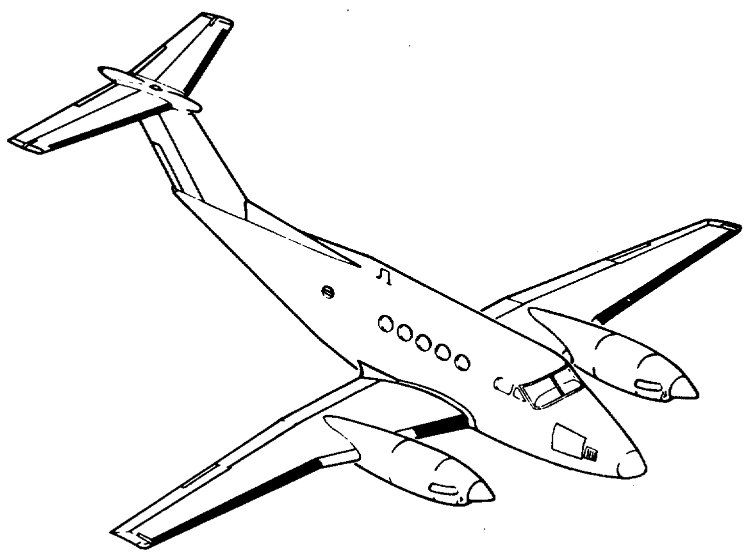
TECHNICAL MANUAL
OPERATOR'S MANUAL
FOR
ARMY MODELS C-12A, C-12C, AND C-12D AIRCRAFT



This copy is a reprint which includes current pages from Changes 1 through 11.

HEADQUARTERS, DEPARTMENT
OF THE ARMY
22 APRIL 1985

URGENT

TM 55-1510-218-10
C14

CHANGE NO. 14

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 21 April 1998

OPERATOR'S MANUAL FOR ARMY MODELS C-12C, C-12D AND C-12F AIRCRAFT

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Remove pages	Insert pages
i and ii	i and ii
5-10A/(5-08B blank)	5-10A and 5-10B
8-29 and 8-30	8-29 and 8-30
——	8-30A/(8-30B blank)
INDEX-3 and INDEX-4	INDEX-3 and INDEX-4

2. Retain this sheet in front of manual for reference purposes.

By Order of the Secretary of the Army:

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General, United States Army
Chief of Staff

Official:

JOEL B. HUDSON
Administrative Assistant to the Secretary of the Army
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TM 55-1510-218-10
C 13

CHANGE
NO. 13

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 12 December 1994

Operator's Manual
For
ARMY MODELS C-12C, C-12D,
AND C-12F AIRCRAFT

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Remove pages	Insert pages
5-11 and 5-12	5-11 and 5-12

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By Order of the Secretary of the Army:

GORDON R. SULLIVAN
General, United States Army
Chief of Staff

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CHANGE NO. 12

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 28 FEBRUARY 1994

Operator's Manual
For
ARMY MODELS C-12C, C-12D,
AND C-12F AIRCRAFT

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2. Remove and insert pages as indicated below. New or changed text material is indicated by a vertical bar in the margin. An illustration change is indicated by a miniature pointing hand.

Remove pages	Insert pages
i and ii	i and ii
5-1 and 5-2	5-1 and 5-2
5-7 and 5-8	5-7/(5-8 blank)
5-17 and 5-18	5-17 and 5-18
6-1 and 6-2	6-1 and 6-2
6-4A/(6-4B blank)	----
6-5 through 6-8	6-5 through 6-8
6-8A/(6-8B blank)	----
6-9 through 6-14	6-9 through 6-14
6-15 and 6-16	----
8-11 and 8-12	8-11 and 8-12
8-17 and 8-18	8-17 and 8-18
8-19 and 8-20	8-19 and 8-20
8-28A/(8-28B blank)	----
8-29 through 8-31/(8-32 blank)	8-29 through 8-32
9-3 and 9-4	9-3 and 9-4
9-12A and 9-12B	9-12A and 9-12B
A-1/(A-2 blank)	A-1/(A-2 blank)

3. Retain this sheet in front of manual for reference purposes.

By Order of the Secretary of the Army:

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TM 55-1510-218-10
C 11

CHANGE }
NO. 11

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 31 July 1992

Operator's Manual
For
ARMY MODELS C-12A, C-12C,
C-12D AND C-12F AIRCRAFT

TM 55-1510-218-10, 22 April 1985, is changed as follows:

1. Remove and insert pages as indicated below. New or changed text material is indicated by a vertical bar in the margin. An illustration change is indicated by a miniature pointing hand.

Remove pages	Insert pages
5-10A/5-O1B	5-10A/5-10B
8-17 and 8-18	8-17 and 8-18
8-18A and 8-18B	8-18A and 8-18B
8-19 and 8-20	8-19 and 8-2U
- - - -	8-28A/8-28B
8-29 and 8-30	8-29 and 8-30

2. Retain this sheet in front of manual for reference purposes.

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CHANGE NO. 10

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 30 June 1992

Operator's Manual
FOR
ARMY MODELS, C-12C, C-12D,
AND C-12F AIRCRAFT

DISTRIBUTION STATEMENT A: Approved for public release; distribution is unlimited.

TM 55-1510-218-10, 22 April 1985, is changed as follows:

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2. Remove and insert pages as indicated below. New or changed text material is indicated by a vertical bar in the margin. An illustration change is indicated by a miniature pointing hand.

Remove pages	Insert pages
2-9 through 2-12	2-9 through 2-12
2-20A/(2-20B blank)	2-20A/(2-20B blank)
2-33 and 2-34	2-33 and 2-34
2-40A/(2-40B blank)	2-40A/(2-40B blank)
3-5 and 3-6	3-5 and 3-6
-.-.-	3-6.1 and 3-6.2
3-49 and 3-50	3-49 and 3-50
5-11 and 5-12	5-11 and 5-12
6-25 through 6-28	6-25 through 6-28
6-31 and 6-32	6-31 and 6-32
7-109 through 7-112	7-109 through 7-112
7-209 through 7-212	7-209 through 7-212
7-221 and 7-222	7-221 and 7-222
7-323 and 7-324	7-323 and 7-324
8-7 through 8-10	8-7 through 8-10
8-10A/(8-10B blank)	8-10A/(8-10B blank)
8-11 through 8-16	8-11 through 8-16
8-25 through 8-28	8-25 through 8-28
8-28A/(8-28B blank)	-----------------------
8-29 through 8-31/(8-32 blank)	8-29 through 8-31/(8-32 blank)
9-3 and 9-4	9-3 and 9-4
9-9 and 9-10	9-9 and 9-10
9-12A and 9-12B	9-12A and 9-12B
Index-5 and Index-6	Index-5 and Index-6

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By Order of the Secretary of the Army:

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TM 55-1510-218-10
C9

CHANGE NO. 9

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 21 JANUARY 1992

Operator's Manual
For
ARMY MODELS C-12A, C-12C,
C-12D AND C-12F AIRCRAFT

TM 55-1510-218-10, 22 April 1985, is changed as follows:

1. Remove and insert pages as indicated below. New or changed text material is indicated by a vertical bar in the margin. An illustration change is indicated by a miniature pointing hand.

Remove pages	Insert pages
8-10A/8-10B	8-10A/8-10B
8-11 and 8-12	8-11 and 8-12
8-17 and 8-18	8-17 and 8-18
8-21 and 8-22	8-21 and 8-22

2. Retain this sheet in front of manual for reference purposes.

By Order of the Secretary of the Army:

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Chief of Staff

Official:

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Administrative Assistant to the
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CHANGE NO. 8

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 30 September 1991

Operator's Manual
For
ARMY MODELS C-12A, C-12C,
C-12D AND C-12F AIRCRAFT

TM 55-1510-218-10, 22 April 1985, is changed as follows:

1. Remove and insert pages as indicated below. New or changed text material is indicated by a vertical bar in the margin. An illustration change is indicated by a miniature pointing hand.

Remove pages	Insert pages
2-69 through 2-72	2-69 through 2-72
2-72A and 2-72B	2-72A and 2-72B
2-85 and 2-86	2-85 and 2-86
2-87 and 2-88	2-87 and 2-88
3-1 and 3-2	3-1 and 3-2
3-15 and 3-16	3-15 and 3-16
----	3-16A/3-16B
3-59 and 3-60	3-59 and 3-60
----	3-60A through 3-60C/3-60D
3-61 and 3-62	3-61 and 3-62
3-125/3-126	3-125 and 3-126
----	3-126A through 3-126C/3-126D
3-127 and 3-128	3-127 and 3-128
3-201/3-202	3-201 through 3-204
8-15 and 8-16	8-15 and 8-16
8-16A and 8-16B	8-16A/8-16B
Index 3 and Index 4	Index 3 and Index 4

2. Retain this sheet in front of manual for reference purposes.

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TM 55-1510-218-10
C 7

CHANGE NO. 7 }	HEADQUARTERS DEPARTMENT OF THE ARMY WASHINGTON, D.C., 18 January 1991

Operator's Manual
For
ARMY MODELS C-12A, C-12C,
C-12D AND C-12F AIRCRAFT

TM 55-1510-218-12, 22 April 1985, is changed as follows:

1. Remove and insert pages as indicated below. New or changed text material is indicated by a vertical bar in the margin. An illustration change is indicated by a miniature pointing hand.

Remove pages	Insert pages
8-3 and 8-4	8-3 and 8-4
8-7 and 8-8	8-7 and 8-8
8-21 and 8-22	8-21 and 8-22

2. Retain this sheet in front of manual for reference purposes.

By Order of the Secretary of the Army:

CARL E. VUONO
General, United States Army
Chief of Staff

Official:

THOMAS F. SIKORA
Brigadier General, United States Army
The Adjutant General

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TM 55-1510-218-10
C 6

CHANGE No. 6

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 9 November 1990

Operator's Manual
For
ARMY MODELS C-12A, C-12C,
AND C-12D AIRCRAFT

TM 55-1510-218-10, 22 April 1985, is changed as follows:

1. Remove and insert pages as indicated below. New or changed text material is indicated by a vertical bar in the margin. An illustration change is indicated by a miniature pointing hand.

Remove pages	Insert pages
9-11 and 9-12	9-11 and 9-12
9-12A and 9-12B	9-12A and 9-12B

2. Retain this sheet in front of manual for reference purposes.

By Order of the Secretary of the Army:

CARL E. VUONO
General, United States Army
Chief of Staff

Official:

THOMAS F. SIKORA
Brigadier General, United States Army
The Adjutant General

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CHANGE NO. 5

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 14 September 1989

Operator's Manual
For
ARMY MODELS C-12A, C-12C,
C-12D AND C-12F AIRCRAFT

TM 55-1510-218-10, 22 April 1985 is changed as follows:

1. Remove and insert pages as indicated below. New or changed text material is indicated by a vertical bar in the margin. An illustration change is indicated by a miniature pointing hand.

Remove pages	Insert pages
a and b	a and b
i through iii/iv	i through iii/iv
1-1 and 1-2	1-1 and 1-2
2-1 through 2-4	2-1 through 2-4
2-4A/2-4B	2-4A/2-4B
2-9 through 2-14	2-9 through 2-14
2-15 and 2-16	2-15 and 2-16
2-16A/2-16B	2-16A/2-16B
2-17 and 2-18	2-17 and 2-18
2-18A/2-18B	2-18A/2-18B
2-19 and 2-20	2-19 and 2-20
2-25 and 2-26	2-25 and 2-26
2-29 and 2-30	2-29 and 2-30
2-35 and 2-36	2-35 and 2-36
2-36A/2-36B	2-36A/2-36B
2-39 and 2-40	2-39 and 2-40
2-41 through 2-44	2-41 through 2-44
2-44A/2-44B	2-44A/2-44B
2-47 and 2-48	2-47 and 2-48
2-49 and 2-50	2-49 and 2-50
2-51 and 2-52	2-51 and 2-52
2-52A/2-52B	2-52A/2-52B
2-53 and 2-54	2-53 and 2-54
2-59 through 2-62	2-59 through 2-62
2-62A/2-62B	2-62A/2-62B
2-63 through 2-72	2-63 through 2-72
2-72A through 2-72C/2-72D	2-72A through 2-72C/2-72D
2-73 and 2-74	2-73 and 2-74
2-74A/2-74B	2-74A/2-74B
2-75 through 2-78	2-75 through 2-78
2-79 and 2-80	2-79 and 2-80
2-80A and 2-80B	2-80A and 2-80B
2-81 and 2-82	2-81 and 2-82
2-82A/2-82B	2-82A/2-82B
2-83 through 2-86	2-83 through 2-86
2-87 and 2-88	2-87 and 2-88
2-88A and 2-88B	2-88A and 2-88B
2-89 and 2-90	2-89 and 2-90

Remove pages	Insert pages
2-90A/2-90B	2-90A/2-90B
2-91 and 2-92	2-91 and 2-92
2-95 and 2-96	2-95 and 2-96
3-1 and 3-2	3-1 and 3-2
3-61 and 3-62	3-61 and 3-62
3-127 and 3-128	3-127 and 3-128
5-5 and 5-6	5-5 and 5-6
5-9 and 5-10	5-9 and 5-10
5-10A/5-10B	5-10A/5-10B
5-15 and 5-16	5-15 and 5-16
6-1 through 6-4	6-1 through 6-4
6-5 through 6-8	6-5 through 6-8
6-9 through 6-20	6-9 through 6-20
6-21 and 6-22	6-21 through 6-32
7-1/7-2	7-1/7-2
7-101/7-102	7-101/7-102
7-201/7-202	7-201/7-202
7-303/7-304	7-303/7-304
A-1/A-2	A-1/A-2
B-1 and B-2	B-1 and B-2
Index-7/Index-8	Index-7/Index-8

2. Retain this sheet in front of manual for reference purposes.

By Order of the Secretary of the Army:

CARL E. VUONO,
General, United States Army
Chief of Staff

Official:

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CHANGE NO. 4

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 11 August 1988

Operator's Manual
For
ARMY MODELS C-12A, C-12C,
C-12D AND C-12F AIRCRAFT

TM 55-1510-218-10, 22 April 1985 is changed as follows:

1. Title has been changed to read as stated above.
2. Remove and insert pages as indicated below. New or changed text material is indicated by a vertical bar in the margin. An illustration change is indicated by a miniature pointing hand.

Remove pages	Insert pages
i and ii	i and ii
— — —	iii/ iv
1-1 and 1-2	1-1 and 1-2
2-1 through 2-4	2-1 through 2-4
— — —	2-4A/2-4B
2-15 and 2-16	2-15 and 2-16
— — —	2-16A/2-16B
2-17 and 2-18	2-17 and 2-18
— — —	2-18A/2-18B
2-19 and 2-20	2-19 and 2-20
— — —	2-20A/2-20B
2-23 and 2-24	2-23 and 2-24
2-29 and 2-30	2-29 and 2-30
— — —	2-30A/2-30B
2-35 and 3-36	2-35 and 2-36
— — —	2-36A/2-36B
2-39 and 2-40	2-39 and 2-40
2-40A and 2-40B	2-40A/2-40B
2-41 through 2-44	2-41 through 2-44
— — —	2-44A/2-44B
2-47 and 2-48	2-47 and 2-48
2-48A/2-48B	2-48A/2-48B
2-49 and 2-50	2-49 and 2-50
— — —	2-50A/2-50B
2-51 and 2-52	2-51 and 2-52
— — —	2-52A/2-52B
2-53 and 2-54	2-53 and 2-54
— — —	2-54A/2-54B
2-61 and 2-62	2-61 and 2-62
— — —	2-62A/2-62B
2-67 through 2-72	2-67 through 2-72
— — —	2-72A through 2-72C/2-72D
2-73 and 2-74	2-73 and 2-74
— — —	2-74A/2-74B
2-75 through 2-78	2-75 through 2-78
2-79 and 2-80	2-79 and 2-80
— — —	2-80A and 2-80B
2-81 and 2-82	2-81 and 2-82

Remove pages	Insert pages
— — —	2-82A/2-82B
2-85 and 2-86	2-85 and 2-86
2-87 and 2-88	2-87 and 2-88
— — —	2-88A through 2-88C/2-88D
2-89 and 2-90	2-89 and 2-90
— — —	2-90A/2-90B
2-97 and 2-98	2-97 and 2-98
— — —	2-98A/2-98B
2-99 and 2-100	2-99 and 2-100
3-1 and 3-2	3-1 and 3-2
3-61 and 3-62	3-61 and 3-62
— — —	3-127 through 3-201/3-202
5-1 and 5-2	5-1 and 5-2
5-9 and 5-10	5-9 and 5-10
5-10A/5-10B	5-10A/5-10B
5-11 and 5-12	5-11 and 5-12
6-1 through 6-4	6-1 through 6-4
— — —	6-4A/6-4B
6-5 through 6-8	6-5 through 6-8
— — —	6-8A/6-8B
6-9 through 6-20	6-9 through 6-20
— — —	6-20A/6-20B
6-21/6-22	6-21 and 6-22
8-1 and 8-2	8-1 and 8-2
— — —	8-2A/8-2B
8-3 and 8-4	8-3 and 8-4
8-7 through 8-10	8-7 through 8-10
— — —	8-10A/8-10B
8-11 through 8-14	8-11 through 8-14
8-17 and 8-18	8-17 and 8-18
8-21 and 8-22	8-21 and 8-22
8-25 and 8-26	8-25 and 8-26
9-5 through 9-12	9-5 through 9-12
9-12A and 9-12B	9-12A and 9-12B
9-13 through 9-18	9-13 through 9-18
Index-1 through Index-6	Index-1 through Index-6
— — —	Index-7/Index-8

2. Retain this sheet in front of manual for reference purposes.

By Order of the Secretary of the Army:

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General, United States Army
Chief of Staff

Official:

R. L. DILWORTH
Brigadier General, United States Army
The Adjutant General

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CHANGE NO. 3

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 8 December 1987

Operator's Manual
for
ARMY MODELS C-12A, C-12C,
C-12D AND C-12F AIRCRAFT

TM 55-1510-218-10, 22 April 1985 is changed as follows:

1. Title is changed as shown above.

2. Remove and insert pages as indicated below. New or changed text material is indicated by a vertical bar in the margin. An illustration change is indicated by a miniature pointing hand.

Remove pages	Insert pages
i and ii	i and ii
1-1 and 1-2	1-1 and 1-2
2-1 through 2-92	2-1 through 2-105/2-106
3-1 and 3-2	3-1 and 3-2
3-61 and 3-62	3-61 and 3-62
5-1 through 5-10	5-1 through 5-10
— — —	5-10A/5-10B
5-15 and 5-16	5-15 and 5-16
7-101/7-102	7-101/7-102
7-107 and 7-108	7-107 and 7-108
7-201/7-202	7-201/7-202
7-207 and 7-208	7-207 and 7-208
— — —	7-303/7-304
— — —	7-305 trough 7-307/7-308
— — —	7-309 through 7-403/7-404
8-3 through 8-18	8-3 through 8-18
— — —	8-18A and 8-18B
8-19 and 8-20	8-19 and 8-20
9-5 and 9-6	9-5 and 9-6
9-11 and 9-12	9-11 and 9-12
9-12A and 9-12B	9-12A and 9-12B
9-13 and 9-14	9-13 and 9-14
Index 1 through Index 6	Index 1 through Index 6

3. Retain these sheets in front of manual for reference purposes.

By Order of the Secretary of the Army:

CARL E. VUONO
General, United States Army
Chief of Staff

Official:

R. L. DILWORTH
Brigadier General, United States Army
The Adjutant General

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CHANGE NO. 2

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C.,20 April 1987

Operator's Manual
for
ARMY MODELS C-12A,
C-12C and C-12D AIRCRAFT

TM 55-1510-218-10, 22 April 1985 is changed as follows:

1. Remove and insert pages as indicated below. New or changed text material is indicated by a vertical bar in the margin. An illustration change is indicated by a miniature pointing hand.

Remove pages	Insert pages
i and ii	i and ii
1-1 and 1-2	1-1 and 1-2
2-1 through 2-14	2-1 through 2-14
— — —	2-14A through 2-14F
2-35 through 2-40	2-35 through 2-40
— — —	2-40A and 2-40B
2-47 and 2-48	2-47 and 2-48
— — —	2-48A/2-48B
2-61 through 2-78	2-61 through 2-78
— — —	2-78A through 2-78J/2-78K
2-83 through 2-86	2-83 through 2-86
— — —	2-86A/2-86B
3-1 and 3-2	3-1 and 3-2
— — —	3-61 through 3-125/3-126
5-5 and 5-6	5-5 and 5-6
5-15 and 5-16	5-15 and 5-16
8-3 and 8-4	8-3 and 8-4
— — —	8-4A/8-4B
8-13 through 8-16	8-13 through 8-16
— — —	8-16A and 8-16B
8-19 and 8-20	8-19 and 8-20
— — —	9-12A and 9-12B
9-13 and 9-14	9-13 and 9-14
Index 1 through Index 6	Index 1 through Index 6

2. Retain this sheet in front of manual for reference purposes.

By Order of the Secretary of the Army:

JOHN A. WICKHAM, JR.
General, United States Army
Chief of Staff

Official:

R. L. DILWORTH
Brigadier General, United States Army
The Adjutant General

DISTRIBUTION:
To be distributed in accordance with DA Form 12-31, -10 and CL Maintenance requirements for C-12A, C-12C and C-12D Airplane, Cargo.

CHANGE NO. 1

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 26 Septrember 1986

Operator's Manual
ARMY MODELS C-12A, C-12C, AND C-12D AIRCRAFT

TM 55-1510-218-10, 7 October 1982, is changed as follows:

1. Remove and insert pages as indicated below.

	Remove pages	Insert pages
Chapter 5	5-1 and 5-2	5-1 and 5-2
	5-11 and 5-12	5-11 and 5-12
Chapter 7	7-49 thru 7-56	7-49 thru 7-56
	7-65 thru 7-68	7-65 thru 7-68
	7-105 and 7-106	7-105 and 7-106
Chapter 8	8-11 and 8-12	8-11 thru 8-12.1/8-12.2
	8-13 and 8-14	8-13 thru 8-14.1/8-14.2
Chapter 9	9-3 and 9-4	9-3 thru 9-4.1/9-4.2
	9-7 and 9-8	9-7 thru 9-8.1/9-8.2

2. New or changed text material is indicated by a vertical bar in the margin. An illustration change is indicated by a miniature pointing hand.

3. Retain this sheet in front of manual for reference purposes.

By Order of the Secretary of the Army:

E. C. MEYER
General, United States Army
Chief of Staff

Official:

ROBERT M. JOYCE
Major General, United States Army
The Adjutant General

DISTRIBUTION:
To be distributed in accordance with Special List.

WARNING PAGE

WARNING

Personnel performing operations, procedures and practices which arc included or implied in this technical manual shall observe the following warnings. Disregard of these warnings and precautionary information can cause serious injury or loss of life.

NOISE LEVELS

Sound pressure levels in this aircraft during some operating conditions exceed the Surgeon General's hearing conservation criteria, as defined in TB MED 501. Hearing protection devices, such as the aviator helmet or car plugs shall be worn by all personnel in and around the aircraft during its operation.

STARTING ENGINES

Operating procedures or practices defined in this Technical Manual must be followed correctly. Failure to do so may result in personnel injury or loss of life.
Exposure to exhaust gases shall be avoided since exhaust gases are an irritant to eyes, skin and respiratory system.

HIGH VOLTAGE

High voltage is a possible hazard around AC inverters, ignition exciter units, and strobe beacons.

USE OF FIRE EXTINGUISHERS IN CONFINED AREAS

Halon gas is very volatile, but is not easily detected by its odor. Although not toxic, it must be considered to be about the same as other freons and carbon dioxide, causing danger to personnel primarily by reduction of oxygen available for proper breathing. During operation of the fire extinguisher, ventilate personnel areas with fresh air. The liquid shall not be allowed to come into contact with the skin, as it may cause frostbite or low temperature burns because of its very low boiling point.

VERTIGO

The strobe/beacon lights should be turned off during flight through clouds to prevent sensations of vertigo, a result of reflections of the light on the clouds.

CARBON MONOXIDE

When smoke, suspected carbon monoxide fumes, or symptoms of lack of oxygen (hypoxia) exist, all personnel shall immediately don oxygen masks, and activate the oxygen system.

FUEL AND OIL HANDLING

Turbine fuels and lubricating oils contain additives which are poisonous and readily absorbed through the skin. Do not allow them to remain on skin.

SERVICING AIRCRAFT

When conditions permit, the aircraft shall be positioned so that the wind will carry the fuel vapors away from all possible sources of ignition. The fueling unit shall maintain a distance of 20 feet between unit and filler point. A minimum of 10 feet shall be maintained between fueling unit and aircraft.

Prior to refueling, the hose nozzle static ground wire shall be attached to the grounding lugs that are located adjacent to filler openings.

SERVICING BATTERY

Improper service of the nickel-cadmium battery is dangerous and may result in both bodily injury and equipment damage. The battery shall be serviced in accordance with applicable manuals by qualified personnel only.

Battery Electrolyte (Potassium Hydroxide) is corrosive. Wear rubber gloves, apron, and face shield when handling batteries. If potassium hydroxide is spilled on clothing, or other material wash immediately with clean water. If spilled on personnel, immediately start flushing the affected area with clean water. Continue washing until medical assistance arrives.

JET BLAST

Occasionally, during starting, excess fuel accumulation in the combustion chamber causes flames to be blown from the exhausts. This area shall be clear of personnel and flammable materials.

RADIOACTIVE MATERIAL

Instruments contained in this aircraft may contain radioactive material (TB 55-1500-314-25). These items present no radiation hazard to personnel unless seal has been broken due to aging or has accidentally been broken. If seal is suspected to have been broken, notify Radioactive Protective Officer.

RF BURNS

Do not stand near the antennas when they are transmitting.

OPERATION OF AIRCRAFT ON GROUND

At all times during a towing operation, be sure there is a man in the cockpit to operate the brakes.

Personnel should take every precaution against slipping or falling. Make sure guard rails are installed when using maintenance stands.

Engines shall be started and operated only by authorized personnel. Reference AR 95-1.

Ensure that landing gear control handle is in the DN position.

TECHNICAL MANUAL
NO. 55-1510-218-10

HEADQUATERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C. 22 APRIL 1985

Operator's Manual

ARMY MODELS C-12C, C-12D AND C-12F AIRCRAFT

REPORTING OR ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistakes or if you know of any way to improve the procedures, please let use know. Mail your letter, DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2 located in the back of this manual directly to: Commander, U.S. Army Aviation and Missile Command, ATTN: AMSAM-MMC-LS-LP, Redstone Arsenal, AL 35898-5230. A reply will be furnished directly to you. You may also send in your comments electronically to our E-mail address at <ls-lp@redstone.army.mil>, or by fax at (205) 842-6546 or DSN 788-6546. Instructions for sending an Electronic DA Form 2028 may be found at the back of this manual immediately preceding the hard copy DA Forms 2028.

TABLE OF CONTENTS

TABLE OF CONTENTS (CONT'D)

CHAPTER 1
INTRODUCTION

1-1. GENERAL
These instructions are for use by the operator(s). They apply to the C-12C, C-12D and C-12F model aircraft.

1-2. WARNINGS, CAUTIONS, AND NOTES.
Warnings, cautions, and notes are used to emphasize important and critical instructions and are used for the following conditions:

WARNING

An operating procedure, practice, etc., which if not correctly followed, could result in personal injury or loss of life.

CAUTION

An operating procedure, practice, etc., which, if not strictly observed, could result in damage to or destruction of equipment.

NOTE

An operating procedure, condition, etc., which is essential to highlight.

1-3. DESCRIPTION.
This manual contains the best operating instructions and procedures for the aircraft under most circumstances. The observance of limitations, performance, and weight/balance data provided is mandatory. The observance of procedures is mandatory except when modification is required because of multiple emergencies, adverse weather, terrain, etc. Your flying experience is recognized, and therefore, basic flight principles are not included. THIS MANUAL SHALL BE CARRIED IN THE AIRCRAFT AT ALL TIMES.

1-4. APPENDIX A, REFERENCES.
Appendix A is a listing of official publications cited within the manual applicable to and available for flight crews.

1-5. APPENDIX B, ABBREVIATIONS AND TERMS.
Appendix B is a listing of abbreviations and terms used throughout the manual.

1-6. INDEX.
The index lists in alphabetical order, every titled paragraph, figure, and table contained in this manual. Chapter 7, Performance Data, has an additional index within the chapter.

1-7. ARMY AVIATION SAFETY PROGRAM.
Reports necessary to comply with the safety program are prescribed in AR 385-40.

1-8. DESTRUCTION OF ARMY MATERIAL TO PREVENT ENEMY USE.
For information concerning destruction of Army material to prevent enemy use, refer to TM 750-2441-5.

1-9. FORMS AND RECORDS.
Army aviators flight record and aircraft maintenance records which are to be used by crew members are prescribed in DA PAM 738-751 and I WEIGHT and BALANCE TM 55-1500-342-23.

1-10. EXPLANATION OF CHANGE SYMBOLS.
Changes, except as noted below, to the text and tables, including new material on added pages, are indicated by a vertical line in the outer margin extending close to the entire area of the material affected; exception: pages with emergency markings, which consist of black diagonal lines around three edges, may have the vertical line or change symbol placed along the inner margins.

Symbols show current changes only. A miniature pointing hand symbol is used to denote a change to an illustration. However, a vertical line in the outer margin, rather than miniature pointing hands, is utilized when there have been extensive changes made to an illustration. Change symbols are not utilized to indicate changes in the following:

a. Introductory material.
b. Indexes and tabular data where the change cannot be identified.

c. Correction of minor inaccuracies, such as spelling, punctuation, relocation of material, etc., unless correction changes the meaning of instructive information and procedures.

1-11. AIRCRAFT DESIGNATION SYSTEM.
The designation system prescribed by AR 70-50 is used in aircraft designations as follows:

EXAMPLE C-12C
C - Basic mission and type symbol (cargo)
12 - Design number
C - Series symbol

1-12. AIRCRAFT EFFECTIVITY DESIGNATORS AND SERIALIZATION.
The aircraft effectivity for content within this manual will be designated by the following symbols: C, D, D1, D2 F, F1 and F2. These symbols may be used individually or in groups as follows:

C - is for all C-12C aircraft.
D - is for all C-12D aircraft.
D1 - is for C-12D aircraft serials prior to serial 84-24375.
D2 - is for C-12D aircraft serials 84-24375 and subsequent.
F - is for all C-12F aircraft.
F1 - is for C-12F aircraft serials 85-51261 thru 85-51272.
F2 - is for C-12F aircraft serials 86-60084 and subsequent.

The effectivity symbols listed are used in conjunction with paragraph titles, text content, performance charts and graphs, tables, figure titles, and specific items on illustrations to show proper effectivity of the material as applicable. If the material applies to all models within the manual, no effectivity designators are used. Where practical, to avoid duplication, descriptive information is written to apply to all models and split series effectivities. Table 2-1 lists the most significant differences between models including the split series effectivities.

Aircraft serials are used only where needed for clarification. Paragraphs, figures, tables and charts which apply to specific model(s) have the corresponding model designator(s) placed following the paragraph or figure title. Model and serial effectivity designators are also placed within tables, charts and text where applicable. No effectivity designator is used, if a paragraph, figure, table or chart is common to all models.

1-13. USE OF WORDS SHALL, SHOULD, AND MAY.
Within this technical manual the word "shall" is used to indicate a mandatory requirement. The word "should" is used to indicate a nonmandatory but preferred method of accomplishment. The word "may" is used to indicate an acceptable method of accomplishment.

1-14. PLACARD ITEMS.
Placard items (switches, controls, etc.) are shown throughout this manual in capital letters.

1-15. AVIONICS CHAPTERS.
This manual contains three Avionics chapters entitled as follows:

Chapter 3 - AVIONICS C-12. **C D1** Aircraft
Chapter 3A - AVIONICS C-12 **D2 F1** Aircraft
Chapter 3B - AVIONICS C-12 **F2** Aircraft

Users are authorized to remove those chapters that are not applicable to their aircraft model. Users are not required to carry on-board those chapters that are not applicable.

1-16. PERFORMANCE CHARTS/GRAPHS.
This manual contains separate performance charts and graphs for C-12**C D** and **F** model aircraft. Users are authorized to remove sections which do not apply to their model of aircraft, and are not required to carry these on.-board.

CHAPTER 2
AIRCRAFT AND SYSTEMS DESCRIPTION AND OPERATION

Section I. AIRCRAFT

2-1. INTRODUCTION.

The purpose of this chapter is to describe the aircraft and its systems and controls which contribute to the physical act of operating the aircraft. It does not contain descriptions of avionics and mission equipment, covered elsewhere in this manual. This chapter contains descriptive information and does not describe procedures for operation of the aircraft. These procedures are contained within appropriate chapters in the manual. This chapter also contains the emergency equipment installed. This chapter is not designed to provide instructions on the complete mechanical and electrical workings of the various systems. Therefore, each system is described only in enough detail to make comprehension of that system sufficiently complete, to allow for its safe and efficient operation.

NOTE

C-12 **F2** aircraft incorporate aviator night vision Imaging (ANVIS) compatible interior lighting in the following areas: All cockpit except emergency lighting; All cabin lights except reading, spar cover, no smoking fasten seat belt, and emergency lighting.

2-2. GENERAL.

The C-12 is a pressurized, low wing, all metal aircraft, powered by two PT6A turboprop engines and has all-weather capability (figs. 2-1 and 2-2). Distinguishable features of the aircraft are the slender, streamlined engine nacelles, square-tipped wing and tail surfaces, a T-tail and ventral fin below the empennage. The basic mission of the aircraft is to provide a transport service supporting staff in the conduct of command and control functions, administration, liaison, and inspection. Cabin entrance is made through a stair-type door on the left side of the fuselage. The pilot and copilot seats are separated from the cabin by a removable partition. Table 2-1 lists main differences between models.

2-3. DIMENSIONS.

Overall aircraft dimensions are shown in figure 2-3.

2-4. GROUND TURNING RADIUS.

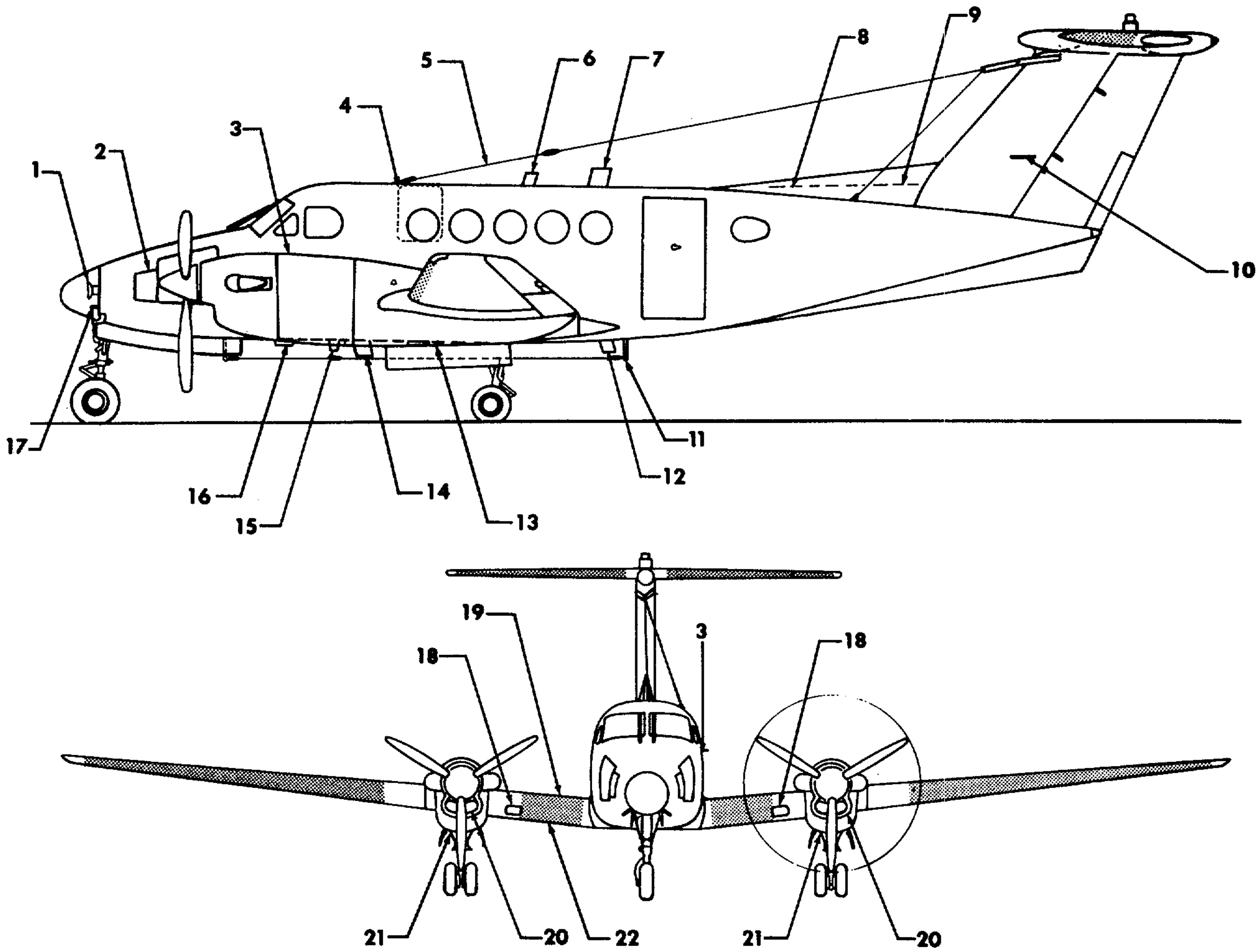
Minimum ground turning radius of the aircraft is shown in figure 2-4.

2-5. MAXIMUM WEIGHTS.

Maximum takeoff gross weight is 12,500 pounds. Maximum landing weight is 12,500 pounds. Maximum ramp weight is 12,590 pounds.

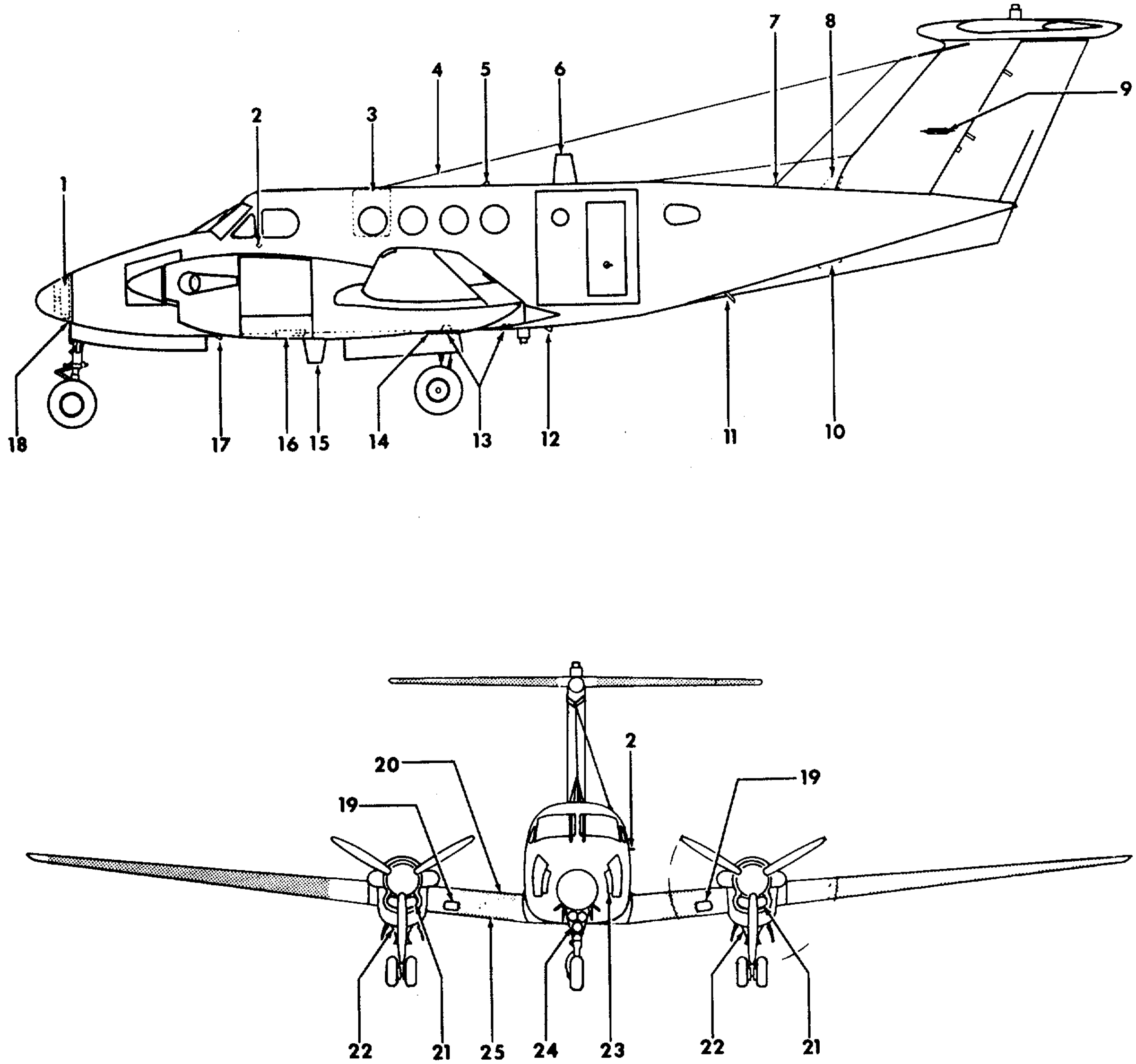
Table 2-1. Main Differences

ITEM	C-12C	C-12D	C-12F
Wing span	54 ft. 6 in.	55 ft. 6.5 in.	55 ft. 6.5 in.
Ground turning radius	39 ft. 10 in.	40 ft. 4 in.	40 ft. 4 in.
Cargo door	Not installed	Height-52 in. Width-52 in.	Height-52 in. Width-52 in.
Engines	PT6A-41	PT6A-41	PT6A-42
Oxygen system	Passenger masks stowed for use	Auto-deployment system	Auto-deployment system
Landing/taxi lights	Located in wing tips	Located on nose gear	Located on nose gear
High flotation landing gear	Not installed	Installed	Installed
Hydraulic landing gear	Not installed	Installed **D2**	Installed
ANVIS lighting	Not installed	Not installed	Installed **F2**



1. Radar Antenna
2. Condenser Air Inlet (Right), Air Exhaust (Left)
3. Free Air Temperature Sensor
4. Emergency Escape Hatch (Right)
5. HF Comm Antenna
6. Upper Transponder Antenna
7. VHF No. 1 and UHF Comm Antenna
8. ADF No. 2 Sense Antenna
9. ELT Antenna
10. VOR No. 1 and No. 2 Antennas (2)
11. ADF No. 1 Sense Antenna
12. Lower Transponder Antenna
13. ADF No. 1 and No. 2 Loop Antennas (2)
14. VHF No. 2 and UHF Comm Antenna
15. DME Antenna
16. Marker Beacon Antenna
17. Glideslope Antenna
18. Heat Exchanger Inlet
19. Battery Exhaust Louvers
20. Engine Air Inlet
21. Engine Air Bypass Door
22. Battery Ram Air Inlet

Figure 2-1. General Exterior Arrangement **C D1** - *Sheet 1 of 3*



1. Radar Antenna
2. Free Air Temperature Sensor
3. Emergency Escape Hatch (Right)
4. HF Comm Antenna
5. Upper Transponder Antenna
6. VHF No. 1 and UHF Comm Antenna
7. ADF No. 2 Sense Antenna
8. ELT Antenna
9. VOR No. 1 and No. 2 Antennas (2)
10. Flight Management Antenna
11. ADF No. 1 Sense Antenna
12. Lower Transponder Antenna
13. Radio Altimeter Antenna
14. ADF No. 1 and No. 2 Loop Antennas (2)
15. VHF No. 2 and UHF Comm Antenna
16. Marker Beacon Antenna
17. Tacan/DME Antenna
18. Glideslope Antenna
19. Heat Exchanger Inlet
20. Battery Exhaust Louvers
21. Engine Air Inlet
22. Engine Air Bypass Door
23. Condenser Air Inlet (Right) Air Exhaust (Left)
24. Landing/Taxi Lights
25. Battery Ram Air Inlet

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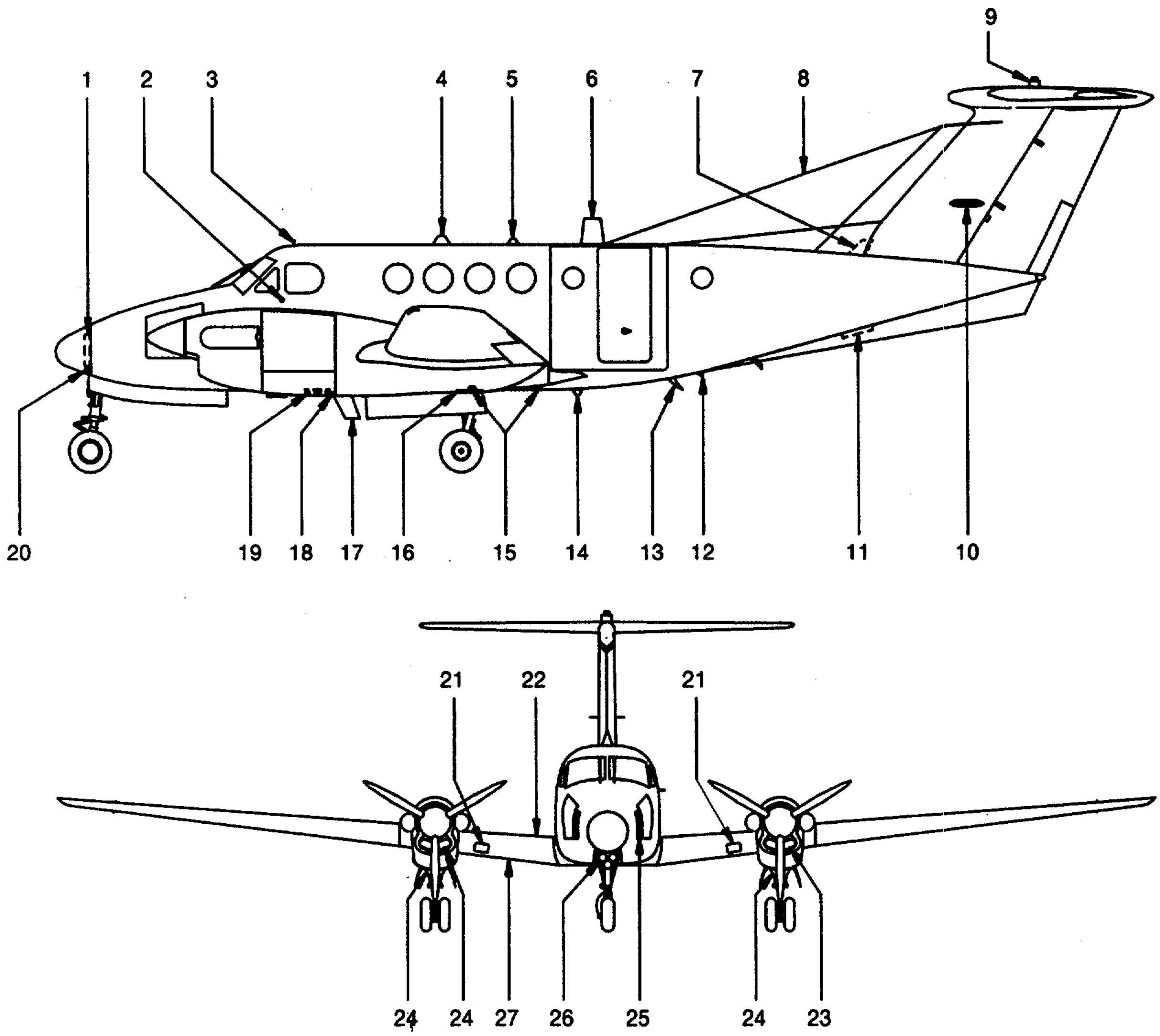
Figure 2-1. General Exterior Arrangement **D2 F1** - *Sheet 2 of 3*



1. Radar Antenna
2. Free Air Temperature Sensor
3. Upper Microwave Landing Antenna
4. Global Positioning Antenna
5. Upper Transponder Antenna
6. VHF No. 1 and UHF Comm Antenna
7. ELT Antenna
8. HF Comm Antenna
9. Upper Strobe Beacon
10. VOR/NAV No. 1 and No. 2 Antennas
11. Flight Management Antenna
12. Lower Microwave Landing Antenna
13. Tacan/DME Antenna
14. Lower Strobe Beacon
15. Radio Altimeter Antenna
16. ADF Loop/Sense Antenna
17. VHF No. 2 and UHF Comm Antenna
18. Lower Transponder Antenna
19. Marker Beacon Antenna
20. Glideslope Antenna
21. Heat Exchanger Inlet
22. Battery Exhaust Louvers
23. Engine Air Inlet
24. Engine Air Bypass Door
25. Condenser Air Inlet(Right) Air Exhaust (Left)
26. Landing/Taxi Lights
27. Battery Ram Air Inlet

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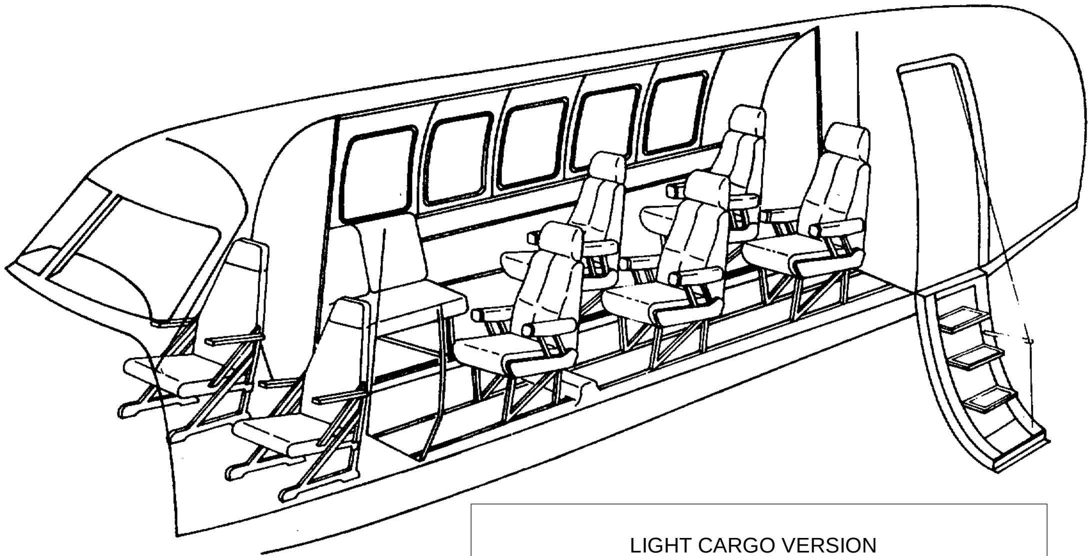
Figure 2-1. General Exterior Arrangement **F2**- *Sheet 3 of 3*



LIGHT CARGO VERSION
CONVERSION TO LIGHT CARGO VERSION CONSISTS OF REMOVING THE EXISTING STAFF SEATING INSTALLATIONS. NO CARGO LOADING OR UNLOADING EQUIPMENT IS PROVIDED. REF TO CHAPTER 6 WEIGHT/BALANCE AND LOADING FOR CARGO HANDLING INFORMATION AND INSTRUCTIONS.

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Figure 2-2. Typical General Interior Arrangement

26. LANDING GEAR SYSTEM C D1.

The landing gear is a retractable, tricycle type, electrically operated by a single DC motor. This motor drives the main landing gear actuators through a gear box and torque tube arrangement, and also drives a chain mechanism which controls the position of the nose gear. Positive down-locks are installed to hold the drag brace in the extended and locked position. The down-locks are actuated by overtravel of the linear jackscrews and are held in position by a spring-loaded overcenter mechanism. The jackscrew in each actuator holds all three gears in the UP position, when the gear is retracted. A friction clutch between the gearbox and the torque shafts protects the motor from electrical overload in the event of a mechanical malfunction. A 150-ampere current limiter, located on the DC distribution bus under the center floorboard, protects against electrical overload. Gear doors are opened and closed through a mechanical linkage connected to the landing gear. The nose wheel steering mechanism is automatically centered and the rudder pedals relieved of the steering load when the landing gear is retracted. Air-oil type shock struts, filled with compressed air and hydraulic fluid, are incorporated with the landing gear. Gear retraction or extension time is approximately six seconds.

a. Landing Gear Control Switch. Landing gear system operation is controlled by a manually actuated wheel-shaped switch placarded LDG GEAR CONTR, UP and DN, on the left subpanel (fig. 2-7). The control switch and associated relay circuits are protected by a 5-ampere circuit breaker, placarded LANDING GEAR RELAY on the overhead circuit breaker panel (fig. 2-23).

b. Landing Gear Down Position-Indicator Lights. Landing gear down position is indicated by three green lights on the left subpanel, placarded GEAR DOWN (fig. 2-7). These lights may be checked by operating the ANNUNCIATOR TEST switch. The circuit is protected by a 5-ampere circuit breaker (fig. 2-23), placarded LANDING GEAR IND, on the overhead circuit breaker panel.

c. Landing Gear Position Warning Lights. Two red bulbs, wired in parallel and activated by microswitches independent of the landing GEAR DOWN position indicator lights, are positioned inside the clear plastic grip on the landing gear control handle (fig. 2-7). These lights illuminate whenever the landing gear handle is in either the UP or

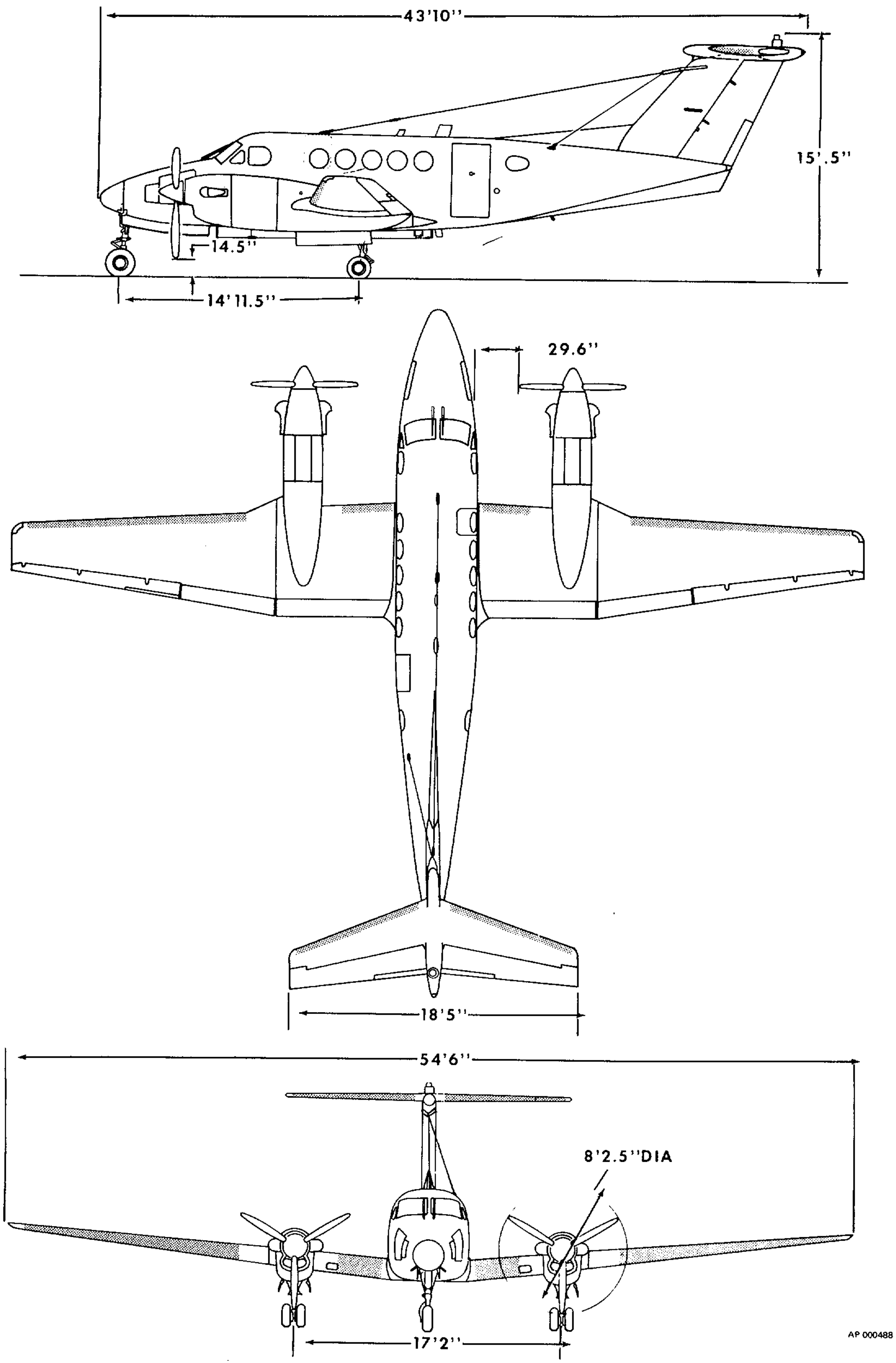


*Figure 2-3. Principal Dimensions **C**-Sheet 1 of 2*

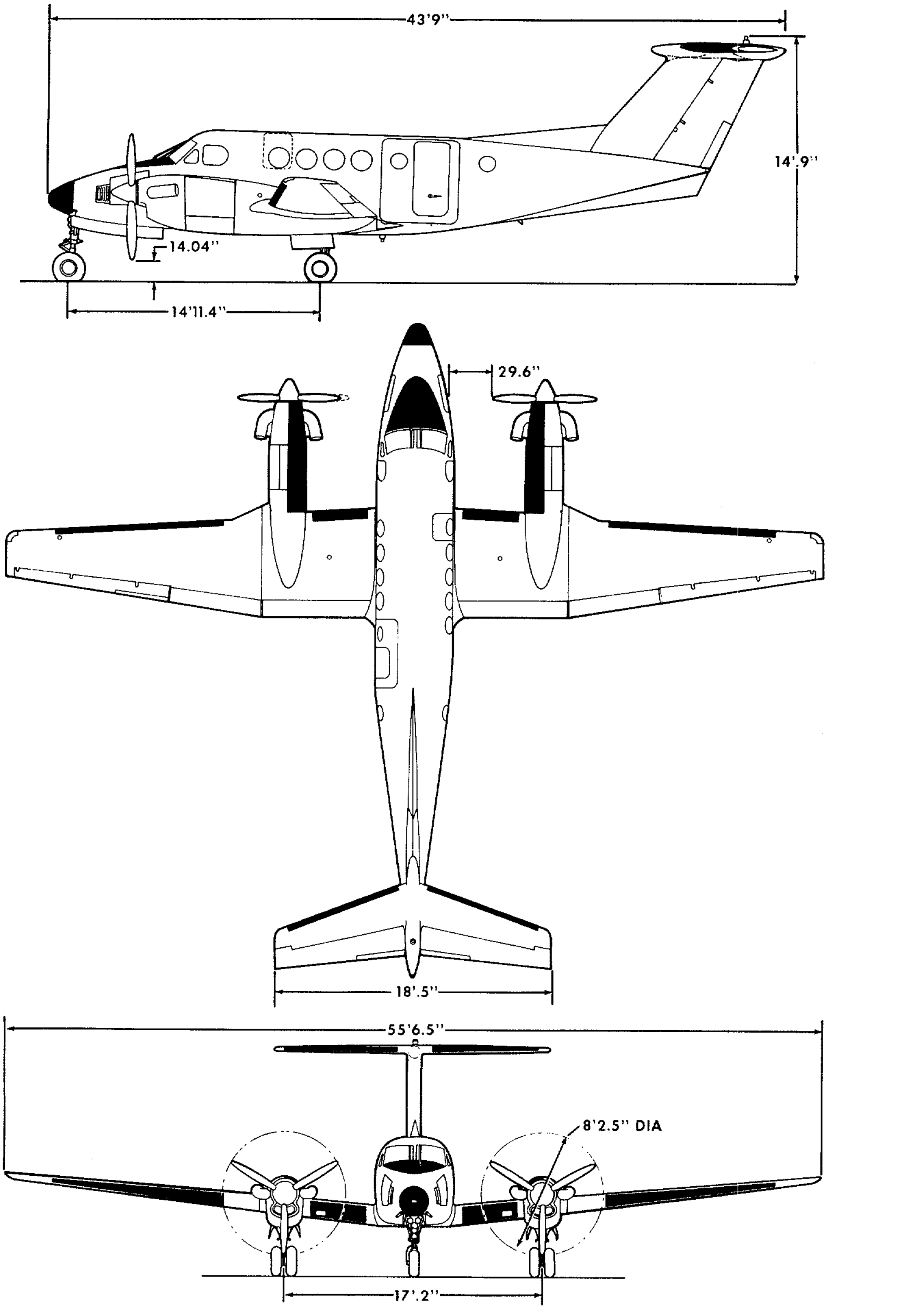


*Figure 2-3. Principal Dimensions **DF**-Sheet 2 of 2*

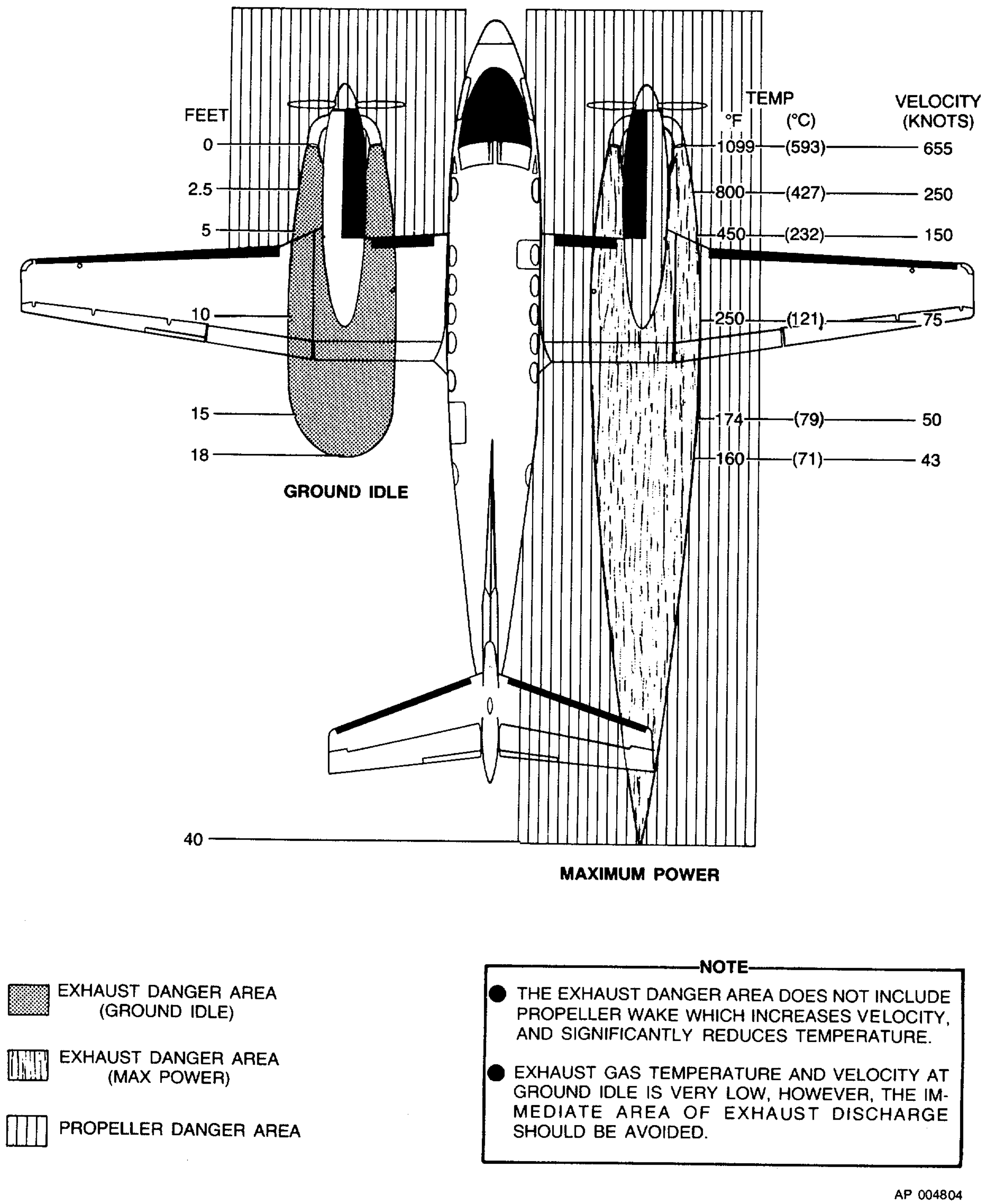
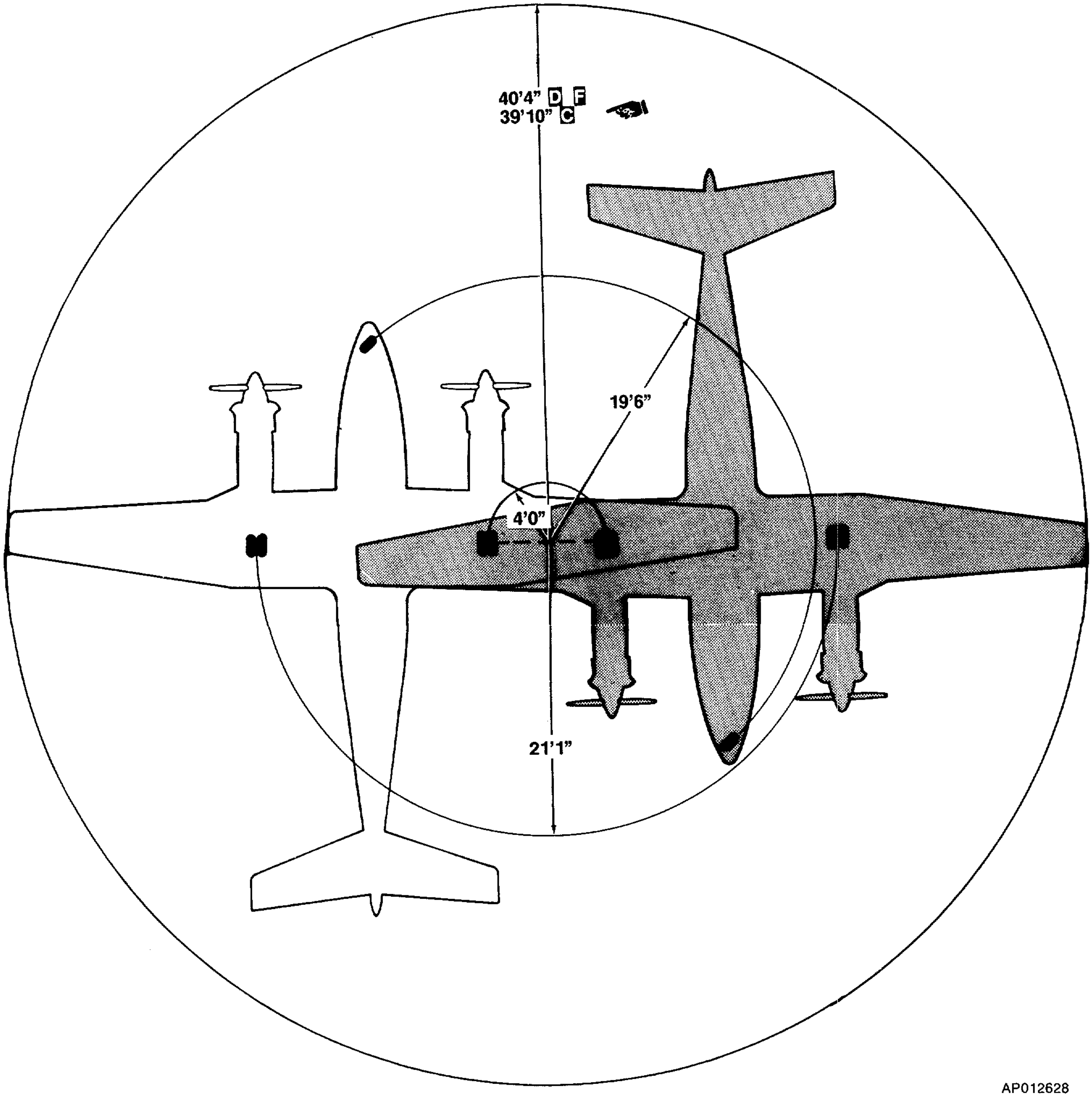


Figure 2-4. Typical Turning Radius and Exhaust Danger Area-Sheet 1 of 2

GROUND TURNING CLEARANCE



RADIUS FOR INSIDE GEAR..........................	4 FEET	
RADIUS FOR NOSE WHEEL	19 FEET	6 INCHES
RADIUS FOR OUTSIDE GEAR	21 FEET	1 INCH
RADIUS FOR WING TIP C	39 FEET	10 INCHES
RADIUS FOR WING TIP D F	40 FEET	4 INCHES

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

Figure 2-4. Typical Turning Radius and Exhaust Danger Area-Sheet 2 of 2

DN position and the gear is in transit. Both bulbs will also illuminate should either or both power levers be retarded below approximately 81% N1 when the landing gear is not down and locked. To turn the handle lights OFF during single-engine operation, the power lever for the inoperative engine must be advanced to a position which is higher than the setting of the warning horn microswitch. Extending the landing gear will also turn the lights off. Both red lights indicate the same warning conditions, but two are provided for a fail-safe indication in event one bulb burns out. The circuit is protected by a 5-ampere circuit breaker, placarded LANDING GEAR IND, on the overhead circuit breaker panel (fig. 2-23).

d. Landing Gear Warning Light Test Button. A test button placarded HDL LT TEST, is located on the left subpanel (fig. 2-7). Failure of landing gear handle to illuminate red, when this button is pressed indicates two defective bulbs or a circuit fault. The circuit is protected by a 5-ampere circuit breaker placarded LANDING GEAR RELAY CONTROL on the overhead circuit breaker panel (fig. 2-23).

e. Landing Gear Warning Horn. When either power lever is retarded below approximate 79% N1, or when the landing gear is not down and locked; or if the flaps are extended beyond 40%, a warning horn (located in the overhead control panel) will sound intermittently. To prevent the horn from sounding during long descents or an ILS approach, a pressure differential "Q" switch is connected into the copilot's static line. This switch prevents the warning horn from sounding until airspeed drops below 140 KIAS. The warning horn circuit is protected by a 5-ampere circuit breaker (placarded LANDING GEAR WARN) on the overhead circuit breaker panel (fig. 2-23).

f. Landing Gear Warning Horn Test Switch. The landing gear warning horn may be tested by a test switch on the right subpanel (fig. 2-7). The switch placarded STALL WARN TEST-OFF-LDG GEAR WARN TEST, will sound the landing gear warning horn and illuminate the landing position warning lights when moved to the momentary LDG GEAR WARN TEST position. The circuit is protected by a 5-ampere circuit breaker placarded LANDINGGEARWARN on the overhead breaker panel (fig. 2-23).

g. Landing Gear Safety Switchs. A switch on each main landing gear shock strut controls the operation of various aircraft systems that function only during flight or during ground operation. These switches are mechanically actuated whenever the main landing gear shock struts are extended (normally after takeoff) or compressed (normally after landing). The safety switch on the right main landing gear strut deactivates the landing gear control circuits, cabin pressurization circuits and the flight hour meter when the strut is compressed. This switch also deactivates a down-lock hook, preventing the landing gear from being raised while the aircraft is on the ground. The hook, which unlocks automatically after takeoff, can be manually overridden by pressing the red button, placarded DN LOCK REL located adjacent to the landing gear handle (fig 2-7). If the override is used and the landing gear control switch is raised, power will be supplied to the warning horn circuit and the horn will sound. The safety switch on the left main landing gear strut activates the left and right engine ambient air shut-off valves when the strut is extended.

h. Alternate Landing Gear Extension Handle.

CAUTION

Continued pumping of handle after GEAR DOWN position indicator lights (3) are illuminated could damage the drive mechanism, and prevent subsequent retractions.

Manual landing gear extension is provided through a manually powered system as a backup to the electrically operated system. Before manually extending the gear, make certain that the landing gear switch handle is in the down position with the LANDING GEAR RELAY circuit breaker pulled. Pulling up on the alternate engage handle, located on the floor, and turning it clockwise, will lock it in that position. When the alternate engage handle is pulled, the motor is electrically disconnected from the system and the alternate drive system is locked to the gearbox and motor. When the alternate drive is locked in, the chain is driven by a continuous actuation ratchet which is activated by pumping the alternate landing gear extension handle (fig. 2-5) adjacent to the alternate engage handle.

CAUTION

After a manual landing gear extension has been made, do not stow the handle, move any landing gear controls, or reset any switches or circuit breakers. The gear cannot be retracted manually.

After a practice manual extension, the alternate handle may be stowed and the landing gear retracted electrically. Rotate the alternate engage handle counterclockwise and push it down. Stow the handle, push in the LANDING GEAR RELAY circuit breaker on the overhead circuit breaker panel and retract the gear in the normal manner with the landing gear handle switch. Refer to Chapter 9 for emergency gear extension procedures.

i. Landing Gear Alternate Engage Handle. During manual landing gear extension, the landing gear motor must be electrically disconnected from the system and the alternate drive system locked to the gearbox and motor. This is accomplished by a manually operated alternate engage handle (Fig 2-6) located adjacent to the landing gear alternate extension handle. Pulling up on the alternate engage handle, turning it clockwise, will lock the manual landing gear extension system in the engage position. Disengage the system, turn the alternate engage handle counterclockwise as far as it will go and release.

2-7. LANDING GEAR SYSTEM D2 F

The retractable tricycle landing gear is electrically controlled and hydraulically actuated. The landing gear assemblies are extended and retracted by a hydraulic power pack, located in the left wing center section, forward of the main spar. The power pack consists primarily of a hydraulic pump, a 28 VDC motor, a gear selector valve and solenoid, a two section fluid reservoir, filter screens, gear up pressure switch and low fluid level sensor. Engine bleed air, regulated to 18 to 20 psi, is plumbed into the power pack reservoir, and the system fill reservoir to prevent cavitation of the pump. The fluid level sensor activates a yellow caution light (placarded HYD FLUID LOW) on the annunciator panel, whenever the fluid level in the power pack is low. The annunciator is tested by pressing the HYD FLUID SENSOR TEST switch located on pilot's subpanel (fig. 2-7).

Power for the power pack is supplied from the No. 5 dual fed buss, through a landing gear motor relay and a 60-ampere circuit breaker located under the floor board forward of the main spar. The motor relay is energized by power furnished through a 2 ampere LANDING GEAR CONTROL circuit breaker located on the overhead circuit breaker panel (fig. 2-23), and the downlock switches. The power pack motor is protected by a time delay module which senses operation voltage through a 5 ampere circuit breaker. Both are located beneath the aisle way floorboards forward of the main spar. Landing gear extension or retraction is normally accomplished in 5 to 6 seconds. Voltage to the power pack is terminated after the fully extended or retracted position is reached (approximately 23 seconds). If electrical power has not terminated after the normal extension or retraction time lapse, a relay and 2-ampere landing gear circuit breaker will open and electrical power to the system power pack will be interrupted.

The landing gear system utilizes folding braces called drag legs, that lock in place when the gear is fully extended. The nose landing gear actuator incorporates an internal down-lock to hold the gear in the fully extended position. However, the two main landing gears are held in the fully extended position by mechanical hook and pin locks. The landing gear is held in the up position by hydraulic pressure.

The pressure is controlled by the power pack pressure switch and an accumulator that is precharged with nitrogen to 800 ± 50 psi. Gear doors are opened and closed through a mechanical linkage connected to the landing gear. The nose wheel steering mechanism is automatically centered and the rudder pedals relieved of the steering load when the landing gear is retracted. Air-oil type shock struts, filled with compressed air and hydraulic fluid, are incorporated with the landing gear.

a. Landing Gear Control Switch. Landing gear system operation is controlled by a manually actuated wheel-shaped switch placarded LDG GEAR CONTROL-UP-DN, on the left subpanel (fig. 2-7). The control switch and associated relay circuits are protected by a 2 ampere circuit breaker, placarded LANDING GEAR CONTROL located on the overhead circuit breaker panel (fig. 2-23).

b. Landing Gear Down Position-Indicator Lights Visual indication of the landing gear position is provided by individual green GEAR DOWN indicator lights placarded NOSE-L-R on the left subpanel. Testing of the indicator lights is accomplished by pressing the annunciator test switch. The circuit is protected by a 5 ampere circuit breaker (fig. 2-23). placarded LANDING GEAR IND, on the over- head circuit breaker panel.

c. Landing Gear Position Warning Lights. Two red parallel-wired indicator lights located in the LDG GEAR CONTROL switch handle (fig. 2-7) illuminate, to show that the gear is in transit or unlocked. The red lights in the handle also illuminate when the landing gear warning horn is actuated. Both red lights indicate the same warning conditions, but two are provided for a fail-safe indication in the event one bulb bums out. The circuit is protected by a 5 ampere circuit breaker, placarded LANDING GEAR IND, on the overhead circuit breaker panel (fig. 2-23).

d. Landing Gear Warning Light Test Switch. A test switch, placarded HDL LT TEST, is located on the left subpanel (fig. 2-7). Failure of the landing gear handle to illuminate red, when this test switch is pressed, indicates two defective bulbs or a circuit fault. The circuit is protected by a 5-ampere circuit breaker, placarded LANDING GEAR WARN, on the overhead circuit breaker panel (fig. 2-23).

e. Landing Gear Warning system D2. 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 the UP or APPROACH position and either or both power levers retarded below approximately 79% N1, 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 switch adjacent to the landing gear switch handle, the light in the landing gear switch handle cannot be canceled. The landing gear warning system will be rearmed if the power lever(s) are advanced. Retardir the second power lever below 79% N1 will activate the landing gear horn even though the silence system has been activated.

To prevent the warning horn sounding during long descents or an ILS approach, a pressure differential "Q" switch is connected into the copilot's static line. This switch prevents the warning horn from sounding until airspeeds drops below 140 KIAS.

With the flaps beyond the APPROACH position, the warning horn and landing gear switch handle lights will be activated regardless of the power setting. The horn cannot be silenced in this case.

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.

At airspeeds above 140 KIAS with flaps in UP or APPROACH position and either or both power levers retarded below approximately 79% N1, the warning horn located in the overhead control panel, will sound and the landing gear switch handle lights will illuminate. The horn is automatically silenced by a "Q" switch however, the gear switch handle lights cannot be extinguished. The pressure differential "Q" switch is connected into the static line. This switch prevents the warning horn from sounding steadily until airspeed drops below 140 KIAS.

At airspeeds below 140 KIAS with flaps in the UP or APPROACH position with either or both power levers retarded below approximately 79% N1 the warning horn will sound and the landing gear switch handle lights will illuminate. The horn can be silenced by actuating the WARNING HORN SILENCE switch located adjacent to the landing gear switch handle, to the up position however, the lights in the landing gear switch handle cannot be canceled. The gear warning silence switch is a magnetically held switch. Once actuated it will stay in the up position until both power levers are advanced above 81% N1 and/or airspeed increases above 140 KIAS.

In either case (speeds above or below 140 KIAS) the landing gear warning system will be rearmed if both power levers are advanced above 81% N1.

With the flaps beyond the APPROACH position, the warning horn and landing gear switch handle lights will be activated regardless of the power setting. The horn cannot be silenced in this case, until either the landing gear is lowered, or the flaps are retracted to the UP or APPROACH position and the WARNING HORN SILENCE switch is actuated to the up position.

f. Landing Gear Warning Horn Test Switch. The warning horn and gear handle lights can be tested by placing the switch placarded STALL WARN TEST-OFF-LDG GEAR WARN TEST to the LDG GEAR WARN TEST position (fig. 2-7). The gear handle lights will illuminate, and warning horn will sound. Releasing the LDG GEAR WARN TEST switch to the OFF position will extinguish the gear handle lights, and silence the warning horn. The landing gear warning horn circuit is protected by 5-ampere circuit breaker placarded LANDING GEAR WARN located on the overhead circuit breaker panel (fig. 2-23).

g. Deleted.

h. Landing Gear Safety Switches. A safety switch on each main landing gear shock strut controls the operation of various aircraft systems that function only during flight or only during ground operation. These switches are mechanically actuated whenever the main landing gear shock struts are extended (normally after takeoff), or compressed (normally after landing). The safety switch on the right main landing gear strut deactivates the landing gear control circuits, cabin pressurization circuits and the flight hour meter when the strut is compressed. This switch also activates a down-lock hook, preventing the landing gear from being raised while the aircraft is on the ground. The hook, which unlocks automatically after takeoff, can be manually overridden by pressing down on the red button, placarded DOWN LOCK REL located adjacent to the landing gear handle (fig. 2-7). If the over-ride is used the landing gear warning horn will sound intermittently and two red, parallel- wired indicator lights located in the landing gear control switch handle will illuminate, provided the battery switch is on. The safety switch on the left main landing gear strut activates the left and right engine ambient air shut-off valves when the strut is extended.

i. Landing Gear Alternate Extension. An extension lever, placarded LANDING GEAR ALTERNATE EXTENSION, is located on the floor between the crew seats. The pump is located under the floor and is used when an alternate extension of the gear is required.

To engage the system pull the LANDING GEAR CONTROL circuit breaker, located on the overhead circuit breaker panel (fig. 2-23), and ensure that the LDG GEAR CONTROL handle is in the DN position. Remove the extension lever from the securing clip and pump the lever up and down until the three green NOSE-L-R gear down indicator lights illuminate. As the handle is moved, hydraulic fluid is drawn from the hand pump suction port of the power pack and routed through the hand pump pressure port to the actuators. After an alternate extension of the landing gears, ensure the extension lever is in the full down position prior to stowing the pump handle in the retaining clip. When the pump handle is stowed, an internal relief valve is actuated to relieve the hydraulic pressure in the pump.

NOTE

If for any reason the green NOSE-L-R GEAR DOWN indicators 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. Do not stow the extension lever, but leave it in the full up position.

WARNING

After an emergency landing gear extension has been made, do not move any landing gear controls, or reset any switches or circuit breakers until the aircraft is on jacks, since the failure may have been in the gear-up circuit and the gear might retract on the ground.

After a practice alternate extension, stow the extension handle, reset the LANDING (GEAR CONTROL circuit breaker, and retract the gear in the normal manner with the landing gear control handle.

j. Tires.

(1) ***C*** The C-12C aircraft is equipped with dual 18 x 5.5, 8 ply rating, tubeless, rim inflation tires on each main gear and a 6.50 x 10, 6 ply rating, tubeless tire on the nose wheel.

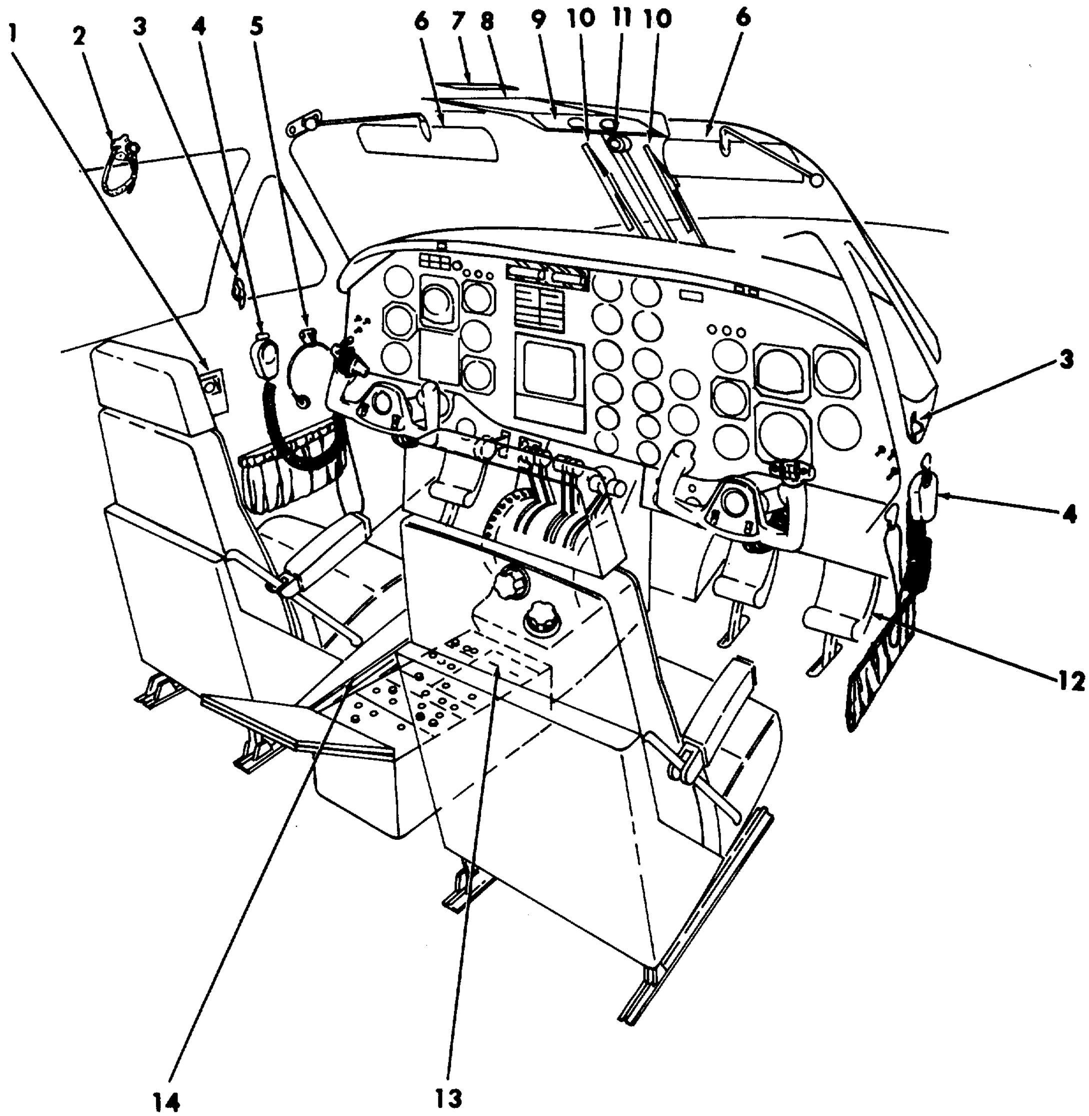
(2) ***DF*** The C-12DF aircraft are equipped with dual 22 x 6.75 x 10, 8 ply rated, tubeless, rim inflation tires on each main gear and a 22 x 6.75 x 10, 8 ply rated, tubeless tire on the nose wheel.

2-8. STEERABLE NOSE WHEEL.

The aircraft can be maneuvered on the ground by the steerable nose wheel system. Direct linkage from the rudder pedals (fig. 2-5) to the nose wheel steering linkage allows the nose wheel to be turned 12° to the left of center or 14° to the right. When rudder pedal steering is augmented by the main wheel braking action, the nose wheel can be deflected up to 48° either side of center. Shock loads which would normally be transmitted to the rudder pedals are absorbed by a spring mechanism in the steering linkage. Retraction of the landing gear automatically centers the nose wheel and disengages the steering linkage from the rudder pedals.

2-9. WHEEL BRAKE SYSTEM.

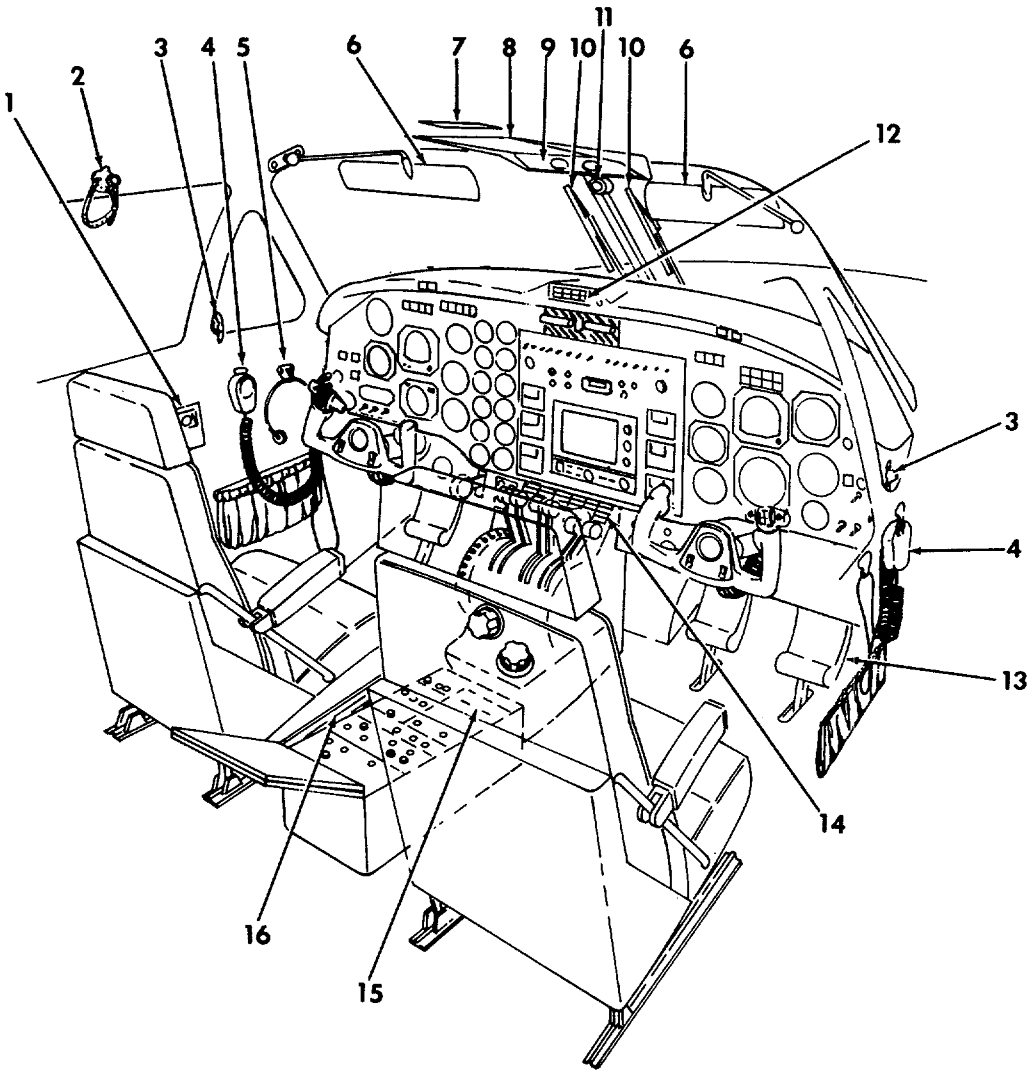
The main landing wheels are equipped with multiple-disc hydraulic brakes actuated by master cylinders attached to the rudder pedals at the pilot's and copilot's position. Braking is permitted from either set of rudder pedals. Brake fluid is supplied to the system from the reservoir in the nose compartment. The toebrake sections of the rudder pedals are connected to the master cylinders which actuate the system for the corresponding wheel. No emergency brake system is provided. Repeated and excessive application of brakes, without allowing sufficient time for cooling to accumulate between



AP 004758

1. Free Air Temperature Gage
2. Oxygen Mask
3. Storm Window Lock
4. Microphone
5. Headset
6. Sunvisor
7. Oxygen Control Panel
8. Overhead Circuit Breaker and Control Panel
9. Fuel Management Panel
10. Windshield Wipers
11. Magnetic Compass
12. Rudder Pedals
13. Pedestal Extension
14. Alternate Landing Gear Extension Handle

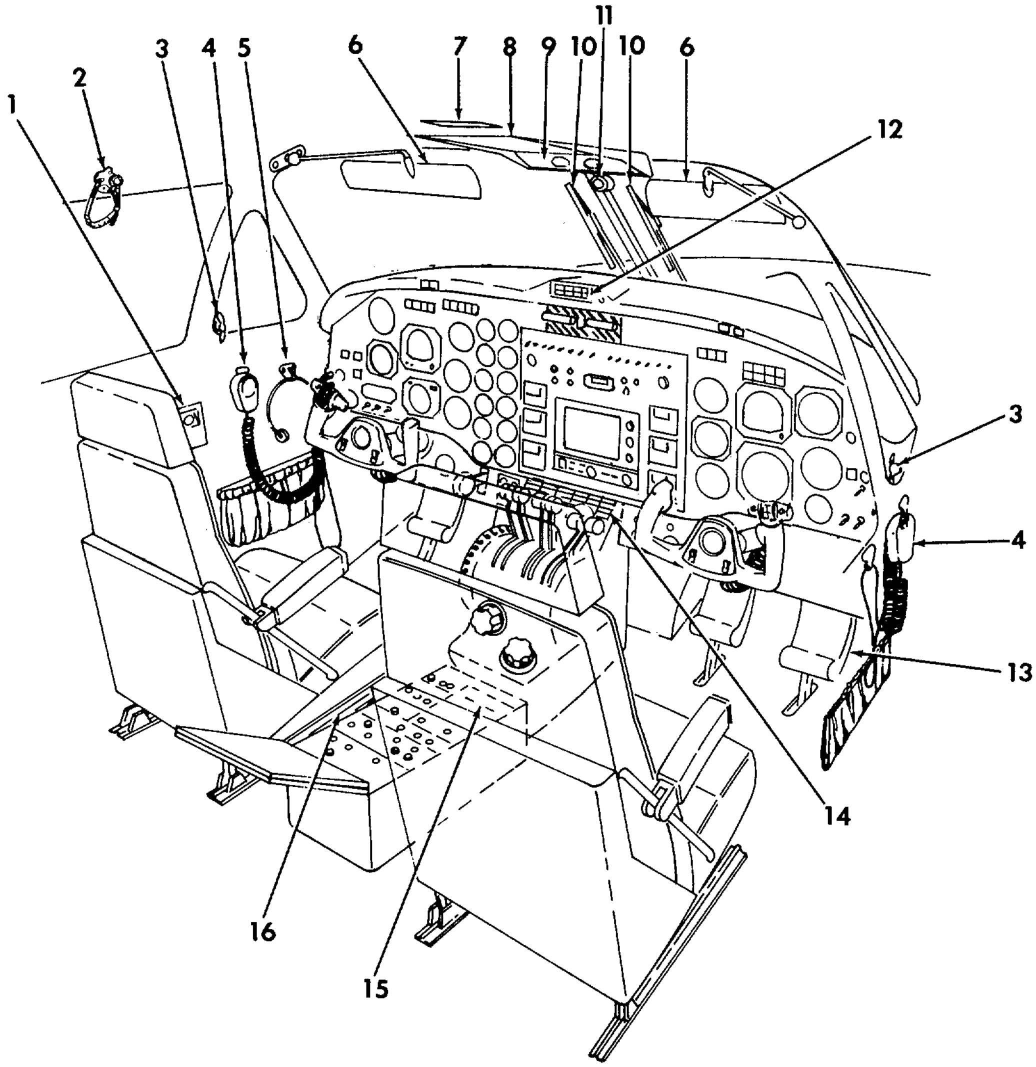
*Figure 2-5. Cockpit **C D1** -Sheet 1 of 2*



1. Free Air Temperature Gage
2. Oxygen Mask
3. Storm Window Lock
4. Microphone
5. Headset
6. Sunvisor
7. Oxygen Control Panel
8. Overhead Circuit Breaker and Control Panel
9. Fuel Management Panel
10. Windshield Wipers
11. Magnetic Compass
12. Warning Annunciator Panel
13. Rudder Pedals
14. Caution Annunciator Panel
15. Pedestal Extension
16. Alternate Landing Gear Extension Handle

AP011578

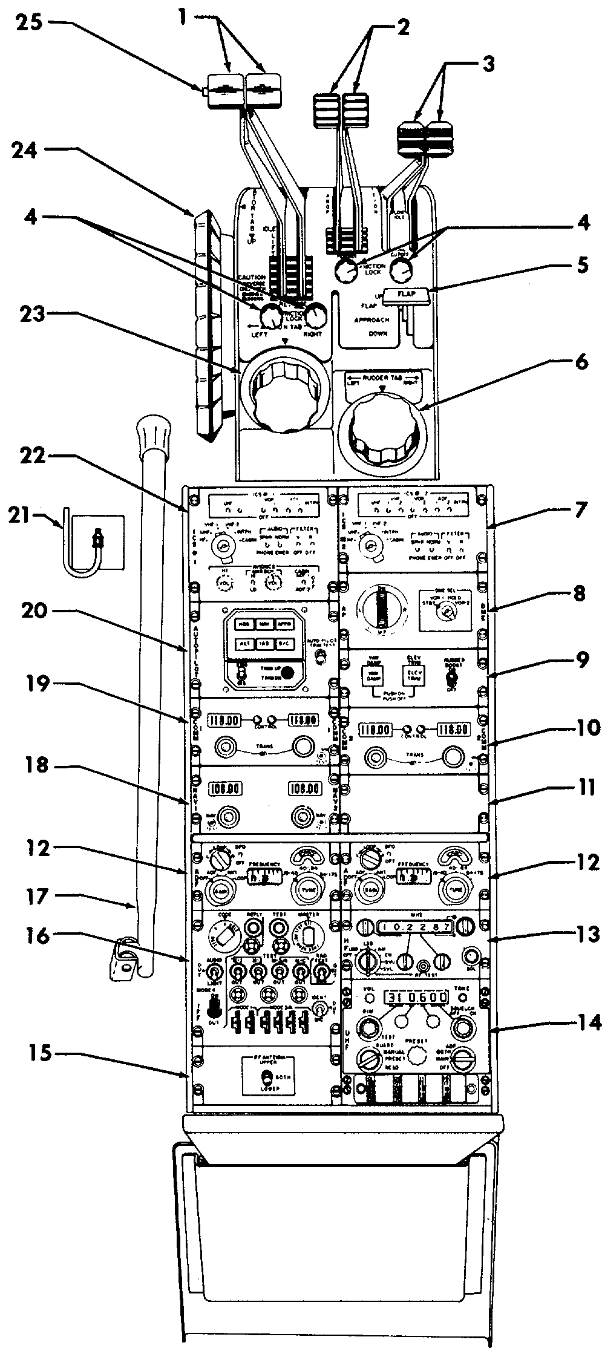
*Figure 2-5. Cockpit **D2 F** -Sheet 2 of 2*

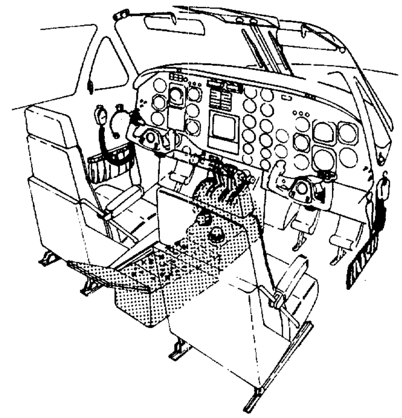


1. Free Air Temperature Gage
2. Oxygen Mask
3. Storm Window Lock
4. Microphone
5. Headset
6. Sunvisor
7. Oxygen Control Panel
8. Overhead Circuit Breaker and Control Panel
9. Fuel Management Panel
10. Windshield Wipers
11. Magnetic Compass
12. Warning Annunciator Panel
13. Rudder Pedals
14. Caution Annunciator Panel
15. Pedestal Extension
16. Alternate Landing Gear Extension Handle

AP011578

Figure 2-5. Cockpit (C-12D Aircraft Serials 84-24375 Thru 84-24380)-(Sheet 2 of 2)





1. Power Levers (2)
2. Propeller Levers (2)
3. Condition Levers (2)
4. FRICTION LOCK Knobs (4)
5. Wing FLAP Switch
6. RUDDER TAB Control and Position Indicator
7. ICS #2 Control Panel
8. AP/DME Control Panel
9. YAW DAMP/RUDDER BOOST Control Panel
10. COMM 2 Control Panel
11. Blank Panel
12. ADF Control Panel (2)
13. HF Control Panel

*14. UHF Control Panel

* *15. IFF Antenna Select Panel

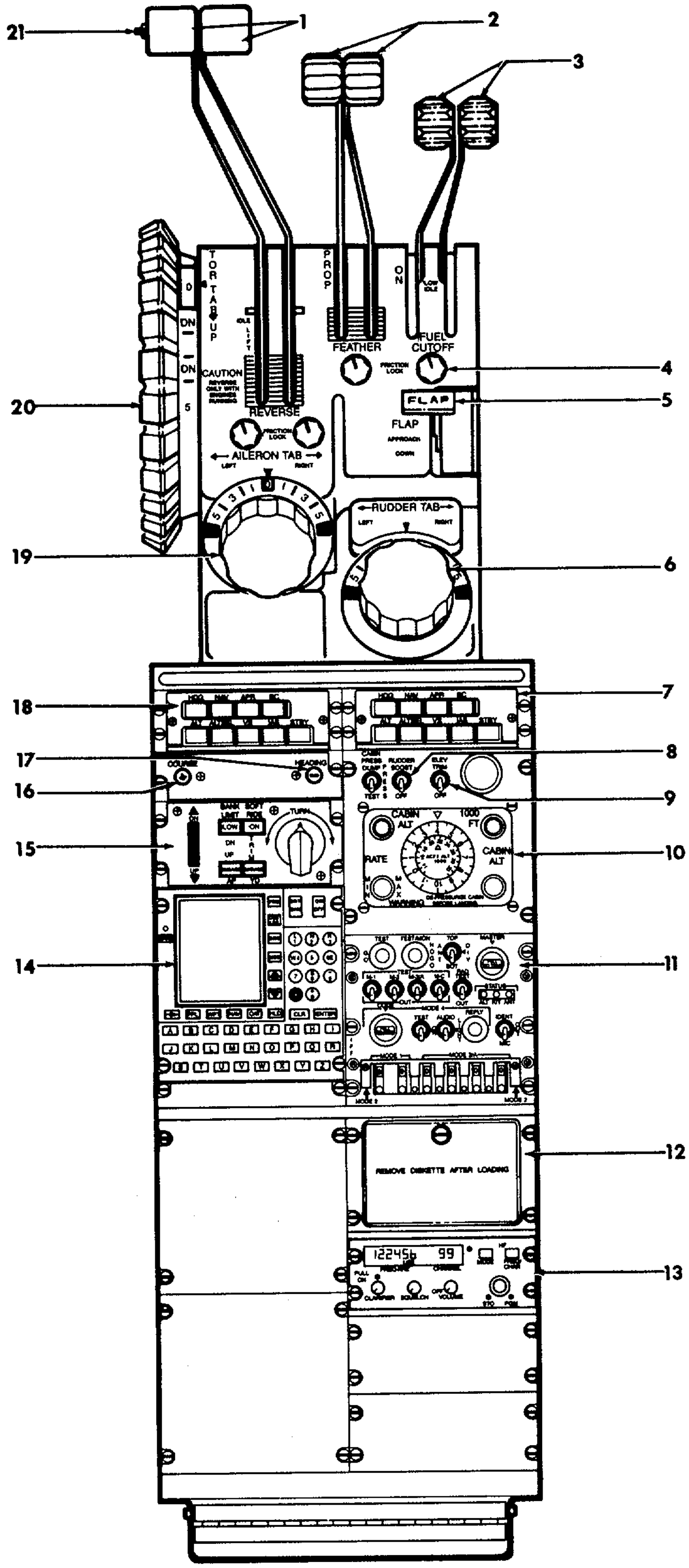
16. Transponder Control Panel
17. Alternate Landing Gear Extension Handle
18. NAV 1/NAV 2 Control Panel
19. COMM 1 Control Panel
20. AUTOPILOT Mode Selector Panel
21. Landing Gear Alternate Engage Handle
22. ICS #1 Control Panel
23. Aileron Tab Control and Position Indicator
24. ELEVATOR Tab Control and Position Indicator
25. Autopilot Go-Around Button

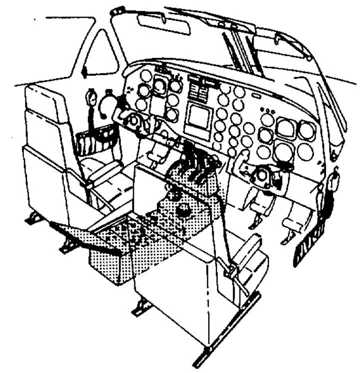
* PROVISIONS ONLY ARE INSTALLED. EITHER OF TWO SETS MAY BE INSTALLED.

* * INSTALLED ONLY IF APX-101 TRANSPONDER IS INSTALLED.

AP004756

Figure 2-6. Control Pedestal (C-12 Aircraft Prior to C-12D Serial 84-24375)-(Sheet 1 of 2)





1. Power Levers (2)
2. Propeller Levers (2)
3. Condition Levers (2)
4. Friction Lock Knobs (4)
5. FLAP Switch
6. RUDDER TAB Control and Position Indicator
7. #2 Flight Director Model Select Panel
8. RUDDER BOOST Switch
9. ELEV TRIM Switch
10. Pressurization Controller
11. Transponder Control Panel
12. Flight Management System Data Loader
13. HF Control Panel
14. Flight Management System Control and Display
15. Autopilot Control
16. #1 HSI COURSE Knob
17. #1 HSI HEADING Knob
18. #1 Flight Director Mode Select Panel
19. AILERON TAB Control and Position Indicator
20. Elevator Tab Control and Position Indicator
21. Go-Around Button

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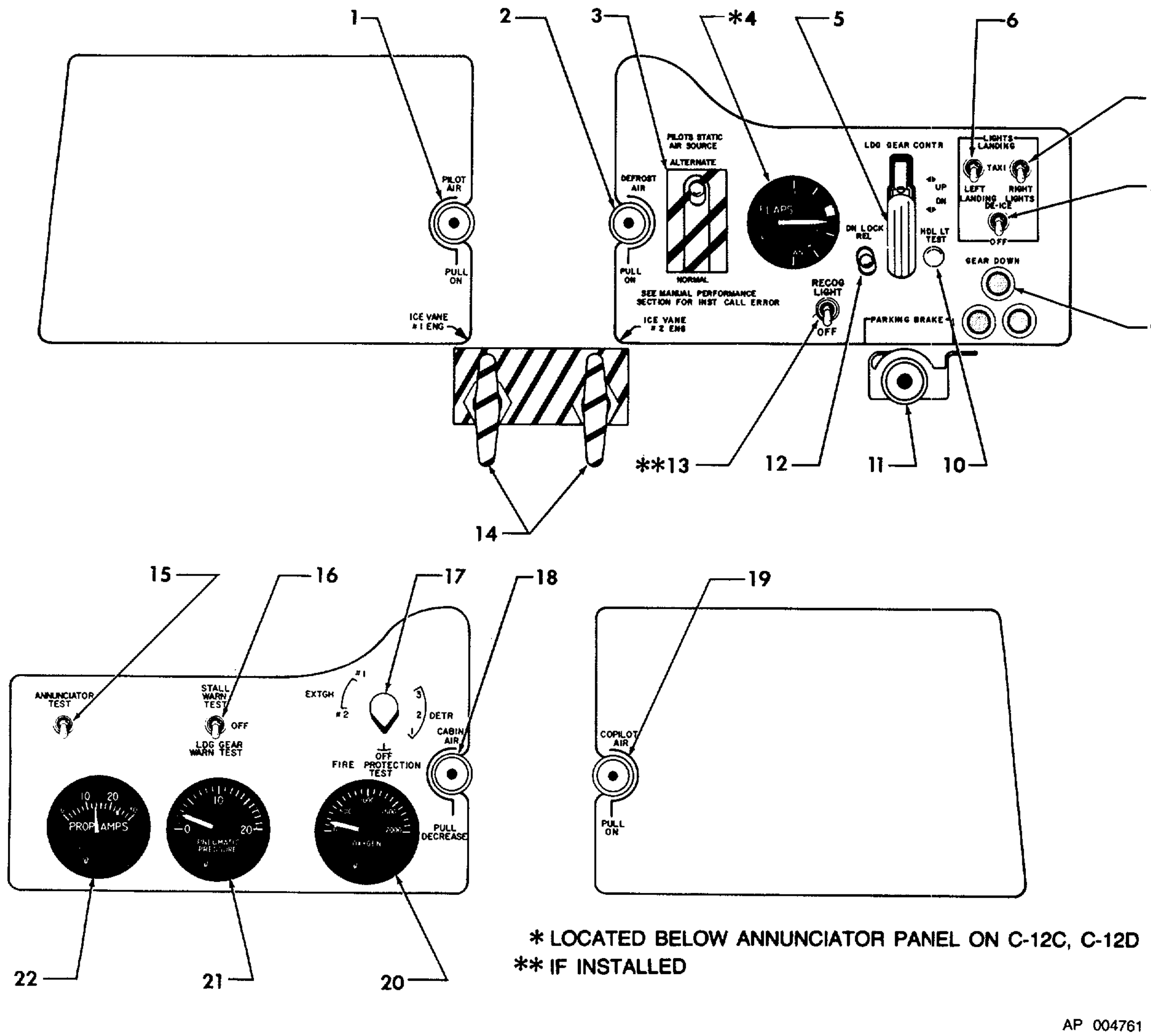
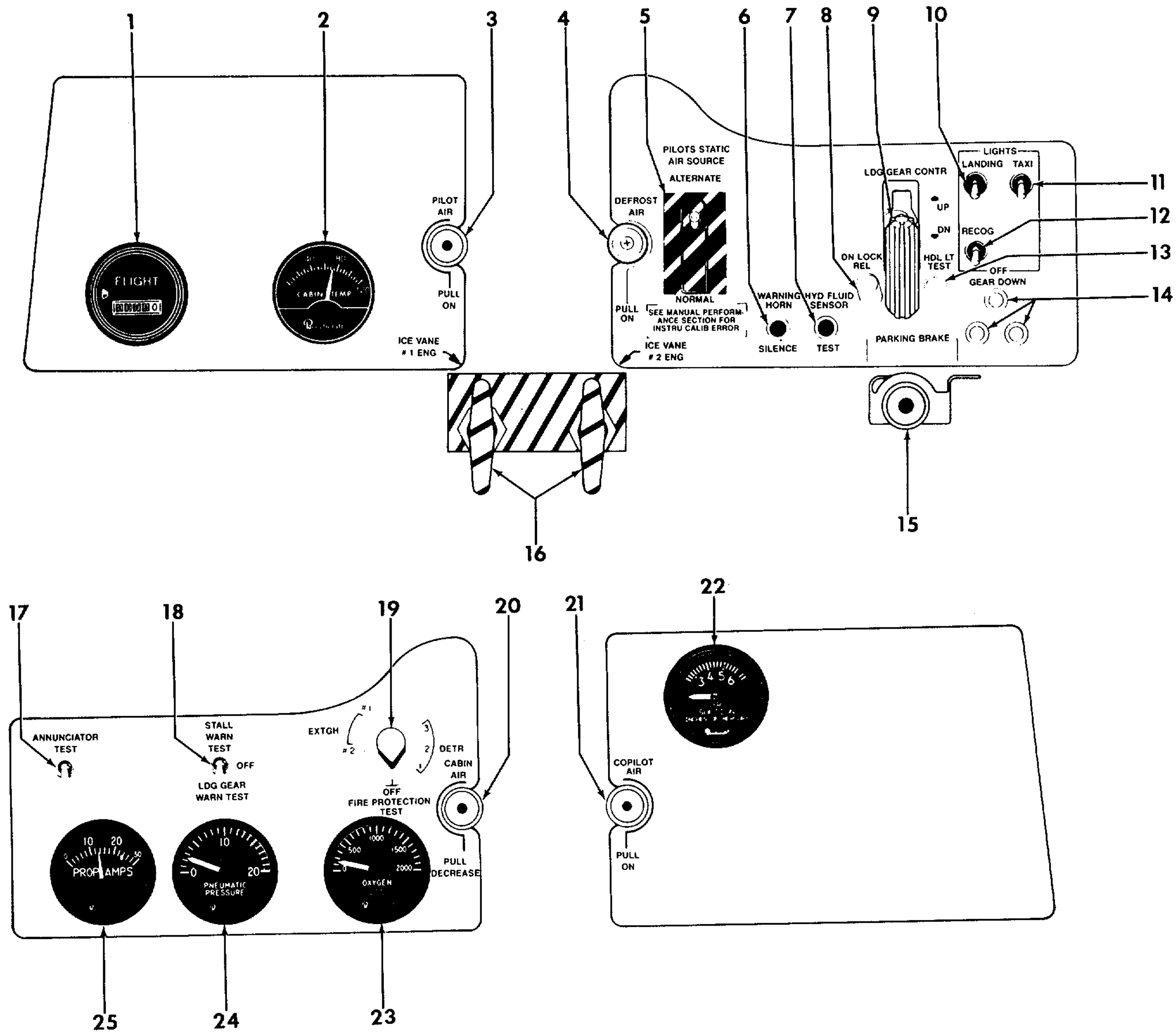
AP011369

Figure 2-6. Control Pedestal (C-12D Aircraft Serials 84-24375 Thru 84-24380)-(Sheet 2 of 2)



1. PILOT AIR Inlet Control
2. DEFROST AIR Control
3. PILOTS STATIC AIR SOURCE Control
4. Flap Position Indicator
5. Landing Gear Control Handle
6. Left Landing/Taxi Light Switch
7. Right Landing/Taxi Light Switch
8. Landing Light Deice Switch
9. GEAR DOWN Indicator Lights (3)
10. Landing Gear Handle Light Test Switch (Light Inside Handle)
11. PARKING BRAKE Control
12. Landing Gear Handle Down Lock Release
13. Recognition Lights Switch
14. Manual Engine ICE VANE Controls
15. ANNUNCIATOR TEST Switch
16. Stall Warning/Landing Gear Warning Test Switch
17. Fire Detection System Test Switch
18. CABIN AIR Control
19. COPILOT AIR INLET Control
20. OXYGEN Pressure Gage
21. PNEUMATIC PRESSURE Gage
22. Propeller Ammeter

Figure 2-7. Subpanels (C-12 Aircraft Prior to C-12D Serial 84-24375)-(Sheet 1 of 2)



1. FLIGHT Hour Indicator
2. CABIN TEMP Indicator
3. PILOT AIR Inlet Control
4. DEFROST AIR Control
5. PILOTS STATIC AIR SOURCE Control
6. WARNING HORN SILENCE Button
7. HYD FLUID SENSOR TEST Button
8. DN LOCK REL (Landing Gear Handle Down Lock Release)
9. LDG GEAR CONTR Handle
10. LANDING LIGHT Switch
11. TAXI LIGHT Switch
12. RECOG (Recognition) Lights Switch
13. HDL LT TEST Switch (Light Inside Landing Gear Control Handle)
14. GEAR DOWN Indicator Lights (3)
15. PARKING BRAKE Control
16. Manual Engine Ice Vane Control
17. ANNUNCIATOR TEST Switch
18. STALL/LDG GEAR WARN TEST Switch
19. FIRE PROTECTION TEST Switch
20. CABIN AIR Control
21. COPILOT AIR INLET Control
22. GYRO SUCTION Gage
23. OXYGEN Pressure Gage
24. PNEUMATIC PRESSURE Gage
25. PROP AMPS Meter

AP011579

Figure 2-7. Subpanels (C-12D Aircraft Serials 84-24375 Thru 84-24380)-(Sheet 2 of 2)

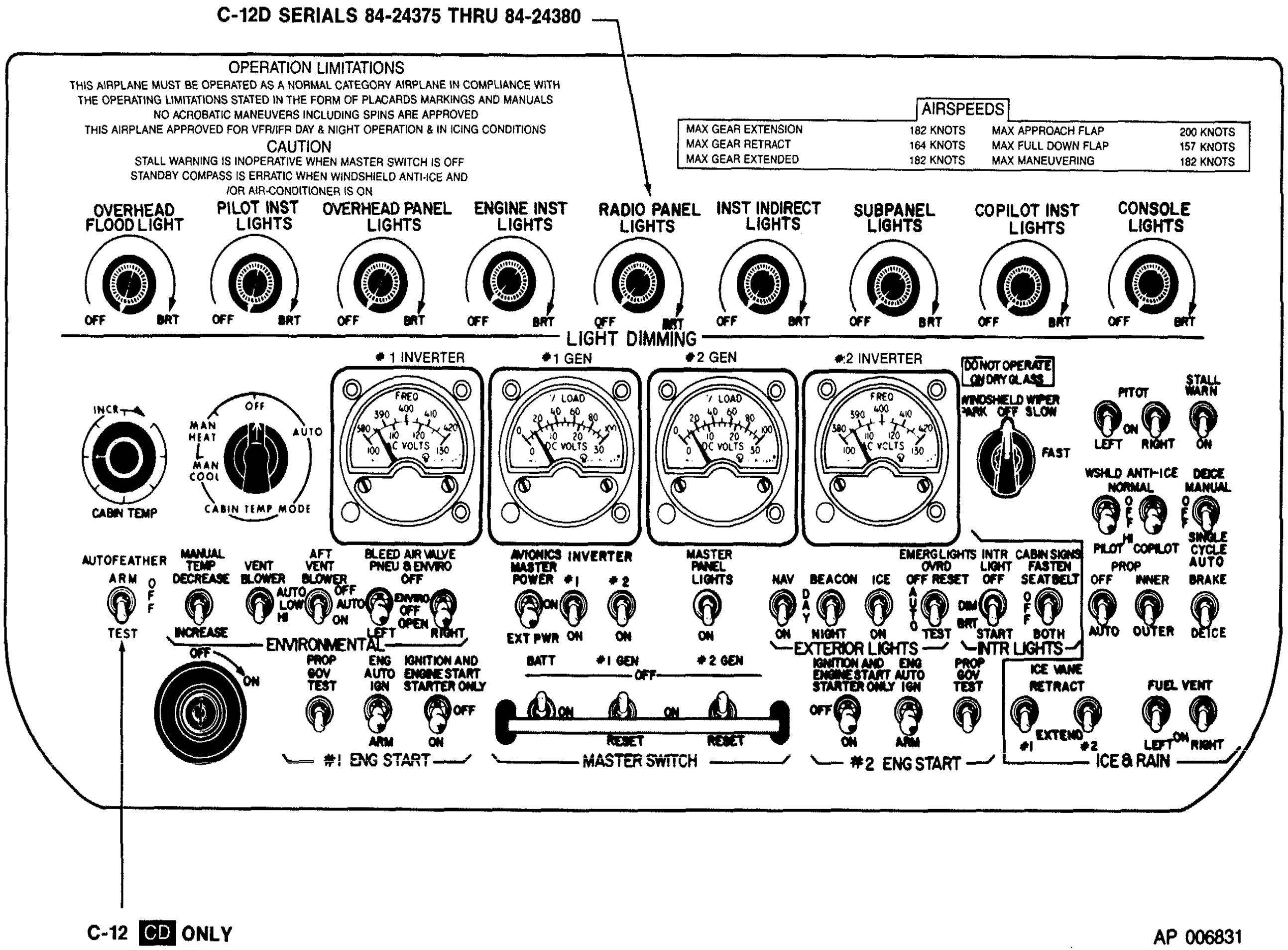
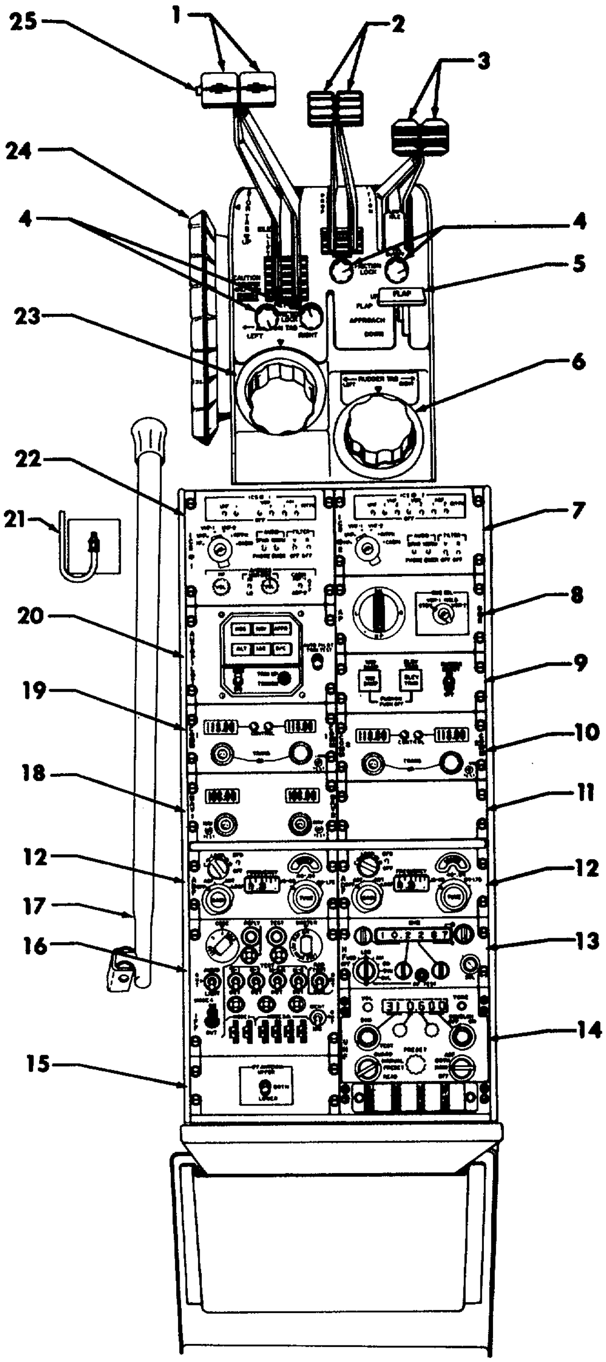
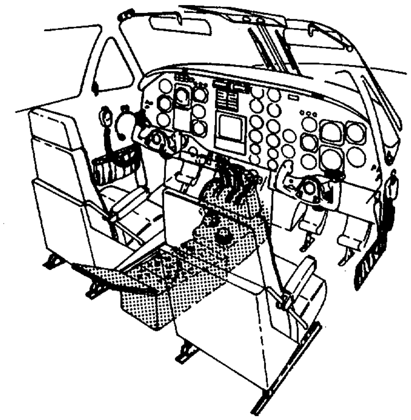


Figure 2-8. Overhead Control Panel-Typical





1. Power Levers (2)
2. Propeller Levers (2)
3. Condition Levers (2)
4. FRICTION LOCK Knobs (4)
5. Wing FLAP Switch
6. RUDDER TAB Control and Position Indicator
7. ICS #2 Control Panel
8. AP/DME Control Panel
9. YAW DAMP/RUDDER BOOST Control Panel
10. COMM 2 Control Panel
11. Blank Panel
12. ADF Control Panel (2)
13. HF Control Panel

*14. UHF Control Panel

* *15. IFF Antenna Select Panel

16. Transponder Control Panel
17. Alternate Landing Gear Extension Handle
18. NAV 1/NAV 2 Control Panel
19. COMM 1 Control Panel
20. AUTOPILOT Mode Selector Panel
21. Landing Gear Alternate Engage Handle
22. ICS #1 Control Panel
23. Aileron Tab Control and Position Indicator
24. ELEVATOR Tab Control and Position Indicator
25. Autopilot Go-Around Button

*PROVISIONS ONLY ARE INSTALLED. EITHER OF TWO SETS MAY BE INSTALLED.

* * INSTALLED ONLY IF APX-101 TRANSPONDER IS INSTALLED.

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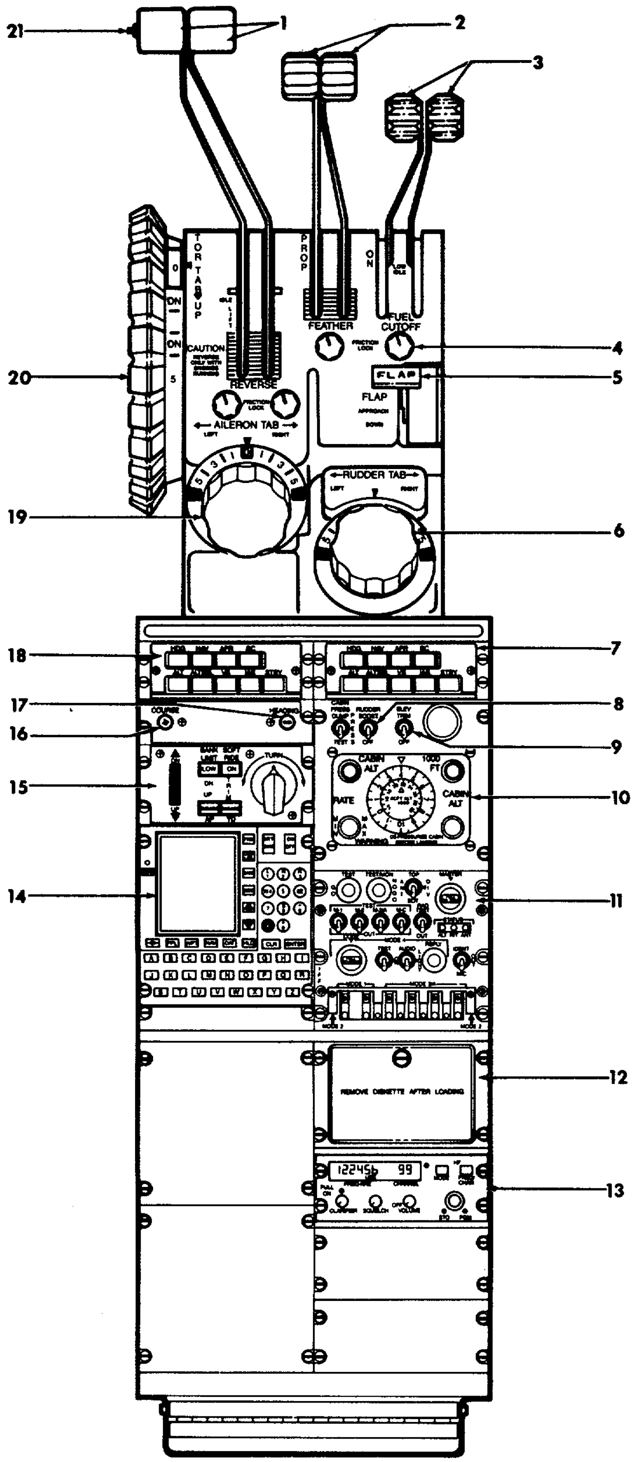
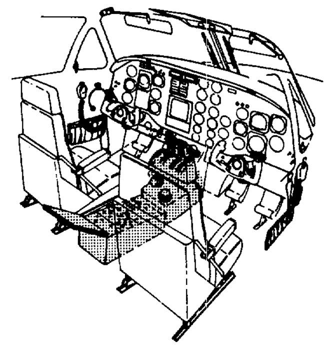
Figure 2-6. Control Pedestal ***C D1****-Sheet 1 of 3*

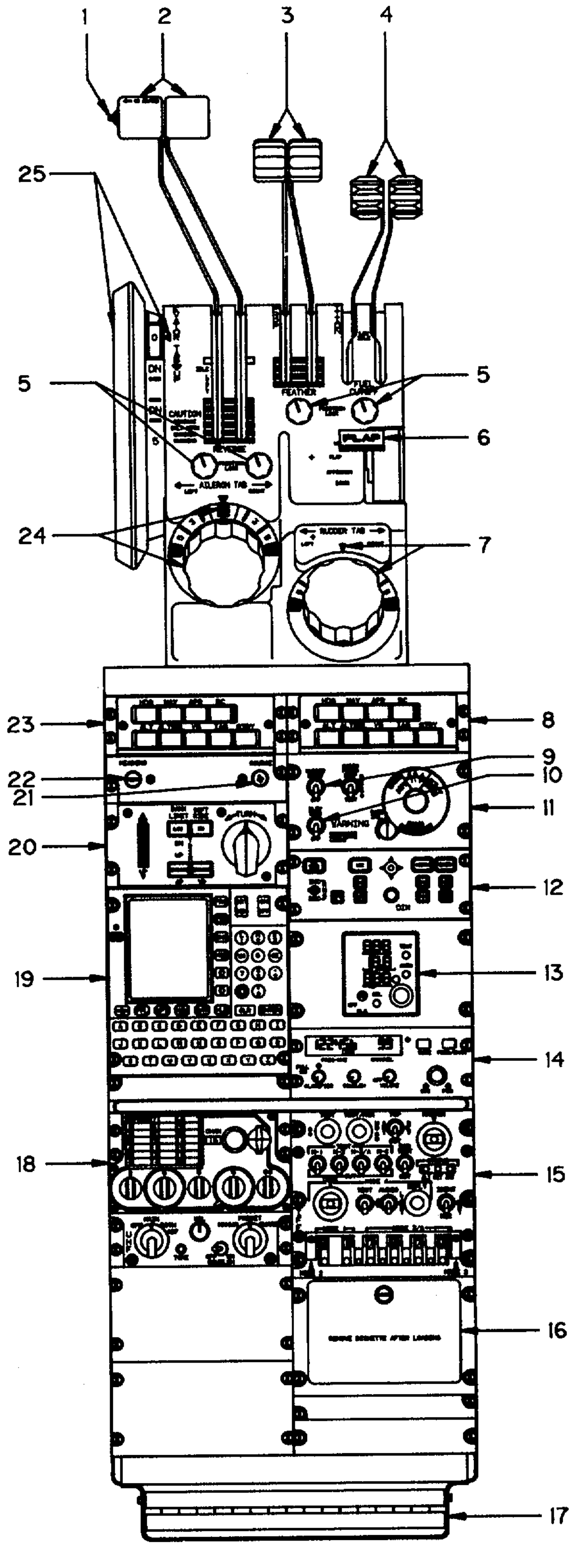




1. Power Levers (2)
2. Propeller Levers (2)
3. Condition Levers (2)
4. Friction Lock Knobs (4)
5. FLAP Switch
6. RUDDER TAB Control and Position Indicator
7. #2 Flight Director Model Select Panel
8. RUDDER BOOST Switch
9. ELEV TRIM Switch
10. Pressurization Controller
11. Transponder Control Panel
12. Flight Management System Data Loader
13. HF Control Panel
14. Flight Management System Control and Display
15. Autopilot Control
16. #1 HSI COURSE Knob
17. #1 HSI HEADING Knob
18. #1 Flight Director Mode Select Panel
19. AILERON TAB Control and Position Indicator
20. Elevator Tab Control and Position Indicator
21. Go-Around Button

AP011369

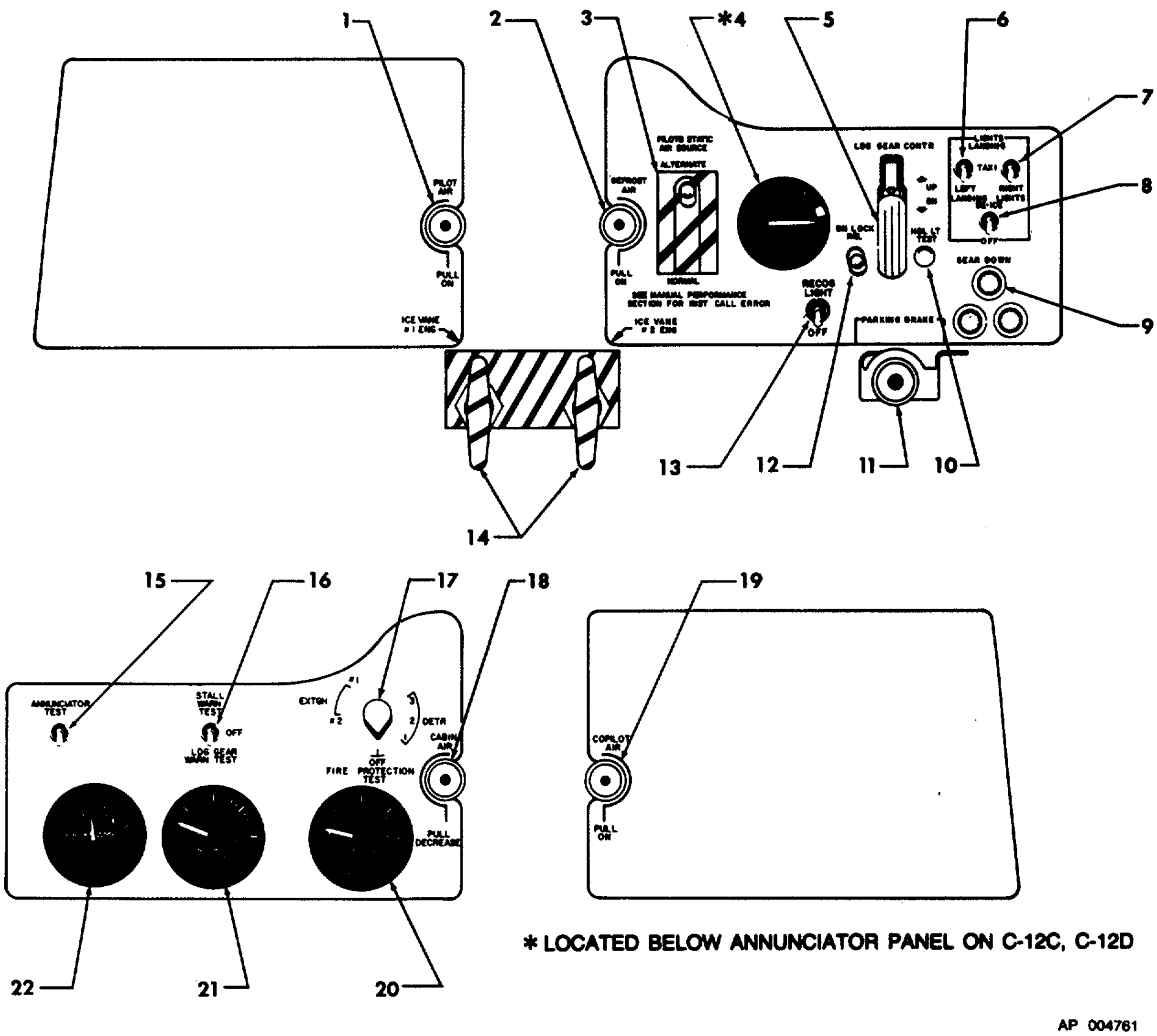
*Figure 2-6. Control Pedestal **D2 F1** -Sheet 2 of 3*



1. Go-Around Switch
2. Power Levers
3. Propeller Levers
4. Condition Levers
5. Friction Lock Knobs
6. Flap Control
7. Rudder Trim Tab Control and Indicator
8. Copilot's Flight Director Mode Selector
9. Rudder Boost Switch
10. Electric Elevator Trim Switch
11. Cabin Pressurization Control Panel
12. Multifunction Display Radar Graphics Control Unit
13. Microwave Landing System Control Unit
14. HF Transceiver Control Unit
15. Transponder Control Panel
16. FMS Data Loader
17. Assist Step
18. UHF Transceiver Control Panel
19. FMS Control-Display Unit
20. Autopilot Control Panel
21. Pilot's HSI Remote Course Selector Knob
22. Pilot's HSI Remote Heading Selector Knob
23. Pilot's Flight Director Mode Selector
24. Aileron Trim Tab Control and Indicator
25. Elevator Trim Tab Control and Indicator

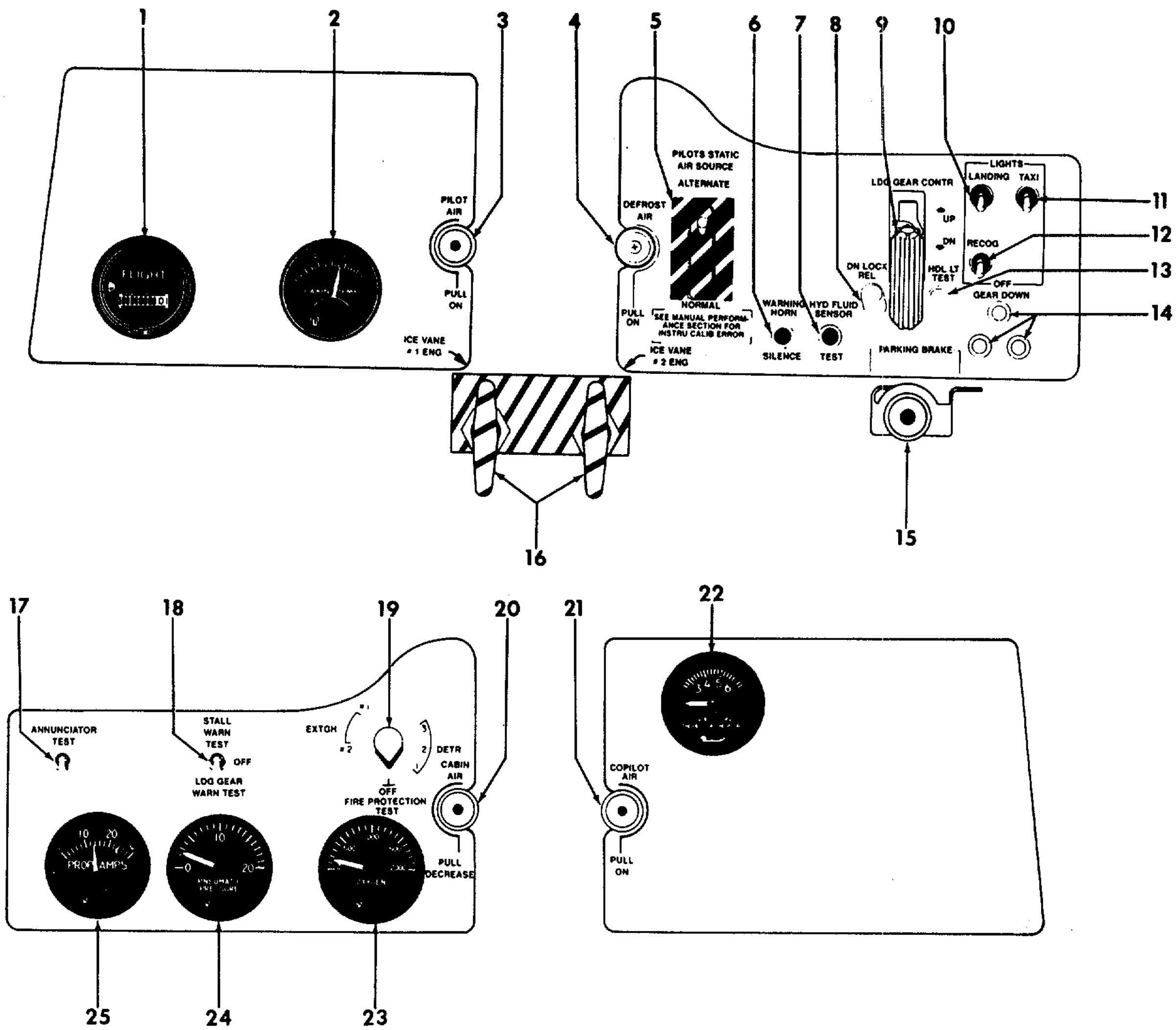
1.

*Figure 2-6. Control Pedestal **F2**- Sheet 3 of 3*



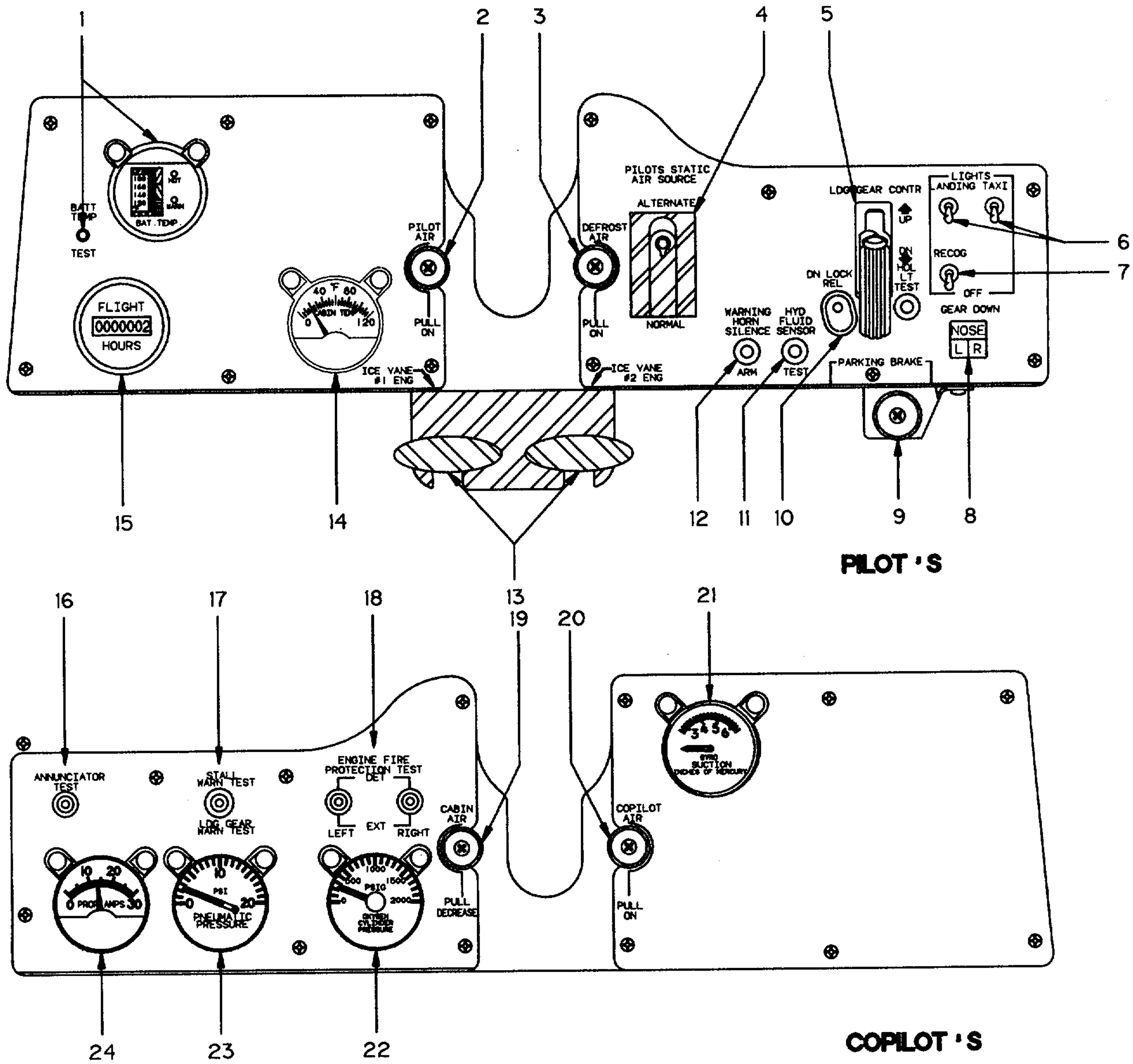
1. PILOT AIR Inlet Control
2. DEFROST AIR Control
3. PILOTS STATIC AIR SOURCE Control
4. Flap Position Indicator
5. Landing Gear Control Handle
6. Left Landing/Taxi Light Switch
7. Right Landing/Taxi Light Switch
8. Landing Light Deice Switch
9. GEAR DOWN Indicator Lights (3)
10. Landing Gear Handle Light Test Switch (Light Inside Handle)
11. PARKING BRAKE Control
12. Landing Gear Handle Down Lock Release
13. Recognition Lights Switch
14. Manual Engine ICE VANE Controls
15. ANNUNCIATOR TEST Switch
16. Stall Warning/Landing Gear Warning Test Switch
17. Fire Detection System Test Switch
18. CABIN AIR Control
19. COPILOT AIR INLET Control
20. OXYGEN Pressure Gage
21. PNEUMATIC PRESSURE Gage
22. Propeller Ammeter

*Figure 2-7. Subpanels **C D1**-Sheet 1 of 3*



1. FLIGHT Hour Indicator
2. CABIN TEMP Indicator
3. PILOT AIR Inlet Control
4. DEFROST AIR Control
5. PILOTS STATIC AIR SOURCE Control
6. WARNING HORN SILENCE Switch
7. HYD FLUID SENSOR TEST Switch
8. DN LOCK REL (Landing Gear Handle Down Lock Release)
9. LDG GEAR CONTR Handle
10. LANDING LIGHT Switch
11. TAXI LIGHT Switch
12. RECOG (Recognition) Lights Switch
13. HDL LT TEST Switch (Light Inside Landing Gear Control Handle)
14. GEAR DOWN Indicator Lights (3)
15. PARKING BRAKE Control
16. Manual Engine Ice Vane Control
17. ANNUNCIATOR TEST Switch
18. STALL/LDG GEAR WARN TEST Switch
19. FIRE PROTECTION TEST Switch
20. CABIN AIR Control
21. COPILOT AIR INLET Control
22. GYRO SUCTION Gage
23. OXYGEN Pressure Gage
24. PNEUMATIC PRESSURE Gage
25. PROP AMPS Meter

*Figure 2-7. Subpanels **D2 F1**-Sheet 2 of 3*



1. Battery Temperature Test Switch and Indicator
2. Pilot Air Inlet Control
3. Defrost Air Control
4. Pilot's Static Air Source Control
5. Landing Gear Control Handle
6. Landing/Taxi Light Switches
7. Recognition Light Switch
8. Landing Gear Position Lights
9. Parking Brake Control
10. Landing Gear Handle Down Lock Release
11. Hydraulic Fluid Sensor Test Switch
12. Landing Gear Warning Horn Silence Switch
13. Engine Ice Vane Manual Control
14. Cabin Temperature Indicator
15. Flight Hour Meter
16. Annunciator Test Switch
17. Stall and Landing Gear Warning Test Switch
18. Engine Fire Detection Test Switches
19. Cabin Air Control
20. Copilot Air Inlet Control
21. Gyro Suction Gage
22. Oxygen Pressure Gage
23. Pneumatic Pressure Gage
24. Propeller Deice Ampere Gage

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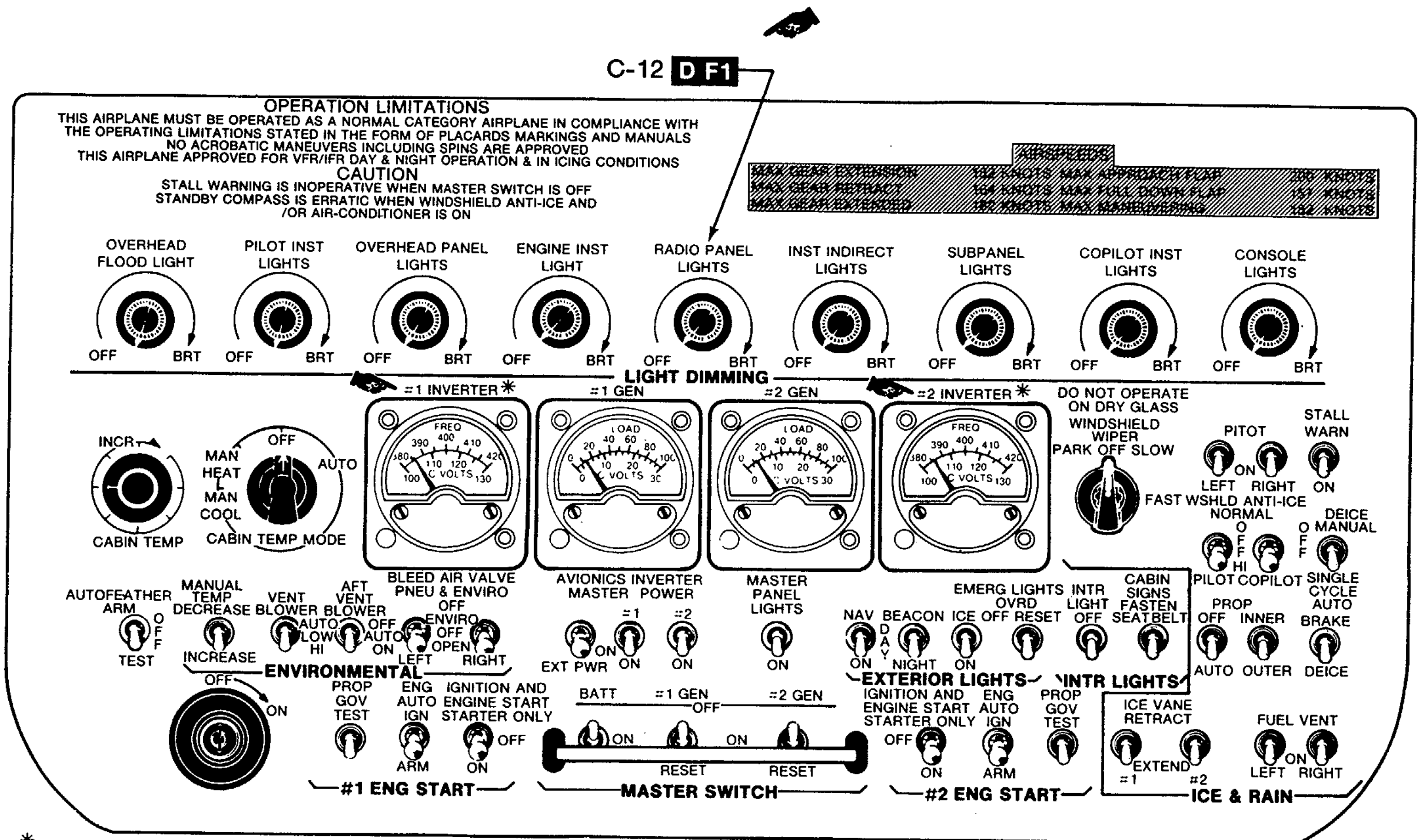
*Figure 2-7. Subpanels **F2**-Sheet 3 of 3*



* #1 AC BUS; #2 AC BUS ON C-12 C D

Figure 2-8. Overhead Control Panel **C D F1**-*Sheet 1 of 2*

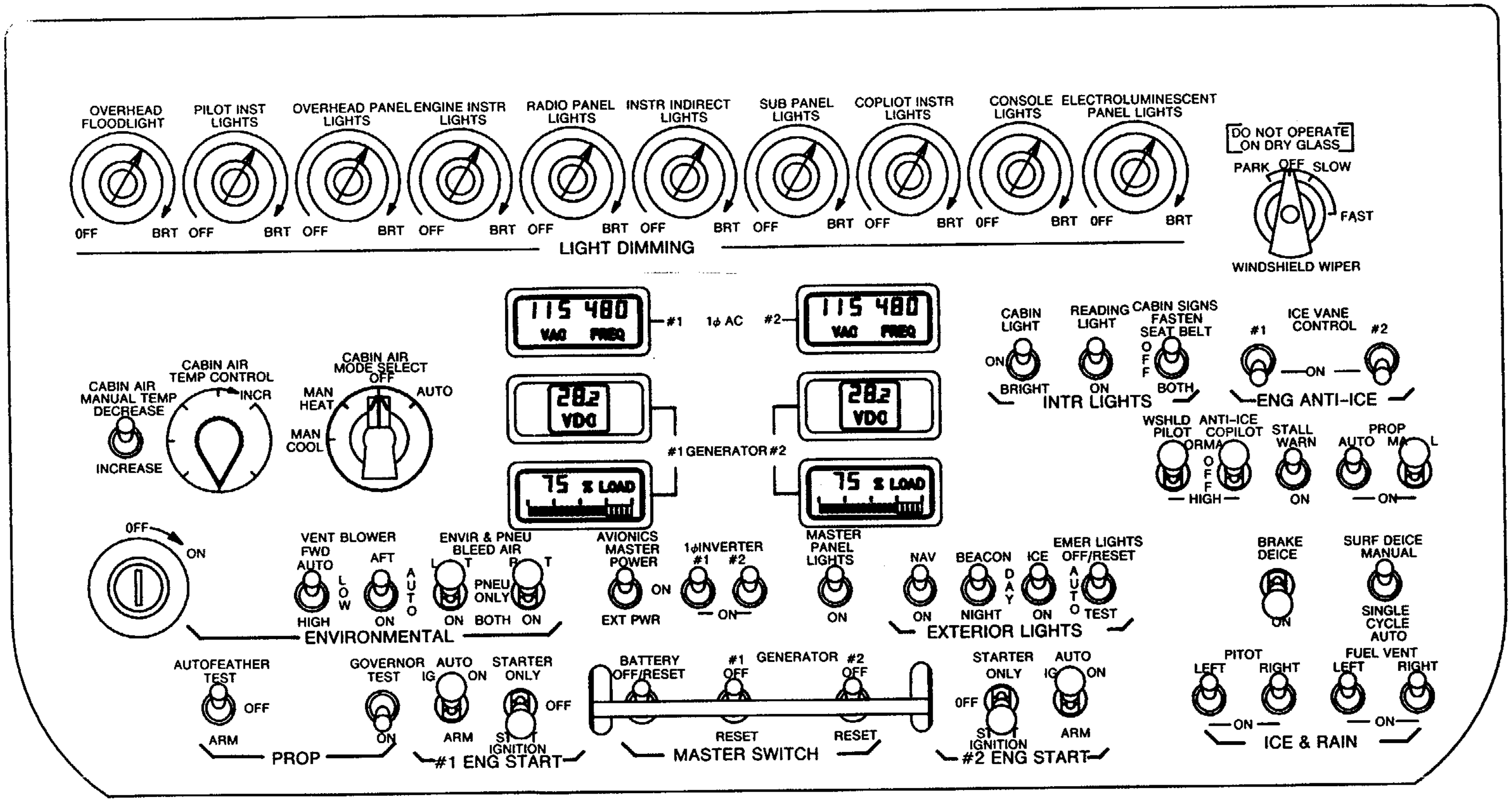


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Figure 2-8. Overhead Control Panel ***F2****-Sheet 2 of 2* applications, will cause loss of braking efficiency, possible failure of brake or wheel structure, possible blowout of tires, and in extreme cases may cause the wheel and brake assem- bly to be destroyed by fire.

2-10. PARKING BRAKE HANDLE.

Dual parking brake valves are installed below the cockpit floor. Both valves can be closed simultaneously by pressing both brake pedals on the pilot's side to build up pressure, and then pulling out the handle placarded PARKING BRAKE, on the left subpanel (fig. 2-7). The parking brake can be set by both the pilot and the copilot on the **D** model only. Pulling the handle full out sets the check valves in the system and any pressure being applied by the toe brakes is maintained. Parking brakes are released when the brake handle is pushed in. Parking brakes shall not be set during flight.

2-11. ENTRANCE AND EXIT PROVISIONS.

CAUTION

Structural damage may be caused if more than one person or a maximum weight of 300 pounds is on the entrance door at a time.

NOTE

Two keys are provided in the loose tools and equipment bag. Both keys will fit the locks on the cabin door, emergency hatch, aft belly access door and the right and left nose avionics doors. These keys will fit all Army C-12 series aircraft. Avoid inadvertently locking the cabin entrance door prior to entering the aircraft.

a. Cabin Door **C**. A swing-down door, hinged at the bottom, provides positive cabin security for flight and a convenient stairway for entry and exit (fig. 2-9). Two of the three steps are movable and automatically fold flat against the door in the closed position. A plastic encased cable provides support for the door in the open position, a handhold for passengers, and a convenience for closing the door from the inside. A hydraulic damper permits the door to lower gradually during opening. An inflatable rubber door seal around the door expands to positively seal the pressure vessel while the aircraft is in flight. Engine bleed air provides the some of pressure to inflate the seal. The door locking mechanism is operated by the handle in the center of the door. The inside and outside handles are mechanically interconnected. When the handle is rotated per placard instructions, two latches hook into the door frame at the top, and two lock bolts on each side of the door lock into the frame on the sides. There are four sight openings on the inner facing of the door; one opening over each locking bolt. A green stripe, painted on the locking bolt, aligns with a black pointer in the sight opening when the door is in a locked condition. A CABIN DOOR annunciator light in the caution/advisory panel will illuminate if the door is not fully locked. The cabin door may be removed for flight by installing Beech Aircraft Corp. Kit 1004006. Flights with the door removed must be in accordance with the FAA approved flight manual supplement which accompanies this kit.

(1) A button adjacent to the door handle, both inside and outside the cabin, must be depressed before the handle can be rotated to open the door. This acts as an aid to preventing accidental opening.

(2) A small round window just above the second step permits observation of the pressurization safety lock bellows. A placard adjacent to the window instructs the operator to make certain the safety lock arm is in position around the bellows shaft. Pushing the red button switch adjacent to the window illuminates the mechanism inside the door.

b. Cabin Door ***DF***. A swing-down door, hinged at the bottom, provides a stairway for normal and emergency entry and exit. Two of the steps are movable and fold flat against the door in the closed position. A step folds down over the door sill when the door opens to provide a platform (step) for door seal protection. A plastic encased cable provides support for the door in the open position, a handhold, and a convenience for closing the door from inside. A hydraulic damper permits the door to lower gradually during opening. A rubber seal around the door seals the pressure vessel while the aircraft is in flight. The door locking mechanism is operated by either of the two mechanically interconnected handles, one inside and the other outside the door. When either handle is rotated, three rotating-cam-type latches on either side of the door capture posts mounted on the cargo door. In the closed position, the door becomes an integral part of the cargo door. A button adjacent to the door handle must be depressed before the handle can be rotated to open the door. A bellows behind the button is inflated when the aircraft is pressurized to prevent accidental unlatching and/or opening of the door. A small round window just above the second step permits observation of the pressurization safety bellows. A placard adjacent to the window instructs the operator to ensure the safety lock arm is in position around the bellows shaft which indicates a properly locked door. Pushing the red button switch adjacent to the window will illuminate the inside door mechanism. A CABIN DOOR annunciator light in the caution/advisory panel will illuminate if the door is not closed and all latches fully locked. The cabin door may be removed for flight by installing Beech Aircraft Corp. Kit 1004006. Flights with the door removed must be in accordance with the FAA approved flight manual supplement which accompanies this kit.

WARNING

The cargo door is a structural panel and shall be closed for flight.

c. Cargo Door **DF**. A swing-up door, hinged at the top, provides cabin access for loading

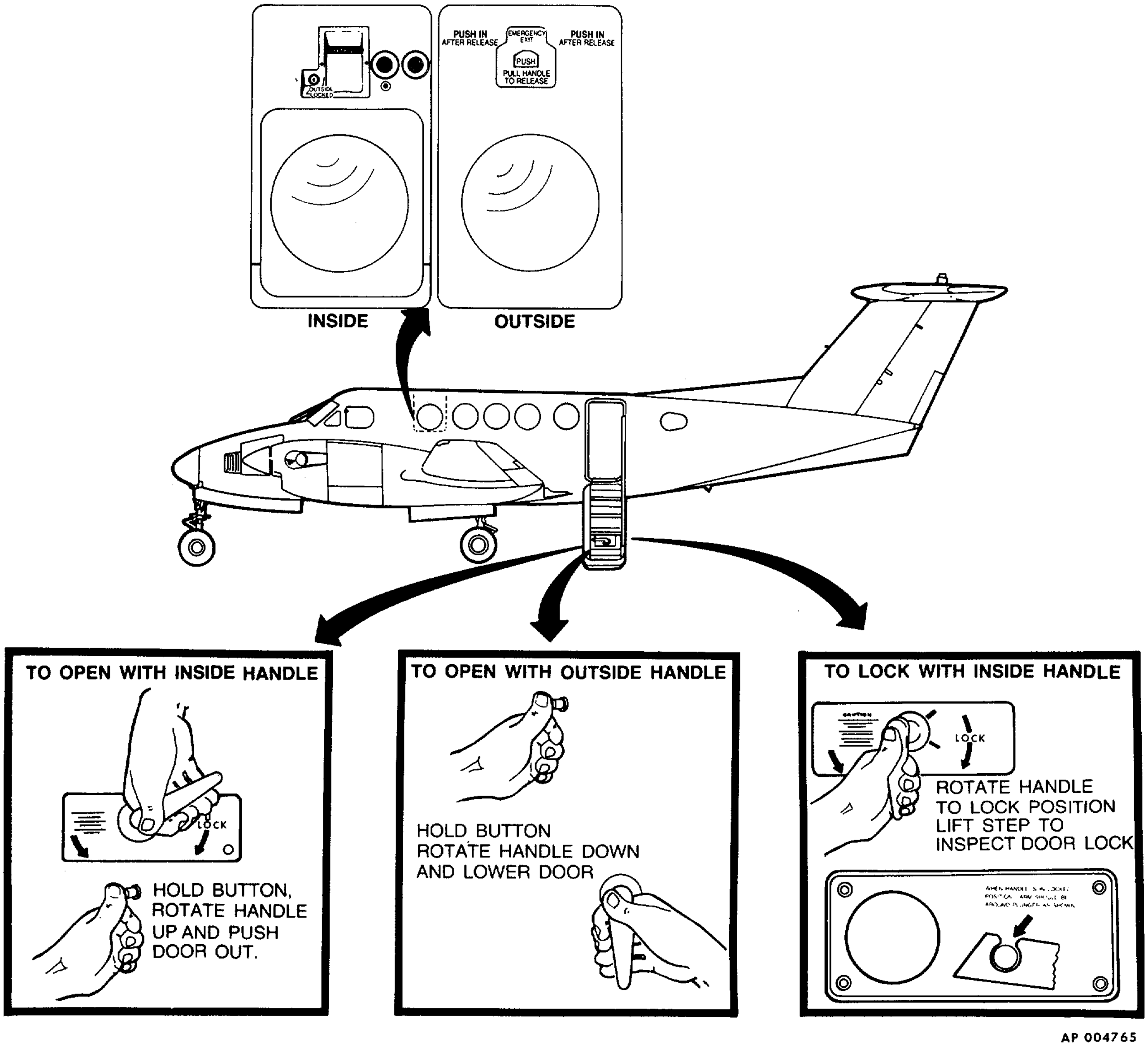


Figure 2-9. Cabin Door and Cabin Emergency Hatch ***C****-Sheet 1 of 2*

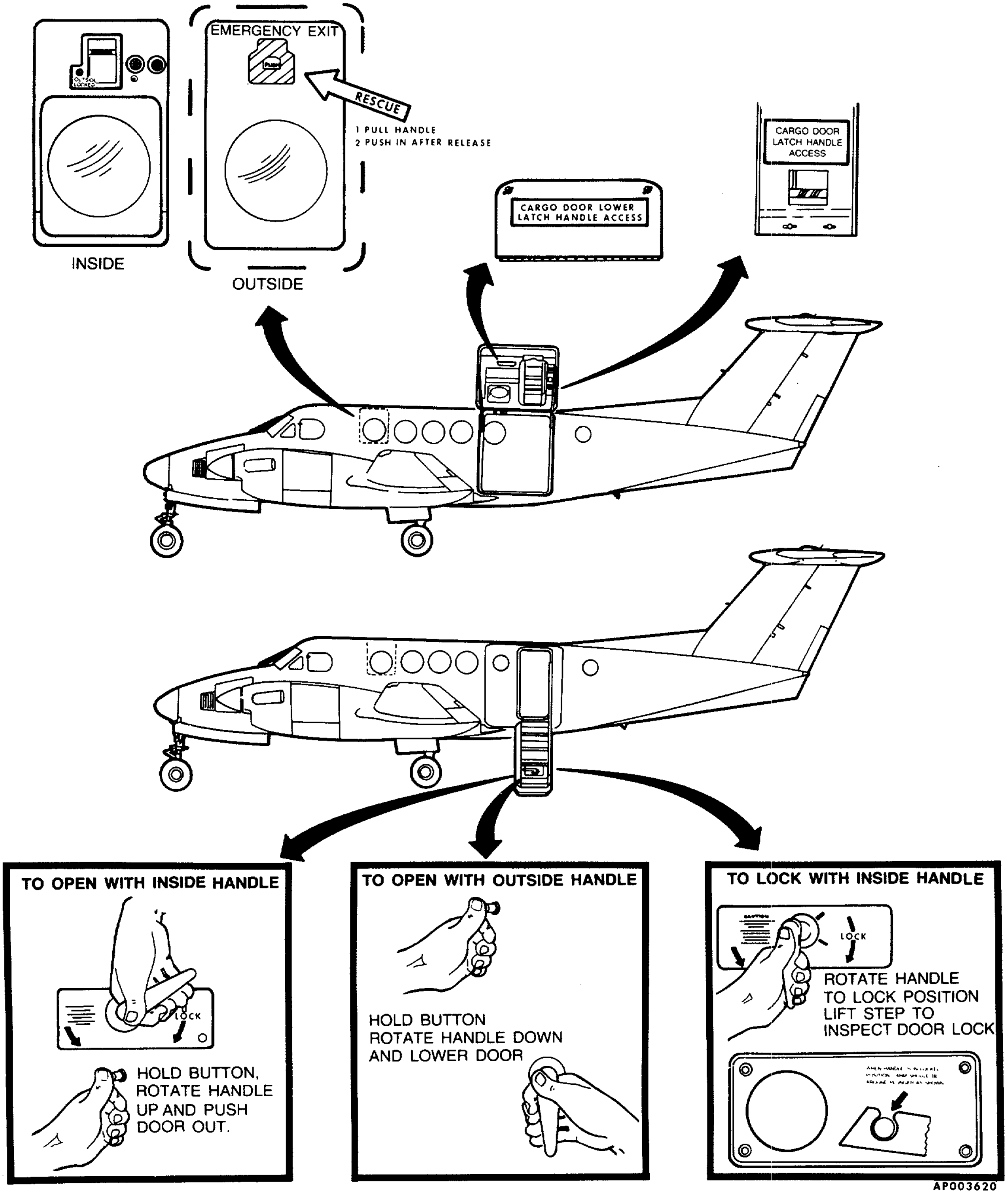


*Figure 2-9. Cabin Door and Cabin Emergency Hatch **DF**-Sheet 2 of 2*

cargo or bulky items. After initial opening force is applied, gas springs will completely open the cargo door automatically. The door is counterbalanced and will remain in the open position. A door sup- port assembly rod is used to hold the door in the open position, and to aid in overcoming the pressure of the gas spring assemblies when closing the door. Once closed, the gas springs apply a closing force to assist in latching the door. A rubber seal around the door seals the pressure vessel while in flight. The door locking mechanism is operated only from inside the aircraft, and is operated by two handles, one in the bottom forward portion of the door and the other in the upper aft portion of the door. When the upper aft handle is operated per placard instruc- tions, two rotating cam-type latches on the forward side of the door and two on the aft side rotate, capturing posts mounted on the fuselage side of the door opening. The bottom handle, when operated per placard instructions, actuates four pin lug latches across the bottom of the door. A button on the upper aft handle must be pressed before the handle can be released to open or latch the door. A latching lever on the bottom handle must be lifted to release the handle before the lower latches can be opened. These act as additional aids in preventing accidental opening or unlatching of the door. The cabin and cargo doors are equipped with dual sensing circuits to provide the crew remote indication of cabin/cargo door security. An annunciator light placarded CABIN DOOR will illuminate if the cabin or cargo door is open and the BATT switch is ON. If the battery switch is OFF, the annunciator will illuminate only if the cargo door is not closed and securely latched. The cargo door sensing circuit receives power from the hot battery bus.

CAUTION

Insure the cabin door is closed and locked. Operating the cargo door while the cabin door is open may damage the door hinges and adjacent structure.

(1) To open the cargo door, unfasten and open the handle access door at the lower forward corner of the door. Lift hook and move the handle to the OPEN position. Secure the access door. Unfasten and open the handle access door at the upper aft corner of the door. Press the button and lift the handle to the OPEN position. Latch handle in place. Secure the access door. Attach one end of the door support assembly to the cargo door ball stud on the forward side of the door. (Insure the support rod detent pin is in place.) Push out on the cabin door sill step, and allow the cargo door to swing open. The gas springs will automatically open the door. Attach the free end of the support rod to the ball stud on the forward fuselage door frame.

CAUTION

Avoid side loading of the gas springs to prevent damage to the mechanism.

(2) To close the cargo door, detach the door support rod from the fuselage door frame ball stud. Firmly grasp the free end of the door support rod while exerting a downward force to overcome the pressure of the gas spring assemblies. Remove the support rod from the door as the gas spring assemblies pass the over center position. The internal pressure of the springs is reversed forcing the door to the closed position. Using the finger hold cavity in the fixed air stair door step, pull the door closed to permit the latching mechanism to engage. Press the button in the center of the handle at the upper aft corner of the door and pull the handle down until the handle latches into position. Pull aft on the handle to assure it is locked in place. Close and fasten access door. Move the handle at the bottom for- ward corner of the door to the full forward position. Insure the safety hook locks the handle in position by pulling aft on the handle.

d. Emergency. The cabin emergency hatch, placarded EXIT-PULL, is located on the right cabin sidewall just aft of the copilot's seat. The hatch may be released, from the inside with a pull-down handle. A flush mounted pull out handle allows the hatch to be released from the outside. The hatch is of the non-hinged, plug type which removes completely from the frame when the latches are released. The hatch can be key locked, from the inside, to prevent opening from the outside. The inside handle will unlatch the hatch whether or not it is locked, by overriding the locking mechanism. The key lock should be unlocked prior to flight to allow removal of the hatch from the outside in the event of an emergency. The key remains in the lock when the hatch is locked and can be removed only when the hatch is unlocked. The key slot is in the vertical position when the hatch is unlocked. Removal of the key from the lock before flight assures the pilot that the hatch can be removed from the outside if necessary.

(1) A wiper type disconnect for the air duct that supplies the air to the eyeball outlet in the cabin emergency hatch is located on the upper aft edge of the door. As the hatch is removed, the duct is disconnected since it is an integral part of the hatch.

(2) An electrical disconnect, located on the lower forward edge of the hatch, will unplug asthe hatch is being removed.

On reinstalling the hatch, the electrical disconnect should be reconnected before moving the hatch into the closed position.

2-12. CABIN DOOR CAUTION LIGHT.

As a safety precaution, two illuminated MASTER CAUTION lights (fig. 2-26), on the glare shield and a steady illuminated CABIN DOOR yellow caution light on the annunciator panel (fig. 2-26) indicate the cabin door is not closed and locked. This circuit is protected by 5-ampere circuit breakers placarded ANN PWR and ANN IND, located on the overhead circuit breaker panel (fig. 2-23).

2-13. WINDOWS.

WARNING

Do not look directly at the sun through the polarized windows, as possible eye damage could result.

a. *Cockpit Windows*. The pilot and copilot have side windows, a windshield and storm windows which provide visibility from the cockpit. The storm windows may be opened on the ground or during flight. Lighting and visibility are provided in the cabin by windows on each side wall and by a pair of smaller windows aft of the cabin entrance door.

b. *Cabin Windows C.* The outer cabin windows, of two-ply construction, are the pressure type and are integral parts of the pressure vessel. Inboard of each pressure cabin window are two inner windows of bonded lamintae construction. Each consists of a tinted neutral gray polarized film between two pieces of clear acrylic. These windows are designed into a sealed unit. The innermost window that faces the inside of the cabin has a protruding knob near the edge and turns freely in its frame. By rotating this window, the polarized windows may be so aligned as to permit varying degrees of light to pass, thereby regulating light intensity.

c. *Cabin Windows DF*. The outer cabin windows, of two-ply construction, are the pressure type and are integral parts of the pressure vessel. Each cabin window has a vertical sliding curtain to regulate light through the window.

2-14. SEATS.

a. *Pilot and Copilot Seats*. The pilot and copilot seats (fig. 2-10) are separated from the cabin by a removable partition with sliding, lockable doors. The controls for vertical height adjustment and fore and aft travel are located under each seat. The fore and aft adjustment handle is located beneath the bottom front inboard corner of each seat. Pulling up on the handle(s) releases the seat position lock allowing the seat to move as desired. Both seats have adjustable headrests and armrests which will raise and lower for access to the cockpit. Handholds on either side of the overhead panels and a fold-away protective pedestal step are provided for pilot and copilot entry into the cockpit. For the storage of maps and the operator's manual, pilot and copilot seats have an expandable pocket affixed to the lower portion of the seat back. Pocket openings are held closed by shock cord tension.

CAUTION

Depending upon individual seat adjustment, certain controls and switches may become inaccessible with the harness locked. Each pilot and copilot should determine for himself to what extent a locked shoulder harness would interfere with aircraft and systems control.

Each pilot and copilot seat is equipped with a lap-type seat belt and shoulder harness connected to an inertia reel. The shoulder harness belt is in the "Y" configuration with the single strap being contained in an inertia reel attached to the base of the seatback. The two straps are worn with one strap over each shoulder and fastened by metal loops into the seat belt buckle. The spring loading at the inertia reel keeps the harness snug but will allow normal movement required during flight operations. The inertia reel is designed with a locking device that will secure the harness in the event of sudden forward movement or an impact action.

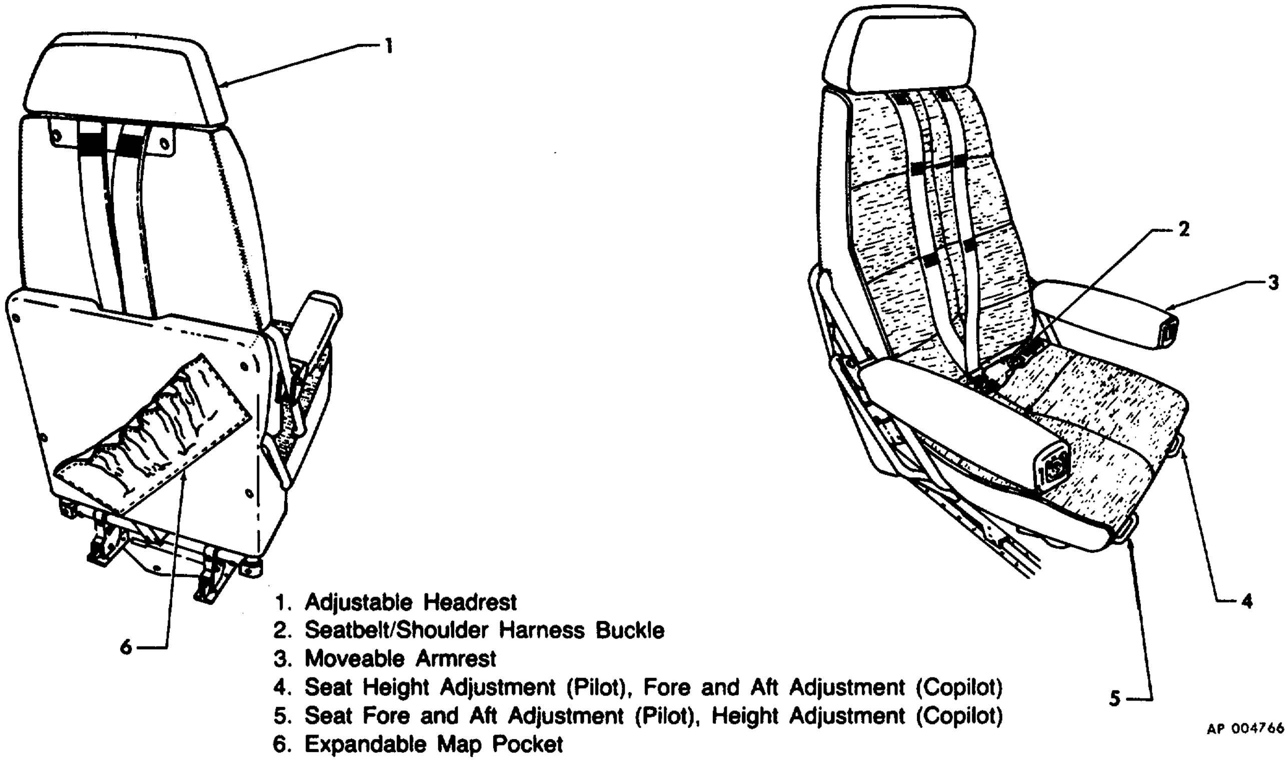


Figure 2-10. Pilot and Copilot Seat

SECTION II. EMERGENCY EQUIPMENT

2-15. DESCRIPTION.

The equipment covered in this section includes all emergency equipment, except that which forms part of a complete system. For example, landing gear system, etc. Chapter 9 describes the operation of emergency exits and location of all emergency equipment.

2-16. FIRST AID KITS.

Three first aid kits are installed.

2-17. HAND-OPERATED FIRE EXTINGUISHER.

WARNING

Repeated or prolonged exposure to high concentrations of Halon gas or decomposition products should be avoided. The liquid shall not be allowed to come into contact with the skin, as it may cause frost bite or low temperature burns because of its very low boiling point.

One hand-operated fire extinguisher is mounted below the pilot's seat and a second extinguisher is mounted beneath the aft left seat. They are of the Halon gas type. The extinguisher is charged to a pressure of 150 to 170 psi, and emits a forceful stream. Use an extinguisher with care within the limited area of the cabin to avoid severe splashing.

NOTE

Engine fire extinguisher systems are described in Section III.

2-18. SURVIVAL KITS.

There are two different survival kits authorized for installation in the aircraft. Depending on the anticipated mission, either an overwater or overland kit may be installed.

The kit is carried in the aft baggage area of the cabin.

2-19. SURVIVAL RADIOS.

Provisions are installed for installation of two AN/PRC-90 Radio Sets: one on the partition aft of the pilot's seat and one/adjacent to the cabin entrance door. Each radio is equipped with a placard giving specific operating instructions.

SECTION III. ENGINES AND RELATED SYSTEMS

2-20. DESCRIPTION.

The aircraft is powered by two PT6A turboprop engines (fig. 2-11). The engine has a three stage axial, single stage centrifugal compressor, driven by a single stage reaction turbine. The power turbine a two 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 two stages of power turbines then 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. The accessory drive at the aft end of the engine provides power to drive the fuel pumps, fuel control, the oil pumps, the refrigerant compressor (right engine), the starter/generator, and the tachometer transmitter. 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.

2-21. ENGINE COMPARTMENT COOLING.

The forward engine compartment including the accessory section is cooled by air entering around the exhaust stub cutouts, the gap between the propeller spinner and forward cowling, and exhausting through ducts in the upper and lower aft cowling.

2-22. AIR INDUCTION SYSTEMS-GENERAL.

Each engine and oil cooler receives ram air ducted from an air scoop located within the lower section of the forward nacelle. Special components of the engine induction system protect the power plant from icing and foreign object damage.

2-23. FOREIGN OBJECT DAMAGE CONTROL.

The engine has an integral air inlet screen designed to obstruct objects large enough to damage the compressor.

2-24. ENGINE ICE PROTECTION SYSTEMS.

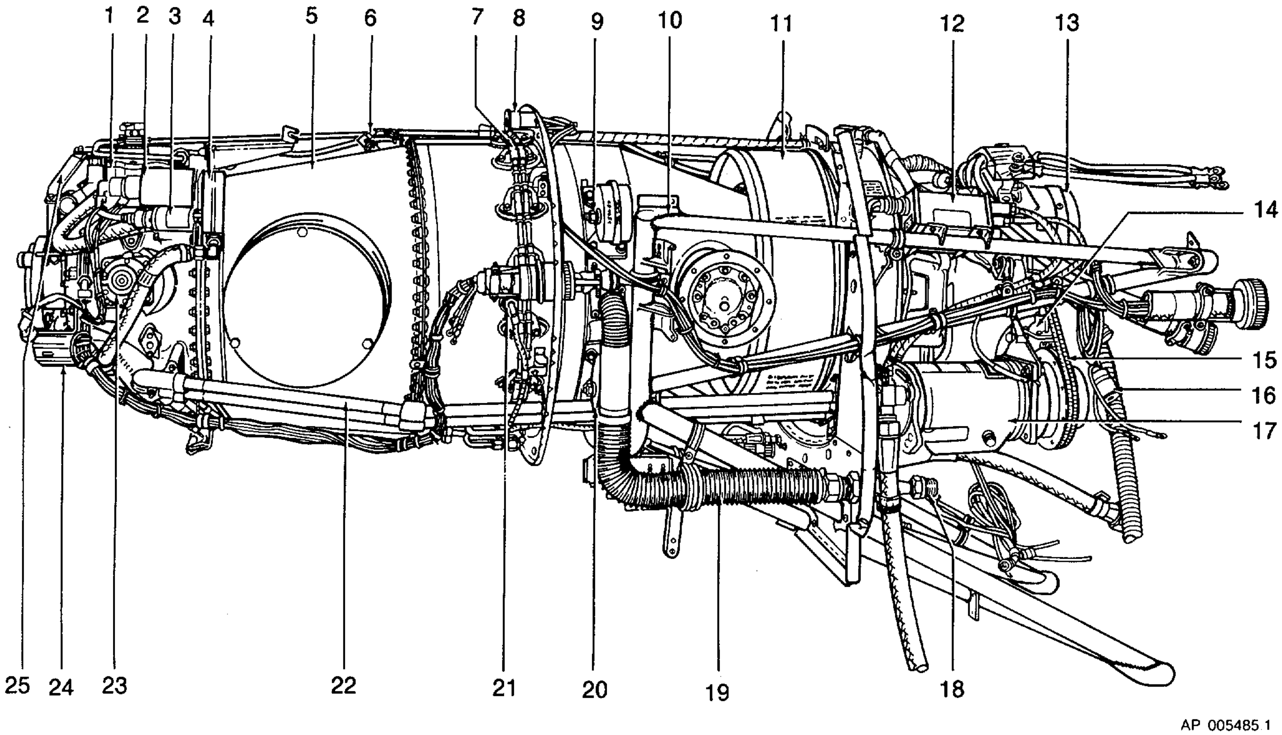
CAUTION

After the vanes have been manually extended, they may be mechanically actuated only. No electrical extension or retraction shall be attempted as damage to the electric actuator will result. Linkage in the nacelle area must be reset prior to operation of the electric system.

a. Inertial Separator. An inertial separation system is built into each engine air inlet to prevent moisture particles from entering the engine inlet plenum under icing conditions. A movable vane and a by-pass door are lowered into the air stream when operating in visible moisture at +5°C or colder, by energizing electrical actuators with the switches, placarded ICE VANE-RETRACT-EXTEND (fig. 2-8), located on the overhead control panel. A mechanical backup system is provided, and is actuated by pulling the T-handles just below the pilot's subpanel placarded ICE VANE-#1 ENG-#2 ENG (fig. 2-7). Decrease airspeed to 160 knots or less to reduce forces for manual extension. Normal air-speed may then be resumed.

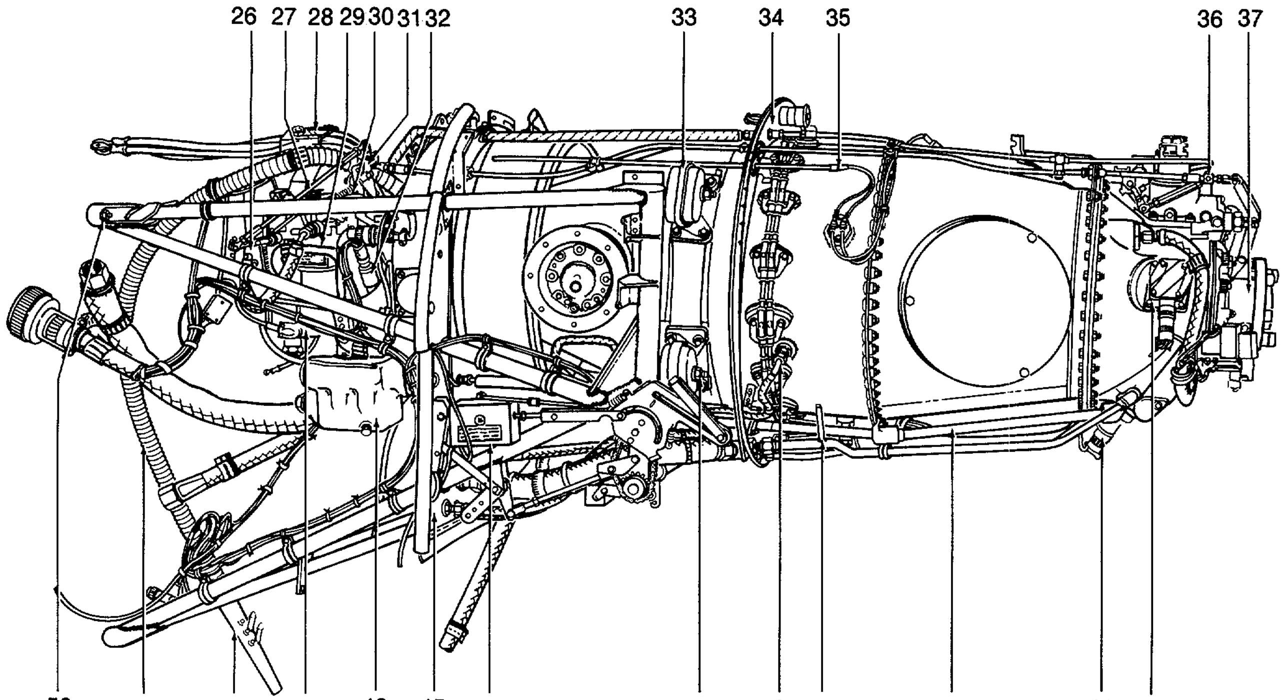
(1) The vane deflects the ram air stream slightly downward to introduce a sudden turn in the air stream to the engine, causing the moisture particles to continue on undeflected, because of their greater momentum, and to be discharged overboard.

(2) While in the icing flight mode, the extended position of the vane and by-pass door is indicated by green annunciator lights, #1 VANE EXT and #2 VANE EXT.



1. Primary Prop Governor
2. Torque Pressure Transmitter
3. Torque Pressure Switch
4. Torque Pressure Manifold
5. Exhaust Duct
6. ITT Temperature Probe
7. Fuel Flow Divider Manifold
8. Fire Detector
9. Engine Mount Bolt
10. Engine Mount Truss Assembly
11. Engine Air Intake Screen
12. Ignition Exciter
13. Starter-Generator
14. Fuel Boost Pump
15. Air Conditioner Compressor Drive Belt (#2 Engine Only)
16. Fire Detector
17. Air Conditioner Compressor (#2 Engine Only)
18. Bleed Air Adapter
19. Bleed Air Line
20. Engine Mount
21. Ignition Exciter Plug
22. Oil Scavenge Tubes
23. Overspeed Governor
24. Prop Deice Brush Block Bracket
25. Prop Reverse Linkage Lever

Figure 2-11. Engine-Sheet 1 of 2



26. Fuel Control Unit
27. Fuel Control Unit Control Rod
28. Starter Generator Leads
29. Engine Driven Fuel Pump
30. Power Control Lever
31. Prop Interconnect Linkage (Aft)
32. Oil Pressure Transducer
33. Engine Mount
34. Fireshield
35. Trim Resistor Thermocouple
36. Prop Interconnect Linkage (Fore)
37. Prop Shaft
38. Tach Generator
39. Chip Detector
40. Oil Pressure Tube
41. Fire Extinguisher Line
42. Ignition Exciter Plug
43. Engine Mount Bolt
44. Linear Actuator
45. Engine Baffle and Seal Assy
46. Fuel/Oil Heater
47. Tach-Generator (Aft)
48. Drain Manifold
49. Overhead Breather Tube
50. Engine Truss Mounting Bolt

Figure 2-11. Engine-Sheet 2 of 2

(3) In the non-ice protection mode, the vane and by-pass door are retracted out of the air stream by placing the ice vane switches in the RETRACT position. The green annunciator lights will extinguish. Retraction should be accomplished at +15°C and above to assure adequate oil cooling. The vanes should be either extended or retracted; there are no intermediate positions.

(4) If for any reason the vane does not attain the selected position within 15 seconds, a yellow #1 VANE FAIL or #2 VANE FAIL light illuminates on the caution/advisory panel. In this event, the manual backup system should be used. When the vane is successfully positioned with the manual system, the yellow annunciator lights will extinguish. During manual system use, the electric motor switch position must match the manual handle position for a correct annunciator readout. inlet lips. Hot exhaust is picked up by a scoop inside each engine exhaust stack and plumbed downward to connect into each end of the inlet lip. Exhaust flows through the inside of the lip downward to the bottom where it is plumbed out through the bottom of the nacelle. No shut-off or temperature indicator is necessary for this system.

b. Engine Air Inlet Deice **CD**. Engine exhaust heat is utilized for heating the engine air inlet lips. Hot exhaust is picked up by a scoop inside each engine exhaust stack and plumbed downward to connect into each end of the inlet lip. Exhaust flows through the inside of the lip downward to the bottom where it is plumbed out through the bottom of the nacelle. No shut-off or temperature indicator is necessary for this system.

F A small duct, facing into the exhaust flow of the engine's left exhaust stack, diverts a small portion of the engine exhaust gases to the engine air inlet anti-ice lip. The gases are circulated through the engine air inlet anti-ice lip and then exhausted through a duct to the engine's right exhaust stack. The continuous flow of hot engine exhaust gases heats the engine air inlet anti-ice lip, preventing the formation of ice.

c. Fuel Heater. 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. Fuel control heat is automatically turned on for all engine operations.

2-25. ENGINE FUEL CONTROL SYSTEM.

CD The basic engine fuel system consists of an engine driven fuel pump, a fuel control unit, a fuel flow divider, a dual fuel manifold and fourteen fuel nozzles. The fuel flow divider acts as a drain valve to clear residual fuel after engine shutdown.

F The basic engine fuel system consists of an engine driven fuel pump, a fuel control unit, a dual fuel manifold, fourteen fuel nozzles, and a fuel purge system. The fuel purge system forces residual fuel from the manifolds to the combustion chamber, where it is consumed.

a. One fuel control unit is on the accessory case of each engine. This unit is a hydro-mechanical metering device which determines the proper fuel schedule for the engine to produce the amount of power requested by the relative position of its power lever. The control of developed engine power is accomplished by adjusting the engine compressor turbine (N1) speed. N1 speed is controlled by varying the amount of fuel injected into the combustion chamber through the fuel nozzles. Engine shutdown is accomplished by moving the appropriate condition lever to the full aft, FUEL CUT-OFF position, which shuts off the fuel supply.

2-26. POWER LEVERS.

CAUTION

Moving the power levers into reverse range without the engines running may result in damage to the reverse linkage mechanisms.

Two power levers are located on the control pedestal (fig. 2-6). These levers regulate power in the reverse, idle, and forward range, and operate so that forward movement increases engine power. Power control is accomplished through adjustment of the N1 speed governor in the fuel control unit. Power is increased when N1 RPM is increased. The power levers also control propeller reverse pitch. Distinct movement (pulling up and then aft on the power lever) by the pilot is required for reverse thrust. Placarding beside the lever travel slots reads POWER. Upper lever travel range is designated INCR (increase), supplemented by an arrow point- ing forward. Lower travel range is marked IDLE, LIFT and REVERSE. A placard below the lever slots reads: CAUTION-REVERSE ONLY WITH ENGINES RUNNING.

2-27. CONDITION LEVERS.

Two condition levers are located on the con- trol pedestal (fig. 2-6). Each lever starts or stops the fuel supply, and controls the idle speed for its engine. The levers have three placarded positions: FUEL CUTOFF, LO IDLE, and HIGH IDLE. In the FUEL CUTOFF position, the condition lever controls the cutoff function of its engine-mounted fuel control unit. From LO IDLE to HIGH IDLE, they control the governors of the fuel control units to establish minimum fuel flow levels. LO IDLE position sets the fuel flow rate to attain 52% ± 2% **C**; **D** 56-58% **F**, (at sea level) minimum N1 and HIGH IDLE position sets the rate to attain 70% minimum N1. The power lever for the corresponding engine can select N1 from the respective idle setting to maximum power. An increase in low idle N. will be experienced at high field elevation.

2-28. FRICTION LOCK KNOBS.

Four friction lock knobs (fig. 2-6) are located on the control pedestal to adjust friction drag. One knob is below the propeller levers, one below the condition levers, and two under the power levers. When a knob is rotated clockwise, friction restraint is increased opposing movement of the affected lever as set by the pilot. Counterclockwise rotation of a knob will decrease friction drag thus permitting free and easy lever movement. Two FRICTION LOCK placards are located on the pedestal adjacent to the knobs.

2-29. ENGINE FIRE DETECTION SYSTEM C D F1

A flame surveillance system is installed on each engine to detect external engine fire and provide alarm to the pilot. Both nacelles are monitored, each having a control amplifier and three detectors. Electrical wiring connects all sensors and control amplifiers to DC power and to the cockpit visual alarm units. In each nacelle, one detector monitors the forward nacelle, a second monitors the upper accessory area, and a third the lower accessory area.

a. Fire emits an infrared radiation that will be sensed by the detector which monitors the area of origin. Radiation exposure activates the relay circuit of a control amplifier which causes signal power to be sent to cockpit warning systems. An activated surveillance system will return to the standby state after the fire is out. The system includes a functional test switch and has circuit protection through the FIRE DETR circuit breaker.

b. Warning of internal nacelle fire is provided as follows: The red MASTER WARNING light on the glare shield illuminates accompanied by the illumination of a red warning light in the appropriate fire control T-handle placarded FIRE PULL (fig. 2-26). Fire detector circuits are protected by a single 5-ampere circuit breaker, placarded FIRE DETR, located on the overhead circuit breaker panel (fig. 2-23).

c. During ground test of the engine fire detection system, an erroneous indication of system fault may be encountered if' an engine cowling is not closed properly, or if the aircraft is headed toward a strong external light source. In this circumstance, close the cowling and/or change the aircraft heading to enable a valid system check.

d. One rotary switch placarded FIRE PROTECTION TEST on the copilot's subpanel is provided to test the engine fire detection system (fig. 2-7). Before checkout, battery power must be on and the FIRE DETR circuit breaker must be closed. Switch position DETR 1, checks the area forward of the air intake of each nacelle, including circuits to the cockpit alarm and indication devices. Switch position DETR 2, checks the circuits for the upper accessory compartment of each nacelle. Switch position DETR 3, checks the circuits for the lower accessory compartment of each nacelle. Each numbered switch position will initiate the cockpit indications previously described.

2-29A. ENGINE FIRE DETECTION SYSTEMS F2.

a. A pneumatic fire detection system is installed to provide an immediate warning in the event of a fire or over temperature in the engine compartment. The main element of the system is a temperature sensing cable routed continuously throughout the engine compartment, terminating in a responder unit. The responder unit is mounted in the accessory area on the upper left hand engine truss just forward of the engine firewall. The responder unit contains two sets of contacts: A set of integrity switch contacts for continuity test functions of the fire detection circuitry, and a set of alarm switch contacts which completes the circuit to activate the fire warning system when the detector cable senses an over temperature condition in critical areas around the engine.

b. The sensor cable consists of an outer tube filled with an inert gas, and an inner hydride core that is filled with an active gas. The gas within the tube forms a pressure barrier that keeps the responder integrity switch contacts closed for fire alarm continuity test functions. As the temperature around the sensing cable increases, the gases within the tube begin to expand. When the pressure from the expanding gases reaches a preset point, the contacts of the responder alarm switch close, activating the respective fire warning system.

c. The fire warning portion of the system consists of two annunciators placarded #1 FIRE PULL and #2 FIRE PULL located in the T handles below the glareshield, two MASTER WARNING annunciators located on opposite sides of the glareshield, and two responder units with pneumatic sensors in the engine compartments.

d. An integrity switch that monitors the system is held in the closed position. If the detector should develop a leak, the loss of gas pressure would allow the integrity switch to open and signal a lack of detector integrity. The system then will not operate during the system test function.

e. Testing the systems integrity, availability of power, and the alarm annunciators, (#1 and #2 FIRE PULL and MASTER WARNING) is accomplished by two switches located on the copilot's left subpanel. The switches are placarded ENG FIRE TEST, DET OFF EXT, LEFT and RIGHT. When either (LEFT or RIGHT) switch is placed in the DET position, electrical current flows through a 5-ampere circuit breaker placarded FIRE DETECTOR located on the overhead circuit breaker panel, through the engine fire detector circuitry to the integrity switch contacts in the respective responder unit, causing the respective alarm annunciators to illuminate. If the circuit breaker opens the system will not operate during a test, or activate the annunciator lights, if the detector cable should sense an overtemperature condition. The system may be tested either pre/post flight, or in flight as desired.

2-30. ENGINE FIRE EXTINGUISHER SYSTEM.

a. The fire extinguisher system utilizes an explosive squib and valve which, when opened, allows the distribution of the pressurized extinguishing agent through a plumbing network of spray nozzles strategically located in the fire zones of the engines.

b. The fire control T handles used to arm the extinguisher system are centrally located on the pilot's instrument panel (Fig. 2-26), immediately below the glareshield. These controls receive power from the hot battery bus. The fire detection system will indicate an engine fire by illuminating the master fault warning light on the copilot's glareshield and the respective 1 or 2 FIRE PULL lights in the fire control T handles. Pulling the fire control T handle will electrically arm the extinguisher system and close the firewall shutoff valve for that particular ENGINE. This will cause the red light in the PUSH TO EXTINGUISH switch and the respective red 1 or 2 FUEL PRESS light in the warning annunciator panel to illuminate. Pressing the lens of the PUSH TO EXTINGUISH switch after lifting one side of its spring-loaded clear

Table 2-2. Engine Fire Extinguisher Gage Pressure

Temp °C	-40	-29	-18	-06	04	16	27	38	48
PSI	190 to 240	220 to 275	250 to 315	290 to 365	340 to 420	390 to 480	455 to 550	525 to 635	605 to 730

plastic guard) will fire the squib, expelling all the agent in the cylinder at one time. The respective yellow caution light, 1 or 2 EXTGH DISCH on the caution/advisory annunciator panel and the master fault caution lights on the glareshield will illuminate and remain illuminated, regardless of the master switch position, until the squib is replaced. The MASTER CAUTION light may be reset.

c. A rotary test switch, placarded FIRE PROTECTION TEST, is located on the copilot's subpanel (fig. 2-7). The test functions, placarded EXTGH #1 #2, are arranged on the left side of the switch and provide a test of the pyrotechnic cartridge circuitry. During preflight, the pilot should rotate the test switch through the two positions and verify the illumination of the green SQUIB OK light on the PUSH TO EXTINGUISH switch and the corresponding yellow #1 or #2 EXTGH DISCH light on the caution/advisory annunciator panel.

d. A gage, calibrated in PSI, is mounted on each supply cylinder for determining the level of charge and should be checked during preflight (Table 2-2).

2-31. OIL SUPPLY SYSTEM.

a. The engine oil tank is integral with the air-inlet casting located forward of the accessory gearbox. Oil for propeller operation, lubrication of the reduction gearbox and engine bearings is supplied by an external line from the high pressure pump. Two scavenge lines return oil to the tank from the propeller reduction gearbox. A non-congealing external oil cooler keeps the engine oil temperature within the operating limits. The capacity of each engine oil tank is 2.3 U.S. gallons. The total system capacity for each engine, which includes the oil tank, oil cooler, lines, etc., is 3.5 U.S. gallons. The oil level is indicated by a dipstick attached to the oil filler cap. Oil grade, specification and servicing points, are described in Section XII, Servicing.

b. The oil system of each engine is coupled into a heat exchanger unit (radiator) of fin-and-tube design. These exchanger units are the only airframe mounted part of the oil system and are attached to the nacelles below the engine air intake. Each heat exchanger incorporates a thermal bypass which assists in maintaining oil at the proper temperature range for engine operation.

2-32. ENGINE CHIP DETECTION SYSTEM.

A magnetic chip detector is installed in the bottom of each engine nose gearbox to warn the pilot of oil contamination and possible engine failure. The sensor is an electrically insulated gap immersed in the oil functioning as a normally-open switch. If a large metal clip or a mass of small particles bridge the detector gap a circuit is completed, sending a signal to illuminate an annunciator panel red indicator light placarded 1 or 2 CHIP DETR (fig. 2-26) and the MASTER WARNING light (fig. 2-26). Chip detector circuits are protected by two 5-ampere circuit breakers, placarded CHIP DETR 1 and 2 on the overhead circuit breaker panel (fig. 2-23).

2-33. ENGINE IGNITION SYSTEM.

a. The basic ignition system consists of a solid state ignition exciter unit, two igniter plugs, two shielded ignition cables, pilot-controlled IGNITION AND ENGINE START switches and the ENG AUTO IGN switch. Placing an IGNITION AND ENGINE START switch to ON (forward) will cause the respective igniter plugs to spark, igniting the fuel/air mixture sprayed into the combustion chamber by the fuel nozzels. The ignition system is activated for ground and air starts, but is switched off after combustion light up.

b. One three-position toggle switch for each engine, located on the overhead control panel, will initiate starter motoring and ignition in the ON/ ENG START position, or will motor the engine in the STARTER ONLY (aft) position (fig. 2-8). The switches are placarded #1 ENG START or #2 ENG START to designate the appropriate engine. The ON switch position completes the starter circuit for engine rotation, energizes the igniter plugs for fuel combustion, and activates the IGN ON light on the annunciator panel. At center position the switch is OFF. Two 5-ampere circuit breakers on the overhead circuit breaker panel, placarded IGNITOR CONTR #1 and #2, protect ignition circuits. Two 5-ampere circuit breakers on the overhead circuit breaker panel, placarded START CONTR #1 and #2, protect starter control circuits (fig. 2-23).

2-34. AUTOIGNITION SYSTEM.

If armed, the autoignition system automatically provides combustion re-ignition of either engine should accidental flameout occur. The system is not essential to normal engine operation, but is used to reduce the possibility of power loss due to icing or other conditions. Each engine has a separate autoignition control switch and a green indicator light placarded #1 or #2 IGN ON, on the annunciator panel. Autoignition is accomplished by energizing the two igniter plugs in each engine.

NOTE

The system should be turned OFF during extended ground operation to prolong the life of the ignitor plugs.

a. Autoignition Switches. Two switches placarded ENG AUTO IGN #1 or #2, with positions ARM and OFF, are located on the overhead control panel (fig. 2-8). ARM position initiates a readiness mode for the autoignition system of the corresponding engine. OFF position disarms the system. Each switch is protected by a corresponding START CONTR #1 or #2 5-ampere circuit breaker on the overhead circuit breaker panel (fig. 2-23).

b. Autoignition Lights. If an armed autoignition system changes from a ready condition to an operating condition energizing the two igniter plugs in an engine a corresponding green annunciator panel light will illuminate. The annunciator panel light is placarded #1 or #2 IGN ON and indicates that the igniters are energized. The autoignition system is triggered from a ready condition to an operating condition when engine torque drops below 20%. Therefore, when an autoignition system is armed, the igniters will be energized continuously during the time when an engine is operating at a level below 20% maximum torque. Autoignition lights are protected by 5-ampere IGNITOR CONTR #1 or #2 circuit breakers on the overhead circuit breaker panel (fig. 2-23).

2-35. ENGINE STARTER-GENERATORS.

One starter-generator is mounted on each engine accessory drive section. Each is able to function either as a starter or as a generator. In starter function, 28 volts DC is required to power rotation. In generator function, each unit is capable of 250 amperes DC output. When the starting function is selected, the starter control circuits receive power through the respective 5-ampere START CONTR circuit breakers on the overhead circuit breaker panel from either the aircraft battery or an external power source. When the generating function is selected, the starter-generator provides electrical power. For additional description of the starter-generator system, refer to Section IX.

2-36. ENGINE INSTRUMENTS.

Engine instruments are vertically mounted near the center of the instrument panel (fig. 2-26).

a. Turbine Gas Temperature Indicators. Two TGT gages on the instrument panel are calibrated in degrees celsius (fig. 2-26). Each gage is connected to thermocouple probes located in the hot gases between the turbine wheels. The gages register the temperature present between the compressor turbine and power turbine for the corresponding engine.

b. Engine Torquemeters. Two torquemeters on the instrument panel indicate torque applied to the propeller shafts of the respective engines (fig. 2-26). Each gage shows torque in percent of maximum using 2 percent graduations and is actuated by an electrical signal from a pressure sensing system located in the respective propeller reduction gear case. Torquemeters are protected by individual 0.5ampere circuit breakers placarded TORQUEMETER #1 or #2 on the overhead circuit breaker panel (fig. 2-23).

c. Turbine Tachometers. Two tachometers on the instrument panel register compressor turbine RPM (N_1) for the respective engine (fig. 2-26). These indicators register turbine RPM as a percentage of maximum gas generator RPM. Each instrument is slaved to a tachometer generator attached to the respective engine.

d. Oil Pressure/Oil Temperature Indicators. Two gages on the instrument panel register oil pressure in PSI and oil temperature in °C (fig. 2-26). Oil pressure is taken from the delivery side of the main oil pressure pump. Oil temperature is transmitted by a thermal sensor unit which senses the temperature of the oil as it leaves the delivery side of the oil pressure pump. Each gage is connected to pressure transmitters installed on the respective engine. Both instruments are protected by 5-ampere circuit breakers, placarded OIL PRESS and OIL TEMP #1 or #2, on the overhead circuit breaker panel (fig. 2-23).

e. Fuel Flow Indicators. Two gages on the instrument panel (fig. 2-26) register the rate of flow for consumed fuel as measured by sensing units coupled into the fuel supply lines of the respective engines. The fuel flow indicators are calibrated in increments of hundreds of pounds per hour. Both circuits are protected by 0.5-ampere circuit breakers placarded FUEL FLOW #1 or #2, on the overhead circuit breaker panel (fig. 2-23).

Section IV. FUEL SYSTEMS

2-37. FUEL SUPPLY SYSTEM.

The engine fuel supply system (fig. 2-12) consists of two identical systems sharing a common fuel management panel and fuel crossfeed plumbing. Each fuel system consists of five interconnected wing tanks, a nacelle tank, an engine driven boost pump mounted on each engine, a standby fuel pump located within the nacelle tank, a fuel heater (engine oil-to-fuel heat exchange unit), a tank vent system, a tank vent heating system and interconnecting wiring and plumbing. The aircraft are equipped with auxiliary (inboard wing) fuel tanks and a fuel transfer pump located within each tank.

a. Engine Driven Boost Pumps.

CAUTION

Engine operation using only the engine-driven primary (high pressure) fuel pump without standby fuel pump or engine-driven boost pump fuel pressure is limited to 10 cumulative hours. This condition is indicated by illumination of either #1 or #2 FUEL PRESS lights on the warning annunciator panel and simultaneous illumination of the master warning light on the glare shield. Refer to Chapter 9. All time in this category shall be entered on DA Form 2408-13 for the attention of maintenance personnel.

A gear-driven boost pump, mounted on each engine supplies fuel under pressure to the inlet of the engine-driven primary high-pressure pump for engine starting and all normal operations. Either the engine-driven boost pump or standby fuel pump is capable of supplying sufficient pressure to the engine-driven primary high-pressure pump and thus maintain normal engine operation.

b. Standby Fuel Pumps. A submerged, electrically operated standby fuel pump, located within each nacelle tank, serves as a backup unit for the engine-driven boost pump. The standby pumps are switched off during normal system operations. A standby fuel pump will be operated during crossfeed to pump fuel from one system to the other. The correct pump is automatically selected when the CROSSFEED switch is activated. Each standby fuel pump has an inertia switch included in the power supply circuit. When subjected to a 5 to 6 G shock loading, as in a crash situation, the inertia switch will remove electrical power from the standby fuel pump. The standby fuel pumps are protected by two 10-ampere circuit breakers placarded STANDBY PUMP 1 or 2, located on the overhead circuit breaker panel (fig. 2-23), and four 5-ampere circuit breakers wired (2 each in parallel) on the hot battery bus.

c. Fuel Transfer Pumps. 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 auxiliary tank sump 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 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 #1 or #2 NO FUEL XFR on the annunciator panel. During engine start, the pilot should note that the NO FUEL XFR lights extinguish 30 to 50 seconds after engine start. The NO FUEL XFR lights will not illuminate if auxiliary tanks are empty. 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 management panel to the OVERRIDE position. This will energize the transfer control motive flow valve. The transfer system is protected by 5-ampere circuit breakers placarded AUXILIARY TRANSFER #1 or #2, located on the overhead circuit breaker panel (fig. 2-23).

CAUTION

In turbulence or during maneuvers, the NO FUEL XFR light may momentarily illuminate after the aux fuel has completed transfer.

d. Fuel Gaging System. The total fuel quantity in the left or right main system or left or right auxiliary tank is measured by a capacitance type fuel gaging system. Two fuel gages, one for the left and one for the right fuel system, read fuel quantity in

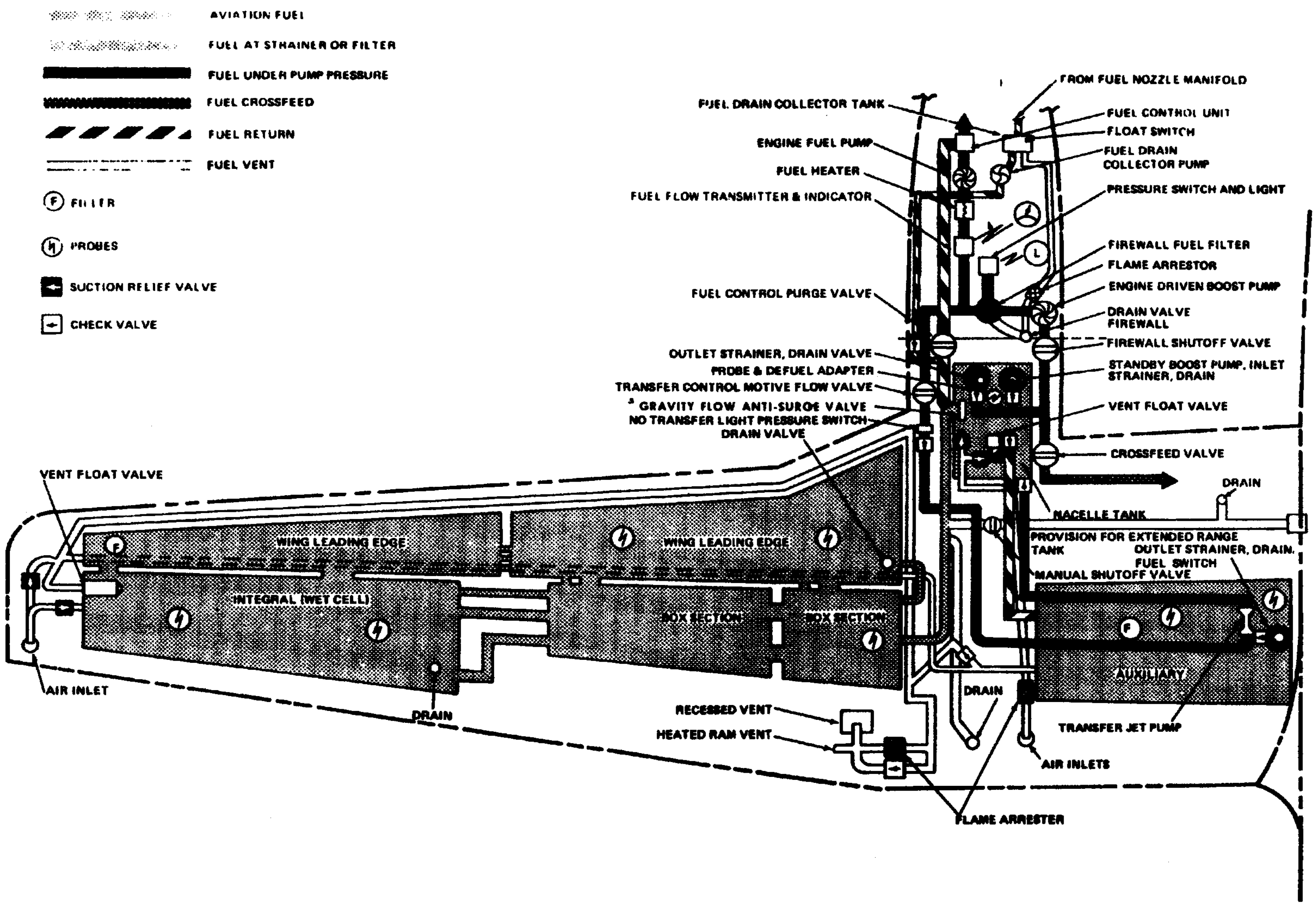
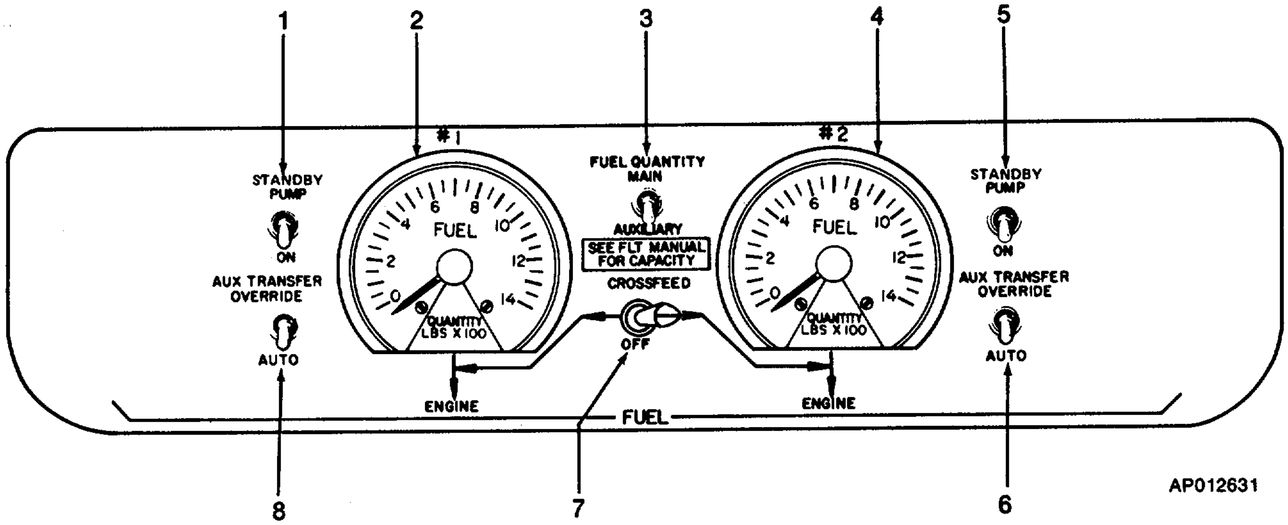


Figure 2-12. Fuel System



1. Standby Fuel Pump Switch (#1 Engine) Over-ride
2. Fuel Quantity Indicator (#1 Engine)
3. Fuel Quantity Gaging System Control Switch
4. Fuel Quantity Indicator (#2 Engine)
5. Standby Fuel Pump Switch (#2 Engine)
6. Auxiliary Fuel Transfer Pump Over-ride Switch (#2 Engine)
7. Crossfeed Valve Switch
8. Auxiliary Fuel Transfer Pump Over-ride Switch (#1 Engine)

Figure 2-13. Fuel Management Panel **CD F1** - *Sheet 1 of 2*

pounds. Refer to Section XII for fuel capacities and weights. A maximum of 3% error may be encountered in each system. However, the system is compensated for fuel density changes due to temperature excursions. In addition to the fuel gages, yellow #1 or #2 NAC LOW lights on the caution/advisory annunciator panel illuminate when there is approximately 153 **C**, 247 **DF** pounds of usable fuel per engine remaining. The fuel gaging system is protected by individual 5-ampere circuit breakers placarded QTY IND and QTY WARN #1 or #2, located on the overhead circuit breaker panel (fig. 2-23).

e. Fuel Management Panel (fig. 2-13). The fuel management panel is located on the cockpit overhead between the pilot and copilot. It contains the fuel gages, standby fuel pump switches, crossfeed valve switch, a fuel gaging system control switch and transfer control switches.

(1) Fuel gaging system control switch. A switch on the fuel management panel (fig. 2-13) placarded FUEL QUANTITY, MAIN AUXILIARY, controls the fuel gaging system. When in the MAIN position the fuel gages read the total fuel quantity in the left and right wing fuel system. When in the AUXILIARY position the fuel gages read the fuel quantity in the left and right auxiliary tanks only.

(2) Standby fuel pump switches. Two switches, placarded STANDBY PUMP ON located on the fuel management panel (fig. 2-13) control a submerged fuel pump located in the corresponding nacelle tank. During normal aircraft operation both switches are off so long as the engine-driven boost pumps function and during crossfeed operation. The loss of fuel pressure, due to failure of an engine driven boost pump will illuminate the MASTER WARNING light on the glareshield and will illuminate the #1 FUEL PRESS or #2 FUEL PRESS on the warning annunciator panel (fig. 2-26). Turning ON the STANDBY PUMP will extinguish the FUEL PRESS lights. The MASTER WARNING light must be manually cleared.

NOTE

Both switches shall be off during crossfeed operation.

(3) Fuel transfer control switches. Two switches on the fuel management panel (fig. 2-13), placarded AUX TRANSFER OVERRIDE AUTO control operation of the fuel transfer pumps. During normal operation both switches are

in AUTO which allows the pump to be automatically actuated by fuel flow to the engine. If either transfer system fails to operate, the fault condition is indicated by two illuminated MASTER CAUTION lights on the glareshield and a steady illuminated yellow No.1 or No.2 NO FUEL XFR light on the caution annunciator panel.

(4) Fuel crossfeed switch. The fuel crossfeed valve is controlled by a 3-position switch (fig. 2-13), located on the fuel management panel, placarded CROSSFEED OFF. Under normal flight conditions the switch is left in the OFF position. During single engine operation, it may become necessary to supply fuel to the operative engine from the fuel system on the opposite side. The crossfeed system is placarded for fuel selection with a simplified diagram on the overhead fuel control panel. Place the standby fuel pump switches in the off position when crossfeeding. A lever lock switch, placarded CROSSFEED, 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 and energizes the standby pump on the side from which crossfeed is desired. During crossfeed operation, auxiliary tank fuel will not crossfeed if the FUEL FIREWALL valve is closed. When the crossfeed mode is energized, a green FUEL CROSSFEED light on the caution/advisory panel (fig. 2-26) will illuminate. Crossfeed system operation is described in Chapter 9. The crossfeed valve is protected by a 5-ampere circuit breaker placarded CROSSFEED VALVE located on the overhead circuit breaker panel (fig. 2-23).

f. Firewall Shutoff Valves.

CAUTION

Do not use the fuel firewall shutoff valve to shut down an engine, except in an emergency. The engine-driven high pressure fuel pump obtains essential lubrication from fuel flow. When an engine is operating, this pump may be severely damaged (while cavitating) if the firewall valve is closed before the condition lever is moved to the FUEL CUTOFF position.

The fuel system incorporates a fuel line shutoff valve on each engine firewall. The firewall shutoff valves close automatically when the fire extinguisher T handles on the instrument panel are pulled out. The firewall shutoff valves receive electrical power from the main buses and also from the battery bus which is connected directly to the battery. The valves are protected by circuit breakers placarded FIRE WALL VALVE I or 2 on the overhead circuit breaker panel (fig. 2-23), and FIREWALL SHUTOFF 1 or 2 on the hot battery bus circuit breaker board.

g. Fuel Tank Sump Drains. A sump drain wrench is provided in the aircraft loose tools to simplify draining a small amount of fuel from the sump drain.

(1) There are five sump drains and one filter drain in each wing. They are 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	Underside of cowling forward of firewall
1	Sump strainer	Bottom center of nacelle forward of wheel well
1	Gravity feed line	Aft of wheel well
1	Aux tank	At wing root just forward of the flap

(2) An additional drain for the extended range fuel system line extends through the bottom of the wing center section adjacent to the fuselage. Anytime the extended range system is in use, a part of the preflight inspection would consist of draining a small amount of fuel from this drain to check for fuel contamination. Whenever the extended range system is removed from the aircraft and the fuel line is capped off in the fuselage, the remaining fuel in the line shall be drained.

h. Fuel Drain Collector System **CD.** Each engine is provided with a fuel drain collector system to return fuel, dumped from the engine during clearing and shutdown operations, back into its respective nacelle tank. The system draws power from the 4 feeder bus and fuel transfer is completely automatic. Fuel from the engine flow divider drains into a collector tank mounted below the aft engine accessory section. An internal float switch actuates an electric scavenger pump which delivers the fuel to the fuel purge line just aft of the fuel purge shutoff valve. A check valve in the line prevents the backflow of fuel during engine purging. The circuit breaker for both pumps is located in the fuel section of the overhead circuit breaker panel; placarded SCAVENGER PUMP. A vent line, plumbed from the top of the collector tank, is routed through an

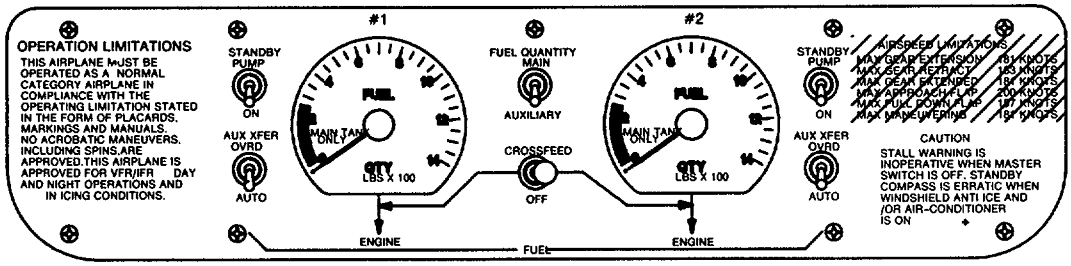


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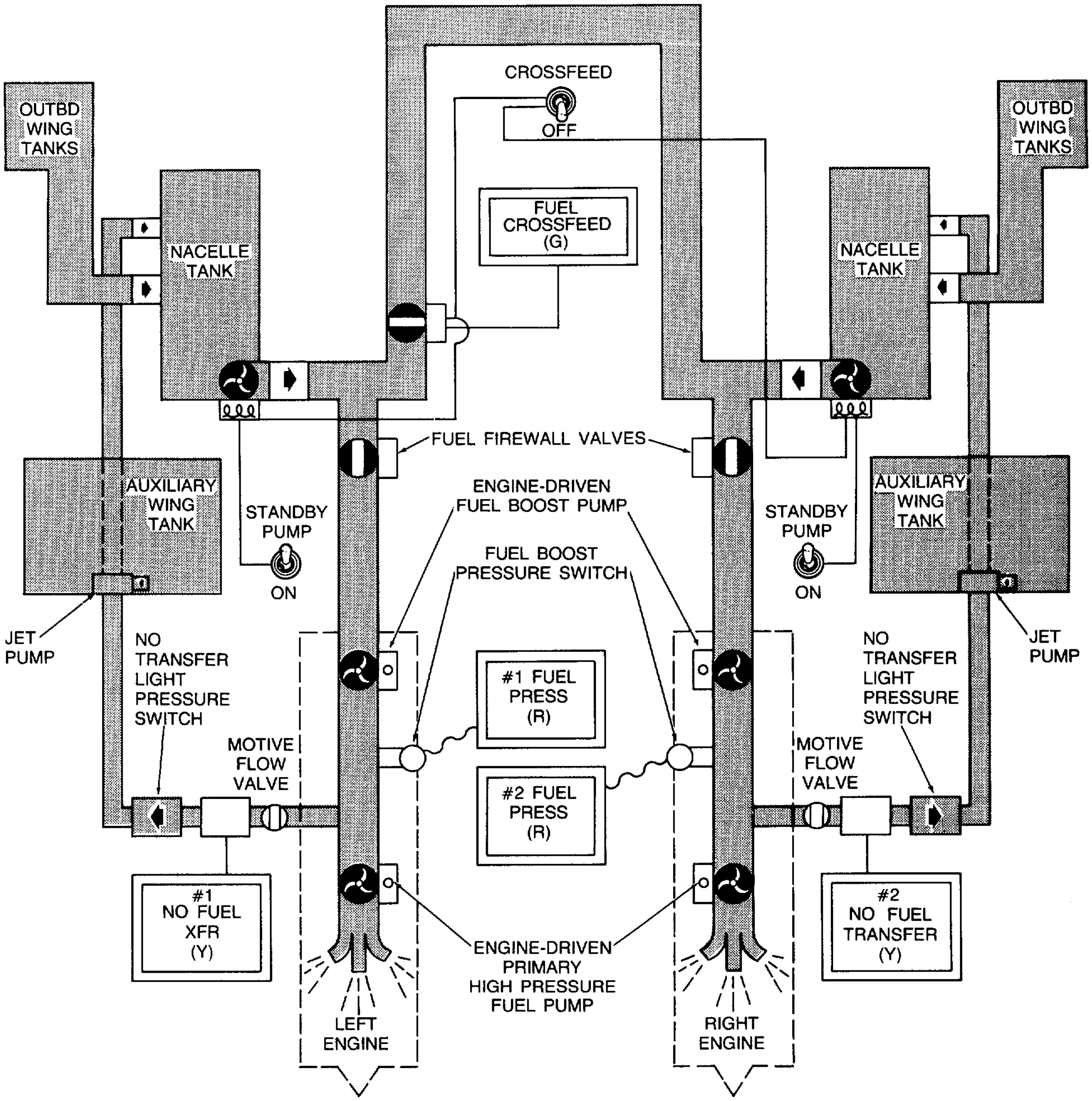
Figure 2-13. Fuel Management Panel **F2** *- Sheet 2 of 2*



NOTE

IN THE EVENT THAT AN ENGINE DRIVEN BOOST PUMP FAILS, PRESSURE CAN BE MAINTAINED BY PLACING THE RESPECTIVE STANDBY PUMP SWITCH TO ON.

NOTE

THE ENGINE-DRIVEN PRIMARY (HIGH PRESSURE) FUEL PUMP IS LIMITED TO 10 HOURS OF OPERATION, THROUGHOUT ITS TBO PERIOD, WITHOUT STANDBY FUEL PUMP OR ENGINE-DRIVEN BOOST PUMP FUEL PRESSURE.

NOTE

THE SYSTEM WILL GRAVITY FEED FUEL ONLY TO ITS RESPECTIVE BOOST PUMP, I.E., LEFT OR RIGHT. FUEL WILL NOT GRAVITY FEED THROUGH THE CROSSFEED SYSTEM.

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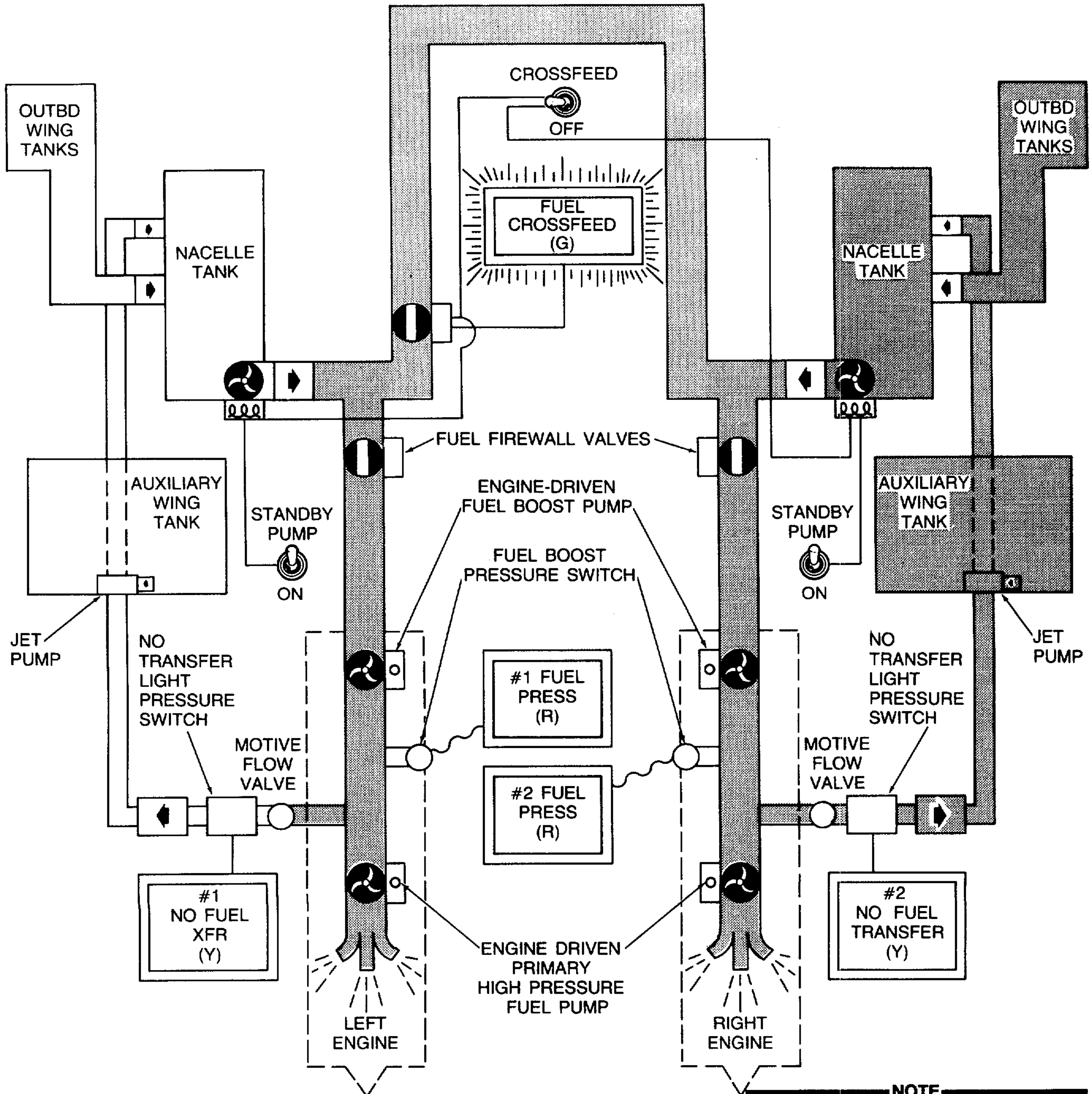
Figure 2-14. Gravity Feed Fuel Flow



NO FUEL FLOW FROM LEFT WING TANKS

NORMAL PRESSURIZED FUEL FLOW FROM RIGHT WING TANKS

NOTE

BOTH STANDBY PUMP SWITCHES WILL BE OFF DURING CROSSFEED OPERATION.

NOTE

THE ENGINE-DRIVEN PRIMARY (HIGH PRESSURE) FUEL PUMP IS LIMITED TO 10 HOURS OF OPERATION THROUGHOUT ITS TBO PERIOD WITHOUT STANDBY FUEL PUMP OR ENGINE-DRIVEN BOOST PUMP FUEL PRESSURE.

NOTE

DIAGRAM SHOWS TYPICAL FUEL CROSSFEED SITUATION WITH RIGHT WING FUEL SYSTEM SUPPLYING BOTH ENGINES (ALL BOOST AND STANDBY PUMPS OPERABLE). FOR SELECTION OF LEFT WING FUEL FOR CROSSFEED REVERSE CROSSFEED SWITCH POSITION. EITHER CONFIGURATION WILL SUPPLY EITHER ENGINE DURING SINGLE-ENGINE OPERATIONS. FUEL WILL NOT CROSSFEED BETWEEN TANK SYSTEMS.

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Figure 2-15. Crossfeed Fuel Flow

inline flame arrestor and then downward to a drain manifold on the underside of the nacelle.

i. Fuel Purge System **F**. Each engine is provided with a fuel purge system. The system is designed to insure that any residual fuel in the fuel manifolds is consumed during engine shutdown. During engine operation, compressor discharge air is routed through a filter and check valve, pressurizing a small air tank mounted on the engine truss mount. On engine shutdown the pressure differential between the air tank and fuel manifolds causes air to be discharged from the air tank, through a check valve, and into manifolds, out through the nozzles and into the combustion chamber. The fuel forced into the combustion chamber is consumed, causing a momentary rise in engine speed.

j. Fuel Vent System. Each fuel system is vented through two ram vents located on the underside of the wing adjacent to the nacelle. To prevent icing of the vent system, one vent is recessed into the wing and the backup vent protrudes out from the wing and contains a heating element. The vent line at the nacelle contains an inline flame arrestor.

k. Engine Oil-to-Fuel Heat Exchanger. An engine oil-to-fuel heat exchanger, located on each engine accessory case, operates continuously and automatically to heat the fuel delivered to the engine sufficiently to prevent the freezing of any water which the fuel might contain. The temperature of the delivered fuel is thermostatically regulated to remain between +21°C and +32°C.

2-38. FUEL SYSTEM MANAGEMENT.

a. Fuel Transfer System. Fuel in the auxiliary tanks will be used first. During transfer of auxiliary fuel, which is automatically controlled, the nacelle tanks are maintained full. A swing check valve in the gravity feed line from the outboard wing prevents reverse fuel flow. Normal gravity transfer of the main wing fuel into the nacelle tanks will begin when auxiliary fuel is exhausted. The system will gravity feed fuel only to its respective side, i.e. left or right (fig. 2-14). Fuel will not graviate through the crossfeed system.

b. Deleted.

c. Operation With Failed Engine-driven Boost Pump or Standby Pump. Two pumps in each fuel system provide inlet head pressure to the engine-driven primary high-pressure fuel pump, and if crossfeed is used, a third pump, the standby fuel pump from the opposite system, will supply the required pressure (fig. 2-15). Operation under this condition will result in an unbalanced fuel load as fuel from one system will be supplied to both engines while all fuel from the system with the failed engine driven and standby boost pumps will remain unused. A triple failure, which is highly unlikely, would result in the engine driven primary pump operating without inlet head pressure. Should this situation occur, the affected engine can continue to operate from its own fuel supply on its engine-driven primary high-pressure fuel pump.

2-39. FERRY FUEL SYSTEM.

Plumbing is installed for connection to long range fuel cells which may be installed in the cabin area.

Section V. FLIGHT CONTROLS

2-40. DESCRIPTION.

The aircraft's primary flight control system consists of conventional rudder, elevator and aileron control surfaces. These surfaces are manually operated from the cockpit through mechanical linkage using control wheels for the ailerons and elevators, and adjustable rudder/brake pedals for the rudder. Both the pilot and copilot have flight controls. Trim control for the rudder, elevator and ailerons is accomplished through a manually actuated cable-drum system for each set of control surfaces. The autopilot has provisions for controlling the position of the ailerons, elevators, elevator trim tab, and rudder. Chapter 3 describes operation of the autopilot system.

2-41. CONTROL WHEELS

a. **C D1** Elevator and aileron control surfaces are operated by manually actuating either the pilot's or copilot's control wheel. Electric switches are installed in the outboard grip of each wheel to operate the elevator trim tabs. These control wheels (fig. 2-16) are installed on each side of the instrument subpanel. A microphone switch is incorporated in each control wheel. A manual wind 8-day clock is installed in the center of each wheel. A map light switch is mounted adjacent to the clock in each wheel (fig. 2-16).

b. **D2** Elevator and aileron control surfaces are operated by manually actuating either the pilot's or copilot's control wheel, or through the automatic flight control system. Electric switches are installed in the grips of the control wheels to operate the elevator trim tabs; to disengage the autopilot yaw damp; to activate the go-around mode (copilot only); press to talk microphone switch; touch control steering and checklist line advancement. A manual wind 8-day clock is installed in the center of each wheel. A map light switch is mounted adjacent to the clock in each wheel (fig. 2-16).

c. **F1** Elevator and aileron control surfaces are operated by manually actuating either the pilot's or copilot's control wheel, or through the automatic flight control system. Electric switches are installed in the grips of the control wheels. The microphone, electric elevator trim, and autopilot/yaw damp disconnect switches are located on the outboard grip of each control wheel. Only a line advance switch is located on the inboard grip of the pilot's wheel. A line advance switch, and a touch control steering switch is located on the inboard grip of the copilot's wheel. A touch control steering switch is located on the outboard grip of the pilot's control wheel. A manually wound 8-day clock is installed in the center of the pilot's wheel, whereas a DC powered digital clock/timer is installed in the center of the copilot's wheel. A map light switch is mounted adjacent to the clock in each wheel (fig. 2-16).

d. **F2** Elevator and aileron control surfaces are operated by manually actuating either the pilot's or copilot's control wheel, or through the automatic flight control system. Electric switches are installed in the grips of the control wheels. The microphone, electric elevator trim, touch control steering (pilot's control wheel), go-around (copilot's control wheel), and autopilot/yaw damp disconnect button/switches are located on the outboard grip of each control wheel. An ident button (pilot's control wheel), map button, and touch control button (copilot's control wheel) are located on the inboard grip. Both control wheels contain identical DC powered digital clock/timers. Each control wheel incorporates a bracket to allow mounting a chart holder (fig. 2-16).

e. *Control Wheel Chart Holder* **F2** An illuminated, quick release chart holder is provided and can be installed on either the pilot's or copilot's control wheel. The chart holder provides a means of securing charts, maps, or small handbooks in an easily accessible and visible location. An L-shaped bracket assembly with a stud-type latch fastener secures the control wheel chart holder to the control wheel. Illumination for reading charts, maps, or handbooks is provided by an adjustable lightbar mounted on the left side of the chart holder. Lights for reading the two digital clocks are located above each clock. Lightbar and clock lights are illuminated by depressing the control wheel map light switch.

When the chart holder is installed the control wheel clock is not visible. However, a battery powered clock/stopwatch and digital timer are provided as part of the chart holder assembly. The clock/stopwatch, located on the upper left portion of the chart holder, indicates 12 (AM/PM) or 24 hour time/date/month/ and may also be used as a stopwatch. The 12 hour time is indicated by an AM or PM flag located on the left side of the display. The digital timer, located on the upper right, serves as a digital stopwatch/elapsed time timer. Depressing the mode select button on the back of the chart holder clamp initiates the clock set, and 12 or 24 hour mode. The SELECT and SET buttons on the chart holder face, are used to set the time, date, and month.

The START/STOP button on the chart holder face is used to start and stop the digital timer. The RESET/LAP button is used to reset the timer to zero, and/or to read elapsed time. Rheostat-type dimmer switches, located behind the clock and timer, regulates light intensity for the lightbar and clocks. The left rheostat controls the lightbar intensity, whereas the right rheostat controls illumination for the clocks.

A power cable supplies electrical power to the chart holder lights when the power cable plug is inserted in the power outlet on either the pilot's or copilot's control wheel. The chart holder electrical circuit is protected through a circuit breaker, placarded SUBPNL & CONSOLE, located on the overhead circuit breaker panel. The clocks operate separately from aircraft power.

The chart holder may be removed from the control wheel and stored as required, however, the mounting brackets remain secured to the control wheels.

2-42. RUDDER SYSTEM.

a. Rudder Pedals. Aircraft directional control and nose wheel steering is accomplished by actuation of the rudder pedals from either pilot's or copilot's station (fig. 2-5). The rudder pedals may be individually adjusted in either a forward or aft position to provide adequate legroom for the pilot and copilot. Adjustment is accomplished by depressing the lever alongside the rudder pedal arm and moving the pedal forward or aft until the locking pin engages in the selected position. Toe brake coverage, is provided in paragraph 2-9.

b. Yaw Damper. A yaw damper system is provided to aid the pilot in maintaining direction stability and increase ride comfort. The system may be used at any altitude and is required for flight above 17,000 feet. It must be deactivated for takeoff and landing and below 200 feet above terrain. The yaw damper system is a part of the auto pilot. Operating instructions for this system are contained in Chapter 3. The system is controlled by a YAW DAMP switch adjacent to the ELEV TRIM switch on the extended pedestal.

c. Rudder Boost. Rudder boost is provided to aid the pilot in maintaining directional stability resulting from an engine failure or a large variation of power between the engines. Incorporated in the rudder cable system are two pneumatic rudder boosting servos that actuate the cables to provide rudder pressure to help compensate for asymmetrical thrust. Rudder boost is not required for flight.

NOTE

Rudder boost may be inoperative when brake deice is on.

(1) 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 closes on the low pressure side which activates 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 overhead control panel to PNEU & ENVIRO - OFF position will disengage the rudder boost system.

NOTE

Condition levers must be in LOW IDLE position to perform rudder boost check.

(2) The system is controlled by a switch located on the extended pedestal below the rudder trim wheel, placarded RUDDER BOOST -ON OFF, and is to be turned on 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 activate the switch to turn on 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. The system is protected by a 5-ampere circuit breaker on the overhead circuit breaker panel placarded RUDDER BOOST (fig. 2-23).

2-43. FLIGHT CONTROL LOCK.

CAUTION

Remove control locks before towing the aircraft or starting engines. Serious damage could result in the steering linkage if towed by a tug with the rudder lock installed.

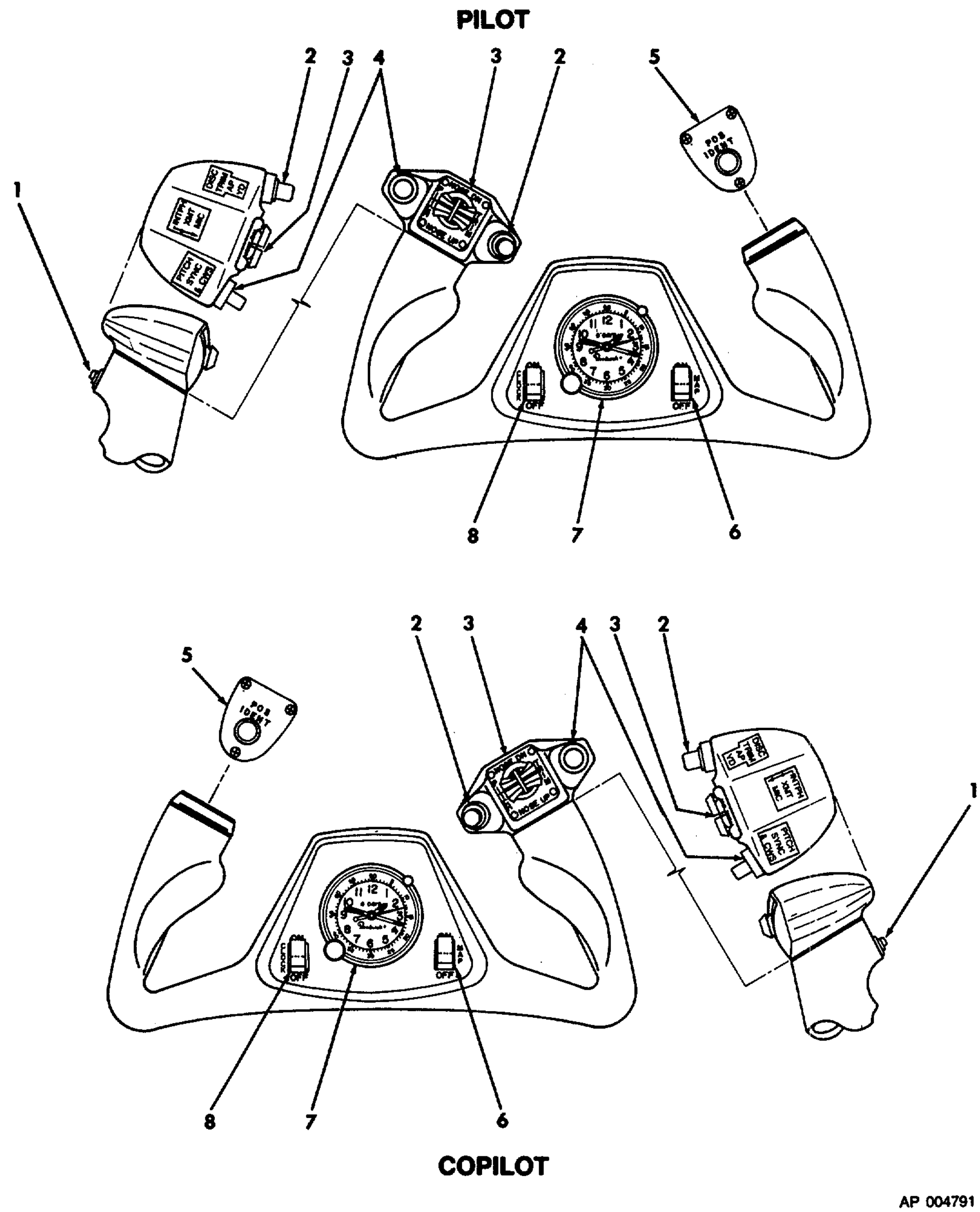
Positive locking of the rudder, elevator and aileron control surfaces, and engine controls (power levers, propeller levers and condition levers) is provided by a removable lock assembly (fig. 2-17) consisting of two pins, and an elongated U-shaped strap interconnected by a chain. Installation of the controls lock is accomplished by inserting the U-shaped strap around the aligned control levers from the copilot's side; then the aileron-elevator locking pin is inserted through a guide hole in the pilot's I control column assembly, thus locking the control wheel. The rudder is held in a neutral position by an L-shaped pin which is installed through a guide hole in the floor aft of the pilots rudder pedals. The rudder pedals must be centered to align the hole in the rudder bellcrank with the guide hole in the floor. Remove the locks in reverse order, i.e., rudder pin, control column pin, and power control clamp.

2-44. TRIM TABS.

Trim tabs are provided for all control surfaces. These tabs are manually activated and are mechanically controlled by a cable-drum and jack screw actuator system, except the right aileron tab which is of the fixed bendable type. Elevator and aileron trim tabs incorporate neutral, non-servo action, i.e., as the elevators or ailerons are displaced from the neutral position, the trim tab maintains an "as adjusted" position. The rudder trim tab incorporates anti-servo action, i.e., as the rudder is displaced from the neutral position the trim tab moves in the same direction as the control surface. This action increases control pressure as rudder is deflected from the neutral position.

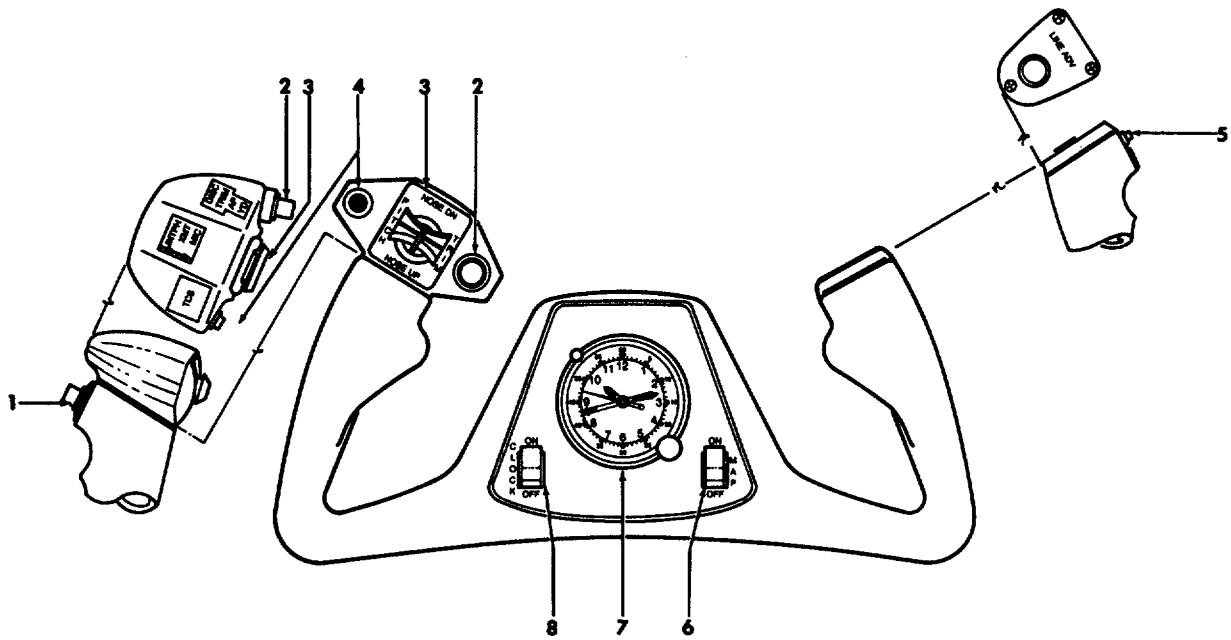
a. Elevator Trim Tab Control. The elevator trim tab control wheel placarded ELEVATOR TAB -DOWN, UP, is on the left side of the control pedestal and controls a trim tab on each elevator (fig. 2-6). The amount of elevator tab deflection, in degrees from a neutral setting, is indicated by a position arrow.

b. Electric Elevator Trim. The electric elevator trim system is controlled by an ELEV TRIM -PUSH ON PUSH OFF switch located on the pedestal, dual element thumb switches on the control wheels, a trim disconnect switch on each control wheel and a circuit breaker on the overhead circuit breaker panel. The PUSH ON PUSH OFF switch must be in the ON position to operate the system. The dual element thumb switch is moved forward for trimming nose down, aft for nose up, and when released returns to the center (off) position. Any activation of the trim system through the copilot's trim switch can be cancelled by activation of the pilot's switch. Operating the pilot's and copilot's switches in opposing directions simultaneously results in no trim action. A preflight check of the switches should be accomplished before flight by moving the switches individually on both control



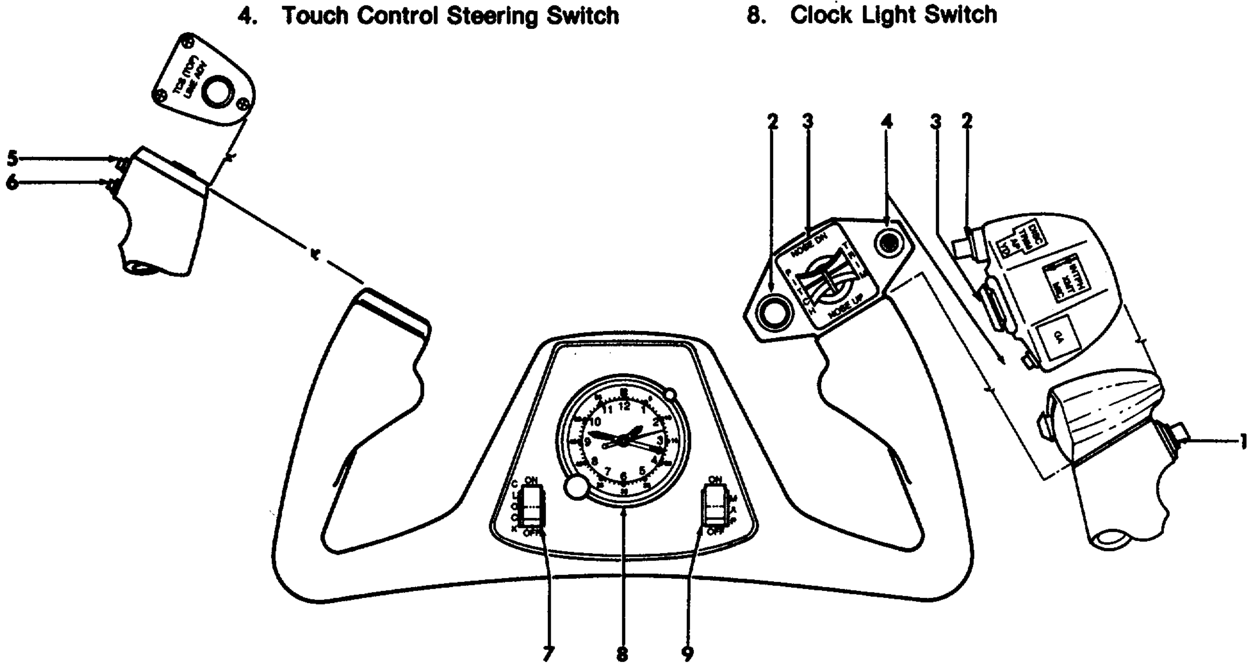
1. Microphone Switch
2. Autopilot/Yaw Damp Disconnect
3. Electric Trim Control Switches
4. Pitch Sync and Control Wheel Steering Switch
5. Transponder Ident Switch
6. Map Light Switch
7. 8-Day Clock

Figure 2-16. Control Wheels **C D1** *- Sheet 1 of 4*



PILOT

1. Microphone Switch
2. Autopilot/Yaw Damp Disconnect Switch
3. Electric Trim Control Switches
4. Touch Control Steering Switch
5. Line Advance Switch
6. Map Light Switch
7. 8-Day Clock
8. Clock Light Switch



COPILOT

1. Microphone Switch
2. Autopilot/Yaw Damp Disconnect Switch
3. Electric Trim Control Switches
4. Go Around Switch
5. Touch Control Steering Switch
6. Line Advance Switch
7. Clock Light Switch
8. 8-Day Clock
9. Map Light Switch

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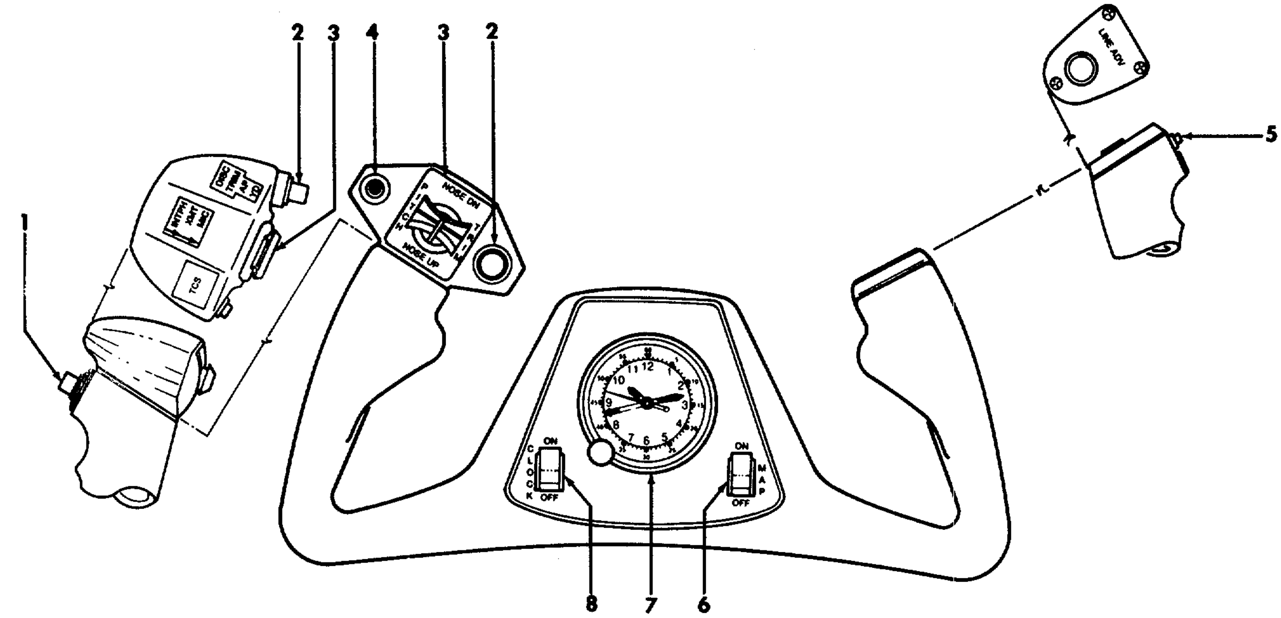
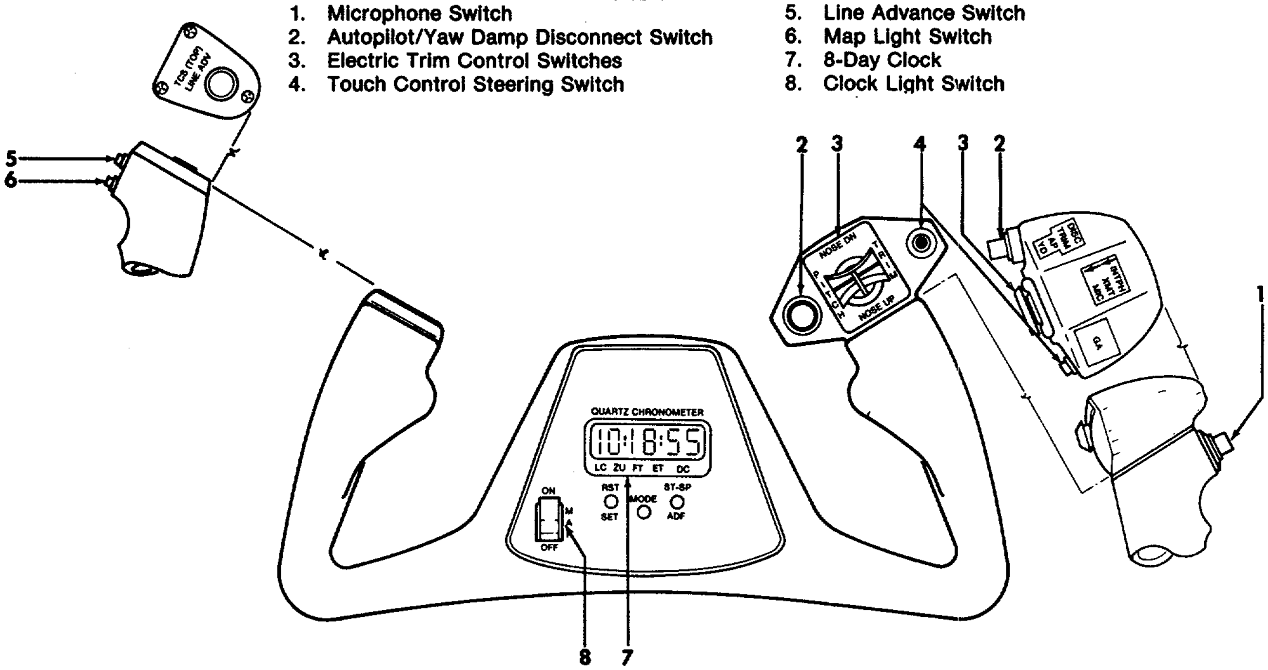
Figure 2-16. Control Wheels **D2** *- Sheet 2 of 4*



PILOT

1. Microphone Switch
2. Autopilot/Yaw Damp Disconnect Switch
3. Electric Trim Control Switches
4. Touch Control Steering Switch
5. Line Advance Switch
6. Map Light Switch
7. 8-Day Clock
8. Clock Light Switch



COPILOT

1. Microphone Switch
2. Autopilot/Yaw Damp Disconnect Switch
3. Electric Trim Control Switches
4. Go Around Switch
5. Touch Control Steering Switch
6. Line Advance Switch
7. Clock
8. Map Light Switch

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Figure 2-16. Control Wheels ***F1*** *- Sheet 3 of 4*

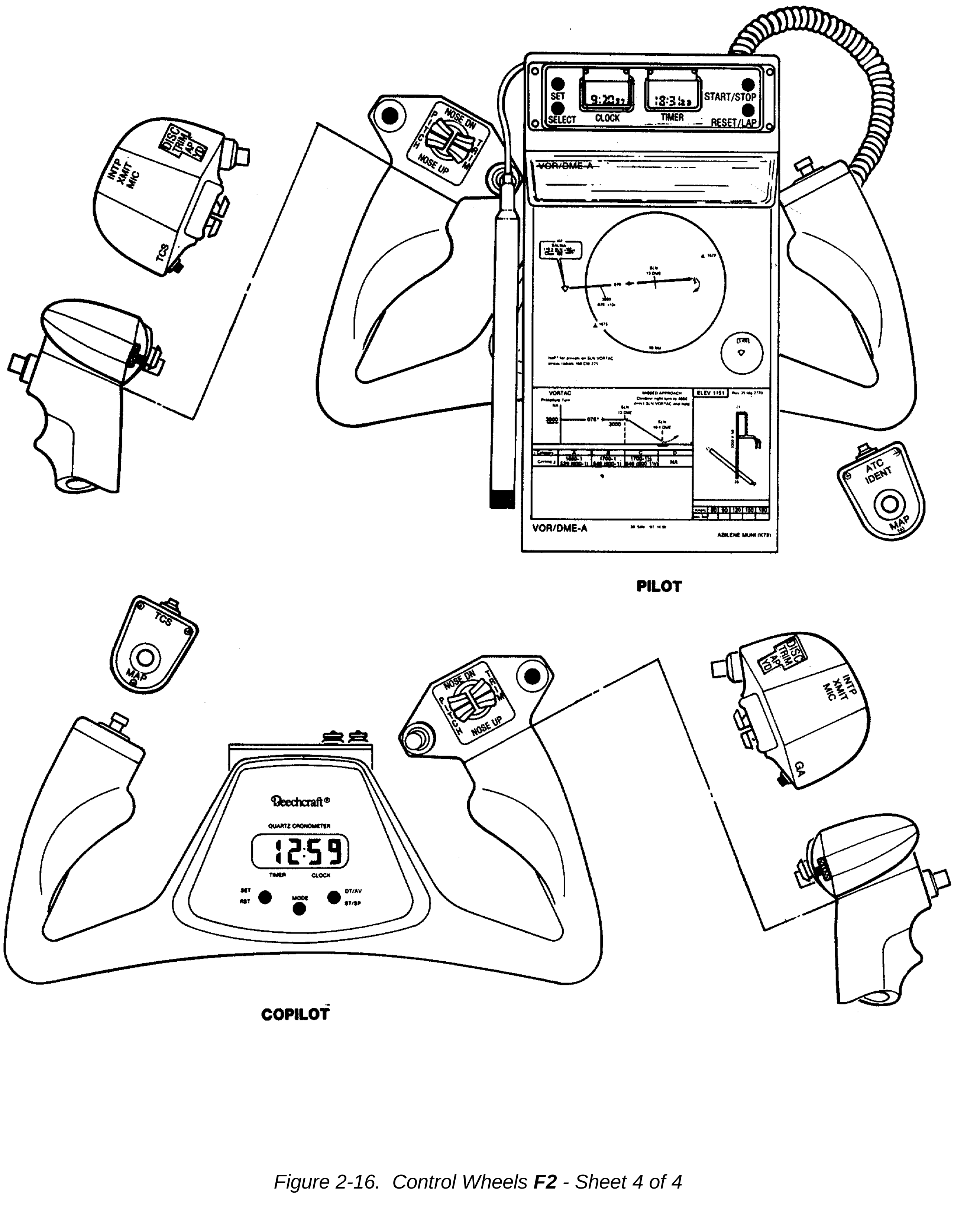


*Figure 2-16. Control Wheels **F2** - Sheet 4 of 4*

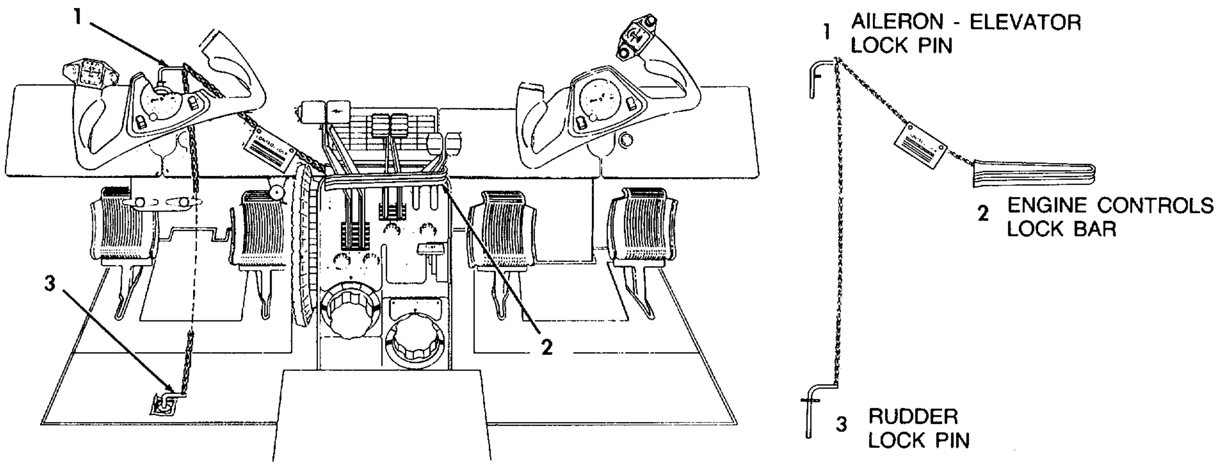


Figure 2-17. Control Lock Installation

wheels. No one switch alone should operate the system; operation of elevator trim should occur only by movement of pairs of switches. The trim system disconnect is a bi-level, push button, momentary type switch, located on the outboard grip of each control wheel. Depressing the switch to the first of two levels disconnects the autopilot and yaw damp system, and the second level disconnects the electric trim system. The system can be reset by pressing the ON OFF switch on the pedestal to ON again. The manual trim control wheel and the electric trim system cannot be used simultaneously.

c . Aileron Trim Tab Control. The aileron trim tab control, placarded AILERON TAB LEFT, RIGHT, is on the control pedestal and will adjust the left aileron trim tab only (fig. 2-6). The amount of aileron tab deflection, from a neutral setting, as indicated by a position arrow, is relative only and is not in degrees. Full travel of the tab control moves the trim tab 7-1/2 degrees up and down.

d Rudder Trim Tab Control. The rudder trim tab control knob, placarded RUDDER TAB -LEFT, RIGHT, is on the control pedestal, and controls adjustment of the rudder trim tab (fig. 2-6). The amount of rudder tab deflection, in degrees from a neutral setting, is indicated by a position arrow.

2-45. WING FLAPS.

The all-metal slot-type wing flaps are electrically operated and consist of two sections for each wing. These sections extend from the inboard end of each aileron to the junction of the wing and fuselage. During extension, or retraction, the flaps are operated as a single unit, each section being actuated by a separate jackscrew actuator. The actuators are driven through flexible shafts by a single, reversible electric motor. Wing flap movement, either up or down, is indicated in percent of travel by a flap position indicator on the subpanel. Full flap extension and retraction time is approximately 11 seconds. The flap control switch is located on the control pedestal. No emergency wing flap actuation system is provided. With flaps extended beyond APPROACH position regardless of power setting, the landing gear warning horn will sound, and the landing gear switch handle lights will illuminate unless the landing gear is down and locked. The circuit is protected by a 20-ampere circuit breaker, placarded FLAP MOTOR, located on the overhead circuit breaker panel (fig. 2-23).

a Wing Flap Control Switch. Flap operation is controlled by a three-position switch with a flapshaped handle on the control pedestal (fig. 2-6). The handle of this switch is placarded FLAP and switch positions are placarded: FLAP UP, APPROACH, and DOWN. The amount of downward extension of the flaps is established by position of the flap switch, and is as follows: UP 0%, APPROACH 40%, and DOWN -100%. Limit switches, mounted on the right inboard flap, control flap travel. The flap control switch, limit switch, and relay circuits are protected by a 5-ampere circuit breaker, placarded FLAP CONTR located on the overhead circuit breaker panel (fig. 2-23). Flap positions between UP and APPROACH cannot be selected. For intermediate flap positions between APPROACH and DOWN, the APPROACH position acts as an off position. To return the flaps to any position between full DOWN and APPROACH place the flap switch to UP and when desired flap position is obtained, return the switch to APPROACH detent. In the event that any two adjacent flap sections extend 3 to 5 degrees out of phase with the other, a safety mechanism is provided to discontinue power to the flap motor.

b. Wing Flap Position Indicator. Flap position in percent of travel from "0" percent (UP) to 100 percent (DOWN), is shown on an indicator, placarded FLAPS below the instrument panel (fig. 2-26). The approach and full down or extended flap position is 14 and 34 degrees, respectively. The flap position indicator is protected by a 5-ampere circuit breaker, placarded FLAP CONTR, located on the overhead circuit breaker panel (fig. 2-23).

Section VI. PROPELLERS

2-46. DESCRIPTION.

A three-bladed aluminum propeller is installed on each engine. The propeller is of the full feathering, constant speed, counter-weighted, reversing type, controlled by engine oil pressure through single action, engine driven propeller governors. The propeller is flange mounted to the engine shaft. 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. Low pitch propeller position is determined by the low pitch stop which is a mechanically actuated, hydraulic stop. Beta and reverse blade angles are controlled by the power levers in the beta and reverse range.

2-47. DELETED

2-48. FEATHERING PROVISIONS.

The aircraft are equipped with both manual and automatic propeller feathering. Manual feathering is accomplished by pulling the corresponding propeller lever aft past a friction detent. To unfeather, the propeller lever is pushed forward into the governing range. An automatic feathering system, will sense loss of torque oil pressure and will feather an unpowered propeller. Feathering springs, will feather the propeller when it is not turning.

a. Automatic Feathering. The automatic feathering system provides a means of immediately dumping oil from the propeller servo to enable the feathering spring and counterweights to start feathering action of the blades in the event of an engine failure. Although the system is armed by a switch on the overhead control panel, placarded AUTOFEATHER ARM OFF TEST, the completion of the arming phase occurs when both power levers are advanced above 90% N1 at which time both indicator light on the caution/advisory annunciator panel indicate a fully armed system. The annunciator panel lights are green and are placarded 1 AUTOFEATHER (left eng) and 2 AUTOFEATHER (right eng). The system will remain inoperative as long as either power levers is retarded below 90% N1 position, unless TEST position of the AUTOFEATHER SWITCH is selected to disable the power lever limit switches. The system is designed for use only during takeoff and landing and should be turned off when establishing cruise climb. During takeoff or landing, should the torque for either engine drop to an indication between 16 21%, the autofeather system for the opposite engine will be disarmed. Disarming is confirmed when the AUTOFEATHER light of the opposite engine becomes extinguished. If torque drops further, to a reading between 9 -14%, oil is dumped from a servo of the affected propeller allowing a feathering spring to move the blades into feathered position. Feathering also causes the AUTOFEATHER light of the feathered propeller to extinguish. At this time, both annunciator AUTOFEATHER lights are extinguished, the propeller of the defective engine has feathered, and the propeller of' the operative engine has been disarmed from the autofeathering capability. Only manual feathering control remains for the second propeller.

b. Propeller Autofeather Switch. Autofeathering is controlled by an AUTOFEATHER switch on the overhead control panel (fig. 2-8). The three position switch is placarded ARM, OFF and TEST, " and is spring-loaded from TEST to OFF. The ARM position is used only during takeoff and landing. At ARM, if engine torque drops below 16-21%, two torque-sensing switches of the affected engine are actuated by loss of torque pressure. Switch actuation applies current through an autofeather relay, to a corresponding dump valve, causing the release of oil pressure which held an established pitch angle on the blades of the affected propeller. Following the release of oil pressure, feathering movement is accomplished by the feathering springs assisted by centrifugal force applied to the blade shank counterweights. The TEST position of the switch, enables the pilot to check readiness of the autofeather systems, below 88% to 92% N1, and is for ground checkout purposes only. Chapter 8 contains normal operating information.

c. Autofeather Lights. Two green lights on the caution/advisory annunciator panel (fig. 2-26) placarded AUTOFEATHER #1 and #2 when illuminated indicate that the autofeather system is armed. Both lights will be extinguished if either propeller has been autofeathered or if the system is disarmed by retarding a power lever. Autofeather circuits are protected by one 5-ampere circuit breaker placarded AUTO FEATHER, located on the overhead circuit breaker panel (fig. 2-23).

2-49. PROPELLER GOVERNORS.

Two governors, a constant speed (primary) governor, and an overspeed governor, control the propeller rpm. The constant speed governor, mounted on top of the reduction housing, control 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 2000 rpm, the overspeed governor cuts in at 2080 rpm and dumps oil from the propeller to keep the rpm from exceeding approximately 2080 rpm. A solenoid, actuated by the PROP GOV TEST switch located on the overhead control panel, is provided for resetting the overspeed governor to approximately 1830 to 1910 rpm for test purposes. If the propeller sticks or moves too slowly during a transient condition causing the propeller governor to act too slowly to prevent an overspeed condition, the power turbine governor, contained within the constant speed governor housing, acts as a fuel topping governor. When the propeller RPM reaches 2120, the fuel topping governor limits the fuel flow to the gas generator, thereby reducing the power driving the propeller. During operation in the reverse range, the power turbine 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.

2-50. PROPELLER TEST SWITCHES.

Two-position propeller governor test switch(s) on the overhead control panel (fig. 2-8), are provided for operational test of the propeller systems. The switch(s), control test circuits for the corresponding propeller. In the test position, the switch(s) are used to test the function of the corresponding overspeed governor. Refer to Chapter 8, for steps of test procedures. Propeller test circuits are protected by one 5ampere circuit breaker, placarded PROP GOV, located on the overhead circuit breaker panel (fig. 223).

2-51. PROPELLER SYNCHROPHASER SYSTEM.

a. ***CD*** *Description.* 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 range of control 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 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 to the right propeller to match the left, the actuator has reached the end of its travel. To recenter, turn the switch off, synchronize the propellers manually, and turn the switch back on.

(1) *Control Box.* 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 propeller 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.

b. ***I*** Description. The propeller synchrophaser automatically matches the RPM of both propellers, and maintains a preset phase angle relationship between the left and right engine. Input signal pulses, occurring once per revolution, are obtained from magnetic pickups (located on brackets bolted to the front of the engine) when the target (mounted on the aft side of the spinner bulkhead) passes the magnetic pickup. A control box converts this signal pulse rate difference into correction commands, which are transmitted to the appropriate governor. Speed trim is accomplished by pulse width modulation of an electro-magnetic coil in each governor. The electro-magnetic coil can increase, but not decrease, the speed set by the propeller control level. The RPM of one engine will follow the changes in RPM of the other engine over a predetermined range (approximately 20 RPM). A toggle switch, placarded PROP SYN-ON-OFF, installed near the synchroscope, turns the system ON. To operate the system, synchronize the propellers in the normal manner and turn the synchrophaser ON. To change RPM, adjust both propellers at the same time. This will keep the setting within the limited range of the system. The propeller synchrophaser may be used on takeoff at the pilot's option. However, the limited range of the synchrophaser will be reduced near maximum propeller RPM.

2-52. SYNCHROSCOPE.

A propeller synchroscope, located on the pilot's instrument panel, provides 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. The system is protected by a 5-ampere circuit breaker placarded PROP SYNC, located on the overhead circuit breaker panel (fig. 2-23).

2-53. PROPELLER LEVERS.

Two propeller levers on the control pedestal (fig. 2-6), placarded PROP, an, used to regulate propeller speeds. Each lever controls a primary governor, which acts to regulate propeller speeds within the normal operation range. The full levers forward position is placarded TAKEOFF, LANDING AND REVERSE and also HIGH RPM. Full levers aft position is placarded FEATHER. When a lever is placed at HIGH RPM, the propeller may attain a static RPM of 2000, depending upon power lever position. As a lever is moved aft, passing through the propeller governing range, but stopping at the feathering detent, propeller RPM will correspondingly decrease to the lowest limit. Moving a propeller lever aft past the detent into FEATHER will feather the propeller.

2-54. PROPELLER REVERSING.

CAUTION

Do not move the power levers into reverse range without the engine running. Damage to the reverse linkage mechanism will occur.

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.

The propeller blade angle may be reversed to shorten landing roll. To reverse, propeller levers must be positioned at HIGH RPM (full forward), and the power levers are lifted up to pass over an IDLE detent, then pulled aft into REVERSE setting. Power levers must be pulled back through normal idle speed range before being positioned in REVERSE. One yellow caution light, placarded REV NOT READY, on the caution/advisory annunciator panel (fig. 2-26), alerts the pilot not to reverse the propellers. This light illuminates only when the landing gear handle is down, and if propeller levers are not at HGH RPM (full forward). This circuit is protected by a 5-ampere circuit breaker, placarded LANDING GEAR RELAY, located on the overhead circuit breaker panel (fig. 2-23).

2-55. PROPELLER TACHOMETERS.

Two tachometers on the instrument panel register propeller speed in hundreds of RPM (fig. 2-26). Each indicator is slaved to a tachometer generator unit attached to the corresponding engine.

2-56. DEFROSTING SYSTEM.

a. *Description.* The defrosting system is an integral part of the heating and ventilation system. The system consists of two warm air outlets connected by ducts to the heating system. One outlet is just below the pilot's windshield and the other is below the copilot's windshield. A push-pull control, placarded DEFROST AIR, on the pilot's subpanel (fig. 2-7), manually controls airflow to the windshield. When pulled out, defrosting air is ducted to the windshield. As the control is pushed in, there is a corresponding decrease in airflow.

b. Automatic Operation.

1. Vent blower switches As required.
2. Cabin Air Mode switch AUTO.
3. Cabin Air Temp control As required.

4. Cabin air, copilot air, pilot air, and defrost air controls As required.

c. Manual Operation.

1. Pilot air, copilot air In.
2. Cabin air and defrost air controls Out.
3. Cabin air mode switch MAN HEAT.
4. Cold air outlets As required.
5. Cabin air manual temp switch As required.

2-57. SURFACE DEICER SYSTEM.

a. Description. Ice accumulation is removed from each inboard and outboard wing leading edge, and both horizontal stabilizers by the flexing of deicer boots which are pneumatically actuated. Engine bleed air, from the engine compressor, is used to supply air pressure to inflate the deicer boots, and to supply vacuum, through the ejector system, for boot hold down during flight. A pressure regulator protects the system from over inflation. When the system is not in operation, a distributor valve applies vacuum to the boots for hold-down.

b. Operation.

(1) Deice boots are intended to remove ice after it has formed rather than prevent its formation. For the most effective deicing operation, allow at least 1/2 inch of ice on the boots to form before attempting ice removal. Very thin ice may crack and cling to the boots instead of shedding.

NOTE

Never cycle the system rapidly, this may cause the ice to accumulate outside the contour of the inflated boots and prevent ice removal.

(2) A three position switchon the overhead control panel placarded DEICE MANUAL OFF SINGLE CYCLE AUTO, controls the deicing operation. The switch is spring loaded to return to the OFF position from SINGLE CYCLE AUTO or MANUAL. When the SINGLE CYCLE AUTO 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 horizontal stabilizer boots. When these boots have inflated and deflated, the cycle is complete.

(3) If the switch is held in the MANUAL position, 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.

(4) Either engine is capable of providing sufficient bleed air for all requirements of the surface deicer system. Check valves in the bleed air and vacuum lines prevent backflow through the system during single-engine operation. Regulated pressure is indicated on a gage, placarded PNEUMATIC PRESSURE, located on the copilot's subpanel (fig. 2-7).

