FAA APPROVED AIRPLANE FLIGHT MANUAL**

## LOG OF REVISIONS

Revision A6.......................................................................................... August, 1983

| Page | Description |
|---|---|
| Title Page | Update |
| "A" Page (A6) | New |
| "a" Page | Revised "INTRODUCTION" and Added "WARNING" |
| 1-1 | Revised "TABLE OF CONTENTS" |
| 1-3 and 1-4 | Revised "USE OF THE HANDBOOK" |
| 1-5 | Shifted Material |
| 1-9 | Revised "APPROVED FUEL ADDITIVE" and "SPECIFICATION" |
| 1-10 | Revised "CABIN AND ENTRY DIMENSIONS" |
| 2-1 and 2-2 | Revised "TABLE OF CONTENTS" |
| 2-5 | Revised "ENGINE OPERATING LIMITS" |
| 2-7 and 2-8 | Revised "APPROVED FUEL ADDITIVE" and Added "FUEL BIOCIDE ADDITIVE" |
| 2-10 | Revised "DATUM" |
| 2-11 | Shifted Material |
| 2-12 | Revised "MAXIMUM OPERATING PRESSURE-ALTITUDE LIMITS" and "STRUCTURAL LIFE" |
| 2-13 and 2-14 | Shifted Material |
| 2-15 thru 2-24 | Revised "PLACARDS" and Shifted Material |
| 2-25 | Revised "COMMUNICATIONS", "ELECTRICAL POWER" and "ENGINE INDICATING INSTRUMENTS" |
| 2-26 | Revised "EQUIPMENT/FURNISHINGS", "FLIGHT CONTROLS", "FUEL" and "ICE AND RAIN PROTECTION" |
| 2-27 | Revised "LANDING GEAR", "LIGHTS" and "NAVIGATION INSTRUMENTS" |
| 2-28 | Revised "OXYGEN", "PROPELLERS" and "VACUUM" |
| 3-2 | Revised "TABLE OF CONTENTS" |
| 3-6 | Revised "ELECTRICAL SMOKE OR FIRE" |
| 3-8 | Revised "FAILURE OF FLIGHT IDLE LOW PITCH STOP" |
| 3-11 and 3-14 | Shifted Material |
| 4-1 and 4-2 | Revised "TABLE OF CONTENTS" |
| 4-6 | Revised "BEFORE ENGINE STARTING" and "ENGINE STARTING (BATTERY)" |
| 4-8 | Revised "BEFORE TAXIING" |
| 4-9 | Revised "BEFORE TAKEOFF (RUNUP)" |
| 4-10 | Revised "BEFORE TAKEOFF (RUNUP)" and "BEFORE TAKEOFF (FINAL ITEMS)" |
| 4-14 | Revised "OXYGEN AVAILABLE WITH PARTIALLY FULL BOTTLE" Graph and "OXYGEN DURATION" |
| 4-17 | Added "ADDING BIOCIDE TO FUEL" |
| 5-57 | Revised "PRESSURIZATION CONTROLLER SETTING FOR LANDING" Graph |
| 7-1 thru 7-3 | Revised "TABLE OF CONTENTS" |
| 7-11 | Revised "ANNUNCIATOR SYSTEM" |
| 7-12 thru 7-14 | Revised "ANNUNCIATOR PANELS" |
| 7-19 | Revised "POLARIZED CABIN WINDOWS" and Added "SHADE TYPE" |
| 7-20 | Shifted Material |
| 7-21 | Revised Illustration |
| 7-23 | Revised "PROPELLER SYNCHROPHASER" |
| 7-24 | Shifted Material |

**A6**

## LOG OF REVISIONS (Cont'd)

| Page | Description |
|---|---|
| 7-24A and 7-24B | Revised "FUEL CONTROL" and Shifted Material |
| 7-25 | Shifted Material |
| 7-26 | Revised "FIRE EXTINGUISHER SYSTEM SCHEMATIC" |
| 7-27 | Revised "LOW PITCH STOPS" |
| 7-28 | Revised "FUEL SYSTEM SCHEMATIC" |
| 7-30 | Revised "FUEL DRAIN COLLECTOR SYSTEM" and Added "FUEL PURGE SYSTEM (LA-57 and AFTER)" |
| 7-31 | Revised "ELECTRICAL SYSTEM" |
| 7-33 | Revised "LEFT GENERATOR BUS", "BATTERY OR TRIPLE FED BUS", "RIGHT GENERATOR BUS" and "HOT BATTERY BUS" |
| 7-34 | Added "AVIONICS POWER" |
| 7-35 | Shifted Material |
| 7-41 and 7-42 | Revised "OXYGEN SYSTEM" |
| 8-1 thru 8-3 | Revised "TABLE OF CONTENTS" |
| 8-5 | Revised "PUBLICATIONS" |
| 8-6 and 8-7 | Shifted Material |
| 8-8 | Revised "EXTERNAL POWER" |
| 8-9 | Revised "TIRES" |
| 8-10 | Revised "OIL SYSTEM" |
| 8-11 and 8-12 | Shifted Material |
| 8-13 | Revised "FUEL GRADES AND TYPES" and "CLEANING FUEL FILTERS" |
| 8-14 and 8-15 | Shifted Material |
| 8-16 and 8-17 | Revised "AIRCRAFT FINISH" |
| 8-18 thru 8-23 | Shifted Material |
| 8-24 thru 8-27 | Revised "CONSUMABLE MATERIALS" |
| 8-28 and 8-29 | Revised "VENDOR ADDRESSES" |
| 8-30 | Revised "ENGINE CONTROLS" |
| 8-31 | Shifted Material |
| 8-32 | Revised "PROPELLER" |
| 8-33 | Shifted Material |
| 8-34 | Revised "AILERON CONTROL SYSTEM" and "FLAP CONTROL SYSTEM" |
| 8-35 | Revised Illustration |
| 8-36 | Revised "RUDDER CONTROL SYSTEM" and "LANDING GEAR RETRACT SYSTEM" |
| 8-37 | Revised Illustration |
| 8-38 | Revised "NOSE LANDING GEAR" and "MAIN LANDING GEAR" |
| 8-39 | Revised Illustration |
| 8-40 | Revised "CONTROL COLUMN", "ELEVATOR CONTROL SYSTEM" and "WINGS" |
| 8-41 | Revised Illustration |
| 8-42 | Shifted Material |
| 8-43 | Revised Illustration |
| 8-44 thru 8-47 | Revised "SERVICING SCHEDULE" |

A6

## LOG OF REVISIONS

Revision A5........................................ March, 1981

| Page | Description |
|---|---|
| Title Page | Added Revision Date |
| Logo Page | Added |
| A Page (A5) | Update |
| 1-8 | Revised "Propellers" |
| 2-7 | Revised "Limitations on the use of Aviation Gasoline" |
| 2-8 | Revised "Oil Specification" and "Propeller Hub and Blade Model Numbers" |
| 3-12 | Revised "Ice Protection System" |
| 4-20 | Revised "Electrothermal Propeller Deice" |
| 7-44 and 7-46 | Revised "Propeller Electric Deice System" |
| | 10-1 Thru 10-23 Revised Safety Section Dated March 1981. |

A5

**BEECHCRAFT KING AIR F90**
**PILOT'S OPERATING HANDBOOK**
**AND**
**FAA APPROVED AIRPLANE FLIGHT MANUAL**

## LOG OF REVISIONS

Revision A4........................................................................................................................January, 1981

| Page | Description |
|---|---|
| Title Page | Update |
| A (A4) | New |
| 2-5 | Revised "Engine Operating Limits" and "Footnotes" |
| 2-7 | Revised "Limitations on The Use of Aviation Gasoline" |
| 3-3 | Revised "Emergency Airspeeds" |
| 3-6 | Revised "Electrical Smoke or Fire" |
| 3-7 | Revised "Glide" |
| 3-9 | Revised "Excessive Current Flow" |
| 4-1 | Revised "Table of Contents" |
| 4-2 | Revised "Table of Contents" |
| 4-5 | Revised "Before Engine Starting" |
| 4-6 | Revised "Engine Starting (Battery)" |
| 4-7 | Revised "Engine Starting (External Power)" |
| 4-8 | Revised "Engine Starting (External Power)" & "Before Taxiing" |
| 4-11 | Revised "Descent" |
| 4-12 | Revised "Maximum Reverse Thrust Landing" |
| 4-13 | Revised "Shutdown and Securing" |
| 4-14 | Revised "Oxygen Duration" |
| 5-26 | Revised Graph |
| 5-62 | Revised Graph |

**A4**

## LOG OF REVISIONS

Revision A3........................................................................................................................................ August, 1980

| Page | Description |
|---|---|
| Title Page | Update |
| A (A3) | New |
| 2-15 and 2-16 | Revised "Required Equipment for Various Conditions of Flight" |
| 3-8 | Revised "Systems Emergencies - Propeller System" |
| 4-9 and 4-10 | Revised "Before Takeoff (Runup)" |
| 7-12 | Revised "Annunciator System" |
| 7-27 | Revised "Propeller System" |
| 7-33 | Revised "Electrical System" |

A3

## LOG OF REVISIONS

Revision A2 . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . February, 1980

| Page | Description |
|---|---|
| Title Page | Update |
| A(A2) | New |
| 1-2 | Revised Table of Contents |
| 1-4 | Revised "Use of the Handbook" |
| 1-9 | Revised "Fuel (Military Grades)" ; "Propellers (Pitch Range, 30-Inch Station)" |
| 1-10 | Revised "Cabin and Entry Dimensions" |
| 1-11 | Revised "General Airspeed Terminology (V1)" |
| 1-13 | Revised "Control and Instrument Terminology (Torquemeter)" |
| 1-14 | Revised "Graph and Tabular Terminology (Accelerate-Go; Accelerate-Stop; Clearway)" |
| 1-15 | Shifted Material |
| 2-6 | Revised "Recommended Engine Fuels (Military Grades)" |
| 4-1 & 4-2 | Revised Table of Contents |
| 5-1 & 5-2 | Revised Table of Contents |
| 5-3 | Revised "Introduction to Performance and Flight Planning (Conditions)" |
| 5-4 | Revised "Introduction to Performance and Flight Planning (Performance Example)" |
| 5-5 | Added "Take-Off Flight Path Example" |
| 5-6 thru 5-8 | Revised "Flight Planning"; Shifted Material |
| 5-9 | Added/Revised "Landing Information"; Shifted Material |
| 5-17 thru 5-19 | Shifted Graphs |
| 5-20 & 5-21 | Revised Graphs (Basic) |
| 5-24 & 5-25 | Revised Graphs (Basic) |
| 5-26 & 5-27 | Added Graphs |
| 5-28 & 5-29 | Revised Graphs (Basic) |
| 5-30 & 5-31 | Added Graphs |
| 5-32 | Revised Graph (Associated Conditions - Flaps) |
| 5-34 & 5-35 | Shifted Graphs |
| 5-36 | Revised Graph (Example) |
| 5-37 thru 5-53 | Shifted Graphs |
| 5-54 | Shifted/Revised Graph (Example) |
| 5-55 thru 5-58 | Shifted Graphs |
| 5-60 thru 5-63 | Revised Graphs (Basic) |
| 7-8 & 7-9 | Improved Illustration Quality |
| 8-12 | Revised "Fuel Grades and Types" |
| 8-23 | Revised "Consumable Materials (Recommended Engine Fuel)" |

A2

# LOG OF REVISIONS

Revision A1 . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . October, 1979

| Page | Description |
|---|---|
| Title Page | Update |
| A(A1) | New |
| 2-5 | Revised "Engine Operating Limits (Max Reverse)" |
| 2-8 | Revised "Propeller Blade Angles at 30-inch Station" |
| 2-10 | Revised "Vacuum (Suction) Gage" |
| 2-16 | Revised "Required Equipment For Various Conditions of Flight (Propellers)" |
| 2-18 | Revised "Ice Vanes (Inertial Separator System) Limitations" |
| 3-8 | Revised "Systems Emergencies (Propeller System)" |
| 4-1 and 4-2 | Revised "Table of Contents" |
| 4-4 | Revised "Preflight Inspection" |
| 4-5 | Revised "Before Engine Starting" ; Shifted Material |
| 4-6 | Revised "Before Engine Starting" |
| 4-7 and 4-8 | Revised "Use of External Power" and "Engine Starting" |
| 4-8 | Revised "Before Taxiing" |
| 4-9 and 4-10 | Revised "Before Takeoff (Runup)" |
| 4-10 | Revised "Before Takeoff (Final Items)" and "On Takeoff Roll" ; Shifted Material |
| 4-11 | Revised "Cruise (Cabin Pressurization for Cruise)", "Descent" and "Before Landing)" |
| 4-12 | Revised "Before Landing" and "Landing (After Touchdown)" |
| 4-13 | Revised "After Landing" and "Shutdown and Securing" |
| 4-17 | Revised "Nickel-Cadmium Battery Condition Check (During Engine Start)" |
| 4-19 | Revised "Icing Flight (Engine Anti-Ice)" |
| 4-21 | Revised "Noise Characteristics" |
| 5-1 | Revised "Table of Contents" |
| 5-26 | Deleted Graph |
| 5-30 | Deleted Graph |
| 5-60 | Revised "Landing Distance Without Propeller Reversing - Flaps 100% (Associated Conditions)" |
| 7-8 and 7-9 | Revised Illustrations |
| 7-11 | Revised "Annunciator System" |
| 7-41 | Revised "Environmental Controls (Bleed Air Control)" |
| 8-35 | Revised "Servicing Schedule (Preflight)" |

A1

**BEECHCRAFT SUPER KING AIR F90**
**PILOT'S OPERATING HANDBOOK**
**AND**
**FAA APPROVED AIRPLANE FLIGHT MANUAL**

## LOG OF REVISIONS

Original Issue (A) ........................................................................ May, 1979

| Page | Description |
|---|---|
| Title Page | |
| a and b | |
| 1-1 thru 1-15 | |
| 2-1 thru 2-28 | |
| 3-1 thru 3-14 | |
| 4-1 thru 4-21 | |
| 5-1 thru 5-63 | |
| 6-1 thru 6-26 | |
| 7-1 thru 7-48 | |
| 8-1 thru 8-38 | |
| 9-1 and 9-2 | |
| Supplements | See Log of Supplements |
| 10-1 thru 10-12 | |

A

# INTRODUCTION

The format and contents of this Pilot's Operating Handbook and FAA Approved Airplane Flight Manual conform to GAMA (General Aviation Manufacturers Association) Handbook Specification Number 1. Use of this specification by all manufacturers will provide the pilot with the same type of data in the same place in all handbooks.

In recent years, BEECHCRAFT handbooks contained most of the data now provided. However, the new handbooks contain more detailed data and some entirely new data.

For example, attention is called to Section X (SAFETY INFORMATION). BEECHCRAFT feels that it is highly important to have Safety Information in a condensed form in the hands of the pilots. The Safety Information should be read and studied. Periodic review will serve as a reminder of good piloting techniques.

## WARNING

Use only genuine BEECHCRAFT or BEECHCRAFT approved parts obtained from BEECHCRAFT approved sources, in connection with the maintenance and repair of Beech airplanes.

Genuine BEECHCRAFT parts are produced and inspected under rigorous procedures to insure airworthiness and suitability for use in Beech airplane applications. Parts purchased from sources other than BEECHCRAFT, even though outwardly identical in appearance, may not have had the required tests and inspections performed, may be different in fabrication techniques and materials, and may be dangerous when installed in an airplane.

Salvaged airplane parts, reworked parts obtained from non-BEECHCRAFT approved sources, or parts, components, or structural assemblies, the service history of which is unknown or cannot be authenticated, may have been subjected to unacceptable stresses or temperatures or have other hidden damage, not discernible through routine visual or usual nondestructive testing techniques. This may render the part, component or structural assembly, even though originally manufactured by BEECHCRAFT, unsuitable and unsafe for airplane use.

BEECHCRAFT expressly disclaims any responsibility for malfunctions, failures, damage or injury caused by use of non-BEECHCRAFT approved parts.

**SUPER KING AIR F90**
**PILOT'S OPERATING HANDBOOK**
**AND**
**FAA APPROVED AIRPLANE FLIGHT MANUAL**

# TABLE OF DIVISIONS

# SECTION I
# GENERAL

## TABLE OF CONTENTS

*SUBJECT* *PAGE*

# SECTION I
# GENERAL

## TABLE OF CONTENTS (CONT'D)

## INTRODUCTION

The format and contents of this Pilot's Operating Handbook and FAA Approved Airplane Flight Manual conform to GAMA (General Aviation Manufacturers Association) Handbook Specification No. 1 through Revision No. 2, dated October 18, 1996. Use of this specification by all manufacturers will provide the pilot with the same type of data in the same place in all handbooks.

Attention is called to Section X (SAFETY INFORMATION). Raytheon Aircraft feels that it is highly important to have Safety Information in condensed form in the hands of the pilots. The Safety Information should be read and studied. Periodic review will serve as a reminder of good piloting techniques.

**WARNING**

Use only genuine Raytheon Aircraft or Raytheon Aircraft approved parts obtained from Raytheon Aircraft approved sources, in connection with the maintenance and repair of Beech airplanes.

Genuine Raytheon Aircraft parts are produced and inspected under rigorous procedures to insure airworthiness and suitability for use in Beech airplane applications. Parts purchased from sources other than Raytheon Aircraft, even though outwardly identical in appearance, may not have had the required tests and inspections performed, may be different in fabrication techniques and materials, and may be dangerous when installed in an airplane.

Salvaged airplane parts, reworked parts obtained from non-Raytheon Aircraft approved sources, or parts, components, or structural assemblies, the service history of which is unknown or cannot be authenticated, may have been subjected to unacceptable stresses or temperatures or have other hidden damage, not discernible through routine visual or usual nondestructive testing techniques. This may render the part, component, or structural assembly, even though originally manufactured by Raytheon Aircraft, unsuitable and unsafe for airplane use.

Raytheon Aircraft expressly disclaims any responsibility for malfunctions, failures, damage or injury caused by use of non-Raytheon Aircraft approved parts.

## IMPORTANT NOTICE

The handbook should be read carefully by the owner and the operator in order to become familiar with the operation of the airplane. Suggestions and recommendations have been made within it to aid in obtaining maximum performance without sacrificing economy. Be familiar with, and operate the airplane in accordance with, the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual and/or placards which are located in the airplane. This handbook includes the material required to be furnished to the pilot by the Federal Aviation Regulations and additional information provided by the manufacturer and constitutes the FAA Approved Airplane Flight Manual.

As a further reminder, the owner and the operator should also be familiar with the Federal Aviation Regulations applicable to the operation and maintenance of the airplane, and, as appropriate, FAR Part 91 General Operating and Flight Rules. Further, the airplane must be operated and maintained in accordance with FAA Airworthiness Directives which may be issued against it.

The Federal Aviation Regulations place the responsibility for the maintenance of this airplane on the owner and the operator, who should ensure that all maintenance is done by qualified mechanics in conformity with all airworthiness requirements established for this airplane.

All limits, procedures, safety practices, time limits, servicing, and maintenance requirements contained in this handbook are considered mandatory for continued airworthiness and to maintain the airplane in a condition equal to that of its original manufacture.

Raytheon Aircraft Authorized Outlets can provide recommended modification, service, and operating procedures issued by both the FAA and Raytheon Aircraft, which are designed to get maximum utility and safety from the airplane.

# USE OF THE HANDBOOK

## WARNINGS, CAUTIONS AND NOTES

The following definitions apply to (WARNINGS), (CAUTIONS), and (NOTES) found throughout the handbook:

**WARNING**

Operating procedures, techniques, etc., which could result in personal injury or loss of life if not carefully followed.

**CAUTION**

Operating procedures, techniques, etc., which could result in damage to equipment if not carefully followed.

**NOTE**

An operating procedure, technique, etc., which is considered essential to emphasize.

## REVISING THE HANDBOOK

The Pilot's Operating Handbook is designed to facilitate maintaining the documents necessary for the safe and efficient operation of the airplane. The handbook has been prepared in loose-leaf form for ease in maintenance. It incorporates quick-reference tabs imprinted with the title of each section.

**NOTE**

In an effort to provide as complete coverage as possible, applicable to any configuration of the airplane, some optional equipment has been included in the scope of the handbook. However, due to the variety of airplane appointments and arrangements available, optional equipment described or depicted herein may not be designated as such in every case.

Immediately following the Title Page is a List Of Effective Pages. A complete listing of all pages is presented along with the current status of the material contained; i.e. Original, Reissued or Revised. A reissue of the manual or the revision of any portion will be received with a new List Of Effective Pages to replace the previous one. Reference to the List Of Effective Page(s) enables the user to determine the current issue, revision, or reissue in effect for each page in the handbook, except for the Supplements Section.

When the handbook is originally issued, and each time it is revised or reissued, a new Log Of Revisions page is provided immediately following the List Of Effective Pages. All Log Of Revisions pages must be retained until the handbook is reissued. A capital letter in the lower right corner of the Log Of Revisions page designates the Original Issue ("A") or reissue ("B","C", etc.) covered by the Log of Revisions page. If a number follows the letter, it designates the sequential revision (1st, 2nd, 3rd, etc,) to the Original Issue or reissue covered by the Log Of Revisions page. Reference to the Log Of Revisions page(s) provides a record of changes made since the Original Issue or the latest reissue.

That portion of a text or an illustration which has been revised by the addition of, or a change in, information is denoted by a solid revision bar located adjacent to the area of change along the outside margin of the page.

## REVISION SERVICE

The following publications will be provided, at no charge, to the registered owner/operator of this airplane:

1. Reissues and revisions of the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual.
2. Original issues and revisions of FAA-approved Airplane Flight Manual Supplements.
3. Original issues and revisions of Raytheon Aircraft Service Bulletins.

The above publications will be provided to the registered owner/operator at the address listed on the FAA Aircraft Registration Branch List or the Raytheon Aircraft Domestic/International Owners Notification List. Further, the owner/operator will receive only those publications pertaining to the registered airplane serial number. For detailed information on how to obtain "Revision Service" applicable to this handbook or other Raytheon Aircraft Service Publications, consult any Raytheon Aircraft authorized outlet, or refer to the latest revision of Raytheon Aircraft Service Bulletin No. 2001.

Raytheon Aircraft expressly reserves the right to supersede, cancel, and/or declare obsolete, without prior notice, any part, part number, kit, or publication referenced in this handbook.

The owner/operator should always refer to all supplements for possible placards, limitations, emergency, normal, and other operational procedures for proper operation of the airplane with optional equipment installed.

**WARNING**

It shall be the responsibility of the owner/operator to ensure that the latest revisions of publications referenced in this handbook are utilized during operation, servicing, and maintenance of the airplane.

## SUPPLEMENTS

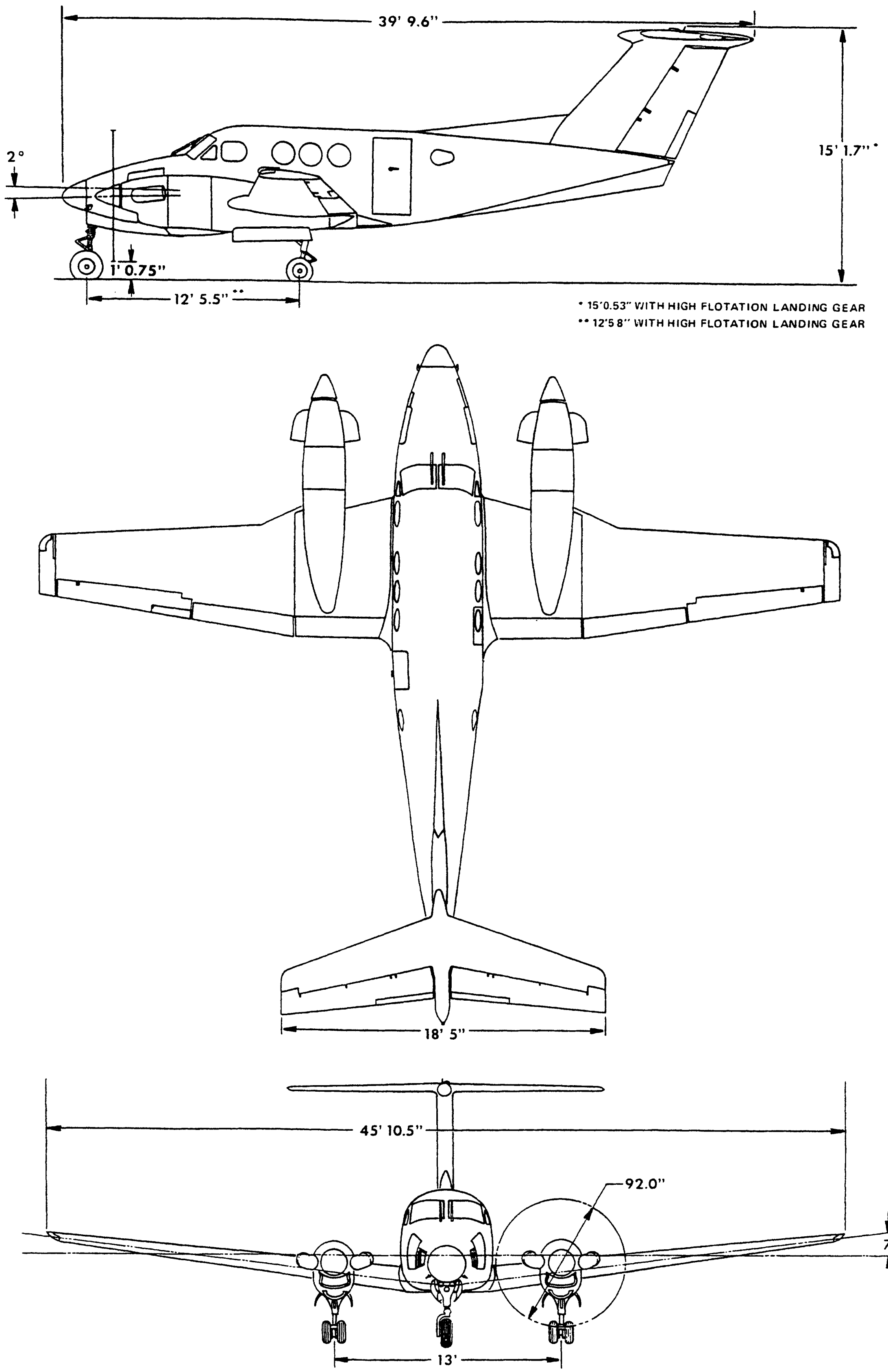
When a new airplane is delivered from the factory, the handbook delivered with it contains either an FAA-approved STC (Supplemental Type Certificate) Supplement or an FAA-approved Raytheon Aircraft Flight Manual Supplement, for every installed item requiring a supplement. If a new handbook for operation of the airplane is obtained at a later date, it is the responsibility of the owner/operator to ensure that all required Supplements (as well as Weight and Balance and other pertinent data) are transferred into the new handbook.

## AIRPLANE FLIGHT MANUAL SUPPLEMENTS REVISION RECORD

Section IX, SUPPLEMENTS, contains the FAA-approved Airplane Flight Manual Supplements, headed by a Log Of Supplements page. On the Log page is a listing of the FAA-approved Supplemental Equipment available for installation on the airplane. When new supplements are received or existing supplements are revised, a new Log page will replace the previous one, since it contains a listing of all previous approvals, plus the new approval. The supplemental material will be added to the Section in accordance with the sequence specified on the Log page.

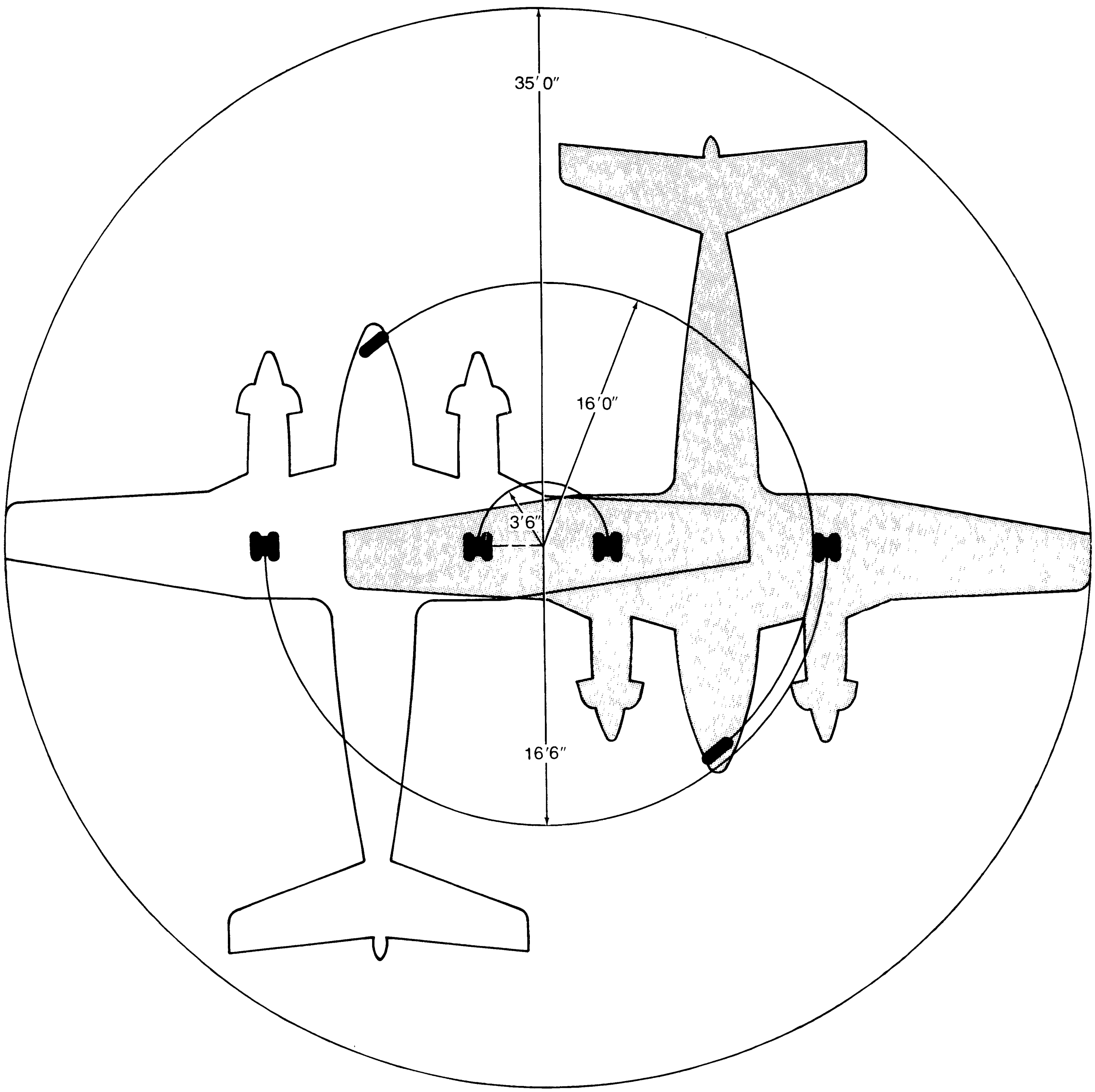
**NOTE**

Upon receipt of a new or revised supplement, compare the existing Log Of Supplements in the handbook with the corresponding applicable Log page accompanying the new or revised supplement. It may occur that the Log page already in the handbook is dated later than the log page accompanying the new or revised supplement. In any case, retain the Log page having the later date and discard the older Log page.


39' 9.6"
2°
15' 1.7" *
1' 0.75"
12' 5.5" **
* 15'0.53" WITH HIGH FLOTATION LANDING GEAR
** 12'5 8" WITH HIGH FLOTATION LANDING GEAR
18' 5"
45' 10.5"
92.0"
7°
13'

THREE VIEW

## GROUND TURNING CLEARANCE




| | |
|---|---|
| Radius for Inside Gear | 3 feet 6 inches |
| Radius for Nose Wheel | 16 feet 0 inches |
| Radius for Outside Gear | 16 feet 6 inches |
| Radius for Wing Tip | 35 feet 0 inches |

F90-601-525

TURNING RADII ARE PREDICATED ON THE USE OF PARTIAL BRAKING ACTION AND DIFFERENTIAL POWER

# DESCRIPTIVE DATA

## ENGINES

NUMBER OF ENGINES: 2

ENGINE MANUFACTURER: Pratt & Whitney Aircraft of Canada Ltd. (Longueuil, Quebec, CANADA)

ENGINE MODEL NUMBER: PT6A-135

ENGINE TYPE: Turbo-propeller Engine

NUMBER OF DRIVE SHAFTS: 2

1 Compressor (Gas Generator) Shaft
1 Power Turbine Shaft

COMPRESSOR STAGES AND TYPES

3 Axial-flow Stages
1 Centrifugal-flow Stage

COMBUSTION CHAMBER TYPE: Annular

TURBINE STAGES AND TYPES

*COMPRESSOR (GAS GENERATOR) TURBINE*

Single-stage Axial-flow Reaction Turbine

*POWER TURBINE*

Single-stage Axial-flow Reaction Turbine

ENGINE SHAFT-HORSEPOWER RATING: 750 SHP

COMPRESSOR (GAS GENERATOR) SHAFT ROTATIONAL SPEED ($N_1$) LIMITS

Maximum Take-off/Maximum Continuous/Cruise Climb Power: 101.5% $N_1$ (38,100 rpm)

PROPELLER ROTATIONAL SPEED ($N_2$) LIMITS

Maximum Take-off/Maximum Continuous/Cruise Climb Power: 1900 rpm

## PROPELLERS

NUMBER OF PROPELLERS: 2

PROPELLER MANUFACTURER: Hartzell Propeller, Inc. (Piqua, Ohio)

PROPELLER HUB AND BLADE MODEL NUMBERS

| | |
|---|---|
| *HUB: LA-1 through LA-120 except LA-20 and LA-97* | HC-B4TN-3B |
| *LA-20, LA-97, LA-121 and after* | HC-B4TN-3A or HC-B4TN-3B |
| *BLADES: LA-1 through LA-130* | T10173FB-10.5 |
| *LA-131 and after* | T10173FK-10.5 |

NUMBER OF BLADES: 4

PROPELLER DIAMETER: 92.0 inches

PROPELLER TYPE

Constant-speed, Full-feathering, Reversing, Counter-weighted, Hydraulically Actuated

PITCH RANGE (30-INCH STATION)

| | |
|---|---|
| Feathered: | $+87.5^\circ \pm 0.5^\circ$ |
| Reverse: | $-8.5^\circ \pm 0.4^\circ$ |

## FUEL

RECOMMENDED ENGINE FUELS

*COMMERCIAL GRADES*

Jet A, Jet A-1, Jet B

*MILITARY GRADES*

JP-4, JP-5, JP-8

EMERGENCY ENGINE FUELS (See LIMITATIONS Section for limitations.)

*COMMERCIAL AVIATION GASOLINE GRADES*

80 Red (Formerly 80/87)
100LL Blue*
100 Green (Formerly 100/130)

*In some countries, this fuel is colored Green and designated "100L."

*MILITARY AVIATION GASOLINE GRADES*

80/87 Red
100/130 Green
115/145 Purple

USABLE FUEL

| | |
|---|---|
| Main Fuel System | 388 gallons |
| Auxiliary Fuel System | 82 gallons |
| Maximum Usable Fuel Quantity | 470 gallons |

APPROVED FUEL ADDITIVE

Anti-ice Additive conforming to Specification MIL-I-27686
Fuel biocide "BIOBOR JF" in concentrations of 135 ppm or 270 ppm

## ENGINE OIL

SPECIFICATION

Any oil specified by brand name in the latest revision of Pratt & Whitney Service Bulletin Number 1001.

TOTAL OIL CAPACITY

14 quarts per engine

DRAIN AND REFILL QUANTITY

Approximately 12.5 quarts per engine

OIL QUANTITY OPERATING RANGE

MAX to 4 QUARTS LOW on dipstick

## MAXIMUM CERTIFICATED WEIGHTS

| | |
|---|---|
| Maximum Ramp Weight | 11,030 pounds |
| Maximum Take-off Weight | 10,950 pounds |
| Maximum Landing Weight | 10,950 pounds |
| Maximum Zero-fuel Weight | 9600 pounds |
| Maximum Weight in Baggage Compartment | 403 pounds |

## CABIN AND ENTRY DIMENSIONS

| | |
|---|---|
| Cabin Width (Maximum) | 54 inches |
| Cabin Length (Maximum Between Pressure Bulkheads) | 13 feet |
| Cabin Height (Maximum) | 57 inches |
| Airstair Entrance Door Width (Minimum) | 27 inches |
| Airstair Entrance Door Height (Minimum) | 51½ inches |
| Pressure Vessel Volume | 313.6 cubic feet |
| Aft Compartment Baggage Volume | 70 cubic feet |
| Avionics Compartment Volume | 16 cubic feet |

## SPECIFIC LOADINGS

WING LOADING: 39.14 pounds per square foot

POWER LOADING: 7.3 pounds per horsepower

## SYMBOLS, ABBREVIATIONS AND TERMINOLOGY

The following glossary is applicable within this handbook.

### GENERAL AIRSPEED TERMINOLOGY

| | |
|---|---|
| **CAS** | *Calibrated Airspeed* is the indicated airspeed of an airplane corrected for position and instrument error. Calibrated airspeed is equal to true airspeed in standard atmosphere at sea level. |
| **GS** | *Ground Speed* is the speed of an airplane relative to the ground. |
| **IAS** | *Indicated Airspeed* is the speed of an airplane as shown on the airspeed indicator. IAS values published in this handbook assume zero instrument error. |
| **KCAS** | *Calibrated Airspeed* expressed in *knots*. |
| **KIAS** | *Indicated Airspeed* expressed in *knots.* |
| **M** | *Mach Number* is the ratio of true airspeed to the speed of sound. |
| **TAS** | *True Airspeed* is the airspeed of an airplane relative to undisturbed air, which is the CAS corrected for altitude, temperature, and compressibility. |
| **$V_1$** | *Take-off Decision Speed.* |
| **$V_2$** | *Take-off Safety Speed.* |
| **$V_A$** | *Maneuvering Speed* is the maximum speed at which application of full available aerodynamic control will not overstress the airplane. |
| **$V_F$** | *Design Flap Speed* is the highest speed permissible at which wing flaps may be actuated. |
| **$V_{FE}$** | *Maximum Flap Extended Speed* is the highest speed permissible with wing flaps in a prescribed extended position. |
| **$V_{LE}$** | *Maximum Landing Gear Extended Speed* is the maximum speed at which an airplane can be safely flown with the landing gear extended. |
| **$V_{LO}$** | *Maximum Landing Gear Operating Speed* is the maximum speed at which the landing gear can be safely extended or retracted. |
| **$V_{LOF}$** | *Lift-off Speed.* |
| **$V_{MCA}$** | *Air Minimum Control Speed* is the minimum flight speed at which the airplane is directionally controllable as determined in accordance with Federal Aviation Regulations. The airplane certification conditions include one engine becoming inoperative and windmilling, a 5-degree bank towards the operative engine, take-off power on operative engine, landing gear up, flaps in take-off position, and most rearward C.G. For some conditions of weight and altitude, stall can be encountered at speeds above $V_{MCA}$ as established by the certification procedure described above, in which event stall speed must be regarded as the limit of effective directional control. |
| **$V_{MCG}$** | *Ground Minimum Control Speed.* |
| **$V_{MO}/M_{MO}$** | *Maximum Operating Limit Speed* is the speed limit that may not be deliberately exceeded in normal flight operations. V is expressed in knots and M in Mach Number. |

| | |
|---|---|
| **$V_R$** | *Rotation Speed.* |
| **$V_S$** | *Stalling Speed* or the minimum steady flight speed at which the airplane is controllable. |
| **$V_{SO}$** | *Stalling Speed* or the minimum steady flight speed at which the airplane is controllable in the *landing configuration.* |
| **$V_{SSE}$** | *Intentional One-Engine-Inoperative Speed* is a speed above both $V_{MCA}$ and stall speed, selected to provide a margin of lateral and directional control when one engine is suddenly rendered inoperative. Intentional failing of one engine below this speed is not recommended. |
| **$V_X$** | *Best Angle-of-Climb Speed* is the airspeed which delivers the greatest gain of altitude in the shortest possible horizontal distance. |
| **$V_Y$** | *Best Rate-of-Climb Speed* is the airspeed which delivers the greatest gain in altitude in the shortest possible time. |

## METEOROLOGICAL TERMINOLOGY

**Altimeter Setting** — Barometric Pressure corrected to sea level.

**Indicated Pressure Altitude** — The number actually read from an altimeter when the barometric subscale has been set to 29.92 inches of mercury (1013.2 millibars).

**IOAT** — *Indicated Outside Air Temperature* is the temperature value read from an indicator.

**ISA** — *International Standard Atmosphere* in which:
(1) The air is a dry perfect gas;
(2) The temperature at sea level is 15° Celsius (59° Fahrenheit);
(3) The pressure at sea level is 29.92 inches of mercury (1013.2 millibars);
(4) The temperature gradient from sea level to the altitude at which the temperature is −56.5°C (−69.7°F) is −0.00198°C (−0.003566°F) per foot and zero above that altitude.

**OAT** — *Outside Air Temperature* is the free air static temperature, obtained either from the temperature indicator (IOAT) adjusted for compressibility effects, or from ground meteorological sources.

**Pressure Altitude** — Altitude measured from standard sea-level pressure (29.92 in. Hg) by a pressure (barometric) altimeter. It is the indicated pressure altitude corrected for position and instrument error. In this handbook, altimeter instrument errors are assumed to be zero. Position errors may be obtained from the Altimeter Correction graph.

**Station Pressure** — Actual atmospheric pressure at field elevation.

**Temperature Compressibility Effects** — An error in the indication of temperature caused by airflow over the temperature probe. The error varies, depending on altitude and airspeed.

**Wind** — The wind velocities recorded as variables on the charts of this handbook are to be understood as the headwind or tailwind components of the reported winds.

## POWER TERMINOLOGY

**Beta Range** — The region of the Power Lever control which is aft of the Idle Stop and forward of reversing range where blade pitch angle can be changed without a change of gas generator rpm.

**Cruise Climb** Is the maximum power approved for normal climb. These powers are torque or temperature (ITT) limited.

**High Idle** Obtained by placing the Condition Lever in the High Idle position. This limits the power operation to a minimum of 70% of $N_1$ rpm.

**Low Idle** Obtained by placing the Condition Lever in the Low Idle position. This limits the power operation to a minimum of 58% of $N_1$ rpm.

**Maximum Continuous Power** Is the highest power rating not limited by time. Use of this rating is intended for emergency situations at the discretion of the pilot.

**Maximum Cruise Power** Is the highest power rating for cruise and is not time limited.

**NOP** *Normal Operating Power* is the highest power rating within the normal operating range. Noise characteristics requirements of FAR 36.1501 have been demonstrated at this power rating.

**Reverse** Reverse thrust is obtained by lifting the Power Levers and moving them aft of the Beta range.

**SHP** *Shaft Horsepower*

**Take-off Power** Is the maximum power rating and is limited to a maximum of 5 minutes operation. Use of this rating should be limited to normal take-off operations and emergency situations.

## CONTROL AND INSTRUMENT TERMINOLOGY

**Condition Lever (Fuel Shut-off Lever)** The fuel shut-off lever actuates a valve in the fuel control unit which controls the flow of fuel at the fuel control outlet and regulates the idle range from Low to High idle.

**ITT (Interstage Turbine Temperature)** Eight probes wired in parallel indicate the temperature between the compressor and power turbines.

**$N_1$ Tachometer (Gas Generator RPM)** The tachometer registers the rpm of the gas generator with 100% representing a gas generator speed of 37,500 rpm.

**Power Lever (Gas Generator $N_1$ RPM)** This lever serves to modulate engine power from full reverse thrust to take-off. The position for idle represents the lowest recommended level of power for flight operation.

**Propeller Control Lever ($N_2$ RPM)** This lever requests the control to maintain rpm at a selected value and, in the maximum decrease rpm position, feathers the propeller.

**Propeller Governor** This governor will maintain the selected speed requested by the propeller control lever, except on reverse selection where the power lever interconnection to the integral pneumatic area of the governor will select a lower speed. The pneumatic area during normal selection will act as an overspeed limiter.

**Torquemeter** The torquemeter system determines the shaft output torque. Torque values are obtained by tapping into two outlets on the reduction gear case and recording the differential pressure from the outlets. Instrument readout is in foot-pounds.

## GRAPH AND TABULAR TERMINOLOGY

**Accelerate-Go** The distance to accelerate to Take-off Decision Speed ($V_1$), experience an engine failure, continue accelerating to lift-off speed ($V_{LOF}$), then climb and accelerate in order to achieve climb speed ($V_2$) at 35 feet above the runway.

**Accelerate-Stop** The distance to accelerate to Take-off Decision Speed ($V_1$) and stop, using brakes and propeller reversing on the operative engine. $V_1$ speed is equal to the take-off rotation speed ($V_R$).

**AGL** *Above Ground Level*

**Best Angle of Climb** The best angle-of-climb speed is the airspeed which delivers the greatest gain of altitude in the shortest possible horizontal distance with gear and flaps up.

**Best Rate of Climb** The best rate-of-climb speed is the airspeed which delivers the greatest gain of altitude in the shortest possible time with gear and flaps up.

**Clearway** A clearway is an area beyond the runway, not less than 500 feet wide, centrally located about the extended centerline of the runway, and under the control of the airport authorities. The clearway is expressed in terms of a clearway plane, extending from the end of the runway with an upward slope not exceeding 1.25 percent, above which no object nor any terrain protrudes. However, threshold lights may protrude above the plane if their height above the end of the runway is 26 inches or less and if they are located to each side of the runway.

**Climb Gradient** The ratio of the change in height during a portion of a climb, to the horizontal distance traversed in the same time interval.

**Demonstrated Crosswind** The maximum 90° crosswind component for which adequate control of the airplane during takeoff and landing was actually demonstrated during certification test.

**Landing Weight** The weight of the airplane at landing touchdown.

**Maximum Zero Fuel Weight** Any weight above the value given must be loaded as fuel.

**MEA** *Minimum Enroute Altitude*

**Ramp Weight** The weight of the airplane before engine start. Included is the take-off weight plus a fuel allowance for start, taxi, run-up and take-off ground roll to lift-off.

**Route Segment** A part of a route. Each end of that part is identified by:
(1) a geographic location; or
(2) a point at which a definite radio fix can be established.

**Take-off Weight** The weight of the airplane at lift-off from the runway.

## WEIGHT AND BALANCE TERMINOLOGY

**Approved Loading Envelope** Those combinations of airplane weight and center of gravity which define the limits beyond which loading is not approved.

**Arm** The distance from the center of gravity of an object to a line about which moments are to be computed.

| | |
|---|---|
| **Basic Empty Weight** | The weight of an empty airplane including full engine oil and unusable fuel. This equals *empty weight* plus the weight of unusable fuel, and the weight of all the engine oil required to fill the lines and tanks. *Basic empty weight* is the basic configuration from which loading data is determined. |
| **Center of Gravity** | A point at which the weight of an object may be considered concentrated for weight and balance purposes. |
| **CG Limits** | The extreme *center of gravity* locations within which the airplane must be operated at a given weight. |
| **Datum** | A vertical plane perpendicular to the airplane longitudinal axis from which fore and aft (usually aft) measurements are made for weight and balance purposes. |
| **Empty Weight** | The weight of an empty airplane before any oil or fuel has been added. This includes all permanently installed equipment, fixed ballast, full hydraulic fluid, full chemical toilet fluid, and all other operating fluids full, except that the engines, tanks, and lines do not contain any engine oil or fuel. |
| **Engine Oil** | That portion of the engine oil which can be drained from the engine. |
| **Jack Point** | Points on the airplane identified by the manufacturer as suitable for supporting the airplane for weighing or other purposes. |
| **Landing Weight** | The weight of the airplane at landing touchdown. |
| **Leveling Points** | Those points which are used during the weighing process to level the airplane. |
| **Maximum Weight** | The largest weight allowed by design, structural, performance or other limitations. |
| **Moment** | A measure of the rotational tendency of a weight, about a specified line, mathematically equal to the product of the weight and the arm. |
| **Payload** | Weight of occupants, cargo and baggage. |
| **PPH** | *Pounds Per Hour* |
| **Ramp Weight** | The airplane weight at engine start assuming all loading is completed. |
| **Standard Empty Weight** | The *basic empty weight* of a standard airplane as specified by the manufacturer. |
| **Station** | The longitudinal distance from some point to the zero datum or zero fuselage station. |
| **Take-off Weight** | The weight of the airplane at lift-off from the runway. |
| **Tare** | The apparent weight which may be indicated by a scales before any load is applied. |
| **Unusable Fuel** | The fuel remaining after consumption of usable fuel. |
| **Usable Fuel** | That portion of the total fuel which is available for consumption as determined in accordance with applicable regulatory standards. |
| **Useful Load** | The difference between the airplane ramp weight and the basic empty weight. |
| **Zero Fuel Weight** | The airplane ramp weight minus the weight of fuel on board. |

# SECTION II
# LIMITATIONS

## TABLE OF CONTENTS

*SUBJECT* *PAGE*

# SECTION II
# LIMITATIONS

## TABLE OF CONTENTS (CONT'D)

*SUBJECT* *PAGE*

**INTERIM ADDENDUM for the Elevator Trim System Check**
**to the**
**65-A90, B90, C90, E90, 200T/200CT**
**FAA Approved Airplane Flight Manual**
**and**
**C90, C90A, F90, 200/200C, B200/B200C,**
**B200T/B200CT, 300 and 1900/1900C**
**Pilot's Operating Handbook and**
**FAA Approved Airplane Flight Manual**

## LIMITATIONS

### PREFLIGHT INSPECTION

*COCKPIT*

1. Control Locks - REMOVE
2. Elevator Trim:
   a. All airplanes except 1900/1900C - SET TO "0" UNITS
   b. 1900/1900C airplanes - SET TWO UNITS NOSE UP

**CAUTION**

The elevator trim system must not be forced past the limits which are indicated on the elevator trim indicator scale, either manually, electrically (except model 300) or by action of the autopilot (except model 300).

*TAIL SECTION*

**NOTE**

On model 65-A90, B90, C90, C90A and E90 airplanes, the elevator trim tab "0" (neutral) position is determined by observing that the alignment marks on the elevator trim tab pushrods align with the alignment marks on the elevator, when the elevator is resting against the downstops.

On F90, 200 Series, 300 and 1900/1900C airplanes, the elevator trim tab "0" (neutral) position is determined by observing that the trailing edge of the elevator trim tab aligns with the trailing edge of the elevator, when the elevator is resting against the downstops.

- Elevator Trim Tab - VERIFY "0" (NEUTRAL) POSITION

Donald H Petro
For W. H. Schultz
Beech Aircraft Corporation
DOA CE-2

The limitations included in this section have been approved by the Federal Aviation Administration, and they must be observed in the operation of the Beechcraft Super King Air F90.

## AIRSPEED LIMITATIONS

| SPEED | KCAS | KIAS | REMARKS |
|---|---|---|---|
| Maneuvering Speed<br>$V_A$ (10,950 pounds) | 169 | 171 | Do not make full or abrupt control movements above this speed. |
| Maximum Flap Extension/ Extended Speed<br>$V_{FE}$<br>Approach Position - 32.5%<br>Full Down Position - 100% | <br><br>182<br>142 | <br><br>184<br>144 | Do not extend flaps or operate with flaps in prescribed position above these speeds. |
| Maximum Landing Gear Operating Speed<br>$V_{LO}$<br>Extension<br>Retraction | <br><br>182<br>164 | <br><br>184<br>166 | Do not extend or retract landing gear above the speeds given. |
| Maximum Landing Gear Extended Speed<br>$V_{LE}$ | 182 | 184 | Do not exceed this speed with landing gear extended. |
| Air Minimum Control Speed<br>$V_{MCA}$ | 91 | 87 | This is the lowest airspeed at which the airplane is directionally controllable when one engine suddenly becomes inoperative and the other engine is at take-off power. (See definition in Section I.) |
| Maximum Operating Speed<br>$V_{MO}$<br>$M_{MO}$ | <br>250<br>.48 Mach | <br>253 | Do not exceed this airspeed in any operation. |

## AIRSPEED INDICATOR MARKINGS*

| MARKING | KCAS VALUE OR RANGE | KIAS VALUE OR RANGE | SIGNIFICANCE |
|---|---|---|---|
| Red Line | 91 | 87 | Air Minimum Control Speed ($V_{MCA}$) |
| White Arc | 81 to 142 | 80 to 144 | Full-flap Operating Range |
| Wide White Arc | 81 to 97 | 80 to 96 | Lower Limit is the Stalling Speed ($V_{SO}$) at maximum weight with Full Flaps (100%) and idle power. |
| Narrow White Arc | 97 to 142 | 96 to 144 | Lower Limit is the Stalling Speed ($V_S$) at maximum weight with Flaps Up (0%) and idle power. Upper Limit is the maximum speed permissible with flaps extended beyond Approach (more than 32.5%). |
| White Triangle | 182 | 184 | Maximum Flaps-to/at-Approach (32.5%) Speed |
| Blue Line | 116 | 117 | One-Engine-Inoperative Best Rate-of-Climb Speed |
| Red and White Hash-marked Pointer | 250 KCAS (253 KIAS) or value equal to .48 Mach, whichever is lower** | | Maximum Speed for any operation. |

**The airspeed indicator is marked in IAS values.*

**Airspeed is not to exceed the Red and White Hashmarked Pointer.

## POWER PLANT LIMITATIONS

### POWER LEVERS

Do not lift the power levers in flight. Lifting the power levers in flight, or moving the power levers in flight below the flight idle position, could result in a nose-down pitch and a descent rate leading to aircraft damage and injury to personnel.

### NUMBER OF ENGINES

2

### ENGINE MANUFACTURER

Pratt & Whitney Canada Corp. (Longueuil, Quebec, Canada)

### ENGINE MODEL NUMBER

PT6A-135

## ENGINE OPERATING LIMITS

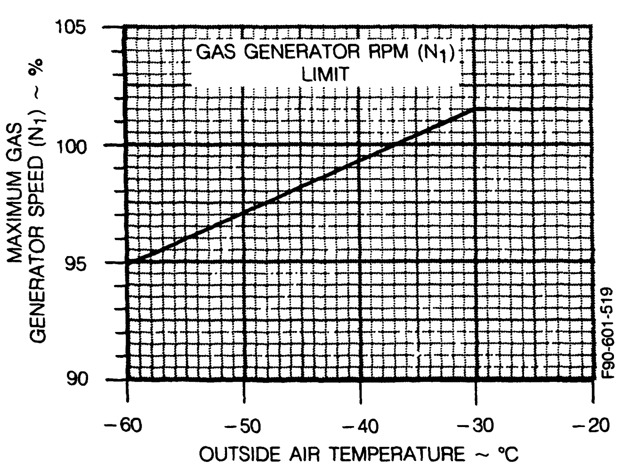
The following limitations shall be observed. Each column is a separate limitation. The limitations presented do not necessarily occur simultaneously. Refer to Pratt and Whitney Engine Maintenance Manual for specific actions required if limits are exceeded.

| OPERATING CONDITION | TORQUE FT-LBS (1) | MAXIMUM OBSERVED ITT °C | GAS GENERATOR RPM $N_1$ (2) % | PROP RPM $N_2$ | OIL PRESS. PSI (3) | OIL TEMP. °C |
|---|---|---|---|---|---|---|
| STARTING | --- | 1090 (4) | --- | --- | --- | -40 (min) |
| LOW IDLE | --- | 685 | --- | 1200 (min) | 40 (min) | -40 to 99 |
| HIGH IDLE | --- | --- | --- | --- | --- | -40 to 99 |
| TAKEOFF AND MAX CONT (5) | 2080 | 805 | 101.5 | 1900 | 85-105 | 10 to 99 |
| MAX CRUISE | 1940 | 805 | 101.5 | 1900 | 85-105 | 10 to 99 |
| CRUISE CLIMB AND REC CRUISE | 1940 | 805 | 101.5 | --- | 85-105 | 0 to 99 |
| MAX REVERSE (6) | 2080 | 805 | 88.0 | 1815 | 85-105 | 0 to 99 |
| TRANSIENT | 2400 | 850 (4) | 102.6 | 2090 | --- | --- |

FOOTNOTES:

(1) Maximum permissible sustained torque is 2080 ft-lbs. Propeller speeds ($N_2$) must be set so as not to exceed power limitation.

(2) For every 10 °C below -30 °C ambient temperature, reduce maximum allowable $N_1$ by 2.2%.




(3) When gas generator speeds are above 72% $N_1$ and oil temperatures are between 60 °C and 70 °C, normal oil pressure is between 85 and 105 psi. Oil pressure between 40 and 84 psi is undesirable; it should be tolerated only for the completion of the flight, and then only at a reduced power setting. Oil pressure below 40 psi is unsafe; it requires that either the engine be shut down, or that a landing be made as soon as possible, using the minimum power required to sustain flight.

(4) These values are time-limited to two seconds.

(5) The Maximum Continuous rating is intended for emergency use at the discretion of the pilot.

(6) Reverse power operation is limited to one minute.

## FUEL PRESSURE

Operation of either engine with its corresponding fuel pressure light (L FUEL PRESS or R FUEL PRESS annunciator) illuminated is limited to 10 hours before overhaul or replacement of the engine-driven fuel pump.

NOTE

Windmilling time need not be charged against this time limit.

## GENERATOR LIMITS

Maximum sustained generator load is limited as follows:

In Flight ........................................ 1.00

| GROUND OPERATION | |
|---|---|
| GENERATOR LOAD | MINIMUM $N_1$ |
| 0.0 to 0.9<br>0.9 to 1.0 | 58%<br>63% |

## APPROVED FUEL GRADES AND ADDITIVE

RECOMMENDED ENGINE FUELS

*COMMERCIAL GRADES*

Jet A
Jet A-1
Jet B

*MILITARY GRADES*

JP-4
JP-5
JP-8

EMERGENCY ENGINE FUELS

*COMMERCIAL AVIATION GASOLINE GRADES*

80 Red (Formerly 80/87)
100LL Blue*
100 Green (Formerly 100/130)

**In some countries, this fuel is colored Green and designated "100L".*

*MILITARY AVIATION GASOLINE GRADES*

80/87 Red
100/130 Green
115/145 Purple

## LIMITATIONS ON THE USE OF AVIATION GASOLINE

1. Operation is limited to 150 hours between engine overhauls.
2. Operation is limited to 17,000 feet pressure altitude or below if either standby boost pump is inoperative.
3. Crossfeed capability is required for climbs above 17,000 feet pressure altitude.
4. Do not put aviation gasoline into the auxiliary tanks.

## APPROVED FUEL ADDITIVES

### *ANTI-ICING ADDITIVE*

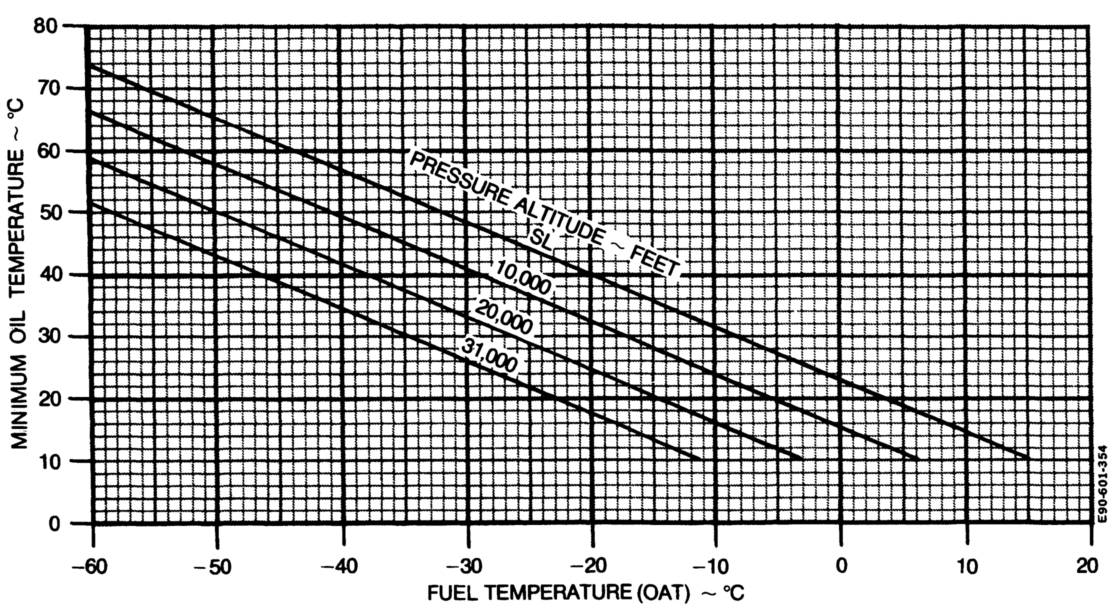
Anti-icing additive conforming to Specification MIL-I-27686 is the only approved fuel additive.

Engine oil is used to heat the fuel upon entering the fuel control. Since no temperature measurement is available for the fuel at this point, it must be assumed to be the same as the OAT. The graph below is supplied for use as a guide in preflight planning, based on known or forecast operating conditions, to allow the operator to become aware of operating temperatures where icing at the fuel control could occur. If the conditions should indicate that oil temperature versus OAT is such that ice formation could occur during takeoff or in flight, anti-icing additive per MIL-I-27686 must be mixed with the fuel at refueling to ensure safe operation.

*CAUTION*

Anti-icing additive must be properly blended with the fuel to avoid deterioration of the fuel cells. The additive concentration by volume shall be a minimum of 0.060% and a maximum of 0.150%. Approved procedure for adding anti-icing concentrate is contained in Section IV.

JP-4 fuel per MIL-T-5624 has anti-icing additive per MIL-I-27686 blended in the fuel at the refinery, and no further treatment is necessary. Some fuel suppliers blend anti-icing additive in their storage tanks. Prior to refueling, check with the fuel supplier to determine whether or not the fuel has been blended. To assure proper concentration by volume of fuel on board, blend only enough additive for the unblended fuel.



### *FUEL BIOCIDE ADDITIVE*

Fuel biocide-fungicide "BIOBOR JF" in concentrations of 135 ppm or 270 ppm may be used in the fuel. BIOBOR JF may be used as the only fuel additive or it may be used with the anti-icing additive conforming to MIL-I-27686 specification. Used together, the additives have no detrimental effect on the fuel system components.

See King Air F90 Maintenance Manual for concentrations to use and for procedures for adding BIOBOR JF to the airplane fuel.

## FUEL MANAGEMENT

1. Do not put any fuel into the auxiliary tanks unless the main tank system on both sides of the airplane is full.
2. Do not take off if fuel quantity gages indicate in yellow arc or less than 265 pounds of fuel in each main tank.
3. Crossfeeding of fuel is permitted only when one engine is inoperative.

**WARNING**

The airplane is approved for takeoff with one standby boost pump inoperative, but in such a case, crossfeeding of fuel will not be available from the side of the inoperative standby boost pump.

## OIL SPECIFICATION

Any oil specified by brand name in the latest revision of Pratt & Whitney Service Bulletin Number 1001 is approved for use in the PT6A-135 engine.

**NUMBER OF PROPELLERS:** 2

**PROPELLER MANUFACTURER:** Hartzell Propeller, Inc.

## PROPELLER HUB AND BLADE MODEL NUMBERS

HUB

| | |
|---|---|
| *LA-1 through LA-120 except LA-20 and LA-97* | HC-B4TN-3B |
| *LA-20, LA-97, LA-121 and after* | HC-B4TN-3A or HC-B4TN-3B |

BLADES

| | |
|---|---|
| *LA-1 through LA-130* | T10173FB-10.5 |
| *LA-131 and after* | T10173FK-10.5 |

## PROPELLER DIAMETER

92.0 inches only

## PROPELLER BLADE ANGLES AT 30-INCH STATION

| | |
|---|---|
| Feathered: | +87.5° ±0.5° |
| Reverse: | −8.5° ±0.4° |

## PROPELLER ROTATIONAL SPEED LIMITS

Transients not exceeding 2 seconds .......... 2090 rpm maximum
Reverse .......... 1815 rpm maximum
All other conditions .......... 1900 rpm maximum
Continuous operation on ground .......... 1200 rpm minimum

## PROPELLER ROTATIONAL OVERSPEED LIMITS

The maximum propeller overspeed limit is 2090 rpm and is time-limited to two seconds. Sustained propeller overspeeds faster than 1900 rpm indicate failure of the primary governor. Sustained propeller overspeeds faster than 1976 rpm indicate failure of both the primary governor and the secondary governor.

**POWER PLANT INSTRUMENT MARKINGS**

| INSTRUMENT | RED LINE MINIMUM LIMIT | GREEN ARC NORMAL OPERATING | RED LINE MAXIMUM LIMIT |
|---|---|---|---|
| INTERSTAGE TURBINE TEMPERATURE* | --- | 400 °C to 805 °C | 805 °C |
| TORQUEMETER | --- | 400 ft-lbs to 1940 ft-lbs | 2080 ft-lbs |
| PROPELLER TACHOMETER ($N_2$) | --- | 1500 rpm to 1900 rpm | 1900 rpm |
| GAS GENERATOR TACHOMETER ($N_1$) | --- | --- | 101.5% |
| OIL TEMPERATURE | --- | 10 °C to 99 °C | 99 °C |
| OIL PRESSURE | 40 psi | 85 psi to 105 psi | 105 psi |

**Starting Limit (Dashed Red Line): 1090 °C*

# MISCELLANEOUS INSTRUMENT MARKINGS

## FUEL QUANTITY INDICATORS

Yellow Arc (No Takeoff Range) .......... 0 to 265 pounds

## CABIN DIFFERENTIAL PRESSURE GAGE

Green Arc (Approved Operating Range) .......... 0 to 5.1 psi
Red Arc (Unapproved Operating Range) .......... above 5.1 psi to end of scale

## PNEUMATIC GAGE

Green Arc (Normal Operating Range) .......... 12 to 20 psi
Red Line (Maximum Operating Limit) .......... 20 psi

## VACUUM (SUCTION) GAGE

Narrow Green Arc (Normal from 15,000 to 30,000 feet MSL) .......... 3.0 to 4.3 in. Hg
(or)
Narrow Green Arc (Normal from 15,000 to 35,000 feet MSL) .......... 2.8 to 4.3 in. Hg

Wide Green Arc (Normal from Sea Level to 15,000 feet MSL) .......... 4.3 to 5.9 in. Hg

## PROPELLER DEICE AMMETER

Green Arc (Normal Operating Range) .......... 17 to 21 amperes

## ENGINE INLET LIP BOOT AMMETER

Green Arc (Normal Operating Range) .......... 14 to 18 amperes

# WEIGHT LIMITS

Maximum Ramp Weight .......... 11,030 pounds
Maximum Take-off Weight .......... 10,950 pounds
Maximum Landing Weight .......... 10,950 pounds
Maximum Zero Fuel Weight .......... 9600 pounds
Maximum Weight in Baggage Compartment .......... 403 pounds

# CENTER-OF-GRAVITY LIMITS

## AFT LIMIT

164.0 inches aft of datum at all weights

## FORWARD LIMITS

154.8 inches aft of datum at 10,950 pounds, with straight line variation to 150.0 inches aft of datum at 9484 pounds. 150.0 inches aft of datum at 9484 pounds or less.

## DATUM

The reference datum is located 160.0 inches forward of the wing main (forward) spar centerline.

### MEAN AERODYNAMIC CHORD (MAC)

The leading edge of the MAC is 135.1 inches aft of the datum. The MAC length is 77.9 inches.

## MANEUVER LIMITS

The Beechcraft Super King Air F90 is a Normal Category airplane. Acrobatic maneuvers, including spins, are prohibited.

## FLIGHT LOAD FACTORS AT 10,950 POUNDS

### FLAPS UP THROUGH APPROACH

3.25 positive g's
1.30 negative g's

### FLAPS BEYOND APPROACH THROUGH FULL DOWN

2.00 positive g's

## MINIMUM FLIGHT CREW

One Pilot

## KINDS OF OPERATION LIMITS

The airplane is approved for the following types of operations when the required equipment is installed and operational as defined within the listing of REQUIRED EQUIPMENT FOR VARIOUS CONDITIONS OF FLIGHT contained in this LIMITATIONS Section of the handbook.

1. VFR Day
2. VFR Night
3. IFR Day
4. IFR Night
5. Known Icing Conditions

## FUEL LIMITATIONS

### USABLE FUEL

Main Fuel System .......... 388 gallons
Auxiliary Fuel System .......... 82 gallons
Maximum Usable Fuel Quantity .......... 470 gallons

## MAXIMUM OPERATING PRESSURE-ALTITUDE LIMITS

Normal Operation . . . . . 31,000 feet

Operation with Aviation Gasoline:

Both Standby Boost Pumps Operative . . . . . 31,000 feet

Either Standby Boost Pump Inoperative . . . . . 17,000 feet

Climbs without Crossfeed Capability . . . . . 17,000 feet

Operation with Yaw Damp System Inoperative. . . . . 17,000 feet

## OUTSIDE AIR TEMPERATURE LIMIT

Do not operate the airplane when the outside air temperature exceeds ISA + 37°C.

## CABIN PRESSURIZATION LIMIT

Maximum Cabin Pressure Differential. . . . . 5.1 psi

## MAXIMUM OCCUPANCY LIMIT

Ten (10)

## AFT-FACING SEATS

Only aft-facing seats (placarded as such on the leg crossmember) are authorized in the aft-facing position. The headrest and seat back of each occupied aft-facing seat must be in the fully raised position for takeoff and landing.

## ICING LIMITATIONS

Minimum Ambient Temperature for Operation of Deicing Boots. . . . . -40°C

Minimum Airspeed for Sustained Icing Flight . . . . . 140 knots

Sustained flight in icing conditions with flaps extended is prohibited except for approach and landings.

The ice vanes shall be extended for operations in ambient temperatures of +5°C or below when flight free of visible moisture cannot be assured.

### APPROVED AIRPLANE DEICING/ANTI-ICING FLUIDS

SAE AMS 1424 Type I

ISO 11075 Type I

SAE AMS 1428 Type II

ISO 11078 Type II

SAE AMS 1428 Type IV. Only the following type IV fluids are approved:

Clariant Safewing MP IV 1957

Clariant Safewing MP IV 2001

UCAR ULTRA+ (Approved for use down to -15°C)

Octagon Max Flight Type IV

## STARTERS

Use of the starter is limited to 40 seconds ON, 60 seconds OFF, 40 seconds ON, 60 seconds OFF, 40 seconds ON, then 30 minutes OFF.

## AUTOPILOT LIMITATIONS

Refer to the applicable FAA Approved Airplane Flight Manual Supplement in the SUPPLEMENTS Section.

## STRUCTURAL LIMITATIONS

Refer to Chapter 4 of the *Beech King Air F90 Maintenance Manual.*

## LIMITATIONS WHEN ENCOUNTERING SEVERE ICING CONDITIONS (Required By FAA AD 98-04-24)

**WARNING**

Severe icing may result from environmental conditions outside of those for which the airplane is certificated. Flight in freezing rain, freezing drizzle, or mixed icing conditions (supercooled liquid water and ice crystals) may result in ice build-up on protected surfaces exceeding the capability of the ice protection system, or may result in ice forming aft of the protected surfaces. This ice may not be shed using the ice protections systems, and may seriously degrade the performance and controllability of the airplane.

1. During flight, severe icing conditions that exceed those for which the airplane is certificated shall be determined by the following visual cues. If one or more of these visual cues exists, immediately request priority handling from Air Traffic Control to facilitate a route or an altitude change to exit the icing conditions.
   a. Unusually extensive ice accumulation of the airframe and windshield in areas not normally observed to collect ice.
   b. Accumulation of ice on the upper surface of the wing, aft of the protected area.
   c. Accumulation of ice on the engine nacelles and propeller spinners farther aft than normally observed.
2. Since the autopilot, when installed and operating, may mask tactile cues that indicate adverse changes in handling characteristics, use of the autopilot is prohibited when any of the visual cues specified above exist, or when unusual lateral trim requirements or autopilot trim warnings are encountered while the airplane is in icing conditions.
3. All wing icing inspection lights must be operative prior to flight into known or forecast icing conditions at night. [NOTE: This supersedes any relief provided by the Master Minimum Equipment List (MMEL).]

## PLACARDS

*On Overhead Panel in Pilot's Compartment:*

OPERATION LIMITATIONS

THIS AIRPLANE MUST BE OPERATED AS A NORMAL CATEGORY AIRPLANE IN COMPLIANCE WITH THE OPERATING LIMITATIONS STATED IN THE FORM OF PLACARDS, MARKINGS AND MANUALS.
NO ACROBATIC MANEUVERS INCLUDING SPINS ARE APPROVED.
THIS AIRPLANE APPROVED FOR VFR, IFR DAY & NIGHT OPERATION & IN ICING CONDITIONS.

CAUTION

STALL WARNING IS INOPERATIVE WHEN MASTER SWITCH IS OFF.
STANDBY COMPASS IS ERRATIC WHEN WINDSHIELD ANTI–ICE AND /OR AIR–CONDITIONER AND/OR ELECTRIC HEAT IS ON.

*Below Fuel Control Panel:*

| AIRSPEEDS | |
|---|---|
| MAX GEAR EXTENSION | 184 KNOTS |
| MAX GEAR RETRACT | 166 KNOTS |
| MAX GEAR EXTENDED | 184 KNOTS |
| MAX APPROACH FLAP | 184 KNOTS |
| MAX FULL DOWN FLAPS | 144 KNOTS |
| MAX MANEUVERING | 171 KNOTS |

*Aft of Overhead Light Control Panel:*

OXYGEN

PASSENGER MANUAL O'RIDE

PULL ON SYS READY

*On Pilot's and Copilot's Window Sills (Diluter Demand System):*

WARNING

DO NOT SMOKE WHILE OXYGEN IS IN USE.
WITH DILUTER-DEMAND CREW MASK
FLOW STOPS WHEN BREATHING STOPS.

*On Fuel Control Panel:*

**SEE MANUAL FOR
FUEL CAPACITY**

*On Instrument Panel Adjacent to Each Gyroscopic Instrument (Depending on Gyro's Power Source) (Omitted When Power Source is Labeled on the Instrument Face or When Instrument has Built-in Adequacy of Power Indicating System):*

AIR AC DC

*On Curved Pedestal Adjacent to Power Levers:*

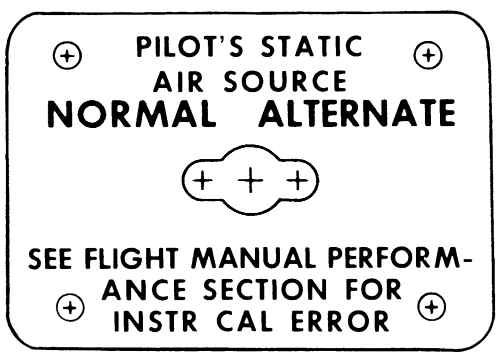
CAUTION
REVERSE
ONLY WITH
ENGINES
RUNNING

*On Pedestal Forward of Cabin Pressurization Controller:*

**WARNING** DE-PRESSURIZE CABIN BEFORE LANDING

*On Floor Left of Pedestal:*


*Below Right Circuit Breaker Panel:*




*Above Handle on Forward Side of Forward Partition and on Aft Side of Aft Partition:*

*On Left Upper Cabin Sidewall:*

NO SMOKING
FASTEN SEAT BELT

*On Inside Surface of Each Passenger Oxygen Access Door (Serials LA-2 thru LA-125):*

WARNING - DO NOT
SMOKE WHILE
OXYGEN IS IN USE

TO USE
- PULL LANYARD PIN
- DON MASK

*On Emergency Exit Hatch Release Cover:*

EMERGENCY DOOR RELEASE

CAUTION: DO NOT OPEN ESCAPE HATCH WHEN CABIN IS PRESSURIZED

OPEN COVER , PULL HOOKS TO OVERRIDE PRESSURE LOCK, PUSH BUTTON AND PULL HANDLE.

*On Emergency Exit Handle (Inside Emergency Exit Hatch Release Cover):*

**PUSH**

*On Shoulder Harness Assembly For All Cabin Chairs:*

SHOULDER HARNESS MUST BE WORN DURING TAKE-OFF AND LANDING WITH SEAT IN OUTBD POSITION, SEAT BACK UPRIGHT AND HEADREST FULLY EXTENDED

*On Cupholders and Tables When Installed:*

STOW BEFORE TAKE - OFF AND LANDING

*OR*

**STOW BEFORE TAKE-OFF AND LANDING**

*In Lavatory:*

NOTICE
FASTEN SHOULDER
HARNESS AND
SEAT BELT
DURING TAKEOFF
AND LANDING

*On Outside Surface of First Aid Oxygen Access Door:*

**FIRST AID OXYGEN – PULL**

*On Inside Surface of First Aid Oxygen Access Door (Serials LA-2 thru LA-125):*

WARNING - DO NOT
SMOKE WHILE
OXYGEN IS IN USE

TO USE
- TURN VALVE ON
- DON MASK

NOTE: CREW SYS MUST BE ON

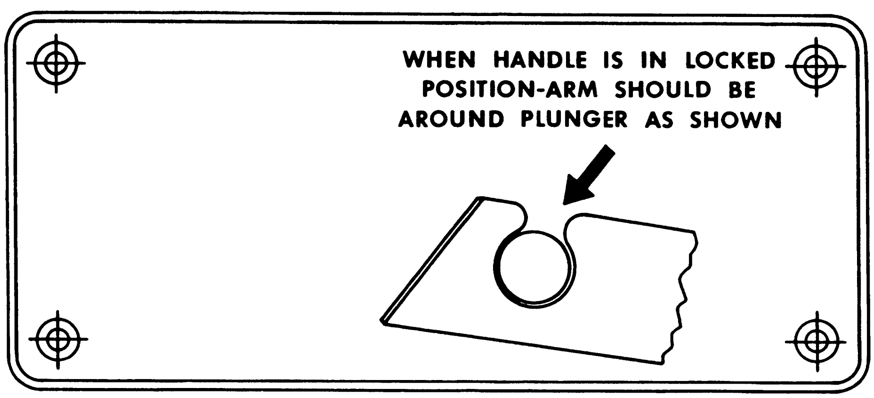
*On Center of Aft Bulkhead:*

# COMPARTMENT CAPACITY

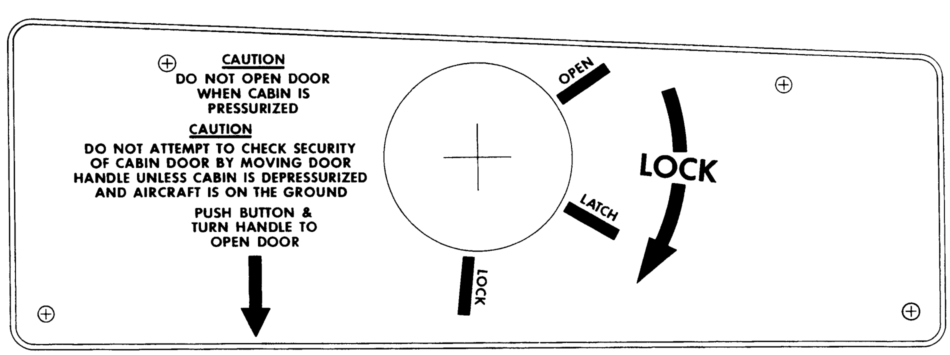
TOTAL COMPARTMENT CAPACITY (INCLUDING BAGGAGE AND/OR PASSENGER AND/OR EQUIPMENT) NOT TO EXCEED 403 POUNDS

SEE WEIGHT AND BALANCE SECTION OF FLIGHT MANUAL FOR LOADING INSTRUCTIONS

*Inside Airstair Door Between Folding Steps:*




*Inside Airstair Door Behind Handle:*



*On Pilot's and Copilot's Oxygen Outlet:*

**OXYGEN**

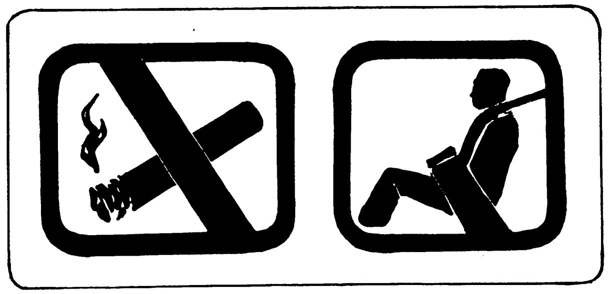
*On Pilot's Window Sill:*

**TURN OFF STROBE LIGHTS WHEN TAXIING
IN VICINITY OF OTHER AIRCRAFT OR DURING
FLIGHT THROUGH FOG OR CLOUDS
STD POSITION LIGHTS TO BE TURNED ON
FOR ALL NIGHT OPERATIONS**

*Inside Airstair Door Step:*

**LIFT STEP TO
INSPECT DOOR
LOCK**

*On Aft Side of Aft Partition:*



*On Center Front of Couch:*

COUCH

**NOT TO BE OCCUPIED AS CHAISE LONGUE DURING TAKE-OFF AND LANDING.**

*or:*

*Stitched to Aft End of Couch Cushion (airplanes equipped with a couch):*

**NOT TO BE OCCUPIED AS CHAISE LOUNGE DURING TAKE-OFF AND LANDING**

INTENTIONALLY LEFT BLANK

## REQUIRED EQUIPMENT FOR VARIOUS CONDITIONS OF FLIGHT

Federal Aviation Regulations Part 23 and Part 91 specify the minimum numbers and types of airplane instruments and equipment which must be installed and operable for various kinds of flight conditions. This includes VFR day, VFR night, IFR day, IFR night, and flight into known icing conditions.

Regulations also require that all airplanes be certificated by the manufacturer for operations under various flight conditions. At certification, all required equipment must be in operating condition and should be maintained to assure continued airworthiness. If deviations from the installed equipment were not permitted, or if the operating rules did not provide for various flight conditions, the airplane could not be flown unless all equipment was operable. With appropriate limitations, the operation of every system or component installed in the airplane is not necessary when the remaining operative instruments and equipment provide for continued safe operation. Operation in accordance with limitations established to maintain airworthiness can permit continued or uninterrupted operation of the airplane.

To enable the pilot to rapidly determine the FAA equipment requirements necessary for a flight into specific conditions, the following equipment requirements and exceptions are presented. It is the final responsibility of the pilot to determine whether the lack of, or inoperative status of, a piece of equipment will limit the conditions under which the airplane may be operated.

No distinction is made between standard and optional equipment. The "Number Installed" column indicates the number of items normally found on the airplane when that item is installed; however, in some cases the actual number may vary due to customized installations.

For the sake of brevity, the Required Equipment Listing does not include obviously required items such as wings, rudder, engines, landing gear, etc. Also, the list does not include items which do not affect the airworthiness of the airplane, such as galley equipment, entertainment systems, passenger convenience items, etc. However, it is important to note that ALL ITEMS WHICH ARE RELATED TO THE AIRWORTHINESS OF THE AIRPLANE AND NOT INCLUDED ON THE LIST ARE AUTOMATICALLY REQUIRED TO BE OPERATIVE.

### LEGEND

Numbers refer to quantities required to be operative for the specified condition.

(-) Indicates that the item may be inoperative for the specified condition.

(*) Refers to the REMARKS AND/OR EXCEPTIONS column for explicit information or reference.

(V) Indicates that the number of items installed varies.

(L) Indicates that the item on the left side of the airplane is required to be operative.

| SYSTEM and/or COMPONENT | Number of items installed | VFR Day | VFR Night | IFR Day | IFR Night | Known Icing Conditions | REMARKS and/or EXCEPTIONS |
|---|---|---|---|---|---|---|---|
| **COMMUNICATIONS** | | | | | | | |
| Static Discharge Wicks | 15 | - | - | 6* | 6* | 6* | – *Minimum required - one wick at the outboard end of each control surface plus top of vertical stabilizer. |
| VHF Communications System | 2 | * | * | * | * | * | – *Per FAR 91 |
| **ELECTRICAL POWER** | | | | | | | |
| AC Volt/Frequency Meter | 1 | - | - | - | - | - | – |
| Battery | 1 | 1 | 1 | 1 | 1 | 1 | – |
| Battery Charge Annunciator | 1 | 1 | 1 | 1 | 1 | 1 | – |
| DC Generator | 2 | 1 | 1 | 2 | 2 | 2 | – |
| DC Generator Caution Annunciator | 2 | 2 | 2 | 2 | 2 | 2 | – |
| DC Loadmeter | 2 | 2 | 2 | 2 | 2 | 2 | – |
| DC Prop/Inlet Heat Ammeter | 1 | – | – | – | – | 1 | – |
| DC Volt Meter | 1 | – | – | – | – | – | – |
| Inverter | 2 | 1 | 1 | 2 | 2 | 2 | – |
| Inverter Warning Annunciator | 1 | - | - | 1 | 1 | 1 | – |
| Meter Select Switch | 1 | – | – | – | – | 1 | – |
| **ENGINE INDICATING INSTRUMENTS** | | | | | | | |
| Chip Detector Annunciator | 2 | 2 | 2 | 2 | 2 | 2 | – |
| Fuel Flow Indicator | 2 | 2 | 2 | 2 | 2 | 2 | – |
| Gas Generator Tachometer | 2 | 2 | 2 | 2 | 2 | 2 | – |
| ITT Indicator | 2 | 2 | 2 | 2 | 2 | 2 | – |
| Oil Pressure Indicator | 2 | 2 | 2 | 2 | 2 | 2 | – |
| Oil Temperature Indicator | 2 | 2 | 2 | 2 | 2 | 2 | – |
| Propeller Synchroscope | 1 | - | - | - | - | - | – |
| Propeller Tachometer | 2 | 1 | 1 | 1 | 1 | 1 | – |
| Torque Indicator | 2 | 2 | 2 | 2 | 2 | 2 | – |
| Oil Pressure Annunciator | 2 | 2 | 2 | 2 | 2 | 2 | – |
| **ENVIRONMENTAL SYSTEMS** | | | | | | | |
| Altitude Warning Annunciator | 1 | 1 | 1 | 1 | 1 | 1 | – May be inoperative provided airplane remains unpressurized. |
| Cabin Rate-of-Climb Indicator | 1 | 1 | 1 | 1 | 1 | 1 | – |
| Differential Pressure/Cabin Altitude | 1 | 1 | 1 | 1 | 1 | 1 | – |
| Outflow Valve | 1 | 1 | 1 | 1 | 1 | 1 | – |
| Pressurization Air Source | 2 | 1 | 1 | 1 | 1 | 1 | – |
| Pressurization Controller | 1 | 1 | 1 | 1 | 1 | 1 | – |
| Safety Valve | 1 | 1 | 1 | 1 | 1 | 1 | – |

| SYSTEM and/or COMPONENT | Number of items installed | VFR Day | VFR Night | IFR Day | IFR Night | Known Icing Conditions | REMARKS and/or EXCEPTIONS |
|---|---|---|---|---|---|---|---|
| **EQUIPMENT/FURNISHINGS** | | | | | | | |
| Emergency Locator Transmitter | 1 | * | * | * | * | * | – *Per FAR 91 |
| Seat Belts | V | * | * | * | * | * | – *Per FAR 91 |
| Shoulder Harness | V | * | * | * | * | * | – *Per FAR 91 |
| **FIRE PROTECTION** | | | | | | | |
| Engine Fire Extinguisher | 2 | - | - | - | - | - | – |
| Fire Detector System | 2 | 2 | 2 | 2 | 2 | 2 | – |
| Portable Fire Extinguisher | 2 | - | - | - | - | - | – |
| **FLIGHT CONTROLS** | | | | | | | |
| Flap Position Indicator | 1 | 1 | 1 | 1 | 1 | 1 | – |
| Flap System | 1 | - | - | - | - | - | – |
| Rudder Boost | 1 | - | - | - | - | - | – |
| Stall Warning Horn | 1 | 1 | 1 | 1 | 1 | 1 | – |
| Trim Tab Indicator - Rudder, Aileron, and Elevator | 3 | 3 | 3 | 3 | 3 | 3 | – |
| Yaw Damp | 1 | 1 | 1 | 1 | 1 | 1 | – May be inoperative for flight at and below 17,000 feet. |
| **FUEL** | | | | | | | |
| Crossfeed Annunciator | 1 | 1 | 1 | 1 | 1 | 1 | – |
| Crossfeed Valve | 1 | 1 | 1 | 1 | 1 | 1 | – |
| Engine Driven Boost Pump | 2 | 2 | 2 | 2 | 2 | 2 | – |
| Firewall Shutoff Valve | 2 | 2 | 2 | 2 | 2 | 2 | – |
| Fuel Pressure Warning Annunciator | 2 | 2 | 2 | 2 | 2 | 2 | – |
| Fuel Quantity Gage Selector Switch | 1 | 1 | 1 | 1 | 1 | 1 | – |
| Fuel Quantity Indicator | 2 | 2 | 2 | 2 | 2 | 2 | – |
| Jet Transfer Pump | 2 | * | * | * | * | * | – *Required only if Aux Tanks contain fuel. |
| Motive Flow Valve | 2 | * | * | * | * | * | – *Required only if Aux Tanks contain fuel. |
| Standby Fuel Boost Pump | 2 | 2 | 2 | 2 | 2 | 2 | – |
| **ICE AND RAIN PROTECTION** | | | | | | | |
| Airfoil Deice System (Wing and Horizontal Stabilizer) | 1 | - | - | - | - | 1 | – |
| Alternate Static Air Source | 1 | 1 | 1 | 1 | 1 | 1 | – |
| Auto Ignition System and Annunciators | 2 | 2 | 2 | 2 | 2 | 2 | – |
| Engine Air Inlet Heat | 2 | – | – | – | – | 2 | – |
| Engine Inertial Ice Vanes | 2 | 2 | 2 | 2 | 2 | 2 | – |
| Heated Fuel Vent | 2 | - | - | - | - | 2 | – |
| Pitot Heater | 2 | - | - | 1 | 1 | 1 | – Pitot heater must be operative on side with an operative pneumatic (non-servoed) airspeed indicator. |

| SYSTEM and/or COMPONENT | Number of items installed | VFR Day | VFR Night | IFR Day | IFR Night | Known Icing Conditions | REMARKS and/or EXCEPTIONS |
|---|---|---|---|---|---|---|---|
| **ICE AND RAIN PROTECTION (Continued)** | | | | | | | |
| Propeller Deice System (Auto) | 1 | - | - | - | - | 1 | – |
| Propeller Deice System (Manual) | 1 | - | - | - | - | 1 | – |
| Stall Warning Heater | 1 | - | - | - | - | 1 | – |
| Windshield Heat (Left and Right) | 2 | - | - | - | - | L | – |
| Windshield Wiper | 2 | - | - | - | - | - | – |
| **LANDING GEAR** | | | | | | | |
| Gear Handle Lights | 2 | 1 | 1 | 1 | 1 | 1 | – |
| Landing Gear Aural Warning | 1 | 1 | 1 | 1 | 1 | 1 | – |
| Landing Gear Motor | 1 | 1 | 1 | 1 | 1 | 1 | – |
| Landing Gear Position Indication Lights | 3 | 3 | 3 | 3 | 3 | 3 | – |
| **LIGHTS** | | | | | | | |
| Cabin Door Caution Annunciator | 1 | 1 | 1 | 1 | 1 | 1 | – |
| Caution Flasher Lights | 2 | - | - | - | - | - | – |
| Cockpit and Instrument Lights | V | - | * | - | * | - | – *Lights must illuminate all instruments and controls. |
| Landing Light | 2 | - | 1 | - | 1 | - | – |
| Passenger Notice System (Fasten Seat Belt and No Smoking) | 2 | 2 | 2 | 2 | 2 | 2 | – |
| Position Lights | 3 | - | 3 | - | 3 | - | – |
| Anticollision Light System | 1 | - | 1 | - | 1 | - | – |
| Strobe Lights | 3 | - | 3 | - | 3 | - | – |
| Taxi Light | 1 | - | - | - | - | - | – |
| Warning Flasher Lights | 2 | - | - | - | - | - | – |
| Wing Ice Lights | 2 | - | - | - | - | L | – |
| Recognition Lights | 2 | - | - | - | - | - | – |
| **NAVIGATION INSTRUMENTS** | | | | | | | |
| Airspeed Indicator | 2 | L | L | L | L | L | – |
| Clock | 2 | - | - | 1 | 1 | 1 | – |
| Directional Gyro | 2 | - | - | L | L | L | – |
| Distance Measuring Equipment | V | * | * | * | * | * | – *Per FAR 91 |
| Horizon Indicator | 2 | - | - | L | L | L | – |
| Magnetic Compass | 1 | 1 | 1 | 1 | 1 | 1 | – |
| Navigation Equipment | V | - | - | * | * | * | – *Per FAR 91 |
| Outside Air Temperature | 1 | 1 | 1 | 1 | 1 | 1 | – |
| Sensitive Altimeter | 2 | L | L | L | L | L | – |
| Transponder | V | * | * | * | * | * | – *Per FAR 91 |
| Turn and Bank Indicator | 2 | - | - | L | L | L | – |
| Vertical Speed Indicator | 2 | - | - | - | - | - | – |

| SYSTEM and/or COMPONENT | Number of Items Installed | VFR Day | VFR Night | IFR Day | IFR Night | Known Icing Conditions | REMARKS and/or EXCEPTIONS |
|---|---|---|---|---|---|---|---|
| **OXYGEN** | | | | | | | |
| Oxygen System | 1 | * | * | * | * | * | – *Per FAR 91, 23. |
| **PROPELLERS** | | | | | | | |
| Autofeathering Armed Light | 2 | - | - | - | - | - | – |
| Autofeathering System | 1 | - | - | - | - | - | – |
| Propeller Governor Test Switch: (Serials LA-2 thru LA-120, except LA-20, LA-97, and airplanes equipped with Kit 90-9070-1) | | | | | | | |
| Low Pitch Indicator Test | 1 | 1 | 1 | 1 | 1 | 1 | – |
| Flight-Idle Stop Test | 1 | 1 | 1 | 1 | 1 | 1 | – |
| Propeller Flight Idle Low-Pitch Stop (Serials LA-2 thru LA-120, except LA-20, LA-97 and airplanes equipped with Kit 90-9070-1) | 2 | 2 | 2 | 2 | 2 | 2 | – |
| Propeller Test Switch: (Serials LA-20, LA-97, LA-121 and after and those airplanes equipped with Kit 90-9070-1) | | | | | | | |
| Ground Idle Stop | 1 | 1 | 1 | 1 | 1 | 1 | – |
| Governor | 1 | 1 | 1 | 1 | 1 | 1 | – |
| Propeller Overspeed Governor | 2 | 2 | 2 | 2 | 2 | 2 | – |
| Propeller Flight Idle Low-Pitch Stop | 2 | 2 | 2 | 2 | 2 | 2 | – |
| Propeller Synchrophaser | 1 | - | - | - | - | - | – |
| Reverse Not Ready Annunciator | 1 | 1 | 1 | 1 | 1 | 1 | – |
| **VACUUM** | | | | | | | |
| Instrument Bleed Air Source | 2 | - | 1 | 1 | 1 | 2 | – |
| Suction Gage | 1 | - | 1 | 1 | 1 | 1 | – |
| Vacuum System | 1 | - | 1 | 1 | 1 | 1 | – |

# SECTION III
# EMERGENCY PROCEDURES
## TABLE OF CONTENTS

*SUBJECT* *PAGE*

# SECTION III
# EMERGENCY PROCEDURES

## TABLE OF CONTENTS (CONT'D)

*All airspeeds quoted in this section are indicated airspeeds (IAS) and assume zero instrument error.*

## EMERGENCY AIRSPEEDS

Air Minimum Control Speed ($V_{MCA}$) .......... 87 knots

Intentional One-Engine-Inoperative Speed ($V_{SSE}$) .......... 102 knots

One-Engine-Inoperative Best Rate-of-Climb Speed ($V_Y$) .......... 117 knots

One-Engine-Inoperative Best Angle-of-Climb Speed ($V_X$) .......... 112 knots

Maximum-Glide-Range Speed .......... 135 knots

## ENGINE FAILURE

### EMERGENCY ENGINE SHUTDOWN

*-ENGINE TORQUE INCREASE - UNSCHEDULED (Ground or Flight)*
*(Not Responsive to Power Lever Movement)*
*-ENGINE FIRE IN FLIGHT*
*-ENGINE FAILURE IN FLIGHT*
*-ILLUMINATION OF MAGNETIC CHIP DETECTOR ANNUNCIATOR*

*Affected Engine:*

1. Condition Lever - CUT-OFF
2. Propeller Lever - FEATHER
3. Fuel Firewall Valve - CLOSED
4. Fire Extinguisher - ACTUATE (if required)
5. Engine Auto Ignition - OFF
6. Generator - OFF
7. Propeller Synchrophaser - OFF
8. Electrical Load - MONITOR

### ENGINE FAILURE DURING GROUND ROLL

1. Power Levers - IDLE
2. Brakes - AS REQUIRED
3. Operative Engine - REVERSE (Maximum Consistent with Directional Control)

**WARNING**

Extreme care must be exercised when using single-engine reversing on surfaces with reduced traction.

*If insufficient runway remains for stopping:*

4. Condition Levers - CUT-OFF
5. Fuel Firewall Valves - CLOSED
6. Master Switch - OFF (Gang bar down)

**ENGINE FAILURE AFTER LIFT-OFF (if conditions preclude an immediate landing)**

1. Power - MAXIMUM ALLOWABLE
2. Airspeed - MAINTAIN (take-off speed or above)
3. Landing Gear - UP

NOTE

If the autofeather system is being used, do not retard the failed engine power lever until the autofeather system has completely stopped propeller rotation. Retarding the power lever will deactivate the autofeather circuit and prevent automatic feathering.

4. Propeller (inoperative engine) - FEATHER
5. Airspeed - BEST RATE-OF-CLIMB SPEED (after obstacle clearance altitude is reached)
6. Flaps - UP
7. Clean-up (inoperative engine):
   a. Condition Lever - CUT-OFF
   b. Fuel Firewall Valve - CLOSED
   c. Engine Auto Ignition - OFF
   d. Autofeather Switch - OFF
   e. Generator - OFF
8. Electrical Load - MONITOR

**ENGINE FAILURE IN FLIGHT BELOW AIR MINIMUM CONTROL SPEED ($V_{MCA}$)**

1. Reduce power on operative engine as required to maintain control.
2. Lower nose to accelerate above minimum control speed.
3. Adjust power as required.
4. Secure affected engine as in EMERGENCY ENGINE SHUTDOWN.

**ENGINE FLAMEOUT (2nd ENGINE)**

1. Power Lever - IDLE
2. Propeller - DO NOT FEATHER
3. Condition Lever - CUT-OFF
4. Conduct Air Start Procedures

NOTE

The propeller will not unfeather without engine operating.

## AIR START

### STARTER ASSIST

*CAUTION*

The pilot should determine the reason for engine failure before attempting an air start. Above 20,000 feet, starts tend to be hotter. During engine acceleration to idle speed, it may become necessary to move the condition lever periodically into CUT-OFF in order to avoid an over-temp condition.

1. Cabin Temp Mode - OFF; Blower - Auto
2. Radar - STANDBY or OFF
3. Windshield Heat - OFF
4. Power Lever - IDLE
5. Condition Lever - CUT-OFF
6. Fuel Firewall Valve - OPEN

NOTE

If conditions permit, retard operative engine ITT to 700°C or less to reduce the possibility of exceeding ITT limit. Reduce electrical load to minimum consistent with flight conditions.

7. Ignition and Start Switch - ON (up). Check IGNITION ON Annunciator - ILLUMINATED
8. Condition Lever - LOW IDLE
9. Ignition and Start Switch - OFF ($N_1$ above 50%)
10. Propeller Lever - AS REQUIRED
11. Power Lever - AS REQUIRED
12. Generator - ON
13. Engine Auto Ignition - ARM
14. Electrical Equipment - AS REQUIRED

### WINDMILLING ENGINE AND PROPELLER (No Starter Assist)

1. Cabin Temp Mode - OFF; Blower - AUTO
2. Radar - STANDBY or OFF
3. Windshield Heat - OFF
4. Power Lever - IDLE
5. Propeller Lever - FULL FORWARD
6. Condition Lever - CUT-OFF
7. Fuel Firewall Valve - OPEN
8. Generator (inoperative engine) - OFF
9. Airspeed - 140 KNOTS MINIMUM
10. Altitude - BELOW 20,000 FEET
11. Engine Auto Ignition - ARM
12. Condition Lever - LOW IDLE
13. Power - AS REQUIRED (after ITT has peaked)
14. Generator - ON
15. Electrical Equipment - AS REQUIRED

# SMOKE AND FIRE

## ENGINE FIRE ON GROUND

*Affected Engine:*

1. Condition Lever - CUT-OFF
2. Fuel Firewall Valve - CLOSED
3. Starter Switch - STARTER ONLY
4. Fire Extinguisher - ACTUATE (as required)

# SMOKE AND FUME ELIMINATION

Attempt to identify the source of smoke or fumes. Smoke associated with electrical failures is usually gray or tan in color, and irritating to the nose and eyes. Smoke produced by environmental system failures is generally white in color, and much less irritating. If smoke is prevalent in the cabin, cabin oxygen masks should not be deployed unless the cabin altitude exceeds 15,000 feet, and then they should be used only until the cabin altitude is reduced to 15,000 feet or lower.

## WINDSHIELD ELECTRICAL FAULT

The smell of an electrical overheat, or observing smoke and/or fire at the lower inboard corner of either windshield, adjacent to the center post, may indicate an overheat condition in the electrical power terminal for the normal heat mode of the pilot's or copilot's windshield heat.

1. WSHLD ANTI-ICE Switches - OFF

*If Smoke and/or Fire Does Not Cease:*

2. Conduct ELECTRICAL SMOKE OR FIRE procedure.

*If Smoke and/or Fire Ceases:*

3. Continue flight with Windshield Anti-Ice OFF if possible.

*If Windshield Anti-Ice is Required:*

4. If the source of the smell, smoke, or fire can be isolated to the pilot's or copilot's windshield, the opposite windshield (without the overheat condition) may be operated in the NORMAL or HI windshield heat mode.

## ELECTRICAL SMOKE OR FIRE

1. Oxygen -
   a. Oxygen Control (System Ready) - PULL ON
   b. Crew (Diluter Demand Mask) - DON MASK (100% position)
   c. MIC Selector - OXYGEN MASK
   d. PASSENGER MANUAL O'RIDE - PULL ON
   e. Passengers - PULL LANYARD PIN, DON MASK
2. Generators - OFF
3. Avionics Master - OFF
4. Non-essential Electrical Equipment - OFF

**NOTE**

When generators are OFF, electrical load is limited to the Battery Bus and selected items on the Center Bus.

*If fire or smoke ceases:*

a. Generators - ON
b. Individually restore only essential avionics and electrical equipment previously turned off.

*If smoke or fire persists:*

a. Cabin Pressure Switch - DUMP
b. Land as soon as practical

## NOTE

Opening a storm window (after depressurizing) will facilitate smoke and fume removal.

### ENVIRONMENTAL SYSTEM SMOKE OR FUMES

1. Oxygen -
   a. Oxygen Control (System Ready) - PULL ON
   b. Crew (Diluter Demand Mask) - DON MASK (100% position)
   c. MIC Selector - OXYGEN MASK
   d. PASSENGER MANUAL O'RIDE - PULL ON
   e. Passenger - PULL LANYARD PIN, DON MASK
2. Cabin Temp Mode - OFF
3. Vent Blower - High position
4. Left Bleed Air Valve - CLOSED

If smoke decreases, continue operation with left bleed air closed. If smoke does not decrease, Left Bleed Air Valve - OPEN and Right Bleed Air Valve - CLOSED. If smoke decreases, continue operation with right bleed air closed.

## NOTE

Each bleed air valve must remain closed long enough to allow time for smoke purging to positively identify the smoke source.

## EMERGENCY DESCENT

1. Power Levers - IDLE
2. Propeller Levers - FULL FORWARD
3. Flaps - APPROACH
4. Landing Gear - EXTEND
5. Airspeed - 184 KNOTS MAXIMUM

## GLIDE

1. Landing Gear - UP
2. Flaps - UP (0%)

**WARNING**

Determine that procedures for re-starting first and second failed engines are ineffective before feathering second propeller.

3. Propellers - FEATHERED
4. Airspeed - 135 KNOTS
5. Glide Ratio - 1.8 NAUTICAL MILES FOR EACH 1000 FEET OF ALTITUDE. (Decrease by 0.2 nautical miles for each 10 knots of headwind)

## LANDING EMERGENCIES

### ONE-ENGINE-INOPERATIVE LANDING

*When it is certain that the field can be reached:*

1. Flaps - APPROACH
2. Landing Gear - DOWN
3. Propeller Lever - FULL FORWARD
4. Airspeed - 5 KNOTS ABOVE NORMAL LANDING APPROACH SPEED

*When it is certain there is no possibility of go-around:*

5. Flaps - DOWN
6. Airspeed - NORMAL LANDING APPROACH SPEED
7. Execute Normal Landing

## NOTE

Single-engine reverse thrust may be used with caution after touchdown on smooth, dry, paved surfaces.

### ONE-ENGINE-INOPERATIVE GO-AROUND

1. Power - MAXIMUM ALLOWABLE
2. Landing Gear - UP
3. Flaps - UP
4. Airspeed - ONE-ENGINE-INOPERATIVE BEST ANGLE-OF-CLIMG SPEED UNTIL CLEAR OF OBSTACLES, THEN BEST RATE-OF-CLIMB SPEED.

## SYSTEMS EMERGENCIES

### ENGINE OIL SYSTEM

*LOW OIL PRESSURE (L or R OIL PRESS annunciator)*

• Power - Reduce to lowest practical value for duration of flight.

### PROPELLER SYSTEM

*FAILURE OF FLIGHT IDLE LOW PITCH STOP*

***(SERIALS LA-2 THRU LA-120, EXCEPT LA-20, LA-97 AND AIRPLANES EQUIPPED WITH KIT 90-9070-1)***

*If either propeller unexpectedly begins feathering in flight:*

1. Power Lever (affected side) - INCREASE TO 500 ft-lbs or more.
2. PROP GOV - TEST Circuit Breaker - PULL (Propeller speed should increase to governor setting)
3. Power Lever (affected side) - RETURN TO DESIRED POWER

### FUEL SYSTEM

*CROSSFEED (ONE-ENGINE-INOPERATIVE OPERATION)*

1. Standby Boost Pumps - OFF
2. Crossfeed Flow Switch - LEFT or RIGHT (as required); CHECK FUEL CROSSFEED Annunciator - ON; Both FUEL PRESS Annunciators - EXTINGUISHED

## CAUTION

Aux Transfer switch must be in AUTO position on side being crossfed. If the firewall valve is closed, the auxiliary fuel supply will not be available (usable), and the fuel pressure annunciator will remain illuminated on the side supplying fuel.

*TO DISCONTINUE CROSSFEED*

- Crossfeed Flow Switch - OFF (Centered)

*ENGINE-DRIVEN BOOST PUMP FAILURE*

- Standby Boost Pump (Failed Side) - ON; Check FUEL PRESS Annunciator - OFF

## ELECTRICAL SYSTEM FAILURE

### *GENERATOR INOPERATIVE (L or R DC GEN annunciator)*

1. Generator - OFF, then RESET (hold for 1 second), then ON

*If generator will not reset:*

2. Generator - OFF
3. Operating Generator - DO NOT EXCEED 1.0 LOAD

### *EXCESSIVE LOADMETER INDICATION (Over 1.0)*

1. Battery - OFF (monitor loadmeter)

*If loadmeter still indicates above 1.0:*

2. Bus Tie Switch - OPEN
3. Non-essential Electrical Equipment - OFF

*If loadmeter indicates 1.0 or below:*

4. Battery - ON

### *EXCESSIVE CURRENT FLOW*

*If the Left or Right BUS SENS OPN annunciator and the GEN TIES OPEN annunciator illuminate, or if the BAT TIE OPEN annunciator illuminates, excessive current flow has occurred at the indicated source and it is now isolated. To restore power:*

1. BUS TIE RESET/TEST Switch - RESET
2. If Annunciator(s) Reïlluminate - DO NOT RESET

**NOTE**

The affected power source is now isolated from the center bus. Refer to the Power Distribution Schematic in Section VII, SYSTEMS DESCRIPTION.

*If the GEN TIES OPEN annunciator illuminates and neither BUS SENS OPN annunciator illuminates:*

1. BUS TIE CLOSE/OPEN Switch - CLOSE
2. If the GEN TIES OPEN Annunciator Reilluminates - SHED ALL NON-ESSENTIAL CIRCUITS.

**NOTE**

This condition indicates a failure in the bus tie logic circuitry, and each generator is now isolated from the center bus. Refer to the Power Distribution Schematic in Section VII, SYSTEMS DESCRIPTION.

### *CIRCUIT BREAKER TRIPPED*

1. Non-essential Circuit - DO NOT RESET IN FLIGHT
2. Essential Circuit
   a. Circuit Breaker - PUSH IN TO RESET
   b. If Circuit Breaker trips again - DO NOT RESET

*INVERTER INOPERATIVE*

- Select the other inverter

*BATTERY CHARGE RATE (BATTERY CHG annunciator)*

Ground Operations:

The BATTERY CHG annunciator will illuminate after an engine start. Do not take off with the annunciator illuminated unless a decreasing battery charge current is confirmed. See Nickel-Cadmium Battery Check in Section IV, NORMAL PROCEDURES.

In Flight:

In-flight illumination of the BATTERY CHG annunciator indicates a possible battery malfunction.

1. Battery - OFF
2. BATTERY CHG Annunciator Extinguished - CONTINUE TO DESTINATION
3. BATTERY CHG Annunciator Still Illuminated - LAND AT NEAREST SUITABLE AIRPORT

## FLIGHT CONTROLS

*UNSCHEDULED ELECTRIC ELEVATOR TRIM*

1. Airplane Attitude - MAINTAIN (using elevator control)
2. Control Wheel Disconnect Switch - DEPRESS FULLY (2nd level)

**NOTE**

Autopilot will disengage when the disconnect switch is depressed.

3. Manually Retrim Airplane
4. ELEV TRIM Control Switch (Pedestal) - OFF

**CAUTION**

DO NOT reactivate electrical system until cause of malfunction has been determined.

*UNSCHEDULED RUDDER BOOST ACTIVATION*

Rudder boost operation without a large variation of power between the engines indicates a failure of the system.

1. Rudder Boost Switch - OFF

*If condition persists:*

2. Rudder Trim - ADJUST

## LANDING GEAR MANUAL EXTENSION

1. Airspeed - ESTABLISH 125 KNOTS
2. Landing Gear Relay Circuit Breaker (pilot's right subpanel) - PULL
3. Landing Gear Switch Handle - DOWN
4. Emergency Engage Handle - LIFT AND TURN CLOCKWISE TO THE STOP TO ENGAGE.
5. Extension Lever - PUMP up and down until the 3 green GEAR DOWN lights are illuminated.

**WARNING**

If for any reason the green GEAR DOWN lights do not illuminate (e.g., in case of an electrical system failure), continue pumping until sufficient resistance is felt to ensure that the gear is down and locked, even though this procedure may damage the drive mechanism.

**CAUTION**

Stop pumping when the 3 green GEAR DOWN lights illuminate. Further movement of the handle could damage the drive mechanism and prevent subsequent gear retraction.

**WARNING**

After an emergency landing gear extension has been made, do not stow pump handle, move any landing gear controls, or reset any switches or circuit breakers until the airplane is on jacks, since the failure may have been in the gear-circuit and the gear might retract on the ground. The landing gear cannot be retracted manually.

## LANDING GEAR RETRACTION AFTER PRACTICE MANUAL EXTENSION

*After a practice manual extension of the landing gear, the gear may be retracted electrically as follows:*

1. Emergency Engage Handle - ROTATE COUNTERCLOCKWISE AND PUSH DOWN
2. Extension Lever - STOW
3. Landing Gear Relay Circuit Breaker (pilot's subpanel) - PUSH IN
4. Landing Gear Switch Handle - UP

## ENVIRONMENTAL SYSTEMS

### *PRESSURIZATION SYSTEM*

*Anytime the differential pressure goes into the Red Arc:*

1. Cabin Altitude Controller - SELECT HIGHER CABIN ALTITUDE SETTING

*If condition persists:*

2. Bleed Air Valves - CLOSED
3. Cabin Pressure Switch (after cabin is depressurized) - DUMP
4. Bleed Air Valves - OPEN

### *LOSS OF PRESSURIZATION*

In the event of pressurization loss at high altitude, USE OXYGEN AND DESCEND AS REQUIRED.

**WARNING**

The following table sets forth the average time of useful consciousness (TUC) (time from onset of hypoxia until loss of effective performance) at various altitudes.

| Cabin Pressure Altitude | TUC |
|---|---|
| 31,000 feet | 1 to 2 minutes |
| 28,000 feet | 2 1/2 to 3 minutes |
| 25,000 feet | 3 to 5 minutes |
| 22,000 feet | 5 to 10 minutes |
| 12 - 18,000 feet | 30 minutes or more |

### *AUTO-DEPLOYMENT OXYGEN SYSTEM*

1. In the event of PASS OXY ON annunciator does not illuminate following illumination of the ALT WARN annunciator, pull PASSENGER MANUAL O'RIDE valve to deploy passenger masks. First aid mask can only be deployed manually.

2. If oxygen quantity is insufficient to sustain both passengers and crew, the supply can be isolated to the crew and First Aid outlets by pulling the OXYGEN CONTROL circuit breaker located in the environmental section of the circuit breaker panel. PASSENGER MANUAL O'RIDE must be in the OFF position.

## ICE PROTECTION SYSTEMS

### ELECTROTHERMAL PROPELLER DEICE (AUTO SYSTEM)

*Abnormal Readings on Deice Ammeter: (Normal operation is 17 to 21 amps)*

1. Zero Amps:
   a. Automatic Propeller Deice Switch - CHECK, AUTO
   b. If OFF, reposition to AUTO after 30 seconds.
   c. If in AUTO with zero amps reading, system is inoperative; position the switch to OFF.
   d. Use manual backup system. (No deice ammeter indication - monitor loadmeter.)
2. Zero to 16 amps:
   a. Continue operation.
   b. If propeller imbalance occurs, increase rpm briefly to aid in ice removal.
3. Over 21 amps:
   a. If circuit breaker does not trip, continue operation.
   b. If propeller imbalance occurs, increase rpm briefly to aid in ice removal.
   c. If circuit breaker trips, use manual system; monitor loadmeter for excessive current drain.
   d. If manual mode circuit breaker trips, avoid icing conditions.

### ELECTROTHERMAL PROPELLER DEICE (MANUAL SYSTEM)

*Airplanes LA-1 through LA-130:*

1. To use manual system, hold manual propeller deice switch in OUTER position for approximately 30 seconds, then in INNER position for approximately 30 seconds.
2. Monitor manual system current requirement with the airplane loadmeters when the manual switch is in the OUTER or INNER position. Small needle deflection (approximately 5%) indicates the system is functioning. Check propellers for ice removal.

*Airplanes LA-131 and after:*

3. To use manual system, hold manual propeller deice switch in MANUAL position for 90 seconds, or until ice is dislodged from blades.
4. Monitor manual system current requirement with the airplane loadmeters when the manual deice switch is in MANUAL position. Small needle deflection (approximately 5%) indicates the system is functioning. Check propellers for ice removal.

### EMERGENCY EXIT

The emergency exit is located at the third right cabin window.

1. Open cover.
2. Push release button.

**NOTE**

If cabin is unpressurized and release button will not push, pull hooks to overcome residual friction and then push the release button.

3. Pull handle and push out door.

### STATIC AIR SYSTEM

PILOT'S ALTERNATE STATIC AIR SOURCE

THE PILOT'S ALTERNATE STATIC AIR SOURCE SHOULD BE USED FOR CONDITIONS WHERE THE NORMAL STATIC SOURCE HAS BEEN OBSTRUCTED. When the airplane has been exposed to moisture and/or icing conditions (especially on the ground), the possibility of obstructed static ports should be considered. Partial obstructions will result in the rate of climb indication being sluggish during a climb or descent. Verification of suspected obstruction is possible by switching to the alternate system and noting a sudden sustained change in rate of climb. This may be accompanied by abnormal indicated airspeed and altitude changes beyond normal calibrated differences.

*Whenever any obstruction exists in the Normal Static Air System, or when the Alternate Static Air System is desired for use:*

1. Pilot's Static Air Source (right side panei) - ALTERNATE
2. For Airspeed Calibration and Altimeter Correction, refer to the PERFORMANCE Section.

**NOTE**

Be certain the static air valve is in the NORMAL position when the alternate system is not needed.

## SPINS

***If a spin is entered inadvertently:***

1. **Control Column - FULL FORWARD**
2. **Full Rudder - OPPOSITE DIRECTION OF SPIN**
3. **Power Levers - IDLE**
4. **Controls - NEUTRALIZE WHEN ROTATION STOPS**
5. **Execute a smooth pullout.**

**NOTE**

Federal Aviation Administration Regulations do not require spin demonstration of airplanes of this weight; therefore, no spin tests have been conducted. The recovery technique is based on the best available information.

## ILLUMINATION OF CABIN DOOR WARNING LIGHT

**WARNING**

The cabin-door locking mechanism must be in the over-centered position (indicated by positioning of safety arm around the diaphragm plunger) in order to provide complete positive locking of the cabin door.

If the cabin is pressurized and the door is not completely locked, any movement of the door handle toward the unlocked position may cause rapid, complete unlocking and opening of the door.

1. If cabin door warning light on annunciator panel indicates that cabin door may not be secure, depressurize cabin (consider altitude first) by activating cabin pressurization dump switch on pedestal.
2. Do not attempt to check cabin door for security until cabin is depressurized and the airplane is on the ground.
3. Check security of cabin door (on the ground) by lifting cabin door step and checking position of arm and plunger. If unlocked position of arm is indicated, turn handle toward locked position until arm and plunger are in position.

## CRACKED WINDSHIELD

1. If it is positively determined that the crack is on the outer panel, no action is required.

**CAUTION**

Windshield wipers may be damaged if used on cracked outer panel. Heating elements may be inoperative in area of crack.

2. If it is determined that the crack is on the inner panel, descend or reset the pressurization controller to achieve 4 psi or less differential pressure within ten minutes. Visibility through the windshield may be significantly impaired.

## SIMULATED ONE-ENGINE-INOPERATIVE (ZERO THRUST)

When establishing zero thrust operation, use the power setting listed below. By using this power setting to establish zero thrust, one avoids the inherent delays of restarting a shut down engine and preserves almost instant power to counter any attendant hazard.

1. Propeller - 1700 RPM
2. Power Lever - SET 125 ft-lbs torque

**NOTE**

This setting will approximate Zero Thrust at low altitudes using recommended One-Engine-Inoperative Climb speeds.

## SEVERE ICING CONDITIONS
## (Alternate Method Of Compliance With FAA AD 98-04-24)

THE FOLLOWING WEATHER CONDITIONS MAY BE CONDUCIVE TO SEVERE IN-FLIGHT ICING:

- Visible rain at temperatures below 0 degrees Celsius ambient air temperature.
- Droplets that splash or splatter on impact at temperatures below 0 degrees Celsius ambient air temperature.

PROCEDURES FOR EXITING THE SEVERE ICING ENVIRONMENT:

These procedures are applicable to all flight phases from takeoff to landing. Monitor the ambient air temperature. While severe icing may form at temperatures as cold as -18 degrees Celsius, increased vigilance is warranted at temperatures around freezing with visible moisture present. If the visual cues specified in the Limitations Section for identifying severe icing conditions are observed, accomplish the following:

1. Immediately request priority handling from Air Traffic Control to facilitate a route or an altitude change to exit the severe icing conditions in order to avoid extended exposure to flight conditions more severe than those for which the airplane has been certificated.
2. Avoid abrupt and excessive maneuvering that may exacerbate control difficulties.
3. Do not engage the autopilot.
4. If the autopilot is engaged, hold the control wheel firmly and disengage the autopilot.
5. If an unusual roll response or uncommanded roll control movement is observed, reduce the angle-of-attack.
6. Do not extend flaps when holding in icing conditions. Operation with flaps extended can result in a reduced wing angle-of-attack, with the possibility of ice forming on the upper surface further aft on the wing than normal, possibly aft of the protected area.
7. If the flaps are extended, do not retract them until the airframe is clear of ice.
8. Report these weather conditions to Air Traffic Control.

THIS PAGE INTENTIONALLY LEFT BLANK

# SECTION IV
# NORMAL PROCEDURES
## TABLE OF CONTENTS

*SUBJECT* *PAGE*

THIS PAGE INTENTIONALLY LEFT BLANK

*All airspeeds quoted in this section are indicated airspeeds (IAS) and assume zero instrument error.*

## AIRSPEEDS FOR SAFE OPERATION

Take-off Speeds:
- Flaps 32.5%:
  - Rotation .......... 100 knots
  - 50-Ft .......... 109 knots
- Flaps 0%:
  - Rotation .......... 107 knots
  - 50-Ft .......... 117 knots

Air Minimum Control Speed ($V_{MCA}$) .......... 87 knots
Intentional One-Engine-Inoperative Speed ($V_{SSE}$) .......... 102 knots
Two-Engine Best Angle-of-Climb Speed ($V_X$) .......... 90 knots
Two-Engine Best Rate-of-Climb Speed ($V_Y$) .......... 117 knots
Cruise Climb Speeds:
- Sea Level to 15,000 feet .......... 140 knots
- 15,000 to 25,000 feet .......... 130 knots
- 25,000 to 31,000 feet .......... 120 knots

Turbulent Air Penetration Speed .......... 169 knots

*CAUTION*

Do not use controls abruptly above 171 knots.

For turbulent air penetration, use an airspeed of 169 knots. Avoid over-action on power levers. Turn off autopilot altitude hold. Keep wings level, maintain attitude, and avoid use of trim. Do not chase airspeed and altitude. Penetration should be at an altitude which provides adequate maneuvering margins when severe turbulence is encountered.

Maximum Demonstrated Crosswind Component .......... 25 knots
Two-Engine Approach Speeds:
- Flaps 100% .......... 108 knots
- Flaps 0% .......... 127 knots

Two-Engine Balked Landing Speed .......... 108 knots

## PROCEDURES BY FLIGHT PHASE

### PREFLIGHT INSPECTION

#### LEFT WING

1. Flaps - CHECK
2. Jet Pump (aft of wheel well) - DRAIN
3. Gravity Line (aft of wheel well) - DRAIN
4. Aileron and Tab - CHECK
5. Flush Outboard Wing Fuel Sump - DRAIN
6. Lights - CHECK
7. Main Fuel Tank - CHECK; Cap - SECURE
8. Stall Warning - CHECK
9. Tie-down and Chocks - REMOVE
10. Deice Boot - CHECK
11. Ram Scoop Fuel Vent - CLEAR
12. Heated Fuel Vent - CLEAR
13. Wing Fuel Sump - DRAIN
14. Fire Extinguisher Pressure - CHECK
15. Landing Gear and Doors - CHECK
16. Fuel Sump (forward of wheel well) - DRAIN
17. Propeller - CHECK
18. Engine Air Intake - CLEAR; Ice Vane - RETRACTED
19. Engine Oil - CHECK QUANTITY; Cap - SECURE
20. Fuel Strainer - DRAIN
21. Cowling, Doors and Panels - CHECK
22. Auxiliary Fuel Tank - CHECK; Cap - SECURE
23. Heat Exchanger Inlet - CLEAR
24. Inboard Fuel Tank Sump - DRAIN
25. Lower Antennas and Beacon - CHECK

#### NOSE SECTION

1. Access Panels - SECURE
2. Air Conditioner Ducts - CLEAR
3. Nose Gear and Doors - CHECK
4. Landing and Taxi Lights - CHECK
5. Pitot Covers - REMOVE
6. Windshield Wipers - CHECK

#### RIGHT WING

1. Inboard Fuel Tank Sump - DRAIN
2. Heat Exchanger Inlet - CLEAR
3. Battery Air Inlet - CLEAR
4. Auxiliary Fuel Tank - CHECK; Cap - SECURE
5. Propeller - CHECK
6. Engine Air Intake - CLEAR; Ice Vane - RETRACTED
7. Engine Oil - CHECK QUANTITY; Cap - SECURE
8. Fuel Strainer - DRAIN
9. Cowling Doors and Panels - CHECK
10. Fuel Sump (forward of wheel well) - DRAIN
11. Fire Extinguisher Pressure - CHECK
12. Landing Gear and Doors - CHECK
13. Heated Fuel Vent - CLEAR
14. Ram Scoop Fuel Vent - CLEAR

15. Wing Fuel Sump - DRAIN
16. Deice Boot - CHECK
17. Tie-down and Chocks - REMOVE
18. Main Fuel Tank - CHECK; Cap - SECURE
19. Lights - CHECK
20. Aileron - CHECK
21. Flush Outboard Wing Tank Sump - DRAIN
22. Flaps - CHECK
23. Gravity Line (aft of wheel well) - DRAIN
24. Jet Pump (aft of wheel well) - DRAIN

TAIL SECTION

1. Oxygen Door - SECURE
2. Emergency Locator Transmitter - ARM
3. Static Ports - CLEAR
4. Tie-down - REMOVE
5. Access Panels - SECURE
6. Deice Boots - CHECK
7. Control Surfaces and Rudder Tab - CHECK
8. Lights - CHECK
9. Top Antennas - CHECK
10. Static Ports - CLEAR

## BEFORE ENGINE STARTING

1. Cabin Door - LOCKED. (Check security by attempting to turn handle toward unlocked position without depressing release button. Handle should not move.)

**WARNING**

Only a crew member should close and lock the door.

2. Load and Baggage - SECURE
3. Weight and CG - CHECKED
*4. Emergency Exit - SECURE
5. Control Locks - REMOVE
6. Seats - POSITIONED; Seatbacks - UPRIGHT; Lateral-tracking Seats - OUTBOARD POSITION
7. Seat Belts and Shoulder Harnesses - FASTENED
8. Brakes - SET
9. Switches - OFF
10. Landing Gear Switch Handle - DOWN
11. Power Levers - IDLE
12. Propeller Controls - FULL FORWARD
13. Condition Levers - CUT-OFF
14. Cabin Sign - NO SMOKE & FSB
15. Cabin Temp Mode - OFF
16. Vent Blower - AUTO
*17. Microphone Switches - NORMAL
*18. Oxygen Supply Pressure - CHECK
19. Oxygen Supply Control Handle - PULL ON SYSTEM READY
*20. Quick-donning Crew Oxygen Masks - CHECK; Selector Lever - 100% POSITION
*21. Circuit Breakers - IN
*22. Pilot's Static Air Source - NORMAL
*23. Fuel Firewall Valves - CLOSED
*24. Fuel Panel Circuit Breakers - IN
*25. Standby Pumps - ON (Listen for operation)
26. Battery Switch - ON (FUEL PRESS Annunciators - ON)

*27. Fuel Firewall Valves - OPEN (FUEL PRESS Annunciators - OFF; F W VALVE Annunciators - ILLUMINATE MOMENTARILY)
*28. Standby Pumps - OFF (FUEL PRESS Annunciators - ON)
*29. Crossfeed - ALTERNATELY LEFT AND RIGHT (FUEL CROSSFEED Annunciator - ON; FUEL PRESS Annunciators - OFF)
*30. Crossfeed - OFF
*31. Auxiliary Transfer Switches - AUTO
*32. NO TRANSFER Lights - PRESS TO TEST
33. Fuel Quantity - CHECK (Main and Auxiliary)

*34. Volt/Amp Meter Select Switch - BAT/PROP (BATTERY READS 23-27 VDC) (All other positions zero)
35. Stall Warning - TEST
36. Fire Detectors and Fire Extinguishers - TEST
37. Annunciator Lights - TEST
*38. Landing Gear Handle Lights Test Switch - PRESS TO TEST LIGHTS; Gear Down Lights - CHECK
39. Rotating Beacons Switch - ON

**May be omitted for quick turn-around at pilot's discretion.*

## ENGINE STARTING (BATTERY)

1. Right Ignition and Engine Start Switch - ON (R FUEL PRESS Annunciator - OFF)
2. Right Condition Lever - LOW IDLE (after $N_1$ rpm stabilizes; 12% minimum)
3. ITT and $N_1$ - MONITOR (1090°C maximum, limit 2 seconds)

*CAUTION*

If no ITT rise is observed within 10 seconds after moving the Condition Lever to LOW IDLE, move the Condition Lever to CUT-OFF. Allow 60 seconds for fuel to drain and starter to cool, then follow ENGINE CLEARING procedures.

4. Right Oil Pressure - CHECK
5. Right Condition Lever - HIGH IDLE
6. Right Ignition and Engine Start Switch - OFF (at 50% $N_1$ or above)
7. Right Generator - RESET (hold for one second) then ON.

NOTE

The generator control switch must first be held upward in the spring-loaded RESET position for a minimum of one second, then released to the ON position. If switch is not held in RESET for at least one second, it will result in the illumination of the BUS SENS OPN annunciator lights.

The BATTERY CHG annunciator will illuminate approximately 6 seconds after generator is on the line. If the annunciator does not extinguish within 5 minutes, refer to NICKEL-CADMIUM BATTERY CONDITION CHECK procedure, this section.

8. Left Ignition and Engine Start Switch - ON (Note L FUEL PRESS Annunciator - OFF)
9. Left Condition Lever - LOW IDLE (after $N_1$ stabilizes, 12% minimum)
10. ITT and $N_1$ - MONITOR (1090°C maximum, limit 2 seconds)
11. Left Oil Pressure - CHECK
12. Left Ignition and Engine Start Switch - OFF (at 50% $N_1$ or above)
13. Left Generator - ON
14. Condition Levers - AS REQUIRED (Maintain propeller 1200 rpm minimum)

## ENGINE STARTING (EXTERNAL POWER)

*CAUTION*

NEVER CONNECT AN EXTERNAL POWER SOURCE TO THE AIRPLANE UNLESS A BATTERY INDICATING A CHARGE OF AT LEAST 20 VOLTS IS IN THE AIRPLANE. If the battery voltage is less than 20 volts, the battery must be recharged, or replaced with a battery indicating at least 20 volts, before connecting external power. Only use an external power source fitted with an AN-type plug.

1. AVIONICS MASTER PWR - OFF
2. GENerator 1 and GENerator 2 Switches - OFF
3. BATtery Switch - ON (The battery will tend to absorb transients present in some auxillary power units.)

NOTE

Set auxillary power unit to 28.25 ± .25 Volts.

4. External Power Source - TURN OFF and CONNECT TO AIRPLANE
5. External Power Source - TURN ON
6. METER SELECT Switch - EXT PWR - Check voltage 27 to 30 volts
7. EXT PWR Switch - ON if voltage within acceptable limits

NOTE

If the battery is partially discharged, the BATTERY CHG annunciator will illuminate approximately 6 seconds after the external power is on the line. If the annunciator does not extinguish within 5 minutes, refer to NICKEL-CADMIUM BATTERY CONDITION CHECK procedure in this section.

8. Right Propeller Control - FEATHERED
9. Right Ignition and Engine Start Switch - ON (R FUEL PRESSure annunciator - OFF)
10. Right Condition Lever - LOW IDLE (after $N_1$ stabilizes; 12% minimum)
11. ITT and $N_1$ - MONITOR (1090°C maximum, limit 2 seconds)

*CAUTION*

If no ITT rise is observed within 10 seconds after moving the Condition Lever to LOW IDLE, move the Condition Lever to CUT-OFF, and release the Ignition and Engine Start Switch to OFF. Allow 60 seconds for fuel to drain and starter to cool, then follow ENGINE CLEARING procedures.

12. Right Oil Pressure - CHECK
13. Right Ignition and Engine Start Switch - OFF (at 50% $N_1$ or above)
14. Left Ignition and Engine Start Switch - ON (L FUEL PRESSure annunciator - OFF)
15. Left Condition Lever - LOW IDLE (after $N_1$ stabilizes; 12% minimum)
16. ITT and $N_1$ - MONITOR (1090°C maximum, limit 2 seconds)
17. Left Oil Pressure - CHECK
18. Left Ignition and Engine Start Switch - OFF (at 50% $N_1$ or above)

19. EXT PWR Switch - OFF
20. External Power - TURN OFF; DISCONNECT; Door - SECURE
21. GENerator 1 and GENerator 2 Switches - RESET (hold for one second, then ON)
22. Right Propeller Control - FULL FORWARD
23. Condition Levers - AS REQUIRED (Maintain propeller 1200 rpm minimum)

## ENGINE CLEARING

1. Condition Lever - CUT-OFF
2. Ignition and Start Switch - STARTER ONLY (for a minimum of 15 seconds)

*CAUTION*

Do not exceed the starter time limits; see LIMITATIONS Section.

3. Ignition and Start Switch - OFF

## BEFORE TAXIING

1. Both Inverters - CHECK NORMAL VOLTAGE & FREQUENCY - CHECK THAT ANNUNCIATOR ILLUMINATES WHEN INVERTERS ARE TURNED OFF
2. Inverter To Be Used - ON
3. Bus Tie Switch - OPEN (GEN TIES OPEN Annunciator - ILLUMINATED)
4. Generator Load Meters - OBSERVE (indications commensurate with equipment selected)
5. Meter Select Switch - LEFT GEN then RIGHT GEN (27.5 - 29.0 volts, within 1.0 volt of each other)
6. Bus Tie Switch - Center Position (GEN TIES OPEN Annunciator - EXTINGUISHED)
7. Generator Load Meters - OBSERVE (paralleled within 10%)
8. Bus Tie Reset/Test Switch - TEST (note yellow GEN TIES OPEN, yellow BAT TIE OPEN, green L BUS SENS OPN, and green R BUS SENS OPN annunciators illuminated)
9. Bus Tie Reset/Test Switch - RESET (All Annunciator Lights - EXTINGUISHED)
10. Avionics Master Power Switch - ON
11. Lights - AS REQUIRED
12. Environmental System Controls - AS REQUIRED
13. Instruments - CHECK
14. Brakes - RELEASED AND CHECKED

NOTE

Propeller Beta Range may be used during taxi with minimum blade erosion up to the point where $N_1$ increases. Care must be exercised when taxiing on unimproved surfaces. If possible, conduct engine check-out on a hard surface free of sand and gravel, to preclude pitting of propeller blades and airplane surfaces.

## BEFORE TAKEOFF (RUNUP)

1. Avionics and Radar - CHECK
2. Pressurization - SET

   a. Cabin Altitude Selector Knob - ADJUST SO THAT INNER SCALE (ACFT ALT) INDICATES 26,000 FEET (end of scale) OR PLANNED CRUISE ALTITUDE PLUS 500 FEET, WHICHEVER IS LOWER. If this setting does not result in an outer scale (CABIN ALT) indication of at least 500 feet above take-off field pressure altitude, adjust as required.
   b. Rate Control Selector Knob - SET INDEX BETWEEN 9- AND 12-O'CLOCK POSITIONS

*3. Autopilot - CHECK
*4. Electric Elevator Trim Control - CHECK

a. Elevator Trim Tab Control Switch (pedestal) - ON (forward to ELEV TRIM position)
b. Pilot's and Copilot's Electric Trim Switches - CHECK OPERATION
c. Pilot's and Copilot's Trim Disconnect Switches - CHECK FOR DEACTIVATION OF SYSTEM
d. Elevator Trim Tab Control Switch - OFF, then ON

**WARNING**

Operation of the electric trim system should occur only by movement of pairs of switches. Any movement of the elevator trim wheel while depressing only one switch denotes a system malfunction. The elevator tab control switch must then be turned OFF and flight conducted only by manual operation of the trim wheel.

NOTE

Pilot's electric trim switches should override copilot's.

5. Trim Tabs - SET
6. Engine Control Friction Locks - SET
7. Flaps - CHECK AND SET
8. Flight Controls - CHECK FOR FREEDOM OF MOVEMENT AND PROPER DIRECTION OF TRAVEL

*9. Overspeed Governors and Rudder Boost - TEST

a. Rudder Boost Control Switch - ON
b. Propeller Levers - FULL FORWARD (Balance of test is performed on individual engines.)
c. Prop Test Switch:
   - LA-2 thru LA-120 (except LA-20, LA-97 and any airplane equipped with Kit 90-9070-1) - HOLD TO PROP GOV TEST.
   - LA-20, LA-97, LA-121 and after (and any earlier airplane equipped with Kit 90-9070-1) - HOLD TO GOV.
d. Power Lever - INCREASE UNTIL PROP IS STABILIZED AT 1720 TO 1800 RPM. CONTINUE TO INCREASE UNTIL RUDDER MOVEMENT IS NOTED. (Observe ITT and Torque Limits.)
e. Power Lever - IDLE
f. Prop Test Switch - RELEASE. Repeat steps c, d, e, and f on the opposite engine.

*10. Primary Governors - EXERCISE AT 1800 RPM.
*11. Instrument Vacuum/Deice Pressure System - CHECK (at 1800 rpm)
*12. Autofeather - CHECK

a. Power Levers - APPROXIMATELY 500 FT-LBS TORQUE
b. Autofeather Switch - HOLD TO TEST (both AUTOFEATHER annunciators illuminated)
c. Power Levers - RETARD INDIVIDUALLY:

(1) At Approximately 400 ft-lbs - OPPOSITE ANNUNCIATOR EXTINGUISHED
(2) At Approximately 220 ft-lbs - BOTH ANNUNCIATORS EXTINGUISHED (propeller starts to feather)

NOTE

Autofeather annunciator lights will cycle on and off with each fluctuation of torque as the propeller feathers.

d. Power Levers - BOTH RETARDED (both annunciators extinguished, neither propeller feathers)

13. Autofeather Switch - ARM

* 14. Flight Idle Low Pitch Stops (Serials LA-2 thru LA-120, except LA-20, LA-97, and airplanes equipped with Kit 90-9070-1) - CHECK
   a. Condition Levers - HIGH IDLE
   b. Power Levers - IDLE (Note propeller rpm)
   c. Prop Low Pitch Indicator Test Switch - DEPRESS AND HOLD (Note the PROP LOW PITCH Annunciators - ILUMINATED)
   d. Prop Test Switch - HOLD TO "FLT IDLE STOP TEST" (Note that rpm decreases and both PROP PITCH annunciators extinguish.)
   e. Prop Low Pitch Indicator Test Switch - RELEASE
   f. Power Levers - LIFT ABOVE DETENT (Note rpm increase to value in step "b".)
   g. Prop Test Switch - RELEASE
   h. Power Levers - RETURN TO IDLE
   i. Condition Levers - LOW IDLE

* 15. Ground Idle Low Pitch Stops (Serials LA-20, LA-97, LA-121 and after, and airplanes equipped with Kit 90-9070-1) - CHECK
   a. Condition Levers - HIGH IDLE
   b. Power Levers - IDLE (note propeller rpm)
   c. Prop Test Switch - HOLD TO GND IDLE STOP
   d. Prop RPM - STABILIZED APPROX. 200 RPM BELOW VALUE IN STEP b.
   e. Prop Test Switch - RELEASE
   f. Prop RPM - VERIFY RETURNS TO VALUE IN STEP b.
   g. Condition Levers - LOW IDLE

16. Propeller Feathering (manual) - CHECK
17. Fuel Quantity, Flight and Engine Instruments - CHECK

** May be omitted for quick turn-around at pilot's discretion.*

## BEFORE TAKEOFF (FINAL ITEMS)

1. Bleed Air Valves - OPEN
2. Annunciator Lights - EXTINGUISHED or considered
3. Transponder - ON
4. Ice Protection - AS REQUIRED
5. Engine Auto Ignition - Arm (both IGNITION annunciators illuminated)

## ON TAKE-OFF ROLL

1. AUTOFEATHER Annunciators - ILLUMINATED
2. IGNITION ON Annunciators - EXTINGUISHED

## TAKEOFF

- Refer to PERFORMANCE Section for minimum take-off power, take-off speed, distance and climb data.
- Monitor ITT and engine torque. Increasing airspeed will cause torque and ITT to increase.
- Rotating beacons, strobe lights, and tail flood lights should be turned off, at the pilot's discretion, when encountering haze, fog, or clouds.

## CLIMB

1. Landing Gear - UP
2. Flaps - UP
3. Yaw Damp - ON
4. Climb Power - SET (Observe maximum ITT, torque, and $N_1$ rpm limits.)

5. Propeller - 1900 rpm
6. Propeller Synchrophaser - ON
7. Autofeather - OFF
8. Engine Instruments - MONITOR
9. Cabin Sign - AS REQUIRED
10. Cabin Pressurization - CHECK

## CRUISE

**WARNING**

Do not lift Power Levers in flight.

1. Cruise Power - SET per CRUISE POWER TABLES OR GRAPHS
2. Engine Instruments - MONITOR
3. Auxiliary Fuel Gage - MONITOR (to ensure fuel is being transferred from auxiliary tanks)

### *CABIN PRESSURIZATION FOR CRUISE*

If a revised flight plan calls for a altitude change, select the new cruise altitude plus 500 feet on the ACFT ALT dial of the cabin pressurization controller.

## DESCENT

1. Cabin Pressurization Controller - SET
   a. Cabin Altitude Selector Knob - SET per PRESSURIZATION CONTROLLER SETTING FOR LANDING graph, or so that "CABIN ALT" DIAL INDICATES LANDING FIELD PRESSURE ALTITUDE PLUS 500 FEET.
   b. Rate Control Knob - AS REQUIRED
2. Altimeter - SET
3. Cabin Sign - AS REQUIRED
4. Windshield Anti-ice - AS REQUIRED (NORMAL or HI well before descent in to warm, moist air, to aid in defogging)
5. Power - AS REQUIRED to give desired rate of descent.

**WARNING**

Approximately 79% $N_1$ is required to maintain the pressurization schedule during descent.

6. RECOGnition Lights - AS REQUIRED

## BEFORE LANDING

1. Pressurization - CHECK
2. Cabin Sign - NO SMOKE & FSB
3. Autofeather Switch - ARM
4. Flaps - APPROACH
5. Landing Gear - DOWN
6. Landing and Taxi Lights - AS REQUIRED

**NOTE**

Under low visibility conditions, landing and taxi lights should be left off due to light reflections.

7. Propeller Synchrophaser - OFF
8. Radar - STANDBY or OFF

NOTE

If crosswind landing is anticipated, determine Crosswind Component from PERFORMANCE Section. Immediately prior to touchdown, lower up-wind wing and align the fuselage with the runway. During rollout, hold aileron control into the wind and maintain directional control with rudder and brakes. Use propeller reverse as desired.

*CAUTION*

If either of the PROP LOW PITCH warning lights has become illuminated in flight, asymmetrical thrust may occur during landing flare as power is reduced to idle.

## LANDING

*When landing Assured:*

1. Flaps - DOWN (100%)
2. Yaw Damp - OFF

*After Touchdown:*

3. Propeller Levers - FULL FORWARD

*CAUTION*

To ensure consistent reversing characteristics, the propeller control must be in FULL INCREASE RPM position.

4. Power Levers - BETA RANGE OR REVERSE as required

## MAXIMUM REVERSE THRUST LANDING

*When Landing Assured:*

1. Flaps - DOWN (100%)
2. Yaw Damp - OFF
3. Condition Levers - HIGH IDLE
4. Propeller Levers - FULL FORWARD

*After Touchdown:*

5. Power Levers - LIFT AND REVERSE
6. Condition Levers - LOW IDLE

**WARNING**

Propellers will NOT reverse at airspeeds in excess of 95 knots IAS.

*CAUTION*

If possible, propellers should be moved out of reverse at approximately 40 knots, to minimize propeller blade erosion. Care must be exercised when reversing on runways with loose sand or dust on the surface. Flying gravel will damage propeller blades, and dust may impair the pilot's forward field of vision at low airplane speeds.

## BALKED LANDING

1. Power - MAXIMUM ALLOWABLE
2. Airspeed - ESTABLISH 108 KNOTS (When clear of obstacles, establish normal climb.)
3. Flaps - UP
4. Landing Gear - UP

## AFTER LANDING

1. Landing and Taxi Lights - AS REQUIRED
2. RECOGnition Lights - OFF
3. Ice Protection - AS REQUIRED
4. Engine Auto-Ignition - OFF
5. Electrical Load - OBSERVE LIMITS
6. Trim - SET
7. Flaps - UP

## SHUTDOWN AND SECURING

1. Parking Brake - SET
2. Avionics Master - OFF
3. Inverter - OFF
4. Autofeather Switch - OFF
5. Light Switches - OFF
6. Ice Protection - OFF
7. Cabin Temp Mode - OFF
8. Vent Blower - AUTO
9. Battery - CHARGED (If BATTERY CHG annunciator is illuminated, refer to NICKEL-CADMIUM BATTERY CONDITION CHECK, this section)
10. ITT - STABILIZED AT MINIMUM TEMPERATURE FOR ONE MINUTE
11. Condition Levers - CUT-OFF
12. Propellers - FEATHERED

*CAUTION*

Monitor ITT during shutdown. If sustained combustion is observed, proceed immediately to the ENGINE CLEARING procedure. During shutdown, ensure that the compressors decelerate freely. Do not close the fuel firewall shutoff valves for normal engine shutdown.

13. Standby Boost Pumps - OFF

*CAUTION*

The standby boost pumps are connected to the battery bus. Failure to turn these switches OFF will discharge the battery.

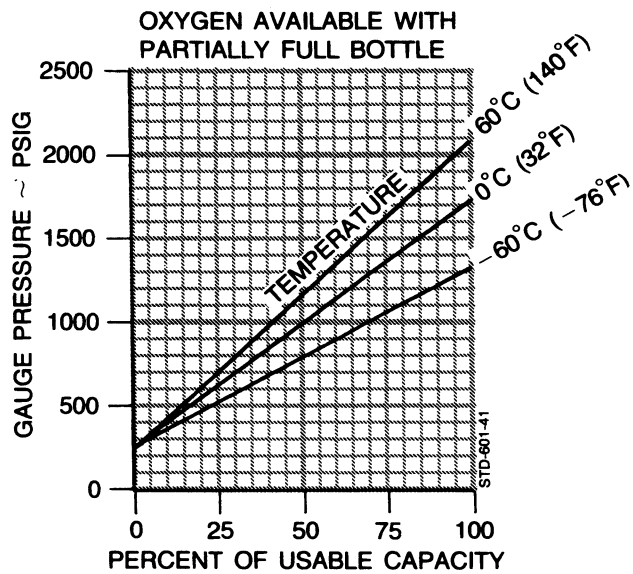
14. Battery and Generator Switches - OFF
15. Oxygen Supply Control Handle - PUSH OFF
16. Control Locks - INSTALL
17. Tie-downs and Chocks - AS REQUIRED
18. Parking Brake - OFF
19. External Covers - INSTALL

## ENVIRONMENTAL SYSTEMS

### OXYGEN SYSTEM

#### PREFLIGHT

1. Oxygen Pressure Gage - CHECK TO ENSURE SUFFICIENT PRESSURE, AND NOTE READING.
2. Percent of Full Bottle - DETERMINE FROM "OXYGEN AVAILABLE WITH PARTIALLY FULL BOTTLE" GRAPH. ⟶
3. Oxygen Duration in Minutes - COMPUTE
   a. Duration with Full Bottle - OBTAIN FROM "OXYGEN DURATION" TABLE BELOW.
   b. Current Oxygen Duration Available - MULTIPLY FULL-BOTTLE DURATION BY PERCENT OF FULL BOTTLE to obtain answer in minutes.
4. Oxygen System Control - "PULL ON SYS READY" POSITION.
5. Diluter Demand System - CHECK OPERATION, SET MASKS AT 100% POSITION.




*OXYGEN DURATION*

Oxygen Duration is computed for the auto-deployed type mask, rated at 3.7 Standard Liters Per Minute (SLPM-NTPD) flow. Early Puritan-Bennett masks are not color coded, while later Puritan-Bennett masks have an orange and black coded plug-in. Scott-Sieria masks have a green fitting-end. This table is also used for the quick-donning, diluter demand crew oxygen masks. Increase "Number Of People Using" by one for each crew member using 100% mode. Crew members may use either NORMAL or 100% mode at pressure altitudes to 20,000 feet but must use 100% mode above 20,000 feet.

| Cylinder Volume Cu Ft | NUMBER OF PEOPLE USING | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| | DURATION IN MINUTES | | | | | | | | | | | |
| **22** | 151 | 75 | 50 | 37 | 30 | 25 | 21 | 18 | 16 | 15 | 13 | 12 |
| **49** | 334 | 167 | 111 | 83 | 66 | 55 | 47 | 41 | 37 | 33 | 30 | 27 |
| **64** | 445 | 222 | 148 | 111 | 89 | 74 | 63 | 55 | 49 | 44 | 40 | 37 |
| **76** | 514 | 257 | 171 | 128 | 102 | 85 | 73 | 64 | 57 | 51 | 46 | 42 |

INFLIGHT

1. Passengers
   - Lanyard Pin - PULL AND DON MASK

NOTE

If system is desired for use, mask can be manually deployed by pulling PASSENGER MANUAL O'RIDE control on pilot's overhead display.

2. Crew

   a. Diluter Demand System - DON QUICK-DONNING MASK (When used at a cabin altitude of 20,000 feet or lower, the selector lever is usually moved to "NORMAL" to conserve oxygen.)

3. First Aid Oxygen

   a. Oxygen System Control - CHECK SYS READY ON
   b. Oxygen Compartment - PULL COVER OPEN
   c. ON/OFF Valve - ON position
   d. DON MASK

AFTER USING OXYGEN

1. Passengers

   a. Lanyard Pin - INSERT
   b. Masks - RETURN TO OVERHEAD CONTAINER AND SECURE DOOR

NOTE

To close overhead doors, the following conditions must be met: Cabin altitude must be below the range requiring oxygen, and the PASSENGER MANUAL O'RIDE must be in the OFF position.

2. Crew Mask - RETURN TO MOUNT (Lever at 100% position).
3. First Aid Oxygen

   a. ON/OFF Valve - OFF position
   b. Mask - RETURN TO COMPARTMENT AND CLOSE COVER

## PRESSURIZATION SYSTEM

FUNCTIONAL CHECK DURING RUNUP

1. Bleed Air Valves - OPEN
2. Cabin Pressure Controller - SET

   a. Cabin Altitude Selector Knob - ADJUST SO THAT "CABIN ALT" DIAL INDICATES AN ALTITUDE 500 FEET BELOW FIELD PRESSURE ALTITUDE.
   b. Rate Control Selector Knob - SET INDEX BETWEEN 9- AND 12-O'CLOCK POSITIONS.

3. Pressurization Switch - HOLD AT THE "TEST" POSITION.
4. Cabin Altitude Indicator Dial - CHECK FOR DESCENT INDICATION.
5. Pressurization Switch - RELEASE TO THE "PRESS" POSITION when pressurizing is confirmed.
6. Pressurization - SET (See BEFORE TAKEOFF procedure.)

### HEATING/COOLING SYSTEM

1. Bleed Air Valves - OPEN (CLOSED for more efficient cooling on the ground.)
2. Cabin Temperature Mode - AUTO
3. Vent Blower - AUTO
4. Electric Heat - AS REQUIRED
5. Temperature Control - AS REQUIRED

NOTE

During operation in AUTO, MANUAL HEAT, or MANUAL COOL, the ventilation blower operates in the low mode. For increased air circulation, turn the Blower Switch to HIGH. For maximum cooling, the ventilation blower should be in the HIGH mode.

### DEFROSTER AIR

1. Windshield Defroster Air Control (right side of pilot's control column) - ON (pull)
2. Pilot, Copilot, and Cabin Air Controls - OFF (if increased defroster air flow is required)

## OTHER NORMAL PROCEDURES

### BLENDING ANTI-ICING ADDITIVE TO FUEL

The following procedure is to be used when blending anti-icing additive (which must conform to specification MIL-I-27686) with the fuel as the airplane is being refueled:

1. Using "HI-FLO PRIST" blender (Model PHF-204), remove cap containing the tube and clip assembly.
2. Attach pistol grip on collar.
3. Press tube into button.
4. Clip tube end to fuel nozzle.
5. Pull trigger firmly to ensure full flow, then lock in place.
6. Start flow of additive when refueling begins. (Refueling should be at a rate of 30 to 60 gallons per minute. A rate of less than 30 gallons per minute may be used when topping off tanks.)

*CAUTION*

Ensure that the additive is directed into the flowing fuel stream; start additive flow after fuel flow starts, and stop before fuel flow stops. Do not allow concentrated additive to contact coated interior of fuel cells or airplane painted surfaces. Use not less than 20 fl oz of additive per 260 gallons of fuel or more than 20 fl oz of additive per 104 gallons of fuel.

## ADDING BIOCIDE TO FUEL

See Beech King Air F90 Maintenance Manual for procedures to follow when adding BIOBOR JF biocide to the airplane fuel.

## NICKEL-CADMIUM BATTERY CHECK (GROUND OPERATION ONLY)

Illumination of the BATTERY CHG annunciator indicates an above-normal charge current. Following an engine start, the battery recharge current is very high and causes the illumination of the BATTERY CHG annunciator. It should normally extinguish within five minutes. If it does not, or if it should reappear, the battery charge current should be monitored using the procedure shown below until it decreases to a level to extinguish the BATTERY CHG annunciator. Check the battery charge current every 90 seconds until the charge current decreases sufficiently to extinguish the annunciator. No decrease in charging current between checks indicates an unsatisfactory condition and the battery should be removed and checked by a qualified nickel-cadmium battery shop. Do not take off with the annunciator illuminated unless a decreasing battery charge current is confirmed.

1. Either Generator - OFF
2. Voltmeter - ENSURE INDICATION OF 28 VOLTS
3. Battery - OFF MOMENTARILY, NOTING DECREASE IN LOADMETER

*If decrease in loadmeter exceeds 2.5%*

4. Battery - CONTINUE TO CHARGE, REPEATING STEP 3 EVERY 90 SECONDS
5. BATTERY CHG Annunciator - EXTINGUISHED WHEN DECREASE IN LOADMETER IS LESS THAN 2.5%

## COLD WEATHER PROCEDURES (SNOW, SLUSH, AND ICE)

### *PREFLIGHT INSPECTION*

Verify that the tires are not frozen to the ramp, and that the brakes are free of ice contamination. Deicing or anti-icing solutions may be used on the tires and brakes if they are frozen. Solutions which contain a lubricant, such as oil, must not be used as they will decrease the effectiveness of the brakes.

In addition to the normal exterior preflight inspection, special attention should be given all vents, openings, static ports, control surfaces, hinge points, the stall warning vane and the wing, tail, and fuselage surfaces for accumulations of ice or snow. Removal of these accumulations is necessary prior to takeoff. Airfoil contours may be altered by the ice and snow to the extent that their lift qualities will be seriously impaired. Ice and snow on the fuselage can increase drag and weight. Frost that may form on the wing fuel tank bottom skins need not be removed prior to flight. Frost that may accumulate on other portions of the wing, the tail surfaces, or on any control surface, must be removed prior to flight.

Inspect the propeller blades and hubs for ice and snow. Unless engine inlet covers have been installed during snow or icing conditions, the propellers should be turned by hand in the direction of normal rotation to make sure they are free to rotate prior to starting engines.

The removal of frozen deposits by chipping or scraping is not recommended. A soft brush, squeegee, or mop may be used to clear snow that is not adhering to the surfaces. If use of deicing/anti-icing fluids are required to produce a clean airplane, special attention must be given to ensure that the pitot masts, static ports, fuel vents, the stall warning vane, cockpit windows and the area forward of the cockpit windows are free of the deicing/anti-icing solution. Both wings and both stabilizers must receive the same complete treatment. The type and concentration of deicing/anti-icing solution being applied and the rate of precipitation will affect the length of time the treatment will be effective. Refer to Chapter 12 of the *Beech King Air F90 Series Maintenance Manual* and Section VIII of this manual for additional information on deicing and anti-icing of airplanes on the ground. See Section II, LIMITATIONS, for a list of approved fluids.

Complete the normal preflight procedures, including a check of the flight controls for complete freedom of movement.

After engine start, exercise the propellers through low-and high-pitch and into reverse range to flush any congealed oil through the system.

If the optional brake deicing system is installed, turn it on prior to taxi if brakes require deicing.

### *TAXIING*

Taxiing through deep snow or slush should be avoided when possible. Snow and slush can be forced into brake assemblies which may cause the brakes to freeze during a prolonged hold on the ground or during the subsequent flight. Keep flaps retracted during taxiing to avoid throwing snow or slush into flap mechanisms and to minimize damage to flap surfaces.

Glaze ice can be difficult to see. Therefore, taxi slowly and allow more clearance from objects when maneuvering the airplane.

### *BEFORE TAKEOFF*

After completion of the normal Before Takeoff checklist, verify that the airplane is still free of frozen contaminants.

Ensure the runway is free from hazards such as snow drifts, glazed ice, and ruts.

**WARNING**

> Ice, frost, or snow on top of deicing/anti-icing solutions must be considered as adhering to the airplane. Takeoff should not be attempted.

If the OAT is +5°C or below and visible moisture will be encountered during the takeoff, engine ice vanes must be extended to reduce the possibility of ice being ingested into the engine air inlet.

### *TAKEOFF*

Allow additional take-off distance when snow or slush is on the runway. Extra cycling of the landing gear when above 500 feet AGL may help clear any contamination from the gear system.

When using FAA Approved SAE Type II or Type IV deicing/anti-icing fluids in the concentrated form, the control column force required to rotate for takeoff may temporarily increase approximately 20 pounds. The cruise, descent, approach and landing phases of flight are not affected by the use of these fluids.

### *LANDING*

If it is possible that the brakes may be restricted by ice accumulations from previous ground or in-flight icing conditions, turn the brake deicing system (if installed) on during the descent.

Braking and steering are less effective on slick runways. Also, hydroplaning may occur under wet runway conditions at higher speeds. Use the rudder to maintain directional control until the tires make solid contact with the runway surface.

Selecting reverse thrust can effectively reduce stopping distances on slick runways; however, reverse thrust may cause snow or moisture to be thrown forward, temporarily reducing visibility.

### *SHUTDOWN AND SECURING*

Avoid setting the parking brake, if possible. This will help reduce the possibility of freezing the brakes. Proper chocking can be used to prevent the airplane from rolling.

## ICING FLIGHT

This airplane is approved for flight in icing conditions as defined in FAR 25, Appendix C. These conditions do not include, nor were tests conducted in, all conditions that may be encountered (e.g., freezing rain, freezing drizzle, mixed conditions, or conditions defined as severe). Some icing conditions not defined in FAR 25 have the potential of producing hazardous ice accumulations, which: 1) exceed the capabilities of the airplane's ice protection equipment; and/or 2) create unacceptable airplane performance. Flight into icing conditions which lie outside the FAR-defined conditions is not prohibited; however, pilots must be prepared to divert the flight promptly if hazardous ice accumulations occur.

Refer to Section I for limitations relating to icing flight, and Section III for emergency procedures associated with icing equipment malfunctions and procedures required for severe icing conditions.

**WARNING**

> Due to distortion of the wing airfoil, ice accumulations on the leading edges can cause a significant loss in rate of climb and in speed performance, as well as increases in stall speed. Even after cycling deicing boots, the ice accumulation remaining on the boots and unprotected areas of the airplane can cause large performance losses. For the same reason, the aural stall warning system may not be accurate and should not be relied upon. Maintain a comfortable margin of airspeed above the normal stall airspeed. In order to minimize ice accumulation on unprotected surfaces of the wing, maintain a minimum of 140 knots during operations in sustained dicing conditions. In the event of windshield icing, reduce airspeed to 226 knots or below. Prior to a landing approach, cycle the deicing boots to shed any accumulated ice.

1. Surface Deice System
   a. Preflight: Check boots for damage and cleanliness
   b. Before takeoff: Deice Switch - CHECK BOTH POSITIONS (SINGLE - Up, MANUAL - Down)
      1) Check deice pressure gage
      2) Check boots visually for inflation and hold down. (Inflation is 6 seconds for wings, then 4 seconds for horizontal stabilizer.)
   c. In flight: (When ice accumulates to 1 inch) - Deice Switch - SINGLE (repeat as required)

## NOTE

Either engine will supply sufficient air pressure for deice operation. In the event of failure of SINGLE cycle, use MANUAL cycle.

2. Engine Anti-Ice
   a. Before takeoff: 600 ft-lbs torque
      1) Engine Ice Vane Controls
         a) Extend - Check for torque drop, indicating vane extension.
         b) Retract - Check for torque increase to previous reading, indicating vane retraction.
      2) Power - REDUCE TO IDLE
   b. In Flight:
      1) Before visible moisture is encountered at +5°C and below or;
      2) At night when freedom from visible moisture is not assured at +5°C and below.
         a) Engine Ice Vanes - EXTEND
         b) Check proper operation by noting torque drop.
   c. Regain torque by increasing power levers if desired (observe ITT limits).

## CAUTION

If in doubt, extend the vanes. Engine icing can occur even though no surface icing is present. If freedom from visible moisture can not be assured, engine ice protection should be activated. Visible moisture is moisture in any form; clouds, ice crystals, snow, rain, sleet, hail or any combination of these. Operation of strobe lights will sometimes show ice crystals not normally visible.

3. Engine Air Inlet:
   - In Flight
     - Engine Lip Boot Switches - ON (before ice forms)
4. Engine Auto Ignition:
   a. Before Takeoff
      1) Power Levers - IDLE
      2) Auto Ignition Switches - ARM
      3) Annunciator Panel - IGNITION ON
      4) Power Levers - ADVANCE TO ABOVE 425 FOOT-POUNDS TORQUE
      5) Auto/Ignition ARM Lights - CHECK ON - (IGNITION LIGHTS OFF)
   b. In Flight
      - Auto Ignition - ARM

## NOTE

Engine Auto Ignition must be ARMED for icing flights and flights at night above 14,000 feet. To prevent prolonged operation of the igniters, during descent when Auto Ignition is armed, do not reduce power below 425 ft lbs torque.

5. Electrothermal Propeller Deice

**CAUTION**

Do not operate propeller deice when the propellers are static.

a. Before Takeoff:

1) Automatic Propeller Deice Switch - AUTO

2) Propeller Deice Ammeter - MONITOR for 2 minutes; normal operating range is 17 to 21 amperes. Indications above or below this range may indicate system malfunction, and should be thoroughly checked before beginning flight in icing conditions.

*Airplanes LA-1 through LA-130:*

3) Manual Propeller Deice Switch - MOMENTARILY HOLD IN INNER POSITION, THEN OUTER (Small loadmeter deflection on both meters in each position indicates manual system is operating.)

*Airplanes LA-131 and after:*

3) Manual Propeller Deice Switch - MOMENTARILY HOLD IN MANUAL POSITION (Small loadmeter deflection on both meters indicates manual system is operating.)

All Airplanes:

**NOTE**

Current for the manual (backup) system will not be indicated on the propeller deice ammeter; however, it will be indicated as part of the airplane's load on the loadmeter (small needle deflection) when the system is switched on.

4) Automatic Propeller Deice Switch - OFF

b. In Flight

1) Automatic Propeller Deice Switch - AUTO. The system may be operated continuously in flight, and will function automatically until the switch is turned off.

2) Relieve propeller imbalance due to ice by increasing rpm briefly and returning to the desired setting. Repeat as necessary.

**CAUTION**

If the deice ammeter does not indicate 17 to 21 amperes refer to the EMERGENCY PROCEDURES Section.

6. Fuel Vent Heat - ON
7. Pitot Heat - ON
8. Stall Warning Heat - ON

**CAUTION**

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

9. Windshield Anti-Ice - AS REQUIRED (before ice forms)
10. Wing Ice Lights - AS REQUIRED
11. Alternate Static Air Source - REFER to EMERGENCY PROCEDURES Section.

### PRACTICE DEMONSTRATION OF $V_{MCA}$

$V_{MCA}$ demonstration may be required for multi-engine pilot certification. The following procedure shall be used at a safe altitude of at least 5000 feet above the ground in clear air only.

**WARNING**

IN-FLIGHT ENGINE CUTS BELOW $V_{SSE}$ SPEED OF 102 KNOTS ARE PROHIBITED.

1. Landing Gear - UP
2. Flaps - UP
3. Airspeed - ABOVE 102 KNOTS ($V_{SSE}$)
4. Propeller Levers - HIGH RPM
5. Power Lever (Simulated inoperative engine) - IDLE
6. Power Lever (Other engine) - MAXIMUM ALLOWABLE
7. Airspeed - Reduce approximately 1 knot per second until either $V_{MCA}$ or stall warning is obtained.

**CAUTION**

Use rudder to maintain directional control (heading) and ailerons to maintain 5° bank towards the operative engine (lateral attitude). At the first sign of either $V_{MCA}$ or stall warning (which may be evidenced by: inability to maintain heading or lateral attitude, aerodynamic stall buffet, or stall warning horn sound) immediately initiate recovery: reduce power to idle on the operative engine and immediately lower the nose to regain $V_{SSE}$.

## NOISE CHARACTERISTICS

Approach to and departure from an airport should be made so as to avoid prolonged flight at low altitude near noise-sensitive areas. Avoidance of noise-sensitive areas, if practical, is preferable to overflight at relatively low altitudes.

For VFR operations over outdoor assemblies of persons, recreational and park areas, and other noise-sensitive areas, pilots should make every effort to fly not less than 2000 feet above the surface, weather permitting, even though flight at a lower level may be consistent with the provisions of government regulations.

**NOTE**

The preceding recommended procedures do not apply where they would conflict with Air Traffic Control clearances or instructions, or where, in the pilot's judgement, an altitude of less than 2000 feet is necessary to adequately exercise his duty to see and avoid other airplanes.

The flyover noise level established in compliance with FAR 36 is:

72.9 dB(A)

No determination has been made by the Federal Aviation Administration that the noise levels of this airplane are or should be acceptable or unacceptable for operation at, into, or out of any airport.

THIS PAGE INTENTIONALLY LEFT BLANK

# SECTION V
# PERFORMANCE

## TABLE OF CONTENTS

## INTRODUCTION TO PERFORMANCE AND FLIGHT PLANNING

The graphs and tables in this section present performance information for takeoff, climb, landing and flight planning at various parameters of weight, power, altitude and temperature. All FAA approved performance information is included within this section. Examples have been presented on all performance graphs. In addition, the calculations for flight time, block speed, and fuel required for a proposed flight are presented using the conditions listed below:

### CONDITIONS

At Billings:
- Outside Air Temperature ........ 25°C (77°F)
- Field Elevation ........ 3606 feet
- Altimeter Setting ........ 29.56 in. Hg
- Wind ........ 360° at 10 knots
- Runway 34 Length ........ 5600 feet

Route of Trip:
BIL-V19-CZI-V247-DGW-V19E-CYS-V19-DEN

Weather Conditions at the planned cruise altitude of 17,000 feet:

| ROUTE SEGMENT | DISTANCE NM | MEA FT | WIND AT 17,000 FT DIR/KTS | OAT AT CRUISE ALT °C | OAT AT MEA °C | ALT SET. IN. HG |
|---|---|---|---|---|---|---|
| BIL-SHR | 88 | 8000 | 010/30 | -10 | 0 | 29.56 |
| SHR-CZI | 57 | 9000 | 350/40 | -10 | -4 | 29.60 |
| CZI-DGW | 95 | 8000 | 040/45 | -10 | 0 | 29.60 |
| DGW-CYS | 47 | 8000 | 040/45 | -10 | 0 | 29.60 |
| | 46 | 8000 | 040/45 | -10 | 0 | 29.60 |
| CYS-DEN | 85 | 8000 | 040/45 | -10 | 0 | 29.60 |

REFERENCE: *Enroute Low Altitude Charts L-8 and L-9*

At Denver:
- Outside Air Temperature ........ 15°C (59°F)
- Field Elevation ........ 5331 feet
- Altimeter Setting ........ 29.60 in. Hg
- Wind ........ 270° at 10 knots
- Runway 26 Length ........ 10,000 feet

To determine the pressure altitude at origin and destination airports, add 1000 feet to field elevation for each 1.00 in. Hg that the reported altimeter setting value is below 29.92 in. Hg, and subtract 1000 feet for each 1.00 in. Hg above 29.92 in. Hg. First, find the difference between 29.92 in. Hg and the reported altimeter setting. Then multiply the answer by 1000 to find the difference in feet between field elevation and pressure altitude.

Pressure Altitude at BIL:
29.92 in. Hg - 29.56 in. Hg = 0.36
0.36 x 1000 feet = 360 feet
The pressure altitude at BIL is 360 feet above field elevation.
Pressure Altitude at BIL = 3606 + 360 = 3966 feet.

Pressure Altitude at DEN:
29.92 in. HG - 29.60 in. Hg = 0.32
0.32 x 1000 feet = 320 feet
The pressure altitude at DEN is 320 feet above field elevation.
Pressure Altitude at DEN = 5331 + 320 = 5651 feet.

NOTE

For flight planning, the difference between cruise altitude and cruise pressure altitude has been ignored.

## PERFORMANCE EXAMPLE

### TAKE-OFF WEIGHT

Maximum take-off weight limit (from LIMITATIONS Section) = 10,950 pounds.

### MAXIMUM TAKE-OFF WEIGHT PERMITTED BY ENROUTE CLIMB REQUIREMENT

There is no weight restriction to meet Enroute Climb Requirements.
Maximum allowable take-off weight = 10,950 pounds.

The maximum take-off weight permitted by the Enroute Climb Requirement graph is the only operating limitation required to meet applicable FAR requirements. Information has been presented, however, to determine the take-off weight, field requirements, and take-off flight path assuming an engine failure occurs during the take-off procedure. The following illustrates the use of these charts.

### TAKE-OFF WEIGHT TO ACHIEVE POSITIVE ONE-ENGINE-INOPERATIVE CLIMB AT LIFT-OFF (FLAPS 0%)

Enter the graph at 25°C, 3966 feet, to determine the maximum weight at which the accelerate-go procedures should be attempted.

Maximum Accelerate-Go Weight .......... 10,950 pounds

### TAKE-OFF DISTANCE (FLAPS 0%)

Enter the graph at 25°C, 3966 feet pressure altitude, 10,950 pounds and 9.5 knot headwind component:

Ground Roll .......... 2930 feet
Total Distance Over 50-foot Obstacle .......... 4120 feet

Take-off Speed:
At Rotation .......... 107 knots
At 50 Feet .......... 117 knots

### ACCELERATE-STOP (FLAPS 0%)

Enter the Accelerate-Stop (Flaps 0%) graph at 25°C, 3966 feet pressure altitude, 10,950 pounds, and 9.5 knots headwind component:

Accelerate-Stop Distance .......... 5420 feet
Takeoff Decision Speed .......... 107 knots

## TAKE-OFF FLIGHT PATH EXAMPLE

The following example assumes the airplane is loaded so that take-off weight is 10,000 pounds:

### ACCELERATE-GO DISTANCE OVER 35-FOOT OBSTACLE (FLAPS 0%)

Enter the graph at 25°C, 3966 feet pressure altitude, 10,000 pounds and 9.5 knot headwind component:

Total Distance Over 35-Foot Obstacle ............ 6000 feet
Speed at Rotation ($V_R$) ............ 102 knots
Speed at 35 Feet Above Runway ($V_2$) ............ 112 knots

### TAKE-OFF CLIMB GRADIENT - ONE-ENGINE-INOPERATIVE - FLAPS 0%

Enter the graph at 25°C, 3966 feet pressure altitude, and 10,000 pounds:

Climb Gradient ............ 4.2%
Climb Speed ............ 112 knots

A 4.2% climb gradient is 42 feet of vertical height per 1000 feet of horizontal distance.

NOTE

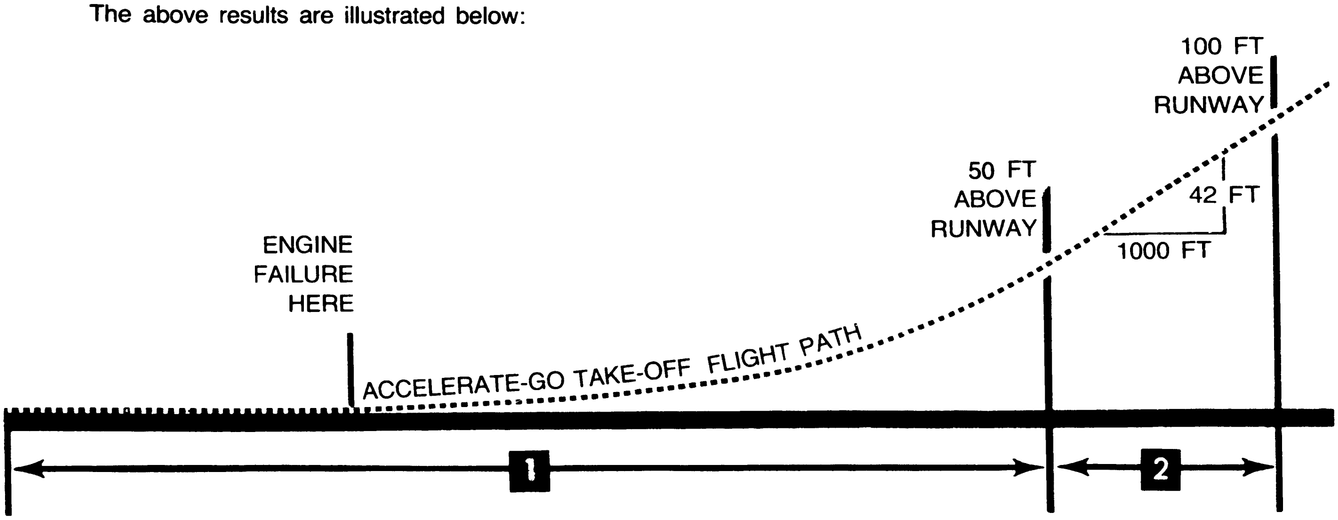
The graphs for take-off climb gradient assume a zero wind condition. Climbing into a headwind will result in higher angles of climb and hence better obstacle clearance capabilities.

Calculation of the horizontal distance to clear an obstacle 100 feet above the runway surface:

Distance from 35 feet to 100 feet = 65 feet
(100 - 35) (1000 ÷ 42) = 1548 feet

Total Distance = 6000 + 1548 = 7548 feet

The above results are illustrated below:




1 ACCELERATE-GO TAKE-OFF = 7800 FEET

2 DISTANCE TO CLIMB FROM 50 FEET TO 100 FEET ABOVE RUNWAY = 1190 FEET

## FLIGHT PLANNING

The following calculations provide information for the flight planning procedure. All examples have been presented on the performance graphs.

| ROUTE SEGMENT | MAGNETIC COURSE | MAGNETIC VARIATION |
|---|---|---|
| BIL-SHR | 114° | 15°E |
| SHR-CZI | 136° | 15°E |
| CZI-DGW | 131° | 14°E |
| DGW-CYS | 138° | 13°E |
| | 169° | 13°E |
| CYS-DEN | 171° | 13°E |

REFERENCE: *Enroute Low Altitude Charts L-8 and L-9*

Enter the ISA Conversion graph at the condition indicated:

ENROUTE: Pressure Altitude (approx) = 17,000 feet
OAT = -10°C
ISA Condition = ISA + 9°C

Enter the Time, Fuel and Distance to Climb graph at 25°C and 3966 feet, and -10°C and 17,000 feet, with an initial weight of 10,950 pounds.

Time to Climb = (9.5 - 2) = 7.5 min
Fuel Used to Climb = (107 - 25) = 82 lbs
Distance Traveled = (25 - 5) = 20 NM

Enter the tables for Maximum Cruise Power at ISA and ISA + 10°C. In each table, read cruise speeds at 16,000 feet and 18,000 feet at 10,500 pounds and 9500 pounds as follows:

| ALTITUDE FEET | CRUISE TRUE AIRSPEED 10,500 POUNDS ISA | 10,500 POUNDS ISA + 10°C | 9500 POUNDS ISA | 9500 POUNDS ISA + 10°C |
|---|---|---|---|---|
| 16,000 | 259 | 257 | 262 | 259 |
| 18,000 | 257 | 254 | 260 | 258 |

The estimated cruise weight is approximately 10,400 pounds.

Interpolate to find the TAS at 17,000 feet, ISA + 9°C, and 10,400 pounds:

Cruise True Airspeed = 256 knots

Enter the graph for Maximum Cruise Power at ISA + 9°C and 17,000 feet pressure altitude:

Torque Setting Per Engine = 1428 ft-lbs
Indicated Outside Air Temperature = −3°C

Enter the graph for Fuel Flow At Maximum Cruise Power at ISA + 9°C (or indicated outside air temperature of −3°C) and 17,000 feet pressure altitude:

| | | |
|---|---|---|
| Fuel Flow Per Engine | = | 299 lbs/hr |
| Total Fuel Flow | = | 598 lbs/hr |

NOTE

Torque setting and fuel flows can also be obtained from tables.

Enter the graph for Time, Fuel and Distance to Descend at 17,000 feet and at 5651 feet:

| | | |
|---|---|---|
| Time to Descend | = | (11 - 4) = 7 min |
| Fuel to Descend | = | (104 - 30) = 74 lbs |
| Distance to Descend | = | (47 - 13) = 34 NM |

Time and fuel used were calculated at maximum cruise power as follows:

| | | |
|---|---|---|
| Time | = | Distance ÷ Ground Speed |
| Fuel Used | = | (Time) (Total Fuel Flow) |

Results are as follows:

| ROUTE | DISTANCE NM | ESTIMATED GROUND SPEED ~ KNOTS | TIME AT CRUISE ALTITUDE HRS : MIN | FUEL USED FOR CRUISE LBS |
|---|---|---|---|---|
| BIL-SHR | 88 - 20 = 68* | 271 | :15 | 150 |
| SHR-CZI | 57 | 294 | :12 | 116 |
| CZI-DGW | 95 | 268 | :21 | 212 |
| DGW-CYS | 47 | 273 | :10 | 103 |
| | 46 | 292 | :09 | 94 |
| CYS-DEN | 85 - 34 = 51* | 293 | :10 | 104 |

*Distance to climb or descend subtracted from segment distance

The fuel used at cruise altitude from BIL to SHR at 17,000 feet and -10°C (ISA +9°C) is:

| | |
|---|---|
| Fuel Flow | 598 lbs/hr |
| Cruise True Airspeed (10,400 lbs) | 256 knots |
| Distance Traveled at 17,000 feet | 68 NM |
| Estimated Ground Speed | 271 knots |
| Fuel Used for 68 NM at 271 knots GS | 150 lbs |

The total fuel used from BIL to SHR is: 82 + 150 = 232 lbs

The estimated weight upon reaching SHR is: Take-off weight of 10,950 - 232 = 10,718 lbs

NOTE

Two-engine rate of climb was determined for cruise altitude and estimated weight at SHR. The MEA at SHR was the highest MEA encountered during the flight; the one-engine-inoperative climb and service ceiling were determined for the MEA and weight at SHR.

| DETERMINATION OF FLIGHT TIME, BLOCK SPEED AND FUEL REQUIREMENTS | | | |
|---|---|---|---|
| ITEM | TIME HRS: MIN | FUEL POUNDS | DISTANCE NAUTICAL MILES |
| Start, Runup, Taxi, and Takeoff | 0:00 | 80 | 0 |
| Climb | 0:08 | 82 | 20 |
| Cruise | 1:17 | 779 | 364 |
| Descent | 0:07 | 74 | 34 |
| TOTAL | 1:32 | 1015 | 418 |

Total Flight Time: 1 Hour, 32 Minutes

Block Speed: 418 NM ÷ 1 Hour 32 Minutes = 273 Knots

## RESERVE FUEL

A 45-minute reserve at Maximum Range Power was assumed. The assumed weight and temperature at the end of the cruise segment used were:
(10,000 lbs, ISA + 9°C, 17,000 ft)

(0:45) (429) = 322 lbs

## TOTAL FUEL REQUIREMENT

1015 + 322 = 1337 lbs

## ZERO FUEL WEIGHT LIMITATION

For this example, the following conditions were assumed:

| | |
|---|---|
| Ramp Weight | = 11,030 pounds |
| Weight of Usable Fuel Onboard | = 1337 pounds |

Zero Fuel Weight = Ramp Weight − Weight of Usable Fuel Onboard

| | |
|---|---|
| Zero Fuel Weight = 11,030 − 1337 | = 9693 pounds |
| Maximum Zero Fuel Weight (from LIMITATIONS section) | = 9600 pounds |
| Maximum Zero Fuel Weight Limitation has been exceeded by | 93 pounds |

In order to avoid exceeding the limitation, at least 93 pounds of payload must be off-loaded. If desired, additional fuel may then be added until the maximum ramp weight limitation of 11,030 pounds is again reached.

## LANDING INFORMATION

### LANDING WEIGHT

The estimated landing weight is determined by subtracting the fuel required for the trip from the ramp weight.

| | | |
|---|---|---|
| Ramp Weight | = | 11,030 lbs |
| Fuel Required for Total Trip | = | 1015 lbs |
| Landing Weight | = | 11,030 - 1015 = 10,015 lbs |

### LANDING DISTANCE WITHOUT PROPELLER REVERSING, FLAPS 100%

Enter the graph at 15°C, 5651 feet pressure altitude, 10,015 lbs, 10 knot headwind.

| | | |
|---|---|---|
| Ground Roll | = | 2125 feet |
| Total Over 50 foot Obstacle | = | 3260 feet |
| Approach Speed | = | 108 knots |

### BALKED LANDING CLIMB

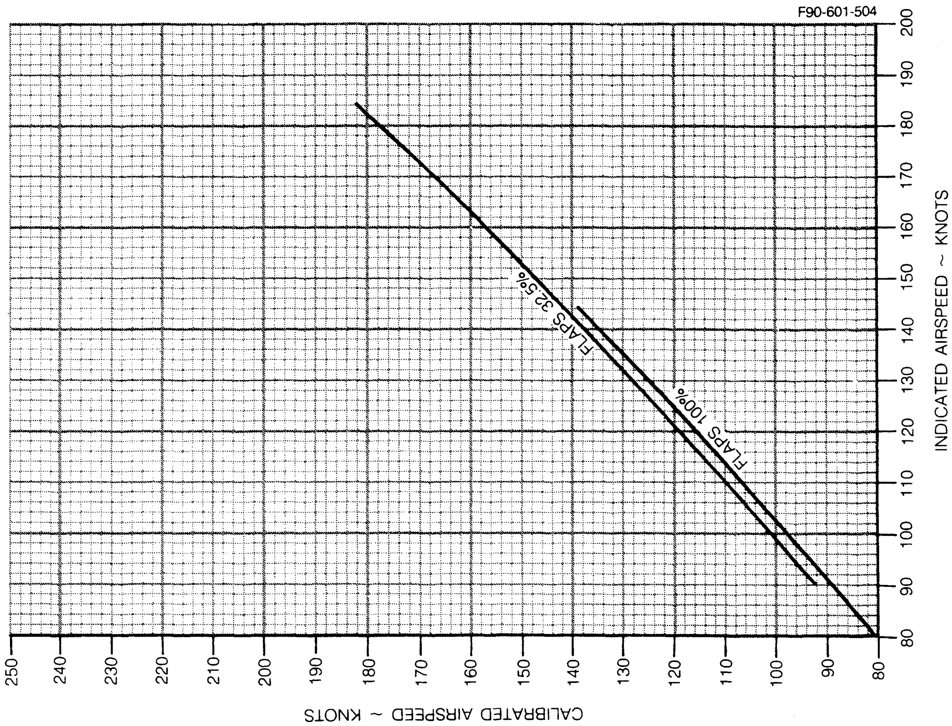
Enter the graph at 15°C, 5651 feet and 10,015 lbs.

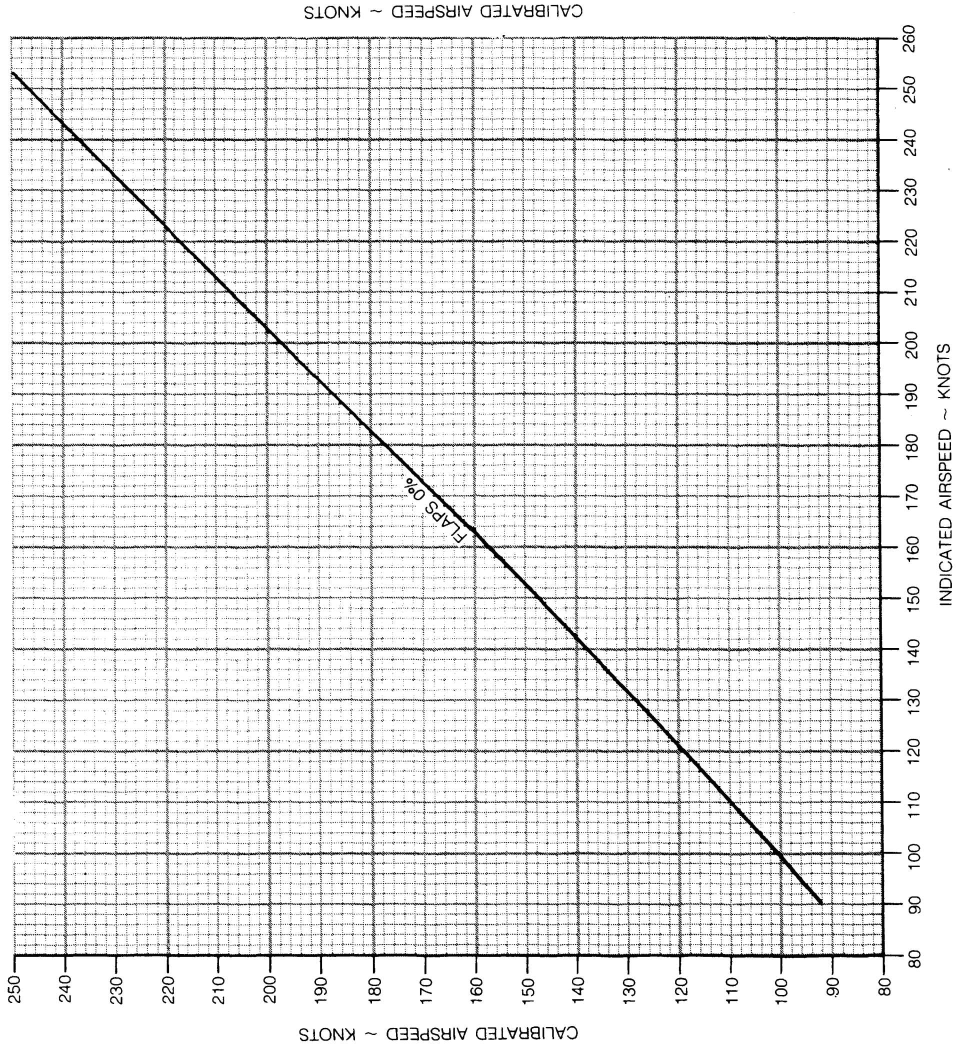
| | | |
|---|---|---|
| Rate of Climb | = | 1014 ft/min |
| Climb Gradient | = | 9.1% |

## COMMENTS PERTINENT TO THE USE OF PERFORMANCE GRAPHS

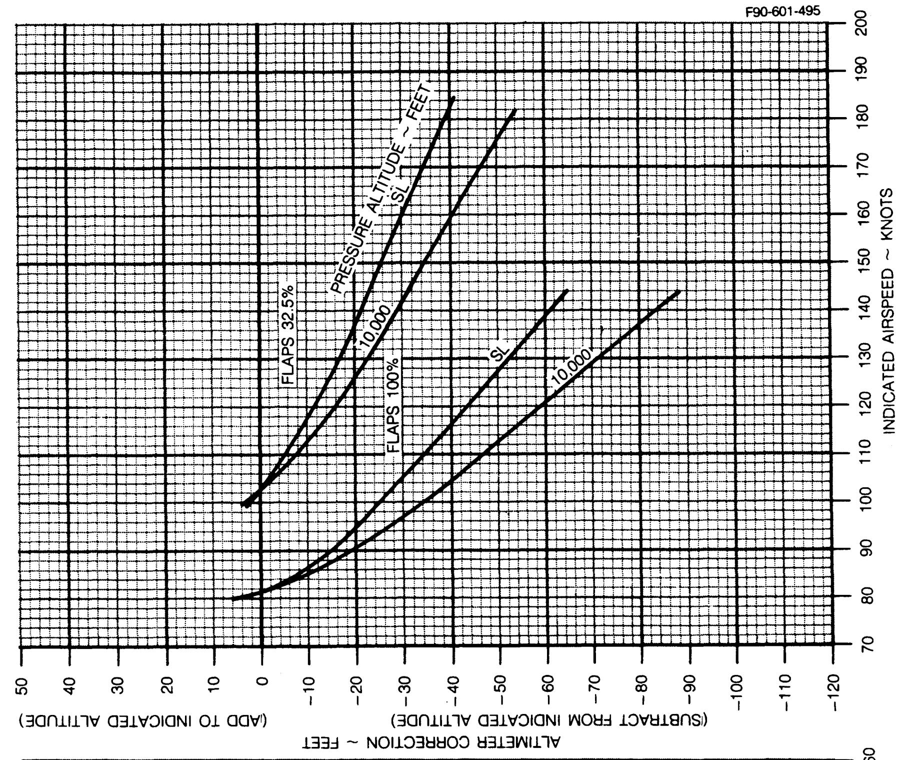
1. In addition to presenting the answer for a particular set of conditions, the example on a graph also presents the order in which the graph should normally be used (e.g., if the first item in the example is OAT, then enter the graph at the known OAT).
2. The reference lines indicate where to begin following the guide lines. Always project to the reference line first, then follow the guide lines to the next known item.
3. Indicated airspeeds (IAS) were obtained by using the Airspeed Calibration Normal System graph.
4. The associated conditions define the specific conditions for which performance parameters have been determined. They are not intended to be used as instructions; however, performance values determined from charts can only be achieved if the specified conditions exist.
5. The full amount of usable fuel is available for all approved flight conditions.

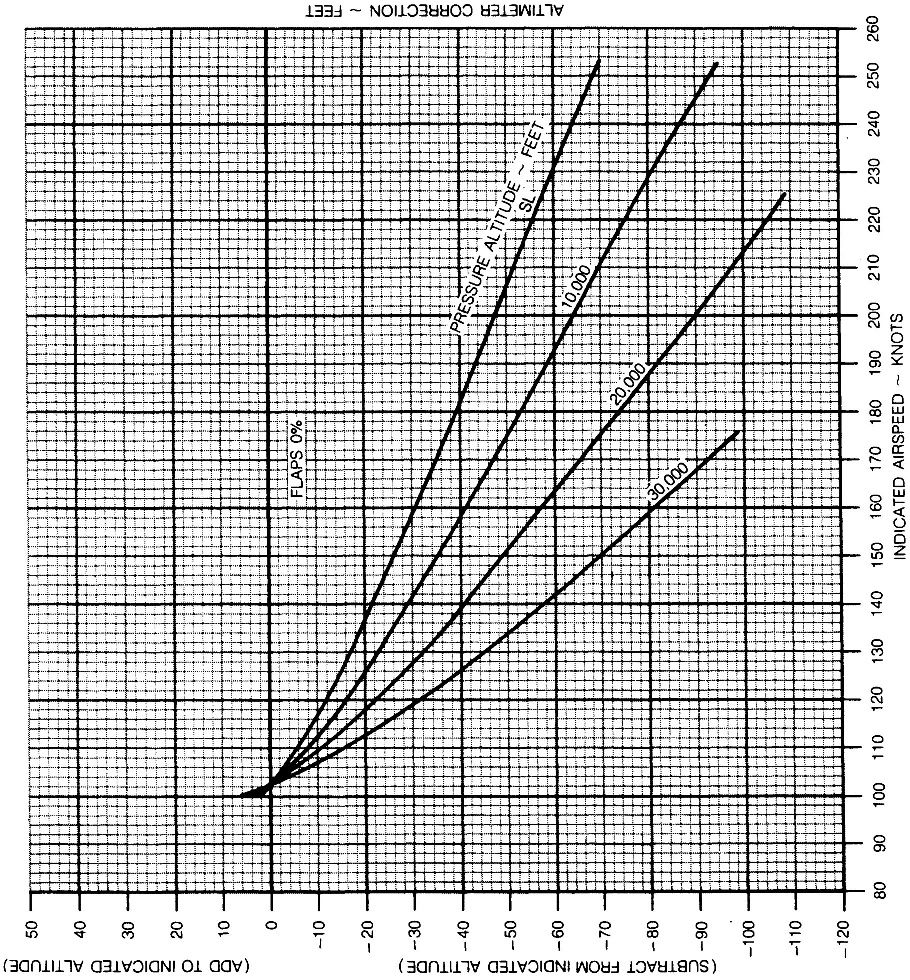
# AIRSPEED CALIBRATION - NORMAL SYSTEM



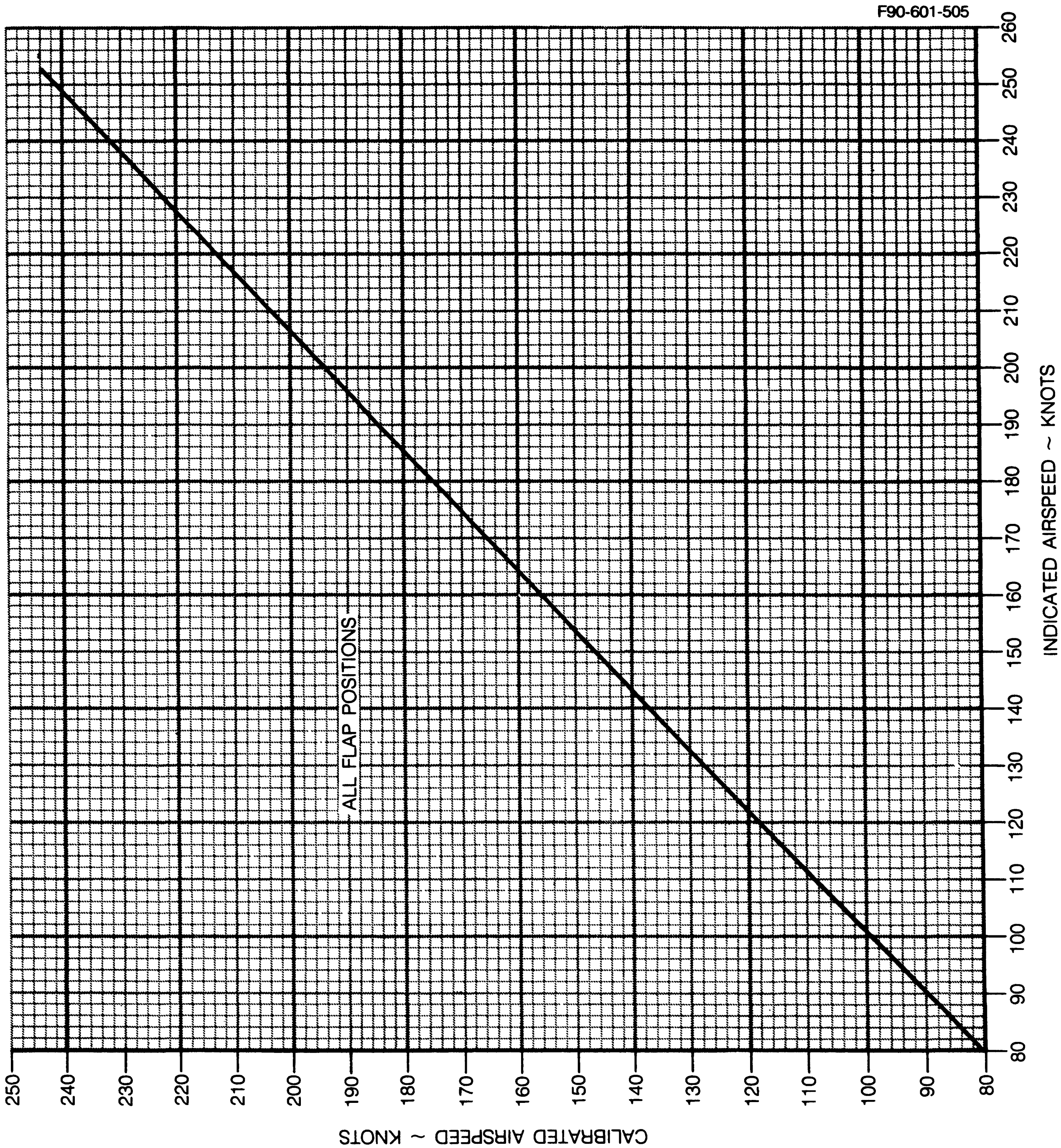



# ALTIMETER CORRECTION - NORMAL SYSTEM



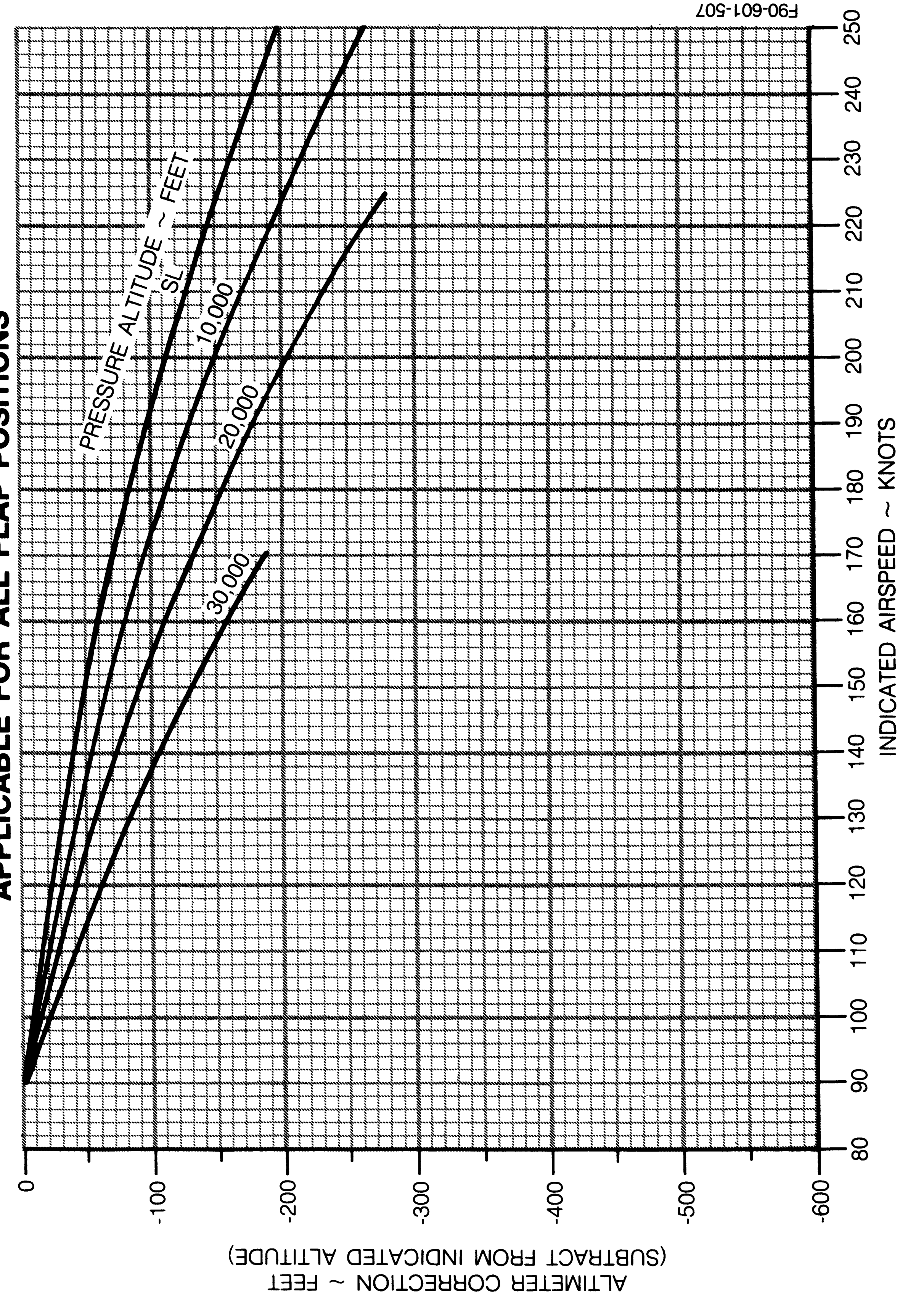



# AIRSPEED CALIBRATION - ALTERNATE SYSTEM



# ALTIMETER CORRECTION – ALTERNATE SYSTEM

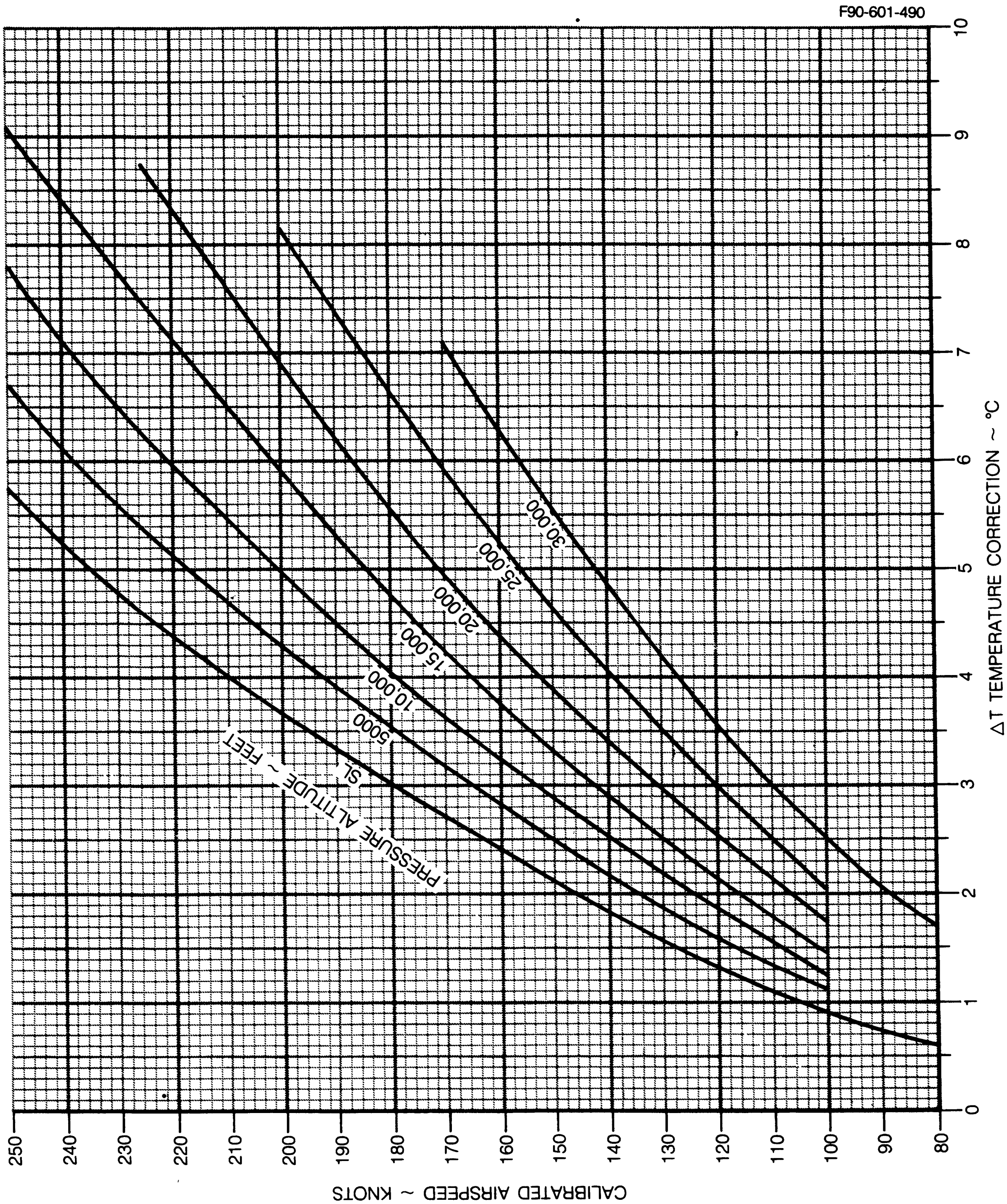
## APPLICABLE FOR ALL FLAP POSITIONS



# INDICATED OUTSIDE AIR TEMPERATURE CORRECTION

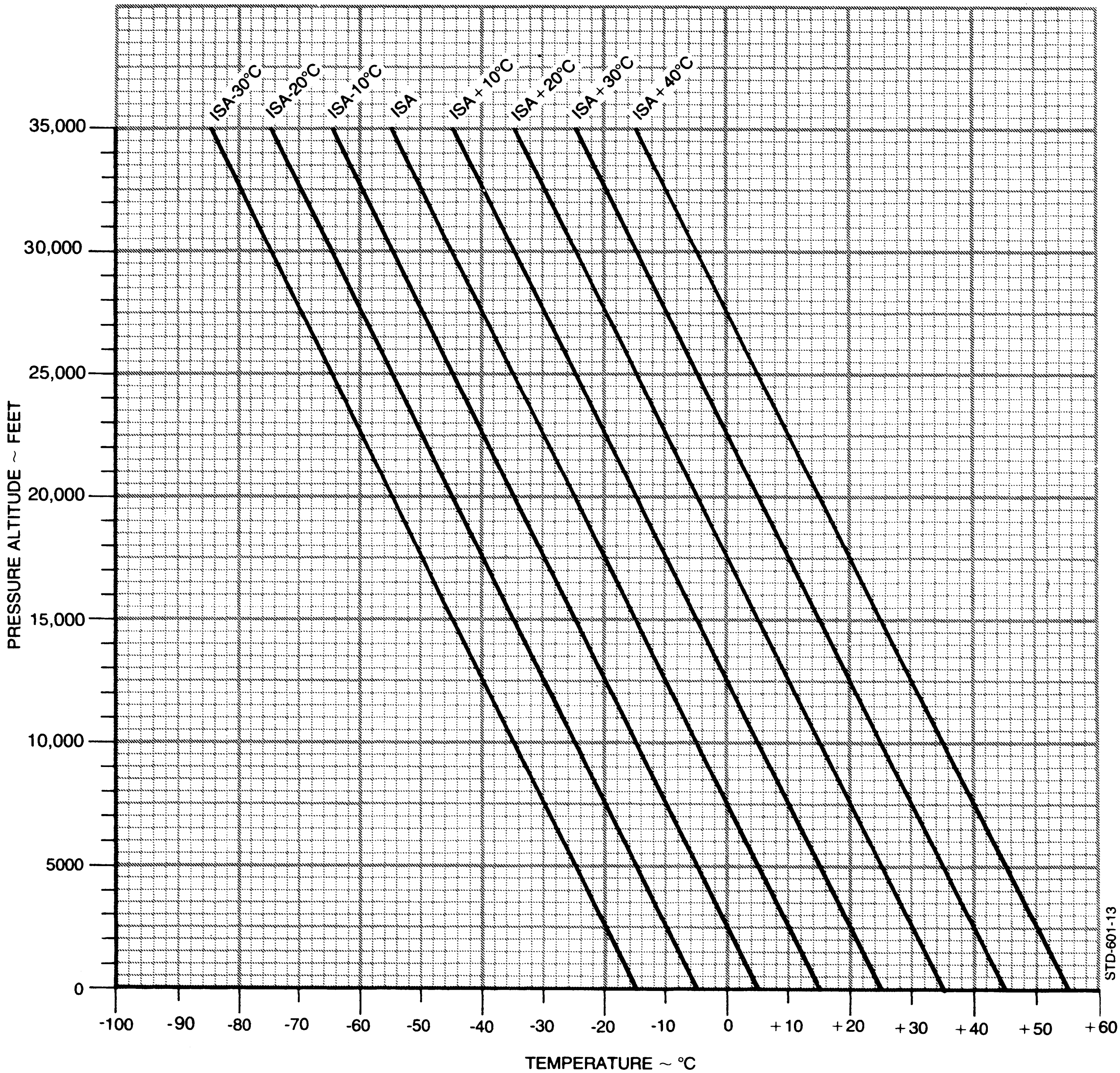
**STANDARD DAY (ISA)**

NOTE: SUBTRACT ΔT FROM INDICATED (GAGE) OAT TO OBTAIN TRUE OAT. (ΔT ASSUMES A RECOVERY FACTOR OF 0.7)

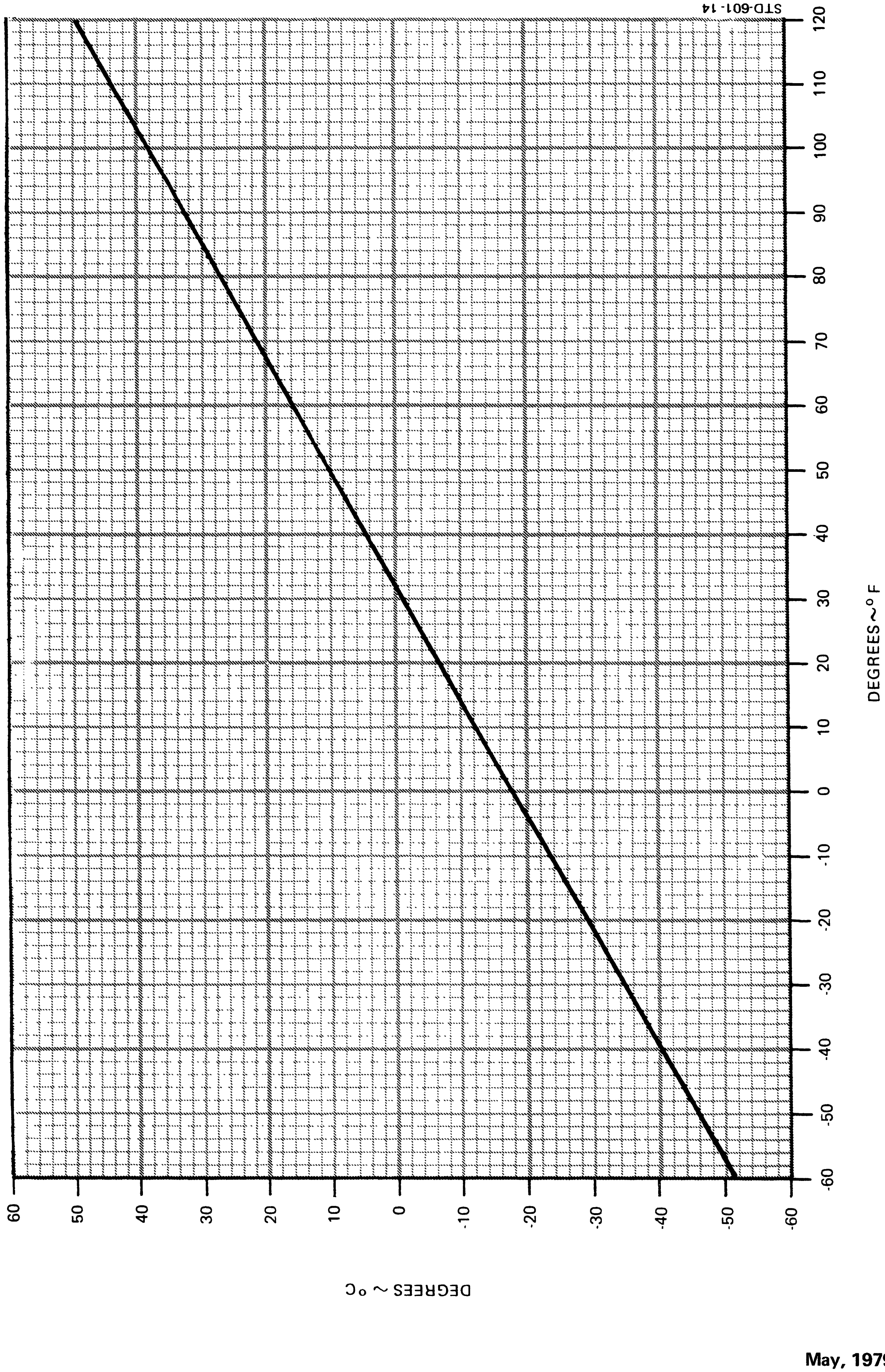


# ISA CONVERSION

PRESSURE ALTITUDE vs OUTSIDE AIR TEMPERATURE



# FAHRENHEIT TO CELSIUS TEMPERATURE CONVERSION



# STALL SPEEDS - POWER IDLE

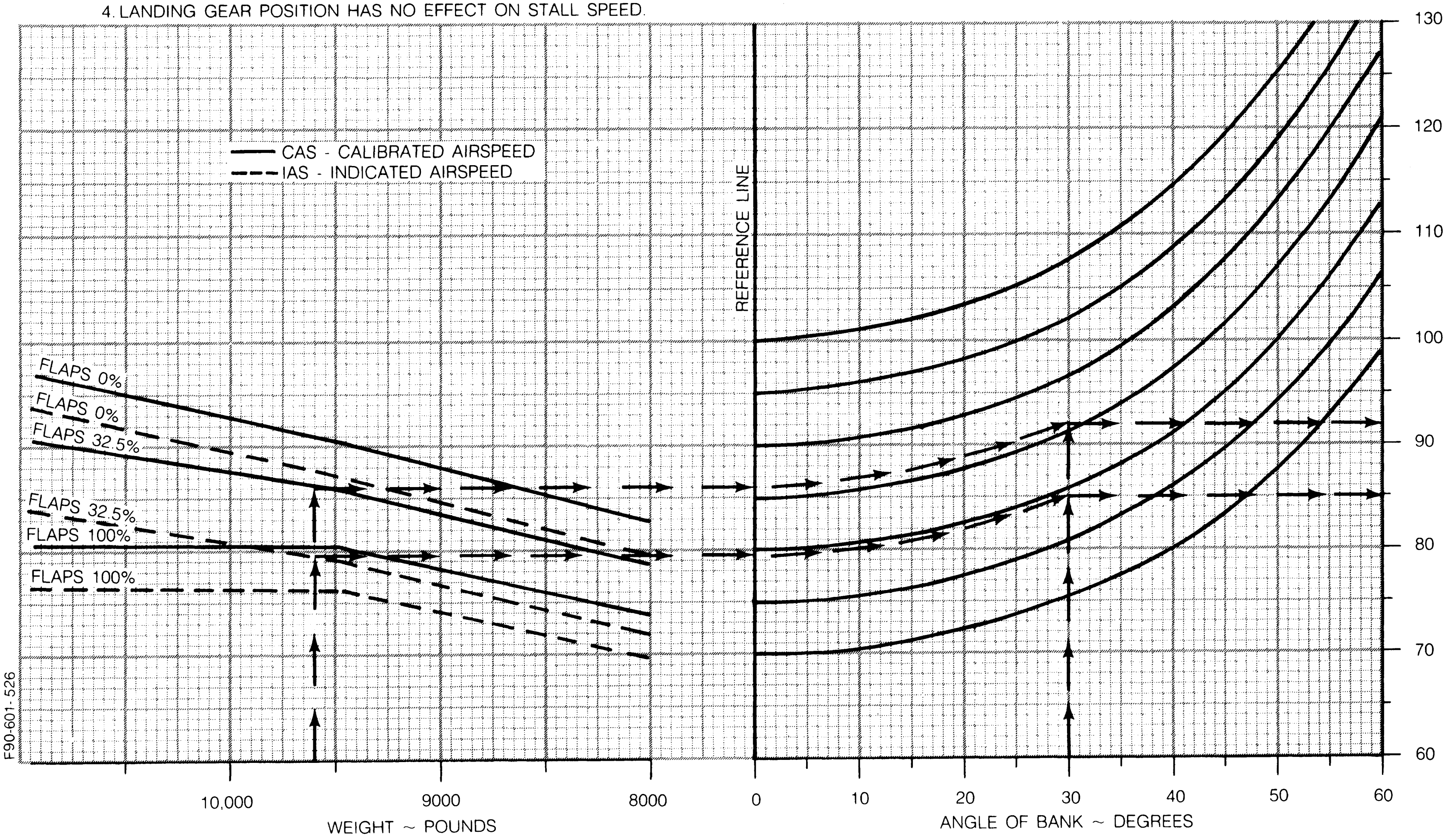
NOTES:

1. ALTITUDE LOSS EXPERIENCED WHILE CONDUCTING STALLS IN ACCORDANCE WITH FAR 23.201 WAS 350 FEET.
2. MAXIMUM NOSE DOWN PITCH ATTITUDE AND ALTITUDE LOSS DURING RECOVERY FROM ONE-ENGINE-INOPERATIVE STALLS PER FAR 23.205 ARE APPROXIMATELY 8° AND 300 FEET RESPECTIVELY.
3. A NORMAL STALL RECOVERY TECHNIQUE MAY BE USED. THE BEST PROCEDURE IS A BRISK FORWARD WHEEL MOVEMENT TO A NOSE DOWN ATTITUDE. LEVEL THE AIRPLANE AFTER AIRSPEED HAS INCREASED APPROXIMATELY 25 KNOTS ABOVE STALL.
4. LANDING GEAR POSITION HAS NO EFFECT ON STALL SPEED.

EXAMPLE:

WEIGHT .................... 9600 LBS
FLAPS ...................... 32.5%
ANGLE OF BANK ........... 30°

STALL SPEED .............. 92 KTS CAS
85 KTS IAS

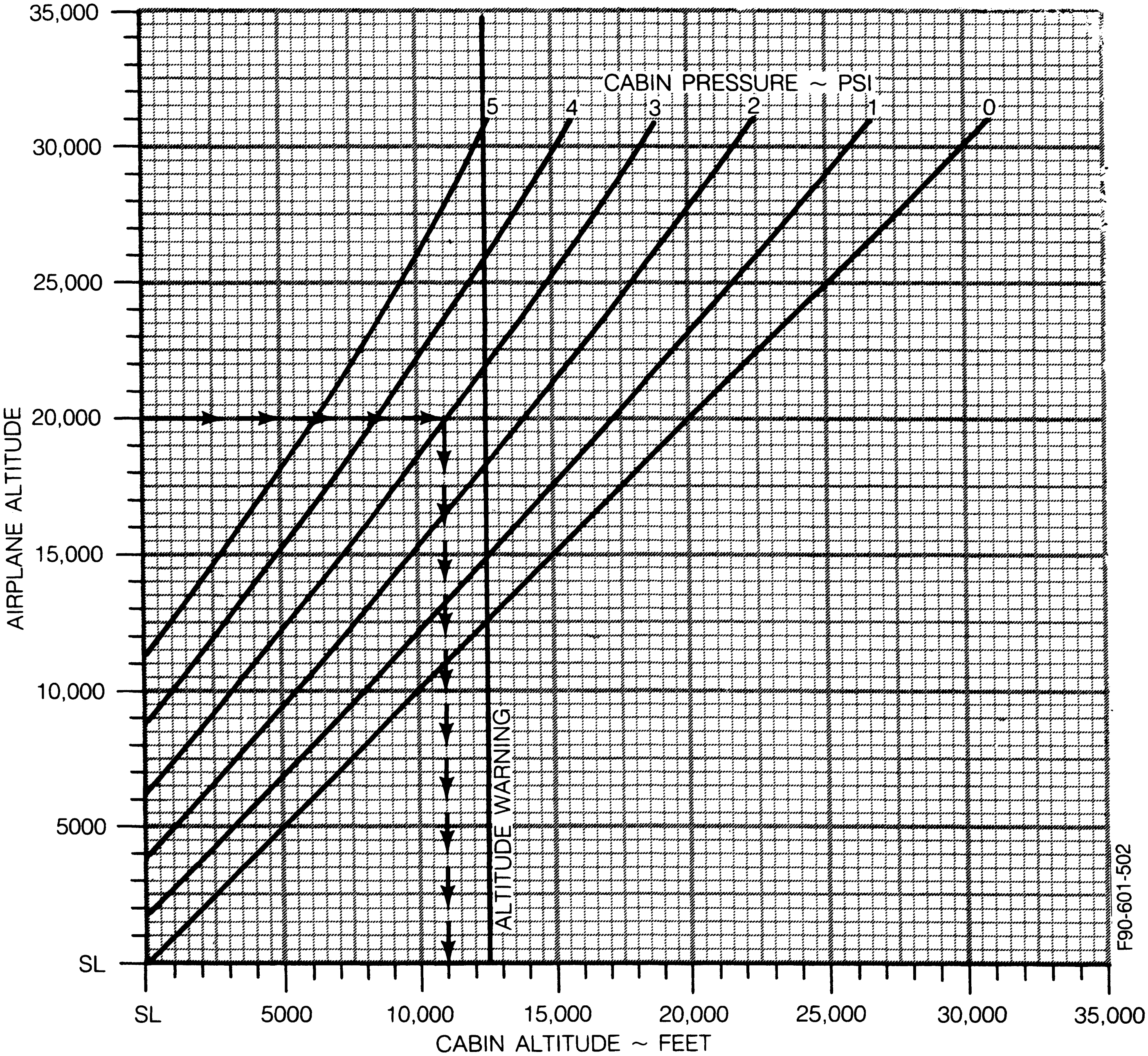


# CABIN ALTITUDE FOR VARIOUS AIRPLANE ALTITUDES

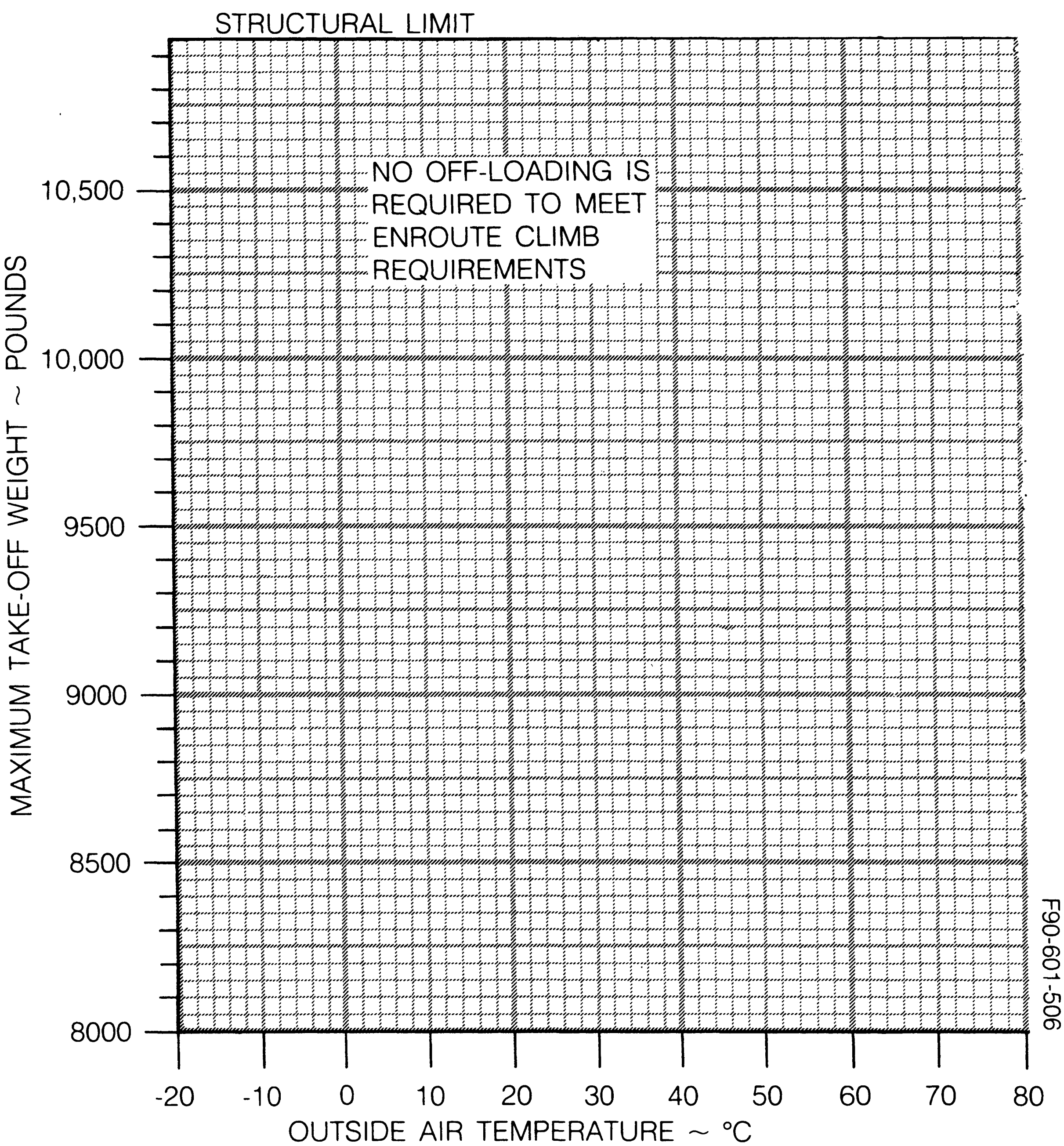
EXAMPLE:

AIRPLANE ALTITUDE .................... 20,000 FT
CABIN PRESSURE ...................... 3.0 PSI

CABIN ALTITUDE ...................... 11,000 FT



# MAXIMUM TAKE-OFF WEIGHT
## PERMITTED BY ENROUTE CLIMB REQUIREMENT



# TAKE-OFF WEIGHT – FLAPS 0%

## TO ACHIEVE POSITIVE ONE-ENGINE-INOPERATIVE CLIMB AT LIFT-OFF

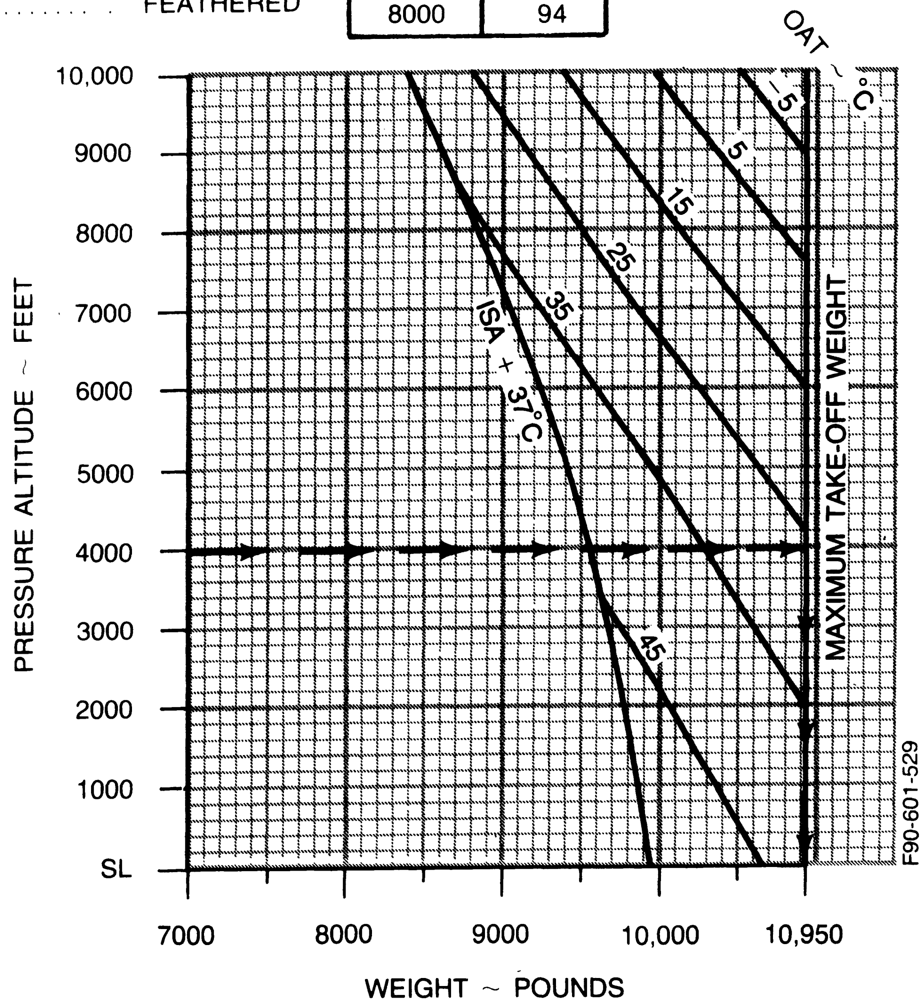
ASSOCIATED CONDITIONS:

| | |
|---|---|
| POWER | TAKE-OFF |
| GEAR | DOWN |
| FLAPS | 0% |
| INOPERATIVE PROPELLER | FEATHERED |

| WEIGHT LBS | SPEED ~ KTS |
|---|---|
| 10,950 | 110 |
| 10,000 | 105 |
| 9000 | 99 |
| 8000 | 94 |

EXAMPLE:

| | |
|---|---|
| PRESSURE ALTITUDE | 3966 FT |
| OAT | 25°C |
| TAKE-OFF WEIGHT | 10,950 LBS |



# TAKE-OFF WEIGHT – FLAPS 32.5%

## TO ACHIEVE POSITIVE ONE-ENGINE-INOPERATIVE CLIMB AT LIFT-OFF

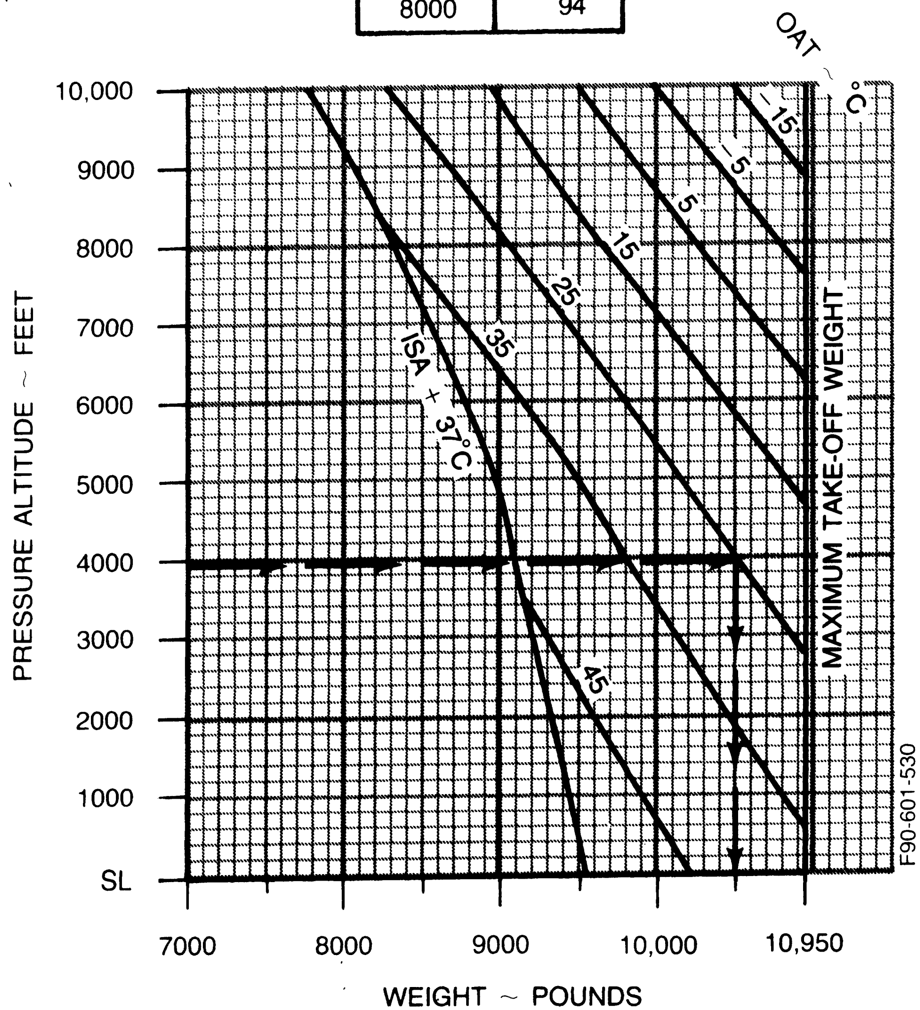
ASSOCIATED CONDITIONS:

| | |
|---|---|
| POWER | TAKE-OFF |
| GEAR | DOWN |
| FLAPS | 32.5% |
| INOPERATIVE PROPELLER | FEATHERED |

| WEIGHT LBS | SPEED KTS |
|---|---|
| 10,950 | 103 |
| 10,000 | 99 |
| 9000 | 94 |
| 8000 | 94 |

EXAMPLE:

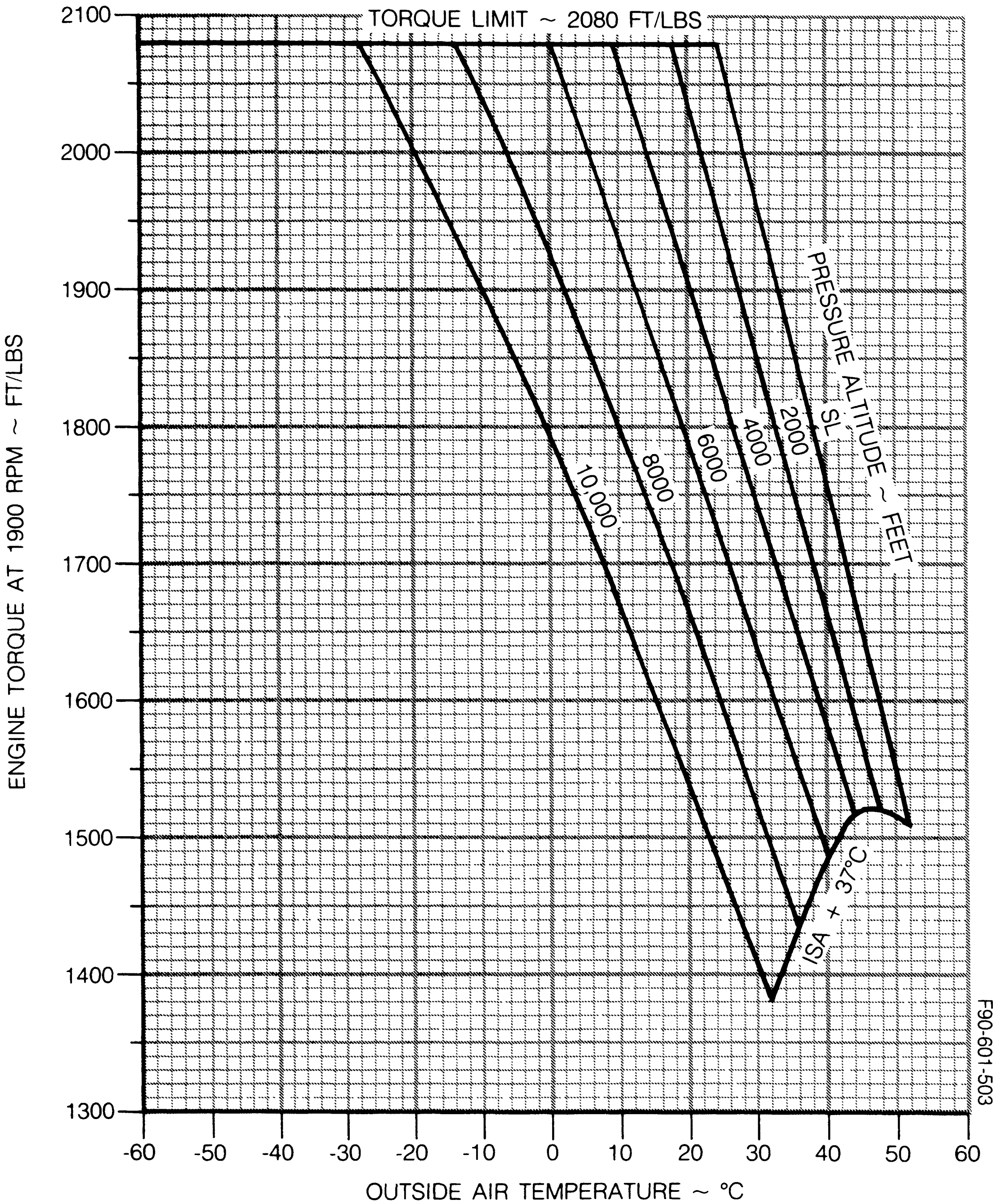
| | |
|---|---|
| PRESSURE ALTITUDE | 3966 FT |
| OAT | 25°C |
| TAKE-OFF WEIGHT | 10,500 LBS |



# MINIMUM TAKE-OFF POWER AT 1900 RPM

## (65 KNOTS)

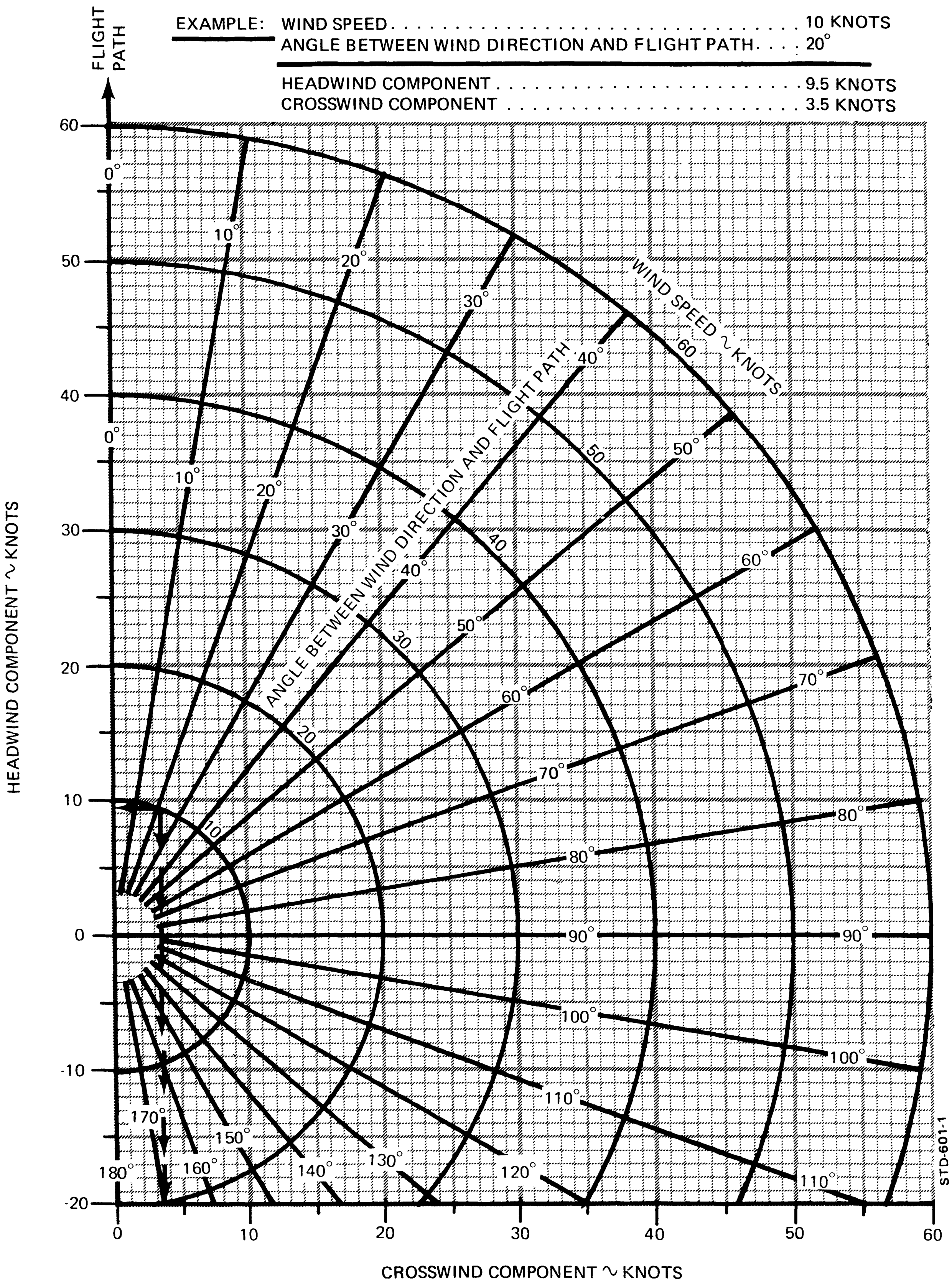
NOTES:
1. TORQUE INCREASES APPROXIMATELY 20 LBS FROM ZERO TO 65 KNOTS.
2. THE POWER (TORQUE) INDICATED IS THE MINIMUM VALUE FOR WHICH TAKE-OFF PERFORMANCE IN THIS SECTION CAN BE OBTAINED. EXCESS POWER WHICH CAN BE DEVELOPED WITHOUT EXCEEDING LIMITATIONS MAY BE UTILIZED.



# WIND COMPONENTS

EXAMPLE: WIND SPEED . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 10 KNOTS
ANGLE BETWEEN WIND DIRECTION AND FLIGHT PATH . . . . 20°

HEADWIND COMPONENT . . . . . . . . . . . . . . . . . . . . . . . . 9.5 KNOTS
CROSSWIND COMPONENT . . . . . . . . . . . . . . . . . . . . . . . 3.5 KNOTS



# TAKE-OFF DISTANCE – FLAPS 0%

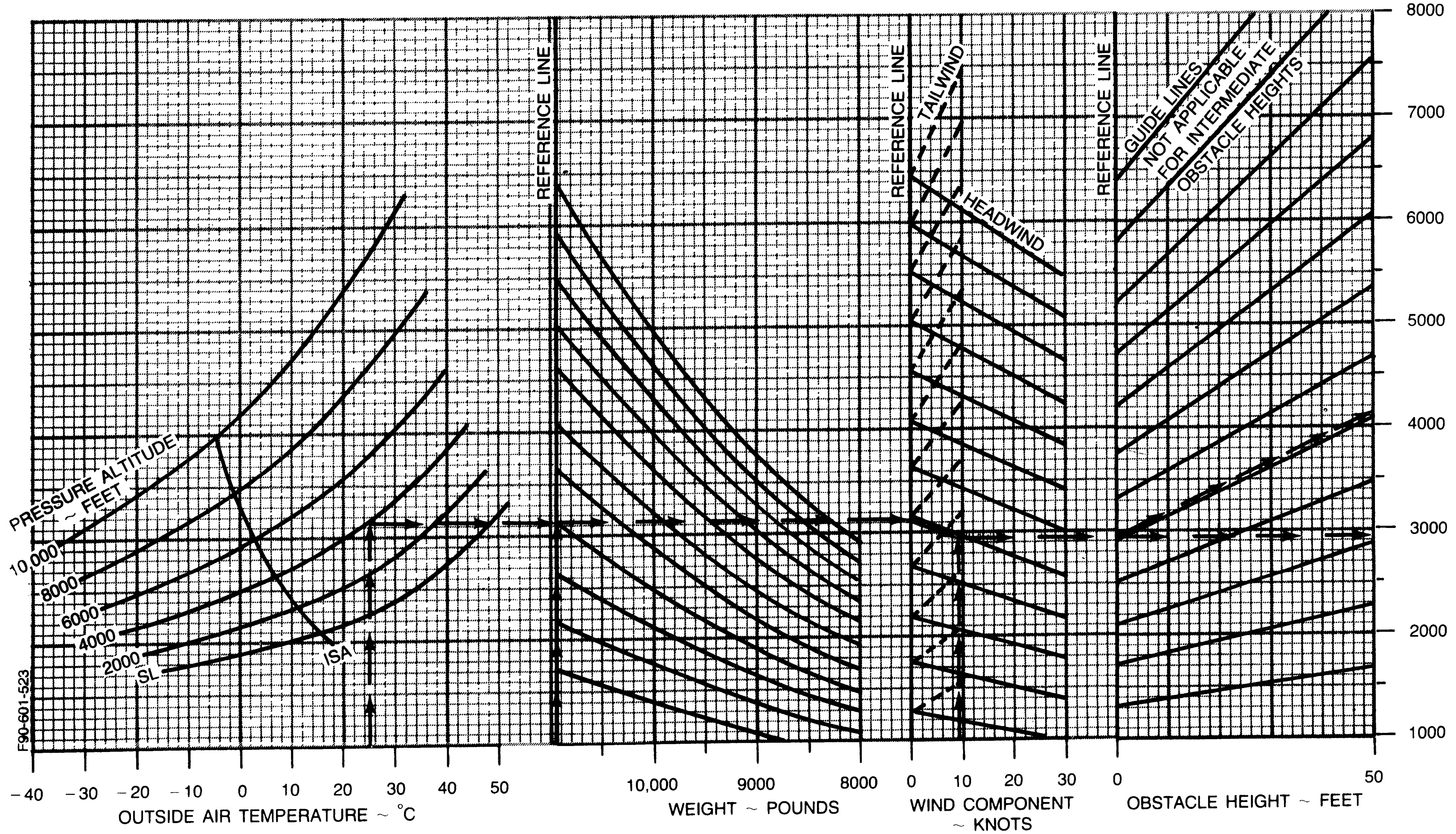
ASSOCIATED CONDITIONS:

| | |
|---|---|
| POWER | TAKE-OFF POWER SET BEFORE BRAKE RELEASE |
| FLAPS | 0% |
| LANDING GEAR | RETRACT AFTER LIFT-OFF |
| RUNWAY | PAVED, LEVEL, DRY SURFACE |

| WEIGHT POUNDS | TAKE-OFF SPEED KNOTS | |
|---|---|---|
| | ROTATION | 50 FT |
| 10,950 | 107 | 117 |
| 10,000 | 102 | 112 |
| 9000 | 96 | 106 |
| 8000 | 91 | 100 |

EXAMPLE:

| | |
|---|---|
| OAT | 25°C |
| PRESSURE ALTITUDE | 3966 FT |
| TAKE-OFF WEIGHT | 10,950 LBS |
| HEADWIND COMPONENT | 9.5 KTS |
| GROUND ROLL | 2930 FT |
| TOTAL DISTANCE OVER 50-FT OBSTACLE | 4120 FT |
| TAKE-OFF SPEED | |
| AT ROTATION | 107 KTS |
| AT 50 FEET | 117 KTS |



# ACCELERATE – STOP – FLAPS 0%

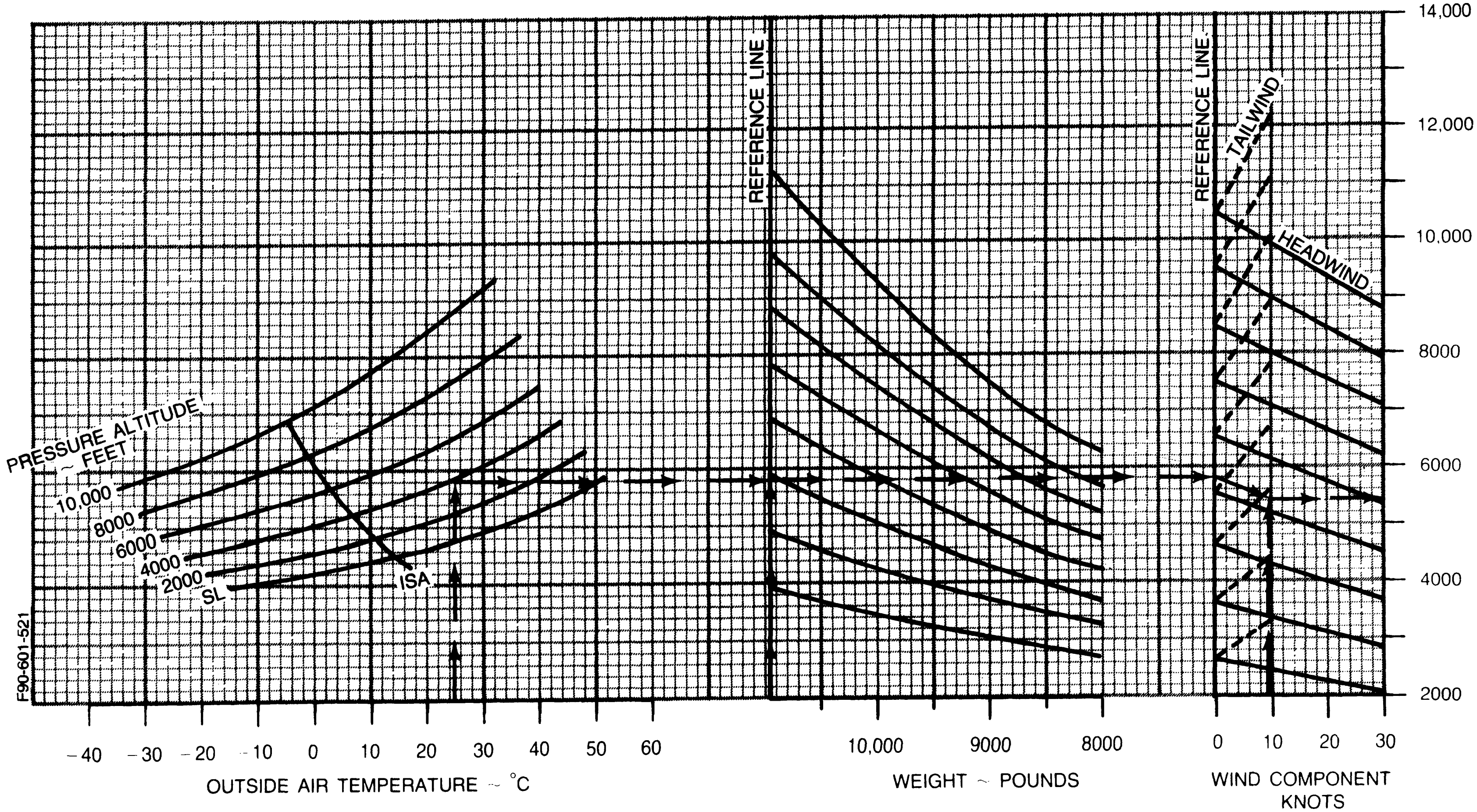
ASSOCIATED CONDITIONS:

| | |
|---|---|
| POWER | 1. TAKE-OFF POWER SET BEFORE BRAKE RELEASE<br>2. BOTH ENGINES IDLE AT $V_1$ SPEED AND REVERSE OPERATING ENGINE |
| FLAPS | 0% |
| AUTOFEATHER | ARMED |
| BRAKING | MAXIMUM |
| RUNWAY | PAVED, LEVEL, DRY SURFACE |

| WEIGHT POUNDS | $V_1$ ~ KNOTS |
|---|---|
| 10,950 | 107 |
| 10,000 | 102 |
| 9000 | 96 |
| 8000 | 91 |

EXAMPLE:

| | |
|---|---|
| OAT | 25°C |
| PRESSURE ALTITUDE | 3966 FT |
| WEIGHT | 10,950 LBS |
| HEADWIND COMPONENT | 9.5 KTS |
| FIELD LENGTH | 5420 FT |
| $V_1$ SPEED | 107 KTS |



# ACCELERATE - GO DISTANCE OVER 35-FT OBSTACLE

## FLAPS 0%

ASSOCIATED CONDITIONS:

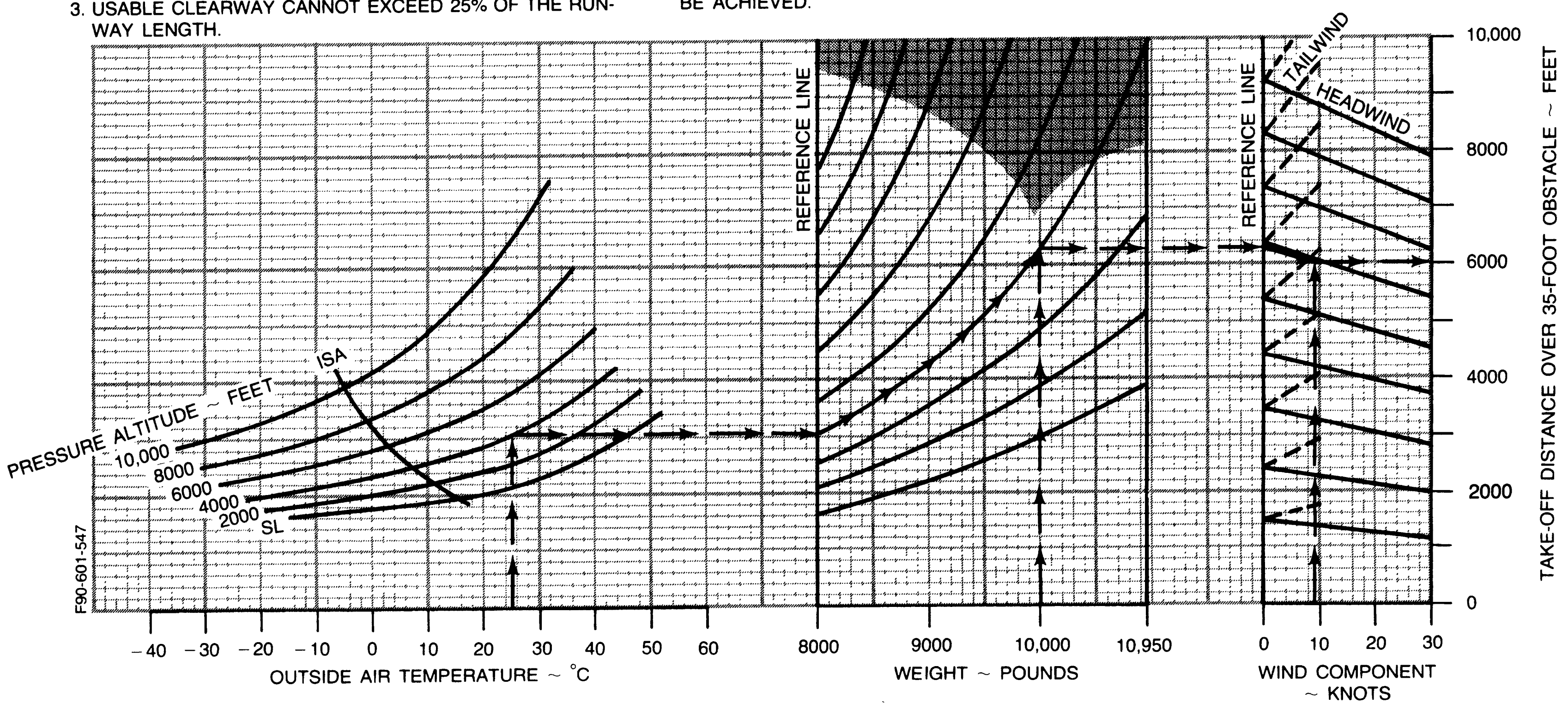
| | |
|---|---|
| POWER | TAKE-OFF POWER SET BEFORE BRAKE RELEASE |
| FLAPS | 0% |
| AUTOFEATHER | ARMED |
| LANDING GEAR | RETRACT AFTER LIFT-OFF |
| RUNWAY | PAVED, LEVEL, DRY SURFACE |

| WEIGHT ~ LBS | SPEED ~ KNOTS | |
|---|---|---|
| | $V_R$ | $V_2$ |
| 10,950 | 107 | 117 |
| 10,000 | 102 | 112 |
| 9000 | 96 | 106 |
| 8000 | 91 | 100 |

EXAMPLE:

| | |
|---|---|
| OAT | 25°C |
| PRESSURE ALTITUDE | 3966 FT |
| TAKE-OFF WEIGHT | 10,000 LBS |
| HEADWIND COMPONENT | 9.5 KTS |
| TAKE-OFF DISTANCE OVER 35-FOOT OBSTACLE | 6000 FT |
| SPEEDS: AT ROTATION | 102 KTS |
| AT 35 FEET | 112 KTS |

NOTES:
1. AIR DISTANCE IS 50% OF TAKE-OFF DISTANCE OVER 35-FT OBSTACLE.
2. DISTANCES ASSUME AN ENGINE FAILURE AT ROTATION SPEED AND PROPELLER IMMEDIATELY FEATHERED.
3. USABLE CLEARWAY CANNOT EXCEED 25% OF THE RUNWAY LENGTH.
4. WEIGHTS IN SHADED AREA MAY NOT PROVIDE POSITIVE ONE-ENGINE-INOPERATIVE CLIMB. REFER TO TAKE-OFF WEIGHT GRAPH FOR MAXIMUM WEIGHT AT WHICH POSITIVE ONE-ENGINE-INOPERATIVE CLIMB AT LIFT-OFF CAN BE ACHIEVED.



# TAKE-OFF CLIMB GRADIENT – ONE-ENGINE-INOPERATIVE
## FLAPS 0%
### ZERO WIND

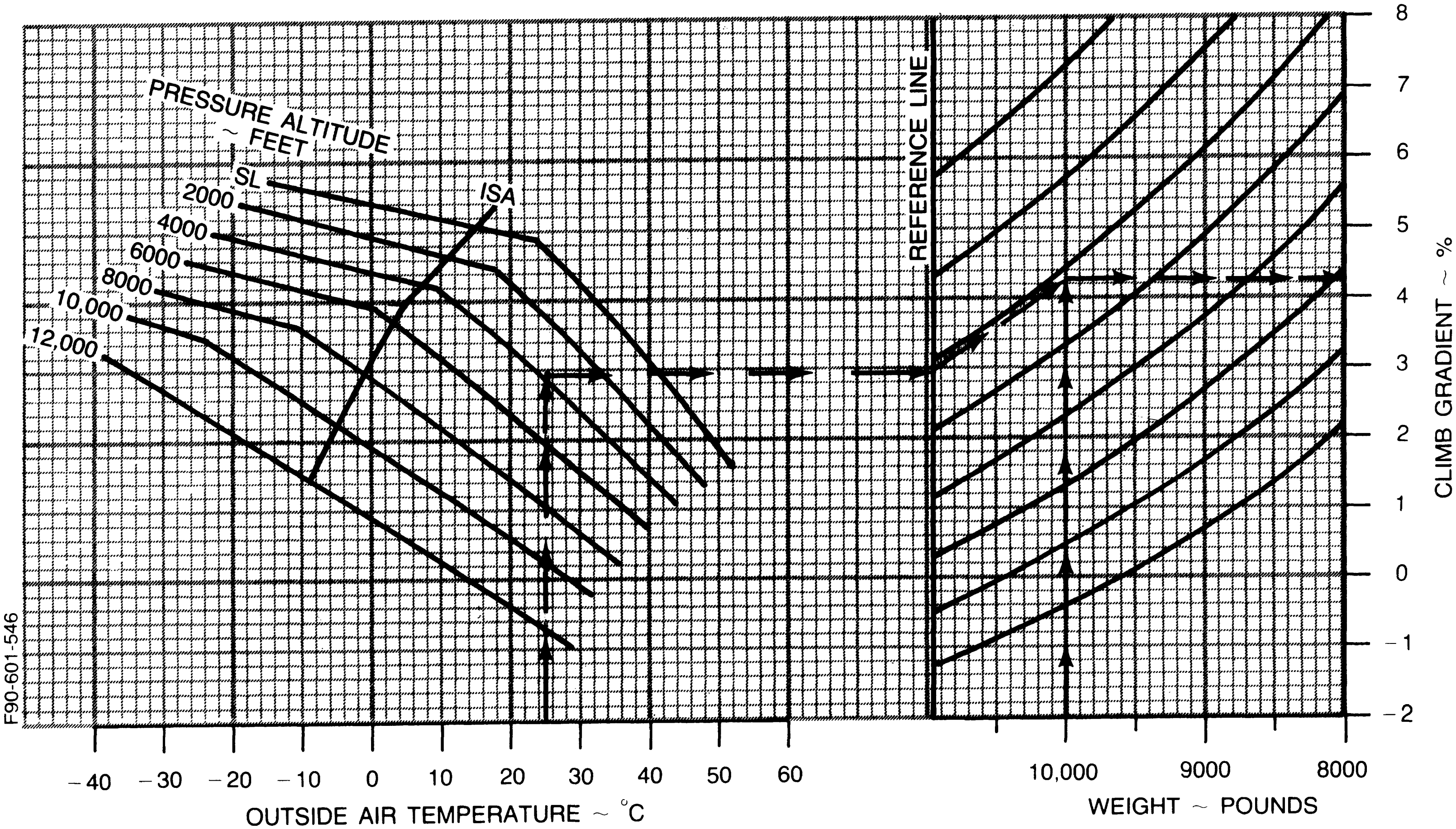
ASSOCIATED CONDITIONS:

| | |
|---|---|
| POWER | TAKE-OFF |
| FLAPS | 0% |
| LANDING GEAR | UP |
| INOPERATIVE PROPELLER | FEATHERED |

| WEIGHT LBS | CLIMB SPEED KNOTS |
|---|---|
| 10,950 | 117 |
| 10,000 | 112 |
| 9000 | 106 |
| 8000 | 100 |

EXAMPLE:

| | |
|---|---|
| OAT | 25°C |
| PRESSURE ALTITUDE | 3966 FT |
| WEIGHT | 10,000 LBS |
| CLIMB GRADIENT | 4.2% |
| SPEED | 112 KTS |



# TAKE-OFF DISTANCE – FLAPS 32.5%

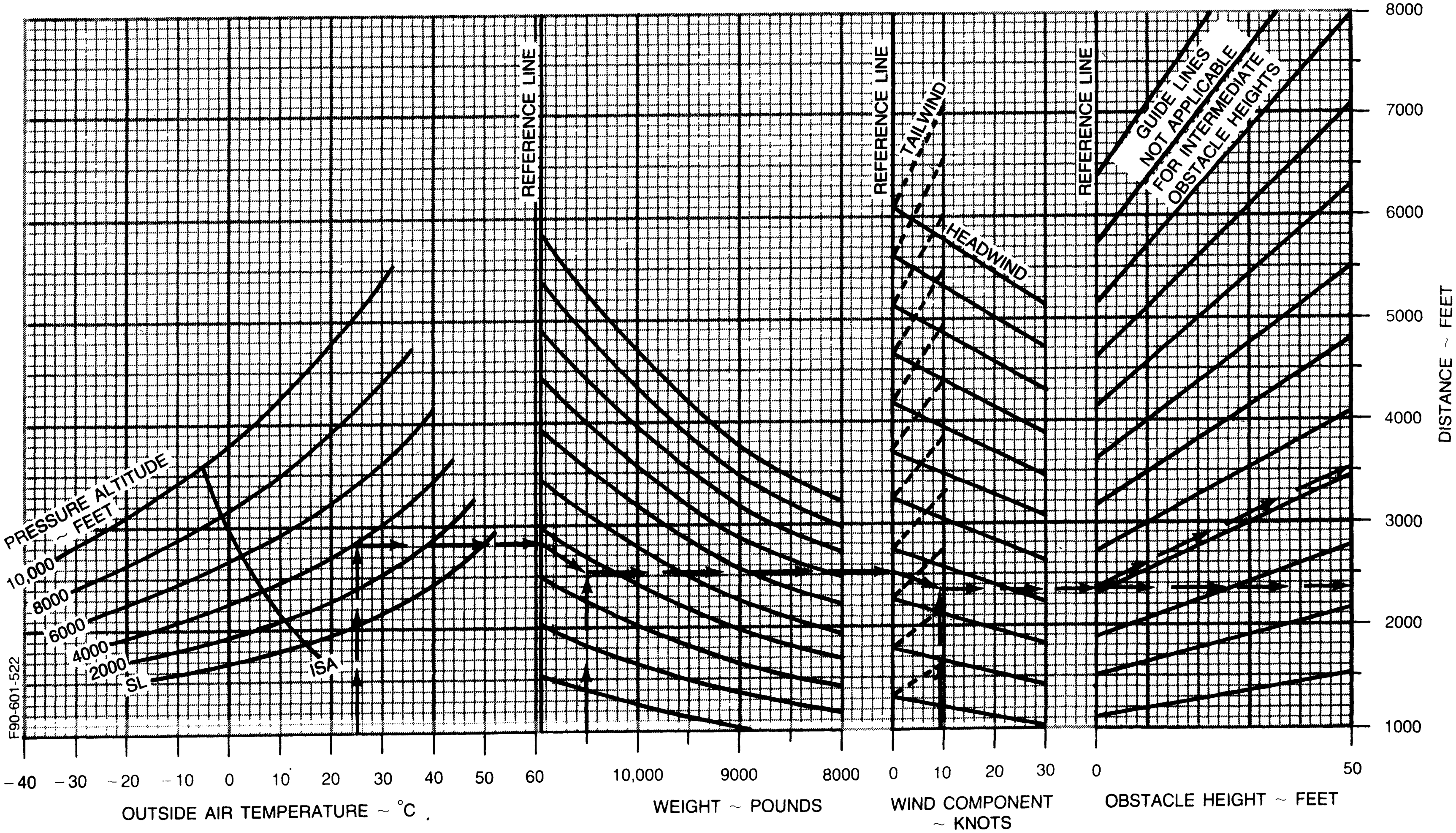
ASSOCIATED CONDITIONS:

| | |
|---|---|
| POWER | TAKE-OFF POWER SET BEFORE BRAKE RELEASE |
| FLAPS | 32.5% |
| LANDING GEAR | RETRACT AFTER LIFT-OFF |
| RUNWAY | PAVED, LEVEL, DRY SURFACE |

| WEIGHT POUNDS | TAKE-OFF SPEED KNOTS | |
|---|---|---|
| | ROTATION | 50 FT |
| 10,950 | 100 | 109 |
| 10,000 | 95 | 105 |
| 9000 | 91 | 100 |
| 8000 | 91 | 100 |

EXAMPLE.

| | |
|---|---|
| OAT | 25°C |
| PRESSURE ALTITUDE | 3966 FT |
| TAKE-OFF WEIGHT | 10,500 LBS |
| HEADWIND COMPONENT | 9.5 KTS |
| GROUND ROLL | 2360 FT |
| TOTAL DISTANCE OVER 50-FT OBSTACLE | 3520 FT |
| TAKE-OFF SPEED | |
| AT ROTATION | 98 KTS |
| AT 50 FEET | 107 KTS |



# ACCELERATE – STOP – FLAPS 32.5%

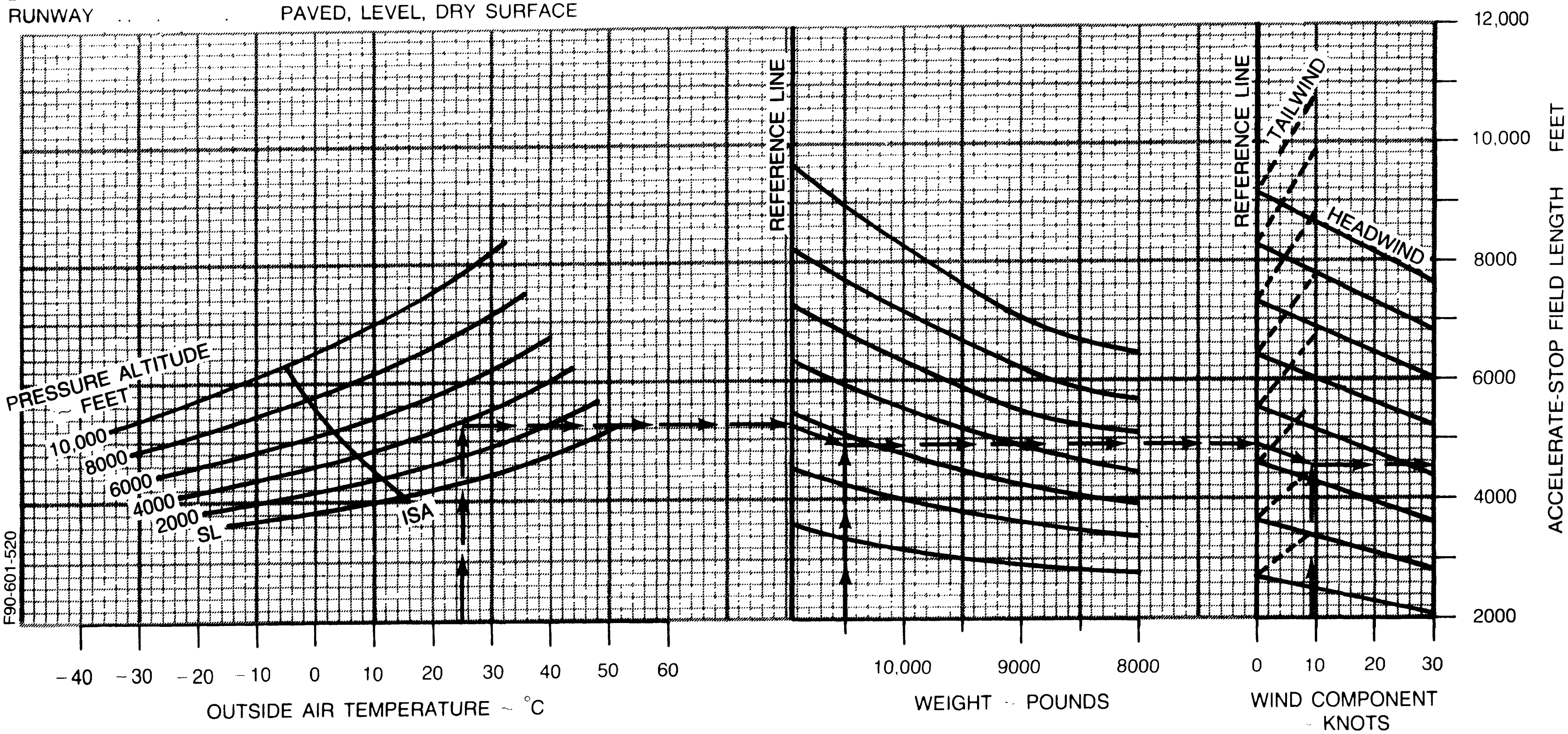
ASSOCIATED CONDITIONS

| | |
|---|---|
| POWER | 1 TAKE-OFF POWER SET BEFORE BRAKE RELEASE<br>2 BOTH ENGINES IDLE AT $V_1$ SPEED AND REVERSE OPERATING ENGINE |
| FLAPS | 32.5% |
| AUTOFEATHER | ARMED |
| BRAKING | MAXIMUM |
| RUNWAY | PAVED, LEVEL, DRY SURFACE |

| WEIGHT POUNDS | $V_1$ KNOTS |
|---|---|
| 10,950 | 100 |
| 10,000 | 95 |
| 9000 | 91 |
| 8000 | 91 |

EXAMPLE.

| | |
|---|---|
| OAT | 25°C |
| PRESSURE ALTITUDE | 3966 FT |
| WEIGHT | 10 500 LBS |
| HEADWIND COMPONENT | 9.5 KTS |
| FIELD LENGTH | 4550 FT |
| $V_1$ SPEED | 98 KTS |



# ACCELERATE-GO DISTANCE OVER 35-FT OBSTACLE

## FLAPS 32.5%

ASSOCIATED CONDITIONS:

POWER . . . . . TAKE-OFF POWER SET BEFORE BRAKE RELEASE
FLAPS . . . . . . . . . . . . 32.5%
AUTOFEATHER . . . . . ARMED
LANDING GEAR . . . . . RETRACT AFTER LIFT-OFF
RUNWAY . . . . . . PAVED, LEVEL, DRY SURFACE

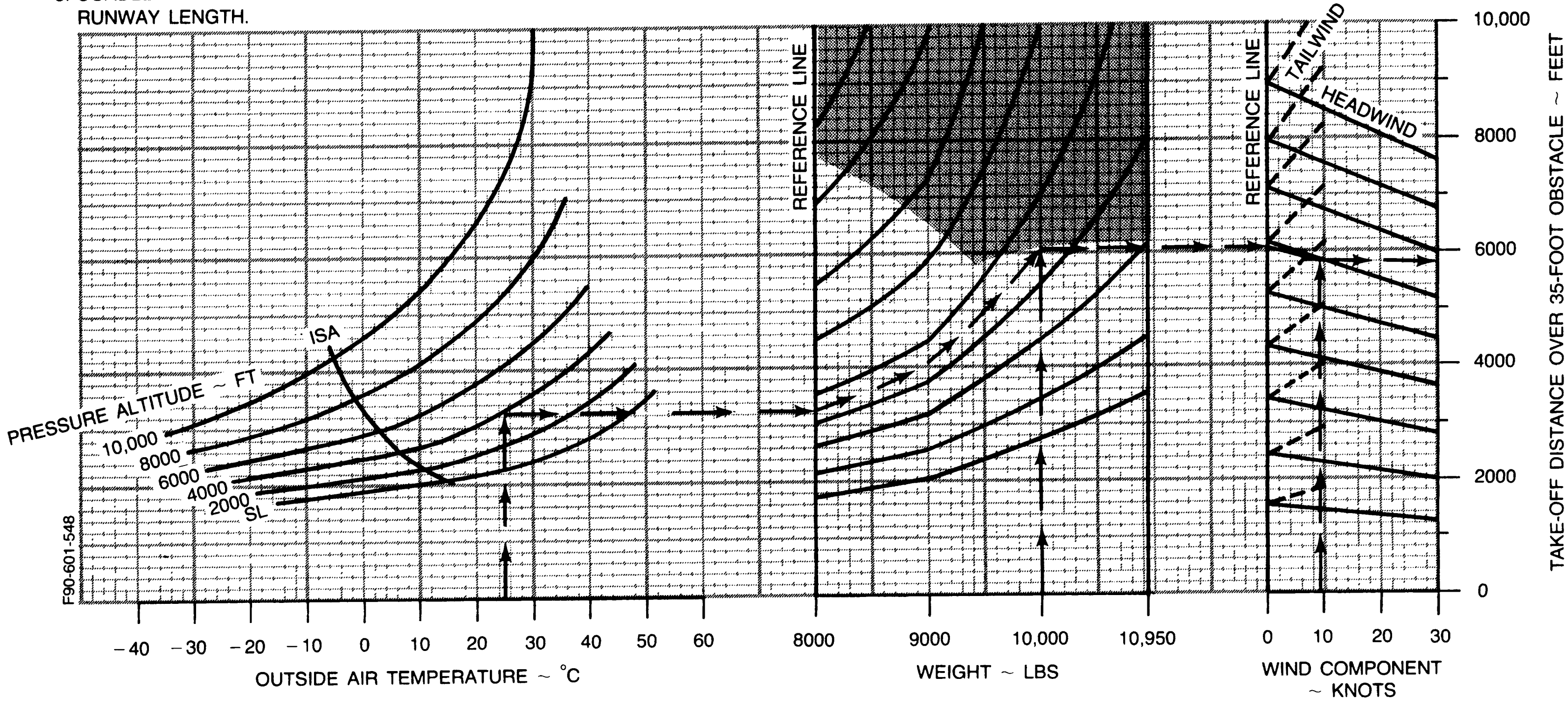
| WEIGHT ~ LBS | SPEED ~ KNOTS | |
|---|---|---|
| | $V_R$ | $V_2$ |
| 10,950 | 100 | 109 |
| 10,000 | 95 | 105 |
| 9000 | 91 | 100 |
| 8000 | 91 | 100 |

EXAMPLE:

OAT . . . . . . . . . . . . . . 25°C
PRESSURE ALTITUDE . . . 3966 FT
TAKE-OFF WEIGHT . . . . . . 10,000 LBS
HEADWIND COMPONENT . . . . 9.5 KTS

TAKE-OFF DISTANCE OVER 35-FOOT OBSTACLE . . 5780 FT
SPEEDS: AT ROTATION . . 95 KTS
AT 35 FEET . . 105 KTS

NOTES:
1. AIR DISTANCE IS 50% OF TAKE-OFF DISTANCE OVER 35-FT OBSTACLE.
2. DISTANCES ASSUME AN ENGINE FAILURE AT ROTATION SPEED AND PROPELLER IMMEDIATELY FEATHERED.
3. USABLE CLEARWAY CANNOT EXCEED 25% OF THE RUNWAY LENGTH.
4. WEIGHTS IN SHADED AREA MAY NOT PROVIDE POSITIVE ONE-ENGINE-INOPERATIVE CLIMB. REFER TO TAKE-OFF WEIGHT GRAPH FOR MAXIMUM WEIGHT AT WHICH POSITIVE ONE-ENGINE-INOPERATIVE CLIMB AT LIFT-OFF CAN BE ACHIEVED.



# TAKE-OFF CLIMB GRADIENT – ONE-ENGINE-INOPERATIVE FLAPS 32.5%

## ZERO WIND

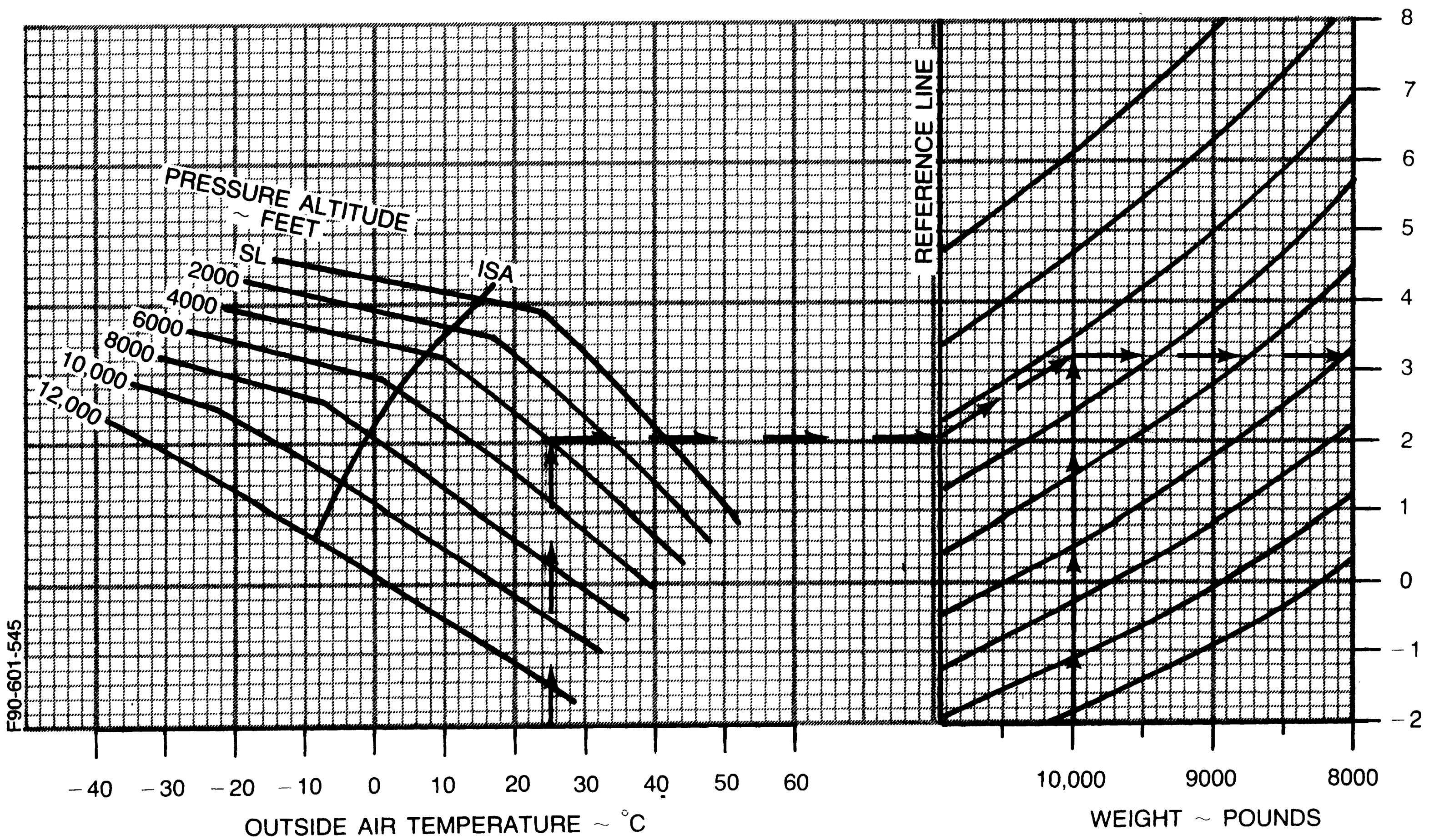
ASSOCIATED CONDITIONS:

| | |
|---|---|
| POWER | TAKE-OFF |
| FLAPS | 32.5% |
| LANDING GEAR | UP |
| INOPERATIVE PROPELLER | FEATHERED |

| WEIGHT LBS | CLIMB SPEED KNOTS |
|---|---|
| 10,950 | 109 |
| 10,000 | 105 |
| 9000 | 100 |
| 8000 | 100 |

EXAMPLE:

| | |
|---|---|
| OAT | 25°C |
| PRESSURE ALTITUDE | 3966 FT |
| WEIGHT | 10,000 LBS |
| CLIMB GRADIENT | 3.2% |
| SPEED | 105 KTS |



# MAXIMUM PERFORMANCE CLIMB - TWO ENGINES - FLAPS 0%

## CLIMB SPEED 117 KNOTS IAS

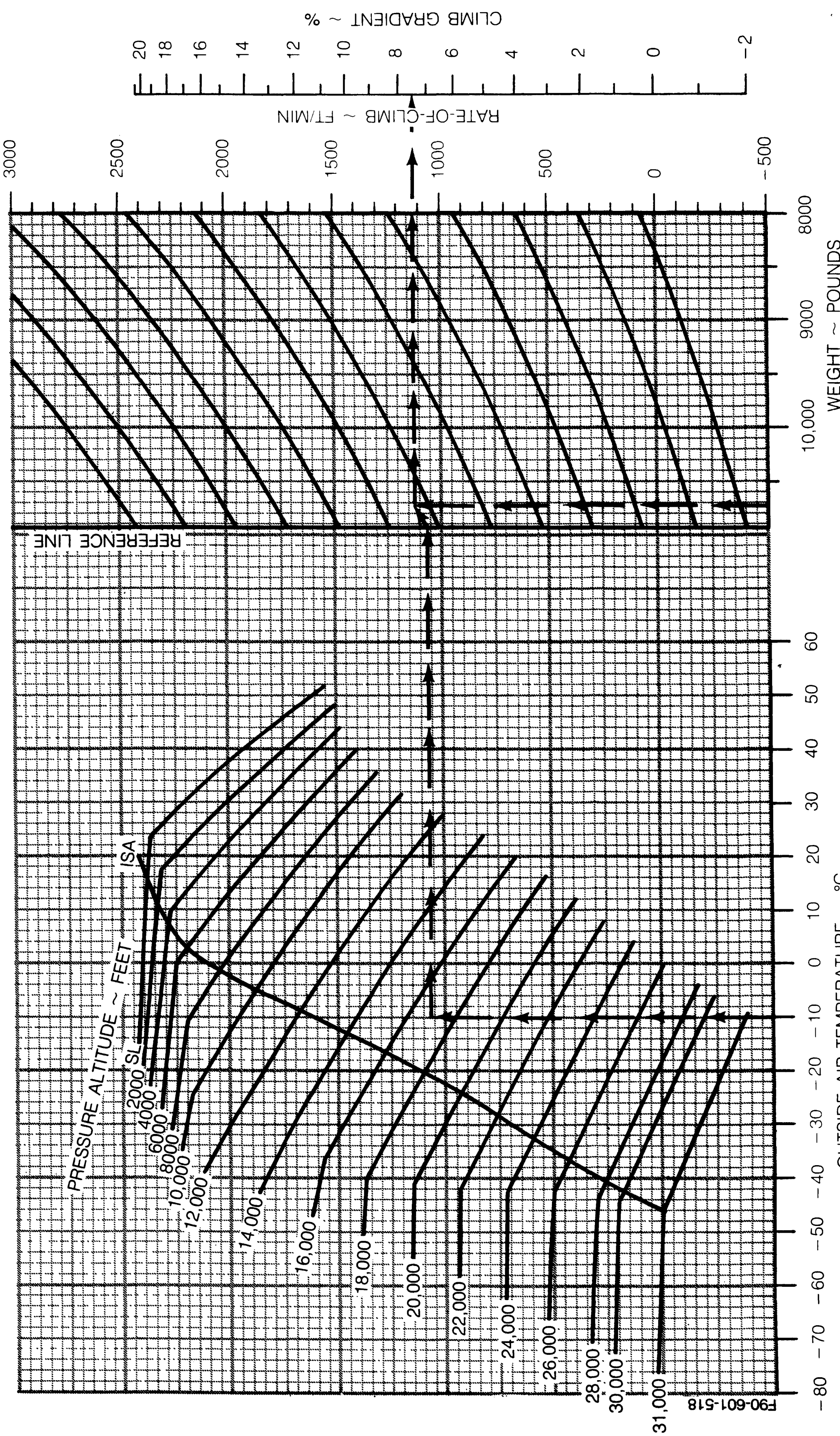
ASSOCIATED CONDITIONS:

POWER . . . . . . . . . . . . MAXIMUM CONTINUOUS
FLAPS . . . . . . . . . . . . 0%
LANDING GEAR . . . . . . . UP

EXAMPLE:

OAT . . . . . . . . . . . . . . −10°C
PRESSURE ALTITUDE . . . . 17,000 FT
WEIGHT . . . . . . . . . . . . 10,718 LBS

RATE-OF-CLIMB . . . . . . . 1130 FT/MIN
CLIMB GRADIENT . . . . . . . 7.7%



# MAXIMUM PERFORMANCE CLIMB – TWO ENGINES – FLAPS 32.5%

**CLIMB SPEED 117 KNOTS IAS**

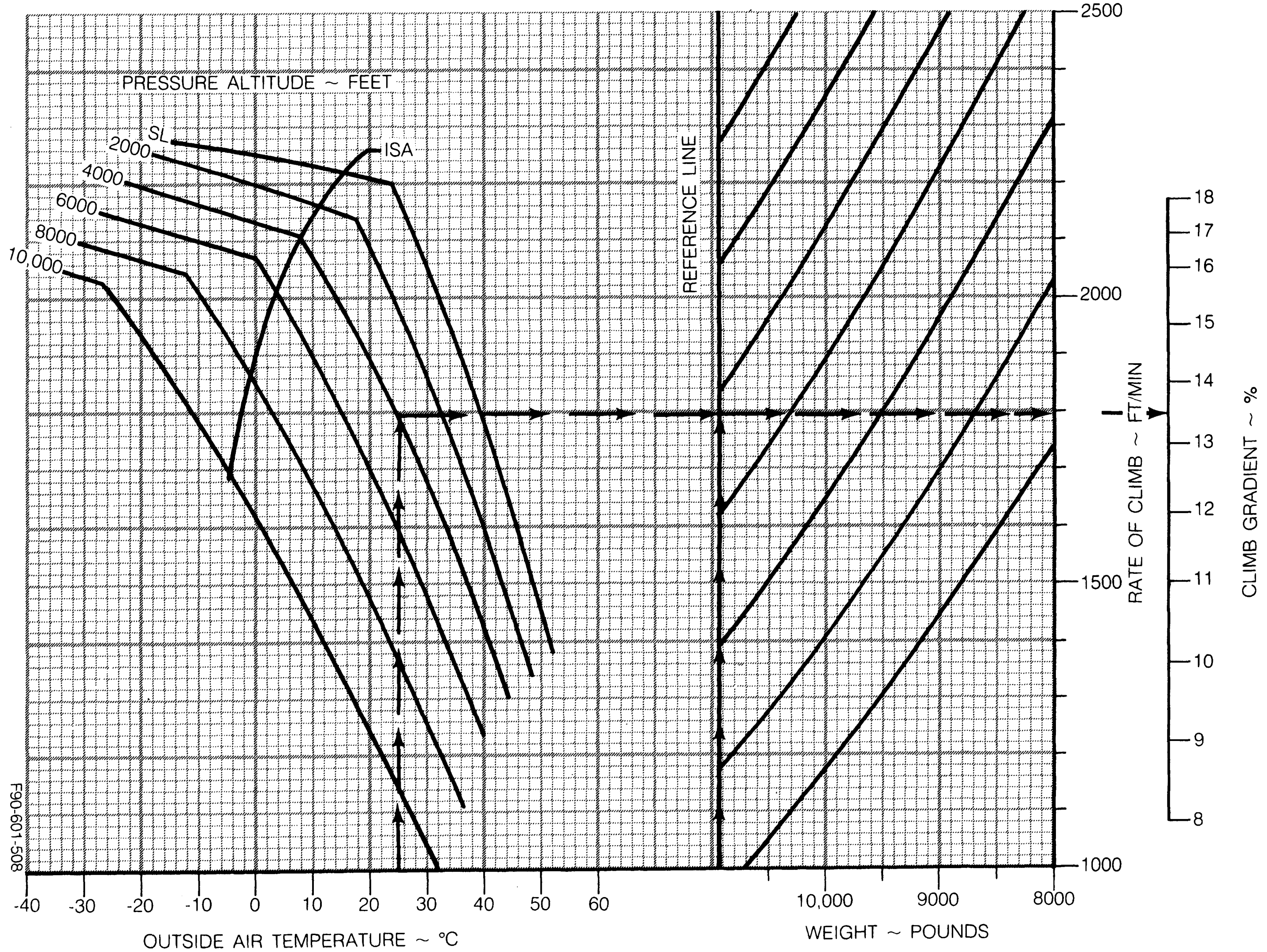
ASSOCIATED CONDITIONS:

POWER .................. MAXIMUM CONTINUOUS
FLAPS .................. 32.5%
LANDING GEAR ........... UP

EXAMPLE:

OAT .................................. 25°C
PRESSURE ALTITUDE .................... 3966 FT
WEIGHT ............................... 10,950 LBS

RATE OF CLIMB ........................ 1795 FT/MIN
CLIMB GRADIENT ....................... 13.5%



# SERVICE CEILING – ONE ENGINE INOPERATIVE

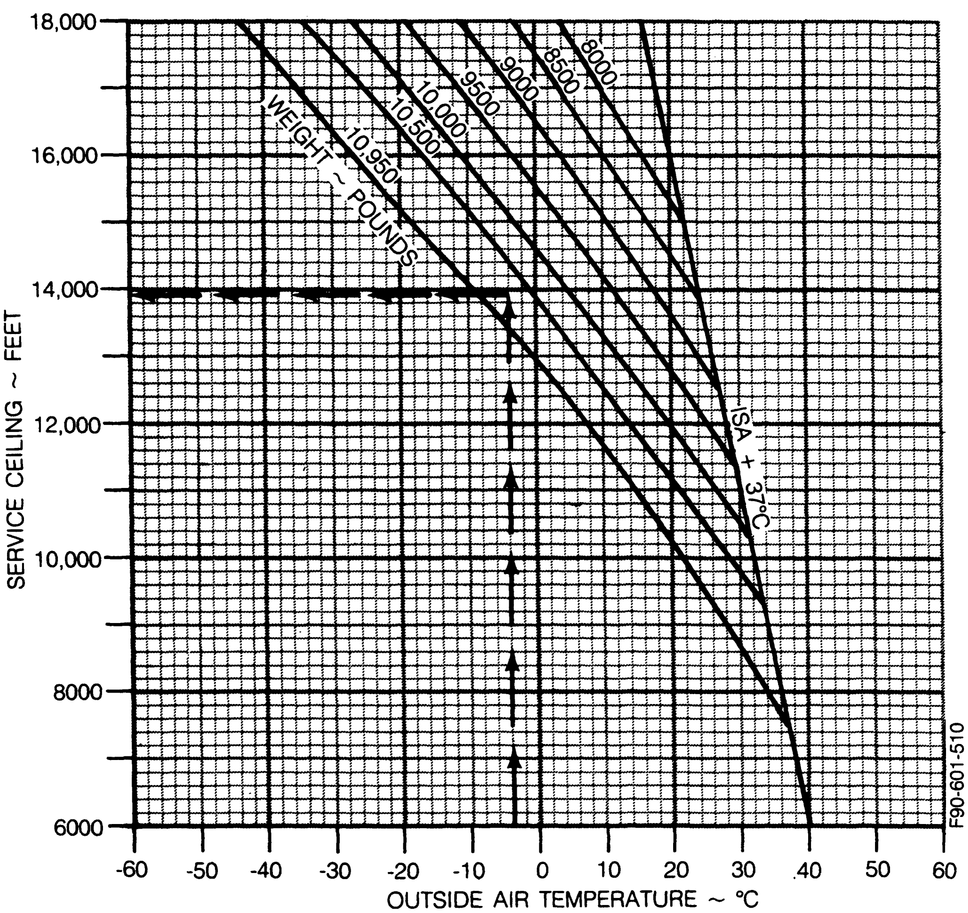
ASSOCIATED CONDITIONS:

| | |
|---|---|
| POWER | MAXIMUM CONTINUOUS |
| LANDING GEAR | UP |
| INOPERATIVE PROPELLER | FEATHERED |
| FLAPS | 0% |

NOTE: SERVICE CEILING IS THE PRESSURE ALTITUDE WHERE THE AIRPLANE HAS CAPABILITY OF CLIMBING 50 FT PER MINUTE WITH ONE PROPELLER FEATHERED.