2-58. PROPELLER ELECTROTHERMAL DEICER SYSTEM *C D F1*

a Description. Electrothermal deicer boots are cemented to each propeller blade to prevent ice formation or to remove ice from the propellers. Each thermal boot consists of one outboard and one inboard heating element, and receives electrical power from the deicer timer. This timer sends current to all propeller thermal boots and prevents the deicers from overheating by limiting the time each element is energized. Four intervals of approximately 30 seconds each complete one cycle. Current consumption is monitored by a propeller ammeter on the copilot's subpanel (fig. 2-7). Two 20-ampere circuit breakers placarded PROP ANTI ICE LEFT and RIGHT, on the overhead circuit breaker panel (fig. 2-23), protect the propeller electrothermal deicer system.

b Normal Operation. A control switch on the overhead control panel placarded PROP -OFF AUTO is provided to activate the automatic system. A deice ammeter on the right subpanel registers the amount of current (14 to 18-amperes) passing through the system being used. During AUTO operation, power to the timer will be cut off if the current rises above 20-amperes. Current flows from the timer to the brush assembly and then to the slip rings installed on the spinner backing plate. The slip rings carry the current to the deice boots on the propeller blades. Heat from the boots reduces the grip of the ice which is then thrown off by centrifugal force, aided by the air blast over the propeller surfaces. Power to the two heating elements on each blade, the inner and outer element, is cycled by the timer in the following sequence: right propeller outer element, right propeller inner element, left propeller outer element, left propeller inner element. Loss of one heating element circuit on one side does not mean that the entire system must be turned off. Proper operation can be checked by noting the correct level of current usage on the ammeter. An intermittent flicker of the needle approximately each 30 seconds indicates switching to the next group of heating elements by the timer.

c. Alternate Operation. The manual prop deice system is provided as a backup to the automatic system. A control switch located on the overhead control panel, placarded PROP INNER OUTER, controls the manual override relays. When the switch is in the OUTER position, the automatic timer is overridden and power is supplied to the outer heating elements of both propellers simultaneously. The switch is of the momentary type and must be held in position until the ice has been dislodged from the propeller surface. After deicing with the outer elements, the switch is to be held in the INNER position to perform the same function for the inner elements of both propellers. The loadmeters will indicate approximately a 5% increase of load per meter when manual prop deice is operating. The prop deice ammeter will not indicate any load in the manual mode of operation.

2-58A. PROPELLER ELECTRIC DEICE SYSTEM F2

a. Description. The propeller electric deicer system consists of electrically heated single element deice boots, slip ring and brush block assemblies, prop ammeter, a timer for automatic operation, three power distribution panel circuit breakers, two prop deice control circuit breakers and two system switches. The system utilizes a metal foil-type single heating element energized by DC voltage. Heat from the elements dislodge the ice formed on the blades, and the ice is thrown off by centrifugal force.

CAUTION

Propeller deice should not be operated when the propellers are not turning. Static operation may damage the brushes and slip ring.

b. Automatic Operation. The automatic deice system is controlled by a two position toggle switch, placarded PROP AUTO (off) ON, located on the overhead control panel. When the switch is placed in the ON position, the propeller ammeter, located on the copilot's inboard subpanel, indicates the current (14 to 18 amperes load) passing through the system, per propeller cycle.

Direct current (DC) flows from the automatic timer to the brush block assembly mounted on the front of the engine case. The brush assembly conducts the current to the slip rings installed on the

propeller spinner bulkhead. The slip rings distribute the current to all heating elements on one propeller. The timer then diverts the current to all heating elements on the other propeller for the same length of time. The timer switches every 90 seconds, resulting in a complete cycle of approximately 3 minutes. The cycles will continue as long as the AUTO switch is in the ON position. The AUTO deice switch is protected by a 5-ampere circuit breaker, placarded PROP ANTI ICE AUTO, located on the overhead circuit breaker panel. The AUTO mode circuit is protected by a circuit breaker located on the DC power distribution panel.

c. Manual Operation. The manual deice system is provided as a backup to the automatic system. The control switch for the manual system is located in the ICE & RAIN group of the overhead control panel, and is placarded PROP MANUAL (Off) ON. This switch is a momentary spring loaded type, and must be held 'to the ON position until the ice has been dislodged from the propeller. When the switch is held to the ON position the automatic timer is overridden, and power is supplied to all elements of both propellers simultaneously. During use of the manual mode, the PROP AMMETER will not indicate any load; however, both aircraft loadmeters will indicate an approximate 0.5 load increase. The manual deice switch is protected by a 5-ampere circuit breaker, placarded PROP ANTI ICE MANUAL, located on the overhead circuit breaker panel. The manual deice circuits are protected by two circuit breakers, located on the DC power distribution panel.

2-59. PITOT AND STALL WARNING HEAT SYSTEM.

CAUTION

Pitot heat should not be used for more than 15 minutes while the aircraft is on the ground. Overheating may damage the heating elements.

a. Pitot Heat. Heating elements are installed in the pitot masts located on the nose. Each heating element is controlled by an individual switch placarded PITOT ON LEFT or RIGHT, located on the overhead control panel (fig. 2-8). 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. Circuit protection is provided by two 7.5-ampere circuit breakers, placarded PITOT HEAT, on the overhead circuit breaker panel (fig. 2-23).

CAUTION

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.

b Stall Warning Heat. 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 overhead control panel placarded STALL WARN. The level of heat is minimal for ground operation but is automatically increased for flight operation through the landing gear safety switch. Circuit protection is provided by a 15-ampere circuit breaker, placarded STALL WARN, on the overhead circuit breaker panel (fig. 2-23).

2-60. STALL WARNING SYSTEM. The stall warning system consists of a transducer, a lift computer, a warning horn, and a test switch. Angle of attack if sensed by aerodynamic pressure on the lift 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 a switch placarded STALL WARN TEST OFF LDG GEAR WARN TEST on the right subpanel (fig. 2-7). Holding this switch in the STALL WARN TEST position actuates the warning horn by moving the transducer vane. The circuit is protected by a 5-ampere circuit breaker, placarded STALL WARN, on the overhead circuit breaker panel.

2-61. BRAKE DEICE SYSTEM.

a. Description. A heated-air brake deice system may be used on the ground or in flight with gear retracted or extended. When activated, hot air is diffused by means of a manifold assembly over the brake discs in each wheel. Manual and automatic controls are provided. There are two primary occasions which require brake deicing. The first is when an aircraft has been parked in a freezing atmosphere allowing the brake systems to become contaminated by freezing rain, snow or ice, and the aircraft must be moved or taxied. The second occasion is during flight through icing conditions with wet brake assemblies presumed to be frozen, which must be thawed prior to landing to avoid possible tire damage and loss of directional control. Hot air for the brake deice system comes from the compressor stage of both engines obtained by means of a solenoid valve attached to the bleed air system which serves both the surface deice system and the pneumatic systems operation.

b. Operation. A switch on the overhead control panel, placarded BRAKE DEICE, controls the solenoid valve by routing power through a control module box under the aisleway floorboards. When the switch is on, power from a 5-ampere circuit breaker on the overhead circuit breaker panel is applied to the control module. A 10-minute timer limits operation and avoids excessive wheel well temperatures when the landing gear is retracted. The control module also contains a circuit to the green BRAKE DEICE ON annunciator light, and has a resetting circuit interlocked with the gearuplock switch. When the system is activated, the BRAKE DEICE ON light should be monitored and the control switch selected OFF after the light extinguishes otherwise, on the next gear extension the system will restart without pilot action. The control switch should also be selected OFF, if deice operation fails to self-terminate after about 10 minutes. If the automatic timer has terminated brake deicer operation after the last retraction of the landing gear, the landing gear must be extended in order to obtain further operation of the system.

(1) BLEED AIR FAIL lights may momentarily illuminate during simultaneous operation of the surface deice and brake deice systems at low N1 speeds. If lights immediately extinguish, they may be disregarded.

(2) During certain ambient conditions, use of the brake deice system may reduce available engine power, and during flight will result in a TGT rise of approximately 20°C. Appropriate performance charts should be consulted before brake deice system use. If specified power cannot be obtained without exceeding limits, the brake deice system must be selected off until after take-off is completed. TGT limitations must also be observed when setting climb and cruise power. The brake deice system is not to be operated above 15°C ambient temperature. The system is not to be operated for longer than 10 minutes (one deicer cycle) with the landing gear retracted. If operation does not automatically terminate after approximately 10 minutes following gear retraction, the system must be manually selected off. During periods of simultaneous brake deice and surface deice operation, maintain 85% N1 or higher. If inadequate pneumatic pressure is developed for proper surface deicer boot inflation, select the break deice system off. Both sources of pneumatic bleed air must be in operation during brake deice system use. Select the brake deice system off during single-engine operation. Circuit protection is provided by a 5-ampere circuit breaker, placarded BRAKE DEICE, on the overhead circuit breaker panel (fig. 2-23).

2-62. FUEL SYSTEM ANTI-ICING.

a. Description. An oil-to-fuel heat exchanger, located on each engine accessory case, operated continuously and automatically to heat the fuel sufficiently to prevent freezing of any water in the fuel. No controls are involved. Two external fuel vents are provided on each wing. One is recessed to prevent ice formation; the other is electrically heated and is controlled by two toggle switches on the overhead control panel placarded FUEL VENT ON, LEFT or RIGHT (fig. 2-8). They are protected by two 5-ampere circuit breakers, placarded FUEL VENT HEAT, RIGHT or LEFT, located on the overhead circuit breaker panel (fig. 2-23). Each fuel governing line is protected against ice by an electrically heated jacket. A 7.5-ampere circuit breaker located on the overhead circuit breaker panel, placarded FUEL CONTR HEAT, LEFT or RIGHT (fig. 2-23) protects the heater. The bleed air pneumatic line is protected against ice by wrap insulation.

CAUTION

To prevent overheat damage to electrically heated anti-ice jackets, FUEL VENT heat switches should not be turned ON unless cooling air will soon pass over the jackets.

b. Normal Operation. For normal operation, switches for the FUEL VENTS anti-ice circuits are turned ON as required during the BEFORE TAKEOFF procedures. Chapter 8 contains normal operations.

2-63. WINDSHIELD ELECTROTHERMAL ANTI-ICE SYSTEMS.

a. Description. Both pilot and copilot windshields are provided with an electrothermal anti-ice system. Each windshield is part of an independent electrothermal anti-ice system. Each system is comprised of the windshield assembly with heating wires sandwiched between glass panels, a temperature sensor attached to the glass, an electrothermal controller, two relays, a control switch, and two circuit breakers. Two switches, placarded WSHLD ANTIICE NORMAL OFF HI PILOT, COPILOT, are located on the overhead control panel (fig. 2-8). Each switch controls one electrothermal windshield system. The NORMAL position energizes only the low power mode. The HI position energizes the high power mode. When energized, the system cycles ON at 94 + 6°F and OFF at 105 + 5°F. The circuits of each system are protected by a 5-ampere circuit breaker which are not accessible to the flight crew. The 50-ampere circuit breakers are located in the power distribution panel under the floor ahead of the main spar. The 5-ampere circuit breakers are located on panels forward of the instrument panel.

b. Normal Operation. Two levels of heat are provided through the three position switches placarded NORMAL in the aft position, OFF in the center position, and HI after lifting the switch over a detent and moving it to the forward position. In the NORMAL position, heat is provided for the major portion of each windshield. In the HI position, heat is provided at a higher watt density to a smaller portion of the windshield. The lever lock feature prevents inadvertent switching to the HI position during system shutdown.

NOTE

Erratic operation of the magnetic compass may occur while windshield heat is being used.

2-64. PRESSURIZATION SYSTEM.

a. Description. A mixture of bleed air from the engines, and ambient air, is available for pressurization to the cabin at a rate of approximately 10 to 17 pounds per minute. Approximately 75% N_1 is required for normal pressurization. Approximately 85% N_1 ***CD*** is required when operating with one engine. The flow control unit of each engine controls the bleed air from the engine to make it usable for pressurization, by mixing ambient air with the bleed air depending upon aircraft altitude and ambient temperature. On take-off, excessive pressure bumps are prevented by landing gear safety switch actuated solenoids incorporated in the flow control units. These solenoids, through a time delay, stage the input of ambient air flow by allowing ambient air flow introduction through the left flow control unit first, then 4 seconds later, air flow through the right flow control unit.

b. Pressure Differential. ***C D F 1*** The pressure vessel is designed for a normal working pressure differential of 6.0 PSI, which will provide a cabin pressure altitude of 3870 feet at an aircraft altitude of 20,000 feet, and a nominal cabin altitude of 9840 feet at an aircraft altitude of 31,000 feet.

b.a. Pressure Differential.***F2*** The pressure vessel is designed for a normal working pressure differential of 6.5 PSI, which will provide a cabin pressure altitude of 8,000 feet at an aircraft altitude of 29,700 feet, and a cabin altitude of 10,000 feet at an aircraft altitude of 34,000 feet. At an altitude of 35, 000 feet the aircraft will have a 10,400 foot cabin.

c. Cabin Altitude and Rate-of-Climb Controller ***CD1.*** A control panel is installed on the copilot's side of the instrument panel for operation of the system. A knob (fig. 2-26), placarded INCR RATE controls the rate of change of pressurization. A control, placarded CABIN CONTROLLER is used to set desired cabin altitude. For proper cabin pressurization the CABIN CONTROLLER should be set 500 feet above cruise altitude. For landing select 500 feet above field pressure altitude. The selected altitude is displayed on a mechanically coupled dial above the control, placarded CABIN ALTFT. Mechanically coupled to the cabin altitude dial is a second dial, placarded ACFT X 1000. This dial indicates the maximum altitude the aircraft may be flown at to maintain the desired cabin altitude without exceeding the design pressure differential. A switch, placarded CABIN PRESS DUMP-PRESSTEST, is provided to control pressurization. The switch is spring loaded to the PRESS position. In the DUMP position, the safety valve will be opened and the cabin will be depressurized to the aircraft altitude. In the PRESS position, cabin altitude is controlled by the CABIN ALT control. In the TEST position, the landing gear safety switch is bypassed to enable testing of the pressurization system on the ground. Operating instructions are contained in Chapter 8.

d. Cabin Altitude and Rate-of-Climb Controller ***D2 F1*** A control panel is installed on the U pedestal for operation of the system. A knob placarded RATE-MIN-MAX controls pressurization rate of change. A control, placarded CABIN ALT is used to set desired cabin altitude. For proper cabin pressurization the CABIN ALT should be set 500 feet above cruise altitude. For landing, select 500 feet above field pressure altitude. The selected altitude is displayed on a mechanically coupled dial above the control, placarded CABIN ALT 1000 FT. Mechanically coupled to the cabin altitude dial is a second dial, placarded ACFT ALT 1000. This dial indicates the maximum altitude the aircraft-may be flown to maintain the desired cabin altitude without exceeding the design pressure differential. A switch, placarded CABIN PRESS DUMP-PRESS-TEST, is provided to control pressurization. The switch is spring loaded to the PRESS position. In the DUMP position, the safety valve will be opened and the cabin will be depressurized to the aircraft altitude. In the PRESS position, cabin altitude is controlled by the CABIN ALT control. In the TEST position, the landing gear safety switch is bypassed to enable testing of the pressurization system on the ground. Operating instructions are contained in Chapter 8.

d.a. Pressurization Controller ***F2.*** The pressurization controller, located on the pedestal extension, provides a display of the selected altitude; an altitude selector, and a rate control selector. The cabin and aircraft altitude display is a mechanically coupled dial. The outer scale, (CABIN ALT) of the display, indicates the selected cabin altitude; the inner scale (ACFT ALT) indicates the corresponding altitude at which the maximum differential pressure would occur. The indicated value on each scale is read per placard ALT-FT XI000. The rate control selector, placarded RATE INC, regulates the rate at which cabin pressure ascends or descends to the selected altitude. The rate change selected may be from 200 to 2000 feet per minute.

e. Cabin Rate-of-Climb Indicator ***C D1.*** An indicator, placarded CABIN CLIMB, is installed in the instrument panel (fig. 2-26), above the cabin altitude and rate-of-climb controller. It is calibrated in thousands-of-feet per-minute change in cabin altitude.

f. Cabin Rate-of-Climb Indicator ***D2 F*****.** An indicator, placarded CABIN CLIMB, is installed just

ahead of the control quadrant. It is calibrated in thousands-of-feet per-minute change in cabin altitude.

g. Cabin Altitude Indicator ***C D1***. An indicator, placarded CABIN ALT, is installed in the instrument panel (fig. 2-26) above the cabin rate-of climb indicator. The longer needle indicates aircraft altitude in thousands-of-feet on the outside dial. The shorter needle indicates pressure differential in PSI (pounds-per-square-inch) on the inner dial. Maximum differential is 6.1 PSI.

h Cabin Altitude Indicator ***D2 F*** An indicator, placarded CABIN ALT, is installed just ahead of the control quadrant. The longer needle indicates aircraft altitude in thousands-of-feet on the outside dial. The shorter needle indicates pressure differential in PSI (pounds-per-square-inch) on the inner dial. Maximum differential is 6.1 PSI.

NOTE

Maximum differential for C-12***F2*** aircraft is 6.5 +PSI.

i. Outflow Valve. A pneumatically operated outflow valve, located on the aft pressure bulkhead, maintains the selected cabin altitude and rate-of climb commanded by the cabin rate-of-climb and altitude controller. As the aircraft climbs, the controller modulates the outflow valve to maintain a selected cabin rate of climb and increases the cabin differential pressure until the maximum cabin pressure differential is reached. At a cabin altitude of 12, 500 feet, a pressure switch mounted on the back of the overhead control panel completes a circuit to illuminate a red warning annunciator light, ALT WARN, to warn of operation requiring oxygen.

j. Safety Valve. Before take-off, the safety valve is open with equal pressure between the cabin and the outside air. The safety valve closes on lift off if the CABIN PRESS DUMP switch is in the PRESS mode. The safety valve adjacent to the outflow valve provides pressure relief in the event of a failure of the outflow valve. This valve is also used as a dump valve and is opened by vacuum which is controlled by a solenoid valve operated by the CABIN PRESS DUMP switch adjacent to the controller. It is also wired through a landing gear safety switch. If either of these switches is open, or the vacuum source or electrical power is lost, the safety valve will close to atmosphere except at maximum pressure differential of 6.1 PSI.

NOTE

C-12 ***F2*** M aircraft have a maximum pressure differential of 6.5PSI.

A screen in the safety valve should be cleaned at 1000 hour intervals. A negative pressure relief diaphragm is also incorporated into the outflow and safety valves to prevent outside atmospheric pressure from exceeding cabin pressure during rapid descent.

k. Drain. A drain in the outflow valve static control line is provided for removal of accumulated moisture. The drain is located behind the lower sidewall upholstery access panel in the baggage section of the aft compartment.

I. Flow Control Unit. A flow control unit forward of the firewall in each nacelle controls bleed air flow and the mixing of ambient air to make up the total air flow to the cabin for pressurization, heating, and ventilation. This unit is fully pneumatic except for an integral electric solenoid firewall shutoff valve controlled by the BLEED AIR VALVE switches on the overhead control panel (fig. 2-8) and a normally open solenoid operated by the landing gear safety switch which controls the introduction of ambient air flow to the cabin on take-off.

(1) The unit receives bleed air from the engine into an ejector which draws ambient air into the venturi of the nozzle. The mixed air is then forced into the bleed air line routed to the cabin.

(2) Bleed air flow is controlled automatically. When the aircraft is on the ground, circuitry from the landing gear safety switch prevents ambient air from entering the flow control unit to provide maximum heating.

(3) The bleed air firewall shutoff valve in the control unit is a spring loaded, bellows operated valve that is held in the open position by bleed air pressure. When the electric solenoid is shut off, or when bleed air diminishes on engine shutdown (in both cases the pressure to the firewall shutoff valve is cut off), the firewall valve closes.

2-65. OXYGEN SYSTEM *C*

WARNING

Do not smoke while oxygen is in use.

a. Description. The oxygen system provided a sufficient supply of oxygen for the pilot, copilot and nine cabin outlets to permit a descent from 31, 000 feet down to 13,000 feet pressure altitude. The system is a constant flow-type for the nine passenger outlets. The pilot and copilot utilize diluter-demand/ 100% masks (fig. 2-18). A 49 cubic foot, lightweight supply cylinder is installed behind the aft pressure bulkhead. The oxygen gage on the copilot's subpanel gives direct readout of cylinder pressure. The pressure regulator and control valve are adjacent to the supply cylinder and are activated by a remote pushpull knob located in the cockpit, immediately aft of the overhead circuit breaker panel. Pulling the knob placarded SYSTEM PULL-ON CREW READY supplies oxygen to the pilot, copilot and aft toilet compartment outlets. Adjacent to the system control knob is another push-pull knob placarded CABIN

PULL-ON PASS READY. This actuates the on-off valve supplying oxygen to the eight cabin outlets. The cabin and aft toilet compartment outlets are located on individual overhead service panels at each seat station. A placard on the overhead oxygen control panel indicates that all masks must be plugged in and immediately available for flights above 25,000 feet. An exception to this is the pilot and copilot masks, which shall be plugged in and hung on the cockpit sidewall hooks at all times, ready for immediate use. The filler fitting is located behind a panel externally accessible on the right side of the empennage (fig. 2-18).

NOTE

Due to the possibility of the oxygen valve control cable freezing, the crew oxygen valve shall be kept open during flight.

NOTE

INPH must be selected on individual Audio Control Panels when using oxygen mask to provide intercommunications between pilots through the headsets.

b. Pilot and Copilot Masks. The pilot and copilot oxygen masks are diluter-demand 100% regulator masks which provide the proper dilution of oxygen with cabin air to conserve oxygen at lower cabin pressure altitudes. Placing the diluter control lever on the mask regulator in the NORMAL position permits the regulator to automatically schedule a proportional increase in oxygen as the cabin pressure altitude increases. When not in use, the masks should be stowed with the lever in the 100% position. While in use, at altitudes below 20,000 feet, the lever may (at the crews discretion) be placed in the NORMAL position to conserve oxygen. Each diluter-demand mask has a pressure detector in the oxygen supply line to provide a visual indication of oxygen pressure. A red signal viewed in the window of the detector indicates low pressure and a green signal indicates adequate pressure.

c. Passenger Masks. The passenger masks are kept in sidewall and seat back pockets in the cabin and in the sidewall pocket in the toilet compartment. All masks are easily connected by pushing the plug firmly into the outlet and turning clockwise approximately one quarter turn. Unplugging is accomplished by reversing the motion. When stowing the mask, coil the breathing line around the mask to avoid any sharp bends in the line.

d. Oxygen Duration. The oxygen duration depends upon the amount of oxygen available and the demand. The amount or useable volume available is 1,222 Liters (L), as measured at 21°C, 760 mm of pressure and no water vapor. These conditions are referred to as "Normal Temperature, Pressure, Dry" or NTPD. The rated or 100% capacity of the cylinder is available at 1,850 psig and 21°C. A percentage of the capacity at other stabilized cylinder temperatures and pressure may be obtained from Figure 2-19. The demand upon this amount depends upon the number of crew and passenger masks in use and the flow of oxygen from the masks. Planning flow rates may be found in Table 2-3. The duration or amount divided by demand, of various combinations of passengers and altitude, is found in Table 2-4. For other conditions or configurations, the duration may be readily calculated with the data provided.

e. Emergency Operation. A control is provided on the masks for the pilot and copilot. The control may be set at 10096 OXY when required.

246. OXYGEN SYSTEM *DF*

WARNING

Do not smoke while oxygen is in use.

a Description. The oxygen system is provided primarily as an emergency use system, however the system may be used to provide supplemental (first aid) oxygen. A 49 cubic foot 1,222 (L) usable oxygen supply cylinder charged with aviators breathing oxygen is installed in the unpressurized portion of the aircraft behind the aft pressure bulkhead. The oxygen pressure gage on the copilots subpanel gives a direct reading of cylinder pressure. The pressure regulator and control valve are located adjacent to the supply cylinder and are actuated by a push-pull control knob placarded PULL ON SYS READY located immediately aft of the overhead circuit breaker panel. The control knob operates a cable which opens and closes the shutoff valve on the supply cylinder (fig. 2-18). Opening the shut-off valve charges the primary oxygen supply line, which in turn delivers oxygen to the pilot, copilot, first aid oxygen mask outlets, and to the passenger oxygen system control valve. Adjacent to the system control knob is another push-pull knob placarded PASSENGER MANUAL O'RIDE. This activates the passenger masks when the PULL ON SYS READY knob is pulled on. Anytime the primary oxygen supply line is charged, oxygen will be available from the first aid oxygen outlet by manually opening the overhead access door placarded FIRST AID OXYGEN-PULL and opening the ON-OFF valve inside. The first aid oxygen is located in the aft portion of the aircraft containing the life raft, toilet etc. A placard inside the door reads NOTE: CREW SYS MUST BE ON as a reminder that the PULL ON SYS READY knob in the cockpit must be pulled on before oxygen will be available at the first aid mask.

NOTE

Due to the possibility of the oxygen valve control cable freezing, The crew oxygen valve shall be kept open during flight.

b. Pilot and Copilot Masks. The pilot and copilot masks are diluter demand, quick-donning, masks equipped with a carbon microphone, and are

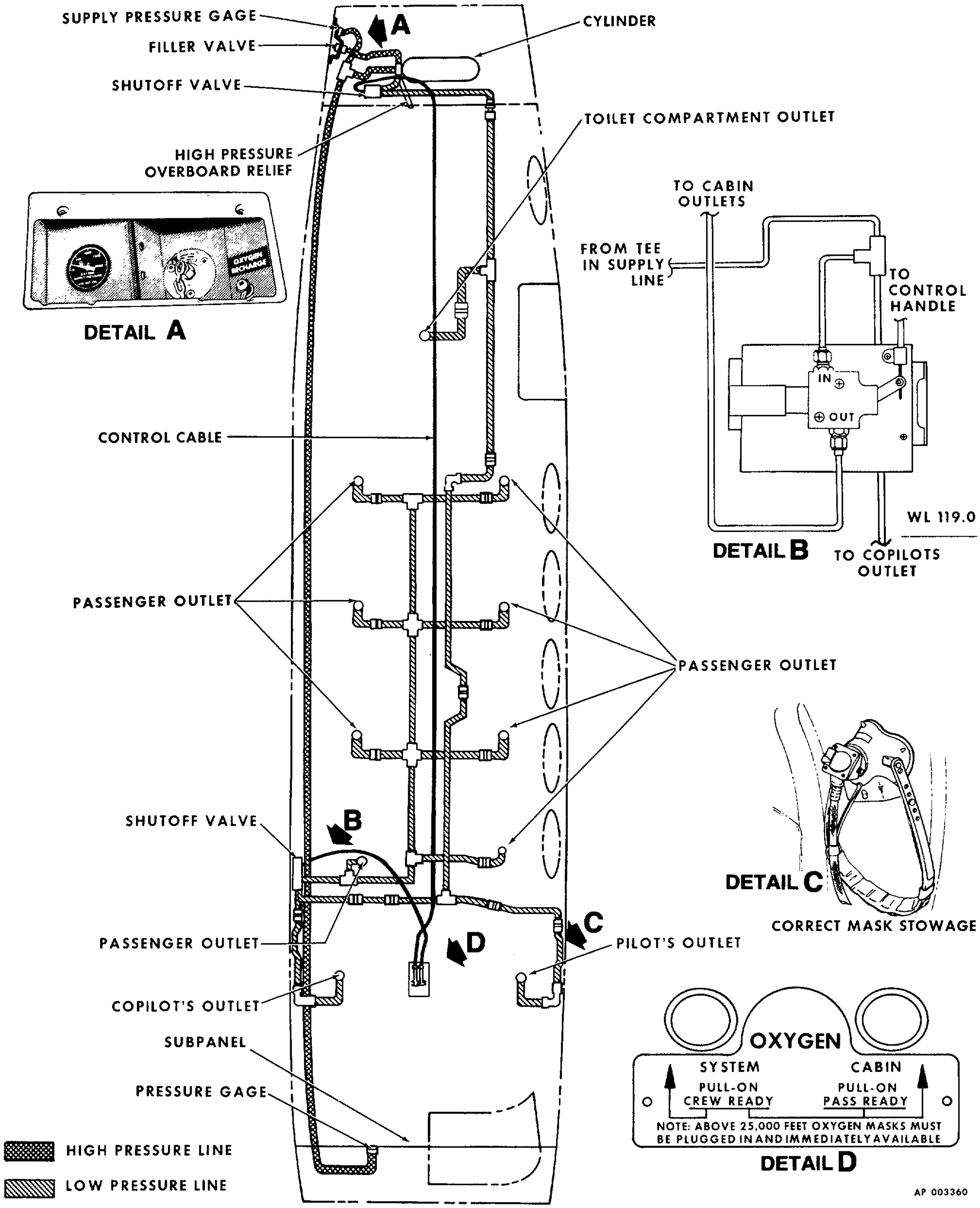


*Figure 2-18. Oxygen System **C**- Sheet 1 of 2*

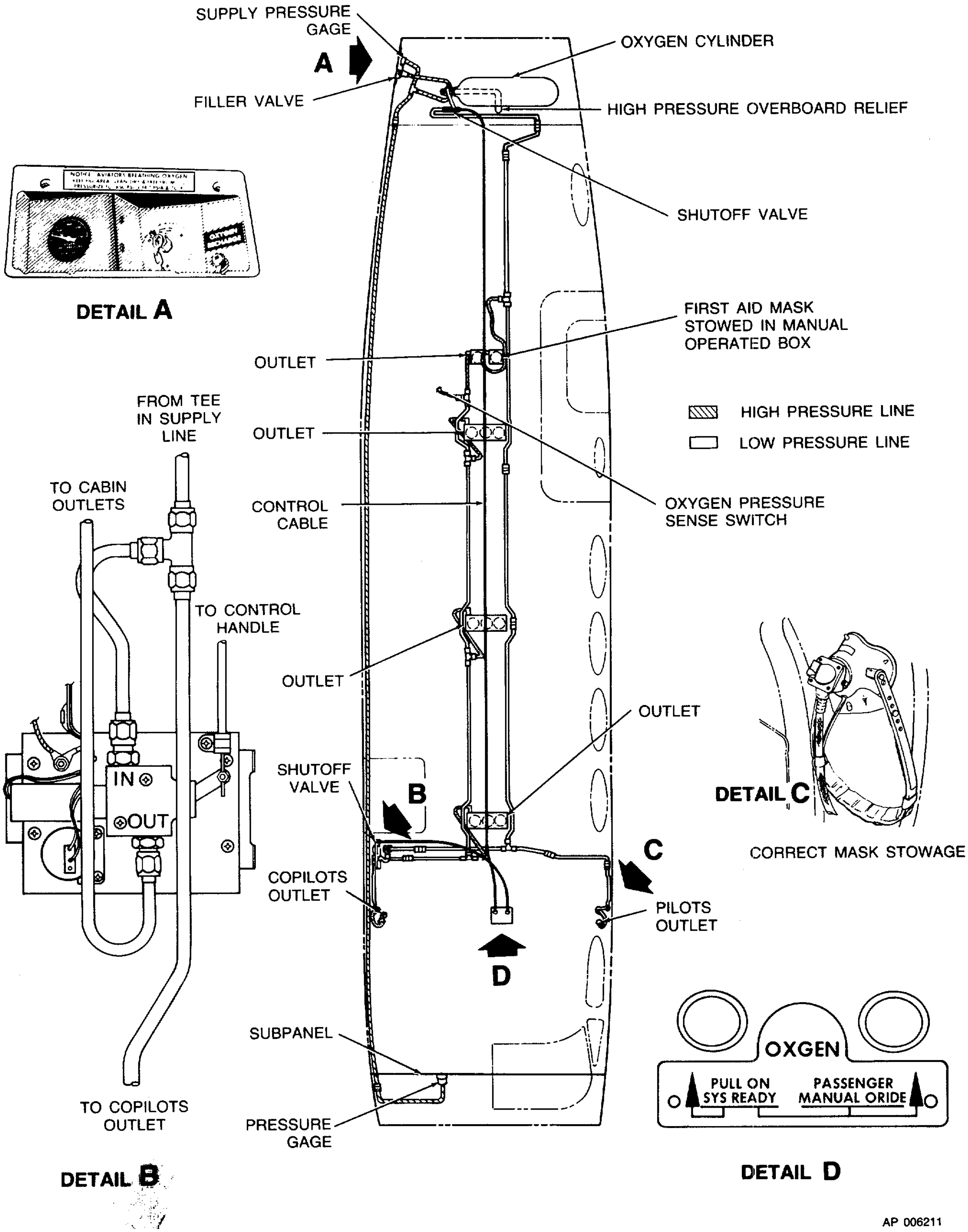


Figure 2-18. Oxygen System ***DF****- Sheet 2 of 2*

Table 2-3. Oxygen Flow Planning Rates VS Altitude

NOTE

All flows in LPM per mask at NTPD

CABIN PRESSURE ALTITUDE IN FEET	CREW MASK NORMAL (DILUTER DEMAND) (1)	CREW MASK 100% OXYGEN (1)	PASSENGER MASK
31,000	0 (2)	4.2	3.7 (3)
30,000	0 (2)	4.4	3.7 (3)
29,000	0 (2)	4.7	3.7 (3)
28,000	0 (2)	5.0	3.7 (3)
27,000	0 (2)	5.3	3.7 (3)
26,000	0 (2)	5.6	3.7 (3)
25,000	0 (2)	5.9	3.7
24,000	0 (2)	6.2	3.7
23,000	0 (2)	6.6	3.7
22,000	0 (2)	6.9	3.7
21,000	0 (2)	7.2	3.7
20,000	3.6	7.6	3.7
19,000	3.9	7.9	3.7
18,000	4.2	8.3	3.7
17,000	4.5	8.7	3.7
16,000	4.8	9.1	3.7
15,000	5.1	9.5	3.7
14,000	5.4	10.0	3.7
13,000	5.8	10.4	3.7
12,000	6.1	10.9	3.7
11,000	6.5	11.3	3.7
10,000	6.9	11.9	3.7

(1) BASED ON MINUTE VOLUME OF 20 LPM-BTPS (Body Temperature and Pressure, Saturated).
(2) USE 100% OXYGEN ABOVE 20,000 FEET.
(3) NOT RECOMMENDED FOR OTHER THAN EMERGENCY DESCENT USE ABOVE 25,000 FEET.

NOTE

If average climb or descent flows are desired, add the values between altitudes and divide by the number of values used. This method is preferred over averaging the extremes as some flow characteristics vary in such a way as to yield an incorrect answer.

Table 2-4. Oxygen Duration in Minutes for 49 Cubic Foot System

	CABIN PRESSURE ALTITUDE	CREW MASK CONDITION	TOTAL FLOW LPM-NTPD	DURATION IN MINUTES (1)
TWO MAN CREW	31,000	100%	8.4	145.5
	20,000	100%	15.2	80.4
	20,000	NORMAL	7.2	169.7
	15,000	100%	19.0	64.3
	15,000	NORMAL	10.2	119.8
	10,000	100%	23.8	51.3
	10,000	NORMAL	13.8	88.6
TWO MAN CREW PLUS ONE PASS	31,000	100%	12.1	101.0
	20,000	100%	18.9	64.7
	20,000	NORMAL	10.9	112.1
	15,000	100%	22.7	53.8
	15,000	NORMAL	13.9	87.9
	10,000	100%	27.5	44.4
	10,000	NORMAL	17.5	69.8
TWO MAN CREW PLUS TWO PASS	31,000	100%	15.8	77.3
	20,000	100%	22.6	54.1
	20,000	NORMAL	14.6	83.7
	15,000	100%	26.4	46.3
	15,000	NORMAL	17.6	69.4
	10,000	100%	31.2	39.2
	10,000	NORMAL	21.2	57.6
TWO MAN CREW PLUS THREE PASS	31,000	100%	19.5	62.7
	20,000	100%	26.3	46.5
	20,000	NORMAL	18.3	66.8
	15,000	100%	30.1	40.6
	15,000	NORMAL	21.3	57.4
	10,000	100%	34.9	35.0
	10,000	NORMAL	24.9	49.1
TWO MAN CREW PLUS FOUR PASS	31,000	100%	23.2	52.7
	20,000	100%	30.0	40.7
	20,000	NORMAL	22.0	55.5
	15,000	100%	33.8	36.2
	15,000	NORMAL	25.0	48.9
	10,000	100%	38.6	31.7
	10,000	NORMAL	28.6	42.7
TWO MAN CREW PLUS FIVE PASS	31,000	100%	26.9	45.4
	20,000	100%	33.7	36.3
	20,000	NORMAL	25.7	47.5
	15,000	100%	37.5	32.6
	15,000	NORMAL	28.7	42.6
	10,000	100%	42.3	28.9
	10,000	NORMAL	32.3	37.8

(1) For 100% capacity of useable oxygen (1,222 liters)

Table 2-4. Oxygen Duration in Minutes for 49 Cubic Foot System (cont'd)

	CABIN PRESSURE ALTITUDE	CREW MASK CONDITION	TOTAL FLOW LPM-NTPD	DURATION IN MINUTES (1)
TWO MAN CREW PLUS SIX PASS	31,000	100%	30.6	39.9
	20,000	100%	37.4	32.7
	20,000	NORMAL	29.4	41.6
	15,000	100%	41.2	29.7
	15,000	NORMAL	32.4	37.7
	10,000	100%	46.0	26.6
	10,000	NORMAL	36.0	33.9
TWO MAN CREW PLUS SEVEN PASS	31,000	100%	34.3	35.6
	20,000	100%	41.1	29.7
	20,000	NORMAL	33.1	36.9
	15,000	100%	44.9	27.2
	15,000	NORMAL	36.1	33.8
	10,000	100%	49.7	24.6
	10,000	NORMAL	39.7	30.8
TWO MAN CREW PLUS EIGHT PASS	31,000	100%	38.0	32.2
	20,000	100%	44.8	27.3
	20,000	NORMAL	36.8	33.2
	15,000	100%	48.6	25.1
	15,000	NORMAL	39.8	30.7
	10,000	100%	53.4	22.9
	10,000	NORMAL	43.4	28.2
TWO MAN CREW PLUS NINE PASS	31,000	100%	41.7	29.3
	20,000	100%	48.5	25.2
	20,000	NORMAL	40.5	30.2
	15,000	100%	52.3	23.4
	15,000	NORMAL	43.5	28.1
	10,000	100%	57.1	21.4
	10,000	NORMAL	47.1	25.9

(1) For 100% capacity of useable oxygen (1,222 liters)

NOTE

When operating with a 100% cylinder capacity, read the duration in minutes directly from the table. However, if operating with less than a 100% cylinder capacity pressure (Ref. Figure 2-19) perform the following computation: Total, crew (2) LPM usage at cabin pressure altitude; Total passenger LPM usage at cabin pressure altitude; (Ref. Table 2-3); Total LPM usage of both crew and passengers. Multiply 1222 liters times the percent of rated capacity at NTPD and divided by total crew and passenger LPM usage to obtain total (oxygen remaining) duration in minutes.

OXYGEN CYLINDER CAPACITY
PERCENT RATED VOLUME VS PRESSURE, TEMPERATURE
(1,850 PSI CYLINDER)

EXAMPLE:

TO DETERMINE PERCENT OF RATED VOLUME OF CYLINDER, ENTER CHART AT TEMPERATURE AND TRACE UP TO INDICATED PRESSURE THEN TRACE LEFT MAINTAINING A PROPORTIONAL DISTANCE ALONG THE PERCENT LINE AND READ PERCENTAGE OF FULL CYLINDER.

TO DETERMINE THE PRESSURE FOR 100% VOLUME, TRACE UP FROM TEMPERATURE TO 100% LINE AND TRACE ACROSS TO CYLINDER PRESSURE.

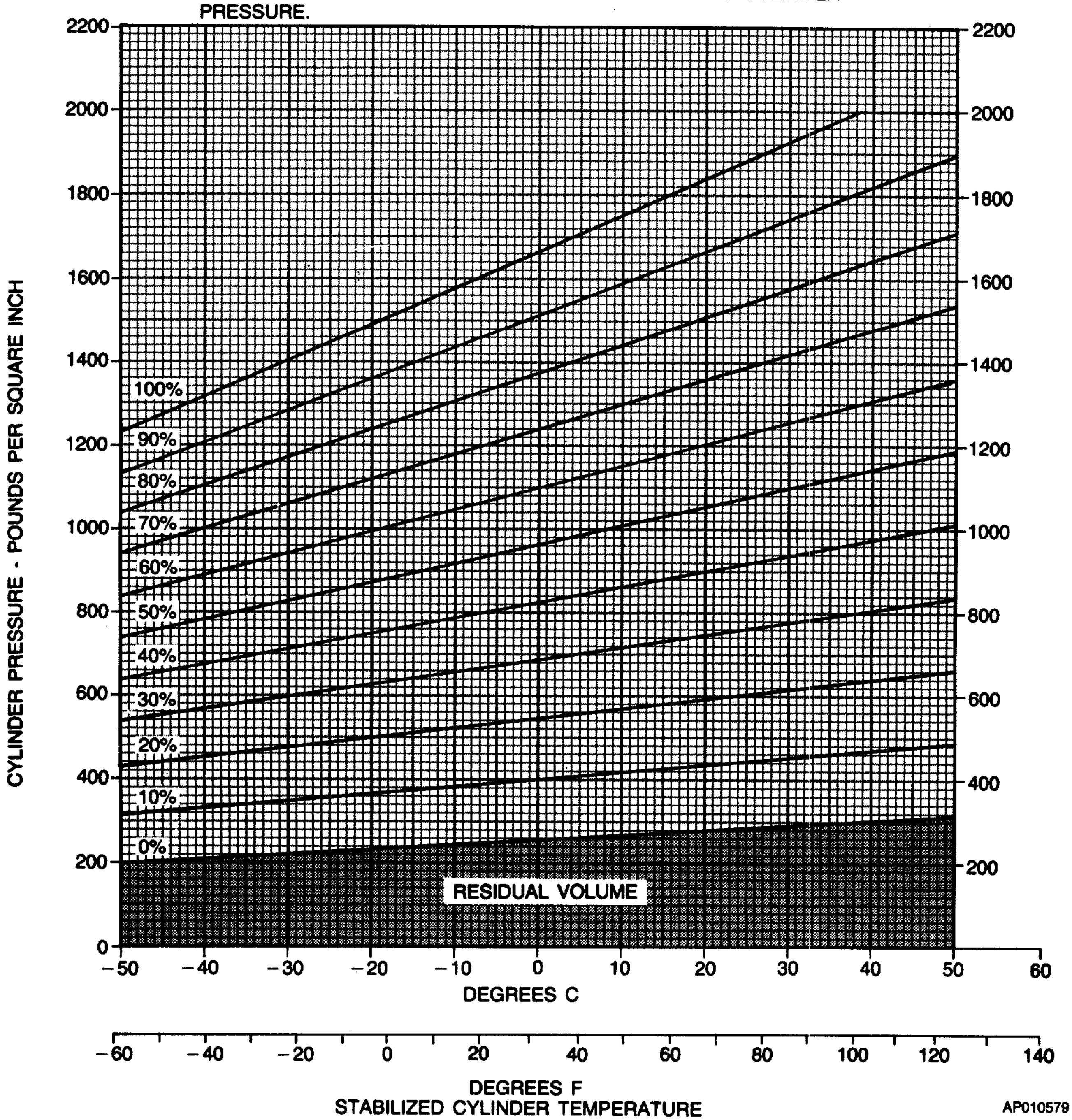


Figure 2-19. Oxygen Graph

stowed on the partition aft and outboard of the pilot and copilot. The masks are held in the armed position by spring tension clips, and can be donned immediately with one hand. The diluter demand masks deliver oxygen only upon inhalation, therefore there is no loss of oxygen when the masks are plugged in and the PULL ON SYS READY control knob is pulled on. The masks are diluter demand 100% regulator masks which provide the proper dilution of oxygen with cabin air to conserve oxygen at lower altitudes. Placing the small diluter control lever on the mask regulator to the NORMAL position permits the regulator to automatically schedule a proportional increase in oxygen as the altitude increases. Each mask has a pressure detector in the supply line. A red signal indicates low pressure, a green signal indicates adequate pressure. The masks will be plugged in and hung on the sidewall at all times.

c. Passenger Oxygen. The auto-deployment passenger oxygen system is of the constant-flow type. When in use, the oxygen is delivered through the masks at a rate of flow of approximately 3.7 LPM-NTPD (Liters Per Minute -Normal Temperature Pressure Dry). If the cabin altitude exceeds approximately 12,500 feet, a barometric pressure switch will energize a solenoid which automatically opens the passenger oxygen system shut-off valve. The oxygen will charge the passenger oxygen system supply line and extend a plunger against each of the passenger mask dispenser doors, forcing the door open. The oxygen masks will then drop down about 9 inches below the dispenser. A lanyard pin at the top of each oxygen mask must be pulled for oxygen to flow to the mask, and must be reinserted to stop oxygen flow when the mask is no longer needed. There are four auto-deployment mask dispensers in the aircraft. Three of the dispensers contain 3 masks each, the other contains a single unit. The shut-off valve can also be opened by pulling the PASSENGER MANUAL O'RIDE knob located adjacent to the PULL ON SYS READY knob. After the passenger system has been opened, either automatically or manually, a pressure sensitive switch in the supply line will activate to illuminate the green PASS OXY ON annunciator legend on the caution/advisory pan- el. Additionally, all cabin lights will illuminate in the full bright mode, regardless of the CABIN LIGHTS switch position. The passenger oxygen may be shut- off and the remaining oxygen isolated to the pilot, copilot and first aid masks by pulling the AUTO OXYGEN circuit breaker in the ENVIRONMENTAL group on the overhead circuit breaker panel (provided the PASSENGER MANUAL ORIDE knob is on the off position).

d. Oxygen Duration. Each passenger oxygen position has its own regulating orifice. The Oxygen Duration Table (table 2-4) is based on a flow rate of TM 55-1510-218-10 3.70 NLPM (Normal Liters Per Minute). The only exception is the diluter-demand pilot/copilot mask when used in the 100% mode.

e. Emergency Operation. A control is provided on the masks for the pilot and copilot. The control may be set to 100% OXY when required.

2-67. WINDSHIELD WIPERS.

a. Description. Two electrically operated windshield wipers (fig. 2-5), are provided for use at takeoff, cruise and landing speed. A rotary switch (fig. 2-8) placarded WINDSHIELD WIPER, located on the overhead control panel, selects mode of wind- shield wiper operation. An information placard above the switch states: DO NOT OPERATE ON DRY GLASS. Function positions on the switch, as read clockwise, are placarded: PARK - OFF -SLOW - FAST. When the switch is held in the spring-loaded PARK setting, the blades will return to their normal inoperative position on the glass, then, when released, the switch will return to OFF position terminating windshield wiper operation. The FAST and SLOW switch positions are separate operating speed settings for wiper operation. The windshield wiper circuit is protected by one 10-ampere circuit breaker, placarded WSHLD WIPER, located on the overhead circuit breaker panel (fig. 2-23).

CAUTION

Do not operate windshield wipers on dry glass. Such action can damage the linkage as well as scratch the windshield glass.

b. Normal Operation. To start, turn WIND-SHIELD WIPER switch to FAST or SLOW speed, as desired. To stop, turn the switch to the PARK position and release. The blades will return to their normal inoperative position and stop. Turning the switch only to the OFF position will stop the wind-shield wipers, without returning them to the normal inactive position.

2-68. CABIN FURNISHINGS.

a. Deleted

a.A. Cabin Area Interior. The cabin has seating arrangements for seven passengers. Seating consists of five executive chairs and one two-place couch attached to floor mounted rails. Track mounting accommodates quick seat removal and spacing adjustment. Five seats face forward. On the right side of the aisleway, the couch faces towards the aisle. On a horizontal leg crossbar, each seat is placarded as FWD FACING or AFT FACING, and MAX 170 LB AFT FACING. All chairs and each place on the couch are equipped with lap-type seat belts. All chairs have adjustable headrests and reclining backs which can be adjusted by a lever on the side for individual comfort. Adjustable armrests, adjacent to the aisle, may be lowered to allow ease of entry. All seat backs shall be in full upright position for takeoff and landing.

b. Deleted.

b.A. *Aft Cabin Area **C** Interiors*. The aft cabin area has two parts: a toilet area (fwd part) opposite to the aircraft entry door, and a storage area which extends from the aft side of the doorway to the back of the pressurized compartment. A partition wall, with lockable internal sliding doors at the aisleway, separates the passenger area from the toilet area. A mirror is mounted on the right forward partition and a removable low profile electric toilet faces the aisle. A garmet hang cable extends between the forward and back partitions above the toilet. A seat belt is provided and allows approved seating of one passenger in the toilet area. This area also has lighting, ventilation air, and oxygen provisions. The toilet and aft storage areas are separated by a partial partition from the right fuselage wall to the aisleway. A garment hand cable extends from this partition to the aft bulkhead of the pressurized compartment. The storage area encompasses the full width of the fuselage and is illuminated by two lights in the headliner. The floor has tiedowns. This area is for the storage of crew and passenger baggage, a life raft and survival gear (up to 410 pounds). Webbing is installed across the storage area to secure baggage/ gear.

c. *4ft Cabin Area Interior **DF***. The aft cabin area has two parts: a lavatory (fwd part) opposite to the main entrance door, and a storage area which extends from the aft side of the cargo door to the back of the pressurized compartment. A privacy curtain separates the removable, low profile, electric toilet from the passenger area.

NOTE

A non-electric, chemical toilet is provided in C-12Z1aircraft.

A seat belt is provided and allows approved seating of one passenger in the toilet area. A garment hand cable extends between the forward and back partitions above the toilet. This area also has lighting, ventilation air, and oxygen provisions. The toilet and aft storage areas are separated by a partial partition from the right fuselage wall to the aisleway. A high garmet hang cable extends from this partition to the aft bulkhead of the pressurized compartment. The storage area encompasses the full width of the fuselage and is illuminated by two lights in the head-liner. The floor has tiedowns. This area is for the storage of crew and passenger baggage, (up to 410 pounds). Webbing is installed across the storage area U to secure baggage/gear.

NOTE

On C-12 **F2** aircraft a baggage/utility compartment area containing 53.3 cubic feet of space provides for storage of 550 pounds of baggage including one survival raft and kit.

d. *Configuration*. The cabin area can be quickly converted for a combination passenger/cargo or all cargo use by removing the seats and partial partition. Cargo containers are secured with tiedown fittings attached to the seat tracks. No cargo loading or unloading equipment is provided. Chapter 6, Aircraft Loading provides cargo handling in- formation and instructions.

2-69. CIGARETTE LIGHTERS AND ASH TRAYS.

The pilot and copilot have individual cigarette lighters and ash trays mounted in escutcheons outboard of their seats. The cigarette lighters are protected by a 5-ampere circuit breaker, placarded CIGAR LIGHTER, on the overhead circuit breaker panel (fig. 2-23). In the cabin area, individual ash trays are mounted in escutcheons along the cabin sidewall upholstery adjacent to each seat. No cigarette lighters are installed in the cabin area.

*2-70. ELECTRIC TOILET **CDF1D***

a. *Description*. An electric toilet is installed in the aft cabin area. A sliding door or privacy curtain closes between the two aft partitions for privacy. The door can be locked from the aft side. On some aircraft, a relief tube is incorporated in the mounting assembly for the toilet. The circuit is protected by a 10-ampere circuit breaker located in the power distribution panel under the floor ahead of the main spar.

b. *Operation*. A switch, placarded PRESS TO FLUSH, is mounted on the seat assembly for operation of the toilet. Pressing the switch applies DC power to the motor which drives the pump. The pump applies flushing fluid through a nozzle in the upper rim and washes the inner surface of the bowl. Waste is carried to the waste tank mounted below the bowl. When desired, the removable waste tank may be removed from the toilet for servicing. Section XII contains servicing instructions.

2-70A. CHEMICAL TOILETS *F2*.

a. Description. A quick-removable sidefacing toilet with seat belt is located in the aft cabin area. Stub partitions and a privacy curtain are provided. The chemical toilet contains an inner liner which holds a plastic disposable bag. The inner liner and disposable bag are removed for disposal of waste. Refer to Section XII for servicing instructions.

CAUTION

When adjusting the sun visors, grasp only by the top metal attachment to avoid damage to the fragile plastic shield.

Two sun visors are provided for the pilot and copilot respectively (fig. 2-5). Each visor is manually adjustable. When not needed as a sun shield, each visor may be manually rotated to a position flush with the top of the cockpit so that it does not obstruct view through the windows.

Section VIII. HEATING, VENTILATION, COOLING, AND ENVIRONMENTAL CONTROL SYSTEM

2-72. HEATING.

Bleed air is extracted from both engines and combined with ambient air through the pressurization and heating flow control unit in each nacelle. The tempered air is then ducted into the cabin (fig. 2-20). On the ground, a solenoid actuated portion of the flow control unit closes off the ambient air to provide only warm bleed air to the cabin. The landing gear safety switch allows the solenoid valve to open during flight, providing a mixture of bleed air and ambient air up to an altitude of approximately 19,000 to 20,000 feet where only bleed air is used. If the mixed bleed air is too warm for cabin comfort, it is further cooled by routing it through the air-to-air heat exchanger located in each wing center section. An air intake of 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 heat exchangers, it is ducted to a mixing plenum where it is mixed with cabin re-circulated air. The air is then ducted to the pilot and copilot outlets, defroster, and through the main ducting system to the floor outlets.

2-73. AIR CONDITIONING.

a. Cabin air conditioning is provided by a refrigerant gas vapor cycle refrigeration system consisting of a belt driven engine mounted compressor, installed on the #2 engine accessory pad, refrigerant plumbing, N1 speed switch, high and low pressure protection switches, condenser coil, condenser blower, forward and aft evaporator, receiver dryer, expansion valve, and a bypass valve. The plumbing from the compressor is routed through the right in- board wing leading edge to the fuselage and then for- ward to the condenser coil, receiver dryer, expansion valve, bypass valve, and forward evaporator which are located in the nose of the aircraft. The high and low pressure limit switches and N1 engine speed switch are provided to prevent compressor operation beyond required operational limits. The N1 speed switch will prevent electrical power from being delivered to the compressor clutch when engine RPM is below 65% RPM. When the N1 speed switch is open and there is a demand for refrigeration, a green light on the caution/advisory annunciator panel, AIR COND N1 LOW, will illuminate.

b. The system incorporates over-pressure and U under-pressure protect switches. Activation of the over-pressure or under-pressure protect switches will · discontinue compressor clutch and condenser blower operation, illuminate its respective lockout light/ reset switch located in the nose wheel well, and trip a 7.5-ampere circuit breaker placarded AIR COND CONTR located in the overhead circuit breaker control panel. When a system shutdown occurs due to over-pressure or under-pressure protect switch actuation, the system should be thoroughly checked be- fore returning it to operation.

c. A second evaporator and blower installation is located in the fuselage center aisle equipment bay aft of the rear spar. Environmental air is circulated through each evaporator automatically in either manual or automatic control mode. The forward evaporator blower has a high speed which can be selected by the VENT BLOWER switch on the over- head control panel. A 33°F thermal sense switch is installed on the forward evaporator. This sense switch actuates a hot gas bypass valve which bleeds off a portion of the refrigerant from the forward evaporator;, thereby preventing icing of the evaporator. The forward evaporator and blower will supply the cockpit, forward ceiling outlets, and forward floor outlets while the rear evaporator and blower supply the aft ceiling outlets, rear floor outlets and toilet compartment. Both blower circuit breakers are located in the DC power distribution panel in the lower equipment bay. A vane-axial blower draws air through the condenser on the ground. A 50-ampere circuit breaker for this blower is located on the DC distribution panel in the lower equipment bay.

d. When operating under very hot, humid conditions, where maximum air conditioning is required, the bleed air valves may be left in ENVIRO OFF until airborne and sufficient altitude is gained.

2-74. UNPRESSURIZED VENTILATION.

Ventilation is provided by two sources. One source is through the bleed air heating system in both the pressurized and unpressurized mode. The second source of ventilation is obtained from ram air through the condenser section in the nose through a check valve in the vent blower plenum. Ventilation from this source is in the unpressurized mode only with CABIN PRESS switch in the DUMP position. The check valve closes during pressurized operation. Ram air ventilation is distributed through the main ducting system to all outlets. Ventilation air, ducted to each individual eyeball cold air outlet, can be directionally controlled by moving

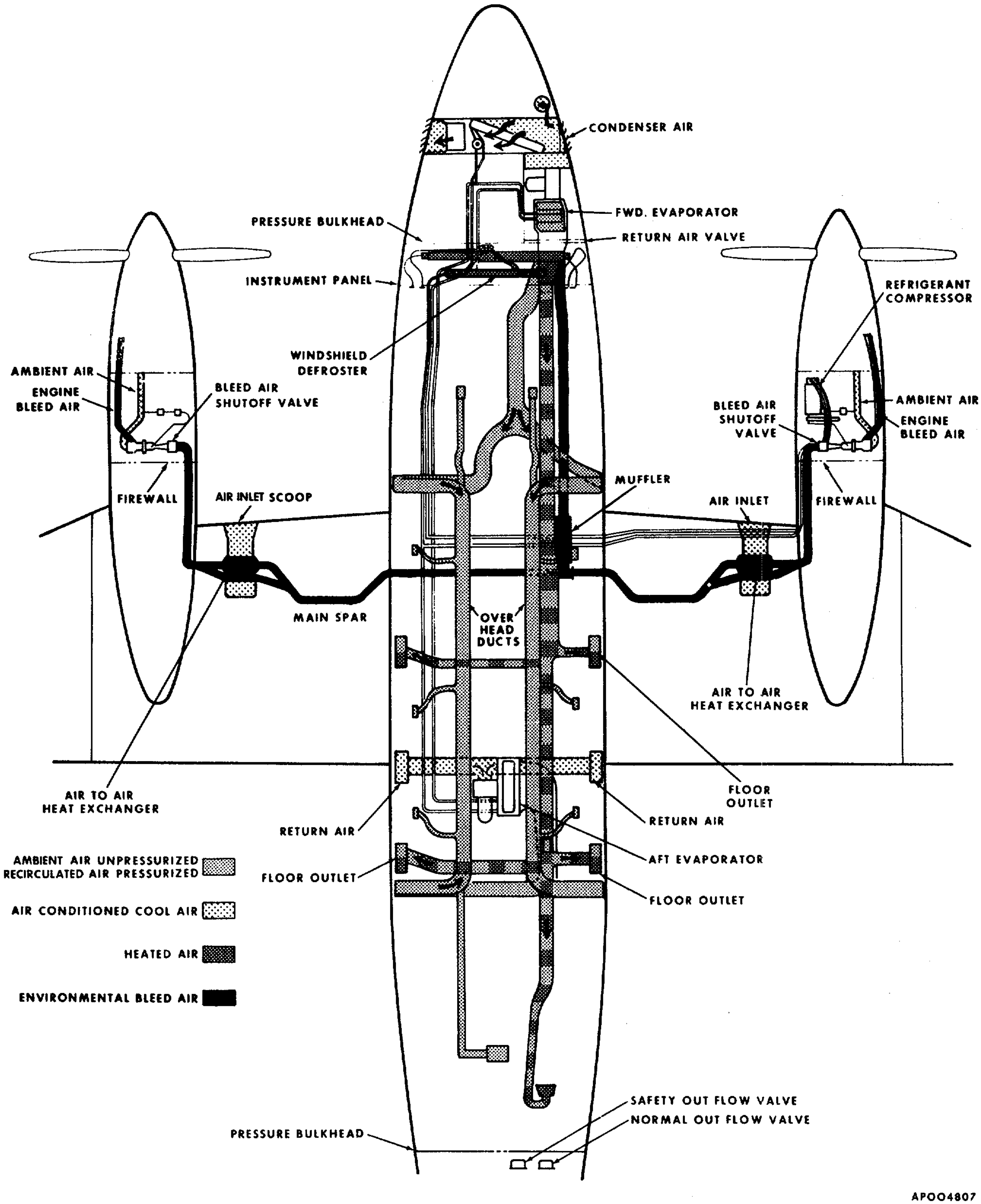


Figure 2-20. Environmental System

the ball in the socket. Volume is regulated by twisting the outlet to open of close the valve.

2-75. ENVIRONMENTAL CONTROLS.

An environmental control section on the overhead control panel provides for automatic or manual control of the system. This section contains all the major controls of the environmental function including bleed air valve switches, a vent blower control switch, an aft vent blower switch, a manual temperature switch for control of the heat exchanger valves, a cabin temperature level control, and the cabin temp mode selector switch for selecting automatic heating or cooling or manual heating or cooling. Four 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.

a. Heating Mode.

(1) If the cockpit is too cold:

1. PILOT and COPILOT AIR knobs - As required.
2. DEFROST AIR knob - As required.
3. CABIN AIR - Pull out in small increments. Allow 3 - 5 minutes after each adjustment for system to stabilize.

(2) If the cockpit is too hot:

1. CABIN AIR knob - As required.
2. PILOT and COPILOT AIR knobs - In as required.
3. DEFROST AIR knob - In as required.

b. Cooling Mode.

(1) If the cockpit is too cold:

1. PILOT and COPILOT AIR knob - In as required.
2. DEFROST AIR knob - In as required.
3. Overheat cockpit outlets - As required.

(2) If the cockpit is too hot:

1. PILOT and COPILOT AIR knobs - Out as required.
2. CABIN AIR knob - Close in small increments. Allow 3 - 5 minutes after each adjustment for system to stabilize. If CABIN AIR knob is completely closed before obtaining satisfactory cockpit comfort, it may be necessary to place the aft vent blower switch in the ON position to activate the aft evaporator to recirculate cabin air.

c. Automatic Mode Control. When the AUTO mode is selected on the cabin temp mode selector switch, the heating and air conditioning systems are automatically controlled. When the temperature of the cabin has reached the selected setting, the automatic temperature control allows heated air to bypass the air-to-air exchangers in the wing center section. The warm bleed air is mixed with the cooled air. The rear evaporator picks up recirculated cabin air only.

(1) When the automatic control drives the environmental system from a heat mode to a cooling mode, the bypass valves close. When the left bypass valve reaches a fully closed position, the refrigeration system will begin cooling, provided the right engine N1 speed is above 65% RPM. When the bypass valve is opened to a position approximately 30° from full open, the refrigeration system will turn off.

(2) 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 for desired cockpit and cabin environment.

d. Manual Mode Control. With the cabin temperature mode selector in the MAN HEAT or MAN COOL position, regulation of the cabin temperature is accomplished manually with the MANUAL TEMP switch.

(1) In the MAN HEAT mode, the automatic system is overridden and the system is con- trolled by opening or closing the bypass valves (two) with the MANUAL TEMP - INCR - DECR switch. To increase cabin temperature, hold the switch at the INCR position, to decrease cabin temperature, hold the switch in the DECR position. Allow approximately 30 seconds per valve to drive the bypass valves to the fully open or fully closed position. Only one valve moves at a time.

(2) With the cabin temperature selector switch in the MAN COOL position, the automatic temperature control system is bypassed. In the manual cooling mode, the refrigeration system is on, providing the right engine N1 speed is above 65% RPM, however, the bypass valves may be manually positioned for the desired temperature. Hold the MANUAL TEMP switch in the DECR position approximately one minute to fully close air-to-air heat exchanger bypass valves.

e. Bleed air and Vent Control.

(1) Bleed air entering the cabin is con- trolled by bleed air valve switches placarded BLEED AIR VALVE - OPEN - ENVIRO OFF - PNEU & ENVIRO OFF. When the switch is in the OPEN position, the environmental flow control unit and the pneumatic valve are open. When the switch is in the ENVIRO OFF position, the environmental flow control unit is closed and the pneumatic bleed air valve is open; in the PNEU & ENVIRO OFF position, both are closed. For maximum cooling on the ground, turn the bleed air valve switches to the ENVIRO OFF position.

(2) The forward vent blower is controlled by a switch placarded VENT BLOWER - AUTO - LOW - HI. The HI and LOW positions regulate the blower to two speeds of operation. In the AUTO position, the fan will run at low speed except when the CABIN TEMP mode selector switch is placed in the OFF position. In the OFF position, the blower will not operate.

(3) The aft vent blower is controlled by a switch placarded AFT VENT BLOWER - OFF - AUTO - ON. The single speed blower operates automatically through the CABIN TEMP mode selector when the AFT VENT BLOWER switch is placed in the AUTO position with the landing gear extended. The blower will automatically shut off when the landing gear is retracted. The blower operates continuously when the switch is placed in the ON position and there is a cool command. In the OFF position, the blower will not operate.

Section IX. ELECTRICAL POWER SUPPLY AND DISTRIBUTION SYSTEM

2-76. DESCRIPTION *C D1*.

The aircraft employ both direct current (DC) and alternating current (AC) electrical power. The DC electrical supply forms the basic power system energizing most aircraft circuits. Electrical power is used to start the engines, to power the landing gear and flap motors, and to operate the standby fuel pump, ventilation blower, lights and electronic equipment. Two inverters operating from DC power produce the required single-phase AC power. The three sources of DC power consist of one 20 cell 34- ampere hour battery and two 250-ampere starter- generators. DC power may be applied to the aircraft through an external power receptacle on the right nacelle. The starter-generators are controlled by generator control units. The output of each generator passes through a cable to the respective generator bus (fig. 2-21). Other buses distribute power to air- craft DC loads, and derive power from the generator buses. The generators are paralleled to balance the DC loads between the two units. When one of the generating systems is not on-line, and no fault exists, aircraft DC power requirements continue to be sup- plied, from the other generating source. Most DC distribution buses are connected to both generator buses but have isolation diodes to prevent power crossfeed between the generating systems, when connection between the generator buses is lost. Thus, when either generator is lost because of a ground fault, the operating generator will supply power for all aircraft DC loads except those receiving power from the inoperative generator's bus which cannot be crossed. When a generator is not operating, reverse current and over-voltage protection is automatically provided.

2-7. DESCRIPTIONS *D2 F.*

The aircraft employ both direct current (DC) and alternating current (AC) electrical power. The DC electrical supply forms the basic power system, energizing most aircraft circuits. Electrical power is used to start the engines; power the landing gear pump motor; power the flap motors; operate the standby fuel pump; power the ventilation blower, lights and electronic equipment. Two 750 VA inverters operating from DC power produce the required single-phase AC power. The three sources of DC power consist of one 20 cell 34-ampere hour battery and two 250-ampere starter-generators. DC power may be applied to the aircraft through an external power receptacle on the right nacelle. The starter-generators are controlled by generator control units. The output of each generator passes through a cable to the respective generator bus (fig. 2-21). Other buses distribute power to aircraft DC loads, and derive power from the generator buses. The generators are paralleled to balance the DC loads between the two units. When one of the generating systems is not on-line, and no fault exists, aircraft DC power requirements continue to be supplied, from the other generating source. Most DC distribution buses are connected to both generator buses but have isolation diodes to prevent power crossfeed between the generating systems, when connection between the generator buses is lost. Thus, when either generator is lost because of a ground fault, the operating generator will supply power for all aircraft DC loads except those receiving power from the inoperative generator's bus which cannot be crossfed. When a generator is not operating, reverse current and over-voltage protection is automatically provided.

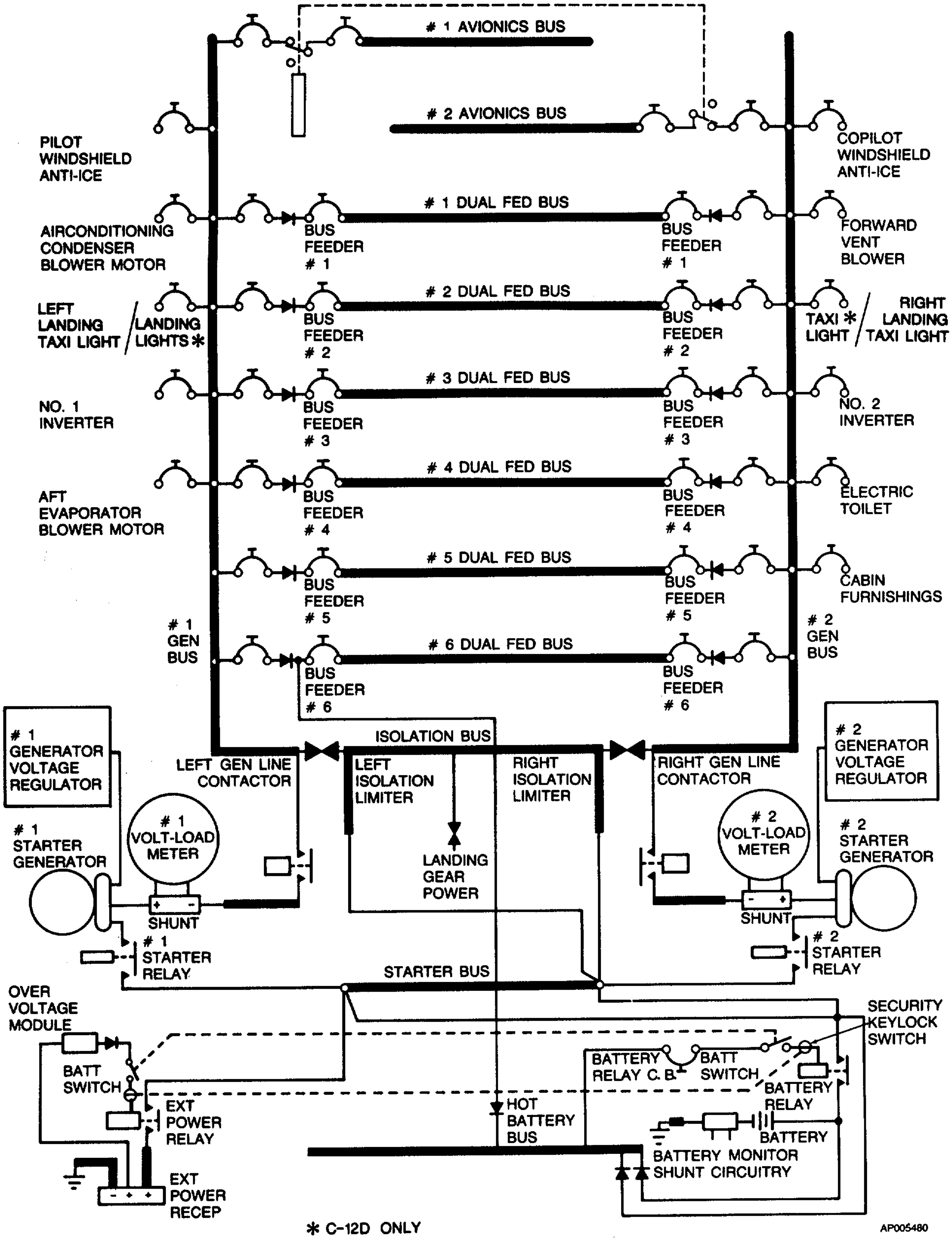


Figure 2-21. DC Electrical System Schematic ***C D1****- Sheet 1 of 9*

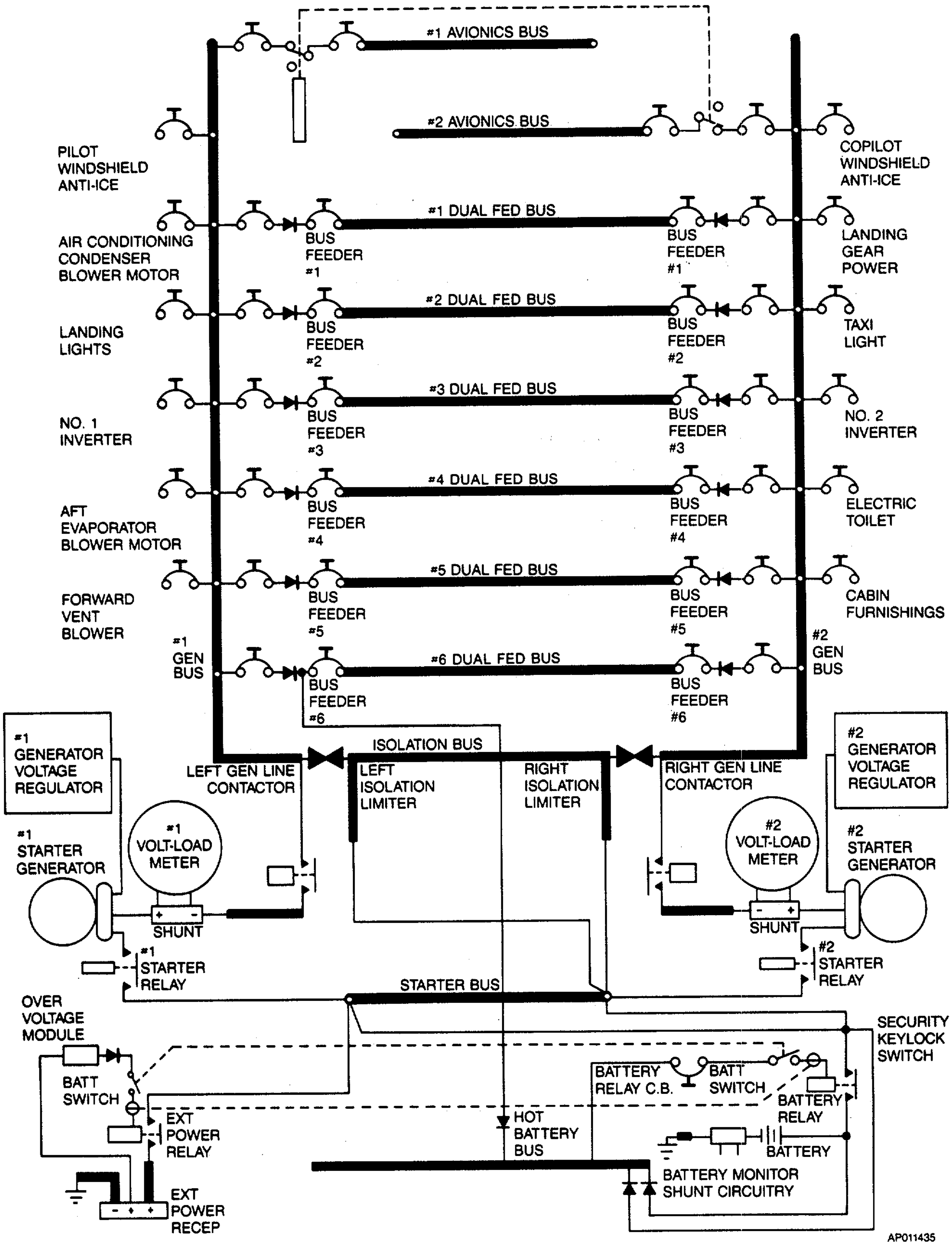


*Figure 2-21. DC Electrical System Schematic **D2 F1**- Sheet 2 of 9*

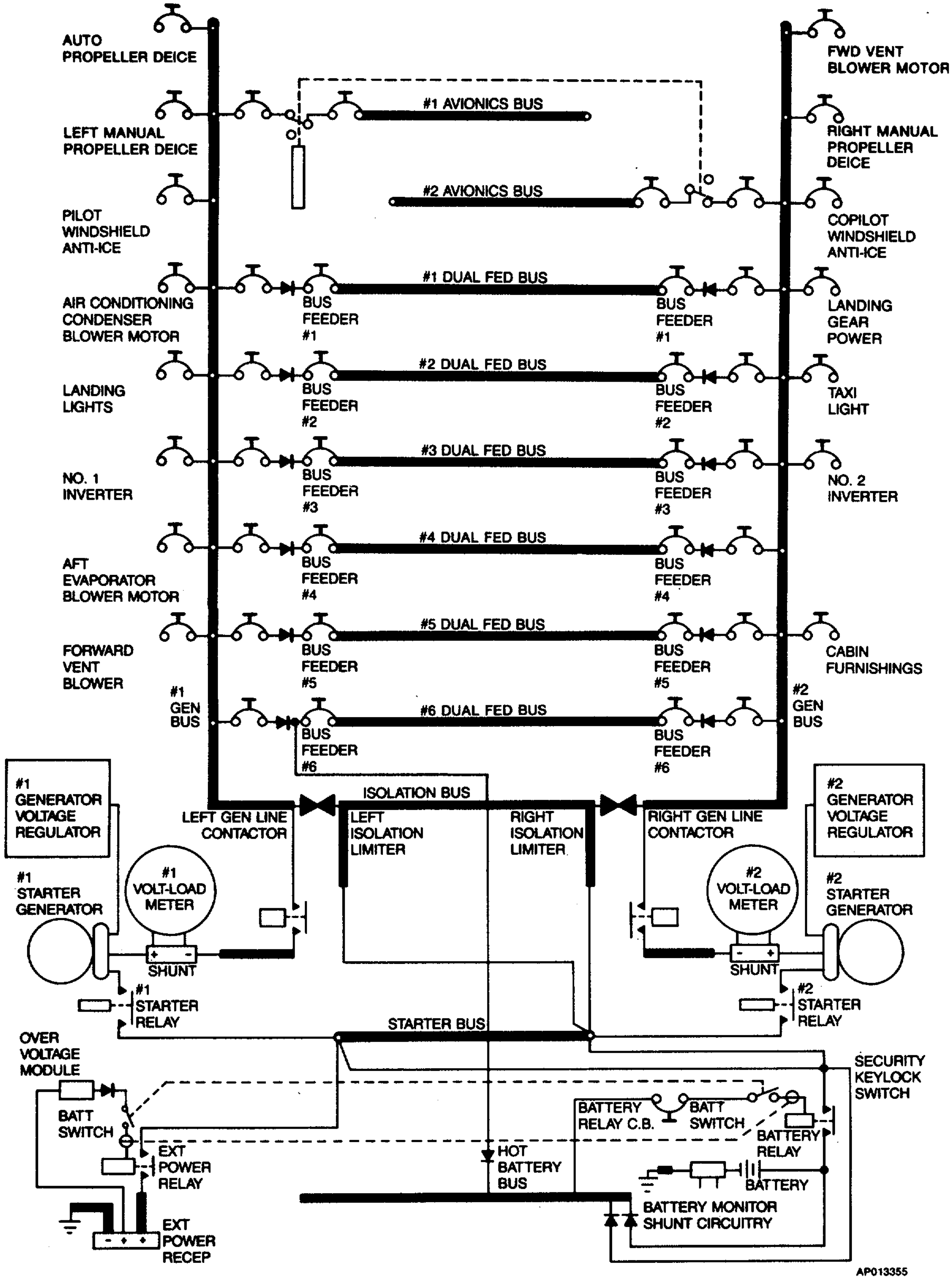


*Figure 2-21. DC Electrical System Schematic **F2** - Sheet 3 of 9*

The following identifies the circuit breakers connected to each bus:

#1 AVIONICS BUS

HF RCVR	PILOT AUDIO	AFCS DIRECT
#1 VHF	DME	INTPH
#1 VOR	TRANSPONDER	AP PWR
#1 ADF	UHF	PLOTS ALT ENCD
# RMI		VOICE ADVSR☜
		RADIO ALTM ☜

#2 AVIKNICS BUS

#2 VHF	COPILOT AUDIO	SERVO DC
#2 VOR	PAGING	RADIO RELAY
#2 ADF		RADARCOPILOT ALT
#2 RMI		

#1 DUAL FED BUS

WARNING		
ANN IND	STALL WARN	LEFT BLEED AIR WARN
#1 CHIP DETR	LANDING GEAR IND	
FUEL		
#1 QTY IND	#1 STANDBY PUMP	(1) #1 AUXILIARY TRANSFER
#1 QTY WARN		
ENGINE		
#1 OIL TEMP	#1 OIL PRESS	

#2 DUAL FED BUS

WARNING		
ANN PWR	FIRE DETR	RIGHT BLEED AIR WARN
#2 CHIP DETR	LANDING GEAR WARN	
FUEL		
#2 QTY IND	#2 STANDBY PUMP	(1) #2 AUXILIARY TRANSFER
#2 QTY WARN		
ENGINE		
#2 OIL TEMP	#2 OIL PRESS	
ELECTRICAL		
BATT CHARGE		

#3 DUAL FED BUS

WEATHER		
WSHLD WIPER	LEFT PROP ANTI-ICE	PROP ANTI-ICE AUTO
SURF DEICE	LEFT FUEL VENT HEAT	LEFT FUEL CONTR HEAT
LEFT PITOT HEAT		
FUEL		
CROSSFEED	#1 FIREWALL VALVE	#1 PRESS WARN
ENGINE		
#1 START CONTR	#1 ICE VANE CONTR	#1 IGNITOR CONTR
(2)(3) PROP SYNC		

#4 DUAL FED BUS

WEATHER		
STALL WARN	RIGHT PROP ANTI-ICE	PROP ANTI-ICE CONTR
BRAKE DEICE	RIGHT FUEL VENT HEAT	RIGHT FUEL CONTR HEAT
RIGHT PITOT HEAT		
FUEL		
SCAVENGER PUMP	#2 FIREWALL VALVE	#2 PRESS WARN
ENGINE		
#2 START CONTR	#2 ICE VANE CONTR	#2 IGNITOR CONTR
(2)(3) AUTOFEATHER	PROP GOV	
AVONICS		
HF POWER		

Figure 2-21. DC Electrical System Schematic ***CD1*** *- Sheet 4 of 9*

#5 DUAL FED BUS

FLIGHT			
	ELEC TRIM	FLAP -MOTOR	PILOT TURN & SUP
	LANDING GEAR RELAY		
LIGHTS			
	ICE	BCN	SUBPANEL & CONSOLE LIGHTS
	INST INDIRECT	LEFT LANDING LIGHTS	(4) RECOG
ENVIRONMENTAL		(3) LANDING LIGHTS	
	TEMP CONTR	LEFT BLEED AIR CONTR	AIR COND CONTR
ELECTRICAL			
	#1 GEN RESET		

#6 DUAL FED BUS

FLIGHT			
	RUDDER BOOST	FLAP CONTR	COPILOT TURN & SLIP
LIGHTS			
	EMERG LIGHTS	FLT INST	NAV
	OVHD LIGHTS	RIGHT L-NDING LIGHTS	FASTEN SEATBELT/NO SMOKE
ENVIRONMENTAL		(3) TAXI LIGHT	
	PRESS CONTR	RIGHT BLEED AIR CONTR	
ELECTRICAL			
	#2 GEN RESET		
FURNISHING			
	CIGAR LIGHTER	(5) CABIN FUR	
AVIONICS			
	AVIONICS MASTER CONTR		

HOT BATTERY BUS

#1 FIREWALL SHUTOFF VALVE		#2 FIREWALL SHUTOFF VALVE
#1 ENGINE FIRE EXTINGUISHER		#2 ENGINE FIRE EXTINGUISHER
#1 STANDBY FUEL PUMP	AFT BAGGAGE LIGHTS	#2 STANDBY FUEL PUMP
(4) TRANSPONDER	SPAR & THRESHOLD LIGHTS	DOORSTEP&OBSERVATION LIGHTS
		(4) ELT

(1) AIRCRAFT WITH AUXILIARY FUEL TANKS ONLY
(2) C-12C AIRCRAFT ONLY
(3) C-12D AIRCRAFT ONLY
(4) IF INSTALLED
(5) AIRCRAFT WITH OPTIONAL INTERIOR ONLY

Figure 2-21. DC Electrical System Schematic ***C D1*** *- Sheet 5 of 9*

The following identifies the circuit breakers connected to each bus:

HF RCVR	PILOT AUDIO	#1 AFCS
#1 VHF	AIR DATA ENCODER	AP PWR
#1 NAV	TRANSPONDER	TACAN
#1 ADF	UHF	
#2 RMI	PAGING	
#2 AVIONICS BUS		
#2 VHF	COPILOT AUDIO	GRAPHIC DISPLAY
#2 NAV	RADIO ALTIMETER	COPILOT ALT
#2 ADF	RADAR	INPTH
#1 RMI	#2 AFCS	G.P.A.A.S. POWER☜
#1 DUAL FED BUS		
WARNING		
ANN IND	STALL WARN	LEFT BLEED AIR WARN
#1 CHIP DETR	LANDING GEAR IND	
FUEL		
#1 QTY IND	#1 STANDBY PUMP	#1 AUXILIARY TRANSFER
#1 QTY WARN		
ENGINE		
#1 OIL TEMP	#1 OIL PRESS	
FURNISHING		
CIGAR LIGHTER		
#2 DUAL FED BUS		
WARNING		
ANN PWR	FIRE DETR	RIGHT BLEED AIR WARN
#2 CHIP DETR	LANDING GEAR WARN	
FUEL		
#2 QTY IND	#2 STANDBY PUMP	#2 AUXILIARY TRANSFER
#2 QTY WARN		
ENGINE		
#2 OIL TEMP	#2 OIL PRESS	
ELECTRICAL		
BATT CHARGE		
#3 DUAL FED BUS		
WEATHER		
WSHLD WIPER	LEFT PROP ANTI-ICE	PROP ANTI-ICE AUTO
SURF DEICE	LEFT FUEL VENT HEAT	LEFT FUEL CONTR HEAT
LEFT PITOT HEAT		
FUEL		
CROSSFEED	#1 FIREWALL VALVE	#1 PRESS WARN
ENGINE		
#1 START CONTR	#1 ICE VANE CONTR	#1 IGNITOR CONTR
PROP SYNC		
#4 DUAL FED BUS		
WEATHER		
STALL WARN	RIGHT PROP ANTI-ICE	PROP ANTI-ICE CONTR
BRAKE DEICE	RIGHT FUEL VENT HEAT	RIGHT FUEL CONTR HEAT
RIGHT PITOT HEAT		
FUEL		
SCAVENGER PUMP C-12 ***D2***	#2 FIREWALL VALVE	#2 PRESS WARN
ENGINE		
#2 START CONTR	#2 ICE VANE CONTR	#2 IGNITOR CONTR
AUTOFEATHER	PROP GOV	
#5 DUAL FED BUS		
FLIGHT		
ELEC TRIM	FLAP MOTOR	PILOT TURN & SLIP
LIGHTS		
ICE	BCN	SUBPANEL & CONSOLE LIGHTS
INST INDIRECT	RECOG	LANDING LIGHTS

*Figure 2-21. DC Electrical System Schematic **D2 F1** Sheet 6 of 9*

ENVIRONMENTAL		
TEMP CONTR	LEFT BLEED AIR CONTR	AIR COND CONTR
ELECTRICAL		
#1 GEN RESET	TAS PROBE HEAT POWER	

#6 DUAL FED BUS

FLIGHT		
RUDDER BOOST	FLAP CONTR	
LIGHTS		
EMERG LIGHTS	FLT INST	NAV
OVHD LIGHTS	TAXI LIGHT	CABIN LTS & SIGNS
READING		
ENVIRONMENTAL		
PRESS CONTR	RIGHT BLEED AIR CONTR	AUTOMATIC OXYGEN CONTROL
RADIANT HEAT CARGO DOOR		
ELECTRICAL		
#2 GEN RESET		
AVIONICS		
AVIONICS MASTER CONTR	COMPASS SWITCHING	TRANSPONDER EMERG MODE
	AVIONICS ANNUNCIATOR	

HOT BATTERY BUS

#1 FIREWALL SHUTOFF VALVE	#2 FIREWALL SHUTOFF VALVE	AFT BAGGAGE LIGHTS
#1 ENGINE FIRE EXTINGUISHER	#2 ENGINE FIRE EXTINGUISHER	SPAR & THRESHOLD LIGHTS
#1 STANDBY FUEL PUMP	#2 STANDBY FUEL PUMP	
DOOR STEP & OBSERVATION LIGHTS		

Figure 2-21. DC Electrical System Schematic ***D2 F1*** *- Sheet 7 of 9*

The following identifies the circuit breakers connected to each bus:

#1 AVIONICS BUS

HF RCVR	PILOT AUDIO	#1 AFCS
#1 VHF	AIR DATA ENCODER	AUTOPILOT
#1 NAV	TRANSPONDER	TACAN
#1 ADF	UHF	GPS
#2 RMI	PAGING	ALTITUDE ALERT
FMS		

#2 AVIONICS BUS

#2 VHF	COPILOT AUDIO	COPILOT ALT
#2 NAV	RADIO ALTIMETER	INPTH
#2 ADF	RADAR & MFD	MLS
#1 RMI	#2 AFCS	G..P.A.A.S. POWER ←

#1 DUAL FED BUS

WARNING		
ANN IND	STALL WARN	LEFT BLEED AIR WARN
#1 CHIP DETR	LANDING GEAR IND	
FUEL		
#1 OTY IND	#1 STANDBY PUMP	#1 AUXILIARY TRANSFER
#1 QTY WARN		
ENGINE		
#1 OIL TEMP	#1 OIL PRESS	
FURNISHING		
CIGAR LIGHTER		

#2 DUAL FED BUS

WARNING		
ANN PWR	FIRE DETR	RIGHT BLEED AIR WARN
#2 CHIP DETR	LANDING GEAR WARN	
FUEL		
#2 QTY IND	#2 STANDBY PUMP	#2 AUXILIARY TRANSFER
#2 OTY WARN		
ENGINE		
#2 OIL TEMP	#2 OIL PRESS	
ELECTRICAL		
BATT CHARGE		

#3 DUAL FED BUS

WEATHER		
WSHLD WIPER	AUTO PROP DEICE CONTROL	LEFT FUEL CONTR HEAT
SURF DEICE	LEFT FUEL VENT HEAT	
LEFT PITOT HEAT		
FUEL		
CROSSFEED	#1 FIREWALL VALVE	#1 PRESS WARN
ENGINE		
#1 START CONTR	#1 ICE VANE CONTR	#1 IGNITOR CONTR
PROP SYNC		

#4 DUAL FED BUS

WEATHER		
STALL WARN	MANUAL PROP DEICE CONTROL	RIGHT FUEL CONTR HEAT
BRAKE DEICE	RIGHT FUEL VENT HEAT	
RIGHT PITOT HEAT		
FUEL		
#2 FIREWALL VALVE	#2 PRESS WARN	
ENGINE		
#2 START CONTR	#2 ICE VANE CONTR	#2 IGNITOR CONTR
AUTOFEATHER	PROP GOV	
AVIONICS		
HF POWER		

Figure 2-21. DC Electrical System Schematics ***F2*** *- Sheet 8 of 9*

#5 DUAL FED BUS

FLIGHT

ELEC TRIM
FLAP MOTOR
PILOT TURN & SLIP
LANDING GEAR

LIGHTS

ICE
BCN
SUBPANEL & CONSOLE LIGHTS
INST INDIRECT
RECOG
LANDING LIGHTS
RADIO PANEL

ENVIRONMENTAL

TEMP CONTR
LEFT BLEED AIR CONTR
AIR COND CONTR

ELECTRICAL

#1 GEN RESET

#6 DUAL FED BUS

FLIGHT

RUDDER BOOST
FLAP CONTR

LIGHTS

EMERG LIGHTS
FLT INST
NAV
OVHD LIGHTS & EDGELIGHT
TAXI LIGHTS
CABIN LTS
PANEL LIGHTS
READING LIGHTS - SIGNS

ENVIRONMENTAL

PRESS CONTR
RIGHT BLEED AIR CONTR
AUTOMATIC OXYGEN CONTROL
RADIANT HEAT CARGO DOOR

ELECTRICAL

#2 GEN RESET

AVIONICS

AVIONICS MASTER CONTR
COMPASS SWITCHING
TRANSPONDER EMERG MODE
AVIONICS ANNUNCIATOR

HOT BATTERY BUS

#1 FIREWALL SHUTOFF VALVE
#2 FIREWALL SHUTOFF VALVE
#1 ENGINE FIRE EXTINGUISHER
#2 ENGINE FIRE EXTINGUISHER
#1 STANDBY FUEL PUMP
#2 STANDBY FUEL PUMP
CABIN LIGHT
BATTERY RELAY

Figure 2-21. DC Electrical System Schematic ***F2*** *- Sheet 9 of 9*

2-78. DC POWER SUPPLY.

a. Description. One nickel-cadmium battery furnishes DC power when the engines are not operating. This 24 volt, 34-ampere-hour battery, located in the right wing center section, is accessible through a panel on the top of the wing. DC power is produced by two engine-driven 28 volt, 250-ampere starter-generators. Controls and indicators associated with the DC supply system are located on the overhead control panel (fig. 2-8) and consists of a single battery switch (BATT), two generator switches (#I GEN and #2 GEN), and two volt-loadmeters.

b. Battery Switch. A switch, placarded BATT (fig. 2-8), is located on the overhead control panel under the MASTER SWITCH. The BATT switch controls the DC power to the aircraft bus system through the battery relay, and must be ON to allow external power to enter aircraft circuits. When the MASTER SWITCH is placed aft, the BATT switch is forced OFF.

c. Generator Switches. Two switches (fig. 2-8), placarded #1 GEN and #2 GEN are located on the overhead control panel under the MASTER SWITCH. The toggle switches control electrical power from the designated generator to paralleling circuits and the bus distribution system. Switch positions are placarded RESET, ON and OFF. RESET is forward (spring-loaded back to ON), ON is center, and OFF is aft. When a generator is removed from the aircraft electrical system, due either to fault or from placing the GEN switch in the OFF position, the affected unit cannot have its output restored to aircraft use until the GEN switch is moved to RESET, then ON.

d. Master Switch. All electrical current may be shut off using the MASTER SWITCH bar (fig. 2-8) which extends above the battery and generator switches. The MASTER SWITCH bar is moved forward when a battery or generator switch is turned on. When moved aft, the bar forces each switch to the OFF position.

e. Volt-Loadmeters ***C D F1***. Two meters (fig. 2-8), on the overhead control panel display voltage readings and show the rate of current usage from left and right generating systems. Each meter is equipped with a spring-loaded push-button switch which when manually pressed will cause the meter to indicate main bus voltage. Each meter normally shows output amperage reading from the respective generator, unless the push-button switch is pressed to obtain bus voltage reading. Current consumption is indicated as a percentage of total output amperage capacity for the generating system monitored.

e.A. DC Load and Voltmeters ***F2***. Four digital meters, located on the overhead panel, display voltage readings and show the rate of current usage from the left and right generating systems. The two load meters indicate output amperage as a percent of rated capacity from the respective generator. Current consumption is indicated as a percentage of total output amperage capacity for the generating system being monitored. The two volt meters indicate bus voltage for the respective generating system.

f. Battery Monitor. Nickel-cadmium battery overheating will cause the battery charge current to increase if thermal runaway is imminent. The aircraft has a charge-current sensor which will detect a charge current. The charge current system senses battery current through a shunt in the negative lead of the battery. Any time the battery charging current exceeds approximately 7-amperes for 6 seconds or longer, the yellow BATTERY CHARGE annunciator light and the master fault caution light will illuminate. Following a battery engine start, the caution light will illuminate approximately six seconds after the generator switch is placed in the ON position. The light will normally extinguish within two to five minutes, indicating that the battery is approaching a full charge. The time interval will increase if the battery has a low state of charge, the battery temperature is very low, or if the battery has previously been discharged at a very low rate (i.e., battery operation of radios or lights for prolonged periods). The caution light may also illuminate for short intervals after landing gear and/or flap operation. If the caution light should illuminate during normal steady-state cruise, it indicates that conditions exist that may cause a battery thermal runaway. If this occurs, the battery switch shall be turned OFF and may be turned back ON only for gear and flap extension and approach to landing. Battery may be usable after a 15 to 20 minute cool down period.

f.A. Battery Temperature Monitoring System ***F2***. A battery temperature indicator system is provided to monitor the temperature of the nickel cadmium battery. The system consists of a battery temperature probe, a DC powered (ANVIS) post lighted indicator, push-to-test switch and system circuit breaker. The battery temperature indicator and push-to-test switch, placarded BAT TEMP TEST, are both located on the pilot's subpanel. The systems circuit breaker placarded BATT TEMP is located in the WARNING section of the overhead circuit breaker panel. Dimming of the post lighted instrument is provided through the SUB PANEL LIGHTS rheostat.

The instrument indicating range is 100°F (bottom of scale), to 190°F (top of scale). A red, yellow and green band located alongside the indicator scale and two annunciators (lower) caution and (upper) warning located on the face of the indicator provide visual battery temperature information. When illuminated, the lower annunciator indicates the battery temperature exceeds 120°F, the upper annunciator indicates the battery temperature exceeds 150F.

The push-to-test switch placarded BAT TEMP TEST. when pressed and held. will normally move the indicator pointer to the top of the scale and illuminate both annunciators. The pointer rate of rise will vary. being somewhat slower with colder battery temperatures. If a probe is faulty or leaking. or a wire is broken. the pointer may not move at all. or may stop down the scale. Allow approximately 45 seconds for the pointer to move to the top of the scale in normal temperatures. 60 seconds in colder temperatures.

g. Generator Out by Warning Lights. Two caution/advisory annunciator panel lights inform the pilot when either generator is not delivering current to the aircraft DC bus system. These lights are placarded #1 DC GEN and #2 DC GEN (fig. 2-26). Two flashing MASTER CAUTION lights and illumination of either fault light indicates that either the identified generator has failed or voltage is insufficient to keep it connected to the power distribution system.

CAUTION

The GPU shall be adjusted to regulate at 28 volts maximum to prevent damage to the aircraft. Do not turn generators on when GPU is supplying power.

h. DC External Power Source. External DC power can be applied to the aircraft through an external power receptacle on the underside of the right wing leading edge just outboard of the engine nacelle. The receptacle is installed inside of the wing structure and is accessible through a hinged access panel. DC power is supplied through the DC external plug and applied directly to the battery bus after passing through the external power relay. Turn off external power while connecting the power cable to. or removing it from. the external power supply receptacle. The holding coil circuit of the relay is energized by the external power source when the keylock and B.TT switches are in the ON position. The GPU shall be adjusted to regulate at 28 volts maximum to prevent damage to the aircraft battery and electronics.

i. Security Keylock Switch. The aircraft has a security keylock switch (fig. 2-8) installed on the overhead control panel. placarded OFF ON. The switch is connected into the battery relay and external power circuits. in series with the battery master power switch. The key cannot be removed from the lock when in the ON position. The key will not fit the keylocks on other Army aircraft.

j. Circuit Breakers. The overhead circuit breaker panel (fig. 2-23) contains circuit breakers for most aircraft systems. The circuit breakers on the panel are grouped into areas which are placarded as to the general function they protect. A DC power distribution panel is mounted beneath the floor forward of the main spar. This panel contains higher current rated circuit breakers and is not accessible to the flight crew under normal conditions.

2-79. AC POWER SUPPILY.

a. Description ***C D1****.* AC power for the air-craft is supplied by inverter units. numbered #1 and #2 (fig. 2-22 sheet I of 2) which obtain operating current from the DC power system. Both inverters are rated at 750 VA and provide single-phase output only. Each inverter provides 115 volt and 26 volt 400 Hz AC output. The inverters are protected by circuit breakers mounted on the DC power distribution panel mounted beneath the floor. Aircraft equipment operating from single-phase AC include the following: autopilot navigation receivers. the tuning portion of the ADF receiver gyro magnetic compass and engine instruments for fuel flow and torquemeters. Controls and indicators of the AC power system are located on the overhead control panel and on the caution/advisory annunciator panel. The pilot selects AC sources using the two inverter select switches located on the overhead control panel.

b. Description ***D2 F***

NOTE

Alternating current (AC) Power for (ANVIS) cathode tube lighting on C-12***F2*** is provided by cathode power packs totally independent of the #1 and #2 aircraft inverters.

AC power for the aircraft is supplied by inverter units. numbered #1 and #2 (fig. 2-22 sheet 2 of 2) which obtain operating current from the DC power system. Both inverters are rated at 750 VA and provide single-phase output only. Each inverter provides 115 volt and 26 volt 400 Hz AC output. The inverters are protected by circuit breakers mounted on the DC power distribution panel mounted beneath the floor. Aircraft equipment operating from single-phase AC include the following: autopilot/flight director. the tuning portion of the ADF receiver, gyro magnetic compass, RMI. pilot's altimeter. transponder IFF computer. and engine instruments for fuel flow and torquemeters. Controls and indicators of the AC power system are located on the overhead control panel and on the caution/advisory annunciator panel. The pilot selects AC sources using the two inverter select switches located on the overhead control panel.

c. AC Power Warning Lights. Two flashing MASTER CAUTION lights and the illumination of an annunciator caution light #1 INVERTER or #2 INVERTER (fig. 2-26) indicate an inverter failure.

d. Inverter Control Switches. Two switches (fig. 2-8), placarded INVERTER #1 or #2 on the overhead control panel give the pilot a choice of inverters to provide single-phase AC power. Two inverters are involved in this selection.

e. Volt-Frequency Meters ***C D F1****.* Two volt-frequency meters (fig. 2-8) are mounted in the overhead control panel to provide monitoring capability for both 115 VAC buses. Normal display on the meter is shown in frequency (Hz). To read voltage, press the button located in the lower left corner of the meter. Normal output of the inverters will be indicated by 115 VAC and 400 Hz on the meters.

f. Volt-Frequency Meters F2. Two digital U display volt-frequency meters (fig. 2-8) are mounted in the overhead control panel to provide a monitoring capability for both 115 VAC buses. Alternating current (AC) power load and frequency (Hz) are continuously displayed. Normal output of the inverters will be indicated by 115 VAC and 400 Hz on the meters.

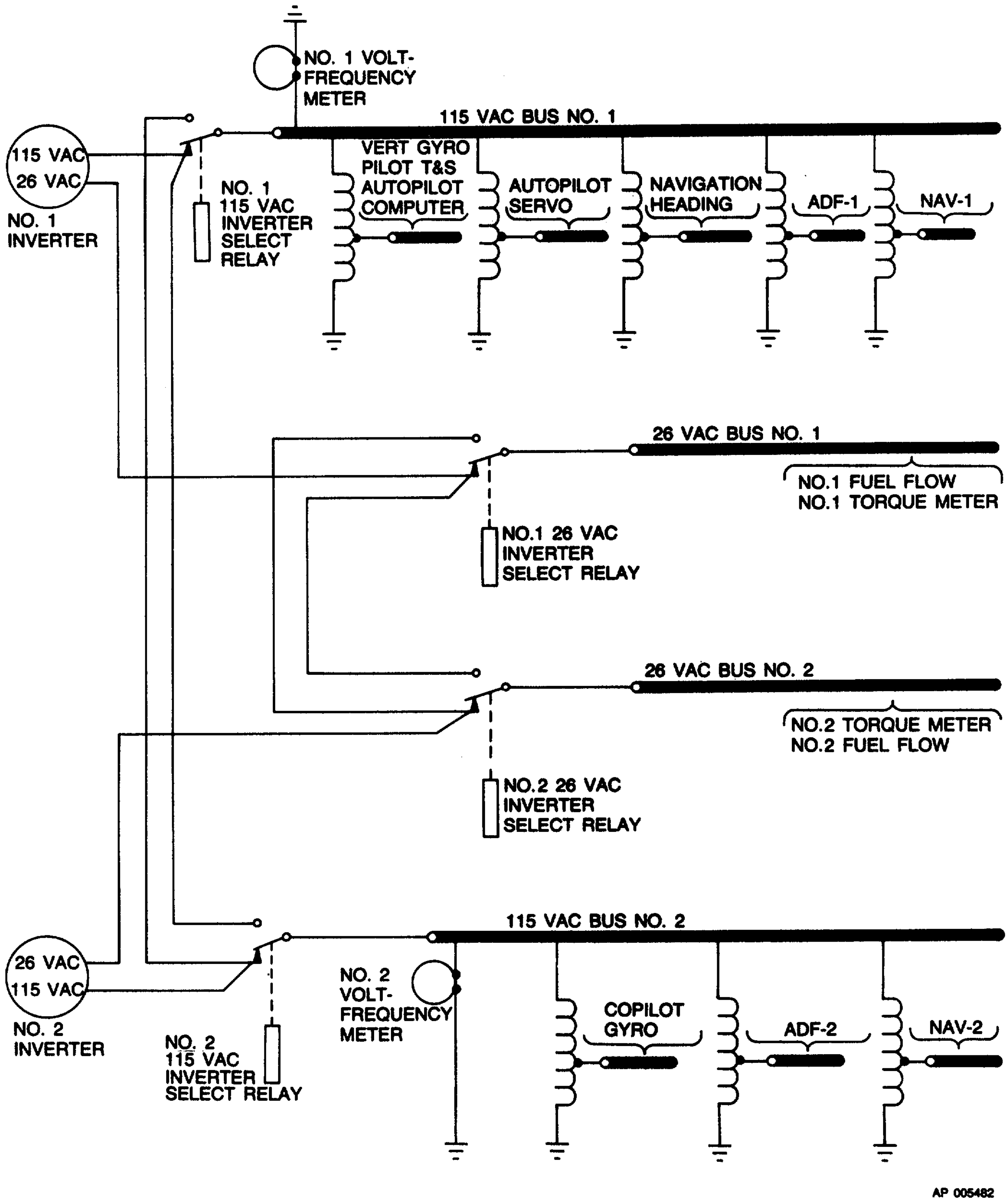


Figure 2-22. AC Electrical System Schematic Diagram **C D1** *- Sheet 1 of 2*

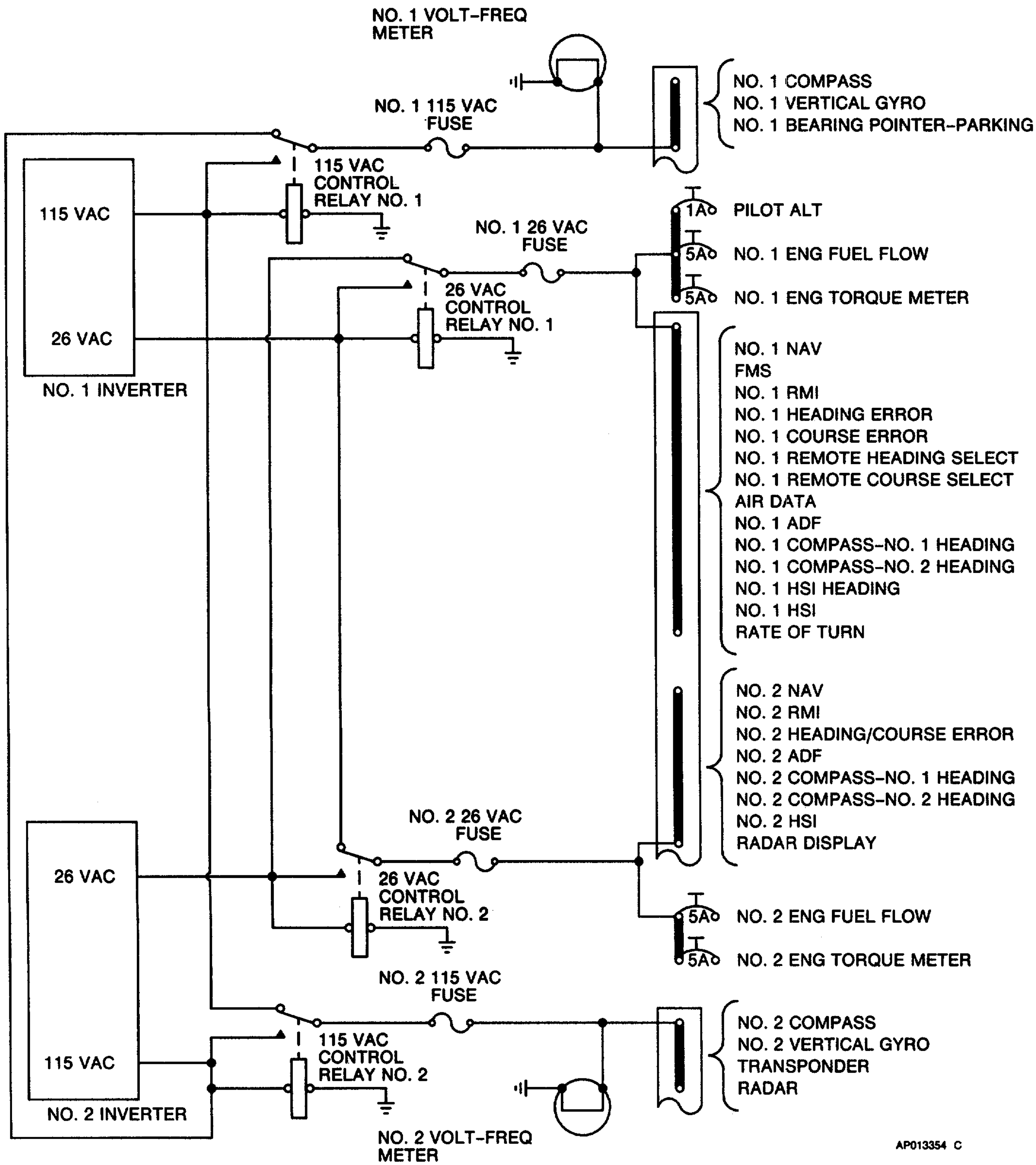


Figure 2-22. AC Electrical System Schematic Diagram ***D2 F*** *- Sheet 2 of 2*

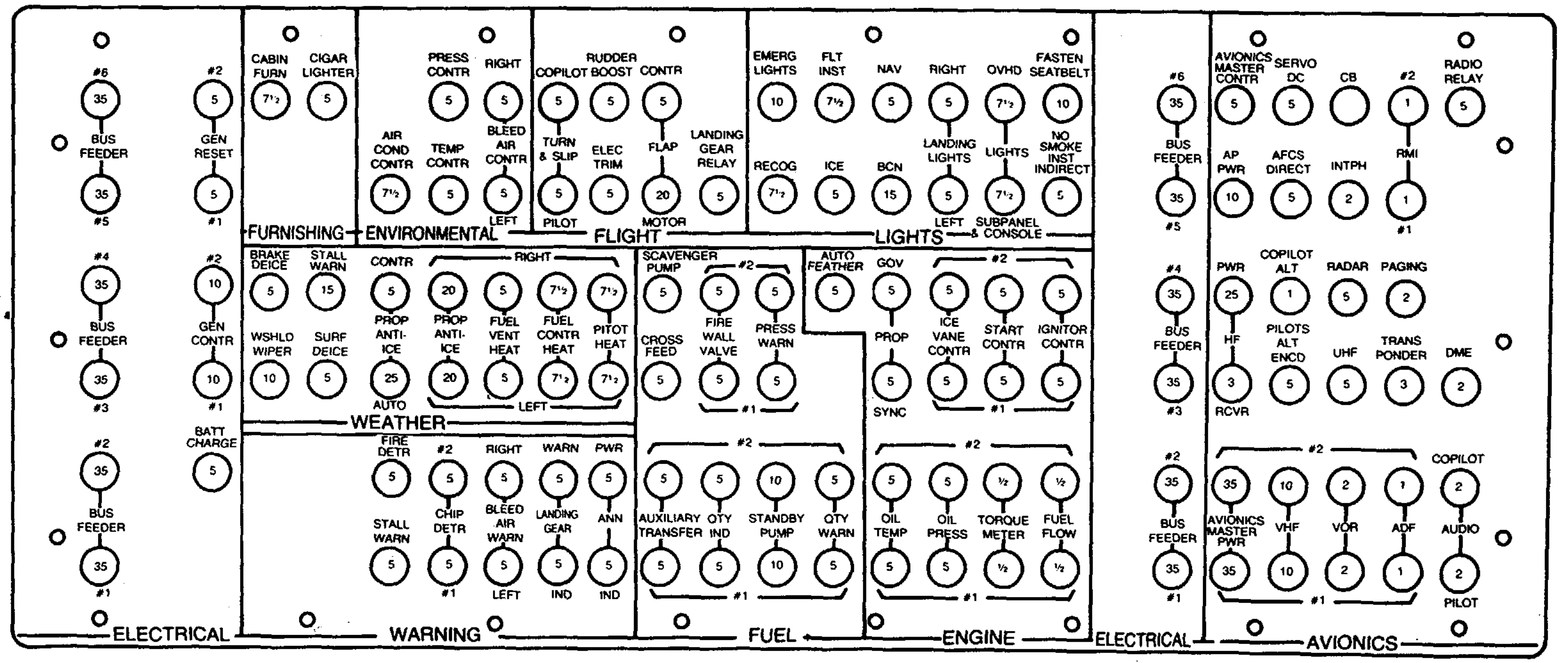


Figure 2-23. Overhead Circuit Breaker Panel **C** - Sheet 1 of 4

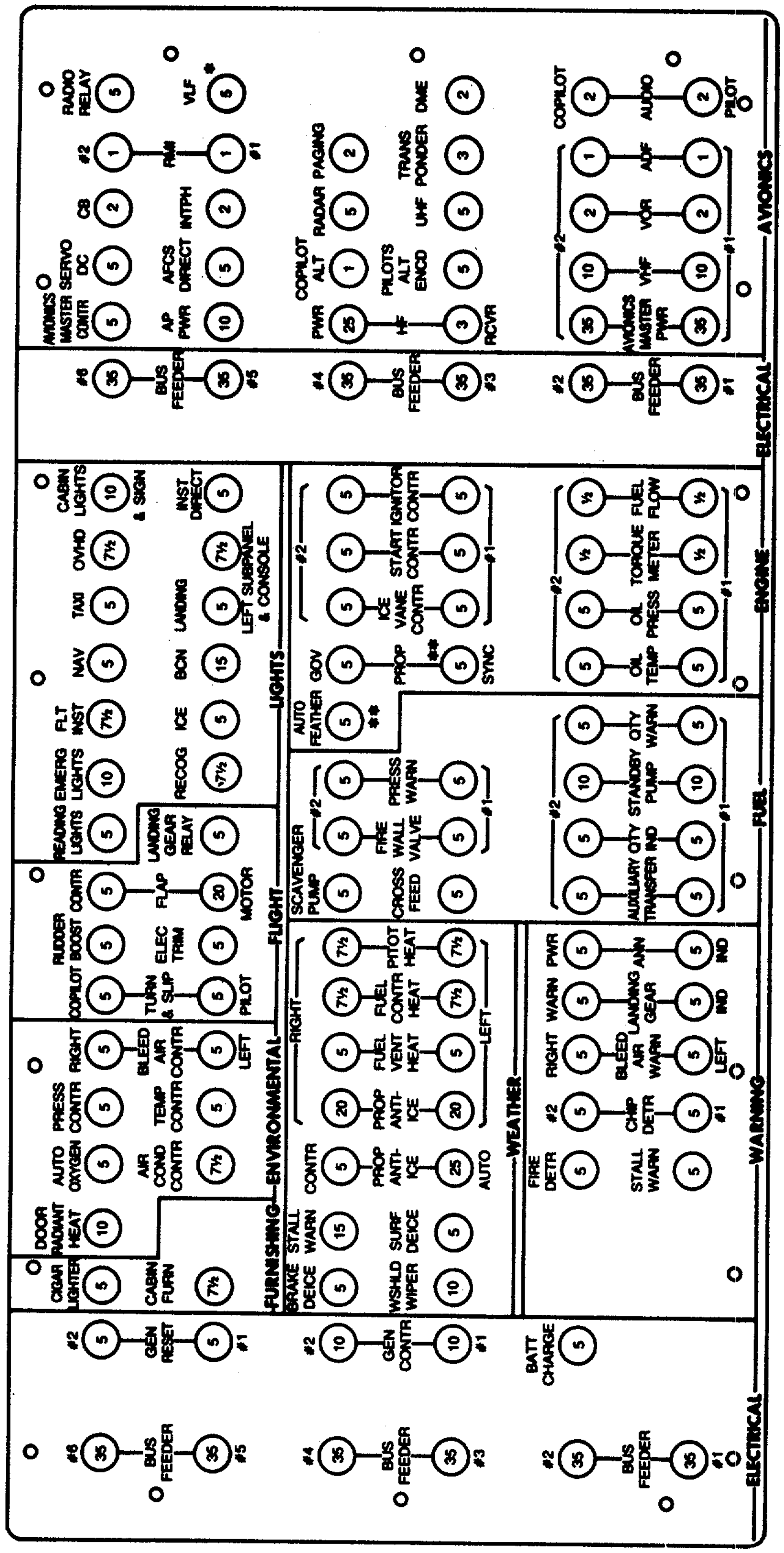
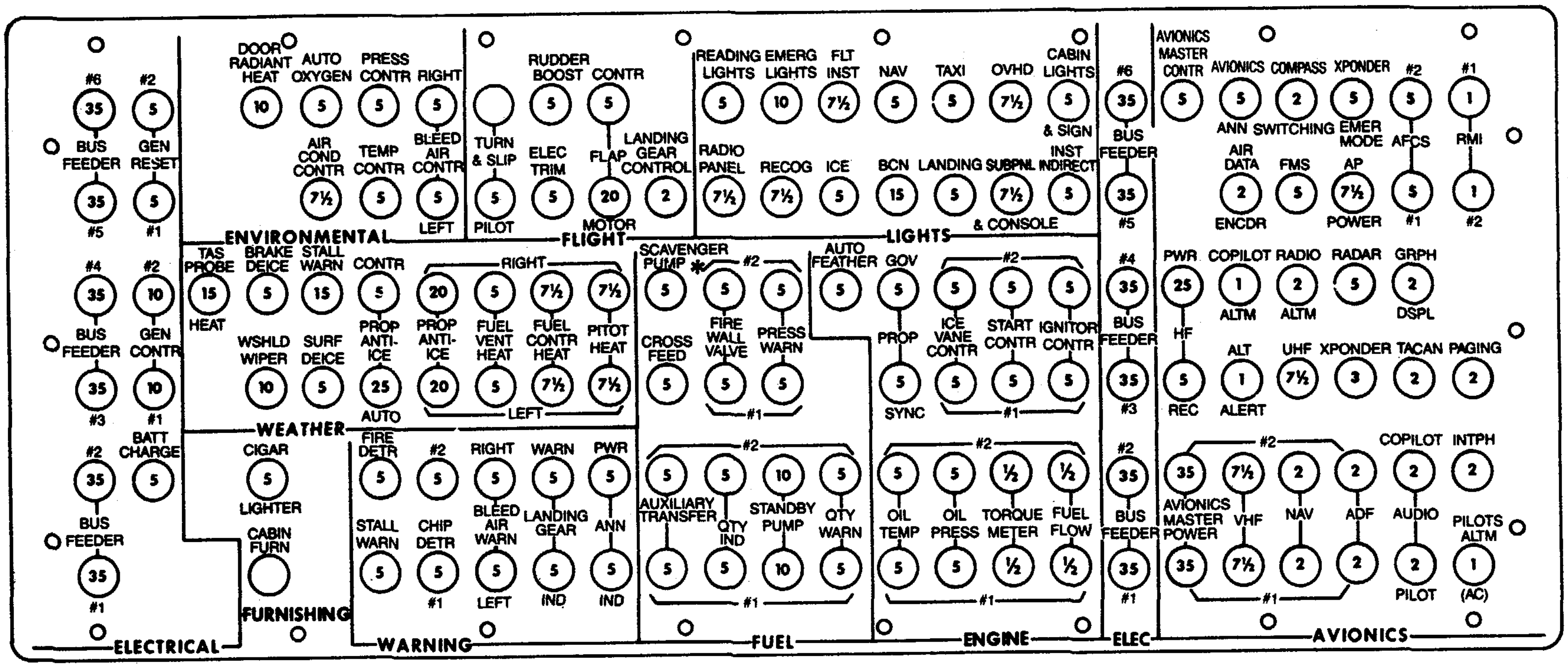


Figure 2-23. Overhead Circuit Breaker Panel **D1** - Sheet 2 of 4



✱ **NOT INSTALLED ON C-12 F1**

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Figure 2-23. Overhead Circuit Breaker Panel ***D2 F1*** *- Sheet 3 of 4*

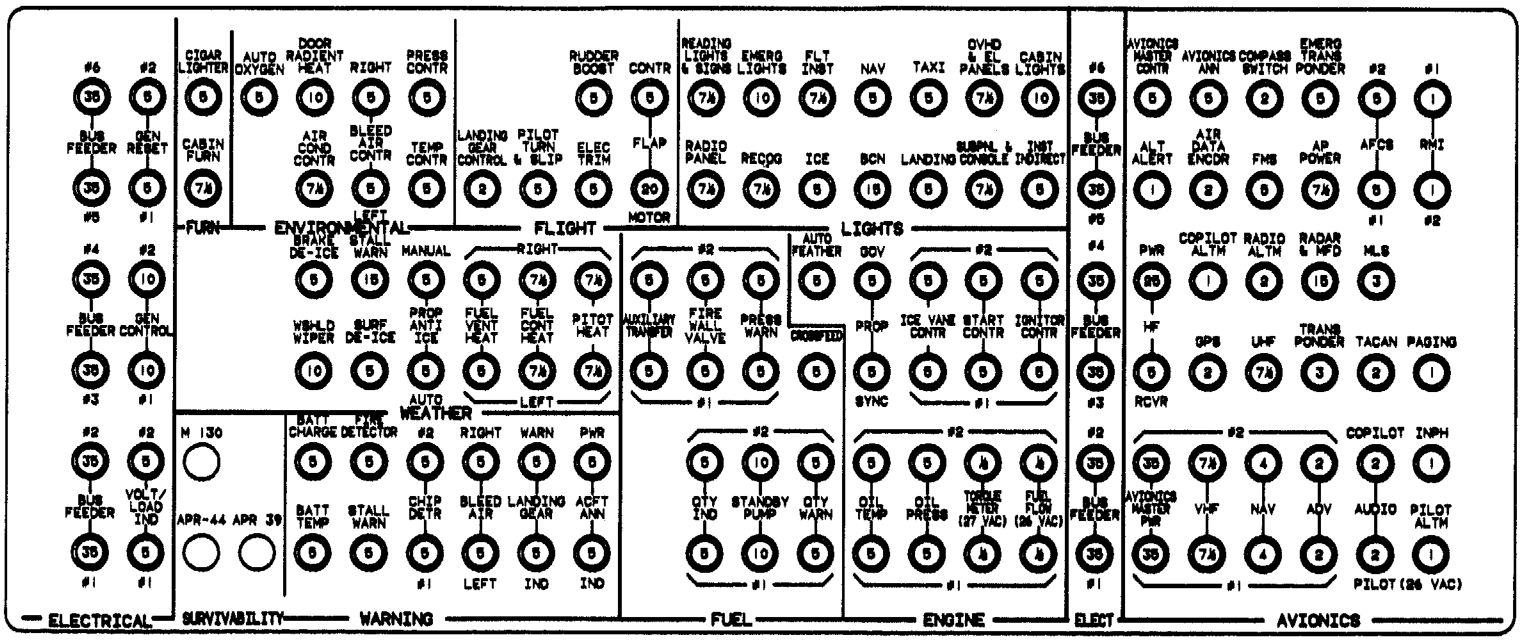


Figure 2-23. Overhead Circuit Breaker Panel F2 - Sheet 4 of 4

Section X. LIGHTING

2-80. EXTERIOR LIGHTING.

a. Description. Exterior lighting (fig. 2-24) consists of a navigation light on the aft top of the vertical stabilizer, one navigation light on each wing tip, two strobe beacons, one on top of the vertical stabilizer and one on the underside of the fuselage center section, one combination landing/taxi light recess mounted in each wing tip ***C*** or dual landing lights and one taxi light mounted on the nose gear assembly ***D F***, and two ice lights, one light flush mounted in each nacelle, positioned to illuminate along the leading edge of each outboard wing. In addition, some aircraft are equipped with a recognition light located in each wing tip.

b. Navigation Lights. The navigation lights are protected by a 5-ampere circuit breaker placarded NAV on the overhead circuit breaker panel (fig. 2-23). Control of the lights is provided by a switch placarded NAV ONon the overhead control panel (fig. 2-8).

c. Strobe Beacons. The strobe beacons are dual intensity units. They are protected by a 15ampere circuit breaker placarded BCN on the overhead circuit breaker panel (fig. 2-23). Control of the lights is provided by a switch placarded BEACON DAY NIGHT (fig. 2-8). Placing the switch in the DAY position will activate the high intensity white section of the strobe lights for greater visibility during daytime operation. Placing the switch in the NIGHT position activates the lower intensity red section of the strobe lights.

d. Landing/Taxi Lights ***C***. Each light is a dual element unit which automatically extends to the correct position when energized. The control circuits are protected by two 5-ampere circuit breakers placarded LANDING LIGHTS RIGHT LEFT on the overhead circuit breaker panel (fig. 2-23). Two 35-ampere circuit breakers provide power circuit protection and are mounted on the DC power distribution panel beneath the floor. Control of the lights is provided by to switches placarded LIGHTS LANDING TAXI LEFT and RIGHT on the pilot's subpanel (fig. 2-7). Placing the switch in the TAXI position illuminates one filament and causes the light to extend to a pre-set position. Placing the switch in the LANDING position illuminates both filaments and causes the light to extend to a pre-set position which will give best illumination in a landing attitude. The landing lights may be extended any time the airspeed is 150 knots or less. Placing the switch in the aft (off) position turns off the light and retracts it. A third switch placarded DE-ICE OFF (fig. 2-7) is provided for freeing the light assembly from accumulated ice. Placing the switch in the DEICE position will illuminate the lights while they are retracted. The heat generated by the lights will melt any ice accumulation and allow the lights to be extended by the LIGHTS LANDING switches.

e. Landing/Taxi Lights D F. Dual landing lights and a single taxi light are mounted on the nose gear assembly. The lights are controlled by switches, placarded LANDING and TAXI, located in the LIGHTS section of the pilot's subpanel. The control circuits are protected by two 5-ampere circuit breakers placarded LANDING LIGHT TAXI LDG on the overhead circuit breaker panel (fig. 2-23). The landing lights and taxi light power circuits are protected by 35-ampere and 15-ampere circuit breakers, respectively, located on the DC power distribution panel, beneath the cockpit floor.

f. Ice Lights. The ice lights are protected by a 5-ampere circuit breaker placarded ICE on the overhead circuit breaker panel (fig. 2-23). Control of the lights is provided by a switch placarded ICE ON on the overhead control panel (fig. 2-8). Prolonged use during ground operation may generate enough heat to damage the lens.

g. Recognition Lights. A RECOG switch, located in the pilot's subpanel LIGHTS section, control a white recognition light in each wing tip. This steady bright light is used for identification. The system is protected by a 7.5-ampere RECOG circuit breaker located on the overhead circuit breaker panel (fig. 2-23).

2-81. INTERIOR LIGHTS.

a. Description.

(1) Interior Lighting ***C D F1***. Lighting U systems are installed for use by the pilot and copilot any by the passengers in the cabin area. The lighting systems in the cockpit are provided with intensity controls on the overhead control panel. A switch placarded MASTER PANEL LIGHTS on the overhead control panel (fig. 2-8) provides overall on-off control for all engine instrument lights, pilot and copilot instrument lights, overhead panel lights, console and subpanel

(2) Interior Lighting ***F2***. Aviation night · vision compatible (ANVIS) lighting is installed in the cockpit and cabin area. The cockpit lighting systems are provided with individually controlled, from OFF to BRT (bright), rheostats on the overhead control panel. Cabin lighting is controlled by two switches placarded CABIN LIGHT BRIGHT ON-OFF and READING LIGHT ON OFF respectively.

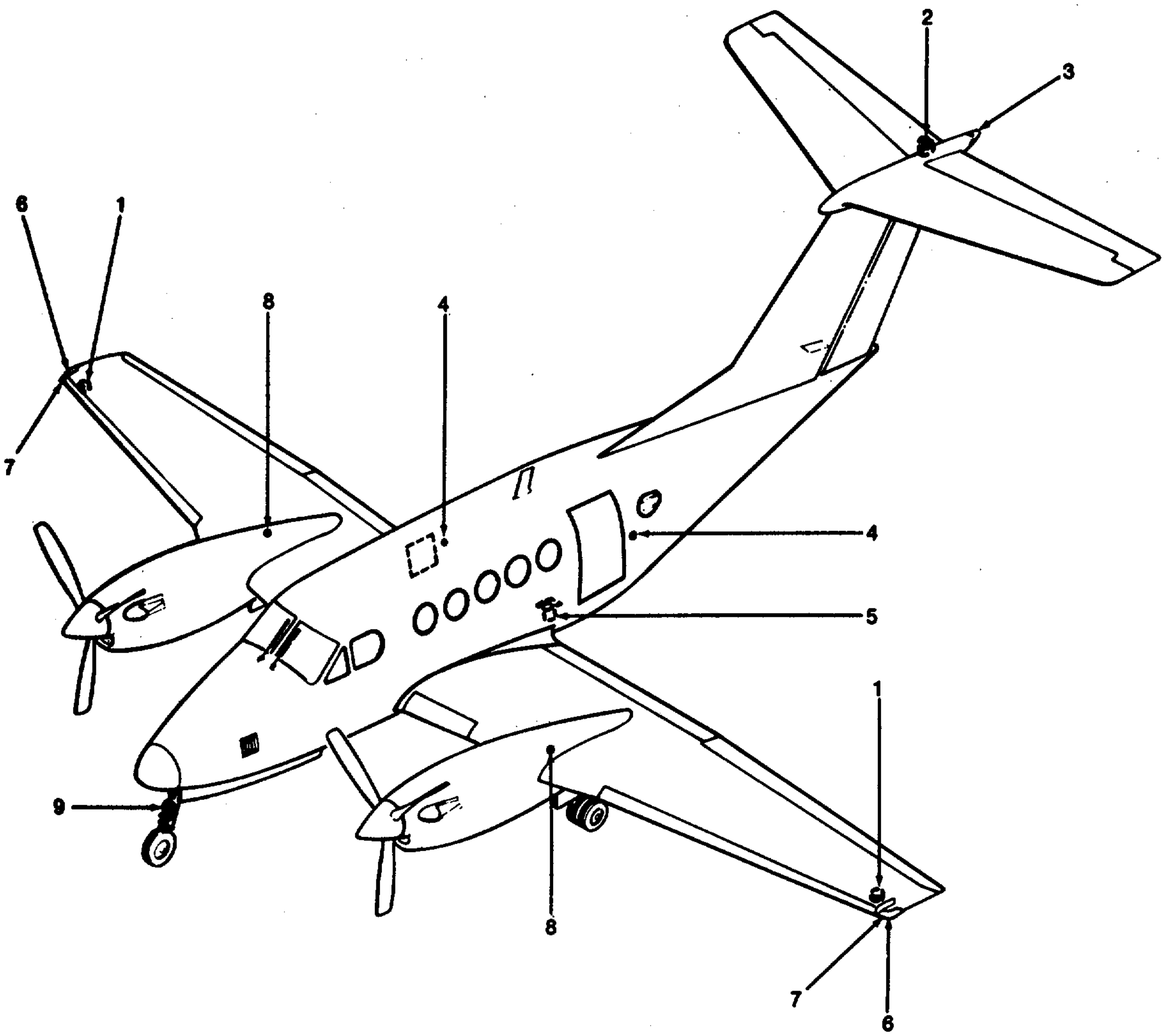
NOTE

The cabin reading lights are not night vision compatible.

A switch placarded MASTER PANEL LIGHTS on the overhead control panel (fig. 2-8) provides an overall power on-off control for all engine instrument lights, pilot and copilot instrument and gyro instrument lights, instrument indirect lights, overhead flood lights, overhead panel lights and electroluminescent edgelights.

b. Cockpit Lighting.

(1) Flight Instrument Lights. Each individual flight instrument contains internal lamps for illumination. The circuit is protected by a 7.5ampere circuit breaker placarded FLT INST on the overhead circuit breaker panel (fig. 2-23). Control is provided by two rheostat switches placarded PILOT or COPILOT INST LIGHTS OFF BRT on the overhead control panel (fig. 2-8). Turning the control clockwise from OFF turns the lights on and increases their brilliance.



1. Landing/Taxi Lights
2. Upper Strobe Beacon
3. Tail Navigation Light
4. Emergency Exit Light
5. Lower Strobe Beacon
6. Wing Navigation Lights
7. Recognition Lights
8. Ice Lights
9. Landing/Taxi Lights

Figure 2-24. Exterior Lighting - Typical

(2) Instrument Indirect Lights. Lights are mounted in the glareshield overhang along the top edge of the instrument panel to provide instrument panel illumination. The circuit is protected by a 5ampere circuit breaker placarded INST INDIRECT on the overhead circuit breaker panel (fig. 2-23). Control is provided by a rheostat switch placarded INST INDIRECT LIGHTS OFF BRT on the overhead control panel (fig. 2-8). Turning the control clockwise from OFF turns the lights on and increases their brilliance.

(3) Radio Panel Instrument Lights ***D2 F.*** Radio panel instrument lights provide direct adjustable lighting for individual radios and switches. A rheostat placarded RADIO PANEL LIGHTS, located on the overhead control panel (fig. 2-8), is utilized to adjust light levels from OFF to BRT (bright). Turning the control clockwise from OFF turns the lights on and increases their brilliance. The circuit is protected through a 7.54ampere circuit breaker, placarded RADIO PANEL, located on the overhead circuit breaker panel (fig. 2-23).

(4) Engine Instrument Lights. Each individual engine instrument contains internal lamps for illumination. The circuit is protected by a 7.5ampere circuit breaker placarded FLT INST on the overhead circuit breaker panel (fig. 2-23). Control is provided by a rheostat switch placarded ENGINE INST LIGHTS on the overhead control panel (fig. 2-8). Turning the control clockwise from OFF turns the lights on and increases their brilliance.

(5) Flood Light. A single overhead flood light is installed in the oxygen control escutcheon aft of the overhead circuit breaker panel. It provides overall illumination of the entire cockpit area. The circuit is protected by a 5-ampere circuit breaker mounted beneath the battery and connected to the emergency battery bus. Control is provided by a rheostat switch placarded OVERHEAD FLOODLIGHT on the overhead control panel (fig. 2-8). Turning the control clockwise from OFF turns the light on and increases its brilliance.

(6) Overhead Panel Lights ***CD F1***. Lamps on the overhead circuit breaker panel, control panel, and fuel management panel are protected by a 7.5-ampere circuit breaker placarded LIGHTS OVHD on the overhead circuit breaker panel (fig. 2-23). Control is provided by a rheostat switch placarded OVERHEAD PANEL LIGHTS OFF-BRT on the overhead control panel (fig. 2-8). Turning the control clockwise from OFF turns the lights on and increases their brilliance.

(6.A.) Overhead Panel Lights ***F2***. The rheostat placarded OVERHEAD PANEL LIGHTS controls lighting for the magnetic compass, #1 and #2 VAC frequency meters, #1 and #2 DC voltmeters and fuel quantity gages. Turning the control clockwise from OFF turns the lights on and increases _ their brilliance. Power and circuit protection is provided through a circuit breaker placarded OVHD & EL PANELS located on the overhead control panel.

(7) Subpanel and Console Lights ***CD F1***. Lamps on the pilot's and copilot's subpanels, E console edge lit panels and pedestal extension panels are protected by a 7.5-ampere circuit breaker placarded LIGHTS SUBPANEL & CONSOLE on the overhead circuit breaker panel (fig. 2-23). Control is provided by two rheostat switches placarded SUBPANEL or CONSOLE LIGHTS OFF BRT on the overhead control panel (fig. 2-8). Turning the control clockwise from OFF' turns the lights. on and increases their brilliance.

(7.A.) Sub Panel Lights ***F2***. Post lighting of E the gages located on the pilot and copilot subpanels, is controlled by a rheostat placarded SUB PANEL LIGHTS, located on the overhead control panel. Turning the control clockwise from OFF turns the lights on and increases their brilliance. These lights receive electrical power through and are protected by a circuit breaker placarded SUBPNL & CONSOLE located in the overhead circuit breaker panel.

(7.B.) Console Lights ***F2***. Edge lighting of I the pressurization controller panel located on extended pedestal, is controlled by the rheostat placarded CONSOLE LIGHTS. Turning the control clockwise from OFF turns the lights on and increases their brilliance. Power is through and circuit protection is provided by a circuit breaker placarded SUBPNL & CONSOLE located in the overhead circuit breaker panel.

(8) Free Air Temperature Lights ***C D F1***. Two post lights are mounted adjacent to the free air temperature gage on the left cockpit sidewall trim panel. The circuit is protected by a 7.5-ampere circuit breaker placarded FLT INST on the overhead circuit breaker panel (fig. 2-23). Control is provided by a push button switch adjacent to the gage. No intensity control is provided.

(8.A.) Free Air Temperature Light ***F2***. A press to light switch, located adjacent to the outside air temperature indicator, controls the indicator ON/OFF power function. However, light intensity is controlled by the COPILOT INSTR LIGHTS rheostat. The light circuitry receives power through, and is protected by the FLT INST circuit breaker located in the overhead circuit breaker panel.

c. Cabin Lighting.

(1) Interior Lights **C D F1**. Dual intensity fluorescent lights are installed on both sides of the overhead trim. The circuit is protected by a 10ampere circuit breaker placarded FASTEN SEAT BELT-NO SMOKE on the overhead circuit breaker panel (fig. 2-23). Control is provided by a switch placarded INTR LIGHT OFF DIM BRT START on the overhead control panel (fig. 2-8). The switch must be placed in the BRT START position to illuminate the lights. Intensity can be reduced by placing the switch in DIM position.

(2.A.) Interior Lights ***F2***. Dual intensity cold cathode lights are installed on both sides of the overhead trim. The circuits are protected by a 10ampere circuit breaker placarded CABIN LIGHTS located on the overhead circuit breaker panel (fig. 2-23). Control is provided by a switch placarded CABIN LIGHT ON BRIGHT located on the overhead control panel (fig. 2-8). Light intensity is increased by placing the switch in BRIGHT position. Cabin light intensity is also increased upon automatic deployment of the oxygen masks.

(2) No Smoking Fasten Seat Belt Lights. One light assembly is mounted in the overhead on each side of the cabin. The circuit is protected by a circuit breaker located on the overhead circuit breaker panel (fig. 2-23). Control is provided by a switch placarded CABIN SIGNS FASTEN SEAT BELT-OFF-BOTH on the overhead control panel (fig. 2-8). Placing the switch in SEAT BELT position will illuminate both FASTEN SEAT BELT lights and sound the audible warning chime mounted behind the upholstery in the cabin. Placing the switch in BOTH position will illuminate both FASTEN SEAT BELT and both NO SMOKING lights and will sound the audible warning chime.

(3) Reading Lights. Reading lights are installed in the upholstery adjacent to each seat position. The circuit is protected by a 10-ampere circuit breaker placarded FASTEN SEAT BELT-NO SMOKE on C-12C aircraft, and a 5-ampere circuit breaker placarded READING LIGHTS on C-12DF aircraft, located on the overhead circuit breaker panel (fig. 2-23). Control is provided by a push button switch adjacent to each light.

(4) Threshold and Spar Cover Lights. A threshold light is installed just above floor level on the left side of the cabin just inside the cabin door.

A spar cover light is installed on the left side of the sunken aisle immediately aft of the main spar cover. Both circuits are protected by a 5-ampere circuit So breaker mounted beneath the battery and connected to the emergency battery bus. Both lights are con- trolled by the switch mounted adjacent to the threshold light. If the lights are illuminated, closing the cabin door will automatically extinguish them.

(5) Dome Light. A dome light is installed in the baggage area, in the overhead. The circuit is protected by a 5-ampere circuit breaker mounted beneath the battery and connected to the emergency battery bus. Control is provided by a switch mounted adjacent to the light.

2-82. EMERGENCY LIGHTING.

a. Description. An independent battery operated lighting system is installed. The system which consists of five lights, is actuated automatically by shock, such as a forced landing. It provides adequate lighting inside and outside the fuselage to permit crew and passengers to read instruction placards and locate exits. An inertia switch, when subjected to a 2-3 G shock, will illuminate interior lights in the cockpit, forward and aft cabin areas, and exterior lights aft of the emergency exit and aft of the cabin door. The battery power source is automatically recharged by the aircraft electrical system. b. Operation. An emergency lights override switch, located on the overhead control panel (fig. 2-8), is provided to turn the system off if it is accidentally actuated. The switch is placarded EMER LIGHTS OFF/ RESET AUTO TEST. Should the system accidentally actuate, placing the switch in the momentary OFF/RESET position will extinguish the lights. To test the system, place the switch in the momentary TEST position. The lights should illuminate. Moving the switch to the OFF/RESET position will turn the system off and reset it.

Section XI. FLIGHT INSTRUMENTS

2-83. PILOT AND STATIC SYSTEM.

a. Description. The pilot and static system provides a source of impact air and static air for the operation of flight instruments. A heated pilot mast is located on each side on the lower portion of the nose. Tubing from each mast extends into the cabin to the instrument panel for the instruments (fig. 2-26).

b. Normal Static System. The normal static system provides two sources of static air to the flight instruments through two static air fittings on each side of the aft fuselage. Each static system utilizes one static button on each side of the fuselage.

c. Alternate Static System. An alternate static air line, which terminates just aft of the rear pressure bulkhead, provides a source of static air for the pilot's instruments in the event of source failure from the pilot's static air line. A control on the pilot's subpanel placarded PILOT'S STATIC AIR SOURCE, may be actuated to select either NORMAL or ALTERNATE air source by a two position selector valve. A valve is secured in the NORMAL position by a spring clip. Altimeter and airspeed information graphs are provided in the Performance section for computation when operating on normal or alternate static air.

d. Static Line Drains. There are three drain petcocks for draining the static air lines located on the right lower sidewall. These are protected by an access cover placarded STATIC AIR LINE DRAIN. These drain petcocks should be opened to release any trapped moisture at each 100-hour inspection, or more often if conditions warrant, and must be closed after draining.

2-84. TURN-AND-SLIP INDICATORS Turn and slip indicators are installed separately on the pilot and copilot sides of the instrument panel (fig. 2-26). The pilot's indicator provides yaw damping information to the autopilot. These indicators are gyroscopically operated. They use DC power and are protected by 5-ampere circuit breakers placarded TURN & SLIP PILOT or COPILOT on the overhead circuit breaker panel (fig. 2-23)

2-85. TURN-AND-SLIP INDICATORS

Turn and slip indicators are installed separately on the pilot and copilot sides of the instrument panel (fig. 2-26). These indicators are gyroscopically operated. The pilot's turn and slip indicator uses DC power, protected by a 5-ampere circuit breaker placarded TURN & SLIP PILOT located on the overhead circuit breaker panel (fig. 2-23). The copilot's turn and slip indicator does not require electrical power.

2-86. AIRSPEED INDICATORS.

Airspeed indicators are installed separately on the pilot and copilot sides of the instrument panel (fig. 2-26). These indicators require no electrical power for operation. The indicator dials are calibrated in knots from 40 to 300. A striped pointer

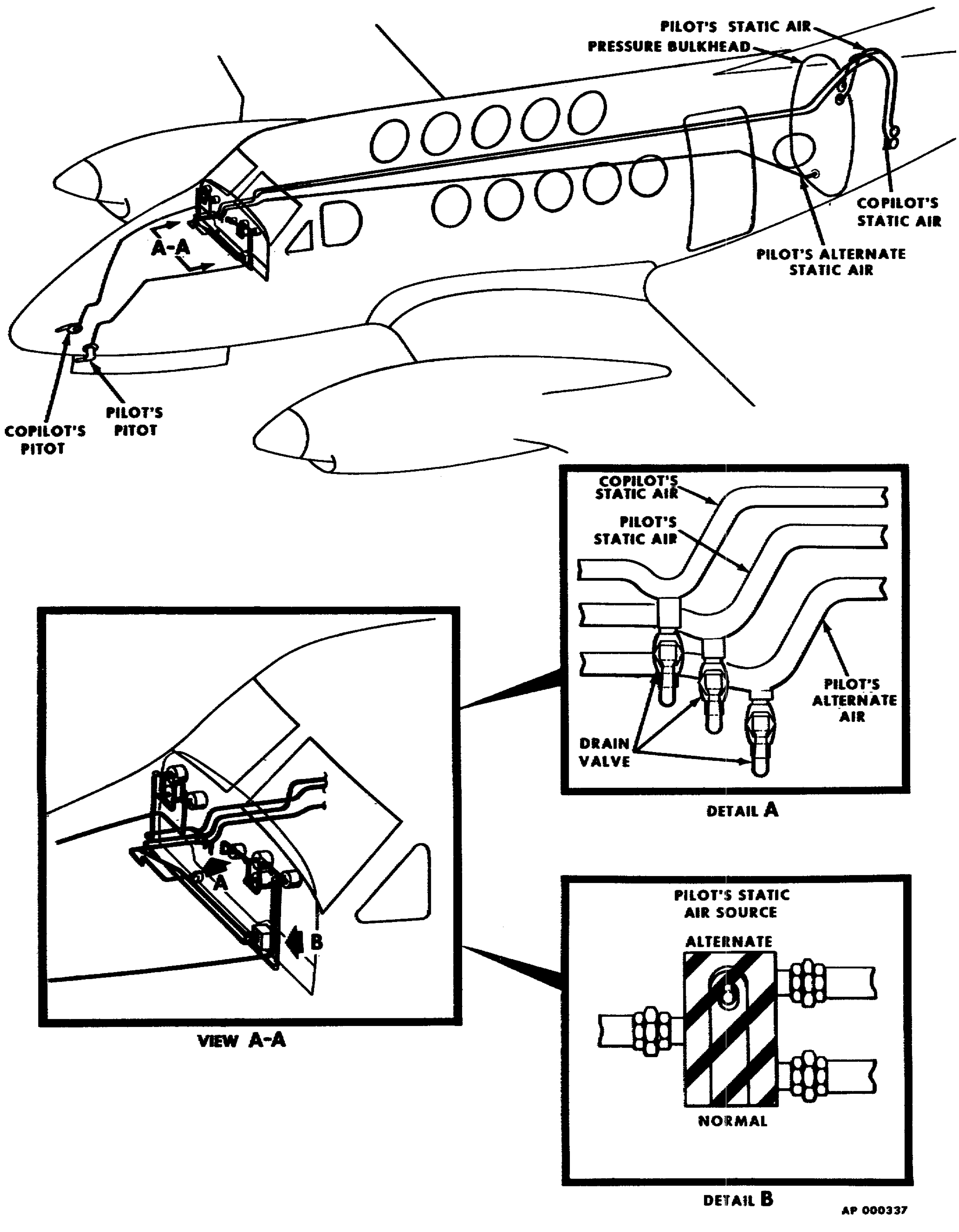


Figure 2-25. Pilot and Static System

automatically displays the maximum allowable airspeed (260 KIAS, 0.52 mach) at the aircraft's present altitude.

2-87. PILOTS ALTIMETER *C D1.*

The altimeter is located on the upper left side of the instrument panel (fig. 2-26). The altimeter is a self-contained unit which consists of a precision pressure altimeter combined with an altitude encoder. The display indicates, and the encoder transmits simultaneously, pressure altitude information to the transponder. Altitude is displayed on the altimeter by a 10,000 foot counter, a 1000 foot counter, and a single needle pointer which indicates hundreds of feet on a circular scale in 20 foot increments. Below an altitude of 10,000 feet, a diagonal warning symbol will appear on the 10,000 foot counter. A barometric pressure setting knob is provided to insert the desired altimeter setting in inches Hg or millibars. A DC powered vibrator operates inside the altimeter whenever aircraft power is on. If DC power to the altitude encoder is lost, a warning flag placarded CODE OFF will appear in the upper left portion of the instrument face, indicating that the altitude encoder is inoperative and that the system is not reporting altitude to ground stations. Operating instructions are contained in Chapter 3.

2-88. PILOTS ALTIMETER *D2 F*.

The pilot's altimeter (fig. 3-21) provides a servoed counter drum/pointer display of barometrically corrected pressure altitude. The barometric pressure is set manually with the BARO knob, and displayed in units of inches of mercury and millibars on baro counters. Altitude is displayed on the altimeter by a 10,000 foot counter, a 1,000 foot counter, and a single needle pointer which indicates hundreds of feet on a circular scale in 20 foot increments. Below an altitude of 10,000 feet, a diagonal warning symbol will appear on the 10,000 foot counter. The altimeter is AC powered and is protected through a lampere circuit breaker, placarded PILOT ALTM (AC) located on the overhead circuit breaker panel (fig. 2-23). Encoding capability is derived from the air data computer. The pilot's altimeter acts as an encoding repeater. For proper encoding operation, the 2ampere AIR DATA ENCDR circuit breaker located on the overhead circuit breaker panel, must be in. Operating instructions are contained in Chapter 3.

2-89. COPILOTS ALTIMETER.

The copilot's altimeter is located on the upper right side of the instrument panel (fig. 2-26). The altimeter is pneumatically operated and requires no electrical power for operation. The altimeter does not have altitude reporting capability.

2-90. VERTICAL VELOCITY INDICATORS.

Vertical velocity indicators are installed separately on the pilot and copilot sides of the instrument panel (fig. 2-26). They indicate the speed at which the aircraft ascends or descends based on changes in atmospheric pressure. The indicator is a direct reading pressure instrument requiring no electrical power for operation.

2-91. FREE AIR TEMPERATURE (FAT) GAGE.

The free air temperature gage, mounted outboard of the pilot's seat, (fig. 2-5), indicates the outside air temperature in degrees Celsius.

2-92. STANDBY MAGNETIC COMPASS.

WARNING

Inaccurate indications on the standby magnetic compass will occur while windshield heat and/or air conditioning is being used.

The standby magnetic compass is located below the overhead fuel management panel to the right of the windshield divider (fig. 2-5). It may be used in the event of failure of the compass system, or for instrument cross check. Readings should be taken only during level flight since errors may be introduced by turning or acceleration. A compass correction chart indicating deviation is located on the magnetic compass.

2-93. MISCELLANEOUS INSTRUMENTS.

a. Annunciator Panels ***C D1***. Two annunciator panels are installed. One is a warning panel with red fault identification lights, and the other is a caution/advisory panel with yellow and green identification lights. The warning panel is mounted near the center of the instrument panel below the glareshield (fig. 2-26) and the caution/advisory panel is located on the center subpanel (fig. 2-26). Illumination of a red warning light signifies the existence of a hazardous condition requiring immediate corrective action. A yellow caution light signifies a condition other than hazardous requiring pilot at-

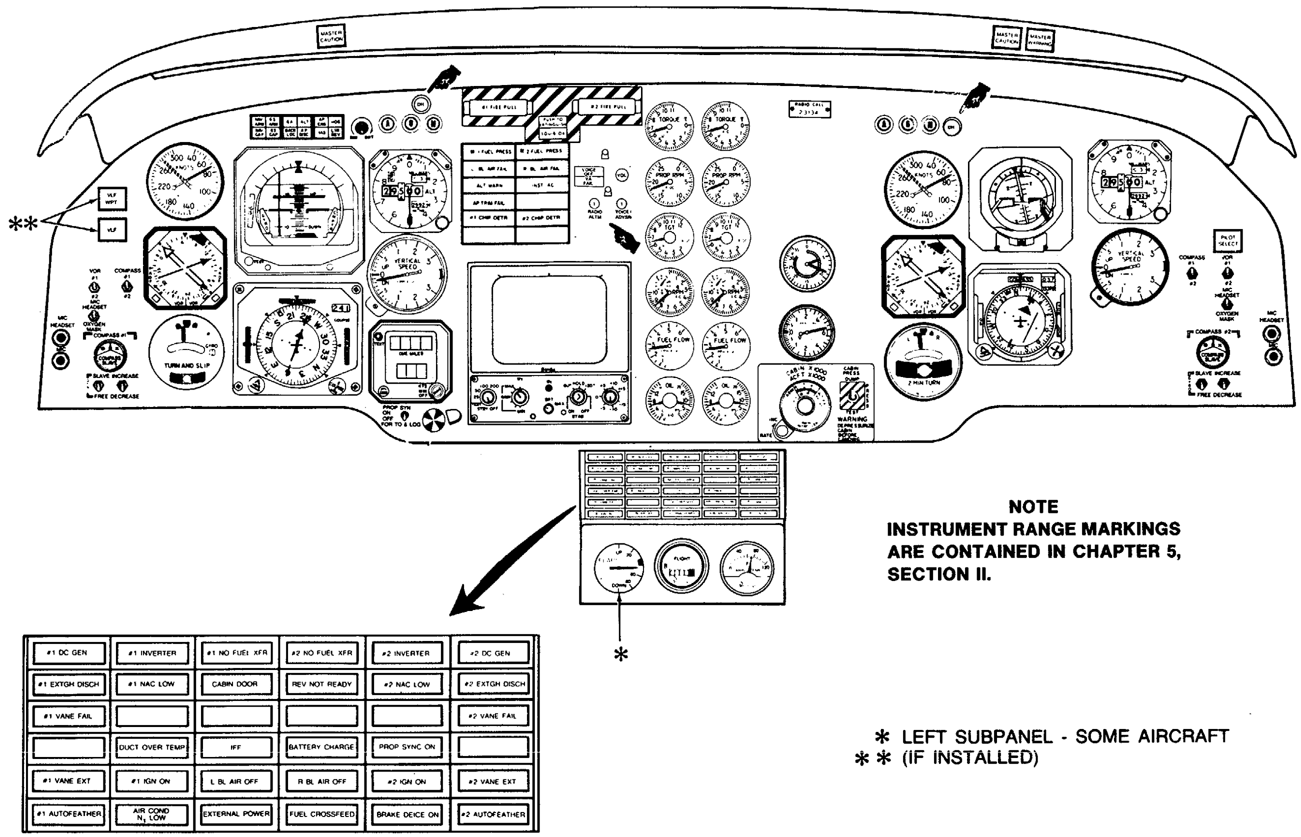


Figure 2-26. Instrument Panels - Sheet 1 of 3

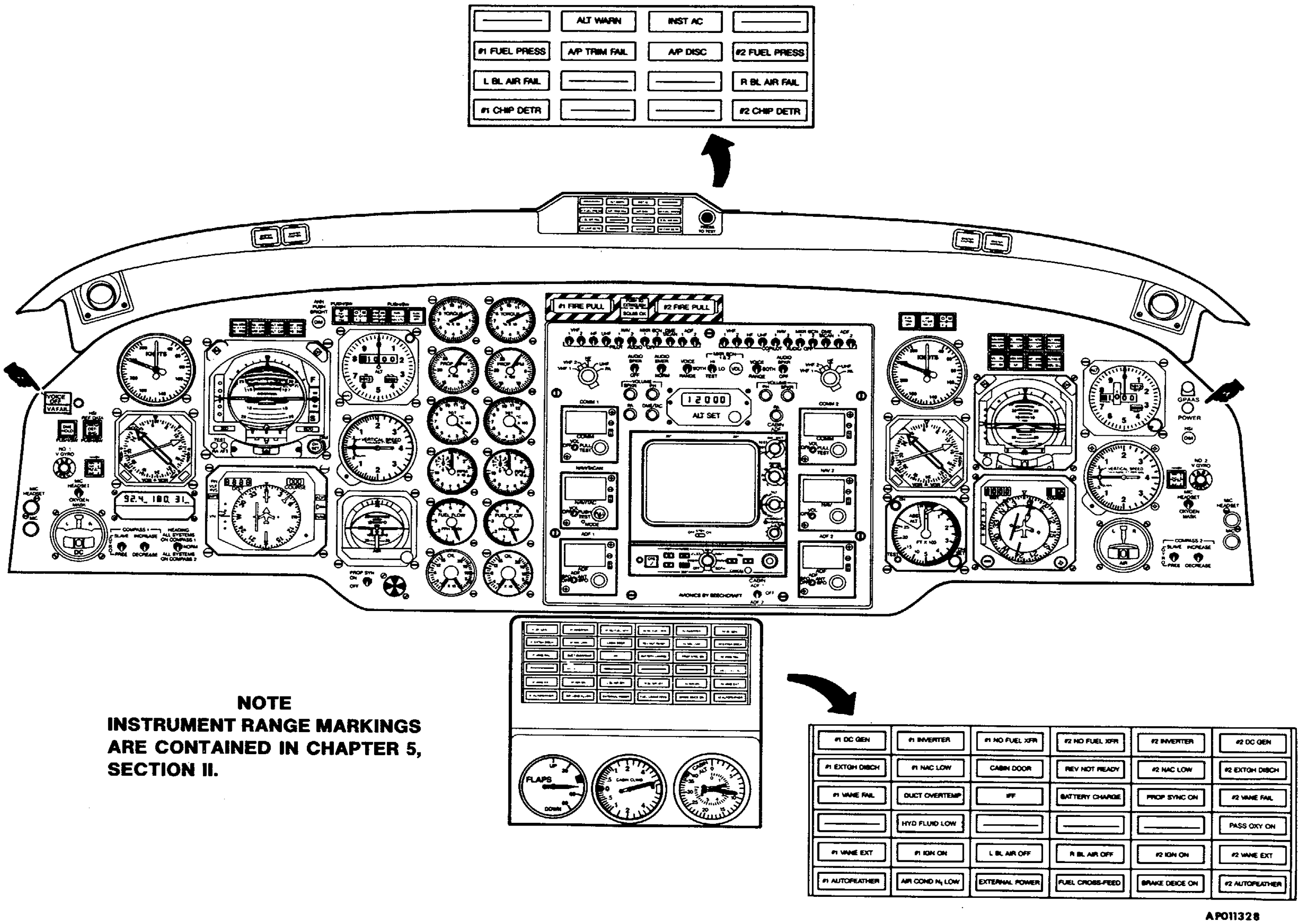
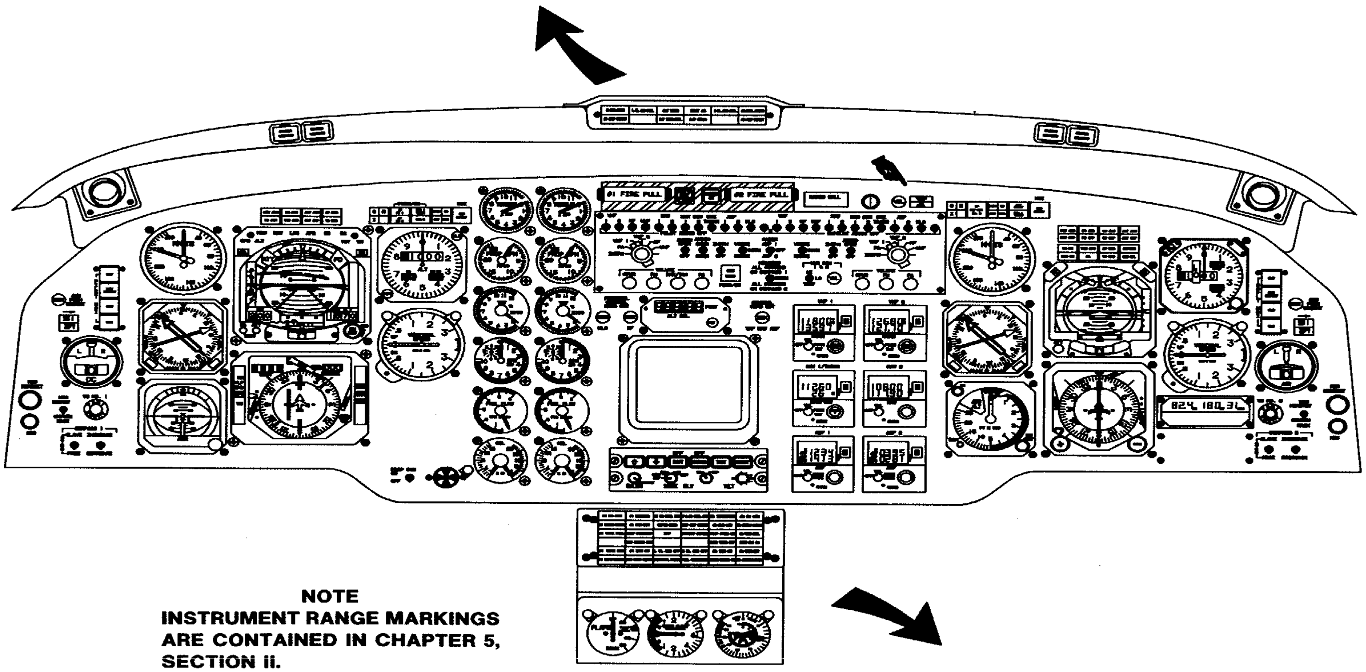


Figure 2-26. Instrument Panel ***D2 F2*** *- Sheet 2 of 3*

#1 FUEL PRESS	L BL AIR FAIL	ALT WARN	INST AC	R BL AIR FAIL	#2 FUEL PRESS
#1 CHIP DETECT		A/P TRIM FAIL	A/P DISC		#2 CHIP DETECT



NOTE
INSTRUMENT RANGE MARKINGS ARE CONTAINED IN CHAPTER 5, SECTION II.

#1 DC GEN	#1 INVERTER	#1 NO FUEL XFR	# 2 NO FUEL XFR	#2 INVERTER	#2 DC GEN
#1 EXTGH DISCH	#1 NAC LOW	CABIN DOOR	REV NOT READY	#2 NAC LOW	#2 EXTGH DISCH
#1 VANE FAIL	DUCT OVERTEMP	IFF	BATTERY CHARGE	PROP SYNC ON	#2 VANE FAIL
	HYD FLUID LOW			ELEC TRIM OFF	PASS OXY ON
#1 VANE EXT	#1 IGN ON	L BL AIR OFF	R BL AIR OFF	#2 IGN ON	#2 VANE EXT
#1 AUTOFEATHER	AIR COND N_1 LOW	EXTERNAL POWER	FUEL CROSSFEED	BRAKE DEICE ON	#2 AUTOFEATHER

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*Figure 2-26. Instrument Panel **F2** - Sheet 3 of 3*

Table 2-5. Annunciator Panels

WARNING ANNUNCIATOR			
NOMENCLATURE	**COLOR**	**CAUSE FOR ILLUMINATIO N**	**AIRCRAFT EFFECTIVITY**
(C-12*C D1*)			
#1 FUEL PRESS	Red	Fuel pressure failure on left side	All
#2 FUEL PRESS	Red	Fuel pressure failure on right side	All
L BL AIR FAIL	Red	Left bleed air warning line has melted or failed indi- cating possible loss of #1 engine bleed air	All
R BL AIR FAIL	Red	Right bleed air warning line has melted or failed, in- dicating possible loss of #2 engine bleed air	All
ALT WARN	Red	Cabin altitude exceeds 12,500 feet	All
INST AC	Red	No AC power to engine instruments	All
AP TRIM FAIL	Red	Trim won't run or running opposite direction commanded -	All
#1 CHIP DETR	Red	Contamination of #1 engine oil detected	All
#2 CHIP DETR	Red	Contamination of #2 engine oil detected	All
(C-12 *D2 F1*)			
ALT WARN	Red	Cabin altitude exceeds 12,500 feet	
INSTR AC	Red	No AC power to engine instruments	
#1 FUEL PRESS	Red	Fuel pressure failure on left side	
A/P TRIM FAIL	Red	Trim won't run or running opposite direction commanded	
A/P DISC	Red	Autopilot is disconnected	
#2 FUEL PRESS	Red	Fuel pressure failure on right side	
L BL AIR FAIL	Red	Left bleed air warning line has melted or failed, indi- ating possible loss of #2 engine bleed air	
R BL AIR FAIL	Red	Right bleed air warning line has melted or failed, in- dicating possible loss of #2 engine bleed air	
#1 CHIP DETR	Red	Contamination of #1 engine oil detected	
#2 CHIP DETR	Red	Contamination of #2 engine oil detected	
(C-12 *F2*)			
#1 FUEL PRESS	ANVIS YELLOW	Fuel pressure failure on left side	
L BL AIR FAIL	ANVIS YELLOW	Left bleed air warning line has melted or failed, indi- cating possible loss of #2 engine bleed air	
ALT WARN	ANVIS YELLOW	Cabin altitude exceeds 12,500 feet	
INSTR AC	ANVIS YELLOW	No AC power to engine instruments	
R BL AIR FAIL	ANVIS YELLOW	Right bleed air warning line has melted or failed, in- dicating possible loss of #2 engine bleed air	
#2 FUEL PRESS	ANVIS YELLOW	Fuel pressure failure on right side	
#1 CHIP DETR	ANVIS YELLOW	Contamination of #1 engine oil detected	
A/P TRIM FAIL	ANVIS YELLOW	Trim won't run or running opposite direction commanded	
A/P DISC	ANVIS YELLOW	Autopilot is disconnected	
#2 CHIP DETR	ANVIS YELLOW	Contamination of #2 engine oil detected	

Table 2-5. Annunciator Panels (cont'd)

NOMENCLATURE	COLOR	CAUTION/ADVISORY ANNUNCIATOR CAUSE FOR ILLUMINATION	AIRCRAFT EFFECTIVITY
		(C-12 *C DF1*)	
#1 DC GEN	Yellow	#1 engine generator off the line	All
#1 INVERTER	Yellow	#1 inverter inoperative	All
#1 NO FUEL XFR	Yellow	Auxiliary fuel tank on side of #1 engine not transferring fuel into nacelle tank	All
#2 NO FUEL XFR	Yellow	Auxiliary fuel tank on side of #2 engine not transferring fuel into nacelle tank	All
#2 INVERTER	Yellow	#2 inverter inoperative	All
#2 DC GEN	Yellow	#2 engine generator off line	All
#1 EXTGH DISCH	Yellow	#1 engine fire extinguisher discharged	All
#1 NAC LOW	Yellow	#1 engine has ***C*** 20 ***D F1*** 30 minutes fuel remaining at sea level, normal cruise power consumption rate	All
CABIN DOOR	Yellow	Cabin/cargo door open or not secure	All
REV NOT READY	Yellow	Propeller levers are not in the high rpm (low pitch position) with the landing gear extended	All
#2 NAC LOW	Yellow	#2 engine has ***C*** 20 ***D F1*** 30 minutes fuel remaining at sea level normal cruise power consumption rate	All
#2 EXTGH DISCH	Yellow	#2 engine fire extinguisher discharged	All
#1 VANE FAIL	Yellow	#1 engine ice vane malfunction. Ice vane has not attained proper position	All
DUCT OVERTEMP	Yellow	Excessive bleed air temperature in environmental heat ducts	All
IFF	Yellow	Transponder fails to reply to a valid mode 4 interrogation	All
BATTERY CHARGE	Yellow	Excessive charge rate on battery	All
PROP SYNC ON	Yellow	Synchrophaser turned on with landing gear extended	C-12***C***, C-12 ***D***
#2 VANE FAIL	Yellow	#2 engine ice vane malfunction. Ice vane has not attained proper position	All
HYD FLUID LOW	Yellow		
HYD FLUID LOW	Yellow	Hydraulic fluid level in reservoir is low	C-12, ***D2 F1***
PASS OXY ON	Green	Passenger oxygen system is on	C-12 ***D***
#1 VANE EXT	Green	#1 ice vane extended	All
#1 IGN ON	Green	#1 engine ignition/start switch on or #1 engine auto ignition switch armed and engine torque below 20 percent	All
L BL AIR OFF	Green	Left environmental bleed air valve closed	All
R BL AIR OFF	Green	Right environmental bleed air valve closed	All
#2 IGN ON	Green	#2 engine ignition/start switch on or #2 engine auto ignition switch armed and engine torque below 20 percent	All
#2 VANE EXT	Green	#2 ice vane extended	All
#1 AUTOFEATHER	Green	#1 engine autofeather armed with power levers advanced above 90% N1	C-12***C***, C-12***D***
AIR COND N1 LOW	Green	#2 engine rpm too low for air conditioning load	All
EXTERNAL POWER	Green	External power connector plugged in	All
FUEL CROSSFEED	Green	Crossfeed valve open	All
BRAKE DEICE ON	Green	Brake deice system activated	All
#2 AUTOFEATHER	Green	#2 engine autofeather armed with power levers advanced above 90% N1	C-12***C***, C-12***D***
		(C-12 *F2*)	
#1 DC GEN	ANVIS GREEN	#1 engine generator off the line	
#1 INVERTER	ANVIS GREEN	#1 inverter inoperative	

Table 2-5. Annunciator Panels (cont'd)

WARNING ANNUNCIATOR		
NOMENCLATURE	**COLOR**	**CAUSE FOR ILLUMINATION**
C-12F (C-12F AIRCRAFT SERIALS 86-60084 THRU 86-60089)		
#1 FUEL PRESS	ANVIS YELLOW	Fuel pressure failure on left side
L BL AIR FAIL	ANVIS YELLOW	Left bleed air warning line has melted or failed, indicating possible loss of #2 engine bleed air
ALT WARN	ANVIS YELLOW	Cabin altitude exceeds 12,500 feet
INSTR AC	ANVIS YELLOW	No AC power to engine instruments
R BL AIR FAIL	ANVIS YELLOW	Right bleed air warning line has melted or failed, indicating possible loss of #2 engine bleed air
#2 FUEL PRESS	ANVIS YELLOW	Fuel pressure failure on right side
#1 CHIP DETR	ANVIS YELLOW	Contamination of #1 engine oil detected
A/P TRIM FAIL	ANVIS YELLOW	Trim won't run or running opposite direction commanded
A/P DISC	ANVIS YELLOW	Autopilot is disconnected
#2 CHIP DETR	ANVIS YELLOW	Contamination of #2 engine oil detected

CAUTION/ADVISORY ANNUNCIATOR		
#1 DC GEN	ANVIS GREEN	#1 engine generator off the line
#1 INVERTER	ANVIS GREEN	#1 inverter inoperative
#1 NO FUEL XFR	ANVIS GREEN	Auxiliary fuel tank on side of #1 engine not transferring fuel into nacelle tank
#2 NO FUEL XFR	ANVIS GREEN	Auxiliary fuel tank on side of #2 engine not transferring fuel into nacelle tank
#2 INVERTER	ANVIS GREEN	#2 inverter inoperative
#2 DC GEN	ANVIS GREEN	#2 engine generator off line
#1 EXTGH DISCH	ANVIS GREEN	#1 engine fire extinguisher discharged
#1 NAC LOW	ANVIS GREEN	#1 engine has 30 minutes fuel remaining at sea level, normal cruise power consumption rate
CABIN DOOR	ANVIS GREEN	Cabin/cargo door open or not secure
REV NOT READY	ANVIS GREEN	Propeller levers are not in the high rpm (low pitch position) with the landing gear extended
#2 NAC LOW	ANVIS GREEN	#2 engine has 30 minutes fuel remaining at sea level normal cruise power consumption rate
#2 EXTGH DISCH	ANVIS GREEN	#2 engine fire extinguisher discharged

Table 2-5. Annunciator Panels (cont'd)

CAUTION/ADVISORY ANNUNCIATOR			
NOMENCLATURE	COLOR	CAUSE FOR ILLUMINATION	AIRCRAFT EFFECTIVITY
#1 NO FUEL XFR	ANVIS GREEN	Auxiliary fuel tank on side of #1 engine not transferring fuel into nacelle tank	
#2 NO FUEL XFR	ANVIS GREEN	Auxiliary fuel tank on side of #2 engine not transferring fuel into nacelle tank	
#2 INVERTER	ANVIS GREEN	#2 inverter inoperative	
#2 DC GEN	ANVIS GREEN	#2 engine generator off line	
#1 EXTGH DISCH	ANVIS GREEN	#1 engine fire extinguisher discharged	
#1 NAC LOW	ANVIS GREEN	#1 engine has 30 minutes fuel remaining at sea level, normal cruise power consumption rate	
CABIN DOOR	ANVIS GREEN	Cabin/cargo door open or not secure	
REV NOT READY	ANVIS GREEN	Propeller levers are not in the high rpm (low pitch position) with the landing gear extended	
#2 NAC LOW	ANVIS GREEN	#2 engine has 30 minutes fuel remaining at sea level normal cruise power consumption rate	
#2 EXTGH DISCH	ANVIS GREEN	#2 engine fire extinguisher discharged	
#1 VANE FAIL	ANVIS GREEN	#1 engine ice vane malfunction. Ice vane has not attained proper position	
DUCT OVERTEMP	ANVIS GREEN	Excessive bleed air temperature in environmental heat ducts	
IFF	ANVIS GREEN	Transponder fails to reply to a valid mode 4 interrogation	
BATTERY CHARGE	ANVIS GREEN	Excessive charge rate on battery	
PROP SYNC ON	ANVIS GREEN	Synchrophaser turned on with landing gear extended	
#2 VANE FAIL	ANVIS GREEN	#2 engine ice vane malfunction. Ice vane has not attained proper position	
HYD FLUID LOW	ANVIS GREEN	Hydraulic fluid level in reservoir is low	
ELEC TRIM OFF	ANVIS GREEN	Electric trim is disconnected	
PASS OXY ON	ANVIS GREEN	Passenger oxygen system is on	
#1 VANE EXT	ANVIS GREEN	#1 ice vane extended	
#1 IGN ON	ANVIS GREEN	#1 engine ignition/start switch on or #1 engine auto ignition switch armed and engine torque below 20 percent	
L BL AIR OFF	ANVIS GREEN	Left environmental bleed air valve closed	
R BL AIR OFF	ANVIS GREEN	Right environmental bleed air valve closed	
#2 IGN ON	ANVIS GREEN percent	#2 engine ignition/start switch on or #2 engine auto ignition switch armed and engine torque below 20	
#2 VANE EXT	ANVIS GREEN	#2 ice vane extended	
#1 AUTOFEATHER	ANVIS GREEN	#1 engine autofeather armed with power levers advanced above 90% N_1	
AIR COND N_1 LOW	ANVIS GREEN	#2 engine rpm too low for air conditioning load	

Table 2-5. Annunciator Panels (cont'd)

CAUTION/ADVISORY ANNUNCIATOR			
NOMENCLATURE	**COLOR**	**CAUSE FOR ILLUMINATION**	**AIRCRAFT EFFECTIVITY**
EXTERNAL POWER	ANVIS GREEN	External power connector plugged in	
FUEL CROSS-FEED	ANVIS GREEN	Crossfeed valve open	
BRAKE DEICE ON	ANVIS GREEN	Brake deice system activated	
#2 AUTOFEATHER	ANVIS GREEN	#2 engine autofeather armed with power levers advanced above 90% N1	
BT00343			

tention. A green advisory light signifies other than hazardous requiring pilot attention. A green advisory light indicates a functional situation. Table 2-5 provides a list of causes for illumination of the individual annunciator lights. In frontal view both panels present rows of small, opaque rectangular indicator lights. Word printing on each indicator identifies the monitored function situation or fault condition, but cannot be read until the light is illuminated. The bulbs of all annunciator panel lights are tested by activating the ANNUNCIATOR TEST switch, which is located on the right side of the caution/advisory panel. The system is protected by two 5-ampere circuit breakers placarded ANN PWR and ANN IND on the overhead circuit breaker panel (fig. 2-23). The annunciator system lights are dimmed when the MASTER PANEL LIGHTS switch is actuated and the pilot's flight instrument lights are on. The lights are automatically reset to maximum brightness if:

(1) The main aircraft power (both DC generators) are off.

(2) The INST INDIRECT LIGHTS switch is on.

(3) The MASTER PANEL LIGHTS switch is off.

(4) The MASTER PANEL LIGHTS switch is ON and the PILOT INST LIGHTS switch is OFF.

b. Annunciator Panels ***. D2 F***

NOTE

On C-12 **F2** aircraft equipped with the aviation night vision imaging system (ANVIS), the annunciator lighting is ANVIS green and ANVIS yellow. Both pilot and copilot sides have a master warning light (ANVIS yellow) and master caution light (ANVIS green) with a PRESS TO TEST switch located in the right inboard subpanel section. The warning annunciator panel is located in the glareshield immediately above the fire extinguisher system controls on the instrument panel. The caution/advisory panel is located on the subpanel. In other respects, the annunciator panels are as described in the following paragraph.

Two annunciator panels are installed. One is a warning panel with red, fault identification lights, and the other is a caution/advisory panel with yellow and green, identification lights. The warning panel is mounted in the center of the glareshield. (fig. 2-26) The caution/advisory panel is located on the center subpanel, just forward of the control quadrant (fig. 2-26). Illumination of a red warning light signifies the existence of a hazardous condition requiring immediate corrective action. A yellow caution light signifies a condition other than hazardous requiring pilot attention. A green advisory light indicates a functional situation. Table 2-5 provides a list of causes for illumination of the individual annunciator lights. In frontal view both panels present rows of small, opaque rectangular indicator lights. Word printing on each indicator identifies the monitored function situation or fault condition -but cannot be read until the light is illuminated. The bulbs of all annunciator panel lights are tested by activating the annunciator PRESS TO TEST switch located on the right side of the warning panel, or the annunciator test switch located on the right sub panel. The system is protected by two 5-ampere circuit breakers placarded ANN PWR and ANN IND on the overhead circuit breaker panel (fig. 2-23). The annunciator system lights are dimmed when the MASTER PANEL LIGHTS switch is actuated and the pilot's flight instrument lights are on. The lights are automatically reset to maximum brightness if:

(1) Main aircraft power (both DC generators) is off.

(2) The INST INDIRECT LIGHTS switch is on.

(3) The MASTER PANEL LIGHTS switch is off.

(4) The MASTER PANEL LIGHTS switch is ON and the PILOT INST LIGHTS switch is OFF.

c. Master Warning Light ***C D1*** A MASTER WARNING light (red) is provided for the copilot, and is located on the right side of the glareshield (fig. 2-26). Any time a warning light illuminates, the MASTER WARNING light will illuminate, and will stay illuminated until the condition is corrected and/ or the MASTER WARNING light is pressed to reset the circuit. If a new condition occurs, the light will be reactivated, and the applicable annunciator panel light will illuminate.

d. Master Warning Light ***D2 F*** *MASTER WARNING lights (red) are provided for both the pilot and copilot. They are* located on the left and right side of the glareshield adjacent to the MASTER CAUTION lights (fig. 2-26). Any time a warning light illuminates, the MASTER WARNING light will illuminate, and will stay illuminated until the condition is corrected and/or the MASTER WARNING light is pressed to reset the circuit. If a new condition occurs, the light will be reactivated, and the applicable annunciator panel light will illuminate.

e. Master Caution Light ***C D1*** A MASTER CAUTION light (yellow) is provided for both the pilot and copilot. One is located adjacent to the MASTER WARNING light and the other is located on the left side of the glareshield (fig. 2-26). Whenever a caution light illuminates, the MASTER CAUTION will illuminate, and will stay illuminated until the condition is corrected and/or the MASTER CAUTION light is pressed to reset the circuit. If a new condition occurs, the light will be reactivated and the appropriate annunciator panel lights will illuminate.

f. Master Caution Light ***D2F*** MASTER U CAUTION lights (yellow) are provided for both the pilot and copilot. They are located on the left and right side of the glareshield adjacent to the MASTER WARNING lights (fig. 2-26). Whenever a caution light illuminates, the MASTER CAUTION will illuminate, and will stay illuminated until the condition is corrected and/or the MASTER CAUTION light is pressed to reset the circuits. If a new condition occurs, the light will be reactivated and the appropriate annunciator panel lights will illuminate.

g. Clocks ***C D*** One manual wind eight day clock is mounted in the center of each control wheel (fig. 2-16).

h. Clocks ***F1*** One manual wind eight day U clock is mounted in the center of the pilot's control wheel, whereas a digital clock/timer is mounted In the copilot's wheel (fig. 2-16).

i. Clocks ***F2.*** Two digital clock/timers are U mounted in the center of the control wheels (2-16). The clocks operate independently of each other receiving DC electrical power through the 5-ampere CABIN LIGHTS circuit breaker located in the overhead circuit breaker panel; and a 1.5-ampere fuse located in the instrument lights fuse panel assembly under the aisleway forward of the main spar.

Section XII. SERVICING, PARKING, AND MOORING

2-94. GENERAL.

The following paragraphs include the procedures necessary to service the aircraft (fig. 2-27), except lubrication. The lubrication requirements of the aircraft are covered in the aircraft maintenance manual. Tables 2-6, 2-7 and 2-8 are used for identification of fuel, oil, etc. used to service the aircraft. The servicing instructions provide procedures and precautions necessary to service the aircraft.

2-95. FUEL HANDLING PRECAUTIONS.

WARNING

During warm weather, open fuel caps slowly to prevent being sprayed with fuel.

Table 2-6, Fuel Quantity Data, lists the quantity and capacity of fuel tanks in the aircraft. Service the fuel tanks after each flight to keep moisture out of the tanks and to keep the bladder type cells from drying out. Observe the following precautions:

WARNING

When aviation gasoline is used in a turbine engine, extreme caution should be used when around the combustion chamber and exhaust area to avoid cuts or abrasions. The exhaust deposits contain lead oxide which will cause lead poisoning.

CAUTION

Proper procedures for handling JP-4 and JP-5 fuel cannot be over stressed. Clean, fresh fuel shall be used and the entrance of water into the fuel storage or aircraft fuel system must be kept to a minimum.

CAUTION

When conditions permit, the aircraft shall be positioned so that the wind will carry the fuel vapors away from all possible sources of ignition. The fuel vehicle shall be positioned to maintain a minimum distance of 10 feet from any part of the aircraft, while maintaining a minimum distance of 20 feet between the fueling vehicle and the fuel filler point.

1. Shut off unnecessary electrical equipment on the aircraft, including radar and radar equipment. The master switch may be left on, to monitor fuel quantity gages, but shall not be moved during the fueling operation. Do not allow operation of any electrical tools, such as drills or buffers, in or near the aircraft during fueling.
2. Keep fuel servicing nozzles free of snow, water, and mud at all times.
3. Carefully remove snow, water, and ice from the aircraft fuel filler cap area before removing the fuel filler cap (fig. 2-27). Remove only one aircraft tank filler cap at any one time, and replace each one immediately after the servicing operation is completed.
4. Wipe all frost from fuel filler necks before servicing.
5. Drain water from fuel tanks, filter cases, and pumps prior to first flight of the day. Preheat, when required, to insure free fuel drainage.
6. Avoid dragging the fueling hose where it can damage the soft, flexible surface of the deicer boots.
7. Observe NO SMOKING precautions.
8. Prior to transferring the fuel, insure that the hose is grounded to the aircraft.
9. Wash off spilled fuel immediately.
10. Handle the fuel hose and nozzle cautiously to avoid damaging the wing skin.
11. Do not conduct fueling operations within 100 feet of energized airborne radar equipment or within 300 feet of energized ground radar equipment installations.
12. Wear only nonsparking shoes near aircraft or fueling equipment, as shoes with nailed soles or metal heel plates can be a source of sparks. functions as a biocide to commercial fuel, not.

Table 2-6. Fuel Quantity Data

	TANKS	NUMBER	GALLONS	**POUNDS
LEFT ENGINE	Wing tanks	5	136	884.0
	Nacelle tank	1	57	370.5
	Auxiliary tank	1	79	513.5
RIGHT ENGINE	Wing tanks	5	136	884.0
	Nacelle tank	1	57	370.5
	Auxiliary tank	1	79	513.5
	* Totals	14	544	3536.0

* Unusable fuel quantity and weight (4 gallons, 26 pounds not included in totals).
** Fuel weight is based on standard day conditions at 6.5 pounds per U.S. gallon. Total fuel system capacity is 548 gallons
BT00345

2-96. FILLING FUEL TANKS.

Fill tanks as follows:

WARNING

Prior to removing the fuel tank filler cap, the hose nozzle static ground wire shall be attached to the grounding lugs that are located adjacent to filler opening.

CAUTION

Do not fill the auxiliary fuel tanks unless outboard main tanks are full.

1. Attach bonding cables to aircraft.
2. Attach bonding cable from hose nozzle to ground socket adjacent to fuel tank being filled.

CAUTION

Do not insert fuel nozzle completely into fuel cell due to possible damage to bottom of fuel cell.

3. Remove fuel tank filler cap and fill main tanks before filling the corresponding auxiliary tank.
4. Secure applicable fuel tank filler cap. Make sure latch tab on cap is pointed aft.
5. Disconnect bonding cables from aircraft.

2-97. DRAINING MOISTURE FROM FUEL SYSTEM.

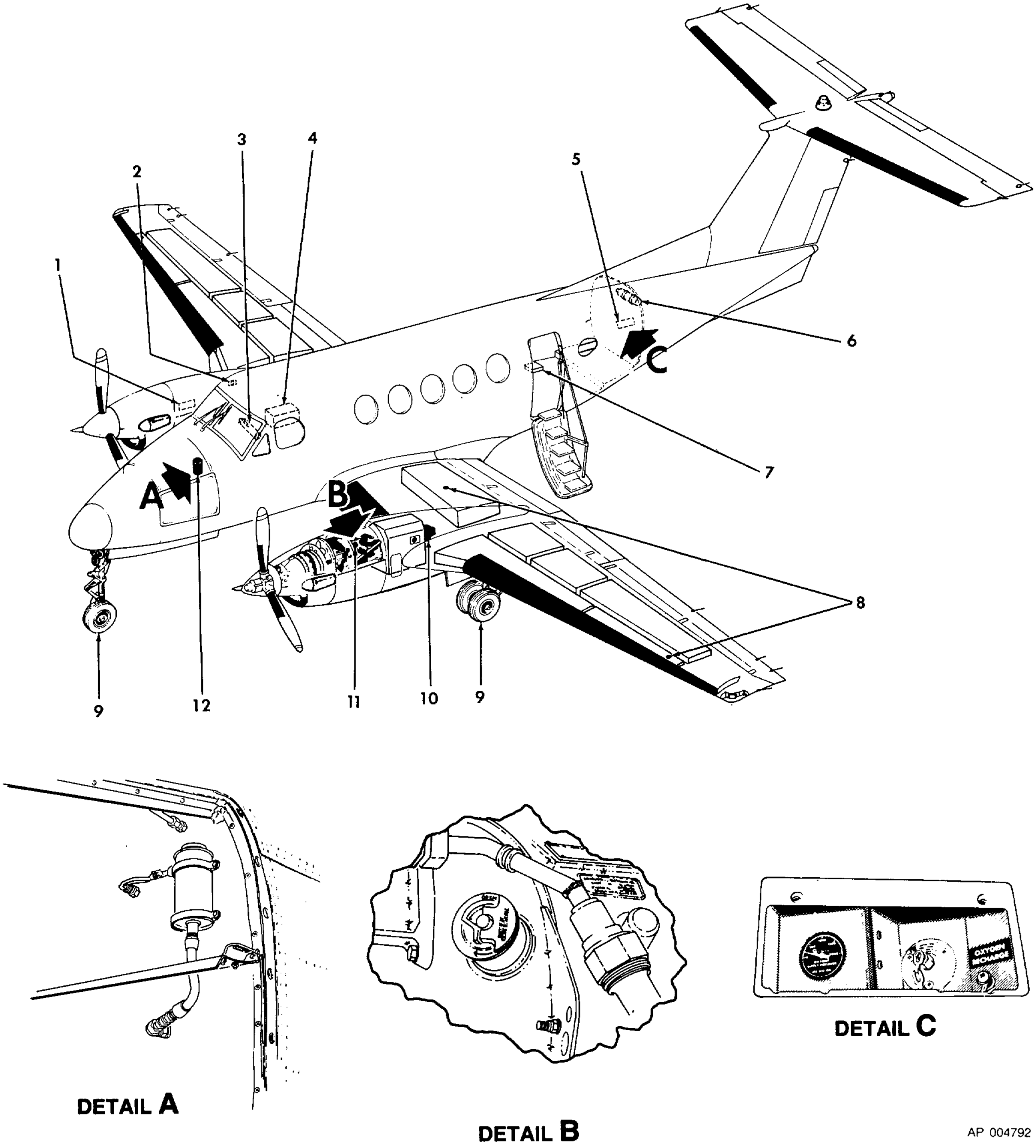
To remove moisture and sediment from the fuel system, 12 fuel drains are installed (plus one for the ferry system, when installed) (fig. 2-28).

2-98. APPROVED FUEL TYPES.

a. *Army Standard Fuels. accordance with accepted commercial procedures*. Army standard fuel is JP-4.

b. *Alternate Fuels*. Army fuels are JP-5 and JP-8.

c. *Emergency Fuel*. Avgas is emergency fuel and subject to 150 hour time limit.



1. Air Conditioning Compressor
2. External Power Receptacle
3. Hand Fire Extinguisher
4. Battery, 24 VDC
5. Oxygen System Filler Port
6. Oxygen Cylinder, 49 Cu. Ft.
7. Electric Toilet
8. Fuel Filler Caps (Typical Left and Right)
9. Landing Gear Tires
10. Engine Fire Extinguisher
11. Engine Oil Filler Cap (Typical Left and Right)
12. Wheel Brake Fluid Reservoir

AP 004792

Figure 2-27. Servicing Locations

Table 2-7. Approved Fuels

SOURCE	PRIMARY OR STANDARD FUEL	ALTERNATE FUEL	
US Military Fuel	JP-4 (MIL-T-5624)	JP-5 (MIL-T-5624)	
NATO Code No.	F-40 (Wide Cut Type)	F-44 (High Flash Type)	
COMMERCIAL FUEL (ASTM-D-1655)	JET B	JET A	JET A-1 NATO F-34
American Oil Co.	American JP-4	American Type A	
Atlantic Richfield	Arcojet B	Arcojet A	Arcojet A-1
Richfield Div.		Richfield A	Richfield A-1
B. P. Trading	B.P.A.T.G.		B.P.A.T.K.
Caltex Petroleum Corp.	Caltex Jet B		Caltex Jet A-1
Cities Service Co.		CITGO A	
Continental Oil Co.	Conoco JP-4	Conoco Jet-50	Conoco Jet-60
Gulf Oil	Gulf Jet B	Gulf Jet A	Gulf Jet A-1
EXXON Co., USA	EXXON Turbo Fuel B	EXXON A	EXXON A-1
Mobil Oil	Mobil Jet B	Mobil Jet A	Mobil Jet A-1
Phillips Petroleum	Philjet JP-4	Philjet A-50	
Shell Oil	Aeroshell JP-4	Aeroshell 640	Aeroshell 650
Sinclair		Superjet A	Superjet A-1
Standard Oil Co.		Jet A Kerosene	Jet A-1 Kerosene
Chevron	Chevron B	Chevron A-50	Chevron A-1
Texaco	Texaco Avjet B	Avjet A	Avjet A-1
Union Oil	Union JP-4	76 Turbine Fuel	
FOREIGN FUEL	**NATO F-40**	**NATO F-44**	
Belgium	BA-PF-2B		
Canada	3GP-22F	3-6P-24e	
Denmark	JP-4 MIL-T-5624		
France	Air 3407A		
Germany (West)	VTL-9130-006	UTL-9130-007/UTL 9130-010	
Greece	JP-4 MIL-T-5624		
Italy	AA-M-C-1 421	AMC-1 43	
Netherlands	JP-4 MIL-T-5624	D. Eng RD 2493	
Norway	JP-4 MIL-T-5624		
Portugal	JP-4 MIL-T-5624		
Turkey	JP-4 MIL-T-5624		
United Kingdom (Britain)	D. Eng RD 2454	D. Eng RD 2498	

NOTE:

Anti-icing and Biocidal Additive for Commercial Turbine Engine Fuel The fuel system icing inhibitor shall conform to MIL-I-27686. The additive provides anti-icing protection and also functions as a biocide to kill microbial growths in aircraft fuel systems. Icing inhibitor conforming to MIL-I-27686 (PRIST) shall be added to commercial fuel, not containing an icing inhibitor, during refueling operations, regardless of ambient temperatures. Refueling operations shall be accomplished in accordance with accepted commercial procedures.

Table 2-8. Approved Military Fuels, Oil, Fluids, and Unit Capacities

SYSTEM	SPECIFICATION	CAPACITY
Fuel	MIL-T-5624 (JP-4, JP-5 and JP-8)	544 U.S. Gallons usable
Engine oil	MIL-L-23699	14 U.S. Quarts per engine
Hydraulic brake reservoir	MIL-H-5606	1 U.S. Pint
* Hydraulic landing gear reservoir	MIL-H-5606	8 U.S. Quarts
Oxygen	MIL-O-27210	49 Cubic feet
Toilet Chemical	Monogram DG-19	3 Ounces
*C-12 ***D2 F*** BT00349		

NOTE:

MIL-L-23699 oil used in engine oil system, is authorized and directed for use. Do not mix different brands or types of oil when adding oil between changes. Different brands or types of oil may be incompatible due to the differences in chemical structure.

Table 2-9. Standard, Alternate and Emergency Fuels

ENGINE	ARMY STANDARD FUEL	ALTERNATE FUEL	EMERGENCY FUEL TYPE	* MAX HOURS
PT6A	MIL-T-5624 Grade JP-4	MIL-T-5624 Grade JP-5 Grade JP-8	MIL-G-5572 Any AV Gas	150
* Maximum operating hours with indicated fuel between engine overhauls (TBO). BT00350				

2-99. USE OF FUELS.

a. Fuel Use Limitations. There is no special limitation on the use of Army standard fuel, but certain limitations are imposed when Alternate or Emergency fuels are used. For the purpose of recording, fuel mixtures shall be identified as to the major component of the mixture, except when the mixture contains leaded gasoline. The use of any fuels other than standard will be entered in the FAULTS/

REMARKS column of DA Form 2408-13, Aircraft Maintenance and Inspection Record, noting the type of fuel, additives, and duration of operation.

b. Use Of Kerosene Fuels. The use of kerosene fuels (JP-5 type) in turbine engines dictates the need for observance of special precautions. Both ground starts and air restarts at low temperature may be more difficult due to low vapor pressure. Kerosene fuels having a freezing point of minus 40 degrees C (minus 40 degrees F) limit the maximum altitude of a mission to 28,000 feet under standard day conditions.

c. Mixing Of Fuels In Aircraft Tanks. When changing from one type of authorized fuel to another, for example JP-4 to JP-5, it is not necessary to drain the aircraft fuel system before adding the new fuel.

d. Fuel Specifications. Fuels having the same NATO code number are interchangeable. Jet fuels conforming to ASTM D-1655 specification may be used when MILT-5624 fuels are not available. This usually occurs during cross country flights where aircraft using NATO F-44 (JP-5) are refueled with NATO F-40 (JP-4) or Commercial ASTM Type B fuels. Whenever this condition occurs, the engine operating characteristics may change in that lower operating temperature, slower acceleration, lower engine speed, easier starting, and shorter range may be experienced. The reverse is true when changing from F-40 (JP-4) fuel to F-44 (JP-5) or Commercial ASTM Type A-1 fuels. Most commercial turbine engines will operate satisfactorily on either kerosene or JP-4 type fuel. The difference in specific gravity may possibly require fuel control adjustments; if so, the recommendations of the manufacturers of the engine and airframe are to be followed.

2-100. SERVICING OIL SYSTEM.

An integral oil tank occupies the cavity formed between the accessory gearbox housing and the compressor inlet case on the engine. The tanks have a calibrated oil dipstick and an oil drain plug. Avoid spilling oil. Any oil spilled must be removed immediately. Use a cloth moistened in solvent to remove oil. Overfilling may cause a discharge of oil through the accessory gearbox breather until a satisfactory level is reached. Service oil system as follows:

1. Open the access door on the upper rear cowling to gain access to the oil filler cap and dipstick.

CAUTION

A cold oil check is unreliable. If possible check oil within 10 minutes after engine shutdown. If over 10 minutes have elapsed, motor the engine (starter only) for 15 20 seconds, then recheck. If over 10 hours have elapsed, start engine and run for 2 minutes, then recheck. Add oil as required. Do not overfill.

2. If oil level is over 2 quarts low, motor or run engine as required, and service as necessary.
3. Remove oil filler cap (fig. 2-27).
4. Insert a clean funnel, with a screen incorporated, into the filler neck.
5. Replenish with oil to within I quart below MAX mark or the MAX COLD on dipstick (cold engine). Fill to MAX or MAX HOT (hot engine).
6. Check oil filler cap for damaged preformed packing, general condition and locking.

CAUTION

Insure that oil filler cap is correctly installed and securely locked to prevent loss of oil and possible engine failure.

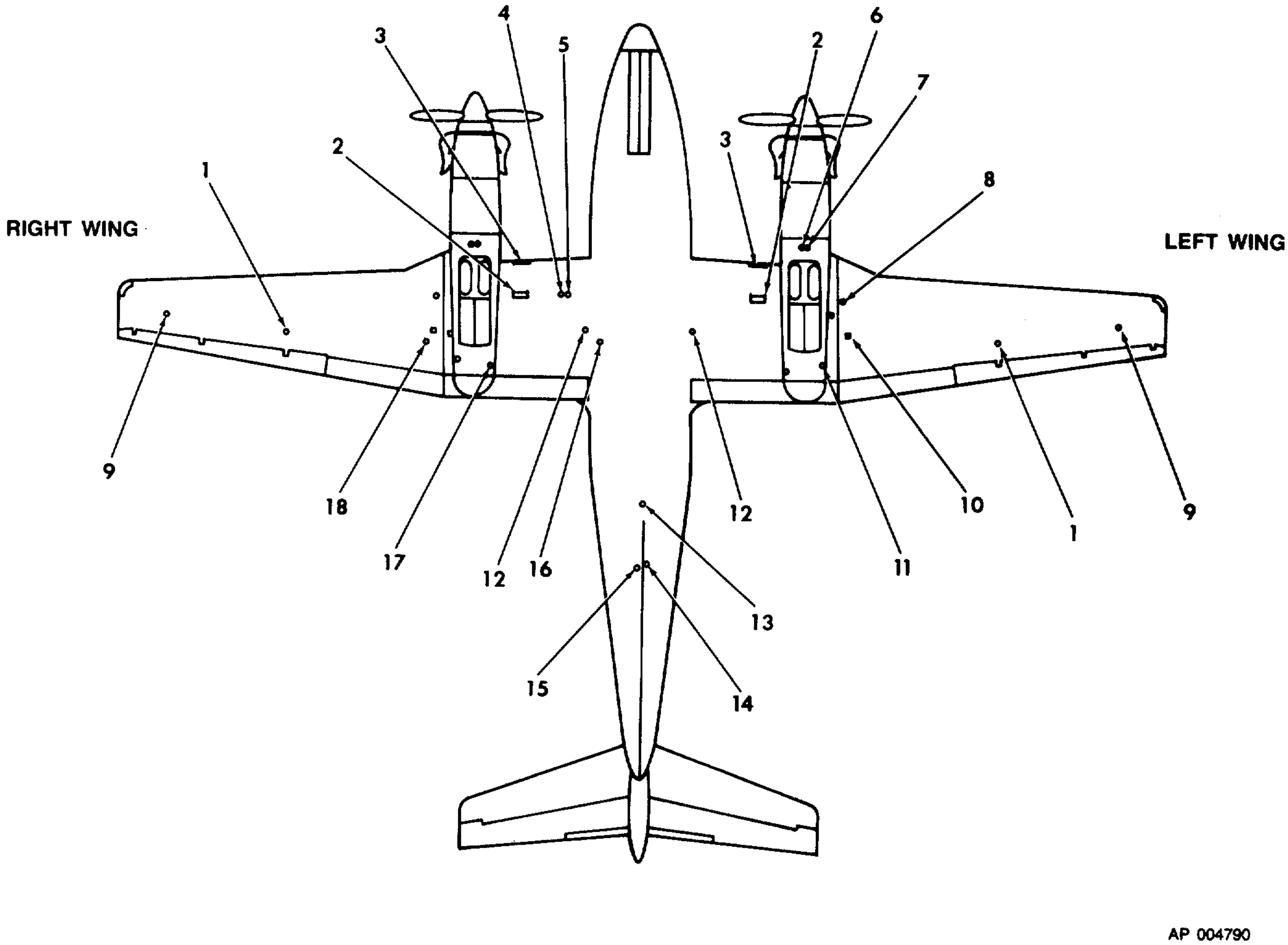
7. Install and secure oil filler cap.
8. Check for any oil leaks.

2-101. SERVICING THE HYDRAULIC SYSTEM.

a. Servicing Hydraulic Brake System Reservoir.

1. Gain access to brake hydraulic system reservoir (fig. 2-27).
2. Remove brake reservoir cap and fill reservoir to washer on dipstick with hydraulic fluid.
3. Install brake reservoir cap.

b. Servicing Hydraulic Landing Gear System ***D2 1*** Servicing the hydraulic landing gear system I consists of maintaining the correct fluid level and maintaining the correct accumulator precharge. The accumulator is located in the reservoir access area and is charged to 800 ±50 PSI using bottled nitrogen. A charging gage is mounted on the accumulator. A reservoir, located just inboard of the LH nacelle and forward of the main spar, has a lid with a dipstick attached marked FLUID TEMP 0°F, 50°F,



1. Outboard Fuel Sump Drain
2. Bleed Air Heat Exchanger Exhaust
3. Bleed Air Heat Exchanger Intake
4. Battery Ram Air Vent
5. Battery Drain
6. Boost Pump Drain (Both Sides)
7. Fuel System Drain (Both Sides)
8. Leading Edge Tank Drain (Both Sides)
9. Fuel Vent
10. Ram Scoop Vent (Both Sides)
11. Engine Oil Vent (Both Sides)
12. Transfer Pump Filter Drain
13. Refreshment Bar Drain (If Installed)
14. Oxygen Regulator Vent
15. Relief Tube Drain
16. Surface Deice Ejector Exhaust
17. Fuel Sump Drain (Both Sides)
18. Heated Fuel Vent (Both Sides)

Figure 2-28. Vent/Drain Locations

100°F. Add MIL-H-5606 hydraulic fluid (consumable materials list) as required to fill the system corrected for temperature.

(1) *Shock Struts*. Servicing the shock struts is part of each 100 hour inspection procedure. If it becomes necessary to service the shock struts due to the leakage of either the hydraulic oil or the air, the following procedures should be followed.

(2) *Nose Gear Strut*.

1. Release all of the air from the strut by depressing the core of the air valve on top of the strut.
2. Remove the air valve and wipe clean. With the strut fully compressed, the end of the filler neck on the air valve should touch the oil. If the oil is below this level, add approved hydraulic fluid. Reinstall and safety the air valve.
23. With the aircraft empty except for full fuel and oil, inflate the nose gear until the inner cylinder is extended 3 to 3.5 inches.

(3) *Main Gear Strut*.

1. Release all the air from the strut through the air valve and remove the core from the valve.
2. Fully compress the strut and attach a small hose over the air valve and immerse the other end of the hose in approved hydraulic fluid. Slowly extending the strut will vacuum the oil into the cylinder. Cycling the strut slightly as it is extended will expel any trapped air. Return the strut slowly to the fully compressed position; this will force the excess oil back into the container and the strut will be properly filled with oil.
3. With the aircraft empty except for full fuel and oil, inflate the strut until the inner cylinder is extended 5.56 to 5.93 inches.

2-102. INFLATING TIRES.
Inflate tires as follows:

1. Inflate nose wheel tire to a pressure between 55 and 60 psi.
2. C Inflate main wheel tires to a pressure between 92 and 96 psi.
3. DF Inflate main wheel tires to a pressure between 60 and 64 psi.

2-103. SERVICING THE ELECTRIC TOILET *C D F* (C-12 AIRCRAFT PRIOR TO C-12F SERIAL 8660084). The toilet should be serviced during routine E ground maintenance of the aircraft following any usage. It is more efficient and convenient to remove, clean and recharge the toilet tank on a regular basis than to wait until the tank is filled to capacity. Instructions for servicing are provided on a decal applied to the front side of the removable tank. Instructions are as follows:

a. *Tank Removal.*
1. Open front access to the toilet, as applicable, to remove the toilet tank.
2. Depress the lock ring of the flush hose quick disconnect coupling located on the right side at the front of the tank top.
3. Drain any -residue of flush fluid in the hose by partially disengaging the plug from the quick disconnect and manipulating the hose to assist drainage.
4. Remove the flush hose from the quick disconnect and place hose in the retaining clip located on the underside of the toilet mounting plate.
5. Install the cap attached to the quick disconnect to seal the coupling.
6. Close the knife valve at the bottom of the toilet bowl by pushing the actuator handle until the valve is fully closed.
7. Press the two fasteners on each side of the knife valve actuator to unlock the tank.
8. Remove the tank by pulling the recessed carrying handle on the tank top.

b. *Tank Cleaning.*
1. Dispose of tank contents by holding the tank upside-down over a sewer or toilet and pull the knife valve actuator handle, opening the valve and allowing the tank to drain.

2. Rinse the tank by filling one-half full with water. Close the knife valve and shake vigorously. Drain tank as in previous step.

NOTE

Commercial detergents and disinfectants can be included in the rinse water if desired. However, do not include these materials in the tank precharge.

3. Rinse and drain the tank several times to ensure that the tank is thoroughly clean.
4. Wipe the exterior surfaces of the tank using a cloth moistened with clear water and disinfectant.

c. Tank Precharge.

CAUTION

During freezing temperature, toilet shall be serviced with antifreeze solution to prevent damage.

Charge the tank with a mixture of 2 quarts of water and 3 ounces of Monogram DG-19 chemical.

NOTE

To assure toilet recirculation system operation during freezing weather, an ethylene glycol base anti-freeze containing antifoam agent may be added to the flush fluid.

d. Tank Installation.

1. Reinstall the tank by inserting the slides located on each side of the knife valve into the slide plate assembly on the bottom of the toilet and slide tank into place.
2. Press the two fasteners to the first detent to secure the tank.
3. Remove the cap in the flush hose quick disconnect and connect the hose coupling to the quick disconnect. Lock the disconnect lock ring.
4. Pull the knife valve actuator to fully open the valve.
5. Lift the toilet seat and shroud assembly from the top of the toilet and wipe with cloth moistened with clear water and disinfectant. Wipe the bowl and surrounding area.
6. Check flushing operation of the toilet and check for leaks.
7. Close access to the toilet.

2-103A.
SERVICING THE CHEMICAL TOILET *F* (C-12F AIRCRAFT SERIALS 86-60084 THRU 86-60089). The toilet is of the standard dry chemical type. The toilet should be removed and emptied after each flight, if used. An approved dry chemical, such as Commode Magic, may be used in accordance with the manufacturer's instructions. A stiff (nonmetallic) bristle brush and a water and detergent solution should be used to clean the bowl. Install a clean waste bag in the bowl before adding chemical.

2-104. ANTI-ICING, DEICING AND DEFROSTING PROTECTION. The aircraft is protected in subfreezing weather by spraying the surfaces (to be covered with protective covers) with defrosting fluid. Spraying defrosting fluid on aircraft surfaces before installing protective covers will permit protective covers to be removed with a minimum of sticking. To prevent freezing rain and snow from blowing under protective covers and diluting the fluid, insure that protective covers are fitted tightly. As a deicing measure, keep exposed aircraft surface wet with fluid for protection against frost.

NOTE

Do not apply anti-icing, deicing and defrosting fluid to exposed aircraft surfaces if snow is expected. Melting snow will dilute the defrosting fluid and form a slush mixture which will freeze in place and become difficult to remove.

2-105. ANTI-ICING, DEICING AND DEFROSTING TREATMENT.
Use undiluted anti-icing, deicing and defrosting fluid (MIL-A-8243 or MIL-F-5566) to treat aircraft surfaces for protection against freezing rain and frost. Spray aircraft surface sufficiently to wet area, but without excessive drainage. A fine spray is recommended to prevent waste. Use diluted, hot fluid to remove ice accumulations.

1. Remove frost or ice accumulations from aircraft surfaces by spraying with diluted anti-icing, deicing, and defrosting fluid mixed in accordance with table 2-9.

2. Spray diluted, hot fluid in a solid stream (not over 15 gallons per minute). Thoroughly saturate aircraft surface and remove loose ice. Keep a sufficient quantity of diluted, hot fluid on aircraft surface coated with ice to prevent liquid layer from freezing. Diluted, hot fluid should be sprayed at a high pressure, but not exceeding 300 psi.

3. When facilities for heating are not available and it is deemed necessary to remove ice accumulations from aircraft surfaces, undiluted defrosting fluid may be used. Spray undiluted defrosting fluid at 15 minute intervals to assure complete coverage. Removal of ice accumulations

Table 2-10. Recommended Fluid Dilution Chart

AMBIENT TEMPERATURE (°F)	PERCENT DEFROSTING FLUID BY VOLUME	PERCENT WATER BY VOLUME	FREEZING POINT OF MIXTURE (°F) (APPROXIMATE)
+30° and above	20	80	+10°
+20°	30	70	0°
+10°	40	60	-15°
0°	45	55	-25°
-10°	50	50	-35°
-20°	55	45	-45°
-30°	60	40	-55°

NOTES:
1. Use anti-icing and deicing fluid (MIL-A-8243 or MIL-F-5566).
2. Heat mixture to a temperature of 820 to 930C (180° to 200°F).

using undiluted defrosting fluid is expensive and slow.
4. If tires are frozen to ground, use undiluted defrosting fluid to melt ice around tire. Move aircraft as soon as tires are free.

2-106. APPLICATION OF EXTERNAL POWER.

CAUTION

Before connecting the power cables from the external power source to the aircraft, insure that the GPU is not touching the aircraft at any point. Due to the voltage drop in the cables, the two ground systems will be of different potentials. Should they come in contact while the GPU is operating, arcing could occur. Turn off all external power while connecting the power cable to, or removing it from the external power supply receptacle. Be certain that the polarity of the external power source is the same as that of the aircraft before it is connected.

CAUTION

Do not charge battery with GPU.

R5 An external source is often needed to supply the electric current required to properly ground service the aircraft electrical equipment and to facilitate starting the aircraft's engines. An external DC power receptacle is installed on the outboard side of the right engine nacelle.

2-107. SERVICING OXYGEN SYSTEM.

The oxygen system furnishes breathing oxygen to the pilot, copilot and passengers. Figure 2-27 shows the location of oxygen cylinder.

OXYGEN CYLINDER CAPACITY
PERCENT RATED VOLUME VS PRESSURE, TEMPERATURE
(1,850 PSI CYLINDER)

EXAMPLE:
TO DETERMINE PERCENT OF RATED VOLUME OF CYLINDER, ENTER CHART AT TEMPERATURE AND TRACE UP TO INDICATED PRESSURE THEN TRACE LEFT MAINTAINING A PROPORTIONAL DISTANCE ALONG THE PERCENT LINE AND READ PERCENTAGE OF FULL CYLINDER. TO DETERMINE THE PRESSURE FOR 100% VOLUME, TRACE UP FROM TEMPERATURE TO 100% LINE AND TRACE ACROSS TO CYLINDER PRESSURE.

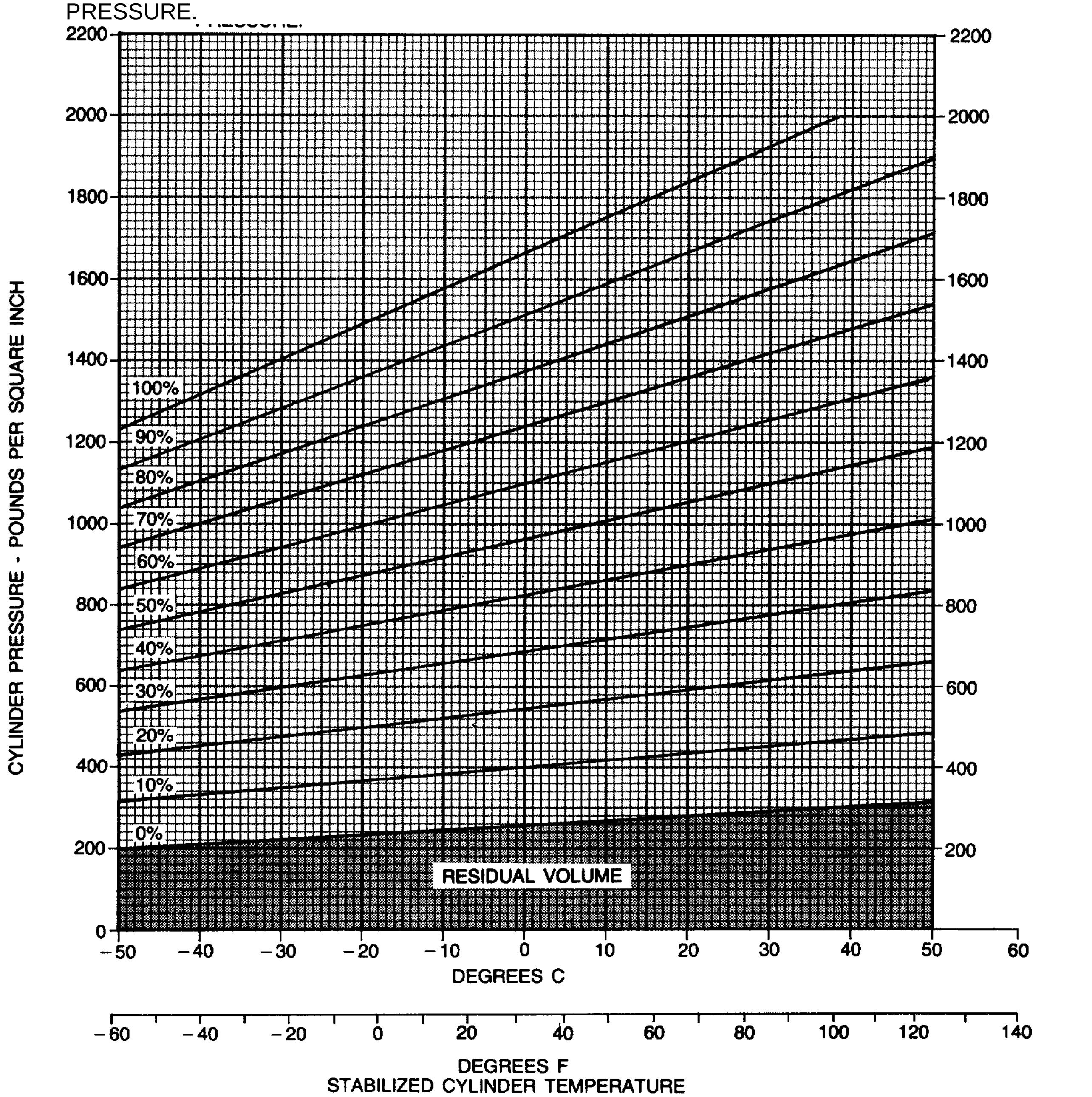


Figure 2-29. Oxygen System Servicing Pressure Chart

a. Oxygen System Safety Precautions.

WARNING

Keep fire and heat away from oxygen equipment. Do not smoke while working with or near oxygen equipment, and take care not to generate sparks with carelessly handled tools when working on the oxygen system.

(1) Keep oxygen regulators, cylinders, gages, valves, fittings, masks, and all other components of the oxygen system free of oil, grease, gasoline, and all other readily combustible substances. The utmost care shall be exercised in servicing, handling, and inspecting the oxygen system.

(2) Do not allow foreign matter to enter oxygen lines.

(3) Never allow electrical equipment to come in contact with the oxygen cylinder.

(4) Never use oxygen from a cylinder without first reducing its pressure through a regulator.

b. Replenishing Oxygen System.

1. Remove oxygen access door on outside of aircraft (fig. 2-27).
2. Remove protective cap on oxygen system filler valve.
3. Attach oxygen hose from oxygen servicing unit to filler valve.

WARNING

If the oxygen system pressure is below 200 PSI, do not attempt to service system. Make an entry on DA Form 2408-13.

4. Insure that supply cylinder shutoff valves on the aircraft are open.
5. Slowly adjust the valve position so that pressure increases at a rate not to exceed 200 PSIG per minute.
6. Close pressure regulating valve on oxygen servicing unit when pressure gage on oxygen system indicates the pressure obtained using the Oxygen System Servicing Pressure Chart (fig. 2-29).

NOTE

To compensate for loss of aircraft cylinder pressure as the oxygen cools to ambient temperature after recharging, the cylinder should be charged initially to approximately 10% over prescribed pressure. Experience will determine what initial pressure should be used to compensate for the subsequent pressure loss upon cooling. A small top-off will create little heat. A complete recharge will create substantial heating.

NOTE

The final stabilized cylinder pressure should be adjusted for ambient temperature (fig. 2-29).

7. Disconnect oxygen hose from oxygen servicing unit and filler valve.
8. Install protective cap on oxygen filler valve.
9. Install oxygen access door.

2-108. GROUND HANDLING.

Towing lugs are provided on the upper torque knee fitting of the nose strut. When it is necessary to tow the aircraft with a vehicle, use the vehicle tow bar. Observe the following:

1. Do not attempt towing or taxiing of the aircraft with control surfaces in the LOCKED position.
2. Do not operate engines while towing equipment is attached to the aircraft, or while the aircraft is tied down.
3. When moving the aircraft, do not push on propeller deicing boots. Damage to the heating elements may result.
4. When the aircraft is being towed, a qualified person shall be in the pilot's seat to maintain control by use of the brakes.
5. When towing, do not exceed nose gear turn limits. Avoid short radius turns, and always keep the inside or pivot wheel turning during the operation.
6. When being moved backwards, do not apply the brakes abruptly.
7. Tow the aircraft slowly, avoiding sudden stops, especially over snowy, icy, rough, soggy or muddy terrain.

8. Do not tow aircraft with deflated shock struts.

2-109. GROUND HANDLING UNDER EXTREME WEATHER CONDITIONS.
Extreme weather conditions necessitate particular care in ground handling of the aircraft. In hot, dry, sandy, desert conditions, special attention shall be devoted to finding a firmly packed parking and towing area. If such areas are not available, steel mats or an equivalent solid base shall be provided for these purposes. In wet, swampy areas, care shall be taken to avoid bogging down the aircraft. Under cold, icy, arctic conditions, additional mooring is required, and added precautions shall be taken to avoid skidding during towing operations. The particular problems to be encountered under adverse weather conditions and the special methods designed to avoid damage to the aircraft are covered by the various phases of the ground handling procedures included in this section of general ground handling instructions. (Refer to TM 55-1500-204-25/1).

2-110. PARKING.
Parking is defined as the normal condition under which the aircraft will be secured while on the ground. This condition may vary from the temporary expedient of setting the parking brake and chocking the wheels to the more elaborate mooring procedures described in paragraph 2-112. The proper steps for securing the aircraft shall be based on the time the aircraft will be left unattended, the aircraft weight, the expected wind direction and velocity, and the anticipated availability of ground and air crews for mooring and/or evacuation.

1. When practical, head the aircraft into the wind, especially if strong winds are forecast or if it will be necessary to leave the aircraft overnight.
2. Set the parking brake, chock the wheels securely, then release the parkingbrake. Do not set parking brakes when the brakes are hot during freezing ambient temperatures. Allow brakes to cool before setting parking brakes.
3. Following engine shutdown, position and engage the control locks.
4. Cowlings and loose equipment will be suitably secured at all times when left in an unattended condition.

2-111. INSTALLATION OF PROTECTIVE COVERS.
The crew will insure that the aircraft protective covers are installed.

2-112. MOORING.
The aircraft is moored to insure its immovability, protection, and security under various weather conditions. The following paragraphs give, in detail, the instructions for proper mooring of the aircraft.

a. Mooring Provisions. Mooring points (fig. 2-30) are provided beneath the wings and tail. Additional mooring cables may be attached to each landing gear. General mooring equipment and procedures necessary to moor the aircraft, in addition to the following, are given in TM 55-1500-204-25/1.

(1) Use mooring cables of 1/4 inch diameter aircraft cable and clamp (clip-wire rope), chain or rope 3/8 inch diameter or larger. Length of the cable or rope will be dependent upon existing circumstances. Allow sufficient slack in ropes, chains, or cable to compensate for tightening action due to moisture absorption of rope or thermal contraction of cable or chain. Do not use slip knots. Use bowline knots to secure aircraft to mooring stakes.

(2) Chock the wheels.

b. Mooring Procedures for High Winds. Structural damage can occur from high velocity winds; therefore, if at all possible, the aircraft should be moved to a safe weather area when winds above 75 knots are expected. If aircraft must be secured use the following steps:

(1) After aircraft is properly located, place nose wheel in centered position. Head aircraft into the wind, or as nearly so as is possible within limits determined by locations of fixed mooring rings. When necessary, a 45 degree variation of direction is considered to be satisfactory. Locate each aircraft at slightly more than wing span distance from all other aircraft. Position nose mooring point approximately 3 to 5 feet downwind from ground mooring anchors.

1. Deflate nose wheel shock strut to within 3/4 inch of its fully deflated position.
2. Fill all fuel tanks to capacity, if time permits.
3. Place wheel chocks fore and aft of main gear wheels and nose wheel. Tie each pair of chocks (wood) together with rope or join together with wooden cleats nailed to chocks on either side of wheels. Tie ice grip chocks together with rope. Use sandbags in lieu of chocks when aircraft is moored on steel mats. Set parking brake as applicable.
4. Accomplish aircraft tiedown by utilizing mooring points shown in figure 2-30.

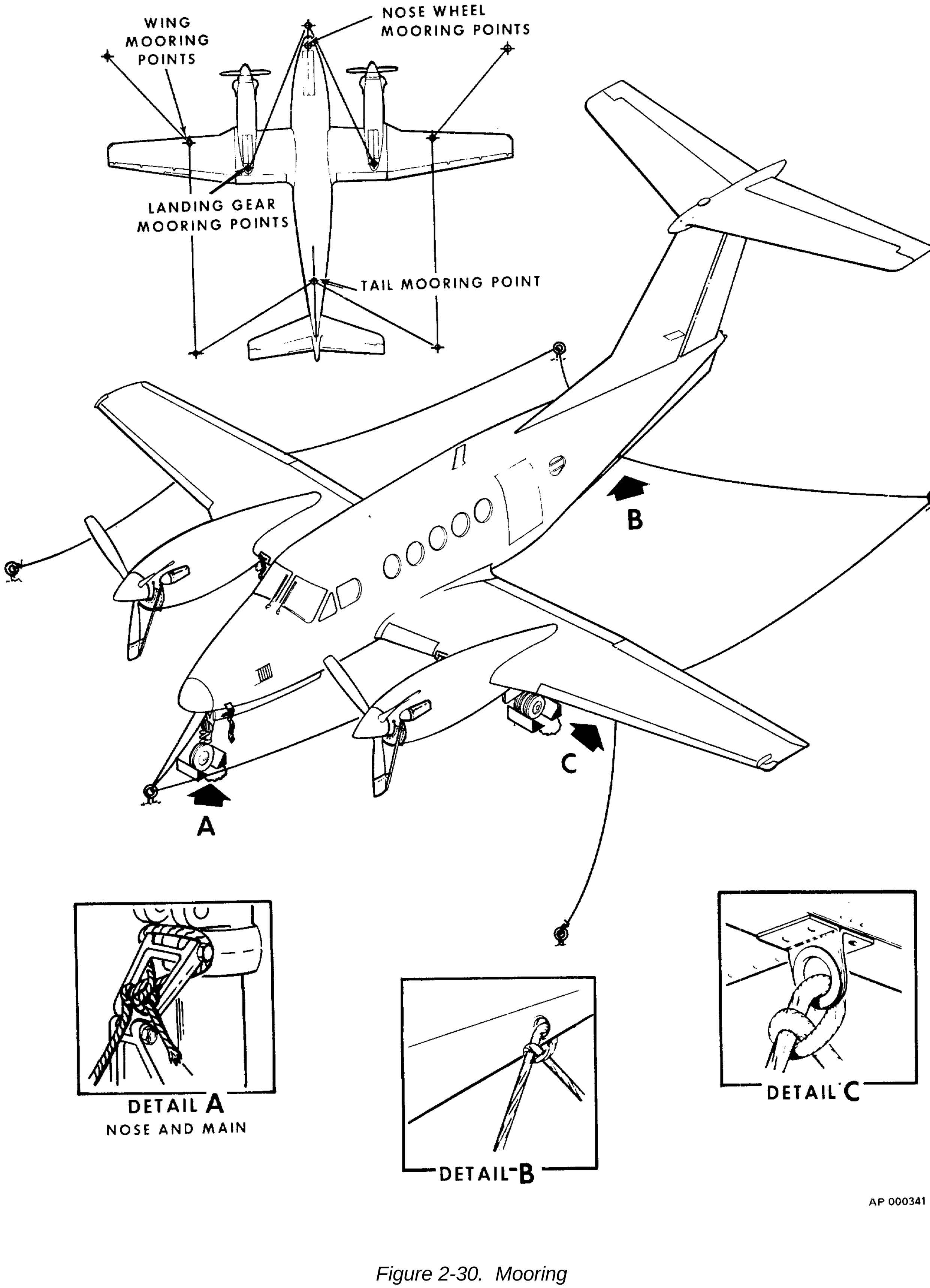


Figure 2-30. Mooring

Make tiedown with 1/4 inch aircraft cable, using two wire rope clips, or bolts, and a chain tested for a 3000 pound pull. Attach tiedowns so as to remove all slack. (Use a 3/4-inch or larger manila rope if cable or chain tiedown is not available.) If rope is used for tiedown, use anti-slip knots, such as bowline knot, rather than slip knots. In the event tiedown rings are not available on hard surfaced areas, move aircraft to an area where portable tiedowns can be used. Locate anchor rods at points shown in figure 2-30. When anchor kits are not available, use metal stakes or dead-man type anchors, providing they can successfully sustain a minimum pull of 3000 pounds.

5. In event nose position tiedown is considered to be of doubtful security due to existing soil condition, drive additional anchor rods at nose tiedown position. Place padded work stand or other suitable support under the aft fuselage tiedown position and secure.
6. Place control surfaces in locked position and trim tab controls in neutral position. Place wing flaps in up position.
7. The requirements for dust excluders, protective covers, and taping of openings will be left to the discretion of the responsible maintenance officer or the pilot of the transient aircraft (fig. 2-30).
8. Secure propellers to prevent windmilling (fig. 2-30).
9. Disconnect battery.
10. During typhoon or hurricane wind conditions, mooring security can be further increased by placing sandbags along the wings to break up the aerodynamic flow of air over the wing, thereby reducing the lift being applied against the mooring by the wind. The storm appears to pass two times, each time with a different wind direction. This will necessitate turning the aircraft after the first passing.
11. After high winds, inspect aircraft for visible signs of structural damage and for evidence of damage from flying objects. Service nose shock strut and reconnect battery.

CHAPTER 3
AVIONICS (C-12 *C D1* AIRCRAFT)
SECTION I. GENERAL

3-1. DESCRIPTION.

This chapter covers the avionics equipment configuration installed in C-12***C D1*** aircraft. It includes, a brief description of the avionics equipment, its technical characteristics, capabilities, and locations. Avionics installed in C-12***D2 F1*** aircraft, are covered in Chapter 3A. Avionics installed in C-12***F2*** aircraft, are covered in Chapter 3B.

3-2. AVIONICS EQUIPMENT CONFIGURATION.

The avionics configuration of the aircraft is comprised of three groups of electronic equipment. The communication equipment group consists of the interphone, UHF command, VHF command, and HF command systems. The navigation equipment group provides the pilot and copilot with the instrumentation required to establish and maintain an accurate flight course and position and to make an approach on instruments under Instrument Meteorological Conditions (IMC). The navigation group includes equipment for determining altitude, attitude, position, destination, range and bearing, heading reference, groundspeed, and drift angle. The transponder and radar group includes an identification, position and emergency tracking system, and a radar system to locate potentially dangerous weather areas. A ground proximity altitude advisory system (GPAAS) is also installed.

3-3. POWER SOURCE.

a. DC Power. DC power for the avionics equipment is provided by four sources: the aircraft battery, left and right generators, and external power. Power is routed through a 50-ampere circuit breaker to the avionics power relay which is controlled by the AVIONICS MASTER POWER SWITCH (fig. 2-8) on the overhead control panel. Individual system circuit breakers and the associated avionics busses are shown in fig. 2-20. With the switch in the ON position, the avionics power relay is de-energized and power is applied through both the AVIONICS MASTER POWER #1 and #2 circuit breakers to the individual avionics circuit breakers on the overhead circuit breaker panel (fig. 2-23). In the off (aft) position, the relay is energized and power is removed from avionics equipment. When external power is applied to the aircraft, the avionics power relay is normally energized, removing power from the avionics equipment. To apply external power to the avionics equipment, move the AVIONICS MASTER POWER switch to the EXT PWR position. This will de-energize the avionics power relay and allow power to be applied to avionics equipment.

b. AC Power. AC power for the avionics equipment is provided by two inverters. The inverters supply 115-volt and 26-volt single-phase AC power when operated by the INVERTER #1 or #2 switches. Either inverter is capable of powering all avionics equipment requiring AC power. 115-volt AC power from the inverters is routed through fuses and transformers in the nose avionics compartment. The transformers provide the required 26 volts AC needed by avionics equipment.

SECTION II. COMMUNICATIONS

3-4. DESCRIPTION.

The communications equipment group consists of the interphone, UHF command, VHF command, and HF command systems.

3-5. MICROPHONE SWITCHES, MICROPHONE JACKS, AND HEADSET JACKS.

a. Microphone Switches. A bi-level microphone switch placarded INTPH, XMIT, MIC, is located on the pilot's and copilot's control wheels and co-pilot's floor. (fig. 2-16).

b. Controls and Functions.

(1) MIC INTPH-XMIT switch. Keys selected facility.

(a) INTPH. When depressed to first detent, keys interphone facility regardless of position of transmitter selector switch.

(b) XMIT. When depressed fully, keys facility indicated on transmitter selector switch.

c. Microphone Jacks. The pilot and copilot are each provided a microphone jack, placarded MIC JACK, located on the extreme left and right sides of the instrument panel (fig. 2-26) for use with the hand held microphone or headset microphone, and a microphone jack for the oxygen mask microphone, located next to the oxygen outlets. Microphone jack functions are as follows:

d. Controls and functions.

(1) MIC HEADSET jack. Provides a means of connecting microphone headset assembly to audio system.

(2) MIC jack. Provides a means of connecting hand-held microphone with push-to-talk capability to the audio system.

e. Microphone Jack Selector Switches. The pilot and copilot are each provided with a switch placarded MIC HEADSET OXYGEN MASK located on the extreme left and right sides of the instrument panel (fig. 2-26). Microphone jack selector switch functions are as follows:

f. Controls and Functions.

(1) MIC HEADSET OXYGEN MASK switch. Selects which microphone will be connected to audio system.

(2) MIC HEADSET. Utilizes either hand-held microphone or headset-microphone assembly with audio system.

(3) OXYGEN MASK. Utilizes microphone in oxygen mask assembly with audio system.

g. External Headset-Microphone Jack. A jack on the nose gear strut placarded MIC JACK is provided for use by ground personnel. The jack connects headphones and microphone to the aircraft's interphone system.

h. Cockpit Floor Foot Microphone Switch. A floor mounted foot microphone switch is installed on the floor on the copilot's side. The switch allows the copilot to key the system selected by the transmitter selector switch on the audio control panel, while utilizing his hands for other operations.

3-6. INTERPHONE SYSTEM.

a. Description. Individual audio control panels are provided for the pilot and copilot. The controls and switches on each panel provide for reception and volume control of interphone, communication, and navigation audio signals and a choice of transmission on UHF, VHF, or HF transmitters. The audio control panels are protected by the 2-ampere AUDIO PILOT and AUDIO COPILOT circuit breakers located on the overhead circuit breaker panel (fig. 2-23). Figures 3-1 and 3-2 illustrate the pilot's and copilot's audio control panels respectively.

b. Controls and Functions, Pilots Audio Control Panel.

(1) Transmitter selector switch. Controls operation of selected system.

(a) HF. Permits reception of audio from the HF transceiver and routes key and mic signals to the HF transceiver.

(b) UHF. Permits reception of audio from the UHF transceiver and routes key and mic signals to the UHF transceiver.

(c) VHF-I. Permits reception of audio from the VHF-1 transceiver and routes key and mic signals to the VHF-I transceiver.

(d) VHF-2. Permits reception of audio from the VHF-2 transceiver and routes key and mic signals to the VHF-2 transceiver.

(e) INTPH. Permits transmission and reception of interphone signals.

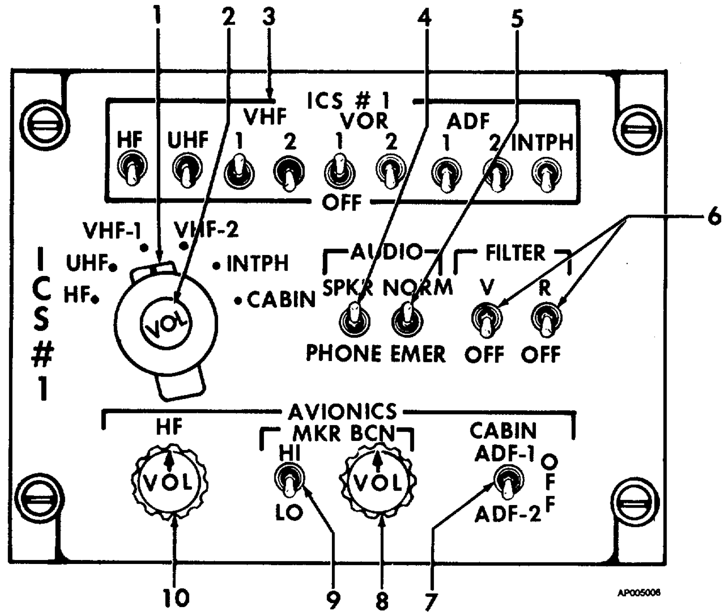
(f) CABIN. Removes ADF audio from cabin speakers and allows pilot to talk to cabin occupants.

(g) VOL control. Adjusts headphone audio volume.

(2) ICS #1-OFF switches. Permits monitoring by pilot of selected audio regardless of position of transmitter selector switch.

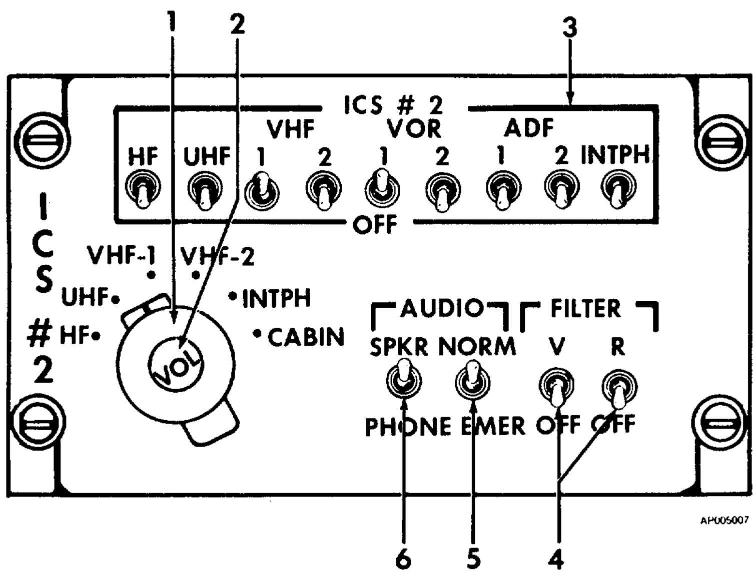
(a) HF. Permits monitoring of HF audio.

(b) UHF. Permits monitoring of UHF audio.



1. Transmitter selector switch
2. VOL control
3. ICS #1-OFF switches
4. AUDIO SPKR-PHONE switch
5. AUDIO NORM-EMER switch
6. FILTER switches
7. CABIN ADF-1/OFF/ADF-2 switch
8. MKR BCN VOL control
9. MKR BCN HI-LO switch
10. HF VOL control

Figure 3-1. Pilot's audio Control Panel



1. Transmitter selector switch
2. VOL control
3. ICS #2 audio switches
4. FILTER switches
5. AUDIO NORM-EMER switch
6. AUDIO SPKR-PHONE switch

Figure 3-2. Copilot's Audio Control Panel

(c) *VHF-I.* Permits monitoring of VHF-1 audio.
(d) *VHF-2.* Permits monitoring of VHF-2 audio.
(e) *VOR-1.* Permits monitoring of VOR-1 audio.
(f) *VOR-2.* Permits monitoring of VOR-2 audio.
(g) *ADF-1.* Permits monitoring of ADF-1 audio.
(h) *ADF-2.* Permits monitoring of ADF-2 audio.
(i) *INTPH.* Permits monitoring of interphone audio.

(3) AUDIO SPKR-PHONE switch. Determines where selected audio will be heard.
(a) *SPKR*. Allows selected audio to be heard via the speaker.
(b) *PHONE*. Allows selected audio to be heard via the headphone.

(4) AUDIO NORM-EMER switch. Controls routing of received audio signals.
(a) *NORM.* Routes audio signal through amplifier to speaker or headphone.
(b) *EMER.* Audio signal bypasses amplifier. Applies audio signal to headphone only.

(5) FILTER V-OFF switch. Filters out voice on ADF and VOR audio.

(6) FILTER R-OFF switch. Filters out identification code on ADF-2 and VOR audio.

NOTE

Either the ADF or VOR switch must be in the OFF position for the other switch to function.

(7) CABIN ADF-1, OFF, ADF-2 switch. Selects desired ADF audio for use with cabin speakers.
(a) *ADF-1.* Selects ADF-1 audio for use.
(b) *ADF-2.* Selects ADF-2 audio for use.
(c) *OFF.* Removes ADF audio from cabin speakers.

(8) MKR BCN HI-LO switch. Selects either HI or LO marker beacon sensitivity.

(9) MKR BCN VOL control. Adjusts volume of marker beacon audio.

(10) HF VOL control. Adjusts volume of HF audio.

c. Controls and Functions, Copilots Audio Control Panel. The copilot's audio control panel is identical to the pilot's with the following exceptions:

(1) HF VOL control. Deleted.
(2) MKR BCN HI-LO switch. Deleted.
(3) MKR BCN VOL control. Deleted.
(4) CABIN ADFI, OFF, ADF-2 switch. Deleted.

d. Audio Control Panel Operation.

(1) Turn-on procedure: The audio control panel is on whenever electrical power is applied to the aircraft and the AVIONICS MASTER PWR switch is ON.

(2) Interphone operating procedure:

1. Transmitter selector switch - INTPH.
2. Microphone switch Press (listen for sidetone).
3. VOL control Adjust sidetone and interphone audio level in headphone.

(3) Navigational aid and receiver monitoring procedure:

1. ICS No. 1 or ICS No. 2-OFF switches-As required.
2. VOL control-Do not disturb. Adjust volume control of system being monitored.

(4) Transmitting procedure:

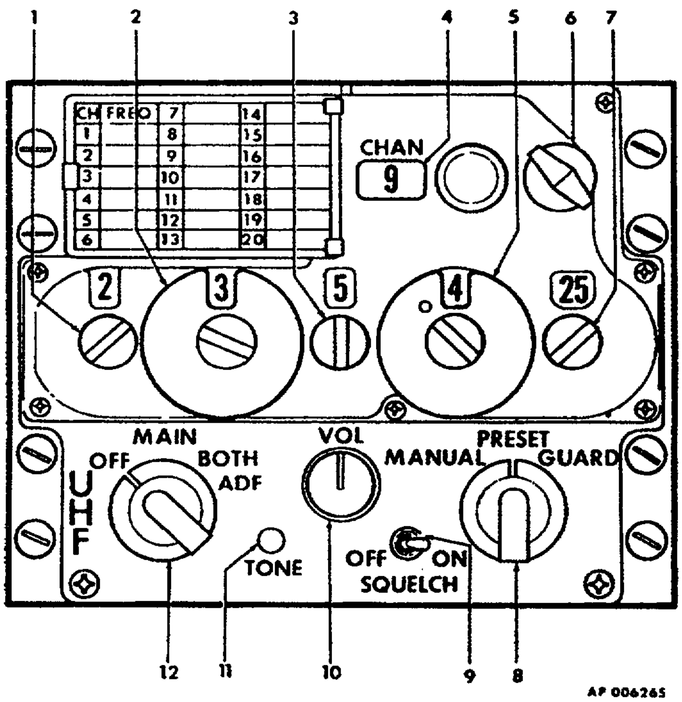
1. Transmitter selector switch-As required.
2. Microphone switch-Press (listen for sidetone).

3. Applicable transceiver volume control-Adjust for comfortable audio level.

e. Audio Control Panel Emergency Operation. An audio fail-safe system is provided for use in the event of an audio amplifier failure. If an audio amplifier fails, receiver audio bypasses the amplifier and is applied directly to the headsets and no audio will be available to the overhead speakers.

3-7. UHF COMMAND SET (AN/ARC-164).

a. Description. The UHF command set provides two way amplitude modulated (AM) voice communication within the frequency range of 225.000 to 399.975 MHz for a distance range of approximately 50 miles line-of-sight. Channel selection is spaced at 0.025 MHz intervals. Additionally, a separate receiver is incorporated to provide monitoring capability for the UHF guard frequency (243.0 MHz). The audio output of the UHF set is applied to the audio control panel where it is made available to the headsets and speakers. The UHF command set is protected by the 5-ampere UHF circuit breaker on the overhead circuit breaker panel (fig. 2-23). Figure 3-3 illustrates the UHF command set. The associated blade type antenna is shown in figure 2-1.



1. Manual frequency (100-MHz) selector-indicator
2. Manual frequency (10-MHz) selector-indicator
3. Manual frequency (I-MHz) selector-indicator
4. CHAN indicator
5. Manual frequency (100-kHz) selector-indicator
6. Preset channel selector
7. Manual frequency (10and I-kHz) selector-indicator
8. Mode selector
9. SQUELCH switch
10. VOL control
11. TONE pushbutton
12. Function switch

Figure 3-3. UHF Command Set (AN/ARC-164)

b. Controls and Functions.

(1) Manual frequency selector switch (hundreds). Selects hundreds digit of frequency (either 2 or 3) in MHz.

(2) Manual frequency selector switch (tens). Selects tens digit of frequency (0 through 9) in MHz.

(3) Manual frequency selector switch (units). Selects units digit of frequency (0 through 9) in MHz.

(4) Manual frequency selector switch (tenths). Selects tenths digit of frequency (0 through 9) in MHz.

(5) Manual frequency selector switch (hundredths and thousandths). Selects hundredths and thousandths digits of frequency (00, 25, 50, or 75) in MHz.

(6) Preset channel selector switch. Selects one of 20 preset channels.

(7) MANUAL-PRESET-GUARD switch. Selects method of frequency selection.

(a) MANUAL. Any one of 7,000 frequencies is manually selected using the five frequency selector switches.

(b) PRESET. Frequency is selected using the preset channel selector switch for selecting any one of 20 preset channels.

(c) GUARD. The main receiver and transmitter are automatically tuned to the guard frequency and the guard receiver is disabled.

(8) SQUELCH ON-OFF switch. Turns on or off squelch circuit of main receiver.
(9) VOL control. Adjusts volume.
(10) TONE switch. Selects transmission of a 1,020 Hz tone on the selected frequency.
(11) Function switch. Selects operating function.
(a) OFF. Shuts down equipment.
(b) MAIN. Selects main receiver and transmitter.
(c) BOTH. Selects main receiver, transmitter, and guard receiver.
(d) ADF. Selects ADF or homing system (if installed) and main receiver.

c. UHF Command Set Operation.

(1) Turn on procedure: Function selector switch (UHF control panel) - BOTH.
(2) Receiver operating procedure:

1. Function selector switch - As required.
2. Frequency-Select required frequency using either preset channel control or manual frequency selector controls.

NOTE

The PRESET channel selector and manual frequency selectors are inoperative when the MANUAL-PRESET-GUARD switch is set to GUARD.

3. Volume-Adjust.
4. Squelch-As required.

(3) Transmitter operating procedure:

1. Transmitter selector switch (audio control panel, fig. 3-1 or 3-2) - UHF position.
2. Microphone switch - Press.

(4) Shut down procedure: Function selector switch (UTHF control panel) - OFF.

d. UHF Command Set Emergency Operation.

NOTE

Transmission on emergency frequencies (guard channel) shall be restricted to emergencies only. An emergency frequency of 121.500 MHz is also available on the VHF command radio set.

1. Transmitter selector switch (audio control panel, fig. 3) - UHF position.
2. Mode selector switch (UHF control panel)- GUARD.
3. Microphone switch - Press.

3-7A. UHF COMMAND SET (AN/ARC-164 HAVE QUICK)

a. Description. The UHF command set is a line-of sight radio transceiver which provides transmission and reception of amplitude modulated (AM) signals in the ultra high frequency range of 225.000 to 399.975 MHz for a distance range of approximately 50 miles. Channel selection is spaced at 0.025 MHz. A separate receiver is incorporated to provide monitoring capability for the UHF guard frequency (243.0 MHz). UHF audio output is applied to the audio panel where it is routed to the headsets.

NOTE

The PRESET channel selector and manual frequency selectors are inoperative when the mode selector is set to GUARD position. The receiver-transmitter will be set to the emergency frequency only.

Existing capabilities of the HAVE QUICK modified radio are preserved to the maximum extent possible when it is operated in the normal (non-hopping) mode. No new procedures are required for normal radio operation.

To operate in the AJ mode, the radio must first be initialized. This initialization requires the setting of two control entries into the radio, Work-of-Day (WOD) and Time-of-Day (TOD). The WOD defines the choice of frequency hopping pattern for the day. The WOD choice is a managerial function and the same WOD may be used for one or more days. The TOD must be loaded into the clock contained within the radio.

The transmitter and receiver sections of the UHF unit operate independently, but share the same power supply and frequency control circuits. Separate cables route transmit and receive signals to their respective receiver/transmitter.

The UHF command set is protected by the 5-ampere UHF circuit breaker in the overhead circuit breaker panel (fig. 2-23). Figure 3-3 illustrates the UHF command set. The associated blade type antenna is shown in figure 2-1.

b. Controls and Functions. UHF control panel (fig. 3-3).

(1) Manual frequency selector/indicator (hundreds). Selects and indicates hundreds digit of frequency (2 or 3) in MHz.

(2) Manual frequency selector/indicator (tens). Selects and indicates tens digit of frequency (0 through 9) in MHz.

(3) Manual frequency selector/indicator (units). Selects and indicates units digit of frequency (0 through 9) in MHz.

(4) Preset channel indicator. Displays preset channel.

(5) Manual frequency selector/indicator (tenths). Selects and indicates tenths digit of frequency (0 through 9) inMHz.

(6) Preset channel selector. Selects one of 20 preset channel frequencies.

(7) Manual frequency selector (hundredths and thousandths). Selects hundredths and thousands digits of frequency (00, 25, 50, or 75) in MHz.

(8) Mode selector. Selects operating mode and method of frequency selection.

(a) MANUAL. Enables the manual selection of any one of 7,000 frequencies.

(b) PRESET. Enables selection of anyone of20 preset channels.

(c) GUARD. Selection automatically tunes the main receiver and transmitter to the guard frequency and the guard receiver is enabled.

(9) SQUELCH switch. Turns main receiver squelch on or off.

(10) OL control. Adjusts volume.

(11) TONE pushbutton. When pressed, transmits a 1,020 Hz tone on the selected frequency.

(12) Function selector. Selects operating function.

(a) OFF. Turns set off.

(b) MAIN. Selects normal transmission with reception on main receiver.

(c) BOTH. Selects normal transmission with reception on both the main receiver and the guard frequency receiver.

(d) ADF. Not used.

c. Normal Operation.

(1) Turn on procedure:

NOTE

It is presumed aircraft power is on and normally used avionic circuit breakers remain depressed.

1. Avionics master power switch - ON.
2. Functions select switch MAIN or BOTH position, as required.

NOTE

If function selector is at MAIN setting, only the normal UHF communications will be received. If selector is at BOTH position, emergency communications on the guard channel and normal UHF communications will both be received.

(2) Receiver operating procedure:

1. Transmitter-interphone selector switch No. 3 position.
2. UHF audio monitor switch ON, No. 3 position.
3. Volume control - Mid position.

(3) To use preset frequency:

1. Mode selector switch - PRESET position.
2. Preset channel selector switch- Rotate todesired channel.

(4) To use non-preset frequency:

1. Mode selector switch - MANUAL position.
2. Manual frequency selectors (5). Rotate each knob to set desired frequency digits.

NOTE

The PRESET channel selector and manual frequency selectors are inoperative when the mode selector switch is set to the GUARD position.

3. Volume - Adjust.

NOTE

To adjust volume when audio is not being received, turn squelch switch OFF, adjust volume for comfortable noise level, then turn squelch switch ON.

4. Squelch - As desired.

(5) Transmitter operating procedure:

1. Transmitter-interphone selector No. 3 position.
2. UHF control panel Set required frequency using either PRESET CHAN control or MANUAL frequency select controls.
3. Microphone jack selector switch- As desired.
4. Microphone switch - Depress to transmit.

(6) Shutdown procedure: Function selector switch (fig. 3-3) - OFF.

3-8. VHF COMMAND SET (VHF-20B).

a. Description. The VHF command set (VHF20B) is aline-of-sight radio transceiver which provides transmission and reception of amplitude modulated signals in the very high frequency range of 116.000 to 151.975 MHz for a distance range of approximately 50 miles. Two VHF radio sets are installed (placarded COMM 1 and COMM 2). Audio signals are applied through the pilot and copilot transmitter selector switches and through the pilot and copilot VHF-I audio switches to their respective headsets. The VHF radio sets are protected by the 10-ampere VHF No. 1 and VHF No. 2 circuit breakers located on the overhead circuit breaker panel (fig. 2-23). Figure 3-4 illustrates the VHF command set control panel. The associated antenna is shown in figure 2-1.

b. Controls and Functions.

(1) Left control.

(a) Frequency indicator. Indicates operating frequency of set if control transfer switch is in left position.

(b) Frequency selectors. Selects desired operating frequency of set if control transfer switch is in left position.

(2) VOL-OFF control. Adjusts volume of received audio and turns set ON or OFF.

(3) CONTROL indicator. Illuminates if control transfer switch is in left position.

(4) TRANS switch. Selects which of two control heads determines operating frequency of set.

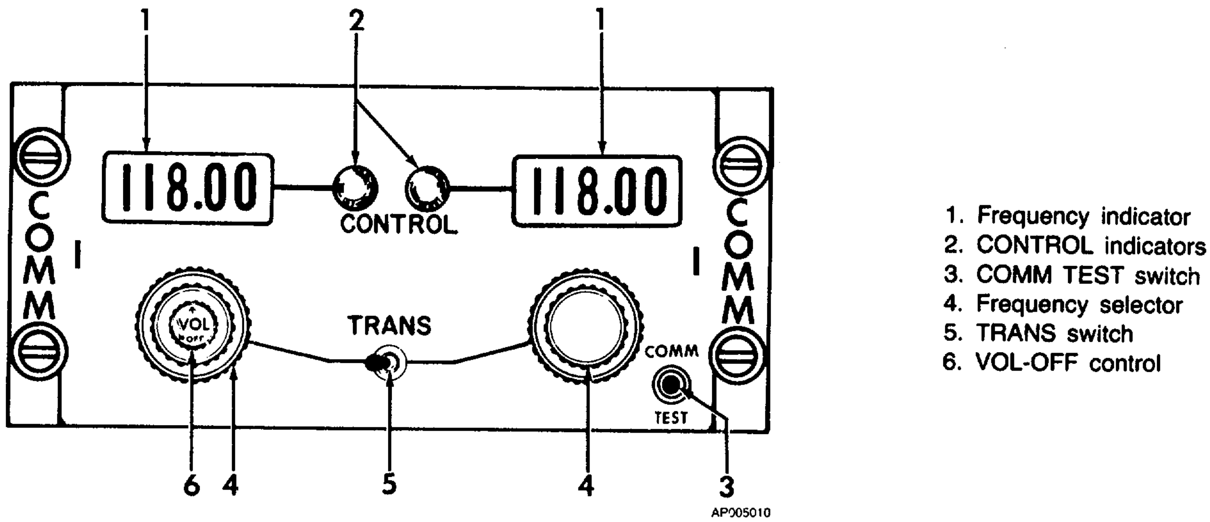


Figure 3-4. VHF Control Panel

(5) *Right control.*

(a) *Frequency indicator*. Indicates operating frequency of set if control transfer switch is in right position.

(b) *Frequency selectors.* Selects desired operating frequency of set if control transfer switch is in right position.

(6) *CONTROL indicator*. Illuminates if control transfer switch is in right position.

(7) *COMM TEST* switch. Overrides automatic squelch circuit.

c. *VHF Command Set Operation.*

(1) *Turn on procedure:*

1. VOL control - Turn clockwise.

(2) *Receiver operating procedure:*

1. Frequency selector - Select desired frequency.
2. VOL control - As required.

(3) *Transmitter operating procedure:*

1. Transmitter selector switch (audio control panel, fig. 3-1 or 3-2) - VHF-1 or VHF-2 position.
2. Microphone switch - Press.

(4) *Shutdown procedure:*

1. VOL control - Counterclockwise (OFF).

d. *VHF Command Set Emergency Operation.*

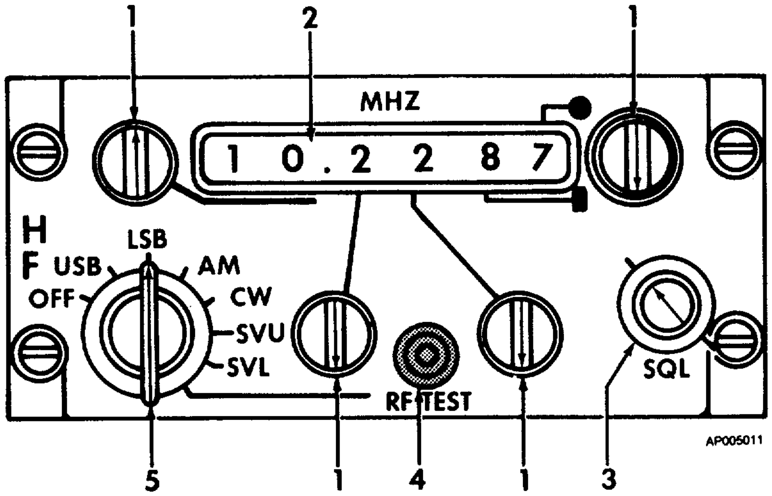
NOTE

Transmission on emergency frequency (121.500 MHz) will be restricted to emergencies only. An emergency frequency of 243.000 MHz (guard channel) is also available on the UHF command radio set.

1. Transmitter selector switch (audio control panel, fig. 3-1 or 3-2) VHF-1 or VHF-2.
2. Frequency selector (VHF control panel) 121.500 MHz (emergency frequency).
3. Microphone switch Press.

3-9. HF COMMAND SET (718U-5).

a. *Description.* The HF command set provides long-range voice communications within the frequency range of 2.000 to 29.999 MHz. The HF command set employs either standard amplitude modulation (AM), lower sideband (LSB) modulation, or upper sideband (USB) modulation. The distance range of the HF command set is approximately 2,500 miles, and varies with atmospheric conditions. The HF command set is protected by the 3-ampere HF RCVR and the 25-ampere HF PWR circuit breakers located on the overhead circuit breaker panel (fig. 2-23). Figure 3-5 illustrates the HF command set control panel. The associated antenna is shown in figure 2-1.



1. Frequency selector
2. MHZ indicator
3. SQL control
4. RF TEST indicator
5. Mode selector

Figure 3-5. HF Control Panel

NOTE

Keying the HF radio set while operating the ADF No. 2 set causes unreliable ADF signals.

b. Frequency Selectors. Operating frequency is selected by turning the frequency selector controls until the desired operating frequency is indicated. The controls may be operated in any order.

c. Squelch Control. The squelch control is adjusted to mute undesired background noise. Setting the control too far counterclockwise can result in blocking out weak signals. There are two different types of squelch control depending on the configuration installed in the aircraft. One configuration is the voiceoperated squelch control that functions to mute the receiver output in the absence of a receive signal. The other type combines with RF gain control. Adjustment method of the squelch control is different for the two configurations.

d. RF Test Lamp. Four conditions of the RF TEST lamp indicate the operational status of the system. The mode selector must be in the RF TEST mode position. Lamp illuminated or flashing with system unkeyed provides a lamp test of the RF TEST lamp. Lamp not illuminated, flashing, or illuminated with the system keyed indicates the operational status of the rest of the system. If the lamp is not illuminated, the system is good; if flashing, the power amplifier-coupler is faulty; if illuminated steadily, the receiver-exciter is faulty.

e. Controls and Functions, HF Command Set Control Panel.

(1) Frequency controls. Adjusts operating' frequency of set.

(2) MHZ indicators. Indicates operating frequency of set.

(3) *SQL control*. Adjusts level of squelch.

(4) *RF TEST indicator.* Indicates operational status of set.

(a) *Illuminated*. Indicates fault in receiver-exciter portion.

(b) *Blinking.* Indicates fault in power amplifier-coupler.

(c) *Extinguished*. System is operational.

(5) *Mode selector*. Turns set off and determines operating mode.

(a) *OFF.* Turns set off.

(b) *USB.* Places set in Upper Sideband mode.

(c) *LSB*. Places set in Lower Sideband mode.

(d) *AM*. Places set in amplitude modulation mode.

(e) *CW.* Not used in this installation.

(f) *SVU*. Not used in this installation.

(g) *SVL*. Not used in this installation.

(h) *RF Test.* Places set in test mode.

f. *HF Command Set Operation.*

NOTE

No warmup is required before operation.

NOTE

The system may be operated in the receive mode continuously.

CAUTION

Operation of the system is limited to one minute transmission (keyed) with a three minute (unkeyed) for SSB voice; one minute transmission (keyed) with a seven minute (unkeyed) for AM, voice modulation up to 55 °F (131 °F) ambient temperature.

1. Mode selector - As required.
2. Frequency selector - Select.
3. Squelch control - Set (turn completely clockwise).
4. Tune the system by momentarily depressing the microphone switch. A constant tone will be heard while the system is tuning (average tuning time is three to five seconds). After tuning, the tone stops and receiver noise will be heard.

NOTE

If a fault occurs during the tuning process, an interrupted tone (beeping) will be heard in the headset. To clear a fault, change any frequency selector knob at least one step and then return to the desired setting. Another tune cycle may now be attempted by depressing the microphone switch.

5. Microphone switch - Press to transmit.

NOTE

The presence of sidetone during transmission is an indication of proper operation. The lack of sidetone is an indication of failure.

6. If squelch operation is desired, rotate squelch control fully clockwise. With no signal present, rotate squelch control counterclockwise until the background noise is reduced to a comfortably audible level or until the control is fully counterclockwise. After a short delay, the receiver will mute.

NOTE

If background noise was reduced to a comfortable level before the audio was muted, the radio is equipped with a combination RF gain/squelch feature and control should be left at setting desired in the above step. If control was rotated to the full counterclockwise position with no reduction in background noise, your system incorporates the standard squelch version and you must perform the following step.

7. Rotate squelch knob clockwise one step at a time until background noise is heard (squelch is broken). Set squelch control one position counterclockwise. After a short delay, the receiver will mute.

8. If a new frequency is desired, repeat steps (2) through (7).

g. Operator Maintenance.

WARNING

Do not touch antenna, or antenna feedline when radio is transmitting. Painful RF burns and possibly death may result from high RF voltages.

(1) Fault Clearing. After the tune cycle has been completed, the normal tune tone should disappear. Should it fail to disappear, an interrupted tone (beeping) will occur approximately 8 seconds after the tune cycle was initiated. This beeping indicates a fault condition. To clear the fault, initiate a new tune cycle by either turning the mode selector to OFF and back to the operating mode, or turning any frequency selector away from and back to the operating frequency. The tune tone should be present for approximately 3 to 6 seconds, and then disappear. If the beeping recurs, try the clearing procedure a second time. If a fault is still indicated, a unit failure is probable.

(2) RF Test. The following paragraphs provide procedures for isolating a malfunction to a faulty unit or cable.

1. Set squelch control fully clockwise and tune to WWV. Check receive operation. Select USB, 20.701.0 MHz, and check for a 1-kHz tone. Select LSB, 20.699.0 MHz, and check for a 1-kHz tone. Select CW, 20.698.0 MHz, and check for a 1-kHz tone in receiver.

2. RF Test Lamp Check (system not keyed). Set the mode switch to the RF TEST position. Observe:

If the RF TEST lamp does not illuminate, the lamp is defective or the receiver-exciter is faulty.

If the RF TEST lamp blinks for more than 1 minute, the receiver-exciter is faulty.

If the RF TEST lamp illuminates immediately or after an initial period of blinking, the RF TEST lamp and fault circuits are operational.

3. Set the mode switch to the RF TEST position. Change frequency selection to any frequency and key the system momentarily. Observe the RF TEST lamp during the tune cycle while the tune tone is audible. Normal tune time is 3 to 8 seconds.

4. System Does Not Complete Tune Cycle. If no tune tone is heard after initial keying, the fault is in the receiver-exciter, the PTT key to the receiver-exciter is faulty, or the exciter tune line between the receiver-exciter and pa-coupler is faulty.

NOTE

Nominal tune time of the pa-coupler is approximately 5 seconds; therefore, the RF TEST lamp indications below are only valid for approximately 5 seconds after initial keying.

5. If the RF TEST lamp stays illuminated continuously, the receiver-exciter is faulty. If the RF TEST lamp blinks ON and OFF, the pa-coupler is faulty.

6. Tune Cycle Complete. If the RF TEST lamp is not illuminated, the tune tone drops, and a beeping tone is heard at the end of the time, the pa-coupler and coupler mount failed to tune the antenna.

7. If RF TEST lamp is not illuminated, switch to the USB mode and supply audio input while holding the system keyed. If sidetone is not audible, check audio interphone or microphone system before replacing the receiver-exciter. Presence of a sidetone indicates that the system is working properly.

3-10. EMERGENCY LOCATOR TRANSMITTER (ELT).

a. Description. An emergency locator transmitter is provided to assist in locating an aircraft and crew in the event an emergency landing is necessitated. The output frequency is 121.5 and 243 MHz simultaneously. Range is approximately line-of-sight. The aircraft may be equipped with one of three different ELTs: the TR70-13, the TR70-17, or the ELT-10. All three have a RESET switch and ON/OFF/ARM switch located on the transmitter. The TR70-13 and ELT-10 are equipped with a switch, accessible through an access opening in the right side of the aft fuselage. In the event the impact switch as been inadvertently actuated, the beacon can be reset by actuating the remote mounted switch to the RE ARM (aft) position (TR7013) or by firmly pressing the RESET switch on the front of the case. Access to the ELT is through the door on the bottom of the aft right fuselage.

b. Controls and Functions, Transmitter.

(1) ON/OFF/ARM switch. Controls operation of the set.

(a) ON. Turns set on for test purposes.

(b) OFF. Turns set off.

(c) ARM. Arms set so that it will turn on automatically in an impact.

NOTE

The TR70 17 has no remote switch.

c. Controls and Functions, Remote Switch (TR70-13).

(1) RE ARM/ARM/XMIT switch. Resets, arms, or activates transmitter.

(a) RE ARM. Resets transmitter if it has been activated.

(b) ARM. Arms transmitter to activate automatically on impact. (Switch on front of transmitter must be set to ARM.)

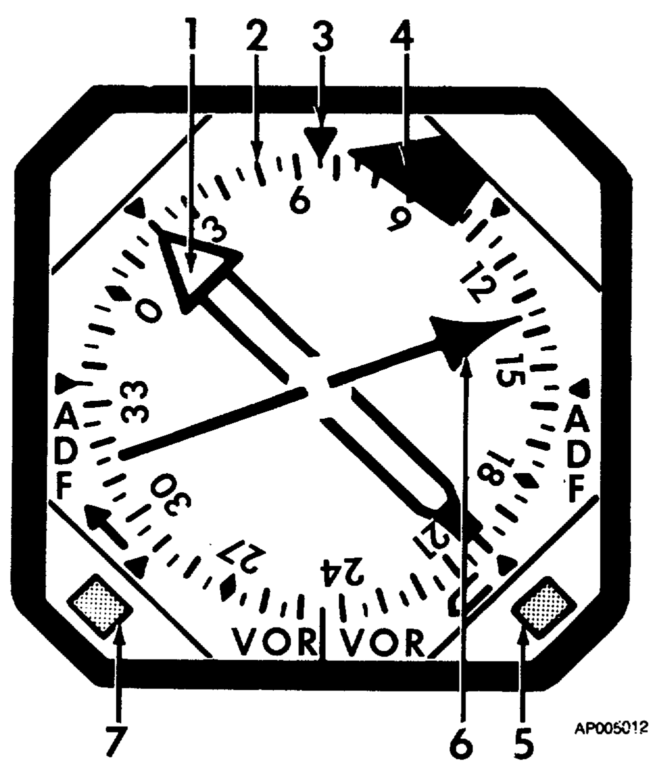
(c) XMIT. Activates transmitter for test purposes. (Switch on front of transmitter may be set to OFF or ARM.)

d. Controls and Functions, Remote Switch (ELT-10).

(1) ARM/XMIT switch. Arms or activates transmitter.

(a) ARM. Arms transmitter when switch on front of transmitter is set to ARM.

(b) XMIT. Activates transmitter for test purposes.



1. Double needle pointer
2. Compass card
3. Heading index
4. Warning flag
5. Double needle switch
6. Single needle pointer
7. Single needle switch

Figure 3-6. Radio Magnetic Indicator (RMI)

Section III. NAVIGATION

3-11. DESCRIPTION.

The overall navigation equipment group provides the pilot and copilot with the instrumentation required to establish and maintain an accurate flight course and position and to make an approach on instruments under Instrument Meteorological Conditions (IMC). The navigation configuration includes equipment for determining attitude, position, destination range and bearing, heading reference and groundspeed.

3-12. RADIO MAGNETIC INDICATORS (RMI).

a. Description. The radio magnetic indicators (fig. 3-6) are navigational aids which provide aircraft magnetic or directional gyro heading, VOR or ADF bearing information. Two radio magnetic indicators are installed. The pilot's RMI is identical in operation with the copilot's except that the copilot's COMPASS No. 1, No. 2 switch is used to select information for display on the compass card of the indicator. The pilot's RMI is protected by the 1-ampere No. 1 RMI circuit breaker and the copilot's RMI is protected by the 1-ampere No. 2 RMI circuit breaker. Both circuit breakers are located on the overhead circuit breaker panel (fig. 2-23).

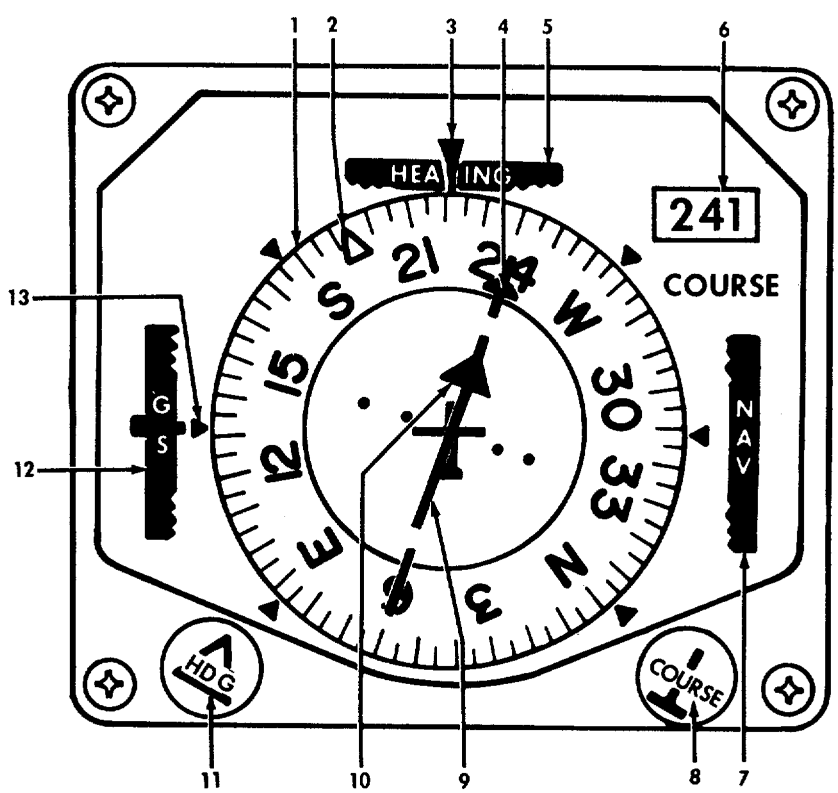
b. Controls and Functions, RMI.

(1) Copilot's COMPASS No. 1, No. 2 switch (instrument panel fig. 2-26. Selects desired source for magnetic heading information for display on pilot's RMI compass card.

(a) No. 1. Selects compass system No. 1 for display.

(b) No. 2. Selects compass system No. 2 for display.

(2) Pilot's COMPASS No. 1, No. 2 switch (instrument panel, fig. 2-26. Selects desired source for magnetic heading information for display on copilot's RMI compass card.



1. Compass card
2. Heading marker
3. Lubber line
4. Course arrow
5. HEADING flag
6. COURSE indicator
7. NAV flag
8. COURSE control
9. Course deviation bar
10. To-from arrow
11. HDG control
12. GS flag
13. Glideslope pointer

Figure 3-7. Pilot's Horizontal Situation Indicator *(a) No. 1*. Selects compass system No. 1 for display.

(b) No. 2. Selects compass system No. 2 for display.

(3) Double needle pointer. Indicates bearing selected by double needle switch.

(4) Compass card. Indicates aircraft heading at top of dial.

(5) Heading index. Reference point for aircraft heading.

(6) Warning flag. Indicates loss of heading signal or that bearing information is unreliable.

(7) Double needle switch. Selects desired signal to be displayed on double needle pointer.

(a) ADF position. Selects ADF No. 2 bearing information.

(b) VOR position. Selects VOR No. 2 bearing information.

(8) Single needle pointer. Indicates bearing selected by single needle switch.

(9) ADF position. Selects ADF No. 1 bearing information.

(10) VOR position. Selects VOR No. 1 bearing information.

3-13. PILOT'S HORIZONTAL SITUATION INDICATOR.

a. Description. The pilot's horizontal situation indicator (HSI) (fig. 3-7) provides heading, course deviation, and glideslope deviation information. Information from this instrument is also fed to the flight control system.

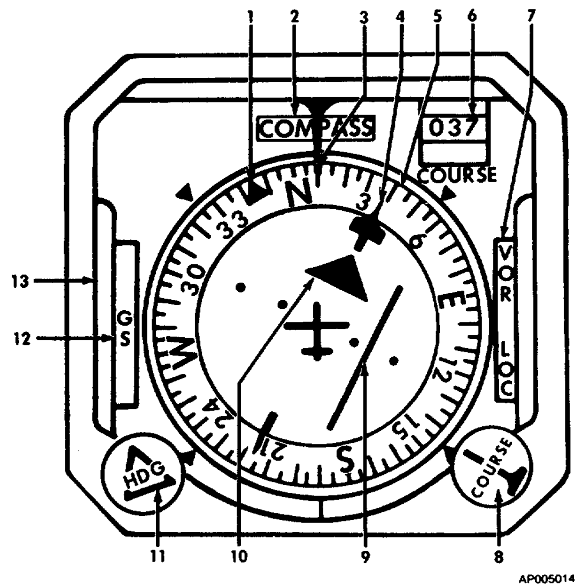
b. Controls/Indicator and Function, Pilot's HSI.

(1) Pilot's VOR No. 1, No. 2 switch (Instrument panel, fig. 2-26). Controls course select and display circuits of the HSI.

(a) No. 1. Circuits are connected to VOR No. 1 receiver.

(b) No. 2. Circuits are connected to VOR No. 2 receiver.

(2) Pilot's VLF switch. Selects VLF information for pilot's HSI display. When pressed, illuminates green to indicate in-use status.



1. Heading marker
2. COMPASS flag
3. Lubber line
4. Course arrow
5. Compass card
6. COURSE indicator
7. VOR LOC flag
8. COURSE control
9. Course deviation bar
10. To-from arrow
11. HDG control
12. GS flag
13. Glideslope pointer

Figure 3-8. Copilot's Horizontal Situation Indicator

(3) Pilot's COMPASS No. I1, No. 2 switch (Instrument panel, fig. 2-26. Selects desired source for magnetic heading information for display on compass card of indicator.

(a) No. 1. Selects compass system No. 1 for display.

(b) No. 2. Selects compass system No. 2 for display.

(4) Compass card. Indicates aircraft magnetic heading supplied by system selected on pilot's COMPASS No. 1, No. 2 switch.

(5) HEADING flag. Indicates loss of reliable heading information.

(6) COURSE readout. Presents a digital readout of course selected by the COURSE knob.

(7) Course arrow. Positioned by COURSE knob to selected VOR radial.

(8) Heading marker. Positioned by HDG knob to selected heading.

(9) Course deviation bar. Indicates lateral course deviation selected by the pilot's VOR No. 1, No. 2, or VLF switch (if installed).

(10) TO-FROM arrow. Indicates direction toward the VOR station or VLF waypoint (if installed and if VLF is selected) along the course selected by the COURSE knob. The arrow is not visible when a localizer frequency is selected.

(11) NAV flag. VOR-1 or VOR-2 selected indicates loss of or unreliable navigation signal VLF selected. The CMA-734 drives the normal VOR/LOC warning flag when VLF information is displayed on the pilot's HSI. The warning flag will be in view anytime the VLF information is invalid or suspected, or when any of the system status annunciators (SYS, SYN, AMB, or DR) are illuminated. If the flag is in view with the AMB (Ambiguity) annunciator illuminated, the flag may be cancelled by depressing the BK (Back) key on the CDU.

(12) COURSE knob. Used to select desired VOR course.

(13) HDG knob. Used to select desired heading.

(14) GS flag. Covers glideslope pointer when not receiving glideslope information.

(15) Glideslope pointer. Displays deviation from correct glideslope during ILS approach.

3-14. COPILOT'S HORIZONTAL SITUATION INDICATOR.

a. Description. The copilot's horizontal situation indicator (HSI) (fig. 3-8) provides heading, course deviation, and glideslope deviation information. It also switches to back localizer sensing whenever a localizer frequency is tuned, and the selected course and aircraft heading differ by more than 105 degrees.

b. Controls and Functions, Copilots HSI.

NOTE

If the pilot and copilot VOR No. 1, No. 2 switches are in the same position, the pilot has control of the course select circuits of the selected receiver and the copilot can only monitor deviation information from the selected receiver. A PILOT SELECT indicator will illuminate to notify the copilot that he has selected the same receiver as the pilot.

NOTE

When the pilot has VLF selected, the copilot has the option of selecting VOR-I or VOR-2 on the copilot HSI.

(1) Copilot's VOR No. 1, No. 2 switch (Instrument panel, fig. 2-26). Controls course select and display circuits of the HSI.

(a) No. 1. Circuits are connected to VOR No. 1 receiver.

(b) No. 2. Circuits are connected to VOR No. 2 receiver.

(2) Copilot's COMPASS No. 1, No. 2 switch (Instrument panel, fig. 2-26). Selects desired source for magnetic heading information for display on compass card of indicator.

(3) Compass card. Indicates aircraft magnetic heading supplied by system selected on copilot's COMPASS No. 1, No. 2 switch.

(4) COMPASS flag. Indicates loss of reliable heading information.

(5) COURSE readout. Presents a digital readout of course selected by the COURSE knob.

(6) Course arrow. Positioned by COURSE knob to selected VOR radial.

(7) Heading marker. Positioned by HDG knob to selected heading.

(8) Course deviation bar. Indicates lateral course deviation selected by the copilot's VOR No. 1, No. 2 switch.

(9) TO-FROM arrow. Indicates direction toward the VOR station along the course selected by the COURSE knob.

(10) VOR LOC flag. Indicates loss of or unreliable navigation signal.

(11) COURSE knob. Used to select desired VOR course.

(12) HD knob. Used to select desired heading.

(13) GS flag. Covers glideslope pointer when not receiving glideslope information.

(14) Glideslope pointer. Displays deviation from correct glideslope during ILS approach.

3-15. HORIZON REFERENCE INDICATOR.

a. Description. The horizon reference indicator (fig. 3-9) is the pilot's basic attitude horizon indicator and the attitude direction instrument for the flight director system.

b. Controls/Indicators and Functions, Horizon Reference Indicator.

(1) Crossed needles. Displays computed steering commands.

(2) Lateral deviation indicator. Displays localizer deviation information from VOR #1 receiver.

(3) Vertical deviation indicator. Displays glideslope deviation information from VOR #1 receiver.

(4) Bank angle pointer. Indicates aircraft bank angle.

(5) Bank angle index. Reference indicating zero-degree bank.

(6) Bank angle scale. Allows measurement of aircraft bank angle from zero to 60 degrees.

(7) Horizon line. Affixed to sphere, remains parallel to the earth's horizon at all times.

(8) Miniature aircraft. Indicates attitude of aircraft with respect to the earth's horizon.

(9) *Sphere*. Remains oriented with the earth's axis at all times.

(10) GYRO flag. Presence indicates loss of power to, or low rotational speed of, vertical gyro.

(11) CMPTR flag. Presence indicates a malfunction within the autopilot computer.

NOTE

When flying coupled to the VLF system, the CMPTR flag will be in view anytime the steering information is invalid or a malfunction exists in the autopilot computer.

(12) GS flag. Presence indicates glideslope information is not being presented on indicator.

(13) TEST push button. When pressed, display indicates an additional 10° nose up and 20° right roll and the GYRO flag is visible.

3-16. PILOT'S TURN AND SLIP INDICATOR.

a. Description. The pilot's turn and slip indicator (fig. 3-10) is used to provide automatic yaw damping information to the autopilot in addition to performing the functions of a turn and slip indicator. It is protected by the 5-ampere PILOT TURN & SLIP circuit breaker located on the overhead circuit breaker panel (fig. 2-23).

b. Controls/Indicators and Function, Pilot's Turn and Slip Indicator.

(1) Turn rate indicator. Deflects to indicate rate of turn.

(2) 2-minute turn marks. Fixed markers indicate 2 minute turn rate when covered by turn rate indicator.

(3) GYRO warning flag. 2p. Indicates when power is not applied to turn gyro.

(4) Inclinometer. Indicates lateral acceleration (side slip) of aircraft.

3-16A. RADIO ALTIMETER (RA-315).

a. Description. The radio altimeter (fig. 3-10A. provides the pilot with the actual altitude of the aircraft above ground or surface level. The indicator displays radio altitude information from 2500 feet to touchdown, with an expanded linear scale below 500 feet.

b. Radio Altimeter (RA-315), Controls and Functions (fig. 3-10A).

(1) Decision height annunciator. An annunciator placarded DH, located on the upper left corner of the radio altimeter indicator, and top center of pilot and copilot instrument panel will illuminate when the aircraft is at or below the selected decision height (DH).

(2) Pointer mask. The pointer mask placarded ABS ALT, covers the pointer for altitudes above 2500 feet.

(3) Failure warning flag. A flag placarded OFF will be in view whenever the radio altimeter system information is unreliable.

(4) Decision height marker. The decision height marker is set to the desired decision height by the DH SET knob.

(5) Altitude pointer. The altitude pointer indicates above ground or surface level.

(6) Decision height set knob. A knob placarded DH SET radar altimeter indicator, is used to set the orange decision height marker to the desired decision height (DH).