EXAMPLE:

| | |
|---|---|
| OAT AT MEA | -4°C |
| WEIGHT | 10,718 LBS |
| ROUTE SEGMENT MEA | 9000 FT |
| SERVICE CEILING | 13,950 FT |



# MAXIMUM PERFORMANCE CLIMB - ONE-ENGINE INOPERATIVE

## CLIMB SPEED 117 KNOTS IAS

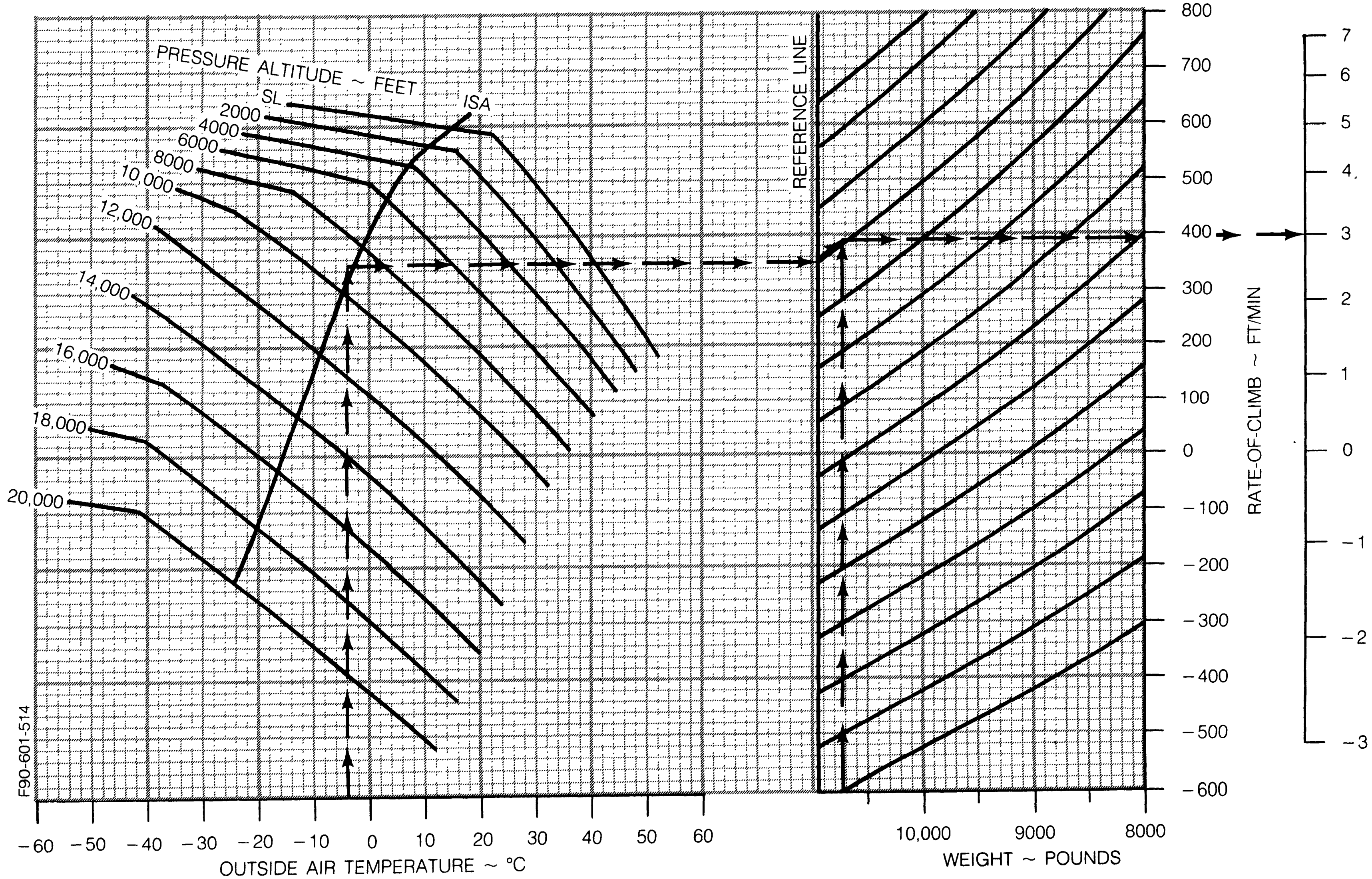
ASSOCIATED CONDITIONS:

POWER .................... MAXIMUM CONTINUOUS
FLAPS...................... 0%
LANDING GEAR............. UP
INOPERATIVE PROPELLER ... FEATHERED

EXAMPLE:

OAT............................ -4°C
PRESSURE ALTITUDE............ 9000 FEET
WEIGHT ....................... 10,718 LBS

RATE-OF-CLIMB ................ 390 FT/MIN
CLIMB GRADIENT ............... 3.0 %



# BALKED LANDING CLIMB

## CLIMB SPEED 108 KNOTS (ALL WEIGHTS)

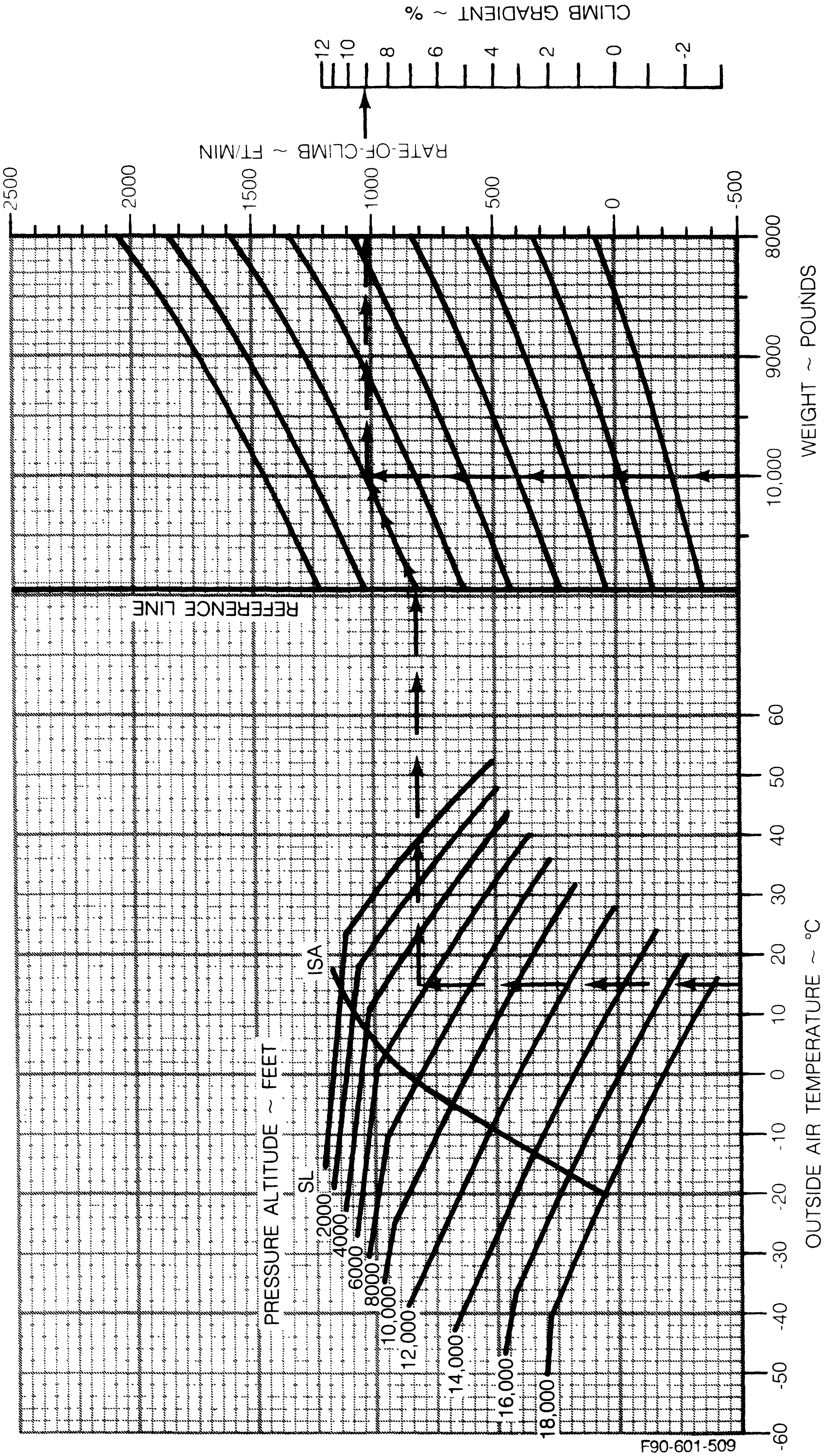
ASSOCIATED CONDITIONS:

POWER TAKE-OFF
FLAPS 100%
LANDING GEAR DOWN

EXAMPLE:

OAT . . . . . . . . . . . . . . . . . . 15°C
PRESSURE ALTITUDE . 5651 FT
WEIGHT 10,015 LBS

RATE-OF-CLIMB 1014 FT/MIN
CLIMB GRADIENT . . . 9.1%



# TIME, FUEL, AND DISTANCE TO CRUISE CLIMB

ASSOCIATED CONDITIONS:

PROPELLER SPEED ......... 1900 RPM
DO NOT EXCEED:
ITT ........................ 805°C
TORQUE ................. 1940 FT-LBS
$N_1$.... SEE ENGINE LIMITATIONS, SECTION II

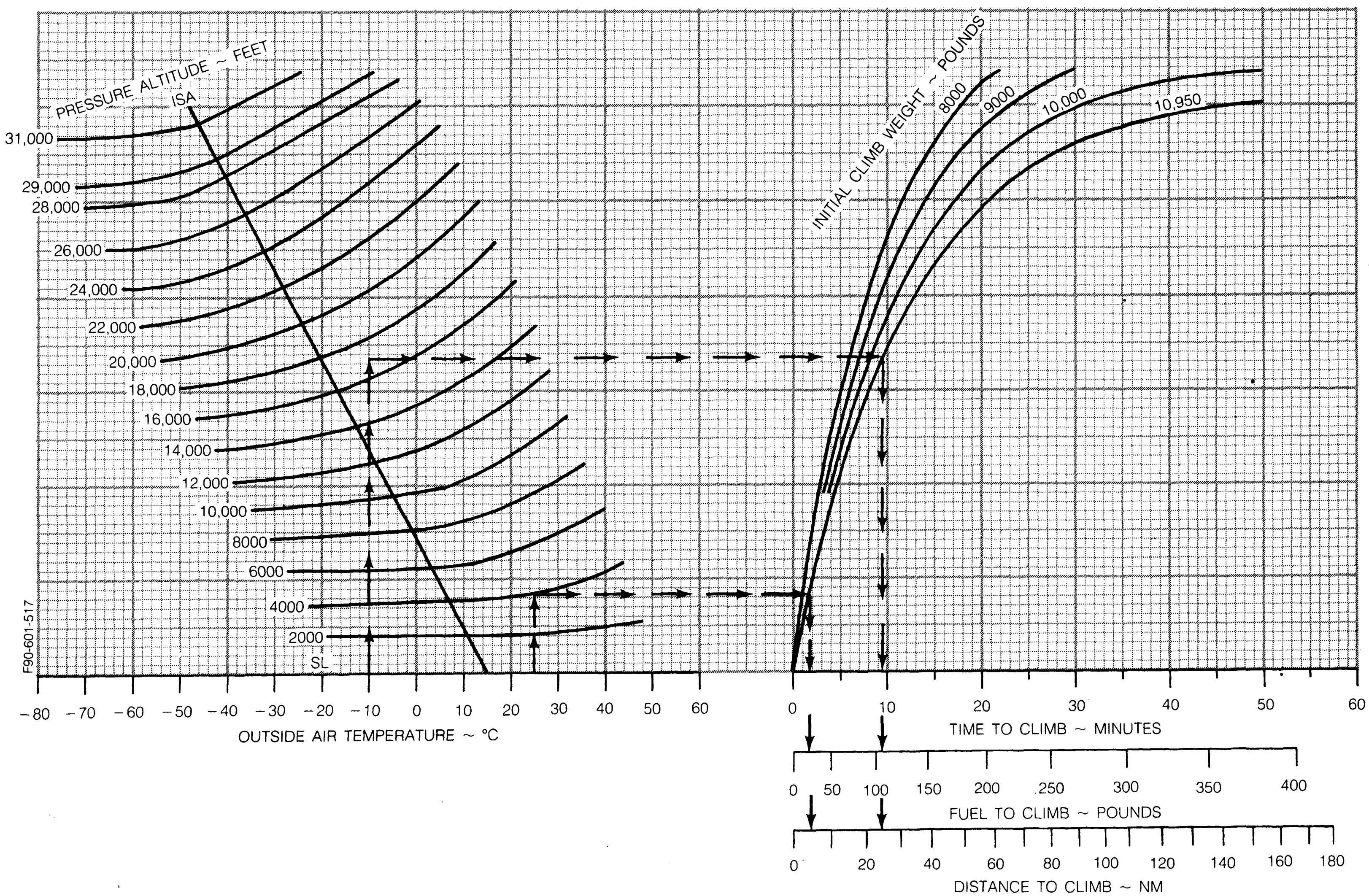
| ALTITUDE ~ FEET | CLIMB SPEED ~ KNOTS |
|---|---|
| SL TO 15,000 | 140 |
| 15,000 TO 25,000 | 130 |
| 25,000 TO 31,000 | 120 |

NOTE: ADD 80 LBS FUEL FOR GROUND OPERATIONS

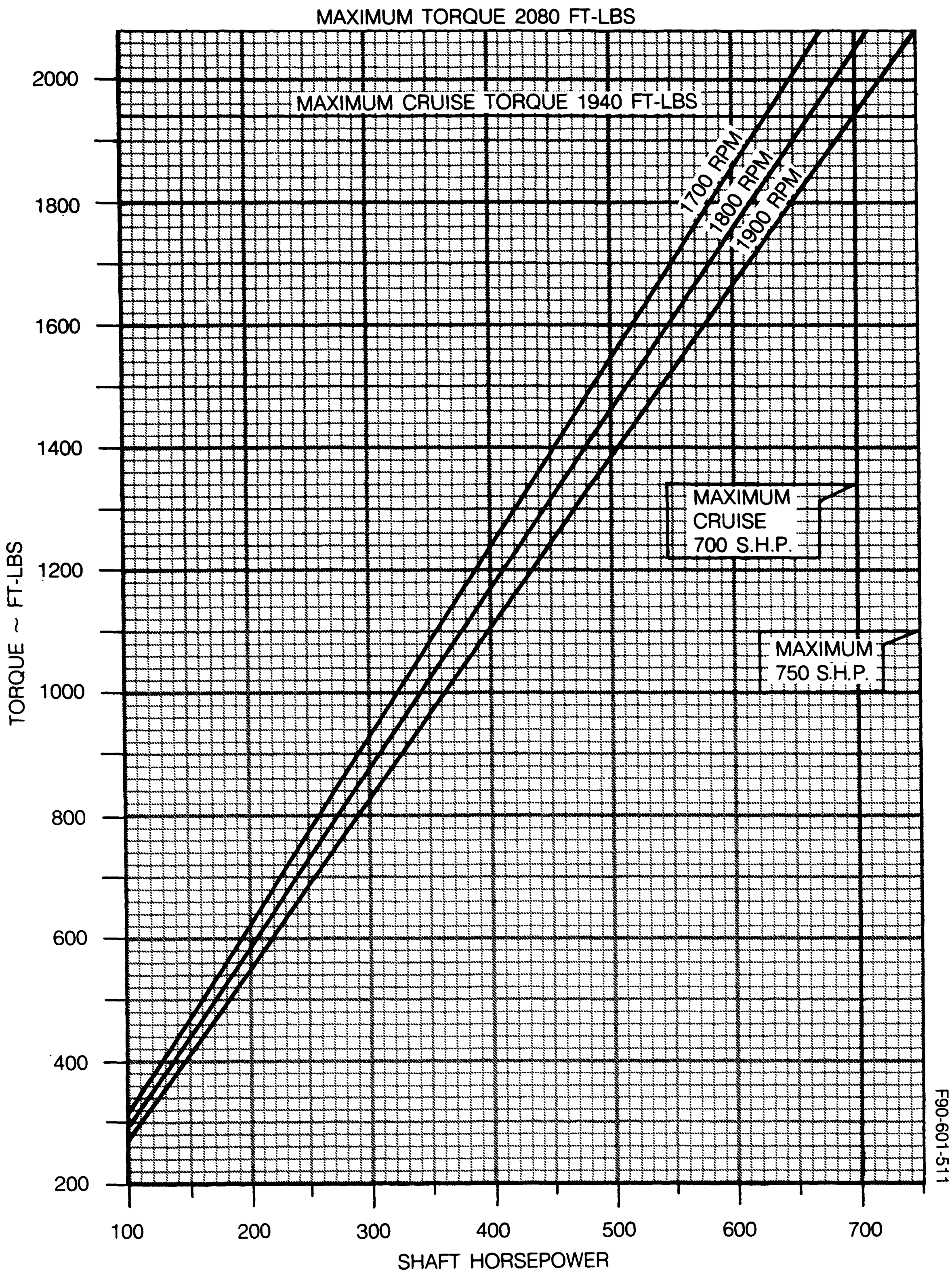
EXAMPLE:

OAT AT TAKEOFF ...................... 25°C
OAT AT CRUISE ....................... −10°C
AIRPORT PRESSURE ALTITUDE .......... 3966 FT
CRUISE ALTITUDE ..................... 17,000 FT
INITIAL CLIMB WEIGHT ................ 10,950 LBS

TIME TO CLIMB ....................... 9.5 − 2 = 7.5 MIN
FUEL TO CLIMB ....................... 107 − 25 = 82 LBS
DISTANCE TO CLIMB ................... 25 − 5 = 20 NM



# SHAFT HORSEPOWER FOR VARIOUS ENGINE SPEEDS



# MAXIMUM CRUISE POWER

## 1900 RPM

### ISA −30°C

NOTE: FOR 1800 RPM, INCREASE TORQUE 5%; FOR 1700 RPM, INCREASE TORQUE 10%. DO NOT EXCEED 1940 FT LBS OR 805 °C.

| PRESSURE ALTITUDE FEET | IOAT °C | OAT °C | TORQUE PER ENGINE FT LBS | FUEL FLOW PER ENGINE LBS/HR | TOTAL FUEL FLOW LBS/HR | AIRSPEED KNOTS | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | @ 10500 LBS | | @ 9500 LBS | | @ 8500 LBS | |
| | | | | | | IAS | TAS | IAS | TAS | IAS | TAS |
| SL | −10 | −15 | 1940 | 425 | 850 | 248 | 232 | 249 | 233 | 250 | 234 |
| 2000 | −14 | −19 | 1940 | 416 | 832 | 246 | 236 | 247 | 237 | 248 | 238 |
| 4000 | −18 | −23 | 1940 | 409 | 818 | 244 | 241 | 245 | 242 | 246 | 243 |
| 6000 | −21 | −27 | 1940 | 404 | 808 | 242 | 246 | 243 | 247 | 244 | 248 |
| 8000 | −25 | −31 | 1940 | 399 | 798 | 240 | 251 | 241 | 252 | 242 | 253 |
| 10000 | −29 | −35 | 1940 | 394 | 788 | 238 | 256 | 239 | 258 | 241 | 259 |
| 12000 | −32 | −39 | 1940 | 393 | 786 | 236 | 262 | 237 | 263 | 239 | 264 |
| 14000 | −36 | −43 | 1940 | 393 | 786 | 234 | 267 | 235 | 268 | 236 | 270 |
| 16000 | −40 | −47 | 1837 | 373 | 746 | 227 | 267 | 228 | 268 | 230 | 270 |
| 18000 | −44 | −51 | 1676 | 342 | 684 | 217 | 263 | 218 | 265 | 220 | 267 |
| 20000 | −48 | −55 | 1525 | 312 | 624 | 206 | 258 | 208 | 261 | 210 | 263 |
| 22000 | −53 | −59 | 1391 | 286 | 572 | 196 | 253 | 198 | 257 | 201 | 259 |
| 24000 | −57 | −63 | 1255 | 260 | 520 | 185 | 247 | 188 | 251 | 190 | 254 |
| 26000 | −61 | −67 | 1133 | 236 | 472 | 173 | 239 | 177 | 244 | 180 | 249 |
| 28000 | −65 | −70 | 1025 | 215 | 430 | 161 | 231 | 166 | 238 | 170 | 243 |
| 29000 | −67 | −72 | 970 | 204 | 408 | 155 | 226 | 160 | 233 | 164 | 239 |
| 31000 | −72 | −76 | 861 | 183 | 366 | 139 | 210 | 147 | 222 | 153 | 231 |

# MAXIMUM CRUISE POWER

## 1900 RPM

### ISA −20°C

NOTE: FOR 1800 RPM, INCREASE TORQUE 5%; FOR 1700 RPM, INCREASE TORQUE 10%. DO NOT EXCEED 1940 FT LBS OR 805 °C.

| PRESSURE ALTITUDE FEET | IOAT °C | OAT °C | TORQUE PER ENGINE FT LBS | FUEL FLOW PER ENGINE LBS/HR | TOTAL FUEL FLOW LBS/HR | AIRSPEED KNOTS @ 10500 LBS IAS | @ 10500 LBS TAS | @ 9500 LBS IAS | @ 9500 LBS TAS | @ 8500 LBS IAS | @ 8500 LBS TAS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SL | 0 | −5 | 1940 | 427 | 854 | 246 | 235 | 247 | 236 | 248 | 237 |
| 2000 | −4 | −9 | 1940 | 419 | 838 | 244 | 240 | 245 | 241 | 246 | 241 |
| 4000 | −7 | −13 | 1940 | 412 | 824 | 243 | 245 | 244 | 246 | 245 | 247 |
| 6000 | −11 | −17 | 1940 | 406 | 812 | 240 | 249 | 242 | 251 | 243 | 252 |
| 8000 | −15 | −21 | 1940 | 401 | 802 | 239 | 255 | 240 | 256 | 241 | 257 |
| 10000 | −19 | −25 | 1940 | 397 | 794 | 237 | 260 | 238 | 261 | 239 | 263 |
| 12000 | −22 | −29 | 1940 | 396 | 792 | 234 | 265 | 235 | 267 | 237 | 268 |
| 14000 | −26 | −33 | 1895 | 387 | 774 | 230 | 268 | 231 | 270 | 233 | 271 |
| 16000 | −30 | −37 | 1753 | 358 | 716 | 221 | 266 | 222 | 267 | 224 | 269 |
| 18000 | −34 | −41 | 1633 | 335 | 670 | 212 | 264 | 214 | 266 | 216 | 268 |
| 20000 | −38 | −45 | 1524 | 314 | 628 | 204 | 262 | 206 | 264 | 208 | 266 |
| 22000 | −42 | −49 | 1400 | 290 | 580 | 195 | 258 | 197 | 261 | 199 | 263 |
| 24000 | −46 | −53 | 1274 | 265 | 530 | 184 | 252 | 187 | 256 | 190 | 259 |
| 26000 | −51 | −57 | 1152 | 241 | 482 | 173 | 245 | 177 | 250 | 180 | 254 |
| 28000 | −55 | −60 | 1043 | 220 | 440 | 161 | 236 | 166 | 243 | 170 | 248 |
| 29000 | −57 | −62 | 988 | 209 | 418 | 154 | 230 | 160 | 239 | 164 | 245 |
| 31000 | −62 | −66 | 877 | 187 | 374 | 138 | 214 | 147 | 227 | 153 | 236 |

# MAXIMUM CRUISE POWER

## 1900 RPM

### ISA −10°C

NOTE: FOR 1800 RPM, INCREASE TORQUE 5%; FOR 1700 RPM, INCREASE TORQUE 10%. DO NOT EXCEED 1940 FT LBS OR 805 °C.

| PRESSURE ALTITUDE FEET | IOAT °C | OAT °C | TORQUE PER ENGINE FT LBS | FUEL FLOW PER ENGINE LBS/HR | TOTAL FUEL FLOW LBS/HR | AIRSPEED KNOTS @ 10500 LBS IAS | @ 10500 LBS TAS | @ 9500 LBS IAS | @ 9500 LBS TAS | @ 8500 LBS IAS | @ 8500 LBS TAS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SL | 10 | 5 | 1940 | 427 | 854 | 245 | 238 | 246 | 239 | 247 | 240 |
| 2000 | 7 | 1 | 1940 | 418 | 836 | 243 | 243 | 244 | 244 | 245 | 245 |
| 4000 | 3 | − 3 | 1940 | 412 | 824 | 241 | 248 | 242 | 249 | 243 | 250 |
| 6000 | − 1 | − 7 | 1940 | 407 | 814 | 239 | 253 | 240 | 254 | 241 | 255 |
| 8000 | − 5 | −11 | 1940 | 403 | 806 | 237 | 258 | 238 | 259 | 239 | 261 |
| 10000 | − 8 | −15 | 1940 | 400 | 800 | 235 | 263 | 236 | 265 | 237 | 266 |
| 12000 | −12 | −19 | 1915 | 394 | 788 | 231 | 267 | 233 | 269 | 234 | 270 |
| 14000 | −16 | −23 | 1788 | 368 | 736 | 223 | 266 | 225 | 267 | 226 | 269 |
| 16000 | −20 | −27 | 1653 | 341 | 682 | 214 | 263 | 216 | 265 | 217 | 267 |
| 18000 | −24 | −31 | 1543 | 319 | 638 | 206 | 261 | 212 | 263 | 209 | 265 |
| 20000 | −28 | −35 | 1444 | 300 | 600 | 198 | 259 | 200 | 262 | 202 | 264 |
| 22000 | −32 | −39 | 1351 | 282 | 564 | 190 | 257 | 192 | 260 | 195 | 263 |
| 24000 | −36 | −43 | 1259 | 264 | 528 | 181 | 253 | 184 | 258 | 187 | 261 |
| 26000 | −41 | −47 | 1166 | 246 | 492 | 172 | 249 | 176 | 254 | 179 | 259 |
| 28000 | −45 | −50 | 1058 | 224 | 448 | 160 | 240 | 165 | 248 | 169 | 253 |
| 29000 | −47 | −52 | 1003 | 214 | 428 | 154 | 245 | 159 | 243 | 164 | 250 |
| 31000 | −51 | −56 | 891 | 192 | 384 | 137 | 218 | 146 | 232 | 152 | 241 |

# MAXIMUM CRUISE POWER

## 1900 RPM

### ISA

NOTE: FOR 1800 RPM, INCREASE TORQUE 5%; FOR 1700 RPM, INCREASE TORQUE 10%. DO NOT EXCEED 1940 FT LBS OR 805 °C.

| PRESSURE ALTITUDE FEET | IOAT °C | CAT °C | TORQUE PER ENGINE FT LBS | FUEL FLOW PER ENGINE LBS/HR | TOTAL FUEL FLOW LBS/HR | AIRSPEED KNOTS @ 10500 LBS IAS | @ 10500 LBS TAS | @ 9500 LBS IAS | @ 9500 LBS TAS | @ 8500 LBS IAS | @ 8500 LBS TAS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SL | 20 | 15 | 1940 | 433 | 866 | 243 | 241 | 244 | 242 | 245 | 243 |
| 2000 | 17 | 11 | 1940 | 425 | 850 | 242 | 246 | 243 | 247 | 244 | 248 |
| 4000 | 13 | 7 | 1940 | 416 | 832 | 240 | 251 | 241 | 252 | 242 | 253 |
| 6000 | 9 | 3 | 1940 | 409 | 818 | 238 | 256 | 239 | 257 | 240 | 258 |
| 8000 | 6 | −1 | 1940 | 404 | 808 | 236 | 261 | 237 | 263 | 238 | 264 |
| 10000 | 2 | −5 | 1920 | 396 | 792 | 232 | 265 | 234 | 267 | 235 | 268 |
| 12000 | −2 | −9 | 1819 | 375 | 750 | 225 | 265 | 227 | 267 | 228 | 269 |
| 14000 | −6 | −13 | 1680 | 349 | 699 | 216 | 262 | 218 | 264 | 219 | 266 |
| 16000 | −10 | −17 | 1552 | 324 | 648 | 207 | 259 | 209 | 262 | 211 | 264 |
| 18000 | −14 | −21 | 1449 | 303 | 606 | 199 | 257 | 201 | 260 | 203 | 263 |
| 20000 | −18 | −25 | 1358 | 285 | 570 | 191 | 255 | 194 | 259 | 196 | 261 |
| 22000 | −22 | −29 | 1273 | 269 | 538 | 183 | 253 | 186 | 257 | 188 | 260 |
| 24000 | −27 | −33 | 1188 | 252 | 504 | 174 | 249 | 178 | 254 | 181 | 259 |
| 26000 | −31 | −37 | 1108 | 236 | 472 | 165 | 245 | 170 | 251 | 173 | 256 |
| 28000 | −35 | −40 | 1030 | 220 | 440 | 156 | 239 | 161 | 247 | 165 | 253 |
| 29000 | −37 | −42 | 991 | 213 | 426 | 150 | 235 | 156 | 244 | 161 | 251 |
| 31000 | −41 | −46 | 911 | 197 | 394 | 137 | 223 | 146 | 237 | 152 | 246 |

# MAXIMUM CRUISE POWER

## 1900 RPM

### ISA +10°C

NOTE: FOR 1800 RPM, INCREASE TORQUE 5%; FOR 1700 RPM, INCREASE TORQUE 10%. DO NOT EXCEED 1940 FT LBS OR 805 °C.

| PRESSURE ALTITUDE FEET | IOAT °C | OAT °C | TORQUE PER ENGINE FT LBS | FUEL FLOW PER ENGINE LBS/HR | TOTAL FUEL FLOW LBS/HR | AIRSPEED KNOTS @ 10500 LBS IAS | @ 10500 LBS TAS | @ 9500 LBS IAS | @ 9500 LBS TAS | @ 8500 LBS IAS | @ 8500 LBS TAS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SL | 31 | 25 | 1940 | 435 | 870 | 242 | 244 | 243 | 245 | 244 | 246 |
| 2000 | 27 | 21 | 1940 | 426 | 852 | 240 | 249 | 241 | 250 | 242 | 251 |
| 4000 | 23 | 17 | 1940 | 418 | 836 | 238 | 254 | 239 | 255 | 240 | 256 |
| 6000 | 19 | 13 | 1938 | 412 | 824 | 236 | 259 | 238 | 260 | 239 | 262 |
| 8000 | 16 | 9 | 1871 | 395 | 790 | 231 | 261 | 232 | 262 | 233 | 264 |
| 10000 | 12 | 5 | 1803 | 377 | 754 | 225 | 262 | 227 | 264 | 228 | 265 |
| 12000 | 8 | 1 | 1713 | 356 | 712 | 219 | 262 | 220 | 264 | 221 | 266 |
| 14000 | 4 | −3 | 1590 | 331 | 662 | 210 | 260 | 212 | 262 | 213 | 264 |
| 16000 | 0 | −7 | 1467 | 306 | 612 | 201 | 257 | 203 | 259 | 205 | 262 |
| 18000 | −5 | −11 | 1374 | 288 | 576 | 193 | 254 | 195 | 258 | 197 | 260 |
| 20000 | −9 | −15 | 1273 | 270 | 540 | 184 | 251 | 187 | 255 | 189 | 258 |
| 22000 | −13 | −19 | 1194 | 255 | 510 | 176 | 248 | 179 | 253 | 182 | 257 |
| 24000 | −17 | −23 | 1114 | 239 | 478 | 167 | 244 | 171 | 250 | 174 | 255 |
| 26000 | −21 | −27 | 1040 | 224 | 448 | 158 | 239 | 163 | 246 | 167 | 252 |
| 28000 | −25 | −30 | 968 | 210 | 420 | 148 | 232 | 154 | 241 | 159 | 249 |
| 29000 | −27 | −32 | 932 | 203 | 406 | 142 | 227 | 149 | 238 | 155 | 247 |
| 31000 | −31 | −36 | 860 | 189 | 378 | 127 | 211 | 138 | 230 | 146 | 241 |

# MAXIMUM CRUISE POWER

## 1900 RPM

### ISA +20°C

NOTE: FOR 1800 RPM, INCREASE TORQUE 5%; FOR 1700 RPM, INCREASE TORQUE 10%. DO NOT EXCEED 1940 FT LBS OR 805 °C.

| PRESSURE ALTITUDE FEET | IOAT °C | OAT °C | TORQUE PER ENGINE FT LBS | FUEL FLOW PER ENGINE LBS/HR | TOTAL FUEL FLOW LBS/HR | AIRSPEED KNOTS @ 10500 LBS IAS | @ 10500 LBS TAS | @ 9500 LBS IAS | @ 9500 LBS TAS | @ 8500 LBS IAS | @ 8500 LBS TAS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SL | 41 | 35 | 1940 | 437 | 874 | 241 | 246 | 242 | 247 | 243 | 248 |
| 2000 | 37 | 31 | 1872 | 417 | 834 | 236 | 248 | 237 | 249 | 238 | 250 |
| 4000 | 33 | 27 | 1832 | 401 | 802 | 232 | 251 | 233 | 252 | 234 | 254 |
| 6000 | 29 | 23 | 1782 | 385 | 770 | 227 | 253 | 229 | 255 | 230 | 256 |
| 8000 | 25 | 19 | 1724 | 370 | 740 | 222 | 255 | 224 | 257 | 225 | 259 |
| 10000 | 21 | 15 | 1667 | 354 | 708 | 217 | 257 | 219 | 259 | 220 | 261 |
| 12000 | 17 | 11 | 1594 | 337 | 674 | 211 | 258 | 213 | 260 | 214 | 262 |
| 14000 | 13 | 7 | 1478 | 313 | 626 | 202 | 255 | 204 | 258 | 206 | 260 |
| 16000 | 9 | 3 | 1364 | 289 | 578 | 193 | 252 | 195 | 255 | 198 | 257 |
| 18000 | 5 | −1 | 1286 | 273 | 546 | 186 | 250 | 188 | 254 | 191 | 257 |
| 20000 | 1 | −5 | 1206 | 257 | 514 | 178 | 247 | 181 | 252 | 184 | 255 |
| 22000 | −3 | −9 | 1124 | 241 | 482 | 169 | 243 | 173 | 249 | 176 | 253 |
| 24000 | −7 | −13 | 1042 | 226 | 452 | 159 | 237 | 164 | 244 | 168 | 250 |
| 26000 | −11 | −17 | 972 | 212 | 424 | 149 | 231 | 155 | 240 | 160 | 247 |
| 28000 | −15 | −20 | 905 | 199 | 398 | 138 | 221 | 146 | 234 | 152 | 243 |
| 29000 | −18 | −22 | 871 | 192 | 384 | 131 | 214 | 141 | 231 | 148 | 241 |
| 31000 | −22 | −26 | 802 | 179 | 358 | — | — | 129 | 219 | 138 | 234 |

# MAXIMUM CRUISE POWER

## 1900 RPM

### ISA +30°C

NOTE: FOR 1800 RPM, INCREASE TORQUE 5%; FOR 1700 RPM, INCREASE TORQUE 10%. DO NOT EXCEED 1940 FT LBS OR 805 °C.

| PRESSURE ALTITUDE FEET | IOAT °C | OAT °C | TORQUE PER ENGINE FT LBS | FUEL FLOW PER ENGINE LBS/HR | TOTAL FUEL FLOW LBS/HR | AIRSPEED KNOTS @ 10500 LBS IAS | @ 10500 LBS TAS | @ 9500 LBS IAS | @ 9500 LBS TAS | @ 8500 LBS IAS | @ 8500 LBS TAS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SL | 50 | 45 | 1736 | 411 | 822 | 230 | 238 | 231 | 240 | 232 | 241 |
| 2000 | 46 | 41 | 1683 | 391 | 782 | 225 | 240 | 226 | 242 | 228 | 243 |
| 4000 | 43 | 37 | 1663 | 377 | 754 | 222 | 244 | 223 | 246 | 225 | 247 |
| 6000 | 39 | 33 | 1628 | 362 | 724 | 218 | 247 | 219 | 249 | 221 | 250 |
| 8000 | 35 | 29 | 1581 | 346 | 692 | 213 | 249 | 215 | 251 | 216 | 253 |
| 10000 | 31 | 25 | 1533 | 331 | 662 | 208 | 251 | 210 | 253 | 212 | 255 |
| 12000 | 27 | 21 | 1470 | 316 | 632 | 203 | 252 | 205 | 255 | 206 | 257 |
| 14000 | 23 | 17 | 1355 | 292 | 584 | 193 | 248 | 196 | 251 | 198 | 254 |
| 16000 | 19 | 13 | 1249 | 270 | 540 | 184 | 244 | 187 | 248 | 189 | 251 |
| 18000 | 15 | 9 | 1181 | 255 | 510 | 177 | 242 | 180 | 247 | 183 | 250 |
| 20000 | 11 | 5 | 1112 | 241 | 482 | 169 | 240 | 173 | 245 | 176 | 249 |
| 22000 | 7 | 1 | 1046 | 228 | 456 | 161 | 240 | 165 | 243 | 169 | 248 |
| 24000 | 3 | −3 | 979 | 214 | 428 | 152 | 231 | 157 | 239 | 162 | 246 |
| 26000 | −1 | −7 | 917 | 202 | 404 | 141 | 223 | 149 | 235 | 154 | 243 |
| 28000 | −6 | −10 | 854 | 189 | 378 | 128 | 210 | 139 | 228 | 146 | 239 |
| 29000 | −8 | −12 | 823 | 182 | 364 | 118 | 197 | 133 | 223 | 141 | 236 |
| 31000 | −12 | −16 | 757 | 170 | 340 | — | — | 119 | 206 | 131 | 228 |

# MAXIMUM CRUISE POWER

## 1900 RPM

### ISA +37°C

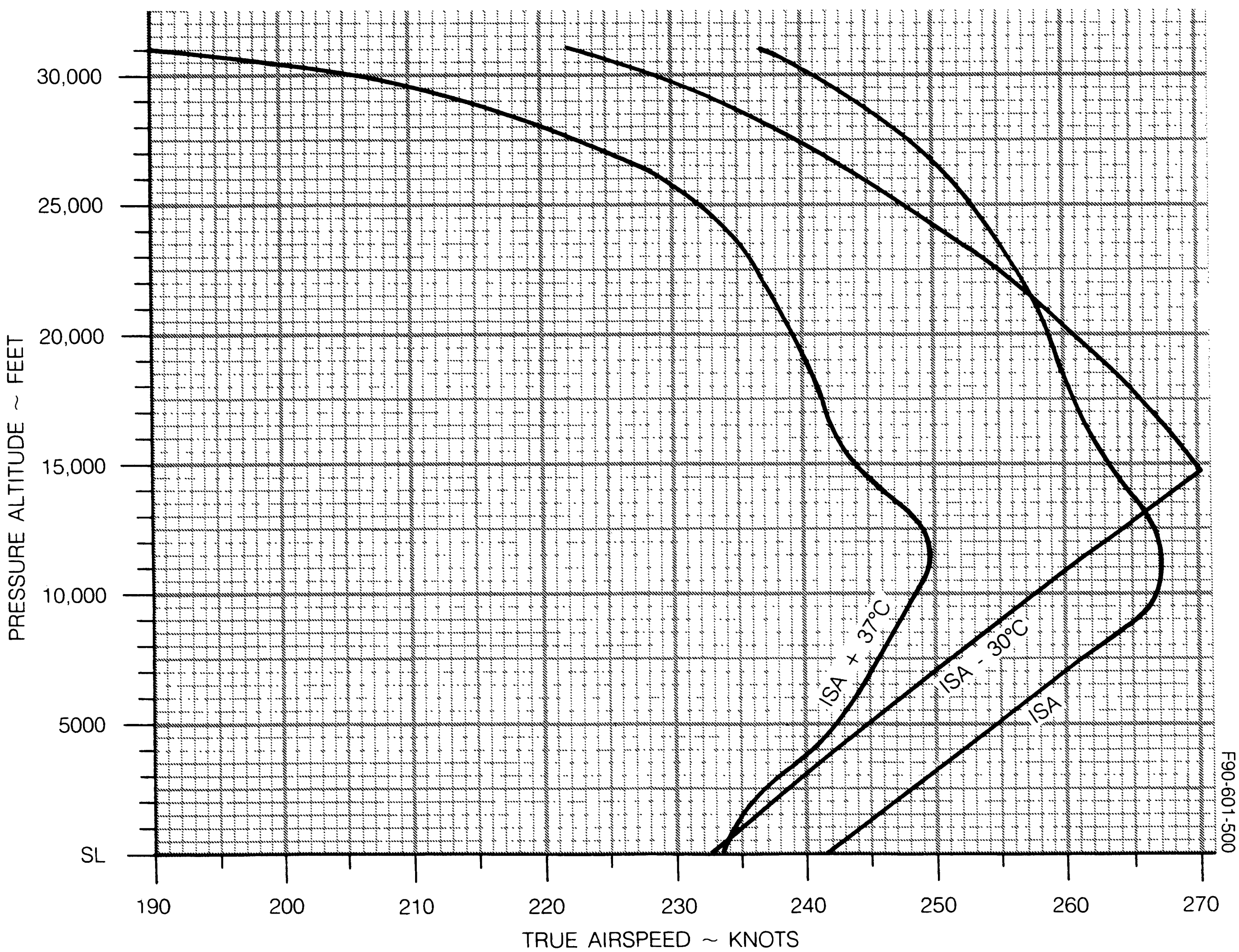
NOTE: FOR 1800 RPM, INCREASE TORQUE 5%; FOR 1700 RPM, INCREASE TORQUE 10%. DO NOT EXCEED 1940 FT LBS OR 805 °C.

| PRESSURE ALTITUDE FEET | IOAT °C | OAT °C | TORQUE PER ENGINE FT LBS | FUEL FLOW PER ENGINE LBS/HR | TOTAL FUEL FLOW LBS/HR | AIRSPEED KNOTS @ 10500 LBS IAS | | @ 9500 LBS IAS | | @ 8500 LBS IAS | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | IAS | TAS | IAS | TAS | IAS | TAS |
| SL | 57 | 52 | 1589 | 391 | 782 | 221 | 232 | 222 | 233 | 224 | 235 |
| 2000 | 53 | 48 | 1549 | 373 | 746 | 217 | 234 | 218 | 236 | 219 | 237 |
| 4000 | 49 | 44 | 1542 | 360 | 720 | 214 | 238 | 216 | 240 | 217 | 242 |
| 6000 | 46 | 40 | 1518 | 346 | 692 | 211 | 242 | 213 | 244 | 214 | 245 |
| 8000 | 42 | 36 | 1479 | 331 | 662 | 206 | 244 | 208 | 246 | 210 | 248 |
| 10000 | 38 | 32 | 1440 | 315 | 630 | 202 | 246 | 204 | 249 | 206 | 251 |
| 12000 | 34 | 28 | 1382 | 301 | 602 | 196 | 247 | 198 | 250 | 200 | 252 |
| 14000 | 30 | 24 | 1268 | 277 | 554 | 186 | 242 | 188 | 246 | 191 | 249 |
| 16000 | 26 | 20 | 1170 | 256 | 512 | 177 | 238 | 180 | 242 | 183 | 246 |
| 18000 | 22 | 16 | 1107 | 243 | 486 | 170 | 236 | 174 | 241 | 177 | 245 |
| 20000 | 18 | 12 | 1045 | 230 | 460 | 162 | 233 | 167 | 239 | 170 | 244 |
| 22000 | 14 | 9 | 988 | 218 | 436 | 154 | 230 | 160 | 237 | 164 | 243 |
| 24000 | 10 | 5 | 931 | 206 | 412 | 145 | 224 | 152 | 234 | 157 | 241 |
| 26000 | 5 | 1 | 874 | 194 | 388 | 134 | 215 | 143 | 229 | 149 | 239 |
| 28000 | 1 | −3 | 816 | 182 | 364 | 117 | 195 | 133 | 221 | 141 | 234 |
| 29000 | −1 | −5 | 786 | 176 | 352 | — | — | 127 | 215 | 137 | 231 |
| 31000 | −6 | −9 | 722 | 163 | 326 | — | — | — | — | 126 | 222 |

# MAXIMUM CRUISE SPEEDS

## 1900 RPM

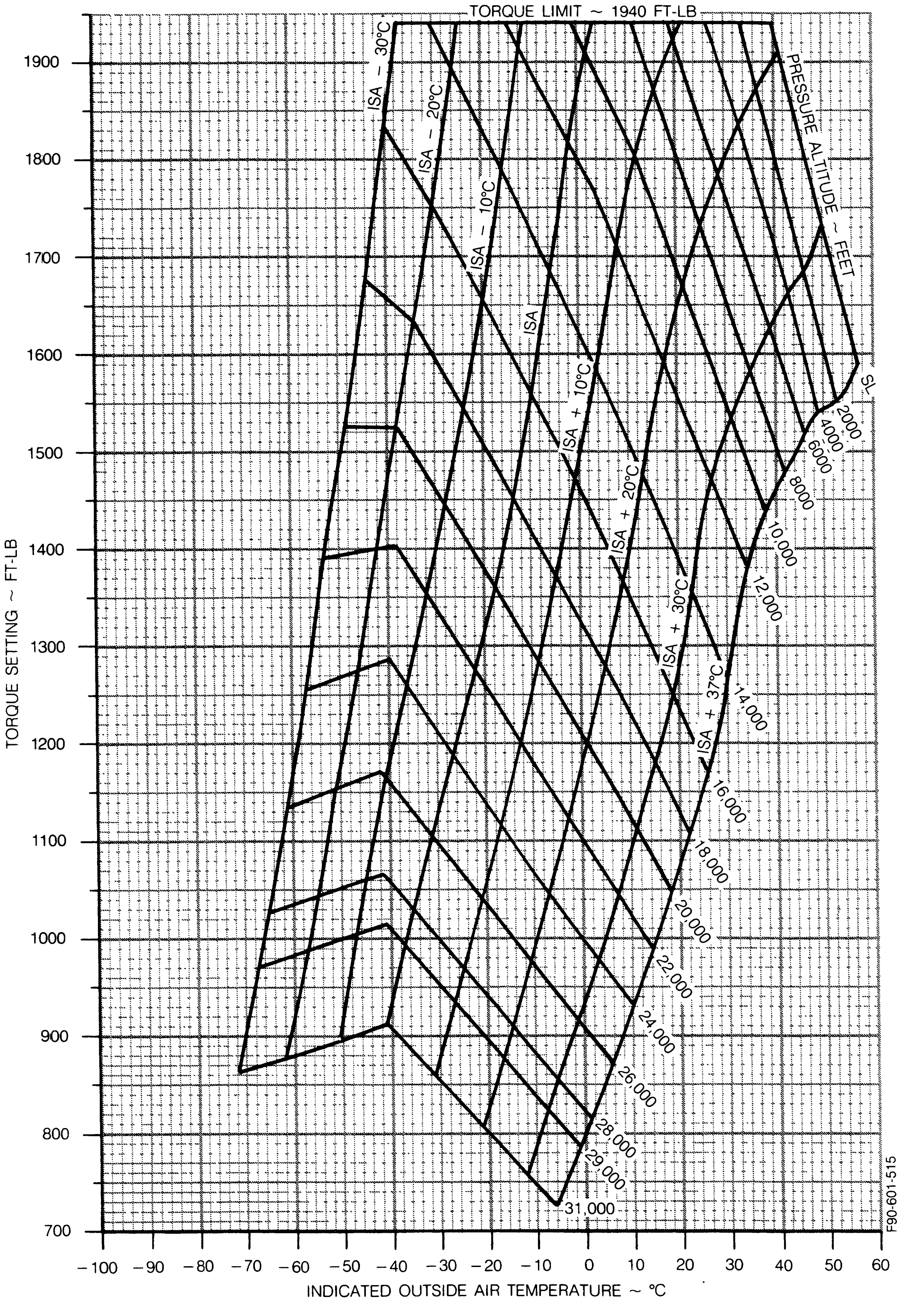
### WEIGHT 9500 LBS



# MAXIMUM CRUISE POWER

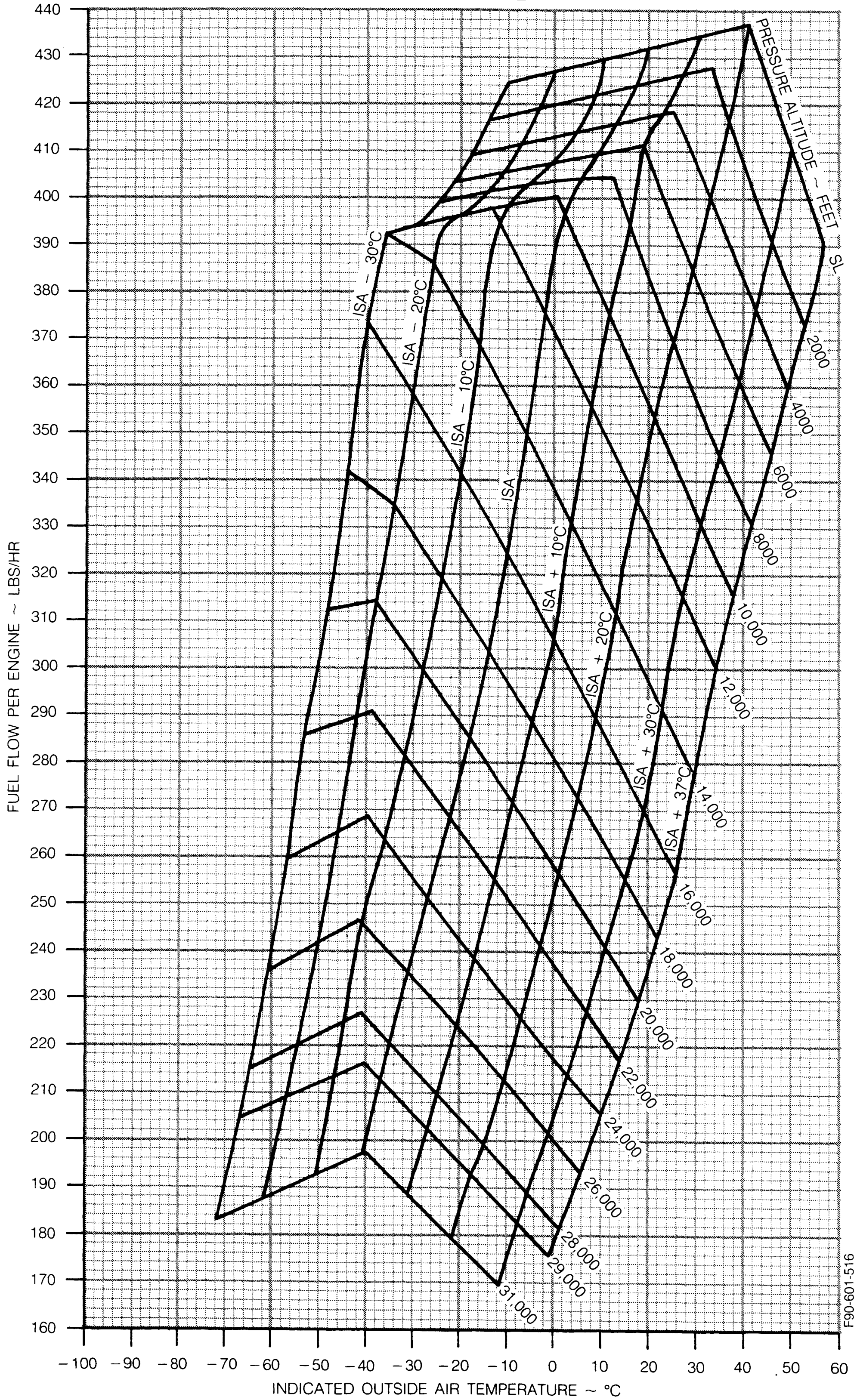
**1900 RPM**

NOTE: FOR 1800 RPM, INCREASE TORQUE 5%
FOR 1700 RPM, INCREASE TORQUE 10%
DO NOT EXCEED 1940 FT-LBS OR 805°C ITT



# FUEL FLOW AT MAXIMUM CRUISE POWER

**1900 RPM**



# MAXIMUM RANGE POWER

## 1800 RPM

### ISA −30°C

NOTE: FOR 1900 RPM, DECREASE TORQUE 5%; FOR 1700 RPM, INCREASE TORQUE 5%. DO NOT EXCEED 1940 FT LBS OR 805 °C.

| WEIGHT → | | | 10500 POUNDS | | | | 9500 POUNDS | | | | 8500 POUNDS | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PRESSURE ALTITUDE | IOAT | OAT | TORQUE PER ENG | FUEL FLOW PER ENG | FUEL FLOW TOTAL | TAS | TORQUE PER ENG | FUEL FLOW PER ENG | FUEL FLOW TOTAL | TAS | TORQUE PER ENG | FUEL FLOW PER ENG | FUEL FLOW TOTAL | TAS |
| FEET | °C | °C | FT LB | LB/HR | LB/HR | KNOTS | FT LB | LB/HR | LB/HR | KNOTS | FT LB | LB/HR | LB/HR | KNOTS |
| SL | −11 | −15 | 1379 | 334 | 668 | 199 | 1339 | 329 | 658 | 197 | 1315 | 325 | 650 | 197 |
| 2000 | −15 | −19 | 1280 | 309 | 618 | 196 | 1247 | 305 | 610 | 195 | 1215 | 300 | 600 | 195 |
| 4000 | −19 | −23 | 1191 | 285 | 570 | 194 | 1161 | 281 | 562 | 193 | 1134 | 277 | 554 | 193 |
| 6000 | −23 | −27 | 1112 | 263 | 526 | 191 | 1085 | 259 | 518 | 192 | 1075 | 257 | 514 | 193 |
| 8000 | −28 | −31 | 1039 | 242 | 484 | 189 | 1011 | 237 | 474 | 189 | 953 | 229 | 458 | 186 |
| 10000 | −32 | −35 | 979 | 222 | 444 | 187 | 937 | 215 | 430 | 186 | 879 | 206 | 412 | 183 |
| 12000 | −36 | −39 | 957 | 212 | 424 | 188 | 898 | 202 | 404 | 186 | 849 | 194 | 388 | 184 |
| 14000 | −40 | −43 | 929 | 203 | 406 | 189 | 869 | 193 | 386 | 187 | 817 | 184 | 368 | 184 |
| 16000 | −44 | −47 | 888 | 192 | 384 | 188 | 823 | 181 | 362 | 185 | 778 | 173 | 346 | 184 |
| 18000 | −48 | −51 | 874 | 187 | 374 | 189 | 773 | 170 | 340 | 181 | 734 | 163 | 326 | 182 |
| 20000 | −51 | −55 | 872 | 185 | 370 | 192 | 780 | 169 | 338 | 186 | 709 | 157 | 314 | 182 |
| 22000 | −55 | −59 | 871 | 183 | 366 | 194 | 785 | 168 | 336 | 190 | 689 | 151 | 302 | 182 |
| 24000 | −59 | −63 | 881 | 183 | 366 | 199 | 784 | 165 | 330 | 192 | 695 | 150 | 300 | 186 |
| 26000 | −63 | −67 | 894 | 184 | 368 | 203 | 781 | 163 | 326 | 195 | 696 | 148 | 296 | 187 |
| 28000 | −67 | −70 | 915 | 187 | 374 | 209 | 800 | 166 | 332 | 200 | 693 | 146 | 292 | 192 |
| 29000 | −69 | −72 | 927 | 189 | 378 | 212 | 805 | 166 | 332 | 203 | 692 | 145 | 290 | 193 |
| 31000 | −72 | −76 | — | — | — | — | 824 | 169 | 338 | 209 | 711 | 148 | 296 | 199 |

98-35088 A

# MAXIMUM RANGE POWER

## 1800 RPM

### ISA

NOTE: FOR 1900 RPM, DECREASE TORQUE 5%; FOR 1700 RPM, INCREASE TORQUE 5%. DO NOT EXCEED 1940 FT LBS OR 805 °C.

| WEIGHT → | | | 10500 POUNDS | | | | 9500 POUNDS | | | | 8500 POUNDS | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PRESSURE ALTITUDE | IOAT | OAT | TORQUE PER ENG | FUEL FLOW PER ENG | FUEL FLOW TOTAL | TAS | TORQUE PER ENG | FUEL FLOW PER ENG | FUEL FLOW TOTAL | TAS | TORQUE PER ENG | FUEL FLOW PER ENG | FUEL FLOW TOTAL | TAS |
| FEET | °C | °C | FT LB | LB/HR | LB/HR | KNOTS | FT LB | LB/HR | LB/HR | KNOTS | FT LB | LB/HR | LB/HR | KNOTS |
| SL | 19 | 15 | 1342 | 339 | 678 | 204 | 1285 | 331 | 662 | 202 | 1233 | 324 | 648 | 200 |
| 2000 | 15 | 11 | 1284 | 327 | 654 | 204 | 1246 | 313 | 626 | 203 | 1201 | 307 | 614 | 202 |
| 4000 | 11 | 7 | 1264 | 303 | 606 | 207 | 1229 | 298 | 596 | 206 | 1179 | 291 | 582 | 204 |
| 6000 | 7 | 3 | 1252 | 290 | 580 | 210 | 1203 | 283 | 566 | 209 | 1146 | 276 | 552 | 206 |
| 8000 | 3 | −1 | 1176 | 270 | 540 | 208 | 1122 | 263 | 526 | 206 | 1072 | 257 | 514 | 205 |
| 10000 | −1 | −5 | 1103 | 251 | 502 | 206 | 1048 | 244 | 488 | 204 | 982 | 235 | 470 | 201 |
| 12000 | −5 | −9 | 1076 | 239 | 478 | 207 | 997 | 229 | 458 | 203 | 951 | 222 | 444 | 202 |
| 14000 | −9 | −13 | 1063 | 232 | 464 | 210 | 970 | 219 | 438 | 205 | 908 | 211 | 422 | 202 |
| 16000 | −13 | −17 | 1022 | 221 | 442 | 209 | 950 | 210 | 420 | 206 | 869 | 199 | 398 | 202 |
| 18000 | −17 | −21 | 996 | 213 | 426 | 210 | 934 | 203 | 406 | 208 | 847 | 190 | 380 | 203 |
| 20000 | −21 | −25 | 959 | 204 | 408 | 209 | 912 | 195 | 390 | 210 | 819 | 182 | 364 | 204 |
| 22000 | −25 | −29 | 933 | 198 | 396 | 209 | 891 | 190 | 380 | 210 | 791 | 174 | 348 | 204 |
| 24000 | −28 | −33 | 937 | 197 | 394 | 212 | 865 | 184 | 368 | 211 | 769 | 168 | 336 | 204 |
| 26000 | −32 | −37 | 965 | 201 | 402 | 219 | 842 | 178 | 356 | 210 | 778 | 167 | 334 | 209 |
| 28000 | −36 | −41 | 965 | 201 | 402 | 222 | 855 | 180 | 360 | 215 | 766 | 163 | 326 | 211 |
| 29000 | −38 | −42 | 979 | 204 | 408 | 225 | 866 | 182 | 364 | 218 | 755 | 161 | 322 | 210 |
| 31000 | −42 | −46 | — | — | — | — | 880 | 185 | 370 | 223 | 753 | 160 | 320 | 213 |

98-35088 A

# MAXIMUM RANGE POWER

## 1800 RPM

### ISA +30°C

NOTE: FOR 1900 RPM, DECREASE TORQUE 5%; FOR 1700 RPM, INCREASE TORQUE 5%. DO NOT EXCEED 1940 FT LBS OR 805 °C.

| WEIGHT → | | | 10500 POUNDS | | | | 9500 POUNDS | | | | 8500 POUNDS | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PRESSURE ALTITUDE | IOAT | OAT | TORQUE PER ENG | FUEL FLOW PER ENG | FUEL FLOW TOTAL | TAS | TORQUE PER ENG | FUEL FLOW PER ENG | FUEL FLOW TOTAL | TAS | TORQUE PER ENG | FUEL FLOW PER ENG | FUEL FLOW TOTAL | TAS |
| FEET | °C | °C | FT LB | LB/HR | LB/HR | KNOTS | FT LB | LB/HR | LB/HR | KNOTS | FT LB | LB/HR | LB/HR | KNOTS |
| SL | 49 | 45 | 1350 | 350 | 700 | 211 | 1266 | 338 | 676 | 207 | 1182 | 327 | 654 | 203 |
| 2000 | 45 | 41 | 1285 | 328 | 656 | 211 | 1222 | 319 | 638 | 209 | 1158 | 310 | 620 | 206 |
| 4000 | 41 | 39 | 1258 | 311 | 622 | 213 | 1215 | 305 | 610 | 212 | 1170 | 298 | 596 | 211 |
| 6000 | 37 | 33 | 1237 | 296 | 592 | 215 | 1188 | 289 | 578 | 214 | 1139 | 283 | 566 | 213 |
| 8000 | 33 | 29 | 1194 | 281 | 562 | 216 | 1137 | 272 | 544 | 214 | 1159 | 265 | 530 | 213 |
| 10000 | 29 | 25 | 1183 | 269 | 538 | 220 | 1088 | 256 | 512 | 215 | 1020 | 246 | 492 | 212 |
| 12000 | 26 | 21 | 1148 | 256 | 512 | 221 | 1060 | 243 | 486 | 216 | 972 | 232 | 464 | 211 |
| 14000 | 22 | 17 | 1089 | 241 | 482 | 219 | 1036 | 233 | 466 | 217 | 943 | 220 | 440 | 213 |
| 16000 | 18 | 13 | 1040 | 229 | 458 | 218 | 994 | 222 | 444 | 218 | 926 | 211 | 422 | 215 |
| 18000 | 14 | 9 | 1014 | 221 | 442 | 218 | 956 | 211 | 422 | 218 | 897 | 202 | 404 | 216 |
| 20000 | 10 | 5 | 987 | 213 | 426 | 218 | 920 | 201 | 402 | 218 | 868 | 193 | 386 | 217 |
| 22000 | 6 | 1 | 995 | 213 | 426 | 223 | 903 | 196 | 392 | 219 | 844 | 186 | 372 | 217 |
| 24000 | 2 | −3 | 993 | 211 | 422 | 225 | 892 | 192 | 384 | 220 | 816 | 179 | 358 | 218 |
| 26000 | −2 | −7 | — | — | — | — | 887 | 190 | 380 | 222 | 796 | 173 | 346 | 218 |
| 28000 | −10 | −6 | — | — | — | — | 886 | 189 | 378 | 225 | 794 | 171 | 342 | 221 |
| 29000 | −8 | −12 | — | — | — | — | — | — | — | — | 791 | 171 | 342 | 222 |
| 31000 | −12 | −16 | — | — | — | — | — | — | — | — | 793 | 170 | 340 | 225 |

98-35088 A

# RANGE PROFILE - FULL MAIN AND AUX TANKS

## STANDARD DAY

ASSOCIATED CONDITIONS:

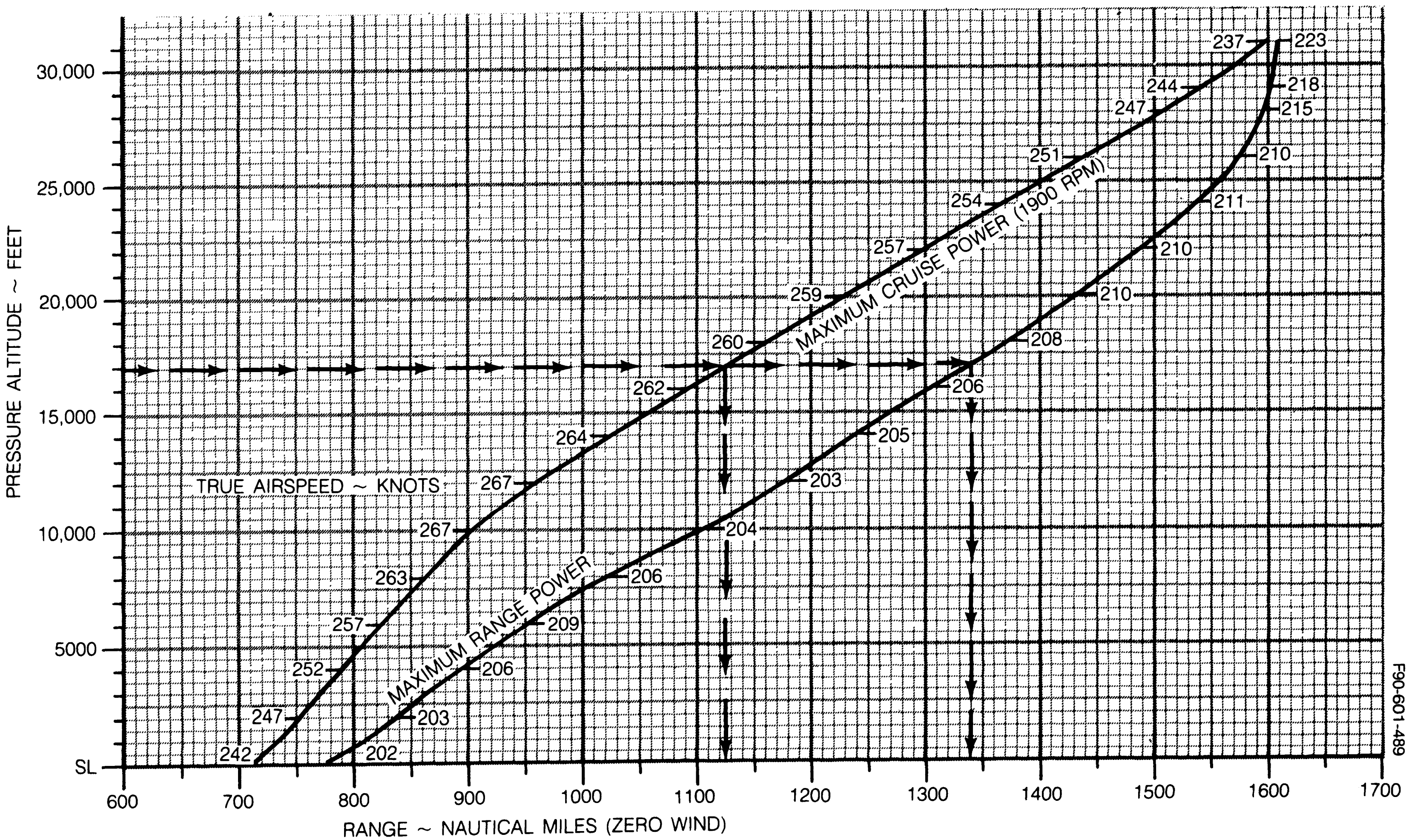
WEIGHT .................... 11,030 LBS BEFORE ENGINE START
FUEL ........................ AVIATION KEROSENE
FUEL DENSITY ............. 6.7 LBS/GAL

EXAMPLE:

PRESSURE ALTITUDE .................... 17,000 FT

RANGE @ MAX CRUISE POWER ......... 1124 NM
RANGE @ MAX RANGE POWER .......... 1340 NM

NOTE: RANGE INCLUDES START, TAXI, CLIMB AND DESCENT WITH 45 MINUTES RESERVE FUEL AT MAXIMUM RANGE POWER



# ENDURANCE PROFILE – FULL MAIN AND AUX TANKS

## STANDARD DAY

ASSOCIATED CONDITIONS:

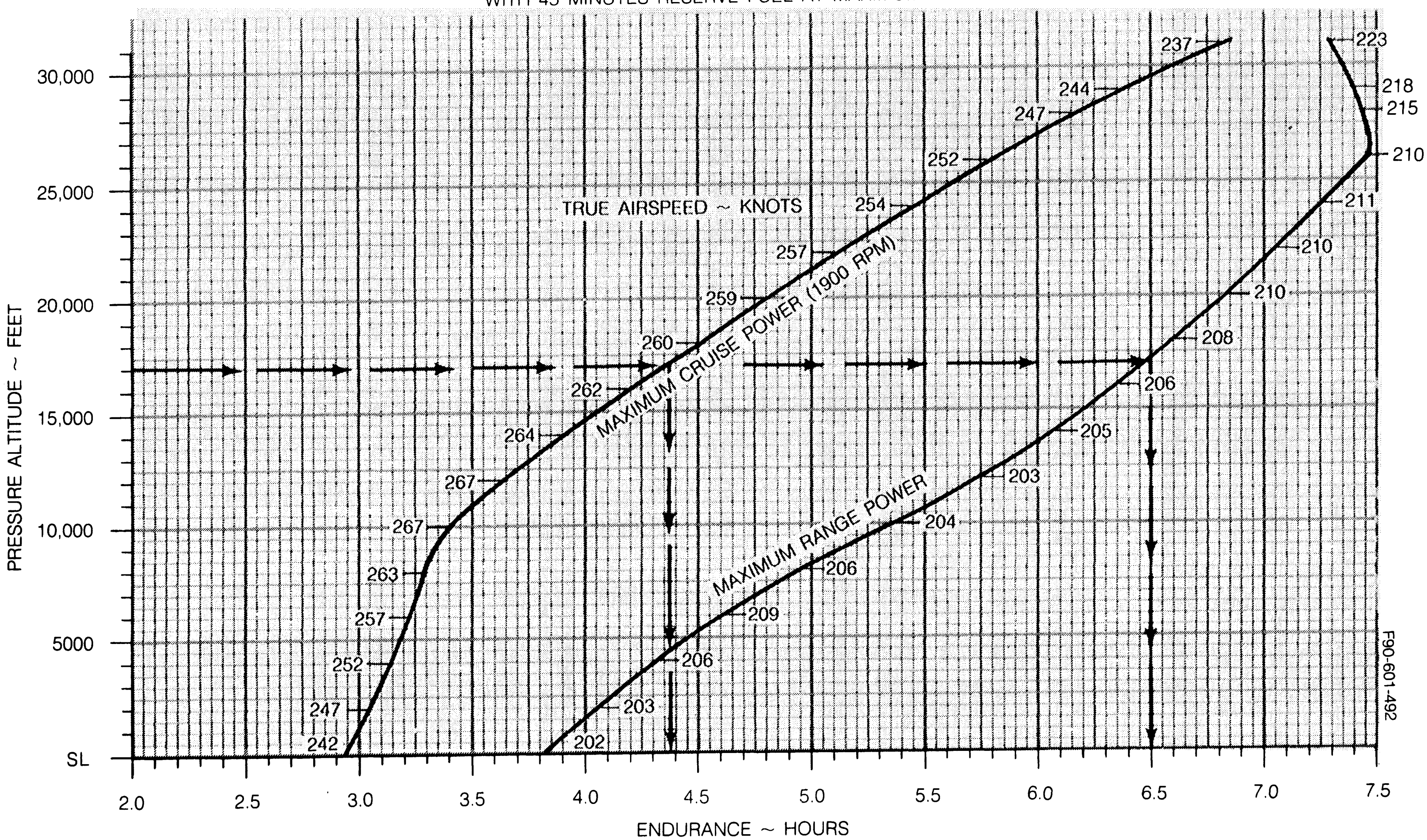
WEIGHT .................. 11,030 LBS BEFORE ENGINE START
FUEL ...................... AVIATION KEROSENE
FUEL DENSITY ............. 6.7 LBS/GAL

EXAMPLE:

PRESSURE ALTITUDE .................. 17,000 FT

ENDURANCE @ MAX CRUISE POWER .... 4.38 HR
ENDURANCE @ MAX RANGE POWER .... 6.5 HR

NOTE: ENDURANCE INCLUDES START, TAXI, CLIMB AND DESCENT WITH 45 MINUTES RESERVE FUEL AT MAXIMUM RANGE POWER



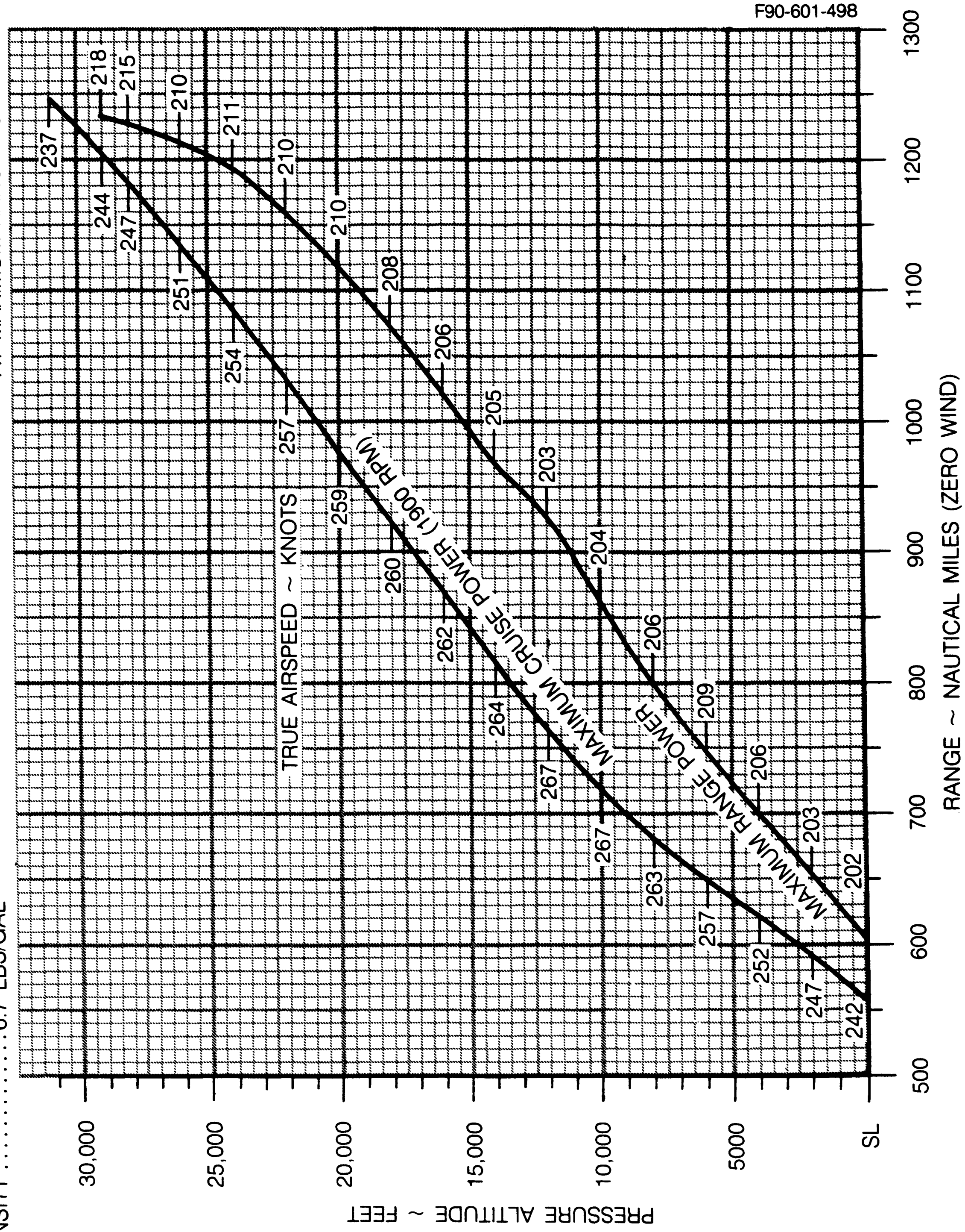
# RANGE PROFILE - FULL MAIN TANKS

## STANDARD DAY

ASSOCIATED CONDITIONS:

WEIGHT ............ 11,030 LBS BEFORE ENGINE START
FUEL .................. AVIATION KEROSENE
FUEL DENSITY .......... 6.7 LBS/GAL

NOTE: RANGE INCLUDES START, TAXI, CLIMB AND DESCENT WITH 45 MINUTES RESERVE FUEL AT MAXIMUM RANGE POWER



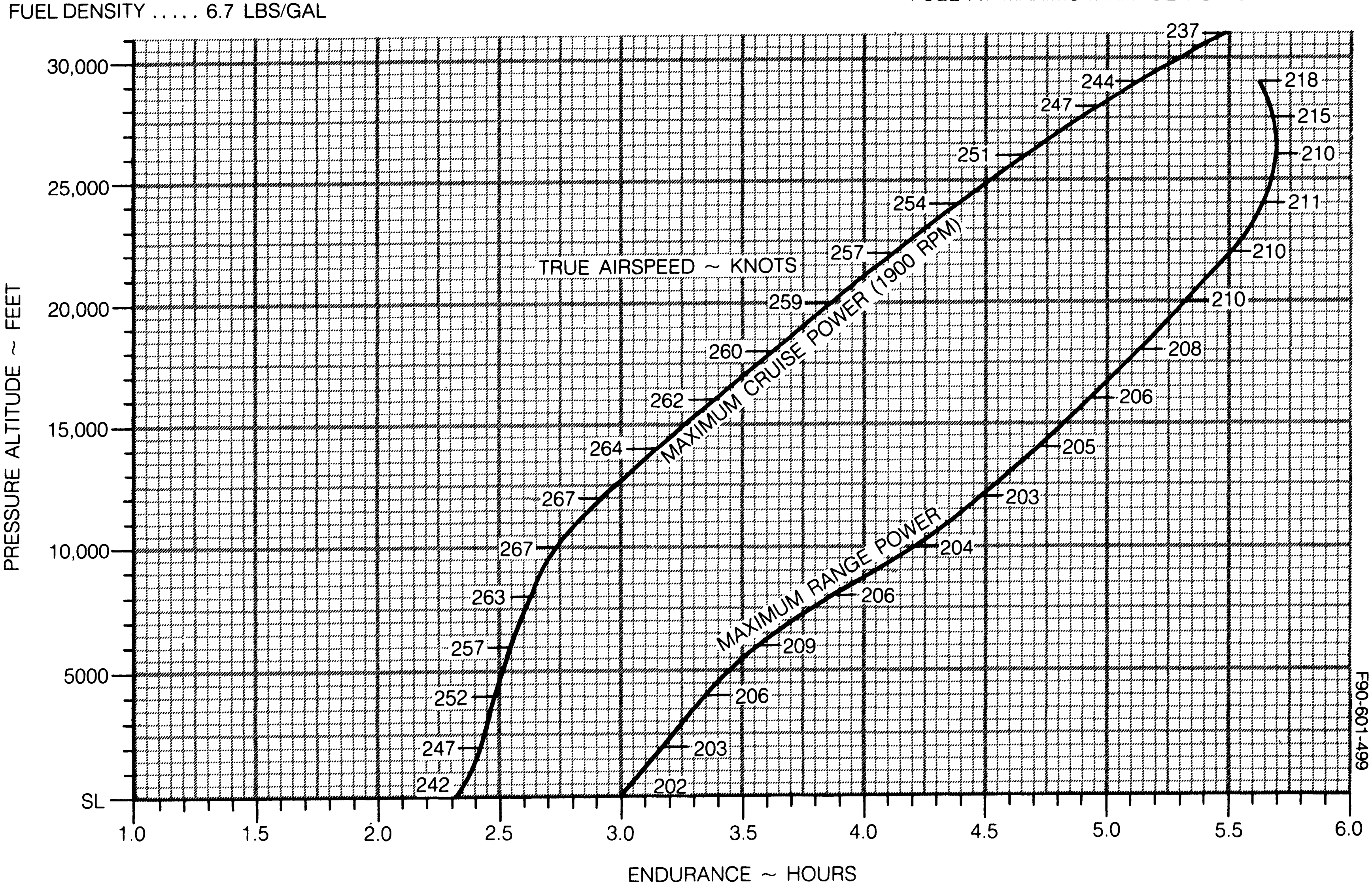
# ENDURANCE PROFILE – FULL MAIN TANKS

## STANDARD DAY

ASSOCIATED CONDITIONS:

WEIGHT ........... 11,030 LBS BEFORE ENGINE START
FUEL.............. AVIATION KEROSENE
FUEL DENSITY ..... 6.7 LBS/GAL

NOTE: ENDURANCE INCLUDES START, TAXI, CLIMB AND DESCENT WITH 45 MINUTES RESERVE FUEL AT MAXIMUM RANGE POWER.

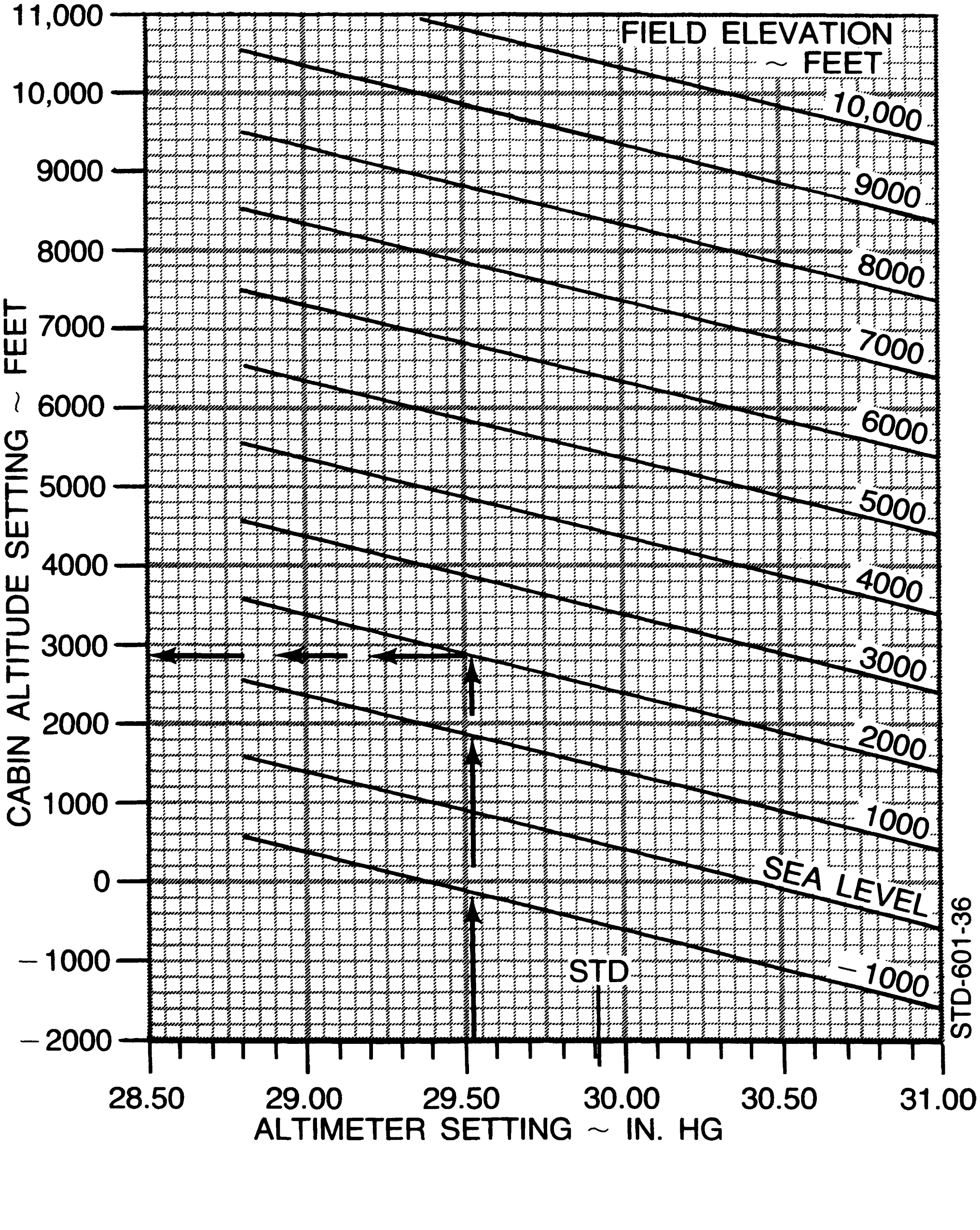


# PRESSURIZATION CONTROLLER SETTING FOR LANDING

EXAMPLE

ALTIMETER SETTING .......... 29.52 IN. HG
LANDING FIELD ELEVATION ... 2000 FT

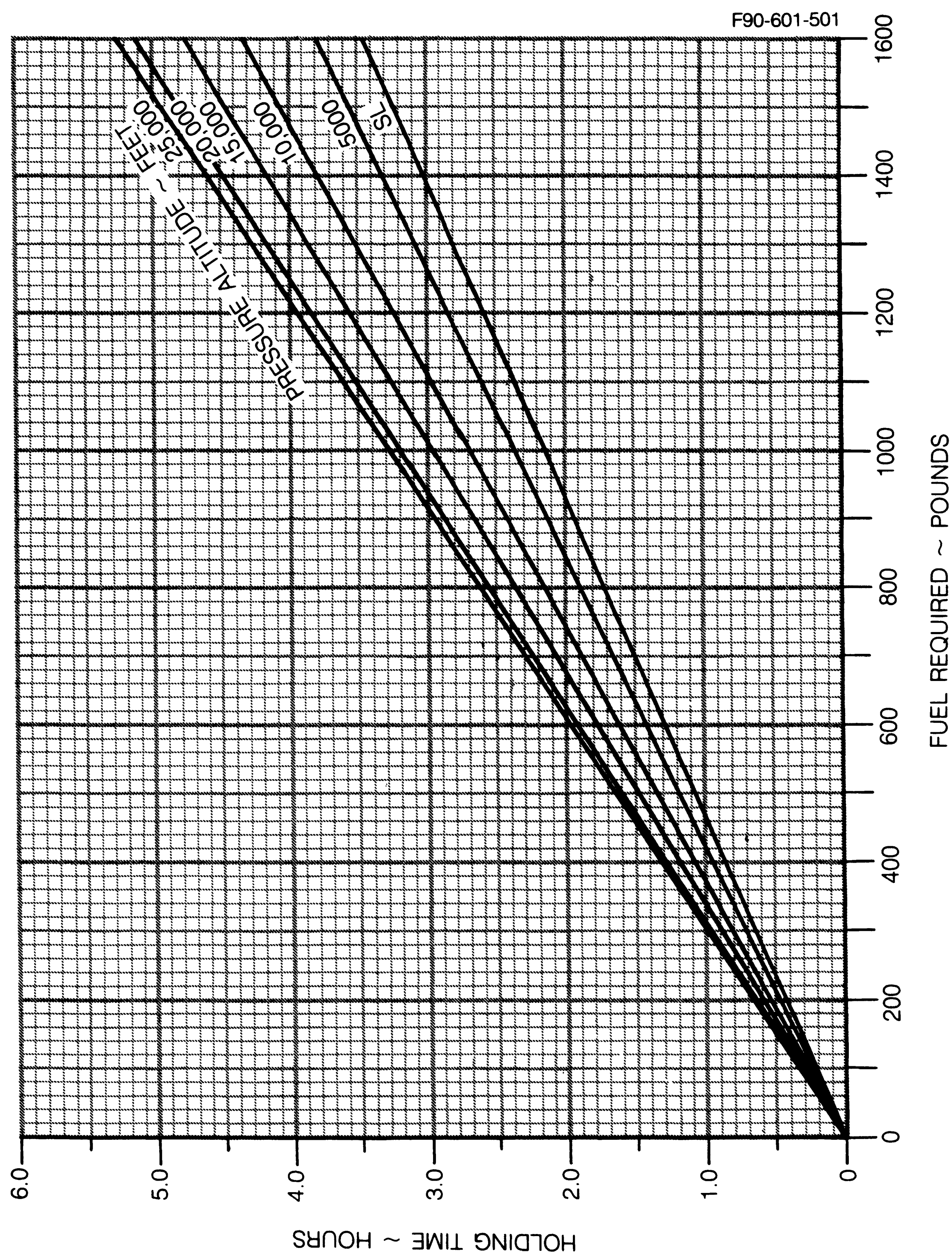
CABIN ALTITUDE SETTING .... 2885 FT



# HOLDING TIME

## AIRSPEED ~ 130 KNOTS

## ALL WEIGHTS, ALL TEMPERATURES



# TIME, FUEL, AND DISTANCE TO DESCEND

ASSOCIATED CONDITIONS:

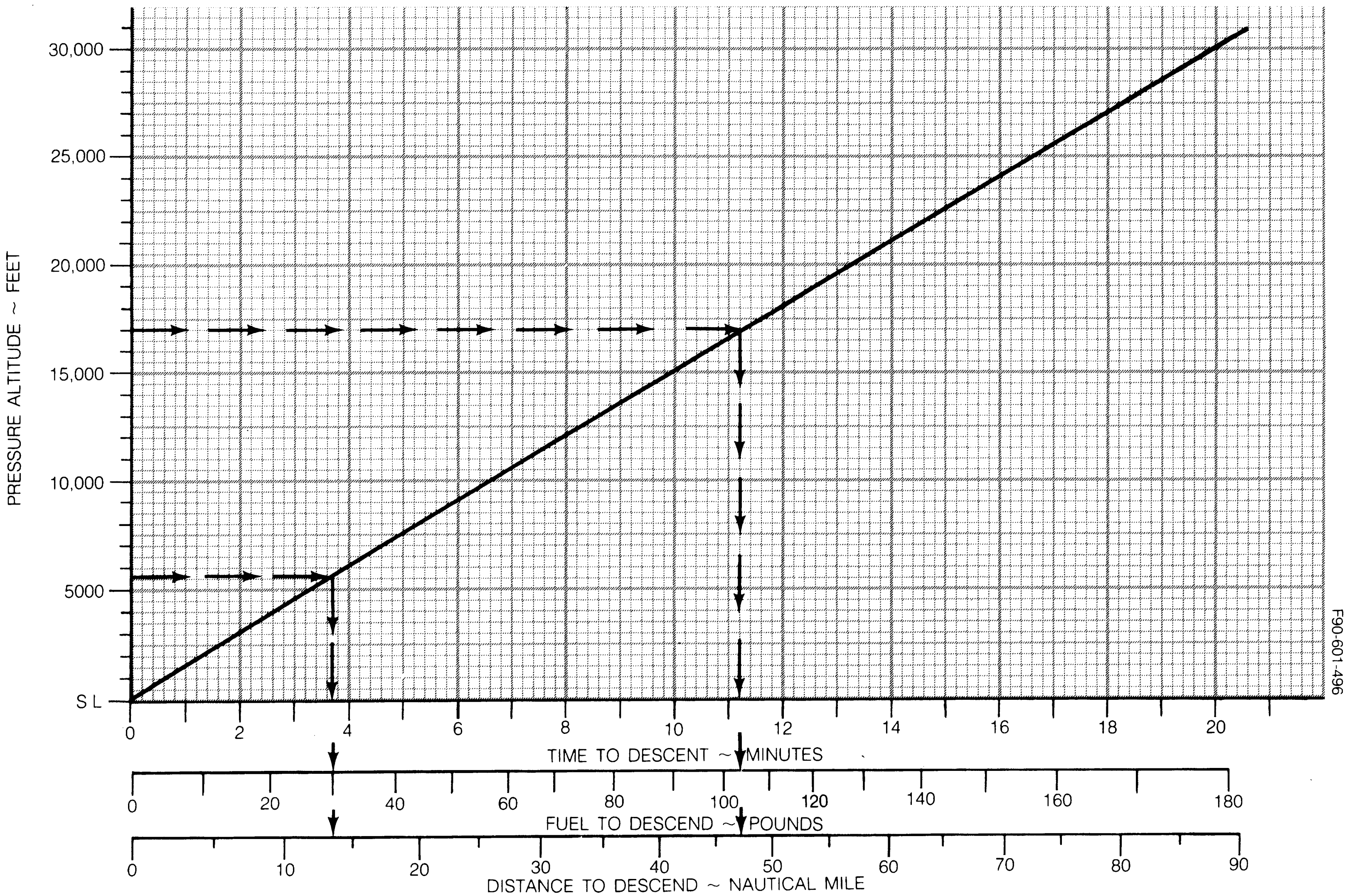
POWER .......... AS REQUIRED TO DESCEND AT 1500 FT/MIN
GEAR ............ UP
FLAPS............ UP

| ALTITUDE ~ FEET | DESCENT SPEED |
|---|---|
| 31,000 TO 18,000 | MMO |
| 18,000 TO SL | 220 KNOTS |

EXAMPLE:

INITIAL ALTITUDE ............. 17,000 FT
FINAL ALTITUDE .............. 5651 FT

TIME TO DESCEND ............ 11-4 = 7 MIN
FUEL TO DESCEND............ 104-30 = 74 LBS
DISTANCE TO DESCEND ....... 47-13 = 34 NM



# LANDING DISTANCE WITHOUT PROPELLER REVERSING – FLAPS 100%

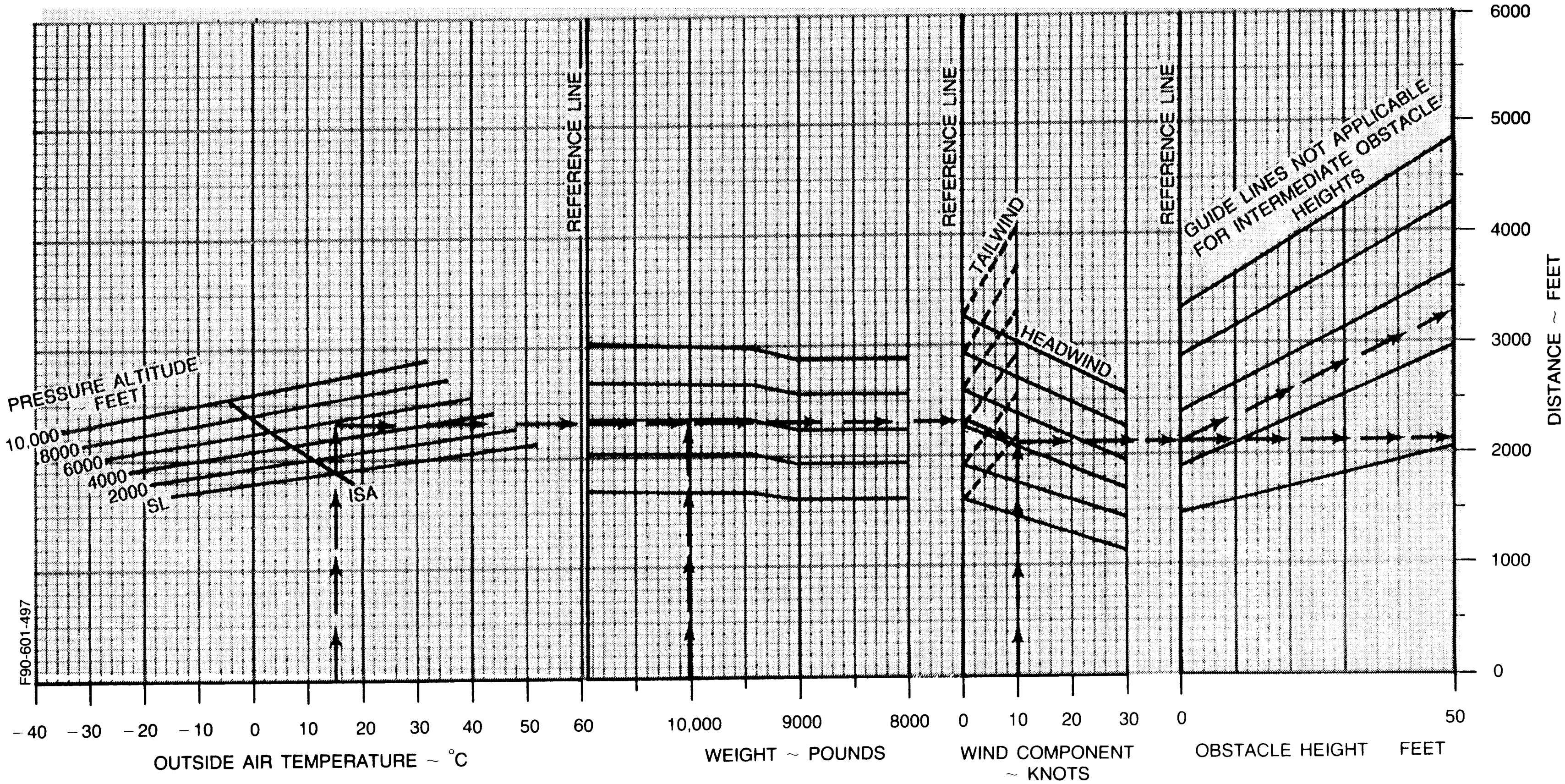
**ASSOCIATED CONDITIONS:**

| | |
|---|---|
| POWER | RETARDED TO MAINTAIN 550 FT/MIN ON FINAL APPROACH |
| FLAPS | 100% |
| RUNWAY | PAVED, LEVEL, DRY SURFACE |
| BRAKING | MAXIMUM |
| CONDITION LEVERS | LOW IDLE |
| PROPELLER CONTROLS | FULL FORWARD |

| WEIGHT ~ POUNDS | APPROACH SPEED ~ KNOTS |
|---|---|
| 10,950 | 108 |
| 10,000 | 108 |
| 9000 | 105 |
| 8000 | 103 |

**EXAMPLE:**

| | |
|---|---|
| OAT | 15°C |
| PRESSURE ALTITUDE | 5651 FT |
| LANDING WEIGHT | 10,015 LBS |
| HEADWIND COMPONENT | 10 KTS |
| GROUND ROLL | 2125 FT |
| TOTAL OVER 50-FT OBSTACLE | 3260 FT |
| APPROACH SPEED | 108 KTS |



# LANDING DISTANCE WITHOUT PROPELLER REVERSING – FLAPS 0%

ASSOCIATED CONDITIONS:

POWER . . . . . RETARDED TO MAINTAIN 750 FT/MIN ON FINAL APPROACH
FLAPS . . . . 0%
RUNWAY . . . PAVED, LEVEL, DRY SURFACE
BRAKING . . . . . MAXIMUM
CONDITION LEVERS . LOW IDLE
PROPELLER CONTROLS . FULL FORWARD

| WEIGHT ~ POUNDS | APPROACH SPEED ~ KNOTS |
|---|---|
| 10,950 | 127 |
| 10,000 | 122 |
| 9000 | 115 |
| 8000 | 108 |

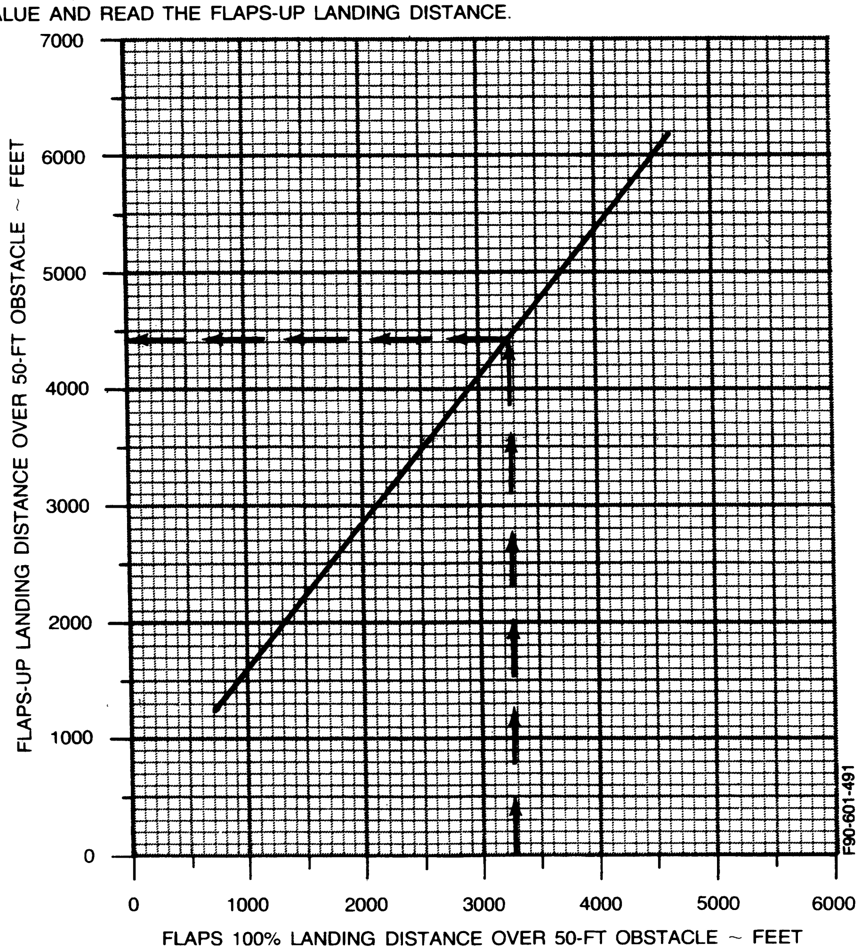
EXAMPLE:

FLAPS - 100% LANDING DISTANCE OVER 50-FOOT OBSTACLE . . . . . . . . . 3260 FT
LANDING WEIGHT . . . . . . . . . . . . 10,015 LBS

FLAPS-UP LANDING DISTANCE OVER 50-FOOT OBSTACLE . . . . . . 4430 FT
APPROACH SPEED . . . . . . . . . . . 122 KTS

NOTES: 1. LANDING WITH FLAPS FULL DOWN (100%) IS NORMAL PROCEDURE. USE THIS GRAPH WHEN IT IS NECESSARY TO LAND WITH FLAPS UP (0%)

2. TO DETERMINE FLAPS-UP LANDING DISTANCE, READ FROM THE **LANDING DISTANCE WITHOUT PROPELLER REVERSING – FLAPS 100%** GRAPH THE LANDING DISTANCE APPROPRIATE TO OAT, ALTITUDE, WEIGHT, WIND, AND 50-FT OBSTACLE, THEN ENTER THIS GRAPH WITH THE DERIVED VALUE AND READ THE FLAPS-UP LANDING DISTANCE.



# LANDING DISTANCE WITH PROPELLER REVERSING – FLAPS 100%

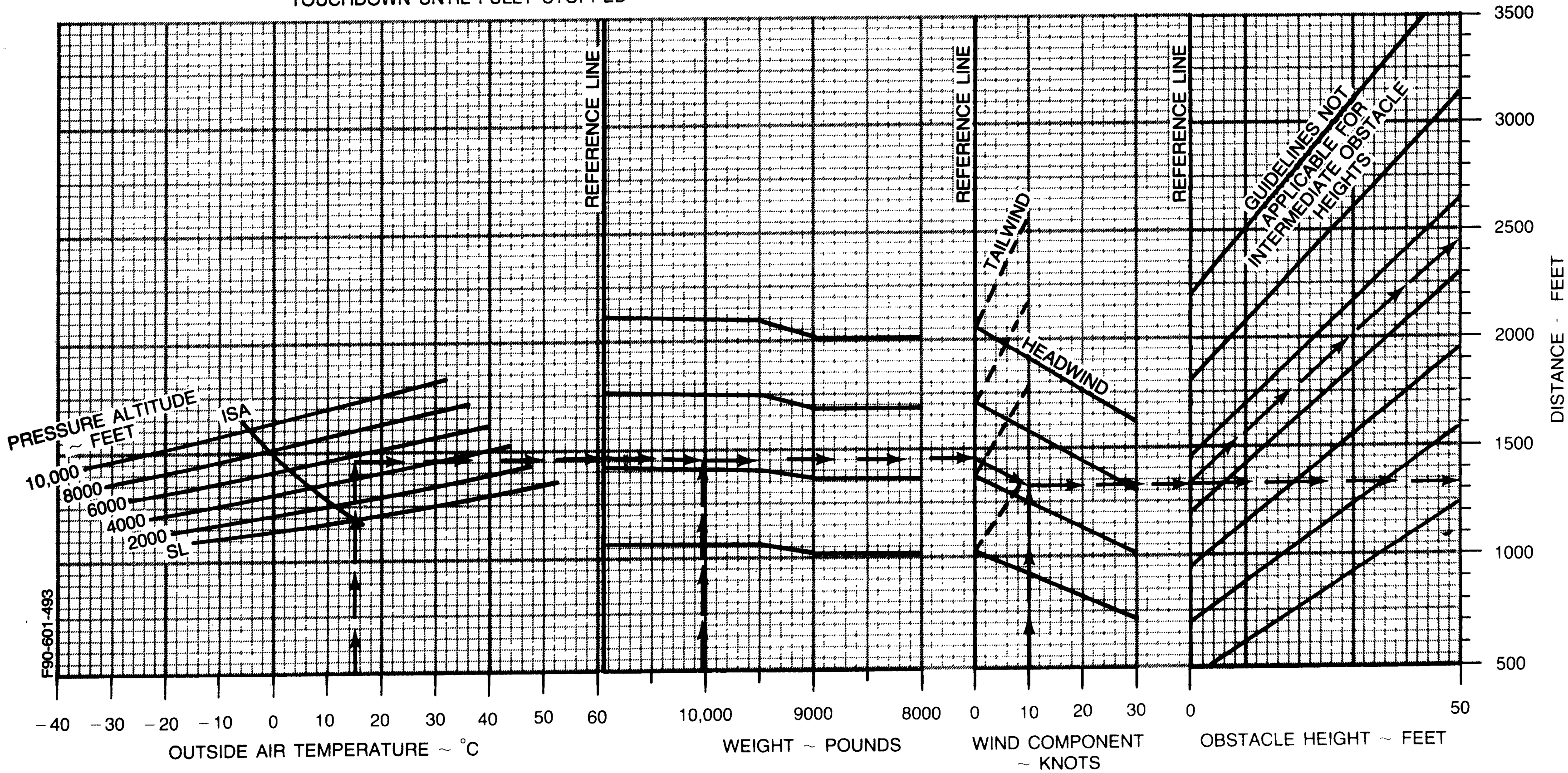
ASSOCIATED CONDITIONS:

| | |
|---|---|
| POWER | RETARDED TO MAINTAIN 550 FT/MIN ON FINAL APPROACH |
| FLAPS | 100% |
| RUNWAY | PAVED, LEVEL, DRY SURFACE |
| BRAKING | MAXIMUM |
| CONDITION LEVERS | HIGH IDLE |
| PROPELLER CONTROLS | FULL FORWARD |
| POWER LEVERS | MAXIMUM REVERSE AFTER TOUCHDOWN UNTIL FULLY STOPPED |

| WEIGHT ~ POUNDS | APPROACH SPEED ~ KNOTS |
|---|---|
| 10,950 | 108 |
| 10,000 | 108 |
| 9,000 | 105 |
| 8,000 | 103 |

EXAMPLE:

| | |
|---|---|
| OAT | 15°C |
| PRESSURE ALTITUDE | 5651 FT |
| LANDING WEIGHT | 10,015 LBS |
| HEADWIND COMPONENT | 10 KTS |
| GROUND ROLL | 1330 FT |
| TOTAL OVER 50-FT OBSTACLE | 2440 FT |
| APPROACH SPEED | 108 KTS |



# LANDING DISTANCE WITH PROPELLER REVERSING – FLAPS 0%

ASSOCIATED CONDITIONS

| | |
|---|---|
| POWER | RETARDED TO MAINTAIN 750 FT MIN ON FINAL APPROACH |
| FLAPS | 0% |
| RUNWAY | PAVED LEVEL, DRY SURFACE |
| BRAKING | MAXIMUM |
| CONDITION LEVERS | HIGH IDLE |
| PROPELLER CONTROLS | FULL FORWARD |
| POWER LEVERS | MAXIMUM REVERSE AFTER TOUCHDOWN UNTIL FULLY STOPPED |

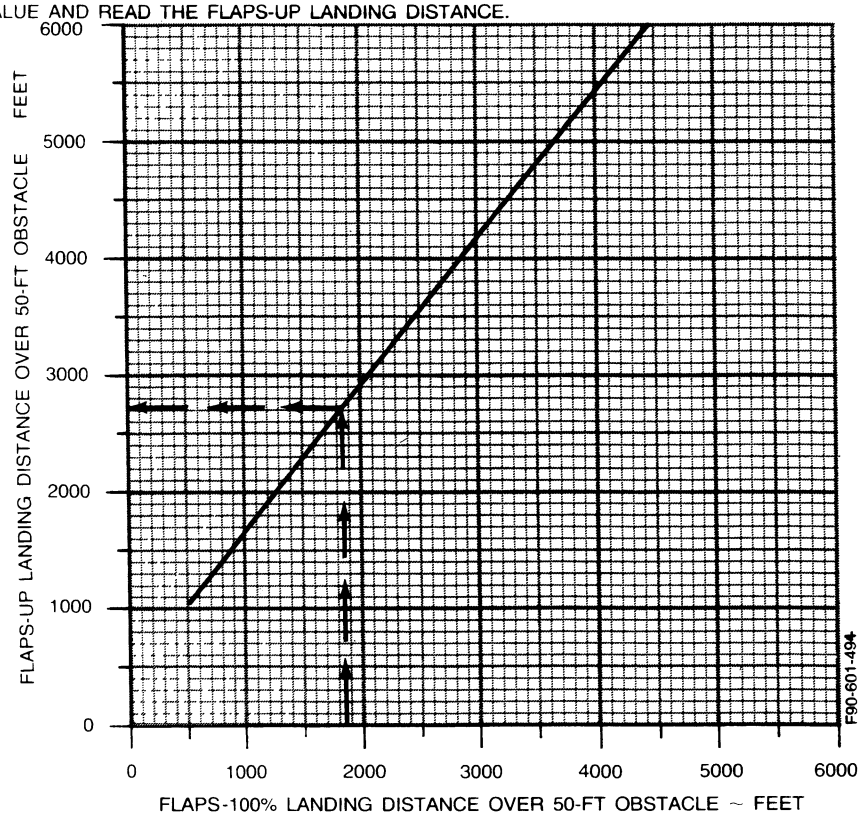
| WEIGHT POUNDS | APPROACH SPEED KNOTS |
|---|---|
| 10,950 | 127 |
| 10,000 | 122 |
| 9000 | 115 |
| 8000 | 108 |

EXAMPLE

| | |
|---|---|
| FLAPS - 100% LANDING DISTANCE OVER 50-FOOT OBSTACLE | 1850 FT |
| LANDING WEIGHT | 10,015 LBS |
| FLAPS-UP LANDING DISTANCE OVER 50-FOOT OBSTACLE | 2720 FT |
| APPROACH SPEED | 122 KTS |

NOTES: 1 LANDING WITH FLAPS FULL DOWN (100%) IS NORMAL PROCEDURE USE THIS GRAPH WHEN IT IS NECESSARY TO LAND WITH FLAPS UP (0%).

2 TO DETERMINE FLAPS-UP LANDING DISTANCE, READ FROM THE **LANDING DISTANCE WITH PROPELLER REVERSING – FLAPS 100%** GRAPH THE LANDING DISTANCE APPROPRIATE TO OAT, ALTITUDE, WEIGHT, WIND, AND 50-FT OBSTACLE, THEN ENTER THIS GRAPH WITH THE DERIVED VALUE AND READ THE FLAPS-UP LANDING DISTANCE.



# SECTION VI
## WEIGHT AND BALANCE/EQUIPMENT LIST

DATE ______________________
SERIAL ______________________
REGISTRATION NO. ______________

### TABLE OF CONTENTS

*SUBJECT* *PAGE*

## WEIGHING INSTRUCTIONS

Periodic weighing of the airplane may be required to keep the Basic Empty Weight current. Frequency of weighing is to be determined by the operator. All changes to the airplane affecting weight and/or balance are the responsibility of the airplane operator.

1. Airplane may be weighed on wheels or jack points. Three jack points are provided: one on the nose section of the fuselage at station 83.5, and one on each wing center section rear spar at station 195.5. Wheel reaction locations should be measured as described in paragraph 6 below.

2. Fuel should be drained preparatory to weighing. Tanks are drained from the regular drain ports with the airplane in static ground attitude. When tanks are drained, 9 pounds of unusable fuel remains in the airplane at an arm of 161 inches. The remainder of the unusuable fuel to be added to a drained system is 32 pounds at station 156. If the airplane is weighed with full fuel, the fuel specific weight (pounds/gallon) should be determined by using a hydrometer. Compute total fuel weight and moment using fuel tables.

3. Engine oil must be at the full level in each tank. Total engine oil aboard when both tanks are full is 58 pounds at an arm of 92 inches.

4. To determine airplane configuration at time of weighing, installed equipment is checked against the airplane equipment list or superseding forms. All equipment must be in its proper place during weighing.

5. The airplane is placed on the scales in level attitude. Leveling screws are located on the fuselage entrance door frame. Leveling is accomplished with a plumb bob. Jack pad leveling may require the nose gear shock to be secured in the static position to prevent its extension. Wheel weighings can be leveled by reducing the pressure in the shocks and/or tires.

6. Measurement of the reaction arms for a wheel weighing is made using the nose jacking point for a reference. Using a steel measuring tape, measurements are taken with the airplane level on the scales from the reference (a plumb bob hung from the center of the nose jacking point) to the axle center line of the nose gear and then from the nose gear axle center line to the main wheel axle center line. The main wheel axle center line is best located by stretching a string across from one main wheel to the other. All measurements are to be taken with the tape level with the hangar floor and parallel to the fuselage center line. The locations of the wheel reactions will be approximately at an arm of 179 inches for main wheels and 30 inches for the nose wheel.

7. The Basic Empty Weight and Moment are determined from the scale readings. Items weighed which are not part of the empty airplane are subtracted, i.e., usable fuel. Unusable fuel and engine oil are added if not already in the airplane.

8. Weighing shall always be made in an enclosed area which is free from air currents. The scales used should be properly calibrated and certified in accordance with the Bureau of Standards.

# BASIC EMPTY WEIGHT AND BALANCE

DATE: ____________

SERIAL NO: ____________

REGISTRATION NO: ____________

PREPARED BY: ____________

| STRUT POSITION | NOSE | MAIN |
|---|---|---|
| EXTENDED | 29.4 | 178.5 |
| COMPRESSED | 30.8 | 180.5 |

| JACK POINT LOCATION | |
|---|---|
| FORWARD | 83.5 |
| AFT | 195.5 |

| REACTION WHEEL - JACK POINTS | SCALE READING | TARE | NET WEIGHT | STATION OR ARM | MOMENT |
|---|---|---|---|---|---|
| LEFT MAIN | | | | | |
| RIGHT MAIN | | | | | |
| SUB TOTAL | | | | | |
| NOSE | | | | | |
| TOTAL (AS WEIGHED) | | | | | |

SPACE BELOW PROVIDED FOR ADDITIONS AND SUBTRACTIONS TO AS WEIGHED CONDITION

| | | | |
|---|---|---|---|
| | | | |
| EMPTY WEIGHT | | | |
| ENGINE OIL<br>UNUSABLE FUEL | 58<br>41 | 92<br>157 | 5336<br>6437 |
| BASIC EMPTY WEIGHT | | | |

F90-600-16

NOTE

Each new airplane is delivered with a completed sample loading, basic empty weight and center of gravity, and equipment list, all pertinent to that specific airplane. It is the owner's responsibility to ensure that changes in equipment are reflected in a new weight and balance and in an addendum to the equipment list. There are many ways of doing this; it is suggested that a running tally of equipment changes and their effect on basic empty weight and CG is a suitable means for meeting both requirements.

The current equipment list and basic empty weight and CG information must be retained with the airplane when it changes ownership. Beech Aircraft Corporation cannot maintain this information; the current status is known only to the owner. If these papers become lost, the FAA will require that the airplane be re-weighed to establish the basic empty weight and CG and that an inventory of installed equipment be conducted to create a new equipment list.

# WEIGHT AND BALANCE RECORD

SERIAL NO. ____________ REGISTRATION NO. ____________ PAGE NO. ____________

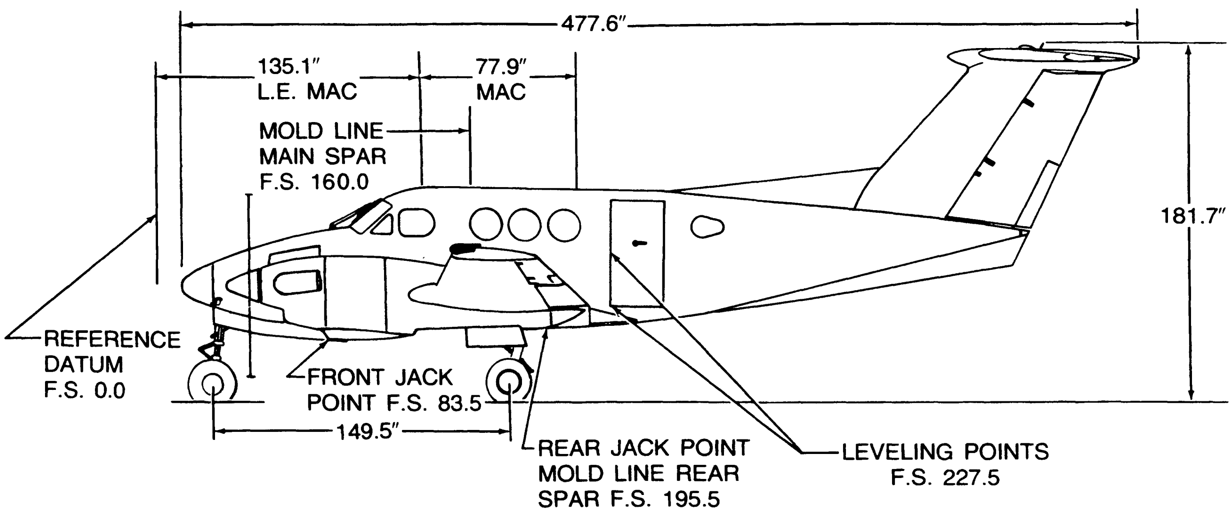
| DATE | ITEM NO. | | DESCRIPTION OF ARTICLE OR CHANGE | WEIGHT CHANGE ADDED(+) OR REMOVED(−) | | | RUNNING BASIC EMPTY WEIGHT | |
|---|---|---|---|---|---|---|---|---|
| | IN | OUT | | WT (LBS) | ARM (IN.) | MOM/100 | WT (LBS) | MOM/100 |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

# WEIGHT AND BALANCE RECORD

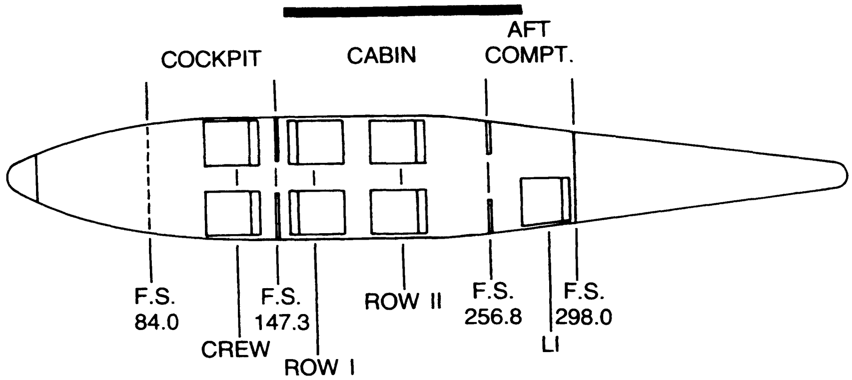
SERIAL NO. ______________ REGISTRATION NO. ______________ PAGE NO. ____________

| DATE | ITEM NO. | | DESCRIPTION OF ARTICLE OR CHANGE | WEIGHT CHANGE ADDED(+) OR REMOVED(−) | | | RUNNING BASIC EMPTY WEIGHT | |
|---|---|---|---|---|---|---|---|---|
| | IN | OUT | | WT (LBS) | ARM (IN.) | MOM/100 | WT (LBS) | MOM/100 |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

# DIMENSIONAL AND LOADING DATA




STANDARD SEATING



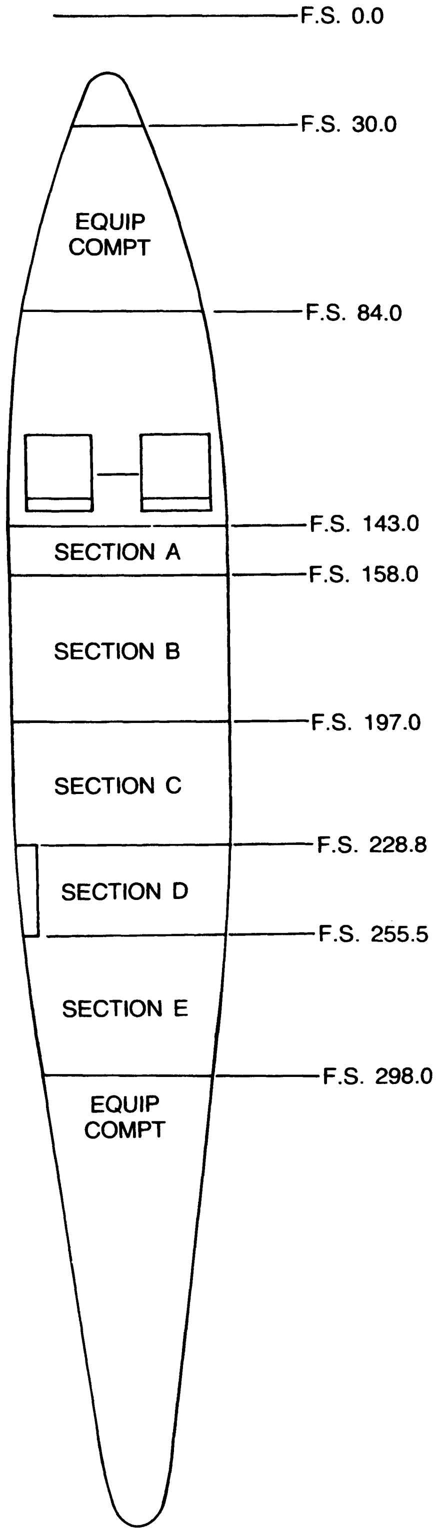

| OCCUPANT | CENTROID |
|---|---|
| COCKPIT | F.S. 129.0 |
| ROW I | F.S. 168.0 |
| ROW II | F.S. 212.0 |
| LI | F.S. 285.0 |

| STANDARD CONFIGURATION-AFT COMPT. | BAGGAGE CAPACITY | CENTROID |
|---|---|---|
| WITHOUT OCCUPANT | 380 LBS | F.S. 280.0 |
| WITH OCCUPANT | 380 LBS LESS WEIGHT OF OCCUPANT | |

NOTE: Loading data for Standard Configuration only. Cockpit and Cabin Seats are adjustable fore and aft on tracks. Occupant locations may vary from positions given. When the aft compartment seat is available for occupancy during flight, maximum weight of baggage shall be reduced by the occupant weight and/or equipment.

F90-603-466

# LOADING DATA
# CARGO CONFIGURATION



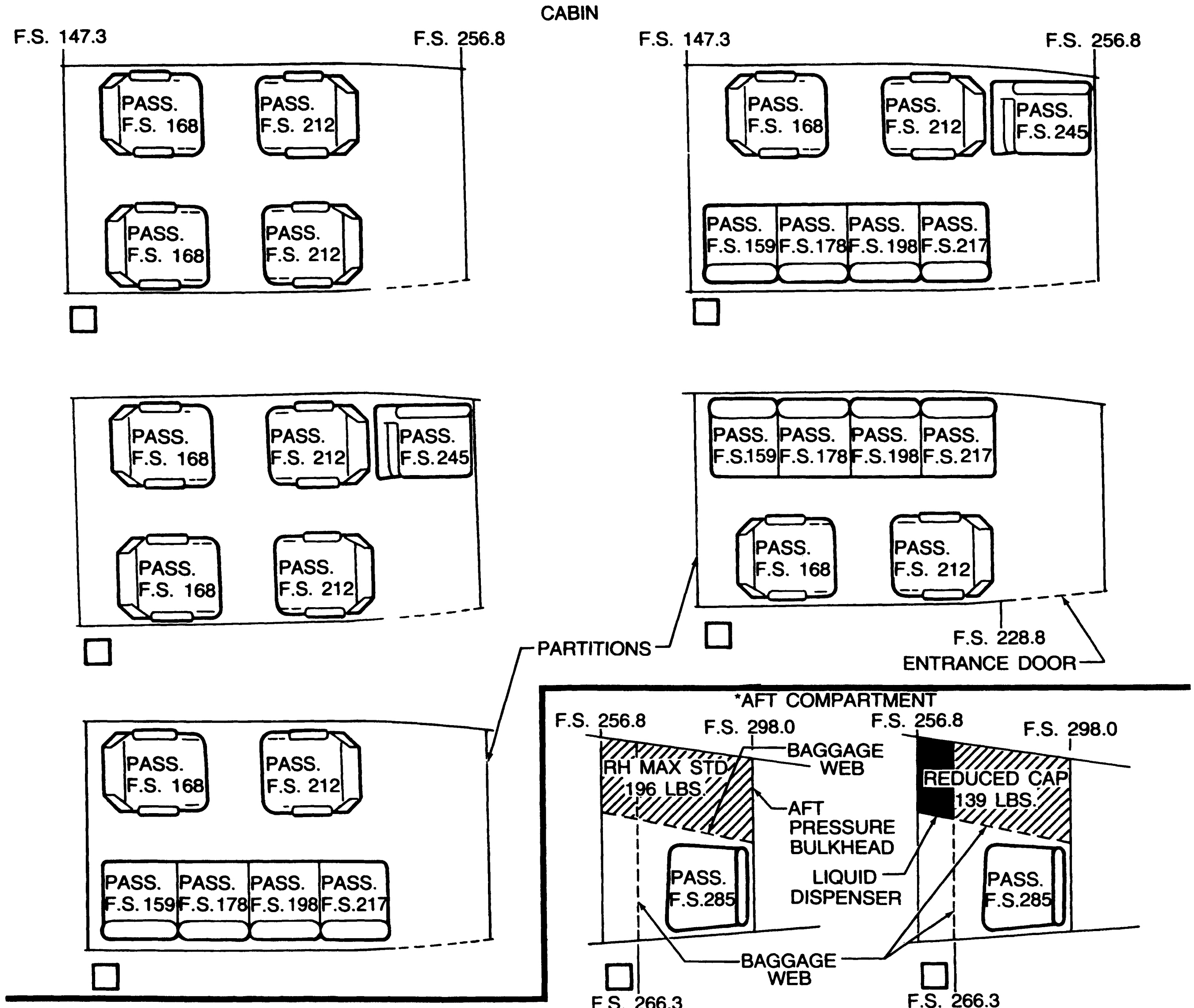

| SECTION | MAXIMUM | CENTROID ARM |
|---|---|---|
| A | 305 LBS | F.S. 153 |
| B | 1080 LBS | F.S. 177 |
| C | 895 LBS | F.S. 213 |
| D | 319 LBS | F.S. 244 |
| E | 403 LBS | F.S. 276 |

CARGO CAPACITY SHALL BE REDUCED FOR ANY EQUIPMENT AND/OR CARGO PROVISIONS.

CARGO SHALL BE SUPPORTED UPON AND TIED DOWN TO THE SEAT TRACKS. CARGO IN SECTION E SHALL BE RESTRAINED BY BAGGAGE WEBS AND/OR TIEDOWNS.

F90-603-465

# CABIN AND AFT COMPARTMENT ARRANGEMENT DIAGRAM




*CAUTION

MAXIMUM STRUCTURAL CAPACITY OF AFT COMPARTMENT IS 403 LBS. INCLUDING ANY COMBINATION OF PASSENGERS AND/OR BAGGAGE AND/OR EQUIPMENT. BAGGAGE CAPACITY IS REDUCED BY WEIGHT OF OTHER ITEMS LOCATED IN AFT COMPARTMENT.

EXAMPLE

| | TOTAL | LEFT | RIGHT |
|---|---|---|---|
| MAXIMUM STRUCTURAL CAPACITY | 403 | 207 | 196 |
| LESS STANDARD TOILET | -23 | -23 | - |
| STANDARD BAGGAGE CAPACITY | 380 | 184 | 196 |
| LESS: | | | |
| OPTIONAL TOILET | -14 | -14 | - |
| LIQUID DISPENSER (EMPTY) | -32 | - | -32 |
| LIQUID DISPENSER CONTENTS | -25 | - | -25 |
| BAGGAGE CAPACITY | 309 | 170 | 139 |

NOTES

The cabin seating may be arranged in different combinations. The diagrams marked ☒ above represent the seating arrangement established for this airplane prior to delivery. The passenger locations shown on the designated diagram are averages. Additional data for modified arrangements are noted.

F90-603-467

## USEFUL LOAD WEIGHTS AND MOMENTS

### OCCUPANTS*

| USE COLUMNS MARKED X → | CREW F.S. 129 | CLUB SEATING AFT FACING F.S. 168 | CLUB SEATING FWD FACING F.S. 212 | AISLE FACING STORAGE SEAT F.S. 245 | AFT COMPARTMENT SEAT F.S. 285 |
|---|---|---|---|---|---|
| | | | | | |
| WEIGHT | MOMENT/100 | | | | |
| 80 | 103 | 134 | 170 | 196 | 228 |
| 90 | 116 | 151 | 191 | 221 | 256 |
| 100 | 129 | 168 | 212 | 245 | 285 |
| 110 | 142 | 185 | 233 | 270 | 314 |
| 120 | 155 | 202 | 254 | 294 | 342 |
| 130 | 168 | 218 | 276 | 319 | 370 |
| 140 | 181 | 235 | 297 | 343 | 399 |
| 150 | 194 | 252 | 318 | 368 | 428 |
| 160 | 206 | 269 | 339 | 392 | 456 |
| 170 | 219 | 286 | 360 | 417 | 484 |
| 180 | 232 | 302 | 382 | 441 | 513 |
| 190 | 245 | 319 | 403 | 466 | |
| 200 | 258 | 336 | 424 | 490 | |
| 210 | 271 | 353 | 445 | 514 | |
| 220 | 284 | 370 | 466 | 539 | |
| 230 | 297 | 386 | 488 | 564 | |
| 240 | 310 | 403 | 509 | 588 | |

*Occupant centroids will vary according to seat position on the track and may differ from locations given.

## USEFUL LOAD WEIGHTS AND MOMENTS

### OCCUPANTS*

| USE COLUMNS MARKED X → | COUCH SEATING | | | |
|---|---|---|---|---|
| | F.S. 159 | F.S. 178 | F.S. 198 | F.S. 217 |
| | | | | |
| WEIGHT | MOMENT/100 | | | |
| 80 | 127 | 142 | 158 | 174 |
| 90 | 143 | 160 | 178 | 195 |
| 100 | 159 | 178 | 198 | 217 |
| 110 | 175 | 196 | 218 | 239 |
| 120 | 191 | 214 | 238 | 260 |
| 130 | 207 | 231 | 257 | 282 |
| 140 | 223 | 249 | 277 | 304 |
| 150 | 239 | 267 | 297 | 326 |
| 160 | 254 | 285 | 317 | 347 |
| 170 | 270 | 303 | 337 | 369 |
| 180 | 286 | 320 | 356 | 391 |
| 190 | 302 | 338 | 376 | 412 |
| 200 | 318 | 356 | 396 | 434 |
| 210 | 334 | 374 | 416 | 456 |
| 220 | 350 | 392 | 436 | 477 |
| 230 | 366 | 409 | 455 | 499 |
| 240 | 382 | 427 | 475 | 521 |

*Occupant centroids will vary according to seat position on the track and may differ from locations given.

### CABINET CONTENTS

| WEIGHT | CABIN | | | AFT COMPT. |
|---|---|---|---|---|
| | F.S. 150 | F.S. 244 | F.S. 250 | F.S. 262 |
| | MOMENT/100 | | | |
| 5 | 8 | 12 | 13 | 13 |
| 10 | 15 | 24 | 25 | 26 |
| 15 | 23 | 37 | 38 | 39 |
| 20 | 30 | 49 | 50 | 52 |
| 25 | 38 | 61 | 63 | 66 |
| 30 | 45 | 73 | 75 | |
| 35 | 53 | 85 | 88 | |
| 40 | 60 | 98 | 100 | |
| 45 | 68 | 110 | 113 | |
| 50 | 75 | 122 | 125 | |

NOTE: Weight and Moment/100 of Cabinet Contents must be included in all loading computations.

# USEFUL LOAD WEIGHTS AND MOMENTS

## BAGGAGE*
### AFT COMPARTMENT (F.S. 256.8 to F.S. 298.0)

The maximum baggage and passenger weight is dependent on how much equipment and operational items (i.e. coffee, water, etc.) are located in the aft compartment. The maximum structural capacity of 403 pounds is reduced by items installed in the partition or anywhere between the partition (F.S. 256.8) and the aft bulkhead (F.S. 298.0). The maximum capacity is reduced to 380 pounds by the passenger accommodations/chemical toilet installation. When the lateral baggage web is used (no passenger occupancy), baggage should be distributed over the entire aft compartment area. When the longitudinal baggage web is used to allow for passenger occupancy, the baggage should all be placed on the right side of the aft compartment and is limited to a maximum of 196 pounds.

| WEIGHT | TOTAL COMPARTMENT BAGGAGE | LEFT SIDE ONLY PASSENGER | RIGHT SIDE ONLY BAGGAGE | |
|---|---|---|---|---|
| | F.S. 280 | F.S. 285 | F.S. 275 | F.S. 280 |
| | MOMENT/100 | | | |
| 25 | 70 | 71 | 69 | 70 |
| 50 | 140 | 143 | 138 | 140 |
| 75 | 210 | 214 | 206 | 210 |
| 100 | 280 | 285 | 275 | 280 |
| 125 | 350 | 356 | 344 | 350 |
| 139 | 389 | 396 | 382 | 389 |
| 150 | 420 | 428 | 413 | |
| 170 | 476 | 485 | 468 | |
| *184 | 515 | 524 | 506 | |
| *196 | 549 | | 539 | |
| 207 | 580 | | | |
| 225 | 630 | | | |
| 250 | 700 | | | |
| 275 | 770 | | | |
| 300 | 840 | | | |
| 309 | 865 | | | |
| 325 | 910 | | | |
| 350 | 980 | | | |
| 375 | 1050 | | | |
| *380 | 1064 | | | |

Baggage shall be restrained by use of baggage webs and/or tie-downs.

*See CAUTION and example of reduced capacities of aft compartment on CABIN AND AFT COMPARTMENT ARRANGEMENT DIAGRAM.

## USEFUL LOAD WEIGHTS AND MOMENTS

### CARGO COMPARTMENT *

| WEIGHT | A<br>F.S. 143.0 - 158.0 | B<br>F.S. 158.0 - 197.0 | C<br>F.S. 197.0 - 228.8 | D<br>F.S. 228.8 - 255.5 | E<br>F.S. 255.5 - 298.0 |
|---|---|---|---|---|---|
| | CENTROID | | | | |
| | F.S. 153 | F.S. 177 | F.S. 213 | F.S. 244 | F.S. 276 |
| | MOMENT/100 | | | | |
| 10 | 15 | 18 | 21 | 24 | 28 |
| 20 | 31 | 35 | 43 | 49 | 55 |
| 30 | 46 | 53 | 64 | 73 | 83 |
| 40 | 61 | 71 | 85 | 98 | 110 |
| 50 | 77 | 89 | 107 | 122 | 138 |
| 60 | 92 | 106 | 128 | 146 | 166 |
| 70 | 107 | 124 | 149 | 171 | 193 |
| 80 | 122 | 142 | 170 | 195 | 221 |
| 90 | 138 | 159 | 192 | 220 | 248 |
| 100 | 153 | 177 | 213 | 244 | 276 |
| 200 | 306 | 354 | 426 | 488 | 552 |
| 300 | 459 | 531 | 639 | 732 | 828 |
| 305 | 467 | 540 | 650 | 744 | 842 |
| 319 | | 565 | 679 | 778 | 880 |
| 400 | | 708 | 852 | | 1104 |
| 403 | | 713 | 858 | | 1112 |
| 500 | | 885 | 1065 | | |
| 600 | | 1062 | 1278 | | |
| 700 | | 1239 | 1491 | | |
| 800 | | 1416 | 1704 | | |
| 895 | | 1584 | 1906 | | |
| 900 | | 1593 | | | |
| 1000 | | 1770 | | | |
| 1080 | | 1912 | | | |

* Refer to LOADING DATA CARGO CONFIGURATION.

*NOTE: All Cargo shall be supported by the seat tracks in a uniform distribution and tied down to the tracks by an FAA approved method. Maximum cargo of 403 pounds in Section E is reduced for the chemical toilet, liquid containers or any other item installed in the aft compartment.*

## USEFUL LOAD WEIGHTS AND MOMENTS

### USABLE FUEL

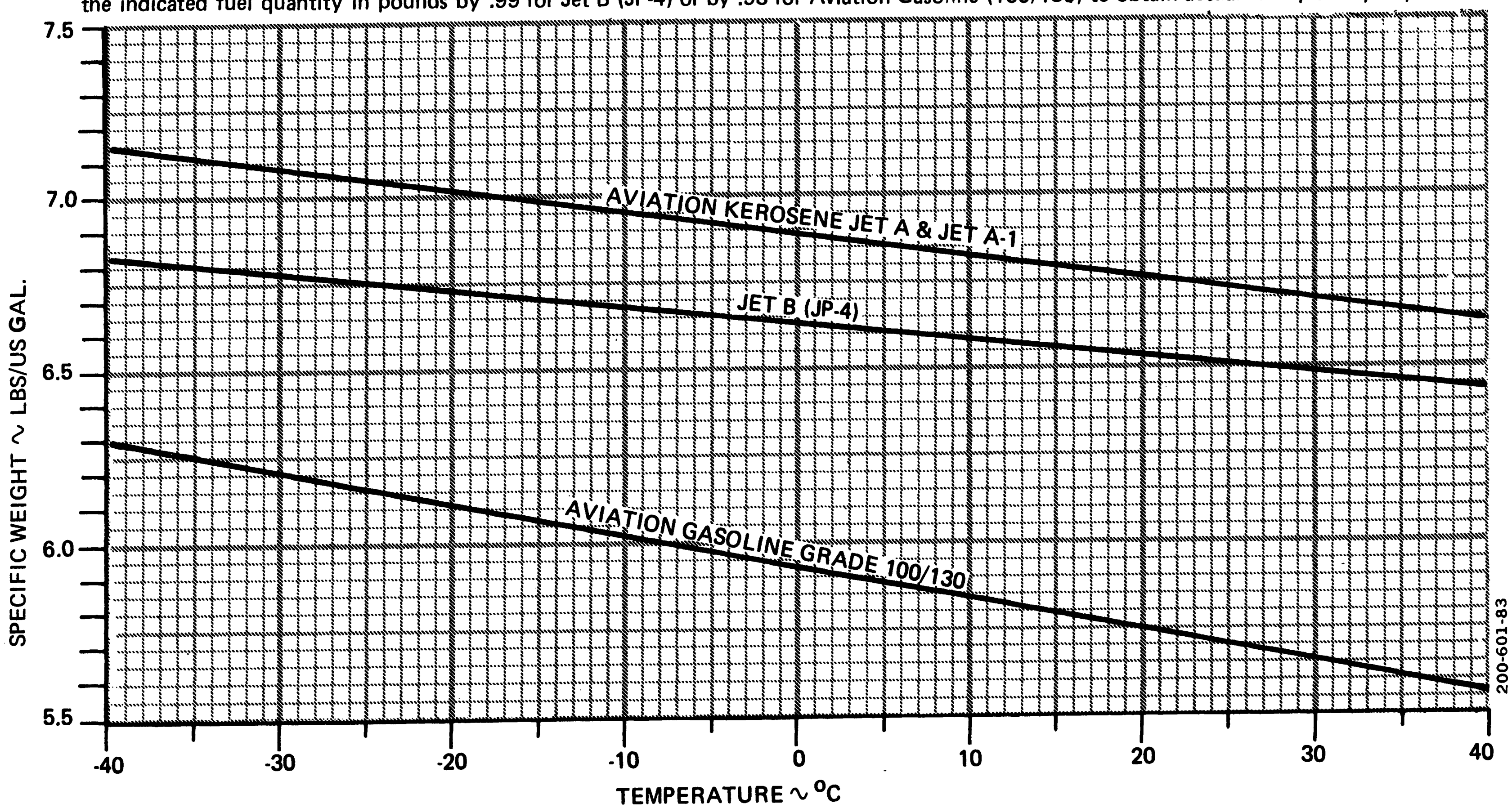
| GALLONS | 6.4 LB/GAL. WEIGHT | 6.4 LB/GAL. MOMENT/100 | 6.5 LB/GAL. WEIGHT | 6.5 LB/GAL. MOMENT/100 | 6.6 LB/GAL. WEIGHT | 6.6 LB/GAL. MOMENT/100 | 6.7 LB/GAL. WEIGHT | 6.7 LB/GAL. MOMENT/100 |
|---|---|---|---|---|---|---|---|---|
| 10 | 64 | 79 | 65 | 80 | 60 | 82 | 67 | 83 |
| 20 | 128 | 159 | 130 | 162 | 132 | 164 | 134 | 167 |
| 30 | 192 | 239 | 195 | 243 | 198 | 247 | 201 | 251 |
| 40 | 256 | 335 | 260 | 341 | 264 | 346 | 268 | 351 |
| 50 | 320 | 432 | 325 | 439 | 330 | 445 | 335 | 452 |
| 60 | 384 | 529 | 390 | 537 | 396 | 546 | 402 | 554 |
| 70 | 448 | 628 | 455 | 637 | 462 | 647 | 469 | 657 |
| 80 | 512 | 727 | 520 | 738 | 528 | 750 | 536 | 761 |
| 90 | 576 | 826 | 585 | 839 | 594 | 852 | 603 | 865 |
| 100 | 640 | 927 | 650 | 941 | 660 | 956 | 670 | 970 |
| 110 | 704 | 1027 | 715 | 1043 | 726 | 1059 | 737 | 1075 |
| 120 | 768 | 1128 | 780 | 1146 | 792 | 1163 | 804 | 1181 |
| 130 | 832 | 1229 | 845 | 1248 | 858 | 1267 | 871 | 1286 |
| 140 | 896 | 1329 | 910 | 1350 | 924 | 1370 | 938 | 1391 |
| 150 | 960 | 1430 | 975 | 1453 | 990 | 1475 | 1005 | 1497 |
| 160 | 1024 | 1529 | 1040 | 1553 | 1056 | 1577 | 1072 | 1600 |
| 170 | 1088 | 1630 | 1105 | 1655 | 1122 | 1681 | 1139 | 1706 |
| 180 | 1152 | 1728 | 1170 | 1755 | 1188 | 1782 | 1206 | 1809 |
| 190 | 1216 | 1828 | 1235 | 1856 | 1254 | 1885 | 1273 | 1913 |
| 200 | 1280 | 1926 | 1300 | 1957 | 1320 | 1987 | 1340 | 2017 |
| 210 | 1344 | 2027 | 1365 | 2058 | 1386 | 2090 | 1407 | 2122 |
| 220 | 1408 | 2125 | 1430 | 2158 | 1452 | 2191 | 1474 | 2224 |
| 230 | 1472 | 2223 | 1495 | 2257 | 1518 | 2292 | 1541 | 2327 |
| 240 | 1536 | 2321 | 1560 | 2357 | 1584 | 2393 | 1608 | 2430 |
| 250 | 1600 | 2419 | 1625 | 2457 | 1650 | 2495 | 1675 | 2533 |
| 260 | 1664 | 2516 | 1690 | 2555 | 1716 | 2595 | 1742 | 2634 |
| 270 | 1728 | 2614 | 1755 | 2655 | 1782 | 2696 | 1809 | 2737 |
| 280 | 1792 | 2713 | 1820 | 2755 | 1848 | 2798 | 1876 | 2840 |
| 290 | 1856 | 2812 | 1885 | 2856 | 1914 | 2900 | 1943 | 2944 |
| 300 | 1920 | 2911 | 1950 | 2956 | 1980 | 3002 | 2010 | 3047 |
| 310 | 1984 | 3012 | 2015 | 3059 | 2046 | 3106 | 2077 | 3153 |
| 320 | 2048 | 3113 | 2080 | 3162 | 2112 | 3210 | 2144 | 3259 |
| 330 | 2112 | 3217 | 2145 | 3267 | 2178 | 3317 | 2211 | 3367 |
| 340 | 2176 | 3321 | 2210 | 3372 | 2244 | 3424 | 2278 | 3476 |
| 350 | 2240 | 3425 | 2275 | 3478 | 2310 | 3532 | 2345 | 3586 |
| 360 | 2304 | 3530 | 2340 | 3585 | 2376 | 3640 | 2412 | 3695 |
| 370 | 2368 | 3635 | 2405 | 3692 | 2442 | 3748 | 2479 | 3805 |
| 380 | 2432 | 3740 | 2470 | 3799 | 2508 | 3857 | 2546 | 3916 |
| 388 | 2483 | 3827 | 2522 | 3886 | 2561 | 3946 | 2600 | 4006 |
| 400 | 2560 | 3958 | 2600 | 4020 | 2640 | 4081 | 2680 | 4143 |
| 410 | 2624 | 4067 | 2665 | 4131 | 2706 | 4194 | 2747 | 4258 |
| 420 | 2688 | 4177 | 2730 | 4242 | 2772 | 4308 | 2814 | 4373 |
| 430 | 2752 | 4288 | 2795 | 4355 | 2838 | 4422 | 2881 | 4489 |
| 440 | 2816 | 4399 | 2860 | 4467 | 2904 | 4536 | 2948 | 4605 |
| 450 | 2880 | 4510 | 2925 | 4581 | 2970 | 4651 | 3015 | 4721 |
| 460 | 2944 | 4622 | 2990 | 4694 | 3036 | 4767 | 3082 | 4839 |
| 470 | 3008 | 4735 | 3055 | 4809 | 3102 | 4883 | 3149 | 4957 |

# DENSITY VARIATION OF AVIATION FUEL

## BASED ON AVERAGE SPECIFIC GRAVITY

| FUEL | AVERAGE SPECIFIC GRAVITY AT 15°C (59°F) |
|---|---|
| AVIATION KEROSENE JET A AND JET A1 | .812 |
| JET B (JP-4) | .785 |
| AV GAS GRADE 100/130 | .703 |

NOTE: The Fuel Quantity Indicator is calibrated for correct indication when using Aviation Kerosene Jet A and Jet A1. When using other fuels, multiply the indicated fuel quantity in pounds by .99 for Jet B (JP-4) or by .98 for Aviation Gasoline (100/130) to obtain actual fuel quantity in pounds.



## LOADING INSTRUCTIONS

It is the responsibility of the airplane operator to ensure that the airplane is properly loaded. At the time of delivery, Beech Aircraft Corporation provides the necessary weight and balance data to compute individual loadings. All subsequent changes in airplane weight and balance are the responsibility of the airplane owner and/or operator. Basic empty weight changes should be itemized on the Basic Empty Weight and Balance Record form to provide a current basic empty weight and moment. The basic empty weight and moment of the airplane at the time of delivery are shown on the Basic Empty Weight and Balance form. Useful load items which may be loaded into the airplane are shown on the Useful Load Weight and Moment tables. The FAA approved minimum and maximum moments are shown on the Moments Limits vs. Weight graph or table. These moments correspond to the forward and aft center of gravity flight limits (landing gear down) for a particular weight. All moments are divided by 100 to simplify computations.

## COMPUTING PROCEDURE

(Use the Weight and Balance Loading form.)

### BASIC EMPTY CONDITION

Reference 1. Record the current basic empty weight and moment/100 from the Basic Empty Weight and Balance form (or from the latest superseding forms). The moment must be divided by 100 to correspond to useful load moments.

### PILOT, PASSENGERS OR CARGO, BAGGAGE & CABINET CONTENTS

Reference 2.
3.
4.
5.
Record the weight and corresponding moment of each item to be carried. The moment values are determined from the Useful Load Weights and Moments tables or by multiplication of weight times arm. Interpolate the weight and moment/100 of useful load items that are between the values given.

### ZERO FUEL CONDITION

Reference 6. Subtotal the weight column and moment/100 column. The total weight without usable fuel must not exceed the Maximum Zero Fuel Weight limitation of 9600 pounds. All weight in excess of this limitation must be fuel.

### FUEL LOADING

Reference 7. Using Useful Load Weights and Moments - Usable Fuel table, determine the weight and corresponding moment of fuel to be on board at engine start up. The auxiliary tanks may be used only when the main tanks are completely filled. A Density Variation of Aviation Fuel graph is provided to assist in determining the specific weight of fuel. For specific weights between those provided in the tables, interpolate between specific weight columns after first determining the number of gallons on board.

### RAMP CONDITION

Reference 8. Subtotal the weight column and moment/100 column. The total ramp weight must not exceed 11,030 pounds and the total moment/100 must be within the minimum and maximum moments/100 shown on the Moment Limits vs. Weight table or graph.

### START, TAXI AND TAKE-OFF FUEL

Reference 9. Determine fuel to be used for start, taxi and the take-off run. It is normally 80 pounds at an average moment/100 of 141.

## TAKE-OFF CONDITION

Reference 10. Subtotal the weight column and moment/100 column. The total take-off weight must not exceed 10,950 pounds and the total moment/100 must be within the minimum and maximum moments/100 shown on the Moment Limits vs. Weight table or graph.

## LANDING CONDITION

Reference 11.
12. Determine the amount of fuel to be used to arrive at the destination. The moment/100 of the fuel used is determined by subtracting from the moment/100 for fuel in Reference 7, the moment/100 from the table for the fuel remaining in the tanks on landing. Example:

| | Volume | Weight | Mom/100 |
|---|---|---|---|
| Fuel load before flight | 470 Gal | 3149 lb | 4957 lb-in. |
| Fuel load after flight | -200 Gal | -1340 lb | -2017 lb-in. |
| Fuel to be used | 270 Gal | 1809 lb | 2940 lb-in. |

For landing condition weight and balance, subtract the weight and moment of fuel to be used in flight from the take-off weight and moment. The landing moment must be within the minimum and maximum moments shown on the Moment Limits vs Weight table or graph for that weight. If the total moment is less than the minimum moment allowed, useful load items must be shifted aft or forward load items reduced. If the total moment is greater than the maximum moment allowed, useful load items must be shifted forward or aft load items reduced. If the quantity or location of load items is changed, the calculations must be revised and the moments rechecked.

INTENTIONALLY LEFT BLANK

Beechcraft® SUPER KING AIR F90

# WEIGHT AND BALANCE LOADING FORM

| SERIAL NO: | REGISTRATION NO: | DATE: |
|---|---|---|

| PAYLOAD COMPUTATIONS | | |
|---|---|---|
| ITEM<br>PASSENGERS OR CARGO<br>NO. LOCATION (ROW, F.S., ETC) | WEIGHT | MOM/100 |
| | | |
| TOTAL PASSENGERS OR CARGO | | |

| REF | ITEM | WEIGHT | MOM/100 |
|---|---|---|---|
| 1 | BASIC EMPTY COND. | | |
| 2 | PILOT | | |
| 3 | PASSENGERS OR CARGO | | |
| 4 | BAGGAGE | | |
| 5 | CABINET CONTENTS | | |
| 6 | SUB TOTAL<br>ZERO FUEL COND. DO NOT EXCEED 9600 LBS | | |
| 7 | FUEL LOADING | | |
| 8 | SUB TOTAL<br>RAMP CONDITION | | |
| 9 | *LESS FUEL FOR START, TAXI, AND TAKE OFF | | |
| 10 | SUB TOTAL<br>TAKE OFF CONDITION | | |
| 11 | LESS FUEL TO DESTINATION | | |
| 12 | LANDING CONDITION | | |

*Fuel for start, taxi and take-off is normally 80 lbs at an average moment/100 of 141.

F90-601-524

# Beechcraft® SUPER KING AIR F90

# WEIGHT AND BALANCE LOADING FORM

| SERIAL NO: | REGISTRATION NO: | DATE: |
|---|---|---|

| PAYLOAD COMPUTATIONS | | |
|---|---|---|
| ITEM<br>PASSENGERS OR CARGO<br>NO. LOCATION (ROW, F.S., ETC) | WEIGHT | MOM/100 |
| | | |
| TOTAL PASSENGERS OR CARGO | | |

| REF | ITEM | WEIGHT | MOM/100 |
|---|---|---|---|
| 1 | BASIC EMPTY COND. | | |
| 2 | PILOT | | |
| 3 | PASSENGERS OR CARGO | | |
| 4 | BAGGAGE | | |
| 5 | CABINET CONTENTS | | |
| 6 | SUB TOTAL<br>ZERO FUEL COND. DO NOT EXCEED 9600 LBS | | |
| 7 | FUEL LOADING | | |
| 8 | SUB TOTAL<br>RAMP CONDITION | | |
| 9 | *LESS FUEL FOR START, TAXI, AND TAKE OFF | | |
| 10 | SUB TOTAL<br>TAKE OFF CONDITION | | |
| 11 | LESS FUEL TO DESTINATION | | |
| 12 | LANDING CONDITION | | |

F90-601-524

*Fuel for start, taxi and take-off is normally 80 lbs at an average moment/100 of 141.

# Beechcraft® SUPER KING AIR F90

# WEIGHT AND BALANCE LOADING FORM

| SERIAL NO: | REGISTRATION NO: | DATE: |
|---|---|---|

| PAYLOAD COMPUTATIONS | | |
|---|---|---|
| **ITEM** PASSENGERS OR CARGO / NO. LOCATION (ROW, F.S., ETC) | **WEIGHT** | **MOM/100** |
| | | |
| **TOTAL PASSENGERS OR CARGO** | | |

| REF | ITEM | WEIGHT | MOM/100 |
|---|---|---|---|
| 1 | BASIC EMPTY COND. | | |
| 2 | PILOT | | |
| 3 | PASSENGERS OR CARGO | | |
| 4 | BAGGAGE | | |
| 5 | CABINET CONTENTS | | |
| 6 | **SUB TOTAL** ZERO FUEL COND. DO NOT EXCEED 9600 LBS | | |
| 7 | FUEL LOADING | | |
| 8 | **SUB TOTAL** RAMP CONDITION | | |
| 9 | *LESS FUEL FOR START, TAXI, AND TAKE OFF | | |
| 10 | **SUB TOTAL** TAKE OFF CONDITION | | |
| 11 | LESS FUEL TO DESTINATION | | |
| 12 | LANDING CONDITION | | |

F90-601-524

*Fuel for start, taxi and take-off is normally 80 lbs at an average moment/100 of 141.

# Beechcraft® SUPER KING AIR F90

# WEIGHT AND BALANCE LOADING FORM

| SERIAL NO: | REGISTRATION NO: | DATE: |
|---|---|---|

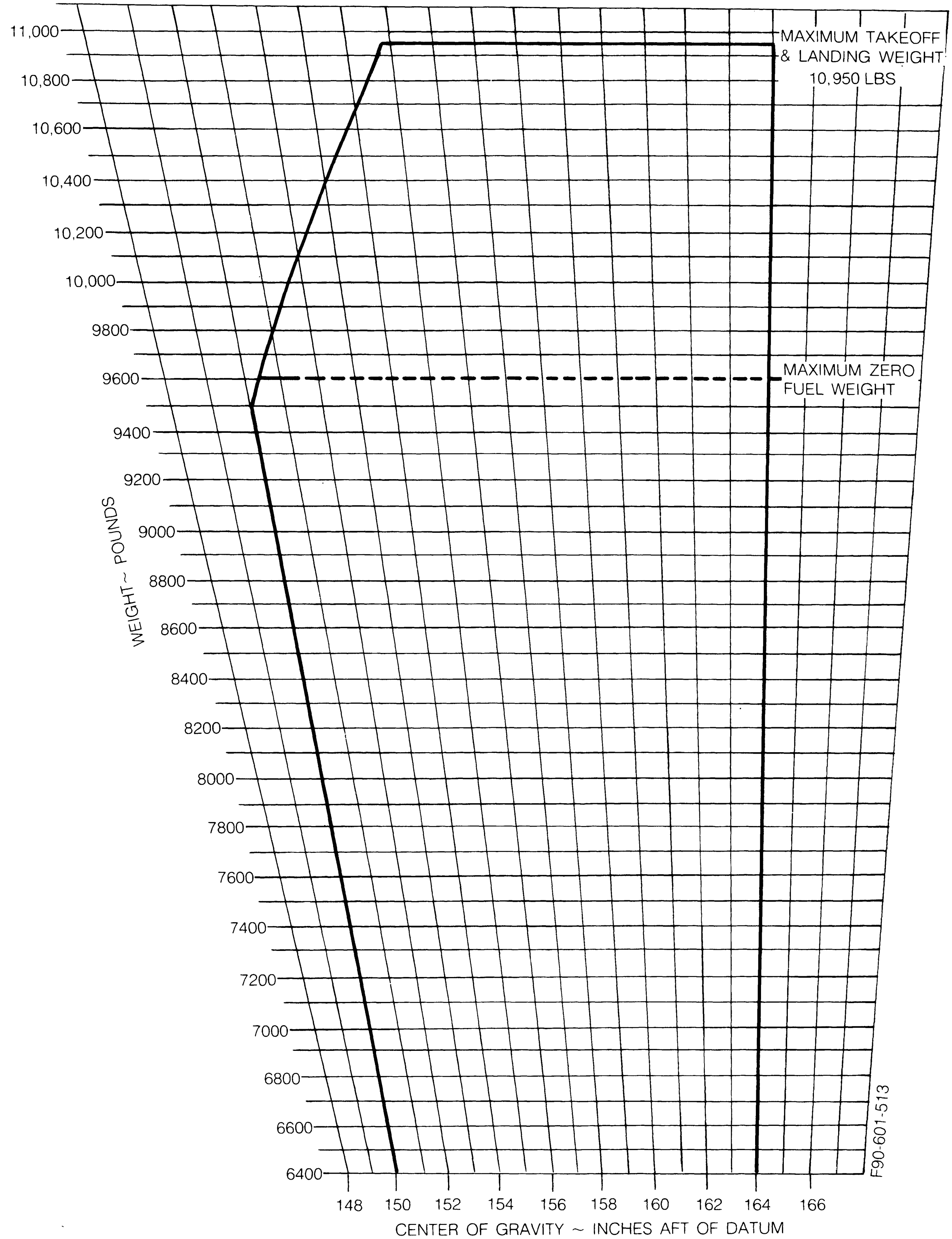
| PAYLOAD COMPUTATIONS | | |
|---|---|---|
| ITEM<br>PASSENGERS OR CARGO<br>NO. LOCATION (ROW, F.S., ETC) | WEIGHT | MOM/100 |
| | | |
| TOTAL PASSENGERS OR CARGO | | |

| REF | ITEM | WEIGHT | MOM/100 |
|---|---|---|---|
| 1 | BASIC EMPTY COND. | | |
| 2 | PILOT | | |
| 3 | PASSENGERS OR CARGO | | |
| 4 | BAGGAGE | | |
| 5 | CABINET CONTENTS | | |
| 6 | SUB TOTAL<br>ZERO FUEL COND. DO NOT EXCEED 9600 LBS | | |
| 7 | FUEL LOADING | | |
| 8 | SUB TOTAL<br>RAMP CONDITION | | |
| 9 | *LESS FUEL FOR START, TAXI, AND TAKE OFF | | |
| 10 | SUB TOTAL<br>TAKE OFF CONDITION | | |
| 11 | LESS FUEL TO DESTINATION | | |
| 12 | LANDING CONDITION | | |

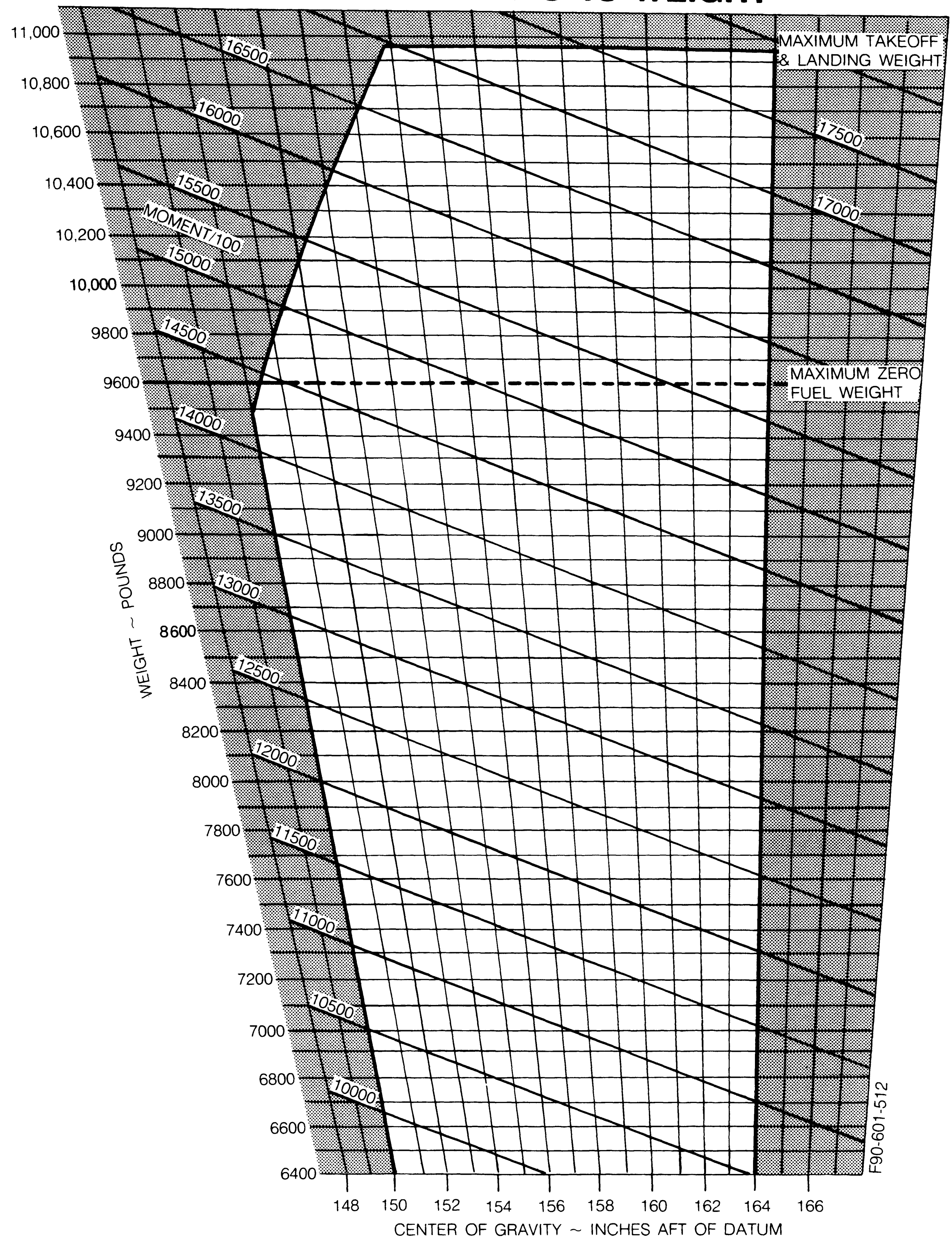
F90-601-524

*Fuel for start, taxi and take-off is normally 80 lbs at an average moment/100 of 141.

# WEIGHT AND BALANCE DIAGRAM



# MOMENT LIMITS vs WEIGHT



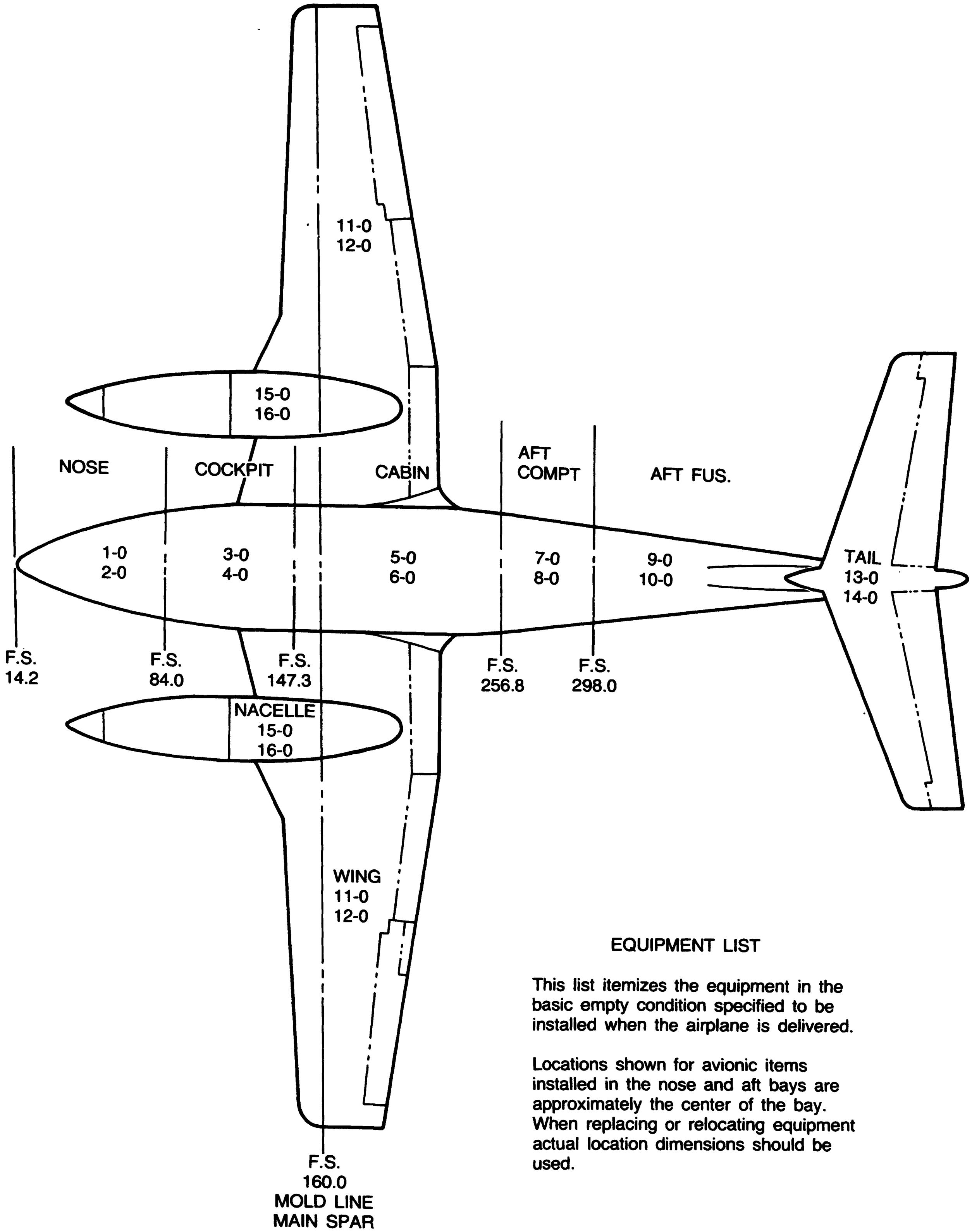
## MOMENT LIMITS VS. WEIGHT

| WEIGHT | MINIMUM MOMENT/100 | MAXIMUM MOMENT/100 | | WEIGHT | MINIMUM MOMENT/100 | MAXIMUM MOMENT/100 |
|---|---|---|---|---|---|---|
| 6400 | 9600 | 10496 | | 8700 | 13050 | 14268 |
| 6450 | 9675 | 10578 | | 8750 | 13125 | 14350 |
| 6500 | 9750 | 10660 | | 8800 | 13200 | 14432 |
| 6550 | 9825 | 10742 | | 8850 | 13275 | 14514 |
| 6600 | 9900 | 10824 | | 8900 | 13350 | 14596 |
| 6650 | 9975 | 10906 | | 8950 | 13425 | 14678 |
| 6700 | 10050 | 10988 | | 9000 | 13500 | 14760 |
| 6750 | 10125 | 11070 | | 9050 | 13575 | 14842 |
| 6800 | 10200 | 11152 | | 9100 | 13650 | 14924 |
| 6850 | 10275 | 11234 | | 9150 | 13725 | 15006 |
| 6900 | 10350 | 11316 | | 9200 | 13800 | 15088 |
| 6950 | 10425 | 11398 | | 9250 | 13875 | 15170 |
| 7000 | 10500 | 11480 | | 9300 | 13950 | 15252 |
| 7050 | 10575 | 11562 | | 9350 | 14025 | 15334 |
| 7100 | 10650 | 11644 | | 9400 | 14100 | 15416 |
| 7150 | 10725 | 11726 | | 9450 | 14175 | 15498 |
| 7200 | 10800 | 11808 | | 9500 | 14255 | 15580 |
| 7250 | 10875 | 11890 | MAX | 9550 | 14346 | 15662 |
| 7300 | 10950 | 11972 | ZERO | 9600 | 14436 | 15744 |
| 7350 | 11025 | 12054 | FUEL | 9650 | 14527 | 15826 |
| 7400 | 11100 | 12136 | WEIGHT | 9700 | 14619 | 15908 |
| 7450 | 11175 | 12218 | | 9750 | 14710 | 15990 |
| 7500 | 11250 | 12300 | | 9800 | 14801 | 16072 |
| 7550 | 11325 | 12382 | | 9850 | 14893 | 16154 |
| 7600 | 11400 | 12464 | | 9900 | 14985 | 16236 |
| 7650 | 11475 | 12546 | | 9950 | 15077 | 16318 |
| 7700 | 11550 | 12628 | | 10000 | 15169 | 16400 |
| 7750 | 11625 | 12710 | | 10050 | 15261 | 16482 |
| 7800 | 11700 | 12792 | | 10100 | 15354 | 16564 |
| 7850 | 11775 | 12874 | | 10150 | 15446 | 16646 |
| 7900 | 11850 | 12956 | | 10200 | 15539 | 16728 |
| 7950 | 11925 | 13038 | | 10250 | 15632 | 16810 |
| 8000 | 12000 | 13120 | | 10300 | 15725 | 16892 |
| 8050 | 12075 | 13202 | | 10350 | 15818 | 16974 |
| 8100 | 12150 | 13284 | | 10400 | 15912 | 17056 |
| 8150 | 12225 | 13366 | | 10450 | 16006 | 17138 |
| 8200 | 12300 | 13448 | | 10500 | 16099 | 17220 |
| 8250 | 12375 | 13530 | | 10550 | 16193 | 17302 |
| 8300 | 12450 | 13612 | | 10600 | 16287 | 17384 |
| 8350 | 12525 | 13694 | | 10650 | 16382 | 17466 |
| 8400 | 12600 | 13776 | | 10700 | 16476 | 17548 |
| 8450 | 12675 | 13858 | | 10750 | 16571 | 17630 |
| 8500 | 12750 | 13940 | | 10800 | 16665 | 17712 |
| 8550 | 12825 | 14022 | | 10850 | 16760 | 17794 |
| 8600 | 12900 | 14104 | | 10900 | 16855 | 17876 |
| 8650 | 12975 | 14186 | | 10950 | 16951 | 17958 |

## CENTER OF GRAVITY LIMITS (LANDING GEAR DOWN)

| WEIGHT CONDITION | FORWARD CG LIMIT | AFT CG LIMIT |
|---|---|---|
| 10,950 LBS (MAX TAKE-OFF OR LANDING) | 154.8 | 164.0 |
| 9,484 LBS OR LESS | 150.0 | 164.0 |

# EQUIPMENT ITEM NUMBER LOCATION DIAGRAM




EQUIPMENT LIST

This list itemizes the equipment in the basic empty condition specified to be installed when the airplane is delivered.

Locations shown for avionic items installed in the nose and aft bays are approximately the center of the bay. When replacing or relocating equipment actual location dimensions should be used.

F90-603-468

# SECTION VII

## SYSTEMS DESCRIPTIONS

### TABLE OF CONTENTS

INTENTIONALLY LEFT BLANK

## AIRFRAME

### STRUCTURE

The Beechcraft Super King Air F90 is an all-metal, low-wing monoplane. It utilizes fully cantilevered wings, and a T-tail empennage.

### SEATING ARRANGEMENTS

The pilot and copilot seats are mounted in a separate forward compartment. Various configurations of passenger chairs and a four-place couch installation may be installed on the continuous tracks mounted on the cabin floor. An aisle-facing storage seat may be installed in the aft cabin area. The toilet is also equipped for use as a seat. Seating for up to 10 persons, including crew, is available. For additional information, refer to the "Cabin and Aft Compartment Arrangement Diagram" in Section VI, WEIGHT AND BALANCE/ EQUIPMENT LIST.

## FLIGHT CONTROLS

### CONTROL SURFACES

The airplane is equipped with conventional ailerons and rudder. It utilizes a T-tail horizontal stabilizer and elevator, mounted at the extreme top of the vertical stabilizer.

### OPERATING MECHANISMS

The airplane is equipped with conventional dual controls for the pilot and copilot. The ailerons and elevators are operated by conventional control wheels interconnected by a T-bar. The rudder pedals are interconnected by linkage below the floor. These systems are connected to the control surfaces through push-rod and cable-and-bellcrank systems. Rudder, elevator, and aileron trim are adjustable with controls mounted on the center pedestal. A position indicator for each of the trim tabs is integrated with its respective control.

### MANUAL ELEVATOR TRIM

Manual control of the elevator trim is accomplished with a handwheel located on the left side of the pedestal. It is a conventional trim wheel which is rolled forward for nose-down trim, and aft for nose-up trim.

### ELECTRIC ELEVATOR TRIM

The electric elevator-trim system, if installed, is controlled by an ELEV TRIM switch located on the pedestal, a dual-element thumb switch on each control wheel, a trim-disconnect switch on each control wheel, and a PITCH TRIM circuit breaker in the FLIGHT group on the right side panel. The ELEV TRIM switch must be on (forward) for the system to operate. Both elements of either dual-element thumb switch must be simultaneously moved forward to achieve nose-down trim, aft for nose-up trim; when released, they return to the center (off) position. Any activation of the trim system by the copilot's thumb switch can be overridden by the pilot's thumb switch. A before take-off check of both dual-element thumb switches should be made by moving each of the four switch elements individually. No one switch element should activate the system; moving the two switch elements on either the pilot's or the copilot's control wheel in opposite directions should not activate the system - only the simultaneous movement of a pair of switch elements in the same direction should activate the electric elevator-trim system.

A bi-level, push-button, momentary-on, trim-disconnect switch is located inboard of the dual-element thumb switch on the outboard grip of each control wheel. The electric elevator-trim system can be disconnected by depressing either of these switches. If an autopilot is installed, depressing either trim-disconnect switch to the first of the two levels disconnects the autopilot and the yaw damp system; depressing the switch to the second level disconnects the autopilot, the yaw damp system, and the electric elevator-trim system. If an autopilot is not installed, depressing the switch to the first level does not do anything, since the yaw damp system is controlled by a separate YAW DAMP switch on the pedestal; depressing the switch to the second level disconnects the electric elevator-trim system. A green annunciator on the caution/advisory annunciator panel, placarded ELEC TRIM OFF, alerts the pilot whenever the system has been disabled with a trim-disconnect switch and the ELEV TRIM switch is on. The system can be reset by cycling the ELEV TRIM switch on the pedestal from on to OFF, then to on again. The manual-trim control wheel can be used to change the trim anytime, whether or not the electric-trim system is in the operative mode.

### RUDDER BOOST

A rudder boost system is provided to aid the pilot in maintaining directional control in the event of an engine failure or a large variation of power between the engines. Incorporated into the rudder cable system are two pneumatic rudder-boosting servos that actuate the cables to provide rudder pressure to help compensate for asymmetrical thrust.

During operation, a differential pressure valve accepts bleed air pressure from each engine. When the pressure varies between the bleed air systems, the shuttle in the differential pressure valve moves toward the low pressure side. As the pressure difference reaches a preset tolerance, a switch on the low pressure side closes, activating the rudder boost system. This system is designed only to help compensate for asymmetrical thrust. Appropriate trimming is to be accomplished by the pilot. Moving either or both of the bleed air valve switches on the copilot's subpanel to the CLOSED position will disengage the rudder boost system.

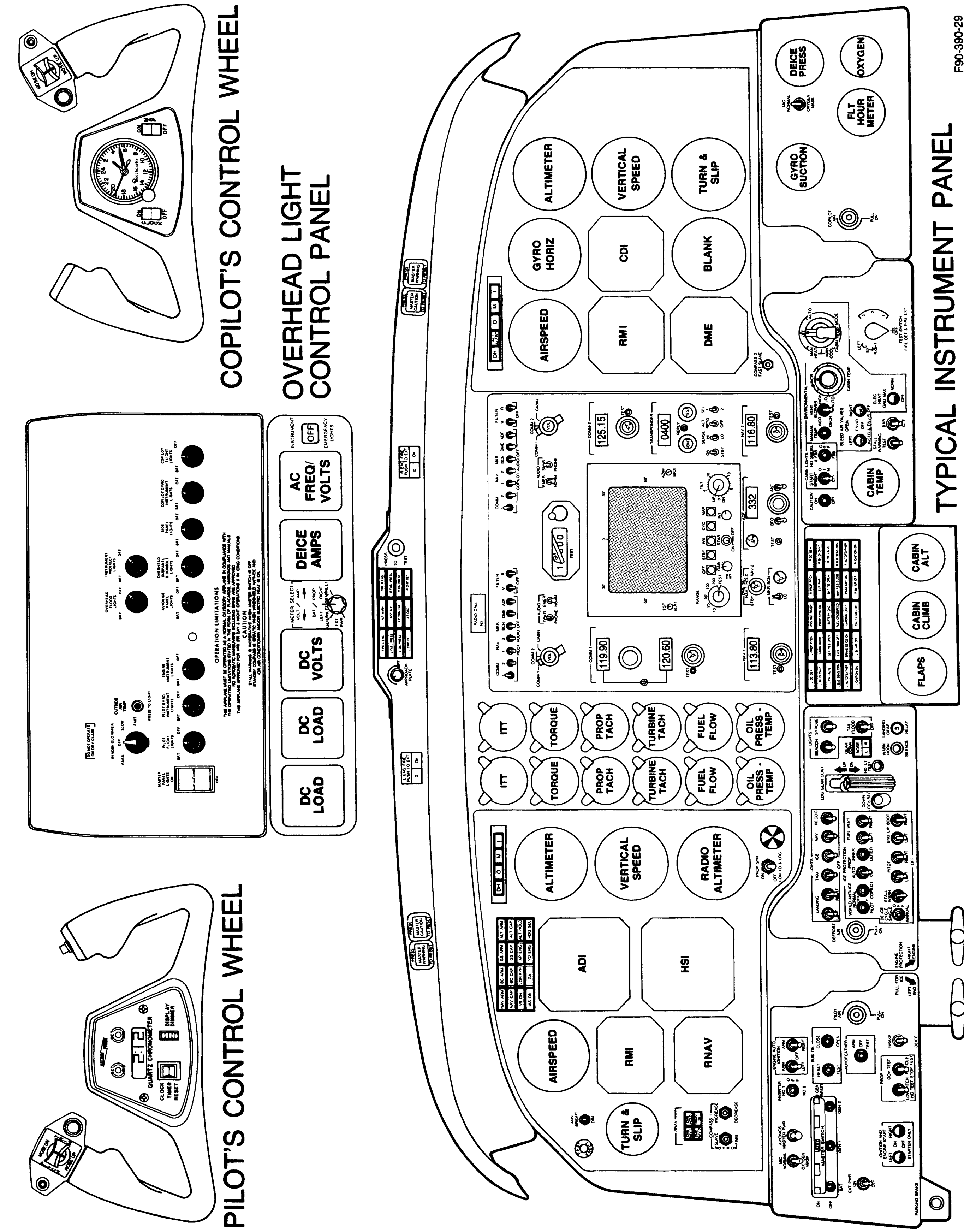
The system is controlled by a toggle switch, placarded RUDDER BOOST - OFF, located on the pedestal. The switch is to be turned on (forward) before flight. A preflight check of the system can be performed during the run-up by retarding the power on one engine to idle and advancing power on the opposite engine until the power difference between the engines is great enough to close the switch that activates the rudder boost system. Movement of the appropriate rudder pedal (left engine idling, right rudder pedal moves forward) will be noted when the switch closes, indicating the system is functioning properly for low engine power on that side. Repeat the check with opposite power settings to check for movement of the opposite rudder pedal.

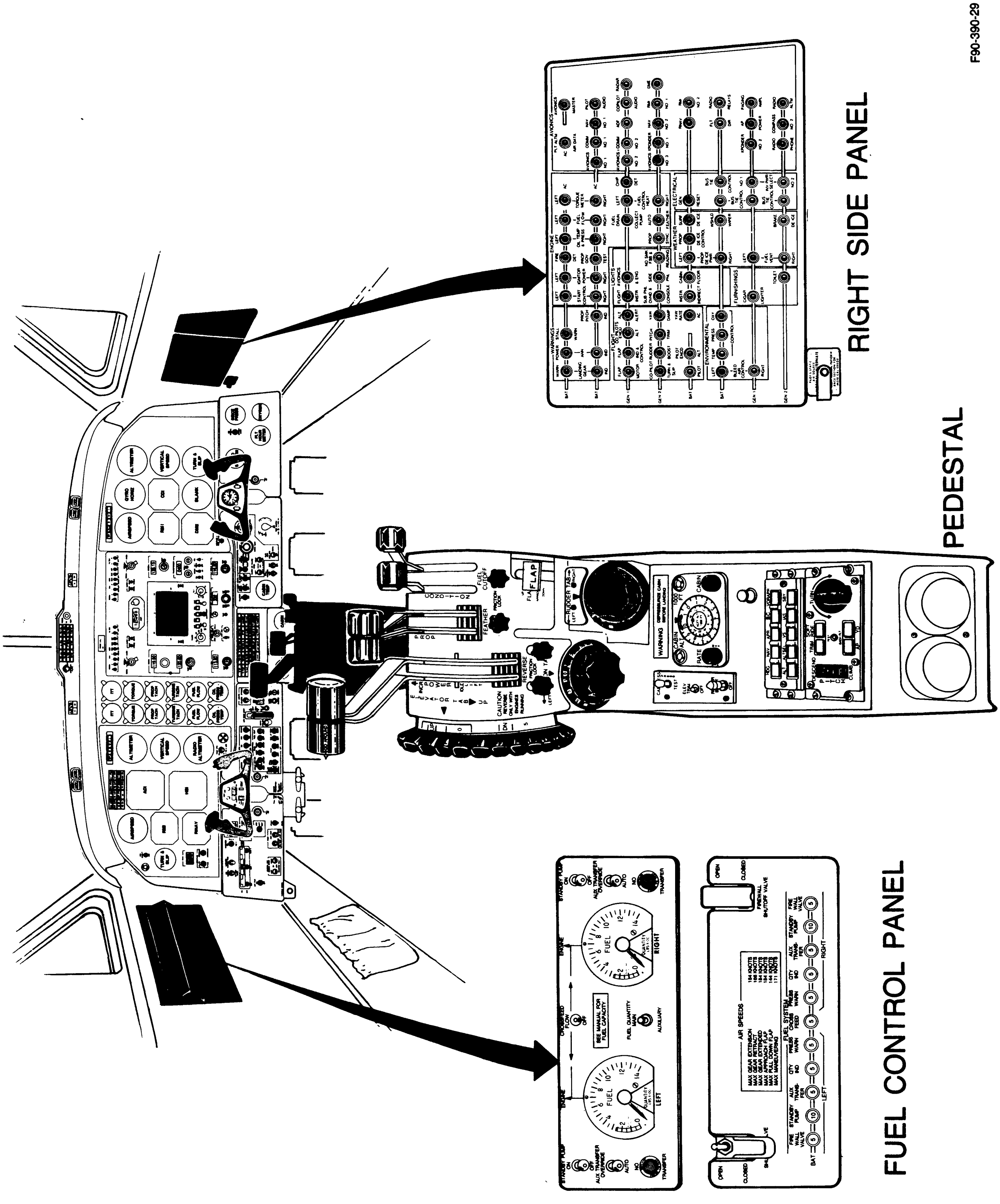
## INSTRUMENT PANEL

The floating instrument panel design allows the flight instruments to be arranged in a group directly in front of the pilot and the copilot. Complete pilot and copilot flight instrumentation is installed, including dual navigation systems, two course indicators, dual gyro horizons, and dual turn and slip indicators.

The operation and use of the instruments, lights, switches, and controls located on the instrument panel is explained under the systems descriptions relating to the subject items.

INTENTIONALLY LEFT BLANK


COPILOT'S CONTROL WHEEL
OVERHEAD LIGHT CONTROL PANEL
PILOT'S CONTROL WHEEL
TYPICAL INSTRUMENT PANEL
F90-390-29
ALTIMETER
VERTICAL SPEED
TURN & SLIP
GYRO HORIZ
CDI
BLANK
AIRSPEED
RMI
DME
DEICE PRESS
OXYGEN
FLT HOUR METER
GYRO SUCTION
CABIN TEMP
CABIN ALT
CABIN CLIMB
FLAPS
ITT
TORQUE
PROP TACH
TURBINE TACH
FUEL FLOW
OIL PRESS - TEMP
RADIO ALTIMETER
ADI
HSI
RNAV
DC LOAD
DC VOLTS
DEICE AMPS
AC FREQ/ VOLTS
QUARTZ CHRONOMETER
CLOCK TIMER RESET
DISPLAY DIMMER
OPERATION LIMITATIONS
CAUTION


F90-390-29
RIGHT SIDE PANEL
PEDESTAL
FUEL CONTROL PANEL

INTENTIONALLY LEFT BLANK

## ANNUNCIATOR SYSTEM

The annunciator system consists of a warning annunciator panel (with red readout) centrally located in the glareshield, a caution/advisory annunciator panel (caution - yellow; advisory - green) located on the center subpanel, two red MASTER WARNING flashers located in the glareshield (one in front of the pilot and one in front of the copilot), two yellow MASTER CAUTION flashers (located just inboard of the MASTER WARNING flashers), a CAUTION - ON - OFF switch located on the copilot's left subpanel, and a PRESS TO TEST switch located immediately to the right of the warning annunciator panel.

The annunciators are of the word readout type. Whenever a fault condition covered by the annunciator system occurs, a signal is generated and the appropriate annunciator is illuminated.

If the fault requires the immediate attention and reaction of the pilot, the appropriate red warning annunciator in the warning annunciator panel illuminates, and both MASTER WARNING flashers begin flashing. Any illuminated lens in the warning annunciator panel will remain on until the fault is corrected. However, the MASTER WARNING flashers can be extinguished by depressing the face of either MASTER WARNING flasher, even if the fault is not corrected. In such a case, the MASTER WARNING flashers will again be activated if an additional warning annunciator illuminates. When a warning fault is corrected, the affected warning annunciator will extinguish, but the MASTER WARNING flashers will continue flashing until one of them is depressed.

If the fault requires the immediate attention but not the immediate reaction of the pilot, the appropriate yellow caution annunciator in the caution/advisory panel illuminates, and both MASTER CAUTION flashers begin flashing. The flashing MASTER CAUTION lights can be extinguished by pressing the face of either of the flashing lights to reset the circuit. Subsequently, when any caution annunciator illuminates, the MASTER CAUTION flashers will be activated again. Normally, an illuminated caution annunciator on the caution/advisory annunciator panel will remain on until the fault condition is corrected, at which time it will extinguish. The MASTER CAUTION flashers will continue flashing until one of them is depressed.

On airplane serials LA-2 thru LA-175 except LA-80, LA-81, LA-100 and LA-111, if the fault indicated by an illuminated caution annunciator is not corrected, the pilot can still extinguish the annunciator by momentarily moving the spring-loaded CAUTION toggle switch down to the OFF position, then releasing it to the center position. This action will extinguish all illuminated caution annunciators, and will illuminate the green CAUT LGND OFF advisory annunciator in the caution/advisory annunciator panel, to remind the pilot that an uncorrected fault condition exists, but that the caution legends have all been extinguished. The annunciator(s) previously extinguished with the CAUTION switch can be reilluminated anytime by momentarily moving the switch to the ON position. This action will also extinguish the green CAUT LGND OFF annunciator. If an additional fault covered by the caution annunciators occurs after the caution legends have been extinguished with the CAUTION switch, the appropriate caution annunciator for the new fault will illuminate, and all previously extinguished annunciators will reilluminate.

The caution/advisory annunciator panel also contains the green advisory annunciators. There are no master flashers associated with these annunciators, since they are only advisory in nature, indicating functional situations which do not demand the immediate attention or reaction by the pilot. An advisory annunciator can be extinguished only by correcting the condition indicated on the illuminated lens.

The warning annunciators, caution annunciators, advisory annunciators, and yellow MASTER CAUTION flashers feature both a "bright" and a "dim" mode of illumination intensity. The "dim" mode will be selected automatically whenever all the following conditions are met: a generator is on the line; the OVERHEAD FLOOD LIGHTS are OFF; the PILOT FLIGHT LIGHTS are ON; and the ambient light level in the cockpit (as sensed by a photoelectric cell located in the overhead light control panel) is below a preset value. Unless all these conditions are met, the "bright" mode will be selected automatically. The MASTER WARNING flashers do not have a "dim" mode.

The lamps in the annunciator system should be tested before every flight, and anytime the integrity of a lamp is in question. Depressing the PRESS TO TEST button, located to the right of the warning annunciator panel in the glareshield, illuminates all the annunciator lights, MASTER WARNING flashers, and MASTER CAUTION flashers. Any lamp that fails to illuminate when tested should be replaced (refer to LAMP REPLACEMENT GUIDE in Section VIII, HANDLING, SERVICING AND MAINTENANCE).

## ANNUNCIATOR PANELS

| NOMENCLATURE | COLOR | CAUSE FOR ILLUMINATION |
|---|---|---|
| | | *WARNING ANNUNCIATOR PANEL* |
| FIRE L ENG (LA-2 thru LA-175 except: LA-80, LA-81, LA-100 and LA-111) | Red | Fire in left engine compartment |
| L ENG FIRE (LA-80, LA-81, LA-100, LA-111, LA-176 and after) | Red | Fire in left engine compartment |
| ALT WARN | Red | Cabin altitude exceeds 12,500 feet |
| FIRE R ENG (LA-2 thru LA-175 except: LA-80, LA-81, LA-100 and LA-111) | Red | Fire in right engine compartment |
| R ENG FIRE (LA-80, LA-81, LA-100, LA-111, LA-176 and after) | Red | Fire in right engine compartment |
| L FUEL PRESS | Red | Fuel pressure failure on left side |
| INST INV (LA-2 thru LA-175 except: LA-80, LA-81, LA-100 and LA-111) | Red | The inverter selected is inoperative |
| INVERTER (LA-80, LA-81, LA-100, LA-111, LA-176 and after) | Red | The inverter selected is inoperative |
| CABIN DOOR (LA-80, LA-81, LA-100, LA-111, LA-176 and after) | Red | Cabin door open or not secure. |
| R FUEL PRESS | Red | Fuel pressure failure on right side |
| L OIL PRESS | Red | Oil pressure failure on left side |
| A/P TRIM FAIL | Red | Improper trim or no trim from autopilot trim command |
| R OIL PRESS | Red | Oil pressure failure on right side |
| L CHIP DET (LA-2 thru LA-175 except: LA-80, LA-81, LA-100 and LA-111) | Red | Contamination in left engine oil is detected |
| L CHIP DETECT (LA-80, LA-81, LA-100, LA-111, LA-176 and after) | Red | Contamination in left engine oil is detected |
| A/P DISC | Red | Autopilot is disconnected |

| NOMENCLATURE | COLOR | CAUSE FOR ILLUMINATION |
|---|---|---|
| R CHIP DET (LA-2 thru LA-175 except: LA-80, LA-81, LA-100 and LA-111) | Red | Contamination in right engine oil is detected |
| R CHIP DETECT (LA-80, LA-81, LA-100, LA-111, LA-176 and after) | Red | Contamination in right engine oil is detected |

*CAUTION/ADVISORY ANNUNCIATOR PANEL*

| NOMENCLATURE | COLOR | CAUSE FOR ILLUMINATION |
|---|---|---|
| L DC GEN | Yellow | Left generator off the line |
| L PROP PITCH (LA-2 thru LA-120, except: LA-20, LA-97, and airplanes modified by Kit 90-9070-1) | Yellow | Left propeller is beyond the flight idle stop |
| RVS NOT READY | Yellow | Propeller levers are not in the high rpm (low pitch) position with landing gear extended. |
| R PROP PITCH (LA-2 thru LA-120, except: LA-20, LA-97, and airplanes modified by Kit 90-9070-1) | Yellow | Right propeller is beyond the flight idle stop |
| R DC GEN | Yellow | Right generator off the line |
| L BK DI OVHT | Yellow | Melted or failed plastic left brake deice plumbing failure warning line |
| CABIN DOOR (LA-2 thru LA-175 except: LA-80, LA-81, LA-100 and LA-111) | Yellow | Cabin door open or not secure |
| PROP SYNC ON * | Yellow | Synchrophaser turned on with landing gear extended |
| EXT PWR | Yellow | External power connector is plugged in |
| R BK DI OVHT | Yellow | Melted or failed plastic right brake deice plumbing failure warning line |
| L FW VALVE | Yellow | Left fuel firewall valve has not reached its selected position |
| GEN TIES OPEN | Yellow | Left and right generator buses isolated from center bus |
| BATTERY CHG | Yellow | Battery charge rate is high |
| BAT TIE OPEN | Yellow | Battery isolated from generator buses |
| R FW VALVE | Yellow | Right fuel firewall valve has not reached its selected position |
| L BUS SENS OPN (LA-2 thru LA-175 except: LA-80, LA-81, LA-100 and LA-111) | Green | Left generator bus isolated from center bus |

| NOMENCLATURE | COLOR | CAUSE FOR ILLUMINATION |
|---|---|---|
| L BUS SEN OPEN (LA-80, LA-81, LA-100, LA-111, LA-176 and after) | Green | Left generator bus isolated from center bus |
| ELEC TRIM OFF | Green | Electric trim de-energized by a trim disconnect switch on the control wheel with the system power switch on the pedestal turned on |
| FUEL CROSSFEED | Green | Crossfeed valve is open |
| MAN TIES CLOSE | Green | Manually closed generator bus ties |
| R BUS SENS OPN (LA-2 thru LA-175 except: LA-80, LA-81, LA-100 and LA-111) | Green | Right generator bus isolated from center bus |
| R BUS SEN OPEN (LA-80, LA-81, LA-100, LA-111, LA-176 and after) | Green | Right generator bus isolated from center bus |
| L AUTOFEATHER | Green | Left autofeather armed with power levers advanced above 90% $N_1$ |
| BRAKE DEICE ON (LA-2 and after except: LA-186 and LA-200) | Green | Brake deice system in operation |
| L BK DI ON (LA-186 and LA-200) | Green | Left brake deice system is in operation |
| LANDING LIGHT | Green | Landing lights on with landing gear up |
| PASS OXY ON | Green | Passenger oxygen system charged |
| R BK DI ON (LA-186 and LA-200) | Green | Right brake deice system is in operation |
| R AUTOFEATHER | Green | Right autofeather armed with power levers advanced above 90% $N_1$ |
| L IGNITION ON | Green | Left ignition and engine start switch is on or left auto ignition system is armed and left engine torque is below 400 ft-lbs |
| L BL AIR OFF | Green | Left environmental bleed air valve is closed |
| CAUT LGND OFF (LA-2 thru LA-175 except: LA-80, LA-81, LA-100 and LA-111) | Green | Caution annunciator is turned off |
| R BL AIR OFF | Green | Right environmental bleed air valve is closed |
| R IGNITION ON | Green | Right ignition and engine start switch is on or right auto ignition system is armed and right engine torque is below 400 ft-lbs |

* Not required on airplanes equipped with Type II Synchrophaser

## GROUND CONTROL

Direct linkage from the rudder pedals allows for nose wheel steering. When the rudder control is augmented by a main wheel brake, the nose wheel deflection can be considerably increased.

The minimum wing-tip turning radius, using partial braking action and differential engine power, is 35 feet.

## FLAPS

Two flaps are installed on each wing. Power is delivered from an electric motor to a gearbox mounted on the forward side of the rear spar. The gearbox drives four flexible driveshafts which are connected to jackscrews, one of which operates each flap. The motor incorporates a dynamic braking system, through the use of two sets of motor windings. This feature helps prevent overtravel of the flaps.

The flaps are operated by a sliding switch handle on the pedestal just below the condition levers. Flap travel, from 0% (full up) to 100% (full down) is registered on an electric indicator on top of the pedestal. A side detent provides for quick selection of the APPROACH position (32.5% flaps). From the UP position to the APPROACH position, the flaps cannot be stopped in an intermediate position. Between APPROACH and DOWN, the flaps can be stopped anywhere by moving the handle to the DOWN position until the flaps reach the desired position, then moving the flap-switch handle back to APPROACH. The flaps can be raised to any position between DOWN and APPROACH by raising the handle to UP until the desired setting is reached, then returning the handle to APPROACH. Selecting the APPROACH position will stop flap travel anytime the flaps are deflected more than 32.5%.

The flap-motor power circuit is protected by a 20-ampere flap-motor circuit breaker placarded FLAP MOTOR, located on the right circuit breaker panel. A 5-ampere circuit breaker for the control circuit (placarded FLAP CONTROL) is also located on this panel.

Lowering the flaps will produce these results:

Attitude - Nose Up
Airspeed - Reduced
Stall Speed - Lowered
Trim - Nose-down Adjustment Required
to Maintain Attitude

## LANDING GEAR

A 28-volt split-field motor, located on the forward side of the center section main spar, extends and retracts the landing gear. The motor incorporates a dynamic braking system, through the use of two motor windings, which prevents overtravel of the gear. Excessive operation of the gear motor, such as during door adjustment or landing gear rigging, may cause the motor to overheat.

Torque shafts drive the main gear actuators, and duplex chains drive the nose gear actuator. Spring-loaded friction clutches between the gear box and the torque shafts protect the system in the event of mechanical malfunction. A 200-ampere current limiter under the center floorboard protects the system from electrical overload.

The Beech air-oil type shock struts are filled with compressed air and hydraulic fluid. Direct linkage from the rudder pedals allows for nose wheel steering. When the rudder control is augmented by a main wheel brake, the nose wheel deflection can be considerably increased. As the nose wheel retracts, it is automatically centered and the steering linkage becomes inoperative.

A safety switch on the right main strut opens the control circuit when the strut is compressed. The safety switch also actuates a solenoid-operated downlock hook, which prevents the landing gear handle from being raised when the airplane is on the ground. The hook automatically unlocks when the airplane leaves the ground and can be manually overridden by pressing down on the red button placarded DOWN LOCK REL while the airplane is on the ground.

Visual indication of landing gear position is provided by individual green GEAR DOWN indicator lights (placarded NOSE, L, R) on the center subpanel. Two red, parallel-wired indicator lights located in the control handle illuminate to show that the gear is in transit or unlocked. They also illuminate when the landing gear warning horn is actuated.

### LANDING GEAR WARNING SYSTEM

The landing gear warning system is provided to warn the pilot that the landing gear is not down and locked during specific flight regimes. Various warning modes result, depending upon the position of the flaps.

With the FLAPS in UP or APPROACH position and either or both power levers retarded below a certain power level, the warning horn will sound intermittently and the landing gear switch handle lights will illuminate. The horn can be silenced by pressing the WARNing HORN SILENCE button adjacent to the landing gear switch handle: the lights in the landing gear switch handle cannot be cancelled. The landing gear warning system will be rearmed if the power lever(s) are advanced sufficiently.

With the FLAPS BEYOND APPROACH position, the warning horn and landing gear switch handle lights will be activated regardless of the power settings, and neither can be cancelled.

## MANUAL LANDING GEAR EXTENSION

Manual landing gear extension is provided through a separate, manually powered, chain-drive system. Pull the LANDING GEAR RELAY circuit breaker (on the pilot's right subpanel) and make certain that the landing gear switch handle is in the down position before manually extending the gear. Pulling up on the emergency engage handle (located on the floor) and turning it clockwise will lock it in that position. When the emergency engage handle is pulled up, the motor is electrically disconnected from the system, and the emergency drive system is locked to the gear box and motor. When the emergency drive is locked in, the chain is driven by a continuous-action ratchet, which is activated by pumping the ratchet handle adjacent to the emergency engage handle.

*CAUTION*

Do not continue pumping the ratchet handle after the GEAR DOWN lights illuminate. Excessive pumping may damage the gear drive mechanism and bind the clutch so that the handle will not release it.

**WARNING**

After an emergency landing gear extension has been made, do not stow pump handle or move any landing gear controls or reset any switches or circuit breakers until the airplane is on jacks. These precautions are necessary because the failure may have been in the gear-up circuit, in which case the gear might retract on the ground. The gear can not be retracted manually.

After a practice manual extension, the landing gear may be retracted electrically. Rotate the emergency engage handle counterclockwise and push it down. Stow the extension lever, push in the landing gear relay circuit breaker on the pilot's subpanel, and retract the gear in the normal manner with the landing gear switch handle.

## BRAKE SYSTEM

The dual hydraulic brakes are operated by depressing the tow portion of either the pilot's or copilot's rudder pedals. Shuttle valves permit braking by either pilot or copilot.

*CAUTION*

If either the pilot's or the copilot's brake pedals are pumped repeatedly while continuous pressure is being applied to the other set of brake pedals, braking capability from the "continuous-pressure" side may be lost. Normal brake function can be restored by momentarily removing all pressure from the pedals on the "continuous-pressure" side.

Dual parking-brake valves are installed adjacent to the rudder pedals between the master cylinders of the pilot's rudder pedals and the wheel brakes. A control for the valves, placarded PARKING BRAKE, is located below the pilot's left subpanel. After the pilot's brake pedals have been depressed to build up pressure in the brake lines, both valves can be closed simultaneously by pulling out the parking brake handle. This retains the pressure in the brake lines. The parking brake is released by depressing the pedals briefly to equalize the pressure on both sides of the valve, then pushing in the parking brake handle to open the valve.

*CAUTION*

The parking brake should be left off and wheel chocks installed if the airplane is to be left unattended. Changes in ambient temperature can cause the brakes to release or to exert excessive pressures.

## TIRES

The airplane is normally equipped with dual 18 x 5.5, 8-ply-rated, tubeless, rim-inflation tires on each main gear. For increased service life, 10-ply-rated tires of the same size may be installed.

Optionally, the airplane may be equipped with dual 22 x 6.75-10, 8-ply-rated, tubeless tires on each main gear. These tires provide higher flotation, and permit operation at approximately 2/3 the inflation pressure required for the standard 18 x 5.5 tires.

The nose gear is equipped with a single 22 x 6.75-10, 8-ply-rated, tubeless tire.

## BAGGAGE COMPARTMENT

The 26.5-cubic-foot baggage compartment on the right side of the lavatory compartment extends aft of the airstair entrance door to the rear pressure bulkhead. A nylon web is provided for the restraining of loose items.

*CAUTION*

Baggage and other objects should be secured by webs, in order to prevent shifting in turbulent air.

Items stowed in the aft-cabin area are easily accessible in flight. The baggage/lavatory area is separated from the cabin by a solid partition with sliding doors.

## SEATS, SEATBELTS, AND SHOULDER HARNESSES

### SEATS

#### COCKPIT

The pilot and copilot seats are adjustable fore and aft, as well as vertically. When the release lever under the front inboard corner of the seat is lifted, the seat can be moved forward or aft as required. When the release lever under the front outboard corner of the seat is lifted and no weight is on the seat, the seat will rise in half-inch increments to its highest position. When weight is on the seat and the lever is lifted, the seat will slowly move downward in half-inch increments until the lever is released, or until the seat reaches its lowest point of vertical travel. The armrests pivot at the aft end and can be raised to facilitate entry to and egress from the seats.

#### CABIN

Various configurations of passenger chairs and a 4-place couch may be installed on the continuous tracks which are mounted on the cabin floor. All passenger chairs are placarded either FRONT FACING ONLY or FRONT OR AFT FACING on the horizontal leg cross brace. Only chairs placarded FRONT OR AFT FACING may be installed facing aft. All aft-facing and all forward-facing chairs are equipped with adjustable headrests.

**WARNING**

Before takeoff and landing, the headrest should be adjusted as required to provide support for the head and neck when the passenger leans against the seatback.

Some passenger chairs can be moved fore and aft, to suit legroom requirements of different passengers, by lifting a horizontal release lever that extends laterally under the front of adjustable seats. ("Front" is the direction opposite the seatback, regardless of whether the chair faces fore or aft.)

The seatbacks can be adjusted to any angle from fully upright to fully reclining, by depressing the release lever located on the side of the seat at the front inboard corner. When the lever is depressed and the passenger leans against the seatback, the seatback will slowly recline until the lever is released, or until the fully reclining position is attained. When no weight is placed against the seatback and the lever is depressed, the seatback will rise until the lever is released, or until the fully upright position is reached. The seatbacks of all occupied seats must be upright for takeoff and landing.

The passenger-chair seatback can also be folded flat over the seat cushion, after releasing the lock lever located on the side of the seat at the back inboard corner.

The optional lateral-tracking passenger chairs incorporate a flat, rectangular release lever underneath the front inboard corner of the seats. When this lever is lifted, the chairs can be adjusted fore and aft, as well as laterally. The seatback adjustments are the same as those on the standard passenger chairs. When occupied, these seats must be in the outboard position (i.e., against the cabin wall) for takeoff and landing.

Inboard armrests on passenger chairs – and both armrests on couches and lateral-tracking chairs – can be folded flush with the top of the seat cushions to facilitate entry to and egress from the seat. The armrests can be lowered by lifting the flat, rectangular release plate located under the front end of the armrest, then moving the armrest toward the front of the seat and downward. The armrest can be raised by pulling the armrest upward and toward the seatback until it locks into place.

The couches are not adjustable.

#### LAVATORY COMPARTMENT

Hinged seat-cushion halves mounted on top of the toilet form an extra passenger seat when the toilet is not in use.

### SEATBELTS

Every seat in the airplane is equipped with a seatbelt. The seatbelt can be lengthened by turning the male half of the buckle at a right angle to the belt, then pulling the male half in the direction away from the anchored end of the belt. The buckle is locked by sliding the male half into the female half of the buckle. The belt is then tightened by pulling the short end of the belt through the male half of the buckle until a snug fit is obtained. The buckle is released by lifting the large, hinged release lever on the female buckle half and pulling the male half of the buckle free. All occupants must wear seatbelts during takeoff and landing.

### SHOULDER HARNESSES

#### COCKPIT

The shoulder harness installations for the pilot and copilot seats consist of two straps each. Each strap is routed from the lower aft area of the seat, up the seatback, and through a retaining loop on top of the seatback. One strap is worn over each shoulder. Each strap terminates in a slotted bayonet-blade fastener which is aligned with one edge of the strap. When the two bayonet blades are placed together, the shoulder harness straps can be secured by sliding the male half of the seatbelt buckle through the bayonet slots and into the female half of the seatbelt buckle.

The shoulder harness straps proceed from inertia reels built into the crew chairs. Spring loading at the inertia reels keeps the shoulder harnesses snug, but allows the pilot and copilot all the freedom of movement normally required in flight. However, the inertia reels incorporate a locking device that will secure the harness straps in the event of sudden forward movement.

### CABIN

The shoulder harness on passenger chairs consists of a single strap. It is routed through the top of the seatback and terminates in a triangular metal fastener. The strap is worn diagonally. It runs from the outboard shoulder to the inboard hip area, where it is secured by hooking the metal fastener around the securing stud on the male half of the seatbelt buckle.

The shoulder harness strap proceeds from an inertia reel built into the passenger chair. Spring loading at the inertia reel keeps the shoulder harness strap snug, but allows considerable freedom of movement. However, the inertia reel incorporates a locking device that will secure the harness strap in the event of sudden forward movement. If the seat is equipped with a shoulder harness (the couch is not), it must be worn during takeoff and landing.

**WARNING**

Ensure that the seatback is in the fully upright position and that the headrest is properly adjusted whenever the shoulder harness is used.

### LAVATORY

The shoulder harness for the toilet seat consists of a single strap which is anchored to the aft pressure bulkhead. The bottom end of the strap is connected to the upper edge of the shoulder harness adjuster. A short adjusting strap extends down from the adjuster, terminating in a slotted bayonet-blade fastener. A small, flexible adjusting tab is also attached to the lower edge of the adjuster.

The shoulder strap is worn down across one shoulder. It is secured by sliding the male half of the seatbelt buckle through the slot in the bayonet blade and into the female half of the seatbelt buckle. The shoulder harness can be lengthened by grasping the tab on the adjuster and pulling upward. The strap can be tightened by grasping the loose end of the adjuster strap and pulling it through the adjuster until the shoulder harness is snug.

## DOORS, WINDOWS, AND EXITS

### AIRSTAIR ENTRANCE DOOR

The cabin door is hinged at the bottom. It swings out and down when opened. A stairway built onto the inboard side of the door facilitates entry to and egress from the airplane. Two of the stairsteps automatically fold flat against the door when the door is closed. A hydraulic damper ensures that the door will swing down slowly when it opens. While the door is open, it is supported by a plastic-encased cable, which also serves as a handrail. Additionally, this cable is utilized when closing the door from inside the airplane. The door closes against an inflatable rubber seal which is installed around the opening in the door frame. When weight is off the landing gear, engine bleed air supplies pressure to inflate the door seal, which provides a positive pressure-vessel seal around the door. The outside door handle can be locked with a key, for security of the airplane on the ground.

*CAUTION*

Only one person at a time should be on the door stairway.

The door locking mechanism is operated by rotating either the outside or the inside door handle, both of which move simultaneously. Two latch bolts at each side of the door, and two latch hooks at the top of the door, lock into the door frame to secure the airstair door.

Whether unlocking the door from the outside or the inside, the release button adjacent to the door handle must be held depressed before the handle can be rotated (counterclockwise from inside the airplane, clockwise from outside) to unlock the door. Consequently, unlocking the door is a two-hand operation requiring deliberate action. The release button acts as a safety device to help prevent accidental opening of the door. As an additional safety measure, a differential-pressure-sensitive diaphragm is incorporated into the release-button mechanism. The outboard side of the diaphragm is open to ambient air pressure, the inboard side to cabin air pressure. As the cabin-to-ambient air pressure differential increases, it becomes increasingly difficult to depress the release button, because the diaphragm moves inboard when either the outside or inside release button is depressed. Never attempt to unlock or even check the security of the door in flight. If the CABIN DOOR caution annunciator illuminates in flight, or if the pilot has any reason whatever to suspect that the door may not be securely locked, the cabin should be depressurized (after first considering altitude), and all occupants instructed to remain seated with their seatbelts fastened. After the airplane has made a full-stop landing and the cabin has been depressurized, a crew member should check the security of the cabin door.

To close the door from outside the airplane, lift up the free end of the airstair door and push it up against the door frame as far as possible. Then grasp the handle with one hand and rotate it clockwise as far as it will go. The door will then move into the closed position. Then rotate the handle counterclockwise as far as it will go. The release button should pop out, and the handle should be pointing aft. Check the security of the door by attempting to rotate the handle clockwise without depressing the release button; the handle should not move.

To close the door from inside the airplane, grasp the handrail cable and pull the airstair door up against the door frame. Then grasp the handle with one hand and rotate it counterclockwise as far as it will go, continuing to pull inward on the door. The door will then move into the closed position. Then turn the handle clockwise as far as it will go. The release button should pop out, and the handle should be pointing down. Check the security of the door by attempting to rotate the handle counterclockwise without depressing the release button; the handle should not move. Next, lift the folded stairstep that is just below the door handle. A placard adjacent to the round observation window advises the observer that the safety lock arm should be in position around the diaphragm shaft (plunger) when the handle is in the locked position. The placard also presents a diagram showing how the arm and shaft should be positioned. A red push-button switch near the window turns on a lamp inside the door, which illuminates the area observable through the window. If the arm is properly positioned around the shaft, proceed to check the indication in each of the visual inspection ports, one of which is located near each corner of the door. The green stripe painted on the latch bolt should be aligned with the black pointer in the visual inspection port. If any condition specified in this door-locking procedure is not met, do not take off.

## EMERGENCY EXIT

The emergency exit is located at the third cabin window on the right side. A flush mounted handle on the inside can be pulled out to open the door. A hinge at the bottom allows the hatch to swing out and down for emergency exit.

## INTERIOR DOORS

Sliding doors are provided between the cockpit and cabin, and between the cabin and aft-cabin area. These doors provide privacy, and prevent the spilling of light from one compartment into another. The doors are closed by sliding the two partition-type door panels to the center of the aisle, where they are held together by a magnetic strip in the edge of each door.

## CABIN WINDOWS

Each cabin window pane, which is composed of a sheet of polyvinyl butyral (PVB) laminated between two sheets of clear acrylic plastic, is stressed to withstand the cabin-to-ambient air pressure differential. It is then sealed into the window opening in the fuselage, and forms an integral part of the pressure vessel.

### POLARIZED TYPE

Two dust panes are mounted inboard of the cabin window pane in each window frame. Each of these dust panes is composed of a film of polarizing material laminated between two sheets of acrylic plastic. The inboard dust pane rotates freely in the window frame and has a protruding thumb knob near the edge. Rotating the pane through an arc of 90° permits complete light regulation as desired. Rotation changes the relative alignment between the polarizing films, thus providing any degree of light transmission from full intensity to almost none.

**WARNING**

Do not look directly at the sun, even through polarized windows, because eye damage could result.

*CAUTION*

When the airplane is to be parked in areas exposed to intensive sunlight, the polarized windows should be rotated to the clear position to prevent deterioration of the polarized material. Sufficient ultraviolet protection is provided to prevent fading of the upholstery.

### SHADE TYPE

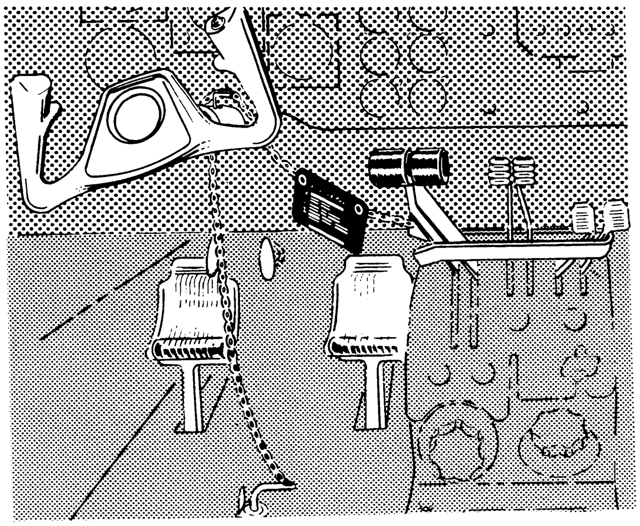
A dust pane, which is a single sheet of tinted acrylic plastic, is mounted inboard of the cabin window pane in each window frame. An adjustable window shade is provided to control the amount of light admitted. The shade is adjusted by squeezing the two latch handles located on the lower center of the shade, and then positioning the shade as desired. Detents in the shade tracks provide positive latching action at various positions.

## CONTROL LOCKS

The control locks consist of a U-shaped clamp and two pins, all connected by a chain. The pins lock the primary flight controls; the U-shaped clamp fits around the engine control levers, serving to warn the pilot not to start the engines with the control locks installed. It is important that all the locks be installed and removed together, to preclude the possibility of attempting to taxi or fly the airplane with the engine control levers released, but with the pins still installed in the flight controls.

Install the control locks in the following sequence:

1. Position the U-clamp around the engine control levers.
2. Move the control column as necessary to align the holes, then insert the small pin.



3. Insert the L-shaped pin through the hole provided in the floor aft of the rudder pedals. The rudder pedals must be centered to align the hole in the rudder bellcrank with the hole in the floor. The pin is then inserted until the flange is resting against the floor. This will prevent any rudder movement.

**WARNING**

Before starting engines, remove the locks, reversing the above procedure.

*CAUTION*

Remove the control locks before towing the airplane. If towed with a tug while the rudder lock is installed, serious damage to the steering linkage can result.

## ENGINES

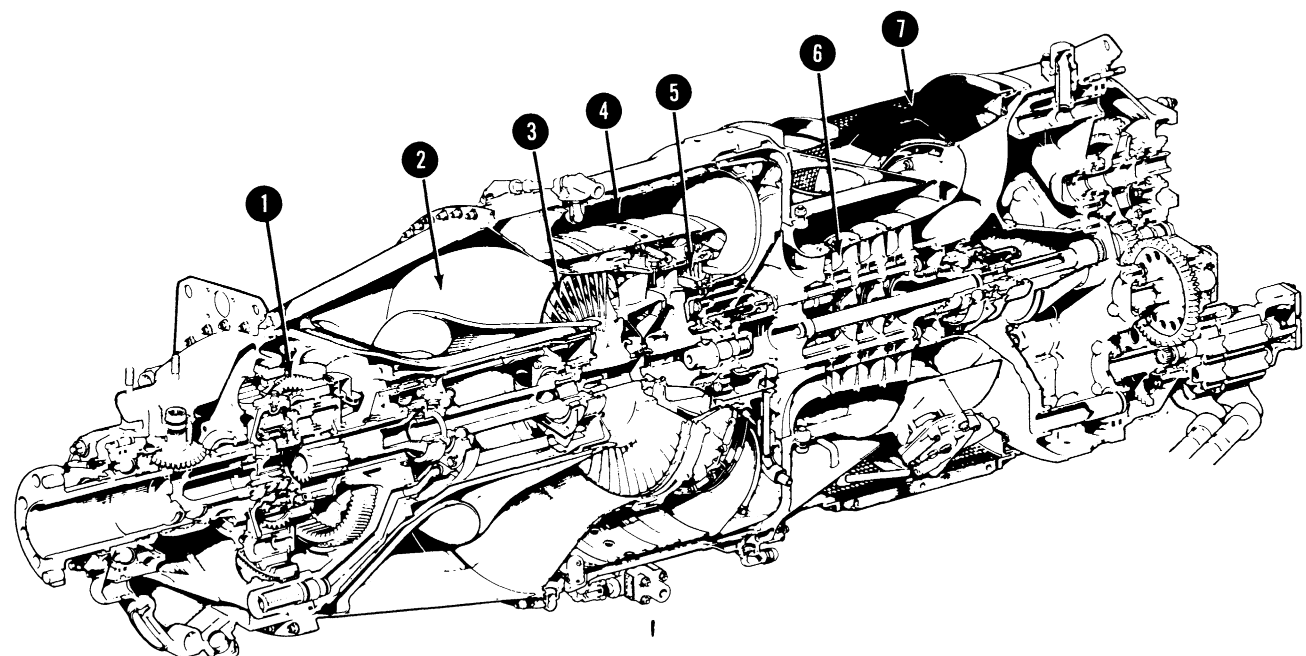
The Beechcraft Super King Air F90 is powered by two Pratt & Whitney Aircraft of Canada Ltd. PT6A-135 turbopropeller engines, each rated at 750 SHP. Each engine has a three-stage axial-flow, single-stage centrifugal-flow compressor, which is driven by a single-stage reaction turbine. The power turbine – a single-stage reaction turbine counter-rotating with the compressor turbine – drives the output shaft. Both the compressor turbine and the power turbine are located in the approximate center of the engine, with their shafts extending in opposite directions. Being a reverse flow engine, the ram air supply enters the lower portion of the nacelle and is drawn in through the aft protective screens. The air is then routed into the compressor. After it is compressed, it is forced into the annular combustion chamber and mixed with fuel that is sprayed in through 14 nozzles mounted around the gas generator case. A capacitance discharge ignition unit and two spark igniter plugs are used to start combustion. After combustion, the exhaust passes through the compressor turbine and the power turbine and is routed through two exhaust ports near the front of the engine. A pneumatic fuel control system schedules fuel flow to maintain the power set by the gas generator power lever. Propeller speed within the governing range remains constant at any selected propeller control lever position through the action of a propeller governor, except in the Beta range where the maximum propeller speed is controlled by the pneumatic section of the propeller governor.

The accessory drive at the aft end of the engine provides power to drive the fuel pumps, fuel control, the oil pumps, the starter/generator, and the tachometer transmitter. At this point, the speed of the drive ($N_1$) is the true speed of the compressor side of the engine, 37,500 rpm (which corresponds to 100% $N_1$). Maximum continuous speed of the engine is 38,100 rpm, which equals 101.5% $N_1$, with a transient overspeed of 38,500 rpm, which equals 102.6% $N_1$.

The reduction gearbox forward of the power turbine provides gearing for the propeller and drives the propeller tachometer transmitter, the propeller overspeed governor, and the propeller governor. Prior to gear reduction, the turbine speed on the power side of the engine is 33,000 rpm at 1900 propeller rpm.

Propeller torque value is measured by a hydro-mechanical device located inside the first stage reduction gear housing to provide an accurate indication of engine power output. The mechanism consists of a torquemeter cylinder, a piston, valve plunger and spring. Rotation of the first stage ring gear in the reduction gearbox is resisted by the helical splines which impart an axial movement to the ring gear and therefore to the torquemeter piston. A torquemeter valve regulated the input of engine oil into the torque cylinder to stabilize the piston position. The pressure created in the torque cylinder is plumbed to the torquemeter transmitter to give a relative reading of torque.

Deceleration on the ground is achieved by bringing the propeller blades through the Beta range into a reversing pitch by utilizing the pitch change mechanism. The power




1 REDUCTION GEAR
2 EXHAUST
3 POWER TURBINE
4 COMBUSTION CHAMBER
5 COMPRESSOR TURBINE
6 COMPRESSOR
7 ENGINE INLET

A100-241-22

levers must be retarded below the IDLE position by raising them over a detent. Reversing power is available in direct proportion to the retarding of the levers in the reversing range.

## PROPULSION SYSTEM CONTROLS

The propulsion system is operated by three sets of controls; the power levers, propeller levers, and condition levers. The power levers serve to control engine power. The condition levers control the flow of fuel at the fuel control outlet and select fuel cut-off, low idle and high idle functions. The propeller levers are operated conventionally and control the constant speed propellers through the primary governor.

### POWER LEVERS

The power levers provide control of engine power from idle through take-off power by operation of the gas generator ($N_1$) governor in the fuel control unit. Increasing $N_1$ rpm results in increased engine power.

### PROPELLER LEVERS

Each propeller lever operates a speeder spring inside the primary governor to reposition the pilot valve, which results in an increase or decrease of propeller rpm. For propeller feathering, each propeller lever manually lifts the pilot valve to a position which causes complete dumping of high pressure oil. Detents at the rear of lever travel prevent inadvertent movement into the feathering range. Operating range is 1500 to 1900 rpm.

### CONDITION LEVERS

The condition levers have three positions; FUEL CUT-OFF, LOW IDLE and HIGH IDLE. Each lever controls the idle cut-off function of the fuel control unit and limits idle speed at 58% $N_1$ for low idle, and 70% $N_1$ for high idle.

### PROPELLER REVERSING

When the power levers are lifted over the IDLE detent, they control engine power through the Beta and reverse ranges.

*CAUTION*

Propeller reversing on unimproved surfaces should be accomplished carefully to prevent propeller erosion from reversed airflow and, in dusty conditions, to prevent obscuring the operator's vision.

Condition levers, when set at HIGH IDLE, keep the engines operating at 70% $N_1$ high idle speed for maximum reversing performance.

*CAUTION*

Power levers should not be moved into the reversing position when the engines are not running because the reversing system will be damaged.

### FRICTION LOCKS

Four friction locks are located on the power quadrant of the pedestal. When they are rotated counterclockwise, the propulsion system control levers can be moved freely. As the friction locks are rotated clockwise, the control levers progressively become more resistant to movement, so that they will not creep out of position.

## ENGINE INSTRUMENTATION

Engine instruments, located on the left of the center portion of the instrument panel, are grouped according to their function. At the top, the ITT (Interstage Turbine Temperature) indicators and torquemeters are used to set take-off power. Climb and cruise power are established with the torquemeters and propeller tachometers while observing ITT limits. Gas generator ($N_1$) operation is monitored by the gas generator tachometers. The lower grouping consists of the fuel flow indicators and the oil pressure temperature indicators.

The ITT indicator gives an instantaneous reading of engine gas temperature between the compressor turbine and the power turbines.

The torquemeters give an indication in foot-pounds of the torque being applied to the propeller.

The propeller tachometer is read directly in revolutions per minute. The $N_1$ or gas generator tachometer is read in percent of rpm, based on a figure of 37,500 rpm at 100%. Maximum continuous gas generator speed is limited to 38,100 rpm or 101.5% $N_1$.

Proper observation and interpretation of these instruments provide an indication of engine performance and condition.

A propeller synchroscope, located to the left of the oil pressure/temperature indicators, operates to give an indication of synchronization of the propellers. If the right propeller is operating at a higher rpm than the left, the face of the synchroscope, a black and white cross pattern, spins in a clockwise rotation. Left, or counterclockwise, rotation indicates a higher rpm of the left propeller. This instrument aids the pilot in obtaining complete synchronization of propellers.

## PROPELLER SYNCHROPHASER (OPTIONAL)

### *TYPE I SYSTEM*

The propeller synchrophaser automatically matches the rpm of the right propeller (slave propeller) to that of the left propeller (master propeller) and maintains the blades of one propeller at a predetermined relative position with the blades of the other propeller. To prevent the right propeller from losing excessive rpm if the left propeller is feathered while the synchrophaser is on, the synchrophaser has a limited adjustment range from the manual governor setting. Normal governor operation is unchanged but the synchrophaser will continuously monitor propeller rpm and reset the governor as required. A magnetic pickup mounted in each propeller overspeed governor and adjacent to each propeller deice brush block transmits electric pulses to a transistorized control box installed forward of the pedestal.

The control box converts any pulse rate differences into correction commands, which are transmitted to a stepping type actuator motor mounted on the right engine cowl forward support ring. The motor then trims the right propeller governor through a flexible shaft and trimmer assembly to exactly match the left propeller. The trimmer, installed between the governor control arm and the control cable, screws in or out to adjust the governor while leaving the control lever setting constant. A toggle switch installed adjacent to the synchroscope turns the system on. With the switch off, the actuator automatically runs to the center of its range of travel before stopping to assure normal function when used again. To operate the system, synchronize the propellers in the normal manner and turn the synchrophaser on. The system is designed for in-flight operations and is placarded to be off for take-off and landing. Therefore, with the system on and the landing gear extended, the caution flashers and a yellow light on the caution/advisory annunciator panel, PROP SYNC ON, will illuminate.

The right propeller rpm and phase will automatically be adjusted to correspond to the left. To change rpm, adjust both propeller controls at the same time. This will keep the right governor setting within the limiting range of the left propeller. If the synchrophaser is on but is unable to adjust the right propeller to match the left, the actuator has reached the end of its travel. To re-center, turn the switch off, synchronize the propellers manually, and turn the switch back on.

### *TYPE II SYSTEM*

The type II system is a replacement for the type I system. The type II system needs fewer components, is an all electronic system and is approved for use during takeoff and landing.

Function of the type II system is as follows:

This synchrophaser automatically matches RPM of the two engines, and also positions the propellers at a pre-set phase relationship. This phase relationship is intended to decrease cabin noise.

Signal pulses are obtained from magnetic pickups, one located at each propeller hub. The pickup is mounted on a bracket on the engine case while the "target" for the pickup is mounted on the back of the propeller spinner bulkhead so that it rotates with the propeller. In this way one pulse is produced for each revolution of the propeller. Electric pulses generated by the "target" passing each magnetic pickup are fed into the control box. An electro-magnetic coil for RPM trimming is mounted in each propeller governor close to the flyweights. Any difference in the pulse rates will cause the control box to vary the governor coil voltages until the propeller RPM's match, due to control by the governor. Propeller RPM is a function of the position of the propeller control lever in its' quadrant, since linkage from the lever sets the governor flyweight position. The synchrophaser cannot reduce the RPM set by the propeller control lever. It can increase the RPM over a predetermined limited range. RPM of one engine will follow changes in RPM of the other engine within the limited range. This limited range limits RPM loss to a fixed value on the operative engine in the event the propeller of one engine is feathered with the synchrophaser ON. In no case will the operative engine RPM fall below the RPM set by the propeller lever.

The propeller synchrophaser may be used on takeoff at the pilots option. (The limited range of the synchrophaser will be reduced near maximum propeller RPM.) For all other operations, the synchrophaser should be switched OFF before adjusting the propeller RPM. Adjust the propeller levers to obtain synchronization and then switch ON the synchrophaser. This will keep the synchrophaser within its limited range.

NOTE

> If the synchrophaser is ON but does not synchronize the propellers, it has reached the limit of its range. Switch the system OFF, adjust the propeller levers to obtain synchronization and then switch the synchrophaser ON.

Since the synchrophaser may be ON during landing, the PROP SYNC ON caution annunciator is not required with this system and is not installed.

## ENGINE LUBRICATION SYSTEM

Engine oil, contained in an integral tank between the engine air intake and the accessory case, cools as well as lubricates the engine. An oil radiator located inside the lower nacelle keeps the engine oil temperature within the operating limits. Engine oil also operates the propeller pitch change mechanism and the engine torquemeter system.

The lubrication system capacity per engine is 3.5 U.S. gallons. The oil tank capacity is 2.3 gallons with 5 quarts measured on the dipstick for adding purposes. Recommended oils and oil changing procedures are listed in the SERVICING section.

### MAGNETIC CHIP DETECTOR

A magnetic chip detector is installed in the bottom of each engine nose gearbox. This detector will activate a red light on the annunciator panel, L CHIP DETECT or R CHIP DETECT, to alert the pilot of oil contamination indicating possible or pending engine failure.

## STARTING AND IGNITION SYSTEM

Each engine is started by a three-position switch located on the left subpanel placarded, IGNITION AND ENGINE START - ON - OFF - STARTER ONLY. Each switch may be moved downward to the STARTER ONLY position to motor the engine for the purpose of clearing it of fuel without the ignition circuit on. The switch is spring loaded and will return to the center position when released. Moving the switch upward to the ON position activates both the starter and ignition, and the appropriate IGNITION ON light on the annunciator panel will illuminate. When engine speed has accelerated through 50% $N_1$ or above on starting, the starter drive action is stopped by placing the switch in the center OFF position.

### AUTO IGNITION

The auto ignition system provides automatic ignition to prevent engine loss due to combustion failure. This system is provided to ensure ignition during takeoff, landing, turbulence, and penetration of icing or precipitation conditions, at the pilot's discretion. To arm the system, move the required ENGINE AUTO IGNITION switches, located on the pilot's subpanel, from OFF to ARM. If for any reason the engine torque falls below 400 foot-pounds, the igniter will automatically energize and the IGNITION ON light on the caution/advisory annunciator panel will illuminate. For extended ground operation, the system should be turned off to prolong the life of the igniter units.

## INDUCTION AIR SYSTEM

The PT6A-135 is a reverse-airflow engine. The compressor draws ambient air into the engine through the induction air inlet at the lower front of the engine nacelle. As airspeed increases, ram air pressure rises, compressing the air inside the induction air duct. The air then flows into an annular inlet-air chamber located at the aft end of the engine compartment. It then passes through a protective screen and into the primary compressor impeller, where it is further compressed. Then the air is forced through a stator ring and successively through the second and third axial-flow compressor stages. It is finally compressed in the centrifugal flow compressor stage, then discharged into the turbine plenum assembly. Air from the plenum enters the annular combustion chamber, and mixes with fuel that is sprayed into the combustion chamber through 14 nozzles mounted around the gas generator case. The air-fuel mixture burns inside the combustion chamber, then the hot gases expand forward out of the chamber and pass through the compressor turbine stage, the power turbine stage, and out to the atmosphere through two exhaust ports located on each side of the nacelle near the front.

### ICE PROTECTION

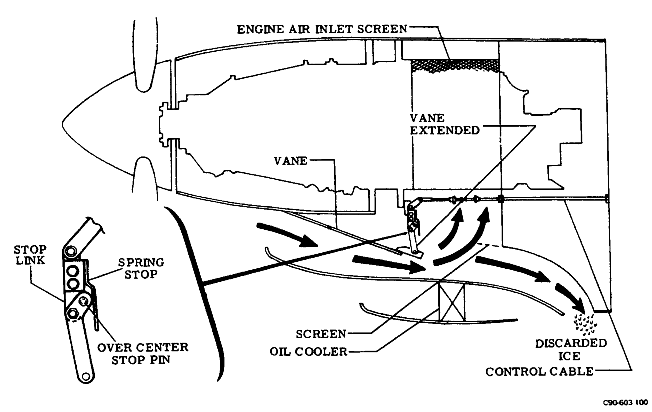
*ENGINE AIR INLET*

The engine air inlet lip boots are electrically heated to prevent the formation of ice and consequent distortion of the airflow. The boots are operated by the two switches on the pilot's subpanel, placarded ENG LIP BOOT - LEFT - RIGHT.

When the left inlet lip boot is on, the amount of current flowing through it can be measured by positioning the METER SELECT switch on the overhead panel to the LEFT GEN/INLET position and reading the value on the ammeter. The same ammeter indicates the current flow to the right inlet boot when the METER SELECT switch is in the RIGHT GEN/INLET position.

*ICE VANES (INERTIAL SEPARATOR SYSTEM)*

An inertial separation system is built into each engine air inlet to prevent moisture particles from entering the engine inlet plenum during icing conditions. This is done by




**ENGINE ICE PROTECTION**

introducing a sudden turn in the airstream to the engine, causing the moisture particles to continue on undeflected, because of their greater momentum, and to be discharged overboard.

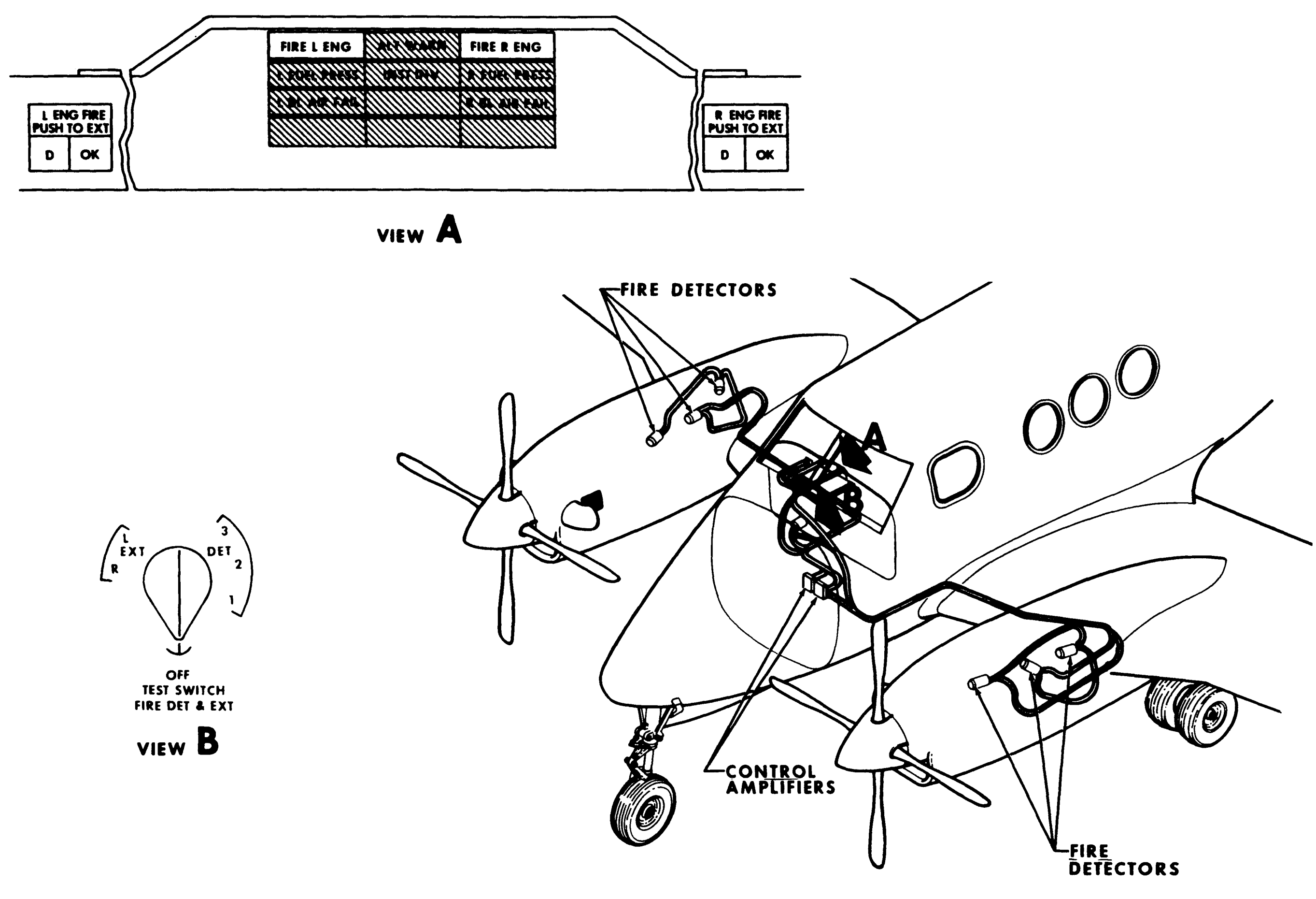
During normal operation, a movable vane is raised out of the direct ram airstream. For cold weather (+5°C or below) operation in visible moisture, it should be lowered into the airstream. The anti-ice vanes are operated by individual T-handle push-pull controls, located below the left subpanel. The controls are placarded PULL FOR ENGINE ICE PROTECTION - LEFT ENG - RIGHT ENG. Vane position during operation is indicated by the position of the T-handles, and by a slight decrease in torque with the engine ice protection controls extended. The vanes should be either fully retracted or fully extended; there are no intermediate positions.

## FUEL CONTROL

The basic engine fuel system consists of an engine driven fuel pump, a fuel control unit, a fuel manifold dump valve, a dual fuel manifold and fourteen fuel nozzles. The automatic fuel drain valves are provided to clear residual fuel after engine shutdown. This fuel control unit is a hydromechanical computing and metering device which determines the proper fuel schedule for the engine to provide the power required, as established by the position of the power levers. This is accomplished by controlling the speed of the compressor turbine. Engine characteristics vary with changes in inlet temperature and the acceleration fuel schedule must in turn be altered to prevent compressor stall and/or excessive turbine temperature.

## FIRE DETECTION SYSTEM

The fire detection system is designed to provide immediate warning in the event of fire in either engine compartment. The system consists of the following: three photoconductive cells for each engine; a control amplifier for each engine; two red warning lights on the warning annunciator panel, one placarded FIRE L ENG, the other FIRE R ENG; a test switch on the copilot's left subpanel; and a circuit breaker placarded FIRE DET on the right side panel. The six photoconductive-cell flame detectors are sensitive to infrared radiation. They are positioned in each engine compartment so as to receive both direct and reflected rays, thus monitoring the entire compartment with only three photocells. Heat level and rate of heat rise are not factors in the sensing method.




FIRE DETECTION SYSTEM SCHEMATIC

Conductivity through the photocell varies in direct proportion to the intensity of the infrared radiation striking the cell. As conductivity increases, the amount of current from the electrical system flowing through the flame detector increases proportionally. To prevent stray light rays from signaling a false alarm, a relay in the control amplifier closes only when the signal strength reaches a preset alarm level. When the relay closes, the appropriate left or right warning annunciators illuminate. When the fire has been extinguished, the cell output voltage drops below the alarm level and the relay in the control amplifier opens. No manual resetting is required to reactivate the fire detection system.

The test switch on the copilot's left subpanel, placarded TEST SWITCH - FIRE DET & FIRE EXT, has six positions: OFF - RIGHT EXT - LEFT EXT - 3 - 2 - 1. (If the optional engine-fire-extinguisher system is not installed, the switch will be placarded TEST SWITCH - FIRE DET, and the RIGHT EXT and LEFT EXT positions on the left side of the test switch will not be installed.) The three test positions for the fire detector system are located on the right side of the switch (3 - 2 - 1). When the switch is rotated from OFF (down) to any one of these three positions, the output voltage of the corresponding flame detector in each engine compartment is increased to a level sufficient to signal the amplifier that a fire is present. The following should illuminate: The red pilot and copilot MASTER WARNING flashers; and, if the optional engine-fire-extinguisher system is installed, the red lenses placarded L ENG FIRE - PUSH TO EXT and R ENG FIRE - PUSH TO EXT on the fire-extinguisher activation switches. The system may be tested anytime, either on the ground or in flight. The TEST SWITCH should be placed in all three positions, in order to verify that the circuitry for all six fire detectors is functional. Illumination failure of all the fire detection system annunciators when the TEST SWITCH is in any one of the three flame-detector-test positions indicates a malfunction in one or both of the two detector circuits (one in each engine) being tested by that particular position of the TEST SWITCH.

INTENTIONALLY LEFT BLANK

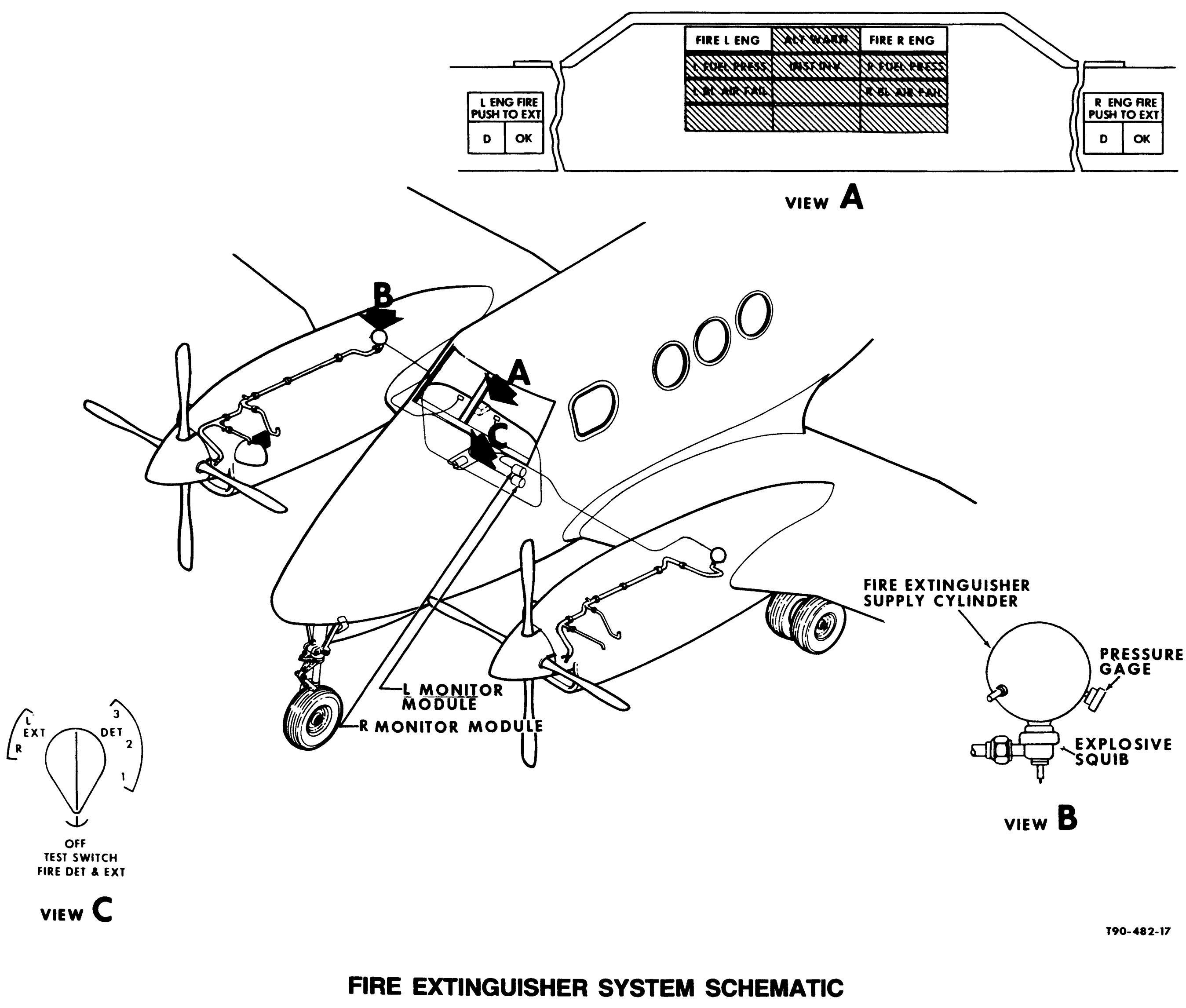
## FIRE EXTINGUISHER SYSTEM

The optional engine-fire-extinguisher system incorporates a pyrotechnic cartridge inside the nacelle of each engine. When the activation valve is opened, the pressurized extinguishing agent is discharged through a plumbing network which terminates in strategically located spray nozzles.

The fire extinguisher control switches used to activate the system are located on the glareshield at each end of the warning annunciator panel. Their power is derived from the hot battery bus. Each push-to-actuate switch incorporates three indicator lenses. The red lens, placarded L (or) R ENG FIRE - PUSH TO EXT, warns of the presence of fire in the engine compartment. The amber lens, placarded D, indicates that the system has been discharged and the supply cylinder is empty. The green lens, placarded OK, is provided only for the test function. To discharge the cartridge, raise the safety-wired clear plastic cover and press the face of the lens. This is a one-shot system and will be completely expended upon activation. The amber D light will illuminate and remain illuminated, regardless of battery switch position, until the pyrotechnic cartridge has been replaced.

The fire-extinguisher system test functions incorporated in the TEST SWITCH - FIRE DET & FIRE EXT test the circuitry of the fire extinguisher pyrotechnic cartridges. During preflight, the pilot should rotate the TEST SWITCH to each of the two positions (RIGHT EXT and LEFT EXT) and verify the illumination of the amber D light and the green OK light on each fire-extinguisher-activation switch on the glareshield.

A gage, calibrated in psi, is provided on each supply cylinder for determining the level of charge. The gages should be checked during preflight.




FIRE EXTINGUISHER SYSTEM SCHEMATIC

# PROPELLER SYSTEM

## DESCRIPTION

Each engine is equipped with a conventional four-blade, full-feathering, constant-speed, counter-weighted, reversing, variable-pitch propeller mounted on the output shaft of the reduction gearbox. The propeller pitch and speed are controlled by engine oil pressure, through single-action, engine-driven propeller governors. Centrifugal counterweights, assisted by a feathering spring, move the blades toward the low rpm (high pitch) position and into the feathered position. Governor boosted engine oil pressure moves the propeller to the high rpm (low pitch) hydraulic stop and reverse position. The propellers have no low rpm (high pitch) stops; this allows the blades to feather after engine shutdown.

Propeller tie-down boots are provided for use on the moored airplane to prevent windmilling at zero oil pressure.

## LOW PITCH STOPS

*(Serials LA-2 thru LA-120 except: LA-20, LA-97, and those airplanes modified by Kit 90-9070-1):*

The airplane is equipped with flight idle and ground idle low pitch stops. The flight idle stop is electrically controlled by a proximity switch which operates a governor-mounted solenoid valve. The ground idle low pitch stop is a mechanically monitored hydraulic stop.

*(Serials LA-20, LA-97, LA-121 and after, and those airplanes equipped with Kit 90-9070-1):*

The airplane is equipped with flight idle and ground idle low pitch stops. The flight idle is a mechanically monitored hydraulic low pitch stop. The ground idle low pitch stop is electrically controlled by a solenoid valve which resets the governor beta valve to produce the desired ground idle low pitch stop.

## PROPELLER GOVERNORS

Two governors, a constant speed governor, and an overspeed governor, control the propeller rpm. The constant speed governor, mounted on top of the gear reduction housing, controls the propeller through its entire range. The propeller control lever operates the propeller by means of this governor. If the constant speed governor should malfunction and request more than 1900 rpm, the overspeed governor cuts in at 1976 rpm and dumps oil from the propeller to keep the rpm from exceeding approximately 1976. A solenoid, actuated by the propeller governor test switch on the pilot's left subpanel, is provided for resetting the overspeed governor to approximately 1720 to 1800 rpm for test purposes.

In the event the propeller should stick, or move too slowly during a transient condition, resulting in an overspeed situation, the pneumatic section of the primary governor acts as a "fuel topping governor" which prevents an overspeed of the power turbine thereby limiting propeller overspeed. During operation in the reverse range, the fuel topping governor is reset to approximately 95% propeller rpm before the propeller reaches a negative pitch angle. This ensures that the engine power is limited to maintain a propeller rpm somewhat less than that of the constant speed governor setting. The constant speed governor therefore will always sense an underspeed condition and direct oil pressure to the propeller servo piston to permit propeller operation in Beta and reverse ranges.

## AUTOFEATHER SYSTEM

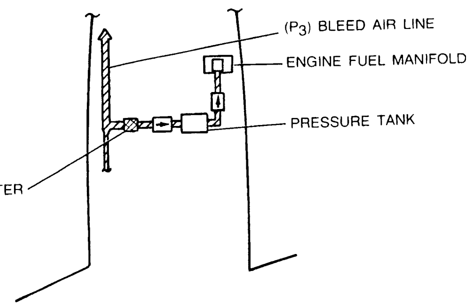
The automatic feathering system provides a means of immediately dumping oil from the propeller servo to enable the feathering spring and counterweights to start the feathering action of the blades in the event of an engine failure. Although the system is armed by a switch on the subpanel, placarded AUTOFEATHER - ARM - OFF - TEST, the completion of the arming phase occurs when both power levers are advanced above 90% $N_1$, at which time both the right and left indicator lights on the caution/advisory annunciator panel indicate a fully armed system. The annunciator panel lights are green, placarded L AUTOFEATHER and R AUTOFEATHER. The system will remain inoperative as long as either power lever is retarded below the 90% $N_1$ position. The system is designed for use only during take-off and landing and should be turned off when establishing cruise climb. During take-off or landing, if torquemeter oil pressure on either engine drops below a prescribed setting, the oil is dumped from the servo, the feathering spring starts the blades toward feather, and the autofeather system of the other engine is disarmed. Disarming of the autofeather portion of the operative engine is further indicated when the annunciator indicator light for that engine extinguishes.

# FUEL SYSTEM

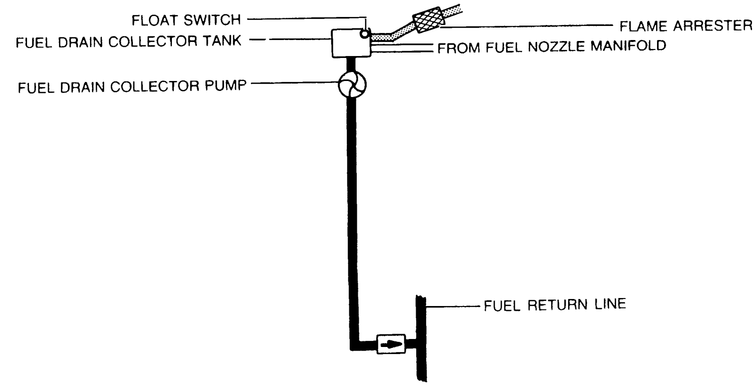
The fuel system consists of two separate systems connected by a valve-controlled crossfeed line. The separate fuel system for each engine is further divided into a main and auxiliary fuel system. The main system consists of a nacelle tank, a wing leading edge tank, two box section bladder tanks, and an integral (wet cell) tank, all interconnected to flow into the nacelle tank by gravity. This system of tanks is filled from the filler located near the wing tip. Each main system has a total of 194 usable gallons.

The auxiliary fuel system consists of a 41-gallon usable fuel center section tank with its own filler opening, and a fuel transfer system to transfer the fuel into the main fuel system when the auxiliary system is being used.

The two systems are vented through a recessed ram vent coupled to a protruding heated ram vent on the underside of the wing adjacent to the nacelle. One vent is recessed to prevent icing and the protruding vent is added as a backup and is heated to prevent icing.




**FUEL DRAIN PURGE SYSTEM**
(LA-57 AND AFTER)




**FUEL DRAIN COLLECTOR SYSTEM**
(LA-2 THRU LA-56)

**NOTE**

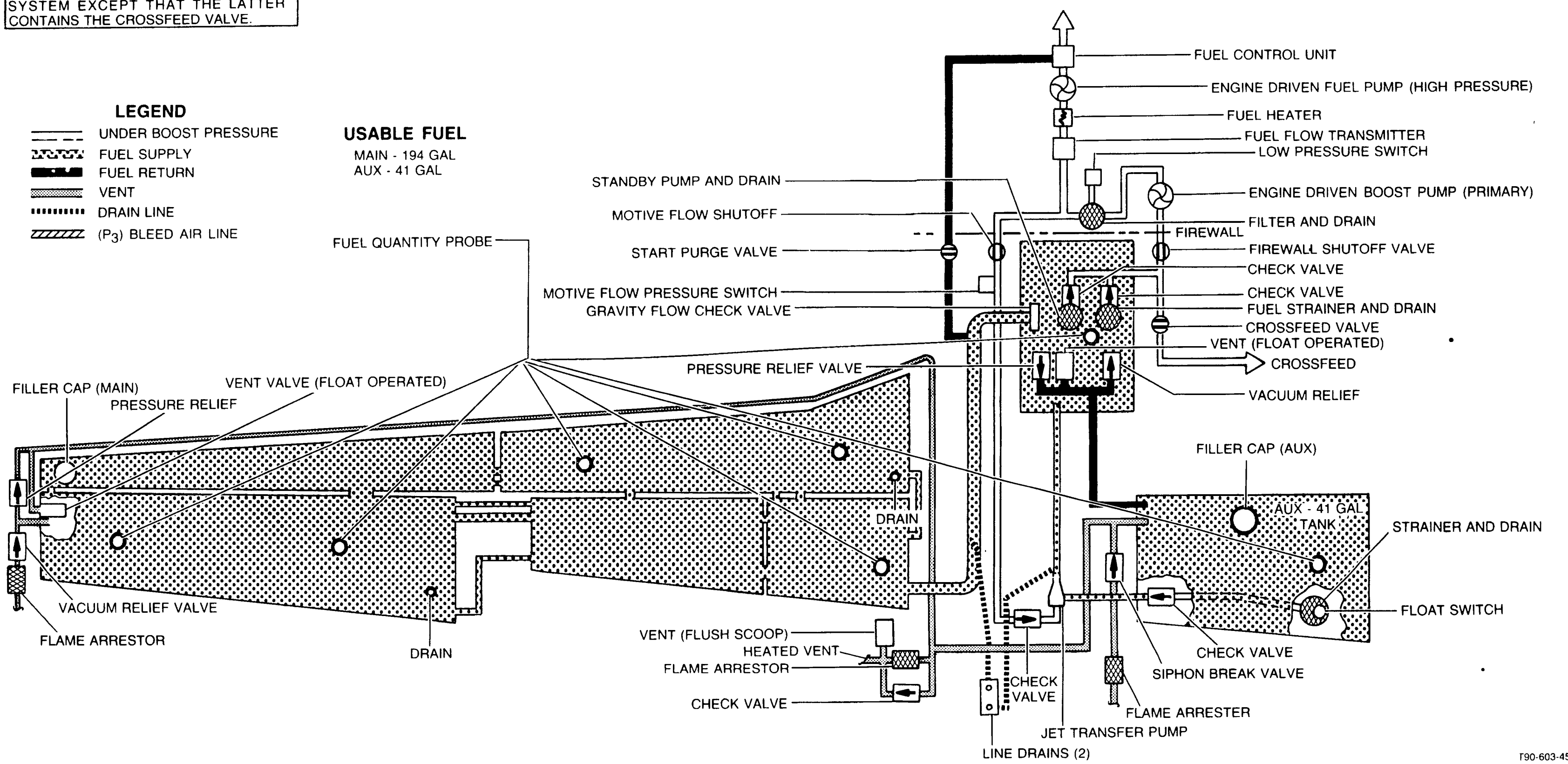
RIGHT SYSTEM IS IDENTICAL TO LEFT SYSTEM EXCEPT THAT THE LATTER CONTAINS THE CROSSFEED VALVE.

**LEGEND**

- UNDER BOOST PRESSURE
- FUEL SUPPLY
- FUEL RETURN
- VENT
- DRAIN LINE
- ($P_3$) BLEED AIR LINE

**USABLE FUEL**

MAIN - 194 GAL
AUX - 41 GAL




**FUEL SYSTEM SCHEMATIC**

## BOOST PUMPS

The engine-driven fuel pump is mounted on the accessory case in conjunction with the fuel control unit. The primary fuel boost pump is also engine driven and is mounted on a drive pad on the aft accessory section of the engine. This pump operates when the gas generator ($N_1$) is turning and provides sufficient fuel for start, takeoff, all flight conditions except operation with hot aviation gasoline above 17,000 feet altitude, and operation with crossfeed.

An electrically driven standby fuel pump located in the bottom of each nacelle tank is provided as a backup pump should the primary fuel boost pump fail, and for use with hot aviation gasoline above 17,000 feet. For crossfeed operations, standby pumps are required. In the event of an inoperative standby pump, crossfeed can only be accomplished from the side of the operative pump.

Electrical power to operate the standby pumps is controlled by lever lock toggle switches on the fuel control panel and is supplied from two independent sources. One source is provided through the LEFT or RIGHT GENERATOR BUSES and is protected by two 10-ampere circuit breakers located below the fuel control panel. This power is only available when the master switch is turned on.

Another supply source comes directly from the battery through the HOT BATTERY BUS and dual 5-ampere fuses located in the right wing center section. The fuse panel may be serviced through an access door on the bottom side of the wing approximately below the battery. This power source makes power available for the pumps at all times, regardless of the battery master switch position. These circuits are protected by diodes on each side of the standby pumps to prevent the failure of one circuit from disabling the other circuit. During shutdown, make certain both standby pump switches are off to prevent battery discharge.

In the event of a primary boost pump failure, the respective red FUEL PRESSure light in the annunciator panel will illuminate. The light illuminates when pressure decreases below 9 to 11 psig. The light will be extinguished by switching on the standby fuel pump on that side, thus increasing pressure above 9 to 11 psig.

*CAUTION*

Operation with the fuel pressure light on is limited to 10 hours between overhaul, or replacement, of the engine driven fuel pump.

When using aviation gasoline during climbs above 17,000 feet, the first indication of insufficient fuel pressure will be an intermittent flicker of the FUEL PRESSure light. A wide fluctuation of the fuel flow indicator may also be noted. These conditions can be eliminated by turning on the standby pumps.

## AUXILIARY TANK FUEL TRANSFER SYSTEM

The auxiliary tank fuel transfer system automatically transfers the fuel from the auxiliary tank to the nacelle tank without pilot action. Motive flow to a jet pump mounted in the wheel well is obtained from the engine fuel plumbing system downstream from the engine driven boost pump and routed through the transfer control motive flow valve. The motive flow valve is energized to the open position by the control system to transfer auxiliary fuel to the nacelle tank to be consumed by the engine during the initial portion of the flight. When an engine is started, pressure at the engine driven boost pump closes a pressure switch which, after a 30 to 50 second time delay to avoid depletion of fuel pressure during starting, energizes the motive flow valve. When the auxiliary fuel is depleted, a low level float switch de-energizes the motive flow valve after a 30 to 60 second time delay provided to prevent cycling of the motive flow valve due to sloshing fuel.

In the event of a failure of the motive flow valve or the associated control circuitry, the loss of motive flow pressure when there is still fuel remaining in the auxiliary fuel tank is sensed by a pressure switch and float switch, respectively, which illuminates a light placarded NO TRANSFER on the fuel control panel. During engine start, the pilot should note that the NO TRANSFER lights extinguish 30 to 50 seconds after engine start. A manual override is incorporated as a backup for the automatic transfer system. This is initiated by placing the AUX TRANSFER switch, located in the fuel control panel to the OVERRIDE position.

## USE OF AVIATION GASOLINE

If aviation gasoline must be used as an emergency fuel, it will be necessary to determine how many hours the airplane is operated on gasoline. Since the gasoline is being mixed with the regular fuel, it is expedient to record the number of gallons of gasoline taken aboard for each engine. Each engine is permitted 150 hours of operation on aviation gasoline between overhauls. This means that if one engine has an average fuel consumption of 40 gallons per hour, for example, it is allowed 6000 gallons of aviation gasoline between overhauls. (Two engines; 12,000 gallons between overhauls.)

## CROSSFEED

During emergency single-engine operation, it may become necessary to supply fuel to the operative engine from the fuel system on the opposite side. The simplified crossfeed system is placarded for fuel selection with a diagram on the upper fuel control panel. Place the standby pump switches in the OFF position when crossfeeding. A lever lock switch, placarded CROSSFEED FLOW, is moved from the center OFF position to the left or to the right, depending on direction of fuel flow. This opens the crossfeed valve, energizing the standby pump on the side from which crossfeed is desired, and de-energizes the motive flow valve in the fuel system on the side being fed. When the crossfeed mode is energized, a green FUEL CROSSFEED light on the caution/advisory panel will illuminate.

NOTE

The crossfeed is to be used only for single-engine operation. Do not feed both engines simultaneously from one side.

## FIREWALL SHUTOFF

The system incorporates two firewall shutoff valves controlled by two switches, one on each side of the fuel system circuit breaker panel on the fuel control panel. These switches, respectively left and right, are placarded FIREWALL SHUTOFF VALVE - OPEN - CLOSED. A red guard over each switch is an aid in preventing accidental operation. Like the boost pumps, the firewall shutoff valves receive electrical power from the GENERATOR BUSSES and also the HOT BATTERY BUS.

## FUEL FILTER

The fuel filter is on the forward side of the firewall and is the main fuel filter. From the main fuel filter, the fuel is routed through the fuel flow indicator transmitter, through a fuel heater that utilizes heat from the engine oil to warm the fuel, and then to the fuel control unit. From there it is directed through the dual fuel manifold to the fuel outlet nozzles and into the annular chamber. Fuel is also taken from just downstream of the main fuel filter to supply the jet transfer pump motive flow.

On the top of the fuel filter is a red button contamination indicator. Pressure differential in the fuel filter due to contamination will cause the red button to pop out, giving an indication that the filter needs servicing. Blockage of the fuel filter will cause fuel to bypass to the engines. Cleaning the filter should be accomplished as soon as practical after the button has popped out, whether or not the regular servicing interval has been reached.

## FUEL DRAIN COLLECTOR SYSTEM (LA-2 thru LA-56)

After engine shutdown, a small amount of fuel present in the fuel nozzle manifold drains into a small collector tank. The tank is mounted to one of the lower fire shields in the aft engine compartment. An electric float switch senses the tank fuel level and activates an electric pump which then transfers the fuel back to the nacelle tank. When the collector tank is emptied, the float switch turns off the pump. The entire operation is automatic and requires no input or additional duties from the crew.

## FUEL PURGE SYSTEM (LA-57 and After)

On engine start-up, fuel manifold pressure closes the fuel manifold poppett-valve, allowing $P_3$ air to pressurize the purge tank. On engine shutdown the fuel manifold pressure subsides, allowing the engine fuel manifold poppet-valve to open. The purge tank pressure then forces fuel out of the engine fuel manifold lines through the nozzles and into the combustion chamber. As the fuel is burned, a momentary surge in ($N_1$) gas generator rpm should be observed. The entire operation is automatic and requires no input from the crew.

## FUEL DRAINS

During each preflight, the fuel sumps on the tanks, pumps, and filters should be drained to check for fuel contamination. There are seven sump drains and one filter drain in each wing located as follows:

| NUMBER | DRAINS | LOCATION |
|---|---|---|
| 1 | Leading Edge Tank | Outboard of nacelle underside of wing. |
| 1 | Integral Tank | Underside of wing forward of aileron. |
| 1 | Firewall Fuel Filter | Pull ring located on firewall under cowling cover, right side of engine. |
| 1 | Standby Boost Pump | Bottom center of nacelle forward of wheel well. |
| 1 | Sump Strainer and Jet Transfer Pump | Bottom of nacelle forward of wheel well. |
| 1 | Auxiliary Tank | At wing root just forward of the flap. |
| 2 | Line Drains | Aft of wheel well. |

## FUEL GAGING SYSTEM

Fuel quantity in either the main or auxiliary fuel system is monitored by a capacitance fuel gaging system. Quantity is read directly in pounds. A maximum 3% error may be encountered in the system. However, the system is compensated for density changes due to temperature excursions. A graph is provided in the WEIGHT AND BALANCE/EQUIPMENT LIST Section to allow more accurate readings for all the approved jet fuels and for aviation gasoline. A selector switch on the fuel control panel, placarded FUEL QUANTITY - MAIN - AUXILIARY, allows monitoring of the main or auxiliary system fuel. There are two gages, one for each side.

## ELECTRICAL SYSTEM

The airplane electrical system is a 28-VDC (nominal) system with the negative lead of each power source grounded to the main airplane structure. DC electrical power is provided by one 34-ampere-hour, air-cooled, 20-cell, nickel-cadmium battery, and two 250-ampere starter/generators connected in parallel. The system is capable of supplying power to all subsystems that are necessary for normal operation of the airplane.

The battery, left generator, and right generator each provide power to four individual buses. In addition, a hot battery bus is provided for emergency operation of certain essential equipment and the cabin entry threshold light circuit. In normal operation, the buses are automatically tied into a single loop system where all sources are supplying power through individual protective devices. The left and right generators supply power to a respective left and right generator bus. The center bus is tied to the generator buses by a cross-tie line and bus-tie relays. This line automatically ties the two generator buses together whenever either generator is brought on the line. The center bus and triple-fed bus are supplied power from the battery and both generators. With the battery switch closed, these buses remain powered by the battery in the event neither generator is supplying power. Systems and equipment powered from the center and triple-fed buses are identified by a white ring around each appropriate switch on the subpanel. Although the normal electric heat, maximum electric heat and air conditioning are powered from the center bus, these systems are automatically shed, without a generator "on line", to reduce battery load. If neither generator is supplying power, systems and equipment powered from the generator buses, plus the normal electric heat, maximum electric heat and air conditioning, can be operated by closing the Bus Tie Open/Close switch. This will tie all the buses together as though a generator were operating. Time of operation on battery power will be reduced in this mode.

The main buses are protected by high current sensing devices and current limiters: In case of excessive current supplied by any power source, this protection will isolate that power source and allow the offending bus to become separated from the system. The other buses will continue to operate normally. During the engine start sequence and landing gear operation, the high current sensing devices are inhibited to allow for high current flow.

The high current sensing devices may be tested using the BUS TIE TEST/RESET switch located on the left subpanel. Adjacent to the BUS TIE/RESET switch is a manual BUS TIE OPEN/CLOSE switch.

Each bus may be monitored with the voltmeter located in the overhead panel by selecting the desired bus using the METER SELECT switch located adjacent to the voltmeter in the overhead panel.

A battery relay, controlled by the BAT switch, connects the battery to the triple fed bus. With the BAT switch ON the center bus is also engaged, through Normal heat and air conditioning, maximum electric heat, propeller deice control, and left and right manual propeller heat are automatically shed without a generator "on line". Isolation diodes permit the battery relay to be energized by external power or generator power in the event the battery charge is insufficient to activate the relay. A normal system potential of 28.25 ± .25 volts maintains the battery at full charge. An overvoltage relay opens the field circuit at 32 to 34 volts to provide overvoltage protection.

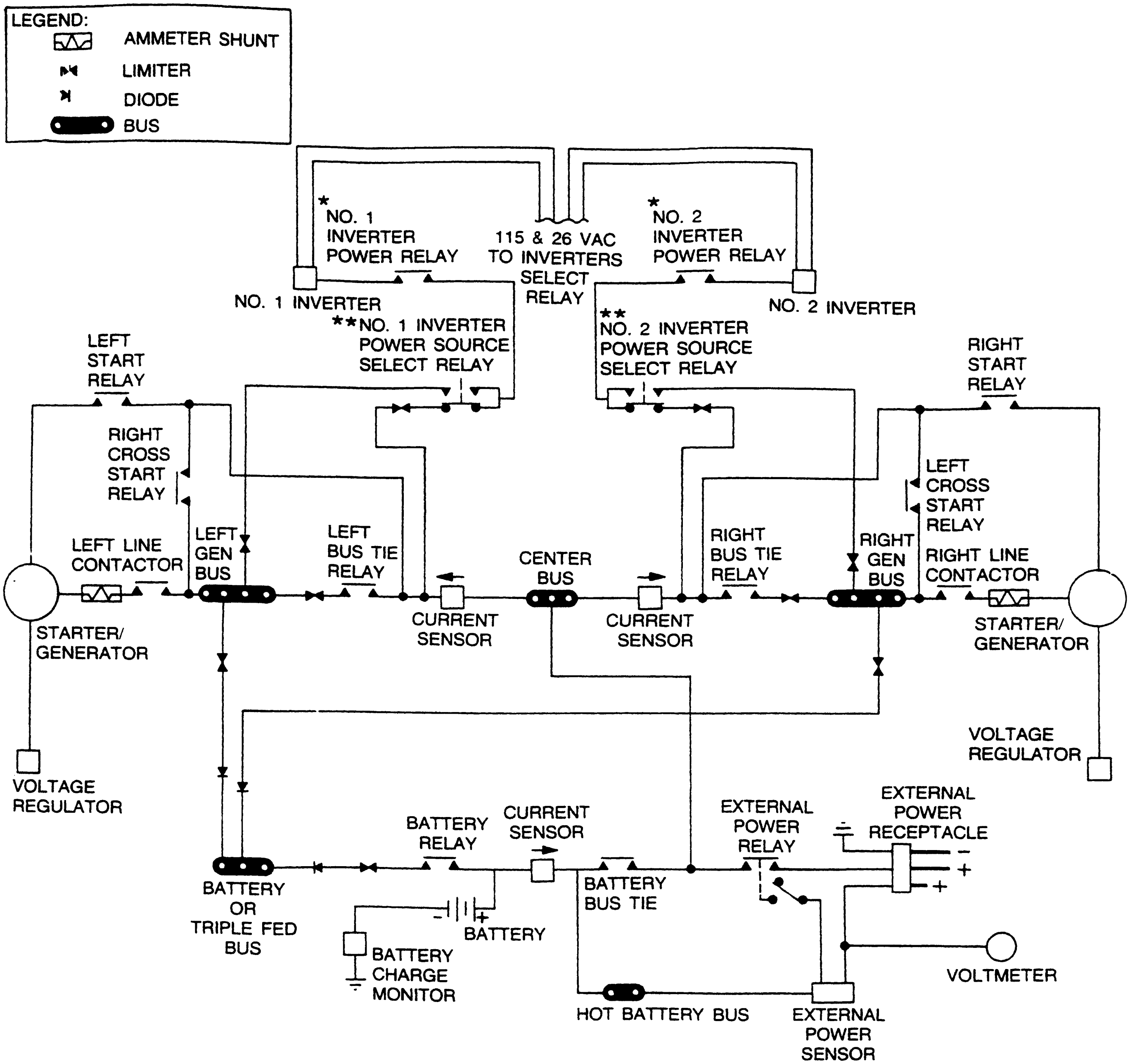
During engine starts, the battery is connected directly to the starter/generator by the starter relay. The starter/generator drives the compressor section of the engine through accessory gearing. The starter/generator initially draws approximately 700 amperes and then drops rapidly to about 300 amperes as the engine reaches 20% gas generator speed.

All electrical loads are divided among four buses except as noted on the accompanying Power Distribution Schematic. The equipment on the buses is arranged so that all items with duplicate functions (such as right and left landing lights) are connected to a different bus. Among the loads on the center bus are the number 1 and number 2 inverters. Through relay circuitry, the INVERTER selector switch activates the selected inverter, which provides 400-hertz, 115-volt, alternating current to the avionics equipment, and 400-hertz, 26 VAC to the torquemeters. The power for the inverters automatically transfers from battery to generator power when a generator is brought on the line. The volt/frequency meter normally indicates the frequency of the alternating current being supplied to the avionics equipment. When the button on the lower left corner of the meter is depressed, it indicates the AC voltage being supplied to the avionics equipment.

The generators are controlled by individual voltage regulators which allow a constant voltage to be presented to the buses during variations in engine speed and electrical load requirements. The generators are manually connected to the voltage regulating circuits by means of control switches located on the pilot's left subpanel. The voltage regulating circuit will automatically disable or enable a generator's capabilities on the bus. The load on each generator is indicated by the respective left and right volt/loadmeter located on the overhead meter panel.

Overheating of the nickel-cadmium battery will cause the battery charge current to increase. Therefore, an amber BATTERY CHG annunciator is provided in the annunciator panel to alert the pilot of the possibility of battery overheating. The BATTERY CHG annunciator will illuminate whenever, a high charging rate exists, such as after an engine start, and should extinguish within 5 minutes.

If the BATTERY CHG annunciator remains illuminated for more than 5 minutes during ground operations, the battery charge current can be monitored using the procedures found in the OTHER NORMAL PROCEDURES portion of Section IV, NORMAL PROCEDURES. If the annunciator illuminates in flight, the procedures found in Section III, EMERGENCY PROCEDURES, under BATTERY CHARGE RATE should be followed.




* INVERTER POWER RELAYS ARE CONTROLLED SO THAT ONLY ONE OF THE TWO INVERTERS IS ON OR BOTH ARE OFF.

** EACH INVERTER HAS A PRIMARY AND AN ALTERNATE POWER SOURCE.

F90-603-469

POWER DISTRIBUTION SCHEMATIC

**LEFT GENERATOR BUS**

NO 1 INVERTER POWER
NO 2 AVIONICS BUS
BUS SENSE
FLAP MOTOR
FLAP INDICATOR
GENERATOR CONTROL
AUTO PROP DEICE POWER
LEFT LIP HEAT CONTROL
LEFT LIP HEAT POWER
PILOT WINDSHIELD HEAT
LEFT FUEL VENT HEAT
LEFT FUEL CONTROL HEAT
LEFT LANDING LIGHT
LEFT AND RIGHT CHIP DETECTORS
LEFT AND RIGHT FUEL DRAIN
COLLECTOR PUMPS (if installed)
RIGHT BLEED AIR CONTROL
RIGHT FIREWALL VALVE
RIGHT STANDBY PUMP
VENT BLOWER
RADIO & ENGINE INSTRUMENT
LIGHTS
FLIGHT INSTRUMENT LIGHTS
ROTATING BEACON
TAIL FLOOD LIGHT
CIGAR LIGHTER

*(AVIONICS)

COMM 2
ADF 1
COPILOT AUDIO
AUTOPILOT
TRANSPONDER 2
DME 2
VLF/OMEGA
AVIONICS NO. 2 (BUS)
WEATHER RADAR
PAGING AMPLIFIER
CHECK LIST (RADAR)
DATA NAV.
VNAV

*Typical avionics busing.
Check avionics circuit breaker
panel or wiring diagram
for specific busing configuration.

**CENTER BUS**

LANDING GEAR MOTOR
NO 1 INVERTER (ALTERNATE)
NO 2 INVERTER (ALTERNATE)
NORMAL HEAT & AIR
CONDITIONING
MAXIMUM ELECTRIC HEAT
SURFACE DEICE
PROP DEICE CONTROL
LEFT MANUAL PROP HEAT
RIGHT MANUAL PROP HEAT
WINDSHIELD WIPERS
GENERATOR RESET
TAXI LIGHTS
NAVIGATION LIGHTS

**BATTERY OR TRIPLE FED BUS**

AVIONICS MASTER CONTROL
NO 1 AVIONICS BUS
LANDING GEAR CONTROL
LANDING GEAR HORN
LANDING GEAR INDICATION
LIGHTS
LEFT START CONTROL
LEFT IGNITION
LEFT BLEED AIR CONTROL
LEFT FUEL FLOW
LEFT OIL TEMP & PRESS
FUEL QUANTITY
FUEL PRESSURE
AUX TRANSFER
FUEL CROSSFEED
PROP GOVERNORS
LOW PITCH INDICATORS
(LA-2 THRU LA-120, EXCEPT
LA-20 AND LA-97 and airplanes
modified by Kit 90-9070-1)
STALL WARNING
FIRE DETECT
AUTOMATIC OXYGEN
CABIN PRESSURE CONTROL
CABIN AIR TEMP
PILOT TURN & SLIP
ANNUNCIATOR POWER
CABIN FLUORESCENT LIGHTS
INSTRUMENT INDIRECT LIGHTS
LEFT PITOT HEAT

*(AVIONICS)

COMM 1
NAV 1
GLIDESLOPE 1
RADIO RELAYS
COMPASS 1
FLIGHT DIRECTOR 1
PILOT AUDIO
MARKER BEACON 1
SERVO ALTIMETER
RNAV
RMI 2
AVIONICS MASTER
AVIONICS NO. 1 (BUS)

**RIGHT GENERATOR BUS**

NO 2 INVERTER POWER
NO 3 AVIONICS BUS
BUS SENSE
RUDDER BOOST
YAW DAMP
GENERATOR CONTROL
BRAKE DEICE CONTROL
RIGHT LIP HEAT CONTROL
RIGHT LIP HEAT POWER
COPILOT WINDSHIELD HEAT
RIGHT FUEL VENT HEAT
RIGHT FUEL CONTROL HEAT
RIGHT LANDING LIGHT
AUTOFEATHER
PROP SYNC
STALL WARNING HEAT
LEFT FIREWALL VALVE
LEFT STANDBY PUMP
RIGHT PITOT HEAT
ELECTRIC TRIM
COPILOT TURN & SLIP
CABIN LIGHTS
OVERHEAD & SUBPANEL LIGHTS
SIDE PANEL LIGHTS
ELECTRIC TOILET
RECOGNITION LIGHTS
REFRESHMENT BAR
STROBE LIGHTS

*(AVIONICS)

NAV 2
GLIDESLOPE 2
TRANSPONDER 1
DME 1
COMPASS 2
FLIGHT DIRECTOR 2
ADF 2
MARKER BEACON 2
HF
RADAR ALTIMETER
RADIO TELEPHONE
RMI 1
AVIONICS NO. 3 (BUS)
STEREO
INTERPHONE
FLIGHT PATH ADVISORY

**HOT BATTERY BUS**

RIGHT FIREWALL VALVE
RIGHT STANDBY BOOST PUMP
RIGHT FIRE EXTINGUISHER
LEFT FIREWALL VALVE
LEFT STANDBY BOOST PUMP
LEFT FIRE EXTINGUISHER
RNAV MEMORY
THRESHOLD LIGHT
INSTRUMENT EMERGENCY LIGHT
BAGGAGE AREA LIGHT
ENTRY LIGHT
CABIN DOOR OBSERVATION LIGHT
CLOCK

### AVIONICS POWER

The avionics are divided among the triple-fed and the two generator 28-VDC buses. In addition, some avionic components receive power from the 26/115 - VAC inverter buses. The general goal is to maintain a form of communication and navigation of each DC bus. For example, if only the right generator bus is operational, the use of headphones allows the receiver output from NAV 1 to be heard and the reply made with the transponder by transmitting "ident". The other items are partly copilot instruments bus usable by the pilot. The specific busing configuration for a particular airplane is depicted on the avionic's circuit breaker panel.

### EXTERNAL POWER

The external power receptacle, located under the right wing outboard of the nacelle, is provided to facilitate connecting an external power unit to the electrical system when the airplane is parked. A relay in the external power sensor will close only if the polarity of the voltage being supplied to the external power receptacle is correct. Whenever an external power plug is connected to the receptacle, the amber EXT PWR annunciator will illuminate, whether or not the auxiliary power unit is turned on. External power voltage can be monitored anytime - even before the EXT PWR switch on the pilot's left subpanel is turned on - by turning the METER SELECT switch in the overhead panel to the EXT PWR position and reading the voltage on the voltmeter. A high voltage sensor will lock out the external power relay if external power is above 31 ± .5 volts DC.

When the EXT PWR switch is turned ON, the external power relay and the left and right bus tie relays close and current flows to all buses. Consequently, the entire electrical system can be operated, including starting.

## LIGHTING SYSTEMS

### COCKPIT

An overhead light control panel, easily accessible to both pilot and copilot, incorporates a functional arrangement of all lighting systems in the cockpit. Each light group has its own rheostat switch placarded BRT - OFF. The MASTER PANEL LIGHTS switch controls the overhead light control panel lights, fuel control panel lights, engine instrument lights, radio panel lights, subpanel and console lights, pilot and copilot instrument lights, and gyro instrument lights. The instrument indirect lights in the glareshield and overhead map lights are individually controlled by separate rheostat switches. The push-button OUTSIDE AIR TEMP switch in the overhead light control panel turns on and off the light in the outside air temperature gage, located in the left sidewall aft of the fuel control panel. In the event of loss of electrical power on either generator bus, some of the lights illuminating the instrument panel will be lost. Four instrument emergency lights are installed below the glareshield on the left side, to provide light for the pilot's instruments in such an emergency. These lights draw power from the hot battery bus. They are turned on and off with a push-on\ push-off switch placarded INSTRUMENT EMERGENCY LIGHTS, located just to the right of the volt/ frequency meter in the overhead meter panel.

### CABIN

A three-position switch on the copilot's subpanel, placarded CABIN LIGHTS - START BRIGHT - DIM - OFF, controls the fluorescent cabin lights. The switch to the right of the interior light switch activates the cabin NO SMOKING/FASTEN SEAT BELT signs and accompanying chimes. This three-position switch is placarded CABIN LIGHTS - NO SMOKE & FSB - OFF - FSB.

The baggage-area light is controlled by a two-position switch just inside the airstair door aft of the door frame.

A threshold light is located forward of the airstair door at floor level. A switch adjacent to the threshold light turns this light on and off. This switch also turns the exterior entry light on and off. When the airstair door is closed, all the lights controlled by the threshold light switch will extinguish.

When the battery switch is on, the individual reading lights along the top of the cabin may be turned on or off by the passengers with a push-button switch adjacent to each light.

### EXTERIOR

Switches for the landing lights, taxi lights, wing ice lights, navigation lights, recognition lights, rotating beacons, and wingtip and tail strobe lights are located on the pilot's subpanel. They are appropriately placarded as to their function.

Tail floodlights, if installed, are incorporated into the horizontal stabilizers and are designed to illuminate both sides of the vertical stabilizer. A switch for these lights, placarded TAIL FLOOD, is located on the left subpanel.

A flush-mounted floodlight forward of the flaps in the bottom of the left wing may be installed. This entry light provides illumination of the area around the airstair door, to provide passenger convenience at night. There are no separate switches for this light; it is controlled by the threshold light switch just inside the door on the forward door frame, and will extinguish automatically whenever the cabin door is closed.

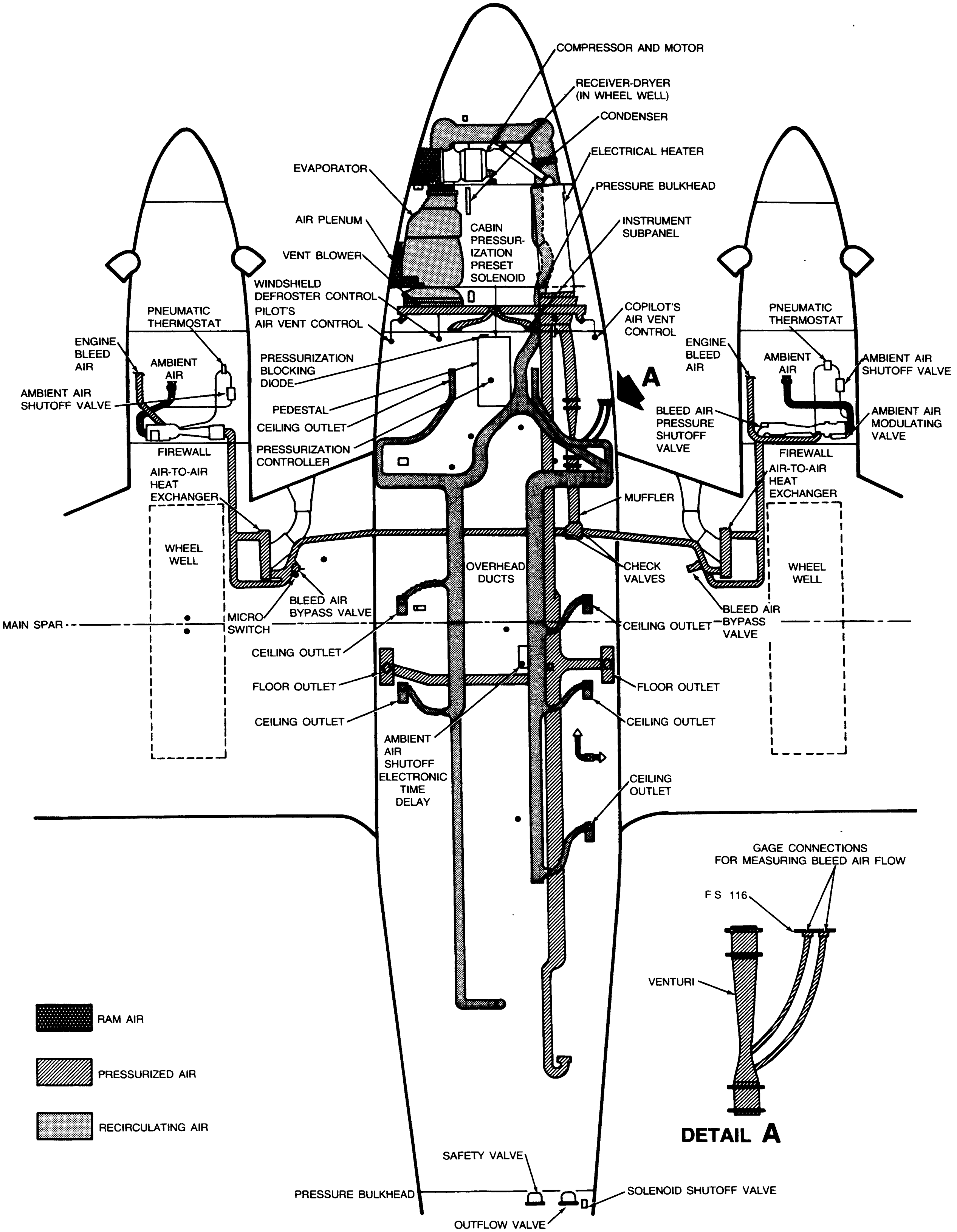
## ENVIRONMENTAL SYSTEM

The environmental system consists of the bleed air pressurization, heating and cooling systems, and their associated controls.

## PRESSURIZATION SYSTEM

The pressurization system is designed to provide a normal working pressure differential of 5.0 $\pm$ .1 psi, which will provide cabin pressure altitudes of approximately 6,000 feet at an airplane altitude of 20,000 feet, and 12,500 feet at 31,000 feet.

Bleed air from the compressor section of each engine is utilized to pressurize the pressure vessel. A flow control unit in the nacelle of each engine controls the pressure of the bleed air and mixes ambient air with it, in order to provide an air mixture suitable for the pressurization function. The mixture flows to the environmental bleed air shutoff valve, which is controlled by a switch placarded BLEED AIR




ENVIRONMENTAL SYSTEM SCHEMATIC

VALVES - LEFT (or) RIGHT - OPEN - CLOSED in the ENVIRONMENTAL controls group on the copilot's subpanel. When this switch is in the OPEN position, the air mixture flows through the valve and to the air-to-air heat exchanger. Depending upon the position of the bypass valves, a greater or lesser volume of the air mixture will be routed through or around the heat exchanger. The temperature of the air flowing through the heat exchanger is lowered as heat is transferred to cooling fins, which are in turn cooled by ram airflow through the fins of the heat exchanger. The air leaving both (left and right) bypass valves is then ducted into a single muffler, located under the right floorboard forward of the main spar, which helps ensure quiet operation of the environmental bleed air system. The air mixture is then ducted from the muffler into the mixing plenum, located under the pilot's floorboard.

A partition divides the mixing plenum into two sections. One section supplies the floor-outlet duct, and the other supplies the ceiling-outlet duct. Both sections receive recirculated cabin air from the vent blower. This air passes through the evaporator, so it will be cooled if the air conditioner is operating. Even in the event that the vent blower becomes inoperative, some air will still be circulated, due to a special nozzle in the discharge side of the mixing plenum.

The environmental bleed air duct is routed into the floor-duct section of the mixing plenum, then curves back to discharge the environmental bleed air toward the aft end of the floor-duct section of the mixing plenum. Forward of the discharge end of the environmental bleed air duct, warm air is tapped off and ducted up through the top of the mixing plenum and into the crew heat duct, which also receives recirculated cabin air from the mixing plenum. A valve on the forward side of the crew heat duct allows air to be tapped off for delivery to the windshield defroster when the DEFROST AIR knob on the pilot's left subpanel is pulled out.

The air from the environmental bleed air duct is mixed with recirculated cabin air (which may or may not be air conditioned) in the mixing plenum, then routed into the floor-outlet duct. This pressurized air is then introduced into the cabin through the floor registers. Finally, the air flows out of the pressure vessel through the outflow valve, located on the aft pressure bulkhead. A silencer on the outflow and safety/dump valves ensures quiet operation.

The mixture from both flow control units is delivered to the pressure vessel at a rate of approximately 12 pounds per minute, depending upon ambient temperature and pressure altitude. Pressure within the cabin and the rate of cabin-pressure changes are regulated by pneumatic modulation of the outflow valve, which controls the rate at which air can escape from the pressure vessel.

A vacuum-operated safety valve is mounted adjacent to the outflow valve on the aft pressure bulkhead. It is designed to serve three functions: to provide pressure relief in the event of a malfunction of the normal outflow valve; to allow depressurization of the pressure vessel whenever the cabin pressure switch is moved into the DUMP position; and to keep the pressure vessel unpressurized while the airplane is on the ground with the left landing-gear safety switch compressed. A negative-pressure relief function is also incorporated into both the outflow and the safety valves. This prevents outside atmospheric pressure's exceeding cabin pressure by more than 0.1 psi during rapid descents, even if bleed air inflow ceases.

When the BLEED AIR VALVE switches on the copilot's subpanel are OPEN (up), the air mixture from the flow control units enters the pressure vessel. While the airplane is on the ground, a left-landing-gear-safety-switch-actuated solenoid valve in each flow control unit keeps the ambient-air intake port closed; allowing only bleed air to be delivered into the pressure vessel. At lift-off, the safety valve closes and the ambient air shutoff solenoid valve in the left flow control unit opens; approximately 6 seconds later, the solenoid in the right flow control unit opens. Consequently, by increasing the volume of airflow into the pressure vessel in stages, excessive pressure bumps during takeoff are avoided.

An adjustable cabin pressurization controller is mounted in the pedestal. It commands modulation of the outflow valve. A dual-scale indicator dial is mounted in the center of the pressurization controller. The outer scale (CABIN ALT) indicates the cabin pressure altitude at which the pressurization controller is set to maintain. The inner scale (ACFT ALT) indicates the maximum ambient pressure altitude at which the airplane can fly without causing the cabin pressure altitude to climb above the value selected on the outer scale (CABIN ALT) of the dial. The indicated value on each scale is read opposite the index mark at the forward (top) position of the dial. Both scales rotate together when the cabin altitude selector knob, placarded CABIN ALT is turned. The maximum cabin pressure altitude is selected by turning the cabin altitude selector knob until the desired setting on the CABIN ALT dial is aligned with the index mark. The maximum cabin altitude selected may be anywhere from -1000 to +10,000 feet MSL. The rate control selector knob is placarded RATE - MIN - MAX. The rate at which the cabin pressure altitude changes from the current value to the selected value is controlled by rotating the rate control selector knob. The rate of change selected may be from approximately 200 to approximately 2000 feet per minute.

The actual cabin pressure altitude is continuously indicated by the cabin altimeter, which is mounted in the right side of the panel that is located between the caution/advisory annunciator panel and the pedestal. Immediately to the left of the cabin altimeter is the cabin vertical speed (CABIN CLIMB) indicator, which continuously indicates the rate at which the cabin pressure altitude is changing.

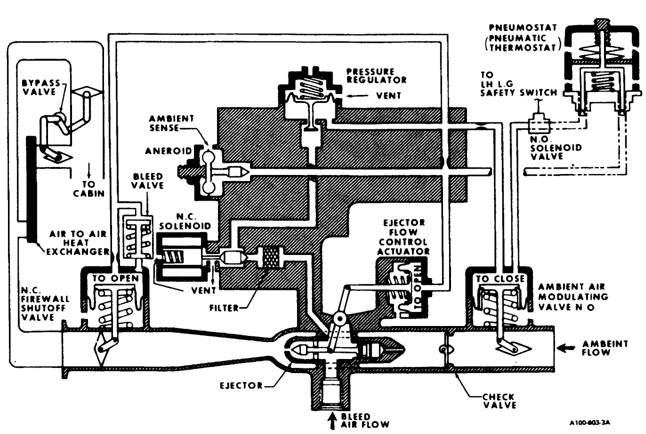
The cabin pressure switch, located to the left of the pressurization controller on the pedestal, is placarded CABIN PRESS - DUMP - PRESS - TEST. When this switch is in the DUMP (forward) position, the safety valve is held open, so that the cabin will depressurize and/or remain unpressurized. When it is in the PRESS (center) position, the safety valve is normally closed in flight, and the outflow valve is controlled by the pressurization controller, so that the cabin will pressurize. When the switch is held in the spring-loaded TEST (aft) position, the safety valve is held closed, bypassing the landing-gear safety switch, to facilitate testing of the pressurization system on the ground.

Prior to takeoff, the cabin altitude selector knob should be adjusted so that the ACFT ALT scale on the indicator dial indicates an altitude approximately 500 feet above the planned cruise pressure altitude, and the CABIN ALT scale indicates an altitude at least 500 feet above the take-off field pressure altitude. The rate control selector knob should be adjusted as desired; setting the index mark between the 9- and 12-o'clock positions will provide the most comfortable cabin rate of climb. The cabin pressure switch should be checked, to ensure that it is in the PRESS position. As the airplane climbs, the cabin pressure altitude climbs at the selected rate of change until the cabin reaches the selected pressure altitude. The system then maintains cabin pressure altitude at the selected value. If the airplane climbs to an altitude higher than the value indexed on the ACFT ALT scale of the dial on the face of the controller, the cabin-to-ambient pressure differential will reach the pressure relief setting of the outflow valve and safety valve. Either or both valves will then override the cabin pressurization controller in order to limit the cabin-to-ambient pressure differential to 5.0 ± .1 psi. If the cabin pressure altitude should reach a value of 12,500 feet, a pressure-sensing switch mounted on the forward pressure bulkhead will close. This causes the ALT WARN annunciator light to illuminate, warning the pilot of operation requiring the use of oxygen. If the auto-deployment oxygen system is installed, a pressure-sensing switch mounted on the cabin sidewall forward of the emergency exit also closes, causing the passenger oxygen masks to drop out and the cabin lights to illuminate. During cruise operation, if the flight plan calls for an altitude change, select the new altitude plus 500 feet on the CABIN ALT dial.

During descent and in preparation for landing, the cabin altitude selector should be set to indicate a cabin altitude of approximately 500 feet above the landing field pressure altitude, and the rate control selector should be adjusted as required to provide a comfortable cabin-altitude rate of descent. The airplane rate of descent should be controlled so that the airplane altitude does not catch up with the cabin pressure altitude until the cabin pressure altitude reaches the selected value and stabilizes. Then, as the airplane descends to and reaches the cabin pressure altitude, the negative-pressure relief function modulates the outflow and safety valve poppets toward the fully open position, thereby equalizing the pressure inside and outside the pressure vessel. As the airplane continues to descend below the preselected cabin pressure altitude, the cabin will be unpressurized and will follow the airplane rate of descent to touchdown.

## FLOW CONTROL UNIT

Each flow control unit consists of an ejector and an integral bleed air modulating valve, firewall shutoff valve, ambient air modulating valve, and a check valve that prevents the bleed air from escaping through the ambient air intake. The flow of bleed air through the flow control unit is controlled as a function of atmospheric pressure and temperature. Ambient air flow is controlled as a function of temperature only. When the BLEED AIR VALVE switches on the copilot's subpanel are OPEN, an electric solenoid valve on each flow control unit opens to allow the bleed air into the unit. As the bleed air enters the flow control unit, it passes through a filter before going to the reference pressure regulator. The regulator will reduce the pressure to a constant value (18 to 20 psi). This reference pressure is then directed to the various components within the flow control unit that regulate the output to the cabin. One reference pressure line is routed to the firewall shutoff valve located downstream of the ejector. An orifice is placed in the line immediately before the shutoff valve to provide a controlled opening rate. At the same time, the reference pressure is directed to the ambient air modulating valve located upstream of the ejector. A pneumatic thermostat with a variable orifice is connected to the modulating valve. The pneumatic thermostat is located on the lower aft side of the fireseal forward of the firewall. The bimetallic sensing discs of the thermostat are inserted into the cowling intake. These discs sense ambient temperature and regulate the size of the thermostat orifices. Warm air will open the orifice; cold air will restrict it until, at -30°F, the orifice will completely close. When the variable orifice is closed, the pressure buildup will cause the modulating valve to close off the ambient air source. An electric solenoid valve located in the line to the pneumatic thermostat is wired to the left landing gear safety switch. When the airplane is on the ground, the solenoid valve is closed, thereby directing the pressure to the modulating valve, causing it to shut off the ambient air source. The exclusion of ambient air allows faster cabin




BLEED AIR FLOW CONTROL UNIT

warmup during cold weather operation. An electric circuit containing a time-delay relay is wired to the above-mentioned solenoid valves to allow the left valve to operate approximately 6 seconds before the right valve. This precludes the simultaneous opening of the shutoff valves, which would result in a sudden pressure surge into the cabin. A check valve, located downstream from the modulating valve, prevents the loss of bleed air through the ambient air intake. At the same time the above operations have been taking place in the control unit, reference pressure is directed to the ejector flow control actuator. This actuator is connected to another variable orifice of the pneumatic thermostat and a variable orifice controlled by an isobaric aneroid. The thermostat orifice is restricted by decreasing ambient temperature, and the isobaric aneroid orifice is restricted by decreasing ambient pressure. The restriction of either orifice will cause a pressure buildup on the ejector flow control actuator, permitting more bleed air to enter the ejector.

## UNPRESSURIZED VENTILATION

Fresh-air ventilation is provided by two sources. One source, which is available during both the pressurized and the unpressurized mode, is the bleed air heating system. This air mixes with recirculated cabin air and enters the cabin through the floor registers. The volume of air from the floor registers is regulated by moving a sliding handle at the side of each inboard-facing register.

The second source of fresh air, which is available during the unpressurized mode only, is ambient air obtained (through a check valve) from the condenser section in the nose of the airplane. During the unpressurized mode, a spring holds the check valve open, so that the forward blower can draw this air into the cabin. The ambient air then mixes with recirculated cabin air, goes through the blower, through the evaporator (if it is operating, the air will be cooled), into the mixing plenum, into both the ceiling-outlet and the floor-outlet duct, and into the cabin through all the ceiling and floor outlets. Air ducted to each individual ceiling eyeball outlet can be directionally controlled by moving the eyeball in the socket. Volume is regulated by twisting the outlet to open or close the damper.

## HEATING

When air is compressed, its temperature is increased. Therefore, the bleed air extracted from the compressor section of each engine for pressurization purposes is hot. This heat is utilized to warm the cabin.

When the left landing gear safety switch is in the on-the-ground position, the ambient air valve in each flow control unit is closed. Consequently, only bleed air is delivered to the environmental bleed air duct when the airplane is on the ground. In flight, the ambient air valve is open, and ambient air is mixed with the engine bleed air in the flow control unit. This environmental bleed air mixture is then routed into the cabin.

If the environmental bleed air mixture is too warm for cabin comfort, the bypass valve routes some or all of it through the air-to-air heat exchanger, located in the wing center section. The position of the damper in the cabin-heat control valve is determined by positioning of the controls in the ENVIRONMENTAL group on the copilot's subpanel. An air intake on the leading edge of the inboard wing brings ram air into the heat exchanger to cool the bleed air. After leaving the heat exchanger, the ram air is ducted overboard through louvers on the underside of the wing.

After the bleed air passes through or around the air-to-air heat exchanger, it is ducted to the mixing plenum. Some of this environmental bleed air is tapped off and delivered to the pilot/copilot heat duct, which is located below the instrument panel. An outlet at each end of this duct is provided to deliver warm air to the pilot and copilot. A mechanically controlled damper in each outlet permits the volume of airflow to be regulated. The pilot's damper is controlled by the PILOT AIR knob, located on the pilot's subpanel just below and outboard of the control column. The copilot's damper is controlled by the CO-PILOT AIR knob, located on the copilot's subpanel just below and outboard of the control column. The DEFROST AIR control knob is located on the pilot's subpanel just below and inboard of the control column. This knob controls a valve at the forward side of the pilot/copilot heat duct which admits air to two ducts that deliver the warm air to the defroster, located just below the windshields in the top of the glareshield.

The remainder of the air in the environmental bleed air duct is discharged into the floor-outlet-duct section of the mixing plenum and mixed with recirculated cabin air. This air mixture is then ducted aft through the floor-outlet duct.

## ELECTRIC HEAT

To the right of the manual temp switch is the ELEC HEAT switch with three positions: GRD MAX - NORM - OFF. This switch is solenoid-held in GRD MAX position when on the ground and will drop down to the NORM position at lift-off when the landing gear safety switch is opened. It provides for maximum electric heat for initial warmup of the cabin. If all the electrical heating elements are not desired for initial warmup as in the GRD MAX position, the switch may be placed in the NORM position for warmup in which only four elements will be utilized. In this position the operation of the four heating elements is automatic in conjunction with the cabin thermostat to supplement bleed air heating. The OFF position turns off all electric heat and leaves cabin heating to be provided by bleed air.

## COOLING

Bleed air that is used during the cooling mode is passed through the heat exchanger in the wing center section. An air intake on the leading edge of the wing brings ram air into the heat exchanger to cool the bleed air that is being ducted into the cabin. This ambient air, upon leaving the heat exchanger, is dumped overboard through louvers on the bottom side of the wing. In the cooling mode, a bypass valve downstream from the heat exchanger routes the bleed air through the heat exchanger. After the air enters the cabin, it is distributed through the ducting system and recirculated. The air conditioner evaporator is mounted in the lower part of the nose forward of the pressure bulkhead. Cooling air is supplied to the air conditioner condenser by being drawn in through a louvered intake in the right side of the nose and exhausted out through louvers in the left side. The unit is electrically driven, has a rated capacity of 16,000 Btu, and uses a refrigerant gas. The current limiter that protects the air conditioner circuit, as well as the circuit for normal electric heat, is located beneath the floor under the pilot's chair.

## ENVIRONMENTAL CONTROLS

The ENVIRONMENTAL control section on the copilot's subpanel provides for automatic or manual control of the system. This section contains all the major controls of the environmental function: bleed air valve switches; a vent blower control switch; an evaporator on/off switch; a manual temperature switch for control of the cabin-temperature control valves in the air-to-air heat exchangers; a cabin-temperature-level control; and the cabin temp mode selector switch, for selecting automatic heating or cooling, manual heating or cooling, or off. Three additional manual controls on the main instrument subpanels may be utilized for partial regulation of cockpit comfort when the cockpit partition door is closed and the cabin comfort level is satisfactory. They are pilot's air, defroster air, and copilot's air control knobs. The fully out position of all these controls will provide the maximum heating to the cockpit, and the fully in position will provide minimum heating to the cockpit.

For warm flights, such as short, low-altitude flights in summer, all the cabin floor registers and ceiling outlets should be fully open for maximum cooling. For cold flights, such as high-altitude flights, night flights, and flights in cold weather, the ceiling outlets should all be closed for maximum heating in the cabin.

If the cabin temperature is comfortable but the cockpit temperature is not, the following procedures are suggested:

### HEATING MODE

*If the cockpit is too cold:*

- PILOT AIR, CO-PILOT AIR, and DEFROST AIR Knobs - PULLED FULLY OUT, or as required.

*If the cockpit is too hot:*

- PILOT AIR, CO-PILOT AIR, and DEFROST AIR Knobs - PUSHED FULLY IN, or as required.

### COOLING MODE

*If the cockpit is too cold:*

- PILOT AIR, CO-PILOT AIR, and DEFROST AIR Knobs - PUSHED FULLY IN, or as required.
- Cockpit Overhead Eyeball Outlets - CLOSED, or as required.

*If the cockpit is too hot:*

- PILOT AIR and CO-PILOT AIR Knobs - PULLED FULLY OUT, or as required.

### AUTOMATIC MODE CONTROL

When the CABIN TEMP MODE selector switch on the copilot's subpanel is in the AUTO position, the heating and air conditioning systems operate automatically. When the temperature in the cabin has reached the selected setting, the automatic temperature control modulates the bypass valves to allow heated air to bypass the air-to-air heat exchangers in the wing center sections. The warm bleed air is mixed with recirculated cabin air (which may or may not be air-conditioned) in the forward mixing plenum.

When the automatic control drives the environmental system from a heating mode to a cooling mode, the cabin-heat control valves close. When the bypass valve is opened to approximately the 30° position, the refrigeration system will turn off.

The CABIN TEMP - INCR control provides regulation of the temperature level in the automatic mode. A temperature-sensing unit in the cabin, in conjunction with the control setting, initiates a heat or cool command to the temperature controller, requesting the desired pressure-vessel environment.

### MANUAL MODE CONTROL

When the CABIN TEMP MODE selector is in the MAN HEAT or MAN COOL position, regulation of the cabin temperature is accomplished manually by momentarily holding the MANUAL TEMP switch to either the INCR or DECR position as desired. When released, this switch will return to the center (no change) position. Moving this switch to the INCR or DECR position results in modulation of the cabin-heat control valves in the bleed air lines. Allow approximately 30 seconds per valve (1 minute total time) for the valves to move to the fully open or fully closed position. Only one valve at a time moves. Movement of these valves varies the amount of bleed air routed through the air-to-air heat exchanger. Consequently, the temperature of the incoming bleed air will vary. This bleed air mixes with recirculated cabin air (which will be air-conditioned if the refrigeration system is operating) in the mixing plenum, and is then ducted to the floor registers. As a result, the cabin temperature will vary according to the position of the cabin-heat control valves, whether or not the air conditioner is operating.

The air conditioner compressor will not operate unless the cabin-heat control valves are closed. To ensure that the valves are closed, hold the manual temperature switch in the decrease position for one minute.

### BLEED AIR CONTROL

Bleed air and pneumatic instrument air switches are located on the copilot's subpanel. With the switches in the up position, both bleed air for environment, and pneumatic air for instrument is available. When the switch is moved to the down position, only the environmental source is terminated.

### VENT BLOWER CONTROL

The vent blower is controlled by a switch in the ENVIRONMENTAL group placarded VENT BLOWER - HI - LO - AUTO. When this switch is in the AUTO position, the vent blower will operate at low speed if the CABIN TEMP MODE selector switch is in any position other than OFF (i.e., MANual COOL, MANual HEAT, or AUTOmatic).

When the VENT BLOWER switch is in the AUTO position and the CABIN TEMP MODE selector switch is in the OFF position, the blower will not operate. Anytime the VENT BLOWER switch is in the LO position, the vent blower will operate at low speed, even if the CABIN TEMP MODE selector switch is OFF. Anytime the VENT BLOWER switch is in the HI position, the vent blower will operate at high speed, regardless of the position of the CABIN TEMP MODE selector switch (i.e., MAN COOL, MAN HEAT, OFF or AUTO).

## OXYGEN SYSTEM

The oxygen system is based on an adequate flow for an altitude of 31,000 feet. The masks and Oxygen Duration Chart (NORMAL PROCEDURES Section) are based on a flow rate of 3.7 Liters Per Minute (LPM-NTPD). The only exception is the diluter-demand crew mask when used in the 100% mode. For oxygen duration computation, each diluter-demand mask being used in the 100% mode is counted as two masks at 3.7 LPM-NTPD. At cabin altitudes above 20,000 feet SELECT 100% MODE.

A push/pull handle (PULL ON - SYStem READY) located aft of the overhead light control panel is used in conjunction with the automatically deployed passenger oxygen system. This handle operates a cable which opens and closes the shut-off valve located at the oxygen supply bottle in the aft, unpressurized area of the fuselage. When this handle is pushed in, no oxygen supply is available anywhere in the airplane. It should be pulled out prior to engine starting, to ensure that oxygen will be immediately available anytime it is needed. When this handle is pulled out, the primary oxygen supply line is charged with oxygen, provided the oxygen supply bottle is not empty. The primary oxygen supply line delivers oxygen to the two crew oxygen outlets in the cockpit, to the first aid oxygen outlet, and to the passenger oxygen system shut-off valve.

The crew is normally provided with diluter-demand, quick-donning oxygen masks. These masks hang on the aft cockpit partition behind and outboard of the pilot and copilot seats. They are held in the armed position by spring-tension clips, and can be donned immediately with one hand. The diluter-demand crew masks deliver oxygen to the user only upon inhalation. Consequently, there is no loss of oxygen when the masks are plugged in and the PULL ON - SYStem READY handle is pulled out, even though oxygen is immediately available upon demand.

A small lever on each diluter-demand oxygen mask permits the selection of two modes of operation: NORMAL and 100%. In the NORMAL position, air from the cockpit is mixed with the oxygen supplied through the mask. This reduces the rate of depletion of the oxygen supply, and it is more comfortable to use than 100% aviator's breathing oxygen. However, in the event of smoke or fumes in the cockpit, the 100% position should be used to prevent the breathing of contaminated air. For this reason, the selector levers should be left in the 100% position when the masks are not in use.

Anytime the primary oxygen supply line is charged, oxygen can be obtained from the first aid oxygen mask, located near the center of the cabin, by manually opening the overhead access door (placarded FIRST AID OXYGEN - PULL) and opening the on/off valve inside the box. A placard (NOTE: CREW SYStem MUST BE ON) reminds the user that the PULL ON-SYStem READY handle in the cockpit must be pulled out before oxygen will flow from the first aid oxygen mask.

The auto-deployment passenger oxygen system is of the constant-flow type. Anytime the cabin pressure altitude exceeds approximately 12,500 feet, a barometric-pressure switch automatically energizes a solenoid which opens the passenger oxygen system shut-off valve. The pilot can open the valve manually anytime by pulling out the PASSENGER MANUAL OverRIDE handle, located aft of the overhead light control panel. Once the passenger oxygen system shut-off valve has been opened (either automatically or manually), oxygen will flow into the passenger oxygen supply line, if the primary oxygen system line has been charged (i.e., if the oxygen supply bottle contains oxygen and the PULL ON - SYStem READY handle in the cockpit is pulled out). When oxygen flows into the passenger oxygen system supply line, a pressure-sensitive switch in the line closes a circuit to illuminate the green PASS OXY ON annunciator on the cautionary/advisory annunciator panel. On serials LA-87 and after, this switch will also cause the cabin lights to illuminate in the full bright mode, regardless of the position of the CABIN LIGHTS switch on the copilot's left subpanel. On serials prior to LA-87 the cabin lights are activated by the cabin altitude switch.

The pressure of the oxygen in the passenger oxygen system supply line then automatically extends a plunger against each of the passenger oxygen mask dispenser doors, forcing the doors open. The oxygen masks then drop down about 9 inches below the dispensers. The lanyard valve pin at the top of the oxygen mask hose must be pulled out in order for oxygen to flow from the mask. The pin is connected to the oxygen mask via a flexible cord; when the oxygen mask is pulled down for use, the cord pulls the pin out of the lanyard valve. The lanyard valve pin must be manually reinserted into the valve in order to stop the flow of oxygen when the mask is no longer needed. The passenger oxygen can be shut off and the remaining oxygen isolated to the crew and first aid outlet by pulling the OXY CONTROL circuit breaker in the ENVIRONMENTAL group on the right side panel, provided the PASSENGER MANUAL O'RIDE handle is pushed in to the off position.

## PITOT AND STATIC SYSTEM

The pitot and static system provides a source of impact air and static air for operation of the flight instruments. A heated pitot mast is located on each side of the lower portion of the nose. Tubing from the left pitot mast is connected to the pilot's airspeed indicator, and tubing from the right pitot mast is connected to the copilot's airspeed indicator.

The normal static system provides two separate sources of static air - one for the pilot's flight instruments, and one for the copilot's. Each of the normal static air lines opens to the atmosphere through two static air ports - one on each side of the aft fuselage.

An alternate static air line is also provided for the pilot's flight instruments. In the event of a failure of the pilot's normal static air source (e.g., if ice accumulations should obstruct the static air ports), the alternate source should be selected by lifting the spring-clip retainer off the PILOT'S STATIC AIR SOURCE valve handle, located on the right side panel, and moving the handle aft to the ALTERNATE position. This will connect the alternate static air line to the pilot's flight instruments. The alternate line obtains static air just aft of the rear pressure bulkhead, from inside the unpressurized area of the fuselage.

**WARNING**

The pilot's airspeed and altimeter indications change when the alternate static air source is in use. Refer to the Airspeed Calibration - Alternate System, and the Altimeter Correction - Alternate System graph in the PERFORMANCE Section for operation when the alternate static air source is in use.