(7) Test switch. A momentary pushbutton switch placarded TEST, located on the lower left corner of the radio altimeter indicator, is used to activate the unit's self test function. When the switch is depressed, the OFF warning flag will

come into view and the altitude pointer will indicate approximately 100 ±20 feet. Releasing the switch will cause the altitude pointer to return to existing altitude, and OFF warning flag to retract from view.

3-17. COPILOT'S ATTITUDE INDICATOR.

a. Description. The copilot's attitude indicator (fig. 3-11) is a flight instrument which indicates the aircraft's attitude. The indicator is designed to operate through all attitudes. There are no front panel fuses or circuit breakers provided for the copilot's attitude indicator.

b. Controls/Indicators and Functions, Copilot's Attitude Indicator.

(1) *Bank angle index*. Reference indicating zero-degree bank.

(2) Bank angle pointer. Indicates aircraft bank angle.

(3) Bank angle scale. Allows measurement of aircraft bank angle from zero to 90 degrees with marks at 10, 20, 30, 45, 60, and 90 degrees.

(4) Horizon line. Affixed to sphere, remains parallel to the earth's horizon at all times.

(5) Miniature aircraft. Indicates attitude of aircraft with respect to the earth's horizon.

(6) G flag. Presence indicates loss of power.

(7) Sphere. Remains oriented with the earth's axis at all times.

(8) Inclinometer. Assists the copilot in making coordinated turns.

3-18. GYROMAGNETIC COMPASS SYSTEMS.

a Description. Dual identical compass systems provide accurate directional information for the aircraft at all latitudes of the earth. As a heading reference, two modes of operation are used: directional gyro (FREE) mode, or slaved (SLAVE) mode. In polar regions of the earth where magnetic heading references are not reliable, the system is operated in the FREE mode. In this mode, the system furnishes an inertial heading reference, with latitude corrections introduced manually. In areas where magnetic heading references are reliable, the system is operated in the SLAVE mode. In this mode, the directional gyro is slaved to the magnetic azimuth detector, which supplies long-term magnetic reference for correction of the apparent drift of the gyro. Magnetic heading information from both systems is applied to various aircraft systems through pilot and copilot

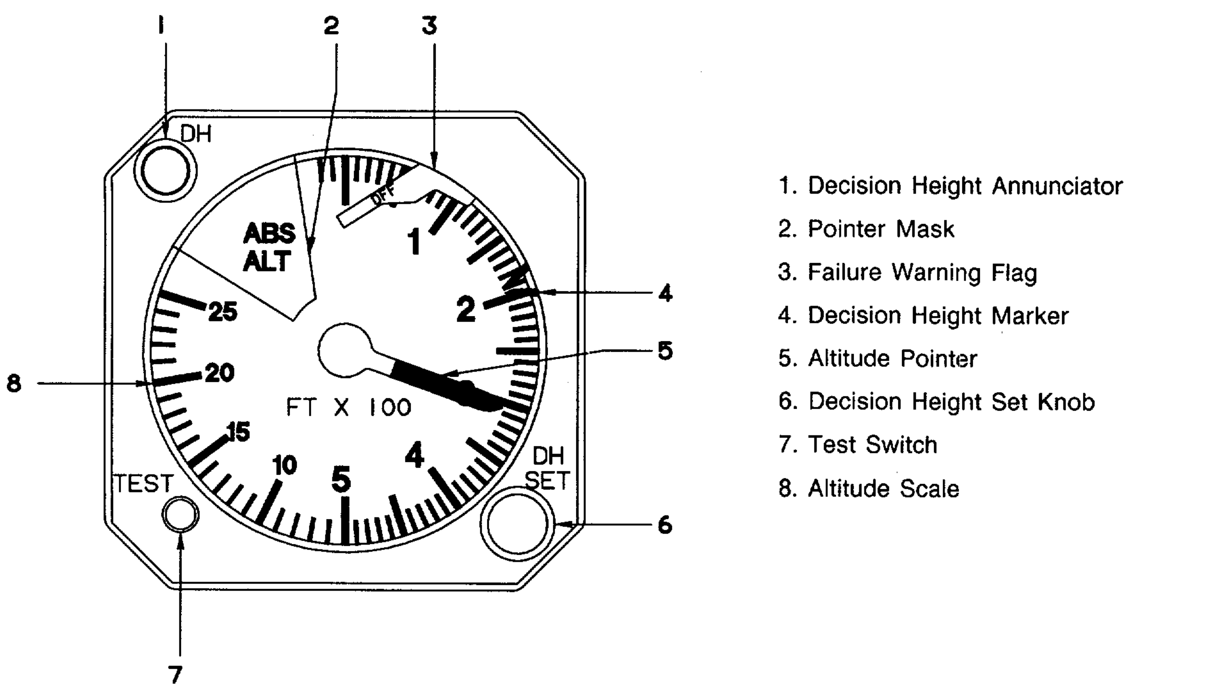
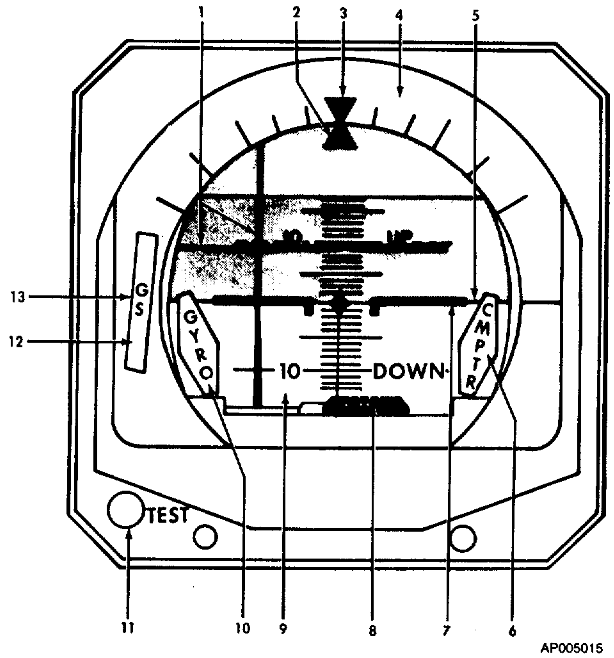


Figure 3-8A. Radio Altimeter (RA-315)



1. Crossed needles
2. Bank angle pointer
3. Bank angle index
4. Bank angle scale
5. Horizon line
6. CMPTR flag
7. Horizontal reference
8. Lateral deviation indicator
9. Sphere
10. GYRO flag
11. TEST pushbutton
12. GS flag
13. Vertical deviation indicator

Figure 3-9. Horizon Reference Indicator

COMPASS switches. There are no front panel fuses or circuit breakers for the gyromagnetic compass systems.

b. Controls and Functions, Gyromagnetic Compass System.

(1) Pilot's COMPASS #1, #2 switches. Selects desired source for magnetic heading information for display on pilot's HSI copilot's RMI.

(a) #1. Selects compass system #1 for display.

(b) #2. Selects compass system #2 for display.

(2) Copilot's COMPASS #1, #2 switch. Selects desired source for magnetic heading information for display on copilot's HSI and pilots RMI.

(a) #1. Selects compass system #1 for display.

(b) #2. Selects compass system #2 for display.

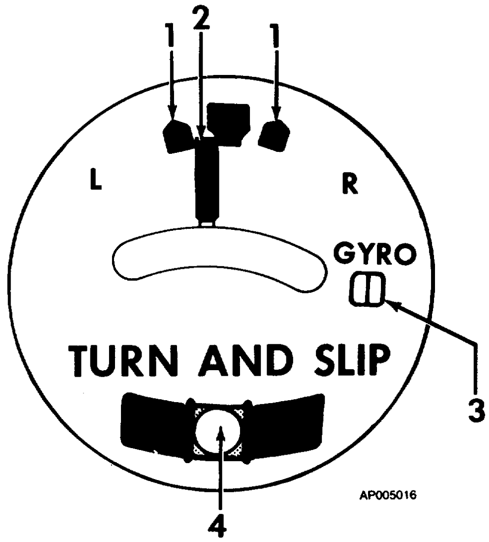
(3) COMPASS SLAVE annunciator. Presents a visual indication of system synchronization operation.

(4) GYRO SLAVE/FREE switch. Controls system mode of operation.

(a) SLAVE. Places system in SLAVE mode.

(b) FREE. Places system in FREE mode.

(5) INCREASE/DECREASE switch. Provides manual fast synchronization for the system.



1. 2-Minute turn marks
2. Turn rate indicator
3. GYRO warning flag
4. Inclinometer

Figure 3-10. Pilot's Turn and Slip Indicator

(a) *INCREASE*. Causes gyro heading output to increase.

(b) *DECREASE*. Causes gyro heading output to decrease.

3-19. VOR RECEIVERS (VIR-30).

a. Description. Two VOR receivers are provided (fig. 3-12). VOR No. 2 is identical in operation to VOR No. 1 except that no marker beacon section is provided in VOR No. 2. The unit is an airborne navigation-communications radio whose function is to receive and interpret VHF omnidirectional radio range (VOR) and localizer (LOC) signals in the frequency range of 108.00 to 117.95 MHz, glideslope signals in the frequency range of 329.15 to 335.00 MHz, and marker beacon signals to 75 MHz. Signal reception is limited to line-of-sight and by the power of the transmitter with a maximum range of 120 miles. The VOR receivers are protected by the 2-ampere VOR No. 1 and VOR No. 2 circuit breakers located on the overhead circuit breaker panel (fig. 2-23).

b. Controls and Functions, VOR.

(1) Pilot's VOR No. 1, No. 2 switch (Instrument panel, fig. 2-26). Controls course select and display circuits of the pilot's HSI.

(a) *No. 1.* Circuits are connected to VOR No. 1 receiver.

(b) *No. 2.* Circuits are connected to VOR No. 2 receiver

(2) Copilot's VOR No. 1, No. 2 switch (Instrument panel, fig. 2-24). Controls course select and display circuits of the copilot's HSI.

(a) *No. 1.* Circuits are connected to VOR No. 1 receiver.

(b) *No. 2.* Circuits are connected to VOR No. 2 receiver.

NOTE

If the pilot and copilot VOR No. 1, No. 2 switches are in the same position, the pilot has control of the course select circuits of the selected receiver and the pilot can only monitor deviation information from the selected receiver. A PILOT SELECT indicator will illuminate to notify the copilot that he has selected the same receiver as the pilot.

(3) AUDIO VOR switch (audio control panel, fig. 3-1, or 3-2). Applies VOR audio to respective headsets.

(4) Frequency indicator. Indicates operating frequency of set.

(5) Frequency control. Selects desired operating frequency.

(6) VOR/OFF control. Turns set on and adjusts volume.

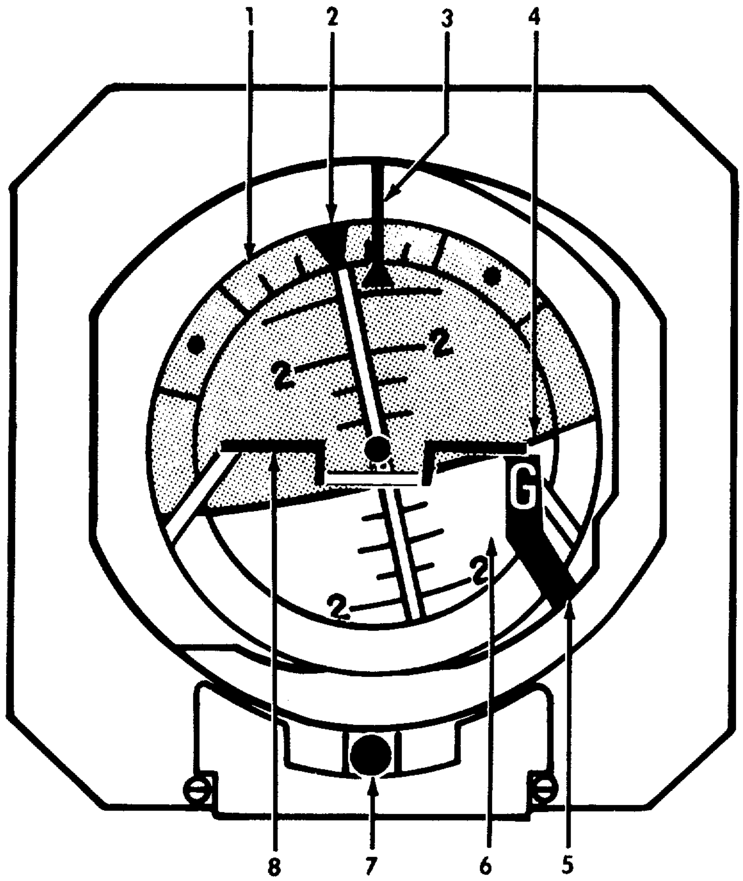
(7) NAV TEST pushbutton. When pressed, the following indications are presented:

1. RMI Single needle indicates 5°.
2. HSI Lateral deviation to the right. Glideslope deviation down.

(8) A indicator (Instrument panel, fig. 2-26). Illuminates when passing over airways marker station.

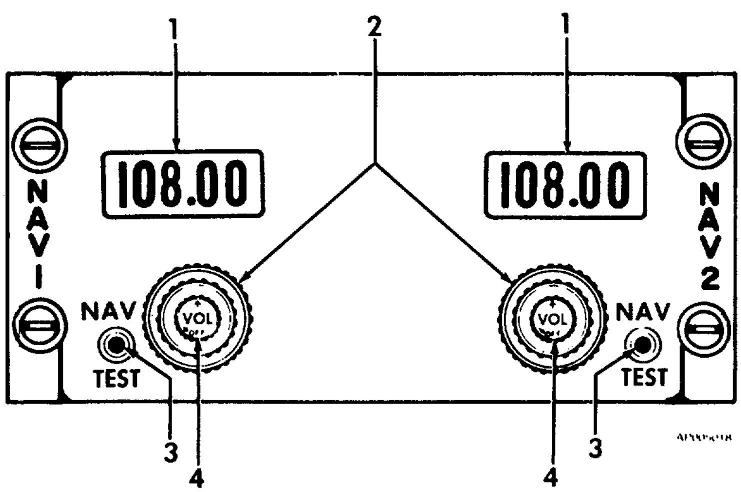
(9) O indicator (Instrument panel, fig. 2-26). Illuminates when passing over outer marker station.

(10) M indicator (Instrument panel, fig. 2-26). Illuminates when passing over middle marker station.



1. Bank angle scale
2. Bank angle index
3. Bank angle pointer
4. Horizon line
5. G flag
6. Sphere
7. Inclinometer
8. Miniature aircraft

Figure 3-11. Copilot's Attitude Indicator



1. Frequency indicator
2. Frequency control
3. NAV TEST pushbutton
4. VOL OFF control

Figure 3-12. VOR Control Panel

(11) MKR BCN HI-LO switch (Pilot's audio control panel, fig. 3-1). Controls sensitivity of marker beacon receiver.

(12) MKR BCN VOL control (Pilot's audio control panel, fig. 3-1). Adjusts volume of received signal.

c. VOR Receiver Operation.

(1) Turn-on procedure:

1. OFF/VOL control - Turn clockwise.

(2) VOR receiver operating procedure.

1. Frequency selectors - Set desired frequency.
2. VOL control - As required.
3. To determine course to station on horizontal situation indicator (fig. 3-7 or 3-8)
   a. VOR No. 1, No. 2 switch - As required.
   b. Course knob - Rotate knob until course deviation bar is centered and TO-FROM arrow indicates TO.
   c. Course readout - Read bearing to station.
4. To determine course to station on RMI (fig. 3-6):
   a. Single or double needle pointer switches - As required (depending upon whether VOR No. 1 or VOR No. 2 is in use).
   b. Single or double needle on RMI - Read course to station.
5. Localizer receiver operating procedure:
   a. Frequency selectors - Set required frequency.
   b. VOR No. 1, No. 2 switch - As required.
   c. Course deviation indicator - Steer aircraft as required to center course deviation bar.
6. Marker beacon operating procedure:
   a. Marker beacon indicator lights (instrument panel, fig. 2-26) - Observe for beacon indication.
   b. Marker beacon HI LO sensitivity switch (Pilot's audio control panel, fig. 3-1) - As required.
   c. Marker beacon VOL control (Pilot's audio control panel, fig. 3-1) - As required.
7. Glideslope operating procedure:
   a. Frequency selectors - Set desired localizer frequency.
   b. VOR No. 1, No. 2 switch (instrument panel, fig. 2-26) - As required.
   c. Glideslope pointer (horizontal situation indicator (fig. 3-8) - Steer aircraft as required to center pointer.
8. VHF communications receiver operating procedure:
   a. Frequency selectors - Set desired frequency.
   b. VOL control - As required.
9. Shutdown procedure: VOL/OFF control - Turn counterclockwise.

3-20. ADF RADIO SETS (DF-203).

a. Description. Two ADF radio sets are installed (fig. 3-13). The units are airborne low frequency radio direction finders which receive signals from transmitters in the 190 to 1750 kHz range to provide a visual and aural indication of the aircraft's bearing in relation to the transmitter. The set can also be used for homing and position fixing. The set also has a beat frequency oscillator (BFO) function (used to more accurately tune weak signals). Reception distance of reliable signals depends on the power output of the transmitting station and the atmospheric conditions. Bearing indications are displayed visually on the RMIs and aural signals are applied to the audio control panels. The ADF radio sets are protected by the 1-ampere ADF No. 1 and ADF No. 2 circuit breakers located on the overhead circuit breaker panel (fig. 2-23).

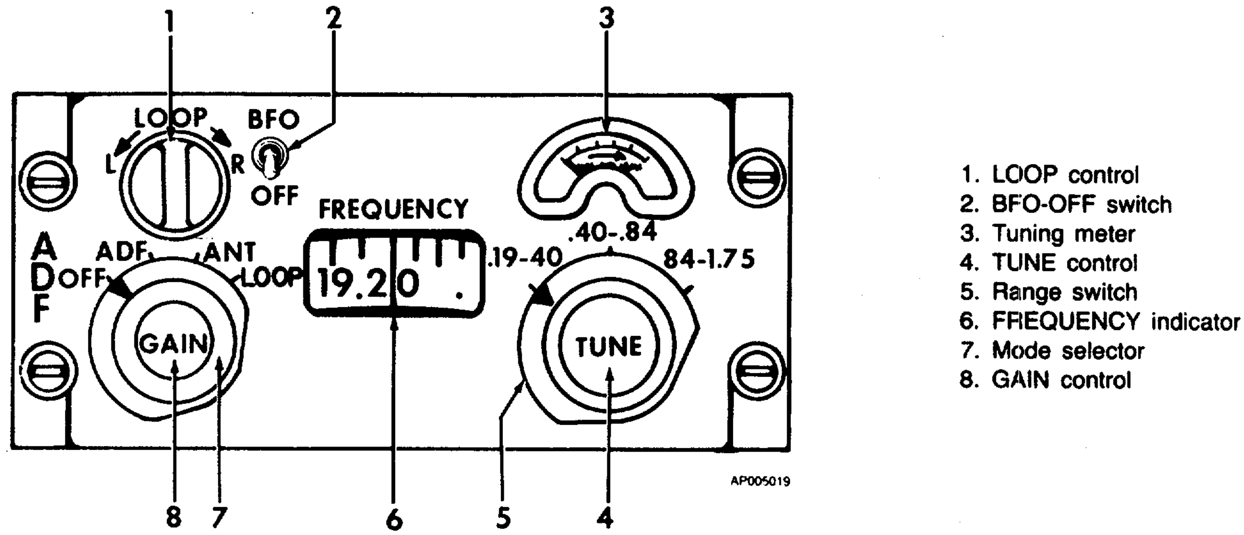


Figure 3-13. ADF Control Panel

NOTE

Keying the HF radio set while operating the ADF No. 2 set will cause a momentarily unreliable ADF signal.

b. Controls and Functions, ADF Control Panel.

(1) LOOP control. Operative only when the function switch is in the LOOP or ADF position. Center position removes rotation signals from the loop antenna and the ADF pointer on the RMI's. First position L (left) or R (right) of center applies slow speed rotation signals to loop antenna and ADF pointer on RMI's for 360-degree rotation left or right. Second position L (left) or R (right) of center applies fastspeed rotation signals to loop antenna and ADF pointer on RMI's for 360-degree rotation left or right.

(2) BFO-OFF switch. Turns BFO on or off.

(3) Turning meter. Indicates relative strength of received signals.

(4) TUNE control. Tunes receiver.

(5) Range switch. Selects operating frequency band.

(6) FREQUENCY indicator. Indicates the operating frequency.

(7) Mode selector. Determines operating mode.

(a) OFF. Turns set off

(b) ADF. Allows homing or automatic direction finding operation.

(c) ANT. Allows reception using sense antenna.

(d) LOOP. Allows aural-null homing and manual direction finding operations.

(8) GAIN control. Adjusts volume of received signals.

(9) AUDIO ADF switch (audio control panel, fig. 3-1 or 3-2). Applies ADF audio to respective headsets.

(10) FILTER V-OFF switch (audio control panel, fig. 3-1 or 3-2). Selects whether voice filter will be used with ADF audio.

(11) FILTER R-OFF switch (audio control panel, fig. 3-1 or 3-2). Selects whether range filter will be used with ADF audio.

(12) CABIN ADF-I, OFF, ADF-2 switch (pilot's audio control panel fig. 3-1). Selects desired ADF audio for use with cabin speakers.

c. ADF Radio Set Operation.

(1) To operate set as automatic direction finder:

1. Mode selector - ADF.
2. BFO-OFF switch - BFO.
3. Range switch - Select.
4. TUNE control - Rotate for maximum reading on tuning meter and zero BFO beat.
5. GAIN control - As required.
6. BFO-OFF switch - OFF.
7. Single or double needle switches (RMI, fig. 3-5) - As required.
8. Single or double needle on RMI - Read course to station.

(2) To operate set for sense antenna direction finding:

1. Mode selector - ANT.
2. Range switch - Select.
3. TUNE control - Rotate for maximum reading on tuning meter.
4. GAIN control - As required.

(3) To operate set for aural-null direction finding:

1. Mode selector - ANT.
2. BFO-OFF switch - BFO.
3. Range switch - Select.
4. TUNE control - Tune desired station.
5. GAIN control - Adjust for minimum audio output.
6. Single or double needle switches (RMI, fig. 3-6) - As required.
7. BFO-OFF switch - OFF.
8. Mode selector - LOOP.
9. LOOP switch - L or R. Turn left or right until a null is reached (minimum sound in headsets).
10. Single or double needle on RMI (fig. 3-6) - Read course to station.

NOTE

The true null and direction to the radio station may be indicated by either end of the single needle. This ambiguity must be solved to determine proper direction to the station.

(4) Shutdown procedure:

1. Mode selector - OFF.

3-21. DISTANCE MEASURING EQUIPMENT SYSTEM (DME-40).

a. Description. The DME system (fig. 3-14 and 3-15) measures the slant range (line-of-sight) distance from the aircraft to a ground station and displays a continuous distance readout in nautical miles. The system also displays aircraft ground speed in knots or time-to-station in minutes. The ground speed and time-to-station are accurate only if the aircraft is flying directly toward the ground station at a sufficient distance that the slant range and ground range are nearly equal. The DME system is protected by the 2-ampere circuit breaker on the overhead circuit breaker panel (fig. 2-23).

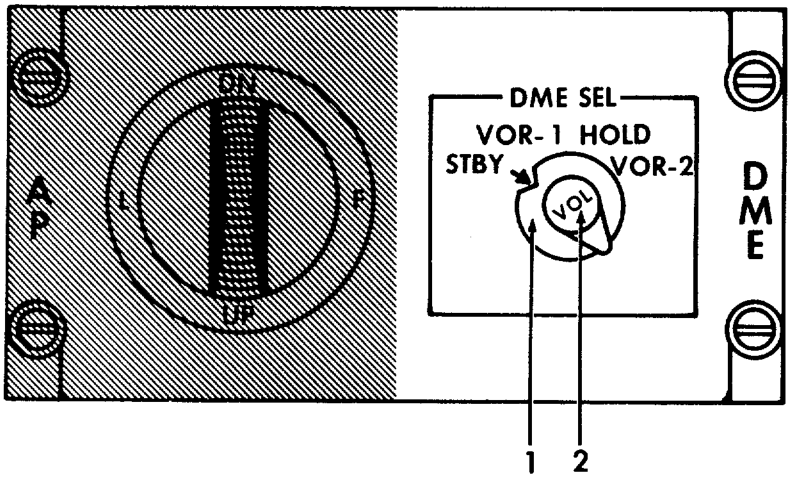
b. Controls and Functions, DME Control Panel.

(1) DME SEL switch. Controls operation of the system.

(a) STBY. Places system in standby.
(b) VOR-1. Allows channel selection using frequency controls for VOR-1.
(c) HOLD. System will remain tuned to previous channel if the VOR is tuned to a new frequency.
(d) VOR-2. Allows channel selection using frequency controls for VOR-2.
(e) VOL control. Controls volume.

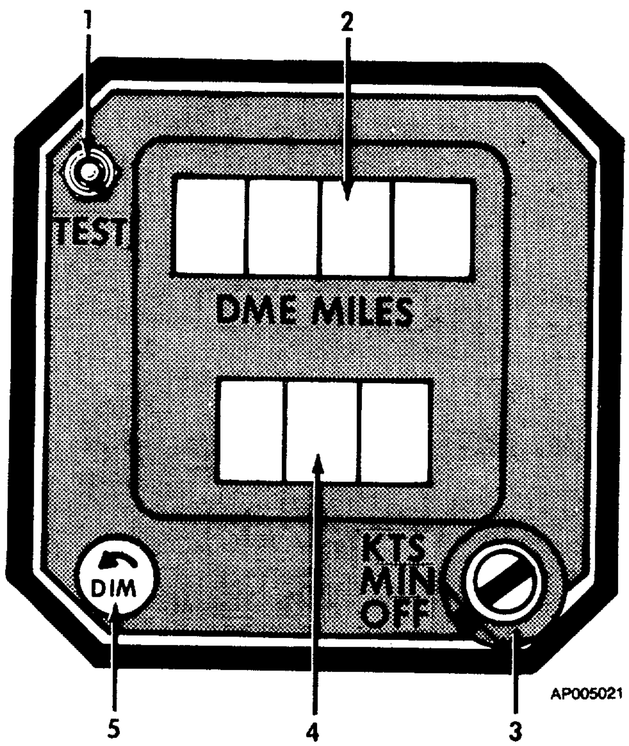
c. Controls/Indicators and Functions, DME Indicator.

(1) TEST pushbutton. Initiates self-test of DME system. When pressed, upper display indicates 0.0 or 0.1 and lower display indicates dashes if control switch is in MIN position or 888 when in the KTS position.



1. DME SEL switch
2. VOL control

Figure 3-14. DME Control Panel



1. TEST pushbutton
2. DME MILES indicator
3. Control switch
4. Knots-minutes display
5. DIM control

Figure 3-15. DME Indicator

(2) *DME MILES indicator.* Digital display of slant-range distance from aircraft to ground station in nautical miles.
(3) *Knots/minutes display*. Digital display of time-to-station in minutes or ground speed of aircraft in knots. This information is accurate only if the aircraft is flying directly toward the ground station.
(4) *Control switch*. Controls operation of the DME system.

(a) *OFF*. Turns system off.
(b) *MIN*. Selects time-to-station in minutes for display on bottom readout.
(c) *KTS*. Selects aircraft ground speed in knots for display on bottom readout.

(5) *DIM control*. Controls intensity of digital readouts.

d. DME Normal Operation.

(1) To determine slant range distance to station:

1. VOR control panel - Tune required station.
2. DME SEL switch - VOR-1 or VOR-2.
3. DME MILES indicator - Read distance in nautical miles.

(2) To determine ground speed and time-to-station:

1. VOR control panel - Tune required station.
2. DME SEL switch - VOR-1 or VOR-2.
3. DME indicator control switch - KTS.
4. DME knots/minutes display - Read aircraft's ground speed in knots and time-to-station in minutes.

3-22. AUTOPILOT SYSTEM (AP-106).

a. Description. The autopilot system is an integral part of the flight control system. The autopilot and flight director have a common computer system. When the autopilot is engaged, the flight control system controls the aircraft and the pilot monitors the flight path by observing the information displayed on the pilot's horizon reference indicator and the pilot's horizontal situation indicator (flight director system indicators). The autopilot system can, (1) maintain a preselected attitude, (2) maintain a barometric altitude, (3) maintain an indicated airspeed, (4) capture and maintain a desired heading, (5) capture and maintain a preselected radio course, and (6) capture and maintain an ILS approach to published minimums. The autopilot/flight director commands are selected by the autopilot mode selector panel (fig. 3-16) located on the pedestal extension. Roll rate and pitch commands can be given to the system through the autopilot pitch-turn panel (fig. 3-17), located on the pedestal extension. The operating status of the autopilot is indicated on the autopilot/ flight director annunciator (fig. 3-18) located on the instrument panel directly above the pilot's horizon reference indicator. Two autopilot control switches are also provided on each control wheel. One is placarded PITCH SYNC & CWS (pitch synchronize and control wheel steering) and the other is placarded DISC TRIM/AP YD (disconnect trim/autopilot yaw damp). The autopilot system is protected by the 10ampere AP PWR circuit breaker located on the overhead circuit breaker panel (fig. 2-23).

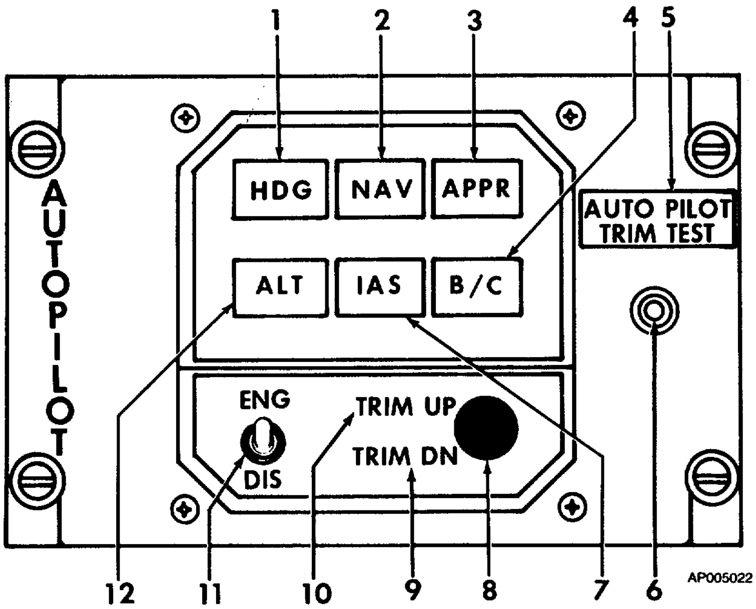
b. Autopilot Mode Selector (fig. 3-16). The autopilot/flight director commands are selected by the autopilot mode selector. Selection is accomplished by pressing the face of the appropriate push-on/push-off switch. The lateral modes are HDG, NAV, APPR and B/C. When not in a lateral mode the flight director command bars are biased out of view. The vertical modes are ALT, IAS, and pitch (these are all hold modes). If a vertical mode is not selected, the pitch hold mode is automatically operational. Selection of a mode causes the legend of that pushbutton switch to illuminate. The self-test switch on the lower right of the autopilot control panel acts as a lamp test when depressed. For operation at night, overall illumination of the autopilot mode selector and switches is adjusted by the CONSOLE light control.

c. Controls and Functions, Mode Selector.

(1) *HDG switch*. Engages heading mode. Commands aircraft to acquire the heading indicated by heading marker on pilot's HSI.
(2) *NAV switch*. Engages navigation mode. VOR-1 or VOR-2 selected, commands intercept and track of VOR radial selected on pilot's HSI. VLF selected, commands track of steering signals from the VLF system. Intercept of approximately 45° and tracking will be computed by the VLF system.

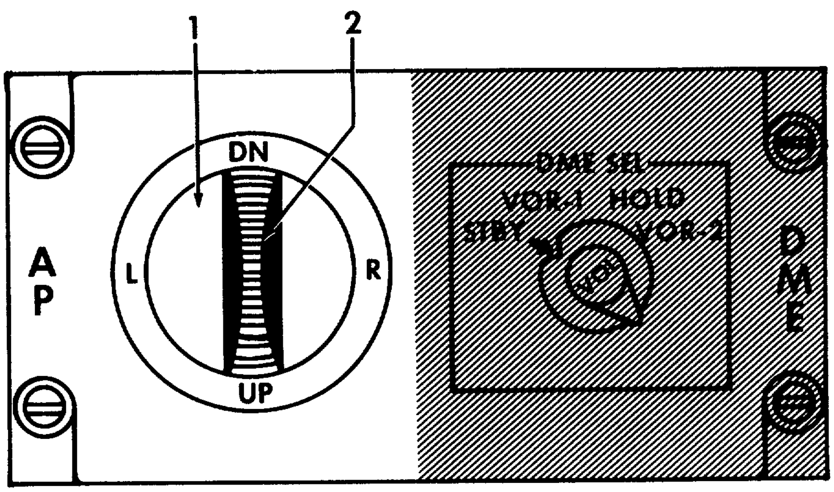
NOTE

APPR cannot be selected with VLF selected.



1. HDG switch-indicator
2. NAV switch-indicator
3. APPR switch-indicator
4. B/C switch-indicator
5. AUTO PILOT TRIM TEST indicator
6. AUTO PILOT TRIM TEST switch
7. IAS switch-indicator
8. Self-test switch
9. TRIM DN indicator
10. TRIM UP indicator
11. ENG-DIS switch
12. ALT switch-indicator

Figure 3-16. Autopilot Mode Selector Panel



1. Turn control knob
2. Pitch control thumbwheel

Figure 3-17. Autopilot Pitch-Turn Panel

(3) APPR switch. Engages approach mode. Commands aircraft to intercept and track ILS inbound course.

(4) ALT switch. Engages altitude hold mode. Commands aircraft to maintain pressure altitude.

(5) IAS switch. Engages airspeed hold mode. Commands aircraft to maintain airspeed.

(6) B/C switch. Engages backcourse mode. Commands aircraft to intercept back course ILS.

(7) ENG-DIS switch. Controls coupling of the automatic pilot.

(a) ENG. Engages autopilot and illuminates engaged indicator.

(b) DIS. Disengages autopilot and illuminates disengaged indicator.

(8) TRIM UP indicator. Illuminates when autopilot is driving trim servo in up direction or, (on some aircraft) if autopilot is disengaged, when manual up trim is required.

(9) TRIM DN indicator. Illuminates when autopilot is driving trim servo in down direction or, (on some aircraft) if autopilot is disengaged, when manual down trim is required.

(10) Self-test switch. Tests display and selector indicator circuits when depressed.

(11) AUTOPILOT TRIM TEST switch. Used to simulate a no-trim condition to test trim monitor system.

d. Controls and Functions, Autopilot PitchTurn Panel.

(1) Turn control knob. Supplies roll rate commands to autopilot. Spring loaded to center detent.

(2) Pitch control thumbwheel. Supplies pitch rate commands to autopilot. Spring loaded to center detent.

e. Controls and Functions, Control Wheel Switch.

(1) DISC-TRIM/AP YD pushbutton. When pressed to first detent, autopilot system and yaw damp are disconnected. When pressed to second detent, electric trim is disconnected.

(2) PITCH SYNC & CWS pushbutton. This button on the control wheels may be used instead of the pitch/turn control to establish the aircraft in a desired attitude. Depressing the button causes the autopilot servos to disengage from the control surfaces, enabling the pilot to manually fly the aircraft to the desired attitude until button is released.

f. Controls and Functions, GO-AROUND Switch.

(1) GO AROUND switch(located on the outboard side of left power lever, fig. 2-6). When pressed, activates the go-around mode of flight director. GA light illuminates on autopilot/flight director annunciator panel (fig. 3-18), the autopilot is disengaged and the pilot's horizon reference indicator gives command for wings level and 70 nose up climb attitude.

g. Autopilot/Flight Director Annunciator Panel (fig. 3-18). The autopilot/flight director 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 lenses and illuminate when the respective conditions are indicated. Dimming of the annunciator panel lights is provided by a switch adjacent to the panel placarded DIM - BRT.

h. Controls/Indicators and Functions, Annunciator Panel.

(1) NAV ARM indicator. Illuminates when computer is armed to accept navigation signals.

(2) NAV CAP indicator. VOR-l or VOR-2 selected, illuminates when selected radial is captured. VLF selected, illuminates when VLF is coupled to the flight director.

(3) GS ARM indicator. Illuminates when approach mode is selected prior to glideslope capture. Extinguishes after glideslope capture.

(4) GS CAP indicator. Illuminates when glideslope is captured.

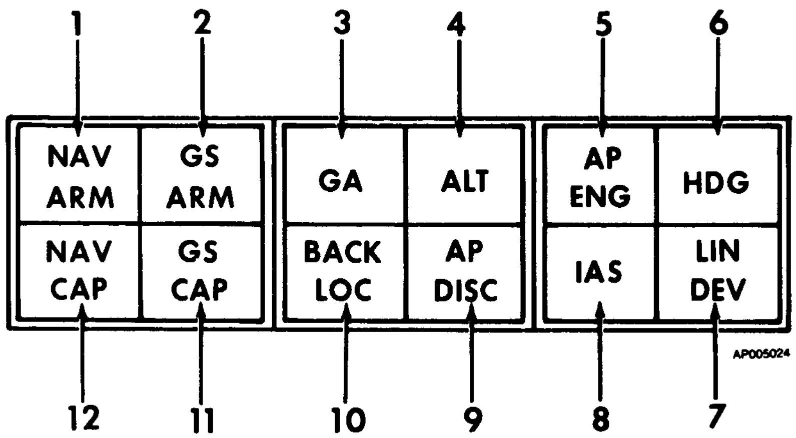
(5) GA indicator. Illuminates when go-around mode is selected.

(6) BACK LOC indicator. Illuminates when back-course mode is selected.

(7) ALT Indicator. Illuminates when altitude hold mode is selected.

(8) AP DISC indicator. Illuminates when autopilot is disengaged.

(9) AP ENG indicator. Illuminates when autopilot is engaged.



1. NAV ARM indicator
2. GS ARM indicator
3. GA indicator
4. ALT indicator
5. AP ENG indicator
6. HDG indicator
7. LIN DEV indicator
8. IAS indicator
9. AP DISC indicator
10. BACK LOC indicator
11. GS CAP indicator
12. NAV CAP indicator

Figure 3-18. Autopilot/Flight Director Annunciator Panel

(10) IAS indicator. Illuminates when airspeed hold mode is selected.

(11) HDG indicator. Illuminates when heading mode is selected.

(12) LIN DEV indicator. Illuminates when distance and bearing data is received from VORTAC and DME is valid.

(13) DIM BRT control. Adjusts intensity of illumination of the flight director annunciator.

i. Autopilot Modes of Operation:

(1) Attitude mode. The autopilot is in the attitude mode when the ENG-DIS switch (autopilot mode selector panel, fig. 3-16) is in the ENG position and no mode selector switches (HDG, NAV, etc., autopilot mode selector panel, fig. 3-16) have been selected. The autopilot will fly the aircraft and accept pitch and roll rate commands from the autopilot pitchturn panel (fig. 3-17).

(2) Guidance mode. When the autopilot is in the attitude mode and a mode selector switch (HDG, NAV, etc., autopilot mode selector panel, fig. 3-16) is pressed, the autopilot is coupled to the flight director and accepts steering commands from the computer. depending on which mode selector switch on the autopilot mode selector control panel is pressed, autopilot operation can be described by the following subguidance modes:

(a) Heading mode. When the HDG mode is selected on the autopilot mode selector panel with the autopilot engaged, the autopilot will fly the aircraft to, and then maintain, the heading under the heading marker on the pilot's horizontal situation indicator.

(b) Navigation mode. When the NAV mode is selected on the autopilot mode selector panel, the system initially switches to the NAV ARM heading-hold submode, as shown by illumination of the NAV ARM and HDG indicators on the autopilot/ flight director annunciator panel. The autopilot will then command the aircraft to follow the heading under the heading marker on the pilot's horizontal situation indicator (with the heading marker set to produce the desired VOR or localizer intercept angle). The flight computer will compute a capture point based on deviation from desired radio beam, the rate at which the aircraft is approaching this beam, and the course intercept angle. When beam capture occurs, the HDG and NAV ARM indicator lamps on the autopilot/flight director annunciator panel will extinguish and the NAV CAP lamp will illuminate. The autopilot will then track the selected radio course with automatic crosswind correction.

(c) Navigation mode (with linear deviation). The system features linearized VOR deviation

when a VORTAC is being used. A LIN DEV light on the autopilot annunciator will illuminate to indicate operation. The lateral deviation bar indicates the distance in nautical miles from the selected radial regardless of how close the aircraft is to the ground station. Linear deviation measures the aircraft's displacement in nautical miles from the selected course rather than degrees of displacement associated with normal VOR navigation. Linear deviation permits flying parallel to any selected course by maintaining the appropriate needle deflection on the horizontal situation indicator. When the LIN DEV light is on, the flight director system is obtaining distance data from the DME and bearing from the VOR-1 receiver. Linear deviation operates only when DME is on NAV1 receiver and is displayed on pilot's indicator only. For enroute operation in the NAV mode, full scale deflection of the lateral deviation bar equals 10 miles from the selected radial. For VOR approach operation, the APPR mode should be selected. This provides linear deviation with the sensitivity limits of the computer increased so that full scale deflection of the lateral deviation bar equals 1 mile from the selected radial. APPR mode should be selected when within 10 miles of the final approach fix. Capture is the same as in the NAV mode.

NOTE

Failure to select APPR for VORTAC or VOR/DME instrument approaches when using linear deviation, may result in not meeting obstruction clearance criteria.

(d) Back-course mode. When BACK LOC mode is selected on the autopilot mode selector panel, localizer capture is the same as in a front-course approach in NAV or APPR mode. Glideslope is inhibited during a back-course approach. The HSI must be set to the front-course heading so that lateral deviation will be directional.

(e) Approach mode. When APPR mode is selected on the autopilot mode selector panel, localizer capture is the same as in the NAV mode but glideslope arm and capture functions are also provided. When the APPR mode is selected the NAV ARM annunciator lamp will illuminate, indicating that the system is armed for localizer capture. As the aircraft approaches the localizer beam, the NAV CAP annunciator lamp will illuminate. Once the localizer is being tracked, the GS ARM annunciator lamp will illuminate. Glideslope capture is dependent on localizer capture and must occur after localizer capture. The localizer is always captured from a selected heading, but the glideslope may be captured with autopilot operating in any vertical mode (pitch hold, altitude hold, or indicated airspeed hold), and from above (not recommended) or below the glideslope. At the point of glideslope intercept, the GS CAP annunciator lamp will illuminate and all preselected vertical modes will be cleared.

NOTE

During coupled approaches if the VOR/localizer signal is lost, or frequency changes, the flight director command bars will remain in view displaying unreliable indications.

(f) Go-around mode. Pressing the GO AROUND button on the outboard side of the left power lever selects the go-around mode. Go-around mode may be selected from any lateral mode (HDG, NAV, APPR, or BACK LOC). When go-around mode is selected (1) the autopilot is disengaged, (2) the GA annunciator lamp will illuminate, and (3) a command presentation for wings level and 70 nose up pitch attitude will appear on the pilot's horizon reference indicator.

NOTE

The heading marker may be preset to the go around heading after the localizer is captured. After go-around airspeed and power settings are established, select the HDG mode to clear the go-around mode. Pitch attitude will remain at that used for go around until changed with the PITCH SYNC & CWS button or the selection of a vertical mode.

(g) Pitch hold mode. The pitch hold mode is selected by (1) selecting none of the vertical mode selector switches, or (2) actuating the pitch synchronize and control wheel steering switch (PITCH SYNC & CWS), located on each control wheel.

(h) Control wheel steering mode. Pressing one of the PITCH SYNC & CWS switches located on each control wheel disconnects the autopilot servos from the control surfaces, allows the pilot to fly the aircraft to a new pitch attitude, and synchronizes the vertical command bar on the pilot's horizon reference indicator to aircraft attitude. The ALT or IAS mode will disengage (if selected) when the PITCH SYNC & CWS button is depressed. When the autopilot is coupled to the HDG, NAV, APPR, or BA(CK I.OC modes, releasing the PITCH SYNC & CWS switch will cause the autopilot to couple to the previously selected mode.

(i) *Altitude hold mode*. Pressing the ALT selector switch on the autopilot mode selector panel when desired altitude has been reached (with autopilot engaged) will (1) cause the autopilot to fly the aircraft to maintain the barometric altitude at which the aircraft was flying when ALT switch was pressed, (2) illuminate the ALT annunciator lamp on the autopilot/flight director annunciator panel, and (3) display the altitude hold commands on the vertical command bar of the pilot's horizon reference indicator with the flight director engaged.

(j) *Indicated airspeed hold mode*. Pressing the IAS selector switch on the autopilot mode selector panel when desired airspeed has been reached (with autopilot engaged) will (1) cause the autopilot to fly the aircraft to maintain the indicated airspeed at which the aircraft was flying when IAS switch was pressed, (2) illuminate the IAS annunciator lamp on autopilot/flight director annunciator panel, and (3) display the IAS hold commands on the vertical command bar of the pilot's horizon reference indicator.

j. Takeoff and Climbout.

(1) Before takeoff.

1. Heading marker (pilot's horizontal situation indicator) Set to runway heading.
2. HDG selector switch (Autopilot mode selector panel) Press. Do not engage autopilot.

(2) Takeoff. Pressing the PITCH SYNC & CWS switch on control wheel will provide pitch sync and the crosspointers on the pilot's horizon reference indicator will command flight to the pitch attitude that existed at the time the PITCH SYNC & CWS switch was pressed.

(3) Climbout.

1. Climb profile - Establish.
2. ENG-DIS switch (autopilot mode selector panel) ENG (when above 200 feet above ground level).
3. IAS selector switch (autopilot mode selector switch) - Press (if desired).
4. HDG knob (pilot's course indicator selector) Move heading marker as required to make heading changes.

(4) Cruise altitude.

1. Vertical speed Reduce to approximately 500 feet per minute just before reaching cruise altitude.
2. ALT button (autopilot mode selector panel) Press when cruise altitude is reached.

k. VOR Operation.

(1) To establish aircraft on a desired VOR radial, perform the following:

1. VOR receiver Tune appropriate frequency.
2. COURSE knob (pilot's horizontal situation indicator) Set desired course to or from station in COURSE window.
3. HDG knob (pilot's horizontal situation indicator) Set desired beam intercept angle under heading marker. The intercept angle with respect to the radio beam may be any angle of 900 or less.
4. NAV selector switch (autopilot mode selector panel) Press. Observe that NAV ARM annunciator lamp illuminates.
5. NAV CAP annunciator lamp Monitor. At point of capture, NAV CAP annunciator lamp will illuminate.

(2) To change course over a VOR station while operating in NAV mode if course change is less than 30 .

1. COURSE knob (pilot's horizontal situation indicator) Set desired heading in COURSE window.

(3) To change course over a VOR station while operatingin NAV mode if course change is greater than 30°:

1. HDG knob (autopilot mode selector panel) Set desired intercept heading under heading marker.
2. HDG selector switch (autopilot mode selector panel) Press. Observe that HDG annunciator lamp illuminates (autopilot/flight director annunciator panel).
3. COURSE knob (pilot's horizontal situation indicator) Set new course in COURSE window.
4. NAV selector switch (Autopilot mode selector panel) Press. Observe that NAV ARM[annunciator lamp illuminates.

5. NAV CAP annunciator lamp Monitor. Illumination indicates capture of new radial.

l. Front-Course Approach.

1. VOR receiver - Tune appropriate frequency.
2. COURSE knob (pilot's horizontal situation indicator) Set inbound runway heading in COURSE window.
3. HDG knob (pilot's horizontal situation indicator) - Set heading marker to desired intercept angle.
4. HDG selector switch (autopilot mode selector panel) Press. Observe that HDG annunciator lamp illuminates (autopilot/flight director annunciator panel).
5. Vertical mode - Select IAS, ALT, or pitch.
6. APPR selector switch (autopilot mode selector panel) Press. Observe that NAV ARM annunciator lamp illuminates (autopilot/flight director annunciator panel).
7. NAV CAP annunciator lamp will illuminate when system has captured localizer course.
8. GS ARM annunciator lamp will illuminate to verify that system is armed for glideslope capture.
9. GS CAP annunciator lamp will illuminate and all vertical modes will be cleared, indicating autopilot is tracking glideslope.

m. Go-Around. If visual runway contact is not made at decision height, execute a missed approach by performing the following:

1. GO AROUND switch (outboard side of left power lever) Press while increasing power to climb power setting and observe the following:
   a. GA annunciator lamp on autopilot/flight director annunciator panel illuminates.
   b. Autopilot is disengaged.
   c. Command presentation is given on pilot's horizon reference indicator for wings level and 70 nose up climb attitude.

NOTE

Go-around mode can be selected anytime after selecting APPR mode.

2. HDG selector switch (autopilot mode selector panel) Press, after aircraft cleanup, go-around power settings, and airspeed are established.

n. Back-Course Approach.

1. VOR receiver Tune appropriate frequency.
2. COURSE knob (pilot's horizontal situation indicator) Set front course inbound runway heading in COURSE window.
3. HDG knob (pilot's horizontal situation indicator) Set heading marker to desired intercept angle.
4. HDG selector switch (autopilot mode selector switch) Press. Observe that HDG lamp illuminates (autopilot/flight director annunciator panel).
5. B/C selector switch (autopilot mode selector panel) Press. Observe that BACK LOC and NAV ARM annunciator lamps illuminate (autopilot/flight director annunciator panel), indicating that system is armed for back localizer capture. Any previously selected vertical mode will cancel.
6. NAV CAP annunciator lamp will illuminate when system has captured back localizer course.
7. PITCH control (autopilot pitch-turn panel) Use to establish and maintain desired rate of descent.

o. Yaw Damper Operation.

(1) The rudder channel of the autopilot may be selected separately for yaw damping by depressing the YAW DAMP switch on the pedestal. The switch face will illuminate when the yaw damper is engaged.

(2) To disengage the yaw damper, press the disconnect button on the pilot's or copilot's control wheel to the first detent or press the YAW DAMP switch on the pedestal.

(3) Refer to Emergency Procedures for other means of disconnecting the yaw damper.

p. Disconnecting Autopilot. The autopilot may be disconnected by any of the following actions:

(1) Pressing DISC TRIM/AP YD switch located on the outboard horn of either control wheel to the first detent.

(2) Placing the ENG-DIS switch on the autopilot mode selector panel to the DIS position.

3-23. VLF NAVIGATION SYSTEM.

a. Description. The CMA-734 (-003) is a fully automatic, computerized navigation system designed for point-to-point area navigation. The system utilizes the OMEGA ground transmitter navigation network and the U.S. Navy very low frequency (VLF) communication stations to provide continuous position and navigational information on a world-wide basis. In the unlikely event that adequate signals are not available from at least three stations, OMEGA and/or VLF, the system automatically goes into a dead reckoning (DR) mode of operation. As soon as adequate signals are again received, the system automatically reverts to its normal mode of operation.

(1) 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 Horizontal Situation Indicator (HSI) rather than in degrees as with conventional VOR navigation. This feature provides for a constant course width of approximately + 7 1/2 nautical miles regardless of the distance to the way point.

(2) The CMA-734 (-003) will, after initialization, automatically operate in the relative (normal) mode of navigation. Relative navigation requires an accurate initial position input and provides the best overall accuracy for navigation. However, position accuracy will slowly degrade with time unless manually updated.

(3) An absolute OMEGA mode of navigation utilizing the principles of hyperbolic navigation with lane identification can be manually selected. This mode should be used if the aircraft position is not precisely known at initialization, if ground facilities are not available for an enroute position update, or during periods of extended overwater flight. The system is protected by a 5-ampere VLF circuit breaker on the overhead circuit breaker panel.

b. Control/Display Unit. The CMA-734 (-003) is programmed and operated from a control/display unit (CDU) mounted on the pedestal extension (fig. 3-19). The control section is used to enter data into the computer and select the computed information to be displayed. The display section, along with the pilot's horizontal situation indicator provides navigation information to the pilot. The display section also shows the data to be entered into the computer.

c. Controls/Indicator and Functions, Control/ Display Unit.

(1) ON/OFF switch. Applies power to VLF system. (Detented in both positions and must be pulled out to unlock before changing from either position.)

(2) Display mode selector. Ten position switch selects the desired output or input data on the left and right numerical displays.

(3) DIM control. Adjusts illumination intensity of displays.

(4) Waypoint number display. Shows which waypoint coordinates are being displayed on the left and right displays.

(5) FR/TO waypoint display. Displays FROM and TO waypoint numbers of leg being navigated.

(6) Annunciators (L, R, N, S, and L, R, E, W). Displays Left or Right, North or South, East or West, or are blanked, dependent upon the position of the Display Mode Selector Switch.

(7) Left/right numerical displays. Displays the data selected by the Display Mode Selector Switch.

(8) WPT DEF switch. Allows entry of waypoint coordinates.

(9) Status indicators. When illuminated, indicates (respectively) the following:

(a) Failure Warning indicator. System failure.

(b) SYS. System failure (Failure Warning indicator may also illuminate; all others blank).

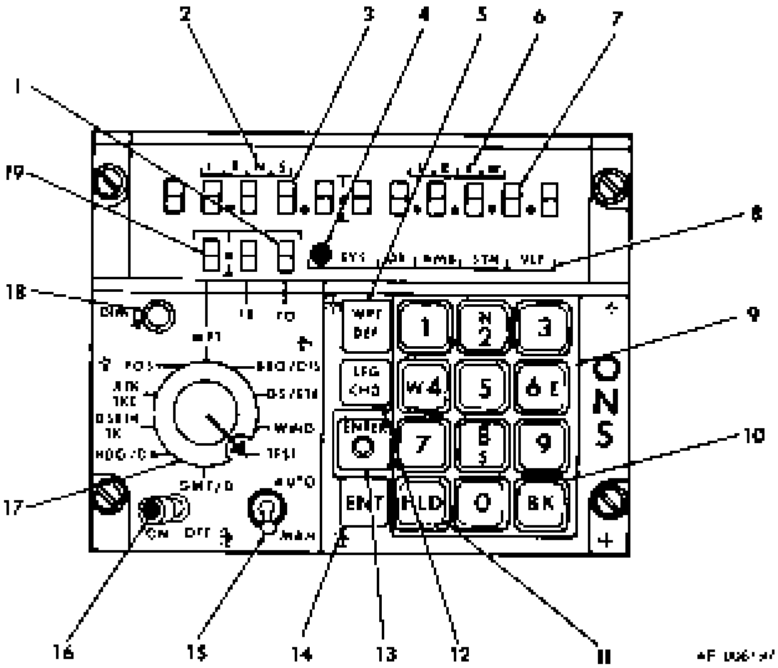
(c) DR. System has entered Dead Reckoning mode.

(d) AMB. Position ambiguity or memory check sum error.

(e) SYN. VLF synchronization status (SYN).

(f) VLF. Indicates system ready to navigate in relative mode.

(10) Data Keyboard. Provides 12 keys, of which 10 (0 through 9) are used for entry of numerical



1. FR-TO waypoint display
2. Left annunciator
3. Left display
4. Failure warning indicator
5. WPT DEF switch
6. Right annunciator
7. Right display
8. Status indicators
9. Data keyboard
10. BK switch
11. HLD switch
12. LEG CHG switch
13. ENTER indicator
14. ENT switch
15. AUTO-MAN switch
16. ON-OFF switch
17. Display mode selector
18. DIM control
19. Waypoint number display

Figure 3-19. VLF Control Display Unit (CDU)

data into the computer. N (north), E (east), S (south), W (west) keys enter the sign of latitude/longitude information.

(11) BK switch. Allows data entry to be backspaced one digit at a time if an error is made during entry. Also frees information frozen by Hold Key operation.

(12) HLD switch. Allows displayed present position information to be frozen (immobilized).

(13) LEG CHG switch. Allows manual initialization of leg change.

(14) ENTER indicator. Illumination means system is in Data Entry Mode.

(15) ENT switch. Transfers entered data into the computer.

(16) AUTO-MAN switch. Allows for automatic sequential selection of route legs, or manual selection of route legs.

d. Controls/Indicators and Functions, Instrument Panel.

(1) VLF pushswitch. When depressed, connects VLF receiver to the pilot's HSI indicator and illuminates GREEN to signal in-use status. Depressing again disconnects the VLF from the pilot's HSI.

(2) VLF WPT Annunciator. Illuminates to announce aircraft is two minutes from arrival at waypoint selected on CDU.

e. Limitations. The CMA-734 (-003) may be used as a means of VMC/IMC enroute navigation provided the following limitations are observed:

(1) IMC operations within the conterminous United States and Alaska are limited to the Relative (normal) mode of navigation. Absolute OMEGA (hyperbolic) mode should be used for navigation in areas where ground facilities are not available for a position update or during extended overwater flight (f (12), Manual Lane Resolution).

(2) The system is not to be used for navigation in terminal areas; during departures from, or approaches to, airports or valleys; 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/DME or TACAN equipment must be installed and operating during navigation on approved RNAV routes.

(5) IMC flight is not approved based on VLF/ OMEGA navigation into any area in which such oper-

ation could not be approved based on the installed equipment required by paragraph 3.

(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 IMC operation when not under radar surveillance and control.

(b) At or prior to arrival at each enroute waypoint during operation on 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 alongtrack or cross-track.

(8) Navigation shall not be predicated on the use of this system during extended 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.

f. Normal Procedures (Programming). Switching on the CMA-734 (-003) automatically initializes a synchronization sequence which, under normal signal conditions, takes a maximum of three minutes. Confirmation that the synchronization process has finalized is indicated when the DR and SYN annunciators extinguish and the VLF annunciator illuminates. Synchronization is an independent function which allows the pilot to carry out other programming procedures while the synchronization sequence is in progress. Prior to departure, Greenwich Mean Time (GMT), date, and the present position (latitude and longitude) are entered into the computer. The time of day and date are entered to compensate for diurnal shift while coordinates (latitude and longitude) for up to nine waypoints can be entered while the aircraft is on the ground or after take-off. After the pilot enters the data and initializes the first leg, the system automatically navigates from waypoint to waypoint (CDU switched to AUTO). Manual operation is also provided (CDU switched to MAN), which allows waypoints to be bypassed or sequence changed to allow for flight plan alterations. Magnetic variation for the entire globe is programmed into the memory, and the value appropriate to present position is automatically selected. All angular displays are referenced to magnetic north.

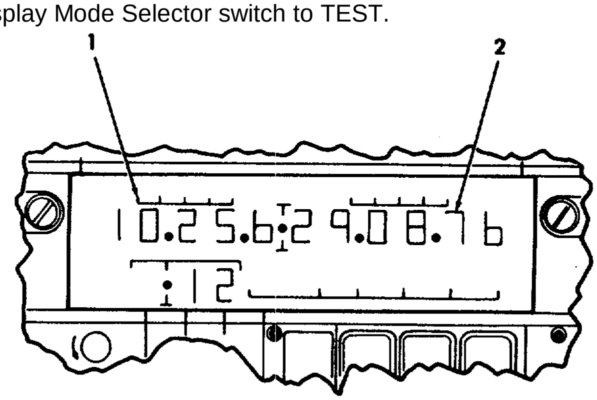
(1) Power On.

1. Turn on aircraft avionics master switch.
2. Pull the ON/OFF switch out to unlock. Set to ON.

NOTE

SYN and DR annunciators illuminate and SYN annunciator extinguishes within approximately three minutes. DR annunciator extinguishes and VLF annunciator illuminates when the system starts tracking three or more VLF/OMEGA stations. E/W and N/S annunciators flash continuously.

3. Set display Mode Selector switch to TEST.



DISPLAYED: TIME 10:25.6 GMT
DATE 29 AUGUST (19)76

1. **Left display - Time to nearest tenth of minute.**
2. **Right display Date in Day/Month/Year order. Must be correct Greenwich Date (year thousands, hundreds assumed).**

Figure 3-20. CDU Display of Greenwich Mean Time and Date (GMT/D)

4. Verify that displays on annunciators are as follows:
   (a) All numerical readouts show 8's.
   (b) All annunciators are illuminated.
   (c) All decimal points are illuminated.
   (d) N, S. E, W annunciators and WPT and TO numerical readouts are flashing.

(2) GMT And DATA Entry.

1. Set Display Mode Selector switch to GMT/D.
2. Insert Greenwich Mean Time (fig. 320) via Data Keyboard to an accuracy of one minute. Display resolution is to 0.1 minutes (i.e. 09:30.5). An entry must be made for the tenth-minute display.
3. Press ENT key once. ENTER indicator remains illuminated.
4. Insert day (one or two digits), month (two digits), and year (two digits), via Data Keyboard (i.e. 29.12.79 or 01.01.80) (fig. 3-20). The date entered must be the current Greenwich Mean Data.
5. Press ENT key once. ENTER indicator extinguishes, indicating the GMT and DATA have been accepted.

NOTE

GMT will not advance until both GMT and date have been inserted and the ENTER indicator extinguishes. In flight update of GMT will cause the system to revert to DR mode momentarily. Recheck position after the DR annunciator extinguishes.

(3) Present Position Entry.

1. Set Display Mode Selector switch to POS.
2. Insert present position latitude (fig. 3-21): N (north) or S (south) must be inserted prior to latitude digits.
3. Press ENT key once. ENTER indicator remains illuminated.
4. Insert present position longitude (fig. 3-21): E (east) or W (west) must be entered prior to longitude digits.
5. Press ENT key once. ENTER indicator extinguishes, indicating present position coordinates have been accepted.

NOTE

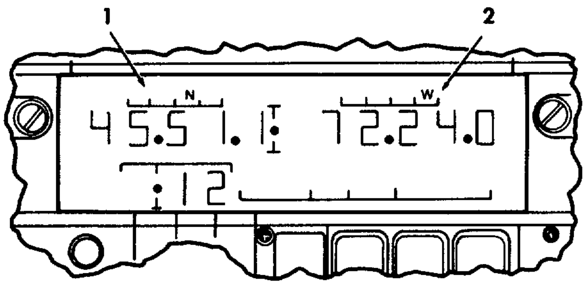
If ENTER indicator flashes, unreasonable data has been inserted. Turn Display Mode Selector switch to WPT, then back to POS. Repeat steps 2 through 5.

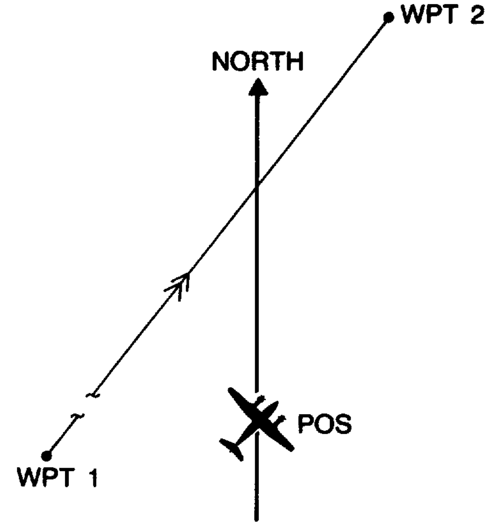
(4) Waypoint Entry. Coordinates (latitude/ longitude) for up to nine waypoints can be entered while the aircraft is on the ground or in flight (fig. 3-22). Once entered, waypoints remain in the computer until new waypoints are entered. Coordinates of the first enroute waypoint are normally entered as waypoint 1, with subsequent waypoints being entered sequentially. Waypoints may be changed at any time by entering new coordinate data in any of the none waypoint positions.

1. Set Display Mode Selector switch to WPT.
2. Press 1 on Data Keyboard. Number I appears in waypoint number display.
3. Press WPT DEF key. ENTER indicator illuminates.
4. Enter latitude of initial enroute waypoint
5. Press ENT key once.
6. Enter longitude of initial enroute waypoint.
7. Press ENT key once. ENTER indicator extinguishes.
8. Repeat steps 2. through 7., selecting next waypoint number in step 2. for up to nine waypoints.
9. When all waypoints have been entered, display each waypoint in sequence by pressing the appropriate waypoint number on the Data Keyboard. Verify each waypoint latitude and longitude are correct.

(5) Runway Line-up (Departure Point).

1. Verify that SYS, DR, and SYN annunciators are extinguished, and that VLF annunciator is illuminated.
2. Verify that aircraft compass is in the slaved mode.
3. Verify that latitude and longitude displayed in POS are correct. If incorrect, re-enter.





DISPLAYED: LATITUDE 45:51.1 DEGREES NORTH
LONGITUDE 72:24.0 DEGREES WEST

NOTE:

DISPLAYED PRESENT POSITION COORDINATES CAN BE FROZEN IN FLIGHT TO FACILITATE A POSITION CHECK OR UPDATE BY PRESSING THE HLD SWITCH. IN THE HOLD MODE, ANNUNCIATORS (N OR S, E OR W) FLASH CONTINUOUSLY TO REMIND OPERATOR THAT THE DISPLAYED POSITION IS NO LONGER THE PRESENT POSITION.

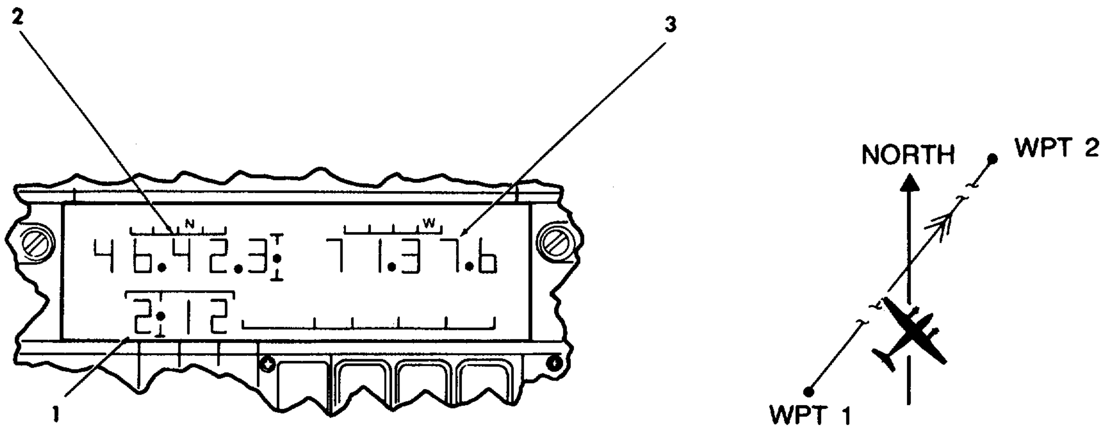
NOTE:

WHILE IN HOLD MODE, VLF CONTINUES TO COMPUTE DISTANCE TRAVELED; THEREFORE WHEN THE SYSTIEM IS RETURNED TO THE NORMAL MODE OF OPERATION, THE CORRECT AND UPDATED PRESENT POSITION IS DISPLAYED.

TO RETURN VLF TO THE NORMAL MODE OF OPERATION, EITHER UPDATE THE PRESENT POSITION, PRESS THE BK SWITCH, OR PRESS THE ENT SWITCH TWICE WITH THE DISPLAY MODE SELECTOR SWITCH IN POS.

1. **Left display Indicates present latitude coordinate in degrees to nearest tenth of arc minute.**
2. **Right display Indicates present longitude coordinate in degrees to nearest tenth of arc minute.**

Figure 3-21. CDU Display, Present Position (POS)



DISPLAYED:	**WAYPOINT NUMBER 2**	
	LATITUDE	**46:42.3 DEGREES NORTH**
	LONGITUDE	**71:37.6 DEGREES WEST**

NOTE:

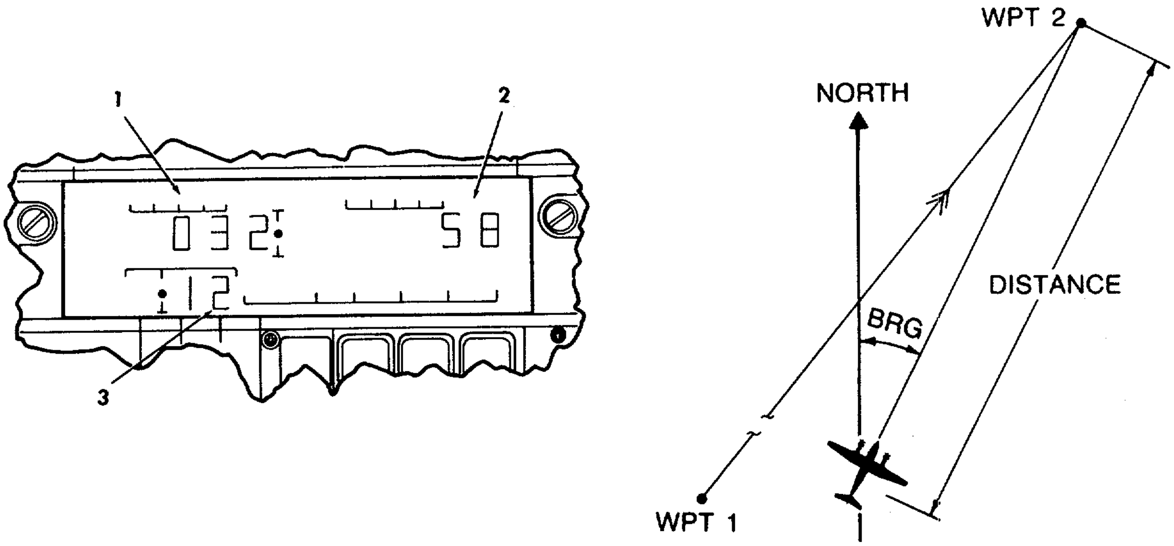
THE STORED LATITUDE AND LONGITUDE OF ANY WAYPOINT CAN BE DISPLAYED BY SELECTING THE WAYPOINT NUMBER ON THE DATA KEYBOARD.

1. **Waypoint display - Indicates number of waypoint whose position coordinates are to be displayed.**

2. **Left display - Indicates latitude coordinate of displayed waypoint to nearest tenth of arc minute.**

3. **Right display - Indicates longitude coordinate of displayed waypoint to nearest tenth of arc minute.**

Figure 3-22. CDU Display, Waypoint (WPT)



DISPLAYED: **BEARING** **032 DEGREES**
DISTANCE **58 NAUTICAL MILES**

NOTE:

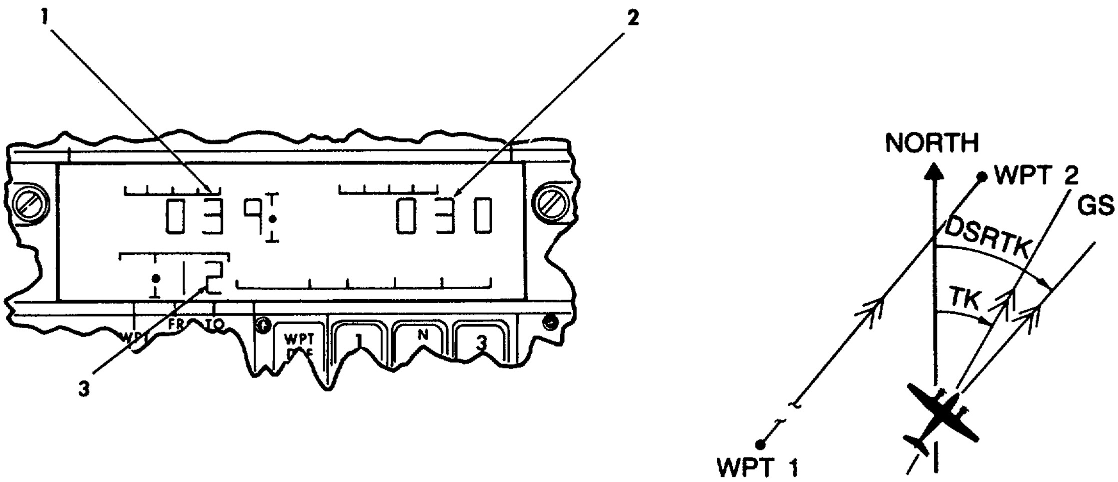
BEARING (BRG) AND DESIRED TRACK (DSRTK) WILL ALWAYS AGREE WHEN THE AIRCRAFT IS CENTERED ON PRESCRIBED GREAT CIRCLE COURSE. IF DEVIATION IS MADE FROM COURSE, THE BEARING WILL UPDATE TO PROVIDE THE ANGLE, AS REFERENCED TO MAGNETIC NORTH, FROM PRESENT POSITION TO SELECTED WAYPOINT. THE DESIRED TRACK ANGLE WILL VARY ONLY AS REQUIRED TO DEFINE THE PREVIOUSLY ESTABLISHED GREAT CIRCLE COURSE.

1. **Left display - Bearing indication (Great Circle angle from present position to next waypoint as referenced to magnetic north). Accurate to nearest degree.**

2. **Right display - Distance indication (Great Circle angle from present position to next waypoint as referenced to magnetic north). Accurate to nearest nautical mile.**

3. **Waypoint display - Relocates number of next waypoint.**

Figure 3-23. CDU Display, Bearing and Distance (BRG/DIS)



DISPLAYED:	DESIRED TRACK	039 DEGREES
	ROUTE	FROM WPT 1 TO WPT 2
	TRACK ANGLE	030 DEGREES

NOTE

DESIRED TRACK IS COMPUTED GREAT CIRCLE COURSE, REFERENCED IN DEGREES TO MAGNETIC NORTH, FROM DISPLAYED WPT FR TO WPT TO DISPLAYED VALUE IS UPDATED PERIODICALLY AS FLIGHT PROGRESSES AND SHOULD BE MAINTAINED ON HSI.

1. **Left Display - Desired track, to nearest degree, of leg indicated by "FR WPT” to "TO WPT"'.**

2. **Right Display - Track angle, to nearest degree.**

3. **Waypoint Display - Indicates route from "FR WPT” to "TO WPT" numbers shown.**

Figure 3-24. CDU Display, Desired Track and Track Angle (DSRTK/TK)

NOTE

Initial position must be correct. Any initial position error will be retained.

NOTE

If a CDU annunciator is illuminated, the pilot's HSI will display the VOR/LOC flag. The pilot must look at the CDU to note action required. If the AMB annunciator is illuminated, the VORILOC flag may be canceled by depressing the BK pushbutton (f (10)).

(6) *Initial Leg Selection.*

1. Press LEG CHG key. ENTER indicator illuminates.
2. Press 0, then number of first selected waypoint on Data Keyboard.
3. Press ENT key once. ENTER indicator extinguishes.
4. FROM number and TO number windows show zero and selected waypoint number respectively.
5. Set Display Mode Selector switch to WPT. Press 0 on Data Keyboard. Note displayed latitude and longitude is that of aircraft when ENT key was pressed in step 3.
6. Set Display Mode Selector switch to BRG/DIS (fig. 3-23). Verify displayed bearing and distance are reasonable.
7. Press the VLF push switch.
8. Set Display Mode Selector switch to DSTK/TK (fig. 3-24). Set pilot's HSI to displayed "Desired Track".

NOTE

If the VOR/LOC flag is in view, it may be necessary to press the BK key to obtain a VLF display on the HSI. The bearing and distance displayed refer to the Great Circle route from aircraft present position to the selected waypoint. Waypoint zero will be the latitude and longitude of the aircraft at the moment ENT key was pressed.

(7) *Top of Climb*. The following procedure can be used to reduce the time required for the system to update the computed groundspeed errors developed during the climb.

1. Set Display Mode Selector switch to GS/ETE.
2. Insert true airspeed or approximate groundspeed. ENTER indicator illuminates.
3. Press ENT key once. ENTER indicator extinguishes.

NOTE

The displayed groundspeed and estimated time enroute will adjust for the headwind/tailwind conditions. The time required will depend on the extent of the adjustment.

(8) *Enroute Operation.*

(a) *Manual Leg Change At Waypoint:*

1. Set mode selector switch to MAN.
2. Press LEG CHG key. ENTERP indicator illuminates.
3. Press present waypoint number, then next selected waypoint number on Data Keyboard. FROM number and TO number windows show present and next waypoint numbers respectively.
4. Press ENT key. ENTER indicator extinguishes.
5. Verify new BRG and DIS are reasonable.
6. Set displayed DSRTK on HSI.

NOTE

Waypoints may be selected in any sequence in this mode.

(b) *Automatic Leg Change At Waypoint:*

1. Set mode selector switch to AUTO.
2. Two minutes before reaching waypoint, the TO waypoint number display fashes and the VLF WPT annunciator illuminates. Before the aircraft reaches the waypoint, the FR/TO waypoint display changes automatically to show the next leg waypoints.
3. Verify new BRG and DIS are reasonable.
4. Set displayed DSRTK on HSI indicator.

NOTE

When in the automatic leg change mode, the system will switch to the next highest waypoint number; therefore, the bearing and distance will be from present position to whatever latitude and longitude are stored in that waypoint. When last desired waypoint appears in the TO window, switch to manual.

(c) Present Position Direct to Any Waypoint:

1. Press LEG CHG key. ENTER indicator illuminates.
2. Press 0, then number of desired TO waypoint on Data Keyboard.
3. Press ENT key once. ENTER indicator extinguishes.
4. Verify new BRG and DIS are reasonable.
5. Set displayed DSRTK on pilot's HSI.

NOTE

Waypoint 0 (present position) becomes a new stored waypoint and replaces those coordinates established in (6) 2.

(d) Bearing And Distance Direct To Any Waypoint.:

1. Set Display Mode Selector switch to BRG/DIS (fig. 3-24).
2. Press 0 on Data Keyboard.
3. Press desired waypoint number on Data Keyboard.
4. Great Circle bearing distance from present position to selected waypoint is displayed.
5. In a similar manner, bearing distance between any two waypoints can be displayed.

NOTE

During this function, the ENTER indicator will illuminate and the normal navigation program continues uninterrupted. To return to normal navigation displays, rotate the Display Mode Selector switch to any other position.

(9) Position Check and Update. During flight, accumulated errors to present position can be reduced by updating over a known reference point.

1. Set Display Mode Selector switch to POS.
2. Press HOLD (HLD) key when directly over the known reference point. N or S and E or W annunciators flash continuously.

NOTE

Do not press HOLD key before arriving at known reference point as this will cause an error in the new position inserted.

NOTE

While in HOLD, the system keeps track of aircraft movement. Therefore, when BK key is pressed in step 4, or ENT key is pressed in step 5(d), the position is immediately updated to include all position movement since pressing HOLD key.

3. Compare displayed coordinates with those of reference points.

4. If displayed position is satisfactory, press BK key to return system to normal mode of operation.
5. If update is required:
   a. Insert known latitude.
   b. Press ENT key.
   c. Insert known longitude.
   d. Press ENT key.
6. N or S and E or W annunciators stop flashing.

(10) Dead Reckoning (DR) and Ambiguity (AMB).

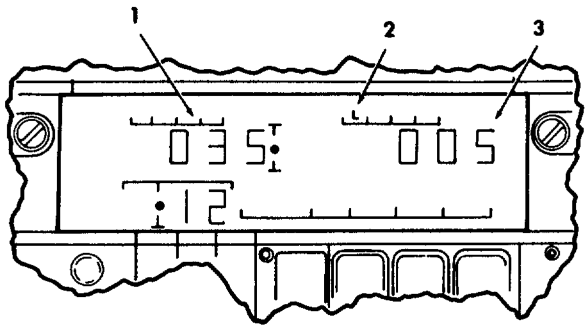
1. The system is constantly monitoring the accuracy of the position in latitude and longitude. It does this by evaluating the DR data, the predicted position and the VLF/OMEGA position which is resolved from all available Station L.O.P.'s (line of Position). The signal to noise ratio and station geometry is evaluated. If less than three stations are received, the DR annunciator illuminates and the VLF annunciator extinguishes. After approximately three minutes, the AMB annunciator will illuminate. The HSI warning flag is activated. When the operator updates position or verifies it to be correct, the HSI flag can be canceled by pressing the BK key.
   a. The DR annunciation means there are not sufficient signals for VLF/ OMEGA navigation. The AMB annunciation signifies that the position error as estimated by the system is greater than 4 NM.
   b. If the system loses synchronization (for any reason), the AMB and DR annunciators stay illuminated and the SYN annunciator also illuminates.
2. When the system synchronizes again, the SYN annunciator will extinguish, and the AMB and DR annunciators will remain illuminated.
3. When sufficient signals are available for VLF/OMEGA navigation, the DR annunciator will extinguish, and the VLF annunciator will illuminate.
4. The AMB annunciator will not extinguish automatically. To extinguish the AMB annunciator, the indicated position must be verified and updated or re-confirmed as necessary. To re-confirm the position, set Display Mode Selector switch to POS and press ENT twice. To update position refer to (9) above. The AMB annunciator will now extinguish.
5. During absolute OMEGA (hyperbolic) operation, the system monitors the position as in step 1. above. If the position error is estimated to exceed 4 NM, then the AMB annunciator illuminates. The HSI warning flag is activated. When the operator updates position or verifies it to be correct, the HSI WARNING FLAG can be canceled by pressing BK key.
6. When in full DR operation, the system uses the last VLF/OMEGA estimate of groundspeed and track.

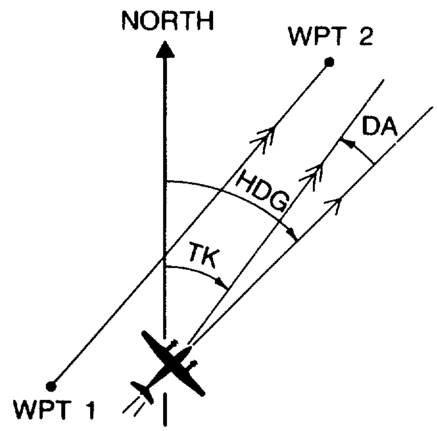
(11) Displayed Data. The following functions of navigational information are available. These functions are shown by placing the Display Mode Selector switch to the appropriate position (figs. 3-20 through 3-27).
   a. Wind Direction And Speed (WIND). No wind information is available. Display should indicate 000/0.
   b. Test Subparagraphs (13)(b) thru (13)(i).

(12) Manual Lane Resolution. On recovery from an extended period of DR, or if the AMB annunciator is on and no VOR or other means is available to update position, then a manual lane resolution can be forced by selecting the absolute OMEGA (hyperbolic) mode (VLF annunciator extinguished) as detailed below:

(a) To Force Absolute Omega Navigation Trigger For Lane Resolution:

1. Turn Display Mode Selector switch to TEST. Press 660 on keyboard. Press ENT twice. 660 should appear in left display. Press ENT once. Press 100 on keyboard. Press ENT once.
2. Turn Display Mode Selector switch to the TEST position, press





DISPLAYED: HEADING 035 DEGREES
DRIFT ANGLE 5 DEGREES LEFT

NOTE:

IF COMPASS INPUT FAILS, HEADING AND DRIFT ANGLE DISPLAYS GO TO 000.000.

1. **Left display - Heading to nearest degree.**
2. **Right Annunciator - Direction of drift from heading (L or R).**
3. **Right display - Drift angle to nearest degree.**

Figure 3-25. CDU Display, Heading and Drift Angle (HDG/DA)

310 on the keyboard. Press ENT twice, 310 should appear in the left display. Press ENT once. Press 1 on the keyboard. Press ENT once. The right hand display then modifies as follows to show status of the Lane Ambiguity Resolution (LAR).

Right Display

0 = LAR Completed
1 = LAR In Progress
2 = LAR Armed, insufficient signals to trigger.
3 = LAR Armed, inadequate geometry for trigger.

When VLF/OMEGA signal quality is adequate, the AMB annunciator will extinguish, and the estimate system update will be applied. Verify resolved position displayed is reasonable.

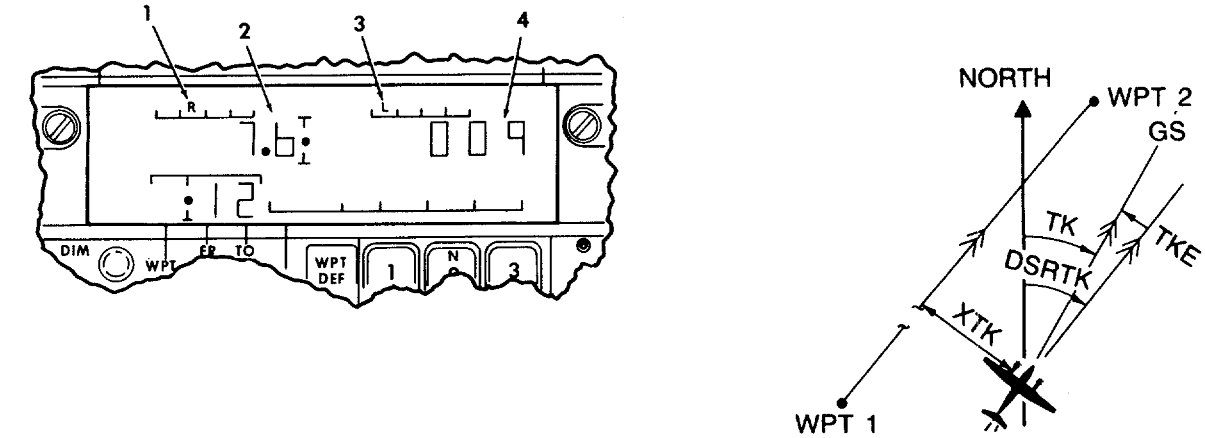
(b) To Return To Relative Navigation Mode.

1. Turn Display Mode Selector switch to TEST. Press ENT three times. Verify 660 appears in the left display. Verify that ENT is illuminated, Press 20 on keyboard. Press ENT once.
2. Turn Display Mode Selector switch to any display mode except TEST and verify VLF annunciator is illuminated and all other annunciators are extinguished.
3. Treat position (POS) with caution until verified by some other approved navigation procedure.

(13) Computer Access Mode.

(a) Flight Planning:

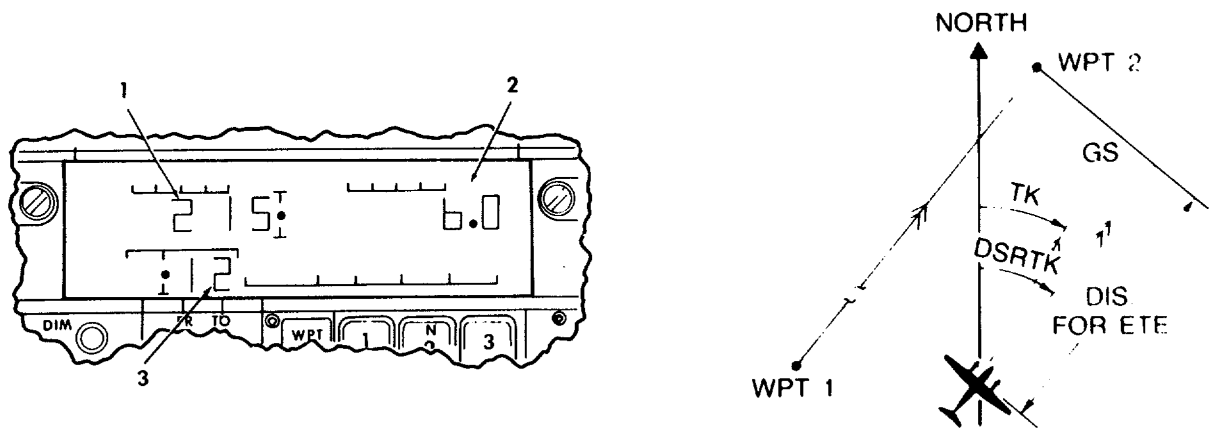
1. Waypoint entries must have been previously made ((4) above).
2. Turn Display Mode Selector switch to BRG/DIS.
3. Press desired FR and TO waypoint numbers on Data Keyboard.
4. After several seconds the Great Circle bearing will be displayed in the left window and the Great Circle distance will be displayed in the right window.
5. If 0 is selected as the FR waypoint, then the data will be from the air-



DISPLAYED:	**CROSS TRACK DISTANCE**	**7.6 NAUTICAL MILES**
	PRESENT POSITION	**RIGHT OF DESIRED CROSS TRACK**
	TRACK ANGLE ERROR	**9 DEGREES**
	PRESENT POSITION	**LEFT OF DESIRED TRACK ANGLE**

1. **Left Annunciator - Indication if aircraft to left or right of desired track (DSRTK).**
2. **Left display - Indicates cross track distance to nearest tenth of nautical mile.**
3. **Right annunciator - Indicates if present track is to left or right of desired track.**
4. **Right display - Indicates track angle error to nearest degree.**

Figure 3-26. CDU Display, Cross Track Distance and Track Angle Error (XTK/TKE)



DISPLAYED:	**GROUNDSPEED**	**215 KNOTS**
	TIME ENROUTE	**6.0 MINUTES**

1. **Left display - Indicates aircraft groundspeed to nearest knot (estimated).**
2. **Right display - Indicates estimated time enroute (ETE). ETE is calculated at the current groundspeed, using distance from present position to a line perpendicular to the desired track through the "TO" waypoint.**
3. **Waypoint display - Indicates number of next waypoint.**

Figure 3-27. CDU Display, Groundspeed and Estimated Time Enroute (GS/ETE) craft present position to the selected waypoint.

6. If bearing and distance to waypoint 0 from any waypoint is desired, press that waypoint, then 0. This 0 is not aircraft present position, but that established in (6) 5.

(b) Station Usage: This procedure allows the operator to determine which VLF/OMEGA stations were used for the last navigation fix.

1. Display Mode Selector switch to TEST.
2. Press 737 on Data Keyboard
3. Press ENT key twice. ENT annunciator extinguishes, 737 appears in left display window.
4. Press WPT DEF key.
5. Press 0 on Data Keyboard. Memory content appears on right display window. This number is the numerical sum of the station identifiers.

OMEGA STATIONS

1	=	Norway
2	=	Liberia
4	=	Hawaii
10	=	North Dakota
20	=	La Reunion
40	=	Argentina
100	=	Australia
100	=	Japan

VLF STATIONS

400	=	NWC (Australia)
1,000	=	NDT (Japan)
2,000	=	GBR (England)
4,000	=	NAA (Maine)
10,000	=	NPM (Hawaii)
20,000	=	NSS (Maryland)
40,000	=	NLK (Washington State)

Thus, the number 54,356 indicates:

40,000	=	NLK
10,000	=	NPM
4,000	=	NAA
200	=	Japan
100	=	Australia
40	=	Argentina
10	=	North Dakota
4	=	Hawaii
2	=	Liberia
54,356	=	TOTAL

6. Turning the Display Mode Selector switch to any other position restores the system to normal operation.
7. This function has no effect on the navigation in process.

(c) Individual OMEGA Station Signal To Noise Ratio:

NOTE

This procedure provides a means of checking individual station signal strength.

1. Display Mode Selector switch to TEST.
2. Press 140 on Data Keyboard. 140 appears in left display window.
3. Press ENT key twice.
4. Press WPT DEF key.
5. Press 3 on Data Keyboard. ENTER indicator extinguishes.

NOTE

Memory content appears in right display window. This number is the signal strength of OMEGA station Norway based on increasing strength scale 0 to 100. Thirteen or above is accepted for navigation.

6. Press the HLD (hold) key once to increment memory location by one. Note that the number in the left display window is now 141. The right display window number is now the quality factor for Liberia.

140	=	Norway
141	=	Liberia
142	=	Hawaii
143	=	North Dakota
144	=	Reunion
145	=	Argentina

146 = Australia
147 = Japan

140 to 147 is the 10 kHz OMEGA Frequency
150 to 157 is the 13 kHz OMEGA Frequency
160 to 167 is the 11 kHz OMEGA Frequency (not displayed in relative mode)

7. The left display number can be backed up in steps of one by pressing BK (Backspace) key.

(d) Individual VLF Station Signal To Noise Ratio. Follow the same procedure used for OMEGA signal strength in (c) above with the following exceptions:

1. In step 2., press 170 on Data Keyboard.
2. In step 6., read:

170 = Australia
171 = Japan
172 = England
173 = Maine
174 = Hawaii
175 = Maryland
176 = Washington State

(e) Display Of System Failure Status. Illumination of the red Failure Warning indicator and/or SYS annunciator, if all other displays are blank, indicates a system failure. No operator action is possible. If an input such as compass heading fails, or if a failure occurs in the system itself, the SYS annunciator will illuminate. The operator can generally identify the failure in the following manner:

1. Display Mode Selector switch to TEST.
2. Press 670 on Data Keyboard.
3. Press ENT key twice. 670 appears in left display window.
4. The number in the right display window is the numerical sum of the system failure identification.

0 = normal
1 = analog to digital failure
2 = true airspeed failure
4 = compass failure
20 = oscillator drift
100 = self test receiver
400 = processor/memory failure

Thus, for example, the number 24 would consist of:

4 = compass failure
20 = oscillator drift

(f) Display Of Receiver Failure.

1. As in (e) above, steps 1. through 3., enter 666.
2. The number in the right display window is the numerical sum of the receiver failure identification.

0 = normal
1 = 10 kHz receiver failure
2 = 13 kHz receiver failure
4 = 11 kHz receiver failure
10 = VLF receiver failure

(g) Display Of Synchro Failure.

1. As in (e) above, steps 1. through 3., enter 671, then 0.
2. The number in the right display window is the numerical sum of the synchro failure identification.

0 = normal
2 = true airspeed discrete failure
12 = true airspeed synchro failure
24 = compass synchro failure

NOTE

An indication of "2" is normal. True Airspeed is not installed.

(h) Magnetic Variation. The system automatically computes magnetic variation for the present latitude and longitude. This variation is applied to the magnetic compass input automatically. To read the magnetic variations in use:

1. Place Display Mode Selector switch to TEST.
2. Press 1032 on Data Keyboard.

3. Press ENT key twice. 1032 appears in left display window.

4. Press WPT DEF key.

5. Press 4 on Data Keyboard. ENTER indicator extinguishes.

6. The right display is the variation in degrees X10. If the L and R annunciators are both on, the variation is WEST. If both L and R annunciators are off, the variation is EAST.

(i) *Station Rejection.* Any VLF/OMEGA station can be rejected if required.

1. Display Mode Selector switch to TEST.

2. Press 657 on Data Keyboard.

3. Press ENT key twice. 657 appears in left display window. If 0 appears in right display window, all stations are being used. Any station can be rejected by means of the Data Keyboard.

4. Press ENT key once.

5. Insert desired content from table, via Data Keyboard. For example, to reject OMEGA stations Hawaii and Australia, press 104 on Data Keyboard.

6. Press ENT key. ENTER indicator extinguishes.

OMEGA STATIONS

0	= use all stations
1	= reject Norway
2	= reject Liberia
4	= reject Hawaii
10	= reject North Dakota
20	= reject Reunion
40	= reject Argentina
100	=reject Australia
200	= reject Japan

VLF STATIONS

400	= reject NWC (Australia)
1,000	= reject NDT (Japan)
2,000	= reject GBR (England)
4,000	= reject NAA (Maine)
10,000	= reject NPM (Hawaii)
20,000	= reject NSS (Maryland)
40,000	= reject NLK (Washington State)

NOTE

Due to intermedal intereference sometimes experienced on westerly transmissions from Liberia over dark or partially dark paths, automatic rejection of Liberia is implemented if the operator has not previously inhibited the automatic deselection feature. Liberia will then automatically be rejected and a 2 will appear in the memory location 657.

(j) To inhibit automatic rejection of Liberia:

1. Place Display Mode Selector switch to TEST.
2. Press 661 on Data Keyboard.
3. Press ENT key twice. 661 appears in left display window.
4. Press ENT key once. ENTER indicator illuminates.
5. Press 1.
6. Press ENT once. ENTER indicator extinguishes.
7. To enable automatic rejection, repeat 1. thru 6. above except press 0 for step 5.

(14) *Gyro Local Grid Operation.*

1. Flights in high latitudes may involve traversing the area of magnetic compass unreliability where the Free Directional Gyro (FREE) capability of the aircraft compass system is used rather than the Magnetically Slaved (SLAVE) mode.

2. Prior to entering the area of magnetic compass unreliability, i.e., while the magnetic compass information is still accurate, switch the compass in use by the VLF to FREE mode. This action, in addition to de-slaving the compass, freezes the variation in use by the system at its current value.

3. Check that the TO waypoint number on the CDU starts flashing. Flashing will continue for approximately 100 seconds, indicating that the VLF is not using the heading input from the compass. Aircraft heading must be kept constant during this time.

NOTE

Do not slew the compass card while in FREE mode for LOCAL GRID operation.

4. After the 100-second delay the TO waypoint number stops flashing, indicating that the VLF is now using the FREE heading input to derive true heading.

5. As the aircraft proceeds along its route, the system continuously calculates the value of earth convergency equivalent to the change in latitude/longitude. This value, together with the fixed value of magnetic variation, is applied by the system to the grid heading obtained from the gyro to derive valid TRUE heading for the required VLF computations.

6. If the aircraft is being flown manually the operator must fly the aircraft to hold the displayed track angle error and cross track (Set Display Mode Selector switch to XTK/TKE) at zero, or convert the displayed DESIRED TRACK to GRID by subtracting variation and earth convergency, then flying that GRID desired track. The operator must keep the TRACK pointer on the HSI lined up with the lubber line as the flight progresses.

7. Reversion to SLAVE Mode. On the compass controller, set the FREE/SLAVE switch to SLAVE. Check that the TO waypoint number starts flashing. Flashing will continue for approximately 100 seconds indicating that the VLF is not using the heading input. Aircraft heading must be kept constant during this time. While the TO waypoint is flashing, slew the compass card to the correct heading. Use the compass annunciator to insure synchronization.

NOTE

If the TO waypoint stops flashing before the compass can be synchronized, set the FREE/SLAVE switch to FREE, then back to SLAVE. This will re initialize the 100 second delay.

(15) Flights Originating in Free Mode.

1. Place the aircraft compass in FREE mode.

2. Turn VLF on.

3. Note that the TO waypoint number does not flash as in paragraph (14) 3. If the compass is in FREE mode when the VLF is turned on.

4. NOTE that it is very important that the TIME, DATE and PRESENT POSITION are re-inserted. DO NOT JUST PRESS THE INSERT KEY. If this full procedure is not followed, the VLF may still apply the old variation and earth convergency in use at the time of VLF turn off.

5. Slew the aircraft compass to the aircraft TRUE heading.

6. Note that the VLF displayed DESIRED TRACK, TRACK, and bearings are displayed in magnetic and that the compass is reading in GRID. Follow the same procedure as in paragraphs (14) 6. and (14) 7.

7. When the flight enters the area of magnetic reliability switch the compass to SLAVE mode (para (14) 8. above).

(16) Earth Convergency in Use.

1. To find earth convergency being used by the VLF, obtain TRUE heading from GRID, set Display Mode Selector switch to TEST.

2. Press 576 on Data Keyboard.

3. Press 4 on Data Keyboard.

4. The number in the right display window is the earth convergency in use.

NOTE

It is assumed that the operator will have followed normal gyro rating procedures on both gyro magnetic compass systems prior to flights in the area of magnetic compass reliability. Standard FREE procedures should be followed for the second gyro in order to provide a reversionary heading reference in the event of VLF failure.

g. Emergency Procedures.

(1) Power Interruption. The only situation requiring immediate pilot action occurs when power to the system is restored after a significant period of primary power interruption. If the interruption exceeds 7 seconds, the system is automatically put in HOLD mode from the time power is restored. GMT and present position must be updated.

1. Note incorrect displayed GMT and obtain time elapsed since power interruption.
2. Enter correct GMT.
3. Note displayed present position. Based on elapsed time (from "1") and best estimate of aircraft track and ground speed, calculate present position at the time power was restored.
4. Enter best estimated position as calculated in "3". The system will automatically update the position for aircraft movement since power was restored.
5. Provided acceptable VLF/OMEGA signals are available, the SYN annunciator should extinguish within 3 minutes.
6. Operation should now be normal. However, position should be treated with caution until confirmed by a positive position check.

(2) Sys Annunciator Illuminated. In the event the SYS annunciator illuminates, no VLF/ OMEGA displayed information can be relied upon. The other onboard navigation equipment must be used as the primary source of navigational information. Refer to Computer Access Mode of NORMAL PROCEDURES in this section for failure analysis.

(3) Compass Failure. In the event of a compass failure, the system will continue to operate. However, the aircraft rate-of-turn must not exceed 20 degrees per minute. By flying the CROSS TRACK and TRACK ANGLE ERROR at zero, the aircraft will follow the DESIRED TRACK.

h. Control Display Unit (CDU) Annunciator Indications.

(1) SYS (System). When steadily illuminated, there is an internal failure, or one of the system inputs has failed.

(2) DR (Dead Reckoning). Whenever the VLF/OMEGA system does not receive sufficient signals for navigation, the DR annunciator will be steadily illuminated.

(3) *AMB (Ambiguity)*. If the displayed position is estimated to be outside a circular area which exceeds a radius of four nautical miles, the AMB annunciator will be steadily illuminated.

If the AMB annunciator is flashing, there has been some loss of operator-inserted data due to a mainpower recycling.

(4) DR and AMB. If both DR and AMB are steady illuminated, the system has not received sufficient stations for some time. If the displayed latitude and longitude in POS can be substantiated with a visual ground fix or other approved navigation equipment, the ENT key should be pressed twice. AMB will extinguish. DR extinguishes when full operation is resumed.

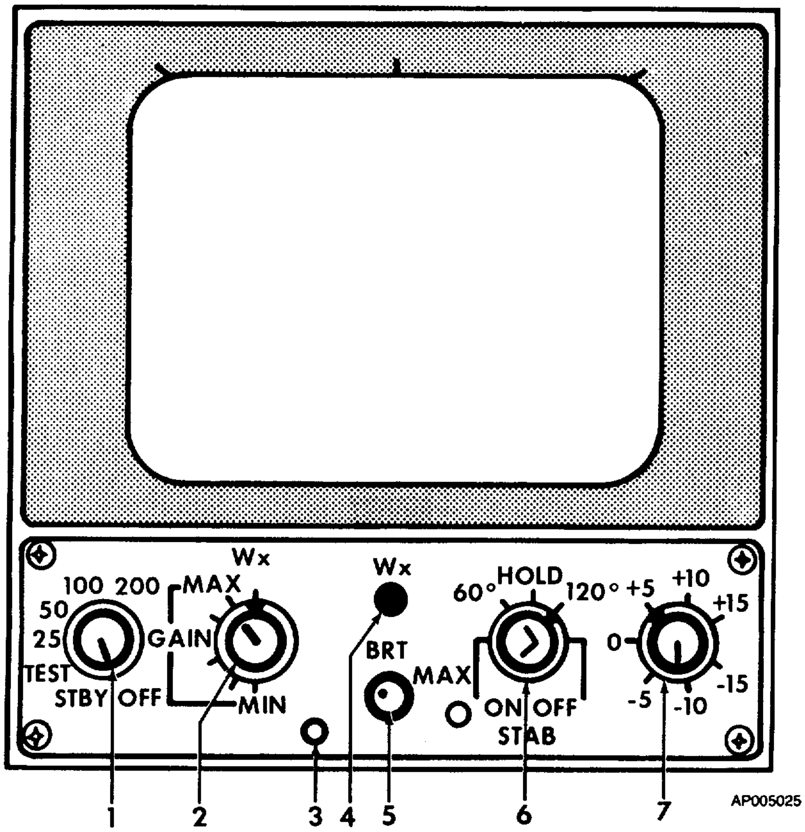
(5) SYN (Synchronization). When illuminated, indicates synchronization to the OMEGA sequence is in progress. During this time, the DR annunciator will be illuminated.

(6) VLF. The VLF annunciator will illuminate when the system is in its primary (relative) navigation mode VLF OMEGA.

(7) WAYPOINT ALERT. Two minutes before reaching the active waypoint, the TO waypoint number flashes and continues to do so as the aircraft approaches the active waypoint.

i. Navigation Displays. Once a navigation leg has been selected, left and right course information will be displayed on the HSI when the VLF mode has been selected by the pilot's VLF switch. Course information is provided for enroute navigation with a constant course width of ± 7 1/2 nautical miles irrespective of the distance to the waypoint. The TO/FROM flag on the HSI reads "TO" when the aircraft has not passed a line at right angles to the desired track which passes through the active "TO" waypoint. It reads "FROM" when the aircraft has passed that line. If the Automatic Manual leg change switch is in the automatic mode, the flag will always indicate "TO".

(1) Warning Flag. The CMA-734 (-003) drives the normal VOR/LOC warning flag when VLF/OMEGA information is displayed on the HSI. The warning flag will be in view anytime the VLF OMEGA information is invalid or suspect (e.g., System Failure SYS, SYN, AMB, DR annunciators).



1. Mode switch
2. Wx/GAIN control
3. Fault indicator
4. Wx pushbutton
5. BRT control
6. STAB-scan selector
7. Antenna tilt control

Figure 3-28. Weather Radar Control/Indicator (RDR-1200)

(2) Horizontal Situation Indicator. The horizontal situation indicator (HSI) displacement is independent of the course selected (similar to a localizer). Therefore, to get relative bearing as well as displacement information, the current desired track (DSRTK) must be set on the HSI. The BRG displayed on the CMA-734 (-003) display unit is always the bearing from the present position to the selected "TO" waypoint. Therefore, the selected leg bearing will be displayed only when the HSI is centered. The bearing of the selected leg will change in flight because the path established between waypoints is a Great Circle route. Therefore, the course indicator must be reset periodically to agree with the displayed desired track (DSRTK).

Section IV. TRANSPONDER AND RADAR

3-24. DESCRIPTION.

The transponder and radar group provides an identification, position, and emergency tracking system and a radar system to locate weather areas.

3-25. WEATHER RADAR SET (RDR-1200).

a. Description. The weather radar set (fig. 3-28) provides a visual presentation of the general sky area of approximately 120° around the nose of the aircraft, extending to a distance of 200 nautical miles. The presentation on the screen of the indicator shows the location of thunderstorms and hailstorms, in terms of distance and azimuth with respect to the aircraft. The radar is also capable of ground mapping operations. The weather radar is protected by the 5-almpere RADAR circuit breaker located on the overhead circuit breaker panel (fig. 2-23).

b. Controls and Functions.

(1) Mode switch. Controls operating mode of the system.

(a) OFF. Turns system off.

(b) STBY. Places system in standby condition during warmup period and when system is not in use.

(c) TEST. Places system in test mode to determine operability of system. No transmission is made in test mode.

(2) 25/50/100/200. Selects operating range in nautical miles of system.

(3) Wx/GAIN control. Controls type of information presented.

(a) Wx. Presents normal weather display.

(b) MAX/MIN. Five levels of gain from MAX to MIN may be selected during ground mapping operation.

(4) Wx pushbutton. When pressed and held, eliminates contour (storm cell) presentation.

(5) BRT control. Adjusts intensity of display for cockpit light conditions. During ground mapping mode, adjusted in conjunction with GAIN control for best presentation.

(6) Scan/Stab selector. Provides 60°, 120°, and HOLD scan presentations on indicator. Also controls on/off operation of antenna stabilization.

(7) 60°. Provides for 60 degree scan presentation.

(8) HOLD. Weather or ground mapping information last presented is retained on indicator for longer evaluation.

(9) 120°. Provides for 120 degree scan presentation.

(10) STAB ON. Antenna stabilization operates normally.

(11) STAB OFF. Antenna pitch and roll inputs are disabled. The manual antenna tilt control remains operative.

(12) Antenna tilt control. Electrically adjusts the antenna to move the radar beam a maximum of 15 degrees up or down from horizontal.

(13) Fault indicator. Amber lamp that illuminates when a fault occurs as a result of low power or a weak receiver. Illuminates in the TEST mode as a cross check of the fault monitor circuit.

c. Weather Radar Normal Operation.

WARNING

Do not operate the weather radar system while personnel, combustible or explosive materials are within 15 feet of the antenna reflector. When the weather radar system is operating, high-power radio-frequency energy is emitted from the antenna reflector which can have harmful effects on the human body and can ignite combustible materials.

CAUTION

Do not operate the weather radar system in a confined space where the nearest metal wall is 50 feet or less from the antenna reflector. Scanning such surfaces within 50 feet of the antenna reflector may damage receiver crystals.

NOTE

During the first five seconds after turning the system on, a distinct noise and/or vibration may occur in the antenna. Do not become alarmed. This is the normal sound of the stepping drive motor which is waiting for the strobe line to catch up for synchronization.

(1) Turn on procedure:

1. Mode switch - TEST.

(2) Initial control settings:

1. Wx/GAIN control - Wx.
2. Scan/stab selector - 120°.
3. Antenna tilt control - 0°.
4. BRT control - As required for best display.

(3) Pre-flight test procedure:

1. After approximately 70 seconds, the test pattern should appear, then check for the following items:

(a) There should be five equally spaced range marks.

(b) Amber fault lamp should be illuminated.

(c) There should be no "noise" appearing on the display.

(d) There should be two distinct brightness levels appearing on the screen.

(e) Starting at the lower center of the display, there should be five bands extending outward. They should be:

1. Light shading.
2. Intermediate shading.
3. Dark or contour area.
4. Intermediate shading.
5. Light shading.

(f) Strobe line (antenna position) should move across the indicator screen through the full 120 without jumping. Absence of the strobe line indicates that the antenna is not operating. Proceed as follows:

1. Scan/stab switch HOLD position. Strobe line should disappear and the test pattern display should freeze on the indicator.
2. Scan/stab switch 60°. Scan area should now be limited to 60°. Strobe line should reappear and sweep ±30° about the aircraft centerline.
3. Scan/stab switch - 120°.
4. Mode selector- 25.
5. Wx/GAIN control - Wx.
6. Antenna tilt control - +4° (initially)
7. BRT - As desired. Amber fault lamp should be extinguished, indicating satisfactory transmitter power and satisfactory receiver gain.
8. Antenna tilt control Vary between 0° and +15° and note that close-in "ground clutter" appears at lower tilt settings and any local moisture-laden weather appears at higher tilt settings.

(4) *Weather observation operating procedure:*

1. Antenna tilt control Adjust until weather pattern is displayed. Include the areas above and below the rainfall areas to obtain a complete display.
2. Mode switch - As required.
3. Wx/GAIN control - Wx.

(5) *Standby procedure*: Mode switch OFF. Full operation is possible approximately one minute after turn-on. The pilot may choose to leave the mode switch in the OFF position, rather than STBY, if no significant weather is in the immediate area of the aircraft. The life of the magnetron transmitting tube will be extended by leaving the system OFF when possible.

(6) *Shutdown procedure*:

1. Mode switch - OFF.

3-26. WEATHER RADAR SIET (AN/APN-215).

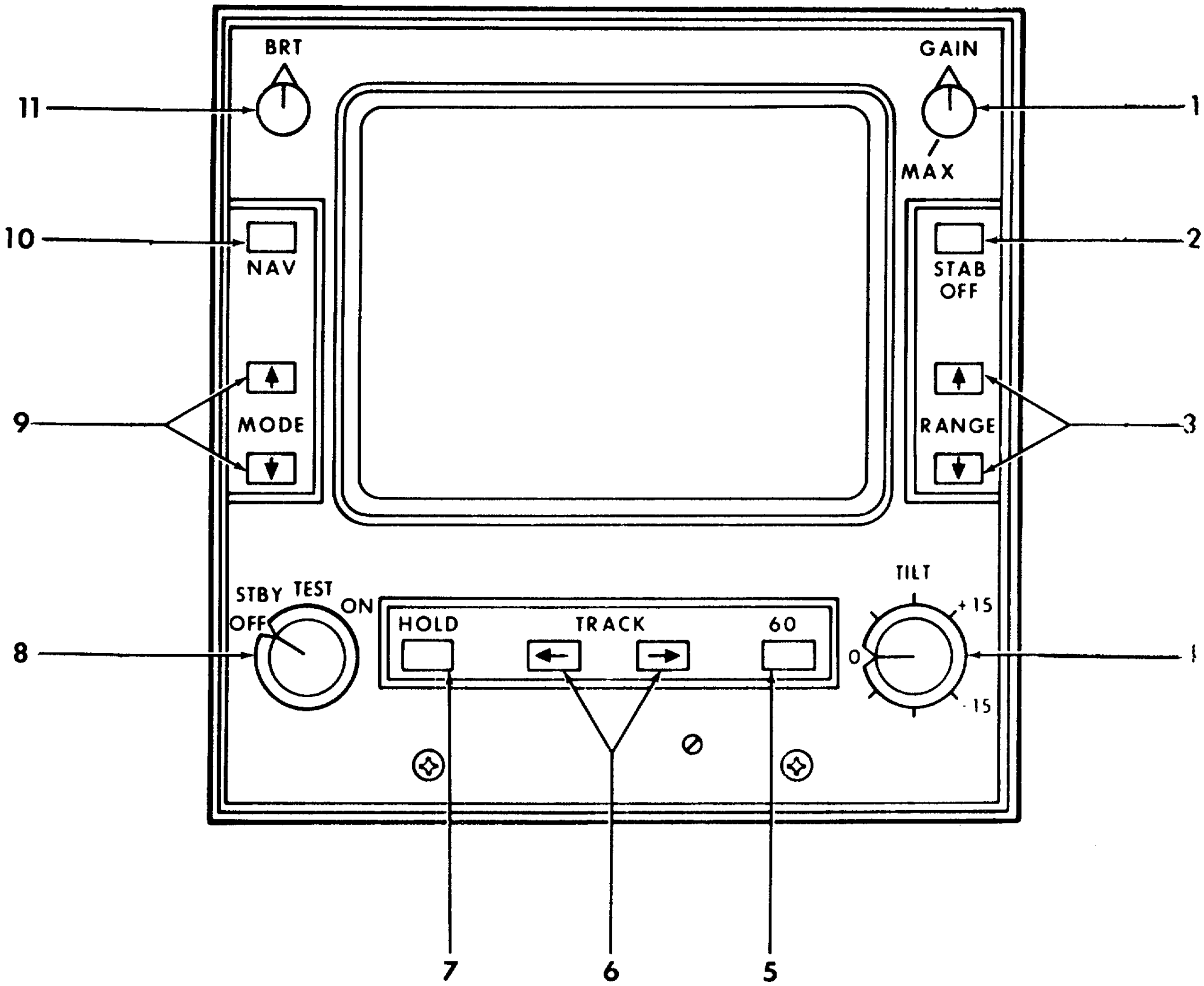
a. Description. The weather radar set provides a visual presentation of the general sky area of approximately 120 degrees around the nose of the aircraft, extending to a distance of 240 nautical miles. The presentation on the screen shows the location of potentially dangerous areas, such as thunderstorms and hailstorms, in terms of distance and azimuth with respect to the aircraft. The radar is also capable of ground mapping operations. The weather radar set is protected by a 5-ampere RADAR circuit breaker located on the overhead circuit breaker panel (fig. 2-23).

b. Controls/Indicators and Functions.

(1) GAIN control. Used to adjust radar receiver gain in the MAP mode only.

(2) STAB OFF switch. Push on/push off type switch. Used to control antenna stabilization signals.

(3) RANGE switches. Momentary action type switches. When pressed, clears the screen and increases or decreases the range depending on switch pressed.



1. GAIN control
2. STAB OFF switch
3. RANGE switches
4. TILT control
5. 600 scan switch
6. TRACK switches
7. HOLD switch
8. Function switch
9. MODE switches
10. NAV switch
11. BRT control

Figure 3-29. Weather Radar Control/Indicator (AN/APN-215)

(4) TILT control. Varies the elevation angle of radar antenna a maximum of 15 degrees up or down from horizontal attitude of aircraft.

(5) 60° switch. Push on/push off type switch. When activated, reduces antenna scan from 120 degrees to 60 degrees.

(6) TRACK switches. Momentary action type switches. When activated, a yellow track line extending from the apex of the display through top range mark appears and moves either left or right, depending on the switch pressed. The track line position will be displayed in degrees in the upper left corner of the screen. The line will disappear approximately 15 seconds after the switch is released. It will then automatically return to 0 degrees.

(7) HOLD switch. Push on/push off type switch. When activated, the last image presented before pressing the switch is displayed and held. The word HOLD will flash on and off in the upper left corner of the screen. Pressing the switch again will update the display and resume normal scan operation.

(8) Function switch. Controls operation of the radar set.

(a) OFF. Turns set off.

(b) STBY. Places set in standby mode. This position also initiates a 90-second warmup delay when first turned on.

(c) TEST. Displays test pattern to check for proper operation of the set. The transmitter is disabled during this mode.

(d) ON. Places set in normal operation.

(9) MODE switches. Momentary action type switches. Pressing and holding either switch will display an information list of operational data on the screen. The data heading will be in blue, all data except present data will be in yellow, and present selected data will show in blue. The three weather levels will be displayed in red, yellow, and green. If WXA mode has been selected, the red bar will flash on and off. If the switch is released and immediately pressed again, the mode will increase or decrease depending on switch pressed. When either top or bottom mode is reached, the opposite switch must be pressed to further change the mode.

(10) NAV switch. Not used. If pressed, the words NO NAV will appear in the lower left corner of the screen.

(11) BRT control. Used to adjust screen brightness.

c. Weather Radar Set Operation.

WARNING

Do not operate the weather radar set while personnel or combustible materials are within 18 feet of the antenna reflector. When the weather radar set is operating, high-power radio-frequency energy is emitted from the antenna reflector, which can have harmful effects on the human body and can ignite combustible materials.

CAUTION

Do not operate the weather radar set in a confined space where the nearest metal wall is 50 feet or less from the antenna reflector. Scanning such surfaces may damage receiver crystals.

(1) Turn-on procedure:

1. Function switch - TEST or ON as required (information will appear after time delay period has elapsed).

(2) Initial adjustments operating procedure:

1. BRT control - As required.
2. MODE switches - Press and release as required.
3. RANGE switches - Press and release as required.
4. TILT control - Move up or down to observe targets above or below aircraft level. The echo display will change in shape and location only.

(3) Test procedure:

1. Function switch - TEST.
2. RANGE switches - Press and release as required to obtain 80-mile display.
3. BRT control - As required.
4. Screen - Observe for proper display. The test display consists of two green bands, two yellow bands, and a red band on a 120-degree scan. The word TEST will be displayed in the upper right corner. The operating mode selected by the MODE switches, either MAP, WX, or WXA, will be displayed on the lower

left corner. If WXA has been selected, the red band in the test pattern will flash on and off. The range will be displayed in the upper right corner beneath the word TEST and appropriate range mark distances will appear along the right edge of the screen.

(4) *Weather observation operating procedure:*

1. Function switch - ON.
2. MODE switches - Press and release as required to select WX.
3. BRT control - As required.
4. TILT control - Adjust until weather pattern is displayed. Include the areas above and below the rainfall areas to obtain a complete display.
5. MODE switches - Press and release to select WXA. Areas of intense rainfall will appear as flashing red. These areas must be avoided.
6. TRACK switches - Press to move track line through area of least weather intensity. Read relative position in degrees in upper left corner of screen.

NOTE

Refer to FM/ 30 for weather observation, interpretation, and application.

(5) *Ground mapping operating procedure:*

1. Function switch - ON.
2. MODE switches - Press and release as required to select MAP.
3. BRT control - As required.
4. GAIN control - As required to present usable display.

(6) *Standby procedure:*

1. Function switch STBY.

(7) *Shutdown procedure:*

1. Function switch OFF.

3-27. TRANSPONDER SET (APX-100).

a. Description. The transponder set (fig. 3-30) is an identification, position tracking, altitude reporting, and emergency tracking device. This set receives, decodes, and responds to interrogations by search radar. The range of the set is normally limited to line-of-sight. The transponder is protected by the 3-ampere TRANSPONDER circuit breaker located on the overhead circuit breaker panel (fig. 2-23). The associated antenna is shown in figure 2-1.

b. Controls and Functions.

(1) *TEST GO indicator*. Illumination indicates successful completion of built-in test (BIT).

(2) *TEST/MON indicator*. Illumination indicates unit has malfunctioned or is being interrogated by a ground station.

(3) *ANT switch.*

(a) *TOP*. Selects use of top antenna.

(b) *DIV*. Selects diversity operation using both antennas.

(c) *BOT*. Selects use of bottom antenna.

(4) *RAD TEST OUT* switch. Enables an appropriately equipped transponder to reply TEST mode interrogations from an AN/UPM-92 or similar test set.

(5) *MASTER control.*

(a) *OFF*. Turns set off.

(b) *STBY*. Places set in warm-up (standby) condition.

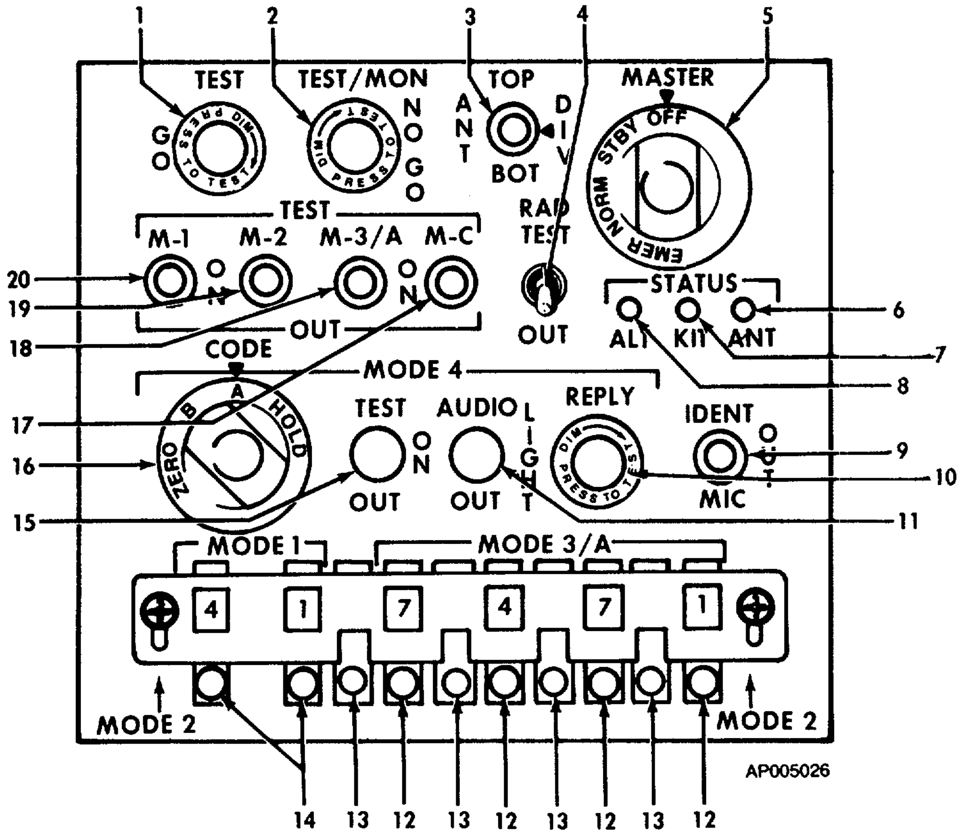
(c) *NORM*. Operates set at normal sensitivity.

(d) *EMER*. Transmits emergency reply code.

(6) *STATUS ANT indicator*. Illumination indicates the BIT or MON failure is due to high VSWR in antenna.

(7) *STATUS KIT indicator*. Illumination indicates the BIT or MON failure is due to external computer.

(8) *STATUS ALT indicator*. Illumination indicates the BIT or NON failure is due to Altitude Digitizer.



1. TEST-GO indicator
2. TEST/MON-NO GO indicator
3. ANT switch
4. RAD TEST-OUT switch
5. MASTER control
6. STATUS ANT indicator
7. STATUS KIT indicator
8. STATUS ALT indicator
9. IDENT-MIC switch
10. MODE 4 REPLY indicator
11. MODE 4 AUDIO-LIGHT-OUT switch
12. MODE 3/A code selectors
13. MODE 2 code selectors
14. MODE 1 code selectors
15. MODE 4 TEST-ON-OUT switch
16. MODE 4 CODE control
17. M-C TEST switch
18. M-3/A TEST switch
19. M-2 TEST switch
20. M-1 TEST switch

Figure 3-30. Transponder Control Panel (APX-100)

(9) IDENT MIC switch.

(a) IDENT. Activates transmission of identification (IP) pulse.

(b) MIC. Enables either control wheel POS IDENT button to activate transmission of ident signal from transponder.

(10) MODE 4 REPLY indicator. Illumination indicates that a reply has been made to a valid Mode 4 interrogation.

(11) MODE 4 AUDIO OUT switch.

(a) AUDIO. Permits aural and reply light monitoring of valid Mode 4 interrogations and replies.

(b) LIGHT. Permits REPLY indicator only monitoring.

(c) OUT. Disables monitoring capability.

(12) MODE 3/A code selectors. Select the desired reply codes for Mode 3/A.

(13) MODE 1 code selectors. Select the desired reply code for Mode 1.

(14) MODE 4 TEST OUT switch.

(a) TEST. Initiates built-in test of Mode 4 operation.

(b) ON. Enables Mode 4 operation.

(c) OUT. Disables Mode 4 operation.

(15) MODE 4 CODE control. Selects dialed-in Mode 4 code of the day.

(16) M-C, M-3A, M-2, and M-1 switches.

(a) TEST. Permits self-test in the selected mode. The transponder set can also reply to ground interrogations in the selected mode while being tested.

(b) On. Permits set to reply in the selected mode.

(c) OUT. Disables replies.

(17) MODE 2 code selectors. Select the desired reply codes for Mode 2. The cover over the mode select switches must be slid forward to display the selected Mode 2 code.

(18) POS IDENT pushbutton (control wheels, fig. 2-16). When pressed, transponder transmits identification reply to ground.

c. Transponder Set Operation (APX-100).

(1) Turn-on procedure:

1. MASTER switch STBY. Depending on the type of receiver installed, the NO GO indicator may illuminate. Disregard this signal.

(2) Test procedure:

NOTE

Make no checks with the master switch in EMER, or with M-3/A codes 7600 or 7700 without first obtaining authorization from the interrogating station(s).

1. Allow set two minutes to warm up.
2. Select codes assigned for use in modes 1 and 3/A by depressing and releasing the push-button for each switch until the desired number appears in the proper window.
3. Lamp indicators - Operate press-to-test feature.
4. M-1 switch - Hold in TEST. Observe that no indicator lamps illuminate.
5. M-1 switch - Return to ON.
6. Repeat steps 4 and 5 for the M-2, M3A and M-C mode switches.
7. MASTER control - NORM.
8. MODE 4 code control - A. Set a code in the external computer.
9. MODE 4 AUDIO/OUT switch - OUT.

(3) Modes 1, 2, 3/A, and/or 4 operating procedure:

NOTE

If the external security computer is not installed, a NO GO light will illuminate any time the Mode 4 switch is moved out of the OFF position.

1. MASTER control - NORM.

2. M-1, M-2, M-3/A, and/or MODE 4 ON-OUT switches ON. Actuate only those switches corresponding to the required codes. The remaining switches should be left in the OUT position.
3. MODE 1 code selectors - Set (if applicable).
4. MODE 3/A code selectors - Set (if applicable).
5. MODE 4 code control - Set (if required).
6. MODE 4 REPLY indicator - Monitor to determine when transponder set is replying to a SIF interrogation.
7. MODE 4 AUDIO OUT switch - Set (as required to monitor Mode 4 interrogations and replies).
8. MODE 4 audio and/or indicator - Listen and/or observe (for Mode 4 interrogations and replies).
9. IDENT-MIC switch - Press to ident momentarily.
10. MODE 4 TEST/OUT switch - TST.
11. Observe that the TEST GO indicator lamp illuminates.
12. MODE 4 TEST/OUT switch - ON.
13. ANT switch - BOT.
14. Repeat steps 4, 5, and 6. Observe that the TEST GO indicator illuminates.
15. ANT switch - TOP.
16. Repeat step 14.
17. ANT switch - DIV.
18. Repeat step 14.
19. When possible, obtain the cooperation of an interrogating station to exercise the TEST mode. Execute the following three steps:
    a. RAD TEST OUT switch - RAD TEST.
    b. Obtain verification from interrogating station that a TEST MODE reply was received.
    c. RAD TEST OUT switch - OUT.

(4) Transponder set identification position operating procedure: The transponder set can make identification-position replies while operating in code Modes 1, 2, and/or 3/A, in response to ground station interrogations. This type of operation is initiated by the operator as follows:

1. Modes 1, 2, and/or 3/A On, as required.
2. IDENT-MIC switch Press momentarily to IDENT, when directed.

NOTE

Holding circuits within the transponder receiver-transmitter will transmit identification position signals for 15 to 30 seconds. This is normally sufficient time for ground control to identify the aircraft's position. During this 15- to 30-second period, it is normal procedure to acknowledge via the aircraft communications set that identification position signals are being generated.

NOTE

Set any of the M1, M2, M3/A, M C, or MODE 4 switches to OUT to inhibit transmission of replies in undesired modes.

NOTE

With the IDENT/OUT/MIC switch set to the MIC position, the POS IDENT button must be depressed to transmit identification pulses.

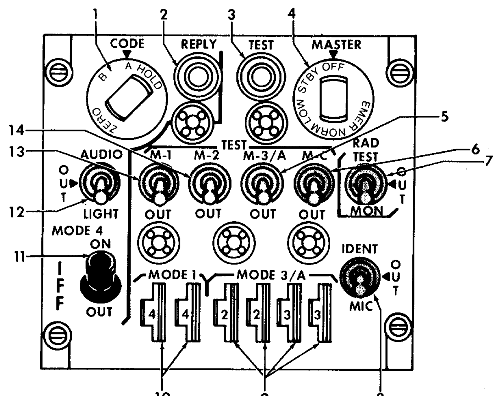
(5) Shutdown procedure:

1. To retain Mode 4 code in external computer during a temporary shutdown:
    a. MODE 4 CODE switch Rotate to HOLD.
    b. Wait 15 seconds.
    c. MASTER control OFF.
2. To zeroize the Mode 4 code in the external computer turn MODE 4 CODE switch to ZERO.

3. MASTER control - OFF. This will automatically zeroize the external computer unless codes have been retained (step 1. above).

3-28. TRANSPONDER SET (APX-101).

a. Description. The transponder set (fig. 3-31) is an identification, position tracking, altitude reporting, and emergency tracking device. This set receives, decodes, and responds to interrogations by search radar. The range of the set is normally limited to line-of-sight. The transponder is protected by the 3-ampere TRANSPONDER circuit breaker located on the overhead circuit breaker panel (fig. 2-23). The associated antenna is shown in figure 2-1.



1. CODE control
2. REPLY indicator
3. TEST indicator
4. MASTER control
5. M-3/A TEST-OUT switch
6. M-C TEST-OUT switch
7. RAD TEST-MON-OUT switch
8. IDENT-MIC-OUT switch
9. MODE 3/A code selectors
10. MODE 1 code selectors
11. MODE 4 ON-OUT switch
12. MODE 4 AUDIO-OUT-LIGHT switch
13. M-1 TEST-OUT switch
14. M-2 TEST-OUT switch

Figure 3-31. Transponder Control Panel (APX-101)

b. Controls/Indicators and Functions.

(1) CODE control. Selects dialed-in Mode 4 code of the day.

(2) REPLY light. Indicates valid Mode 4 interrogations and replies when MODE 4 AUDIO LIGHT switch is in AUDIO or LIGHT positions.

(3) TEST light. Indicates the proper response has been generated when the M-1, M-2, M-3/A, or M-C switches are placed in TEST position. Also illuminated when RAD TEST-MON switch is in MON position and replies are made to SIF interrogations.

(4) MASTER control.

(a) OFF. Turns set off.

(b) STBY. Places set in warm-up (standby) condition.

(c) LOW. Places set at low sensitivity.

(d) NORM. Operates set at normal sensitivity.

(e) EMER. Transmits emergency reply.

(5) M-1, M-2, M-3/A and M-C switches.

(a) ON. Permits set to reply in the selected mode.

(b) OUT. Disables replies.

(c) TEST. Permits self test in the selected mode. The transponder set can also reply to ground interrogations in the selected mode while being tested.

(6) RAD TEST-MON switch.

(a) RAD TEST. Enables an appropriately equipped transponder to reply to TEST mode interrogations from an AN/UPM-92, or similar test set.

(b) *MON*. Turns on SIF monitoring circuits in the transponder test set.

(7) *IDENT-MIC switch.*

(a) *IDENT*. Activates identification features.

(b) *MIC*. Enables either control wheel POS IDENT button to activate transmission of ident signal from transponder.

(8) *MODE 1 and MODE 3/A code selectors*. Selects the desired reply codes for modes 1 and 3/A.

(9) *MODE 4 ON-OUT switch*.

(a) *ON*. Permits transponder to decode a Mode 4 interrogation. The transponder computer must be installed in order for the transponder set to make a reply to a Mode 4 interrogation.

(b) *OUT*. Disables Mode 4 decoding.

(10) *MODE 4 AUDIO LIGHT switch.*

(a) *AUDIO*. Permits aural and reply light monitoring of valid Mode 4 interrogations and replies.

(b) *LIGHT*. Permits only REPLY light monitoring.

(11) *IFF ANTENNA switch (transponder antenna control panel, fig. 3-32).* Controls which antenna is used with set.

(a) *UPPER.* Connects upper transponder antenna to set.

(b) *BOTH.* Allows diversity operation using both antennas.

(c) *LOWER*. Connects lower transponder antenna to set.

(12) *POS IDENT.* pushbutton (control wheels, fig. 2-16). When pressed, transponder transmits identification reply to ground.

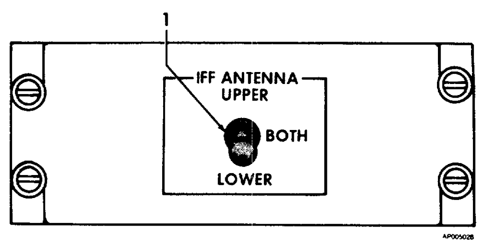
c. *Transponder Set Operation (APX-101).*

(1) *Turn-on procedure:*

1. MASTER control NORM (allow 2minute warmup period).

(2) *Test procedure:*

1. RAD TEST-MON switch RAD TEST.



1. IFF ANTENNA switch

Figure 3-32. IFF Antenna Switch

2. TEST indicator light Press to test, insure light illuminates.
3. M-1, M-2, M-3/A and M-C switches Individually hold each mode switch in the TEST position. The green TEST indicator light should illuminate each time.
4. RAD TEST-MON switch MON. (3) Modes 1, 2, 3/A, and/or 4 operating procedure:

NOTE

MODE 2 code selectors are located on the transponder receiver-transmitter and should be set prior to flight when required.

1. MASTER control NORM.
2. M-1, M-2, M-3/A, and/or MODE 4 ON-OUT switches ON. Actuate only those switches corresponding to the required codes. The remaining switches should be left in the OUT position.
3. MODE 1 code selectors Set (if applicable).

4. MODE 3/A code selectors Set (if applicable).
5. Mode 4 code control Set (if required).
6. MODE 4 REPLY indicator Monitor to determine when transponder set is replying to a SIF interrogation.
7. MODE 4 AUDIO OUT switch Set (as required to monitor Mode 3 interrogations and replies).
8. MODE 4 audio and/or REPLY indicator Listen and/or observe (for Mode 4 interrogations and replies).
9. IDENT-MIC switch Press to ident momentarily.

(4) Transponder set identification position operation procedure: The transponder set can make identification-position replies while operating in code Modes 1, 2, and/or 3/A, in response to ground station interrogations. This type of operation is initiated by the operator as follows:

1. Modes 1, 2, and/or 3/A Operating.
2. IDENT-MIC switch Press momentarily to IDENT, when directed.

NOTE

Holding circuits within the transponder receiver transmitter will transmit identification-position signals for 15 to 30 seconds. This is normally sufficient time for ground control to identify the aircraft's position. During this 15 to 30 second period, it is normal procedure to acknowledge via the aircraft communications set that identification-position signals are being generated.

NOTE

Set any of the M1, M2, M3/A, M-C, or MODE 4 switches to OUT to inhibit transmission of replies in undesired modes.

NOTE

With the IDENT/OUT/MIC switch set to the MIC position, the microphone press-to-talk key must be depressed to transmit identification pulses.

(5) Shutdown procedure:

1. To retain Mode 4 code in external computer during a temporary shutdown:
   a. MODE 4 CODE switch Rotate to HOLD.
   b. Wait 15 seconds.
   c. MASTER control OFF.
2. To zeroize the Mode 4 code in the external computer turn MODE 4 CODE switch to ZERO.
3. MASTER control OFF. This will automatically zeroize the external computer unless codes have been retained (step 1. above).

3-29. PILOT'S ENCODING ALTIMETER.

a. Description. The encoding altimeter (fig. 3-33) provides the pilot with an indication of his altitude above sea level in addition to providing the transponder with altitude information for use in Mode C. The encoding altimeter is protected by the 5-ampere PILOTS ALT ENCD circuit breaker located on the overhead circuit breaker panel (fig. 2-23).

b. Controls/Indicators and Functions.

(a) MILLIBARS. Indicates local barometric pressure in millibars. Adjusted by use of set knob.

(1) IN HG. Indicates local barometric pressure in inches of mercury. Adjusted by use of set knob.

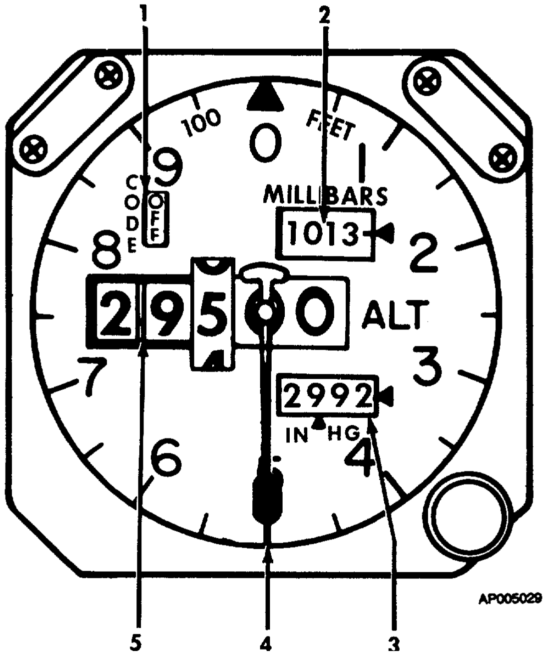
(2) Drum indicator. Indicates aircraft altitude in ten thousands, thousands, and hundreds of feet above sea level.

(3) Needle indicator. Indicates aircraft altitude in hundreds of feet with subdivisions at fifty-foot intervals.

(4) CODE flag (Pilot only). Presence indicates loss of power to instrument.

c. Encoding Altimeter Operation.

(1) Turn-on procedure: Encoding altimeter will operate when transponder is operating with M-C switch set to center position.



1. COD[E OFF flag
2. MILLIBARS display
3. IN HG display
4. Needle pointer
5. Drum display

Figure 3-33. Pilot's Encoding Altimeter

1. Barometric set knob - Set desired altimeter setting in IN. HG. window.
2. CODE OFF flag - Check not visible.
3. Needle indicator - Check operation.

NOTE

If the altimeter does not read within 70 feet of field elevation when the correct local barometric setting is used, the altimeter needs calibration or internal failure has occurred. An error of greater than 70 feet also nullifies use of the altimeter for IFR Flight.

d. Encoding Altimeter Emergency Operation.

1. Altimeter circuit breaker - Pull (if encoder fault occurs).

3-30. GROUND PROXIMITY ALTITUDE ADVISORY SYSTEM (GPAAS).

WARNING

The ground proximity altitude advisory system will provide little, if any, warning for flight into precipitous terrain approaching a sheer wall if there is little gradually rising terrain before reaching the steep terrain.

a. Description. The ground proximity altitude advisory system (GPAAS) is provided to aid the flight crew in terrain avoidance (fig. 3-34).

The GPAAS is a completely automatic system (requiring no input from the crew) which continuously monitors the aircraft's flight path at altitudes of between 100 and 2000 feet above ground level (AGL).

The GPAAS computer processes the data and, when conditions warrant, selects the appropriate digitized voice advisory/warning message from its memory. This message is then announced over the pilot's and copilot's audio systems. If the condition is not corrected, the GPAAS will rearm, and will again announce and repeat the warning if the condi-

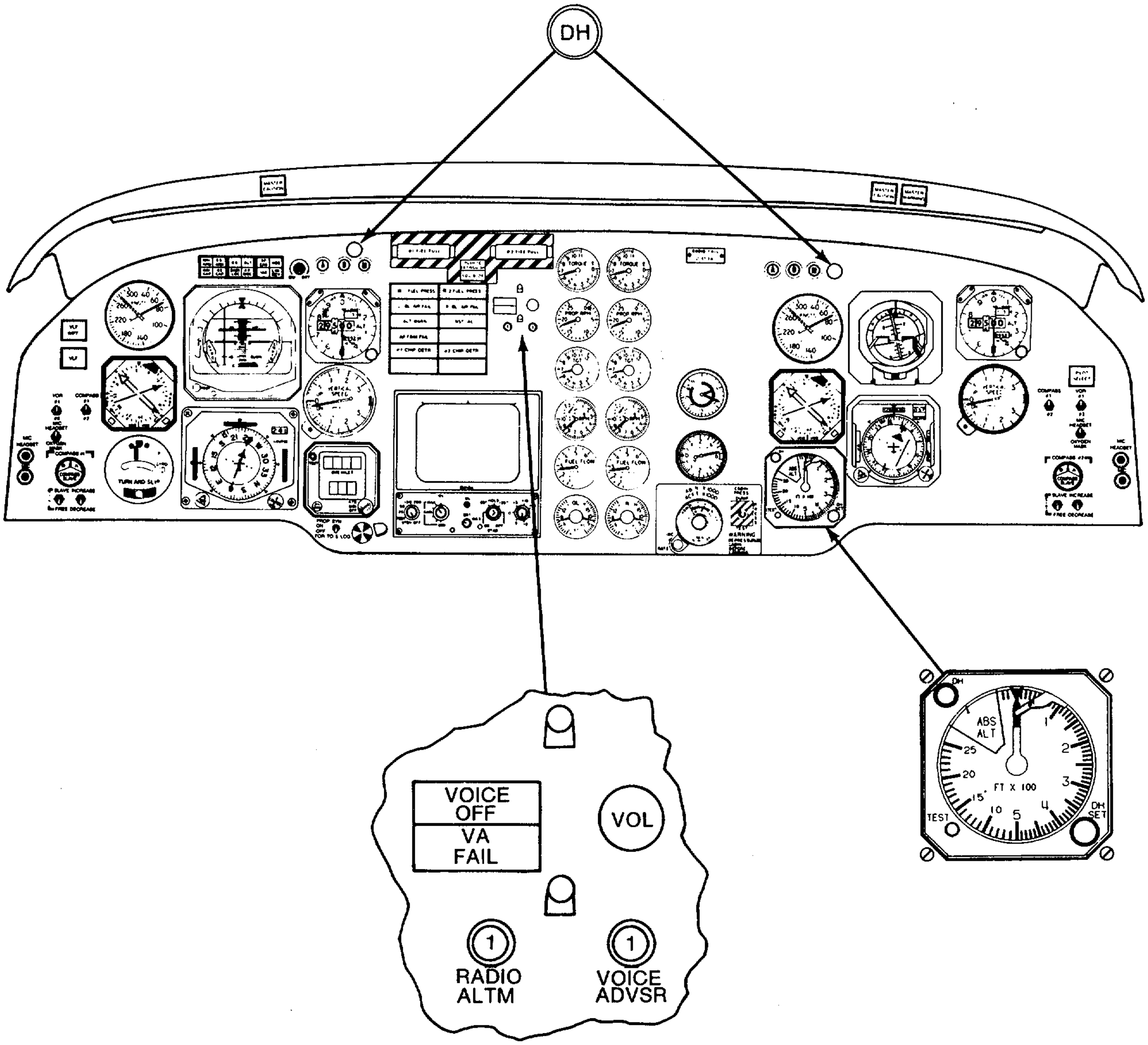


Figure 3-34. Ground Proximity Altitude Advisory System Controls and Indicator

tion recurs. The GPAAS computer remains ready to announce a different message during the intervals between repetitions. All messages are disabled below 100 feet AGL.

The GPAAS system receives 28 VDC power through a 1-ampere circuit breaker placarded VOICE ADVSR, located on the instrument panel.

(1) GPAAS switch-indicator lights. A switch-indicator is located on the instrument panel. The upper half of the switch-indicator (yellow) is placarded VOICE OFF. The lower half is an indicator (red) only and is placarded VA FAIL.

Depressing the upper (VOICE OFF) switch indicator disables the GPAAS voice advisory, and illuminates the VOICE OFF indicator light.

The VA FAIL annunciator light (red) will illuminate when the GPAAS fails.

(2) GPAAS volume control. A GPAAS volume control placarded VOL, located on the instrument panel, controls the audio volume of the GPAAS advisory/warning messages down to a certain minimum level.

(3) GPAAS Aural Warning Indications. The following is a list of aural indications. Due to the possibility of activating more than one condition at a time, a warning priority has been established. The highest priority message will be announced first. If a higher priority item is received after a message is started, voice annunciation of the higher priority message shall be announced after a lower priority message in progress at the end of the message segment. It will not stop in the middle of a word. On messages that are repeated three times at four second intervals, the priority list will be scanned for higher priority messages and will insert them in the interval between the messages. The messages provided by the system are listed in descending order of priority as follows:

1. "Two thousand" at 2000 feet AGL.
2. "One thousand" at 1000 feet AGL.
3. "Nine hundred" at 900 feet AGL.
4. "Eight hundred" at 800 feet AGL.
5. "Seven hundred" at 700 feet AGL.
6. "Six hundred" at 600 feet AGL.
7. "Five hundred" at 500 feet AGL.
8. "Check gear" will be announced immediately after 500 foot announcement if gear is not down.
9. "Four hundred" at 400 feet AGL.
10. "Check gear" will be announced immediately after 400 foot announcement if gear is not down.
11. "Three hundred" at 300 feet AGL.
12. "Check gear" will be announced immediately after 300 foot announcement if gear is not down.
13. "Two hundred" at 200 feet AGL.
14. "Check gear" will be announced immediately after 200 foot announcement if gear is not down.
15. "One hundred" at 100 feet AGL.
16. "Check gear" will be announced immediately after 100 foot announcement if gear is not down.
17. "Minimum, minimum" at decision height.
18. "Localizer" at 1.3 to 1.5 dots either side of center of beam. Will be repeated three times at four second intervals.
19. "Glideslope" at 1.3 to 1.5 dots above or below center of beam. Will be repeated three times at four second intervals.
20. "Altitude, altitude" at excessive deviation from altitude selected on the altitude alerter.
21. "Check trim" when trim failure has occurred. Will be repeated three times at four second intervals.
22. "Autopilot" when autopilot has disconnected.

The highest priority message will be announced first. If a higher priority item is received after a message has been started, voice annunciation of the higher priority message shall immediately override the lower priority message in progress at the end of the message segment. It will not stop in the middle of a word. On messages that are repeated three times at four second intervals, the priority list will be scanned for higher priority messages. If found, they will be inserted into the interval between the messages.

b. Normal Operation.

(1) Turn-on procedure. The GPAAS is operable when the following conditions have been met:

1. Battery switch - ON.
2. Avionics master switch - On.
3. VOICE ADVSR circuit breaker - SET.
4. RADIO ALTM circuit breaker - SET.
5. VA FAIL annunciator light - Extinguished.

(2) GPAAS ground check.

1. GPAAS voice advisory VOL control - Full clockwise.

2. VOICE OFF switch-indicator - Extinguished.

3. Audio control panel - Set listening audio level.

4. VA FAIL annunciator light - Extinguished.

5. Radio altimeter DH - SET control Set to 200 feet.

6. Radio altimeter TEST switch - Press and hold. "Minimum, minimum" will be annunciated once followed by the illumination of the VA FAIL light.

7. Radio altimeter TEST switch - Release.

c. GPAAS Modes of Operation. The GPAAS operates in the following modes of operation:

(1) Aural "TWO THOUSAND" advisory (mode 1). The aural advisory "TWO THOUSAND" indicates that the aircraft is at a radio altitude of 2000 feet above ground level. This advisory is canceled when valid information from the radio altimeter is lost, during climb, or whenever the aircraft is out of the operating altitude range of the radio altimeter.

(2) Hundred foot increment aural altitude advisories (mode 2). The aural advisories "ONE THOUSAND, NINE HUNDRED, EIGHT HUNDRED, SEVEN HUNDRED, SIX HUNDRED, FIVE HUNDRED, FOUR HUNDRED, THREE HUNDRED, TWO HUNDRED, ONE HUNDRED" indicate that the aircraft is at the associated radio altitude in feet above ground level. This advisory is canceled when valid information from the radio altimeter is lost, during climb, or whenever the aircraft is out of the operating altitude range of the radio altimeter.

(3) Aural "LOCALIZER" advisory (mode 3). The aural advisory "LOCALIZER" indicates that the aircraft has deviated from the center of the localizer beam in excess of 1.3 to 1.5 dots. The localizer advisory is armed when a valid localizer signal is detected and the aircraft is below 1000 feet above ground level. It will be repeated no more that 3 times at 4 second intervals unless the aircraft is returned to less than 1.3 to 1.5 dots from the center of the localizer course. The localizer advisory is disabled when a valid localizer signal has been lost, during climb, below the decision height set on the radio altimeter, or if the navigation receiver is not tuned to a localizer frequency.

(4) Aural "CHECK GEAR" advisory (mode 4). The aural "CHECK GEAR" advisory indicates that the aircraft has descended to 500 feet AGL and the landing gear is not down. This advisory is repeated once at 100 foot intervals down to 100 feet AGL.

(5) Aural "GLIDESLOPE" advisory (mode 5). The aural advisory "GLIDESLOPE" indicates that the aircraft has exceeded 1.3 to 1.5 dots above or below the center of the glideslope beam. The glideslope advisory is armed when a valid glideslope signal is detected and the aircraft is below 1000 feet AGL. It will be repeated no more than three times at 4 second intervals unless the aircraft is returned to less than 1.3 to 1.5 dots from the center of the beam. The glideslope advisory is disabled upon loss of a valid glideslope signal, during climb, on a localizer back course, below the decision height set on the radio altimeter or, if the navigation receiver is not tuned to a localizer frequency. This advisory is inhibited by the weight on wheels strut switch.

(6) Aural advisory "MINIMUM, MINIMUM" (mode 6). The aural advisory "MINIMUM, MINIMUM" indicates that the aircraft is at the radio altitude selected by the crew with the radio altimeter indicator decision height knob. This advisory is canceled when valid information from the radio altimeter is lost, during climb, whenever the aircraft is above 1000 feet AGL, or whenever the aircraft is out of the operating altitude range of the radio altimeter.

(7) Aural "ALTITUDE, ALTITUDE" advisory (mode 7). The aural advisory "ALTITUDE, ALTITUDE" indicates the approach to a preselected altitude as the aircraft reaches a point 1000 feet from the selected altitude or, after reaching the selected altitude, when the aircraft deviates more than 250 feet from the selected altitude.

(8) Aural "CHECK TRIM, CHECK TRIM, CHECK TRIM" advisory. The aural advisory "CHECK TRIM, CHECK TRIM, CHECK TRIM" indicates that the autopilot has had a trim failure.

(9) Aural "AUTOPILOT" advisory. The aural advisory "AUTOPILOT" indicates that the autopilot has disengaged.

d. Emergency procedures. If an emergency or malfunction makes it necessary to disable the GPAAS, pull the VOICE ADVSR circuit breaker located on the instrument panel (GPAAS audio may be turned off by depressing the VOICE OFF switch).

CHAPTER 3A
AVIONICS (C-12 *D2 F1)*
Section I. GENERAL

3.1 DESCRIPTION.

This chapter covers the avionics equipment configuration installed in C-12***D2 F1*** aircraft. It includes a brief description of the avionics equipment, its technical characteristics, capabilities, and locations. Avionics installed in C-12 ***C D1*** aircraft, are covered in Chapter 3. Avionics installed in C-12 ***F2*** aircraft, are covered in Chapter 3B.

3-2. AVIONICS EQUIPMENT CONFIGURATION .

The avionics configuration of the aircraft is comprised of three groups of electronic equipment. The communication equipment group consists of the interphone, UHF command, VHF command, and HF command systems. The navigation equipment group provides the pilot and copilot with the instrumentation required to establish and maintain an accurate flight course and position and to make an approach on instruments under instrument meteorological conditions (IMC). The navigation group includes equipment for determining altitude, attitude, position, destination, range 'and bearing, heading reference, ground speed, and drift angle. The transponder and radar group includes an identification, position and emergency tracking system, and a radar system to locate potentially dangerous weather areas. A ground proximity altitude advisory system (GPAAS) is also installed.

3-3. POWER SOURCE.

a. DC Power. DC power for the avionics equipment is provided by four sources: the aircraft battery, left and right generators, and external power. Power is routed through two 50-ampere circuit breaker to the avionics power relay which is controlled by the AVIONICS MASTER POWER SWITCH (fig. 2-8) on the overhead control panel. Individual system circuit breakers and the associated avionics busses are shown in fig. 2-21. With the switch in the ON position, the avionics power relay is de-energized and power is applied through both 50-ampere AVIONICS MASTER. POWER #1 and #2 circuit breakers to the individual avionics circuit breakers on the overhead circuit breaker panel (fig. 2-23).

NOTE

Should the AVIONICS MASTER POWER switch fail to operate, power to the individual avionics circuit breakers can be provided by pulling the 5-ampere circuit breaker, placarded AVIONICS MASTER CONTROL, located on the overhead circuit breaker panel.

In the off (aft) position, the relay is energized and power is removed from avionics equipment. When external power is applied to the aircraft, the avionics power relay is normally energized, removing power from the avionics equipment. To apply external power to the avionics equipment, move the AVIONICS MASTER POWER switch to the EXT PWR position. This will de-energize the avionics power relay and allow power to be applied to avionics equipment.

a. AC Power. AC power for the avionics equipment is provided by two 750 volt-ampere inverters. The inverters supply 115-volt and 25-volt single-phase AC power when operated by the INVERTER #1 or #2 switches. Normally both switches will be ON for operation. However, either inverter will provide power for all avionics equipment requiring AC power, should one inverter fail. 115-volt AC power from the inverters is routed through fuses and transformers in the nose avionics compartment. The transformers provide the required 26 volts AC needed by avionics equipment.

Section II. Communications

3-4. DESCRIPTION.

The communications equipment group consists of the interphone, UHF command, VHF command, and HF command systems.

3-5. MICROPHONE SWITCHES, MICROPHONE JACKS, AND HEADSET JACKS .

a. Microphone Switches. A bi-level microphone switch placarded INTPH, XMIT-MIC, is located on the pilot's and copilot's control wheels (fig. 2-16). A foot operated microphone key switch is provided for the copilot.

b. Controls and Functions.

(1) INTPH, XMIT-MIC switch. Keys interphone or selected facility.

(a) INTPH. When depressed to first detent, keys interphone facility regardless of position of transmitter selector switch.

(b) XMIT. When depressed fully, keys facility selected.

c. Microphone Jacks. The pilot and copilot are each provided a microphone jack, placarded MIC located on the extreme left and right sides of the instrument panel (fig. 2-26) for use with the hand held microphone; MIC HEAD SET for use with headset microphones, and a microphone jack for the oxygen mask microphone, located next to the oxygen outlets. Microphone jack functions are as follows:

d. Controls and functions.

(1) MIC jack. Provides a means of connecting hand-held microphone with push-to-talk capability to

(2) the audio system.

(2) MIC HEADSET jack. Provides a means of connecting microphone headset assembly to audio system.

e. Microphone Jack Selector Switches. The pilot and copilot are each provided with a switch placarded MIC HEADSET - OXYGEN MASK located on the extreme left and right sides of the instrument panel (fig. 2-26). Microphone jack selector switch functions are as follows:

f Controls and Functions.

(1) MIC HEADSET OXYGEN MASK

switch. Selects which microphone will be connected to audio system.

(1) MIC HEADSET. Utilizes either hand-held microphone or headset-microphone assembly with audio system.

(3) OXYGEN MASK. Utilizes microphone in oxygen mask assembly with audio system.

g. External Headset-Microphone Jack. A jack on the nose gear strut placarded MIC JACK is provided for use by ground personnel. The jack connects headphones and microphone to the aircraft's interphone system.

h. Cockpit Floor Foot Microphone Switch. A floor mounted foot microphone switch is installed on the copilot's side. The switch allows the copilot to key the system selected by the transmitter selector switch on the audio control panel, while utilizing his hands for other operations.

3-6. INTERPHONE SYSTEM.

a. Description. Individual audio control panels, part of the radio panel, are provided for the a pilot and copilot (fig. 3-1). The controls and switches provide for selection of transmission on VHF, UHF, or HF transmitters and volume control of communication, navigation and interphone audio signals. Figure 3-1 illustrates the pilot's and copilot's audio control panel.

b. Controls and Functions, Audio Control Panels.

(1) Transmitter selector switch. Controls operation of selected system.

(a) VHF #1. Routes key and mic signals to the #1 VHF transceiver.

(b) VHF #2. Routes key and mic signals to the #2 VHF transceiver.

(c) HF. Permits reception of audio from the HF transceiver and routes key and microphone signals to the HF transceiver.

(d) UHF: Permits reception of audio from the UHF transceiver and routes key and microphone signals to the UHF transceiver.

(e) PA. Permits cabin paging.

(2) VOL control. Controls audio volume.

(a) SPKR. Adjusts volume of cock- B-pit speakers.

(b) PH. Adjusts volume of headset.

(c) PA. Adjusts volume of cabin speakers.

(d) DME/TAC. Adjusts volume of DME/TAC audio. Located on pilot's audio panel only.

(3) Inter-communication switching. Permits monitoring of selected audio regardless of position of transmitter selector switch.

(a) VHF #1. Permits monitoring of #1 VHF audio.

(b) VHF #2. Permits monitoring of #2 VHF audio.

(c) HF. Permits monitoring of HF audio.

(d) UHF. Permits monitoring of UHF audio.

(e) *NAV #1*. Permits monitoring of #1 NAV audio.

(f) *NAV #2*. Permits monitoring of #2 NAV audio.

(g) *MKR BCN #1, #2.* Permits monitoring of #1 and #2 marker beacon audio.

(h) *DME/TACAN*. Permits monitoring of DME/TACAN audio.

(i) *ADF #1*. Permits monitoring of #1 ADF audio.

(j) *ADF #2*. Permits monitoring of #2 ADF audio.

(4) *AUDIO SPKR* switch. Determines where selected audio will be heard.

(5) *AUDIO EMER-NORM switch*. Controls routing of received audio signals. Located on pilot's audio panel only.

(a) *EMER.* Audio signal bypasses amplifier. Applies audio signal to headphone only.

(b) *NORM.* Routes audio signal through amplifier to speaker or headphone.

(6) *VOICE-BOTH-RANGE switch*. Controls both voice and range tone.

(a) *VOICE.* Kills range, allows voice (ADF and VOR).
(b) *BOTH.* Allows both voice and range (ADF and VOR).

(c) *RANGE*. Kills voice, allows 1020 Hz range tone (ADF and VOR).

(7) M*KR BCN #1* and #2 HI-LO-TEST switch. Selects either sensitivity or TEST function.

(a) *HI.* Selects high sensitivity.

(b) *LO.* Selects low sensitivity.

(c) *TEST*. Permits testing of marker beacon annunciators.

(d) *VOL control*. Adjusts volume of marker beacon audio.

c. *Audio Control Panel Operation*.

(1) *Turn-on procedure*. The audio control panel is on whenever electrical power is applied to the aircraft and the AVIONICS MASTER POWER switch is ON.

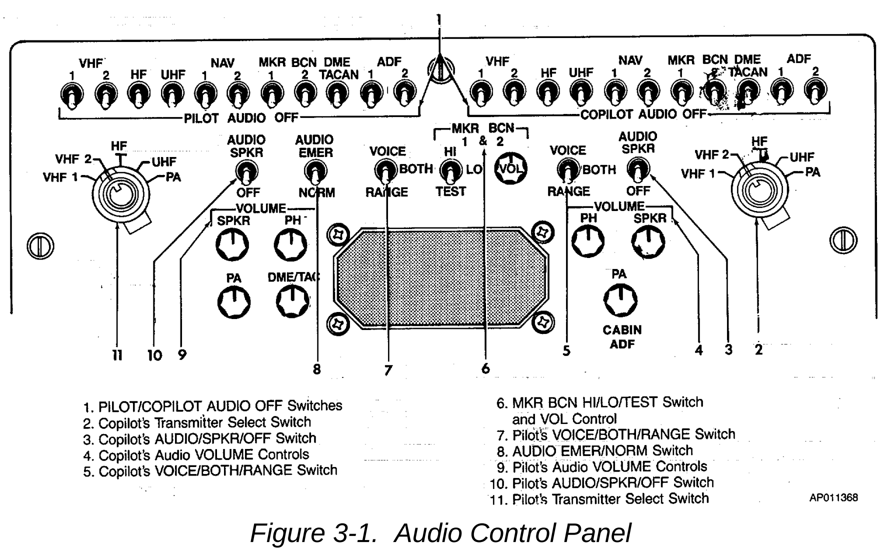


Figure 3-1. Audio Control Panel

(2) *Interphone operating procedure.*

1. Transmitter selector switch PA.
2. Microphone switch Press (listen for sidetone).
3. VOL control Adjust sidetone and interphone audio level in headphone.

(3) *Navigational aid and receiver monitoring procedure.*

1. Inter-communication switches As required.
2. VOL control Adjust volume control of system being monitored.

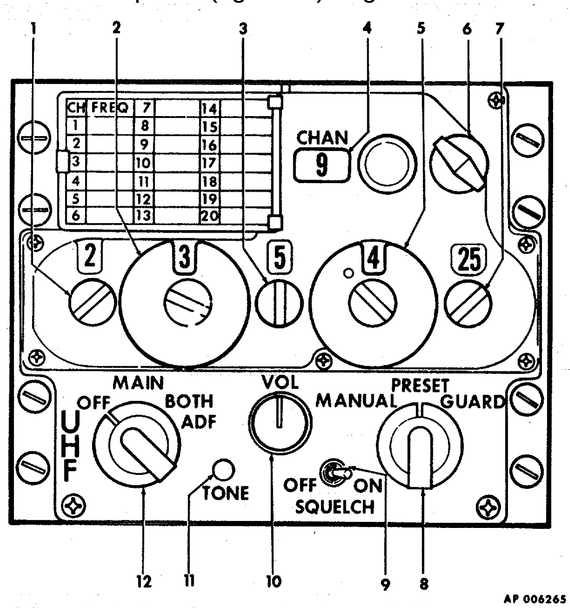
(4) *Transmitting procedure.*

1. Transmitter selector switch As required.
2. Microphone switch Press (listen for sidetone).
3. Applicable transceiver volume control Adjust for comfortable audio level.

d. Audio Control Panel Emergency Operation. An audio fail-safe system is provided for use in the event of an audio amplifier failure. If an audio amplifier fails, receiver audio bypasses the amplifier and is applied directly to the headsets. No audio will be available to the overhead speakers.

3-7. UHF COMMAND SET (AN/ARC-164).

a. Description. The UHF command set provides two-way amplitude modulated (AM) voice communication within the frequency range of 225. 000 to 399.975 MHz for a distance range of approximately 50 miles line-of-sight. Channel selection is spaced at 0.025 MHz intervals. Additionally, a separate receiver is incorporated to provide monitoring capability for the UHF guard frequency (243.0 MHz). The audio output of the UHF set is applied to the audio control panel where it is made available to the headsets and speakers. The UHF command set is protected by a 7 1/2-ampere circuit breaker placarded UHF, located on the overhead circuit breaker panel (fig. 2-23). figure 3-2 illustrates the



1. Manual Frequency (100-MHz) Selector-Indicator
2. Manual Frequency (10-MHz) Selector-Indicator
3. Manual Frequency (1-MHz) Selector-Indicator
4. CHAN Indicator
5. Manual Frequency (KHz) Selector-Indicator
6. Preset Channel Selector
7. Manual Frequency (10 and 1-KHz) Selector-Indicator
8. Mode Selector
9. SQUELCH Switch
10. VOL Control
11. TONE Pushbutton
12. Function Switch

UHF command set. The associated blade type antenna is shown in figure 2-1.

b. Controls and Functions.

(1) Manual frequency selector switch (hundreds). Selects hundreds digit of frequency (either 2 or 3) in MHz.

(2) Manual frequency selector switch (tens). Selects tens digit of frequency (0 through 9) in MHz.

(3) Manual frequency selector switch (units). Selects units digit of frequency (0 through 9) in MHz.

(4) Manual frequency selector switch (tenths). Selects tenths digit of frequency (0 through 9) in MHz.

(5) Manual frequency selector switch (hundredths and thousandths). Selects hundredths and thousandths digits of frequency (00, 25, 50, or 75) in MHz.

(6) Preset channel selector switch. Selects one of 20 preset channels.

(7) MANUAL-PRESET-GUARD switch. Selects method of frequency selection.

(a) MANUAL. Any one of 7,000 frequencies is manually selected using the five frequency selector switches.

(b) PRESET. Frequency is selected using the preset channel selector switch for selecting any one of 20 preset channels.

(c) GUARD. The main receiver and transmitter are automatically tuned to the guard frequency and the guard receiver is disabled.

(8) SQUELCH ON-OFF switch. Turns on or off squelch circuit of main receiver.

(9) VOL control. Adjusts volume.

(10) TONE switch. Selects transmission of a 1,020 Hz tone on the selected frequency.

(11) Function switch. Selects operating function.

(a) OFF. Shuts down equipment.

(b) MAIN. Selects main receiver and transmitter.

(c) BOTH. Selects main receiver, transmitter, and guard receiver.

(d) ADF. Selects ADF or homing system (if installed) and main receiver.

c. UHF Command Set Operation.

(1) Turn on procedure. Function selector switch (UHF control panel) BOTH.

(2) Receiver operating procedure.

1. Function selector switch As required.
2. Frequency Select required frequency using either preset channel control or manual frequency selector controls.

NOTE

The PRESET channel selector and manual frequency selectors are inoperative when the MANUAL-PRESET-GUARD switch is set to GUARD.

3. Volume Adjust.
4. Squelch As required.

(3) Transmitter operating procedure.

1. Transmitter selector switch (audio control panel, fig. 3-1) UHF position.
2. Microphone switch Press.

(4) Shutdown procedure. Function selector switch (UHF control panel) OFF.

d. UHF Command Set Emergency Operation.

NOTE

Transmission on emergency frequencies (guard channel) shall be restricted to emergencies only. An emergency frequency of 121.500 MHz is also available on the VHF command radio set.

1. Transmitter selector switch (audio control panel, fig. 3-1) -UHF position.
2. Mode selector switch (UHF control panel) GUARD.
3. Microphone switch Press.

3-8. VHF COMMAND SET (KTR-908).

a. Description. The VHF command set is a line-of-sight radio transceiver which provides transmission and reception of amplitude modulated signals in the very high frequency range of 118.000 to 151.975 MHz. The two, KTR-908 transceivers incorporate identically operated COMM #1 and COMM #2 KFS-598A control units. The control units provide means for operating the transceivers, and displays selected frequencys. Audio signals are applied through the pilot and copilot transmitter selector switches, through the VHF-1/VHF-2 audio switches and the AUDIO-SPKR-OFF (headset) selector switches. Each VHF radio set is protected by a 7 1/2 ampere circuit breaker placarded VHF #1 or VHF #2, located on the overhead circuit breaker control panel (fig. 2-23). Figure 3-3 illustrates the VHF control unit. The associated antenna is shown in figure 2-1.

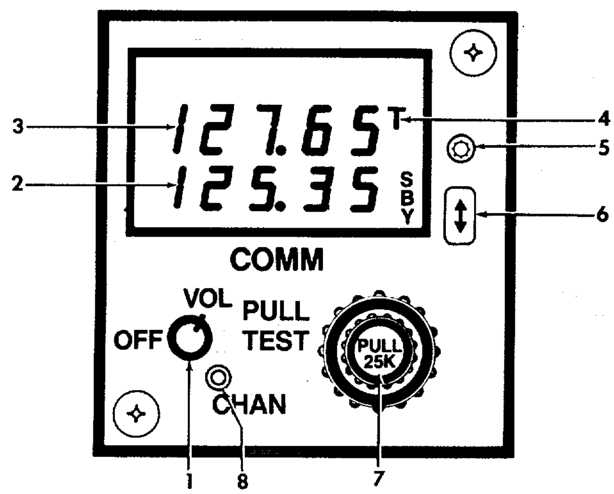
b. Controls and Functions.

(1) Volume control, off switch. Turning the OFF-VOL switch clockwise will turn the unit on. Turning the switch further clockwise will increase volume. The control unit volume control is aligned with the remote VOLUME-SPKR-PH switch (located on the audio control panel). The remote volume control level is designed so the audio level that is inputted to the control unit from the COMM receiver, is constant and at its maximum level.

(2) Display modes.

(a) Frequency mode. The upper display is the active frequency, or the frequency to which the transceiver is tuned. The lower display is a standby frequency. The standby frequency is changed by the tuning knobs in the lower right corner of the unit. The active/standby frequencies are interchanged by momentarily depressing the transfer switch located to the right of the display windows. A T will be displayed to the right of the active frequency, whenever the transceiver is transmitting.

(b) Channel mode. Momentarily pressing the CHAN switch while in the frequency mode puts the unit into channel mode. The upper display contains a CH corresponding to channel, and a channel number 1 thru 9. The lower display contains a frequency. Turning the tuning knobs will change the channel number provided that there is a valid frequency programmed into a different channel. If there are no valid frequencies programmed, the unit will display CH 1 in the active display and dashes in the standby display. Momentarily depressing the transfer switch returns the unit to the frequency mode placing the channel frequency in the active display with the previous active frequency in the standby display. If no channels are programmed, the active and standby frequencies are then exchanged. Momentarily pressing the CHAN switch returns the unit to the frequency mode and the standby and active frequencys return to what they were prior to entering channel mode.



1. OFF/VOL Control
2. SBY Frequency Display
3. Active Frequency Display
4. Transmit Symbol
5. Light Sensor
6. Frequency Transfer Switch
7. Frequency Selector Knobs
8. CHAN Switch

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(c) Program mode. Pressing and holding the CHAN switch for two seconds places the unit in the program mode. The unit will display a P and a channel number in the active display. A frequency or dashes will be displayed in the standby display. After entering the program mode, the channel number will flash indicating that rotating the tuning knobs will change the channel number. Momentarily pressing the transfer switch causes the channel number to stop flashing and the frequency to start flashing, indicating that turning the tuning knobs will change the frequency. Dashes will be displayed, when incrementing past the maximum or minimum frequency.

When the unit has been placed in the program mode, the last active frequency, whether it was in frequency or channel mode, will be tuned. If the unit was in channel mode, the unit will be tuned to the frequency of the channel which was in the active window before entering the program mode. If the frequency of that channel is changed, the tuned frequency of the unit is also changed. If dashes are shown in the standby window the unit is tuned to the previously tuned frequency that was in the active window in frequency mode. Momentarily pressing the CHAN switch returns the unit to its previous mode. No front panel activity for 20 seconds will also return the unit to frequency mode.

(3) Light sensor. A photocell automatically adjusts brightness of the display, based on ambient light conditions.

(4) Frequency transfer switch. Momentarily pressing the switch will interchange the active or standby frequency display.

(5) Frequency selector knobs.

(a) Frequency selection. In frequency mode, the transfer switch, when momentarily depressed, causes the active and standby frequencies to interchange. When the transfer switch is depressed and held, the two frequencies interchange on the display and approximately two seconds later the standby frequency blanks with the original active frequency reappearing in the active display. Depressing the transfer switch momentarily causes the standby frequency to reappear.

In the standby entry or in program mode with the frequency flashing the tuning knobs will tune the frequency in the standby display. The outer knob selects the single digit typically from 18 to 51 MHz. The inner knob when pushed in increments and decrements the 100 digit kHz in 50 kHz steps. When the inner knob is pulled out it increments and decrements the 100 digit kHz steps.

(6) Mode CHAN switch. Pressing the CHAN switch will transfer to the channel or program mode.

(a) Channel mode Momentarily press.

(b) Program mode Press and hold for two seconds.

(7) PULL Test switch. Pulling the PULL TST switch unsquelches the radio.

c. VHF Command Set Operation.

(1) Turn on procedure. OFF-VOL switch Turn clockwise.

(2) Operating procedure.

1. Transmitter selector switch (audio control panel) VHF-1/ VHF-2 position.
2. VHF-1/VHF-2 audio switch (audio control panel) On, as required.
3. MODE switch As required.
4. Frequency Set, as required.
5. Volume control Adjust, as required.
6. Microphone switch Press.

(3) Shutdown procedure. OFF-VOL switch Turn counter-clockwise to OFF position. d. VHF Command Unit Emergency Operation.

NOTE

Transmission on emergency frequency 121.500 MHz will be restricted to emergencies only. An emergency frequency of 243.000 MHz (guard channel) is also available on the UHF command radio set.

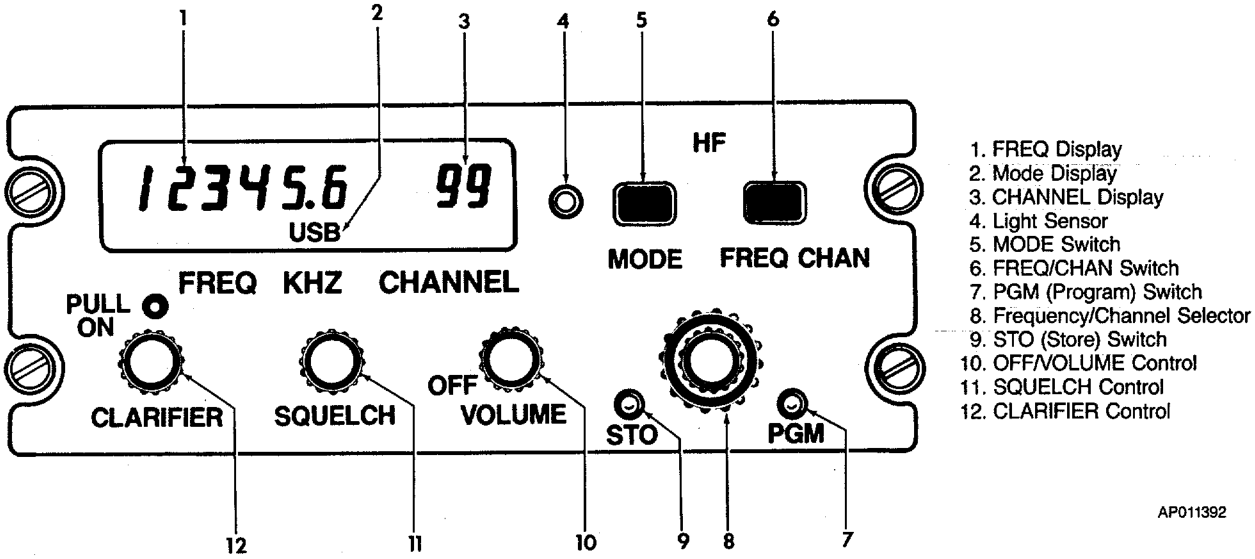
1. Transmitter selector switch (audio control panel) VHF-1/ VHF-2.
2. Audio control switch (audio control panel) VHF-1/VHF-2.
3. Mode switch As required.
4. Frequency selector Select 121. 500 MHz.
5. Volume control As required.
6. Microphone switch Press. A T character will display to the right of the active frequency, whenever the transceiver is transmitting.

3-9. HF COMMUNICATION SET (KHF-950).

a. Description. The KHF-950 HF system consists of three units; the pedestal mounted KCU951 control panel (fig. 3-2), the remote KAC-952 power amplifier/antenna coupler, and the KTR-953 receiver/exciter. The system will operate on any 0.1 kHz frequency between 2,000 and 29,999.9 kHz.

With the capability to preset and store 99 frequencies for selection during flight, the system also allows for selection of other frequencies manually (direct tuning), or reprogramming of any preset frequency. The system will automatically match the antenna by keying the microphone. Power to the system is routed through a 25 ampere circuit breaker placarded HF PWR. The receiving portion of the system is protected by a 5 ampere circuit breaker placarded HF REC. Both circuit breakers are located on the overhead circuit breaker panel.

The HF system has two methods of frequency selection. The first method is called direct tuning (frequency agile). The second is a channelized operation in which desired operating frequencies are preset, stored and referenced to a channel number.



b. Controls and Functions.

(1) HF control panel.

(a) FREQ display. Displays frequency selected.

(b) Mode display. Displays selected LSB, AM, or USB mode.

(c) CHANNEL display. Displays channel selected.

(d) Light sensor. The light sensor is a photocell which adjust brightness of the display

(e) MODE switch. The mode switch is a momentary pushbutton switch that selects LSB, AM or USB.

(f) FREQ/CHAN switch. Transfers the HF system from a direct frequency operation to a channelized form of operation.

(g) PGM (program) recessed switch. Enables channelized data to be modified. The PGM message will be displayed whenever this switch is depressed.

1 PROGRAM. The program mode must be used for setting or changing any of the.

99 preset frequencies. Each of the 99 channels may be preset to receive and transmit on separate frequencies (semi-duplex), receive only, or transmit and receive on the same frequency (simplex). The operating mode (LSB, USB or AM) must be the same for both receive and transmit and can also be preset.

(h) Frequency/channel selector. This selector consists of two concentric knobs that control the channel and frequency digits, plus the lateral position of the cursor.

1 FREQUENCY CONTROL. The outer knob becomes a cursor (flashing digit) control with the FREQ/CHAN switch in the FREQ position. The flashing digit is then increased/ decreased with the inner knob.

2 CHANNEL CONTROL. The outer knob is not functional when the FREQ/ CHAN switch is in the CHAN position. The inner knob will provide channel control from 1 through 99, displayed at the right end of the display window.

(i) STO (store) recessed switch. Stores displayed data when programming preset channels.

(j) OFF-VOLUME. Applies power to the unit and controls the audio output level.

(k) SQUELCH. Provides variable squelch threshold control.

(l) CLARIFIER.. Provides 250 Hz of local oscillator adjustment.

c. Operating procedures.

(1) OFF-VOLUME switch. Turn clockwise out of OFF position. Adjust volume as desired.

(*2) Frequency operation (simplex only).* Each digit of the frequency may be selected instead of dialing up or down to a frequency. The larger concentric knob is used to select the digit to be changed. This digit will flash when selected. Rotation of the knob moves the flashing cursor in the direction of rotation. After the digit to be changed is flashing, the smaller concentric knob is used to select the numeral desired. This process is repeated until the new frequency has been selected. The flashing cursor may then be stowed by moving it to the extreme left or right of the display and then one more click. This stows the cursor behind the display until needed again. The cursor may be recalled by turning the concentric knob one click left or right.

(a) redirect frequency tuning (simplex only).

1. FREQ/CHAN button out (FREQ).
2. Select desired mode (USB, LSB,or AM).
3. Select digit to be changed (outer knob), digit (cursor) will flash.
4. Select numerical value of digit (inner knob).
5. Stow cursor (or repeat procedure for additional changes).
6. Tune antenna coupler (press microphone button).

(2) Channel programming. There are three ways to set up a channel: Receive only, simplex, and semi-duplex. To gain access to channelized operation, depress FREQ/CHAN button. To utilize the existing programmed channels (i.e. no programming required) use the small control knob to select the desired channel number. Then momentarily key the microphone to tune the antenna coupler. If channel programming is required, it is necessary to activate the program mode as follows. With the FREQ/CHAN button in (CHAN), use a pencil or other pointed object to push the PGM button in. The button is an alternate action switch: push-on, push-off. The letters PGM will appear in the lower part of the display window and the system will remain in the program mode until the PGM button is pressed again.

(a) Receive only.

1. Stow the cursor if a frequency digit is flashing.
2. Select the channel to be preset.
3. Set the desired operating mode (LSB, USB or AM).
4. Set the desired frequency. (Refer to frequency tuning)
5. Push and release STO button once.

NOTE

T will flash in the display window, however a receive only frequency is being set. The flashing T should be ignored.

If another channel is to be set, the cursor must be stowed before a new channel can be selected. Use the smaller concentric knob to select the channel and repeat the steps for selecting a new frequency.

6. To return to an operating mode, push the PGM button.

(b) Simplex. Setting a channel up for simplex operation (receive and transmit on the same frequency).

1. FREQ/CHAN button in (cursor stowed).
2. PGM button in (PGM displayed).
3. Select channel to be preset.
4. Set mode (LSB, USB or AM).
5. Set desired frequency. (Refer to frequency tuning)
6. Push and release STO button twice.

The first press of the STO button stores the frequency in the receive position and the second press stores the same frequency in the transmit position. The second push also stores the cursor. If another channel is to be reset, use the smaller concentric knob to select the channel and repeat the steps for selecting a new frequency. The cursor was automatically stowed. To return to one of the operating modes, push the PGM button again.

(c) Semi-duplex. Setting a channel for semi-duplex (transmit on one frequency and receive on another).

1. Select channel to be preset.
2. Set desired frequency. (Refer to frequency selection)
3. Set mode (LSB, USB, or AM).
4. Push STO button once.
5. Set transmit frequency.
6. Push STO button again.

If another channel is to be reset, use the smaller concentric knob to select the channel and repeat the steps.

7. To return to an operating mode, push the PGM button.

NOTE

The mode for each channel (LSB,USB or AM) is stored along with the frequency. If the mode is changed, the system will receive and transmit in the mode selected for transmit.

3-10. EMERGENCY LOCATOR TRANSMITTER (ELT).

a. Description. An automatic or manually activated emergency locator transmitter (ELT) is located in the right side of the fuselage at approximately FS 340.00. The associated antenna is mounted on top of the aft fuselage at the same location (fig. 2-2). An access hole with a spring-loaded cover is located in the right fuselage skin adjacent to the transmitter, enabling a downed pilot to manually initiate, terminate, or reset the ELT to an armed mode. Self-contained batteries provide operation for a minimum of 48 hours.

The transmitter contains an impact G switch that automatically activates the transmitter following a 3 to 7 G impact along the flight axis of the aircraft. When activated, it will simultaneously radiate omni-directional RF signals on the international distress frequencies of 121.5 and 243.0 MHz. The radiated signal is modulated with an audio swept tone.

b. Controls and Functions.

(1) ON-ARM-OFF switch.

1. ON Turns set on, initiating emergency signal transmissions.
2. ARM Establishes readiness state to start automatic emergency signal transmissions, when the force of impact exceeds a preset threshold.
3. OFF Turns set off.

Section III. NAVIGATION

3-11. DESCRIPTION.

The overall navigation equipment group provides the pilot and copilot with the instrumentation required to establish and maintain an accurate flight course and position and to make an approach on instruments under instrument meteorological conditions (IMC). The navigation configuration includes equipment for determining attitude, position, destination range and bearing, heading reference and ground speed.

3-12. RADIO MAGNETIC INDICATORS (RMI).

a. Description. Two identical KNI-582 RMI indicators (fig. 3-5) are installed. Each RMI provides aircraft heading and radio bearing information to/from a VOR, TACAN or ADF facility. A selector switch on the RMI allows the operator to select either #1 ADF and #1 VOR or #1 ADF and TACAN for single needle display. The double needle always points to the #2 ADF or #2 VOR bearing as selected by the double needle switch. The pilot's RMI is protected by a I ampere circuit breaker, placarded #1 RMI. The copilot's RMI is protected by a 1 ampere circuit breaker, placarded #2 RMI. Both circuit breakers are located on the overhead circuit breaker panel (fig. 2-23).

b. Controls and Functions.

(1) COMPASS #1, #2 switch (pilot's instrument panel, Fig. 2-26). Selects desired source for magnetic heading information for display on copilot's RMI compass card.

(a) #1. Selects compass system #1.

(b) #2. Selects compass system #2.

(2) COMPASS #1, #2 switch (copilot's instrument panel, Fig. 2-26). Selects desired source for magnetic heading information for display on pilot's RMI compass card.

(a) #1. Selects compass system #1.

(b) #2. Selects compass system #2.

(*3*) *Warning flag*. Indicates loss of heading signal, or that bearing information is unreliable.

(4) Compass card. Gyro stabilized to indicate aircraft heading and bearing information.

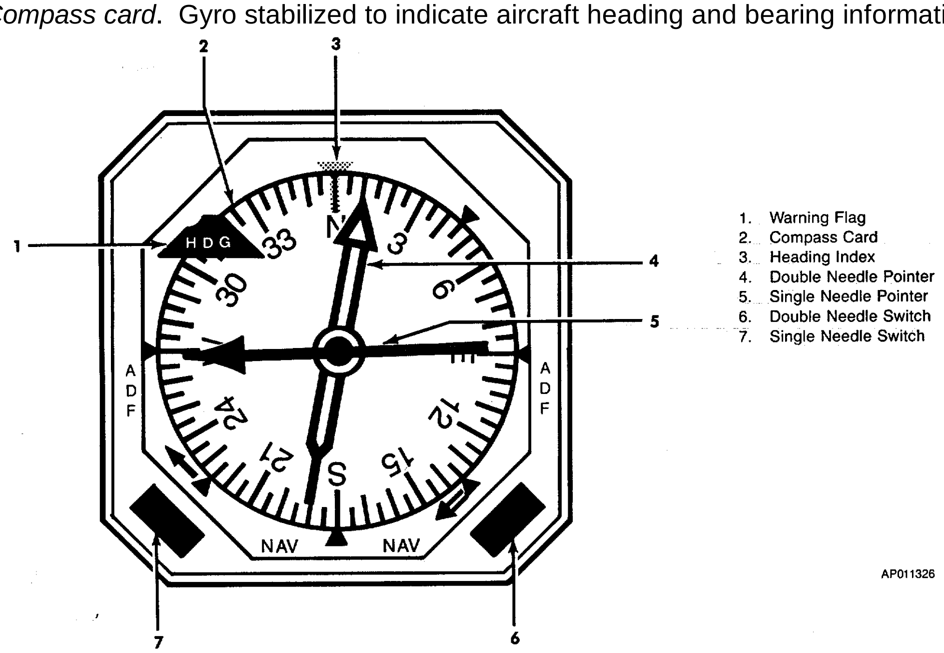


Figure 3-5. Radio Magnetic Indicator (RMI)

(5) *Heading index*. Reference point for aircraft heading.

(6) *Double needle pointer*. Indicates #2 ADF or #2 VOR bearing as selected by double needle switch.

(7) *Single needle pointer*. Indicates #1 ADF or VOR/TACAN bearing as selected by single needle switch.

(8) *Double needle switch*. Selects desired signal to be displayed on double needle pointer.

(a) *ADF position*. Selects #2 ADF bearing information.

(b) *VOR position*. Selects #2 VOR bearing information.

(9) *Single needle switch.*

(a) *ADF position*. Selects #1 ADF bearing information.

(b) *VOR position*. Selects #1 VOR/ waypoint bearing information.

3-13. PILOT'S HORIZONTAL SITUATION INDICATOR .

a. Description. The pilot's horizontal situation indicator (HSI) (fig. 3-6) combines numerous displays to provide a presentation of the aircraft position (fig. 3-6). The -indicator displays aircraft displacement relative to VOR, localizer, glide slope beam, VLF, TACAN, and selected heading, with respect to magnetic north. Any warning flag in view indicates that portion of the HSI display is unreliable. Display brightness is controlled by a dimming knob which is concentric with the DH SET knob, located on the pilot's ADI.

b. Controls/Indicators and Function.

(1) *Distance display*. Provides digital displays of DME/TACAN, waypoint or VLF distance. DME/TACAN and waypoint distance is displayed in 1/10 mile increments. VLF distance is displayed in whole mile increments. The display will show dashes when the distance input data is invalid or absent.

(2) *Rotating heading (azimuth) dial*. Displays gyro stabilized magnetic compass information

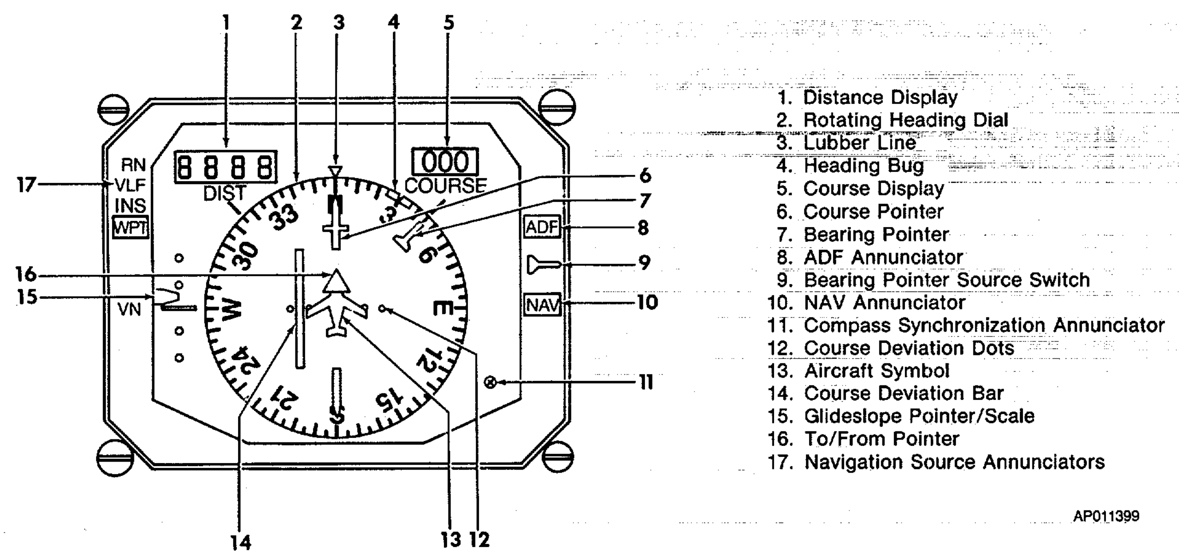


Figure 3-6. Pilot's Horizontal Situation Indicator (HSI)

on a dial which rotates with the aircraft throughout 360 degrees. The azimuth ring is graduated in 5 degree increments.

(3) Lubber line. Fixed heading marks located at the fore (upper) and aft (lower) position.

(4) Heading bug. The notched orange the heading bug is positioned on the rotating head in dial by the heading knob, to select and display a preselected compass heading. Once set to the desired heading, the heading bug maintains its position on the heading dial. The difference between the bug and the fore (upper) lubber line index is the amount of heading select error applied to the flight director computer. In the heading mode the ADI will display the proper bank commands to turn to and maintain this selected heading.

(5) HDG flag. Indicates loss of reliable heading information.

(6) Course display. Provides a digital readout of selected magnetic course.

(7) Course pointer. The yellow course pointer is positioned on the heading dial by the remote course knob, to a magnetic bearing that coincides with the selected course being flown. The course pointer is also positioned by the RNAV, or VLF modes of operation. The course pointer rotates with the heading dial to provide a continuous readout of course error to the computer.

(8) Bearing pointer. Indicates ADF or NAV relative bearing as selected by the bearing pointer source switch.

(*9) ADF annunciator*. When illuminated, indicates ADF bearing information is being displayed.

(10) Bearing pointer source switch. The bearing pointer source switch, located on the pilot's HSI, provides for selecting between ADF or NAV bearing information as presented by the bearing pointer. Each push of the select switch alternates selection of ADF or NAV. Upon power-up or following long-term power interruption, NAV is displayed.

(*11) NAV annunciator*. When illuminated, indicates NAV bearing information is being displayed.

(12) NA V flag. Indicates loss of NAV 1, or unreliable VLF navigation signal.

(13) Compass synchronization annunciator. The compass synchronization annunciator consists of a dot and X symbol display. When the compass system is in the slaved mode, the display will oscillate between the dot and X symbol, indicating the heading dial is synchronized with a gyro stabilized magnetic heading.

(14) Course knob (located on the pedestal). Positions the course pointer.

(15) Course deviation dots. In VOR operation, each dot represents 5 degree deviation from the centerline (+10 degrees). In ILS operation, each dot represents 1 degree deviation from the centerline.

(16) Aircraft symbol. The fixed miniature aircraft symbol corresponds to the longitudinal axis of the aircraft and lubber line markings. The symbol shows aircraft position and heading with respect to a radial course and the rotating heading (azimuth) dial.

(17) Course deviation bar. The course deviation bar represents the centerline of the selected VOR or localizer course. The miniature aircraft symbol pictorially shows actual aircraft position in relation to this selected course.

(18) Heading knob (located on the pedestal). Positions the heading bug to a preselected heading.

(19) Glide slope pointer/scale. The glide slope pointer displays glide slope deviation. The pointer is in view only when tuned to a localizer frequency. If the aircraft is below glide slope path, the pointer is displayed upward on the scale. Each dot on the scale represents approximately 0.4 degree displacement.

(20) To-from pointer. The to-from pointers aligned on the course pointer, are located 180 degrees apart. One always points in the direction of the station, along the selected VOR radial.

(21) VERT flag. Covers glide slope pointer when not receiving glide slope information.

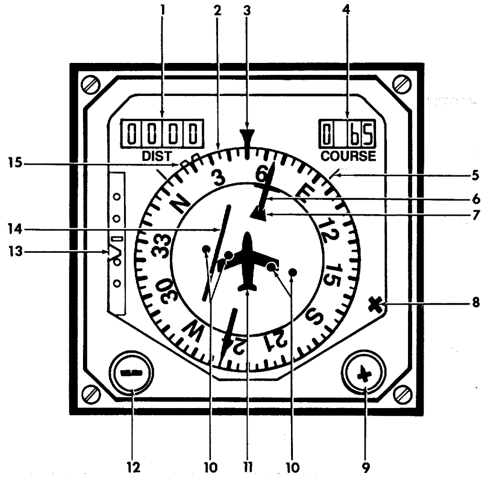
(22) Navigation source annunciators. Two different annunciators display navigation data sources. They are: RN for area navigation, and VLF for very low frequency (Omega).

3-14. COPILOT'S HORIZONTAL SITUATION INDICATOR.

a. Description. The copilot's horizontal situation indicator (HSI) combines numerous displays to provide a presentation of the aircraft position (fig. 3-7). The indicator displays aircraft displacement relative to VOR, localizer, glide slope beam, and heading with respect to magnetic north. Any warning flag in view indicates that portion of the HSI display is unreliable. Display brightness is adjusted with a reostat placarded HSI located on the copilot's instrument panel.

b. Controls/Indicators and Function.

(1) Distance display. Provides digital display of station distance.



1. Digital DIST Display
2. Rotating Azimuth
3. Lubber Line Mark
4. Digital COURSE Display
5. Azimuth Marks
6. Course Pointer
7. To-From Pointer
8. Compass Sync Annunciator
9. Course Knob
10. Course Deviation Dots
11. Aircraft Symbol
12. Heading Knob
13. Glidescope Pointer and Scale
14. Course Deviation Bar
15. Heading Bug

(2) Rotating heading (azimuth) dial. Displays gyro stabilized magnetic compass information on a dial which rotates with the aircraft throughout 360 degrees. The azimuth ring is graduated in 5 degree increments.

(3) Lubber line. Fixed heading marks located at the fore (upper) and aft (lower) position.

(4) HDG flag. Indicates loss of reliable heading information.

(5) Course display. Provides a digital readout of selected magnetic course.

(6) Course pointer. The yellow course pointer is positioned on the heading dial by the course knob to select a magnetic bearing that coincides with the desired VOR radial or localizer course. The course pointer rotates with the heading dial to provide a continuous readout of course error to the computer. When either one of the radio modes is selected, the vertical command bar on the attitude flight director (ADI) will display bank commands to intercept and maintain the selected radio course.

(7) To-from pointer. The to-from pointers aligned on the course pointer, are located 180 degrees apart. One always points in the direction of the station, along the selected VOR radial.

(8) Glide slope pointer/scale. The glide slope pointer displays glide slope deviation. The pointer is in view only when tuned to a localizer frequency. If the aircraft is below glide slope path, the pointer is displayed upward on the scale. Each dot on the scale represents approximately 0.4 degree displacement. (9) VERT flag. Covers glide slope pointer when not receiving glide slope information.

(10) Compass synchronization annunciator. The compass synchronization annunciator consists of a dot and X symbol display. When the compass system is in the slaved mode, the display will oscillate between the dot and X symbol, indicating the heading dial is synchronized with a gyro stabilized magnetic heading.

(11) Course knob. Positions the course indicator.

(12) Course deviation bar. The course deviation bar represents the centerline of the selected VOR or localizer course. The miniature aircraft symbol pictorially shows actual aircraft position in relation to this selected course.

(13) Aircraft symbol. The fixed miniature aircraft symbol corresponds to the longitudinal axis of the aircraft and lubber line markings. The symbol shows aircraft position and heading with respect to a radio course and the rotating heading (azimuth) dial.

(14) Heading knob. Positions the heading bug to a preselected compass heading.

(15) Course deviation dots. In VOR operation, each dot represents 5 degree deviation from the centerline (+10 degrees). In ILS operation, each dot represents 1 degree deviation from the centerline.

(16)NAV flag. Indicates loss of NAV 2.

(17) Heading bug. The notched orange heading bug is positioned on the rotating heading dial by the heading knob, and displays preselected compass heading. The bug rotates with the heading dial. The difference between the bug and the fore (upper) lubber line index is the amount of heading error applied to the flight director computer. In the heading mode the ADI will display the proper bank commands to turn to and maintain this selected heading.

3-15. PILOT'S ATTITUDE DIRECTOR INDICATOR.

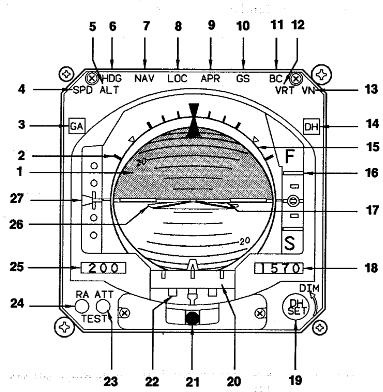
a. Description. The pilot's attitude director indicator (ADI) (fig. 3-8) combines the attitude sphere display with computed steering information to provide the commands required to intercept and maintain a desired flight path. It also contains an eyelid display, expanded localizer, glide slope, radio altitude display, rate-of-turn indicator, mode annunciators, go-around and decision height annunciators, and inclinometer. Any warning flag in view indicates that portion of information is unreliable.

b. Controls/Indicators and Functions.

(1) Attitude sphere. Moves with respect to the symbolic aircraft reference to display actual pitch and roll attitude. Pitch attitude marks are in 5 degree increments on a blue and brown sphere.

(2) Roll attitude index. Displays actual roll attitude through a movable index and fixed scale reference marks at 0, 10, 20, 30, 45, 60 and 90 degrees.

(3) GA (go-around) annunciator. Illuminates when go-around mode has been selected.



1. Attitude Sphere
2. Roll Attitude Index
3. GA Annunciator
4. SPD Annunciator
5. ALT Annunciator
6. HDG Annunciator
7. NAV Annunciator
8. LOC Annunciator
9. APR Annunciator
10. GS Annunciator
11. BC Annunciator
12. VRT Annunciator
13. VN Annunciator
14. DH Annunciator
15. Eyelid Display
16. Speed Command Display
17. Flight Director Command Cue
18. Radio Altitude Display
19. Decision Height Set Knob
20. Expand Localizer
21. Inclinometer
22. Rate of Turn
23. Attitude Test Switch
24. Radio Altitude Test Switch
25. Decision Height Display
26. Symbolic Miniature Aircraft
27. Glideslope Scale/Pointer

Figure 3-8. Pilot's Attitude Director Indicator

(4) SPD annunciator. Illuminates when airspeed is being held by the flight director, in the IAS mode.

(5) ALT annunciator. Illuminates when altitude is being held by the flight director.

(6) HDG annunciator. Illuminates when heading is being held by the flight director, in the NAV ARM, BC ARM mode.

(7) NAV annunciator. Illuminates when navigation is being controlled by the flight director, in the NAV CAP, VOR APR mode.

(8) LOC annunciator. Illuminates whenever the flight director is controlling a localizer approach, in the NAV CAP mode.

(9) APR annunciator. Illuminates whenever the flight director is controlling a approach, in the NAV CAP, VOR APR mode.

(10) GS annunciator. Illuminates whenever the flight director is in GS CAP mode, and glide slope has been captured.

(11) BC annunciator. Illuminates whenever the flight director is in BC CAP mode, and has captured the back course approach heading.

(12) VRT annunciator. Illuminates when vertical speed is being held by the flight director, in the VS mode.

(13) DH annunciator. Illuminates when aircraft descends below selected decision height as set on the radio altimeter indicator.

(14) Eyelid display. Surrounds the attitude sphere and provides positive attitude identification by means of a blue eyelid which always shows the relative position of the sky, and a brown eyelid which always shows the relative position of the ground. The eyelids maintain the proper ground-sky relationship, regardless of sphere position.

(15) Speed command display. The pointer indicates relative airspeed provided by the angle-of attack/speed command system.

(16) Flight director command cue. Displays computed commands to capture and maintain a desired flight path. Always fly the symbolic miniature aircraft to the flight director cue. The cue will bias from view should a failure occur in either the pitch or roll channel.

(17) Radio altitude display. Radio altitude is digital displayed. The range capability of the display is from -20 to 2500 feet AGL. The display resolution between 200 and 2500 feet is in 10 foot increments. The display resolution below 200 feet is 5 feet. The display will be blank at altitudes over 2500 feet AGL. Dashes are displayed whenever invalid radio altitude is being received.

(18) DH SET control knob. Sets decision height from 0 to 990 feet. Decision height displays in the DH window on lower left corner of ADI. The brightness of the digital radio altitude and decision height display is controlled by the dimming knob which is concentric with the DH SET knob. The dimming knob also dims the distance and course display on the pilot's HSI, and the altitude alert display.

(19) Expanded localizer. Raw localizer displacement data from the navigation receiver (HSI display) is amplified approximately 7 1/2 times to permit the expanded localizer pointer to be used as a sensitive reference indicator of the aircraft's position, with respect to the center of the localizer. It is normally used for assessment only, since the pointer is very sensitive and difficult to fly throughout the entire approach. During final approach, the pointer serves as an indicator of the Category II window. Full scale deflection of the expanded localizer pointer is equal to 1/4 degree of beam signal. The expanded localizer is displayed by the localizer pointer only when a valid localizer signal is available.

(20) Inclinometer. Gives the pilot a conventional display of aircraft slip or skid, and is used as an aid to coordinated maneuvers.

(21) Rate of turn. Rate of turn is displayed by the pointer at the bottom of the ADI. The marks at the extreme left and right sides of the scale represent a standard rate turn.

(22) Attitude (ATT) test switch. When depressed, the sphere will show an approximate attitude change of 20 degrees of right bank at 10 degrees pitch-up. The ATT warning flag will appear. In addition, all mode annunciator lights except DH will illuminate.

(23) Radio altitude (RA) test switch. Pressing the RA test button causes the following displays on the radio altitude readout: all digits display 8's then dashes, and then the preprogrammed test altitude as set in the radio altimeter R/T unit, until the test button is released at which time the actual altitude is displayed. The DH display during the test displays all 8's with the altitude display and then displays the current set altitude for the remainder of the test. RA test is inhibited as a function of APR CAP.

(24) Decision height (DH) display. The digital DH display, displays decision height range from 0 to 990 feet in 10 foot increments. The decision height is set by the knob in the lower right corner of the ADI.

(25) Symbolic miniature aircraft. Serves as a stationary symbol of the aircraft. Aircraft pitch and roll attitudes are displayed by the relationship between the fixed miniature aircraft and the moveable

sphere. The symbolic aircraft is flown to align the command cue to the aircraft symbol in order to satisfy the commands of the selected flight director mode.

(26) Glide slope scale and pointer. Displays aircraft deviation from glide slope beam center only when tuned to a ILS frequency and a valid glide slope is present. The aircraft is below glide path if pointer is displaced upward. The glide slope dot represents approximately 0.4 degree deviation from the beam centerline.

3-16. COPILOT'S ATTITUDE DIRECTOR INDICATOR.

a. Description. The copilot's attitude director indicator (ADI) combines the attitude sphere display with computed steering information to provide the commands required to intercept and maintain a desired flight path (fig. 3-9). It also contains an eyelid display, expanded localizer, glide slope, rising radio altitude bar and inclinometer. The indicator has go-around and decision height annunciators. Any warning flag in view indicates that portion of information is unreliable.

b. Controls/Indicators and Functions.

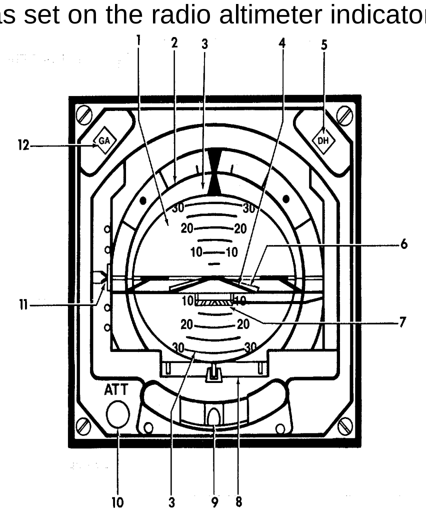
(1) Attitude sphere. Moves with respect to the symbolic aircraft reference to display actual pitch and roll attitude. Pitch attitude marks are in 5 degree increments on a blue and brown sphere.

(2) Roll attitude index.. Displays actual roll attitude through a movable index and fixed reference marks at 0, 10, 20, 30, 45, 60 and 90 degrees.

(3) Eyelid display. Surrounds the attitude sphere and provides positive attitude identification by means of a blue eyelid which always shows the relative position of the sky, and a brown eyelid which always shows the relative position of the ground. The eyelids maintain the proper ground-sky relationship, regardless of sphere position.

(4) Flight director command cue. The three-dimensional command cue displays the computed steering commands to intercept and maintain a desired flight path. The cue moves up or down to present pitch commands and rotates clockwise or counterclockwise for roll commands.

(5) Decision height annunciator. Illuminates when the aircraft descends below a selected decision height as set on the radio altimeter indicator.



1. Attitude Sphere
2. Roll Attitude Index
3. Eyelid Displays
4. FD Command Cue
5. DH Annunciator
6. Symbolic Miniature Aircraft
7. Radio Altitude Bar
8. Expanded Localizer
9. Inclinometer
10. ATT Test Switch
11. Glidescope Scale and Pointer
12. GA Annunciator

Figure 3-9. Copilot's Attitude Director Indicator

(6) Symbolic miniature aircraft. Serves as a stationary symbol of the aircraft. Aircraft pitch and roll attitudes are displayed by the relationship between the fixed miniature aircraft and the movable sphere. The symbolic aircraft is flown to, and aligned with, the command cue to satisfy the commands of the flight director mode selected.

(7) Radio altitude bar. For added backup during the critical approach phase of flight, absolute altitude above the terrain is displayed below 200 feet by a barber-pole radio altitude bar. The bar appears at 200 feet and moves toward the miniature aircraft as the aircraft descends toward the runway, contacting the bottom of the symbolic aircraft at touchdown.

(8) Expanded localizer. Raw localizer displacement data from the navigation receiver (HSI display) is amplified approximately 7 1/2 times to permit the expanded localizer pointer to be used as a sensitive reference indicator of the aircraft's position, with respect to the center of the localizer. -It is normally used for assessment only, since the pointer is very sensitive and difficult to fly throughout the entire approach. During final approach, the pointer serves as an indicator of the Category II window. Full scale deflection of the expanded localizer pointer is equal to 1/4 degree of beam signal. The expanded localizer is displayed by the localizer pointer only when a valid localizer signal is available.

(9) Inclinometer. Gives the pilot a conventional display of aircraft slip or skid, and is used as an aid to coordinated maneuvers.

(10) Attitude test switch. Operates the attitude self-test. When depressed, the sphere will show approximately a 20-degree right bank and a 10-degree pitch-up attitude, and the ATT warning flag will appear.

(11) Glide slope scale and pointer. Displays aircraft deviation from glide slope beam center only when tuned to a ILS frequency and a valid glide slope signal is present. The aircraft is below glide path if pointer is displaced upward. The glide slope dot represent approximately 0.4 degree deviation from the beam centerline.

(12) Go-around annunciator. Illuminates when go-around mode has been selected.

3-17. TURN AND SLIP INDICATORS.

a. Description. Two turn and slip indicators are installed separately on the pilot and copilot sides of the instrument panel. These indicators are gyroscopically controlled. The pilot's unit is operated by DC power. It is protected by a 5 ampere circuit breaker placarded PILOT TURN & SLIP, on the overhead circuit breaker panel (fig. 2-23).

The copilot's indicator is a vacuum instrument operated by reduced engine bleed air pressure. Visual information provided is the same as on the pilot's indicator.

b. Control Indicator and Functions.

(1) Turn rate indicator. Indicates direction and rate of turn. A 2 minute turn rate is indicated when the turn rate indicator is deflected one needle width to the left or right of the index.

(*2) Index*. A reference mark for alignment of the turn rate indicator.

(3) GYRO warning flag (pilot's indicator). When in view, indicates loss of power to the gyro.

(4) Inclinometer. Indicates lateral acceleration (side slip) of aircraft.

3-18. RADIO ALTIMETER INDICATOR.

a. Description. The AA-300 Radio Altimeter Indicator (fig. 3-10) provides the pilot with actual altitude of the aircraft. The indicator displays radio altitude information from 2500 feet to touchdown, with an expanded scale under 500 feet.

b. Controls and Functions.

(1) DH annunciator. The DH annunciator will illuminate when the aircraft is at or below the selected decision height (DH).

(2) Decision height bug. The decision height bug is set to the desired decision height, by the DH SET knob.

(3) OFF warning flag. The OFF warning flag will be in view whenever the system information is unreliable.

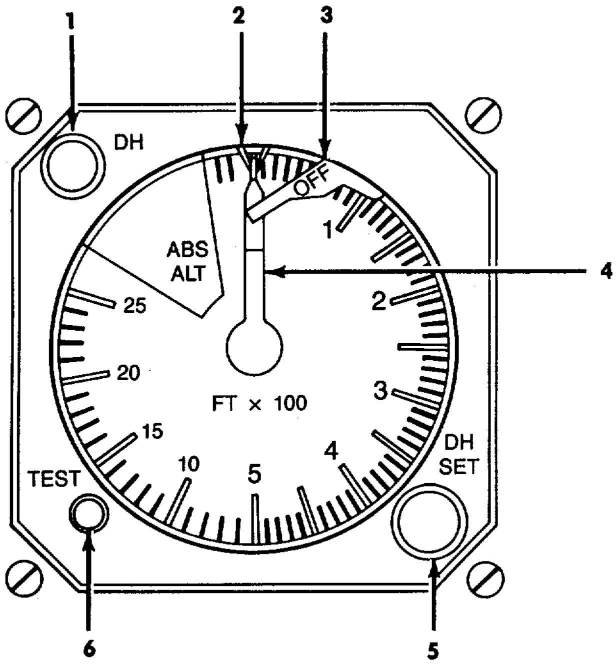
(4) Altitude pointer. The altitude pointer will point to the existing altitude.

(5) DH SET knob. The DH SET knob is used to set the decision height bug to the desired decision height (DH).

(6) TEST button. When depressed the OFF warning flag will come in to view and the altitude pointer will indicate approximately 100 feet. Release of the button will cause the altitude pointer to return to existing altitude, and OFF warning flag to retract.

3-19. ALTITUDE SELECT CONTROLLER.

a. Description. The altitude select controller provides a means for setting the desired altitude reference for the altitude alerting and altitude preselect system. It is protected through a 1-ampere circuit



1. Decision Height Annunciator
2. Decision Height Bug
3. Failure Warning Flag
4. Altitude Pointer
5. Decision Height Set Knob
6. Test Pushbutton

breaker, placarded ALT ALERT located on the overhead circuit breaker panel (fig. 2-23).

b. Controls and Functions.

(1) Altitude display. Displays the selected altitude.

(2) Selector SET knob. The selector SET knob is used to set the desired altitude.

3-20. GYROMAGNETIC COMPASS SYSTEM.

a. Description. Two identical compass systems provide accurate directional information for the aircraft at all latitudes of the earth. For heading reference, two modes of operation are used: directional gyro (FREE) mode, or slaved (SLAVE) mode. In areas where magnetic references are reliable, the system is operated in the SLAVE mode. In this mode, the directional gyro is slaved to the magnetic flux valve which supplies magnetic reference for correction of the apparent drift of the gyro. In FREE mode, the system is operated as a free gyro. In this mode latitude corrections are manually introduced using the INCREASE/DECREASE switches. The slave/free mode is selected as desired using the SLAVE/FREE switches.

Gyro compass #1 provides magnetic heading information for the pilot's flight director/autopilot, HSI, flight management system, and copilot's RMI. Gyro compass #2 serves the copilot's flight director/ autopilot, HSI, and the pilot's RMI. Both compass systems are AC powered through either pilot selected inverter.

b. Controls and Functions.

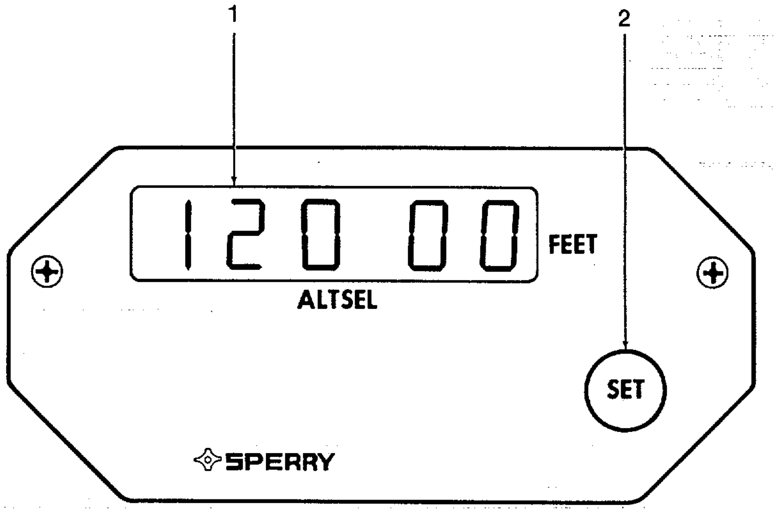
(1) COMPASS #1, #2 switches (pilot's instrument panel fig. 2-26). Selects desired source of magnetic heading information for pilot and copilot flight director/autopilot, HSI, RMI, and the pilot's flight management system.

(a) #1. Selects compass system #1 for display.

(b) #2. Selects compass system #2 for display.

(2) COMPASS #1, #2 switch (copilot's instrument panel fig. 2-26). Selects desired source of magnetic heading information for copilot's flight director/autopilot, HSI, and pilots RMI.

(a) #1. Selects compass system #1 for display.



1. Selected Altitude Display
2. Altitude Selector Knob

Figure 3-11. Altitude Select Controller

(b) #2. Selects compass system #2 for display.

(3) COMPASS SLAVE annunciator. Two compass slave annunciators, located on each (pilot and copilot) HSI, provides a visual indication of system synchronization.

(4) All systems on compass #1 NORM All systems On Compass #2 Switch. This switch, located adjacent to the pilot's compass switch, allows the pilot to select all systems to operate off compass #1, or compass 2. When the switch is in the NORM position, magnetic heading information is provided to the pilot's flight director/autopilot, HSI, flight management system, and copilot's RMI.

(5) GYRO SLAVE/FREE switch. Controls system mode of operation.

(a) SLAVE. Places system in SLAVE mode.

(b) FREE. Places system in FREE mode.

(c) INCREASE/DECREASE switch. Provides manual fast synchronization for the system.

(d) INCREASE. Causes gyro heading output to increase.

(e) DECREASE. Causes gyro heading output to decrease.

3-21. NAV RECEIVERS (KFS-579A, KNR-634).

a. Description. Two NAV (KFS-579A/ KNR-634 and KFS-564A/KNR-634) airborne navigation receivers (fig. 3-12 and fig. 3-13) are provided which allow selection and storing of navigation frequencies.

The NAV receivers, receive and interpret VHF omnidirectional radio range (VOR) and localizer (LOC) signals in the frequency range of 108.00 to 117.95 MHz, glideslope signals in the frequency range of 329.15 to 335.00 MHz, and marker beacon signals to 75 MHz.

In addition, the KFS-579A #1 NAV/TAC control tunes the KTU-709 DME/TACAN system to 252 TACAN channels. 52 TACAN channels are paired with frequencies in the COMM band. These are channels 1 through 16, and 60 through 69, which correspond to VHF frequencies 134.40 MHz through 135.95 MHz respectively.

Marker beacon receivers are utilized with the NAV receivers, to provide accurate fixes informing the pilot of his passage over beacon stations. Three types of beacons are used. They are the outer (blue annunciator) marker, middle (amber annunciator) marker, and inner (white annunciator) marker. The three markers are used in conjunction with radio instrument landing systems. The markers are all transmitted at a frequency of 75 MHz using three different frequencies of AM modulation.

Signal reception is limited to line-of-sight, and power of the transmitting station with a maximum range of 120 miles. The NAV receivers are protected by 2 ampere circuit breakers placarded NAV #1; NAV #2, located on the overhead circuit breaker panel (fig. 2-23).

b. Controls and Functions.

(1) OFF/VOL control. Turns the system on/off, and adjusts audio volume.

(2) Control indicator. Provides a digital readout of selected active and standby (SBY) frequencies.

(3) Light sensor. Automatically adjusts indicator display brightness.

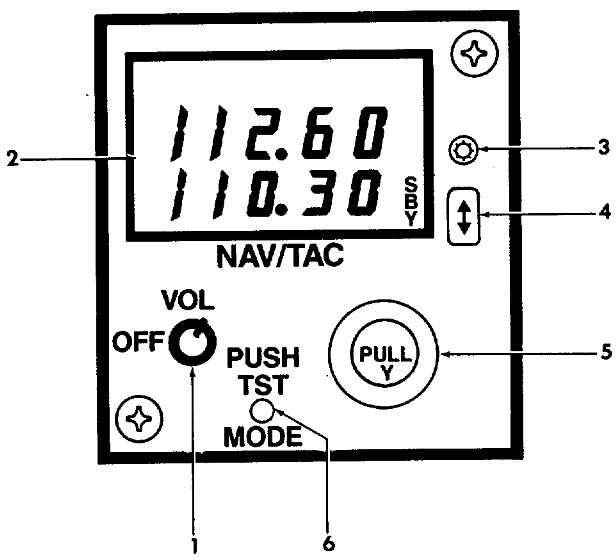
(4) Frequency transfer switch. Allows transferring of active or standby frequencies.

(5) Frequency selector knobs. Allows for selection of desired frequency. Normally, frequencies are selected while in the SBY (standby display). However, if you wish to by-pass the frequency transfer mode of operation and directly tune the set, you may do so by pulling out on the unit's small inner concentric tuning knob until the standby display shows dashes, then select the desired frequency. To re-engage the frequency transfer mode, push the small tuning knob back in.

(6) PUSH-TST-MODE knob (#1 NAV/TAC). A self test is provided to verify range and bearing computation. When the NAV/TAC control unit is tuned to a TACAN station, and the PUSH-TST-MODE knob is depressed, range data of 0 to 0.1 and bearing data of 180 ±2 degrees will appear on the DME slave indicator and both HSI's.

c. NAV Receiver Operation.

(*1*) *Turn on procedure*. OFF-VOL switch - Turn clockwise.



1. OFF/VOL Control Switch
2. Frequency Display
3. Light Sensor
4. Frequency Transfer Switch
5. Frequency Selector Knobs
6. PUSH TST Mode Knob

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Figure 3-12. #1 NAV/TAC Control Unit

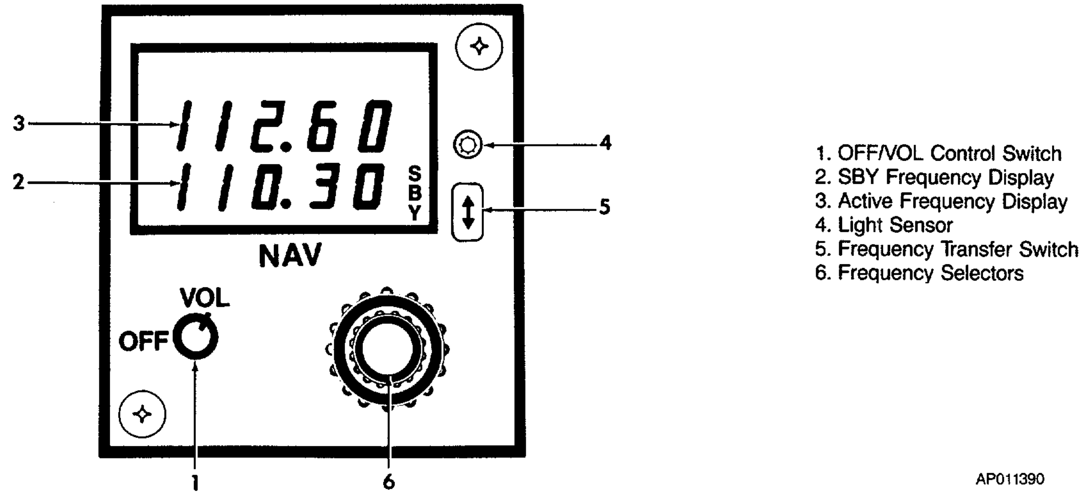


Figure 3-13. #2 NAV Control Unit

(2) *Receiver operating procedure.*

1. Frequency selector - Select desired frequency and press the frequency transfer switch.
2. NAV-1/NAV-2 switch (audio control panel) - As required.
3. VOL control - As required.

(3) *Shutdown procedure*. OFF-VOL control - Turn counter-clockwise to OFF position.

3-22. ADF RADIO SETS (KDF-806).

a. Description. Two ADF radio sets are installed (fig. 3-14). The units are airborne low frequency radio direction finders which receive signals from transmitters in the 190 to 1750 kHz range, to provide a visual and aural indication of the aircraft's bearing in relation to the transmitter. The set can also be used for homing and position fixing. The KDF-806 has a beat frequency oscillator (BFO) function (used to more accurately tune weak signals). Reception distance of reliable signals depends on the power output of the transmitting station and the atmospheric conditions. Bearing indications are displayed visually on the RMI's and aural signals are applied to the audio control panels. The system is protected by 2 ampere circuit breakers placarded ADF 1 and ADF 2 located on the overhead circuit breaker panel.

The KDF-806 incorporates a KFS-586A control unit (fig. 3-14). The control unit contains a digital display that presents both the active and standby frequencies. A photocell automatically adjusts the display brightness according to changes in ambient light conditions. The KFS-586A switches/controls provides power to the receiver, controls the audio output level, controls the OFF, BFO/ADF, and ANT/BFO modes of the receiver, maintains the active and standby frequencies, and tunes the receiver to the active frequency. The KFS-586A will retain the active and standby frequencies through a power off condition.

b. Controls and Functions.

(1) *Control display*. Provides a display of selected frequencies and bearing validity. The display contains two frequencies and an X character The upper frequency is the active frequency, or the frequency to which the receiver is tuned. The lower frequency is the standby frequency. The standby frequency is changed by the frequency select knobs in

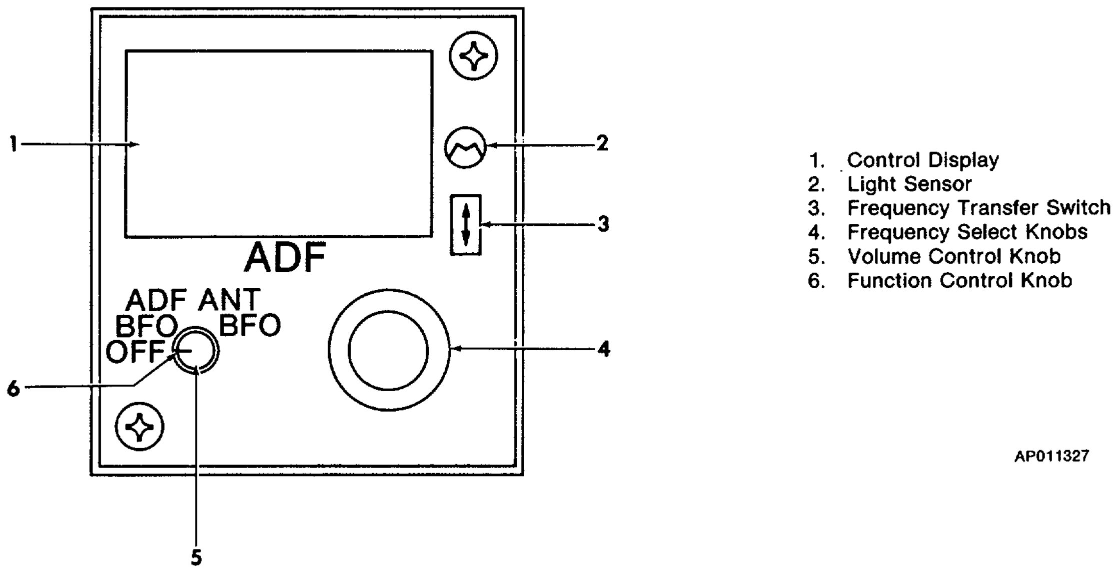


Figure 3-14. ADF Control Unit

the lower right corner of the control unit. An X, to the right of the active frequency, informs the pilot that the bearing indicator (RMI) directional information is not valid.

(2) Light sensor. A photocell automatically adjusts the display brightness according to changes in ambient light conditions.

(3) Frequency transfer switch. Provides a means of interchanging the active/standby displayed frequencies. The transfer switch, when momentarily depressed, causes the active and standby frequencies to interchange. When the transfer switch is depressed and held, the two frequencies interchange on the display and approximately two seconds later the standby frequency will blank out. Depressing the transfer switch momentarily again will cause the standby frequency to reappear.

(4) Frequency select knobs. Provides a means of selecting frequencies. The normal method of selecting a frequency is with both the active and standby frequencies showing. The frequency select knobs will then tune the standby frequency. However, the active frequency may be changed, by depressing and holding the frequency transfer switch for approximately two seconds. The standby frequency display will blank out. The active frequency display may then be directly tuned by rotating the frequency select knobs.

The outer control knob selects from 100 to 1700 kHz in increments of 100 kHz, then will roll over to 2182 kHz. The smaller inner knob selects from 100 to 1799 kHz in increments of 10 kHz with the small knob pushed in, and I kHz with the small knob pulled out. Between 2180 and 2189 kHz the small inner knob selects the I kHz whether pushed in or pulled out.

(5) OFF, BFO/ADF, ANT/BFO, VOL control switch. Controls operational functions of the unit.

(a) *Outer knob.*

1 OFF. Removes power from the unit.
2 BFO. Allows for audio identification of stations with unmodulated signals.
3 ADF. Selects normal operation. The needle will point to the station.
4 ANT. Operates as aural receiver only. Bearing-Needle will park in a horizontal position.

(b) *Inner knob.*

1 VOL. Adjusts volume of audio.

c. *Operating Procedure.*

1. Control switch Turn clockwise, out of OFF position.
2. ADF #1 or #2 audio switch (on audio control panel) - On.
3. BFO switch - As required.
4. ADF switch - As required.
5. ANT switch - As required.
6. VOL control - Adjust as required.

3-23. TACAN/DME.

a. *Description.* The KTU-709 TACAN system consists of the following components: KFS579A NAV/TAC control unit, and KDI-573B DME slave indicator.

The KTU-709 tactical air navigation (TACAN) system is a polar coordinate UHF navigation system that provides relative bearing and slant-range distance information with respect to a selected TACAN or VORTAC ground station. The effective range of the TACAN is limited to the line-of-sight. Actual operating range depends on the altitude of the aircraft, weather, type of terrain, location and altitude of the ground transmitter and transmitter power. Usually line-of-sight limitations will prevent an aircraft on the ground from receiving and locking on to a TACAN or VORTAC ground station.

The range measurement portion of the KTU709 TACAN system electronically converts elapsed time-to-station, by measuring the length of time between the transmission of a radio signal to a preselected TACAN or VORTAC station and reception of the reply signal. The distance is then indicated in nautical miles on the range/groundspeed/time-to station indicator. The distance is measured on a slant from the aircraft to the ground and is commonly referred to as slant-range distance. Slant range distance should not be confused with actual ground distance. The difference between slant-range distance and ground distance is smallest at a low altitude and long range. However, if the range is three times the altitude or greater, the error is negligible. To obtain accurate ground speed and time-to station, the aircraft must be on a direct course to or from a TACAN or VORTAC ground station.

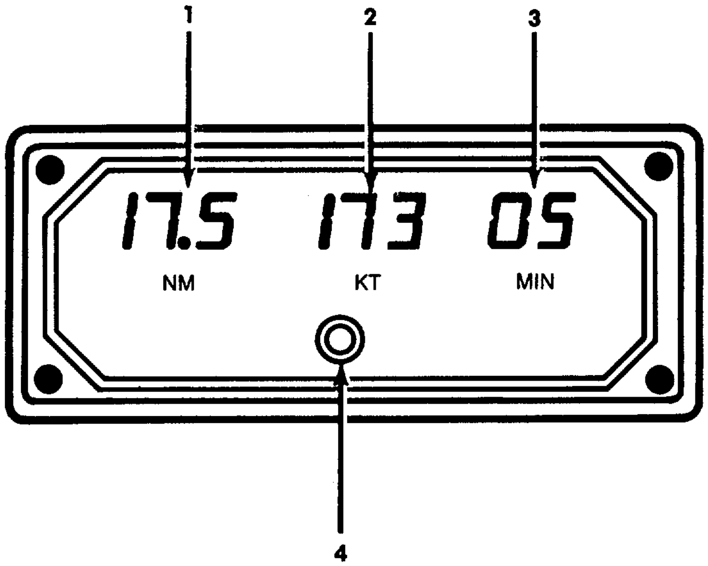
The KTU-709 TACAN system provides an audio capability allowing the pilot to identify the TACAN or VORTAC ground station by listening to the identification tones transmitted by the ground station at 30 second intervals. It also features a in flight self-test mode for both bearing and range. The system is protected by a 2 ampere circuit breaker placarded TACAN, located on the overhead circuit breaker panel (fig. 2-23).

The KFS-579A NAV/TAC (fig. 3-12) tunes the KTU-709 to 252 TACAN channels. 52 TACAN channels are paired with frequencies in the COMM band. These are channels 1 through 16 and 60 through 69, which correspond to VHF frequencies 134.40 MHz through 135.95 MHz respectively. Distance and bearing information is displayed on the pilot's #1 HSI. Associating the #1 NAV with the pilot's #1 HSI will be helpful in maintaining a sequence of operation.

The KDI-573B DME slave indicator (fig. 3-15) displays range to the nearest tenth of a nautical mile from 0 to 99.9 nautical miles, an to the nearest 1 (one) nautical mile from 100 to 389 nautical miles. Groundspeed is displayed to the nearest knot from 0 to 999 knots. Time-to-station is displayed to the nearest minute from 0 to 99 minutes. The display will indicate 99 minutes for any computed time-to station greater than 99 minutes. The indicator will display RNAV when the displayed range, groundspeed and time-to-station are derived from an area navigation system. The indicator will display dashes while in search or when power is first turned on, or momentarily interrupted while in the frequency hold mode indicating loss of the DME holding frequency. A photocell automatically adjusts display brightness to compensate for changes in the ambient light level.

Pilot selection of #2 NAV to tune the TACAN will remove the TACAN derived steering information from the #1 HSI display. This action allows only the steering information obtained from the #1 NAV/TAC control to be displayed on the #1 HSI display. Pilot selection of #1 NAV/TAC DMEHOLD will also remove the steering information from the #1 HSI display.

A DME-HOLD push switch located on the pilot's instrument panel is utilized to select DME-



1. NM (Nautical Miles)
2. KT (Knot)
3. MIN (Minutes)
4. Photocell

Figure 3-15. DME Slave Indicator

HOLD mode of operation. A DME/TAC source selector switch, located on the pilot's radio panel, permits selection of DME or TACAN mode of operation. With the switch in the tacan mode, bearing information is derived from the tacan signal of the TACAN station. The KTU-709 system is now serving as a navigation receiver as well as a DME. Distance and bearing information will be displayed on the pilot's HSI along with a display of range/ groundspeed/time-to-station data on the DME slave indicator.

CAUTION

Since the TACAN ground system does not provide guidance during ILS (instrument landing system) approaches, any ILS approach must be flown in the VOR/ILS mode, using the TACAN for DME only.

b. Controls and Functions. KDI-573B (fig. 3-15*).*

(1) Control indicator. Allows display of nautical miles, groundspeed, and time-to-station.

(a) NM. Displays nautical miles to the station.

(b) KT. Displays aircraft groundspeed.

(c) MIN. Displays time-to-station.

(2) Photocell. Allows for automatic brightness control of the display. KFS-579A (fig. 3-12).

(3) OFF-VOL switch. Turns the system on/off, and adjusts audio volume. Automatic squelch eliminates the need for manual squelch adjustment. However, a manual squelch override is provided by pulling this switch out.

(4) Control indicator. Provides a digital readout of selected active and standby (SBY) frequencys.

(5) Photocell. Allows for automatic brightness control of the display.

(6) Frequency transfer switch. Momentarily pressing the switch will interchange the active or standby (SBY) frequency display.

(7) Frequency selector knobs. Selects desired operating frequency of set if control transfer button is in the SBY (standby) position.

(a) Mode switch. The mode switch is a momentary pushbutton switch that selects either the program (PGM) or standby (SBY) mode.

(8) PUSH-TST knob. Provides a means of self testing, to verify range and bearing compution. When the #1 NAV/TAC is tuned to a TACAN station, and the PUSH-TST button is depressed, range data of 0 to 0.1 NM and bearing data of 180 ±2 degrees will display on the DME indicator and both HSI's.

c. TACAN/DME System Operation.

CAUTION

Power to the KTU-709 TACAN system should be turned on only after engine start-up. This procedure will increase the reliability of the solid state circuitry.

(1) Operating procedure.

1. OFF VOL control Turn clockwise.
2. DME/TAC source selector switch - As required.
3. Frequency selector - Select desired frequency, and press the mode button as required.

NOTE

Prior to station lock-on, dashes will appear in the window of the KDI-773 DME slave control indicator, as the system searches for the station. Search time is usually about one second. Once the system has locked on, the distance read-out will appear, followed quickly by groundspeed and time-to-station computations.

4. DME/TACAN audio switch On. Verify station.
5. VOL control - As required.
6. DME-HOLD switch As required.

(2) Shutdown procedure. OFF VOL switch - OFF.

3-24. AUTOMATIC FLIGHT CONTROL SYSTEM.

a. Description. The Automatic Flight Control System is a completely integrated autopilot/ flight director/air data system which has a full complement of horizontal and vertical flight guidance modes. These include all radio guidance modes, and air data oriented vertical modes.

When engaged and coupled to the flight director (FD) commands the system will control the aircraft using the same commands displayed on the attitude director indicator. When engaged and uncoupled from the flight director commands, manual pitch and roll commands may be inserted using the Touch Control Steering (TCS) or the pitch wheel and turn knob.

When the autopilot is coupled, the flight director instruments act as a means to monitor the performance of the autopilot. When the autopilot is not engaged, the same modes of operation are available for flight director only. The pilot maneuvers the aircraft to satisfy the flight director commands, as does the autopilot when it is engaged.

b. Air Data Computer. A digital air data computer located in the forward avionics compartment provides the altitude information for the pilot's encoding altimeter, altitude alerter, flight data recorder, and transponder. The computer also provides altitude and airspeed hold function data to the flight control computers. The air data computer receives 28 VDC power through, and is protected by, a 2 amp circuit breaker placarded AIR DATA ENCDR located in the AVIONICS section of the overhead circuit breaker panel. All air data computer functions are automatic in nature and require no flight crew action.

c. Autopilot Flight Director Transfer Switch. An alternate action autopilot and flight director transfer switch placarded AP FD 1 and AP FD 2, is located on the pilot's instrument panel, directly below the glare shield. This switch is used to select which autopilot flight director computer controls the aircraft flight servos. If AP FD 2 is selected, the annunciator placarded AP FLT DIR NO. 2, located on the copilot's instrument panel directly below the glare shield, will illuminate to alert the pilot that the No. 2 autopilot flight director computer is controlling the aircraft.

NOTE

The autopilot will disengage when transferring between the pilot and copilot flight directors.

d. Flight Director/Mode Selector. The flight director/mode selector (fig. 3-16), located on the pedestal, provides for selection of all modes (except go-around which is initiated by remote switches located on the left power lever and on the copilot's control wheel) for the flight director. The top row of split light annunciated pushbuttons contains the lateral modes and the bottom row contains the vertical modes. The mode buttons will illuminate when manually selected, or automatically selected through other modes.

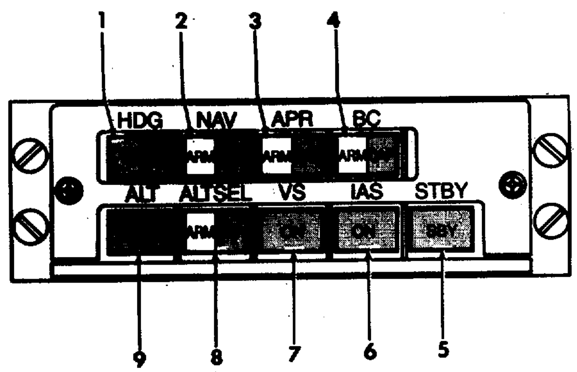
The split light pushbutton annunciators, illuminate amber for armed conditions and green for captured. When more than one lateral or vertical mode is selected, the flight director system automatically arms and captures the submode. Mode annunciations are also presented on remote annunciator blocks, located above both (pilot and copilot) attitude director indicators (ADI's), and on the pilot's ADI.

e. Autopilot Modes of Operation.

(1) Heading select mode (HDG). The heading select mode is selected by depressing the HDG button on the mode selector. In the HDG mode the flight director computer provides inputs to the command cue to command a turn to the heading indicated by the heading bug on the HSI. The heading select signal is gain programmed as a function of airspeed. When HDG is selected, it overrides the NAV, BC APR and VOR APR modes. In the event of a loss of valid signal from the VG or compass, the command cue on the ADI is biased out of view.

(2) Navigation mode (NAV). The navigation mode represents a family of modes for various navigation systems including VOR, localizer, TACAN and VLF.

(3) VOR mode. The VOR mode is selected by depressing the NAV button on the mode selector with the navigation receiver tuned to a VOR frequency and DME greater than 20 miles from the station. Prior to VOR capture, the command cue receives a heading select command as described above and the HDG mode switch is illuminated along with the NAV ARM annunciators. Upon VOR capture the system automatically: switches to the VOR mode; HDG and NAV ARM annunciators extinguish; NAV capture (NAV CAP) annunciators will illuminate. At capture, a command is generated to capture and track the VOR beam. VOR deviation is gain programmed as a function of distance from the station. This programming corrects for beam convergence thus optimizing the gain through the useful VOR range. To utilize this feature the DME must be tuned to the same VOR station as the NAV receiver which is feeding the flight director.



1. Heading Mode Selector
2. Navigation Mode Selector
3. Approach Mode Selector
4. Backcourse Mode Selector
5. Standby Mode Selector
6. Indicated Airspeed Mode Selector
7. Vertical Speed Mode Selector
8. Altitude Preselect Mode Selector
9. Altitude Hold Mode Selector

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Figure 3-16. Flight Director/Mode Selector

The course error signal is gain programmed as a function of airspeed. Cross-wind washout is included which maintains the aircraft on beam center in the presence of crosswind. The intercept angle and DME distance are used in determining the capture point to ensure smooth and comfortable performance during bracketing.

When passing over the station, an overstation sensor detects station passage removing the VOR deviation signal from the command until it is no longer erratic. While over the station, course changes may be made by selecting a new course on the HSI.

If the NAV receiver is not valid prior to the capture point, the lateral beam sensor will not trip and the system will remain in the HDG mode. After capture, if the NAV receiver, compass data or vertical gyro go invalid, the ADI command cue will bias out of view. Also, the NAV CAP annunciators will extinguish if the NAV receiver becomes invalid.

(4) VOR approach mode. The VOR approach mode is selected by depressing the NAV button on the mode selector with the navigation receiver tuned to a VOR frequency and less than 20 DME miles from the station. The mode operates identically to the VOR mode with the gains optimized for a VOR approach.

(5) Localizer mode. The localizer mode is selected by depressing the NAV button on the mode selector with the navigation receiver tuned to a LOC frequency. Mode selection and annunciation in the LOC mode is similar to the VOR mode. The localizer deviation signal is gain programmed as a function of radio altitude, time and airspeed. If the radio altimeter is invalid, gain programming is a function of glide slope capture, time and airspeed. Other valid logic is the same as the VOR mode.

(6) Back course mode (BC). The back course mode is selected by pressing the BC button on the mode selector. Back course operates the same as the LOC mode with the deviation and course signals reversed to make a back course approach on the localizer. When BC is selected, and outside the lateral beam sensor trip point, BC ARM and HDG annunciators will illuminate. At the capture point, BC CAP will be annunciated with BC ARM and HDG annunciators extinguished. When BC is selected, the glideslope circuits are locked out.

(7) Localizer approach mode (APR). The approach mode is used to make an ILS approach. Pressing the APR button with a ILS frequency tuned, arms both the NAV and APR modes to capture the localizer and glide slope respectively. No alternate NAV source can be selected. Operating LOC mode is the same as described above except, if the radio altimeter is invalid in APR mode, gain programming is a function of glide slope capture, time, and airspeed.

With the APR mode armed, the pitch axis can be in any one of the other pitch modes except go-around. When reaching the vertical beam sensor trip point, the system automatically switches to the glide slope mode. The pitch mode and APR ARM annunciators extinguish and APR CAP annunciator illuminates on the controller. At capture, a command is generated to asymptotically approach the glide slope beam. Capture can be made from above or below the beam. The glide slope gain is programmed as a function of radio altitude, time and airspeed. The APR CAP annunciator on the mode selector will extinguish if the GS receiver becomes invalid after capture.

Glide slope capture is interlocked so that the localizer must be captured prior to glide slope capture. If the glide slope receiver is not valid prior to capture, the vertical beam sensor will not trip and the system will remain in the pitch mode. After capture, if the NAV receiver, GS receiver, compass data or vertical gyro becomes invalid, ADI command cue will bias out of view. If the radio altimeter is not valid, the glide slope gain programming will be a function of GS capture, time and airspeed.

While in the localizer approach mode, the pilot is able to use a flight management system (FMS) preprogrammed runway/outermarker waypoint for reference, by depressing the OMEGA DIST/BGR switch, located on the pilot's instrument panel. Depressing the switch while in the APR (NAV) mode with the NAV CTL mode selector switch also depressed, will cause the waypoint distance and bearing to display on the pilot's HSI. This function will be disabled if the FMS switch and/or the TACAN mode of operation has been selected.

(8) Pitch hold mode. Whenever a roll mode is selected without a pitch mode, the ADI command cue will display a pitch attitude hold command. The pitch attitude can be changed by pressing the TCS button on the control wheel and maneuvering the aircraft. The command cue will be synchronized to zero while the button is depressed. Upon release of the button, the pitch command will be such as to maintain the new pitch attitude. In the pitch hold mode, the ADI command cue will be biased out of view if the VG is not valid.

(9) TACAN mode. The TACAN mode is selected by depressing the DME/TAC alternate source selector switch, located on the pilot's radio control panel. Annunciators, placarded TACAN/ ADF 1 located on the instrument panel (both pilot and copilot side) will illuminate. TACAN navigation information will display on the pilot's HSI, and on the DME slave indicator.

NOTE

The NAV/TAC receiver must be tuned to a valid TACAN frequency.

TACAN functions are identical to VOR using TACAN information rather then VOR signals. The ARM/CAP annunciation is the same as in VOR mode.

(10) Altitude hold mode (ALT). The altitude hold mode is selected by depressing the ALT button on the mode selector. When ALT mode is selected, it overrides the APR CAP, GA, IAS, VS, and ALTSEL CAP modes. In the ALT mode the pitch command is proportional to the altitude error provided by the air data computer. The altitude error signal is gain programmed as a function of airspeed. Depressing and holding the TCS button allows the pilot to maneuver the aircraft to a new altitude hold reference without disengaging the mode. Once engaged in the altitude hold mode, the mode will be reset if the air data computer is not valid and the ADI command cue will bias out of view if the VG is not valid.

NOTE

If the baro setting on the altimeter is changed, a command is generated to fly the aircraft back to the original altitude reference.

(11) Indicated airspeed hold mode (IAS). The indicated airspeed hold mode is selected by depressing the IAS button on the mode selector. When IAS is selected, it overrides the APR CAP, GA, ALT, VS, and ALTSEL CAP modes. In the IAS mode the pitch command is proportional to airspeed error provided by the air data computer. Depressing and holding the TCS button allows the pilot to maneuver the aircraft to a new airspeed hold reference without disengaging the mode. Once engaged in the IAS mode, the mode will be reset if the air data computer is not valid. The ADI command cue will bias out of view if the VG is not valid.

(12) Vertical speed hold mode (VS). The vertical speed hold mode is selected by depressing the VS button on the mode selector. When VS is selected, it overrides the APR CAP, GA, ALT, ALTSEL CAP, and IAS modes. In the VS mode, the pitch command is proportional to VS error provided by the air data computer. Depressing and holding the TCS button allows the pilot to maneuver the aircraft to a new vertical speed hold reference without disengaging the mode. Once engaged in the VS mode, the mode will be reset if the air data computer is not valid. The ADI command cue will bias out of view if the VG is not valid.

(13) Altitude preselect mode (ALTSEL). The altitude preselect mode is selected by pressing the ALTSEL button on the mode selector. The desired altitude is selected on the altitude preselect controller. Pitch hold, VS or IAS may be selected as a mode to fly to the selected altitude. When outside the altitude bracket trip point, the ALTSEL ARM annunciator along with the selected pitch mode is illuminated on the mode selector. When reaching the bracket altitude, the system automatically switches to the ALTSEL CAP mode and the previously selected pitch mode is cancelled. When the altitude is reached, the ALTSEL CAP mode is automatically cancelled and the flight director switches to the ALT hold mode. If the air data computer is not valid, the altitude preselect mode cannot be selected. The ADI command cue will bias out of view if the VG is not valid.

(14) Standby mode (SBY). The standby mode is selected by depressing the SBY button on the mode selector. This resets all the other flight director modes and biases the ADI command cue from view. While depressed, SBY acts as a lamp test causing all mode annunciators to illuminate and the flight director warning flag on the ADI to come in view. When the button is released, the mode annunciator lights extinguish and the flight director warning flag retracts from view.

(15) Go-around mode. The go-around mode is selected by depressing the remote go-around switch. When selected all other modes are reset, and the remote go-around (GA) and yaw damp (YD ENG) annunciators will be illuminated. The ADI command cue receives a wings level command (zero command when roll is zero). The command cue also receives the go-around command which is a 7-degree visual pitch up attitude command. Selecting GA disconnects the autopilot. However, the yaw damper remains on.

Once go-around is selected any roll mode can be selected. The wings level roll command will cancel. The go-around mode is cancelled by selecting another pitch mode, or TCS.

f. Autopilot Controller. The autopilot controller (fig. 3-17), provides the means of engaging the autopilot and yaw damper as well as manually controlling the autopilot through the turn knob and pitch wheel. The autopilot system limits are:

Mode	Control or Sensor	Parameter	Value
Yaw Damper	Yaw Control	Engage Limit	Unlimited
Basic A/P	Touch Control Steering TCS	Roll Control Limit Pitch Control Limit	Up to ±45° Roll Up to ±20° Pitch
	Turn Knob	Roll Angle Limit Roll Rate Limit	±30° ±15°/sec
	Pitch Wheel	Pitch Angle Limit	±15° Pitch
	Heading Hold	Roll Angle Limit	Less than 6° and no roll mode selected
Heading Select	HSI Heading Select Knob	Roll Angle Limit Roll Rate Limit	±25° ±3.5°/sec
		CAPTURE	
VOR	Course Knob, NAV Receiver and DME Receiver	Beam Angle Intercept (HDG SEL)	Up to ±90°
		Roll Angle Limit Course Cut Limit at Capture	±25° ±45° Course
		Capture Point	Function of beam, beam rate, course error, and DME distance.
		ON COURSE Roll Angle Limit Crosswind Correction	 ± 13° Roll Up to ±45° Course Error
		OVER STATION Course Change Roll Angle Limit	 Up to +90° ± 17°
		LOC CAPTURE	
LOC or APR or BC	Course Knob and NAV Receiver	Beam Intercept	Up to ±90°
		Roll Angle Limit Roll Rate Limit Capture Point	±25° ±5°/sec Function of Beam, Beam Rate and Course Error.
		NAV ON-COURSE Roll Angle Limit Crosswind Correction Limit Gain Programming	 ±17° Roll ±30° of course error Function of Time and (TAS) starts at 1200 ft radio altitude.
		GLIDESLOPE CAPTURE	
	GS Receiver and Air Data Computer	Beam Capture	Function of beam and beam rate.
		Pitch Command Limit Glide slope Damping Pitch Rate Limit Gain Programming	±10° Vertical Velocity Function of (TAS) Function of Time and (TS) Starts at 1200 ft radio altitude. Function of (Radio Alt) Starts at 250 ft.
GA	Control Switch on Power Lever	Fixed Pitch-Up Command, Wings Level	7° Pitch Up

Mode	Control or Sensor	Parameter	Value
Pitch Sync	TCS Switch on Control Wheel	Pitch Altitude Command	±20° max
ALT Hold	Air Data Computer	ALT Hold Engage Range ALT Hold Engage Error Pitch Limit Pitch Rate Limit	0 to 50,000 ft +20 ft ±20° Function of (TAS)
VS Hold	Air Data Computer	VERT Speed Engage Range ALT Speed Hold Engage Error Pitch Limit Pitch Rate Limit	0 to +6000 ft/min ±30 ft ± 20° Function of (TAS)
IAS Hold	Air Data Computer	IAS Engage Range IAS Hold Engage Error Pitch Limit Pitch Rate Limit	80 to 450 knots ±5 knots ±20° Function of (TAS)
ALT Preselect	Air Data Computer	Preselect Capture Range Maximum Vertical Speed for Capture Maximum Gravitational Force During Capture Maneuver Pitch Limit Pitch Rate Limit	0 to 50,000 ft ±4000 ft/min ±20° ±20° Function of (TAS)

g. Controls and Functions.

(1) 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. Movement of the pitch wheel cancels any other previously selected vertical mode. However, movement of the pitch wheel has no effect with the autopilot coupled to the glide slope.

(2) BANK LIMIT PUSHBUTTON. Selection of the bank limit mode on the autopilot controller provides a lower maximum bank angle while in the Heading Select mode. LOW will illuminate on the bank limit switch. The lower bank limit is inhibited and LOW is extinguished during NAV mode captures. If heading select is again engaged, bank limit will again be illuminated. Pressing bank limit when illuminated will return autopilot to normal bank limits.

(3) SOFT RIDE pushbutton. Soft ride reduces autopilot gains while still maintaining stability in rough air. This mode may be used with any flight director mode selected.

(4) TURN knob. Rotation of the turn knob out of detent results in a roll command. The roll angle is proportional to and in the direction of the turn knob rotation. the turn knob must be in detent (center position) before the autopilot can be engaged. Rotation of the turn knob cancels any other previously selected lateral mode.

(5) YD ENGAGE pushbutton. When the autopilot is not engaged, the yaw damper may be utilized by depressing the YD ENGAGE pushbutton.

(6) AP ENGAGE pushbutton. The AP ENGAGE switch is used to engage the autopilot. Engaging the autopilot automatically engages the yaw damper. The autopilot may be engaged with the airplane in any reasonable attitude.

(*7) Autopilot disengage*. The autopilot is normally disengaged by momentarily depressing the control wheel AP DISC switch. The autopilot may however be disengaged by any of the following:

(a) Actuation of the control wheel AP DISC button. Disengagement is confirmed by 5 flashes of the AP ENG annunciator.

(b) Pressing the respective vertical gyro FAST ERECT button.

(c) Actuation of respective compass INCREASE-DECREASE switch.

(*d*) Selection of go-around mode. Disengagement is confirmed by the AP ENG annunciator flashing 5 times and illumination of the GA and YD ENG annunciators.

(e) Pulling the autopilot AP POWER circuit breaker.
(f) Pressing the autopilot AP ENGAGE pushbutton.
(g) When transferring between pilot and copilot flight directors.

Any of the following malfunctions will cause the autopilot to automatically disengage.

(a) Vertical gyro failure.
(b) Directional gyro failure.
(c) Autopilot power or circuit failure.
(d) Torque limiter failure.

Disengaging under any of the previous four conditions will illuminate the AP DISC annunciator and the flashing MASTER WARNING light. Pressing the control wheel AP DISC switch will extinguish the AP DISC annunciator.

(8) Elev TRIM annunciators. The elevator trim annunciator indicates UP or DN when a sustained signal is being applied to the elevator servo. The annunciator should not be illuminated when engaging the autopilot.

h. Touch control steering (TCS). The TCS push button located on the control wheel allows the pilot to manually change aircraft attitude, altitude, vertical speed and/or airspeed without disengaging the autopilot. After completing the manual maneuver, the TCS pushbutton is released, and the autopilot will automatically resynchronize to the vertical mode. Example: with IAS mode selected, the pilot may depress the TCS pushbutton and manually change airspeed. Once trimmed at the new airspeed the TCS pushbutton is released, and the autopilot will hold this airspeed. If a large pitch attitude change is made, the pilot should trim the aircraft normally before releasing the TCS button.

NOTE

Either pilot's TCS button will permit changing of the autopilot regardless of which pilot has control of the autopilot. However, use of the TCS will cancel the other pilot's flight director GA mode.

3-25. FLIGHT MANAGEMENT SYSTEM.

a. Description. The KNS-660 is an integrated, long range, multi-sensor flight management system. It may be used

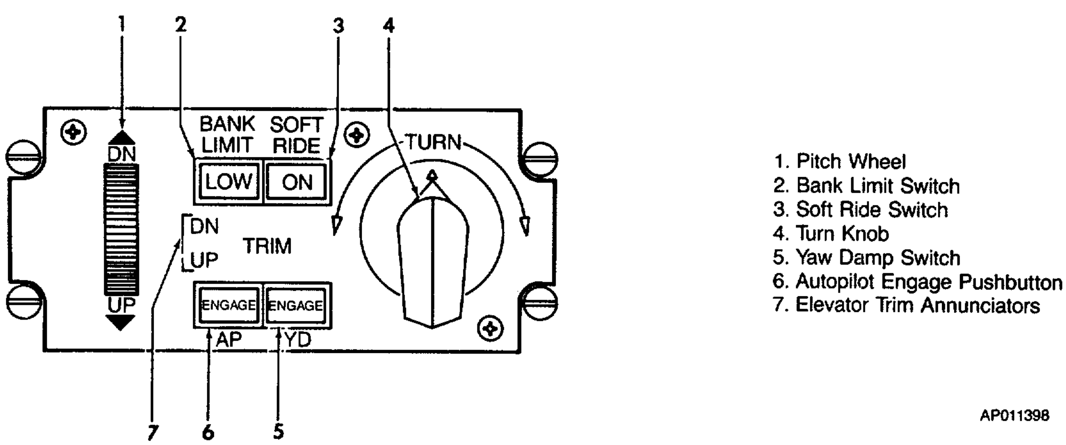


Figure 3-17. Autopilot Controller

to manage the entire range of navigational functions including trip planning, long range great circle navigation, and instrument approaches. The KNS-660 serves as a computer processor/display for inputs from a choice of sensors such as VOR/DME, OMEGA/VLF, TACAN or TAS. Navigation sensors may be selected separately or blended within the computer. It provides for manual operation to selected waypoints or automatic operation, providing uninterrupted navigation throughout a complete flight plan. The KNS-660 consists of a cockpit mounted control display unit (CDU) (fig. 3-18); a remote-mounted navigation computer; and an "H" field antenna (fig. 2-1).

In general, the KNS-660 is an earth oriented navigation system. This means that the system keeps track of its present position in terms of the earth's latitude and longitude coordinate system. The pilot, must tell the system his destination in a latitude and longitude format or in a format that the KNS-660 can convert to latitude and longitude. Also, the position sensors inputting to the KNS-660 must tell the system where the aircraft is in a latitude and longitude format or in a format the system can convert to latitude and longitude.

The KNS-660 accepts navigation inputs from the VOR, DME, TACAN and OMEGA/VLF navaids. In addition the system uses aircraft heading and altitude inputs. With the exception of OMEGA/ VLF, each of the sensors used is mounted enternal to the navigation computer.

The KNS-660 incorporates a self-contained data base. The data base consists of 175 storage locations accommodating any combination of ground stations and/or airports. If required, any number of these 175 user generated waypoints can be secured against cockpit alteration. There are two primary ways that the data base is used by the system. The first way can be thought of as a sophisticated lookup table. Rather than having to manually locate and then enter the latitude and longitude for a specific waypoint, the data base allows the pilot to enter an alpha-numeric ICAO identifier and have the data base automatically look up and display the associated latitude and longitude. The other primary way the system uses the data base, is to allow navigation with the VOR and DME (or TACAN) sensors. To do so navaids must be loaded in the data base. The information stored in the data base is updated, using a periodically supplied 3.5 inch diskette. A small battery housed internal to the navigation computer keeps the data base alive when power is removed from the system. Typical battery life is 6 years.

In addition to the data base memory, the KNS-660 has additional memory capacity which enables support of 100 flight plans, consisting of 25 alpha/numeric designated waypoints. These flight plans may be composed of any combination of waypoints taken from the data base or user generated waypoints.

Dedicated special function keys are physically and visually separated from the alpha/numeric keys used in the generation and storage of flight plans and waypoints.

The KNS-660 interfaces with the KGR-358 radar graphics unit, providing a radar graphics presentation on the weather radar display. This includes such items as flight plan waypoints, selected course, and reference ground stations.

The KNS-660 system is protected through a 5 ampere circuit breaker placarded FMS, located on the overhead circuit breaker panel.

b. Controls and Functions.

(1) (ON/OFF) switch. A rocker type switch which, when pressed at the top, turns the system on and initiates the self test process. When pushed at the bottom and held for approximately 2 seconds, the unit turns off. Prior to turning off, a caution message is presented on the screen.

(2) Alpha-numeric entry keys. The control display unit (CDU) has 36 alpha-numeric keys, 10 of which are used to enter numericals 0 to 9 and 26 keys which are dedicated to entering the characters A through Z. Eight of the 10 numeric keys are also used to enter: North, South, East, West, left, right, minus (-), and plug (+).

(3) (ENTER) enter key. The enter key is used to insert the data displayed under the cursor or a complete page of information into the computer memory. It is also used to select various menu items and to approve specific cursor statements.

(4) (CLR) clear key. This key can be used to clear a single character in a data field, a complete data field, or an entire page depending on the procedure used. It is also used on non-enterable fields preceded by a right caret (>) to cycle between two or more related selections.

(5) (HLD) hold key. Pressing the hold key allows the control display unit (CDU) to display the two hold pages (HOLD 1 and HOLD 2). The HOLD 1 page is displayed the first time the HLD key is pressed and the HOLD 2 page is displayed when the HLD key is pressed again (alternate action). The HOLD functions are used for updating the KNS-660 present position and for creating a waypoint at the aircraft's present position.

(6) (DAT) data key. The data key is used for viewing the two data menu pages (DATA 1 and DATA 2). It is also used for returning from lower level data pages to higher level data pages.

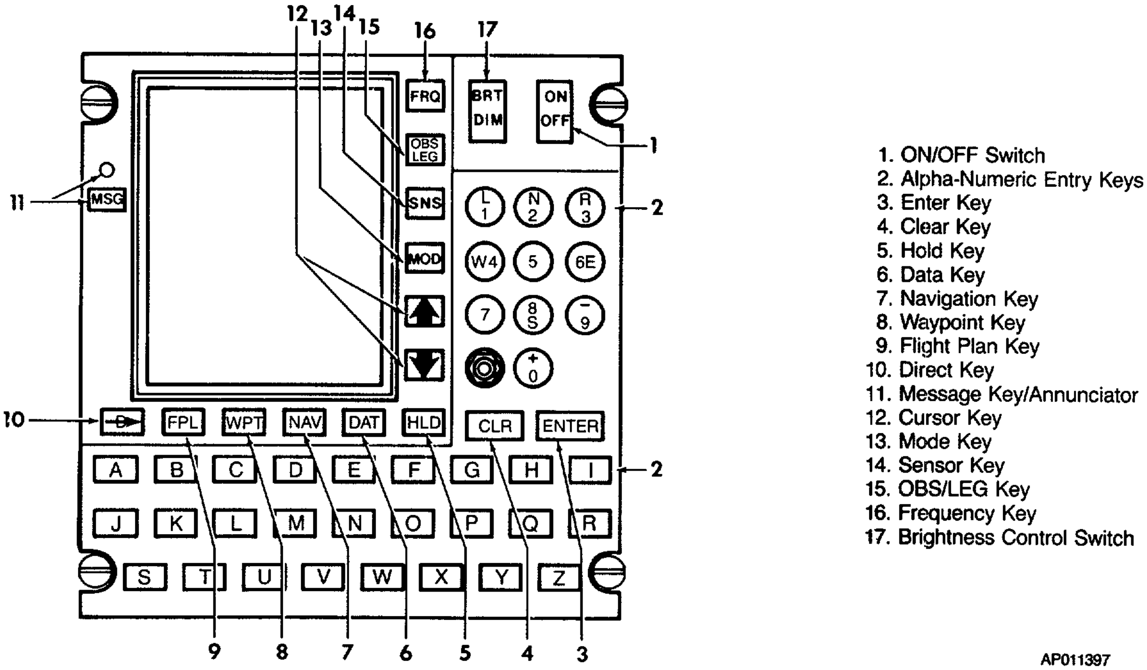


Figure 3-18. KNS-660 Control Display Unit (CDU)

(7) (NAV) navigation key. Pressing this alternate action key allows viewing of the two NAV pages (NAV 1 and NAV 2). The NAV 1 page is displayed by pressing the NAV key once the NAV 2 page is displayed by pressing the NAV key again.

(8) (WPT) waypoint key. The waypoint key has two functions: (1) To cycle through the waypoint pages associated with the active flight plan (FPL 0). (2) To display the waypoint pages of other waypoints in the system.

(9) (FPL) flight plan key. The flight plan key is used to select viewing of the active flight plan page (FPL 0) or the flight plan menu pages (FPLS). Pressing the key repeatedly will cycle through the FPL 0 page and all FPLS pages and then back to the FPL 0 page. If the control display unit (CDU) is displaying a page other than the FPL 0 page or a FPLS page, pressing the FPL key once will display the FPL 0 page.

(10) (D) direct to key. When pressed, allows selection of direct to operation. It may be used anytime after system initialization.

(11) (MSG) message key. When the alternate action message key is pressed it will allow display of the message page. Press once to select and again to deselect. The message key is used to acknowledge a MSG light. The MSG light will go out only after the message has been satisfactorily acknowledged.

(12) (↑ and ↓) cursor keys. These keys are used to position the cursor (a bright inverse video rectangle) over information in a line or portion of a line on the control display unit in order to approve or change that information. If the cursor is out of view it can be brought onto the screen at the top or bottom by using the↓ (down) or the ↑ (up) cursor keys.

(13) (MOD) mode key. The mode key allows selection of NAV, RNV ENR (RNAV enroute), or RNV APR (RNAV approach) modes of operation. When NAV is selected, normal angular HSI deviation bar sensitivity occurs (+ 10° full scale). When RNV ENR is selected the deviation bar indicates + 5 nautical mile full scale and when in RNV APR the deviation indicates ± 1.25 nautical mile full scale. When an ILS frequency is selected the sensor annunciated is ILS. OBS will be displayed as the method of operation and ILS will be displayed and the mode of operation. When the OMEGA or BLEND sensor is selected, RNV ENR is automatically selected as the only mode of operation.

(14) (SNS) sensor key. The SNS key selects the active sensor to be used for navigation. Alternate key strokes will select VOR, OMEGA, TACAN, or BLEND. When the VOR sensor is selected, navigation is based upon available VOR/DME signals. When an ILS frequency has been selected as the active waypoint the sensor annunciation indicates ILS. When the OMEGA sensor is selected, navigation is based upon available omega and VLF signals. When the BLEND sensor is selected, navigation is based on a computer blend of position inputs from all active sensors.

(15) (OBS/LEG) key. The OBS/LEG key selects method of operation. Each key push selects the next method of operation in the sequence of OBS, AUTO/LEG then back to OBS.

(16) (REQ) frequency key. Selects the two frequency pages which allow frequency management of compatible avionics.

(17) (BRT/DIM) brightness control switch. A rocker type switch which, when pressed at the top, increases the picture brightness and message light intensity in incremental steps to the maximum level. When pushed at the bottom, the brightness is decreased in incremental steps to the minimum level. When the unit is turned on the brightness is preset to 80% of the maximum level.

c. Page Display Definitions. The control display unit (CDU) presents information to the pilot arranged like pages in a book. Individual displays on the CDU are therefore referred to as pages.

With the exception of the self test page and the system failed page, each page has a header at the top consisting of:

Page Name - located in the upper left portion of the header.
Selected Sensor - located in the lower left portion of the header.
Method of Operation - located in the upper right portion of the header.
Mode of Operation - located in the lower right portion of the header.

The following is a list of page names that will appear (as selected in the page name field:

NAV 1	FREQ 2
NAV 2	INIT
WPT	HOLD 1
DUPL	HOLD 2
FPLS	DATA
FPL #	MSG
FPL 0	DATA 1
FREQ 1	DATA 2

The method of operation field (selected with the OBS/LEG key) displays the selected method of operation. This field normally displays either OBS or AUTO/LEG.

The selected sensor field displays the sensor chosen to provide navigation inputs to the system. The sensor key is used to make the sensor selection. The following is a list of possible sensor annunciations:

Blend	- System uses position inputs from all available sensors except the IRU.
VOR	- VOR and DME.
TACAN	- Tactical air navigation.
OMEGA	- Omega and VLF.
ILS	- Instrument landing system (displayed when a localizer frequency is active).

The mode of operation displays in the mode of operation field. Possible modes of operation displayed are:

RNAV ENR	- RNAV enroute (± 5 NM full scale HSI deviation bar sensitivity).
RNAV APR	- RNAV approach (± 1.25 NM full scale HSI deviation bar sensitivity).
NAV	- Navigation (±10° full scale HSI deviation bar sensitivity).
ILS	- Instrument landing system (displayed when a localizer frequency is active).

(1) Self test page. The self test page is the first page of information presented when the unit is turned on. Following an automatic self test the status of the system is displayed as well as a list of navigation data for the pilot to

verify on actual aircraft instruments and displays. They are:

SYSTEM OK	- Indicates that the unit has passed the self test.
RMI 130°	- The aircraft's RMI needle should be pointing to 130°.
DIS 34.3 NM	- The aircraft's DME display should be indicating 34.3 NM.
SEL CRS 315°	- The course arrow on the HSI should be indicating 315°.
HORZ DEV RT 3	- The deviation bar on the HSI or CDI should be 3 dots to the right of center (or an indication of 3 NM to the right of center).
VNAV DEV UP 3	- The VNAV indicator should be displaying an up 3 dot deflection (or an indication of 300 feet below the desired vertical flight path).
CHECK	- RMI-DIS
CHECK	- CDI-CRS
CHECK	- ANN LTS The annunciator lights illuminate to re mind the pilot to check the applicable data values displayed on the control display unit with the actual aircraft instruments.
ORS	- Operation revision status. A control number which indicates what level of operational capabilities are applicable to the system.
TEST OK?	- Cursor position used to approve the self test page.
C1984 KING/RADIO	- Copyright logo.

(2) Initialization page. The initialization page will be displayed after the self test page is approved.

DATE:	- Greenwich date in the order of day-month-year. The first three letters of each month are used for month abbreviations.
GMT:	- Greenwich mean time in hours and minutes. The correct date and GMT are retained even when aircraft power is removed.
REF NAVAID ID	- The NAVAID (within 50 NM miles) closest to the systems last computed position before power was removed.
WPT ID:	- A data entry field where the waypoint identifier of the aircraft's present position may be entered.
POS:	- The last known computer generated present position.
EST GS:	- Estimated ground speed manually entered. Should be 0 if the aircraft is on the ground, or a close estimate if in flight.
APPROVE?	- Used to approve the data on the page and enter the data into the computer memory. Other pages are not accessible until this step is completed.

(3) Omega restart initialization page. If the system is sensing through a omega sensor, in the NAV status, and power to the system is lost for more than seven seconds but less than seven minutes and the selected sensor is BLEND or OMEGA, an omega restart initialization page will be displayed instead of the normal initialization page.

LAST GMT	- The greenwich mean time when power was lost.
LAST KNOWN PRES	- The calculated position of the system when power was lost.
GMT:	- The present greenwich mean time.
ESTIMATED PRES POS:	- The dead reckoning calculated position. If this is incorrect the correct position can be entered on the HOLD 1 or HOLD 2 page.
APPROVE?	- The cursor position used to approve the omega restart initialization page.

(4) Message page. The message (MSG) annunciators come on whenever there is a situation that requires the pilot's attention. The MSG annunciators will flash continuously until acknowledged by pressing the MSG key, which displays the message page. The message page lists the various messages which are applicable to the unit's

operation at that time.

After viewing the message, the operator may either select a new page by pressing another page key or by pressing the MSG key which will return to the previous page. In either case, the message light will be extinguished unless there is a situation which requires operator action. In this case the message light will remain on solid until the pilot's action is taken. Whenever new messages are displayed which have never been seen by the operator, they are separated from the previously viewed messages by a blank line.

(5) Flight plan pages. The flight plan menu pages (FPLS) display a listing of the flight plans contained in the systems memory. The flight plans are listed in increasing order of flight plan number. When initialization is complete, the first flight plan menu page appears. A maximum of 100 flight plans may be listed by the flight plan numbers 0 to 99. If more than 9 flight plans are stored, then successively pressing the FPL key will display additional FPLS pages containing the remaining stored flight plans.

SEL FPL:	- The desired flight plan number is entered into this field. The flight plan number selected does not have to be displayed on this page.
0	- The 0 indicates the first flight plan number. Flight plan 0 is the active flight plan and is displayed on each flight plan menu page.
>	- The > notes that another operation can be performed by pressing the CLR key while the cursor is over this field. When indexed to the left of a flight plan, it provides the option to store that flight plan in any unused flight plan position.
(*) Asterisk	- The asterisk (*) indicates that this is a protected flight plan.
FPLS AVAIL	- Indicates the number of empty flight plans available for use.

(6) Flight plan # page. Each flight plan page is called up via the flight plan menu page. A flight plan is limited to a maximum of 25 waypoints. An asterisk (*) after FPL would indicate that this is a protected flight plan.

ACTIVATE?	- This flight plan can be made active by placing the cursor over ACTIVATE? and pressing ENTER.
INVERT	- The option of activating this flight plan in inverted order is available (first waypoint becomes the last and last waypoint becomes the first) by placing the cursor over INVERT? and pressing ENTER.
NEXT PAGE?	- When more than nine waypoints are used in a flight plan, the next page (or pages) can be displayed by placing the cursor over NEXT PAGE? and pressing ENTER. From the last page of the flight plan this procedure is used to return to the first page of the flight plan.
DIS	- Distance is displayed from the initial waypoint.
REF WPT	- A data entry field where a reference navaid or airport identifier may be entered to create an on course waypoint.

(7) Flight plan 0 page. The flight plan 0 page is a display of the active flight plan and its associated data.

DIR:	- This line is present only when direct to operation is being used. The direct to waypoint name and distance to this waypoint are displayed. Estimated time of arrival (ETA) and estimated time enroute (ETE) to the direct waypoint may also be displayed.
>DIS	- A cyclic field which changes from distance (>DIS) to estimated time of arrival (>ETA) to estimated time enroute (>ETE). As with all cyclic fields, the field is changed by positioning the cursor over the field and pressing the CLR key.

The distance displayed under the >DIS column beside each waypoint are the cumulative distances from the aircraft's present position to each waypoint along the flight plan route.

>ETA - This column displays the estimated time of arrival in GMT and is based on the current ground speed and distance to each waypoint from the aircraft's present position.

>ETE - This column displays the estimated time enroute to each waypoint based on the current ground speed and distance to each waypoint from the aircraft's present position.

>ALT - This column displays the selected altitudes associated with the flight plan waypoints.

DEP - The departure time is the GMT that the system first calculated a ground speed greater than 50 knots. DEP is displayed only when ETA has been selected.

FLT - The total elapsed time in flight. The elapsed time begins when the system first calculates a ground speed of 50 knots. FLT is displayed only when ETE is selected.

1 FIRST - The first waypoint is displayed at the top of the list of waypoints regardless of the number of waypoints in FPL 0. This line can become a non-enterable cursor field and will display WPT? when used for manual scrolling of the waypoints.

* - A single * designates the direct to waypoint if it is part of FPL 0. A single * also designates the active waypoint when in OBS method of operation.

*
* - When the system is in AUTO/LEG operation and the direct to feature is not being utilized, a pair of asterisk's (*) designate the active FROM waypoint (top *) and TO waypoint (bottom *). Thus, the pair of asterisk's define the active flight plan leg. The asterisk's change automatically as the aircraft moves along the flight plan.

The last waypoint in FPL 0, and its associated distance, estimated time of arrival, or estimated time enroute are displayed at the bottom of the list of waypoints. This line can become a non-enterable cursor field and display WPT? when used for manual scrolling of the waypoints.

REF WPT: - A data entry field where a reference navaid or airport identifier may be entered to create an on course waypoint.

(8) Waypoint page. The waypoint page is used to display, verify, and create waypoints for use in the operation of the system.

WPT* - If the displayed waypoint has a protected status, an asterisk (*) will appear next to the WPT page field.

DSP - Indicates the displayed waypoint number from the active flight plan. A "D" would indicate that the waypoint being displayed is a direct to waypoint which is not part of the active flight plan. If the displayed waypoint is not part of the active flight plan and is not a direct to waypoint, dashes will be displayed.

The field may be used to display a waypoint from flight plan 0 by entering the desired waypoint number into this data entry field.

ACT - Indicates the active waypoint number from the active flight plan. If the direct to feature is being used and the direct to waypoint is not contained in the active flight plan, then a "D" will be displayed.

USE? - Queries the operator if he wants to make the displayed waypoint the active waypoint. To do so the cursor is positioned over this field and the ENTER key is pressed.

WPT NAME: - The identifier or name of the displayed waypoint. From 1 to 5 alpha-numeric characters are used to identify a waypoint.

REF NAME: - Reference facility identifier. The pilot may enter a navaid, airport, or any other waypoint stored in memory within 200 NM of the waypoint being defined. However, to utilize the VOR sensor (VOR or BLEND sensor selected) while operating in OBS method of operation the REF NAME entry must be a navaid identifier. In OBS operation the reference navaid is the only station tuned by the VOR navigation receiver and the DME (or TACAN).

FREQ - Frequency of the reference navaid. If the reference facility input is a navaid, its frequency is automatically entered. When the reference facility identifier entered is not a navaid, blanks are displayed.

A caret (>) will be displayed between FREQ and the frequency field when using the TACAN sensor. With the cursor over the frequency field the CLEAR key is used to select either frequencies or TACAN channels. The system will remain in the FREQ or CHNL select mode until changed by the pilot.

RAD:

DIS: - Radial and distance from the reference facility to the waypoint.

LAT:

LON: - Position of the waypoint presented as latitude and longitude coordinates using degrees, minutes and tenths of minutes.

RUNWAY/OM? - This cursor field allows selection of runway thresholds and outer markers. It appears whenever the data base is loaded with runway thresholds and/or outer markers and when the identifier displayed in the WPT NAME field is an airport.

44 WPTS AVAIL - When the waypoint page is initially displayed, after having been previously approved, the number of memory locations available for waypoint storage is displayed.

APPROVE? - Following the first data entry on the waypoint page the WPTS AVAIL will be removed. The APPROVE? field will then appear.

When clearing a waypoint page, the interrogative field DELETE? will appear in place of APPROVE?.

(9) Waypoint used-in page. The waypoint used-in page is used for deleting a waypoint. The page displays the identifier of the waypoint to be deleted.

DELETE? With the cursor over the field to be deleted, the field is deleted by pressing the ENTER key.

(10) Waypoint runway/outer marker page. When the selected waypoint is an airport and the data base contains runway and/or outer marker information the message RUNWAY/OM? will appear at the bottom of the waypoint page. The runway/ outer marker page can then be selected. A runway or outer marker may be selected from the listing on this page.

SEL RW/OM: - The menu number to the left of the desired runway threshold or outer marker may be entered in this field.

NEXT PAGE - If all the runway thresholds and outer markers aren't contained on one page this field is used to view the remainder which are contained on another page.

(11) Waypoint duplication page. When an identifier is entered in a waypoint identifier field and multiple definitions for this identifier exist in the system data base, the waypoint duplication page will be displayed.

SEL COUNTRY: - The number associated with the desired country may be entered in this field.

IDENTIFIER TOP	- The identifier having multiple definitions stored in the data base. A listing of the countries containing the same waypoint identifier will display under IDENTIFIER TOP. If an identifier for an intersection has been entered, a "T" or an "E" will be displayed next to the country name to indicate that the intersection is terminal or enroute.

(12) NAV PAGES. There are two NAV pages (NAV 1 and NAV 2) alternately selected by pressing the NAV key.

NAV 1 PAGE	- The NAV 1 page format varies somewhat depending on whether the method of operation is OBS or AUTO/ LEG.

(a) OBS method of operation display.