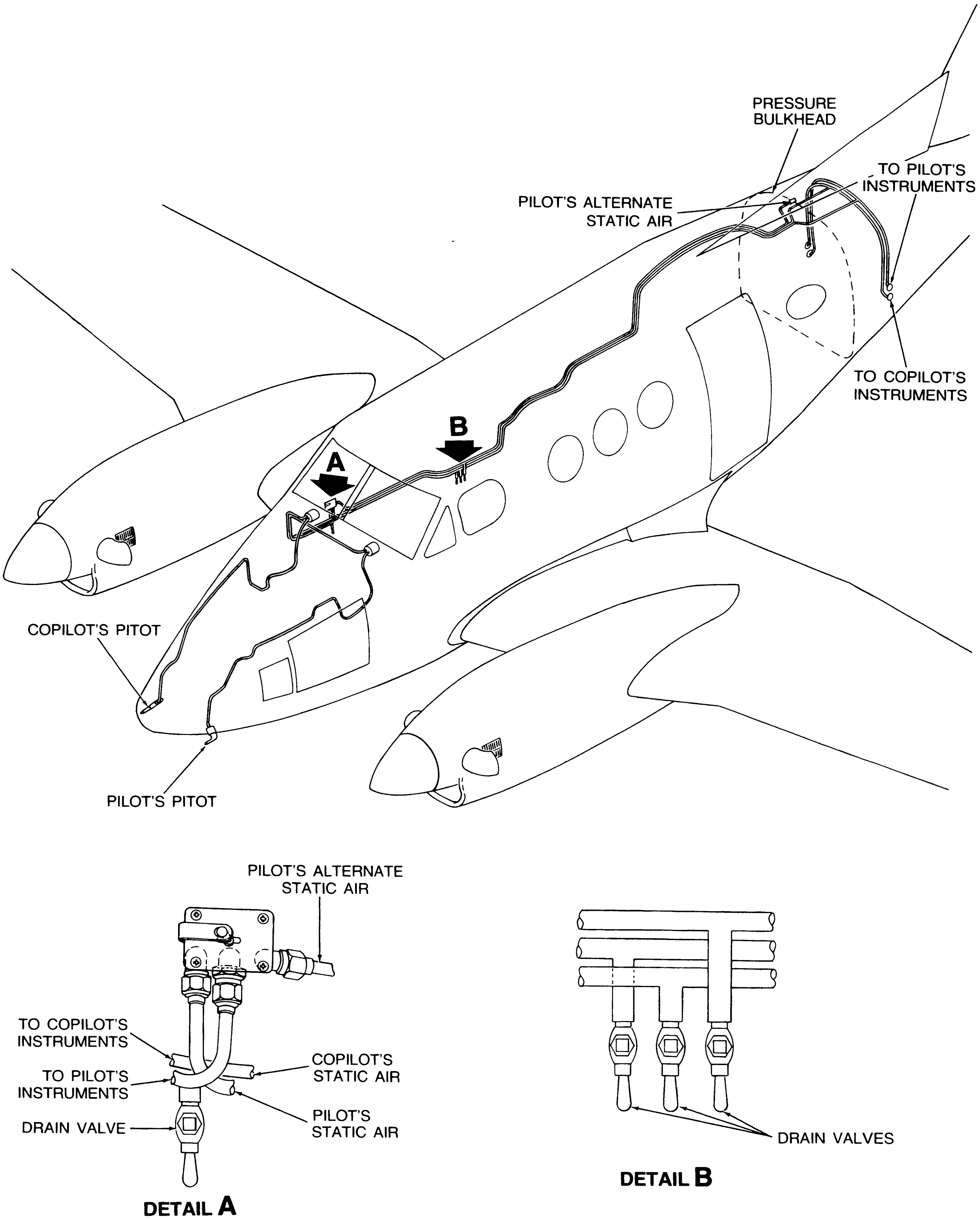
When the alternate static air source is not needed, ensure that the PILOT'S STATIC AIR SOURCE valve handle is held in the forward (NORMAL) position by the spring-clip retainer.

Four petcocks are provided to facilitate draining moisture from the static air lines. Three are located at the floor on the right cabin sidewall, aft of the rear spar, and one is located below the PILOT'S STATIC AIR SOURCE valve. The drain valves should be opened to release any trapped moisture at each 100-hour inspection, and after exposure to visible moisture on the ground. They must be closed after draining.

## ENGINE BLEED AIR PNEUMATIC SYSTEM

High-pressure bleed air from each engine compressor, routed through the firewall shutoff valves and regulated at 18 psi, supplies pressure for the surface deice system and vacuum source. Vacuum for the flight instruments is derived from a bleed air ejector. One engine can supply sufficient bleed air for all these systems.

During single-engine operation, a check valve in the bleed air line from each engine prevents flow back through the line on the side of the inoperative engine. A suction gage calibrated in inches of mercury, located on the copilot's subpanel, indicates instrument vacuum. To the right of the suction gage is a pneumatic pressure gage, calibrated in pounds per square inch, which indicates air pressure available to the deice distributor valve.




**PITOT AND STATIC SYSTEM SCHEMATIC**

## AUTOMATIC DEVICES IN THE CONTROL SYSTEM

### YAW DAMP

A yaw damp system is provided to aid the pilot in maintaining directional control, and to increase ride comfort. The system may be used at any altitude, and is required for flight above 17,000 feet. It should be deactivated for takeoff and landing.

If the airplane is equipped with an autopilot, the yaw damp system will be a part of the autopilot. Operating instructions for this system will be contained in the appropriate Airplane Flight Manual Supplement.

If an autopilot is not installed in the airplane, yaw damping is provided by an independent yaw damp system. The components include a yaw sensor, amplifier, and control valve. Regulated air pressure from the control valve is directed to the same pneumatic servos used for the rudder boost system. The system (on airplanes without autopilots) is controlled by a YAW DAMP switch adjacent to the RUDDER BOOST switch on the pedestal. In the event the YAW DAMP switch is inadvertently left ON during takeoff or landing, the circuit for the yaw damping system will be interrupted by the left landing gear safety switch while the airplane is on the ground, rendering it inoperative.

## STALL WARNING SYSTEM

The stall warning system consists of a transducer, a lift computer, a warning horn, and a test switch. Angle of attack is sensed by aerodynamic pressure on the left transducer vane located on the left wing leading edge. When a stall is imminent, the output of the transducer activates a stall warning horn.

The system has preflight test capability through the use of the STALL WARN TEST Switch on the right subpanel. Holding this switch in the TEST (up) position actuates the warning horn.

## ICE PROTECTION SYSTEMS

### WINDSHIELD HEAT

Two levels of heat are provided. When the switches are in the normal (up) position, heat is supplied to the major portion of the windshields. When they are in the HI (down) position, a higher level of heat is supplied to a smaller area of the windshields. Each switch must be lifted over a detent before it can be moved into the HI position. This lever-lock feature prevents inadvertent selection of the HI position when moving the switches from NORM to the OFF (center) position.

Controllers with temperature-sensing units provide for proper heat at the windshield surfaces. Five-ampere circuit breakers, located on a panel on the forward pressure bulkhead, protect the control circuits. The power circuit of each system is protected by a circuit breaker located in the power distribution panel under the floor forward of the main spar.

NOTE

Erratic operation of the magnetic compass may occur while windshield heat is being used.

## PROPELLER ELECTRIC DEICE SYSTEM

The propeller electric deice system includes: an electrically heated boot for each propeller blade, brush assemblies, slip rings, an ammeter, a timer for automatic operation, and a manual control circuit for backup.

*Airplanes LA-1 through LA-130*

A circuit breaker switch on the pilot's subpanel, placarded PROP-AUTO-OFF, is provided to activate the automatic system and insure against circuit overload. The deice ammeter in the overhead meter panel registers the amount of current (normally 17 to 21 amperes) passing through the system when the METER SELECT switch is in the BAT/PROP (12 o'clock) position. The timer directs current to the two-element boot on each blade in the following sequence: right propeller outer elements, then inner elements, then the timer switches to the outer elements, then inner elements of the left propeller. Loss of one heating element circuit on one side does not mean that the entire system must be turned off. The timer completes one cycle in approximately 2 min.

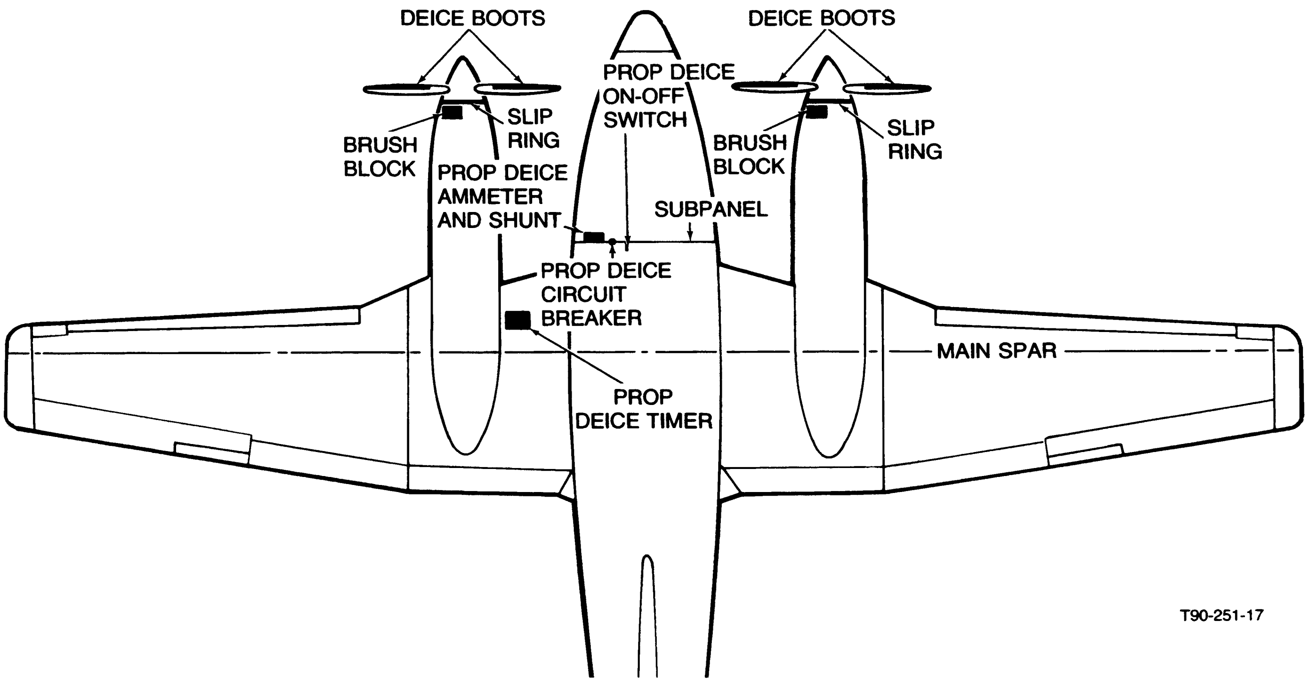
Proper operation can be checked by noting the correct level of current usage on the propeller deice ammeter. Readings which fall outside the normal range of 17 to 21 amperes may indicate a malfunction of the system. Consult the EMERGENCY PROCEDURES section for procedures to be followed.

The manual prop deice system is provided as a backup to the automatic system. A control switch located on the left subpanel, placarded PROP-INNER-OUTER, controls the manual override relays. When the switch is in the OUTER position the timer is overridden and power is supplied simultaneously to the outer heating elements of both propellers. The switch is of the momentary type and must be held in place until ice is dislodged from the blades. Then the switch is held in the INNER position to perform the same function with the inner elements of both propellers. The propeller deice ammeter will not show a load during manual operation; however, the load meters will indicate approximately a .05 increase in load on each side.

*Airplanes LA-131 and after:*

A circuit breaker switch on the pilot's subpanel, placarded PROP-AUTO-OFF, is provided to activate the automatic system and insure against circuit overload. The deice ammeter in the overhead meter panel registers the amount of current (normally 17 to 21 amperes) passing through the system when the METER SELECT switch is in the BAT/PROP (12 o'clock) position. The timer directs current to the single-element boot on each blade in the following sequence: right propeller all elements, then left propeller all elements. Loss of one heating element circuit on one side does not mean that the entire system must be turned off. The timer switches every 90 seconds resulting in a complete cycle in approximately 3 minutes.

Proper operation can be checked by noting the correct level of current usage on the propeller deice ammeter.




**PROPELLER ELECTRIC DEICE SYSTEM SCHEMATIC**

Readings which fall outside the normal range of 17 to 21 amperes may indicate a malfunction of the system. Consult the EMERGENCY PROCEDURES section for procedures to be followed.

The manual prop deice system is provided as a backup to the automatic system. A control switch located on the left subpanel, placarded PROP MANUAL-OFF, controls the manual override relays. When the switch is in the MANUAL position the automatic timer is overridden and power is supplied simultaneously to all of the heating elements on both propellers. The switch is of the momentary type and must be held in place until ice is dislodged from the blades. The propeller deice ammeter will not show a load during manual operation; however, the loadmeters will indicate approximately a .05 increase in load on each side.

### SURFACE DEICE SYSTEM

The surface deice system removes ice accumulations from the leading edges of the wings and horizontal stabilizers. Ice removal is accomplished by alternately inflating and deflating the deicer boots. Pressure-regulated bleed air from the engines supplies pressure to inflate the boots. A venturi ejector, operated by bleed air, creates vacuum to deflate the boots and hold them down while not in use. To assure operation of the system in the event of failure of one engine, a check valve is incorporated in the bleed air line from each engine to prevent loss of pressure through the compressor of the inoperative engine. Inflation and deflation phases are controlled by a distributor valve.

A three-position switch on the pilot's subpanel, placarded DEICE CYCLE - SINGLE - OFF - MANUAL, controls the deicing operation. The switch is spring-loaded to return to the OFF position from SINGLE or MANUAL. When the SINGLE position is selected, the distributor valve opens to inflate the wing boots. After an inflation period of approximately 6 seconds, an electronic timer switches the distributor to deflate the wing boots, and a 4-second inflation begins in the horiziontal stabilizer boots. When these boots have inflated and deflate, the cycle is complete.

When the switch is held in the MANUAL position, all the boots will inflate simultaneously and remain inflated until the switch is released. The switch will return to the OFF position when released. After the cycle, the boots will remain in the vacuum hold down condition until again actuated by the switch.

For most effective deicing operation, allow at least one inch of ice to form before attempting ice removal. Very thin ice may crack and cling to the boots instead of shedding. Subsequent cyclings of the boots will then have a tendency to build up a shell of ice outside the contour of the leading edge, thus making ice removal efforts ineffective.

### PITOT MAST

Heating elements are installed in the pitot masts located on the nose. Each heating element is controlled by an individual circuit breaker switch placarded PITOT - LEFT - RIGHT, located on the pilot's subpanel. It is not advisable to operate the pitot heat system on the ground except for testing or for short intervals of time to remove ice or snow from the mast.

### STALL WARNING VANE

The lift transducer is equipped with anti-icing capability on both the mounting plate and the vane. The heat is controlled by a switch located on the pilot's subpanel placarded STALL WARN. The level of heat is minimal for ground operation, but is automatically increased for flight operation through the left landing gear safety switch.

**WARNING**

The heating elements protect the lift transducer vane and face plate from ice. However, a buildup of ice on the wing may change or disrupt the airflow and prevent the system from accurately indicating an imminent stall. Remember that the stall speed increases whenever ice accumulates on any airplane.

### FUEL

An oil-to-fuel heat exchanger, located on the engine accessory case, operates continuously and automatically to heat the fuel sufficiently to prevent ice from collecting in the fuel control unit.

Each pneumatic fuel control line is protected against ice by an electrically heated jacket. Power is supplied to each fuel control air line jacket heater by two switches actuated by moving the condition levers in the pedestal out of the fuel cut-off range. Fuel control heat is automatically turned on for all flight operations.

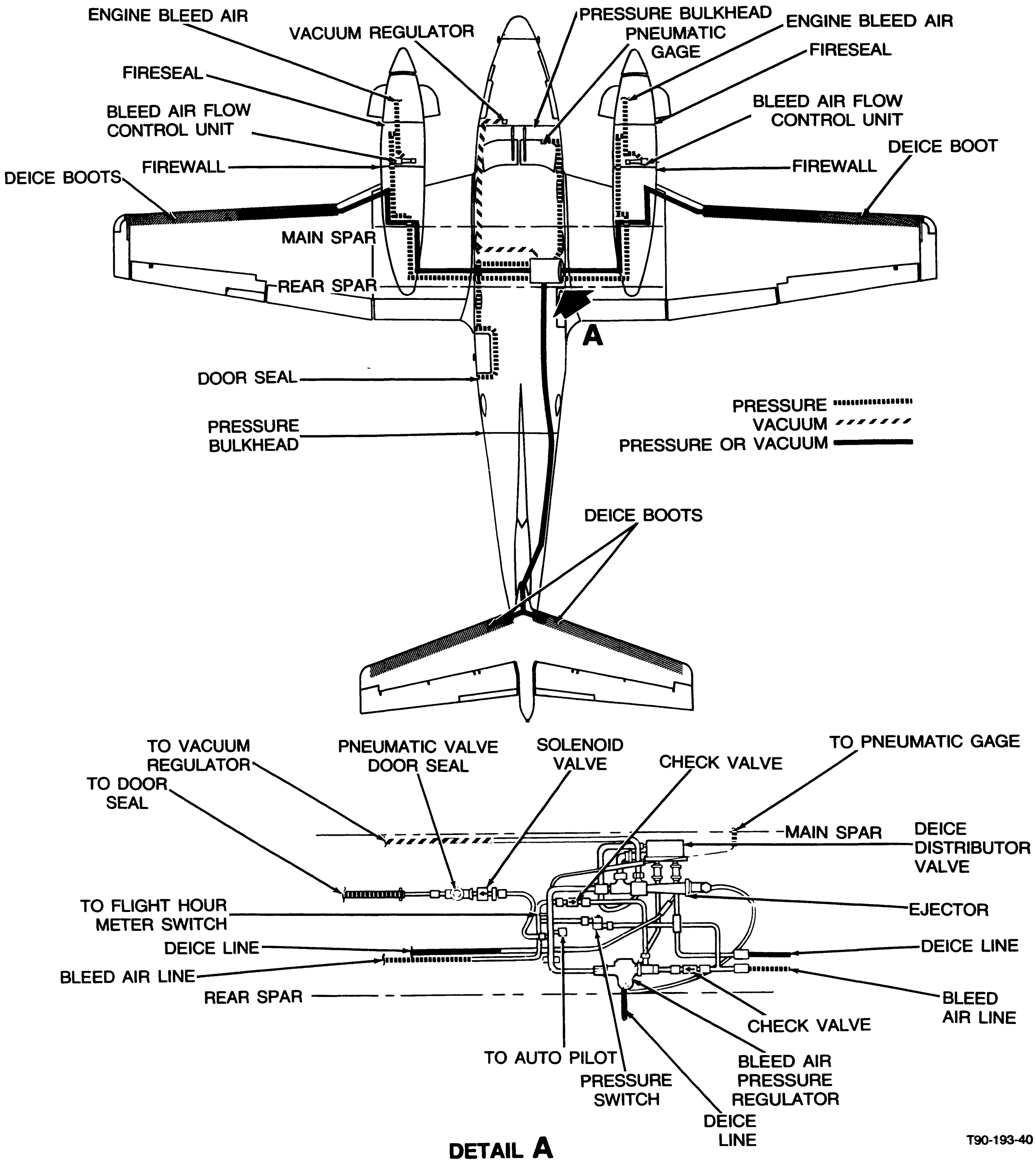
## COMFORT FEATURES

### TOILET

The toilet is installed in the left side of the baggage area and faces forward. It can be closed off from the cabin by sliding the two partition-type door panels to the center of the fuselage, where they are held closed by magnetic strips. The toilet may be either the chemical type or the electrically flushing type. In either case, the two hinged lid half-sections must be raised to gain access to the toilet. A toilet tissue dispenser is contained in a slide-out compartment on the side of the toilet cabinet.

*CAUTION*

If a Monogram electrically flushing toilet is installed, the sliding knife valve should be open at all times, except when actually servicing the unit. The cabinet below the toilet must be opened in order to gain access to the knife valve actuator.




SURFACE DEICE SYSTEM SCHEMATIC

## RELIEF TUBES

A relief tube is contained in the cabin sidewall just forward of the toilet. A relief tube may also be installed in the cockpit, and stowed under the pilot or copilot chair. The hose on the cockpit relief tube is of sufficient length to permit use by both pilot and copilot.

A valve lever on the side of the relief tube horn opens the tube to the atmosphere. This valve lever must be depressed at all times while the relief tube is in use, and it should be held depressed for a few seconds after use to ensure that no moisture remains in the tube. Moisture remaining in the tube could freeze and block the tube, preventing subsequent use during the flight.

NOTE

The relief tubes are designed for use during flight only.

## CABIN FEATURES

### FIRE EXTINGUISHERS

An optional portable fire extinguisher may be installed on the floor on the left side of the airplane forward of the airstair entrance door, just aft of the rearmost seat. Another one may also be installed underneath the copilot's seat.

## WINDSHIELD WIPERS

The dual windshield wiper installation consists of a motor, arm assemblies, drive shafts, and converters, all located forward of the instrument panel. The system includes a control switch, located in the upper left corner of the overhead panel. The system circuit breaker is located in the right subpanel. Windshield wipers may be operated for both flight and ground operations. Do not use them on dry glass. The control knob, placarded PARK-OFF-SLOW-FAST, controls the wipers. They have two speeds, one for light and one for heavy precipitation. After the control is turned to PARK to bring the wiper to their most inboard position, spring-loading returns the control to the OFF position.

# SECTION VIII
# HANDLING, SERVICING AND MAINTENANCE

## TABLE OF CONTENTS

*SUBJECT* *PAGE*

# SECTION VIII
# HANDLING, SERVICING AND MAINTENANCE

## TABLE OF CONTENTS (CONT'D)

*SUBJECT* *PAGE*

## INTRODUCTION TO SERVICING

The purpose of this section is to outline to the Owner and Operator the requirements for maintaining the Beech King Air F90 in a condition equal to that of its original manufacture. This information sets the time intervals at which the airplane should be taken to a Raytheon Aircraft authorized outlet for periodic servicing or preventive maintenance.

The Federal Aviation Regulations place the responsibility for the maintenance of this airplane on the Owner and the Operator, who should make certain that all maintenance is done by qualified mechanics in conformity with all airworthiness requirements established for this airplane. All limits, procedures, safety practices, time limits, servicing and maintenance requirements contained in this handbook an the *Beech King Air F90 Maintenance Manual* are considered mandatory.

Raytheon Aircraft authorized outlets can provide recommended modification service, and operating procedures issued by both the FAA and Raytheon Aircraft Company, which are designed to get maximum utility and safety from the airplane. If a question arises concerning the care of the airplane, it is important that the airplane serial number be included in any correspondence. The serial number appears on the Manufacturer's Identification Plaque, located on the aft frame of the airstair door opening.

**WARNING**

The Beech King Air F90 is a pressurized airplane. Drilling, modification, or any type of work which creates a break in the pressure vessel is considered the responsibility of the owner or facility performing the work. Obtaining approval of the work is, therefore, their responsibility.

## PUBLICATIONS

The following publications for the Beech King Air F90 are available through Raytheon Aircraft authorized outlets.

1. Pilot's Operating Handbook and FAA Approved Airplane Flight Manual
2. Pilot's Check List
3. Maintenance Manual
4. Component Maintenance Manual (Includes Supplier Data)
5. Wiring Diagram Manual
6. Parts Catalog
7. Service Bulletins

The following publications will be provided, at no charge, to the registered owner/operator of this airplane:

- Reissues and revisions of the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual.
- Original issues and revisions of FAA Approved Airplane Flight Manual Supplements.
- Original issues and revisions of Raytheon Aircraft Service Bulletins.

The above publications will be provided to the registered owner/operator at the address listed on the FAA Aircraft Registration Branch List or the Raytheon Aircraft Domestic/International Owners Notification List. Further, the owner/operator will receive only those publications pertaining to the registered airplane serial number. For detailed information on how to obtain "Revision Service" applicable to this handbook or other Raytheon Aircraft Service Publications, consult any Raytheon Aircraft authorized outlet, or refer to the latest revision of Raytheon Aircraft Service Bulletin No. 2001.

## AIRPLANE INSPECTION PERIODS

Refer to the following for required inspections:

1. Raytheon Aircraft Maintenance Manual
2. Raytheon Aircraft Structural Inspection Repair Manual

**NOTE**

The FAA may require other inspections by issuance of Airworthiness Directives applicable to the airplane, engines, propellers, and components. It is the responsibility of the owner/operator to ensure that all applicable Airworthiness Directives are complied with, and when repetitive inspections are required, to assure compliance with subsequent inspection requirements. It is also the responsibility of the owner/operator to ensure that all FAA required inspections and most Raytheon Aircraft recommended inspections are accomplished by properly certificated mechanics at properly certificated agencies (both meeting FAR 91 and FAR 43 requirements). Consult any Raytheon Aircraft authorized outlet for assistance in determining and complying with these requirements.

### SPECIAL CONDITIONS CAUTIONARY NOTICE

Airplanes operated for Air Taxi, or other than normal operation, and airplanes operated in humid tropics or cold and damp climates, etc., may need more frequent inspections for wear, corrosion, and/or lack of lubrication. In these areas, periodic inspections should be performed until the operator can set his own inspection periods based on experience. The required periods do not constitute a guarantee that the item will reach the period without malfunction, as the aforementioned factors cannot be controlled by the manufacturer.

## PREVENTIVE MAINTENANCE THAT MAY BE ACCOMPLISHED BY A CERTIFICATED PILOT

1. A certificated pilot may perform limited maintenance. Refer to FAR Part 43 for the items which may be accomplished.

To ensure that proper procedures are followed, obtain a *Beech King Air F90 Maintenance Manual* prior to performing preventive maintenance.

2. All other maintenance must be performed by properly certificated personnel. Contact a Raytheon Aircraft authorized outlet.

**NOTE**

Pilots operating airplanes of other than U.S. registry should refer to the regulations of the country of registry for information on preventive maintenance which may be performed by a pilot.

## ALTERATIONS OR REPAIRS TO AIRPLANE

The FAA should be contacted prior to any alterations on the airplane to ensure that the airworthiness of the airplane is not violated.

**NOTE**

Alterations or repairs to the airplane must be accomplished by properly licensed personnel.

**WARNING**

Use only genuine Raytheon Aircraft or Raytheon Aircraft approved parts obtained from Raytheon Aircraft approved sources, in connection with the maintenance and repair of Beech airplanes. Genuine Raytheon Aircraft parts are produced and inspected under rigorous procedures to ensure airworthiness and suitability for use in Beech airplane applications. Parts purchased from sources other than Raytheon Aircraft, even though outwardly identical in appearance, may not have had the required tests and inspections performed, may be different in fabrication techniques and materials, and may be dangerous when installed in an airplane. Salvaged airplane parts, reworked parts obtained from non-Raytheon Aircraft approved sources, or parts, components, or structural assemblies, the service history of which is unknown or cannot be authenticated, may have been subjected to unacceptable stresses or temperatures or have other hidden damage not discernible through routine visual or usual non-destructive testing techniques. This may render the part, component or structural assembly, even though originally manufactured by Raytheon Aircraft, unsuitable and unsafe for airplane use.

Raytheon Aircraft expressly disclaims any responsibility for malfunctions, failures, damage or injury caused by use on non-Raytheon Aircraft approved parts.

## GROUND HANDLING

The "Three View" drawing in Section I, GENERAL, shows the minimum hangar clearances for a standard airplane. Allowances must be made for any special radio antennas and the possibility of an under-inflated strut or tire.

### TOWING

The tow bar connects to the upper torque knee fitting of the nose strut. The airplane is steered with the tow bar when moving the airplane by hand. An optional tow bar is available for towing the airplane with a tug.

Although the tug will control the steering of the airplane, position someone in the pilot's seat to operate the brakes as a safety precaution.

**CAUTION**

Always ensure that the airplane control locks are removed before towing the airplane. Serious damage to the steering linkage can result if the airplane is towed while the control locks are installed.

Do not tow the airplane with a flat shock strut.

The nose gear strut has turn limit warning marks to inform the tug driver when turning limits of the gear will be exceeded. Damage will occur to the nose gear and linkage if the turn limit is exceeded. The maximum nose wheel turn angle is 48° left and right.

When ground handling the airplane, do not use the propellers or control surfaces as hand holds to push or move the airplane.

**CAUTION**

Do not exert force on the propeller or control surfaces. Do not place weight on the stabilizers to raise the nose wheel. When towing, limit turns to prevent damage to the nose gear. Do not tow the airplane backward using the tail tie-down ring as an attach point.

### PARKING

The parking brake control is located on the left side, below the pilot's subpanel. The parking brake may be set by depressing the toe portion of the pilot's rudder pedals and then pulling outward the parking brake control. The parking control closes dual valves in the brake lines that trap the hydraulic pressure applied to the brakes and prevents pressure loss through the master cylinders. To release the parking brake, depress the pilot's brake pedals to equalize the pressure on both sides of the parking brake valves and push the parking brake control fully in.

**CAUTION**

Avoid setting the parking brake when the brakes are hot from severe usage, or when moisture conditions and freezing temperature could form ice locks.

The parking brake should be disengaged and wheel chocks installed if the airplane is to be left unattended. Changes in ambient temperature can cause the brakes to release or to exert excessive pressures.

### TIE-DOWN

Three mooring eyes are provided: one underneath each wing, and one in the ventral fin. To moor the airplane, chock the wheels fore and aft, install the control locks, and tie the airplane down at all three points. See "Control Locks" in Section VII, SYSTEMS DESCRIPTION. If extreme weather is anticipated, it is advisable to nose the airplane into the wind before tying it down. Install engine inlet and exhaust covers, propeller tie-down boots (one blade down) and pitot mast covers when mooring the airplane.

**NOTE**

Unrestrained propellers are apt to windmill. Windmilling at zero oil pressure, if prolonged, could result in bearing damage. Windmilling propellers are a SAFETY HAZARD.

### JACKING AND LEVELING

The Beech King Air F90 is provided with three jacking points to raise the airplane for servicing. The forward point is on the left side of the wheel well opening near the aft end of the nose wheel doors. The main gear points are on the rear spar just inboard of the nacelle fairing. All three points are easily identified by the placarding, JACK PAD, adjacent to the jack points. The areas around the jack pads are unobstructed to facilitate the use of jacks. All adapters extend 0.7 inch or more below the structure surface.

Leveling screws are located on the fuselage entrance door frame. Leveling is accomplished with a plumb bob. Jack pad leveling may require the nose gear shock strut to be secured in the static position to prevent its extension. Wheel weighings can be leveled by varying the amounts of air in the shocks and tires.

## PROLONGED OUT-OF-SERVICE CARE

Refer to the *Beech King Air F90 Maintenance Manual.*

## ENGINE CARE IN SALTY ENVIRONMENTS

Refer to the *Beech King Air F90 Maintenance Manual.*

## SERVICING

### FUEL SYSTEM

*FUEL HANDLING PRACTICES*

All hydrocarbon fuels contain some dissolved and some suspended water. The quantity of water contained in the fuel depends on temperature and the type of fuel. Kerosene, with its higher aromatic content, tends to absorb and suspend more water than aviation gasoline. Along with the water, it will suspend rust, lint and other foreign materials longer. Given sufficient time, these suspended contaminants will settle to the bottom of the tank. However, the settling time for kerosene is five times that of aviation gasoline. Due to this fact, jet fuels require good fuel handling practices to assure that the airplane is serviced with clean fuel. If recommended ground procedures are carefully followed, solid contaminants will settle and free water can be reduced to 30 parts per million (PPM), a value that is currently accepted by the major airlines. Since most suspended matter can be removed from the fuel by sufficient settling time and proper filtration, it is not a major problem. Dissolved water has been found to be the major fuel contamination problem. Its effects are multiplied in airplanes operating primarily in humid regions and warm climates.

Dissolved water cannot be filtered from the fuel by micronic-type filters, but can be released by lowering the fuel temperature, such as will occur in flight. For example, a kerosene fuel may contain 65 ppm (8 fl oz. per 1000 gallons) of dissolved water at 80°F. When the temperature is lowered to 15°F, only about 25 ppm will remain in solution. The difference of 40 ppm will have been released as supercooled water droplets which need only a piece of solid contaminant or an impact shock to convert them to ice crystals. Tests indicate that these water droplets will not settle during flight and are pumped freely through the system. If they become ice crystals in the tank, they will not settle since the specific gravity of ice is approximately equal to that of kerosene. The 40 ppm of suspended water seems like a very small quantity, but when added to suspended water in the fuel at the time of delivery, is sufficient to ice a filter. While the critical fuel temperature range is from 0°F to -20°F, which produces severe system icing, water droplets can freeze at any temperature below 32°F.

Water in jet fuel also creates an environment favorable to the growth of a microbiological "sludge" in the settlement areas of the fuel cells. This sludge, plus other contaminants in the fuel, can cause corrosion of metal parts in the fuel system as well as clogging the fuel filters. The airplane uses bladder-type fuel cells. All metal parts (except the main boost pumps and transfer pumps) are mounted above the settlement areas. The possibility of filter clogging and corrosive attacks on fuel pumps exists if contaminated fuels are consistently used.

Since fuel temperature and settling time affect total water content and foreign matter suspension, contamination can be minimized by keeping equipment clean. Use adequate filtration equipment and careful water drainage procedures. Store fuel in the coolest areas possible, and allow adequate settling time. Underground storage is recommended for fuels. Filtering the fuel each time it is transferred will minimize the quantity of suspended contaminants carried by the fuel.

The primary means of fuel contamination control by the owner/operator is careful handling. This applies not only to fuel supply, but to keeping the airplane system clean. The following is a list of steps that may be taken to prevent and recognize contamination problems.

1. Know your supplier. It is impractical to assume that fuel free from contaminants will always be available, but it is feasible to exercise caution and be watchful for signs of fuel contamination.
2. Assure, as much as possible, that the fuel obtained has been properly stored, filtered as it is pumped to the truck, and again as it is pumped from the truck to the airplane.
3. Perform filter inspections to determine if sludge is present.
4. Periodically flush the fuel tanks and systems. The frequency of flushing will be determined by the climate and the presence of sludge.
5. Use only clean fuel servicing equipment.
6. After refueling, allow a three-hour settle period whenever possible, then drain a small amount of fuel from each drain.

**CAUTION**

Fuel spills on tires have a deteriorating effect and the tires should be cleaned promptly.

## *FILLING THE TANKS*

When filling the airplane fuel tanks, always observe the following:

1. Make sure the airplane is statically grounded to the servicing unit and to the ramp.
2. Service the nacelle tank of each side first. The nacelle tank filler caps are located at the top of each nacelle. The wing tank filler caps are located in the top of the wing, outboard of the nacelles.

**NOTE**

Servicing the nacelle tanks first prevents fuel transfer through the gravity feed interconnect lines from the wing fuel tanks into the nacelle tanks, during fueling. If wing tanks are filled first, fuel will transfer from them into the nacelle tank leaving the wing tanks only partially filled. Be sure the nacelle tanks are completely full after servicing the fuel system to assure proper automatic fuel transfer during flight operation.

3. Allow a three-hour settle period whenever possible, then drain a small amount of fuel into a container from each drain point. Check fuel at each drain point for contamination.

## *FUEL GRADES AND TYPES*

Aviation Kerosene Grades Jet A, Jet A-1, Jet B, JP-4, JP-5, and JP-8 may be mixed in any ratio. Aviation Gasoline Grades 60 (80/87), 100LL, 100 (100/130), and 115/145 are emergency fuels and may be mixed with the recommended fuels in any ratio; however, use of the lowest octane rating available is suggested. Operation on Aviation Gasoline shall be limited to 150 hours per engine during each time-between-overhaul (TBO) period. Refer to Section II, LIMITATIONS for additional limitations on the use of Aviation Gasoline.

**CAUTION**

Do not allow the fuel cells to dry out and crack. At a later servicing, the cracks would allow fuel to diffuse through the walls of the fuel cell. If any fuel cell is to remain empty for an extended interval, ensure that it last contained jet fuel. If it last contained aviation gasoline, coat the interior with oil.

## *FUEL ADDITIVES*

### *ICING INHIBITOR*

Approved fuel system icing inhibitor may be used in amounts not to exceed 0.15% by volume when soluble in jet turbine fuel (minimum concentration by volume is 0.10%).

### *BLENDING ANTI-ICING ADDITIVE TO FUEL*

Refer to the *Beech King Air F90 Maintenance Manual* for procedures to follow when blending anti-icing additive to the airplane fuel.

### *ADDING BIOCIDE TO FUEL*

Refer to the *Beech King Air F90 Maintenance Manual* for procedures to follow when adding Biobor JF biocide to the airplane fuel.

## *DRAINING FUEL SYSTEM*

Open each fuel drain daily to drain off any water or other contamination collected in the low places. Along with the drain on the firewall mounted fuel filter, there are four other drains: the nacelle tank fuel pump drain, center section tank transfer pump drain, and the inboard end of the outboard wing tank drain. The fuel pump and tank drains are accessible from the underside of the airplane.

## NOTE

The firewall shutoff valve has to be electrically opened to drain large quantities of fuel from the firewall fuel filter drain.

Fuel may be drained from the tank by gravity flow through the center section transfer pump drains into suitable containers. Fuel may also be pumped out of the tanks utilizing an external pump and suction hoses inserted into the filler openings. For the fastest means of draining the system see the procedures in the *Beech King Air F90 Maintenance Manual.*

Procedures for draining the fuel system, in the event any fuel pump requires replacement, are found in the *Beech King Air F90 Maintenance Manual.*

*ENGINE FUEL FILTERS AND SCREENS*

Normal intervals and procedures for inspecting all fuel filters and screens as well as suspected fuel contamination can be found in the *Beech King Air F90 Maintenance Manual.* In addition to such precautions, all fuel filters and the tank sump should be cleaned any time the submerged boost pump is removed.

*CLEANING FIREWALL FUEL FILTERS*

Refer to the *Beech King Air F90 Maintenance Manual.*

*CLEANING ENGINE-DRIVEN FUEL PUMP FILTER AND SCREEN*

Refer to the *Beech King Air F90 Maintenance Manual.*

### OIL SYSTEM

Servicing the engine oil system primarily involves maintaining the engine oil at the proper level, inspecting and cleaning, or replacing the filter element, and changing the oil as conditions require. Refer to the *Beech King Air F90 Maintenance Manual* and Pratt and Whitney Service Bulletin 1001 for oil system servicing procedures and requirements

**CAUTION**

Do not mix different brands of oil when adding oil between changes. Different brands or types of oil may be incompatible because of the difference in their chemical structures.

The oil tank is provided with an oil filler neck, quantity dipstick and cap. The filler neck and dipstick protrudes through the accessory gearcase housing at the eleven o'clock position. The dipstick is marked in U.S. quarts and indicates the last 5 quarts of oil required to bring the system to full. Access to the dipstick is through an access door on the engine cowl (aft).

Before servicing the airplane with engine oil, obtain the latest copy of Pratt and Whitney SB 1001. Only those engine oils listed in P&WC Service Bulletin 1001 are to be used in the PT6A-135 engines. Do not mix different oil brands. Oil tank capacity is 2.3 U.S. gallons. When a dry engine is first serviced it will require approximately 5 quarts in addition to tank capacity to fill the lines and the cooler, giving a total system capacity of 14 quarts. The engine will trap approximately 1.5 quarts which cannot be drained; therefore, when performing an oil change, refill the system with 12 quarts and add additional oil, based on the dipstick reading. While the airplane is standing idle, engine oil could possibly seep into the scavenge pump reservoir, causing a low dipstick reading. Anytime an engine has been shutdown for 12 hours or more, or if the oil has just been changed, run the engine for a least two minutes before checking the oil level.

## NOTE

The normal oil level is at the one quart mark. Overfilling may cause a discharge of oil through the breather until a satisfactory level is reached.

**CAUTION**

Spilled oil should be removed immediately to prevent the possibility of contaminating the airplane's tires. Oil (in some instances) can cause the rubber of the tires to deteriorate.

*OIL FILTER SERVICING*

For cleaning or replacement of the oil filter, refer to the *Beech King Air F90 Maintenance Manual.*

*CHANGING THE ENGINE OIL*

Refer to the *Beech King Air F90 Maintenance Manual.*

### SERVICING THE OXYGEN SYSTEM

*OXYGEN COMPONENTS*

Oxygen for unpressurized, high-altitude flight is supplied by a cylinder located in the compartment immediately aft of the aft pressure bulkhead. A 22-, 49-, 64- or a 76-cubic-foot cylinder may be installed. The oxygen system is serviced by a filler valve accessible by removing an access plate on the right side of the aft fuselage. The system has two pressure gages, one located on the right subpanel in the crew compartment for in-flight use, and one adjacent to the filler valve for checking system pressure during filling.

Refer to "Oxygen System Schematic" Section VII, SYSTEMS DESCRIPTION.

A shutoff valve and regulator, located on the cylinder, controls the flow of oxygen to the crew and passenger outlets. The shutoff valve is actuated by a push-pull type control located overhead and aft of the overhead light control panel in the cockpit. The regulator is a constant-flow type which supplies low pressure oxygen through system plumbing to the outlets.

### *OXYGEN SYSTEM PURGING*

Offensive odors may be removed from the oxygen system by purging. The system should also be purged any time system pressure drops below 50 psi or a line in the system is opened. Purging is accomplished simply by connecting a recharging cart into the system and permitting oxygen to flow through the lines and outlets until any offensive odors have been carried away. The following precautions should be observed when purging the oxygen system:

1. Avoid any operation that could make sparks. Keep burning cigarettes or fire away from the vicinity of the airplane when the outlets are in use.
2. Inspect the filler connection for cleanliness before attaching it to the filler valve.
3. Make sure that hands, tools, and clothing are clean. Look particularly for grease or oil stains, because these contaminants are extremely dangerous in the vicinity of oxygen.
4. As a further precaution against fire, open and close all oxygen valves slowly during filling.

### *FILLING THE OXYGEN SYSTEM*

When filling the oxygen system, use only Aviator's Breathing Oxygen, MIL-0-27210.

**CAUTION**

DO NOT USE MEDICAL or INDUSTRIAL OXYGEN. It contains moisture which can cause the oxygen valve to freeze.

Fill the oxygen system slowly by adjusting the recharging rate with the pressure regulating valve on the servicing cart, because the oxygen, under high pressure, will cause excessive heating of the filler valve. Fill the cylinder (22-cubic-foot cylinder installation) to a pressure of 1800 ±50 psi at a temperature of 70°F. This pressure may be increased an additional 3.5 psi for each degree of increase in temperature; similarly, for each degree of drop in temperature, reduce the pressure for the cylinder by 3.5 psi. The oxygen system, after filling, will need to cool and stabilize for a short period before an accurate reading on the gages can be obtained. The larger cylinder installations (49-, 64-, or 76-cubic foot cylinders) may be charged to a pressure of 1850 ±50 psi at a temperature of 70°F. When the system is properly charged, disconnect the filler hose from the filler valve and replace the protective cap on the filler valve.

### *OXYGEN CYLINDER RETESTING*

Oxygen cylinders used in the airplane are of two types. Light weight cylinder, stamped "3HT" on the plate on the side, must be hydrostatically tested every three years and the test date must appear on the cylinder. This bottle has a service life of 4380 pressurizations or 24 years, whichever occurs first, and then must be discarded. Regular weight cylinders stamped "3A" or *"3AA"* must be hydrostatically tested every five years and the retest date must appear on the cylinders. Service life of these cylinders is not limited.

## AIR CONDITIONING SYSTEM

If an extended period of time occurs during which the air conditioning system is not operated, moisture may condense and settle in the system low spots, resulting in corrosion of the refrigerant lines. Also, the system seals may dry out, shrink, and crack, due to the lack of lubrication. In order to protect the integrity of the system, the air conditioner should be operated at least 10 minutes every month.

**CAUTION**

Do not attempt to operate the air conditioner when the ambient temperature is below 50°F (10°C). If for several weeks, it is impossible to obtain an ambient temperature of at least 50°F (10°C), the recommended monthly interval for operating the air conditioner may be extended somewhat.

For air conditioner system servicing information, refer to the *Beech King Air F90 Maintenance Manual.*

**WARNING**

Refrigerant and oil are under pressure within the refrigeration system. Injury to personnel or damage to the system could occur if the maintenance is not performed properly. The refrigerant system should be serviced only by qualified air conditioner technicians.

### *CABIN AIR FILTER*

A flexible, fiberglass-type cabin air filter covers the coils of the air conditioner evaporator and is also known as an evaporative filter. This filter should be inspected and replaced at the interval shown in the *Beech King Air F90 Maintenance Manual* or whenever dirty.

### *EVAPORATOR FILTER REPLACEMENT*

1. Remove the access door in the nose wheel-well keel under the refrigerant plumbing.
2. Pull the filter down and out of the retaining springs on the evaporator coil. Remove the filter carefully so as not to distort the small tubing in the area.
3. Fold the new filter to insert it through the access doors. The filter must be carefully inserted between the coil assembly and the refrigerant plumbing under the retaining springs.
4. Replace the access doors.

## BATTERY

Servicing the 24-volt, 20-cell, air-cooled nickel-cadmium battery is normally limited to checking the electrolyte level, cleaning the battery box and associated components, and equalizing the cells. For detailed servicing of the battery, refer to the *Beech King Air 90 Series Maintenance Manual.*

## EXTERNAL POWER

The airplane is equipped with an external power receptacle, located just outboard of the right engine in the lower side of the wing center section. The receptacle will accept a standard AN-type plug. The airplane electrical system is automatically protected from reverse polarity (i.e., positive ground) by a diode network.

An overvoltage sensor, detecting an overvoltage condition from the external power source of 31 ±.5 volts or more, will lock out the external power relay to prevent a high voltage condition on the airplane bus.

External power can be used to operate all the airplane electrical equipment (this includes avionic checkouts) during ground operations without the engine running, and it can be used to start the engines. An electrical circuit in the external power installation, activated by the insertion of the external power plug of the external power unit, illuminates the amber EXT PWR annunciator, in the annunciator panel. The external power unit should be capable of producing 1000 amperes for 5 seconds, 500 amperes for 2 minutes and 300 amperes continuously. A maximum continuous load of 350 amperes will damage the external power relay and power cables of the airplane.

**CAUTION**

Any current in excess of 1000 amperes may overtorque the drive shaft of the starter-generator or produce heat sufficient to shorten the life of the unit.

The following precautions must be observed when using an external power source:

1. AVIONICS MASTER PWR Switch (pilot's left subpanel) - OFF
2. GEN 1 and GEN 2 Switches - OFF
3. BAT Switch - ON
4. VOLTMETER BUS SELECT Switch - BAT/PROP position
5. Voltmeter (overhead panel) - Read battery voltage

**CAUTION**

NEVER CONNECT AN EXTERNAL POWER SOURCE TO THE AIRPLANE UNLESS A BATTERY INDICATING A CHARGE OF AT LEAST 20 VOLTS IS IN THE AIRPLANE. If the battery voltage is less than 20 volts, the battery must be recharged, or replaced with a battery indicating at least 20 volts, before connecting external power. Voltage is required to energize the Avionics Master power relays to remove power from the avionic equipment. Never apply external power to the airplane without first supplying battery voltage. If the battery is removed from the airplane, or if the BAT Switch is to be placed in the OFF position, connect an external battery in parallel to the external power unit prior to switching the auxiliary power unit ON.

6. Auxiliary Power Unit Output Voltage - SET VOLTAGE AT 28.0 TO 28.4
7. Auxiliary Power Unit - OFF before connecting to airplane.

**CAUTION**

Only use an external power source fitted with an AN-type plug. If uncertain of the polarity, check it with a voltmeter to ensure that it is a negative-ground plug.

8. External Power Source Plug - PLUG INTO AIRPLANE RECEPTACLE
9. Auxiliary Power Unit - ON
10. VOLTMETER BUS SELECT Switch - EXT PWR
11. Voltmeter (overhead panel) - MONITOR EXTERNAL POWER VOLTAGE

**CAUTION**

The battery may be damaged if exposed to voltages higher than 30 volts for extended periods of time.

12. EXT PWR Switch - ON
13. OBSERVE that BAT TIE OPEN, GEN TIES OPEN annunciators are NOT illuminated.

## TIRES

The airplane is equipped with dual tires on the main gear, and a single tire on the nose gear. The standard configuration features 18X5.5, 8-ply-rated (or optionally, 10-ply-rated) tubeless tires on the main gear, and a 22x6.75-10, 8-ply-rated tubeless tire on the nose gear.

Airplanes equipped with the optional high flotation landing gear are equipped with 22x6.75-10, 8-ply-rated tubeless tires on the main gear and on the nose gear.

**CAUTION**

Tires that have picked up a film of fuel, hydraulic fluid or oil should be washed down as soon as possible with a detergent solution to prevent deterioration of the rubber.

Maintaining proper tire inflation will help to avoid damage from landing shock and contact with sharp stones and ruts, and will minimize tread wear. When inflating the tires, inspect them for cuts, cracks, breaks, and tread wear. Refer to the *Beech King Air F90 Maintenance Manual* for more detailed inspection and repair procedures. Inflate the 8-ply-rated standard main gear tires to 98 ±2 psi. Inflate 10-ply-rated standard main gear tires to 88 ±2. Inflate high flotation main gear tires to 57 ±2 psi. Inflate nose gear tire (either standard or high flotation) to 57 ±2 psi.

**CAUTION**

Raytheon Aircraft Company cannot recommend the use of recapped tires. Recapped tires have a tendency to swell as a result of the increased temperature generated during takeoff. Increased tire size can jeopardize proper function of the landing gear retract system, with the possibility of damage to the landing gear doors and the retract mechanism.

**NOTE**

While Raytheon Aircraft Company cannot recommend the use of recapped tires, tires retreaded by an FAA-approved repair station with a specialized service-limited rating, in accordance with the latest revision of TSO-C62 may be used.

## BRAKE SYSTEM

Brake system servicing is limited to maintaining adequate hydraulic fluid in the reservoir mounted on the bulkhead in the upper left corner of the nose avionic compartment. A dipstick is provided for measuring the fluid level. When the reservoir is low on fluid, add a sufficient quantity of approved hydraulic fluid to fill the reservoir to the full mark on the dipstick.

The only other requirement related to servicing involves the wheel brakes themselves. Brake lining adjustment is automatic, eliminating the need for periodic adjustment of the brake clearance. For additional information about servicing and maintenance of brakes, refer to the *Beech King Air F90 Maintenance Manual.*

## INSTRUMENT VACUUM AIR

Air at a pressure less than atmospheric is commonly referred to as a vacuum. Vacuum for the flight instruments is obtained by operating an ejector with bleed air from the engines. During operation, the ejector draws air in through the instrument filter and the gyros. A vacuum relief regulator valve regulates instrument air pressure.

The instrument filter, located at the top of the avionic compartment, is of prime importance and should be replaced at the interval shown in the *Beech King Air F90 Maintenance Manual*, or more often if conditions warrant (smokey, dusty conditions).

The vacuum relief regulator valve, located on the forward pressure bulkhead in the bottom of the avionic compartment, is protected by a foam sponge-type filter which should be cleaned in solvent at the interval shown in the *Beech King Air F90 Maintenance Manual.* If vacuum pressure rises above a normal reading, clean the filter, and recheck vacuum pressure before adjusting the vacuum relief regulator valve.

## SHOCK STRUTS

Service the shock struts according to the *Beech King Air F90 Maintenance Manual.*

## DEICING AND ANTI-ICING OF AIRPLANES ON THE GROUND

Deicing is the removal of ice, frost, and snow from the airplane's exterior after it has formed. Anti-icing is a means of keeping the surface clear of subsequent accumulations of ice, snow and frost.

Snow and ice on an airplane will seriously affect its performance. Removal of these accumulations is necessary prior to takeoff. Airfoil contours may be altered by the ice and snow to the extent that their lift qualities will be seriously impaired. Ice and snow on the fuselage can increase drag and weight.

### *SNOW REMOVAL*

The removal of frozen deposits by chipping or scraping is not recommended. The best way to remove snow is to brush it off with a squeegee, soft brush, or mop. Exercise care so as not to damage any components that may be attached to the outside of the airplane, such as antennas, vents, stall warning vanes, etc. Remove loose snow from the airplane before heating the airplane interior; otherwise, at low temperatures, the snow may melt and refreeze to build up a considerable depth of ice. If the airplane has been hangared and snow is falling, coat the airplane surfaces with an anti-icing solution; snow falling on the warm surface will have a tendency to melt, then refreeze.

After snow has been removed from the airplane, inspect the airplane for evidence of residual snow. Special attention should be given all vents, openings, static ports, control surfaces, hinge points, the stall warning vane and the wing, tail and fuselage surfaces for obstructions or accumulations of snow. Check the exterior of the airplane for damage to external components that may have occurred during the snow removal operations.

Control surfaces should be moved to ascertain that they have full and free movement. The landing gear mechanism, doors, wheel wells, uplocks, and microswitches should be checked for ice deposits that may impair function.

When the airplane is hangared to melt snow, any melted snow may freeze again if the airplane is subsequently moved into subzero temperatures. Any measures taken to remove frozen deposits while the airplane is on the ground must also prevent the possibility of refreezing of the liquid.

Following snow removal, should freezing precipitation continue, the airplane surface should be treated for anti-icing.

*FROST REMOVAL*

Frost that may form on the wing fuel tank bottom skins need not be removed prior to flight. Frost that may accumulate on other portions of the wing, the tail surfaces, or on any control surface, must be removed prior to flight. Frost that cannot be removed by wiping with a gloved hand or soft towel must be removed by placing the airplane in a warm hangar or by the application of a deicing fluid.

After removal of all frost from the airplane exterior, check all external components for damage that may have occurred during frost removal.

*ICE REMOVAL*

Moderate or heavy ice and residual snow deposits should be removed with a deicing fluid. No attempt should be made to remove ice deposits or break an ice bond by force.

After completing the deicing process, the airplane should be inspected to ensure that its condition is satisfactory for flight. All external surfaces should be examined for residual ice or snow, special attention should be given all vents, openings, static ports, control surfaces, hinge points, the stall warning vane and the wing, tail and fuselage surfaces for obstructions or accumulations of ice or snow.

Control surfaces should be moved to ascertain that they have full and free movement. The landing gear mechanism, doors, wheel wells, uplocks, and microswitches should be checked for ice deposits that may impair function.

When the airplane is hangared to melt ice, any melted ice may freeze again if the airplane is subsequently moved into freezing temperatures. Any measures taken to remove frozen deposits while the airplane is on the ground must also prevent the possible refreezing of the liquid.

Following ice removal, should freezing precipitation continue, the airplane surfaces should be treated for anti-icing.

*DEICING AND ANTI-ICING FLUID APPLICATION*

Airplane deicing fluids may be used diluted or undiluted according to manufacturer's recommendations for deicing. For anti-icing purposes, the fluids should always be used undiluted. Deicing fluids may be applied either heated or unheated. Refer to Section II, LIMITATIONS, for a listing of approved airplane deicing/anti-icing fluids.

**NOTE**

Type II and Type IV anti-icing fluids should only be applied at low pressure by trained personnel with proper equipment.

If a sprayer is not available, anti-icing fluid may be brushed or painted onto the airplane's surfaces.

## MISCELLANEOUS MAINTENANCE

### CLEANING AND CARE

*EXTERIOR PAINTED SURFACES*

**CAUTION**

Polyester urethane, acrylic urethane, and epoxy finishes undergo a curing process for a period of 30 days after application. Alkyd enamel (sometimes called "automotive enamel"), acrylic enamel, lacquer, and dope finishes require a curing period of approximately 90 days. Wash uncured painted surfaces with a mild non-detergent soap (MILD detergents can be used on urethane finishes) and cold or lukewarm water only. Use soft cloths, keeping them free of dirt and grime. Any rubbing of the surface should be done gently and held to a minimum to avoid damaging the paint film. Rinse thoroughly with clear water. Oil or soot deposits that cling tenaciously to airplane finish may be removed with automotive tar removers.

Prior to cleaning, cover the wheels, making certain the brake discs are covered. Attach the pitot covers securely, and plug or mask off all other openings. Be particularly careful to mask off all static air buttons before washing or waxing. Use special care to avoid removing lubricant from lubricated areas.

Washing the airplane by hand may be accomplished by flushing away loose dirt with clean water, then washing with a mild soap and water, using soft cleaning cloths or a chamois. Avoid harsh, abrasive, or alkaline soaps or detergents which could cause corrosion or scratches. Thorough clear-water rinsing prevents buildup of cleaning agent residue, which can dull the paint's appearance. To remove oily residue or exhaust soot, use a cloth dampened with an automotive tar remover. Wax or polish the affected area, if necessary.

**WARNING**

Do not expose elevator, rudder, and aileron trim tab hinge lines and their pushrod systems to the direct stream or spray of high-pressure, soap and water washing equipment. Fluid dispensed at high pressure could remove the protective lubricant, allowing moisture from heavy or prolonged rain to collect at hinge lines, and then to freeze at low temperatures. After high pressure or hand washing, and at each periodic inspection, lubricate trim tab hinge lines and trim tab pushrod end fittings

When using high-pressure washing equipment, keep the spray or stream clear of wheel bearings, propeller hub bearings, wing attachment areas, etc., and openings such as pitot tubes, static air buttons, and battery and avionic equipment cooling ducts, which should be securely covered or masked off. Avoid directing high-pressure sprays toward the fuselage, wings, and empennage from the rear, where moisture and chemicals might more easily enter the structure, causing corrosion damage to structural members and moving parts.

**CAUTION**

Use care when washing wing to not remove the anti-corrosive grease from the wing attach bolt.

When cleaning wheel well areas with solvent, especially if high-pressure equipment is used, exercise care to avoid washing away grease from landing gear components. After washing the wheel well areas with solvent, lubricate all lubrication points, or premature wear may result.

There is some variation in the procedures required for proper care of the several types of exterior paint. During the curing period, do not make prolonged flights in heavy rain or sleet, and avoid all operating conditions which might cause abrasion or premature finish deterioration.

**CAUTION**

Do not apply wax, polish, rubbing compound, or abrasive cleaner to any uncured painted surface. Use of such items can permanently damage the surface finish. Also, waxes and polishes seal the paint from the air and prevent curing.

Waxing of polyester urethane finishes, although not required, is permitted; however, never use abrasive cleaner type waxes, polishes, or rubbing compounds, as these products cause eventual deterioration of the characteristic urethane gloss. Acrylic urethane may be waxed for protection from the elements, but should not be polished unless polishing or buffing is required to restore a damaged area. Epoxy finishes should be waxed on a regular basis, and may be polished and buffed to restore appearance should "chalking" occur. Alkyd enamel, lacquer, and dope finishes must be polished and waxed periodically to maintain luster, and to assure protection from the weather. Acrylic enamel should be waxed and may be polished, if desired.

For waxing, select a high quality automotive or aircraft waxing product. Do not use a wax containing silicones, as silicone polishes are difficult to remove from surfaces.

A buildup of wax on any exterior paint finish will yellow with age; therefore, wax should be removed periodically. Generally, aliphatic naphtha is adequate and safe for this purpose.

**NOTE**

Before returning the airplane to service, remove all maskings and coverings, and relubricate as necessary.

## *LANDING GEAR*

After operation on salty or muddy runways, wash the main and nose landing gear with low-pressure water and a mild detergent as soon as practicable. Rinse with clear water and blow dry with low-pressure air immediately after rinsing. Relubricate as necessary.

## *WINDOWS AND WINDSHIELDS*

### *WINDOWS*

The plastic windows should be kept clean and waxed. To prevent scratches, wash the windows carefully with plenty of mild soap and water, using the palm of the hand to dislodge dirt and mud. Flood the surface with clean water to rinse away dirt and soap. After rinsing, dry the windows with a clean, moist chamois. Rubbing the surface of the plastic with a dry cloth should be avoided, as it builds up an electrostatic charge on the surface, which attracts dust particles.

If oil or grease is present on the surface of the plastic, remove it with a cloth moistened with kerosene, aliphatic naptha, or hexene, then rinse the surface with clear water. Never use gasoline, benzine, alcohol, acetone, carbon tetrachloride, fire-extinguisher or anti-ice fluid, lacquer thinner, or glass cleaner. These materials will soften the plastic and may cause it to craze.

If it is desired to use a commercial cleaner to clean the plastic windows, use only cleaners that are approved by Raytheon Aircraft Company and follow the directions on the container. It will not be necessary to apply wax to windows after use of commercial cleaners, as these cleaners contain wax, as well as cleaning agents.

After thoroughly cleaning, wax the surface with a good grade of commercial wax that does not have an acrylic base. The wax will fill in minor scratches and help prevent further scratching. Apply a thin, even coat of wax and bring it to a high polish by rubbing lightly with a clean, dry, soft, flannel cloth. Do not use a power buffer; the heat generated by the buffing pad may soften the plastic.

### *WINDSHIELDS*

Glass windshields with antistatic coating should be cleaned as follows:

1. Wash excessive dirt and other substances from the glass with clean water.
2. Clean the windshield with mild soap and water or a 50/50 solution of isopropyl alcohol and water. Wipe the glass surface in a straight rubbing motion with a soft cloth or sponge. Never use any abrasive materials or any strong acids or bases to clean the glass.
3. Rinse the glass thoroughly and dry, but do not apply wax.

## *POLARIZED CABIN WINDOWS*

The polarized cabin windows consist of two plastic window panes installed with the polarized surfaces facing each other in a sealed assembly. To clean the interior exposed surface of the window requires only careful application of the practices for cleaning plastic windows. If it should become necessary to clean the inner surface of the sealed assembly and the inside of the pressure glass, the sealed assembly may be removed by removing the escutcheon, four screws, and the sealed assembly. Clean the interior windows and reinstall the sealed assembly and escutcheon.

### *SURFACE DEICE BOOT CLEANING*

The deice boots are made of soft, flexible stock, which may be damaged if gasoline hoses are dragged over the surface of the boots or if ladders and platforms are rested against them. Keep deice boots free of oil, fuel, paint remover, solvents, and other injurious substances. Deice boots should be cleaned regularly with mild soap and water solution. The temperature of the solution should not exceed 180°F.

### *INTERIOR CARE*

To remove dust and loose dirt from the upholstery, headliner, and carpet, clean the interior regularly with a vacuum cleaner.

Blot up any spilled liquid promptly with a paper tissue or with rags. Do not pat the spot; press the blotting material firmly and hold it for several seconds. Continue blotting until no more liquid is taken up. Scrape off sticky materials with a dull knife, then spot-clean the area.

**CAUTION**

The colors of many leathers may only be accomplished by surface dye processing. The color may be rubbed off by continuously dragging hard or coarse material across the leather. While working in the cabin, use protective covers on the leather upholstery. Use only mild detergent with a soft cloth to clean soiled leather.

Oily spots may be cleaned with household spot removers used sparingly. Before using any solvent, read the instructions on the container and test it on an obscure place on the fabric to be cleaned. Never saturate the fabric with a volatile solvent; it may damage the padding and backing materials.

Soiled upholstery and carpet may be cleaned with foam-type detergent, used according to the manufacturer's instructions. To minimize wetting the fabric, keep the foam as dry as possible and remove it with a vacuum cleaner.

The plastic trim need only be wiped with a damp cloth. Oil and grease on the control wheel and control knobs can be removed with a cloth moistened with isopropyl alcohol. Volatile solvents (such as mentioned in the article on care of plastic windows) should never be used, since they will soften the plastic and may cause it to craze.

## CONSUMABLE MATERIALS

Refer to the *Beech King Air F90 Maintenance Manual* for consumables (type and brand name) approved for use in the Beech King Air F90.

## LAMP REPLACEMENT GUIDE

### EXTERIOR

| | |
|---|---|
| Empennage Floodlight | DS0079-BJ |
| Landing Lights | 4596 |
| Rotating Beacons (Upper/Lower) | A7079B-24 |
| Strobe Flashtubes | 55-0221-1 |
| Tail Navigation Light | 1683 |
| Taxi Light | 4587 |
| Wing Ice Light | A7079B-24 |
| Wing Navigation Light | A7512-24 |
| Wing-tip Recognition Light | LP1982SP |

### PASSENGER COMPARTMENT

| | |
|---|---|
| Aft Dome Light | 303 |
| Aisle Light | MS25231-313 |
| Cabin Door Overhead Light | 1864 |
| Cabin Sign Light | MS25231-313R |
| Fluorescent Light Tube | 5108WW |
| Reading and Chair Light | 1864 |
| Spar Cover Light | 303 |
| Step Light | 313 |
| Table Light | 1309 or 303 |
| Threshold Light | 313 |

### FLIGHT COMPARTMENT

| | |
|---|---|
| All Edge-lighted Placards and Panels | D158-100-5 |
| Cabin Door Lock Light | 1364 |
| Fuel Panel Circuitboard Light | D158-100-3 |
| Glareshield Light | 1864 |
| Instrument Indirect Lights (Red/White) | 1864R / 1864 |
| Lights for all other Instruments, Indicators, Annunciators, and Switches | 327 |
| Map Light | 327 |
| Map Overhead Light (Red/White) | 1309 / 1495 |

# SECTION IX

## SUPPLEMENTS

NOTE

The supplemental data contained in this Section is for equipment that was delivered on the airplane, and for standard optional equipment that was available (whether or not it was installed). Supplements or Flight Manuals for equipment for which the vendor obtained a Supplemental Type Certificate were included as loose equipment with the airplane at the time of delivery. If a new handbook is obtained for official use, the STC Supplements and Flight Manuals, and Supplements or Flight Manuals for equipment that was installed after the airplane was delivered new from the factory, should be transferred to this Section (SUPPLEMENTS) of the new Pilot's Operating Handbook and FAA Approved Airplane Flight Manual.

INTENTIONALLY LEFT BLANK

**RAYTHEON AIRCRAFT**
**BEECH KING AIR® F90 LANDPLANES**
**(Serials LA-2 Thru LA-204, Except LA-202)**
**PILOT'S OPERATING HANDBOOK**
**and**
**FAA APPROVED AIRPLANE FLIGHT MANUAL**
**P/N 109-590010-3**
**LOG OF SUPPLEMENTS**

*FAA Supplement must be in the airplane for flight operation when subject equipment is installed.*

| Part Number | Subject | Rev No. | Date |
|---|---|---|---|
| 109-590010-37 | Sperry SPZ-200A/Stars IV D, SPZ-200A/SPI-80/81 or SPZ-200A/SPI-400/500 Series Automatic Flight Control System, Category I | 3 | June, 1982 |
| 101-590010-55 | King KNC-610 Area Navigation System | 8 | April, 1984 |
| 101-590010-105 | AirData AD611/D Area Navigation System/Vertical Navigation System | 6 | December, 1983 |
| 109-590010-31 | Brake Deice System | 1 | September, 1984 |
| 101-590010-71 | Collins ANS-31/31A Area Navigation System or Collins NCS-31/31A Navigation Control System | 8 | December, 1983 |
| 109-590010-39 | High Flotation Landing Gear | | February, 1980 |
| 109-590010-41 | King KFC-300 Automatic Flight Control System, Category I | 1 | November, 1980 |
| 90-590012-49 | King KNR-665/KNR-665A Area Navigation System | 3 | September, 1984 |
| 101-590010-109 | Collins LRN-70 (ONTRAC IIIA)/LRN-80 (ONTRAC III) VLF/OMEGA Navigation System | 7 | December, 1983 |
| 109-590010-45 | Collins FCS-80 Automatic Flight Control System | | April, 1980 |
| 109-590010-49 | Airplanes Certificated in France | | May, 1980 |
| 101-590010-169 | Airplanes Equipped With a Secondary Encoding Altimeter | 3 | January, 1994 |
| 101-590010-175 | Foster AirData RNAV-612 Area Navigation System | 1 | December, 1983 |
| 90-590010-85 | Ground Communications Electric Power Bus | 7 | September, 1994 |
| 101-590010-177 | Global GNS-500A VLF/OMEGA Navigation System Series 3A, 3B, 3C, or 4 with Optional Vandling Navigation Data Bank | 4 | July, 1987 |
| 90-590010-81 | King KNS-81 Integrated Navigation System | 3 | September, 1985 |
| 109-590010-67 | DC Volt Meter/Battery Ammeter BEECHCRAFT Kit P/N 90-3097 | | November, 1983 |
| 101-590010-363 | Deleted | | December, 1998 |
| 101-590010-373 | ARTEX ELT 110-4-002 With Remote Cockpit Switch (Raytheon Aircraft Kit P/N 101-3210 or 101-3214) | | December, 1998 |

*NOTE: Supplements applicable to equipment other than that installed may, at the discretion of the owner/operator, be removed from the manual.*

** Supplements marked with an asterisk will not be supplied with flight manuals sold through Authorized Beech Outlets due to their limited applicability. If a document is required for your airplane, please order the document through normal channels.*

# BEECHCRAFT F90 LANDPLANES
## PILOT'S OPERATING HANDBOOK AND FAA APPROVED AIRPLANE FLIGHT MANUAL SUPPLEMENT

**for the**

**SPERRY SPZ-200A/STARS IV D AUTOMATIC FLIGHT CONTROL SYSTEM**

**or**

**SPERRY SPZ-200A/SPI-80/81 AUTOMATIC FLIGHT CONTROL SYSTEM**

**or**

**SPERRY SPZ-200A/SPI-400/500 SERIES AUTOMATIC FLIGHT CONTROL SYSTEM**

**CATEGORY I**

## GENERAL

The information in this supplement is FAA Approved material which together with the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual is applicable to the operation of the airplane when modified by the installation of the Sperry SPZ-200A/STARS IV D or SPI-80/81 or SPI-400/500 Automatic Flight Control System installed in accordance with Beech-approved data. The information in this supplement supersedes or adds to that of the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual only as set forth within this document. Users of the handbook are advised always to refer to this supplement for possibly superseding information and placarding applicable to the operation of this airplane.

## LIMITATIONS

1. During autopilot operations, pilot must be seated at the controls with seat belt fastened.
2. Maximum speed for autopilot operation is 253 KIAS/0.48 Mach, $V_{MO}/M_{MO}$.
3. Do not use autopilot under 200 feet above the terrain during an instrument approach.
4. Autopilot and yaw damper must not be used during takeoff or landing.
5. Autopilot test must be conducted and found satisfactory prior to each flight on which the autopilot is to be used.

## EMERGENCY PROCEDURES

If the AP TRIM FAIL and MASTER WARNING annunciators illuminate while the autopilot is engaged, immediately disconnect while restraining the control wheel for a possible out of trim force.

*IN THE EVENT OF AN AUTOPILOT MALFUNCTION, disengagement can be accomplished by one of the following:*

1. Pressing (momentarily) to the first level the pilot's or copilot's AP/YD & TRIM DISC button on the control wheel.
2. Pressing (momentarily) the go-around button on the left power lever.
3. Pressing the TEST button on the Autopilot Engage Controller.

4. Opening the autopilot circuit breaker.

5. If necessary, the autopilot may be overpowered by either pilot.

*IN THE EVENT OF AN ENGINE FAILURE:*

1. Disengage the autopilot, retrim the airplane and re-engage the autopilot. Maintain at least 120 knots for one-engine-inoperative approach.

*MAXIMUM ALTITUDE LOSSES DURING MALFUNCTION TESTS WERE:*

| CONFIGURATION | ALTITUDE LOSS |
|---|---|
| Climb | 380 feet |
| Cruise | 380 feet |
| Maneuvering | 40 feet |
| Descent | 400 feet |
| Approach/ILS Coupled | 50 feet |
| One-engine-inoperative Approach/ILS Coupled | 110 feet |

## NORMAL PROCEDURES

### FLIGHT DIRECTOR OPERATION

The pilot can select any of the following flight modes using the flight director mode selector pushbuttons which provide both the flight director and autopilot mode control and annunciation. All modes on the mode selector have push on - push off capability. When no mode has been selected, the command bars on the Attitude Display Indicator (ADI) are retracted from view.

1. Standby (SBY): In this mode, flight director is ready for operation of the other modes. The command bars on the Attitude Display Indicator are retracted from view. Depressing the SBY pushbutton tests all flight control system annunciators and resets the flight director mode.

2. Heading Select (HDG): This mode provides lateral commands on the Attitude Display Indicator command bar to acquire and maintain the heading displayed on the heading cursor on the Horizontal Situation Indicator. The desired heading is selected by turning the heading select knob.

3. Low Bank: This mode, used only with Heading Select, provides reduced bank-angle commands on the Attitude Display Indicator command bar. The pushbutton LOW BANK switch (IF INSTALLED) is located on the autopilot controller.

4. VOR/RNAV/Front Course Localizer (NAV): Selecting NAV with the radio tuned to a VOR or localizer frequency results in the NAV ARM light illuminating. The desired radial or inbound course is set on the Horizontal Situation Indicator course selector by turning the course knob. When NAV is selected with the airplane outside the edge of the beam, the HDG mode is automatically selected. The heading select cursor can be used to set the intercept angle to the beam. When the capture point is reached, the HDG mode drops out, the NAV mode goes from ARM to CAP, and the flight director command bars provide commands to track the VOR radial or localizer beam. Crosswind correction is automatically provided.

5. ILS Approach (APR): Selecting APR with the radio tuned to a localizer frequency will result in both the APR ARM and NAV ARM lights illuminating which indicate glideslope and localizer signals respectively are armed. The inbound course should be set on the Horizontal Situation Indicator course selector. The heading mode will be automatically selected if the airplane is outside the edge of the localizer beam. An appropriate intercept angle should be set with the heading select cursor. When the localizer is captured, the HDG mode drops out and the NAV mode goes from ARM to CAP. The APR mode goes from ARM to CAP upon intercepting the glideslope. Glideslope capture will not occur until after the localizer has been captured. If ALT, VS or IAS modes were selected, they will drop out at glideslope capture.

6. Back Course Localizer (BC): This mode provides lateral commands on the flight director to fly back course approaches or outbound on the front course. The inbound front course should be set on the Horizontal Situation Indicator course selector. Lateral beam sensor operation is as described in the NAV mode.

7. VOR/RNAV Approach (VOR APR): Selecting VOR APR with the radio tuned to a VOR frequency results in the VOR APR ARM and NAV ARM lights illuminating. Course intercept and capture operation is as described in the NAV mode. When the course capture is accomplished, the ARM lights will extinguish and the VOR APR CAP and NAV CAP lights will illuminate. This mode provides optimum gains for the VOR/RNAV approach.

8. Altitude Hold (ALT): This mode provides pitch commands on the flight director to maintain the engaged altitude. If the autopilot is engaged, selection of the ALT mode should be made at vertical speeds less than 2000 feet per minute.

   Altitude excursion due to lowering the wing flaps may be minimized by lowering the flaps below their placarded limit speeds or by utilizing the Touch Control Steering (TCS) feature and trimming nose down with the main elevator trim system as the flaps extend.

9. Altitude Preselect (ALT SEL): This mode operates in conjunction with the Altitude Alert Controller on which the desired altitude is set. Pressing ALT SEL will illuminate the ARM annunciator indicating the flight director is armed to automatically capture the selected altitude. Pitch hold, IAS or VS modes may be used to fly to the selected altitude. When the difference between the airplane's altitude and the selected altitude is approximately one quarter of the vertical rate, the ARM and any selected vertical mode annunciators will extinguish and the CAP annunciator will illuminate. The flight director will command a programmed flare to the selected altitude. When the altitude is reached, the altitude hold mode automatically engages and the CAP annunciator will extinguish.

10. Vertical Speed (VS): The VS mode maintains the existing vertical speed at the time of selection through pitch commands on the flight director.

11. Airspeed Hold (IAS): The IAS mode is used to maintain a constant indicated airspeed by controlling pitch attitude. The IAS mode is selected when the airplane is at the desired airspeed. The flight director commands pitch attitude changes to maintain the selected airspeed.

12. Go-Around: This mode provides commands to the flight director when an approach is to be terminated. A fixed pitch-up, wings-level command of 7 degrees is presented. The GO-AROUND mode cancels all other modes and is selected by depressing the go-around switch on the left power lever. Selection of the GO-AROUND mode will disengage the autopilot; however, the yaw damper will be retained.

    After GO-AROUND is selected, any roll mode can be selected and will cancel the wings level roll command. The GO-AROUND mode is cancelled by either selecting another pitch mode, selecting TCS or engaging the autopilot.

## AUTOPILOT FEATURES

1. Autopilot Controller: The autopilot controller provides the means of engaging the yaw damper and autopilot. The controller also contains a pitch wheel and turn knob for manual control of the autopilot.

2. Yaw Damper Engage: The yaw damper is engaged by depressing the Y/D ENGAGE button on the autopilot controller. The YAW DAMPER may be engaged independently of the autopilot to provide yaw stabilization.

3. Autopilot Engage: When the A/P ENGAGE button is pressed the yaw damper is engaged and, with no modes selected on the Flight Director mode selector, pitch attitude is held, roll attitude is brought to zero, and airplane heading is maintained.

### NOTE

To engage the autopilot, the yaw damper must be operable.

4. Elevator Trim Annunciator: The elevator trim light illuminates when a sustained signal is being applied to the trim actuator. IF EITHER THE DN OR UP TRIM ANNUNCIATOR IS ILLUMINATED, THE AUTOPILOT SHOULD NOT BE ENGAGED.

5. Soft Ride Mode: Selection of the SOFT RIDE mode on autopilot controller reduces autopilot response in both roll and pitch axes. This mode should be used for turbulence penetration or any other time that softer response is desired.

6. Turn Knob: Rotation of the turn knob out of its detent results in a roll command proportional to, and in direction of, the turn knob rotation. If HDG, NAV, APR, BC, or VOR APR is on the flight director mode selector, rotation of the turn knob cancels the mode. These modes cannot be reselected and the autopilot cannot be engaged until the turn knob is in its detent.

7. Pitch Wheel: Rotation of the pitch wheel results in a change of pitch attitude proportional to the rotation of the pitch wheel and in the direction of wheel movement. If IAS, ALT, VS, or ALT SEL CAP is on the flight director mode selector, rotation of the pitch wheel cancels the mode.

8. Touch Control Steering: When the touch control steering (TCS) switch on the control wheel is depressed, the elevator and aileron axes of the autopilot will disengage, the AP ENGAGE annunciator will extinguish, and the pilot can manually control the airplane. When the TCS switch is released, the autopilot will re-engage and illuminate the AP ENGAGE annunciator. TCS can only be used with the turn knob in the center detent.

   If no mode has been selected on the flight director, the existing pitch attitude will be maintained when the TCS switch is released. If the airplane roll attitude is more than 6 degrees, the roll attitude will be maintained. If the roll attitude is less than 6 degrees, the airplane heading will be maintained.

   The TCS feature also allows the pilot to modify the commanded flight path from the flight director computer. When coupled to ALT, VS, IAS, or APR, touch control steering can be selected and the altitude, vertical speed, airspeed or position on the glideslope can be manually changed through pitch attitude or power changes. Upon release of the TCS switch, the new reference will be held or the autopilot will recouple to APR. If the autopilot is coupled to the roll mode, TCS allows maneuvering in roll while the switch is depressed. Upon release, the autopilot will couple to the previously selected lateral mode.

NOTE

If the ALT hold mode is engaged, vertical speed should be less than 3000 feet per minute prior to release of the TCS switch.

## AUTOPILOT COUPLING TO FLIGHT DIRECTOR

The autopilot uses the Flight Director computer for autopilot commands. Whenever the autopilot is engaged, it will fly the roll and/or pitch mode selected except for the GO-AROUND mode. When the autopilot is engaged and a roll mode is on the flight director, operation of the turn knob will cancel the selected roll mode. When the autopilot is engaged with a pitch mode on the flight director, operation of the pitch wheel will cancel the selected pitch mode. If a roll mode is selected prior to moving the pitch wheel, the command indicator will synchronize to the existing attitude.

The following modes on the flight director are also autopilot modes:

HDG - Heading Select
NAV - VOR, RNAV or Front Course Localizer Beam Tracking
APR - Front Course ILS Beam Tracking
BC - Back Course Localizer Beam Tracking
VOR APR - VOR or RNAV Approach

NOTE

Conduct the final segment of all autopilot-coupled approaches with the landing gear down, 32.5% flaps and a minimum of 120 KIAS.

ALT - Altitude Hold
ALT SEL - Altitude Preselect
VS - Vertical Speed Hold
IAS - Airspeed Hold
LOW BANK

If no mode is selected, the autopilot will fly heading hold and pitch hold. When GO-AROUND mode is selected, the autopilot will disengage; however, the yaw damper will remain engaged. Re-engagement of the autopilot when the Flight Director is in the GO-AROUND mode results in a pitch attitude hold command for the autopilot. If a Flight Director mode is previously selected, the autopilot will couple to the selected mode.

## AUTOPILOT OPERATION

### *PREFLIGHT*

1. Elevator Trim Annunciator - CHECK (Observe that autopilot trim light on autopilot controller is not indicating UP or DN. A steady UP or DN light denotes automatic synchronization is not functioning and the autopilot should not be engaged.)

2. Turn Knob - IN CENTER DETENT POSITION.

3. Autopilot - TEST

   a. Control Wheel to mid-travel - DEPRESS AP ENGAGE ANNUNCIATOR SWITCH

   b. Control movement - CHECK (that the system can be overpowered by slowly moving the controls of all three axes.)

   *CAUTION*

   If autopilot disengages, do not use.

   c. Elevator Trim followup - CHECK

   (1) Hold control wheel forward of mid-travel. Elevator trim will run nose up after approximately 2 seconds. Actuate the trim switches to nose down. AP TRIM FAIL and MASTER WARNING annunciators will illuminate.

   (2) Hold control wheel aft of mid-travel. AP TRIM FAIL annunciator will extinguish and elevator trim will run nose down after approximately 2 seconds. Actuate the trim switches to nose up. AP TRIM FAIL and MASTER WARNING annunciators will illuminate.

   d. AP/YD & TRIM DISC Button - DEPRESS THROUGH FIRST LEVEL (Autopilot will disengage.)

   e. Re-engage Autopilot.

   f. Autopilot TEST Button - DEPRESS (Autopilot will disengage and AP DISC and MASTER WARNING annunciators will illuminate.)

   *CAUTION*

   If autopilot does not disengage when the test button is depressed, it indicates autopilot torque monitors are not functioning properly. DO NOT USE AUTOPILOT IN FLIGHT UNTIL CORRECTIVE ACTION HAS BEEN TAKEN.

   g. Annunciators - CLEAR (AP DISC annunciator will extinguish by depressing the control wheel AP/YD & TRIM DISC button and the MASTER WARNING annunciator will extinguish by depressing its face.)

h. Elevator Trim - RESET AS REQUIRED.

*IN-FLIGHT ENGAGEMENT OF AUTOPILOT*

1. All autopilot and Flight Director Circuit Breakers - IN
2. Elevator Trim Indicator - CHECK (Observe that autopilot trim annunciators on autopilot controller are not illuminated.)
3. Turn Knob - IN CENTER DETENT POSITION
4. Autopilot Controller AP ENGAGE Annunciator Switch - DEPRESS

*DISENGAGING THE AUTOPILOT*

The autopilot may be disengaged by:

1. Actuation of the AP/YD & TRIM DISC buttons on either control wheel to the first level. (Copilot's button causes MASTER WARNING and AP DISC annunciators to illuminate.)

NOTE

The AP/YD & TRIM DISC button is a two-level switch. The first level disengages the autopilot while the second level disengages both autopilot and electric trim.

2. Pressing the TEST button on the Autopilot Engage Controller. (MASTER WARNING and AP DISC annunciator will illuminate.)
3. Pressing the go-around mode switch on the left power lever. (AP DISC annunciator will illuminate.)

NOTE

The AP DISC annunciator light is extinguished by depressing the pilot's AP/YD & TRIM DISC button. The MASTER WARNING annunciator is extinguished by depressing its face.

*DISENGAGING THE YAW DAMPER*

The yaw damper may be disengaged by actuation of the AP/YD & TRIM DISC button on either control wheel to the first level.

## PREFLIGHT ALTITUDE ALERTING

The alerting sequence can be verified by the following procedure:

1. Set the altitude on the altitude alert controller for 1500 feet above the altitude on the pilot's altimeter.
2. Using the baro set on the pilot's altimeter, adjust altitude toward the alert controller reading. At 1000 feet from the desired altitude, the alert light on the altimeter will illuminate and the alert tone will sound.
3. Within 250 feet of selected altitude, the alert light will extinguish.
4. Using the baro set to return to the original altitude, the alert light will illuminate and the tone will sound when the altimeter has deviated over 250 feet from that on the alert controller. At 1000 feet from the selected altitude, the alert light will extinguish.

**PERFORMANCE** - No change

Approved: *Donald St Peter*

*For* W. H. Schultz
Beech Aircraft Corporation
DOA CE-2

# BEECHCRAFT KING AIR C90 (LJ-502 thru LJ-1062), C90A (LJ-1063 and after), E90, F90, A100, B100, and SUPER KING AIR 200, 200C, 200T, 200CT, B200, B200C, B200T & B200CT LANDPLANES PILOT'S OPERATING HANDBOOK and FAA APPROVED AIRPLANE FLIGHT MANUAL SUPPLEMENT for the KING KNC-610 AREA NAVIGATION SYSTEM

## GENERAL

The information in this supplement is FAA-approved material and must be attached to the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual when the airplane has been modified by installation of the King KNC-610 Area Navigation System in accordance with Beech-approved data.

The information in this supplement supersedes or adds to the basic Pilot's Operating Handbook and FAA Approved Airplane Flight Manual only as set forth within this document. Users of the handbook are advised always to refer to the supplement for possibly superseding information and placarding applicable to operation of the airplane.

## LIMITATIONS

1. This system may not be used as a primary system under IFR conditions except on approved approach procedures, approved area navigation airways, and random area navigation routes when approved by Air Traffic Control.

2. This system can only be used with co-located facilities. (VOR and DME signals originate from the same geographical location).

3. An area navigation installation located on the right instrument panel may be used for primary navigation only if a qualified pilot occupies the right seat.

## EMERGENCY PROCEDURES

*CAUTION*

DME may unlock due to loss of signal with certain combinations of distance from station, altitude, and angle of bank.

1. VOR or Distance flag appears while in RNAV mode:
   a. Selected Frequency - CHECK FOR CORRECT FREQUENCY
   b. VOR or Distance flag intermittent or lost - UTILIZE OTHER NAV EQUIPMENT AS REQUIRED
2. VOR or Distance flag appears while in APPR mode:
   a. If flag appears while on an approach, execute published missed approach and utilize other approved facility.

## NORMAL PROCEDURES

1. VHF NAV - ON
2. DME - ON
3. Mode Selector - SELECT VOR/DME RNAV, or APPR (whichever is appropriate)

NOTE

Assure Mode Selector switch is in VOR/DME position for best Flight Director performance in an ILS approach mode.

4. NAV Frequency - SET
5. DME Frequency - SET
6. Waypoint Bearing - SET WAYPOINT RADIAL FROM VORTAC
7. Waypoint Distance - SET WAYPOINT DISTANCE FROM VORTAC
8. OBS Control - DESIRED MAGNETIC COURSE
9. Self-Test - PRESS BUTTON (must have VOR reception)

**PERFORMANCE** - No change

**WEIGHT AND BALANCE** - No change

**SYSTEMS DESCRIPTION**

The RNAV function of the King KNC-610 system performs a vector computation that results in a visual display of the magnetic bearing and distance to or from a selected waypoint. The computer, in effect, moves the selected reference facility (VORTAC or colocated VOR/DME facility) to a different location called a waypoint. The waypoint, which is expressed in terms of nautical miles along a selected radial from the VORTAC, is programmed into the system by the pilot.

Steering guidance is presented as a left/right display on the Horizontal Situation Indicator (HSI). The display format differs from the conventional VOR course deviation of ± 10 degrees called "angular course deviation". Rather, course deviation is presented in nautical miles from the course centerline. This feature, referred to as "linear course deviation", provides for a constant course width irrespective of the distance to the waypoint. Two levels of sensitivity are available for area navigation. The enroute sensitivity, available when the Mode Selector switch is positioned to RNAV, provides a constant course width of ± 5 nautical miles. Approach sensitivity, available when the Mode Selector switch is positioned to APPR, provides a constant course width of ± 1.25 nautical miles. Approach sensitivity should be used when within ten nautical miles of the terminal waypoint.

The Range Monitor feature (optional) provides for the separation of the RNAV computed range to a waypoint from the steering guidance of the pilot's Horizontal Situation Indicator. Selecting the Range Monitor switch to the RANGE MONITOR position will connect the RNAV computer to the NAV 2 receiver. The pilot's Horizontal Situation Indicator will be retained on the NAV 1 receiver.

On an ILS approach, for example, it is desirable to know distance to the outer marker and then to the runway threshold. By selecting RANGE MONITOR and setting the appropriate NAV 2 frequency and waypoint parameters into the system, the distance to the desired fix will be continuously displayed while ILS steering guidance on the Horizontal Situation Indicator will be conventional. The result is the ability to fly a localizer or full ILS steering situation while retaining RNAV computed distance to a selected fix.

*CAUTION*

It is imperative the Range Monitor switch be placed in the NORMAL position during RNAV operation. If left in the RANGE MONITOR position, the range display will be based on the NAV 2 frequency and waypoint parameters, and the pilot's Horizontal Situation Indicator will display conventional VOR steering based on the selected NAV 1 frequency.

**HANDLING, SERVICING AND MAINTENANCE** - No change

Approved: Donald H Petro

for W. H. Schultz
Beech Aircraft Corporation
DOA CE-2

# BEECHCRAFT SUPER KING AIR 200, 200C, 200T, 200CT, B200, B200C, B200T, B200CT KING AIR A100, B100, F-90, E90 C90 (LJ-668 thru LJ-1062, EXCEPT LJ-670), and C90A (LJ-1063 AND AFTER) LANDPLANES

## PILOT'S OPERATING HANDBOOK AND FAA APPROVED AIRPLANE FLIGHT MANUAL SUPPLEMENT

## for the

## AIRDATA AD611/D AREA NAVIGATION/VERTICAL NAVIGATION SYSTEM

### GENERAL

The information in this supplement is FAA-approved material and must be attached to the FAA Approved Airplane Flight Manual when the airplane has been modified by installation of the AirData AD611/D Area Navigation/Vertical Navigation System in accordance with Beech-approved data.

The information in this supplement supersedes or adds to the basic FAA Approved Airplane Flight Manual only as set forth within this document. Users of the manual are advised always to refer to the supplement for possibly superseding information and placarding applicable to operation of the airplane.

The RNAV function of the AirData AD611/D system performs a vector computation that results in a visual display of the magnetic bearing and distance to or from a selected waypoint. The computer, in effect, moves the selected reference facility (VORTAC or colocated VOR/DME facility) to a different location called a waypoint. The waypoint, which is expressed in terms of nautical miles along a selected radial from the VORTAC, is programmed into the system on the Manual Waypoint Setter.

Steering guidance is presented as a left/right display on the Horizontal Situation Indicator(HSI). The display format differs from the conventional VOR course deviation of 10 degrees called "angular course deviation". Rather, course deviation is presented in nautical miles from the course centerline. This feature, referred to as "linear course deviation", provides for a constant course width irrespective of the distance to the waypoint. Two levels of sensitivity are available for area navigation. The enroute senstivity, available when the APPR pushbutton on the system's range indicator is not activated, provides a constant course width of 5 nautical miles. Approach sensitivity, available with the APPR pushbutton depressed, provides a constant course width of 1.25 nautical miles. Approach sensitivity should be used when within ten nautical miles of the terminal waypoint.

The Multi-Waypoint Memory System is an option to the basic AD611/D Area Navigation Computer System. This system consists of a Horizontal Display Unit (61HDU) and the Data Entry Unit (61DEU). These units may be used in conjunction with or in lieu of the Manual Waypoint Setter. The Multi-Waypoint System stores RADIAL/DISTANCE and TRACK/FREQUENCY information for up to 10 different waypoints. The memory does not erase when electrical power to the unit is turned off.

The VNAV function of the AirData AD611/D does not depend on interconnection with the encoding altimeter nor does it drive the vertical needle on the HSI. It does not depend on wind or groundspeed, but is based solely on vertical triangulation. Two versions of the VNAV controller are available, the 61CAC and the 541CAC. With the 61CAC installed, the VNAV displays as a set of numbers the MSL altitude the airplane "should be at" for a 3.0 degree (330 feet per nautical mile) approach slope to the runway waypoint. The pilot compares the computed "should be at" altitude with the standard altimeter in the cockpit and manually adjusts the airplane flight path as required. The display takes into account the MSL elevation of the waypoint, which is a value entered by the pilot. There is also provision for entering an MDA value appropriate to the approach conditions. The "count down" of the altitude display ceases at the MDA value and the screen blinks to indicate that further descent must be based on visual observations.

Airplanes equipped with the 541CAC operate the same as those equipped with the 61CAC except that a 1.5° (165 feet per nautical mile) slope is also available. Operation is the same as for the 3° slope except NO MDA FUNCTION IS PROVIDED. A 1.5° descent should NEVER be used to a waypoint placed at a runway elevation.

## LIMITATIONS

1. The area navigation system may not be used as a primary system under IFR conditions except on approved approach procedures, approved airways, and random area navigation routes when approved by Air Traffic Control.

2. This system can only be used with colocated facilities. (VOR and DME signals originate from same geographical location.)

3. An area navigation installation located on the right instrument panel may be used for primary navigation only if a qualified pilot occupies the right seat.

4. The vertical navigation system does not adversely affect any other airplane system. The computed vertical slope on those systems with the 61CAC controller is preprogrammed to a single value of 3.0 degrees. Systems with the optional 541CAC controller offer an additional 1.5 degree vertical slope. This mode MUST NOT be used for an approach descent. Pending publication of certification requirements, use of the 3.0 degree computed vertical slope to stabilize the flight path is permitted provided the maximum/minimum altitudes specified in the published procedures are observed.

## EMERGENCY PROCEDURES

CAUTION

DME may unlock due to loss of signal with certain combinations of distance from station, altitude and angle of bank.

1. If NAV flag appears while in the enroute mode, check for correct frequency.

2. If VOR or DME equipment is intermittent or lost, utilize other navigation equipment as required.

3. If NAV flag appears during an approach, execute published missed approach and utilize another approved facility.

## NORMAL PROCEDURES

The AirData AD611/D system is programmed and operated from a Digital Range/Mode Control unit, one or more Waypoint Setter Units, and a Command Altitude Computer for VNAV display. Frequency selection and course display are provided by the standard navigation controls and HSI.

### *CONTROLS AND DISPLAYS*

#### *DIGITAL RANGE/MODE CONTROL UNIT (RNAV 61 DRM)*

1. RNAV ON-OFF Pushswitch:

   Used to activate and deactivate the RNAV system. It is a push on/push off switch that is backlighted whenever it is in the ON state. When selected ON, it connects the RNAV computer to the HSI. When selected OFF, the HSI display presents conventional VOR/LOC information.

2. APPR Pushswitch:

   Used to activate or deactivate the RNAV approach mode of operation. This operation increases the sensitivity of the HSI presentation and is used when approaching a waypoint in an approach to landing. The switch is backlighted whenever it is switched ON.

3. Digital Display:

   Normally indicates the distance to the waypoint in nautical miles from present position. The airplane's standard DME distance indicator will continue to display DME distance to the reference VORTAC.

4. BRG Pushbutton:

   Used to temporarily cause the digital display to indicate the magnetic bearing from the airplane to the selected waypoint. Valid VOR and DME signals must be received for this function.

5. TEST Pushbutton:

   Illuminates the three diagnostic annunciator lights to verify their operation. Temporarily causes the digital display to indicate the waypoint DISTANCE value entered on the active waypoint setter unit. Also, a reference bearing output is sent to the HSI which causes the left/right needle to center when the course selector is set to the RADIAL value entered on the active waypoint setter unit. Depressing both the TEST and BRG buttons simultaneously causes the waypoint RADIAL value entered on the active waypoint setter unit to appear on the digital display.

   These tests require at least 10 nautical miles to be set into the waypoint DISTANCE and reception of a valid VOR signal.

6. Diagnostic Lights:

   Each of the three fault annunciators will flash and the digital display will be blank under the specified conditions.

   DTW: Indicates that "distance to waypoint" computation cannot be made. This can be an excessive distance (over 199.9 N.M. to waypoint), excessive RADIAL setting (over 359.9°) or a computer malfunction.

   VOR: Indicates that computation quality of VOR signal has been lost.

   DME: Indicates a loss of DME signal.

*WAYPOINT SETTER UNIT (RNAV 61 WPS)*

1. RADIAL Thumbwheels:

   Set to indicate the bearing from the VOR to the waypoint. The DTW diagnostic annunciator will flash if a RADIAL entry exceeds 359.9 degrees or results in a distance-to-waypoint exceeding 199.9 nautical miles.

2. DISTANCE Thumbwheels:

   Set to indicate the distance from the VOR to the waypoint.

3. ACTIVATE Pushbutton:

   Depressing white pushbutton, located above the RADIAL thumbwheels, activates that waypoint setter unit, placing its RADIAL and DISTANCE information into the RNAV computer. In systems containing more than one waypoint setter unit, the number 1 unit is automatically activated when the RNAV ON-OFF switch is selected ON. Any other waypoint setter unit can then be activated by depressing the ACTIVATE pushbutton on the desired waypoint setter unit.

   Depressing the ACTIVATE pushbutton also performs a "fast update" function for the RNAV computer each time it is depressed. Fast update allows current VOR and DME information on airplane position into the computer without averaging out the errors in these signals. Fast update would be used after channeling a new frequency into the NAV equipment, after regaining DME lock-on, or after changing a thumbwheel setting on an active waypoint setter unit.

4. Waypoint Indicator Light:

   Yellow light, located above DISTANCE thumbwheels, illuminates whenever its waypoint setter unit is activated. These lights are numbered when more than one waypoint setter unit is installed.

*HORIZONTAL DISPLAY UNIT (61 HDU)*

1. RADIAL/DISTANCE Pushswitch:

   Depressing pushswitch causes RADIAL (upper line) and DISTANCE (lower line) information to be displayed from either the active waypoint or from a new waypoint being entered into the MEMORY.

2. TRACK/FREQUENCY Pushswitch:

   Depressing pushswitch causes prestored TRACK and FREQUENCY information for the selected waypoint to be displayed.

*DATA ENTRY UNIT (61 DEU)*

1. ACTIVE Pushbutton:

   This pushbutton selects the Memory Waypoint System for use when installed in conjunction with a Manual Waypoint Setter (61WPS). The pushbutton also engages the AD611/D computer "Fast Update".

2. MEMORY Pushbutton:

   Pressing pushbutton opens the MEMORY allowing data to be stored in the MEMORY. After data has been entered, pressing the pushbutton again closes the MEMORY and permanently stores the data.

3. Thumbwheel "SCRATCH PAD":

   Set to indicate information to be entered into MEMORY.

4. ENTER Pushbuttons:

   Pushbuttons are pressed after MEMORY is opened to enter "SCRATCH PAD" data into the waypoint MEMORY; Upper pushbuttons enter RADIAL or TRACK information and the lower pushbuttons enter DISTANCE or FREQUENCY information.

5. WAYPOINT Number Window:

   This window displays the number of the waypoint currently selected.

6. WAYPOINT Select Pushbuttons:

   These pushbuttons, located above and below the waypoint number window, are used to change the waypoint number selected to a larger number (upper pushbutton) or a smaller number (lower pushbutton).

*COMMAND ALTITUDE COMPUTER (VNAV 61CAC)*

1. Digital Display:

   Normally displays COMMAND ALTITUDE (altitude MSL that airplane currently "should be at" in order to achieve a 3.0°/330 feet per nautical mile approach descent angle to the runway waypoint). It also displays values set for waypoint altitude and MDA.

2. ON-STBY Switch:

   Turns the VNAV computer ON. W/P MSL and MDA MSL values may be set in either ON or STBY switch positions.

3. W/P-SET-MDA Switch:

   W/P position enters the value set by the W/P MSL knob into the VNAV computer. MDA position enters the value set by the MDA MSL knob into the VNAV computer. It should be in the SET position for normal VNAV operation.

4. W/P MSL Knob:

   Sets the altitude MSL of the waypoint.

5. MDA MSL:

   Sets the selected minimum decision altitude.

*COMMAND ALTITUDE COMPUTER (VNAV 541CAC)*

1. Digital Display:

   Normally displays COMMAND ALTITUDE (altitude MSL that airplane currently "should be at" in order to achieve a 3°/330 feet per nautical mile approach descent angle to the runway waypoint or a 1.5°/165 feet per nautical mile cruise descent). It also displays values set for waypoint altitude and, in the 3° descent, MDA.

2. ON Lamp/Pushbutton:

   An illuminated push-on/push-off switch which illuminates when in the ON position. Turns the VNAV computer ON.

3. ALT-SET-MDA Switch:

   ALT position enters the value set by the rotary knob into the computer for desired altitude at the waypoint. MDA position enters the value set by the rotary knob for minimum decision altitude into the computer. It should be in the SET position for normal VNAV operation.

4. 1.5°/3° Lamp/Pushbuttons:

   When pushed these switches select either the 1.5° or 3° descent angle. The appropriate switch illuminates when that descent angle is selected.

5. Rotary Knob:

   Sets the altitude MSL of the waypoint or the minimum decision altitude, depending on the setting of the ALT - SET - MDA Switch.

## PREFLIGHT (MANUAL WAYPOINT SELECTOR)

The preflight check is to test the computation accuracy of the computer and to assure the proper operation of the controls and displays. This procedure should be completed prior to programming for the intended flight.

1. Depress RNAV pushswitch to ON.
2. Set RADIAL thumbwheels to 000.0°.
3. Set DISTANCE thumbwheels to 25.0 NM.
4. Set NAV 1 receiver to a VOR or VORTAC within receiving range.
5. Press and hold TEST button. Adjust course control on HSI to produce centered needle with "TO" indication. Check that:

   a. Digital display indicates 25.0 ± 1 NM.

   b. The course setting is 000 ± 2 degrees.

6. Press and hold BRG and TEST buttons. Check that:

   a. Digital display indicates 0 ± 1 degree.

7. Release BRG and TEST buttons.

NOTE

If any of the preflight tests are not within the prescribed tolerances, the RNAV system will not meet the required standards of accuracy. Corrective adjustment or maintenance is required. This procedure does not test the DME.

PREFLIGHT (Multi-Waypoint Memory System)

To preflight check the RNAV system using the Multi-Waypoint Memory System prior to flight, the following procedure should be used.

1. Depress RNAV pushswitch to ON.

2. Press ACTIVE pushbutton on Data Entry Unit (providing unit is used in conjunction with one or more manual waypoint setters).

3. Firmly press MEMORY pushbutton to open MEMORY (Horizontal display unit readout will flash indicating MEMORY is open).

4. Set thumbwheel "SCRATCH PAD" to 000.00.

5. Press upper ENTER button to enter data into MEMORY.

6. Set thumbwheel "SCRATCH PAD" to 25.00.

7. Press lower ENTER pushbutton.

8. Set NAV 1 receiver to VOR or VORTAC within receiving range.

9. Press and hold TEST button. Adjust course control on HSI to produce centered needle with "TO" indication.

   a. Digital display indicates 25.0 ± 1 NM.

   b. Course setting is 000 ± 2 degrees.

10. Press and hold BRG and TEST buttons. Check that digital display indicates 0 ± 1 degree.

11. Release BRG and TEST buttons.

NOTE

If any of the preflight tests are not within the prescribed tolerances, the RNAV system will not meet the required standards of accuracy. Corrective adjustment or maintenance is required. This procedure does not test the DME.

PROGRAMMING

1. RNAV ON-OFF Pushswitch - ON (switch illuminated)

NOTE

The number 1 waypoint setter unit is automatically selected when the RNAV pushswitch is turned ON.

2. Waypoint Definition - Determine in terms of RADIAL and DISTANCE from a specific VORTAC.

NOTE

The maximum allowable RADIAL setting is 359.9 degrees. If a RADIAL of 360.0 degrees is desired, use a value of 000.0 degrees. The maximum allowable DISTANCE setting is 199.9 NM. The maximum allowable range from the airplane to the waypoint is also 199.9 NM. If any of these restrictions are exceeded, select a waypoint that is within these values.

3. Manual Waypoint Setter Units or Multi-Waypoint Memory System.

   a. Manual Waypoint Setters - Set RADIAL and DISTANCE thumbwheels.

   b. Multi-Waypoint Memory System - Enter data.

      1. Press MEMORY pushbutton to "open" MEMORY - Digital display will blink.

      2. Select category of data to be entered - (RADIAL/DISTANCE or TRACK/FREQUENCY) and press appropriate pushswitch.

      3. Select waypoint number.

      4. Set proper data on "SCRATCH PAD" thumbwheels.

      5. Enter data - If RADIAL or TRACK data, press upper ENTER pushbutton; If DISTANCE or FREQUENCY data, press lower ENTER pushbutton.

NOTE

RADIAL/DISTANCE information entered is used by the RNAV to compute course information. TRACK/FREQUENCY information entered is used as a reference only and is provided as a reminder of what information is pertinent to that waypoint. TRACK/FREQUENCY information is not used by the RNAV for computation of any kind.

      6. Check digital display for proper data entry.

      7. Press MEMORY pushbutton to close MEMORY, digital display will stop blinking.

NOTE

The MEMORY does not erase when power to the RNAV unit is turned off.

4. NAV Receivers (VOR and DME) - ON. Frequency set.

5. Digital Display - Check to insure that distance to waypoint value appears.

6. HSI Course Control - SET to desired magnetic course.

## ENROUTE

Using the AirData AD611/D system enroute corresponds to flying VOR airways, except navigation is now to or from waypoints. The waypoint parameters (radial and distance) in effect "move" the VORTAC. Once this is accomplished, the horizontal situation indicator and AD611/D digital range indicator will provide guidance to the waypoint similar to conventional VOR/DME navigation. The only notable difference is that the course deviation needle on the HSI will maintain a constant sensitivity of ± 5 nautical miles irrespective of the distance to the waypoint. The range indicator will count down to approximately 0.2 nautical mile when, upon reaching the waypoint, the "TO" flag will change to "FROM".

When the next waypoint is required for navigation, depress the ACTIVATE pushbutton on the next waypoint setter unit in sequence, confirm the proper VORTAC frequency is set, and set the desired magnetic course on the horizontal situation indicator.

The next waypoint is selected on the Multi-Waypoint Memory System by pressing the appropriate waypoint select pushbutton until the desired waypoint number appears in the waypoint number window.

NOTE

If an ILS frequency is selected on NAV 1 while in an RNAV mode, the NAV flag will appear on the horizontal situation indicator and the VOR diagnostic light will flash. The RNAV must be selected OFF for ILS or conventional VOR operation (except for Approach Range Monitor operation).

Data may be entered into the MEMORY system or data already entered may be reviewed while the system is being used in flight. The MEMORY may be opened at any time to enter or review data. When this happens, the waypoint data currently being used is locked in to the computer; the RNAV continues to use this data for navigation while the MEMORY is open. Data may be entered at this time as previously described. After all desired data changes or reviews have been made, the MEMORY is closed. This causes the data displays to revert back to the currently active waypoint.

## APPROACH

Using the AirData AD611/D system for an approach is similar to making a localizer approach. However, the system is using VOR and DME information and the MDA will be higher than when conducting a precision approach. Insert the waypoint parameters from the approach chart into the waypoint setter units. These parameters must be taken from an approved RNAV approach procedure for IFR operations. Activate the approach mode by depressing the APPR pushswitch. This will increase the horizontal situation indicator navigation sensitivity to a ± 1.25 nautical miles course width. For smoother operation, the computed distance to the waypoint should not exceed 30 nautical miles while in the approach mode.

Set the appropriate inbound course to each waypoint in turn and depress the ACTIVATE pushbutton on the appropriate waypoint setter unit to establish the next waypoint. If landing cannot be made upon reaching the MAP, follow the missed approach procedure outlined on the approved plate.

## VERTICAL NAVIGATION (VNAV 61CAC)

The digital display screen of the Command Altitude Computer indicates the altitude the airplane "should be at" on a descent profile of 3.0° (330 feet per nautical mile) to the runway waypoint. The screen will count down as the airplane proceeds toward the runway waypoint and will count up as the airplane flies from the runway waypoint. The display will stop counting when the airplane should be at the MDA, at which point the display will flash the MDA value. The maximum altitude of the display is 9900 feet.

1. ON-STBY Switch - STBY.
2. SET Switch - W/P Position.
3. W/P MSL Knob - TURN until altitude MSL of runway waypoint shows in display.
4. SET Switch - MDA Position.

5. MDA MSL Knob - TURN until altitude MSL of MDA shows in display.

6. SET Switch - Center Position.

Immediately prior to reaching descent waypoint:

7. ON-STBY Switch - ON.

8. Command Altitude - READ from digital display.

9. MDA Reached - Display starts flashing and stops decreasing.

*CAUTION*

It is essential that the runway end waypoint setter unit be activated when the Command Altitude Computer is being used. DO NOT activate the VNAV while navigating to the Final Approach Fix waypoint.

## VERTICAL NAVIGATION (VNAV 541CAC)

*PROCEDURES FOR 3° DESCENT ANGLE*

The digital display screen of the Command Altitude Computer (CAC) indicates the altitude the airplane "should be at" on a descent profile of 3.0° (330 feet per nautical mile) to the runway waypoint. The screen will count down as the airplane proceeds toward the runway waypoint and will count up as the airplane flies from the runway waypoint. The display will stop counting when the airplane should be at the MDA, at which point the display will flash the MDA value. The maximum altitude of the display is 9900 feet.

1. ALT-SET-MDA Switch - ALT Position.

2. Rotary Knob - TURN until altitude MSL of runway waypoint shows in display.

3. ALT-SET-MDA Switch - MDA Position.

4. Rotary Knob - TURN until altitude MSL of MDA shows in display.

5. ALT-SET-MDA Switch - SET Position.

Immediately prior to reaching descent waypoint:

6. ON Button - PRESS.

7. 3° Button - PRESS.

8. Command Altitude - READ from digital display.

9. MDA Reached - Display starts flashing and stops decreasing.

*CAUTION*

It is essential that the runway end waypoint setter unit be activated when the Command Altitude Computer is being used DO NOT activate the VNAV while navigating to the Final Approach Fix waypoint.

*PROCEDURES FOR 1.5° DESCENT ANGLE*

The digital display screen of the Command Altitude Computer indicates the altitude the airplane "should be at" on a cruise descent profile of 1.5° (165 feet per nautical mile) to a selected altitude at a waypoint. The screen will count down as the airplane proceeds toward the waypoint. The display screen will commence flashing while counting down when the airplane is within 1000 feet of the set altitude. The 3° lamp also commences flashing at this time to assure the pilot is aware that the 3° slope must be selected to complete an approach.

1. Complete steps 1 thru 4 for 3° slope.
2. ALT-SET-MAD Switch - ALT Position.
3. ON Lamp/Pushbutton - ON.
4. 1.5° Lamp/Pushbutton - PUSH, 3° lamp extinguishes and 1.5° lamp illuminates.

Within 1000 feet of set altitude the CAC display and 3° lamp commence flashing. Countdown of altitude continues.

*CAUTION*

The 1.5° slope is NOT to be used as an approach descent.

5. 3° Lamp/Pushbutton - PUSH, 3° altitude data presented

   or

6. ALT-SET-MDA Switch - SET Position, 3° altitude data presented.

## APPROACH RANGE MONITOR

The Approach Range Monitor feature provides for the separation of the RNAV computed range to a waypoint from the steering guidance of the pilot's horizontal situation indicator. Selecting the Approach Range Monitor switch to the RANGE MONITOR position will connect the RNAV computer to the NAV 2 receiver. The pilot's horizontal situation indicator will be retained on the NAV 1 receiver.

On an ILS approach, for example, it is desirable to know distance to the outer marker and then to the runway threshold. By selecting RANGE MONITOR and setting the appropriate NAV 2 frequency and waypoint parameters in the waypoint setter unit, the distance to the desired fix will be continuously displayed while ILS steering guidance on the horizontal situation indicator will be conventional. The result is the ability to fly a localizer or full ILS steering situation while retaining RNAV computed distance to a selected fix.

*CAUTION*

It is imperative the Approach Range Monitor switch be placed in the NORMAL position during RNAV operations. If left in the RANGE MONITOR position, the range display will be based on the NAV 2 frequency and waypoint setter unit parameters, and the pilots horizontal situation indicator will display conventional VOR steering based on the selected NAV 1 frequency.

**PERFORMANCE -** No Change

Approved: Donald H Retto

For W. H. Schultz
Beech Aircraft Corporation
DOA CE-2

# PILOT'S OPERATING HANDBOOK AND FAA APPROVED AIRPLANE FLIGHT MANUAL SUPPLEMENT

for the

# BRAKE DEICE SYSTEM

## GENERAL

The information in this supplement is FAA-approved material and must be attached to the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual when the airplane has been modified by installation of a Brake Deice System in accordance with Beech-approved data.

The information in this manual supersedes or adds to the basic Pilot's Operating Handbook and FAA Approved Airplane Flight Manual only as set forth within this document. Users of the handbook are advised always to refer to the supplement for possibly superseding information and placarding applicable to operation of the airplane.

## LIMITATIONS

1. Brake deice system is not to be operated above 15°C ambient temperature.
2. Brake deice system is not to be operated longer than 10 minutes (one deice timer cycle) with the landing gear retracted. If operation does not automatically terminate approximately 10 minutes after gear retraction, system must be manually selected off.
3. Maintain 85% $N_1$ or higher during periods of simultaneous brake deice and wing boot operation. If inadequate pneumatic pressure is developed for proper wing boot inflation, select brake deice system off.
4. Both sources of instrument bleed air must be in operation. Select brake deice system off during single engine operation.

## EMERGENCY PROCEDURES

ILLUMINATION OF BRAKE DEICE OVERHEAT (BK DI OVHT) ANNUNCIATOR

If either Brake Deice Overheat annunciator illuminates in flight:

1. Ensure that the brake deice system is turned off.
2. Bleed Air Valve on affected side - INSTR & ENVIR OFF

NOTE

Brake Deice Overheat annunciators may momentarily illuminate during simultaneous wing boot and brake deice operation at low $N_1$ speeds. If annunciators immediately extinguish, they may be disregarded.

RUDDER BOOST OPERATION

The rudder boost system may not operate when the brake deice system is in use. Consequently, increased rudder-pedal forces should be anticipated in the event of single-engine operation. Availability of the rudder boost system will be restored to normal when the brake deice system is turned off.

SMOKE AND FIRE

*ENVIRONMENTAL SYSTEM SMOKE OR FUMES*

1. Oxygen -
   a. Oxygen Control (System Ready)- PULL ON
   b. Crew (Diluter Demand Mask) - DON MASK (100% position)
   c. MIC Selector - OXYGEN MASK
   d. PASSENGER MANUAL O'RIDE - PULL ON
   e. Passenger - PULL LANYARD PIN, DON MASK
2. Cabin Temp Mode - OFF
3. Vent Blower - HIGH position
4. Left Bleed Air Valve - ENVIR OFF

   If Smoke Decreases:
   a. Continue operation with left bleed air off.

   If Smoke Does Not Decrease:
   a. Left Bleed Air Valve - OPEN
   b. Right Bleed Air Valve - ENVIR OFF
   c. If smoke decreases, continue operation with right bleed air off.

NOTE

Each bleed air valve must remain closed long enough to allow time for smoke purging to positively identify the smoke source.

ENVIRONMENTAL SYSTEMS

*PRESSURIZATION SYSTEM*

Anytime the differential pressure goes into the Red Arc:

1. Cabin Altitude Controller - SELECT HIGHER CABIN ALTITUDE SETTING

If condition persists:

2. Bleed Air Valves - ENVIR OFF
3. Cabin Pressure Switch (after cabin is depressurized) - DUMP
4. Bleed Air Valves - OPEN

**NORMAL PROCEDURES**

BEFORE TAXIING

If brakes require deicing:

1. Bleed Air Valves - OPEN
2. Brake Deice - ON (check annunciator illuminated)
3. Condition Levers - HIGH IDLE

NOTE

Once brakes have been deiced, the condition levers may be returned to LOW IDLE.



**FAA Approved**
**Revised: September, 1984**
**P/N 109-590010-31**

BEFORE TAKEOFF (RUNUP)

1. Avionics and Radar - CHECK
2. Pressurization - SET

   a. Cabin Altitude Selector Knob - ADJUST SO THAT INNER SCALE (ACFT ALT) INDICATES 26,000 FEET (end of scale), OR PLANNED CRUISE ALTITUDE PLUS 500 FEET, WHICHEVER IS LOWER. If this setting does not result in an outer scale (CABIN ALT) indication of at least 500 feet above take off field pressure altitude, adjust as required.
   b. Rate Control Selector Knob - SET INDEX BETWEEN 9- and 12-O'CLOCK POSITIONS.

*3. Autopilot - CHECK
*4. Electric Elevator Trim Control - CHECK

   a. Elevator Trim Tab Control Switch (pedestal) - ON (forward to ELEV TRIM position)
   b. Pilot's and Copilot's Electric Trim Switches - CHECK OPERATION
   c. Pilot's and Copilot's Trim Disconnect Switches - CHECK FOR DEACTIVATION OF SYSTEM
   d. Elevator Trim Tab Control Switch - OFF, then ON

**WARNING**

Operation of the electric trim system should occur only by movement of pairs of switches. Any movement of the elevator trim wheel while depressing only one switch denotes a system malfunction. The elevator tab control switch must then be turned OFF and flight conducted only by manual operation of the trim wheel.

NOTE

Pilot's electric trim switches should override copilot's.

5. Trim Tabs - SET
6. Engine Control Friction Locks - SET
7. Flaps - CHECK AND SET
8. Flight Controls - CHECK FOR FREEDOM OF MOVEMENT AND PROPER DIRECTION OF TRAVEL
*9. Overspeed Governors and Rudder Boost - TEST

   a. Rudder Boost Control Switch - ON
   b. Propeller Levers - FULL FORWARD (Balance of test is performed on individual engines.)
   c. Prop Test Switch:
      - LA-2 thru LA-120 (except LA-20, LA-97 and any airplane equipped with Kit 90-9070-1) - HOLD TO PROP GOV TEST.
      - LA-20, LA-97, LA-121 and after (and any earlier airplane equipped with Kit 90-9070-1) - HOLD TO GOV.
   d. Power Lever - INCREASE UNTIL PROP IS STABILIZED AT 1720 TO 1800 RPM. CONTINUE TO INCREASE UNTIL RUDDER MOVEMENT IS NOTED. (Observe ITT and Torque Limits.)
   e. Power Lever - IDLE
   f. Prop Test Switch - RELEASE. Repeat steps c, d, e, and f on the opposite engine.

*10. Primary Governors - EXERCISE AT 1800 RPM.
*11. Instrument Vacuum/Deice Pressure System - CHECK (at 1800 rpm)

   a. Both Bleed Air Valves - INSTR & ENVIR OFF

      (1) Pneumatic Pressure Gage - SHOULD INDICATE ZERO PRESSURE
      (2) Both BK DI OVHT Annunciators - SHOULD ILLUMINATE

   b. Both Bleed Air Valves - ENVIR OFF or OPEN as desired
      (1) Pneumatic Pressure Gage - SHOULD INDICATE IN GREEN ARC
      (2) Gyro Suction Gage - SHOULD INDICATE IN WIDE GREEN ARC
      (3) Both BK DI OVHT Annunciators - EXTINGUISHED

*12. Autofeather - CHECK

a. Power Levers - APPROXIMATELY 500 FT-LBS TORQUE
b. Autofeather Switch - HOLD TO TEST (both AUTOFEATHER annunciators illuminated)
c. Power Levers - RETARD INDIVIDUALLY:

(1) At Approximately 400 ft-lbs - OPPOSITE ANNUNCIATOR EXTINGUISHED
(2) At Approximately 220 ft-lbs - BOTH ANNUNCIATORS EXTINGUISHED (propeller starts to feather)

NOTE

Autofeather annunciator lights will cycle on and off with each fluctuation of torque as the propeller feathers.

d. Power Levers - BOTH RETARDED (both annunciators extinguished, neither propeller feathers)

13. Autofeather Switch - ARM

*14. Flight Idle Low Pitch Stops (Serials LA-2 thru LA-120, except LA-20, LA-97, and airplanes equipped with Kit 90-9070-1) - CHECK

a. Condition Levers - HIGH IDLE
b. Power Levers - IDLE (Note propeller rpm)
c. Prop Low Pitch Indicator Test Switch - DEPRESS AND HOLD (Note the PROP LOW PITCH Annunciators - ILLUMINATED)
d. Prop Test Switch - HOLD TO "FLT IDLE STOP TEST" (Note that rpm decreases and both PROP PITCH annunciators extinguish.)
e. Prop Low Pitch Indicator Test Switch - RELEASE
f. Power Levers - LIFT ABOVE DETENT (Note rpm increase to value in step "b".)
g. Prop Test Switch - RELEASE
h. Power Levers - RETURN TO IDLE
i. Condition Levers - LOW IDLE

*15. Ground Idle Low Pitch Stops (Serials LA-20, LA-97, LA-121 and after, and airplanes equipped with Kit 90-9070-1) - CHECK

a. Power Levers - IDLE (Note propeller rpm)
b. Prop Test Switch - HOLD TO "GND IDLE STOP" (Note decrease in propeller rpm in both right and left engines)
c. Prop Test Switch - RELEASE (Note rpm increase to value in step a.)

16. Propeller Feathering (manual) - CHECK
17. Fuel Quantity, Flight and Engine Instruments - CHECK

**May be omitted for quick turn-around at pilot's discretion.*

BEFORE LANDING

If it is possible that brakes may be restricted by ice accumulations from previous ground operation or inflight icing conditions.

1. Brake Deice - ON (check annunciator illuminated)

NOTE

If automatic timer has terminated brake deice operation after last retraction of the landing gear, the landing gear must be extended to obtain further operation of the system.



**FAA Approved**
**Revised: September, 1984**
**P/N 109-590010-31**

ENVIRONMENTAL SYSTEMS

*HEATING/COOLING SYSTEM*

1. Bleed Air Valves - OPEN (ENVIR OFF for more efficient cooling on the ground).
2. Cabin Temperature Mode - AUTO
3. Vent Blower - AUTO
4. Electric Heat - AS REQUIRED
5. Temperature Control - AS REQUIRED

NOTE

During operation in AUTO, MANUAL HEAT, or MANUAL COOL, the ventilation blower operates in the low mode. For increased air circulation, turn the Blower Switch to HIGH. For maximum cooling, the ventilation blower should be in the HIGH mode.

**PERFORMANCE**

Use of the brake deice system during certain ambient conditions may reduce available engine power. Consult the MINIMUM TAKE-OFF POWER chart in the PERFORMANCE section of the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual to determine minimum torque value permitted for takeoff. If this value cannot be obtained, without exceeding engine limitations, the brake deice system must be selected off until after the takeoff has been completed.

Use of the brake deice system in flight will result in an ITT rise of approximately 20°C. Observe ITT limitations when setting climb and cruise power.

**SYSTEMS DESCRIPTION**

FLIGHT CONTROLS

*RUDDER BOOST*

Moving either or both of the bleed air valve switches on the copilot's subpanel to the INSTR & ENVIR OFF position will disengage the rudder boost system.

ENVIRONMENTAL SYSTEM

*ENVIRONMENTAL CONTROLS*

*Bleed Air Control*

On airplanes equipped with Brake Deice, bleed air entering the cabin is controlled by the switches placarded BLEED AIR VALVE-OPEN-ENVIR OFF-INSTR & ENVIR OFF. When the switch is in the OPEN position, the environmental flow control unit and the pneumatic instrument air valve are open. When the switch is in the ENVIR OFF position, the environmental flow control unit is closed and the pneumatic instrument air valve is open; in the INSTR & ENVIR OFF position, both are closed. For maximum cooling on the ground, turn the bleed air valve switches to the ENVIR OFF position.

ICE PROTECTION SYSTEMS

*BRAKE DEICE SYSTEM*

High temperature engine compressor bleed air is directed onto the brake assemblies by a distributor manifold on each main landing gear. This heated air is supplied by the standard bleed air pneumatic system which also provides regulated pressure to the surface deice system and vacuum source. High temperature air from the pneumatic system is routed through a solenoid control valve in each main wheel well, through a flexible hose on the main gear strut, and to the distribution manifold around the brake assembly.

A switch on the pilot's subpanel, placarded BRAKE DEICE, controls the brake deice system. When this switch is activated, both solenoid control valves are opened and an annunciator, BRAKE DEICE ON, is illuminated to advise that the system is in operation.

The brake deice system may be operated as required on a continuous basis with the landing gear extended, provided the appropriate LIMITATIONS are observed. To avoid excessive wheel well temperatures with the landing gear retracted, a timer is incorporated to automatically terminate system operation approximately ten minutes after the landing gear is retracted. The system indicator light should be monitored and the control switch positioned to OFF when the light extinguishes or if brake deice operated has not automatically terminated within approximately ten minutes. The landing gear must be extended before the timer will reset and permit subsequent system activation.

The brake deice overtemp warning system is designed to illuminate a warning annunciator in the cockpit prior to reaching excessive temperatures in the wheel well area. This is accomplished with a temperature sensitive tube which ruptures at approximately 200°F, causing the warning annunciator to illuminate. Once illuminated, the warning annunciator will not extinguish until the ruptured sensing element is replaced.

**HANDLING, SERVICING AND MAINTENANCE** - No Change

Approved:

W. H. Schultz
Beech Aircraft Corporation
DOA CE-2

**BEECHCRAFT SUPER KING AIR 200, 200C, 200T, 200CT, B200, B200C, B200T, B200CT AND KING AIR C90 (LJ-668 thru LJ-1062, except LJ-670), C90A (LJ-1063 and after), E90, F90, A100 AND B100 LANDPLANES**

# PILOT'S OPERATING HANDBOOK AND FAA APPROVED AIRPLANE FLIGHT MANUAL SUPPLEMENT for the

## COLLINS ANS-31 OR ANS-31A AREA NAVIGATION SYSTEM OR COLLINS NCS-31 OR NCS-31A NAVIGATION CONTROL SYSTEM

## GENERAL

The information in this supplement is FAA-approved material and must be attached to the *FAA Approved Airplane Flight Manual* when the airplane has been modified by installation of the Collins ANS-31 Area Navigation System or the Collins NCS-31 Navigation Control System in accordance with Beech-approved data.

The information in this supplement supersedes or adds to the basic *FAA Approved Airplane Flight Manual* only as set forth within this document. Users of the manual are advised always to refer to the supplement for possibly superseding information and placarding applicable to operation of the airplane.

Except as noted, all references to the ANS-31 or NCS-31 systems also apply respectively to the ANS-31A or NCS-31A systems.

## LIMITATIONS

1. The Area Navigation mode may not be used as a primary system under IFR conditions except on approved approach procedures, approved airways, and random area navigation routes when approved by Air Traffic Control.

2. The Area Navigation mode can only be used with colocated facilities. (VOR and DME signals originate from same geographical location.)

## EMERGENCY PROCEDURES

*CAUTION*

DME may unlock due to loss of signal with certain combinations of distance from station, altitude and angle of bank.

1. If NAV flag appears while in the enroute mode, check for correct frequency.

2. If VOR or DME equipment is intermittent or lost, utilize other navigation equipment as required.

3. If NAV flag appears during an approach, execute published missed approach and utilize another approved facility.

## NORMAL PROCEDURES

The Collins ANS-31/NCS-31 Systems are push-button operated navigation computers with ten waypoint memory capacities. They contain a numerical keyboard for data entry and digital displays for data readout. Included is the capability to tune the VOR/DME, localizer and glideslope receivers, and electronically "move" the VOR to a phantom location called a waypoint. A waypoint is a convenient navigational position either at or within reception range of a selected VOR/DME station. The position of the waypoint is a function of its bearing and distance from the station.

In addition to the navigation function, the NCS-31 system can provide for the frequency control of two VHF communications radios, two ADF radios, two ATC transponders, and a second VOR and DME radio. Refer to the appropriate Collins manual for specific operating instructions of this feature.

The ANS-31/NCS-31 systems operate in three fundamental modes: VOR, localizer/glideslope, and Area Navigation. In the VOR mode, the units operate as conventional VOR converters with an "angular course deviation" scale factor of ± 10 degrees presented on the Horizontal Situation Indicator. The localizer/glideslope mode presents data in a conventional display with an "angular course deviation" scale factor appropriate to the specific approach facility.

*CAUTION*

Always operate the ANS-31/NCS-31 systems in the VOR mode when the system is used during takeoff.

For Area Navigation, course deviation is presented in nautical miles on the Horizontal Situation Indicator rather than in degrees as with the VOR mode. This feature, referred to as "linear course deviation", provides for a constant course width irrespective of the distance to the waypoint. Two levels of sensitivity are available in the Area Navigation mode. They are designated ENROUTE and APPROACH for use in enroute and terminal/approach navigation. The ENROUTE sensitivity, available when the flight control system is not in the approach mode, provides a constant course width of ± 10 nautical miles. APPROACH sensitivity, available when the flight control system is in the approach mode, provides a constant course width of ± 2 nautical miles. APPROACH sensitivity should be used when within ten nautical miles of the terminal waypoint.

## DISPLAYS AND CONTROLS

The ANS-31/NCS-31 systems are programmed and operated from a panel mounted control unit. Information such as waypoint number, station frequency, station elevation, waypoint bearing, and waypoint distance are entered into memory from the keyboard on the control unit. During the flight, the desired waypoints are recalled from memory and the modes of operation are selected on the control unit.

1. WPT Window:

   Identifies the waypoint defined by the displayed data. The letter "P" precedes the waypoint number when the displayed waypoint/frequency/code data is inactive/preset. The "P" blinks when the displayed data is on the scratch pad only.

2. FREQ Window:

   Displays the programmed VOR/DME/localizer frequency (108.00 through 117.95).

3. EL 100′ Window:

   a. Displays the programmed VOR/DME station elevation in hundreds of feet.

   b. Displays the VOR-only mode of operation (VOR).

   c. Displays the localizer mode of operation (LOC).

4. BRG Window:

   a. Displays the waypoint bearing from the VOR/DME station (000.0° through 359.9°).

   b. Displays the localizer bearing in the LOC mode (000° through 359°).

   c. Displays the held VOR/DME frequency when DME HOLD is in use.

5. DIST Window:

   a. Displays the waypoint distance from the VOR/DME station (000.0 through 249.9 nautical miles).

   b. Annunciates DME HOLD is in use (dh).

6. TEST Button:

   Momentary push button to initiate ANS-31/NCS-31 self-test.

7. Data Keyboard:

   Ten digital (0 through 9) momentary keys for entry of numerical data.

8. CLR Key:

   Momentary key to clear scratch pad for correction of entry errors or revision of stored data.

9. PRE Key:

   Momentary key to store data displayed on scratch pad into memory.

10. WPT Key:

    Momentary key to display active waypoint data on the scratch pad. When used in conjunction with a digital key, the WPT key recalls the desired waypoint data from memory to the scratch pad.

11. USE Key:

    Momentary key to transfer displayed data on the scratch pad to the navigation computer and the VOR/DME/localizer receivers. Annunciates active data by blanking the display for 1/2 second before displaying active data.

NOTE

> NAV/DME TEST and DME HOLD keys are located on the panel mounted control unit (ANS-31) or the mode select unit (NCS-31). The momentary NAV/DME TEST key only serves to initiate the VOR and DME receivers self-test. The particular system under test should be monitored for proper test indications. These tests will not affect the ANS-31/NCS-31 operation provided the key is not depressed for more than 8 seconds in the enroute mode, or more than 1 second in the approach mode. The DME HOLD key is an on-off pushbutton to hold the DME frequency.

A second panel-mounted component, the remote readout unit, displays the active navigation information in use. Distance or time to the waypoint, waypoint number, computed ground speed, waypoint passage alert, and various navigational modes are displayed on this unit.

1. MILES/MIN Window:

   Displays either the distance or time to or from the waypoint as selected by the MILES/MIN toggle switch.

2. WPT Window:

   a. Displays the active waypoint number in use.

   b. Displays the active VOR/DME frequency when DME HOLD is in use.

3. KTS Window:

   a. Displays the computed ground speed.

   b. Annunciates the VOR-only mode of operation is in use (VOR).

c. Annunciates the localizer mode of operation is in use (LOC).

d. Annunciates computer is in dead reckoning mode of operation (d-r).

e. Annunciates DME HOLD is in use (dh).

4. ALERT Light:

a. Indicates approach of waypoint (steady light).

b. Indicates crossing the TO/FROM line (flashing light).

c. Indicates recovery of valid VOR/DME signal after a prolonged loss in the dead reckoning, enroute mode (flashing light).

d. **(ANS-31A/NCS-31A only):** When depressed, displays bearing to waypoing (RNAV mode) or bearing to station (VOR mode) in place of distance or time to waypoint.

## MEMORY FUNCTION

*CAUTION*

Memory function is intended for a maximum use period of three hours with airplane's main electrical system off. Memory should be turned off if down time is to exceed three hours.

The status of the ANS-31/NCS-31 computer memory is annunciated on the upper scratch pad display of the control unit when avionic power is applied. If the memory has been erased, as would normally be the case when avionic power was last removed, the letters "POC" appear in the WPT and EL 100′ display windows.

Actuation of the remote memory switch prior to removing avionic power will hold the programmed data in the computer memory. Subsequent reapplication of avionic power will confirm the program has been saved by showing the letters "POC" only in the WPT display window. The memory save function permits the computer to be programmed in advance of the flight and held in storage without the airplane's main electrical system activated. A small light adjacent to the memory switch indicates the memory function has been selected.

## PREFLIGHT

### *SELF-TEST*

This abbreviated self-test prescribes a procedure to check the ANS-31/NCS-31 prior to flight. Complete self-test procedures for maintenance checks are available in the system maintenance section (523-0765313/523-0765291) of the Collins ANS-31/NCS-31 Navigation Control System Instruction Manual (523-0765309/523-0765286). Abbreviated self-test procedures without fault isolation are available in the Collins ANS-31/NCS-31 Self-Test Guide (523-0765453/523-0765454).

1. Press the TEST button once on the control unit. The figure "8" will appear in all positions of the upper scratch pad.

2. Press the TEST button the second time. The figure "8" will extinguish from all positions and the figure "2" will appear in the WPT display. All other positions will be blank.

3. Press the TEST button the third time.

a. Press the USE button, the numeral "1" key, and the numeral "8" key. The figure "8" will again appear in all positions of the upper scratch pad.

b. Press the USE button, the numeral "2" key, and the numeral "8" key. The figure "8" will appear in all positions of the lower scratch pad.

c. Press the USE button, the numeral "3" key, and the numeral "8" key. The figure "8" will appear in all positions (except position 5) of the remote readout unit.

4. Press the CLR key to exit the self-test program.

*CAUTION*

Engaging the ANS-31/NCS-31 self-test in flight may disrupt navigation calculations.

*AREA NAVIGATION FUNCTIONAL TEST*

The following procedure applies only to airports equipped with, or in range of, a colocated VOR/DME station.

1. Place the MILES/MIN switch on the remote readout unit in the MILES position.
2. Press WPT key.
3. Press any number key.
4. Enter the local VOR/DME station frequency and elevation.
5. Press USE key.
6. Adjust the course control knob on the Horizontal Situation Indicator to center the deviation bar.
7. The course arrow on the Horizontal Situation Indicator will point to the local station and the remote readout unit will display the distance.

## PROGRAMMING

Pertinent information (waypoint number, station frequency, station elevation, waypoint bearing, and waypoint distance) for up to ten waypoints is entered into memory from the control unit. Programming the computer may be completed prior to take-off or during the flight. Any combination of navigational facilities (RNAV waypoint, VOR/DME, ILS) may be loaded into the computer; however, it is desirable that each facility be numbered and loaded in the sequence it is to be used.

*RNAV WAYPOINTS*

1. Press the WPT key. One of two display conditions will occur on the control unit.
   a. The display will be blank indicating the absence of an active waypoint. This is a normal display when loading the initial waypoint parameters.
   b. Active waypoint data will appear on the display.
2. Select the first waypoint by pressing the keyboard number "1" key.
   a. If the waypoint has not been previously stored in the memory, only the letter "P" and the waypoint number "1" will appear on the display.
   b. If the selected waypoint has been preset, the letter "P", the waypoint number, and the waypoint parameters will appear on the display.
3. Select the VOR/DME frequency by pressing the keyboard number keys in the proper sequence. A total of five digits must be entered to complete the frequency input (i.e., frequency 113.8 entered as 113.80). Prior data is blanked when the first frequency digit is entered. The letter "P" will blink as long as data displayed is on the scratch pad only (not stored in memory.)

Entries beyond the allowable range of navigational frequencies (108.00 through 117.95 MHz in .05 MHz increments) are annunciated immediately by the letters "CLR" appearing on the right edge of the scratch pad. Further entries are inhibited until the CLR key is pressed to erase the false digit.

4. Select the VOR/DME station elevation in hundreds of feet by pressing the keyboard number keys in the appropriate sequence. Two digits must be entered. Use a leading zero for elevations less than 1000 feet.

5. Successively press the keyboard number keys to select the waypoint bearing (radial) and waypoint distance from the station. All four digits must be entered, using leading zeros as required. Bearing and distance entries are not required when the waypoint is colocated with the VOR/DME station site.

   Entries beyond the allowable range of values for bearing (000.0° through 359.9°) and distance (000.0 through 249.9 nautical miles) are annunciated immediately by the letters "CLR" appearing on the right edge of the scratch pad. Further entries are inhibited until the CLR key is pressed to erase the false digit.

NOTE

If an error is noted during the programming, corrections or revisions of data within the allowable range of values can be made by pressing the CLR key. Data is erased by fields (FREQ, EL 100′, BRG, and DIST) in the reverse order of entry each time CLR is pressed. Enter the correct data. Values for fields of correct data that were erased must be reentered.

6. Press the PRE key to place the displayed data into memory. This action will cause the display to go blank.

7. This completes the programming for the first waypoint. Follow these procedures for all selected waypoints up to a maximum of ten.

*CONVENTIONAL VOR*

The programming technique for conventional navigation directly toward or away from a VOR facility without a colocated DME is similar to that for RNAV waypoints. Inputing the waypoint number and frequency into the memory is accomplished in the same manner. Since the station has no DME, it cannot be electronically "moved" to a new location (waypoint). Therefore, no values are programmed in the EL 100′, BRG or DIST displays. Only angular deviation on the Horizontal Situation Display is available in this mode.

*ILS APPROACH (Front Course and Back Course)*

Programming an ILS approach is accomplished in the same manner as programming conventional VOR. The control unit decodes the frequency as it is entered. Upon detecting the frequency is in the ILS range, the letters "LOC" are annunciated immediately in the EL 100′ display thereby inhibiting an elevation entry. Although not required for ILS operation, the localizer bearing (000° through 359°) may be programmed into the BRG display for convenient reference. Only angular deviation is provided in the ILS mode.

*MISSED APPROACH*

If the published missed approach utilizes an RNAV waypoint or VOR facility, it may be entered into memory any time prior to the approach. It is recommended that WPT "O" (keyboard numeral 0) be reserved for this operation. Any other waypoint storage (1 thru 9) could be used; however, habitual use of WPT "O" eliminates the possibility of error that could be experienced when selecting an intermediate digit during this critical flight phase.

## INFLIGHT

Preset waypoints may be recalled from memory and put into active use as required.

1. Press the WPT key. If an active waypoint is displayed on the remote readout unit, the waypoint data will appear on the control unit display. Otherwise, the display will be blank.

2. Press the appropriate number key to select the desired waypoint. The preset waypoint data will replace any active waypoint data on the control unit display. The letter "P" is annunciated adjacent to the waypoint number to indicate that this is not the active waypoint. Information displayed on the remote readout unit, Horizontal Situation Indicator, and signals supplied to the flight control system will continue to reference the active waypoint and selected course.

3. Verify that the displayed data is correct.

NOTE

Revisions to the waypoint data can be programmed at this time by entering the new waypoint parameters. Entry of the first frequency digit blanks the remainder of the display.

4. When reference to the next waypoint is desired, press the USE key. The letter "P" is blanked to indicate that this is now the active waypoint. The Horizontal Situation Indicator NAV flag will momentarily come into view, the deviation signals supplied to the course deviation bar and flight control system will be zero, and the remote readout unit will be blanked until the NAV radios complete retuning the new active waypoint.

5. Select the desired course on the Horizontal Situation Indicator course arrow.

NOTE

Any waypoint may be used without being preset (PRE key) by entering the waypoint data in the normal manner and immediately pressing the USE key. The waypoint data will be put into active use and also stored into memory.

*RNAV OPERATION*

This is the normal mode of operation. If the VOR/DME radios are receiving valid signals from a colocated VOR/DME station, the ANS-31/NCS-31 computer will supply linear deviation information to the Horizontal Situation Indicator. The ENROUTE sensitivity, available when the flight control system is not in the approach mode, provides a constant course width of ±10 nautical miles. APPROACH sensitivity, available when the flight control system is in the approach mode, provides a constant course width of ±2 nautical miles. APPROACH sensitivity should be used when within ten nautical miles of the terminal waypoint.

Distance or time to the waypoint, waypoint number, and computed groundspeed are displayed on the remote readout unit. The ANS-31/NCS-31 computer combines inputs from the encoding altimeter with the VOR/DME station elevation to correct DME slant range error.

NOTE

The RNAV mode of operation requires the programming of station elevation to correct DME slant range error. Operation in this mode is recommended even if navigating directly toward or away from a VOR/DME facility. This provides the advantages of linear deviation and smooths the received signals to improve autopilot operation.

*CONVENTIONAL VOR OPERATION*

This is the mode of operation when either DME is not available or the DME is not colocated with the desired VOR facility. The VOR mode is annunciated by the letters "VOR" appearing on the control unit display in place of station elevation, and on the remote readout unit in place of ground speed. Raw DME distance will be displayed on the remote readout unit if a valid DME signal is received. However, slant range correction and computed ground speed will not be available. The ANS-31/NCS-31 computer supplies angular deviation information to the Horizontal Situation Indicator.

*ILS OPERATION (Front Course and Back Course)*

This is the mode of operation when the navigation receiver is tuned to a localizer frequency. The localizer mode is annunciated by the letters "LOC" appearing on the control unit display in place of station elevation, and on the remote readout unit in place of ground speed. Raw DME distance will be displayed on the remote readout unit if a valid DME signal is received. It is essential that only the inbound front course localizer bearing be set on the Horizontal Situation Indicator for both front course and back course approaches. This will assure the Flight Director display and autopilot maintain the proper left/right logic. Only angular deviation information is provided in the ILS mode.

*DEAD RECKONING OPERATION*

The ANS-31/NCS-31 will automatically enter the dead reckoning mode from either the enroute or approach RNAV mode whenever the VOR or DME signal is lost, or when passing over the VOR/DME station being used for navigation. Navigation calculations will continue using the ground speed and wind values available at the time the dead reckoning mode is entered. Changes in ground speed or wind velocity while in the dead reckoning mode will result in degradation of the accuracy of position estimates.

The loss of the VOR or DME signal for less than 9 seconds in the enroute mode or 1 second in the approach mode will not affect normal operation.

When operating in the enroute mode, loss of signal for more than 9 seconds forces the ANS-31/NCS-31 into dead reckoning. The dead reckoning mode is annunciated by displaying the letters "d-r" in place of ground speed on the remote readout unit. Recovery of the signal after 9 seconds but before 72 seconds returns the ANS-31/NCS-31 to the enroute mode and replaces the letters "d-r" with the normal ground speed display. If an invalid signal condition exceeds 72 seconds, the NAV flag on the Horizontal Situation Indicator will come into view and automatic reentry to the enroute mode will be inhibited.

Signal recovery after the NAV flag has been displayed is indicated by the ALERT light flashing. Normal operation may be regained by pressing the WPT key, the desired waypoint number key, and the USE key.

NOTE

A flashing ALERT light may also indicate crossing the TO/FROM line. This is verified by a zero distance or time to the waypoint displayed on the remote readout unit. Press the WPT key to extinguish the light.

When operating in the approach mode, loss of signal for more than 1 second forces the ANS-31/NCS-31 into dead reckoning. The letters "d-r" will again appear on the remote readout unit. Loss of signal in excess of 9 seconds causes the NAV flag on the Horizontal Situation Indicator to come into view. Recovery of the signal at any time returns the ANS-31/NCS-31 to the normal approach mode of operation and replaces the letters "d-r" with ground speed.

When operating under conventional VOR (including DME HOLD) conditions, the system will not enter dead reckoning in the event of an invalid signal. However, the NAV flag will be displayed and the annunciation "VOR" on the remote readout unit will be blanked.

*WAYPOINT ALERT*

Active waypoint approach is annunciated by an illuminated ALERT light on the remote readout unit when within 24 seconds flying time from the waypoint. This feature is available only in the enroute and approach RNAV modes of operation.

Crossing the TO/FROM line is indicated by a flashing ALERT light and reversal of the TO/FROM arrow on the Horizontal Situation Indicator. The ALERT light will automatically extinguish 24 seconds after crossing the TO/FROM line or it may be manually extinguished by pressing the WPT key.

*DME HOLD OPERATION*

The DME HOLD function inhibits changing the DME receiver frequency. Engaging DME HOLD and then selecting a new waypoint forces the ANS-31/NCS-31 into either a conventional VOR or LOC mode of operation according to the newly selected frequency.

If the waypoint to be selected is a conventional VOR or LOC waypoint, engage the DME HOLD as follows:

1. Press the DME HOLD key.
2. Select the new waypoint data on the scratch pad by pressing the WPT key and the appropriate waypoint number key.
3. Press the USE key once. The upper scratch pad of the control unit will display the letter "P", waypoint number, frequency and the letters "VOR" or "LOC". The lower scratch pad will display the active frequency on which the DME is to be held and the letters "dh" flashing on and off.
4. Verify the displayed data.
5. Press the USE key the second time. The NAV receiver will be tuned to the new waypoint frequency. The DME will remain tuned to the previously active frequency. The held DME frequency and the letters "dh" will be displayed steadily on the lower scratch pad, and also will appear on the remote readout unit in the place of waypoint number and computed ground speed. Raw DME distance to the held DME facility will be displayed on the remote readout unit.

NOTE

Only VOR radials may be flown with angular deviation provided.

Releasing the DME HOLD key will tune the DME receiver to the active NAV frequency. The lower scratch pad on the control unit will be cleared. Raw DME distance (if the signal is valid), waypoint number, and the letters "VOR" or "LOC" will appear on the remote readout unit.

*CAUTION*

The DME HOLD function should not be used when navigating between RNAV waypoints. These waypoints require valid signals from colocated VOR and DME facilities to establish their geographical positions. If the VOR and DME receivers are not tuned to a colocated facility, the DME HOLD function will cause raw DME distance to the held facility to be displayed on the remote readout unit and angular deviation to the VOR facility on the Horizontal Situation Indicator.

**PERFORMANCE** - No change

Approved: Donald W Peter

for W. H. Schultz
Beech Aircraft Corporation
DOA CE-2

# BEECHCRAFT KING AIR F90 LANDPLANES
# PILOT'S OPERATING HANDBOOK
# AND
# FAA APPROVED AIRPLANE FLIGHT MANUAL
# SUPPLEMENT
# FOR
# HIGH FLOTATION LANDING GEAR

## GENERAL

The information in this supplement is FAA-approved material and must be attached to the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual if the airplane is equipped with Beech-installed high flotation landing gear.

The information in this supplement supersedes or adds to the basic Pilot's Operating Handbook and FAA Approved Airplane Flight Manual only as set forth within this document. Users of the Pilot's Operating Handbook are advised always to refer to the supplement for possibly superseding information and placarding applicable to operation of the airplane.

When the high flotation landing gear (22x6.75-10 tires on 6.50x10 wheels) is installed, the pilot will find the use of the performance data contained in this supplement more convenient and expeditious if the entire contents of the PERFORMANCE Section of the handbook are relocated to the back of the handbook, and the PERFORMANCE portion of this supplement inserted behind the PERFORMANCE divider tab.

## LIMITATIONS

No change.

## EMERGENCY PROCEDURES

No change.

## NORMAL PROCEDURES

No change.

## PERFORMANCE

A complete PERFORMANCE Section for the high flotation landing gear is provided at the end of this supplement. The pages are numbered to correspond with the PERFORMANCE Section of the handbook. If the airplane is equipped with the high flotation landing gear, the PERFORMANCE data included in this supplement totally replaces all PERFORMANCE data provided in the PERFORMANCE Section of the basic Pilot's Operating Handbook and FAA Approved Airplane Flight Manual.

## WEIGHT AND BALANCE/EQUIPMENT LIST

No change.

**SYSTEMS DESCRIPTIONS**

No change.

**HANDLING, SERVICING, AND MAINTENANCE**

No change.

Approved: Donald H Peter

for W. H. Schultz
Beech Aircraft Corporation
DOA CE-2

# SECTION V
# PERFORMANCE

TABLE OF CONTENTS

## INTRODUCTION TO PERFORMANCE AND FLIGHT PLANNING

The graphs and tables in this section present performance information for takeoff, climb, landing and flight planning at various parameters of weight, power, altitude and temperature. All FAA approved performance information is included within this section. Examples have been presented on all performance graphs. In addition, the calculations for flight time, block speed, and fuel required for a proposed flight are presented using the conditions listed below:

## CONDITIONS

At Billings:
- Outside Air Temperature .......... 25°C (77°F)
- Field Elevation .......... 3606 feet
- Altimeter Setting .......... 29.56 in. Hg
- Wind .......... 360° at 10 knots
- Runway 34 Length .......... 5600 feet

Route of Trip:
BIL-V19-CZI-V247-DGW-V19E-CYS-V19-DEN

Weather Conditions at the planned cruise altitude of 17,000 feet:

| ROUTE SEGMENT | DISTANCE NM | MEA FT | WIND AT 17,000 FT DIR/KTS | OAT AT CRUISE ALT °C | OAT AT MEA °C | ALT SET. IN. HG |
|---|---|---|---|---|---|---|
| BIL-SHR | 88 | 8000 | 010/30 | -10 | 0 | 29.56 |
| SHR-CZI | 57 | 9000 | 350/40 | -10 | -4 | 29.60 |
| CZI-DGW | 95 | 8000 | 040/45 | -10 | 0 | 29.60 |
| DGW-CYS | 47 | 8000 | 040/45 | -10 | 0 | 29.60 |
| | 46 | 8000 | 040/45 | -10 | 0 | 29.60 |
| CYS-DEN | 85 | 8000 | 040/45 | -10 | 0 | 29.60 |

REFERENCE: *Enroute Low Altitude Charts L-8 and L-9*

At Denver:
- Outside Air Temperature .......... 15°C (59°F)
- Field Elevation .......... 5331 feet
- Altimeter Setting .......... 29.60 in. Hg
- Wind .......... 270° at 10 knots
- Runway 26 Length .......... 10,000 feet

To determine the pressure altitude at origin and destination airports, add 1000 feet to field elevation for each 1.00 in. Hg that the reported altimeter setting value is below 29.92 in. Hg, and subtract 1000 feet for each 1.00 in. Hg above 29.92 in. Hg. First, find the difference between 29.92 in. Hg and the reported altimeter setting. Then multiply the answer by 1000 to find the difference in feet between field elevation and pressure altitude.

Pressure Altitude at BIL:
29.92 in. Hg - 29.56 in. Hg = 0.36
0.36 x 1000 feet = 360 feet
The pressure altitude at BIL is 360 feet above field elevation.
Pressure Altitude at BIL = 3606 + 360 = 3966 feet

Pressure Altitude at DEN:
29.92 in. HG - 29.60 in. Hg = 0.32
0.32 x 1000 feet = 320 feet
The pressure altitude at DEN is 320 feet above field elevation.
Pressure Altitude at DEN = 5331 + 320 = 5651 feet

NOTE

For flight planning, the difference between cruise altitude and cruise pressure altitude has been ignored.

## PERFORMANCE EXAMPLE

### TAKE-OFF WEIGHT

Maximum take-off weight limit (from LIMITATIONS section) = 10,950 pounds.