USE	- The number displayed is the active waypoint number. When using the direct to feature (DIR) is displayed.
ID	- The identifier code of the active waypoint.
DIS	- Distance to the active waypoint in nautical miles.
ETE	- Estimated time enroute to the active waypoint in hours and minutes. This value is based on the present calculated ground speed, assuming that the actual track is equal to the bearing to the waypoint.
GS	- Ground speed in knots.
TAS:	- The colon (:), when displayed, indicates this is an enterable data field, only when there is no true airspeed source available. A true airspeed may be manually entered so that the system can make a wind calculation.
WIND	- The computed wind using the TAS. Displayed in degrees true and knots. This field will display dashes if the computed wind is less 10 knots.
BRG	- The bearing from the aircraft's present position to the active waypoint.
HDG	- The current aircraft heading.
>POS RAD	
MKC DIS	- The aircraft's present position displayed in terms of a navaid, and the radial and distance from it. Another navaid identifier may be manually inputted. The present position will be referenced to that facility. If the navaid is manually changed, the system will resume automatic navaid selection for this field in approximately one minute.
>POS	- The aircraft's present position coordinates in latitude and longitude. The pilot may change the present position back and forth as desired between the navaid identifier, radial, and distance format and the latitude/longitude format by placing the cursor over the >POS field and pressing the CLEAR key. When an ILS frequency is active the POS block displays the ILS frequency and the radial and distance display dashes.

(b) Auto/leg method of operation display.

LEG	- Active leg of flight plan. When operating direct to a waypoint, (DIR) and the waypoint identifer are displayed.
DIS	- Distance to the active waypoint in nautical miles.
ETE	- Estimated time enroute to the active waypoint in hours and minutes. This value is based on the present calculated ground speed, assuming that the actual track is

equal to the bearing to the waypoint.

GS	Ground speed in knots.
TAS:	The colon (:), when displayed, indicates this is an enterable data field, only when there is no true airspeed source available. A true airspeed may be manually entered so that the system can make a wind calculation.
WIND	The computed wind using the TAS. Displayed in degrees true and knots. This field will display dashes if the computed wind is less than 10 knots.
DTK	Desired track. The great circle course in degrees along the active leg of the flight plan.
TK	Actual track. The track the aircraft is flying over the ground.
BRG	The bearing from the aircraft's present position to the active waypoint.
DA	The drift angle left or right in degrees. If the aircraft's actual track over the ground is to the right of the aircraft's heading a right (R) drift angle is indicated. If the track is to the left of the aircraft's heading a left (L) drift angle is indicated.
POS	The aircraft's present position displayed in terms of a navaid, and the radial from it. Another navaid identifier may be manually inputted and the present position will be referenced to that facility. If the navaid is manually changed, the system will resume automatic navaid selection for this field in approximately one minute.

(13) Nav 2 page.

LEG	Varies somewhat depending on whether the method of operation is OBS or AUTO/LEG.
ACT	This column header indicates that data in this column is pilot selectable.
L XTK: R	The data to the left side of XTK: is the actual cross track error, which is the lateral displacement of the aircraft in nautical miles left or right of the desired track. If parallel track operation is desired, the selected cross track may be entered to the right of the XTK: field. The selected cross track distance provides steering to a left or right offset course parallel to the desired track.
REF MAG	The data to the left of REF is the actual magnetic variation in degrees computed for the present position of the aircraft. The data to the right of REF is the system compass mode. BGR, DTKM HDG, and TK are referenced with respect to the displayed system compass mode.
VNAV	The VNAV (vertical navigation) field and the associated VNAV lines below it are displayed only when the system is configured for manual VNAV operation. When present, the pilot can initiate a manual VNAV system configuration by entering data into the appropriate data fields.
ALT:	The data to the left of ALT: is the actual present aircraft altitude. The pilot may enter a selected altitude in the data field to the right of ALT:.
ANG:	The data to the left of ANG: is the actual vertical angle between the present aircraft position and the active vertical waypoint or vertical offset point if selected, between 0 and 9.9 degrees. If manual VNAV operation is utilized the pilot may select a vertical angle in the data entry field to the right of ANG:. If manual

VNAV operation is not engaged this field displays the actual vertical angle.

OFST: The data to the left of OFST: is the distance to the vertical waypoint or vertical offset point if selected. The pilot may enter an along track offset (nautical mile) in the data field to the right of OFST:. A positive number puts the vertical offset point past the waypoint and a negative number puts the vertical offset point between the aircraft and the waypoint.

(14) Hold 1 page. The HOLD 1 page is used to check position accuracy, to update the KNS660 position or to create a waypoint at the aircraft's present position.

POS The present position calculated by the system which was frozen in this display when the HOLD key was pressed.

IDENT: The waypoint identifier of the fix contained in the systems memory, that was over flown to check or update position. If the identifier entered here is not contained in memory this becomes the identifier of a waypoint with the coordinates displayed adjacent to POS.

FIX: The actual coordinates of the position overflown.

DIF The difference in position between the systems calculated position and the FIX position in degrees, minutes and tenths of minutes.

UPDATE? A cursor field used to update the systems position when the ENTER key is pressed.

(15) Hold 2 page. The HOLD 2 page is used to update the system position. It is also used to make manual altitude, heading, or ground speed entries when required by the system.

IDENT: The waypoint identifier of a point to be overflown for position updating.

FIX: The actual coordinates of the point to be overflown for position updating.

MAN HDG:°t This field will be present on the HOLD 2 page only if all of the system's heading source inputs fail. The pilot may manually enter the aircraft's heading referenced to true north in this data field.

MAN ALT: FT This field will be present only if all of the system's altitude inputs fail. The aircraft's altitude may then be manually entered in this data field.

EST GS: This field will be present if the omega receiver requires dead reckoning inputs to gain navigational status. The estimated ground speed may then be manually entered in this data field.

UPDATE? A cursor field used to update the system position when the ENTER key is pressed. This field does not effect operation of the MAN HDG:, MAN ALT:, or EST GS fields.

(16) Frequency 1 page. The FREQ 1 page is used for frequency management.

[ ] Transponder code or frequency entered in the scratch pad area of display, displays here. SEL OPTION: The appropriate menu number choice may be entered in this field.

STBY Menu numbers chosen from this column will result in the scratch pad frequency being loaded into the standby window of the appropriate control head.

ACT Menu numbers chosen from this column will result in the scratch pad frequency.

or transponder code being loaded into the appropriate control head's active window.

(17) Frequency 2 page.

[ ]	Frequency or transponder code entered in the scratch pad area of display, displays here.
FREQ SUMMARY	A non-cursor field which indicates that the listing below is all control heads connected for frequency management capability and their respective active frequency/codes.

Each of the ADF control heads tied to the frequency management is listed along with its respective active frequency/code. The frequency/code fields are manually enterable.

When the number one VOR NAV receiver is being used as a sensor for the KNS-660, a dot is displayed to indicate that data cannot be entered in this field. If the NAV CTL function is activated thereby removing the number one VOR NAV receiver as a sensor, the active NAV 1 frequency will be displayed and this will be an enterable data field.

(18) Data 1 menu page. The DATA 1 menu page lists the actual data pages which can be selected from this page. Specific data pages are selected by entering the corresponding menu number into the SEL MENU ITEM: data field and pressing the ENTER key. They may also be selected by placing the cursor over the menu item and pressing the ENTER key.

(19) Nearest airports page. The nearest airport page may be called up at any time to provide three airports from the data base closest to the aircraft's present position (within 200 nautical miles).

NEAREST AIRPORTS	The last greenwich mean AS OF GMT time (GMT) the data base was queried for the three nearest airports. The data base is queried approximately every two minutes.
IDENT BGR DIS	The ICAO identifiers for the three nearest airports are displayed along with the respective bearing and distance to these airports from the aircraft's present position. The bearing and distance displayed are real time data.
4:	This field provides a means to determing the bearing and distance to any airport entered which is listed in the data base, or any user defined airport.

(20) Trip planning menu page. The trip planning menu page is a secondary menu which allows the pilot to choose from three different types of trip planning.

SEL MENU ITEM: The menu number of the desired kind of trip planning can be entered in this data field.

1. WPT REL TO PRESENT POS-Trip planning from the aircraft's present position to another waypoint.
2. WPT TO WPT ANALYSIS-Trip planning between any two waypoints.
3. FPL ANALYSIS-Trip planning of one of the flight plans stored in the FPLS pages.

(21) Waypoint relative to present position trip planning page.

WPT NAME:	Desired waypoint identifier.
LAT:	The waypoint location presented in latitude coordinate.
LON:	The waypoint location presented in longitude coordinate.
DIS NM	The distance in nautical miles from the aircraft's present position to the selected waypoint. Not updated as the present position changes.
BRGTO	The bearing in degrees from the aircraft's present position to the selected waypoint. Not updated as the present position changes.
ENTER GS:	The aircraft's estimated ground speed for the trip can be entered in this data field.

ETE H: M	The estimated time enroute for the trip based on ground speed.

(22) Fuel planning page.

REM:	The total fuel remaining in pounds. Must be manually inputted. Automatically counts down as a function of time and the manually entered fuel flow.
FLOW:	The total fuel flow in Ibs/ hr. Must be manually inputted.
RESERVE:	The desired fuel reserve in pounds. Must be manually inputted.
LAST UPDATE	Time in minutes since the pilot has updated any of the fuel planning data. After 15 minutes the HRS, RANGE, and NM/1 00 LB fields blank and an UPDATE IN-PUTS message flashes at the bottom of the page.
HRS	The endurance in hours and minutes based upon the manually inputted fuel remaining, fuel flow and fuel reserve data.
RANGE (NM)	The range in nautical miles based upon endurance and the aircraft's present ground speed as calculated by the system.
NM/100 LB	The aircraft's fuel economy in nautical miles per 100 lbs. of fuel based upon the present ground speed and manually inputted fuel flow.
UPDATED INPUTS	This flashing message appears only if data has not been updated for 15 minutes.

(23) Position summary page. The position summary page displays the aircraft's position in latitude and longitude coordinates as determined by each of the sensors.

POS	The aircraft's present position coordinates based on inputs from the pilot selected sensor. When BLEND sensor has been selected this position is a computer optimized position which blends the position information from all the sensors.
VOR	The aircraft's present position coordinates based on inputs from the VOR and/or DME sensors.
OMEGA	The aircraft's present position coordinates based on inputs from the omega/VLF sensor. If the omega/VLF status page displays AUTO/ UPDATE and the VOR/ DME status page indicates that the system is providing rho-rho coordinates (DME distance from two separate navaids). Under any other conditions the coordinates presented here are purely from the omega/VLF sensor.
NEXT PAGE?	The NEXT PAGE field displays when remaining sensors are displayed on the next page. The next page is displayed by placing the cursor over this field and pressing the ENTER key.

(24) VOR/DME status page. The VOR/ DME status page may be used to monitor the VOR and/or DME stations being used by the system.

VOR 1 REC	Indicates that the NAV sensor has tuned a programmed VOR station frequency. REC indicates that a valid (not flagged) signal is being received, and the station radial on which the aircraft is located.
DME 1 REC	Indicates that the DME sensor is tuned to a programmed paired VOR frequency. REC indicates a valid (not flagged) signal is being received, and distance from the station to the aircraft.
DME 2. NM.	Indicates that valid DME distance is not being received from a second station. The system is therefore providing rho-theta (angle provided by the VOR, and

distance from the DME) navigation data.

DME 2 REC — When valid DME data is received from a second DME station this area displays REC, the identifier and frequency of the station utilized, and the aircraft's distance from the station. Under these conditions, the system is providing rho-rho navigation data.

When the system is providing rho-rho navigation it is not unusual for the VOR station identifier to be different from either of the DME station identifiers. It is also possible under valid rho-rho conditions for the VOR data to be blanked or flagged. It is normal during rho-rho operation for the DME stations to temporarily flag due to recalculation of optimum station pair.

(25) Tacan status page. The TACAN status page may be monitored to view the status of the TACAN stations being used by the system.

TACAN REC — Indicates valid (not flagged) TACAN bearing information is being received. The TACAN channel and radial the aircraft is on will display.

DME 1 REC — Indicates valid (not flagged) DME distance information is being received. Frequency and DME distance will display.

DME 2. NM. — Indicates that valid DME distance is not being received from a second station. The system is therefore providing rho-theta navigation data.

DME 2 REC — When valid DME data is received from a second DME station this area displays REC, the identifier and paired VHF frequency of the station utilized, and the aircraft's distance from the station. Under these conditions, the system is providing rho-rho navigation data. When the system is providing rho-rho navigation the TACAN bearing data is dashed out.

(26) Omega/VLF status page. The omega/VLF status page may be displayed to monitor the status of the omega/VLF or to make operational selections affecting the omega/VLF.

AUTO UPDATE — Normally this line will display AUTO UPDATE which means that the DME sensor updates the omega system when rho-rho navigation is being provided. By placing the cursor over this field and pressing the CLEAR key this field will cycle between AUTO UPDATE and NO AUTO UPDATE. The omega system is not being updated when NO AUTO UPDATE is selected. The system always defaults to AUTO UPDATE when power is removed and later turned back on. If the omega system requires a relane operation this line will display RE-LANE?. To select the omega re-lane operation, place the cursor over RE-LANE? and press the ENTER key. The system then displays the re-lane page.

SYNC — This field can indicate either SYNC or NO SYNC. NO SYNC will appear until the received omega stations are sorted out and identified. At that time SYNC will be displayed.

NAV — This field can indicate INIT, NAV, WARN or FAIL. INIT will be displayed until the present position is determined, then NAV will be displayed. FAIL will be displayed whenever the present position cannot be determined either due to an equipment failure or due to the number of stations presently received.

CAUTION

The system should not be used for navigation purposes when relying on the omega/ VLF sensor and INIT or FAIL are displayed.

OMEGA/VLF — Indicates the primary and secondary sensors being used by the omega/VLF system, where the left most sensor displayed is the primary one, when two sensors are being used. The following fields are used: VLF, VLF/OMEGA, OMEGA or OMEGA/VLF.

OMEGA VLF — The identifiers and associated data under the OMEGA column pertain to the omega stations. The identifiers and associated data under the VLF column pertain to the VLF stations. The locations of the station identifiers are as listed below.

(a) Omega stations.

NOR-Norway

LIB-Liberia

HAW-Hawaii

NDK-North Dakota

LRN-LaReunion

ARG-Argentina

AUS-Australia

JPN-Japan

(b) VLF stations. The system will automatically choose to display the closest eight VLF stations to the aircraft's position from the list below:

NOR-Norway

GBR-Great Britain

HAW-Hawaii

WAS-Washington

MAR-Maryland

MAI-Maine

AUS-Australia

JPN-Japan

PRT-Puerto Rico

LIB-* GBR — Columns 1 and 3 display the three letter station identification of the omega station.
Column 4 displays either a blank space or a minus sign. A minus sign indicates that the pilot has manually deselected the station. The station may be deselected by placing the cursor over this field and pressing the 9/key and the ENTER key. If the entry is pilot deselected, the deselection can be removed by placing the cursor over the (minus sign) and pressing the 0/ + key and the ENTER key.
Columns 5 and 6 display a quality factor number from 0 to 99 that is representative of the signal to noise ratio of the omega station. The system will utilize the omega station if the number is above 30. If the station is deselected, either manually or by the omega/VLF system, the number displayed is invalid.
Column 7 displays an asterisk (*) or a blank space. An asterisk indicates that the omega system has automatically deselected the station for use or the station has been manually deselected. The system will automatically deselect stations based on distance (too close or to far) and on other criteria relating to signal interference. A blank space indicates that the system is able to use the station. Column 10 thru 12 display the three letter station identification of the VLF station.
Column 13 displays either a blank space or a minus (-) sign. A minus sign indicates that the pilot has manually deselected the station. The station may be deselected by placing the cursor over this

field and pressing the 9/key and the ENTER key. IF the station is pilot deselected, it can be restored by placing the cursor over the minus (-) sign and pressing the 0/ + key and the ENTER key.

Columns 14 and 15 display a quality factor number from 0 to 99 that is representative of the signal to noise ratio of the VLF station. The system will utilize the VLF station if the number is greater than 50. If the station is deselected, omega/ VLF system, the number displayed is invalid.

Column 16 displays an asterisk (*) or a blank space. An asterisk indicates that the omega/VHF system has automatically deselected the station for use, or the station has been manually deselected. The system will automatically deselect stations based on distance (too close or to far) and on other criteria relating to signal interference. A blank space indicates that the system is able to use the station.

(c) Omega re-lane page. Under certain rare conditions it is possible for the omega/VLF to detect an uncertainty in its calculated position. Under these specific conditions the system will illuminate the message light and display a message stating:

OMEGA RE-LANING

SEL OMG DATA PAG

The pilot should then select the omega/VLF status page. When the system annunciates the above message the omega/VLF status page will display RELANE? instead of AUTO UPDATE or NO AUTO UPDATE. To select the omega re-lane operation, the cursor is placed over the RE-LANE? field and the ENTER key is pressed. The omega re-lane page is then displayed.

CURRENT POS? The normal omega/VLF derived position coordinates of the aircraft's present position.

RE-LANE POS? An alternative omega determination of the aircraft's present position based upon omega data only. The pilot should determine which of the two positions is correct by comparison with other system sensor solutions, other navigation equipment on board the aircraft, or by visual reference to known positions on the ground. Selection is made by placing the cursor over the interrogative field of the desired position and pressing the ENTER key.

d. Data 2 Menu Page. The data 2 menu page lists the actual data pages which can be selected from its menu. Specific data pages are selected by entering the corresponding menu number into the SEL MENU ITEM: data field and pressing the ENTER key. They may also be selected by placing the cursor over the menu item and pressing the ENTER key.

(1) Navaid page. This page is used to display the frequency, type, class, elevation, magnetic variation, latitude and longitude of a selected navaid. If the selected navaid is contained in the data base, the above information will be displayed when the navaid identifier is inputted into the station identifier field. A user defined navaid can be created by entering the above data into their respective fields and approving the page.

STA IDENT: Navaid identifier.

FREQ: Navaid frequency or TACAN channel depending on which format is selected on the waypoint page. When TACAN channel is selected, FREQ: will be replaced with CHNL:.

TYPE> VORTAC Displays the type of navaid. Also used when a user navaid is being defined, as a cyclic field in conjunction with the CLEAR key to choose the type of navaid from among the following choices: DME, VOR/DME, VORTAC, TACAN, ILS/ DME or VOR.

CLASS>HIGH Displays the class of navaid. Also used when a user navaid is being defined.

It is a cyclic field and is modified with the CLEAR key to choose the class of navaid from the following choices: LOW, HIGH, TERMINAL, and UNDEFINED.

ELEV: FT — The elevation (to the nearest 10 feet) of the navaid being displayed or defined.

MAG VAR: — The published magnetic variation in degrees of the navaid being displayed or defined.

LAT:

LON: — The position of the navaid in latitude and longitude.

APPROVE? — A cursor field used to approve a user defined navaid.

(2) Airport page. The airport page is used to display the elevation and the position of the airport reference point (ARP) of a selected airport. If the selected airport is contained in the data base, the above information will be displayed when the airport ICAO identifier is inputted. User defined airports can be created by inputting the above data into their respective fields and approving the page.

ICAO AIRPORT IDENTIFIER: — Airport ICAO identifer or other user defined airport identifier.

ELEV: FT. — Airport elevation to the nearest 10 feet referenced to sea level. LAT:

LON: — Position in latitude and longitude of the airport reference point (ARP).

APPROVE? — A cursor field used to approve a user defined airport.

(3) Data/time page. The data displayed on the data/time page is for reference only and can not be changed from this page.

DATE — The current greenwich date in the sequence day-month-year.

GMT — The current greenwich mean time.

DEP TIME — The departure time which is defined as the time (GMT) the system first calculated a ground speed that exceeded 50 knots.

FLT TIME — The flight time in hours and minutes, which is defined as the elapsed time since the system first calculated a ground speed that exceeded 50 knots.

(4) Update data base page. This page serves as a master menu for initiating three types of data base operations: (1) reviewing the present configuration of what is currently loaded in the data base (2) modifying the configuration of what is to be loaded into the data base and (3) loading the data base with the data loader.

SEL MENU ITEM: — The number associated with the desired menu item is entered in this field.

REVIEW D/BASE — This menu item is selected to display additional data base review pages which are used to review what is presently loaded in the data base. The pages accessed via this menu item are the review data base page and the review elements page.

SELECT D/BASE — This menu item is selected to display additional data base modification pages which are used to configure the data base prior to being loaded with the data loader.

NEXT UPDATE — A non-enterable cursor field which displays the greenwich date indicating when the next 28 day data base revision update is due.

LOAD D/BASE? — A flashing cursor field used to initiate a loading of the data base withthe data loader.

*ON GROUND ONLY
*AFTER D/BASE

SELECT COMPLETE — A non-enterable cursor field displaying an advisory message that the data base is to be / loaded only while the aircraft is on the ground and only after the data base configuration has been verified or modified as desired.

(5) Review data base page. This page is used to review those regions of the world having data presently loaded in the data base. The world is divided into 10 regions all of which are displayed on this page. The data base cannot be modified, from this page.

SEL MENU ITEM: The number associated with the desired geographic region can be entered in this field to display the region's review elements page. Directly below the SEL MENU ITEM:, the 10 regions display. The asterisk (*) denotes that data is presently loaded in the data base for that region. No asterisk (*) indicates that data for those regions have not been loaded in the data base. (6) Review elements page. This page is used to review the navigational elements loaded in the data base for a particular region of the world. The data base cannot be modified from this page.

NAVAID * Navaids include VORTAC's, VOR/DME's, VOR's TACAN's DME's and ILS DME's. The asterisk (*) denotes that navaids for that region are presently loaded in the data base.

APT>4000 FT * Airports having a hard surface runway at least 4000 feet in length. The asterisk (*) denotes that these airports are presently loaded in the data base.

APT>3000 FT * Airports having a hard surface runway at least 3000 feet in length. Only one of the two airport elements may be selected. No asterisk (*) denotes the element is not presently contained in the data base.

RW THRESHOLD * Runway thresholds for which there exists verified latitude and longitude coordinates. No asterisk (*) denotes the element is not presently contained in the data base.

OUTER MKR Outer markers.

HI ALT WPT High altitude waypoints are named intersections which appear on high altitude enroute charts

LO ALT WPT Low altitude waypoints are named intersections which appear on low altitude enroute charts.

SID/STAR Standard instrument departure (SID) and standard terminal arrival route (STAR) waypoints and intersections.

APR INTRSC Approach intersections are named intersections which appear on instrument approach charts. They do not include outer markers since outer markers are a separate category.

MULT WPT Waypoints which are used for multiple functions. For example if a waypoint serves as both a low altitude waypoint and as an approach intersection it is considered a multiple waypoint. Also, multiple waypoints include on-airway NDB's. If any type of waypoint (HI ALT, LO ALT, SID/STAR, or APR INTRSC) is loaded in the data base the multiple waypoints are automatically included.

(7) Modify data base page. This page is used to select regions of the world from which data will be loaded in the data base. It is one of two pages used to configure the data base to the aircraft's specific requirements prior to using the data loader to actually load the data into the data base.

SEL MENU ITEM: The number associated with the desired menu item can be entered in this field.

The regions of the world are the same as those on the review data base page. The meaning of the asterisk (*), however, is different. On this page the asterisk (*) denotes those regions of the world which will be loaded by the data loader. The asterisk (*) on the review data base page denotes those regions of the world which are currently loaded in the data base.

(8) Modify elements page. This page is used to select the navigation elements for a particular region of the world which will be loaded into the data base with the data loader.

BLKS AVAIL The number of blocks of data base memory remaining(for entire data base, not just region being displayed).

The number decreases each time an element below is selected.

NAVAID * — The data base elements listed are the same ones described on the review elements page. The number to the right of the element is the number of blocks required to store the element in the data base memory for the region of the world displayed. No numbers appear next to RW THRSHLD or OUTER MKR until one of the two APT (airport) elements has been selected. Whenever any or all of the waypoint elements (HI ALT WPT, LO ALT WPT, SID/ STAR, or APR INTRSEC) are selected, the MULT WPT is automatically included. MULT WPT cannot be selected unless at least one of the four waypoint elements is selected.

The asterisk (*) denotes those elements which are being selected to be loaded into the data base with the data loader. An element without an asterisk (*) has not been selected.

(9) Unused waypoints page. These pages display in alphabetical order the identifiers of user created waypoints that are not currently being used in any existing flight plan and are not in a protected status. If the system is put into system protect mode this page will also show protected waypoints which are not being used in any flight plan.

This page can be used to delete unused waypoints from the system by placing the cursor over the waypoint identifier and pressing the CLEAR key and then the ENTER key.

PREVIOUS PAGE? — A cursor field used to display the previous page of unused waypoints when there is more than one page of these waypoints.

NEXT PAGE? — A cursor field used to display the next page of unused waypoints when there is more than one page of these waypoints.

(10) User defined navaids page. These pages are used to view the identifiers of the navaids contained in the supplement data base memory which have been defined by the user. The identifiers are listed in alphabetical order. These pages are also used to delete these user navaids from the supplemental data base.

PREVIOUS PAGE? — A cursor field used to display the previous page of user defined navaids when there is more than one page of these navaids.

(11) User defined airports page. These pages are used to view the identifiers of airports contained in the supplemental data base memory which have been defined by the user. The identifiers are listed in alphabetical order. These pages are also used to delete user defined airports from the supplemental data base.

PREVIOUS PAGE? — A cursor field used to display the previous page of user defined airports when there is more than one page of these airports.

NEXT PAGE? — A cursor field used to display the next page of user defined airports when there is more than one page of these airports.

e. FMS/NA V CTL and OMEGA DIST/BRG Switches. FMS Activation of the FMS/NAV CTL switch (FMS illuminated) allows the KNS-660 navigation data to be displayed on the pilot's HSI and both RMI's. Active tuning of the VOR and DME sensors is now controlled by the KNS-660.

NAV CTL Activation of the FMS/NAV CTL switch (NAV CTL illuminated) allows basic NAV (VOR/LOC/GS) and DME data to be displayed on the pilot's HSI and VOR bearing on both RMI's. Active tuning of the VOR and DME sensors is now controlled by the pilot's NAV I frequency control head.

OMEGA DIST/BRG Activation of the HSI REF DATA switch (OMEGA DIST/BRG illuminated) allows bearing and distance to the active KNS660 VLF/OMEGA waypoint to be displayed on the pilot's HSI bearing pointer, and DME readout during operation in NAV CTL. VOR #1 drives the pilot's HSI course needle and both RMI's during this operation.

f. Navigation Displays.

(1) PILOT'S HSI.

FMS — With FMS selected the KNS-660 provides automatic course needle drive while using the AUTO/LEG method of operation. However, it will not provide course needle drive while using the OBS method of operation. In this case, the pilot must set the selected course manually either via the HSI course knob, located on the pedestal, or through the KNS-660 control unit. The course needle provides left/ right steering information from the KNS-660. The DME display provides distanceto the waypoint in nautical miles. Also, the DME slave indicator will display distance, ground speed in knots, and time to the station. The bearing pointer provides bearing information derived from either the ADF or the KNS660 depending upon whether ADF or NAV respectively are selected by the RMI selector.

NAV CTL — With NAV CTL selected the pilot must set the selected course manually via the HSI course knob, located on the pedestal. VOR/LOC/GS tuning is through the NAV 1 frequency control unit. Both VOR and LOC signals provide left/right steering information. The DME display provides distance to the station in nautical miles. Also, the DME slave indicator will display distance, ground speed in knots, and time to station. The bearing pointer provides bearing information derived from either the ADF or the NAV 1 receiver depending upon whether ADF or NAV respectively are selected by the RMI selector.

(2) PILOT'S and COPILOT'S RMI.

FMS — With FMS selected, the single bar needle provides bearing information derived from either the ADF or the KNS-660 depending upon whether ADF or NAV respectively are selected on the RMI.

NAV CTL — With NAV CTL selected, the single bar needle provides bearing information derived from either the ADF or the NAV 1 receiver depending upon whether ADF or NAV respectively are selected on the RMI.

g. Operating Procedures.

NOTE

Operation must be in conformity with the KNS-660 Pilot's Guide, P/N 006-839400, dated November 15, 1984 or later.

(1) Turn on procedures.

1. ON-OFF rocker switch Press top half. Allow 8 to 10 seconds for initial warmup.
2. BRT-DIM rocker switch ADJUST screen brightness as desired.

(2) Self test.

1. Self test page CHECK that SYSTEM OK is being displayed.

NOTE

If SYSTEM FAIL is displayed, turn the system off and then back on using the ON/OFF rocker switch. If SYSTEM FAIL continues to display, the system requires service and must not be utilized.

2. Navigation instruments CHECK as prompted by self test page.
   a. RMI pointer on 130°.
   b. DME display reads 34.3 NM.

c. Course selector slewed to 315°.

d. Course deviation indicator displaying 3 dots right.

e. VNAV deviation indicating 3° up.

3. Remote annunciators CHECK ON.

4. ENTER key PRESS to verify satisfactory completion of self test page items.

(3) Initialization page.

CAUTION

Position accuracy in initialization is very important, since it is possible that the amount of initialization error will be carried by the system throughout the flight.

Either one of the following initilization procedures (A or B) may be used.

(a) Procedure A.

1. DATE: CHECK. If incorrect, enter the correct greenwich date in sequence (day-month-year).

2. GMT: CHECK. If incorrect, enter the correct greenwich time.

3. POS: CHECK the last known system generated position. If incorrect, perform steps 4 thru 6.

4. Cursor J or t key-PRESS so that the cursor field appears over the WPT ID: data field.

5. Known ICAO airport identifier or waypoint identifier INPUT.

6. ENTER key PRESS to enter the identifier. The waypoint page will automatically display. If the waypoint identifier is contained in system memory (waypoint latitude and longitude are listed on waypoint page), perform steps 7 and 8.

7. Cursor or f key PRESS, if necessary, to place cursor field over APPROVE?.

8. ENTER key PRESS. The initialization page will again appear with the cursor over APPROVE?. Continue with step 16.
   If the waypoint identifier is not contained in memory (no latitude or longitude entry and the cursor over REF NAME: field, perform steps 9 thru 15.

9. REF NAME: INPUT the identifier of a navaid or location contained in system memory from which the new waypoint can be referenced.

10. ENTER key PRESS to enter the identifier.

11. RAD: INPUT the radial in degrees and tenths of a degree from the navaid or location in the REF NAME field to the waypoint being defined.

12. ENTER key PRESS to enter the radial into memory.

13. DIS: INPUT the distance to the nearest tenth of a nautical mile from the navaid or location in the REF NAME data field to the waypoint being defined.

14. ENTER key PRESS to enter the distance into memory.

15. ENTER key PRESS twice to advance the cursor to the APPROVE? field.

NOTE

Steps (9) thru (15) may be skipped and the latitude and longitude inputted directly, if known.

16. ENTER key PRESS to approve the waypoint page.

The initialization page will appear with the cursor over APPROVE?.

17. EST GS:-If on the ground verify that 0 is displayed. If in flight, PRESS cursor t key to position cursor over EST GS: data field, input estimated ground speed, then PRESS ENTER.

18. APPROVE?-PRESS ENTER to approve all of the data on the initialization page and enter the data into memory. The first of the flight plan menu pages (FPLS) will now appear.

(b) Procedure B.

1. DATE:-CHECK. If incorrect, enter the correct greenwich date in sequence day month-year.

2. GMT:-CHECK. If incorrect, enter the correct greenwich mean time.

3. POS:-CHECK the last known system generated position. If incorrect perform steps 4 thru 8.

4. Cursor 4 or t key PRESS so that the cursor appears over the latitude position.

5. Latitude-INPUT. Use North or South key first, followed by the known latitude in degrees, minutes and tenths of a minute.

6. ENTER key PRESS to enter the latitude into memory.

7. Longitude-INPUT. Use East or West key first, followed by the known longitude in degrees, minutes and tenths of minute.

8. ENTER key PRESS to enter the longitude into memory.

9. EST GS:. If on the ground, verify that 0 is displayed and PRESS ENTER. If in flight, INPUT estimated ground speed, then PRESS ENTER.

10. APPROVE? PRESS ENTER to approve all of the data on the initialization page and enter the data in memory. The first page of the flight plan menu (FPLS) will now appear.

NOTE

The configuration of the main data base can be reviewed at any time after initialization. Since so many of the system capabilities depend upon the data base it is important to review which geographic region and which navigational elements within these regions are actually loaded in the data base.

(4) Reviewing the data base.

CAUTION

The data base should be reviewed prior to takeoff, since the system cannot provide a navigation function while the data base is being loaded.

1. DAT key PRESS as required to display the DATA 2 menu page.

2. Menu item UPDATE D/BASE SELECT using the menu selection procedure. The UPDATE D/BASE page will display.

3. Menu item REVIEW D/BASE SELECT. The REVIEW D/ BASE page will display. Only the geographic regions followed by an asterisk (*) are presently contained in the main data base.

4. Desired geographic region SELECT. The review elements page for the selected region will display. Only the geographic regions followed by an asterisk (*) are presently contained in the main data base.

5. DAT key PRESS to return to the review data base page. Navigational elements stored for each of the other geographic regions

with asterisks (*) can be viewed by repeating steps 4 and 5 as many times as necessary.

(5) Configuring the data base.

CAUTION

If the VOR and DME (TACAN) sensors are to be utilized, navaids for the geographic regions in which flight is to occur must be loaded in the data base.

NOTE

Since not all the worldwide data on the revision diskette can be contained at one time in the main data base, it is necessary to select which geographic regions and which navigational elements within these regions will be loaded into the data base. The data base does not need to be reconfigured if there are no configuration changes from the previous loading.

NOTE

The system must be turned on and initialization must be complete before configuring the data base.

1. Data loader cover-OPEN.

2. Update diskette INSERT into data loader. The diskette will not lock into place if it is positioned incorrectly.

3. DAT key PRESS twice or as required to display the DATA 2 menu page.

4. Menu item 5-SELECT as follows:

   a. Cursor ↑ or ↓; key PRESS to position cursor over item 5.

   b. ENTER key PRESS. The update data base page will display.

5. Menu item 2 SELECT as follows:

   a. Cursor ↑ or ↓ key PRESS to position cursor over item 2.

   b. ENTER key-PRESS. The modify data base page will display.

6. Delete the geographic regions no longer required as follows:

   a. Cursor ↓ key PRESS to position over region.

   b. CLR key PRESS to delete the asterisk (*).

7. Update data base for desired region as follows:

   a. Menu item (region) desired SELECT as follows:

   (1) Cursor t or 4 key PRESS to position cursor over menu item (region) desired.

   (2) ENTER key PRESS. The modify elements page for that region will display. The number proceeding BLKS AVAIL, indicates a blocks of data base memory remaining (for entire data base, not just for region selected).

NOTE

There are a total of 10,000 blocks of data base memory. These blocks can be filled with any combinations of geographic regions and navigational elements within those regions as long as the total blocks chosen do not exceed 10,000.

   b. Cursor ↑ or ↓ key PRESS if necessary, to position over navaid to be updated.
   c. ENTER key-PRESS.
   d. Repeat steps b and c, as necessary, to update other navaids.

8. DAT key-PRESS once to return to the modify data base page. Asterisks (*) will now display to the right of regions updated.

9. Repeat steps 1 through 8, as necessary, to update other desired geographic regions.

10. DAT key PRESS as required to display the DATA 2 menu page. 11. Menu item 5SELECT as follows:

    a. Cursor ↑ or ↓ key PRESS to position over new item 5.

    b. ENTER key PRESS. The update data base page will now display.

12. Cursor ↓ or ↑ key PRESS to position cursor over LOAD D/BASE?.

13. ENTER key PRESS to initiate data base loading.

14. Diskette reject button PUSH to unlock diskette. Remove diskette from data loader and close clear protective cover.

CAUTION

Leaving update diskettes inserted in the data loader for extended periods of time will cause excessive wear to occur to data loader. Also, failing to keep the clear protective cover closed could allow a foreign substance to enter, damaging the mechanism or electronics.

(6) Establishing operational status. Establishing the correct operational status means selecting the proper method of operation, sensor and mode combination for the desired navigational phase of flight. The KNS-660 allows the operational status combinations presented in Table 3-1.

1. OBS/LEG key PRESS as required to select method of operation.

2. SNS key PRESS as required to select desired sensor.

3. MOD key PRESS as required to select desired mode of operation.

NOTE

The OBS/LEG, SNS, and MOD keys will cause the control display to immediately reflect the operational status change. However, the system will not actually activate the new operational status for a period of one second. Repeated presses of these keys during this one second period will reset the delay back to one second.

NOTE

Automatic navaid selection does not occur when operating the system in AUTO/ LEG, VOR or TACAN, RNV APR. The pilot must specify a reference navaid for each waypoint in the reference name field of each waypoint page. This reference navaid is the particular navaid which the VOR navigation receiver and DME will be turned to when this waypoint is activated.

h. Shutdown Procedure: ON-OFF rocker switch Press lower half.

3-26. EMERGENCY PROCEDURES.
If the KNS-660 system information is intermittent or lost, secure the system and utilize the remaining operational navigation equipment as required.

1. FMS/NAV CTL switch Press. Verify NAV CTL illuminated.

2. CDU ON/OFF switch-Off.

3. FMS circuit breaker-Pull.

Table 3-1. Methods of Operation

OBS METHOD OF OPERATION				
SENSOR	**BLEND**	**VOR**	**TACAN**	**OMEGA/VLF**
MODE	RNV ENR	RNV ENR RNV APR NAV	RNV ENR RNV APR NAV	RNV ENR
AUTO/LEG METHOD OF OPERATION				
SENSOR	**BLEND**	**VOR**	**TACAN**	**OMEGA/VLF**
MODE	RNV ENR	RNV ENR RNV APR	RNV ENR RNV APR	RNV ENR

Section IV. TRANSPONDER AND RADAR

3-27. TRANSPONDER SET (AN/APX-100).

a. Description. The transponder system receives, decodes, and responds to interrogations from air traffic control (ATC) radar to allow aircraft identification, altitude reporting, position tracking, and emergency tracking. The system receives a radar frequency of 1030 MHz and transmits preset coded reply pulses on a radar frequency of 1090 MHz at a minimum peak power of 200 watts. The range of the system is limited to line-of-sight.

The transponder system consists of a combined receiver/transmitter contol panel (fig. 3-19) located on the pedestal extension; a pair of remote switches, one on each control wheel; and two antennas located on the underside and top of the fuselage. The system is protected by a 3-ampere circuit breaker, placarded XPONDER located on the overhead circuit breaker panel (fig. 2-23).

b. Controls/Indicators and Functions.

(1) TEST-GO indicator. Illuminates to indicate successful completion of built-in-test (BIT).

(2) TEST-MON indicator. Illuminates to indicate system malfunction or interrogation by a ground station.

(3) ANT switch. Selects desired antenna for signal input.

(a) TOP. Selects upper antenna.
(b) DIV. Selects diverse (both) antennas.
(c) BOT. Selects lower antenna.

(4) RAD TEST-OUT switch. Enables reply to TEST mode interrogations from test set.

(*5*) *MASTER CONTROL.* Selects system operating mode.

(a) OFF. Deactivates system.

(b) STBY. Activates system warmup (standby) mode.
(c) NORM. Activates normal operating mode.
(d) EMER. Transmits emergency reply code.

(6) STATUS ANT indicator. Illuminates to indicate the BIT or MON fault is caused by high VSWR in antenna.

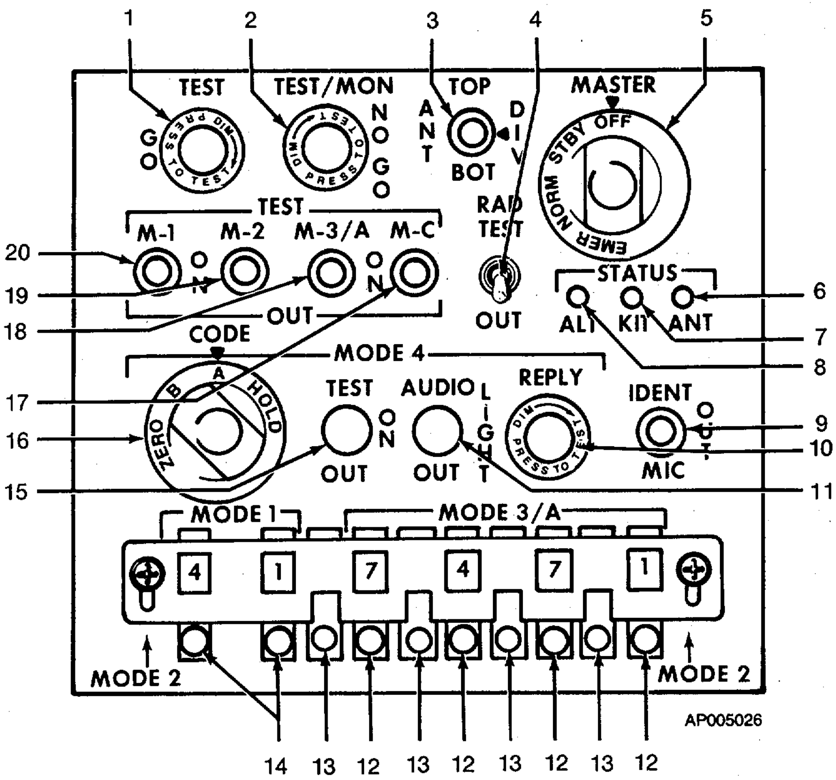
(7) STATUS KIT indicator. Illuminates to indicate the BIT or MON fault is caused by external computer.

(8) STATUS ALT indicator. Illuminates to indicate the BIT or MON fault is caused by the altitude digitizer.

(9) IDENT-MIC-OUT switch. Selects source of aircraft indentification signal.

(a) IDENT. Activates transmission of identification pulse (IP).
(b) MIC. Enables either control wheel POS IDENT switch to activate transmission of ident signal fromtransponder.
(c) OUT. Disallows outgoing signal.

(10) MODE 4 reply indicator light. Illuminates to indicate a reply has been made to a valid mode 4 interrogation.



1. TEST-GO Indicator
2. TEST/MON-NO GO Indicator
3. ANT Switch
4. RAD TEST-OUT Switch
5. MASTER Control
6. STATUS ANT Indicator
7. STATUS KIT Indicator
8. STATUS ALT Indicator
9. IDENT-MIC Switch
10. MODE 4 REPLY Indicator
11. MODE 4 AUDIO-LIGHT-OUT Switch
12. MODE 3/A Code Selectors
13. MODE 2 Code Selectors
14. MODE 1 Code Selectors
15. MODE 4 TEST-ON-OUT Switch
16. MODE 4 CODE Control
17. M-C TEST Switch
18. M-3/A TEST Switch
19. M-2 TEST Switch
20. M-1 TEST Switch

(11) MODE 4 AUDIO OUT switch. Selects monitor mode for mode 4 operation.

(a) AUDIO. Enables sound and sight monitoring of mode 4 operation.
(b) LIGHT. Enables monitoring REPLY indicator for mode 4 operation.
(c) OUT. Deactivates monitor mode.

(12) MODE 3/A code selectors. Select desired reply codes for mode 3/A operation.
(13) MODE 1 code selectors. Select desired reply codes for mode 1 operation.
(14) MODE 4 TEST-ON-OUT switch. Selects test mode of mode 4 operation.

(a) TEST. Activates built-in-test of mode 4 operation.
(b) ON. Activates mode 4 operation.
(c) OUT. Disables mode 4 operation.

(15) MODE 4 code control. Selects preset mode 4 code.
(16) M-C, M-3A, M-2, and M-1 switches. Select test or reply mode of respective codes.
(17) TEST. Activates self-test of selected code. Transponder can also reply
(18) ON. Activates normal operation.
(19) OUT. Deactivates operation of selected code.
(20) MODE 2 code selectors. Select desired reply codes for mode 2 operation. The cover over mode select switches must be slid forward to display the selected mode 2 code.
(21) POS IDENT pushbutton (control wheels, fig. 2-16). When pressed, activates transponder identification reply.

c. Transponder Normal Operation.

(1) Turn-on procedure. MASTER switch STBY. Depending on the type of receiver installed, the TEST/MON NO GO indicator may illuminate. Disregard this signal.
(2) Test procedure.

NOTE

Make no checks with the master switch in EMER, or with M-3/A codes 7600 or 7700 without first obtaining authorization from the interrogating station(s).

1. Allow set two minutes to warm up.
2. Select codes assigned for use in modes 1 and 3/A by depressing and releasing the pushbutton for each switch until the desired number appears in the proper window.
3. Lamp indicators Operate press to-test feature.
4. M switch Hold in TEST. Observe that no indicator lights illuminate.
5. M-1 switch Return to ON.
6. Repeat steps 4 and 5 for the M-2, M-3/A and M-C mode switches.
7. MASTER control NORM.
8. MODE 4 code control A. Set a code in the external computer.
9. MODE 4 AUDIO OUT switch OUT.

(3) *Modes 1, 2, 3/A, and/or 4 operating procedure:*

NOTE

If the external security computer is not installed, a NO GO light will illuminate any time the mode 4 switch is moved out of the OFF position.

1. MASTER control NORM.
2. M-1, M-2, M-3/A, and/or MODE 4 ON-OUT switches ON. Actuate only those switches corresponding to the required codes. The remaining switches should be left in the OUT position.
3. MODE 1 Code selectors Set (if applicable).
4. MODE 3/A code selectors Set (if applicable).
5. MODE 4 Code control Set (if required).
6. MODE 4 REPLY indicator-Monitor to determine when transponder set is replying to a SIF interrogation.
7. MODE 4 AUDIO OUT switch Set (as required to monitor Mode 4 interrogations and replies).
8. MODE 4 Audio and/or indicator Listen and/or observe (for Mode 4 interrogations and replies).
9. IDENT-MIC-OUT switch Press to IDENT momentarily.
10. MODE 4 TEST-ON-OUT switch TEST.
11. Observe that the TEST GO indicator light illuminates.
12. MODE 4 TEST-ON-OUT switch ON.
13. ANT switch BOT.
14. Repeat steps 4, 5, and 6. Observe that the TEST GO indicator illuminates.
15. TOP-DIV-BOT-ANT switch TOP.
16. Repeat step 14.
17. TOP-DIV-BOT-ANT switch DIV.
18. Repeat step 14.
19. When possible, obtain the cooperation of an interrogating station to exercise the TEST mode. Execute the following steps:

    a. RAD TEST-OUT switch RAD TEST.
    b. Obtain verification from interrogating station that a TEST MODE reply was received.
    c. RAD TEST-OUT switch OUT.

(4) *Transponder set identification position operating procedure.* The transponder set can make identification-position replies while operating in code modes 1, 2, and/or 3/A, in response to

ground station interrogations. This type of operation is initiated by the operator as follows:

1. Modes 1, 2, and/or 3/A ON, as required.
2. IDENT-OUT-MIC switch Press momentarily to IDENT, when directed.

NOTE

Holding circuits within the transponder receiver-transmitter will transmit identification-position signals for 15 to 30 seconds. This is normally sufficient time for ground control to identify the aircraft's position. During the 15 to 30 second period, it is normal procedure to acknowledge via the aircraft communications set that identification-position signals are being generated.

NOTE

Set any of the M1, M2, M3/A, M-C, or MODE 4 switches to OUT to inhibit transmission of replies in undesired modes.

NOTE

With the IDENT-OUT-MIC switch set to the MIC position, the POS IDENT button must be depressed to transmit identification pulses.

(5) Shutdown procedure.

1. To retain Mode 4 code in external computer during a temporary shutdown:

   a. MODE 4 CODE switch Rotate to HOLD.
   b. Wait 15 seconds.
   c. MASTER control OFF.

2. To zeroize the mode 4 code in the external computer turn MODE 4 CODE switch to ZERO.
3. MASTER control OFF. This will automatically zeroize the external computer unless codes have been retained (step 1. above).

d. Transponder Emergency Operation. Not applicable.

3-28. PILOT'S ALTIMETER.

a. Description. The altimeter (fig. 3-20) provides a servoed counter drum/pointer display of barometrically corrected pressure altitude derived from the air data system. The barometric pressure is set manually with the BARO knob and displayed in units of inches mercury and millibars on baro counters. The altimeter is AC powered and is protected through a 1 ampere circuit breaker, placarded PILOT ALTM (AC) located on the overhead circuit breaker panel (fig. 2-23).

b. Control and Functions.

(1) Pointer display. Displays altitude between 1000-foot levels with 20-foot graduations

WARNING

In the event of a total AC and DC electrical power loss, the warning flag will be in view, the altimeter will be inoperative, and the indicated altitude will remain as existed at the time of failure.

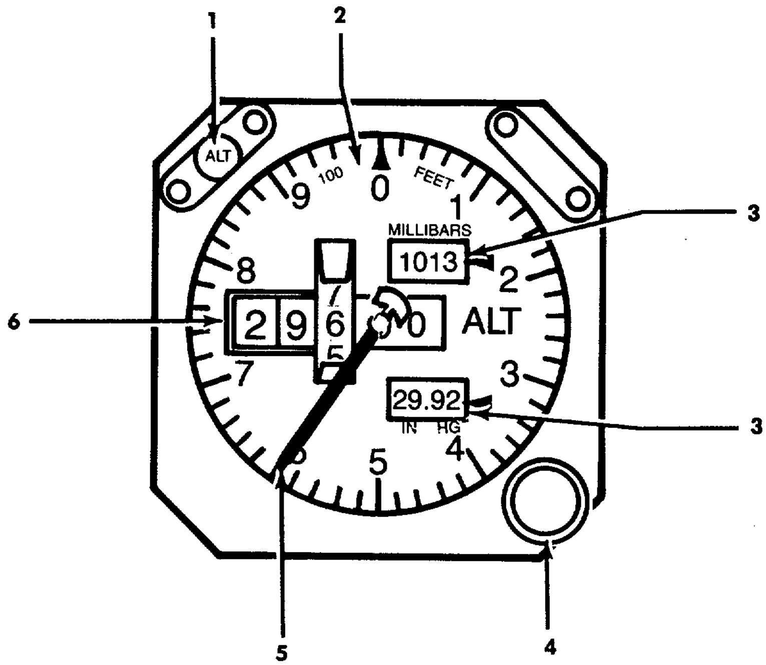
(2) OFF warning flag. A failure warning flag in view indicates the altitude information is unreliable, however the mode C information may be valid.

(3) Counter drum display. The counter drum displays altitude and is marked in 20-foot increments. Altitudes below 10,000 feet are annunciated by a black and white crosshatch on the left-hand digit position of the counter display.

(4) Altitude alert annunciator. The altitude alert annunciator illuminates to provide a visual indication when the aircraft is within 1000 feet of the preselected altitude during the capture maneuver an extinguishes when the aircraft is within 250 feet of the preselected altitude. After capture, the annunciator will illuminate if the aircraft departs more than 250 feet from the selected altitude, and extinguish when the aircraft has departed more than 1000 feet from the selected altitude.

(5) Barometric pressure and millibar counter. The barometric pressure and millibar counter, set with the BARO knob, displays barometric pressure in inches of mercury and millibars.

(6) BARO knob. The BARO knob is used to set the barometric pressure and millibar counter.



1. Altitude Alert (ALT) Annunciator
2. Pointer Display
3. Barometric Pressure and Millibar Counter
4. Baro Knob
5. Altitude Pointer
6. Counter Drum Display

Figure 3-20. Pilot's Altimeter

(7) Altitude pointer. The altitude pointer, points to the altitude on the pointer display between 1000-foot levels, in 20-foot increments.

c. Operating Procedure.

1. Barometric set knob Set desired altimeter setting in IN. HG. window.

2. Warning flag Check not visible.

3. Needle indicator Check operation.

NOTE

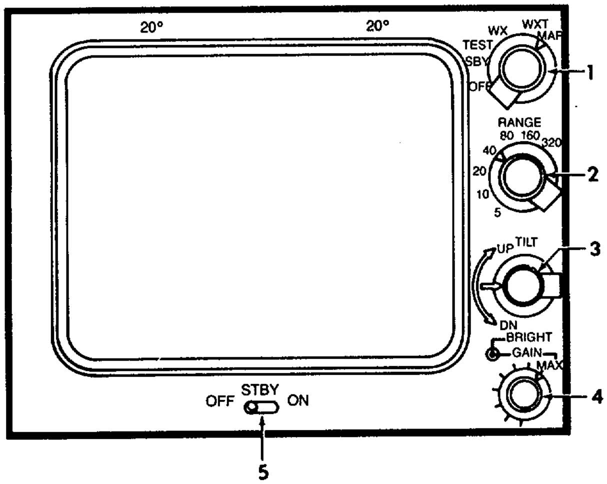
If the altimeter does not read within 70 feet of field elevation when the correct local barometric setting is used, the altimeter needs calibration or internal failure has occurred. An error of greater than 70 feet also nullifies use of the altimeter for IFR Flight.

3-29. WEATHER RADAR (KWX-58) SYSTEM.

a. Description. The KWX-58 color weather radar (fig. 3-21), not only displays inflight weather, but also permits incorporation of the KGR-358 radar graphics unit (fig. 3-22). The color weather radar is used to detect significant enroute weather formations to preclude undesirable penetration of heavy weather and its usually associated turbulence. The weather radar system provides a 320 nautical mile display, with a 250 nautical mile weather avoidance range plus weather penetration advantages. With the radar graphics unit in the NAV mode, navigation information is integrated with the weather display. The phased array antenna (flat plate), located in the nose of the aircraft, is fully stabilized to compensate for aircraft pitch and roll. The antenna provides a full 90 degree scan angle, +12 degree tilt, and a 3.75 microsecond pulse width in both weather and ground mapping modes.

Extended sensitivity time control (STC) increases the displayed intensity of storms outside the normal STC range. Extended STC relates the storm intensity to its distance and assigns a corresponding color. As a result, the display presents a more accurate picture of storm intensity.

Weather systems are displayed as 4 colors, depicting rainfall intensity overlaid with range rings. Bearing marks at dead ahead and 20 degrees on either side, aids the pilot in judging the bearing of storms and necessary heading changes.



1. Mode Selector Control Knob
2. Range Selector Control Knob
3. Tilt Control Knob
4. Brightness/Gain Control Knobs
5. Off/Stabilize/On Switch

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Figure 3-21. Weather Radar Control Indicator

With radar graphics interfaced, a circle mode may be activated by pressing the page button located on the radar graphics control panel. Functional operation in this mode is the same as in the standard display mode and is advailable in both weather and SBY modes. The range information is displayed in the upper right corner and represents the outer ring. The inside ring represents half the displayed distance. The off screen pointer is replaced by an RMI BUG placed on the outer ring in the direction of the active waypoint and color coded to each navigation system. Position of the aircraft is indicated by the green airplane symbol in the center of the screen.

Indicator brightness is adjustable to accommodate varying ambient light conditions while automatically maintaining equal brightness between the four display colors. The system is protected through a 5 ampere circuit breaker, placarded RADAR located on the overhead circuit breaker panel (fig. 2-23).

b. Controls and Functions.

(1) Mode selector control knob. The mode selector knob is utilized to turn the system on/ off, and select SBY, TEST, WX, WXT, and MAP positions.

(a) SBY. In SBY mode the display is blanked and transmitter circuits are disabled with the magnetron heater remaining on.

(b) TEST. When placed in the TEST mode all circuitry is activated, except the transmitter. All weather colors will display for verification in the TEST mode as well as the WX, WXT and MAP modes.

(c) WX. The WX mode, is the normal weather mode with green for light, yellow for moderate, red for heavy, and magenta for extremely heavy precipitation.

(d) WXT. The WXT mode is used to alert the pilot of weather that is beyond the displayed range. Only returns of significant intensity between 83 and 320 nautical miles are displayed with a white arc at the approximate azimuth of the storm. A yellow "T" on a red background will appear in the upper left corner of the display, indicating that a storm target has been located.

(e) MAP. The MAP mode is used for terrain mapping. Prominent ground features such as lakes, bays, rivers, cities, coastlines and offshore drilling rigs can be clearly discerned and used as a navigation cross-reference. The display colors

are changed in the MAP mode as follows: green to cyan, yellow stays the same, red to magenta, magenta to blue. When using the MAP mode, the gain control is used to adjust the prominence of ground features.

(2) RANGE selector control knob. The range selector knob selects for displays, range at 5, 10, 20, 40, 80, 160, and 320 nautical miles. This enables the pilot to select the displayed distance for most weather conditions that exist. There are four range calibration rings on each range setting with numerical read-out of their range in nautical miles. In addition to the range rings, bearing markers are positioned dead ahead and 20 degrees to either side of the aircraft heading for use in judging the storm bearing and necessary heading changes.

(3) TILT control knob. The TILT knob is used to adjusts the radar antenna angle +12 degrees, relative to the horizon. Proper tilt adjustment is one of the most important factors in obtaining optimum use from the weather radar. Too high an angle will pass the majority of the radar beam above the storm cell, particularly when the storm is a great distance away. Too low an antenna tilt will clutter the indicator with ground returns. The maximum distance at which ground clutter can be obtained will depend greatly on the terrain and aircraft altitude. The tilt setting is displayed in the top right corner of the screen. When the stab switch is in the ON position the designation TILT is replaced by STAB.

(4) *BRIGHT-GAIN-MAX control knobs*. These knobs control display brightness, and manual adjustment of gain. Brightness of the display screen is fully adjustable to compensate for a range of ambient light levels, while automatically maintaining equal brightness between the three colors displayed. Likewise, the gain control can be manually adjusted in both weather and ground mapping modes to provide maximum flexibility in target interpretation. Whenever the gain is varied from the preset maximum level, the screen will annunciate VAR to remind the pilot to reset the gain for standard intensity levels.

(5) OFF-STAB-ON selector switch. The selector knob permits the pilot to select gyro stabilized control of the weather radar system. In the ON position, the radar's antenna scan is kept parallel to the horizon and at the same relative tilt angle previously selected. The displayed view is kept straight and level, despite changes in aircraft pitch and roll, thus preventing ground clutter from wiping out potential weather targets.

c. Weather Radar System Operation.

WARNING

Never operate the weather radar in the WX, WXT, or MAP modes on the ground when personnel are forward of the aircraft wing and within 5 feet of the aircraft nose. Failure to observe this warning may result in permanent damage to the eyes and other body organs of those persons.

NOTE

To increase the solid state circuitry reliability, it is recommended that the aircraft engines be started before applying power to the weather radar system.

(1) Turn on procedure. Mode selector switch Turn clockwise past detent to SBY position.

NOTE

Warmup period is approximately 10 seconds.

(2) Operating procedure.

1. Mode selector switch Test. Verify that all four colors are present.

NOTE

If TEST mode is bypassed and either WX, WXT, or MAP mode is selected, the display will light up, and the warmup annunciator in the lower left corner will illuminate. The transmitter will become operational after 60 seconds.

2. Mode selector switch SBY while taxing and until clear of personnel, then as required.

(3) Shutdown procedure. Mode selector switch Turn counterclockwise to OFF position.

3-30. RADAR GRAPHICS.

a. Description. The KGR-358 radar graphics unit interfaces with the weather radar system (KWX-58), and receives navigation data from the flight management system (KNS-660). The unit can display NAV I or NAV 2 or both in a weather overlay, or as navigation information only display. In addition NAV information can be viewed in a 360 degree (circle) display with weather in the top 90 degree sector. Two checklist modes are also provided for complete checklist capability, when utilizing the pocket terminal (fig. 3-23).

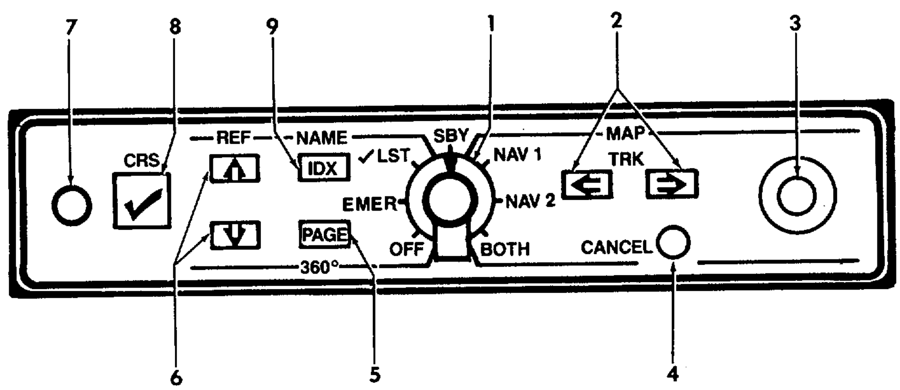
With the KGR-358 in any of the NAV modes, the radar screen will display a normal weather picture, plus the location of the waypoints listed in the active flight plan. Data referenced to NAV I is displayed in the lower left portion of the radar display. Data referenced to NAV 2 will display in the lower right portion of the display. Included in the data is the active waypoint name, the selected course bearing, and the aircraft position (radial to, and distance) from the active navigation fix. Aircraft magnetic heading is displayed in the upper left section of the radar display.

A line representing the course selected by the flight management system is drawn through the corresponding active waypoint. Selected course bearing for each NAV system is displayed with NAV data on each side of the screen. A waypoint line will also be displayed connecting the waypoints in numerical sequence. An R on the left side of the screen indicates all visible NAV aids selected by the flight management system will be displayed. The level of NAV aids displayed is indicated by one, two, or three dots on the left side of the R.

A joystick control is provided to move a waypoint to any position on the screen. The coordinates for this new waypoint will appear in the lower left or right corner depending upon which NAV is selected replacing the active waypoint data. If both NAV systems are selected the new coordinates will be displayed corresponding to NAV 1, and may be switched to NAV 2. Pressing the check button will cause the data to transfer to the flight management system and be fixed as a position on the earth. Once the data is transferred to the flight management system the pilot may enter it as he desires.

A track line enables a quick determination of how many degrees deviation left or right of a present heading is needed to provide for a clear path through weather or to a new fix. The number of degrees and a L or R is shown in the upper left corner replacing the magnetic heading when track mode is in operation.

Power is provided for the unit through a 2 ampere circuit breaker, placarded GRPH-DSPL located on the overhead circuit breaker panel.



1. Mode Selector Knob
2. Left/Right Cursor Switches
3. Joystick
4. Cancel Switch
5. Page Switch
6. Up/Down Cursor Switches
7. Input Jack
8. Checklist Switch
9. Index Switch

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Figure 3-22. Radar Graphics

b. Controls and Functions.

(1) Mode selector knob. Allows the operator to turn the unit on, and select desired mode.

(a) OFF Power is removed from the unit when mode selector knob is in the OFF position.

(b) EMER Checklists of emergency procedures for the aircraft are displayed in the emergency (EMER) mode. The emergency index contains the titles of the emergency checklists. The selected checklist item is shown in yellow while the others are shown in magenta.

(c) ✓LST Selects the preprogrammed checklist for display.

(d) SBY Selects the standby mode. Nothing is displayed on the screen when in the standby (SBY) mode.

(e) NAV 1 -Selects NAV 1 information to be displayed. Data referenced to NAV 1 will be displayed in cyan, in the lower left portion of the radar display. If NAV data is invalid, the data will be replaced with dashes.

(f) NAV 2 -Selects NAV 2 information to be displayed. Data referenced to NAV 2 will be displayed in yellow, in the lower right portion of the radar display. If NAV data is invalid, the data will be replaced with dashes.

(g) BOTH Selects both NAV 1 and NAV 2 information to be displayed.

(2) < or > button. When the < or > button is pressed, a track line will appear, and move in the direction indicated by the button pressed. The track line will disappear 6 to 10 seconds after the button has been released.

(3) Joystick. The joystick is used to move a waypoint to any position on the radar screen.

(4) CANCEL button. When pressed, the CANCEL button will remove displays from the radar screen.

(5) PAGE button. The PAGE button is used to view consecutive pages within a checklist. It is also used, along with the t or 4 buttons, to bypass items without checking them off, or return to items previously bypassed.

(6) ↑ and ↑ button. The buttons are used along with the PAGE button to bypass items in the checklist without checking them off, or return to items previously bypassed.

(7) ✓check button. Pressing the ✓ check button causes the selected checklist to be displayed. With the checklist displayed, the ✓ check button is used to check off items. When the last item in a list is checked off, the display automatically returns to any items previously bypassed. When all items have been checked off, the display returns to the index with the next checklist selected. An END OF LIST statement follows the last title in an index and the last item in a checklist. The pilot may return to the index prior to checking off all items by pressing the index (IDX) button.

(8) Input jack. Provides a means of connecting the pocket terminal to the unit.

(9) IDX button. Allows the pilot to return to index.

c. Operating Procedures. The following statement is displayed in all modes except standby (SBY) when the unit is first turned on. The statement will automatically disappear after 20 seconds or can be made to disappear sooner by pressing the CANCEL button:

THE NAVIGATION DATA PRESENTED ON THIS SCREEN IS NOT TO BE USED FOR PRIMARY NAVIGATION. CONTENTS OF THE CHECKLISTS ARE THE RESPONSIBILITY OF THE USER/INSTALLER.

1. Mode selector - switch As required.

3-31. POCKET TERMINAL.

d. Description. The KA-68 pocket terminal (fig. 3-23) is used to program normal and emergency checklist information into the radar graphics control panel. The pocket terminal plugs into a jack on the front of the radar graphics unit.

e. Operating Procedures.

(1) Programming checklist index. The title of a checklist is programmed into the appropriate index by selecting the desired mode on the KGR-358 (EMER, or ✓ LST) and pressing the index (IDX) button, if necessary, to enter the index. If the index already contains some titles, the ↑ and ↓ buttons on the KGR-358 are used to determine the location of the title to be added. If the number of index titles exceeds one page, the following pages may be selected by using the page button rather than cycling through the index with the ↑ or ↓ buttons. The last page of each index is indicated by an END OF LIST statement.

NOTE

The @, [ ], / characters cannot be written into the KGR-358 even though they are shown on the pocket terminal keyboard.

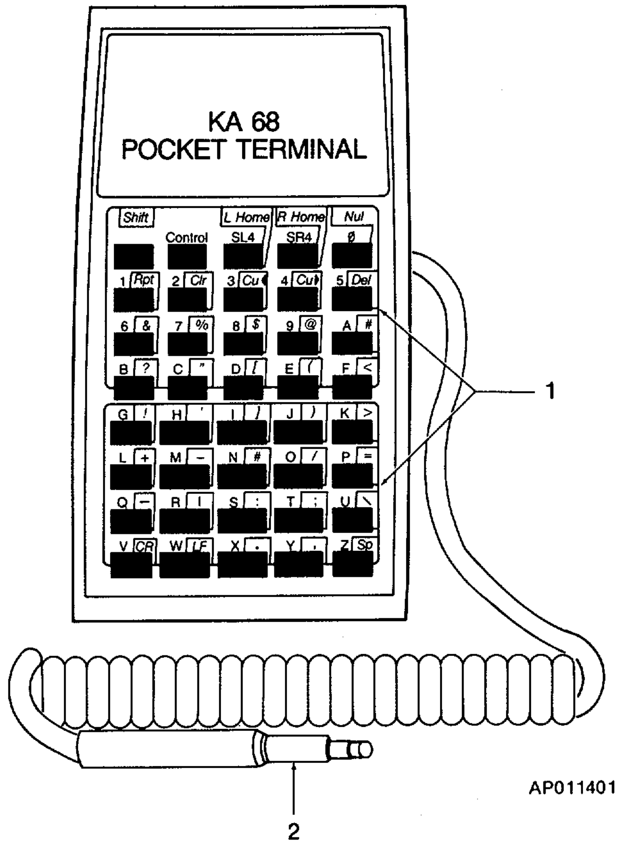

Figure 3-23. Pocket Terminal

The title is entered by pressing the appropriate keys on the pocket terminal. The title may consist of any combination of alphanumeric characters, spaces or punctuation up to a length of 27 characters (1 line). Any of the shaded functions are obtained by pressing the shift key prior to pressing the key with the desired function. For example to obtain a space, press and release the shift key and then press the key placarded SP. As the title is entered, a white CSR BLK appears to the right of the last entered character indicating the location where the next character will be inserted. When the title is complete, it must be terminated by a carriage return (SHIFT CR) to make the cursor disappear.

(2) Programming checklist items. The checklist item is entered by pressing the appropriate keys on the pocket terminal. A checklist item may consist of any combination of alphanumeric characters, spaces, or punctuations up to a length of 15 lines (450 characters). If the item is longer than one line long, do not use the carriage return to move from one line to the next. Use spaces (SHIFT SP) as necessary to move the cursor to the end of the line and to the beginning of the following line. The carriage return (SHIFT CR) should be used only at the end of the entire item to make the cursor disappear.

(3) Error correction. Error correction is accomplished with the delete function, SHIFT DEL on the pocket terminal. While in insert mode (cursor on the screen), pressing SHIFT DEL will delete individual characters. Once an item has been terminated with a carriage return (no cursor on the screen), SHIFT DELETE will delete the entire selected item (shown in yellow).

Special functions.

Certain special functions can be obtained on the pocket terminal by pressing the control key prior to pressing X, C, or I. Control X , erases everything (all checklists) stored in nonvolatile memory in the KGR-358. After pressing control X the message ERASE ENTIRE MEMORY YES/NO appears on the radar screen, if Y-E-S is entered, the radar graphics unit will carry out the command. If N-O or any other key is pressed the erase command is aborted. Control C on the pocket terminal duplicates the function of &rad. button on the radar graphics control panel. Control I on the pocket terminal duplicates the function of the IDX button on the radar graphics control panel.

3-32. GROUND PROXIMITY ALTITUDE ADVISORY SYSTEM (GPAAS).

WARNING

The ground proximity altitude advisory system will provide little, if any, warning for flight into precipitous terrain approaching a sheer wall if there is little gradually rising terrain before reaching the steep terrain.

a. Description. The ground proximity altitude advisory system (GPAAS) is provided to aid the flight crew in terrain avoidance (fig. 3-23A).

The GPAAS is a completely automatic system (requiring no input from the crew) which continuously monitors the aircraft's flight path at altitudes of between 100 and 2000 feet above ground level (AGL).

The GPAAS computer processes the data and, when conditions warrant, selects the appropriate digitized voice advisory/warning message from its memory. This message is then announced over the pilot's and copilot's audio systems. If the condition is not corrected, the GPAAS will rearm, and will again announce and repeat the warning if the condition recurs. The GPAAS computer remains ready to announce a different message during the intervals between repetitions. All messages are disabled below 100 feet AGL. The GPAAS system receives 28 VDC power through a 1-ampere circuit breaker placarded G.P.A.A.S. POWER, located on the instrument panel.

(1) GPAAS switch-indicator lights. A switch-indicator is located on the instrument panel. The upper half of the switch-indicator (yellow) is placarded VOICE OFF. The lower half is an indicator (red) only and is placarded VA FAIL.

Depressing the upper (VOICE OFF) switchindicator disables the GPAAS voice advisory, and illuminates the VOICE OFF indicator light.

The VA FAIL annunciator light (red) will illuminate when the GPAAS fails.

(2) GPAAS volume control GPAAS volume control placarded VOL, located on the instrument panel, controls the audio volume of the GPAAS advisory/warning messages down to a certain minimum level.

(3) GPAAS Aural Warning Indications. The following is a list of aural indications. Due to the possibility of activating more than one condition at a time, a warning priority has been established. The highest priority message will be announced first.

If a higher priority item is received after a message is started, voice annunciation of the higher priority message shall be announced after a lower priority message in progress at the end of the message seg,' ment. It will not stop in the middle of a word. On messages that are repeated three times at four second intervals, the priority list will be scanned for higher priority messages and will insert them in the interval between the messages. The messages provided by the system are listed in descending order of priority as follows:

1. "Two thousand" at 2000 feet AGL.
2. "One thousand" at 1000 feet AGL.
3. "Nine hundred" at 900 feet AGL.
4. "Eight hundred" at 800 feet AGL.
5. "Seven hundred" at 700 feet AGL.
6. "Six hundred" at 600 feet AGL.
7. "Five hundred" at 500 feet AGL.
8. "Check gear" will be announced immediately after 500 foot announcement if gear is not down.
9. "Four hundred" at 400 feet AGL.
10. "Check gear" will be announced immediately after 400 foot announcement if gear is not down.
11. "Three hundred" at 300 feet AGL.
12. "Check gear" will be announced immediately after 300 foot announcement if gear is not down.
13. "Two hundred" at 200 feet AGL.
14. "Check gear" will be announced immediately after 200 foot announcement if gear is not down.
15. "One hundred" at 100 feet AGL.
16. "Check gear" will be announced immediately after 100 foot announcement if gear is not down.
17. "Minimum, minimum" at decision height.
18. "Localizer" at 1.3 to 1.5 dots either side of center of beam. Will be repeated three times at four second intervals.
19. "Glideslope" at 1.3 to 1.5 dots above or below center of beam. Will be repeated three times at four second intervals.
20. "Altitude, altitude" at excessive deviation from altitude selected on the altitude alerter.
21. "Check trim" when trim failure has occurred. Will be repeated three times at four second intervals.

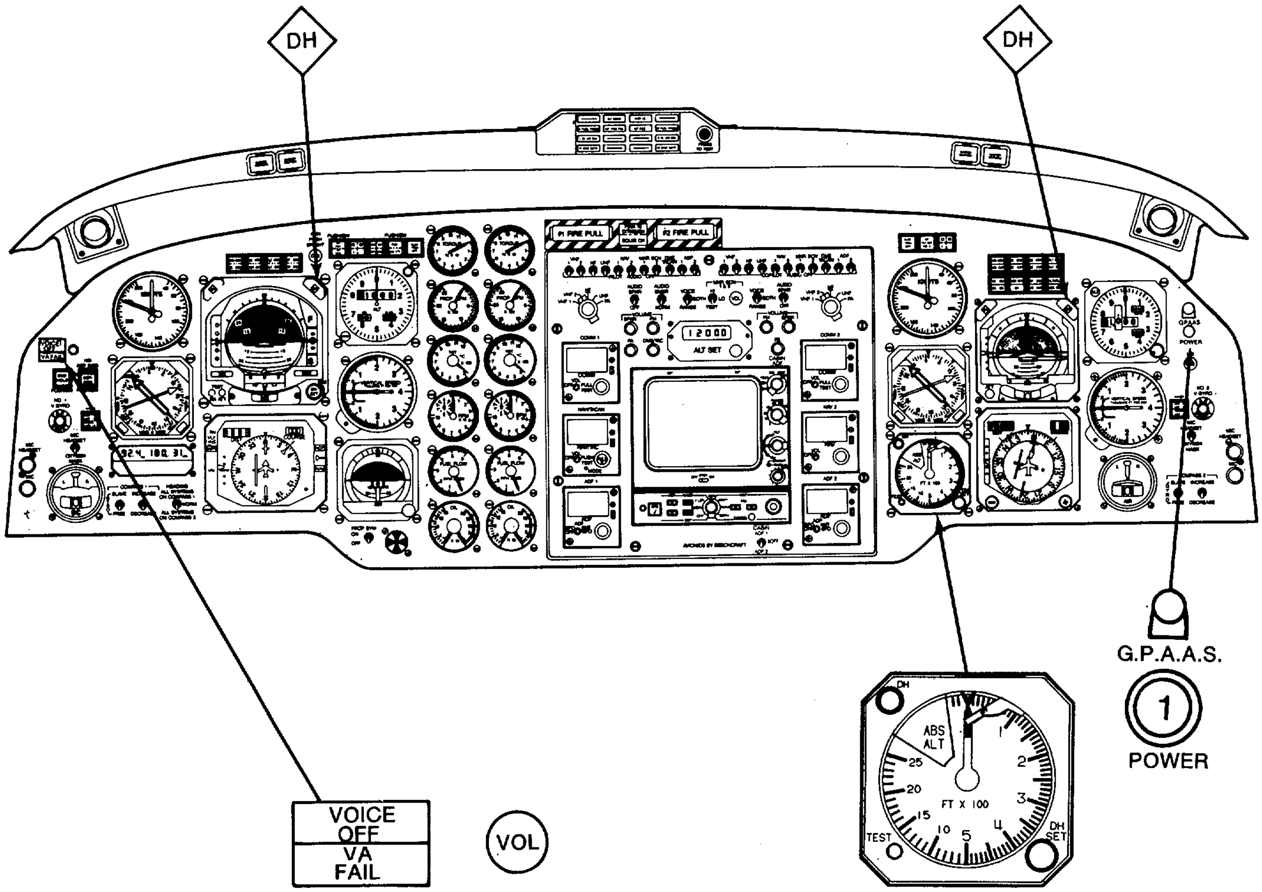

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Figure 3-23A. Ground Proximity Altitude Advisory System Controls and Indicators

22. "Autopilot" when autopilot has disconnected.

The highest priority message will be announced first. If a higher priority item is received after a message has been started, voice annunciation of the higher priority message shall immediately override the lower priority message in progress at the end of the message segment. It will not stop in the middle of a word. On messages that are repeated three times at four second intervals, the priority list will be scanned for higher priority messages. If found, they will be inserted into the interval between the messages.

b. Normal Operation.

(1) Turn-on procedure. The GPAAS is operable when the following conditions have been met:

1. Battery switch ON.
2. Avionics master switch On.
3. G.P.A.A.S. POWER circuit breaker SET.
4. RADIO ALTM circuit breaker SET.
5. VA FAIL annunciator light Extinguished.

(2) GPAAS ground check.

1. GPAAS voice advisory VOL control Full clockwise.
2. VOICE OFF switch-indicator Extinguished.
3. Audio control panel Set listening audio level.
4. VA FAIL annunciator light Extinguished.
5. Radio altimeter DH SET control Set to 200 feet.
6. Radio altimeter TEST switch Press and hold. "Minimum, minimum" will be annunciated once followed by the illumination of the VA FAIL light.
7. Radio altimeter TEST switch Release.

c GPAAS Modes of Operation. The GPAAS operates in the following modes of operation:

(1) Aural "TWO THOUSAND" advisory (mode 1). The aural advisory "TWO THOUSAND" indicates that the aircraft is at a radio altitude of 2000 feet above ground level. This advisory is cancelled when valid information from the radio altimeter is lost, during climb, or whenever the aircraft is out of the operating altitude range of the radio altimeter.

(2) Hundred foot increment aural altitude advisories (mode 2). The aural advisories "ONE THOUSAND, NINE HUNDRED, EIGHT HUNDRED, SEVEN HUNDRED, SIX HUNDRED, FIVE HUNDRED, FOUR HUNDRED, THREE HUNDRED, TWO HUNDRED, ONE HUND DRED" indicate that the aircraft is at the associated radio altitude in feet above ground level. This advisory is cancelled when valid information from the radio altimeter is lost, during climb, or whenever the aircraft is out of the operating altitude range of the radio altimeter.

(3) Aural "LOCALIZER" advisory (mode 3). The aural advisory "LOCALIZER" indicates that the aircraft has deviated from the center of the localizer beam in excess of 1.3 to 1.5 dots. The localizer advisory is armed when a valid localizer signal is detected and the aircraft is below 1000 feet above ground level. It will be repeated no more that 3 times at 4 second intervals unless the aircraft is returned to less than 1.3 to 1.5 dots from the center of the localizer course. The localizer advisory is disabled when a valid localizer signal has been lost, during climb, below the decision height set on the radio altimeter, or if the navigation receiver is not tuned to a localizer frequency.

(4) Aural "CHECK GEAR" advisory (mode 4). The aural "CHECK GEAR" advisory indicates that the aircraft has descended to 500 feet AGL and the landing gear is not down. This advisory is repeated once at 100 foot intervals down to 100 feet AGL.

(5) Aural "GLIDESLOPE" advisory (mode 5). The aural advisory "GLIDESLOPE" indicates that the aircraft has, exceeded 1.3 to 1.5 dots above or below the center of the glideslope beam. The glideslope advisory is armed when a valid glideslope signal is detected and the aircraft is below 1000 feet AGL. It will be repeated no more than three times at 4 second intervals unless the aircraft is returned to less than 1.3 to 1.5 dots from the center of the beam. The glideslope advisory is disabled upon loss of a valid glideslope signal, during climb, on a localizer back course, below the decision height set on the radio altimeter or, if the navigation receiver is not tuned to a localizer frequency. This advisory is inhibited by the weight on wheels strut switch.

(6) Aural advisory "MINIMUM, MINIMUM" (mode 6). The aural advisory "MINIMUM, MINIMUM" indicates that the aircraft is at the radio altitude selected by the crew with the radio altimeter indicator decision height knob. This advisory is cancelled when valid information from the radio altimeter is lost, during climb, whenever the aircraft is above 1000 feet AGL, or whenever the aircraft is out of the operating altitude range of the . radio altimeter.

(7) Aural "ALTITUDE, ALTITUDE" advisory (mode 7). The aural advisory "ALTITUDE, ALTITUDE" indicates the approach to a preselected altitude as the aircraft reaches a point 1000 feet from the selected altitude or, after reaching the selected altitude, when the aircraft deviates more than 250 feet from the selected altitude.

(8) Aural "CHECK TRIM, CHECK TRIM, CHECK TRIM" advisory. The aural advisory "CHECK TRIM, CHECK TRIM, CHECK TRIM" indicates that the autopilot has had a trim failure.

(9) Aural "AUTOPILOT" advisory. The aural advisory "AUTOPILOT" indicates that the autopilot has disengaged.

d. Emergency procedures. If an emergency or malfunction makes it necessary to disable the GPAAS, pull the G.P.A.A.S. POWER circuit breaker located on the instrument panel (GPAAS audio may be turned off by depressing the VOICE OFF switch).

CHAPTER 3B
AVIONICS (C-12 F2 AIRCRAFT)
Section I. GENERAL

3-1. DESCRIPTION.

This chapter covers the avionics equipment configuration installed in C-12 **F2** aircraft. It includes a brief description of the avionics equipment, its technical characteristics, capabilities, and locations. It covers systems and controls and provides the proper techniques and procedures to be employed when operating the equipment. For more detailed operational information consult the vendor manuals that accompany the aircraft's loose tools. Avionics installed in C-12 **C D1** aircraft are covered in Chapter 3. Avionics installed in C-12 **D2 F1** aircraft are covered in Chapter 3A.

3-2. AVIONICS EQUIPMENT CONFIGURATION.

The avionics configuration of the aircraft consists of three groups of electronic equipment. The communication equipment group consists of the interphone and UHF, VHF, and HF communications transceivers. The navigation equipment group provides the pilot and copilot with the instrumentation required to establish and maintain an accurate flight course and position and to make an approach on instruments in instrument meteorological conditions (IMC). The navigation group includes equipment for determining altitude, attitude, position, destination, range, bearing, heading, groundspeed, and drift angle. The transponder and radar group includes an identification, position, and emergency tracking system, and a radar system to locate potentially dangerous weather areas. A ground proximity altitude advisory system is also installed.

3-3. POWER SOURCE.

a. DC Power. The avionics equipment is supplied with DC power from four sources: the aircraft battery, left and right generators, and external power. Power is routed through two 50-ampere circuit breakers to the avionics power relay which is controlled by the avionics master power switch, located on the overhead control panel (fig. 2-8). Individual system circuit breakers and the associated avionics busses are shown in figure 2-21. A threeposition switch placarded AVIONICS MASTER POWER ON EXT PWR, located on the overhead control panel (fig. 2-8) controls a relay which applies power to two 35-ampere circuit breakers placarded AVIONICS MASTER PWR #1 and #2, located on the overhead circuit breaker panel (fig. 2-23). When the AVIONICS MASTER POWER switch is set to the ON (center) position, the avionics power relay is de-energized and power is applied through two 35ampere circuit breakers placarded AVIONICS MASTER PWR #1 and #2, located on the overhead circuit breaker panel (fig. 2-23).

NOTE

If the AVIONICS MASTER POWER switch fails to operate, power to the individual avionics circuit breakers can be provided by pulling the 5-ampere circuit breaker, placarded AVIONICS MASTER CONTR, located on the overhead circuit breaker panel.

In the off (aft) position, the relay is energized and power is removed from avionics equipment. When external power is applied to the aircraft, the avionics power relay is normally energized, automnatically removing power from the avionics equipment. To apply external power to the avionics equipment, move the AVIONICS MASTER POWER switch to the EXT PWR position, which over-rides the automatic avionics lockout system. This will de-energize the avionics power relay and allow power to be applied to the avionics equipment.

b. AC Power. AC power for the avionics equipment and AC engine instruments is provided by two 400 Hz 750 volt-ampere single-phase inverters. During normal operation the number I inverter supplies 115 VAC and 26 VAC to the number I avionics and navigation system and the left engine AC instruments, while the number 2 inverter supplies 115 VAC and 26 VAC to the number 2 avionics and navigation system and the right AC engine instruments. If either inverter fails, the total AC load will be switched to the remaining inverter automatically, unless a ground fault exists. The inverters are controlled by two switches placarded INVERTER #1, #2 - ON, located on the overhead control panel (fig. 2-21).

Section II. COMMUNICATIONS

3-4. DESCRIPTION.

The communications equipment group consists of an interphone system, and UHF, VHF, and HF communications transceivers.

3-5. MICROPHONE SWITCHES, MICROPHONE JACKS, AND HEADSET JACKS.

a. Microphone Switches. A bi-level microphone switch placarded INTPH, XMIT-MIC, is located on the pilot's and copilot's control wheels (fig. 2-16). A foot-operated microphone switch is installed on the floorboard forward of the copilot's seat. The switch allows the copilot to key the system selected by the transmitter selector switch on the audio control panel.

b. Controls and Functions.

(1) Control wheel microphone switches (fig. 2-16).

(a) INTPH (depressed to first detent). Keys interphone facility regardless of position of transmitter-interphone selector switch.

(b) XMIT (depressed full down). Keys facility selected by transmitter-interphone selector switch.

(2) Floorboard microphone switch. A foot-operated switch, located on the floor forward of the copilot's seat connects the selected microphone to the audio system when held depressed.

c. Microphone Jacks. The pilot and copilot are each provided with three microphone jacks. Two are located on the extreme left and right sides of the instrument panel (fig. 2-26). The upper microphone jack, placarded MIC HEADSET is for use with headset microphones. The lower microphone jack, placarded MIC is for use with the hand held microphone. The third microphone jack, located next to the oxygen outlets, is for use with the oxygen mask. Microphone jack functions are as follows:

(1) Controls and functions.

(a) MIC jack. Provides a means of connecting hand-held microphone with push-to-talk capability to the audio system.

(b) MIC HEADSET jack. Provides a means of connecting microphone-headset assembly to audio system.

(2) Microphone jack selector switches. The pilot and copilot are each provided with a switch placarded MIC HEADSET OXYGEN MASK located on the extreme left and right sides of the instrument panel (fig. 2-26). Microphone jack selector switch functions are as follows:

(a) MIC HEADSET. Connects headset microphone jack to audio system.

(b) OXYGEN MASK. Connects oxygen mask microphone jack to audio system.

(c) External headset jack. An external jack placarded MIC JACK, located on the nose gear strut is installed to facilitate intercommunication with ground maintenance personnel through a headset with push-talk switch, and a 40 foot walkaround cord. Ground maintenance personnel will be able to talk to either the pilot or copilot by depressing the press-to-talk switch provided with the headset, if the pilot or copilot has the interphone on.

3-6. AUDIO CONTROL PANEL.

a. Description. The audio control panel (fig. 3-1), located on the instrument panel (fig. 2-26), contains controls and switches which provide the pilot and copilot with a means of selecting desired reception and transmission sources, and also a means of controlling the volume of audio signals received from interphone, communication, and navigation systems. The user selects between the VHF, UHF, or HF transceivers. The audio control panel is fed through two 2-ampere circuit breakers placarded AUDIO, located on the overhead circuit breaker panel (fig. 2-23).

b. Controls and Functions, Audio Control Panel.

(1) Receiver audio switches. The pilot and copilot are each provided with a set of the following list of receiver audio switches, which are located across the top of the audio control panel. These two position switches permit monitoring of the selected audio facility. These switches are listed in this paragraph using their placarded names. The switches are moved to the up position, to select the desired audio facility, and down to the off position which is placarded either PILOT AUDIO OFF, or COPILOT AUDIO OFF.

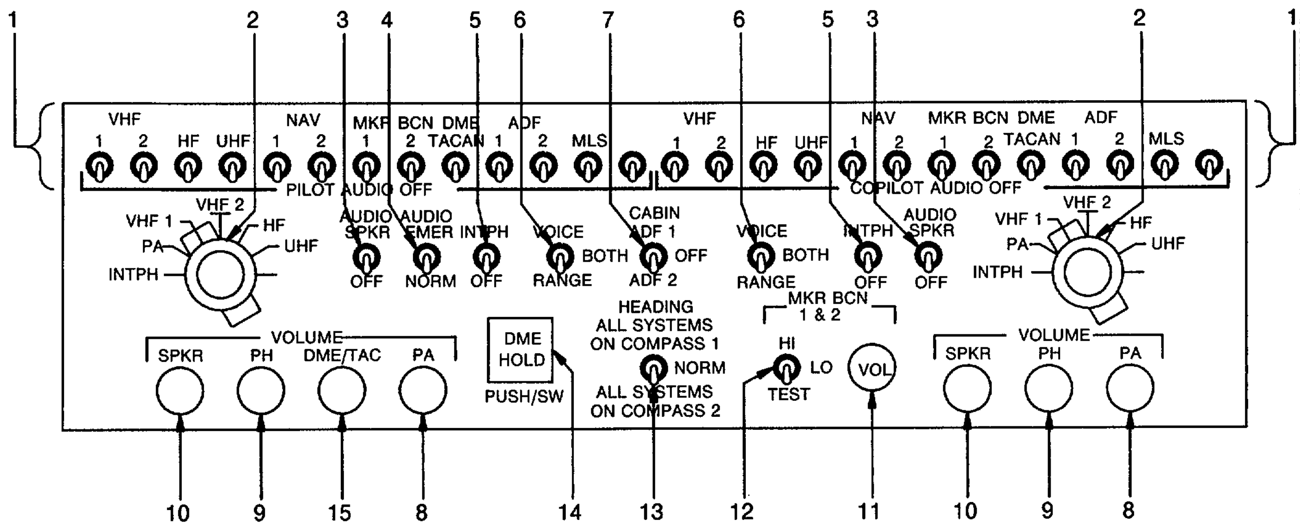
(a) VHF 1 switch. Permits monitoring of VHF 1 audio.

(b) VHF 2 switch. Permits monitoring of VHF 2 audio.

(c) HF. Permits monitoring of HF audio.

(d) UHF switch. Permits monitoring of UHF audio.

(e) NAV 1 switch. Permits monitoring of NAV 1 audio.



1. Receiver Audio Switches
2. Transmitter Selector Switch
3. Audio Speaker Switch
4. Audio Emergency/Normal Switch
5. Interphone Switch
6. Voice/Range Switch
7. Cabin ADF Switch
8. Public Address Volume Control
9. Headphone Volume Control
10. Cockpit Speaker Volume Control
11. Marker Beacon Volume Control
12. Marker Beacon Sensitivity/Test Switch
13. Compass System Selector Switch
14. DME Hold Switch
15. DME/TACAN Volume Control

Figure 3-1. Audio Control Panel

(f) NAV 2 switch. Permits monitoring of NAV 2 audio.

(g) MKR BCN 1, 2 switch. Permits monitoring of marker beacon 1 or 2 audio.

(h) DME/TACAN switch. Permits monitoring of DME/TACAN audio.

(i) ADF 1 switch. Permits monitoring of ADF 1 audio.

(j) ADF 2 switch. Permits monitoring of ADF 2 audio.

(k) MLS switch. Permits monitoring of MLS audio.

(l) Unmarked switch. Nonfunctional

(2) Transmitter-selector switches. The pilot and copilot are each provided with a transmitter-selector switch. These switches connect the user's microphone and headset to the selected radio transmitter, intercom, or paging system, regardless of the position of the respective receiver audio switch.

(a) INTPH. When the pilot's or copilot's transmitter selector switch is set to the INTPH position, the pilot at that station is able to talk to the other pilot by depressing his microphone switch and speaking into his microphone. He will not be able to receive the other pilot's intercom transmission unless the other pilot's transmitterselector switch is also set to the INTPH position, or the interphone/off switch is in the interphone position and the audio speaker switch is in the OFF position.

(b) PA. Setting the transmitter selector switch to the PA (public address) position allows the pilot at that station to speak through the four cabin speakers when his microphone is keyed. Talking through the PA speakers will override cabin ADF audio.

(c) VHF 1. Setting the transmitter selector switch to the VHF 1 position routes key and microphone signals to the number 1 VHF transmitter.

(d) VHF 2. Setting the transmitter selector switch to the VHF 2 position routes key and microphone signals to the number 2 VHF transmitter.

(e) HF. Setting the transmitter selector switch to the HF position routes key and microphone signals to the HF transmitter.

(f) UHF. Setting the transmitter selector switch to the UHF position routes key and microphone signals to the UHF transmitter.

(3) Audio speaker switch. The pilot and copilot are each provided with a switch placarded AUDIO, SPKR OFF, located on the pilot's and copilot's side of the audio control panel, which provide a means of controlling audio to the respective pilot's and copilot's speaker system. When either of these switches is set to the SPKR position, audio is applied to the respective speaker system. When set to the OFF position audio is removed from the respective speaker system. Headphone audio is independent of the position of these switches.

(4) Audio emergency/normal switch. A two-position switch placarded AUDIO, EMER NORM located on the pilot's side of the audio control panel, provides a means of selecting a secondary audio source in the event of a failure disabling both audio amplifiers. When the switch is set to the EMER position, power is removed from both audio amplifiers and audio is routed directly from the receivers to the headphones. Speaker audio and cabin public address will be inoperative. When the switch is set to the NORM position, audio is routed normally through amplifier to speakers or headphones.

c. Interphone switch. The pilot and copilot are each provided with a two-position switch placarded INTPH OFF, located on their respective sides of the audio control panel, which controls the operation of their voice-actuated interphone systems. When the switch is set to the INTPH position, the headset microphone of the pilot at that station will be actuated whenever the microphone is spoken into, and will be heard by the other pilot. When both the pilot's and copilot's INTPH switches are on (up), continuous voice-actuated intercom is available. When the switch is set to the OFF position, voice-actuated intercom operation is discontinued. The interphone switch is connected through the speaker OFF switch to disable the hot interphone when the speaker is ON.

(1) Voice/range switch. The pilot and copilot are each provided with a three-position switch placarded VOICE BOTH RANGE, located on their respective sides of the audio control panel, which controls selection of ADF voice or range filtering. When the switch is set to the VOICE position, the range tone is disabled, enhancing voice identification. When the switch is set to the RANGE position, the 1020 Hz range tone is enhanced, and voice is suppressed.

(2) Cabin ADF switch. A two-position switch placarded CABIN ADF 1, OFF, ADF 2, located in the center of the audio control panel, controls the selection of ADF audio which is routed to the four cabin speakers. When set to the ADF 1 or ADF 2 position, audio from the respective ADF 1 or ADF 2 receiver is channeled to the cabin speakers. When set to the OFF position, ADF audio is removed from the cabin speakers.

(3) Volume controls. The pilot and copilot are each provided with separate identical volume controls for controlling speaker, headset, or paging volume. The pilot has an additional volume control for controlling DME/TACAN audio.

(a) Public address volume control. This knob placarded PA adjusts audio volume to the four cabin speakers.

(b) Headphone volume control. This knob placarded PH adjusts audio volume to headphones.

(c) Cockpit speaker volume control. This knob placarded SPKR adjusts audio volume to cockpit speakers.

(4) Marker beacon volume control. The marker beacon volume control knob, placarded MKR BCN 1 & 2 VOL, is used to control the audio volume from the marker beacon receivers.

(5) Marker beacon sensitivity/test switch. A three position switch placarded MKR BCN 1 & 2, HI LO TEST, located on the audio control panel, selects sensitivity of the marker beacon receivers and test function. When the switch is set to the HI position, the marker beacon receivers are set to high sensitivity. When the switch is set to the LO position, the marker beacon receivers are set to low sensitivity. When the switch is held in the spring-loaded TEST position, the marker beacon annunciator lights will be illuminated.

(a) DME/TACAN volume control. This knob placarded DME/TAC, located on the pilot's side of the audio control panel only, adjusts DME or TACAN audio volume.

(6) DME hold switch. A push-on, pushoff switch placarded DME HOLD PUSH/SW, located on the audio control panel, controls selection of the DME hold function. When the DME hold switch is pushed to the on position, the DME/ TACAN distance frequency in the DME/TACAN receiver-transmitter will be held constant regardless of the frequency selected on the NAV 1 control unit. The DME hold switch will illuminate when the DME hold function is selected, and will be extinguished when DME hold function is deselected. The DME hold switch is disabled in TACAN mode or if the FMS is controlling the DME.

d. Audio Control Panel Operation.

(1) Turn-on procedure. Electrical power is applied to the audio control panel whenever electrical power is applied to the aircraft and the avionics master switch is set to the ON position.

(2) Interphone operating procedure (voice-actuated continuous microphone availability).

(a) Pilot's and copilot's interphone switches (audio control panel) INTPH.

(b) Pilot's and copilot's speaker switches (audio control panel) OFF.

(c) Begin speaking into headset microphone to actuate intercom operation.

(d) Volume controls Adjust audio level in headphones.

(1) Interphone operating procedure (press-to-talk microphone operation).

(a) Microphone switch Depress to first level then speak into microphone.

OR:

(b) Pilot's and copilot's transmitter selector switches INTPH.

(c) Microphone switch Depress to second level then speak into microphone.

OR:

(d) Copilot Depress foot switch then speak into microphone.

(4) Navigation aid and receiver monitoring procedure.
(a) Receiver audio monitor switches Set switches of desired receivers to on position.
(b) Adjust volume control of individual receiver being monitored.

(5) Transmitting procedure.
(a) Transmitter selector switch Set to desired transmitter.
(b) Microphone switch Press.
(c) Speak into microphone.

e. Audio Control Panel Emergency Operation.

(1) Audio emergency/normal switch EMER.
(2) Pilot/copilot audio switches OFF. Audio will bypass the amplifiers and will be applied directly to the headsets. Turn OFF unused receivers or turn down individual volume controls to eliminate undesired audio.

3-7. UHF COMMUNICATIONS TRANSCEIVER (AN/ ARC-1 64(V)).

a. Description. The UHF communications transceiver (fig. 3-3) provides line-of-sight transmission and reception of amplitude modulated (AM) signals in the ultra high frequency range of 225.000 to 399.975 MHz for a distance range of approximately 50 miles. Channel selection is spaced at 0.025 MHz. A separate receiver is incorporated to provide monitoring capability for the UHF emergency (guard) frequency (243.0 MHz). UHF audio output is applied to the audio control panel where it is routed to the headphones or speakers.

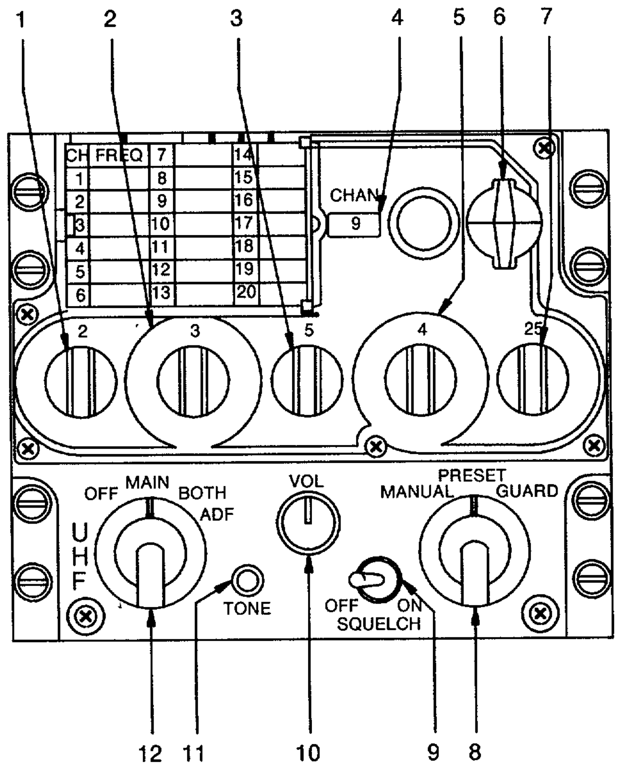
NOTE

The PRESET channel selector and manual frequency selectors are inoperative when the mode selector is set to the GUARD position. The receiver transmitter will be set to the emergency frequency only.

The transmitter and receiver sections of the UHF unit operate independently, but share the same power supply and frequency control circuits. Separate cables route transmit and receive signals to their respective receiver/transmitter. The UHF transceiver is powered through a 7.5-ampere circuit breaker placarded UHF, located on the overhead circuit breaker panel (fig. 2-23). The associated blade type antenna is shown in figure 2-1.

b. Controls and Functions. UHF control panel (fig. 3-2):

(1) Manual frequency selector (hundreds). Selects hundreds digit of frequency (either 2 or 3) in MHz.
(2) Manual frequency selector (tens). Selects tens digit of frequency (0 through 9) in MHz.
(3) Manual frequency selector (units). Selects units digit of frequency (0 through 9) in MHz.
(4) Preset channel selector indicator. This indicator, placarded CHAN, displays the selected preset channel.
(5) Manual frequency selector (tenths). Selects tenths digit of frequency (0 through 9) in kHz.



1. Manual Frequency (100 MHz) Selector–Indicator
2. Manual Frequency (10 MHz) Selector–Indicator
3. Manual Frequency (1 MHz) Selector–Indicator
4. Preset Channel Number Indicator
5. Manual Frequency (100 KHz) Selector–Indicator
6. Preset Channel Selector Knob
7. Manual Frequency (1 and 10 MHz) Selector–Indicator
8. Mode Selector Switch
9. Squelch Switch
10. Volume Control
11. Tone Pushbutton Switch
12. Function Selector Switch

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Figure 3-2. UHF Transceiver Control Panel (AN/ARC-164(V))

(6) Manual frequency selector (hundredths and thousandths). Selects hundredths and thousandths digits of frequency (00, 25, 50, or 75) in kHz.

(7) Preset channel selector. This knob is used to select one of 20 preset channel frequencies.

(8) Mode selector switch. This switch, placarded MANUAL PRESET GUARD, Selects operating mode and method of frequency selection. Setting the switch to the MANUAL position enables manual selection of any one of 7,000 frequencies. Setting the switch to the PRESET position enables the selection of any one of 20 preset channels. Setting the switch to the GUARD position automatically tunes the main receiver and transmitter to the guard frequency and the guard receiver is enabled.

(9) Squelch switch. This switch, placarded SQUELCH, OFF ON, turns main receiver squelch on or off.

(10) Volume control. This knob, placarded VOL, is used to adjust UHF audio volume.

(11) Tone switch. This pushbutton switch, placarded TONE, when depressed, causes a 1,020 Hz tone to be transmitted on the selected frequency.

(12) Function selector switch. This switch, placarded OFF MAIN BOTH ADF, selects operating function. When the switch is set to the OFF position, power is removed from the UHF Transceiver. Setting the switch to the MAIN position selects normal transmission with reception on the main receiver. Setting the switch to the BOTH position selects normal transmission with reception on both the main receiver and the guard frequency receiver. Setting the switch to the ADF position activates the ADF or homing system (if installed) and the main receiver.

c. UHF Transceiver Normal Operation.

(1) Turn-on procedure.

(a) Avionics master power switch (overhead control panel, fig. 2-8) On.

(b) Function switch (UHF control panel, fig. 3-2) MAIN or BOTH position, as required.

NOTE

If the function selector switch is set to the MAIN position, only normal UHF communications will be received. If the function selector switch is set to the BOTH position, emergency communications on the guard channel and normal UHF communications will both be received.

(2) Receiver operating procedure.

(a) UHF receiver audio switch (audio control panel, fig. 3-1) On (up).

(b) Volume control (UHF control panel) Mid position.

(3) To use preset frequency (UHF control panel).

(a) Mode selector switch PRESET position.
(b) Preset channel selector switch Rotate to desired channel.

(4) To use manual frequency selection (UHF control panel).

(a) Mode selector switch MANUAL position.
(b) Manual frequency selectors (5) Rotate each knob to set desired frequency digits.

NOTE

The PRESET channel selector and manual frequency selectors are inoperative when the mode selector switch is set to the GUARD position.

(c) Volume Adjust.

NOTE

To adjust volume when audio is not being received, turn squelch switch OFF, adjust volume for comfortable noise level, then turn squelch ON.

(d) Squelch As desired.

(5) Transmitter operating procedure.

(a) Transmitter selector switch (audio control panel, fig. 3-1) UHF.
(b) UHF control panel (fig. 3-2) Set required frequency using either PRESET CHAN control or MANUAL frequency select controls.
(c) Microphone jack selector switch (instrument panel, fig. 2-26) -As desired.
(d) Microphone switch Depress, then speak into microphone.

(6) Shutdown procedure.

(a) Function selector switch (UHF control panel, fig. 3-2) OFF.

3-8. VHF COMMUNICATIONS TRANSCEIVERS (KTR-908).

a. Description. Two VHF communications transceivers are installed to provide line-of-sight transmission and reception of amplitude modulated signals in the very high frequency range of 118.000 to 151.975 MHz (1,360 possible frequencies). Two KFS-598A control units (fig. 3-3), located on the instrument panel provide a means for operating the transceivers and displaying selected frequencies. Audio signals are applied to the audio control panel and routed through the VHF 1 and VHF 2 receiver audio switches to the headphones or speakers. Each VHF radio set is powered through a 7.5-ampere circuit breaker placarded VHF #1 or VHF #2, located on the overhead circuit breaker panel (fig. 2-23). The associated antenna is shown in figure 2-1.

b. Controls and Functions.

(1) Frequency display. Liquid crystal digital readouts provide a continuous display of both the active frequency (top line) and standby frequency (bottom line, placarded SBY) when the system is in the frequency mode (system mode is controlled by the CHAN pushbutton switch). When the system is in the channel mode, the upper digital display reads CH (channel) and a channel number (1 through 9), while the lower digital readout displays the frequency of the displayed channel number. When the system is in the program mode, the upper digital display will read P (program) and a channel number, while the lower digital display will read the frequency of the displayed channel. In all modes, a small TX will appear at the right end of the upper digital display when the system is transmitting. Display brightness is controlled by a dimming switch,

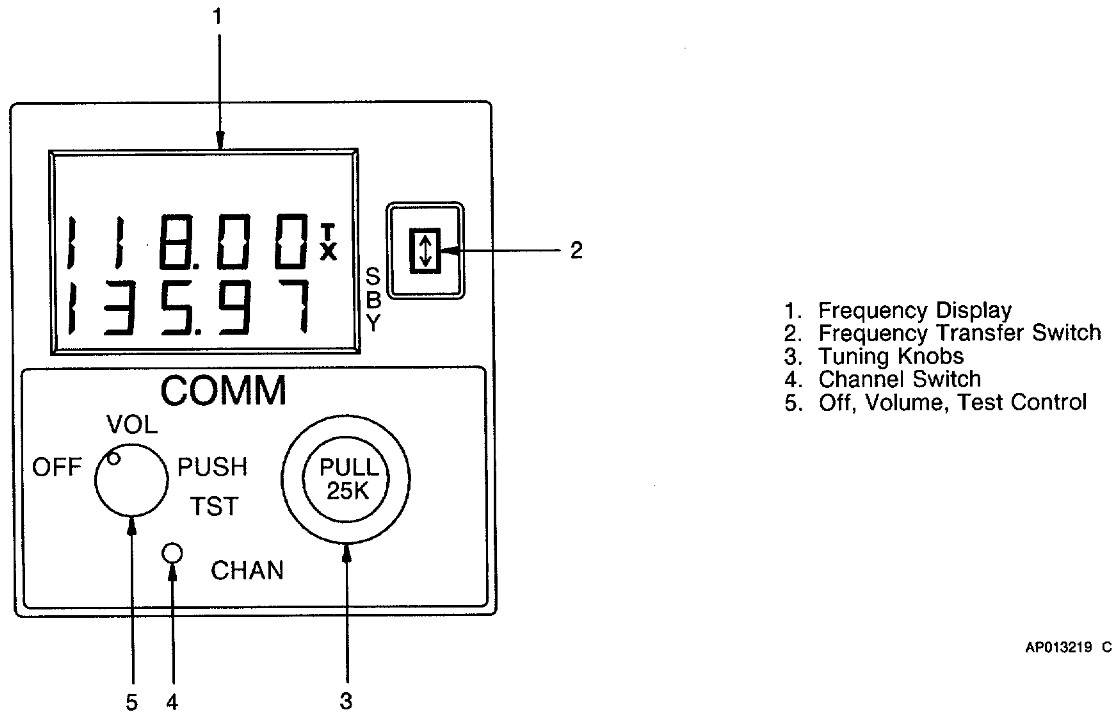


Figure 3-3. VHF Transceiver Control Unit (KFS-598A)

placarded VHF-NAV-ADF, located right of the altitude alert indicator on the instrument panel.

(2) Frequency transfer switch. The frequency transfer switch is a momentary pushbutton switch placarded with a two-headed vertical arrow, located to the right of the digital display. The functions of this switch when the unit is in different modes of operation are shown as follows:

(a) Standby entry mode. Depressing the frequency transfer switch with the unit in the standby entry mode causes the frequency displayed in the upper (active) digital display to interchange with the frequency shown in the lower (standby) digital display.

(b) Active entry mode. While the unit is in the standby entry mode or the channel mode, holding the transfer switch depressed for longer than 2 seconds will cause the unit to enter the active entry mode. While in the active entry mode, momentarily depressing the transfer switch will return the unit to the standby entry mode.

(c) Channel mode. When the unit is in the channel mode, depressing the transfer switch will return the unit to the frequency standby mode. The channel frequency will become the new active frequency, and the last active frequency will become the new standby frequency. If the unit was in the active entry mode prior to entering the channel mode, depressing the transfer switch will return the unit to the standby entry mode.

(3) Tuning knobs. Two concentric tuning knobs, located on the right side of the VHF transceiver control panel are used to set the frequency or channel shown on the digital display, depending upon the mode of operation being used.

(a) Frequency standby entry mode. When the unit is in the frequency standby entry mode, ,the larger concentric knob is used to increase or decrease the first two digits to the left of the decimal point (18 to 51), of the lower (standby) digital display. When the larger concentric knob is turned so as to increase the digits above 51, the display will start over at 18. Conversely, when the knob is turned so as to decrease the digits below 18, the display will start over at 51. When in the pushed-in position, the smaller concentric knob, placarded PULL 25 K, is used to set frequencies with 50 kHz spacing (for example: .75, .80, .85, .90, etc.). When the smaller concentric knob is turned in the pulled out position frequencies are set with 25 kHz spacing (for example: .72, .77, .82, .87, .92, etc.).

NOTE

The digital frequency displays show only five of the six digits of a frequency. The sixth digit is understood to be a zero when the fifth digit is a 0 or 5, or a 5 when the fifth digit is a 2 or 7.

(b) Frequency active entry mode. When in the active entry mode, the tuning knobs operate the same as they do in the standby entry mode, but will change the upper digital display frequency (active), rather than the lower (standby) frequency.

(c) Channel mode. When the unit is in the channel mode, turning either tuning knob will change the channel number in the upper display and the corresponding frequency in the lower display.

(d) Program mode. When the unit is in the program mode, the tuning knobs are used to select the channel number in the upper display (when flashing), or the channel frequency in the lower display (when flashing).

(4) Channel switch. A momentary pushbutton switch placarded CHAN, located on the lower portion of the VHF control unit, is used to put the unit into the channel and program modes. Momentarily depressing the channel switch while in a frequency mode puts the unit into the channel mode. Holding the channel switch depressed for longer than two seconds puts the unit into the program mode.

(5) Off, volume, test control. A control knob on the front of the VHF control unit placarded OFF, VOL, PUSH TST controls the operation of the unit. Turning the knob in the clockwise direction from the OFF position (detent) applies power to the unit, and audio volume output is increased as the knob is turned further to the right. Depressing the switch (PUSH TST), overrides the automatic squelch circuitry. Turning the knob clockwise past the automatic squelch threshold (while the automatic squelch circuitry is overridden) will allow background audio to be heard through the headphones or speaker and demonstrate whether the receiver is working or not, and allow setting of audio volume. To return the transceiver to automatic squelch control, depress the PUSH TST control knob again.

c. Modes of Operation. The VHF transceiver control unit may be operated in the following modes: frequency mode (either standby entry or active entry), channel mode, or program mode.

(1) Frequency modes. The VHF transceiver control unit may be operated in two frequency entry modes: standby entry, and active entry.

(a) Standby entry. When the unit is operated in the standby entry frequency mode, a new frequency is set on the lower (standby) digital display, using the tuning knobs. When the operator is ready, the frequency is then transferred to the upper (active) display by depressing the frequency transfer switch.

(b) Active entry. When the unit is operated in the active entry frequency mode, a new frequency is set on the upper (active) digital display using the tuning knobs. The active entry mode is entered from the standby entry mode by depressing the transfer switch for longer than 2 seconds. The lower (standby) digital display will be blank while the unit is in the active mode.

(2) Channel mode. When the VHF transceiver control unit is in the channel mode, the upper digital display will show a channel number (1 through 9), and the lower digital display will show the frequency assigned to the channel number in the upper digital display. The tuning knobs will change the channel number and corresponding frequency shown on the displays. The channel mode is entered by momentarily depressing the CHAN button located on the VHF transceiver control unit. If there are no valid frequencies programmed, the unit will display a CH I in the upper display and dashes in the lower display. The unit can be changed from the channel mode to the frequency mode in three ways:

(a) Momentarily depressing the transfer switch will return the unit to the frequency mode, placing the channel frequency in the upper (active) display and the previous active frequency in the lower (standby) display.

(b) Momentarily depressing the CHAN switch will return the unit to the frequency mode, and will return the upper (active) and lower (standby) displays to what they displayed prior to entering the channel mode.

(c) The unit will return to the frequency mode if no knob activity takes place for five seconds after the unit was put into channel mode. When returned in this manner, the channel frequency will be put into the lower (standby) display with the upper (active) frequency remaining as it was before entering channel mode. If no frequencies were programmed, the frequencies will remain the same as they were before entering channel mode.

(3) Program mode. The preset channels and frequencies are set using the program mode. Depressing and holding the CHAN switch for two seconds will place the unit into the program mode. A "P" and a channel number will be show in the upper (active) display, and a frequency or dashes

will be shown in the lower (standby) display. Immediately after entering the program mode the channel number will begin to flash, indicating that rotating the tuning knobs will change the channel number. Momentarily depressing the transfer switch will cause the channel number to stop flashing and cause the frequency to begin flashing, indicating that rotating the tuning knobs will change the frequency. Momentarily depressing the CHAN switch will return the unit to the frequency mode. The standby frequency will return to what it was prior to entering the program mode. The unit will automatically return to the frequency mode if no front panel activity takes place for 20 seconds.

d. VHF Communications Transceiver Operation.

(1) Turn-on procedure.

(a) Avionics master switch (overhead control panel, fig. 2-12) ON.

(b) Off, volume, test knob Turn clockwise out of detent, then depress to turn off automatic squelch circuit. Continue turning knob clockwise until background noise is heard in headphones or speaker, assuring that receiver is operating, then set audio volume to desired level. Depress knob again to return unit to automatic squelch control.

(2) Receiver operating procedure.

(a) Channel pushbutton switch As required.

(b) Tuning knobs Set desired frequency or channel.

(c) VHF 1 or VHF 2 receiver audio switch (audio control panel, fig. 3-1) On (up).

(d) Volume control Adjust as required.

(2) Transmitter operating procedure.

(a) Channel pushbutton switch As required.

(b) Tuning knobs Set desired frequency or channel.

(c) Transmitter selector switch (audio control panel, fig. 3-1) VHF 1 or VHF 2.

(d) Microphone jack selector switch (instrument panel, fig. 2-26). As required.

(e) Microphone switch Depress, then speak into microphone.

3-9. HF COMMUNICATIONS TRANSCEIVER (KHF950).

a. Description. The HF communications transceiver provides long-range voice communications within the frequency range of 2.0000 to 29. 9999 MHz (280,000 possible frequencies). The unit can employ either amplitude modulation (AM), upper sideband (USB) modulation, or lower sideband (LSB) modulation. The KHF-950 HF system consists of a KCU-951 control display unit located on the pedestal extension (fig. 2-6A), a KTR-953 receiver/exciter, and KAC-952 power amplifier/ antenna coupler (the latter two items are located aft of the rear pressure bulkhead). The system is powered through a 25-ampere circuit breaker placarded HF PWR, and a 5-ampere circuit breaker placarded HF RCVR. Both circuit breakers are located on the overhead circuit breaker panel (fig. 2-23).

b HF Transceiver Control-Display Unit (ig. 3-4) Controls and Functions.

(1) Digital display. A digital display located on the upper left portion of the controldisplay unit provides frequency, mode, and operational status information. The upper (larger) display shows 6-digit frequency information, and two-digit channel numbers. The lower (smaller) display shows signal emission mode (LSB, AM, and USB) transmitter operation (TX), and program mode (PGM). Display brightness is controlled by a dimming control, placarded HF, located left of the altitude alert indicator on the instrument panel.

(2) Emission mode switch. A pushbutton switch placarded MODE, located on the HF control unit, selects transmission and reception mode. Momentary depression of the MODE switch cycles the system from upper sideband (USB) mode, to lower sideband (LSB), to amplitude modulation (AM) modes. Mode selection is indicated on the display by the illumination of the respective USB, LSB, or AM annunciators.

(3) Frequency/channel switch. A two position push-button switch placarded FREQ/ CHAN, located on the upper right portion of the HF control unit controls the method of frequency selection. When the switch is in the out position, the system is in the direct frequency tuning (simplex) mode. When the switch is in the depressed position the system is in the preset channel mode.

(4) Program switch. A momentary pushbutton switch placarded PGM, located on the lower

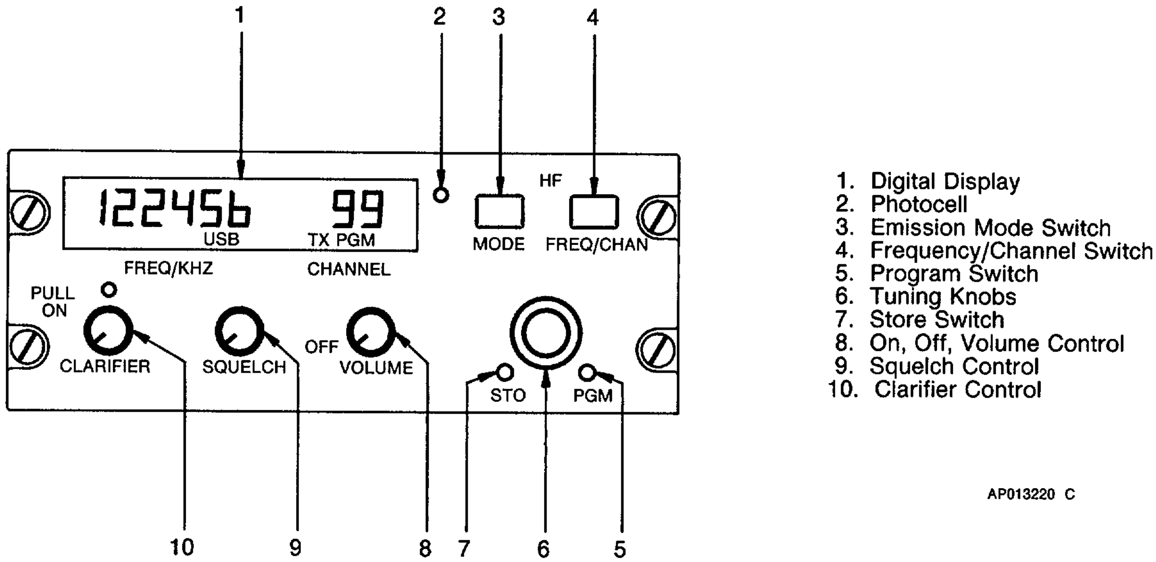


Figure 3-4. HF Transceiver Control-Display Unit (KCU-951)

right side of the HF control unit, causes the system to enter the program mode when depressed. When the system is in the program mode, frequencies and the transceiver emission mode may be assigned to a preset channel number and stored in the memory for future use the preset channel m

(5) Tuning knobs. Two concentric tuning knobs on the HF control unit are provided to set frequencies and preset channel numbers. The outer knob becomes a cursor control (flashing light) with the frequency/channel switch in the FREQ (out) position. The cursor is moved over the digit which is to be changed by rotating the outer concentric tuning knob, causing the digit to flash. The flashing digit can then be changed by rotation of the inner concentric knob. When all digits have been changed, the cursor should be stowed by moving it to the right or left of the display, then turning the tuning knob one more click to position the cursor off the display. To recall the flashing cursor, twist the larger concentric tuning knob in either direction until the cursor reappears.

(6) Store switch. A momentary push button switch placarded STO is located on the HF control panel to the left of the tuning knobs is used to store in memory the displayed data when programming preset channels.

(7) On, off, volume control. A knob placarded OFF, VOLUME located on the HF control panel turns the system off and on and controls volume. Clockwise rotation from the detent applies power to the system. Further clockwise rotation increases audio output level.

(8) Squelch control. A knob placarded SQUELCH on the HF control unit provides a variable squelch threshold control.

(9) Clarifier control. A knob placarded CLARIFIER, PULL ON located on the lower left corner of the HF control unit is used to eliminate unnatural audio quality when operating in the single sideband (SSB) mode by slightly shifting the receiver generated frequency to match the frequency of the signal being received. To operate the clarifier, the knob is pulled out and rotated in either direction from the index mark (which is located directly above the clarifier knob) until the audio quality is optimized. When the voice quality is natural the clarifier knob should be pushed in. Turning the clarifier knob has no effect when pushed in.

c. Frequency Selection. The HF system has two methods of frequency selection: frequency mode and channel mode. In the frequency mode, frequencies are tuned directly on the display using the tuning knobs. In the channel mode, preset channels are programmed with an assigned channel number (1 through 99) and stored in memory.

(1) Frequency mode. In the frequency mode the desired frequency is set into the display using the tuning knobs. Only simplex operation is allowed while operating in the frequency mode.

(2) Channel mode. When the HF control unit is in the channel mode, channels and their respective frequencies are changed using the tuning knobs. To place the unit into the channel mode, depress the frequency/channel switch. This allows access to existing programmed channels. Frequencies in the channel mode are stored with channel number, emission mode (USB, LSB, or AM), and transmit and receive frequency.

(3) Program mode. When the HF control unit is in the program mode, channel numbers, emission mode (USB, LSB, or AM), and transmit and receive frequency are set up and stored in memory. The program mode is entered from the channel mode by depressing the program switch with a pencil or other pointed object. When in the program mode, channel number, emission mode, and transmit frequency are all displayed. Transmitter operation is inhibited. The transmit frequency may be examined by keying the microphone. Channels may be programmed for the following types of operation:

(a) Receive only. The operator programs a frequency in the receive portion of transmit frequency. The transmitter is locked out when a channel has been programmed for receive only operation. The receive-only function is used for listening to weather, time, omega status, frequency standard, and geophysical alert broadcasts.

(b) Simplex operation. The operator programs the same frequency in receive and transmit, and assigns an operating mode (USB, LSB, or AM). The simplex function is used by air traffic control, ARINC, and others.

(c) Semi-duplex. In semi-duplex operation the operator programs two different frequencies, one for transmit and one for receive. The semi-duplex function is used by maritime radiotelephone network (public correspondence) stations.

d. HF Communications Transceiver Operation.

(1) Direct frequency tuning operation (simplex only).

(a) Frequency/channel switch FREQ (out position).
(b) Mode selector switch Set emission mode (USB, LSB, or AM).
(c) Tuning knobs Set desired frequency, then stow cursor.
(d) Tune antenna coupler (press microphone button).

(2) Programming preset channels.

(a) Receive only.

1 Cursor Stow if a frequency digit is flashing.
2 Tuning knobs Select channel to be preset and desired frequency.
3 Mode selector switch Set emission mode (USB, LSB, or AM).
4 Store switch (STO) Depress.

NOTE

A flashing TX will appear in the display window, but should be ignored since a receive only frequency is being set.

NOTE

If another channel is to be set, the cursor must be stowed before a new channel can be selected. Use the smaller concentric knob to select the channel and repeat the steps for selecting a new frequency.

5 To return to an operating mode, push the PGM switch.

(b) Simplex.

1 Cursor Stow if a flashing digit is present.
2 Frequency/channel switch CHAN (in).
3 Program switch (PGM) Depress, check that PGM annunciator in the display is illuminated.
4 Tuning knobs Select channel to be preset and desired frequency.
5 Mode selector switch Select emission mode (LSB, USB, or AM).

6 Store switch (STO) Depress and release twice. The first press of the STO button stores the frequency in the receive position and the second press stores the same frequency in the transmit position. The second push also stores the cursor.

7 If another channel is to be reset, use the smaller concentric knob to select the channel and repeat the steps for selecting a new frequency. The cursor will be automatically stowed. To return to an operating modes, push the PGM button again.

(c) Semi-duplex.

1 Cursor Stow if a flashing digit is present.

2 Frequency/channel switch CHAN (in).

3 Mode selector switch Set emission mode (USB,LSB, or AM).

4 Program switch (PGM) Depress, check that PGM annunciator in the display is illuminated.

5 Tuning knobs Select channel to be preset, operating mode (USB,LSB, or AM), and desired receive frequency.

6 Store switch (STO) Depress and release once.

7 Transmit frequency Set

8 Store switch (STO) Depress again. If another channel is to be preset, use the smaller concentric knob to select the channel and repeat the steps.

9 To return to an operating mode, push the PGM button.

NOTE

The mode for each channel (LSB, USB, or AM) is stored along with the frequency. If the mode is changed, the system will receive and transmit in the mode selected for transmit.

3-10. EMERGENCY LOCATOR TRANSMITTER (DM ELT8.1).

a. Description. An automatic or manually activated emergency locator transmitter (ELT) is located on the right side of the aft fuselage. The associated antenna is mounted on top of the aft fuselage at the same location (fig. 2-1). An access hole with a spring-loaded cover is located in the right fuselage skin adjacent to the transmitter, enabling a downed pilot to manually initiate, terminate, or reset the ELT to an armed mode. Self contained batteries provide operation for a minimum of 50 hours at 200 milliwatts. The transmitter contains an impact G switch which automatically activates the transmitter following a 10 G impact along any axis of the aircraft. When activated, it will simultaneously radiate omni-directional RF signals on the international distress frequencies of 121.5 and 243.0 MHz. The radiated signal is modulated with an audio swept tone.

b. ELT Controls and Functions.

(1) ON-ARM-OFF switch (located on ELT).

(a) ON Turns set on, initiating emergency signal transmission.

(b) ARM Establishes a readiness state to start automatic emergency signal transmission when forces on the ELT exceed a preset threshold.

(c) OFF Turns set off.

(2) Remote RESET-A UTO-XMIT switch.

(a) AUTO Arms the set to operate automatically upon impact.

(b) XMIT Turns set on.

(c) RESET - In the event the ELT is accidentally triggered, pushing the switch to the reset position five times within three seconds will deactivate the transmitter and return the set to the armed (AUTO) condition.

Section III. NAVIGATION

3-11. DESCRIPTION. The navigation equipment group provides the pilot and copilot with the instrumentation required to establish and maintain an accurate flight course and position, and to make an approach on instruments in instrument meteorological conditions (IMC). The navigation configuration includes equipment for determining attitude, position, destination, range, bearing, heading, and groundspeed.

3-12. RADIO MAGNETIC INDICATORS (KNI-582).

a. Description. Two identical radio magnetic indicators (RMI) provide aircraft heading and radio bearing information to or from a VOR, TACAN, NDB, or a waypoint established in the flight management system (FMS). The pilot's RMI is powered through a 1-ampere circuit breaker, placarded #1 RMI. The copilot's RMI is powered through a 1-ampere circuit breaker, placarded #2 RMI. Both circuit breakers are located on the overhead circuit breaker panel (fig. 2-23).

b. RMI Controls and Functions (fig. 3-5).

(1) Compass system selector switch. A three-position switch placarded HEADING, ALL SYSTEMS ON COMPASS 1, NORM ALL SYSTEMS ON COMPASS 2, located on the audio control panel (fig. 3-1), controls the selection of the compass system which will supply heading information to the pilot's and copilot's RMI. When the switch is set to the ALL SYSTEMS ON COMPASS 1 position both RMI's receive compass information from compass system number 1. When the switch is set to the NORMAL position, the copilot's RMI will receive heading information from compass system number 2, while the pilot's RMI will receive heading information from compass system number 1. When the switch is set to the ALL SYSTEMS ON COMPASS 2 position both RMI's will receive heading information from compass system number 2.f 121.5 and 243.0 MH

(2) Single-needle annunciators. Two annunciator lights, identified with a placarded single-needle symbol, located on the extreme left and right sides of the instrument panel (fig. 2-26), are provided to the pilot and copilot to show what bearing information source is being used by the single needle pointer of their respective RMI. When illuminated, the upper annunciator, placarded NAV 1 ADF 1, shows that the RMI single needle is displaying bearing information from NAV 1 (or FMS if the respective HSI selector switch is set to FMS), if the single-needle selector switch on the RMI is set to the

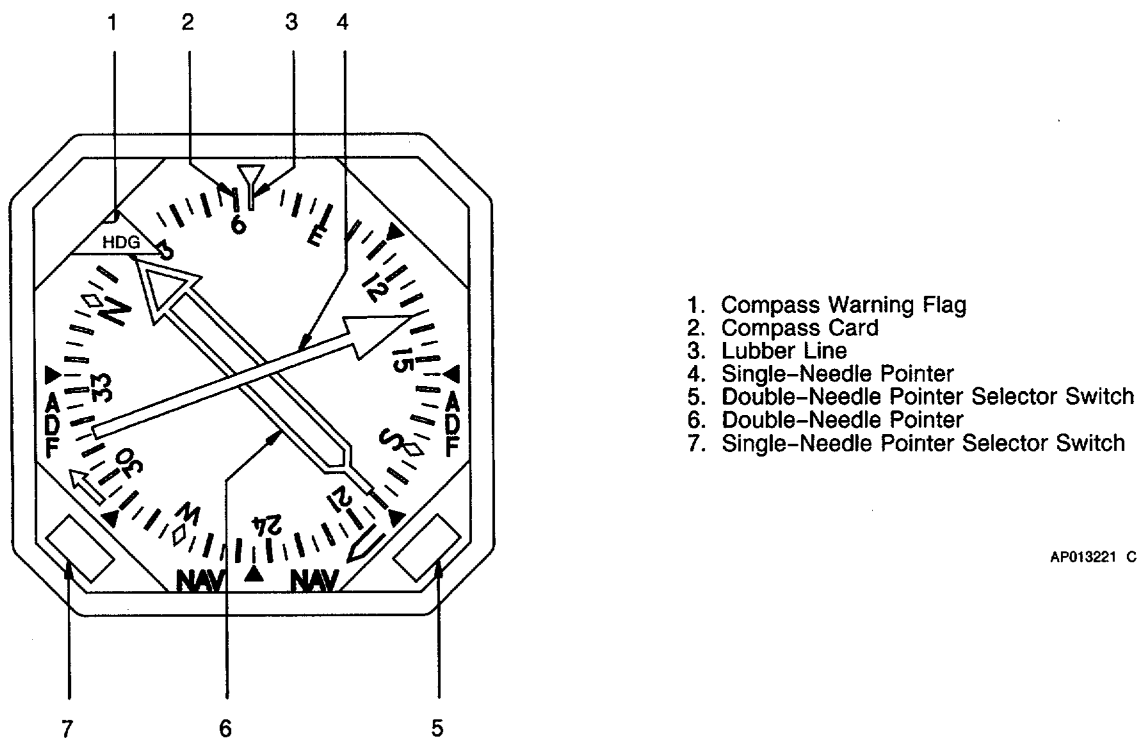


Figure 3-5. Radio Magnetic Indicator (KNI-582)

NAV position, or that the single needle is displaying information from ADF 1, if the single-needle selector switch is set to the ADF position. When the lower annunciator, placarded TACAN ADF 1, is illuminated, it shows that the single needle is displaying bearing information from TACAN, if the single-needle selector switch on the RMI is set to the NAV position, or ADF I if the single-needle selector switch is set to the ADF position.

(3) Compass warning flag. The compass warning flag (placarded HDG), located on the upper left portion of each RMI, comes into view whenever the compass system determines that the heading information displayed on the compass card is invalid.

(4) Compass card. This rotating card repeats gyro stabilized magnetic compass information.

(5) Lubber line. Aircraft heading is read from the compass card under the lubber line.

(6) Single-needle pointer. The arrow of this pointer indicates the magnetic heading to a VOR station, an NDB station, or a waypoint in the flight management system. The single-needle pointer can display bearing information from NAV 1, TACAN, ADF 1, or the flight management system, depending upon the position of the single-needle pointer selector switch, the pilot's HSI selector switch, and the NAV 1/TACAN mode switch.

(7) Double-needle pointer. The arrow of this pointer indicates the magnetic heading to a VOR or NDB station. The double-needle pointer can display bearing information from NAV 2 or ADF 2 depending upon the position of the doubleneedle pointer selector switch.

(8) Double-needle pointer selector switch. This is a two-position, press to change selector switch, located on the lower right corner of each RMI. When depressed to the in position, ADF 2 bearing information is supplied to the double needle, and the double-needle indicator on the RMI points to ADF. Depressing the switch when it is in the in position returns it to the out position. When in the out position, NAV 2 bearing information is supplied to the double-needle pointer, and the double-needle indicator points to NAV.

(9) Single-needle pointer selector switch. This is a two-position, press to change selector switch, located on the lower left corner of the RMI. When depressed to the in position, ADF 1 bearing information is supplied to the single needle, and the single-needle indicator on the RMI points to ADF. Depressing the switch when it is in the in position returns it to the out position. When in the out position, NAV 1 or flight management system bearing information is supplied to the single-needle pointer, and the single-needle indicator points to NAV. With the single-needle pointer switch in the out (NAV) position, flight management system bearing information will be displayed by the RMI single-needle pointer if the pilot's HSI FMS selector is depressed and bearing information is being supplied by the FMS.

3-13. PILOT'S HORIZONTAL SITUATION INDICATOR (RD-650B).

a. Description. The pilot's horizontal situation indicator (HSI) combines several navigation information displays to provide a map-like presentation of the aircraft's position with respect to magnetic heading. The indicator displays aircraft displacement relative to VOR, TACAN, localizer, glideslope, MLS and flight management system course to waypoint, and selected heading. Relative bearing to a VOR, TACAN, or NDB station, or FMS waypoint is displayed with respect to magnetic north.

b. Pilot's HSI Controls, Indicators, and Functions (fig. 3-6).

(1) Distance display. Provides a digital electronic display which indicates the distance in nautical miles to the selected DME or TACAN station, or flight management system waypoint. DME or TACAN distance is displayed in a 0 to 399.9 nautical mile format. Flight management system distance to waypoint is displayed in a 0 to 3999 nautical mile format. Display brightness is controlled by a dimming control located on the pilot's attitude director indicator. The distance display will show all dashes when the distance input is invalid or absent.

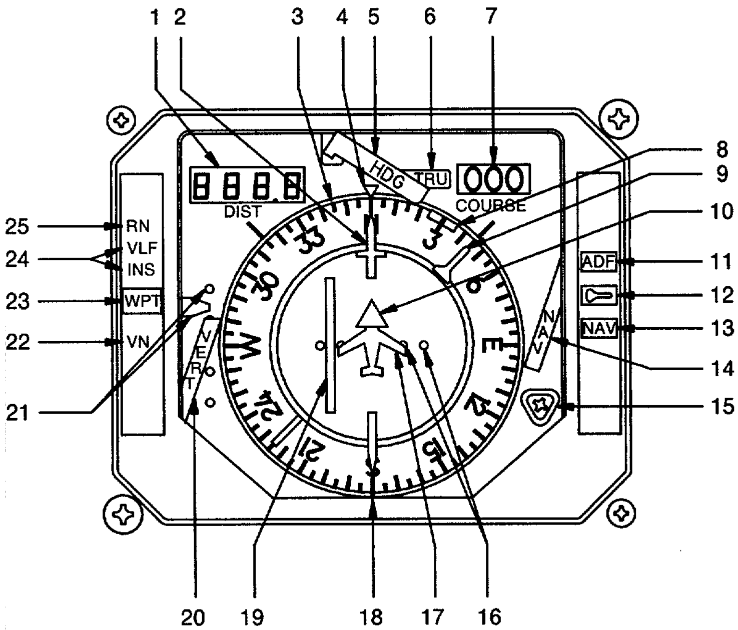
(2) Course pointer. The yellow course pointer is positioned on the heading dial by the remote course knob to a magnetic bearing that coincides with a selected VOR or TACAN radial. The course pointer can also be positioned by the flight management system (FMS). The FMS will automatically keep the course pointer slewed to the correct great circle course. Upon reaching a leg change point, the FMS will drive the course pointer to a new great-circle course defined by the next waypoint.

(3) Compass card. This rotating card repeats gyro stabilized magnetic compass information in 5 degree increments.

(4) Lubber line. Aircraft heading is read from the compass card under the lubber line.

(5) Heading flag. A flag placarded HDG, located on the upper portion of the HSI, comes into view when heading information is unreliable.

(6) TRUE (TRU) heading source annunciator. Non-functional in this installation.



1. Distance Display
2. Course Pointer
3. Compass Card
4. Lubber Line
5. Heading Flag
6. TRU Annunciator
7. Course Display
8. Heading Marker
9. Bearing Pointer
10. To–From Indicator
11. ADF Bearing Source Annunciator
12. Bearing Pointer Source Selector Switch
13. NAV Bearing Source Annunciator
14. NAV Flag
15. Compass Synchronization Indicator
16. Course Deviation Scale
17. Symbolic Miniature Aircraft
18. Reciprocal Heading Index
19. Course Deviation Bar
20. Vertical (Glide Slope) Warning Flag
21. Glide Slope Pointer and Scale
22. Vertical Navigation Annunciator (Not Used)
23. Waypoint Annunciator
24. INS and VLF Annunciators (Not Used)
25. Area Navigation (FMS) Annunciator

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Figure 3-6. Pilot's Horizontal Situation Indicator (RD-650B)

(7) Course display. Provides a digital readout in degrees of the course selected by the course knob.

(8) Heading marker. The notched orange heading marker is positioned on the compass card by the heading knob to select and display a preselected compass heading. Once set to the desired heading, the heading marker maintains its position on the compass card. The difference between the heading marker and the lubber line index is the amount of heading select error applied to the flight director computer. In the heading mode the ADI flight director command cue will display the proper bank commands to turn to and maintain this selected heading.

(9) Heading knob (pedestal extension fig. 2-6). The remote heading knob, placarded with a notched orange heading marker, located on the pedestal extension (fig. 2-6), is used to position the heading marker on the HSI.

(10) Course knob (pedestal extension, fig. 2-6). The remote course knob placarded with a yellow course arrow, located on the pedestal extension (fig. 2-6), is used to position the course arrow on the HSI.

(11) Bearing pointer. This pointer (pink) indicates the magnetic heading to a VOR station, TACAN station, an NDB station, or a waypoint in the flight management system.

(12) To-from indicator. Two white triangular to-from indicators which remain aligned with the yellow course pointer, indicate VOR, TACAN or FMS to-from information.

(13) ADF bearing source annunciator. When illuminated, indicates ADF bearing information is being displayed by the bearing pointer.

(14) Bearing pointer source selector switch. The bearing pointer source selector switch is a momentary pushbutton switch marked with a pink bearing-pointer arrow symbol which provides a means of selecting whether ADF or NAV bearing information will be presented by the bearing pointer. Each push of this switch alternates selection between ADF and NAV. Upon power-up or following long-term power interruption, NAV will be displayed.

(15) NAV bearing source annunciator. When illuminated, this annunciator indicates that VOR/TACAN or FMS bearing is being displayed by the bearing pointer, as selected by the HSI select switches.

(16) NAV flag. The NAV warning flag, located on the left side of the HSI, comes into view to indicate a loss of or unreliable signal from the navigation source being used by the HSI course deviation indicator.

(17) Compass synchronization indicator. The compass synchronization indicator consists of a dot and X symbol display. When the compass system is in the slaved mode, the display will oscillate between the dot and X symbol, indicating that the compass card is synchronized with a gyro stabilized magnetic heading.

(18) Course deviation scale. During VOR or TACAN operation, the distance between each graduation (dot) represents a 5 degree deviation from course. During MLS and localizer operation, the distance between each graduation (dot) represents a 1 degree deviation from course. During flight management system enroute operation the distance between each graduation represents 2 1/2 miles deviation from course to waypoint. During flight management system approach operation the distance between each graduation (dot) represents 0.625 nautical mile deviation from course.

(19) Symbolic miniature aircraft. The fixed miniature aircraft pictorially shows actual aircraft position in relation to the selected course.

(20) Reciprocal heading index. The reciprocal heading index marks the reciprocal of the heading under the lubber line.

(21) Course deviation bar. The course deviation bar represents the centerline of the selected VOR or TACAN course, localizer course, MLS course or flight management system course to waypoint.

(22) Vertical (glide slope) warning flag. A flag placarded VERT on the left side of the HSI comes into view when valid ILS or MLS glide slope information is not being received.

(23) Glide slope pointer and scale. The glide slope pointer displays ILS or MLS glide slope deviation information. The pointer is in view only when tuned to a localizer frequency. If the aircraft is below glide slope path, the pointer is displayed upward on the scale. Each division (dot) on the scale represents approximately 0.4 degree deviation from glide slope when operating on an ILS signal. When operating on an MLS signal, the value of each scale division will vary with the approach slope set into the aircraft's MLS control unit.

(24) Waypoint annunciator. An annunciator light placarded WPT on the upper left portion of the HSI will illuminate (when operating in the flight management system mode) in order to alert the pilot that automatic waypoint sequencing and a leg change are about to occur. Illumination of the waypoint annunciator will occur approximately 15 seconds before the FMS turns the aircraft onto the transition course. If the aircraft is approaching the last non-ILS waypoint in the flight plan or is approaching a "direct to" waypoint which is not part of the active flight plan, illumination of the WPT annunciator will begin approximately 90 seconds before reaching the waypoint.

(25) Area navigation (FMS) annunciators. Three annunciator lights placarded RN, VLF, and INS are located on the upper left portion of the HSI. Illumination of the RN (RNAV) annunciator indicates that the HSI is receiving information from the flight management system (FMS). The VLF and INS annunciators are not functional, but will illuminate when the annunciators are tested.

3-14. COPILOT'S HORIZONTAL SITUATION INDICATOR (RD-450).

a. Description. The copilot's horizontal situation indicator (HSI) combines several navigation information displays to provide a map-like presentation of the aircraft's position with respect to magnetic heading. The indicator displays aircraft displacement relative to VOR, TACAN, localizer, glide slope, MLS and flight management system course to waypoint, and selected heading. Relative bearing to a VOR, TACAN, or NDB station or FMS waypoint is displayed with respect to magnetic north.

b. Copilot's HSI Controls, Indicators, and Functions (fig. 3-7).

(1) Heading marker. The notched orange heading marker is positioned on the compass card by the heading knob, to select and display a preselected compass heading. Once set to the desired heading, the heading marker maintains its position on the compass card. The difference between the heading marker and the lubber line index is the amount of heading select error applied to the flight director computer. In the heading mode the ADI flight director command cue will display the proper bank commands to turn to and maintain this selected heading.

(2) Compass card. This rotating card repeats gyro stabilized magnetic compass information in 5 degree increments.

(3) Lubber line. Aircraft heading is read from the compass card under the lubber line.

(4) Heading flag. A flag placarded HDG, located on the upper portion of the HSI, comes into view when heading information is unreliable.

(5) Course pointer. The yellow course pointer is positioned on the heading dial by the course knob to a magnetic bearing that coincides with a selected VOR or TACAN radial, or FMS desired track to the waypoint or localizer or MLS front course.

(6) Glide slope pointer and scale. The glide slope pointer displays ILS or MLS glide slope

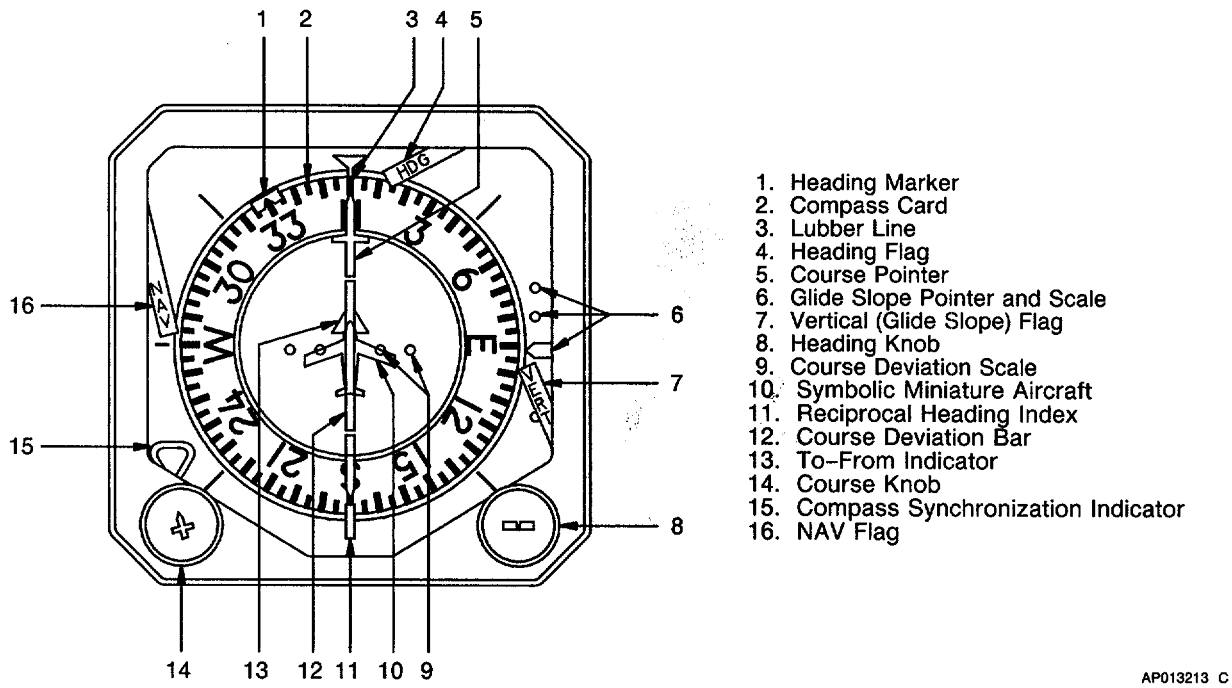


Figure 3-7. Copilot's Horizontal Situation Indicator (RD-450)

deviation information. The pointer is in view only when tuned to a localizer frequency. If the aircraft is below glide slope path, the pointer is displayed upward on the scale. Each division (dot) on the scale represents approximately 0.4 degree deviation from glide slope when operating on an ILS signal. When operating on an MLS signal, the value of each scale division will vary with the approach slope set into the aircraft's MLS control unit.heading.of the activ

(7) Vertical (glideslope) flag. A flag placarded VERT on the left side of the HSI comes into view when valid ILS or MLS glide slope information is not being received.

(8) Heading knob. The heading knob, placarded with an orange heading marker symbol, located on the lower right side of the HSI, is used to position the heading marker on the HSI.

(9) Course deviation scale. During VOR or TACAN operation, the distance between each graduation (dot) represents a 5 degree deviation from course. During localizer operation, the distance between each graduation (dot) represents a 1 degree deviation from course. During flight management system enroute operation the distance between each graduation represents 2 1/2 miles deviation from course to waypoint. During flight management system approach operation the distance between each graduation (dot) represents 0.625 nautical mile deviation from course.

(10) Symbolic miniature aircraft. The fixed miniature aircraft symbol pictorially shows actual aircraft position in relation to selected course.

(11) Reciprocal heading index. The reciprocal heading index marks the reciprocal of the heading under the lubber line.

(12) Course deviation bar. The course deviation bar represents the centerline of the selected VOR or TACAN course, localizer or MLS course, or flight management system (FMS) course to waypoint.

(13) To-from indicators. Two white triangular to-from indicators which remain aligned with the yellow course pointer, indicate VOR to-from information. the yellow course pointer, indicate VOR to-from information.

(14) Course knob. The course knob, placarded with a yellow course arrow, located on the left side of the HSI, is used to position the course arrow on the HSI.

(15) Compass synchronization indicator. The compass synchronization indicator consists of a dot and X symbol display. When the compass system is in the slaved mode, the display will oscillate

between the dot and X symbol, indicating the compass card is synchronized with a gyro stabilized magnetic heading.

(16) NAV flag. Indicates a loss of or unreliable signal from navigation source being used by HSI.

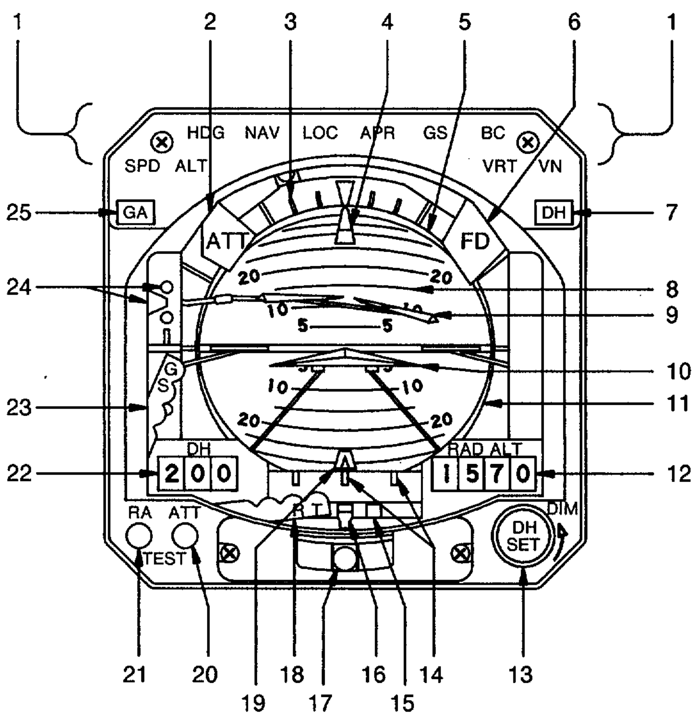
3-15. PILOT'S ATTITUDE DIRECTOR INDICATOR (AD-650B).

a. Description. The pilot's attitude director indicator (ADI) combines an attitude sphere display with computed steering information to provide the commands required to intercept and maintain a desired flight path. It also contains an eyelid display, expanded localizer, glide slope, radio altitude display, rate-of-turn indicator, mode annunciators, goaround and decision height annunciators, and an inclinometer.

b. Pilot's ADI (fig. 3-8) Controls, Indicators, and Functions.

(1) Flight director mode annunciators. Twelve flight director mode annunciators, located on the upper portion of the ADI, will illuminate when their respective mode is engaged into the flight director.

(a) SPD annunciator. Not used in this installation.
(b) ALT annunciator. Illuminates when altitude is being held by the flight director.
(c) HDG annunciator. Illuminates when heading is being held by the flight director.
(d) NA V annunciator. Illuminates when the flight director is tracking a navigation signal.
(e) LOC annunciator. Illuminates whenever the flight director is tracking a localizer signal.
(f) APR annunciator. Illuminates whenever the flight director is tracking an approach signal.
(g) GS annunciator. Illuminates whenever the flight director is tracking a glide slope signal.
(h) BC annunciator. Illuminates whenever the flight director is tracking a back localizer signal.
(i) VRT annunciator. Illuminates when vertical speed is being held by the flight director.
(j) VN annunciator. Not used in this installation.



1. Autopilot/Flight Director Mode Annunciators
2. Attitude Warning Flag
3. Bank Angle Scale
4. Bank Angle Pointer
5. Upper (Blue) Eyelid Display
6. Flight Director Warning Flag
7. Decision Height Annunciator
8. Pitch Angle Scale
9. Flight Director Command Cue
10. Symbolic Miniature Aircraft
11. Lower (Brown) Eyelid Display
12. Radio Altitude Readout
13. Decision Height Set Knob/Light Dimming Control Knob
14. Expanded Localizer Scale
15. Standard-Rate Turn Index
16. Rate-of-Turn Indicator Pointer
17. Inclinometer
18. Rate-of-Turn Warning Flag
19. Expanded Localizer Indicator
20. Attitude Indicator Test Switch
21. Radio Altitude Test Switch
22. Decision Height Digital Display
23. Glide Slope Warning Flag
24. Glide Slope Pointer and Scale
25. Go-Around Annunciator

Figure 3-8. Pilot's Attitude Director Indicator (AD-650B)

(2) Attitude warning flag. This flag comes into view when the attitude information presented by the ADI is unreliable.

(3) Bank angle scale and pointer. The moveable bank angle pointer indicates aircraft bank angle by moving around a fixed bank angle scale.

(4) Eyelid display. The eyelid display surrounds the attitude sphere and provides positive attitude identification. When the aircraft is in an upright position the upper (blue) eyelid is located next to the upper (blue) half of the attitude sphere, while the lower (brown) eyelid display is located next to the lower (brown) half of the attitude sphere. Thus the eyelid display maintains the proper ground-sky relationship, regardless of the position of the sphere, to aid in recovery from unusual attitudes.

(5) Flight director warning flag. The FD flag will come into view when the flight control computer is not operating or has failed.

(6) Decision height annunciator. The decision height annunciator illuminates when the aircraft's altitude approaches decision height.

(7) Pitch angle scale. Aircraft pitch angle may be read at the upper point of the orange symbolic miniature aircraft on a vertical pitch angle scale located on the attitude sphere. The pitch scale is graduated in 5 degree increments.

(8) Flight director command cue. Displays commands computed by the flight director computer to capture and maintain a desired flight path. To follow the flight director computer commands the symbolic miniature aircraft is flown to the flight director command cue. The command cue will move from view if a failure occurs in either the pitch or roll channel.

(9) Symbolic miniature aircraft. Aircraft pitch and roll attitudes are displayed by the relationship between the fixed miniature aircraft and the movable attitude sphere.

(10) Radio altitude display. Radio altitude is displayed by a 4 digit display on the lower right portion of the ADI. The altitude range of the display is from -20 to to 2500 feet AGL. The display resolution between 200 and 2500 feet is in 10 foot increments. The display resolution below 200 feet is in 5 foot increments. The display will be blank at altitudes over 2500 feet AGL. Dashes are displayed whenever invalid radio altitude is being displayed.

(11) Decision height set knob/light dimming control knob. Two concentric knobs placarded DH SET DIM, located on the lower right corner of the ADI controls setting decision height and controls the brightness of the ADI and HSI displays. The smaller (inner) concentric DH SET knob is used to set the decision height in the DH display, located on the lower left portion of the ADI. The decision height display may be set to any decision height between 0 and 990 feet in 10 foot increments. The larger (outer) concentric knob is used to set the brightness of the decision height and radio altitude display on the ADI and the course and distance display on the pilot's HSI.

(12) Expanded localizer. The expanded localizer pointer and scale, located below the attitude sphere, takes raw localizer displacement data from the navigation receiver (HSI display) and amplifies it approximately 7 1/2 times to permit the expanded localizer pointer to be used as a sensitive reference indicator of the aircraft's position with respect to the localizer or MLS course. It is normally used for assessment only, since the pointer is very sensitive and difficult to fly throughout the entire approach. During final approach, the pointer serves as an indicator of the category II window. Full scale deflection of the expanded localizer pointer is equal to 1/4 degree of displacement from the localizer course. The expanded localizer is displayed by the localizer pointer only when a valid localizer signal is being received.

(13) Rate of turn indicator. The rate of turn indicator and scale is located directly below the expanded localizer indicator and scale. Alignment of the turn needle with either of the marks (blocks) on the extreme right and left sides of the scale indicate a standard rate (3 degrees per second) turn. Rate of turn is displayed by the pointer at the bottom of the ADI. The marks at the extreme left and right sides of the scale represent a standard rate turn.

(14) Inclinometer. The inclinometer, located below the rate of turn indicator and scale, provides an indication of aircraft slip or skid. It is used for coordinating maneuvers.

(15) Rate of turn warning flag. A flag placarded R T comes into view over the left side of the rate of turn indicator scale when rate of turn information is unreliable.

(16) Attitude test switch. A momentary pushbutton switch placarded ATT TEST, located on the lower left portion of the ADI, controls the operation of the ADI self test function. When depressed, the sphere will show an approximate attitude of 20 degrees right bank and 10 degrees pitch-up, the ATT warning flag will come into view, and all ADI mode annunciator lights except I)H will illuminate.

(17) Radio altitude test switch. A momentary pushbutton switch placarded RA TEST, located on the lower left corner of the ADI, controls the operation of the radio altimeter self test function. When the RA TEST switch is depressed, causes the

radio altitude readout to display all 8's, then all dashes, then the preprogrammed test altitude as set in the radio altimeter receiver/transmitter unit. When the test switch is released the actual altitude will be displayed. The DH indicator readout will display all 8's during the test, then return the current set altitude. RA test is inhibited as a function of APR CAP.

(18) Decision height display. The digital DH readout displays the decision height as set by the DH SET knob located on the lower right corner of the ADI. The decision height range is 0 to 990 feet in 10 foot increments.

(19) Glide slope warning flag. The glide slope warning flag, placarded GS, comes into view over the lower portion of the glide slope scale when valid ILS or MLS glide slope information is not being received.

(20) Glide slope pointer and scale. The glide slope pointer displays ILS or MLS glide slope deviation information. The pointer comes into view only when tuned to a localizer frequency. If the aircraft is below glide slope path, the pointer is displayed upward on the scale. Each division (dot) on the scale represents approximately 0.4 degree deviation from glide slope when operating on an ILS signal. When operating on an MLS signal, the value of each scale division will vary with the approach slope set into the aircraft's MLS control unit.

(21) Go-around annunciator. The go-around (GA), located on the upper left portion of the ADI, illuminates when go-around mode has been selected.

3-16. COPILOT'S ATTITUDE DIRECTOR INDICATOR (AD-500A).

a. Description. The copilot's attitude director indicator (ADI) combines an attitude sphere display with computed steering information to provide the commands required to intercept and maintain a desired flight path. It also contains an eyelid display, expanded localizer, glide slope, radio altitude rising runway display, go-around and decision height annunciators, and inclinometer.

b. Copilot's ADI (fig. 3-9) Controls, Indicators, and Functions.

(1) Go-around annunciator. The go around (GA), located on the upper left portion of the ADI, illuminates when go-around mode has been selected.

(2) Flight director warning flag. The FD flag will come into view when the flight control computer is not operating or has failed.

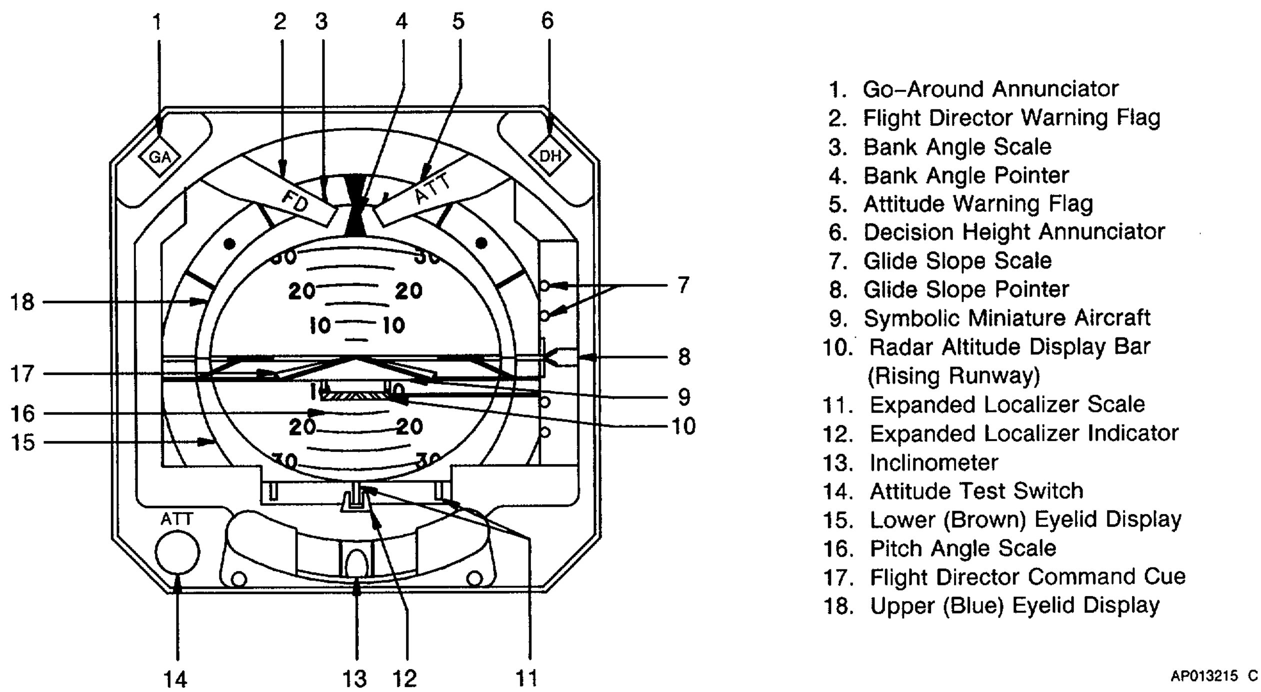


Figure 3-9, Copilot's Attitude Director Indicator (AD-500A)

(3) Bank angle scale and pointer. The moveable bank angle pointer indicates aircraft bank angle by moving around a fixed bank angle scale.

(4) Attitude warning flag. This flag comes into view when the attitude information presented by the ADI is unreliable.

(5) Decision height annunciator. The decision height (DH) annunciator illuminates when the aircraft's altitude approaches decision height.

(6) Glide slope pointer and scale. The glide slope pointer displays ILS or MLS glide slope deviation information. The pointer comes into view only when tuned to a localizer frequency. If the aircraft is below glide slope path, the pointer is displayed upward on the scale. Each division (dot) on the scale represents approximately 0.4 degree deviation from glide slope when operating on an ILS signal. When operating on an MLS signal, the value of each scale division will vary with the approach slope set into the aircraft's MLS control unit.

(7) Symbolic miniature aircraft. Aircraft pitch and roll attitudes are displayed by the relationship between the fixed miniature aircraft and the movable attitude sphere.

(8) Radio altitude display bar. Radio altitude (absolute altitude above the terrain) is displayed below 200 feet by an barber-pole radio altitude bar, which is located on the lower half of the attitude sphere. The bar appears when the aircraft is 200 feet above ground level (AGL) and moves vertically toward the symbolic miniature aircraft as the aircraft descends toward the runway, contacting the bottom of the symbolic aircraft at touchdown.

(9) Expanded localizer. The expanded localizer pointer and scale, located below the altitude sphere, takes raw localizer displacement data from the navigation receiver (HSI display) and amplifies it approximately 7 1/2 times to permit the expanded localizer pointer to be used as a sensitive reference indicator of the aircraft's position with respect to the localizer or MLS course. It is normally used for assessment only, since the pointer is very sensitive and difficult to fly throughout the entire approach. During final approach, the pointer serves as an indicator of the category II window. Full scale deflection of the expanded localizer pointer is equal to 1/4 degree of displacement from the localizer course. The expanded localizer is displayed by the localizer pointer only when a valid localizer signal is being received.

(10) Inclinometer. The inclinometer, located below the rate of turn indicator and scale, provides an indication of aircraft slip or skid. It is used for coordinating maneuvers.

(11) Attitude test switch. A momentary pushbutton switch placarded ATT TEST, located on the lower left portion of the ADI, controls the operation of the ADI self test function. When depressed, the sphere will show an approximate attitude of 20 degrees right bank and 10 degrees pitch-up, and the ATT warning flag will come into view.

(12) Eyelid display. The eyelid display surrounds the attitude sphere and provides positive attitude identification. When the aircraft is in an upright position the upper (blue) eyelid is located next to the upper (blue) half of the attitude sphere, while the lower (brown) eyelid display is located next to the lower (brown) half of the attitude sphere. Thus the eyelid display maintains the proper ground-sky relationship, regardless of the position of the sphere, to aid in recovery from unusual attitudes.

(13) Pitch angle scale. Aircraft pitch angle may be read at the upper point of the orange symbolic miniature aircraft on a vertical pitch angle scale located on the attitude sphere. The pitch scale is graduated in 5 degree increments.

(14) Flight director command cue. Displays commands computed by the flight director computer to capture and maintain a desired flight path. To follow the flight director computer commands the symbolic miniature aircraft is flown to the flight director command cue. The command cue will move from view if a failure occurs in either the pitch or roll channel.

3-17. RADIO ALTIMETER (RA-315).

a. Description. The radio altimeter (fig. 3-10) provides the pilot with the actual altitude of the aircraft above ground or surface level. The indicator displays radio altitude information from 2500 feet to touchdown, with an expanded linear scale below 500 feet.

b. Radio Altimeter (RA-315), Controls and Functions (fig. 3-10).

(1) Decision height annunciator. An annunciator placarded DH, located on the upper left corner of the radio altimeter indicator, will illuminate when the aircraft is at or below the selected decision height (DH).

(2) Pointer mask. The pointer mask placarded ABS ALT, covers the pointer for altitudes above 2500 feet.

(3) Failure warning flag. A flag placarded OFF will be in view whenever the radio altimeter system information is unreliable.

(4) Decision height marker. The decision height marker is set to the desired decision height by the DH SET knob.

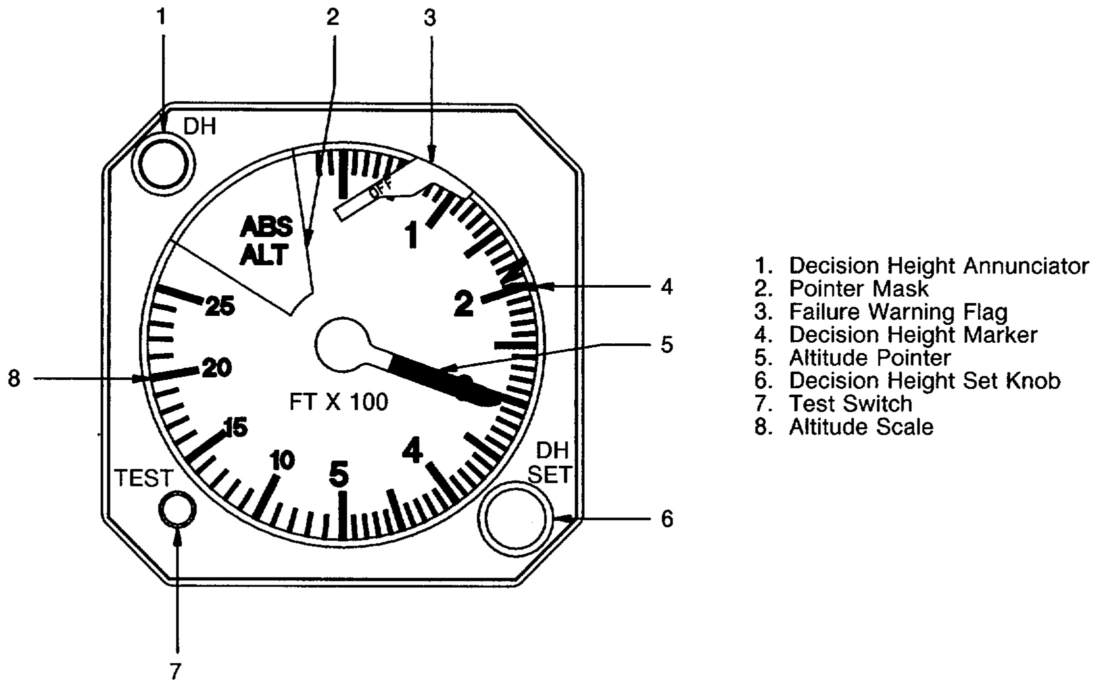


Figure 3-10. Radio Altimeter (RA-315)

(5) Altitude pointer. The altitude pointer indicates altitude above ground or surface level.

(6) Decision height set knob. A knob placarded DH SET located on the lower right corner of the radar altimeter indicator, is used to set the orange decision height marker to the desired decision height (DH). (7) Test switch. A momentary pushbutton switch placarded TEST, located on the lower left corner of the radio altimeter indicator, is used to activate the unit's self test function. When the switch is depressed the OFF warning flag will come into view and the altitude pointer will indicate approximately 100 +20 feet. When the switch will cause the altitude pointer to return to existing altitude, and OFF warning flag to retract from view.

3-18. ALTITUDE ALERTER/PRESELECTOR (AL800).

a. Description. The altitude alerter/preselector provides a means for setting the desired altitude reference for the altitude alerting and altitude preselect system. The altitude alerter/preselector is powered through a 1-ampere circuit breaker placarded ALT ALERT , located on the overhead circuit breaker panel (fig. 2-23). b. Altitude Alerter/Preselector Control, Indicator, and Functions.

(1) Altitude display. The altitude display indicates the selected altitude.

(2) Altitude selector knob. A knob placarded SET on the altitude select controller is used to set the altitude in the display.

c. Altitude Alerter/Preselector Operation.

(1) Altitude preselection.

(a) Selector knob Set desired altitude in display window.

(b) Altitude selector switch (flight director mode controller (fig. 2-6) Push on.

(c) Pilot must now initiate the altitude preselect maneuver by 'flying toward the preselected altitude.

(d) Flight director mode controller (pedestal extension, fig. 2-6) Select pitch hold mode (pitch hold, IAS, or VS) if desired.

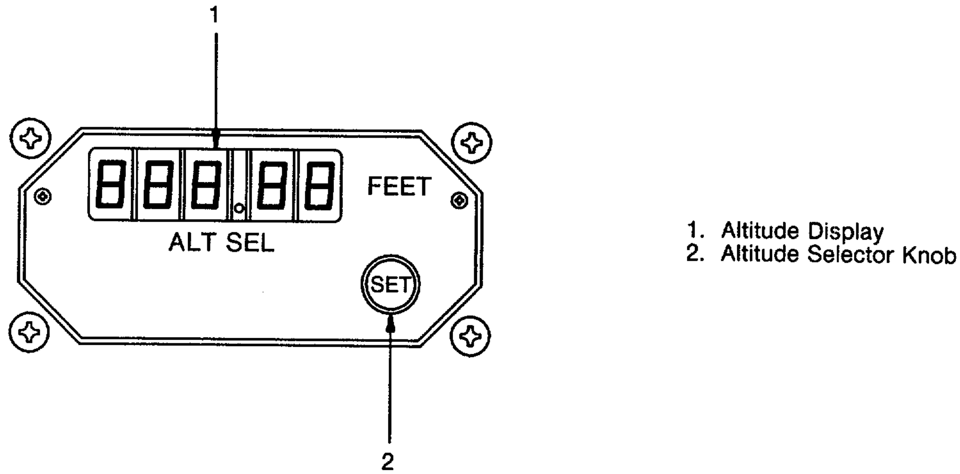


Figure 3-11. Altitude Alerter/Preselector (AL-800)

(e) Autopilot controller (pedestal extension, fig. 2-6) Engage if desired.
(f) Upon capture of preselected altitude, the previously selected pitch mode will be reset.

(2) Altitude alert.
(a) Altitude selector control knob Set desired altitude in altitude display window.
(b) When aircraft reaches an altitude 1000 feet from the selected altitude ALT annunciator on upper right corner of pilot's altimeter and ALT ALERT annunciator in the annunciator block above the copilot's airspeed indicator will illuminate, and a warning horn will sound for one second. The lights will remain illuminated until the aircraft reaches an altitude 250 feet from the selected altitude. If the aircraft now deviates from the selected altitude by more than 250 feet the ALT lights will again be illuminated. The lights will remain illuminated until the aircraft is once again within 250 feet of the selected altitude.

3-19. GYROMAGNETIC COMPASS SYSTEMS (C14A).

a. Description. Two identical compass systems are installed to provide accurate directional information for the aircraft. For heading reference, two modes of operation are used: directional gyro (FREE) mode, or slaved compass (SLAVE) mode. In areas where magnetic references are reliable, the system is operated in the slaved compass mode. In this mode, the directional gyro is slaved to the magnetic flux valve which supplies a magnetic reference for correction of gyro precession. In the free gyro mode, the system is operated as a free gyro. In this mode heading corrections are manually introduced using the pilot's or copilot's INCREASE/DECREASE switches. The slave/free mode is selected as desired using the pilot's or copilot's SLAVE/FREE switches.

b. Gyromagnetic Compass System Controls, Indicators, and Functions.

(1) Compass system selector switch. A three-position switch placarded HEADING, ALL SYSTEMS ON COMPASS I - NORM - ALL SYS-

TEMS COMPASS 2, located on the audio control panel, controls the selection of compass system. When the switch is set to the ALL SYSTEMS ON COMPASS 1 position, both horizontal situation indicators, both flight director computers, both radio magnetic indicators, and the flight management system receive heading information from compass system number 1. When the switch is set to the NORMAL position, the flight director computer number 1, horizontal situation indicator number 1, radio magnetic indicator number 2, and flight management system receive heading information from compass system number 1, while the flight director computer number 2, horizontal situation indicator number 2, and radio magnetic indicator number 1 receive heading information from compass system number 2. When the switch is set to the ALL SYSTEMS ON COMPASS 2 position, both horizontal situation indicators, both flight director computers, both radio magnetic indicators, and the flight management system receive heading information from compass system number 2.

(2) Compass slave annunciator. A compass slave annunciator is located on the pilot's and copilot's horizontal situation indicator (HSI) to provide a visual indication of compass system synchronization.

(3) Gyro slave/free switches. The pilot and copilot are each provided with a switch placarded GYRO, SLAVE FREE, located on the extreme left and right sides of the instrument panel. When the switch is in the SLAVE position the pilot's flight instruments are receiving heading information based on magnetic north. When the switch is in the FREE position the respective pilot or copilot's HSI, RMI, and FMS are receiving heading information referenced to a free gyro.

(4) Gyro increase/decrease switches. The pilot and copilot are each provided with three position switch spring-loaded to the center (off) position, placarded GYRO, INCREASE/ DECREASE, located on the extreme left and right sides of the instrument panel. When the respective pilot's or copilot's gyro slave/free switch is in the FREE position, these switches may be used to increase or decrease the magnetic heading indication of the respective pilot's or copilot's HSI and RMI.

3-20. NAVIGATION RECEIVERS (KNR-634A).

a. Description. Two VOR/localizer/glide slope/marker beacon navigation receivers (KNR634A) and a TACAN/DME unit (KTU-709) are controlled by two control units (KFS-579A, and KFS564A, fig. 3-12 and 3-13) which are mounted in the instrument panel.

The NAV receivers, receive and interpret VHF omnidirectional radio range (VOR) and localizer (LOC) signals in the frequency range of 108.00 to 117.95 MHz, glide slope signals in the frequency range of 329.15 to 335.00 MHz, and 75 Hz marker beacon signals. In addition, the KFS-579A #1 NAV/ TAC control tunes the KTU-709 TACAN/DME system to all 252 TACAN channels. The NAV receivers are powered through two 2-ampere circuit breakers placarded NAV #1 and NAV #2, located on the overhead circuit breaker panel (fig.2-23).

b. NAV/TAC Control Unit (KFS-579A) Controls, Indicators, and Functions.

(1) Frequency display. Liquid crystal digital readouts provide a continuous display of both the active frequency or TACAN channel and standby frequency or TACAN channel (bottom line, placarded SBY) when the system is in the frequency mode. Display brightness is controlled by a switch, placarded VHF-NAV-ADF, located right of the altitude alert on the instrument panel.

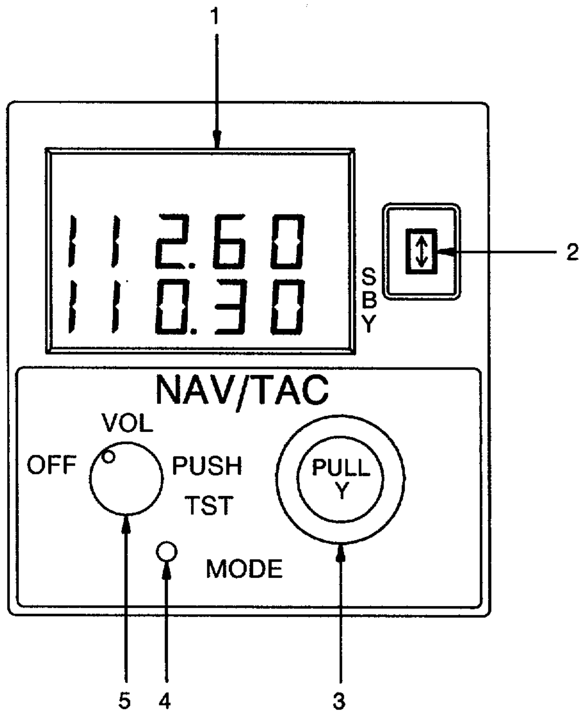
(2) Frequency transfer switch. The frequency transfer switch is a momentary pushbutton switch placarded with a two-headed vertical arrow, located to the right of the digital display. The functions of this switch when the unit is in different modes of operation are shown as follows:

(a) Standby entry mode. Depressing the frequency transfer switch with the unit in the standby entry mode causes the frequency or TACAN channel displayed in the upper (active) digital display to interchange with the frequency or TACAN channel shown in the lower (standby) digital display.

(b) Active entry mode. While the unit is in the standby entry mode, holding the transfer switch depressed for longer than 2 seconds will cause the unit to enter the active entry mode. While in the active entry mode, momentarily depressing the transfer switch will return the unit to the standby entry mode.

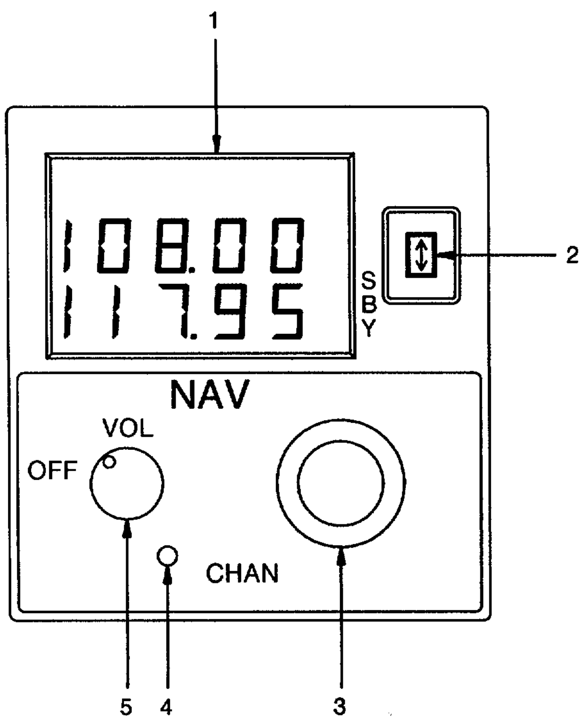
(3) Tuning Knobs. Two concentric tuning knobs, located on the right side of the NAV/ TACAN control panel are used to set the frequency or TACAN channel shown on the digital display, depending on the mode being used.

(a) Frequency or TACAN channel standby entry mode. When the unit is in the frequency or TACAN channel standby entry mode, the larger concentric knob is used to increase or decrease the first two digits to the left of the decimal point from 08 to 17 MHz (frequencies) or 01 to 29 (TACAN channels) of the lower (standby) digital display. When the larger concentric knob is turned so as to increase the digits above 17 (frequencies) or 29 (TACAN channels) the display will start over at 08 or 00 respectively. Conversely, when the knob is turned so as to decrease the digits below 08 (frequencies) or 00 (TACAN channels) the display will



1. Frequency Display
2. Frequency Transfer Switch
3. Tuning Knobs
4. Mode Switch
5. Off, Volume, Test Control

Figure 3-12. NAV/TAC Control Unit (KFS-579A)



1. Frequency Display
2. Frequency Transfer Switch
3. Tuning Knobs
4. Channel Switch
5. Off, Volume, Test Control

Figure 3-13. Number 2 NAV Control Unit (KFS-64A) start over at 17 or 29 respectively. When in the frequency mode, the smaller concentric knob, placarded PULL Y, is used to set frequencies with 50 kHz spacing (for example: .75, .80, .85, .90, etc.). When in the TACAN mode, and the smaller concentric knob is turned in the pulled-out position, the TACAN X designator will be changed to aY.rizontal situation i

(b) Frequency active entry mode. When in the active entry mode, the tuning knobs operate the same as they do in the standby entry mode, but will change the upper digital display frequency or TACAN channel, rather than the lower (standby) frequency.

(4) Mode switch. A momentary pushbutton switch placarded MODE, located on the lower portion of the NAV/TAC control unit, is used to put the unit into the TACAN mode. Momentarily depressing the mode switch while in a frequency mode puts the unit into the TACAN mode.

(5) Off, volume, test control. A control knob on the front of the NAV/TACAN control unit placarded OFF, VOL, PUSH TST controls the operation of the unit. Turning the knob in the clockwise direction from the OFF position (detent) applies power to the unit, and audio volume output is increased as the knob is turned further to the right. Depressing the switch (PUSH TST), overrides the automatic squelch circuitry. Turning the knob clockwise past the automatic squelch threshold (while the automatic squelch circuitry is overridden) will allow background audio to be heard through the headphones or speaker and demonstrate whether the receiver is working or not, and allow setting of audio volume. To return the unit to automatic squelch control, depress the PUSH TST control knob again.

c. Modes of Operation. The NAV/TACAN control unit may be operated in TACAN or frequencyfrequency mode in either standby entry or active entry mode.

(1) Standby entry mode (frequency or TACAN channel). When the unit is operated in the standby entry mode, a new frequency or TACAN channel is set on the lower (standby) digital display, using the tuning knobs. When the operator is ready, the frequency or channel is then transferred to the upper (active) display by depressing the transfer switch.

(2) Active entry (frequency or TACAN channel). When the unit is operated in the active entry mode, a new frequency or TACAN channel is set on the upper (active) digital display using the tuning knobs. The active entry mode is entered from the standby entry mode by depressing the transfer switch for longer than 2 seconds. The lower (standby) digital display will be blank while the unit is in the active mode.

(3) TACAN mode. The TACAN mode is entered by momentarily depressing the mode switch. While in this mode, the tuning knobs change the TACAN channel numbers.

d. NAV/TACAN Control Unit (KFS-579A) Operation.

(1) Turn on procedure.

(a) Avionics master switch (overhead control panel, fig. 2-8) ON.

(b) Off, volume, test knob Turn clockwise out of detent, then depress to turn off automatic squelch circuit. Continue turning knob clockwise until background noise is heard in headphones or speaker, assuring that receiver is operating, then set audio volume to desired level. Depress knob again to return unit to automatic squelch control.

(2) Receiver operating procedure.

(a) Mode pushbutton switch As required.

(b) Tuning knobs Set desired frequency or channel.

(c) NAV I receiver audio switch (audio control panel, fig. 3-1) On (up).

(d) Volume control Adjust as required.

(3) Shutdown procedure.

(a) Off, volume, test control Turn counter-clockwise to OFF position.

e. NAV Control Unit (KFS-564A) Controls and Functions.

(1) Frequency display. Liquid crystal digital readouts provide a continuous display of both the active frequency (top line) and standby frequency (bottom line, placarded SBY) when the system is in the frequency mode (system mode is controlled by the CHAN pushbutton switch). When the system is in the channel mode, the upper digital display reads CH (channel) and a channel number (1 through 9), while the lower digital readout displays the frequency of the displayed channel number. When the system is in the program mode, the upper digital display will read P (program) and a channel number, while the lower digital display will read the

frequency of the displayed channel. In all modes, a small TX will appear at the right end of the upper digital display when the system is transmitting.

(2) Frequency transfer switch. The frequency transfer switch is a momentary pushbutton switch placarded with a two-headed vertical arrow, located to the right of the digital display. The functions of this switch when the unit is in different modes of operation are shown as follows:

(a) Standby entry mode. Depressing the frequency transfer switch with the unit in the standby entry mode causes the frequency displayed in the upper (active) digital display to interchange with the frequency shown in the lower (standby) digital display.

(b) Active entry mode. While the unit is in the standby entry mode or the channel mode, holding the transfer switch depressed for longer than 2 seconds will cause the unit to enter the active entry mode. While in the active entry mode, momentarily depressing the transfer switch will return the unit to the standby entry mode.

(c) Channel mode. When the unit is in the channel mode, depressing the transfer switch will return the unit to the frequency standby mode. The channel frequency will become the new active frequency, and the last active frequency will become the new standby frequency. If the unit was in the active entry mode prior to entering the channel mode, depressing the transfer switch will return the unit to the standby entry mode.

(3) Tuning knobs. Two concentric tuning knobs, located on the right side of the NAV receiver control panel are used to set the frequency or channel shown on the digital display, depending upon the mode of operation being used.

(a) Frequency standby entry mode. When the unit is in the frequency standby entry mode, the larger concentric knob is used to increase or decrease the first two digits to the left of the decimal point (08 to 17), of the lower (standby) digital display. When the larger concentric knob is turned so as to increase the digits above 17, the display will start over at 08. Conversely, when the knob is turned so as to decrease the digits below 08, the display will start over at 17. The smaller concentric knob, is used to set frequencies with 50 kHz spacing (for example: .75, .80, .85, .90, etc.).

(b) Frequency active entry mode. When in the active entry mode, the tuning knobs operate the same as they do in the standby entry mode, but will change the upper digital display frequency (active), rather than the lower (standby) frequency.

(c) Channel mode. When the unit is in the channel mode, turning either tuning knob will change the channel number in the upper display and the corresponding frequency in the lower display.

(d) Program mode. When the unit is in the program mode, the tuning knobs are used to select the channel number in the upper display (when flashing), or the channel frequency in the lower display (when flashing).

(4) Channel switch. A momentary pushbutton switch placarded CHAN, located on the lower portion of the NAV control unit, is used to put the unit into the channel and program modes. Momentarily depressing the channel switch while in a frequency mode puts the unit into the channel mode. Holding the channel switch depressed for longer than two seconds puts the unit into the program mode.

(5) Off, volume, test control. A control knob on the front of the VHF control unit placarded OFF, VOL, PUSH TST controls the operation of the unit. Turning the knob in the clockwise direction from the OFF position (detent) applies power to the unit, and audio volume output is increased as the knob is turned further to the right. Depressing the switch (PUSH TST), overrides the automatic squelch circuitry. Turning the knob clockwise past the automatic squelch threshold (while the automatic squelch circuitry is overridden) will allow background audio to be heard through the headphones or speaker and demonstrate whether the receiver is working or not, and allow setting of audio volume. To return the transceiver to automatic squelch control, depress the PUSH TST control knob again.

f. Modes of Operation. The NAV receiver control unit may be operated in the following modes: frequency mode (either standby entry or active entry), channel mode, or program mode.

(1) Frequency modes. The NAV receiver control unit may be operated in two frequency entry modes: standby entry, and active entry.

(a) Standby entry. When the unit is operated in the standby entry frequency mode, a new frequency is set on the lower (standby) digital display, using the tuning knobs. When the operator is ready, the frequency is then transferred to the upper (active) display by depressing the frequency transfer switch.

(b) Active entry. When the unit is operated in the active entry frequency mode, a new frequency is set on the upper (active) digital display using the tuning knobs. The active entry mode is entered from the standby entry mode by depressing the transfer switch for longer than 2 seconds. The lower (standby) digital display will be blank while the unit is in the active mode.

(2) Channel mode. When the NAV receiver control unit is in the channel mode, the upper digital display will show a channel number (1 through 9), and the lower digital display will show the frequency assigned to the channel number in the upper digital display. The tuning knobs will change the channel number and corresponding frequency shown on the displays. The channel mode is entered by momentarily depressing the CHAN button located on the VHF transceiver control unit. If there are no valid frequencies programmed, the unit will display a CH 1 in the upper display and dashes in the lower display. The unit can be changed from the channel mode to the frequency mode in three ways:

(a) Momentarily depressing the transfer switch will return the unit to the frequency mode, placing the channel frequency in the upper (active) display and the previous active frequency in the lower (standby) display.

(*b*) Momentarily depressing the CHAN switch will return the unit to the frequency mode, and will return the upper (active) and lower (standby) displays to what they displayed prior to entering the channel mode.

(*c*) The unit will return to the frequency mode if no knob activity takes place for five seconds after the unit was put into channel mode. When returned in this manner, the channel frequency will be put into the lower (standby) display with the upper (active) frequency remaining as it was before entering channel mode. If no frequencies were programmed, the frequencies will remain the same as they were before entering channel mode.

(1) Program mode. The preset channels and frequencies are set using the program mode. Depressing and holding the CHAN switch for two seconds will place the unit into the program mode. A "P" and a channel number will be shown in the upper (active) display, and a frequency or dashes will be shown in the lower (standby) display. Immediately after entering the program mode the channel number will begin to flash, indicating that rotating the tuning knobs will change the channel number. Momentarily depressing the transfer switch will cause the channel number to stop flashing and cause the frequency to begin flashing, indicating that rotating the tuning knobs will change the frequency. Momentarily depressing the CHAN switch will return the unit to the frequency mode. The standby frequency will return to what it was prior to entering the program mode. The unit will automatically return to the frequency mode if no front panel activity takes place for 20 seconds.

g. NAV/TACAN Control Unit (KFS-564A) Operation.

(1) Turn on procedure.

(a) Avionics master switch (overhead control panel, fig. 2-8) - ON.

(b) Off, volume, test knob - Turn clockwise out of detent, then depress to turn off automatic squelch circuit. Continue turning knob clockwise until background noise is heard in headphones or speaker, assuring that receiver is operating, then set audio volume to desired level. Depress knob again to return unit to automatic squelch control.

(2) Receiver operating procedure.

(a) Mode pushbutton switch - As required.

(b) Tuning knobs - Set desired frequency or channel.

(c) NAV 1 receiver audio switch (audio control panel, fig. 3-1) - On (up).

(d) Volume control - Adjust as required.

(3) Shutdown procedure.

(a) Off, volume, test control - Turn counter-clockwise to OFF position.

3-21. TACAN/DME (KTU-709).

a. Description. The tactical air navigation (TACAN) system is a polar coordinate UHF navigation system that provides relative bearing and slant range distance information with respect to a selected TACAN or VORTAC ground station. The effective range of the TACAN is limited to the line-of-sight. Actual operating range depends on the altitude of the aircraft, weather, type of terrain, location and altitude of the ground transmitter and transmitter power.

TACAN audio is applied to the audio control panel. The TACAN system also has a self-test mode for both bearing and distance functions. The NAV/TAC control unit (fig. 3-12) tunes the KTU-709 to all 252 TACAN channels, and all DME channels. TACAN course deviation information may be displayed on the pilot's or copilot's HSI. Bearing to the selected TACAN station may be displayed by the single- needle pointers of the pilot's or copilot's RMI, or the bearing pointer on the pilot's HSI. TACAN or DME distance information is displayed on the pilot's HSI or the TACAN/DME indicator. The system is protected by a 2-ampere circuit breaker placarded TACAN, located on the overhead circuit breaker panel (fig. 2-23).

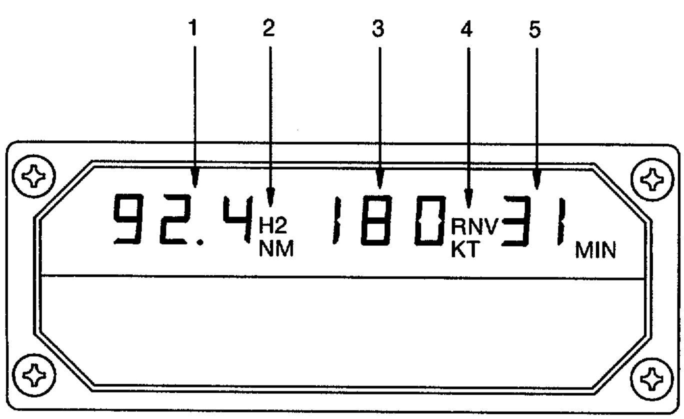
b. TA CAN/DME Indicator, Controls, Indicators, and Functions.

(1) Digital display. The TACAN/DME liquid crystal digital display (fig. 3-15) shows range to the nearest tenth of a nautical mile from 0 to 99.9 nautical miles, and to the nearest 1 (one) nautical mile from 100 to 389 nautical miles. Groundspeed is displayed to the nearest knot from 0 to 999 knots. Time-to-station is displayed to the nearest minute from 0 to 99 minutes. The display will indicate 99 minutes for any computed time-to-station greater than 99 minutes. The RNAV annunciator in the TACAN/DME distance indicator will be illuminated whenever the displayed information is being derived from the flight management system. The indicator will display dashes while searching or when power is first applied, or momentarily interrupted while in the frequency hold mode indicating loss of the DME holding frequency.

(2) DME hold switch. A push-on, push-off switch placarded DME HOLD PUSH/SW, located on the audio control panel, controls selection of the DME hold function. When the DME hold switch is pushed to the on position, the DME/ TACAN distance frequency in the DME/TACAN receiver-transmitter will be held constant regardless of the frequency selected on the NAV 1 control unit. The DME hold switch will illuminate when the DME hold function is selected, and will be extinguished when DME hold function is deselected. The DME hold switch is inoperative when the NAV/TAC is in the TAC MODE or if the FMS is controlling the DME. management system.

3-22. MICROWAVE LANDING SYSTEM (MLZ-910).

The microwave landing system (MLS) receiver provides course guidance (azimuth) and elevation angle (glide slope) information in conjunction with microwave landing system ground equipment. The MLS system will receive 200 MLS channels in the C band frequency range of 5031.0 to 5090.7 MHz. Tuning an MLS channel will also tune a collocated DME facility. Elevation angle (glide slope) is pilot selectable from 2 to 4.0 degrees. Azimuth angle is limited to 0 degrees in the receiver. The microwave landing system is powered through a 3-ampere circuit breaker placarded MLS, located on the overhead circuit breaker panel (fig. 2-23)



1. Distance Display
2. Hold Mode Indicator
3. Groundspeed Display
4. Area Navigation Indicator
5. Time Display

AP013227 C

Figure 3-14. TACAN/DME Indicator (KDI-573B)

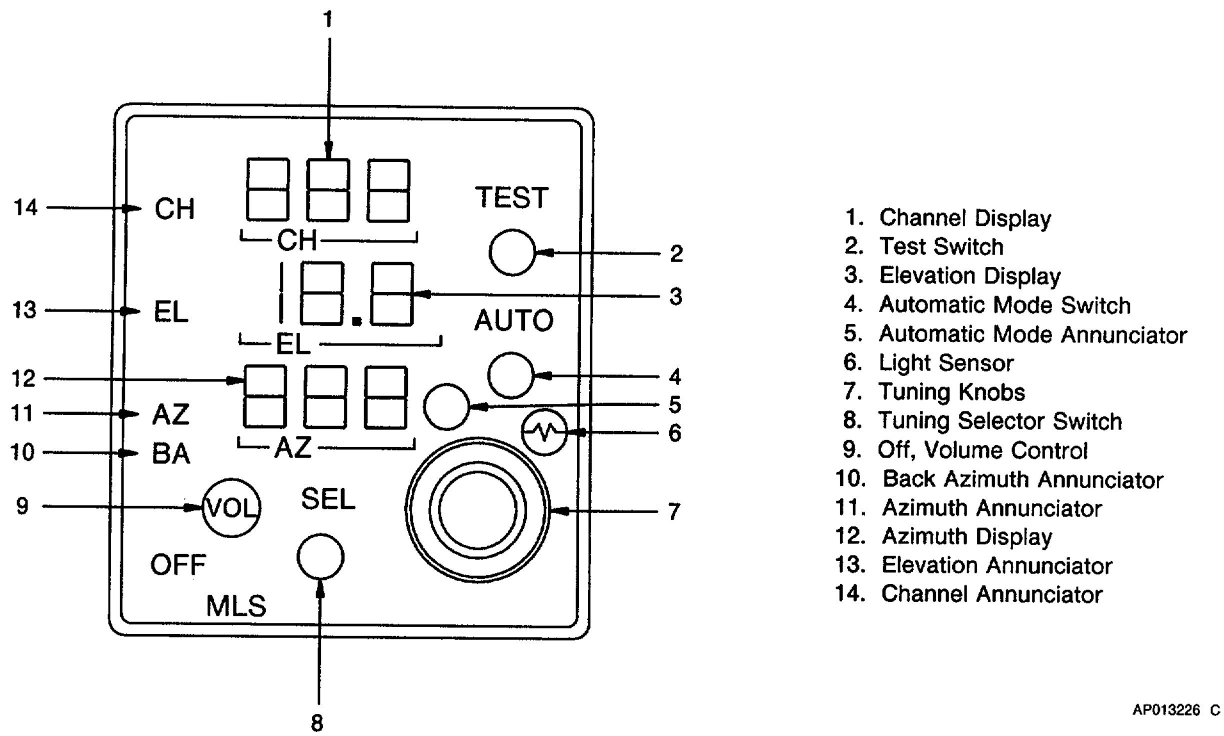


Figure 3-15. Microwave Landing System Control Unit (LC-910)

(a) MLS Control Unit (LC-910) Controls, Indicators, and Functions.

(1) Channel display. The three digit channel display, identified by a CH placard, indicates which MLS channel number has been selected by the tuning knobs. The channel number range is from 500 to 699.

(2) Test switch. A momentary pushbutton switch placarded TEST initiates the MLS receiver's built-in test equipment and indicator lamp test. When the TEST switch is depressed an internal MLS signal is generated and fed into the receiver. This eleven second test verifies proper operation of a major portion of the receiver, including all decoding and computational functions. When the TEST switch is depressed the following indications will occur:

(a) All MLS controller indicator lamps will remain illuminated and all three digital displays will read all 8's for as long as the TEST switch is held depressed. Display brightness is controlled by a switch, placarded MLS, located left of the altitude alert indicator on the instrument panel.

(b) The morse code letter B (...) will be heard when course deviation indicators and glide slope pointers are deflected by the built-in test equipment.

(c) Course deviation indicators and glide slope pointers wll be centered and flags will be in view.

(d) Glide slope pointers will move up two dots, course deviation indicators will move left two dots, and flags will move out of view.

(e) Course deviation indicators and glide slope pointers will be centered and flags will be in view.

(f) Glide slope pointers will move down two dots, course deviation indicators will move right two dots, and flags will move out of view.

(g) This test sequence will last 11 seconds.

(3) Elevation angle display. The digital elevation display, identified by the placard EL, indicates the elevation angle (glide slope angle) which has been selected by the tuning knobs. Elevation angle may be

selected from 2 to 4.0 degrees.

(4) Automatic mode switch and annunciator. A momentary pushbutton switch placarded AUTO is used to engage the automatic elevation and azimuth angle setting feature. When the automatic mode is selected the auto annunciator, located next to the AUTO switch, will be illuminated and the azimuth angle will be set to zero degrees while the elevation angle will be set to the minimum elevation angle as transmitted from the ground station. While in the automatic mode the tuning knobs are connected to the channel display to preclude inadvertent angle tuning. When the select switch is depressed again and a tuning knob is rotated, the automatic mode is disengaged and the automatic annunciator will be extinguished. The selected angles will remain at the automatic setting until a knob is rotated one detent.

(5) Tuning knobs. Two concentric rotary tuning knobs are used to set channel number, elevation angle (glide slope angle), and azimuth on the digital displays. The inner knob changes the ones digit on the channel number display and the azimuth display, and the tenths of a degree digit on the elevation display. The larger concentric knob changes the tens and hundreds digits on the channel number, azimuth, and elevation angle displays, and the ones digit of the elevation angle display.

(*6) Tuning select switch.* A momentary pushbutton placarded SEL, is used to select which display will be set by the tuning knobs. Each depression of the switch changes the display which will be changed (channel, elevation, or azimuth) by the tuning knobs.

(7) Off volume control. A control knob placarded OFF, VOL controls the operation of the unit. Turning the knob clockwise from the OFF position (detent) applies power to the unit, and audio volume output is increased as the knob is turned further to the right.

(8) Back azimuth annunciator. The back azimuth annunciator, placarded BA, illuminates when a back azimuth course has been selected to be set by the tuning knobs.

(9) Azimuth annunciator. The azimuth annunciator, placarded AZ, illuminates when the azimuth display has been selected by the SEL switch to be set by the tuning knobs.

(10) Elevation annunciator. The elevation annunciator, placarded EL, illuminates when the elevation display has been selected by the SEL switch to be set by the tuning knobs.

(11) Channel annunciator. The channel annunciator, placarded CH, illuminates when the channel display has been selected by the SEL switch to be set by the tuning knobs.

b. Microwave Landing System Operation.

(1) Turn-on procedure.

(a) Avionics master switch (overhead control panel, 2-12) - ON.

(b) MLS receiver audio switch (audio control panel, fig. 3-1) - On (up).

(c) Off, volume control - Turn clockwise out of detent, then continue turning clockwise until desired audio volume is reached.

(d) Test switch - Depress and observe that all indicator lights illuminate and that self-test procedure takes place as follows:

1 All MLS controller indicator lamps will remain illuminated and all three digital displays will read all 8's for as long as the TEST switch is held depressed.

2 The morse code letter B (...) will be heard when course deviation indicators and glide slope pointers are deflected by the built-in test equipment.

3 Course deviation indicators and glide slope pointers will be centered and flags will be in view.

4 Glide slope pointers will move up two dots, course deviation indicators will move left two dots, and flags will move out of view.

5 Course deviation indicators and glide slope pointers will be centered and flags will be in view.

6 Glide slope pointers will move down two dots, course deviation indicators will move right two dots, and flags will move out of view.

7 This test sequence will last 11 seconds.

(2) Microwave landing system receiver operating procedure.

(a) Tuning knobs - Set channel number and elevation angle.

(b) Automatic switch - As required.

(c) Pilot's or copilot's HSI MLS pushbutton switch indicator (instrument panel, fig. 2-26) - Depress on. Check illuminated.

3-23. ADF RECEIVER (KDF-806).

a. Description. Two ADF navigation receivers (fig. 3-16) receivers are installed to provide a visual indication of the relative bearing to a selected ground radio station. The units are airborne low frequency radio direction finders which receive signals from transmitters in the 190 to 1799 kHz range, and the international distress frequency of 2182 kHz. The ADF receiver can also be used for homing and position fixing. The ADF receiver is equipped with a beat frequency oscillator (BFO) which is used to more accurately tune weak signals. Reception distance of reliable signals depends upon the power output of the transmitting station and the atmospheric conditions. Bearing information from the number 1 ADF receiver may be displayed visually by the single-needle pointer on the pilot's and copilot's RMI, and by the bearing pointer on the pilot's HSI. Bearing information from the number 2 ADF receiver may be displayed visually by the double-needle pointer on the pilot's and copilot's RMI. ADF audio signals are applied to the audio control panel. The ADF receivers are powered through two 2-ampere circuit breakers placarded ADF 1 and ADF 2, located on the overhead circuit breaker panel (fig. 2-23).

b. ADF Control Unit (KFS-586A) Controls, Indicators, and Functions.

(1) Frequency display. Liquid crystal digital readouts provide a continuous display of both the active frequency (top line) and standby frequency (bottom line, placarded SBY) when the system is in the frequency mode (system mode is controlled by the CHAN pushbutton switch). When the system is in the channel mode, the upper digital display reads CH (channel) and a channel number (1 through 9), while the lower digital readout displays the frequency of the displayed channel number. When the system is in the program mode, the upper digital display will read P (program) and a channel number, while the lower digital display will read the frequency of the displayed channel. The operating mode (ANT, ADF, and BFO) is also shown in the display. A small X located on the left of the active

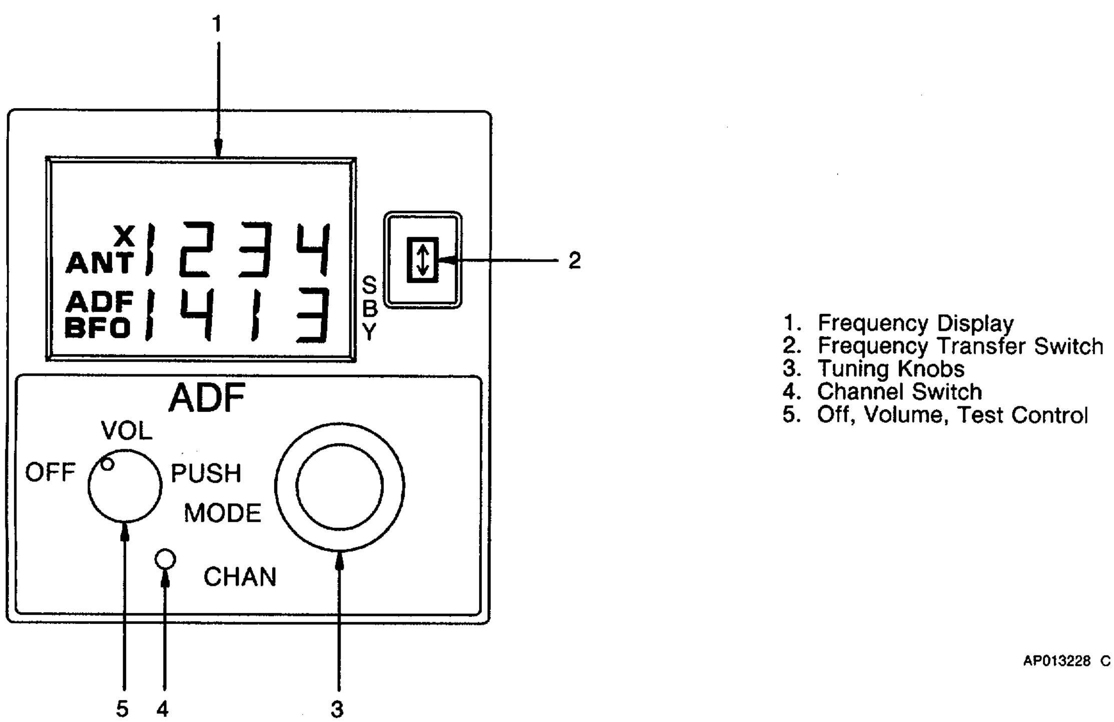


Figure 3-16. ADF Receiver Control Unit (KFS-586A)

display informs the operator that the bearing information is invalid. Display brightness is controlled by a dimming control, placarded VHF-NAV-ADF, located right of the altitude alert indicator on the instrument panel.

(2) Frequency transfer switch. The frequency transfer switch is a momentary pushbutton switch placarded with a two-headed vertical arrow, located to the right of the digital display. The functions of this switch when the unit is in different modes of operation are shown as follows:

(a) Standby entry mode. Depressing the frequency transfer switch with the unit in the standby entry mode causes the frequency displayed in the upper (active) digital display to interchange with the frequency shown in the lower (standby) digital display.

(b) Active entry mode. While the unit is in the standby entry mode or the channel mode, holding the transfer switch depressed for longer than 2 seconds will cause the unit to enter the active entry mode. While in the active entry mode, momentarily depressing the transfer switch will return the unit to the standby entry mode.

(c) Channel mode. When the unit is in the channel mode, depressing the transfer switch will return the unit to the frequency standby mode. The channel frequency will become the new active frequency, and the last active frequency will become the new standby frequency. If the unit was in the active entry mode prior to entering the channel mode, depressing the transfer switch will return the unit to the standby entry mode.

(3) Tuning Knobs. Two concentric tuning knobs, located on the right side of the ADF receiver control panel are used to set the frequency or channel shown on the digital display, depending upon the mode of operation being used.

(a) Frequency standby entry mode. When the unit is in the frequency standby entry mode, the larger concentric knob is used to increase or decrease the hundreds kHz digits (1 to 17), of the lower (standby) digital display. When the larger concentric knob is turned so as to increase the digits above 17, the display will start over at 1. Conversely, when the knob is turned so as to decrease the digits below 1, the display will start over at 17. When the control unit is in the standby entry mode or in the program mode when the frequency is flashing and the larger tuning knob is turned so as to increase the hundred kHz digits above 17, the display will change to 2182 kHz. If the larger concentric knob is turned so as to increase the frequency above 2182 kHz, the hundred KHz digits will start over at 1. The smaller concentric knob, is used to set the 10 kHz digits when pushed in. When pulled out it is used to set the 1 kHz digits. When the display is changed to 2182 kHz the smaller knob will change the ones digits (from 2180 to 2189 kHz) whether pushed in or pulled out.

(b) Frequency active entry mode. When in the active entry mode, the tuning knobs operate the same as they do in the standby entry mode, but will change the upper digital display frequency (active), rather than the lower (standby) frequency.

(c) Channel mode. When the unit is in the channel mode, turning either tuning knob will change the channel number in the upper display and the corresponding frequency in the lower display.

(d) Program mode. When the unit is in the program mode, the tuning knobs are used to select the channel number in the upper display (when flashing), or the channel frequency in the lower display (when flashing).

(4) Mode switch. A momentary pushbutton switch placarded MODE is used to select the operating mode of the ADF receiver. Each depression of the mode switch cycles the system through the following modes: ANT, ADF, ANT/BFO, and ADF/BFO (the mode that is being used is shown on the display).

(5) Channel switch. A momentary pushbutton switch placarded CHAN, located on the lower portion of the ADF control unit, is used to put the unit into the channel and program modes. Momentarily depressing the channel switch while in a frequency mode puts the unit into the channel mode. Holding the channel switch depressed for longer than two seconds puts the unit into the program mode.

(6) Off volume, test control. A control knob on the front of the ADF control unit placarded OFF, VOL, PUSH TST controls the operation of the unit. Turning the knob in the clockwise direction from the OFF position (detent) applies power to the unit, and audio volume output is increased as the knob is turned further to the right. Depressing the switch (PUSH TST), overrides the automatic squelch circuitry. Turning the knob clockwise past the automatic squelch threshold (while the automatic squelch circuitry is overridden) will allow background audio to be heard through the headphones or speaker and demonstrate whether the receiver is working or not, and allow setting of audio volume. To return the transceiver to automatic squelch control, depress the PUSH TST control knob again.

c. Frequency/Channel Selection Modes. The ADF receiver control unit may be operated in the following frequency/channel modes: frequency mode (either standby entry or active entry), channel mode, or program mode.

(1) Frequency modes. The ADF receiver control unit may be operated in two frequency entry modes: standby entry, and active entry.

(a) Standby entry. When the unit is operated in the standby entry frequency mode, a new frequency is set on the lower (standby) digital display, using the tuning knobs. When the operator is ready, the frequency is then transferred to the upper (active) display by depressing the frequency transfer switch.

(b) Active entry. When the unit is operated in the active entry frequency mode, a new frequency is set on the upper (active) digital display using the tuning knobs. The active entry mode is entered from the standby entry mode by depressing the transfer switch for longer than 2 seconds. The lower (standby) digital display will be blank while the unit is in the active mode.

(2) Channel mode. When the ADF receiver control unit is in the channel mode, the upper digital display will show a channel number (1 through 9), and the lower digital display will show the frequency assigned to the channel number in the upper digital display. The tuning knobs will change the channel number and corresponding frequency shown on the displays. The channel mode is entered by momentarily depressing the CHAN button located on the ADF receiver control unit. If there are no valid frequencies programmed, the unit will display a CH 1 in the upper display and dashes in the lower display. The unit can be changed from the channel mode to the frequency mode in three ways:

(*a*) Momentarily depressing the transfer switch will return the unit to the frequency mode, placing the channel frequency in the upper (active) display and the previous active frequency in the lower (standby) display.

(b) Momentarily depressing the CHAN switch will return the unit to the frequency mode, and will return the upper (active) and lower (standby) displays to what they displayed prior to entering the channel mode.

(c) The unit will return to the frequency mode if no knob activity takes place for five seconds after the unit was put into channel mode. When returned in this manner, the channel frequency will be put into the lower (standby) display with the upper (active) frequency remaining as it was before entering channel mode. If no frequencies were programmed, the frequencies will remain the same as they were before entering channel mode.

(3) Program mode. The preset channels and frequencies are set using the program mode. Depressing and holding the CHAN switch for two seconds will place the unit into the program mode. A -P- and a channel number will be shown in the upper (active) display, and a frequency or dashes will be shown in the lower (standby) display. Immediately after entering the program mode the channel number will begin to flash, indicating that rotating the tuning knobs will change the channel number. Momentarily depressing the transfer switch will cause the channel number to stop flashing and cause the frequency to begin flashing, indicating that rotating the tuning knobs will change the frequency. Momentarily depressing the CHAN switch will return the unit to the frequency mode. The standby frequency will return to what it was prior to entering the program mode. The unit will automatically return to the frequency mode if no front panel activity takes place for 20 seconds.

d. Modes of Operation. The ADF receiver mode of operation is selected by a momentary pushbutton switch placarded MODE. The operating mode changes from ADF to ANT to ADF/BFO to ANT/BFO with each depression of the mode switch.

(1) Antenna mode (ANT). When the ADF receiver is in the ANT mode audio will be present in the speaker or headphone (if the respective number 1 or 2 ADF receiver audio switch is on), and the RMI indicator needle that is being used will be parked at the 90 degree relative position.

(2) Automatic direction finder (ADF) mode. When the ADF receiver is in the ADF mode of operation, the RMI needle or HSI bearing pointer that is being used will indicate the relative bearing to the station.

(3) Beat frequency oscillator (BFO) Mode. The BFO is used to hear audio when the tuned station is a keyed continuous wave (CW) station. The BFO may be used either in the ANT or ADF mode.

e. ADF Receiver Control Unit (KFS-564A) Operation.

(1) Turn on procedure.

(a) Avionics master switch (overhead control panel, fig. 2-8 - ON.

(b) (Off, volume, test knob - Turn clockwise out of detent, then depress to turn off automatic squelch circuit. Continue turning knob clockwise until background noise is heard in headphones or speaker, assuring that receiver is operating, then set audio volume to desired level. Depress knob again to return unit to automatic squelch control.

f. ADF Operating Procedure.

(1) Number 1 or number 2 ADF receiver audio monitor switch (audio control panel, fig. 3-1) - On (up).
(2) Mode switch - Set operating mode as required.
(3) Tuning knobs - Set desired frequency or channel.
(4) Volume control - AS required.
(5) RMI switch - AS required.

3-24. AUTOMATIC FLIGHT CONTROL SYSTEM (SPZ-4000).

a. Description. The automatic flight control system is an integrated autopilot/flight director/air data system.

When the autopilot is engaged and coupled to the commands of the flight director, the flight control system will control the aircraft using the same commands which are displayed on the attitude director indicator by the flight director command cue. When the autopilot is engaged and uncoupled from the flight director commands, manual pitch and roll commands may be inserted using the touch control steering (TCS) on the control wheels (fig. 2-16), or the pitch wheel and turn knob on the autopilot control panel (fig. 3-18).

When the autopilot is coupled, the flight director command cue indications on the attitude director indicator provide a means of monitoring the performance of the autopilot. When the autopilot is not engaged, the same modes of operation are available for flight director only. The pilot maneuvers the aircraft to satisfy the flight director commands, as does the autopilot when it is engaged.

Table 3-1 provides operating parameters for operation of the automatic flight control system.

b. Air Data Computer. A digital air data computer located in the forward avionics compartment provides the altitude information for the pilot's altimeter, altitude alerter, and transponder. The computer also provides altitude and airspeed hold function data to the flight control computers. The air data computer is powered through a 2-ampere circuit breaker placarded AIR DATA ENCDR on the overhead circuit breaker panel (fig. 2-23). All air data computer functions are automatic in nature and require no flight crew action.

c. Pilot's Autopilot/Flight Director Switch/Indicator. An alternate action autopilot/flight director switch-indicator placarded AP FD 1 and AP FD 2, is located on the pilot's instrument panel, directly below the glare shield (fig. 2-26). This switch is used to select which autopilot/flight director computer will control the aircraft flight servos.

d. Copilot's Autopilot/Flight Director Number 2 Annunciator. If AP FD 2 is selected by the pilot, an annunciator placarded AP FLT DIR NO. 2, located on the copilot's instrument panel directly below the glare shield, will illuminate to alert the copilot that the No. 2 autopilot flight director computer is controlling the aircraft.

NOTE

The autopilot will disengage when transferring between the pilot and copilot flight directors.

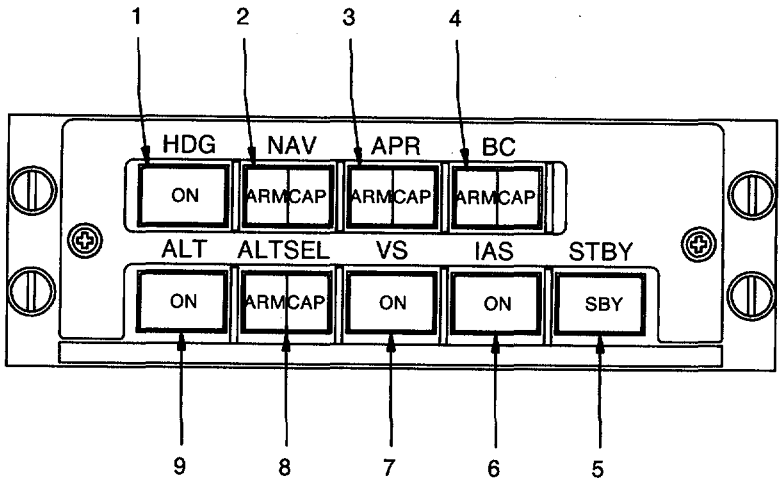
e. Flight Director Mode Selector (MS-400). The flight director/mode selector (fig. 3-17), located on the pedestal extension (fig. 2-26), provides for selection of all flight director modes except go around (which is initiated by remote switches located on the left power lever and on the copilot's control wheel). The top row of split light annunciated pushbuttons contains the lateral modes and the bottom row contains the vertical modes. The mode buttons will illuminate when manually selected, or automatically selected through other modes. The split light pushbutton annunciators illuminate amber for armed conditions and green for captured. When more than one lateral or vertical mode is selected, the flight director system automatically arms and captures the submode. Mode annunciations are also presented on remote annunciator blocks, located above both the pilot's and copilot's ADI, and on the pilot's ADI.

f. Autopilot Modes of Operation.

(1) Heading select mode (HDG). The heading select mode is selected by depressing the HDG button on the mode selector. In the HDG mode the flight director computer provides inputs to the command cue to command a turn to the heading indicated by the heading bug on the HSI. The heading select signal is gain programmed as a function of airspeed. When HDG is selected, it overrides the NAV, BC APR and VOR APR modes. In the event of a loss of valid signal from the vertical gyro or compass, on the ADI is biased out of view.

(2) Navigation mode (NAV). The navigation mode represents a family of modes for various navigation systems including VOR, localizer, TACAN, and FMS.

(3) VOR mode. The VOR mode is selected by depressing the NAV button on the mode



1. Heading Mode Selector
2. Navigation Mode Selector
3. Approach Mode Selector
4. Back Course Mode Selector
5. Standby Mode Selector
6. Indicated Airspeed Mode Selector
7. Vertical Speed Mode Selector
8. Altitude Preselect Mode Selector
9. Altitude Hold Mode Selector

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Figure 3-17. Flight Director Mode Selector

selector with the navigation receiver tuned to a VOR frequency and DME greater than 20 miles from the station. Prior to VOR capture, the command cue receives a heading select command as described above and the HDG mode switch is illuminated along with the NAV ARM annunciators. Upon VOR capture the system automatically switches to the VOR mode, HDG and NAV ARM annunciators extinguish, and NAV capture (NAV CAP) annunciators will illuminate. At capture, a command is generated to capture and track the VOR beam. VOR deviation is gain programmed as a function of distance from the station. This programming corrects for beam convergence thus optimizing the gain through the useful VOR range. To utilize this feature the DME must be tuned to the same VOR station as the NAV receiver which is feeding the flight director, and DME hold must not be selected. The course error signal is gain programmed as a function of airspeed. Cross-wind washout is included which maintains the aircraft on beam center in the presence of crosswind. The intercept angle and DME distance are used in determining the capture point to insure smooth and comfortable performance during bracketing.

When passing over the station, an overstation sensor detects station passage removing the VOR deviation signal from the command until it is no longer erratic. While over the station, course changes may be made by selecting a new course on the HSI. If the NAV receiver is not valid prior to the capture point, the lateral beam sensor will not trip and the system will remain in the HDG mode. After capture, if the NAV receiver, compass data or vertical gyro go invalid, the ADI command cue will bias out of view. Also, the NAV CAP annunciators will extinguish if the NAV receiver becomes invalid.

(4) VOR approach mode. The VOR approach mode is selected by depressing the NAV button on the mode selector with the navigation receiver tuned to a VOR frequency and less than 20 DME miles from the station. The mode operates identically to the VOR mode with the gains optimized for a VOR approach.

(5) Localizer mode. The localizer mode is selected by depressing the NAV button on the mode selector with the navigation receiver tuned to a localizer frequency. Mode selection and annunciation in the LOC mode is similar to the VOR mode. The localizer deviation signal is gain programmed as a function of radio altitude, time and airspeed. If the radio altimeter is invalid, gain programming is a function of glide slope capture, time and airspeed. Other valid logic is the same as the VOR mode.

(6) Back course mode (BC). The back course mode is selected by pressing the BC button

on the mode selector. Back course operates the same as the LOC mode with the deviation and course signals reversed to make a back course approach on the localizer. When BC is selected, and outside the lateral beam sensor trip point, BC ARM and HDG annunciators will illuminate. At the capture point, BC CAP will be annunciated with BC ARM and HDG annunciators extinguished. When BC is selected, the glide slope circuits are locked out.

(7) Localizer approach mode (APR). The approach mode is used to make an ILS approach. Pressing the APR button with a ILS frequency tuned, arms both the NAV and APR modes to capture the localizer and glide slope respectively. No alternate NAV source can be selected. Operating LOC mode is the same as described above except, if the radio altimeter is invalid in APR mode, gain programming is a function of glide slope capture, time, and airspeed.

With the APR mode armed, the pitch axis can be in any one of the other pitch modes except go-around. When reaching the vertical beam sensor trip point, the system automatically switches to the glide slope mode. The pitch mode and APR ARM annunciators extinguish and APR CAP annunciator illuminates on the controller. At capture, a command is generated to asymptotically approach the glide slope beam. Capture can be made from above or below the beam. The glide slope gain is programmed as a function of radio altitude, time and airspeed. The APR CAP annunciator on the mode selector will extinguish if the GS receiver becomes invalid after capture.

Glide slope capture is interlocked so that the localizer must be captured prior to glide slope capture. If the glide slope signal is not valid prior to capture, the vertical beam sensor will not trip and the system will remain in the pitch mode. After capture, if the NAV receiver, GS receiver, compass data, or vertical gyro becomes invalid, ADI command cue will bias out of view. If the radio altimeter is not valid, the glide slope gain programming will be a function of GS capture, time and airspeed.

(8) Pitch hold mode. Whenever a roll mode is selected without a pitch mode, the ADI command cue will display a pitch attitude hold command. The pitch attitude can be changed by pressing the TCS button on the control wheel and maneuvering the aircraft. The command cue will be synchronized to zero while the button is depressed. Upon release of the button, the pitch command will be such as to maintain the new pitch attitude. In the pitch hold mode, the ADI command cue will be biased out of view if the vertical gyro is not valid.

(9) TACAN mode. The TACAN mode is selected by depressing the HSI source selector NAV switch, located on the instrument panel (fig. 2-26). TACAN navigation information will be displayed on the HSI if the NAV/TACAN control unit is tuned to a valid TACAN frequency. TACAN distance information will be displayed on the TACAN distance indicator and on the HSI.

NOTE

The NAV/TAC receiver must be tuned to a valid TACAN frequency.

TACAN functions are identical to VOR using TACAN information rather than VOR signals. The ARM/CAP annunciation is the same as in VOR mode.

(10) TACAN approach mode. The TACAN approach mode is the same as a VOR approach mode except it uses a TACAN in place of a VOR station.

(11) Altitude hold mode (ALT). The altitude hold mode is selected by depressing the ALT button on the mode selector. When ALT mode is selected, it overrides the APR CAP, GA, IAS, VS, and ALTSEL CAP modes. In the ALT mode the pitch command is proportional to the altitude error provided by the air data computer. The altitude error signal is gain programmed as a function of airspeed. Depressing and holding the TCS button allows the pilot to maneuver the aircraft to a new altitude hold reference without disengaging the mode. Once engaged in the altitude hold mode, the mode will be reset if the air data computer is not valid and the ADI command cue will bias out of view if the vertical gyro is not valid.

NOTE

If the baro setting on the altimeter is changed, a command is generated to fly the aircraft back to the original altitude reference.

(12) Indicated airspeed hold mode (IAS). The indicated airspeed hold mode is selected by depressing the IAS button on the mode selector. When IAS is selected, it overrides the APR CAP, GA, ALT, VS, and ALTSEL CAP modes. In the IAS mode the pitch command is proportional to airspeed error provided by the air data computer. Depressing and holding the TCS button allows the pilot to maneuver the aircraft to a new airspeed hold reference without disengaging the mode. Once engaged in the IAS mode, the mode will be reset if the air data computer is not valid. The ADI command cue will bias out of view if the vertical gyro is not valid.

(13) Vertical speed hold mode (VS). The vertical speed hold mode is selected by depressing

the VS button on the mode selector. When VS is selected, it overrides the APR CAP, GA, ALT, ALTSEL CAP, and IAS modes. In the VS mode, the pitch command is proportional to VS error provided by the air data computer. Depressing and holding the TCS button allows the pilot to maneuver the aircraft to a new Vertical Speed Hold reference without disengaging the mode. Once engaged in the VS mode, the mode will be reset if the air data computer is not valid. The ADI command cue will bias out of view if the vertical gyro is not valid.

(14) Altitude preselect mode (ALTSEL). The altitude preselect mode is selected by pressing the ALTSEL button on the mode selector. The desired altitude is selected on the altitude preselect controller. Pitch hold, VS or IAS may be selected as a mode to fly to the selected altitude. When outside the altitude bracket trip point, the ALTSEL ARM annunciator along with the selected pitch mode is illuminated on the mode selector. When reaching the bracket altitude, the system automatically switches to the ALTSEL CAP mode and the previously selected pitch mode is cancelled. When the altitude is reached, the ALTSEL CAP mode is automatically cancelled and the flight director switches to the ALT hold mode. If the air data computer is not valid, the altitude preselect mode cannot be selected. The ADI command cue will bias out of view if the vertical gyro is not valid.

(15) Standby mode (SBY). The standby mode is selected by depressing the SBY button on the mode selector. This resets all the other flight director modes and biases the ADI command cue from view. While depressed, SBY acts as a lamp test causing all mode annunciators to illuminate and the flight director warning flag on the ADI to come in view. When the button is released, the mode annunciator lights extinguish and the flight director warning flag retracts from view.

(16) Go-around mode. The go-around mode is selected by depressing one of the remote goaround switches. One go-around switch is located on the left power lever (fig. 2-6), and the other is located on the copilot's control wheel (fig. 2-16). When selected all other modes are reset, and the remote go-around (GA) and yaw damp (YD ENG) annunciators will be illuminated. The ADI command cue receives a wings level command (zero command when roll is zero). The command cue also receives the go-around command which is a 7-degree visual pitch up attitude command. Selecting GA disconnects the autopilot. However, the yaw damper remains on.

Once go-around is selected any roll mode can be selected. The wings level roll command will cancel. The go-around mode is cancelled by selecting another pitch mode, or TCS.

g. Autopilot Controller. The autopilot controller (fig. 3-18), provides the means of engaging the autopilot and yaw damper as well as manually controlling the autopilot through the turn knob and pitch wheel. The autopilot system limits are:

Table 3-1. Operating Parameters

Mode	Control or Sensor	Parameter	Value
Yaw Damper	Yaw Control	Engage Limit	Unlimited
A/P Engage		Engage Limit	Roll Up to ± 90° Pitch UP to ± 30°
Basic	Touch Control	Roll Control Limit	Up to ± 45° Roll
A/P	Steering TCS	Pitch Control Limit	Up to ± 20° Pitch
	Turn Knob	Roll Angle Limit	± 30°
		Roll Rate Limit	± 15°/sec
	Pitch Wheel	Pitch Angle Limit	± 15° Pitch
	Heading Hold	Roll Angle Limit	Less than 6° and no roll mode selected.
Heading	HSI Heading	Roll Angle Limit	± 25°
Select	Select Knob	Roll Rate Limit	± 3.5°/sec
CAPTURE			
VOR	Course Knob, NAV Receiver and DME	Beam Angle Intercept (HDG SEL)	Up to ± 90°

Table 3-1. Operating Parameters (cont'd)

Mode	Control or Sensor	Parameter	Value
	Receiver	Roll Angle Limit	±25°
		Course Cut Limit at Capture	±45° Course
		Capture Point	Function of beam, beam rate, course error, and DME distance.
		ON COURSE Roll Angle Limit	±13° Roll
		Crosswind	Up to ±45°
		Correction	Course Error
		OVER STATION Course Change	Up to ±90°
		Roll Angle Limit	±17°
		LOC CAPTURE	
LOC or	Course Knob	Beam Intercept	Up to ±90°
APR or	and		
BC	NAV Receiver	Roll Angle Limit	±25°
		Roll Rate Limit	±5°/sec
		Capture Point	Function of Beam, Beam Rate and Course Error.
		NAV ON-COURSE	
		Roll Angle Limit	± 17° Roll
		Crosswind	±30° of course
		Correction Limit	error.
		Gain Programming	Function of Time and (TAS) starts at 1200 ft radio altitude.
GLIDESLOPE CAPTURE			
LOC or APR or BC (cont.)	GS Receiver and Air Data Computer	Beam Capture	Function of beam and beam rate
		Pitch Command Limit	±10°
		Glide slope Damping	Vertical Velocity
		Pitch Rate Limit	Function of (TAS)
		Gain Programming	Function of Time and TAS) Starts at 1200 ft radio altitude.
			Function of (Radio Alt) Starts at 250 ft.
GA	Control Switch on	Fixed Pitch-Up Command,	7° Pitch Up
	Power Lever	Wings Level	
Pitch Sync	TCS Switch on Control Wheel	Pitch Attitude Command	±20° max.
ALT Hold	Air Data Computer	ALT Hold Engage Range ALT Hold Engage Error Pitch Limit Pitch Rate Limit	0 to 50,000 ft ±20 ft ±20° Function of (TAS)
VS Hold	Air Data Computer	VERT Speed Engage Range	0 to ±6000 ft/min
		ALT Speed Hold	±30 ft

Table 3-1. Operating Parameters (cont'd)

Mode	Control or Sensor	Parameter	Value
		Engage Error Pitch Limit	±20°
		Pitch Rate Limit	Function of (TAS)
IAS Hold	Air Data Computer	IAS Engage Range	80 to 450 knots
		IAS Hold Engage Error	±5 knots
		Pitch Limit	±20°
		Pitch Rate Limit	Function of (TAS)
ALT Preselect	Air Data Computer	Preselect Capture Range	0 to 50,000 ft
		Maximum Vertical Speed for Capture	±4000 ft/min
		Maximum Gravitational Force During Capture Maneuver	±20g
		Pitch Limit	±20°
		Pitch Rate Limit	Function of (TAS)

h. Autopilot Controller (PC-400), Controls and Functions.

(1) Pitch thumbwheel. Rotation of the pitch thumbwheel with the autopilot engaged results in a change of pitch attitude proportional to the rotation of the pitch wheel and in the direction of wheel movement. Movement of the pitch thumbwheel will cancel any other previously selected vertical mode. However, for safety, movement of the pitch thumbwheel has no effect with the autopilot coupled to the a glide slope signal.

(2) Bank limit pushbutton. Selection of the bank limit mode on the autopilot controller provides a lower maximum bank angle while in the heading select mode. LOW will illuminate on the bank limit switch. The lower bank limit is inhibited and LOW is extinguished during NAV mode captures. If heading select is again engaged, bank limit will again be illuminated. Pressing bank limit when illuminated will return autopilot to normal bank limits.

(3) SOFT RIDE pushbutton. Soft ride reduces autopilot gains while still maintaining stability in rough air. This mode may be used with any flight director mode selected.

(4) TURN knob. Rotation of the turn knob out of detent results in a roll command. The roll angle is proportional to and in the direction of the turn knob rotation. The turn knob must be in detent (center position) before the autopilot can be engaged. Rotation of the turn knob cancels any other previously selected lateral mode.

(5) YD ENGAGE pushbutton. When the autopilot is not engaged, the yaw damper may be utilized by depressing the YD ENGAGE pushbutton.

(6) AP ENGAGE pushbutton. The AP ENGAGE switch is used to engage the autopilot. Engaging the autopilot automatically engages the yaw damper. The autopilot may be engaged with the airplane in any reasonable attitude.

(7) Disengaging the autopilot. The autopilot is normally disengaged by momentarily depressing the control wheel AP DISC switch. The autopilot may however be disengaged by any o the following:

(a) Actuation of the control wheel AP DISC button. Disengagement is confirmed by 5 flashes of the AP ENG annunciator.

(b) Pressing the respective vertical gyro FAST ERECT button.

(c) Actuation of respective compass INCREASE-DECREASE switch.

(d) Selection of go-around mode. Disengagement is confirmed by the AP ENG annunciator flashing 5 times and illumination o the GA and YD ENG annunciators.

(e) Pulling the autopilot AP POWER circuit breaker.

(f) Pressing the autopilot AP ENGAGE pushbutton.

(g) When transferring between pilot and copilot flight directors. Any of the following malfunctions will cause the autopilot to automatically disengage.

(h) Vertical gyro failure.

(i) Directional gyro failure.

(j) Autopilot power or circuit failure.

(k) Torque limiter failure.

Disengaging under any of the previous four conditions will illuminate the AP DISC annunciator and the flashing MASTER WARNING light. Pressing the control wheel AP DISC switch will extinguish the AP DISC annunciator.

(8) Elev TRIM annunciators. The elevator trim annunciator indicates UP or DN when a sustained signal is being applied to the elevator servo. The annunciator should not be illuminated when engaging the autopilot.

i. Touch Control Steering (TCS). The TCS push button located on the control wheel allows the pilot to manually change aircraft attitude, altitude, vertical speed and/or airspeed without disengaging the autopilot. After completing the manual maneuver, the TCS pushbutton is released, and the autopilot will automatically resynchronize to the vertical mode. Example: with IAS mode selected, the pilot may depress the TCS pushbutton and manually change airspeed. Once trimmed at the new airspeed the TCS pushbutton is released, and the autopilot will hold this airspeed. If a large pitch attitude change is made, the pilot should trim the aircraft normally before releasing the TCS button.he ALT hold mode. I

NOTE

Only the TCS button on the side that has the controlling autopilot will permit changing the autopilot.

3-25. FLIGHT MANAGEMENT SYSTEM (KNS-660).

a. Description. The flight management system (FMS) is an integrated, long range, multi-sensor flight management system. It may be used to manage the entire range of navigational functions including trip planning, long range great circle navigation, instrument approaches, and frequencies. The FMS serves as a computer processor/display for inputs from a choice of sensors such as VOR/DME, OMEGA/VLF, GPS, or TACAN. Navigation sensors may be selected separately or blended' within the computer. It provides for manual operation to selected waypoints or automatic operation, providing uninterrupted navigation throughout a complete flight plan. The FMS consists of a cockpit mounted control display unit (CDU) (fig. 3-19); a remote mounted navigation computer; and an "H" field

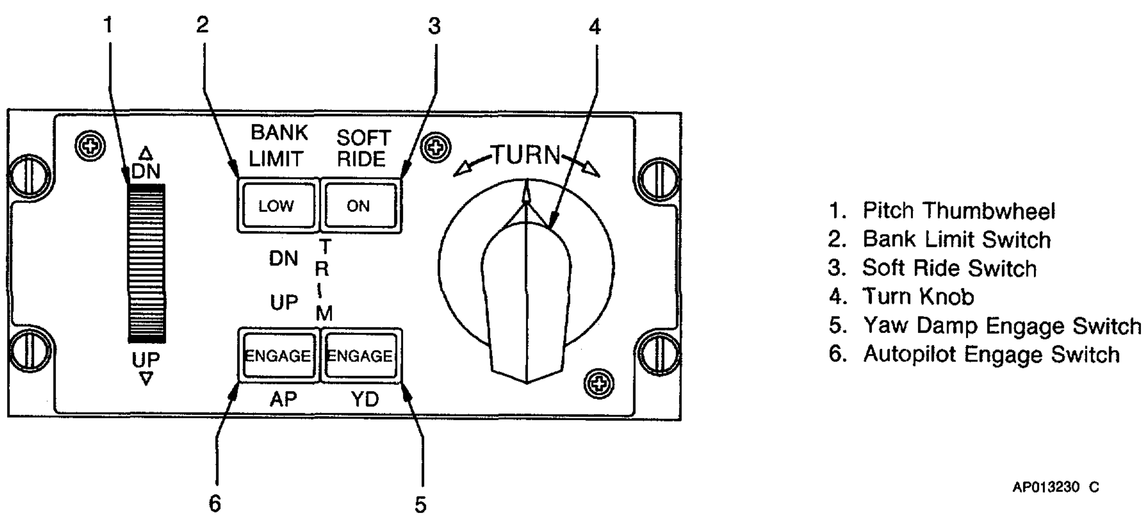

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Figure 3-18. Autopilot Controller

antenna (fig. 2-1). The FMS calculates its present position in terms of latitude and longitude coordinates. The flight's destination must be inserted into the FMS in a latitude and longitude format or in a format that the FMS can convert to latitude and longitude, such as ICAO identifiers of navaids, airports, or intersections.

The FMS can use navigation inputs from VOR, DME, TACAN, GPS, and OMEGA/VLF navaids. In addition the system uses aircraft heading and altitude inputs.

The FMS system is protected through a 5-ampere circuit breaker placarded FMS, located on the overhead circuit breaker panel (fig. 2-23).

b. Data Base. The FMS incorporates a self contained data base. This data base consists of an extensive library of navigation data which is loaded into the system at the time of manufacture. This data is updated by means of a 3 1/2 inch diskette using the data loader in the pedestal extension (fig. 2-6) every 28 days. The diskette contains updated worldwide navigation data which is broken down into ten geographic regions. The following are the geographic regions:

USA

Canada

Latin America

Europe

South America

Mid East

Africa

Eastern Europe

Pacific

South Pacific

The diskette contains the following navigational elements for each of these ten regions:

Navaids (VORTAC's, VOR/DME's, VOR's, ILS/DME's, DME's, and TACAN's).

Airports having a hard surface runway which is at least 4,000 feet in length.

Airports having a hard surface runway which is at least 3,000 feet in length.

Runway thresholds.

Outer markers.

High altitude waypoints.

Low altitude waypoints.

SID/STAR waypoints.

Approach intersections.

Multiple waypoints (waypoints which serve as members of any combination of high and low altitude waypoints, SID/STAR's, or approach intersections). VLF station data.

c. Configuring the Data Base. Not all the worldwide navigation data contained on the diskette will fit into the FMS system's internal data base (memory) at one time. It is necessary to choose which geographical regions and which navigational elements within those geographical regions are desired to be loaded at one time. The diskette may be used as often as necessary during the 28 day valid period.

d. Supplemental Data Base. In addition to the published navigation data base the FMS has an additional non-volatile memory capacity which may be utilized for storing waypoints, flight plans, and other user defined data. This additional memory can store 100 flight plans, 800 waypoints, and 175 user defined navaids and airports.

e. Data Base Revision Cycle. Every 28 days, several days prior to the effective date of the next revision, a diskette is sent to each database subscriber which includes a complete new set of worldwide data. The update should be accomplished before the effective date of the revision. If the FMS is not in operation at 0000 GMT on the effective date, the system automatically switches to the revised data. If the FMS is in operation at 0000 GMT on the effective date, the system automatically switches to the revised data the next time it is turned on. If the FMS does not get updated with the latest revision data prior to the effective date, the system will continue to function but will provide a message stating: D/BASE OUT DATED.

f. Data Base Battery. A small battery located internally in the FMS computer keeps the data base alive when power is removed from the system. Typical battery life is 6 years. When about one week of battery life remains, the system will display a message stating: D/BASE BATT LOW. The battery should be replaced by maintenance technicians at this time.

g. ICAO Identifiers. In order to access data from the data base it is necessary to use International Civil Aviation Organization (ICAO) identifiers. In most cases the proper ICAO identifiers may be taken directly from navigation publication such as high altitude charts, low altitude charts, area charts, approach plates, SID's, STAR's, and other references.

(1) Airport ICAO identifiers. Airport reference points are stored by the airport ICAO identifier. The majority of airport identifiers have four let-

ters beginning with a prefix letter that corresponds to the geographic area in which it is located (for example, KJFK). The prefix letter for the continental United States is "K". The prefix letter for Hawaii and Alaska is "P". Some airport identifiers are a combinations of three or four letters and numbers such as 3LA, 7TX6, or M33. Most published airport identifiers in the continental United States are in the official ICAO format. The exception is an airport identifier which consists of only three letters and no numbers, such as Chanute, Kansas (CNU). It is necessary in this case to add the "K" prefix to make the letter KCNU.

(2) Navaid ICAO identifiers. Most navaid identifiers are made up of three letters, but combinations of two or three letters and number also exist.

(3) Waypoint ICAO identifiers. Most waypoint identifiers (high altitude, low altitude, multiple, and approach intersections) consist of five letters, however, some waypoint identifiers consist of combinations of three to five letters and numbers such as GOONI, D3N, and L121.

(4) Runway thresholds and outer markers. Runway thresholds and outer markers are not stored in the data base by ICAO identifiers. Access is from the appropriate airport waypoint page.

(5) On-airway NDB ICAO identifiers. NDB's which are located on an airway are contained in the data base whenever any type of waypoint (high altitude, low altitude, SID/STAR, or approach intersection) has been loaded into the data base. On airway NDB's are accessed by the two or three character identifier plus an NB suffix, such as GNINB.

h. Dedicated Special Function Keys. Dedicated special function keys are physically and visually separated from the alpha/numeric keys used in the generation and storage of flight plans and waypoints.

i. FMS Interface with the MFD Radar Graphics Unit. The FMS interfaces with the MFD radar graphics unit, providing a radar graphics presentation on the weather radar display. This includes such items as flight plan waypoints, selected course, and reference ground stations.

j. Bulk Loading and Saving Using Data Loader. In addition to updating the data base, the data loader may be used to load and save flight plans, waypoints, and the user generated supplemental data base.

k. FMS Control-Display Unit Controls and Functions.

(1) Message key and annunciator. An alternate-action key placarded MSG, when

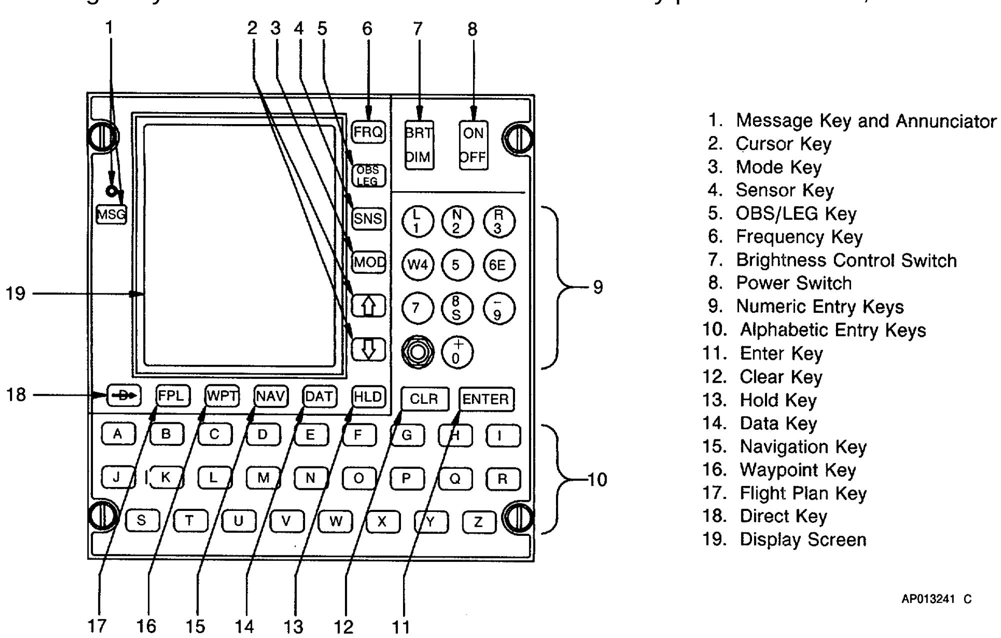

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Figure 3-19. FMS Control Display Unit (CDU) depressed causes the message page to be displayed. Depressing the key once selects the message page, depressing the key again deselects the message page. The message annunciator is located above the message key. Illumination of the message light indicates that a message will be displayed on the FMS control displayed unit when the message key is depressed. The message key is used to acknowledge a message annunciator. The message annunciator will be extinguished only after the message has been satisfactorily acknowledged.

(2) Cursor keys. Two cursor keys are provided, one placarded with a down-pointing arrow, and the other placarded with an up pointing arrow, to position the cursor (a bright inverse video rectangle) over information in a line or portion of a line on the control display unit, in order to approve or change that information. If the cursor is out of view it can be brought onto the screen at the top or bottom by using the up or down cursor key.

(3) Mode key. This key, placarded MODE, allows selection of NAV, RNV ENR (RNAV enroute), or RNV APR (RNAV approach) modes of operation. When NAV is selected, normal angular HSI deviation bar sensitivity occurs (+ 10° full scale). When RNV ENR s selected the deviation bar indicates + 5 nautical mile full scale and when in RNV APR the deviation indicates ±1.25 nautical mile full scale. When an ILS frequency is selected the sensor annunciated is ILS. OBS will be displayed as the method of operation and ILS will be displayed and the mode of operation. When the OMEGA or BLEND sensor is selected, RNV ENR is automatically selected as the only mode of operation.

(4) Sensor key. The sensor key, placarded SNS, selects the active sensor to be used for navigation. Alternate key strokes will select VOR, OMEGA, TACAN, GPS, or BLEND. When the VOR sensor is selected, navigation is based upon available VOR/DME signals. When an ILS frequency has been selected as the active waypoint the sensor annunciation indicates ILS. When the OMEGA sensor is selected, navigation is based upon available omega and VLF signals. When the GPS sensor is selected, the NAVSTAR satellite global positioning system (GPS) is used for navigation information. When the BLEND sensor is selected, navigation is based on a computer blend of position inputs from all active sensors.

(5) OBS/LEG key. The OBS/LEG key selects method of operation. Each key push selects the next method of operation in the sequence of OBS, AUTO/LEG then back to OBS.

(6) Frequency key. The frequency key, placarded FREQ, selects the two frequency pages which allow frequency management of the VHF transceivers, NAV/TACAN, NAV 2, and the ADF receivers.

(7) Brightness control switch. The brightness control switch, placarded BRT DIM, is a rocker type switch which, when pressed at the top, increases the picture brightness and message light intensity in incremental steps to the maximum level. When pushed at the bottom, the brightness is decreased in incremental steps to the minimum level. When the unit is turned on, the brightness is preset to 80% of the maximum level.

(8) Power switch. The power switch, placarded ON OFF, is a rocker type switch which, when pressed at the top, turns the system on and initiates the self test process. When pushed at the bottom and held for approximately 2 seconds, the unit will turn off. Prior to turning off, a caution message is presented on the screen.

(9) Alpha-numeric entry keys. The control display unit (CDU) has 36 alpha-numeric keys, 10 of which are used to enter numerals 0 to 9 and 26 keys which are dedicated to entering the characters A through Z. Eight of the 10 numeric keys are also used to enter: North, South, East, West, left, right, minus (-), and plus (+).

(10) Enter key. This key, placarded ENTER, is used to insert the data displayed under the cursor or a complete page of information into the computer memory. It is also used to select various menu items and to approve specific cursor statements.

(11) Clear key. The clear key, placarded CLR, may be used to clear a single character in a data field, a complete data field, or an entire page depending upon the procedure used. It is also used on non-enterable fields preceded by a right caret (>) to cycle between two or more related selections.

(12) Hold key. Depressing the hold key, placarded HLD, allows the control display unit (CDU) to display the two hold pages (HOLD 1 and HOLD 2). The HOLD 1 page is displayed the first time the HLD key is pressed and the HOLD 2 page is displayed when the HLD key is pressed again (alternate action). The HOLD functions are used for updating the FMS present position and for creating a waypoint at the aircraft's present position.

(13) Data key. The data key, placarded DAT, is used for viewing the two data menu pages (DATA 1 and DATA 2). It is also used for returning from lower level data pages to higher level data pages.

(14) Navigation key. Depressing the alternate-action navigation key, placarded NAV, allows viewing of the two NAV pages (NAV 1 and NAV 2). The NAV 1 page is displayed by pressing the NAV

key once the NAV 2 page is displayed by pressing the NAV key again.

(15) Waypoint key. The waypoint key, placarded WPT, has two functions: to cycle through the waypoint pages associated with the active flight plan (FPL 0), and to display the waypoint pages of other waypoints in the system.

(16) Flight plan key. The flight plan key, placarded FPL, is used to select viewing of the active flight plan page (FPL 0) or the flight plan menu pages (FPLS). Pressing the key repeatedly will cycle through the FPL 0 page and all FPLS pages and then back to the FPL 0 page. If the control display unit (CDU) is displaying a page other than the FPL 0 page or a FPLS page, pressing the FPL key once will display the FPL 0 page.

(17) Direct to key. The direct to key, placarded with a D with a superimposed arrow, when depressed, allows selection of direct to operation. It may be used anytime after system initialization.

l. Page Display Definitions. The control display unit (CDU) presents information to the pilot arranged like pages in a book. Individual displays on the CDU are therefore referred to as pages. With the exception of the self test page and the system failed page, each page has a header at the top consisting of:

Page Name located in the upper left portion of the header.

Selected Sensor located in the lower left portion of the header.

Method of Operation located in the upper right portion of the header.

Mode of Operation located in the lower right portion of the header.

The following is a list of page names that will appear (as selected) in the page name field:

NAV 1
NAV 2
WPT
DUPL
FPLS
FPL
FPL 0
FREQ 1
FREQ 2
INIT
HOLD 1
HOLD 2
DATA
MSG
DATA 1
DATA 2

The method of operation field (selected with the OBS/LEG key) displays the selected method of operation. This field normally displays either OBS or AUTO/LEG.

The selected sensor field displays the sensor chosen to provide navigation inputs to the system. The sensor key is used to make the sensor selection. The following is a list of possible sensor annunciations:

Blend -System uses position inputs from all available sensors.

VOR -VOR and DME.

TACAN -Tactical air navigation.

OMEGA -Omega and VLF.

ILS -Instrument landing system (displayed when a localizer frequency is active).

GPS -Global Positioning System. The mode of operation displays in the mode of operation field. Possible modes of operation displayed are:

RNAV ENR -RNAV enroute (+ 5 NM full scale HSI deviation bar sensitivity).

RNAV APR -RNAV approach ([1.25 NM full scale HSI deviation bar sensitivity).

NAV -Navigation (+10° full scale HSI deviation bar sensitivity).

ILS -Instrument landing system (displayed when a localizer frequency is active).

(1) Self test page. The self test page is the first page of information presented when the unit is turned on. Following an automatic self test the status of the system is displayed as well as a list of navigation data for the pilot to verify on actual aircraft instruments and displays. They are:

SYSTEM OK -Indicates that the unit has passed the self test.

RMI 130° -The aircraft's RMI needle should be pointing to 130°.

DIS 34.3	- The aircraft's DME display should be indicating 34.3 NM.
SEL CRS 315°	- The course arrow on the HSI should be indicating 315°.
HORZ DEV RT 3	- The deviation bar on the HSI 3 or CDI should be 3 dots to the right of center (or an indication of 3 NM to the right of center).
VNAV DEV UP 3	- The VNAV indicator should be displaying an up 3 dot deflection (or an indication of 300 feet below the desired vertical flight path).
CHECK	- RMI-DIS
CHECK	- CDI-CRS
CHECK	- ANN LTS - The annunciator lights illuminate to remind the pilot to check the applicable data values displayed on the control display unit with the actual aircraft instruments.
ORS	- Operation revision status. A control number which indicates what level of operational capabilities are applicable to the system.
TEST OK?	- Cursor position used to approve the self test page.
C 1984 King/ RADIO	- Copyright logo.

(2) Initialization page. The initialization page will be displayed after the self test page is approved.

DATE:	- Greenwich date in the order of day-month-year. The first three letters of each month are used for month abbreviations.
GMT:	- Greenwich mean time in hours and minutes. The correct date and GMT are retained even when aircraft power is removed.
REF NAVAID	- The NAVAID (within 50 NM ID miles) closest to the systems last computed position before power was removed.
WPT ID:	- A data entry field where the waypoint identifier of the air- craft's present position may be entered.
POS:	- The last known computer generated present position.
EST GS:	- Estimated ground speed manually entered. Should be 0 if the aircraft is on the ground, or a close estimate if in flight.
APPROVE?	- Used to approve the data on the page and enter the data into the computer memory. Other pages are not accessible until this step is completed.

(3) Omega restart initialization page. If the system is sensing through a omega sensor, in the NAV status, and power to the system is lost for more than seven seconds but less than seven minutes and the selected sensor is BLEND or OMEGA, an omega restart initialization page will be displayed instead of the normal initialization page.

LASR GMT	-The greenwich mean time when power was lost.
LAST KNOWN PRES	-The calculated position of the system when power was lost.
GMT:	-The present greenwich mean time.
ESTIMATED PRES POS:	-The dead reckoning calculated position. If this is incorrect the correct position can be entered on the HOLD 1 or HOLD 2 page.
APPROVE?	-The cursor position used to approve the omega restart initialization page.

(4) Message page. The message (MSG) annunciators illuminate on whenever there is a situation that requires the pilot's attention. The MSG annunciators will flash continuously until acknowledged by pressing the MSG key, which displays the message page. The message page lists the various messages which are applicable to the unit's operation at that time.

After viewing the message, the operator may either select a new page by pressing another page key or by pressing the MSG key which will return to the previous page. In either case, the message light will be extinguished unless there is a situation which requires operator action. In this case the message light will remain on solid until the pilot's action is taken. Whenever new messages are displayed which have never been seen by the operator, they are separated from the previously viewed messages by a blank line.

(5) Flight plan pages. The flight plan menu pages (FPLS) display a listing of the flight plans contained in the systems memory. The flight plans are listed in increasing order of flight plan number.

When initialization is complete, the first flight plan menu page appears. A maximum of 100 flight plans may be listed by the flight plan numbers 0 to 99. If more than 9 flight plans are stored, then successively pressing the FPL key will display additional FPLS pages containing the remaining stored flight plans.

SEL FPL: - The desired flight plan number is entered into this field. The flight plan number selected does not have to be displayed onthis page.

0 - The 0 indicates the first flight plan number. Flight plan 0 is the active flight plan and is displayed on each flight plan menu page.

> - The > notes that another operation can be performed by pressing the CLR key while the cursor is over this field. When indexed to the left of a flight plan, it provides the option to store that flight plan in any unused flight plan position.

(*) Asterisk - The asterisk (*) indicates that this is a protected flight plan.

FPLS AVAIL - Indicates the number of empty flight plans available for use.

(*6*) *Flight plan # page*. Each flight plan page is called up via the flight plan menu page. A flight plan is limited to a maximum of 25 waypoints. An asterisk (*) after FPL would indicate that this is a protected flight plan.

ACTIVATE? - This flight plan can be made active by placing the cursor over ACTIVATE? and pressing ENTER.

INVERT - The option of activating this flight plan in inverted order is available (first waypoint becomes the last and last waypoint becomes the first) by placing the cursor over INVERT? and pressing ENTER.

NEXT PAGE? - When more than nine waypoints are used in a flight plan, the next page (or pages) can be displayed by placing the cursor over NEXT PAGE? and pressing ENTER. From the last page of the flight plan this procedure is used to return to the first page of the flight plan.

DIS - Distance is displayed from the initial waypoint.

REF WPT - A data entry field where a reference navaid or airport identifier may be entered to create an on course waypoint.

(7) Flight plan 0 page. The flight plan 0 page is a display of the active flight plan and its associated data.

DIR: - This line is present only when direct to operation is being used. The direct to waypoint name and distance to this waypoint are displayed. Estimated time of arrival (ETA) and estimated time enroute (ETE) to the direct waypoint may also be displayed.

>DIS - A cyclic field which changes from distance (>DIS) to estimated time of arrival (>ETA) to estimated time enroute (>ETE). As with all cyclic fields, the field is changed by positioning the cursor over the field and pressing the CLR key.

The distance displayed under the >DIS column beside each waypoint are the cumulative distances from the aircraft's present position to each waypoint along the flight plan route.

>ETA - This column displays the estimated time of arrival in GMT and is based on the current ground speed and distance to each waypoint from the aircraft's present position.

>ETE - This column displays the estimated time enroute to each waypoint based on the current ground speed and distance to each waypoint from the aircraft's present position.

>ALT - This column displays the selected altitudes associated with GMT that the system first calculated a ground speed greater than 50 knots. DEP is displayed only when ETA has been selected.

DEP - The departure time is the GMT that the system first calculated a ground speed greater than 50 knots. DEP is displayed only when ETA has been selected.

FLT -The total elapsed time in flight. The elapsed time begins when the system first calculates a ground speed of 50 knots. FLT is displayed only when ETE is selected.

1 FIRST -The first waypoint is displayed at the top of the list of waypoints regardless of the number of waypoints in FPL 0. This line can become a non-enterable cursor field and will display WPT? when used for manual scrolling of the waypoints.

* 7: -A single * designates the direct to waypoint if it is part of FPL 0. A single * also designates the active waypoint when in OBS method of operation.

* 6:
* 7: -When the system is in AUTO/ LEG operation and the direct to feature is not being utilized, a pair of asterisk's (*) designate the active FROM waypoint (top *) and TO waypoint (bottom *). Thus, the pair of asterisk's define the active flight plan leg. The asterisk's change automatically as the aircraft moves along the flight plan.

The last waypoint in FPL 0, and its associated distance, estimated time of arrival, or estimated time enroute are displayed at the bottom of the list of waypoints. This line can become a non-enterable cursor field and display WPT? when used for manual scrolling of the waypoints.

REF WP: -A data entry field where a reference navaid or airpot identifier may be entered to create an on course waypoint.

(8) Waypoint page. The waypoint page is used to display, verify, and create waypoints for use in the operation of the system.

WPT* -If the displayed waypoint has a protected status, an asterisk (*) will appear next to the WPT page field.

DSP: -Indicates the displayed waypoint number from the active flight plan. A -D would indicate that the waypoint being displayed is a direct to waypoint which is not part of the active flight plan. If the displayed waypoint is not part of the active flight plan and is not a direct to waypoint, dashes will be displayed.

The field may be used to display a waypoint from flight plan 0 by entering the desired waypoint number into this data entry field.

ACT -Indicates the active waypoint number from the active flight plan. If the direct to feature is being used and the direct to waypoint is not contained in the active flight plan, then a "D" will be displayed.

USE? -Queries the operator if he wants to make the displayed waypoint the active waypoint. To do so the cursor is positioned over this field and the ENTER key is pressed.

WPT NAME: -The identifier or name of the displayed waypoint. From 1 to 5 alpha-numeric characters are used to identify a waypoint.

REF NAME: -Reference facility identifier. The pilot may enter a navaid, airport, or any other waypoint stored in memory within 200 NM of the waypoint being defined. However, to utilize the VOR sensor (VOR or BLEND sensor selected) while operating in OBS method of operation the REF NAME entry must be a navaid identifier. In OBS operation the reference navaid is the only station tuned by the VOR navigation receiver and the DME (or TACAN).

FREQ -Frequency of the reference navaid. If the reference facility input is a navaid, its frequency is automatically entered. When the reference facility identifier entered is not a navaid, blanks are displayed.

A caret (>) will be displayed between FREQ and the frequency field when using the TACAN sensor. With the cursor over the frequency field the CLEAR key is used to select either frequencies or TACAN channels. The system will remain in the FREQ or CHNL select mode until changed by the pilot.

RAD
DIS: Radial and distance from the reference facility to the waypoint.
LAT:

LON:	Position of the waypoint presented as latitude and longitude coordinates using degrees, minutes and tenths of minutes.
RUNWAY/OM?	-This cursor field allows selection of runway thresholds and outer markers. It appears whenever the data base is loaded with runway thresholds and/or outer markers and when the identifier displayed in the WPT NAME field is an airport.
44 WPTS AVAIL	-When the waypoint page is initially displayed, after having been previously approved, the number of memory locations available for waypoint storage is displayed.
APPROVE?	-Following the first data entry on the waypoint page the WPTS AVAIL will be removed. The APPROVE? field will then appear.

When clearing a waypoint page, the interrogative field DELETE? will appear in place of APPROVE?.

(9) Waypoint used-in page. The waypoint used-in page is used for deleting a waypoint. The page displays the identifier of the waypoint to be deleted.

DELETE?	-With the cursor over the field to be deleted, the field is deleted by pressing the ENTER key.

(10) Waypoint runway/outer marker page. When the selected waypoint is an airport and the data base contains runway and/or outer marker information the message RUNWAY/OM? will appear at the bottom of the waypoint page. The runway/outer marker page can then be selected. A runway or outer marker may be selected from the listing on this page.

SEL RW/OM:	The menu number to the left of the desired runway threshold or outer marker may be entered in this field.
NEXT PAGE	If all the runway thresholds and outer markers aren't contained on one page this field is used to view the remainder which are contained on another page.

(11) Waypoint duplication page. When an identifier is entered in a waypoint identifier field and multiple definitions for this identifier exist in the system data base, the waypoint duplication page will be displayed.

SEL COUN-TRY	-The number associated with: the desired country may be entered in this field.
IDENTIFIER TOPTOP	-The identifier having multiple definitions stored in the data base. A listing of the countries containing the same waypoint identifier will display under IDENTIFIER TOP. If an identifier for an intersection has been entered, a "T" or an "E" will be displayed next to the country name to indicate that the intersection is terminal or enroute.

(12) NAV PAGES. There are two NAV pages (NAV 1 and NAV 2) alternately selected by pressing the NAV key.

NAV 1 PAGE	-The NAV 1 page format varies somewhat depending on whether the method of operation is OBS or AUTO/LEG.

(a) OBS method of operation display.

USE	-The number displayed is the active waypoint number. When using the direct to feature (DIR) is displayed.
ID	-The identifier code of the active waypoint.
DIS	-Distance to the active waypoint in nautical miles.
ETE	Estimated time enroute to the active waypoint in hours and minutes. This value is based on the present calculated ground speed, assuming that the actual track is equal to the bearing to the waypoint.
GS	-Ground speed in knots.
TAS:	-The colon (:), when displayed, indicates this is an enterable data field, only when there is no

	true airspeed source available. A true airspeed may be manually entered so that the system can make a wind calculation.
WIND	-The computed wind using the TAS. Displayed in degrees true and knots. This field will display dashes if the computed wind is less 10 knots.
BRG	-The bearing from the aircraft's present position to the active waypoint.
HDG	-The current aircraft heading.
>POS RAD	MKC DIS The aircraft's present position displayed in terms of a navaid, and the radial and distance from it. Another navaid identifier may be manually inputted. The present position will be referenced to that facility. If the navaid is manually changed, the system will resume automatic navaid selection for this field in approximately one minute.
POS	-The aircraft's present position coordinates in latitude and longitude. The pilot may change the present position back and forth as desired between the navaid identifier, radial, and distance format and the latitude/ longitude format by placing the cursor over the >POS field and pressing the CLEAR key. When an ILS frequency is active the POS block displays the ILS frequency and the radial and distance display dashes.

(b) Auto/leg method of operation display.

LEG	-Active leg of flight plan. When operating direct to a waypoint, (DIR) and the waypoint identifier are displayed.
DIS	-Distance to the active waypoint in nautical miles.
ETE	-Estimated time enroute to the active waypoint in hours and minutes. This value is based on the present calculated ground speed, assuming that the actual track is equal to the bearing to the waypoint.
GS	-Ground speed in knots.
TAS:	-The colon (:), when displayed, indicates this is an enterable data field, only when there is no true airspeed source available. A true airspeed may be manually entered so that the system can make a wind calculation.
WIND	-The computed wind using the TAS. Displayed in degrees true and knots. This field will display dashes if the computed wind is less than 10 knots.
DTK	-Desired track. The great circle course in degrees along the active leg of the flight plan.
TK	-Actual track. The track the aircraft is flying over the ground.
BRG	-The bearing from the aircraft's present position to the active waypoint.
DA	-The drift angle left or right in degrees. If the aircraft's actual track over the ground is to the right of the aircraft's heading a right (R) drift angle is indicated. If the track is to the left of the aircraft's heading a left (L) drift angle is indicated.
POS	-The aircraft's present position displayed in terms of a navaid, and the radial from it. Another navaid identifier may be manually inputted and the present position will be referenced to that facility. If the navaid is manually changed, the system will resume automatic navaid selection for this field in approximately one minute.

(13) Nav 2 page.

LEG	-Varies somewhat depending on whether the method of operation is OBS or AUTO/LEG.
ACT	-This column header indicates that data in this column is pilot selectable.
L XTK: R	-The data to the left side of XTK: is the actual cross track error, which is the lateral displacement of the aircraft in nautical miles left or right of the desired track. If parallel track

	operation is desired, the selected cross track may be entered to the right of the XTK: field. The selected cross track distance provides steering to a left or right offset course parallel to the desired track.
REF MAG	-The data to the left of REF is the actual magnetic variation in degrees computed for the present position of the aircraft. The data to the right of REF is the system compass mode. BGR, DTKM HDG, and TK are referenced with respect to the displayed system compass mode.
VNAV	-The VNAV (vertical navigation) field and the associated VNAV lines below it are displayed only when the system is configured for manual VNAV operation. When present, the pilot can initiate a manual VNAV system configuration by entering data into the appropriate data fields.
ALT:	-The data to the left of ALT: is the actual present aircraft altitude. The pilot may enter a selected altitude in the data field to the right of ALT:.
ANG:	-The data to the left of ANG: is the actual vertical angle between the present aircraft position and the active vertical waypoint or vertical offset point if selected, between 0 and 9.9 degrees. If manual VNAV operation is utilized the pilot may select a vertical angle in the data entry field to the right of ANG:. If manual VNAV operation is not engaged this field displays the actual vertical angle.
OFST:	-The data to the left of OFST: is the distance to the vertical waypoint or vertical offset point if selected. The pilot may enter an along track offset (nautical mile) in the data field to the right of OFST:. A positive number puts the vertical offset point past the waypoint and a negative number puts the vertical offset point between the aircraft and the waypoint.

(14) Hold 1 page. The HOLD 1 page is used to check position accuracy, to update the KNS-660 position or create a waypoint at the aircraft's present position.

POS	-The present position calculated by the system which was frozen in this display when the HOLD key was pressed.
IDENT:	-The waypoint identifier of the fix contained in the systems memory, that was over flown to check or update position. If the identifier entered here is not contained in memory this becomes the identifier of a waypoint with the coordinates displayed adjacent to POS.
FIX:	-The actual coordinates of the position overflown.
DIF	-The difference in position between the systems calculated position and the FIX position in degrees, minutes and tenths o minutes.
UPDATE?	-A cursor field used to update the systems position when the ENTER key is pressed.

(15) Hold 2 page. The HOLD 2 page is used to update the system position. It is also used to make manual altitude, heading, or ground speed entries when required by the system.

IDENT:	-The waypoint identifier of a point to be overflown for position updating.
FIX:	-The actual coordinates of the point to be overflown for position updating.
MAN HDG:°t	-This field will be present on the HOLD 2 page only if all o the system's heading source inputs fail. The pilot may manually enter the aircraft's heading referenced to true north in this data field.
MAN ALT: FT	-This field will be present only if all of the system's altitude inputs fail. The aircraft's altitude may then be manually entered in this data field.
EST GS:	-This field will be present if the omega receiver requires dead reckoning inputs to gain naviga

tional status. The estimated ground speed may then be manually entered in this data field.

UPDATE WHEN OVER POSITION FIX	-A non-cursor field, to remind the pilot that updating the item using the HOLD 2 page is done the position fix.
UPDATE?	-A cursor field used to update the system position when the ENTER key is pressed. This field does not effect operation of the MAN HDG:, MAN ALT:, or EST GS fields.

(16) Frequency 1 page. The FREQ 1 page is used for frequency management.

[ ]	-Transponder code or frequency entered in the scratch pad area of display, displays here.
SEL OPTION	-The appropriate menu number choice may be entered in this field.
STBY	-Menu numbers chosen from this column will result in the scratch pad frequency being loaded into the standby window of the appropriate control head.
ACT	-Menu numbers chosen from this column will result in the scratch pad frequency or transponder code being loaded into the appropriate control head's active window.

(17) Frequency 2 page.

[ ]	-Frequency or transponder code entered in the scatch pad area of display, displays here.
FREQ SUMMARY	-A non-cursor field which indicates that the listed below is all control heads connected for frequency management capability and their respective active frequency/codes.

Each of the ADF control heads tied to the frequency management is listed along with its respective active frequency/code. The frequency/code fields are manually enterable.

When the number one VOR NAV receiver is being used as a sensor for the KNS-660, a dot is displayed to indicate that data cannot be entered in this field. If the NAV CTL function is activated thereby removing the number one VOR NAV receiver as a sensor, the active NAV 1 frequency will be displayed and this will be an enterable data field.

m. Data 1 menu page. The DATA I menu page lists the actual data pages which can be selected from this page. Specific data pages are selected by entering the corresponding menu number into the SEL MENU ITEM: data field and pressing the ENTER key. They may also be selected by placing the cursor over the menu item and pressing the ENTER key.

(1) Nearest airports page. The nearest airport page may be called up at any time to provide three airports from the data base closest to the aircraft's present position (within 200 nautical miles).

NEAREST AIRPORTS AS OF GMT	-The last greenwich mean time (GMT) the data base was queried for the three nearest airports. The data base is queried approximately every two minutes.
IDENT BGR	-The ICAO identifiers for the DIS three nearest airports are displayed along with the respective bearing and distance to these airports from the aircraft's present position. The bearing and distance displayed are real time data.
4:	-This field provides a means to determine the bearing and distance to any airport entered which is listed in the data base, or any user defined airport.

(2) Trip planning menu page. The trip planning menu page is a secondary menu which allows the pilot to choose from three different types of trip planning.

SEL MENU ITEM:	-The menu number of the desired kind of trip planning can be entered in this data field.

(a) WPT REL TO PRESENT POS Trip planning from the aircraft's present position to another waypoint.
(b) WPT TO WPT ANALYSIS Trip planning between any two waypoints.
(c) FPL ANALYSIS Trip planning of one of the flight plans stored in the FPLS pages.

(3) Waypoint relative to present position trip planning page.

WPT NAME:	-Desired waypoint identifier.
LAT:	-The waypoint location presented in latitude coordinate.
LON:	-The waypoint location presented in longitude coordinate.
DIS NM	-The distance in nautical miles from the aircraft's present position to the selected waypoint. Not updated as the present position changes.
BRGTO	-The bearing in degrees from the aircraft's present position to the selected waypoint. Not updated as the present position changes.
ENTER GS:	-The aircraft's estimated ground speed for the trip can be entered in this data field.
ETE H: M	-The estimated time enroute for the trip based on ground speed.

(4) Fuel planning page.

REM	-The total fuel remaining in pounds. Must be manually inputted. Automatically counts down as a function of time and the manually entered fuel flow.
FLOW:	-The total fuel flow in lbs/hr. Must be manually inputted.
RESERVE:	-The desired fuel reserve in pounds. Must be manually inputted.
LAST UPDATE	-Time in minutes since the pilot has updated any of the fuel planning data. After 15 minutes the HRS, RANGE, and NM/100 LB fields blank and an UPDATE INPUTS message flashes at the bottom of the page.
HRS	-The endurance in hours and minutes based upon the manually inputted fuel remaining, fuel flow and fuel reserve data.
RANGE (NM)	-The range in nautical miles based upon endurance and the aircraft's present ground speed as calculated by the system.
NM/100LB	-The aircraft's fuel economy in nautical miles per 100 lbs. of fuel based upon the present ground speed and manually inputted fuel flow. UPDATED This flashing message appear INPUTS only if data has not been updated for 15 minutes.

(5) Position summary page. The position summary page displays the aircraft's position in latitude and longitude coordinates as determined by each of the sensors.

POS	-The aircraft's present position coordinates based on inputs from the pilot selected sensor. When BLEND sensor has been selected this position is a computer optimized position which blends the position information from all the sensors.
VOR	-The aircraft's present position coordinates based on inputs from the VOR and/or DME sensors.
TACAN	-The aircraft's present position coordinates based on inputs from the TACAN sensor.
OMEGA	-The aircraft's present position coordinates based on inputs from the omega/VLF sensor. If the omega/VLF status page displays AUTO/UPDATE and the VOR/DME status page indicates that the system is providing rhorho coordinates (DME distance from two separate navaids). Under any other conditions the coordinates presented here are purely from the omega/VLF sensor.
NEXT PAGE?	-The NEXT PAGE field displays indicating the remaining sensors (GPS) is displayed on the next page. The next page is displayed by placing the cursor over this field and pressing the ENTER key.

(6) VOR/DMEI status page. The VOR/ DME status page may be used to monitor the VOR and/or DME stations being used by the system.

VOR 1 REC	-Indicates that the NAV sensor has tuned a programmed VOR station frequency. REC indicates that a valid (not flagged) signal is being received, and the station radial on which the aircraft is located.
DME 1 REC	-Indicates that the DME sensor is tuned to a programmed paired

	VOR frequency. REC indicates a valid (not flagged) signal is being received, and distance from the station to the aircraft.
DME 2	-Indicates that valid DME distance is not being received from a second station. The system is therefore
NM	providing rho-theta (angle provided by the VOR, and distance from the DME) navigation data.
DME 2 REC	-When valid DME data is received from a second DME station this area displays REC, the identifier and frequency of the station utilized, and the aircraft's distance from the station. Under these conditions, the system is providing rho-rho navigation data.

When the system is providing rho-rho navigation it is not unusual for the VOR station identifier to be different from either of the DME station identifiers. It is also possible under valid rho-rho conditions for the VOR data to be blanked or flagged. It is normal during rho-rho operation for the DME stations to temporarily flag due to recalculation of optimum station pair.

(7) TACAN status page. The TACAN status page may be monitored to view the status of the TACAN stations being used by the system.

TACAN REC	-Indicates valid (not flagged) TACAN bearing information is being received. The TACAN channel and radial the aircraft is on will display.
DME 1 REC	-Indicates valid (not flagged) DME distance information is being received. Frequency and DME distance will display.
DME 2	-Indicates that valid DME distance is not being received from a second station. The system is therefore
NM	-providing rho-theta navigation data.
DME 2 REC	-When valid DME data is received from a second DME station this area displays REC, the identifier and paired VHF frequency of the station utilized, and the aircraft's distance from the station. Under these conditions, the system is providing rho-rho navigation data. When the system is providing rho-rho navigation the TACAN bearing data is dashed out.

(8) Omega/VLF status page. The omega/ VLF status page may be displayed to monitor the status of the omega/VLF or to make operational selections affecting the omega/VLF.

AUTO	-Normally this line will display AUTO UPDATE which means that the DME sensor updates the omega
UPDATE	-system when rho-rho navigation is being provided. By placing the cursor over this field and pressing the
	CLEAR key this field will cycle between AUTO UPDATE and NO AUTO UPDATE. The omega system is not being updated when NO AUTO UPDATE is selected. The system always defaults to AUTO UPDATE when power is removed and later turned back on. If the omega system requires a re-lane operation this line will display RE-LANE?. To select the omega re-lane operation, place the cursor over RE-LANE? and press the ENTER key. The system then displays the re-lane page.
SYNC	-This field can indicate either SYNC or NO SYNC. NO SYNC will appear until the received omega stations are sorted out and identified. At that time SYNC will be displayed.
NAV	-This field can indicate INIT, NAV, WARN or FAIL. INIT will be displayed until the present position is determined, then NAV will be displayed. FAIL will be displayed whenever the present position cannot be determined either due to an equipment failure or due to the number of stations presently received.

CAUTION

The system should not be used for navigation purposes when relying on the omega/ VLF sensor and INIT or FAIL are displayed.

OMEGA/VLF -Indicates the primary and secondary sensors being used by the omega/VLF system, where the left most sensor displayed is the primary one, when two sensors are being used. The following fields are used: VLF, VLF/ OMEGA, OMEGA or OMEGA/ VLF.

OMEGA VLF -The identifiers and associated data under the OMEGA column pertain to the omega stations. The identifiers and associated data under the VLF column pertain to the VLF stations. The locations of the station identifiers are as listed below.

(a) Omega stations.

NOR - Norway
LIB - Liberia
HAW - Hawaii
DK - North Dakota
LRN - LaReunion
ARG - Argentina
AUS - Australia
JPN - Japan

(b) VLF stations. The system will automatically choose to display the closest eight VLF stations to the aircraft's position from the list below:

NOR - Norway
GBR - Great Britain
4AW - Hawaii
AS - Washington
AR - Maryland
MAI - Maine
AUS - Australia
PN - Japan
PRT - Puerto Rico

LIB * GBR Columns 1 and 3 display the three letter station identification of the omega station.

-Column 4 displays either a blank space or a minus sign. A minus sign indicates that the pilot has manually deselected the station. The station may be deselected by placing the cursor over this field and pressing the 9/key and the ENTER key. If the entry is pilot deselected, the deselection can be removed by placing the cursor over the (minus sign) and pressing the 0/+ key and the ENTER key.

-Columns 5 and 6 display a quality factor number from 0 to 99 that is representative of the signal to noise ratio of the omega station. The system will utilize the omega station if the number is above 30. If the station is deselected, either manually or by the omega/VLF system, the number displayed is invalid.

-Column 7 displays an asterisk (*) or a blank space. An asterisk indicates that the omega system has automatically deselected the station for use or the station has been manually deselected. The system will automatically deselect stations based on distance (too close or to far) and on other criteria relating to signal interference. A blank space indicates that the system is able to use the station.

-Column 10 thru 12 display the three letter station identification of the VLF station.

-Column 13 displays either a blank space or a minus (-) sign. A minus sign indicates that the pilot has manually deselected the station. The station may be deselected by placing the cursor over this field and pressing the 9/key and the ENTER key. If the station is pilot deselected, it can be restored by placing the cursor over the minus (-) sign and pressing the 0/+ key and the ENTER key.