### MAXIMUM TAKE-OFF WEIGHT PERMITTED BY ENROUTE CLIMB REQUIREMENT

There is no weight restriction to meet Enroute Climb Requirements.
Maximum allowable take-off weight = 10,950 pounds.

The maximum take-off weight permitted by the Enroute Climb Requirement graph is the only operating limitation required to meet applicable FAR requirements. Information has been presented, however, to determine the take-off weight, field requirements, and take-off flight path assuming an engine failure occurs during the take-off procedure. The following illustrates the use of these charts.

### TAKE-OFF WEIGHT TO ACHIEVE POSITIVE ONE-ENGINE-INOPERATIVE CLIMB AT LIFT-OFF (FLAPS 0%)

Enter the graph at 25°C and 3966 feet to determine the maximum weight at which the accelerated-go procedures should be attempted.

Maximum Accelerate-Go Weight .......... 10,950 pounds

### TAKE-OFF DISTANCE (FLAPS 0%)

Enter the graph at 25°C, 3966 feet pressure altitude, 10,950 pounds and 9.5 knot headwind component:

Ground Roll .......... 2930 feet
Total Distance Over 50-foot Obstacle .......... 4120 feet

Take-off Speed
At Rotation .......... 107 knots
At 50 Feet .......... 117 knots

### ACCELERATE-STOP (FLAPS 0%)

Enter the Accelerate-Stop (Flaps 0%) graph at 25°C, 3966 feet pressure altitude, 10,950 pounds, and 9.5 knots headwind component:

Accelerate-Stop Distance .......... 5420 feet
Takeoff Decision Speed .......... 107 knots

Section V
HFG Performance

## TAKE-OFF FLIGHT PATH EXAMPLE

The following example assumes the airplane is loaded so that take-off weight is 10,000 pounds.

### ACCELERATE-GO DISTANCE OVER 35-FOOT OBSTACLE (FLAPS 0%)

Enter the graph at 25°C, 3966 feet pressure altitude, 10,000 pounds and 9.5 knot headwind component:

Total Distance Over 35-Foot Obstacle .......... 6 000 feet
Speed at Rotation ($V_R$) .......... 102 knots
Speed at 35 Feet Above Runway ($V_2$) .......... 112 knots

### TAKE-OFF CLIMB GRADIENT - ONE-ENGINE-INOPERATIVE - FLAPS 0%

Enter the graph at 25°C, 3966 feet pressure altitude, and 10,000 pounds:

Climb Gradient .......... 4.2%
Climb Speed .......... 112 knots

A 4.2% climb gradient is 42 feet of vertical height per 1000 feet of horizontal distance.

NOTE

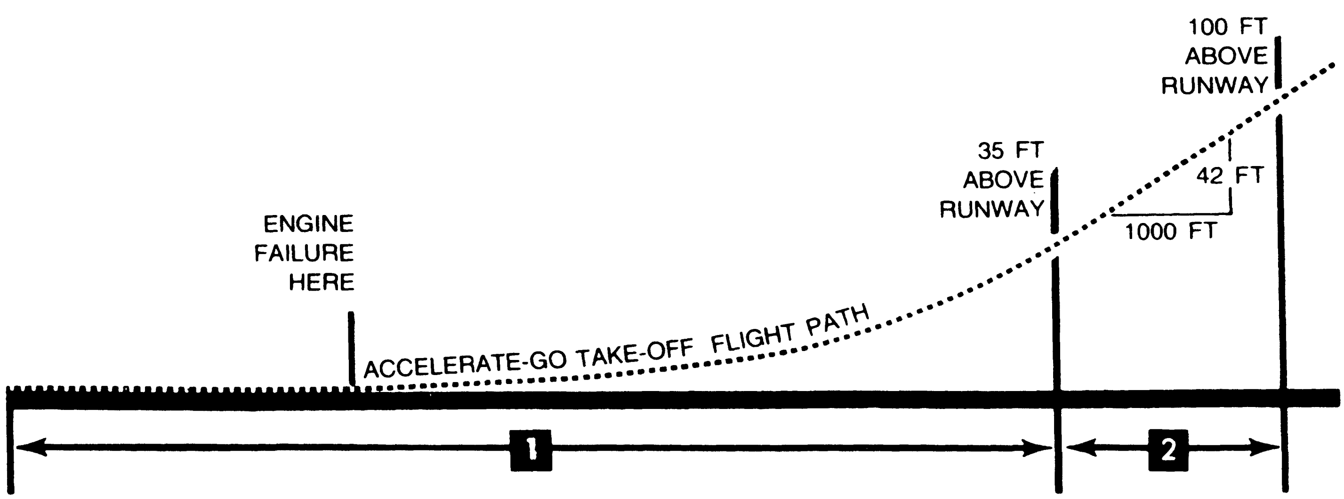
The graphs for take-off climb gradient assume a zero wind condition. Climbing into a headwind will result in higher angles of climb and hence better obstacle clearance capabilities.

Calculation of the horizontal distance to clear an obstacle 100 feet above the runway surface:

Distance from 35 feet to 100 feet = 65 feet
(100 - 35) (1000 ÷ 42) = 1548 feet

Total Distance = 6000 + 1548 = 7548 feet

The above results are illustrated below:




**1** ACCELERATE-GO TAKE-OFF = 6000 FEET

**2** DISTANCE TO CLIMB FROM 35 FEET TO 100 FEET ABOVE RUNWAY = 1548 FEET

## FLIGHT PLANNING

The following calculations provide information for the flight planning procedure. All examples have been presented on the performance graphs.

| ROUTE SEGMENT | MAGNETIC COURSE | MAGNETIC VARIATION |
|---|---|---|
| BIL-SHR | 114° | 15°E |
| SHR-CZI | 136° | 15°E |
| CZI-DGW | 131° | 14°E |
| DGW-CYS | 138° | 13°E |
| | 169° | 13°E |
| CYS-DEN | 171° | 13°E |

REFERENCE: *Enroute Low Altitude Charts L-8 and L-9*

Enter the ISA Conversion graph at the condition indicated:

| | | | |
|---|---|---|---|
| ENROUTE: | Pressure Altitude (approx) | = | 17,000 feet |
| | OAT | = | -10°C |
| | ISA Condition | = | ISA + 9°C |

Enter the Time, Fuel and Distance to Climb graph at 25°C and 3966 feet, and -10°C and 17,000 feet, with an initial weight of 10,950 pounds.

| | | |
|---|---|---|
| Time to Climb | = | (9.5 - 2) = 7.5 min |
| Fuel Used to Climb | = | (107 - 25) = 82 lbs |
| Distance Traveled | = | (25-5) = 20 NM |

Enter the tables for Maximum Cruise Power at ISA and ISA + 10°C. In each table, read cruise speeds at 16,000 feet and 18,000 feet at 10,500 pounds and 9500 pounds as follows:

| CRUISE TRUE AIRSPEED | | | | |
|---|---|---|---|---|
| ALTITUDE | 10,500 POUNDS | | 9500 POUNDS | |
| FEET | ISA | ISA + 10°C | ISA | ISA + 10°C |
| 16,000 | 253 | 250 | 255 | 253 |
| 18,000 | 251 | 248 | 254 | 251 |

The estimated cruise weight is approximately 10,400 pounds.

Interpolate to find the TAS at 17,000 feet, ISA + 9°C, and 10,400 pounds:

Cruise True Airspeed = 250 knots

Enter the graph for Maximum Cruise Power at ISA + 9°C and 17,000 feet pressure altitude:

| | | |
|---|---|---|
| Torque Setting Per Engine | = | 1430 ft-lbs |
| Indicated Outside Air Temperature | = | -4°C |

Enter the graph for Fuel Flow At Maximum Cruise Power at ISA + 9°C (or indicated outside air temperature of −4°C) and 17,000 feet pressure altitude:

| | | |
|---|---|---|
| Fuel Flow Per Engine | = | 299 lbs/hr |
| Total Fuel Flow | = | 598 lbs/hr |

NOTE

Torque setting and fuel flows can also be obtained from tables.

Enter the graph for Time, Fuel and Distance to Descend at 17,000 feet and at 5651 feet:

| | | | | |
|---|---|---|---|---|
| Time to Descend | = | (11 - 4) | = | 7 min |
| Fuel to Descend | = | (104 - 30) | = | 74 lbs |
| Distance to Descend | = | (47 - 13) | = | 34 NM |

Time and fuel used were calculated at maximum cruise power as follows:

| | | |
|---|---|---|
| Time | = | Distance ÷ Ground Speed |
| Fuel Used | = | (Time) (Total Fuel Flow) |

Results are as follows:

| ROUTE | DISTANCE NM | ESTIMATED GROUND SPEED ~ KNOTS | TIME AT CRUISE ALTITUDE HRS : MIN | FUEL USED FOR CRUISE LBS |
|---|---|---|---|---|
| BIL-SHR | 88 - 20 = 68* | 265 | :15 | 153 |
| SHR-CZI | 57 | 288 | :12 | 118 |
| CZI-DGW | 95 | 262 | :22 | 217 |
| DGW-CYS | 47 | 267 | :11 | 105 |
| | 46 | 286 | :10 | 96 |
| CYS-DEN | 85 - 34 = 51* | 285 | :11 | 107 |

*Distance to climb or descend subtracted from segment distance

The fuel used at cruise altitude from BIL to SHR at 17,000 feet and -10°C (ISA + 9°C) is:

| | |
|---|---|
| Fuel Flow | 598 lbs/hr |
| Cruise True Airspeed (10,400 lbs) | 250 knots |
| Distance Traveled at 17,000 feet | 68 NM |
| Estimated Ground Speed | 265 knots |
| Fuel Used for 68 NM at 265 knots GS | 153 lbs |

The total fuel used from BIL to SHR is: 82 + 153 = 235 lbs

The estimated weight upon reaching SHR is: Take-off weight of 10,950 - 235 = 10,715 lbs

NOTE

Two-engine rate of climb was determined for cruise altitude and estimated weight at SHR. The MEA at SHR was the highest MEA encountered during the flight; the one-engine-inoperative climb and service ceiling were determined for the MEA and weight at SHR.

| DETERMINATION OF FLIGHT TIME, BLOCK SPEED AND FUEL REQUIREMENTS | | | |
|---|---|---|---|
| ITEM | TIME HRS: MIN | FUEL POUNDS | DISTANCE NAUTICAL MILES |
| Start, Runup, Taxi, and Takeoff | 0:00 | 80 | 0 |
| Climb | 0:08 | 82 | 20 |
| Cruise | 1:21 | 796 | 364 |
| Descent | 0:07 | 74 | 34 |
| TOTAL | 1:36 | 1032 | 418 |

Total Flight Time: 1 Hour, 36 Minutes

Block Speed: 418 NM ÷ 1 Hour 36 Minutes = 261 Knots

## RESERVE FUEL

A 45-minute reserve at Maximum Range Power was assumed. The assumed weight and temperature at the end of the cruise segment used were:

(10,000 lbs, ISA + 9°C, 17,000 ft)

(0:45) (429) = 322 lbs

## TOTAL FUEL REQUIREMENT

1032 + 322 = 1354 lbs

## ZERO FUEL WEIGHT LIMITATION

For this example, the following conditions were assumed:

| | |
|---|---|
| Ramp Weight | = 11,030 pounds |
| Weight of Usable Fuel Onboard | = 1354 pounds |

Zero Fuel Weight = Ramp Weight − Weight of Usable Fuel Onboard

| | |
|---|---|
| Zero Fuel Weight = 11,030 − 1354 | = 9676 pounds |
| Maximum Zero Fuel Weight (from LIMITATIONS section) | = 9600 pounds |
| Maximum Zero Fuel Weight limitation has been exceeded by | 76 pounds |

In order to avoid exceeding the limitation, at least 76 pounds of payload must be off-loaded. If desired, additional fuel may then be added until the maximum ramp weight limitation of 11,030 pounds is again reached.

## LANDING INFORMATION

### LANDING WEIGHT

The estimated landing weight is determined by subtracting the fuel required for the trip from the ramp weight.

| | | |
|---|---|---|
| Ramp Weight | = | 11,030 lbs |
| Fuel Required for Total Trip | = | 1032 lbs |
| Landing Weight | = | 11,030 - 1032 = 9998 lbs |

### LANDING DISTANCE WITHOUT PROPELLER REVERSING, FLAPS 100%

Enter the graph at 15°C, 5651 feet pressure altitude, 9998 lbs, 10 knot headwind.

| | | |
|---|---|---|
| Ground Roll | = | 2125 feet |
| Total Over 50 foot Obstacle | = | 3260 feet |
| Approach Speed | = | 108 knots |

NOTE: Example on graph is for 10,015 pounds.

### BALKED LANDING CLIMB

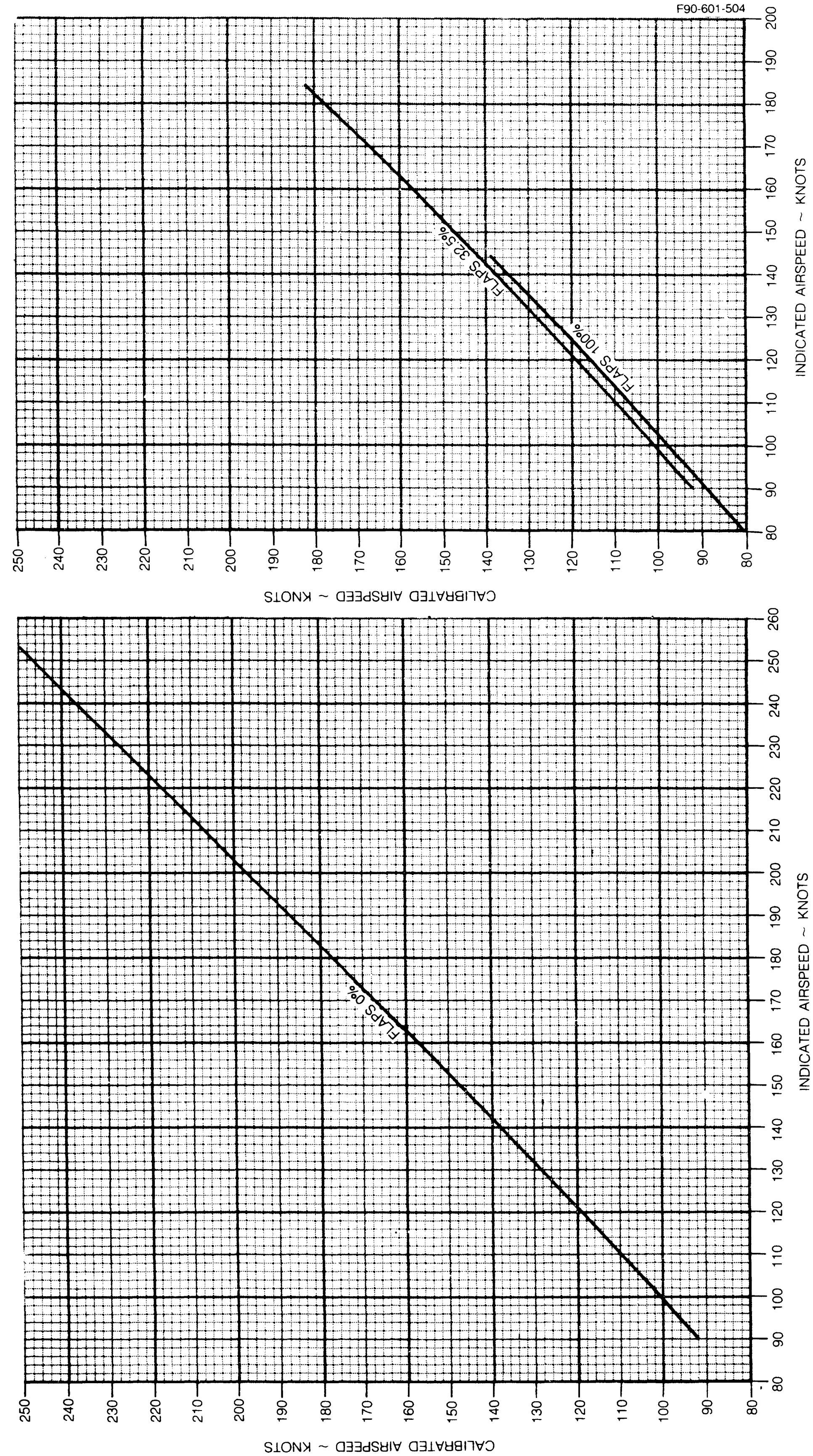
Enter the graph at 15°C, 5651 feet and 9998 lbs.

| | | |
|---|---|---|
| Rate of Climb | = | 1018 ft/min |
| Climb Gradient | = | 9.1% |

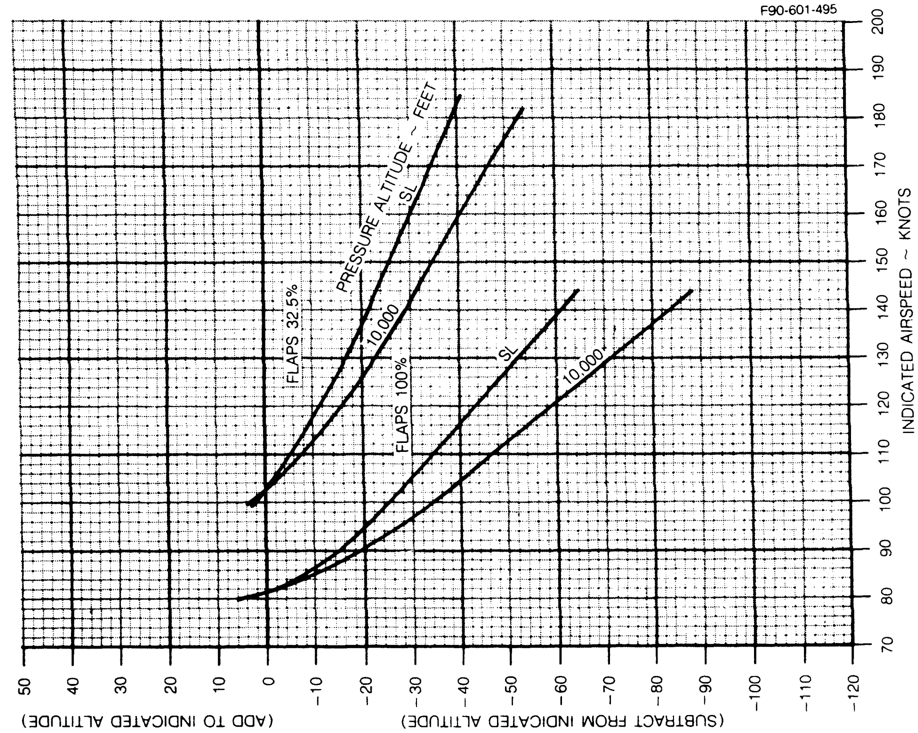
## COMMENTS PERTINENT TO THE USE OF PERFORMANCE GRAPHS

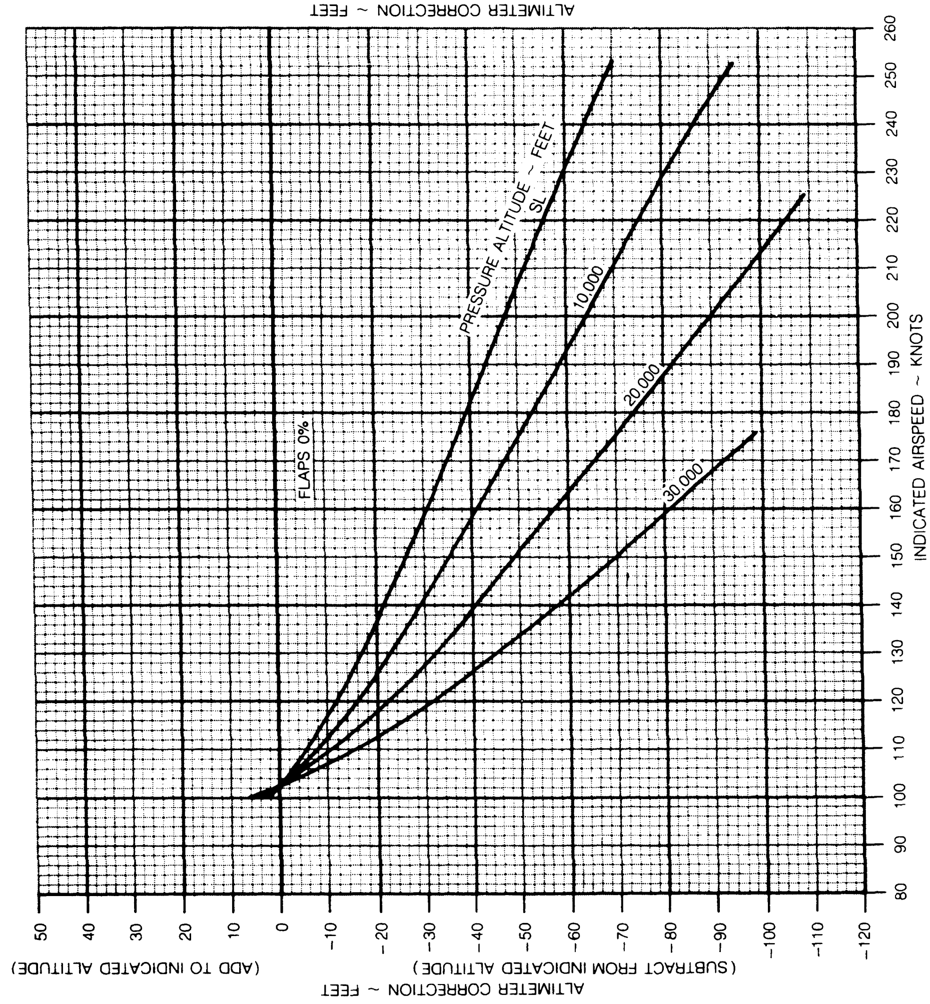
1. In addition to presenting the answer for a particular set of conditions, the example on a graph also presents the order in which the graph should normally be used (e.g., if the first item in the example is OAT, then enter the graph at the known OAT).
2. The reference lines indicate where to begin following the guide lines. Always project to the reference line first, then follow the guide lines to the next known item.
3. Indicated airspeeds (IAS) were obtained by using the Airspeed Calibration Normal System graph.
4. The associated conditions define the specific conditions for which performance parameters have been determined. They are not intended to be used as instructions; however, performance values determined from charts can only be achieved if the specified conditions exist.
5. The full amount of usable fuel is available for all approved flight conditions.

# AIRSPEED CALIBRATION - NORMAL SYSTEM

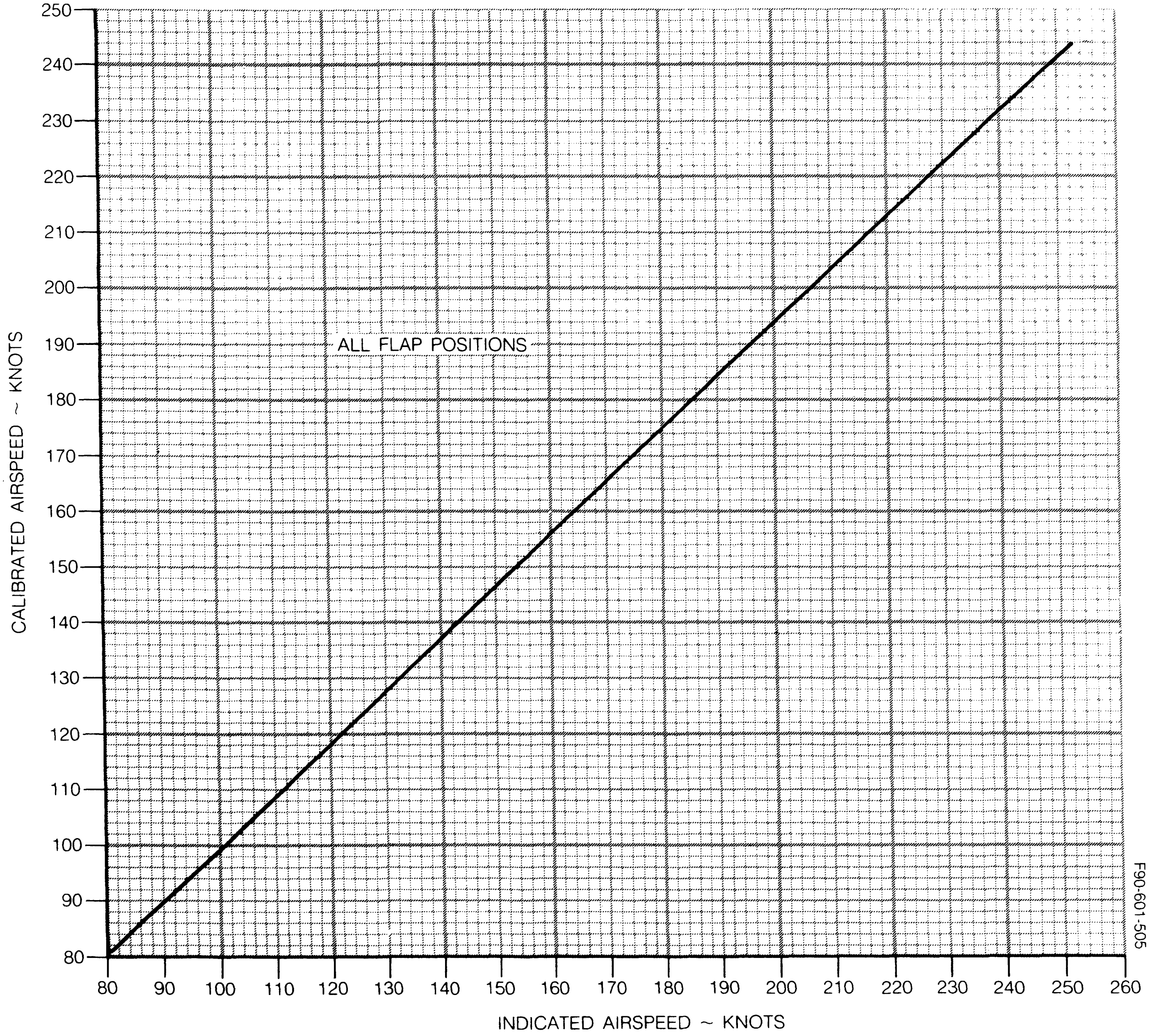


## ALTIMETER CORRECTION - NORMAL SYSTEM



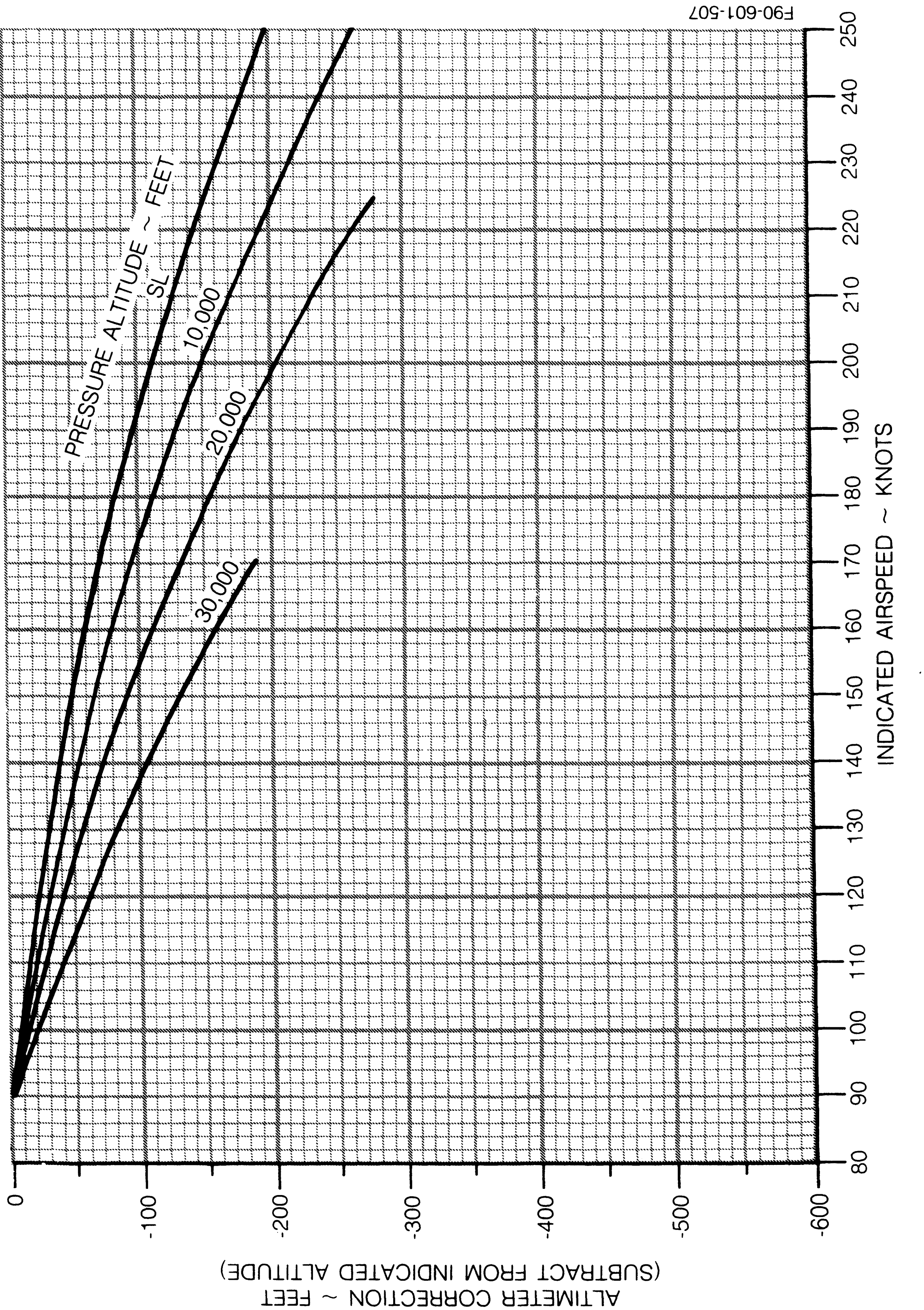



# AIRSPEED CALIBRATION - ALTERNATE SYSTEM



# ALTIMETER CORRECTION - ALTERNATE SYSTEM

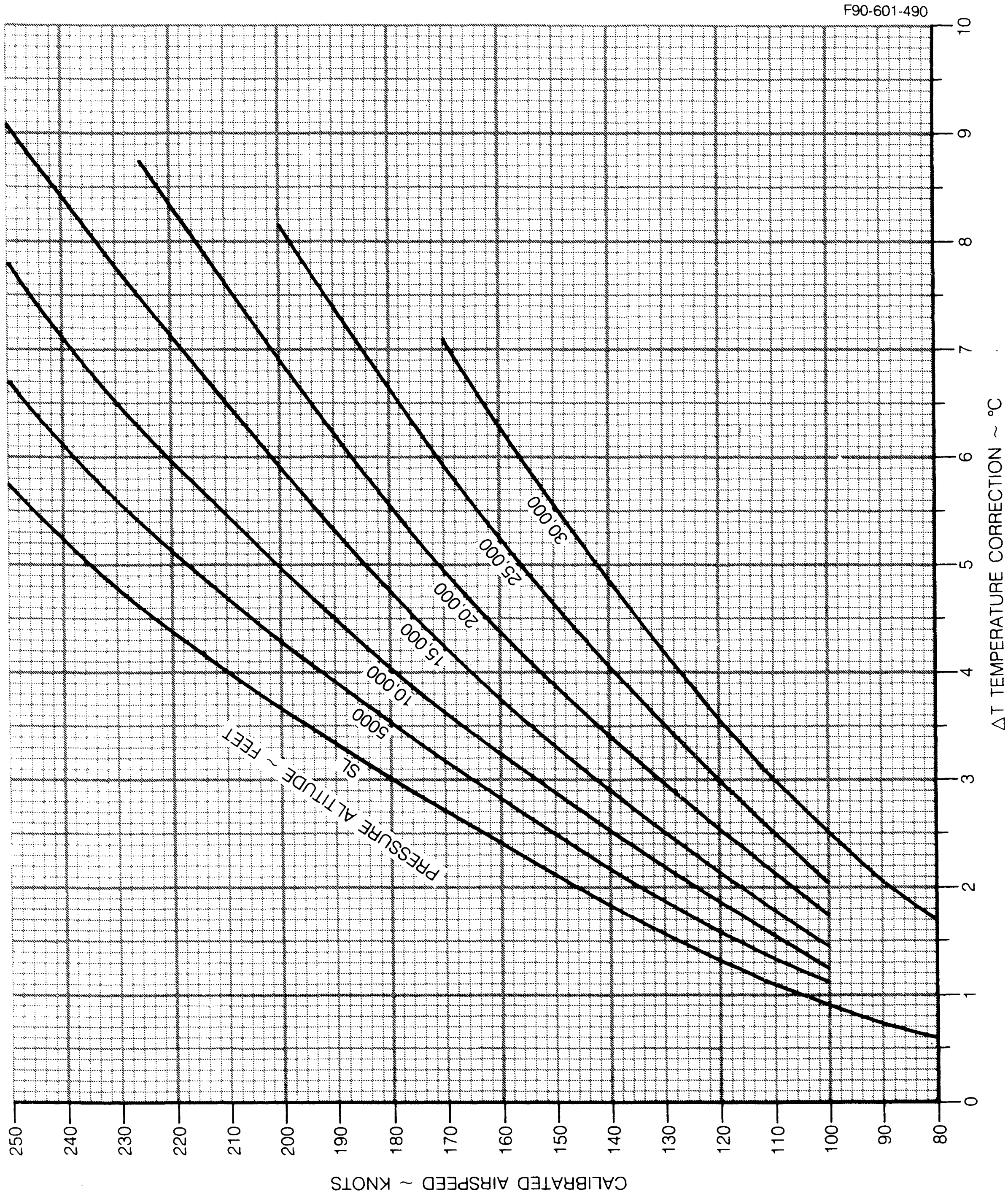
## APPLICABLE FOR ALL FLAP POSITIONS



# INDICATED OUTSIDE AIR TEMPERATURE CORRECTION

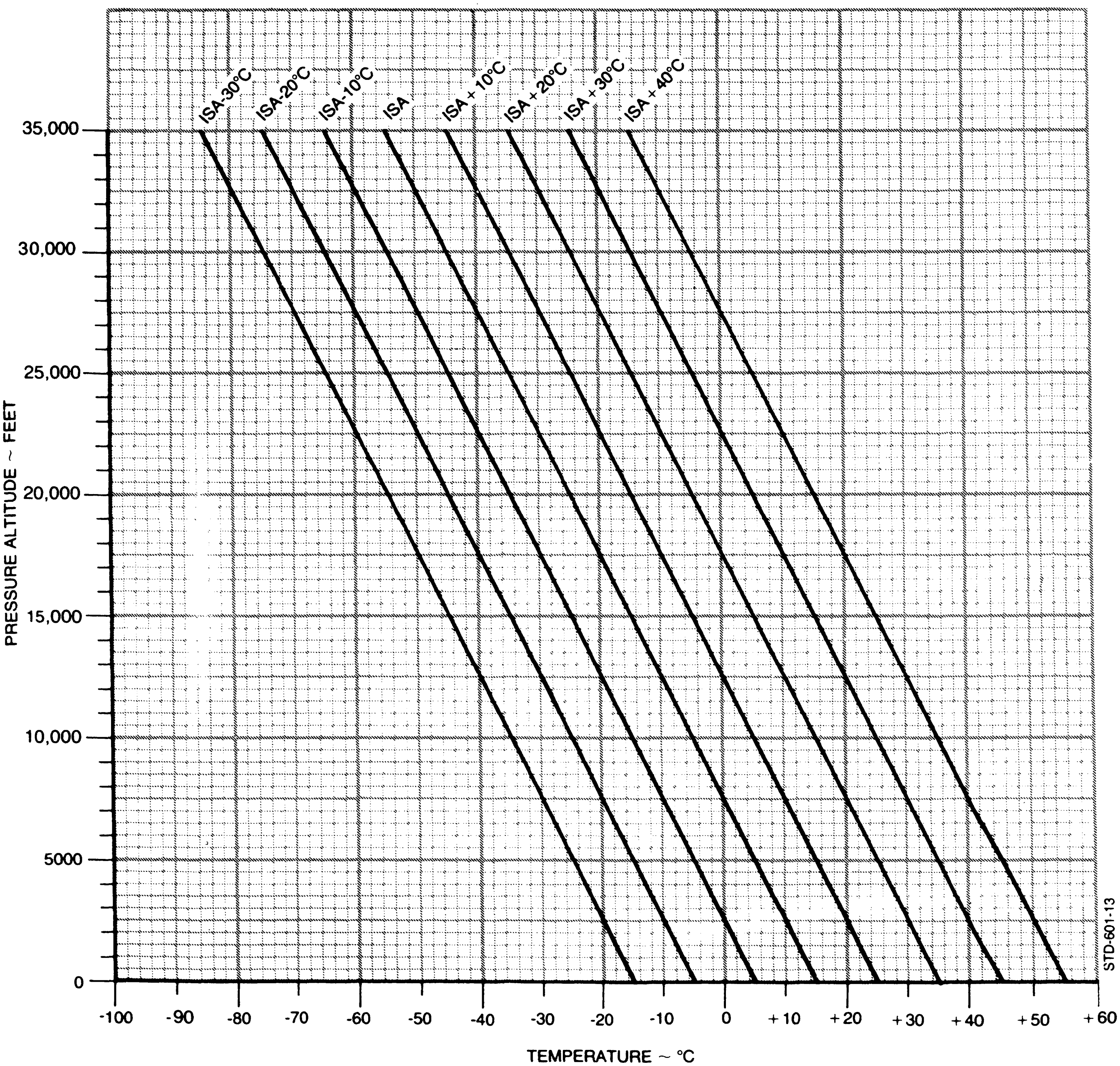
## STANDARD DAY (ISA)

NOTE: SUBTRACT ΔT FROM INDICATED (GAGE) OAT TO OBTAIN TRUE OAT. (ΔT ASSUMES A RECOVERY FACTOR OF 0.7)

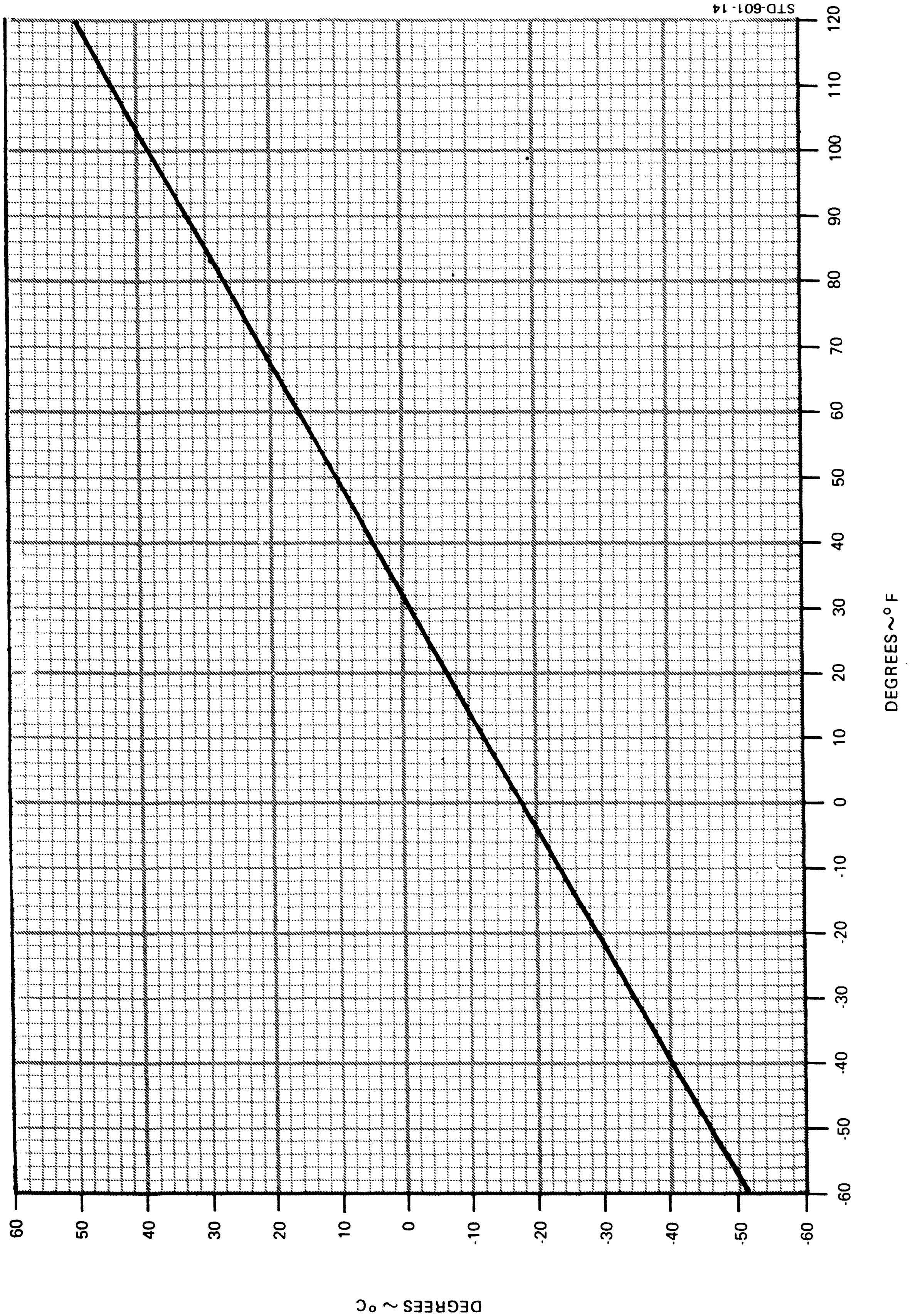


# ISA CONVERSION

PRESSURE ALTITUDE vs OUTSIDE AIR TEMPERATURE



# FAHRENHEIT TO CELSIUS TEMPERATURE CONVERSION

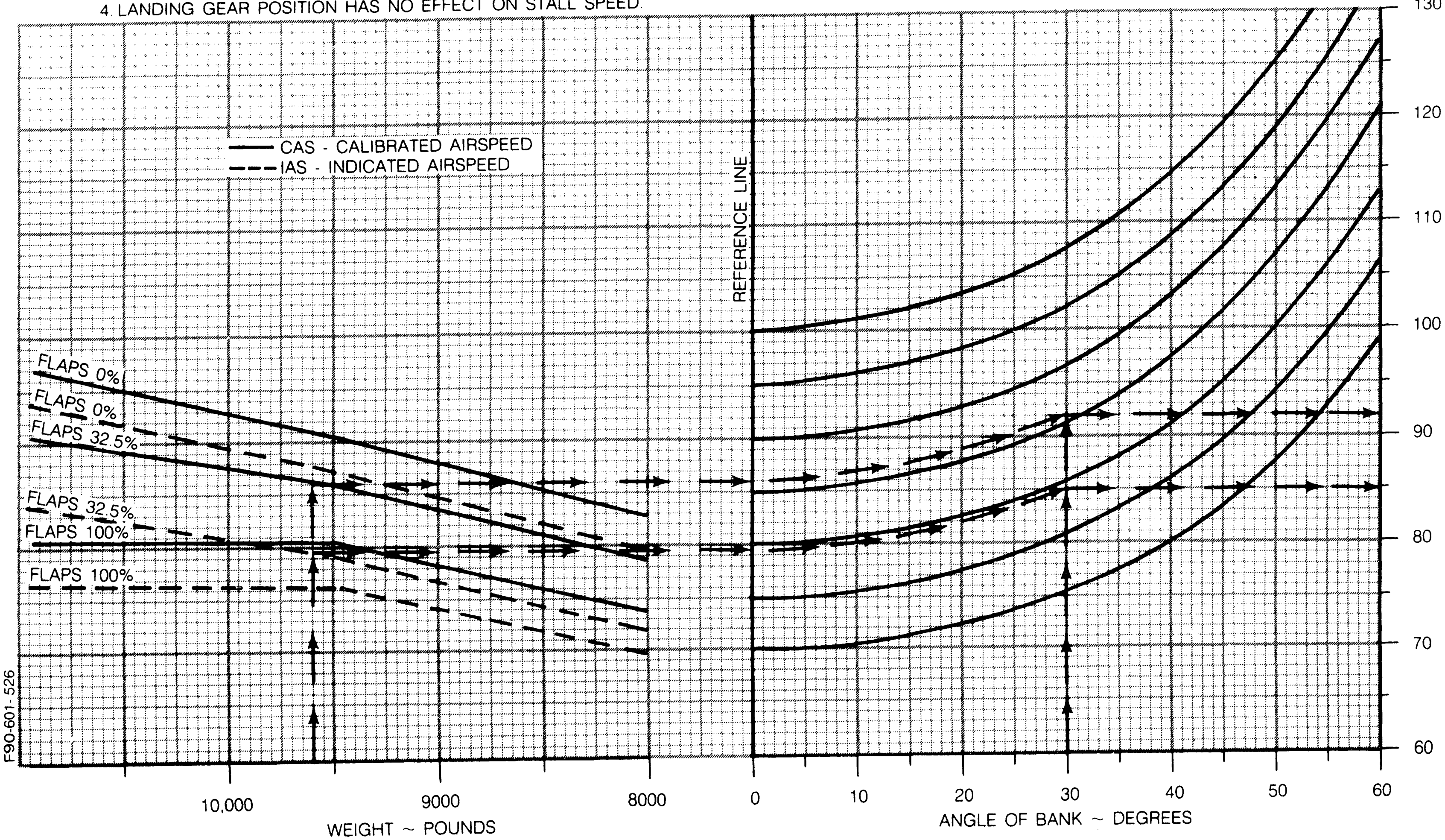


# STALL SPEEDS - POWER IDLE

NOTES:
1. ALTITUDE LOSS EXPERIENCED WHILE CONDUCTING STALLS IN ACCORDANCE WITH FAR 23.201 WAS 350 FEET.
2. MAXIMUM NOSE DOWN PITCH ATTITUDE AND ALTITUDE LOSS DURING RECOVERY FROM ONE-ENGINE-INOPERATIVE STALLS PER FAR 23.205 ARE APPROXIMATELY 8° AND 300 FEET RESPECTIVELY.
3. A NORMAL STALL RECOVERY TECHNIQUE MAY BE USED. THE BEST PROCEDURE IS A BRISK FORWARD WHEEL MOVEMENT TO A NOSE DOWN ATTITUDE. LEVEL THE AIRPLANE AFTER AIRSPEED HAS INCREASED APPROXIMATELY 25 KNOTS ABOVE STALL.
4. LANDING GEAR POSITION HAS NO EFFECT ON STALL SPEED.

EXAMPLE:

| | |
|---|---|
| WEIGHT | 9600 LBS |
| FLAPS | 32.5% |
| ANGLE OF BANK | 30° |
| STALL SPEED | 92 KTS CAS<br>85 KTS IAS |

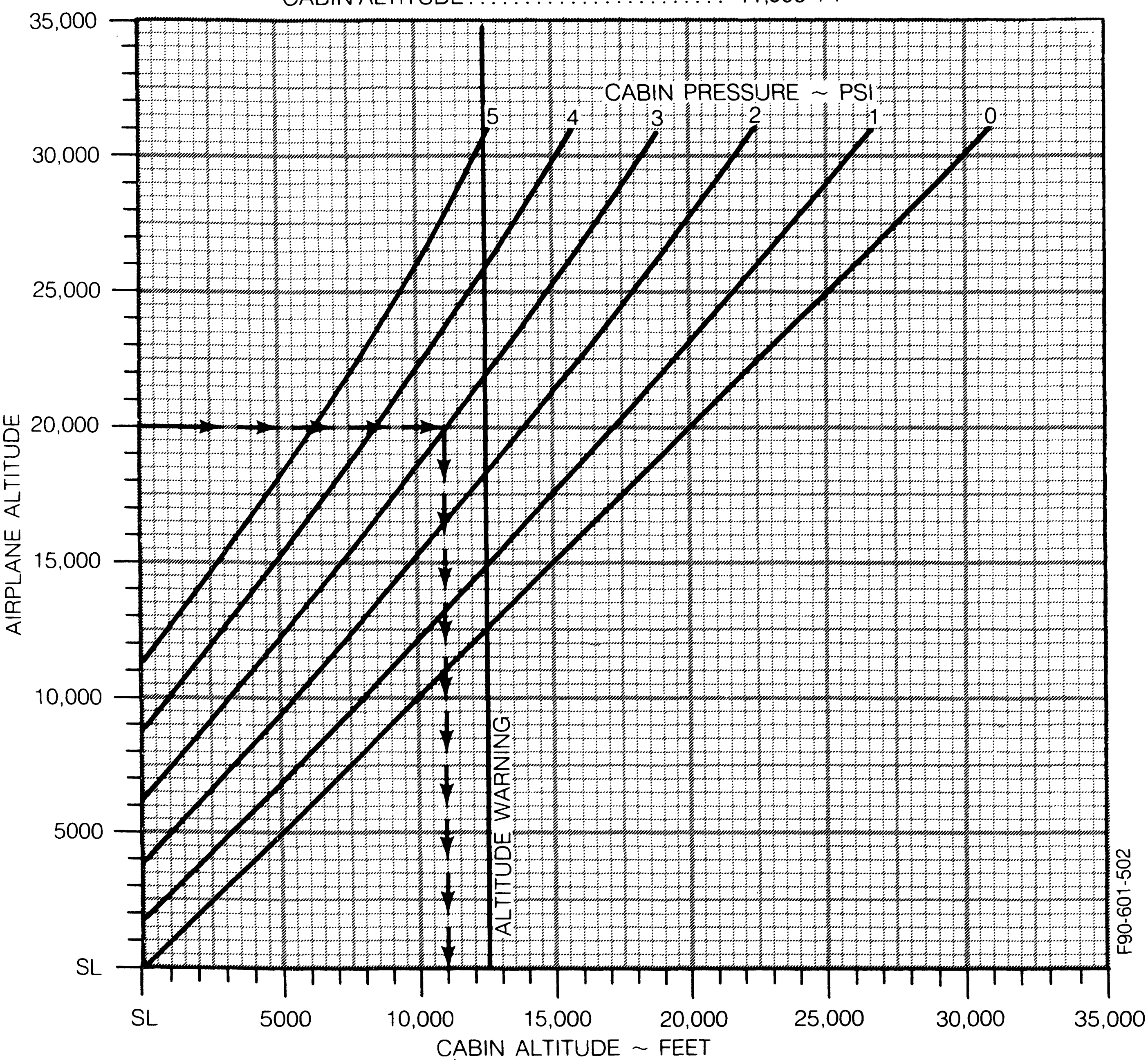


# CABIN ALTITUDE FOR VARIOUS AIRPLANE ALTITUDES

EXAMPLE:

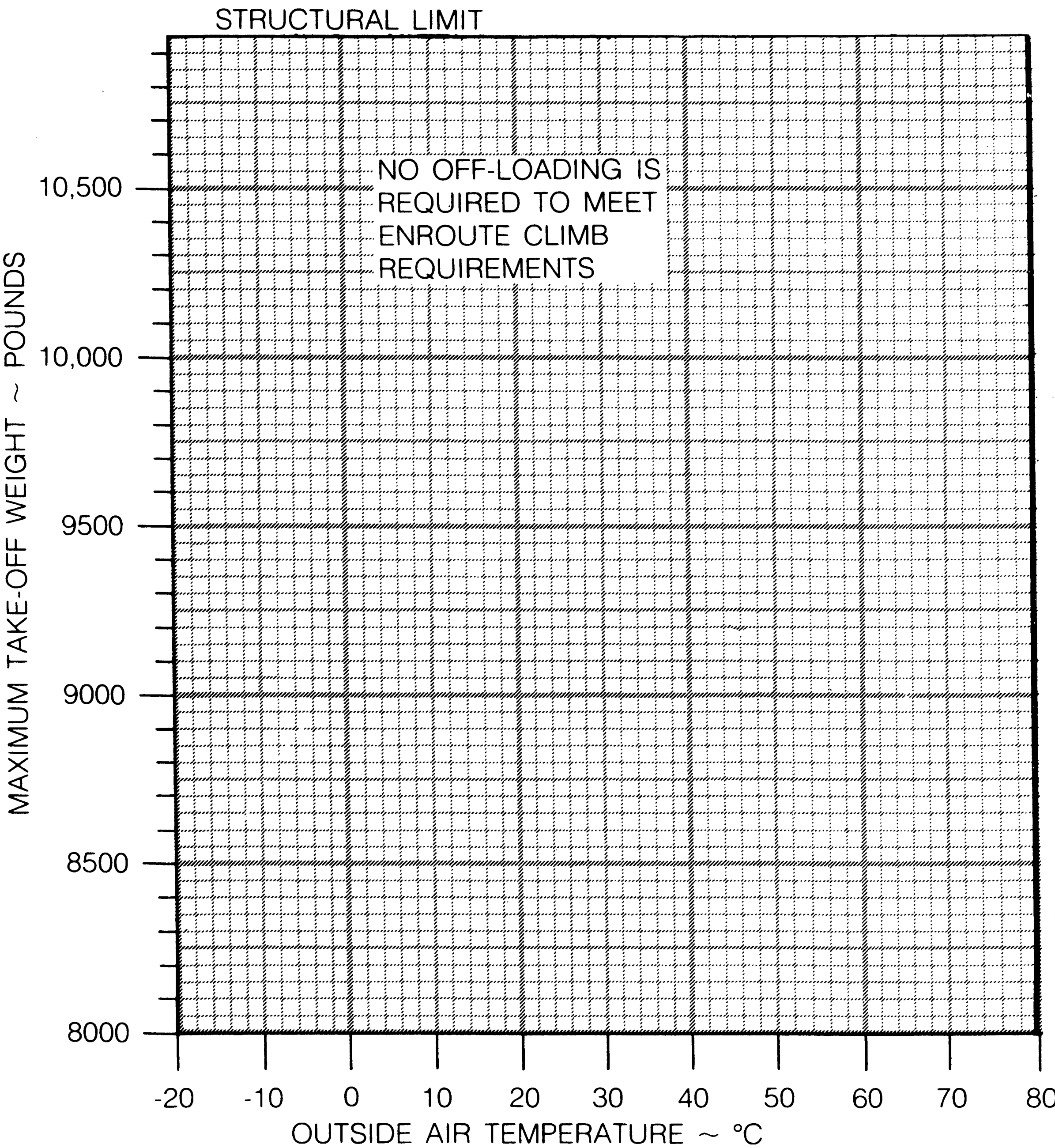
AIRPLANE ALTITUDE .................. 20,000 FT
CABIN PRESSURE ...................... 3.0 PSI

CABIN ALTITUDE ...................... 11,000 FT



# MAXIMUM TAKE-OFF WEIGHT

## PERMITTED BY ENROUTE CLIMB REQUIREMENT



# TAKE-OFF WEIGHT – FLAPS 0%

## TO ACHIEVE POSITIVE ONE-ENGINE-INOPERATIVE CLIMB AT LIFT-OFF

ASSOCIATED CONDITIONS:

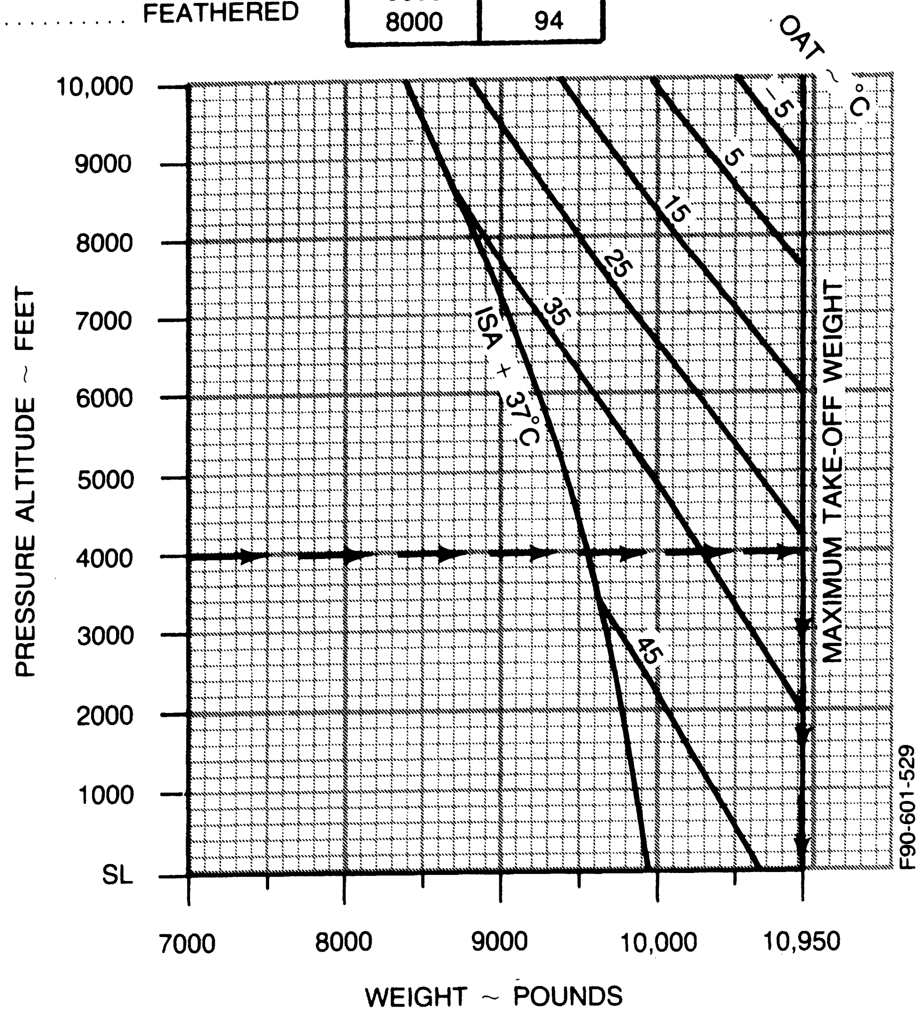
POWER .................... TAKE-OFF
GEAR ..................... DOWN
FLAPS .................... 0%
INOPERATIVE
PROPELLER ............. FEATHERED

| WEIGHT ~ LBS | SPEED ~ KTS |
|---|---|
| 10,950 | 110 |
| 10,000 | 105 |
| 9000 | 99 |
| 8000 | 94 |

EXAMPLE:

PRESSURE ALTITUDE .......... 3966 FT
OAT .......................... 25°C

TAKE-OFF WEIGHT ............ 10,950 LBS



# TAKE-OFF WEIGHT – FLAPS 32.5%

## TO ACHIEVE POSITIVE ONE-ENGINE-INOPERATIVE CLIMB AT LIFT-OFF

ASSOCIATED CONDITIONS:

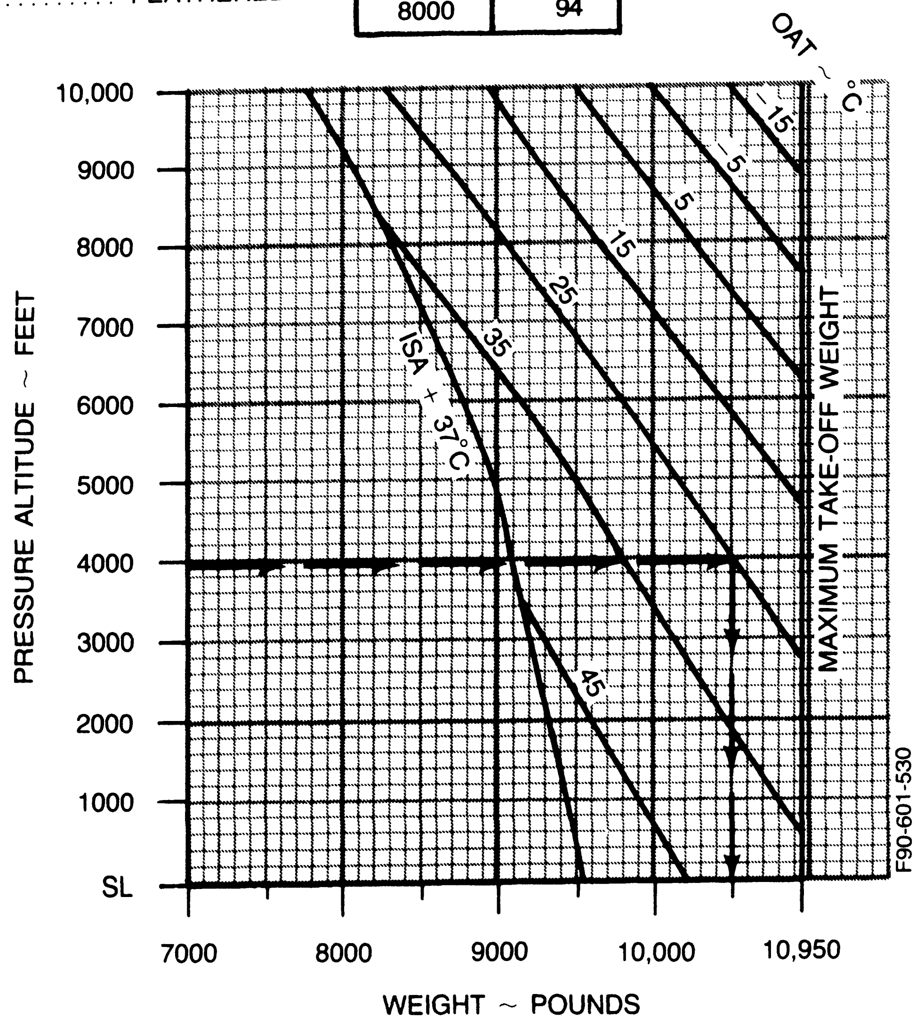
POWER .................... TAKE-OFF
GEAR ...................... DOWN
FLAPS ..................... 32.5%
INOPERATIVE
PROPELLER ............... FEATHERED

| WEIGHT ~ LBS | SPEED ~ KTS |
|---|---|
| 10,950 | 103 |
| 10,000 | 99 |
| 9000 | 94 |
| 8000 | 94 |

EXAMPLE:

PRESSURE ALTITUDE .......... 3966 FT
OAT ............................ 25°C

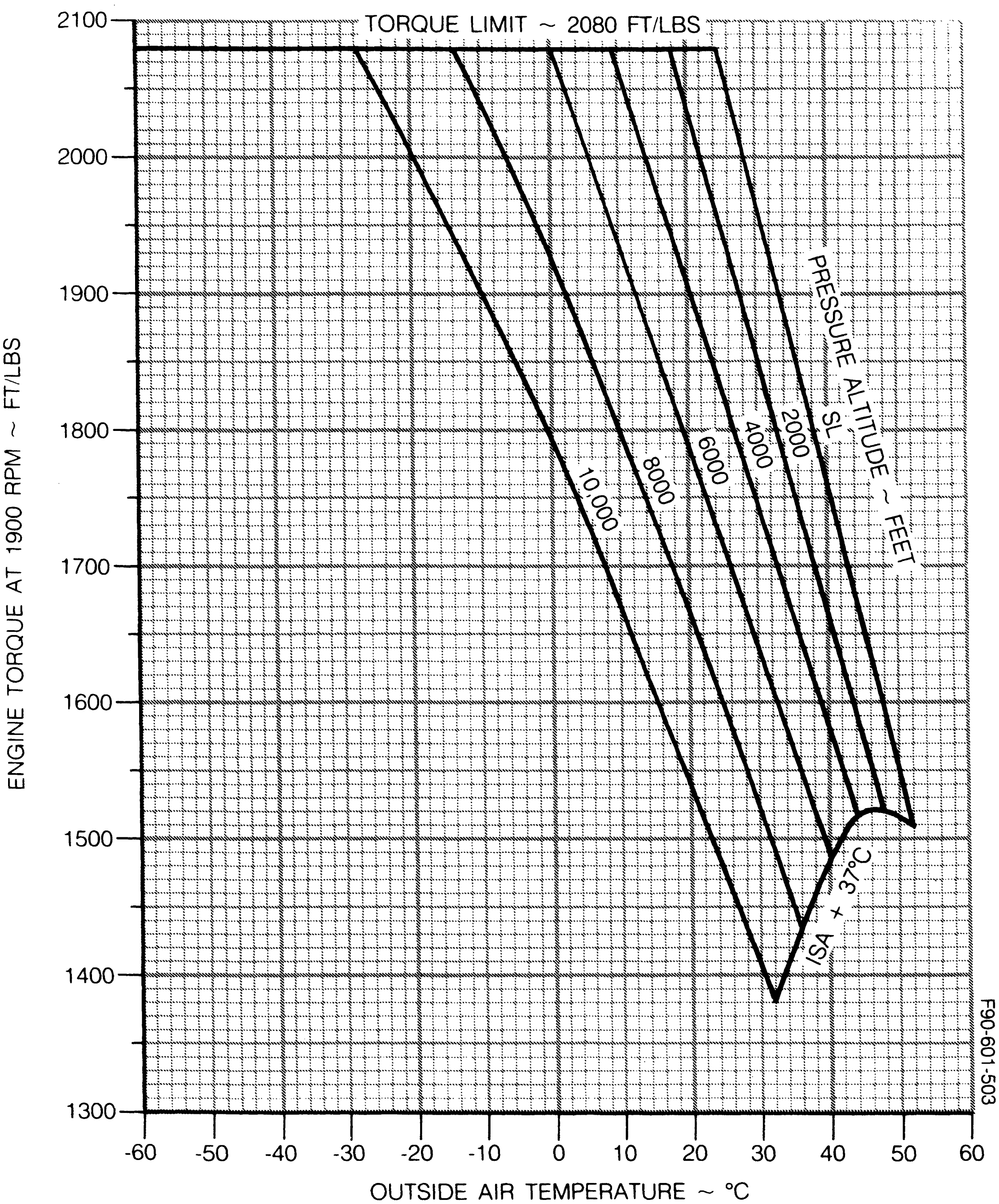
TAKE-OFF WEIGHT ............. 10,500 LBS



# MINIMUM TAKE-OFF POWER AT 1900 RPM

## (65 KNOTS)

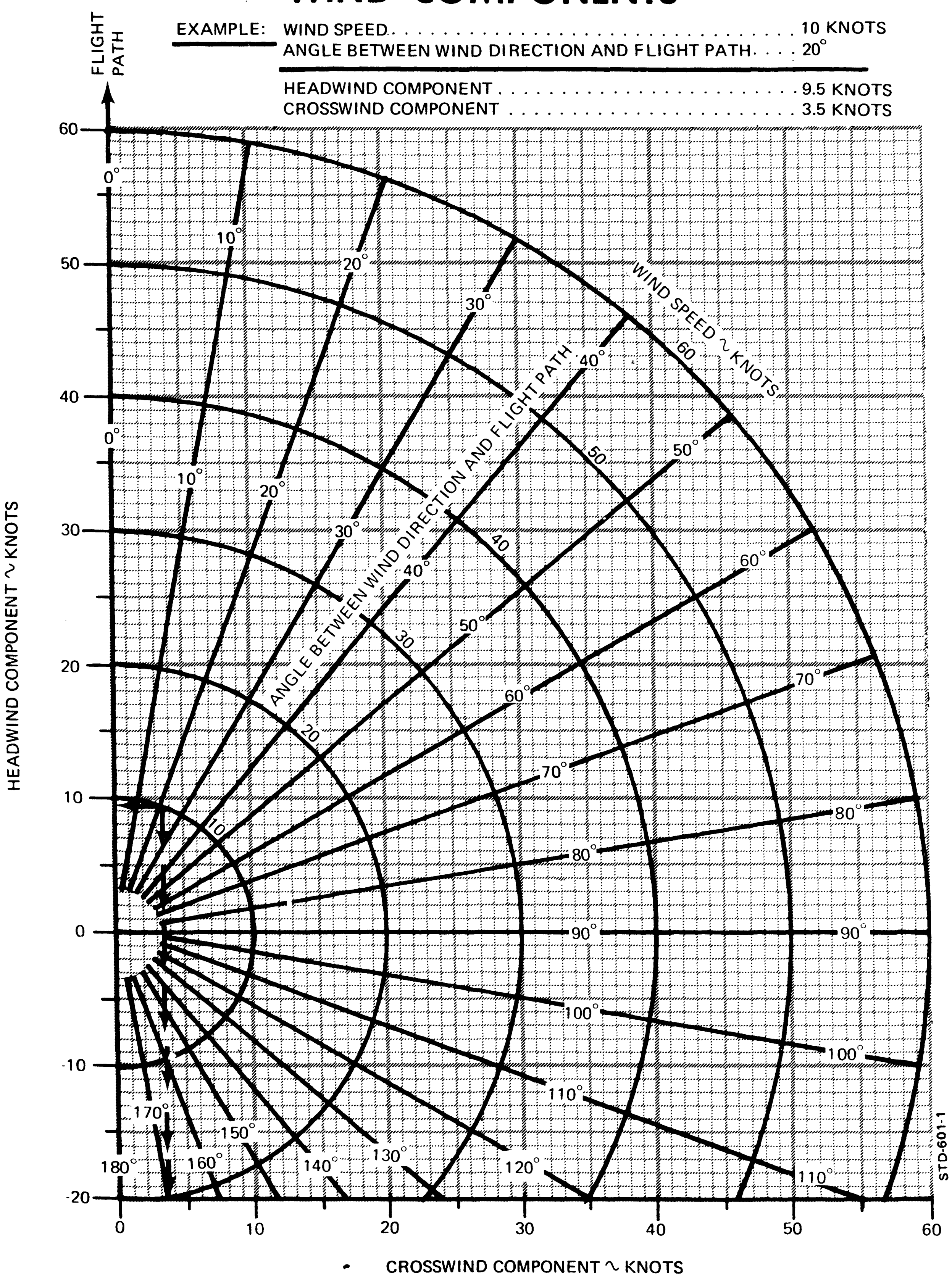
NOTES:
1. TORQUE INCREASES APPROXIMATELY 20 LBS FROM ZERO TO 65 KNOTS.
2. THE POWER (TORQUE) INDICATED IS THE MINIMUM VALUE FOR WHICH TAKE-OFF PERFORMANCE IN THIS SECTION CAN BE OBTAINED. EXCESS POWER WHICH CAN BE DEVELOPED WITHOUT EXCEEDING LIMITATIONS MAY BE UTILIZED.



# WIND COMPONENTS

EXAMPLE:

| | |
|---|---|
| WIND SPEED | 10 KNOTS |
| ANGLE BETWEEN WIND DIRECTION AND FLIGHT PATH | 20° |
| HEADWIND COMPONENT | 9.5 KNOTS |
| CROSSWIND COMPONENT | 3.5 KNOTS |



# TAKE-OFF DISTANCE - FLAPS 0%

ASSOCIATED CONDITIONS:

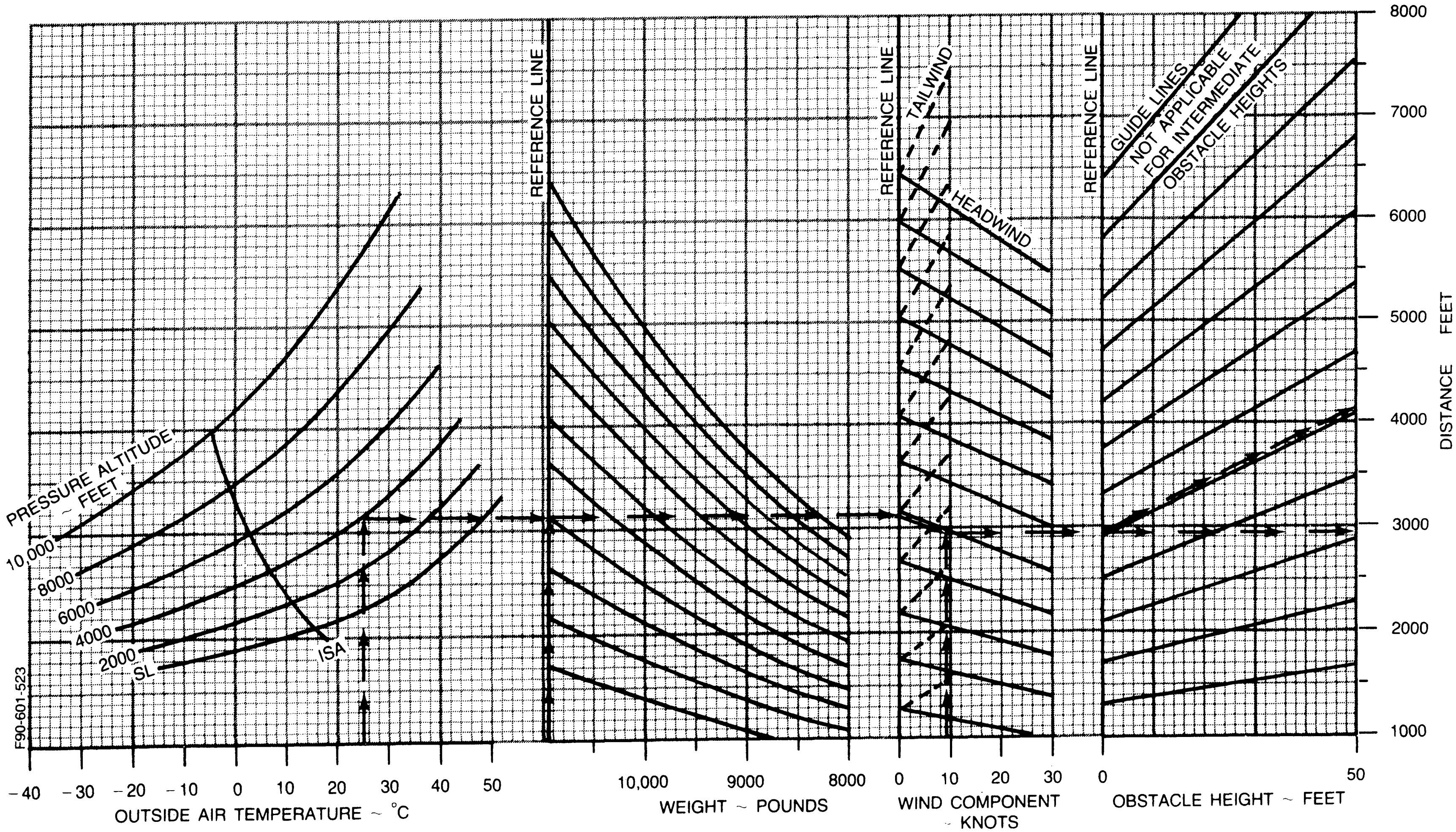
POWER .................... TAKE-OFF POWER SET BEFORE BRAKE RELEASE
FLAPS ..................... 0%
LANDING GEAR............ RETRACT AFTER LIFT-OFF
RUNWAY.................. PAVED, LEVEL, DRY SURFACE

| WEIGHT ~ POUNDS | TAKE-OFF SPEED ~ KNOTS | |
|---|---|---|
| | ROTATION | 50 FT |
| 10,950 | 107 | 117 |
| 10,000 | 102 | 112 |
| 9000 | 96 | 106 |
| 8000 | 91 | 100 |

EXAMPLE:

OAT .......................... 25°C
PRESSURE ALTITUDE ......... 3966 FT
TAKE-OFF WEIGHT ............ 10,950 LBS
HEADWIND COMPONENT ...... 9.5 KTS

GROUND ROLL ................ 2930 FT
TOTAL DISTANCE OVER 50-FT OBSTACLE ............ 4120 FT
TAKE-OFF SPEED
AT ROTATION ............. 107 KTS
AT 50 FEET ................ 117 KTS



# ACCELERATE – STOP – FLAPS 0%

ASSOCIATED CONDITIONS:

POWER .................... 1. TAKE-OFF POWER SET BEFORE BRAKE RELEASE
2. BOTH ENGINES IDLE AT $V_1$ SPEED AND REVERSE OPERATING ENGINE

FLAPS .................... 0%

AUTOFEATHER ............ ARMED

BRAKING .................. MAXIMUM

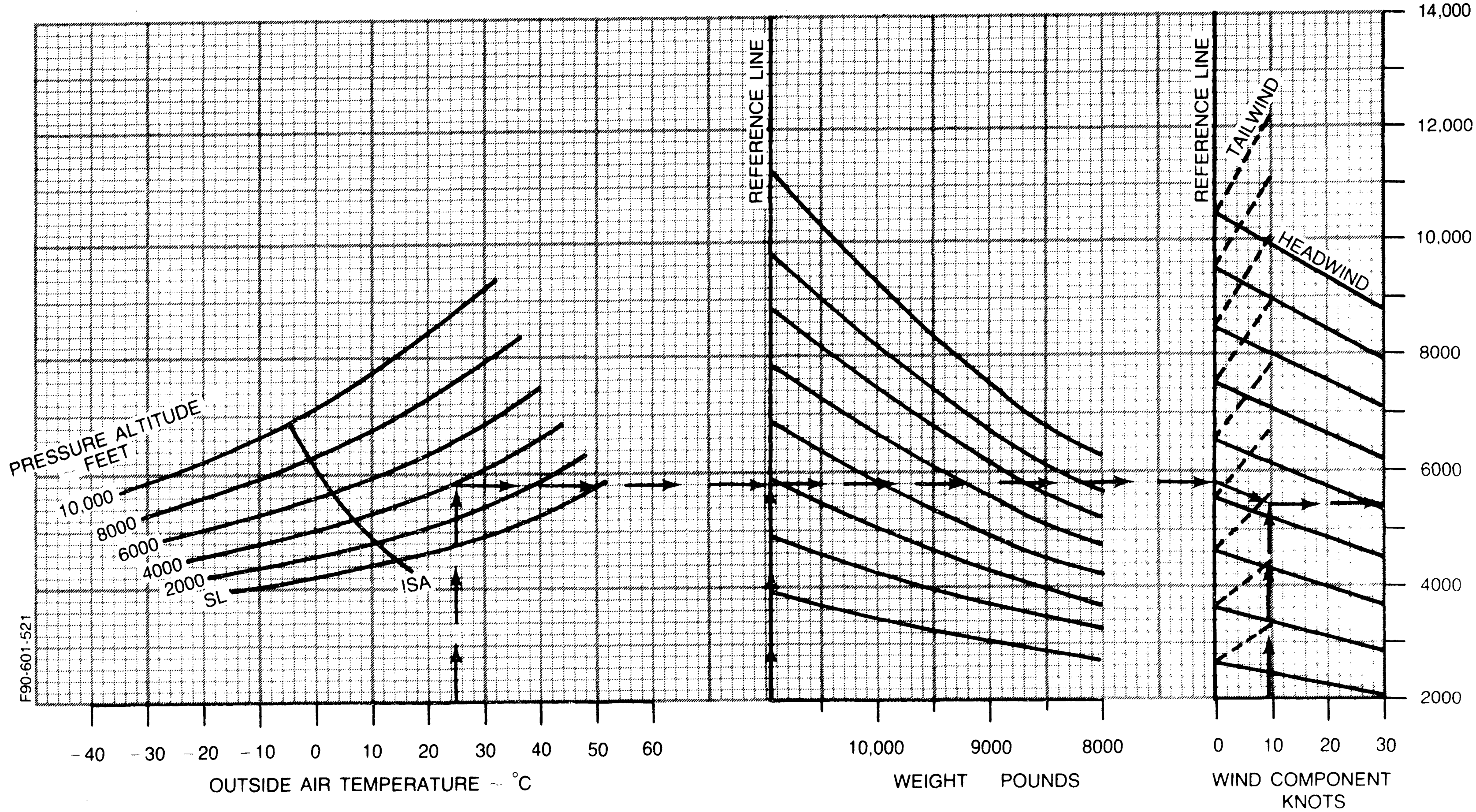
RUNWAY .................. PAVED, LEVEL, DRY SURFACE

| WEIGHT ~ POUNDS | $V_1$ ~ KNOTS |
|---|---|
| 10,950 | 107 |
| 10,000 | 102 |
| 9000 | 96 |
| 8000 | 91 |

EXAMPLE:

OAT .......................... 25°C
PRESSURE ALTITUDE .......... 3966 FT
WEIGHT ....................... 10,950 LBS
HEADWIND COMPONENT ....... 9.5 KTS

FIELD LENGTH ................ 5420 FT
$V_1$ SPEED ..................... 107 KTS



# ACCELERATE - GO DISTANCE OVER 35-FT OBSTACLE

## FLAPS 0%

ASSOCIATED CONDITIONS:

POWER .................... TAKE-OFF POWER SET BEFORE BRAKE RELEASE
FLAPS ..................... 0%
AUTOFEATHER ............ ARMED
LANDING GEAR ............ RETRACT AFTER LIFT-OFF
RUNWAY .................. PAVED, LEVEL, DRY SURFACE

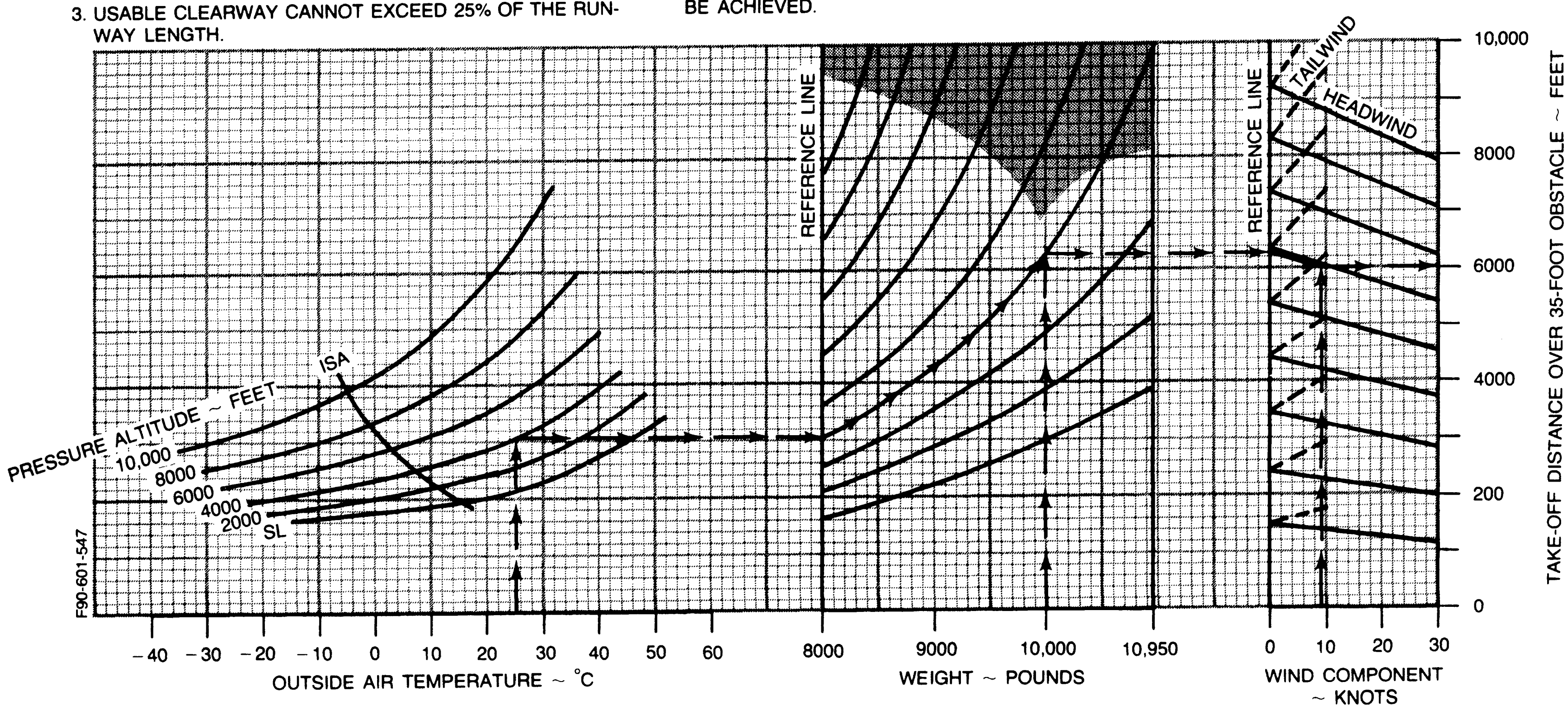
| WEIGHT ~ LBS | SPEED ~ KNOTS | |
|---|---|---|
| | $V_R$ | $V_2$ |
| 10,950 | 107 | 117 |
| 10,000 | 102 | 112 |
| 9000 | 96 | 106 |
| 8000 | 91 | 100 |

EXAMPLE:

OAT .......................... 25°C
PRESSURE ALTITUDE .......... 3966 FT
TAKE-OFF WEIGHT ............ 10,000 LBS
HEADWIND COMPONENT ...... 9.5 KTS

TAKE-OFF DISTANCE OVER 35-FOOT OBSTACLE ......... 6000 FT
SPEEDS: AT ROTATION ........ 102 KTS
AT 35 FEET ........... 112 KTS

NOTES:
1. AIR DISTANCE IS 50% OF TAKE-OFF DISTANCE OVER 35-FT OBSTACLE.
2. DISTANCES ASSUME AN ENGINE FAILURE AT ROTATION SPEED AND PROPELLER IMMEDIATELY FEATHERED.
3. USABLE CLEARWAY CANNOT EXCEED 25% OF THE RUNWAY LENGTH.
4. WEIGHTS IN SHADED AREA MAY NOT PROVIDE POSITIVE ONE-ENGINE-INOPERATIVE CLIMB. REFER TO TAKE-OFF WEIGHT GRAPH FOR MAXIMUM WEIGHT AT WHICH POSITIVE ONE-ENGINE-INOPERATIVE CLIMB AT LIFT-OFF CAN BE ACHIEVED.



# TAKE-OFF CLIMB GRADIENT – ONE-ENGINE-INOPERATIVE
## FLAPS 0%
### ZERO WIND

ASSOCIATED CONDITIONS:

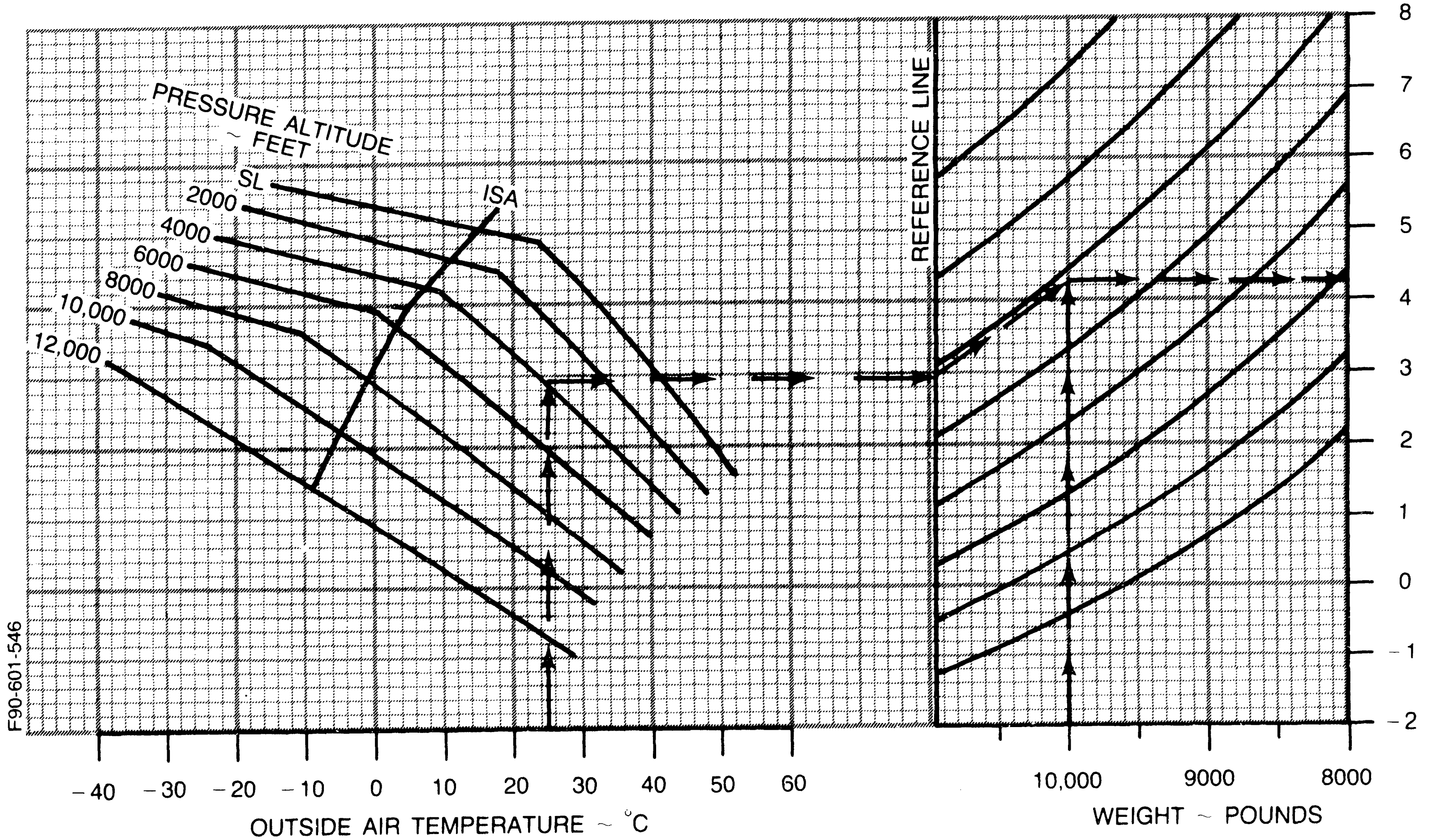
POWER .......... TAKE-OFF
FLAPS .......... 0%
LANDING GEAR .......... UP
INOPERATIVE PROPELLER .......... FEATHERED

| WEIGHT ~ LBS | CLIMB SPEED ~ KNOTS |
|---|---|
| 10,950 | 117 |
| 10,000 | 112 |
| 9000 | 106 |
| 8000 | 100 |

EXAMPLE:

OAT .......... 25°C
PRESSURE ALTITUDE .......... 3966 FT
WEIGHT .......... 10,000 LBS

CLIMB GRADIENT .......... 4.2%
SPEED .......... 112 KTS



# TAKE-OFF DISTANCE – FLAPS 0%
## GRASS SURFACE

ASSOCIATED CONDITIONS:

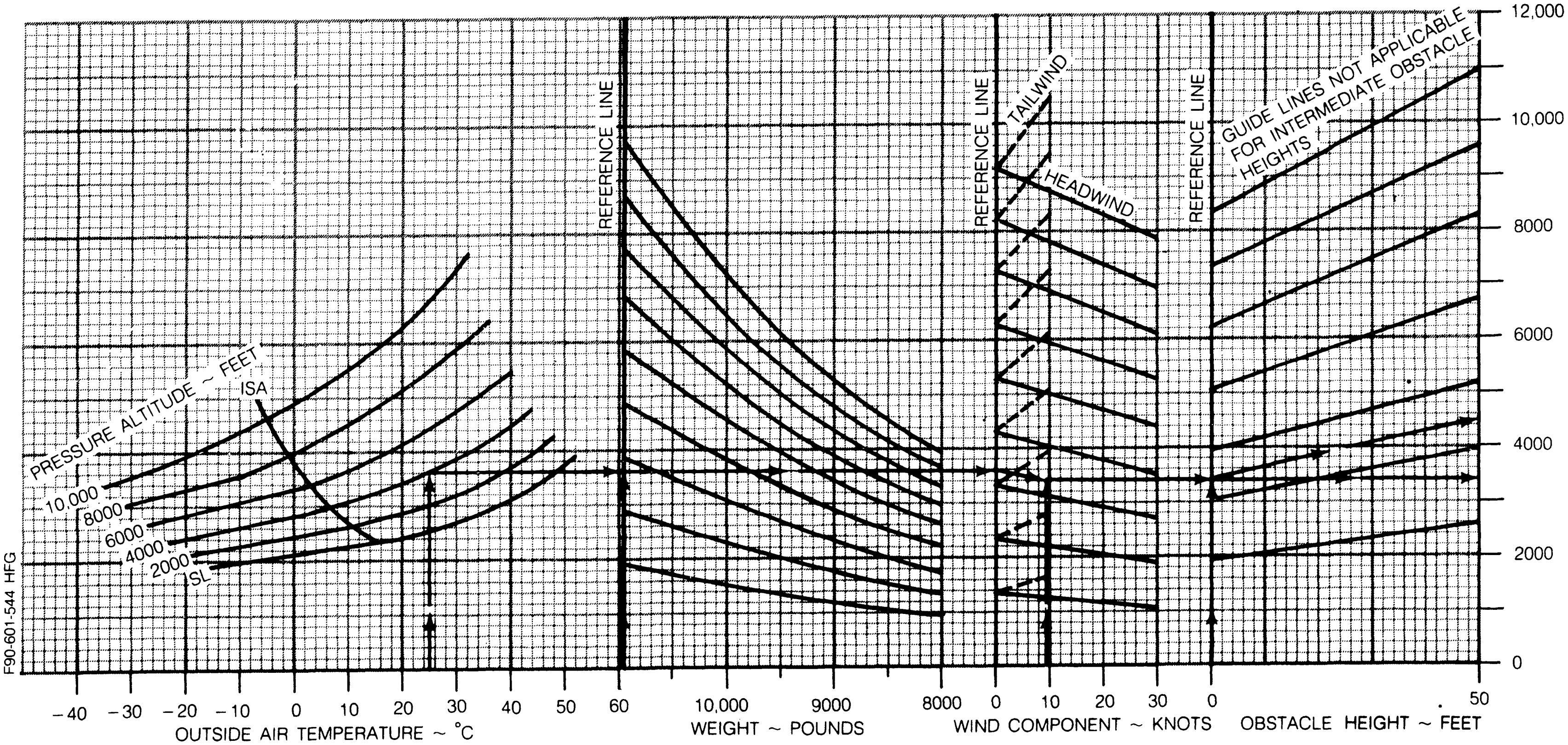
POWER .................. TAKE-OFF POWER SET BEFORE BRAKE RELEASE
FLAPS..................... 0%
LANDING GEAR............ RETRACT AFTER LIFT-OFF
RUNWAY .................. SHORT, DRY, GRASS WITH FIRM SUBSOIL

| WEIGHT ~ POUNDS | TAKE-OFF SPEED ~ KNOTS | |
|---|---|---|
| | ROTATION | 50 FT |
| 10,950 | 107 | 117 |
| 10,000 | 102 | 112 |
| 9000 | 96 | 106 |
| 8000 | 91 | 100 |

EXAMPLE:

OAT................................ 25°C
PRESSURE ALTITUDE................ 3966 FT
TAKE-OFF WEIGHT .................. 10,950 LBS
HEADWIND COMPONENT............ 9.5 KNOTS

GROUND ROLL ..................... 3400 FT
TOTAL DISTANCE OVER 50-FT OBSTACLE.................. 4500 FT



INTENTIONALLY LEFT BLANK

# TAKE-OFF DISTANCE - FLAPS 32.5%

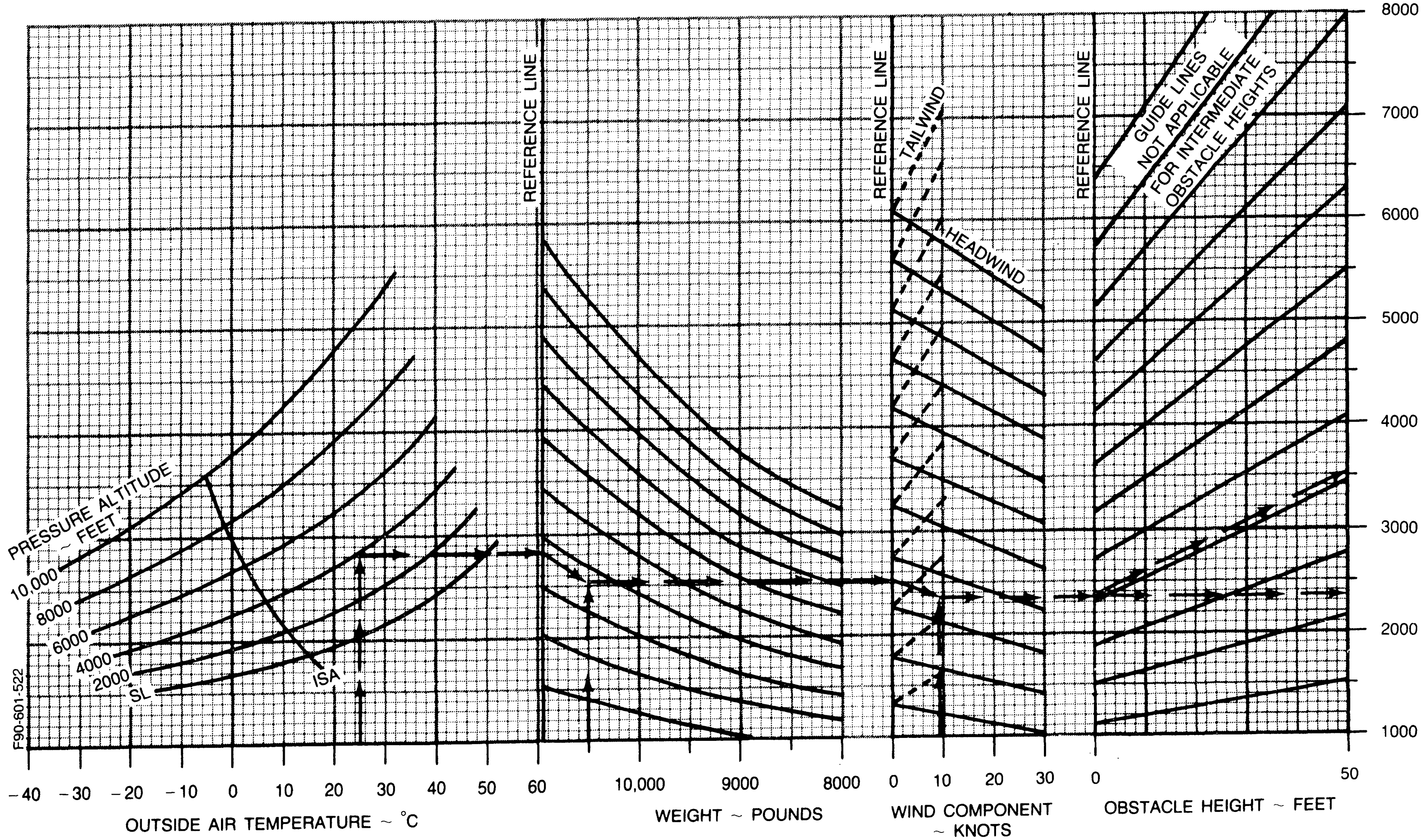
ASSOCIATED CONDITIONS:

| | |
|---|---|
| POWER | TAKE-OFF POWER SET BEFORE BRAKE RELEASE |
| FLAPS | 32.5% |
| LANDING GEAR | RETRACT AFTER LIFT-OFF |
| RUNWAY | PAVED, LEVEL, DRY SURFACE |

| WEIGHT ~ POUNDS | TAKE-OFF SPEED ~ KNOTS | |
|---|---|---|
| | ROTATION | 50 FT |
| 10,950 | 100 | 109 |
| 10,000 | 95 | 105 |
| 9000 | 91 | 100 |
| 8000 | 91 | 100 |

EXAMPLE:

| | |
|---|---|
| OAT | 25°C |
| PRESSURE ALTITUDE | 3966 FT |
| TAKE-OFF WEIGHT | 10,500 LBS |
| HEADWIND COMPONENT | 9.5 KTS |
| GROUND ROLL | 2360 FT |
| TOTAL DISTANCE OVER 50-FT OBSTACLE | 3520 FT |
| TAKE-OFF SPEED AT ROTATION | 98 KTS |
| AT 50 FEET | 107 KTS |



# ACCELERATE – STOP – FLAPS 32.5%

ASSOCIATED CONDITIONS:

POWER .................. 1. TAKE-OFF POWER SET BEFORE BRAKE RELEASE
2. BOTH ENGINES IDLE AT $V_1$ SPEED AND REVERSE OPERATING ENGINE

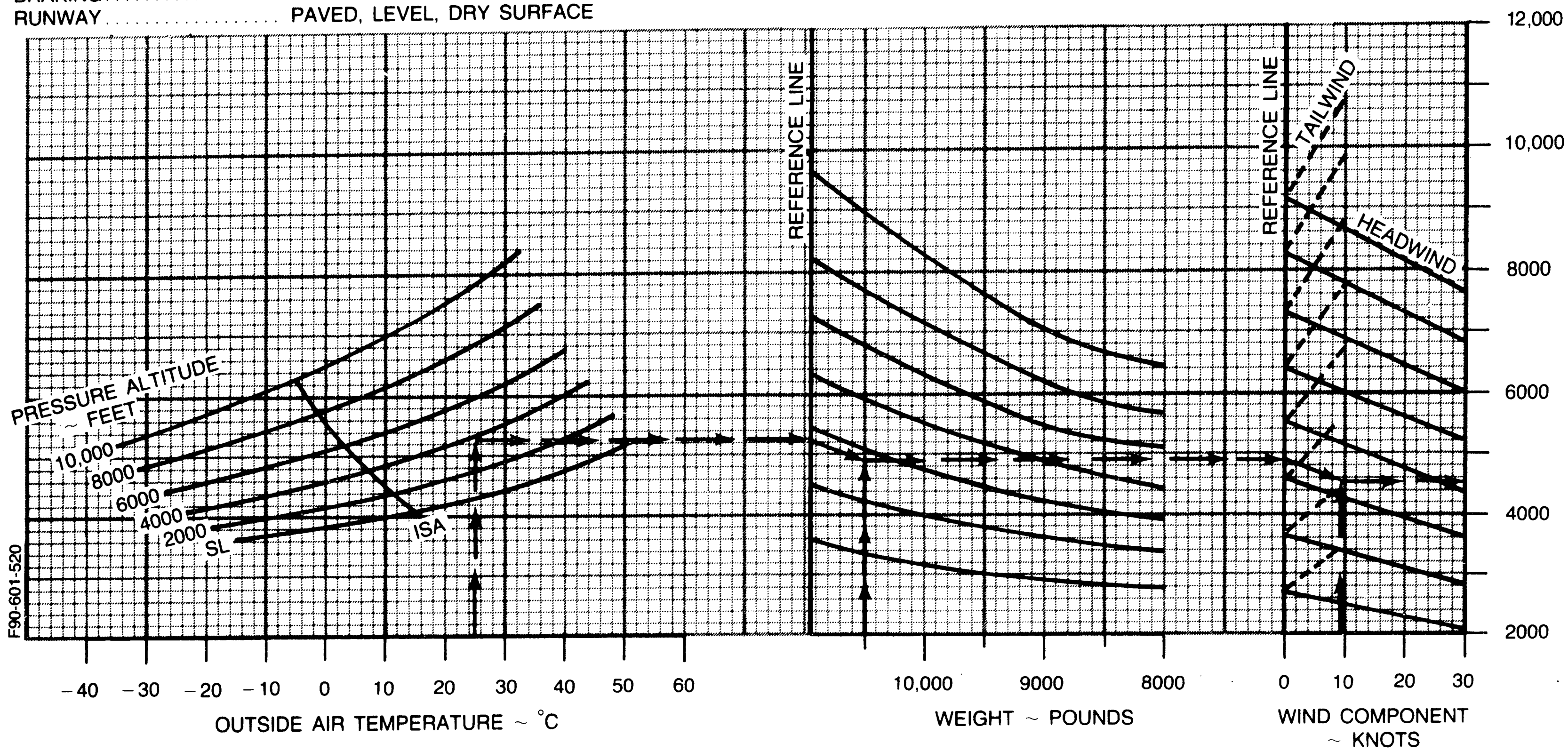
FLAPS .................... 32.5%
AUTOFEATHER ............ ARMED
BRAKING .................. MAXIMUM
RUNWAY .................. PAVED, LEVEL, DRY SURFACE

| WEIGHT ~ POUNDS | $V_1$ ~ KNOTS |
|---|---|
| 10,950 | 100 |
| 10,000 | 95 |
| 9000 | 91 |
| 8000 | 91 |

EXAMPLE:

OAT .......................... 25°C
PRESSURE ALTITUDE .......... 3966 FT
WEIGHT ....................... 10,500 LBS
HEADWIND COMPONENT ...... 9.5 KTS

FIELD LENGTH ................ 4550 FT
$V_1$ SPEED .................... 98 KTS



# ACCELERATE-GO DISTANCE OVER 35-FT OBSTACLE

## FLAPS 32.5%

ASSOCIATED CONDITIONS:

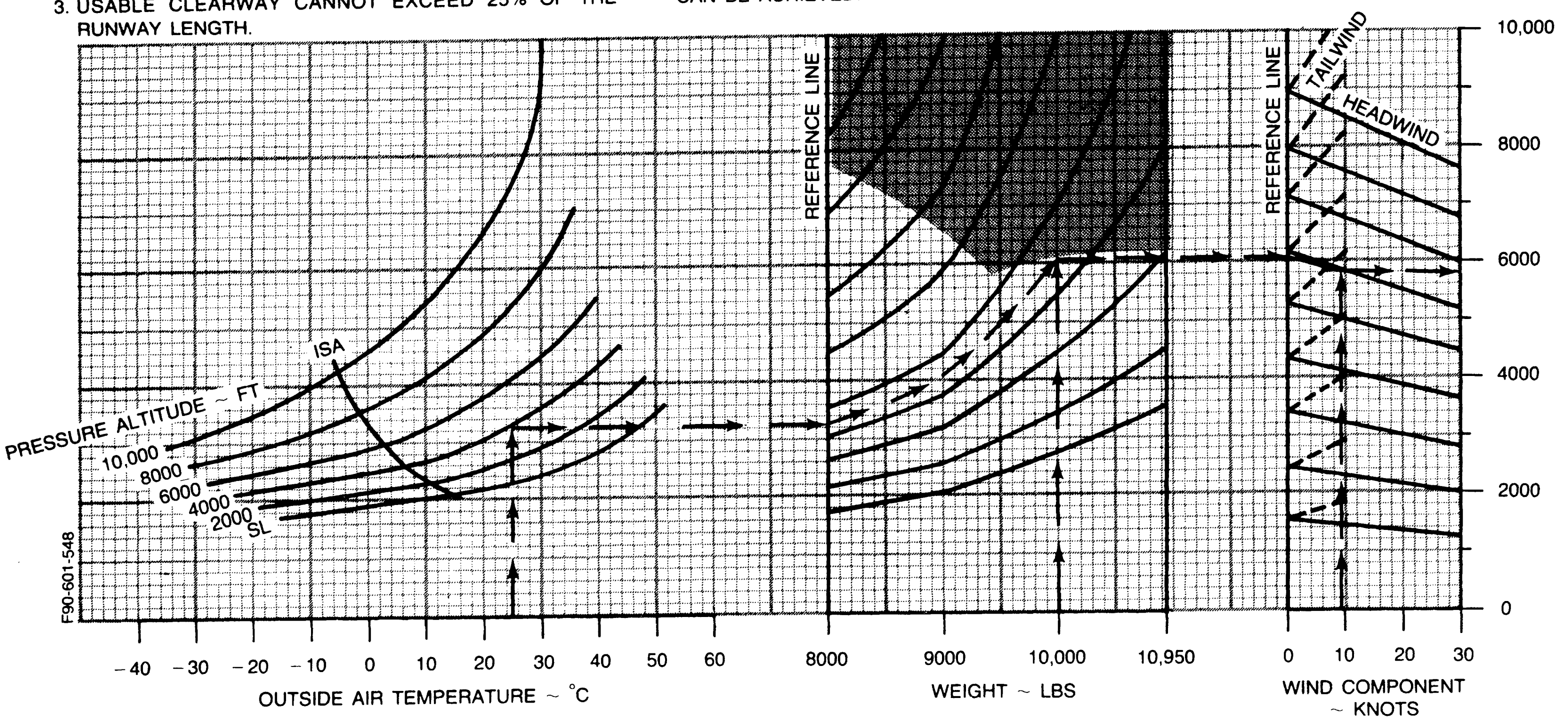
| | |
|---|---|
| POWER | TAKE-OFF POWER SET BEFORE BRAKE RELEASE |
| FLAPS | 32.5% |
| AUTOFEATHER | ARMED |
| LANDING GEAR | RETRACT AFTER LIFT-OFF |
| RUNWAY | PAVED, LEVEL, DRY SURFACE |

| WEIGHT ~ LBS | SPEED ~ KNOTS | |
|---|---|---|
| | $V_R$ | $V_2$ |
| 10,950 | 100 | 109 |
| 10,000 | 95 | 105 |
| 9000 | 91 | 100 |
| 8000 | 91 | 100 |

EXAMPLE:

| | |
|---|---|
| OAT | 25°C |
| PRESSURE ALTITUDE | 3966 FT |
| TAKE-OFF WEIGHT | 10,000 LBS |
| HEADWIND COMPONENT | 9.5 KTS |
| TAKE-OFF DISTANCE OVER 35-FOOT OBSTACLE | 5780 FT |
| SPEEDS: AT ROTATION | 95 KTS |
| AT 35 FEET | 105 KTS |

NOTES:
1. AIR DISTANCE IS 50% OF TAKE-OFF DISTANCE OVER 35-FT OBSTACLE.
2. DISTANCES ASSUME AN ENGINE FAILURE AT ROTATION SPEED AND PROPELLER IMMEDIATELY FEATHERED.
3. USABLE CLEARWAY CANNOT EXCEED 25% OF THE RUNWAY LENGTH.
4. WEIGHTS IN SHADED AREA MAY NOT PROVIDE POSITIVE ONE-ENGINE-INOPERATIVE CLIMB. REFER TO TAKE-OFF WEIGHT GRAPH FOR MAXIMUM WEIGHT AT WHICH POSITIVE ONE-ENGINE-INOPERATIVE CLIMB AT LIFT-OFF CAN BE ACHIEVED.



# TAKE-OFF CLIMB GRADIENT – ONE-ENGINE-INOPERATIVE
# FLAPS 32.5%
## ZERO WIND

ASSOCIATED CONDITIONS:

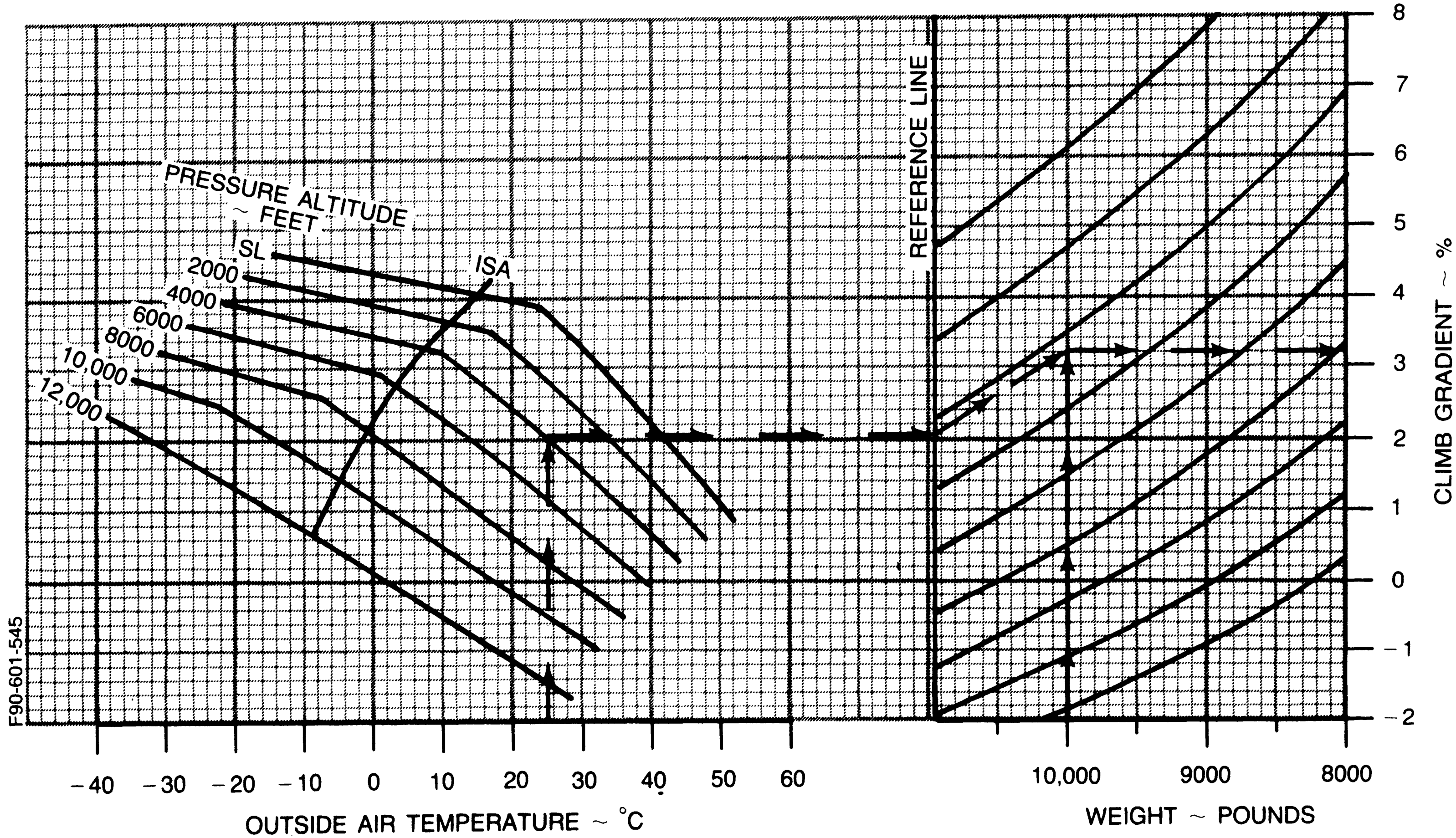
POWER .................... TAKE-OFF
FLAPS .................... 32.5%
LANDING GEAR ............ UP
INOPERATIVE
PROPELLER ............ FEATHERED

| WEIGHT ~ LBS | CLIMB SPEED ~ KNOTS |
|---|---|
| 10,950 | 109 |
| 10,000 | 105 |
| 9000 | 100 |
| 8000 | 100 |

EXAMPLE:

OAT .......................... 25°C
PRESSURE ALTITUDE .......... 3966 FT
WEIGHT ...................... 10,000 LBS

CLIMB GRADIENT .............. 3.2%
SPEED ....................... 105 KTS



# TAKE-OFF DISTANCE - FLAPS 32.5%

## GRASS SURFACE

ASSOCIATED CONDITIONS:

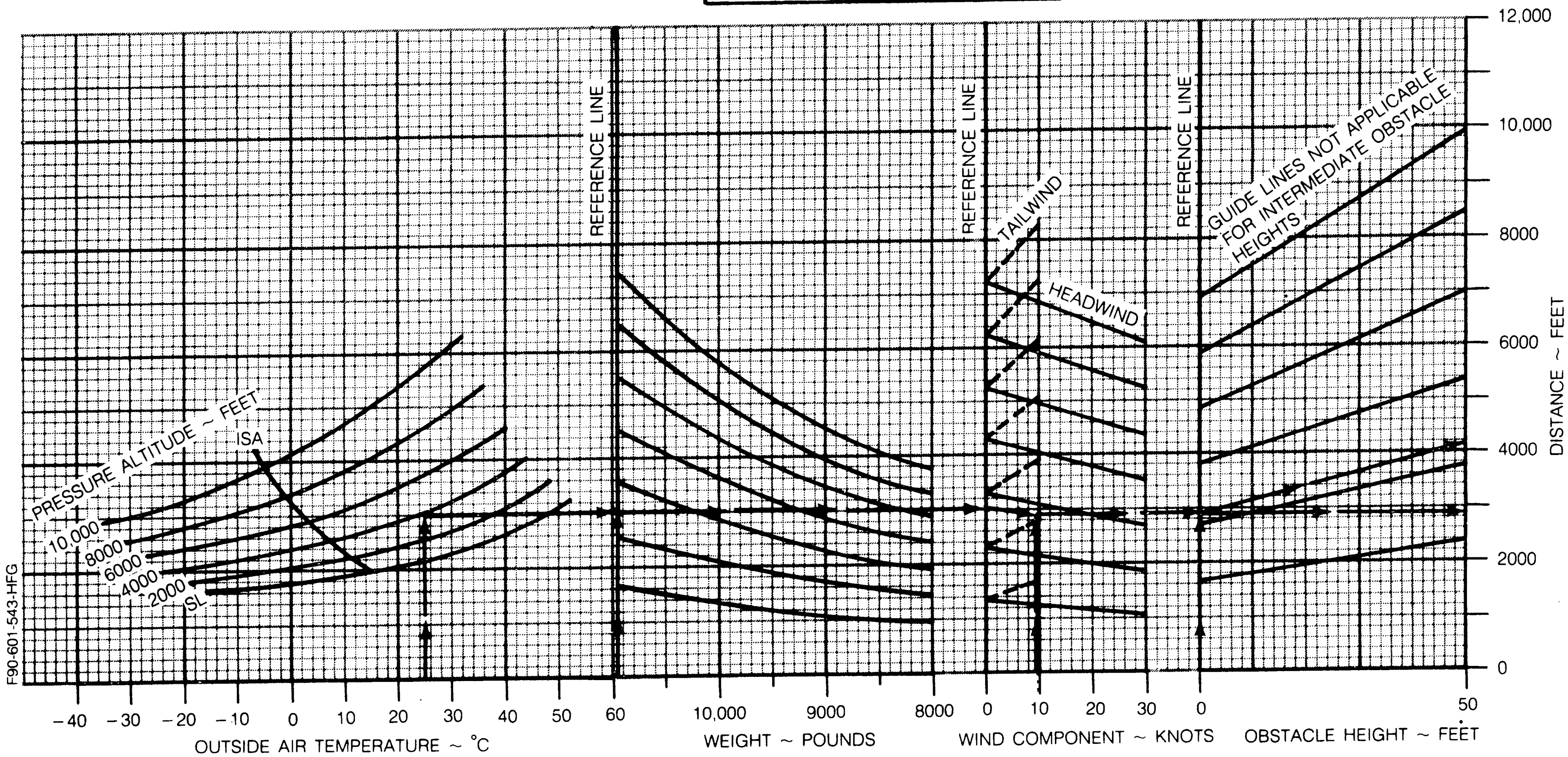
POWER .................... TAKE-OFF POWER SET BEFORE BRAKE RELEASE
FLAPS .................... 32.5%
LANDING GEAR ............ RETRACT AFTER LIFT-OFF
RUNWAY .................. SHORT, DRY, GRASS WITH FIRM SUBSOIL

| WEIGHT ~ POUNDS | TAKE-OFF SPEED ~ KNOTS | |
|---|---|---|
| | ROTATION | 50 FT |
| 10,950 | 100 | 109 |
| 10,000 | 95 | 105 |
| 9000 | 91 | 100 |
| 8000 | 91 | 100 |

EXAMPLE:

OAT .................................. 25°C
PRESSURE ALTITUDE .................. 3966 FT
TAKE-OFF WEIGHT .................... 10,950 LBS
HEADWIND COMPONENT ............... 9.5 KNOTS

GROUND ROLL ........................ 2900 FT
TOTAL DISTANCE OVER 50-FT OBSTACLE .............. 4150 FT



INTENTIONALLY LEFT BLANK

# MAXIMUM PERFORMANCE CLIMB - TWO ENGINES - FLAPS 0%

## CLIMB SPEED 117 KNOTS IAS

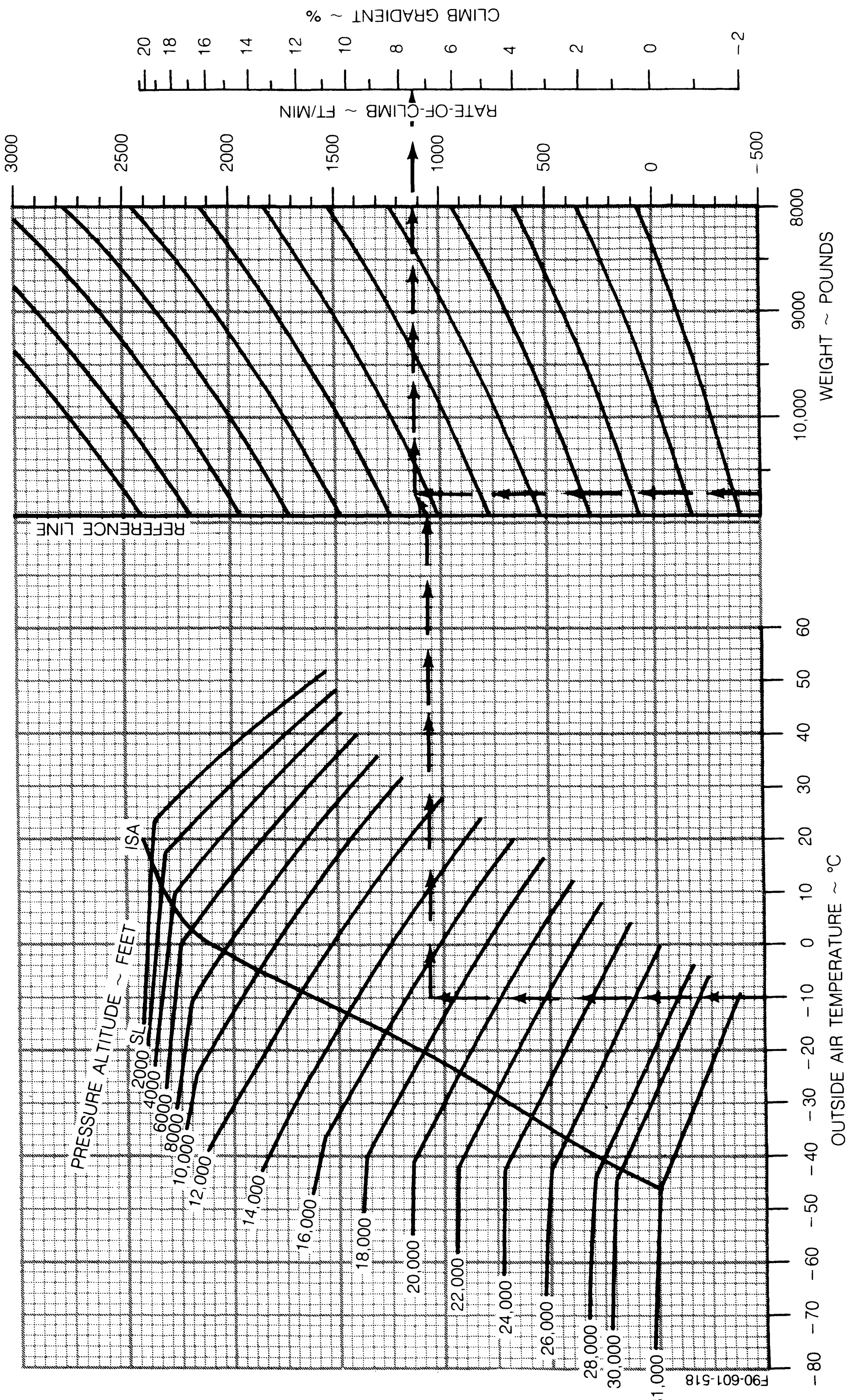
ASSOCIATED CONDITIONS:

POWER ........................ MAXIMUM CONTINUOUS
FLAPS ........................ 0%
LANDING GEAR ................. UP

EXAMPLE:

OAT ........................ -10°C
PRESSURE ALTITUDE ........................ 17,000 FT
WEIGHT ........................ 10,718 LBS

RATE-OF-CLIMB ........................ 1130 FT/MIN
CLIMB GRADIENT ........................ 7.7%



# MAXIMUM PERFORMANCE CLIMB – TWO ENGINES – FLAPS 32.5%

## CLIMB SPEED 117 KNOTS IAS

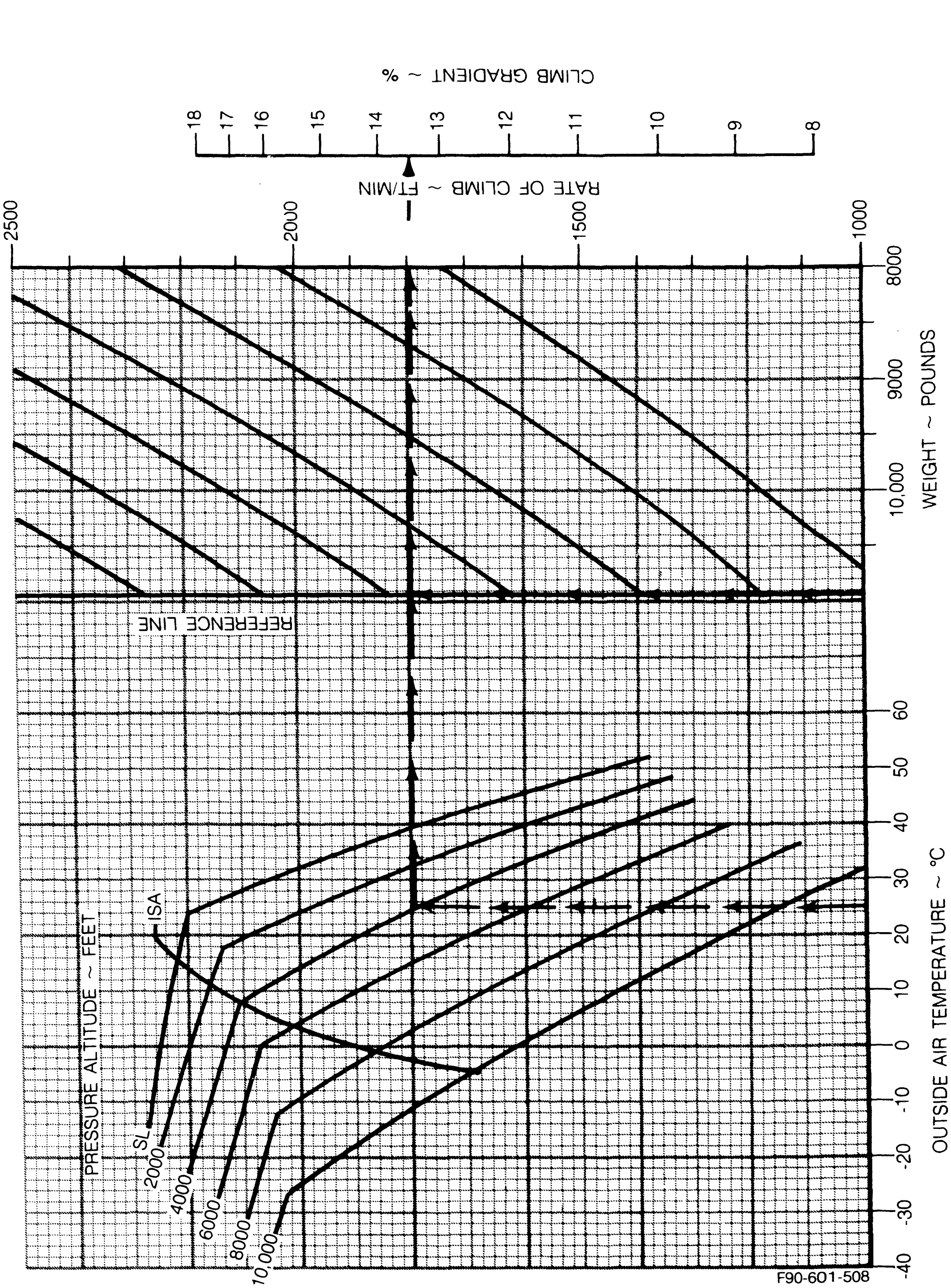
ASSOCIATED CONDITIONS:

POWER . . . . . . . . . . MAXIMUM CONTINUOUS
FLAPS . . . . . . . . . . 32.5%
LANDING GEAR . . . . . . . . . . UP

EXAMPLE:

OAT . . . . . . . . . . 25°C
PRESSURE ALTITUDE . . . . . . . . . . 3966 FT
WEIGHT . . . . . . . . . . 10,950 LBS

RATE OF CLIMB . . . . . . . . . . 1795 FT/MIN
CLIMB GRADIENT . . . . . . . . . . 13.5%



# SERVICE CEILING – ONE ENGINE INOPERATIVE

ASSOCIATED CONDITIONS:

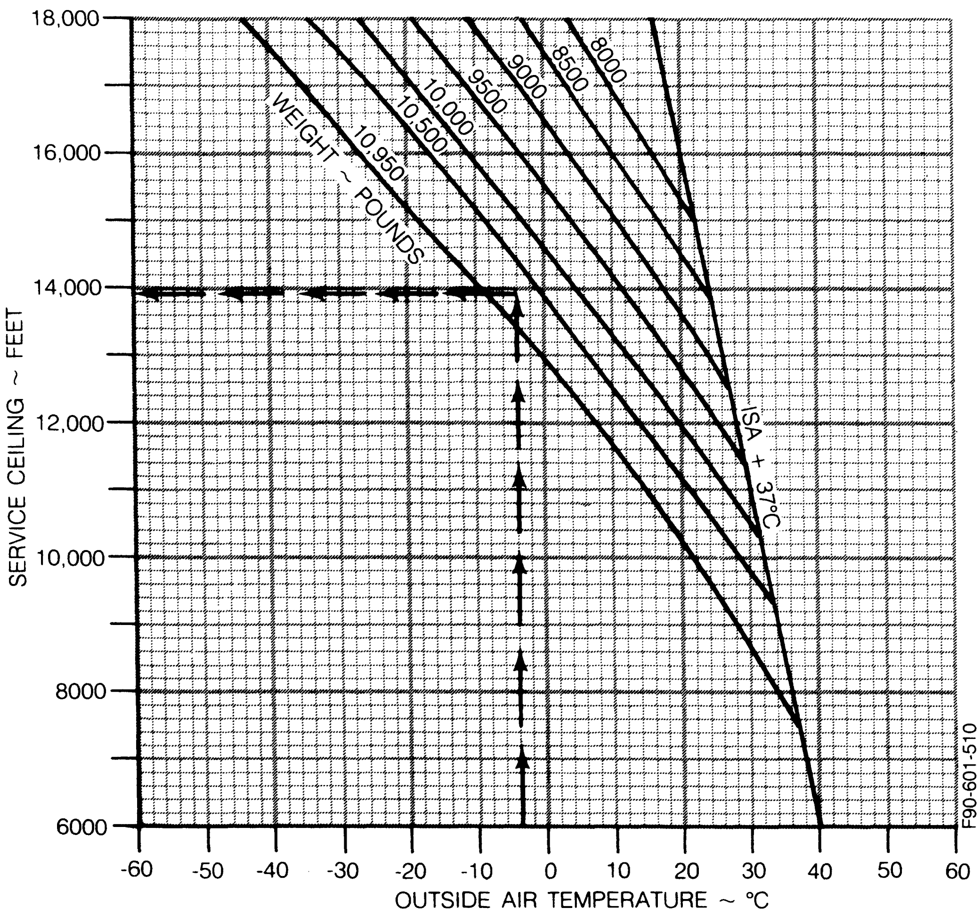
POWER .................... MAXIMUM CONTINUOUS
LANDING GEAR ............ UP
INOPERATIVE PROPELLER .. FEATHERED
FLAPS...................... 0%

NOTE: SERVICE CEILING IS THE PRESSURE ALTITUDE WHERE THE AIRPLANE HAS CAPABILITY OF CLIMBING 50 FT PER MINUTE WITH ONE PROPELLER FEATHERED.