-Columns 14 and 15 display a quality factor number from 0 to 99 that is representative of the signal to noise ratio of the VLF station. The system will utilize the VLF station if the number is greater than 50. If the station is deselected, omega/VLF system, the number displayed is invalid.

-Column 16 displays an asterisk (*) or a blank space. An asterisk indicates that the omega/VHF system has automatically deselected the station for use, or the station has been manually deselected. The system will automatically deselect stations based on distance (too close or to far) and on other criteria relating to signal interference. A blank space indicates that the system is able to use the station.

(9) Omega re-lane page. Under certain rare conditions it is possible for the omega/VLF to detect an uncertainty in its calculated position. Under these specific conditions the system will illuminate the message light and display a message stating:

OMEGA RE-LANING
SEL OMG DATA PAG

The pilot should then select the omega/VLF status page. When the system annunciates the above message the omega/VLF status page will display RELANE? instead of AUTO UPDATE or NO AUTO UPDATE. To select the omega re-lane operation, the cursor is placed over the RE-LANE? field and the ENTER key is pressed. The omega re-lane page is then displayed.

CURRENT POS?	-The normal omega/VLF derived position coordinates of the aircraft's present position.
RE-LANE POS?	-An alternative omega determination of the aircraft's present position based upon omega data only. The pilot should determine which of the two positions is correct by comparison with other system sensor solutions, other navigation equipment on board the aircraft, or by visual reference to known positions on the ground. Selection is made by placing the cursor over the interrogative field of the desired position and pressing the ENTER key.

(10) GPS status page. The GPS STATUS page is used to monitor the status of the GPS sensor.

(a) State line. The STATE line indictes the status of the GPS sensor. The GPS sensor may be in any one of the following states:

INIT	In the process of initialization.
STS	In the process of searching the sky.
ACQ	In the process of acquiring satellites.
TRN	Transitioning between acquisition (ACQ) and navigation (NAV) modes.
NAV	In the navigation mode.
NAV DAT	In the process of data collection.
WARN	Degraded position information is being supplied.
FAIL CPU	CPU or 429 receiver has failed (catastrophic).
FAIL MEM	Memory has failed (catastrophic).
FAIL REC	Receiver hardware has failed (catastrophic).
EPE	The estimated position error for the GPS sensor is displayed on this line. It is in units of feet rather than nautical miles due to the higher accuracy available from the GPS system.
RESTART?	This field will appear if the GPS sensor is in an INIT, STA, ACQ, TRN, FAIL CPU, FAIL MEM, or FAIL REC state. Moving the cursor over this field when it appears and pressing the ENTER key will cause the GPS RESTART page to be displayed.
SAT SNR ELE HLT	This area of the GPS status page provides information on up to eight of the NAVSTARGPS satellites visible to the GPS sensor. Below the column labeled SAT appear the numerical designations of various satellites visible to the GPs sensor. An asterisk to the far left of the identifier indicates that the GPS sensor is not using the specific satellite in its position solution. The SNR (signal to noise ratio) column provides signal strength information for individual satellites. Typical SNR values will be in the 30 to 55 range. The elevation above the horizon is provided by the ELE column. Elevation is displayed in degrees and will typically be in the range of 5" to 90°. The last column, HLT, indicates the health state of each satellite. Three states are possible: GD (signal is good), WK (signal is weak), and BD (signal is bad).

(11) GPS Restart Page. This page is used to re-initialize (restart) the GPS sensor.

(a) Date line (DATE). This line displays the Greenwich date in the order of day-month-year.
(b) Time line (GMT). This line displays Greenwich Mean Time in hours and minutes.
(c) Waypoint identifier line (WPT ID). The space after WPT ID: is a data entry field where the present position waypoint identifier may be entered.
(d) Latitude and longitude lines (POS.). The latitude and longitude of the aircraft's

resent position which has been derived from either ther position sensors or the waypoint identifier (WPT ID) will be displayed here or may be manually entered here.

(e) Mode line. The mode field (MODES) allows one of three restart modes: NORMAL, COLD, or SEARCH SKY to be selected. (f) Estimated groundspeed line (EST GS). Estimated groundspeed is manually entered here.

n. Data 2 Menu Page. The data 2 menu page lists the actual data pages which can be selected from its menu. Specific data pages are selected by entering the corresponding menu number into the SEL MENU ITEM: data field and pressing the ENTER key. They may also be selected by placing the cursor over the menu item and pressing the ENTER key.

(1) Navaid page. This page is used to display the frequency, type, class, elevation, magnetic variation, latitude and longitude of a selected navaid. If the selected navaid is contained in the data base, the above information will be displayed when the navaid identifier is inputted into the station identifier field. A user defined navaid can be created by entering the above data into their respective fields and approving the page.

STA IDENT	-Navaid identifier.
FREQ:	-Navaid frequency or TACAN channel depending on which format is selected on the waypoint page. When TACAN channel is selected, FREQ: will be replaced with CHNL:.
TYPE>	-Displays the type of navaid.
VORTAC	Also used when a user navaid is being defined, as a cyclic field in conjunction with the CLEAR key to choose the type of navaid from among the following choices: DME, VOR/DME, VORTAC, TACAN, ILS/DME or VOR.
CLASS>:	-HIGH Displays the class of navaid. Also used when a user navaid is being defined. It is a cyclic field and is modified with the CLEAR key to choose the class of navaid from the following choices: LOW, HIGH, TERMINAL, and UNDEFINED.
ELEV: FT:	-The elevation (to the nearest 10 feet) of the navaid being displayed or defined.
MAG VAR:	-The published magnetic variation in degrees of the navaid being displayed or defined.
LAT: LON:	The position of the navaid in latitude and longitude.
APPROVE?	-A cursor field used to approve a user defined navaid.

(2) Airport page. The airport page is used to display the elevation and the position of the airport reference point (ARP) of a selected airport. If the selected airport is contained in the data base, the above information will be displayed when the airport ICAO identifier is inputted. User defined airports can be created by inputting the above data into their respective fields and approving the page.

ICAO AIRPORT IDENTIFIER:	-Airport ICAO identifier or other user defined airport identifier.
ELEV: FT.	-Airport elevation to the nearest 10 feet referenced to sea level.
LAT: LON:	Position in latitude and longitude of the airport reference point (ARP).
APPROVE?	-A cursor field used to approve a user defined airport.

(3) Data/time page. The data displayed on the data/time page is for reference only and can not be changed from this page.

DATE	-The current greenwich date in the sequence day-month-year.
GMT	-The current greenwich mean time.
DEP TIME	-The departure time which is defined as the time (GMT) the system first calculated a ground speed that exceeded 50 knots.
FLT TIME	-The flight time in hours and minutes, which is defined as the elapsed time since the system first calculated a ground speed that exceeded 50 knots.

(4) Update data base page. This page serves as a master menu for initiating three types of data base operations: (1) reviewing the present configuration of what is currently loaded in the data base (2) modifying the configuration of what is to be loaded into the data base and (3) loading the data base with the data loader.

SEL MENU ITEM:	-The number associated with the desired menu item is entered in this field.

REVIEW D/BASE	-This menu item is selected to display additional data base review pages which are used to review what is presently loaded in the data base. The pages accessed via this menu item are the review data base page and the review elements page.
SELECT D/BASE	-This menu item is selected to display additional data base modification pages which are used to configure the data base prior to being loaded with the data loader.
NEXT UPDATE	-A non-enterable cursor field which displays the greenwich date indicating when the next 28 day data base revision update is due.
LOAD D/BASE? *ON GROUND ONLY	-A flashing cursor field used to initiate a loading of the data base with the data loader. *AFTER D/BASE SELECT COMPLETE

(5) Review data base page. This page is used to review those regions of the world having data presently loaded in the data base. The world is divided into 10 regions all of which are displayed on this page. The data base cannot be modified, from this page.

SEL MENU ITEM:	-The number associated with the desired geographic region can be entered in this field to display the region's review elements page.

Directly below the SEL MENU ITEM:, the 10 regions display. The asterisk (*) denotes that data is presently loaded in the data base for that region. No asterisk (*) indicates that data for those regions have not been loaded in the data base.

(6) Review elements page. This page is used to review the navigational elements loaded in the data base for a particular region of the world. The data base cannot be modified from this page.

NAVAID*	-Navaids include VORTAC's, VOR/DME's, VOR's TACAN's DME's and ILS DME's. The asterisk (*) denotes that navaids for that region are presently loaded in the data base.
APT‡4000 FT *	-Airports having a hard surface runway at least 4000 feet in length. The asterisk (*) denotes that these airports are presently loaded in the data base.
APT‡3000 FT *	-Airports having a hard surface runway at least 3000 feet in length. Only one of the two airport elements may be selected. No asterisk (*) denotes the element is not presently contained in the data base.
RW THRESH OLD *	-Runway thresholds for which there exists verified latitude and longitude coordinates. No asterisk (*) denotes the element is not presently contained in the data base.
OUTER MKR	-Outer markers.
HI ALT WPT	-High altitude waypoints are named intersections which appear on high altitude enroute charts.
LO ALT WPT	-Low altitude waypoints are named intersections which appear on low altitude enroute charts.
SID/STAR	Standard instrument departure (SID) and standard terminal arrival route (STAR) waypoints and intersections.
APR INTRSC	-Approach intersections are named intersections which appear on instrument approach charts. They do not include outer markers since outer markers are a separate category.
MULT WPT	-Waypoints which are used for multiple functions. For example if a waypoint serves as both a low altitude waypoint and as an approach intersection it is considered a multiple waypoint. Also, multiple waypoints include on-airway NDB's. If any type of waypoint (HI ALT, LO ALT, SID/STAR, or APR INTRSC) is loaded in the data base the multiple waypoints are automatically included.

(7) Modify data base page. This page is used to select regions of the world from which data will be loaded in the data base. It is one of two pages used to configure the data base to the aircraft's specific requirements prior to using the data loader to actually load the data into the data base.

SEL MENU ITEM: -The number associated with the desired menu item can be entered in this field.

The regions of the world are the same as those on the review data base page. The meaning of the asterisk (*), however, is different. On this page the asterisk (*) denotes those regions of the world which will be loaded by the data loader. The asterisk (*) on the review data base page denotes those regions of the world which are currently loaded in the data base.

(8) Modify elements page. This page is used to select the navigation elements for a particular region of the world which will be loaded into the data base with the data loader.

BLKS AVAIL -The number of blocks of data base memory remaining (for entire data base, not just region being displayed). The number decreases each time an element below is selected.

NAVAID * -The data base elements listed are the same ones described on the review elements page. The number to the right of the element is the number of blocks required to store the element in the data base memory for the region of the world displayed. No numbers appear next to RW THRSHLD or OUTER MKR until one of the two APT (airport) elements has been selected. Whenever any or all of the waypoint elements (HI ALT WPT, LO ALT WPT, SID/ STAR, or APR INTRSEC) are selected, the MULT WPT is automatically included. MULT WPT cannot be selected unless at least one of the four waypoint elements is selected.

The asterisk (*) denotes those elements which are being selected to be loaded into the data base with the data loader. An element without an asterisk (*) has not been selected.

(9) Unused waypoints page. These pages display in alphabetical order the identifiers of user created waypoints that are not currently being used in any existing flight plan and are not in a protected status. If the system is put into system protect mode this page will also show protected waypoints which are not being used in any flight plan.

This page can be used to delete unused waypoints from the system by placing the cursor over the waypoint identifier and pressing the CLEAR key and then the ENTER key.

PREVIOUS PAGE? -A cursor field used to display the previous page of unused waypoints when there is more than one page of these waypoints.

NEXT PAGE? -A cursor field used to display the next page of unused waypoints when there is more than one page of these waypoints.

(10) User defined navaids page. These pages are used to view the identifiers of the navaids contained in the supplement data base memory which have been defined by the user. The identifiers are listed in alphabetical order. These pages are also used to delete these user navaids from the supplemental data base.

PREVIOUS PAGE? -A cursor field used to display the previous page of user defined navaids when there is more than one page of these navaids.

(11) User defined airports page. These pages are used to view the identifiers of airports contained in the supplemental data base memory which have been defined by the user. The identifiers are listed in alphabetical order. These pages are also used to delete user defined airports from the supplemental data base.

PREVIOUS PAGE? -A cursor field used to display the previous page of user defined airports when there is more than one page of these airports.

NEXT PAGE? -A cursor field used to display the next page of user defined airports when there is more than one page of these airports.

o. Navigation Displays.

(1) Pilot's HSI.

FMS -With FMS selected the KNS660 provides automatic course needle drive while using the AUTO/LEG method of operation. However, it will not provide course needle drive while using the OBS method of operation. In this case, the pilot must set the selected course manually either via the HSI course knob, located on the pedestal, or through the KNS-660 control unit. The course needle provides left/right steering information from the KNS-660. The DME display provides distance to the waypoint in nautical miles. Also, the DME slave indicator will display distance, ground speed in knots, and time to the station. The bearing pointer provides bearing information derived from either the ADF or the KNS-660 depending upon whether ADF or NAV respectively are selected by the RMI selector.

(2) Copilot's HSI.

FMS -The copilot's HSI operate's the same as the pilot's HSI with FMS selected except, it does not provide automatic course needle drive when in AUTO LEG mode and does not provide distance or bearing information.

NAV -With NAV selected the pilot must set the selected course manually via the HSI course knob, located on the pedestal. VOR/LOC/GS tuning is through the NAV 1 frequency control unit. Both VOR and LOC signals provide left/right steering information. The DME display provides distance to the station in nautical miles. Also, the DME slave indicator will display distance, ground speed in knots, and time to station. The bearing pointer provides bearing information derived from either the ADF 1 or the NAV 1 receiver depending upon whether ADF or NAV respectively are selected by the RMI selector.

(3) Pilot's and copilot's RMI.

FMS -With FMS selected, the single bar needle provides bearing information derived from either the ADF or the KNS-660 depending upon whether ADF or NAV respectively are selected on the RMI.

NAV -With NAV selected, the single bar needle provides bearing information derived from either the ADF or the NAV 1 receiver depending upon whether ADF or NAV respectively are selected on the RMI.

p. FMS Operating Procedures.

NOTE

Operation must be in conformity with the KNS-660 Pilot's Guide, P/N 0068394-00, dated November 15, 1984 or later.

(1) Turn on procedures.

(a) ON-OFF rocker switch Press top half. Allow 8 to 10 seconds for initial warmup.
(b) BRT-DIM rocker switch ADJUST screen brightness as desired.

(2) Self test.

(a) Self test page CHECK that SYSTEM OK is being displayed.

NOTE

If SYSTEM FAIL is displayed, turn the system off and then back on using the ON/OFF rocker switch. If SYSTEM FAIL continues to display, the system requires service and must not be utilized.

(b) Navigation instruments CHECK as prompted by self test page.

1 RMI pointer on 130°.
2 DME display reads 34.3 NM.
3 Course selector slewed to 315°.
4 Course deviation indicator displaying 3 dots right.
5 VNAV deviation indicating 3° up.

(c) Remote annunciators CHECK ON.

(d) ENTER key PRESS to verify satisfactory completion of self test page items.

(3) Initialization page.

CAUTION

Position accuracy in initialization is very important, since it is possible that the amount of initialization error will be carried by the system throughout the flight.

Either one of the following initialization procedures (A or B) may be used.

(a) Procedure A.

1. DATE: CHECK. If incorrect, enter the correct greenwich date in sequence (day-month-year).
2. GMT: CHECK. If incorrect, enter the correct greenwich time.
3. POS: CHECK the last known system generated position. If incorrect, procedure as follows:
   a. Cursor ↓ or ↑ key PRESS so that the cursor field appears over the WPT ID: data field.
   b. Known ICAO airport identifier or waypoint identifier INPUT.
   c. ENTER key PRESS to enter the identifier. The waypoint page will automatically display.
      (1) If the waypoint identifier is contained in system memory (waypoint latitude and longitude are listed on waypoint page).
   d. Cursor ↓ or ↑ key-PRESS, if necessary, to place cursor field over APPROVE?.
   e. ENTER key PRESS. The initialization page will again appear with the cursor over APPROVE?. Continue with step 4.
      (2) If the waypoint identifier is not contained in memory (no latitude or longitude entry and the cursor over REF NAME: field.
   f. REF NAME: INPUT the identifier of a navaid or location contained in system memory from which the new waypoint can be referenced.
   g. ENTER key PRESS to enter the identifier.
   h. RAD: INPUT the radial in degrees and tenths of a degree from the navaid or location in the REF NAME field to the waypoint being defined.
   i. ENTER key PRESS to enter the radial into memory.
   j. DIS: INPUT the distance to the nearest tenth of a nautical mile from the navaid or location in the REF NAME data field to the waypoint being defined.
   k. ENTER key PRESS to enter the distance into memory.
   l. ENTER key PRESS twice to advance the cursor to the APPROVE? field.

NOTE

Steps (a) thru (g) may be skipped and the latitude and longitude inputted directly, if known.

m. ENTER key PRESS to approve the waypoint page. The initialization page will appear with the cursor over APPROVE?.

4. EST GS:
   a. If on the ground verify that 0 is displayed.
   b. If in flight, PRESS cursor (↑) key to position cursor over EST GS: data field, input estimated ground speed, then PRESS ENTER.
5. APPROVE? - PRESS ENTER to approve all of the data on the initialization page and enter the data into memory. The first of the flight plan menu pages (FPLS) will now appear.

(b) Procedure B.

1. DATE: CHECK. If incorrect, enter the correct greenwich date in sequence day month-year.
2. GMT: CHECK. If incorrect, enter the correct greenwich mean time.
3. POS: CHECK the last known system generated position. If incorrect proceed as follows.
   a. Cursor ↓ or ↑ key PRESS so that the cursor appears over the latitude position.
   b. Latitude INPUT. Use North or South key first, followed by the known latitude in degrees, minutes and tenths of a minute.
   c. ENTER key PRESS to enter the latitude into memory.
   d. Longitude INPUT. Use East or West key first, followed by the known longitude in degrees, minutes and tenths of minute.
   e. ENTER key PRESS to enter the longitude into memory.
4. EST GS:.
   a. If on the ground, verify that 0 is displayed and PRESS ENTER.
   b. If in flight, INPUT estimated ground speed, then PRESS ENTER.
5. APPROVE? PRESS ENTER to approve all of the data on the initialization page and enter the data in memory. The first page of the flight plan menu (FPLS) will now appear.

NOTE

The configuration of the main data base can be reviewed at any time after initialization. Since so many of the system capabilities depend upon the data base it is important to review which geographic region and which navigational elements within these regions are actually loaded in the data base.

(4) Reviewing the data base.

CAUTION

The data base should be reviewed prior to takeoff, since the system cannot provide a navigation function while the data base is being loaded.

(a) DAT key PRESS as required to display the DATA 2 menu page.

(b) Menu item UPDATE D/BASE SELECT using the menu selection procedure. The UPDATE D/BASE page will display.
(c) Menu item REVIEW D/BASE SELECT. The REVIEW D/BASE page will display. Only the geographic regions followed by an asterisk (*) are presently contained in the main data base.
(d) Desired geographic region SELECT. The review elements page for the selected region will display. Only the geographic regions followed by an asterisk (*) are presently contained in the main data base.
(e) DAT key PRESS to return to the review data base page. Navigational elements stored for each of the other geographic regions with asterisks (*) can be viewed by repeating steps 4 and 5 as many times as necessary.

(5) Configuring the data base.

CAUTION

If the VOR and DME (TACAN) sensors are to be utilized, navaids for the geographic regions in which flight is to occur must be loaded in the data base.

NOTE

Since not all the worldwide data on the revision diskette can be contained at one time in the main data base, it is necessary to select which geographic regions and which navigational elements within these regions will be loaded into the data base.

NOTE

The data base does not need to be reconfigured if there are no configuration changes from the previous loading.

NOTE

The system must be turned on and initialization must be complete before configuring the data base.

(a) Data loader cover OPEN.
(b) Update diskette INSERT into data loader. The diskette will not lock into place if it is positioned incorrectly.
(c) DAT key - PRESS twice or as '' required to display the DATA 2 menu page.
(d) Menu item 5 SELECT as follows:
    1. Cursor ↑ or ↓ key PRESS to position cursor over item 5.
    2. ENTER key PRESS. The update data base page will display.
(e) Menu item 2 SELECT as follows:
    1. Cursor ↑ or ↓ key PRESS to position cursor over item 2.
    2. ENTER key PRESS. The modify data base page will display.
(f) Delete the geographic regions no longer required as follows:
    1. Cursor ↓ key PRESS to position over region.
    2. CLR key PRESS to delete the asterisk (*).
(g) Update data base for desired region.
    1. Menu item (region) desired SELECT as follows:
        a. Cursor ↑ or ↓ key PRESS to position cursor over menu item (region) desired.
        b. ENTER key PRESS. The modify elements page for that region will display. The number proceeding BLKS AVAIL, indicates blocks of data base memory remaining (for entire data base, not just for region selected).

NOTE

There are a total of 10,000 blocks of data base memory. These blocks can be filled with any combinations of geographic regions and navigational elements within those regions as long as the total blocks chosen do not exceed 10,000.

(h) Cursor ↓ or ↑ key PRESS, if necessary, to position over navaid to be updated.

(i) ENTER key PRESS.

(j) Repeat steps 9 and 10, as necessary, to update other navaids.

(k) DAT key PRESS once to return to the modify data base page. Asterisks (*) will now display to the right of regions updated.

(l) Repeat steps 1 through 10, as necessary, to update other desired geographic regions.

(m) DAT key PRESS as required to display the DATA 2 menu page.

(n) Menu item 5SELECT as follows:

1. Cursor ↑ or ↓ key PRESS to position over menu item 5.

2. ENTER key PRESS. The update data base page will now display.

(o) Cursor ↓ or ↑ key PRESS to position cursor over LOAD D/BASE?.

(p) ENTER key PRESS to initiate data base loading.

(q) Diskette reject button PUSH to unlock diskette. Remove diskette from data loader and close clear protective cover.

CAUTION

Leaving a update diskette inserted in the data loader for extended periods of time will cause excessive wear to occur to data loader. Also, failing to keep the clear protective cover closed could allow a foreign substance to enter, damaging the mechanism or electronics.

(6) Establishing operational status.

(a) OBS/LEG key PRESS as required to select method of operation.

(b) SNS key PRESS as required to select desired sensor.

(c) MOD key PRESS as required to select desired mode of operation.

NOTE

The OBS/LEG, SNS, and MOD keys will cause the control display to immediately reflect the operational status change. However, the system will not actually activate the new operational status for a period of one second. Repeated presses of these keys during this one second period will reset the delay back to one second.

Table 3-2. Methods of Operation

OBS METHOD OF OPERATION				
SENSOR	**BLEND**	**VOR**	**TACAN**	**OMEGA**
MODE	RNV ENR	RNV ENR	RNV ENR	RNV ENR
		RNV APR	RNV APR	
		NAV	NAV	
AUTO/LEG METHOD OF OPERATION				
SENSOR	**BLEND**	**VOR**	**TACAN**	**OMEGA**
MODE	RNV ENR	RNV ENR	RNV ENR	RNV ENR
		RNV APR*	RNV APR*	
*See below note.				

NOTE

Automatic navaid selection does not occur when operating the system in AUTO/LEG, VOR or TACAN, RNV APR. The pilot must specify a reference navaid for each waypoint in the reference name field of each waypoint page. This reference navaid is the particular navaid which the VOR navigation receiver and DME will be turned to when this waypoint is activated.

Section IV. TRANSPONDER AND RADAR

q. Shutdown Procedure.

(1) ON-OFF rocker switch Press lower half.

3-26. EMERGENCY PROCEDURES. If the KNS-660 system information is intermittent or lost, secure the system and utilize the remaining operational navigation equipment as required.

a. FMS/NAV CTL switch - Press. Verify NAV CTL illuminated.
b. CDU ON/OFF switch Off.
c. FMS circuit breaker Pull.

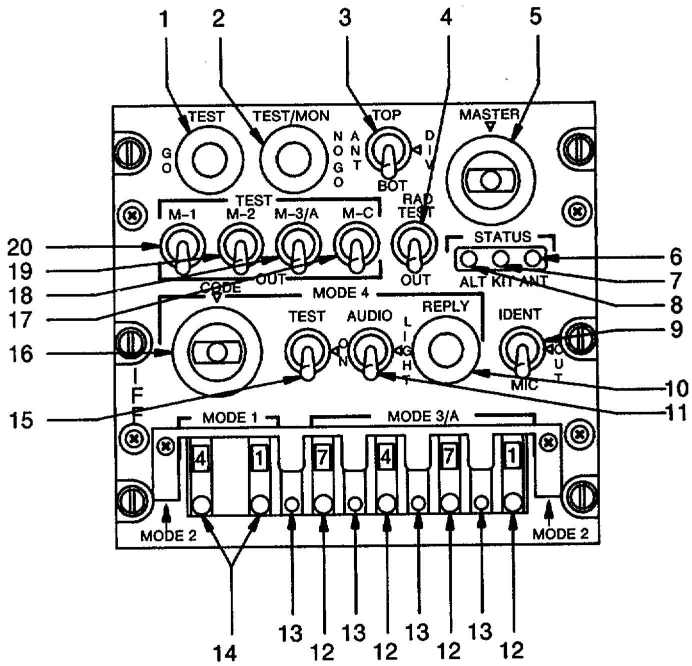
3-27. TRANSPONDER SET (AN/APX-100).

a. Description. The transponder system receives, decodes, and responds to interrogations from air traffic control (ATC) radar to allow aircraft identification, altitude reporting, position tracking, and emergency tracking. The system receives a radar frequency of 1030 MHz and transmits preset coded reply pulses on a radar frequency of 1090 MHz at a minimum peak power of 200 watts. The range of the system is limited to line-of-sight.

The transponder system consists of a combined receiver/transmitter control panel (fig. 3-20) located on the pedestal extension; a remote switch located on the pilot's control wheel; and two antennas located on the underside and top of the fuselage. The system is protected by a 3-ampere circuit breaker, placarded XPONDER located on the overhead circuit breaker panel (fig. 2-23).

b. Controls/Indicators and Functions.

(1) TEST-GO indicator. Illuminates to indicate successful completion of built-in-test (BIT).
(2) TEST-MON indicator. Illuminates to indicate system malfunction or interrogation by a ground station.
(3) ANT switch. Selects desired antenna for signal input.
(a) TOP. Selects upper antenna.
(b) DIV. Selects diverse (both) antennas.
(c) BOT. Selects lower antenna.
(4) RAD TEST-OUT switch. Enables reply to TEST mode interrogations from test set.
(5) MASTER CONTROL. Selects system operating mode.



1. TEST-GO Indicator
2. TEST/MON, NO GO Indicator
3. Antenna Switch
4. RAD TEST-OUT Switch
5. MASTER Control
6. STATUS ANT Indicator
7. STATUS KIT Indicator
8. STATUS ALT Indicator
9. IDENT MIC-OUT Switch
10. Mode 4 Reply Indicator
11. Mode 4 AUDIO-LIGHT-OUT Switch
12. Mode 3/A Code Selectors
13. Mode 2 Code Selectors
14. Mode 1 Code Selectors
15. Mode 4 TEST-ON-OUT Switch
16. Mode 4 Code Selector
17. M-C Test Switch
18. M-3/A Test Switch
19. M-2 Test Switch
20. M-1 Test Switch

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FIGURE 3-20. Transponder Control Panel (AN/APX-100)

(a) *OFF.* Deactivates system.
(b) *STBY.* Activates system warm-up (standby) mode.
(c) *NORM*. Activates normal operating mode.
(d) *EMER*. Transmits emergency reply code.

(6) *STATUS ANT indicator.* Illuminates to indicate the BIT or MON fault is caused by high VSWR in antenna.
(7) *STATUS KIT indicator.* Illuminates to indicate the BIT or MON fault is caused by external computer.
(8) *STATUS ALT indicator.* Illuminates to indicate the BIT or MON fault is caused by the altitude digitizer.
(9) *IDENT-MIC-OUT switch.* Selects source of aircraft identification signal.
(a) *IDENT*. Activates transmission of identification pulse (IP).
(b) *MIC*. Enables either control wheel POS IDENT switch to activate transmission of ident signal from transponder.
(c) *OUT*. Dis-allows outgoing signal.

(10) *MODE 4 reply indicator light.* Illuminates to indicate a reply has been made to a valid mode 4 interrogation.
(11) *MODE 4 AUDIO OUT switch.* Selects monitor mode for mode 4 operation.
(a) *AUDIO*. Enables sound and sight monitoring of mode 4 operation.
(b) *LIGHT*. Enables monitoring REPLY indicator for mode 4 operation.
(c) *OUT*. Deactivates monitor mode.

(12) *MODE 3/A code selectors*. Select desired reply codes for mode 3/A operation.
(13) *MODE 1 code selectors*. Select desired reply codes for mode 1 operation.
(14) *MODE 4 TEST-ON-OUT switch.* Selects test mode of mode 4 operation.
(a) *TEST*. Activates built-in-test of mode 4 operation.
(b) *ON.* Activates mode 4 operation.
(c) *OUT*. Disables mode 4 operation.

(15) MODE 4 code control. Selects preset ode 4 code.

(16) M-C, M-3A, M-2, and M-1 switches. Select test or reply mode of respective codes.

(17) TEST. Activates self-test of selected ode. Transponder can also reply

(18) ON. Activates normal operation.

(19) OUT. Deactivates operation of elected code.

(20) MODE 2 code selectors. Select desired reply codes for mode 2 operation. The cover mode select switches must be slid forward to display the selected mode 2 code.

(21) POS IDENT pushbutton (control wheels, fig. 2-16). When pressed, activates transponder identification reply.

c. Transponder Normal Operation.

(1) Turn-on procedure.

(a) MASTER switch STBY. Depending on the type of receiver installed, the TEST/MON NO GO indicator may illuminate. Disregard this signal.

(2) Test procedure.

NOTE

Make no checks with the master switch in EMER, or with M-3/A codes 7600 or 7700 without first obtaining authorization from the interrogating station(s).

(a) Allow set two minutes to warm up.
(b) Select codes assigned for use in modes 1 and 3/A by depressing and releasing the pushbutton for each switch until the desired number appears in the proper window.
(c) Lamp indicators Operate press-to-test feature.
(d) M-1 switch Hold in TEST. Observe that no indicator lights illuminate.
(e) M-1 switch Return to ON.
(f) Repeat steps 4 and 5 for the M-2, M-3/A and M-C mode switches.
(g) MASTER control NORM.
(h) MODE 4 code control A. Set a code in the external computer.
(i) MODE 4 AUDIO OUT switch OUT.

(3) Modes 1, 2, 3/A, and/or 4 operating procedure.

NOTE

If the external security computer is not installed, a NO GO light will illuminate any time the mode 4 switch is moved out of the OFF position.

(a) MASTER control - NORM.
(b) M-1, M-2, M-3/A, and/or MODE 4 ON-OUT switches - ON. Actuate only those switches corresponding to the required codes. The remaining switches should be left in the OUT position.
(c) MODE 1 Code selectors Set (if applicable).
(d) MODE 3/A code selectors Set (if applicable).
(e) MODE 4 Code control Set (if required).
(f) MODE 4 REPLY indicator Monitor to determine when transponder set is replying to a SIF interrogation.
(g) MODE 4 AUDIO OUT switch Set (as required to monitor Mode 4 interrogations and replies).
(h) MODE 4 Audio and/or indicator Listen and/or observe (for Mode 4 interrogations and replies).
(i) IDENT'-MIC-OUT switch Press to IDENT momentarily.
(j) MODE 4 TEST-ON-OUT switch TEST.
(k) Observe that the TEST GO indicator light illuminates.
(l) MODE 4 TEST-ON-OUT switch ON.
(m) ANT switch BOT.

(n) Repeat steps 4, 5, and 6. Observe that the TEST GO indicator illuminates.
(o) TOP-DIV-BOT-ANT switch TOP.
(p) Repeat step 14.
(q) TOP-DIV-BOT-ANT switch DIV.
(r) Repeat step 14.
(s) When possible, obtain the cooperation of an interrogating station to exercise the TEST mode. Execute the following steps:

1. RAD TEST-OUT switch RAD TEST.
2. Obtain verification from interrogating station that a TEST MODE reply was received.
3. RAD TEST-OUT switch OUT.

(4) Transponder set identification position operating procedure. The transponder set can make identification-position replies while operating in code modes 1, 2, and/or 3/A, in response to ground station interrogations. This type of operation is initiated by the operator as follows:

(a) Modes 1, 2, and/or 3/A - ON, as required.
(b) IDENT-OUT-MIC switch. Press momentarily to IDENT, when directed.

NOTE

Holding circuits within the transponder receiver-transmitter will transmit identification-position signals for 15 to 30 seconds. This is normally sufficient time for ground control to identify the aircraft's position. During the 15 to 30 second period, it is normal procedure to acknowledge via the aircraft communications set that identification-position signals are being generated.

NOTE

Set any of the M1, M2, M3/A, M-C, or MODE 4 switches to OUT to inhibit transmission of replies in undesired modes.

NOTE

With the IDENT-OUT-MIC switch set to the MIC position, the POS IDENT button must be depressed to transmit identification pulses.

(5) Shutdown procedure.

(a) To retain Mode 4 code in external computer during a temporary shutdown:

1. MODE 4 CODE switch Rotate to HOLD.
2. Wait 15 seconds.
3. MASTER control OFF.

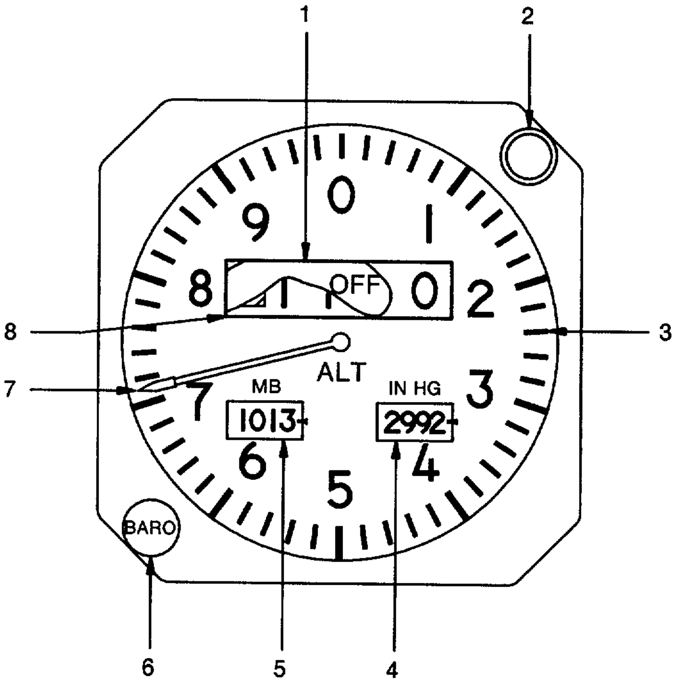
(b) To zeroize the mode 4 code in the external computer tun MODE 4 CODE switch to ZERO.
(c) MASTER control OFF. This will automatically zeroize the external computer unless codes have been retained (step 1. above).

d. Transponder Emergency Operation. Not applicable.

3-28. PILOT'S ALTIMETER (BA-141).

a. Description. The pilot's altimeter (fig. 3-21) provides a servoed counter drum/pointer display of barometrically corrected pressure altitude. In addition, it provides the transponder with altitude information for mode C operation. The barometric pressure (altimeter setting) is set manually with the BARO knob and displayed in units of inches mercury and millibars on counter-drum indicators. The altimeter is AC is powered through a 1-ampere circuit breaker, placarded PILOT ALTM (AC) located on the overhead circuit breaker panel (fig. 2-23).

b. Pilot's Altimeter Controls, Indicators, and Functions.



1. Failure Warning Flag
2. Altitude Alert Annunciator
3. Altitude Scale
4. Barometric Pressure Counter-Drum Indicator Window (Inches of Mercury)
5. Barometric Pressure Counter-Drum Indicator Window (Millibars)
6. Manual Barometric Pressure Setting Knob
7. Altitude Indicator Needle
8. Counter-Drum Altitude Display

Figure 3-21. Pilots Altimeter (BA-141)

WARNING

In the event of a total AC and DC electrical power loss, the warning flag will be in view, the altimeter will be inoperative, and the indicated altitude will remain as existed at the time of failure.

(1) Failure warning flag. A failure warning flag placarded OFF, comes into view to indicate that the altitude information is unreliable, however, the mode C information may be valid.

(2) Altitude alert annunciator. The altitude alert annunciator illuminates to provide a visual indication that the aircraft is within 1000 feet of the preselected altitude during the capture maneuver and extinguishes when the aircraft is within 250 feet of the preselected altitude. After capture, the ALT annunciator on upper right corner of pilot's altimeter and ALT ALERT annunciator in the annunciator block above the copilot's airspeed indicator will illuminate if the aircraft departs more than 250 feet from the selected altitude, and will extinguish when the aircraft has departed more than 1000 feet from the selected altitude.

(3) Barometric pressure and millibar counter-drum indicator windows. The barometric pressure and millibar counter-drum indicator windows, display barometric pressure in inches of mercury and millibars.

(4) Manual barometric pressure setting knob. The manual barometric pressure setting knob placarded BARO, is used to set the barometric pressure and millibar counter-drum indicators.

(5) Altitude indicator needle. The altitude indicator needle points to the altitude on the pointer display between 1000-foot levels, in 20-foot increments.

(6) Counter-drum altitude display. The counter drum displays altitude and is marked in 20foot increments. Altitudes below 10,000 feet are annunciated by a black and white crosshatch on the left-hand digit position of the counter display.

c. Operating Procedure.

(1) Barometric set knob Set desired altimeter setting.

(2) Warning flag Check not visible.

(3) Needle indicator Check operation.

NOTE

If the altimeter does not read within 70 feet of field elevation when the correct local barometric setting is used, the altimeter needs calibration or internal failure has occurred. An error of greater than 70 feet also nullifies use of the altimeter for IFR Flight.

3-29. WEATHER RADAR AND MULTIFUNCTION DISPLAY (ED-600).

WARNING

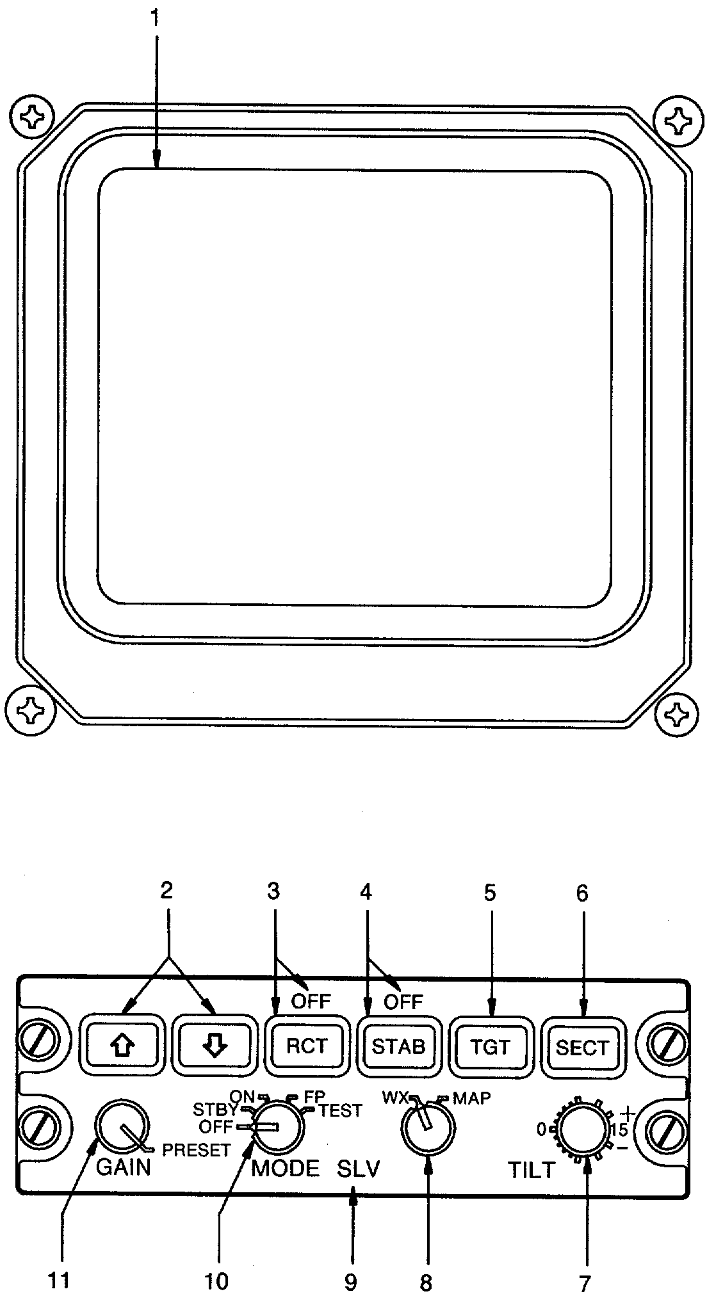
The radar system is intended for weather detection or ground mapping only, and is not intended nor should it be used or relied upon for proximity warning, anticollision, or terrain avoidance.

a. Description. The weather radar/ multifunction display (MFD) system provides long and short range navigation maps, checklists and weather radar. The system contains two controllers: The MFD controller provides for the selection and control of the MFD formats, modes, and waypoint designators. The weather radar controller selects the radar modes and adjustable quantities which may then be displayed on the radar screen. The system consists of a receiver-transmitter antenna (RTA), located in the radome, symbol generator located on the bottom shelf of the nose avionics compartment, the multifunction display (MFD) and radar controller, both of which are located in the center of the instrument panel (fig. 2-26), and the MFD controller (fig. 3-23) located on the pedestal extension (fig. 2-6). The radar is operated in conjunction with the multifunction display to provide a composite display of weather and navigation information. In the weather detection mode, the system gives the pilot a color visual indication of storm intensity.

Table 3-1 shows the relationship between the intensity levels displayed on the MFD and the National Weather Service VIP (video integrated processor) levels. In this mode, target returns are displayed at one of five video levels (0, 1, 2, 3 or 4), with level 0 represented by a black screen because of weak or no returns, and levels 1, 2, 3, or 4 represented by green, yellow, red, and magenta to show progressively stronger returns. In ground mapping mode, video levels of increasing reflectivity are displayed as black, cyan, yellow and magenta.

Table 3-3. Radar Display Levels Related to National Weather Service VIP Levels.

DISPLAY LEVEL	RAINFALL RATE (MN/HR)	RAINFALL RATE (INCHES/HR)	VIDEO INTEGRATED PROCESSOR (VIP) CATEGORIZATIONS			MAXIMUM CALIBRATED RANGE (NM) 12-INCH FLAT-PLATE
			STORM CATEGORY	VIP LEVEL	RAINFALL RATE (MN/HR) (INCHES/HR)	
4 MAGENTA	GREATER THAN 52	GREATER THAN 2.1	EXTREME	6	GREATER THAN 125	175
			INTENSE	5	50-125 (2-5)	
3 (RED) (0.5-1)	GREATER THAN 12 12-52	GREATER THAN 0.5 0.5-2.1	VERY STRONG	4	25-50 (1-2)	175
			STRONG	3	12-25	
2 (YELLOW)	4-12	0.17-0.5	MODERATE	2	2.5-12 (0.1-0.5)	175
1 (GREEN)	1-4	0.04-0.17	WEAK	0.25-2.5 1	(0.01-0.1)	175
0 (BLACK) BT00098	LESS THAN 1	LESS THAN 0.04				———



1. Multifunction Display
2. Range Switches
3. Range Echo Attenuation Compensation Technique Switch and Off Annunciator
4. Stabilization Switch and Off Annunciator
5. Target Alert Switch
6. Sector Selection Switch
7. Tilt Control
8. Weather/Map Selector Switch
9. Slave Annunciator (Not Used)
10. Mode Selector Switch
11. Gain Control

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Figure 3-22. Radar Control Unit (WC-650) and Multifunction display (ED-600)

(1) Multifunction display indicator (ED650). The multifunction display indicator (fig. 3-22), is an instrument panel mounted full-color digital display system. Both weather display, ground mapping, and text functions are provided. The inputs are displayed on the screen together with range, mode, and status alphanumerics to facilitate evaluation of the picture.

b. Radar Control Unit (WC-650). The radar control unit is located directly beneath the CRT indicator, and contains all controls necessary for operating the radar system. The radar system controls are described below.

(1) Range switches. The range switches are two alternate action pushbutton switches, one placarded with a down-pointing arrow and one placard with an up pointing arrow, which are used to select the radar operating range from 5 to 300 nautical miles full scale in the ON mode or 5 to 1000 nautical miles full scale in the flight plan mode. The up arrow pushbutton selects increasing ranges, and the down arrow pushbutton selects decreasing ranges.

(2) Rain echo attenuation compensation technique switch. This is a momentary alternate action pushbutton switch placarded RCT which activates the rain echo attentuation compensation technique circuity. Selecting the RCT mode activates a cyan colored background field which indicates ranges at which the radar receiver calibration has been exceeded. The rain echo attentuation compensation technique is active at all times in the WX mode to compensate for attentuation of the radar signal as it passes through a storm. This is accomplished by increasing the gain of the receiver as weather is detected. An OFF annunciator above the RCT switch indicates that the RCT circuitry has been disabled.

(3) Stabilization switch. The stabilization switch is a momentary alternate-action pushbutton switch placarded STAB, which permits disabling of stabilization inputs. When disabled, the OFF condition is annunciated above the switch. In this case pitch and roll inputs are assumed to be zero.

(4) Target alert switch. The target alert switch is a momentary alternate-action pushbutton switch placarded TGT, which selects the target alert function. TGT mode annunciates significant weather conditions within +7.5 degrees of dead ahead. Selecting TGT disables the variable gain rotary control.

(5) Sector selection switch. A momentary alternate-action pushbutton switch placarded SECT selects either full azimuth scan (120 degrees) or sector azimuth scan (60 degrees).

(6) Tilt control. The tilt control is a rotary control placarded TILT, which regulates antenna tilt between 15 degrees up and 15 degrees down. The range between §5 degrees and -5 degrees is expanded to allow more precise setting.

(7) Weather/map selector switch. The weather/map selector switch is a two-position rotary switch placarded WX/MAP, which selects weather or map display when the mode switch is in the ON position.

(8) Mode selector switch. The mode selector switch is a five-position rotary switch placarded MODE, OFF STBY ON FP TEST, which selects primary radar operating mode:

(a) OFF. Removes system power.

(b) STBY. Places system in nonoperational status.

(c) ON. Selects the WX or MAP weather display.

(d) FP. Selects system flight plan (navigation) display mode.

(e) TEST. Selects system self-test mode.

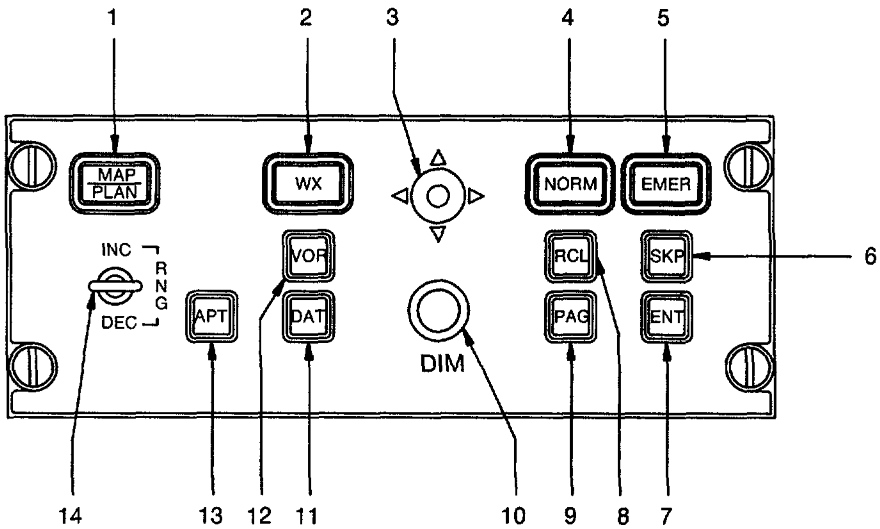
(9) Gain control. The gain control is a rotary control which regulates receiver gain. A detented PRESET position is provided at the full clockwise end of rotation. Full counterclockwise rotation sets minimum receiver gain. Full clockwise rotation (not into the detent) commands minimum gain of approximately 6 to 8 decibels higher than preset gain.

c. Multifunction Display Radar Graphics Control Unit (MC-800).

(1) Map/plan key. The map/plan key selects either the MAP or PLAN display mode. In MAP mode, radar sensitivity time control (STC) circuitry is disabled for ground mapping operations. In PLAN mode, a NAV PLAN format is selected. This mode is a -north up-mode in which the aircraft symbol is positioned with respect to the NAV route and progresses along the displayed route. Weather information is not displayed while in PLAN mode.

(2) Weather key. The weather key, placarded WX, adds weather information to the multifunction display.

(3) Cursor joystick. The cursor joystick positions the cursor on the multifunction display screen while in the MAP or PLAN mode. While the system is displaying the normal or emergency checklists, vertical actuation of the stick changes the active line while horizontal actuation controls paging. Right actuation selects the next page, left actuation selects the previous page.



1 Map/Plan Key
2 Weather Key
3 Cursor Joystick
4 Normal Checklist Key
5 Emergency Checklist Key
6 Skip Key
7 Enter Key
8 Recall Key
9 Page Key
10 Multifunction Display Brightness Control
11 Data Key
12 VOR Key
13 Airport Key
14 Range Control

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Figure 3-23. Multifunction Display Graphics Control Unit (MC-800)

(4) Normal checklist key. The normal checklist key, placarded NORM, provides entry into the multifunction display normal checklist mode.

(5) Emergency checklist key. The emergency checklist key, placarded EMER, provides entry into the multifunction display emergency checklist mode.

(6) Skip key. This key, placarded SKIP, moves the cursor to the next displayed waypoint in the MAP or PLAN mode or skips the active line in a checklist or index and advances the active selection to a subsequent line when text is being displayed on the MFD.

(7) Enter key. This key, pacarded ENT, enters the displayed designator position (LAT/LON) as a waypoint in place of a TO waypoint in the MAP or PLAN mode. In a text mode (checklist or index), actuation of the switch checks off a line in a checklist or selects an index line item for display.

(8) Recall key. This key, placarded RCL, recalls the cursor to it's home position when in MAP or PLAN mode. In a text mode (NORM or EMER checklist), actuation of this switch recalls the lowest numbered skipped line in a checklist.

(9) Page key. This key, placarded PAG advances the page and places the active line selection at the first line of the page.

(10) Multifunction display brightness control. This control, placarded DIM, controls multifunction display brightness.

(11) Data key. This key, placarded DAT, adds long range navigation information to the MFD MAP or PLAN displays.

(12) VOR key. This key, placarded VOR, adds VOR/DME symbols to the MFD MAP or PLAN displays.

(13) Range control. This control, placarded RNG, INC DEC, selects map range limits of 5, 10, 25, 50, 100, 200, 300, and 600 nautical miles. Movement of switch toward INC increases the selected range, while movement toward DEC decreases selected range. This switch is active only when WX is not selected for display. When WX is selected, range is controlled by the radar controller.

d. MFD Weather Radar Normal Operation.

WARNING

If the radar system is operated in any other mode other than standby while the aircraft is on the ground.

Direct the nose of the aircraft so that the antenna scan sector is free of large metallic objects such as hangars or other aircraft for a distance of 100 feet (30 meters), and tilt the antenna fully upwards.

Do not operate radar during refueling of aircraft or during refueling operations which are within 100 feet (30 meters).

Do not operate radar if personnel are standing too close to the 270 degree forward sector of the aircraft.

Output power is radiated in TEST mode.

(1) Initial control settings.

(a) Mode control OFF.
(b) Gain control Preset position.
(c) Tilt control + 15 degrees.

(2) Turn on procedure.

(a) Avionics master switch (overhead control panel, fig. 2-8) ON.
(b) Mode control (MFD radar control unit, fig. 3-22) STBY.

NOTE

When power is first applied, the radar will be in WAIT for 45 seconds to allow the magnetron to warm up.

(3) Weather radar operation.

(a) Weather/map switch-WX.
(b) Range switches-As required.

3-30. GROUND PROXIMITY ALTITUDE ADVISORY SYSTEM (GPAAS).

WARNING

The ground proximity altitude advisory system will provide little, if any, warning for flight into precipitous terrain approaching a sheer wall if there is little gradually rising terrain before reaching the steep terrain.

a. Description. The ground proximity altitude advisory system (GPAAS) is provided to aid the flight crew in terrain avoidance (fig. 3-24). The GPAAS is a completely automatic system (requiring no input from the crew) which continuously monitors the aircraft's flight path at altitudes of between 100 and 2000 feet above ground level (AGL).

The GPAAS computer processes the data and, when conditions warrant, selects the appropriate digitized voice advisory/warning message from its memory. This message is then announced over the pilot's and copilot's audio systems. If the condition is not corrected, the GPAAS will rearm, and will again announce and repeat the warning if the condition recurs. The GPAAS computer remains ready to announce a different message during the intervals between repetitions. All messages are disabled below 100 feet AGL. The GPAAS system receives 28 VDC power through a 1-ampere circuit breaker placarded G.P.A.A.S. POWER, located on the instrument panel.

(1) GPAAS switch-indicator lights. A switch-indicator is located on the instrument panel. The upper half of the switch-indicator (yellow) is placarded VOICE OFF. The lower half is an indicator (red) only and is placarded VA FAIL. Depressing the upper (VOICE OFF) switch indicator disables the GPAAS voice advisory, and illuminates the VOICE OFF indicator light. The VA FAIL annunciator light (red) will illuminate when the GPAAS fails.

(2) GPAAS volume control. A GPAAS volume control placarded VOL, located on the instrument panel, controls the audio volume of the GPAAS advisory/warning messages down to a certain minimum level.

(3) GPAAS Aural Warning Indications. The following is a list of aural indications. Due to the possibility of activating more than one condition at a time, a warning priority has been established. The highest priority message will be announced first. If a higher priority item is received after a message is started, voice annunciation of the higher priority message shall be announced after a lower priority message in progress at the end of the message segment. It will not stop in the middle of a word. On messages that are repeated three times at four second intervals, the priority list will be scanned for higher priority messages and will insert them in the interval between the messages. The messages provided by the system are listed in descending order of priority as follows:

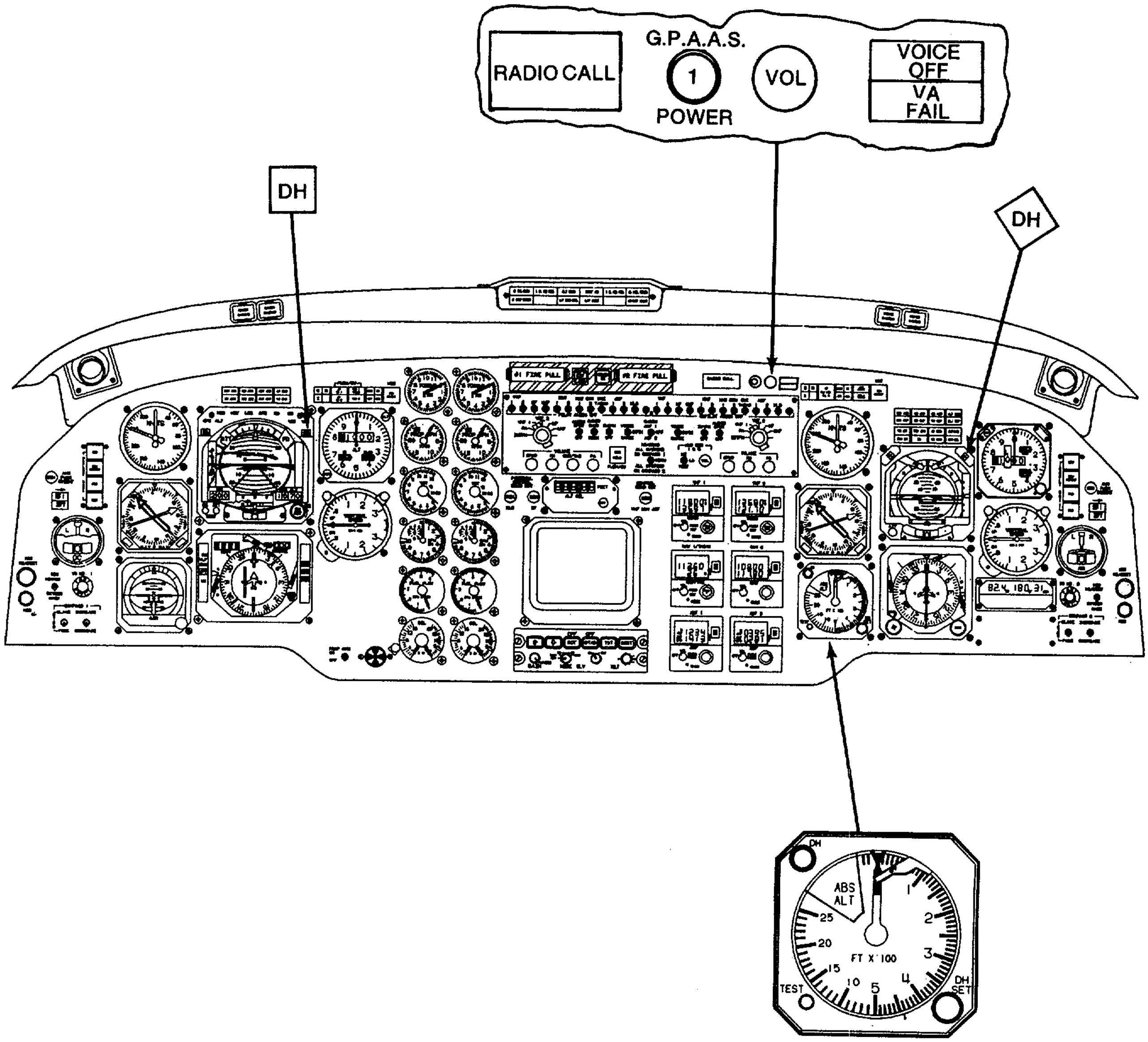

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Figure 3-24. Ground Proximity Altitude Advisory System Controls and Indicators.

1. "Two thousand" at 2000 feet AGL.
2. "One thousand" at 1000 feet AGL.
3. "Nine hundred" at 900 feet AGL.
4. "Eight hundred" at 800 feet AGL.
5. "Seven hundred" at 700 feet AGL.
6. "Six hundred" at 600 feet AGL.
7. "Five hundred" at 500 feet AGL.
8. "Check gear" will be announced immediately after 500 foot announcement if gear is not down.
9. "Four hundred" at 400 feet AGL.
10. "Check gear" will be announced immediately after 400 foot announcement if gear is not down.
11. "Three hundred" at 300 feet AGL.
12. "Check gear" will be announced immediately after 300 foot announcement if gear is not down.
13. "Two hundred" at 200 feet AGL.
14. "Check gear" will be announced immediately after 200 foot announcement if gear is not down.
15. "One hundred" at 100 feet AGL.
16. "Check gear" will be announced immediately after 100 foot announcement if gear is not down.
17. "Minimum, minimum" at decision height.
18. "Localizer" at 1.3 to 1.5 dots either side of center of beam. Will be repeated three times at four second intervals.
19. "Glideslope" at 1.3 to 1.5 dots above or below center of beam. Will be repeated three times at four second intervals.
20. "Altitude, altitude" at excessive deviation from altitude selected on the altitude alerter.
21. "Check trim" when trim failure has occurred. Will be repeated three times at four second intervals.
22. "Autopilot" when autopilot has disconnected.

The highest priority message will be announced first. If a higher priority item is received after a message has been started, voice annunciation of the higher priority message shall immediately override the lower priority message in progress at the end of the message segment. It will not stop in the middle of a word. On messages that are repeated three times at four second intervals, the priority list will be scanned for higher priority messages. If found, they will be inserted into the interval between the messages.

b. Normal Operation.

(1) Turn-on procedure. The GPAAS is operable when the following conditions have been met:

1. Battery switch ON.
2. Avionics master switch On.
3. G.P.A.A.S. POWER circuit breaker SET.
4. RADIO ALTM circuit breaker SET.
5. VA FAIL annunciator light Extinguished.

(2) GPAAS ground check.

1. GPAAS voice advisory VOL control Full clockwise.
2. VOICE OFF switch-indicator Extinguished.
3. Audio control panel Set listening audio level.
4. VA FAIL annunciator light Extinguished.
5. Radio altimeter DH SET control Set to 200 feet.
6. Radio altimeter TEST switch Press and hold. "Minimum, minimum" will be annunciated once followed by the illumination of the VA FAIL light.
7. Radio altimeter TEST switch Release.

c. GPAAS Modes of Operation. The GPAAS operates in the following modes of operation:

(1) Aural "TWO THOUSAND" advisory (mode 1). The aural advisory "TWO THOUSAND" indicates that the aircraft is at a radio altitude of 2000 feet above ground level. This advisory is cancelled when valid information from the radio altimeter is lost, during climb, or whenever the aircraft is out of the operating altitude range of the radio altimeter.

(2) Hundred foot increment aural altitude advisories (mode 2). The aural advisories "ONE THOUSAND, NINE HUNDRED, EIGHT HUNDRED, SEVEN HUNDRED, SIX HUNDRED, FIVE HUNDRED, FOUR HUNDRED, THREE HUNDRED, TWO HUNDRED, ONE HUNDRED" indicate that the aircraft is at the associated radio altitude in feet above ground level. This advisory is cancelled when valid information from the radio altimeter is lost, during climb, or whenever the aircraft is out of the operating altitude range of the radio altimeter.

(3) Aural "LOCALIZER" advisory (node 3). The aural advisory "LOCALIZER" indicates that

the aircraft has deviated from the center of the localizer beam in excess of 1.3 to 1.5 dots. The localizer advisory is armed when a valid localizer signal is detected and the aircraft is below 1000 feet above ground level. It will be repeated no more that 3 times at 4 second intervals unless the aircraft is returned to less than 1.3 to 1.5 dots from the center of the localizer course. The localizer advisory is disabled when a valid localizer signal has been lost, during climb, below the decision height set on the radio altimeter, or if the navigation receiver is not tuned to a localizer frequency.

(4) Aural "CHECK GEAR" advisory (mode 4). The aural "CHECK GEAR" advisory indicates that the aircraft has descended to 500 feet AGL and the landing gear is not down. This advisory is repeated once at 100 foot intervals down to 100 feet AGL.

(5) Aural "GLIDESLOPE" advisory (mode 5). The aural advisory "GLIDESLOPE" indicates that the aircraft has exceeded 1.3 to 1.5 dots above or below the center of the glideslope beam. The glideslope advisory is armed when a valid glideslope signal is detected and the aircraft is below 1000 feet AGL. It will be repeated no more than three times at 4 second intervals unless the aircraft is returned to less than 1.3 to 1.5 dots from the center of the beam. The glideslope advisory is disabled upon loss of a valid glideslope signal, during climb, on a localizer back course, below the decision height set on the radio altimeter or, if the navigation receiver is not tuned to a localizer frequency. This advisory is inhibited by the weight on wheels strut switch.

(6) Aural advisory "MINIMUM, MINIMUM" (mode 6). The aural advisory "MINIMUM, MINIMUM" indicates that the aircraft is at the radio altitude selected by the crew with the radio altimeter indicator decision height knob. This advisory is cancelled when valid information from the radio altimeter is lost, during climb, whenever the aircraft is above 1000 feet AGL, or whenever the aircraft is out of the operating altitude range of the radio altimeter.

(7) Aural "ALTITUDE, ALTITUDE" advisory (mode 7). The aural advisory "ALTITUDE, ALTITUDE" indicates the approach to a preselected altitude as the aircraft reaches a point 1000 feet from the selected altitude or, after reaching the selected altitude, when the aircraft deviates more than 250 feet from the selected altitude.

(8) Aural "CHECK TRIM, CHECK TRIM, CHECK TRIM" advisory. The aural advisory "CHECK TRIM, CHECK TRIM, CHECK TRIM" indicates that the autopilot has had a trim failure.

(9) Aural "AUTOPILOT" advisory. The aural advisory "AUTOPILOT" indicates that the autopilot has disengaged.

d. Emergency procedures. If an emergency or malfunction makes it necessary to disable the GPAAS, pull the G.P.A.A.S. POWER circuit breaker located on the instrument panel (GPAAS audio may be turned off by depressing the VOICE OFF switch).

CHAPTER 4
MISSION EQUIPMENT

This aircraft is not equipped with mission equipment.

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CHAPTER 5
OPERATING LIMITS AND RESTRICTIONS

SECTION I. GENERAL

5-1. PURPOSE.

This chapter identifies or refers to all important operating limits and restrictions that shall be observed during ground and flight operations.

5-2. GENERAL.

The operating limitations set forth in this chapter are the direct result of design analysis, test, and operating experiences. Compliance with these limits will allow the pilot to safely perform the assigned missions and to derive maximum utility from the aircraft. Limits concerning maneuvers, weight, and center of gravity are also covered in this chapter.

5-3. EXCEEDING OPERATIONAL LIMITS.

Anytime an operational limit is exceeded an appropriate entry shall be made on DA Form 240813. Entry shall state what limit or limits were exceeded, range, time beyond limits, and any additional data that would aid maintenance personnel in the maintenance action that may be required.

5-4. MINIMUM CREW REQUIREMENTS.

The minimum crew required for flight is two pilots. Additional crewmembers as required will be added at the discretion of the commander, in accordance with pertinent Department of the Army regulations. MACOMs may authorize maintenance test flights to be conducted with one qualified pilot at the pilot's station, and a trained technical observer at the copilot's station, in day visual meteorological conditions only.

SECTION II. SYSTEM LIMITS

5-5. INSTRUMENT MARKINGS.

Instruments which display operation limitations are illustrated in figure 5-1. The operating limitations are color coded on the instrument faces. Color coding of each instrument is explained in the illustration.

5-6. INSTRUMENT MARKING COLOR CODES.

Operating limitations and ranges are illustrated by the colored markings which appear on the dial faces of engine, flight, and utility system instruments. RED markings indicated the limit above or below which continued operation is likely to cause damage or shorten life. The GREEN markings indicate the safe or normal range of operation. The YELLOW markings indicate the range when special attention should be given to the operation covered by the instrument. Operation is permissible in the yellow range, but should be avoided. WHITE marking on the instruments indicate flap operating range. The BLUE marking on the airspeed indicator indicates best rate of climb with one engine inoperative, at maximum gross weight, forward gross loadingc.g., sea level standard day conditions.

5-7. INSTRUMENT GLASS ALIGNMENT MARKS.

Limitation markings consist of strips of semitransparent color tape which adhere to the glass outside of an indicator dial. Each tape strip shall align to increment marks on the dial face so correct operating limits are portrayed. The pilot should occasionally verify alignment of the glass to the dial face. For this purpose, some engine instruments which have limitation markings shall have short, vertical white alignment marks extending from the bottom part of the dial glass onto the fixed base of the indicator. These slippage marks appear as a single vertical line when limitation markings on the glass properly align with reading increments on the dial face. However, the slippage marks appear as separate radial lines when a dial glass has rotated.

TORQUE

49% MAXIMUM BELOW 1600 RPM

20-100% NORMAL OPERATING RANGE

100% MAXIMUM
123% TRANSIENT (5 SECONDS)

TURBINE TACHOMETER (N1 SPEED)

52% CD MINIMUM LOW IDLE
56% F MINIMUM LOW IDLE
88% MAXIMUM REVERSE (ONE MINUTE)
101.5% MAXIMUM
100.1% MAXIMUM BELOW − 48°C
102.6% TRANSIENT (10 SECONDS)

TURBINE GAS TEMPERATURE CDF

CD 400-750°C NORMAL OPERATING RANGE
F 400-800°C NORMAL OPERATING RANGE
660°C MAXIMUM LOW IDLE
725°C MAXIMUM CRUISE
725°C MAXIMUM CRUISE CLIMB

CD 750°C MAXIMUM CONTINUOUS
F 800°C MAXIMUM CONTINUOUS
CD 750°C MAXIMUM REVERSE (1 MINUTE)

850°C MAXIMUM TRANSIENT
1000°C MAXIMUM STARTING (5 SECONDS)

Figure 5-1. Instrument Markings and Operating Limits (Sheet 1 of 4).

OIL TEMPERATURE AND PRESSURE CDF

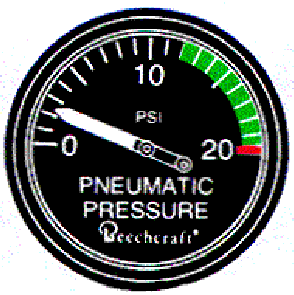
OIL TEMPERATURE SCALE

- (Green) 10-99°C NORMAL OPERATING RANGE
  0-99°C CRUISE CLIMB AND RECOMMENDED SPEED
  – 40-99°C STARTING, LOW IDLE, HIGH IDLE
- (Red) 99°C MAXIMUM
  104°C TRANSIENT (5 MINUTES)

OIL PRESSURE SCALE

- (Red) 60 PSI MINIMUM
  60 TO 85 PSI, 49% TORQUE MAXIMUM
- (Green/Yellow) CD 85-135 PSI NORMAL OPERATING ABOVE 21,000 FEET
  F 85-100 PSI NORMAL RANGE ABOVE 21,000 FEET
  CD 85-105 PSI CAUTION RANGE BELOW 21,000 FEET
  F 85-100 PSI CAUTION RANGE BELOW 21,000 FEET
- (Green) CD 105-135 PSI NORMAL OPERATING BELOW 21,000 FEET
  F 100-135 PSI NORMAL OPERATING BELOW 21,000 FEET
- (Red) 200 PSI MAXIMUM STARTING WITH COLD OIL

NOTE: 10 PSI FLUCTUATIONS ARE ACCEPTABLE



PNEUMATIC PRESSURE

- (Green) 12-20 PSI NORMAL OPERATING RANGE
- (Red) 20 PSI MAXIMUM

PROPELLER DEICER AMMETER

- (Green) 14-18 AMPERES NORMAL OPERATION

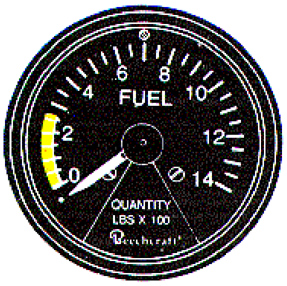
PROPELLER TACHOMETER

- (Green) 1600-2000 RPM NORMAL OPERATING RANGE
  1900 RPM MAXIMUM REVERSE (1 MINUTE)
- (Red) 2000 RPM MAXIMUM
  2200 RPM TRANSIENT (5 SECONDS)

G
Y
R

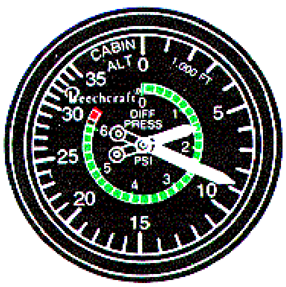
AP012654

Figure 5-1. Instrument Markings and Operating Limits (Sheet 2 of 4).



FUEL QUANTITY

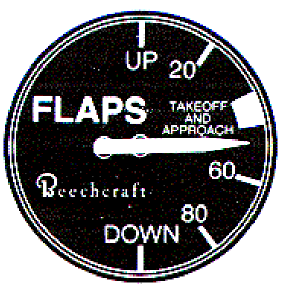
0-265 LBS NO TAKEOFF RANGE



CABIN ALTIMETER AND DIFFERENTIAL PRESSURE

0-6.1 PSI NORMAL RANGE

6.1 PSI MAXIMUM

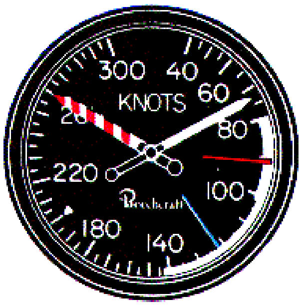


FLAP POSITION INDICATOR

40% TAKEOFF AND APPROACH

R
Y
G

Figure 5-1. Instrument Markings and Operating Limits (Sheet 3 of 4).



AIRSPEED INDICATOR C

260 KCAS MAXIMUM (Vmo) (260 KIAS .52 MACH)

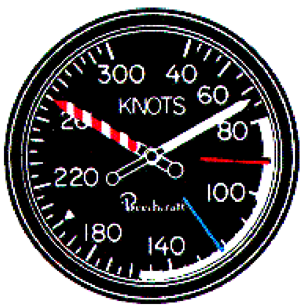
NOTE
MAXIMUM ALLOWABLE AIRSPEED (RED STRIPED) POINTER IS SELF ADJUSTING WITH ALTITUDE

91 KCAS (86 KIAS) MINIMUM SINGLE-ENGINE CONTROL SPEED (Vmca)

122 KCAS (121 KIAS) ONE-ENGINE INOPERATIVE BEST RATE-OF-CLIMB (Vyse)

80-144 KCAS (75-143 KIAS) FULL FLAP OPERATING RANGE

200 KCAS (199 KIAS) MAXIMUM APPROACH FLAP EXTENSION SPEED



AIRSPEED INDICATOR D F

260 KCAS MAXIMUM (Vmo) (260 KIAS .52 MACH)

NOTE
MAXIMUM ALLOWABLE AIRSPEED (RED STRIPED) POINTER IS SELF ADJUSTING WITH ALTITUDE

91 KCAS (86 KIAS) MINIMUM SINGLE-ENGINE CONTROL SPEED (Vmca)

122 KCAS (121 KIAS) ONE-ENGINE INOPERATIVE BEST RATE-OF-CLIMB (Vyse)

D 80-155 KCAS (75-154 KIAS) FULL FLAP OPERATING RANGE
F 75-157 (KIAS) FULL FLAP OPERATING

200 KCAS (199 KIAS) MAXIMUM APPROACH FLAP EXTENSION SPEED

R
B

AP012655

Figure 5-1. Instrument Markings and Operating Limits (Sheet 4 of 4).

5-8. PROPELLER LIMITATIONS.

The maximum propeller overspeed limits is 2200 RPM. Propeller speeds above 2000 RPM indicate failure of the constant speed (primary) governor. Propeller speeds above 2080 RPM indicate failure of both primary and overspeed governors. Torque is limited to 81%, for sustained operation above 2000 RPM.

5-9. STARTER LIMITATIONS.

The starters in this aircraft are limited to an operating time of 40 seconds on, then 60 seconds OFF, for two starter operations. After two starter operations the starter shall be operated for 40 seconds on, then 30 minutes OFF.

5-10. AUTOPILOT LIMITATIONS.

a. A pilot must be seated at the controls with the seat belt fastened when the autopilot is in operation.
b. Operation of the autopilot and yaw damper is prohibited during takeoff and landing, and below 200 feet above terrain. Maximum speed for autopilot operation is 260 knots/0.52 Mach.
c. During coupled ILS approach do not operate-the propellers in the 1750 to 1850 RPM range.

5-11. FUEL SYSTEM LIMITS.

NOTE

Aviation gasoline (AVGAS) contains a form of lead which has an accumulative adverse effect on gas turbine engines. The lowest octane AVGAS available (less lead content) should be used. If any AVGAS is used the total operating time must be entered on DA Form 2408-13.

a. Operating Limits. Operation with FUEL PRESS light on is limited to 10 hours. Log FUEL PRESS light on time on DA Form 2408-13. One standby boost pump may be inoperative for takeoff. Crossfeed fuel will not be available from the side with the inoperative standby boost pump. Operation on aviation gasoline is time limited to 150 hours between engine overhaul and altitude limited to 20, 000 feet with one standby boost pump inoperative. Crossfeed capability is required for climb, when using aviation gasoline above 20,000 feet.
b. Fuel Management. Fuel shall not be added to auxiliary tanks unless the corresponding main tank is full. Maximum allowable fuel imbalance is 1000 LBS. Do not take off if fuel quantity gages indicate in yellow arc (less than 265 LBS. of fuel in each main tank). Crossfeed only during single engine operation.
c. Fuel System Anti-lcing. Icing inhibitor conforming to MIL-1-27686 (PRIST) shall be added to commercial fuel, not containing an icing inhibitor, during fueling operations, regardless of ambient temperatures. The additive provides anti-icing protection and also functions as a biocide to kill microbial growth in aircraft fuel systems.

5-12. LANDING GEAR CYCLING AND BRAKE DEICE LIMITATIONS.

a. Hydraulic Landing Gear ***D2 1*** While U conducting training operations, the landing gear cyclic rate shall not exceed 5 complete (extension and retraction) cycles equal spaced in 20 minutes, without allowing a 10 to 15 minute interval between the 20 minute time groupings. It is suggested the cycle rate should not exceed 10 cycles equal spaced in one (1) hour. This rate is to keep the power pack motor operations within an intermittent duty class.
b. Brake Deice Limitations. The following limitations apply to the brake deice system:

1. The brake deice system shall not be operated at ambient temperatures above 15"C.
2. The brake deice system shall not be operated longer than 10 minutes (one timer cycle) with the landing gear retracted. If operation does not automatically terminate approximately 10 minutes after gear retraction, turn the brake deice switch OFF.
3. Maintain 85% N. or higher during simultaneous operation of brake deice and surface deice systems. If adequate pneumatic pressure cannot be provided for simultaneous operation of the brake deice and surface deice systems, turn OFF the brake deice system.
4. The brake deice system shall be turned OFF during single engine operation, in order to maintain an adequate supply of systems pneumatic bleed air.

5-13. PNEUMATIC SURFACE DEICE BOOTS LIMITATIONS.

The pneumatic surface deice system shall not be operated when ambient temperatures are below -40"C. Permanent damage to the deice boots can occur.

Table 5-1. Engine Operating Limitations

NOTE

The following limitations shall be observed. Each column presents limitations. The limits presented do not necessarily occur simultaneously. Whenever operating limits are exceeded the pilot will record the value and duration of the condition encountered on DA Form 2408-13.

OPERATING CONDITION	TORQUE PERCENT (1)	MAXIMUM OBSERVED TGT °C	GAS GENERATOR RPM N_1 (2) RPM		GAS GENERATOR RPM N_1 (2) %	PROP RPM N_2	OIL PRESS PSI (3)	OIL TEMP °C (4)(5)
STARTING	—	1000 (6)	—		—	—	—	-40 (min)
MINIMUM IDLE	—	660***CD*** 750***F***	19.500 21.000	(7)	52***CD*** 56 ***F***	—	60 (min)	-40 to 99
TAKEOFF AND MAX CONTINUOUS (8)	100	750***CD*** 800***F***	38,100		101.5	2000	105-135***CD*** 100-135***F***	10 to 99 ***CD*** 0 to 99***F'***
NORMAL CLIMB AND CRUISE (9)	—	725***CD*** 770***F***	—		—	—	—	—
MAX REVERSE (10)	—	750	—		—	1900	105-135***CD*** 100-135***F***	0 to 99
TRANSIENT	123 (6)	850	38,500	(11)	102.6	2200 (6)	—	0 to 104 (5)

NOTES

(1) Torque limit applies within range of 1600-2000 propeller (N_2) rpm. Below 1600 rpm torque is limited to 49%. Above 2000 rpm. torque is limited to 81%

(2) Below -48C (-55°F) ambient temperature the maximum allowable N_1 is reduced by 1.6%.

(3) Normal takeoff and max continuous oil pressures are 105 to 135 psig CD (100 to 135 psig F) at gas generator speeds (N_1) greater than 27.000 rpm (72%) with oil temperature between 60°C and 71°C. Above 21,000 feet the minimum oil pressure is 85 psig.

Oil pressure between 60 and 85 psig should be tolerated only for the completion of the flight; and then oly with a poser setting not exceeding 49% torque.

Oil pressures below 60 psig are unsafe and require either the engine be shut down or a landing be made as soon as possible. using minimum power required to sustain flight.

During extreme cold starts. oil pressure may reach 200 psig. Fluctuations of ±10 psig are acceptable.

(4) A minimum of 74°C to 80°C (165°F to 176°F) is recommended. A minimum oil temperature of 55°C (130°F) is recommended for fuel heater operation at takeoff.

(5) Oil temperature limits are -40°C to 99°C (40°F to 210°F) with limited times of five minutes at 104°C (220°F).

(6) These values are time limited to 5 seconds.

(7) Advance power levers to maintain this value.

(8) The maximum power available from the engine for takeoff and for emergency use at the pilot's discretion.

(9) Continued operation above recommended TGT limits will reduce engine life.

(10) These values arc time limited to 1 minute.

(11) These values arc time limited to 10 seconds.

Section III. POWER LIMITS

5-14. ENGINE LIMITATIONS.

Operation of the engines is monitored by instruments, with the operating limits marked on the face of each instrument.

CAUTION

Engine operation using only the engine driven fuel pump without boost pump fuel pressure is limited to 10 cumulative hours. All time in this category shall be entered on DA Form 2408-13 for the attention of maintenance personnel.

CAUTION

Use of aviation gasoline is time-limited to 150 hours of operation during any Time-Between-Overhaul (TBO) period. It may be used in any quantity with primary or alternate fuel.

NOTE

Aviation gasoline (AVGAS) contains a form of lead which has an accumulative adverse effect on gas turbine engines. The lowest octane AVGAS available (less lead content) should be used. If any AVGAS is used the total operating time must, be entered on DA Form 2408-13.

5-15. OVERTEMPERATURE AND OVERSPEED LIMITATIONS.

a. Whenever the limiting temperatures listed in the Engine Operating Limitations Table are exceeded and cannot be controlled, by retarding the power levers, the engine will be shut down or a landing made as soon as possible.

b. During engine starting the temperatures and time limits listed in the Engine Operating Limitations Table must be observed. When these limits are exceeded, the incident will be entered as an engine discrepancy in the appropriate maintenance forms. It is particularly important to record the amount and duration of overtemperature.

c. Whenever the prescribed engine overspeed limit or engine RPM operating limit is exceeded, the incident must be reported as an engine discrepancy in the appropriate maintenance forms. It is particularly important to record the maximum percent of RPM registered by the tachometer, and the duration of overspeed.

d. Continued operation above 725°C IS; 770°C for F models, TGT will reduce engine life.

5-16. POWER DEFINITIONS FOR ENGINE OPERATION.

Takeoff and Maximum Continuous The maximum power available from the engine for takeoff, and for emergency use at the pilot's discreation.

5-17. AMBIENT TEMPERATURE TAKEOFF LIMITATION.

A limitation based on pressure altitude and ambient temperature prohibits aircraft takeoff under certain high ambient temperature conditions.

5-18. GENERATOR LIMITS.

Maximum generator load is limited to 100% for flight and 85% during ground operations. Observe the limits shown in table 5-2 during ground operation.

Table 5-2. Generator Limits C D

GENERATOR LOAD	MINIMUM GAS GENERATOR RPM N_1	
	WITHOUT AIR CONDITIONING	*WITH AIR CONDITIONING
0% to 70%	52%	61%
70% to 75%	55%	61%
75% to 80%	60%	61%
80% to 85%	65%	65%

*Right engine only, after stabilized.

Table 5-2. Generator Limits I

GENERATOR LOAD	MINIMUM GAS GENERATOR RPM N_1 WITHOUT AIR CONDITIONING	*WITH AIR CONDITIONING
0% to 75%	56%	62%
75% to 80%	60%	62%
80% to 85%	65%	65%

*Right engine only, after stabilized.

Maximum generator load is limited to 100% for flight and 85% during ground operations. Observe the limits shown in table 5-2 during ground operation.

Section IV. LOADING LIMITS

5-19. CENTER OF GRAVITY LIMITATIONS.

Center of gravity limits and instructions for computation of the center of gravity are contained in Chapter 6. The center of gravity range will remain within limits, providing the aircraft loading is accomplished according to instructions in Chapter 6.

5-20. WEIGHT LIMITATIONS.

The maximum gross weight is 12,500 pounds for takeoff and landing. Maximum ramp weight is 12, 590 pounds. Maximum zero fuel weight is 10,400 I pounds C D F1; 11,000 pounds F2

Section V. AIRSPEED LIMITS MAXIMUM AND MINIMUM

5-21. AIRSPEED LIMITATIONS.

Airspeed indicator readings contained in procedures, text, and illustrations throughout thisOperator's Manual are given as indicated airspeed (IAS). Airspeed indicator markings (fig. 5-1) and placarded airspeeds, located on the cockpit overhead control panel (fig. 2-8), are calibrated airspeeds (CAS) for C D models, and indicated airspeeds (IAS) for F model aircraft. Airspeed Calibration Charts are provided in Chapter 7.

5-22. MAXIMUM ALLOWABLE AIRSPEED.

The maximum allowable airspeed is 260 KIAS/0.52 Mach.

5-23. LANDING GEAR EXTENSION SPEED.

The airspeed limit for extending the landing gear and for flight with the landing gear extended is C D 181 KIAS; F 182 KIAS.

5-24. LANDING GEAR RETRACTION SPEED.

The airspeed limit for retracting the landing gear is 163 KIAS.

5-25. WING FLAP EXTENSION SPEEDS.

The airspeed limit for APPROACH extension (40%) of the wing flaps is 199 KIAS. The airspeed limit for full DOWN extension (100%) of the wing flaps is: C 143 KIAS; D 154 KIAS; F 157 KIAS. If wing flaps are extended above these speeds, the flaps or their operating mechanism may be damaged.

5-26. LANDING LIGHTS EXTENSION SPEED C.

The airspeed limit for extending the landing lights and for flight with the landing lights extended is 150 KIAS.

5-27. MINIMUM SINGLE-ENGINE CONTROL AIRSPEED (V_{MC}).

The minimum single-engine control speed (V_{MC}) at sea level standard conditions is 86 KIAS.

NOTE

Single engine stall speed may be higher than V_{MC}.

5-28. MAXIMUM MANEUVERING SPEED.

The maximum maneuvering speed, flaps retracted is 181 KIAS; flaps fully entended is 111 KIAS.

SECTION VI. MANUEVERING LIMITS

5-29. MANEUVERS.

a. The following maneuvers are prohibited:

(1) Spins.

(2) Aerobatics of any kind.

(3) Abrupt maneuvers above 181 KIAS.

(4) Any maneuver which results in a positive load factor of 3.17G' s or a negative load factor of 1.27G' s with wing flaps up, or a positive load factor of 2.0G' s or a negative 1.27G' s with wing flaps down.

b. Recommended turbulent air penetration airspeed is 170 KIAS.

5-30. BANK AND PITCH LIMITS.

a. Bank limits are 60° left or right.

b. Pitch limits are 30° above or below the horizon.

SECTION VII. ENVIRONMENTAL RESTRICTIONS

5-31. ALTITUDE LIMITATIONS.

The maximum altitude that the aircraft may be operated at is 31,000 C D F1 ; 35,000 F2 feet. When operating with inoperative yaw damp, the altitude limit is 17,000 feet.

5-32. TEMPERATURE LIMITS.

a. The aircraft shall not be operated when the ambient temperatures are warmer than ISA +37° C at SL to 25,000 feet, or ISA +31° C above 25,000 feet.

b. Engine ice vanes shall be retracted at +15° C and above.

5-33. FLIGHT UNDER IMC (INSTRUMENT METEOROLOGICAL CONDITIONS).

This aircraft is qualified for operation in instrument meteorological conditions.

5-33A. ICING LIMITATIONS (TYPICAL).

WARNING

While in icing conditions, if there is an unexplained 30% increase of torque needed to maintain airspeed in level flight, a cumulative total of two or more inches of ice accumulation on the wing, an unexplained decrease of 15 knots IAS, or an unexplained deviation between pilot's and copilot's airspeed indicators, the icing environment should be exited as soon as practicable. Ice accumulation on the pitot tube assemblies could cause a complete loss of airspeed indication.

The following conditions indicate a possible accumulation of ice on the pitot tube assemblies and unprotected airplane surfaces. If any of these conditions are observed, the icing environment should be exited as soon as practicable.

1. Total ice accumulation of two inches or more on the wing surfaces. Determination of ice thickness can be accomplished by summing the estimated ice thickness on the wing prior to each pneumatic boot deice cycle (e.g. four cycles of minimum recommended M-inch accumulation.

2. A 30 percent increase in torque per engine required to maintain an desired airspeed in level flight (not to exceed 85 percent torque) when operating at recommended holding speed.

3. A decrease in indicated airspeed of 15 knots after entering the icing condition (not slower than 1.4 power off stall speed) if maintaining original power setting in level flight. This can be determined by comparing pre-icing condition entry speed to the indicated speed after a surface and antenna deice cycle is completed.

4. Any variations from normal indicated airspeed between the pilot' s and copilot' s airspeed indicators.

5-33B. ICING LIMITATIONS (SEVERE).

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 a build-up on protective surfaces exceeding the capability of the ice protection system, or may result in ice forming aft of these protected surfaces. This ice may not shed using ice protection systems, and may seriously degrade the performance and controllability of the airplane.

a. 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:

(1) Unusually extensive ice accreted on the airframe in areas not normally observed to collect ice.

(2) Accumulation of ice on the upper (or lower, as appropriate) surface of the wing aft of the protected area.

(3) Accumulation of ice on the propeller spinner farther aft than normally observed.

b. Since the autopilot 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.

NOTE

All icing detection lights must be operative prior to flight into icing conditions at night. This supersedes any relief provided by the master minimum equipment list (MMEL) or equivalent.

5-34. OXYGEN REQUIREMENTS.

a. One oxygen mask must be provided for each passenger and crewmember. A minimum ten minute supply of supplemental oxygen shall be available during flight at or above an altitude of 25,000 feet based on the highest total aircraft oxygen flow rates.

b. In addition to the supply required by the information in paragraph 5-34.a., sufficient oxygen will be carried for each flight, assuming a decompression will occur at the altitude of point of flight that is most critical from the standpoint of oxygen need, and that after decompression the aircraft will descend, in accordance with the emergency procedures, to a flight altitude that will allow successful termination of the flight. Following decompression, the cabin pressure altitude is considered to be the same as the flight altitude.

c. **C** When flying at altitudes above 25,000 feet, one mask per occupant must be coupled to the oxygen outlet and immediately available.

d Oxygen system data/duration tables may be found in Chapter 2.

5-35. Cabin Pressure Limits.

Maximum cabin differential pressure is 6.1 PSI-CDF (C-12F prior to serial 86-60084); 6.6 PSI F (Serials 86-60084 thru 86-60089 and 87-70160 thru 87-70161).

5-36. Cracked Cabin Window/Windshield.

If a crack occurs in the a single ply of a cabin exterior window the aircraft is limited to presized flight. If a crack occurs in both outer and inner plys of the cabin exterior window, the aircraft shall not be flown unless proper authorization is, obtained for an unpressized ferry flight. If a outer ply crack occurs in a widshield, no action is required in flight. If a inner ply crack occurs in a windshield, or if either/both plys of a cabin window becomes cracked in flight, refer to Chapter 9, emergency procedures.

Section VI. OTHER LIMITATIONS

5-37. Passenger Seats

The cabin passenger seats may be used in the forward or aft positions. The headrest and seat back, when occupied, must be in the fully upright position for takeoff and landing. The side facing couch and lavatory are limited to 170 pounds per occupant.

5-38. ILS Limits

During an ILS approach do not operate the propellers in the 1750 to 1850 RPM range.

5-39. Intentional Engine Cut Speed.

In flight engine cuts below the safe one-engine inoperative speed (V_{MC} 104 KIAS) are prohibited.

5-40. Landing On Unprepared Runway.

CAUTION

Operation on unimproved, soft, or rough surfaces are not recommended for aircraft not equipped with a high floatation landing gear.

CAUTION

Except in an emergency, propellers should be moved out of reverse above 40 knots to minimize propeller blade erosion, and during crosswind, to minimize stress imposed on propeller, engine and air fame. 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 pilots forward visibility at low airplane speeds. The aircraft has demonstrated landings on hard, smooth surfaces and dry sod runways. Hard braking i.e., skidding tires while operating on other than smooth surfaces, can result in damage to the landing gear. Operations from unimproved runways (rocks, potholes, mud, deteriorated surfaced) are prohibited. When landing on other than dry surfaces, use discretionary propeller reverse to stop the airplane on the available runway.

5-41. Minimum Oil Temperature Required For Flight.

Engine oil is use to heat the fuel on 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 minimum 0.1 temperature graph (fig. 5-2) is provided for use as a guide in preflight planning, based on known or forecast operating conditions, to allow the operator to be come aware of operating temperatures where icing at the fuel control could occur. If the plot should indicate that oil temperatures versus OAT are such that ice formation could occur during take of for in flight anti-icing additive per MIL 1-27686 should be mixed with the fuel at refueling to ensure safe operation In the event that authorized fuels are not available, limitations on graph (figure 5-2) apply.

CAUTION

Anti-icing additive must be properly blended with the fuel to avoid deterioration of the fuel cell. The additive concentration by volume shall be a minimum of.0 60% and a maximum of. 15%. Approved procedure for adding anti-icing concentrate is contained in Chapter 2, Section XII.

MINIMUM OIL TEMPERATURE REQUIRED FOR OPERATION WITHOUT ANTI-ICING ADDITIVE

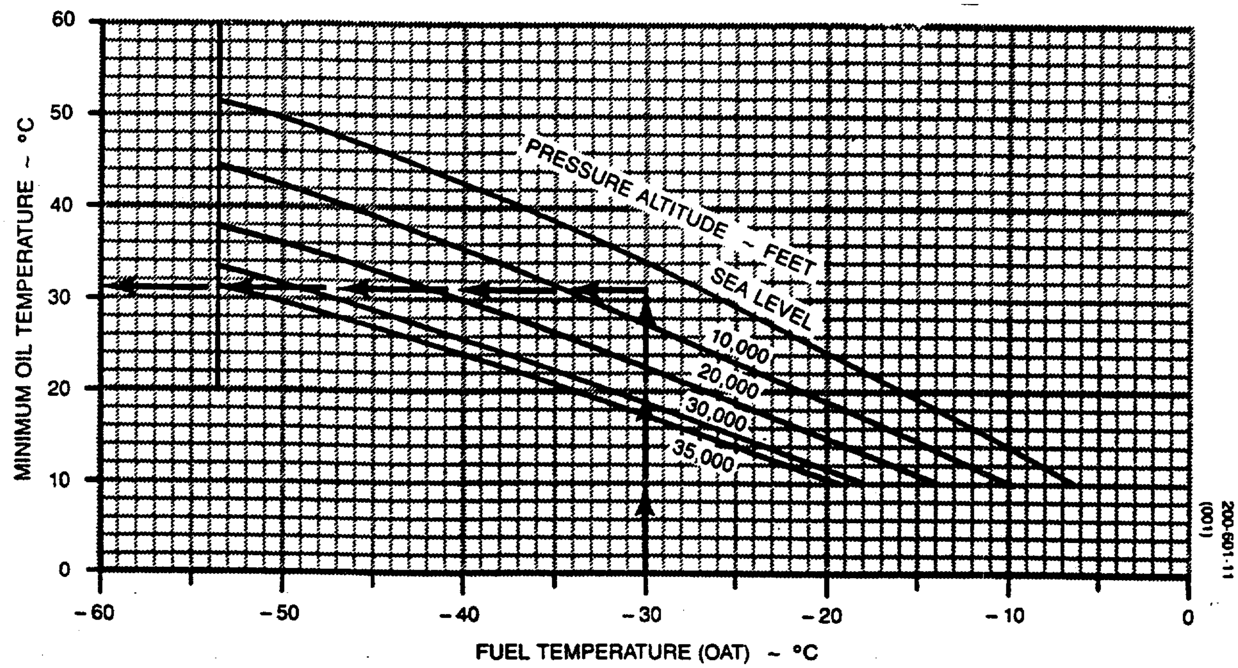


Figure 5-2. Oil/Fuel Temperature Graph

CAUTION

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 if fuel has been blended. To assure proper concentration by volume of fuel on board, blend only enough additive for the unblended fuel.

5-42. Tire Limitations.

Maximum tire speeds are:
High Flotation Gear ..... 139 Knots (160 MPH)
Standard Gear .... 155 Knots (180 MPH)

5-43. Structural Limitations.

Maximum sink rate at touchdown
(12,500 pounds) .... 600 FPM
Refer to chapter four of the A200/A200CT/B200C Maintenance Manual for structural limitations.

Section IX. REQUIRED EQUIPMENT FOR VARIOUS CONDITIONS OF FUGHT

5-44. REQUIRED EQUIPMENT LISTING

a. A Required Equipment for Various Conditions of Flight listing (fig. 5-3) is provided to enable the pilot to indentify those systems/components required for flight. For the sake of brevity, the listing does not include obviously required items such as wings, rudders, flaps, engines, landing gear, etc. Also the list does not include items which do not affect the airworthiness of the aircraft 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 AIRCRAFT AND NOT INCLUDED ON THE LIST ARE AUTOMATICALLY REQUIRED TO BE OPERATIVE.

b. It is the final responsibility of the pilot to determine whether the lack or inoperative status of a piece of equipment on his aircraft will limit the conditions under which he may operate the aircraft.

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

(*) refers to remarks and/or exceptions column for explicit information or reference

Numbered items contained in ( ) are required for flights by AR 95-1.

c. The pilot is responsible for exercising the necessary operational control to assure that no aircraft is flown with multiple items inoperative, without first determining that any interface or interrelationship between inoperative systems or components will not result in a degradation in the level of safety and/or cause an undue increase in crew workload.

d. The exposure to additional failures during continued operation with inoperative systems or components must also be considered in determining that an acceptable level of safety is being maintained. The REL may not deviate from requirements of the Operators Manual limitations section, emergency procedures or safety of flight messages.

SYSTEM and/or COMPONENT	Number of items installed	VFR Day	VFR Night	IFR Day	IFR Night	Icing Conditions	REMARKS and/or Exceptions
AIR CONDITIONING							
Bleed Air Fail Light	2	-	-	1	1	2	Provided bleed air is not used from side of failed light.
Pressurization Controller	1	1	1	1	1	1	
Safety Valve	1	1	1	1	1	1	
Outflow Valve	1	1	1	1	1	1	
Altitude Warning	1	1	1	1	1	1	May be inoperative provided airplane remains unpressurized.
Cabin Rate of Climb	1	1	1	1	1	1	
Differential Pressure/Cabin Altitude	1	1	1	1	1	1	
Pressurization Air Source	2	1	1	1	1	1	
Duct Overtemp Light	1	-	-	-	-	-	May be inoperative provided bleed air is not used.
COMMUNICATIONS							
Interphone System	1	-	-	-	-	-	
VHF Communications System	2	-	-	-	-	-	
Static Discharge Wicks	15	-	-	6	6	6	Minimum required - one wick at the outboard end of each control surface plus top of vertical stabilizer.
ELECTRICAL POWER							
Battery	1	1	1	1	1	1	
Battery Charge Light	1	1	1	1	1	1	
DC Generator	2	1	1	2	2	2	
DC Loadmeter	2	2	2	2	2	2	One may be inoperative provided corresponding generator caution light is monitored.
DC Generator Caution Light	2	2	2	2	2	2	One may be inoperative provided corresponding loadmeter is monitored.
Inverter	2	1	1	2	2	2	
Inverter Warning Light	1	-	-	1	1	1	May be inoperative provided both inverters are operative.
AC Frequency/Voltmeter	2	2	2	2	2	2	
EQUIPMENT FURNISHINGS							
Seat Belts	10	*	*	*	*	*	
Shoulder Harness; Pilot and Co-Pilot	2	*	*	*	*	*	*One per installed seat.

Figure 5-3. Required Equipment Listing (1 of 5)

SYSTEM and/or COMPONENT	Number of items installed	VFR Day	VFR Night	IFR Day	IFR Night	Icing Conditions	REMARKS and/or Exceptions
Emergency Locator Transmitter	1	-	-	-	-	-	
FIRE PROTECTION							
Fire Detector System	2	2	2	2	2	2	
Engine Fire Extinguisher	2	2	2	2	2	2	
Portable Fire Extinguisher	2	2	2	2	2	2	
FLIGHT CONTROLS							
Trim Tab Indicators - Rudder, Aileron, and Elevator	3	3	3	3	3	3	May be inoperative provided that the tabs are visually checked in the neutral position prior to each takeoff and checked for full range of operation.
Flap Position Indicator	1	1	1	1	1	1	May be inoperative provided that the flap travel is visually inspected prior to takeoff.
Flap System	1	-	-	-	-	-	
Rudder Boost	1	-	-	-	-	-	
Yaw Damp	1	1	1	1	1	1	May be inoperative for flight at and below 17,000 feet.
Stall Warning	1	1	1	1	1	1	
Autopilot	1	-	-	-	-	-	
FUEL EQUIPMENT							
Standby Fuel Boost Pump	2	1	1	1	1	1	Both required for operation on aviation gasoline above 20,000 feet.
Engine Driven Boost Pump	2	2	2	2	2	2	
Firewall Shutoff Valve	2	2	2	2	2	2	
Fuel Quantity Indicator	2	2	2	2	2	2	One may be inoperative provided other side is operational and amount of fuel on board can be established to be adequate for intended flight. Fuel flow on affected side must be operational and monitored.
Crossfeed Valve	1	-	-	-	-	-	Required for (1) operation with aviation gasoline above 20,000 feet. (2) When operating with aviation kerosene when one standby boost pump is inoperative. If takeoff with inoperative crossfeed is planned, mission should be limited to that range attainable with single engine operation, one engine supplying fuel.

Figure 5-3. Required Equipment Listing (2 of 5)

SYSTEM and/or COMPONENT	Number of items installed	VFR Day	VFR Night	IFR Day	IFR Night	Icing Conditions	REMARKS and/or Exceptions
Crossfeed Light	1	1	1	1	1	1	May be inoperative provided proper operation of crossfeed system is checked prior to takeoff. Both fuel pressure lights must be operative.
Fuel Flow Indicator	2	2	2	2	2	2	One may be inoperative provided fuel quantity gages are operative.
Fuel Pressure Warning Light	2	2	2	2	2	2	One may be inoperative provided standby boost pump operation is ascertained using opposite light with crossfeed prior to engine start. Standby boost pump on side of failed light must be operated in flight to assure fuel pressure, should the engine driven boost pump fail.
(Deleted)							(Deleted)
							(Deleted)
ICE AND RAIN PROTECTION							
Airfoil Deice System (Wing and Horizontal Stabilizer)	1	-	-	-	-	1	
Engine Inertial Ice Vanes	2	2	2	2	2	2	
Ice Vane Lights	4	4	4	4	4	4	May be inoperative provided manual ice vane controls are operational and used.
Windshield Heat, Left and Right	2	-	-	-	-	1	Right side may be inoperative.
Windshield Wiper	2	-	-	-	-	-	
Auto Ignition System and Lights	2	2	2	2	2	2	
Pitot Heater	2	-	-	1	1	1	Right side may be inoperative.
Alternate Static Air Source	1	1	1	1	1	1	
Propeller Deice System (Auto)	1	-	-	-	-	1	
Propeller Deice System (Manual)	1	-	-	-	-	1	
Heated Fuel Vent	2	-	-	-	-	2	
Stall Warning Heater	1	-	-	-	-	1	
Brake Deicer System	1	-	-	-	-	-	
LANDING GEAR							
Landing Gear Motor D1	1	1	1	1	1	1	May be inoperative provided operations are continued only to a point where repairs can be accomplished.
Hydraulic Power Pack Motor D2 F	1	1	1	1	1	1	May be inoperative provided operations are continued only to a point where repairs can be accomplished.

Figure 5-3. Required Equipment Listing - Sheet 3 of 5

SYSTEM and/or COMPONENT	Number of items installed	VFR Day	VFR Night	IFR Day	IFR Night	Icing Conditions	REMARKS and/or Exceptions
Landing Gear Position Indicator Lights	3	3	3	3	3	3	One of three may be inoperative provided gear handle light is monitored
Gear Handle Light	1	1	1	1	1	1	
Landing Gear Aural Warning	1	1	1	1	1	1	
LIGHTS							
Cockpit and Instrument Lights	*	-	*	-	*	-	*Lights must illuminate all instruments and controls.
Landing and Taxi Light	2	-	-	-	-	-	
Strobe Beacon	2	-	2	-	2	-	
Position Lights	3	-	3	-	3	-	
Wing Ice Lights	2	-	-	-	-	*	*One required for night icing flight.
Passenger Notice System (Fasten Seat Belt and No Smoking)	2	*	*	*	*	*	*May be inoperative provided adequate passenger briefing has been accomplished.
Master Fault Warning Light	1	-	-	-	-	-	
Master Fault Caution Lights	2	-	-	-	-	-	
Cabin Door Caution Light	1	*	*	*	*	*	*May be inoperative provided visual indicators are checked prior to each takeoff.
NAVIGATION INSTRUMENTS							
Altimeter	2	1	1	1	1	1	Right side may be inoperative.
Airspeed Indicator	2	1	1	1	1	1	Right side may be inoperative.
Vertical Speed Indicator	2	-	-	-	-	-	
Standby Magnetic Compass	1	1	1	1	1	1	
Horizon Indicator	2	-	-	1	1	1	Right side may be inoperative.
Outside Air Temperature	1	1	1	1	1	1	
Turn and Bank Indicator	2	-	-	1	1	1	Right side may be inoperative.
Directional Gyro	2	-	-	1	1	1	Right side may be inoperative.
Clock	2	-	-	1	1	1	
Transponder	1	-	-	1	1	-	
Distance Measuring Equipment	1	-	-	-	-	-	
Navigation Equipment	*	-	-	*	*	*	*Per AR-95-1

Figure 5-3. Required Equipment Listing (4 of 5)

SYSTEM and or COMPONENT	Number of items installed	VFR Day	VFR Night	IFR Day	IFR Night	Icing Conditions	REMARKS and/or Exceptions
OXYGEN							
Oxygen system	1	1	1	1	1	1	
Oxygen Mask	*	-	-	-	-	-	*Refer to Oxygen Requirements in section VI.
PROPELLERS							
Propeller Overspeed Governor	2	2	2	2	2	2	
Propeller Governor Test Switch	2	2	2	2	2	2	
Autofeathering System C D	1	-	-	-	-	-	
Autofeathering Armed Light C D	2	-	-	-	-	-	
Reverse Not Ready Light	1	1	1	1	1	1	May be inoperative provided propeller controls are in HIGH RPM A; FULL INCREASE RPM C D position for reversing.
Propeller Synchrophaser	1	-	-	-	-	-	
ENGINE INDICATING INSTRUMENTS							
Propeller Tachometer Indicator	2	1	1	1	1	1	
Propeller Synchroscope C D	1	-	-	-	-	-	
Gas Generator Tachometer Indicator	2	2	2	2	2	2	
TGT Indicator	2	2	2	2	2	2	
Torque Indicator	2	2	2	2	2	2	
ENGINE OIL INDICATORS							
Oil Pressure Indicator	2	2	2	2	2	2	
Oil Temperature Indicator	2	2	2	2	2	2	
Chip Detector Light	2	2	2	2	2	2	

Figure 5-3. Required Equipment Listing (5 of 5)

CHAPTER 6
WEIGHT/BALANCE AND LOADING

Section I. GENERAL

6-1. EXTENT OF COVERAGE.

Sufficient data has been provided so that, knowing the basic weight and moment of the aircraft, any combination of weight and balance can be computed.

6-2. CLASS.

Army Model C-12 is in class 2. Additional directives governing weight and balance of class 2 aircraft forms and records are contained in AR 95-3, TM 55-1500-342-23 and DA PAM 738-751.

6-3. AIRCRAFT COMPARTMENT AND STATIONS.

The aircraft is separated into two compartments associated with loading. These compartments are the cockpit and the cabin. Figure 6-1 illustrates the general description of aircraft compartments.

Section II. WEIGHT AND BALANCE

6-4. PURPOSE.

The data to be inserted on weight and balance charts and forms are applicable only to the individual aircraft, the serial number of which appears on the title page of the booklet entitled WEIGHT AND BALANCE DATA supplied by the aircraft manufacturer and on the various forms and charts which remain with the aircraft. The charts and forms referred to in this chapter may differ in nomenclature and arrangement from time to time, but the principle on which they are based will not change.

6-5. CHARTS AND FORMS.

The standard system of weight and balance control requires the use of several different charts and forms. Within this Chapter, the following are used:

a. Chart C Basic Weight and Balance Record, DD Form 365-3.
b. Form F Weight and Balance Clearance Form F, DD Form 365-4 (Transport).

6-6. RESPONSIBILITY.

The aircraft manufacturer inserts all aircraft identifying data on the title page of the booklet entitled WEIGHT AND BALANCE DATA and on the various charts and forms. All charts, including one sample Weight and Balance Clearance Form F, if applicable, are completed at time of delivery. This record is the basic weight and balance data of the aircraft at delivery. All subsequent changes in weight and balance are compiled by the weight and balance technician.

6-7. WEIGHT DEFINITIONS.

Weight definitions-Deleted.

6-8. BALANCE DEFINITIONS.

Balance definitions-Deleted

6-8a. WEIGHT AND BALANCE ADVISORY COMPUTER.

The pocket size weight and balance advisory computer (WBAC) is a battery operated alphanumeric programmable computer equipped with a custom application module, and a custom keyboard overlay.

The computer batteries normally last about 9 to 1.2 months, depending on computer use time. With alkaline batteries installed, the [BAT] annunciator in the display will illuminate when about 10 to 30 days of operating time remains. New size -N-batteries (preferably alkaline) should be installed.

Each program has been assigned a two-letter Z code name (e.g., ZL, ZH, ZM) to facilitate operation under low ambient light conditions. By pressing the [Z] key and the the other letter assigned to a particular program anytime the display asks NAME PLEASE?, the computer begins the corresponding program just as if the abbreviated name for the program had been entered. For example, to run the WEIGHT AND BALANCE program, enter the abbreviated name WEIGHT using the blue letters. But if the illumination is poor and it is difficult to read the blue letters, press the [1] ([Z]) key (which is the second key up from the bottom of the keyboard and the second key from the left) and the [SIN] ([HI) key (which is the third key in the second row from the

Deleted

Figure 6-1. Aircraft Compartments and Stations A - Sheet 1 of 3

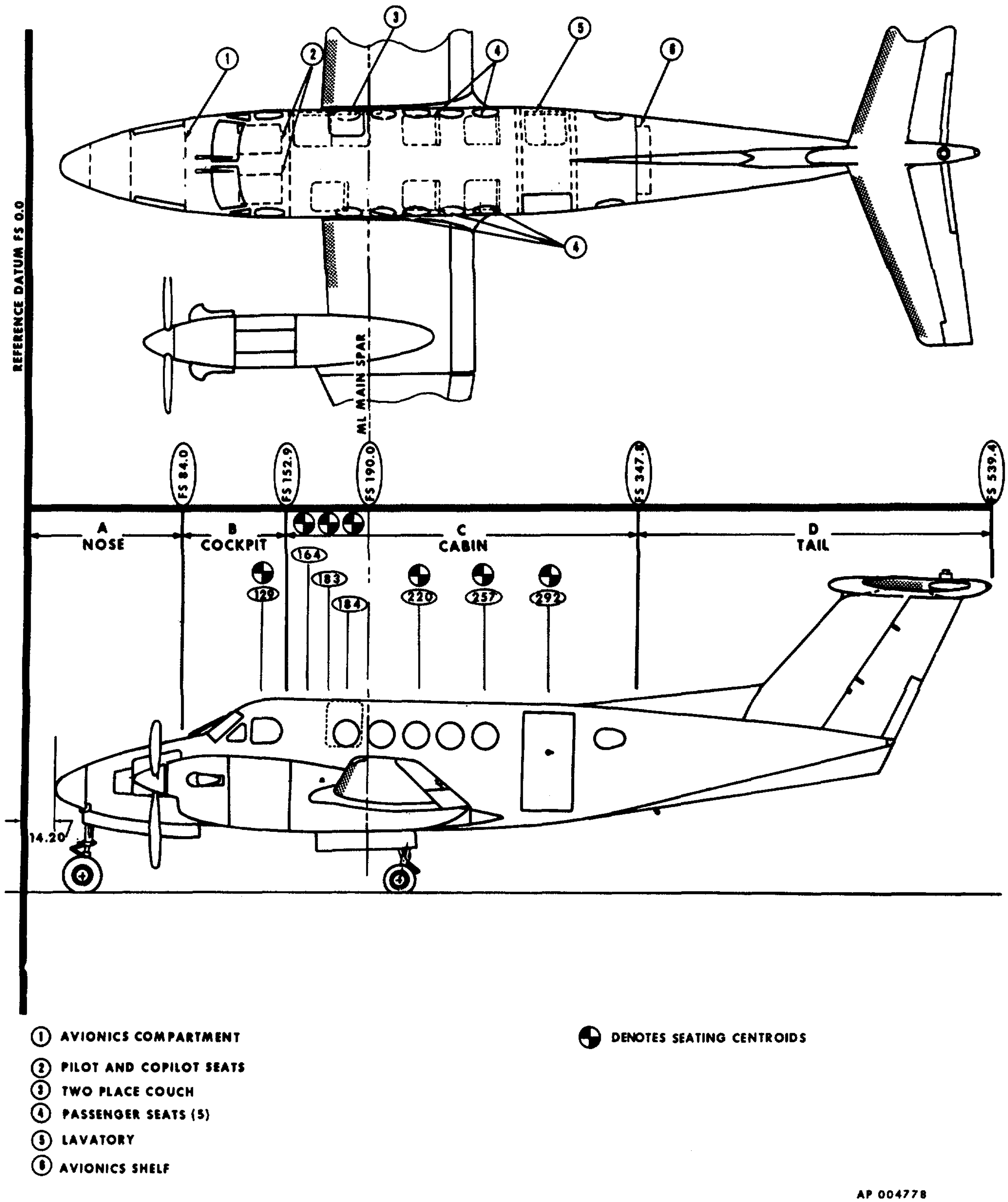

Figure 6-1. Aircraft Compartments and Station - Sheet 2 of 3

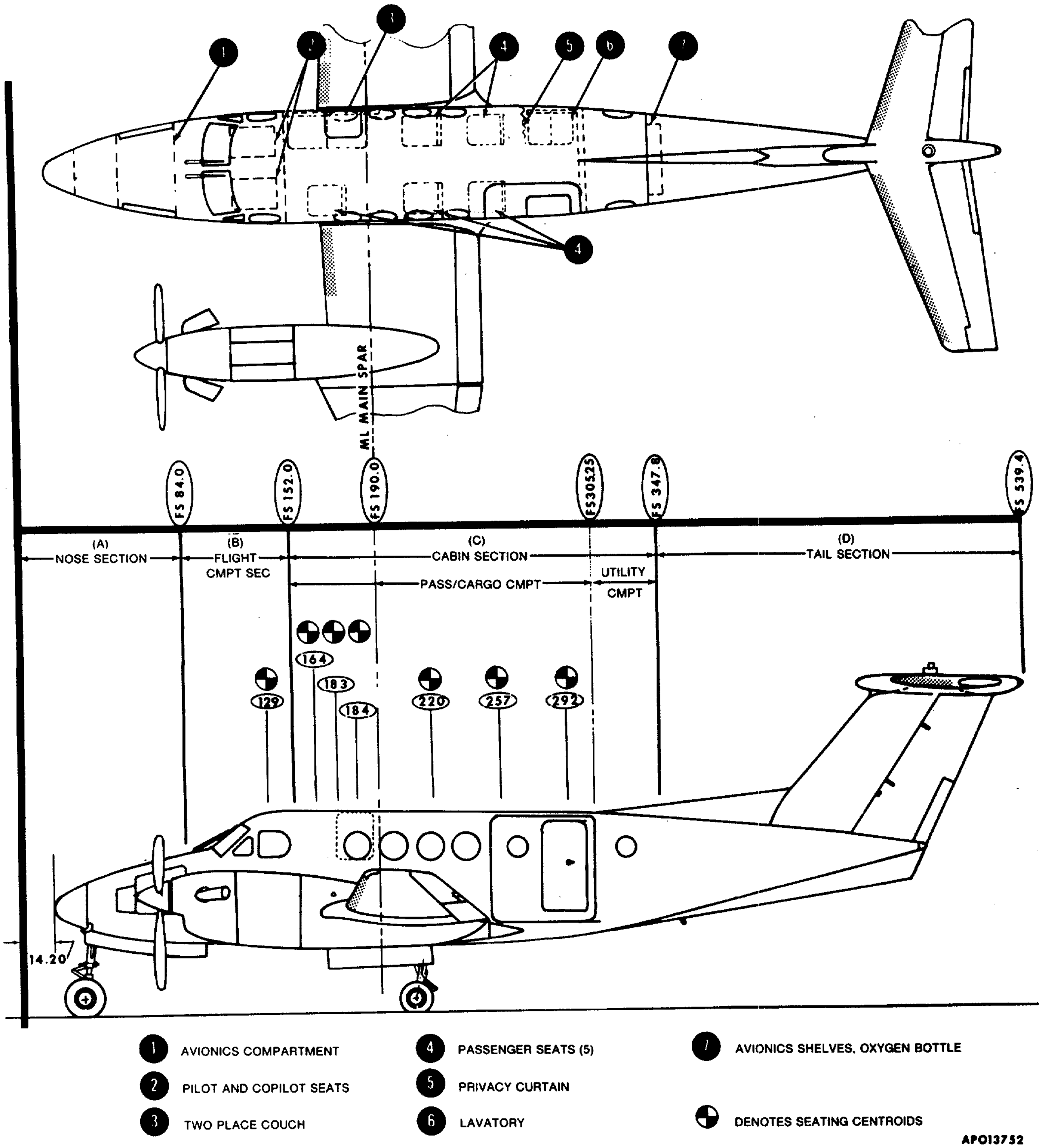

Figure 6-1. Aircraft Compartments and Stations F2 - Sheet 3 of 3

top of the keyboard). Since the blue letters are in alphabetical order, the Z codes can be used by feeling for the location of the keys.

Whenever referring to the Z code or special assignment keys the blue letters on the front of the keys are referenced, rather than the white symbols on top of the keys. Since the WBAC labels [AGAIN] and [ANSWER] are special assignment keys, they are referred to as [AGAIN] ([A]) and [ANSWER] ([El) rather than as [AGAIN] ([+]) and [ANSWER] ([LN]).

The other keys given special names on the overlay are shown first as the WBAC name, then as the white symbol on top of the key. This allows continued use of the computer even if the WBAC with the special labels on it is misplaced. The special WBAC' labels that are not special assignment keys (i.e..
[AGAIN] and ([ANSWER]) are:

[YES]	([Re])
[NO]	([SIN])
[NEG]	([CHS])
[NAME]	([TAN])
[NEXT]	([R/S])

a. Program Descriptions. A brief description of each of the programs is given below.

START/ZM - This program has no inputs, answers, or special key assignments. It is used to set up the computer prior to the first run, after memory has been cleared, or if the status of the computer is in doubt. The program also checks for the proper SIZE set-up, and various other items.

NOTE

Always run the LOAD program again after running the START program, because the START program clears some of the data loaded into the computer by the LOAD program.

LOAD)/ZL - Loads the empty weight, moment, and other special items for the specific aircraft into the computer memory. This program must be run before running the WEIGHT program the first time. This program need only, be run once, unless the data is cleared from the memory. Turning the computer off for extended periods will not clear this data from memory.

WEIGHT/ZH - Advises whether or not a specific aircraft is loaded within C.G. and weight limits.

b. Safety The programs have been designed to save preflight planning time. However, due to rounding and programming limitations, some of the results obtained with this system will differ slightly from those obtained by using the data presented in the weight and balance tables.

WARNING

Use of the computer does not relieve the pilot of his responsibility to ensure that all operations are conducted according to the limitations presented in Chapter 5 (Limitations), and tables and/or graphs presented in Chapter 6.

Whenever a discrepancy exists, answers derived by using the tables and graphs shall be assumed to be correct and shall be used in preference to answers obtained with the weight and balance computer.

It is imperative that the pilot check all answers for reasonability, and verify them with the tabular and graph data. Enter only conditions that do not violate any of the limitations.

NOTE

The safety and compatibility of any other user programs with the WBAC module cannot be guaranteed. If the computer [STO] function is used, this may also interfere with the WBAC program. To ensure that no conflicts occur when running the WBAC program after using any other application program, user written program or after the [STO] function has been used, always perform the entire keyboard setup procedure.

c. Setting tip the computer. If the status of the computer is in doubt perform the setup operation as follows.

NOTE

Refer to the Owner's Handbook and Programming Guide for illustration and additional information.

Install the batteries using the following steps.

1. Position the computer with the display end toward you, then turn it upside down.
2. Pull on the lip of the battery holder.
3. Check the polarity marks (+ and -) on the exposed end of the battery holder.
4. Remove the holder and insert the batteries as indicated.
5. Re-insert the battery holder into the computer so that the exposed ends of' the batteries are pointing toward the display end of the unit.
6. Press down on the exposed end of the battery holder until it snaps into place.

Install the keyboard overlay using the following steps.

1. With the computer in an upright position, locate the black latch at the top center of the keyboard and move it to the uppermost position.
2. Insert tabs on bottom of the overlay into the slots at the bottom of the keyboard.
3. Position the overlay over the keyboard.
4. Lock the overlay into place by moving the latch to the downmost position.
5. Each label printed on the overlay will apply to the key below the label when the remainder of the SETUP procedure has been completed.

Insert the weight and balance advisory module as follows:

CAUTION

Always turn the computer off before inserting or removing a module. Failure to do so could damage both the computer and the module. Press the [ON] button (upper left area of computer) once to turn the computer on. Press it again to turn the computer off.

1. Turn the computer OFF.
2. Remove one port cap from display end of the computer and store. This cap should be re-inserted into the empty port whenever the module is removed.
3. Position the module so that the label is facing downward, and insert into any port.

Remove the weight and balance advisory module as follows:

1. Turn the computer OFF.
2. Grasp the module handle and pull it out. Store the module.
3. Place a port cap into the empty port.

d. Keyboard Control Operations.

NOTE

If the computer is left on with no entries for five minutes, it will shut down. Bring the program back up by pressing [ON] then [NEXT] ([R/S]).

1. The [ON] button is located in the upper left corner of the computer. Press it once to turn the computer on, and press it again to turn the computer off.
2. Key in numbers by pressing the number keys in sequence. The decimal point also must be keyed in if it is part of the number (unless it is to be right of the last digit). As a number is keyed, notice how the underscore prompts for each number.
3. To key in a negative number, press the keys for the number, then press [NEG] ([CHS]). The number, preceded by a minus sign (-), will appear in the display. For example, to input -20, key in:

2
0
[NEG] ([CHS])

[NEXT] ([R/S])

4. One display character at a time may be deleted using the [←] key. The underscore (_) will prompt moves back.

e. Keyboard Setup Procedure. To be sure that the computer does not have some previous assignment or data that will conflict with the WBAC program, use the computer master clear technique procedures as follows:

1. Turn computer OFF.
2. Press and hold [-] key while turning computer back ON.
3. Release [-] key.
4. The display will momentarily read MEMORY LOST then display 0.0000.

NOTE

This clearing procedure will clear all registers, program memories, special key assignments, special flag assignments, etc.

5. Set SIZE to 063, using the following keystrokes:

KEYSTROKES	DISPLAY
[XEQ]	XEQ
[ALPHA]	XEQ _
S	XEQ S _
I	XEQ SI _
Z	XEQ SIZ _
E	XEQ SIZE _
[ALPHA]	SIZE ___
0	SIZE 0 __
6	SIZE 06 _
3	SIZE 063
	0.0000

f General Program Rules For The WBAC. When the display stops and a question mark (?) is shown, the user must input a value. Normally a number is required, but there are two exceptions: 1. Blue letters spelling the abbreviated program name or Z code are required when the display reads NAME PLEASE?; 2. [YES] ([RI]) or [NO] (]SIN[) must be pressed when the display asks YES OR NO followed by a question and a question mark (?). After the number or blue letter name is correct in the display, it will be entered into the computer, stored and/or processed only after [NEXT] ([R/S]) is pressed.

NOTE

The [NEXT] ([R/S]) key should not be pressed after pressing either [YES] ([R↓]) or [NO] ([SIN]).

If the display is showing important data which is not routinely displayed during program execution, the display will stop until the user acknowledges the display by pressing [NEXT] ([R/S]). The PRGM annunciator extinguishes to indicate this type of stopping.

g. To Run A Program.

1. Press [ON] button to turn computer on.
2. Press [NAME] ([TAN]). Display should read NAME PLEASE?.

NOTE

If (J) appears in the display, the program was already in the NAME PLEASE? mode when [NAME] ([TAN]) was pressed. To recover, press [NEXT] ([R/S]); wait until display says NONEXISTENT (because there is no program named "J" in, the WBAC module); then press [NAME] ([TAN]) again. Display should read NAME PLEASE?.

3. Using the blue letters on the bottom front of the keys, spell the ABBREVIATED NAME of the program or use the two-letter Z CODE. Then press [NEXT] ([R/S]). The computer will display the title of the program and other relevant information, with a short time delay for ease in reading. Answer the question the computer asks by keying the correct answer, then pressing [NEXT] ([R/S]). If the value displayed in front of the question mark is correct, press [NEXT] ([R/S]). When the computer has all the input it needs to calculate the answers, it will start the computing process. When it has the answers, it will display the answers, pause after nice-to-know answers, and stop after each need-to-know answer, indicating this stop by extinguishing the PRGM annunciator located in the lower right border of the display window. If the PRGM legend is OFF, press [NEXT] ([R/S]) to get additional answers.

NOTE

Never press [NEXT] ([R/S]) when the PRGM annunciator is ON. The program will stop (indicated by extinguishing of the PRGM annunciator) and display a meaningless answer. In order to restart 'the program, press [NEXT] ([R/S]) again and verify the PRGM annunciator is ON.

h. Run START Program.

1. Run START program by using the following keystrokes:

KEYSTROKES	DISPLAY
[NAME] ([TAN])	NAME PLEASE?
S	S _
T	ST _
A	STA _
R	STAR _
T	START _
[NEXT] ([R/S])	

NOTE

The keystrokes may be replaced by keying in the Z code, ZM if desired.

Display will be clear, except that the USER and PRGM annunciators will be on, and the program execution annunciator will be moving across the screen. Within about 40 seconds, the computer will beep and display NAME PLEASE?.

2. If an error message **SIZE** > = **63 appears** Run SIZE portion of procedure again.

i. Run LOAD Program.

NOTE

The LOAD program must be run prior to running the WEIGHT program. The WEIGHT program will not work until this is done.

(1) How To Run Load Program.

1. Display will show NAME PLEASE? Enter L O A D, or Z code ZL as applicable. This program loads weight and balance information for a specific aircraft registration (serial) number into the computer memory. This information must be loaded before the other programs will run properly. If an error is made in entering data, use the [-] key to erase the data. If [NEXT] ([R/S]) is pressed before the error is discovered, press [AGAIN] ([A]) to start over at the beginning of the program. All data must then be re-entered, because all values in the LOAD program revert to zero anytime the program is started or restarted. Once the program has been successfully loaded the operator need only to answer queried information. Answer each question, then press [NEXT] ([R/S]):

BASIC. EMPTY. WEIGHT? - This is asking for the basic empty weight as shown on Chart C - Basic Weight and Balance Record (DD Form 365-3).

BASIC. EMPTY. MOMENT? - This is asking for the basic empty moment of a specific aircraft, found on Chart C - Basic Weight and Balance Record (DD Form 365-3. Input the entire moment value; DO NOT divide it by 100. The computer will not accept a basic empty moment value below 1,000,000.

REG. NO.? - This is asking for the aircraft registration (serial) number.

SN BJ-XX? - The BJ serial number prefix is not relevant to this program, enter the numerals 00. The computer will then automatically begin the WEIGHT program, so that data just entered can be checked for accuracy. See WEIGHT program description for details on running WEIGHT program.

STD. CONF Y/N? - This question relates to internal cabin configuration and seating arrangement. Answer using the [YES] ([R]↓) or the [NO] ([SIN]) key. A NO answer will prompt for FS's. Use a 0.0 FS to continue to the next FS label, e.g., PAX, CAB, CARGO.

Special key assignments:

[A] = AGAIN - Start over from beginning of program

[D] = CON-FIGURATION - Queries the internal cabin configuration and seating arrangement. Pressing [D] returns the program to the **STD. CONF Y/N?** display.

Error messages:

- On Input: - Basic Empty Moment - DO NOT/100 (Meaning: the value entered is less than 1,000,000; do not divide the moment by 100.)
- On Output: - There are no outputs from this program.

j. How To Run Weight Program. The WEIGHT program provides aircraft loading information data that would otherwise have to be determined from the weight & balance tables.

1. Display will show NAME PLEASE? Enter W E I G H T, or Z code ZH as applicable. This program advises how much fuel may be loaded without exceeding limitations, and advises either the take-off and landing weights and centers of gravity are OK or exceed limitations, and what the value for each is, based on the loading information entered. The information must then be verified by referring to the appropriate weight and balance tables. Once the program has been successfully loaded the operator needs only to answer the queried questions. Answer each question, then press [NEXT] ([R/S]).

NOTE

This program will not run properly unless the LOAD program has been run once for your specific aircraft registration (serial) number.

Answer the questions as follows:

CREW WT ? - This is asking for the total weight, in pounds, of the occupants of the pilot and copilot seats. If no entry is made before [NEXT] ([R/S]) is pressed, the program will assume 340 pounds (i.e., two average 170-pound occupants).

NOTE

If passengers, cargo, baggage or additional equipment will not be seated/stored aft of the crew compartment, pressing [YES] ([R,]) will advance the program display to **FUEL LB/GAL? .**

PAS FSxxx? - This is asking for the weight, in pounds, of the passenger(s) located at F.S. xxx. If both a left and a right seat are installed at F.S. xxx (refer to the Useful Load Weights And Moments Table Occupants. Include the combined weight of both passengers who are seated at F.S.xxx. If no entry is made, the program assumes zero.

Press [NEXT] ([R/S]), the program will ask for the weight of occupants at the next fuselage station. If no occupant is at this station, press [NEXT] ([R/S]). When in the standard configuration the computer will skip over F.S. 183 until F.S. 184 query has been answered.

NOTE

If cargo, baggage or additional equipment will not be stored aft of the last fuselage station query, pressing [YES] ([R↓]) will advance the program display to **FUEL LB/GAL?**

CARGO FS This is asking for the weight, in pounds, of the load with F.S. xxx as its centroid Zero is assumed if no entry is made. No check is made for compliance with compartment maximum weight limitations. Refer to Cargo Loading Typical (fig. 6-8).

Press [NEXT] ([R/S]), the program will ask for the weight of cargo at the next fuselage station. If no cargo is at this station, press [NEXT] ([R/S]).

BAGS FS325? This is asking for the weight, in pounds, of the baggage secured with its centroid at F.S. 325. Zero is assumed if no entry is made. A check is made for compliance with compartment maximum weight limitations. If the weight entered for F.S. 325 exceeds the compartment limit, the display will show a > (greater than sign) along with WGT FS325. Press [NEXT] ([R/S]). The display will show how much weight must be removed/relocated to satisfy the compartment weight limit.

NOTE

In the standard configuration the program will always prompt for CARGO 325? and BAGS FS325?. These both represent the same location in the aircraft. Therefore, it is important that the total values input for F.S. 325 equal the total weight of cargo and/or baggage secured with its centroid at F.S. 325.

ADD.LOAD? Y/N This is asking if any additional non-standard (survival kits etc.) loads are onboard. If there are none, press either [NO] ([SIN]) or ([NEXT]) (R/S). If there are other loads, press [YES] ([RS↓]) and answer the following questions:

NOTE

Survival equipment is normally stored at F.S. 315.

F.S.? This is asking for the fuselage station of the centroid of the additional load.

LBS. ? This is asking for the weight, in pounds, of the additional load. If a piece of equipment has been removed, enter the weight of that item, then press [NEG] ([CHS]), :hen press [NEXT] ([R/S]). After entering the weight of the additional item or subtracting the weight of a removed item, the computer will ask if yet other nonstandard loads are onboard. After pressing either [NO] ([SIN]) or [NEXT] ([R/S]), the program will continue with the following questions.

FUEL LB/ This is asking for the density of GAL? the fuel onboard, in pounds per U.S. gallon. If no value is entered before [NEXT] ([R/S]) is pressed, the program will assume a density of 6.8 pounds per U.S. gallon.

MAX FUEL = xxx This is not a question, so no question mark is displayed. This is a statement advising that the maximum amount of fuel (in gallons) that can be carried without exceeding, either the maximum take-off weight limitation for normal category operation or the total fuel system capacity (which ever is less), is xxx U.S. gallons. If weight, rather than fuel system capacity is the limiting value, the value displayed assumes a 90 pound fuel burnoff during start, taxi, run-up, and the take-off roll.

YOUR FUEL? This is asking for the quantity, in U.S. gallons, of fuel onboard. If no entry is made before pressing [NEXT] ([R/S]), the program assumes the value stated earlier in the MAX FUEL = xxx display.

If onboard fuel quantity is greater then the MAX FUEL value, the program will query: NORM. CAT? Y/NThis is asking if the aircraft will be operating in the normal category. For normal category n flight, press [YES] ([R↓]).

Answers provided:

TO COND OK	The take-off conditions of weight and center of gravity are within limits. The take-off conditions are figured at ramp weight less 90 pounds of fuel for start, taxi, run-up, and take-off roll.
FLIGHT FUEL?	This is a query, asking for the expected quantity of fuel to be burned in U.S. gallons.
LAND COND OK	The landing conditions of weight and center of gravity will be within limits.
TO WT = xx, xxx	Take-off weight is xx,xxx pounds.
TO CG = xxx. xx	Take-off center of gravity is xxx. xx inches aft of datum.
LD WT = x, xxx	Landing weight will equal x,xxx pounds.
LD CG = xxx. xx	Landing center of gravity will be xxx.xx inches aft of datum. Special key assignments (will be usable only if take-off condition is not OK):
[A] = AGAIN	Start over from beginning of program
[E] = FUEL DENSITY	Lb/Gal

Error messages:

>544 GALS	The fuel quantity entered exceeds the maximum quantity that the tanks will hold. Press [NEXT] ([R/S]) again, and the display will again ask for your fuel quantity.
>0 FUEL LIM	The zero-fuel weight limitation has been exceeded. Press [NEXT] ([R/S]) and read:
REDUCE xxx	This advises how much payload weight (i.e., anything except fuel) must be removed from the aircraft in order to meet the zero fuel weight limitation. Press [NEXT] ([R/S]) and the computer will show **NO-GO** display. Press [NEXT1 ([R/S]) again and the computer will display START OVER, then automatically go to the beginning of the program and ask for the crew weight.
>TO WGT	Take-off weight will be above the limit of 12,500 pounds for normal category operation even after subtracting 90 pounds of run-up fuel from the ramp weight. Press [Next] ([R/S]) and read:
TO WT = xx xxx	Press [NEXT] ([R/S]) and read:
REDUCE xxx	This advises how much weight must be removed from the aircraft in order to meet the take-off weight limitation. Press [NEXT] ([R/S]) and the computer will give the **NO-GO** display. Press [NEXT] ([R/S]) again, and the computer will continue with the other outputs.
NO-GO	At least one weight or center of gravity limitation has been exceeded. This is a no-takeoff condition.
TO OUT OF CG	Take-off center of gravity is out of limits.
LD OUT OF CG	Landing center of gravity will be out of limits.

Assumptions made:

The program allows for 90 pounds (moment =17,700) fuel burn-off before takeoff

6-9. CHART C BASIC WEIGHT AND BALANCE RECORD.

Chart C is a continuous history of the basic weight and moment resulting from structural and equipment changes made in service. At all times, the last weight and moment/100 entry is considered the current weight and balance status of the basic aircraft.

6-10. WEIGHT AND BALANCE CLEARANCE FORM F, DD FORM 365-4

a. General. Form F is a summary of the actual disposition of load in the aircraft. It records the balance status of the aircraft step by step. It serves as a worksheet on which the weight and balance technician records the calculations and any corrections that must be made to ensure the aircraft will be within weight and CG limits. It is necessary to complete Form F prior to flight whenever an aircraft is loaded in a manner for which no previous valid Form F is available.

The form is used to derive the gross weight and CG of any aircraft. The Form F furnishes a record of the aircraft weight and balance status at each step of loading process. It serves as a worksheet to record weight and balance calculations and corrections that must be made to ensure that the aircraft will be within weight and CG limits. Instructions for filling out a Form F are given in TM 55-1500-342-23. Refer to Figures 6-4, 6-6, 6-7, 6-9 and 6-11 for loading information.

Deleted

Figure 6-2. Chart C, Basic Weight and Balance Record - Typical

Deleted

Figure 6-3. Weight and Balance Clearance Form F - Typical main in the manual for the duration of the flight. On a cross-country flight this form aids the weight and balance technician at refueling bases and stop- over stations.

b. Use Of Form F (DD Form 365-4)-Deleted.

Section III. FUEL / OIL

6-11. FUEL LOAD.

Fuel loading imposes a restriction on the amount of load which can be carried. The required fuel must first be determined, then that weight subtracted from the total weight of passengers, baggage and fuel. Weights up to and including the remaining allowable capacity can be subtracted directly from the weight of passengers, baggage and fuel. As the fuel load is increased, the loading capacity is reduced.

6-12. FUEL AND OIL DATA.

a. Fuel Moment Chart. This chart (fig. 6-4) shows fuel moment/100 US gallons and pounds for JP-4 and JP-5. The fuel quantity indicator is calibrated for correct indication when using JP-5. When using other fuels multiply the indicated fuel quantity in pounds by .99 for JP-4 or by .98 for Aviation Gasoline (100/130) to obtain actual fuel quantity in pounds.

b. Oil Data. Total oil weight is 62 pounds and is included in the basic weight of the aircraft. Servicing information is provided in Section XII of Chapter 2.

Pages 6-15 and 6-16 have been deleted.

FUEL MOMENT CHART

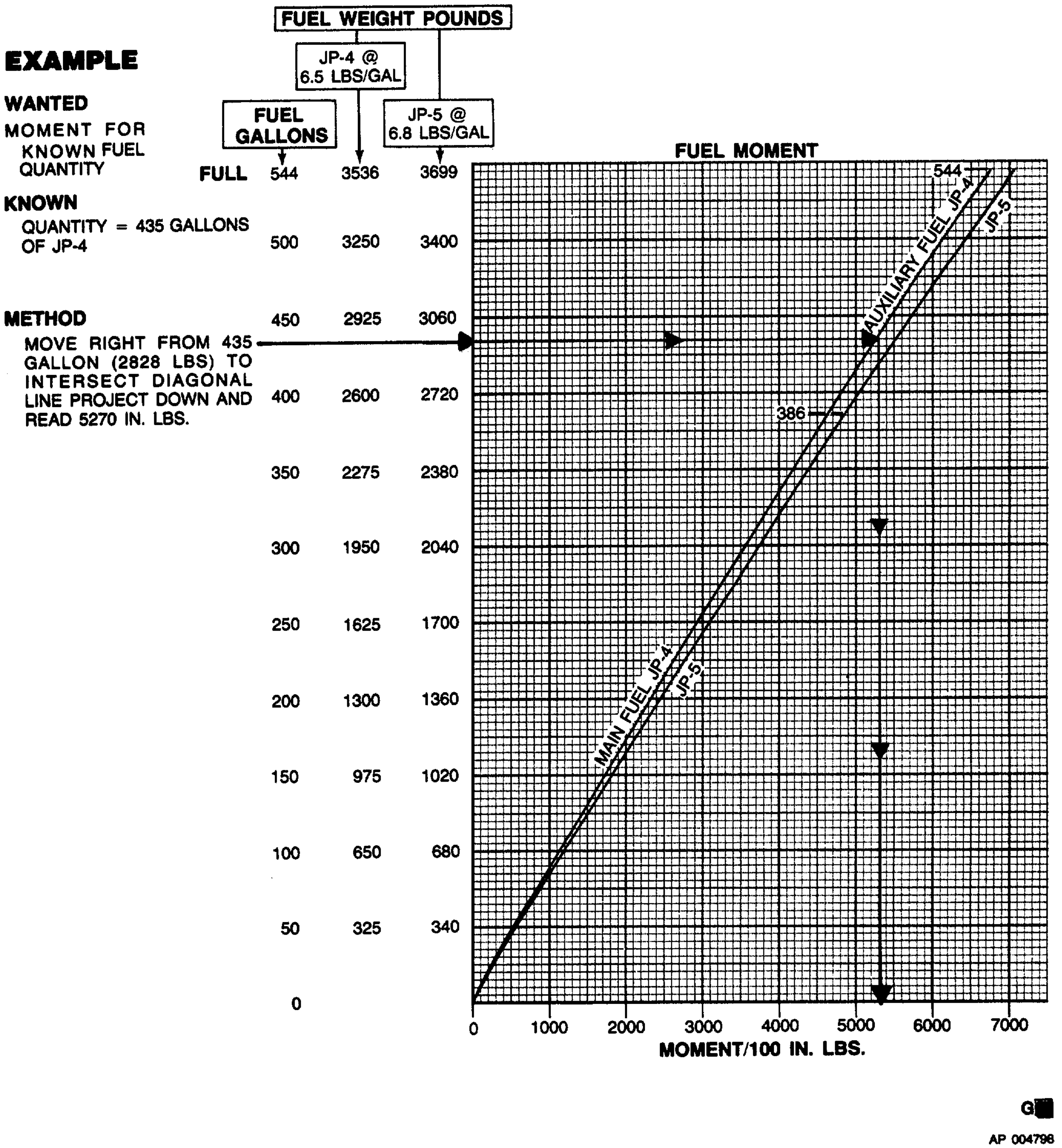

Figure 6-4. Fuel Moment Chart

Section IV. PERSONNEL

6-13. CABIN AREA.

a. *Cabin*. The cabin extends from the back of the cockpit partition to the aft cabin wall. This area provides 253.0 cubic feet of space. The cabin is 57.0 inches high and 54.0 inches wide. Access is gained through the entrance door which measures 51.5 inches high and 26.7 inches wide. The cabin section flooring will withstand a loading of 200 lbs. per sq. ft. for storage supported on the seat tracks. Floor areas where seat tracks are not present (walkways and aft baggage/utility area) will only support 100 lbs. per sq. ft. floor loads. Refer to Section V, to determine maximum cargo capacity and load position. Payload shall be limited in conjunction with fuel loading to stay within the design gross weight limitations.

b. Deleted.

c. Standard Seating Arrangement. Seating is provided for 8 passengers (fig. 6-5). A two place couch is installed aft of the cockpit partition on the right side. Five forward facing seats are installed with two on the right side and three on the left. These seats may be installed facing aft provided the occupant weighs no more than 170 pounds. A side facing toilet is installed across from the cabin entrance door, separated from the passenger area by a partition. A seat belt is provided and seating of one passenger is allowed in the toilet area. A baggage storage area is provided in the farthest aft portion of the cabin. Reference figure 6-7 for baggage moments.

NOTE

On C-12 **F2** aircraft the baggage/utility compartment area, containing 53.3 cubic feet of space, provides for storage of 550 pounds of baggage.

6-14. PERSONNEL LOADING AND UNLOADING.

a. Seat Installation. The seats are mounted on full length seat tracks to provide for quick removal and various seating arrangements. The armrests adjacent to the aisle may be lowered to allow ease of entry. The seats have reclining backs that may be adjusted for individual comfort. Seat back must be in the full upright position for takeoff and landing.

b. Seat Belts and Shoulder Harnesses. The pilot's and copilot's seats are equipped with shoulder harnesses. The belt for the shoulder harness is in a "Y" configuration with a single strap contained in an inertia reel attached to the seat back. One strap is worn over each shoulder and fastened by metal loops to the seat belt buckle. Spring loading of the inertia reel allows normal movement. A locking device will secure the harness in the event of sudden forward movement or impact action. Each passenger seat is equipped with a lap seat belt. An over the shoulder restraint belt, in addition to the lap belt, is installed on **F2** models.

6-15. PERSONNEL LOAD COMPUTATION.

When aircraft are operated at critical gross weights, the exact weight of each individual occupant plus equipment should be used. If weighing facilities are not available, or if the tactical situation dictates otherwise, loads shall be computed as follows:

a. Combat equipped soldiers: 275 lbs per individual.

b. Combat equipped paratroopers: 320 lbs per individual.

c. Crew and passengers with no equipment: compute weight according to each individual's estimate.

NOTE

Personnel loading configurations other than those shown in figure 6-6 shall be computed using Cargo Moment Chart, figure 6-9.

Deleted

Figure 6-5. Personnel Loading ***A*** *- Sheet 1 of 2*

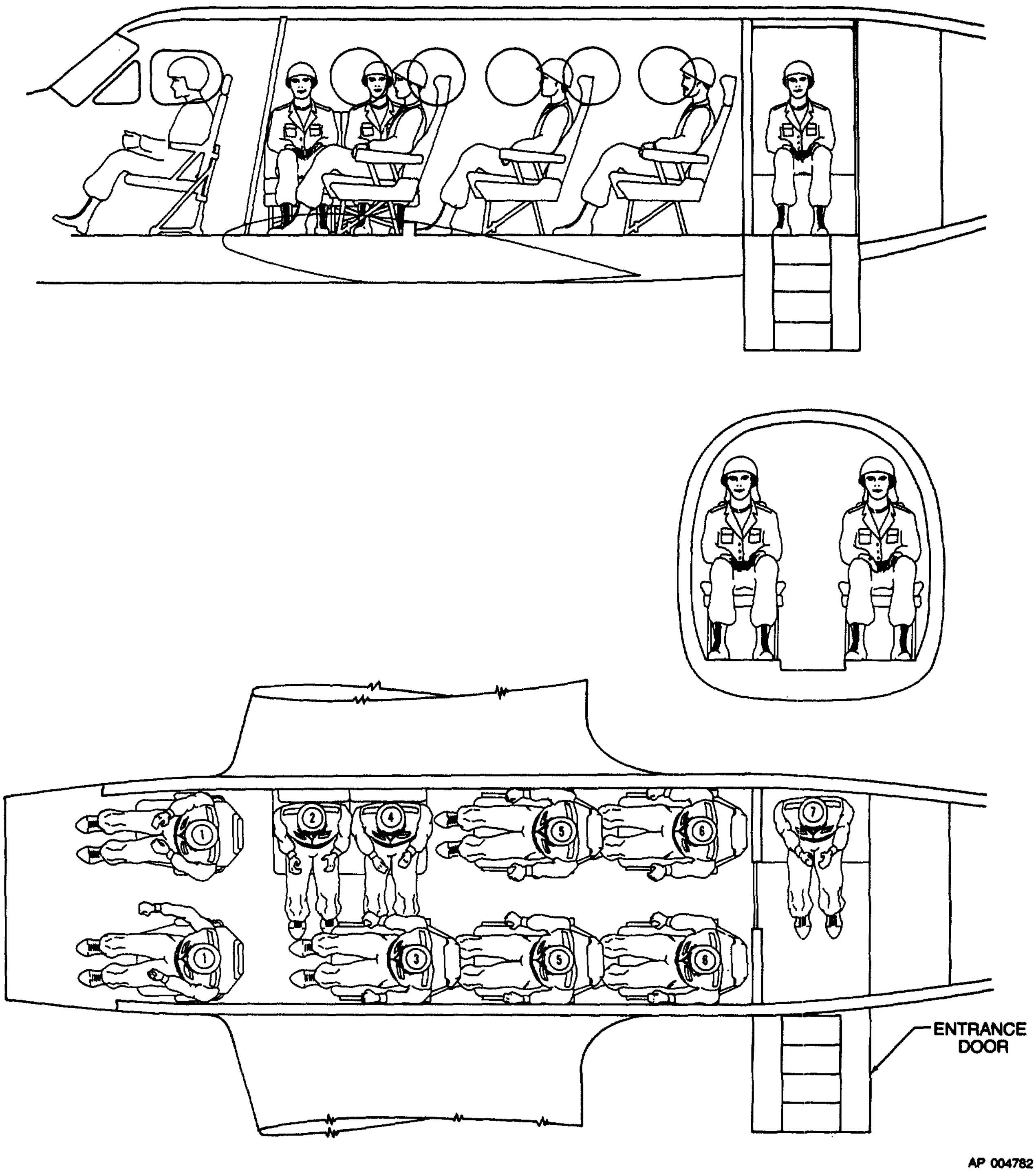

Figure 6-5. Personnel Loading - Sheet 2 of 2

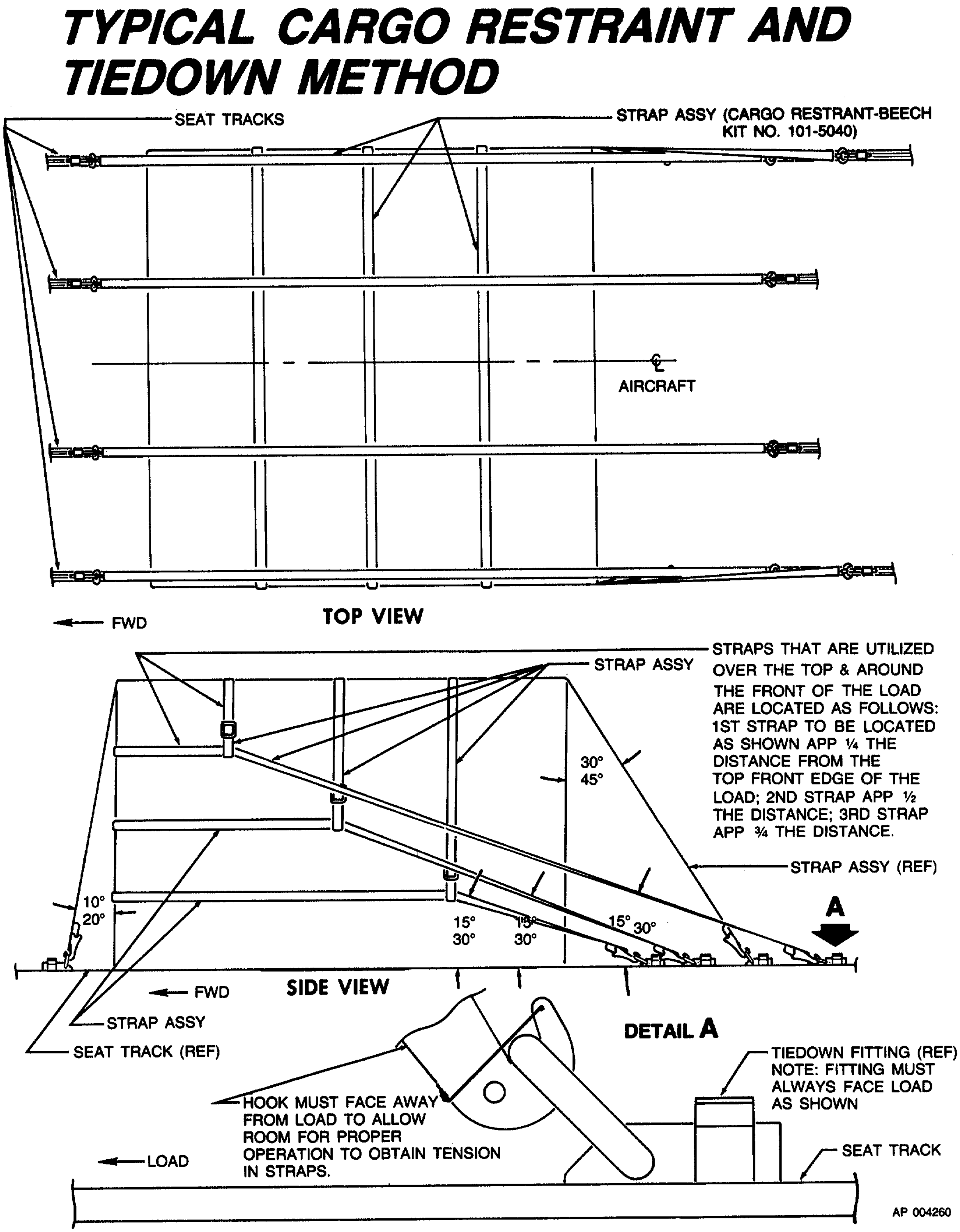

Figure 6-10. Cargo Restraint and Tiedown Method.

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Figure 6-6. Personnel Moments ***A*** *- Sheet 1 of 2*

PERSONNEL MOMENTS

EXAMPLE

WANTED
PERSONNEL MOMENT

KNOWN
PRESONNEL WEIGHT = 200 LBS
POSITION IS PILOT - COPILOT SEAT
= STATION 129

METHOD
ENTER WEIGHT AT EACH
SEAT POSITION HERE
MOVE RIGHT TO SEAT POSITION
MOVE DOWN, READ MOMENT = 258

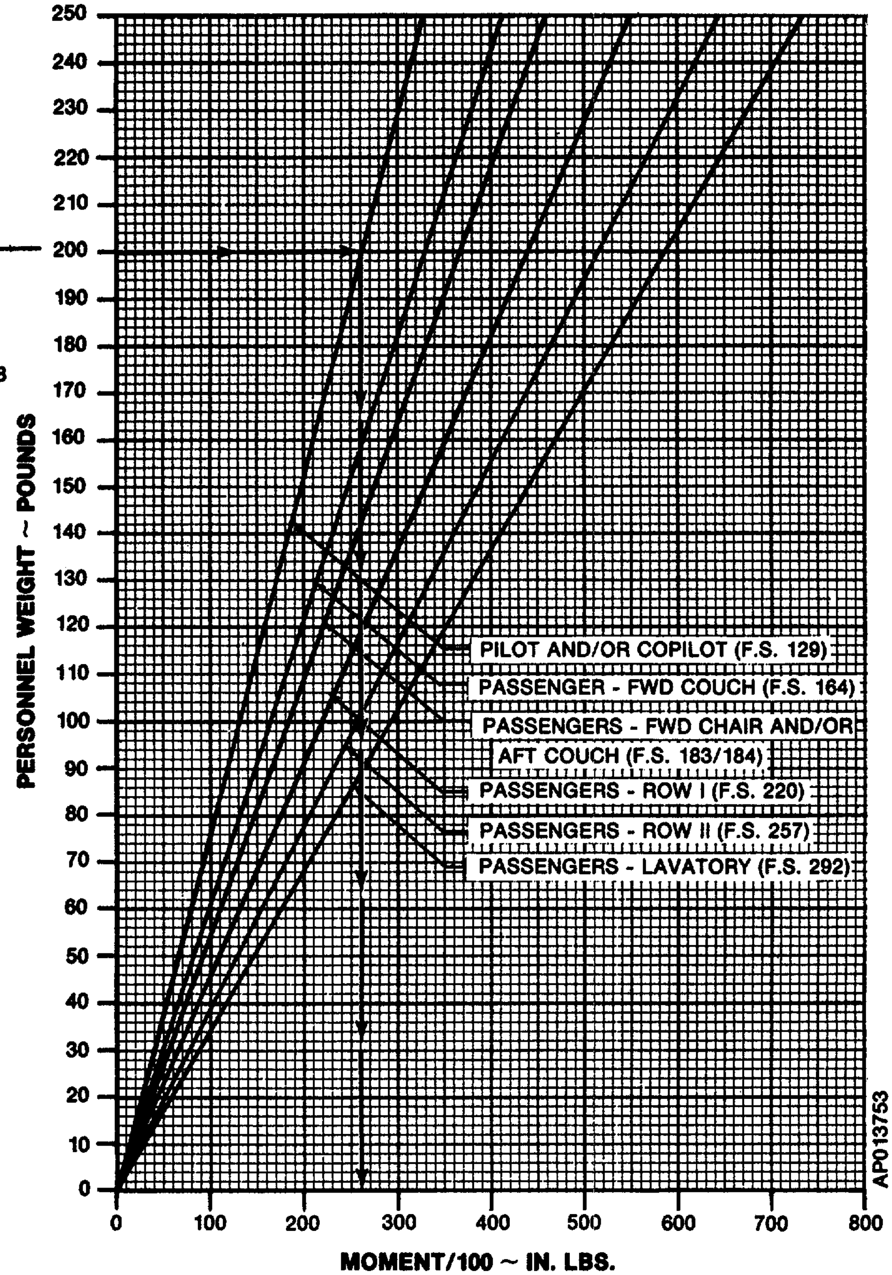


Figure 6-6. Personnel Moments - Sheet 2 of 2

Deleted

Figure 6-7. Baggage Moment ***A*** *- Sheet 1 of 2*

EXAMPLE

WANTED
BAGGAGE MOMENT

KNOWN
BAGGAGE WEIGHT = 310 POUNDS
BAGGAGE LOCATION = STATION 325

METHOD
ENTER WEIGHT OF BAGGAGE HERE
MOVE RIGHT TO BAGGAGE LOCATION
MOVE DOWN, READ MOMENT = 1008

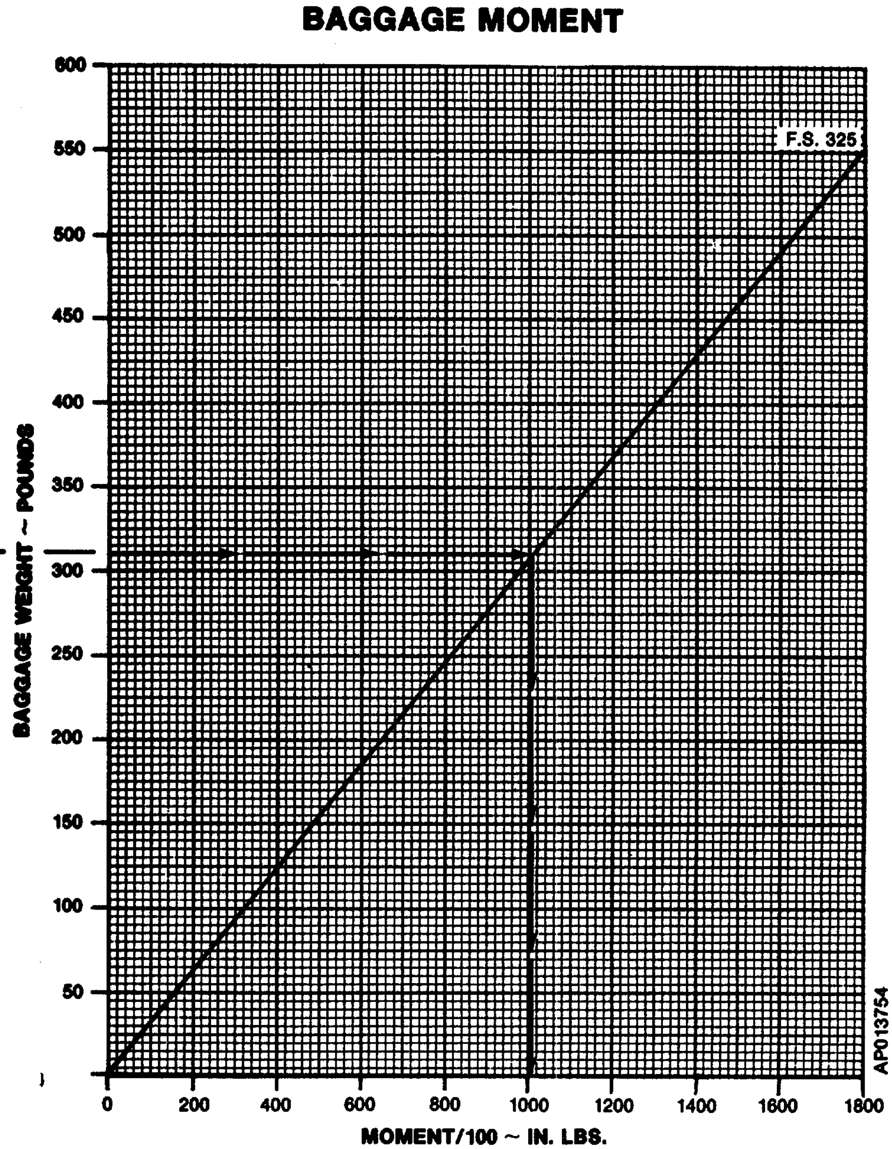


Figure 6-7. Baggage Moment - Sheet 2 of 2

Section V. CARGO LOADING

6-16. AIR CARGO FEATURES.

The 245 cubic foot cabin area is easily converted for mixed or all cargo use, by removal of passenger seats and a partial partition (fig. 6-8). A top-hinged cargo door with an opening 52 inches wide by 52 inches high, is provided on the left side of the fuselage to admit bulk cargo **DF** The floor is designed to support 200 pounds per square foot when supported by the seat tracks. The areas where seat track support is not possible will support 100 pounds per square foot floor loading. Seat tracks are to be used for securing cargo containers.

6-16A. AERIAL DELIVERY SYSTEM.

WARNING

Procedures for aerial delivery of personnel and cargo have not been developed.

The cargo door is a structural panel and shall be closed for flight.

There are no provisions for static lines; however, freefall parachute operations may be accomplished. The cabin door may be removed for flight by installing Beech Aircraft Corp. Kit 100-4006. Flights with the door removed must be in accordance with the Federal Aviation Administration approved flight manual supplement which accompanies this kit.

6-17. PREPARATION OF GENERAL CARGO.

Before loading cargo, loading personnel should determine such data as weight, dimensions, center of gravity, and contact areas of the individual cargo items for use in positioning the load.

6-18. CARGO CENTER OF GRAVITY PLANNING.

The cargo loading shall be planned so that the center of gravity of the loaded aircraft will fall within the operating limits shown on Center of Gravity Limitations graph (fig. 6-11).

6-19. LOAD PLANNING.

The basic factors to be considered in any loading situation are as follows:

a. Cargo shall be arranged to permit access to all emergency equipment and exits during flight.

b. Floorboard and bulkhead structural capacity shall be considered in the loading of heavy or sharp edged containers and equipment. Shorings shall be used to distribute highly condensed weights evenly over the cargo areas.

c. All cargo shall be adequately secured to prevent damage to the aircraft, other cargo, or the item itself.

6-20. LOADING PROCEDURE.

Loading of cargo is accomplished through the cabin door or cargo door **DF**

6-21. SECURING LOADS.

All cargo shall be secured with restraints strong enough to withstand the maximum force exerted in any direction. The maximum force can be determined by multiplying the weight of the cargo item by the applicable load factor. These established load factors (the ratio between the total force and the weight of the cargo item) are 1.5 to the side and rear, 3.0 up 3.0 down, and 9.0 forward.

6-22. RESTRAINT DEVICES.

The aircraft is equipped with full length seat tracks which are used to support the cargo and provide attachment points for the cargo tiedown devices (fig. 6-10). When cargo is properly secured by tiedown devices, it will be restrained from moving in any direction within the aircraft.

6-23. CARGO RESTRAINING METHOD.

CAUTION

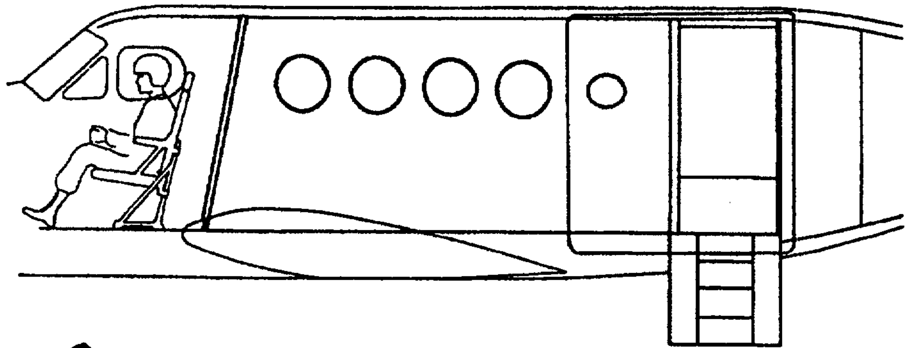
To avoid structural damage all cargo shall be restrained in accordance with Beech Kit Drawing NO. 101-5040, which provides the correct methods for restraint and approved hardware.

Cargo is restrained by passing tiedown devices over and around the cargo and attaching the ends of the tiedown device to the seat tracks as shown in figure 6-10. The number of tiedown devices required to restrain a given weight of cargo may vary.

6-24. CARGO UNLOADING.

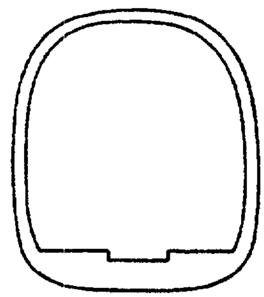
Unloading of cargo shall be accomplished through the cabin door, or cargo door **DF**

CARGO VERSION



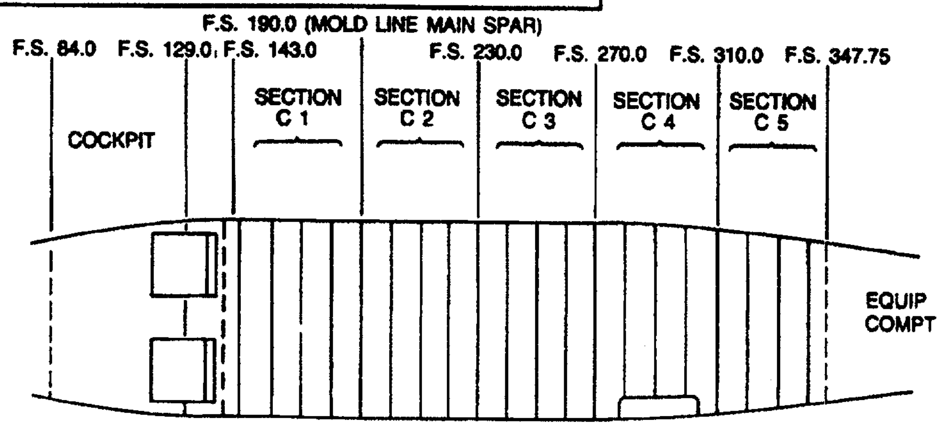
D F1

CARGO ENTRANCE DOOR OPENING		MAIN ENTRANCE DOOR OPENING	
HEIGHT	52 IN.	HEIGHT	51.5 IN.
WIDTH	52 IN.	WIDTH	26.7 IN.



SECTION	MAXIMUM	CENTROID ARM
C1	880 LB.	F.S. 167
C2	860 LB.	F.S. 210
C3	830 LB.	F.S. 250
C4	550 LB.	F.S. 290
C5	410 LB.	F.S. 325

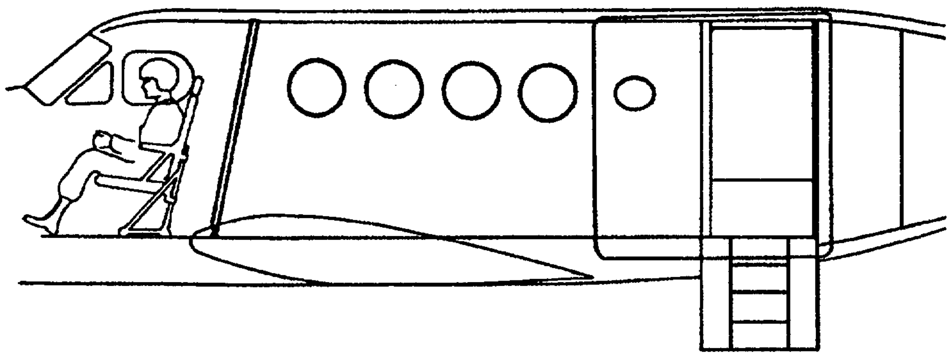
CARGO TIEDOWN PROVISIONS ARE NOT PROVIDED. CARGO SHALL BE SUPPORTED UPON AND TIED DOWN TO THE SEAT TRACKS.



AP 004793

Figure 6-8. Cargo Loading ***CD FI*** *- Sheet 1 of 2*

CARGO VERSION

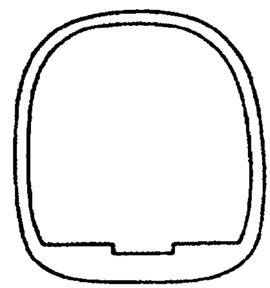


CARGO ENTRANCE DOOR OPENING

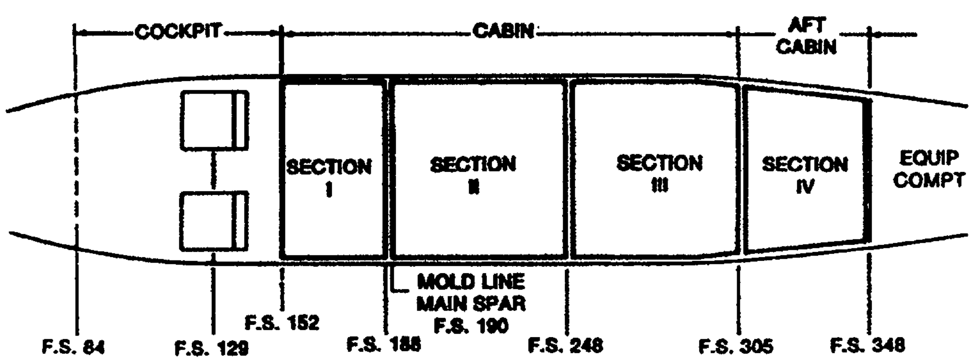
HEIGHT	52 IN.
WIDTH	52 IN.

MAIN ENTRANCE DOOR OPENING

HEIGHT	51.5 IN.
WIDTH	26.7 IN.



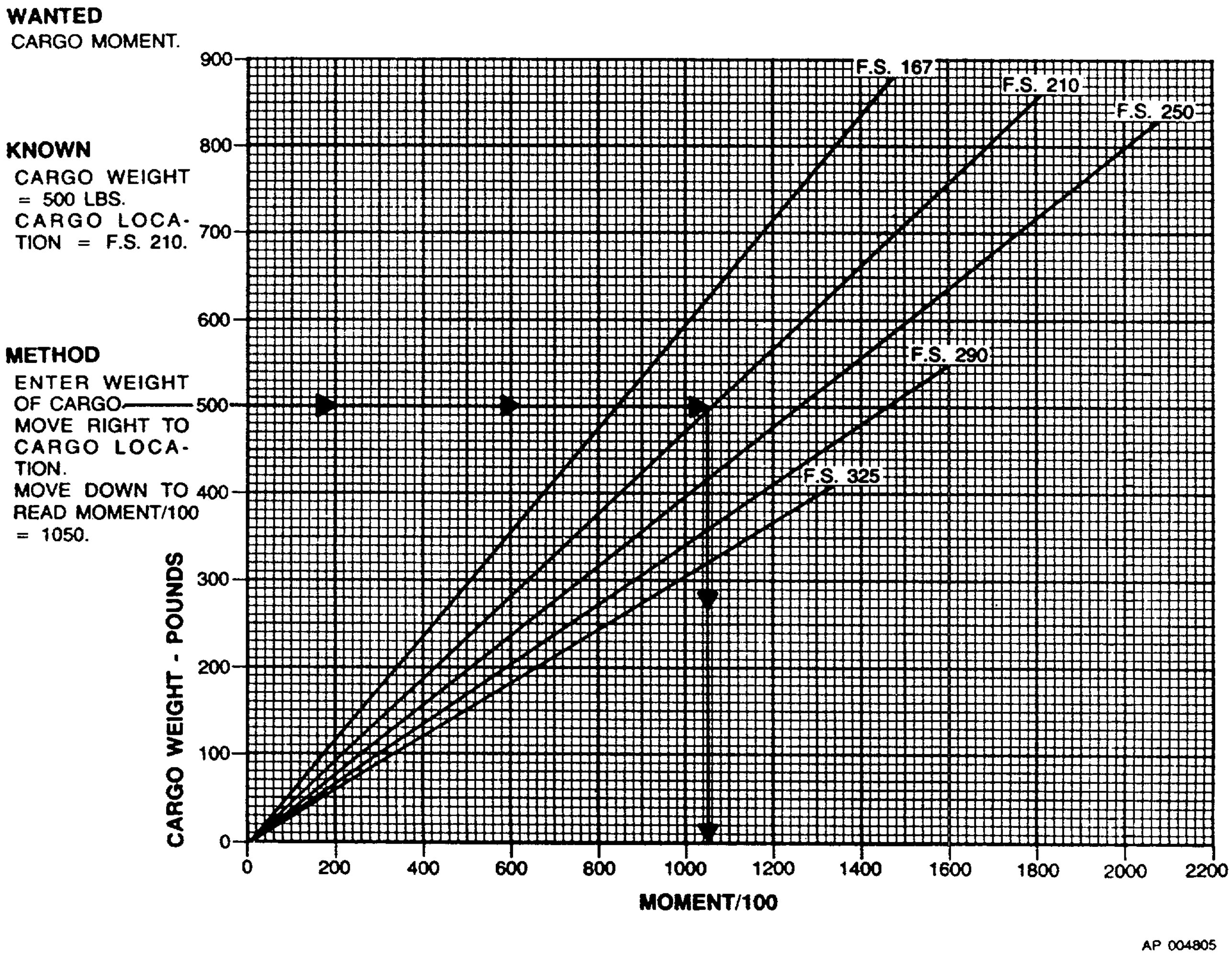
SECTION	MAXIMUM STRUCTURAL CAPACITY	CENTROID ARM
I	800 LBS	F.S. 170
II	1300 LBS	F.S. 218
III	1370 LBS	F.S. 276
IV	550 LBS	F.S. 325



AP013755

Figure 6-8. Cargo Loading ***F2*** *- Sheet 2 of 2*

CARGO MOMENT



WARNING

OPERATION OF THIS AIRCRAFT (IN THE CARGO CONFIGURATION) WITH PILOT AND CO-PILOT ONLY MAY EXCEED THE FORWARD C.G. LIMIT. ADD BAGGAGE AND/OR REMOVABLE BALLAST IN AFT BAGGAGE COMPARTMENT AS REQUIRED UP TO ALLOWABLE MAXIMUM.

*Figure 6-9. Cargo Moment **C D FI** - Sheet 1 of 2*

CARGO MOMENT

WARNING

OPERATION OF THIS AIRCRAFT (IN THE CARGO CONFIGURATION) WITH PILOT AND CO-PILOT ONLY MAY EXCEED THE FORWARD C.G. LIMIT. ADD BAGGAGE AND/OR REMOVABLE BALLAST IN AFT BAGGAGE COMPARTMENT AS REQUIRED UP TO ALLOWABLE MAXIMUM.

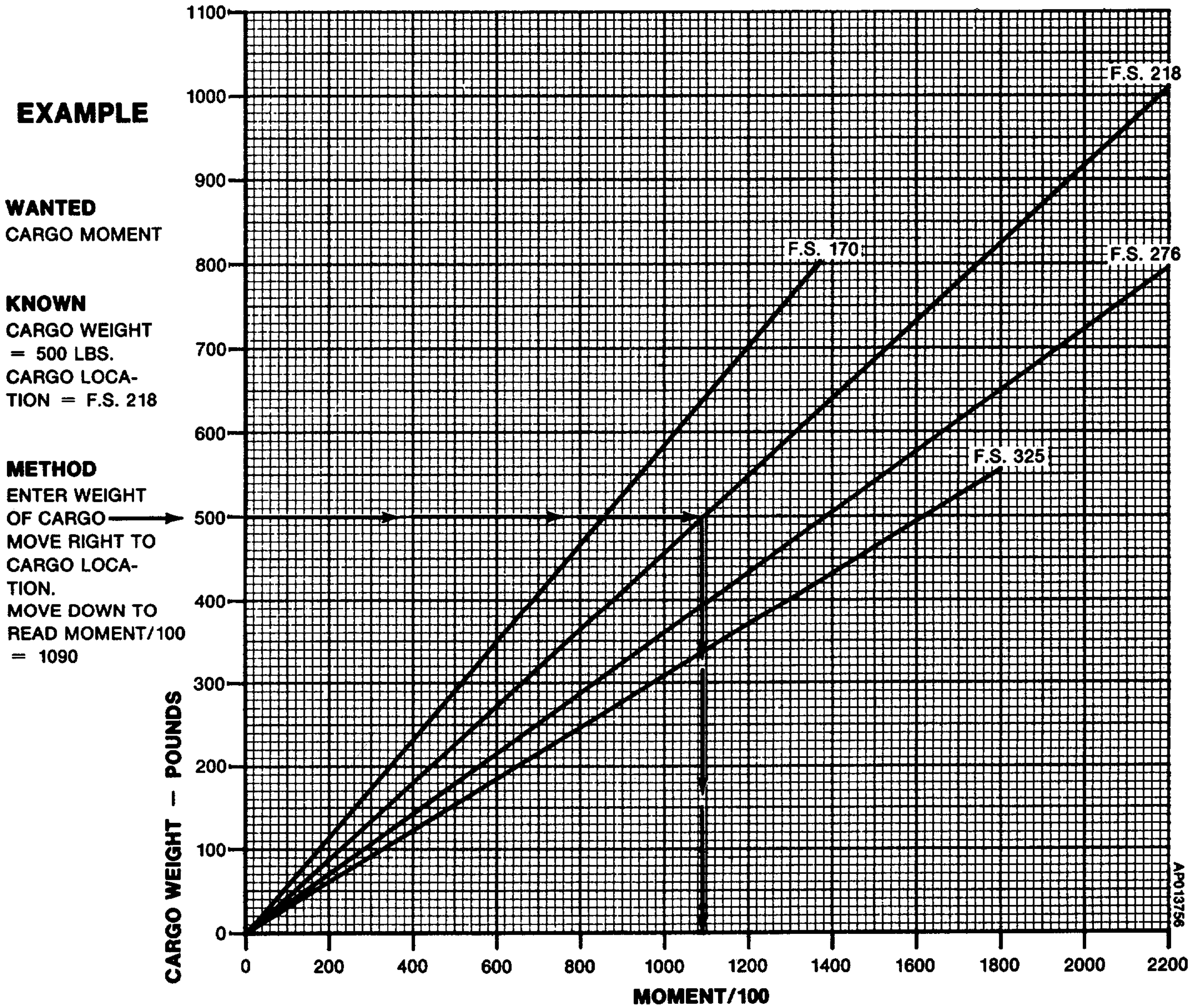


*Figure 6-9. Cargo Moment **F2**-Sheet 2 of 2*

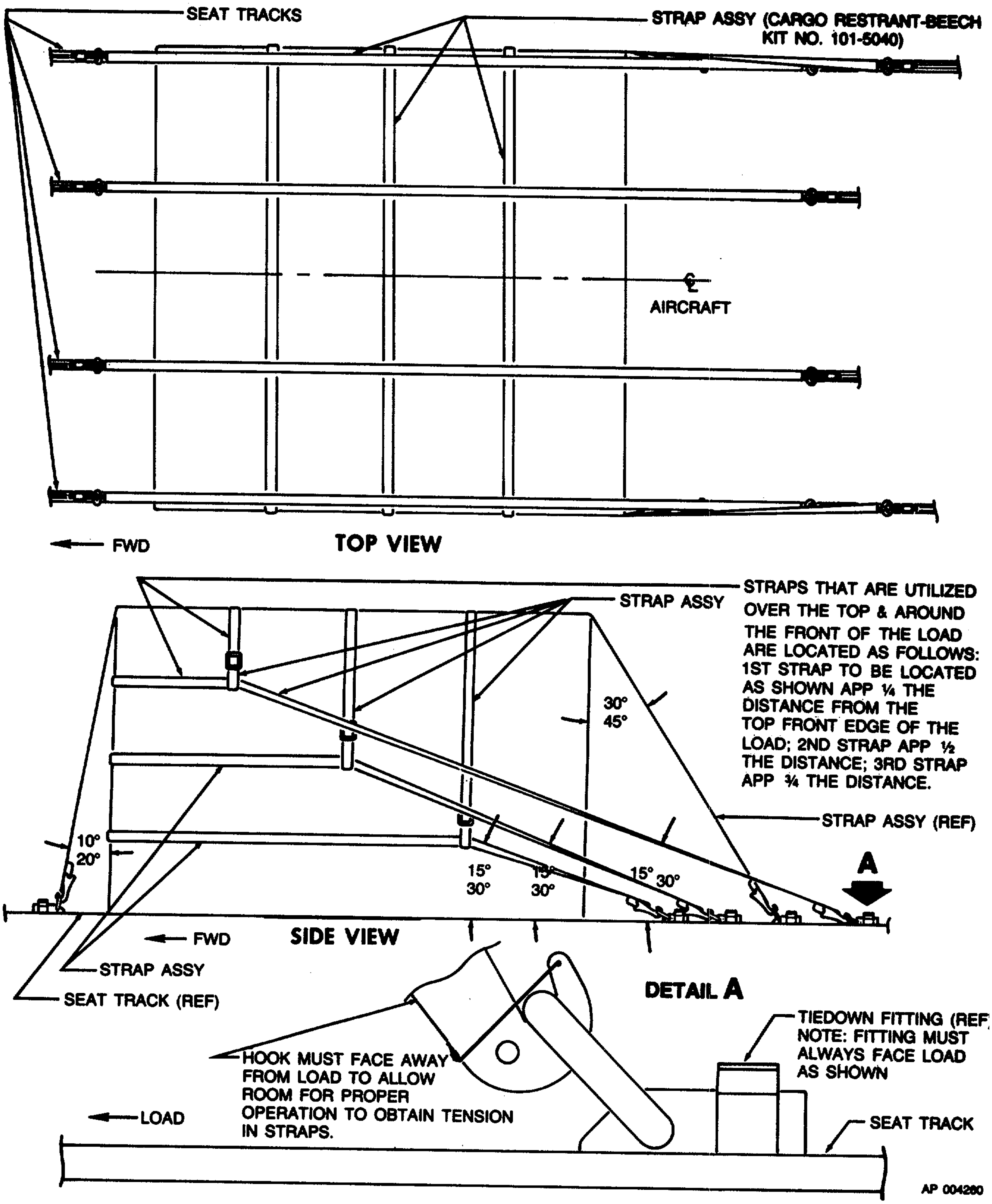


Figure 6-10. Cargo Restraint and Tiedown Method

Section VI. CENTER OF GRAVITY

6-25. CENTER OF GRAVITY LIMITATIONS.

Center of gravity limitations are expressed in ARM inches which refers to a positive measurement from the aircraft's reference datum. The forward CG limit at 11,279 lbs or less is 181.0 ARM inches. At 12,500 lbs, the forward CG limit is 185.0 ARM inches and a straight line variation is used between given points. At 12,500 lbs or less, the aft CG limit is 196.4 ARM inches (fig. 6-11). The Center of Gravity Limitations graph (fig. 6-11) is designed to establish forward and aft CG limitations.

EXAMPLE

WANTED
DETERMINE IF LOADING LIMITS ARE EXCEEDED AND DETERMINE CG POSITION

KNOWN
GW = 12070
MOMENT/100 = 22680

METHOD
ENTER GROSS WEIGHT HERE
MOVE RIGHT TO TOTAL MOMENT = 22,680
READ LOAD WITHIN LIMITS
MOVE DOWN
READ ARM = 187.9

▲ C-12 F2

▲▲ C-12 C D F1

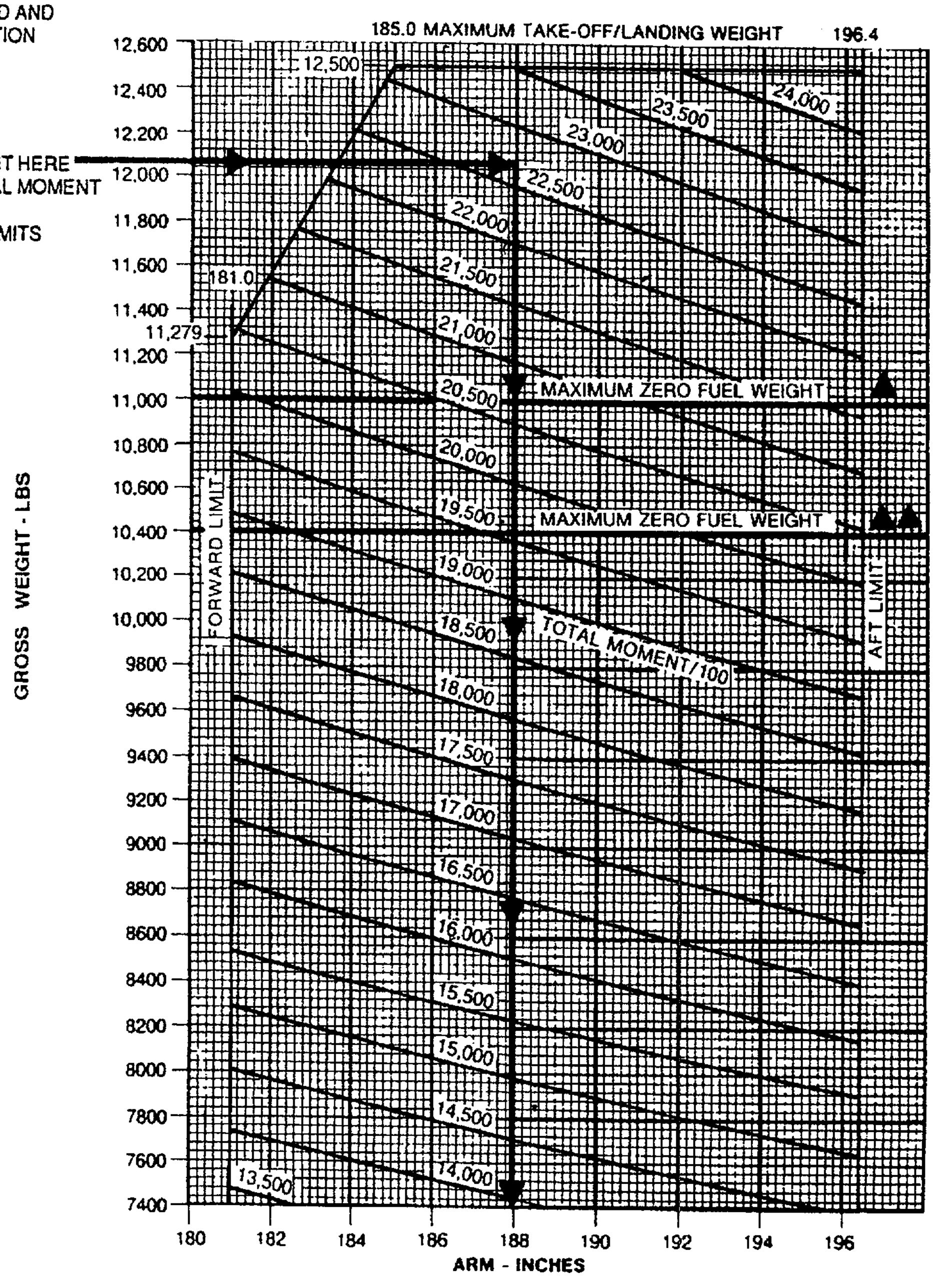


Figure 6-11. Center of Gravity Limitations

CHAPTER 7

Section I

All data on pages 7-3 through 7-100, including figures 7-1 through 7-86, have been deleted.

CHAPTER 7

Section II MODEL C-12 *C*

INTRODUCTION

The performance and cruise data contained in this section of Chapter 7 pertains to C12***C*** model aircraft. Data for C-12 ***DF*** models may be found in sections III, and IV respectively. Users are authorized to re move whichever sections not applicable to their model aircraft, and are not required to carry on-board all sections.

SECTION II MODEL C-12C

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Section II. MODEL C-12C
INTRODUCTION TO PERFORMANCE DATA

7-1. DESCRIPTION.

The charts presented in this chapter are based on and are consistent with the recommended operating procedures and techniques set forth in other chapters of this manual. The charts contain the performance data necessary for preflight and inflight mission planning. Explanatory text applicable to each type of chart is included to illustrate the use of the data presented.

The data contained in this section of Chapter 7 pertains only to the C-12C model aircraft. Data for the A, D and F models can be found in sections I, III and IV respectively. The user is authorized to remove sections which are not applicable to his model aircraft; only the applicable section is required to be carried on-board.

7-2. PURPOSE.

a. The purpose of this chapter is to provide the best available performance data for the C-12 aircraft. Regular use of this information will enable you to receive maximum safe utilization from the aircraft. Although maximum performance is not always required, regular use of this chapter is recommended for the following reasons:

(1) Knowledge of your performance margin will allow you to make better decisions when unexpected conditions or alternate missions are encountered.

(2) Situations requiring maximum performance will be more readily recognized.

(3) Familiarity with the data will allow performance to be computed more easily and quickly.

(4) Experience will be gained in accurately estimating the effects of variables for which data are not presented.

b. The information is primarily intended for mission planning and is most useful when planning operations in unfamiliar areas or at extreme conditions. The data may also be used in flight, to establish unit or area standing operating procedures, and to inform ground commanders of performance/risk tradeoffs.

7-3. GENERAL.

The pre-flight planning shall cover the maximum range of conditions and performance that can reasonably be expected. In each area of performance, the effects of altitude, temperature, gross weight, and other parameters relating to that phase of flight are presented. In addition to the presented data, your judgment and experience will be necessary to accurately obtain performance under a given set of circumstances. The conditions for the data are listed under the title of each chart. The effects of different conditions are discussed in the text accompanying each phase of performance. Where practical, data is presented at conservative conditions. All performance data presented is within the applicable limits of the aircraft.

CAUTION

Exceeding operating limits can cause permanent damage to critical components. Overlimit operation can decrease performance, cause immediate failure, or failure on a subsequent flight.

7-4. LIMITS.

Performance generally deteriorates rapidly beyond limits. If limits are exceeded, minimize the amount and time. Enter the maximum value and time above limits on DA Form 2408-13 so proper maintenance action can be taken.

7-5. CHART EXPLANATION.

A complete series of performance charts is provided for C-12 aircraft in this manual. The charts include data on takeoff, climb, landing, and operating instructions for cruising flight from maximum endurance to normal rated power. All charts are based on ambient temperature conditions and pressure altitude.

Section II. MODEL C-12 C
INTRODUCTION TO PERFORMANCE
NOTE

All speeds are IAS except as noted.

The graphs and tables in this part present performance information for takeoff, climb and landing at various parameters of weight, altitude and temperature. All performance information except cruise examples have been presented on performance graphs. A ramp weight of 12,590 pounds has been assumed. Included is information required to construct a single engine takeoff flight path. Included are (1) takeoff distance assuming an engine failure at lift off and (2) zero wind climb gradient at takeoff speeds with one engine inoperative.

NOTE

The following exemplary conditions illustrate the types of data needed for pre-flight planning. In some cases, this data has been utilized in the graph examples. However, examples shown on graphs do not in all cases represent data shown in the following flight planning example problem.

CONDITIONS

At Billings:

Outside Air Temperature............................ 25°C (770F)
Field Elevation .... 3606 feet
Altimeter Setting .... 29.56 in. Hg
Wind.. 360° at 10 knots
Runway 34 Length.................................... 5600 feet

Route of Trip:

BIL-V 1 9-CZI-V247-DGW-V 19E-CYS-V 1 9-DEN Weather Conditions IFR to 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	ALT SET. °C	IN. HG
BIL-SHR	88	8000	0100/30	-10		0	29.56
SHR-CZI	57	9000	3500/40	-10		-4	29.60
CZI-DGW	95	8000	0400/45	-10		0	29.60
DGW-CYS	47	8000	0400/45	-10		0	29.60
	46	8000	0400/45	-10		0	29.60
CYS-DEN	81	8000	0400/45	-10		0	29.60
REFERENCE: En route Low Altitude charts L-8 and L-9							

At Denver:

Outside Air Temperature............................ 15°C (59°F)
Field Elevation .... 5330 feet
Altimeter Setting .... 29.60 in. Hg
Wind.. 270° at 10 knots
Runway 26L length.................................... 10,000 feet

To determine pressure altitude at origin and destination airports, add 100 feet to field elevation for each .1 in. Hg below 29.92 and subtract 100 feet from field elevation for each .1 in. Hg above 29.92.

Pressure Altitude at BIL:
29.92-29.56 = .36 in. Hg
The pressure altitude at BIL is 360 feet above the field elevation.
3606 + 360 = 3966 Feet
Pressure Altitude at DEN:
29.92-29.60 = .32 in. Hg
The pressure altitude at DEN is 320 feet above the field elevation.
5330 + 320 = 5650 Feet

Takeoff performance has been presented to determine the maximum takeoff weight, takeoff distance field length requirements (accelerate-stop), and liftoff flight path assuming an engine failure occurs during the takeoff procedure. The following illustrates the use of these charts.

Enter the graph for Takeoff Weight Flaps 0% To Achieve Positive, Single Engine Inoperative Climb At Liftoff, at 3966 feet, to25°C, to determine the maximum weight at which the accelerate after liftoff procedure should be attempted:

Takeoff Weight.. 12,500 lbs

The following example assumes the aircraft is loaded so that takeoff weight is 12,500 lbs.

Enter the graph for Takeoff Distance Flaps at 25° C, 3966 feet pressure altitude, 12,500 pounds takeoff weight, and 9.5 knots headwind component:

Ground Roll .... 3500 f feet
Total Distance Over a 50 Foot Obstacle...... 4680 ft
Rotation Speed... 110 kn
50 Foot Speed.. 121 kn

Enter the graph for Accelerate-Stop-Flaps 0% at 25°C, 3966 feet pressure altitude, 12,500 pounds takeoff weight, and 9.5 knots headwind component:

Accelerate-Stop Field Length...................... 5800 feet
Engine Failure Speed.................................. 113 knots

Enter the graph for Accelerate After Lift-of Flaps 0% at 25°C, 3966 feet pressure altitude, 12,500 pounds takeoff weight, and 9.5 knots headwind component:

Ground Roll .... 4300 feet
Total Distance Over 50 Foot Obstacle......... 9300 feet
Take-Off Speed at Rotation......................... 110 knots
at 50 feet... 121 knots

Enter the graph for Single Engine Gradient of Climb -Flaps 0% at 25°C, 3966 feet pressure altitude, and 12,500 pounds (not shown on graph examples):

Climb Gradient.. 3.45%
Climb Speed .... 121 knots

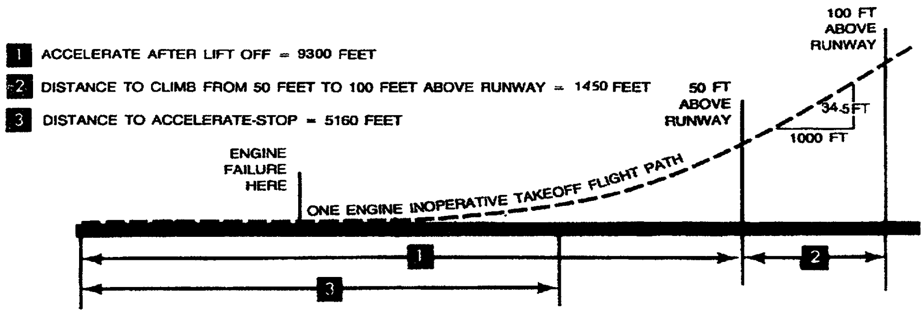
A 3.45% climb gradient is 34.5 feet of vertical height per 1000 feet of horizontal distance.

NOTE

> The single engine gradient of climb graphs assume a zero wind condition. Climbing into ahead wind 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, assuming engine fails at lift-off:

Distance from 50 feet to 100 feet = 50 feet (100-50) (1000 34.5) 1450 = feet
Total Distance = 9300 + 1450 = 10,750 feet
The above results are illustrated below:
The above results are illustrated below:



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

Ramp Weight... 12,590 lbs
Expected Fuel Usage................................. 1744 lbs
Landing Weight... 12,590-1744 = 10,846 lbs

NOTE

Refer to the Cruise Control Part of this section to determine Expected Fuel Usage.

Enter the graph for Landing Distance Without Propeller Reversing Flaps 100% at 15C, 5650 feet pressure altitude, 10,846 lbs, 10 knots headwind component:

Ground Roll .... 1500 feet
Total Over 50 foot Obstacle .... 2550 feet
Approach Speed... 99 knots

Enter the graph for Climb-Balked Landing at 15C, 5650 feet, and 10,846 lbs.

Rate of Climb.. 1510 ft/min
Climb Gradient.. 16.5%

Check for compliance with the Maximum Zero Fuel Weight Limitation:

NOTE

Zero Fuel Weight shall not exceed 10,400 pounds.

For this example, the following conditions were assumed:

Ramp Weight... 12,590 lbs
Weight of Usable Fuel Onboard.................. 2054 lbs

NOTE

Refer to the Cruise Control Part of this section to determine Weight of Usable Fuel Onboard.

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

Zero Fuel Weight = 10,536 lbs
12,590-2054
Maximum Zero Fuel

Weight (from
LIMITATIONS Section) = 10,400 lbs

Maximum Zero Weight
Limitation has been exceeded by 136 lbs

In order to avoid exceeding the limitation, at least 136 pounds of payload must be off-loaded. If desired, additional fuel may then be added until the maximum ramp weight limitation of 12,590 pounds is again reached.

7-6. 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 various scales on the graph should be used. For instance, if the first item in the example is OAT, then enter the graph at the existing OAT.

2. The reference lines indicate where to begin following the guidelines. Always project to the reference line first, then allow the guidelines to the next known item by maintaining the same PROPORTIONAL DISTANCE between the guideline above and the guideline below the projected line. For instance, if the projected line intersects the reference line in the ratio of 30% down/70% up between the guidelines, then maintain this same 30%/70% relationship between the guide lines and follow them to the next known item.

3. The associated conditions define the specific conditions from 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.

4. Indicated airspeeds (IAS) were obtained by using either the Airspeed Calibration Normal System Graph or the Airspeed Calibration Normal System Takeoff Ground Roll Graph.

5. The full amount of usable fuel is available for all approved flight conditions.

6. Notes have been provided to approximate performance with ice vanes extended. The effect is estimated by entering the graph at a temperature higher than the actual temperature. The effect is approximate and will vary depending upon airspeed, temperature, altitude and ambient conditions. Existing TGT and torque limits still apply.

7. Operations with ice vanes extended should be conducted only when the temperature is below + 15°C and flight free of visible moisture cannot be assured.

7-7. ENGINE FAILURE PRIOR TO LIFTOFF

1. If an engine fails prior to liftoff, the abort procedure should be performed. Directional control while identifying and feathering the inoperative engine and distance required to accelerate may not be sufficient to continue takeoff.

7-8. ENGINE FAILURE AT LIFTOFF.

1. If an engine fails at or immediately after liftoff, climb to 50 feet may be critical. Positive pilot actions will be required to maintain aircraft control; the distance required to attain 50 feet AGL will be significant.

Single engine climb performance predictions can only be realized in a zero side-slip. This is accomplished by maintaining a 3' to 5' bank angle and ½ ball off center towards the operating engine.

AIRSPEED CALIBRATION – NORMAL SYSTEM

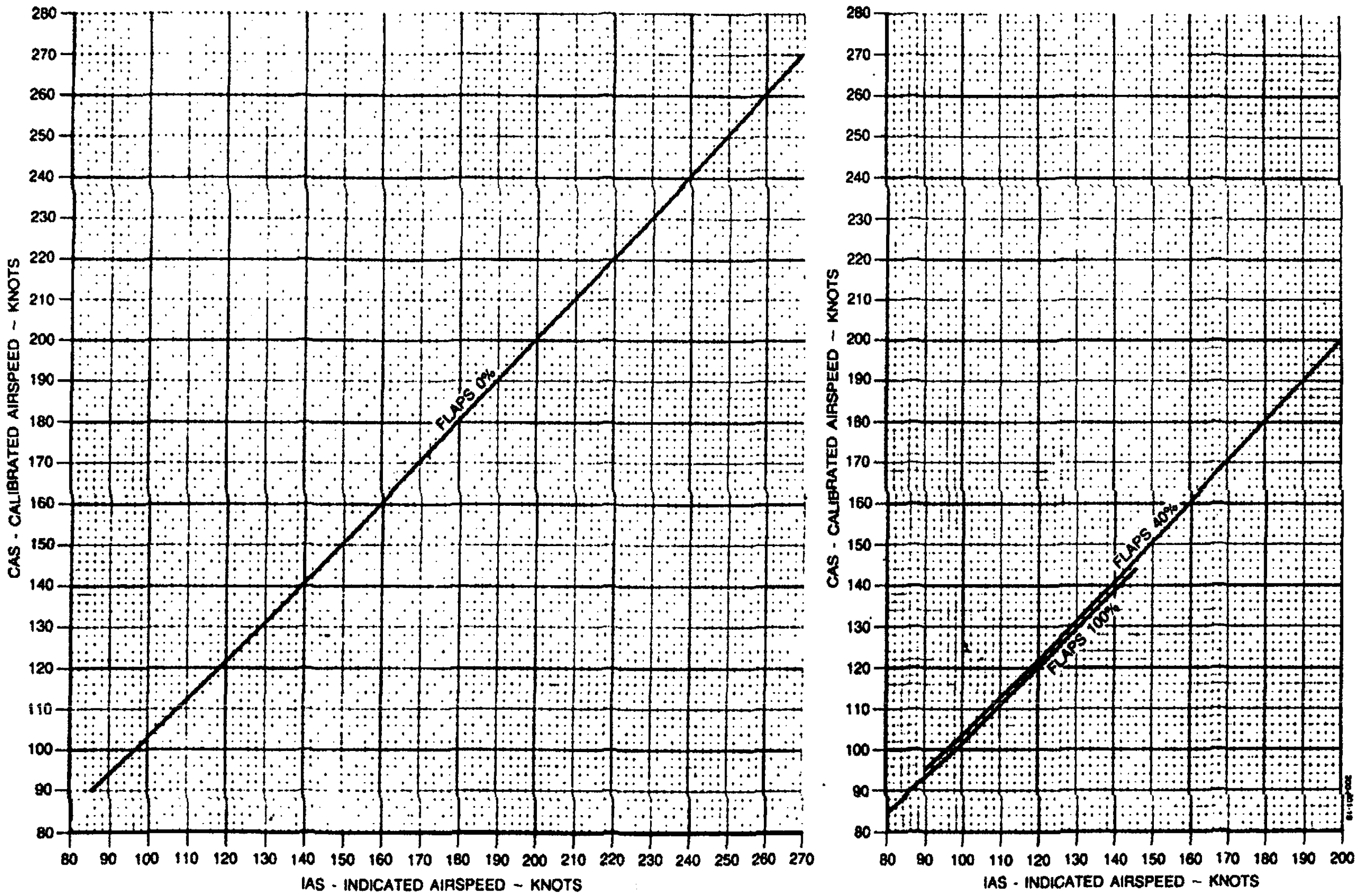


Figure 7-87. Airspeed Calibration Normal Speed

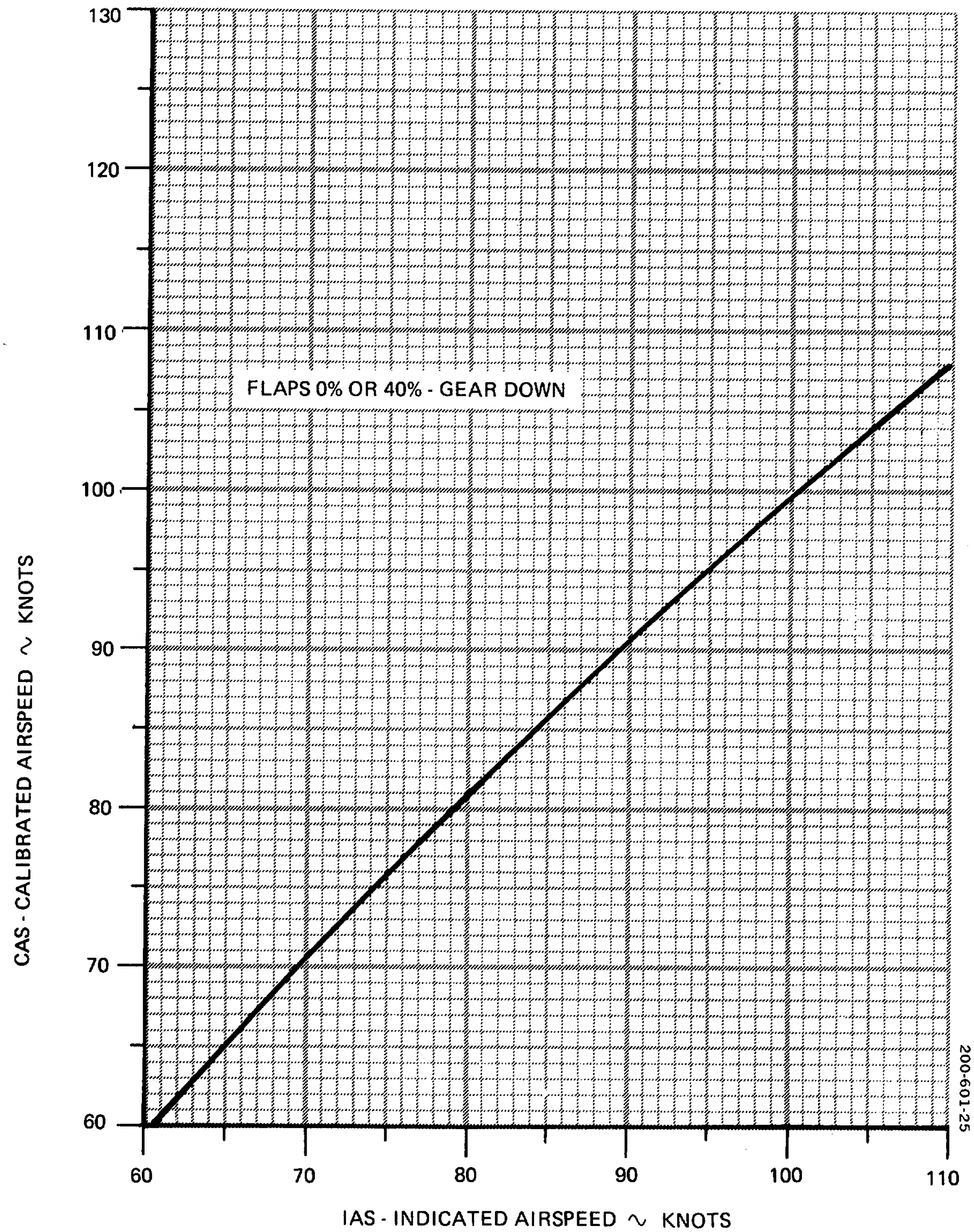


Figure 7-88. Airspeed Calibration Normal System Take-off Ground Roll

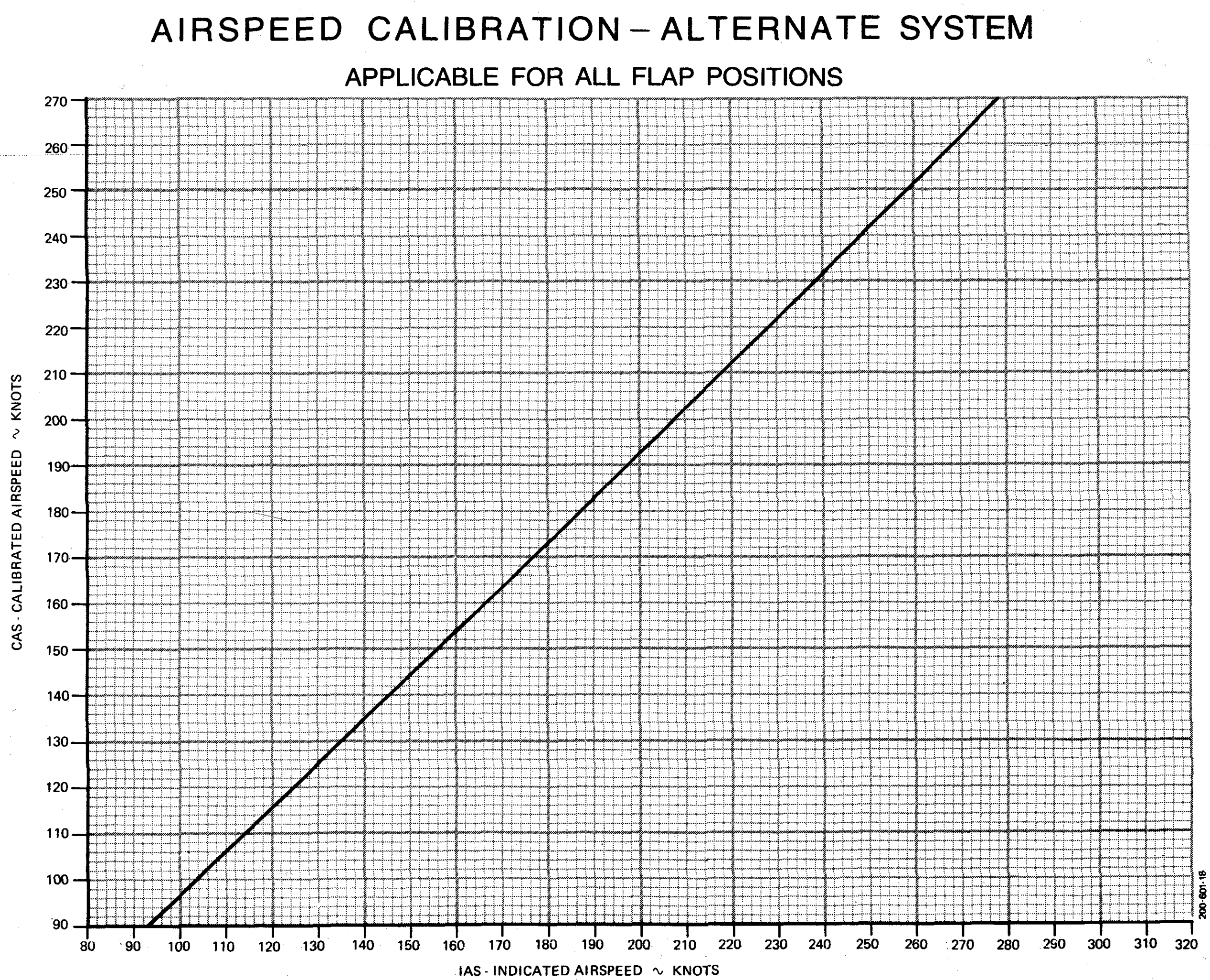


Figure 7-89. Airspeed Calibration Alternate System

ALTIMETER CORRECTION – NORMAL SYSTEM

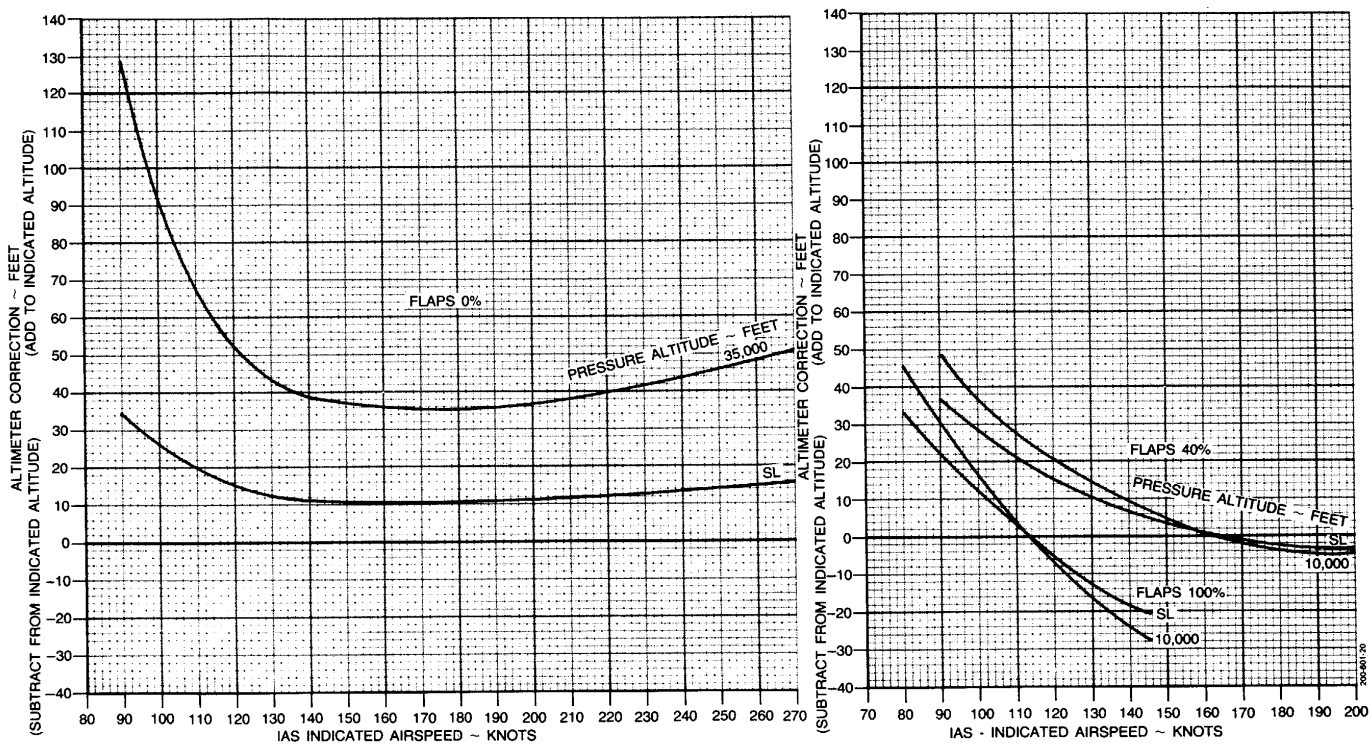


Figure 7-90 Altimeter Correction Normal System

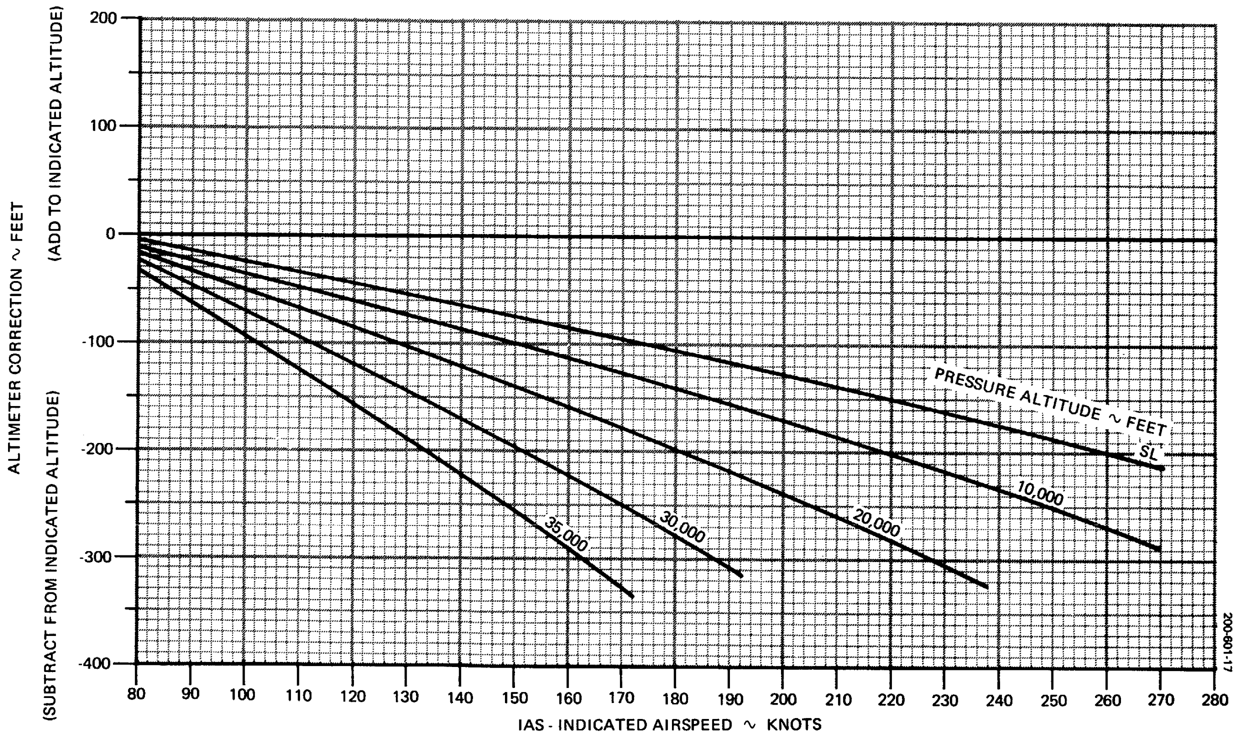


Figure 7-91. Altimeter Correction-Alternate System

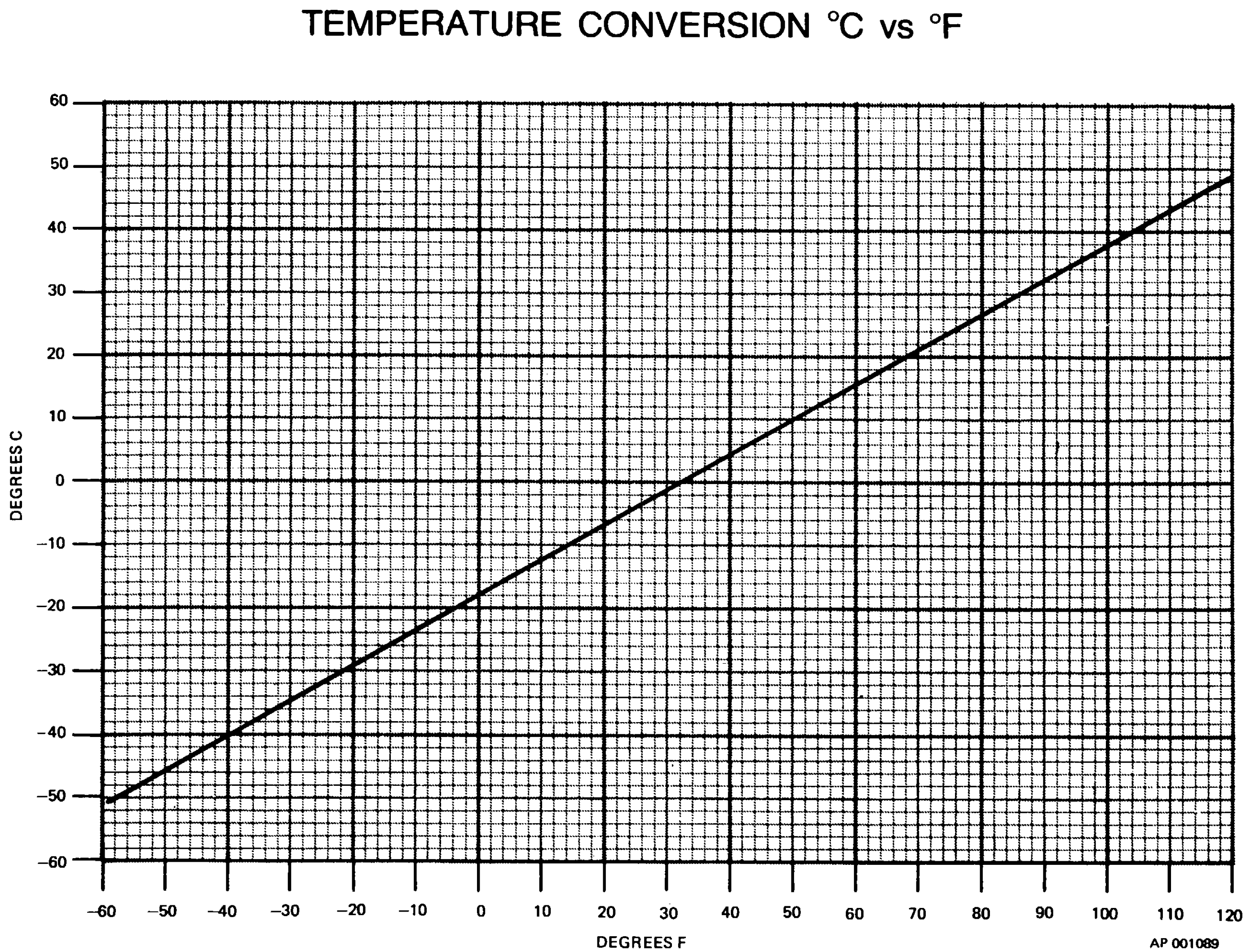


Figure 7-92. Temperature Conversion °C vs °F

MINIMUM TAKE-OFF POWER AT 2000 RPM
(ICE VANES RETRACTED)
(65 KNOTS)

NOTE: 1. TORQUE INCREASES APPROXIMATELY 1% FROM 0 TO 65 KNOTS
2. THE PERCENT TORQUE INDICATED IN THIS FIGURE IS THE MINIMUM VALUE AT WHICH TAKE-OFF PERFORMANCE PRESENTED IN THIS SECTION CAN BE REALIZED. ANY EXCESS POWER WHICH MAY BE DEVELOPED WITHOUT EXCEEDING ENGINE LIMITATIONS MAY BE UTILIZED.

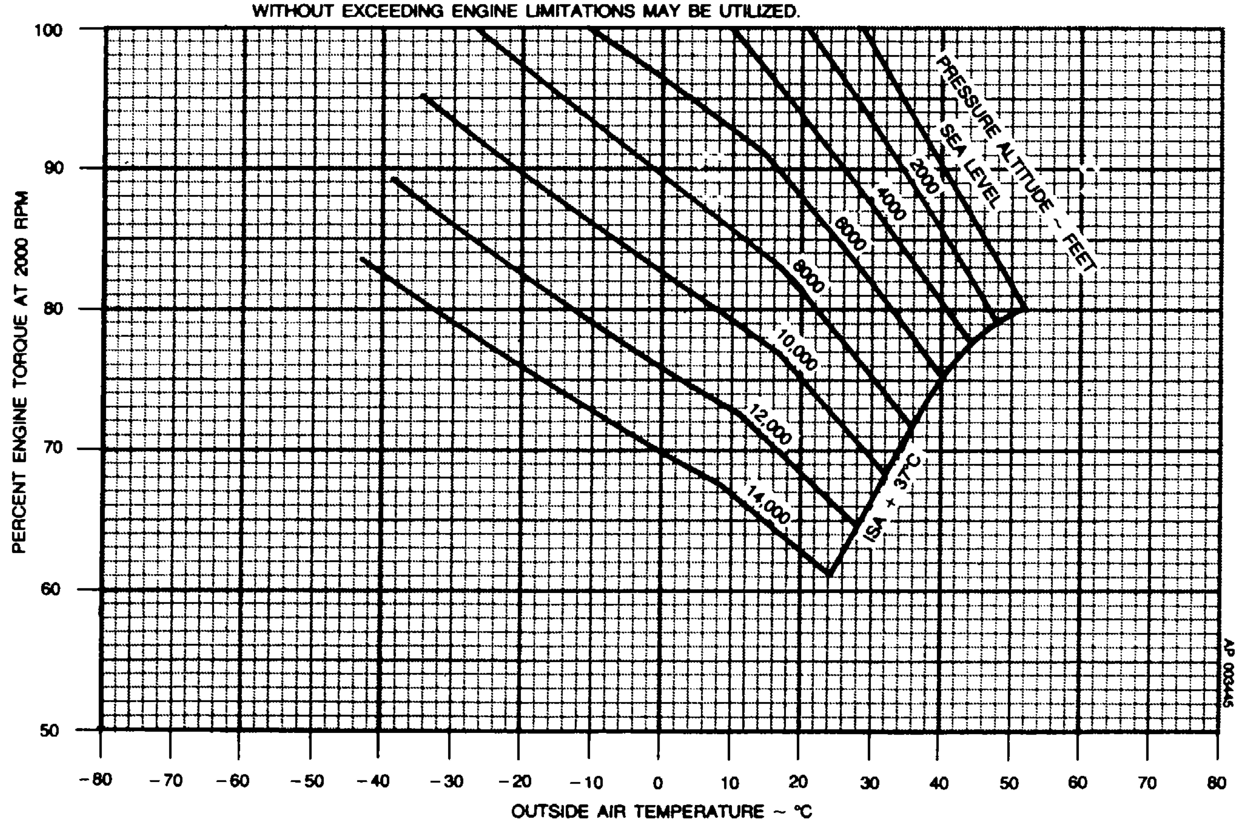


Figure 7-93. Minimum Take-off Power at 2000 RPM - Ice vanes Retracted

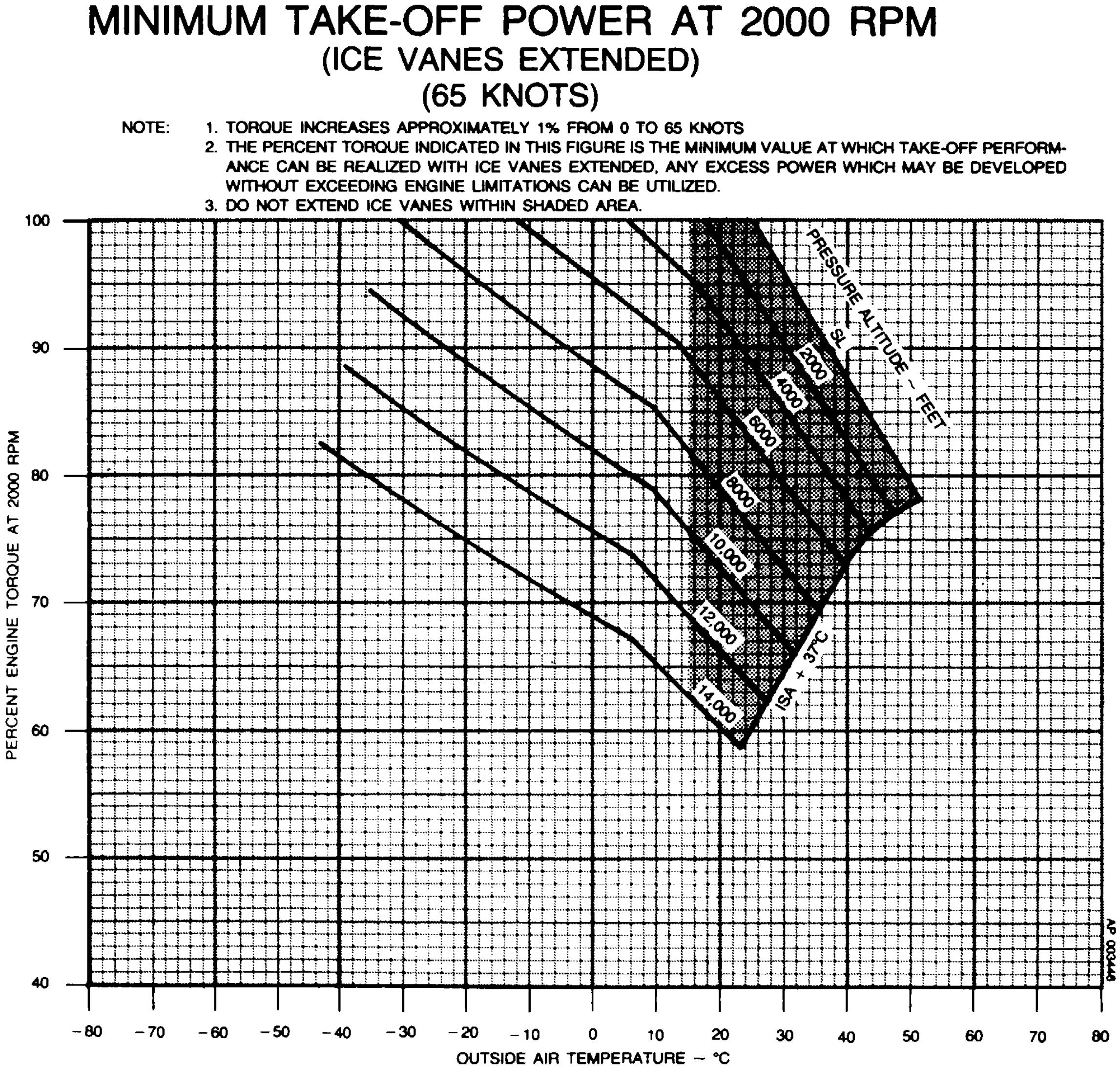


Figure 7-94. Minimum Take-off Power at 2000 RPM - Ice Vanes Extended

STALL SPEEDS – POWER IDLE

NOTES:
1. ALTITUDE LOSS EXPERIENCED WHILE CONDUCTING STALLS IN ACCORDANCE WITH FAR 23.201 WAS 800 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 . . . . 11,700 LBS
FLAPS 40%
ANGLE OF BANK . . . . . 30 DEG.

STALL SPEED . . . . 96 KTS CAS
90 KTS IAS

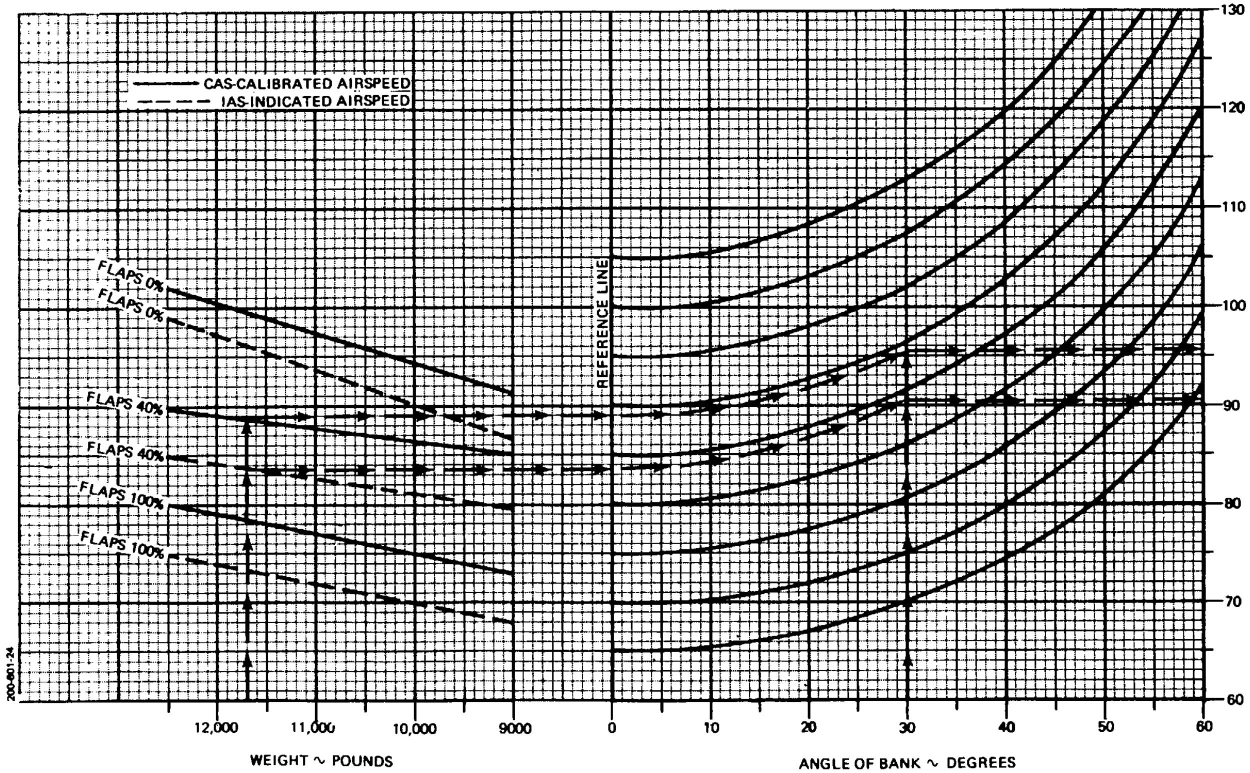


Figure 7-95. Stall Speeds - Power Idle

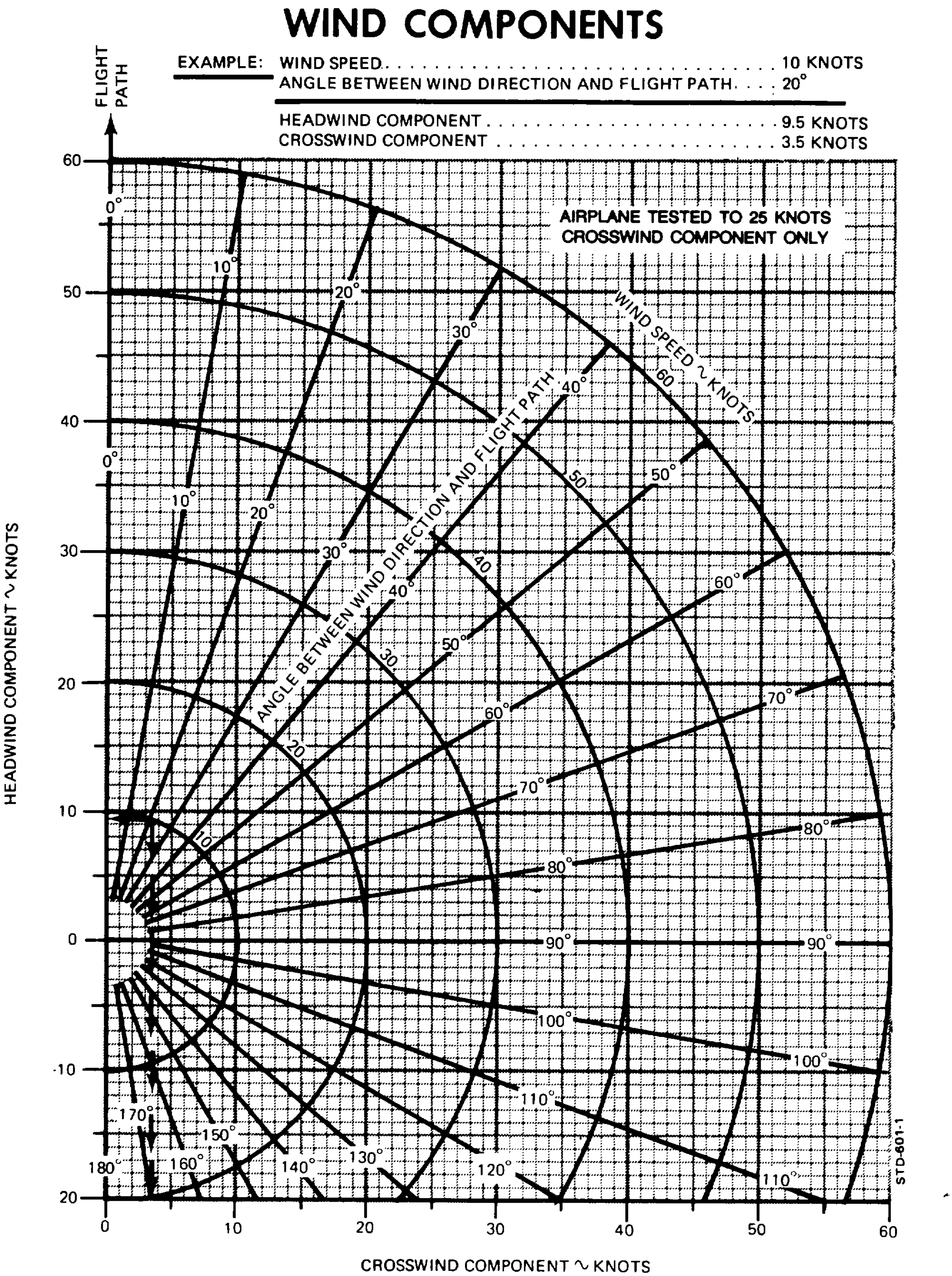


Figure 7-96. Wind Components

TAKE-OFF WEIGHT – FLAPS 0%
TO ACHIEVE POSITIVE SINGLE ENGINE CLIMB AT LIFT-OFF

ASSOCIATED CONDITIONS:

AIRPLANE . . . . AIRBORNE
POWER . . . . TAKE-OFF
FLAPS . . . . UP
INOPERATIVE
PROPELLER . . . . . FEATHERED

EXAMPLE:

PRESSURE ALTITUDE . . 3966 FT
OAT . . . . 25°C

TAKE-OFF WEIGHT . . . 12,500 LBS

NOTE: FOR OPERATION WITH ICE VANES EXTENDED, NO OFF LOADING IS REQUIRED.

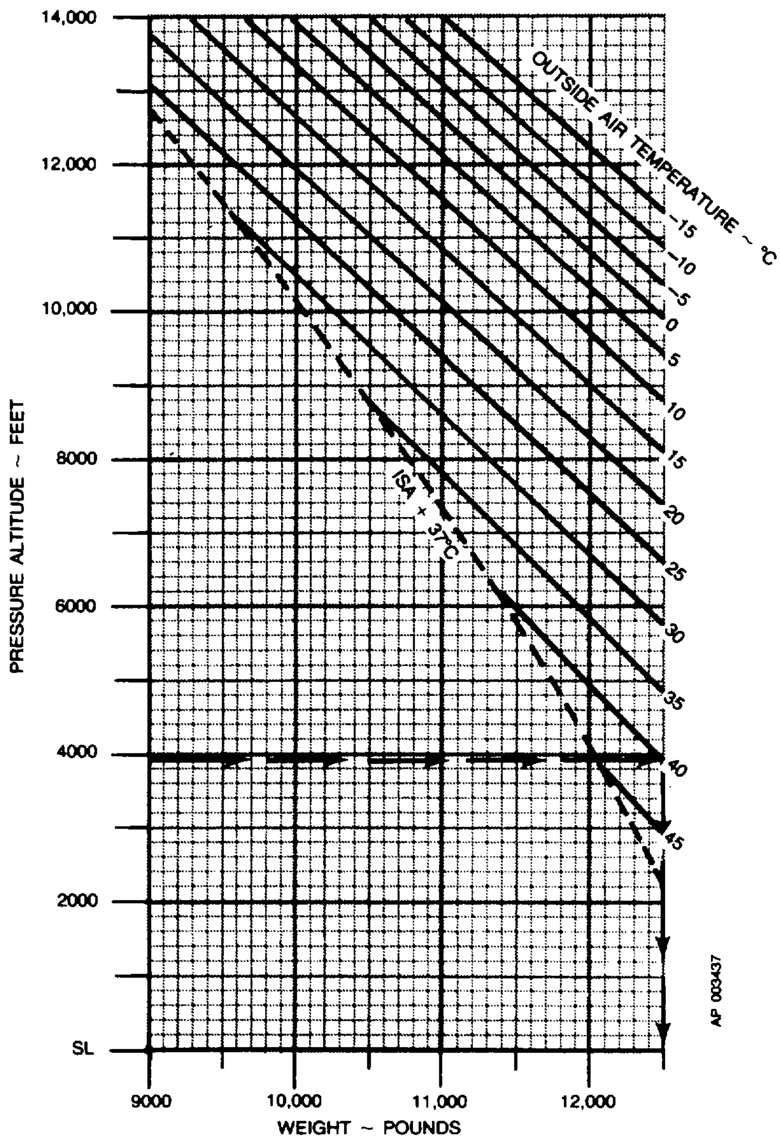


Figure 7-97. Take-Off Weight - Flaps 0%

TAKE-OFF DISTANCE – FLAPS 0%

ASSOCIATED CONDITIONS:

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

WEIGHT ~ LB.	TAKE-OFF SPEED ~ KTS	
	ROTATION	50 FT
12,500	110	121
12,000	109	119
11,000	106	115
10,000	103	111
9000	100	107

EXAMPLE:

OAT .... 25°C
PRESSURE ALTITUDE .... 3966 FT
TAKE-OFF WEIGHT .... 12,500 LBS
HEADWIND COMPONENT .... 9.5 KTS

GROUND ROLL .... 3500 FT
TOTAL DISTANCE OVER 50 FT OBSTACLE .... 4680 FT
TAKE-OFF SPEED AT ROTATION .... 110 KTS
AT 50 FT .... 121 KTS

NOTE: 1. FOR OPERATION WITH ICE VANES EXTENDED, ADD 10°C TO THE ACTUAL OAT BEFORE ENTERING GRAPH.
2. ADD OR SUBTRACT 5% OF TAKE-OFF GROUND ROLL FOR EACH 1% OF RUNWAY SLOPE (DOWN - SUBTRACT, UP - ADD).

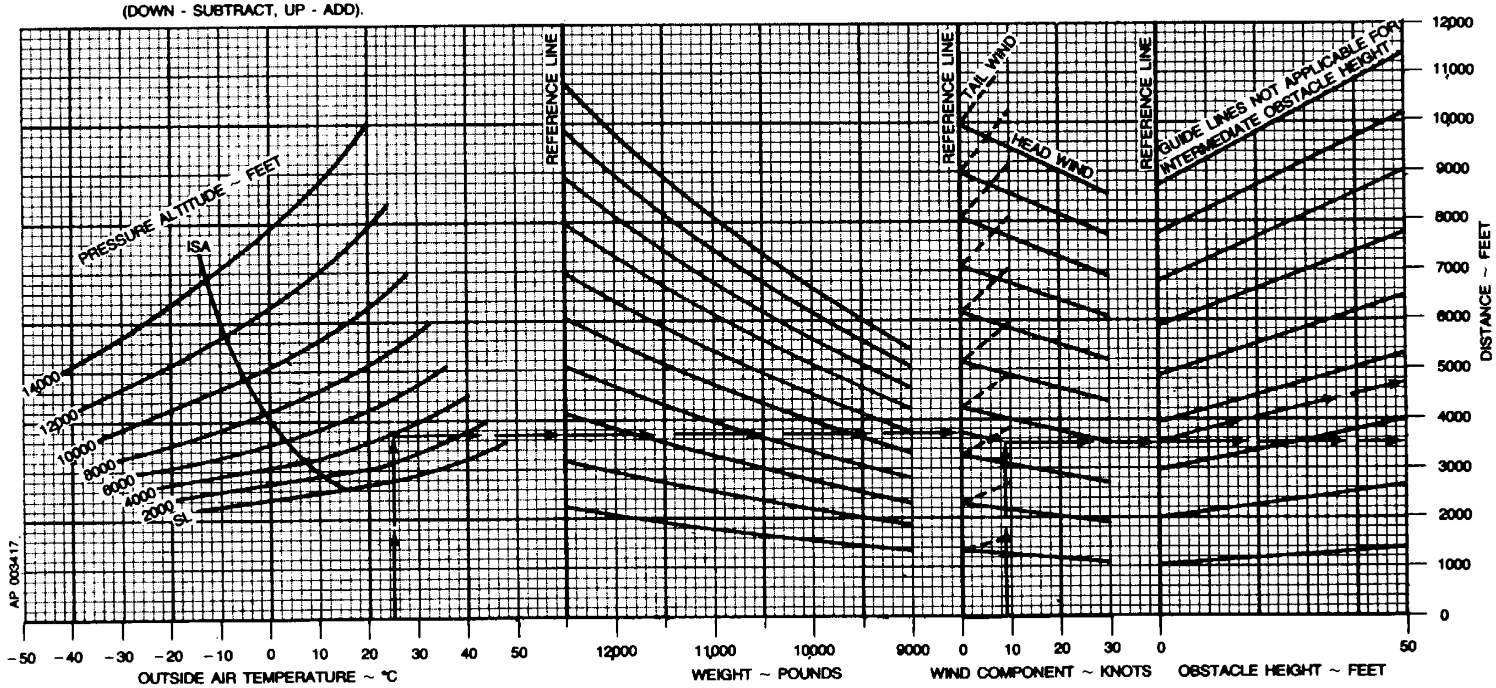


Figure 7-98. Take Off Distance - Flaps 0%

ACCELERATE – STOP – FLAPS 0%

ASSOCIATED CONDITIONS:

POWER . . . . 1. TAKE-OFF POWER SET BEFORE BRAKE RELEASE
2. BOTH POWER LEVERS IDLE AT ENGINE FAILURE SPEED AND REVERSE OPERATIVE ENGINE

FLAPS 0%

BRAKING . . . MAXIMUM

RUNWAY . . . PAVED, LEVEL, DRY SURFACE

CAUTION: LIMIT REVERSING, AS REQUIRED, TO MAINTAIN DIRECTIONAL CONTROL

WEIGHT ~ LBS	ENGINE FAILURE SPEED ~ KTS
12,500	113
12,000	112
11,000	109
10,000	106
9000	103

EXAMPLE:

OAT	25°C
PRESSURE ALTITUDE	3966 FT
WEIGHT	12,500 LBS
HEADWIND COMPONENT	9.5 KTS
FIELD LENGTH	5800 FT
ENGINE FAILURE SPEED	113 KTS

NOTE: 1. FOR OPERATION WITH ICE VANES EXTENDED, PERFORMANCE IS NOT AFFECTED.
2. ADD OR SUBTRACT 2% OF TOTAL DISTANCE FOR EACH 1% OF RUNWAY SLOPE (DOWN-SUBTRACT, UP-ADD).

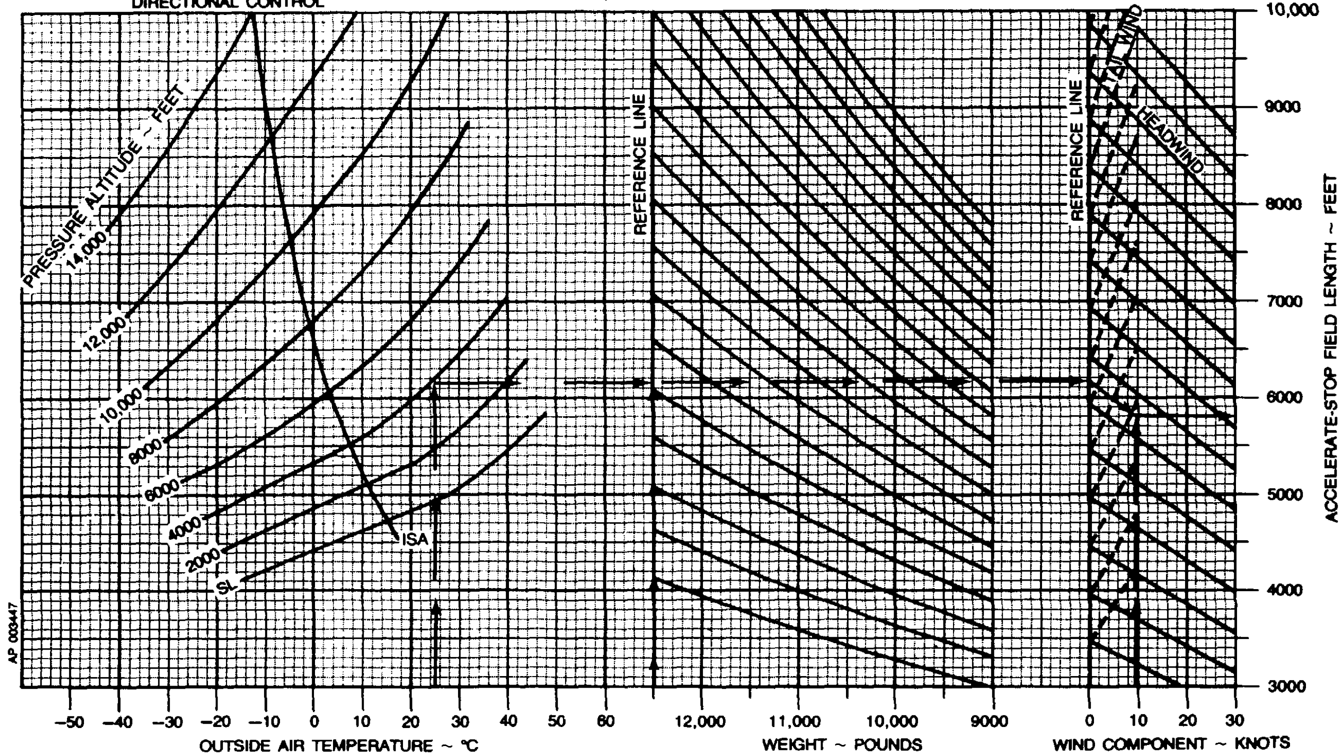


Figure 7-99. Accelerate-Stop - Flaps 0%

ACCELERATE AFTER LIFT-OFF – FLAPS 0%

ASSOCIATED CONDITIONS:

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

WEIGHT ~ LBS	TAKE-OFF SPEED ~ KTS ROTATION	50 FT
12,500	110	121
12,000	109	119
11,000	106	115
10,000	103	111
9000	100	107

EXAMPLE:

OAT .... 25°C
PRESSURE ALTITUDE .... 3966 FT
WEIGHT .... 12,500 LBS
HEADWIND COMPONENT .... 9.5 KTS

GROUND ROLL .... 4300 FT
TOTAL DISTANCE OVER 50 FT OBSTACLE .... 9300 FT
TAKE-OFF SPEED AT ROTATION .... 110 KTS
AT 50 FT .... 121 KTS

NOTE:
1. DISTANCES ASSUME AN ENGINE FAILURE AT LIFT-OFF SPEED AND ENGINE FAILURE AFTER LIFT-OFF EMERGENCY PROCEDURES INITIATED.
2. LIFT-OFF SPEED IS ASSUMED EQUAL TO ENGINE FAILURE SPEED ON ACCELERATE-STOP GRAPH.
3. FOR OPERATION WITH ICE VANES EXTENDED, ADD 6°C TO THE ACTUAL OAT BEFORE ENTERING THE GRAPH.
4. ADD OR SUBTRACT 5% OF TAKE-OFF GROUND ROLL FOR EACH 1% OF RUNWAY SLOPE (DOWN - SUBTRACT, UP - ADD).
5. WEIGHTS IN SHADED AREA MAY NOT PROVIDE POSITIVE GEAR DOWN SINGLE ENGINE CLIMB GRADIENT. REFER TO TAKE-OFF WEIGHT GRAPH FOR THE MAXIMUM WEIGHT AT WHICH THE ACCELERATE AFTER LIFT-OFF PROCEDURE SHOULD BE ATTEMPTED.

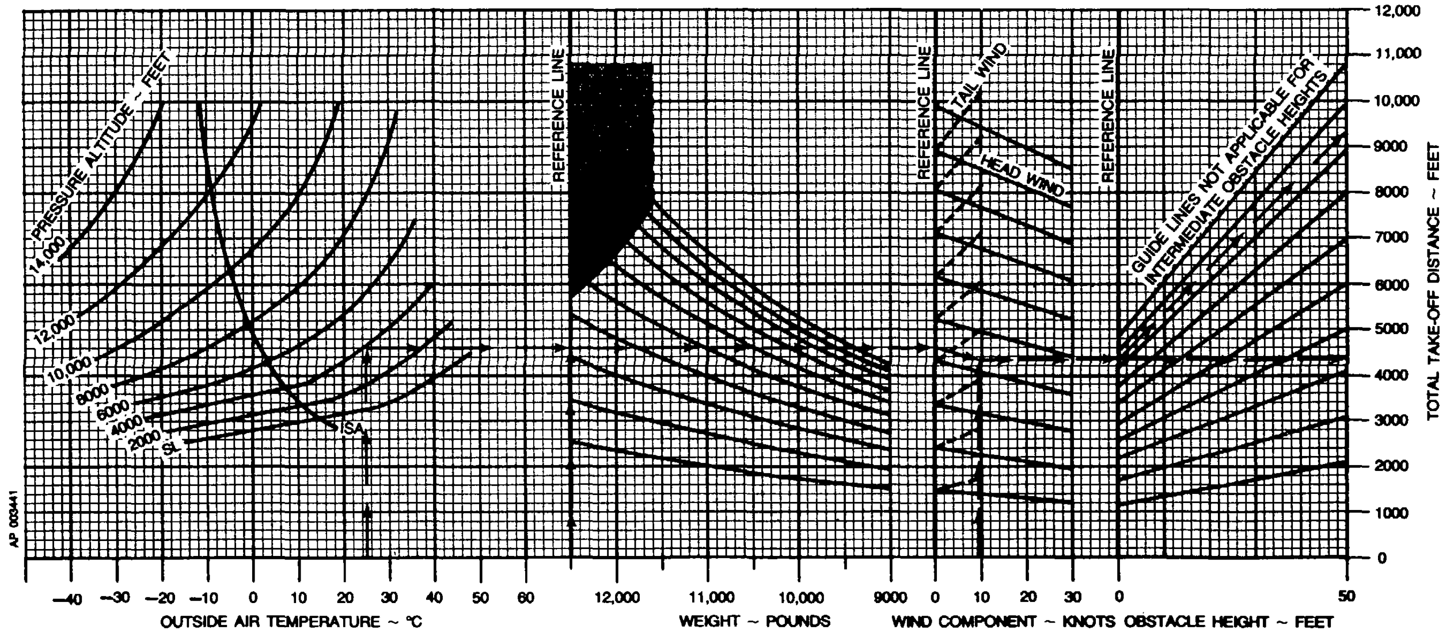


Figure 7-100. Accelerate After Lift-Off - Flaps 0%

SINGLE ENGINE GRADIENT OF CLIMB – FLAPS 0%

ASSOCIATED CONDITIONS:

POWER............ TAKEOFF MAINTAINED ON OPERATIVE ENGINE
LANDING GEAR............ UP
FLAPS............ UP
INOPERATIVE PROPELLER............ FEATHERED

WEIGHT ~ LBS	CLIMB SPEED ~ KTS
12,500	121
12,000	119
11,000	115
10,000	111
9000	107

EXAMPLE:

OAT............ 25°C
PRESSURE ALTITUDE............ 3966 FT
WEIGHT............ 12,500 LBS

GRADIENT OF CLIMB............ 3.45%
CLIMB SPEED............ 121 KTS

NOTE: 1. FOR OPERATION WITH ICE VANES EXTENDED, ADD 10°C TO THE ACTUAL OAT BEFORE ENTERING GRAPH.
2. ESTABLISH 3° TO 5° BANK AND MAINTAIN HALF BALL FROM CENTER TOWARD THE OPERATING ENGINE.

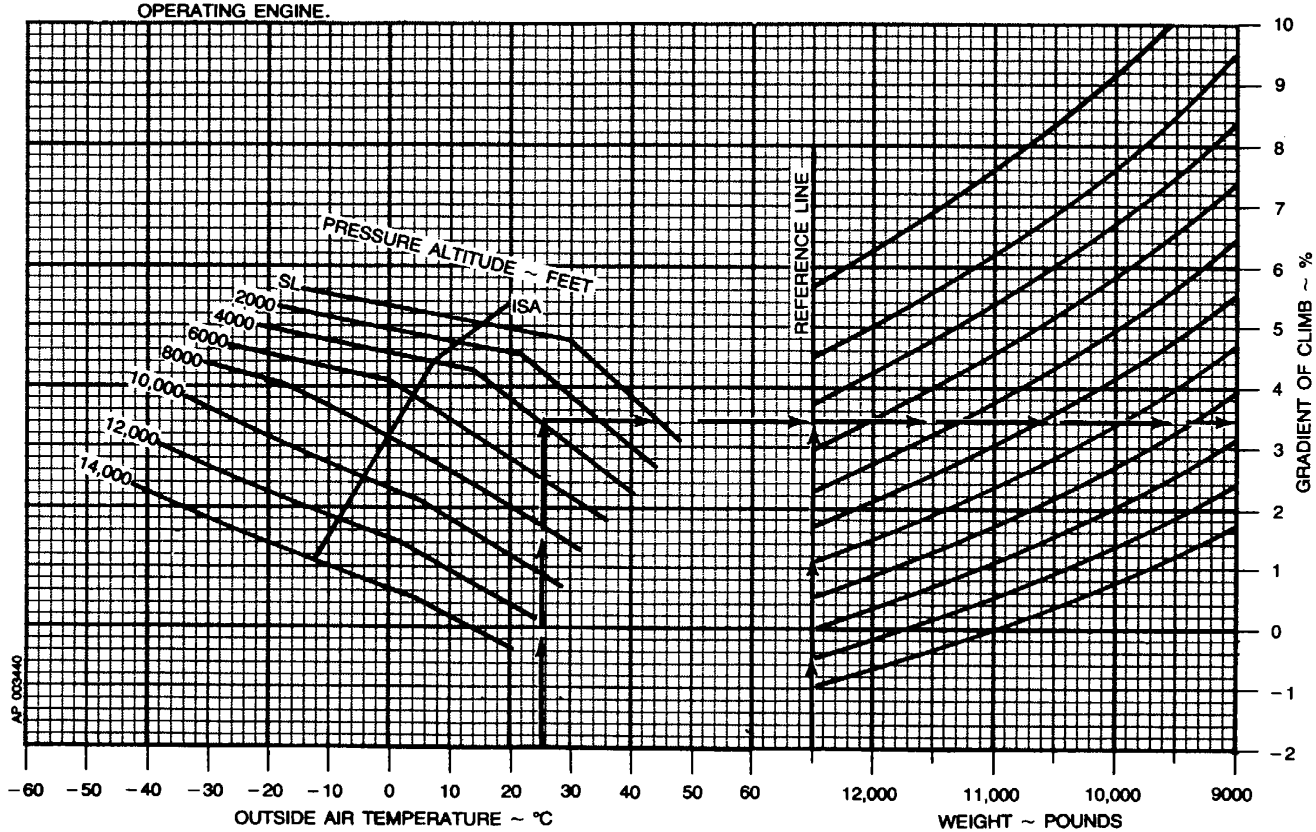


Figure 7-101. Single Engine Gradient of Climb - Flaps 0%

TAKE-OFF WEIGHT – FLAPS 40%
TO ACHIEVE POSITIVE SINGLE ENGINE CLIMB AT LIFT-OFF

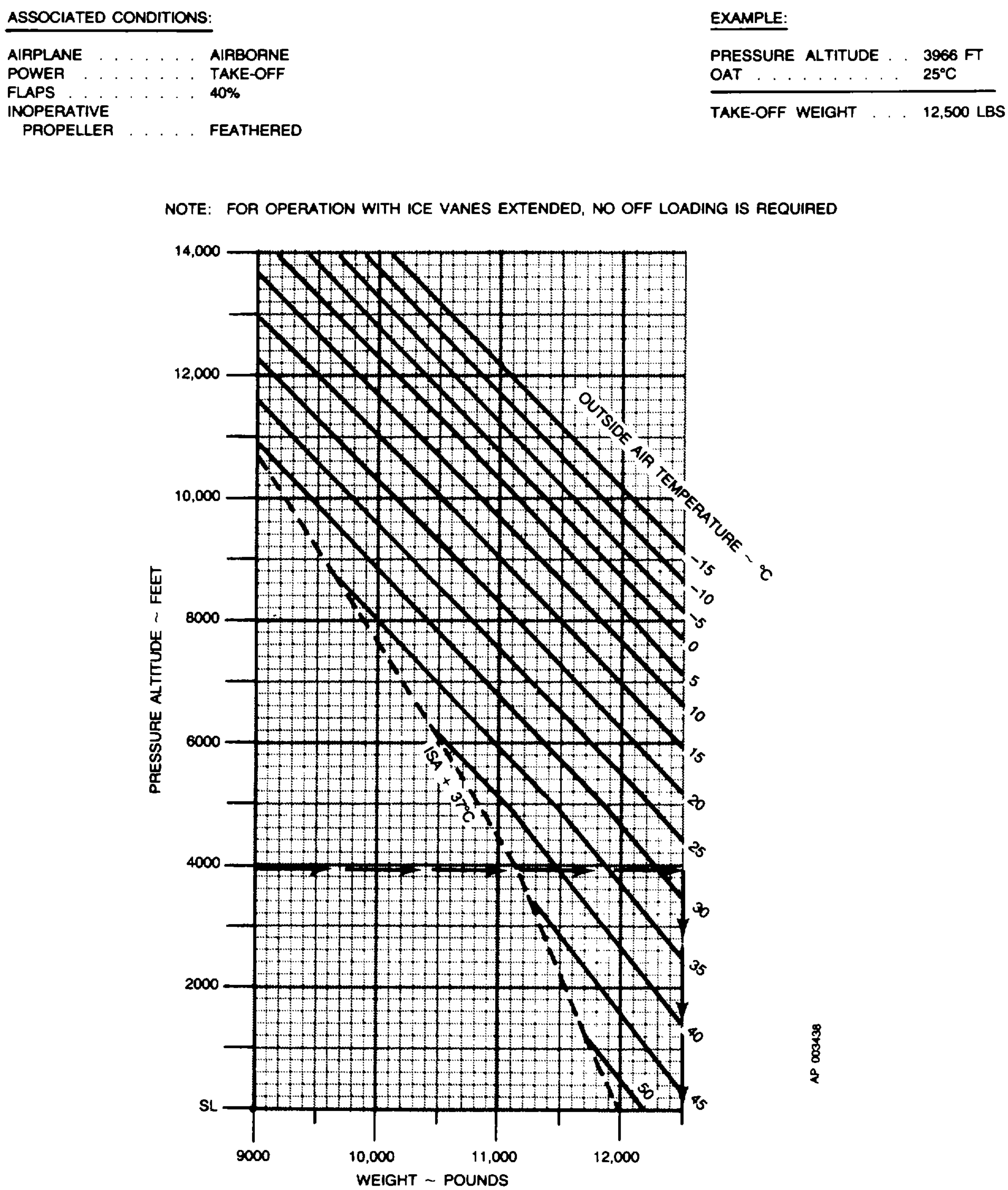


Figure 7-102. Take-Off Weight - Flaps 40%

TAKE-OFF DISTANCE - FLAPS 40%

ASSOCIATED CONDITIONS:

POWER .... TAKE-OFF POWER SET BEFORE BRAKE RELEASE
FLAPS 40%
LANDING GEAR .... RETRACT AFTER LIFT-OFF
RUNWAY .... PAVED, LEVEL, DRY SURFACE

WEIGHT ~ LBS	TAKE-OFF SPEED ~ KTS.	
	ROTATION	50 FT.
12,500	99	106
12,000	98	105
11,000	97	103
10,000	96	101
9000	95	99

EXAMPLE:

OAT .... 25°C
PRESSURE ALTITUDE .... 3966 FT
TAKE-OFF WEIGHT .... 12500 LBS.
HEADWIND COMPONENT .... 9.5 KTS.

GROUND ROLL .... 2690 FT.
TOTAL DISTANCE OVER 50 FT. OBSTACLE .... 3610 FT.
TAKE-OFF SPEED AT ROTATION .... 99 KTS.
AT 50 FT. .... 106 KTS.

NOTE: 1. FOR OPERATION WITH ICE VANES EXTENDED, ADD 10°C TO THE ACTUAL OAT BEFORE ENTERING GRAPH.
2. ADD OR SUBTRACT 5% OF TAKEOFF GROUND ROLL FOR EACH 1% OF RUNWAY SLOPE (DOWN - SUBTRACT, UP - ADD).

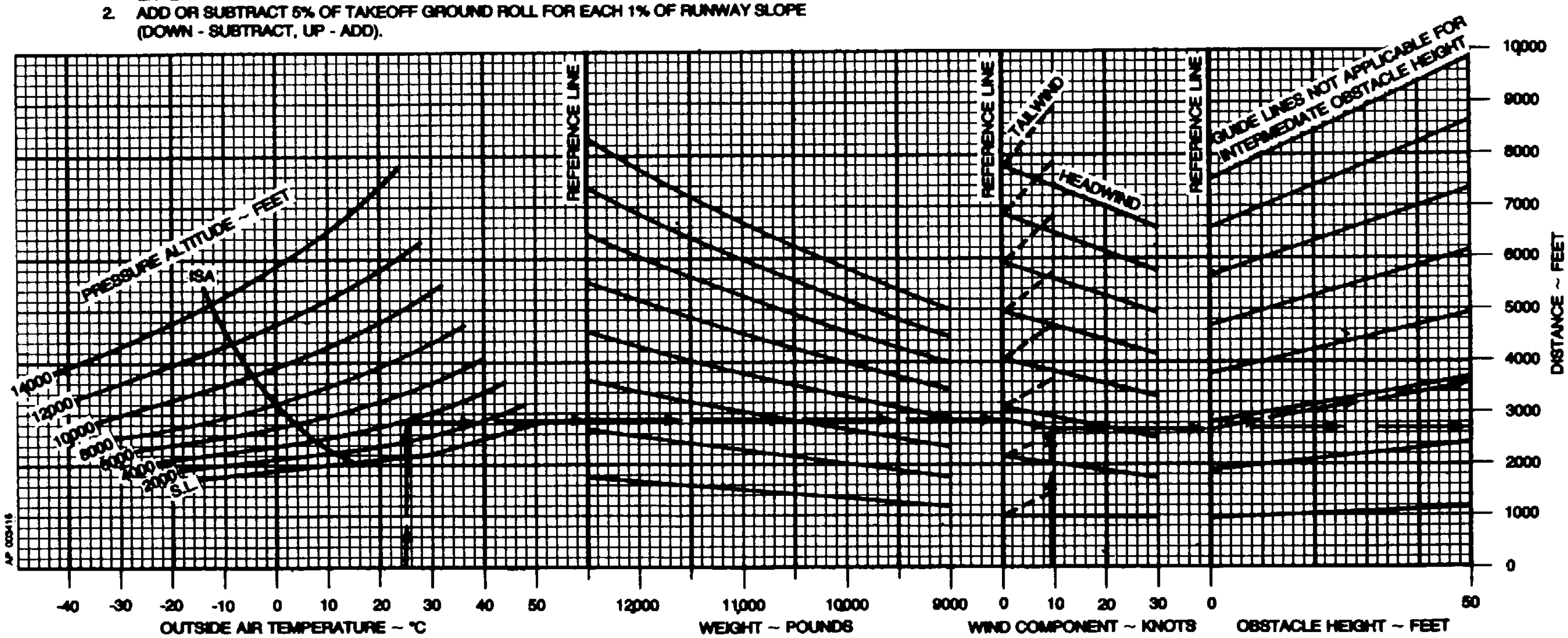


Figure 7-103. Take Off Distance - Flaps 40%

ACCELERATE-STOP-FLAPS 40%

ASSOCIATED CONDITIONS:

POWER . . . . 1. TAKE-OFF POWER SET BEFORE BRAKE RELEASE
2. BOTH POWER LEVERS IDLE AT ENGINE FAILURE SPEED AND REVERSE OPERATING ENGINE

FLAPS 40%

BRAKING . . . . . . MAXIMUM

RUNWAY . . . . . . PAVED, LEVEL, DRY SURFACE

WEIGHT~LBS	ENGINE FAILURE SPEED~KTS
12,500	102
12,000	101
11,000	100
10,000	99
9000	98

EXAMPLE:

OAT . . . . 25 °C
PRESSURE ALTITUDE . . . . 3966 FT
WEIGHT . . . . 12,500 LBS
HEADWIND COMPONENT . . . . . 9.5 KTS

FIELD LENGTH . . . . 4820 FT
ENGINE FAILURE SPEED . . . . . . 102 KTS

NOTE: 1. FOR OPERATION WITH ICE VANES EXTENDED, PERFORMANCE IS NOT AFFECTED.
2. ADD OR SUBTRACT 2% OF TOTAL DISTANCE FOR EACH 1% OF RUNWAY SLOPE (DOWN-SUBTRACT, UP-ADD).

CAUTION: LIMIT REVERSING, AS REQUIRED, TO MAINTAIN DIRECTIONAL CONTROL

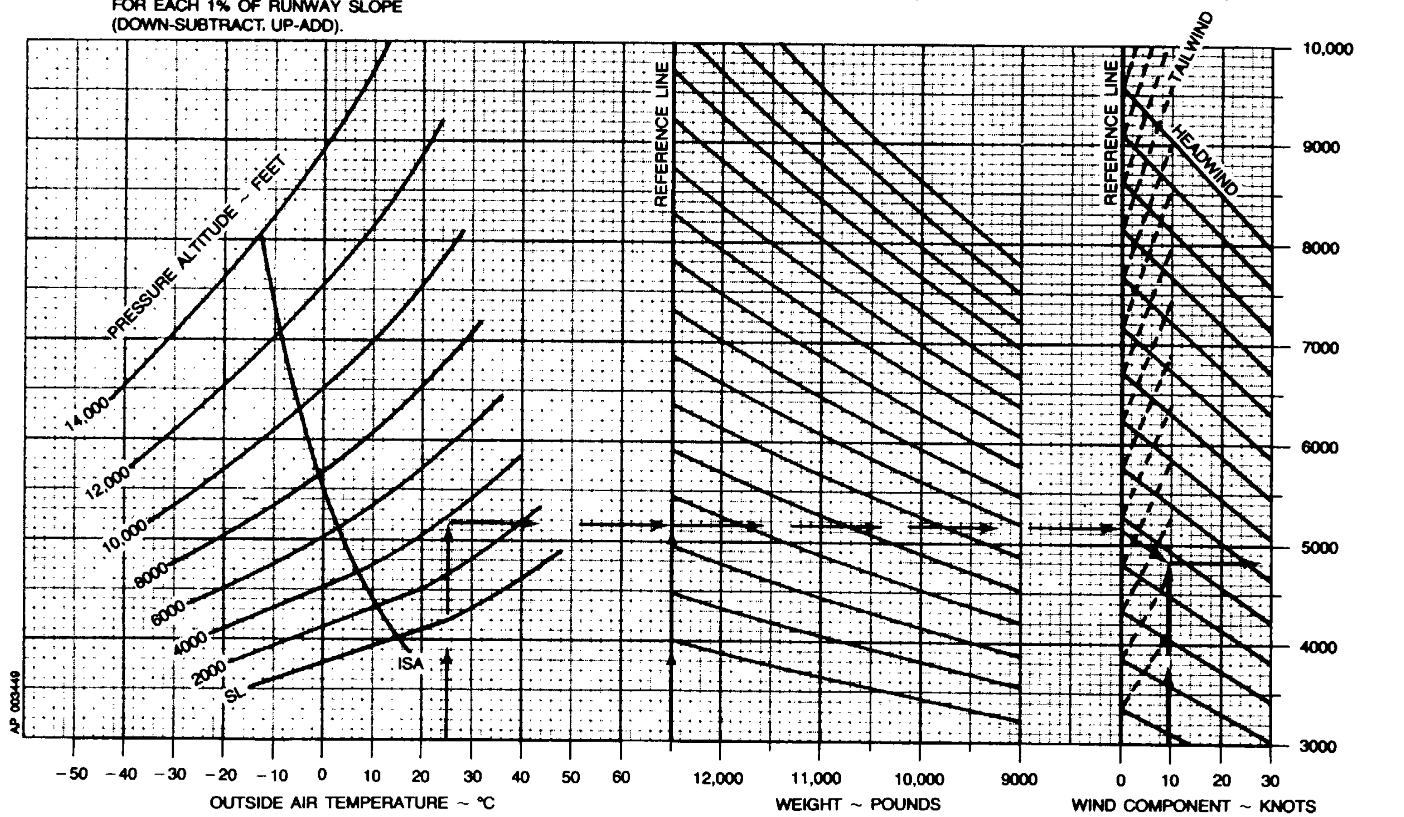


Figure 7-104. Accelerate-Stop - Flaps 40%

ACCELERATE AFTER LIFT-OFF - FLAPS 40%

ASSOCIATED CONDITIONS:

POWER . . . . TAKE-OFF POWER SET BEFORE BRAKE RELEASE
AUTOFEATHER . . . . ARMED
FLAPS 40%
LANDING GEAR . . . . RETRACT AFTER LIFT-OFF
RUNWAY . . . . PAVED, LEVEL, DRY SURFACE

WEIGHT ~ LBS	TAKE-OFF SPEED ~ KTS	
	ROTATION	50 FT
12,500	99	106
12,000	98	105
11,000	97	103
10,000	96	101
9000	95	99

EXAMPLE:

OAT . . . . 25°C
PRESSURE ALTITUDE . . . . . . 3966 FT
HEADWIND COMPONENT . . . . . 9.5 KTS

WEIGHT (FOR SINGLE ENGINE CLIMB CAPABILITY) . . . . 12,500 LBS
GROUND ROLL . . . . 3300 FT
TOTAL DISTANCE OVER 50 FT OBSTACLE . . . . 8550 FT
TAKE-OFF SPEED AT ROTATION . . 99 KTS
AT 50 FT . . . . 106 KTS

NOTE:
1. DISTANCES ASSUME AN ENGINE FAILURE AT LIFT-OFF SPEED AND ENGINE FAILURE AFTER LIFT-OFF EMERGENCY PROCEDURES INITIATED.
2. LIFT-OFF SPEED IS ASSUMED EQUAL TO ENGINE FAILURE SPEED ON ACCELERATE-STOP GRAPH.
3. FOR OPERATION WITH ICE VANES EXTENDED, ADD 6°C TO THE ACTUAL OAT BEFORE ENTERING THE GRAPH.
4. ADD OR SUBTRACT 5% TO TAKE-OFF GROUND ROLL FOR EACH 1% OF RUNWAY SLOPE (DOWN - SUBTRACT, UP - ADD).
5. WEIGHTS IN SHADED AREA MAY NOT PROVIDE POSITIVE GEAR DOWN SINGLE ENGINE CLIMB GRADIENT. REFER TO TAKE-OFF WEIGHT GRAPH FOR THE MAXIMUM WEIGHT AT WHICH THE ACCELERATE AFTER LIFT-OFF PROCEDURE SHOULD BE ATTEMPTED.

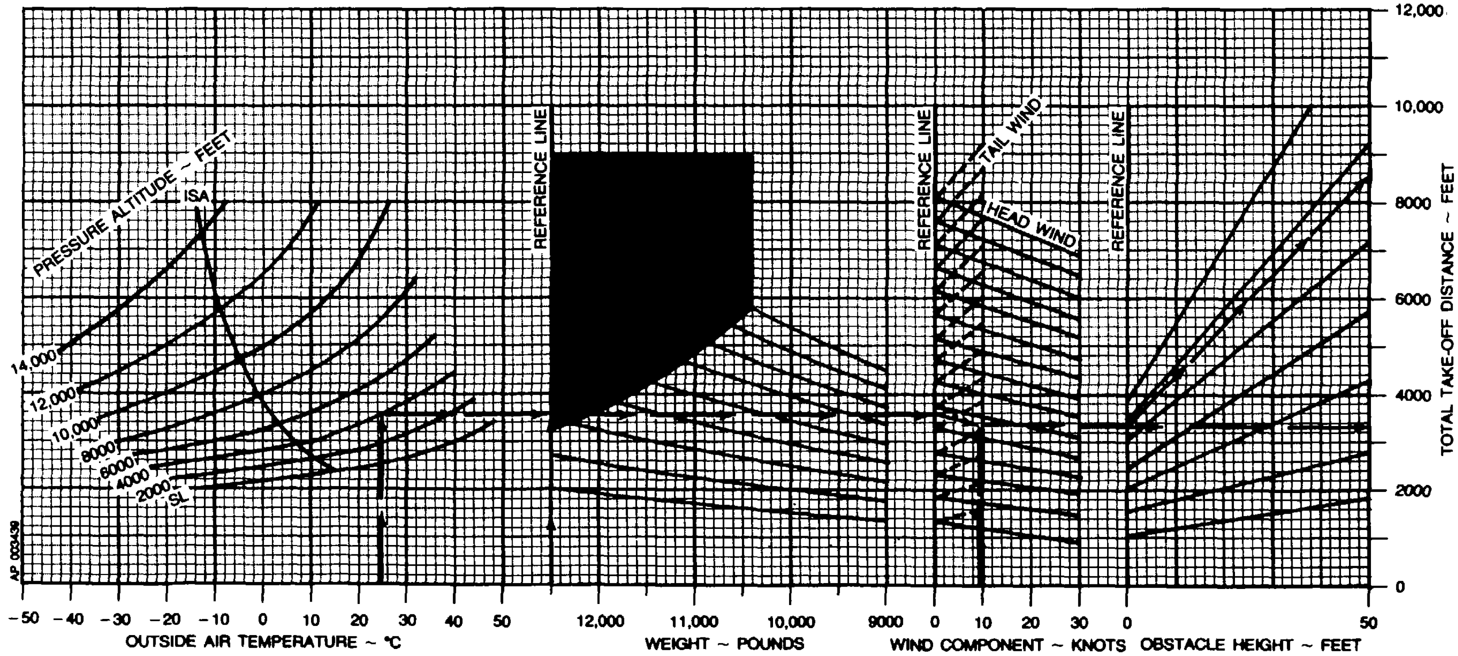


Figure 7-105. Accelerate After Lift-Off - Flaps 40%

SINGLE ENGINE GRADIENT OF CLIMB – FLAPS 40%

ASSOCIATED CONDITIONS:

POWER . . . . TAKE-OFF MAINTAINED ON OPERATIVE ENGINE
LANDING GEAR . . . . . . UP
FLAPS 40%
INOPERATIVE PROPELLER . . . . . . FEATHERED

WEIGHT ~ LBS	CLIMB SPEED ~ KTS
12,500	106
12,000	105
11,000	103
10,000	101
9000	99

EXAMPLE:

OAT . . . . 25°C
PRESSURE ALTITUDE . . . . 3966 FT
WEIGHT . . . . 12,500 LBS

GRADIENT OF CLIMB 2.25%
CLIMB SPEED . . . . 106 KTS

NOTE: 1. FOR OPERATION WITH ICE VANES EXTENDED, ADD 10°C TO THE ACTUAL OAT BEFORE ENTERING GRAPH.
2. ESTABLISH 3° TO 5° BANK AND MAINTAIN HALF BALL FROM CENTER TOWARD THE OPERATING ENGINE.