EXAMPLE:

OAT AT MEA ............................ -4°C
WEIGHT ................................ 10,718 LBS
ROUTE SEGMENT MEA ................. 9000 FT

SERVICE CEILING ...................... 13,950 FT



# MAXIMUM PERFORMANCE CLIMB - ONE-ENGINE INOPERATIVE

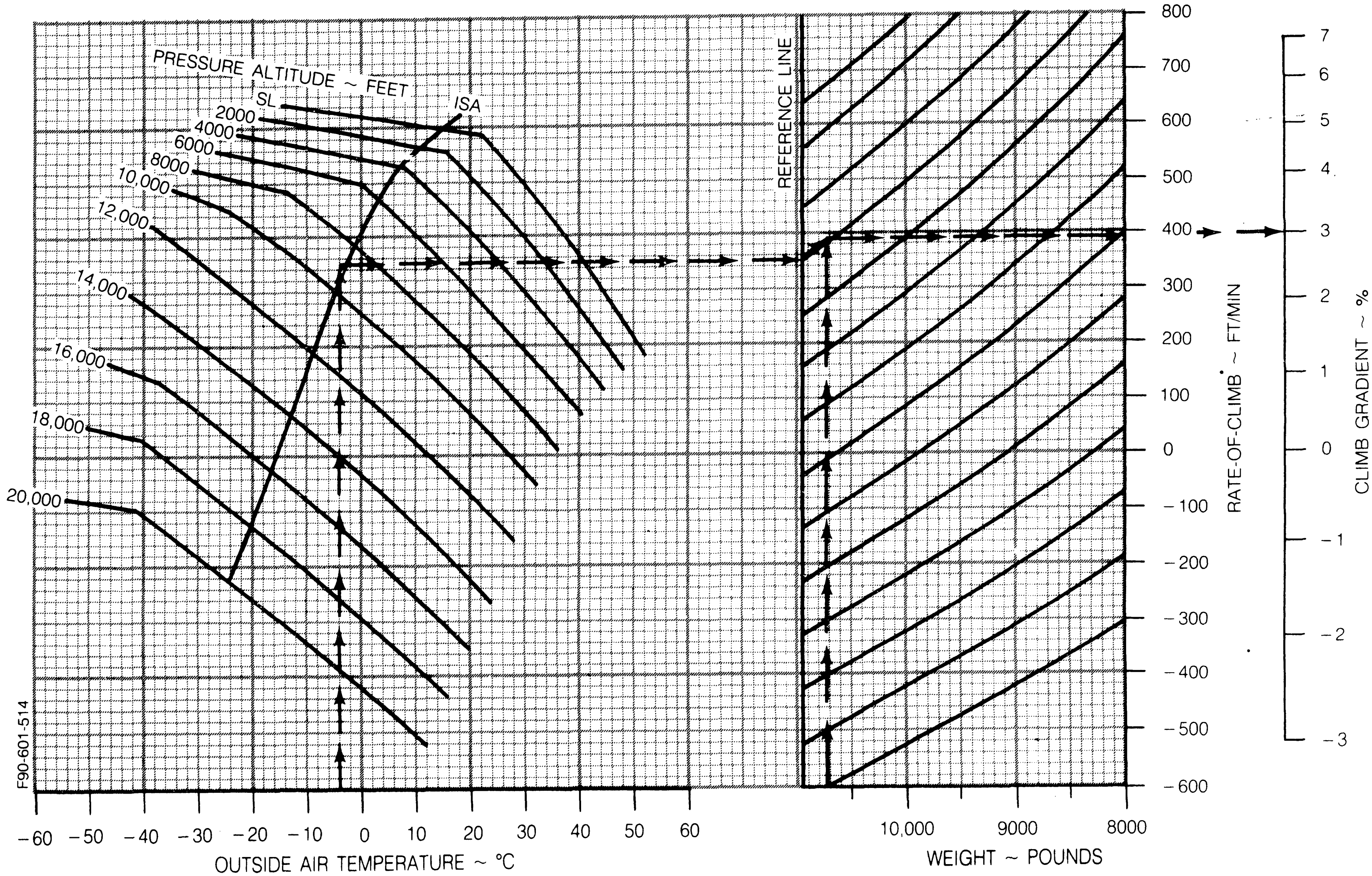
## CLIMB SPEED 117 KNOTS IAS

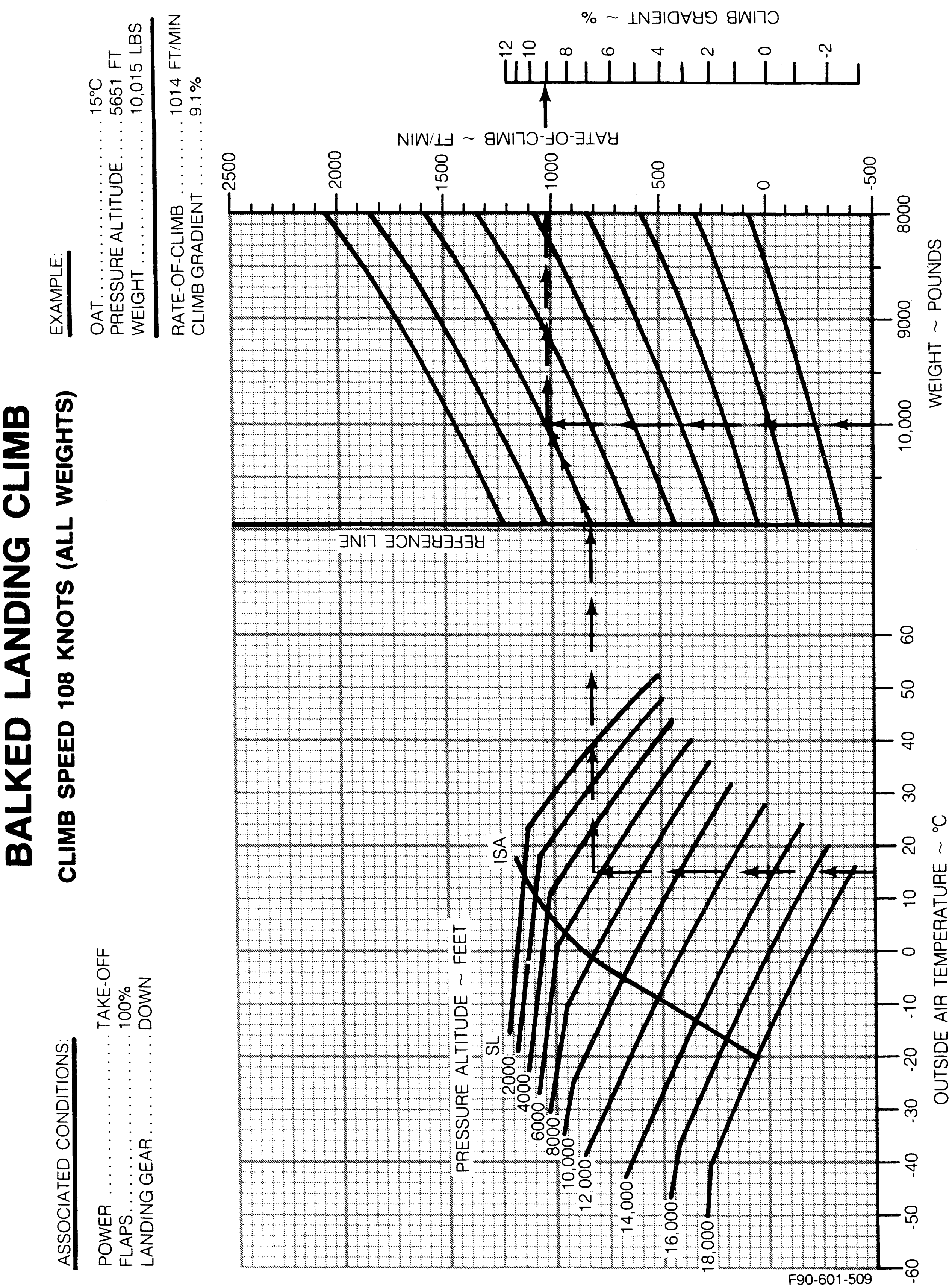
ASSOCIATED CONDITIONS:

| | |
|---|---|
| POWER | MAXIMUM CONTINUOUS |
| FLAPS | 0% |
| LANDING GEAR | UP |
| INOPERATIVE PROPELLER | FEATHERED |

EXAMPLE:

| | |
|---|---|
| OAT | -4°C |
| PRESSURE ALTITUDE | 9000 FEET |
| WEIGHT | 10,718 LBS |
| RATE-OF-CLIMB | 390 FT/MIN |
| CLIMB GRADIENT | 3.0 % |




BALKED LANDING CLIMB
CLIMB SPEED 108 KNOTS (ALL WEIGHTS)
ASSOCIATED CONDITIONS:
POWER ........ TAKE-OFF
FLAPS ........ 100%
LANDING GEAR ........ DOWN
EXAMPLE:
OAT ........ 15°C
PRESSURE ALTITUDE ........ 5651 FT
WEIGHT ........ 10,015 LBS
RATE-OF-CLIMB ........ 1014 FT/MIN
CLIMB GRADIENT ........ 9.1%
CLIMB GRADIENT ~ %
12
10
8
6
4
2
0
-2
RATE-OF-CLIMB ~ FT/MIN
2500
2000
1500
1000
500
0
-500
8000
9000
10,000
WEIGHT ~ POUNDS
REFERENCE LINE
ISA
PRESSURE ALTITUDE ~ FEET
SL
2000
4000
6000
8000
10,000
12,000
14,000
16,000
18,000
60
50
40
30
20
10
0
-10
-20
-30
-40
-50
-60
OUTSIDE AIR TEMPERATURE ~ °C
F90-601-509

# TIME, FUEL, AND DISTANCE TO CRUISE CLIMB

**ASSOCIATED CONDITIONS:**

PROPELLER SPEED ......... 1900 RPM
DO NOT EXCEED:
ITT ....................... 805°C
TORQUE ................. 1940 FT-LBS
$N_1$.... SEE ENGINE LIMITATIONS, SECTION II

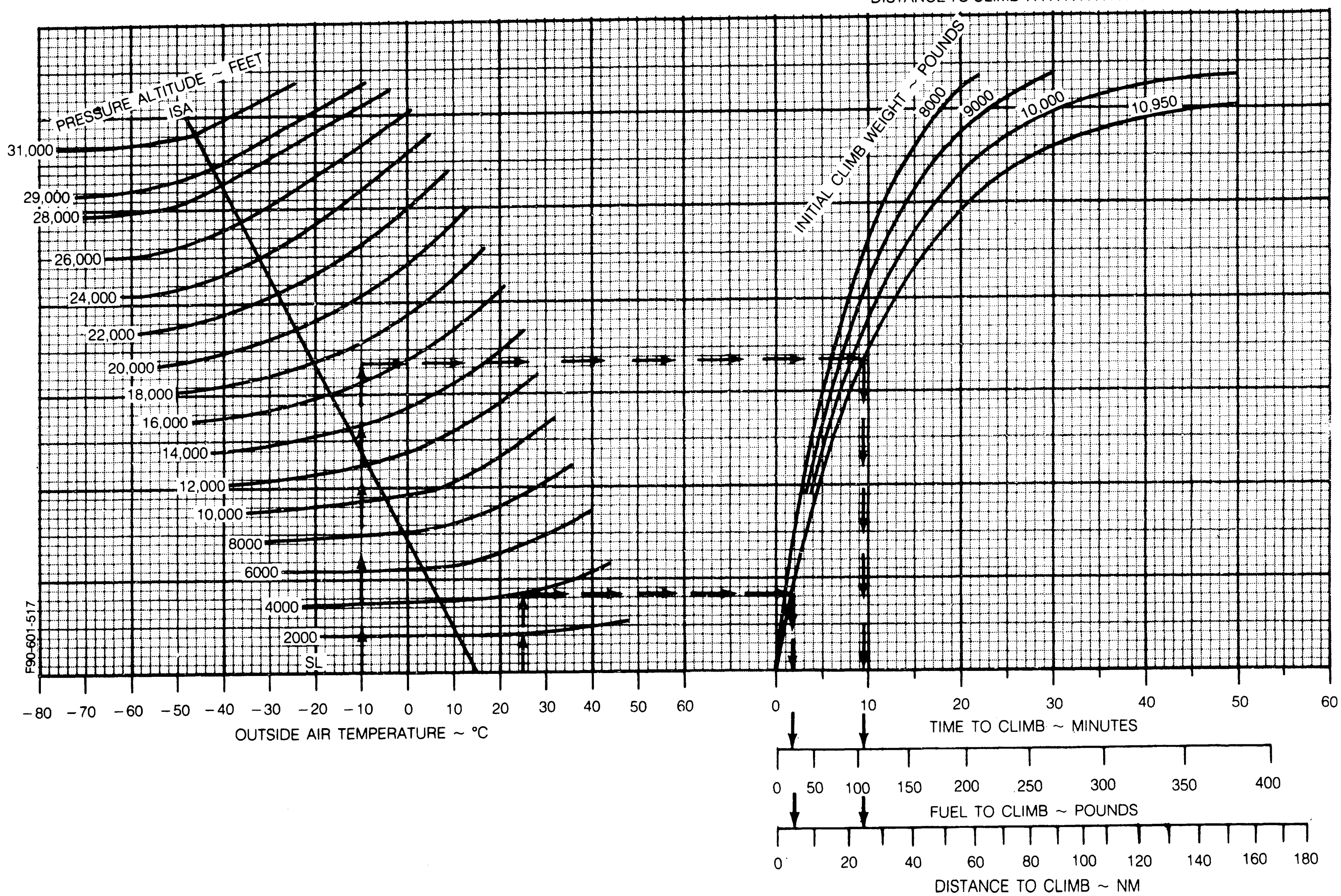
| ALTITUDE ~ FEET | CLIMB SPEED ~ KNOTS |
|---|---|
| SL TO 15,000 | 140 |
| 15,000 TO 25,000 | 130 |
| 25,000 TO 31,000 | 120 |

NOTE: ADD 80 LBS FUEL FOR GROUND OPERATIONS

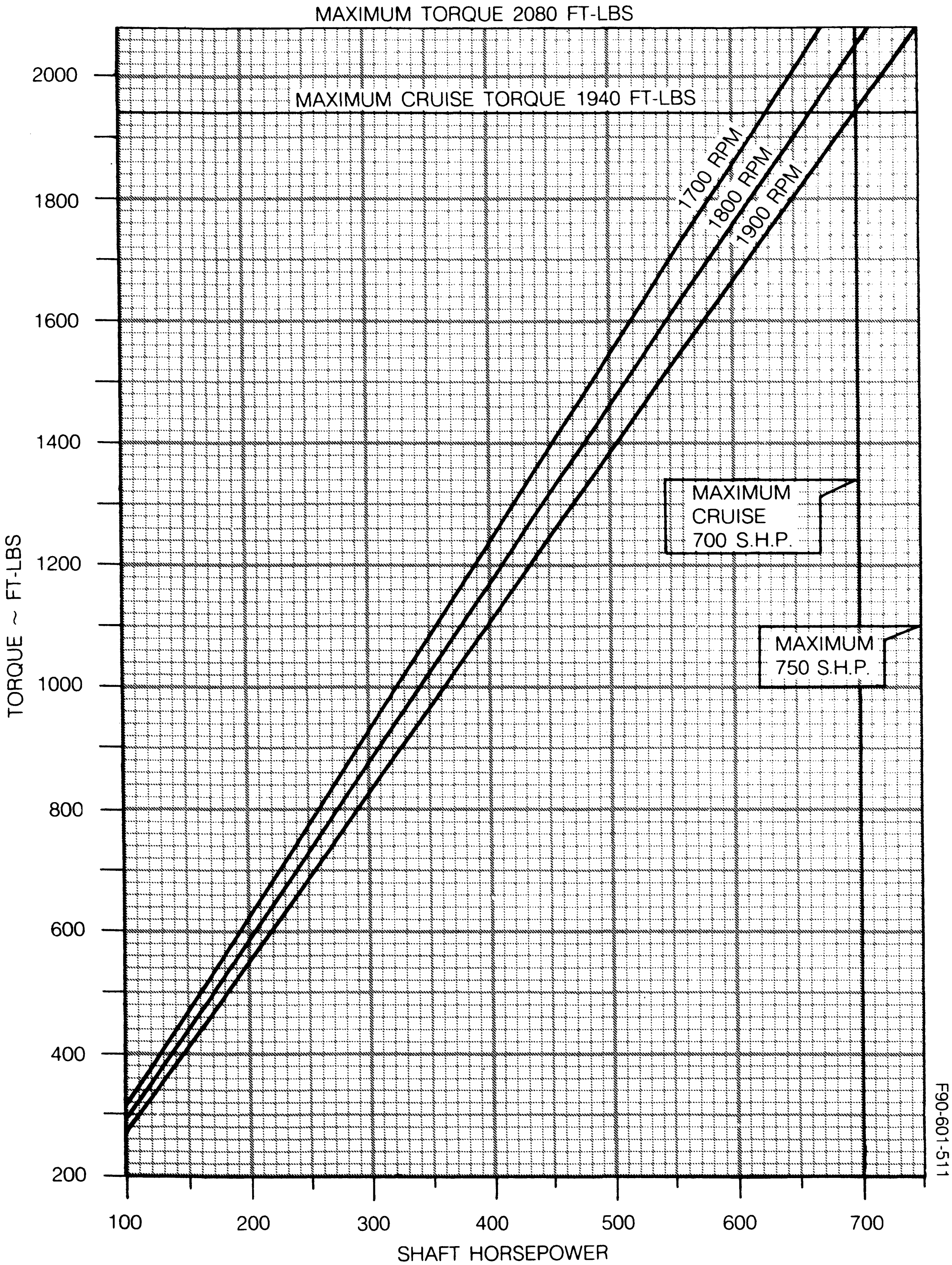
**EXAMPLE:**

OAT AT TAKEOFF ..................... 25°C
OAT AT CRUISE ....................... −10°C
AIRPORT PRESSURE ALTITUDE .......... 3966 FT
CRUISE ALTITUDE ..................... 17,000 FT
INITIAL CLIMB WEIGHT ................. 10,950 LBS

TIME TO CLIMB ....................... 9.5 − 2 = 7.5 MIN
FUEL TO CLIMB ....................... 107 − 25 = 82 LBS
DISTANCE TO CLIMB .................. 25 − 5 = 20 NM



# SHAFT HORSEPOWER FOR VARIOUS ENGINE SPEEDS



# MAXIMUM CRUISE POWER

## 1900 RPM

### ISA −30°C

NOTE: FOR 1800 RPM, INCREASE TORQUE 5%; FOR 1700 RPM, INCREASE TORQUE 10%. DO NOT EXCEED 1940 FT LBS OR 805 °C.

| PRESSURE ALTITUDE FEET | IOAT °C | OAT °C | TORQUE PER ENGINE FT LBS | FUEL FLOW PER ENGINE LBS/HR | TOTAL FUEL FLOW LBS/HR | AIRSPEED KNOTS @ 10,500 LBS IAS | @ 10,500 LBS TAS | @ 9500 LBS IAS | @ 9500 LBS TAS | @ 8500 LBS IAS | @ 8500 LBS TAS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SL | -10 | -15 | 1940 | 426 | 852 | 243 | 227 | 244 | 228 | 245 | 229 |
| 2000 | -14 | -19 | 1940 | 418 | 836 | 241 | 232 | 242 | 233 | 242 | 233 |
| 4000 | -18 | -23 | 1940 | 411 | 822 | 239 | 236 | 240 | 237 | 241 | 238 |
| 6000 | -21 | -27 | 1940 | 405 | 810 | 237 | 241 | 238 | 242 | 239 | 243 |
| 8000 | -25 | -31 | 1940 | 400 | 800 | 235 | 246 | 236 | 247 | 237 | 248 |
| 10,000 | -29 | -35 | 1940 | 396 | 792 | 233 | 251 | 234 | 252 | 235 | 253 |
| 12,000 | -33 | -39 | 1940 | 394 | 788 | 231 | 256 | 232 | 258 | 233 | 259 |
| 14,000 | -36 | -43 | 1940 | 394 | 788 | 229 | 261 | 231 | 263 | 232 | 264 |
| 16,000 | -40 | -47 | 1831 | 373 | 746 | 221 | 260 | 223 | 262 | 224 | 264 |
| 18,000 | -44 | -51 | 1669 | 341 | 682 | 211 | 256 | 213 | 258 | 214 | 260 |
| 20,000 | -48 | -55 | 1519 | 311 | 622 | 201 | 252 | 203 | 254 | 205 | 256 |
| 22,000 | -53 | -59 | 1384 | 285 | 570 | 191 | 247 | 194 | 250 | 196 | 253 |
| 24,000 | -57 | -63 | 1249 | 259 | 518 | 179 | 240 | 183 | 244 | 185 | 248 |
| 26,000 | -61 | -67 | 1128 | 235 | 470 | 168 | 233 | 172 | 238 | 175 | 242 |
| 28,000 | -66 | -70 | 1020 | 214 | 428 | 156 | 224 | 161 | 231 | 165 | 236 |
| 29,000 | -68 | -72 | 966 | 204 | 408 | 150 | 219 | 156 | 227 | 160 | 233 |
| 31,000 | -72 | -76 | 857 | 182 | 364 | 134 | 203 | 143 | 215 | 149 | 224 |

# MAXIMUM CRUISE POWER

## 1900 RPM

### ISA −20°C

NOTE: FOR 1800 RPM, INCREASE TORQUE 5%; FOR 1700 RPM, INCREASE TORQUE 10%. DO NOT EXCEED 1940 FT LBS OR 805 °C.

| PRESSURE ALTITUDE FEET | IOAT °C | OAT °C | TORQUE PER ENGINE FT LBS | FUEL FLOW PER ENGINE LBS/HR | TOTAL FUEL FLOW LBS/HR | AIRSPEED KNOTS @ 10,500 LBS IAS | @ 10,500 LBS TAS | @ 9500 LBS IAS | @ 9500 LBS TAS | @ 8500 LBS IAS | @ 8500 LBS TAS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SL | 0 | - 5 | 1940 | 429 | 858 | 241 | 230 | 242 | 231 | 243 | 232 |
| 2000 | - 4 | - 9 | 1940 | 420 | 840 | 239 | 235 | 240 | 236 | 240 | 236 |
| 4000 | - 8 | -13 | 1940 | 413 | 826 | 237 | 239 | 238 | 240 | 239 | 241 |
| 6000 | -11 | -17 | 1940 | 407 | 814 | 235 | 244 | 236 | 245 | 237 | 246 |
| 8000 | -15 | -21 | 1940 | 402 | 804 | 233 | 249 | 234 | 250 | 235 | 251 |
| 10,000 | -19 | -25 | 1940 | 398 | 796 | 231 | 254 | 232 | 256 | 233 | 257 |
| 12,000 | -22 | -29 | 1940 | 397 | 794 | 229 | 259 | 231 | 261 | 232 | 262 |
| 14,000 | -26 | -33 | 1890 | 386 | 772 | 224 | 262 | 225 | 263 | 227 | 265 |
| 16,000 | -30 | -37 | 1748 | 358 | 716 | 216 | 259 | 218 | 261 | 220 | 263 |
| 18,000 | -34 | -41 | 1630 | 335 | 670 | 207 | 257 | 209 | 259 | 211 | 261 |
| 20,000 | -38 | -45 | 1521 | 314 | 628 | 199 | 255 | 202 | 258 | 204 | 260 |
| 22,000 | -43 | -49 | 1396 | 289 | 578 | 189 | 251 | 191 | 254 | 194 | 257 |
| 24,000 | -47 | -53 | 1268 | 264 | 528 | 179 | 245 | 182 | 249 | 185 | 253 |
| 26,000 | -51 | -57 | 1147 | 240 | 480 | 168 | 238 | 172 | 243 | 175 | 248 |
| 28,000 | -55 | -60 | 1038 | 219 | 43ε | 156 | 229 | 161 | 236 | 165 | 242 |
| 29,000 | -57 | -62 | 983 | 208 | 416 | 149 | 223 | 155 | 232 | 160 | 238 |
| 31,000 | -62 | -66 | 872 | 187 | 374 | 132 | 206 | 142 | 220 | 148 | 229 |

# MAXIMUM CRUISE POWER

## 1900 RPM

### ISA −10°C

NOTE: FOR 1800 RPM, INCREASE TORQUE 5%; FOR 1700 RPM, INCREASE TORQUE 10%. DO NOT EXCEED 1940 FT LBS OR 805 °C.

| PRESSURE ALTITUDE FEET | IOAT °C | OAT °C | TORQUE PER ENGINE FT LBS | FUEL FLOW PER ENGINE LBS/HR | TOTAL FUEL FLOW LBS/HR | AIRSPEED KNOTS @ 10,500 LBS IAS | AIRSPEED KNOTS @ 10,500 LBS TAS | AIRSPEED KNOTS @ 9500 LBS IAS | AIRSPEED KNOTS @ 9500 LBS TAS | AIRSPEED KNOTS @ 8500 LBS IAS | AIRSPEED KNOTS @ 8500 LBS TAS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SL | 10 | 5 | 1940 | 429 | 858 | 240 | 233 | 241 | 234 | 242 | 235 |
| 2000 | 6 | 1 | 1940 | 420 | 840 | 238 | 238 | 239 | 239 | 240 | 240 |
| 4000 | 3 | -3 | 1940 | 414 | 828 | 236 | 242 | 237 | 243 | 238 | 244 |
| 6000 | -1 | -7 | 1940 | 408 | 816 | 234 | 247 | 235 | 248 | 236 | 250 |
| 8000 | -5 | -11 | 1940 | 405 | 810 | 232 | 252 | 233 | 254 | 234 | 255 |
| 10,000 | -9 | -15 | 1940 | 402 | 804 | 230 | 258 | 231 | 259 | 232 | 260 |
| 12,000 | -12 | -19 | 1912 | 394 | 788 | 226 | 261 | 227 | 263 | 228 | 264 |
| 14,000 | -16 | -23 | 1782 | 368 | 736 | 218 | 259 | 219 | 261 | 221 | 263 |
| 16,000 | -21 | -27 | 1648 | 341 | 682 | 209 | 256 | 210 | 259 | 212 | 261 |
| 18,000 | -25 | -31 | 1540 | 319 | 638 | 201 | 254 | 203 | 257 | 205 | 259 |
| 20,000 | -29 | -35 | 1441 | 300 | 600 | 193 | 252 | 195 | 256 | 197 | 258 |
| 22,000 | -33 | -39 | 1349 | 282 | 564 | 185 | 250 | 187 | 254 | 190 | 257 |
| 24,000 | -37 | -43 | 1257 | 264 | 528 | 176 | 247 | 179 | 251 | 182 | 255 |
| 26,000 | -41 | -47 | 1163 | 246 | 492 | 167 | 242 | 171 | 247 | 174 | 252 |
| 28,000 | -45 | -50 | 1053 | 224 | 448 | 155 | 233 | 160 | 241 | 164 | 247 |
| 29,000 | -47 | -52 | 998 | 213 | 426 | 149 | 227 | 155 | 236 | 159 | 243 |
| 31,000 | -52 | -56 | 887 | 191 | 382 | 131 | 209 | 141 | 224 | 148 | 234 |

# MAXIMUM CRUISE POWER

## 1900 RPM

### ISA

NOTE: FOR 1800 RPM, INCREASE TORQUE 5%; FOR 1700 RPM, INCREASE TORQUE 10%. DO NOT EXCEED 1940 FT LBS OR 805 °C.

| PRESSURE ALTITUDE FEET | IOAT | OAT | TORQUE PER ENGINE FT LBS | FUEL FLOW PER ENGINE LBS/HR | TOTAL FUEL FLOW LBS/HR | AIRSPEED KNOTS | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | @ 10,500 LBS | | @ 9500 LBS | | @ 8500 LBS | |
| | °C | °C | | | | IAS | TAS | IAS | TAS | IAS | TAS |
| SL | 20 | 15 | 1940 | 435 | 870 | 239 | 236 | 240 | 237 | 241 | 238 |
| 2000 | 16 | 11 | 1940 | 426 | 852 | 237 | 240 | 238 | 242 | 239 | 243 |
| 4000 | 13 | 7 | 1940 | 417 | 834 | 234 | 245 | 235 | 246 | 237 | 247 |
| 6000 | 9 | 3 | 1940 | 411 | 822 | 233 | 250 | 234 | 252 | 235 | 253 |
| 8000 | 5 | -1 | 1940 | 406 | 812 | 231 | 256 | 233 | 257 | 234 | 258 |
| 10,000 | 1 | -5 | 1917 | 396 | 792 | 227 | 259 | 228 | 261 | 229 | 262 |
| 12,000 | -2 | -9 | 1817 | 375 | 750 | 220 | 259 | 222 | 261 | 223 | 262 |
| 14,000 | -7 | -13 | 1675 | 349 | 698 | 211 | 256 | 213 | 258 | 214 | 260 |
| 16,000 | -11 | -17 | 1546 | 323 | 646 | 202 | 253 | 204 | 255 | 206 | 258 |
| 18,000 | -15 | -21 | 1446 | 303 | 606 | 194 | 251 | 196 | 254 | 198 | 256 |
| 20,000 | -19 | -25 | 1355 | 285 | 570 | 186 | 249 | 188 | 252 | 191 | 255 |
| 22,000 | -23 | -29 | 1270 | 268 | 536 | 176 | 246 | 181 | 250 | 184 | 254 |
| 24,000 | -27 | -33 | 1186 | 252 | 504 | 169 | 243 | 173 | 248 | 176 | 252 |
| 26,000 | -31 | -37 | 1105 | 235 | 470 | 161 | 238 | 165 | 244 | 168 | 250 |
| 28,000 | -35 | -40 | 1027 | 220 | 440 | 151 | 232 | 156 | 240 | 161 | 247 |
| 29,000 | -37 | -42 | 988 | 212 | 424 | 146 | 228 | 152 | 237 | 157 | 245 |
| 31,000 | -42 | -46 | 908 | 197 | 394 | 132 | 215 | 142 | 230 | 148 | 239 |

# MAXIMUM CRUISE POWER

## 1900 RPM

### ISA +10°C

NOTE: FOR 1800 RPM, INCREASE TORQUE 5%; FOR 1700 RPM, INCREASE TORQUE 10%. DO NOT EXCEED 1940 FT LBS OR 805 °C.

| PRESSURE ALTITUDE FEET | IOAT | OAT | TORQUE PER ENGINE FT LBS | FUEL FLOW PER ENGINE LBS/HR | TOTAL FUEL FLOW LBS/HR | AIRSPEED KNOTS | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | @ 10,500 LBS | | @ 9500 LBS | | @ 8500 LBS | |
| | °C | °C | | | | IAS | TAS | IAS | TAS | IAS | TAS |
| SL | 30 | 25 | 1940 | 437 | 874 | 237 | 239 | 238 | 240 | 239 | 241 |
| 2000 | 27 | 21 | 1940 | 428 | 856 | 235 | 243 | 236 | 244 | 237 | 245 |
| 4000 | 23 | 17 | 1940 | 420 | 840 | 233 | 248 | 234 | 249 | 235 | 250 |
| 6000 | 19 | 13 | 1937 | 413 | 826 | 231 | 253 | 232 | 255 | 233 | 256 |
| 8000 | 15 | 9 | 1869 | 395 | 790 | 225 | 255 | 227 | 256 | 228 | 258 |
| 10,000 | 11 | 5 | 1801 | 377 | 754 | 220 | 256 | 221 | 258 | 223 | 259 |
| 12,000 | 7 | 1 | 1711 | 356 | 712 | 213 | 256 | 215 | 258 | 216 | 260 |
| 14,000 | 3 | -3 | 1585 | 331 | 662 | 204 | 253 | 207 | 256 | 208 | 258 |
| 16,000 | -1 | -7 | 1463 | 306 | 612 | 196 | 250 | 198 | 253 | 200 | 255 |
| 18,000 | -5 | -11 | 1371 | 288 | 576 | 187 | 248 | 190 | 251 | 192 | 254 |
| 20,000 | -9 | -15 | 1270 | 270 | 540 | 178 | 244 | 182 | 248 | 184 | 252 |
| 22,000 | -13 | -19 | 1191 | 254 | 508 | 170 | 241 | 174 | 246 | 177 | 250 |
| 24,000 | -17 | -23 | 1111 | 239 | 478 | 162 | 237 | 166 | 243 | 170 | 248 |
| 26,000 | -21 | -27 | 1036 | 224 | 448 | 153 | 232 | 158 | 239 | 162 | 245 |
| 28,000 | -25 | -30 | 965 | 210 | 420 | 143 | 224 | 149 | 235 | 154 | 242 |
| 29,000 | -27 | -32 | 930 | 203 | 406 | 137 | 219 | 144 | 232 | 150 | 240 |
| 31,000 | -32 | -36 | 858 | 188 | 376 | 120 | 201 | 134 | 222 | 141 | 234 |

# MAXIMUM CRUISE POWER

## 1900 RPM

### ISA +20°C

NOTE: FOR 1800 RPM, INCREASE TORQUE 5%; FOR 1700 RPM, INCREASE TORQUE 10%. DO NOT EXCEED 1940 FT LBS OR 805 °C.

| PRESSURE ALTITUDE FEET | IOAT °C | OAT °C | TORQUE PER ENGINE FT LBS | FUEL FLOW PER ENGINE LBS/HR | TOTAL FUEL FLOW LBS/HR | AIRSPEED KNOTS @ 10,500 LBS IAS | @ 10,500 LBS TAS | @ 9500 LBS IAS | @ 9500 LBS TAS | @ 8500 LBS IAS | @ 8500 LBS TAS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SL | 40 | 35 | 1939 | 438 | 876 | 236 | 241 | 237 | 242 | 238 | 243 |
| 2000 | 37 | 31 | 1868 | 417 | 834 | 230 | 242 | 232 | 243 | 233 | 245 |
| 4000 | 33 | 27 | 1829 | 401 | 802 | 226 | 245 | 227 | 246 | 229 | 248 |
| 6000 | 29 | 23 | 1781 | 385 | 770 | 222 | 247 | 223 | 249 | 225 | 250 |
| 8000 | 25 | 19 | 1723 | 370 | 740 | 217 | 249 | 218 | 251 | 219 | 253 |
| 10,000 | 21 | 15 | 1665 | 354 | 708 | 212 | 251 | 214 | 253 | 215 | 255 |
| 12,000 | 17 | 11 | 1592 | 337 | 674 | 206 | 252 | 208 | 254 | 209 | 256 |
| 14,000 | 13 | 7 | 1472 | 312 | 624 | 197 | 248 | 199 | 251 | 200 | 254 |
| 16,000 | 9 | 3 | 1358 | 289 | 578 | 188 | 245 | 190 | 248 | 192 | 251 |
| 18,000 | 5 | -1 | 1283 | 273 | 546 | 181 | 243 | 183 | 247 | 186 | 250 |
| 20,000 | 1 | -5 | 1203 | 257 | 514 | 173 | 241 | 176 | 245 | 179 | 249 |
| 22,000 | -3 | -9 | 1121 | 241 | 482 | 164 | 237 | 168 | 242 | 171 | 247 |
| 24,000 | -7 | -13 | 1039 | 226 | 452 | 154 | 231 | 159 | 238 | 163 | 244 |
| 26,000 | -11 | -17 | 969 | 212 | 424 | 144 | 224 | 151 | 233 | 155 | 241 |
| 28,000 | -16 | -20 | 902 | 199 | 398 | 133 | 213 | 141 | 227 | 147 | 237 |
| 29,000 | -18 | -22 | 868 | 192 | 384 | 125 | 205 | 136 | 223 | 143 | 234 |
| 31,000 | -22 | -26 | 799 | 179 | 358 | 97 | 168 | 123 | 211 | 134 | 227 |

# MAXIMUM CRUISE POWER

## 1900 RPM

### ISA +30°C

NOTE: FOR 1800 RPM, INCREASE TORQUE 5%; FOR 1700 RPM, INCREASE TORQUE 10%. DO NOT EXCEED 1940 FT LBS OR 805 °C.

| PRESSURE ALTITUDE FEET | IOAT °C | OAT °C | TORQUE PER ENGINE FT LBS | FUEL FLOW PER ENGINE LBS/HR | TOTAL FUEL FLOW LBS/HR | AIRSPEED KNOTS @ 10,500 LBS IAS | AIRSPEED KNOTS @ 10,500 LBS TAS | @ 9500 LBS IAS | @ 9500 LBS TAS | @ 8500 LBS IAS | @ 8500 LBS TAS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SL | 50 | 45 | 1730 | 411 | 822 | 224 | 233 | 226 | 234 | 227 | 235 |
| 2000 | 46 | 41 | 1679 | 391 | 782 | 219 | 235 | 221 | 236 | 222 | 238 |
| 4000 | 42 | 37 | 1659 | 377 | 754 | 216 | 238 | 218 | 240 | 219 | 241 |
| 6000 | 39 | 33 | 1625 | 362 | 724 | 212 | 241 | 214 | 243 | 215 | 244 |
| 8000 | 35 | 29 | 1578 | 347 | 694 | 208 | 243 | 210 | 245 | 211 | 247 |
| 10,000 | 31 | 25 | 1530 | 331 | 662 | 203 | 245 | 205 | 247 | 207 | 249 |
| 12,000 | 27 | 21 | 1467 | 315 | 630 | 197 | 246 | 199 | 248 | 201 | 251 |
| 14,000 | 23 | 17 | 1349 | 291 | 582 | 188 | 241 | 190 | 245 | 193 | 248 |
| 16,000 | 19 | 13 | 1245 | 270 | 540 | 179 | 238 | 182 | 241 | 184 | 245 |
| 18,000 | 15 | 9 | 1177 | 255 | 510 | 172 | 236 | 175 | 240 | 178 | 244 |
| 20,000 | 11 | 5 | 1109 | 241 | 482 | 164 | 233 | 168 | 239 | 171 | 243 |
| 22,000 | 7 | 1 | 1043 | 227 | 454 | 156 | 229 | 161 | 236 | 164 | 242 |
| 24,000 | 2 | -3 | 977 | 214 | 428 | 147 | 224 | 153 | 233 | 157 | 239 |
| 26,000 | -2 | -7 | 915 | 201 | 402 | 136 | 215 | 144 | 228 | 150 | 236 |
| 28,000 | -6 | -10 | 852 | 189 | 378 | 122 | 201 | 134 | 220 | 142 | 232 |
| 29,000 | -8 | -12 | 820 | 182 | 364 | 108 | 181 | 128 | 215 | 137 | 229 |
| 31,000 | -13 | -16 | 754 | 169 | 338 | 97 | 173 | 112 | 196 | 127 | 220 |

# MAXIMUM CRUISE POWER

## 1900 RPM

### ISA +37°C

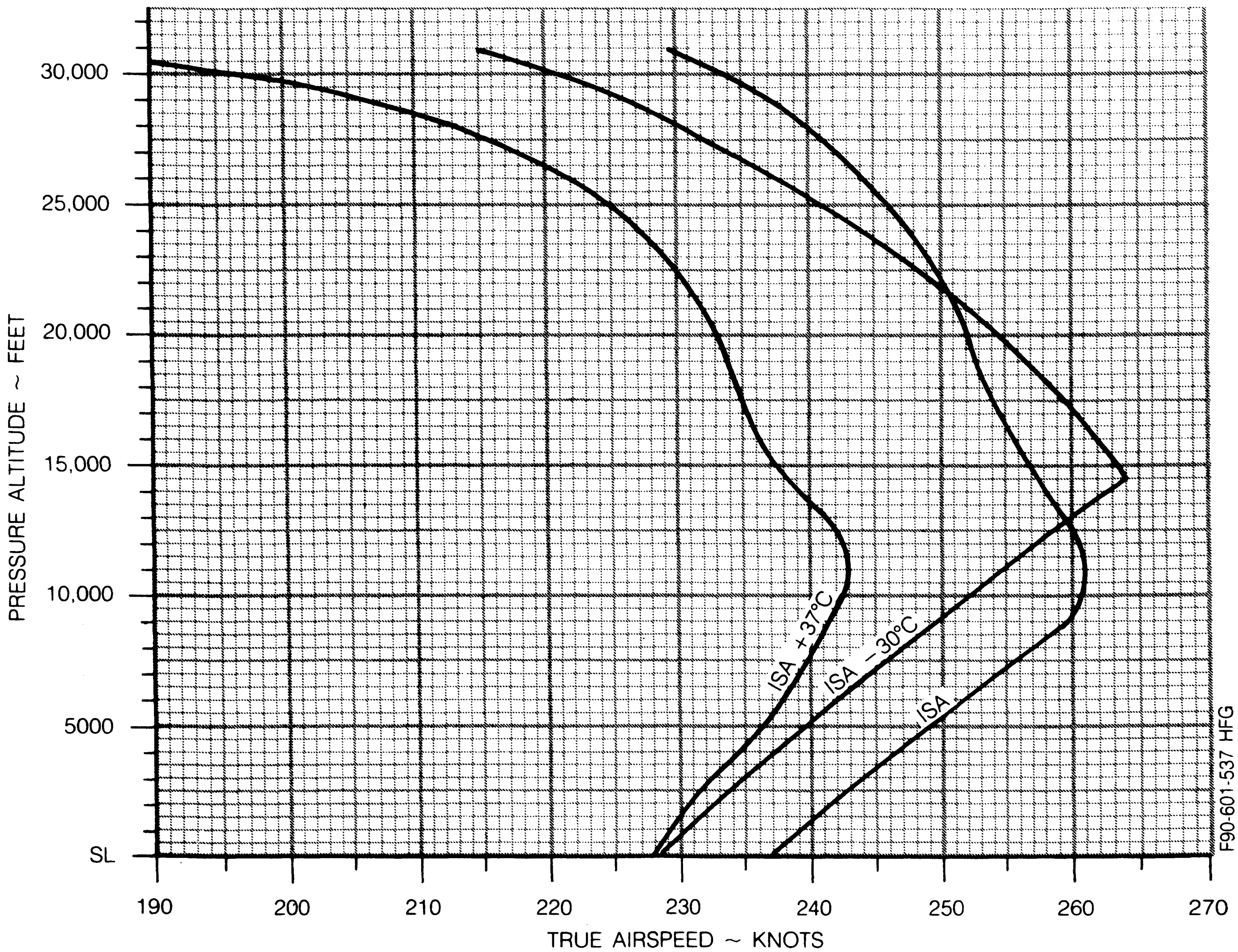
NOTE: FOR 1800 RPM, INCREASE TORQUE 5%; FOR 1700 RPM, INCREASE TORQUE 10%. DO NOT EXCEED 1940 FT LBS OR 805 °C.

| PRESSURE ALTITUDE FEET | IOAT °C | OAT °C | TORQUE PER ENGINE FT LBS | FUEL FLOW PER ENGINE LBS/HR | TOTAL FUEL FLOW LBS/HR | AIRSPEED KNOTS @ 10,500 LBS IAS | AIRSPEED KNOTS @ 10,500 LBS TAS | AIRSPEED KNOTS @ 9500 LBS IAS | AIRSPEED KNOTS @ 9500 LBS TAS | AIRSPEED KNOTS @ 8500 LBS IAS | AIRSPEED KNOTS @ 8500 LBS TAS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SL | 57 | 52 | 1584 | 391 | 782 | 216 | 226 | 217 | 228 | 219 | 229 |
| 2000 | 53 | 48 | 1545 | 374 | 748 | 212 | 229 | 213 | 230 | 215 | 232 |
| 4000 | 49 | 44 | 1539 | 360 | 720 | 209 | 233 | 211 | 235 | 212 | 236 |
| 6000 | 45 | 40 | 1515 | 346 | 692 | 206 | 236 | 208 | 238 | 209 | 240 |
| 8000 | 42 | 36 | 1475 | 331 | 662 | 201 | 238 | 203 | 240 | 205 | 242 |
| 10,000 | 38 | 32 | 1436 | 315 | 630 | 197 | 240 | 198 | 243 | 201 | 245 |
| 12,000 | 34 | 28 | 1375 | 300 | 600 | 190 | 240 | 193 | 243 | 195 | 246 |
| 14,000 | 30 | 24 | 1262 | 276 | 552 | 181 | 236 | 184 | 240 | 186 | 243 |
| 16,000 | 25 | 20 | 1166 | 256 | 512 | 172 | 232 | 175 | 236 | 178 | 240 |
| 18,000 | 21 | 16 | 1103 | 243 | 486 | 165 | 230 | 169 | 235 | 172 | 239 |
| 20,000 | 17 | 12 | 1042 | 230 | 460 | 158 | 227 | 162 | 233 | 165 | 238 |
| 22,000 | 13 | 8 | 985 | 218 | 436 | 149 | 223 | 155 | 231 | 159 | 237 |
| 24,000 | 9 | 4 | 928 | 205 | 410 | 140 | 217 | 147 | 227 | 152 | 235 |
| 26,000 | 5 | 0 | 872 | 193 | 386 | 129 | 207 | 139 | 222 | 145 | 232 |
| 28,000 | 1 | -3 | 813 | 182 | 364 | 107 | 178 | 128 | 213 | 137 | 227 |
| 29,000 | -1 | -5 | 783 | 176 | 352 | 97 | 168 | 122 | 207 | 133 | 224 |
| 31,000 | -7 | -9 | 715 | 163 | 326 | ----- | ----- | ----- | ----- | ----- | ----- |

# MAXIMUM CRUISE SPEEDS

## 1900 RPM

### WEIGHT 9500 LBS

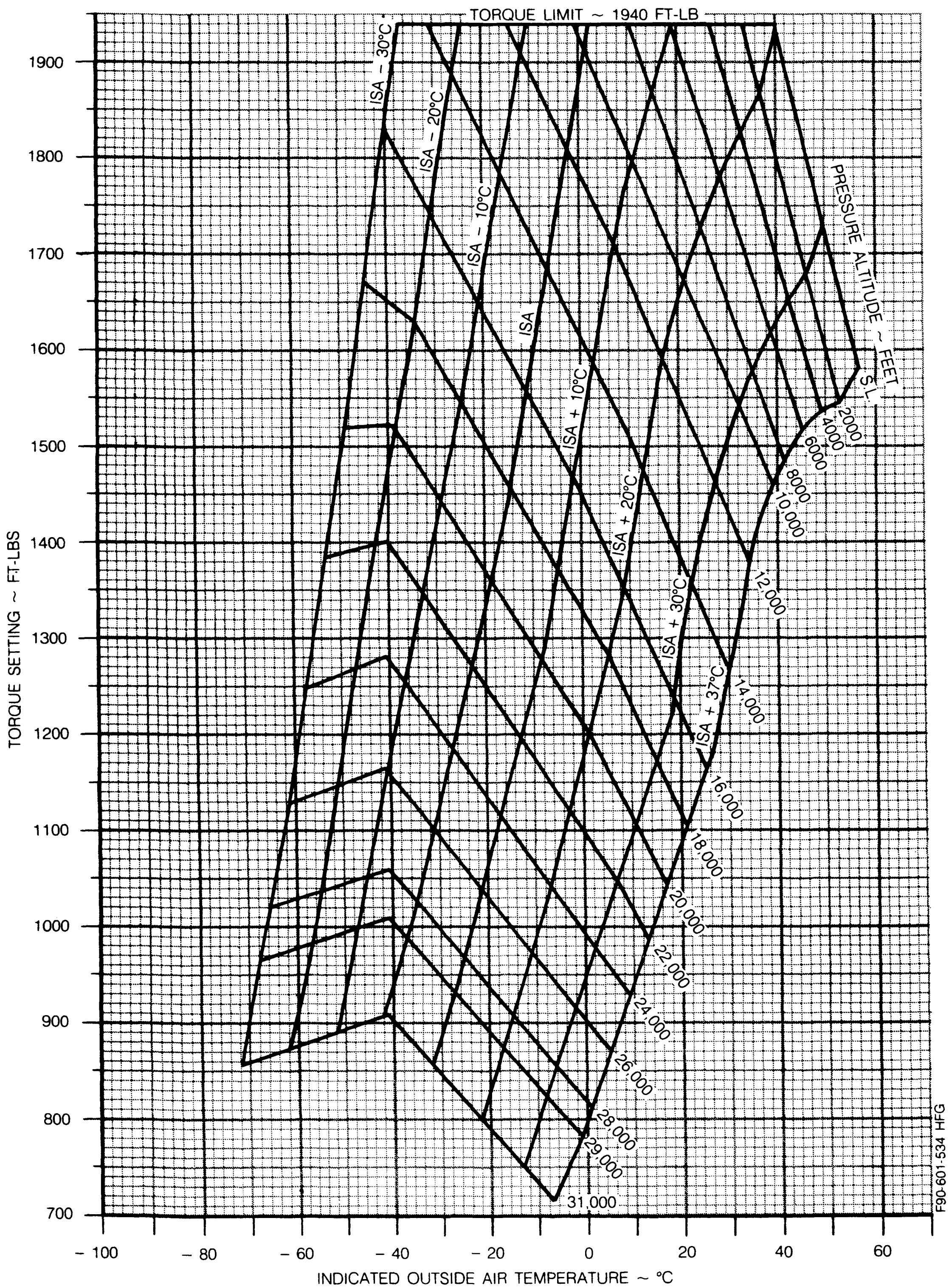


# MAXIMUM CRUISE POWER

**1900 RPM**

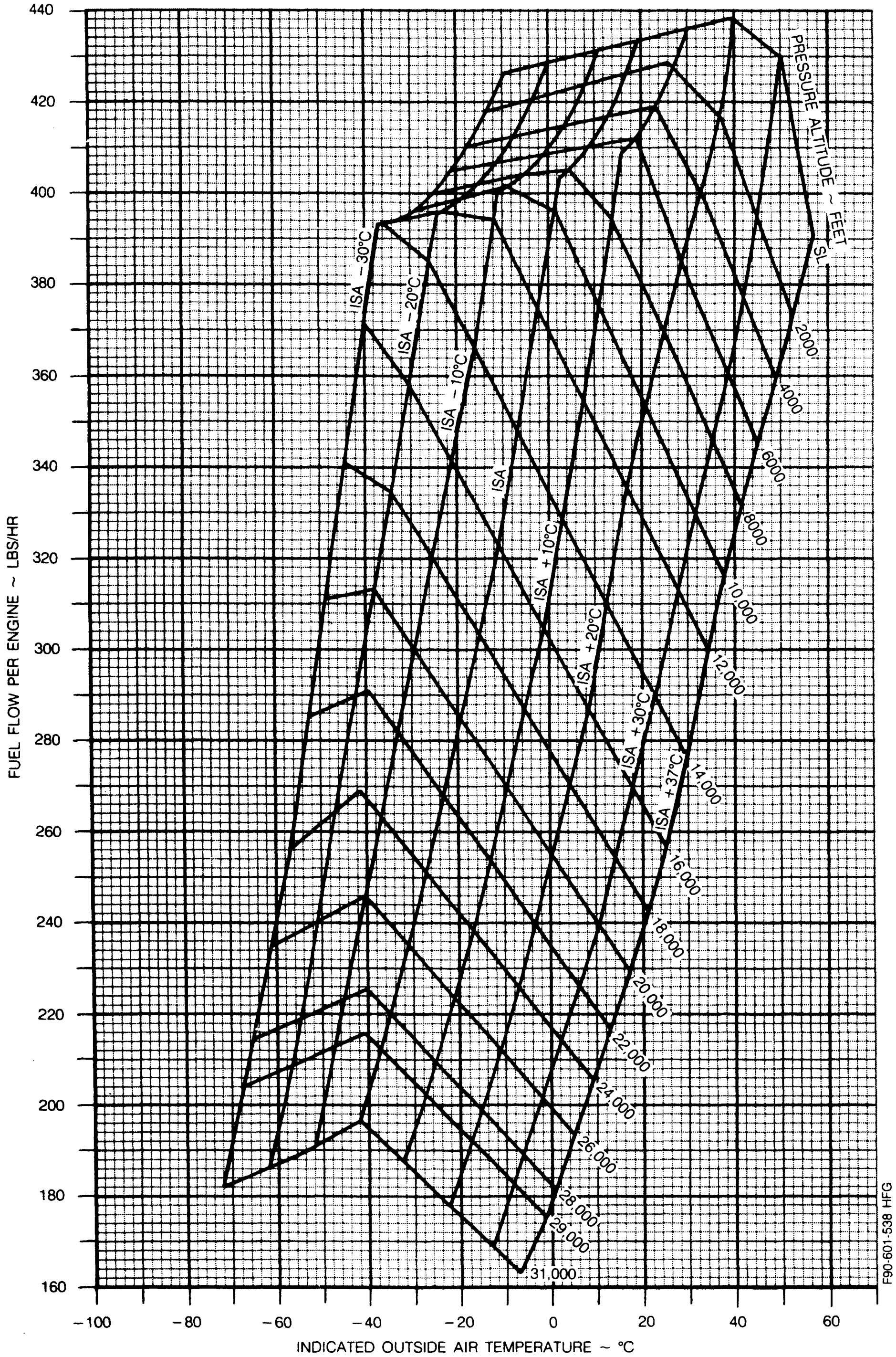
DO NOT EXCEED 1940 FT-LBS OR 805°C ITT

NOTE: FOR 1800 RPM, INCREASE TORQUE 5%
FOR 1700 RPM INCREASE TORQUE 10%



# FUEL FLOW AT MAXIMUM CRUISE POWER

**1900 RPM**



# MAXIMUM RANGE POWER

## 1800 RPM

### ISA −30°C

NOTE: FOR 1900 RPM, DECREASE TORQUE 5%; FOR 1700 RPM, INCREASE TORQUE 5%. DO NOT EXCEED 1940 FT LBS OR 805 °C.

| WEIGHT → | | | 10,500 POUNDS | | | | 9500 POUNDS | | | | 8500 POUNDS | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PRESSURE ALTITUDE | IOAT | OAT | TORQUE PER ENG | FUEL FLOW PER ENG | FUEL FLOW TOTAL | TAS | TORQUE PER ENG | FUEL FLOW PER ENG | FUEL FLOW TOTAL | TAS | TORQUE PER ENG | FUEL FLOW PER ENG | FUEL FLOW TOTAL | TAS |
| FEET | °C | °C | FT LB | LB/HR | LB/HR | KNOTS | FT LB | LB/HR | LB/HR | KNOTS | FT LB | LB/HR | LB/HR | KNOTS |
| SL | -11 | -15 | 1353 | 332 | 664 | 193 | 1331 | 328 | 656 | 197 | 1308 | 325 | 650 | 193 |
| 2000 | -16 | -19 | 1271 | 309 | 618 | 191 | 1246 | 305 | 610 | 191 | 1215 | 301 | 602 | 191 |
| 4000 | -20 | -23 | 1189 | 285 | 570 | 189 | 1164 | 282 | 564 | 189 | 1120 | 275 | 550 | 188 |
| 6000 | -24 | -27 | 1122 | 265 | 530 | 188 | 1086 | 259 | 518 | 187 | 1038 | 252 | 504 | 185 |
| 8000 | -28 | -31 | 1065 | 246 | 492 | 187 | 1017 | 239 | 478 | 186 | 965 | 231 | 462 | 183 |
| 10,000 | -32 | -35 | 987 | 224 | 448 | 183 | 947 | 217 | 434 | 183 | 904 | 210 | 420 | 182 |
| 12,000 | -36 | -39 | 943 | 210 | 420 | 182 | 907 | 204 | 408 | 183 | 870 | 198 | 396 | 182 |
| 14,000 | -40 | -43 | 914 | 201 | 402 | 183 | 864 | 193 | 386 | 182 | 829 | 187 | 374 | 182 |
| 16,000 | -44 | -47 | 897 | 194 | 388 | 184 | 815 | 180 | 360 | 179 | 781 | 174 | 348 | 180 |
| 18,000 | -48 | -51 | 879 | 188 | 376 | 185 | 795 | 174 | 348 | 180 | 732 | 163 | 326 | 177 |
| 20,000 | -52 | -55 | 889 | 188 | 376 | 189 | 794 | 172 | 344 | 183 | 709 | 157 | 314 | 177 |
| 22,000 | -55 | -59 | 886 | 185 | 370 | 191 | 794 | 169 | 338 | 186 | 709 | 155 | 310 | 181 |
| 24,000 | -59 | -63 | 895 | 185 | 370 | 195 | 800 | 168 | 336 | 190 | 704 | 152 | 304 | 183 |
| 26,000 | -63 | -67 | 915 | 188 | 376 | 201 | 796 | 166 | 332 | 192 | 698 | 149 | 298 | 185 |
| 28,000 | -67 | -70 | 919 | 188 | 376 | 203 | 817 | 169 | 338 | 198 | 706 | 149 | 298 | 189 |
| 29,000 | -69 | -72 | 941 | 191 | 382 | 208 | 825 | 170 | 340 | 200 | 707 | 148 | 296 | 191 |
| 31,000 | -73 | -76 | ----- | ----- | ----- | ----- | 831 | 170 | 340 | 204 | 721 | 150 | 300 | 196 |

# MAXIMUM RANGE POWER

## 1800 RPM

### ISA

NOTE: FOR 1900 RPM, DECREASE TORQUE 5%; FOR 1700 RPM, INCREASE TORQUE 5%. DO NOT EXCEED 1940 FT LBS OR 805 °C.

| WEIGHT → | | | 10,500 POUNDS | | | | 9500 POUNDS | | | | 8500 POUNDS | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PRESSURE ALTITUDE | IOAT | OAT | TORQUE PER ENG | FUEL FLOW PER ENG | FUEL FLOW TOTAL | TAS | TORQUE PER ENG | FUEL FLOW PER ENG | FUEL FLOW TOTAL | TAS | TORQUE PER ENG | FUEL FLOW PER ENG | FUEL FLOW TOTAL | TAS |
| FEET | °C | °C | FT LB | LB/HR | LB/HR | KNOTS | FT LB | LB/HR | LB/HR | KNOTS | FT LB | LB/HR | LB/HR | KNOTS |
| SL | 19 | 15 | 1295 | 333 | 666 | 196 | 1261 | 328 | 656 | 196 | 1231 | 324 | 648 | 195 |
| 2000 | 15 | 11 | 1259 | 315 | 630 | 198 | 1225 | 311 | 622 | 197 | 1199 | 307 | 614 | 197 |
| 4000 | 11 | 7 | 1256 | 302 | 604 | 201 | 1217 | 297 | 594 | 201 | 1184 | 292 | 584 | 200 |
| 6000 | 7 | 3 | 1213 | 286 | 572 | 202 | 1174 | 280 | 560 | 202 | 1137 | 275 | 550 | 201 |
| 8000 | 3 | -1 | 1170 | 270 | 540 | 203 | 1113 | 263 | 526 | 201 | 1050 | 254 | 508 | 198 |
| 10,000 | -1 | -5 | 1119 | 254 | 508 | 202 | 1058 | 245 | 490 | 200 | 988 | 236 | 472 | 197 |
| 12,000 | -5 | -9 | 1083 | 241 | 482 | 203 | 1020 | 232 | 464 | 201 | 954 | 223 | 446 | 198 |
| 14,000 | -9 | -13 | 1042 | 230 | 460 | 202 | 985 | 222 | 444 | 201 | 929 | 214 | 428 | 200 |
| 16,000 | -13 | -17 | 1015 | 220 | 440 | 203 | 953 | 211 | 422 | 202 | 895 | 203 | 406 | 200 |
| 18,000 | -17 | -21 | 993 | 213 | 426 | 204 | 922 | 202 | 404 | 202 | 863 | 193 | 386 | 200 |
| 20,000 | -21 | -25 | 963 | 205 | 410 | 204 | 902 | 194 | 388 | 203 | 832 | 184 | 368 | 200 |
| 22,000 | -25 | -29 | 942 | 199 | 398 | 204 | 884 | 189 | 378 | 204 | 804 | 176 | 352 | 200 |
| 24,000 | -29 | -33 | 944 | 198 | 396 | 207 | 867 | 184 | 368 | 205 | 787 | 171 | 342 | 201 |
| 26,000 | -33 | -37 | 971 | 202 | 404 | 214 | 853 | 181 | 362 | 206 | 775 | 167 | 334 | 203 |
| 28,000 | -36 | -40 | 986 | 205 | 410 | 218 | 874 | 184 | 368 | 212 | 767 | 164 | 328 | 205 |
| 29,000 | -38 | -42 | 1007 | 209 | 418 | 222 | 876 | 184 | 368 | 213 | 761 | 162 | 324 | 205 |
| 31,000 | -42 | -46 | ----- | ----- | ----- | ----- | 906 | 190 | 380 | 221 | 765 | 163 | 326 | 209 |

# MAXIMUM RANGE POWER

## 1800 RPM

### ISA +30°C

NOTE: FOR 1900 RPM, DECREASE TORQUE 5%; FOR 1700 RPM, INCREASE TORQUE 5%. DO NOT EXCEED 1940 FT LBS OR 805 °C.

| WEIGHT → | | | 10,500 POUNDS | | | | 9500 POUNDS | | | | 8500 POUNDS | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PRESSURE ALTITUDE | IOAT | OAT | TORQUE PER ENG | FUEL FLOW PER ENG | FUEL FLOW TOTAL | TAS | TORQUE PER ENG | FUEL FLOW PER ENG | FUEL FLOW TOTAL | TAS | TORQUE PER ENG | FUEL FLOW PER ENG | FUEL FLOW TOTAL | TAS |
| FEET | °C | °C | FT LB | LB/HR | LB/HR | KNOTS | FT LB | LB/HR | LB/HR | KNOTS | FT LB | LB/HR | LB/HR | KNOTS |
| SL | 49 | 45 | 1308 | 345 | 690 | 204 | 1215 | 332 | 664 | 199 | 1169 | 326 | 652 | 198 |
| 2000 | 45 | 41 | 1241 | 323 | 646 | 203 | 1188 | 315 | 630 | 201 | 1136 | 308 | 616 | 200 |
| 4000 | 41 | 37 | 1225 | 307 | 614 | 205 | 1172 | 300 | 600 | 204 | 1131 | 294 | 588 | 203 |
| 6000 | 37 | 33 | 1227 | 295 | 590 | 210 | 1160 | 286 | 572 | 207 | 1109 | 279 | 558 | 206 |
| 8000 | 33 | 29 | 1201 | 282 | 564 | 212 | 1117 | 270 | 540 | 208 | 1045 | 261 | 522 | 205 |
| 10,000 | 29 | 25 | 1160 | 266 | 532 | 212 | 1075 | 254 | 508 | 208 | 994 | 244 | 488 | 204 |
| 12,000 | 25 | 21 | 1131 | 254 | 508 | 214 | 1052 | 243 | 486 | 210 | 962 | 231 | 462 | 205 |
| 14,000 | 21 | 17 | 1090 | 242 | 484 | 214 | 1025 | 232 | 446 | 212 | 938 | 220 | 440 | 207 |
| 16,000 | 17 | 13 | 1040 | 230 | 460 | 212 | 998 | 223 | 446 | 213 | 919 | 211 | 422 | 209 |
| 18,000 | 14 | 9 | 1101 | 219 | 438 | 211 | 961 | 212 | 424 | 213 | 891 | 201 | 402 | 210 |
| 20,000 | 10 | 5 | 998 | 215 | 430 | 214 | 923 | 202 | 404 | 212 | 871 | 194 | 388 | 212 |
| 22,000 | 6 | 1 | 1011 | 216 | 432 | 218 | 896 | 195 | 390 | 211 | 850 | 187 | 374 | 213 |
| 24,000 | 2 | -3 | 1019 | 216 | 432 | 222 | 894 | 193 | 386 | 214 | 817 | 179 | 358 | 212 |
| 26,000 | -2 | -7 | ----- | ----- | ----- | ----- | 907 | 194 | 388 | 219 | 795 | 173 | 346 | 212 |
| 28,000 | -10 | -10 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 798 | 172 | 344 | 215 |
| 29,000 | -8 | -12 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 807 | 174 | 348 | 218 |
| 31,000 | -12 | -16 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |

# RANGE PROFILE - FULL MAIN AND AUX TANKS

## STANDARD DAY

ASSOCIATED CONDITIONS:

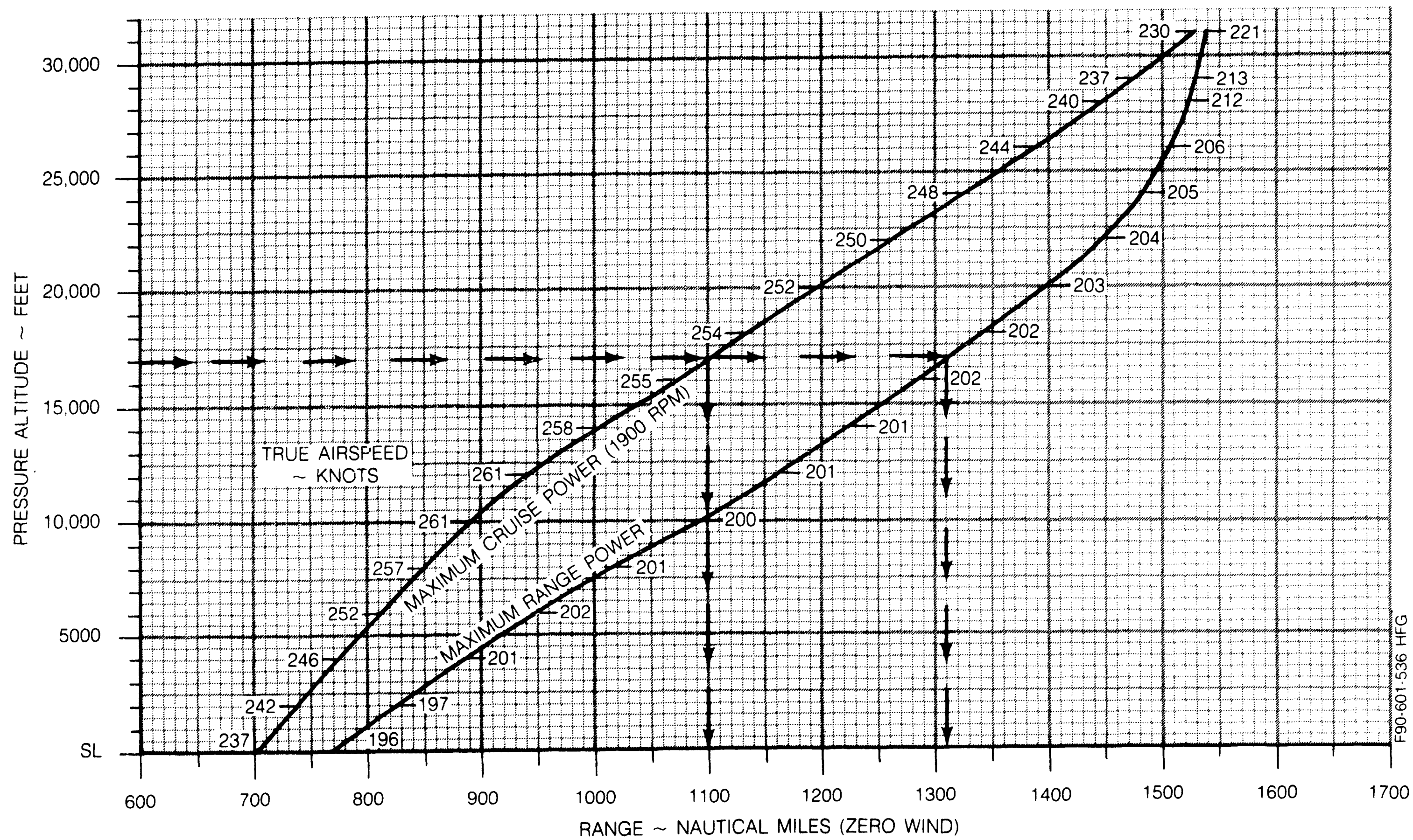
WEIGHT .................... 11,030 LBS BEFORE ENGINE START
FUEL ...................... AVIATION KEROSENE
FUEL DENSITY ............. 6.7 LBS/GAL

EXAMPLE:

PRESSURE ALTITUDE ........... 17,000 FT

RANGE @ MAX CRUISE POWER ............... 1100 NM
RANGE @ MAX RANGE POWER ............... 1310 NM

NOTE: RANGE INCLUDES START, TAXI, CLIMB AND DESCENT WITH 45 MINUTES RESERVE FUEL AT MAXIMUM RANGE POWER.



# ENDURANCE PROFILE - FULL MAIN AND AUX TANKS

## STANDARD DAY

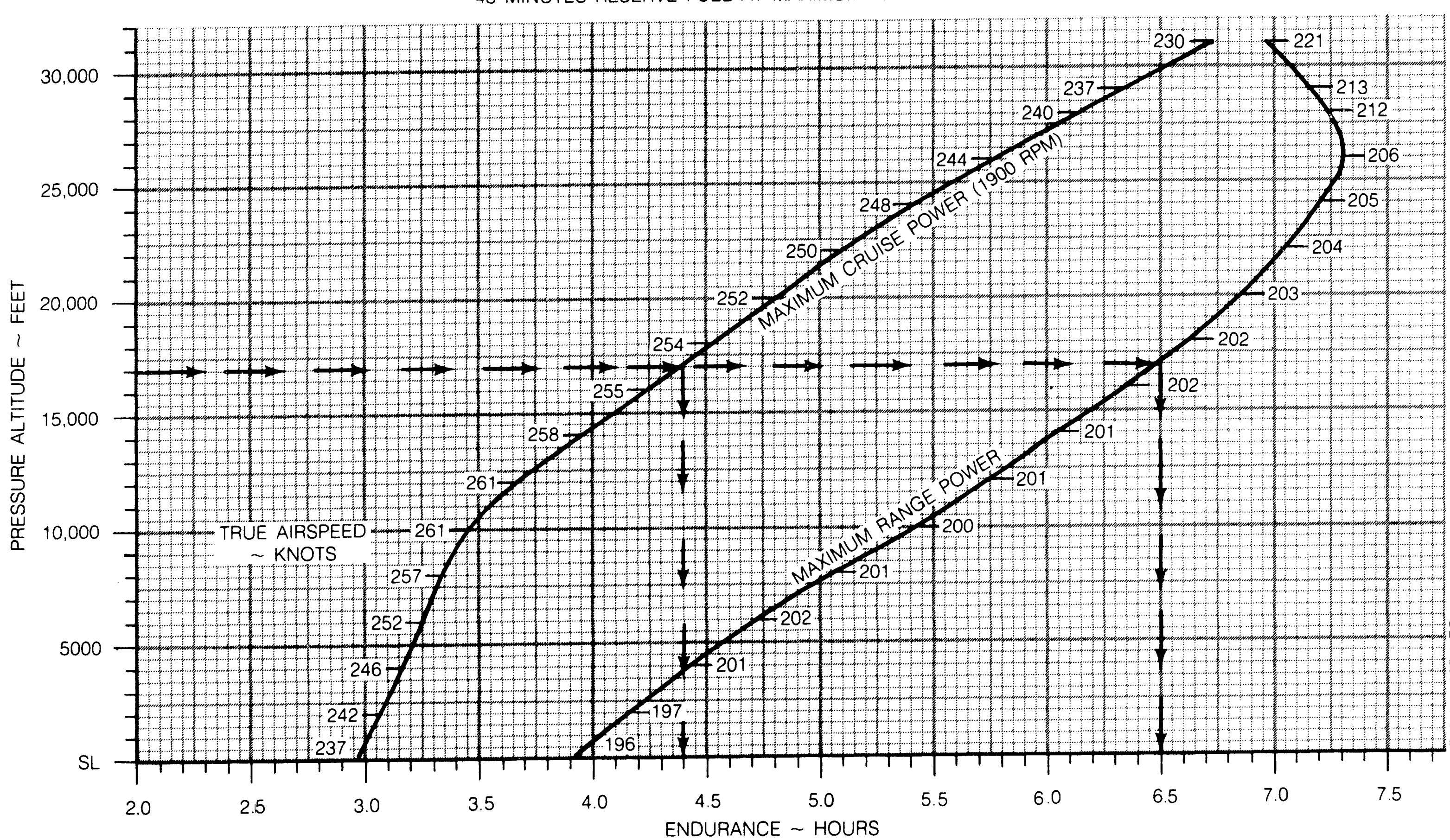
ASSOCIATED CONDITIONS:

WEIGHT .................. 11,030 LBS BEFORE ENGINE START
FUEL ...................... AVIATION KEROSENE
FUEL DENSITY ............. 6.7 LBS/GAL

EXAMPLE:

PRESSURE ALTITUDE ........... 17,000 FT
ENDURANCE @ MAX CRUISE POWER ............... 4.4 HRS
ENDURANCE @ MAX RANGE POWER ............... 6.5 HRS

NOTE: ENDURANCE INCLUDES START, TAXI, CLIMB AND DESCENT WITH 45 MINUTES RESERVE FUEL AT MAXIMUM RANGE POWER.



# RANGE PROFILE – FULL MAIN TANKS

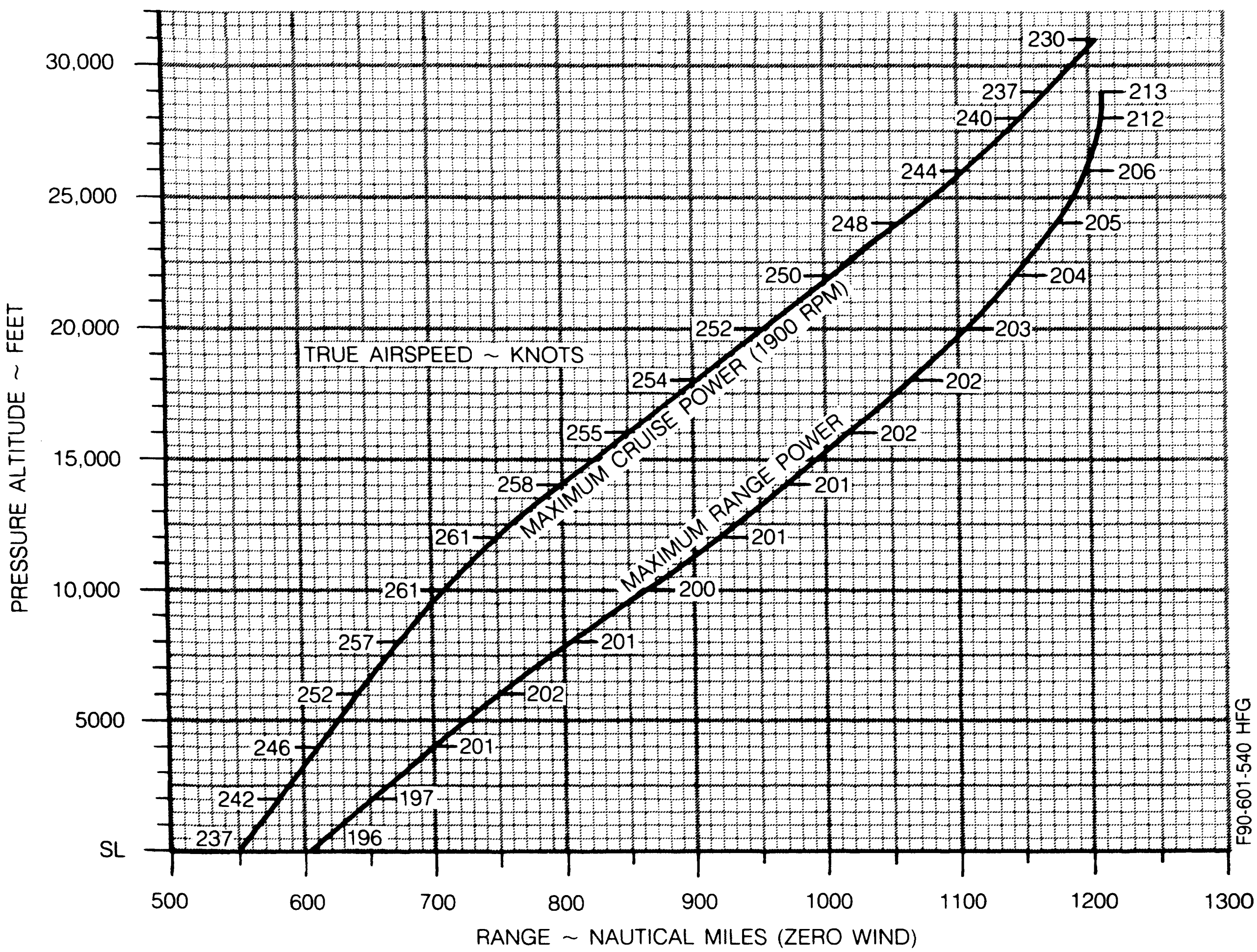
## STANDARD DAY

ASSOCIATED CONDITIONS:

WEIGHT .................. 11,030 LBS BEFORE ENGINE START
FUEL ..................... AVIATION KEROSENE
FUEL DENSITY ............ 6.7 LBS/GAL

NOTE:

RANGE INCLUDES START, TAXI, CLIMB AND DESCENT WITH 45 MINUTES RESERVE FUEL AT MAXIMUM RANGE POWER.



# ENDURANCE PROFILE – FULL MAIN TANKS

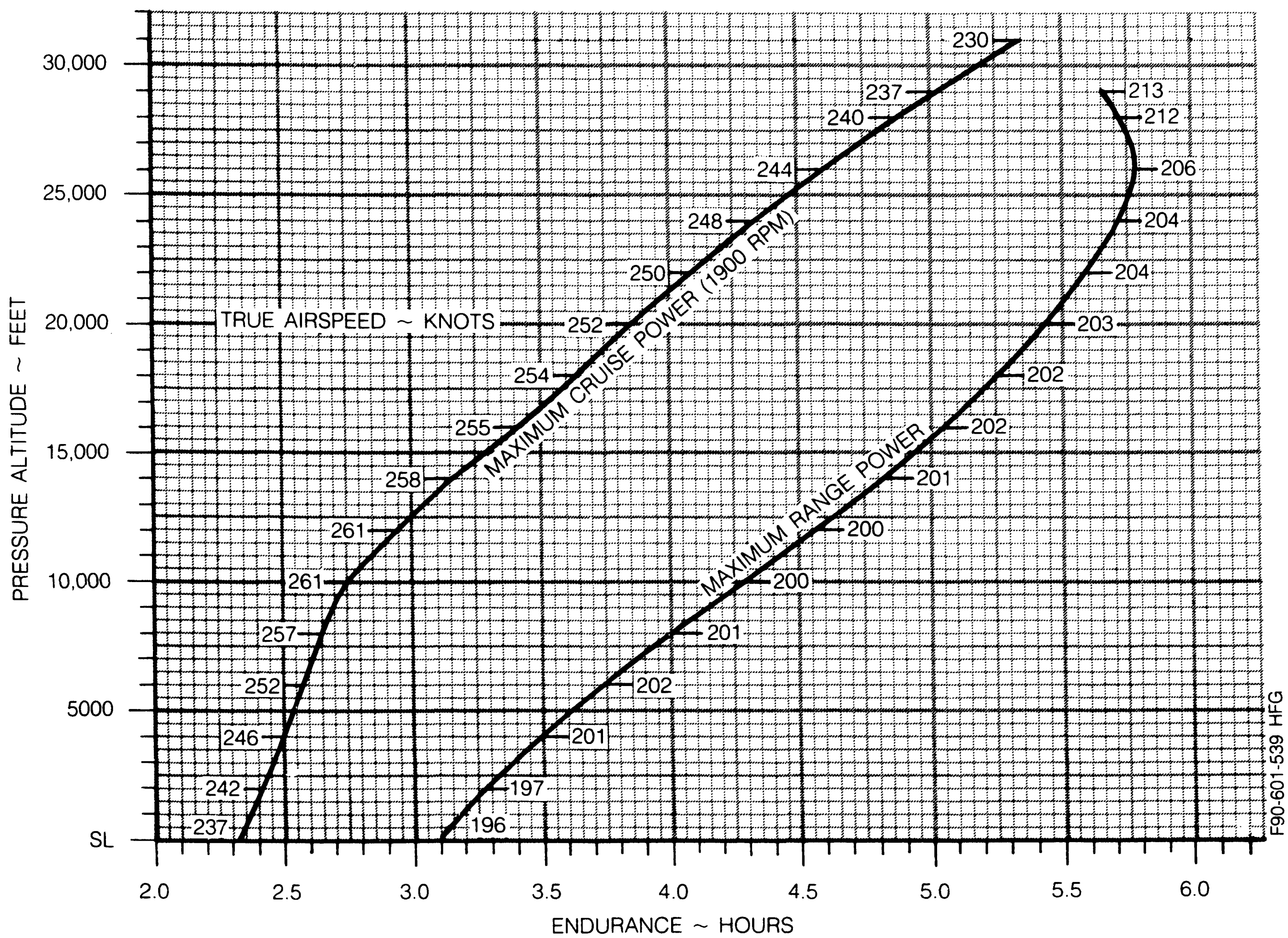
## STANDARD DAY

ASSOCIATED CONDITIONS:

WEIGHT .................. 11,030 LBS BEFORE ENGINE START
FUEL ...................... AVIATION KEROSENE
FUEL DENSITY ............ 6.7 LBS/GAL

NOTE:

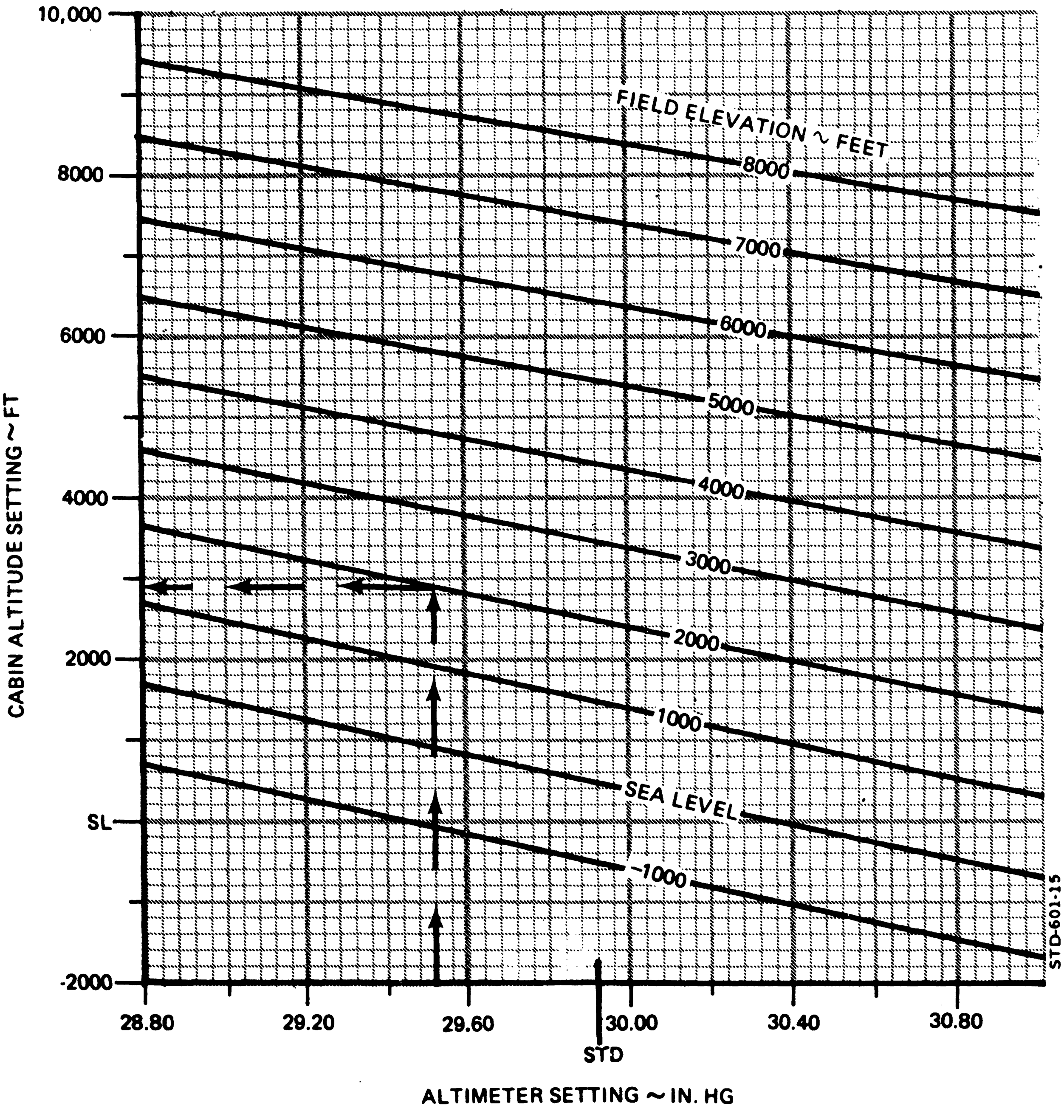
ENDURANCE INCLUDES START, TAXI, CLIMB AND DESCENT WITH 45 MINUTES RESERVE FUEL AT MAXIMUM RANGE POWER.



# PRESSURIZATION CONTROLLER SETTING FOR LANDING

EXAMPLE:

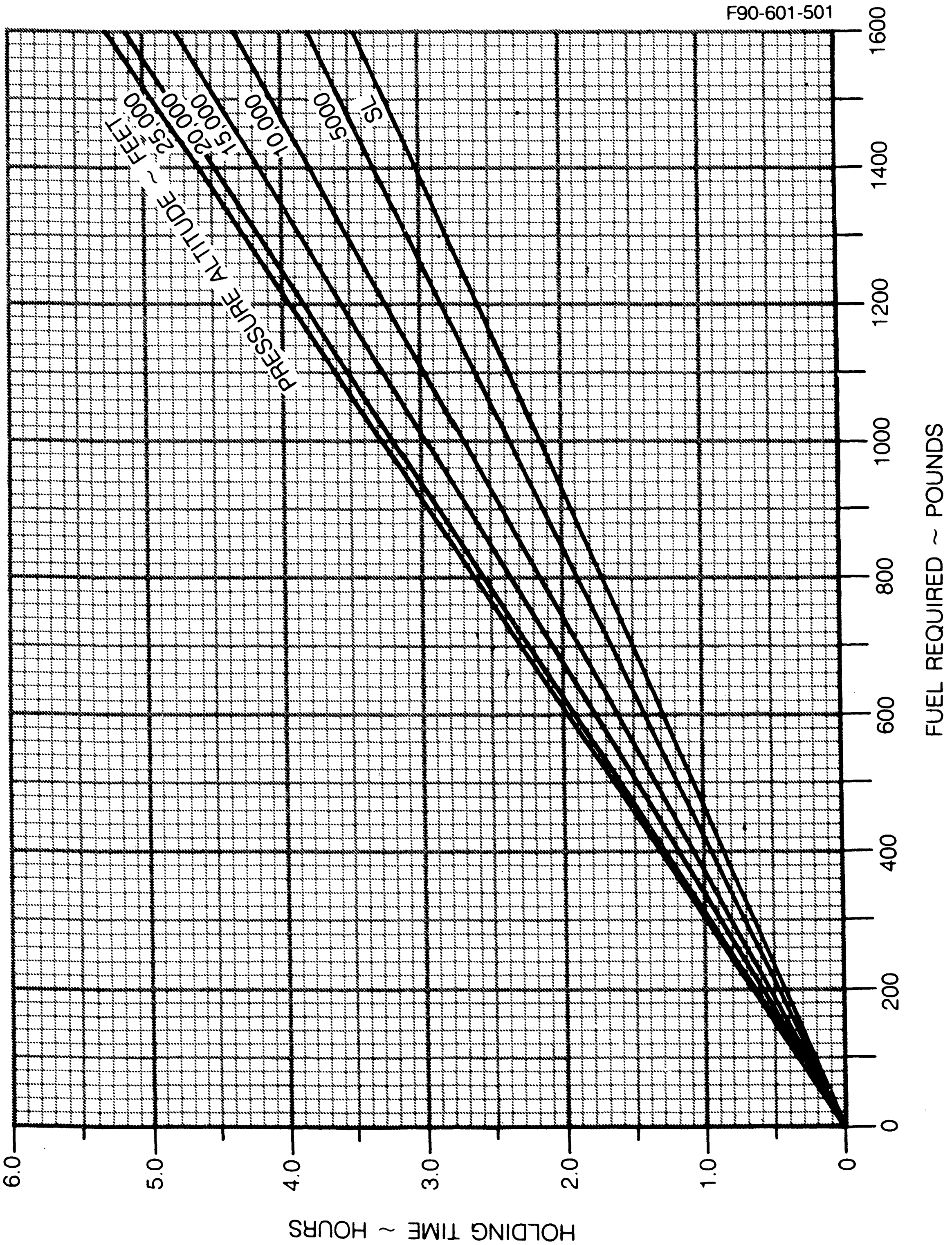
ALTIMETER SETTING . . . . . . . 29.52 In.Hg
LANDING FIELD ELEVATION. . 2000 FEET
CABIN ALTITUDE SETTING . . . 2885 FEET



# HOLDING TIME

## AIRSPEED ~ 130 KNOTS

## ALL WEIGHTS, ALL TEMPERATURES



# TIME, FUEL, AND DISTANCE TO DESCEND

ASSOCIATED CONDITIONS:

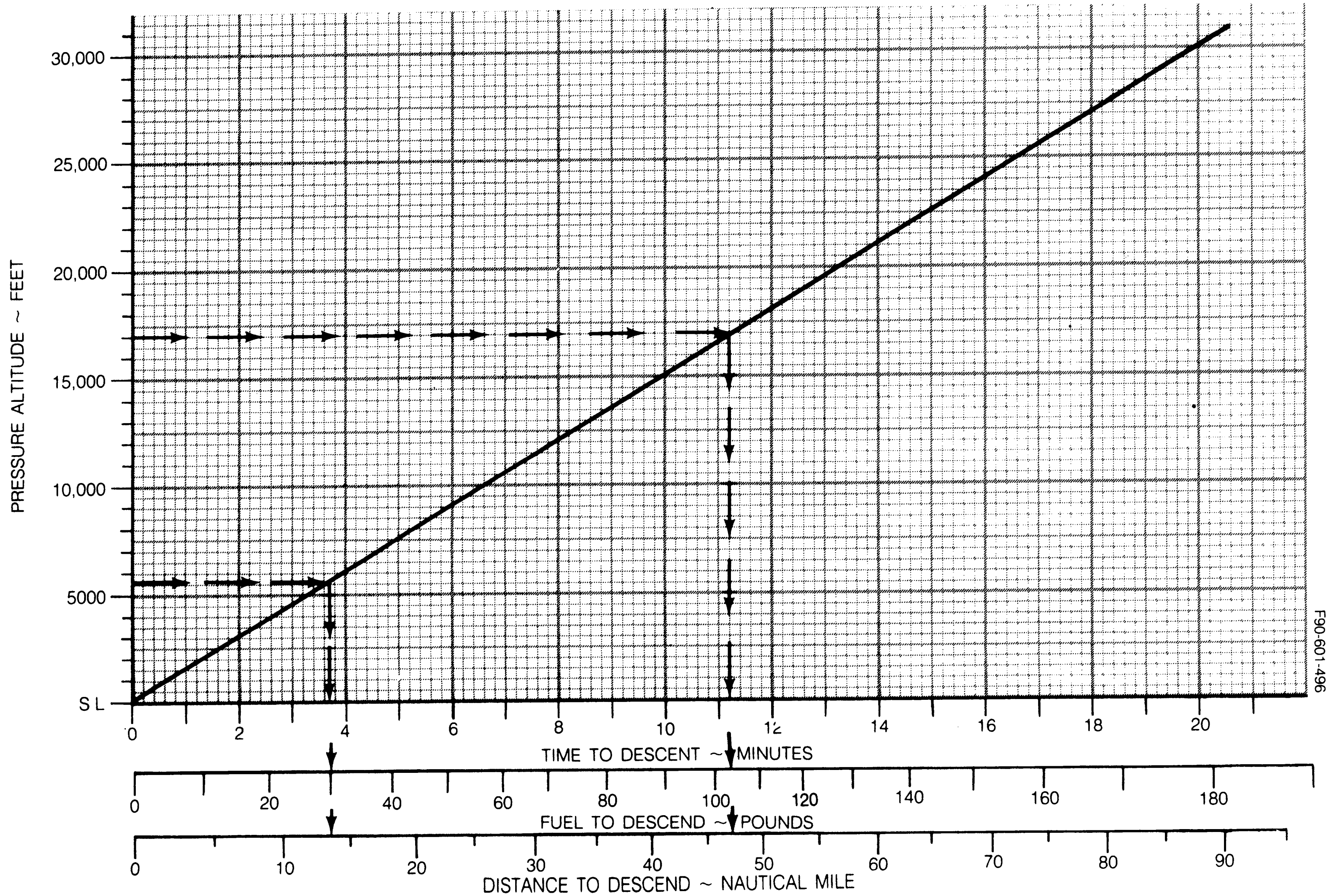
POWER ..........AS REQUIRED TO DESCEND AT 1500 FT/MIN
GEAR ............UP
FLAPS............UP

| ALTITUDE ~ FEET | DESCENT SPEED |
|---|---|
| 31,000 TO 18,000 | MMO |
| 18,000 TO SL | 220 KNOTS |

EXAMPLE:

INITIAL ALTITUDE .............17,000 FT
FINAL ALTITUDE ..............5651 FT

TIME TO DESCEND ............11-4 = 7 MIN
FUEL TO DESCEND............104-30 = 74 LBS
DISTANCE TO DESCEND.......47-13 = 34 NM



# LANDING DISTANCE WITHOUT PROPELLER REVERSING – FLAPS 100%

ASSOCIATED CONDITIONS:

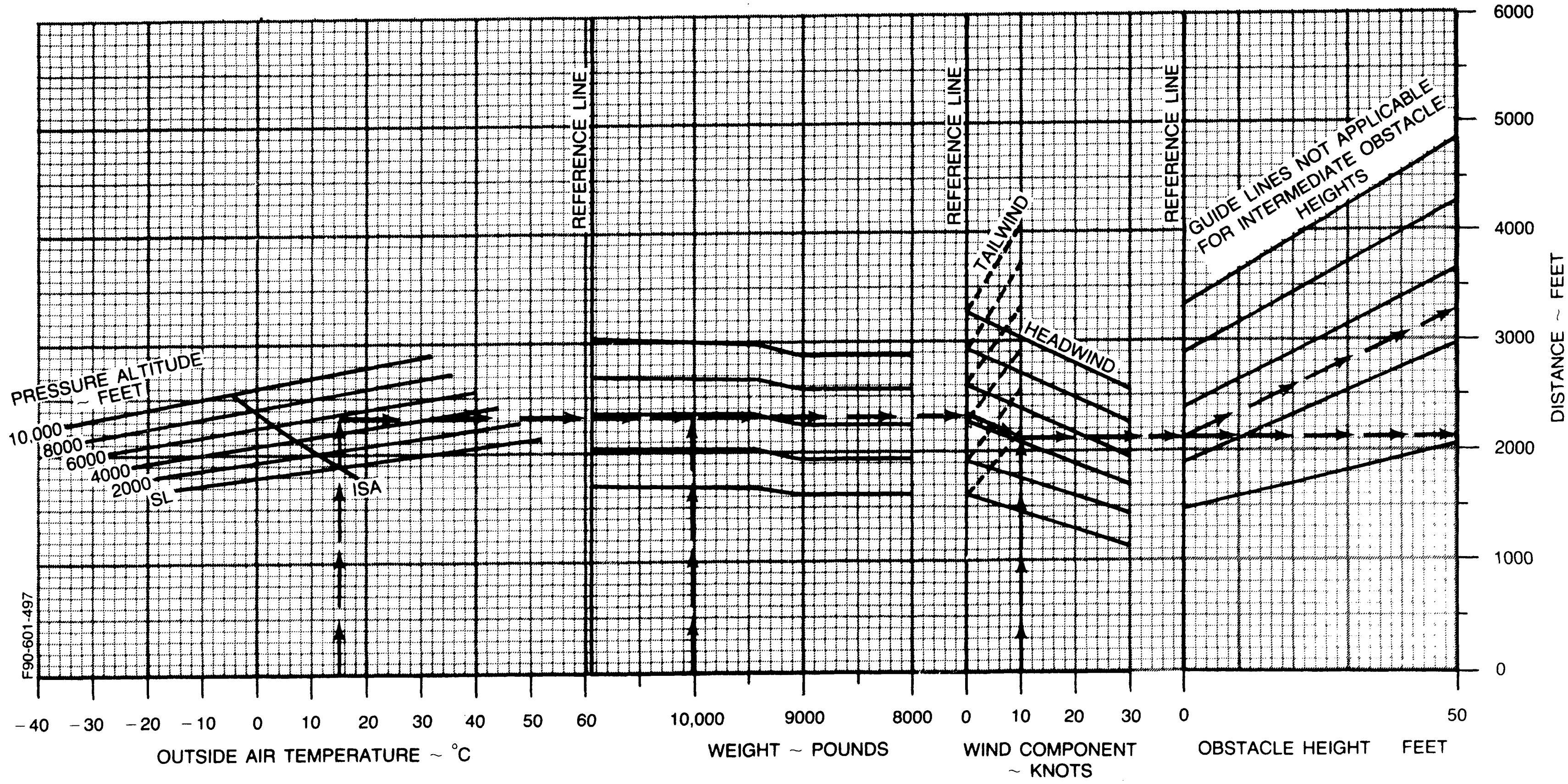
POWER .................... RETARDED TO MAINTAIN 550 FT/MIN ON FINAL APPROACH
FLAPS ..................... 100%
RUNWAY.................... PAVED, LEVEL, DRY SURFACE
BRAKING.................... MAXIMUM
CONDITION LEVERS ....... LOW IDLE
PROPELLER CONTROLS ... FULL FORWARD

| WEIGHT ~ POUNDS | APPROACH SPEED ~ KNOTS |
|---|---|
| 10,950 | 108 |
| 10,000 | 108 |
| 9000 | 105 |
| 8000 | 103 |

EXAMPLE:

OAT .......................... 15°C
PRESSURE ALTITUDE ......... 5651 FT
LANDING WEIGHT ............. 10,015 LBS
HEADWIND COMPONENT ...... 10 KTS

GROUND ROLL ................ 2125 FT
TOTAL OVER 50-FT OBSTACLE ............ 3260 FT
APPROACH SPEED ............ 108 KTS



# LANDING DISTANCE WITHOUT PROPELLER REVERSING – FLAPS 0%

ASSOCIATED CONDITIONS:

POWER .................... RETARDED TO MAINTAIN 750 FT/MIN ON FINAL APPROACH
FLAPS .................... 0%
RUNWAY.................... PAVED, LEVEL, DRY SURFACE
BRAKING................... MAXIMUM
CONDITION LEVERS ....... LOW IDLE
PROPELLER CONTROLS ... FULL FORWARD

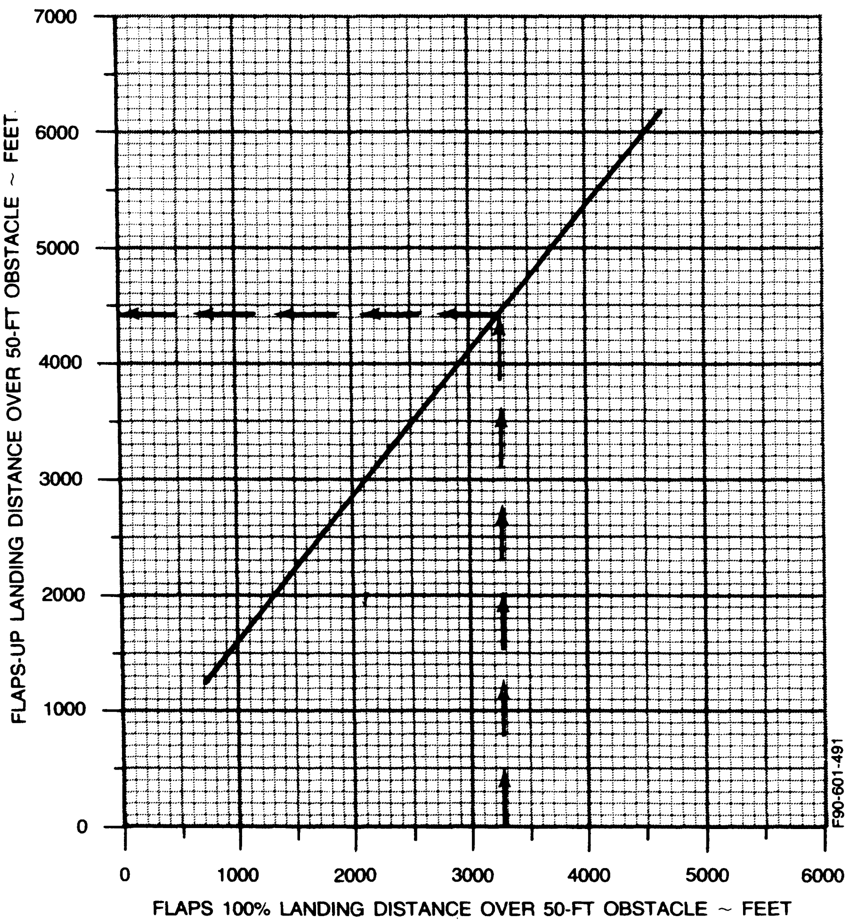
| WEIGHT ~ POUNDS | APPROACH SPEED ~ KNOTS |
|---|---|
| 10,950 | 127 |
| 10,000 | 122 |
| 9000 | 115 |
| 8000 | 108 |

EXAMPLE:

FLAPS - 100% LANDING DISTANCE OVER 50-FOOT OBSTACLE ............ 3260 FT
LANDING WEIGHT.............. 10,015 LBS

FLAPS-UP LANDING DISTANCE OVER 50-FOOT OBSTACLE ............ 4430 FT
APPROACH SPEED ............ 122 KTS

NOTES: 1. LANDING WITH FLAPS FULL DOWN (100%) IS NORMAL PROCEDURE. USE THIS GRAPH WHEN IT IS NECESSARY TO LAND WITH FLAPS UP (0%)
2. TO DETERMINE FLAPS-UP LANDING DISTANCE, READ FROM THE **LANDING DISTANCE WITHOUT PROPELLER REVERSING – FLAPS 100%** GRAPH THE LANDING DISTANCE APPROPRIATE TO OAT, ALTITUDE, WEIGHT, WIND, AND 50-FT OBSTACLE, THEN ENTER THIS GRAPH WITH THE DERIVED VALUE AND READ THE FLAPS-UP LANDING DISTANCE.



# LANDING DISTANCE WITHOUT PROPELLER REVERSING-FLAPS 100%
## GRASS SURFACE

ASSOCIATED CONDITIONS:

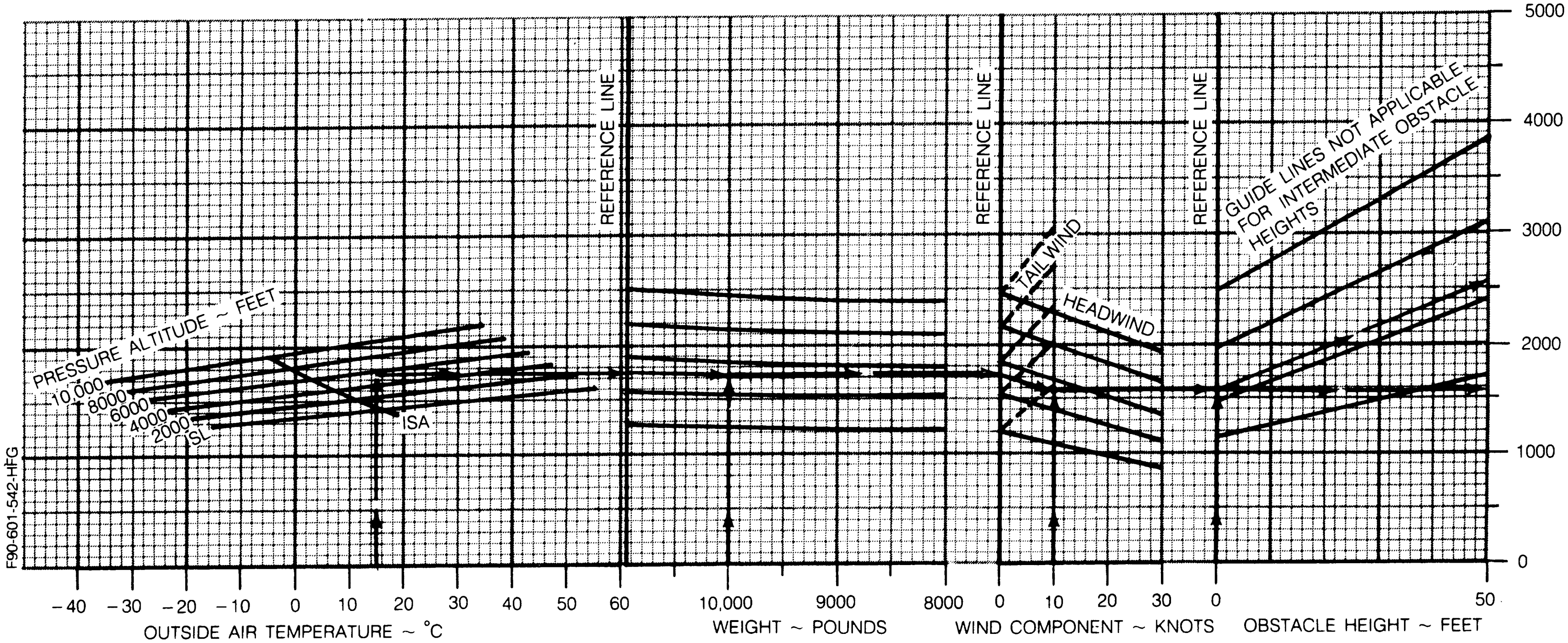
POWER .................... RETARDED TO MAINTAIN 550 FT/MIN ON FINAL APPROACH
FLAPS...................... 100%
RUNWAY .................. SHORT, DRY, GRASS WITH FIRM SUBSOIL
BRAKING.................. MAXIMUM
CONDITION LEVERS........ LOW IDLE
PROPELLER CONTROLS .... FULL FORWARD

| WEIGHT ~ POUNDS | APPROACH SPEED ~ KNOTS |
|---|---|
| 10,950 | 108 |
| 10,000 | 108 |
| 9000 | 105 |
| 8000 | 103 |

EXAMPLE:

OAT.............................. 15°C
PRESSURE ALTITUDE.............. 5651 FEET
LANDING WEIGHT................. 9998 LBS
HEADWIND COMPONENT.......... 10 KNOTS

GROUND ROLL .................. 1580 FT
TOTAL OVER 50-FT OBSTACLE ..... 2560 FT



INTENTIONALLY LEFT BLANK

# LANDING DISTANCE WITH PROPELLER REVERSING – FLAPS 100%

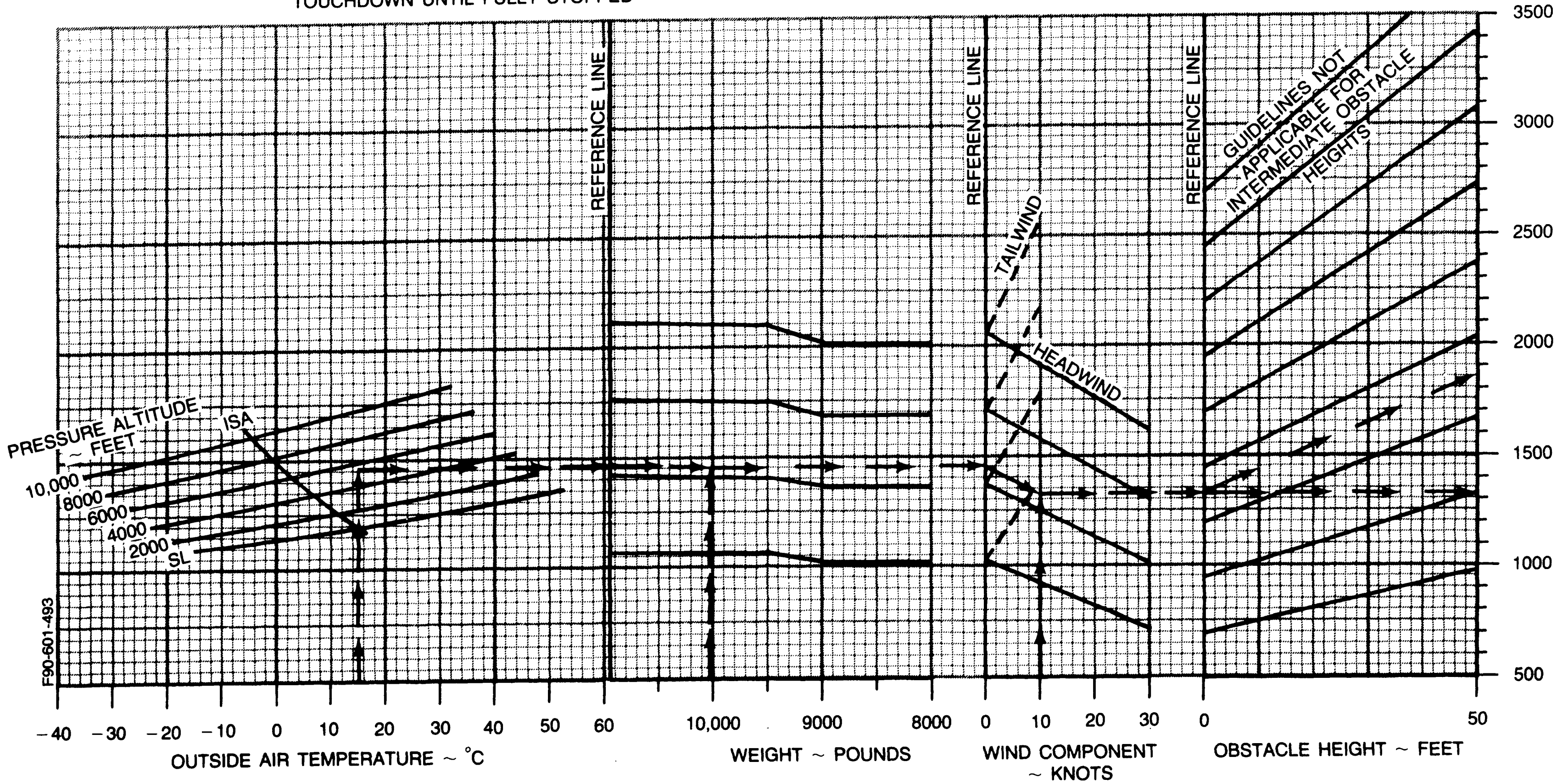
ASSOCIATED CONDITIONS:

| | |
|---|---|
| POWER | RETARDED TO MAINTAIN 550 FT/MIN ON FINAL APPROACH |
| FLAPS | 100% |
| RUNWAY | PAVED, LEVEL, DRY SURFACE |
| BRAKING | MAXIMUM |
| CONDITION LEVERS | HIGH IDLE |
| PROPELLER CONTROLS | FULL FORWARD |
| POWER LEVERS | MAXIMUM REVERSE AFTER TOUCHDOWN UNTIL FULLY STOPPED |

| WEIGHT ~ POUNDS | APPROACH SPEED ~ KNOTS |
|---|---|
| 10,950 | 108 |
| 10,000 | 108 |
| 9,000 | 105 |
| 8,000 | 103 |

EXAMPLE:

| | |
|---|---|
| OAT | 15°C |
| PRESSURE ALTITUDE | 5651 FT |
| LANDING WEIGHT | 10,015 LBS |
| HEADWIND COMPONENT | 10 KT |
| GROUND ROLL | 1330 FT |
| TOTAL OVER 50-FT OBSTACLE | 1850 FT |
| APPROACH SPEED | 108 KTS |



# LANDING DISTANCE WITH PROPELLER REVERSING – FLAPS 0%

ASSOCIATED CONDITIONS:

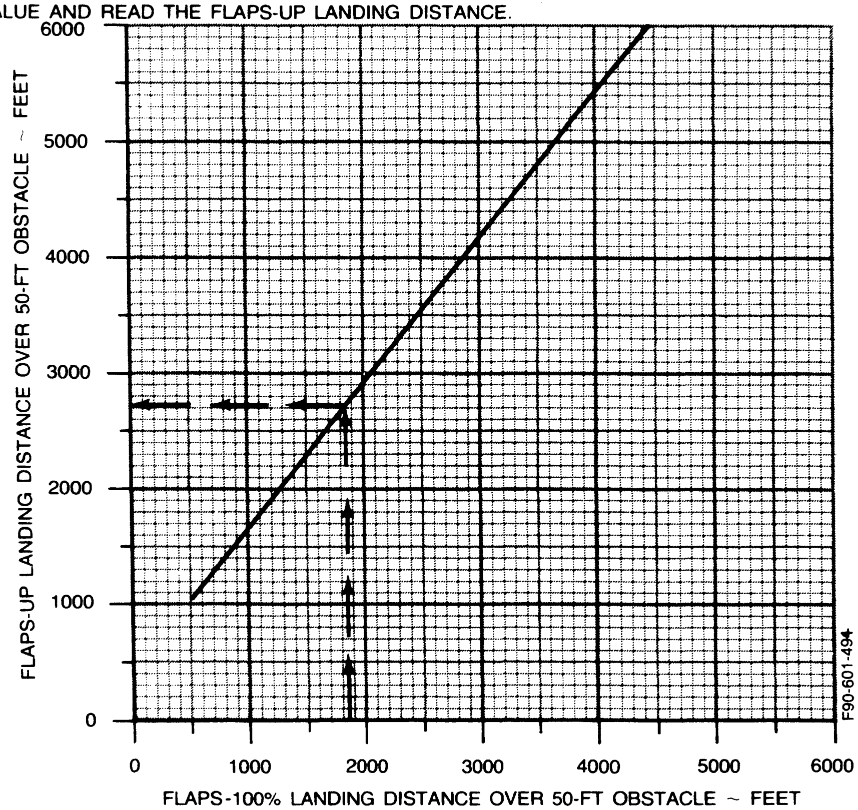
| | |
|---|---|
| POWER | RETARDED TO MAINTAIN 750 FT/MIN ON FINAL APPROACH |
| FLAPS | 0% |
| RUNWAY | PAVED, LEVEL, DRY SURFACE |
| BRAKING | MAXIMUM |
| CONDITION LEVERS | HIGH IDLE |
| PROPELLER CONTROLS | FULL FORWARD |
| POWER LEVERS | MAXIMUM REVERSE AFTER TOUCHDOWN UNTIL FULLY STOPPED |

| WEIGHT ~ POUNDS | APPROACH SPEED ~ KNOTS |
|---|---|
| 10,950 | 127 |
| 10,000 | 122 |
| 9000 | 115 |
| 8000 | 108 |

EXAMPLE:

| | |
|---|---|
| FLAPS - 100% LANDING DISTANCE OVER 50-FOOT OBSTACLE | 1850 FT |
| LANDING WEIGHT | 10,015 LBS |
| FLAPS-UP LANDING DISTANCE OVER 50-FOOT OBSTACLE | 2720 FT |
| APPROACH SPEED | 122 KTS |

NOTES:
1. LANDING WITH FLAPS FULL DOWN (100%) IS NORMAL PROCEDURE. USE THIS GRAPH WHEN IT IS NECESSARY TO LAND WITH FLAPS UP (0%).
2. TO DETERMINE FLAPS-UP LANDING DISTANCE, READ FROM THE **LANDING DISTANCE WITH PROPELLER REVERSING – FLAPS 100%** GRAPH THE LANDING DISTANCE APPROPRIATE TO OAT, ALTITUDE, WEIGHT, WIND, AND 50-FT OBSTACLE, THEN ENTER THIS GRAPH WITH THE DERIVED VALUE AND READ THE FLAPS-UP LANDING DISTANCE.



# LANDING DISTANCE WITH PROPELLER REVERSING ~ FLAPS 100%

## GRASS SURFACE

ASSOCIATED CONDITIONS:

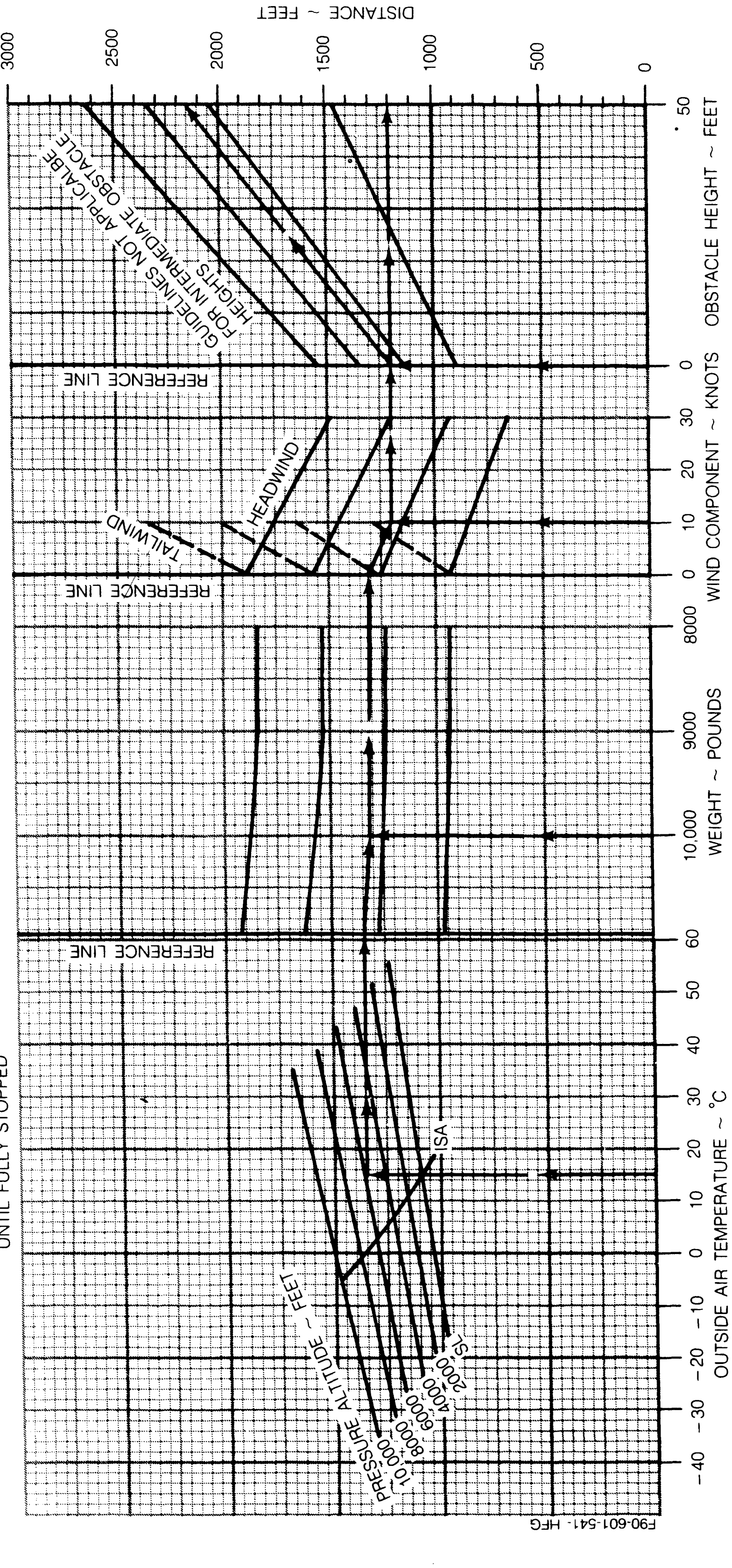
POWER ........................ RETARD TO MAINTAIN 550 FT/MIN DESCENT ON FINAL APPROACH
FLAPS ........................ 100%
RUNWAY ....................... SHORT, DRY, GRASS WITH FIRM SUBSOIL
BRAKING ...................... MAXIMUM
CONDITION LEVERS ............. HIGH IDLE
PROPELLER CONTROLS ........... FULL FORWARD
POWER LEVERS ................. MAXIMUM REVERSE AFTER TOUCHDOWN UNTIL FULLY STOPPED

| WEIGHT ~ POUNDS | APPROACH SPEED ~ KNOTS |
|---|---|
| 10,950 | 108 |
| 10,000 | 108 |
| 9000 | 105 |
| 8000 | 103 |

EXAMPLE:

OAT ........................ 15°C
PRESSURE ALTITUDE ........... 5651 FT
LANDING WEIGHT .............. 9998 LBS
HEADWIND COMPONENT .......... 10 KNOTS

GROUND ROLL ................. 1200 FT
TOTAL OVER 50-FT OBSTACLE ... 2150 FT



# BEECHCRAFT KING AIR F90
# LANDPLANE

## PILOT'S OPERATING HANDBOOK AND FAA APPROVED

## AIRPLANE FLIGHT MANUAL SUPPLEMENT

## for the

## KING KFC 300 AUTOMATIC FLIGHT CONTROL SYSTEM
## (RNAV AND VNAV OPTIONAL)
## CATEGORY I

The information in this supplement is FAA-approved material and must be attached to the *Pilot's Operating Handbook and FAA Approved Airplane Flight Manual* when the airplane has been modified by installation of the King KFC 300 Automatic Flight Control System in accordance with Beech approved data.

The information in this supplement supersedes or adds to the basic *Pilot's Operating Handbook and FAA Approved Airplane Flight Manual* only as set forth within this document. Users of the manual are advised always to refer to the supplement for possibly superseding information and placarding applicable to operation of the airplane.

### LIMITATIONS

1. During autopilot operations, pilot must be seated at the controls with seat belt fastened.
2. Maximum speed limit for autopilot operation is unchanged from the airplane maximum airspeed limit ($V_{MO}/M_{MO}$).
3. Do not use autopilot under 200 feet above terrain.
4. Do not use autopilot or yaw damper during takeoff or landing.
5. The Vertical Navigation (VNAV) function is NOT approved for use in the IFR Approach configuration.
6. The flaps must not be operated beyond the Approach position with the autopilot engaged.

### NORMAL PROCEDURES

NOTE

The autopilot incorporates its own annunciator panel located just above the flight director display on the instrument panel. The modes and indications given on the annunciator panel are placarded on the face of the plastic lenses and illuminate when the respective conditions are indicated. Located on the left side of the autopilot annunciator panel is a light sensitive dimmer switch to control light intensity for night operation. The switches on the mode selector are push-on, push-off type. When engaged, the corresponding flight director annunciator light illuminates. For operation at night, the OVERHEAD SUBPANEL AND CONSOLE light control for the backlighting of the switches is located on the overhead console.

## PREFLIGHT

Neither the autopilot nor the flight director may be turned on if the attitude flag is visible on the flight command indicator or if the gyros are not up to operating speed.

1. Check that all circuit breakers for the autopilot are in.
2. Turn the battery, inverter, and avionics switches on and engage the flight director to bring the command bars into view.
3. Engage the autopilot and yaw damper. (The autopilot will not engage when the flight director is inoperative.) Check that the system can be overpowered in all three axes.
4. Press and hold the preflight test button located on the lower left corner of the flight command indicator. This will activate a self test cycle provided to preflight the autopilot and flight director system. Note the following sequence for the test cycle:
   a. All autopilot and flight director warning and mode lights should illuminate and remain lighted until the test has been completed.
   b. A simulated climbing right turn of 10° pitch up and 10° right roll will appear on the attitude display.
   c. The command bars will remain centered with the airplane reference symbol until the flight director, autopilot computer, and servos check valid.
   d. All three servo actuator monitors will trip.
   e. The autopilot and yaw damper will disengage to demonstrate proper computer monitor operation.
   f. The command bars will come into exact alignment with the original horizon display after the flight director computer, autopilot computer, and servos check valid.
5. Release the preflight test button and check to see that warning and mode lights extinguish. A warning light illuminated after the test button is released indicates malfunction for that mode.
6. Check for proper trim action as follows:
   a. Position the command bars approximately 5° above the airplane reference symbol with the vertical trim switch (on mode controller).
   b. Engage the autopilot and yaw damper. Trim should run in nose up direction 3 to 4 seconds after autopilot engagement.
   c. Depress and hold the TRIM TEST switch (on pedestal). The trim should cease operation and the A/P TRIM FAIL light should illuminate in 15 to 20 seconds.
   d. Release and depress the TRIM TEST switch. Actuate the control wheel trim switches to the nose down direction. The trim should run in the nose down direction and the A/P TRIM FAIL light should illuminate immediately.
   e. Repeat the procedures with the command bars positioned approximately 5° below the aircraft symbol. Trim operation should be reversed from the previous as specified.
7. Disengage the autopilot by depressing the AP/YD DISC switch on the pilot's control wheel.

## INFLIGHT

### *ENGAGING THE AUTOPILOT*

1. Engage the flight director by depressing the FLT DIR switch on the mode controller or by depressing

the PITCH SYNC & CWS switch on the pilot's control wheel. The existing pitch attitude and heading information will be retained on the flight command indicator command bars as they are brought into view.

2. Engage the autopilot. The autopilot action is always in response to, and consistent with, flight director commands. When engaged by the solenoid-held toggle switch on the mode controller, the autopilot will respond to any operating mode through a fader circuit, which allows engagement into an unsatisfied flight director command without an abrupt control transient.

3. Depressing the control wheel steering (PITCH SYNC & CWS) button located on the horn of the pilot's control wheel, allows the pilot to momentarily revert to manual control in pitch and roll (yaw damper stays engaged), while retaining his previous mode program, and to conveniently resume that program upon release of the switch.

4. The autopilot, together with the yaw damper, provides three-axis rate stabilization, automatic turn coordination, and automatic elevator trim as well as automatic response to all flight director modes.

NOTE

To obtain the best overall autopilot performance, airspeeds of less than 115 knots are not recommended with the autopilot engaged.

### *HEADING CONTROL OPERATION*

The flight control system is electrically connected to the directional gyro for heading hold information whenever the system is in basic flight director mode. Heading hold is automatically disengaged when an incompatible lateral mode is engaged or when the control wheel PITCH SYNC & CWS switch is depressed and held.

Pressing the HDS SEL mode button automatically causes the airplane to execute a pre-selected heading change as set on the pictorial navigation indicator with either the HDG control knob on the indicator or the HDG SEL spring loaded knob on the mode controller. Heading changes using HDG SEL mode will bank the airplane 1.5 degrees for every degree of heading change selected up to a maximum bank angle of 25 degrees.

### *VERTICAL CONTROL OPERATION*

1. Vertical Trim:

   Operation of the vertical trim switch (on mode controller), provides a convenient means of adjusting the reference parameter of all the vertical modes except glideslope and vertical navigation. This permits the pilot to change his vertical reference without disengaging and re-engaging modes.

2. Altitude Hold:

   The altitude hold mode may be engaged by pressing the ALT mode switch on the mode controller. The airplane will maintain the pressure altitude existing at the time the switch is depressed. Altitude hold may be engaged at any rate-of-climb or descent. For best performance, engagement should be made after establishing stabilized operation in any other vertical mode. Altitude hold is automatically disengaged when any other vertical mode is selected. The vertical trim switch may be used to trim the referenced altitude up or down at approximately 500 fpm.

3. Altitude Select:

   This mode allows the pilot to select, arm, and upon approaching the pre-set altitude, obtain an automatic visual pitch command to capture and hold the preselected altitude. Prior to selecting the function, the pilot must set the desired altitude (by means of rotary control knobs) into the selected altitude readout of the vertical navigation computer (or altitude selector). The ALT ARM button on the vertical navigation computer (or altitude selector) may be depressed any time during climb or descent, to arm the altitude capture circuitry and the ALT ARM annunciator will illuminate. As the airplane approaches the selected altitude, the ALT ARM annunciator will extinguish, and as the airplane passes through the selected altitude, the altitude hold will automatically engage and the ALT HOLD annunciator light will illuminate.

4. Indicated Airspeed Hold:

   Engaging the indicated airspeed hold mode will introduce a computed, visually-displayed pitch command to maintain the reference airspeed. The mode is utilized by maneuvering the airplane, and setting engine power, to attain the desired speed in climb, descent, or level flight and then depressing the IAS button. The reference airspeed may be adjusted at a rate of approximately one knot per second by operation of the vertical trim switch on the mode controller.

5. Speed Profile:

   Engaging the speed profile mode will introduce a visually displayed pitch command on the flight command indicator which varies the indicated climb or descent speed as a function of altitude. During climb, airspeed is decreased at the rate of 1.75 knots per 1000 feet. The proper initial airspeed must be set up by the pilot and correct power settings maintained before depressing the SPD PRF button. After engagement, airspeed reference may be trimmed using the vertical trim switch.

6. Vertical Navigation:

   The vertical navigation computer provides a computed pitch command, which is displayed on the flight command indicator, to capture and maintain a vertical track angle in ascent or descent to a selected waypoint or VORTAC facility.

   An MDA toggle switch on the vertical navigation computer allows the pilot to activate the MDA annunciator and warning horn for warning when the minimum descent altitude is reached.

7. Altitude Alerting:

   Two altitude alert lights, one on the vertical navigation computer (or altitude selector) and one on the servoed altimeter, provide altitude alerting with the vertical navigation (or altitude selector) computer. When the airplane climbs, or descends, to within 1000 feet of the selected altitude, the alert lights illuminate and remain illuminated through a 500 foot (700 foot with altitude selector) altitude warning band. At 500 feet (300 feet with altitude selector) from the selected altitude, the lights extinguish. When the airplane reaches the selected altitude, a two-second aural tone indicates the desired flight altitude has been achieved. The two-second tone is also heard when the lights first illuminate upon penetration of a warning band.

8. Go-around:

   Engagement of the go-around mode using the go-around button on the left power lever will introduce a wings level, 7°, nose-up display on the flight command indicator command bars. The 7° go-around angle is based on a worst-case, single engine condition. Operation of go-around cancels all other vertical modes and also disengages the autopilot, if the autopilot has been engaged. The autopilot may be re-engaged in the go-around mode after the pitch attitude has been established and the airplane is in a trimmed, climbing configuration. The go-around mode may be used as a take-off pitch reference, if desired, by engaging go-around mode on the runway. Momentary operation of the trim switch disengages the go-around mode.

### *FLYING RADIO FACILITIES*

### VOR PROCEDURES

1. Tune the NAV receiver to the appropriate frequency. (RNAV mode selector in VOR-DME.)

2. Set the desired course to or from the station on the pilot's course indicator.

3. Set the desired intercept heading. (Heading hold or HDG SEL may be used)

NOTE

The intercept angle with respect to the VOR radial selected may be any angle up to 90°.

4. Arm the navigation mode by depressing the NAV switch on the mode controller. The NAV ARM light on the flight director annunciator panel illuminates indicating that the system is armed to capture the selected radial. At the point of capture, the NAV ARM light on the annunciator extinguishes and the NAV CPLD annunciator light illuminates, indicating the system has captured the selected course.

5. The selected track may be changed while in the tracking mode, by setting a new course using the COURSE knob on the pictorial navigation indicator. Course changes made at less than 4° per second with the COURSE knob are acquired without leaving the tracking mode. However, if the COURSE knob is moved at a rate exceeding 4° per second, a pre-programmed intercept angle of 45° is automatically engaged without having to return to the heading mode. When over the navigational facility, the course selection should be made at the change from "to" to "from", for best results.

## AREA NAVIGATION ENROUTE

1. Tune the NAV and DME receivers supplying information to the area navigation computer to the radio facility (VORTAC) being used. The signal must be valid.

2. Set the area navigation bearing and distance to establish the desired waypoint.

3. Set the area navigation mode switch to RNAV position.

4. Set the desired course using the COURSE knob on the pilot's pictorial navigation indicator.

5. Set the desired intercept heading (heading hold or HDG SEL may be used).

NOTE

The intercept angle, relative to the RNAV radial, may be any angle of 90° or less.

6. Arm the navigation mode by depressing the NAV switch on the mode controller. The NAV ARM light on the flight director annunciator panel illuminates indicating that the system is armed to capture the selected radial. At the point of capture, the NAV ARM light on the annunciator will extinguish and the NAV CPLD annunciator light illuminates, indicating the system has captured the selected course.

## VERTICAL NAVIGATION (VNAV)

Vertical navigation provides a computed pitch command, displayed on the flight command indicator, to capture and maintain a vertical track angle in ascent or descent to an RNAV waypoint or VORTAC facility. The following prerequisites must be fulfilled prior to flight director/autopilot coupling to the vertical navigation system:

1. Tune the NAV and DME receivers supplying information to the RNAV computer to the radio facility (VORTAC) being used. The signal must be valid.

2. The desired course to a selected waypoint or VORTAC facility must be set on the pictorial navigation indicator and a "TO" flag must be in view.

3. The RNAV computer mode switch must be placed in the RNAV or APPR position.

4. The selected climb or descent track angle must be less than 5.5 degrees.

*Programming the vertical navigation computer:*

1. Preset the desired altitude in the selected altitude window.

2. Set the altitude of the VORTAC facility being used, using the VTAC ALT - 1000 FT tab.

3. If altitude acquisition is desired prior to reaching the selected waypoint or VORTAC facility, program the mileage offset (0 to 30 miles) using the DIST BIAS MILES knob. (Bias is the distance short of the selected waypoint.)

If the NAV receiver, RNAV computer, servo altimeter and DME are valid, the vertical track angle will be indicated on the right display scale of the flight command indicator in degrees of angle, to a maximum of ± 5°. As the airplane flys toward the waypoint or VORTAC facility at a constant altitude, the displayed vertical track angle will slowly increase. When the vertical track angle has reached a value desired by the pilot, the pilot must manually couple VNAV by depressing the VNAV CPLD button on the VNAV computer. The vertical track angle displayed upon engagement becomes the reference flight path angle and the display pointer then becomes a deviation display above or below the selected flight path. The maximum scale deflection in the VNAV coupled mode is ± 250 feet. Selection of the VNAV CPLD mode automatically activates ALT ARM to capture the selected altitude.

4. The HDG SEL mode may be used with VNAV coupled to deviate from the selected course momentarily, for radar vectors, traffic, etc. HDG SEL turns of more than 90° are not recommended.

NOTE

VNAV accuracy to make good the selected VNAV waypoint cannot be guaranteed with tracking offsets of more than 2 nautical miles on the selected RNAV course.

APPROACH

1. VOR

   VOR approaches may be made by coupling VOR in the approach mode. This gives proper responses for a close in non-precision approach.

2. ILS FRONT COURSE

   a. Tune the NAV receiver to the correct ILS frequency, set the course selector to the inbound runway heading, set the heading bug to the desired intercept angle, and set the decision height on the radio altimeter.

NOTE

With both NAV receivers tuned to the same ILS facility, if the number 2 NAV receiver deviates more than 35 millivolts from the number 1 NAV receiver on either localizer or glideslope, the appropriate APPR CPLD or GS CPLD annunciator will flash indicating monitor limits have been exceeded.

Localizer and glideslope are captured automatically on front course. The localizer must be captured before glideslope capture is possible.

If the airplane heading is within 90° of the back course heading, the REV LOC annunciator will illuminate.

b. Engage HDG mode and arm the APPR mode. The APPR ARM annunciator will illuminate, indicating the system is armed to capture the localizer beam. As the airplane nears the beam, the APPR CPLD annunciator will illuminate and the system will intercept the localizer. At the point of glide path intercept, the GS CPLD annunciator will illuminate and all vertical modes will be disengaged, indicating the system is locked on to the glide slope.

c. The decision height light on the flight command indicator will illuminate when the airplane reaches the decision height previously selected by the pilot on the radio altimeter.

d. To assure manual control of the airplane for landing, depress the autopilot disengage switch on the pilot's control wheel.

e. The minimum recommended approach speed is 120 knots.

f. Disengage the autopilot at no less than 200 feet above the ground prior to manually landing the airplane.

g. Go-around mode may be selected by pressing the go-around button on the left power lever any time the pilot needs to execute a missed approach. The autopilot will be disengaged and the flight command indicator will command a 7° nose-up wings level attitude.

3. ILS BACK COURSE

a. Tune the NAV receiver to the correct ILS frequency, set the course selector to the inbound front course runway heading, set the heading indicator to establish the desired intercept angle and set decision height on the radio altimeter.

NOTE

With both NAV receivers tuned to the same ILS facility, if the number 2 NAV receiver deviates more than 35 millivolts from the number 1 NAV receiver on localizer, the appropriate APPR CPLD annunciator will flash indicating monitor limits have been exceeded.

b. Engage HDG mode and arm the APPR mode. The APPR ARM annunciator will illuminate, indicating the system is armed to capture the localizer beam. As the airplane nears the beam, the APPR CPLD annunciator will illuminate and the system will intercept the localizer. If the airplane heading is within 90° of the back course heading, the REV LOC annunciator will light.

c. Indicated airspeed hold or pitch attitude hold may be used to establish a descent while on reverse localizer.

d. Disengage the autopilot at no less than 200 feet above the ground prior to manually landing the airplane.

e. Go around operation is the same as for front course operation.

4. RNAV APPROACH

a. Tune the NAV receiver and DME to the appropriate VORTAC frequency.

b. Set RNAV bearing and distance as given on the navigation charts for RNAV approaches. Set RNAV to APPR mode when within ten miles of the selected waypoint.

c. Set vertical navigation to give minimum descent altitude and bias as desired. Set the MDA switch to the MDA WARN position.

d. Set the required course on the pictorial navigation indicator and establish an intercept angle to the inbound radial. Arm the approach mode.

e. After RNAV approach is coupled, observe the vertical navigation deviation on the flight command indicator and depress the VNAV CPLD button when desired descent angle is displayed.

f. When the MDA annunciator on the flight director indicator illuminates, a go-around should be executed unless the pilot has the field in sight.

### *DISENGAGING THE AUTOPILOT*

1. Hold the controls prior to disengagement. Under normal operating conditions the automatic pitch trim will have the airplane properly trimmed in the pitch axis at the pitch attitude existing when the system is disengaged.

2. Disengage the system by pressing the pilot's or copilot quick disconnect switch, pilot/copilot trim switches, or returning the autopilot engage switch to OFF. The flight director may be turned off which will also disengage the autopilot.

## SPECIAL NOTES

1. The V-bars on the flight director indicator will disappear to the top of the instrument when no flight director modes are engaged.

2. The V-bars must be in view before the autopilot can be engaged.

3. When the autopilot is not engaged, the system may be used as a manual flight director system.

## EMERGENCY PROCEDURES

*The autopilot can be disengaged by any of the following methods:*

1. Press the A/P disconnect switch on the pilot's or copilot's control wheel.

2. Move the on-off switch to the off position.

3. Engage the go-around mode. (Yaw damper will remain engaged.)

4. Pull the flight director/autopilot circuit breaker out (off).

5. Turn off the airplane master switch.

6. Turn off the avionics master switch.

7. Any interruption or failure of power.

8. Operate main trim switches UP or DN. (Yaw damper will remain engaged.)

*The following conditions will cause the autopilot to disengage automatically:*

1. Vertical gyro failure indication.

2. Flight control system power or circuit failure.

*The following will cause a servo to disengage:*

1. Rapidly overpowering any servo will cause disengagement of only that servo through operation of the servo monitor. The servo may be re-engaged by turning off the autopilot and waiting for the monitor light to extinguish before re-engaging the autopilot.

2. A hardover failure in any of the primary servos will result in only that servo being automatically disengaged.

*In the event of an engine failure:*

1. Disengage the autopilot, retrim the airplane, and re-engage the autopilot. Maintain at least 120 knots for single-engine approach.

*Maximum altitude losses during malfunction tests were:*

| CONFIGURATION | ALTITUDE LOSS |
|---|---|
| Climb | 200 ft |
| Cruise | 350 ft |
| Maneuvering | 100 ft |
| Descent | 350 ft |
| Approach/ILS Coupled | 50 ft |
| Single Engine Approach/ILS Coupled | 60 ft |

Approved: Donald St Peter

for W. H. Schultz
Beech Aircraft Corporation
DOA CE-2

**BEECHCRAFT KING AIR C90 (LJ-668 thru LJ-1062 except LJ-670), C90A (LJ-1063 and after), E90 and F90 LANDPLANES PILOT'S OPERATING HANDBOOK AND FAA APPROVED AIRPLANE FLIGHT MANUAL SUPPLEMENT**

**for the**

**KING KNR-665 OR KNR-665A AREA NAVIGATION SYSTEM**

## GENERAL

The information in this supplement is FAA Approved material, which along with the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual, is applicable to the operation of the airplane when modified by the installation of the King KNR-665 or KNR-665A Area Navigation System. The information in this supplement supersedes or adds to that of the Pilot's Operating Handbook and FAA Approved Flight Manual. Users of this manual are advised always to refer to the supplement for possible superseding information and placarding applicable to operation of this airplane

## LIMITATIONS

1. The Area Navigation Function may not be used as a primary system under IFR conditions except on approved approach procedures, approved area navigation airways, and random area navigation routes when approved by Air Traffic Control.
2. The Area Navigation Function can only be used with co-located facilities. (VOR and DME signals originate from same geographical location.)

## EMERGENCY PROCEDURES

*CAUTION*

DME may unlock due to loss of signal with certain combinations of distance from station, altitude, and angle of bank.

1. If NAV flag appears while in the ENROUTE mode, check for correct frequency.
2. If VOR or DME equipment is intermittent or lost, utilize other navigation equipment as required.
3. If NAV flag appears during an approach while in the APPR mode, execute published missed approach and utilize another approved facility.

## NORMAL PROCEDURES

The King KNR-665 or KNR-665A Area Navigation System is a push-button tuned, navigational unit with a ten waypoint memory capacity. Included is the capability to select the VOR/DME, localizer and glideslope frequencies, electronically "move" the VOR to a phantom location called a Waypoint, and set the navigational course in the Flight Director.

The KNR-665 or KNR-665A functions in three modes. In the VOR mode, the unit operates as a conventional VOR Converter with a course deviation scale factor of ± 10 degrees presented on the Pictorial Navigation Indicator. This mode is also utilized for localizer/glideslope approaches with a conventional display. Two Area Navigation modes are available. They are designated ENROUTE and APPR for use in enroute and terminal/approach navigation. For Area Navigation, the course deviation is presented in nautical miles on the

Pictorial Navigation Indicator rather than in degrees as with the VOR mode. This is referred to as "constant course width". The ENROUTE mode provides a constant course width of ± 5 nautical miles (1 nautical mile per 1 dot deviation). APPR mode has a constant course width of ± 1.25 nautical miles (1/4 nautical mile per 1 dot deviation) and should be used when within ten miles of the terminal waypoint.

## CONTROL FUNCTIONS

The KNR-665 or KNR-665A Area Navigation System is programmed and operated from a panel mounted control unit. Information such as station frequency, course, waypoint radial and way point distance is entered into memory from the keyboard on the control unit. During the flight, the desired waypoints are recalled from memory and the modes of operation are selected from the control unit.

1. Mode Switch:

   This three position switch selects conventional VOR/DME operation designated "VOR", enroute Area Navigation designated "ENROUTE", and terminal/approach Area Navigation designated "APPR".

2. 0 thru 9 Keys:

   Each depression of one of these keys enters one digit into the FREQ/KEYBOARD window.

3. FREQ/KEYBOARD Window:

   a. Displays the Waypoint facility frequency when display is constant.

   b. Serves as a "scratch pad" to confirm the input of the keyboard when display is flashing.

4. COURSE Window:

   Displays the selected course in degrees.

5. WPT Radial Window:

   Displays the VOR radial on which the Waypoint is placed.

6. WPT DISTANCE Window:

   Displays the distance along the selected VOR radial on which the Waypoint is placed.

7. Load Keys:

   Load keys are located to the right of the FREQ/KEYBOARD, COURSE, WPT RADIAL and WPT DISTANCE windows. The load keys cause data from the keyboard to be loaded into the respective windows.

8. WPT-CRS-DSPY Window:

   Annunciates the waypoint and course being displayed.

9. WPT-CRS-IN USE Window:

   Annunciates the waypoint and course in use.

10. → Transfer Key:

    Puts the displayed waypoint into use.

11. CRS 1 Key:

    Selects Course 1 (Inbound course).

12. CRS 2 Key:

    Selects Course 2 (Outbound course).

13. AUTO CRS Key:

    Computes and enters the direct course from present position to the facility. VOR (In VOR mode) or waypoint (In ENROUTE or APPR mode).

14. KYBD CLR Key:

    The Keyboard Clear Key clears the "scratch pad" (FREQ/KEYBOARD window when flashing).

15. NAV TEST Key:

    Initiates an automatic, three-part, sequential self-test. Active in ENROUTE mode only.

## PREFLIGHT

The preflight check consists of a sequential test of the entire RNAV system, including a test of the computation accuracy of the computer and all displays. The RNAV system will not test with the autopilot engaged or with the navigation receiver tuned to an ILS frequency.

1. Set mode selector switch to ENROUTE.
2. Press and hold NAV TEST key for approximately 15 seconds to initiate three-part self-test.

   Part 1. All lamp segments are illuminated to numeral "8" (except the extreme left digit of FREQ/KEYBOARD window which illuminates to numeral "1").

   Part 2. The airplane is placed over the VOR, the waypoint is located 30.0 miles on the 90.0° radial, the selected course is 30°. The FREQ/KEYBOARD, DSPY, and IN USE windows are extinguished. The Pictorial Navigation Indicator course needle will rotate to 30°.

   Part 3. The course required to fly to the waypoint is computed (90°) and entered into the COURSE window. The Pictorial Navigation Indicator course needle will rotate to 90°.

Failure to satisfy the preflight test requirements indicates an inoperative RNAV computer. Set the mode selector to VOR and use navigational units in conventional VOR/DME operation.

## PROGRAMMING

Pertinent information (frequency, course, waypoint radial, waypoint distance, waypoint number) for up to ten waypoints is entered into memory from the panel mounted keyboard unit. Programming the computer may be completed prior to take-off or during the flight. Any combination of navigational facilities (RNAV waypoint, VOR/DME, ILS) may be loaded into the computer; however, it is desirable that each facility be numbered and loaded in the sequence it is to be used.

### *RNAV WAYPOINTS*

1. Select the first waypoint and the inbound course by depressing keyboard number "1" and CRS 1 pushbuttons. These numbers will appear in the top center DSPY window over WPT and CRS.

NOTE

If the navigational facility is at or near the departure point and the first route segment is outbound from that facility, depress keyboard number "1" and CRS 2 pushbuttons.

2. Select the VORTAC frequency by depressing the keyboard buttons in the number sequence. A total of five digits must be entered to complete the frequency input (i.e., frequency 113.8 entered as 113.80). The frequency will appear flashing in the FREQ/KEYBOARD window. Upon confirming the proper frequency has been entered on the keyboard, it is stored into memory by depressing the load key adjacent to the FREQ/KEYBOARD window. The flashing presentation will become steady which confirms frequency storage.

3. Select inbound course to the waypoint on the keyboard. The frequency number in the FREQ/KEYBOARD window will be replaced by the flashing course numbers. Confirm accuracy of course numbers and store into memory with the load key adjacent to the COURSE window. The inbound course number in the FREQ/KEYBOARD window will transfer to the COURSE window and the VORTAC frequency will reappear in the FREQ/KEYBOARD window.

4. Select outbound course from the waypoint by depressing CRS 2 pushbutton. The number 2 will appear in the DSPY window over CRS and adjacent to WPT number 1. Select and load the outbound course value using the same procedure as the inbound course.

5. Select the waypoint radial on the keyboard and enter into memory (after checking) by depressing the load key adjacent to the WPT RADIAL window.

6. Select the waypoint distance following the same procedure as with the selection of the waypoint radial. Enter the value into memory by depressing the load key adjacent to the WPT DISTANCE window.

NOTE

WPT RADIAL and WPT DISTANCE are decimal readouts. Program these values to the nearest tenth unit.

7. This completes the programming for the first waypoint and inbound/outbound courses. Follow these procedures for all selected waypoints up to a maximum of ten.

NOTE

If an error is noted while the value in the FREQ/KEYBOARD window is still flashing, depress the KYBD CLR button and select the correct value on the keyboard. This will not affect any information already stored in the memory. If the error is noted after the value has been loaded, select the proper value on the keyboard, confirm its accuracy in the flashing FREQ/KEYBOARD window, and reload the value into the appropriate window.

### *CONVENTIONAL VOR*

The programming technique for conventional navigation directly toward or away from a VOR facility is similar to that for RNAV waypoints. Inputing the waypoint number, course number, frequency and course values into the memory is accomplished in the same manner. Since the station is not to be electronically "moved" to a new location (waypoint), no values are programmed into the WPT RADIAL and WPT DISTANCE windows.

### *ILS APPROACH (Front Course and Back Course)*

Programming an ILS approach is accomplished in the same manner as programming conventional VOR. However, it is essential that only the inbound front course localizer bearing be entered into the COURSE window for both front course and back course approaches. This will assure that the Pictorial Navigation Indicator and autopilot maintain the proper left/right logic.

*MISSED APPROACH*

If the published missed approach utilizes an RNAV waypoint or VOR facility, it may be entered into memory anytime prior to the approach. It is recommended that WPT "O" (keyboard numeral 0) be reserved for this operation. Any other waypoint storage (1 thru 9) could be used; however, habitual use of WPT "O" eliminates the possibility of error that could be experienced when selecting an intermediate digit during this critical flight phase.

## ENROUTE OPERATION

Prior to take-off, select ENROUTE on the mode switch. Flight in this mode is recommended even if navigating directly toward or away from a VORTAC facility. The ENROUTE mode provides the advantages of "constant course width" and smooths the received signals to improve autopilot operation. An exception to this procedure would be caused by the lack of a DME signal co-located with the VOR facility. In this case, the VOR mode would be selected.

1. Place WPT 1/CRS 1 in the DSPY window by depressing keyboard number "1" and CRS 1 pushbuttons. This calls up waypoint 1 information from the memory bank and displays that information in the appropriate windows for checking.

NOTE

At this point, changes to a waypoint parameter may be made by replacing the original numbers with a new entry without affecting the other parameters that are in memory.

2. Depress → (transfer key) to place the displayed information into active use. The waypint numbers WPT 1/CRS 1 will appear in the IN USE window. This action also automatically tunes the VOR/DME receivers to the appropriate frequencies and causes the course needle on the Pictorial Navigation Indicator to be driven to the displayed course.

3. As the waypoint is approached, recall the outbound course by depressing the CRS 2 pushbutton. This places WPT 1/CRS 2 in the DSPY window. The waypoint information and outbound course are displayed for checking. However, navigation continues on the inbound course. The IN USE window will flash WPT 1/CRS 1 to advise the waypoint and course currently displayed are not in use. Transition to the outbound course is accomplished by depressing the → (transfer key). The displayed waypoint parameters will be placed in use and WPT 1/CRS 2 will appear steady in the IN USE window.

4. Follow these procedures for subsequent waypoints.

## AUTOCOURSE OPERATION

The "autocourse" function allows for navigation from the airplane's present location direct to an IN USE waypoint or VORTAC.

1. DIRECT TO WAYPOINT

   Depress AUTO CRS pushbutton. The direct course will be computed and displayed in the COURSE window. The course needle on the Pictorial Navigation Indicator will be driven to the displayed course.

2. DIRECT TO VORTAC

Select VOR on mode switch. Depress AUTO CRS pushbutton. The direct course will be computed and displayed as above. (To obtain the advantages of "constant course width", load 0 nautical miles into the WPT DISTANCE window and return the mode switch to ENROUTE.)

Approved: [signature]

for W. H. Schultz
Beech Aircraft Corporation
DOA CE-2



**FAA Approved**
**Revised: September, 1984**
**P/N 90-590012-49**

# BEECHCRAFT SUPER KING AIR 200, 200C, 200T, 200CT, B200, B200C, B200T, B200CT, KING AIR B100, E90, F90, C90 (LJ-668 THRU LJ-1062, EXCEPT LJ-670) AND C90A (LJ-1063 AND AFTER) LANDPLANES

## PILOT'S OPERATING HANDBOOK AND FAA APPROVED AIRPLANE FLIGHT MANUAL SUPPLEMENT for the COLLINS LRN-70 (ONTRAC IIIA) AND LRN-80 (ONTRAC III) VLF/OMEGA NAVIGATION SYSTEMS

### GENERAL

The information in this supplement is FAA-approved material and must be attached to the *FAA Approved Airplane Flight Manual* when the airplane has been modified by installation of the Collins LRN-70 (ONTRAC III A) or LRN-80 (ONTRAC III) VLF/OMEGA Navigation System in accordance with Beech-approved data.

The information in this supplement supersedes or adds to the basic *FAA Approved Airplane Flight Manual* only as set forth within this document. Users of the manual are advised always to refer to the supplement for possibly superseding information and placarding applicable to operation of the airplane.

### LIMITATIONS

The LRN-70/LRN-80 meet the approved criteria for VLF/Omega navigation systems as established by AC 20-101A. It may be used as a means of VFR/IFR enroute navigation provided the following limitations are observed:

1. Only enroute operations in the conterminous United States and Alaska are approved.
2. The system is not to be used for navigation in terminal areas or during departures from or approaches to airports or into valleys or between peaks in mountainous terrain or below Minimum Enroute Altitude (MEA).
3. Additional equipment which would permit navigation appropriate to the available ground facilities must be installed and operating.
4. VOR and DME equipment must be installed and operating during navigation on approved RNAV routes.
5. IFR flight is not approved based on VLF/OMEGA navigation into any area in which such operation could not be approved based on the installed equipment required by paragraph 3. This includes overwater flights beyond the range of approved ground navigation facilities.
6. The VLF/OMEGA position information must be checked for accuracy (reasonableness) against a visual ground fix or other approved navigation equipment under the following conditions:
    a. Prior to compulsory reporting points during IFR operation when not under radar surveillance or control.
    b. At or prior to arrival at each enroute waypoint during operation on an approved RNAV route.
    c. At hourly intervals during operation off of approved RNAV routes.
7. The VLF/OMEGA position information should be updated when a cross-check with other onboard approved navigation equipment reveals an error greater than 2 nautical miles along track or crosstrack.
8. Navigation shall not be predicated on the use of this system during periods of dead reckoning.

9. Following a period of dead reckoning, the VLF/OMEGA position information must be verified and updated as required by a visual ground fix or by using other approved navigation equipment.

## EMERGENCY PROCEDURES

An emergency battery pack is provided in the event the primary power source is lost. If the primary power is interrupted, the system will switch to the emergency battery pack until the primary power is restored, at which time the system will switch back to primary power. The system cannot be turned on using only the emergency battery. Battery power will only function with loss of primary power. It is important the system power switch be selected off at the conclusion of flight to avoid depleting the emergency battery. The system can operate from the emergency battery pack for approximately 30 seconds at 70°F. The battery pack will recharge in approximately ten hours when the system is on the primary power source.

In the event that the WARN light illuminates, or any time the navigational information is questioned based on information from other onboard navigation equipment, the other onboard navigational equipment must be used as the primary source of navigational information.

## NORMAL PROCEDURES

The LRN-70/LRN-80 is a very low frequency (VLF) radio navigation system designed for area navigation utilizing existing VLF and OMEGA transmitting stations. Airplane position is determined by automatically making position fixes by time referencing radio signals from several stations. Generally, two stations can determine a position on the surface of the earth. From changes in latitutde/longitude position, the system derives distance to go, bearing, desired track, cross track error, ground speed and time to waypoint/destination. With an airplane true airspeed input, the system can compute the current wind direction and speed.

Navigation is computed along a Great Circle flight path to provide the shortest distance between positions. Course deviation is presented in nautical miles on the Pilot's Course Indicator rather than in degrees as with conventional VOR navigation. This feature provides for a constant course width of approximately ± 3 nautical miles regardless of the distance to the waypoint.

### CONTROLS AND DISPLAYS

The system is programmed and operated from a pedestal mounted control/display unit (CDU). The control section is used to enter data in to the computer and select the computed information to be displayed. The display section provides navigational information to the pilot. It also displays the data to be entered into the computer.

1. Data Keyboard:
   Ten momentary keys for entry of data into the computer. Digit keys (0 through 9) enter numerical data. N (north), E (east), S (south), W (west) keys enter the sign of latitude/longitude information.

2. CLR Key:
   Clears the computer of data in the position selected by the FUNCTION selector.

3. CAL Key:
   Activates the calibration of the system to a known position.

4. ON/OFF Switch:
   Applies power to all system components.

5. WAYPOINT Selector:
   Ten position switch to select either the start position or one of nine waypoint/destination positions.

6. LAMP TEST Switch:
   Tests all lights on the display section, except BATT. All digits display the number "8".

7. DIM Switch:
Adjusts background lighting for display section.

8. FUNCTION Selector:
Twelve position switch to select the desired input or output mode of operation.

9. Numerical Display Registers:
Left display is a five digit register to indicate latitude, bearing, desired track, wind direction, and time to selected waypoint. Right display is a six digit register to indicate longitude, distance to selected waypoint, cross track error, ground speed, magnetic variation, wind speed, DME, GMT, and date.

10. Function Indicators:
Lamps to indicate S (south) and N (north) for latitude; E (east) and W (west) for longitude and magnetic variation.

11. DR (Dead Reckoning) Light:
Illuminates when less than two VLF/OMEGA transmitting stations are being received or when only stations of unusable geometry are being received (see Enroute Operation). In the DR mode, the airplane's position is updated based on true airspeed, heading, and last known wind information. DR will remain illuminated until the system is recalibrated or the position is checked.

12. WARN light:
Illuminates with a computer or system malfunction or improper pilot operation procedure. Navigational information should be considered unreliable.

13. BATT Light:
Illuminates when the system is operating on the emergency battery pack.

14. SY Light:
Illuminates to indicate the received OMEGA stations are being synchronized.

15. STD Light:
Illuminates when the Frequency Standard is stabilizing. The computer is ready to navigate when the STD and SY lights extinguish.

16. Station Received Indicators:
Illuminate to indicate those VLF and OMEGA stations which are being received.

NOTE

The LRN-70 is a condensed version of the LRN-80 intended primarily for operation in the United States. VLF station availability is limited to Maine, Washington, Maryland and England in this installation.

| *VLF STATIONS* | *OMEGA STATIONS* |
|---|---|
| 1. -MAIN | A. -NORWAY |
| 2. -WASHINGTON | B. -LIBERIA |
| 3. -AUSTRALIA | C. -HAWAII |
| 4. -ENGLAND | D. -NORTH DAKOTA |
| 5. -MARYLAND | E. -LA REUNION |
| 6. -TBD | F. -ARGENTINA |
| 7. -JAPAN | G. -TRINIDAD |
| 8. -NORWAY | H. -JAPAN |
| 9. -SPARE | |

17. ENROUTE Light:
Illuminates when the system is calibrated and navigating.

18. OFFSET Light:
Illuminates when the selected waypoint is offset by an input of radial and DME distance.

19. ALERT Light:
Illuminates approximately one minute from selected waypoint/destination.

20. L-R Lights:
Illuminate in conjunction with the FUNCTION selector XTK (crosstrack) position. Indicate airplane's position left or right of the desired track.

21. DECIMALS:
Each decimal point illuminates in the proper position appropriate to the data selected by the FUNCTION selector.

22. FD NAV/FD VLF Selector:
Lighted push switch which selects and indicates which course information is displayed on the pilot's course indicator (NAV or VLF). Selection of VLF provides for display of VLF course information.

NOTE

For the airplanes listed below, localizer information is always displayed when an ILS frequency is tuned on the selected NAV control. Models 200 (prior to BB-746 except BB-706), C90 (prior to LJ-625), E90 (prior to LW-344), F90 (prior to LA-82), B100 (prior to BE-104), 200C (prior to BL-14), 200T (prior to BT-21).

23. VLF MSG Light:
Illuminates to call attention to the CDU for one or more of the following messages: DR, WARN, BATT, or ALERT.

## PROGRAMMING

Prior to take-off, the departure point latitude/longitude data is entered into the computer. This is referred to as a START position. Although the following procedures specify use of the START (S) position for system calibration, any waypoint position may be used for this purpose, provided that the position used is selected each time the START (S) position appears in the procedures. After calibration is complete, the waypoint position used for calibration may then be used as an additional enroute waypoint. In addition, the date and time of day are entered for the computer to compensate for diurnal shift while navigating. Coordinates (latitude/longitude) for up to nine waypoints (ten if system is calibrated) can be entered while the airplane is on the ground or after take-off.

1. Turn on airplane's avionics master-switch.
2. Set system master switch to ON.
3. Depress TEST switch. Verify all lights on display section are functional.
4. Set WAYPOINT switch to S (start).
5. Set FUNCTION switch to DATE.

NOTE

Verify that six zero's are shown on the right display register. This indicates the computer is ready to accept data. The STD and SY light should be illuminated.

6. Enter present month (one or two digits) day (two digits) and year (two digits) by depressing the keyboard buttons in the number sequence. The date entered must be the current Greenwich Mean Date.

DATA FORMAT: XX.XX.XX i.e., 12-29-75 or 1-01-76

NOTE

Leading zeros need not be entered, but all subsequent zeros must be entered.

7. Set FUNCTION switch to GMT. Enter current Greenwich Mean Time (within +5 minutes).

DATA FORMAT: XX.XX i.e., 22-06 or 02-27

8. Set FUNCTION switch to VAR. Enter existing variation to the nearest 0.1 degree. If variation is not known to a 0.1 degree, enter a zero for this digit.

DATA FORMAT: E/W XX-X i.e., E9.5 or W10.0

NOTE

Magnetic variation need not be entered unless it is desired that the bearing and desired track outputs be referenced to magnetic north. If no variation is entered, bearing and desired track information displayed will be referenced to true north and the N function indicator will illuminate in both functions. Variation *MUST* be entered for accurate WIND calculations.

9. Enter departure position into computer.

   a. Assure WAYPOINT switch is set to S (start).

   b. Set FUNCTION switch to LAT. Enter latitude (5 digits) of departure position, N (north) or S (south) must be entered prior to latitude digits.

DATA FORMAT: N/S-XX.XX.X i.e., N-33.40.2

   c. Set FUNCTION switch to LON. Enter longitude (6 digits) of departure position. E (east) or W (west) must be entered prior to longitude digits.

DATA FORMAT: E/W-XXX.XX i.e., W-117.48.0

10. Calibrate the system to the previously entered present position.

NOTE

Do not attempt to calibrate the system or calculate distances until the STD and SY lights have extinguished. This may require a period of up to 10 minutes in very low start up temperatures. This time may be used to enter desired waypoints.

If the airplane is located in or near a hangar, or near a noise source where good signals cannot be received, the system cannot synchronize to the OMEGA pattern. In these conditions, the SY light will remain illuminated until adequate signals are received and the system has synchronized.

a. Set the WAYPOINT selector to S (start).

b. Set the FUNCTION selector to POS (CAL key will flash).

c. Press the CAL key ONCE, verify that displayed data agrees with the actual start position (CAL key will continue to flash).

d. Press the CAL key again (it will stop flashing).

e. Note that the ENROUTE light illuminates within approximately 60 seconds, (DR will illuminate if insufficient navigation signals are received).

NOTE

After the ENROUTE light has illuminated, the system is navigating and sensing airplane movement. It is preferable to calibrate the system near the start of the take-off roll to minimize any errors which may be incurred while taxiing long distances while being exposed to extraneous ground interference.

## WAYPOINT ENTRIES

Coordinates (latitude/longitude) for up to nine (ten after system calibration) waypoints can be entered while the airplane is on the ground or after take-off. Once entered, waypoints remain in the computer until new waypoints are entered. Waypoints may be changed any time during the flight by eliminating one previously entered. If entered waypoint data is incorrect, press CLR button and re-enter. All navigational information is automatically cleared when the ON/OFF switch is set to OFF. The waypoint data and last known position will be retained.

1. Set WAYPOINT switch to 1 and FUNCTION switch to LAT. Enter latitude of first waypoint. North or south must be entered prior to latitude digits.

DATA FORMAT: N/S-XX.XX.X i.e., N-39.56.0

2. WAYPOINT switch remains at 1. Set FUNCTION switch to LON. Enter longitude of first waypoint. East or west must be entered prior to longitude digits.

DATA FORMAT: E/W-XXX.XX.X i.e., W-86.03.0

3. Set WAYPOINT switch to 2 through 9. Enter coordinates of additional waypoints as required.

If the bearing (RAD) and distance (DME) from a known latitude/longitude waypoint are known, this information can be inserted into the computer to define a new waypoint OFFSET from the latitude/longitude waypoint. This is accomplished as follows:

1. Enter latitude and longitude of reference waypoint as described above.

2. Set FUNCTION selector to DME - enter distance to the offset position to the nearest 0.1 mi.

DATA FORMAT: XXX.X i.e., 30.0

3. Set FUNCTION selector to RAD/VAR

   a. Enter bearing from waypoint (RAD) to the nearest 0.1 degree leading zeros must be entered.

   b. Enter variation (VAR).

DATA FORMAT: XXX.X and E/WXX.X, i.e., 0.94.2 and E9.5

The OFFSET light will illuminate indicating the selected waypoint has been offset by the values of RAD and DME.

## PREFLIGHT

The preflight check is to test the computation accuracy of the computer and to assure its capability for proper operation. This procedure should be completed prior to programming for the intended flight.

Coordinates for a calibrated start position and destination are programmed into the computer along with the current date and Greenwich Mean Time. Upon selecting the BRG/DIS enroute mode, a predetermined bearing and distance should be displayed.

1. Set WAYPOINT switch to S (start).
2. Set FUNCTION switch to DATE. Enter current date.
3. Set FUNCTION switch to GMT. Enter current Greenwich Mean Time.
4. Set FUNCTION switch to LAT. Enter: N-33.40.2.
5. Set FUNCTION switch to LON. Enter: W-117.48.0.
6. Calibrate the system (See Step 10 Above - PROGRAMMING).

NOTE

The test waypoint may be entered while waiting for the STD light to extinguish.

7. Set WAYPOINT switch to 1.
8. Set FUNCTION switch to LAT. Enter: N-44.38.9
9. Set FUNCTION switch to LON. Enter: W-67.16.9
10. Set FUNCTION switch to BRG/DIS (after system calibration). The numerical display registers should indicate a bearing of 058.6 degrees and a distance of 2406.6 nautical miles.

## ENROUTE OPERATION

The desired waypoint/destination may be selected prior to take-off or when airborne. When the desired waypoint is selected, the computer determines the desired track (DTK), bearing (BRG), and distance (DIS) from the airplane's position when the waypoint is selected. If autopilot tracking is desired, set the displayed value of desired track on the pilot's course indicator and select FD VLF with the selector switch. The computed course information is now displayed on the pilot's Course Indicator. Autopilot tracking is accomplished by selecting the flight director's navigation mode and engaging the autopilot. While enroute, the following functions of navigational information are available. These functions are selected by placing the FUNCTION switch to the appropriate position and reading the display.

*POS Function (Latitude/Longitude)*

This position displays the current latitude and longitude in degrees, minutes, and tenths of minutes. Airplane position is updated every five seconds and is stable to approximately 2/10 minutes of latitude.

*BRG/DIS Function (Bearing/Distance)*

The bearing and distance to the waypoint as selected on the WAYPOINT switch will be displayed. Bearing is defined as the Great Circle angle from the airplane's current position to the waypoint as referenced to North (true or magnetic). The N light will be displayed if the bearing is defined to true North (i.e., no variation has been entered). If a magnetic course or route is desired, the magnetic variation for the area of flight should be entered and periodically updated in the VAR position of the FUNCTION switch. The N light will not be displayed if the bearing is magnetic. Bearing is calculated to 1/10 degree and distance to 1/10 nautical mile. The display is updated every four seconds.

*DTK/XTK Function (Desired Track/Cross Track)*

The desired track is defined as a Great Circle path from the airplane's position to the selected waypoint. This track is established when the waypoint is selected on the WAYPOINT switch. The DTK function displays to the nearest 1/10 degree the angle of the desired track flight path as referenced to North (true or magnetic). A magnetic desired track will be displayed provided the area magnetic variation has been entered.

Bearing (BRG) and desired track (DTK) will always agree when the airplane is centered on the prescribed Great Circle Course. If a deviation is made from the course, the bearing will update to provide the angle, as referenced to North, from the current position to the selected waypoint. The desired track angle will vary only as required to define the previously established Great Circle course.

NOTE

If it is desired to approach a waypoint on a predetermined track, this track may be inserted into the computer by (1) selecting DTK/XTK, (2) entering desired track to the nearest 0.1 degree. (If 0.1 degree is not known, enter a zero for this digit). The entered desired track will be referenced to the entered magnetic variation. This track should also be set on the pilot's course indicator.

Approximately one minute from the selected waypoint, the ALERT light will flash. The WAYPOINT selector should be set to the next waypoint, the desired track read in the DTK/XTK mode, and the Horizontal Situation Indicator course set to agree.

Crosstrack is defined as the lateral deviation from the desired track. The crosstrack error is displayed to the nearest 1/10 nautical mile. The L/R lights indicate whether the airplane is to the left or right of the desired track.

*TIME/GS Function (Time/Ground speed)*

Time to any of the programmed waypoints is available by setting the WAYPOINT switch to the desired waypoint. The computed time is presented in hours, minutes, and tenths of minutes and is updated every 4 seconds and assumes the airplane is on track and headed toward the waypoint.

The GS (ground speed) function is independent of the selected waypoint and indicates the true ground speed in knots. The ground speed display will remain valid even when not tracking to a waypoint. Ground speed is not accurate until navigation has been established for 3 minutes. If TAS and HDG inputs are supplied to the system, ground speed is updated every six seconds; otherwise, ground speed is updated every three to five minutes.

*WIND FUNCTION*

Wind direction, to the nearest 0.1 degree referenced to true north, is displayed in the left display register and wind speed, in knots, is displayed in the right register. If the computer does not have enough information to calculate the wind, the following flags will appear when the WIND position is selected:

1. The left display register will indicate four zeros if no VAR is entered.

2. The right display register will indicate.

   a. The digit 1 with no TAS input

   b. The digit 2 with no HDG input

   c. The digit 3 with no HDG and no TAS input.

The heading input comes from the pilot's compass system and can not be entered manually. True airspeed must be manually entered, unless the airplane is equipped with an Air Data System with a TAS output. TAS may be manually inserted into the computer by: (1) selecting the WIND position, (2) entering TAS in knots (three digits), and (3) selecting a different function, such as BRG/DIS, for several seconds and then returning to the WIND position. The displayed wind information will not be reliable for approximately 6 minutes after TAS is manually inserted. During this time, TIME and GS are also not reliable.

*Unusable Station Geometry*

If the airplane's position is such that the geometry of the received stations is not suitable for navigation, the system will go into the DR (dead reckoning) mode. This is because the geometry of the received stations makes for potentially large navigation errors. This condition usually happens in cases of only two station reception, but in very rare situations can happen with three stations. The airplane's position will be updated based on true airspeed, heading, and last known wind information. When the airplane flys out of the unusable geometry condition, the ENROUTE light will again illuminate. However, DR will remain illuminated, and navigation is not approved utilizing the LRN-70/LRN-80. To resume normal navigation and extinguish the DR light, the system's position must be recalibrated to a visual ground fix or to other approved navigation equipment.

*INFLIGHT CALIBRATION*

During flight, accumulated error can be reduced by calibrating over an entered waypoint or an offset waypoint.

1. Set the WAYPOINT selector to the upcoming waypoint or reference waypoint (if offset).
2. If the calibration point is the waypoint (no offset), assure that the DME position reads zero. If offset, enter the DME and RAD/VAR to define the offset.
3. Set the Function Selector to POS.
4. Prior to crossing the calibration point, press the CAL key once, the latitude/longitude of the waypoint will be displayed for verification and the CAL key will flash.
5. Directly at the reference point, press the CAL key a second time. The computer will calibrate on the coordinates of the selected waypoint (or waypoint offset). The enroute light will extinguish for up to 30 seconds during the calibration process and illuminate after calibration.