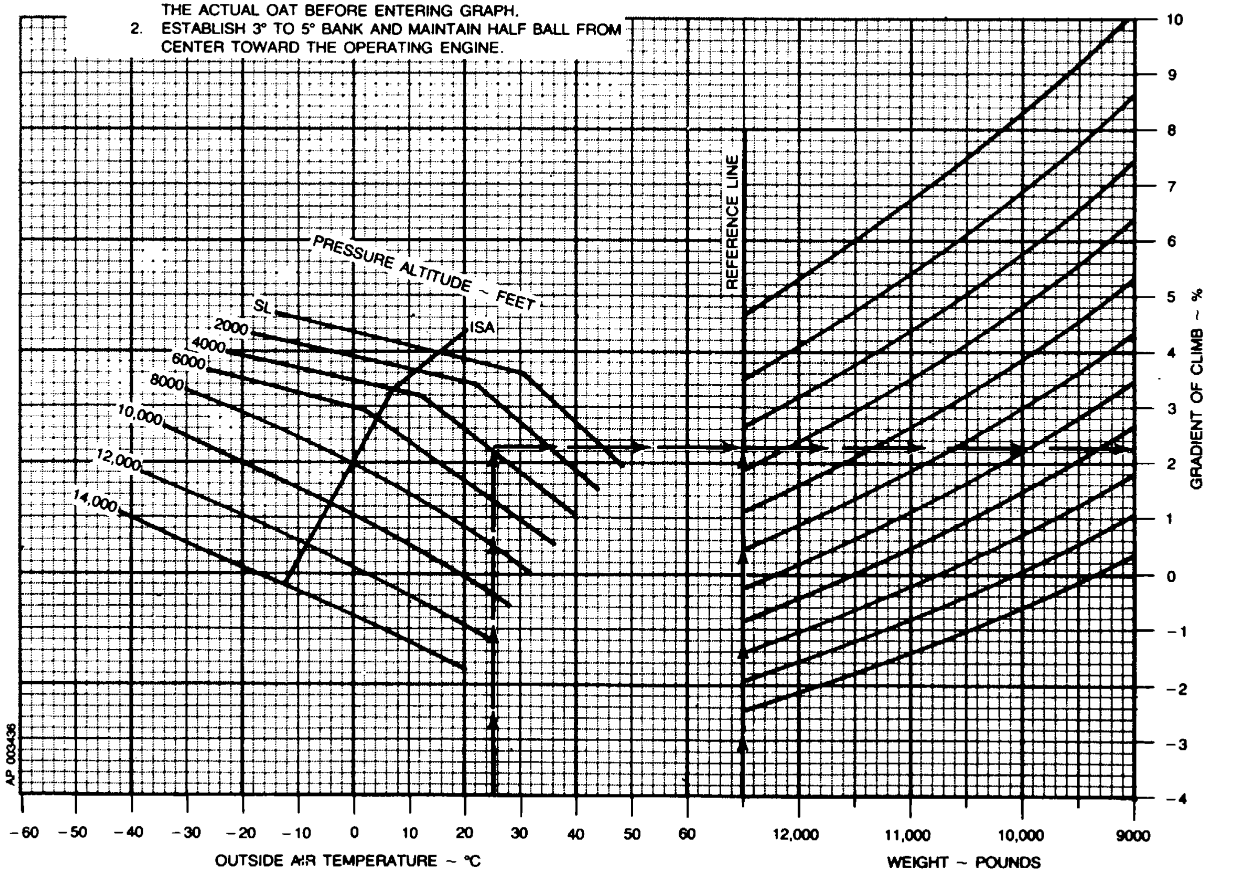


Figure 7-106. Single Engine Gradient of Climb - Flaps 40%

CLIMB – TWO ENGINES – FLAPS 0%

ASSOCIATED CONDITIONS:

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

WEIGHT ~ LBS.	CLIMB SPEED ~ KTS
12,500	125
12,000	124
11,000	121
10,000	118
9000	115

EXAMPLE:

OAT .... -10°C
PRESSURE ALTITUDE .... 17,000 FT
WEIGHT .... 12,186 LBS

RATE-OF-CLIMB .... 1190 FT MIN
CLIMB GRADIENT 7.2%
CLIMB SPEED .... 124 KTS

NOTE: FOR OPERATION WITH ICE VANES EXTENDED, ADD 15°C TO THE ACTUAL OAT BEFORE ENTERING GRAPH.

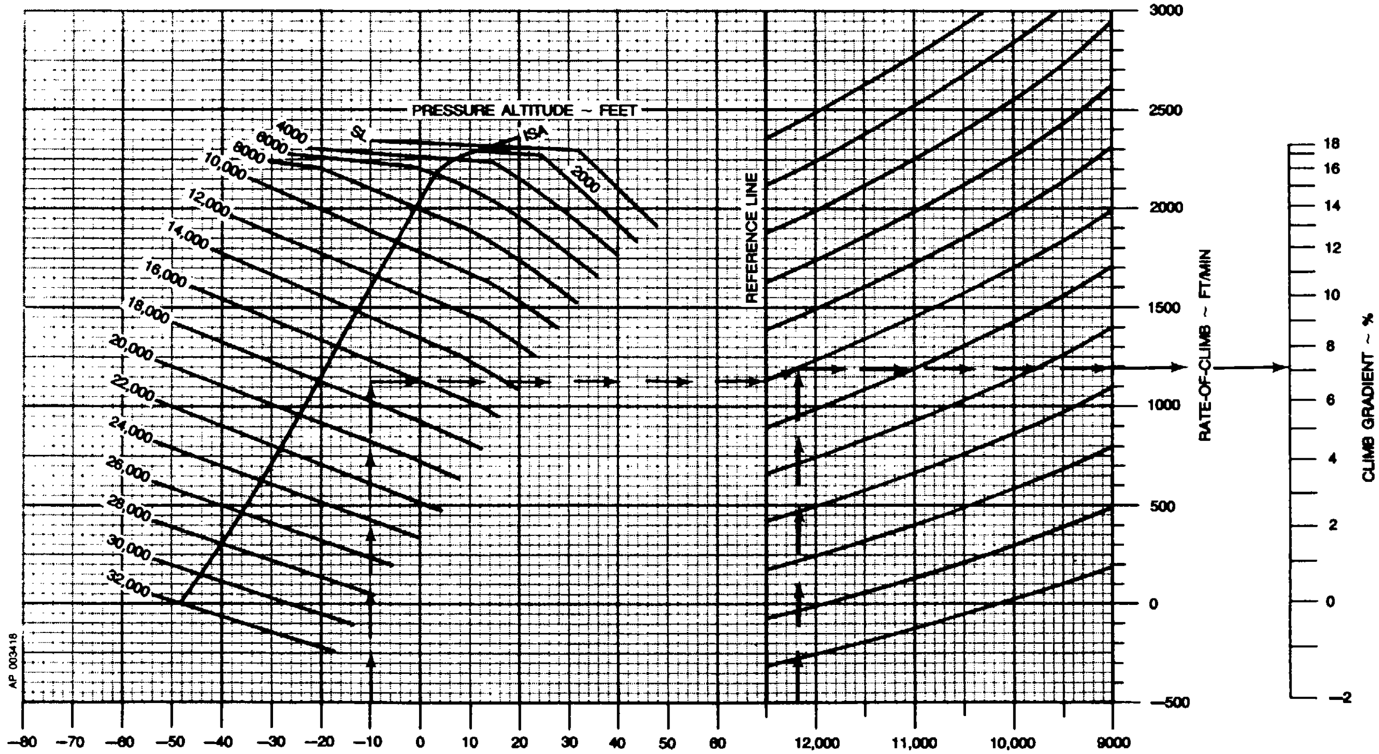


Figure 7-107. Climb - Two Engines - Flaps 0%

CLIMB–TWO ENGINES–FLAPS 40%

ASSOCIATED CONDITIONS:

POWER .... MAXIMUM CONTINUOUS
FLAPS 40%
LANDING GEAR .... UP

WEIGHT ~ LBS	CLIMB SPEED ~ KTS
12,500	125
12,000	124
11,000	121
10,000	118
9000	115

EXAMPLE:

OAT .... -10°C
PRESSURE ALTITUDE .... 17,000 FT
WEIGHT .... 12,186 LBS

RATE-OF-CLIMB .... 850 FT/MIN
CLIMB GRADIENT 5.1%
CLIMB SPEED .... 124 KTS

NOTE: FOR OPERATION WITH ICE VANES EXTENDED, ADD 15°C TO THE ACTUAL OAT BEFORE ENTERING GRAPH.

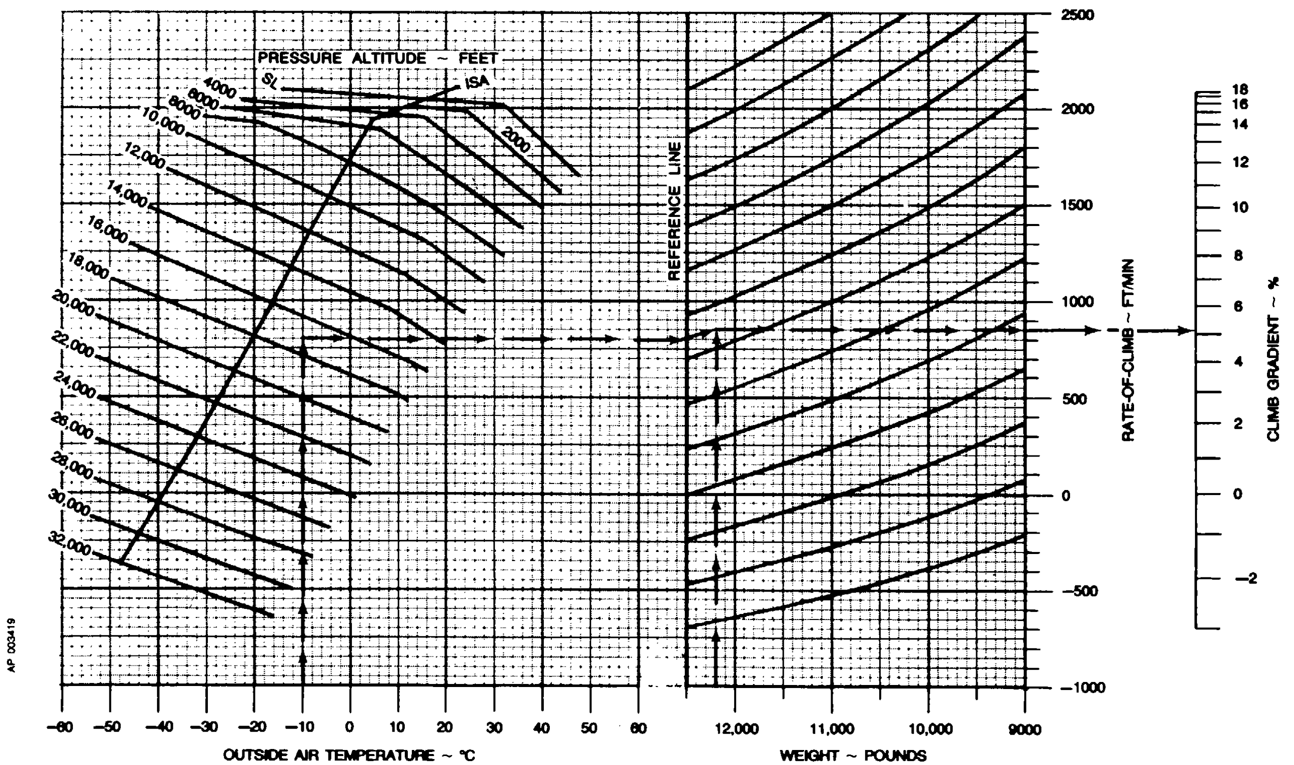


Figure 7-108. Climb - Two Engines - Flaps 40%

CLIMB - ONE ENGINE INOPERATIVE

ASSOCIATED CONDITIONS:

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

WEIGHT ~ LBS	CLIMB SPEED ~ KTS
12,500	121
12,000	119
11,000	117
10,000	114
9000	111

EXAMPLE:

OAT .... 0°C
PRESSURE ALTITUDE .... 8000 FT
WEIGHT .... 12,186 LBS

RATE-OF-CLIMB .... 475 FT/MIN
CLIMB SPEED .... 119 KTS

NOTE: FOR OPERATION WITH ICE VANES EXTENDED, ADD 10°C TO THE ACTUAL OAT BEFORE ENTERING GRAPH.

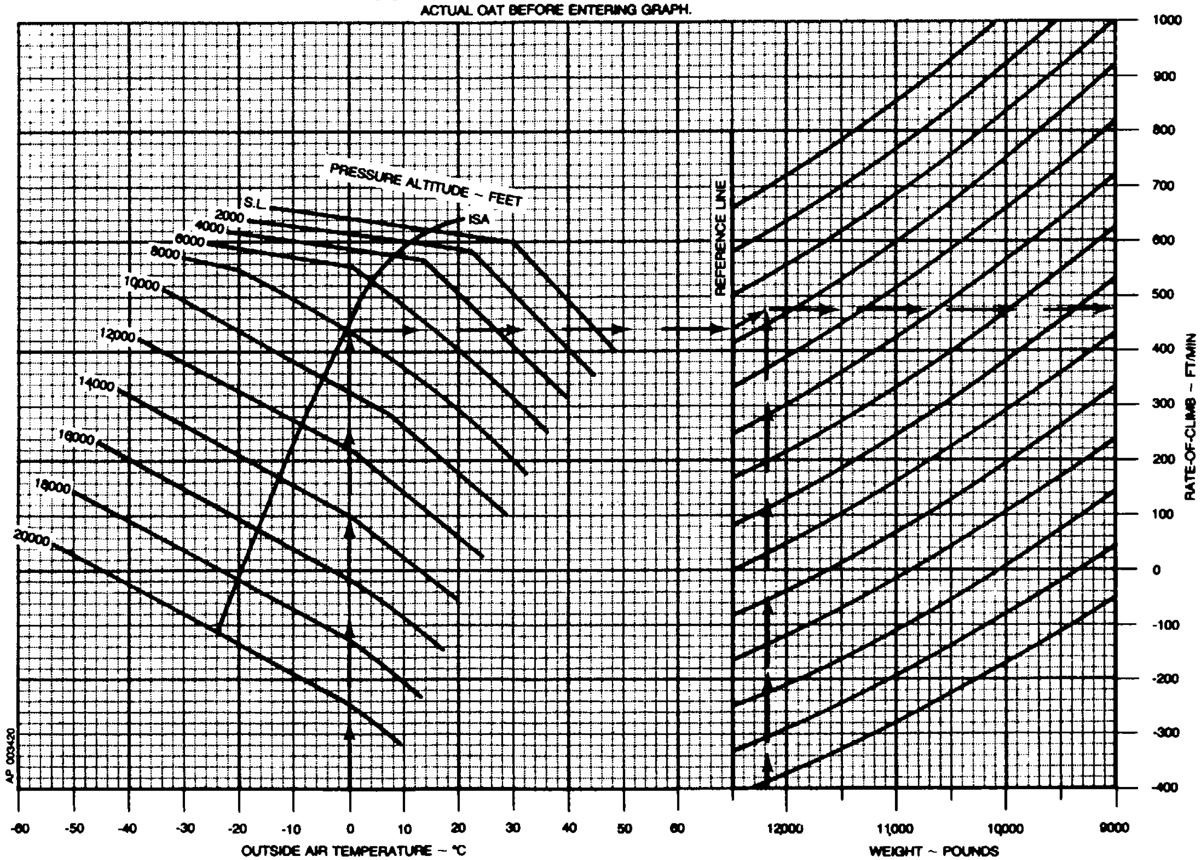


Figure 7-109. Climb - One Engine Inoperative

CLIMB - BALKED LANDING

100 KNOTS
ALL WEIGHTS

ASSOCIATED CONDITIONS:

POWER................................ TAKE-OFF
FLAPS.................................. 100%
LANDING GEAR.................... DOWN

EXAMPLE:

OAT.. 15°C
PRESSURE ALTITUDE .... 5650 FT
WEIGHT.. 11,180 LBS

RATE-OF-CLIMB .... 1430 FT/MIN
CLIMB GRADIENT........................ 14.1%

FOR OPERATION WITH ICE VANES EXTENDED, ADD 10°C TO THE ACTUAL OAT BEFORE ENTERING GRAPH

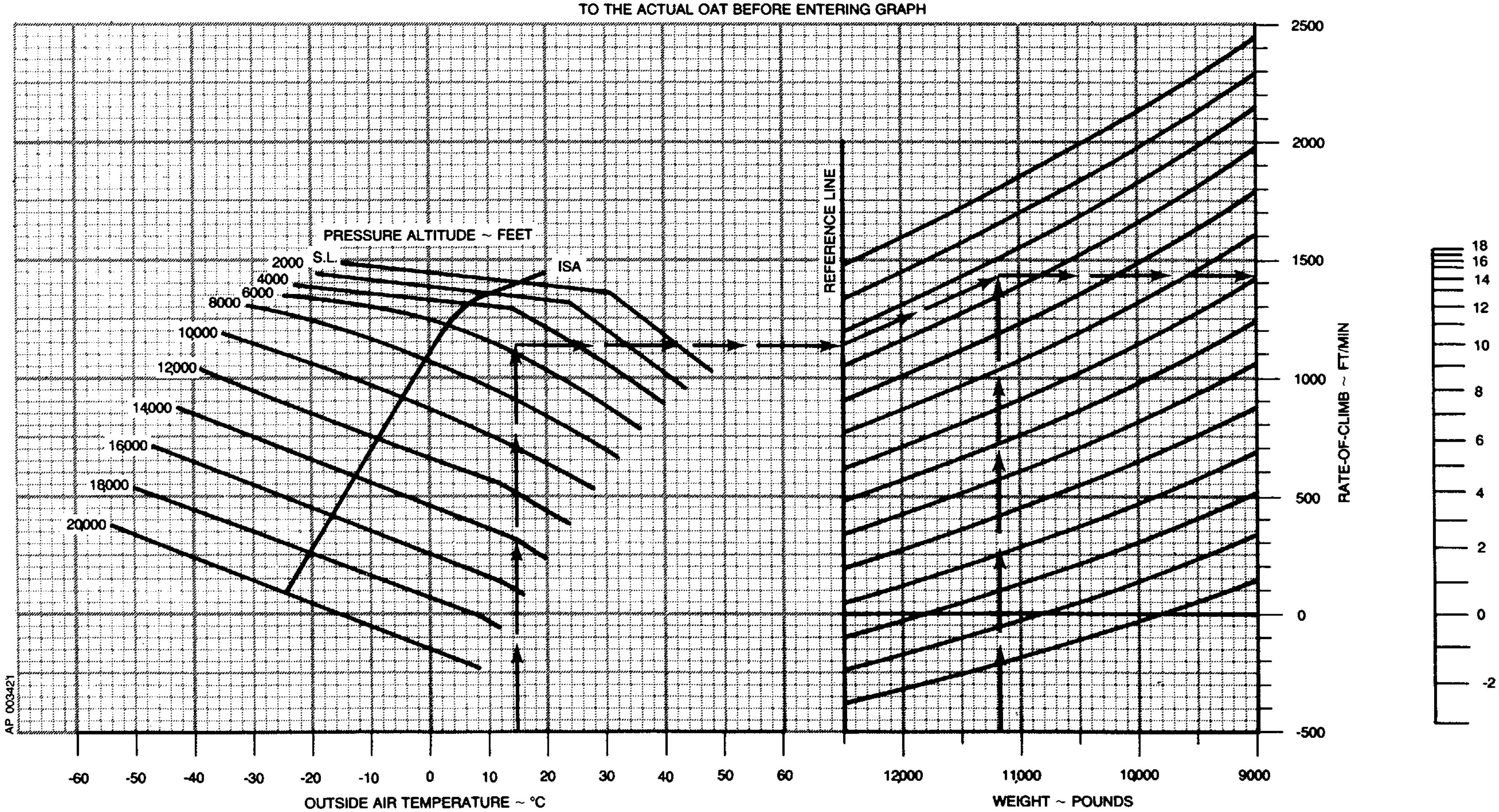


Figure 7-110. Climb - Balked Landing

LANDING DISTANCE WITHOUT PROPELLER REVERSING-FLAPS 100%

ASSOCIATED CONDITIONS:

POWER .... RETARDED TO MAINTAIN 800 FT/MIN ON FINAL APPROACH
FLAPS........................... 100%
RUNWAY....................... PAVED, LEVEL, DRY SURFACE
APPROACH SPEED..... IAS AS TABULATED
BRAKING...................... MAXIMUM

WEIGHT ~ LBS	APPROACH SPEED ~ KTS
12,500	103
12,000	102
11,000	99
10,000	96
9000	93

EXAMPLE:

OAT .... 15°C
PRESSURE ALTITUDE......................... 5650 FT
LANDING WEIGHT .... 11,180 LBS
HEADWIND COMPONENT.................. 10 KTS

GROUND ROLL .... 1580 FT
TOTAL OVER 50 FT. OBSTACLE......... 2700 FT
APPROACH SPEED .... 99 KTS

NOTE: ADD OR SUBTRACT 4% OF TOTAL GROUND ROLL FOR EACH 1% RUNWAY SLOPE (DOWN - ADD, UP - SUBTRACT).

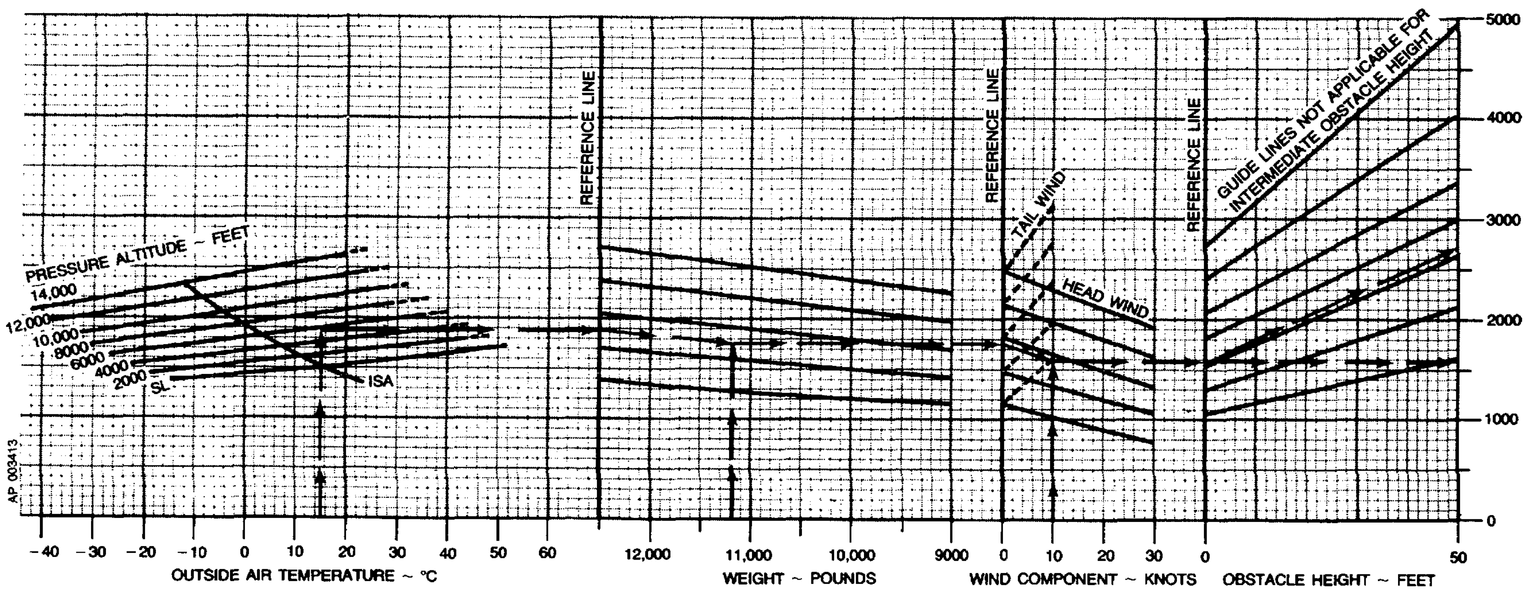


Figure 7-111. Landing Distance Without Propeller Reversing - Flaps 100%

LANDING DISTANCE WITHOUT PROPELLER REVERSING - FLAPS 0%

ASSOCIATED CONDITIONS:

POWER................. RETARDED TO MAINTAIN 900 FT/MIN ON FINAL APPROACH
FLAPS.................... UP
RUNWAY............... PAVED, LEVEL, DRY SURFACE
BRAKING .... MAXIMUM

EXAMPLE:

FLAPS 100% LANDING DISTANCE OVER 50 FT. OBSTACLE..................... 2700 FT
LANDING WEIGHT.............................. 11,180 LBS

FLAPS UP LANDING DISTANCE OVER 50 FT. OBSTACLE..................... 3800 FT
APPROACH SPEED............................ 126 KTS

WEIGHT ~ LBS	APPROACH SPEED ~ KTS
12,500	132
12,000	130
11,000	126
10,000	122
9000	117

NOTE: 1. TO DETERMINE FLAPS UP LANDING DISTANCE, READ THE FLAPS 100% LANDING DISTANCE APPROPRIATE TO THE OAT, ALTITUDE, WEIGHT AND WIND FROM THE LANDING DISTANCE GRAPH WITHOUT REVERSING - FLAPS 100%. ENTER THE FLAPS UP LANDING DISTANCE GRAPH AND READ THE DISTANCE.
2. ADD OR SUBTRACT 4% OF TOTAL GROUND ROLL FOR EACH 1% RUNWAY SLOPE (DOWN - ADD, UP - SUBTRACT).

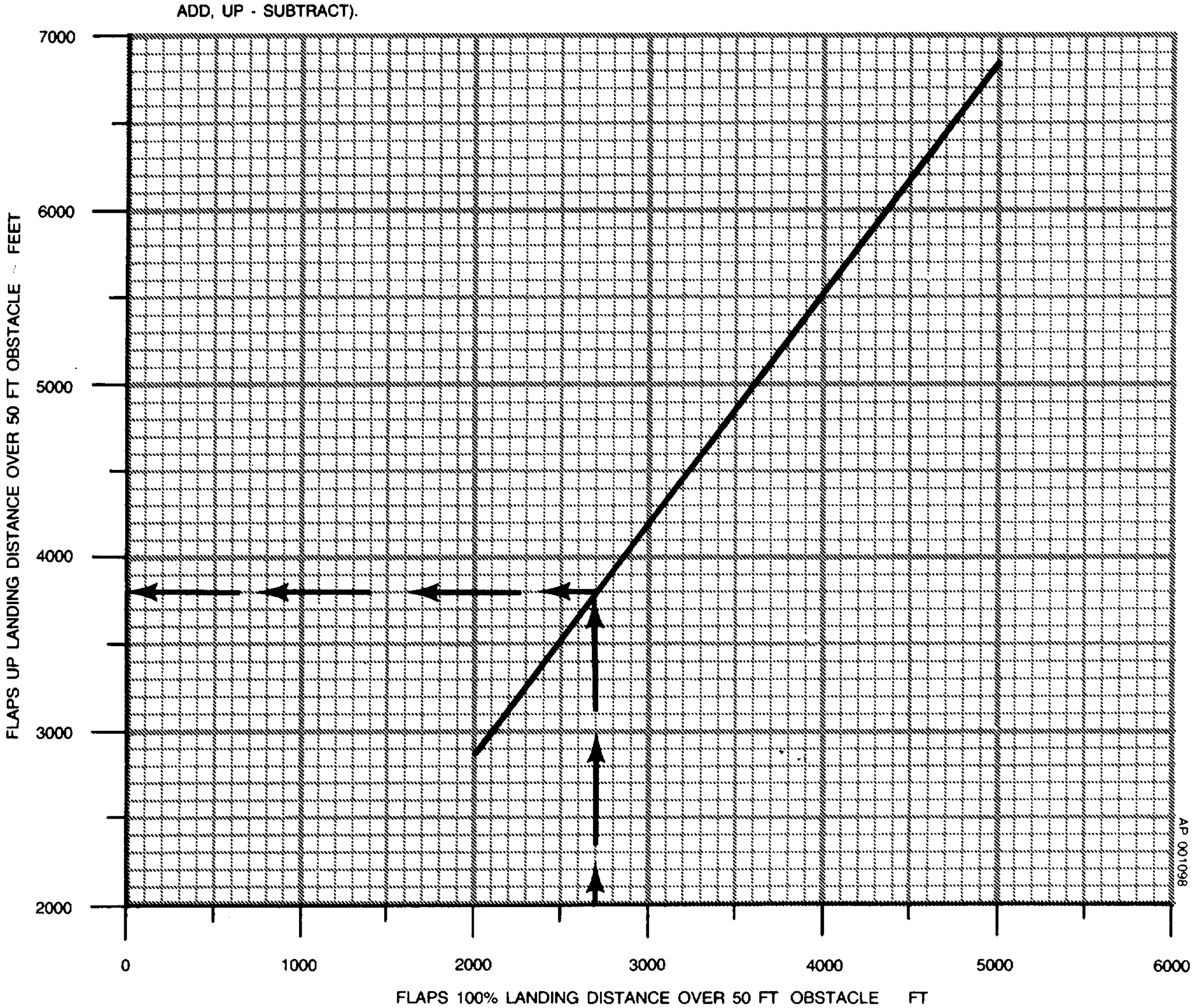


Figure 7-112. Landing Distance Without Propeller Reversing - Flaps 0%

LANDING DISTANCE WITH PROPELLER REVERSING - FLAPS 100%

ASSOCIATED CONDITIONS:

POWER .... RETARDED TO MAINTAIN 800 FT/MIN ON FINAL APPROACH
FLAPS........................... 100%
RUNWAY .... PAVED, LEVEL, DRY SURFACE
APPROACH SPEED..... IAS AS TABULATED
BRAKING...................... MAXIMUM

WEIGHT ~ LBS	APPROACH SPEED ~ KTS
12,500	103
12,000	102
11,000	99
10,000	96
9000	93

EXAMPLE:

OAT .... 15°C
PRESSURE ALTITUDE......................... 5650 FT
LANDING WEIGHT............................... 11,180 LBS
HEADWIND COMPONENT.................. 10 KTS

GROUND ROLL.................................... 1200 FT
TOTAL OVER 50 FT OBSTACLE .... 2100 FT
APPROACH SPEED............................. 99 KTS

NOTE: ADD OR SUBTRACT 5% FROM TOTAL GROUND ROLL FOR EACH 1% RUNWAY SLOPE (DOWN - ADD, UP - SUBTRACT).

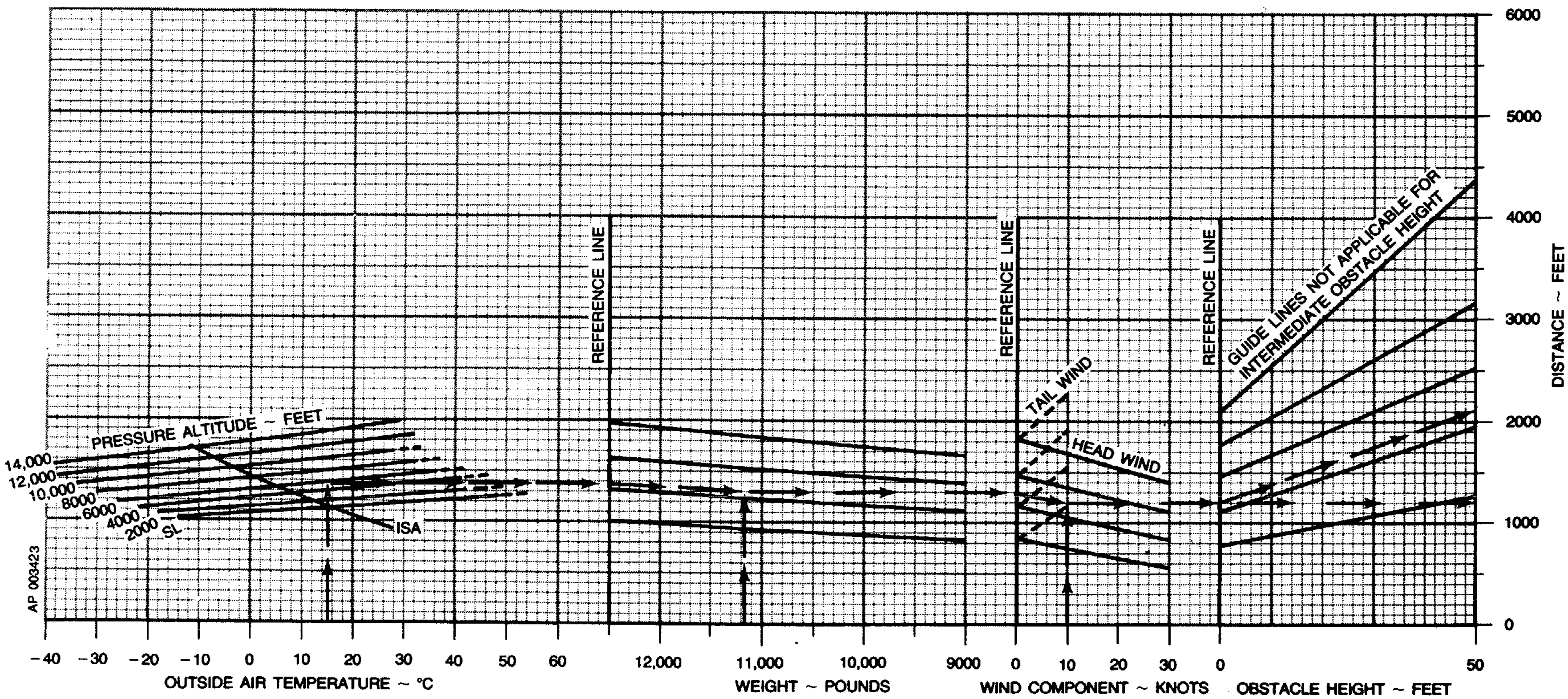


Figure 7-113. Landing Distance With Propeller Reversing - Flaps 100%

LANDING DISTANCE WITH PROPELLER REVERSING - FLAPS 0%

ASSOCIATED CONDITIONS:

POWER .... RETARDED TO MAINTAIN 1000 FT/MIN ON FINAL APPROACH
FLAPS................................... UP
RUNWAY .... PAVED, LEVEL, DRY SURFACE
APPROACH SPEED............. IAS AS TABULATED
BRAKING.............................. MAXIMUM
CONDITION LEVERS........... HIGH IDLE
PROPELLER CONTROLS.... FULL FORWARD
POWER LEVERS .... MAXIMUM REVERSE AFTER TOUCHDOWN

EXAMPLE:

FLAPS 100% LANDING DISTANCE OVER 50 FT OBSTACLE.................. 2100 FT
LANDING WEIGHT .... 11,180 LBS

FLAPS UP LANDING DISTANCE OVER 50 FOOT OBSTACLE .... 2670 FT
APPROACH SPEED .... 126 KTS

WEIGHT -- LBS	APPROACH SPEED -- KTS
12,500	132
12,000	130
11,000	126
10,000	122
9000	117

NOTE: 1. TO DETERMINE FLAPS UP LANDING DISTANCE, READ THE FLAPS 100% LANDING DISTANCE APPROPRIATE TO THE OAT, ALTITUDE, WEIGHT, AND WIND FROM THE LANDING DISTANCE GRAPH WITH REVERSING - FLAPS 100%, ENTER THE FLAPS UP LANDING DISTANCE GRAPH AND READ THE DISTANCE.

2. ADD OR SUBTRACT 5% FROM TOTAL GROUND ROLL FOR EACH 1% RUNWAY SLOPE (DOWN - ADD, UP - SUBTRACT).

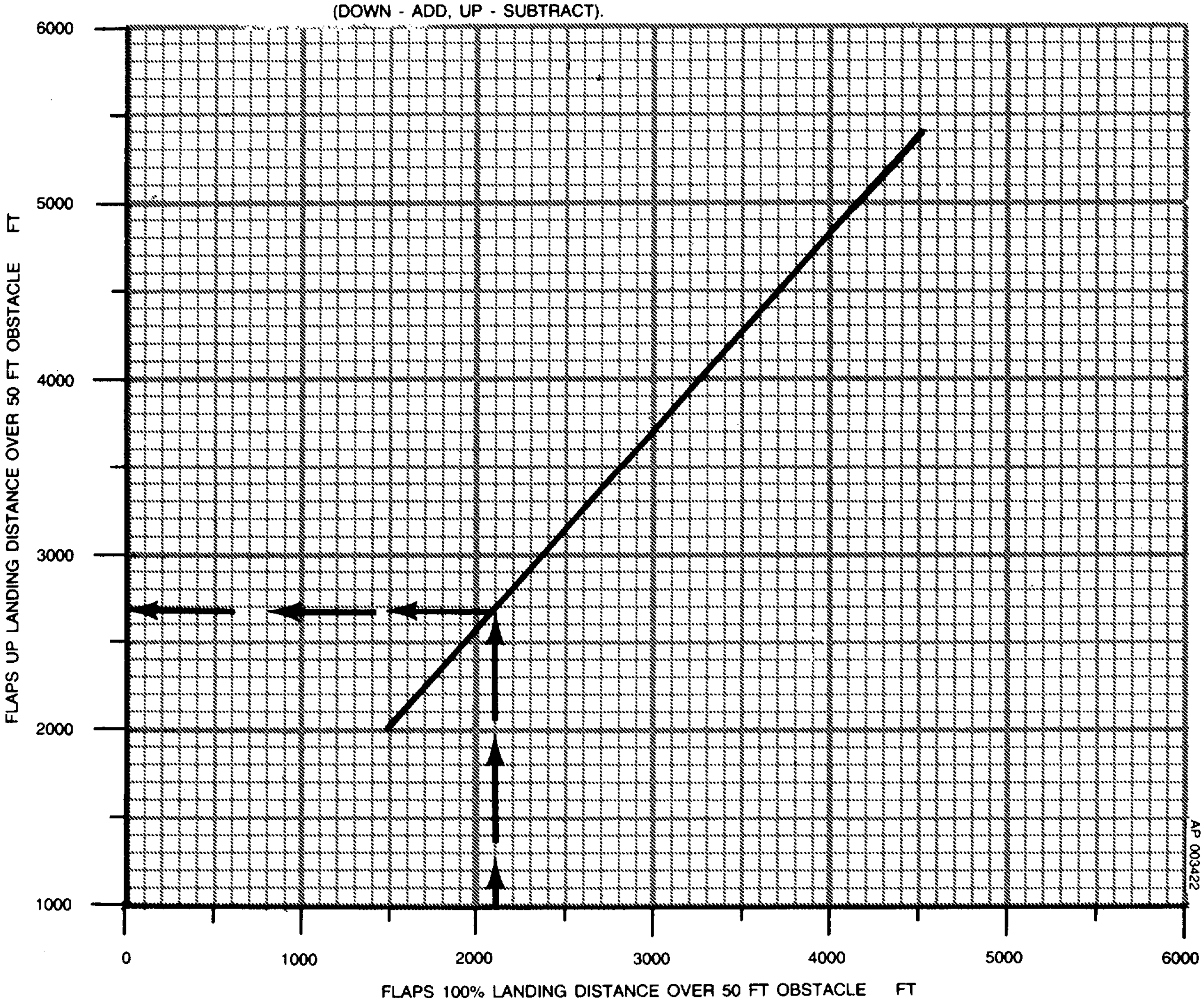


Figure 7-114. Landing Distance With Propeller Reversing - Flaps 0%

STOPPING DISTANCE FACTORS

EXAMPLE:

1. LANDING DISTANCE (FLAPS 100% NO REV)

GROUND ROLL (DRY)	1580 FT
TOTAL OVER 50 FT OBSTACLE	2700 FT
RUNWAY CONDITION READING	8.0
LANDING WEIGHT	11,180 LBS
STOPPING FACTOR	1.62
LANDING DISTANCE (FACTORED)	
GROUND ROLL (1580 x 1.62)	2560
AIR DISTANCE (2700 − 1580)	1120
TOTAL OVER 50 FT OBSTACLE	3680

2. ACCELERATE - STOP DISTANCE (FLAPS 0% NO REV)

ACCELERATE - STOP DISTANCE	5890 FT
ACCELERATE AFTER LIFT-OFF GROUND ROLL	4750 FT
RUNWAY CONDITION READING	10.0
TAKE-OFF WEIGHT	12,500 LBS
STOPPING FACTOR	1.34
STOPPING DISTANCE [(5890 − 4750) x 1.34]	1528 FT
ACCELERATE DISTANCE	4750 FT
ACCELERATE - STOP DISTANCE (1528 + 4750)	6278 FT

NOTE: 1. IF RCR READING IS NOT AVAILABLE, ASSUME ICY RUNWAY RCR = 5.0 AND WET RUNWAY RCR = 12.0.
2. ONE ENGINE INOPERATIVE STOPPING DISTANCES WILL NOT ACCOUNT FOR REVERSING

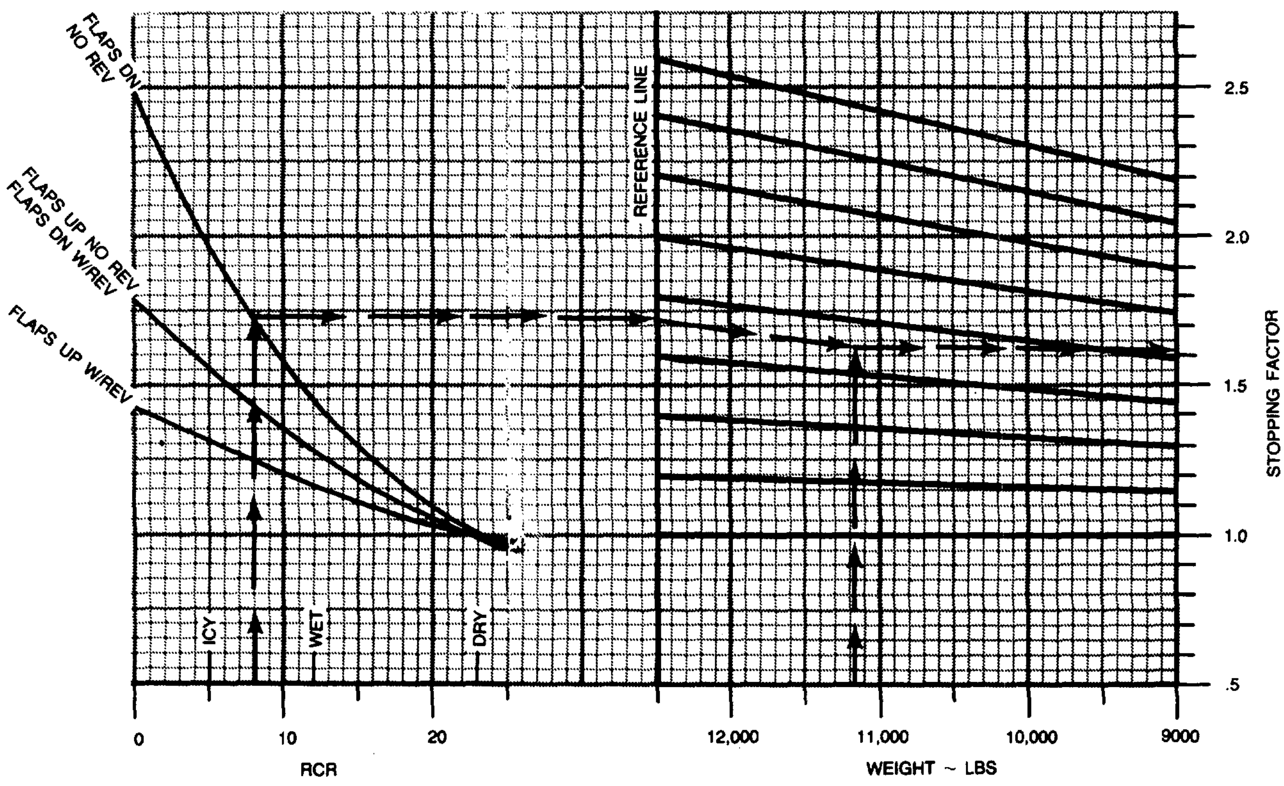


Figure 7-115. Stopping Distance Factors.

SECTION II MODEL C-12C
INTRODUCTION TO CRUISE CONTROL

NOTE

The graphs and tables in this part present cruise information for various parameters of weight, power, altitude and temperature. Examples have been presented using conditions specified below.

The following calculations provide information for flight planning at various parameters of weight, power, altitude, and temperature.

Calculations for flight time, block speed, and fuel requirements for a proposed flight from Denver to Reno at FL260 are detailed below.

Enter the ISA CONVERSION Graph at the conditions indicated:

DEN	Pressure Altitude.................. 5430 feet
	OAT.............................. ....28°C
	ISA Condition.................... ISA + 23°C
DEN - SLC	Pressure Altitude............... 26,000 feet
	OAT.............................. .... - 10°C
	ISA Condition.................... ISA + 27°C
SLC - RNO	Pressure Altitude............... 26,000 feet
	OAT.............................. .... -20°C
	ISA Condition.................... ISA + 17°C
RNO	Pressure Altitude.................. 4730 feet
	OAT.............................. ....32°C
	ISA Condition.................... ISA + 27°C

Enter the TIME, FUEL, AND DISTANCE TO CLIMB Graph at 28°C, to 5430 feet, and to 12,500 pounds, and enter at -10°C, to 26,000 feet and to 12,500 pounds, and read:

Time to Climb............................... ..... 33 - 4 = 29 minutes
Fuel Used to Climb.........................335 - 60 = 275 pounds
Distance Traveled...................106 - 11 = 95 nautical miles

Enter the TIME, FUEL, AND DISTANCE TO DESCEND Graph at 26,000 feet, and enter again at 4730 feet to read:

Time to Descend ....17.5 - 3.2 = 14.3 minutes
Fuel Used to Descend.....................219 - 46 = 173 pounds
Descent Distance.........82.5 - 14 = 68.5 nautical miles

The estimated average cruise weight is approximately 11,600 pounds.

Enter the tables for MAXIMUM CRUISE POWER at 1700 RPM for ISA + 10°C, ISA + 20°C, and ISA + 30°C, and read the cruise speeds for 26,000 feet at 12,000 pounds and 11,000 pounds.

Interpolate between these speeds for ISA + 27°C and ISA + 17°C at 11,600 pounds:

Cruise True Airspeed (ISA + 27°C) .... 244 knots
Cruise True Airspeed (ISA + 17°C) .... 253 knots

CRUISE TRUE AIRSPEEDS AT FL 260					
12,000 POUNDS			11,000 POUNDS		
ISA+ 10°C	ISA+20°C	ISA+30°C	ISA+ 10°C	ISA+20°C	ISA+ 30°C
254	250	240	259	255	248

Enter the *MAXIMUM CRUISE POWER at 1700 RPM Graph at 26,000 feet, and read the torque settings for ISA + 27°C (-3°C IOAT) and ISA + 17°C (-13°C IOAT):

ISA + 27°C (-3°C IOAT)..................57% torque per engine
ISA + 17°C (-13° IOAT) ....62% torque per engine

Enter the *FUEL FLOW AT MAXIMUM CRUISE POWER at 1700 RPM Graph at 26,000 feet, and read the fuel flow for ISA + 27°C (-3°C IOAT) and ISA + 17°C (-13°C IOAT):

Time and Fuel Used were calculated at Maximum Cruise Power at 1700 RPM as follows:

Total Fuel ....Flow 488 lbs/hr

ISA + 17°C (- 13°C IOAT)

Fuel Flow Per Engine.............................. ....256 lbs/hr
Total Fuel Flow.............................. .... 512 lbs/hr

ISA + 27°C (-3°C IOAT)

Fuel Flow Per Engine.............................. .... 244 lbs/hr

***NOTE:** For flight planning, enter these graphs at the forecasted ISA condition; for enroute power settings and fuel flow, enter the graphs at the actual IOAT.

Time = Ground Speed
Fuel Used = (Time)(Total Fuel Flow)

Distance

Results are as follows:

ROUTE	DISTANCE NM	ESTIMATED GROUND SPEED KNOTS	TIME AT CRUISE ALTITUDE HRS: MIN	FUEL USED FOR CRUISE LBS
DEN - EKR	*60	229	00:15.7	128
EKR - SLC	192	225	00:51.2	417
SLC - BVL	81	241	00:20.2	172
BLV - BAM	145	240	00:36.3	310
BAM - RNO	*76.5	219	00:21.0	179
*Distance required to climb or descend has been subtracted from segment distance.				

ITEM	TIME- FUEL - DISTANCE TIME HRS: MINS	FUEL POUNDS	DISTANCE NM
Start, Runup, Taxi, and Take-off Acceleration	0:00.0	90	0.0
Climb	0:29.0	275	95.0
Cruise	2:24.4	1206	554.5
Descent	0:14.3	173	68.5
Total	3:07.7	1744	718.0
Total Flight Time: 3 hours, 07.7 minutes Block Speed: 718 NM . - 3 hours, 07.7 minutes = 230 knots			

Reserve Fuel (45 minutes at Maximum Range Power): Weight at end of cruise was assumed to be 11,000 pounds. Enter the tables for MAXIMUM RANGE POWER at 1700 RPM for ISA + 10°C and ISA + 20°C at 26,000 feet.

ISA + 10°C .... 406 lbs/hr Total Fuel Flow
ISA + 20°C .... 416 lbs/hr Total Fuel Flow

Interpolate to find fuel flow at ISA + 17°C:

Total fuel flow for reserve = 406 + 7 = 413 lbs/hr

Reserve Fuel = 45 minutes X 413 lbs/hr = 310 lbs

Total Fuel: 1744 + 310 = 2054 pounds (307 gallons Aviation Kerosene)

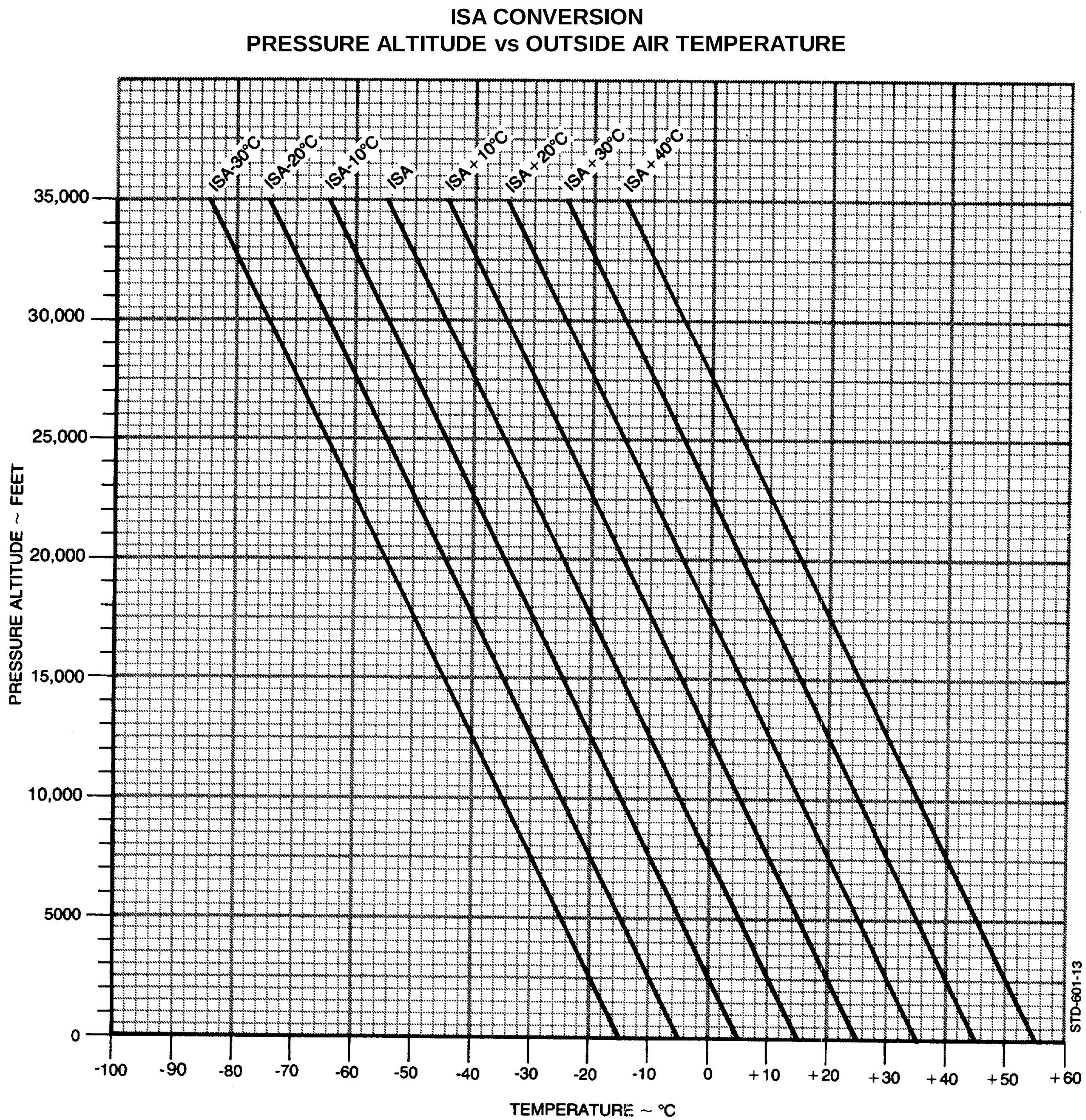


Figure 7-116. ISA Conversion.

ASSOCIATED CONDITIONS:
PROPELLER SPEED . 1900 RPM
TGT . . . . 725 °C
TORQUE 100%

ALTITUDE ~ FT	CRUISE CLIMB ~ KTS
SL TO 10,000	160
10,000 TO 20,000	140
20,000 TO 25,000	130
25,000 TO 31,000	120

EXAMPLE:

OAT AT TAKE-OFF . . . . 25 °C
OAT AT CRUISE . . . . −10 °C
AIRPORT PRESSURE ALTITUDE . . 3966 FT
CRUISE PRESSURE ALTITUDE . . 17,000 FT
INITIAL CLIMB WEIGHT . . . . 12,500 LBS

TIME TO CLIMB . . . . 9 MIN
FUEL TO CLIMB . . . . 117 LBS
DISTANCE TO CLIMB . . . . 27 MILES

NOTE: FOR OPERATION WITH ICE VANES EXTENDED, ADD 20°C TO THE ACTUAL OAT BEFORE ENTERING GRAPH.

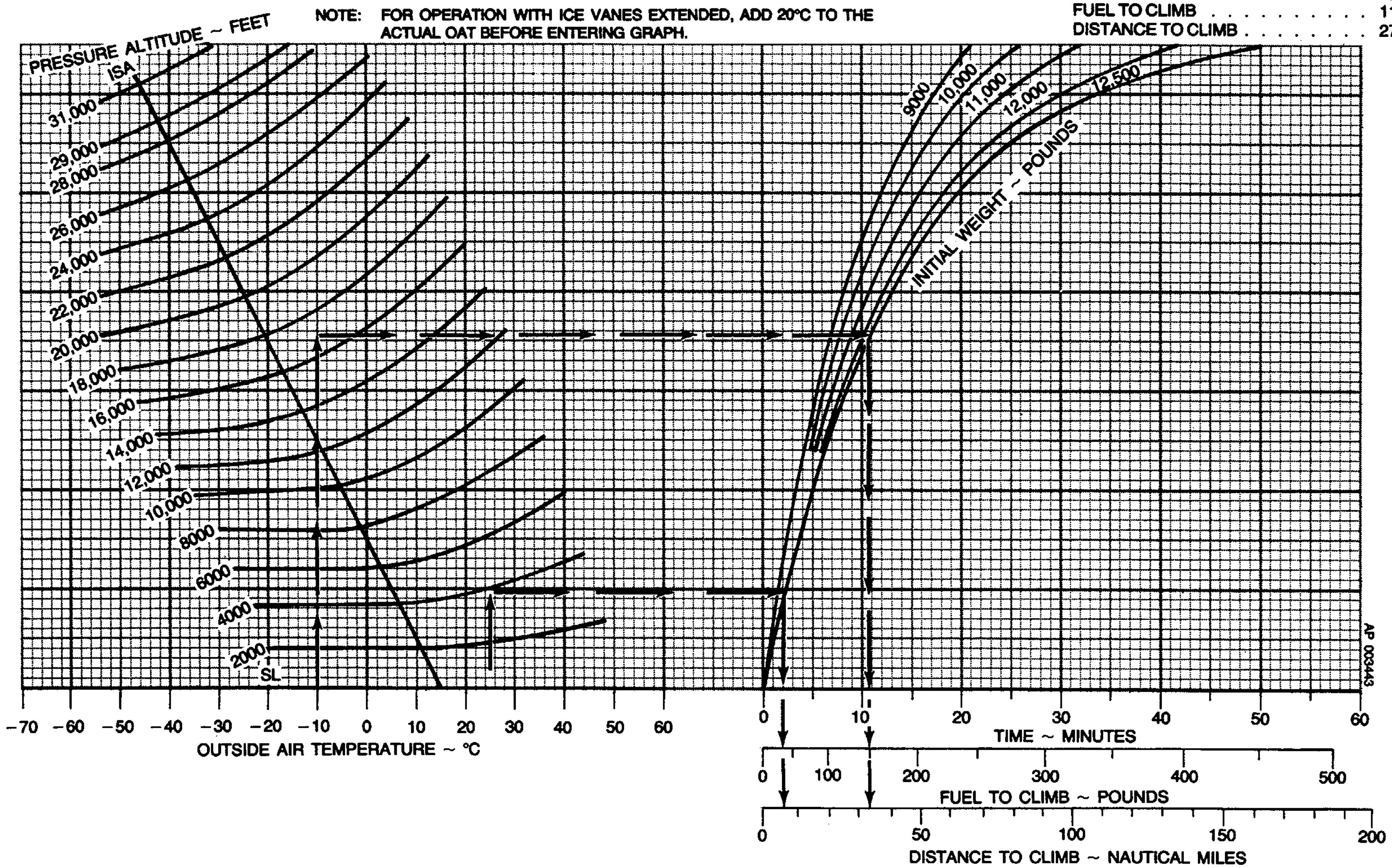


Figure 7-117. Time, Fuel, and Distance to Climb

TIME, FUEL AND DISTANCE TO DESCEND

ASSOCIATED CONDITIONS:

POWER . . . . AS REQUIRED TO DESCEND
GEAR . . . . UP
FLAPS . . . . UP

EXAMPLE:

INITIAL ALTITUDE . . . . 17,000 FT
FINAL ALTITUDE . . . . 5650 FT

TIME TO DESCEND . . . . 7.5 MIN
FUEL TO DESCEND . . . . 110 LBS
DISTANCE TO DESCEND . . . . 39 NM

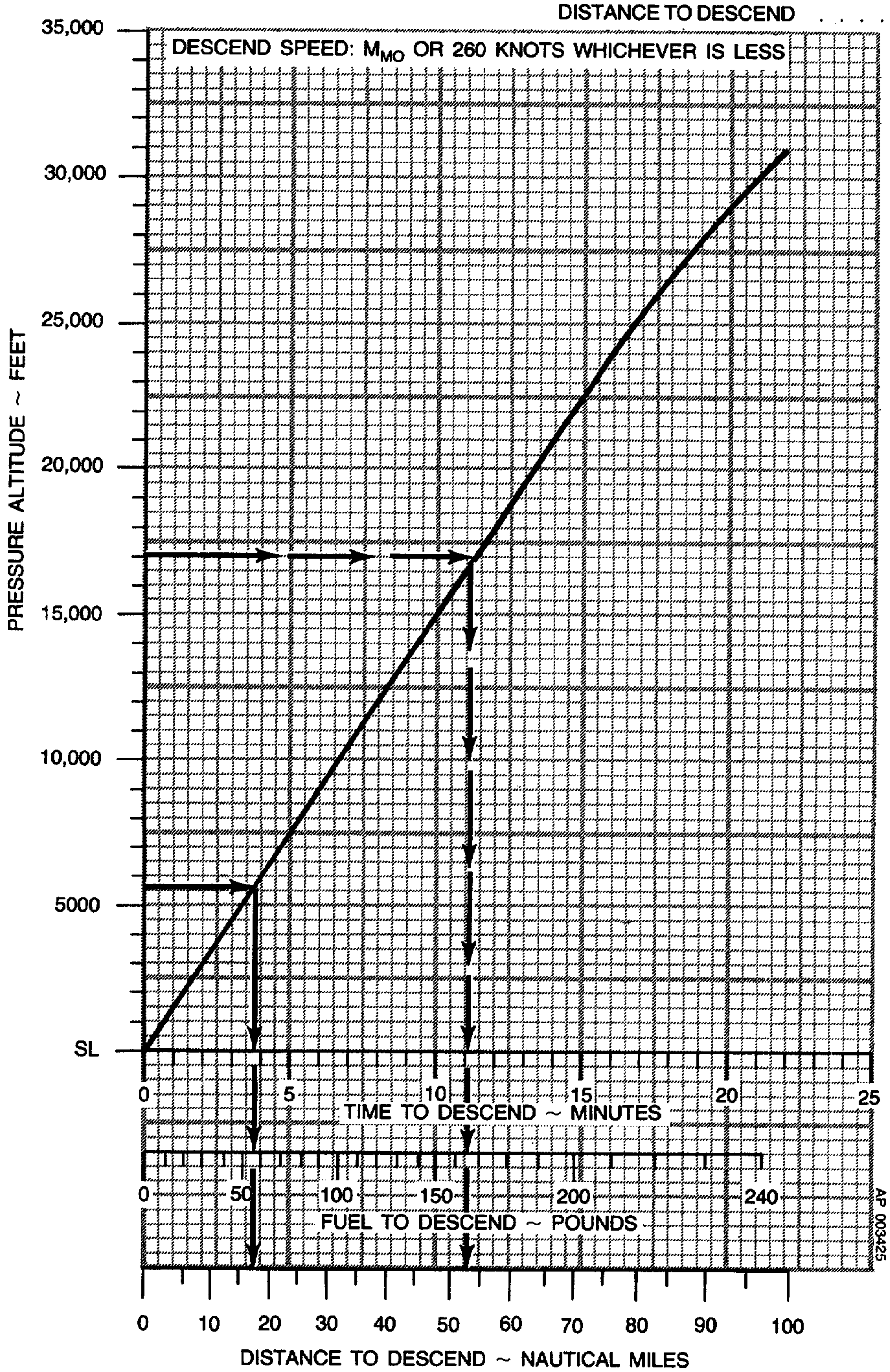


Figure 7-118. Time, Fuel, and Distance to Descend

MAXIMUM CRUISE POWER – 1700 RPM

ISA –30°C

FOR EFFECT OF ICE VANE EXTENSION, REFER TO RECOMMENDED CRUISE SPEEDS, RECOMMENDED CRUISE POWER AND FUEL FLOW AT RECOMMENDED CRUISE POWER GRAPHS.

PRESSURE ALTITUDE	IOAT		TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	AIRSPEED KNOTS					
						12000		11000		10000	
FEET	°C	°F	%	LBS/HR	LBS/HR	CAS	TAS	CAS	TAS	CAS	TAS
SL	-10	14	100	468	936	239	226	240	227	240	228
2000	-14	7	100	455	910	237	230	238	231	238	232
4000	-18	0	100	443	886	234	235	235	235	236	236
6000	-22	-8	100	432	864	232	239	233	240	234	241
8000	-25	-13	100	422	844	230	244	231	245	232	245
10000	-29	-20	100	413	826	228	248	229	249	230	250
12000	-33	-27	100	406	812	226	253	227	254	227	255
14000	-37	-35	100	400	800	223	258	224	259	225	260
16000	-40	-40	100	396	792	221	263	222	264	223	266
18000	-44	-47	100	392	784	219	268	220	270	221	271
20000	-48	-54	98	384	768	214	271	216	273	217	275
22000	---	---	---	---	---	---	---	---	---	---	---
24000	---	---	---	---	---	---	---	---	---	---	---
26000	---	---	---	---	---	---	---	---	---	---	---
28000	---	---	---	---	---	---	---	---	---	---	---
29000	---	---	---	---	---	---	---	---	---	---	---
31000	---	---	---	---	---	---	---	---	---	---	---

Figure 7-119. Maximum Cruise Power-1700 RPM-ISA-30°C

MAXIMUM CRUISE POWER – 1700 RPM

ISA –20°C

FOR EFFECT OF ICE VANE EXTENSION, REFER TO RECOMMENDED CRUISE SPEEDS, RECOMMENDED CRUISE POWER AND FUEL FLOW AT RECOMMENDED CRUISE POWER GRAPHS.

PRESSURE ALTITUDE	IOAT		TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	AIRSPEED KNOTS					
						12000		11000		10000	
FEET	°C	°F	%	LBS/HR	LBS/HR	CAS	TAS	CAS	TAS	CAS	TAS
SL	0	32	100	471	942	237	229	238	230	239	230
2000	-4	25	100	457	914	235	233	236	234	237	235
4000	-8	18	100	445	890	233	237	234	238	234	239
6000	-11	12	100	434	868	230	242	231	243	232	244
8000	-15	5	100	424	848	228	247	229	248	230	249
10000	-19	-2	100	415	830	226	252	227	253	228	253
12000	-23	-9	100	407	814	224	256	225	258	226	258
14000	-26	-15	100	401	802	221	261	222	263	223	264
16000	-30	-22	100	397	794	219	267	220	268	221	269
18000	-34	-29	100	394	788	216	272	217	273	219	274
20000	-38	-36	94	369	738	208	270	210	272	211	274
22000	-42	-44	87	345	690	200	268	202	271	204	272
24000	-46	-51	81	321	642	192	266	194	268	196	271
26000	-48	-54	78	309	618	183	262	190	267	188	268
28000	---	---	---	---	---	---	---	---	---	---	---
29000	---	---	---	---	---	---	---	---	---	---	---
31000	---	---	---	---	---	---	---	---	---	---	---

Figure 7-120. Maximum Cruise Power-1700 RPM-ISA-20°C

MAXIMUM CRUISE POWER – 1700 RPM

ISA –10°C

FOR EFFECT OF ICE VANE EXTENSION, REFER TO RECOMMENDED CRUISE SPEEDS, RECOMMENDED CRUISE POWER AND FUEL FLOW AT RECOMMENDED CRUISE POWER GRAPHS.

PRESSURE ALTITUDE	IOAT		TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	AIRSPEED KNOTS					
						12000		11000		10000	
FEET	°C	°F	%	LBS/HR	LBS/HR	CAS	TAS	CAS	TAS	CAS	TAS
SL	10	50	100	472	944	236	231	236	232	237	233
2000	6	43	100	459	918	233	236	234	237	235	237
4000	2	36	100	447	894	231	240	232	241	233	242
6000	-1	30	100	437	874	229	245	230	246	231	247
8000	-5	23	100	426	852	227	250	228	251	228	252
10000	-9	16	100	417	834	224	255	225	256	226	257
12000	-13	9	100	409	818	222	259	223	261	224	262
14000	-16	3	100	404	808	220	265	221	266	222	267
16000	-20	-4	100	399	798	217	270	218	271	219	272
18000	-24	-11	96	382	764	211	271	212	272	214	274
20000	-28	-18	89	356	712	203	269	204	271	206	273
22000	-32	-26	83	333	666	195	267	197	269	198	271
24000	-36	-33	77	309	618	186	264	188	267	190	269
26000	-40	-40	71	287	574	178	260	180	264	182	267
28000	-44	-47	66	266	532	169	256	172	260	174	264
29000	-46	-51	63	256	512	164	253	167	258	170	263
31000	---	---	---	---	---	---	---	---	---	---	---

Figure 7-121. Maximum Cruise Power-1700 RPM-ISA-10°C

MAXIMUM CRUISE POWER – 1700 RPM

ISA

FOR EFFECT OF ICE VANE EXTENSION, REFER TO RECOMMENDED CRUISE SPEEDS, RECOMMENDED CRUISE POWER AND FUEL FLOW AT RECOMMENDED CRUISE POWER GRAPHS.

PRESSURE ALTITUDE	IOAT		TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	AIRSPEED KNOTS					
						12000		11000		10000	
FEET	°C	°F	%	LBS/HR	LBS/HR	CAS	TAS	CAS	TAS	CAS	TAS
SL	20	68	100	476	952	234	234	235	235	236	236
2000	16	61	100	462	924	232	238	233	239	233	240
4000	13	55	100	449	898	229	243	230	244	231	245
6000	9	48	100	437	874	227	248	228	249	229	250
8000	5	41	100	427	854	225	253	226	254	227	255
10000	1	34	100	419	838	223	258	224	259	224	260
12000	-2	28	100	412	824	220	263	221	264	222	265
14000	-6	21	100	406	812	218	268	219	269	220	270
16000	-10	14	99	396	792	214	271	215	273	216	274
18000	-14	7	92	369	738	206	269	207	271	209	273
20000	-18	0	85	344	688	197	267	199	269	201	272
22000	-22	-8	79	321	642	189	265	191	268	193	270
24000	-26	-15	73	298	596	181	261	183	265	185	268
26000	-30	-22	68	276	552	172	257	175	261	177	265
28000	-34	-29	62	256	512	163	253	166	258	169	262
29000	-36	-33	60	246	492	158	250	162	256	165	260
31000	-41	-42	55	228	456	147	241	153	250	156	256

Figure 7-122. Maximum Cruise Power-1700 RPM-ISA

MAXIMUM CRUISE POWER – 1700 RPM

ISA +10°C

FOR EFFECT OF ICE VANE EXTENSION, REFER TO RECOMMENDED CRUISE SPEEDS, RECOMMENDED CRUISE POWER AND FUEL FLOW AT RECOMMENDED CRUISE POWER GRAPHS.

PRESSURE ALTITUDE	IOAT		TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	AIRSPEED KNOTS					
						12000		11000		10000	
FEET	°C	°F	%	LBS/HR	LBS/HR	CAS	TAS	CAS	TAS	CAS	TAS
SL	30	86	100	478	956	233	237	233	237	234	238
2000	26	79	100	465	930	230	241	231	242	232	243
4000	23	73	100	452	904	228	246	229	247	230	248
6000	19	66	100	440	880	226	251	227	252	228	253
8000	15	59	100	430	860	223	255	224	256	225	258
10000	12	54	100	419	838	221	260	222	262	223	263
12000	8	46	100	412	824	219	266	220	267	221	268
14000	4	39	98	401	802	214	269	216	270	217	272
16000	0	32	92	376	752	207	268	208	270	210	271
18000	-4	25	87	352	704	199	267	201	269	203	271
20000	-8	18	81	329	658	192	265	194	267	195	270
22000	-12	10	76	308	616	184	262	186	265	188	268
24000	-16	3	70	287	574	175	259	178	263	180	266
26000	-20	-4	64	266	532	166	254	169	259	172	263
28000	-24	-11	59	246	492	157	249	161	255	164	260
29000	-27	-17	57	237	474	151	245	156	252	159	258
31000	-31	-24	52	219	438	139	233	146	245	151	253

Figure 7-123. Maximum Cruise Power-1700 RPM-ISA-10°C

MAXIMUM CRUISE POWER – 1700 RPM

ISA +20°C

FOR EFFECT OF ICE VANE EXTENSION, REFER TO RECOMMENDED CRUISE SPEEDS, RECOMMENDED CRUISE POWER AND FUEL FLOW AT RECOMMENDED CRUISE POWER GRAPHS.

PRESSURE ALTITUDE	IOAT		TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	AIRSPEED KNOTS					
						12000		11000		10000	
FEET	°C	°F	%	LBS/HR	LBS/HR	CAS	TAS	CAS	TAS	CAS	TAS
SL	40	104	100	482	964	231	239	232	240	233	241
2000	37	99	100	468	936	229	244	230	245	231	245
4000	33	91	100	455	910	227	248	228	249	228	250
6000	29	84	100	443	886	224	253	225	254	226	255
8000	25	77	100	432	864	222	258	223	259	224	260
10000	22	72	100	422	844	220	263	221	265	221	266
12000	18	64	96	403	806	214	265	215	266	216	268
14000	14	57	91	379	758	207	265	209	267	210	268
16000	10	50	86	356	712	200	264	202	266	203	268
18000	6	43	81	333	666	193	263	195	265	196	267
20000	2	36	75	311	622	185	260	187	263	188	265
22000	-2	28	70	291	582	177	258	179	261	181	264
24000	-6	21	65	272	544	169	254	171	259	174	262
26000	-10	14	60	253	506	160	250	163	255	166	259
28000	-15	5	56	235	470	149	242	154	250	158	256
29000	-17	1	53	226	452	144	237	150	247	154	254
31000	-21	-6	49	209	418	230	223	139	238	145	248

Figure 7-124. Maximum Cruise Power-1700 RPM-ISA+20°C

MAXIMUM CRUISE POWER – 1700 RPM

ISA +30°C

FOR EFFECT OF ICE VANE EXTENSION, REFER TO RECOMMENDED CRUISE SPEEDS, RECOMMENDED CRUISE POWER AND FUEL FLOW AT RECOMMENDED CRUISE POWER GRAPHS.

PRESSURE ALTITUDE	IOAT		TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	AIRSPEED KNOTS					
						12000		11000		10000	
FEET	°C	°F	%	LBS/HR	LBS/HR	CAS	TAS	CAS	TAS	CAS	TAS
SL	50	122	100	485	970	230	241	231	242	231	243
2000	47	117	100	471	942	228	246	229	247	229	248
4000	43	109	100	457	914	225	251	226	252	227	253
6000	39	102	100	445	890	223	256	224	257	225	258
8000	35	95	97	424	848	218	258	219	259	220	260
10000	31	88	93	402	804	212	259	214	261	215	262
12000	28	82	89	380	760	206	259	207	261	209	263
14000	24	75	84	357	714	199	259	201	261	202	263
16000	20	68	79	335	670	192	258	194	260	195	262
18000	16	61	75	314	628	185	257	187	260	189	262
20000	12	54	70	294	588	178	255	180	258	182	261
22000	7	45	65	275	550	169	252	172	256	175	259
24000	3	37	60	256	512	160	247	164	252	167	256
26000	-1	30	56	238	476	150	240	155	248	159	253
28000	-5	23	51	221	442	139	231	146	242	151	250
29000	-7	19	49	213	426	133	225	141	238	147	247
31000	-12	10	45	197	394	114	200	129	226	137	240

Figure 7-125. Maximum Cruise Power-1700 RPM-ISA+30°C

MAXIMUM CRUISE POWER – 1700 RPM

ISA +37°C

FOR EFFECT OF ICE VANE EXTENSION, REFER TO RECOMMENDED CRUISE SPEEDS, RECOMMENDED CRUISE POWER AND FUEL FLOW AT RECOMMENDED CRUISE POWER GRAPHS.

PRESSURE ALTITUDE	IOAT		TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	AIRSPEED KNOTS					
						12000		11000		10000	
FEET	°C	°F	%	LBS/HR	LBS/HR	CAS	TAS	CAS	TAS	CAS	TAS
SL	58	136	100	487	974	229	243	230	244	231	245
2000	54	129	98	467	934	225	246	226	247	227	248
4000	50	122	96	448	896	221	249	222	250	223	251
6000	46	115	94	428	856	217	252	218	253	219	254
8000	42	108	91	408	816	212	253	213	255	214	256
10000	38	100	88	387	774	207	255	208	257	209	258
12000	34	93	84	365	730	200	255	202	257	203	259
14000	30	86	79	342	684	193	254	195	257	197	259
16000	26	79	74	321	642	186	253	188	256	190	258
18000	22	72	70	300	600	179	252	181	255	183	257
20000	18	64	65	281	562	171	249	174	253	176	256
22000	14	57	61	263	526	163	246	167	251	169	255
24000	10	50	57	246	492	154	241	159	248	162	252
26000	6	43	53	228	456	144	233	150	243	154	249
28000	2	36	48	212	424	132	221	140	235	146	244
29000	-1	30	46	204	408	123	211	134	229	141	240
31000	-5	23	42	187	374	90	161	120	213	130	231

Figure 7-126. Maximum Cruise Power-1700 RPM-ISA+37°C

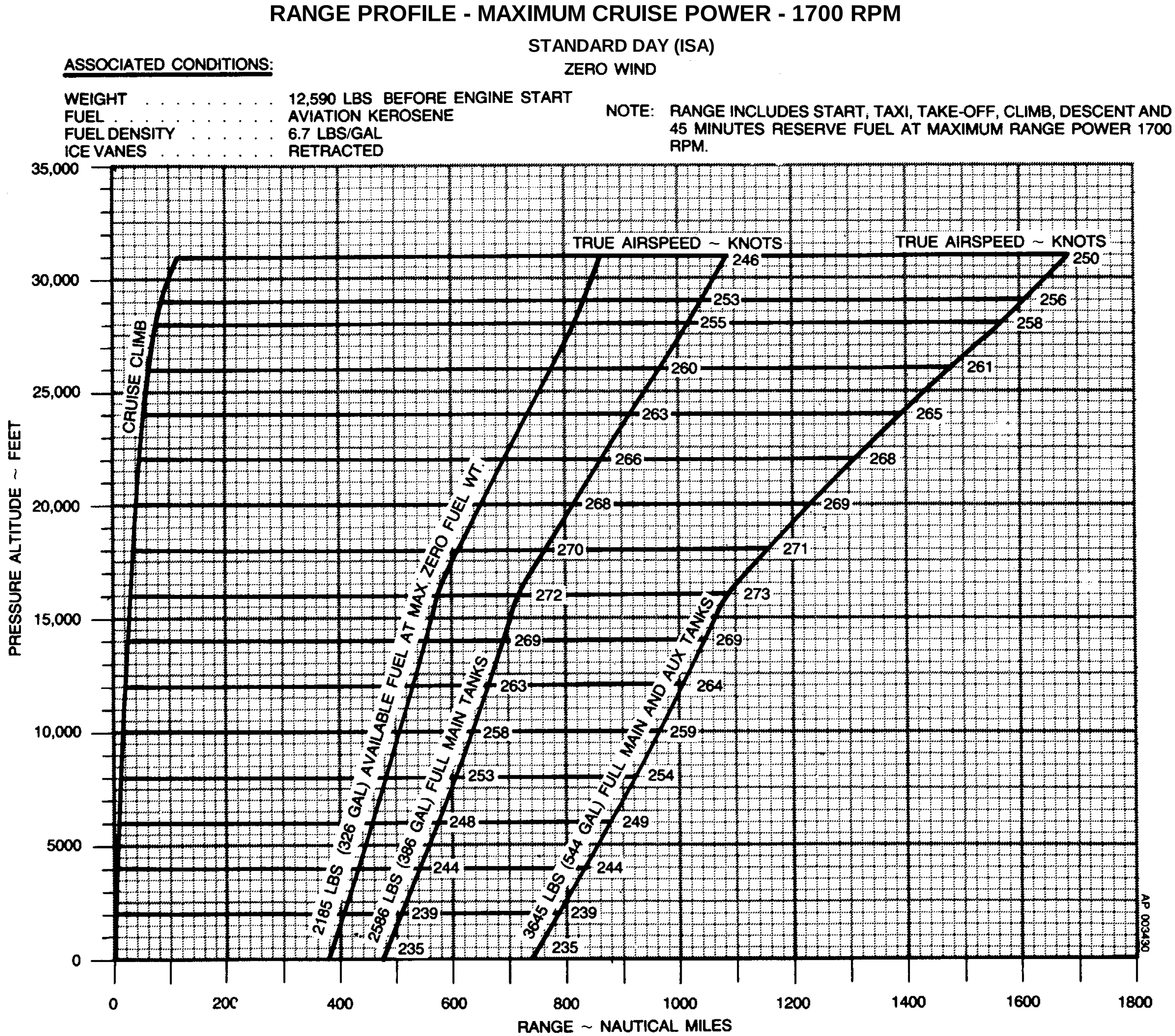


Figure 7-127. Range Profile-Maximum Cruise Power-1700 RPM

MAXIMUM RANGE POWER - 1700 RPM
ISA -30 °C

FOR OPERATION WITH ICE VANES EXTENDED, MAINTAIN SAME POWER AS WITH ICE VANES RETRACTED AND INCREASE TOTAL FUEL FLOW BY 15%.

			12000 POUNDS				11000 POUNDS				10000 POUNDS			
PRESSURE ALTITUDE	IOAT		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	°F	%	LB/HR	LB/HR	KNOTS	%	LB/HR	LB/HR	KNOTS	%	LB/HR	LB/HR	KNOTS
SL	-12	10	67	378	756	195	65	371	742	193	62	365	730	191
2000	-16	3	62	348	696	191	58	340	680	189	56	331	662	186
4000	-20	-4	56	320	640	188	53	310	620	185	50	300	600	182
6000	-24	-11	52	296	592	186	49	285	570	182	45	274	548	178
8000	-28	-18	50	277	554	185	46	265	530	181	42	254	508	177
10000	-32	-26	48	258	516	185	43	246	492	180	39	234	468	176
12000	-36	-33	46	245	490	186	42	232	464	181	38	219	438	176
14000	-40	-40	46	235	470	188	41	221	442	182	36	207	414	176
16000	-44	-47	46	226	452	190	41	212	424	184	36	198	396	178
18000	-47	-53	45	218	436	193	41	204	408	187	36	190	380	181
20000	---	---	---	---	---	---	---	---	---	---	---	---	---	---
22000	---	---	---	---	---	---	---	---	---	---	---	---	---	---
24000	---	---	---	---	---	---	---	---	---	---	---	---	---	---
26000	---	---	---	---	---	---	---	---	---	---	---	---	---	---
28000	---	---	---	---	---	---	---	---	---	---	---	---	---	---
29000	---	---	---	---	---	---	---	---	---	---	---	---	---	---
31000	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Figure 7-128. Maximum Range Power-1700 RPM-ISA-30°C

MAXIMUM RANGE POWER - 1700 RPM

ISA -20ºC

FOR OPERATION WITH ICE VANES EXTENDED, MAINTAIN SAME POWER AS WITH ICE VANES RETRACTED AND INCREASE TOTAL FUEL FLOW BY 15%.

			12000 POUNDS				11000 POUNDS				10000 POUNDS			
PRESSURE ALTITUDE	IOAT		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	°F	%	LB/HR	LB/HR	KNOTS	%	LB/HR	LB/HR	KNOTS	%	LB/HR	LB/HR	KNOTS
SL	-1	30	71	389	778	201	68	382	764	199	66	376	752	198
2000	-5	23	66	362	724	199	63	355	710	197	61	348	696	195
4000	-9	16	61	335	670	196	58	326	652	194	55	318	636	191
6000	-13	9	57	312	624	195	54	302	604	192	51	293	586	189
8000	-17	1	54	292	584	194	51	282	564	191	48	272	544	188
10000	-22	-8	52	272	544	193	48	261	522	189	44	250	500	185
12000	-25	-13	50	259	518	194	46	247	494	190	42	235	470	186
14000	-29	-20	50	247	494	196	45	235	470	192	41	223	446	187
16000	-33	-27	49	237	474	198	45	225	450	194	40	212	424	188
18000	-37	-35	48	228	456	201	44	215	430	195	40	203	406	190
20000	-41	-42	48	225	450	202	43	207	414	198	39	194	388	192
22000	-45	-49	48	216	432	207	43	202	404	201	39	188	376	195
24000	---	---	---	---	---	---	---	---	---	---	---	---	---	---
26000	---	---	---	---	---	---	---	---	---	---	---	---	---	---
28000	---	---	---	---	---	---	---	---	---	---	---	---	---	---
29000	---	---	---	---	---	---	---	---	---	---	---	---	---	---
31000	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Figure 7-129. Maximum Range Power - 1700 RPM - ISA -20ºC

MAXIMUM RANGE POWER - 1700 RPM

ISA -10ºC

FOR OPERATION WITH ICE VANES EXTENDED, MAINTAIN SAME POWER AS WITH ICE VANES RETRACTED AND INCREASE TOTAL FUEL FLOW BY 15%.

			12000 POUNDS				11000 POUNDS				10000 POUNDS			
PRESSURE ALTITUDE	IOAT		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	°F	%	LB/HR	LB/HR	KNOTS	%	LB/HR	LB/HR	KNOTS	%	LB/HR	LB/HR	KNOTS
SL	9	48	67	381	762	199	66	378	756	199	65	375	750	199
2000	5	41	66	362	724	201	64	359	718	201	62	354	708	200
4000	1	34	64	344	688	203	61	337	674	201	58	329	658	199
6000	-3	27	61	324	648	203	58	315	630	200	55	307	614	197
8000	-7	19	58	303	606	202	54	293	586	198	51	284	568	195
10000	-11	12	55	283	566	200	51	273	546	197	48	263	526	194
12000	-15	5	53	269	538	202	49	257	514	198	46	247	494	194
14000	-19	-2	52	256	512	203	48	244	488	198	44	233	466	194
16000	-23	-9	51	246	492	206	47	233	466	200	43	221	442	195
18000	-27	-17	51	237	474	209	46	223	446	202	42	211	422	197
20000	-31	-24	50	228	456	210	46	216	432	206	42	203	406	200
22000	-35	-31	49	220	440	211	46	210	420	209	41	197	394	203
24000	-38	-36	48	211	422	211	45	203	406	211	41	191	382	206
26000	-42	-44	48	208	416	214	44	196	392	211	41	186	372	209
28000	-46	-51	49	210	420	221	43	190	380	211	40	183	366	210
29000	-48	-54	49	208	416	221	44	191	382	215	40	177	354	211
31000	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Figure 7-130. Maximum Range Power - 1700 RMP - ISA -10ºC

MAXIMUM RANGE POWER - 1700 RPM

ISA

FOR OPERATION WITH ICE VANES EXTENDED, MAINTAIN SAME POWER AS WITH ICE VANES RETRACTED AND INCREASE TOTAL FUEL FLOW BY 15%.

			12000 POUNDS				11000 POUNDS				10000 POUNDS			
PRESSURE ALTITUDE	IOAT		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	°F	%	LB/HR	LB/HR	KNOTS	%	LB/HR	LB/HR	KNOTS	%	LB/HR	LB/HR	KNOTS
SL	19	66	64	378	756	198	62	371	742	197	60	366	732	196
2000	15	59	61	354	708	198	60	349	698	197	59	346	692	197
4000	11	52	60	335	670	200	59	332	664	200	58	328	656	200
6000	7	45	59	319	638	202	57	315	630	202	56	310	620	201
8000	3	37	57	303	606	203	55	298	596	203	53	292	584	201
10000	-1	30	56	287	574	204	53	281	562	203	51	273	546	201
12000	-5	23	54	272	544	205	51	265	530	204	48	255	510	200
14000	-9	16	52	259	518	206	50	252	504	205	46	241	482	201
16000	-13	9	51	247	494	207	49	239	478	206	45	229	458	202
18000	-17	1	50	236	472	208	47	228	456	207	44	219	438	204
20000	-21	-6	49	228	456	210	46	218	436	208	43	210	420	207
22000	-25	-13	49	223	446	214	45	209	418	209	43	202	404	208
24000	-28	-18	50	219	438	218	44	202	404	210	41	193	386	209
26000	-32	-26	50	215	430	220	45	199	398	214	40	184	368	208
28000	-36	-33	50	213	426	224	45	198	396	220	40	180	360	211
29000	-38	-36	51	215	430	227	45	197	394	221	40	180	360	214
31000	-42	-44	52	217	434	233	45	195	390	224	41	180	360	219

Figure 7-131. Maximum Range Power - 1700 RMP - ISA

MAXIMUM RANGE POWER - 1700 RPM

ISA +10ºC

FOR OPERATION WITH ICE VANES EXTENDED, MAINTAIN SAME POWER AS WITH ICE VANES RETRACTED AND INCREASE TOTAL FUEL FLOW BY 15%.

			12000 POUNDS				11000 POUNDS				10000 POUNDS			
PRESSURE ALTITUDE	IOAT		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	°F	%	LB/HR	LB/HR	KNOTS	%	LB/HR	LB/HR	KNOTS	%	LB/HR	LB/HR	KNOTS
SL	29	84	68	391	782	205	65	381	762	203	62	373	746	200
2000	25	77	65	366	732	204	61	355	710	201	58	346	692	198
4000	21	70	60	338	676	202	57	329	658	199	54	322	644	197
6000	17	63	57	316	632	201	54	309	618	199	52	303	606	198
8000	13	55	55	298	596	201	52	291	582	200	51	287	574	200
10000	9	48	53	282	564	203	51	276	552	202	50	271	542	202
12000	5	41	52	269	538	205	50	261	522	203	48	256	512	203
14000	1	34	52	258	516	207	48	248	496	203	46	242	484	203
16000	-3	27	52	251	502	211	47	237	474	205	44	229	458	203
18000	-7	19	52	244	488	215	46	227	454	207	43	217	434	204
20000	-10	14	52	237	474	218	47	222	444	212	42	208	416	206
22000	-14	7	51	229	458	219	47	217	434	216	42	202	404	209
24000	-18	0	49	220	440	219	47	211	422	219	42	196	392	213
26000	-22	-8	51	219	438	224	45	203	406	218	42	132	384	217
28000	-26	-15	52	221	442	231	46	201	402	222	42	187	374	218
29000	-28	-18	52	219	438	232	47	202	404	226	41	184	368	219
31000	-31	-24	---	---	---	---	47	202	404	230	42	183	366	223

Figure 7-132. Maximum Range Power - 1700 RPM - ISA +10ºC

MAXIMUM RANGE POWER - 1700 RPM

ISA +20ºC

FOR OPERATION WITH ICE VANES EXTENDED, MAINTAIN SAME POWER AS WITH ICE VANES RETRACTED AND INCREASE TOTAL FUEL FLOW BY 15%.

			12000 POUNDS				11000 POUNDS				10000 POUNDS			
PRESSURE ALTITUDE	IOAT		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	°F	%	LB/HR	LB/HR	KNOTS	%	LB/HR	LB/HR	KNOTS	%	LB/HR	LB/HR	KNOTS
SL	39	102	66	385	770	204	64	380	760	203	62	374	748	202
2000	35	95	64	366	732	206	62	360	720	204	59	352	704	203
4000	31	88	63	348	696	208	60	340	680	206	56	330	660	202
6000	27	81	61	330	660	209	57	319	638	205	53	308	616	201
8000	23	73	59	311	622	210	54	298	596	205	50	287	574	200
10000	19	66	56	292	584	210	51	278	556	204	47	266	532	199
12000	15	59	55	279	558	212	50	265	530	206	46	253	506	201
14000	11	52	55	267	534	214	50	253	506	208	45	239	478	202
16000	7	45	54	256	512	216	49	244	488	212	44	228	456	204
18000	4	39	52	245	490	217	49	235	470	215	44	220	440	208
2000	0	32	51	235	470	217	48	227	454	217	44	216	432	213
22000	-4	25	51	230	460	221	47	217	434	217	44	209	418	217
24000	-8	18	52	228	456	226	46	209	418	218	43	200	400	217
26000	-12	10	52	225	450	229	47	208	416	223	41	191	382	216
28000	-16	3	53	228	456	237	47	207	414	228	42	188	376	220
29000	-18	0	---	---	---	---	47	206	412	230	42	189	378	223
31000	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Figure 7-133. Maximum Range Power - 1700 RPM - ISA +20ºC

MAXIMUM RANGE POWER - 1700 RPM

ISA +30°C

FOR OPERATION WITH ICE VANES EXTENDED, MAINTAIN SAME POWER AS WITH ICE VANES RETRACTED AND INCREASE TOTAL FUEL FLOW BY 15%.

			12000 POUNDS				11000 POUNDS				10000 POUNDS			
PRESSURE ALTITUDE	IOAT		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	°F	%	LB/HR	LB/HR	KNOTS	%	LB/HR	LB/HR	KNOTS	%	LB/HR	LB/HR	KNOTS
SL	49	120	67	391	782	207	63	380	760	203	60	371	742	201
2000	45	113	62	364	728	205	59	355	710	203	57	349	698	202
4000	41	106	60	343	686	206	58	336	672	205	56	330	660	203
6000	37	99	59	326	652	208	57	319	638	207	54	312	624	205
8000	33	91	57	310	620	210	55	303	606	208	53	296	592	207
10000	29	84	56	294	588	211	54	287	574	210	51	278	556	208
12000	25	77	55	280	560	213	52	271	542	211	49	262	524	208
14000	21	70	54	267	534	214	51	258	516	212	47	248	496	209
16000	18	64	53	257	514	217	49	246	492	214	46	236	472	211
18000	14	57	53	249	498	221	48	234	468	215	45	226	452	213
20000	10	50	54	243	486	225	48	227	454	218	45	216	432	215
22000	6	43	53	239	478	227	49	223	446	223	43	208	416	216
24000	2	36	52	229	458	227	48	218	436	226	43	203	406	220
26000	-2	28	54	233	466	237	47	211	422	226	43	199	398	224
28000	-5	23	---	---	---	---	49	213	426	234	43	194	388	226
29000	---	---	---	---	---	---	---	---	---	---	---	---	---	---
31000	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Figure 7-134. Maximum Range Power - 1700 RPM - ISA +30°C

MAXIMUM RANGE POWER - 1700 RPM

ISA +37ºC

FOR OPERATION WITH ICE VANES EXTENDED, MAINTAIN SAME POWER AS WITH ICE VANES RETRACTED AND INCREASE TOTAL FUEL FLOW BY 15%.

			12000 POUNDS				11000 POUNDS				10000 POUNDS			
PRESSURE ALTITUDE	IOAT		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	°F	%	LB/HR	LB/HR	KNOTS	%	LB/HR	LB/HR	KNOTS	%	LB/HR	LB/HR	KNOTS
SL	56	133	67	394	788	209	63	381	762	205	59	370	740	202
2000	52	126	65	372	744	210	60	360	720	206	57	349	698	202
4000	48	118	62	349	698	209	58	337	674	206	54	328	656	203
6000	44	111	59	327	654	209	55	317	634	206	53	309	618	204
8000	40	104	57	311	622	211	54	300	600	207	51	293	586	206
10000	36	97	56	294	588	212	52	284	568	209	50	277	554	208
12000	32	90	55	282	564	215	51	270	540	210	48	262	524	209
14000	28	82	55	272	544	218	50	257	514	212	47	248	496	209
16000	25	77	55	263	526	222	50	248	496	215	45	235	470	211
18000	21	70	54	254	508	225	50	240	480	219	45	225	450	213
20000	17	63	53	244	488	226	50	233	466	223	44	217	434	216
22000	13	55	52	237	474	227	49	225	450	225	45	212	424	221
24000	9	48	53	235	470	233	48	217	434	226	45	206	412	224
26000	5	41	---	---	---	---	48	213	426	229	44	199	398	226
28000	---	---	---	---	---	---	---	---	---	---	---	---	---	---
29000	---	---	---	---	---	---	---	---	---	---	---	---	---	---
31000	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Figure 7-135. Maximum Range Power - 1700 RPM - ISA +37ºC

RANGE PROFILE - MAXIMUM RANGE POWER - 1700 RPM
STANDARD DAY (ISA)
ZERO WIND

ASSOCIATED CONDITIONS:

WEIGHT . . . . 12,590 LBS BEFORE ENGINE START
FUEL . . . . AVIATION KEROSENE
FUEL DENSITY . . . . . . 6.7 LBS/GAL
ICE VANES . . . . RETRACTED

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

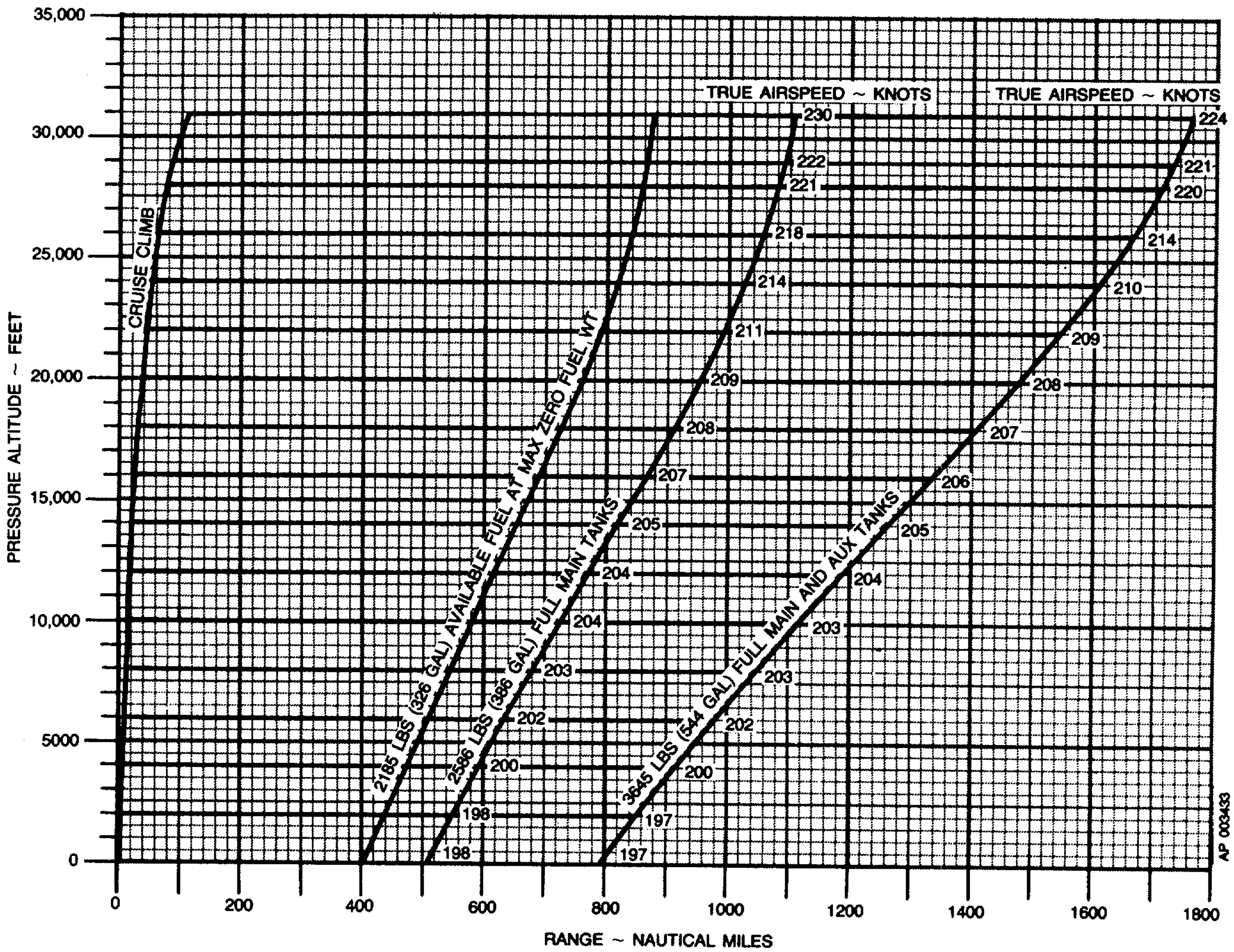


Figure 7-136. Range Profile - Maximum Range Power - 1700 RPM

MAXIMUM CRUISE POWER - 1800 RPM

ISA -30ºC

FOR EFFECT OF ICE VANE EXTENSION, REFER TO MAXIMUM CRUISE SPEEDS, MAXIMUM CRUISE POWER AND FUEL FLOW AT MAXIMUM CRUISE POWER GRAPHS.

PRESSURE ALTITUDE	IOAT		TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	AIRSPEED KNOTS					
						12000		11000		10000	
FEET	°C	°F	%	LBS/HR	LBS/HR	CAS	TAS	CAS	TAS	CAS	TAS
SL	-10	14	100	488	976	244	231	245	232	246	232
2000	-14	7	100	475	950	242	235	243	236	243	237
4000	-18	0	100	462	924	240	240	240	241	241	241
6000	-21	-6	100	451	902	237	244	238	245	239	246
8000	-25	-13	100	442	884	235	249	236	250	237	251
10000	-29	-20	100	433	866	233	254	234	255	234	255
12000	-33	-27	100	426	852	231	259	232	260	232	261
14000	-36	-33	100	420	840	228	264	229	265	230	266
16000	-40	-40	100	416	832	226	269	227	270	228	271
18000	-44	-47	100	412	824	224	274	225	276	226	277
20000	-48	-54	93	384	768	215	273	217	274	218	276
22000	-52	-62	87	359	718	207	271	209	273	210	275
24000	-56	-69	81	334	668	199	268	201	271	202	273
26000	-60	-76	74	309	618	190	265	192	268	194	271
28000	-64	-83	68	286	572	180	261	183	265	185	268
29000	-66	-87	65	273	546	175	257	178	262	181	265
31000	-70	-94	58	246	492	162	247	166	253	170	258

Figure 7-137. Maximum Cruise Power - 1800 RPM - ISA -30ºC

MAXIMUM CRUISE POWER – 1800 RPM

ISA –20°C

FOR EFFECT OF ICE VANE EXTENSION, REFER TO MAXIMUM CRUISE SPEEDS, MAXIMUM CRUISE POWER AND FUEL FLOW AT MAXIMUM CRUISE POWER GRAPHS.

PRESSURE ALTITUDE	IOAT		TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	AIRSPEED KNOTS					
						12000		11000		10000	
FEET	°C	°F	%	LBS/HR	LBS/HR	CAS	TAS	CAS	TAS	CAS	TAS
SL	0	32	100	490	980	242	234	243	235	244	235
2000	-4	25	100	478	956	240	238	241	239	242	240
4000	-7	19	100	465	930	238	243	239	243	239	244
6000	-11	12	100	453	906	236	247	236	248	237	249
8000	-15	5	100	444	888	233	252	234	253	235	254
10000	-19	-2	100	434	868	231	257	232	258	233	259
12000	-22	-8	100	427	854	229	262	230	263	231	264
14000	-26	-15	100	421	842	227	267	227	268	228	269
16000	-30	-22	100	417	834	224	273	225	274	226	275
18000	-34	-29	95	396	792	218	273	219	275	220	276
20000	-38	-36	89	370	740	210	272	211	273	212	275
22000	-42	-44	83	346	692	202	270	203	272	205	274
24000	-46	-51	77	321	642	193	267	195	270	197	272
26000	-50	-58	71	298	596	184	264	187	267	189	270
28000	-54	-65	65	277	554	175	259	178	264	180	267
29000	-56	-69	63	266	532	170	257	174	262	176	265
31000	-60	-76	57	246	492	160	250	164	256	168	262

Figure 7-138. Maximum Cruise Power - 1800 RPM - ISA -20ºC

MAXIMUM CRUISE POWER – 1800 RPM

ISA –10°C

FOR EFFECT OF ICE VANE EXTENSION, REFER TO MAXIMUM CRUISE SPEEDS, MAXIMUM CRUISE POWER AND FUEL FLOW AT MAXIMUM CRUISE POWER GRAPHS.

PRESSURE ALTITUDE	IOAT		TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	AIRSPEED KNOTS					
						12000		11000		10000	
FEET	°C	°F	%	LBS/HR	LBS/HR	CAS	TAS	CAS	TAS	CAS	TAS
SL	10	50	100	491	982	241	237	242	237	242	238
2000	6	43	100	478	956	238	241	239	242	240	243
4000	3	37	100	466	932	236	245	237	246	238	247
6000	-1	30	100	455	910	234	250	235	251	235	252
8000	-5	23	100	445	890	231	255	232	256	233	257
10000	-9	16	100	436	872	229	260	230	261	231	262
12000	-12	10	100	428	856	227	265	228	266	229	267
14000	-16	3	100	423	846	225	271	226	272	227	273
16000	-20	-4	98	411	822	220	274	222	275	223	277
18000	-24	-11	91	383	766	212	272	214	274	215	275
20000	-28	-18	85	356	712	204	270	206	272	207	274
22000	-32	-26	79	333	666	196	268	198	271	199	273
24000	-36	-33	73	309	618	187	265	189	268	191	271
26000	-40	-40	68	287	574	178	262	181	265	183	268
28000	-44	-47	62	266	532	169	257	173	262	175	265
29000	-46	-51	60	256	512	164	254	168	259	171	264
31000	-50	-58	55	237	474	154	246	158	254	162	259

Figure 7-139. Maximum Cruise Power - 1800 RPM - ISA -10°C

MAXIMUM CRUISE POWER – 1800 RPM

ISA

FOR EFFECT OF ICE VANE EXTENSION, REFER TO MAXIMUM CRUISE SPEEDS, MAXIMUM CRUISE POWER AND FUEL FLOW AT MAXIMUM CRUISE POWER GRAPHS.

PRESSURE ALTITUDE	IOAT		TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	AIRSPEED KNOTS					
						12000		11000		10000	
FEET	°C	°F	%	LBS/HR	LBS/HR	CAS	TAS	CAS	TAS	CAS	TAS
SL	20	68	100	495	990	239	239	240	240	241	241
2000	17	63	100	480	960	237	244	238	245	238	245
4000	13	55	100	466	932	235	248	235	249	236	250
6000	9	48	100	455	910	232	253	233	254	234	255
8000	5	41	100	446	892	230	258	231	259	232	260
10000	2	36	100	438	876	228	263	229	264	229	265
12000	-2	28	100	430	860	225	268	226	270	227	271
14000	-6	21	100	424	848	223	274	224	275	225	276
16000	-10	14	94	397	794	215	273	216	274	217	276
18000	-14	7	87	369	738	207	271	208	273	210	275
20000	-18	0	81	344	688	199	269	200	271	202	273
22000	-22	-8	76	321	642	190	266	192	269	194	271
24000	-26	-15	70	298	596	182	263	184	266	186	269
26000	-30	-22	64	276	552	172	258	175	263	178	266
28000	-34	-29	59	256	512	163	253	167	259	170	263
29000	-36	-33	57	246	492	158	250	162	256	166	261
31000	-41	-42	52	228	456	147	241	152	250	157	257

Figure 7-140. Maximum Cruise Power - 1800 RPM - ISA

MAXIMUM CRUISE POWER – 1800 RPM

ISA +10°C

FOR EFFECT OF ICE VANE EXTENSION, REFER TO MAXIMUM CRUISE SPEEDS, MAXIMUM CRUISE POWER AND FUEL FLOW AT MAXIMUM CRUISE POWER GRAPHS.

PRESSURE ALTITUDE	IOAT		TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	AIRSPEED KNOTS					
						12000		11000		10000	
FEET	°C	°F	%	LBS/HR	LBS/HR	CAS	TAS	CAS	TAS	CAS	TAS
SL	30	86	100	497	994	238	242	238	243	239	243
2000	27	81	100	484	968	235	246	236	247	237	248
4000	23	73	100	471	942	233	251	234	252	235	253
6000	19	66	100	459	918	231	256	232	257	232	258
8000	16	61	100	448	896	228	261	229	262	230	263
10000	12	54	100	437	874	226	266	227	267	228	268
12000	8	46	99	427	854	223	271	224	272	225	273
14000	4	39	93	401	802	215	270	217	271	218	273
16000	0	32	88	376	752	208	269	209	271	211	272
18000	-4	25	82	353	706	200	268	202	270	204	272
20000	-8	18	77	330	660	193	266	195	269	196	271
22000	-12	10	72	308	616	185	264	187	267	189	269
24000	-16	3	66	287	574	176	260	179	264	181	267
26000	-20	-4	61	266	532	167	255	170	260	173	264
28000	-24	-11	56	246	492	157	249	161	255	164	261
29000	-27	-17	54	237	474	151	245	156	252	160	258
31000	-31	-24	49	219	438	140	234	146	245	151	253

Figure 7-141. Maximum Cruise Power - 1800 RPM - ISA +10ºC

MAXIMUM CRUISE POWER – 1800 RPM

ISA +20°C

FOR EFFECT OF ICE VANE EXTENSION, REFER TO MAXIMUM CRUISE SPEEDS, MAXIMUM CRUISE POWER AND FUEL FLOW AT MAXIMUM CRUISE POWER GRAPHS.

PRESSURE ALTITUDE	IOAT		TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	AIRSPEED KNOTS					
						12000		11000		10000	
FEET	°C	°F	%	LBS/HR	LBS/HR	CAS	TAS	CAS	TAS	CAS	TAS
SL	41	106	100	500	1000	236	244	237	245	238	246
2000	37	99	100	486	972	234	249	235	250	235	251
4000	33	91	100	473	946	231	254	232	255	233	256
6000	29	84	100	460	920	229	259	230	260	231	261
8000	26	79	100	449	898	226	263	228	265	229	266
10000	22	72	96	427	854	221	265	222	266	223	268
12000	18	64	91	403	806	215	265	216	267	217	268
14000	14	57	87	379	758	208	266	209	267	211	269
16000	10	50	82	356	712	201	265	203	267	204	269
18000	6	43	77	333	666	194	264	195	266	197	268
20000	2	36	71	311	622	185	261	187	264	189	266
22000	-2	28	67	292	584	177	258	180	262	182	265
24000	-6	21	62	272	544	169	255	172	259	175	263
26000	-10	14	57	253	506	159	249	163	255	167	260
28000	-15	5	53	235	470	149	242	154	250	158	256
29000	-17	1	51	226	452	144	238	149	247	154	254
31000	-21	-6	46	209	418	131	225	139	238	145	248

Figure 7-142. Maximum Cruise Power - 1800 RPM - ISA +20ºC

MAXIMUM CRUISE POWER – 1800 RPM

ISA +30°C

FOR EFFECT OF ICE VANE EXTENSION, REFER TO MAXIMUM CRUISE SPEEDS, MAXIMUM CRUISE POWER AND FUEL FLOW AT MAXIMUM CRUISE POWER GRAPHS.

PRESSURE ALTITUDE	IOAT		TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	AIRSPEED KNOTS					
						12000		11000		10000	
FEET	°C	°F	%	LBS/HR	LBS/HR	CAS	TAS	CAS	TAS	CAS	TAS
SL	51	124	100	502	1004	235	247	236	248	236	248
2000	47	117	99	486	972	232	251	233	252	233	253
4000	43	109	97	466	932	228	254	229	255	230	256
6000	39	102	95	446	892	223	256	224	257	225	259
8000	35	95	92	424	848	218	258	219	259	220	261
10000	32	90	88	402	804	213	260	214	261	215	263
12000	28	82	84	380	760	206	260	208	262	209	263
14000	24	75	79	357	714	199	259	201	261	202	263
16000	20	68	75	335	670	192	258	194	261	196	263
18000	16	61	71	314	628	185	257	188	260	190	263
20000	12	54	66	294	588	178	255	180	259	183	262
22000	8	46	62	275	550	169	252	172	256	175	260
24000	3	37	57	256	512	160	247	164	252	167	257
26000	-1	30	53	238	476	151	240	155	247	159	253
28000	-5	23	49	221	442	140	232	146	242	151	249
29000	-7	19	47	213	426	134	226	141	238	147	247
31000	-12	10	43	197	394	118	207	130	228	137	240

Figure 7-143. Maximum Cruise Power - 1800 RPM - ISA +30ºC

MAXIMUM CRUISE POWER – 1800 RPM

ISA +37°C

FOR EFFECT OF ICE VANE EXTENSION, REFER TO MAXIMUM CRUISE SPEEDS, MAXIMUM CRUISE POWER AND FUEL FLOW AT MAXIMUM CRUISE POWER GRAPHS.

PRESSURE ALTITUDE	IOAT		TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	AIRSPEED KNOTS					
						12000		11000		10000	
FEET	°C	°F	%	LBS/HR	LBS/HR	CAS	TAS	CAS	TAS	CAS	TAS
SL	58	136	94	487	974	229	243	230	244	231	245
2000	54	129	93	467	934	225	246	226	247	227	248
4000	50	122	91	448	896	221	249	222	250	223	251
6000	46	115	89	428	856	217	252	218	253	219	254
8000	42	108	86	408	816	212	253	213	255	214	256
10000	38	100	83	387	774	207	255	208	257	210	259
12000	34	93	79	365	730	200	255	202	258	203	259
14000	30	86	75	342	684	193	255	195	257	197	259
16000	26	79	70	321	642	186	253	188	256	190	259
18000	22	72	66	300	600	179	252	181	255	183	258
20000	18	64	62	281	562	172	249	174	253	177	257
22000	14	57	58	263	526	163	246	167	251	170	255
24000	10	50	54	246	492	154	241	159	247	162	253
26000	6	43	50	228	456	145	234	150	243	154	249
28000	2	36	46	212	424	133	223	140	236	146	244
29000	-1	30	44	204	408	125	215	135	230	141	241
31000	-5	23	40	188	376	90	161	122	216	131	232

Figure 7-144. Maximum Cruise Power - 1800 RPM - ISA +37°C

RANGE PROFILE - MAX CRUISE POWER - 1800 RPM

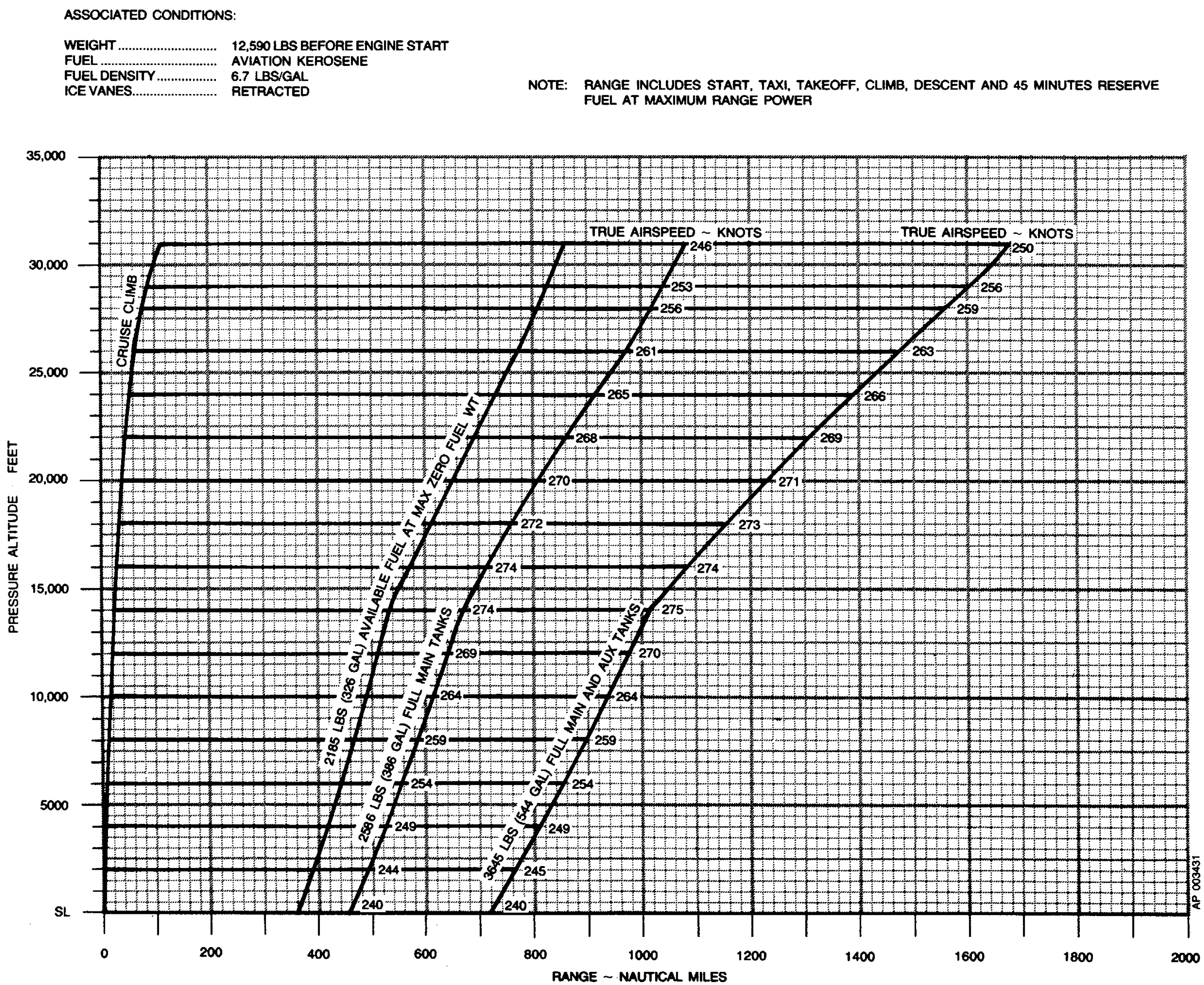


Figure 7-145. Range Profile - Maximum Cruise Power - 1800 RPM

MAXIMUM CRUISE POWER - 1800 RPM

ISA -30ºC

FOR OPERATION WITH ICE VANES EXTENDED, MAINTAIN SAME POWER AS WITH ICE VANES RETRACTED AND INCREASE TOTAL FUEL FLOW BY 15%.

			12000 POUNDS				11000 POUNDS				10000 POUNDS			
PRESSURE ALTITUDE	IOAT		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	°F	%	LB/HR	LB/HR	KNOTS	%	LB/HR	LB/HR	KNOTS	%	LB/HR	LB/HR	KNOTS
SL	-11	12	74	412	824	207	71	404	808	204	68	396	792	202
2000	-15	5	65	374	748	200	63	366	732	198	60	360	720	196
4000	-19	-2	59	341	682	196	56	333	666	193	54	325	650	191
6000	-24	-11	55	315	630	193	51	305	610	190	48	296	592	187
8000	-28	-18	52	295	590	192	48	284	568	188	44	273	546	184
10000	-32	-26	49	274	548	191	45	262	524	187	41	250	500	182
12000	-36	-33	47	259	518	192	43	247	494	187	39	235	470	182
14000	-39	-38	46	246	492	193	42	234	468	188	38	221	442	183
16000	-43	-45	45	235	470	194	41	222	444	189	37	210	420	184
18000	-47	-53	44	225	450	196	40	212	424	191	36	199	398	185
20000	---	---	---	---	---	---	---	---	---	---	---	---	---	---
22000	---	---	---	---	---	---	---	---	---	---	---	---	---	---
24000	---	---	---	---	---	---	---	---	---	---	---	---	---	---
26000	---	---	---	---	---	---	---	---	---	---	---	---	---	---
28000	---	---	---	---	---	---	---	---	---	---	---	---	---	---
29000	---	---	---	---	---	---	---	---	---	---	---	---	---	---
31000	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Figure 7-146. Maximum Range Power - 1800 RPM - ISA -30ºC

MAXIMUM CRUISE POWER - 1800 RPM

ISA -20ºC

FOR OPERATION WITH ICE VANES EXTENDED, MAINTAIN SAME POWER AS WITH ICE VANES RETRACTED AND INCREASE TOTAL FUEL FLOW BY 15%.

PRESSURE ALTITUDE	IOAT		12000 POUNDS				11000 POUNDS				10000 POUNDS			
			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	°F	%	LB/HR	LB/HR	KNOTS	%	LB/HR	LB/HR	KNOTS	%	LB/HR	LB/HR	KNOTS
SL	-1	30	70	405	810	205	70	402	804	205	69	400	800	206
2000	-5	23	69	385	770	207	68	382	764	207	66	377	754	206
4000	-9	16	65	360	720	207	63	353	706	205	60	345	690	202
6000	-13	9	60	332	664	203	57	323	646	200	54	315	630	198
8000	-17	1	56	308	616	201	53	299	598	198	49	290	580	195
10000	-21	-6	52	286	572	199	49	276	552	196	45	265	530	192
12000	-25	-13	51	271	542	200	47	260	520	196	43	249	498	192
14000	-29	-20	49	258	516	201	46	246	492	197	42	235	470	193
16000	-33	-27	48	246	492	203	45	235	470	199	41	223	446	194
18000	-37	-35	47	236	472	205	44	224	448	200	40	212	424	195
20000	-41	-42	47	227	454	207	43	214	428	201	38	202	404	196
22000	-45	-49	46	221	442	209	42	207	414	204	38	194	388	198
24000	---	---	---	---	---	---	---	---	---	---	---	---	---	---
26000	---	---	---	---	---	---	---	---	---	---	---	---	---	---
28000	---	---	---	---	---	---	---	---	---	---	---	---	---	---
29000	---	---	---	---	---	---	---	---	---	---	---	---	---	---
31000	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Figure 7-147. Maximum Range power - 1800 RPM - ISA -20ºC

MAXIMUM CRUISE POWER - 1800 RPM

ISA -10ºC

FOR OPERATION WITH ICE VANES EXTENDED, MAINTAIN SAME POWER AS WITH ICE VANES RETRACTED AND INCREASE TOTAL FUEL FLOW BY 15%.

			12000 POUNDS				11000 POUNDS				10000 POUNDS			
PRESSURE ALTITUDE	IOAT		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	°F	%	LB/HR	LB/HR	KNOTS	%	LB/HR	LB/HR	KNOTS	%	LB/HR	LB/HR	KNOTS
SL	9	48	66	393	786	202	65	390	780	202	64	386	772	202
2000	5	41	64	373	746	204	63	370	740	204	62	368	736	204
4000	1	34	63	355	710	206	62	353	706	206	61	350	700	207
6000	-3	27	61	337	674	208	60	334	668	208	59	329	658	207
8000	-7	19	59	318	636	208	57	312	624	207	54	305	610	205
10000	-11	12	56	298	596	208	53	288	576	204	50	279	558	201
12000	-15	5	54	281	562	208	50	270	540	204	47	261	522	200
14000	-19	-2	52	267	534	209	48	255	510	205	45	245	490	200
16000	-23	-9	51	254	508	210	47	243	486	206	43	232	464	201
18000	-27	-17	49	242	484	211	46	232	464	208	42	221	442	203
20000	-31	-24	48	231	462	212	45	222	444	210	41	211	422	205
22000	-34	-29	46	222	444	212	44	214	428	211	40	203	406	207
24000	-38	-36	46	214	428	213	43	206	412	212	40	195	390	209
26000	-42	-44	46	212	424	217	42	198	396	212	39	188	376	211
28000	-46	-51	47	211	422	146	42	194	388	215	38	183	366	212
29000	-48	-54	46	208	416	143	42	194	388	218	38	179	358	212
31000	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Figure 7-148. Maximum Range Power - 1800 RPM - ISA -10ºC

MAXIMUM RANGE POWER - 1800 RPM

ISA

FOR OPERATION WITH ICE VANES EXTENDED, MAINTAIN SAME POWER AS WITH ICE VANES RETRACTED AND INCREASE TOTAL FUEL FLOW BY 15%.

			12000 POUNDS				11000 POUNDS				10000 POUNDS			
PRESSURE ALTITUDE	IOAT		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	°F	%	LB/HR	LB/HR	KNOTS	%	LB/HR	LB/HR	KNOTS	%	LB/HR	LB/HR	KNOTS
SL	19	66	70	408	816	210	68	400	800	208	65	392	784	205
2000	15	59	64	374	748	206	61	366	732	203	59	359	718	201
4000	11	52	59	346	692	203	58	342	684	203	56	338	676	203
6000	7	45	57	328	656	204	56	324	648	204	55	321	642	205
8000	3	37	55	309	618	205	54	307	614	206	53	304	608	206
10000	-1	30	54	293	586	206	53	290	580	207	51	285	570	207
12000	-5	23	52	277	554	207	51	273	546	208	49	268	536	207
14000	-9	16	50	263	526	208	49	258	516	208	47	252	504	207
16000	-13	9	49	251	502	209	47	245	490	209	45	238	476	208
18000	-17	1	48	240	480	210	46	232	464	209	43	225	450	208
20000	-21	-6	48	232	464	213	44	221	442	210	42	214	428	209
22000	-24	-11	48	226	452	216	43	212	424	210	41	205	410	210
24000	-28	-18	47	221	442	220	43	205	410	213	39	195	390	210
26000	-32	-26	47	216	432	221	43	202	404	217	38	186	372	210
28000	-36	-33	46	211	422	223	43	199	398	221	38	183	366	213
29000	-38	-36	47	212	424	226	43	196	392	221	39	182	364	217
31000	-42	-44	48	213	426	230	42	193	386	223	39	180	360	220

Figure 7-149. Maximum Range Power - 1800 RPM - ISA

MAXIMUM RANGE POWER - 1800 RPM

ISA + 10°C

FOR OPERATION WITH ICE VANES EXTENDED, MAINTAIN SAME POWER AS WITH ICE VANES RETRACTED AND INCREASE TOTAL FUEL FLOW BY 15%.

			12000 POUNDS				11000 POUNDS				10000 POUNDS			
PRESSURE ALTITUDE	IOAT		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	°F	%	LB/HR	LB/HR	KNOTS	%	LB/HR	LB/HR	KNOTS	%	LB/HR	LB/HR	KNOTS
SL	29	84	70	408	816	211	68	404	808	211	67	400	800	211
2000	25	77	67	386	772	212	65	379	758	211	63	374	748	210
4000	21	70	63	360	720	211	60	351	702	209	57	343	686	206
6000	17	63	59	335	670	209	55	323	646	205	52	315	630	203
8000	13	55	56	313	626	208	53	303	606	205	50	297	594	204
10000	9	48	53	291	582	207	50	283	566	205	48	278	556	204
12000	5	41	51	276	552	208	49	268	536	206	47	263	506	206
14000	1	34	51	266	532	211	47	253	506	206	45	247	494	205
16000	-3	27	50	256	512	214	46	242	484	207	43	233	466	205
18000	-7	19	50	248	496	218	46	233	466	211	42	222	444	207
20000	-10	14	50	239	478	220	46	226	452	215	41	213	426	209
22000	-14	7	48	230	460	220	45	220	440	218	41	206	412	212
24000	-18	0	47	221	442	220	44	212	424	220	41	200	400	215
26000	-22	-8	48	219	438	225	43	204	408	220	40	194	388	218
28000	-26	-15	48	219	438	230	43	201	402	223	40	188	376	220
29000	-28	-18	48	217	434	230	44	201	402	226	39	185	370	220
31000	-32	-26	---	---	---	---	44	199	398	230	39	183	366	224

Figure 7-150. Maximum Range Power - 1800 RPM - ISA + 10°C

MAXIMUM RANGE POWER - 1800 RPM

ISA + 20°C

FOR OPERATION WITH ICE VANES EXTENDED, MAINTAIN SAME POWER AS WITH ICE VANES RETRACTED AND INCREASE TOTAL FUEL FLOW BY 15%.

			12000 POUNDS				11000 POUNDS				10000 POUNDS			
PRESSURE ALTITUDE	IOAT		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	°F	%	LB/HR	LB/HR	KNOTS	%	LB/HR	LB/HR	KNOTS	%	LB/HR	LB/HR	KNOTS
SL	39	102	66	401	802	209	64	396	792	208	63	391	782	208
2000	35	95	64	379	758	210	62	374	748	210	61	370	740	209
4000	31	88	62	359	718	212	61	354	708	211	59	350	700	211
6000	27	81	60	340	680	213	59	335	670	213	56	328	656	211
8000	23	73	58	321	642	214	56	315	630	213	53	305	610	210
10000	19	66	56	302	604	214	53	293	586	212	49	282	564	208
12000	15	59	54	286	572	215	51	276	552	212	47	265	530	208
14000	11	52	52	271	542	216	49	261	522	213	45	250	500	208
16000	8	46	51	259	518	218	48	249	498	215	44	237	474	210
18000	4	39	50	248	496	219	47	238	476	217	43	226	452	212
20000	0	32	49	239	478	220	46	229	458	218	43	219	438	215
22000	-4	25	49	234	468	224	45	220	440	219	42	211	422	217
24000	-8	18	49	229	458	227	44	213	426	221	41	202	404	218
26000	-12	10	48	223	446	229	44	209	418	225	40	193	386	218
28000	-16	3	49	221	442	233	44	206	412	228	40	190	380	222
29000	-18	0	50	223	446	236	44	204	408	229	40	189	378	225
31000	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Figure 7-151. Maximum Range Power - 1800 RPM - ISA + 20°C

MAXIMUM RANGE POWER - 1800 RPM

ISA + 30°C

FOR OPERATION WITH ICE VANES EXTENDED, MAINTAIN SAME POWER AS WITH ICE VANES RETRACTED AND INCREASE TOTAL FUEL FLOW BY 15%.

			12000 POUNDS				11000 POUNDS				10000 POUNDS			
PRESSURE ALTITUDE	IOAT		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	°F	%	LB/HR	LB/HR	KNOTS	%	LB/HR	LB/HR	KNOTS	%	LB/HR	LB/HR	KNOTS
SL	49	120	71	416	832	217	68	407	814	214	64	398	796	212
2000	45	113	65	384	768	213	62	375	750	211	59	368	736	209
4000	41	106	60	356	712	211	58	349	698	210	56	343	686	209
6000	37	99	58	335	670	212	56	329	658	210	54	324	648	210
8000	33	91	56	317	634	213	54	311	622	212	53	306	612	211
10000	29	84	54	298	596	213	52	292	584	212	51	287	574	212
12000	25	77	53	284	568	215	50	276	552	213	48	270	540	212
14000	22	72	52	272	544	217	49	261	522	214	47	255	510	213
16000	18	64	52	262	524	220	47	249	498	215	45	241	482	214
18000	14	57	51	253	506	224	47	238	476	218	44	229	458	215
20000	10	50	52	246	492	228	47	231	462	221	42	218	436	216
22000	6	43	50	237	474	228	47	226	452	225	42	211	422	218
24000	2	36	48	228	456	227	46	219	438	227	42	205	410	222
26000	-2	28	49	227	454	233	44	210	420	227	42	200	400	226
28000	-5	23	---	---	---	---	45	209	418	231	41	194	388	227
29000	---	---	---	---	---	---	---	---	---	---	---	---	---	---
31000	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Figure 7-152. Maximum Range Power - 1800 RPM - ISA + 30°C

MAXIMUM RANGE POWER - 1800 RPM

ISA + 37°C

FOR OPERATION WITH ICE VANES EXTENDED, MAINTAIN SAME POWER AS WITH ICE VANES RETRACTED AND INCREASE TOTAL FUEL FLOW BY 15%.

			12000 POUNDS				11000 POUNDS				10000 POUNDS			
PRESSURE ALTITUDE	IOAT		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	°F	%	LB/HR	LB/HR	KNOTS	%	LB/HR	LB/HR	KNOTS	%	LB/HR	LB/HR	KNOTS
SL	56	133	70	414	828	217	68	408	816	216	65	400	800	214
2000	52	126	67	391	782	218	64	383	766	216	61	373	746	213
4000	48	118	63	365	730	217	60	355	710	213	56	345	690	210
6000	44	111	59	341	682	215	56	330	660	212	53	322	644	210
8000	40	104	57	322	644	216	53	310	620	212	51	302	604	210
10000	36	97	55	302	604	216	51	291	582	213	49	285	570	211
12000	32	90	54	288	576	218	50	276	552	213	47	267	534	211
14000	29	84	53	277	554	221	49	263	526	215	45	253	506	212
16000	25	77	53	267	534	224	48	252	504	218	44	240	480	213
18000	21	70	52	257	514	227	48	244	488	222	43	229	458	216
20000	17	63	51	245	490	227	48	236	472	226	43	221	442	219
22000	13	55	49	236	472	227	47	227	454	227	43	215	430	224
24000	9	48	49	231	462	231	45	216	432	226	43	208	416	226
26000	5	41	---	---	---	---	44	210	420	227	41	200	400	227
28000	---	---	---	---	---	---	---	---	---	---	---	---	---	---
29000	---	---	---	---	---	---	---	---	---	---	---	---	---	---
31000	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Figure 7-153. Maximum Range Power - 1800 RPM - ISA + 37°C

RANGE PROFILE - MAX RANGE POWER - 1800 RPM
STANDARD DAY (ISA)
ZERO WIND

ASSOCIATED CONDITIONS:

WEIGHT .... 12,590 LBS BEFORE ENGINE START
FUEL .... AVIATION KEROSENE
FUEL DENSITY .... 6.7 LBS/GAL
ICE VANES........................ RETRACTED

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

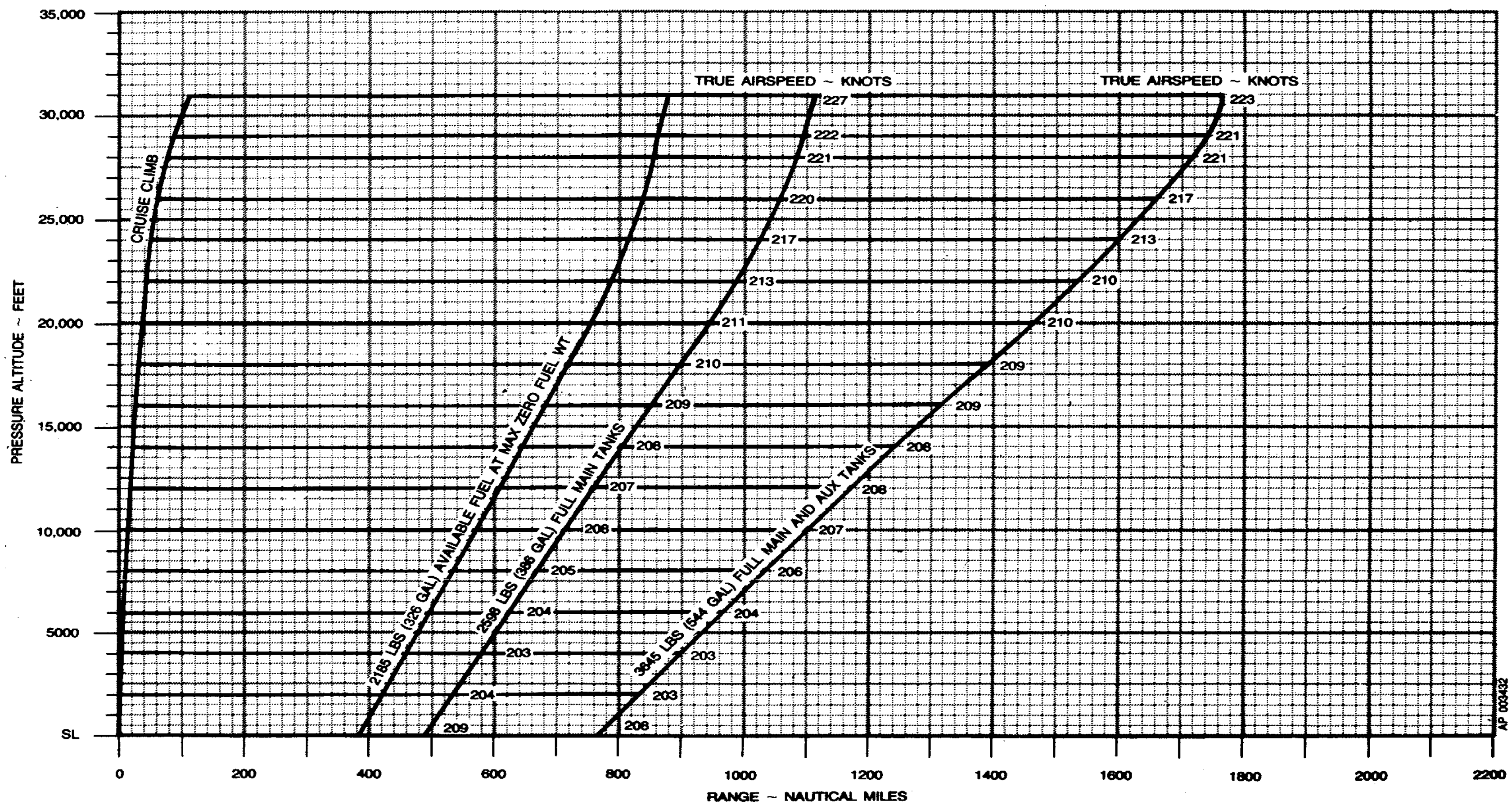


Figure 7-154. Range Profile - Maximum Range Power - 1800 RPM

ONE ENGINE INOPERATIVE MAXIMUM CRUISE POWER – 1800 RPM

ISA –30°C

FOR OPERATION WITH ICE VANES EXTENDED, DECREASE FUEL FLOW AND TAS BY 7% AND ESTABLISH THE LIMIT POWER WHICH IS AVAILABLE BY OBSERVING MAXIMUM CRUISE ENGINE LIMITS.

PRESSURE ALTITUDE	IOAT		TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	AIRSPEED KNOTS					
						12000		11000		10000	
FEET	°C	°F	%	LBS/HR	LBS/HR	CAS	TAS	CAS	TAS	CAS	TAS
SL	-13	9	100	506	1012	155	147	158	149	160	151
2000	-17	1	100	492	984	153	149	155	151	158	153
4000	-21	-6	100	479	958	151	151	153	154	156	156
6000	-25	-13	100	468	936	148	153	151	156	153	158
8000	-29	-20	100	457	914	146	155	149	158	151	161
10000	-32	-26	100	448	896	143	156	146	160	149	163
12000	-36	-33	100	440	880	140	158	144	162	146	165
14000	-40	-40	100	434	868	137	159	141	164	144	167
16000	-44	-47	94	407	814	128	153	134	160	138	165
18000	-48	-54	87	379	758	---	---	125	155	131	162
20000	---	---	---	---	---	---	---	---	---	---	---
22000	---	---	---	---	---	---	---	---	---	---	---
24000	---	---	---	---	---	---	---	---	---	---	---
26000	---	---	---	---	---	---	---	---	---	---	---
28000	---	---	---	---	---	---	---	---	---	---	---
29000	---	---	---	---	---	---	---	---	---	---	---
31000	---	---	---	---	---	---	---	---	---	---	---

Figure 7-155. One Engine Inoperative Maximum Cruise Power - 1800 RPM - ISA - 30°C

ONE ENGINE INOPERATIVE MAXIMUM CRUISE POWER – 1800 RPM

ISA –20°C

FOR OPERATION WITH ICE VANES EXTENDED, DECREASE FUEL FLOW AND TAS BY 7% AND ESTABLISH THE UNIT POWER WHICH IS AVAILABLE BY OBSERVING MAXIMUM CRUISE ENGINE LIMITS.

PRESSURE ALTITUDE	IOAT		TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	AIRSPEED KNOTS					
						12000		11000		10000	
FEET	°C	°F	%	LBS/HR	LBS/HR	CAS	TAS	CAS	TAS	CAS	TAS
SL	-3	27	100	509	1018	154	148	156	151	158	153
2000	-7	19	100	495	990	151	150	154	153	156	155
4000	-11	12	100	482	964	149	152	152	155	154	157
6000	-15	5	100	470	940	146	154	149	157	152	160
8000	-19	-2	100	459	918	144	156	147	159	150	162
10000	-22	-8	100	449	898	141	157	144	161	147	164
12000	-26	-15	100	440	880	138	158	142	163	145	167
14000	-30	-22	97	422	844	131	156	136	162	140	166
16000	-34	-29	90	393	786	121	148	128	157	133	163
18000	-39	-38	83	366	732	---	---	---	---	126	159
20000	---	---	---	---	---	---	---	---	---	---	---
22000	---	---	---	---	---	---	---	---	---	---	---
24000	---	---	---	---	---	---	---	---	---	---	---
26000	---	---	---	---	---	---	---	---	---	---	---
28000	---	---	---	---	---	---	---	---	---	---	---
29000	---	---	---	---	---	---	---	---	---	---	---
31000	---	---	---	---	---	---	---	---	---	---	---

Figure 7-156. One Engine Inoperative Maximum Cruise Power - 1800 RPM - ISA - 20°C

ONE ENGINE INOPERATIVE MAXIMUM CRUISE POWER – 1800 RPM

ISA –10°C

FOR OPERATION WITH ICE VANES EXTENDED, DECREASE FUEL FLOW AND TAS BY 7% AND ESTABLISH THE LIMIT POWER WHICH IS AVAILABLE BY OBSERVING MAXIMUM CRUISE ENGINE LIMITS.

PRESSURE ALTITUDE	IOAT		TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	AIRSPEED KNOTS					
						12000		11000		10000	
FEET	°C	°F	%	LBS/HR	LBS/HR	CAS	TAS	CAS	TAS	CAS	TAS
SL	7	45	100	510	1020	152	150	155	152	157	154
2000	3	37	100	496	992	150	151	152	154	155	157
4000	-1	30	100	483	966	147	153	150	156	153	159
6000	-5	23	100	472	944	145	155	148	159	150	161
8000	-8	18	100	461	922	142	157	145	161	148	164
10000	-10	10	100	450	900	139	158	143	162	146	166
12000	-16	3	99	439	878	135	158	139	164	143	168
14000	-20	-4	93	409	818	125	152	132	160	136	165
16000	-25	-13	86	380	760	---	---	123	154	129	161
18000	-29	-20	79	352	704	---	---	---	---	120	156
20000	---	---	---	---	---	---	---	---	---	---	---
22000	---	---	---	---	---	---	---	---	---	---	---
24000	---	---	---	---	---	---	---	---	---	---	---
26000	---	---	---	---	---	---	---	---	---	---	---
28000	---	---	---	---	---	---	---	---	---	---	---
29000	---	---	---	---	---	---	---	---	---	---	---
31000	---	---	---	---	---	---	---	---	---	---	---

Figure 7-157. One Engine Inoperative Maximum Cruise Power - 1800 RPM - ISA - 10°C

ONE ENGINE INOPERATIVE MAXIMUM CRUISE POWER – 1800 RPM

ISA

FOR OPERATION WITH ICE VANES EXTENDED, DECREASE FUEL FLOW AND TAS BY 7% AND ESTABLISH THE LIMIT POWER WHICH IS AVAILABLE BY OBSERVING MAXIMUM CRUISE ENGINE LIMITS.

PRESSURE ALTITUDE	IOAT		TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	AIRSPEED KNOTS					
						12000		11000		10000	
FEET	°C	°F	%	LBS/HR	LBS/HR	CAS	TAS	CAS	TAS	CAS	TAS
SL	17	63	100	512	1024	151	151	153	153	156	156
2000	13	55	100	497	994	148	153	151	156	153	158
4000	9	48	100	483	966	146	155	149	158	151	160
6000	5	41	100	471	942	143	156	146	160	149	163
8000	2	36	100	461	922	140	157	144	162	146	165
10000	-2	28	100	451	902	137	159	141	163	144	167
12000	-6	21	95	424	848	129	154	134	161	138	166
14000	-10	14	89	396	792	---	---	126	156	132	163
16000	-15	5	82	369	738	---	---	---	---	124	158
18000	---	---	---	---	---	---	---	---	---	---	---
20000	---	---	---	---	---	---	---	---	---	---	---
22000	---	---	---	---	---	---	---	---	---	---	---
24000	---	---	---	---	---	---	---	---	---	---	---
26000	---	---	---	---	---	---	---	---	---	---	---
28000	---	---	---	---	---	---	---	---	---	---	---
29000	---	---	---	---	---	---	---	---	---	---	---
31000	---	---	---	---	---	---	---	---	---	---	---

Figure 7-158. One Engine Inoperative Maximum Cruise Power - 1800 RPM - ISA

ONE ENGINE INOPERATIVE MAXIMUM CRUISE POWER – 1800 RPM

ISA +10°C

FOR OPERATION WITH ICE VANES EXTENDED, DECREASE FUEL FLOW AND TAS BY 7% AND ESTABLISH THE LIMIT POWER WHICH IS AVAILABLE BY OBSERVING MAXIMUM CRUISE ENGINE LIMITS.

PRESSURE ALTITUDE	IOAT		TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	AIRSPEED KNOTS					
						12000		11000		10000	
FEET	°C	°F	%	LBS/HR	LBS/HR	CAS	TAS	CAS	TAS	CAS	TAS
SL	27	81	100	514	1028	149	152	152	155	154	157
2000	23	73	100	499	998	147	154	150	157	152	159
4000	19	66	100	485	970	144	156	147	159	150	162
6000	16	61	100	472	944	141	157	145	161	147	164
8000	12	54	99	456	912	137	157	141	162	144	165
10000	8	46	94	431	862	130	154	135	160	139	164
12000	3	37	89	405	810	121	147	128	156	133	162
14000	-1	30	83	378	756	---	---	119	150	126	158
16000	---	---	---	---	---	---	---	---	---	---	---
18000	---	---	---	---	---	---	---	---	---	---	---
20000	---	---	---	---	---	---	---	---	---	---	---
22000	---	---	---	---	---	---	---	---	---	---	---
24000	---	---	---	---	---	---	---	---	---	---	---
26000	---	---	---	---	---	---	---	---	---	---	---
28000	---	---	---	---	---	---	---	---	---	---	---
29000	---	---	---	---	---	---	---	---	---	---	---
31000	---	---	---	---	---	---	---	---	---	---	---

Figure 7-159. One Engine Inoperative Maximum Cruise Power - 1800 RPM - ISA + 10°C

ONE ENGINE INOPERATIVE MAXIMUM CRUISE POWER – 1800 RPM

ISA +20°C

FOR OPERATION WITH ICE VANES EXTENDED, DECREASE FUEL FLOW AND TAS BY 7% AND ESTABLISH THE LIMIT POWER WHICH IS AVAILABLE BY OBSERVING MAXIMUM CRUISE ENGINE LIMITS.

PRESSURE ALTITUDE	IOAT		TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	AIRSPEED KNOTS					
						12000		11000		10000	
FEET	°C	°F	%	LBS/HR	LBS/HR	CAS	TAS	CAS	TAS	CAS	TAS
SL	37	99	100	514	1028	148	153	151	156	153	158
2000	33	31	100	500	1000	145	155	148	158	151	161
4000	29	84	99	481	962	141	155	145	159	148	162
6000	25	77	95	458	916	136	153	140	158	143	162
8000	21	70	91	433	866	129	150	134	156	138	161
10000	17	63	87	408	816	121	145	128	154	133	160
12000	13	55	82	382	764	---	---	120	149	126	157
14000	9	48	77	359	718	---	---	---	---	119	153
16000	---	---	---	---	---	---	---	---	---	---	---
18000	---	---	---	---	---	---	---	---	---	---	---
20000	---	---	---	---	---	---	---	---	---	---	---
22000	---	---	---	---	---	---	---	---	---	---	---
24000	---	---	---	---	---	---	---	---	---	---	---
26000	---	---	---	---	---	---	---	---	---	---	---
28000	---	---	---	---	---	---	---	---	---	---	---
29000	---	---	---	---	---	---	---	---	---	---	---
31000	---	---	---	---	---	---	---	---	---	---	---

Figure 7-160. One Engine Inoperative Maximum Cruise Power - 1800 RPM - ISA + 20°C

ONE ENGINE INOPERATIVE MAXIMUM CRUISE POWER – 1800 RPM

ISA +30°C

FOR OPERATION WITH ICE VANES EXTENDED, DECREASE FUEL FLOW AND TAS BY 7% AND ESTABLISH THE LIMIT POWER WHICH IS AVAILABLE BY OBSERVING MAXIMUM CRUISE ENGINE LIMITS.

PRESSURE ALTITUDE	IOAT		TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	AIRSPEED KNOTS					
						12000		11000		10000	
FEET	°C	°F	%	LBS/HR	LBS/HR	CAS	TAS	CAS	TAS	CAS	TAS
SL	47	117	93	495	990	141	148	145	152	148	155
2000	43	109	92	475	950	137	149	141	153	144	156
4000	39	102	90	456	912	133	149	138	154	141	157
6000	35	95	87	435	870	128	147	133	153	137	157
8000	31	88	84	411	822	---	---	127	150	132	156
10000	27	81	80	387	774	---	---	120	147	126	154
12000	---	---	---	---	---	---	---	---	---	---	---
14000	---	---	---	---	---	---	---	---	---	---	---
16000	---	---	---	---	---	---	---	---	---	---	---
18000	---	---	---	---	---	---	---	---	---	---	---
20000	---	---	---	---	---	---	---	---	---	---	---
22000	---	---	---	---	---	---	---	---	---	---	---
24000	---	---	---	---	---	---	---	---	---	---	---
26000	---	---	---	---	---	---	---	---	---	---	---
28000	---	---	---	---	---	---	---	---	---	---	---
29000	---	---	---	---	---	---	---	---	---	---	---
31000	---	---	---	---	---	---	---	---	---	---	---

Figure 7-161. One Engine Inoperative Maximum Cruise Power - 1800 RPM - ISA + 30°C

ONE ENGINE INOPERATIVE MAXIMUM CRUISE POWER – 1800 RPM

ISA +37°C

FOR OPERATION WITH ICE VANES EXTENDED, DECREASE FUEL FLOW AND TAS BY 7% AND ESTABLISH THE LIMIT POWER WHICH IS AVAILABLE BY OBSERVING MAXIMUM CRUISE ENGINE LIMITS.

PRESSURE ALTITUDE	IOAT		TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	AIRSPEED KNOTS					
						12000		11000		10000	
FEET	°C	°F	%	LBS/HR	LBS/HR	CAS	TAS	CAS	TAS	CAS	TAS
SL	54	129	86	475	950	135	143	139	148	142	151
2000	50	122	85	457	914	131	143	136	148	139	152
4000	46	115	84	438	876	126	143	132	149	136	153
6000	42	108	82	418	836	120	140	127	148	132	153
8000	38	100	78	396	792	---	---	121	145	127	152
10000	34	93	75	373	746	---	---	---	---	121	150
12000	---	---	---	---	---	---	---	---	---	---	---
14000	---	---	---	---	---	---	---	---	---	---	---
16000	---	---	---	---	---	---	---	---	---	---	---
18000	---	---	---	---	---	---	---	---	---	---	---
20000	---	---	---	---	---	---	---	---	---	---	---
22000	---	---	---	---	---	---	---	---	---	---	---
24000	---	---	---	---	---	---	---	---	---	---	---
26000	---	---	---	---	---	---	---	---	---	---	---
28000	---	---	---	---	---	---	---	---	---	---	---
29000	---	---	---	---	---	---	---	---	---	---	---
31000	---	---	---	---	---	---	---	---	---	---	---

Figure 7-162. One Engine Inoperative Maximum Cruise Power - 1800 RPM - ISA + 37°C

HOLDING TIME

TORQUE SETTING
36% AT 1800 RPM
43% AT 1700 RPM
APPLICABLE FOR ALL TEMPERATURES

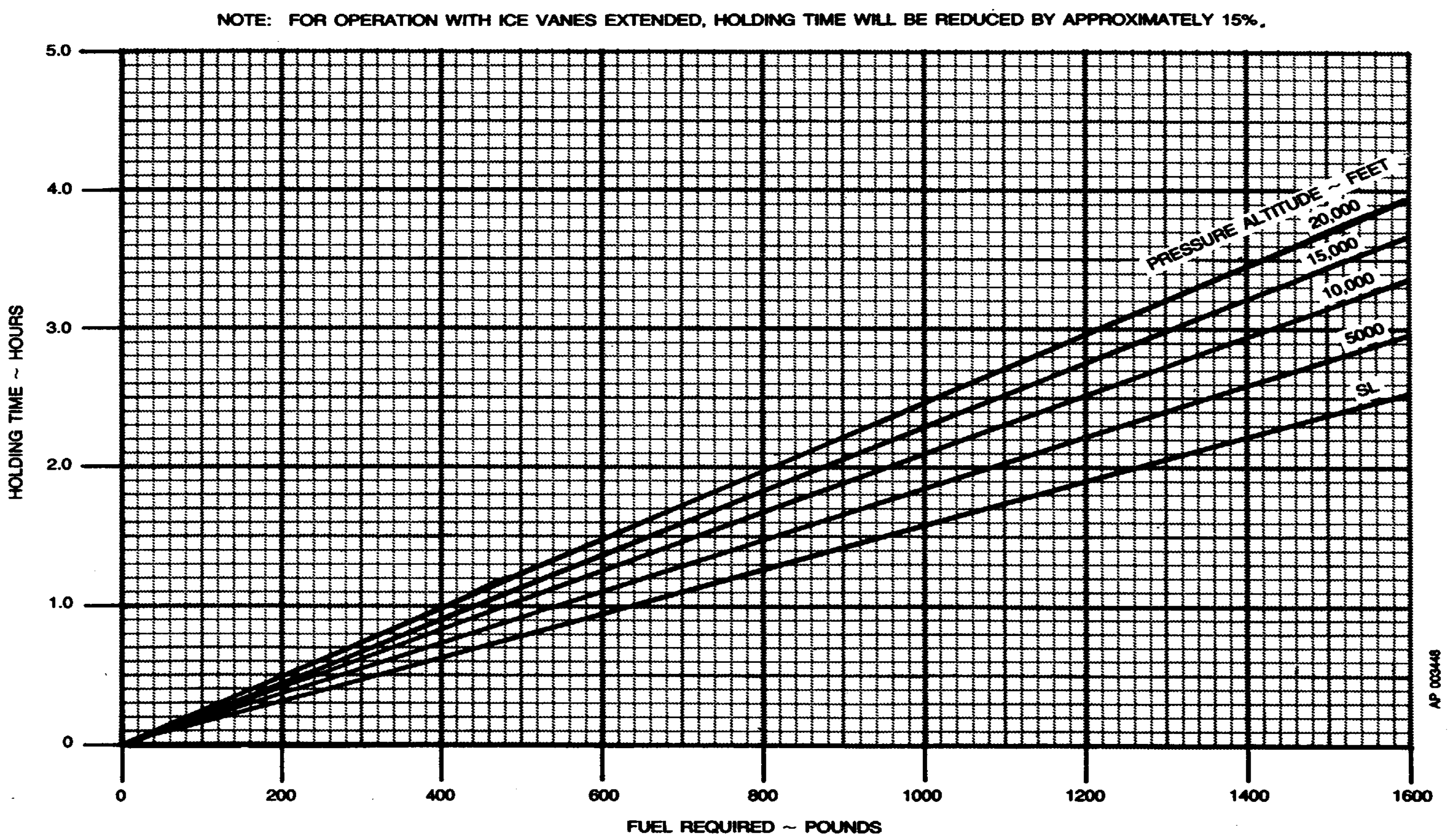


Figure 7-163. Holding Time

MAXIMUM CRUISE SPEEDS - 1700 RPM

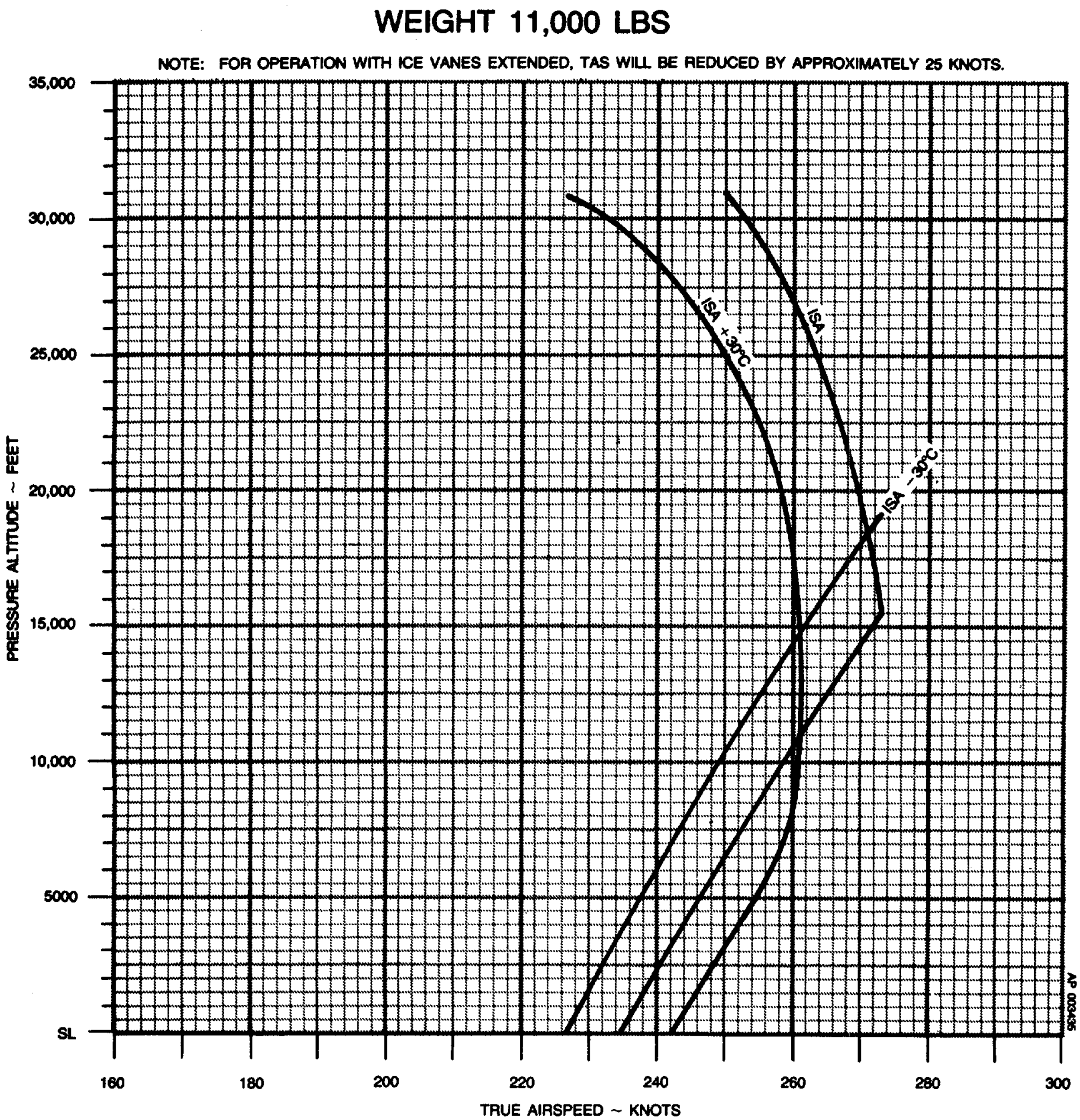


Figure 7-164. Maximum Cruise Speeds - 1700 RPM

MAXIMUM CRUISE POWER - 1700 RPM

NOTE: 1. FOR OPERATION WITH ICE VANES EXTENDED ADD 35°C TO THE ACTUAL OR INDICATED TEMPERATURE BEFORE ENTERING GRAPH.

2. ISA DEVIATION LINES REFLECT ACTUAL TEMPERATURES (FLIGHT PLANNING) AND INDICATED TEMPERATURES SHOULD BE USED FOR INFLIGHT CRUISE POWER SETTINGS.

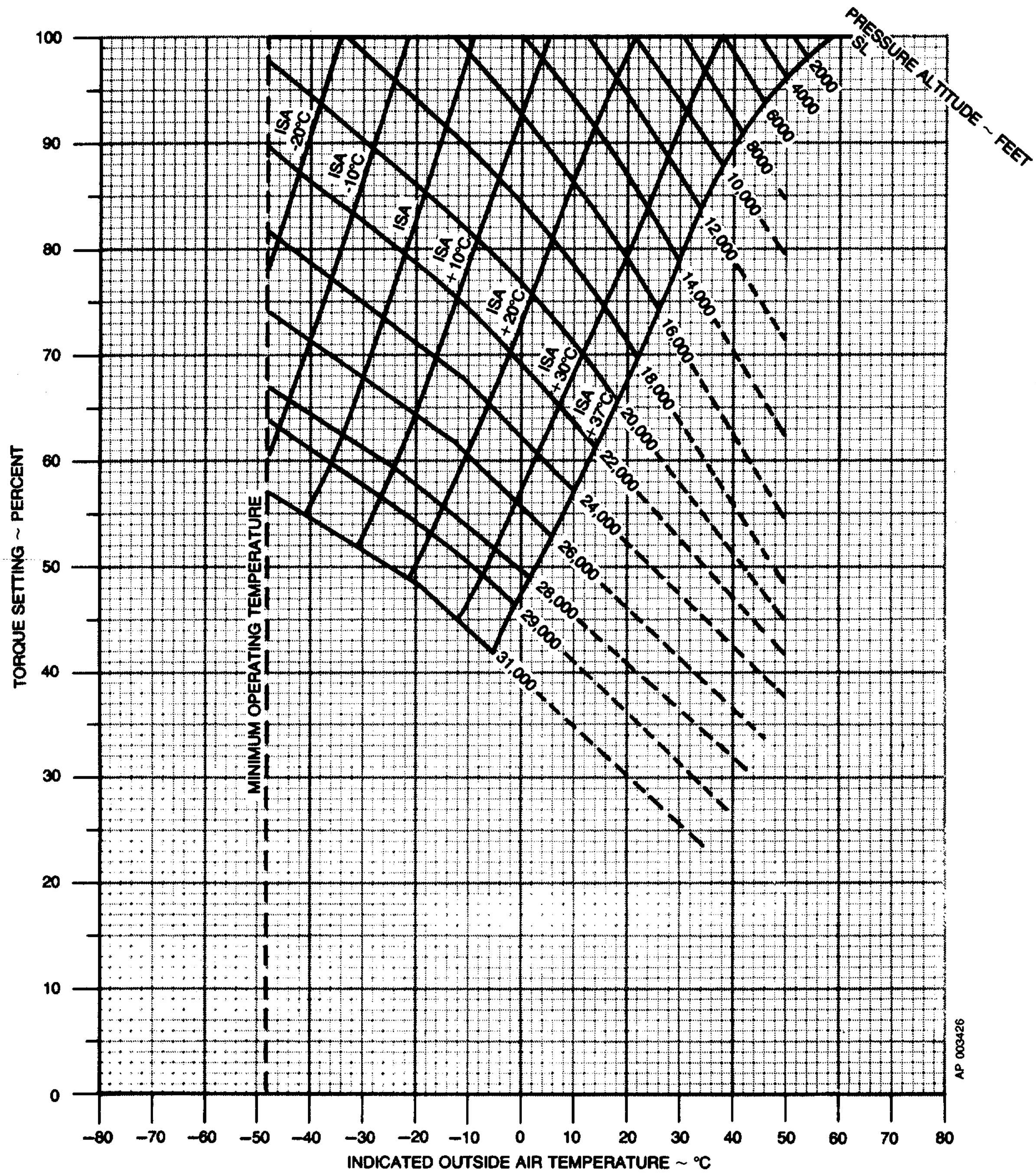


Figure 7-165. Maximum Cruise Power - 1700 RPM

FUEL FLOW AT MAXIMUM CRUISE POWER - 1700 RPM

NOTE 1. FOR OPERATION WITH ICE VANES EXTENDED, ADD 30°C TO THE ACTUAL OR INDICATED TEMPERATURE BEFORE ENTERING GRAPH.

2. ISA DEVIATION LINES REFLECT ACTUAL TEMPERATURES (FLIGHT PLANNING) AND INDICATED TEMPERATURES SHOULD BE USED FOR INFLIGHT CRUISE POWER SETTINGS.

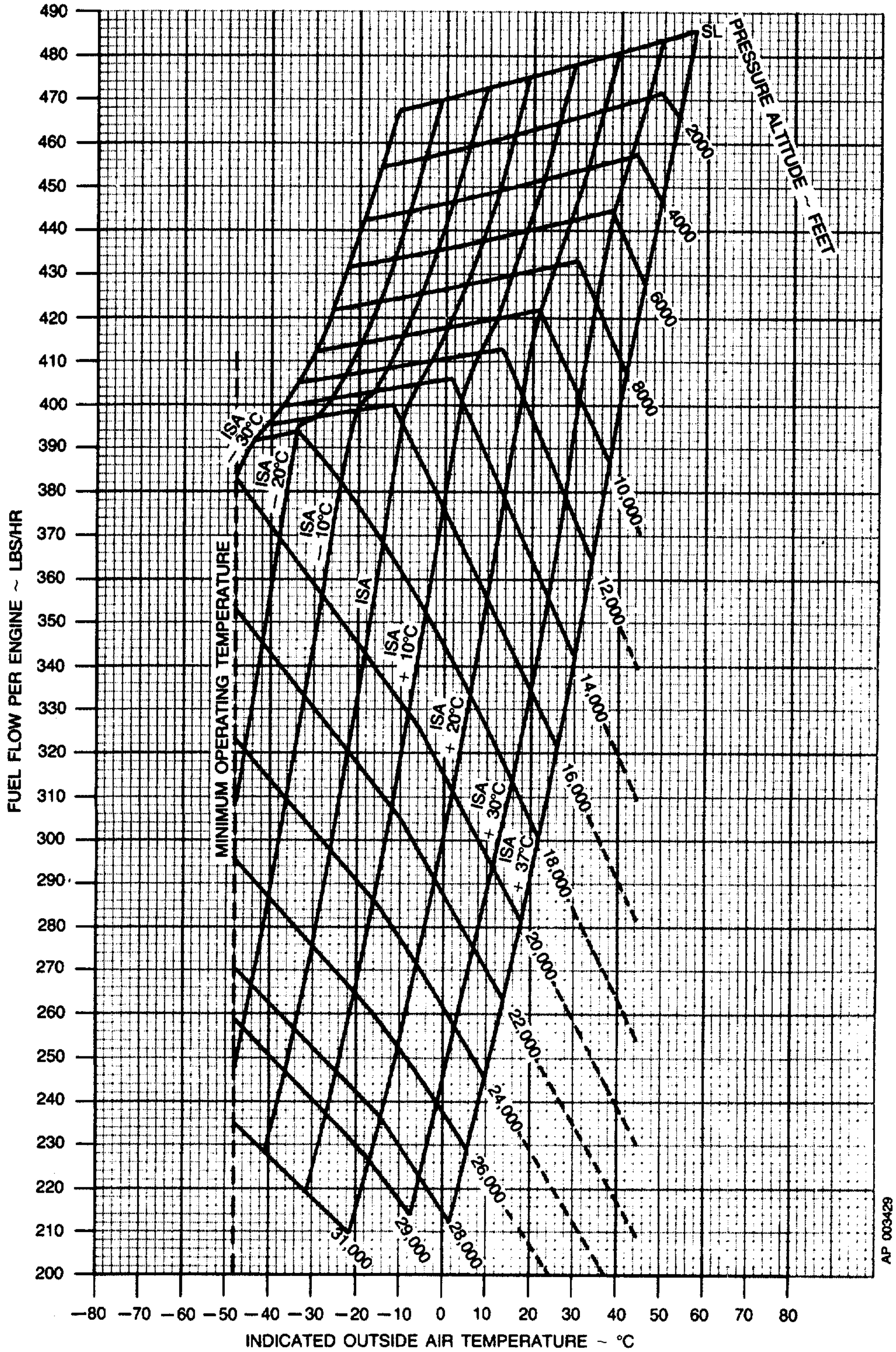


Figure 7-166. Fuel Flow at Maximum Cruise Power - 1700 RPM

MAXIMUM CRUISE SPEEDS - 1800 RPM

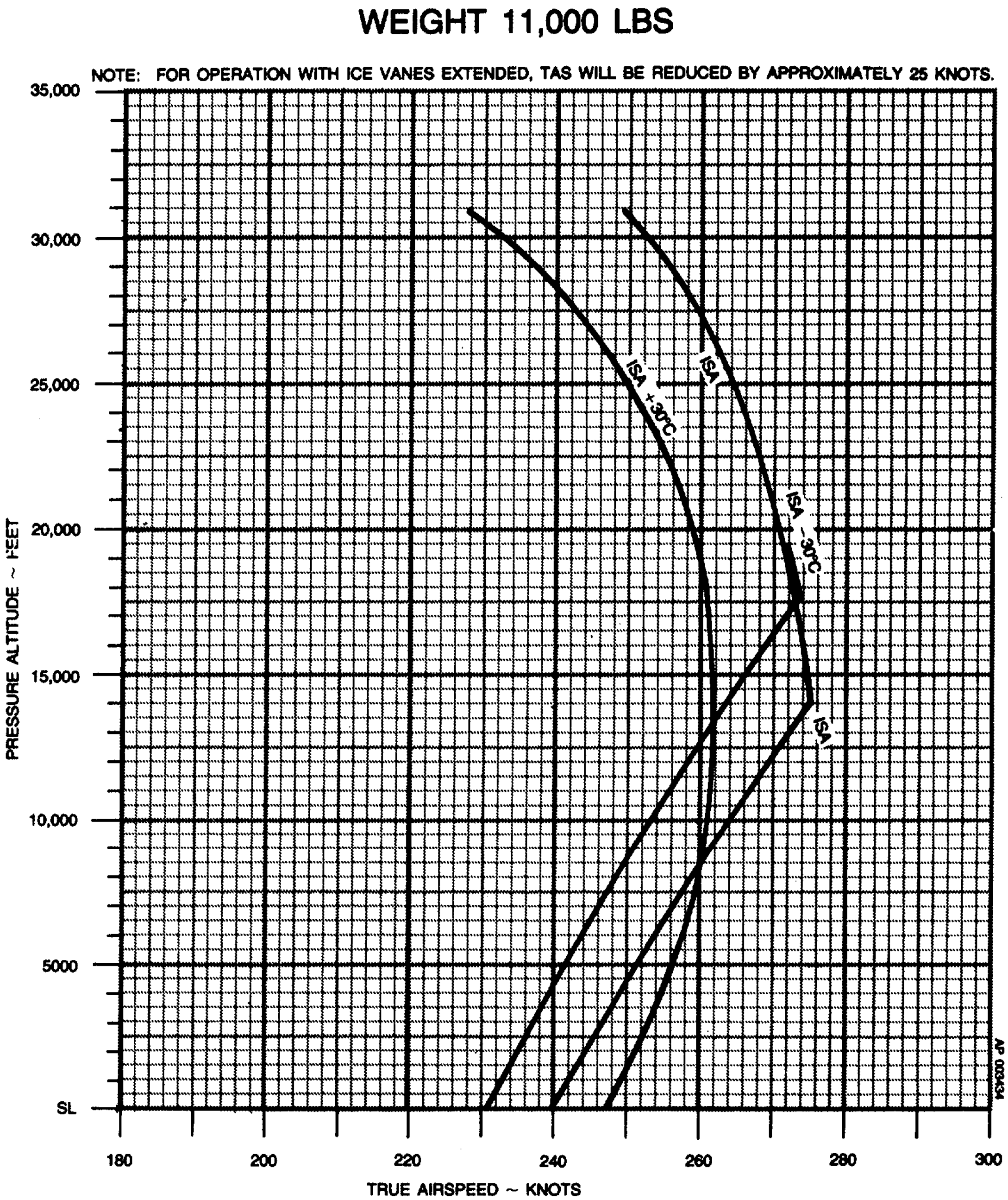


Figure 7-167. Maximum Cruise Speeds - 1800 RPM

MAXIMUM CRUISE SPEEDS - 1800 RPM

WEIGHT 11,000 LBS

NOTE: 1. FOR OPERATION WITH ICE VANES EXTENDED, ADD 40°C TO THE ACTUAL OR INDICATED TEMPERATURE BEFORE ENTERING GRAPH.

2. ISA DEVIATION LINES REFLECT ACTUAL TEMPERATURES (FLIGHT PLANNING) AND INDICATED TEMPERATURES SHOULD BE USED FOR INFLIGHT CRUISE POWER SETTINGS.

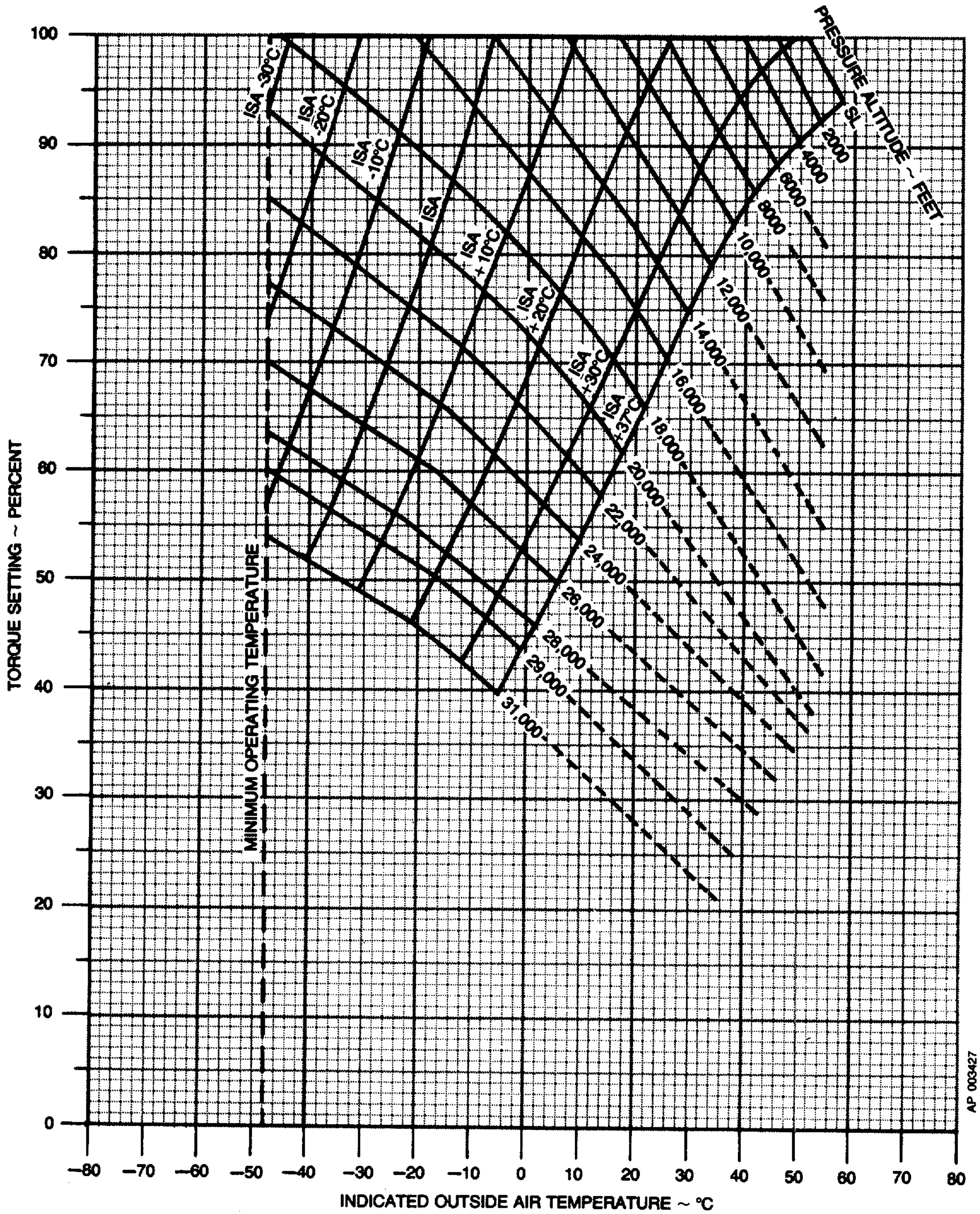


Figure 7-168. Maximum Cruise Speeds - 1800 RPM

FUEL FLOW AT MAXIMUM CRUISE POWER - 1800 RMP

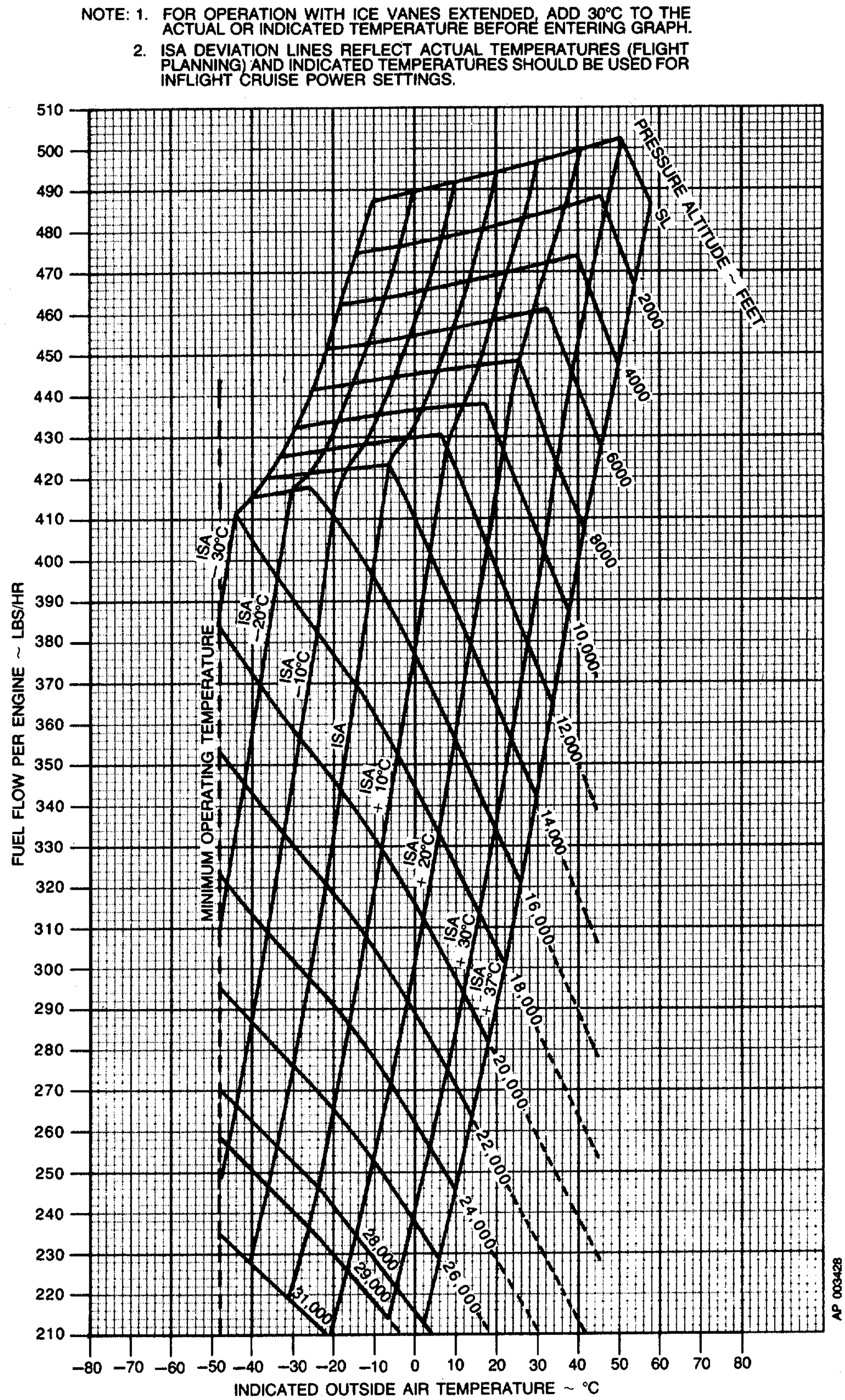


Figure 7-169. Fuel Flow at Maximum Cruise Power - 1800 RPM

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)

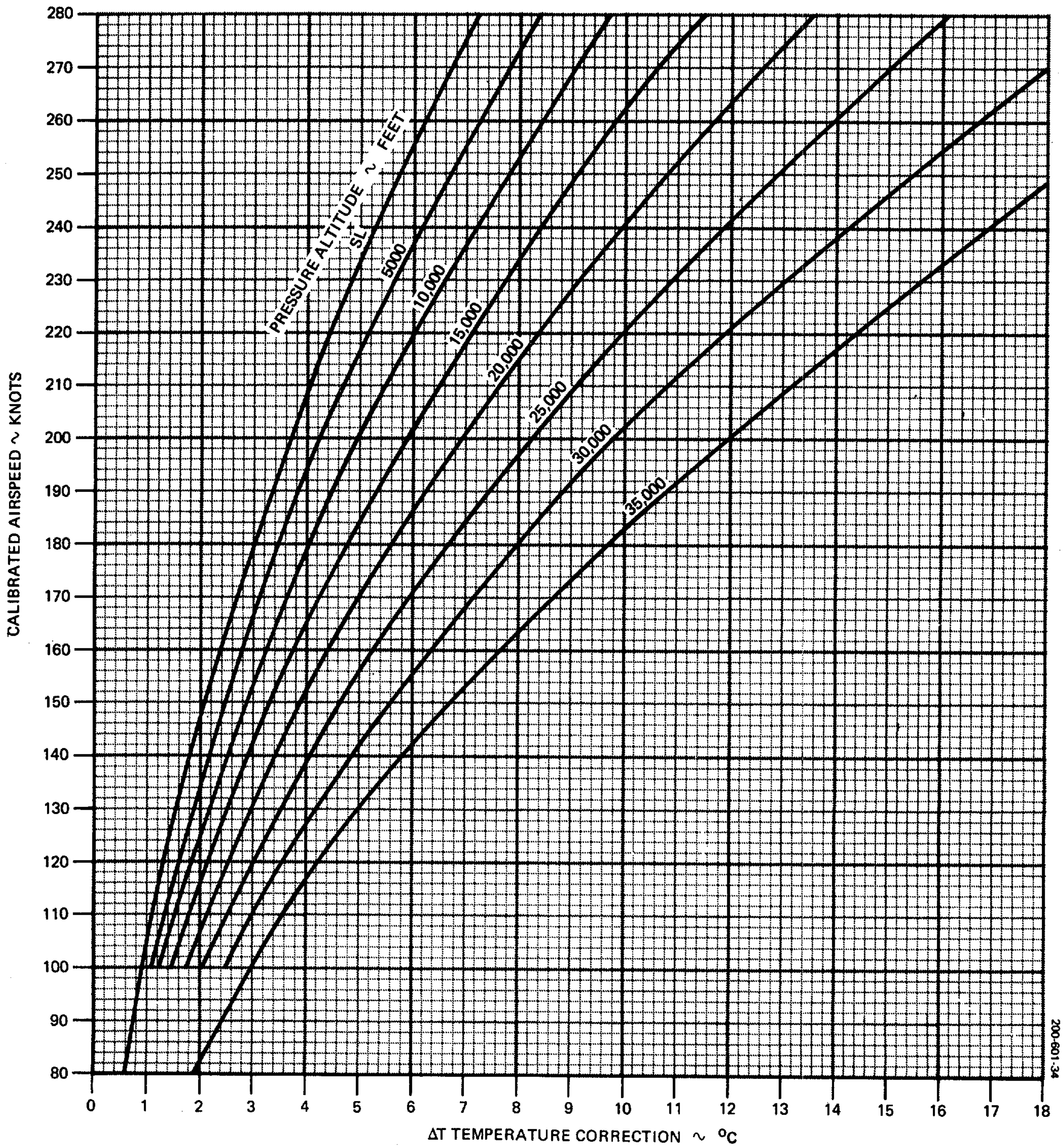


Figure 7-170. Outside Air Temperature Correction

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.

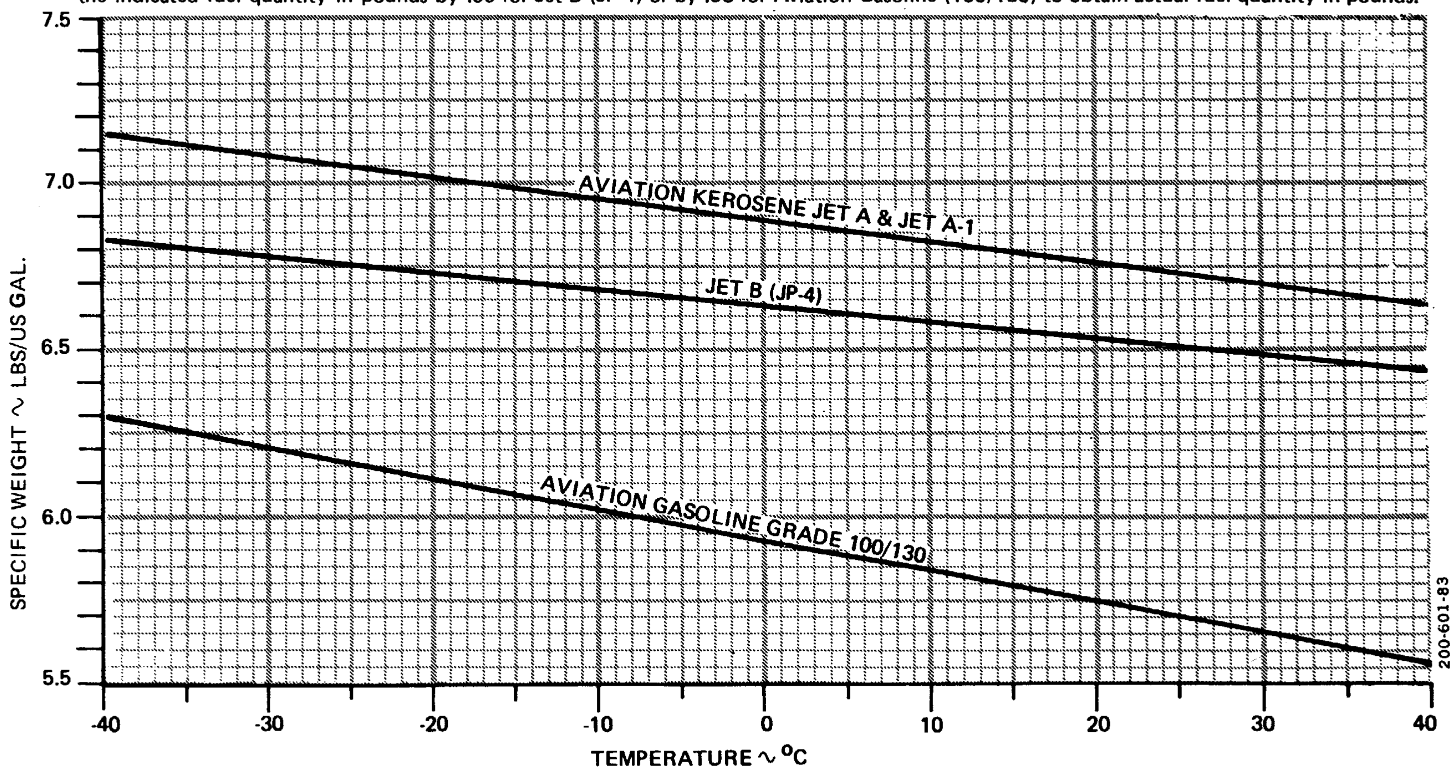


Figure 7-171. Density Variation of Aviation Fuel

PRESSURIZATION CONTROLLER SETTING FOR LANDING

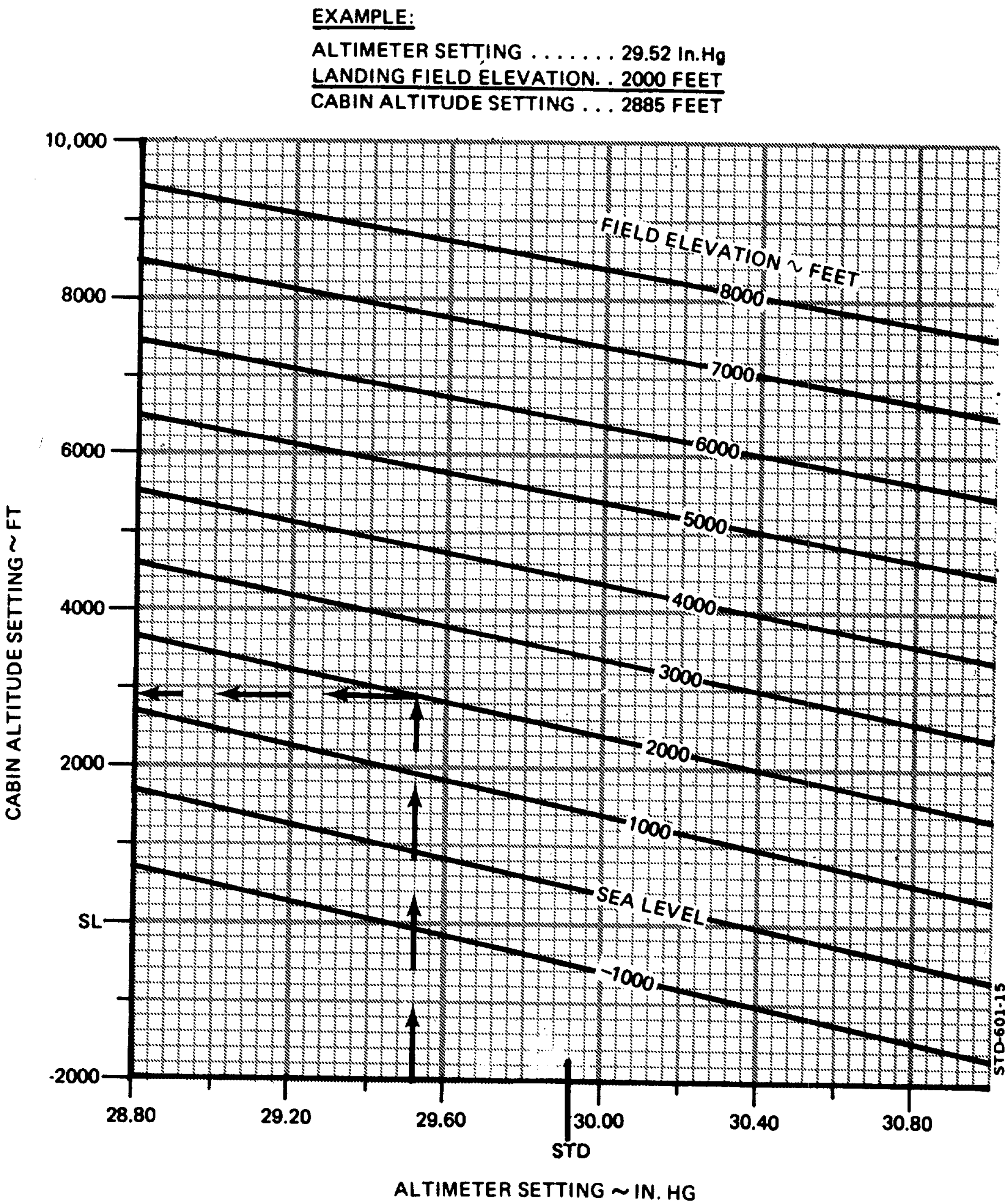


Figure 7-172. Pressurization Controller Setting for Landing

CHAPTER 7

Section III MODEL C-12 *D*

INTRODUCTION

The performance and cruise data contained in this section of Chapter 7 pertains to C-12***D*** model aircraft. Data for C-12 ***CF*** aircraft may be found in sections II and IV respectively. Users are authorized to remove whichever sections not applicable to their model aircraft, and are not required to carry on-board all sections.

SECTION III MODEL C-12D

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Section III MODEL C-12D

INTRODUCTION TO PERFORMANCE DATA

7-1. DESCRIPTION.

The charts presented in this chapter are based on and are consistent with the recommended operating procedures and techniques set forth in other chapters of this manual. The charts contain the performance data necessary for preflight and inflight mission planning. Explanatory text applicable to each type of chart is included to illustrate the use of the data presented.

The data contained in this section of Chapter 7 pertains only to the C-12D model aircraft. Data for A, C and F models can be found in sections I, II and IV respectively. The user is authorized to remove sections which are not applicable to his model aircraft; only the applicable section is required to be carried on-board.

7-2. PURPOSE.

a. The purpose of this chapter is to provide the best available performance data for the C-12 aircraft. Regular use of this information will enable you to receive maximum safe utilization from the aircraft. Although maximum performance is not always required, regular use of this chapter is recommended for the following reasons:

(1) Knowledge of your performance margin will allow you to make better decisions when unexpected conditions or alternate missions are encountered.

(2) Situations requiring maximum performance will be more readily recognized.

(3) Familiarity with the data will allow performance to be computed more easily and quickly.

(4) Experience will be gained in accurately estimating the effects of variables for which data are not presented.

b. The information is primarily intended for mission planning and is most useful when planning operations in unfamiliar areas or at extreme conditions. The data may also be used in flight, to establish unit or area standing operating procedures, and to inform ground commanders of performance/risk tradeoffs.

7-3. GENERAL.

The pre-flight planning shall cover the maximum range of conditions and performance that can reasonably be expected. In each area of performance, the effects of altitude, temperature, gross weight, and other parameters relating to that phase of flight are presented. In addition to the presented data, your judgment and experience will be necessary to accurately obtain performance under a given set of circumstances. The conditions for the data are listed under the title of each chart. The effects of different conditions are discussed in the text accompanying each phase of performance. Where practical, data is presented at conservative conditions. All performance data presented is within the applicable limits of the aircraft.

CAUTION

Exceeding operating limits can cause permanent damage to critical components. Overlimit operation can decrease performance, cause immediate failure, or failure on a subsequent flight.

7-4. LIMITS.

Performance generally deteriorates rapidly beyond limits. If limits are exceeded, minimize the amount and time. Enter the maximum value and time above limits on DA Form 2408-13 so proper maintenance action can be taken.

7-5. CHART EXPLANATION.

A complete series of performance charts is provided for C-12 aircraft in this manual. The charts include data on takeoff, climb, landing, and operating instructions for cruising flight from maximum endurance to normal rated power. All charts are based on ambient temperature conditions and pressure altitude.

Section III MODEL C-12 D

INTRODUCTION TO PERFORMANCE

NOTE

All speeds are IAS except as noted.

The graphs and tables in this part present performance information for takeoff, climb and landing at various parameters of weight, altitude and temperature. All performance information except cruise examples have been presented on performance graphs. A ramp weight of 12,590 pounds has been assumed. Included is information required to construct a single engine takeoff flight path. Included are (1) takeoff distance assuming an engine failure at lift off and (2) zero wind climb gradient at takeoff speeds with one engine inoperative.

NOTE

The following exemplary conditions illustrate the types of data needed for pre-flight planning. In some cases, this data has been utilized in the graph examples. However, examples shown on graphs do not in all cases represent data shown in the following flight planning example problem.

CONDITIONS
At Billings:
Outside Air Temperature.. 250C (77ºF)
Field Elevation.. 3606 feet
Altimeter Setting... 29.56 in. Hg
Wind .... 3600 at 10 knots
Runway 34 Length.. 5600 feet

Route of Trip:
BIL-V 19-CZI-V247-DGW-V 19E-CYS-V 19-DEN
Weather Conditions IFR to 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	ALT SET. °C	IN. HG
BIL-SHR	88	8000	010º/30	-10		0	29.56
SHR-CZI	57	9000	350°/40	-10		-4	29.60
CZI-DGW	95	8000	040º/45	-10		0	29.60
DGW-CYS	47	8000	040º/45	-10		0	29.60
	46	8000	0400/45	-10		0	29.60
CYS-DEN	81	8000	040º/45	-10		0	29.60
REFERENCE: Enroute Low Altitude charts L-8 and L-9							

At Denver:
Outside Air Temperature.. 15ºC (59ºF)
Field Elevation.. 5330 feet
Altimeter Setting... 29.60 in. HG
Wind .... 270º at 10 knots
Runway 26L length.. 10,000 feet

To determine pressure altitude at origin and destination airports, add 100 feet to field elevation for each .1 in. Hg below 29.92 and subtract 100 feet from field elevation for each .1 in. Hg above 29.92.

Pressure Altitude at BIL:
29.92 29.56 = .36 in. Hg
The pressure altitude at BIL is 360 feet above the
3606 + 360 = 3966 Feet
Pressure Altitude at DEN:
29.92 29.60 = .32 in. Hg
The pressure altitude at DEN is 320 feet above the field elevation.
5330 + 320 = 5650 Feet

Takeoff performance has been presented to determine the maximum takeoff weight, takeoff distance, field length requirements (accelerate-stop), and takeoff flight path assuming an engine failure occurs during the takeoff procedure. The following illustrates the use of these charts.

Enter the graph for Takeoff Weight Flaps 0% To Achieve Positive, Single Engine Climb At Liftoff, at 3966 feet, to 25°C, to determine the maximum weight at which the accelerate after liftoff procedure should be attempted:

Takeoff Weight .... 12,500 lbs

The following example assumes the aircraft is loaded so that take off weight is 12,500 lbs.

Enter the graph for Takeoff Distance - Flaps 0% at 25°C, 3966 feet pressure altitude, 12,500 pounds takeoff weight, and 9.5 knots headwind component:

Ground Roll .... 3500 feet
Total Distance Over a 50 Foot Obstacle .... 4680 feet
Rotation Speed .... 110 knots
50 Foot Speed .... 121 knots

Enter the graph for Accelerate-Stop - Flaps 0% at 25ºC, 3966 feet pressure altitude, 12,500 pounds takeoff weight, and 9.5 knots headwind component:

Accelerate-Stop Field Length .... 5800 feet
Engine Failure Speed .... 113 knots

Enter the graph for Accelerate After Liftoff-Flaps 0% at 25°C, 3966 feet pressure altitude, 12,500 pounds takeoff weight, and 9.5 knots headwind component:

Ground Roll .... 4300 feet
Total Distance Over 50 Foot Obstacle .... 9300 feet
Takeoff Speed at Rotation .... 110 knots
at 50 feet .... 121 knots

Enter the graph for Net Gradient of Climb - Flaps 0% at 25°C, 3966 feet pressure altitude, and 12,500 pounds (not shown on graph examples):

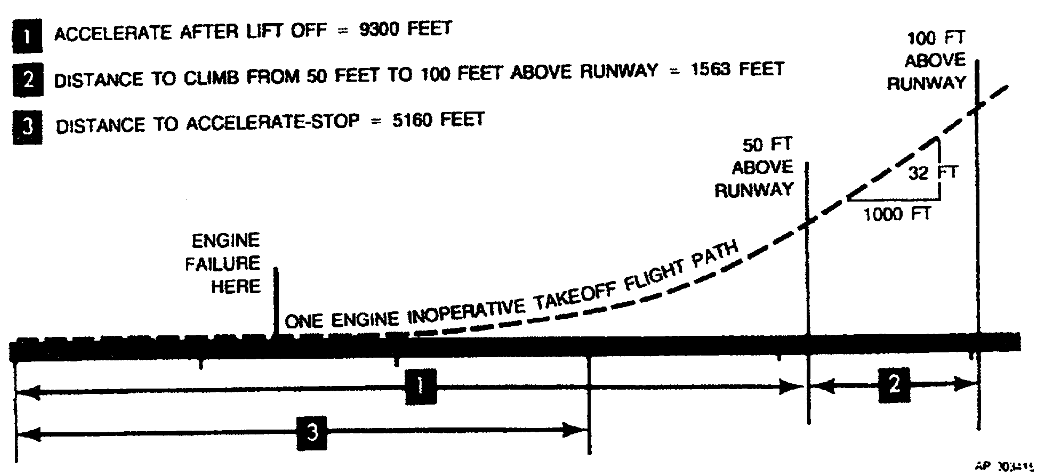
Climb Gradient 3.2%
Climb Speed .... 121 knots

A 3.2% climb gradientis32 feet of vertical height per 1000 feet of horizontal distance.

NOTE

The net gradient of climb graphs 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, assuming engine fails at lift-off:

Distance from 50 feet to 100 feet = 50 feet (100- 50) (1000÷ 32) = 1563 feet
Total Distance = 9300 + 1563 = 10,863 feet
The above results are illustrated below:



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

Ramp Weight	12,590 lb
Expected Fuel Usage..	1699 lbs
Landing Weight..	12,590 - 1699 = 10,891 lbs

NOTE

Refer to the Cruise Control Part of this section to determine Expected Fuel Usage.

Enter the graph for Landing Distance Without Propeller Reversing Flaps 100% at 15C, 5650 feet pressure altitude, 10,891 lbs, 10 knots headwind component:

Ground Roll..	1495 feet
Total Over 50 foot Obstacle..	2500 feet
Approach Speed..	99 knots

Enter the graph for Climb-Balked Landing at 15ºC, 5650 feet, and 10,891 lbs.

Rate of Climb	1640 ft/min
Climb Gradient	15.1%

Check for compliance with the Maximum Zero Fuel Weight Limitation:

NOTE

Zero Fuel Weight shall not exceed 10,400 pounds.

For this example, the following conditions were assumed:

Ramp Weight	12,590 lbs
Weight of Usable Fuel Onboard..	2017 lbs

NOTE

Refer to the Cruise Control Part of this section to determine Weight of Usable Fuel Onboard.

Zero Fuel Weight = Ramp Weight
Weight of Usable
Fuel Onboard

Zero Fuel Weight = 12,590 - 2017 = 10,573 lbs.

Maximum Zero Fuel Weight (from
LIMITATIONS Section) = 10,400 lbs

Maximum Zero Weight
Limitation has been
exceeded by 173 lbs

In order to avoid exceeding the limitation, at least 173 pounds of payload must be off-loaded. If desired, additional fuel may then be added until the maximum ramp weight limitation of 12,590 pounds is again reached.

7-6. 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 various scales on the graph should be used. For instance, if the first item in the example is OAT, then enter the graph at the existing OAT.
2. The reference lines indicate where to begin following the guidelines. Always project to the reference line first, then follow the guide-lines to the next known item by maintaining the same PROPORTIONAL DISTANCE between the guideline above and the guide-line below the projected line. For instance, if the projected line intersects the reference line intheratioof30% down/70%upbetween the guidelines, then maintain this same 30%/0o70% relationship between the guide lines and follow them to the next known item.
3. The associated conditions define the specific conditions from 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.
4. Indicated airspeeds (IAS) were obtained by using either the Airspeed Calibration Normal System Graph or the Airspeed Calibration Normal System - Takeoff Ground Roll Graph.

5. The full amount of usable fuel is available for all approved flight conditions.

6. Notes have been provided to approximate performance with ice vanes extended. The effect is estimated by entering the graph at a temperature higher than the actual temperature. The effect is approximate and will vary depending upon airspeed, temperature, altitude and ambient conditions. Existing TGT and torque limits still apply.

7. Operations with ice vanes extended should be conducted only when the temperature is below +15°C and flight free of visible moisture cannot be assured.

7-7. ENGINE FAILURE PRIOR TO LIFTOFF

1. If an engine fails prior to liftoff, the abort procedure should be performed. Directional control while identifying and feathering the inoperative engine and distance required to accelerate may not be sufficient to continue takeoff.

7-8. ENGINE FAILURE AT LIFTOFF.

1. If an engine fails at or immediately after liftoff, climb to 50 feet may be critical. Positive pilot actions will be required to maintain aircraft control; the distance required to attain 50 feet AGL will be significant.

Single engine climb performance predictions can only be realized in a zero side-slip. This is accomplished by maintaining a 3° to 5° bank angle and 1/2 ball off center towards the operating engine.

AIRSPEED CALIBRATION - NORMAL SYSTEM

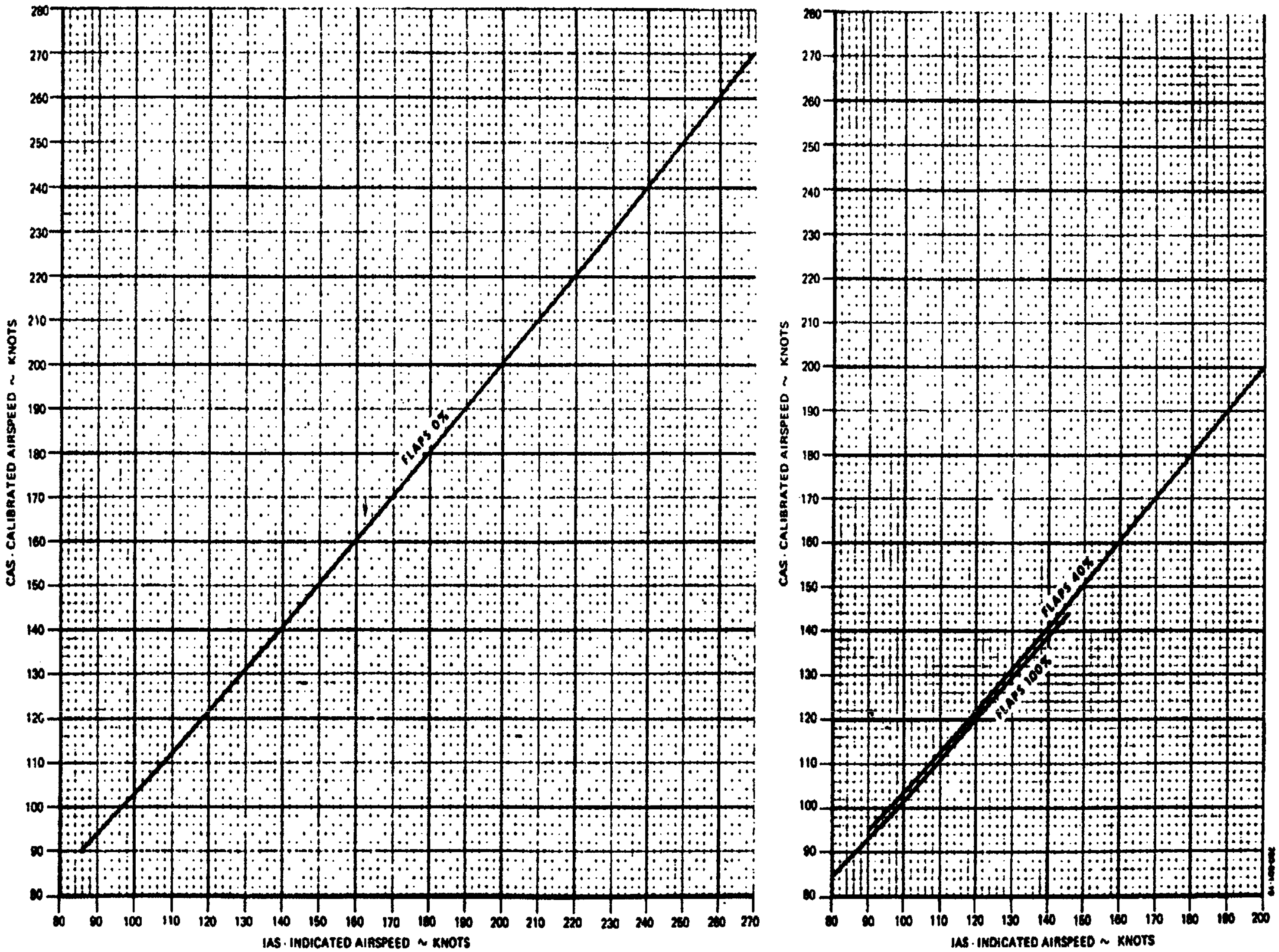


Figure 7-173. Airspeed Calibration - Normal System

AIRSPEED CALIBRATION — NORMAL SYSTEM

TAKE-OFF GROUND ROLL

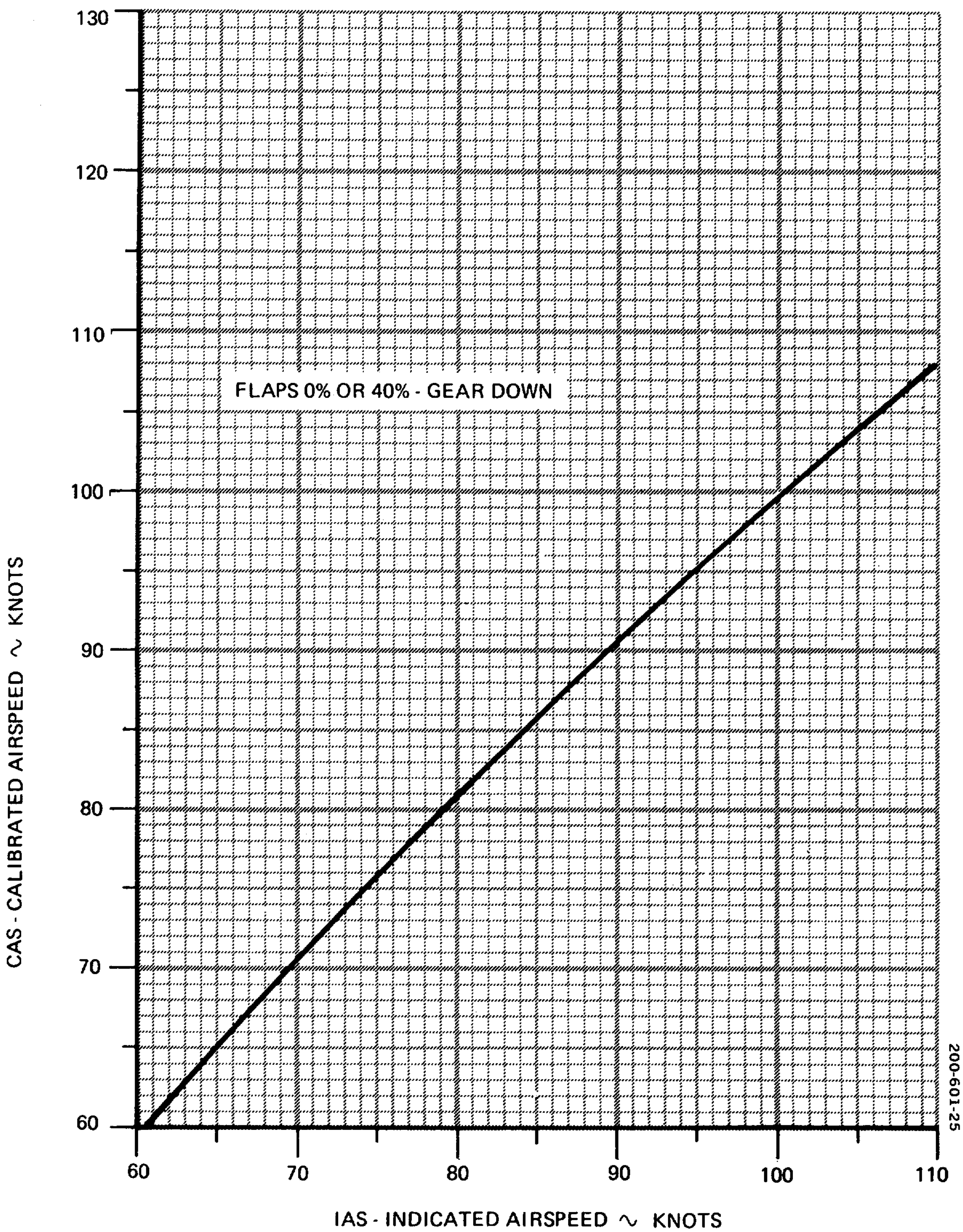


Figure 7-174. Airspeed Calibration - Normal System - Take-off Ground Roll

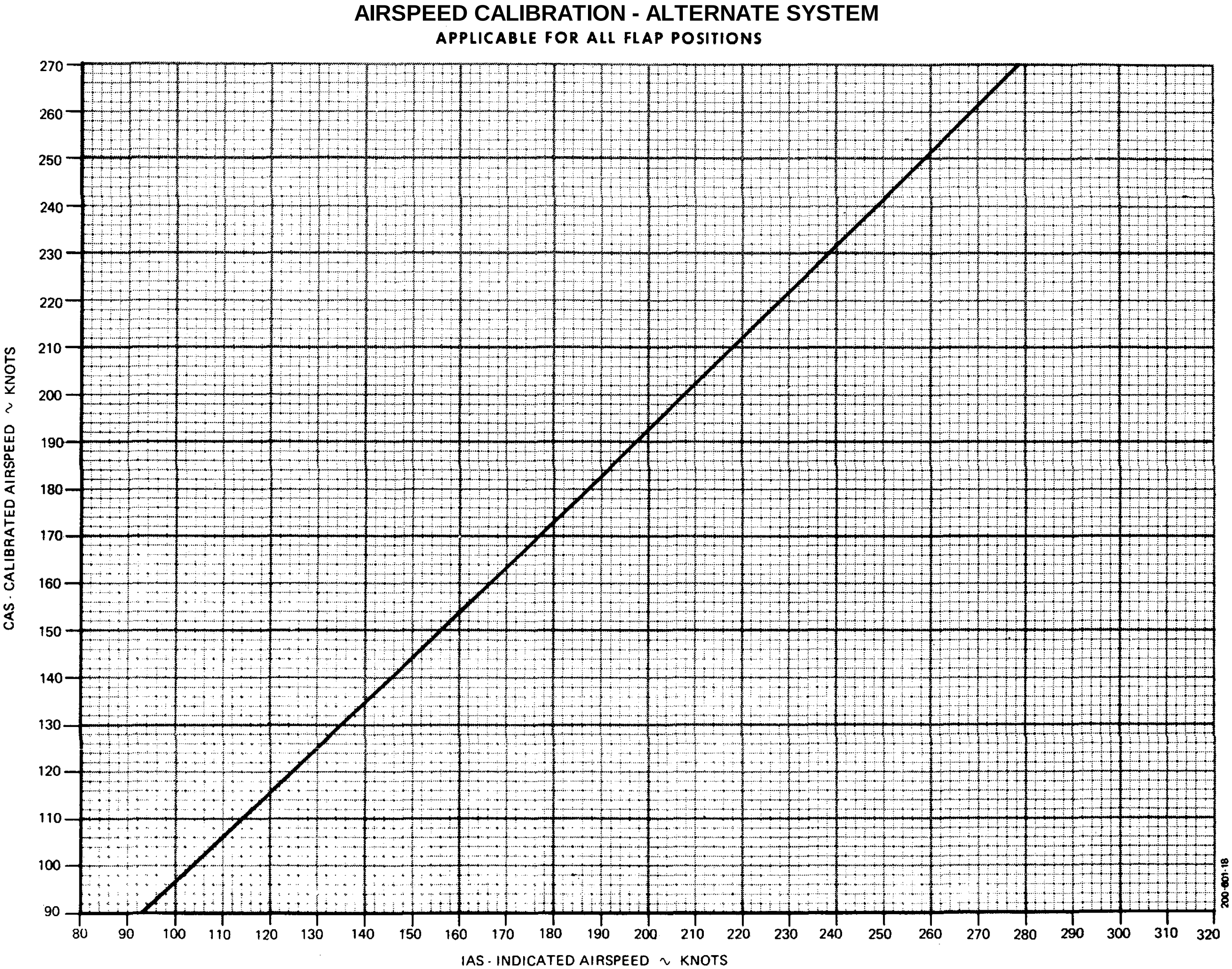


Figure 7-175. Airspeed Calibration - Alternate System

ALTIMETER CORRECTION - NORMAL SYSTEM

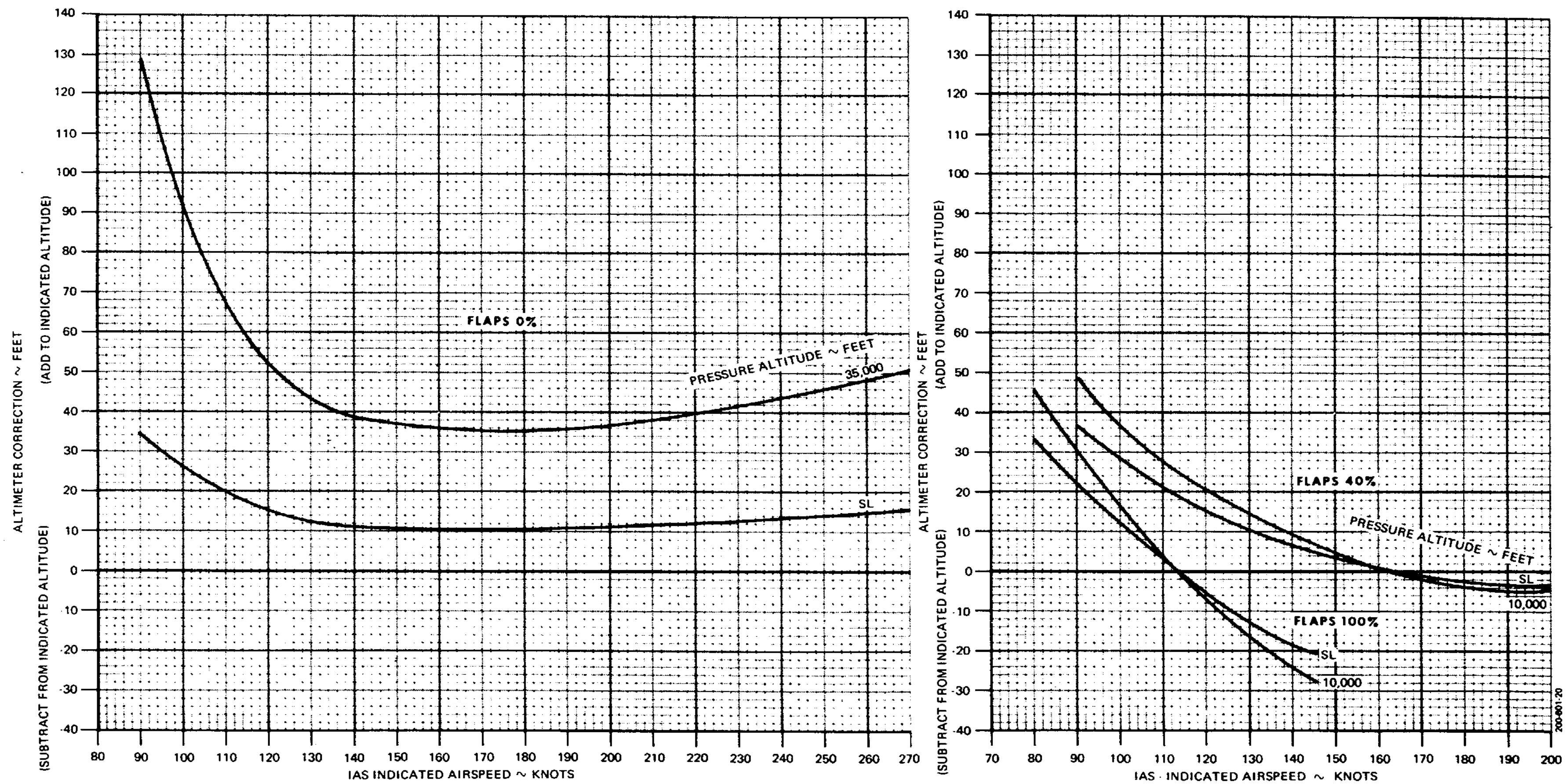


Figure 7-176. Altimeter Correction - Normal System

ALTIMETER CORRECTION - ALTERNATE SYSTEM

APPLICABLE FOR ALL FLAP POSITIONS

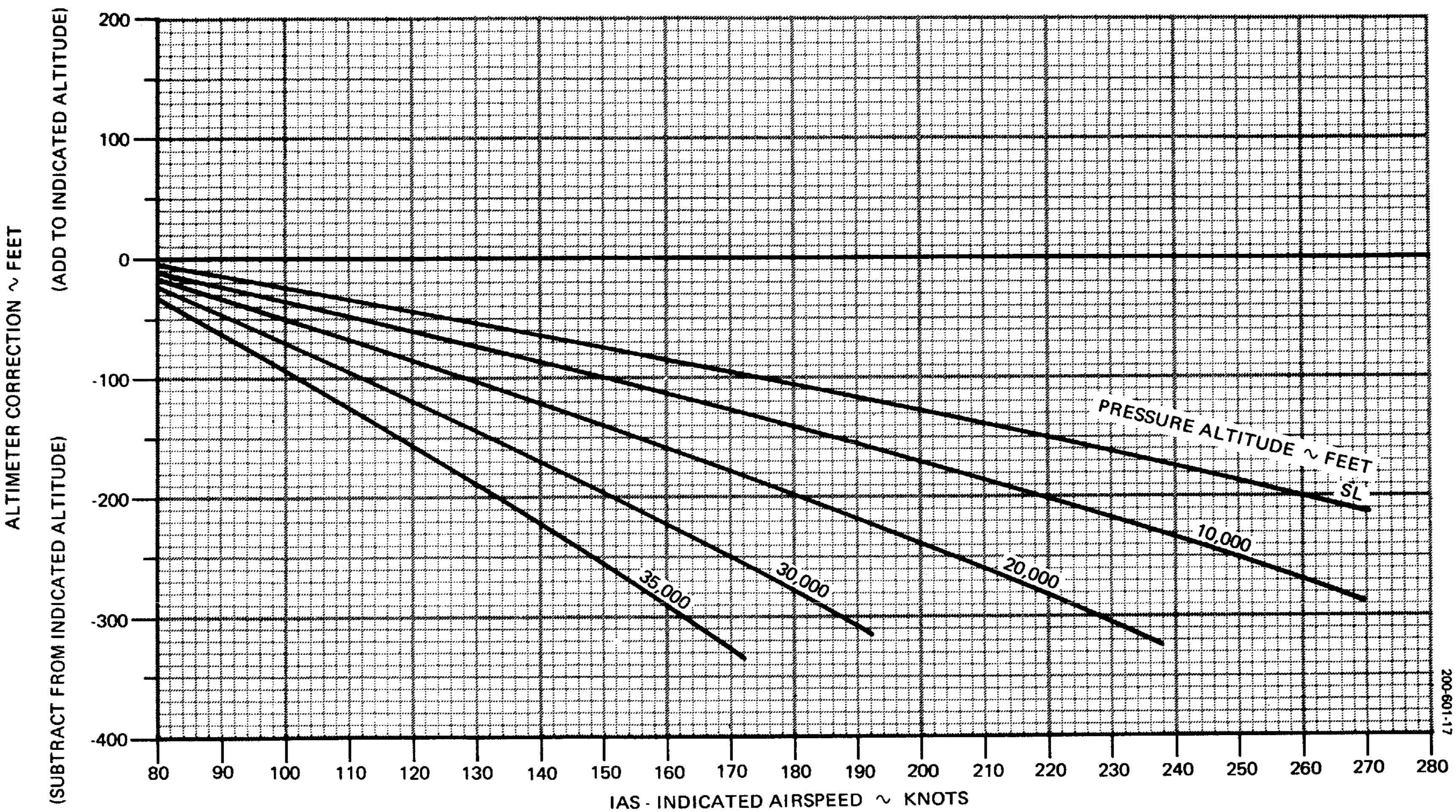


Figure 7-177. Altimeter Correction - Alternate System

TEMPERATURE CONVERSION °C vs °F

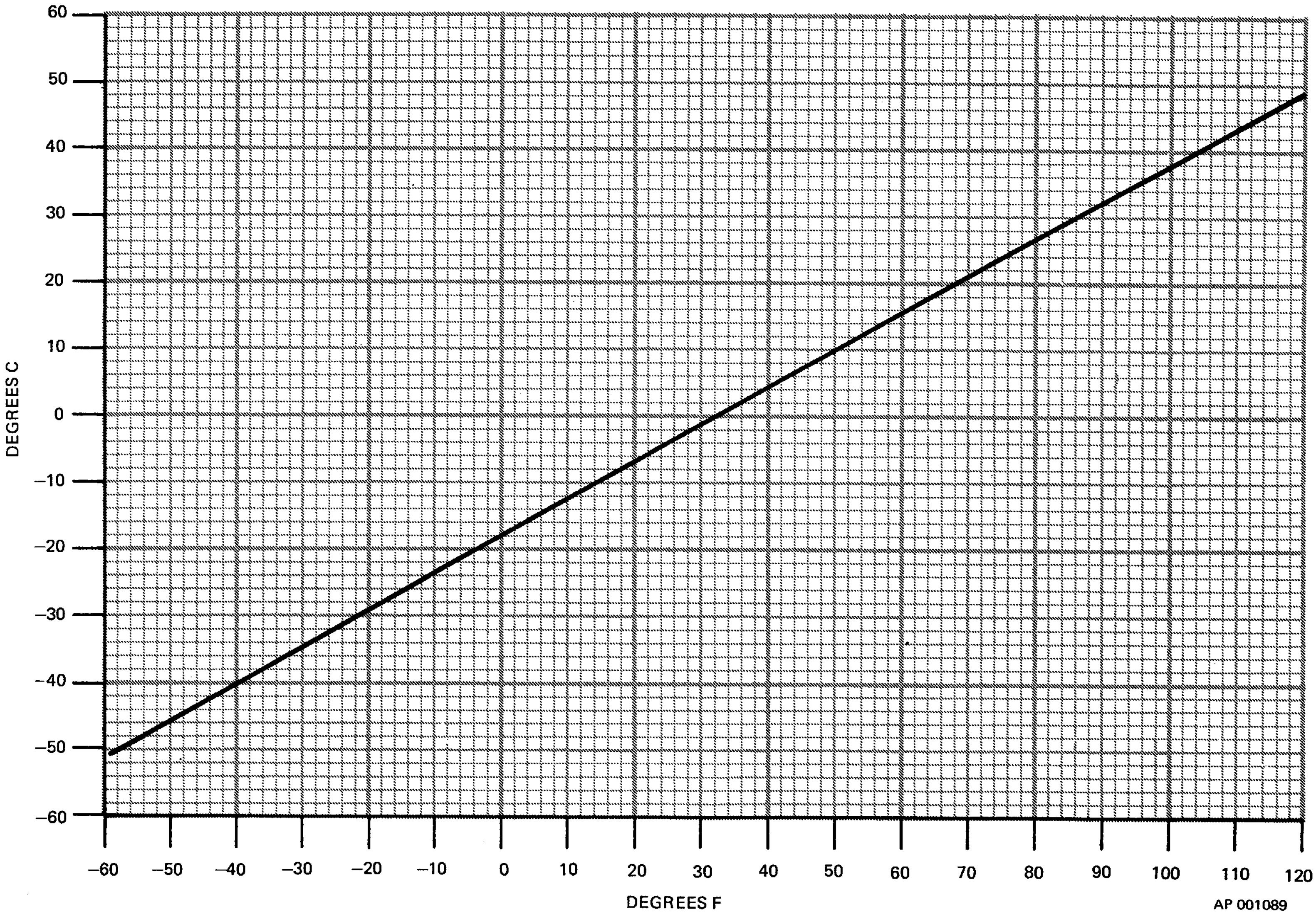


Figure 7-178. Temperature Conversion °C vs °F

Minimum Take-off Power At 2000 RPM (Ice Vanes Retracted) (65 KNOTS)

NOTE:

1. TORQUE INCREAEES APPROXIMATELY 1% FROM 0 TO 65 KNOTS
2. THE PERCENT TORQUE INDICATED IN THIS FIGURE IS THE MINIMUM VALUE AT WHICH TAKE-OFF PERFORMANCE PRESENTED IN THIS SECTION CAN BE REALIZED. ANY EXCESS POWER WHICH MAY BE DEVELOPED WITHOUT EXCEEDING ENGINE LIMITATIONS MAY BE UTILIZED.
3. ADD 6% TO VALUES DERIVED FROM GRAPH BELOW

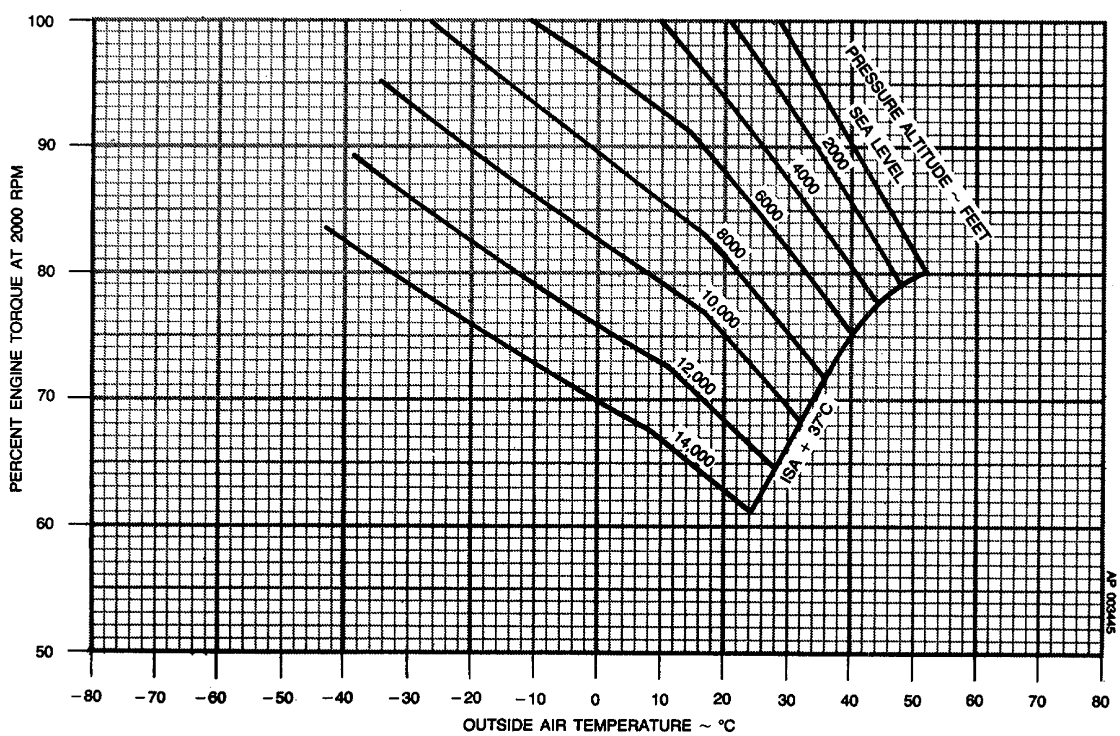


Figure 7-179. Minimum Take-off Power At 2000 RPM (Ice Vanes Retracted)

Minimum Take-off Power At 2000 RPM (Ice Vanes Extended)
(ICE VANES EXTENDED)
(65 KNOTS)

NOTE:

1. TORQUE INCREASES APPROXIMATELY 1% FROM 0 TO 65 KNOTS
2. THE PERCENT TORQUE INDICATED IN THIS FIGURE IS THE MINIMUM VALUE AT WHICH TAKE-OFF PERFORMANCE CAN BE REALIZED WITH ICE VANES EXTENDED, ANY EXCESS POWER WHICH MAY BE DEVELOPED WITHOUT EXCEEDING ENGINE LIMITATIONS CAN BE UTILIZED
3. DO NOT EXTEND ICE VANES WITHIN SHADED AREA.
4. ADD 2% TO VALUES DERIVED FROM GRAPH BELOW

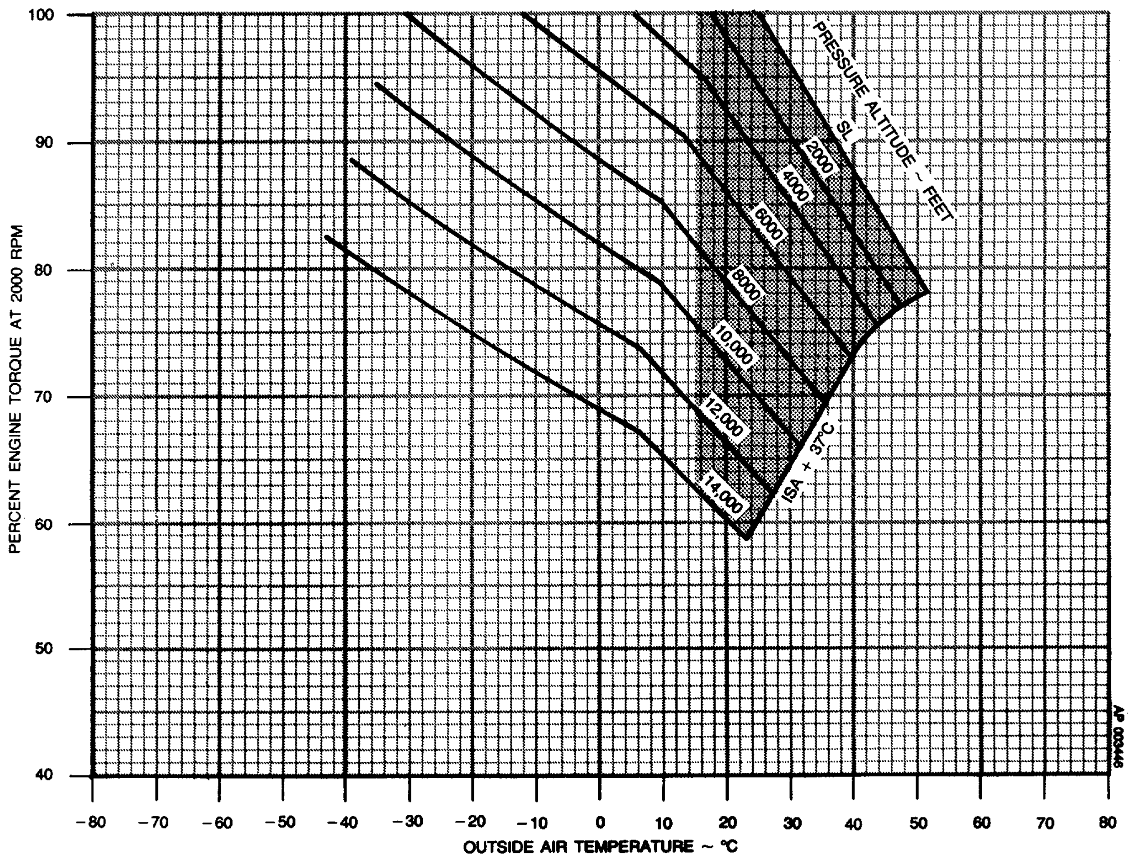


Figure 7-180. Minimum Take-off Power At 2000 RPM (Ice Vanes Extended)

Stall Speeds - Power Idle

NOTES:

1. ALTITUDE LOSS EXPERIENCED WHILE CONDUCTING STALLS IN ACCORDANCE WITH FAR 23.201 WAS 800 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 . . . . 11,700 LBS
FLAPS 40%
ANGLE OF BANK . . . . . 30 DEG.

STALL SPEED . . . . 96 KTS CAS
90 KTS IAS

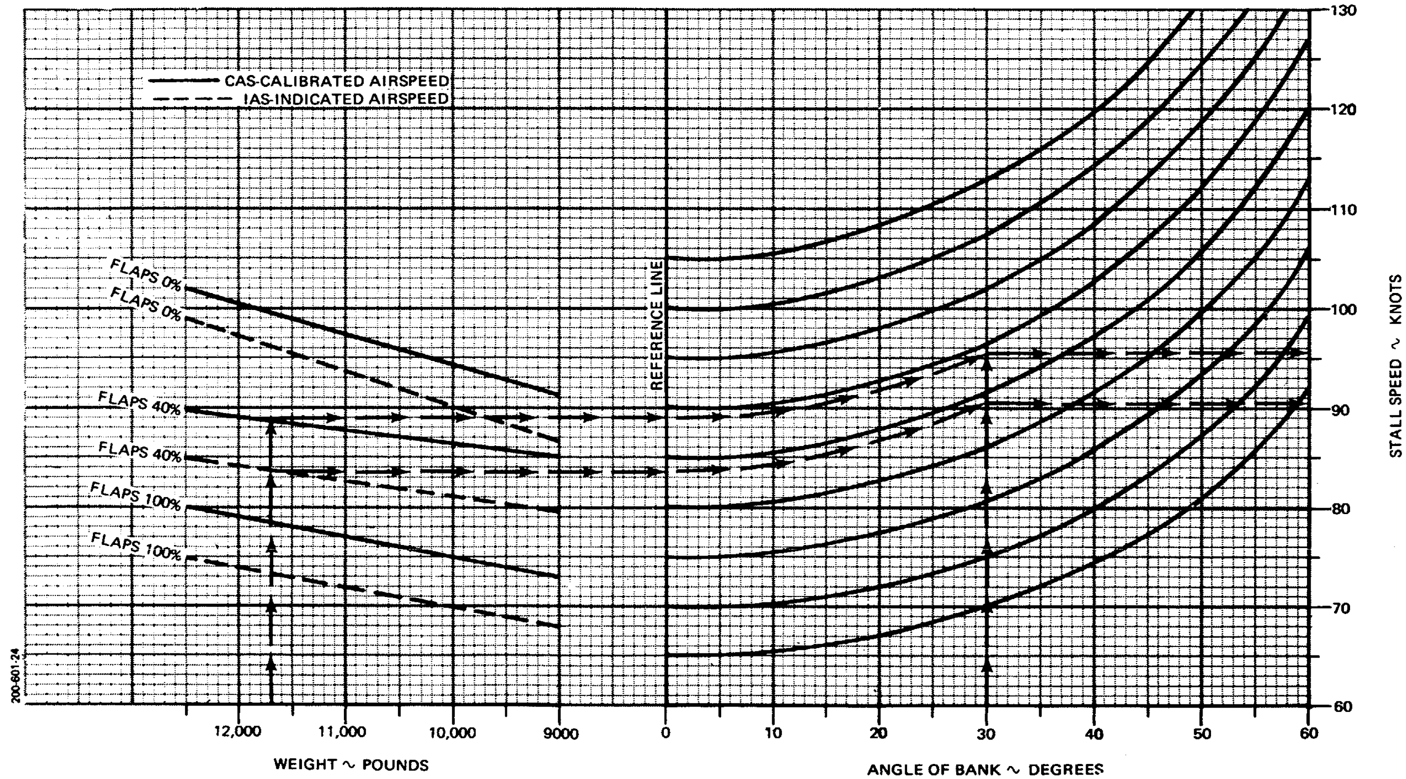


Figure 7-181. Stall Speeds - Power Idle

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

NOTE: AIRPLANE TESTED TO 25 KNOTS CROSSWIND COMPONENT ONLY.

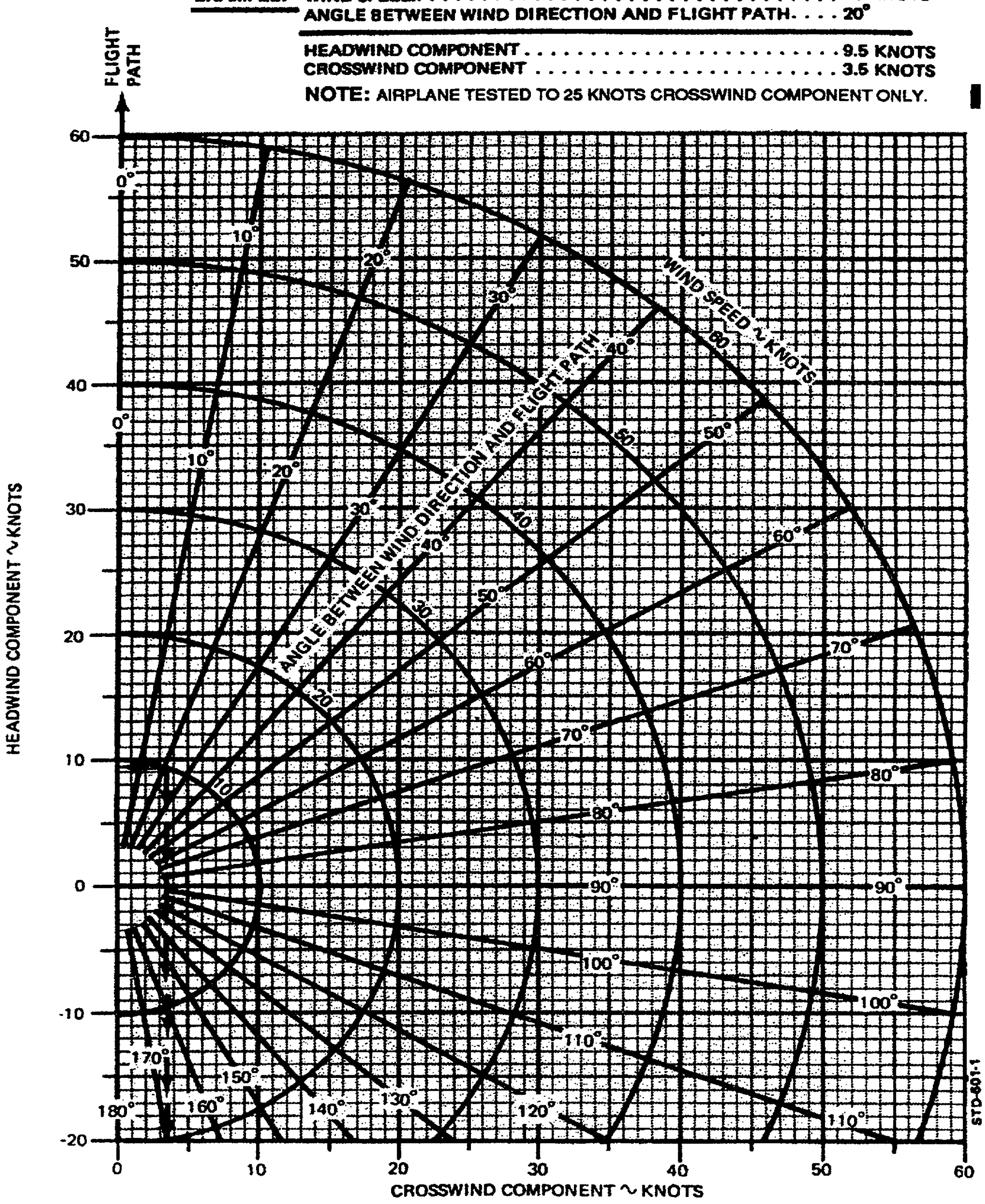


Figure 7-182. Wind Components

TAKE-OFF WEIGHT - FLAPS 0%
TO ACHIEVE POSITIVE SINGLE ENGINE CLIMB AT LIFT-OFF

ASSOCIATED CONDITIONS:

AIRPLANE . . . . AIRBORNE
POWER . . . . TAKE-OFF
FLAPS . . . . UP
INOPERATIVE
PROPELLER . . . . . FEATHERED

EXAMPLE:

PRESSURE ALTITUDE . . 3966 FT
OAT . . . . 25°C

TAKE-OFF WEIGHT . . . 12,500 LBS

NOTE: FOR OPERATION WITH ICE VANES EXTENDED, NO OFF LOADING IS REQUIRED.

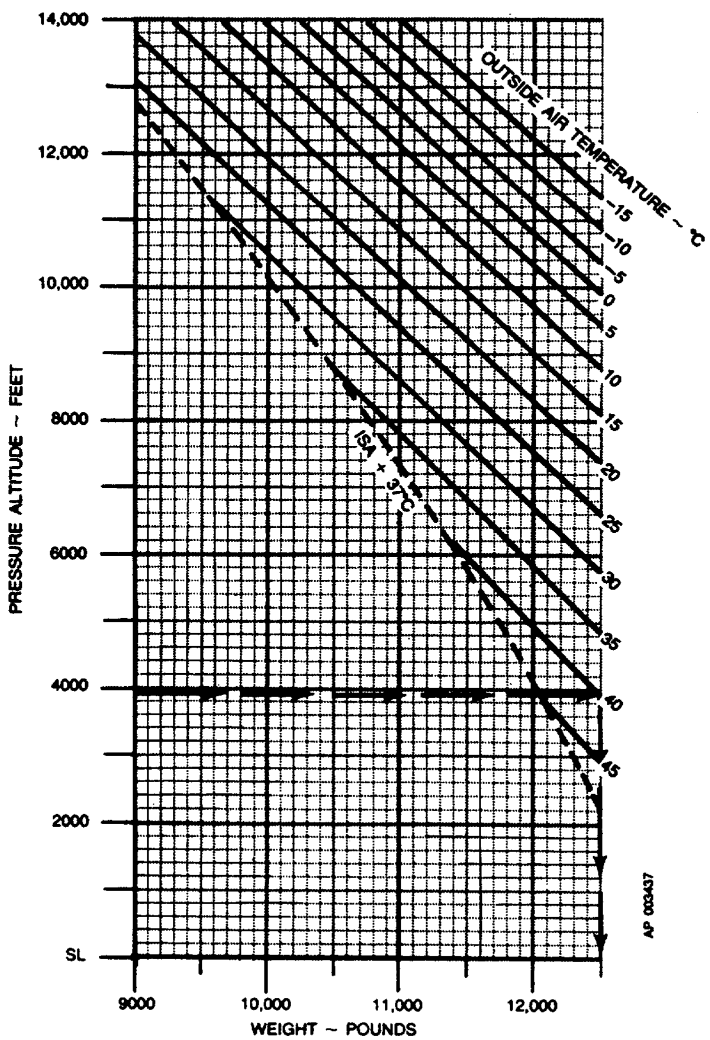


Figure 7-183. Take-off Weight - Flaps 0% (To Achieve Positive Single Engine Climb at Lift-Off)

TAKE-OFF DISTANCE - FLAPS 0%

ASSOCIATED CONDITIONS:

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

WEIGHT ~ LB.	TAKE-OFF SPEED ~ KTS	
	ROTATION	50 FT
12,500	110	121
12,000	109	119
11,000	106	115
10,000	103	111
9000	100	107

EXAMPLE:

OAT	25°C
PRESSURE ALTITUDE	3966 FT
TAKE-OFF WEIGHT	12,500 LBS
HEADWIND COMPONENT	9.5 KTS
GROUND ROLL	3500 FT
TOTAL DISTANCE OVER 50 FT OBSTACLE	*4680 FT*
TAKE-OFF SPEED AT ROTATION	110 KTS
AT 50 FT.	121 KTS

NOTE: 1. FOR OPERATION WITH ICE VANES EXTENDED, ADD 10°C TO THE ACTUAL OAT BEFORE ENTERING GRAPH.
2. ADD OR SUBTRACT 5% OF TAKE-OFF GROUND ROLL FOR EACH 1% OF RUNWAY SLOPE (DOWN - SUBTRACT, UP - ADD).

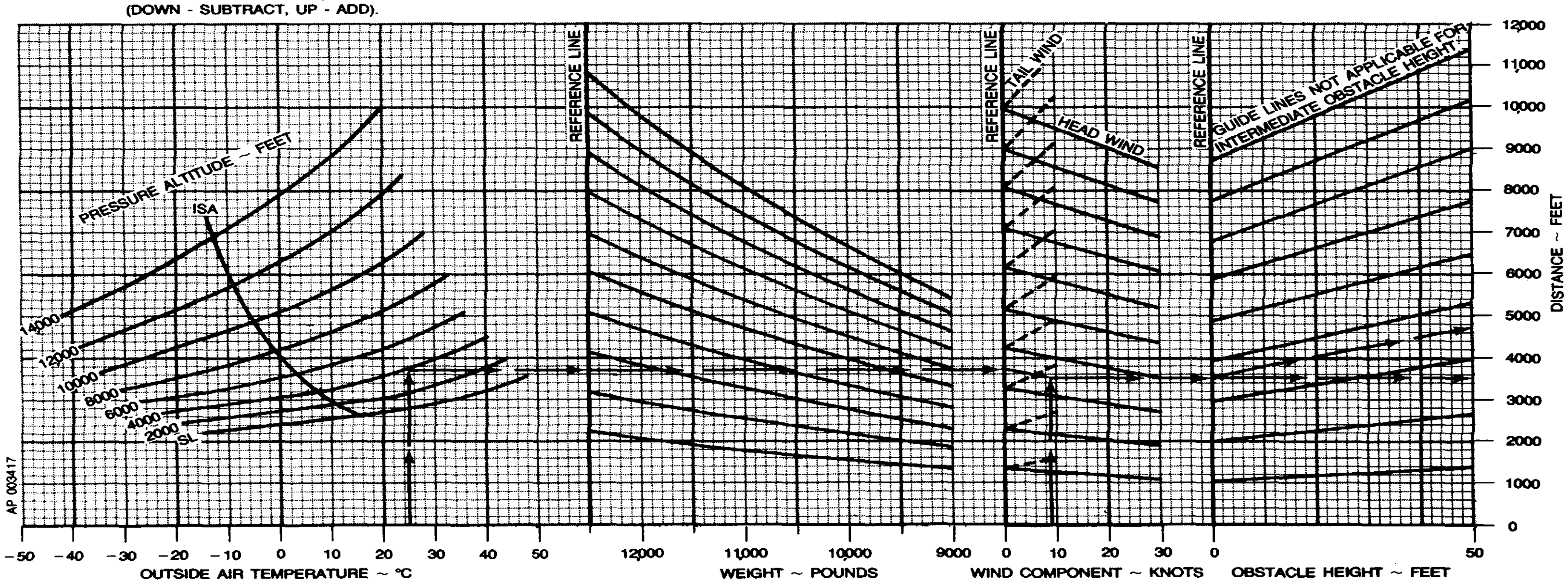


Figure 7-184. Take-off Distance - Flaps 0%

ACCELERATE-STOP - FLAPS 0%

ASSOCIATED CONDITIONS:

POWER	1.	TAKE-OFF POWER SET BEFORE BRAKE RELEASE
	2.	BOTH POWER LEVERS IDLE AT ENGINE FAILURE SPEED AND REVERSE OPERATIVE ENGINE
FLAPS		0%
BRAKING		MAXIMUM
RUNWAY		PAVED, LEVEL, DRY SURFACE

CAUTION: LIMIT REVERSING, AS REQUIRED, TO MAINTAIN DIRECTIONAL CONTROL

WEIGHT ~ LBS	ENGINE FAILURE SPEED ~ KTS
12,500	113
12,000	112
11,000	109
10,000	106
9000	103

EXAMPLE:

OAT	25°C
PRESSURE ALTITUDE	3966 FT
WEIGHT	12,500 LBS
HEADWIND COMPONENT	9.5 KTS
FIELD LENGTH	5800 FT
ENGINE FAILURE SPEED	113 KTS

NOTE:
1. FOR OPERATION WITH ICE VANES EXTENDED, PERFORMANCE IS NOT AFFECTED.
2. ADD OR SUBTRACT 2% OF TOTAL DISTANCE FOR EACH 1% OF RUNWAY SLOPE (DOWN-SUBTRACT, UP-ADD).

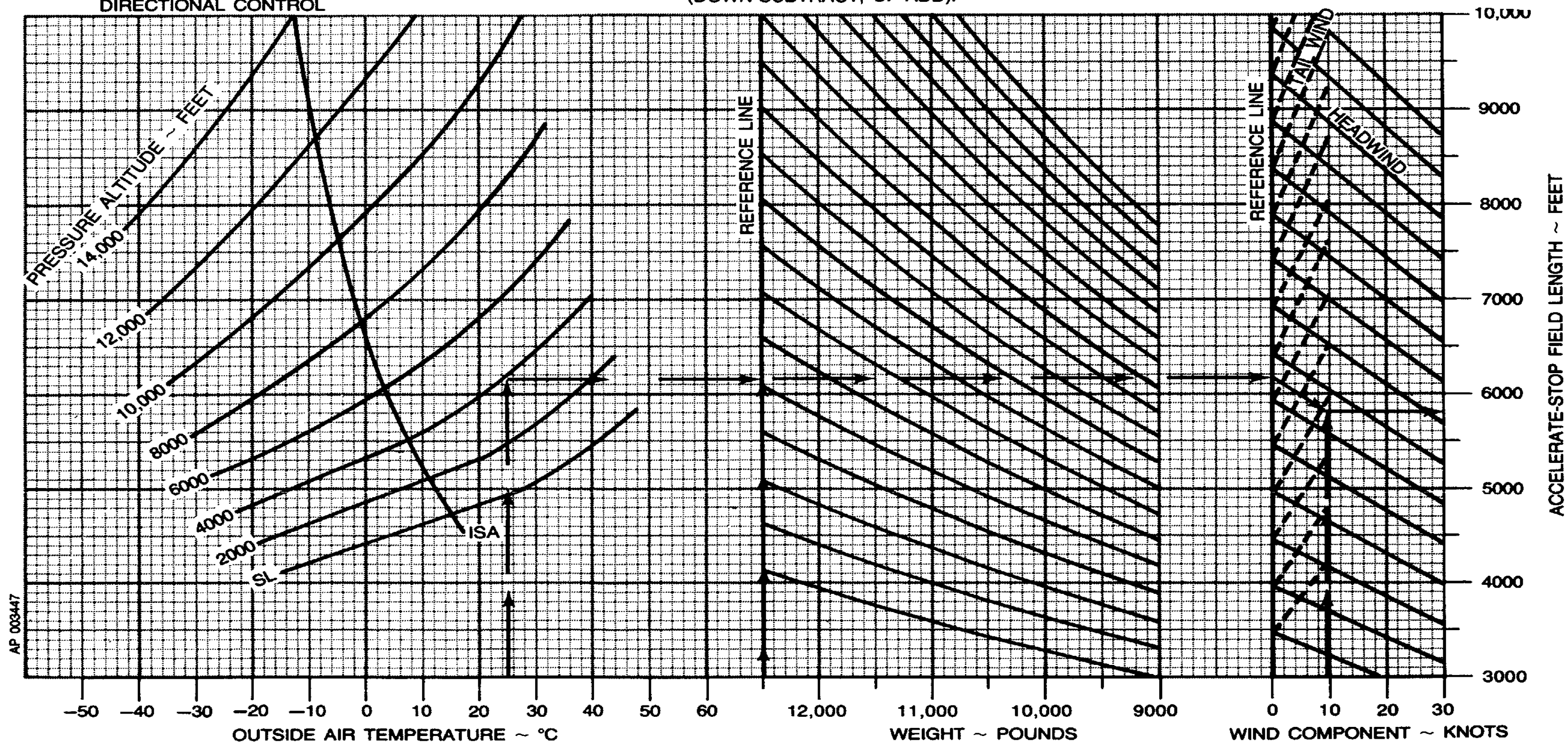


Figure 7-185. Accelerate-Stop - Flaps 0%

ACCELERATE AFTER LIFT-OFF - FLAPS 0%

ASSOCIATED CONDITIONS:

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

WEIGHT ~ LBS	TAKE-OFF SPEED ~ KTS	
	ROTATION	50 FT
12,500	110	121
12,000	109	119
11,000	106	115
10,000	103	111
9000	100	107

EXAMPLE:

OAT .... 25°C
PRESSURE ALTITUDE .... 3966 FT
WEIGHT .... 12,500 LBS
HEADWIND COMPONENT .... 9.5 KTS

GROUND ROLL .... 4300 FT
TOTAL DISTANCE OVER 50 FT OBSTACLE .... 9300 FT
TAKE-OFF SPEED AT ROTATION .... 110 KTS
AT 50 FT .... 121 KTS

NOTE:
1. DISTANCES ASSUME AN ENGINE FAILURE AT LIFT-OFF SPEED AND ENGINE FAILURE AFTER LIFT-OFF EMERGENCY PROCEDURES INITIATED.
2. LIFT-OFF SPEED IS ASSUMED EQUAL TO ENGINE FAILURE SPEED ON ACCELERATE-STOP GRAPH.
3. FOR OPERATION WITH ICE VANES EXTENDED, ADD 6°C TO THE ACTUAL OAT BEFORE ENTERING THE GRAPH.
4. ADD OR SUBTRACT 5% OF TAKE-OFF GROUND ROLL FOR EACH 1% OF RUNWAY SLOPE (DOWN - SUBTRACT, UP - ADD).
5. WEIGHTS IN SHADED AREA MAY NOT PROVIDE POSITIVE GEAR DOWN SINGLE ENGINE CLIMB GRADIENT. REFER TO TAKE-OFF WEIGHT GRAPH FOR THE MAXIMUM WEIGHT AT WHICH THE ACCELERATE AFTER LIFT-OFF PROCEDURE SHOULD BE ATTEMPTED.

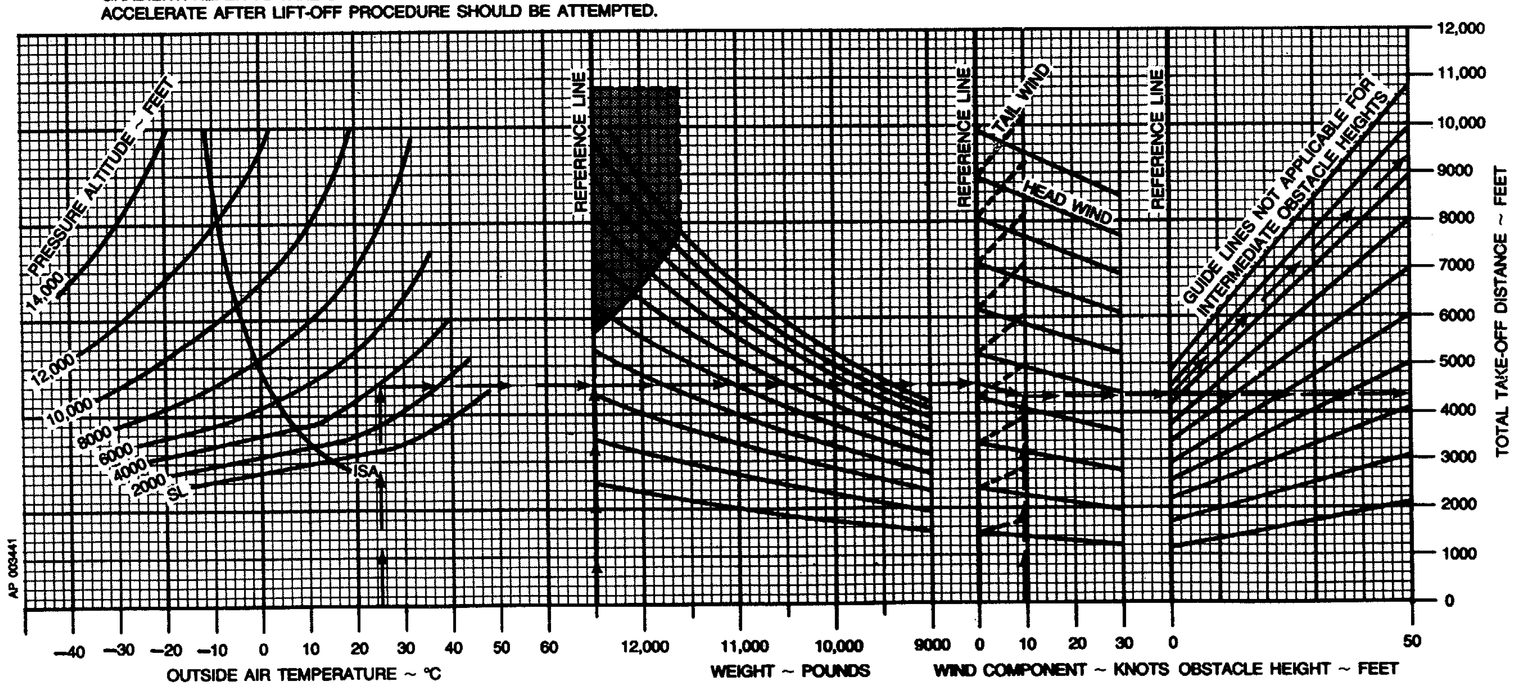


Figure 7-186. Accelerate After Lift-Off - Flaps 0%

NET GRADIENT OF CLIMB — FLAPS 0%

ASSOCIATED CONDITIONS:

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

WEIGHT ~ POUNDS	CLIMB SPEED ~ KNOTS
12,500	121
12,000	119
11,000	115
10,000	111
9000	108

NOTE: FOR OPERATION WITH ICE VANES EXTENDED, ADD 10°C TO THE ACTUAL OAT BEFORE ENTERING GRAPH.

EXAMPLE:

OAT. . . . . 28°C
PRESSURE ALTITUDE. . . 5430 FEET

WEIGHT ~ POUNDS	NET GRADIENT OF CLIMB ~ %
10,600	4.2
9700	5.2
10,314	4.5

CLIMB SPEED (10,314 LBS). . . 112 KNOTS

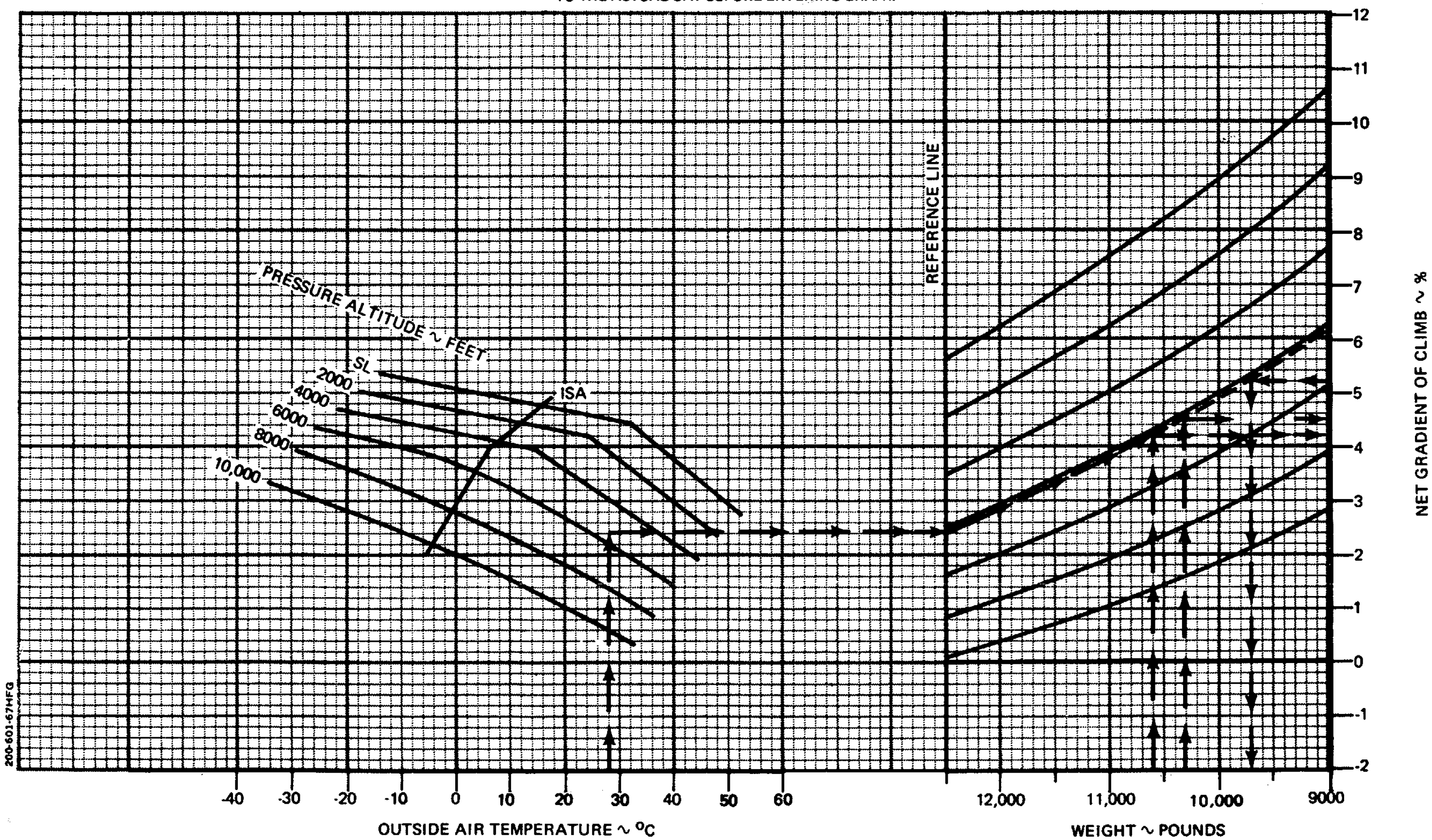


Figure 7-187. Net Gradient of Climb - Flaps 0%

TAKE-OFF WEIGHT - FLAPS 40%
(TO ACHIEVE POSITIVE SINGLE ENGINE CLIMB AT LIFT-OFF)

ASSOCIATED CONDITIONS:

AIRPLANE . . . . AIRBORNE
POWER . . . . TAKE-OFF
FLAPS 40%
INOPERATIVE
PROPELLER . . . . . . FEATHERED

EXAMPLE:

PRESSURE ALTITUDE . . 3966 FT
OAT . . . . 25°C

TAKE-OFF WEIGHT . . . 12,500 LBS

NOTE: FOR OPERATION WITH ICE VANES EXTENDED, NO OFF LOADING IS REQUIRED

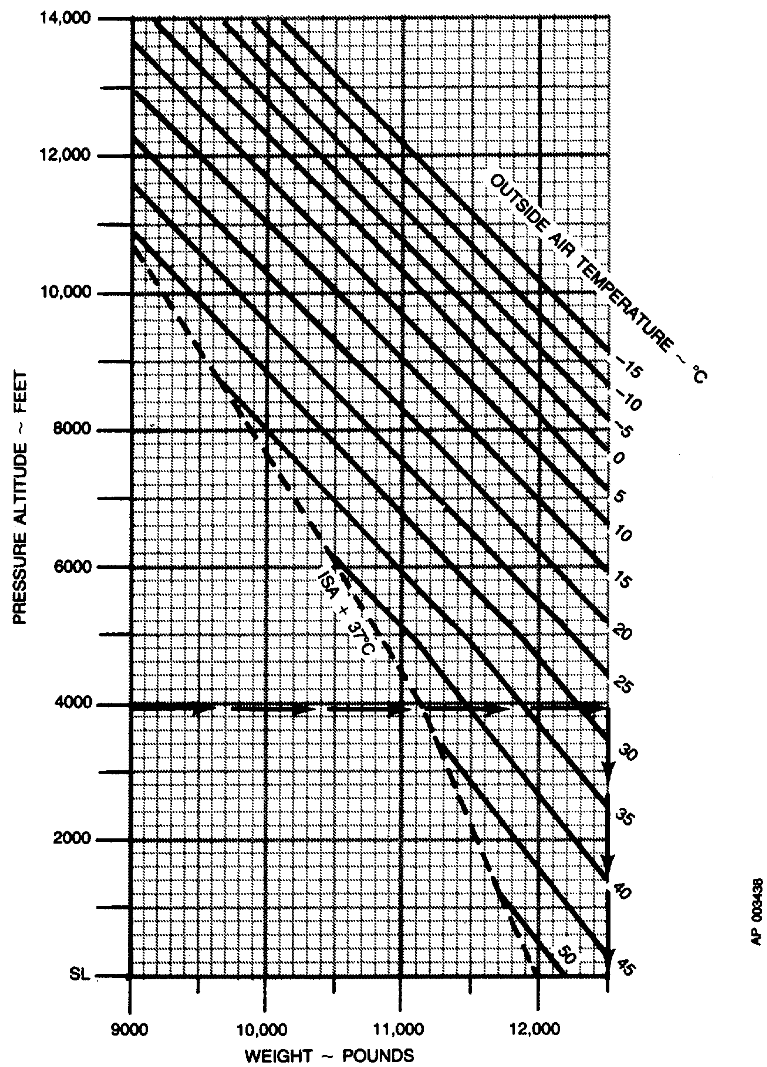


Figure 7-188. Take-off Weight - Flaps 40% (To Achieve Positive Single Engine Climb at Lift-off)

TAKE-OFF DISTANCE - FLAPS 40%

ASSOCIATED CONDITIONS:

POWER................................ TAKE-OFF POWER SET BEFORE BRAKE RELEASE
FLAPS.................................. 40%
LANDING GEAR.................... RETRACT AFTER LIFT-OFF
RUNWAY.............................. PAVED, LEVEL, DRY SURFACE

WEIGHT ~ LBS	TAKE-OFF SPEED ~ KTS.	
	ROTATION	50 FT.
12500	99	106
12000	98	105
11000	97	103
10000	96	101
9000	95	99

EXAMPLE:

OAT.. 25°C
PRESSURE ALTITUDE................................ 3966 FT
TAKE-OFF WEIGHT.................................... 12500 LBS.
HEADWIND COMPONENT........................... 9.5 KTS.

GROUND ROLL.. 2690 FT.
TOTAL DISTANCE OVER
50 FT. OBSTACLE.................................... 3510 FT.
TAKE-OFF SPEED AT ROTATION.............. 99 KTS.
AT 50 FT.. 106 KTS.

NOTE: 1. FOR OPERATION WITH ICE VANES EXTENDED, ADD 10°C TO THE ACTUAL OAT BEFORE ENTERING GRAPH.
2. ADD OR SUBTRACT 5% OF TAKEOFF GROUND ROLL FOR EACH 1% OF RUNWAY SLOPE (DOWN - SUBTRACT, UP - ADD).

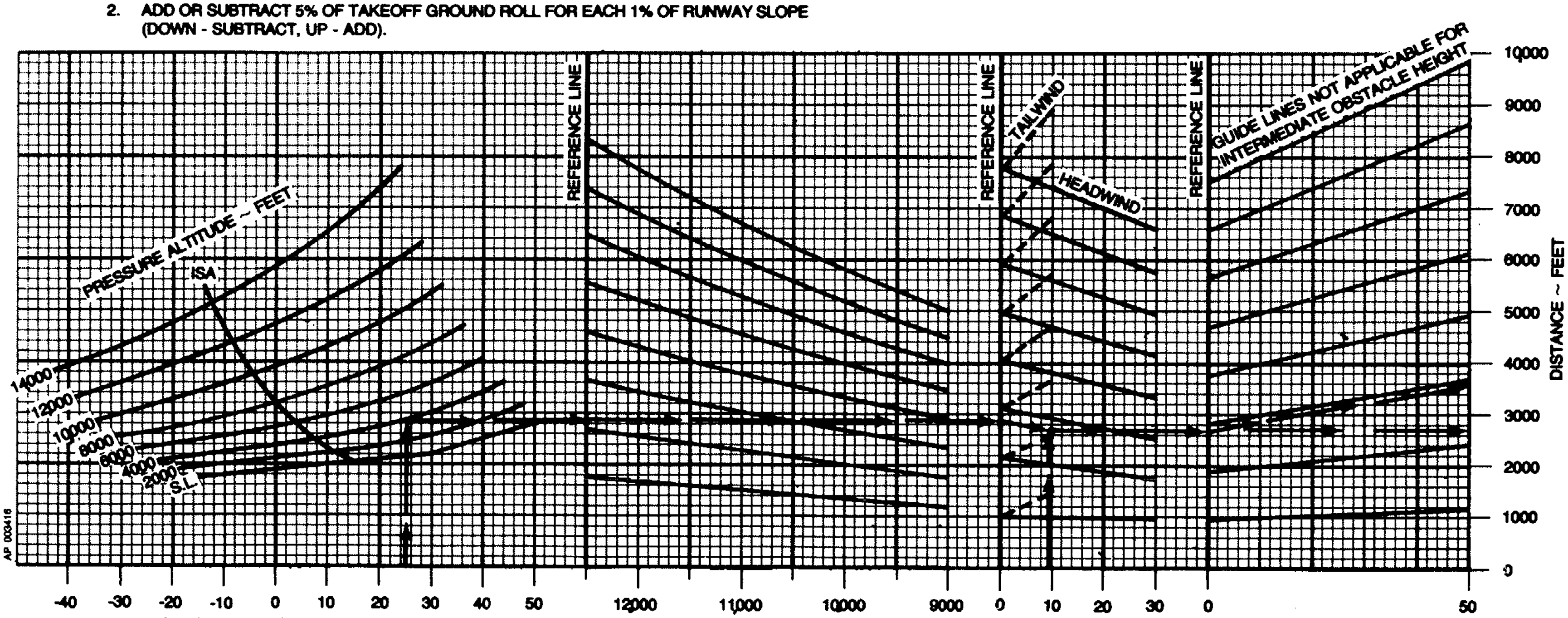


Figure 7-189. Take-off Distance - Flaps 40%

ACCELERATE-STOP - FLAPS 40%

ASSOCIATED CONDITIONS:

POWER . . . . 1. TAKE-OFF POWER SET BEFORE BRAKE RELEASE
2. BOTH POWER LEVERS IDLE AT ENGINE FAILURE SPEED AND REVERSE OPERATING ENGINE

FLAPS 40%
BRAKING . . . . . . MAXIMUM
RUNWAY . . . . . . PAVED, LEVEL, DRY SURFACE

WEIGHT~LBS	ENGINE FAILURE SPEED~KTS
12,500	102
12,000	101
11,000	100
10,000	99
9000	98

EXAMPLE:

OAT . . . . 25 °C
PRESSURE ALTITUDE . . . . 3966 FT
WEIGHT . . . . 12,500 LBS
HEADWIND COMPONENT . . . . . 9.5 KTS

FIELD LENGTH . . . . 4820 FT
ENGINE FAILURE SPEED . . . . . . 102 KTS

NOTE: 1. FOR OPERATION WITH ICE VANES EXTENDED, PERFORMANCE IS NOT AFFECTED.
2. ADD OR SUBTRACT 2% OF TOTAL DISTANCE FOR EACH 1% OF RUNWAY SLOPE (DOWN-SUBTRACT, UP-ADD).

CAUTION: LIMIT REVERSING, AS REQUIRED, TO MAINTAIN DIRECTIONAL CONTROL

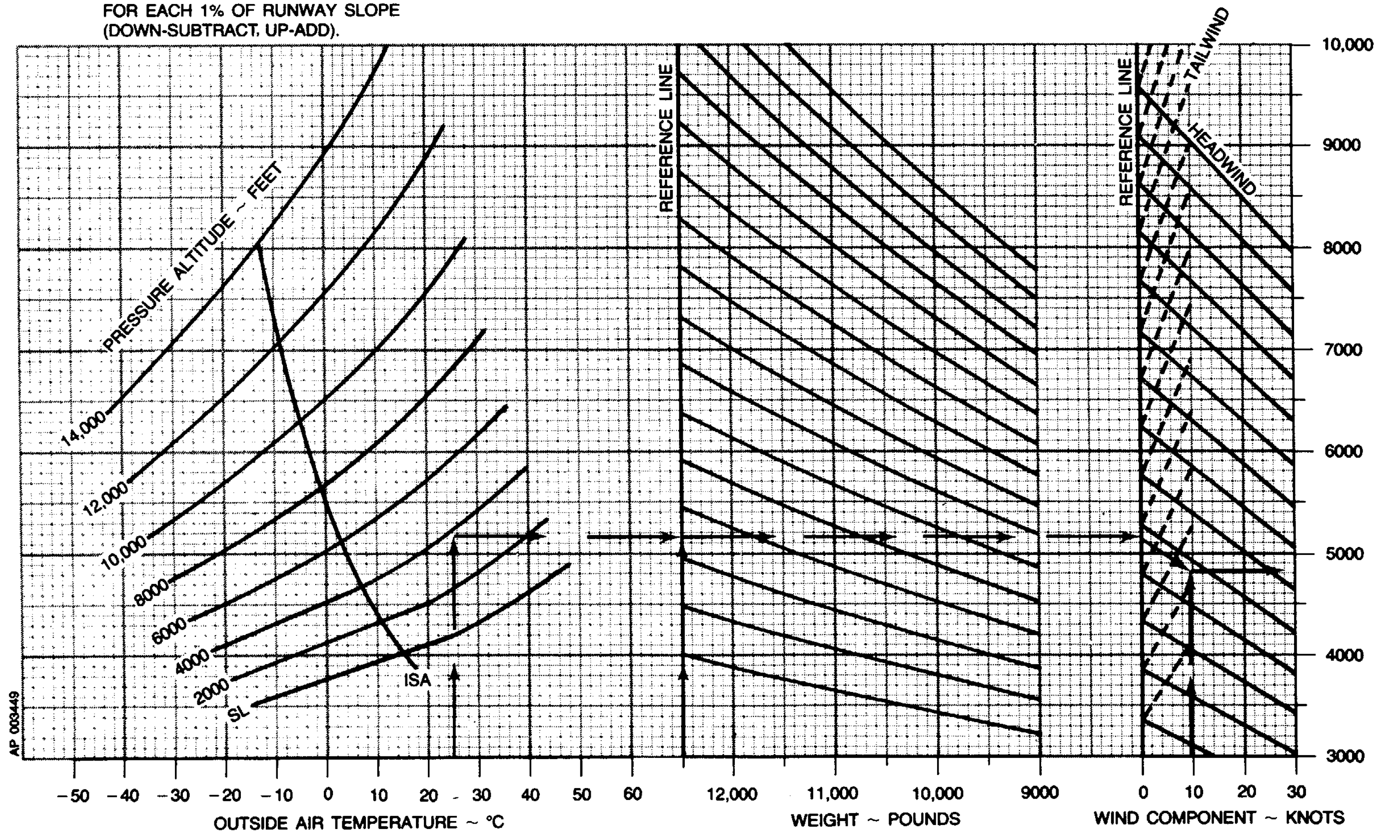


Figure 7-190. Accelerate-Stop - Flaps 40%

ACCELERATE AFTER LIFT-OFF - FLAPS 40%

WEIGHT ~ POUNDS	CLIMB SPEED ~ KNOTS
12,500	125
12,000	124
11,000	121
10,000	118
9000	115

ASSOCIATED CONDITIONS:

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

EXAMPLE:

OAT....................-6°C
PRESSURE ALTITUDE 16,000FT
WEIGHT................ 12,405LBS

RATE OF CLIMB.........1325 FT/MIN
CLIMB GRADIENT...... 7.8%
CLIMB SPEED...........125 KTS

NOTE: FOR OPERATION WITH ICE VANES EXTENDED, ADD 15° C TO THE ACTUAL OAT BEFORE ENTERING GRAPH.

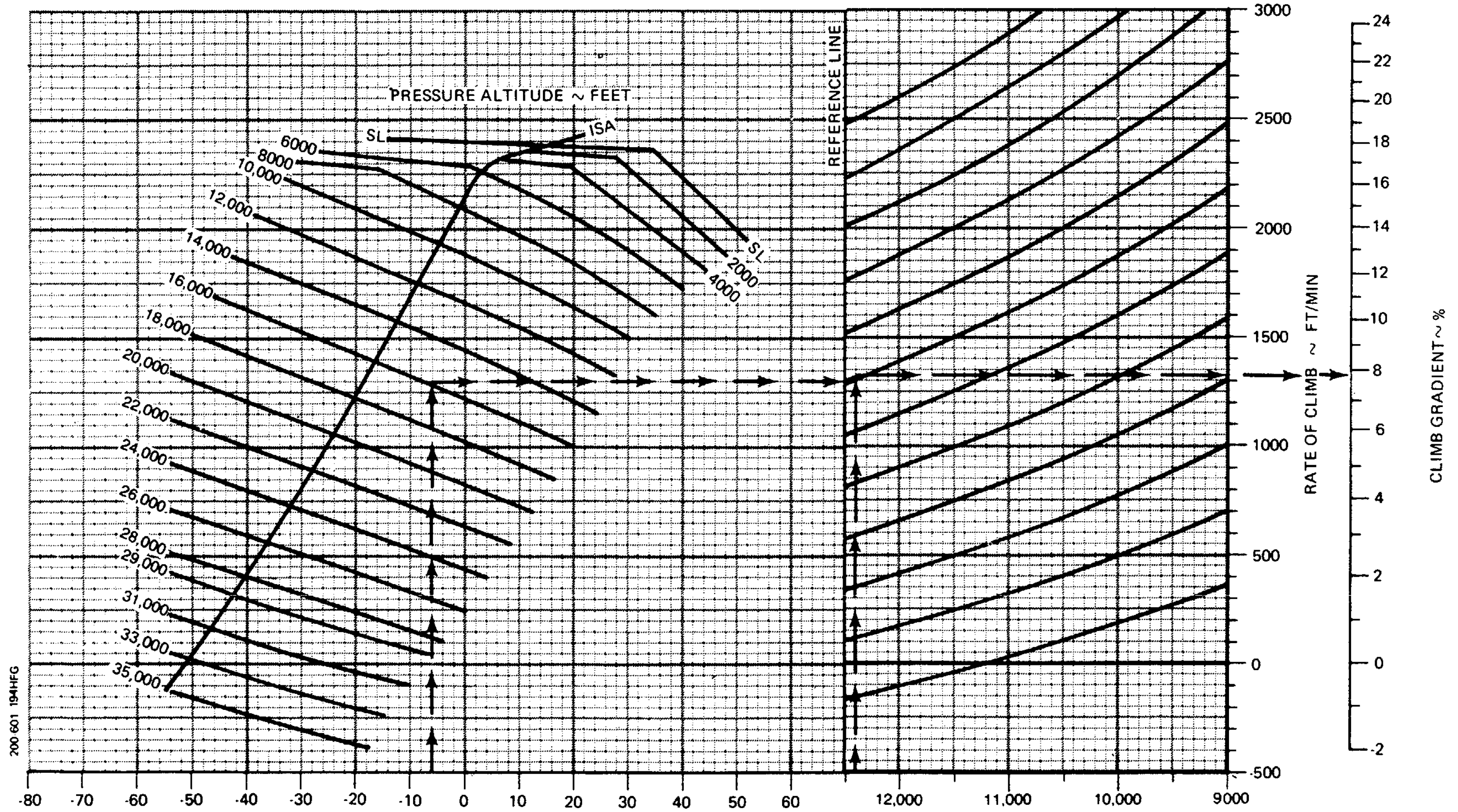


Figure 7-191. Accelerate-After Lift-off - Flaps 40%

NET GRADIENT OF CLIMB — FLAPS 40%

ASSOCIATED CONDITIONS:

POWER . . . . TAKE-OFF
FLAPS 40%
GEAR . . . . UP
INOPERATIVE PROPELLER . . . FEATHERED

WEIGHT ~ POUNDS	CLIMB SPEED ~ KNOTS
12,500	106
12,000	105
11,000	103
10,000	101
9000	99

NOTE: FOR OPERATION WITH ICE VANES EXTENDED, ADD 10°C TO THE ACTUAL OAT BEFORE ENTERING GRAPH.