NOTE

To minimize DME slant range error, all inflight calibrations using a VORTAC as the reference waypoint and VOR/DME equipment to define the offset calibration point should be restricted to a distance greater than twice the airplane altitude and less than 60 NM from the VORTAC.

## OMEGA RE-SYNCHRONIZATION PROCEDURE

The system will automatically synchronize to the OMEGA stations with system turn on. Re-synchronization is only to be done if incorrect synchronization is suspected.

Never re-synchronize for normal calibration (up-date) of the system. Once the system has synchronized and has not been switched off, the OMEGA receivers lock to the frequency standard and the system will remain synchronized.

If the system has mis-synchronized, do not attempt to re-synchronize until the amber STD light extinguishes.

1. Set FUNCTION switch to WIND
2. Set WAYPOINT switch to S
3. Press CAL key

NOTE

The SY light will illuminate for approximately two to six minutes during synchronization. The system must be calibrated after manual synchronization.

## SYNCHRONIZATION BYPASS

When the system is synchronizing (SY light illuminated), it cannot be used for preflight navigation computations. If OMEGA reception is poor, such as in or near a hangar, the system may stay in the synchronization mode indefinitely. The synchronization bypass procedure permits preflight navigation computations prior to normal synchronization.

*BYPASS PROCEDURE*

1. Set FUNCTION switch to GMT
2. Enter all 8's on display
3. SY light will extinguish

*RESYNCHRONIZATION PROCEDURE*

1. Set FUNCTION switch to GMT
2. Press CLR key
3. Set FUNCTION switch to Wind
4. Set WAYPOINT switch to S
5. Press CAL key once.

Or

1. Turn system OFF; then back ON.

*CAUTION*

Prior to flight operations, the system must be synchronized to the OMEGA format and calibrated. Use of the LRN-70/LRN-80 as an additional means of navigation is not authorized while using fewer than two OMEGA stations.

## GENERAL NOTES

1. An illuminated BATT light indicates the system is operating on the emergency battery pack and not on the primary power source. The system cannot be turned on without primary power first being applied. The emergency battery pack should not be used for ground check or warm-up.

2. To redefine a new desired track from the airplane's present position to the waypoint being used, set the WAYPOINT selector to another waypoint position for at least five seconds, then switch back to the original waypoint.

3. While enroute, the system calibration can be checked utilizing VOR/DME equipment. This can be accomplished by entering, as waypoints, known VORTAC stations (or fixes offset from known VORTAC stations) and comparing the system indications relative to these waypoints against the VOR and DME indications. Any fix whose latitude and longitude are known (visual, VOR, VOR/DME, ADF or combination thereof) may be utilized to check for system calibration by entering its location as a waypoint and comparing the system indications relative to the fix with those of other approved equipment.

Approved: Donald St Peter

For W. H. Schultz
Beech Aircraft Corporation
DOA CE-2

# BEECHCRAFT KING AIR F90
# LANDPLANE
# PILOT'S OPERATING HANDBOOK
# AND
# FAA APPROVED AIRPLANE FLIGHT MANUAL SUPPLEMENT
# FOR THE
# COLLINS FCS-80 AUTOMATIC FLIGHT CONTROL SYSTEM

## CATEGORY I

### GENERAL

The information in this supplement is FAA-approved material and must be attached to the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual when the airplane has been modified by installation of the Collins FCS-80 Automatic Flight Control System in accordance with Beech-approved data.

The information in this supplement supersedes or adds to the basic Pilot's Operating Handbook and FAA Approved Airplane Flight Manual only as set forth within this document. Users of the manual are advised always to refer to the supplement for possibly superseding information and placarding applicable to operation of the airplane.

### LIMITATIONS

1. Maximum speed limit for autopilot operation is unchanged from the airplane maximum airspeed limit ($V_{MO}/M_{MO}$).
2. Do not use autopilot under 200 feet above terrain.
3. Do not use autopilot or yaw damper during takeoff or landing.
4. Pilot must be seated at the controls with the seat belt fastened during autopilot operations.
5. Autopilot preflight check must be conducted and found satisfactory prior to each flight on which the autopilot is to be used.
6. Disengage autopilot if TRIM FAIL annunciator illuminates.
7. Do not extend landing gear above 15,000 feet with autopilot engaged.

### EMERGENCY PROCEDURES

The autopilot can be disengaged by any of the following methods:

1. Press the AP-YD/TRIM disconnect switch on the pilot's or copilot's control wheel.
2. Move the engage levers to the DISENGAGED position.
3. Select the go-around mode. (Yaw damper will remain on.)
4. Pull out (off) the AP POWER circuit breaker. (Yaw damper will remain on.)
5. Pull out (off) the AP ENGAGE circuit breaker. (Yaw damper will remain on.)
6. Pull out (off) and YAW DAMP circuit breaker.
7. Turn off the airplane MASTER SWITCH (Gang Bar - DOWN).

8. Turn off the AVIONICS MASTER PWR switch. (Yaw damper will remain on.)

9. Operate the electric trim.

*The following conditions will cause the autopilot to disengage automatically:*

1. Any interruption or failure of power.

2. Vertical gyro failure indication.

3. Automatic flight control system power or circuit failure.

*In the event of an engine failure:*

1. Disengage the autopilot, retrim the airplane, and re-engage the autopilot. Maintain at least 120 KIAS until landing is assured.

Maximum altitude losses during malfunction tests were:

| OPERATION CONFIGURATION | ALTITUDE LOSS |
|---|---|
| Climb | 150 feet |
| Cruise | 200 feet |
| Maneuvering | 50 feet |
| Descent | 400 feet |
| Approach/ILS Coupled | 60 feet |
| Single Engine Approach/ILS Coupled | 60 feet |

## NORMAL PROCEDURES

NOTE

The push buttons on the mode selector are the push-on, push-off type. When engaged, amber "gull wings" appear above the selected button. For operation at night, the push buttons are illuminated by the OVERHEAD SUBPANEL & CONSOLE LIGHTS control.

The FCS-80 incorporates its own annunciator panel, located just above the flight director display on the instrument panel. The modes and indications given on the annunciator panel are placarded on the face of the plastic lenses and illuminate when the respective conditions are indicated.

### PREFLIGHT CHECK

*AUTOPILOT*

1. Pull the control wheel aft to mid-travel and engage the autopilot by moving the AP paddle switch forward to the ENGAGED position. Push forward on the control wheel and hold. The trim wheel should move in the nose-up direction. Pull the control wheel aft and hold. The trim wheel should move in the nose-down direction.

2. Move the pitch wheel (UP - DN) and the TURN knob. The control wheel should respond accordingly.

3. Set HSI heading marker under lubber line, select HDG mode, and move the heading marker. The control wheel should respond accordingly.

4. Depress the autopilot-yaw damp/trim disconnect switch on the control wheel. Ensure that the AP paddle switch moves aft to the DISENGAGED position. If the amber AP DISC annunciator begins flashing, recycle the AP-YD/TRIM disconnect switch to extinguish it.

5. Apply force to the primary controls. They should not resist movement.

NOTE

The position of the elevator trim tab should be checked after the autopilot is disengaged, to ensure that the trim servo did not move it from the desired position.

*ELECTRIC ELEVATOR TRIM*

1. Depress the ELEV TRIM push-button switch (on pedestal) to ON (ELEV TRIM illuminates on face of the push button).

2. Check operation of dual-element thumb switches as detailed in the Pilot's Operating Handbook.

**WARNING**

Operation of the electric trim system should occur only by movement of pairs of switches. Any movement of the elevator trim wheel while actuating only one switch denotes a system malfunction. If a malfunction of the electric trim system is indicated, electric trim must be disengaged and trim changes made with manual trim ONLY.

*AIR DATA SYSTEM (if installed)*

1. Press and hold the cockpit-mounted ADC TEST switch for the Air Data Computer. Check for the following:

   A. Air data instrument flags come into view, and the instruments go into the loss-of-data mode.

   B. Altitude pointer goes to the 250-foot mark.

   C. Vertical speed pointer goes to 6000-ft/min rate of descent mark.

   D. Airspeed Indicator IAS and $V_{MO}$ pointers go to zero.

2. Release the ADC TEST switch and check for the following:

   A. Data transmissions to the air data instruments are restored.

   B. All air data instrument flags go out of view.

3. Press and hold the TEST switch on the Vertical Speed Indicator, and check for the following:

   A. The warning flag comes into view.

   B. The pointer slews to the 6000-ft/min rate of climb mark.

4. Release the TEST switch, and check for the following:

   A. The flag goes out of view.

B. The pointer returns to zero.

5. Press and hold the PUSH TEST switch on the Airspeed Indicator, and check for the following:

   A. The warning flag comes into view, and both pointers (IAS and $V_{MO}$) slew to 160 knots.

   B. After approximately 1 second, both pointers slew to zero.

6. Release the PUSH TEST switch and check for the following:

   A. The flag goes out of view.

   B. The barber pole ($V_{MO}$ indicator) returns to 260 knots.

The following items apply only to installations incorporating the Collins Barometric Altimeter:

7. Press and hold the TEST switch on the Barometric Altimeter, and check for the following:

   A. The warning flag comes into view in approximately ½ second.

   B. The altitude pointer goes to the 750-foot mark.

NOTE

The output from the altimeter to the transponder is inhibited during the self test.

8. Release the altimeter TEST switch, and check for the following:

   A. The flag goes out view.

   B. The altitude pointer returns to the actual altitude.

9. Turn the BARO knob on the altimeter and observe that the baroset digits and altitude pointer respond accordingly.

10. Push BARO knob in to obtain baroset values in In. Hg. Set the barometric display to the correct local pressure value. (Pull BARO knob out if display of baroset values in millibars is desired.)

11. Press and hold the ALT ALERT annunciator/switch on the Altitude Preselector/Alerter, and check for the following:

    A. The ALT ALERT annunciator illuminates.

    B. The warning flag comes into view.

    C. Both remote ALT ALERT annunciators illuminate.

12. Release the ALT ALERT annunciator/switch, and check for the following:

    A. The ALT ALERT annunciator extinguishes.

    B. The warning flag goes out of view.

    C. Both remote ALT ALERT annunciators extinguish.

## GENERAL OPERATION

### *ENGAGING AUTOPILOT*

Hold the AP ENGAGED - DISENGAGED switch lever on the autopilot controller in the ENGAGED position momentarily. The yaw damp system may be engaged separately by moving the YD paddle switch to the ENGAGED position.

### *DISENGAGING AUTOPILOT*

Press the control wheel AP-YD/TRIM disconnect switch for normal autopilot and/or YD disengagement.

### *OPERATING MODES*

The autopilot has three modes of operation: Manual Mode, Autopilot Sync Mode, and Guidance Mode.

#### *Manual Mode*

When the autopilot is engaged (engage lever in the ENGAGED position) and no modes are selected on the flight guidance panel or with the go-around button, the autopilot is in the manual mode. The autopilot accepts pitch and roll rate commands from the pitch wheel (UP - DN) and the TURN knob on the autopilot panel.

#### *Guidance Mode*

When the autopilot is engaged and a lateral and/or vertical mode is selected, the autopilot is in the guidance mode and accepts steering commands from the flight guidance computer.

#### *Autopilot Sync Mode*

Autopilot sync mode is controlled by the PITCH SYNC & CWS (control wheel steering) button on the control wheel. With the autopilot engaged and in either manual or guidance mode, depressing the PITCH SYNC & CWS button allows the pilot to maneuver the airplane, with servo assistance, without disengaging the autopilot. When the PITCH SYNC & CWS button is released, the autopilot maintains the attitude existing at the time the button is released if in manual mode, or follows commands received from the flight guidance computer if in guidance mode.

NOTE

The PITCH SYNC & CWS button simultaneously controls autopilot sync mode and the flight director system vertical sync mode.

### *FLIGHT DIRECTOR*

The flight director supplies steering commands for the pilot and autopilot. When the autopilot is engaged, the pilot monitors autopilot performance on the attitude director indicator. When the autopilot is not engaged, the pilot flies the airplane manually in response to the attitude director indicator commands.

### *1/2 BANK*

In ½ BANK mode, the bank limit in HDG or NAV mode is reduced to one-half the normal value. The ½ BANK mode is interlocked so that selection of APPR mode or localizer capture clears the ½ BANK mode if selected, or prevents its being selected.

### *VERTICAL MODES*

All of the air data hold modes (i.e., altitude, and the optional vertical speed and indicated airspeed) operate identically. Commands are generated to hold the reference value which exists at the time the desired mode is selected. Only one of the air data hold modes can be selected at any given time.

### *TAKEOFF (FLIGHT DIRECTOR ONLY)*

While rotating to climb attitude, press the PITCH SYNC & CWS button and establish climb airspeed. As soon as the desired climb attitude is established, release the PITCH SYNC & CWS button on the control wheel. The command bars then command flight to the pitch attitude that existed at the time the PITCH SYNC & CWS button was released. Selection of another vertical mode cancels pitch hold mode.

**WARNING**

Autopilot must be disengaged for takeoff.

NOTE

A lateral mode must be selected to bring the command bars into view and to obtain vertical sync.

### *CLIMB*

Engage the autopilot. Make heading changes by moving the heading marker on the HSI. The flight control system maneuvers the airplane in a coordinated turn to the new heading. The course arrow can be set to the first VOR course. Adjust the COURSE knob until the desired course appears in the course display window on the HSI. The head of the course arrow now indicates the direction of the selected course.

### *CRUISE ALTITUDE CAPTURE (WITH ALTITUDE PRESELECT)*

Set desired altitude on Altitude Preselector. Engage ALT SEL mode. Using desired vertical mode, maneuver the airplane toward the desired altitude. As the airplane approaches the selected altitude, the ALT CAP annunciator will illuminate, and the VS or IAS button (if selected) will automatically disengage.

### *CRUISE ALTITUDE CAPTURE (WITHOUT ALTITUDE PRESELECT)*

Prior to reaching cruise altitude, lower vertical speed to not more than 500 feet per minute. When at the cruise altitude, press the ALT button.

### *VOR NAVIGATION*

To establish the airplane on a desired VOR course, perform the following:

1. With the autopilot engaged and HDG mode selected, maintain the lateral flight path by adjusting the heading marker as required. Any vertical mode may be selected to maintain the desired vertical flight path.

2. Tune the navigation receiver to the desired VOR and verify the station identifier.

3. Set the COURSE display on the course indicator to the desired course. The head of the course arrow now represents the desired VOR course.

4. Set the heading marker on the course indicator to the desired intercept heading, and allow the autopilot to establish the airplane on the intercept heading (intercept angle not to exceed 90 degrees).

5. With the airplane established on the intercept heading, press the NAV button on the mode selector. The NL ARM annunciator will illuminate, indicating that the system is armed for VOR capture.

With the above procedures completed, the airplane follows the selected heading to the point of beam capture. At VOR course capture, the NL CAP annunciator illuminates and the HDG and NL ARM annunciators extinguish.

After capture, the system commands rollout on the VOR course, and provides automatic crosswind correction.

Normally, the lateral deviation bar on the HSI represents angular deviation from the selected course. However, if the optional linear deviation feature is in operation, the lateral deviation bar represents linear deviation. In that case, full-scale deflection (2 dots) represents an offset of 10 NM from the selected course in NAV mode, or 2 NM in APPR mode. To select the linear deviation feature, place the flight director deviation selector switch (FLT DIR DEV - ANGULAR - LINEAR ENABLED) on the pilot's instrument panel down into the LINEAR ENABLED position. If valid VOR and DME signals are being received and either NAV or APPR mode is selected on the flight guidance panel, the LIN DEV annunciator in the FCS-80 annunciator panel will illuminate, to advise the pilot that the lateral deviation bar is indicating linear deviation.

When passing over a VOR station, the autopilot computer may go into the Dead Reckoning submode, indicated by the flashing NL CAP annunciator. In the Dead Reckoning submode, the bank angle goes to zero and the airplane maintains the average course value flown just before entering the signal cone. After passing the station, the system will resume tracking the outbound course when the computer switches out of Dead Reckoning submode, indicated by steady illumination of the NL CAP annunciator.

Outbound course changes may be selected when passing the VOR station, provided the course change is not more than 60 degrees. Set the course arrow to the new outbound course at the time the to-from arrow changes from inbound to outbound. The autopilot will turn the airplane to attain the new selected course, and station passage will be as described above.

### *VOR APPROACH*

To fly a typical VOR approach, track in to the station in NAV mode. The flight control system tracks the selected course to the station. The to-from pointer will reverse at station passage. Set the heading marker under the lubber line and select HDG mode. Then proceed as follows:

1. Track outbound by adjusting the heading marker to position the airplane on the desired track. Set the course arrow to the published inbound course at this time. To start the procedure turn, adjust the heading marker to the appropriate heading for the published procedure turn.

2. Continue adjusting the heading marker not more than 135 degrees at a time for the 180-degree portion of the procedure turn. If letdown is desired during the turn, use the pitch wheel on the Autopilot Panel to set the desired rate of descent. If altitude hold is desired, press the ALT button on the mode selector at the desired altitude.

3. Maneuver the airplane to the intercept angle (not to exceed 90 degrees) in the HDG mode. When established on the desired intercept course, select APPR mode. The NL ARM annunciator will illuminate. As the flight control system intercepts the selected inbound course, the HDG and NL ARM annunciators will extinguish, and the NL CAP annunciator will illuminate.

### *FRONT COURSE APPROACH*

On an ILS front course approach, the localizer and glideslope are automatically and independently captured. The localizer is always captured from a selected heading. The glideslope can be captured from any of the vertical modes and from above or below the glideslope. To fly a front course approach, perform the following:

1. Set the heading marker to current airplane heading. Select HDG and any vertical mode on the flight guidance panel.

2. Turn the navigation receiver to the localizer frequency and verify the station identifier. Set the course arrow to the published inbound course. The runway symbol at the bottom of the attitude director indicator appears when the ILS frequency is tuned and a valid localizer signal is being received. With HDG mode still selected, set the heading marker to the desired intercept heading (intercept angle not to exceed 75°) and allow the autopilot to establish the airplane on the intercept heading. With the airplane established on the intercept heading, press the APPR button on the flight guidance panel.

3. The HDG, NL ARM, and GS ARM annunciators illuminate to indicate that the system is armed for ILS capture. As the airplane nears the localizer, the HDG and NL ARM annunciators extinguish and the NL CAP annunciator illuminates. The airplane makes a coordinated rollout on the localizer.

NOTE

The published missed approach heading may be set with the heading marker at this time.

4. Maneuver the airplane toward the glideslope using the pitch knob or any vertical mode. When the glideslope is captured, the GS ARM annunciator extinguishes and the GS CAP annunciator illuminates. Any selected vertical mode automatically releases at glideslope capture. Commands are generated to maintain the center of the localizer and glideslope.

5. If a radio altimeter is installed, the decision height (DH) annunciator illuminates when the preselected radio altitude is reached.

6. At decision height, disengage the autopilot for landing or select go-around mode, as required.

### *BACK-COURSE APPROACH*

As in a front course approach, the localizer is captured automatically. Glideslope circuits are automatically inhibited during a back course approach. To perform a back course approach, perform the following:

1. Set heading marker to current airplane heading. Select HDG mode on the flight guidance panel. Any vertical mode may be selected.

2. Tune navigation receiver to localizer frequency and verify the station identifier. Set course arrow to the published inbound (front) course. The runway symbol at the bottom of the attitude director indicator appears when the ILS frequency is tuned and a valid localizer signal is being received. Note that course arrow is always set to the front localizer course. With HDG mode still selected, set heading marker to the desired intercept heading (intercept angle not to exceed 75°) and allow the autopilot to establish the airplane on the intercept heading.

3. With the airplane established on the intercept heading, press the APPR button on the mode selector. The NL ARM, and BL annunciators illuminate to indicate that the system is armed for back localizer capture.

4. As the airplane nears the center of the localizer, the HDG and NL ARM annunciators extinguish and the NL CAP annunciator illuminates. The airplane makes a coordinated turn and rollout to track the center of the back course localizer.

5. If desired, set minimum altitude on the Altitude Preselector and select ALT SEL mode. Use the pitch wheel on the autopilot panel to establish the desired rate of descent. If minimum altitude is reached before visual contact is made and ALT SEL mode has not been used, select ALT hold to maintain minimum altitude until visual contact is made or until time to missed approach has elapsed. The autopilot must be disengaged for landing.

6. The decision height (DH) annunciator and go-around operation are the same as for a front course approach.

NOTE

It is recommended that the HDG mode be used if less than 1 mile from the runway, due to the large radio deviations encountered when flying near the localizer transmitter on a back course approach.

### *GO-AROUND*

The runway heading or published missed approach heading may be set with the heading marker on the HSI as soon as localizer capture occurs.

Execute a missed approach as follows:

1. Press the GA button. All other modes will cancel, the autopilot will disengage (yaw damp remains engaged), and steering commands will be provided for a wings-level, 7°-pitch-up attitude.

NOTE

Go-around mode can be selected anytime during the approach.

2. The 7°-nose-up pitch reference can be changed by depressing the PITCH SYNC & CWS button on the control wheel, flying the airplane to the desired pitch attitude, then releasing the PITCH SYNC & CWS button. Wings-level lateral commands continue to be presented.

3. After airplane cleanup, go-around power settings, and airspeed are established, select HDG mode on the flight guidance panel (cancels go-around mode). Commands are generated to maintain the desired heading selected with the heading marker on the HSI and to maintain the pitch attitude that existed at the time HDG mode was selected.

4. Engage the autopilot. Make heading changes by adjusting the heading marker. Use the pitch wheel on the autopilot panel to change pitch attitude.

### *TURBULENCE MODE*

Pressing the TURB button softens the autopilot gains to provide proper control in turbulence. The TURB button is a push-on, push-off switch. An interlock disables TURB mode when APPR mode is selected. The "gull wings" above the button illuminate when the TURB mode is selected.

### *AILERON MISTRIM ANNUNCIATION*

Illumination of the AIL TRIM annunciator indicates that the ailerons and/or rudder are out of trim. Disengaging the autopilot under such conditions will result in an out of trim condition. To extinguish the annunciator, adjust the aileron and/or rudder trim as required. It is neither necessary nor desirable to disengage the autopilot prior to retrimming.

### *SPECIAL NOTES*

1. With the autopilot disengaged, always maneuver the airplane to "fly" the ADI airplane symbol into the command bars to satisfy pitch and bank commands.

2. The pilot may preset the missed approach heading during the approach (after NL CAP occurs) so that missed approach steering commands will be available by selecting the HDG mode.

3. Course may be changed over a VOR station when operating in NAV mode (with NL CAP annunciator illuminated), as long as the course change is not more than 60 degrees. If the course change is more than 60 degrees, select a new intercept heading with the HSI heading marker, select HDG, set the desired VOR course, then select NAV mode again. The system reverts back to HDG and NL ARM mode, and a new capture cycle will occur.

4. When flying inbound toward a VOR at normal cruise speeds, do not set up a VOR capture problem within approximately 15 miles of the VOR station. The system does not have time to solve the problem and stabilize on course before passing over the station.

5. Limit all VOR intercept angles to 90 degrees or less, and LOC front course and back course intercept angles to 75 degrees or less. When setting the capture angle, allow for speed and distance from station, so that the system can capture without excessive overshoots.

6. When tracking outbound on a VOR course (system in NL CAP), the pilot can retune the navigation receiver to the next VOR and track inbound on the proper course without selecting HDG mode. Retune the navigation receiver at the appropriate segment changeover point. The system will remain in NL CAP during the retuning. If the signal from the new station is reliable, the to-from pointer on the HSI will change and indicate "to" the new station. If the signal is unreliable, the NAV flag on the HSI will appear. In this case, HDG mode should be selected to maintain the flight path.

7 Closely monitor outbound tracking after VOR station passage to ensure that the system is maintaining the desired track, especially after course changes or during low-altitude operations. The NL CAP annunciator will flash anytime the system is in Dead Reckoning mode.

8 Unless otherwise annunciated, distance displayed on the pilot's HSI is raw DME distance.

9. The APPR mode should be used for flying all approaches (Front Course, Back Course, VOR, and RNAV). Fly the final segment of all autopilot-coupled approaches at or above 120 KIAS, flaps 40%, and landing gear extended.

10 Linear deviation is inhibited if a localizer frequency is tuned, regardless of the position of the selector switch.

11. If the autopilot automatically disengages, the flashing AP DISC annunciator can be extinguished by depressing the AP-YD/TRIM disconnect switch on the control wheel.

**PERFORMANCE** - No Change

**WEIGHT AND BALANCE/EQUIPMENT LIST** - No Change

## SYSTEMS DESCRIPTIONS

AUTOPILOT ANNUNCIATOR PANEL

| *ANNUNCIATOR* | *CONDITIONS UNDER WHICH IT ILLUMINATES* | *COLOR* |
|---|---|---|
| NL ARM | After APPR or NAV mode is selected, after an ILS or VOR frequency is tuned, and before course capture. | Amber |

| | | |
|---|---|---|
| NL CAP (Steady) | After APPR or NAV mode is selected and signal captured. | Green |
| (Flashing) | System is in dead reckoning. | Green |
| GS ARM | After APPR mode is selected, a localizer frequency is tuned, and a glideslope valid is received on a front course approach. | Amber |
| GS CAP | After glideslope capture in APPR mode on a front course approach. | Green |
| ALT ARM | Selection of altitude preselect mode. | Amber |
| ALT CAP | Preselected altitude has been captured. | Green |
| HDG | Selection of HDG mode. Also illuminates when in NL ARM submode. | Green |
| GA | Selection of go-around mode. | Green |
| BL | After APPR or NAV mode is selected, a localizer frequency is tuned, and the difference between airplane heading and the course arrow exceeds approximately 105 degrees. | Green |
| AIL TRIM | Ailerons and/or rudder are out of trim. | Amber |
| TRIM FAIL A (or) B | Dual monitoring when elevator trim system fails or when trim runs away when autopilot is engaged. | Red |
| ALT HLD | Selection of altitude hold mode. | Green |
| AP DISC (Flashing) | Autopilot is disengaged. | Amber |
| LIN DEV | Linear deviation is being displayed. | Green |
| IAS | Selection of IAS hold mode. | Green |
| VS | Selection of VS hold mode. | Green |

## WARNING FLAGS

The flight control system flags are positive monitoring. The proper operating signals must be present to keep the associated flags from view. Limited system operation is possible with some of the flags in view. The following paragraphs describe malfunctions that cause each flag to appear, and specify the information that remains reliable in each case. Check to determine whether or not the apparent malfunction can be corrected by resetting circuit breakers, recycling an associated receiver, or slaving or erecting a gyro.

### *HEADING*

The HEADING flag indicates a failure of the compass system. All heading display and command information is unusable. For enroute operation, set the flight guidance panel mode select buttons to off to remove the command bars from view. For terminal operation, VOR/LOC deviation and glideslope information is correct.

### *GLIDESLOPE*

The GS flags indicate a malfunction of the glideslope receiver or an unreliable glideslope signal when tuned to a localizer frequency. Vertical commands in approach mode are unusable. Command information in the heading or NAV mode is correct. Attitude, heading, and VOR/LOC position information is correct.

### *NAV*

The NAV flag indicates either a malfunction of the navigation receiver or an unreliable radio signal, and warns that the lateral deviation displays and roll commands computed from VOR or localizer information are unusable.

### *COMPUTER*

The computer flag monitors the active inputs to the flight director system. If the CMPTR flag appears, command information is unusable. Attitude, heading, VOR/LOC position, and glideslope information may still be reliable. Display of one or more additional flags indicates which information is unreliable.

### *GYRO*

The GYRO flag indicates failure of the vertical reference gyro or attitude circuits. Attitude and command information is unusable. VOR/LOC position and heading information is still correct.

## HANDLING, SERVICING AND MAINTENANCE

### SERVICING SCHEDULE

If a Collins Altimeter is installed, one additional static-line drain is installed. It is located inside the nose avionics compartment in the pilot's static air line that provides static pressure to the digital air data computer. This drain should be opened to release any trapped moisture at each 100-hour inspection and after exposure to visible moisture on the ground. It must be closed after draining.

APPROVED:

For W. H. Schultz
Beech Aircraft Corporation
DOA CE-2



**FAA Approved**
**Issued: April, 1980**
**P/N 109-590010-45**

# BEECHCRAFT KING AIR F90 LANDPLANES

# PILOT'S OPERATING HANDBOOK AND FAA APPROVED AIRPLANE FLIGHT MANUAL SUPPLEMENT for AIRPLANES CERTIFICATED IN FRANCE

## GENERAL

The information in this supplement is FAA-approved material and must be attached to the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual when the airplane has been certificated for and is operated in France.

The information in this supplement supersedes or adds to the basic Pilot's Operating Handbook and FAA Approved Airplane Flight Manual only as set forth within this document. Users of the manual are advised always to refer to the supplement for possibly superseding information and placarding applicable to operation of the airplane.

## LIMITATIONS

### ENGINE OPERATING LIMITS

Engine operation at zero or negative g's is limited to 5 seconds.

*CAUTION*

Intentional negative g's are prohibited.

## EMERGENCY PROCEDURES

### ELECTRICAL SYSTEM FAILURE

*GENERATOR INOPERATIVE (DC GEN annunciator light on)*

1 Generator Switch - OFF, then to reset position for 1 second, then ON

If generator will not reset:

2. Generator Switch - OFF
3 Operating Generator - DO NOT EXCEED 1.0 LOAD

*EXCESSIVE LOADMETER INDICATION (over 1.0)*

1 Battery Switch - OFF (Monitor Loadmeter)

If loadmeter still indicates above 1.0:

2. Bus Tie Switch - OPEN
3. Non-essential Electrical Equipment - OFF

If loadmeter indicates 1.0 or below:

4. Battery Switch - ON

NOTE

Flaps and landing gear may be operated electrically with one generator inoperative.

## NORMAL PROCEDURES

### MAXIMUM REVERSE THRUST LANDING

When Landing Assured:

1. Flaps - DOWN (100%)
2. Yaw Damp - OFF
3. Condition Levers - HIGH IDLE
4. Propeller Levers - FULL FORWARD

After Touchdown:

5. Power Levers - LIFT AND REVERSE
6. Condition Levers - LOW IDLE

*CAUTION*

Propellers will NOT reverse at airspeeds in excess of 95 knots IAS.

*CAUTION*

If possible, propellers should be moved out of reverse at approximately 40 knots, to minimize propeller blade erosion. Care must be exercised when reversing on runways with loose sand or dust on the surface. Flying gravel will damage propeller blades, and dust may impair the pilot's forward field of vision at low airplane speeds.

**PERFORMANCE** - No change

**WEIGHT AND BALANCE** - No change

## SYSTEMS DESCRIPTION

### FLAPS

Two flaps are installed on each wing. Power is delivered from an electric motor to a gearbox mounted on the forward side of the rear spar. The gearbox drives four flexible driveshafts which are connected to jackscrews, one of which operates each flap. The motor incorporates a dynamic braking system through the use of two sets of motor windings. This feature helps prevent overtravel of the flaps.

The flaps are operated by a sliding switch handle on the pedestal just below the condition levers. Flap travel, from 0% (full up) to 100% (full down), is registered on an electric indicator on top of the pedestal. Three positions of flap setting are available. These settings are UP (0%), APPROACH (32.5%) and DOWN (100%). The flaps cannot be stopped at other intermediate positions. A side detent provides for quick selection of the APPROACH position of the flap system control switch.

The flap-motor power circuit is protected by a 20-ampere flap-motor circuit breaker placarded FLAP MOTOR, located on the right circuit breaker panel. A 5-ampere circuit breaker for the control circuit (placarded FLAP CONTROL) is also located on this panel.

Lowering the flaps will produce these results:

Attitude - Nose Up
Airspeed - Reduced
Stall Speed - Lowered
Trim - Nose-down Adjustment Required to Maintain Attitude

**HANDLING, SERVICING AND MAINTENANCE** - No change

Approved: Donald H Peter

for W. H. Schultz
Beech Aircraft Corporation
DOA CE-2

Beechcraft®

# SUPER KING AIR® 200, 200C, 200T, 200CT, B200, B200C, B200T, B200CT & KING AIR® C90 (LJ-668 thru LJ-1062, except LJ-670), C90A (LJ-1063 and after), E90, F90, A100 & B100 LANDPLANES

## Pilot's Operating Handbook and FAA Approved Airplane Flight Manual Supplement for AIRPLANES EQUIPPED WITH A SECONDARY ENCODING ALTIMETER

This Supplement is applicable to the following manual(s):

90-590010-61, 90-590010-87, 90-590012-3, 90-590024-5, 90-590024-23, 90-590024-35, 90-590024-69, 100-590032-1, 100-590038-1, 101-590010-127, 101-590010-147, 101-590010-327, 101-590037-3, 101-590037-29, 101-590037-57, 109-590010-3, 109-590010-57

Airplane Serial Number: ______________________________

Airplane Registration Number: ______________________________

FAA Approved: A. C. Jackson

A.C. Jackson
Beech Aircraft Corporation
DOA CE-2

## GENERAL

The information in this supplement is FAA-approved material and must be attached to the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual when the airplane has been modified by installation of a secondary encoding altimeter on the copilot's instrument panel in addition to the primary encoding altimeter installed on the pilot's instrument panel in accordance with Beech-approved data.

The information in this supplement supersedes or adds to the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual only as set forth in this document. Users of the manual are advised always to refer to the supplement for possibly superseding information and placarding applicable to operation of the airplane.

## LIMITATIONS

No change.

## EMERGENCY PROCEDURES

No change.

## ABNORMAL PROCEDURES

No change.

## NORMAL PROCEDURES

No change.

## PERFORMANCE

No change.

## WEIGHT AND BALANCE/EQUIPMENT LIST

No change.

## SYSTEMS DESCRIPTION

Airplanes equipped with a secondary encoding altimeter on the copilot's side may be configured in either of the following ways.

1. Encoded altitude information from either altimeter is provided to both transponders using the Altimeter Select switch as follows:

   Altimeter Select Switch on No. 1 - Pilot's altimeter will provide encoded information to both transponders.

   Altimeter Select Switch on No. 2 - Copilot's altimeter will provide encoded information to both transponders.

2. Encoded altitude information from the pilot's altimeter is provided only to the No. 1 transponder. Encoded altitude information from the copilot's altimeter is provided only to the No. 2 transponder. Airplanes configured in this manner do not have an Altimeter Select Switch.

## NOTE

Encoded altitude information is not dependent on the altimeter setting.

## HANDLING, SERVICING, AND MAINTENANCE

No change.

THIS PAGE INTENTIONALLY LEFT BLANK

# BEECHCRAFT DUKE B60, KING AIR C90 (LJ-668 THRU LJ-1062, except LJ-670), C90A (LJ-1063 and after) E90, F90, A100, B100, SUPER KING AIR 200, 200C, 200T, 200CT, B200, B200C, B200T AND B200CT LANDPLANES

# PILOT'S OPERATING HANDBOOK AND FAA APPROVED AIRPLANE FLIGHT MANUAL SUPPLEMENT for the FOSTER AIRDATA RNAV 612 AREA NAVIGATION SYSTEM

## GENERAL

The information in this supplement is FAA-approved material and must be attached to the Pilot's Operating Handbook and FAA-Approved Airplane Flight Manual when the airplane has been modified by installation of the Foster AirData RNAV-612 Area Navigation System in accordance with Beech-approved data.

The information in this supplement supersedes or adds to the basic Pilot's Operating Handbook and FAA-Approved Airplane Flight Manual only as set forth within this document. Users of the manual are advised always to refer to the supplement for possibly superseding information and placarding applicable to operation of the airplane.

## LIMITATIONS

1. The Area Navigation mode may not be used as a primary system under IFR conditions except on approved approach procedures, approved airways, and random area navigation routes when approved by Air Traffic Control.

2. The Area Navigation mode can only be used with colocated facilities. (VOR and DME signals originate from the same geographical location.)

## EMERGENCY PROCEDURES

*CAUTION*

DME may unlock due to loss of signal with certain combinations of distance from station, altitude and angle of bank.

1. If NAV flag appears while in the enroute mode, check for correct frequency.

2. If VOR or DME equipment is intermittent or lost, utilize other navigation equipment as required.

3. If NAV flag appears during an approach, execute published missed approach and utilize another approved facility.

## NORMAL PROCEDURES

### ANNUNCIATOR AND DIGITAL DISPLAY SELF-TEST

1. Rotate MODE SELECT knob to VOR/LOC.

2. Press Test Button "T" and hold. Digital display segments will read all 8's. Release Test Button.

3. Press each waypoint button (1 through 4, and AUTO WPT), and release. Each lamp will illuminate briefly.

4. Rotate MODE SELECT knob through all positions. Corresponding annunciator lamps will illuminate in each position. In CRS mode, note position of OBS indication and compare with CRS digital display. Push Test Button "T" in CRS mode to display OBS setting to 0.1° resolution.

## RNAV SELF-TEST

1. Select RNAV mode. Active waypoint button will be solidly lit.
2. Press Test Button "T" and hold. Active waypoint address will be displayed. BRG and RNG annunciators will be solidly lit.
3. Check for centered needles on proper BRG value with TO flag.
4. Release Test Button "T".

## PROGRAMMING

Waypoints 1 through 4 and AUTO WPT function as standard programmable waypoints when manually programmed. AUTO WPT may be programmed for automatic computation of waypoint addresses on either VOR cardinal radials or the airplane's VOR/DME Present Position.

### PROGRAMMABLE WAYPOINTS

1. Rotate MODE SELECT knob to RAD/DIST.
2. Press desired waypoint button. Button to be programmed will blink continuously, while waypoint button in use remains solidly lit. RAD annunciator blinks continuously, and DST annunciator is solidly lit.
3. Use DATA knobs to enter desired Radial in left display. Small knob changes "tenths" digit in 0.1° steps. Large knob changes "tens" digit in 10° steps. Overflow from any digit carries over to next digit to left. "Rate Sensing" provides accelerated display changes with rapid knob movements, to speed programming.
4. Press blinking waypoint button again. DST annunciator blinks continuously and RAD annunciator is solidly lit.
5. Use DATA knobs to enter desired Distance in right display. Small knob changes "tenths" digit in 0.1 NM steps. Large knob changes "tens" digit in 10 NM steps. Overflow and rate sensing same as (3).
6. Rotate MODE SELECT knob to FREQ/ELEV.
7. Push the blinking waypoint button again. The FREQ annunciator will commence blinking.
8. Program the NAV receiver to the correct frequency. Rotate the DATA knobs to program the VOR frequency. Display of the three digits left of the decimal point is controlled by the large knob and appears in the left display. The first digit right of the decimal point, and the left most digit in the right display are controlled by the small knob. The last digit displays 0 or 5 only, for 50kHz channel spacing.
9. Push blinking waypoint button again. The ELV annunciator will blink.
10. Program the VOR station MSL elevation (in thousands) in the right hand digit of the right display by rotating the large DATA knob. Waypoint address is now stored.

NOTE

When reprogramming an active (in use) waypoint, waypoint lamp status will change from solidly lit to blinking. New waypoint information will immediately modify active waypoint address, HSI/CDI display, and autopilot control.

## AUTOMATIC WAYPOINTS

1. Set HSI/CDI OBS to desired course between departure and destination points and tune NAV receiver to first reference VORTAC.

2. Rotate MODE SELECT knob to SET (AUTO WPT). AUTO WPT flashes. RAD and DST annunciators are solidly lit.

3. Rotate large DATA knob until desired Cardinal Radial (0°, 90°, 180°, 270°) appears in left display and waypoint distance appears in right display. Note that only Cardinal Radials can be selected.

   If the courseline does not intercept the selected cardinal radial within 299.9 NM of the VORTAC, the right display will show horizontal bars. In this case, the courseline, cardinal radial or VORTAC must be altered.

4. Rotate MODE SELECT knob to RNAV and activate Automatic Waypoint by pressing the AUTO WPT button. Displays will show bearing and Range to Waypoint. BRG and RNG annunciators will be solidly lit. If Auto WPT "DIST" is invalid, displays will be all bars and DST annunciator will blink.

   HSI/CDI steering and autopilot will respond to established courseline, as set by the OBS.

5. Program and activate each new automatic waypoint as the active waypoint is crossed, by tuning the NAV receiver to new VORTAC frequency ahead of the airplane along the established courseline, and repeating steps 2 through 4.

6. As sequential VORTAC stations with differing magnetic variations are selected, modify the OBS setting to maintain the desired track to the destination.

## PRESENT POSITION WAYPOINTS

1. Establish airplane in RNAV MODE over desired geographic location.

2. Rotate MODE SELECT knob to RAD/DIST. Press AUTO WPT causing it to blink.

3. Press VOR/DME pushbutton to transfer into memory, the aircraft's Present Position waypoint (radial and distance) relative to selected VORTAC.

## CROSSTRACK OFFSET

Crosstrack (XTK) is used to create an RNAV courseline which is parallel to and up to 20 NM either side of the courseline to a waypoint. In the RNAV mode, crosstrack may be programmed simultaneously for all waypoints in memory.

1. Rotate the MODE SELECT knob from RNAV position to CRS/XTK position. XTK annunciator and R annunciator are solidly lit.

2. The small DATA knob controls "tenths" and the large knob controls "units". Rotate knobs clockwise for right crosstrack offset and counterclockwise for left crosstrack offset. L annunciator is solidly lit for left crosstrack settings and R annunciator is off. Displayed crosstrack offset is now stored in memory. L or R and XTK annunciators will flash during entry of new data.

3. Activate pre-programmed XTK in each waypoint by placing the steering mode switch at top of RNAV612 in XTK position. L or R and XTK will be solidly lit when XTK mode is selected.

NOTE

XTK cannot be programmed if mode knob is turned to XTK from VOR/LOC position. XTK can only be programmed when mode knob is turned to XTK position from RNAV mode.

## NAVIGATION

### RNAV NAVIGATION PROCEDURES

The RNAV612 is in the RNAV mode at all times when the MODE SELECT knob is in the RNAV position, or when it is rotated from the RNAV position to CRS/XTK, RAD/DIST, FREQ/ELEV or SET (AUTO WPT). Digital bearing and distance to the waypoint are continuously displayed (except during programming, self-test or recall of other data), and the BRG and RNG annunciators are solidly lit.

The RNAV provides left/right steering, flag and to/from signals to the HSI/CDI. RMI steering and flag signals are optional. The steering method (Enroute, Approach, Crosstrack) is determined by the position of the steering selector switch.

#### *WAYPOINT ADDRESS DISPLAY*

Any active or inactive waypoint address (radial and distance) may be recalled and digitally displayed. The RAD and DST annunciators will be solidly lit during recall and display.

#### *ACTIVE WAYPOINT*

With MODE SELECT knob in RNAV position, press and hold the active waypoint button to display its address.

2. In the RNAV mode, with the MODE SELECT knob in RAD/DIST position, the active waypoint address is automatically displayed.

#### *INACTIVE WAYPOINTS*

1. With the MODE SELECT knob in the RAD/DIST position, inactive waypoint addresses may be displayed by pressing the desired waypoint pushbutton. Returning to the RNAV mode will restore the active waypoint BRG/RNG display.
2. With the MODE SELECT knob in the VOR/LOC or CRS/XTK position, press and hold any inactive waypoint button to display its address radial and distance in the left and right digital displays.

#### *GROUNDSPEED/TIME-TO-WAYPOINT DISPLAY*

In the RNAV mode, press and hold the KTS/MIN button. The left digital display will show groundspeed (knots) to the waypoint. The right digital display will show time (minutes) to the waypoint. The KTS and MIN annunciators will be solidly lit.

RNAV groundspeed computation will normally be valid after 15 miles of flight toward a waypoint. When orbiting a waypoint, groundspeed of 60 KTS or less will not be displayed.

*PRESENT POSITION DISPLAY*

PRESENT POSITION is commonly used to identify the exact airplane position relative to the VORTAC while flying computed RNAV routes.

With the MODE SELECT knob in any position except OFF, press and hold the VOR/DME button. The left digital display will show the radial from the VOR to the airplane position. If the station is a VORTAC, the right digital display will show airplane distance from the VORTAC along this radial. The VOR and RAD (VOR Radial) and DME annunciators will be solidly lit.

*HSI/CDI OBS SETTING AND CROSSTRACK OFFSET DISPLAY*

**In the RNAV mode, rotate the MODE SELECT knob to the CRS/XTK position. The left digital display shows CDI/HSI OBS setting and the CRS annunciator will be solidly lit.**

**Rotation of the OBS knob will cause a corresponding change in the digital CRS display. This feature can be used to reduce pilot setting error when selecting a course.**

NOTE

To obtain 0.1° course OBS resolution, push Test Button "T".

While in this mode, the right digital display shows any crosstrack offset programmed for the active waypoint, and the XTK and R or L annunciators will be solidly lit.

VOR/LOC OPERATION

The RNAV612 is in either the VOR or Localizer mode at all times when the MODE SELECT knob is in the VOR/LOC position, or when it is rotated from the VOR/LOC position to CRS/XTK.

When the RNAV612 is in the VOR/LOC mode and the NAV receiver is channeled to a VORTAC station, the digital displays show VOR bearing and DME distance TO the station. The VOR and DME annunciators will be solidly lit.

When the localizer receiver is used (Localizer mode), the left display will show dashes and annunciators will be off. The RNAV612 displays continuous digital distance to the terminal DME in the right display, and the DME annunciator will be solidly lit.

If there is no terminal DME, the right display will also show dashes and the DME annunciator will be off.

*HSI/CDI OBS SETTING DISPLAY*

**In the VOR/LOC mode, rotate the MODE SELECT knob to CRS/XTK. The left digital display will show the CDI/HSI OBS setting and the CRS annunciator will be solidly lit. The right digital display will be blank, indicating XTK is neither operational nor programmable in the VOR/LOC mode.**

NOTE

To obtain 0.1° CRS display resolution, push Test Button "T" while in CRS mode.

*GROUNDSPEED/TIME-TO-VORTAC DISPLAY*

In the VOR/LOC mode, press and hold the KTS/MIN button. The left digital display will show groundspeed (knots) to the station. The right digital display will show time (minutes) to the VORTAC. The KTS and MIN annunciators will be solidly lit.

### *PRESENT POSITION DISPLAY*

With the MODE SELECT knob in the VOR/LOC or CRS/XTK position, press and hold the VOR/DME button. The left digital display will show the radial from the VOR to the airplane position. If this station is a VORTAC, the right digital display will show the airplane distance from the VORTAC along this radial. The VOR and RAD (VOR Radial) and DME annunciators will be solidly lit.

## RNAV STEERING

RNAV612 provides linear (constant course width) HSI/CDI steering information in the RNAV mode, with Enroute (ENR), Approach (APP) or Crosstrack (XTK) steering.

### *ENROUTE (ENR)*

With the RNAV612 steering selector in the Enroute (ENR) position, full scale course width is a constant ±5 NM.

### *APPROACH (APR)*

The RNAV612 steering selector may be moved to the Approach (APR) position for increased HSI/CDI steering resolution. Full scale course width is ±1.25 NM.

Approach mode steering sensitivity should be used only on RNAV instrument approaches inside the Final Approach Fix.

### *CROSSTRACK (XTK)*

The RNAV612 may be programmed to establish a parallel courseline up to 20 NM either side of an RNAV course. When Crosstrack (XTK) steering has been selected, the HSI/CDI needle will center when the aircraft is on the programmed parallel offset course. As with enroute steering, full scale HSI/CDI needle deflection is ±5 NM.

## VOR/LOC STEERING

When a VOR station has been selected in the VOR/LOC mode, HSI/CDI steering will be based on conventional $\pm 10^\circ$ full scale track angle deviation from the selected courseline. The HSI/CDI needle will center when the aircraft is on the courseline set into the OBS. When the localizer has been selected, HSI/CDI needle sensitivity will assume standard localizer course width characteristics.

## DIGITAL STEERING

The RNAV612 has fully digital navigation steering capability in both the RNAV and VOR modes, including left/right steering and range to waypoint or DME distance to the VORTAC. The RNAV612 digital steering is a viable and precise method of navigation, and can also be employed as a backup to the HSI/CDI.

Digital steering follows the same rule as ADF steering. When inbound TO a waypoint or VOR, fly right to reduce the displayed bearing and left to increase it.

## APPROACH RANGE MONITOR

The Approach Range Monitor feature provides for the separation of the RNAV computed range to a waypoint from the steering guidance of the pilot's horizontal situation indicator. Selecting the Approach Range Monitor switch to the RANGE MONITOR position will connect the RNAV computer to the NAV 2 receiver. The pilot's horizontal situation indicator will be retained on the NAV 1 receiver.

On an ILS approach, for example, it is desirable to know distance to the outer marker and then to the runway threshold. By selecting RANGE MONITOR and setting the appropriate NAV 2 frequency and waypoint parameters, the distance to the desired fix will be continuously displayed while ILS steering guidance on the horizontal situation indicator will be conventional. The result is the ability to fly a localizer or full ILS steering situation while retaining RNAV computed distance to a selected fix.

*CAUTION*

It is imperative the Approach Range Monitor switch be placed in the NORMAL position during RNAV operations. If left in the RANGE MONITOR position, the range display will be based on the NAV 2 frequency, and the pilots horizontal situation indicator will display conventional VOR steering based on the selected NAV 1 frequency.

Approved: Donald St Retter

For W. H. Schultz
Beech Aircraft Corporation
DOA CE-2

Beechcraft®

# SUPER KING AIR® B200, B200C, B200T, B200CT
# KING AIR® C90 (LJ-668 thru LJ-1062, except LJ-670), C90A (LJ-1063 and after), E90, F90 and B100 LANDPLANES

## Pilot's Operating Handbook and FAA Approved Airplane Flight Manual Supplement for the GROUND COMMUNICATIONS ELECTRIC POWER BUS

This Supplement is applicable to the following manual(s):

P/N 90-590010-61, P/N 90-590010-87, P/N 90-590012-3, P/N 90-590024-5,
P/N 90-590024-23, P/N 90-590024-35, P/N 90-590024-43, P/N 90-590024-61,
P/N 90-590024-69, P/N 100-590038-1, P/N 101-590010-147, P/N 101-590010-327,
P/N 101-590037-29, P/N 101-590037-57, P/N 109-590010-3 and P/N 109-590010-57

Airplane Serial Number: ______________________

Airplane Registration Number: ______________________

FAA Approved:

A.C. Jackson
Beech Aircraft Corporation
DOA CE-2

## GENERAL

The information in this supplement is FAA-approved material and must be attached to the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual when the airplane has been modified by installation of the Ground Communications Electric Power Bus in accordance with Beech-approved data.

The information in this supplement supersedes or adds to the basic Pilot's Operating Handbook and FAA Approved Airplane Flight Manual only as set forth within this document. Users of the handbook are advised always to refer to the supplement for possibly superseding information and placarding applicable to operation of the airplane.

## LIMITATIONS

Operation of the Ground Communications Electric Power Bus is restricted to ground operation only. No authorization is extended to operate this system in any flight configuration.

The Ground Communications Electric Power Bus must not be used when refueling the airplane.

## EMERGENCY PROCEDURES

No change.

## ABNORMAL PROCEDURES

No change.

## NORMAL PROCEDURES

*SYSTEM ACTIVATION:*

1. Battery and Generator Switches - OFF
2. GND COMM PWR Switch - Press ON (GND COMM PWR annunciator illuminates.)

**NOTE**

Activation of this system by any means other than the prescribed procedure is not approved.

*SYSTEM DEACTIVATION:*

1. GND COMM PWR Switch - Press OFF (GND COMM PWR annunciator extinguishes)

**CAUTION**

Ensure the ground communications power switch is off before leaving the airplane so a drain on the battery will not occur.

## PERFORMANCE

No change.

## WEIGHT & BALANCE

No change.

## SYSTEMS DESCRIPTION

The Ground Communications Electric Power Bus provides electric power directly from the battery (auxiliary battery, if installed) when selected by the pilot. Control of the system consists of a push on/push off solenoid-held annunciator switch located on the instrument panel. Circuit protection is provided by the GND COMM circuit breaker. Audio is provided in the headphones, with speaker audio optional. Subsequent activation of the battery switch (or appropriate generator switch with engine running) will result in automatic disconnection of the ground communications bus from the comm system; however, the normal method for deactivation of the system is accomplished by pressing the GND COMM PWR switch.

## HANDLING, SERVICING & MAINTENANCE

No change.

THIS PAGE INTENTIONALLY LEFT BLANK

**BEECHCRAFT SUPER KING AIR 200, 200C,**
**200T, 200CT, B200, B200C, B200T, B200CT**
**AND KING AIR F90 LANDPLANES**

PILOT'S OPERATING HANDBOOK AND FAA APPROVED
AIRPLANE FLIGHT MANUAL SUPPLEMENT

for the

GLOBAL GNS-500A VLF/OMEGA NAVIGATION SYSTEM
SERIES 3A, 3B, 3C, OR 4
WITH OPTIONAL VANDLING NAVIGATION DATA BANK

**THIS SUPPLEMENT IS APPLICABLE TO**
**PILOT'S OPERATING HANDBOOK AND**
**FAA APPROVED AIRPLANE FLIGHT MANUAL**
**P/N's: 101-590010-127, 101-590037-3B,**
**101-590010-147, 101-590037-29, 109-590010-3,**
**AND 109-590010-57**

Airplane Serial Number:____________________

Airplane Registration Number:____________________

FAA Approved: Donald H. Petts

for W. H. Schultz
Beech Aircraft Corporation
DOA CE-2

**CONTENTS**



## GENERAL

The information in this supplement is FAA-approved material and must be attached to the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual when the airplane has been modified by installation of the Global GNS-500A Series 3A, 3B, 3C, or 4 VLF/OMEGA Navigation System in accordance with Beech-approved data.

The information in this supplement supersedes or adds to the basic Pilot's Operating Handbook and FAA Approved Airplane Flight Manual only as set forth within this document. Users of the manual are advised always to refer to the supplement for possibly superseding information and placarding applicable to the operation of the airplane.

The appropriate Global Navigation GNS-500A Operator's Manuals, Report 1080 for Series 3 installations, Report 1230 for Series 4 installations and Reports 1230 and 1250 for Series 4 installations with the optional Special Mission software package are available from Global Navigation Incorporated, 2144 Michelson Drive, Irvine, California 92715. The appropriate Vandling Corporation NDB-2 Operator's Manual, Report Number 10 is available from Vandling Corporation, 16270 Raymer Street, Van Nuys, California 91406. It is the responsibility of the owner/operator to maintain the appropriate operator's manuals in current status.

## LIMITATIONS

The GNS-500A Series 3A, 3B, 3C, or 4 may be used as an additional means of enroute navigation during VFR/IFR conditions provided the following limitations are observed:

1. Operation must be in conformity with the Global Navigation GNS-500A Operator's Manual, Report 1080 dated September 1, 1980, or later issue for Series 3A, revised June 1, 1981 or later issue for Series 3B, revised October 1, 1982 or later issue for Series 3C, or Report 1230 dated April 1, 1986 or later issue for Series 4, and Report 1230 dated April 1, 1986 or later issue and Report 1250 dated February 1,1987 or later issue for Series 4 with optional Special Mission software package. Operation of the Optional Vandling Navigation Data Bank must be in conformity with the Vandling NDB-2 Operator's Manual, Report Number 10 dated January 19, 1981 or later issue for Series 3A or 3B, revised November 1, 1981 or later issue for Series 3C, or revised April 1, 1986 or later issue for Series 4.
2. Only enroute operations in the continuous United States and Alaska are approved.
3. The system is not to be used for navigation in terminal areas, during departures from or approaches to airports, into valleys or between peaks in mountainous terrain, or below Minimum Enroute Altitude (MEA).
4. Additional equipment which would permit navigation appropriate to the available ground facilities must be installed and operating.
5. VOR and DME equipment must be installed and operating during navigation on approved RNAV routes.
6. IFR flight is not approved based on VLF/OMEGA navigation into any area in which such operation could not be approved based on the installed equipment required by paragraph 4. This includes overwater flights beyond the range of approved navigation facilities.
7. The VLF/OMEGA position information must be checked for accuracy (reasonableness) against a visual ground fix or other approved navigation equipment under the following conditions:
   a. Prior to compulsory reporting points during IFR operation when not under radar surveillance or control.
   b. At or prior to arrival at each enroute waypoint during operations on an approved RNAV route.

c. At hourly intervals during operation off of approved RNAV routes.

8. Update VLF/OMEGA position information when a cross-check with other onboard approved navigation equipment reveals an error greater than 2 nautical miles along track or crosstrack.

9. Navigation shall not be predicated on the use of this system during periods of dead reckoning.

10. Following a period of dead reckoning, the VLF/OMEGA position information must be verified and updated as required by a visual ground fix, or by using other approved navigation equipment.

## EMERGENCY PROCEDURES

Refer to Global Navigation GNS-500A Operator's Manual, Report 1080 dated September 1, 1980 or later issue for Series 3A, revised June 1, 1981 or later issue for Series 3B, revised October 1, 1982 or later issue for Series 3C or Report 1230 dated April 1, 1986 or later issue for Series 4, and Report·1230 dated April 1,1986 or later issue and Report 1250 dated February 1,1987 or later issue for Series 4 with optional Special Mission software package.

## NORMAL PROCEDURES

Refer to Global Navigation GNS-500A Operator's Manual, Report Number 1080 dated September 1, 1980 or later issue for Series 3A, revised June 1, 1981 or later issue for Series 3B, revised October 1, 1982 or later issue for Series 3C, or Report 1230 dated April 1, 1986 or later issue for Series 4, or Report 1230 dated April 1, 1986 or later issue and Report 1250 dated February 1,1987 or later issue for Series 4 with optional Special Mission software package.

Refer to Vandling Corporation NDB-2 Operator's Manual, Report Number 10, dated January 19, 1981 or later issue for Series 3A and 3B, revised November 1, 1981 or later issue for Series 3C or revised April 1, 1986 or later issue for Series 4, for operation of navigation data bank, if installed.

Computer Program Identification:

1. Turn system-ON
2. When initialization page automatically appears, note program version (3A, 3B, 3C, or 4A) on the bottom line. The display will read:

| | |
|---|---|
| PROG 3A | XXXX/X |
| PROG 3B | XXXX/X |
| PROG 3C | XXXX/X |
| PROG 4A | XXXX/X |

### VLF/OMEGA AUTOMATIC FLIGHT CONTROL SYSTEM INTERFACE

When tracking a VLF/OMEGA course with AFCS, utilize the heading mode to accomplish course changes greater than 25°. The enroute navigation mode may then be re-engaged to capture and track the new course.

## PERFORMANCE

No Change

## WEIGHT & BALANCE

No Change

## SYSTEMS DESCRIPTION

No Change

## HANDLING, SERVICING, AND MAINTENANCE

No Change

**BEECHCRAFT KING AIR C90 (LJ-668 thru LJ-1062, except LJ-670), C90A (LJ-1063 and after) E90, F90 SUPER KING AIR B200, B200C, B200T, and B200CT LANDPLANES**

**PILOT'S OPERATING HANDBOOK AND FAA APPROVED AIRPLANE FLIGHT MANUAL SUPPLEMENT for the KING KNS-81 INTEGRATED NAVIGATION SYSTEM**

## GENERAL

The information in this supplement is FAA-approved material and must be attached to the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual when the airplane has been modified by installation of the King KNS-81 Navigation System in accordance with Beech-approved data.

The information in this supplement supersedes or adds to the basic Pilot's Operating Handbook and FAA Approved Airplane Flight Manual only as set forth within this document. Users of this manual are advised always to refer to the supplement for possibly superseding information and placarding applicable to operation of the airplane.

For airplanes so equipped, the Pilot's Guide for the TACAN-compatible KNS-81 Integrated Navigation System, KPN 006-8369-00 5K dated 11/82 or later revision, is available from: King Radio Corporation, 400 N. Rogers Road, Olathe, KS 66062. It is the responsibility of the owner/operator to maintain the above pilot's guide in current status.

## LIMITATIONS

1. The Area Navigation mode may not be used as a primary system under IFR conditions except on approved approach procedures, approved airways, and random area navigation routes when approved by Air Traffic Control.

2. The Area Navigation and VOR-PAR modes can only be used with colocated facilities (VOR and DME signals originate from the same geographical location).

3. VOR or VOR-PAR modes may be selected only when flying directly to or from a VORTAC facility. TAC mode may be selected only when flying to or from a VORTAC or TAC-only facility.

4. An area navigation installation located on the right instrument panel may be used for primary navigation only if a qualified pilot occupies the right seat.

5. In addition to this supplement, operation of the TACAN-compatible KNS-81 system must be in conformity with King Radio Pilot's Guide for the TACAN-Compatible KNS-81 Integrated Navigation System, KPN 006-8369-00 5K, dated 11/82, or later revision.

## EMERGENCY PROCEDURES

*CAUTION*

DME may unlock due to loss of signal with certain combinations of distance from station, altitude and angle of bank.

1. If NAV flag appears while in the Area Navigation mode, use CHK button to check for validity of raw DME and VOR data.

2. If VOR or DME equipment is intermittent or lost, utilize other navigation equipment as required.

3. If NAV flag appears and/or DME information is lost during an approach, execute published missed approach and utilize another approved facility.

## NORMAL PROCEDURES

For airplanes equipped with the optional TACAN-compatible KNS-81, refer to the Pilot's Guide (item 5 of Limitations) for procedures related to the TACAN mode of operation.

### PREFLIGHT

*AREA NAVIGATION FUNCTIONAL TEST*

The following procedure applies only to airports equipped with, or in range of, a colocated VOR/DME STATION.

1. Place the KNS-81 in VOR mode.

2. Find and record the angle from the VOR station by centering the course deviation needle with the TO/FROM flag giving a "FROM" indication.

3. Program a waypoint radial angle equal to the OBS value determined in Step 2.

4. Program a waypoint distance equal to the indicated DME value.

5. Place the KNS-81 in RNAV.

The KNS-81 is operating properly if the distance to waypoint is 0 + 1.0 NM and the course deviation needle is within a dot of being centered.

### PROGRAMMING

Pertinent information (waypoint number, station frequency, waypoint radial, and waypoint distance) can be entered into the memory. Programming may be completed prior to takeoff or during the flight. Any combination of navigational facilities (RNAV waypoint, VOR/DME, ILS) may be loaded into the computer, however, it is desirable that each facility be numbered and loaded in the sequence it is to be used.

*RNAV WAYPOINTS*

1. Turn the system on by rotating the ON/OFF switch clockwise.

2. Put waypoint 1 in the WPT window by turning the WPT knob. Turn the knob in either direction to get "1".

3. Select the waypoint 1 frequency using the data input controls which are the two concentric knobs on the right.

4. Select the waypoint 1 radial by depressing the DATA button. This will move the > < (caret) from FRQ to RAD. Select the new radial with the data input controls.

5. Select the waypoint 1 distance by again depressing the DATA button. This will move the > < from RAD to DST. Select the new distance with the data input controls.

6. This completes the programming for the first waypoint. Follow these procedures for all selected waypoints.

*CONVENTIONAL VOR*

1. The programming technique for conventional navigation directly toward or away from a VOR facility without a colocated DME is similar to that for RNAV waypoints. Putting the waypoint number and frequency

into the memory is accomplished in the same manner. The RAD and DST displays will display dashes during VOR and VOR-PAR operation.

*ILS APPROACH (Front course and Back course)*

1. Programming and ILS approach is accomplished in the same manner as programming conventional VOR.

*MISSED APPROACH*

1. If the published missed approach utilizes an RNAV waypoint or VOR facility, it may be entered into the memory any time prior to the approach. This is accomplished in the same manner set forth in CONVENTIONAL VOR and RNAV WAYPOINTS in this section.

*INFLIGHT*

1. Preset waypoints may be recalled from memory and put into active use as required. Turn the WPT knob as required to select the desired waypoint. The preset waypoint number, frequency, radial and distance will appear in their respective displays. The WPT display will blink to indicate that the waypoint displayed is other than the active waypoint.

2. Verify that the data is correct.

NOTE

Revisions to the waypoint data can be programmed at this time by entering the new waypoint parameters.

3. When return to the active waypoint is desired, press the RTN button. The active waypoint along with its data will be displayed.

4. When navigation to the displayed (blinking WPT) waypoint is desired, press the USE button. The WPT display will cease blinking and the displayed waypoint becomes the active waypoint.

5. The raw VOR & DME data can be checked at any time by pressing the CHK button. The radial from the VOR will be displayed above RAD and the DME distance will be displayed above DST.

*RNAV OPERATION*

If the system is receiving valid signals from a colocated VOR-DME facility, it will supply linear deviation information to the Horizontal Situation Indicator (or Course Deviation Indicator). Enroute (RNAV) sensitivity, available by turning the MODE selector knob until RNAV is displayed, provides a constant course width of ± 5 NM full scale.

Approach (RNAV-APR) sensitivity, available by turning the MODE selector knob until RNAV-APR is displayed, provides a constant course width of ± 1¼ NM full scale. Approach sensitivity should be selected just prior to final approach course interception. Time and distance to the waypoint, and computed groundspeed are displayed on the DME display.

*CONVENTIONAL VOR OPERATION*

VOR or VOR-PAR modes are selected by turning the MODE selector knob until VOR or VOR-PAR is displayed. In VOR mode the remote DME is automatically tuned when the KNS-81 is selected as the tuning source. Upon lock-on, distance, groundspeed and time to the VORTAC station will be displayed on the DME display. The HSI (CDI) will display conventional angular crosstrack deviation from the selected course (±10° full scale). In VOR-PAR mode, operation is identical to VOR except the HSI (CDI) will display crosstrack deviation of ±5 NM full scale from the selected course. Course width will be constant irrespective of distance from the VORTAC. The VOR-PAR mode is not available in the TACAN-compatible KNS-81.

Anytime the RAD button is engaged, the radial from the waypoint/station will be displayed on the DME knots display along with an "F" on the DME time to station display.

NOTE

> The RAD switch is not the momentary type, therefore, the switch must be pressed again for the normal DME information to be displayed.

*ILS OPERATION*

Whenever an ILS Frequency is put "IN USE" the mode display will remain the same (either VOR, VOR-PAR, RNAV, RNAV-APR displayed) but the RAD & DST displays will be blanked. Absence of the LOC/GS functions is annunciated by the NAV and GS flags in the HSI (CDI). Only angular deviation is provided in the ILS Mode.

*RNAV APPROACH*

The RNAV Approach (RNAV-APR) mode may be used for runway location (by placing a waypoint at the approach end of the runway) during an approach to an airport. Turn the MODE selector knob to select RNAV-APR. In RNAV-APR the deviation needle on the HSI (CDI) will display crosstrack deviation of $\pm 1\frac{1}{4}$ NM full scale. All other aspects of the RNAV-APR mode are identical to the RNAV mode.

*RANGE MONITOR (OPTIONAL)*

The range monitor feature provides for the separation of the RNAV computed range to a waypoint from the steering guidance of the pilot's horizontal situation indicator. Pressing the SPLIT switch in the cluster of nav function switches will result in the RNAV computer (NAV-2) distance and bearing being presented on the pilot's horizontal situation indicator. NAV-1 steering will be retained. This is indicated by the background illumination of the DME-2, HSI-1 and RMI-2 legends on the SPLIT switch.

On an ILS approach, for example, it is desirable to know distance to the outer marker and then to the runway threshold. By selecting SPLIT and setting the appropriate NAV-2 frequency and waypoint parameters into the system, the distance to the desired fix will be continuously displayed while ILS steering guidance on the horizontal situation indicator will be conventional. The result is the ability to fly a localizer or full ILS steering situation while retaining RNAV computed distance to a selected fix.

*CAUTION*

> It is imperative the NAV-2 switch be selected during RNAV operation or the NAV-1 or NAV-2 switch be selected during conventional VOR/ILS operation. If the SPLIT switch is activated, the range display will be based on the NAV-2 frequency and waypoint parameters, and the pilot's horizontal situation indicator will display conventional VOR steering based on the selected NAV-1 frequency.

**PERFORMANCE -** No change

**WEIGHT AND BALANCE -** No change

**SYSTEM DESCRIPTION**

The King KNS-81 is an integrated navigation system combining a 200 channel VOR/Localizer receiver, a 40 channel glideslope receiver and a digital RNAV computer with a capability of preselection and storage of 9, or on later models 10, VOR/LOC frequencies and equivalent sets of RNAV waypoint parameters. A DME System must be used in conjunction with the KNS-81.

The KNS-81 can be operated in any one of three basic modes: VOR, RNAV, or ILS. To change from one mode to another the rotary MODE selector knob on the left side of the panel is rotated, except that the ILS Mode is entered automatically whenever an ILS frequency is channeled as the ACTIVE frequency. The display will annunciate the mode by lighting a message beside the WPT display, except in the ILS mode in which case the RAD & DST displays are blanked to denote the ILS mode. In addition to the standard VOR & RNAV enroute (RNAV) modes, the KNS-81 has a constant course width or parallel VOR mode (VOR-PAR) and an RNAV approach mode (RNAV-APR). The same rotary MODE selector knob is used to place the unit in either of these secondary modes. The VOR-PAR mode is not available in the TACAN-compatible KNS-81.

All waypoint information (station frequency, waypoint distance and waypoint radial) is entered with the increment/decrement rotary switch on the right side of the panel and displayed in their respective displays. The small knob affects the least significant digits while the large knob changes the most significant digits. The tenth's position of waypoint radial and distance can be changed by pulling the small knob to the out position. The type of data being selected is indicated by the illuminated carets (> <) located by either FRQ, RAD or DST. Frequency, radial or distance information for a waypoint can be selected sequentially by pressing the DATA push button. The increment/decrement switch changes only the information being displayed with the carets.

The KNS-81 can store frequency, radial and distance information for up to ten waypoints. The waypoint number of the data being displayed is located above the message WPT. This waypoint number is changed by rotating the WPT selector knob (small center knob) on the left side of the panel. If the waypoint in use is different from the displayed Waypoint (WPT blinking), pressing the USE button will cause the displayed WPT to become the waypoint in use.

## DISPLAYS

1. FRQ, RAD, DST Display
   a. FRQ Display

      Displays frequency from 108.00 to 117.95 MHz in increments of .05 MHz. Least significant digit displays only zero or five.

   b. RAD Display

      Displays ground station radial on which waypoint is located from 0.0 to 359.9 degrees.

   c. DST Display

      Displays the offset distance of the waypoint from the ground station over a range of 0.0 to 199.9 NM.

2. VOR, PAR, RNAV, RNAV-APR Displays

   System mode lights

3. WPT Display

   Displays waypoint number of data being displayed.

4. Carets (> <) Display

   Indicates which waypoint data (FRQ, RAD or DST) the increment/decrement rotary switch will change.

5. DME Indicator (Remote)

   Displays NM to/from the waypoint/station, KT ground speed and MIN time to the waypoint/station. Also, the waypoint radial is displayed whenever the KNS-81 RAD button is pressed.

6. RMI Display (Optional)

   Displays the bearing to the waypoint/station.

## CONTROLS

1. WPT/MODE Control

   Dual concentric knobs.

   a. The outer knob selects the MODE of unit operation. Turning the knob clockwise causes the mode to sequence thru VOR, VOR-PAR, RNAV, RNAV-APR and then back to the VOR mode.

   b. The center knob selects the WPT to be displayed. Turning the knob causes the displayed waypoint to increment by one thru the waypoint sequence of 1, 2, 8, 9, 1, or on later models 0, 1, . . . . 8, 9, 0.

2. USE Button

   Momentary pushbutton which, when pressed, causes the active waypoint to take on the same value as the displayed waypoint.

3. RTN Button

   Momentary pushbutton which, when pressed, causes the active waypoint to return to the display.

4. RAD Button

   Push-on, push-off button which, when pushed on, causes the radial from the waypoint and "F" to be displayed on the remote DME display.

5. CHK Button

   Momentary pushbutton which, when pressed, causes the raw data from the NAV Receiver and DME to be displayed. The radial from the VOR Ground Station will be displayed on the RAD display and the distance from the station will be displayed on the DST display. There is no effect on any other data output.

6. DATA Button

   Momentary pushbutton which, when pressed, causes the caret (> <) display to change from FRQ to RAD to DST and back to FRQ.

7. ON/OFF/Pull ID Control

   Rotary switch/potentiometer which, when turned clockwise, applies power to the KNS-81 and increases NAV audio level. The switch may be pulled out to hear VOR ident.

8. DATA INPUT Control

   Dual concentric knobs with the center knob having an "in" and "out" position.

   a. Frequency Data

      The outer knob varies the 1 MHz and 10 MHz digits and the center knob varies the frequency in .05 MHz increments which carry to/from the .1 MHz digit regardless of whether the switch is in its "in" or "out" position.

   b. Radial Data

      The outer knob varies the 10 degree digit with a carryover occuring from the tens to hundreds position. The center knob in the "in" position varies the 1 degree digit and in the "out" position varies the 0.1 degree digit.

   c. Distance Data

      The outer knob varies the 10 NM digit with a carryover occuring from the tens to hundreds place.

The center knob in the "in" position varies the 1 NM digit and in the "out" position varies the 0.1 NM digit.

**HANDLING, SERVICE AND MAINTENANCE -** No change

Approved: Donald H Petts

For W. H. Schultz
Beech Aircraft Corporation
DOA CE-2

# BEECHCRAFT F-90 KING AIR LANDPLANE
# PILOT'S OPERATING HANDBOOK
# and
# FAA APPROVED AIRPLANE FLIGHT MANUAL SUPPLEMENT

## for the

## DC VOLT METER/BATTERY AMMETER
## BEECHCRAFT KIT NO. 90-3097

## GENERAL

The information in this supplement is FAA-approved material and must be attached to the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual when the airplane has been modified by DC Volt Meter/Battery Ammeter BEECHCRAFT Kit No. 90-3097 in accordance with Beech-approved data.

The information in this supplement supersedes or adds to the basic Pilot's Operating Handbook and FAA Approved Airplane Flight Manual only as set forth below. Users of the manual are advised always to refer to the supplement for possibly superseding information and placarding applicable to operation of the airplane.

## LIMITATIONS

### REQUIRED EQUIPMENT LIST (LA-2 thru LA-204, except LA-202)/ KINDS OF OPERATIONS EQUIPMENT LIST (LA-202, LA-205 and after)

Battery Ammeter is required to be operable for all conditions of flight.

## EMERGENCY PROCEDURES

### ELECTRICAL SYSTEM FAILURE

EXCESSIVE LOADMETER INDICATION (OVER 100%)

1. Battery Ammeter - CHECK (If ammeter indicates +10 amps or over and is increasing, turn battery switch OFF)

*If loadmeter still indicates above 100%:*

2. Bus Tie Switch - OPEN
3. Non-essential Electrical Equipment - OFF

*If loadmeter indicates 100% or below:*

4. Battery Switch - ON

## NORMAL PROCEDURES

### ENGINE STARTING (BATTERY AND EXTERNAL POWER)

Anytime the battery is partially discharged, the BATTERY CHARGE annunciator will illuminate approximately 6 seconds after power (external or generator) is on the line. If the annunciator does not extinguish within 5 minutes, monitor the Battery Ammeter. If the Battery Ammeter indicates +10 amps or over and is increasing, shut down the engine and remove the battery for servicing.

### CRUISE

If the BATTERY CHARGE annunciator illuminates, monitor the Battery Ammeter for decreasing amperage. If increasing amperage is indicated, position the Battery Switch OFF. Prior to landing, position the Battery Switch ON.

## SHUTDOWN AND SECURING

Prior to turning the Battery and Generator Switch OFF, check that BATTERY CHARGE annunciator is extinguished. If the BATTERY CHARGE annunciator is illuminated and the Battery Ammeter indicates +10 amps and is increasing, the battery should be removed for servicing.

## NICKEL-CADMIUM BATTERY CONDITION CHECK

Remove entire procedure.

## PERFORMANCE

No change.

## WEIGHT AND BALANCE

No change.

## SYSTEMS DESCRIPTION

### ELECTRICAL SYSTEM

The illumination of the BATTERY CHARGE annunciator in flight indicates that conditions may exist that could eventually damage the battery. A check of the battery current charge with the Battery Ammeter should be made. If the current charge is +10 amps and increasing, switch the battery OFF and inspect or service the battery after landing.

### DC VOLT METER/BATTERY AMMETER

The DC Volt Meter portion of the DC Volt Meter/Battery Ammeter provides a means to monitor DC voltage on each individual bus as selected by the Meter Select Switch mounted adjacent to the indicator in the overhead panel. The Battery Ammeter portion of the DC Volt Meter/Battery Ammeter provides a means to monitor battery-current charge conditions independent of the position of the Meter Select Switch.

## HANDLING, SERVICING AND MAINTENANCE

No change.

Approved:

For W. H. Schultz
Beech Aircraft Corporation
DOA CE-2

# Raytheon Aircraft

**Beech King Air® 65-90, 65-A90, B90, C90, C90A (Serials LJ-1 thru LJ-1402) E90, F90, 100 (Serials B-2 thru B-89, B-93), A100 (Serials B-1, B-90 thru B-92, B-94, B-100 thru B-247), B100 Landplanes**
**Beech Super King Air® 200/200C, B200/B200C Landplanes (Serials BB-2, BB-6 thru BB-1438, BB-1440 thru BB-1443 and BB-1463; BL-1 thru BL-72, BL-113 thru BL-117, BL-124 thru BL-138), 200T/200CT, B200T/B200CT Landplanes (Serials BT-1 thru BT-38; BN-1 thru BN-4)**

## PILOT'S OPERATING HANDBOOK
## AND
## FAA APPROVED AIRPLANE FLIGHT MANUAL SUPPLEMENT

**for the**

## ARTEX ELT 110-4-002 With Remote Cockpit Switch
## (Raytheon Aircraft Kit P/N 101-3210 or 101-3214)

*This Supplement is applicable to the following Manual(s):*

*130695B, 130766B, 65-001123-7, 65-001123-13, 65-001123-25, 65-001123-31, 90-590010-5, 90-590010-53, 90-590010-61, 90-590010-87, 90-590012-3, 90-590024-5, 90-590024-23, 90-590024-35, 90-590024-43, 90-590024-61, 90-590024-69, 100-590026-1, 100-590032-1, 100-590038-1, 101-590010-127, 101-590010-147, 101-590010-327, 101-590037-3, 101-590037-29, 101-590037-57, 109-590010-3, 109-590010-57*

Airplane Serial Number: ______________________________

Airplane Registration Number: ______________________________

FAA Approved by: ______________________________
A.C. Jackson
Raytheon Aircraft Company
DOA CE-2

## CONTENTS



## SECTION I - GENERAL

The information in this supplement is FAA-approved material and must be attached to the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual when the airplane is operated with an ARTEX ELT 110-4-002 With Remote Cockpit Switch in accordance with Raytheon Aircraft Kit P/N 101-3210 or 101-3214.

The information in this supplement supersedes or adds to the basic Pilot's Operating Handbook and FAA Approved Airplane Flight Manual only as set forth within this document. Users of the handbook are advised to always refer to the supplement for possibly superseding information and placarding applicable to operation of the airplane.

## SECTION II - LIMITATIONS

No Change

## SECTION III - EMERGENCY PROCEDURES

Add the following procedure.

### IN FLIGHT EMERGENCIES

If needed, the ELT may be activated in flight as follows:

- ELT Switch - ON, Yellow XMT Annunciator - BLINKING

## SECTION IIIA - ABNORMAL PROCEDURES

No Change

## SECTION IV - NORMAL PROCEDURES

### PREFLIGHT INSPECTION

Delete reference to arming the ELT.

### BEFORE ENGINE STARTING

Add the following step:

- ELT Switch - ARM, XMT Annunciator - EXTINGUISHED

## SECTION V - PERFORMANCE

No Change

## SECTION VI - WEIGHT & BALANCE/EQUIPMENT LIST

No Change

## SECTION VII - SYSTEMS DESCRIPTION

The ARTEX 110-4-002 Emergency Locator Transmitter (ELT) System is designed to meet the requirements of TSO C91a. The system consists of the ELT transmitter, located in the aft fuselage area, an antenna mounted on the aft fuselage, and a remote switch with a yellow transmit light, located on the left cockpit sidewall next to the OAT gage. The switch is lever-locked in the ARM and the ON positions. Neither this switch, nor the switch on the ELT transmitter, can be positioned to prevent the automatic activation of the ELT transmitter. The system is independent from other airplane systems except for the transmit light, which is hot-wired to the airplane battery, and the edge lit panel which is controlled by the side panel lights rheostat located on the overhead panel.

The ELT will automatically activate during a crash and transmit a sweeping tone on 121.5 and 243.0 MHz. This activation is independent of the remote switch setting or availability of aircraft power. The remote switch is installed to perform the following functions:

- Test the ELT.
- Deactivate the ELT if it has been inadvertently activated by the "G" switch.
- Activate the ELT in an in-flight emergency if an off-airport landing is anticipated.
- Activate the ELT after an off-airport landing, if the impact did not automatically activate it.

The ELT should be tested every three months. The test consists of turning the unit on and then resetting it using the following procedures:

- Tests should be conducted between the times of on-the-hour until 5 minutes after the hour.
- Notify any nearby control towers.
- Provide power to an aircraft radio and tune it to 121.5 MHz.
- Place the ELT remote switch on ON. Wait for at least 3 sweeping tones on the aircraft radio, which will take about 1 second, then return the switch to ARM.
- The test is successful if the sweeping tones are heard and the transmit light next to the switch illuminates immediately. If there is a delay in the illumination of the transmit light, the system is not working properly.

If the ELT should be inadvertently activated by the "G" switch, the transmit light next to the switch will blink. The ELT can be deactivated by momentarily placing the remote switch ON and then back to ARM.

## SECTION VIII - HANDLING, SERVICING & MAINTENANCE

No Change

THIS PAGE INTENTIONALLY LEFT BLANK



FAA Approved
Issued: December, 1998
P/N 101-590010-373

# SECTION X
## SAFETY INFORMATION
## TABLE OF CONTENTS

*SUBJECT* *PAGE*

THIS PAGE INTENTIONALLY LEFT BLANK

## INTRODUCTION

Beech Aircraft Corporation has developed this special summary publication of Safety Information to refresh pilots' and owners' knowledge of safety related subjects. Topics in this publication are dealt with in more detail in FAA Advisory Circulars and other publications pertaining to the subject of safe flying.

The skilled pilot recognizes that safety consciousness is an integral - and never ending - part of his or her job. Be thoroughly familiar with your airplane. Know its limitations and your own. Maintain your currency, or fly with a qualified instructor until you are current and proficient. Practice emergency procedures at safe altitudes and airspeeds, preferably with a qualified instructor pilot, until the required action is instinctive. Periodically review this Safety Information as part of your recurrency training regimen.

BEECHCRAFT airplanes are designed and built to provide you with many years of safe and efficient transportation. By maintaining your BEECHCRAFT properly and flying it prudently you will realize its full potential.

...... Beech Aircraft Corporation

**WARNING**

Because your airplane is a high performance, high speed transportation vehicle, designed for operation in a three-dimensional environment, special safety precautions must be observed to reduce the risk of fatal or serious injuries to the pilot(s) and occupant(s).

It is mandatory that you fully understand the contents of this manual and the other manuals which accompany the airplane; that FAA requirements for ratings, certifications and review be scrupulously complied with; and that you allow only persons who are properly licensed and rated, and thoroughly familiar with the contents of the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual to operate the airplane.

IMPROPER OPERATION OR MAINTENANCE OF AN AIRPLANE, NO MATTER HOW WELL BUILT INITIALLY, CAN RESULT IN CONSIDERABLE DAMAGE OR TOTAL DESTRUCTION OF THE AIRPLANE, ALONG WITH SERIOUS OR FATAL INJURIES TO ALL OCCUPANTS.

## GENERAL

As a pilot, you are responsible to yourself and to those who fly with you, to other pilots and their passengers and to people on the ground, to fly wisely and safely.

The following material in this Safety Information Section covers several subjects in limited detail.

## SOURCES OF INFORMATION

There is a wealth of information available to the pilot, created for the sole purpose of making flying safer, easier and more efficient. Take advantage of this knowledge and be prepared for an emergency in the remote event that one should occur.

## PILOT'S OPERATING HANDBOOK AND FAA APPROVED AIRPLANE FLIGHT MANUAL

You must be thoroughly familiar with the contents of your operating manuals, placards, and check lists to ensure safe utilization of your airplane. When the airplane was manufactured, it was equipped with the following: placards, Pilot's Operating Handbook and FAA Approved Airplane Flight Manual, and Pilot's Checklist. Beech has revised and reissued many of the early manuals for certain models of airplanes in GAMA Standard Format as Pilot's Operating Handbooks and FAA Approved Airplane Flight Manuals. For simplicity and convenience, all official manuals for various models are referred to in this publication as the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual. If the airplane has changed ownership, the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual may have been misplaced or may not be current. If missing or out of date, a replacement handbook must be obtained from any BEECHCRAFT Aviation Center.

## BEECHCRAFT SERVICE PUBLICATIONS

Beech Aircraft Corporation publishes a wide variety of manuals, service letters, service instructions, service bulletins, safety communiques and other publications for the various models of BEECHCRAFT airplanes. Information on how to obtain publications relating to your airplane is contained in BEECHCRAFT Service Bulletin Number 2001, entitled "General - BEECHCRAFT Service Publications - What Is Available and How to Obtain It."

Beech Aircraft Corporation automatically mails original issues and revisions of BEECHCRAFT Service Bulletins (Mandatory, Recommended and Optional), FAA Approved Airplane Flight Manual Supplements, reissues and revisions of FAA Approved Airplane Flight Manuals, Flight Handbooks, Owner's Manuals, Pilot's Operating Manuals and Pilot's Operating Handbooks, and original issues and revisions of BEECHCRAFT Safety Communiques to BEECHCRAFT owner addresses as listed by the FAA Aircraft Registration Branch List and the BEECHCRAFT International Owner Notification Service List. While this information is distributed by Beech Aircraft Corporation, we can not make changes in the name or address furnished by the FAA. The owner must contact the FAA regarding any changes to name or address. Their address is: FAA Aircraft Registration Branch (AAC250) P.O. Box 25082, Oklahoma City, OK 73125, Phone (405) 680-2131.

It is the responsibility of the FAA owner of record to ensure that any mailings from Beech are forwarded to the proper persons. Often the FAA registered owner is a bank, financing company or an individual not in possession of the airplane. Also, when an airplane is sold, there is a lag in processing the change in registration with the FAA. If you are a new owner, contact your BEECHCRAFT dealer and ensure that your manuals are up to date.

Beech Aircraft Corporation provides a subscription service which provides for direct factory mailing of BEECHCRAFT publications applicable to a specific serial number airplane. Details concerning the fees and ordering information for this owner subscription service are contained in Service Bulletin Number 2001.

For owners who choose not to apply for a publications revision subscription service, Beech provides a free Owner Notification Service by which owners are notified by post card of BEECHCRAFT manual reissues, revisions and supplements which are being issued applicable to the airplane owned. On receipt of such notification, the owner may obtain the publication through a BEECHCRAFT Aviation Center, Aero Center or International Distributor. This notification service is available when requested by the owner. This request may be made by using the owner notification request card furnished with the loose equipment of each airplane at the time of delivery, or by a letter requesting this service, referencing the specific airplane serial number owned. Write To:

Supervisor, Special Services
Dept. 52
Beech Aircraft Corporation
P.O. Box 85
Wichita, Kansas 67201-0085

From time to time Beech Aircraft Corporation issues BEECHCRAFT Safety Communiques dealing with the safe operation of a specific series of airplanes, or airplanes in general. It is recommended that each owner/operator maintain a current file of these publications. Back issues of BEECHCRAFT Safety Communiques may be obtained without charge by sending a request including airplane model and serial number to the Supervisor, Special Services, at the address listed above.

## FEDERAL AVIATION REGULATIONS

FAR Part 91, General Operating and Flight Rules, is a document of law governing operation of airplanes and the owner's and pilot's responsibilities. Some of the subjects covered are:

Responsibilities and authority of the pilot-in-command

Certificates required

Liquor and drugs

Flight plans

Preflight action
Fuel requirements
Flight rules
Maintenance, preventive maintenance, alterations, inspection and maintenance records

You, as a pilot, have responsibilities under government regulations. The regulations are designed for your protection, the protection of your passengers and the public. Compliance is mandatory.

## AIRWORTHINESS DIRECTIVES

FAR Part 39 specifies that no person may operate a product to which an Airworthiness Directive issued by the FAA applies, except in accordance with the requirements of that Airworthiness Directive.

Airworthiness Directives (AD's) are not issued by the manufacturer. They are issued and available from the FAA.

## AIRMAN'S INFORMATION MANUAL

The Airman's Information Manual (AIM) is designed to provide airmen with basic flight information and ATC procedures for use in the national airspace system of the United States. It also contains items of interest to pilots concerning health and medical facts, factors affecting flight safety, a pilot/controller glossary of terms in the Air Traffic Control system, information on safety, and accident/hazard reporting. It is revised at six-month intervals and can be purchased from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

This document contains a wealth of pilot information. Among the subjects are:

Controlled Airspace
Emergency Procedures
Service Available to Pilots
Weather and Icing
Radio Phraseology and Technique
Mountain Flying
Airport Operations
Wake Turbulence - Vortices
Clearances and Separations
Medical Facts for Pilots
Preflight
Bird Hazards
Departures - IFR
Good Operating Practices
En route - IFR
Airport Location Director
Arrival - IFR

All pilots must be thoroughly familiar with and use the information in the AIM.

## ADVISORY INFORMATION

Notams (Notices to Airmen) are documents that have information of a time-critical nature that would affect a pilot's decision to make a flight; for example, an airport closed, terminal radar out of service, or enroute navigational aids out of service.

## FAA ADVISORY CIRCULARS

The FAA issues Advisory Circulars to inform the aviation public in a systematic way of nonregulatory material of interest. Advisory Circulars contain a wealth of information with which the prudent pilot should be familiar. A complete list of current FAA Advisory Circulars is published in AC OO-2, which lists Advisory Circulars that are for sale, as well as those distributed free of charge by the FAA, and provides ordering information. Many Advisory Circulars which are for sale can be purchased locally in aviation bookstores or at FBO's. These documents are subject to periodic revision. Be certain the Advisory Circular you are using is the latest revision available. Some of the Advisory Circulars of interest to pilots are:

| | |
|---|---|
| ***00-6** | Aviation Weather |
| **00-24** | Thunderstorms |
| **00-30** | Rules of Thumb For Avoiding or Minimizing Encounters with Clear Air Turbulence |
| ***00-45** | Aviation Weather Services |
| **00-46** | Aviation Safety Reporting Program |
| **20-32** | Carbon Monoxide (CO) Contamination in Aircraft - Detection and Prevention |
| **20-35** | Tie-Down Sense |
| **20-43** | Aircraft Fuel Control Control Surfaces |
| **20-105** | Engine Power-Loss Accident Prevention |
| **20-125** | Water in Aviation Fuels |
| **21-4** | Special Flight Permits for Operation of Overweight Aircraft |
| **43-9** | Maintenance Records: General Aviation Aircraft |
| **43-12** | Preventive Maintenance |
| **60-4** | Pilot's Spatial Disorientation |
| **60-6** | Airplane Flight Manuals (AFM), Approved Manual Materials, Markings and Placards - Airplanes |
| **60-12** | Availability of Industry-Developed Guidelines for the Conduct of the Biennial Flight Review |
| **60-13** | The Accident Prevention Counselor Program |
| ***61-21** | Flight Training Handbook |

| | |
|---|---|
| ***61-23** | Pilot's Handbook of Aeronautical Knowledge |
| ***61-27** | Instrument Flying Handbook |
| **61-67** | Hazards Associated with Spins in Airplanes Prohibited from Intentional Spinning. |
| **61-84** | Role of Preflight Preparation |
| ***67-2** | Medical Handbook for Pilots |
| **90-23** | Aircraft Wake Turbulence |
| **90-42** | Traffic Advisory Practices at Nontower Airports |
| **90-48** | Pilot's Role in Collision Avoidance |
| **90-66** | Recommended Standard Traffic Patterns for Airplane Operations at Uncontrolled Airports |
| **90-85** | Severe Weather Avoidance Plan (SWAP) |
| **91-6** | Water, Slush and Snow On the Runway |
| **91-8** | Use of Oxygen by General Aviation Pilots/Passengers |
| **91-13** | Cold Weather Operation of Aircraft |
| ***91-23** | Pilot's Weight and Balance Handbook |
| **91-26** | Maintenance and Handling of Air Driven Gyroscopic Instruments |
| **91-35** | Noise, Hearing Damage, and Fatigue in General Aviation Pilots |
| **91-43** | Unreliable Airspeed Indications |
| **91-44** | Operational and Maintenance Practices for Emergency Locator Transmitters and Receivers |
| **91-46** | Gyroscopic Instruments - Good Operating Practices |
| **91-50** | Importance of Transponder Operations and Altitude Reporting |
| **91-51** | Airplane Deice and Anti-Ice Systems |
| **91-65** | Use of Shoulder Harness in Passenger Seats |
| **103-4** | Hazards Associated with Sublimation of Solid Carbon Dioxide (Dry Ice) Aboard Aircraft |
| **210-5A** | Military Flying Activities |

*** For Sale**

## FAA GENERAL AVIATION NEWS

FAA General Aviation News is published by the FAA in the interest of flight safety. The magazine is designed to promote safety in the air by calling the attention of general aviation airmen to current technical, regulatory and procedural matters affecting the safe operation of airplanes. FAA General Aviation News is sold on subscription by the Superintendent of Documents, Government Printing Office, Washington D.C. 20402.

## FAA ACCIDENT PREVENTION PROGRAM

The FAA assigns accident prevention specialists to each Flight Standards and General Aviation District Office to organize accident prevention program activities. In addition, there are over 3,000 volunteer airmen serving as accident prevention counselors, sharing their technical expertise and professional knowledge with the general aviation community. The FAA conducts seminars and workshops, and distributes invaluable safety information under this program.

Usually the airport manager, the FAA Flight Service Station (FSS), or Fixed Base Operator (FBO) will have a list of accident prevention counselors and their phone numbers available. All Flight Standards and General Aviation District Offices have a list of the counselors serving the district.

Before flying over unfamiliar territory, such as mountainous terrain or desert areas, it is advisable for transient pilots to consult with local counselors. They will be familiar with the more desirable routes, the wind and weather conditions, and the service and emergency landing areas that are available along the way. They can also offer advice on the type of emergency equipment you should be carrying.

## ADDITIONAL INFORMATION

The National Transportation Safety Board and the Federal Aviation Administration periodically issue, in greater detail, general aviation pamphlets concerning aviation safety. FAA Regional Offices also publish material under the FAA General Aviation Accident Prevention Program. These can be obtained at FAA Offices, Weather Stations, Flight Service Stations or Airport Facilities. Some of these are titled:

12 Golden Rules for Pilots
Weather or Not
Disorientation
Plane Sense
Weather Info Guide for Pilots
Wake Turbulence

Don't Trust to Luck, Trust to Safety
Rain, Fog, Snow
Thunderstorm - TRW
Icing
Pilot's Weather Briefing Guide
Thunderstorms Don't Flirt . . . Skirt 'em
IFR-VFR - Either Way Disorientation Can Be Fatal
IFR Pilot Exam-O-Grams
VFR Pilot Exam-O-Grams
Impossible Turn
Wind Shear
Estimating Inflight Visibility
Is the Aircraft Ready for Flight
Tips on Mountain Flying
Tips on Desert Flying
Always Leave Yourself An Out
Tips on the Use of Ailerons and Rudder
Some Hard Facts About Soft Landings
Propeller Operation and Care
Torque "What it Means to the Pilot"
Weight and Balance - An Important Safety Consideration for Pilots

## GENERAL INFORMATION ON SPECIFIC TOPICS

### MAINTENANCE

Safety of flight begins with a well maintained airplane. Make it a habit to keep your airplane and all of its equipment in first-class, airworthy condition. Keep a "Squawk List" on board, and see that all discrepancies, however minor, are noted and promptly repaired.

Schedule your maintenance regularly, and have your airplane serviced by a reputable organization. Be suspicious of bargain prices for maintenance, repairs and inspections.

If repairs or modifications are made to the flight control system, make sure the control surfaces are properly balanced and the controls can be moved freely from the cockpit in the proper direction and through their designed range of travel.

It is the responsibility of the owner and the operator to assure that the airplane is maintained in an airworthy condition and that proper maintenance records are kept.

Use only genuine BEECHCRAFT or BEECHCRAFT approved parts obtained from BEECHCRAFT approved sources, in connection with the maintenance and repair of Beech airplanes.

Genuine BEECHCRAFT Parts are produced and inspected under rigorous procedures to ensure airworthiness and suitability for use in Beech airplane applications. Parts purchased from sources other than BEECHCRAFT, even though outwardly identical in appearance, may not have had the required tests and inspections performed, may be different in fabrication techniques and materials, and may be dangerous when installed in an airplane.

Salvaged airplane parts, reworked parts obtained from non-BEECHCRAFT approved sources, or parts, components, or structural assemblies, the service history of which is unknown or cannot be authenticated, may have been subjected to unacceptable stresses or temperatures, or have other hidden damage not discernible through routine visual or nondestructive testing techniques. This may render the part, component or structural assembly, even though originally manufactured by BEECHCRAFT, unsuitable and unsafe for airplane use.

BEECHCRAFT expressly disclaims any responsibility for malfunctions, failures, damage or injury caused by use of non-BEECHCRAFT parts.

Airplanes operated for Air Taxi or other than normal operation, and airplanes operated in humid tropics, or cold and damp climates, etc., may need more frequent inspections for wear, corrosion and/or lack of lubrication. In these areas, periodic inspections should be performed until the operator can set his own decreased inspection periods based on experience.

**NOTE**

The required periods do not constitute a guarantee that the item will reach the period without malfunction, as the aforementioned factors cannot be controlled by the manufacturer.

Corrosion and its effects must be treated at the earliest possible opportunity. A clean, dry surface is virtually immune to corrosion. Make sure that all drain holes remain unobstructed. Protective films and sealants help to keep corrosive agents from contacting metallic surfaces. Corrosion inspections should be made most frequently under high-corrosion-risk operating conditions, such as in areas of excessive airborne salt concentrations (e.g., near the sea) and in high-humidity areas (e.g., tropical regions).

If you have purchased a used airplane, have your mechanic inspect the airplane registration records, logbooks and maintenance records carefully. An unexplained period of time for which the airplane has been out of service, or unexplained significant repairs, may well indicate the airplane has been seriously damaged in a prior accident. Have your mechanics inspect a used airplane carefully. Take the time to ensure that you really know what you are buying when you buy a used airplane.

### HAZARDS OF UNAPPROVED MODIFICATIONS

Many airplane modifications are approved under Supplemental Type Certificates (STC's). Before installing an STC on your airplane, check to make sure that the STC does not conflict with other STC's that have already been installed. Because approval of an STC is obtained by the individual STC holder, based upon modification of the original type design, it is possible for two STC's to interfere with each other when both are installed. Never install an unapproved modification of any type, however innocent the apparent modification may seem. Always obtain proper FAA approval.

Airplane owners and maintenance personnel are particularly cautioned not to make attachments to, or otherwise modify, seats from original certification without approval from the FAA Engineering and Manufacturing District Office having original certification responsibility for that make and model.

Any unapproved attachment or modification to seat structure may increase load factors and metal stress which could cause failure of seat structure at a lesser "G" force than exhibited for original certification. Examples of unauthorized attachments are drilling holes in seat tubing to attach fire extinguishers and drilling holes to attach approach plate book bins to seats.

## FLIGHT PLANNING

FAR Part 91 requires that each pilot in command, before beginning a flight, familiarize himself with all available information concerning that flight.

Obtain a current and complete preflight briefing. This should consist of local, enroute and destination weather and enroute navaid information. Enroute terrain and obstructions, alternate airports, airport runways active, length of runways, and take-off and landing distances for the airplane for conditions expected should be known.

The prudent pilot will review his planned enroute track and stations and make a list for quick reference. It is strongly recommended a flight plan be filed with Flight Service Stations, even though the flight may be VFR. Also, advise Flight Service Stations of changes or delays of one hour or more and remember to close the flight plan at destination.

The pilot must be completely familiar with the performance of the airplane and performance data in the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual. The effects of temperature and pressure altitude must be taken into account in performance. An applicable FAA Approved Airplane Flight Manual must be aboard the airplane at all times, including the weight and balance forms and equipment list.

## PASSENGER INFORMATION CARDS

Beech has available, for your Beech airplane, passenger information cards which contain important information on the proper use of restraint systems, oxygen masks, emergency exits and emergency bracing procedures. Passenger information cards may be obtained at any BEECHCRAFT Aviation Center. A pilot should not only be familiar with the information contained in the cards, but should, prior to flight, always inform the passengers of the information contained in the information cards. The pilot should orally brief the passengers on the proper use of restraint systems, doors and emergency exits, and other emergency procedures, as required by Part 91 of the FAR's.

## STOWAGE OF ARTICLES

Airplane seats are designed to absorb energy in a downward direction. In order to accomplish this action, the space between the seat pan and the floor is utilized to provide space for seat displacement. If hard, solid objects are stored beneath seats, the energy absorbing feature is lost and severe spinal injuries can occur to occupants.

Prior to flight, pilots should assure that articles are not stowed beneath seats that would restrict seat pan energy absorption or penetrate the seat in event of a high vertical velocity accident.

Ensure that cargo and baggage is stowed and properly secured with tie-down straps and cargo nets.

## FLIGHT OPERATIONS

### *GENERAL*

The pilot must be thoroughly familiar with all information published by the manufacturer concerning the airplane, and is required by law to operate the airplane in accordance with the FAA Approved Airplane Flight Manual and placards installed.

### *PREFLIGHT INSPECTION*

In addition to maintenance inspections and preflight information required by FAR Part 91, a complete, careful preflight inspection is imperative.

Each airplane has a checklist for the preflight inspection which must be followed. USE THE CHECKLIST.

### *WEIGHT AND BALANCE*

Maintaining center of gravity within the approved envelope throughout the planned flight is an important safety consideration.

The airplane must be loaded so as not to exceed the weight and center of gravity (C.G.) limitations. Airplanes that are loaded above the maximum take-off or landing weight limitations will have an overall lower level of performance compared to that shown in the Performance section of the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual. If loaded above maximum takeoff weight, the takeoff distance and the landing distance will be longer than that shown in the Performance section; the stalling speed will be higher; rate of climb, cruising speed, and range of the airplane will all be lower than shown in the Performance section.

If an airplane is loaded so that the C.G. is forward of the forward limit, it will require additional control movements for maneuvering the airplane with correspondingly higher control forces. The pilot may experience difficulty during takeoff and landing because of the elevator control limits.

If an airplane is loaded aft of the aft C.G. limit, the pilot will experience a lower level of stability. Airplane characteristics that indicate a lower stability level are; lower control forces, difficulty in trimming the airplane, lower control forces for maneuvering with attendant danger of structural overload, decayed stall characteristics, and a lower level of lateral-directional damping.

Ensure that all cargo and baggage is properly secured before takeoff. A sudden shift in balance at rotation can cause controllability problems.

### *AUTOPILOTS AND ELECTRIC TRIM SYSTEMS*

Because there are several different models of autopilots and electric trim systems installed in Beech airplanes and different installations and switch positions are possible from airplane to airplane, it is essential that every owner/operator review his Airplane Flight Manual (AFM) Supplements and ensure that the supplements properly describe the autopilot and trim installations on his specific airplane. Each pilot, prior to flight, must be fully aware of the proper procedures for operation, and particularly disengagement, for the system as installed.

In addition to ensuring compliance with the autopilot manufacturer's maintenance requirements, all owners/operators should thoroughly familiarize themselves with the operation, function and procedures described in the Airplane Flight Manual Supplements. Ensure a full understanding of the methods of engagement and disengagement of the autopilot and trim systems.

Compare the descriptions and procedures contained in the supplements to the actual installation in the airplane to ensure that the supplement accurately describes your installation. Test that all buttons, switches and circuit breakers function as described in the supplements. If they do not function as described, have the system repaired by a qualified service agency. If field service advice or assistance is necessary, contact Beech Aircraft Corporation, Customer Support Department.

As stated in all AFM Supplements for autopilot systems and trim systems installed on Beech airplanes, the preflight check must be conducted before every flight. The preflight check assures not only that the systems and all of their features are operating properly, but also that the pilot, before flight, is familiar with the proper means of engagement and disengagement of the autopilot and trim system.

Autopilot AFM Supplements caution against trying to override the autopilot system during flight without disengaging the autopilot because the autopilot will continue to trim the airplane and oppose the pilot's actions. This could result in a severely out-of-trim condition. This is a basic feature of all autopilots with electric trim followup.

Do not try to manually override the autopilot during flight

IN CASE OF EMERGENCY, YOU CAN OVERPOWER THE AUTOPILOT TO CORRECT THE ATTITUDE, BUT THE AUTOPILOT AND ELECTRIC TRIM MUST THEN IMMEDIATELY BE DISENGAGED.

It is often difficult to distinguish an autopilot malfunction from an electric trim system malfunction. The safest course is to deactivate both. Do not re-engage either system until after you have safely landed. Then have the systems checked by a qualified service facility prior to further flight.

Depending upon the installation on your airplane, the following additional methods may be available to disengage the autopilot or electric trim in the event that the autopilot or electric trim does not disengage utilizing the disengage methods specified in the supplements.

**CAUTION**

Transient control forces may occur when the autopilot is disengaged.

1. Turn off the autopilot master switch, if installed.
2. Pull the autopilot and trim circuit breaker(s) or turn off the autopilot switch breaker, if installed.
3. Turn off the RADIO MASTER SWITCH, if installed (if the autopilot system and the trim system are wired through this switch).

**CAUTION**

Radios, including VHF COMM, are also disconnected when the radio master switch is off.

4. Turn off the ELECTRIC MASTER SWITCH.

**WARNING**

Almost all electrically powered systems will be inoperative. Therefore, the cabin will depressurize. Consult the AFM for further information.

5. Push the GA switch on throttle grip, if installed (depending upon the autopilot system).
6. Push TEST EACH FLT switch on the autopilot controller, if installed.
7. Position inverter switch(es) (INV 1/INV 2) to OFF momentarily, then return to original position.

**CAUTION**

While the switch(es) are placed OFF, the AC power will also be removed from AC-driven equipment.

## NOTE

After the autopilot is positively disengaged, it may be necessary to restore other electrical functions. Be sure when the master switches are turned on that the autopilot does not re-engage.

It is essential that you read your airplane's Pilot's Operating Handbook and FAA Approved Airplane Flight Manual and applicable supplements for your autopilot system and check the function and operation of your system.

The engagement of the autopilot must be done in accordance with the instructions and procedures contained in the AFM Supplement.

Particular attention must be paid to the autopilot settings prior to engagement. If you attempt to engage the autopilot when the airplane is out of trim, a large attitude change may occur.

IT IS ESSENTIAL THAT THE PROCEDURES SET FORTH IN THE APPROVED AFM SUPPLEMENTS FOR YOUR SPECIFIC INSTALLATION BE FOLLOWED BEFORE ENGAGING THE AUTOPILOT.

### *FLUTTER*

Flutter is a phenomenon that can occur when an aerodynamic surface begins vibrating. The energy to sustain the vibration is derived from airflow over the surface. The amplitude of the vibration can (1) decrease, if airspeed is reduced; (2) remain constant, if airspeed is held constant and no failures occur; or (3) increase to the point of self-destruction, especially if airspeed is high and/or is allowed to increase. Flutter can lead to an in-flight break up of the airplane. Airplanes are designed so that flutter will not occur in the normal operating envelope of the airplane as long as the airplane is properly maintained. In the case of any airplane, decreasing the damping and stiffness of the structure or increasing the trailing edge weight of control surfaces will tend to cause flutter. If a combination of those factors is sufficient, flutter can occur within the normal operating envelope.

Owners and operators of airplanes have the primary responsibility for maintaining their airplanes. To fulfill that responsibility, it is imperative that all airplanes receive a thorough preflight inspection. Improper tension on the control cables or any other loose condition in the flight control system can also cause or contribute to flutter. Pilots should pay particular attention to control surface attachment hardware including tab pushrod attachment during preflight inspection. Looseness of fixed surfaces or movement of control surfaces other than in the normal direction of travel should be rectified before flight. Further, owners should take their airplanes to mechanics who have access to current technical publications and prior experience in properly maintaining that make and model of airplane. The owner should make certain that control cable tension inspections are performed as outlined in the applicable Beech Inspection Guide. Worn control surface attachment hardware must be replaced. Any repainting or repair of a moveable control surface will require a verification of the control surface balance before the airplane is returned to service. Control surface drain holes must be open to prevent freezing of accumulated moisture, which could create an increased trailing-edge-heavy control surface and flutter.

If an excessive vibration, particularly in the control column and rudder pedals, is encountered in flight, this may be the onset of flutter and the procedure to follow is:

1. IMMEDIATELLY REDUCE AIRSPEED (lower the landing gear, if necessary).
2. RESTRAIN THE CONTROLS OF THE AIRPLANE UNTIL THE VIBRATION CEASES.
3. FLY AT THE REDUCED AIRSPEED AND LAND AT THE NEAREST SUITABLE AIRPORT.
4. HAVE THE AIRPLANE INSPECTED FOR AIRFRAME DAMAGE, CONTROL SURFACE ATTACHING HARDWARE CONDITION/SECURITY, TRIM TAB FREE PLAY, PROPER CONTROL CABLE TENSION, AND CONTROL SURFACE BALANCE BY ANOTHER MECHANIC WHO IS FULLY QUALIFIED.

### *TURBULENT WEATHER*

A complete and current weather briefing is a requirement for a safe trip.

Updating of weather information enroute is also essential. The wise pilot knows that weather conditions can change quickly, and treats weather forecasting as professional advice, rather than an absolute fact. He obtains all the advice he can, but stays alert to any sign or report of changing conditions.

Plan the flight to avoid areas of reported severe turbulence. It is not always possible to detect individual storm areas or find the in-between clear areas.

The National Weather Service classifies turbulence as follows:

| Class of Turbulence | Effect |
|---|---|
| **Extreme** | Airplane is violently tossed about and is practically impossible to control. May cause structural damage. |
| **Severe** | Airplane may be momentarily out of control. Occupants are thrown violently against the belts and back into the seat. Unsecured objects are tossed about. |
| **Moderate** | Occupants require seat belts and occasionally are thrown against the belt. Unsecured objects move about. |

| | |
|---|---|
| **Light** | Occupants may be required to use seat belts, but objects in the airplane remain at rest. |

Thunderstorms, squall lines and violent turbulence should be regarded as extremely dangerous and must be avoided. Hail and tornadic wind velocities can be encountered in thunderstorms that can destroy any airplane, just as tornadoes destroy nearly everything in their path on the ground.

Thunderstorms also pose the possibility of a lightning strike on an airplane. Any structure or equipment which shows evidence of a lightning strike, or being subjected to a high current flow due to a strike, or is a suspected part of a lightning strike path through the airplane, should be thoroughly inspected and any damage repaired prior to additional flight.

A roll cloud ahead of a squall line or thunderstorm is visible evidence of violent turbulence; however, the absence of a roll cloud should not be interpreted as denoting that severe turbulence is not present.

Even though flight in severe turbulence must be avoided, flight in turbulent air may be encountered unexpectedly under certain conditions.

The following recommendations should be observed for airplane operation in turbulent air:

> Flying through turbulent air presents two basic problems, the answer to both is proper airspeed. On one hand, if you maintain an excessive airspeed, you run the risk of structural damage or failure; on the other hand, if your airspeed is too low, you may stall.
>
> If turbulence is encountered, reduce speed to the turbulent air penetration speed, if given, or to the maneuvering speed, which is listed in the Limitations Section of the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual. These speeds give the best assurance of avoiding excessive stress loads, and at the same time providing the proper margin against inadvertent stalls due to gusts.
>
> Beware of overcontrolling in an attempt to correct for changes in attitude; applying control pressure abruptly will build up G-forces rapidly and could cause structural damage or even failure. You should watch particularly your angle of bank, making turns as wide and shallow as possible. Be equally cautious in applying forward or back pressure to keep the airplane level. Maintain straight and level attitude in either up or down drafts. Use trim sparingly to avoid being grossly out of trim as the vertical air columns change velocity and direction. If necessary to avoid excessive airspeeds, lower the landing gear.

## *WIND SHEAR*

Wind shears are rapid, localized changes in wind direction, which can occur vertically as well as horizontally. Wind shear can be very dangerous to all airplanes, large and small, particularly on approach to landing when airspeeds are slow.

A horizontal wind shear is a sudden change in wind direction or speed that can, for example, transform a headwind into a tailwind, producing a sudden decrease in airspeed because of the inertia of the airplane. A vertical wind shear is a sudden updraft or downdraft. Microbursts are intense, highly localized severe downdrafts.

The prediction of wind shears is far from an exact science. Monitor your airspeed carefully when flying in storms, particularly on approach. Be mentally prepared to add power and go around at the first indication that a wind shear is being encountered.

## *FLIGHT IN ICING CONDITIONS*

Every pilot should be intimately acquainted with the FAA Approved National Weather Service definitions for ice intensity and accumulation which we have reprinted below:

| Intensity | Ice Accumulation |
|---|---|
| **Trace** | Ice becomes perceptible. Rate of accumulation slightly greater than rate of sublimation. It is not hazardous even though deicing/anti-icing equipment is not utilized, unless encountered for an extended period of time (over 1 hour). |
| **Light** | The rate of accumulation may create a problem if flight is prolonged in this environment (over 1 hour). Occasional use of deicing/anti-icing equipment will prevent or remove accumulation. It does not present a problem if the deicing/anti-icing equipment is used. |
| **Moderate** | The rate of accumulation is such that even short encounters become potentially hazardous and use of deicing/anti-icing equipment, or diversion, is necessary. |
| **Severe** | The rate of accumulation is such that deicing/anti-icing equipment fails to reduce or control the hazard. Immediate diversion is necessary. |

It is no longer unusual to find deicing and anti-icing equipment on a wide range of airplane sizes and types. Since the capability of this equipment varies, it becomes the pilot's primary responsibility to understand limitations which restrict the use of the airplane in icing conditions and the conditions which may exceed the systems capacity.

Pilots and airplane owners must carefully review the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual in order to ascertain the required operable equipment needed for flight in icing conditions. In addition, they must ascertain from the same sources the limits of approval or certification of their airplane for flight in icing conditions, and plan the flight accordingly if icing conditions are known or forecast along the route.

Remember that regardless of its combination of deicing/anti-icing equipment, any airplane not fully equipped and functional for IFR flight is not properly equipped for flight in icing conditions. An airplane which does not have all critical areas protected in the required manner by fully operational equipment must not be exposed to icing encounters of any intensity. When icing is detected, the pilot of such an airplane must make immediate diversion by flying out of the area of visible moisture or going to an altitude where icing is not encountered.

Even airplanes fully equipped and certified for flight in the icing conditions described in Appendix C to FAR Part 25 must avoid flights into those conditions defined by the National Weather Service as "Severe". No airplane equipped with any combination of deicing/anti-icing equipment can be expected to cope with such conditions. As competent pilots know, there appears to be no predictable limits for the severest weather conditions. For essentially the same reasons that airplanes, however designed or equipped for IFR flight, cannot be flown safely into conditions such as thunderstorms, tornadoes, hurricanes or other phenomena likely to produce severe turbulence, airplanes equipped for flight in icing conditions cannot be expected to cope with "Severe" icing conditions as defined by the National Weather Service. The prudent pilot must remain alert to the possibility that icing conditions may become "Severe" and that his equipment will not cope with them. At the first indication that such condition may have been encountered or may lie ahead, he should immediately react by selecting the most expeditious and safe course for diversion.

Every pilot of a properly fully-equipped Beech airplane who ventures into icing conditions must maintain the minimum speed (KIAS) for operation in icing conditions, which is set forth in the Normal Procedures section, and in the Limitations section, of his Pilot's Operating Handbook and FAA Approved Airplane Flight Manual. The pilot must remain aware of the fact that if he allows his airspeed to deteriorate below this minimum speed, he will increase the angle of attack of his airplane to the point where ice may build up on the under side of the wings aft of the area protected by the deice/anti-icing equipment.

Ice build-up, and its extent in unprotected areas may not be directly observable from the cockpit. Due to distortion of the wing airfoil, increased drag and reduced lift, stalling speeds will increase as ice accumulates on the airplane. For the same reasons, stall warning devices are not accurate and cannot be relied upon in icing conditions.

Even though the pilot maintains the prescribed minimum speeds for operating in icing conditions, ice is still likely to build up on the unprotected areas. Under some atmospheric conditions, it may even build up aft of the de-iced areas despite the maintenance of the prescribed minimum speed. The effect of ice accumulation on any unprotected surface is aggravated by length of exposure to the icing conditions. Ice buildup on unprotected surfaces will increase drag, add weight, reduce lift, and generally, adversely affect the aerodynamic characteristics and performance of the airplane. It can progress to the point where the airplane is no longer capable of flying. Therefore, the pilot operating even a fully-equipped airplane in sustained icing conditions must remain sensitive to any indication, such as observed ice accumulation, loss of airspeed, the need for increased power, reduced rate of climb, or sluggish response, that ice is accumulating on unprotected surfaces and that continued flight in these conditions is extremely hazardous, regardless of the performance of the deicing/anti-icing equipment.

Since flight in icing conditions is not an everyday occurrence, it is important that you maintain a proper proficiency and awareness of the operating procedures necessary for safe operation of the airplane and that the airplane is in a condition for safe operation.

Ensure moisture drains in the airplane structure are maintained open as specified in the Aircraft Maintenance Manual, so that moisture will not collect and cause freezing in the control cable area. Also, control surface tab hinges should be maintained and lubricated as specified in the Aircraft Maintenance Manual.

In icing conditions the autopilot should be disengaged at an altitude sufficient to permit the pilot to gain the feel of the airplane prior to landing. In no case should this be less than the minimum altitude specified in the Autopilot Airplane Flight Manual Supplement.

Observe the procedures set forth in your Pilot's Operating Handbook and FAA Approved Airplane Flight Manual during operation in icing conditions.

Activate your deice and anti-icing systems before entering an area of moisture where you are likely to go through a freezing level.

For any owner or pilot whose use pattern for an airplane exposes it to icing encounters, the following references are required reading for safe flying:

- The airplane's Pilot's Operating Handbook and FAA Approved Airplane Flight Manual, especially the sections on Normal Procedures, Emergency Procedures, Abnormal Procedures, Systems, and Safety Information.
- FAA Advisory Circular 91-51 - Airplane Deice and Anti-ice Systems.
- Weather Flying by Robert N. Buck.

Finally, the most important ingredients to safe flight in icing conditions - regardless of the airplane or the combination of deicing/anti-icing equipment - are a complete and current weather briefing, sound pilot judgment, close attention to the rate and type of ice accumulations, and the knowledge that "severe icing" as defined by the National Weather Service is beyond the capability of modern airplanes and an immediate diversion must be made. It is the inexperienced or uneducated pilot who presses on "regardless" hoping that steadily worsening conditions will improve, only to find himself flying an airplane which has become so loaded with ice that he can no longer maintain altitude. At this point he has lost most, if not all, of his safety options, including perhaps a 180 degree turn to return along the course already traveled.

The responsible and well-informed pilot recognizes the limitations of weather conditions, his airplane and its systems, and reacts promptly.

### *WEATHER RADAR*

Airborne weather avoidance radar is, as its name implies, for avoiding severe weather - not for penetrating it. Whether to fly into an area of radar echoes depends on echo intensity, spacing between the echoes, and the capabilities of you and your airplane. Remember that weather radar detects precipitation drops. Except for the most advanced radar units, it does not detect turbulence. Therefore, the radar scope provides no assurance of avoiding turbulence. The radar scope also does not provide assurance of avoiding instrument weather from clouds and fog. Your scope may be clear between intense echoes; this clear area does not necessarily mean you can fly between the storms and maintain visual sighting of them.

Thunderstorms build and dissipate rapidly. Therefore, do not attempt to plan a course between echoes. The best use of ground radar information is to isolate general areas and coverage of echoes. You must avoid individual storms by in-flight observations either by visual sighting or airborne radar. It is better to avoid the whole thunderstorm area than to detour around individual storms, unless they are scattered.

Remember that while hail always gives a radar echo, it may fall several miles from the nearest visible cloud and hazardous turbulence may extend to as much as 20 miles from the echo edge. Avoid intense or extreme level echoes by at least 20 miles; that is, such echoes should be separated by at least 40 miles before you fly between them. With weaker echos you can reduce the distance by which you avoid them.

Above all, remember this; never regard any thunderstorm lightly. Even when radar observers report the echoes are of light intensity, avoiding thunderstorms is the best policy. The following are some do's and don'ts of thunderstorm avoidance:

1. Don't land or take off in the face of an approaching thunderstorm. Sudden gust-front low level turbulence could cause loss of control.
2. Don't attempt to fly under a thunderstorm even if you can see through to the other side. Turbulence and wind shear under the storm could be disastrous.
3. Don't fly without airborne radar into a cloud mass containing scattered embedded thunderstorms. Scattered thunderstorms not embedded usually can be visually circumnavigated.
4. Don't trust the visual appearance to be a reliable indicator of the turbulence inside a thunderstorm.
5. Do avoid by at least 20 miles any thunderstorm identified as severe or giving an intense radar echo. This is especially true under the anvil of a large cumulonimbus.
6. Do circumnavigate the entire area if the area has 6/10 or more thunderstorm coverage.
7. Do remember that vivid and frequent lightning indicates the probability of a severe thunderstorm.
8. Do regard as extremely hazardous any thunderstorm with tops 35,000 feet or higher whether the top is visually sighted or determined by radar.

If you cannot avoid penetrating a thunderstorm, the following are some do's BEFORE entering the storm:

9. Tighten your safety belt, put on your shoulder harness, and secure all loose objects.
10. Plan and hold your course to take you through the storm in minimum time.
11. To avoid the most critical icing, establish a penetration altitude below the freezing level or an altitude where the OAT is -15°C or colder.
12. Verify that pitot heat is on, and activate anti-ice systems. Icing can be rapid at any altitude and can cause almost instantaneous power failure and/or loss of airspeed indication.

### *MOUNTAIN FLYING*

Pilots flying in mountainous areas should inform themselves of all aspects of mountain flying, including the effects of topographic features on weather conditions. Many good articles have been published, and a synopsis of mountain flying operations is included in the FAA Airman's Information Manual, Part 1.

Avoid flight at low altitudes over mountainous terrain, particularly near the lee slopes. If the wind velocity near the level of the ridge is in excess of 25 knots and approximately perpendicular to the ridge, mountain wave conditions are likely over and near the lee slopes. If the wind velocity at the level of the ridge exceeds 50 knots, a strong mountain wave is probable with extreme up and down drafts and severe turbulence. The worst turbulence will be encountered in and below the rotor zone, which is usually 8 to 10 miles downwind from the ridge. This zone is sometimes characterized by the presence of "roll clouds" if sufficient moisture is present. Altocumulus standing lenticular clouds are also visible signs that a mountain wave exists, but their presence is likewise dependent upon moisture. Mountain wave turbulence can, of course, occur in dry air and the absence of such clouds should not be taken as assurance that mountain wave turbulence will not be encountered. A mountain wave downdraft may exceed the climb capability of your airplane. Avoid mountain wave downdrafts.

### *VFR AT NIGHT*

When flying VFR at night, in addition to the altitude appropriate for the direction of flight, pilots should maintain a safe minimum altitude as dictated by terrain, obstacles such as TV towers, or communities in the area. This is especially true in mountainous terrain, where there is usually very little ground reference. Minimum clearance is 2,000 feet above the highest obstacle enroute. Do not depend on your ability to see obstacles in time to miss them. Flight on dark nights over sparsely populated country can be the same as IFR.

### *VERTIGO - DISORIENTATION*

Disorientation can occur in a variety of ways. During flight, inner-ear balancing mechanisms are subjected to varied forces not normally experienced on the ground. This, combined with loss of outside visual reference, can cause vertigo. False interpretations (illusions) result, and may confuse the pilot's conception of the attitude and position of his airplane.

Under VFR conditions, the visual sense, using the horizon as a reference, can override the illusions. Under low visibility conditions (night, fog, clouds, haze, etc.) the illusions predominate. Only through awareness of these illusions, and proficiency in instrument flight procedures, can an airplane be operated safely in a low visibility environment.

Flying in fog, dense haze or dust, cloud banks, or very low visibility, with strobe lights or rotating beacons turned on can contribute to vertigo. They should be turned off in these conditions, particularly at night.

Motion sickness often precedes or accompanies disorientation and may further jeopardize the flight.

Disorientation in low visibility conditions is not limited to VFR pilots. Although IFR pilots are trained to look at their instruments to gain an artificial visual reference as a replacement for the loss of a visual horizon, they do not always do so. This can happen when: the pilot's physical condition will not permit him to concentrate on his instruments, when the pilot is not proficient in flying instrument conditions in the airplane he is flying, or when the pilot's work load of flying by reference to his instruments is compounded by such factors as turbulence. Even an instrument rated pilot encountering instrument conditions, intentional or unintentional, should ask himself whether or not he is sufficiently alert and proficient in the airplane he is flying to fly under low visibility conditions and the turbulence anticipated or encountered.

All pilots should check the weather and use good judgement in planning flights. If any doubt exists, the flight should not be made or it should be discontinued as soon as possible.

The result of vertigo is loss of control of the airplane. If the loss of control is sustained, it will result in an excessive speed accident. Excessive speed accidents occur in one of two manners - either as an inflight airframe separation or as a high speed ground inpact, and they are fatal accidents in either case. All airplanes are subject to this form of accident.

Excessive speed accidents occur at airspeeds greatly in excess of two operating limitations which are specified in the manuals (Maximum maneuvering speed and the "red line" or maximum operating speed). Such speed limits are set to protect the structure of an airplane. For example, control surfaces are designed to be used to their fullest extent only below a the airplane's maximum maneuvering speed. As a result, the control surfaces should never be suddenly or fully deflected above maximum maneuvering speed. Turbulence penetration should not be performed above that speed. The accidents we are discussing here occur at airspeeds greatly in excess of these limitations. No airplane should ever be flown beyond its FAA approved operating limitations.

### *FLIGHT WITH ONE ENGINE INOPERATIVE*

Safe flight with one engine out requires an understanding of the basic aerodynamics involved, as well as proficiency in engine-out procedures.

Loss of power from one engine affects both climb performance and controllability of twin-engine airplanes. Climb performance depends on an excess of power over that required for level flight. Loss of power from one engine obviously represents a 50% loss of power but, in virtually all twin-engine airplanes, climb performance is reduced by at least 80%. A study of the charts in your Pilot's Operating Handbook and FAA Approved Airplane Flight Manual will confirm this fact. Single-engine climb performance depends on four factors:

| | |
|---|---|
| **Airspeed** | Too little, or too much, will decrease climb performance |
| **Drag** | Gear, flaps, and windmilling prop |
| **Power** | Amount available in excess of that needed for level flight |
| **Weight** | Passengers, baggage, and fuel load greatly affect climb performance |

Loss of power on one engine creates yaw due to asymetric thrust. Yaw forces must be balanced with the rudder. Loss of power on one engine also reduces airflow over the wing. In addition, yaw affects the lift distribution over the wing causing a roll toward the "dead" engine. These roll forces may be balanced by banking slightly (up to 5°) into the operating engine.

Airspeed is the key to safe single-engine operations. For most twin-engine airplanes there is:

| Symbol | Description |
|---|---|
| $V_{MCA}$ | Airspeed below which directional control cannot be maintained |
| $V_{SSE}$ | Airspeed below which an intentional engine cut should never be made |

$V_{YSE}$ — Airspeed that will give the best single engine rate-of-climb (or the slowest loss of altitude)

$V_{XSE}$ — Airspeed that will give the steepest angle-of-climb with one engine out

### *AIR MINIMUM CONTROL SPEED ($V_{MCA}$)*

$V_{MCA}$ is designated by the red radial on the airspeed indicator and indicates the minimum control speed, airborne at sea level. $V_{MCA}$ is determined by FAA regulations as the minimum airspeed at which it is possible to recover directional control of the airplane within 20 degrees heading change, and therefore maintain straight flight, with not more than 5 degrees of bank if one engine fails suddenly with:

- Takeoff power on the operative engine
- Rearmost allowable center of gravity
- Flaps in takeoff position
- Propeller on failed engine windmilling (feathered if Auto-Feather system is required)

However, sudden engine failures rarely occur with all factors listed above, and therefore, the actual $V_{MCA}$ under any particular situation may be a little slower than the red radial on the airspeed indicator. Most airplanes will not maintain level flight at speeds at or near $V_{MCA}$. Consequently, it is not advisable to fly at speeds approaching $V_{MCA}$, except in training situations or during flight tests. Adhering to the practice of never flying at or below the published $V_{MCA}$ speed for your airplane will virtually eliminate loss of directional control as a problem in the event of an engine failure.

### *INTENTIONAL ONE-ENGINE-INOPERATIVE SPEED ($V_{SSE}$)*

$V_{SSE}$ is specified by the airplane manufacturer and is the minimum speed to perform intentional engine cuts. Use of $V_{SSE}$ is intended to reduce the accident potential from loss of control after engine cuts at or near minimum control speed. $V_{MCA}$ demonstrations are necessary in training but should only be made at safe altitude above the terrain and with power reduction on one engine made at or above $V_{SSE}$.

### *ONE-ENGINE-INOPERATIVE BEST RATE-OF-CLIMB SPEED ($V_{YSE}$)*

$V_{YSE}$ is designated by the blue radial on the airspeed indicator. $V_{YSE}$ delivers the greatest gain in altitude in the shortest possible time, and is based on the following criteria:

- Critical engine inoperative, and its propeller in the minimum drag position.
- Operating engine set at not more than the maximum continuous power.
- Landing gear retracted.
- Wing flaps in the most favorable (i.e., best lift/drag ratio) position.
- Airplane flown at recommended bank angle.

Drag caused by a windmilling propeller, extended landing gear, or flaps in the landing position, will severely degrade or destroy single-engine climb performance. Since climb performance varies widely with weight, temperature, altitude, and airplane configuration, the climb gradient (altitude gain or loss per mile) may be marginal - or even negative - under some conditions. Study the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual for your specific airplane and know what performance to expect with one engine out.

### *ONE-ENGINE-INOPERATIVE BEST ANGLE-OF-CLIMB SPEED ($V_{XSE}$)*

$V_{XSE}$ is used only to clear obstructions during initial climb-out as it gives the greatest altitude gain per unit of horizontal distance. It requires more rudder control input than $V_{YSE}$.

### *SINGLE ENGINE SERVICE CEILING*

The single engine service ceiling is the maximum altitude at which an airplane will climb at a rate of at least 50 feet per minute in smooth air, with one engine inoperative.

The single-engine service ceiling graph should be used during flight planning to determine whether the airplane, as loaded, can maintain the Minimum Enroute Altitude (MEA) if IFR, or terrain clearance if VFR, following an engine failure.

### *BASIC SINGLE ENGINE PROCEDURES*

Know and follow, to the letter, the single-engine emergency procedures specified in your Pilot's Operating Handbook and FAA Approved Airplane Flight Manual for your airplane. However, the basic fundamentals of all the procedures are as follows:

1. Maintain airplane control and airspeed at all times. **THIS IS CARDINAL RULE NUMBER ONE.**
2. Usually, apply 100% torque to the operating engine. However, if the engine failure occurs at a speed below $V_{MCA}$, or during cruise or in a steep turn, you may elect to use only enough power to maintain a safe speed and altitude. If the failure occurs on final approach, use power only as necessary to complete the landing.
3. Reduce drag to an absolute minimum.
4. Secure the failed engine and related sub-systems.

The first three steps should be done promptly and from memory. The check list should then be consulted to be sure that the inoperative engine is secured properly and that the appropriate switches are placed in the correct position. The airplane must be banked about 5° into the live engine, with the "slip/skid" ball slightly out of center toward the live engine, to achieve rated performance.

ANOTHER NOTE OF CAUTION. Be sure to identify the dead engine positively, before securing it. Remember: First identify the suspected engine (i.e., "Dead foot means dead engine"), second, verify with cautious throttle movement, then secure.

## ENGINE FAILURE ON TAKEOFF

If an engine fails before attaining $V_1$, the only proper action is to discontinue the takeoff. If the engine fails after $V_1$, the takeoff may be continued using the procedures specified in the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual.

Your Pilot's Operating Handbook and FAA Approved Airplane Flight Manual contains charts that are used in calculating the runway length required to stop if the engine fails at $V_1$ speed and also has charts showing the single-engine performance after takeoff.

Study your charts carefully. No airplane is capable of climbing out on one engine under all weight, pressure altitude and temperature conditions. The maximum take-off weight must be limited to achieve the required performance as specified in the LIMITATIONS section.

## WHEN YOU FLY $V_X$, $V_Y$, $V_{XSE}$ AND $V_{YSE}$

During normal two-engine operations always fly the published take-off speeds on initial climb out. Then, accelerate to your cruise climb airspeed after you have obtained a safe altitude. Use of cruise climb airspeed will give you increased inflight visibility and better fuel economy. However, at first indication of an engine failure during climb out, or while on approach, establish $V_{YSE}$ or $V_{XSE}$, whichever is appropriate. (Consult your Pilot's Operating Handbook and FAA Approved Airplane Flight Manual for specifics.)

## STALLS, SLOW FLIGHT AND TRAINING

The stall warning system must be kept operational at all times and must not be deactivated by interruption of circuits or circuit breakers. Compliance with this requirement is especially important in all high performance multi-engine airplanes during engine-out practice or stall demonstrations, because the stall speed is critical in operation of high-performance airplanes.

The single-engine stall speed of a twin-engine airplane is generally slightly below the power off (engines idle) stall speed for a given weight condition. Single-engine stalls in multi-engine airplanes are not recommended. Single-engine stalls should not be conducted in high performance airplanes by other than qualified engineering test pilots.

$V_{MCA}$ demonstrations should not be attempted when the altitude and temperature are such that the engine-out minimum control speed is known, or discovered to be, close to the stalling speed. Loss of directional or lateral control, just as a stall occurs, is potentially hazardous.

$V_{SSE}$, the airspeed below which an engine should not be intentionally rendered inoperative for practice purposes, was established because of the apparent practice of some pilots, instructors, and examiners, of intentionally rendering an engine inoperative at a time when the airplane is being operated at a speed close to, or below, the flight idle stall speed. Unless the pilot takes immediate and proper corrective action under such circumstances, it is possible to enter an inadvertent spin.

It is recognized that flight below $V_{SSE}$ with one engine inoperative, or simulated inoperative, may be required for conditions such as practice demonstration of $V_{MCA}$ for multi-engine pilot certification. Refer to the procedure set forth in the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual for your airplane. This procedure calls for simulating one engine inoperative by reducing the power lever on one engine to zero thrust while operating at an airspeed above $V_{SSE}$. Power on the other engine is set at maximum, then airspeed is reduced at approximately one knot per second until either $V_{MCA}$ or stall warning is obtained. During this transition, rudder should be used to maintain directional control, and ailerons should be used to maintain a 5° bank toward the operative engine. At the first sign of either $V_{MCA}$ or stall warning (which may be evidenced by inability to maintain longitudinal, lateral or directional control, aerodynamic stall buffet, or stall warning horn sound), recovery must be initiated immediately by reducing power to zero thrust on the operative engine and lowering the nose to regain $V_{SSE}$. Resume normal flight. This entire procedure should be used at a safe altitude of at least 5,000 feet above the ground in clear air only.

If stall warning is detected prior to the first sign of $V_{MCA}$, an engine-out minimum control speed demonstration cannot be accomplished under the existing gross weight conditions and should not be attempted.

## SPINS

A major cause of fatal accidents in general aviation airplanes is a spin. Stall demonstrations and practice are a means for a pilot to acquire the skills to recognize when a stall is about to occur and to recover as soon as the first signs of a stall are evident. IF A STALL DOES NOT OCCUR - A SPIN CANNOT OCCUR. It is important to remember, however, that a stall can occur in any flight attitude, at any airspeed, if controls are misused.

Your airplane has not been tested for spin recovery characteristics, and is placarded against intentional spins.

The pilot of an airplane placarded against intentional spins should assume that the airplane may become uncontrollable in a spin, since its performance characteristics beyond certain limits specified in the FAA regulations have not been tested and are unknown. This is why airplanes are placarded against intentional spins, and this is why stall avoidance is your protection against an inadvertent spin.

Pilots are taught that intentional spins are entered by deliberately inducing a yawing moment with the controls as the airplane is stalled. Inadvertent spins result from the same combination - stall plus yaw. That is why it is important to use coordinated controls and to recover at the first indication of a stall when practicing stalls.

In any twin engine airplane, fundamental aerodynamics dictate that if the airplane is allowed to become fully stalled while one engine is providing lift-producing thrust, the yawing moment which can induce a spin will be present. Consequently, it is important to immediately reduce power on the operating engine, lower the nose to reduce the angle of attack, and increase the airspeed to recover from the stall.

In any twin engine airplane, if application of stall recovery controls is delayed, a rapid rolling and yawing motion may develop, even against full aileron and rudder, resulting in the airplane becoming inverted during the onset of a spinning motion. Once the airplane has been permitted to progress beyond the stall and is allowed to reach the rapid rolling and yawing condition, the pilot must then immediately initiate the generally accepted spin recovery procedure for multi-engine airplanes, which is as follows:

Immediately move the control column full forward, apply full rudder opposite to the direction of the spin and reduce power on both engines to idle. These three actions should be done as near simultaneously as possible; then continue to hold this control position until rotation stops and then neutralize all controls and execute a smooth pullout. Ailerons should be neutral during recovery. THE LONGER THE PILOT DELAYS BEFORE TAKING CORRECTIVE ACTION, THE MORE DIFFICULT RECOVERY WILL BECOME.

Always remember that extra alertness and good pilot techniques are required for slow flight maneuvers, including the practice or demonstration of stalls or $V_{MCA}$. In addition to the foregoing mandatory procedure, always:

- Be certain that the center of gravity of the airplane is as far forward as possible. Forward C.G. aids stall recovery, spin avoidance and spin recovery. An aft C.G. can create a tendency for a spin to flatten out, which delays recovery.
- Conduct any maneuvers which could possibly result in a spin at altitudes in excess of five thousand (5,000) feet above ground level in clear air only.
- Remember that an airplane, at or near traffic pattern and approach altitudes, cannot recover from a spin, or perhaps even a stall, before impact with the ground. When descending to traffic altitude and during pattern entry and all other flight operations, maintain speed no lower than $V_{SSE}$. On final approach maintain at least the airspeed shown in the flight manual. Recognize that under some conditions of weight, density altitude, and airplane configuration, a twin engine airplane cannot climb or accelerate on a single engine; hence a single engine go-around is impossible and the airplane is committed to a landing. Plan your approach accordingly.
- Remember that, if a stall or spin occurs under instrument conditions, the pilot, without reference to the horizon, is certain to become disoriented. He may be unable to recognize a stall, spin entry, or the spin condition and he may be unable to determine even the direction of the rotation.
- Finally, never forget that stall avoidance is your best protection against an inadvertent spin. MAINTAIN YOUR AIRSPEED.

### *VORTICES - WAKE TURBULENCE*

Every airplane generates wakes of turbulence while in flight. Part of this is from the propeller or jet engine, and part from the wing tip vortices. The larger and heavier the airplane, the more pronounced and turbulent the wakes will be. Wing tip vortices from large, heavy airplanes are very severe at close range, degenerating with time, wind and distance. These are rolling in nature, from each wing tip. In tests, vortex velocities of 133 knots have been recorded. Encountering the rolling effect of wing tip vortices within two minutes after passage of large airplanes is extremely hazardous to small airplanes. This roll effect can exceed the maximum counter roll obtainable in a small airplane. The turbulent areas may remain for three minutes or more, depending on wind conditions, and may extend several miles beyond the airplane. Plan to fly slightly above and to the windward side of other airplanes. Because of the wide variety of conditions that can be encountered, there is no set rule to follow to avoid wake turbulence in all situations. However, the Airman's Information Manual, and to a greater extent Advisory Circular 90-23, Aircraft Wake Turbulence, provides a thorough discussion of the factors you should be aware of when wake turbulence may be encountered.

### *TAKEOFF AND LANDING CONDITIONS*

When taking off on runways covered with water or freezing slush, the landing gear should remain extended for approximately ten seconds longer than normal, allowing the wheels to spin and dissipate the freezing moisture. The landing gear should then be cycled up, then down, wait approximately five seconds and then retracted again. Caution must be exercised to ensure that the entire operation is performed below Maximum Landing Gear Operating Airspeed.

Use caution when landing on runways that are covered by water or slush which cause hydroplaning (aquaplaning), a phenomenon that renders braking and steering ineffective because of the lack of sufficient surface friction. Snow and ice covered runways are also hazardous. The pilot should also be alert to the possibility of the brakes freezing.

Use caution when taking off or landing during gusty wind conditions. Also be aware of the special wind conditions caused by buildings or other obstructions located near the runway in a crosswind pattern.

## MEDICAL FACTS FOR PILOTS

### *GENERAL*

When the pilot enters the airplane, he becomes an integral part of the man-machine system. He is just as essential to a successful flight as the control surfaces. To ignore the pilot in preflight planning would be as senseless as failing to inspect the integrity of the control surfaces or any other vital part of the machine. The pilot has the responsibility for determining his reliability prior to entering the airplane for flight. When piloting an airplane, an individual should be free of conditions which are harmful to alertness, ability to make correct decisions, and rapid reaction time.

### *FATIGUE*

Fatigue generally slows reaction time and causes errors due to inattention. In addition to the most common cause of fatigue, insufficient rest and loss of sleep, the pressures of business, financial worries, and family problems can be important contributing factors. If you are tired, don't fly.

### *HYPOXIA*

Hypoxia, in simple terms, is a lack of sufficient oxygen to keep the brain and other body tissues functioning properly. There is a wide individual variation in susceptibility to hypoxia. In addition to progressively insufficient oxygen at higher altitudes, anything interfering with the blood's ability to carry oxygen can contribute to hypoxia (anemias, carbon monoxide, and certain drugs). Also, alcohol and various drugs decrease the brain's tolerance to hypoxia.

Your body has no built-in alarm system to let you know when you are not getting enough oxygen. It is impossible to predict when or where hypoxia will occur during a given flight, or how it will manifest itself. Some of the common symptoms of hypoxia are increased breathing rate, a light-headed or dizzy sensation, tingling or warm sensation, sweating, reduced visual field, sleepiness, blue coloring of skin, fingernails and lips, and behavior changes. A particularly dangerous feature of hypoxia is an increased sense of well-being, called euphoria. It obscures a person's ability and desire to be critical, slows reaction time, and impairs thinking ability. Consequently, an hypoxic individual commonly believes things are getting progressively better while he nears total collapse.

The symptoms are slow but progressive, insidious in onset, and are most marked at altitudes above ten thousand feet. Night vision, however, can be impaired starting at an altitude of 5,000 feet. Persons who have recently overindulged in alcohol, who are moderate to heavy smokers, or who take certain drugs, may be more susceptible to hypoxia. Susceptibility may also vary in the same individual from day to day or even morning to evening.

Depending upon altitude, a hypoxic individual requires more time to make decisions and perform useful acts, even though he may remain conscious for a longer period. If pressurization equipment fails, the pilot and passengers have only a certain amount of time to get an oxygen mask on before they exceed their time of useful consciousness. The time of useful consciousness is approximately 3-5 minutes at 25,000 feet of altitude for the average individual and diminishes markedly as altitude increases. At 30,000 feet, altitude, for example, the time of useful consciousness is approximately 1-2 minutes. Therefore, in the event of depressurization, oxygen masks should be used immediately.

Should symptoms occur that cannot definitely be identified as either hypoxia or hyperventilation, try three or four deep breaths of oxygen. The symptoms should improve markedly if the condition was hypoxia (recovery from hypoxia is rapid).

Pilots who fly to altitudes that require or may require the use of supplemental oxygen should be thoroughly familiar with the operation of the airplane oxygen systems. A preflight inspection of the system should be performed, including proper fit of the mask.

The passengers should be briefed on the proper use of their oxygen system before flight.

Pilots who wear beards should be careful to ensure that their beard is carefully trimmed so that it will not interfere with proper sealing of the oxygen masks. If you wear a beard or mustache, test the fit of your oxygen mask on the ground for proper sealing. Studies conducted by the military and oxygen equipment manufacturers conclude that oxygen masks do not seal over beards or heavy facial hair.

Federal Aviation Regulations related to the use of supplemental oxygen by flight crew and passengers must be adhered to if flight to higher altitudes is to be accomplished safely. Passengers with significant circulatory or lung disease may need to use supplemental oxygen at lower altitudes than specified by these regulations.

Pilots of pressurized airplanes should receive physiological training with emphasis on hypoxia and the use of oxygen and oxygen systems. Pilots of airplanes with pressure demand oxygen systems should undergo training, experience altitude chamber decompression, and be familiar with pressure breathing before flying at high altitude. This training is available throughout the United States at nominal cost. Information regarding this training may be obtained by request from the Chief, Civil Aeromedical Institute, Attention: Aeromedical Education Branch, AAC-140, Mike Monroney Aeronautical Center, P.O. Box 25082, Oklahoma City, Oklahoma 73125

### *HYPERVENTILATION*

Hyperventilation, or overbreathing, is a disturbance of respiration that may occur in individuals as a result of emotional tension or anxiety. Under conditions of emotional stress, fright, or pain, breathing rate may increase, causing increased lung ventilation, although the carbon dioxide output of the body cells does not increase. As as result, carbon dioxide is "washed out" of the blood. The most common symptoms of hyperventilation are: dizziness, nausea, sleepiness, and finally, unconsciousness. If the symptoms persist, discontinue use of oxygen and consciously slow your breathing rate until symptoms clear, and then resume normal breathing rate. Normal breathing can be aided by talking aloud.

### *ALCOHOL*

Common sense and scientific evidence dictate that you must not fly as a crew member while under the influence of alcohol. Alcohol, even in small amounts, produces (among other things):

- A dulling of critical judgement.
- A decreased sense of responsibility.
- Diminished skill reactions and coordination.
- Decreased speed and strength of muscular reflexes (even after one ounce of alcohol).
- Decreases in efficiency of eye movements during reading (after one ounce of alcohol).
- Increased frequency of errors (after one ounce of alcohol).
- Constriction of visual fields.
- Decreased ability to see under dim illuminations.

- Loss of efficiency of sense of touch.
- Decrease of memory and reasoning ability.
- Increased susceptibility to fatigue and decreased attention span.
- Decreased relevance of response.
- Increased self confidence with decreased insight into immediate capabilities.

Tests have shown that pilots commit major errors of judgment and procedure at blood alcohol levels substantially less than the minimum legal levels of intoxication for most states. These tests further show a continuation of impairment from alcohol up to as many as 14 hours after consumption, with no appreciable diminution of impairment. The body metabolizes ingested alcohol at a rate of about one-third of an ounce per hour. Even after the body completely destroys a moderate amount of alcohol, a pilot can still be severely impaired for many hours by hangover. The effects of alcohol on the body are magnified at altitudes; 2 oz. of alcohol at 18,000 feet produce the same adverse effects as 6 oz. at sea level.

Federal Aviation Regulations have been amended to reflect the FAA's growing concern with the effects of alcohol impairment. FAR 91 states:

**"Alcohol or drugs.**

(a) No person may act or attempt to act as a crewmember of a civil aircraft -

(1) Within 8 hours after the consumption of any alcoholic beverage;

(2) While under the influence of alcohol;

(3) While using any drug that affects the person's faculties in any way contrary to safety; or

(4) While having .04 percent by weight or more alcohol in the blood.

(b) Except in an emergency, no pilot of a civil aircraft may allow a person who appears to be intoxicated or who demonstrates by manner or physical indications that the individual is under the influence of drugs (except a medical patient under proper care) to be carried in that aircraft."

Because of the slow destruction of alcohol by the body, a pilot may still be under influence eight hours after drinking a moderate amount of alcohol. Therefore, an excellent rule is to allow at least 12 to 24 hours between "bottle and throttle," depending on the amount of alcoholic beverage consumed.

### *DRUGS*

Self-medication or taking medicine in any form when you are flying can be extremely hazardous. Even simple home or over-the-counter remedies and drugs such as aspirin, antihistamines, cold tablets, cough mixtures, laxatives, tranquilizers, and appetite suppressors may seriously impair the judgment and coordination needed while flying. The safest rule is to take no medicine before or while flying, except after consultation with your Aviation Medical Examiner.

### *SCUBA DIVING*

Flying shortly after any prolonged scuba diving could be dangerous. Under the increased pressure of the water, excess nitrogen is absorbed into your system. If sufficient time has not elapsed prior to takeoff for your system to rid itself of this excess gas, you may experience the bends at cabin altitudes even under 10,000 feet.

### *CARBON MONOXIDE AND NIGHT VISION*

The presence of carbon monoxide results in hypoxia which will affect night vision in the same manner and extent as hypoxia from high altitudes. Even small levels of carbon monoxide have the same effect as an altitude increase of 8,000 to 10,000 feet. Smoking several cigarettes can result in a carbon monoxide saturation sufficient to affect visual sensitivity equal to an increase of 8,000 feet altitude.

### *DECOMPRESSION SICKNESS*

Pilots flying unpressurized airplanes at altitudes in excess of 10,000 feet should be alert for the symptoms of 'decompresson sickness'. This phenomenon, while rare, can impair the pilot's ability to perform and in extreme cases, can result in the victim being rendered unconscious. Decompression sickness, also known as dysbarism and aviator's "bends", is caused by nitrogen bubble formation in body tissue as the ambient air pressure is reduced by climbing to higher altitudes. The symptoms are pain in the joints, abdominal cramps, burning sensations in the skin, visual impairment and numbness. Some of these symptoms are similar to hypoxia. The only known remedy for decompression sickness is recompression, which can only be accomplished in an unpressurized airplane by descending. The pilot should immediately descend if it is suspected that this condition existed, since the effect will only worsen with continued exposure to the reduced pressure environment at altitude and could result if uncorrected, in complete incapacitation. The possibility of decompression sickness can be greatly reduced by pre-breathing oxygen prior to flight and by commencing oxygen breathing well below the altitudes where it is legally mandatory.

## A FINAL WORD

Airplanes are truly remarkable machines. They enable us to shrink distance and time, and to expand our business and personal horizons in ways that, not too many years ago, were virtually inconceivable. For many businesses, the general aviation airplane has become the indispensable tool of efficiency.

Advances in the mechanical reliability of the airplane we fly have been equally impressive, as attested by the steadily declining statistics of accidents attributed to mechanical causes, at a time when the airframe, systems and powerplants have grown infinitely more complex. The explosion in capability of avionics systems is even more remarkable. Radar, RNAV, LORAN, sophisticated autopilots, EFIS and other devices which, just a few years ago, were too large and prohibitively expensive for general aviation size airplanes, are becoming increasingly commonplace in even the smallest airplanes.

Thus, this SAFETY INFORMATION is directed to the pilot, for it is in the area of the skill and proficiency of you, the pilot, that the greatest gains in safe flying are to be made over the years to come. Intimate knowledge of your airplane, its capabilities and its limitations, and disciplined adherence to the procedures for your airplane's operation, will enable you to transform potential tragedy into an interesting hangar story when - as it inevitably will - the abnormal situation is presented.

Know your airplane's limitations, and your own. Never exceed either.

Safe Flying,

BEECH AIRCRAFT CORPORATION