EXAMPLE:

OAT . . . . 28°C
PRESSURE ALTITUDE . . 5430 FEET

WEIGHT ~ POUNDS	NET GRADIENT OF CLIMB ~ %
11,380	2.1
9000	5.2
10,360	3.3

CLIMB SPEED (10,360 LBS) . . . 102 KNOTS

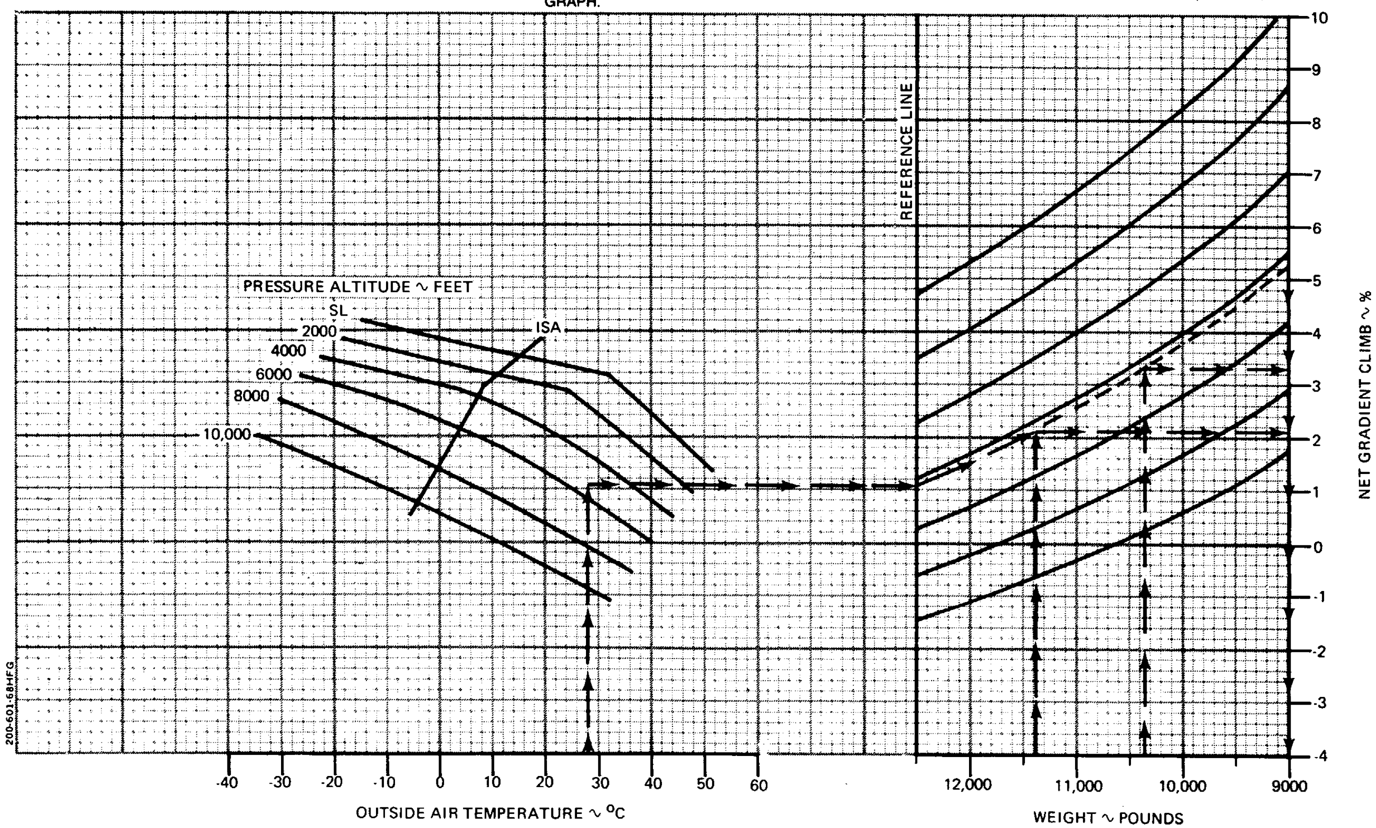


Figure 7-192. Net Gradient of Climb - Flaps 40%

CLIMB - TWO ENGINES - FLAPS 0%

WEIGHT ~ POUNDS	CLIMB SPEED ~ KNOTS
12,500	125
12,000	124
11,000	121
10,000	118
9000	115

ASSOCIATED CONDITIONS:

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

EXAMPLE:

OAT .... -6°C
PRESSURE ALTITUDE .... 16,000 FT
WEIGHT .... 12,405 LBS

RATE OF CLIMB .... 1325 FT/MIN
CLIMB GRADIENT 7.8%
CLIMB SPEED .... 125 KTS

NOTE: FOR OPERATION WITH ICE VANES EXTENDED, ADD 15° C TO THE ACTUAL OAT BEFORE ENTERING GRAPH.

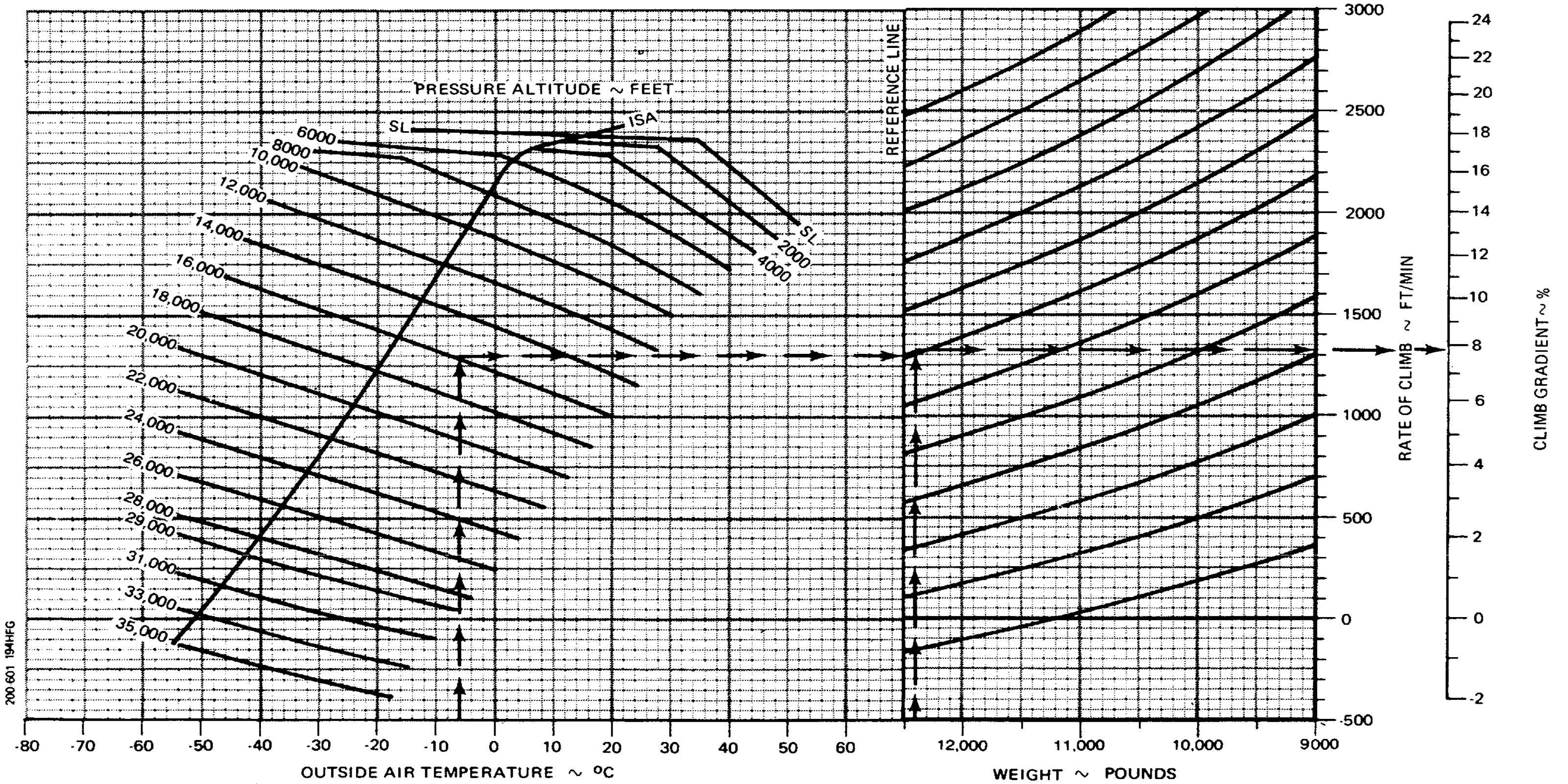


Figure 7-193. Climb - Two Engines - Flaps 0%

CLIMB — TWO ENGINES — FLAPS 40%

ASSOCIATED CONDITIONS:

POWER............. MAXIMUM CONTINUOUS
FLAPS............. 40%
LANDING GEAR.... UP

WEIGHT ~ POUNDS	CLIMB SPEED ~ KNOTS
12,500	125
12,000	124
11,000	121
10,000	118
9000	115

EXAMPLE:

OAT.................... -6°C
PRESSURE ALTITUDE... 16,000 FT
WEIGHT................ 12,405 LBS

RATE-OF-CLIMB .... 1125 FT/MIN
CLIMB GRADIENT....... 7.0%
CLIMB SPEED........... 125 KTS

NOTE: FOR OPERATION WITH ICE VANES EXTENDED, ADD 15°C TO THE ACTUAL OAT BEFORE ENTERING GRAPH.

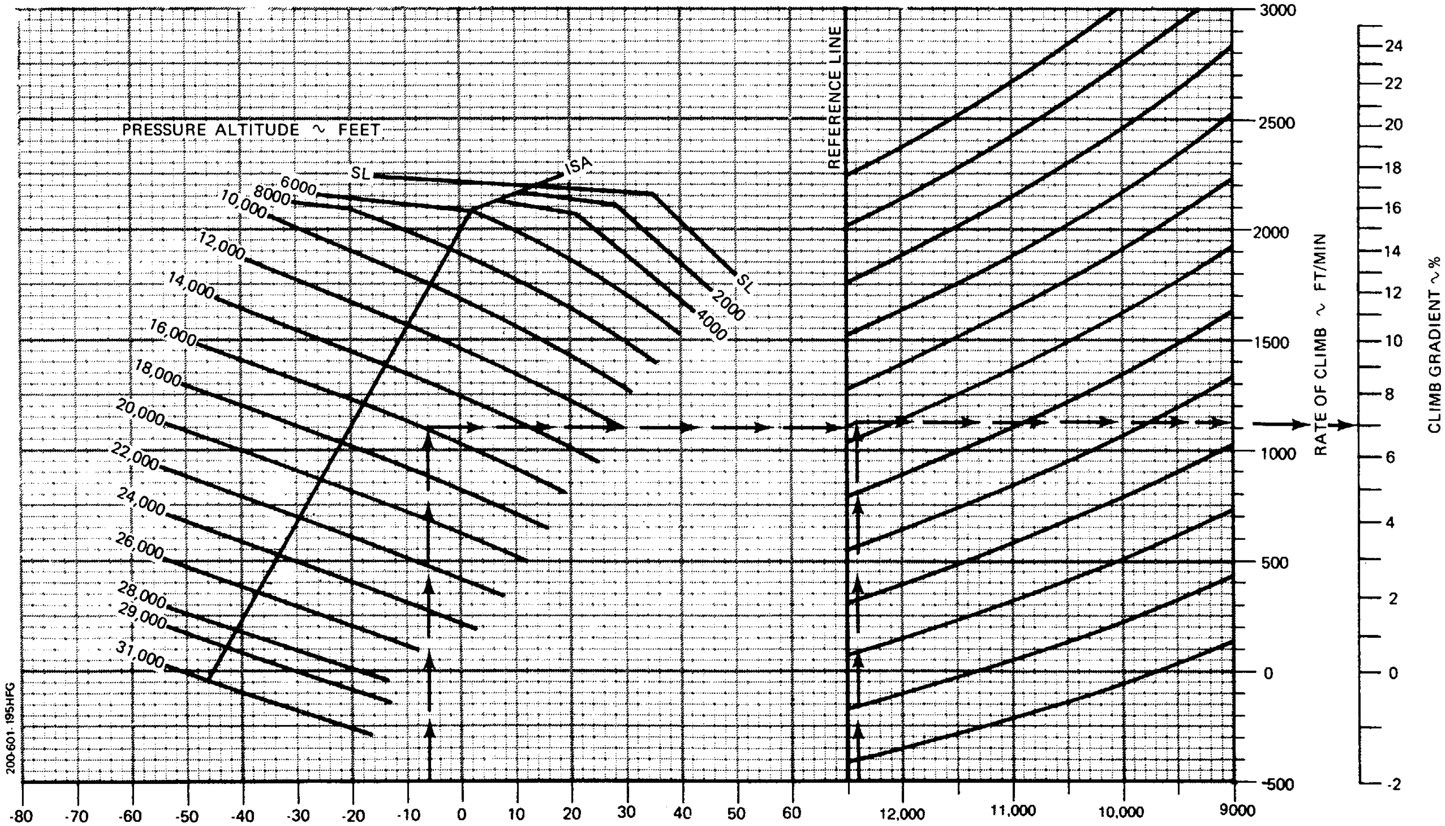


Figure 7-194. Climb - Two Engines - Flaps 40%

CLIMB — ONE ENGINE INOPERATIVE

ASSOCIATED CONDITIONS:

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

NOTE: FOR OPERATION WITH ICE VANES EXTENDED, ADD 10° C TO THE ACTUAL OAT BEFORE ENTERING GRAPH.

WEIGHT ~ POUNDS	CLIMB SPEED ~ KNOTS
12,500	121
12,000	119
11,000	117
10,000	114
9000	111

EXAMPLE:

OAT .... -6°C
PRESSURE ALTITUDE ..... 16,000 FT
WEIGHT .... 12,405 LBS

RATE-OF-CLIMB .... 118 FT/MIN
CLIMB GRADIENT 0.8%
CLIMB SPEED .... 121 KTS

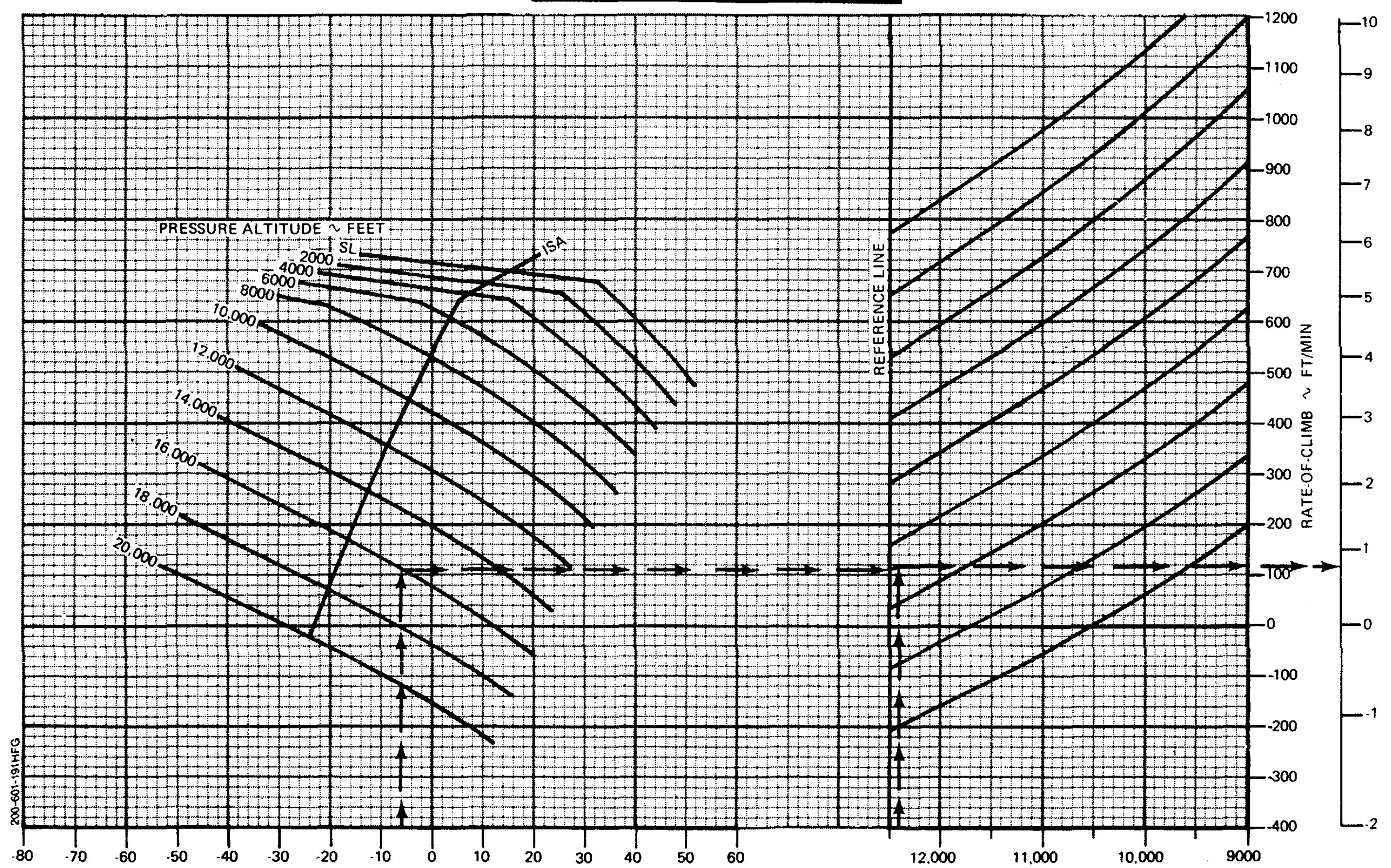


Figure 7-195. Climb - One Engines-Inoperative

SERVICE CEILING - ONE ENGINE INOPERATIVE

ASSOCIATED CONDITIONS:

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

EXAMPLE:

OAT .... −6°C
WEIGHT .... 12,500 LBS
ROUTE SEGMENT MEA .... 16,000 FT

SERVICE CEILING .... 17,400 FT

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

NOTE: SERVICE CEILING IS ABOVE ENROUTE MEA.

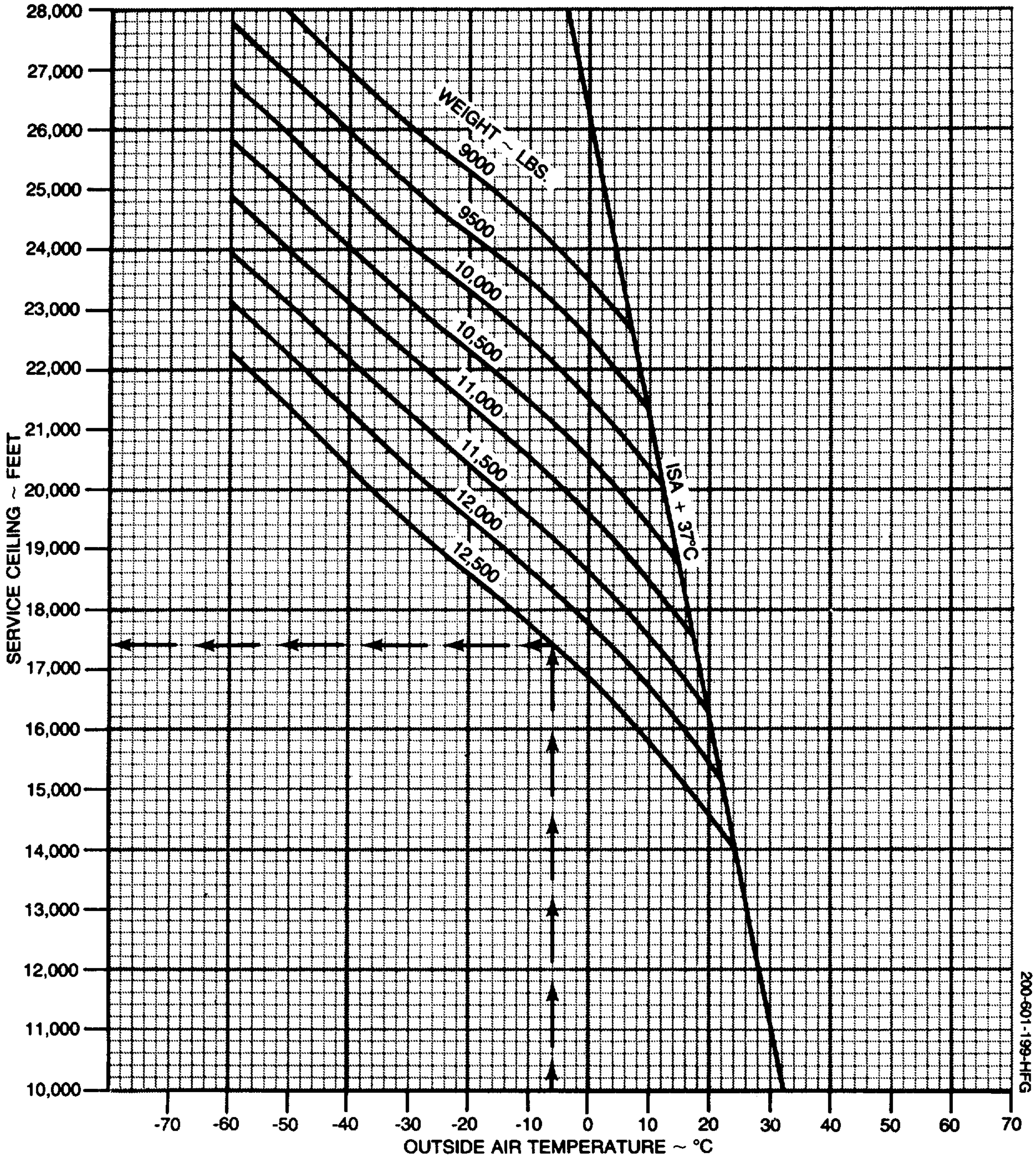


Figure 7-196. Service Ceiling - One Engine-Inoperative.

CLIMB — BALKED LANDING

CLIMB SPEED 100 KNOTS (ALL WEIGHTS)

ASSOCIATED CONDITIONS:

POWER . . . . . . TAKE-OFF
FLAPS 100%
LANDING GEAR . . DOWN

NOTE: FOR OPERATION WITH ICE VANES EXTENTED, ADD 10° C TO ACTUAL OAT BEFORE ENTERING GRAPH.

EXAMPLE:

OAT . . . . 32°C
PRESSURE ALTITUDE . 4730 FT
WEIGHT . . . . 10,937 LBS

RATE-OF-CLIMB . . . . 1450 FT/MIN
CLIMB GRADIENT . . . 12.8 %

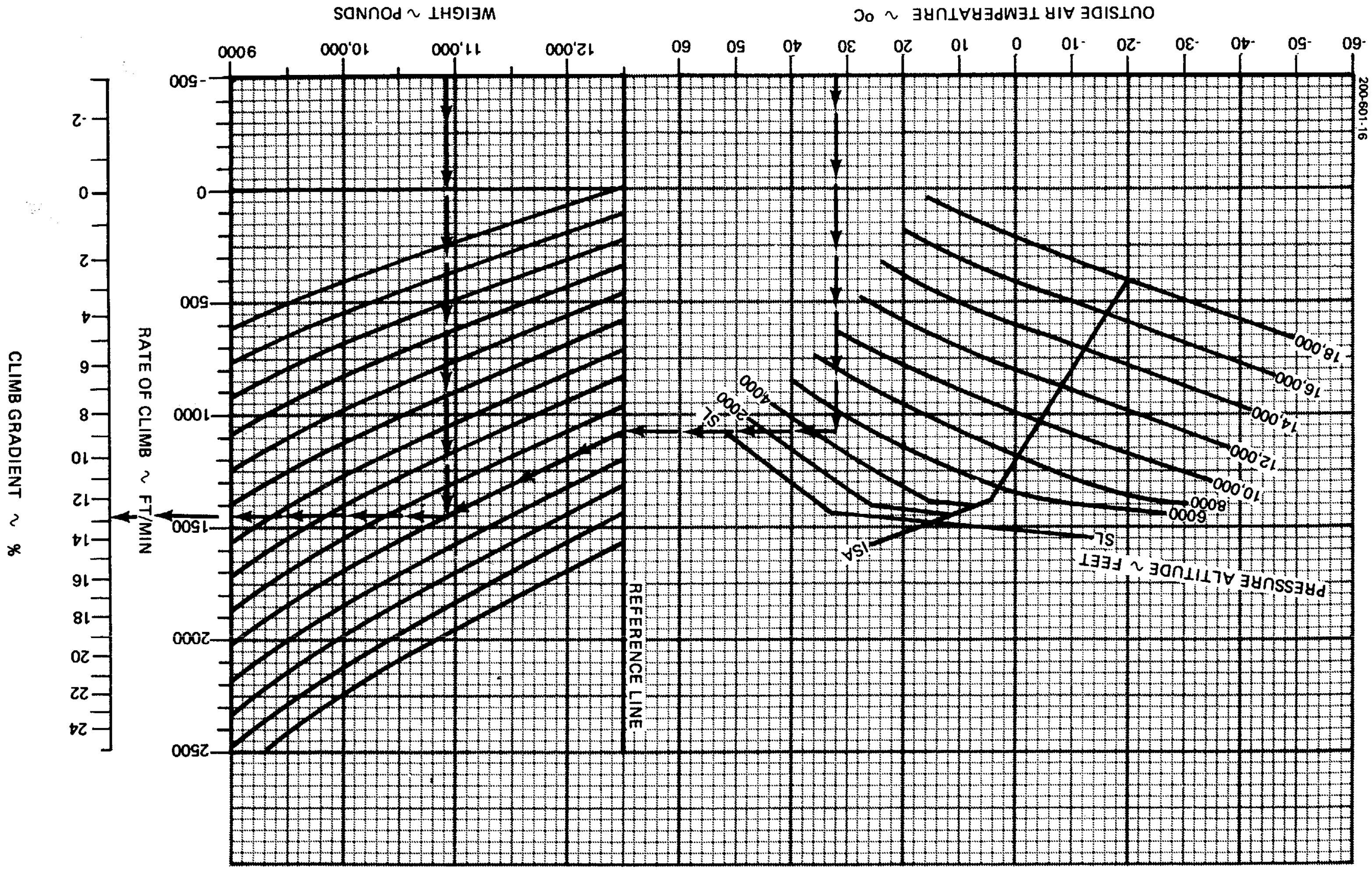


Figure 7-197. Climb - Balked Landing

ASSOCIATED CONDITIONS:

POWER .... RETARDED TO MAINTAIN 800 FT/MIN ON FINAL APPROACH
FLAPS.......................... 100%
RUNWAY...................... PAVED, LEVEL, DRY SURFACE
APPROACH SPEED..... IAS AS TABULATED
BRAKING...................... MAXIMUM

WEIGHT ~ LBS	APPROACH SPEED ~ KTS
12,500	103
12,000	102
11,000	99
10,000	96
9000	93

EXAMPLE:

OAT .... 15°C
PRESSURE ALTITUDE........................ 5650 FT
LANDING WEIGHT .... 11,180 LBS
HEADWIND COMPONENT.................. 10 KTS

GROUND ROLL .... 1580 FT
TOTAL OVER 50 FT. OBSTACLE........ 2700 FT
APPROACH SPEED .... 99 KTS

NOTE: ADD OR SUBTRACT 4% OF TOTAL GROUND ROLL FOR EACH 1% RUNWAY SLOPE (DOWN - ADD, UP - SUBTRACT).

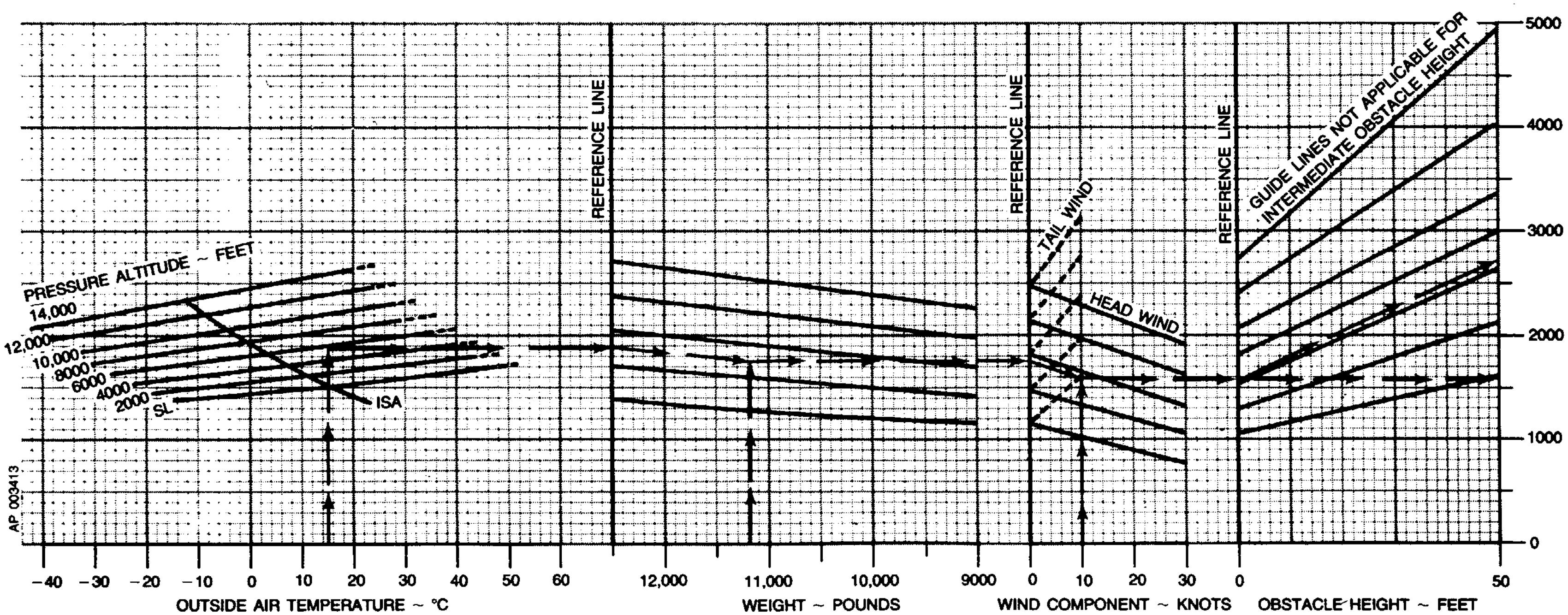


Figure 7-198. Landing Distance Without Propeller Reversing - Flaps 100%

LANDING DISTANCE WITHOUT PROPELLER REVERSING-FLAPS 0%

ASSOCIATED CONDITIONS:

POWER .... RETARDED TO MAINTAIN 900 FT/MIN ON FINAL APPROACH
FLAPS .... UP
RUNWAY .... PAVED, LEVEL, DRY SURFACE
BRAKING .... MAXIMUM

WEIGHT ~ LBS	APPROACH SPEED ~ KTS
12,500	132
12,000	130
11,000	126
10,000	122
9000	117

EXAMPLE:

FLAPS 100% LANDING DISTANCE OVER 50 FT OBSTACLE .... 2700 FT
LANDING WEIGHT .... 11,180 LBS

FLAPS UP LANDING DISTANCE OVER 50 FT. OBSTACLE .... 3800 FT
APPROACH SPEED .... 127 KTS

NOTE: 1. TO DETERMINE FLAPS UP LANDING DISTANCE, READ THE FLAPS 100% LANDING DISTANCE APPROPRIATE TO THE OAT, ALTITUDE, WEIGHT AND WIND FROM THE LANDING DISTANCE GRAPH WITHOUT REVERSING - FLAPS 100%. ENTER THE FLAPS UP LANDING DISTANCE GRAPH AND READ THE DISTANCE.
2. ADD OR SUBTRACT 4% OF TOTAL GROUND ROLL FOR EACH 1% RUNWAY SLOPE (DOWN - ADD, UP - SUBTRACT).

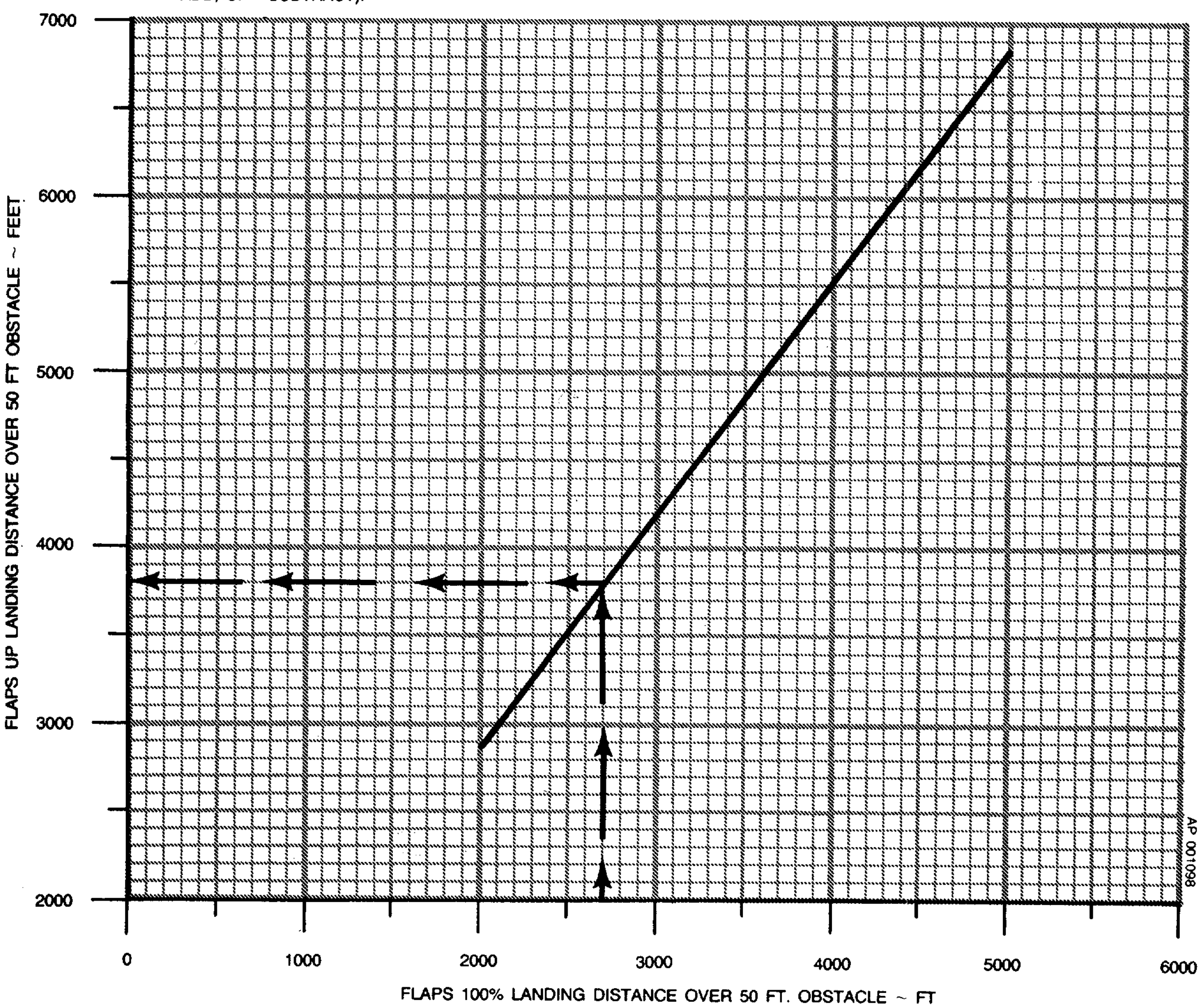


Figure 7-199. Landing Distance Without Propeller Reversing - Flaps 0%

LANDING DISTANCE WITHOUT PROPELLER REVERSING-FLAPS 100%

ASSOCIATED CONDITIONS:

POWER .... RETARDED TO MAINTAIN 800 FT/MIN ON FINAL APPROACH
FLAPS........................... 100%
RUNWAY...................... PAVED, LEVEL, DRY SURFACE
APPROACH SPEED..... IAS AS TABULATED
BRAKING...................... MAXIMUM

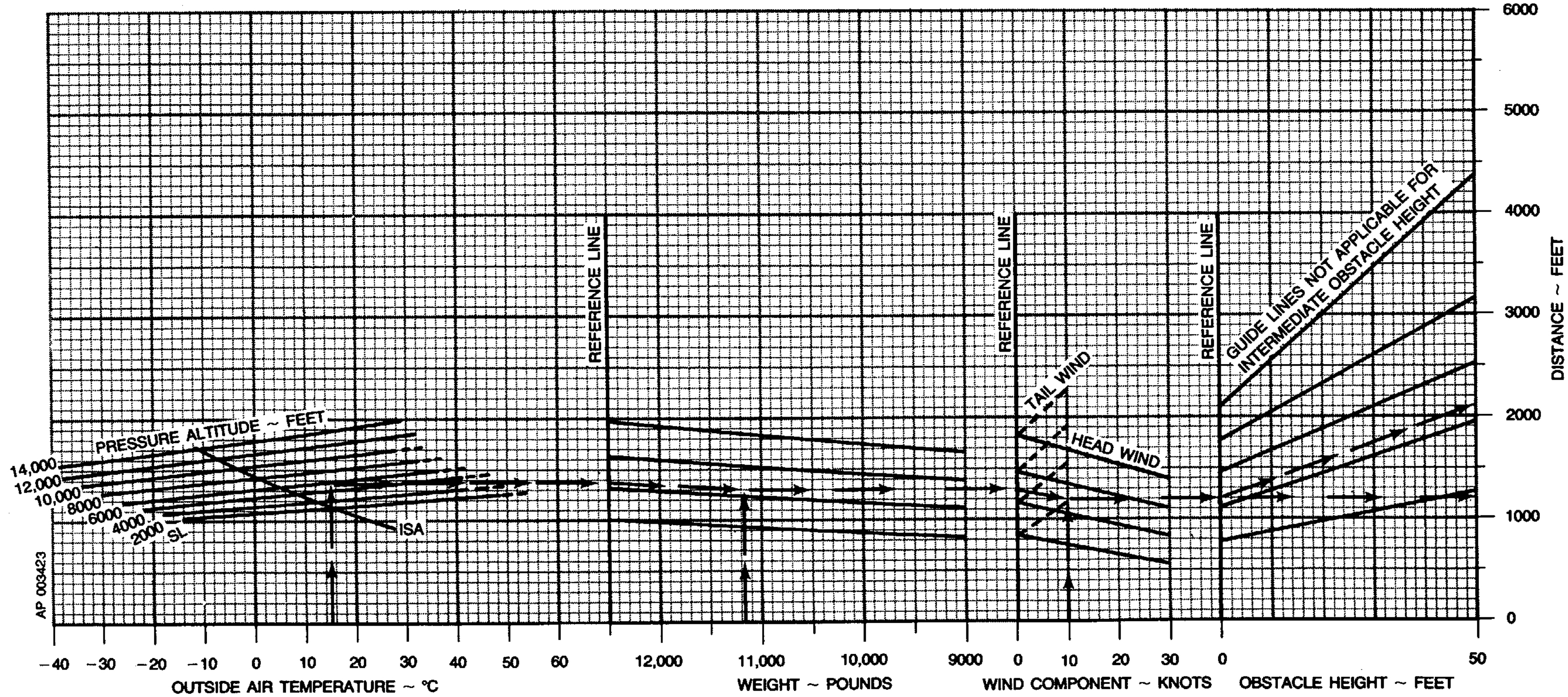
WEIGHT ~ LBS	APPROACH SPEED ~ KTS
12,500	103
12,000	102
11,000	99
10,000	96
9000	93

EXAMPLE:

OAT .... 15°C
PRESSURE ALTITUDE.................... 5650 FT
LANDING WEIGHT .... 11,180 LBS
HEADWIND COMPONENT.............. 10 KTS

GROUND ROLL .... 1200 FT
TOTAL OVER 50 FT OBSTACLE..... 2100 FT
APPROACH SPEED .... 100 KTS

NOTE: ADD OR SUBTRACT 5% FROM TOTAL GROUND ROLL FOR EACH 1% RUNWAY SLOPE (DOWN - ADD, UP - SUBTRACT).



Landing Distance Without Propeller Reversing-Flaps 0%

LANDING DISTANCE WITH PROPELLER REVERSING-FLAPS 0%

ASSOCIATED CONDITIONS:

POWER .... RETARDED TO MAINTAIN 1000 FT/MIN ON FINAL APPROACH
FLAPS .... UP
RUNWAY .... PAVED, LEVEL, DRY SURFACE
APPROACH SPEED .... IAS AS TABULATED
BRAKING .... MAXIMUM
CONDITION LEVERS .... HIGH IDLE
PROPELLER CONTROLS.... FULL FORWARD
POWER LEVERS .... MAXIMUM REVERSE AFTER TOUCHDOWN

EXAMPLE:

FLAPS 100% LANDING DISTANCE OVER 50 FT OBSTACLE .... 2100 FT
LANDING WEIGHT .... 11,180 LBS

FLAPS UP LANDING DISTANCE OVER 50 FOOT OBSTACLE .... 2670 FT
APPROACH SPEED .... 127 KTS

WEIGHT LBS	APPROACH SPEED KTS
12,500	132
12,000	130
11,000	126
10,000	122
9000	117

NOTE: 1. TO DETERMINE FLAPS UP LANDING DISTANCE, READ THE FLAPS 100% LANDING DISTANCE APPROPRIATE TO THE OAT, ALTITUDE, WEIGHT, AND WIND FROM THE LANDING DISTANCE GRAPH WITH REVERSING - FLAPS 100%, ENTER THE FLAPS UP LANDING DISTANCE GRAPH AND READ THE DISTANCE.
2. ADD OR SUBTRACT 5% FROM TOTAL GROUND ROLL FOR EACH 1% RUNWAY SLOPE (DOWN - ADD, UP - SUBTRACT).

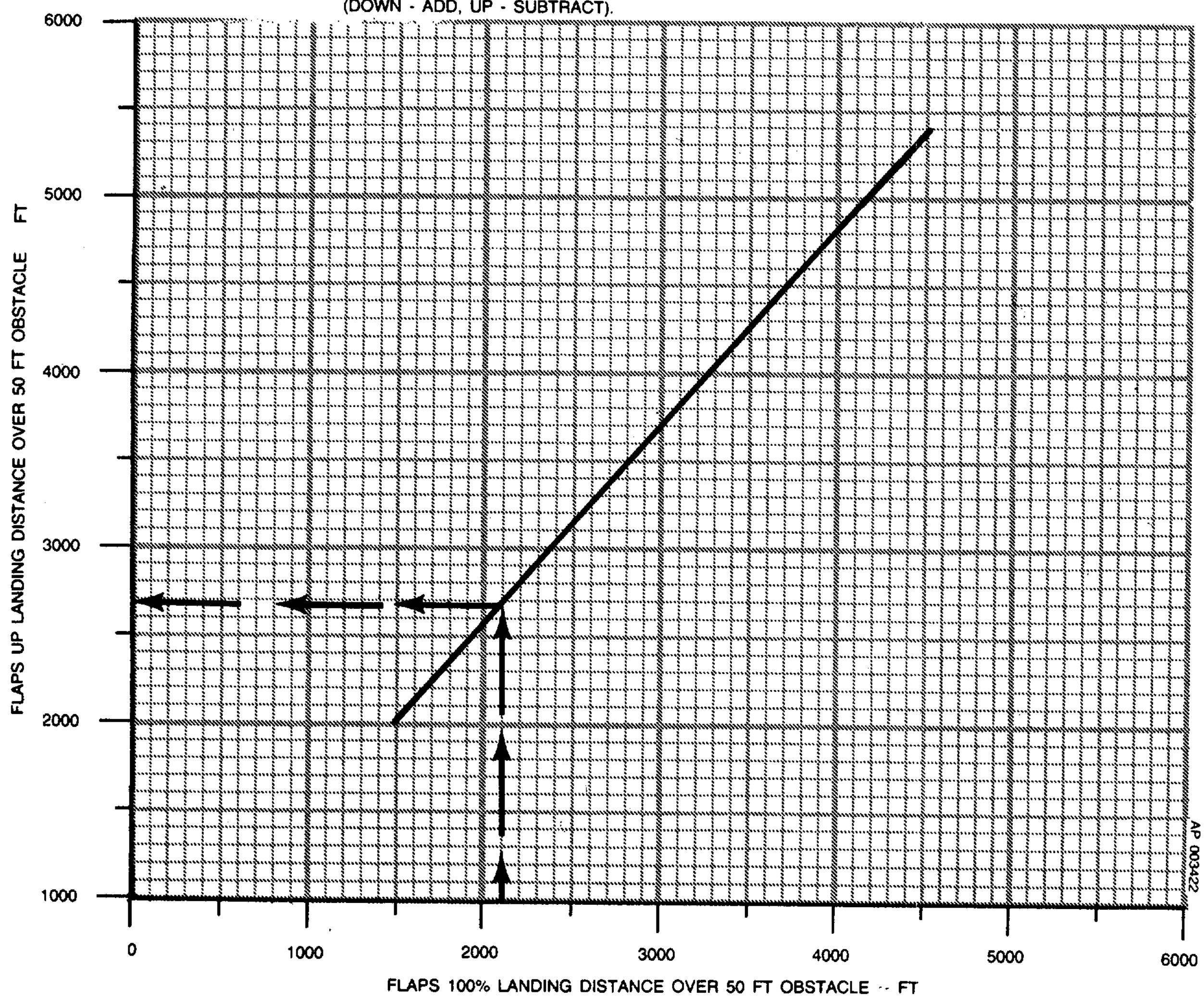


Figure 7-201. Landing Distance With Propeller Reversing-Flaps 0%

STOPPIN DISTANCE FACTORS

EXAMPLE:

1. LANDING DISTANCE (FLAPS 100% NO REV)
   GROUND ROLL (DRY) .... 1580 FT
   TOTAL OVER 50 FT OBSTACLE .... 2700 FT
   RUNWAY CONDITION READING 8.0
   LANDING WEIGHT .... 11,180 LBS

   STOPPING FACTOR 1.62
   LANDING DISTANCE (FACTORED)
   GROUND ROLL (1580 x 1.62) 2560
   AIR DISTANCE (2700 − 1580) 1120
   TOTAL OVER 50 FT OBSTACLE 3680

2. ACCELERATE - STOP DISTANCE (FLAPS 0% NO REV)
   ACCELERATE - STOP DISTANCE .... 5890 FT
   ACCELERATE AFTER LIFT-OFF
   GROUND ROLL .... 4750 FT
   RUNWAY CONDITION READING 10.0
   TAKE-OFF WEIGHT .... 12,500 LBS

   STOPPING FACTOR 1.34
   STOPPING DISTANCE
   [(5890 − 4750) x 1.34] .... 1528 FT
   ACCELERATE DISTANCE .... 4750 FT
   ACCELERATE - STOP DISTANCE
   (1528 + 4750) .... 6278 FT

NOTE: 1. IF RCR READING IS NOT AVAILABLE, ASSUME ICY RUNWAY RCR = 5.0 AND WET RUNWAY RCR = 12.0.
2. ONE ENGINE INOPERATIVE STOPPING DISTANCES WILL NOT ACCOUNT FOR REVERSING

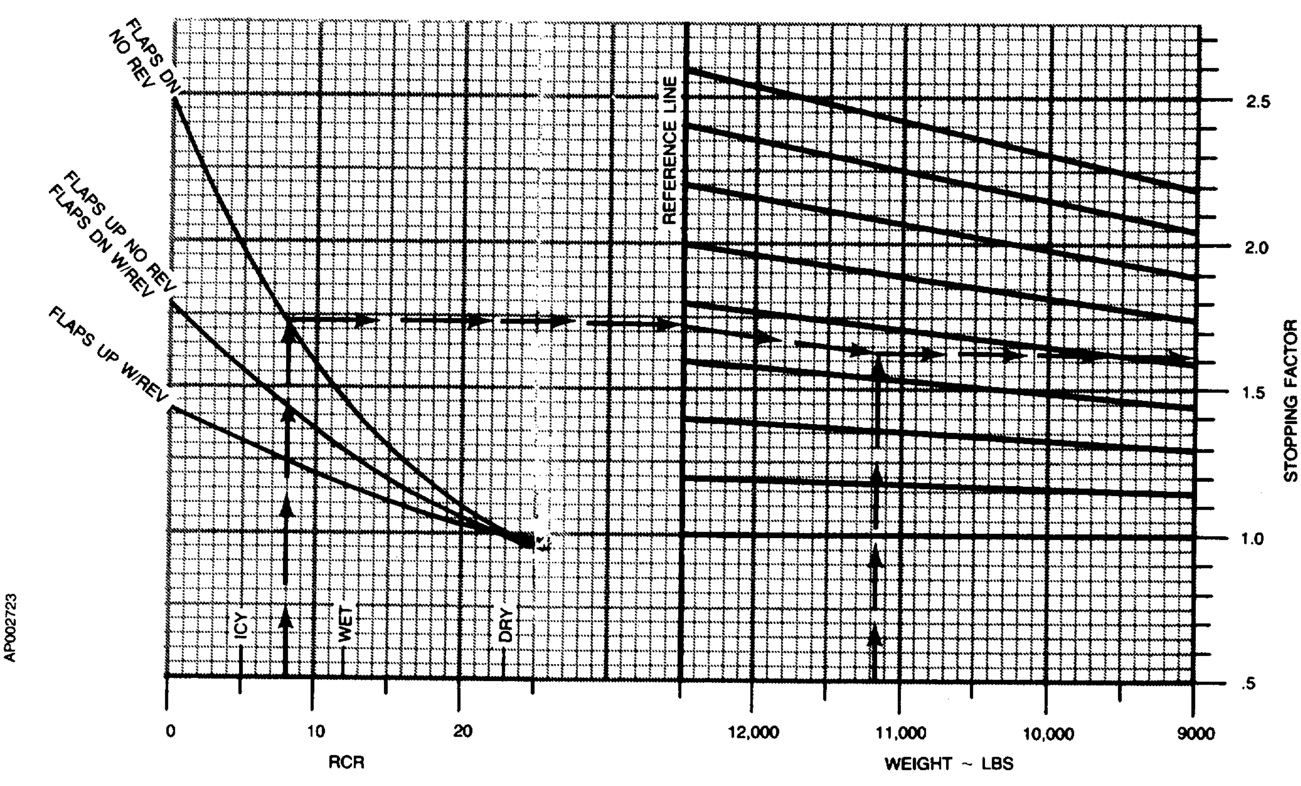


Figure 7-202. Stopping Distance Factors

SECTION III MODEL C-12D
INTRODUCTION TO CRUISE CONTROL

NOTE

The graphs and tables in this part present cruise information for various parameters of weight, power, altitude and temperature. Examples have been presented using conditions specified below.

The following calculations provide information for flight planning at various parameters of weight, power, altitude, and temperature.

Calculations for flight time, block speed, and fuel requirements for a proposed flight from Denver to Reno at FL260 are detailed below.

Enter the ISA CONVERSION Graph at the conditions indicated:

DEN	Pressure Altitude	5430 feet
	OAT	280C
	ISA Condition	ISA + 230C
DEN - SLC	Pressure Altitude	26,000 feet
	OAT	-10°C
	ISA Condition	ISA + 270C
SLC - RNO	Pressure Altitude	26,000 feet
	OAT	-200C
	ISA Condition	ISA + 170C
RNO	Pressure Altitude	4730 feet
	OAT	320C
	ISA Condition	ISA + 270C

Enter the TIME, FUEL, AND DISTANCE TO CLIMB Graph at 280C, to 5430 feet, and to 12,500 pounds, and enter at -100C, to 26,000 feet and to 12,500 pounds, and read:

Time to Climb .... 25 - 3 = 22 minutes
Fuel Used to Climb .... 275 - 45 = 230 pounds
Distance Traveled............ 80 - 11 = 69 nautical miles

Enter the TIME, FUEL, AND DISTANCE TO DESCEND Graph at 26,000 feet, and enter again at 4730 feet to read:

Time to Descend .... 17 - 3 = 14 minutes
Fuel Used to Descend............ 168 - 36 = 132 pounds
Descent Distance............ 81 - 14 = 67 nautical miles

The estimated average cruise weight is approximately 11,600 pounds.

Enter the tables for RECOMMENDED CRUISE POWER at 1700 RPM for ISA + 100C, ISA + 200C, and ISA + 300C, and read the cruise speeds for 26,000 feet at 12,000 pounds and 11,000 pounds.

Interpolate between these speeds for ISA + 270C and ISA + 170C at 11,600 pounds:

Cruise True Airspeed (ISA + 270C) .... 251 knots
Cruise True Airspeed (ISA + 170C) .... 257 knots

CRUISE TRUE AIRSPEEDS AT FL 260

12,000 POUNDS			11,000 POUNDS		
ISA+100C	**ISA+200C**	**ISA+300C**	**ISA+10OC**	**ISA+200C**	**ISA+300C**
257	254	246	262	260	254

Enter the *RECOMMENDED CRUISE POWER at 1700 RPM Graph at 26,000 feet, and read the torque settings for ISA + 270C (-30C IOAT) and ISA + 170C (-130C IOAT):

ISA + 270C (-30C IOAT) .... 59% torque per engine
ISA + 170C (-13° IOAT) .... 63% torque per engine

Enter the *FUEL FLOW AT RECOMMENDED CRUISE POWER at 1700 RPM Graph at 26,000 feet, and read the fuel flow for ISA + 270C (-30C IOAT) and ISA + 170C (-130C IOAT):

Time and Fuel Used were calculated at Maximum Cruise Power at 1700 RPM as follows:

Distance
Total Fuel Flow .... 516 lbs/hr
ISA + 270C (-30C IOAT) Fuel Flow Per Engine .... 246 lbs/hr
Total Fuel Flow .... 492 lbs/hr

ISA + 170C (-130C IOAT) Fuel Flow Per Engine. .... 258 lbs/hr

***NOTE**

For flight planning, enter these graphs at the forecasted ISA condition; for enroute power settings and fuel flow, enter the graphs at the actual IOAT.

Time = 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
DEN - EKR	*86	236	00:22	180
EKR - SLC	192	232	00:50	408
SLC - BVL	81	245	00:20	171
BLV - BAM	145	244	00:36	307
BAM - RNO	*78	223	00:21	181
*Distance required to climb or descend has been subtracted from segment distance.				

ITEM	TIME - FUEL - DISTANCE TIME HRS: MINS	FUEL POUNDS	DISTANCE NM
Start, Runup, Taxi, and Take-off Acceleration	00:00.0	90	0.0
Climb	00:22.0	230	69.0
Cruise	02:29.0	1247	582.0
Descent	00:14.0	132	67.0
Total	03:05.0	1699	718.0
Total Flight Time: 3 hours, 05 minutes Block Speed: 718 NM+ 3 hours, 05 minutes = 233 knots			

Reserve Fuel (45 minutes at Maximum Range Power): Weight at end of cruise was assumed to be 11,000 pounds. Enter the tables for MAXIMUM RANGE POWER at 1700 RPM for ISA + 100C and ISA + 200C at 26,000 feet.

ISA + 10°C .... 416 lbs/hr Total Fuel Flow
ISA + 20°C .... 426 lbs/hr Total Fuel Flow

Interpolate to find fuel flow at ISA + 17°C:

Total fuel flow for reserve = 416 + 7 = 423 lbs/hr

Reserve Fuel = 45 minutes X 423 lbs/hr = 318 lbs

Total Fuel: 1699 + 318 = 2017 pounds (301 gallons Aviation Kerosene)

ISA CONVERSION

PRESSURE ALTITUDE vs OUTSIDE AIR TEMPERATURE

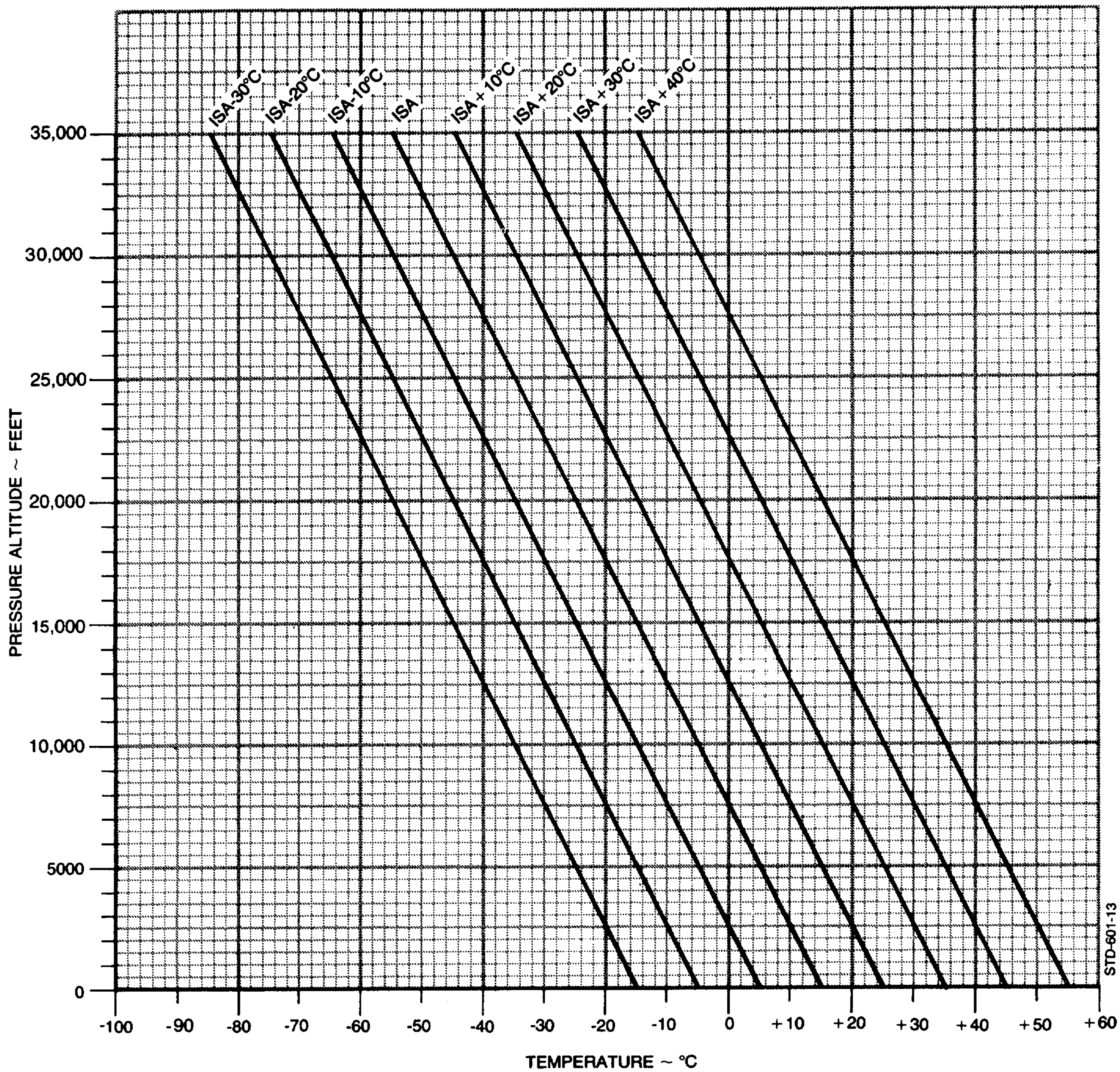


Figure 7-203. ISA Conversion

TIME, FUEL, AND DISTANCE TO CLIMB

ASSOCIATED CONDITIONS:

PROPELLER .... 1900 RPM
TGT, OR .... 725°C
TORQUE 100%

ALTITUDE ~ FEET	CLIMB SPEED ~ KNOTS
S L TO 10,000	155
10,000 TO 20,000	135
20,000 TO 25,000	125
25,000 TO 35,000	115

EXAMPLE:

OAT AT TAKE-OFF .... 28°C
OAT AT CRUISE .... -10°C
AIRPORT PRESSURE ALTITUDE .... 5430 FT
CRUISE ALTITUDE .... 26000 FT
INITIAL CLIMB WEIGHT .... 12500 LBS

TIME TO CLIMB (25 - 3) .... 22 MIN
FUEL TO CLIMB (275 - 45) .... 230 LBS
DISTANCE TO CLIMB (80 - 11) .... 69 NM

NOTE: 1. ADD 90 LBS FUEL FOR START, TAXI AND TAKE-OFF.
2. FOR OPERATION WITH ICE VANES EXTENDED, ADD 20°C. TO THE ACTUAL OAT BEFORE ENTERING THE GRAPH.

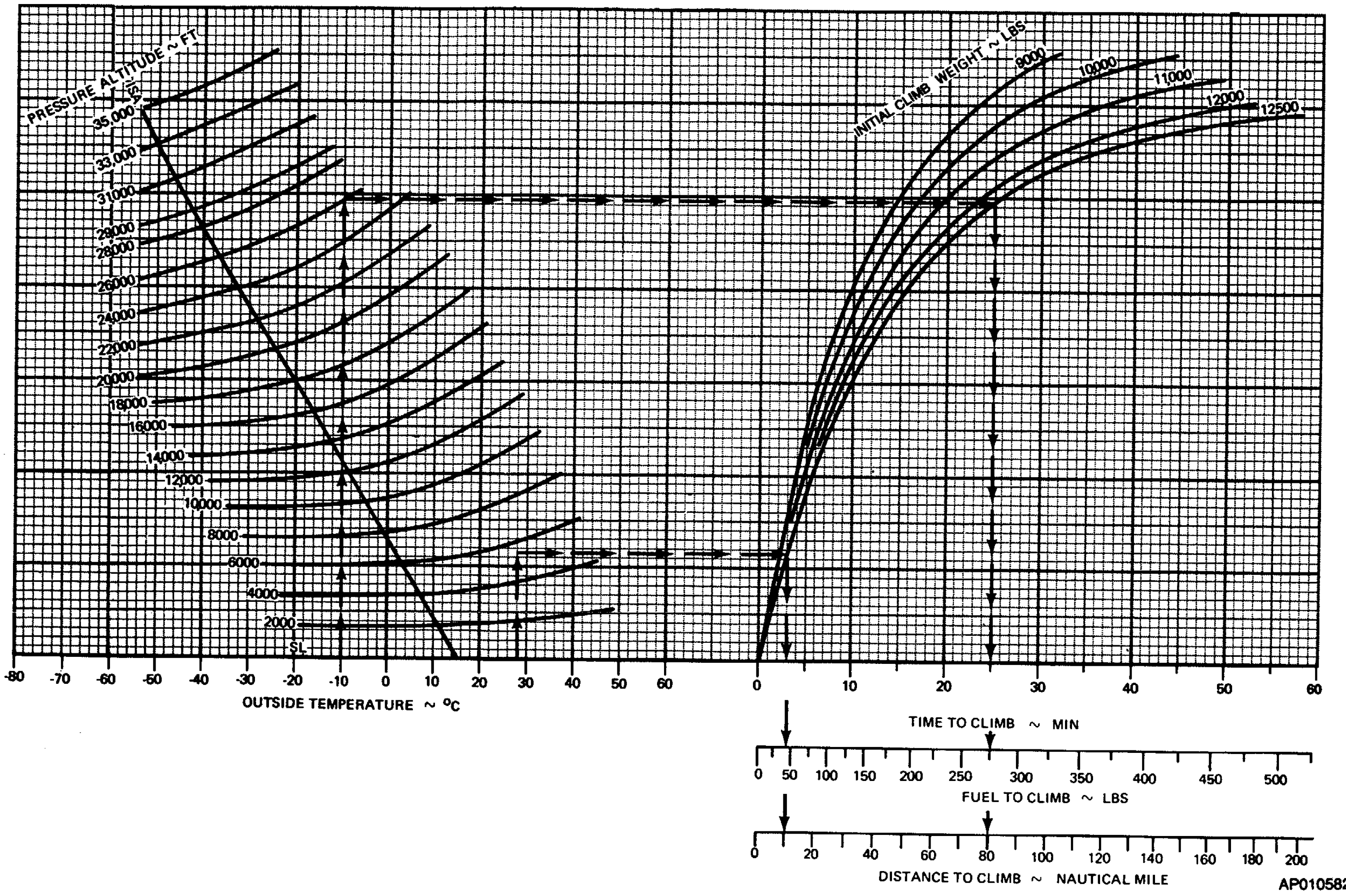


Figure 7-204. Time, Fuel, and Distance to Climb

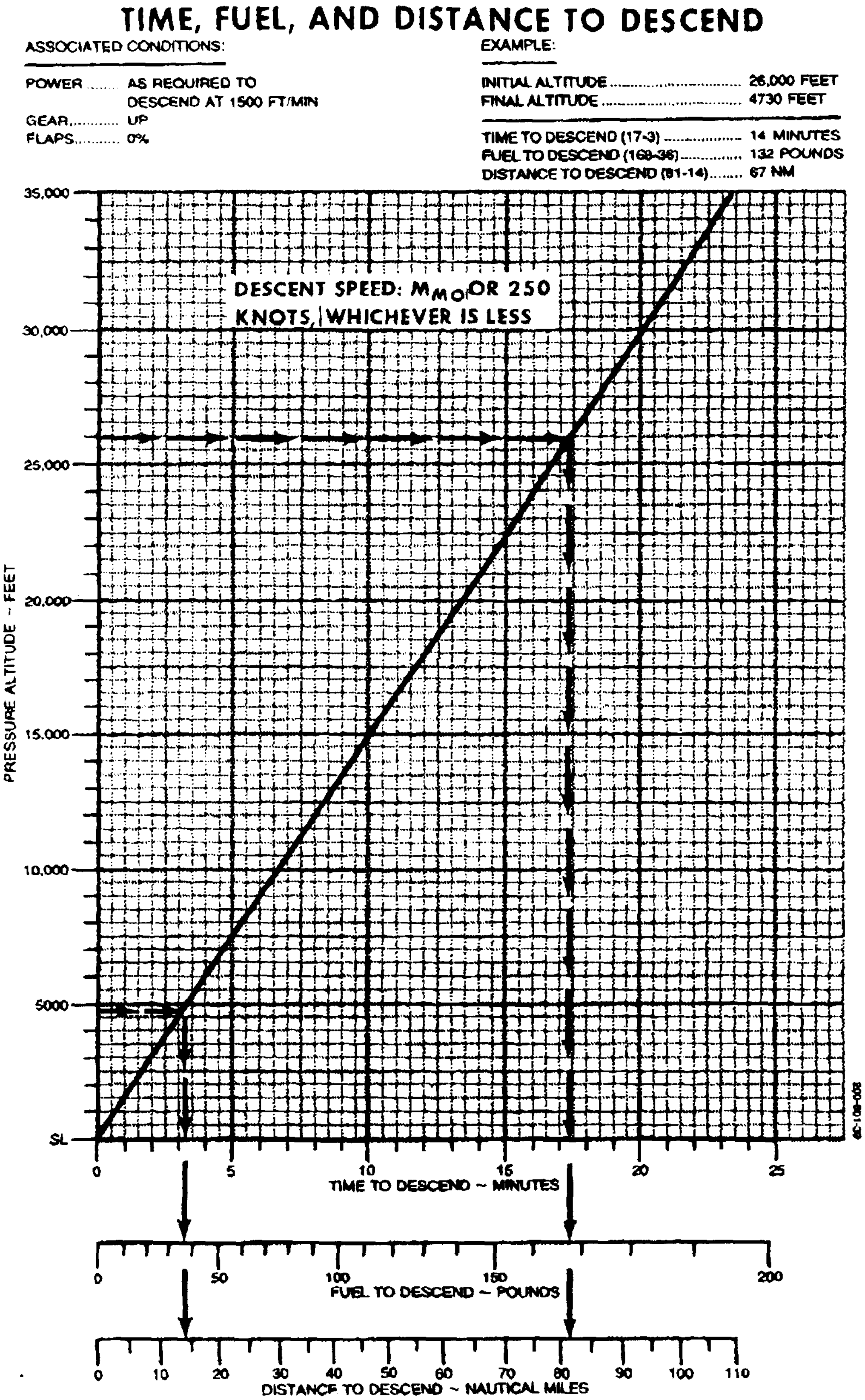


Figure 7-205. Time, Fuel, and Distance to Descend

1700 RPM

ISA – 30°C

PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENG.	TOTAL FUEL FLOW	AIRSPEED ~ KNOTS					
						@ 12,000 LBS		@ 11,000 LBS		@ 10,000 LBS	
FEET	°C	°C	%	LBS/HR	LBS/HR	IAS	TAS	IAS	TAS	IAS	TAS
SL	– 10	– 15	100	464	928	241	229	242	230	243	231
2000	– 14	– 19	100	452	904	239	233	239	234	240	235
4000	– 18	– 23	100	440	880	236	237	237	238	238	239
6000	– 21	– 27	100	429	858	234	242	235	243	236	244
8000	– 25	– 31	100	419	838	232	246	233	248	234	249
10,000	– 29	– 35	100	410	820	230	251	231	252	232	253
12,000	– 33	– 39	100	403	806	227	256	228	257	229	258
14,000	– 36	– 43	100	397	794	225	261	226	262	227	263
16,000	– 40	– 47	100	393	786	223	266	224	268	225	269
18,000	– 44	– 51	100	389	778	220	271	221	273	223	274
20,000	---	---	---	---	---	---	---	---	---	---	---
22,000	---	---	---	---	---	---	---	---	---	---	---
24,000	---	---	---	---	---	---	---	---	---	---	---
26,000	---	---	---	---	---	---	---	---	---	---	---
28,000	---	---	---	---	---	---	---	---	---	---	---
29,000	---	---	---	---	---	---	---	---	---	---	---
31,000	---	---	---	---	---	---	---	---	---	---	---
33,000	---	---	---	---	---	---	---	---	---	---	---
35,000	---	---	---	---	---	---	---	---	---	---	---

Figure 7-206. Recommended Cruise Power - 1700 RPM -ISA -30°C

RECOMMENDED CRUISE POWER

1700 RPM

ISA – 20°C

PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENG.	TOTAL FUEL FLOW	AIRSPEED ~ KNOTS					
						@ 12,000 LBS		@ 11,000 LBS		@ 10,000 LBS	
FEET	°C	°C	%	LBS/HR	LBS/HR	IAS	TAS	IAS	TAS	IAS	TAS
SL	0	– 5	100	467	934	239	232	240	233	241	233
2000	– 4	– 9	100	453	906	237	236	238	237	239	238
4000	– 8	– 13	100	440	880	235	240	236	241	236	242
6000	– 11	– 17	100	429	858	232	245	233	246	234	247
8000	– 15	– 21	100	420	840	230	250	231	251	232	252
10,000	– 19	– 25	100	412	824	228	254	229	255	230	257
12,000	– 23	– 29	100	404	808	225	259	226	261	227	262
14,000	– 26	– 33	100	398	796	223	264	224	266	225	267
16,000	– 30	– 37	100	394	788	221	270	222	271	223	272
18,000	– 34	– 41	100	391	782	218	275	219	276	220	278
20,000	– 38	– 45	95	370	740	211	274	212	276	214	278
22,000	– 42	– 48	88	346	692	202	272	204	274	206	277
24,000	– 46	– 50	82	321	642	194	269	196	272	198	275
26,000	---	---	---	---	---	---	---	---	---	---	---
28,000	---	---	---	---	---	---	---	---	---	---	---
29,000	---	---	---	---	---	---	---	---	---	---	---
31,000	---	---	---	---	---	---	---	---	---	---	---
33,000	---	---	---	---	---	---	---	---	---	---	---
35,000	---	---	---	---	---	---	---	---	---	---	---

Figure 7-207. Recommended Cruise Power - 1700 RPM - ISA -20°C

RECOMMENDED CRUISE POWER

1700 RPM

ISA – 10°C

PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENG.	TOTAL FUEL FLOW	AIRSPEED ~ KNOTS					
						@ 12,000 LBS		@ 11,000 LBS		@ 10,000 LBS	
FEET	°C	°C	%	LBS/HR	LBS/HR	IAS	TAS	IAS	TAS	IAS	TAS
SL	10	5	100	470	940	237	234	238	235	239	236
2000	6	1	100	456	912	235	239	236	240	237	240
4000	3	– 3	100	444	888	233	243	234	244	235	245
6000	– 1	– 7	100	432	864	231	248	232	249	233	250
8000	– 5	– 11	100	421	842	228	253	229	254	230	255
10,000	– 9	– 15	100	412	824	226	257	227	259	228	260
12,000	– 12	– 19	100	406	812	224	262	225	264	226	265
14,000	– 16	– 23	100	400	800	221	268	222	269	223	270
16,000	– 20	– 27	100	396	792	219	273	220	274	221	276
18,000	– 24	– 31	97	384	768	213	275	215	277	216	279
20,000	– 28	– 35	90	357	714	205	272	207	275	208	277
22,000	– 32	– 38	84	333	666	196	270	199	273	200	275
24,000	– 36	– 42	78	309	618	188	367	190	270	192	273
26,000	– 40	– 46	72	287	574	179	263	181	267	184	271
28,000	– 44	– 50	66	266	532	169	258	173	263	176	267
29,000	– 46	– 52	64	256	512	165	255	169	261	172	265
31,000	– 50	– 56	58	237	474	153	247	159	255	162	261
33,000	---	---	---	---	---	---	---	---	---	---	---
35,000	---	---	---	---	---	---	---	---	---	---	---

Figure 7-208. Recommended Cruise Power - 1700 RPM - ISA -10°C

RECOMMENDED CRUISE POWER

1700 RPM

ISA

PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENG.	TOTAL FUEL FLOW	AIRSPEED ~ KNOTS					
						@ 12,000 LBS		@ 11,000 LBS		@ 10,000 LBS	
FEET	°C	°C	%	LBS/HR	LBS/HR	IAS	TAS	IAS	TAS	IAS	TAS
SL	20	15	100	473	946	236	237	237	238	238	239
2000	16	11	100	459	918	234	241	235	242	235	243
4000	13	7	100	446	892	231	246	232	247	233	248
6000	9	3	100	434	868	229	251	230	252	231	253
8000	5	– 1	100	423	846	227	255	228	257	229	258
10,000	2	– 5	100	414	818	224	260	225	262	226	263
12,000	– 2	– 9	100	406	812	222	265	223	267	234	268
14,000	– 6	– 13	100	401	802	219	271	221	272	222	274
16,000	– 10	– 17	100	396	792	216	276	218	277	219	279
18,000	– 14	– 21	94	372	744	208	274	210	276	211	278
20,000	– 18	– 25	86	344	688	199	271	201	273	203	276
22,000	– 22	– 28	80	321	642	191	268	193	271	195	274
24,000	– 26	– 32	74	298	596	182	265	185	268	187	272
26,000	– 30	– 36	69	276	552	173	260	176	265	178	269
28,000	– 34	– 40	63	256	512	163	255	167	260	170	265
29,000	– 36	– 42	59	246	492	158	251	162	258	166	263
31,000	– 41	– 48	56	228	456	147	242	153	252	157	259
33,000	– 45	– 50	51	209	418	127	218	141	241	148	252
35,000	– 50	– 54	45	190	380	—	—	122	218	136	242

Figure 7-209. Recommended Cruise Power - 1700 RPM - ISA

RECOMMENDED CRUISE POWER

1700 RPM

ISA +10°C

PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENG.	TOTAL FUEL FLOW	AIRSPEED ~ KNOTS					
						@ 12,000 LBS		@ 11,000 LBS		@ 10,000 LBS	
FEET	°C	°C	%	LBS/HR	LBS/HR	IAS	TAS	IAS	TAS	IAS	TAS
SL	30	25	100	475	950	234	239	235	240	236	241
2000	27	21	100	462	924	232	244	233	245	234	246
4000	23	17	100	449	898	230	249	231	250	232	251
6000	19	13	100	437	874	227	253	228	254	229	256
8000	15	9	100	426	852	225	258	226	259	227	261
10,000	12	5	100	416	832	223	263	224	265	225	266
12,000	8	1	100	409	818	220	269	221	270	222	271
14,000	4	−3	100	402	804	217	273	219	275	220	276
16,000	1	−7	95	380	760	210	273	212	275	213	277
18,000	−4	−11	89	357	714	203	272	205	274	206	276
20,000	−8	−15	84	333	666	195	270	197	273	199	275
22,000	−12	−18	77	310	620	186	267	188	270	190	273
24,000	−16	−22	71	287	574	177	262	179	266	182	270
26,000	−20	−26	65	266	532	167	257	170	262	173	266
28,000	−24	−30	60	246	492	157	251	161	257	165	263
29,000	−26	−32	58	237	474	151	246	157	254	160	261
31,000	−31	−36	53	219	438	138	232	146	247	151	255
33,000	−36	−40	47	200	400	---	---	132	231	141	247
35,000	−40	−44	44	185	370	---	---	---	---	128	233

Figure 7-210. Recommended Cruise Power - 1700 RPM - ISA +10°C

RECOMMENDED CRUISE POWER

1700 RPM

ISA +20°C

PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENG.	TOTAL FUEL FLOW	AIRSPEED ~ KNOTS @ 12,000 LBS		AIRSPEED ~ KNOTS @ 11,000 LBS		AIRSPEED ~ KNOTS @ 10,000 LBS	
FEET	°C	°C	%	LBS/HR	LBS/HR	IAS	TAS	IAS	TAS	IAS	TAS
SL	40	35	100	479	958	233	242	234	243	235	244
2000	37	31	100	465	930	231	246	232	248	233	249
4000	33	27	100	452	904	228	251	229	252	230	253
6000	29	23	100	440	880	226	256	227	257	228	258
8000	26	19	100	429	858	223	261	225	262	226	263
10,000	22	15	100	419	838	221	266	222	268	223	269
12,000	18	11	98	406	812	217	270	218	271	220	273
14,000	14	7	93	382	764	211	269	212	271	213	273
16,000	10	3	88	359	718	203	269	205	271	206	273
18,000	6	−1	83	337	674	195	267	197	270	199	272
20,000	2	−5	78	315	630	187	265	190	268	192	271
22,000	−2	−8	73	295	590	179	263	182	266	184	270
24,000	−6	−12	67	275	550	171	259	174	263	177	267
26,000	−10	−16	62	255	510	161	254	165	260	169	265
28,000	−14	−20	57	237	474	151	246	156	254	160	260
29,000	−17	−22	55	228	456	144	240	151	251	155	258
31,000	−21	−26	50	209	418	126	218	139	239	146	251
33,000	---	---	---	---	---	---	---	---	---	---	---
35,000	---	---	---	---	---	---	---	---	---	---	---

Figure 7-211. Recommended Cruise Power - 1700 RPM - ISA +20°C

RECOMMENDED CRUISE POWER

1700 RPM

ISA +30°C

PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENG.	TOTAL FUEL FLOW	AIRSPEED ~ KNOTS					
						@ 12,000 LBS		@ 11,000 LBS		@ 10,000 LBS	
FEET	°C	°C	%	LBS/HR	LBS/HR	IAS	TAS	IAS	TAS	IAS	TAS
SL	51	45	100	482	964	231	244	233	245	233	246
2000	47	41	100	468	936	229	249	230	250	231	251
4000	43	37	100	454	908	227	254	228	255	229	256
6000	39	33	100	441	882	224	259	225	260	226	261
8000	36	29	100	428	856	221	263	223	264	224	266
10,000	32	25	95	405	810	215	264	217	266	218	267
12,000	28	21	91	383	766	209	264	210	266	212	268
14,000	24	17	86	360	720	202	263	203	266	205	268
16,000	20	13	81	338	676	195	262	197	265	198	267
18,000	16	9	76	317	634	187	261	190	264	192	267
20,000	12	5	72	297	594	180	259	182	263	185	266
22,000	8	2	67	278	556	172	256	175	261	177	265
24,000	4	−2	63	259	518	163	252	167	258	170	262
26,000	−1	−6	58	242	484	154	246	158	254	162	260
28,000	−5	−10	54	225	450	142	236	149	249	154	256
29,000	−7	−12	52	217	424	135	229	144	244	150	254
31,000	−11	−16	47	200	400	—	—	131	230	140	246
33,000	—	—	—	—	—	—	—	—	—	—	—
35,000	—	—	—	—	—	—	—	—	—	—	—

Figure 7-212. Recommended Cruise Power - 1700 RPM - ISA +30°C

RECOMMENDED CRUISE POWER

1700 RPM

ISA + 37°C

PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENG.	TOTAL FUEL FLOW	AIRSPEED ~ KNOTS					
						@ 12,000 LBS		@ 11,000 LBS		@ 10,000 LBS	
FEET	°C	°C	%	LBS/HR	LBS/HR	IAS	TAS	IAS	TAS	IAS	TAS
SL	58	52	100	484	968	231	246	232	247	233	248
2000	54	48	100	470	940	228	251	229	252	230	253
4000	50	44	98	451	902	224	254	225	255	226	256
6000	46	40	97	433	866	220	257	222	258	223	260
8000	42	36	94	412	824	215	259	217	261	218	262
10,000	39	32	90	390	780	210	260	211	262	212	263
12,000	35	28	86	368	736	203	260	205	262	206	264
14,000	31	24	81	345	690	196	259	198	261	200	264
16,000	27	20	76	324	648	189	258	191	261	193	263
18,000	23	16	72	304	608	181	256	184	260	186	263
20,000	19	12	67	284	568	173	253	176	258	179	261
22,000	14	9	63	266	532	165	250	169	256	172	260
24,000	10	5	59	248	496	156	245	161	252	164	258
26,000	6	1	55	231	462	146	237	152	248	157	254
28,000	2	− 3	50	215	430	132	224	142	240	148	250
29,000	0	− 5	48	207	414	123	212	136	234	144	247
31,000	− 5	− 9	44	191	382	—	—	121	216	133	238
33,000	—	—	—	—	—	—	—	—	—	—	—
35,000	—	—	—	—	—	—	—	—	—	—	—

Figure 7-213. Recommended Cruise Power - 1700 RPM - ISA + 37°C

RECOMMENDED CRUISE SPEEDS

1700 RPM

WEIGHT 11,000 LBS

NOTE: FOR OPERATION WITH ICE VANES EXTENDED, TAS WILL BE REDUCED BY APPROXIMATELY 25 KNOTS

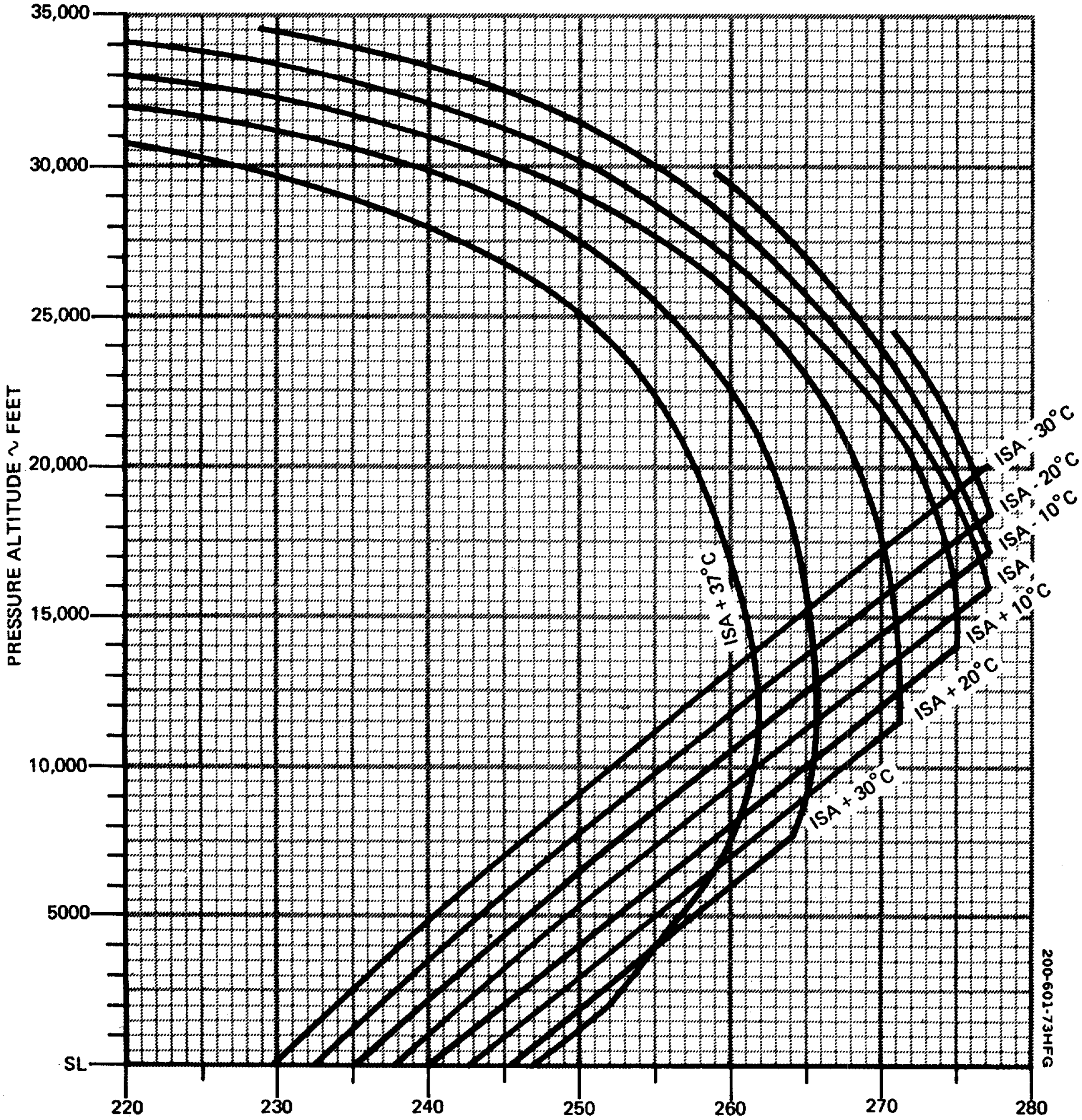


Figure 7-214. Recommended Cruise Speeds - 1700 RPM

RECOMMENDED CRUISE POWER

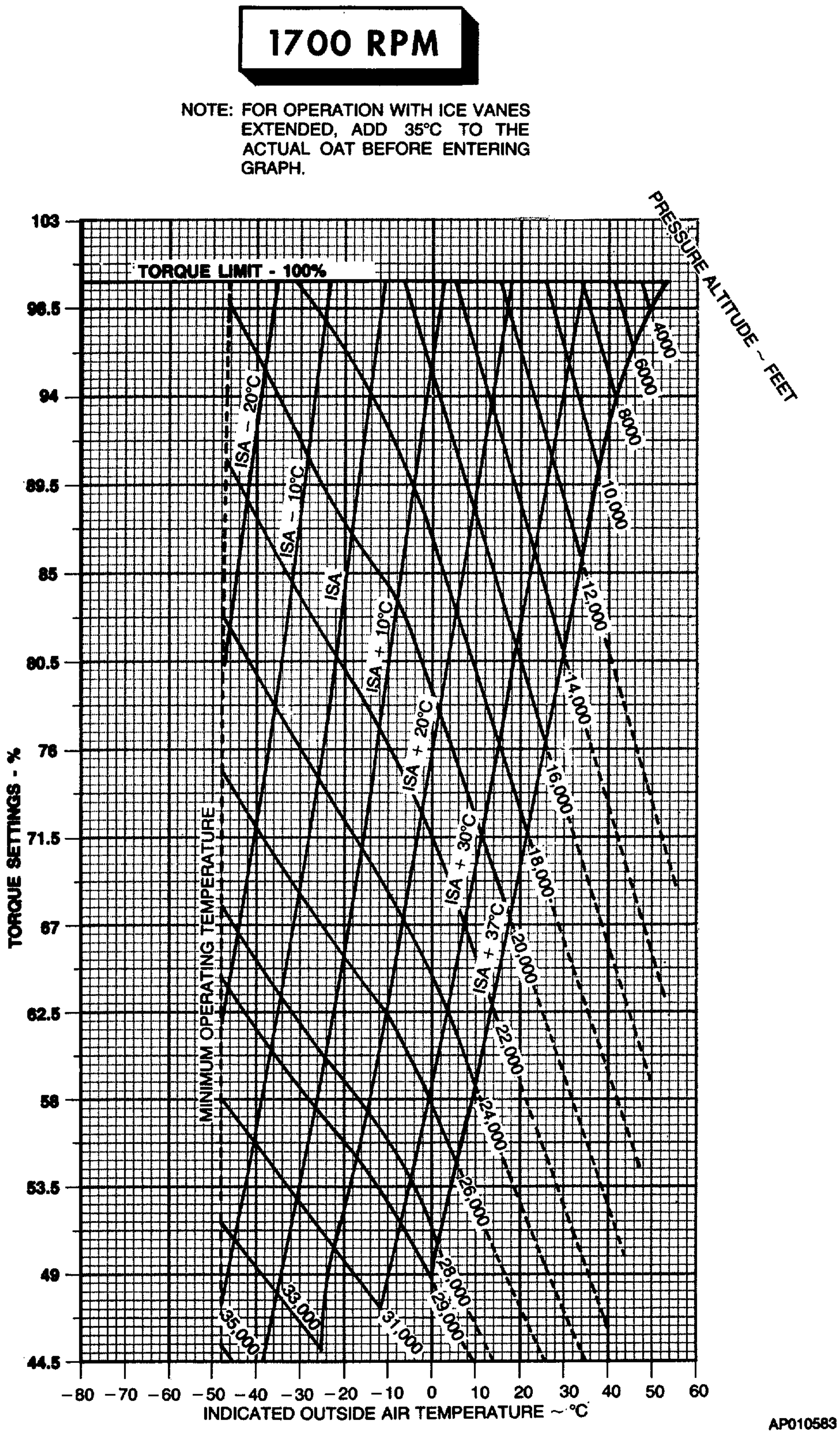


Figure 7-215. Recommended Cruise Power - 1700 RPM

FUEL FLOW AT RECOMMENDED CRUISE POWER

1700 RPM

NOTE: FOR OPERATION WITH ICE VANES EXTENDED, ADD 30°C TO THE ACTUAL OAT BEFORE ENTERING GRAPH.

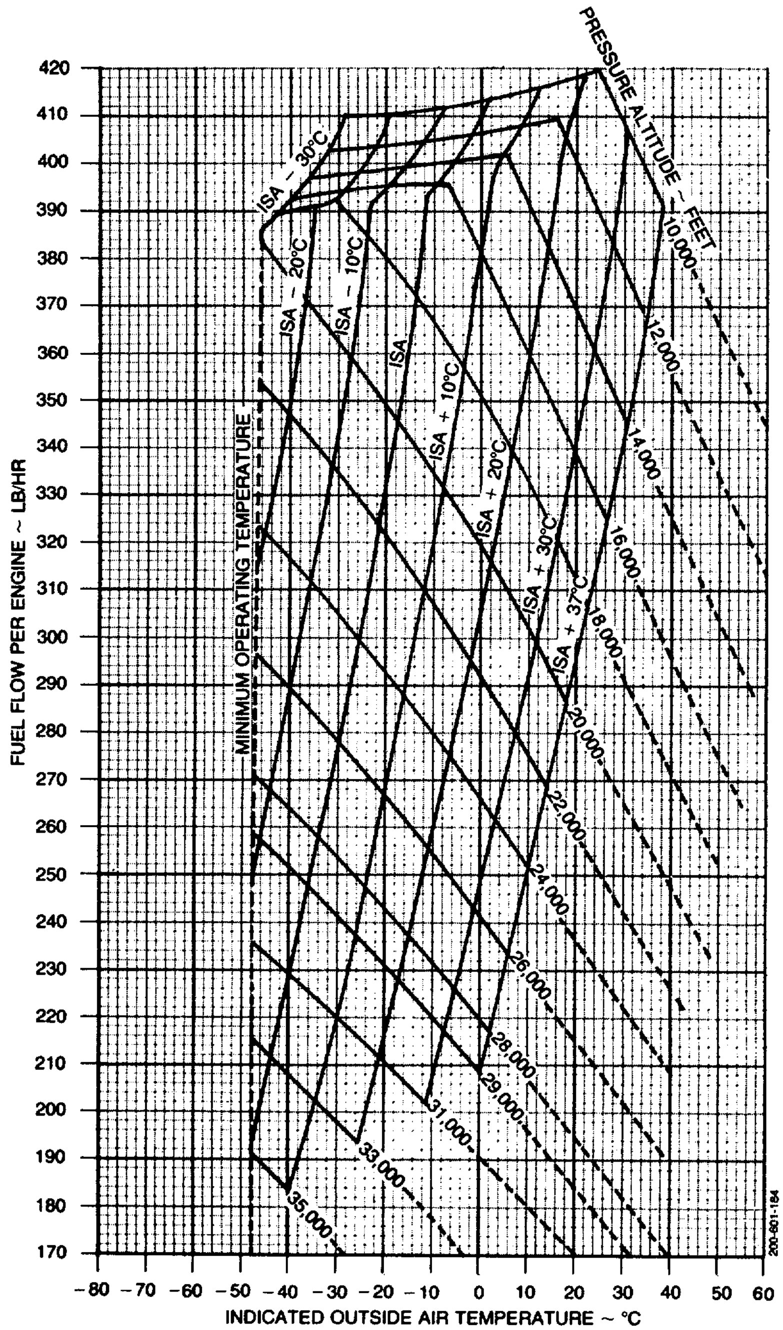


Figure 7-216. Fuel Flow at Recommended Cruise Power - 1700 RPM

RECOMMENDED CRUISE POWER

1800 RPM

ISA – 30°C

PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENG.	TOTAL FUEL FLOW	AIRSPEED ~ KNOTS					
						@ 12,000 LBS		@ 11,000 LBS		@ 10,000 LBS	
FEET	°C	°C	%	LBS/HR	LBS/HR	IAS	TAS	IAS	TAS	IAS	TAS
SL	– 10	– 15	100	484	968	246	234	247	235	248	235
2000	– 14	– 19	100	472	944	244	238	245	239	245	240
4000	– 17	– 23	100	460	920	242	243	242	243	243	244
6000	– 21	– 27	100	448	896	239	247	240	248	241	249
8000	– 25	– 31	100	438	876	237	252	238	253	239	254
10,000	– 29	– 35	100	429	858	235	257	236	258	237	259
12,000	– 32	– 39	100	422	844	233	262	234	263	234	264
14,000	– 36	– 43	100	417	834	230	267	231	268	232	269
16,000	– 40	– 47	100	413	826	228	272	229	273	230	275
18,000	– 43	– 51	100	409	818	225	278	227	279	228	280
20,000	---	---	---	---	---	---	---	---	---	---	---
22,000	---	---	---	---	---	---	---	---	---	---	---
24,000	---	---	---	---	---	---	---	---	---	---	---
26,000	---	---	---	---	---	---	---	---	---	---	---
28,000	---	---	---	---	---	---	---	---	---	---	---
29,000	---	---	---	---	---	---	---	---	---	---	---
31,000	---	---	---	---	---	---	---	---	---	---	---
33,000	---	---	---	---	---	---	---	---	---	---	---
35,000	---	---	---	---	---	---	---	---	---	---	---

Figure 7-217. Recommended Cruise Power - 1800 RPM - ISA - 30°C

RECOMMENDED CRUISE POWER

1800 RPM

ISA – 20°C

PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENG.	TOTAL FUEL FLOW	AIRSPEED ~ KNOTS					
						@ 12,000 LBS		@ 11,000 LBS		@ 10,000 LBS	
FEET	°C	°C	%	LBS/HR	LBS/HR	IAS	TAS	IAS	TAS	IAS	TAS
SL	0	– 5	100	486	972	244	237	245	238	246	238
2000	– 4	– 9	100	473	946	242	241	243	242	244	243
4000	– 7	– 13	100	460	920	240	246	241	246	241	247
6000	– 11	– 17	100	449	898	237	250	238	251	239	252
8000	– 15	– 21	100	440	880	235	255	236	256	237	257
10,000	– 19	– 25	100	431	862	233	260	234	261	235	262
12,000	– 22	– 29	100	423	846	231	265	232	266	233	267
14,000	– 26	– 33	100	418	836	228	270	229	272	230	273
16,000	– 30	– 37	100	414	828	226	276	227	277	228	278
18,000	– 33	– 41	97	399	798	220	278	222	279	223	281
20,000	– 38	– 45	90	370	740	212	276	213	278	215	279
22,000	– 42	– 48	84	346	692	203	273	205	276	207	278
24,000	– 46	– 52	78	321	642	195	270	197	273	199	276
26,000	—	—	—	—	—	—	—	—	—	—	—
28,000	—	—	—	—	—	—	—	—	—	—	—
29,000	—	—	—	—	—	—	—	—	—	—	—
31,000	—	—	—	—	—	—	—	—	—	—	—
33,000	—	—	—	—	—	—	—	—	—	—	—
35,000	—	—	—	—	—	—	—	—	—	—	—

Figure 7-218. Recommended Cruise Power - 1800 RPM - ISA - 20°C

RECOMMENDED CRUISE POWER

1800 RPM

ISA – 10°C

PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENG.	TOTAL FUEL FLOW	AIRSPEED ~ KNOTS					
						@ 12,000 LBS		@ 11,000 LBS		@ 10,000 LBS	
FEET	°C	°C	%	LBS/HR	LBS/HR	IAS	TAS	IAS	TAS	IAS	TAS
SL	10	5	100	489	978	243	239	244	240	244	241
2000	7	1	100	475	950	240	244	241	245	242	246
4000	3	– 3	100	463	926	238	248	239	249	240	250
6000	– 1	– 7	100	451	902	236	253	237	254	238	255
8000	– 5	– 11	100	440	880	233	258	234	259	235	260
10,000	– 8	– 15	100	431	862	231	263	232	264	233	265
12,000	– 12	– 19	100	425	850	229	268	230	270	231	271
14,000	– 16	– 23	100	420	840	226	274	227	275	228	276
16,000	– 19	– 27	99	413	826	223	278	224	280	226	281
18,000	– 24	– 31	93	385	770	215	276	216	278	218	280
20,000	– 28	– 35	86	357	714	206	274	208	276	209	278
22,000	– 32	– 38	80	333	666	198	272	200	275	202	277
24,000	– 36	– 42	74	310	620	189	269	191	272	193	275
26,000	– 40	– 46	68	287	574	180	265	182	268	185	272
28,000	– 44	– 50	63	266	532	170	259	174	265	177	269
29,000	– 46	– 52	60	256	512	165	256	169	262	172	267
31,000	– 50	– 56	55	237	474	153	247	159	256	163	262
33,000	---	---	---	---	---	---	---	---	---	---	---
35,000	---	---	---	---	---	---	---	---	---	---	---

Figure 7-219. Recommended Cruise Power - 1800 RPM - ISA - 10°C

RECOMMENDED CRUISE POWER

1800 RPM

ISA

PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENG.	TOTAL FUEL FLOW	AIRSPEED ~ KNOTS					
						@ 12,000 LBS		@ 11,000 LBS		@ 10,000 LBS	
FEET	°C	°C	%	LBS/HR	LBS/HR	IAS	TAS	IAS	TAS	IAS	TAS
SL	20	15	100	492	984	241	242	242	243	243	244
2000	17	11	100	478	956	239	247	240	247	240	248
4000	13	7	100	464	928	236	251	237	252	238	253
6000	9	3	100	451	902	234	256	235	257	236	258
8000	6	−1	100	441	882	232	261	233	262	234	263
10,000	2	−5	100	433	866	229	266	230	268	231	269
12,000	−2	−9	100	425	850	227	272	228	273	229	274
14,000	−6	−13	100	419	838	225	277	226	278	227	280
16,000	−9	−17	96	400	800	218	278	220	280	221	281
18,000	−14	−21	89	372	744	210	276	211	278	213	280
20,000	−18	−25	82	345	690	201	272	202	275	204	277
22,000	−22	−28	76	322	644	192	270	194	273	196	276
24,000	−26	−32	71	298	596	183	266	186	270	188	273
26,000	−30	−36	65	276	552	174	262	177	266	180	270
28,000	−34	−40	60	256	512	164	255	168	262	171	267
29,000	−36	−42	57	246	492	158	251	163	259	167	265
31,000	−41	−46	53	228	456	146	242	153	252	158	260
33,000	−45	−50	48	209	418	130	223	141	241	148	252
35,000	−50	−54	43	190	380	—	—	125	223	136	242

Figure 7-220. Recommended Cruise Power - 1800 RPM - ISA

RECOMMENDED CRUISE POWER

1800 RPM

ISA + 10°C

PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENG.	TOTAL FUEL FLOW	AIRSPEED ~ KNOTS					
						@ 12,000 LBS		@ 11,000 LBS		@ 10,000 LBS	
FEET	°C	°C	%	LBS/HR	LBS/HR	IAS	TAS	IAS	TAS	IAS	TAS
SL	31	25	100	494	988	239	245	240	246	241	246
2000	27	21	100	481	962	237	249	238	250	239	251
4000	23	17	100	468	936	235	254	236	255	237	256
6000	19	13	100	455	910	232	259	234	260	234	261
8000	16	9	100	444	888	230	264	231	265	232	266
10,000	12	5	100	434	868	228	269	229	271	230	272
12,000	8	1	100	427	854	225	275	226	276	227	277
14,000	4	– 3	96	405	810	219	275	220	277	221	278
16,000	0	– 7	90	380	760	212	275	213	277	214	278
18,000	– 4	– 11	85	357	714	204	274	206	276	207	278
20,000	– 8	– 15	79	334	668	196	272	198	275	200	277
22,000	– 12	– 18	74	311	622	187	269	190	272	192	275
24,000	– 16	– 22	68	288	576	178	264	181	268	183	272
26,000	– 20	– 26	62	266	532	167	258	171	264	174	268
28,000	– 24	– 30	57	246	492	157	251	162	258	166	264
29,000	– 26	– 32	55	237	472	151	246	157	255	161	262
31,000	– 31	– 36	50	218	436	138	233	146	246	152	256
33,000	– 36	– 40	45	200	400	---	---	133	233	141	247
35,000	– 41	– 44	40	181	362	---	---	---	---	128	234

Figure 7-221. Recommended Cruise Power - 1800 RPM - ISA + 10°C

RECOMMENDED CRUISE POWER

1800 RPM

ISA + 20°C

PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENG.	TOTAL FUEL FLOW	AIRSPEED ~ KNOTS					
						@ 12,000 LBS		@ 11,000 LBS		@ 10,000 LBS	
FEET	°C	°C	%	LBS/HR	LBS/HR	IAS	TAS	IAS	TAS	IAS	TAS
SL	41	35	100	497	994	238	247	239	248	240	249
2000	37	31	100	483	966	236	252	237	253	237	254
4000	33	27	100	470	940	233	257	234	258	235	259
6000	30	23	100	457	914	231	262	232	263	233	264
8000	26	19	100	446	892	229	267	230	268	231	269
10,000	22	15	98	430	860	224	270	225	271	227	273
12,000	18	11	93	406	812	218	270	219	272	220	273
14,000	14	7	88	382	764	211	270	212	272	214	274
16,000	10	3	84	359	718	204	270	205	272	207	274
18,000	6	−1	79	337	674	196	268	198	271	200	273
20,000	2	−5	74	315	630	188	267	191	270	193	272
22,000	−2	−8	69	295	590	180	264	183	268	185	271
24,000	−6	−12	64	275	550	172	260	175	265	178	269
26,000	−10	−16	59	256	512	162	254	166	261	169	266
28,000	−14	−20	54	237	474	151	246	156	255	161	262
29,000	−17	−22	52	228	456	144	240	151	250	156	259
31,000	−21	−26	47	210	420	128	222	139	240	146	251
33,000	−26	−30	42	191	392	—	—	122	219	134	240
35,000	−30	−34	37	173	356	—	—	—	—	119	222

Figure 7-222. Recommended Cruise Power - 1800 RPM - ISA + 20°C

RECOMMENDED CRUISE POWER

1800 RPM

ISA + 30°C

PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENG.	TOTAL FUEL FLOW	AIRSPEED ~ KNOTS					
						@ 12,000 LBS		@ 11,000 LBS		@ 10,000 LBS	
FEET	°C	°C	%	LBS/HR	LBS/HR	IAS	TAS	IAS	TAS	IAS	TAS
SL	51	45	100	499	998	237	250	238	251	238	251
2000	47	41	100	485	970	234	254	235	255	236	256
4000	43	37	99	469	938	231	258	232	260	233	261
6000	40	33	97	450	900	227	262	228	263	229	264
8000	36	29	94	428	856	222	264	223	265	224	266
10,000	32	25	90	405	810	216	264	217	266	218	268
12,000	28	21	86	383	766	209	265	211	267	212	268
14,000	24	17	81	360	720	202	264	204	266	206	268
16,000	20	13	77	338	676	195	263	197	266	199	268
18,000	16	9	72	317	634	188	262	190	265	192	268
20,000	12	5	68	297	594	180	260	183	264	185	267
22,000	8	2	64	278	556	172	257	175	262	178	266
24,000	4	− 2	59	260	520	163	252	167	258	170	263
26,000	− 1	− 6	55	242	484	153	246	158	254	162	260
28,000	− 5	− 10	51	225	450	142	237	149	248	154	256
29,000	− 7	− 12	49	217	434	136	231	144	244	150	254
31,000	− 11	− 16	45	200	400	---	---	131	232	141	245
33,000	− 16	− 20	---	---	---	---	---	---	---	126	231
35,000	---	---	---	---	---	---	---	---	---	---	---

Figure 7-223. Recommended Cruise Power - 1800 RPM - ISA + 30°C

RECOMMENDED CRUISE POWER

1800 RPM

ISA + 37°C

PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENG.	TOTAL FUEL FLOW	AIRSPEED ~ KNOTS @ 12,000 LBS		@ 11,000 LBS		@ 10,000 LBS	
FEET	°C	°C	%	LBS/HR	LBS/HR	IAS	TAS	IAS	TAS	IAS	TAS
SL	58	52	97	491	982	232	243	234	249	235	250
2000	54	48	95	471	942	228	251	230	252	231	253
4000	50	44	93	451	902	224	254	226	255	227	256
6000	46	40	91	433	866	220	257	222	259	223	260
8000	42	36	89	413	826	216	259	217	261	218	263
10,000	39	32	85	390	780	210	260	212	262	213	264
12,000	35	28	81	368	736	203	260	205	263	207	265
14,000	31	24	76	345	690	196	259	198	262	200	264
16,000	27	20	72	324	648	189	258	191	261	193	264
18,000	23	16	68	304	608	181	256	184	260	182	263
20,000	19	12	64	284	568	173	254	177	258	179	262
22,000	15	9	60	266	532	165	250	169	256	172	260
24,000	10	5	56	248	496	156	245	161	252	165	258
26,000	6	1	52	231	462	146	237	152	247	157	254
28,000	2	−3	48	215	430	134	226	142	240	148	250
29,000	0	−5	46	207	414	125	216	137	235	144	247
31,000	−5	−9	42	191	382	—	—	123	220	133	238
33,000	—	—	—	—	—	—	—	—	—	—	—
35,000	—	—	—	—	—	—	—	—	—	—	—

Figure 7-224. Recommended Cruise Power - 1800 RPM - ISA + 37°C

RECOMMENDED CRUISE SPEEDS

1800 RPM

WEIGHT 11,000 LBS

NOTE: FOR OPERATION WITH ICE VANES EXTENDED, TAS WILL BE REDUCED BY APPROXIMATELY 25 KNOTS.

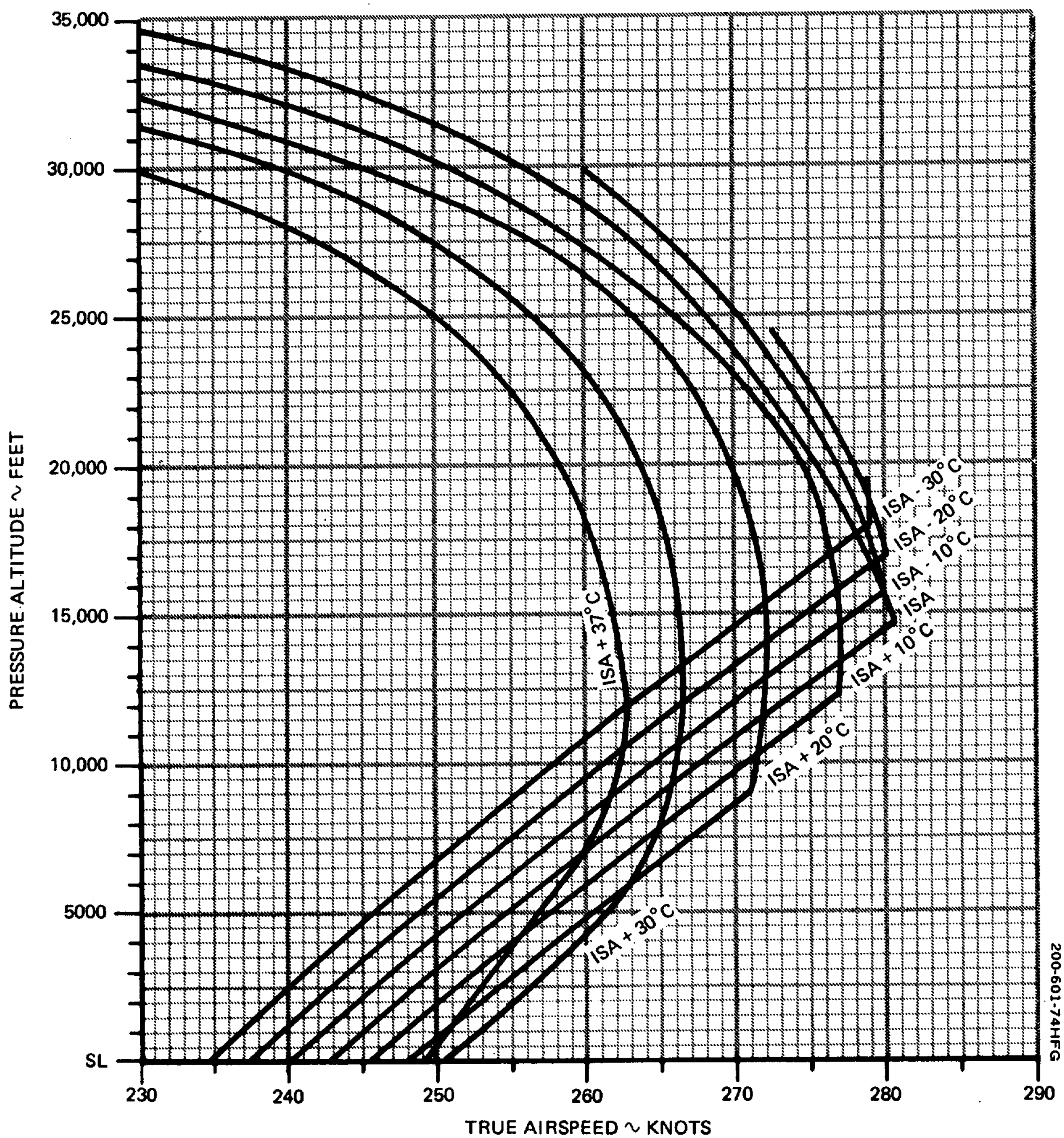


Figure 7-225. Recommended Cruise Speeds - 1800 RPM

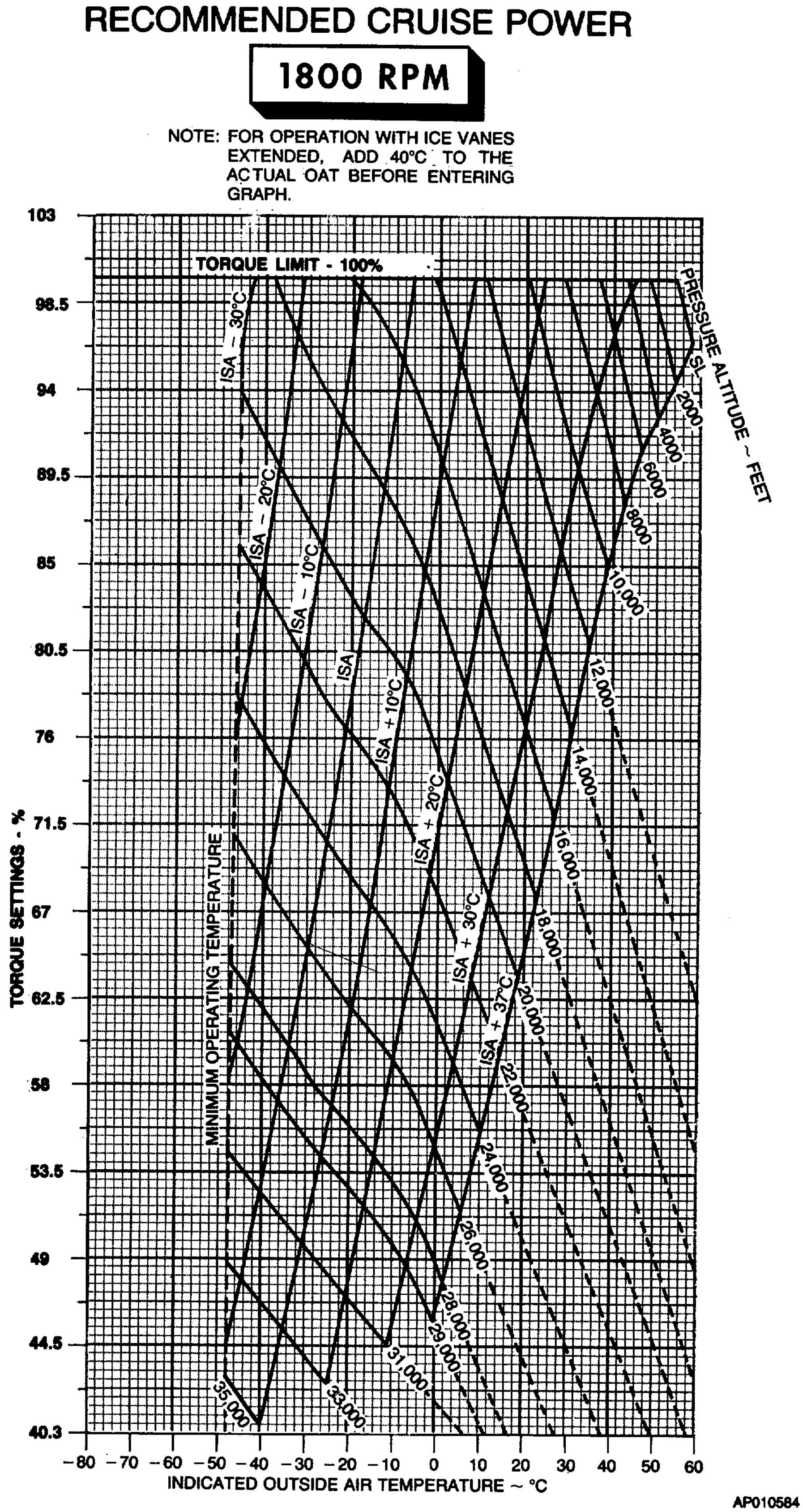


Figure 7-226. Recommended Cruise Power - 1800 RPM

FUEL FLOW AT RECOMMENDED CRUISE POWER

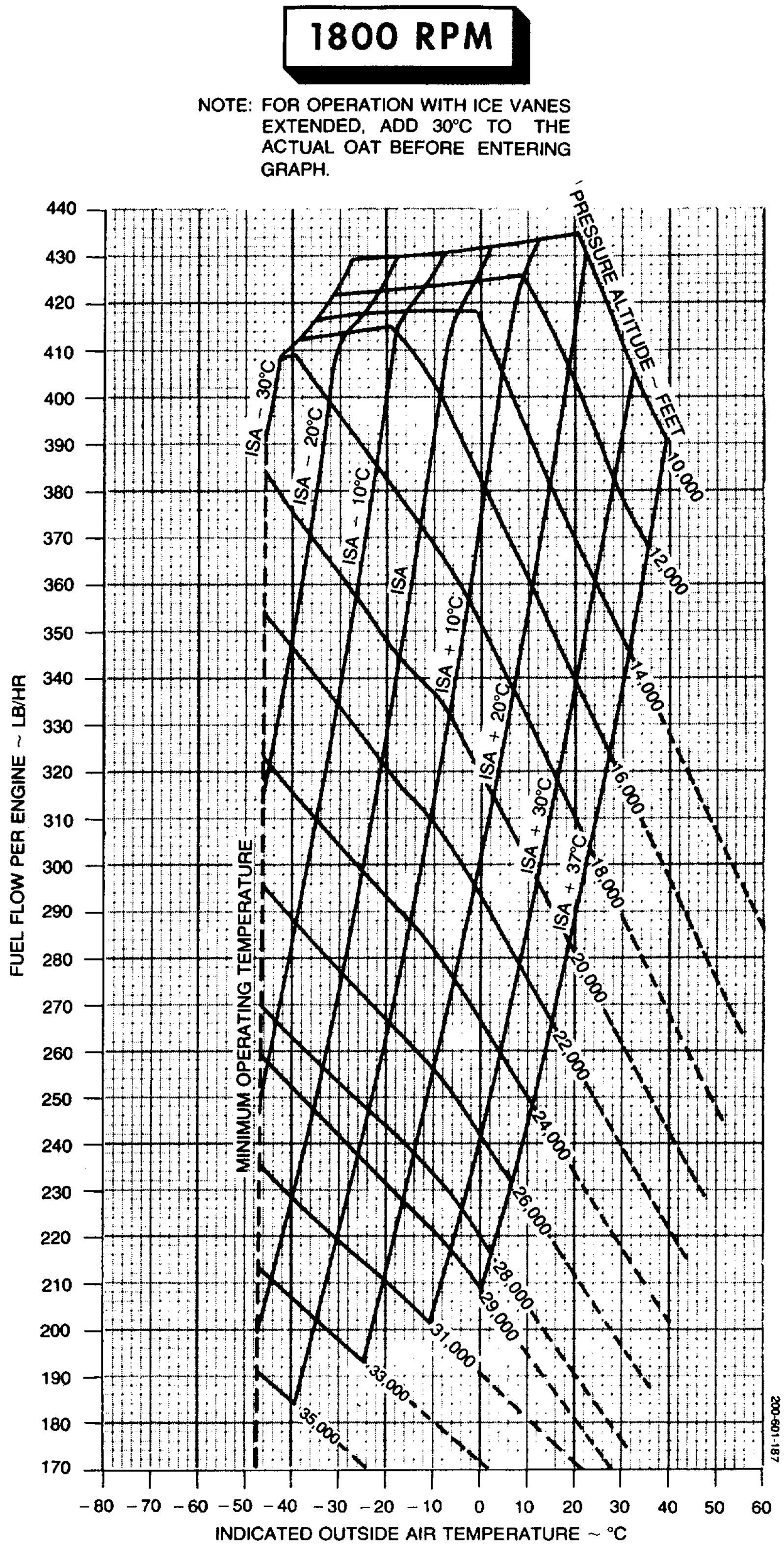


Figure 7-227. Fuel Flow at Recommended Cruise Power - 1800 RPM

MAXIMUM CRUISE POWER

1900 RPM

ISA – 30°C

PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENG.	TOTAL FUEL FLOW	AIRSPEED ~ KNOTS @ 12,000 LBS		@ 11,000 LBS		@ 10,000 LBS	
FEET	°C	°C	%	LBS/HR	LBS/HR	IAS	TAS	IAS	TAS	IAS	TAS
SL	– 10	– 15	100	500	1000	251	238	252	239	252	240
2000	– 14	– 19	100	488	976	249	243	249	244	250	244
4000	– 17	– 23	100	477	954	247	248	247	248	248	249
6000	– 21	– 27	100	466	932	244	252	245	253	246	254
8000	– 25	– 31	100	457	914	242	257	243	258	244	259
10,000	– 28	– 35	100	449	898	240	262	241	263	241	264
12,000	– 32	– 39	100	442	884	237	267	238	268	239	269
14,000	– 36	– 43	100	437	874	235	272	236	274	237	275
16,000	– 40	– 47	100	433	866	233	278	234	279	235	280
18,000	– 43	– 51	99	428	856	230	283	231	284	232	286
20,000	—	—	—	—	—	—	—	—	—	—	—
22,000	—	—	—	—	—	—	—	—	—	—	—
24,000	—	—	—	—	—	—	—	—	—	—	—
26,000	—	—	—	—	—	—	—	—	—	—	—
28,000	—	—	—	—	—	—	—	—	—	—	—
29,000	—	—	—	—	—	—	—	—	—	—	—
31,000	—	—	—	—	—	—	—	—	—	—	—
33,000	—	—	—	—	—	—	—	—	—	—	—
35,000	—	—	—	—	—	—	—	—	—	—	—

Figure 7-228. Maximum Cruise Power - 1900 RPM - ISA - 30°C

MAXIMUM CRUISE POWER

1900 RPM

ISA – 20°C

PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENG.	TOTAL FUEL FLOW	AIRSPEED ~ KNOTS					
						@ 12,000 LBS		@ 11,000 LBS		@ 10,000 LBS	
FEET	°C	°C	%	LBS/HR	LBS/HR	IAS	TAS	IAS	TAS	IAS	TAS
SL	0	– 5	100	503	1006	249	241	250	242	251	243
2000	– 3	– 9	100	490	980	247	246	248	247	249	247
4000	– 7	– 13	100	478	956	245	251	246	252	246	252
6000	– 11	– 17	100	467	934	242	255	243	256	244	257
8000	– 15	– 21	100	459	918	240	260	241	261	242	262
10,000	– 18	– 25	100	450	900	238	265	239	266	240	267
12,000	– 22	– 29	100	443	886	235	271	236	272	237	273
14,000	– 26	– 33	100	439	878	233	276	234	277	235	278
16,000	– 29	– 37	100	435	870	231	282	232	283	233	284
18,000	– 33	– 41	95	413	826	224	282	225	284	226	285
20,000	– 37	– 45	88	383	766	215	280	217	282	218	284
22,000	– 41	– 48	82	358	716	207	278	209	280	210	282
24,000	– 45	– 52	76	332	664	198	275	200	278	202	280
26,000	—	—	—	—	—	—	—	—	—	—	—
28,000	—	—	—	—	—	—	—	—	—	—	—
29,000	—	—	—	—	—	—	—	—	—	—	—
31,000	—	—	—	—	—	—	—	—	—	—	—
33,000	—	—	—	—	—	—	—	—	—	—	—
35,000	—	—	—	—	—	—	—	—	—	—	—

Figure 7-229. Maximum Cruise Power - 1900 RPM - ISA - 20°C

MAXIMUM CRUISE POWER

1900 RPM

ISA – 10°C

PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENG.	TOTAL FUEL FLOW	AIRSPEED ~ KNOTS					
						@ 12,000 LBS		@ 11,000 LBS		@ 10,000 LBS	
FEET	°C	°C	%	LBS/HR	LBS/HR	IAS	TAS	IAS	TAS	IAS	TAS
SL	11	5	100	505	1010	248	244	248	245	249	246
2000	7	1	100	492	984	245	249	246	250	247	250
4000	3	– 3	100	480	960	243	254	244	254	245	255
6000	– 1	– 7	100	468	936	243	258	242	259	242	260
8000	– 4	– 11	100	458	916	238	268	239	264	240	265
10,000	– 8	– 15	100	450	900	236	269	237	270	238	271
12,000	– 12	– 19	100	445	890	234	274	235	275	236	276
14,000	– 15	– 23	100	440	880	231	280	232	281	233	282
16,000	– 19	– 27	98	428	856	227	283	228	284	229	286
18,000	– 23	– 31	91	399	798	218	281	220	283	221	284
20,000	– 27	– 35	85	370	740	210	279	211	281	213	283
22,000	– 31	– 38	79	345	690	201	276	203	279	205	281
24,000	– 35	– 42	73	321	642	192	273	195	276	197	279
26,000	– 40	– 46	67	297	594	183	269	186	273	188	276
28,000	– 44	– 50	62	275	550	173	264	177	269	179	273
29,000	– 46	– 52	59	265	530	168	261	172	266	175	271
31,000	—	—	—	—	—	—	—	—	—	—	—
33,000	—	—	—	—	—	—	—	—	—	—	—
35,000	—	—	—	—	—	—	—	—	—	—	—

Figure 7-230. Maximum Cruise Power - 1900 RPM - ISA - 10°C

MAXIMUM CRUISE POWER

1900 RPM

ISA

PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENG.	TOTAL FUEL FLOW	AIRSPEED ~ KNOTS @ 12,000 LBS		@ 11,000 LBS		@ 10,000 LBS	
FEET	°C	°C	%	LBS/HR	LBS/HR	IAS	TAS	IAS	TAS	IAS	TAS
SL	21	15	100	508	1016	246	247	247	248	248	249
2000	17	11	100	494	988	244	252	245	253	245	253
4000	13	7	100	481	962	241	256	242	257	243	258
6000	9	3	100	470	940	239	261	240	262	241	263
8000	6	– 1	100	461	922	237	267	237	268	238	269
10,000	2	– 5	100	452	904	234	272	235	273	236	274
12,000	– 2	– 9	100	445	890	232	277	233	279	234	280
14,000	– 5	– 13	99	437	874	229	282	230	284	231	285
16,000	– 9	– 17	93	410	820	221	281	222	283	223	284
18,000	– 13	– 21	87	384	768	213	280	214	282	216	283
20,000	– 17	– 25	81	357	714	204	277	206	280	207	282
22,000	– 21	– 28	75	333	666	196	275	198	278	200	280
24,000	– 26	– 32	70	309	618	186	271	189	275	191	278
26,000	– 30	– 36	64	286	572	178	266	180	271	183	275
28,000	– 34	– 40	59	266	530	167	261	171	266	174	271
29,000	– 36	– 42	57	255	510	162	257	166	264	170	269
31,000	– 40	– 46	52	236	472	151	249	156	258	161	264
33,000	– 45	– 50	47	217	434	137	235	145	248	151	258
35,000	---	---	---	---	---	---	---	---	---	---	---

Figure 7-231. Maximum Cruise Power - 1900 RPM - ISA

MAXIMUM CRUISE POWER

1900 RPM

ISA + 10°C

PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENG.	TOTAL FUEL FLOW	AIRSPEED ~ KNOTS @ 12,000 LBS		@ 11,000 LBS		@ 10,000 LBS	
FEET	°C	°C	%	LBS/HR	LBS/HR	IAS	TAS	IAS	TAS	IAS	TAS
SL	31	25	100	512	1024	244	250	245	251	246	251
2000	27	21	100	499	998	242	254	243	255	244	256
4000	23	17	100	486	972	240	259	241	260	241	261
6000	20	13	100	474	948	237	264	238	265	239	266
8000	16	9	100	463	926	235	270	236	271	237	272
10,000	12	5	100	454	908	233	275	234	276	235	277
12,000	8	1	99	441	882	229	279	230	280	231	282
14,000	5	−3	93	415	830	222	279	223	280	224	282
16,000	1	−7	88	389	778	214	278	216	280	217	281
18,000	−3	−11	82	365	730	206	277	208	279	209	281
20,000	−8	−15	77	341	682	198	275	200	277	202	280
22,000	−12	−18	72	319	638	189	272	192	275	194	278
24,000	−16	−22	66	296	592	180	268	183	272	186	275
26,000	−20	−26	61	275	550	171	263	174	268	177	272
28,000	−24	−30	56	256	512	161	257	165	263	169	269
29,000	−26	−32	54	246	492	155	253	160	260	164	266
31,000	−30	−36	49	227	454	144	242	150	253	155	261
33,000	−35	−40	45	209	418	126	221	138	242	147	254
35,000	−40	−44	38	190	380	---	---	121	222	133	243

Figure 7-232. Maximum Cruise Power - 1900 RPM - ISA + 10°C

MAXIMUM CRUISE POWER

1900 RPM

ISA +20°C

PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENG.	TOTAL FUEL FLOW	AIRSPEED ~ KNOTS					
						@ 12,000 LBS		@ 11,000 LBS		@ 10,000 LBS	
FEET	°C	°C	%	LBS/HR	LBS/HR	IAS	TAS	IAS	TAS	IAS	TAS
SL	41	35	100	515	1030	243	252	244	253	245	254
2000	37	31	100	502	1004	241	257	241	258	242	259
4000	33	27	100	488	976	238	262	239	263	240	264
6000	30	23	100	476	952	236	267	237	268	238	269
8000	26	19	100	465	930	233	272	234	274	235	275
10,000	22	15	96	441	882	227	274	228	275	230	276
12,000	18	11	91	417	834	220	274	222	275	223	277
14,000	14	7	86	392	784	213	274	215	276	216	277
16,000	10	3	82	368	736	206	273	208	275	210	277
18,000	6	−1	77	345	690	199	272	201	274	203	277
20,000	2	−5	72	323	646	191	270	193	273	195	276
22,000	−2	−8	67	302	604	182	267	185	271	188	274
24,000	−6	−12	62	282	564	174	263	177	268	180	272
26,000	−10	−16	58	262	524	164	258	168	264	171	269
28,000	−14	−20	53	243	486	154	251	159	258	163	265
29,000	−16	−22	51	234	468	148	246	153	255	158	262
31,000	−21	−26	46	216	432	134	232	143	246	148	255
33,000	−26	−30	42	198	396	---	---	129	231	138	247
35,000	---	---	---	---	---	---	---	---	---	---	---

Figure 7-233. Maximum Cruise Power-1900 RPM-ISA +20° C

MAXIMUM CRUISE POWER

1900 RPM

ISA + 30°C

PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENG.	TOTAL FUEL FLOW	AIRSPEED ~ KNOTS					
						@ 12,000 LBS		@ 11,000 LBS		@ 10,000 LBS	
FEET	°C	°C	%	LBS/HR	LBS/HR	IAS	TAS	IAS	TAS	IAS	TAS
SL	51	45	100	518	1036	242	255	242	256	243	257
2000	47	41	100	504	1008	239	259	240	260	241	261
4000	43	37	98	482	964	234	262	235	263	236	264
6000	40	33	96	462	924	230	265	231	266	232	268
8000	36	29	92	440	880	225	267	226	268	227	270
10,000	32	25	88	417	834	219	268	220	270	221	271
12,000	28	21	84	393	786	212	268	214	270	215	272
14,000	24	17	80	369	738	205	267	207	270	208	272
16,000	20	13	75	347	694	198	367	200	269	201	272
18,000	16	9	71	326	652	190	265	193	269	195	271
20,000	12	5	66	304	608	183	263	185	267	188	270
22,000	8	2	62	285	570	175	261	178	265	180	269
24,000	4	−2	58	266	532	166	257	170	262	173	267
26,000	0	−6	54	248	496	156	251	161	258	165	264
28,000	−5	−10	50	231	462	146	243	152	253	156	260
29,000	−7	−12	48	222	444	140	237	147	249	152	257
31,000	−11	−16	43	205	410	123	218	135	238	142	250
33,000	---	---	---	---	---	---	---	---	---	---	---
35,000	---	---	---	---	---	---	---	---	---	---	---

Figure 7-234. Maximum Cruise Power-1900 RPM-ISA +30°C

MAXIMUM CRUISE POWER

1900 RPM

ISA +37°C

PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENG.	TOTAL FUEL FLOW	AIRSPEED ~ KNOTS @ 12,000 LBS		@ 11,000 LBS		@ 10,000 LBS	
FEET	°C	°C	%	LBS/HR	LBS/HR	IAS	TAS	IAS	TAS	IAS	TAS
SL	58	52	95	506	1012	236	252	237	253	238	254
2000	54	48	93	485	970	232	255	233	256	234	257
4000	50	44	91	464	928	228	258	229	259	230	260
6000	46	40	90	445	890	224	261	225	262	226	264
8000	43	36	87	424	848	219	263	220	265	221	266
10,000	39	32	84	401	802	213	264	214	266	216	268
12,000	35	28	80	378	756	206	264	208	266	210	268
14,000	31	22	75	355	710	199	263	201	266	203	268
16,000	27	18	71	333	666	192	262	194	265	196	268
18,000	23	14	67	312	624	184	260	187	264	189	267
20,000	19	10	62	292	584	176	258	179	262	182	266
22,000	15	7	59	273	546	168	255	172	260	175	264
24,000	11	3	55	255	510	160	250	164	257	167	262
26,000	6	−1	51	237	474	150	244	155	252	159	259
28,000	2	−5	47	221	442	138	234	146	246	151	254
29,000	0	−7	45	213	426	132	227	141	242	146	252
31,000	−5	−11	41	197	394	---	---	128	229	137	244
33,000	---	---	---	---	---	---	---	---	---	---	---
35,000	---	---	---	---	---	---	---	---	---	---	---

Figure 7-235. Maximum Cruise Power-1900 RPM-ISA +37°C

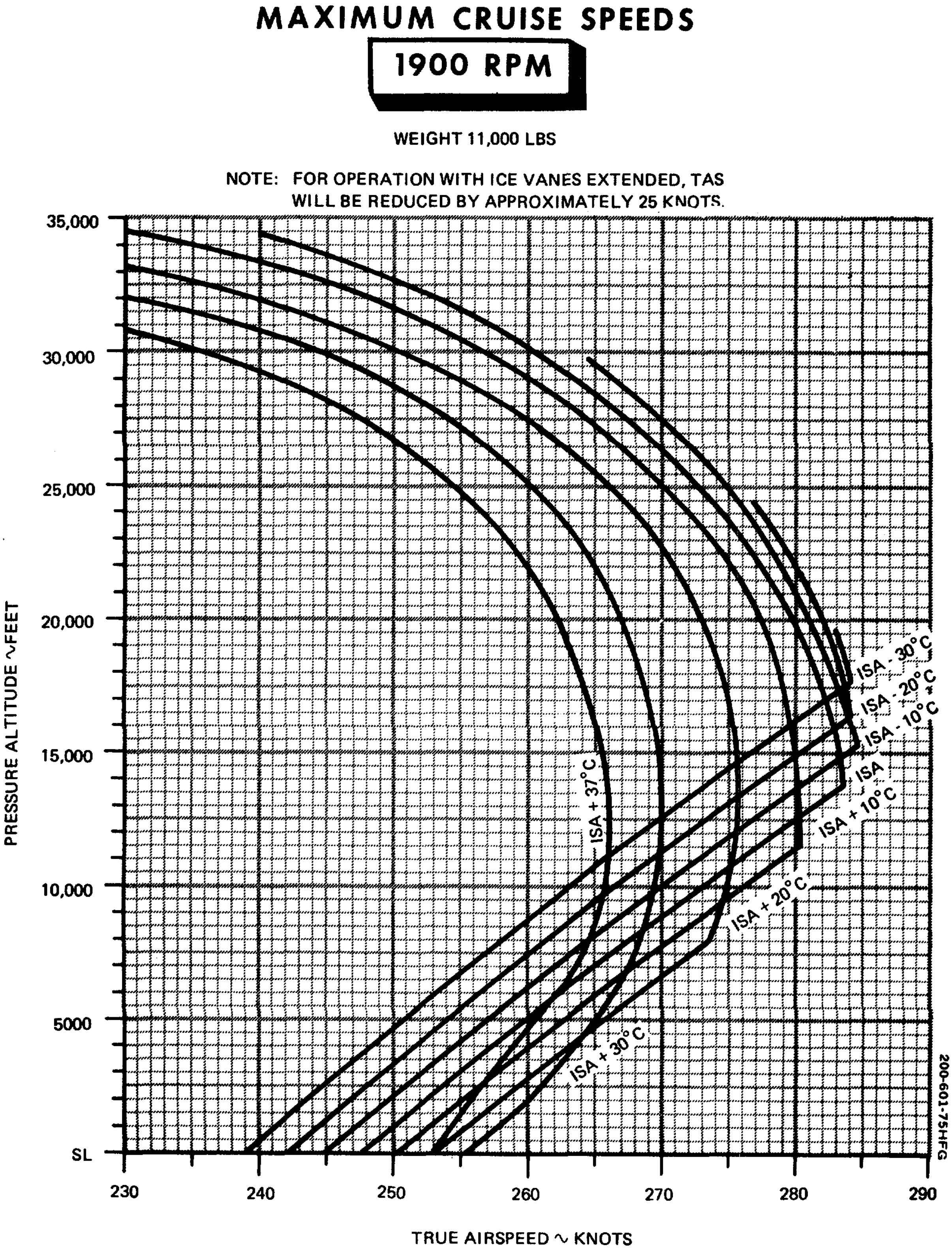


Figure 7-236. Maximum Cruise Speeds-1900 RPM

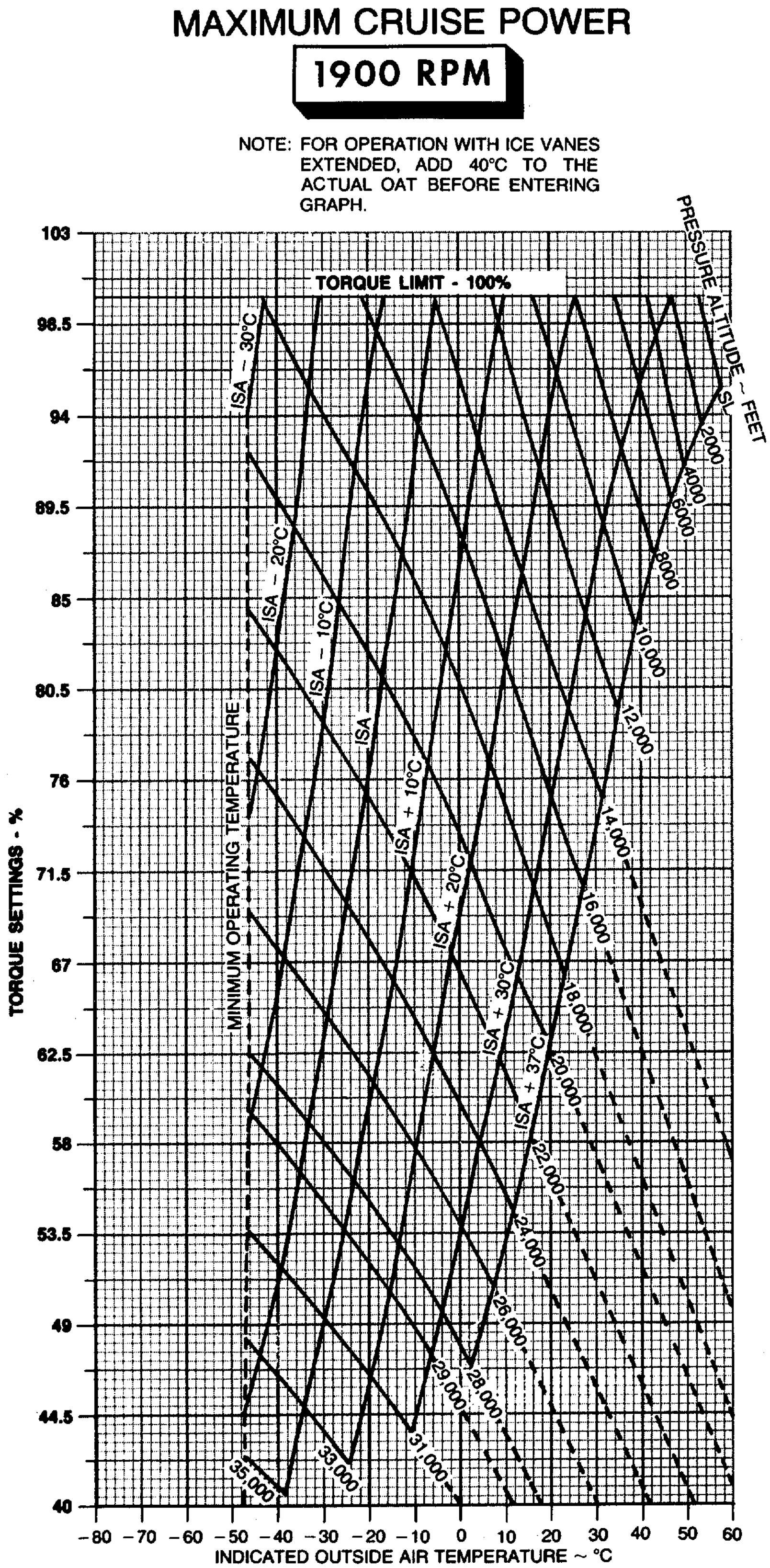


Figure 7-237. Maximum Cruise Speeds-1900 RPM

FUEL FLOW AT MAXIMUM CRUISE POWER

1900 RPM

NOTE: FOR OPERATION WITH ICE VANES EXTENDED, ADD 30°C TO THE ACTUAL OAT BEFORE ENTERING THE GRAPH.

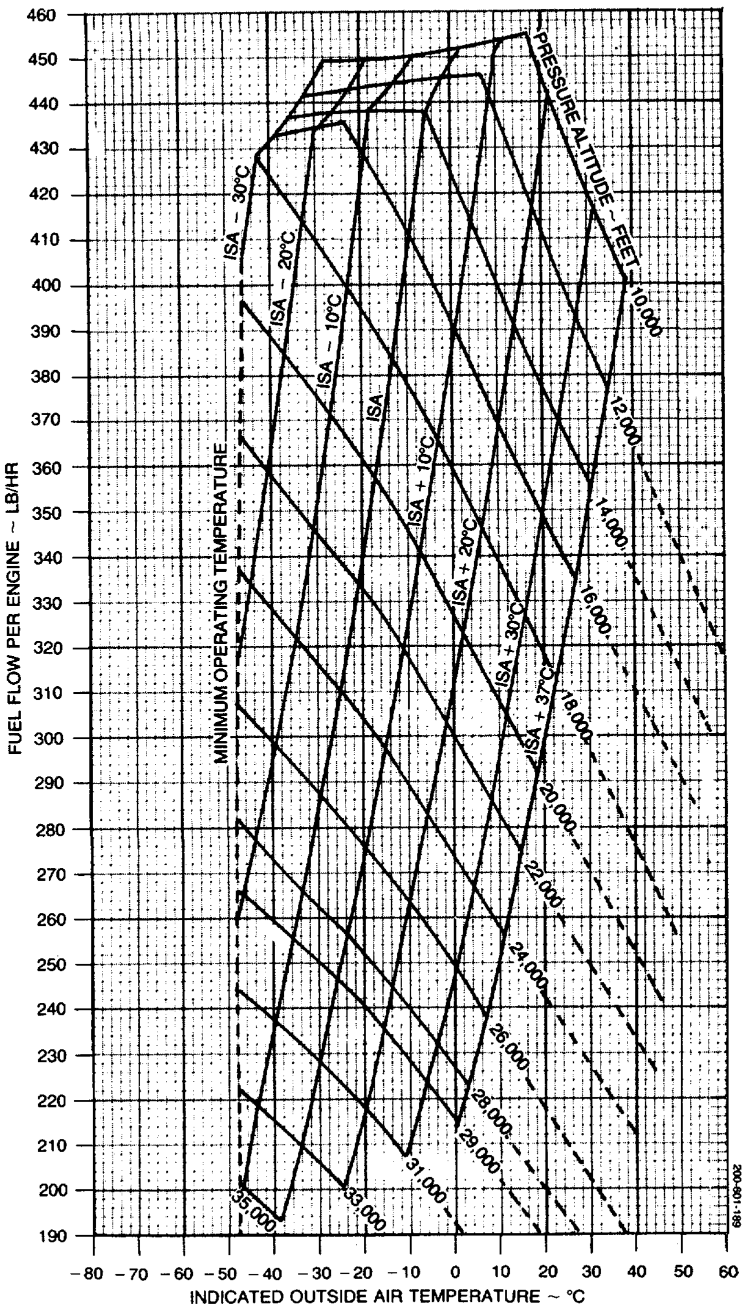


Figure 7-238. Fuel Flow at Maximum Cruise Power-1900 RPM

MAXIMUM RANGE POWER

1700 RPM

ISA − 30°C

NOTE: FOR OPERATION WITH ICE VANES EXTENDED, MAINTAIN SAME POWER AS WITH ICE VANES RETRACTED. FUEL FLOW WILL INCREASE APPROXIMATELY 15%.

WEIGHT →			12,000 POUNDS				11,000 POUNDS				10,000 POUNDS			
PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENG.	FUEL FLOW TOTAL	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG.	FUEL FLOW TOTAL	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG.	FUEL FLOW TOTAL	TAS
FEET	°C	°C	%	LB/HR	LB/HR	KNOTS	%	LB/HR	LB/HR	KNOTS	%	LB/HR	LB/HR	KNOTS
SL	−12	−15	66	373	746	196	62	363	726	193	57	350	700	189
2000	−16	−19	64	354	708	197	60	343	686	194	56	333	666	190
4000	−19	−23	62	336	672	198	58	326	652	195	54	315	630	191
6000	−23	−27	60	319	638	199	57	310	620	196	54	300	600	193
8000	−27	−31	59	303	606	200	56	294	588	197	52	284	568	194
10,000	−31	−35	57	287	574	201	54	277	554	198	50	268	536	195
12,000	−35	−39	56	273	546	202	52	262	524	199	49	252	504	196
14,000	−39	−43	54	260	520	204	51	249	498	200	47	239	478	197
16,000	−43	−47	54	250	500	206	50	239	478	202	46	228	456	198
18,000	−47	−51	53	242	484	208	49	230	460	204	45	219	438	200
20,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—
22,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—
24,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—
26,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—
28,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—
29,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—
31,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—
33,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—
35,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Figure 7-239. Maximum Range Power-1700 RPM-ISA-30° C

MAXIMUM RANGE POWER

1700 RPM

ISA – 20°C

NOTE: FOR OPERATION WITH ICE VANES EXTENDED, MAINTAIN SAME POWER AS WITH ICE VANES RETRACTED. FUEL FLOW WILL INCREASE APPROXIMATELY 15%.

WEIGHT →			12,000 POUNDS				11,000 POUNDS				10,000 POUNDS			
PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENG.	FUEL FLOW TOTAL	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG.	FUEL FLOW TOTAL	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG.	FUEL FLOW TOTAL	TAS
FEET	°C	°C	%	LB/HR	LB/HR	KNOTS	%	LB/HR	LB/HR	KNOTS	%	LB/HR	LB/HR	KNOTS
SL	– 2	– 5	65	372	744	197	61	360	720	194	57	350	700	191
2000	– 5	– 9	63	353	706	199	60	343	686	196	55	332	664	192
4000	– 9	– 13	61	335	670	200	58	325	650	197	53	313	626	193
6000	– 13	– 17	60	318	636	201	56	308	616	198	52	297	594	194
8000	– 17	– 21	58	301	602	202	54	291	582	199	50	280	560	195
10,000	– 21	– 25	57	286	572	203	53	276	552	200	49	265	530	196
12,000	– 25	– 29	56	273	546	205	52	262	524	201	48	251	502	197
14,000	– 29	– 33	54	260	520	206	50	249	498	202	46	238	476	198
16,000	– 33	– 37	54	250	500	209	50	238	476	204	46	227	454	200
18,000	– 37	– 41	54	243	486	212	49	230	460	207	45	219	438	203
20,000	– 41	– 45	54	236	472	215	49	222	444	210	45	210	420	205
22,000	– 44	– 48	53	230	460	220	50	219	438	215	45	205	410	209
24,000	– 48	– 52	53	224	448	221	50	215	430	220	45	201	402	213
26,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—
28,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—
29,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—
31,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—
33,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—
35,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Figure 7-240. Maximum Range Power-1700 RPM-ISA -20° C

MAXIMUM RANGE POWER

1700 RPM

ISA – 10°C

NOTE: FOR OPERATION WITH ICE VANES EXTENDED, MAINTAIN SAME POWER AS WITH ICE VANES RETRACTED. FUEL FLOW WILL INCREASE APPROXIMATELY 15%.

WEIGHT →			12,000 POUNDS				11,000 POUNDS				10,000 POUNDS			
PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENG.	FUEL FLOW TOTAL	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG.	FUEL FLOW TOTAL	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG.	FUEL FLOW TOTAL	TAS
FEET	°C	°C	%	LB/HR	LB/HR	KNOTS	%	LB/HR	LB/HR	KNOTS	%	LB/HR	LB/HR	KNOTS
SL	8	5	62	367	734	196	59	359	718	194	57	351	702	192
2000	5	1	60	347	694	197	57	339	678	195	54	331	662	193
4000	1	– 3	59	329	658	198	56	320	640	196	53	312	624	194
6000	– 3	– 7	58	312	624	200	54	303	606	198	51	294	588	195
8000	– 7	– 11	57	298	596	202	53	287	574	199	50	278	556	196
10,000	– 11	– 15	56	283	566	204	51	272	544	200	48	262	524	197
12,000	– 15	– 19	54	269	538	205	50	257	514	200	46	246	492	197
14,000	– 19	– 23	53	258	516	207	49	246	492	202	45	234	468	198
16,000	– 23	– 27	54	251	502	211	49	237	474	206	44	225	450	201
18,000	– 27	– 31	54	244	488	215	50	232	464	211	45	219	438	205
20,000	– 30	– 35	53	234	468	216	50	225	450	215	46	212	424	210
22,000	– 34	– 38	51	224	448	215	49	218	436	217	46	208	416	214
24,000	– 38	– 42	50	217	434	216	48	209	418	217	46	202	404	217
26,000	– 42	– 46	51	216	432	221	46	201	402	216	44	195	390	219
28,000	– 46	– 50	52	217	434	227	46	196	392	218	43	186	372	217
29,000	– 48	– 52	52	217	434	229	47	197	394	221	42	183	366	217
31,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—
33,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—
35,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Figure 7-241. Maximum Range Power-1700 RPM-ISA-10° C

MAXIMUM RANGE POWER

1700 RPM

ISA

NOTE: FOR OPERATION WITH ICE VANES EXTENDED, MAINTAIN SAME POWER AS WITH ICE VANES RETRACTED. FUEL FLOW WILL INCREASE APPROXIMATELY 15%.

WEIGHT →			12,000 POUNDS				11,000 POUNDS				10,000 POUNDS			
PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENG.	FUEL FLOW TOTAL	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG.	FUEL FLOW TOTAL	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG.	FUEL FLOW TOTAL	TAS
FEET	°C	°C	%	LB/HR	LB/HR	KNOTS	%	LB/HR	LB/HR	KNOTS	%	LB/HR	LB/HR	KNOTS
SL	19	15	66	382	764	202	61	367	734	197	56	353	706	193
2000	15	11	61	351	702	199	57	339	678	195	53	330	660	192
4000	11	7	58	328	656	199	55	319	638	196	52	310	620	194
6000	7	3	57	311	622	200	53	302	604	198	50	293	586	195
8000	3	– 1	56	296	592	202	52	286	572	200	49	277	554	197
10,000	– 1	– 5	55	282	564	204	51	271	542	201	47	261	522	197
12,000	– 5	– 9	54	270	540	207	50	258	516	202	46	246	492	198
14,000	– 9	– 13	54	259	518	209	49	246	492	205	45	234	468	200
16,000	– 13	– 17	53	251	502	212	50	239	478	209	45	226	452	203
18,000	– 16	– 21	53	243	486	215	50	232	464	212	46	221	442	209
20,000	– 20	– 25	52	235	470	217	49	223	446	214	46	214	428	213
22,000	– 24	– 28	53	230	460	221	47	214	428	215	45	207	414	215
24,000	– 28	– 32	53	226	452	224	47	208	416	216	44	197	394	215
26,000	– 32	– 36	52	222	444	226	47	206	412	221	42	189	378	214
28,000	– 36	– 40	54	223	446	233	48	204	408	226	42	185	370	217
29,000	– 38	– 42	54	225	450	236	48	203	406	227	43	185	370	220
31,000	– 42	– 46	—	—	—	—	49	205	410	234	43	185	370	225
33,000	– 46	– 50	—	—	—	—	—	—	—	—	44	186	372	231
35,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Figure 7-242. Maximum Range Power-1700 RPM-ISA

MAXIMUM RANGE POWER

1700 RPM

ISA + 10°C

NOTE: FOR OPERATION WITH ICE VANES EXTENDED, MAINTAIN SAME POWER AS WITH ICE VANES RETRACTED. FUEL FLOW WILL INCREASE APPROXIMATELY 15%.

WEIGHT →			12,000 POUNDS				11,000 POUNDS				10,000 POUNDS			
PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENG.	FUEL FLOW TOTAL	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG.	FUEL FLOW TOTAL	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG.	FUEL FLOW TOTAL	TAS
FEET	°C	°C	%	LB/HR	LB/HR	KNOTS	%	LB/HR	LB/HR	KNOTS	%	LB/HR	LB/HR	KNOTS
SL	29	25	72	398	796	211	69	389	778	209	65	379	758	206
2000	25	21	68	373	746	211	64	362	724	207	59	348	696	202
4000	21	17	64	348	696	209	58	331	662	202	52	315	630	196
6000	17	13	59	321	642	206	54	305	610	200	49	293	586	196
8000	13	9	57	301	602	206	52	287	574	200	48	275	550	196
10,000	9	5	56	286	572	207	50	271	542	201	46	260	520	198
12,000	5	1	55	274	548	210	50	259	518	204	45	246	492	199
14,000	1	− 3	55	264	528	213	49	248	496	206	44	234	468	201
16,000	− 3	− 7	55	257	514	218	49	240	480	210	44	226	452	204
18,000	− 6	−11	55	250	500	222	50	234	468	215	45	220	440	209
20,000	−10	−15	55	241	482	224	50	226	452	219	45	212	424	212
22,000	−14	−18	53	233	466	224	50	222	444	222	45	206	412	215
24,000	−18	−22	52	226	452	225	49	215	430	224	45	202	404	219
26,000	−22	−26	54	229	458	233	48	208	416	224	44	197	394	223
28,000	−26	−30	55	230	460	239	49	209	418	231	44	192	384	224
29,000	−28	−34	—	—	—	—	50	210	420	234	44	190	380	225
31,000	-32	−36	—	—	—	—	—	—	—	—	44	190	380	231
33,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—
35,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Figure 7-243. Maximum Range Power-1700 RPM-ISA + 10° C

MAXIMUM RANGE POWER

1700 RPM

ISA + 20°C

NOTE: FOR OPERATION WITH ICE VANES EXTENDED, MAINTAIN SAME POWER AS WITH ICE VANES RETRACTED. FUEL FLOW WILL INCREASE APPROXIMATELY 15%.

WEIGHT →			12,000 POUNDS				11,000 POUNDS				10,000 POUNDS			
PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENG.	FUEL FLOW TOTAL	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG.	FUEL FLOW TOTAL	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG.	FUEL FLOW TOTAL	TAS
FEET	°C	°C	%	LB/HR	LB/HR	KNOTS	%	LB/HR	LB/HR	KNOTS	%	LB/HR	LB/HR	KNOTS
SL	39	35	69	392	784	210	66	385	770	208	64	378	756	207
2000	35	31	67	373	746	211	64	365	730	210	62	358	716	209
4000	31	27	66	354	708	213	63	346	692	212	59	336	672	208
6000	27	23	65	337	674	216	60	325	650	212	55	312	624	207
8000	23	19	62	318	636	217	57	305	610	212	52	289	578	205
10,000	19	15	60	300	600	217	55	286	572	211	49	269	538	203
12,000	15	11	59	286	572	218	53	272	544	213	47	255	510	205
14,000	12	7	58	274	548	221	53	261	522	216	47	244	488	208
16,000	8	3	56	261	522	222	53	250	500	219	47	235	470	212
18,000	4	−1	55	250	500	222	52	241	482	221	47	227	454	216
20,000	0	−5	54	240	480	224	51	230	460	222	47	219	438	219
22,000	−4	−8	54	235	470	227	49	221	442	223	46	212	424	222
24,000	−8	−12	55	234	468	233	48	214	428	224	45	204	408	223
26,000	−12	−16	55	232	464	238	49	213	426	230	44	196	392	223
28,000	−15	−20	—	—	—	—	50	214	428	236	44	193	386	226
29,000	−18	−22	—	—	—	—	—	—	—	—	45	194	388	230
31,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—
33,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—
35,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Figure 7-244. Maximum Range Power-1700 RPM-ISA +20° C

MAXIMUM RANGE POWER

1700 RPM

ISA +30°C

NOTE: FOR OPERATION WITH ICE VANES EXTENDED, MAINTAIN SAME POWER AS WITH ICE VANES RETRACTED. FUEL FLOW WILL INCREASE APPROXIMATELY 15%.

WEIGHT →			12,000 POUNDS				11,000 POUNDS				10,000 POUNDS			
PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENG.	FUEL FLOW TOTAL	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG.	FUEL FLOW TOTAL	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG.	FUEL FLOW TOTAL	TAS
FEET	°C	°C	%	LB/HR	LB/HR	KNOTS	%	LB/HR	LB/HR	KNOTS	%	LB/HR	LB/HR	KNOTS
SL	49	45	71	402	804	215	67	390	780	211	63	380	760	208
2000	45	41	66	372	744	212	63	364	728	210	60	355	710	207
4000	41	37	64	351	702	213	61	343	686	211	58	335	670	209
6000	37	33	63	334	668	215	60	326	652	213	57	319	638	212
8000	33	29	61	317	634	216	59	310	620	215	56	303	606	214
10,000	30	25	59	301	602	218	57	294	588	217	54	285	570	215
12,000	26	21	58	286	572	219	55	279	558	218	52	269	538	216
14,000	22	17	56	273	546	220	53	263	526	218	50	254	508	216
16,000	18	13	56	263	526	223	52	251	502	219	49	242	484	218
18,000	14	9	56	256	512	227	51	240	480	221	48	231	462	219
20,000	10	5	56	249	498	231	51	232	464	224	47	220	440	220
22,000	6	2	56	242	484	233	51	227	454	228	45	211	422	222
24,000	2	−2	55	237	474	236	51	222	444	232	45	205	410	224
26,000	−1	−6	—	—	—	—	50	217	434	234	46	201	402	229
28,000	−5	−10	—	—	—	—	—	—	—	—	46	199	398	233
29,000	−7	−12	—	—	—	—	—	—	—	—	46	198	396	236
31,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—
33,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—
35,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Figure 7-245. Maximum Range Power-1700 RPM-ISA +30° C

MAXIMUM RANGE POWER

1700 RPM

ISA + 37°C

NOTE: FOR OPERATION WITH ICE VANES EXTENDED, MAINTAIN SAME POWER AS WITH ICE VANES RETRACTED. FUEL FLOW WILL INCREASE APPROXIMATELY 15%.

WEIGHT →			12,000 POUNDS				11,000 POUNDS				10,000 POUNDS			
PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENG.	FUEL FLOW TOTAL	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG.	FUEL FLOW TOTAL	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG.	FUEL FLOW TOTAL	TAS
FEET	°C	°C	%	LB/HR	LB/HR	KNOTS	%	LB/HR	LB/HR	KNOTS	%	LB/HR	LB/HR	KNOTS
SL	56	52	73	406	812	218	67	392	784	213	63	380	760	209
2000	52	48	70	383	766	218	64	369	738	213	60	357	714	209
4000	48	44	66	359	718	217	61	345	690	212	57	335	670	209
6000	44	40	63	335	670	216	59	325	650	213	56	316	632	211
8000	40	36	61	318	636	218	57	308	616	215	54	299	598	213
10,000	37	32	60	304	608	220	56	292	584	216	53	283	566	214
12,000	33	28	59	291	582	222	54	277	554	218	51	269	538	216
14,000	29	24	58	279	558	225	53	265	530	220	50	254	508	216
16,000	25	20	58	269	538	228	53	255	510	222	48	241	482	218
18,000	21	16	57	260	520	230	52	246	492	226	47	231	462	220
20,000	17	12	56	249	498	231	52	238	476	229	47	222	444	222
22,000	13	10	56	244	488	234	51	230	460	231	47	216	432	226
24,000	9	6	—	—	—	—	50	222	444	232	47	210	420	230
26,000	6	2	—	—	—	—	52	222	444	240	46	204	408	231
28,000	2	−2	—	—	—	—	—	—	—	—	46	201	402	236
29,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—
31,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—
33,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—
35,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Figure 7-246. Maximum Range Power-1700 RPM-ISA +37°C

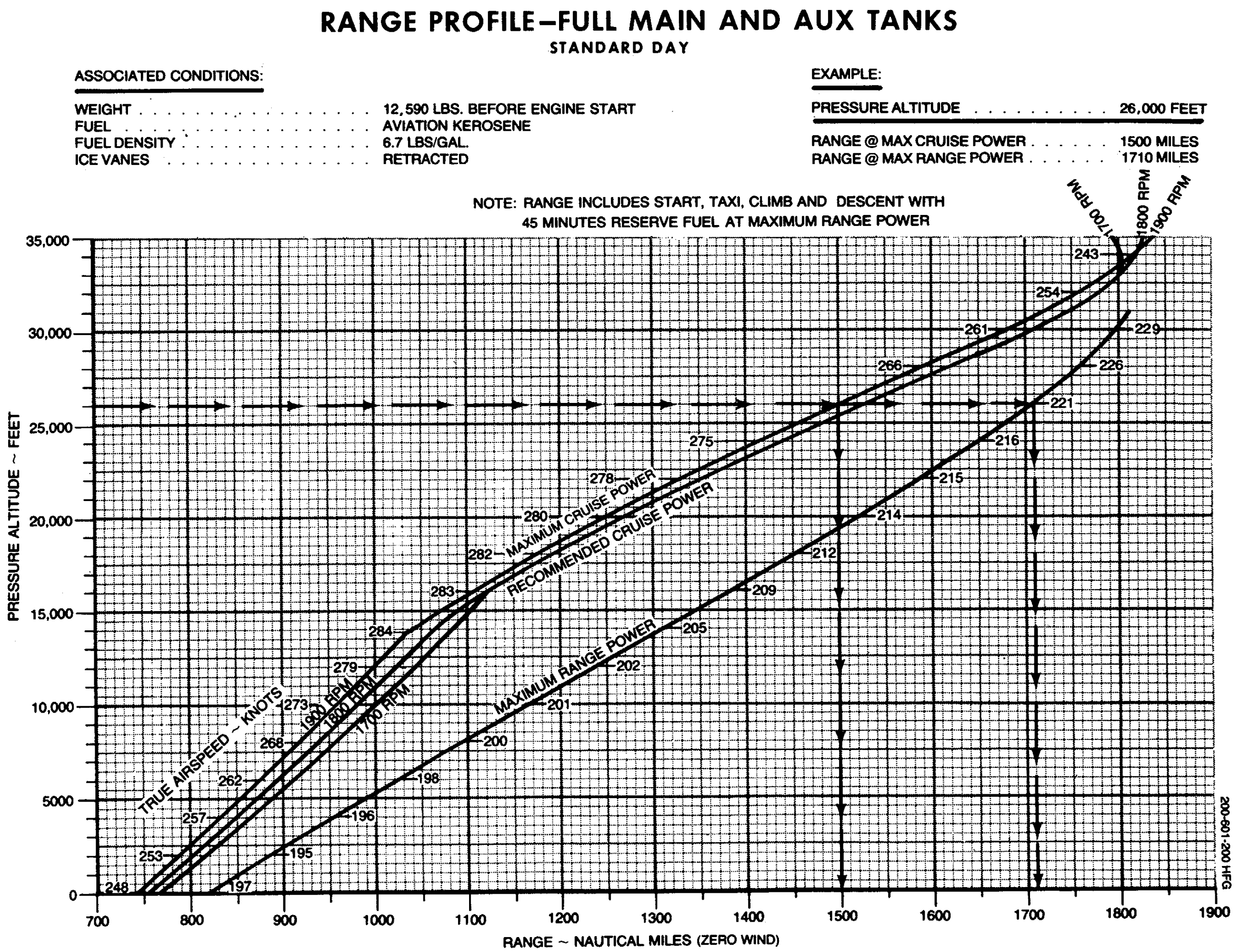


Figure 7-247. Range Profile-Full Main and Full Aux Tanks

ENDURANCE PROFILE — FULL MAIN AND AUX TANKS

STANDARD DAY

ASSOCIATED CONDITIONS:

WEIGHT . . . . 12,590 LBS BEFORE ENGINE START
FUEL . . . . AVIATION KEROSENE
FUEL DENSITY . . . . . . 6.7 LBS/GAL
ICE VANES . . . . RETRACTED

EXAMPLE:

PRESSURE ALTITUDE .... 26,000 FEET

ENDURANCE @ MAX CRUISE POWER.................. 5.625 HRS
ENDURANCE @ MAX RANGE POWER .... 7.8 HRS

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

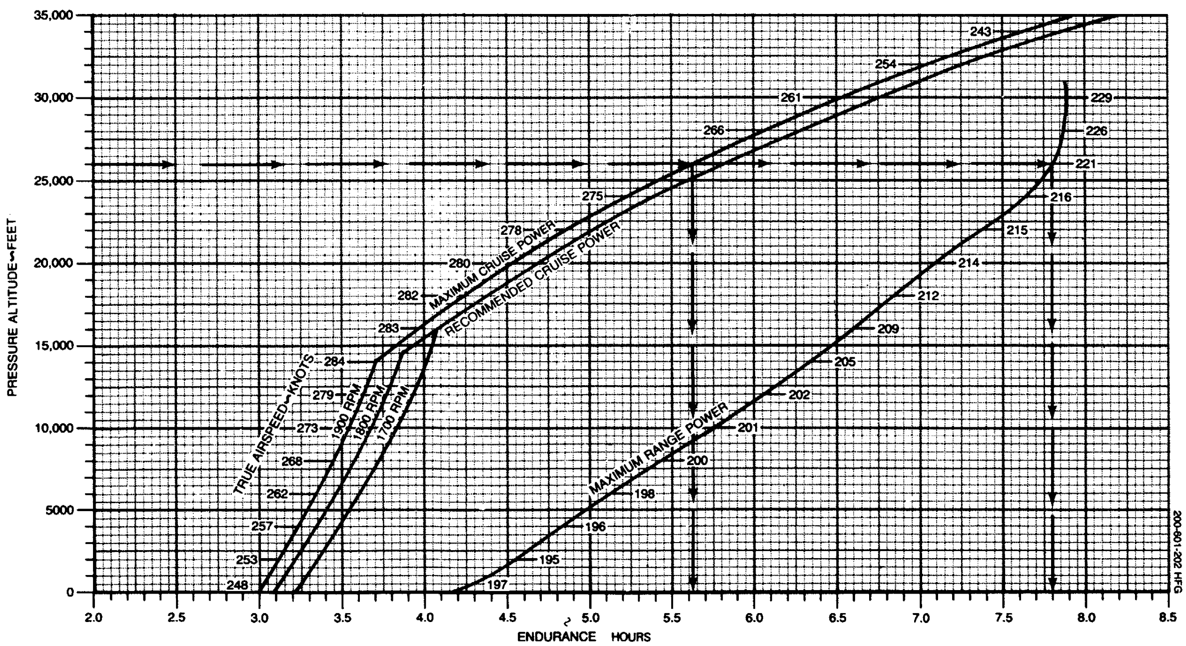


Figure 7-248. Endurance Profile-Full Main and Full Aux Tanks

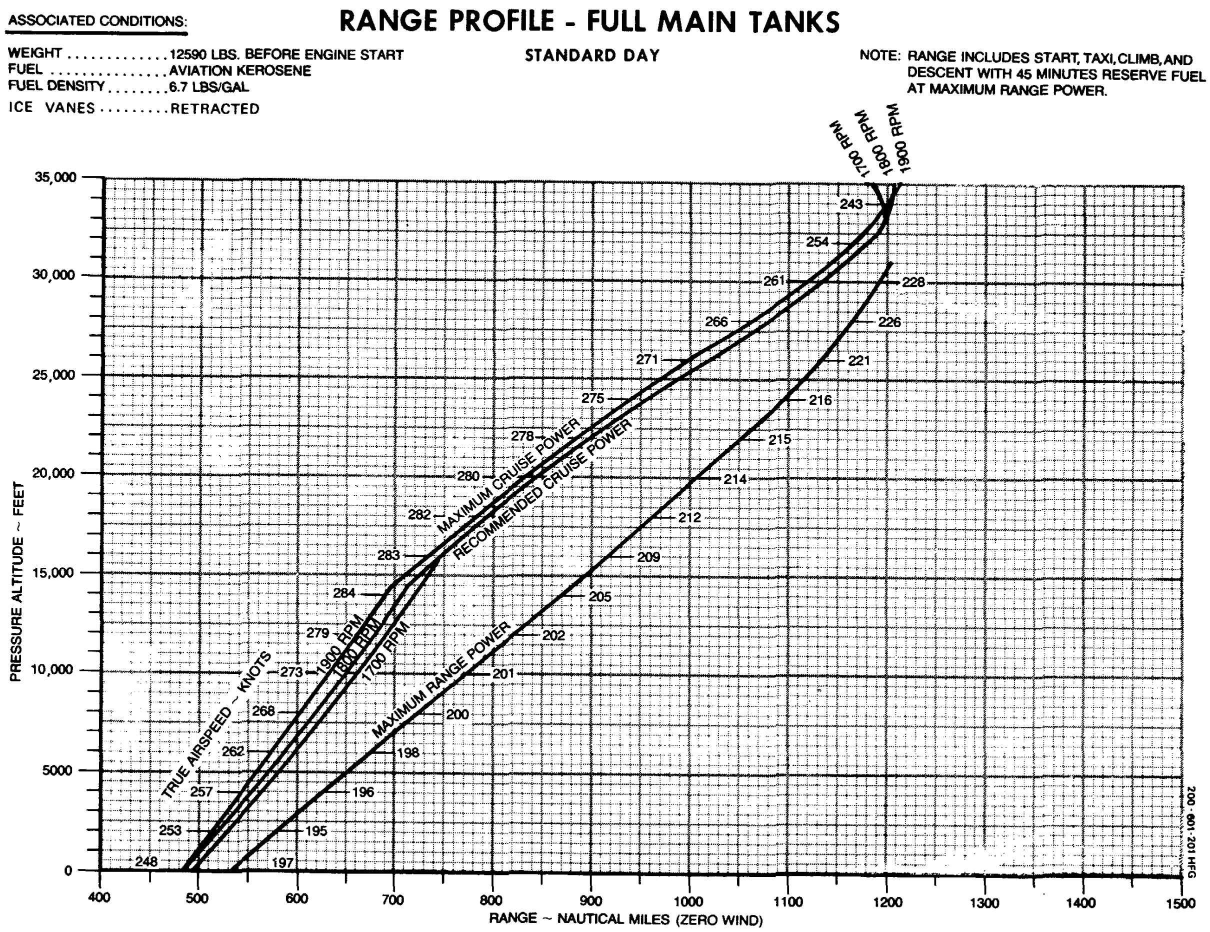


Figure 7-249. Range Profile-Full Main Tanks

ENDURANCE PROFILE — FULL MAIN TANKS

STANDARD DAY

ASSOCIATED CONDITIONS:

WEIGHT . . . . 12,590 LBS BEFORE ENGINE START
FUEL . . . . AVIATION KEROSENE
FUEL DENSITY . . . . 6.7 LBS/GAL
ICE VANES . . . . RETRACTED

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

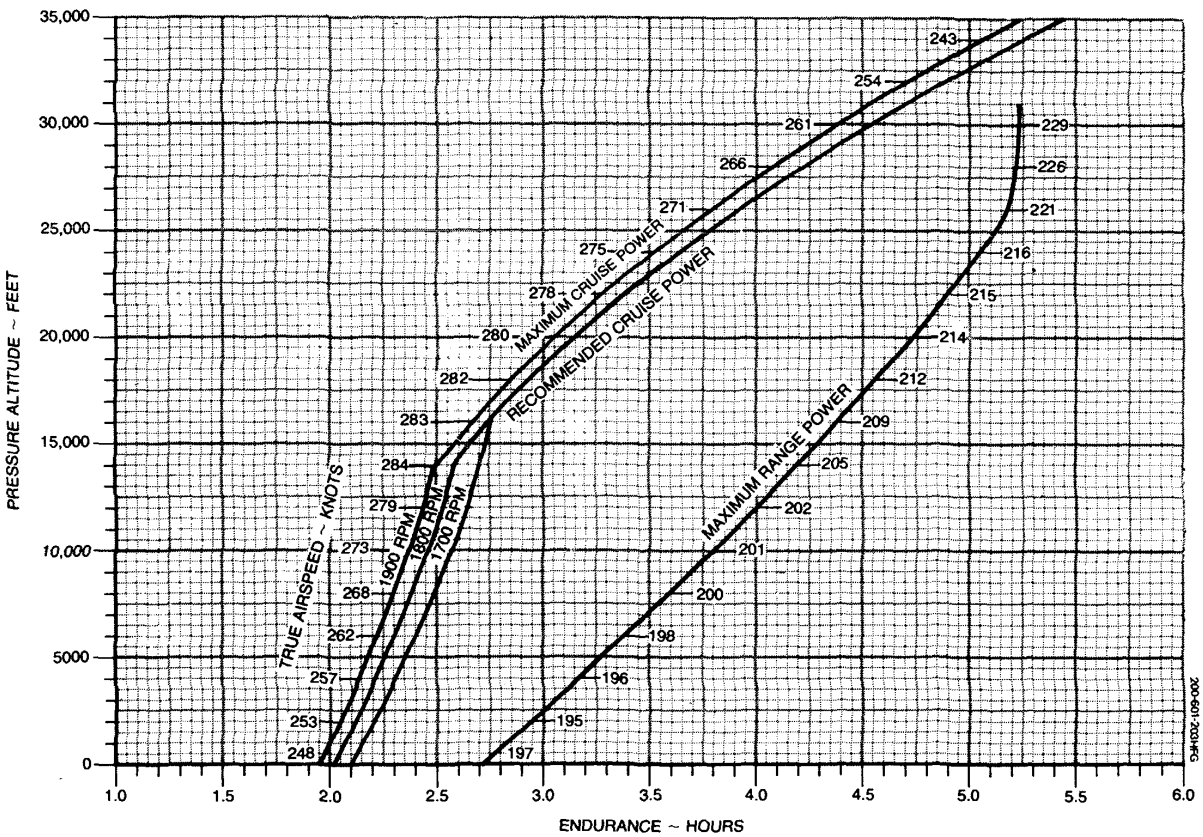


Figure 7-250. Endurance Profile-Full Main Tanks

ONE ENGINE INOPERATIVE MAXIMUM CRUISE POWER

1900 RPM

ISA – 30°C

NOTE: FOR OPERATION WITH ICE VANE EXTENDED, DECREASE FUEL FLOW AND TAS BY 7%.

PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENG.	TOTAL FUEL FLOW	AIRSPEED ~ KNOTS					
						@ 12,000 LBS		@ 11,000 LBS		@ 10,000 LBS	
FEET	°C	°C	%	LBS/HR	LBS/HR	IAS	TAS	IAS	TAS	IAS	TAS
SL	–12	–15	100	512	512	191	182	193	183	194	185
2000	–16	–19	100	500	500	189	185	191	187	192	188
4000	–20	–23	100	488	488	186	188	188	190	190	191
6000	–23	–27	100	477	477	184	191	186	193	188	195
8000	–27	–31	100	467	467	182	194	184	196	186	198
10,000	–31	–35	100	458	458	179	197	182	199	184	202
12,000	–35	–39	100	452	452	177	200	179	203	181	205
14,000	–39	–43	100	448	448	174	203	177	206	179	209
16,000	–43	–47	96	431	431	168	202	171	206	174	209
18,000	–47	–51	90	401	401	159	198	163	203	167	207
20,000	—	—	—	—	—	—	—	—	—	—	—
22,000	—	—	—	—	—	—	—	—	—	—	—
24,000	—	—	—	—	—	—	—	—	—	—	—
26,000	—	—	—	—	—	—	—	—	—	—	—
28,000	—	—	—	—	—	—	—	—	—	—	—
29,000	—	—	—	—	—	—	—	—	—	—	—
31,000	—	—	—	—	—	—	—	—	—	—	—
33,000	—	—	—	—	—	—	—	—	—	—	—
35,000	—	—	—	—	—	—	—	—	—	—	—

Figure 7-251. One-Engine-Inoperative Maximum Cruise Power-1900 RPM-ISA-30° C

ONE ENGINE INOPERATIVE
MAXIMUM CRUISE POWER

1900 RPM

ISA – 20°C

NOTE: FOR OPERATION WITH ICE VANE EXTENDED, DECREASE FUEL FLOW AND TAS BY 7%.

PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENG.	TOTAL FUEL FLOW	AIRSPEED ~ KNOTS					
						@ 12,000 LBS		@ 11,000 LBS		@ 10,000 LBS	
FEET	°C	°C	%	LBS/HR	LBS/HR	IAS	TAS	IAS	TAS	IAS	TAS
SL	– 2	– 5	100	515	515	189	184	191	185	193	187
2000	– 6	– 9	100	501	501	187	187	189	189	191	190
4000	– 10	– 13	100	489	489	185	190	187	192	189	194
6000	– 13	– 17	100	478	478	182	193	184	195	186	197
8000	– 17	– 21	100	467	467	180	196	182	198	184	200
10,000	– 21	– 25	100	460	460	177	199	180	202	182	204
12,000	– 25	– 29	100	454	454	175	202	177	205	180	207
14,000	– 29	– 33	99	445	445	171	203	174	207	177	210
16,000	– 33	– 37	92	416	416	162	199	166	204	169	208
18,000	– 37	– 41	86	387	387	153	195	158	201	162	205
20,000	– 41	– 45	80	360	360	143	188	149	196	154	202
22,000	– 45	– 48	74	335	335	130	177	139	189	145	197
24,000	– 50	– 52	68	310	310	—	—	127	179	136	191
26,000	—	—	—	—	—	—	—	—	—	—	—
28,000	—	—	—	—	—	—	—	—	—	—	—
29,000	—	—	—	—	—	—	—	—	—	—	—
31,000	—	—	—	—	—	—	—	—	—	—	—
33,000	—	—	—	—	—	—	—	—	—	—	—
35,000	—	—	—	—	—	—	—	—	—	—	—

Figure 7-252. One-Engine-Inoperative Maximum Cruise Power-1900 RPM-ISA-20° C

ONE ENGINE INOPERATIVE MAXIMUM CRUISE POWER

1900 RPM

ISA – 10°C

NOTE: FOR OPERATION WITH ICE VANE EXTENDED, DECREASE FUEL FLOW AND TAS BY 7%.

PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENG.	TOTAL FUEL FLOW	AIRSPEED ~ KNOTS @ 12,000 LBS		@ 11,000 LBS		@ 10,000 LBS	
FEET	°C	°C	%	LBS/HR	LBS/HR	IAS	TAS	IAS	TAS	IAS	TAS
SL	8	5	100	517	517	188	185	190	187	192	189
2000	4	1	100	503	503	185	188	188	191	189	192
4000	1	– 3	100	490	490	183	191	185	194	187	196
6000	– 3	– 7	100	479	479	181	195	183	197	185	199
8000	– 7	– 11	100	469	469	178	198	181	200	183	203
10,000	– 11	– 15	100	461	461	175	201	178	204	180	206
12,000	– 15	– 19	100	455	455	173	204	175	207	178	209
14,000	– 19	– 23	95	430	430	165	201	169	205	172	209
16,000	– 23	– 27	86	401	401	157	197	161	202	164	206
18,000	– 27	– 31	82	374	374	147	191	153	198	157	203
20,000	– 31	– 35	76	347	347	135	182	143	192	148	199
22,000	– 35	– 38	71	323	323	---	---	133	184	140	194
24,000	– 40	– 42	65	299	299	---	---	---	---	130	187
26,000	---	---	---	---	---	---	---	---	---	---	---
28,000	---	---	---	---	---	---	---	---	---	---	---
29,000	---	---	---	---	---	---	---	---	---	---	---
31,000	---	---	---	---	---	---	---	---	---	---	---
33,000	---	---	---	---	---	---	---	---	---	---	---
35,000	---	---	---	---	---	---	---	---	---	---	---

Figure 7-253. One-Engine-Inoperative Maximum Cruise Power-1900 RPM-ISA-10°C

ONE ENGINE INOPERATIVE MAXIMUM CRUISE POWER

1900 RPM

ISA

NOTE: FOR OPERATION WITH ICE VANE EXTENDED, DECREASE FUEL FLOW AND TAS BY 7%.

PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENG.	TOTAL FUEL FLOW	AIRSPEED ~ KNOTS @ 12,000 LBS		@ 11,000 LBS		@ 10,000 LBS	
FEET	°C	°C	%	LBS/HR	LBS/HR	IAS	TAS	IAS	TAS	IAS	TAS
SL	18	15	100	522	522	186	187	188	189	190	191
2000	14	11	100	508	508	184	190	186	192	188	194
4000	11	7	100	494	494	181	193	184	196	186	198
6000	7	3	100	482	482	179	196	181	199	184	201
8000	3	− 1	100	472	472	176	200	179	202	181	205
10,000	− 1	− 5	100	462	462	174	202	176	205	179	208
12,000	− 5	− 9	97	445	445	168	203	172	206	174	210
14,000	− 9	−13	91	416	416	160	199	164	204	167	208
16,000	−13	−17	85	388	388	151	194	156	200	160	205
18,000	−17	−21	79	361	361	141	187	147	195	152	201
20,000	−21	−25	73	334	334	126	173	137	188	143	196
22,000	−26	−28	67	311	311	—	—	125	177	134	190
24,000	−31	−32	60	283	283	—	—	—	—	123	181
26,000	—	—	—	—	—	—	—	—	—	—	—
28,000	—	—	—	—	—	—	—	—	—	—	—
29,000	—	—	—	—	—	—	—	—	—	—	—
31,000	—	—	—	—	—	—	—	—	—	—	—
33,000	—	—	—	—	—	—	—	—	—	—	—
35,000	—	—	—	—	—	—	—	—	—	—	—

Figure 7-254. One-Engine-Inoperative Maximum Cruise Power-1900 RPM-ISA

ONE ENGINE INOPERATIVE MAXIMUM CRUISE POWER

1900 RPM

ISA + 10°C

NOTE: FOR OPERATION WITH ICE VANE EXTENDED, DECREASE FUEL FLOW AND TAS BY 7%.

PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENG.	TOTAL FUEL FLOW	AIRSPEED ~ KNOTS @ 12,000 LBS		@ 11,000 LBS		@ 10,000 LBS	
FEET	°C	°C	%	LBS/HR	LBS/HR	IAS	TAS	IAS	TAS	IAS	TAS
SL	28	25	100	525	525	185	189	187	191	189	193
2000	25	21	100	511	511	182	192	185	194	187	196
4000	21	17	100	497	497	180	195	182	198	184	200
6000	17	13	100	485	485	177	198	180	201	182	203
8000	13	9	100	474	474	175	201	177	204	180	207
10,000	9	5	96	449	449	168	200	172	204	174	207
12,000	5	1	91	422	422	161	197	165	202	168	206
14,000	1	– 3	85	396	396	153	194	158	199	161	204
16,000	– 3	– 7	80	371	371	144	188	150	196	154	201
18,000	– 7	– 11	75	347	347	133	179	141	191	147	198
20,000	– 12	– 15	70	322	322	---	---	131	183	138	193
22,000	– 16	– 18	64	300	300	---	---	---	---	128	186
24,000	---	---	---	---	---	---	---	---	---	---	---
26,000	---	---	---	---	---	---	---	---	---	---	---
28,000	---	---	---	---	---	---	---	---	---	---	---
29,000	---	---	---	---	---	---	---	---	---	---	---
31,000	---	---	---	---	---	---	---	---	---	---	---
33,000	---	---	---	---	---	---	---	---	---	---	---
35,000	---	---	---	---	---	---	---	---	---	---	---

Figure 7-255. One-Engine-Inoperative Maximum Cruise Power-1900 RPM-ISA- +10°C

ONE ENGINE INOPERATIVE MAXIMUM CRUISE POWER

1900 RPM

ISA +20°C

NOTE: FOR OPERATION WITH ICE VANE EXTENDED, DECREASE FUEL FLOW AND TAS BY 7%.

PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENG.	TOTAL FUEL FLOW	AIRSPEED ~ KNOTS					
						@ 12,000 LBS		@ 11,000 LBS		@ 10,000 LBS	
FEET	°C	°C	%	LBS/HR	LBS/HR	IAS	TAS	IAS	TAS	IAS	TAS
SL	33	35	100	529	529	183	191	186	193	187	195
2000	35	31	100	514	514	181	194	183	196	185	198
4000	31	27	100	499	499	178	196	181	199	183	202
6000	27	23	97	476	476	173	197	176	200	189	203
8000	23	19	93	451	451	167	196	171	200	173	203
10,000	19	15	88	425	425	160	194	164	199	167	202
12,000	15	11	84	400	400	153	191	157	196	161	201
14,000	11	7	79	375	375	144	186	150	193	154	199
16,000	7	3	74	352	352	134	179	142	189	147	196
18,000	2	−1	70	329	329	---	---	132	183	139	192
20,000	−2	−5	65	306	306	---	---	119	170	131	186
22,000	−7	−8	59	283	283	---	---	---	---	120	177
24,000	---	---	---	---	---	---	---	---	---	---	---
26,000	---	---	---	---	---	---	---	---	---	---	---
28,000	---	---	---	---	---	---	---	---	---	---	---
29,000	---	---	---	---	---	---	---	---	---	---	---
31,000	---	---	---	---	---	---	---	---	---	---	---
33,000	---	---	---	---	---	---	---	---	---	---	---
35,000	---	---	---	---	---	---	---	---	---	---	---

Figure 7-256. One-Engine-Inoperative Maximum Cruise Power-1900 RPM-ISA +20°C

ONE ENGINE INOPERATIVE MAXIMUM CRUISE POWER

1900 RPM

ISA +30°C

NOTE: FOR OPERATION WITH ICE VANE EXTENDED DECREASE FUEL FLOW AND TAS BY 7%.

PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENG.	TOTAL FUEL FLOW	AIRSPEED ~ KNOTS					
						@ 12,000 LBS		@ 11,000 LBS		@ 10,000 LBS	
FEET	°C	°C	%	LBS/HR	LBS/HR	IAS	TAS	IAS	TAS	IAS	TAS
SL	48	45	95	517	517	178	188	181	191	183	193
2000	44	41	94	496	496	174	190	177	193	179	195
4000	41	37	92	475	475	170	191	173	194	176	197
6000	37	33	89	453	453	165	191	169	195	171	198
8000	33	29	86	429	429	159	190	163	195	166	198
10,000	29	25	82	404	404	152	187	157	193	160	197
12,000	25	21	77	379	379	144	183	150	190	154	196
14,000	20	17	73	355	355	134	176	142	186	147	193
16,000	16	13	69	333	333	—	—	133	180	141	189
18,000	12	9	64	311	311	—	—	121	170	131	185
20,000	7	5	58	287	287	—	—	—	—	121	176
22,000	—	—	—	—	—	—	—	—	—	—	—
24,000	—	—	—	—	—	—	—	—	—	—	—
26,000	—	—	—	—	—	—	—	—	—	—	—
28,000	—	—	—	—	—	—	—	—	—	—	—
29,000	—	—	—	—	—	—	—	—	—	—	—
31,000	—	—	—	—	—	—	—	—	—	—	—
33,000	—	—	—	—	—	—	—	—	—	—	—
35,000	—	—	—	—	—	—	—	—	—	—	—

Figure 7-257. One-Engine-Inoperative Maximum Cruise Power-1900 RPM-ISA-30°C

ONE ENGINE INOPERATIVE MAXIMUM CRUISE POWER

1900 RPM

ISA +37°C

NOTE: FOR OPERATION WITH ICE VANE EXTENDED, DECREASE FUEL FLOW AND TAS BY 7%.

PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENG.	TOTAL FUEL FLOW	AIRSPEED ~ KNOTS @ 12,000 LBS		@ 11,000 LBS		@ 10,000 LBS	
FEET	°C	°C	%	LBS/HR	LBS/HR	IAS	TAS	IAS	TAS	IAS	TAS
SL	55	52	89	497	497	172	184	175	187	177	189
2000	51	48	87	477	477	168	185	171	188	174	191
4000	47	44	86	457	457	164	186	167	190	170	193
6000	43	40	84	437	437	159	186	163	191	166	194
8000	40	36	81	414	414	153	185	158	190	161	194
10,000	35	32	77	390	390	146	182	151	188	155	193
12,000	31	28	73	366	366	137	176	144	185	149	191
14,000	27	24	69	342	342	124	165	135	180	142	188
16,000	23	20	65	320	320	—	—	125	171	134	184
18,000	18	16	59	295	295	—	—	—	—	124	177
20,000	—	—	—	—	—	—	—	—	—	—	—
22,000	—	—	—	—	—	—	—	—	—	—	—
24,000	—	—	—	—	—	—	—	—	—	—	—
26,000	—	—	—	—	—	—	—	—	—	—	—
28,000	—	—	—	—	—	—	—	—	—	—	—
29,000	—	—	—	—	—	—	—	—	—	—	—
31,000	—	—	—	—	—	—	—	—	—	—	—
33,000	—	—	—	—	—	—	—	—	—	—	—
35,000	—	—	—	—	—	—	—	—	—	—	—

Figure 7-258. One-Engine-Inoperative Maximum Cruise Power-1900 RPM-ISA +37°C

PRESSURIZATION CONTROLLER SETTING FOR LANDING

EXAMPLE:

ALTIMETER SETTING . . . . 29.52 In.Hg
LANDING FIELD ELEVATION. . 2000 FEET
CABIN ALTITUDE SETTING . . . 2885 FEET

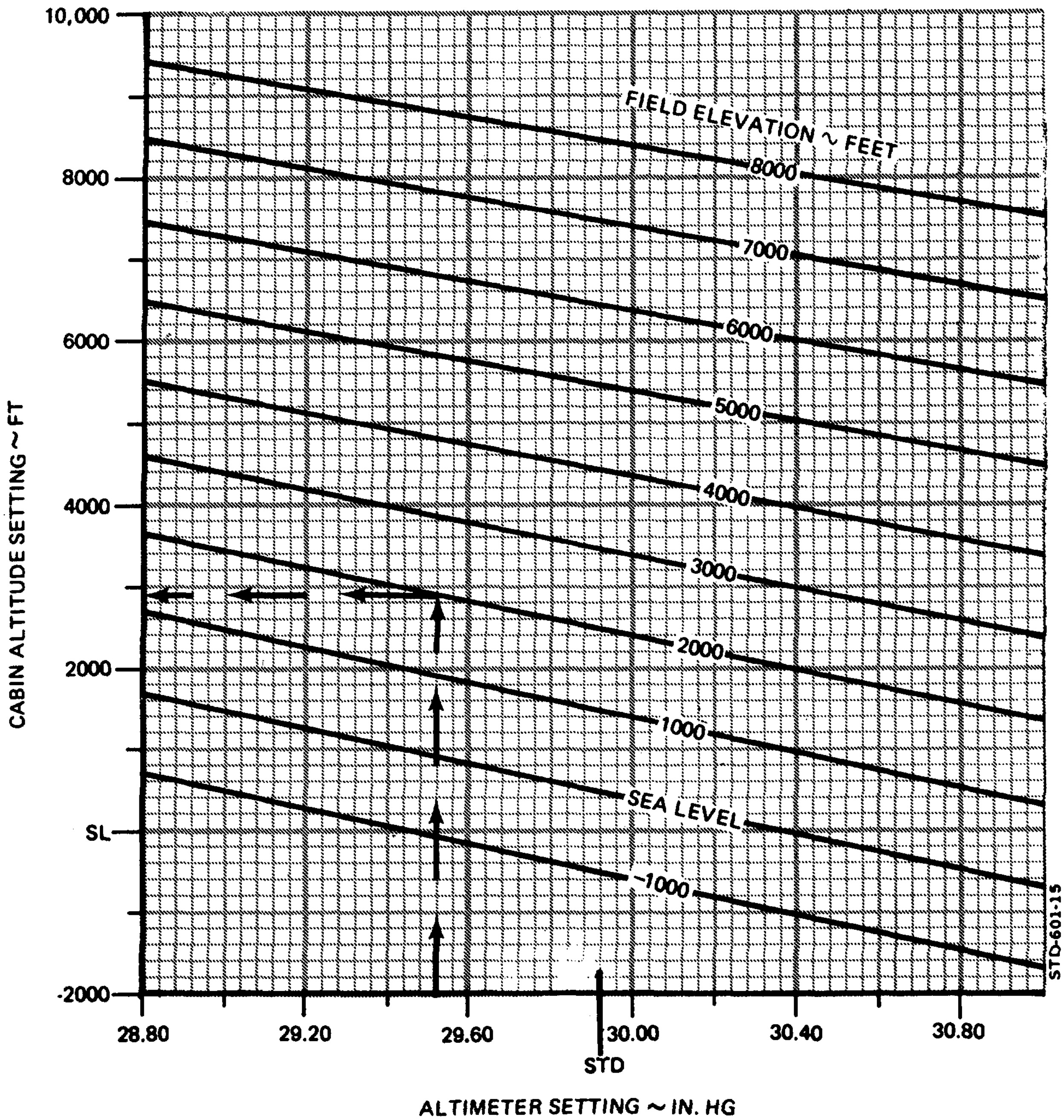


Figure 7-259. Pressurization Controller Setting for Landing

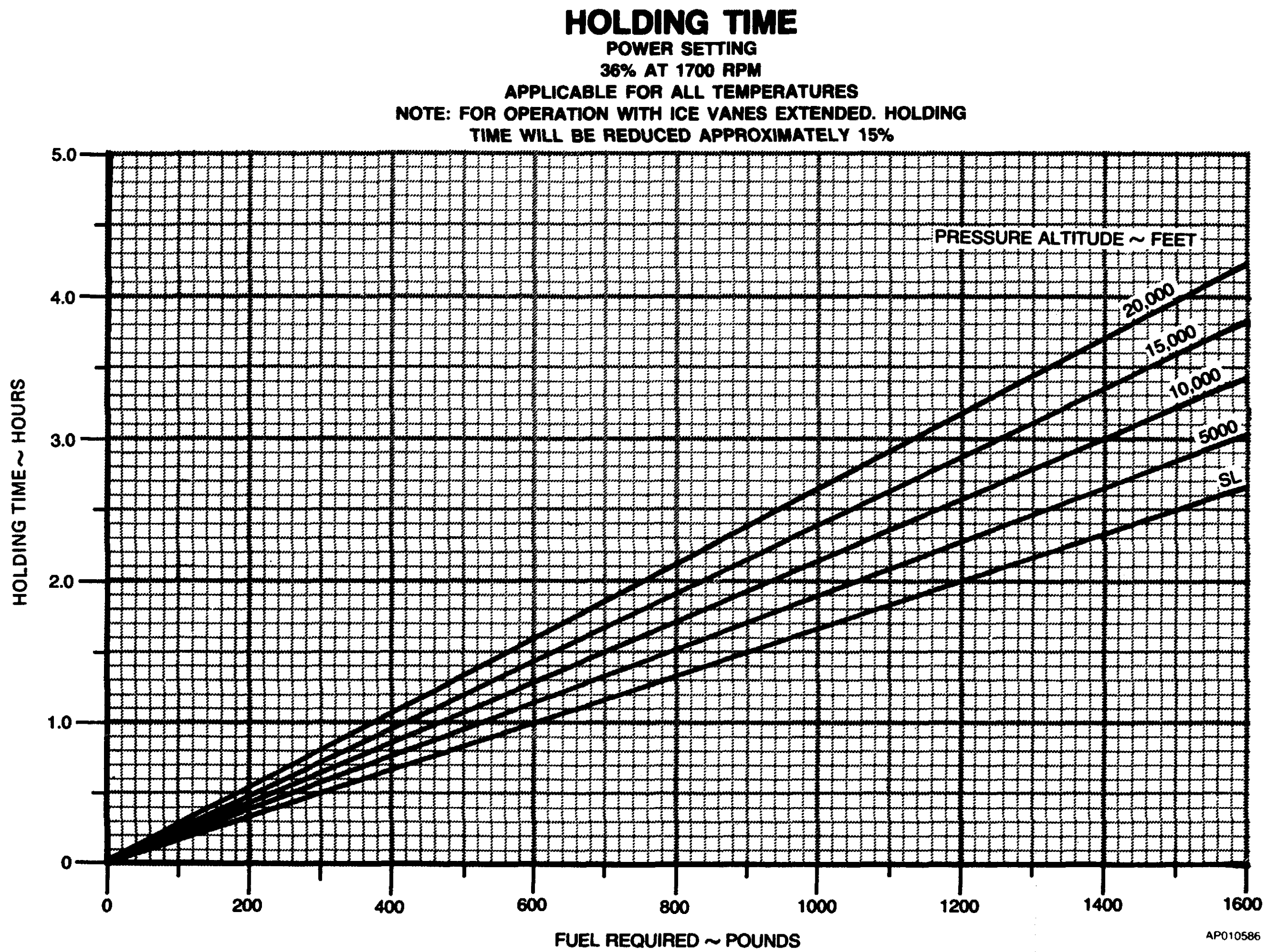


Figure 7-260. Holding Time

CHAPTER 7

Section IV MODEL C-12 *F*

INTRODUCTION

The performance and cruise data contained in this section of Chapter 7 pertains to C-12***F*** model aircraft. Data for C-12 ***CD*** aircraft can be found in section **II**, and **III** respectively. Users are authorized to remove whichever sections not applicable to their model aircraft, and are not required to carry on-board all sections.

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Section IV. MODEL C-12F
INTRODUCTION TO PERFORMANCE DATA

7-1. DESCRIPTION.

The charts presented in this chapter are based on and are consistent with the recommended operating procedures and techniques set forth in other chapters of this manual. The charts contain the performance data necessary for preflight and inflight mission planning. Explanatory text applicable to each type of chart is included to illustrate the use of the data presented.

The data contained in this section of Chapter 7 pertainsonly to the C-12F model aircraft. Data for A, C and D models can be found in sections I, II and III respectively. The user is authorized to remove sections which are not applicable to his model aircraft; only the applicable section is required to be carried on-board.

7-2. PURPOSE.

a. The purpose of this chapter is to provide the best available performance data for the C-12F aircraft. Regular use of this information will enable you to receive maximum safe utilization from the aircraft. Although maximum performance is not always required, regular use of this chapter is recommended for the following reasons:

(1) Knowledge of your performance margin will allow you to make better decisions when unexpected conditions or alternate missions are encountered.

(2) Situations requiring maximum performance will be more readily recognized.

(3) Familiarity with the data will allow performance to be computed more easily and quickly.

(4) Experience will be gained in accurately estimating the effects of variables for which data are not presented.

b. The information is primarily intended for mission planning and is most useful when planning operations in unfamiliar areas or at extreme conditions. The data may also be used in flight, to establish unit or area standing operating procedures, and to inform ground commanders of performance/risk tradeoffs.

7-3. GENERAL.

The pre-flight planning shall cover the maximum range of conditions and performance that can reasonably be expected. In each area of performance, the effects of altitude, temperature, gross weight, and other parameters relating to that phase of flight are presented. In addition to the presented data, your judgement and experience will be necessary to accurately obtain performance under a given set of circumstances. The conditions for the data are listed under the title of each chart. The effects of different conditions are discussed in the text accompanying each phase of performance. Where practical, data is presented at conservative conditions. All performance data presented is within the applicable limits of the aircraft.

CAUTION

Some data provided may exceed that required for operating limits of the aircraft. Pilots must ensure they do not exceed aircraft operating limits. Exceeding operating limits can cause permanent damage to critical components. Overlimit operation can decrease performance, cause immediate failure, or failure on a subsequent flight.

7-4. LIMITS.

Performance generally deteriorates rapidly beyond limits. If limits are exceeded, minimize the amount and time. Enter the maximum value and time above limits on DA Form 2408-13 so proper maintenance action can be taken.

7-5. CHART EXPLANATION.

A complete series of performance charts is provided for C-12 aircraft in this manual. The charts include data on takeoff, climb, landing, and operating instructions for cruising flight from maximum endurance to normal rated power. All charts are based on ambient temperature conditions and pressure altitude

Section IV. MODEL C-12F
INTRODUCTION TO PERFORMANCE

NOTE

All speeds are IAS except as noted.

The graphs and tables in this part present performance information for takeoff, climb and landing at various parameters of weight, altitude and temperature. All performance information except cruise examples have been presented on performance graphs. A ramp weight of 12,590 pounds has been assumed. Included is information required to construct a single engine takeoff flight path. Included are (1) takeoff distance assuming an engine failure at lift off and (2) zero wind climb gradient at takeoff speeds with one engine inoperative.

NOTE

The following exemplary condition illustrate the types of data needed for preflight planning. In some case, this data has been utilized in the graph examples. However, examples shown on graphs do not in all cases represent data shown in the following flight planning example problem.

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-V 19-CZI-V247-DGW-V 19E-CYS-V 19-DEN

Weather Conditions IFR to cruise altitude of 17,000 feet

At Denver:

Outside Air Temperature... 15°C (59°F)
Field Elevation...5330 feet
Altimeter Setting ....29.60 in. Hg
Wind .... 270° at 10 knots
Runway 26L length... 10,000 feet

To determine pressure altitude at origin and destination airports, add 100 feet to field elevation for each .1 in. Hg below 29.92 and subtract 100 feet from field elevation for each .1 in. Hg above 29.92.

Pressure Altitude at BIL:

29.92 -29.56 = .36 in. Hg

The pressure altitude at BIL is 360 feet above the field elevation.

3606 +360 = 3966 Feet

Pressure Altitude at DEN:

29.92 -29.60 = .32 in. Hg

The pressure altitude at DEN is 320 feet above the field elevation.

5330 +320 - 5650 Feet

Takeoff performance has been presented to determine the maximum takeoff weight, takeoff distance, field length requirements (accelerate-stop), and takeoff flight path assuming an engine failure occurs during the takeoff procedure. The following illustrates the use of these charts.

Enter the graph for Takeoff Weight Flaps 0% To Achieve Positive, Single Engine Climb At Lift-off, at 3966 feet, to 25°C, to determine the maximum weight at which the accelerate after lift-off procedure should be attempted:

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	81	8000	040°/45	-10	0	29.60

REFERENCE: Enroute Low Altitude charts L-8 and L-9

Takeoff Weight.. 12,500 lbs

The following example assumes the aircraft is loaded so that takeoff weight is 12,500 lbs.

Enter the graph for Takeoff Distance - Flaps 0% at 25°C, 3966 feet pressure altitude, 12,500 pounds takeoff weight, and 9.5 knots headwind component:

Ground Roll..3500 feet
Total Distance Over a 50 Foot Obstacle...........................4680 feet
Rotation Speed.. 110 knots
50 Foot Speed... 121 knots

Enter the graph for Accelerate-Stop Flaps 0% at 25°C, 3966 feet pressure altitude, 12,500 pounds takeoff weight, and 9.5 knots headwind component:

Accelerate-Stop Field Length.......................................5800 feet
Engine Failure Speed.. 113 knots

Enter the graph for Accelerate After Lift-off Flaps 0% at 25°C, 3966 feet pressure altitude, 12,500 pounds takeoff weight, and 9.5 knots headwind component:

Ground Roll..4300 feet
Total Distance Over 50 Foot Obstacle.............................9300 feet
Takeoff Speed at Rotation.. 110 knots
at 50 feet.. 121 knots

Enter the graph for Net Gradient of Climb Flaps 0% at 25°C, 3966 feet pressure altitude, and 12,500 pounds (not shown on graph examples):

Climb Gradient 3.2%
Climb Speed.. 121 knots

A 3.2% climb gradient is 32 feet of vertical height per 1000 feet of horizontal distance.

NOTE

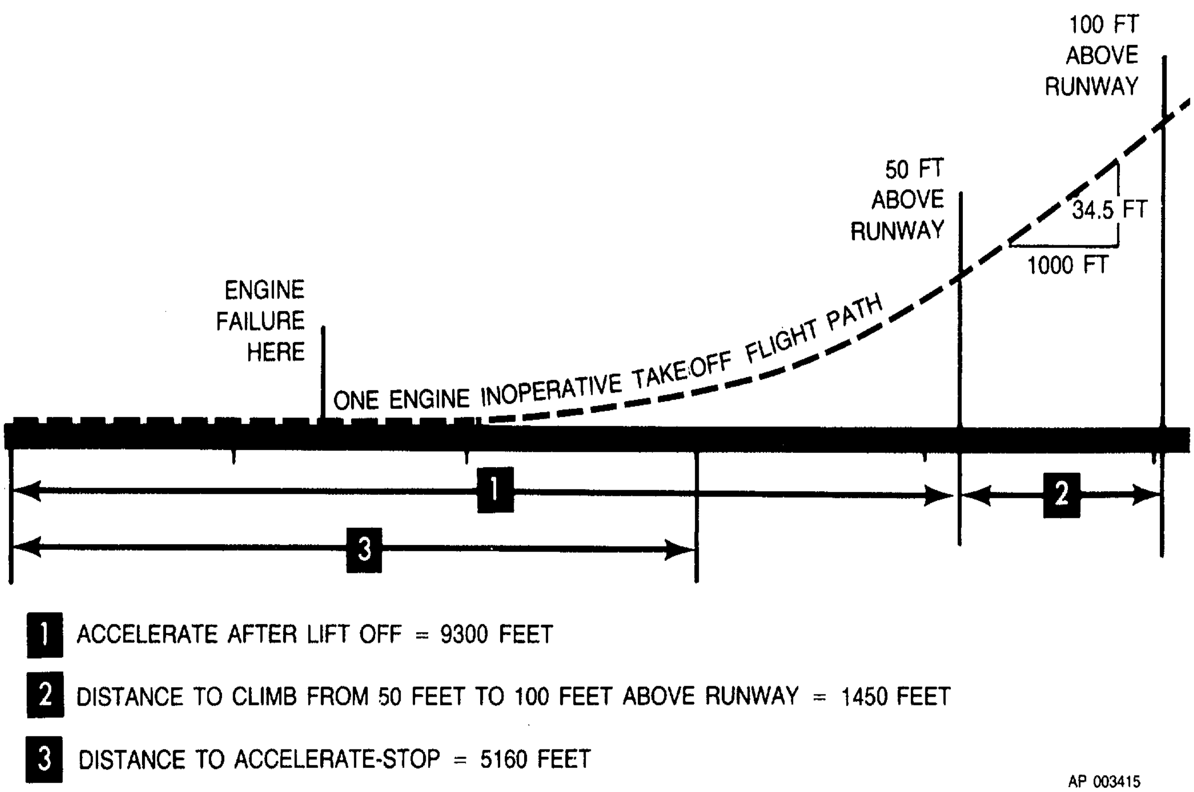
The net gradient of climb graphs assume a zero wind condition. Climbing into a headwind will result in higher angles of climb and hence better obstacle clearance capabilities.

Calculation of the horizontal distance to clear an obstacle 100 feet above the runway surface, assuming engine fails at lift-off:

Distance from 50 feet to 100 feet = 50 feet (100 -50) (1000 - 32) = 1563 feet

Total Distance = 9300 +1563 = 10,863 feet

The preceding results are illustrated below:



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

Ramp Weight .... 12,590 lbs
Expected Fuel Usage.. 1699 lbs
Landing Weight.................................12,590 -1699 = 10,891 lbs

NOTE

Refer to the Cruise Control Part of this section to determine expected fuel usage. The expected fuel usage obtained in the cruise control example is assumed for this landing example.

Enter the graph for Landing Distance Without Propeller Reversing Flaps 100% at 15°C, 5650 feet pressure altitude, 10,891 lbs, 10 knots headwind component:

Ground Roll...1495 feet
Total Over 50 foot Obstacle...2500 feet
Approach Speed.. 99 knots

Enter the graph for Climb-Balked Landing at 15°C, 5650 feet, and 10,891 lbs.

Rate of Climb .... 1675 ft/min
Climb Gradient 15.5%

Check for compliance with the Maximum Zero Fuel Weight Limitation:

NOTE

Zero Fuel Weight shall not exceed 10,400 pounds.

For this example, the following conditions were assumed:

Ramp Weight .... 12,590 lbs
Weight of Usable Fuel Onboard.. 2011 lbs

NOTE

Refer to the Cruise Control Part of this section to determine Weight of Usable Fuel Onboard.

Zero Fuel Weight = Ramp Weight - Weight of Usable Fuel Onboard
Zero Fuel Weight = 12,590 -2011 = 10,579 lbs
Maximum Zero Fuel Weight (from LIMITATIONS Section) = 10,400 lbs
Maximum Zero Weight Limitation has been exceeded by 179 lbs

In order to avoid exceeding the limitation, at least 179 pounds of payload must be off-loaded. If desired, additional fuel may then be added until the maximum ramp weight limitation of 12,590 pounds is again reached.

7-6. 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 various scales on the graph should be used. For instance, if the first item in the example is OAT, then enter the graph at the existing OAT.
2. The reference lines indicate where to begin following the guidelines. Always project to the reference line first, then follow the guidelines to the next known item by maintaining the same PROPORTIONAL DISTANCE between the guideline above and the guideline below the projected line. For instance, if the projected line intersects the reference line in the ratio of 30% down/70% up between the guidelines, then maintain this same 30%/70% relationship between the guide lines and follow them to the next known item.
3. The associated conditions define the specific conditions from 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.
4. Indicated airspeeds (IAS) were obtained by using either the Airspeed Calibration Normal System Graph or the Airspeed Calibration Normal System Takeoff Ground Roll Graph.
5. The full amount of usable fuel is available for all approved flight conditions.
6. Notes have been provided to approximate performance with ice vanes extended. The effect is estimated by entering the graph at a temperature higher than the actual temperature. The effect is approximate and will vary depending upon airspeed, temperature, altitude and ambient conditions. Existing TGT and torque limits still apply.

7. Operations with ice vanes extended should be conducted only when the temperature is below +15°C, and flight free of visible moisture cannot be assured.

7-7. ENGINE FAILURE PRIOR TO LIFT-OFF.

1. If an engine fails prior to lift-off, the abort procedure should be performed. Directional control while identifying and feathering the inoperative engine and distance required to accelerate may not be sufficient to continue takeoff.

7-8. ENGINE FAILURE AT LIFT-OFF.

1. If an engine fails at or immediately after lift-off, climb to 50 feet may be critical. Positive pilot actions will be required to maintain aircraft control; the distance required to attain 50 feet AGL will be significant.

Single engine climb performance predictions can only be realized in a zero sideslip. This is accomplished by maintaining a 3° to 5° bank angle and 1/2 ball off center towards the operating engine.

AIRSPEED CALIBRATION — NORMAL SYSTEM

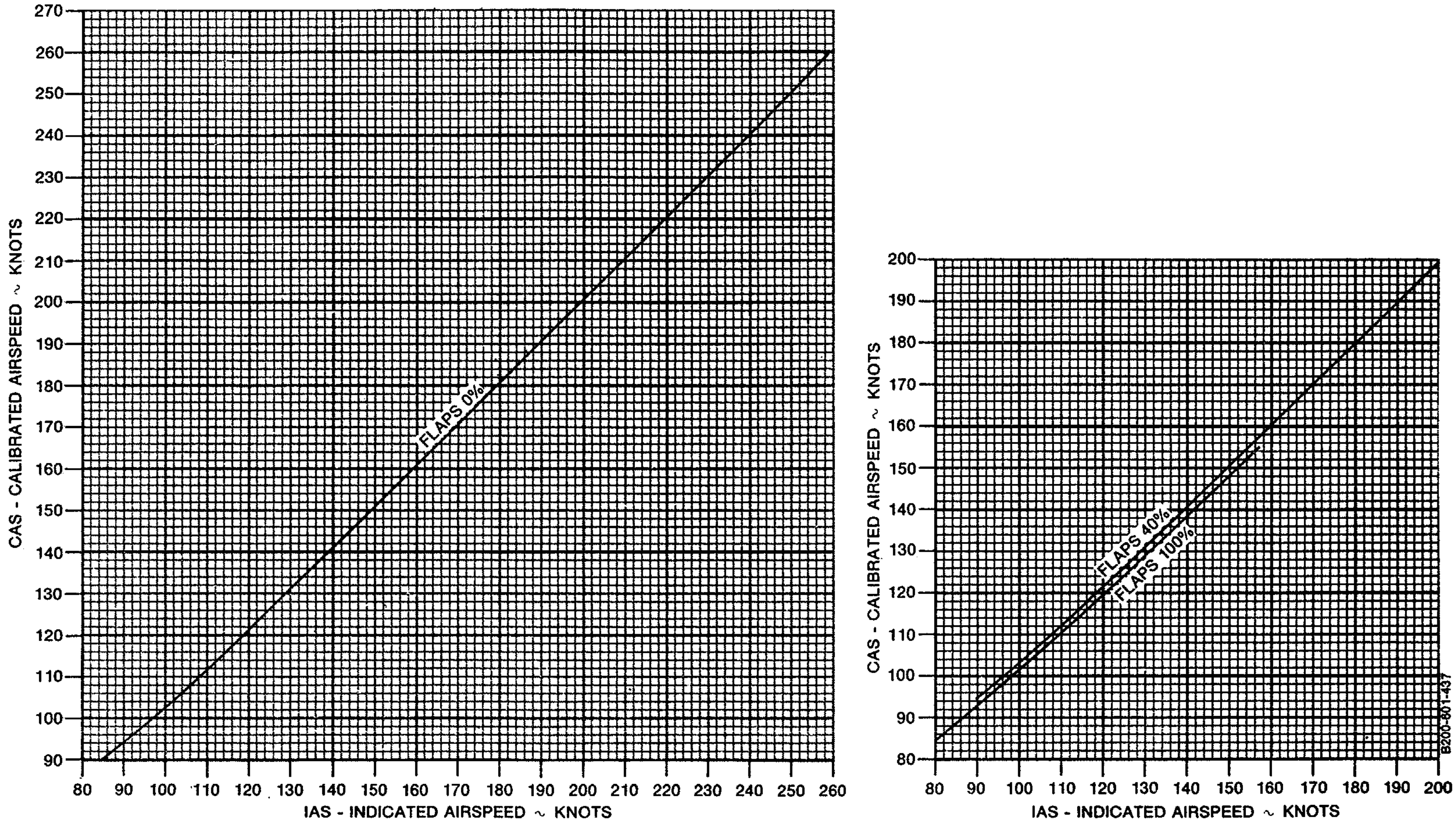


Figure 7-261. Airspeed Calibration - Normal System

AIRSPEED CALIBRATION – NORMAL SYSTEM

TAKEOFF GROUND ROLL

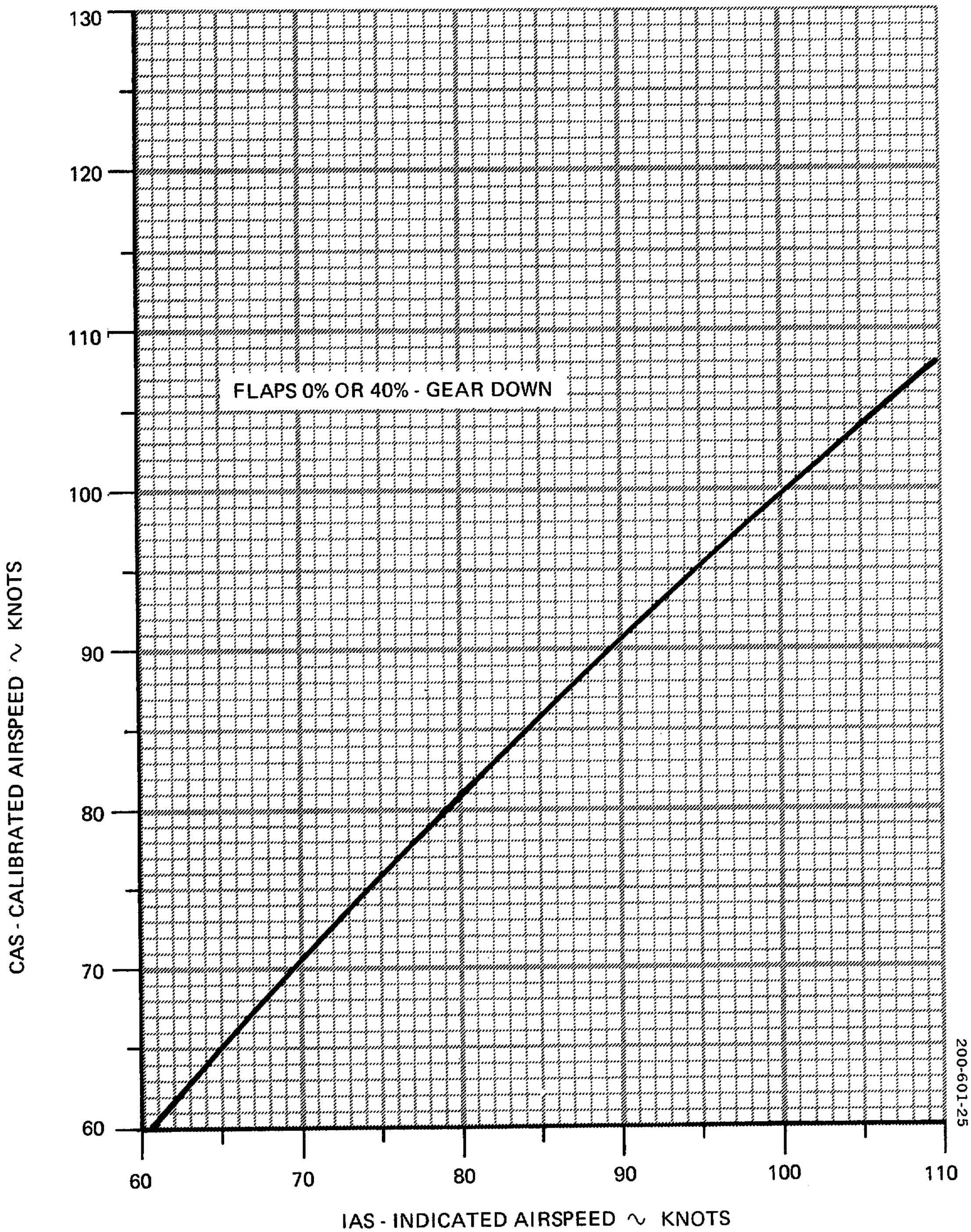


Figure 7-262. Airspeed Calibration-Normal System-Takeoff Ground Roll

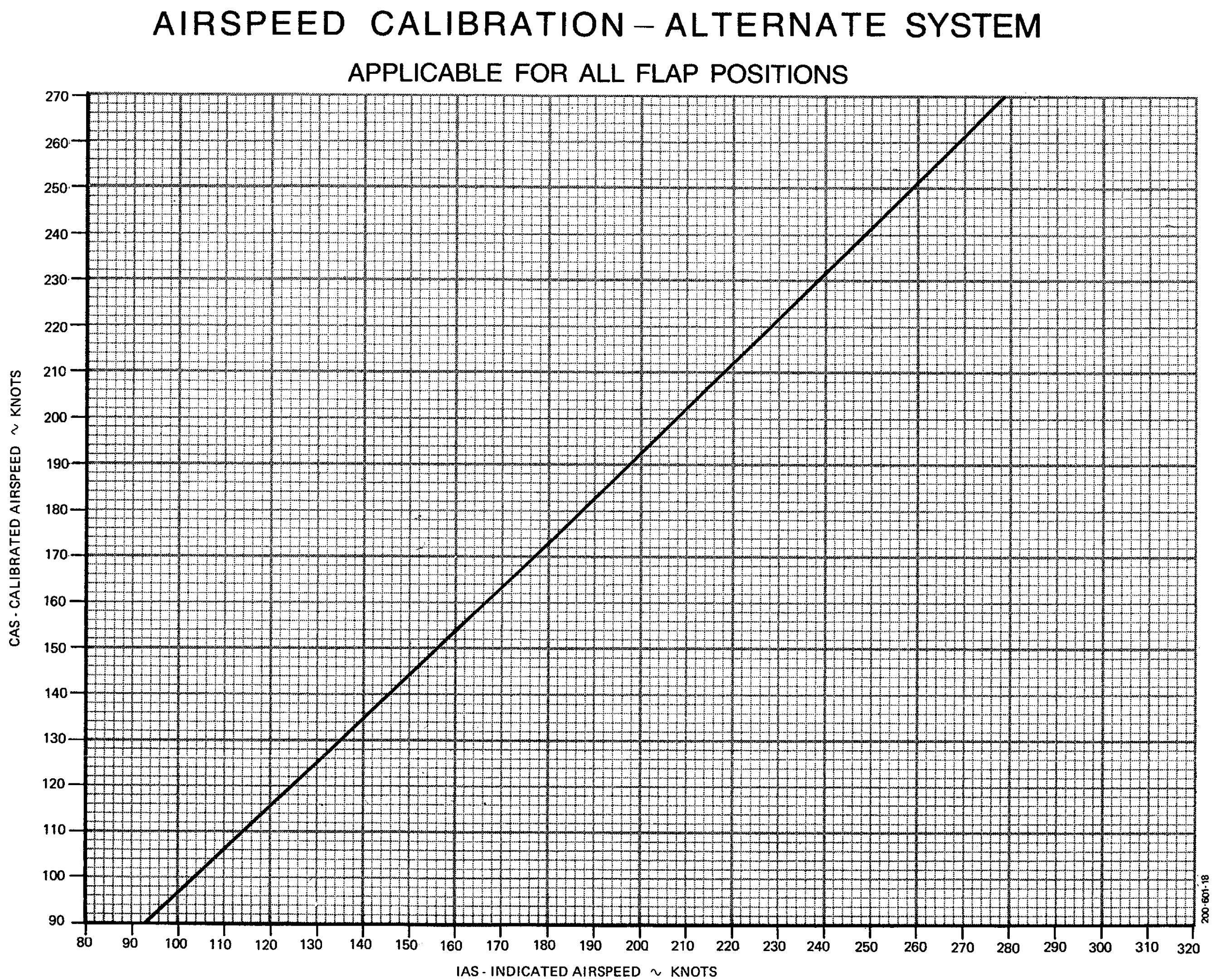


Figure 7-263. Airspeed Calibration-Alternate System

ALTIMETER CORRECTION – NORMAL SYSTEM

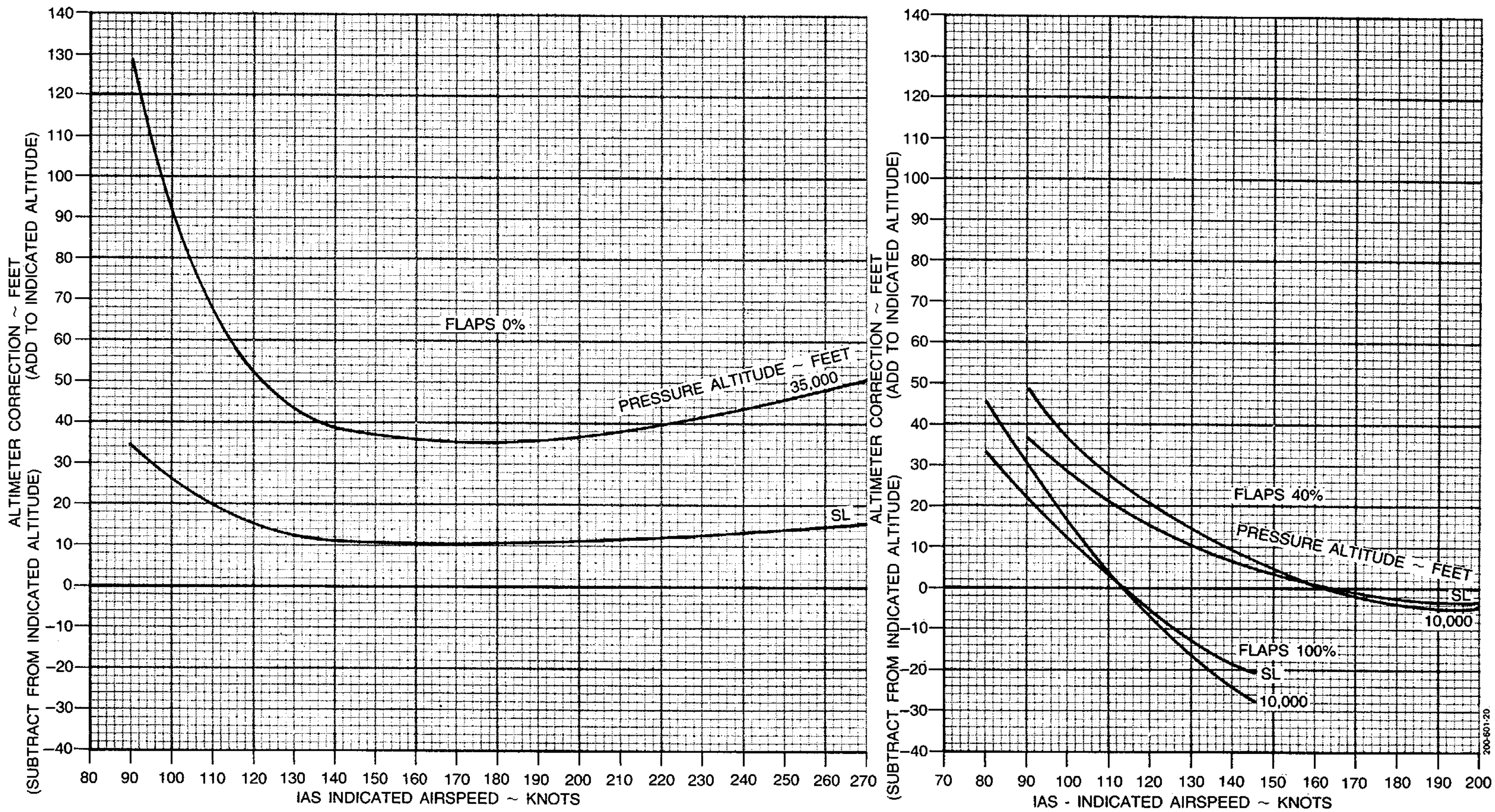


Figure 7-264. Altimeter Correction-Normal System

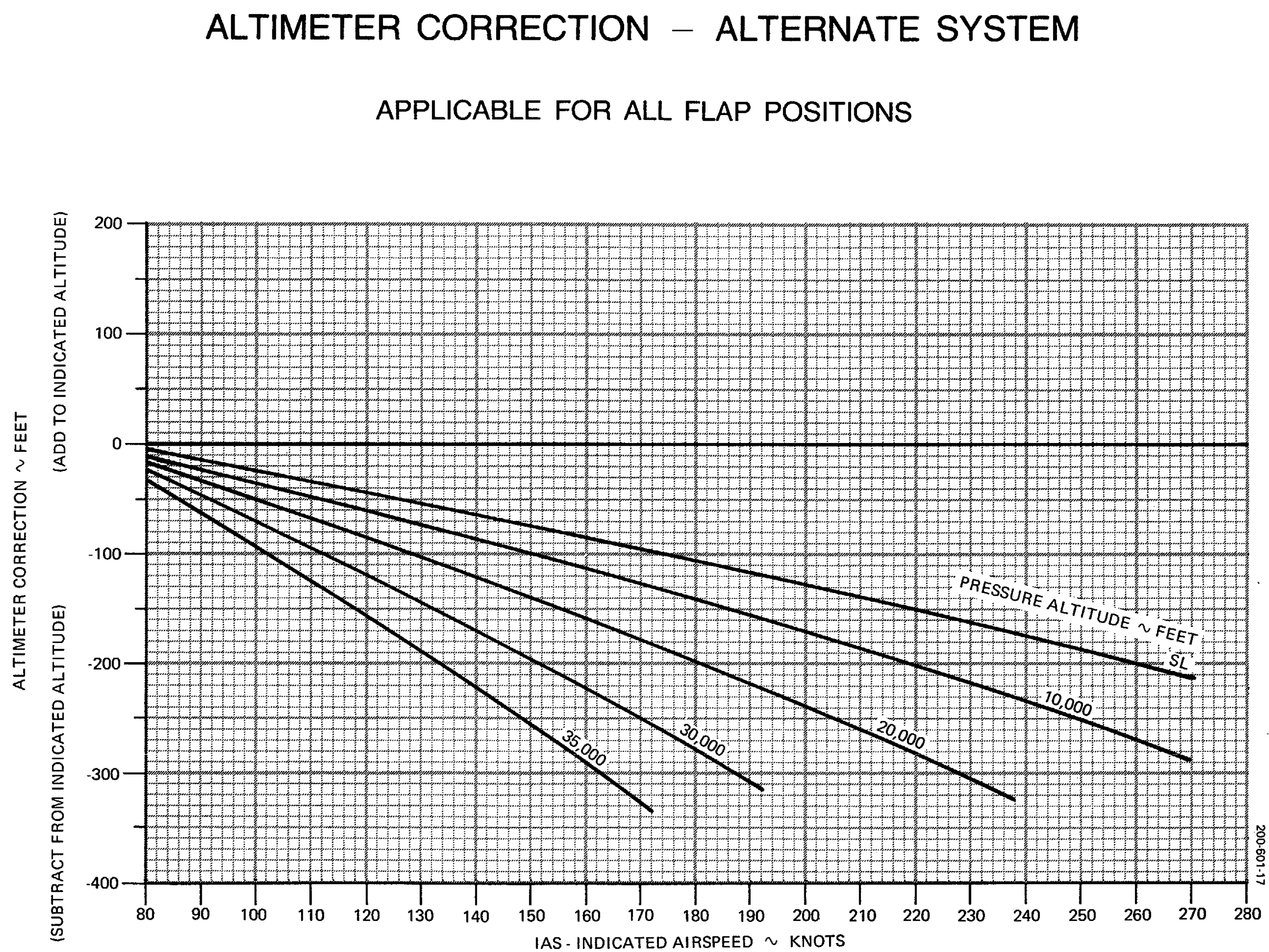


Figure 7-265. Altimeter Correction-Alternate System

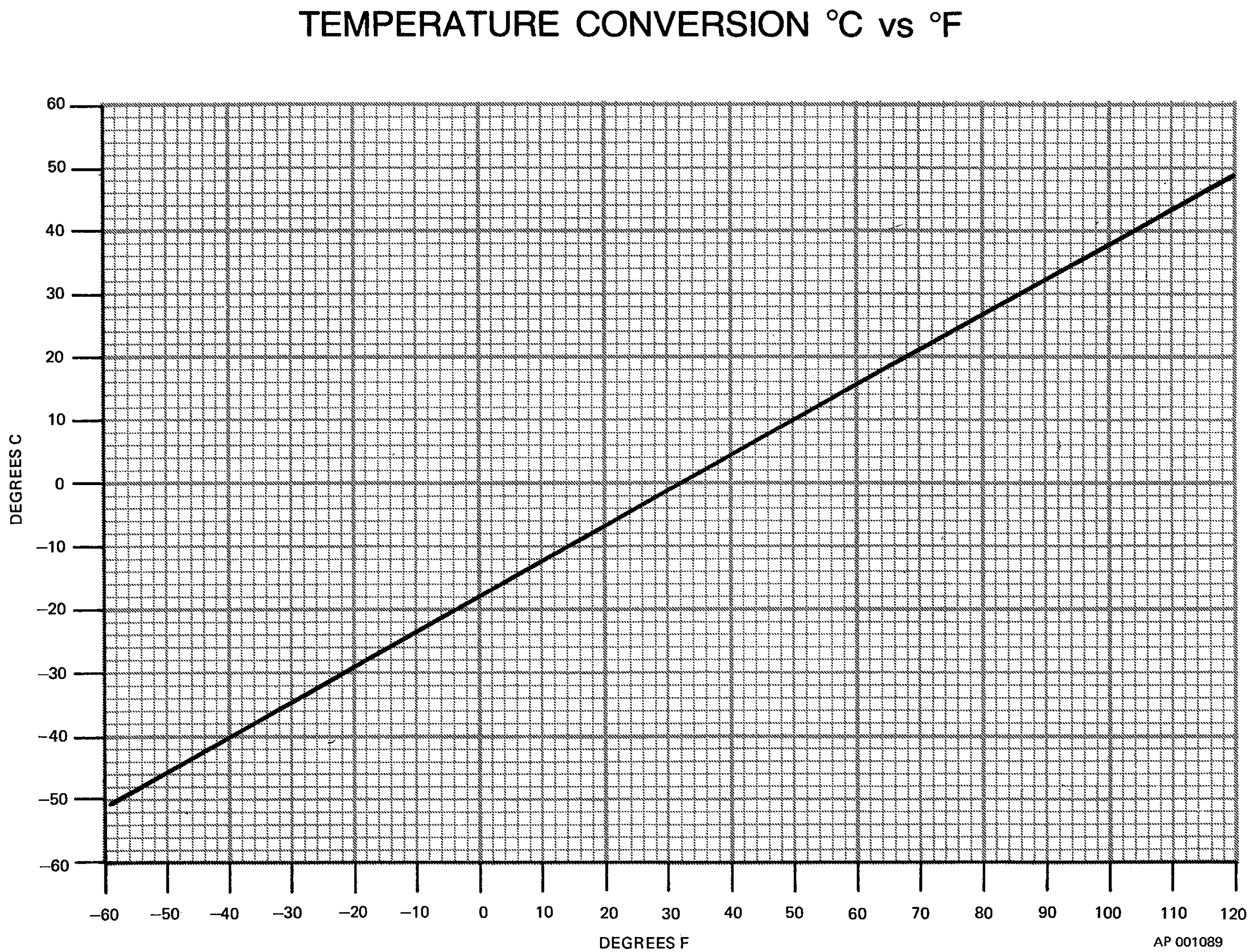


Figure 7-266. Temperature Conversion °C VS °F

MINIMUM TAKEOFF POWER AT 2000 RPM
(ICE VANES RETRACTED)
(65 KNOTS)

NOTE:

1. TORQUE INCREAES APPROXIMATELY 1% FROM 0 TO 65 KNOTS
2. THE PERCENT TORQUE INDICATED IN THIS FIGURE IS THE MINIMUM VALUE AT WHICH TAKEOFF PERFORMANCE PRESENTED IN THIS SECTION CAN BE REALIZED. ANY EXCESS POWER WHICH MAY BE DEVELOPED WITHOUT EXCEEDING ENGINE LIMITATIONS MAY BE UTILIZED.
3. ADD 6% TO VALUES DERIVED FROM GRAPH BELOW

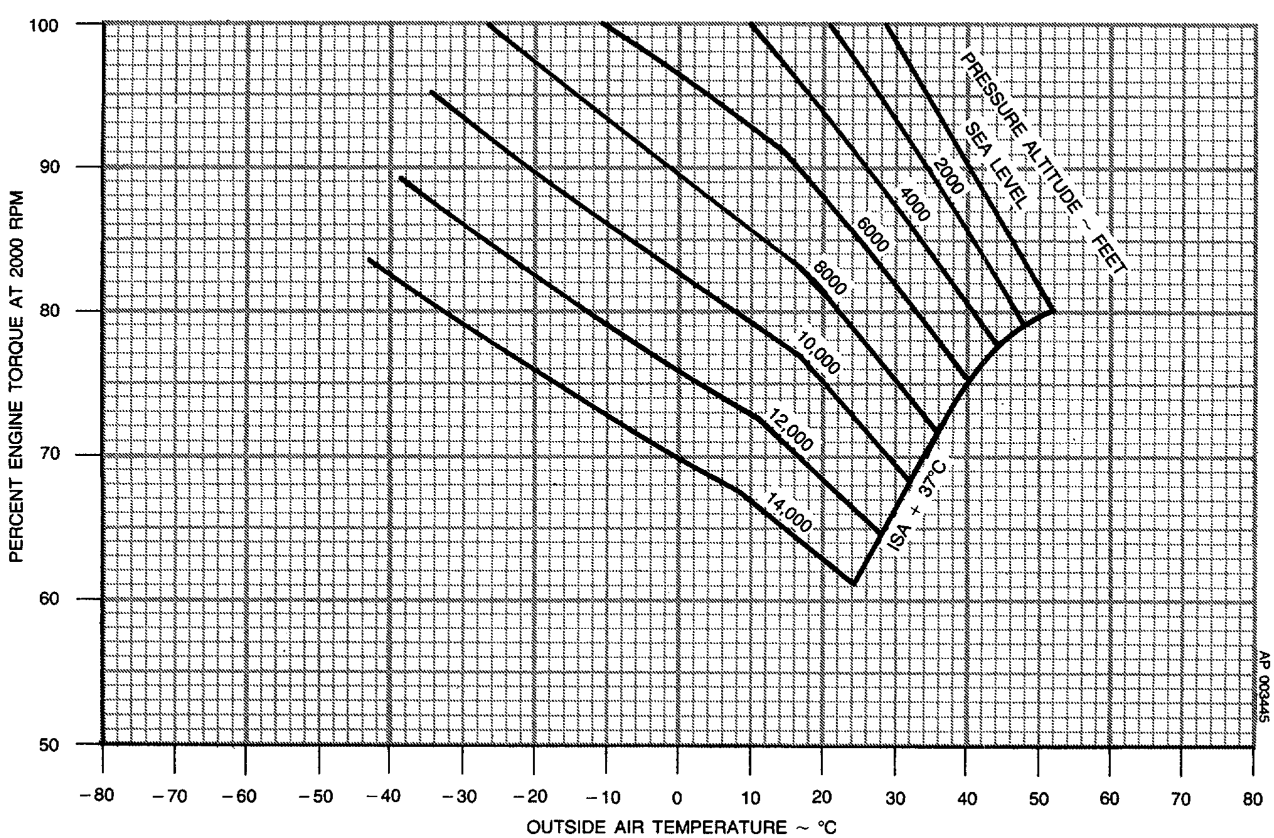


Figure 7-267. Minimum Takeoff Power At 2000 RPM (Ice Vanes Retracted)

MINIMUM TAKEOFF POWER AT 2000 RPM
(ICE VANES EXTENDED)
(65 KNOTS)

NOTE:

1. TORQUE INCREASES APPROXIMATELY 1% FROM 0 TO 65 KNOTS
2. THE PERCENT TORQUE INDICATED IN THIS FIGURE IS THE MINIMUM VALUE AT WHICH TAKEOFF PERFORMANCE CAN BE REALIZED WITH ICE VANES EXTENDED, ANY EXCESS POWER WHICH MAY BE DEVELOPED WITHOUT EXCEEDING ENGINE LIMITATIONS CAN BE UTILIZED
3. DO NOT EXTEND ICE VANES WITHIN SHADED AREA.
4. ADD 2% TO VALUES DERIVED FROM GRAPH BELOW

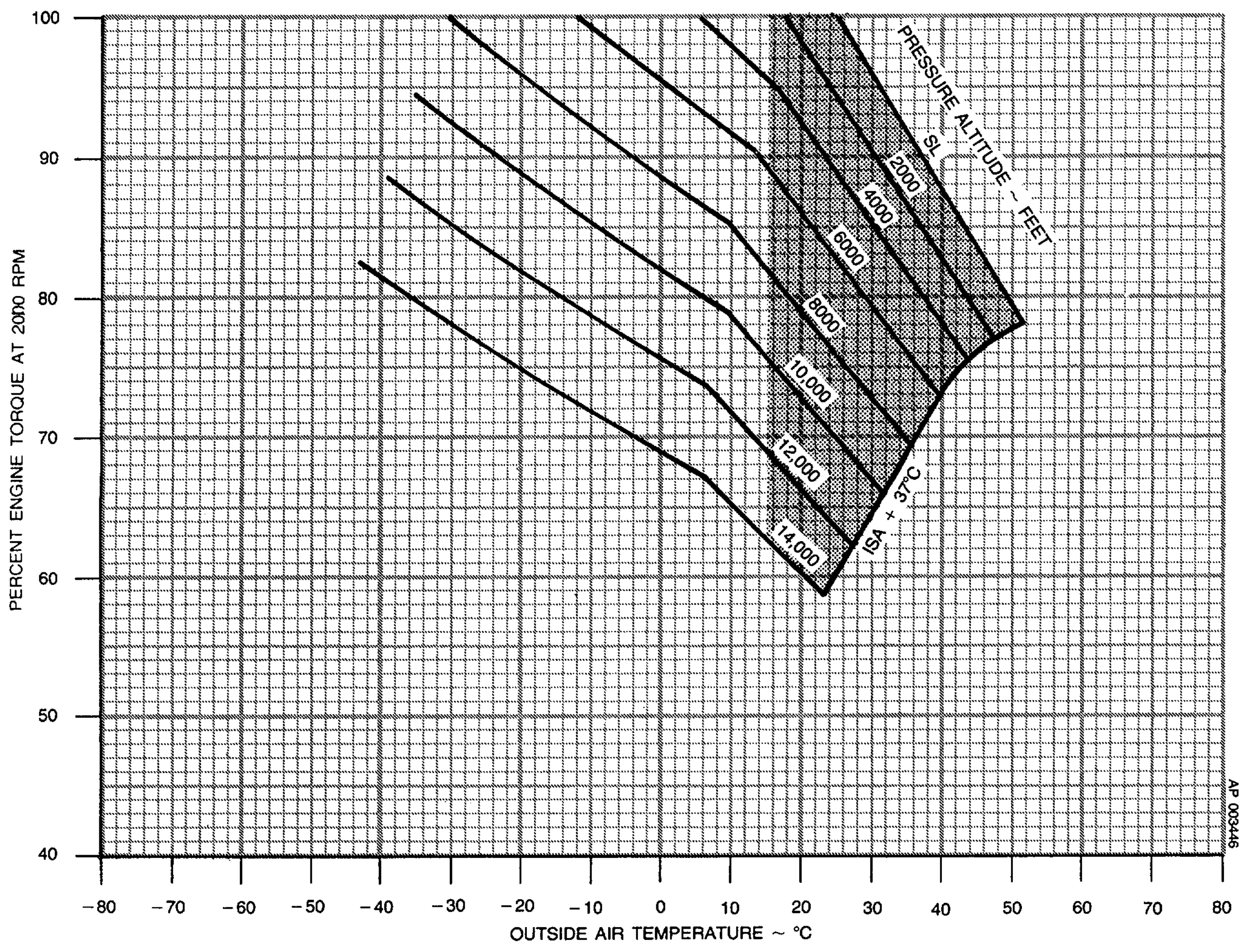


Figure 7-268. Minimum Takeoff Power At 2000 RPM (Ice Vanes Retracted)

STALL SPEEDS – POWER IDLE

NOTES:
1. ALTITUDE LOSS EXPERIENCED WHILE CONDUCTING STALLS IN ACCORDANCE WITH FAR 23.201 WAS 800 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 . . . . 11,700 LBS
FLAPS 40%
ANGLE OF BANK . . . . . 30 DEG.

STALL SPEED . . . . 96 KTS CAS
90 KTS IAS

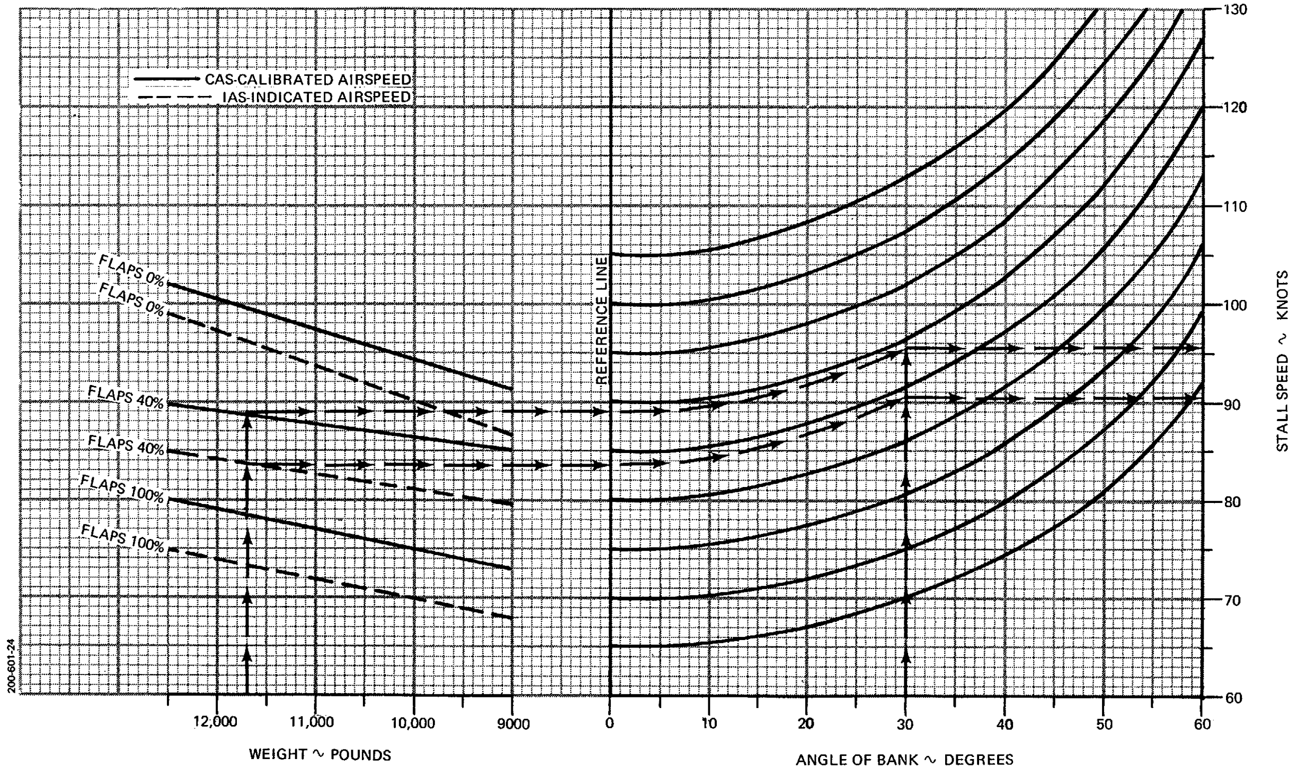


Figure 7-269. Stall Speeds-Power Idle

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

NOTE: AIRPLANE TESTED TO 25 KNOTS CROSSWIND COMPONENT ONLY.

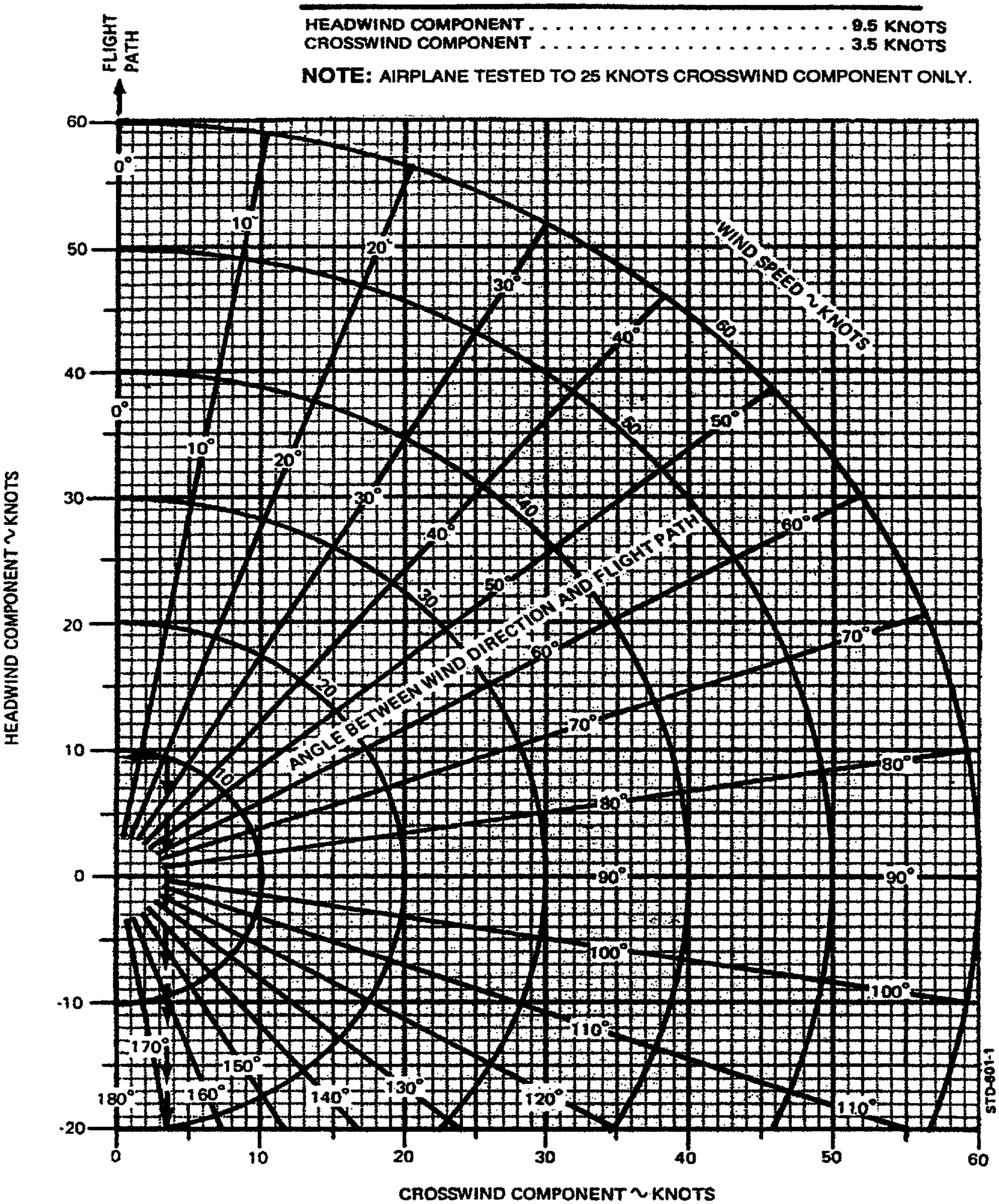


Figure 7-270. Wind Components

TAKEOFF WEIGHT – FLAPS 0%
TO ACHIEVE POSITIVE SINGLE ENGINE CLIMB AT LIFT-OFF

ASSOCIATED CONDITIONS:

AIRPLANE . . . . AIRBORNE
POWER . . . . TAKEOFF
FLAPS . . . . UP
INOPERATIVE
PROPELLER . . . . . FEATHERED

EXAMPLE:

PRESSURE ALTITUDE . . 3966 FT
OAT . . . . 25°C

TAKEOFF WEIGHT . . . 12,500 LBS

NOTE: FOR OPERATION WITH ICE VANES EXTENDED, NO OFF LOADING IS REQUIRED.

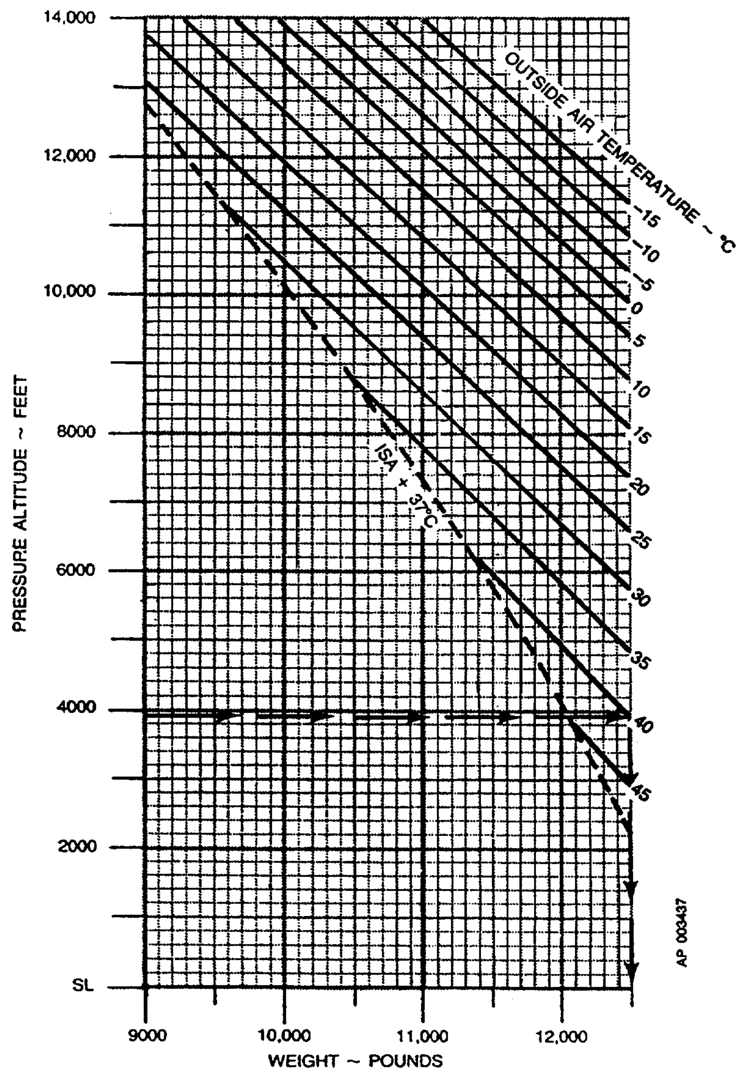


Figure 7-271. Takeoff Weight-Flaps 0% (To Achieve Positive single Engine Climb at Lift-Off)

TAKEOFF DISTANCE – FLAPS 0%

ASSOCIATED CONDITIONS:

POWER .... TAKEOFF POWER SET BEFORE BRAKE RELEASE
FLAPS .... UP
LANDING GEAR .... RETRACT AFTER LIFT-OFF
RUNWAY .... PAVED, LEVEL, DRY SURFACE

WEIGHT ~ LB.	TAKEOFF SPEED ~ KTS	
	ROTATION	50 FT
12,500	110	121
12,000	109	119
11,000	106	115
10,000	103	111
9000	100	107

EXAMPLE:

OAT	25°C
PRESSURE ALTITUDE	3966 FT
TAKEOFF WEIGHT	12,500 LBS
HEADWIND COMPONENT	9.5 KTS
GROUND ROLL	3500 FT
TOTAL DISTANCE OVER 50 FT OBSTACLE	4680 FT
TAKEOFF SPEED AT ROTATION	110 KTS
AT 50 FT.	121 KTS

NOTE: 1. FOR OPERATION WITH ICE VANES EXTENDED, ADD 10°C TO THE ACTUAL OAT BEFORE ENTERING GRAPH.
2. ADD OR SUBTRACT 5% OF TAKEOFF GROUND ROLL FOR EACH 1% OF RUNWAY SLOPE (DOWN - SUBTRACT, UP - ADD).

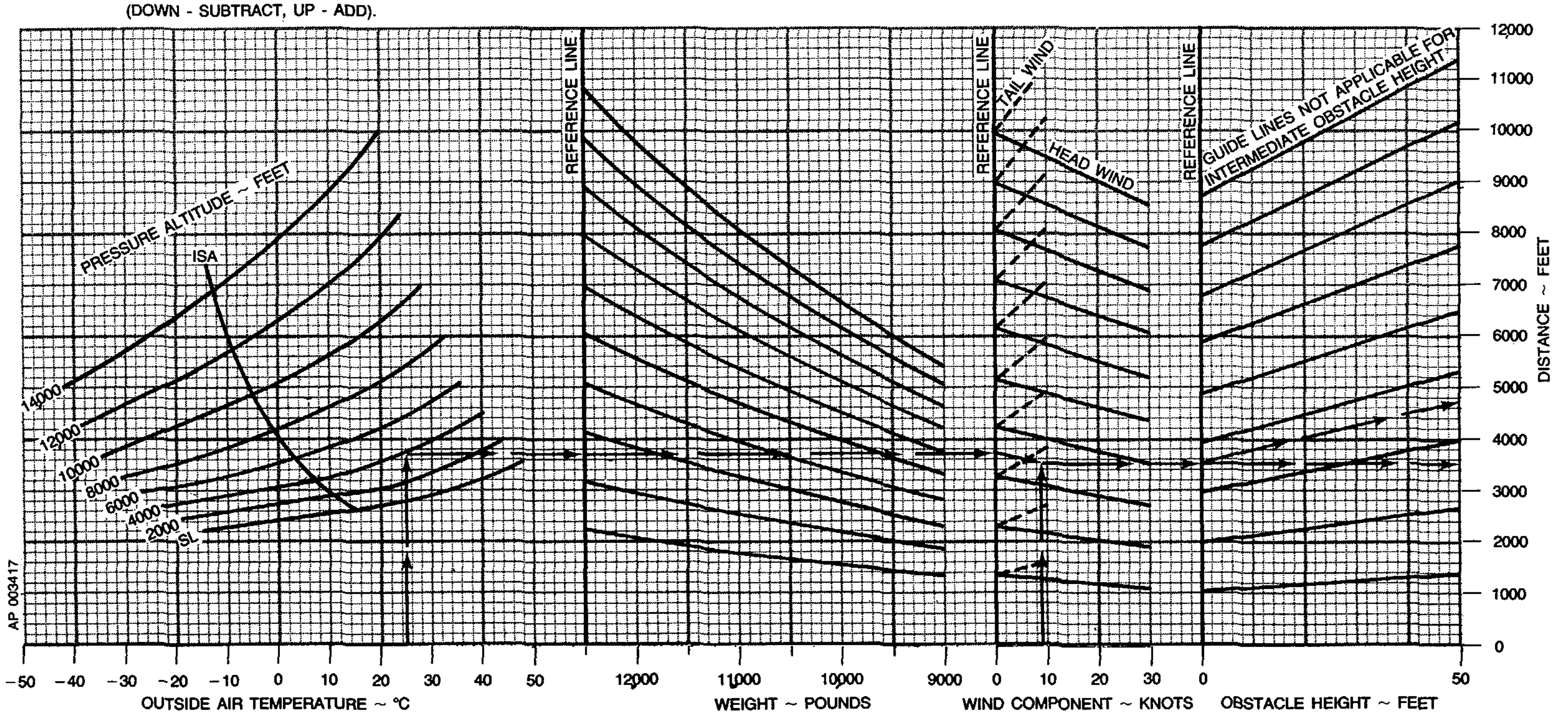


Figure 7-272. Takeoff Distance-Flaps 0%

ACCELERATE – STOP – FLAPS 0%

ASSOCIATED CONDITIONS:

POWER . . . . 1. TAKEOFF POWER SET BEFORE BRAKE RELEASE
2. BOTH POWER LEVERS IDLE AT ENGINE FAILURE SPEED AND REVERSE OPERATIVE ENGINE

FLAPS 0%

BRAKING . . . . . . MAXIMUM

RUNWAY . . . . . . PAVED, LEVEL, DRY SURFACE

CAUTION: LIMIT REVERSING, AS REQUIRED, TO MAINTAIN DIRECTIONAL CONTROL

WEIGHT ~ LBS	ENGINE FAILURE SPEED ~ KTS
12,500	113
12,000	112
11,000	109
10,000	106
9000	103

NOTE: 1. FOR OPERATION WITH ICE VANES EXTENDED, PERFORMANCE IS NOT AFFECTED.
2. ADD OR SUBTRACT 2% OF TOTAL DISTANCE FOR EACH 1% OF RUNWAY SLOPE (DOWN-SUBTRACT, UP-ADD).

EXAMPLE:

OAT . . . . 25°C
PRESSURE ALTITUDE . . . . 3966 FT
WEIGHT . . . . 12,500 LBS
HEADWIND COMPONENT . . . . . 9.5 KTS

FIELD LENGTH . . . . 5800 FT
ENGINE FAILURE SPEED . . . . . . 113 KTS

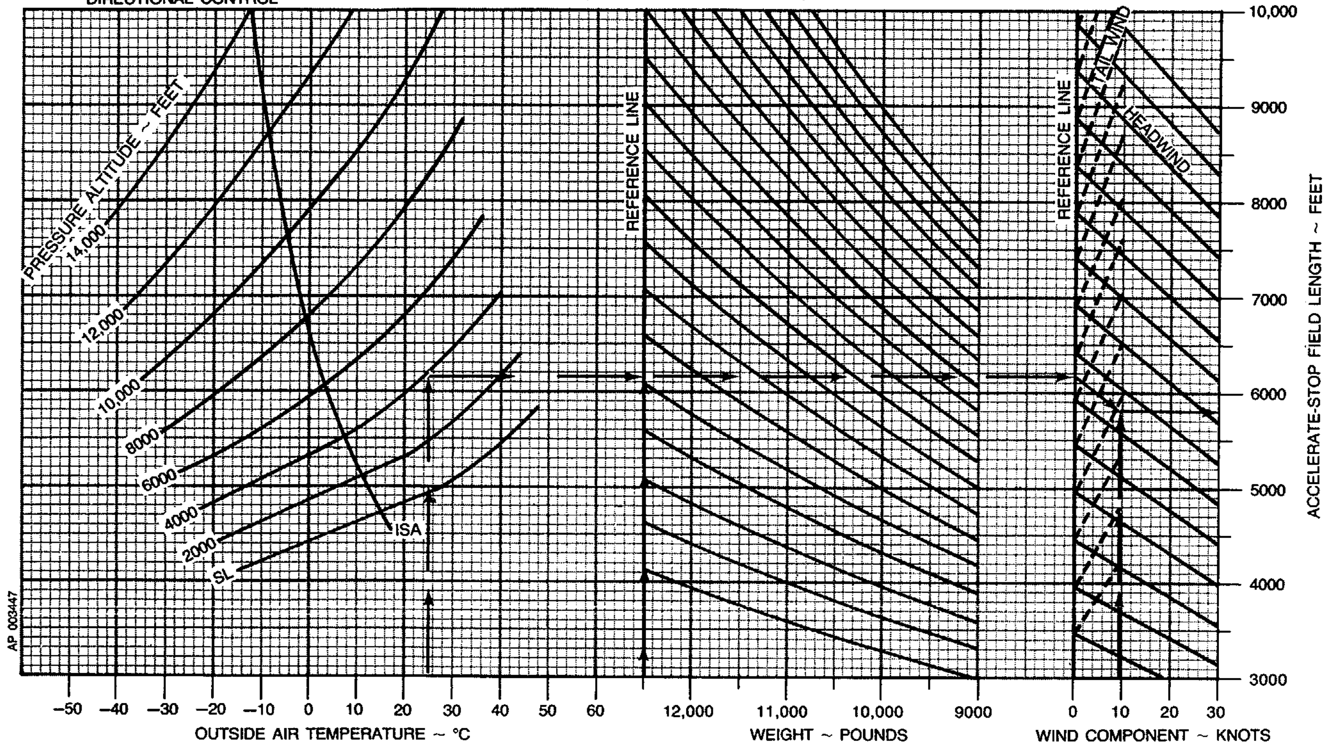


Figure 7-273. Accelerate Stop-Flaps 0%

ACCELERATE AFTER LIFT-OFF – FLAPS 0%

ASSOCIATED CONDITIONS:

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

WEIGHT ~ LBS	TAKEOFF SPEED ~ KTS ROTATION	50 FT
12,500	110	121
12,000	109	119
11,000	106	115
10,000	103	111
9000	100	107

EXAMPLE:

OAT .... 25°C
PRESSURE ALTITUDE .... 3966 FT
WEIGHT .... 12,500 LBS
HEADWIND COMPONENT .... 9.5 KTS

GROUND ROLL .... 4300 FT
TOTAL DISTANCE OVER 50 FT OBSTACLE .... 9300 FT
TAKEOFF SPEED AT ROTATION .... 110 KTS
AT 50 FT .... 121 KTS

NOTE:
1. DISTANCES ASSUME AN ENGINE FAILURE AT LIFT-OFF SPEED AND ENGINE FAILURE AFTER LIFT-OFF EMERGENCY PROCEDURES INITIATED.
2. LIFT-OFF SPEED IS ASSUMED EQUAL TO ENGINE FAILURE SPEED ON ACCELERATE-STOP GRAPH.
3. FOR OPERATION WITH ICE VANES EXTENDED, ADD 6°C TO THE ACTUAL OAT BEFORE ENTERING THE GRAPH.
4. ADD OR SUBTRACT 5% OF TAKE-OFF GROUND ROLL FOR EACH 1% OF RUNWAY SLOPE (DOWN - SUBTRACT, UP - ADD).
5. WEIGHTS IN SHADED AREA MAY NOT PROVIDE POSITIVE GEAR DOWN SINGLE ENGINE CLIMB GRADIENT. REFER TO TAKE-OFF WEIGHT GRAPH FOR THE MAXIMUM WEIGHT AT WHICH THE ACCELERATE AFTER LIFT-OFF PROCEDURE SHOULD BE ATTEMPTED.

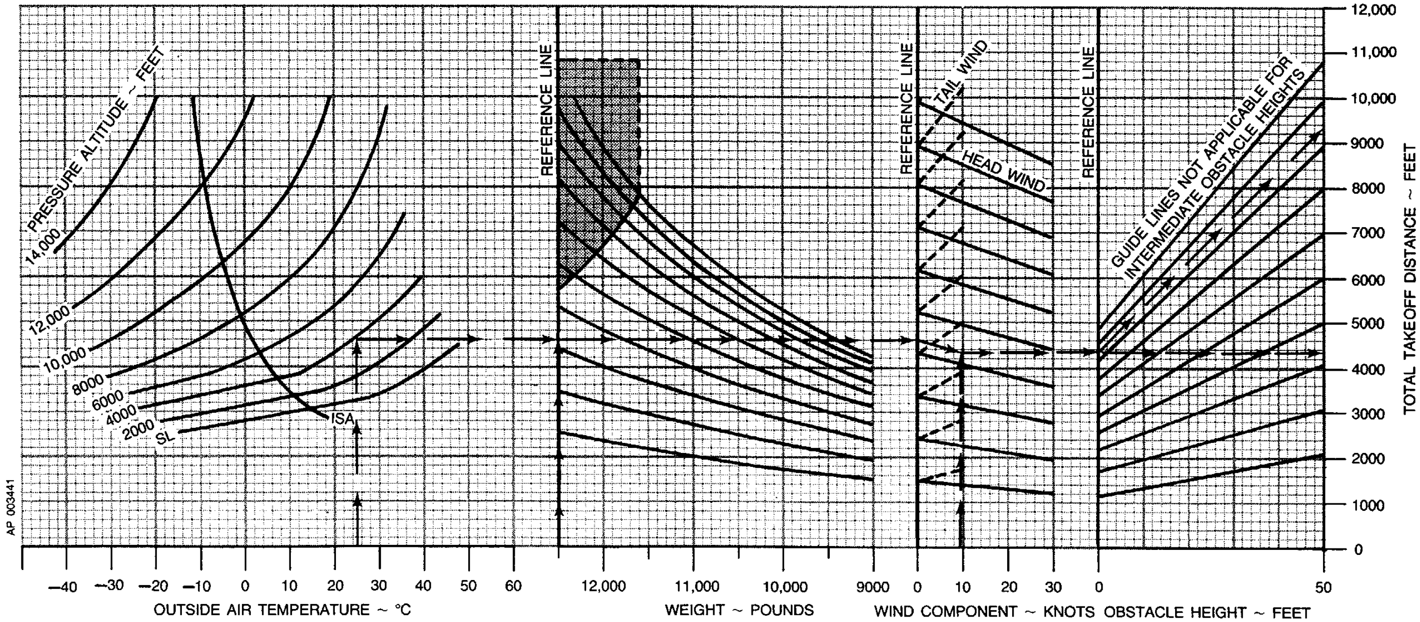


Figure 7-274. Accelerate After Lift-Off-Flaps 0%

NET GRADIENT OF CLIMB — FLAPS 0%

ASSOCIATED CONDITIONS:

POWER . . . . TAKEOFF
FLAPS 0%
GEAR . . . . UP
INOPERATIVE
PROPELLER. . . FEATHERED

WEIGHT ~ POUNDS	CLIMB SPEED ~ KNOTS
12,500	121
12,000	119
11,000	115
10,000	111
9000	108

NOTE: FOR OPERATION WITH ICE VANES EXTENDED, ADD 10°C TO THE ACTUAL OAT BEFORE ENTERING GRAPH.

EXAMPLE:

OAT. . . . . 28°C
PRESSURE ALTITUDE. . .5430 FEET

WEIGHT ~ POUNDS	NET GRADIENT OF CLIMB ~ %
10,600	4.2
9700	5.2
10,314	4.5

CLIMB SPEED (10,314 LBS). . . .112 KNOTS

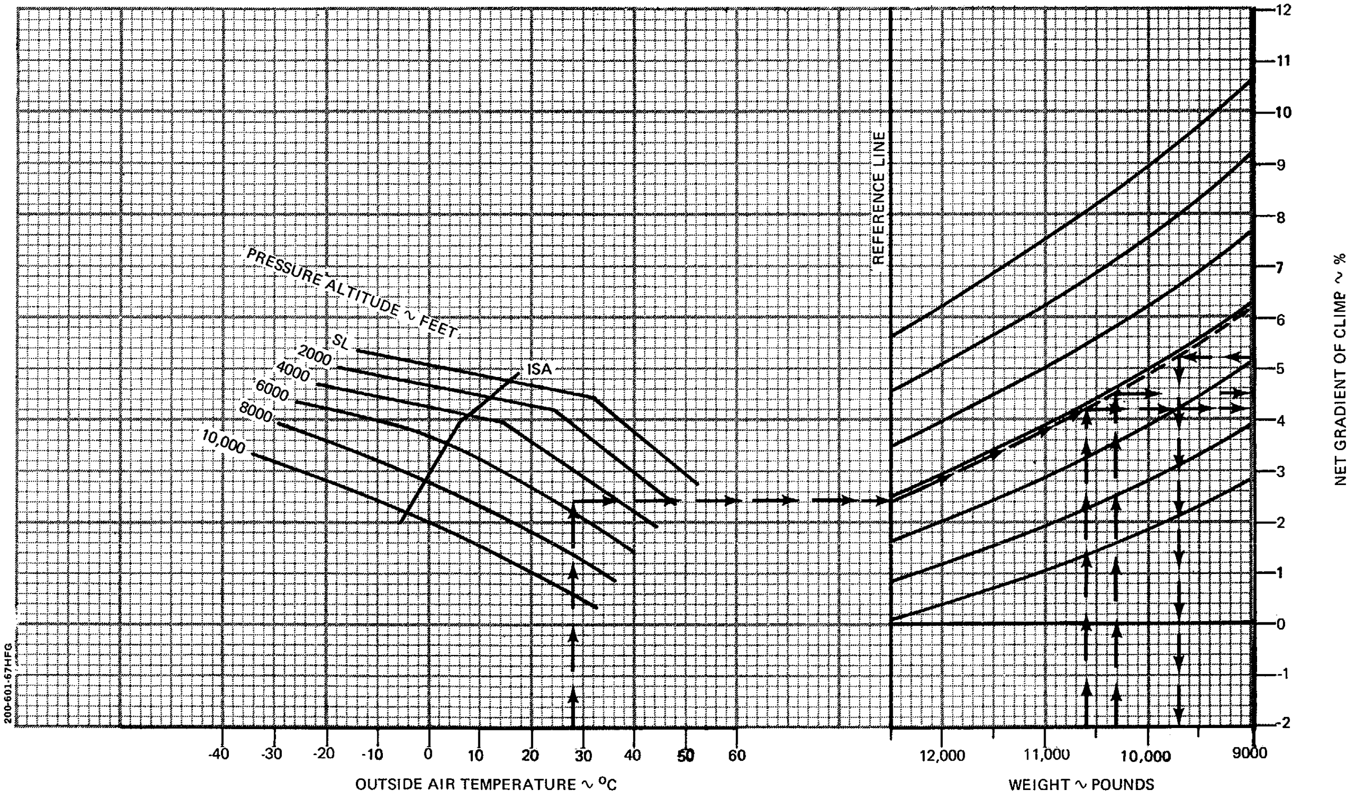


Figure 7-275. Net Gradient of Climb-Flaps 0%

TAKEOFF WEIGHT – FLAPS 40%
TO ACHIEVE POSITIVE SINGLE ENGINE CLIMB AT LIFT-OFF

ASSOCIATED CONDITIONS:

AIRPLANE . . . . AIRBORNE
POWER . . . . TAKEOFF
FLAPS 40%
INOPERATIVE
PROPELLER . . . . . . FEATHERED

EXAMPLE:

PRESSURE ALTITUDE . . 3966 FT
OAT . . . . 25°C

TAKEOFF WEIGHT . . . 12,500 LBS

NOTE: FOR OPERATION WITH ICE VANES EXTENDED, NO OFF LOADING IS REQUIRED

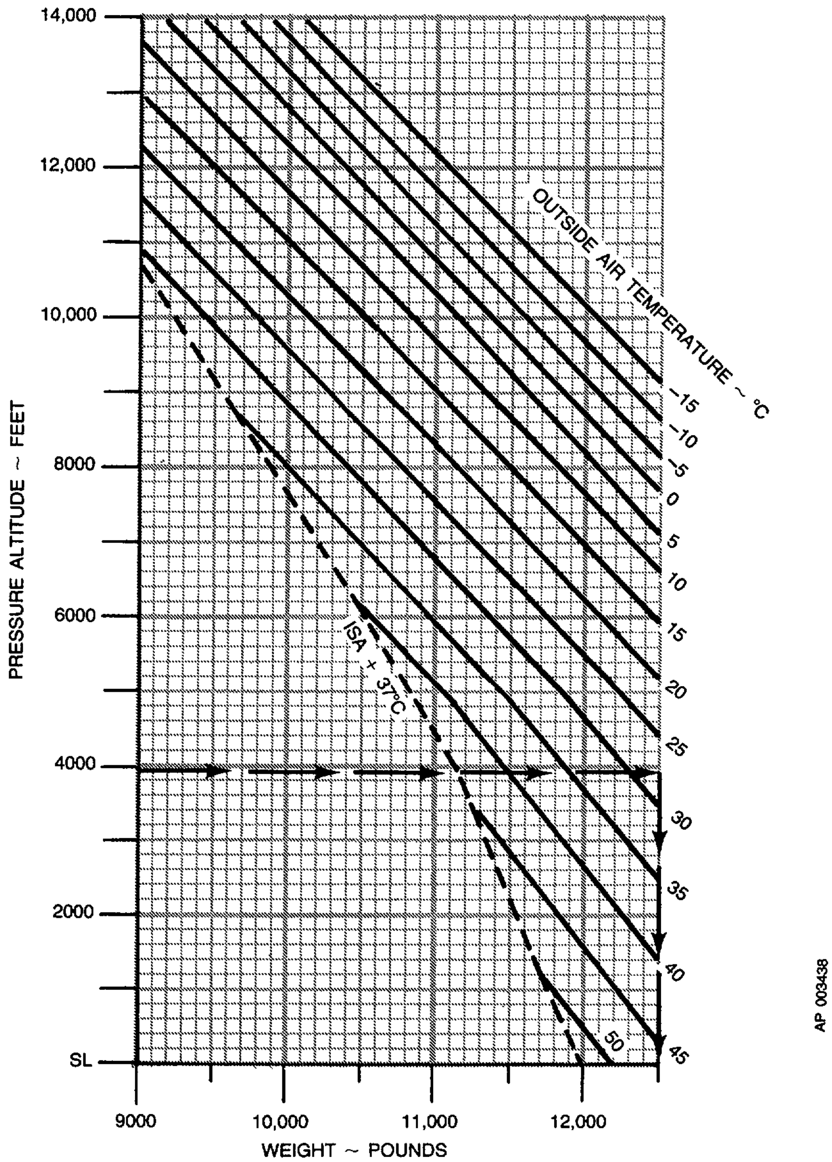


Figure 7-276. Takeoff Weight-Flaps 40% (To Achieve Positive single Engine Climb at Lift-off)

TAKEOFF DISTANCE - FLAPS 40%

ASSOCIATED CONDITIONS:

POWER.................................. TAKEOFF POWER SET BEFORE BRAKE RELEASE
FLAPS.................................. 40%
LANDING GEAR.................... RETRACT AFTER LIFT-OFF
RUNWAY................................ PAVED, LEVEL, DRY SURFACE

WEIGHT ~ LBS	TAKEOFF SPEED ~ KTS. ROTATION	50 FT.
12,500	99	106
12,000	98	105
11,000	97	103
10,000	96	101
9000	95	99

EXAMPLE:

OAT.. 25°C
PRESSURE ALTITUDE.............................. 3966 FT
TAKEOFF WEIGHT.................................. 12500 LBS.
HEADWIND COMPONENT.............................. 9.5 KTS.

GROUND ROLL...................................... 2690 FT.
TOTAL DISTANCE OVER 50 FT. OBSTACLE.............. 3510 FT.
TAKEOFF SPEED AT ROTATION........................ 99 KTS.
AT 50 FT.. 106 KTS.

NOTE: 1. FOR OPERATION WITH ICE VANES EXTENDED, ADD 10°C TO THE ACTUAL OAT BEFORE ENTERING GRAPH.
2. ADD OR SUBTRACT 5% OF TAKEOFF GROUND ROLL FOR EACH 1% OF RUNWAY SLOPE (DOWN - SUBTRACT, UP - ADD).

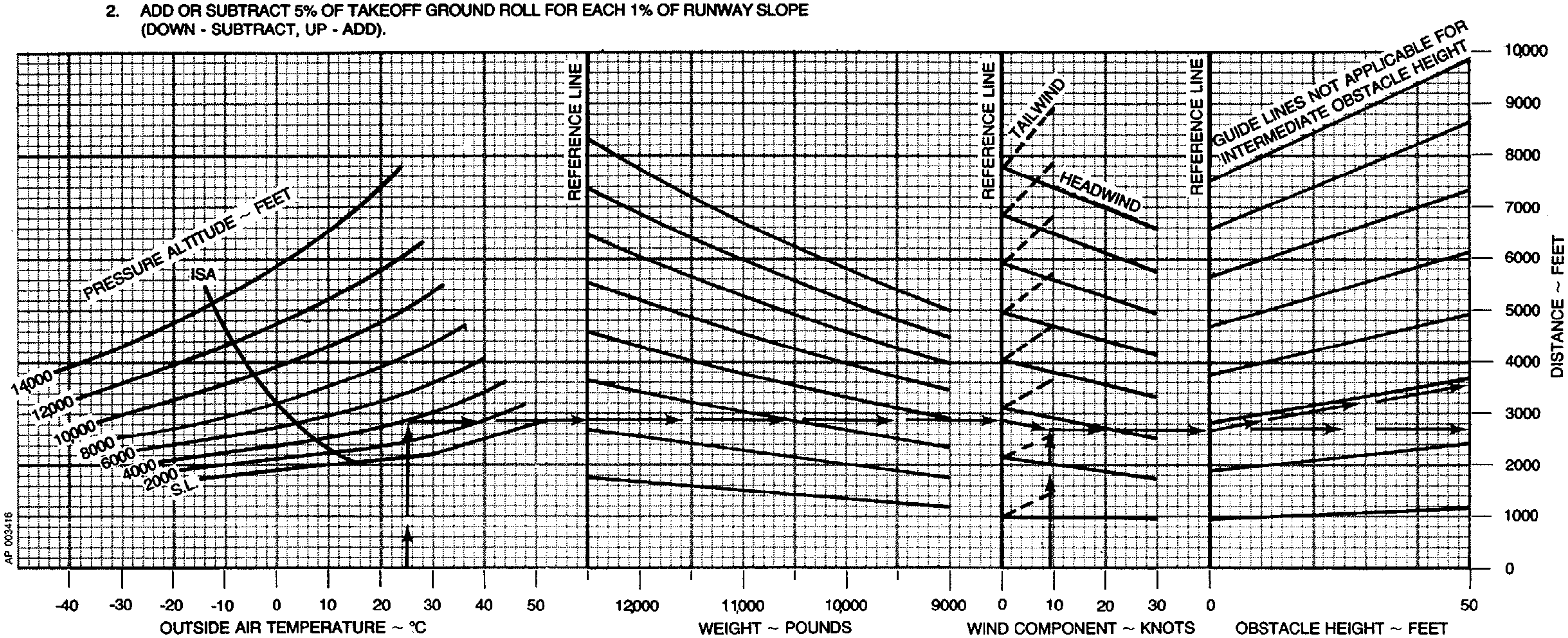


Figure 7-277. Takeoff Distance-Flaps 40%

ACCELERATE-STOP-FLAPS 40%

ASSOCIATED CONDITIONS:

POWER . . . . 1. TAKEOFF POWER SET BEFORE BRAKE RELEASE
2. BOTH POWER LEVERS IDLE AT ENGINE FAILURE SPEED AND REVERSE OPERATING ENGINE

FLAPS 40%

BRAKING . . . . . . MAXIMUM

RUNWAY . . . . . . PAVED, LEVEL, DRY SURFACE

WEIGHT~LBS	ENGINE FAILURE SPEED~KTS
12,500	102
12,000	101
11,000	100
10,000	99
9000	98

EXAMPLE:

OAT . . . . 25 °C
PRESSURE ALTITUDE . . . . 3966 FT
WEIGHT . . . . 12,500 LBS
HEADWIND COMPONENT . . . . . 9.5 KTS

FIELD LENGTH . . . . 4820 FT
ENGINE FAILURE SPEED . . . . . . 102 KTS

NOTE: 1. FOR OPERATION WITH ICE VANES EXTENDED, PERFORMANCE IS NOT AFFECTED.
2. ADD OR SUBTRACT 2% OF TOTAL DISTANCE FOR EACH 1% OF RUNWAY SLOPE (DOWN-SUBTRACT, UP-ADD).

CAUTION: LIMIT REVERSING, AS REQUIRED, TO MAINTAIN DIRECTIONAL CONTROL

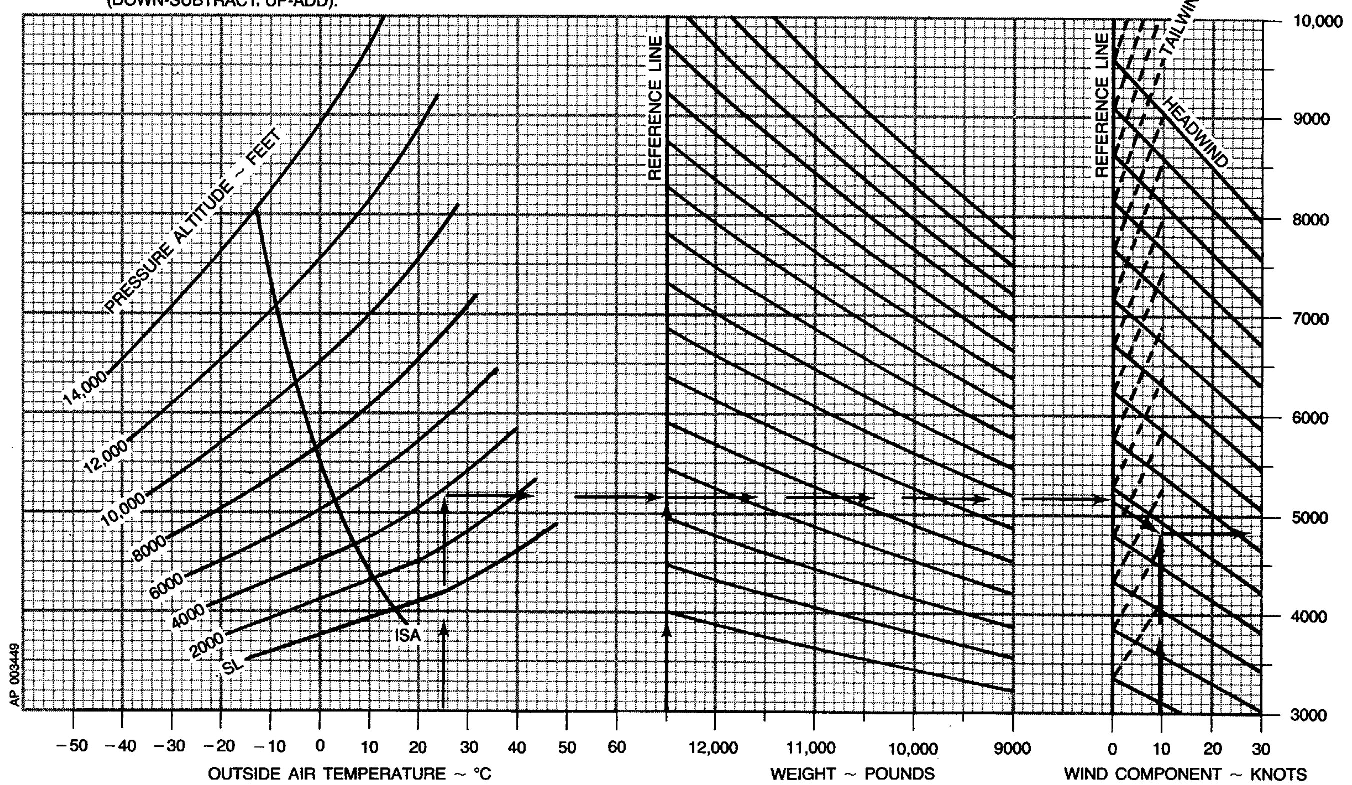


Figure 7-278. Accelerate Stop-Flaps 40%

ACCELERATE AFTER LIFT-OFF - FLAPS 40%

ASSOCIATED CONDITIONS:

POWER . . . . TAKEOFF POWER SET BEFORE BRAKE RELEASE
AUTOFEATHER . . . . ARMED
FLAPS 40%
LANDING GEAR . . . . RETRACT AFTER LIFT-OFF
RUNWAY . . . . PAVED, LEVEL, DRY SURFACE

WEIGHT ~ LBS	TAKEOFF SPEED ~ KTS	
	ROTATION	50 FT
12,500	99	106
12,000	98	105
11,000	97	103
10,000	96	101
9000	95	99

EXAMPLE:

OAT .... 25°C
PRESSURE ALTITUDE .... 3966 FT
WEIGHT .... 12,500 LBS
HEADWIND COMPONENT .... 9.5 KTS

GROUND ROLL .... 3300 FT
TOTAL DISTANCE OVER 50 FT OBSTACLE .... 8550 FT
TAKEOFF SPEED AT ROTATION .... 99 KTS
AT 50 FT .... 106 KTS

NOTE:
1. DISTANCES ASSUME AN ENGINE FAILURE AT LIFT-OFF SPEED AND ENGINE FAILURE AFTER LIFT-OFF EMERGENCY PROCEDURES INITIATED.
2. LIFT-OFF SPEED IS ASSUMED EQUAL TO ENGINE FAILURE SPEED ON ACCELERATE-STOP GRAPH.
3. FOR OPERATION WITH ICE VANES EXTENDED, ADD 6°C TO THE ACTUAL OAT BEFORE ENTERING THE GRAPH.
4. ADD OR SUBTRACT 5% TO TAKE-OFF GROUND ROLL FOR EACH 1% OF RUNWAY SLOPE (DOWN - SUBTRACT, UP - ADD).
5. WEIGHTS IN SHADED AREA MAY NOT PROVIDE POSITIVE GEAR DOWN SINGLE ENGINE CLIMB GRADIENT. REFER TO TAKE-OFF WEIGHT GRAPH FOR THE MAXIMUM WEIGHT AT WHICH THE ACCELERATE AFTER LIFT-OFF PROCEDURE SHOULD BE ATTEMPTED.

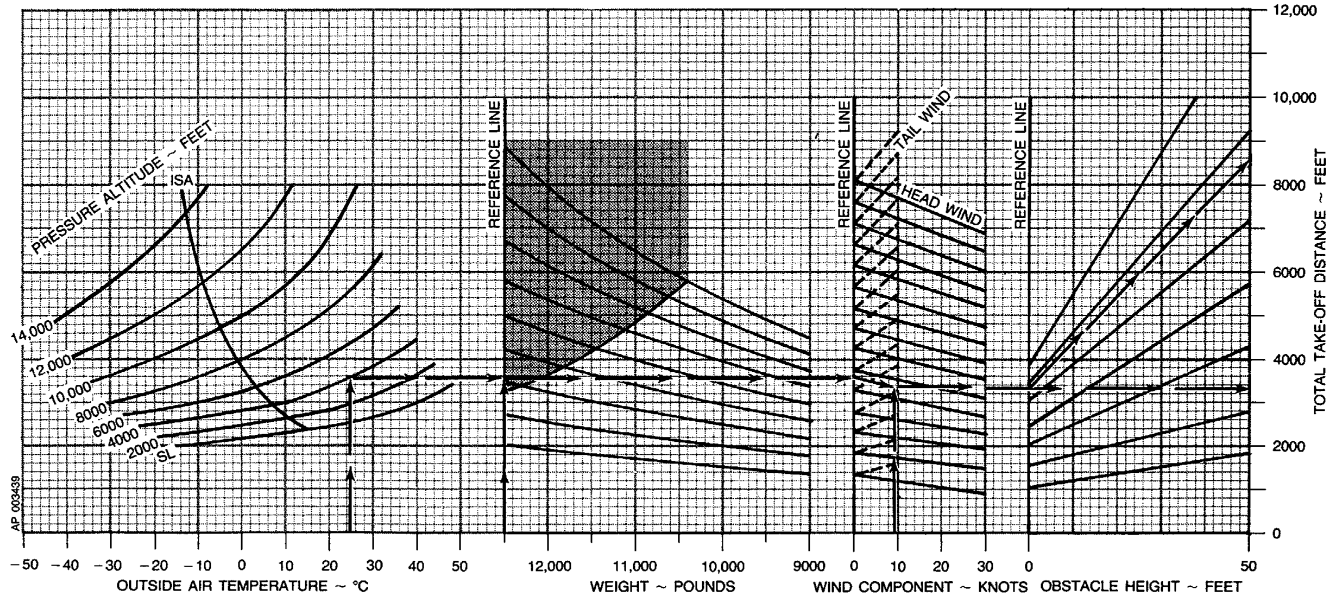


Figure 7-279. Accelerate After Lift-Off-Flaps 40%

NET GRADIENT OF CLIMB — FLAPS 40%

ASSOCIATED CONDITIONS:

POWER . . . . TAKEOFF
FLAPS 40%
GEAR . . . . UP
INOPERATIVE
PROPELLER . . . FEATHERED

WEIGHT ∿ POUNDS	CLIMB SPEED ∿ KNOTS
12,500	106
12,000	105
11,000	103
10,000	101
9000	99

NOTE: FOR OPERATION WITH ICE VANES EXTENDED, ADD 10°C TO THE ACTUAL OAT BEFORE ENTERING GRAPH.

EXAMPLE:

OAT . . . . 28°C
PRESSURE ALTITUDE. . 5430 FEET

WEIGHT ∿ POUNDS	NET GRADIENT OF CLIMB ∿ %
11,380	2.1
9000	5.2
10,360	3.3

CLIMB SPEED (10,360 LBS) . . .102 KNOTS

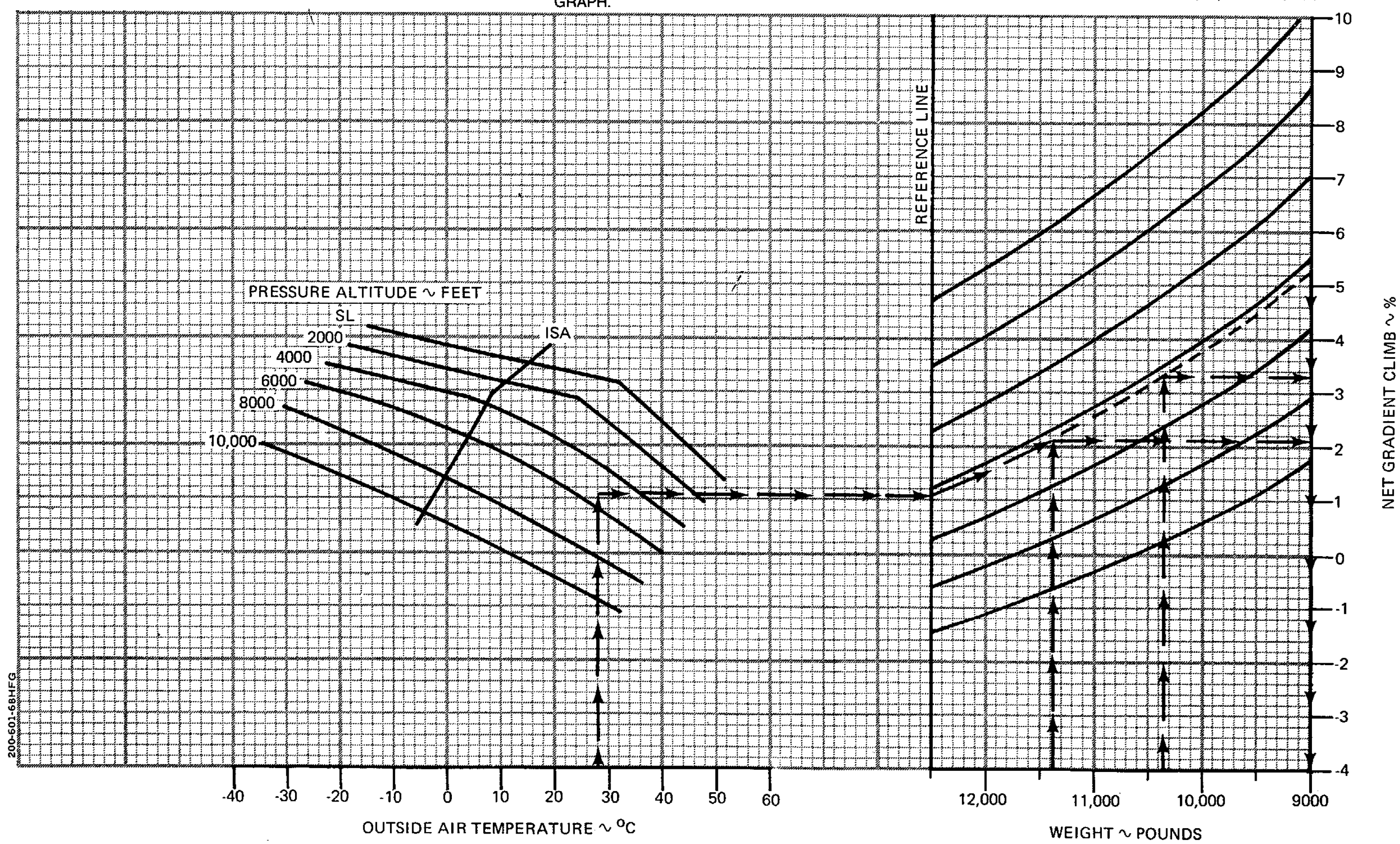


Figure 7-280. Net Gradient of Climb-Flaps 40%

CLIMB – TWO ENGINES – FLAPS 0%

ASSOCIATED CONDITIONS:

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

WEIGHT ~ POUNDS	CLIMB SPEED ~ KNOTS
12,500	125
12,000	124
11,000	121
10,000	118
9000	115

EXAMPLE:

OAT .... −6°C
PRESSURE ALTITUDE ...... 18,000 FT
WEIGHT .... 12,397 LBS

RATE OF CLIMB .... 1350 FT/MIN
CLIMB GRADIENT 8.0%
CLIMB SPEED .... 125 KNOTS

NOTE: DURING OPERATION WITH ICE VANES EXTENDED, RATE OF CLIMB WILL BE REDUCED APPROXIMATELY 250 FEET PER MINUTE.

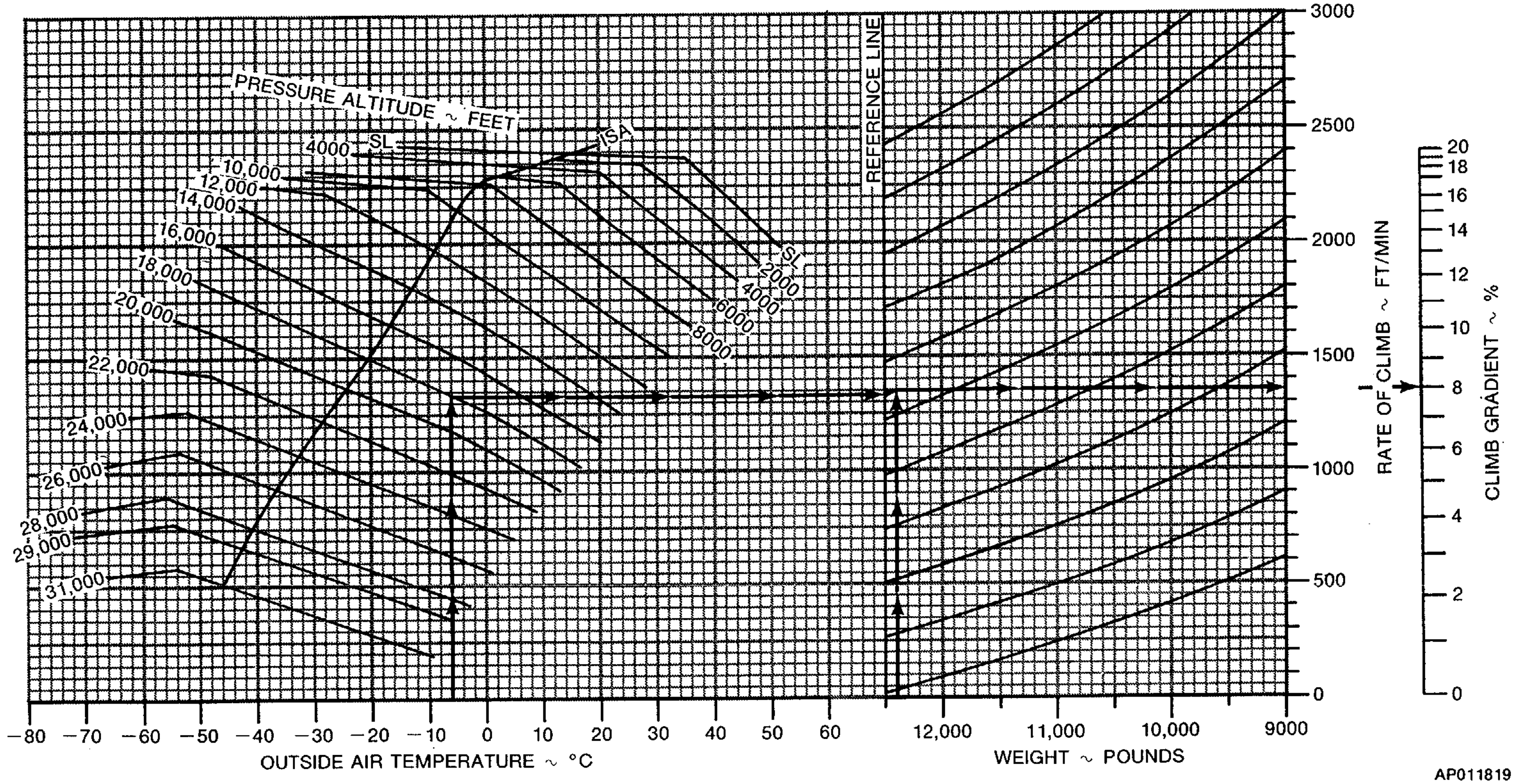


Figure 7-281. Climb-Two Engines-Flaps 0%

CLIMB – TWO ENGINES – FLAPS 40%

ASSOCIATED CONDITIONS:

POWER .... MAXIMUM CONTINUOUS
FLAPS 40%
LANDING GEAR .... UP

WEIGHT ~ POUNDS	CLIMB SPEED ~ KNOTS
12,500	125
12,000	124
11,000	121
10,000	118
9000	115

EXAMPLE:

OAT .... −6°C
PRESSURE ALTITUDE ...... 18,000 FT
WEIGHT .... 12,397 LBS

RATE-OF-CLIMB .... 1150 FT/MIN
CLIMB GRADIENT 6.9%
CLIMB SPEED .... 125 KNOTS

NOTE: DURING OPERATION WITH ICE VANES EXTENDED, RATE-OF-CLIMB WILL BE REDUCED APPROXIMATELY 250 FEET PER MINUTE.

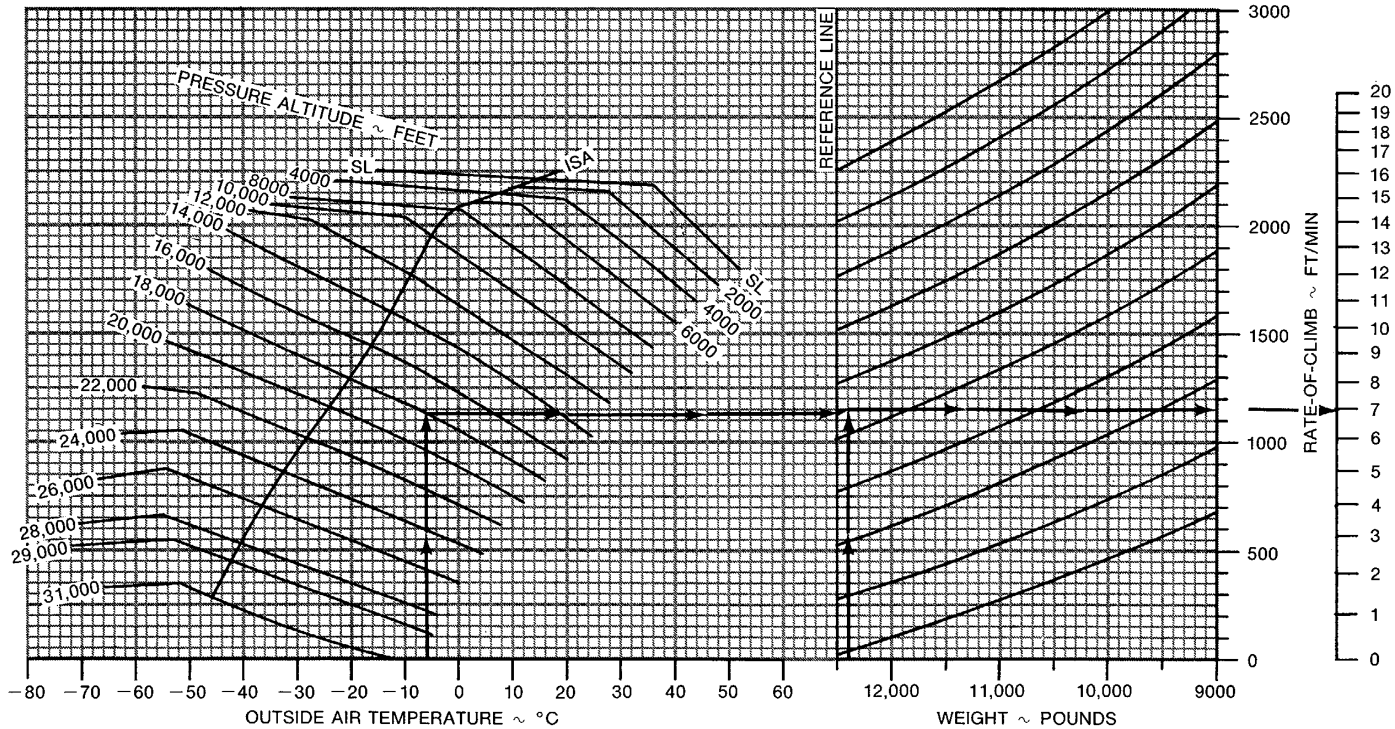


Figure 7-282. Climb - Two Engines - Flaps 40%

CLIMB — ONE ENGINE INOPERATIVE

ASSOCIATED CONDITIONS:

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

WEIGHT ~ POUNDS	CLIMB SPEED ~ KNOTS
12,500	121
12,000	119
11,000	117
10,000	114
9000	111

EXAMPLE:

OAT .... −6°C
PRESSURE ALTITUDE .... 18,000 FT
WEIGHT .... 12,397 LBS

RATE-OF-CLIMB .... 90 FT/MIN
CLIMB GRADIENT 0.5%
CLIMB SPEED .... 121 KNOTS

NOTE: DURING OPERATION WITH ICE VANES EXTENDED, RATE-OF-CLIMB WILL BE REDUCED APPROXIMATELY 100 FEET PER MINUTE.

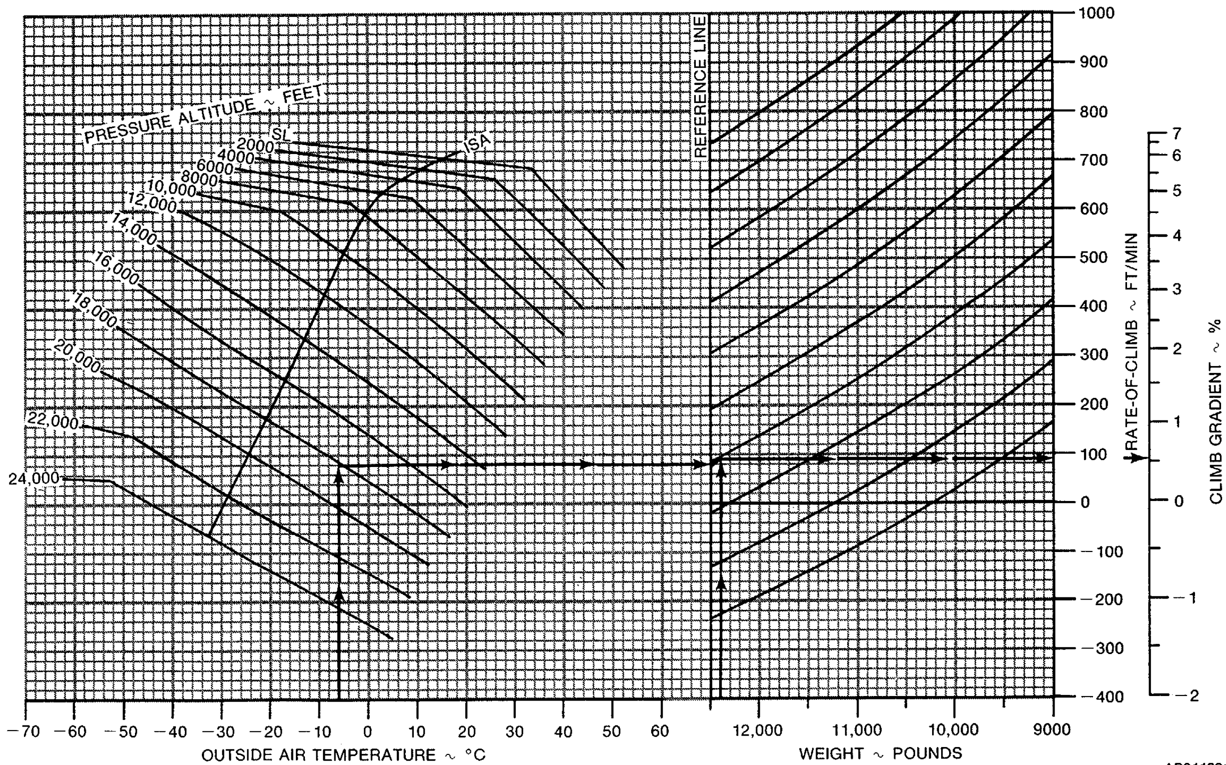


Figure 7-283. Climb - One Engine Inoperative

SERVICE CEILING — ONE ENGINE INOPERATIVE

ASSOCIATED CONDITIONS:

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

NOTE: SERVICE CEILING IS THE MAXIMUM PRESSURE ALTITUDE AT WHICH THE AIRPLANE IS CAPABLE OF CLIMBING 50 FT/MINUTE WITH ONE PROPELLER FEATHERED.

EXAMPLE:

OAT AT MEA (WORST LEG) ......0°C
WEIGHT ....12,397 LBS
ROUTE SEGMENT MEA ....18,000 FT

SERVICE CEILING ....18,200 FT
SERVICE CEILING IS ABOVE ENROUTE MEA

NOTE: DURING OPERATION WITH ICE VANES EXTENDED, SERVICE CEILING WILL BE LOWERED APPROXIMATELY 1500 FEET.

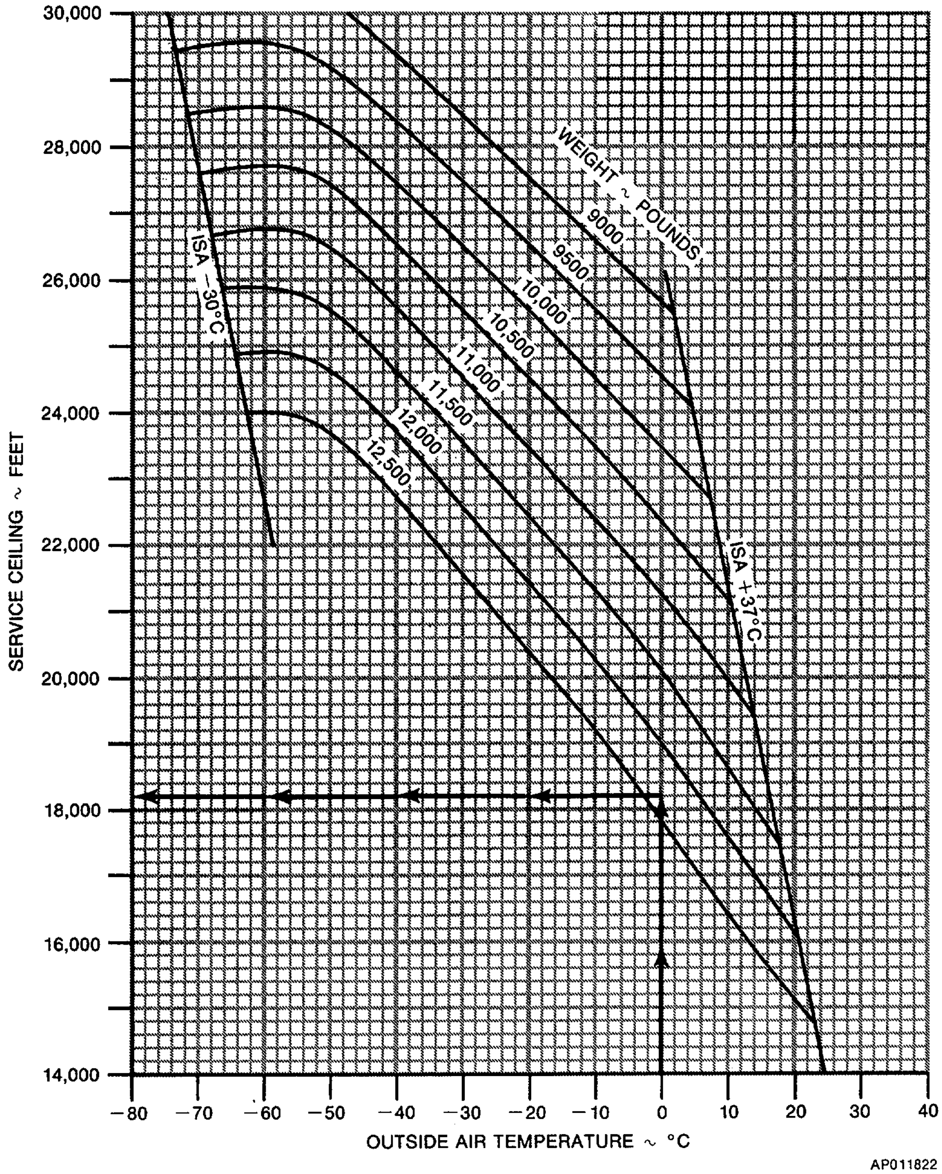


Figure 7-284. Service Ceiling - One Engine Inoperative

CLIMB — BALKED LANDING

CLIMB SPEED 100 KNOTS (ALL WEIGHTS)

ASSOCIATED CONDITIONS:

POWER . . . . . . TAKEOFF
FLAPS 100%
LANDING GEAR . . DOWN

NOTE: FOR OPERATION WITH ICE VANES EXTENTED, ADD 10° C TO ACTUAL OAT BEFORE ENTERING GRAPH.

EXAMPLE:

OAT . . . . 32°C
PRESSURE ALTITUDE . 4730 FT
WEIGHT . . . . 10,937 LBS

RATE-OF-CLIMB . . . . 1450 FT/MIN
CLIMB GRADIENT . . . 12.8 %

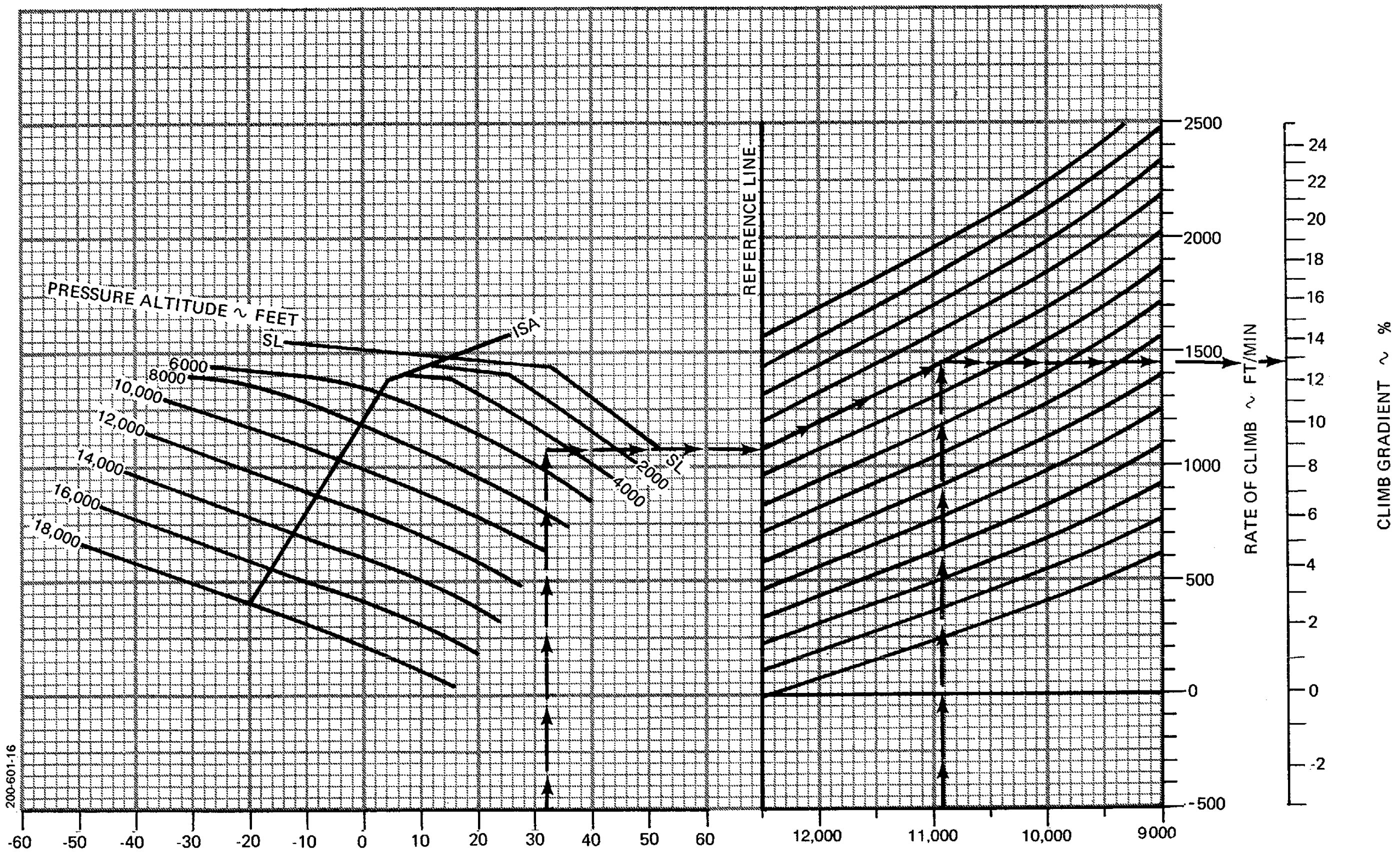


Figure 7-285. Climb - Balked Landing

LANDING DISTANCE WITHOUT PROPELLER REVERSING-FLAPS 100%

ASSOCIATED CONDITIONS:

POWER .... RETARDED TO MAINTAIN 800 FT/MIN ON FINAL APPROACH
FLAPS........................... 100%
RUNWAY...................... PAVED, LEVEL, DRY SURFACE
APPROACH SPEED..... IAS AS TABULATED
BRAKING...................... MAXIMUM

WEIGHT ~ LBS	APPROACH SPEED ~ KTS
12,500	103
12,000	102
11,000	99
10,000	96
9000	93

EXAMPLE:

OAT .... 15°C
PRESSURE ALTITUDE........................ 5650 FT
LANDING WEIGHT .... 11,180 LBS
HEADWIND COMPONENT.................. 10 KTS

GROUND ROLL .... 1580 FT
TOTAL OVER 50 FT. OBSTACLE........ 2700 FT
APPROACH SPEED .... 99 KTS

NOTE: ADD OR SUBTRACT 4% OF TOTAL GROUND ROLL FOR EACH 1% RUNWAY SLOPE (DOWN - ADD, UP - SUBTRACT).

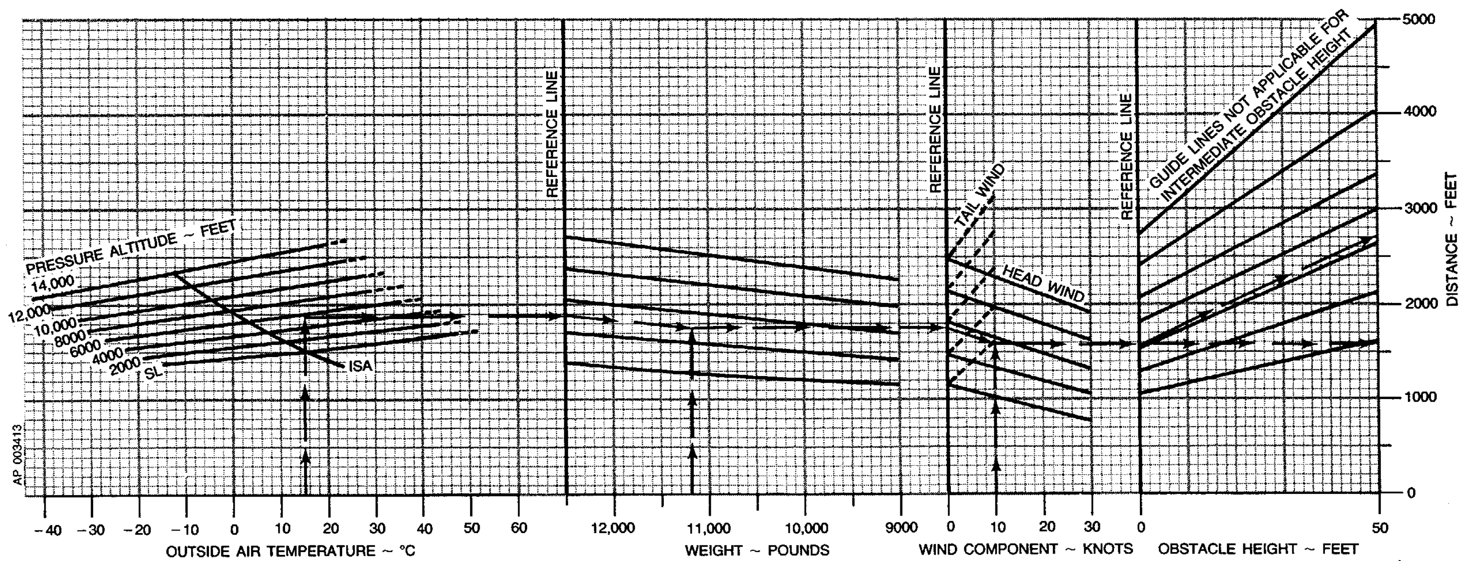


Figure 7-286. Landing Distance Without Propeller Reversing - Flaps 100%

LANDING DISTANCE WITHOUT PROPELLER REVERSING-FLAPS 0%

ASSOCIATED CONDITIONS:

POWER .... RETARDED TO MAINTAIN 900 FT/MIN ON FINAL APPROACH
FLAPS .... UP
RUNWAY............... PAVED, LEVEL, DRY SURFACE
BRAKING .... MAXIMUM

WEIGHT ~ LBS	APPROACH SPEED ~ KTS
12,500	132
12,000	130
11,000	126
10,000	122
9000	117

EXAMPLE:

FLAPS 100% LANDING DISTANCE
OVER 50 FT OBSTACLE .... 2700 FT
LANDING WEIGHT .... 11,180 LBS

FLAPS UP LANDING DISTANCE
OVER 50 FT. OBSTACLE .... 3800 FT
APPROACH SPEED .... 127 KTS

NOTE: 1. TO DETERMINE FLAPS UP LANDING DISTANCE, READ THE FLAPS 100% LANDING DISTANCE APPROPRIATE TO THE OAT, ALTITUDE, WEIGHT AND WIND FROM THE LANDING DISTANCE GRAPH WITHOUT REVERSING - FLAPS 100%. ENTER THE FLAPS UP LANDING DISTANCE GRAPH AND READ THE DISTANCE.
2. ADD OR SUBTRACT 4% OF TOTAL GROUND ROLL FOR EACH 1% RUNWAY SLOPE (DOWN - ADD, UP - SUBTRACT).

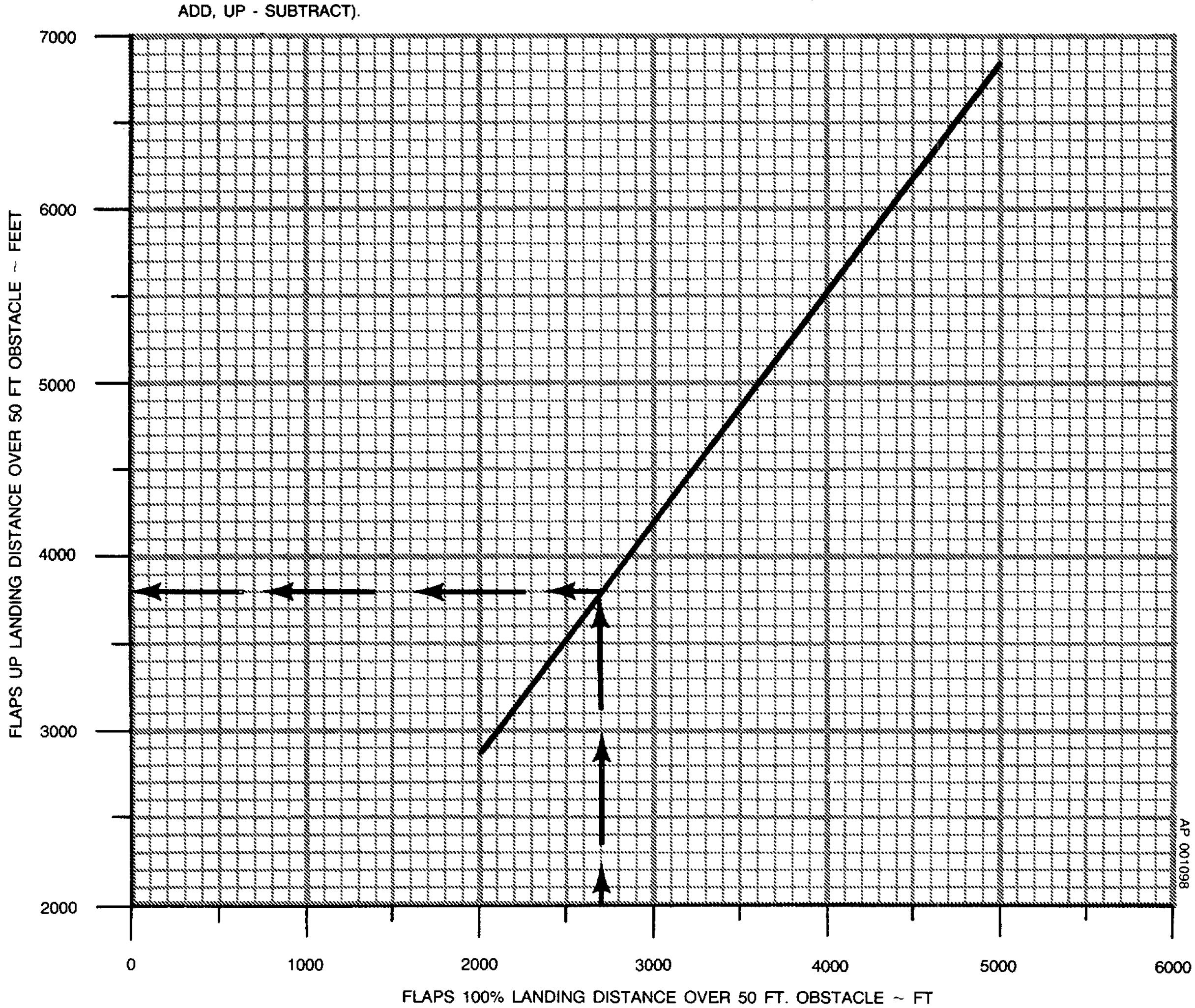


Figure 7-287. Landing Distance Without Propeller Reversing - Flaps 0%

LANDING DISTANCE WITH PROPELLER REVERSING – FLAPS 100%

ASSOCIATED CONDITIONS:

POWER .... RETARDED TO MAINTAIN 800 FT/MIN ON FINAL APPROACH
FLAPS........................... 100%
RUNWAY....................... PAVED, LEVEL, DRY SURFACE
APPROACH SPEED..... IAS AS TABULATED
BRAKING...................... MAXIMUM

WEIGHT ~ LBS	APPROACH SPEED ~ KTS
12,500	103
12,000	102
11,000	99
10,000	96
9000	93

EXAMPLE:

OAT .... 15°C
PRESSURE ALTITUDE.................... 5650 FT
LANDING WEIGHT .... 11,180 LBS
HEADWIND COMPONENT................ 10 KTS

GROUND ROLL .... 1200 FT
TOTAL OVER 50 FT OBSTACLE..... 2100 FT
APPROACH SPEED .... 100 KTS

NOTE: ADD OR SUBTRACT 5% FROM TOTAL GROUND ROLL FOR EACH 1% RUNWAY SLOPE (DOWN - ADD, UP - SUBTRACT).

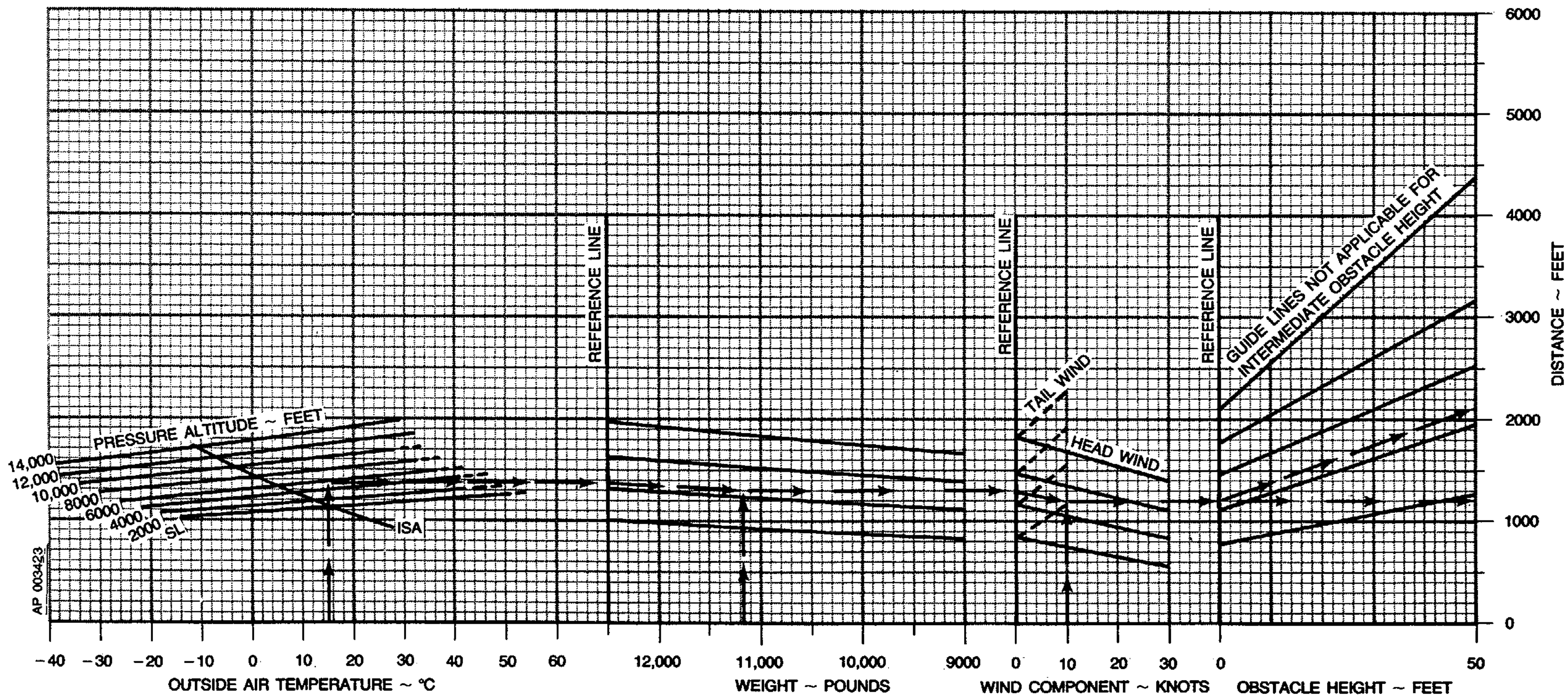


Figure 7-288. Landing Distance With Propeller Reversing - Flaps 100%

LANDING DISTANCE WITH PROPELLER REVERSING – FLAPS 0%

ASSOCIATED CONDITIONS:

POWER	RETARDED TO MAINTAIN 1000 FT/MIN ON FINAL APPROACH
FLAPS	UP
RUNWAY	PAVED, LEVEL, DRY SURFACE
APPROACH SPEED	IAS AS TABULATED
BRAKING	MAXIMUM
CONDITION LEVERS	HIGH IDLE
PROPELLER CONTROLS	FULL FORWARD
POWER LEVERS	MAXIMUM REVERSE AFTER TOUCHDOWN

EXAMPLE:

FLAPS 100% LANDING DISTANCE OVER 50 FT OBSTACLE	2100 FT
LANDING WEIGHT	11,180 LBS
FLAPS UP LANDING DISTANCE OVER 50 FOOT OBSTACLE	2670 FT
APPROACH SPEED	127 KTS

WEIGHT ~ LBS	APPROACH SPEED ~ KTS
12,500	132
12,000	130
11,000	126
10,000	122
9000	117

NOTE: 1. TO DETERMINE FLAPS UP LANDING DISTANCE, READ THE FLAPS 100% LANDING DISTANCE APPROPRIATE TO THE OAT, ALTITUDE, WEIGHT, AND WIND FROM THE LANDING DISTANCE GRAPH WITH REVERSING - FLAPS 100%, ENTER THE FLAPS UP LANDING DISTANCE GRAPH AND READ THE DISTANCE.

2. ADD OR SUBTRACT 5% FROM TOTAL GROUND ROLL FOR EACH 1% RUNWAY SLOPE (DOWN - ADD, UP - SUBTRACT).

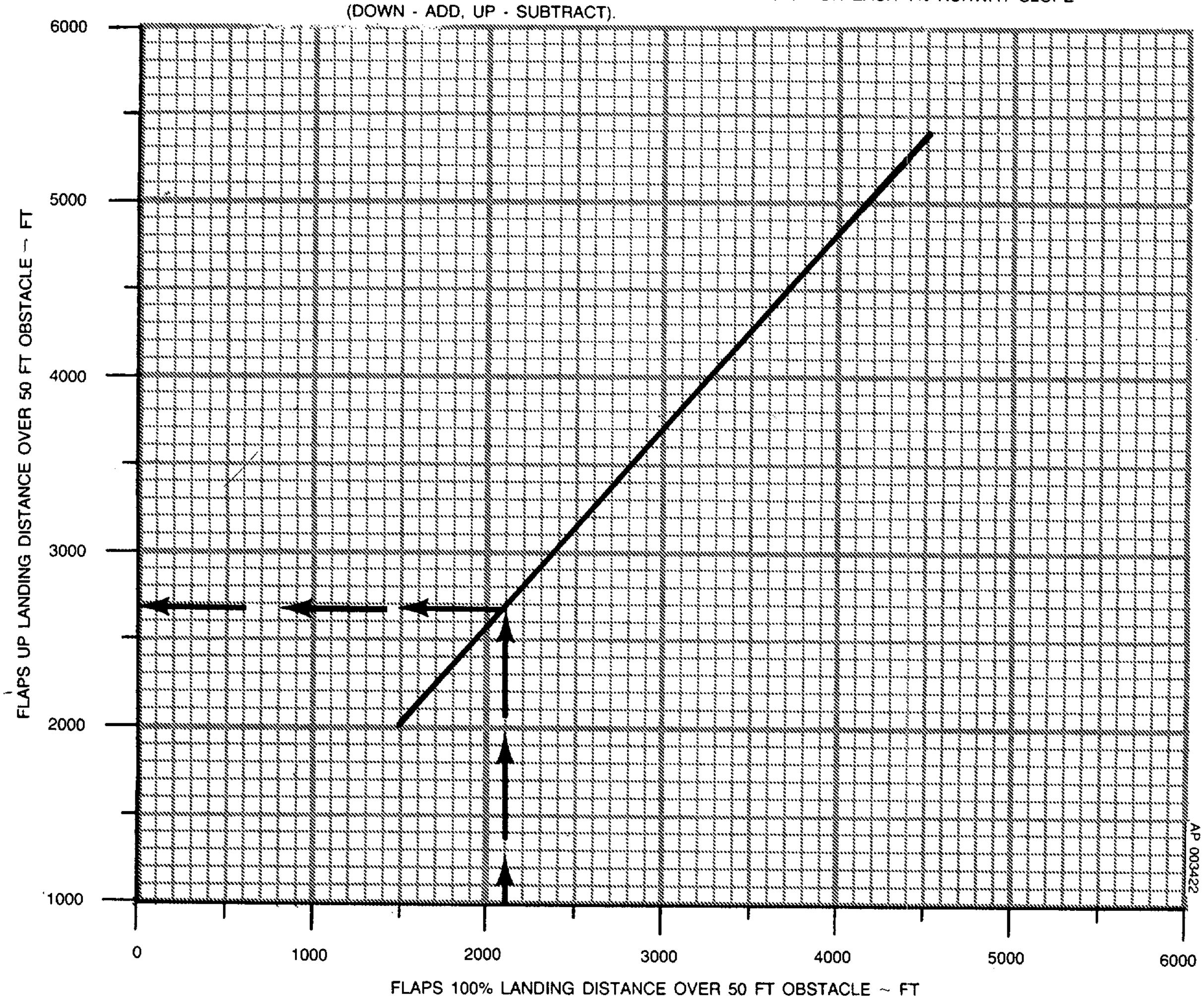


Figure 7-289. Landing Distance With Propeller Reversing - Flaps 0%

STOPPING DISTANCE FACTORS

EXAMPLE:

1. LANDING DISTANCE (FLAPS 100% NO REV)
   GROUND ROLL (DRY) .... 1580 FT
   TOTAL OVER 50 FT OBSTACLE .... 2700 FT
   RUNWAY CONDITION READING 8.0
   LANDING WEIGHT .... 11,180 LBS

   STOPPING FACTOR 1.62
   LANDING DISTANCE (FACTORED)
   GROUND ROLL (1580 x 1.62) 2560
   AIR DISTANCE (2700 − 1580) 1120
   TOTAL OVER 50 FT OBSTACLE 3680

2. ACCELERATE-STOP DISTANCE
   (FLAPS 0% NO REV)
   ACCELERATE-STOP DISTANCE ....5890 FT
   DECELERATE-STOP DISTANCE ....2310 FT
   RUNWAY CONDITION READING 10.0
   TAKE-OFF WEIGHT ....12,500 LBS

   STOPPING FACTOR 1.34
   BRAKED DISTANCE (2310 x 1.34) .... 3095 FT
   ACCELERATE + REACTION
   DISTANCE (5890 - 2310) .... 3580 FT
   RCR 10 ACCELERATE-STOP
   DISTANCE (3580 + 3095) .... 6675 FT

NOTE: 1. IF RCR READING IS NOT AVAILABLE, ASSUME ICY RUNWAY RCR = 5.0 AND WET RUNWAY RCR = 12.0.
2. USE "NO REV" CURVE FOR ONE ENGINE REVERSING.

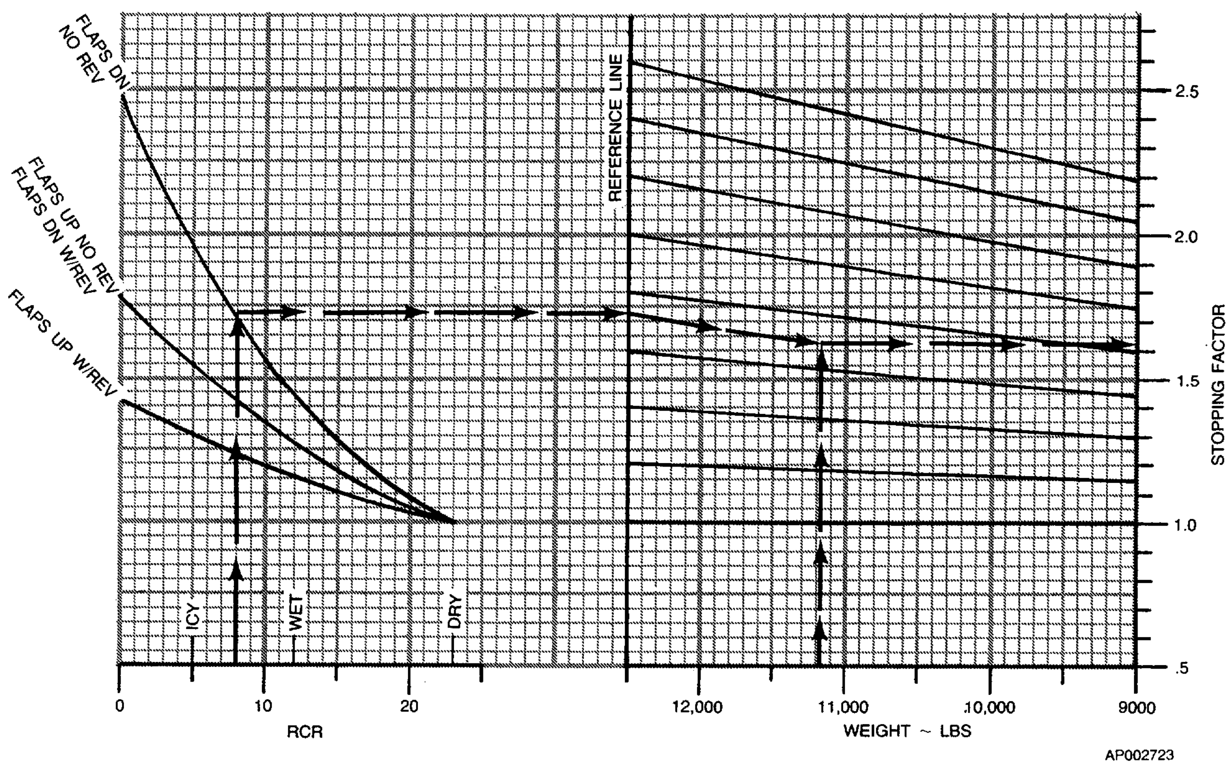


Figure 7-290. Stopping Distance Factors

Section IV. MODEL C-12F

INTRODUCTION TO CRUISE CONTROL

NOTE

The graphs and tables in this part present cruise information for various parameters of weight, power, altitude and temperature. Examples have been presented using conditions specified below. The following calculations provide information for flight planning at various parameters of weight, power, altitude, and temperature.

Detailed calculations for flight time, block speed, and fuel requirements for a proposed flight from Denver to Reno at FL260 are as follows:

Enter the ISA CONVERSION Graph at the conditions indicated:

DEN Pressure Altitude .... 5433 feet
OAT .... 28°C
ISA Condition .... ISA +23°C
DEN - SLC Pressure Altitude .... 26,000 feet
OAT .... -10°C
ISA Condition .... ISA +27°C
SLC - RNO Pressure Altitude .... 26,000 feet
OAT .... -20°C
ISA Condition .... ISA + 17°C
RNO Pressure Altitude . 4732 feet
OAT .... 32°C
ISA Condition .... ISA +27°C

Enter the TIME, FUEL, AND DISTANCE TO CLIMB Graph at 28°C, to 5433 feet, and to 12, 500 pounds, and enter at -10°C, to 26,000 feet and to 12,500 pounds, and read:

Time to Climb .... 21 -3 = 18 minutes
Fuel Used to Climb .... 251 -43 = 208 pounds
Distance Traveled .... 65 -7 = 58 nautical miles

Enter the TIME, FUEL, AND DISTANCE TO DESCEND Graph at 26,000 feet, and enter again at 4732 feet to read:

Time to Descend .... 17 -3 = 14 minutes
Fuel Used to Descend .... 163 -37 = 126 pounds
Descent Distance .... 81 -14 = 67 nautical miles

The estimated average cruise weight is approximately 11,600 pounds.

Enter the tables for RECOMMENDED CRUISE POWER 1700 RPM for ISA +10°C, ISA +20°C, and ISA +30°C, and read the cruise speed for 26,000 feet at 12,000 pounds and 11,000 pounds.

Interpolate between these speeds for ISA +27°C and ISA +17°C at 11,600 pounds:
Cruise True Airspeed (ISA +27°C) .... 265 knots
Cruise True Airspeed (ISA +17°C) .... 269 knots

Enter the *RECOMMENDED CRUISE POWER 1700 RPM Graph at 26,000 feet, and read the torque settings for ISA +27°C
(-3°C IOAT) and ISA +17°C (-13°C IOAT):

ISA +27°C (-3°C IOAT) .... 67% torque per engine
ISA +17°C (-13° IOAT). .... 70% torque per engine

Enter the *FUEL FLOW AT RECOMMENDED CRUISE POWER 1700 RPM Graph at 26,000 feet, and read the fuel flow for ISA +27°C (-3°C IOAT) and ISA +17°C (-13°C IOAT):

ISA +27°C (-3°C IOAT)
Fuel Flow Per Engine .... 262 lbs/hr
Total Fuel Flow .... 524 lbs/hr
ISA +17°C (-13°C IOAT)
Fuel Flow Per Engine .... 273 lbs/hr
Total Fuel Flow .... 546 lbs/hr

NOTE

For flight planning, enter these graphs at the forecasted ISA condition; for enroute power settings and fuel flow, enter the graphs at the actual IOAT.

Time and Fuel Used were calculated at Maximum Cruise Power 1700 RPM as follows:

Time = Distance + Ground Speed

CRUISE TRUE AIRSPEEDS AT FL 260

12,000 POUNDS			11,000 POUNDS		
ISA +10°C	ISA +20°C	ISA +30°C	ISA +10°C	ISA +20°C	ISA +30°C
269	266	262	273	271	268

Fuel Used = (Time) (Total Fuel Flow)

Results are as follows:

Reserve Fuel (45 minutes at Maximum Range Power): Weight at end of cruise was assumed to be 11,000 pounds. Enter the tables for MAXIMUM RANGE POWER 1700 RPM for ISA +10°C and ISA +20°C at 26,000 feet.

ISA + 10°C .... 416 lbs/hr Total Fuel Flow

ISA +20°C .... 416 lbs/hr Total Fuel Flow

Interpolate to find fuel flow at ISA +17°C:

Total fuel flow for reserve = 416 +0 = 416 lbs/hr

Reserve Fuel = 45 minutes X 423 lbs/hr = 312 lbs

Total Fuel: 1699 +312 = 2011 pounds (301 gallons aviation kerosene.)

ROUTE SEGMENT	DISTANCE NM	ESTIMATED GROUND SPEED KNOTS	TIME AT CRUISE ALTITUDE HRS : MIN	FUEL USED FOR CRUISE LBS
DEN - EKR	*97	250	00:23	203
EKR - SLC	192	246	00:47	409
SLC - BVL	81	257	00:19	172
BLV - BAM	145	256	00:34	310
BAM - RNO	*78	235	00:20	181

*Distance required to climb or descend has been subtracted from segment distance.

TIME - FUEL - DISTANCE

ITEM	TIME HRS: MINS	FUEL POUNDS	DISTANCE NM
Start, Runup, Taxi, and Takeoff Acceleration	00:00	90	0.0
Climb	00:18	208	58.0
Cruise	02:23	1275	593.0
Descent	00:14	126	67.0
Total	02:55	1699	718.0

Total Flight Time 2 hours, 55 minutes
Block Speed: 718 NM *- 2 hours, 55 minutes = 246 knots

ISA CONVERSION

PRESSURE ALTITUDE vs OUTSIDE AIR TEMPERATURE

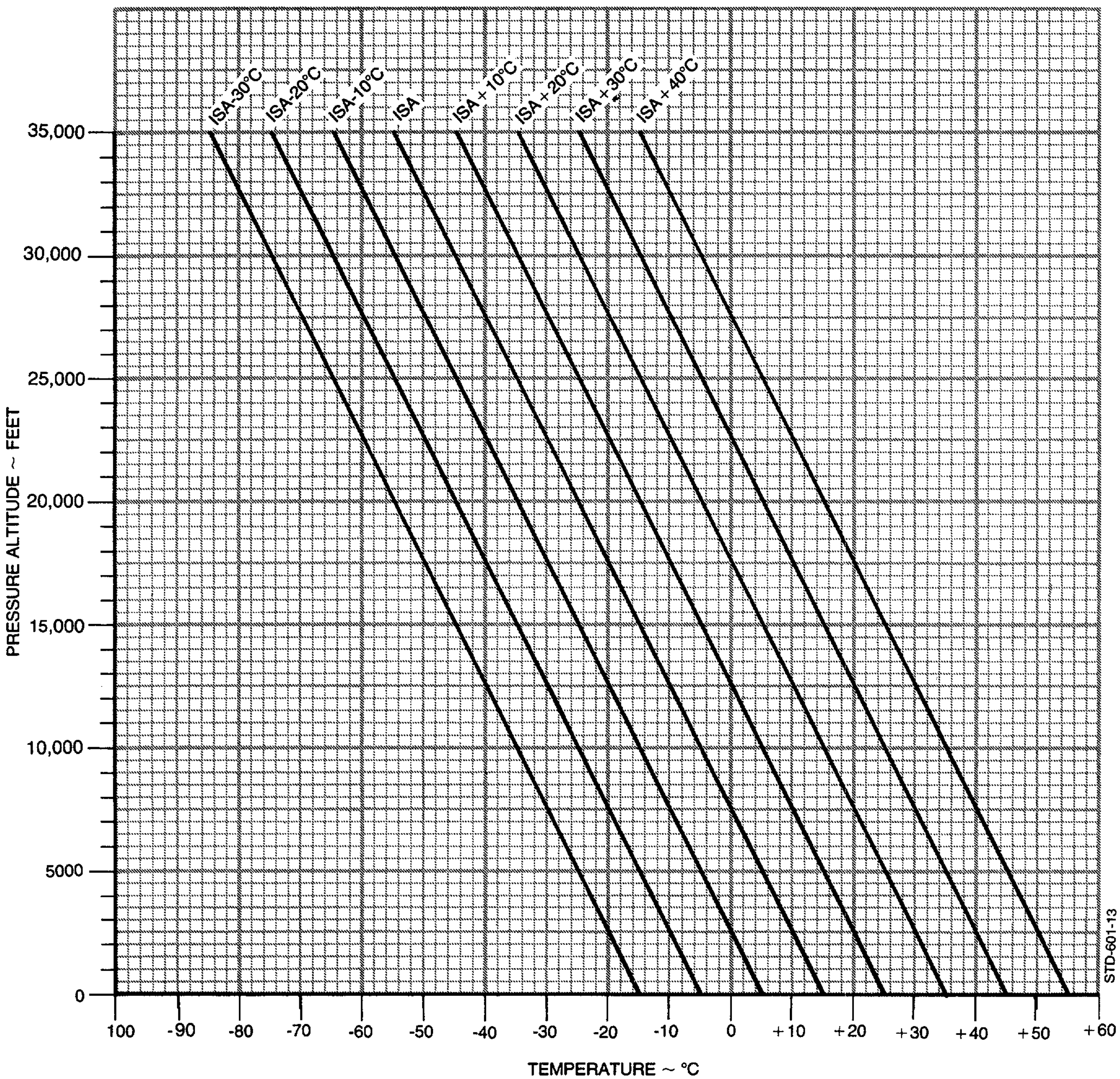


Figure 7-291. ISA Conversion

TIME, FUEL, AND DISTANCE TO CLIMB

ASSOCIATED CONDITIONS:

PROPELLER SPEED .... 1900 RPM
TGT .... 770°C
OR TORQUE 100%

ALTITUDE ~ FEET	CLIMB SPEED ~ KNOTS
SL TO 10,000	160
10,000 TO 20,000	140
20,000 TO 25,000	130
25,000 TO 35,000	120

EXAMPLE:

OAT AT TAKEOFF .... 28°C
OAT AT CRUISE .... −10°C
AIRPORT PRESSURE ALTITUDE .... 5433 FT
CRUISE ALTITUDE .... 26,000 FT
INITIAL CLIMB WEIGHT .... 12,500 LBS

TIME TO CLIMB (21−3) .... 18 MIN
FUEL TO CLIMB (251−43) .... 208 LBS
DISTANCE TO CLIMB (65−7) .... 58 MIN

NOTE: 1. ADD 90 LBS OF FUEL FOR START, TAXI AND TAKEOFF.
2. FOR OPERATION WITH ICE VANES EXTENDED, ADD 20°C TO THE ACTUAL OAT BEFORE ENTERING THE GRAPH.

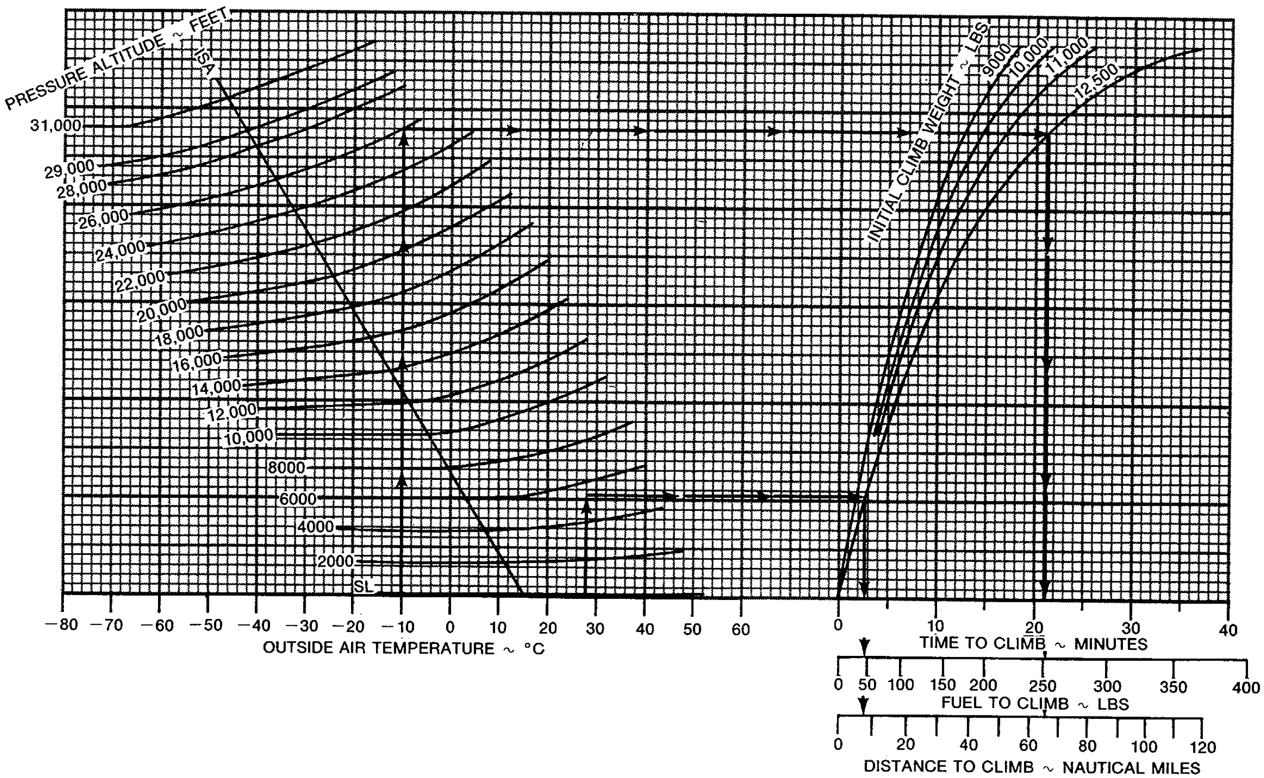


Figure 7-292. Time, Fuel, and Distance to Climb

TIME, FUEL, AND DISTANCE TO DESCEND

ASSOCIATED CONDITIONS:

POWER ....AS REQUIRED TO DESCEND AT 1500 FT/MIN
GEAR ....UP
FLAPS 0%

EXAMPLE:

INITIAL ALTITUDE ....26,000 FT
FINAL ALTITUDE ....4732 FT

TIME TO DESCEND (17−3)............14 MIN
FUEL TO DESCEND (163−37) ....126 LBS
DISTANCE TO DESCEND (81−14)......67 NM

DESCENT SPEED: M_{MO} OR 250 KNOTS, WHICHEVER IS LESS.

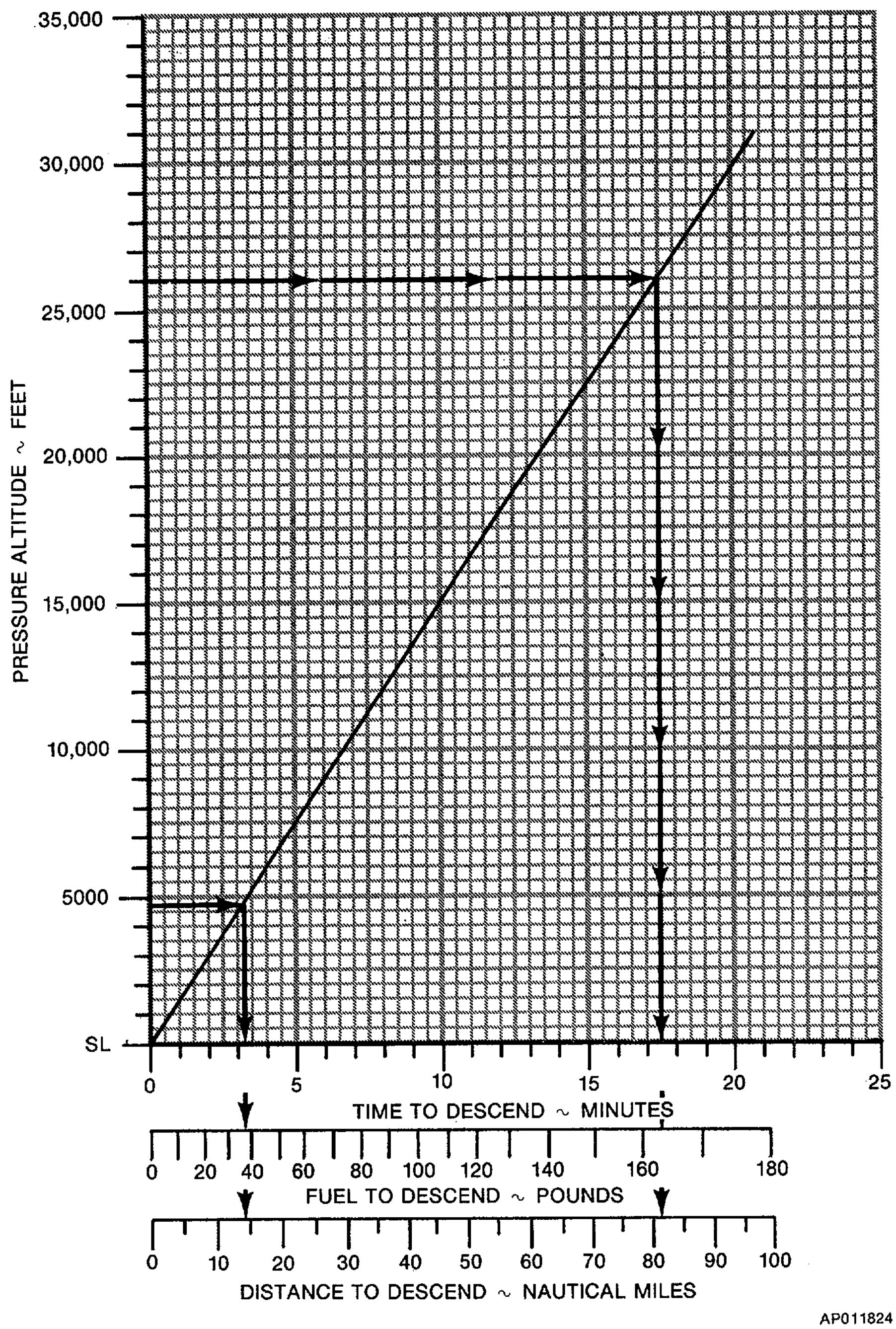


Figure 7-293. Time, Fuel, and Distance to Descend

RECOMMENDED CRUISE POWER
1700 RPM
ISA -30°C

PRESSURE ALTITUDE FEET	IOAT °C	OAT °C	TORQUE PER ENGINE %	FUEL FLOW PER ENGINE LBS/HR	TOTAL FUEL FLOW LBS/HR	AIRSPEED/KNOTS 12,000 LBS IAS	TAS	11,000 LBS IAS	TAS	10,000 LBS IAS	TAS
SL	-10	-15	100	465	930	241	229	242	230	242	231
2000	-14	-19	100	453	906	239	233	239	234	240	235
4000	-18	-23	100	440	880	236	237	237	238	238	239
6000	-21	-27	100	429	850	234	242	235	243	236	244
8000	-25	-31	100	417	834	232	246	233	248	234	249
10,000	-29	-35	100	407	814	229	251	231	252	231	253
12,000	-33	-39	100	397	794	227	256	228	257	229	258
14,000	-36	-43	100	390	780	225	261	226	262	227	263
16,000	-40	-47	100	384	768	222	266	224	268	225	269
18,000	-44	-51	100	379	758	220	271	221	273	222	274
20,000	-47	-55	100	376	752	217	276	219	278	220	279
22,000	-51	-59	100	374	748	214	281	216	283	217	285
24,000	-55	-63	94	351	702	207	280	209	283	210	285
26,000	-59	-67	87	324	648	198	277	200	280	202	283
28,000	-63	-71	79	293	586	187	271	190	275	192	278
29,000	-66	-72	74	277	554	181	267	184	271	186	275
31,000	-70	-76	67	248	496	—	—	—	—	175	268

NOTE

IOAT, TORQUE, AND FUEL FLOW BASED ON 11,000 POUNDS.

Figure 7-294. Recommended Cruise Power - 1700 RPM - ISA -30°C

RECOMMENDED CRUISE POWER
1700 RPM
ISA -20°C

PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	AIRSPEED/KNOTS					
						12,000 LBS		11,000 LBS		10,000 LBS	
FEET	°C	°C	%	LBS/HR	LBS/HR	IAS	TAS	IAS	TAS	IAS	TAS
SL	-0	-5	100	467	934	239	232	240	232	241	233
2000	-4	-9	100	453	906	237	236	238	237	239	238
4000	-8	-13	100	440	880	234	240	235	241	236	242
6000	-11	-17	100	429	858	232	245	233	246	234	247
8000	-15	-21	100	418	836	230	250	231	251	232	252
10,000	-19	-25	100	409	818	228	254	229	256	230	257
12,000	-23	-29	100	398	796	225	259	226	261	227	262
14,000	-26	-33	100	391	782	223	264	224	266	225	267
16,000	-30	-37	100	385	770	221	270	222	271	223	272
18,000	-34	-41	100	381	762	218	275	219	276	220	278
20,000	-37	-45	100	378	756	215	280	216	281	218	283
22,000	-41	-49	96	363	726	209	281	211	283	212	285
24,000	-45	-53	91	340	680	201	279	203	282	205	284
26,000	-49	-57	84	315	630	192	276	195	280	197	283
28,000	-53	-61	77	289	578	183	272	186	276	188	279
29,000	-56	-62	71	276	552	178	269	181	274	184	277
31,000	-60	-66	63	252	504	167	262	171	268	174	273

NOTE

IOAT, TORQUE, AND FUEL FLOW BASED ON 11,000 POUNDS.

Figure 7-295. Recommended Cruise Power - 1700 RPM - ISA -20°C

RECOMMENDED CRUISE POWER
1700 RPM
ISA -10°C

PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	AIRSPEED/KNOTS 12,000 LBS		11,000 LBS		10,000 LBS	
FEET	°C	°C	%	LBS/HR	LBS/HR	IAS	TAS	IAS	TAS	IAS	TAS
SL	10	5	100	470	940	237	234	238	235	239	236
2000	6	1	100	457	914	235	239	236	240	237	240
4000	3	-3	100	444	888	233	243	234	244	235	245
6000	-1	-7	100	431	862	231	248	232	249	233	250
8000	-5	-11	100	420	840	228	253	229	254	230	255
10,000	-9	-15	100	409	818	226	257	227	259	228	260
12,000	-12	-19	100	400	800	223	262	225	264	226	265
14,000	-16	-23	100	393	786	221	268	222	269	223	270
16,000	-20	-27	100	387	744	218	273	220	274	221	276
18,000	-23	-31	100	383	766	216	278	217	279	218	281
20,000	-27	-35	96	367	734	210	279	211	281	213	283
22,000	-31	-39	92	349	698	203	279	205	281	207	284
24,000	-35	-43	86	327	654	195	277	197	280	199	283
26,000	-39	-47	80	304	608	187	274	189	278	191	281
28,000	-43	-51	74	280	560	177	270	180	275	183	278
29,000	-45	-52	71	268	536	172	267	176	272	179	277
31,000	-50	-56	65	247	494	162	261	166	267	170	273

NOTE

IOAT, TORQUE, AND FUEL FLOW BASED ON 11,000 POUNDS.

Figure 7-296. Recommended Cruise Power - 1700 RPM - ISA -10°C

RECOMMENDED CRUISE POWER
1700 RPM
ISA °C

PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	AIRSPEED/KNOTS 12,000 LBS		11,000 LBS		10,000 LBS	
FEET	°C	°C	%	LBS/HR	LBS/HR	IAS	TAS	IAS	TAS	IAS	TAS
SL	20	15	100	473	946	236	237	237	238	238	239
2000	16	11	100	460	920	234	241	234	242	235	243
4000	13	7	100	446	892	231	246	232	247	233	248
6000	9	3	100	433	866	229	251	230	252	231	253
8000	5	-1	100	421	842	226	255	228	257	229	258
10,000	2	-5	100	410	820	224	260	225	262	226	263
12,000	-2	-9	100	400	800	222	266	223	267	224	268
14,000	-6	-13	100	393	786	219	271	221	272	222	274
16,000	-10	-17	100	388	776	216	276	218	277	219	279
18,000	-13	-21	96	372	744	210	276	212	279	213	280
20,000	-17	-25	92	354	708	204	277	206	279	207	281
22,000	-21	-29	88	336	672	197	277	199	280	201	282
24,000	-25	-33	82	315	630	189	275	192	278	194	281
26,000	-29	-37	76	291	582	181	272	183	276	186	279
28,000	-33	-41	70	268	536	171	267	175	272	177	276
29,000	-36	-42	67	258	516	166	264	170	269	173	274
31,000	-40	-46	62	237	474	156	256	160	264	164	270

NOTE

IOAT, TORQUE, AND FUEL FLOW BASED ON 11,000 POUNDS.

Figure 7-297. Recommended Cruise Power - 1700 RPM - ISA 0°C

RECOMMENDED CRUISE POWER
1700 RPM
ISA +10°C

PRESSURE ALTITUDE FEET	IOAT °C	OAT °C	TORQUE PER ENGINE %	FUEL FLOW PER ENGINE LBS/HR	TOTAL FUEL FLOW LBS/HR	AIRSPEED/KNOTS 12,000 LBS IAS	12,000 LBS TAS	11,000 LBS IAS	11,000 LBS TAS	10,000 LBS IAS	10,000 LBS TAS
SL	30	25	100	476	952	234	239	235	240	236	241
2000	27	21	100	462	924	232	244	233	245	234	246
4000	23	17	100	449	898	230	249	231	250	232	251
6000	19	13	100	436	872	227	253	228	255	229	256
8000	15	9	100	424	848	225	258	226	259	227	261
10,000	12	5	100	413	826	222	263	224	265	225	266
12,000	8	1	100	402	804	220	269	221	270	222	271
14,000	4	-3	100	395	790	217	273	219	275	220	276
16,000	0	-7	97	378	756	212	275	213	277	215	279
18,000	-4	-11	92	357	714	205	275	207	277	208	279
20,000	-7	-15	88	341	682	199	276	201	278	202	281
22,000	-11	-19	84	324	648	192	275	194	278	196	281
24,000	-15	-23	78	303	606	184	273	186	276	189	280
26,000	-20	-27	73	280	560	175	269	178	273	180	277
28,000	-24	-31	67	258	516	165	263	169	269	172	274
29,000	-26	-3	64	247	494	160	259	164	266	167	271
31,000	-30	-36	59	228	456	149	251	154	260	158	267

NOTE

IOAT, TORQUE, AND FUEL FLOW BASED ON 11,000 POUNDS.

Figure 7-298. Recommended Cruise Power - 1700 RPM - ISA +10°C

RECOMMENDED CRUISE POWER
1700 RPM
ISA +20°C

PRESSURE ALTITUDE FEET	IOAT °C	OAT °C	TORQUE PER ENGINE %	FUEL FLOW PER ENGINE LBS/HR	TOTAL FUEL FLOW LBS/HR	AIRSPEED/KNOTS 12,000 LBS IAS	12,000 LBS TAS	11,000 LBS IAS	11,000 LBS TAS	10,000 LBS IAS	10,000 LBS TAS
SL	40	35	100	479	958	233	242	234	243	235	244
2000	37	31	100	465	930	231	246	232	248	233	249
4000	33	27	100	452	904	228	251	229	252	230	253
6000	29	23	100	439	878	226	256	227	257	228	258
8000	26	19	100	427	854	223	261	224	262	225	263
10,000	22	15	100	416	832	221	266	222	268	223	269
12,000	18	11	99	403	806	218	271	219	272	220	274
14,000	14	7	95	382	764	212	271	213	273	215	275
16,000	10	3	91	361	722	205	272	207	274	209	276
18,000	6	-1	87	341	682	199	272	201	275	202	277
20,000	2	-5	84	328	656	193	273	195	276	197	279
22,000	-1	-9	81	313	626	187	274	189	277	191	280
24,000	-6	-13	75	292	584	179	271	182	275	184	279
26,000	-10	-17	70	270	540	169	266	173	271	176	275
28,000	-14	-21	63	248	496	159	259	163	265	167	271
29,000	-16	-22	61	237	474	153	254	158	262	162	268
31,000	-21	-26	56	218	436	140	242	148	255	153	263

NOTE

IOAT, TORQUE, AND FUEL FLOW BASED ON 11,000 POUNDS.

Figure 7-299. Recommended Cruise Power - 1700 RPM - ISA +20°C

RECOMMENDED CRUISE POWER
1700 RPM
ISA +30°C

PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	AIRSPEED/KNOTS					
						12,000 LBS		11,000 LBS		10,000 LBS	
FEET	°C	°C	%	LBS/HR	LBS/HR	IAS	TAS	IAS	TAS	IAS	TAS
SL	51	45	100	482	964	231	244	232	245	233	246
2000	47	41	100	468	936	229	249	230	250	231	251
4000	43	37	100	454	908	227	254	228	255	229	256
6000	39	33	100	441	882	224	259	225	260	226	261
8000	36	29	100	429	858	222	264	223	265	224	266
10,000	32	25	98	410	820	217	266	219	268	220	269
12,000	28	21	93	383	766	211	266	212	268	214	270
14,000	24	17	89	363	726	205	267	206	269	208	271
16,000	20	13	85	344	688	198	268	200	270	202	272
18,000	16	9	82	326	652	192	268	194	271	196	273
20,000	13	5	79	313	626	187	270	189	273	191	276
22,000	8	1	77	301	602	182	271	184	275	186	278
24,000	4	-3	72	280	560	173	268	176	272	179	276
26,000	0	-7	66	259	518	164	262	168	268	171	273
28,000	-4	-11	61	238	476	153	255	158	263	162	269
29,000	-6	-12	58	228	456	148	250	153	259	157	266
31,000	-11	-16	53	210	420	131	231	142	250	148	260

Figure 7-300. Recommended Cruise Power-1700 RPM-ISA +30°C

RECOMMENDED CRUISE POWER
1700 RPM
ISA +37°C

PRESSURE ALTITUDE FEET	IOAT °C	OAT °C	TORQUE PER ENGINE %	FUEL FLOW PER ENGINE LBS/HR	TOTAL FUEL FLOW LBS/HR	AIRSPEED/KNOTS 12,000 LBS IAS	TAS	11,000 LBS IAS	TAS	10,000 LBS IAS	TAS
SL	58	52	100	484	968	231	246	232	247	232	248
2000	54	48	100	478	940	228	251	229	252	230	253
4000	50	44	100	456	912	226	255	227	257	228	258
6000	46	40	100	443	886	223	260	224	262	225	263
8000	43	36	97	419	838	218	262	219	263	220	265
10,000	39	32	93	396	792	212	263	214	265	215	267
12,000	35	28	88	370	740	205	263	207	265	209	267
14,000	31	34	85	353	700	200	264	201	266	203	268
16,000	27	20	81	332	664	194	265	196	267	197	270
18,000	23	16	78	315	630	188	265	190	268	192	271
20,000	19	12	76	303	606	183	267	185	270	187	273
22,000	15	8	73	292	584	177	268	180	272	182	275
24,000	11	4	69	272	544	169	264	172	270	175	274
26,000	7	9	64	251	502	160	259	164	266	167	271
28,000	3	-4	59	231	462	149	251	154	260	158	266
29,000	1	-5	56	221	442	142	244	149	256	154	263
31,000	-4	-9	51	203	406	—	—	137	245	144	257

NOTE

IOAT, TORQUE, AND FUEL FLOW BASED ON 11,000 POUNDS.

Figure 7-301. Recommended Cruise Power-1700 RPM-ISA +37°C

RECOMMENDED CRUISE SPEEDS

1700 RPM

WEIGHT 11,000 LBS

NOTE: DURING OPERATION WITH ICE VANES EXTENDED, TRUE AIRSPEED WILL BE REDUCED APPROXIMATELY 30 KNOTS IF ORIGINAL POWER IS NOT OR CANNOT BE RESET, BUT WILL BE UNCHANGED IF THE ORIGINAL POWER IS RESET.

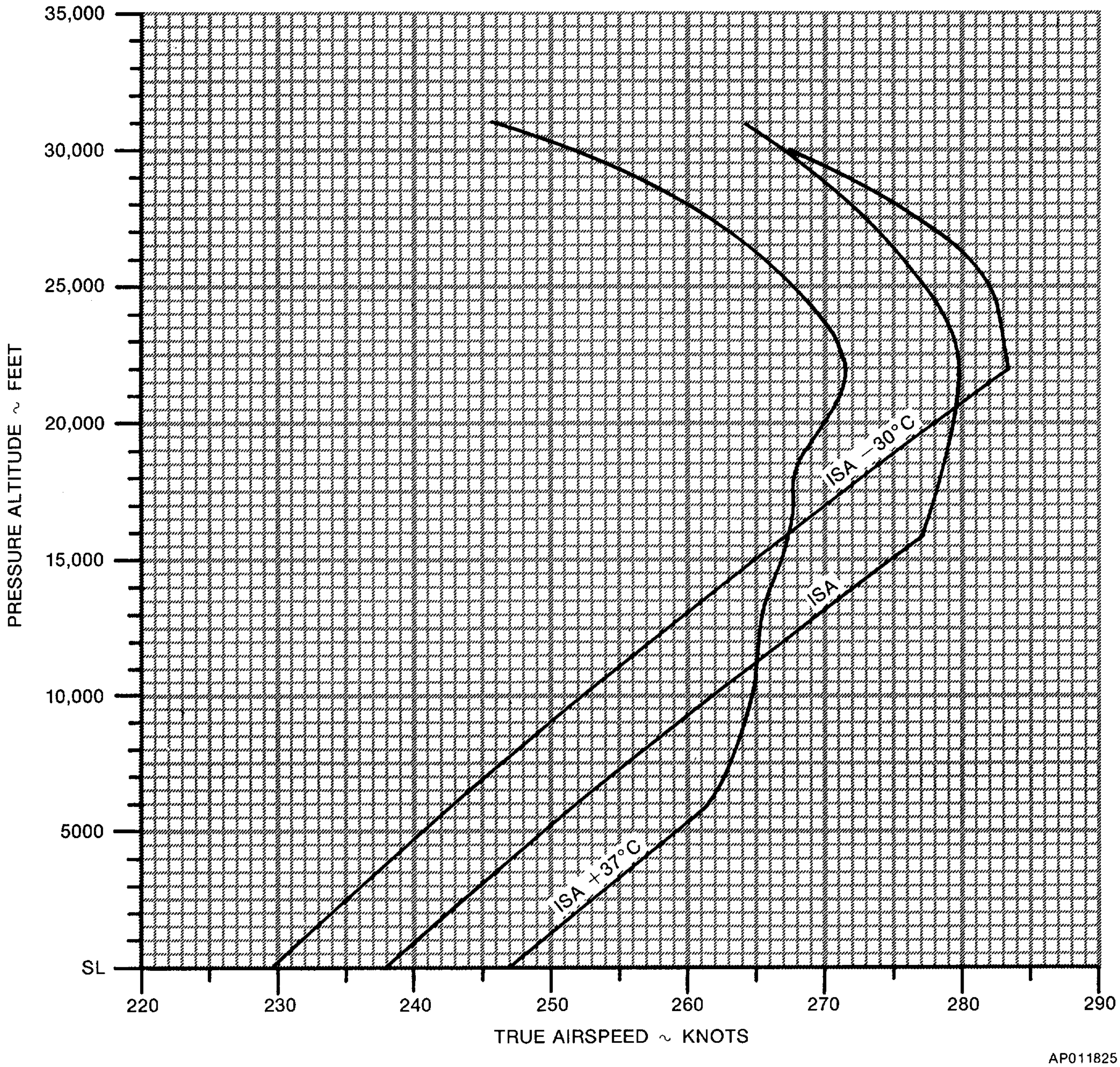


Figure 7-302. Recommended Cruise Speeds-1700 RPM

RECOMMENDED CRUISE POWER

1700 RPM

NOTE: DURING OPERATION WITH ICE VANES EXTENDED, TORQUE WILL DECREASE APPROXIMATELY 20%. IF DESIRED, ORIGINAL POWER MAY BE RESET, PROVIDED ITT LIMIT IS NOT EXCEEDED.

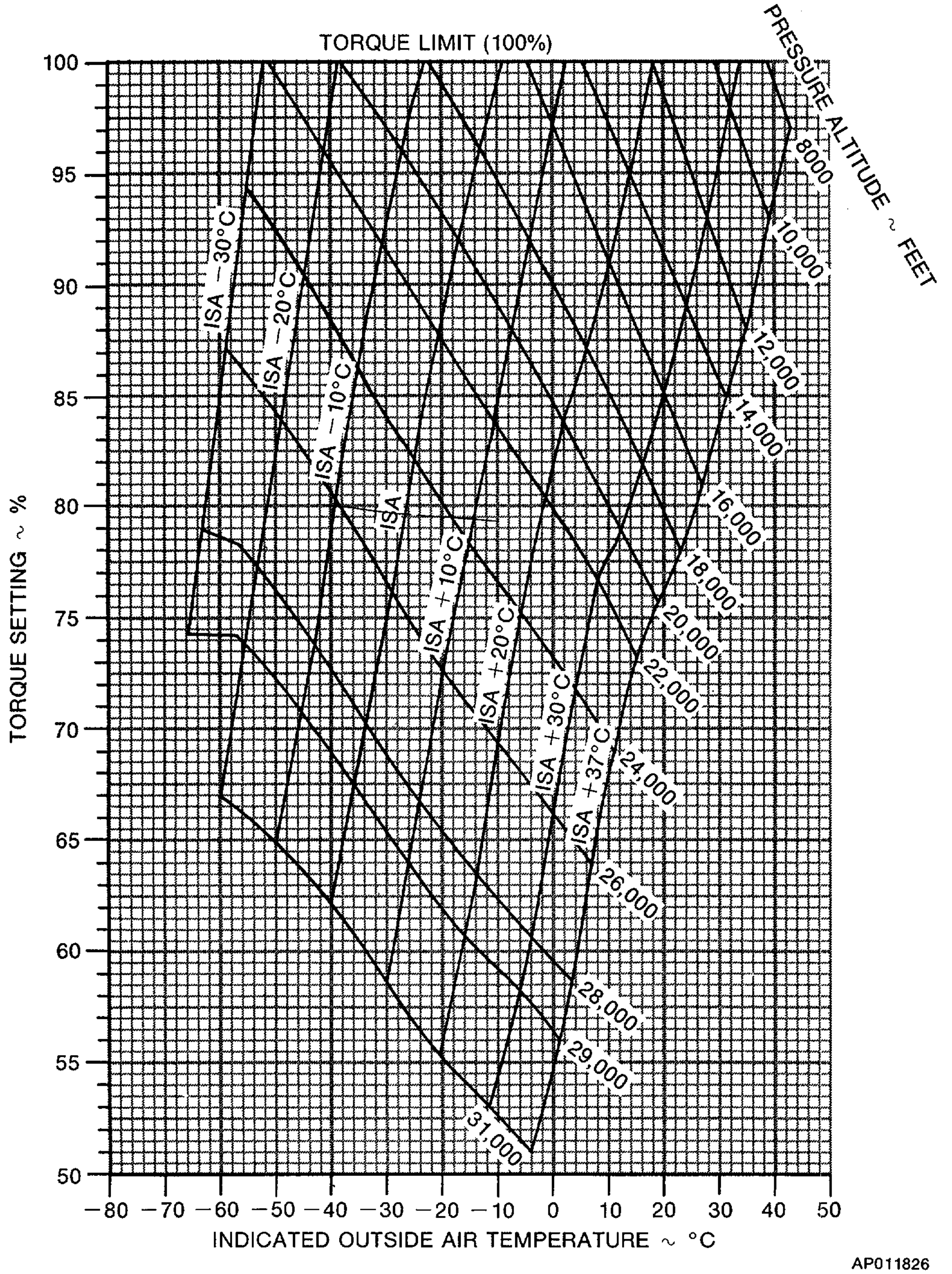


Figure 7-303. Recommended Cruise Power-1700 RPM

FUEL FLOW AT RECOMMENDED CRUISE POWER

1700 RPM

NOTE: DURING OPERATION WITH ICE VANES EXTENDED, FUEL FLOW WILL DECREASE APPROXIMATELY 10% IF ORIGINAL POWER IS NOT OR CANNOT BE RESET. IF ORIGINAL POWER IS RESET, FUEL FLOW WILL INCREASE APPROXIMATELY 30 LBS/HR/ENG.

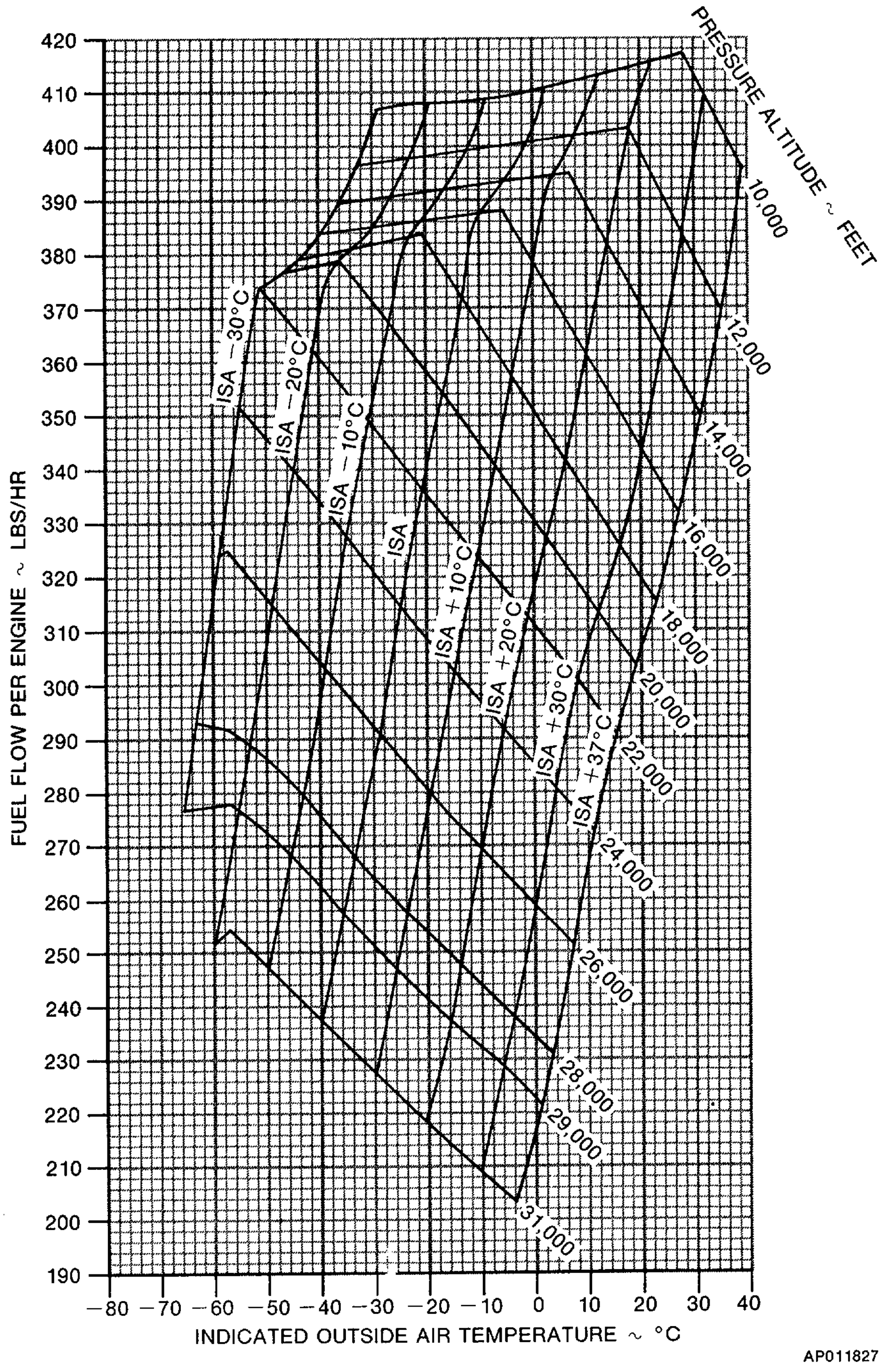


Figure 7-304. Fuel Flow at Recommended Cruise Power-1700 RPM

RECOMMENDED CRUISE POWER
1800 RPM
ISA -30°C

PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	AIRSPEED/KNOTS 12,000 LBS		11,000 LBS		10,000 LBS	
FEET	°C	°C	%	LBS/HR	LBS/HR	IAS	TAS	IAS	TAS	IAS	TAS
SL	-10	-15	100	485	970	246	234	247	235	248	235
2000	-14	-19	100	472	944	244	238	245	239	245	240
4000	-17	-23	100	460	920	241	243	242	243	243	244
6000	-21	-27	100	448	896	239	247	240	248	241	249
8000	-25	-31	100	437	874	237	252	238	253	239	254
10,000	-29	-35	100	427	854	235	257	236	258	237	259
12,000	-32	-39	100	416	832	232	262	233	263	234	264
14,000	-36	-43	100	409	818	230	267	231	268	232	269
16,000	-40	-47	100	404	808	228	272	229	273	230	275
18,000	-43	-51	100	399	798	225	278	226	279	228	280
20,000	-47	-55	100	395	790	223	283	224	285	225	286
22,000	-51	-59	96	377	754	217	284	218	286	220	288
24,000	-55	-63	90	352	704	209	283	211	285	212	287
26,000	-59	-67	83	325	650	200	280	202	283	204	286
28,000	-63	-71	75	294	588	189	274	192	278	194	281
29,000	-66	-72	71	277	554	182	269	185	273	188	277
31,000	-72	-76	50	201	402	131	200	149	228	177	270

NOTE

IOAT, TORQUE, AND FUEL FLOW BASED ON 11,000 POUNDS.

Figure 7-305. Recommended Cruise Power-1800 RPM-ISA -30°C

RECOMMENDED CRUISE POWER
1800 RPM
ISA -20°C

PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	AIRSPEED/KNOTS					
						12,000 LBS		11,000 LBS		10,000 LBS	
FEET	°C	°C	%	LBS/HR	LBS/HR	IAS	TAS	IAS	TAS	IAS	TAS
SL	0	-5	100	486	972	244	237	245	238	246	238
2000	-4	-9	100	473	946	242	241	243	242	244	243
4000	-7	-13	100	461	922	240	246	241	246	241	247
6000	-11	-17	100	449	898	237	250	238	251	239	252
8000	-15	-21	100	438	876	235	255	236	256	237	257
10,000	-19	-25	100	428	856	233	260	234	261	235	262
12,000	-22	-29	100	417	834	230	265	231	266	232	267
14,000	-26	-33	100	410	820	228	270	229	272	230	273
16,000	-30	-37	100	405	810	226	276	227	277	228	278
18,000	-33	-41	100	400	800	223	281	225	283	226	284
20,000	-37	-45	96	383	766	217	283	219	285	220	286
22,000	-41	-49	92	364	728	211	283	213	285	214	287
24,000	-45	-53	86	341	682	203	282	205	285	207	287
26,000	-49	-57	80	316	632	195	280	197	283	199	285
28,000	-53	-61	74	290	580	185	275	188	279	190	282
29,000	-55	-62	71	277	554	180	272	183	277	186	280
31,000	-60	-66	64	252	504	169	265	173	271	176	275

NOTE

IOAT, TORQUE, AND FUEL FLOW BASED ON 11,000 POUNDS.

Figure 7-306. Recommended Cruise Power-1800 RPM-ISA -20°C

RECOMMENDED CRUISE POWER
1800 RPM
ISA -10°C

PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	AIRSPEED/KNOTS					
						12,000 LBS		11,000 LBS		10,000 LBS	
FEET	°C	°C	%	LBS/HR	LBS/HR	IAS	TAS	IAS	TAS	IAS	TAS
SL	10	5	100	489	978	243	239	244	240	244	241
2000	7	1	100	475	950	240	244	241	245	242	246
4000	3	-3	100	462	924	238	248	239	249	240	250
6000	-1	-7	100	450	900	236	253	237	254	237	255
8000	-5	-11	100	438	876	233	258	234	259	235	260
10,000	-8	-15	100	427	854	231	263	232	264	233	265
12,000	-12	-19	100	419	838	229	268	230	270	231	271
14,000	-16	-23	100	412	824	226	274	227	275	228	276
16,000	-19	-27	100	406	812	224	279	225	281	226	282
18,000	-23	-31	96	388	776	218	281	219	283	221	284
20,000	-27	-35	92	368	736	211	281	213	283	214	285
22,000	-31	-39	88	350	700	205	282	207	284	208	286
24,000	-35	-43	82	328	656	197	281	200	283	201	286
26,000	-39	-47	77	305	610	189	278	191	281	194	284
28,000	-43	-51	71	281	562	180	274	183	278	185	282
29,000	-46	-52	68	269	538	175	271	178	276	181	280
31,000	-50	-56	62	248	496	164	264	169	271	172	276

NOTE

IOAT, TORQUE, AND FUEL FLOW BASED ON 11,000 POUNDS.

Figure 7-307. Recommended Cruise Power-1800 RPM-ISA -10°C

RECOMMENDED CRUISE POWER
1800 RPM
ISA °C

PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	AIRSPEED/KNOTS					
						12,000 LBS		11,000 LBS		10,000 LBS	
FEET	°C	°C	%	LBS/HR	LBS/HR	IAS	TAS	IAS	TAS	IAS	TAS
SL	20	15	100	492	984	241	242	241	243	243	244
2000	17	11	100	478	956	239	247	240	247	240	248
4000	13	7	100	464	928	236	251	237	252	238	253
6000	9	3	100	451	902	234	256	235	257	236	258
8000	6	-1	100	440	880	232	261	233	262	234	263
10,000	2	-5	100	429	858	229	266	230	267	231	269
12,000	-2	-9	100	419	838	227	272	228	273	229	274
14,000	-6	-13	100	411	822	224	277	226	278	227	280
16,000	-9	-17	97	396	792	219	279	221	281	222	283
18,000	-13	-21	91	372	744	212	279	213	281	215	282
20,000	-17	-25	88	354	708	206	279	207	282	209	284
22,000	-21	-29	84	337	674	199	280	201	283	203	285
24,000	-25	-33	78	315	630	192	278	194	282	196	284
26,000	-29	-37	73	292	584	183	275	186	279	188	282
28,000	-33	-41	67	269	538	174	271	177	275	179	279
29,000	-36	-42	64	258	516	168	267	172	273	175	277
31,000	-40	-46	59	238	476	158	260	163	268	166	273

NOTE

IOAT, TORQUE, AND FUEL FLOW BASED ON 11,000 POUNDS.

Figure 7-308. Recommended Cruise Power-1800 RPM-ISA °C

RECOMMENDED CRUISE POWER
1800 RPM
ISA +10°C

PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	AIRSPEED/KNOTS					
						12,000 LBS		11,000 LBS		10,000 LBS	
FEET	°C	°C	%	LBS/HR	LBS/HR	IAS	TAS	IAS	TAS	IAS	TAS
SL	31	25	100	494	988	239	245	240	246	241	246
2000	27	21	100	481	962	237	249	238	250	239	251
4000	23	17	100	467	934	235	254	236	255	237	256
6000	19	13	100	455	910	232	259	233	260	234	261
8000	16	9	100	442	884	230	264	231	265	232	266
10,000	12	5	100	431	862	228	269	229	270	230	272
12,000	8	1	100	420	840	225	275	226	276	227	277
14,000	4	-3	97	401	802	220	277	221	278	222	280
16,000	1	-7	92	379	758	213	277	215	279	216	281
18,000	-3	-11	88	358	716	207	277	208	280	210	281
20,000	-7	-15	84	341	682	201	278	203	281	204	283
22,000	-11	-19	80	325	650	194	278	196	281	198	283
24,000	-15	-23	75	304	608	186	276	188	279	191	282
26,000	-19	-27	69	281	562	177	272	180	277	183	280
28,000	-24	-31	64	258	516	167	267	171	272	174	277
29,000	-26	-32	61	248	496	162	263	166	270	169	275
31,000	-30	-36	56	228	456	150	253	156	263	161	270

NOTE

IOAT, TORQUE, AND FUEL FLOW BASED ON 11,000 POUNDS.

Figure 7-309. Recommended Cruise Power-1800 RPM-ISA +10°C

RECOMMENDED CRUISE POWER
1800 RPM
ISA +20°C

PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	AIRSPEED/KNOTS					
						12,000 LBS		11,000 LBS		10,000 LBS	
FEET	°C	°C	%	LBS/HR	LBS/HR	IAS	TAS	IAS	TAS	IAS	TAS
SL	41	35	100	497	994	238	247	239	248	240	249
2000	37	31	100	483	966	236	252	237	253	237	254
4000	33	27	100	470	940	233	257	234	258	235	259
6000	30	23	100	457	914	231	262	232	263	233	264
8000	26	19	100	445	890	228	267	230	268	230	269
10,000	22	15	99	431	862	225	271	227	273	228	274
12,000	18	11	94	403	806	219	271	220	273	221	275
14,000	14	7	91	382	764	213	273	214	274	215	276
16,000	10	3	87	361	722	207	273	208	276	210	277
18,000	6	-1	83	342	684	200	274	202	276	204	279
20,000	3	-5	80	328	656	195	276	197	279	199	281
22,000	-1	-9	77	313	626	189	277	191	280	193	283
24,000	-5	-13	72	293	586	181	274	184	278	186	282
26,000	-10	-17	66	270	540	172	270	175	274	178	279
28,000	-14	-21	61	248	496	161	263	165	269	169	274
29,000	-16	-22	58	238	476	155	257	160	266	164	272
31,000	-20	-26	53	219	438	142	245	150	258	155	266

NOTE

IOAT, TORQUE, AND FUEL FLOW BASED ON 11,000 POUNDS.

Figure 7-310. Recommended Cruise Power-1800 RPM-ISA +20°C

RECOMMENDED CRUISE POWER
1800 RPM
ISA +30°C

PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	AIRSPEED/KNOTS					
						12,000 LBS		11,000 LBS		10,000 LBS	
FEET	°C	°C	%	LBS/HR	LBS/HR	IAS	TAS	IAS	TAS	IAS	TAS
SL	51	45	100	500	1000	237	250	237	251	238	252
2000	47	41	100	486	972	234	254	235	255	236	256
4000	43	37	100	472	944	232	259	233	261	234	262
6000	40	33	100	458	916	229	264	230	265	231	267
8000	36	29	96	434	868	224	266	225	267	226	268
10,000	32	25	93	410	820	218	267	219	269	220	270
12,000	28	21	88	383	766	211	267	213	269	214	271
14,000	24	17	84	363	726	205	268	207	270	208	272
16,000	20	13	81	344	688	199	269	201	271	203	273
18,000	16	9	78	326	652	194	270	196	273	197	275
20,000	12	5	76	314	628	189	272	191	275	193	278
22,000	9	1	73	301	602	184	274	186	277	188	281
24,000	4	-3	68	281	562	175	271	178	275	181	279
26,000	0	-7	63	260	520	166	266	170	272	173	276
28,000	-4	-11	58	239	478	156	259	160	266	164	272
29,000	-6	-12	56	229	458	149	252	155	263	160	270
31,000	-11	-16	51	210	420	134	236	144	253	150	263

NOTE

IOAT, TORQUE, AND FUEL FLOW BASED ON 11,000 POUNDS.

Figure 7-311. Recommended Cruise Power-1800 RPM-ISA +30°C

RECOMMENDED CRUISE POWER
1800 RPM
ISA +37°C

PRESSURE ALTITUDE FEET	IOAT °C	OAT °C	TORQUE PER ENGINE %	FUEL FLOW PER ENGINE LBS/HR	TOTAL FUEL FLOW LBS/HR	AIRSPEED/KNOTS 12,000 LBS IAS	TAS	11,000 LBS IAS	TAS	10,000 LBS IAS	TAS
SL	58	52	100	501	1002	236	251	236	252	237	253
2000	54	48	99	485	970	232	255	233	256	234	257
4000	50	44	97	465	930	228	258	229	260	231	261
6000	46	40	95	443	886	224	261	225	262	226	263
8000	43	36	91	420	840	218	262	220	264	221	265
10,000	39	32	88	396	792	213	264	214	266	215	267
12,000	35	28	84	370	740	206	264	208	266	209	268
14,000	31	24	80	350	700	200	265	202	267	203	269
16,000	27	20	77	332	664	194	265	196	268	198	270
18,000	23	16	74	315	630	189	266	191	269	193	272
20,000	19	12	72	304	608	184	269	186	272	188	275
22,000	15	8	70	292	584	179	271	182	274	184	278
24,000	11	4	66	273	546	171	268	174	273	177	277
26,000	7	0	61	252	504	162	263	166	269	169	274
28,000	3	-4	56	232	464	151	254	156	263	160	270
29,000	1	-5	54	222	444	143	247	151	259	156	267
31,000	-4	-9	49	204	408	125	223	139	247	146	260

NOTE

IOAT, TORQUE, AND FUEL FLOW BASED ON 11,000 POUNDS.

Figure 7-312. Recommended Cruise Power-1800 RPM-ISA +37°C

RECOMMENDED CRUISE SPEEDS

1800 RPM

WEIGHT 11,000 LBS

NOTE: DURING OPERATION WITH ICE VANES EXTENDED, TRUE AIRSPEED WILL BE REDUCED APPROXIMATELY 30 KNOTS IF ORIGINAL POWER IS NOT OR CANNOT BE RESET, BUT WILL BE UNCHANGED IF THE ORIGINAL POWER IS RESET.

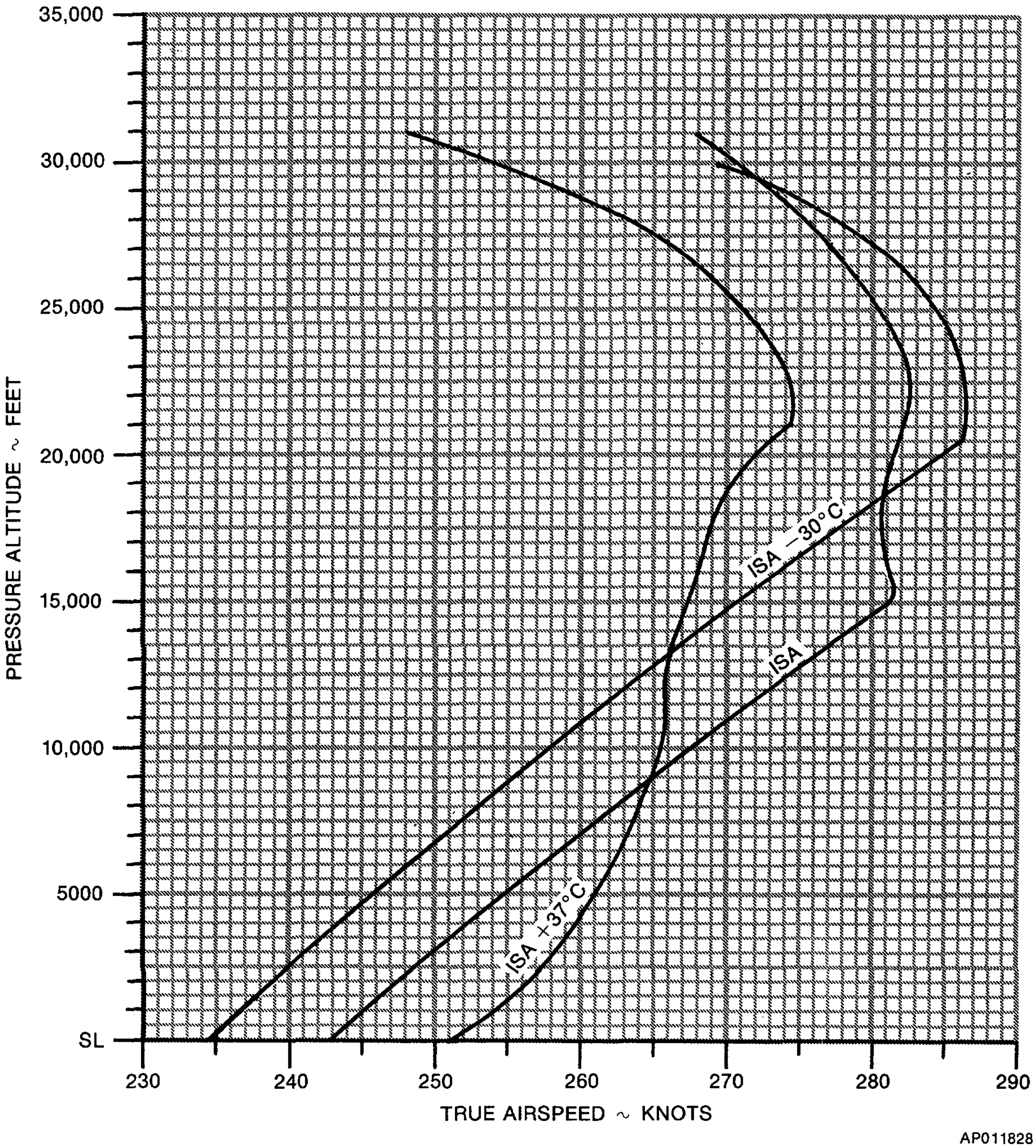


Figure 7-313. Recommended Cruise Speeds-1800 RPM

RECOMMENDED CRUISE POWER

1800 RPM

NOTE: DURING OPERATION WITH ICE VANES EXTENDED, TORQUE WILL DECREASE APPROXIMATELY 20%. IF DESIRED, ORIGINAL POWER MAY BE RESET, PROVIDED ITT LIMIT IS NOT EXCEEDED.

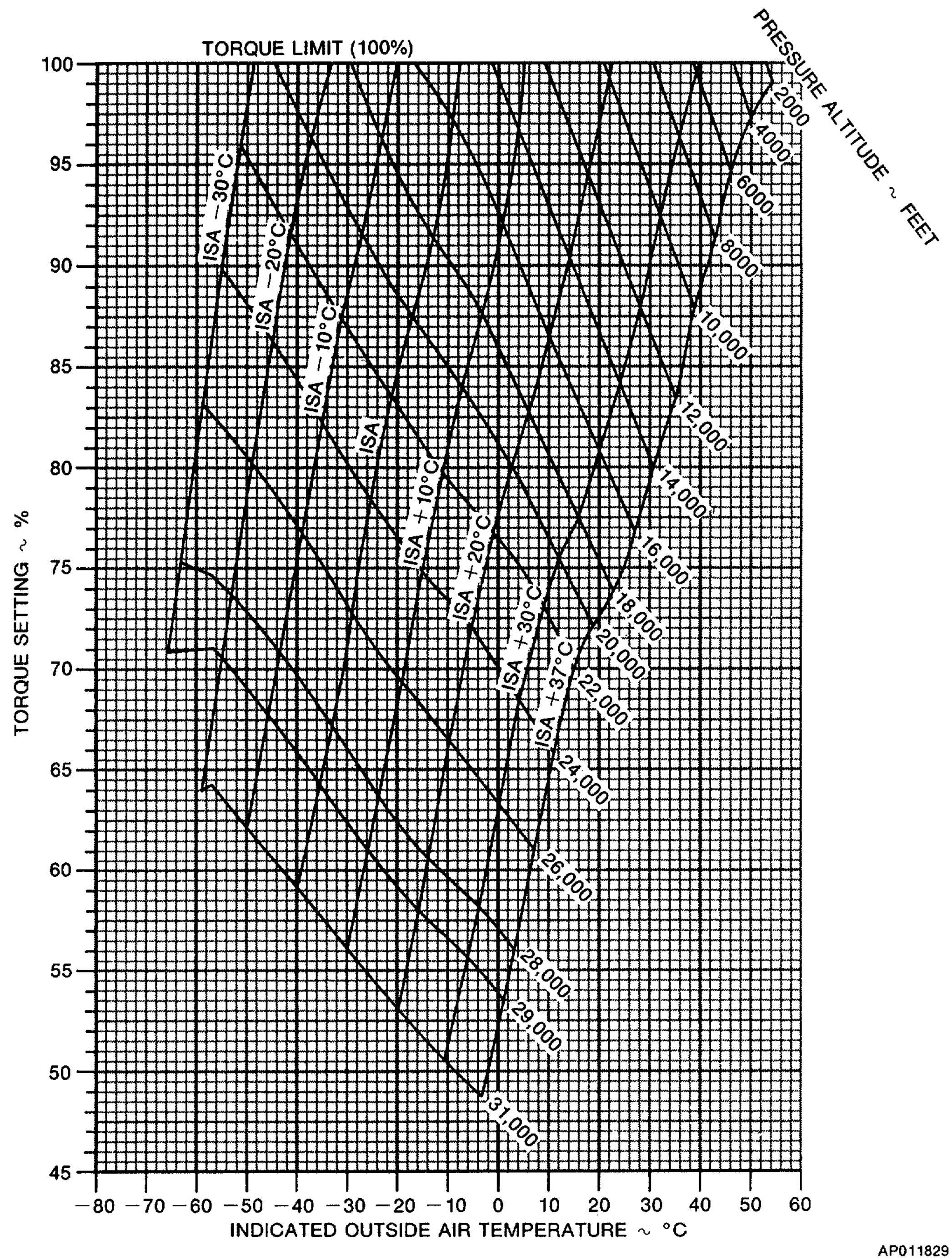


Figure 7-314. Recommended Cruise Power-1800 RPM

FUEL FLOW AT RECOMMENDED CRUISE POWER

1800 RPM

NOTE: DURING OPERATION WITH ICE VANES EXTENDED, FUEL FLOW WILL DECREASE APPROXIMATELY 10% IF ORIGINAL POWER IS NOT OR CANNOT BE RESET. IF ORIGINAL POWER IS RESET, FUEL FLOW WILL INCREASE APPROXIMATELY 30 LBS/HR/ENG.

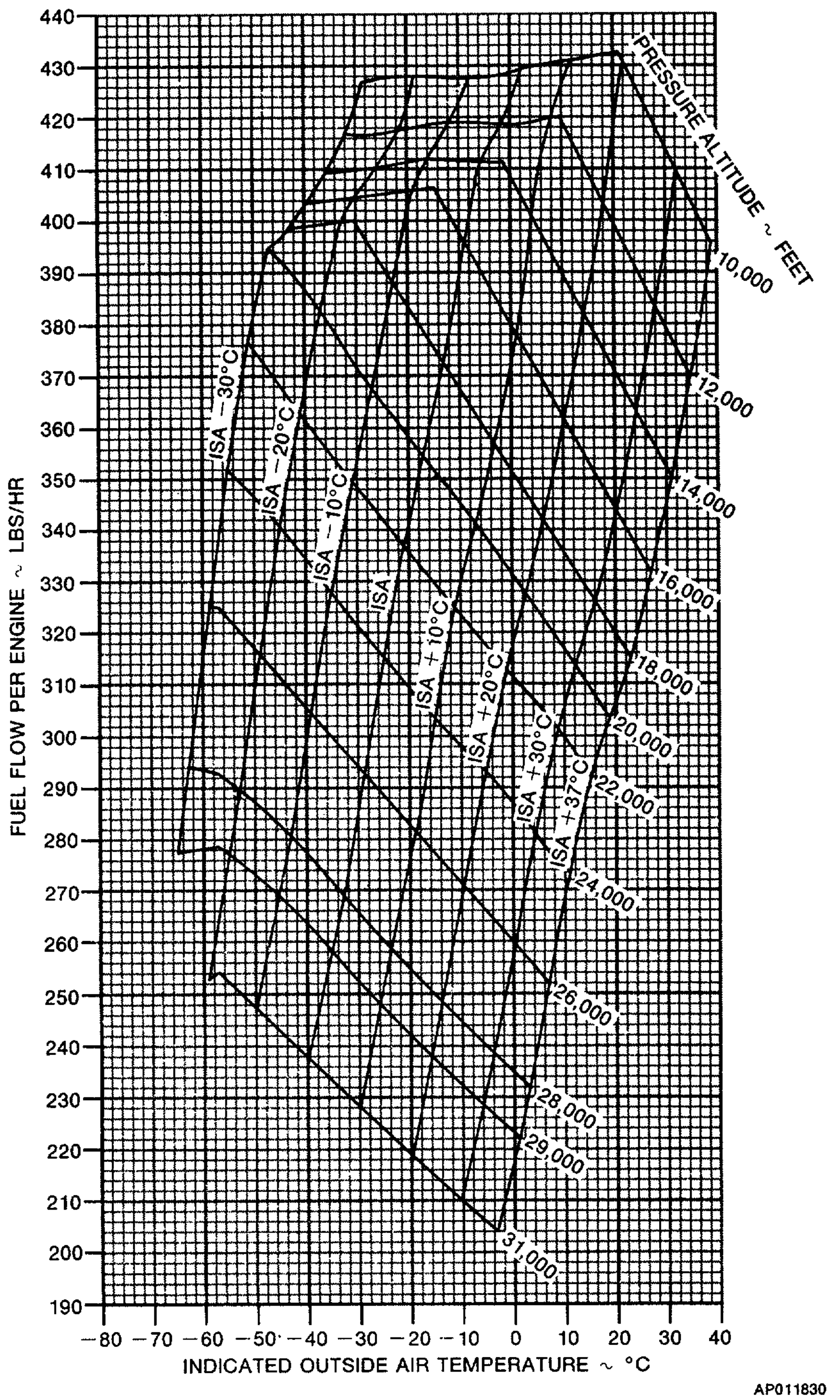


Figure 7-315. Fuel Flow at Recommended Cruise Power-1800 RPM

MAXIMUM CRUISE POWER
1800 RPM
ISA -30°C

PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	AIRSPEED/KNOTS					
						12,000 LBS		11,000 LBS		10,000 LBS	
FEET	°C	°C	%	LBS/HR	LBS/HR	IAS	TAS	IAS	TAS	IAS	TAS
SL	-10	-15	100	485	970	246	234	247	235	248	235
2000	-14	-19	100	472	944	244	238	245	239	245	240
4000	-17	-23	100	460	920	241	243	242	243	243	244
6000	-21	-27	100	448	896	239	247	240	248	241	249
8000	-25	-31	100	437	874	237	252	238	253	239	254
10,000	-29	-35	100	427	854	235	257	236	258	237	259
12,000	-32	-39	100	416	832	232	262	233	263	234	264
14,000	-36	-43	100	409	818	230	267	231	268	232	269
16,000	-40	-47	100	404	808	228	272	229	273	230	275
18,000	-43	-51	100	399	798	225	278	226	279	228	280
20,000	-47	-55	100	395	790	223	283	224	285	225	286
22,000	-51	-59	99	389	778	220	288	221	290	223	292
24,000	-55	-63	93	363	726	212	287	213	289	215	291
26,000	-59	-67	85	333	666	202	283	204	286	206	288
28,000	-63	-71	77	299	598	191	276	193	280	195	283
29,000	-66	-72	72	282	564	184	271	187	276	190	279
31,000	-70	-76	64	252	504	132	202	175	267	178	272

NOTE

IOAT, TORQUE, AND FUEL FLOW BASED ON 11,000 POUNDS.

Figure 7-316. Maximum Cruise Power-1800 RPM-ISA -30°C

MAXIMUM CRUISE POWER
1800 RPM
ISA -20°C

PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	AIRSPEED/KNOTS					
						12,000 LBS		11,000 LBS		10,000 LBS	
FEET	°C	°C	%	LBS/HR	LBS/HR	IAS	TAS	IAS	TAS	IAS	TAS
SL	0	-5	100	486	972	244	237	245	238	246	238
2000	-4	-9	100	473	946	242	241	243	242	244	243
4000	-7	-13	100	461	922	240	246	241	246	241	247
6000	-11	-17	100	449	898	237	250	238	251	239	252
8000	-15	-21	100	438	876	235	255	236	256	237	257
10,000	-19	-25	100	428	856	233	260	234	261	235	262
12,000	-22	-29	100	417	834	230	265	231	266	232	267
14,000	-26	-33	100	410	820	228	270	229	272	230	273
16,000	-30	-37	100	405	810	226	276	227	277	228	278
18,000	-33	-41	100	400	800	223	281	225	283	226	284
20,000	-37	-45	100	396	792	221	287	222	289	223	290
22,000	-41	-49	96	378	756	214	288	216	290	217	292
24,000	-45	-53	90	353	706	206	286	208	289	210	291
26,000	-49	-57	83	326	652	198	284	200	287	202	289
28,000	-53	-61	77	299	598	188	280	191	283	193	286
29,000	-55	-62	73	287	574	184	277	186	281	188	284
31,000	-60	-66	66	260	520	172	269	176	275	179	279

NOTE

IOAT, TORQUE, AND FUEL FLOW BASED ON 11,000 POUNDS.

Figure 7-317. Maximum Cruise Power-1800 RPM-ISA -20°C

MAXIMUM CRUISE POWER
1800 RPM
ISA -10°C

PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	AIRSPEED/KNOTS					
						12,000 LBS		11,000 LBS		10,000 LBS	
FEET	°C	°C	%	LBS/HR	LBS/HR	IAS	TAS	IAS	TAS	IAS	TAS
SL	10	5	100	489	978	243	239	244	240	244	241
2000	7	1	100	475	950	240	244	241	245	242	246
4000	3	-3	100	462	924	238	248	239	249	240	250
6000	-1	-7	100	450	900	236	253	237	254	237	255
8000	-5	-11	100	438	876	233	258	234	259	235	260
10,000	-8	-15	100	427	854	231	263	232	264	233	265
12,000	-12	-19	100	419	838	229	268	230	270	231	271
14,000	-16	-23	100	412	824	226	274	227	275	228	276
16,000	-19	-27	100	406	812	224	279	225	281	226	282
18,000	-23	-31	100	401	802	221	285	223	287	224	288
20,000	-27	-35	96	382	764	215	286	217	288	218	289
22,000	-31	-39	91	363	726	208	286	210	288	212	290
24,000	-35	-43	86	341	682	201	285	203	288	204	290
26,000	-39	-47	80	317	634	192	283	195	286	197	289
28,000	-43	-51	74	292	584	183	279	186	283	188	286
29,000	-45	-52	71	279	558	178	276	181	280	184	284
31,000	-49	-56	65	256	512	168	270	172	276	175	280

NOTE

IOAT, TORQUE, AND FUEL FLOW BASED ON 11,000 POUNDS.

Figure 7-318. Maximum Cruise Power-1800 RPM-ISA -10°C

MAXIMUM CRUISE POWER
1800 RPM
ISA °C

PRESSURE ALTITUDE FEET	IOAT °C	OAT °C	TORQUE PER ENGINE %	FUEL FLOW PER ENGINE LBS/HR	TOTAL FUEL FLOW LBS/HR	AIRSPEED/KNOTS 12,000 LBS IAS	12,000 LBS TAS	11,000 LBS IAS	11,000 LBS TAS	10,000 LBS IAS	10,000 LBS TAS
SL	20	15	100	492	984	241	242	242	243	243	244
2000	17	11	100	478	956	239	247	240	247	240	248
4000	13	7	100	464	928	236	251	237	252	238	253
6000	9	3	100	451	902	234	256	235	257	236	258
8000	6	-1	100	440	880	232	261	233	262	234	263
10,000	2	-5	100	429	858	229	266	230	267	231	269
12,000	-2	-9	100	419	838	227	272	228	273	229	274
14,000	-6	-13	100	411	822	224	277	226	278	227	280
16,000	-9	-17	100	406	812	222	283	223	284	224	285
18,000	-13	-21	96	387	774	216	283	217	285	218	287
20,000	-17	-25	91	368	736	209	284	211	286	212	288
22,000	-21	-29	87	349	698	203	284	204	287	206	289
24,000	-25	-33	82	328	656	195	283	197	286	199	288
26,000	-29	-37	76	304	608	186	280	189	284	191	287
28,000	-33	-41	70	281	562	177	276	180	281	183	284
29,000	-35	-42	68	270	540	172	273	176	278	178	283
31,000	-40	-46	62	249	498	162	267	167	274	170	279

NOTE

IOAT, TORQUE, AND FUEL FLOW BASED ON 11,000 POUNDS.

Figure 7-316. Maximum Cruise Power-1800 RPM-ISA °C

MAXIMUM CRUISE POWER
1800 RPM
ISA +10°C

PRESSURE ALTITUDE FEET	IOAT °C	OAT °C	TORQUE PER ENGINE %	FUEL FLOW PER ENGINE LBS/HR	TOTAL FUEL FLOW LBS/HR	AIRSPEED/KNOTS 12,000 LBS IAS	TAS	11,000 LBS IAS	TAS	10,000 LBS IAS	TAS
SL	31	25	100	494	988	239	245	240	246	241	246
2000	27	21	100	481	962	237	249	238	250	239	251
4000	23	17	100	467	934	235	254	236	255	237	256
6000	19	13	100	455	910	232	259	233	260	234	261
8000	16	9	100	442	884	230	264	231	265	232	266
10,000	12	5	100	431	862	228	269	229	270	230	272
12,000	8	1	100	420	840	225	275	226	276	227	277
14,000	5	-3	100	412	824	223	280	224	282	225	283
16,000	1	-7	96	391	782	216	281	218	283	219	284
18,000	-3	-11	91	371	742	210	282	212	284	213	286
20,000	-7	-15	88	354	708	204	283	206	285	207	287
22,000	-11	-19	83	337	674	197	282	199	285	201	288
24,000	-15	-23	78	315	630	189	281	192	284	194	287
26,000	-19	-27	73	292	584	181	277	183	281	186	285
28,000	-23	-31	67	270	540	171	273	175	278	177	282
29,000	-26	-32	64	259	518	166	270	170	275	173	280
31,000	-30	-36	59	239	478	156	262	161	270	164	276

NOTE

IOAT, TORQUE, AND FUEL FLOW BASED ON 11,000 POUNDS.

Figure 7-320. Maximum Cruise Power- 1800 RPM - ISA +10 ^{0}C

MAXIMUM CRUISE POWER
1800 RPM
ISA +20°C

PRESSURE ALTITUDE FEET	IOAT °C	OAT °C	TORQUE PER ENGINE %	FUEL FLOW PER ENGINE LBS/HR	TOTAL FUEL FLOW LBS/HR	AIRSPEED/KNOTS 12,000 LBS IAS	TAS	11,000 LBS IAS	TAS	10,000 LBS IAS	TAS
SL	41	35	100	497	994	238	247	239	248	240	249
2000	37	31	100	483	966	236	252	237	253	237	254
4000	33	27	100	470	940	233	257	234	258	235	259
6000	30	23	100	457	914	231	262	232	263	233	264
8000	26	19	100	445	890	228	267	230	268	230	269
10,000	22	15	100	433	866	226	272	227	273	228	275
12,000	18	11	96	410	820	220	274	222	275	223	277
14,000	14	7	93	391	782	215	276	216	277	218	279
16,000	11	3	90	372	744	210	277	211	279	213	281
18,000	7	-1	87	355	710	204	279	206	281	207	283
20,000	3	-5	83	340	680	198	280	200	283	202	285
22,000	-1	-9	80	324	648	192	281	194	284	196	287
24,000	-5	-13	75	304	608	184	279	187	283	189	286
26,000	-9	-17	69	281	562	175	275	178	279	181	283
28,000	-13	-21	64	259	518	165	269	169	275	172	279
29,000	-16	-22	61	248	496	160	265	164	272	168	277
31,000	-20	-26	56	229	458	148	255	154	266	159	273

NOTE
IOAT, TORQUE, AND FUEL FLOW BASED ON 11,000 POUNDS.

Figure 7-321. Maximum Cruise Power- 1800 RPM - ISA +20 °C

MAXIMUM CRUISE POWER
1800 RPM
ISA +30°C

PRESSURE ALTITUDE FEET	IOAT °C	OAT °C	TORQUE PER ENGINE %	FUEL FLOW PER ENGINE LBS/HR	TOTAL FUEL FLOW LBS/HR	AIRSPEED/KNOTS 12,000 LBS IAS	12,000 LBS TAS	11,000 LBS IAS	11,000 LBS TAS	10,000 LBS IAS	10,000 LBS TAS
SL	51	45	100	500	1000	237	250	237	251	238	252
2000	47	41	100	486	972	234	254	235	255	236	256
4000	43	37	100	472	944	232	259	233	261	234	262
6000	40	33	100	458	916	229	264	230	266	231	267
8000	36	29	98	440	880	225	267	226	269	227	270
10,000	32	25	94	415	830	219	269	221	270	222	272
12,000	28	21	89	388	776	212	269	214	270	215	272
14,000	24	17	86	370	740	207	271	209	273	210	275
16,000	20	13	84	353	706	202	273	204	275	205	277
18,000	16	9	81	338	676	197	275	199	277	201	279
20,000	13	5	79	325	650	192	277	194	280	196	283
22,000	9	1	76	311	622	187	278	189	281	191	284
24,000	5	-3	71	291	582	179	276	181	280	184	283
26,000	1	-7	66	270	540	170	272	173	277	176	281
28,000	-4	-11	61	249	498	160	266	164	273	168	278
29,000	-6	-12	59	239	478	154	261	159	269	163	276
31,000	-10	-16	54	220	440	141	248	149	262	154	270

NOTE

IOAT, TORQUE, AND FUEL FLOW BASED ON 11,000 POUNDS.

Figure 7-322. Maximum Cruise Power- 1800 RPM - ISA +30 °C

MAXIMUM CRUISE POWER
1800 RPM
ISA +37°C

PRESSURE ALTITUDE FEET	IOAT °C	OAT °C	TORQUE PER ENGINE %	FUEL FLOW PER ENGINE LBS/HR	TOTAL FUEL FLOW LBS/HR	AIRSPEED/KNOTS 12,000 LBS IAS	TAS	11,000 LBS IAS	TAS	10,000 LBS IAS	TAS
SL	58	52	100	501	1002	236	251	236	252	237	253
2000	54	48	100	487	974	233	256	234	257	235	258
4000	50	44	99	470	940	230	260	231	261	232	262
6000	47	40	96	448	896	225	262	226	264	227	265
8000	43	36	93	424	848	219	264	221	265	222	267
10,000	39	32	89	400	800	214	265	215	267	216	268
12,000	35	28	85	373	746	207	265	209	267	210	269
14,000	31	24	82	357	714	202	267	204	269	205	271
16,000	27	20	80	341	682	197	269	199	272	201	274
18,000	23	16	77	326	652	192	271	194	274	196	276
20,000	19	12	75	314	628	187	274	190	277	192	280
22,000	16	8	73	302	604	182	275	185	279	187	282
24,000	12	4	69	282	564	174	273	177	277	180	281
26,000	7	0	64	262	524	166	269	169	274	172	279
28,000	3	-4	59	241	482	156	262	160	269	164	275
29,000	1	-5	56	232	464	149	256	155	266	159	273
31,000	-4	-9	51	213	426	134	239	144	257	150	267

NOTE

IOAT, TORQUE, AND FUEL FLOW BASED ON 11,000 POUNDS.

Figure 7-323. Maximum Cruise Power- 1800 RPM - ISA +37 °C

MAXIMUM CRUISE SPEEDS

1800 RPM

WEIGHT 11,000 LBS

NOTE: DURING OPERATION WITH ICE VANES EXTENDED, TRUE AIRSPEED WILL BE REDUCED APPROXIMATELY 30 KNOTS IF ORIGINAL POWER IS NOT OR CANNOT BE RESET, BUT WILL BE UNCHANGED IF THE ORIGINAL POWER IS RESET.

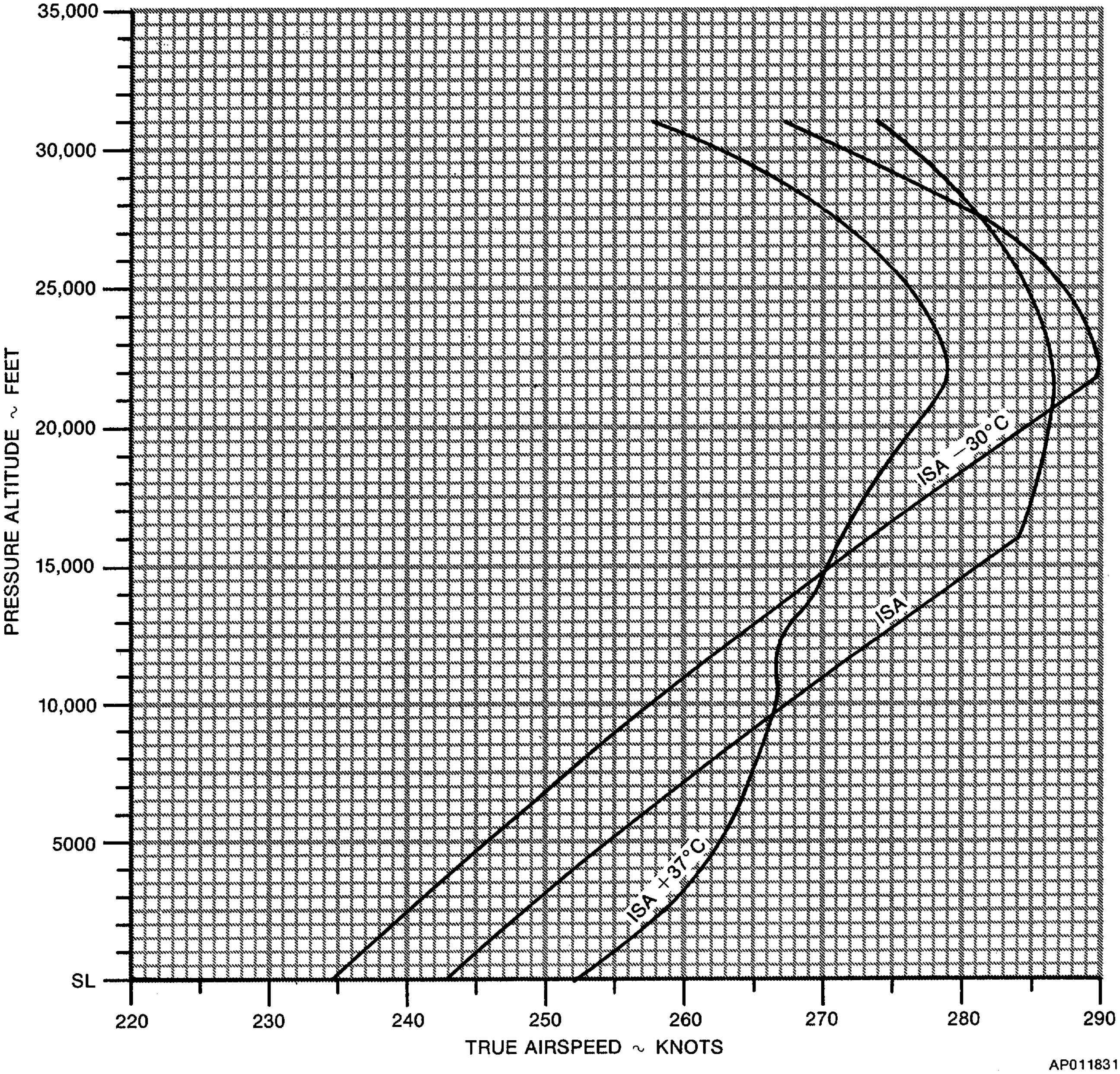


Figure 7-324. Maximum Cruise Speeds - 1800 RPM

MAXIMUM CRUISE POWER

1800 RPM

NOTE: DURING OPERATION WITH ICE VANES EXTENDED, TORQUE WILL DECREASE APPROXIMATELY 20%. IF DESIRED, ORIGINAL POWER MAY BE RESET, PROVIDED ITT LIMIT IS NOT EXCEEDED.

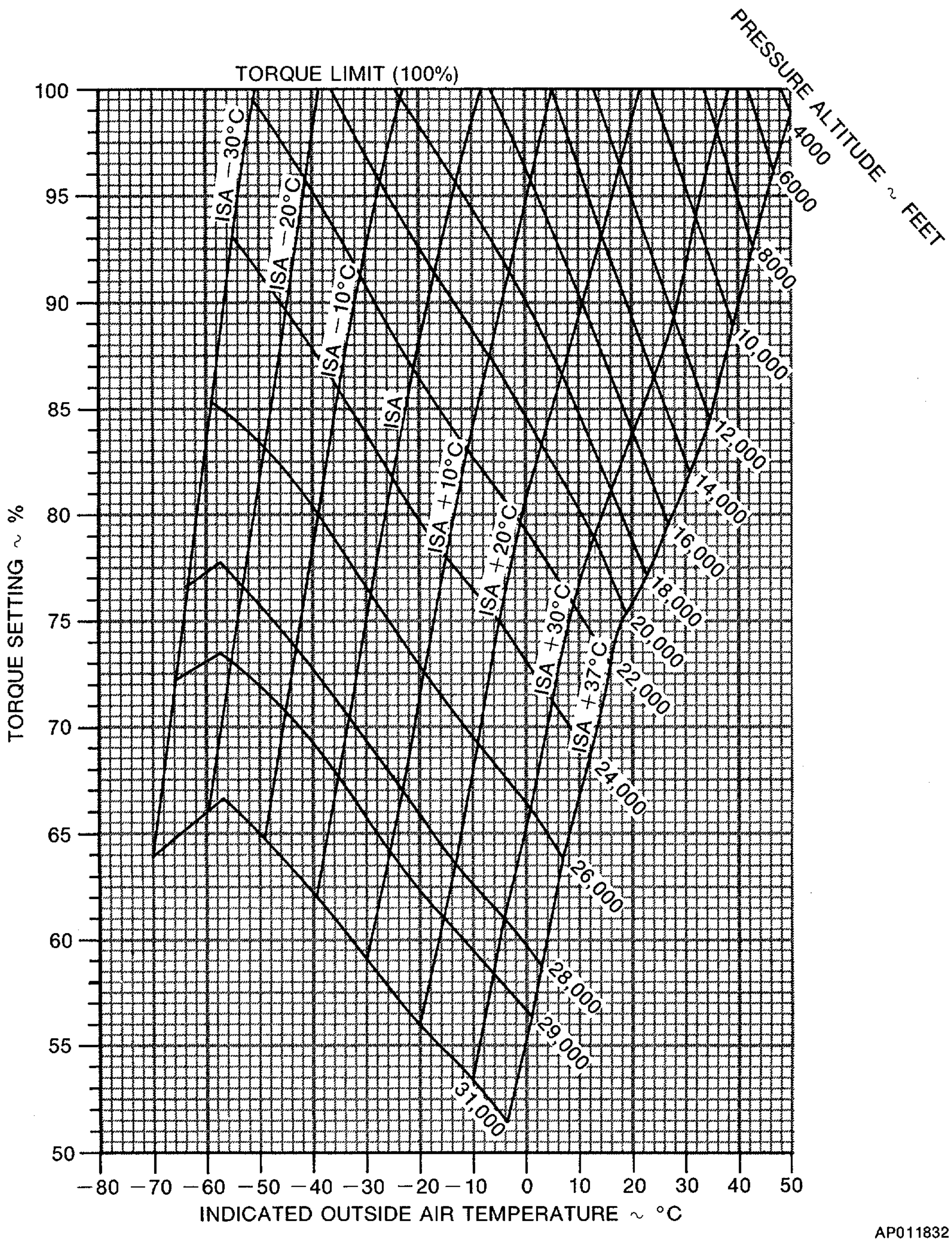


Figure 7-325. Maximum Cruise Power- 1800 RPM

FUEL FLOW AT MAXIMUM CRUISE POWER

1800 RPM

NOTE: DURING OPERATION WITH ICE VANES EXTENDED, FUEL FLOW WILL DECREASE APPROXIMATELY 10% IF ORIGINAL POWER IS NOT OR CANNOT BE RESET. IF ORIGINAL POWER IS RESET, FUEL FLOW WILL INCREASE APPROXIMATELY 30 LBS/HR/ENG.

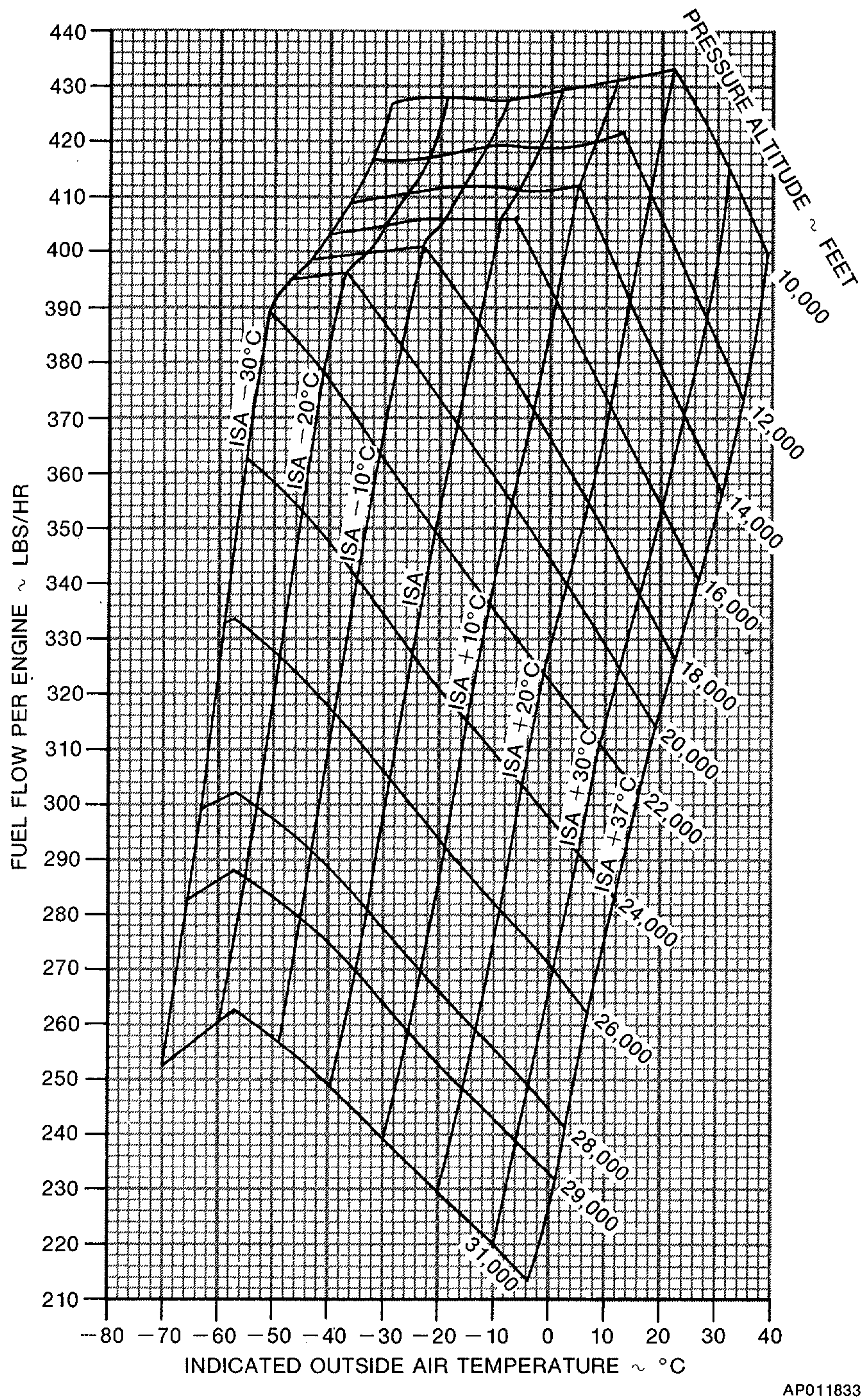


Figure 7-326. Fuel Flow at Maximum Cruise Power - 1800 RPM

MAXIMUM RANGE POWER
1700 RPM
ISA -30°C

NOTE: FOR APPLICABLE NOTES SEE BELOW.

WEIGHT			12,000 POUNDS				11,000 POUNDS				10,000 POUNDS			
PRESSURE ALTITUDE FEET	IOAT °C	OAT °C	TORQUE PER ENG %	FUEL FLOW PER ENG LBS/HR	FUEL FLOW TOTAL LBS/HR	TAS KNOTS	TORQUE PER ENG %	FUEL FLOW PER ENG LBS/HR	FUEL FLOW TOTAL LBS/HR	TAS KNOTS	TORQUE PER ENG %	FUEL FLOW PER ENG LBS/HR	FUEL FLOW TOTAL LBS/HR	TAS KNOTS
SL	11	15	69	384	768	197	66	376	752	195	63	368	736	193
2000	-16	-19	64	355	710	195	61	346	692	192	57	338	676	190
4000	-20	-23	59	327	654	192	55	316	632	189	51	306	612	186
6000	-24	-27	55	302	604	191	51	290	580	187	47	278	556	183
8000	-28	-31	52	280	560	189	48	267	534	185	43	255	510	180
10,000	-32	-35	49	260	520	188	45	246	492	184	40	233	466	179
12,000	-36	-39	48	244	488	189	43	229	458	184	38	215	430	178
14,000	-40	-43	46	230	460	189	41	214	428	182	36	199	398	176
16,000	-44	-47	45	218	436	190	39	201	402	183	34	184	368	175
18,000	-48	-51	44	206	412	190	38	188	376	182	31	169	338	172
20,000	-52	-55	43	195	390	190	36	174	348	180	29	154	308	169
22,000	-56	-59	43	189	378	193	36	167	334	182	29	147	294	171
24,000	-59	-63	44	190	380	199	38	170	340	189	31	147	294	177
26,000	-63	-67	46	191	382	205	40	171	342	196	33	150	300	185
28,000	-67	-71	48	193	386	213	42	173	346	203	35	153	306	193
29,000	-69	-72	49	196	392	217	43	174	348	207	36	154	308	196
31,000	-73	-76	—	—	—	—	—	—	—	—	37	148	296	200

NOTE: DURING OPERATION WITH ICE VANE EXTENDED, TORQUE WILL DECREASE. IN ORDER TO MAINTAIN MAXIMUM RANGE CONFIGURARTION, DO NOT RESET POWER TO ORIGINAL SETTING.FUEL FLOW WILL REMAIN ABOUT THE SAME, BUT TRUE AIRSPEED WILL BE REDUCED APPROXIMATELY 10 KNOTS.

Figure 7-327. Maximum Range Power - 1700 RPM - ISA -30 °C

MAXIMUM RANGE POWER
1700 RPM
ISA -20°C

NOTE: FOR APPLICABLE NOTES SEE BELOW.

WEIGHT			12,000 POUNDS				11,000 POUNDS				10,000 POUNDS			
PRESSURE ALTITUDE FEET	IOAT °C	OAT °C	TORQUE PER ENG %	FUEL FLOW PER ENG LBS/HR	FUEL FLOW TOTAL LBS/HR	TAS KNOTS	TORQUE PER ENG %	FUEL FLOW PER ENG LBS/HR	FUEL FLOW TOTAL LBS/HR	TAS KNOTS	TORQUE PER ENG %	FUEL FLOW PER ENG LBS/HR	FUEL FLOW TOTAL LBS/HR	TAS KNOTS
SL	-1	-5	74	398	796	205	70	388	776	202	67	380	760	200
2000	-5	-9	68	368	736	202	64	358	716	198	61	349	698	196
4000	-9	-13	63	340	680	199	59	330	660	196	56	321	642	194
6000	-13	-17	59	316	632	198	56	306	612	195	52	296	592	192
8000	-17	-21	56	294	588	197	52	283	566	194	49	273	546	191
10,000	-21	-25	53	273	546	196	49	261	522	192	45	250	500	189
12,000	-25	-29	52	257	514	197	48	245	490	193	43	233	466	188
14,000	-29	-33	50	243	486	197	46	230	460	193	41	217	434	187
16,000	-33	-37	49	230	460	198	44	216	432	192	38	201	402	186
18,000	-37	-41	48	220	440	199	42	204	408	193	37	187	374	185
20,000	-41	-45	47	210	420	200	41	192	384	193	35	174	348	183
22,000	-45	-49	47	204	408	203	41	185	370	195	34	166	332	185
24,000	-49	-53	48	202	404	208	42	183	366	200	36	164	328	191
26,000	-53	-57	49	201	402	214	43	181	362	205	37	162	324	196
28,000	-56	-61	51	203	406	222	44	182	364	212	38	163	326	202
29,000	-58	-62	52	205	410	226	45	184	368	216	39	163	326	205
31,000	-62	-66	53	207	414	233	47	187	374	224	40	166	332	213

NOTE: DURING OPERATION WITH ICE VANE EXTENDED, TORQUE WILL DECREASE. IN ORDER TO MAINTAIN MAXIMUM RANGE CONFIGURARTION, DO NOT RESET POWER TO ORIGINAL SETTING. FUEL FLOW WILL REMAIN ABOUT THE SAME, BUT TRUE AIRSPEED WILL BE REDUCED APPROXIMATELY 10 KNOTS.

Figure 7-328. Maximum Range Power - 1700 RPM - ISA -20 °C

MAXIMUM RANGE POWER
1700 RPM
ISA -10°C

NOTE: FOR APPLICABLE NOTES SEE BELOW.

WEIGHT			12,000 POUNDS				11,000 POUNDS				10,000 POUNDS			
PRESSURE ALTITUDE FEET	IOAT °C	OAT °C	TORQUE PER ENG %	FUEL FLOW PER ENG LBS/HR	FUEL FLOW TOTAL LBS/HR	TAS KNOTS	TORQUE PER ENG %	FUEL FLOW PER ENG LBS/HR	FUEL FLOW TOTAL LBS/HR	TAS KNOTS	TORQUE PER ENG %	FUEL FLOW PER ENG LBS/HR	FUEL FLOW TOTAL LBS/HR	TAS KNOTS
SL	9	5	76	405	810	210	72	395	790	207	69	387	774	205
2000	5	1	72	380	760	209	68	370	740	206	64	360	720	203
4000	1	-3	67	352	704	207	62	341	682	203	59	330	660	199
6000	-3	-7	63	328	656	205	58	316	632	201	55	306	612	198
8000	-7	-11	60	305	610	204	55	293	586	200	52	283	566	197
10,000	-11	-15	57	283	566	203	52	271	542	199	49	261	522	196
12,000	-15	-19	55	268	536	204	51	255	510	200	47	244	488	196
14,000	-19	-23	53	253	506	205	49	240	480	200	44	229	458	196
16,000	-23	-27	52	241	482	206	47	227	454	200	43	214	428	195
18,000	-27	-31	51	230	460	207	45	214	428	200	40	200	400	194
20,000	-31	-35	50	220	440	209	44	205	410	201	39	189	378	194
22,000	-35	-39	50	215	430	212	44	197	394	204	38	180	360	196
24,000	-39	-43	51	213	436	218	45	194	388	209	39	176	352	200
26,000	-42	-47	52	211	422	224	46	192	384	215	40	173	346	205
28,000	-46	-51	53	210	420	230	47	191	382	221	41	172	344	211
29,000	-48	-52	53	210	420	232	48	192	384	224	41	172	344	214
31,000	-52	-56	54	212	424	238	49	193	386	231	43	173	346	221

NOTE: DURING OPERATION WITH ICE VANE EXTENDED, TORQUE WILL DECREASE. IN ORDER TO MAINTAIN MAXIMUM RANGE CONFIGURARTION, DO NOT RESET POWER TO ORIGINAL SETTING. FUEL FLOW WILL REMAIN ABOUT THE SAME, BUT TRUE AIRSPEED WILL BE REDUCED APPROXIMATELY 10 KNOTS.

Figure 7-329. Maximum Range Power - 1700 RPM - ISA -10 °C

MAXIMUM RANGE POWER
1700 RPM
ISA °C

NOTE: FOR APPLICABLE NOTES SEE BELOW.

WEIGHT			12,000 POUNDS				11,000 POUNDS				10,000 POUNDS			
PRESSURE ALTITUDE FEET	IOAT °C	OAT °C	TORQUE PER ENG %	FUEL FLOW PER ENG LBS/HR	FUEL FLOW TOTAL LBS/HR	TAS KNOTS	TORQUE PER ENG %	FUEL FLOW PER ENG LBS/HR	FUEL FLOW TOTAL LBS/HR	TAS KNOTS	TORQUE PER ENG %	FUEL FLOW PER ENG LBS/HR	FUEL FLOW TOTAL LBS/HR	TAS KNOTS
SL	19	15	78	411	822	215	74	402	804	213	72	395	790	211
2000	15	11	73	385	770	214	69	375	750	211	66	366	732	208
4000	11	7	70	362	724	214	66	352	704	210	63	342	684	207
6000	7	3	66	336	672	212	61	325	650	208	58	315	630	204
8000	3	-1	63	316	632	212	59	304	608	208	55	294	588	204
10,000	-1	-5	60	294	588	212	56	282	564	207	52	271	542	203
12,000	-5	-9	58	277	554	212	54	265	530	208	50	253	506	203
14,000	-9	-13	56	262	524	213	52	249	498	208	47	237	474	203
16,000	-13	-17	55	250	500	214	50	235	470	208	45	222	444	202
18,000	-17	-21	54	241	482	216	48	224	448	209	43	210	420	202
20,000	-21	-25	53	233	466	219	47	214	428	209	42	198	396	202
22,000	-24	-29	53	226	452	221	47	207	414	212	41	190	380	204
24,000	-28	-33	54	222	444	227	48	204	408	218	42	185	370	208
26,000	-32	-37	55	220	440	233	49	201	402	224	43	183	366	214
28,000	-36	-41	54	214	428	234	50	200	400	230	44	181	362	221
29,000	-38	-42	54	213	426	236	50	198	396	232	44	181	362	224
31,000	-41	-46	55	214	428	241	49	195	390	235	45	180	360	230

NOTE: DURING OPERATION WITH ICE VANE EXTENDED, TORQUE WILL DECREASE. IN ORDER TO MAINTAIN MAXIMUM RANGE CONFIGURARTION, DO NOT RESET POWER TO ORIGINAL SETTING. FUEL FLOW WILL REMAIN ABOUT THE SAME, BUT TRUE AIRSPEED WILL BE REDUCED APPROXIMATELY 10 KNOTS.

Figure 7-330. Maximum Range Power - 1700 RPM - ISA - ^{0}C

MAXIMUM RANGE POWER
1700 RPM
ISA +10°C

NOTE: FOR APPLICABLE NOTES SEE BELOW.

WEIGHT			12,000 POUNDS				11,000 POUNDS				10,000 POUNDS			
PRESSURE ALTITUDE FEET	IOAT °C	OAT °C	TORQUE PER ENG %	FUEL FLOW PER ENG LBS/HR	FUEL FLOW TOTAL LBS/HR	TAS KNOTS	TORQUE PER ENG %	FUEL FLOW PER ENG LBS/HR	FUEL FLOW TOTAL LBS/HR	TAS KNOTS	TORQUE PER ENG %	FUEL FLOW PER ENG LBS/HR	FUEL FLOW TOTAL LBS/HR	TAS KNOTS
SL	29	25	75	406	812	215	73	401	802	214	70	394	788	212
2000	25	21	73	387	774	217	71	380	760	215	68	372	744	213
4000	21	17	71	367	734	218	68	357	714	215	64	347	694	212
6000	17	13	69	347	694	219	65	336	672	216	61	325	650	212
8000	13	9	66	324	648	219	62	313	626	215	58	302	604	211
10,000	9	5	63	303	606	219	58	290	580	214	54	279	558	209
12,000	6	1	62	288	576	221	57	275	550	216	53	264	528	212
14,000	2	-3	60	273	546	222	55	260	520	216	50	247	494	211
16,000	-2	-7	58	260	520	223	53	246	492	217	48	231	462	210
18,000	-6	-11	57	249	498	225	52	233	466	218	46	217	434	209
20,000	-10	-15	56	239	478	226	50	222	444	218	44	205	410	209
22,000	-14	-19	56	234	468	229	50	217	434	221	44	199	398	212
24,000	-18	-23	56	229	458	234	50	212	424	226	44	195	390	217
26,000	-22	-27	55	220	440	234	51	208	416	232	45	191	382	223
28,000	-25	-31	55	217	434	238	50	202	404	234	46	188	376	229
29,000	-27	-32	55	217	434	241	50	200	400	234	46	187	374	231
31,000	-31	-36	--	--	--	--	50	199	398	239	45	183	366	233

NOTE: DURING OPERATION WITH ICE VANE EXTENDED, TORQUE WILL DECREASE. IN ORDER TO MAINTAIN MAXIMUM RANGE CONFIGURARTION, DO NOT RESET POWER TO ORIGINAL SETTING. FUEL FLOW WILL REMAIN ABOUT THE SAME, BUT TRUE AIRSPEED WILL BE REDUCED APPROXIMATELY 10 KNOTS.

Figure 7-331. Maximum Range Power - 1700 RPM - ISA +10 °C

MAXIMUM RANGE POWER
1700 RPM
ISA +20°C

NOTE: FOR APPLICABLE NOTES SEE BELOW.

WEIGHT			12,000 POUNDS				11,000 POUNDS				10,000 POUNDS			
PRESSURE ALTITUDE FEET	IOAT °C	OAT °C	TORQUE PER ENG %	FUEL FLOW PER ENG LBS/HR	FUEL FLOW TOTAL LBS/HR	TAS KNOTS	TORQUE PER ENG %	FUEL FLOW PER ENG LBS/HR	FUEL FLOW TOTAL LBS/HR	TAS KNOTS	TORQUE PER ENG %	FUEL FLOW PER ENG LBS/HR	FUEL FLOW TOTAL LBS/HR	TAS KNOTS
SL	39	35	71	399	798	212	69	393	786	212	68	388	776	211
2000	35	31	69	379	758	214	68	374	748	214	65	368	736	213
4000	31	27	69	363	726	217	67	357	714	217	64	350	700	215
6000	28	23	67	344	688	219	65	338	676	219	62	329	658	216
8000	24	19	65	325	650	221	63	317	634	219	59	307	614	216
10,000	20	15	63	306	612	222	60	297	594	220	56	286	572	215
12,000	16	11	62	289	578	224	59	281	562	222	55	269	538	217
14,000	12	7	60	275	550	225	57	267	534	223	53	255	510	219
16,000	8	3	59	263	526	227	56	253	506	224	51	241	482	219
18,000	4	-1	58	252	504	229	54	241	482	226	49	227	454	219
20,000	0	-5	57	244	488	231	53	230	460	227	47	214	428	219
22,000	-4	-9	57	236	472	233	52	221	442	228	46	205	410	220
24,000	-8	-13	55	227	454	234	52	215	430	232	46	199	398	224
26,000	-11	-17	55	222	444	237	51	208	416	234	47	195	390	230
28,000	-15	-21	56	223	446	244	50	203	406	236	46	190	380	233
29,000	-19	-22	56	222	444	245	51	204	408	240	46	187	374	233
31,000	-23	-26	--	--	--	--	51	205	410	245	46	185	370	237

NOTE: DURING OPERATION WITH ICE VANE EXTENDED, TORQUE WILL DECREASE. IN ORDER TO MAINTAIN MAXIMUM RANGE CONFIGURARTION, DO NOT RESET POWER TO ORIGINAL SETTING. FUEL FLOW WILL REMAIN ABOUT THE SAME, BUT TRUE AIRSPEED WILL BE REDUCED APPROXIMATELY 10 KNOTS.

Figure 7-332.. Maximum Range Power - 1700 RPM - ISA +20 ^{0}C

MAXIMUM RANGE POWER
1700 RPM
ISA +30°C

NOTE: FOR APPLICABLE NOTES SEE BELOW.

WEIGHT			12,000 POUNDS				11,000 POUNDS				10,000 POUNDS			
PRESSURE ALTITUDE FEET	IOAT °C	OAT °C	TORQUE PER ENG %	FUEL FLOW PER ENG LBS/HR	FUEL FLOW TOTAL LBS/HR	TAS KNOTS	TORQUE PER ENG %	FUEL FLOW PER ENG LBS/HR	FUEL FLOW TOTAL LBS/HR	TAS KNOTS	TORQUE PER ENG %	FUEL FLOW PER ENG LBS/HR	FUEL FLOW TOTAL LBS/HR	TAS KNOTS
SL	49	45	70	398	796	213	67	390	780	211	64	382	764	209
2000	45	41	67	375	750	213	65	368	736	212	62	362	724	211
4000	41	37	65	356	712	215	63	349	698	214	61	344	688	214
6000	37	33	64	337	674	217	62	332	664	216	60	326	652	216
8000	34	29	62	318	636	218	60	313	626	218	58	307	614	217
10,000	30	25	60	299	598	219	58	294	588	219	56	288	576	219
12,000	26	21	58	282	564	220	57	277	554	221	55	272	544	221
14,000	22	17	57	269	538	222	56	264	528	223	53	258	516	222
16,000	18	13	57	258	516	224	55	252	504	225	52	245	490	224
18,000	14	9	56	247	494	226	54	242	484	227	51	233	466	226
20,000	10	5	56	242	484	231	54	234	468	231	49	222	444	226
22,000	6	1	55	234	468	233	53	225	450	233	48	212	424	228
24,000	2	-3	55	226	452	234	51	214	428	233	48	204	408	231
26,000	-1	-7	57	228	456	244	50	205	410	232	47	196	392	232
28,000	-5	-11	56	223	446	245	52	209	418	244	45	187	374	232
29,000	79	-12	56	223	446	247	52	207	414	244	46	188	376	236
31,000	-11	-16	--	--	--	--	52	205	410	246	47	188	376	242

NOTE: DURING OPERATION WITH ICE VANE EXTENDED, TORQUE WILL DECREASE. IN ORDER TO MAINTAIN MAXIMUM RANGE CONFIGURARTION, DO NOT RESET POWER TO ORIGINAL SETTING. FUEL FLOW WILL REMAIN ABOUT THE SAME, BUT TRUE AIRSPEED WILL BE REDUCED APPROXIMATELY 10 KNOTS.

Figure 7-333.. Maximum Range Power - 1700 RPM - ISA +30 °C

MAXIMUM RANGE POWER
1700 RPM
ISA +37°C

NOTE: FOR APPLICABLE NOTES SEE BELOW.

WEIGHT			12,000 POUNDS				11,000 POUNDS				10,000 POUNDS			
PRESSURE ALTITUDE FEET	IOAT °C	OAT °C	TORQUE PER ENG %	FUEL FLOW PER ENG LBS/HR	FUEL FLOW TOTAL LBS/HR	TAS KNOTS	TORQUE PER ENG %	FUEL FLOW PER ENG LBS/HR	FUEL FLOW TOTAL LBS/HR	TAS KNOTS	TORQUE PER ENG %	FUEL FLOW PER ENG LBS/HR	FUEL FLOW TOTAL LBS/HR	TAS KNOTS
SL	56	45	73	407	814	218	68	394	788	214	64	383	766	210
2000	52	48	69	381	762	217	64	369	738	213	61	360	720	210
4000	48	44	65	357	714	216	62	348	696	214	60	341	682	212
6000	44	40	63	335	670	216	60	327	654	215	58	321	642	214
8000	40	36	61	316	632	218	58	308	616	216	56	303	606	216
10,000	37	32	59	298	596	219	56	290	580	217	55	284	568	217
12,000	33	28	58	283	566	221	55	274	548	219	53	269	538	219
14,000	29	24	57	269	538	222	54	260	520	220	52	255	510	221
16,000	25	20	56	257	514	224	53	249	498	223	51	243	486	223
18,000	21	16	56	248	496	227	52	238	476	225	50	232	446	225
20,000	17	12	55	241	482	230	52	232	464	229	50	223	448	229
22,000	13	8	55	235	470	234	51	223	446	231	49	214	428	231
24,000	9	4	57	234	468	242	50	213	426	232	47	204	408	232
26,000	6	0	57	229	458	245	51	211	422	239	46	194	388	231
28,000	2	4	57	228	456	247	52	210	420	245	46	189	378	234
29,000	0	-5	--	--	--	--	52	209	418	247	46	190	380	239
31,000	-4	-9	--	--	--	--	--	--	--	--	47	190	380	245

NOTE: DURING OPERATION WITH ICE VANE EXTENDED, TORQUE WILL DECREASE. IN ORDER TO MAINTAIN MAXIMUM RANGE CONFIGURARTION, DO NOT RESET POWER TO ORIGINAL SETTING. FUEL FLOW WILL REMAIN ABOUT THE SAME, BUT TRUE AIRSPEED WILL BE REDUCED APPROXIMATELY 10 KNOTS.

Figure 7-334.. Maximum Range Power - 1700 RPM - ISA +37 °C

RANGE PROFILE - FULL MAIN AND AUX TANKS
STANDARD DAY

ASSOCIATED CONDITIONS:

WEIGHT ....12,590 LBS BEFORE ENGINE START

FUEL ....AVIATION KEROSENE
FUEL DENSITY ....6.7 LBS/GAL
ICE VANES ....RETRACTED

EXAMPLE:

PRESSURE ALTITUDE .... 26,000 FT

RANGE @ MAX CRUISE - 1800 RPM .... 1488 NM
RANGE @ MAX CRUISE - 1700 RPM .... 1759 NM

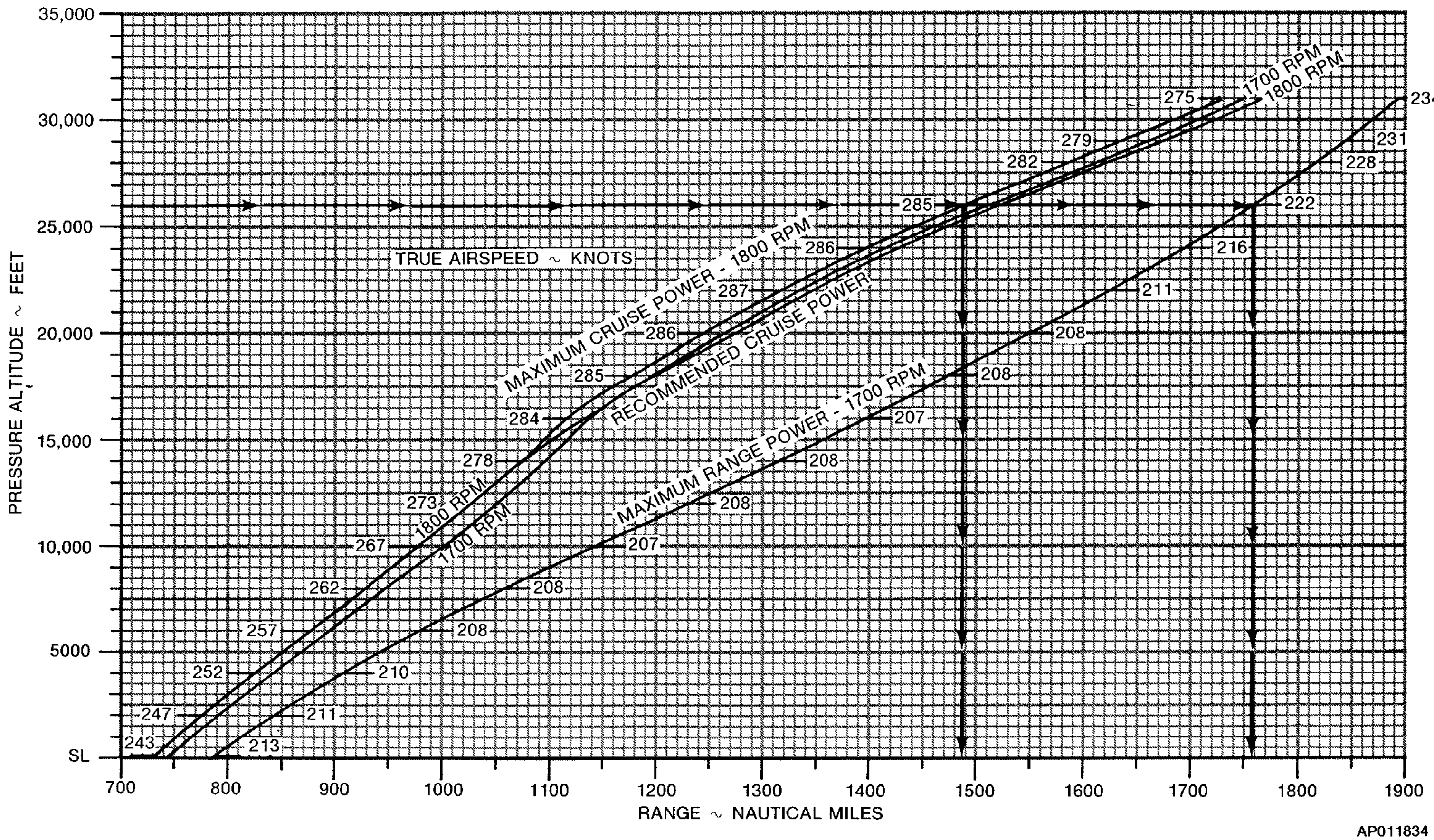


Figure 7-335. Range Profile - Full Main and Aux Tanks

ENDURANCE PROFILE - FULL MAIN AND AUX TANKS
STANDARD DAY

ASSOCIATED CONDITIONS:

WEIGHT ....12,590 LBS BEFORE ENGINE START
FUEL ....AVIATION KEROSENE
FUEL DENSITY......6.7 LBS/GAL
ICE VANES............RETRACTED

EXAMPLE:

PRESSURE ALTITUDE .... 26,000 FT
ENDURANCE @ MAX CRUISE - 1800 RPM 5.33 HRS
ENDURANCE @ MAX RANGE - 1700 RPM... 7.9 HRS

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

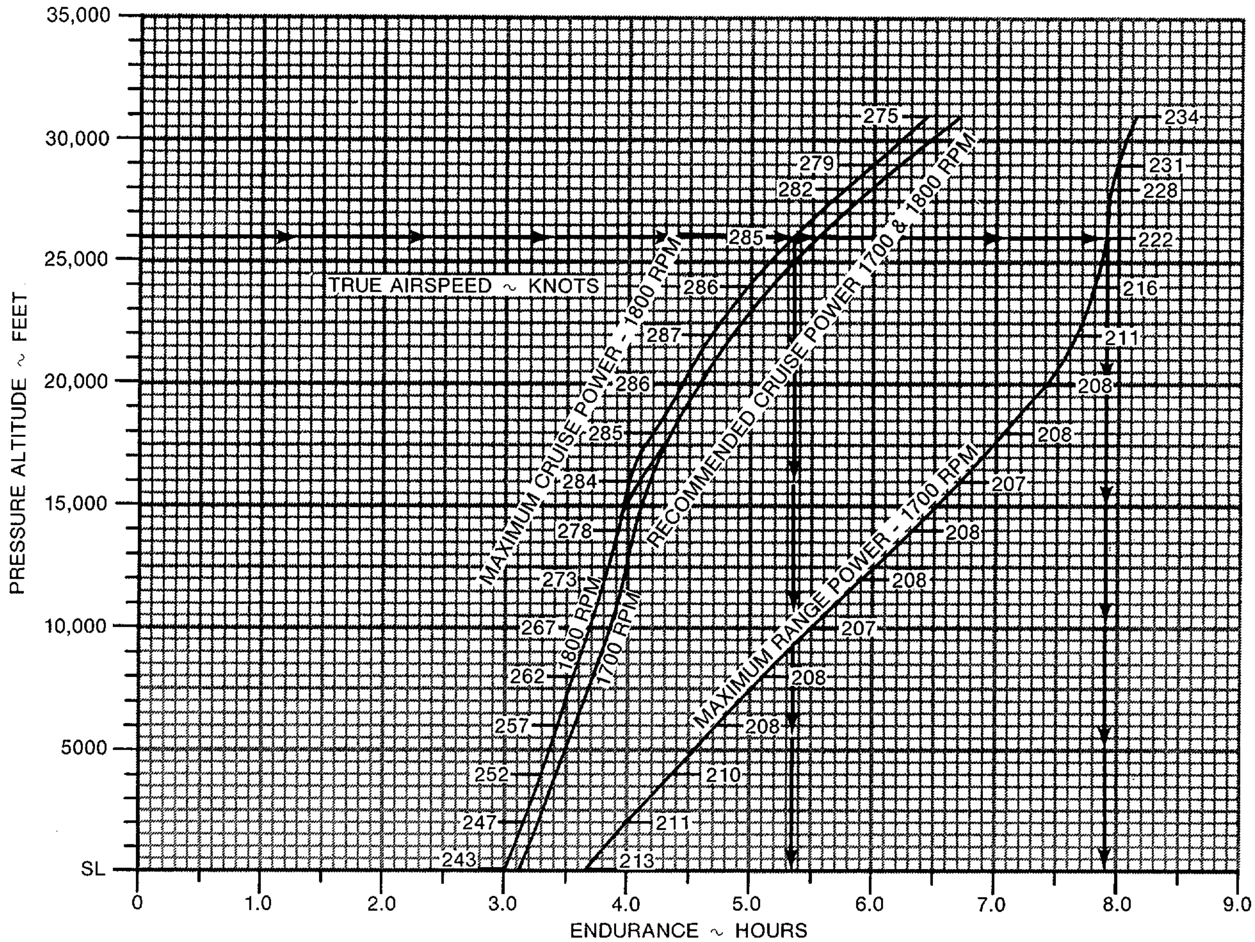


Figure 7-336. Endurance Profile - Full Main and aux Tanks

RANGE PROFILE - FULL MAIN TANKS
STANDARD DAY

ASSOCIATED CONDITIONS:

WEIGHT ....12,590 LBS BEFORE ENGINE START
FUEL ....AVIATION KEROSENE
FUEL DENSITY......6.7 LBS/GAL
ICE VANES............RETRACTED

EXAMPLE:

PRESSURE ALTITUDE..............................26,000 FT
RANGE @ MAX CRUISE POWER.............986 NM
RANGE @ MAX RANGE POWER..............1137 NM

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

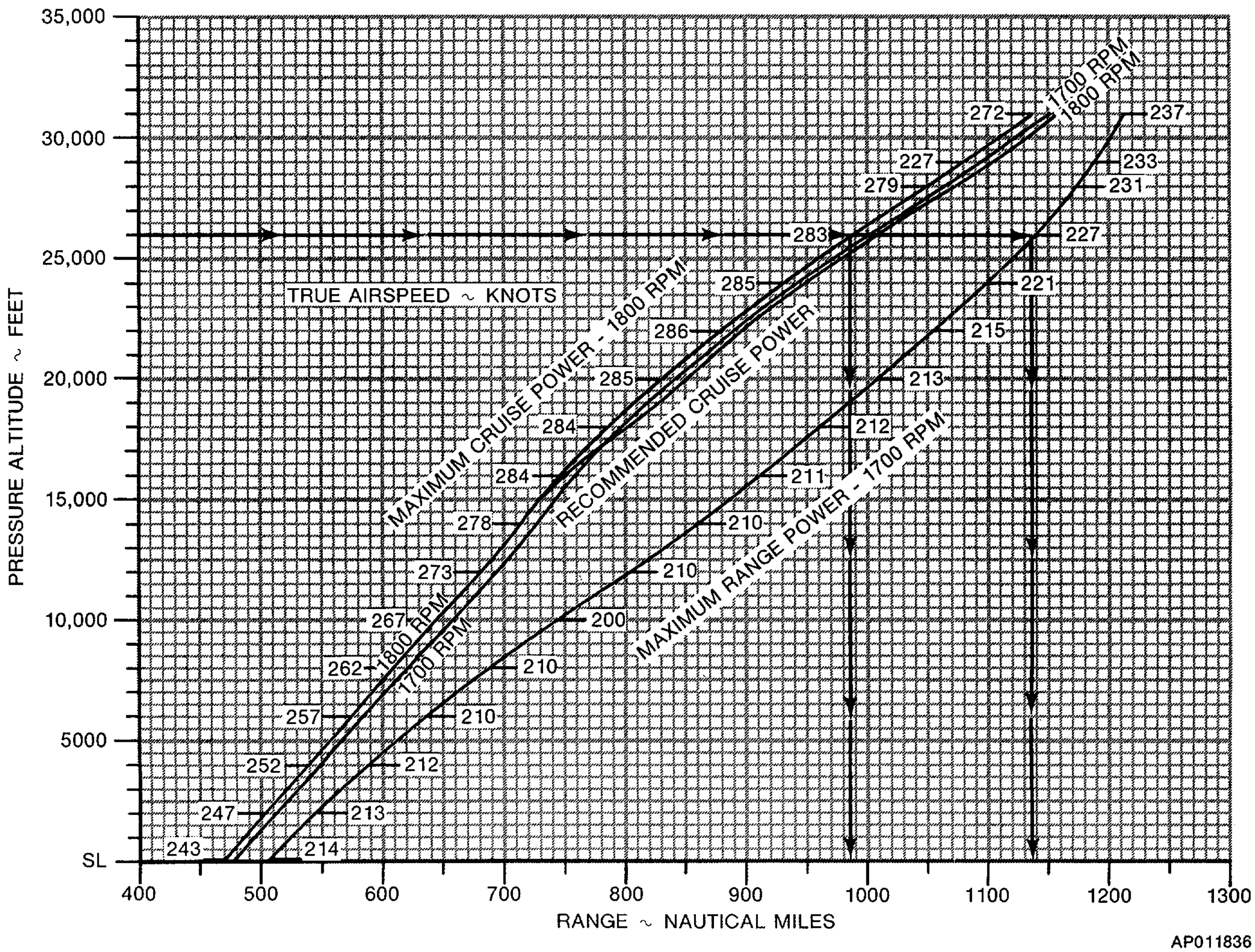


Figure 7-337. Range Profile - full Main Tanks

ENDURANCE PROFILE - FULL MAIN TANKS
STANDAFRD DAY

ASSOCIATED CONDITIONS:

WEIGHT ....12,590 LBS BEFORE ENGINE START
FUEL ....AVIATION KEROSENE
FUEL DENSITY......6.7 LBS/GAL
ICE VANES............RETRACTED

EXAMPLE:

PRESSURE ALTITUDE..............................26,000 FT
ENDURANCE @ MAX CRUISE - 1800 RPM....3.59 HRS
ENDURANCE @ MAX RANGE - 1700 RPM.....5.0HRS

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

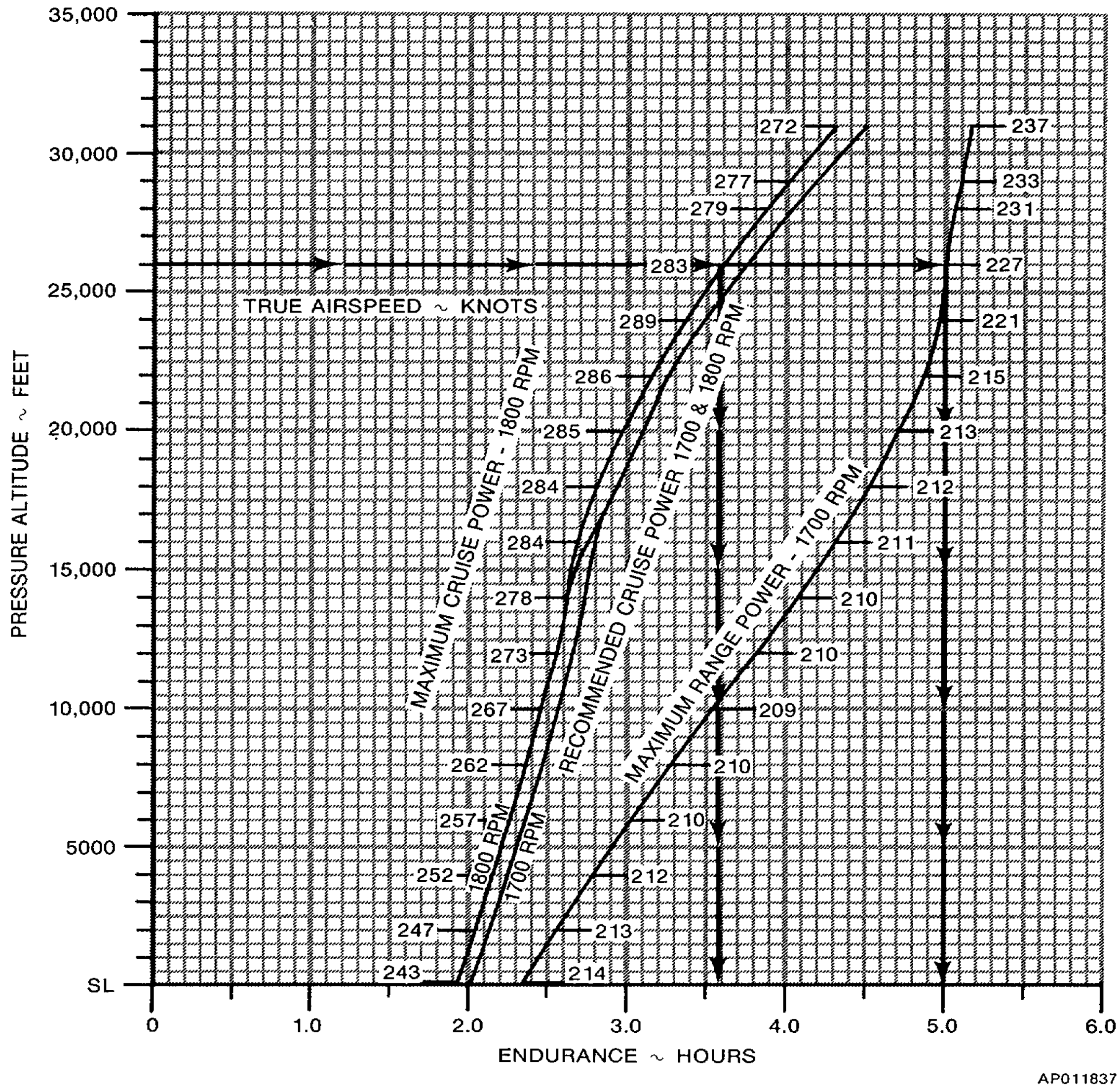


Figure 7-388. Endurance Profile - Main Tanks

ONE ENGINE INOPERATIVE
MAXIMUM CRUISE POWER
1900 RPM
ISA -30°C

PRESSURE ALTITUDE FEET	IOAT °C	OAT °C	TORQUE PER ENGINE %	FUEL FLOW PER ENGINE LBS/HR	TOTAL FUEL FLOW LBS/HR	AIRSPEED/KNOTS 12,000 LBS IAS	12,000 LBS TAS	11,000 LBS IAS	11,000 LBS TAS	10,000 LBS IAS	10,000 LBS TAS
SL	-12	-15	100	517	517	191	182	193	183	194	185
2000	-16	-19	100	505	505	189	185	191	187	192	188
4000	-20	-23	100	492	492	186	188	188	190	190	192
6000	-23	-27	100	479	479	184	191	186	193	188	195
8000	-27	-31	100	467	467	182	194	184	196	186	198
10,000	-31	-35	100	454	454	179	179	182	199	184	202
12,000	-35	-39	100	445	445	177	200	179	203	181	205
14,000	-39	-43	100	439	439	174	203	177	206	179	208
16,000	-43	-47	100	434	434	171	206	174	209	176	212
18,000	-47	-51	97	416	416	165	205	169	209	172	213
20,000	-51	-55	91	393	393	157	202	162	207	165	212
22,000	-55	-59	86	368	368	148	196	154	204	158	209
24,000	-59	-63	77	331	331	133	182	142	195	148	203
26,000	-64	-67	68	294	294	—	—	126	179	136	193
28,000	-68	-71	61	265	265	—	—	—	—	121	178
29,000	—	—	—	—	—	—	—	—	—	—	—
31,000	—	—	—	—	—	—	—	—	—	—	—

Figure 7-339. One - Engine - Inoperative Maximum Cruise Power - 1900 RPM - ISA - 30 ^{0}C

NOTE

1. DURING OPERATION WITH ICE VANE EXTENDED,TORQUE WILL DECREASE. IF ORIGINAL POWER IS NOT OR CANNOT BE RESET,TRUE AIRSPEED WILL DECREASE APPROXIMATELY 7%. IF ORIGINAL POWER IS RESET, TRUE AIRSPEED WILL BE UNCHANGED AND FUEL FLOW WILL INCREASE APPROXIMATELY 30 LBS/HR/ENG.

2. IOAT, TORQUE, AND FUEL FLOW BASED ON 11,000 POUNDS.

ONE ENGINE INOPERATIVE
MAXIMUM CRUISE POWER
1900 RPM
ISA -20°C

PRESSURE ALTITUDE FEET	IOAT °C	OAT °C	TORQUE PER ENGINE %	FUEL FLOW PER ENGINE LBS/HR	TOTAL FUEL FLOW LBS/HR	AIRSPEED/KNOTS 12,000 LBS IAS	TAS	11,000 LBS IAS	TAS	10,000 LBS IAS	TAS
SL	-2	-5	100	519	519	189	184	191	185	193	187
2000	-6	-9	100	505	505	187	187	189	189	191	190
4000	-10	-13	100	492	492	185	190	187	192	189	194
6000	-13	-17	100	479	479	182	193	184	195	186	197
8000	-17	-21	100	467	467	180	196	182	198	184	201
10,000	-21	-25	100	456	456	177	199	180	202	182	204
12,000	-25	-29	100	445	445	175	202	177	205	179	207
14,000	-29	-33	100	440	440	172	205	175	208	177	211
16,000	-33	-37	98	424	424	166	204	170	209	173	212
18,000	-37	-41	92	401	401	159	202	163	207	166	211
20,000	-41	-45	88	380	380	151	199	156	205	160	210
22,000	-45	-49	83	358	358	142	193	149	202	154	208
24,000	-49	-53	76	329	329	127	179	138	194	145	203
26,000	-53	-57	69	300	300	—	—	124	181	135	195
28,000	-57	-61	63	274	274	—	—	—	—	121	182
29,000	--	--	--	--	--	—	—	—	—	--	--
31,000	--	--	--	--	--	—	—	—	—	--	--

NOTE

1. DURING OPERATION WITH ICE VANE EXTENDED, TORQUE WILL DECREASE. IF ORIGINAL POWER IS NOT OR CANNOT BE RESET, TRUE AIRSPEED WILL DECREASE APPROXIMATELY 20 KNOTS AND FUEL FLOW WILL DECREASE APPROXIMATELY 7%. IF ORIGINAL POWER IS RESET, TRUE AIRSPEED WILL BE UNCHANGED AND FUEL FLOW WILL INCREASE APPROXIMATELY 30 LBS/HR/ENG.
2. IOAT, TORQUE, AND FUEL FLOW BASED ON 11,000 POUNDS.

Figure 7-340. One-Engine-Inoperative Maximum Cruise Power-1900 RPM-ISA-20 °C

ONE ENGINE INOPERATIVE
MAXIMUM CRUISE POWER
1900 RPM
ISA -10°C

PRESSURE ALTITUDE FEET	IOAT °C	OAT °C	TORQUE PER ENGINE %	FUEL FLOW PER ENGINE LBS/HR	TOTAL FUEL FLOW LBS/HR	AIRSPEED/KNOTS 12,000 LBS IAS	12,000 LBS TAS	11,000 LBS IAS	11,000 LBS TAS	10,000 LBS IAS	10,000 LBS TAS
SL	8	5	100	522	522	188	186	190	187	191	189
2000	4	1	100	508	508	185	188	187	191	189	192
4000	1	-3	100	493	493	183	191	185	194	187	196
6000	-3	-7	100	480	480	181	195	183	197	185	199
8000	-7	-11	100	468	468	178	198	181	200	183	203
10,000	-11	-15	100	455	455	175	201	178	204	180	206
12,000	-15	-19	100	446	446	173	204	175	207	178	209
14,000	-19	-23	97	430	430	167	203	170	207	173	211
16,000	-23	-27	92	407	407	160	201	164	206	167	210
18,000	-27	-31	88	385	385	153	198	157	204	161	209
20,000	-31	-35	84	366	366	145	194	151	202	155	208
22,000	-35	-39	79	345	345	134	187	143	198	148	206
24,000	-39	-43	73	318	318	—	—	132	189	140	200
26,000	-44	-47	66	290	290	—	—	—	—	129	192
28,000	—	—	—	—	—	—	—	—	—	—	—
29,000	—	—	—	—	—	—	—	—	—	—	—
31,000	—	—	—	—	—	—	—	—	—	—	—

NOTE

1. DURING OPERATION WITH ICE VANE EXTENDED, TORQUE WILL DECREASE. IF ORIGINAL POWER IS NOT OR CANNOT BE RESET, TRUE AIRSPEED WILL DECREASE APPROXIMATELY 20 KNOTS AND FUEL FLOW WILL DECREASE APPROXIMATELY 7%. IF ORIGINAL POWER IS RESET, TRUE AIRSPEED WILL BE UNCHANGED AND FUEL FLOW WILL INCREASE APPROXIMATELY 30 LBS/HR/ENG.
2. IOAT, TORQUE, AND FUEL FLOW BASED ON 11,000 POUNDS.

Figure 7-341. One-Engine-Inoperative Maximum Cruise Power-1900 RPM-ISA-10 °C

ONE ENGINE INOPERATIVE
MAXIMUM CRUISE POWER
1900 RPM
ISA °C

PRESSURE ALTITUDE FEET	IOAT °C	OAT °C	TORQUE PER ENGINE %	FUEL FLOW PER ENGINE LBS/HR	TOTAL FUEL FLOW LBS/HR	AIRSPEED/KNOTS 12,000 LBS IAS	12,000 LBS TAS	11,000 LBS IAS	11,000 LBS TAS	10,000 LBS IAS	10,000 LBS TAS
SL	18	15	100	525	525	186	187	188	189	190	191
2000	14	11	100	511	511	184	190	186	192	188	194
4000	11	7	100	496	496	181	193	184	196	186	198
6000	7	3	100	482	482	179	196	181	199	183	201
8000	3	-1	100	469	469	176	200	179	202	181	205
10,000	-1	-5	100	456	456	174	202	176	206	179	208
12,000	-5	-9	98	437	437	169	203	172	207	174	210
14,000	-9	-13	93	413	413	162	201	166	206	169	209
16,000	-13	-17	88	391	391	154	198	159	204	163	208
18,000	-17	-21	84	370	370	146	194	152	201	156	206
20,000	-21	-25	80	352	352	137	188	145	198	150	205
22,000	-25	-29	75	332	332	123	175	136	193	143	202
24,000	-30	-33	69	305	305	—	—	123	180	133	196
26,000	-33	-37	65	283	283	—	—	—	—	121	185
28,000	—	—	—	—	—	—	—	—	—	—	—
29,000	—	—	—	—	—	—	—	—	—	—	—
31,000	—	—	—	—	—	—	—	—	—	—	—

NOTE

1. DURING OPERATION WITH ICE VANE EXTENDED, TORQUE WILL DECREASE. IF ORIGINAL POWER IS NOT OR CANNOT BE RESET, TRUE AIRSPEED WILL DECREASE APPROXIMATELY 20 KNOTS AND FUEL FLOW WILL DECREASE APPROXIMATELY 7%. IF ORIGINAL POWER IS RESET, TRUE AIRSPEED WILL BE UNCHANGED AND FUEL FLOW WILL INCREASE APPROXIMATELY 30 LBS/HR/ENG.
2. IOAT, TORQUE, AND FUEL FLOW BASED ON 11,000 POUNDS.

Figure 7-342. One-Engine-Inoperative Maximum Cruise Power-1900 RPM-ISA °C

ONE ENGINE INOPERATIVE
MAXIMUM CRUISE POWER
1900 RPM
ISA +10°C

PRESSURE ALTITUDE FEET	IOAT °C	OAT °C	TORQUE PER ENGINE %	FUEL FLOW PER ENGINE LBS/HR	TOTAL FUEL FLOW LBS/HR	AIRSPEED/KNOTS 12,000 LBS IAS	TAS	11,000 LBS IAS	TAS	10,000 LBS IAS	TAS
SL	28	25	100	527	527	185	189	187	191	189	193
2000	25	21	100	513	513	182	192	185	194	186	196
4000	21	17	100	498	498	180	195	182	198	184	200
6000	17	13	100	484	484	177	198	180	201	182	203
8000	13	9	100	471	471	174	201	177	204	179	207
10,000	9	5	95	442	442	168	199	171	203	174	207
12,000	5	1	91	415	415	161	198	165	202	168	206
14,00	1	-3	88	396	396	155	196	160	202	163	206
16,000	-3	-7	84	376	376	148	194	153	201	158	206
18,000	-7	-11	80	356	356	140	189	147	198	151	205
20,000	-11	-15	77	339	339	130	182	139	195	145	203
22,000	-15	-19	72	319	319	—	—	128	186	137	198
24,000	-19	-23	67	296	296	—	—	—	—	126	190
26,000	—	—	—	—	—	—	—	—	—	—	—
28,000	—	—	—	—	—	—	—	—	—	—	—
29,000	—	—	—	—	—	—	—	—	—	—	—
31,000	—	—	—	—	—	—	—	—	—	—	—

NOTE

1. DURING OPERATION WITH ICE VANE EXTENDED, TORQUE WILL DECREASE. IF ORIGINAL POWER IS NOT OR CANNOT BE RESET, TRUE AIRSPEED WILL DECREASE APPROXIMATELY 20 KNOTS AND FUEL FLOW WILL DECREASE APPROXIMATELY 7%. IF ORIGINAL POWER IS RESET, TRUE AIRSPEED WILL BE UNCHANGED AND FUEL FLOW WILL INCREASE APPROXIMATELY 30 LBS/HR/ENG.
2. IOAT, TORQUE, AND FUEL FLOW BASED ON 11,000 POUNDS.

Figure 7-343. One-Engine-Inoperative Maximum Cruise Power-1900 RPM-ISA + 10 °C

ONE ENGINE INOPERATIVE MAXIMUM CRUISE POWER 1900 RPM ISA +20°C

PRESSURE ALTITUDE FEET	IOAT °C	OAT °C	TORQUE PER ENGINE %	FUEL FLOW PER ENGINE LBS/HR	TOTAL FUEL FLOW LBS/HR	AIRSPEED/KNOTS 12,000 LBS IAS	TAS	11,000 LBS IAS	TAS	10,000 LBS IAS	TAS
SL	38	35	100	530	530	183	191	185	193	187	195
2000	35	31	100	515	515	181	194	183	196	185	198
4000	31	27	100	500	500	178	197	181	200	183	202
6000	27	23	97	475	475	173	197	176	200	178	203
8000	23	19	93	447	447	167	196	170	200	173	203
10,000	19	15	88	419	419	160	194	164	198	167	202
12,000	15	11	84	395	395	153	192	158	197	161	202
14,000	11	7	82	377	377	147	190	153	197	157	202
16,000	7	3	79	360	360	140	187	147	196	152	202
18,000	3	-1	76	344	344	132	182	141	194	146	201
20,000	-1	-5	73	327	327	111	166	133	895	140	199
22,000	-6	-9	69	307	307	—	—	120	178	132	195
24,000	-9	-13	64	285	285	—	—	—	—	120	184
26,000	—	—	—	—	—	—	—	—	—	—	—
28,000	—	—	—	—	—	—	—	—	—	—	—
29,000	—	—	—	—	—	—	—	—	—	—	—
31,000	—	—	—	—	—	—	—	—	—	—	—

NOTE

1. DURING OPERATION WITH ICE VANE EXTENDED, TORQUE WILL DECREASE. IF ORIGINAL POWER IS NOT OR CANNOT BE RESET, TRUE AIRSPEED WILL DECREASE APPROXIMATELY 20 KNOTS AND FUEL FLOW WILL DECREASE APPROXIMATELY 7%. IF ORIGINAL POWER IS RESET, TRUE AIRSPEED WILL BE UNCHANGED AND FUEL FLOW WILL INCREASE APPROXIMATELY 30 LBS/HR/ENG.
2. IOAT, TORQUE, AND FUEL FLOW BASED ON 11,000 POUNDS.

Figure 7-344. One-Engine-Inoperative Maximum Cruise Power-1900 RPM-ISA + 20 °C

ONE ENGINE INOPERATIVE MAXIMUM CRUISE POWER 1900 RPM ISA +30°C

PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENGINE	FUEL FLOW PER ENGINE	TOTAL FUEL FLOW	AIRSPEED/KNOTS					
						12,000 LBS		11,000 LBS		10,000 LBS	
FEET	°C	°C	%	LBS/HR	LBS/HR	IAS	TAS	IAS	TAS	IAS	TAS
SL	48	45	97	521	521	179	189	182	192	184	194
2000	44	41	94	499	499	175	190	178	193	180	196
4000	41	37	93	478	478	171	192	174	195	176	198
6000	37	33	90	454	454	166	192	169	195	172	199
8000	33	29	86	426	426	159	190	163	194	166	198
10,000	29	25	82	398	398	152	187	157	193	160	198
12,000	25	21	79	376	376	145	185	151	192	155	197
14,00	21	17	76	359	359	138	182	145	191	150	197
16,000	17	13	74	343	343	130	177	139	189	145	197
18,000	13	9	72	329	329	—	—	133	187	140	196
20,000	8	5	70	316	316	—	—	125	181	134	195
22,000	5	1	66	297	297	—	—	—	—	125	189
24,000	—	—	—	—	—	—	—	—	—	—	—
26,000	—	—	—	—	—	—	—	—	—	—	—
28,000	—	—	—	—	—	—	—	—	—	—	—
29,000	—	—	—	—	—	—	—	—	—	—	—
31,000	—	—	—	—	—	—	—	—	—	—	—

NOTE

1. DURING OPERATION WITH ICE VANE EXTENDED, TORQUE WILL DECREASE. IF ORIGINAL POWER IS NOT OR CANNOT BE RESET, TRUE AIRSPEED WILL DECREASE APPROXIMATELY 20 KNOTS AND FUEL FLOW WILL DECREASE APPROXIMATELY 7%. IF ORIGINAL POWER IS RESET, TRUE AIRSPEED WILL BE UNCHANGED AND FUEL FLOW WILL INCREASE APPROXIMATELY 30 LBS/HR/ENG.
2. IOAT, TORQUE, AND FUEL FLOW BASED ON 11,000 POUNDS.

Figure 7-345. One-Engine-Inoperative Maximum Cruise Power-1900 RPM-ISA + 30 °C

ONE ENGINE INOPERATIVE MAXIMUM CRUISE POWER 1900 RPM ISA +37°C

PRESSURE ALTITUDE FEET	IOAT °C	OAT °C	TORQUE PER ENGINE %	FUEL FLOW PER ENGINE LBS/HR	TOTAL FUEL FLOW LBS/HR	AIRSPEED/KNOTS 12,000 LBS IAS	TAS	11,000 LBS IAS	TAS	10,000 LBS IAS	TAS
SL	55	52	91	503	503	173	185	176	188	178	190
2000	51	48	89	481	481	169	186	172	189	174	192
4000	47	44	87	461	461	165	187	168	191	171	194
6000	44	40	85	438	438	160	187	163	191	167	195
8000	40	36	81	412	412	153	185	158	190	161	194
10,000	36	32	77	385	385	146	182	151	189	156	194
12,000	31	28	75	364	364	139	179	145	187	150	193
14,000	27	24	72	347	347	131	175	140	186	145	193
16,000	23	20	70	332	332	120	166	133	183	140	192
18,000	19	16	68	318	318	—	—	126	179	135	191
20,000	16	12	67	306	306	—	—	—	—	129	189
22,000	12	8	63	289	289	—	—	—	—	119	182
24,000	—	—	—	—	—	—	—	—	—	—	—
26,000	—	—	—	—	—	—	—	—	—	—	—
28,000	—	—	—	—	—	—	—	—	—	—	—
29,000	—	—	—	—	—	—	—	—	—	—	—
31,000	—	—	—	—	—	—	—	—	—	—	—

NOTE

1. DURING OPERATION WITH ICE VANE EXTENDED, TORQUE WILL DECREASE. IF ORIGINAL POWER IS NOT OR CANNOT BE RESET, TRUE AIRSPEED WILL DECREASE APPROXIMATELY 20 KNOTS AND FUEL FLOW WILL DECREASE APPROXIMATELY 7%. IF ORIGINAL POWER IS RESET, TRUE AIRSPEED WILL BE UNCHANGED AND FUEL FLOW WILL INCREASE APPROXIMATELY 30 LBS/HR/ENG.
2. IOAT, TORQUE, AND FUEL FLOW BASED ON 11,000 POUNDS.

Figure 7-346. One-Engine-Inoperative Maximum Cruise Power-1900 RPM-ISA + 37 °C

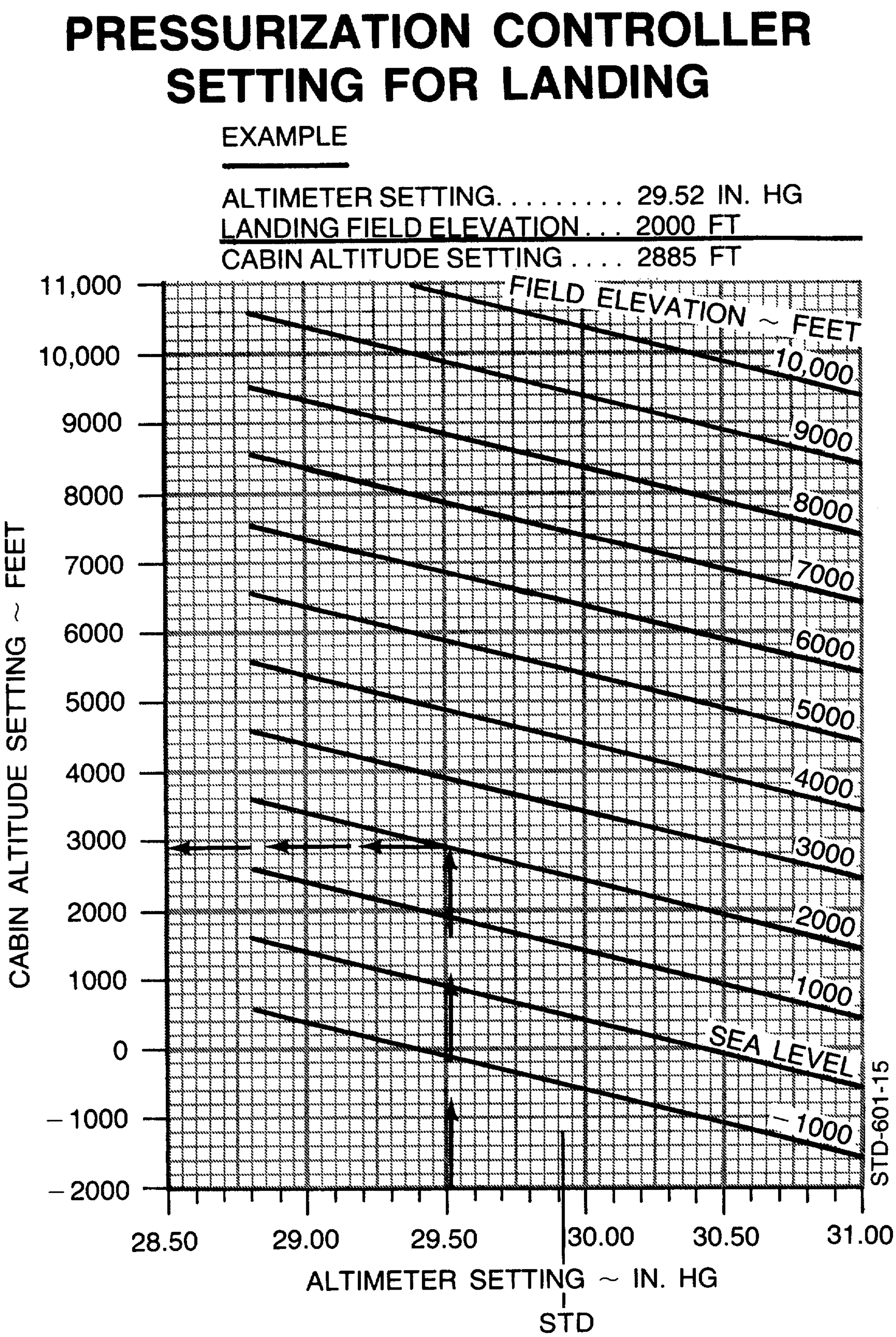


Figure 7-347. Pressurization Controller Setting for Landing

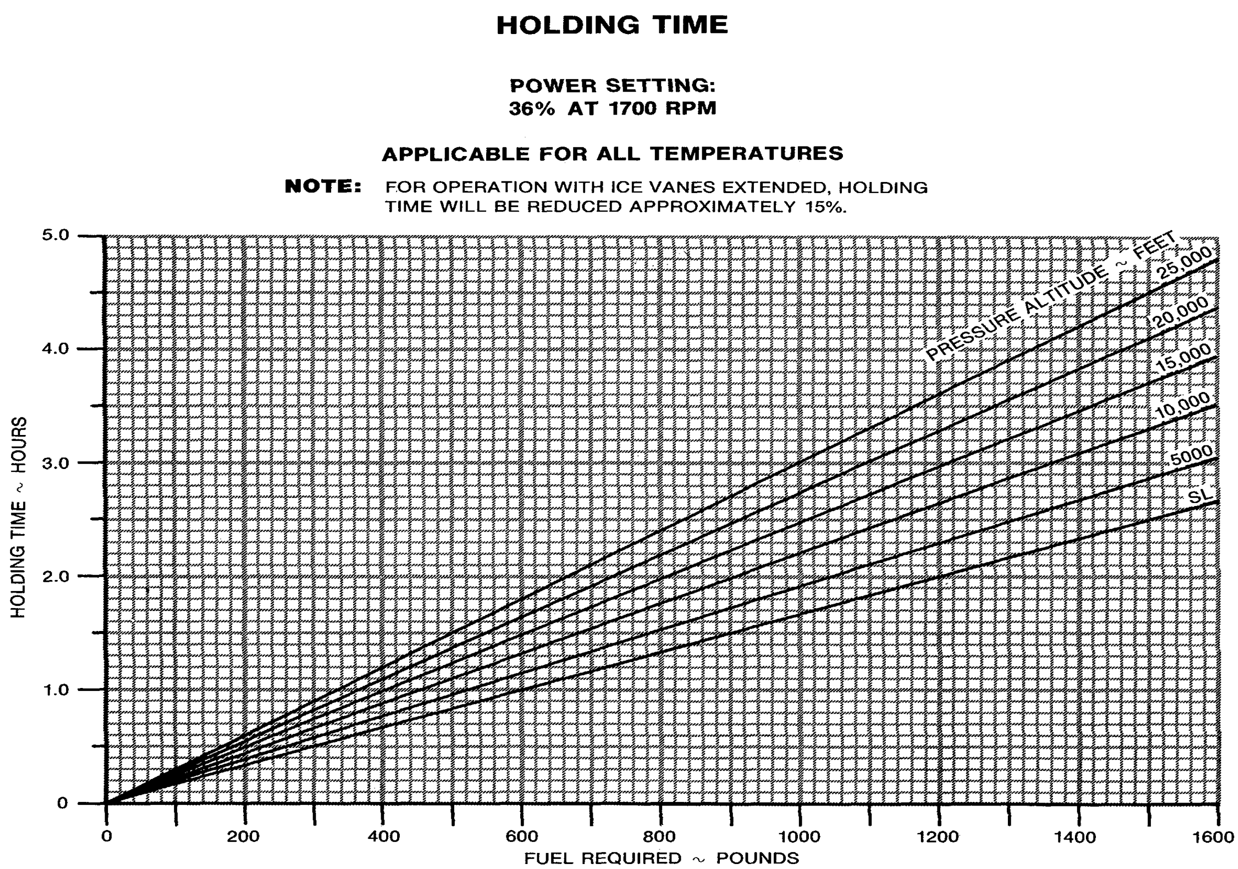


Figure 7-348. Holding Time

CHAPTER 8

NORMAL PROCEDURES

Section I. MISSION PLANNING.

8-1. MISSION PLANNING.

Mission planning begins when the mission is assigned and extends to the preflight check of the aircraft. It includes, but is not limited to, checks of operating limits and restrictions; weight/balance, and loading; performance; publications; flight plan; and crew and passenger briefings. The pilot in command shall insure compliance with the contents of this manual that are applicable to the mission.

8-2. OPERATING LIMITS AND RESTRICTIONS.

The minimum, maximum, normal, and cautionary operational ranges represent careful aerodynamic and structural calculations, substantiated by flight test data. These limitations must be adhered to during all phases of the mission. Refer to Chapter 5, OPERATING LIMITS AND RESTRICTIONS, for detailed information.

8-3. WEIGHT, BALANCE, AND LOADING.

The aircraft must be loaded, cargo and passengers secured, and weight and balance verified per Chapter 6, WEIGHT/BALANCE, AND LOADING.

8-4. PERFORMANCE.

Refer to Chapter 7, PERFORMANCE DATA, to determine the capability of the aircraft for the entire mission. Consideration must be given to changes in performance resulting from variation in loads, temperatures, and pressure altitudes. Record the data on the Performance Planning Card for use in completing the flight plan and for reference throughout the mission.

8-5. FLIGHT PLAN.

A flight plan must be completed and filed per AR 95-1, DODFLIP, and local regulations.

8-6. CREW AND PASSENGER BRIEFINGS.

A crew/passenger briefing must be conducted for a thorough understanding of individual and team responsibilities. The briefing should include, but not be limited to, co-pilot, crew chief, and ground crew responsibilities and the coordination necessary to complete the mission most efficiently. A review of visual signals is desirable when ground guides do not have a direct voice communications link with the crew. Refer to Section VI for crew and passenger briefings.

Section II. OPERATING PROCEDURES AND MANEUVERS

8-7. OPERATING PROCEDURES AND MANEUVERS.

This section deals with normal procedures and includes all steps necessary for safe and efficient operation of the aircraft from the time a preflight begins until the flight is completed and the aircraft is parked and secured. Unique feel, characteristics; and reaction of the aircraft during various phases of operation and the techniques and procedures used for taxiing, takeoff, climb, etc., are described, including precautions to be observed. Only the duties of the minimum crew necessary for the actual operation of the aircraft are included.

8-8. ADDITIONAL DATA.

Additional crew duties are covered as necessary in Section VI, CREW DUTIES. Mission equipment checks are in Chapter 4, MISSION EQUIPMENT. Procedures specifically related to instrument flight that are different from normal procedures are covered in this section following normal procedures. Descriptions of functions, operations, and effects of controls are covered in Section III, FLIGHT CHARACTERISTICS, and are repeated in this section only when required for emphasis. -Checks that must be made under adverse environmental conditions, such as desert and cold weather operations, supplement normal procedures checks in this section and are covered in Section V, ADVERSE ENVIRONMENTAL CONDITIONS.

8-9. CHECKLIST.

Normal procedures are given primarily in checklist form and are amplified as necessary in accompanying paragraph form when a detailed description of a procedure or maneuver is required. A condensed version of the amplified checklist, omitting all explanatory text, is contained in the Operator's and Crewmember's-Checklist, TM 55-1510-218-CL. To provide for easier cross referencing, the procedural steps are numbered to coincide with the corresponding numbered steps in TM 55-1510-218-CL.

8-10. USE OF CHECKLIST.

Although a good working knowledge of all aircraft procedures is desirable, it is not mandatory that they be committed to memory. The pilot is responsible for the initiation and accomplishment of all required checks. -Checklist items will be called out orally and the action verified using the pilot's checklist (-CL). The co-pilot will normally read the checklist and perform such duties as indicated, as well as those directed by the pilot. "As required" will not be used as a oral response; instead the actual position or setting of the unit or item, such as "ON" or "UP" or "APPROACH" will be stated. Upon completion of each checklist, the co-pilot will advise the pilot that the checklist called for has been completed.

8-11. CHECKS.

Items which apply only to night or only to instrument flying shall have an "N" or "I" respectively, immediately preceding the check to which it is pertinent. The symbol O shall be used to indicate "if installed." Those duties which are the responsibility of the co-pilot at the command of the pilot, will be indicated by a circle around the step number, i.e., ④ Circuit breakers-In. The star symbol ★ indicates an operational check contained in the performance section of the condensed checklist. The asterisk symbol ✻ indicates that performance of the step is mandatory for all thru-flights. The asterisk applies only to checks performed prior to takeoff. Placarded items appear in upper case. Due to placarding variance between models, where applicable, both placards will appear separated by a virgule (/). Example: 1. BRAKE DEICE switch DEICE/ON

8-12. BEFORE EXTERIOR CHECK.

✻ 1. Publications-Check DA Forms 2408-12, -13, -14, and -18, DD Form 365-4,locally required forms and publications, and availability of operator's manual (-10) and checklist (-CL).

✻ 2. Oxygen system-Check that oxygen quantity is sufficient for entire mission, passenger manual override in **D F** models, is pushed, that crew masks operate normally, and that diluter selector is set at 100%. Check that sufficient masks are available for all passengers**A** and **C** models. Refer to Chapter 5 for oxygen requirements.

CAUTION

If high or gusty winds are present, and the flight controls are unlocked, control surfaces may be damaged by buffeting.

✻ 3. Flight controls-Unlock and checked.

✻ 4. Parking brake-Set.

CAUTION

The elevator trim system shall not be forced past the limits which are shown on the elevator trim indicator scale.

✻ 5. Manual trim-Zero.

CAUTION

Do not cycle landing gear handle on the ground.

✻ 6. GEAR-DN.

7. ICE VANE handles-IN.

∗ 8. Key lock switch-ON.

9. Battery switch-ON.

10 Lighting systems-Check as required, to include position lights, recognition lights, landing/taxi light, wing ice lights, beacons, emergency lights, and interior lights, then OFF.

NOTE

The emergency lights override switch should be placed in the TEST position and the emergency lights (5) checked for illumination and intensity. A dim light indicates a weak battery pack. At the completion of the check, the switch must be cycled from the TEST position to the OFF-RESET position and then placed in AUTO.

11. Fuel gauges-Check fuel quantity and gauge operation.

12. Battery switch-OFF.

(0) 13 Galley power switches-OFF.

14. Electric toilet CDF (C-12 aircraft prior to C-12F serial 86-60084)-Check condition and that knife valve is open approximately 1/8 inch. (Chapter 2 provides information for servicing during freezing temperatures.)

14.A Chemical toilet F (C-12F aircraft serials 86-60084 thru 86-60089)-Check.

15. Emergency equipment-Check that all required emergency equipment is available and that fire extinguishers (2) and first-aid kits (3) have current inspection date.

8-13. FUEL SAMPLE.

NOTE

Fuel and oil quantity check may be performed prior to EXTERIOR CHECK to preclude carrying ladder and fuel sample container around during the inspection. During warm weather open fuel cap slowly to prevent being sprayed by fuel under thermal pressure.

∗1. Fuel sample-Check collective fuel sample from all drains for possible contamination. (Refer to Chapter 2 for locations.)

8-14. LEFT WING AREA 1.

1. Left wing area-Check as follows (fig. 8-1):

   ∗a. General condition-Check for skin damage such as buckling, splitting, distortion, dents, or fuel leaks.
   b. Flaps-Check for full retraction (approximately ¼-inch play) and skin damage such as buckling, splitting, distortion, or dents.
   c. Fuel sump drains-Check for leaks.
   d. Controls and trim tab-Check security and trim tab ring.
   e. Static wicks-Check security and condition.
   f. Wing tip and position lights-Check condition and for cracked lens.
   g. Recognition light-Check condition.
   h. Landing/taxi light-Check condition.
   i. Outboard wing fuel vent-Check free of obstruction.
   ∗j. Main tank fuel and cap-Check fuel level visually, condition of seal, and cap tight and properly installed. Locking tab aft.
   k. Outboard deice boot-Check for secure bonding, cracks, loose patches, stall strips, and general condition.
   l. Stall warning vane-Check free.
   ∗m. Tiedown-Released.
   n. Wing ice light-Check condition.
   o. Recessed and heated fuel vents-Check free of obstruction.

2. Left main landing gear-Check as follows:

   ∗a. Tires-Check for cuts, bruises, wear, appearance of proper inflation, wheel condition, and that both tires have same tread design.
   b. Brake assembly-Check brake lines for damage or signs of leakage, and brake linings for wear. Also check brake deice assembly and bleed air hose for condition and security.
   ∗c. Shock strut-Check for signs of leakage, minimum strut extension (4 inches **C**, 5.5 inches **D F**), and that left and right strut extension is approximately equal.
   d. Torque knee-Check condition.
   e. Safety switch-Check condition, wire, and security.
   ★f. Fire extinguisher pressure-Check pressure within limits (Chapter 2).
   g. Wheel well, doors, and linkage-Check for signs of leaks, broken wires, security, and general condition.

h. Fuel sump drains (forward)-Check for leaks.

3. Left engine and propeller-Check as follows:

CAUTION

A cold oil check is unreliable. Oil should be checked within 10 minutes after stopping engine. If more than 10 minutes have elapsed, motor engine for 40 seconds, then recheck. If more than 10 hours have elapsed, run engine for 2 minutes, then recheck. Add oil as required. Do not overfill.

*a. Engine oil-check oil level, no more than 3 quarts low, all caps secured, locking tabs aft.
b. Engine compartment, left side-Check for fuel and oil leaks, security of oil cap, door locking pin, and general condition. Lock compartment access door (secure front latch first).
c. Left cowl locks-Locked.
d. Left exhaust stub-Check for cracks and free of obstructions.
e. Propeller blades and spinner-Check blade condition, security of spinner and free propeller rotation.
f. Engine air inlets and ice vane-Check free of obstruction and ice vane retracted.
g. Bypass door-Check condition.
h. Right cowl locks-Locked.
i. Right exhaust stub-check for cracks and free of obstructions.
j. Engine compartment, right side-Check for fuel and oil leaks, ice vane linkage, door locking pins, and general condition. Lock compartment access door (secure front latch first).

4. Left wing center section-Check as follows:
a. Heat exchanger inlet and outlet-Check for cracks and free of obstructions.
b. Auxiliary tank fuel sump drain-Check for leaks.
c. Hydraulic reservoir vent and pump seal drain **D F** (C-12D Aircraft Serials 84-24375 thru 84-24380)-Check vent clear of obstructions, and that no excessive fluid is present.
d. Deice boot-Check for bonding, cracks, loose patches, and general condition.

(O) * e. Auxiliary tank fuel and cap-Check fuel level visually, condition of seal, and cap tight and properly installed.

5. Fuselage underside-Check as follows:
a. General condition-Check for skin damage, such as buckling, splitting, distortion, dents, or fuel leaks.
b. Antennas-Check wire, security, and general condition.

8-15. NOSE SECTION, AREA 2.

1. Nose section-Check as follows:

a. Outside air temperature probe-Check condition.

b. Avionics door, left side-Check secure.

c. Air conditioner exhaust-Check free of obstruction.

d. Wheel well-Check for signs of leaks, broken wires and general condition.

e. Doors and linkage-Check condition, security, and alignment.

f. Nose gear turning stop-Check condition.

* g. Tire-Check for cuts, bruises, wear, appearance of proper inflation, and wheel condition.

* h. Shock strut-Check for signs of leakage and three inches minimum extension.

i. Torque knee-Check condition.

j. Shimmy damper and linkage-Check for security and condition.

k. Headset jack cover-Check installed.

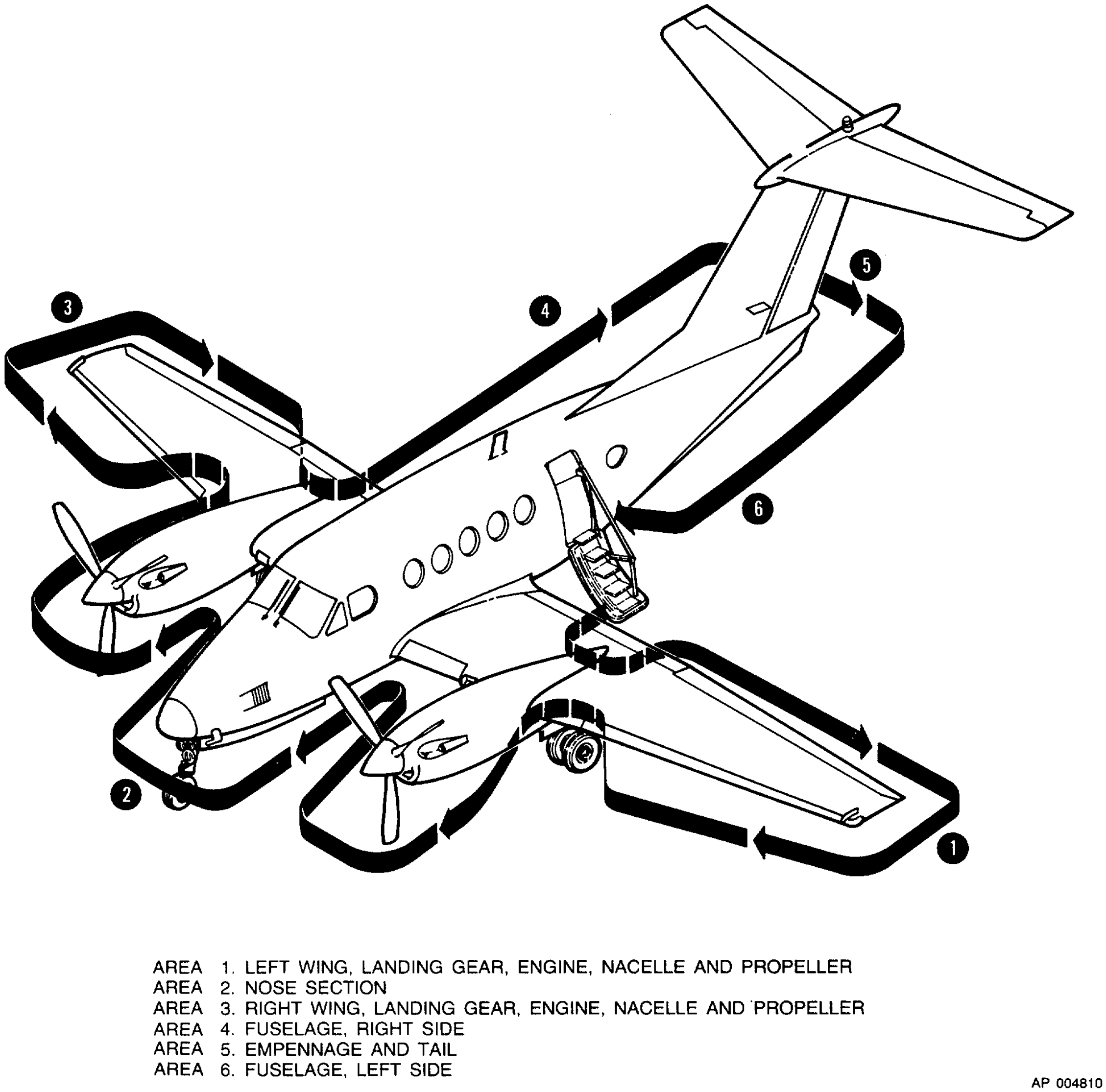


Figure 8-1. Exterior Inspection

l. Landing and taxi lights-Check for security and condition.

m. Pitot tubes-Check covers removed, alignment, security, and free of obstructions.

n. Radome-Check condition.

CAUTION

Do not move wipers on dry windshield or clean windshield with anything other than mild soap and water.

o. Windshields and wipers-Check windshield for cracks and cleanliness and wipers for contact with glass surface.
p. Air conditioner inlet-Check free of obstructions.
q. Avionics door, right side-Check secure.

8-16. RIGHT WING, AREA 3.

1. Right wing center section-Check as follows:

   a. Deice boot-Check for secure bonding, cracks, loose patches and general condition
   b. Battery access panel-Secure.
   c. Battery exhaust louvers-Check free of obstruction.
   ✻ d. Auxiliary tank fuel and cap-Check fuel level visually, condition of seal, and cap tight and properly installed. Locking tab aft.
   e. Battery compartment drain-Check free of obstruction.
   f. Battery ram air intake-Check free of obstruction.
   g. Auxiliary tank fuel sump drain-Check for leaks.
   h. Heat exchanger outlet and inlet-Check for cracks and free of obstructions.

2. Right engine and propeller-Check as follows:

CAUTION

A cold oil check is unreliable. Oil should be checked within 10 minutes after stopping engine. If more than 10 minutes have elapsed, motor engine for 40 seconds, then recheck. If more than 10 hours have elapsed, run engine for 2 minutes, then recheck. Add oil as required. Do not overfill.

   ✻ a. Engine oil-Check oil level, oil cap secure, and access door locked. Locking tabs aft.
   b. Engine compartment, left side-Check for fuel and oil leaks, security of oil cap, door locking pin, and general condition. Lock compartment access door (secure front latch first).
   c. Left cowl locks-Locked.
   d. Left exhaust stub-Check for cracks and free of obstructions.
   e. Propeller blades and spinner-Check blade condition, security of spinner, and free propeller rotation.
   f. Engine air inlets and ice vane-Check free of obstruction and ice vane retracted.
   g. Bypass door-Check condition.
   h. Right cowl locks-Locked.
   i. Right exhaust stub-Check for cracks and free of obstructions.
   j. Engine compartment, right side-Check for fuel and oil leaks, ice vane linkage, door locking pins, and general condition. Lock compartment access door (secure front latch first).

3. Right main landing gear-Check as follows:
   a. Fuel sump drains (forward)-Check for leaks.
   * b. Tires-Check for cuts, bruises, wear, appearance of proper inflation, wheel condition, and that both tires have the same tread design.
   c. Brake assembly-Check brake lines for damage or signs of leakage, and brake linings for wear. Also check brake deice assembly and bleed-air hose for condition and security.

∗ d. Shock strut-Check for signs of leak and minimum strut extension (4 inches for **C**; 5.5 inches for **D F**).
e. Torque knee-Check condition.
f. Safety switch-Check condition, wire, and security.
★ g. Fire extinguisher pressure-Check pressure within limits (Chapter 2).
h. Wheel well, doors, and linkage-Check for signs of leaks, broken wires, security, and general condition.

4. Right wing-Check as follows:

a. Recessed and heated fuel vents-Check free of obstructions.
b. GPU access door-Secured.
c. Wing ice light-Check condition.
d. Outboard deice boot-Check for secure bonding, cracks, loose patches, stall strips, and general condition.
∗ e. Tiedown-Released.
∗ f. Main tank fuel and cap-Check fuel level visually, condition of seal, and cap tight and properly installed. Locking tab aft.
g. Outboard wing fuel vent-Check free of obstruction.
h. Landing/Taxi light-Check condition.
i. Wing tip and position light-Check condition and for cracked lens.
j. Recognition light-Check condition.
k. Static wicks-Check security and condition.
l. Controls and trim tab-Check security and condition of ground adjustable tab.
m. Fuel sump drain (3)-Check for leaks.
n. Flaps-Check for full retraction (approximately ¼-inch play) and skin damage, such as buckling, splitting, distortion, or dents.
∗ o. General condition-Check for skin damage, such as buckling, splitting, distortion, dents, or fuel leaks.

8-17. FUSELAGE RIGHT SIDE, AREA 4.

1. Fuselage right side-Check as follows:

a. General condition-Check for skin damage such as buckling, splitting, distortion or dents.
b. Emergency light-Check condition.
c. Beacon-Check condition.
d. Aft access door-Check secure.
e. Oxygen filler door-Check secure.
f. Static ports-Check clear of obstructions.
g. Emergency locator transmitter-ARMED.
h. Emergency locator transmitter antenna-Check condition.

8-18. EMPENNAGE, AREA 5.

1. Empennage-Check as follows:

a. Vertical stabilizer, rudder, and trim tab-Check for skin damage, such as buckling, distortion, or dents, and trim tab rig.

b. Antennas-Check condition.

c. Deice boots-Check for secure bonding, cracks, loose patches, and general condition.

d. Horizontal stabilizer, elevator, and trim tab-Check for skin damage, such as buckling, distortion, or dents, and trim tab rig.

WARNING

If the possibility of ice accumulation on the horizontal stabilizer or elevator exists, do not attempt takeoff.

e. Elevator trim tab Verify "O" (neutral) position. The elevator trim tab "O" (neutral) position is determined by observing that the trailing edge of the elevator trim tab aligns with the trailing edge of the elevator while the elevator is resting against the downstops.

f. Static wicks-Check.
g. Position and beacon lights-Check condition.

8-19. FUSELAGE, LEFT SIDE, AREA 6.

1. Fuselage left side-Check as follows:

   a. General condition-Check for skin damage, such as buckling, distortion, or dents.
   b. Static ports-Check clear of obstructions.
   c. Emergency light-Check condition.
   d. Cabin door-Check door seal and general condition.
   e. Fuselage top side-Check general condition.

∗ 2. Chocks and tiedowns-Check removed.

8-20. ∗ INTERIOR CHECK.

1. Cargo/loose equipment-Check secure.

2. Cabin door-Locked and checked. Ensure that the cabin door is closed and locked as follows: -Check position of safety arm and diaphragm plunger (lift door step) and that on **C** the four sight openings on the inner facing of the door, and green stripe on each locking bolt, align with a pointer, and that on **D F** each of the six rotary cam locks align within the orange sight indicators. **D F.** In addition, the following inspection and test shall be performed prior to the first flight of the day:

   a. Open cabin door-Check that the "cabin door" annunciator light is extinguished.
   b. Latch cabin door but do not lock-Check that the "cabin door" annunciator light illuminates.
   c. Battery switch ON-Check that the "cabin door" annunciator light is still illuminated.
   d. Close and lock the cabin door-Check that the "cabin door" annunciator light is extinguished.
   e. Battery switch-OFF.

(O) ∗3. Cargo door-Locked and checked. Ensure that the cargo door is closed and locked as follows:

   a. Upper handle position-Closed and locked (the orange index marks on each of the four rotary cam locks must align within the sight indicators).
   b. Lower pin latch handle position-Closed and latched (the orange colored indicator must align with orange stripe on carrier rod).

NOTE

The untapered shoulder of the latching pins extend past each attachment lug.

4. Emergency exit-Check secure and key removed.

★ 5. Crew/passenger briefing-As required. Refer to passenger briefing in Section VI.

8-21. BEFORE STARTING ENGINES.

∗ 1. Oxygen system-Set (PULL ON CREW READY/SYS READY).

2. Circuit breakers-Check circuit breakers in.

*3. Overhead panel-Check.

a. LIGHT DIMMING controls-As required.
b. Cabin air mode switch-OFF.
c. Bleed air valves-ENVIRO OFF/PNEU ONLY.
d. ICE & RAIN switches-OFF (Ice vane-RETRACT/OFF).
e. INTR LIGHT switches-As required.
f. EXTERIOR LIGHT switches-As required.
g. MASTER PANEL LIGHTS switch-As required.
h. INVERTER switches-OFF.
i. AVIONICS MASTER POWER switch-OFF.
j. AUTOFEATHER switch-OFF.
k. ENVIRONMENTAL switches-As required.
l. No. 1 ENGINE START switches-OFF.

m. MASTER switch - OFF.
n. No 2 ENGINE START switches OFF.

*4. Fuel panel switches Check.
a. STANDBY PUMP switches - OFF.
b. Auxiliary transfer switches - AUTO.
c. CROSSFEED switch - OFF.

5. Magnetic compass - Check for fluid, heading, and current deviation card.
6. CLOCK and MAP lights - OFF.

CAUTION

Movement of the power levers into REVERSE range while the CONDITION levers are in FUEL CUT-OFF may result in bending and damage to control linkage.

*7. Pedestal controls - Set.
a. POWER levers - IDLE.
b. PROP levers - HIGH RPM.
c. CONDITION levers - FUEL CUTOFF.
d. FLAPS - UP

8. Lower console switches - Set.
a. Avionics - As required.
b. RUDDER BOOST switch - ON.

9. Gear alternate engage and ratchet handles - Stowed.
10. Free air temperature gage - Check. Note current reading
11. Pilot's instrument panel - Check and set.
a. VOR/NAV and COMPASS switches - #1.
b. MIC switch - HEADSET.
c. GYRO switch - SLAVE.
d. Flight instruments - Check instrument for protective glass, warning flags (10), static readings, and heading correction card. TM 55-1510-218-10
e. Radar - Off.
f. PROP SYN switch - OFF.
g. Engine instruments - Check instrument for protective glass, and static readings.

12. Copilots instrument panel - Check and set.
a. Copilot's flight instruments - Check instruments for protective glass, warning flags (5), and static readings.
b. Copilot's COMPASS and VOR/NAV switches - #2.
c. Copilot's MIC switch - HEADSET.
d. Copilot's GYRO switch - SLAVE.

13. Subpanel - Check and set
a. Engine fire protection test switch - OFF.
b. Landing, taxi, and deice lights - OFF.
c. LDG GEAR CONTR - Recheck DN.
d. RECOG lights - OFF.
e. PILOT'S' STATIC AIR SOURCE - NORMAL.

CAUTION

Do not use alternate static source during takeoff and landing except in an emergency. Pilot's instruments will show a variation in airspeed and altitude.

* 14. Fuel pumps/crossfeed operation Check as follows:
a. FIRE PULL handles - Pull.
b. STANDBY PUMP switches - ON.
c. Battery switch - ON.
d. #1 and #2 FUEL PRESS warning lights - Illuminated.
e. FIRE PULL handles - In.

f. #1 and #2 FUEL PRESS warning lights - Extinguished.
g. STANDBY PUMP switches - STANDBY PUMP.
h. #1 and #2 FUEL PRESS warning lights - Illuminated.
i. CROSSFEED - Check. Check system operation by activating switch momentarily left then right, noting that #1 and #2 FUEL PRESS warning lights extinguish and that the FUEL CROSSFEED advisory light illuminates as switch is energized.
j. Battery switch - OFF (GPU start).

*15. GPU - As required.
*16. EXTERNAL POWER advisory light - As required
*17. Battery switch - ON.
18. Annunciator panels - Test as follows:
a. Check illumination of the MASTER CAUTION, MASTER WARNING, NO. 1 FUEL PRESS, NO. 2 FUEL PRESS, L BL AIR FAIL, R BL AIR FAIL, INST AC warning lights and #1 DC GEN, #1 INVERTER, #2 INVERTER, and the #1 NO FUEL XFR and #2 NO FUEL XFR (if applicable) caution lights
b. ANNUNCIATOR TEST switch - Press and hold. Check that all lights in both annunciator panels, FIRE PULL handle lights. marker beacon lights, MASTER CAUTION and MASTER WARNING lights are illuminated. Release switch and check that all lights except those in step (a) are extinguished.
c. MASTER CAUTION and MASTER WARNING lights - Press and release. Both lights should extinguish.

*19. Stall and gear warning system - Check as follows:
a. STALLWARN TEST switch - TEST. Check that warning horn sounds.
b. LDG GEAR WARN TEST switch - TEST. Check that warning horn sounds and that the LDG GEAR CONTR handle warning lights (2) illuminate.

20. Engine fire protection system ***CDF*** C-12 aircraft prior to C-12F serial 86-60084-Check as follows:
a. FIRE DETECTOR TEST switch - Rotate switch counterclockwise to check three DETR positions. FIRE PULL handles should illuminate in each position. MASTER WARNING must be reset in each position.
b. FIRE DETECTOR TEST switch - Rotate switch counterclockwise to check two EXTGH position. SQUIB OK light, associated EXTGH DISCH caution light and MASTER CAUTION light should illuminate in each position.

21. Engine fire protection system ***F*** C-12F aircraft serials 86-60084 thru 8660089 - Check as follows:
a. ENGINE FIRE PROTECTION TEST switches - Hold switches to DET position, check that FIRE PULL handle warning lights, and MASTER WARNING lights illuminate.
b. ENGINE FIRE PROTECTION TEST switches - Hold switches to EXT position, check that SQUIB OK and PUSH TO EXT FIRE annunciators, and MASTER WARNING lights illuminate.

NOTE

If MASTER WARNING is cancelled between tests, it may not re-illuminate.

8-22. * FIRST ENGINE START (BATTERY START).

Starting procedures are identical for both engines except that second engine generator is kept off line after the second engine start to allow performing the current limiters check. When making a battery start, the right engine should be started first. When making a ground power unit (GPU) start, the left engine should be started first due to the GPU receptacle being located adjacent to the right engine. Normally, only one engine is started utilizing the GPU, reverting to the BATTERY START procedure for the second engine start. A crew member should monitor the outside observer throughout the engine start.

1. EXTERIORLIGHTS switches - As required.

2. Propeller - Clear.

3. Ignition and engine starter switch - ON. IGN ON light should illuminate associated FUEL PRESS light should extinguish.

CAUTION

If the ignition does not occur within 10 seconds after moving condition lever to LOW IDLE, initiate ENGINE CLEARING procedure. If for any reason a starting attempt is discontinued, the entire starting sequence must be repeated after allowing the engine to come to a complete stop (1 minute minimum).

4. CONDITION lever (after N1 RPM stabilizes, 12% for 5 seconds minimum) - LOW IDLE.

CAUTION

Monitor TGT to avoid a hot start. If there is a rapid rise in TGT, be prepared to abort the start before limits are exceeded. During starting, the maximum allowable TGT is 1000'C for five seconds. If this limit is exceeded, use ABORT START procedure and discontinue start. Enter the peak temperature and duration on DA Form 2408-13.

5. TGT and N1 - Monitor (TGT 1000 C maximum N1 ***CD*** 52%, ***F*** 56% minimum).
6. Oil pressure - Check (60 PSI minimum).
7. Ignition and engine starter switch - OFF after 50% N1.
8. CONDITION lever - HIGH IDLE. Monitor TGT as the condition lever advanced.
9. Generator switch - RESET, then ON.

8-23. *SECOND ENGINE START (BATTERY START).

1. First engine generator load 50% or less - GEN switch OFF.
2. Propeller - Clear.
3. Ignition and engine starter switch - ON. IGN ON light should illuminate and associated FUEL PRESS light should extinguish.

CAUTION

If ignition does not occur within 10 seconds after moving condition lever to LOW IDLE, initiate ENGINE CLEARING procedure. If for any reason a starting attempt is discontinued, the entire starting sequence must be repeated after allowing the engine to come to a complete stop (1 minute minimum).

4. CONDITION lever (after N1 RPM stabilizes above 12% for 5 seconds minimum) - LOW IDLE.
5. Generator switch (first engine) - RESET then ON.

CAUTION

Monitor TGT to avoid a hot start. If there is a rapid rise in TGT, be prepared to abort the start before limits are exceeded. During staring, the maximum allowable TGT is 1000°C for five seconds. If this limit is exceeded, use ABORT START procedure and discontinue start. Enter the peak temperature and duration on DA Form 2408-13.

6. TGT and N1 - Monitor (TGT 1000°C maximum, N1 ***CD*** 52%, ***F*** 56% minimum).
7. Oil pressure - Check (60 PSI minimum).
8. Ignition and engine starter switch - OFF after 50% N1.
9. BATTERY CHARGE, light ON - Check.
10. INVERTER switches - ON, check is INVERTER lights OFF.
11. Second engine generator switch - RESET, then ON
12. CONDITION levers - As required.
13. Red anti-collision light - Reset.

NOTE

To reset, turn OFF approximately 5 seconds, then ON.

NOTE

When voltage drops below approximately 20 volts, the red anti-collision light may become inoperative.

8-24. ABORT START.

1. CONDITION lever - FUEL CUTOFF.
2. Ignition and engine starter switch - START ONLY.
3. TGT - Monitor for drop in temperature.
4. Ignition and engine starter switch - OFF.

8-25. ENGINE CLEARING.

1. CONDITION lever - FUEL CUTOFF.
2. Ignition and engine starter switch - OFF (1 minute minimum).

CAUTION

Do not exceed starter limitation of 40 seconds on and 60 seconds off for two starting attempts and engine clearing procedure. Allow 30 minutes off before additional starter operation.

3. Ignition and engine starter switch - STARTER ONLY (15 seconds minimum, 40 seconds maximum).
4. Ignition and engine starter switch - OFF.

8-26. *FIRST ENGINE START (GPU START).

1. EXTERIOR LIGHT switches - As required.
2. Propeller - Clear.
3. Ignition and engine starter switch - ON IGN ON light should illuminate and associated FUEL PRESS light should extinguish.

CAUTION

If ignition does not occur within 10 seconds after moving condition lever to LOW IDLE, initiate ENGINE CLEARING procedure. If for any reason a starting attempt is discontinued, the entire starting sequence must be repeated after allowing the engine to come to a complete stop (1 minute minimum).

4. CONDITION lever (After N1, RPM stabilizes above 12% for 5 seconds minimum) - LOW IDLE.

CAUTION

Monitor TGT to avoid a hot start. If there is a rapid rise in TGT, be prepared to abort the start before limits are exceeded. During engine start, the maximum allowable TGT is 1000°C for five seconds. If this limit is exceeded, use ABORT START procedures and discontinue start. Record peak temperature on DD Form 2408-13.

5. TGT and N1 - Monitor (TGT 1000°C maximum, N1 ***CD*** 52%, ***F*** 56% minimum).
6. Oil pressure - Check (60 PSI minimum).
7. Ignition and engine starter switch - OFF after 50% N1
8. CONDITION lever - HIGH IDLE. Monitor TGT as the condition lever is advanced.
9. GPU disconnect - As required.

CAUTION

Do not turn on generators with GPU connected.

10. GEN switch(GPU disconnected) - RESET, then ON.

8-27. *SECOND ENGINE START (GPU START).

1. Propeller - Clear.
2. Ignition and engine starter switch ON IGN ON - light should illuminate and associated FUEL PRESS light should extinguish.

CAUTION

If ignition does not occur within 10 seconds after moving condition lever to LOW IDLE, initiate ENGINE CLEARING procedure. If for any reason a starting attempt is discontinued, the entire starting sequence must be repeated after allowing the engine to come to a complete stop (1 minute minimum).

3. CONDITION lever (after N1 RPM stabilizes, above 12% for 5 seconds minimum) - LOW IDLE.

CAUTION

Monitor TGT to avoid a hot start. If there is a rapid rise in TGT, be prepared to abort the start before limits are exceeded. During engine start, the maximum allowable TGT is 1000°C for five seconds. If this limit is exceeded, use ABORT START procedure to discontinue start. Record the peak temperature and duration on DA Form 2408-13.

4. TGT and N. - Monitor (TGT 1000 °C maximum N1 ***CD*** 52%, ***F*** 56% minimum).
5. Oil pressure - Check (60 PSI minimum).
6. Ignition and engine starter switch - OFF after 50% N_1.
7. Right PROP lever - FEATHEFR
8. GPU - Disconnect.
9. Right PROP lever - HIGH RPM.
10. INVERTER switches - ON, check INVERTER lights OFF.
11. GEN, switches - RESET, then ON.
12. CONDITION levers - As required.
13. Red anti-collision light - Reset.

NOTE

To reset, turn OFF approximately 5 seconds, then ON.

NOTE

When voltage drops below approximately 20 volts, the red anti-collision light may become inoperative.

8-28. BEFORE TAXIING.

*1. Bleed air valves - OPEN/BOTH.

*2. Brake deice - As required. To activate the brake deice system proceed as follows:
   a. Bleed air valves - OPEN/BOTH.
   b. CONDITION levers - HIGH IDLE.
   c. BRAKE DEICE switch - DEICE/ON. Check BRAKE DEICE light illuminated.

NOTE

Once brakes have been deiced, the CONDITION lever may be returned to LOW IDLE.

*3. Cabin air mode and temperature switches Set as desired.

NOTE

For maximum cooling on the ground, turn the bleed air valve switches to ENVIRO OFF/PNEU ONLY position.

*4. AC/DC power Check for:
   a. AC frequency - 394 406 Hz
   b. AC voltage - 104 - 124 VAC
   c. DC load - 85% maximum per generator.
   d. DC voltage - 28 - 28.5.

*5. AVIONICS MASTER POWER switch ON.

WARNING

Do not operate radar in congested areas.

CAUTION

Do not operate the weather radar system in a confined space where the nearest metal wall is 50 feet or less from the antenna reflector. Scanning such surfaces within 50 feet of the antenna reflector may damage receiver crystals.

*6. AVIONICS controls - As required.

NOTE

The radar system should be tested before each flight on which the system is to be used. If no significant weather is in the immediate area of the aircraft, the system should be left in the OFF position.

*7. Electric elevator trim, autopilot/flight director operation (C-12 ***CD*** Aircraft Prior to C-12D Serial 84-24375) - Check as follows:

a. Pilot and copilot PITCH TRIM switches - Press to NOSE UP and NOSE DN positions, singularly and in pairs. Check that trim wheel moves in proper direction and operates only when trim switches are pressed in pairs. Any deviation requires that electric elevator trim be turned off and flight conducted using only manual trim.
b. DISC TRIM switch - Press to second detent and verify that electric trim disconnects and that ELEV TRIM light extinguishes.
c. Flight Director (FD) and Radio Magnetic Indicator (RMI) warning flags masked - Check.

NOTE

Since the pressure of airflow that normally opposes movement of control surfaces is absent during preflight check, it is possible to get a hard over control surface deflection if an autopilot command is allowed to remain active for any appreciable length of time. Move turn knob and pitch thumbwheel only enough to check operation, then return them to the center position.

d. Select HDG mode - Check.
e. Horizontal Situation Indicator (HSI) heading marker under lubber line and vertical needle centered - Set.
f. Engage autopilot and check controls stiff - Check.
g. Move HSI heading marker 10° left and right and verify that FD and control wheels respond in the appropriate direction - Check.
h. Press AP/YD disengage switch to first detent and verify that autopilot disengages and that flight controls are free - Check.
i. Elevator trim - Check on.
j. Engage autopilot - Check.
k. Command 5° trim UP with AP pitch wheel and verify that manual trim wheel moves nose UP and AP trim light indicates UP trim - Check.
l. Press PITCH TRIM switch NOSE DN and verify that autopilot disengages and AUTO PILOT TRIM FAIL and MASTER WARNING lights illuminate - Check.

NOTE

The AP TRIM FAIL annunciator will extinguish by pressing the AP/YD disconnect button on the control wheel to the first detent.

m. Repeat steps g through i above using opposite commands.
n. Engage autopilot - Check.
o. Move HSI heading marker to command a bank on Flight Director - Check.
p. Press go-around switch and verify that GA light illuminates, autopilot disengages, and that Flight Director commands a wings level, 7° nose-up attitude - Check.
q. Press TEST switch (pilot's HRI) and verify that attitude display indicates an additional 10° pitch up and 20° right bank - Check.

*8. Autopilot trim fail system (C-12 ***CD*** Aircraft Prior to C-12D Serial 84-24375) - Check as follows:

a. Engage autopilot command DN with AP pitch wheel and engage, AUTO PILOT TRIM TEST switch when elevator trim wheel starts to rotate.
b. Verify that autopilot disengages and AP TRIM FAIL and MASTER WARNING lights illuminate within 10 seconds.

*9. Automatic flight control system (C-12 ***DF*** Aircraft (C-12D Aircraft Serials 84-24375 thru 8424380) - Check as follows:

a. Altitude alert.

NOTE

Pause a few seconds after each step to allow time for the proper indications.

(1) Set alert controller more than 1000 feet above altitude indicated on pilot's altimeter.

The pilot's altimeter alert light should be extinguished.

(2) Decrease the alert controller to within 1000 feet of the pilot's altimeter setting. The alert light should illuminate.

(3) Decrease the controller to less than 250 feet abovethe pilot's altimeter setting. The alert light should extinguish.

(4) Increase the controller to 300 ±50 feet above the pilot's altimeter indication and check that the alert light illuminates.

(5) Set the desired altitude.

b. Autopilot.

(1) Autopilot controller UP TRIM, DN TRIM annunciators - CHECK not illuminated.

CAUTION

A steady illumination of UP TRIM or DN TRIM annunciator indicates that the automatic synchronization is not functioning and the autopilot should not be engaged.

(2) Turn knob - Center.

(3) Elevator trim control switch - ON.

(4) Control wheel - Hold to mid travel.

(5) AP button - Press. AP ENGAGE and YD ENGAGE annunciators on autopilot controller will flash. Servo clutches will engage. FD flag on ADI should be in view.

(6) Control movement - Check.

(a) Rudder pedals Overpower slowly. YD ENGAGE annunciator stops flashing.

(b) Control wheel - Overpower slowly in both pitch and roll axis. AP ENGAGE annunciator stops flashing. FD flag on ADI retracts.

WARNING

If autopilot or yaw damper disengages during overpower test, or if AP ENGAGE or YD ENGAGE annunciator continues to flash, the system is considered non-operative and should not be used. The elevator trim system must not be forced beyond the limits which are indicated on the elevator trim tab indicator.

(7) Elevator trim follow-up - Check.

(a) Control wheel - Hold aft of mid travel. Trim wheel should run nose down after approximately 3 seconds. Trim down annunciator should illuminate after approximately 8 seconds.

(b) Control wheel - Hold forward of mid travel. Trim wheel should run nose up after approximately 3 seconds, trim up annunciator should illuminate after approximately 8 seconds, and AP TRIM FAIL annunciator and MASTER WARNING lights should illuminate after approximately 15 seconds.

(8) AP/YD & TRIM DISC Button - Depress through second level. Autopilot and yaw damper should disengage and ELEC TRIM OFF annunciator should illuminate. AP ENG and YD ENG annunciators on instrument panel should flash 5 times.

(9) Elevator trim control switch - OFF, then ON. (ELEC TRIM OFF annunciator should extinguish.)

(10) AP - Re-engage and overpower another time.

(11) Turn controller - Check that control wheel follows in each applied direction, then center.

(12) Pitch wheel - Check that trim responds to pitch wheel movement. (UP TRIM and DN TRIM annunciators may illuminate.)

(13) Heading bug - Center and engage HDG. Check that control follows a turn in each direction.
(14) Disengage AP by selecting GA. Check that AP disengages and FD commands 7° nose up, wings level attitude.

10. Electric elevator trim ***D2F*** - Check.
    a. Elevator trim switch - ON.
    b. Pilot and copilot trim switches - Check operation.

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 element denotes a system malfunction. The electric elevator trim control switch must then be turned OFF and flight conducted by operating the elevator trim wheel manually. Do not use autopilot.

(1) Pilot and copilot. Check individual element for no movement of trim, then check proper operation of both elements.
(2) Check pilot switches override copilot switches while trimming in opposite directions, and trim moves in direction commanded by pilot.

    c. Check pilot and copilot trim disconnects while activating trim.
    d. Elevator trim switch - OFF then ON (ELEC TRIM OFF annunciator extinguishes.)

10A. Ground proximity altitude advisory system (GPAAS) Check as follows:
    a. GPAAS voice advisory VOL control - Full clockwise.
    b. VOICE OFF switch-indicator - Extinguished.
    c. Audio control panel - Set listening audio level.
    d. VA FAIL annunciator light - Extinguished.
    e. Radio altimeter DH SET control - Set to 200 feet.
    f. Radio altimeter TEST switch - Press and hold. "Minimum, minimum" will be announced once followed by the illumination of the VA FAIL light.
    g. Radio altimeter TEST switch - Release.

11. Avionics - Check and set as required.
12. Flaps - Check.
13. Altimeters - Set and checked.

8-29. * TAXING.

Taxi speed can be effectively controlled by the use of power application and the use of the variable pitch propellers in the BETA range. Normal turns may be made with the steerable nose wheel; however, a turn may be tightened by using full rudder and inside brake as necessary. Turns should not be started with brakes alone, nor should the aircraft be pivoted sharply on one main gear.

DF If the aircraft must be taxied in conditions of mud, tall grass or other conditions of high surface friction, taxi at a slow but steady speed using power as necessary and minimum braking. Hold the yoke full aft to reduce pressure on the nose wheel. Attempt to prevent unnecessary stops on a soft surface.

1. Brakes - Check.
2. Flight instruments - Check for normal operation.

8-30. ENGINE RUNUP.

CAUTION

Monitor oil temperature closely during ground operation with propellers in FEATHER due to lack of air flow over oil cooler.

1. Propeller feathering - Check by pulling propeller levers aft through detent to FEATHER. Check that propeller will feather, then advance levers to the HIGH RPM position.

*2. AUTOFEATHER - Check as follows:
    a. Condition levers LOW IDLE.
    b. AUTOFEATHER switch - Hold to TEST.
    c. POWER levers - Advance until AUTO FEATHER lights are illuminated. (approximately 22% torque).

d. Number 1 POWER lever - Retard and check:
   (1) At 16 - 21% torque - #2 AUTOFEATHER light out.
   (2) At 9 - 14% torque Both AUTOFEATHER lights out (propeller starts to feather).

e. Number 1 POWER lever - Approximately 22% torque.

f. Repeat steps (b) and (d) for number 2 engine.

   g. POWER levers - IDLE (both lights out, neither propeller feathers).

3. Overspeed governors - Check as follows:
   a. Power levers - Set approximately 1950 RPM (both engines).
   b. Propeller governor test switch - Hold to TEST position.
   c. #1 propeller RPM 1830 to 1910 - Check.
   d. Repeat steps b and c for # 2 engine.
   e. Power levers - Set 1800 RPM.

*4. Primary govenors - Check as follows:
   a. Power 1800 RPM - Set
   b. PROP levers aft to detent - Set.
   c. Propeller RPM 1600 to 1640 - Check.
   d. PROP levers to HIGH RPM - Set.

*5. Ice vanes - Check as follows:
   a ICE VANE - switches to EXTEND/ON. Verify torque drop, TGT increase, and illumination of ICE VANE EXT light - Check.
   b. ICE VANE switches to RETRACT Off. Verify return to original torque and TGT, and ICE VANE light extinguished - Check.

6. CONDITION levers HIGH IDLE - Set.
7. POWER levers IDLE - Set

*8. Anti-ice and deice systems - Check as follows:
   a. BEACON - Off.
   b. Generator switch (either) - OFF.
   c. LEFT PITOT switch ON - Check for loadmeter rise, then off.
   d. RIGHT PITOT switch ON - Check for loadmeter rise, then off.
   e. STALL WARN switch ON - Check for loadmeter rise, then off.
   f. FUEL VENT switch ON - Check for loadmeter rise, then off.

NOTE

If PITOT, FUEL VENT, and STALL WARN systems do not indicate a loadmeter rise when checked activate windshield anti-ice and recheck.

   g. WSHLD ANTI-ICE switches NORMAL - Check PILOT and COPILOT (individually) for loadmeter rise, then OFF.
   h. PROP switches - INNER and OUTER/MANUAL (momentarily), check for loadmeter rise.
   i. DEICE switch SINGLE CYCLE AUTO - Check for a drop in pneumatic pressure and wing deice boots inflation and after 6 seconds for a second drop in pneumatic pressure.
   j. GEN switch - RESET, then ON.
   k. BEACON - As required (DAY or NIGHT).

*9. Pneumatic pressure Check as follows:
   a. Left bleed air valve switch - OFF.
   b. Pneumatic pressure 12 to 20 PSI - Check.
   c. L BL AIR OFF light on - Check.
   d. Right bleed air valve switch - OFF.
   e. L & R BL AIR OFF and L & R BL AIR FAIL lights on - Check.
   f. Left bleed air valve switch - OPEN/BOTH.
   g. L BL AIR OFF and L & R BL AIR FAIL lights off, and pneumatic pressure at 12 20 PSI - Check.
   h. Right bleed air valve switch - OPEN/BOTH.
   i. BLAIR OFF light off - Check.

*10. Automatic flight control system (C-12 r I Aircraft (C-12D Aircraft Serials 84-24375 thru 84-24380) - Check

**11. Pressurization system Check and set as follows:
   a. CABIN DOOR caution light extinguished - Check

b. Vent windows closed - Check.
c. Bleed air valve switches OPEN/BOTH - Check.
d. Cabin altitude 500 feet lower than field pressure altitude - Set.
e. CABIN PRESS switch - TEST (hold).
f. CABIN CLIMB gage descending indication - Check, then release TEST switch.
g. ACFT ALT set to planned cruise altitude plus 500 feet - Check (if this setting does not result in CABIN ALT indication of at least 500 feet over takeoff field pressure altitude, adjust as required).
h. RATE control set between 9 and 12 o'clock - Check.

12. CONDITION levers - As required.
13. WINDSHIELD ANTI-ICE - As required.

NOTE

If windshield anti-ice is needed prior to takeoff, use normal setting for a minimum of 15 minutes prior to selecting high temperature to provide adequate preheating and minimize effects of thermal shock.

8-31. *BEFORE TAKEOFF.

1. AUTOFEATHER switch - ARM.
2. Bleed air valves - As required.
3. ICE & RAIN switches - As required. As a minimum, the PITOT, STALL WARN, and FUEL VENT switches shall be on.
4. FUEL panel - Check fuel quantity and switches positions.
5. Flight and engine instruments - Check for normal indications.
6. CABIN CONTROLLER - Set.
7. Annunciator panels - Check (Note indications).
8. PROP levers - HIGH RPM.
9. Flaps - As required.
10. Trim - Set.
11. Avionics - Set.
12. Flight Controls - Check.

*13. Departure briefing - Complete.

8-32. *LINE UP.

1. Altitude alerter (C-12 ***DF*** Aircraft (C-12D Aircraft Serials 84-24375 thru 84-24380) - Check. Set as required.
2. Transponder - As required.
3. Engine autoignition switch - ARM.
4. Power stabilized - Check 25% minimum.
5. CONDITION levers - LOW IDLE.
6. Lights - As required.

NOTE

Landing lights may be used for takeoff to assist in avoiding bird strikes and to make the aircraft more visible while operating in congested areas.

8-33. TAKEOFF.

To aid in planning the takeoff and to obtain maximum aircraft performance, make full use of the information affecting takeoff shown in Chapter 7. The data shown is achieved by setting brakes, setting TAKEOFF POWER, and then releasing brakes. When runway lengths permit, the normal takeoff may be modified by starting the takeoff after power has been stabilized at approximately 25% torque, then applying power smoothly so as to attain full power no later than 65 KIAS. This will result in a smoother takeoff but could increase takeoff distance by approximately 600 feet.

a. Normal Takeoff. After LINE UP procedures have been completed, release brakes and smoothly apply power to within 5% of target. Power should be applied at a rate that will produce takeoff power by 40 KIAS. Maintain directional control with nosewheel steering, rudder, and differential power, while maintaining wings level with ailerons. The pilot should retain a light hold on the power levers throughout the takeoff and be ready to initiate ABORT procedures if required. The copilot should insure that the AUTOFEATHER advisory lights are illuminated (if applicable), adjust and maintain power at the exact TAKEOFF POWER settings, and monitor all engine instruments. Rotate at the recommended rotation speed (Vr) and establish the climb attitude (9° to 16°) that will attain best rate-of-climb airspeed (Vy) during the initial climb. Rotation should be at a rate that will allow liftoff at liftoff airspeed (Vlof).

NOTE

Maximum demonstrated crosswind component is 25 knots.

b. *Crosswind Takeoff.* Position the aileron control into the wind at the start of the takeoff roll to maintain a wings level attitude. Under strong crosswind conditions, leading with upwind power at the beginning of the takeoff roll will assist in maintaining directional control. As the nosewheel comes off the ground, the rudder is used as necessary to prevent turning (crabbing) into the wind. Rotate in a positive manner to keep from side-skipping as weight is lifted from the chock struts. To prevent damage to the landing gear in the event that the aircraft were to settle back onto the runway, remain in "slipping" flight until well clear of the ground; and then crab into the wind to continue a straight flight path. (Chapter 7, CROSSWIND TAKEOFF Chart.)

c. Minimum Run Takeoff

WARNING

Spectacular takeoff performance can be obtained by lifting off at speeds below those recommended in Chapter 7. However, control of the aircraft will be lost if an engine failure occurs immediately following liftoff until a safe speed can be attained. Except during soft field takeoff liftoff below recommended speeds will not be performed.

Minimum run takeoffs are performed with flaps extended to 40% although at some conditions, use of flaps during takeoff may result in the inability to attain positive single-engine climb if an engine fails immediately after liftoff.

To compensate for torque effect during the beginning of the takeoff roll, align the aircraft with the nose approximately 10° right of centerline. After LINE UP procedures have been completed, hold brakes firmly and apply TAKEOFF POWER, allowing for some increase in power as airspeed increases during the takeoff roll. Copilot action is the same as for normal takeoff. Release brakes and maintain directional control and nosewheel steering and rudder. Do not use brakes unless absolutely necessary. Hold the elevators in a neutral position, maintaining wings level with ailerons. Allow the aircraft to roll with its full weight on the wheels until the recommended rotation speed (Vr) is reached. At this speed rotate smoothly and firmly at a rate that will allow liftoff at liftoff air speed (Vlof). When flight is assured, retract the landing gear.

d. Obstacle Clearance Climb. Follow procedures as outlined for a minimum run takeoff, to the point of actual liftoff. When flight is assured, retract the landing gear and establish a wings level climb attitude, maintaining the computed obstacle clearance airspeed (Vx). Climb at this speed until clear of the obstacle. After the obstacle is cleared, lower the nose slowly and accelerate to best rate-of-climb airspeed (Vy). Retract flaps after attaining single engine best rate-of-climb airspeed (Vyse).

NOTE

The best angle-of-climb speed (Vx) is very close to single engine power-off stall speed. To provide for a margin of safety in the event of engine failure immediately after takeoff, the obstacle clearance airspeed value is used in lieu of true Vx for maximum angle takeoff climbs. Takeoff performance data shown in Chapter 7 is based on the use of obstacle clearance climb speed.

e. Soft Field Takeoff. If a takeoff must be made in conditions of mud, snow, tall grass, rough surface or other conditions of high surface friction, the following procedure should be used. Set flaps at TAKEOFF (40%), align the aircraft with the runway, and with the yoke held firmly aft, begin a slow steady acceleration, avoiding rapid or transient accelerations. Continue to hold full aft yoke so as to transfer the weight of the aircraft from the wheels to the wings as soon as possible. When the aircraft rotates, control pitch attitude (nose) so as to lift off from the soft surface at the slowest possible speed. When airborne, level off immediately in ground effect just above the surface, and accelerate to normal lift-off airspeed (Vlof) before rotating to climb attitude and retracting the landing gear. Consider the effects of snow or mud on gear retraction as applicable.

8-34. AFTER TAKEOFF.

WARNING

Immediately after takeoff, the pilot flying the aircraft should avoid adjusting controls located on the aft portion of the extended pedestal to preclude inducing spatial disorientation due to coriolis illusion.

After the aircraft is positively airborne and flight is assured, retract the landing gear. Adjust pitch attitude as required (9° to 16°) to maintain best rate-of-climb airspeed (Vy). If required, limit climb attitude to 16° and accept a higher airspeed during the initial climb. Retract flaps after attaining best single-engine rate-of-climb airspeed (Vyse) and then retract the landing taxi lights. The copilot should continue to maintain power at the computed setting and to monitor instruments. At single-engine maneuvering attitude, adjust pitch attitude to obtain cruise climb airspeed (or slow cruise if required). As cruise climb airspeed is attained, adjust power to the climb power setting (maximum continuous, maximum climb, or as required.) The copilot then activates the YAW DAMP and checks that the cabin is pressurizing. Both pilots check the wings and nacelles for fuel or oil leaks. The procedural steps after takeoff are as follows:

1. GEAR - UP.
2. FLAPS - UP.
3. LANDING LIGHTS - OFF.
4. Climb power - Set.
5. PROP SYNC switch - As required.
6. YAW DAMP switch - As required.
7. AUTOFEATHER switch - As required.
8. CABIN SIGNS switch - As required.
9. BRAKE DEICE - As required.
10. Cabin pressurization - Check, adjust RATE control knob so that cabin rate-of-climb equals one-third aircraft rate-of climb.
11. Wings and nacelles - Check.

8-35. CLIMB.

a. Cruise Climb. Cruise climb is performed at a speed which is the best combination of climb, fuel burn-off, and distance covered. Set propellers at 1900 RPM and torque at 100% (or maximum climb TGT). Adhere to the following airspeed schedule as closely as possible.

	C	***DF***
SL to 10,000 feet	160	155 KIAS
10,000 to 20,000 feet	140	135 KIAS
20,000 to 25,000 feet	130	125 KIAS
25,000 to 31,000 feet	120	115 KIAS

Maneuvering should be held to a minimum, and climbing turns should not exceed 20-25° bank angle. Banks of more than 25° materially effect climb performance, reducing rate of climb through loss of vertical lift, while banks of 30° or more may cause passenger discomfort due to imposing high load factors.

b. Climb Maximum Rate. Maximum rate of climb performance is obtained by setting propellers at 2,000 RPM, torque at 100% (or maximum climb TGT), and maintaining best rate-of-climb airspeed. This airspeed will vary with gross weight and must also be reduced as available power is reduced with altitude. As a rule of thumb, reduce airspeed approximately one knot for each 2,000 feet of altitude above that altitude where maximum power cannot be maintained. Refer to Chapter 7 for rate of-climb airspeed for specific weights.

8-36. CRUISE.

Cruise power settings are entirely dependent upon the prevailing circumstances and the type of mission being flown. Refer to Chapter 7 for airspeed, power settings, and fuel flow information. The following procedures are applicable to all cruise requirements.

1. Power - Set. Refer to the cruise power graphs contained in Chapter 7. To account for ram air temperature increase, it is essential that temperature be obtained at stabilized cruise airspeed. Power is set using RPM and torque as the primary control. Maximum allowable torque must not be exceeded and TGT must also be observed as a separate limit.

NOTE

A new engine operated at the torque value presented in the cruise power charts will show a TGT margin below the maximum cruise limit for the torque value presented in the charts. With ice vanes retracted, if cruise torque settings shown on the cruise power charts cannot be obtained without exceeding TGT limits, the engine should be inspected.

2. ICE & RAIN switches - As required. Insure that anti-ice equipment is activated before entering icing conditions.

NOTE

Ice vanes must be extended when operating in visible moisture at +5°C or less. Visible moisture in any form, clouds, ice crystals, snow, rain, sleet, hail, or any combination of these.

3. CABIN SIGNS switch - As required.
4. Auxiliary fuel gages - Monitor. Insure that fuel is being transferred from auxiliary tanks. (Chapter 2, Section IV.)
5. Altimeters - Check. Verify that altimeter setting complies with transition altitude requirement.
6 Engine instrument indications - Noted. Check all engine instruments for normal indications.
7. RECOG lights - As required.

8-37. DESCENT.

Descent from cruising altitude should normally be made by letting down at cruise airspeed with reduced power. Refer to Chapter 7 for power settings and rates of descent.

NOTE

CABIN pressure CONTROLLER should be adjusted prior to starting descent.

a. DESCENT - Max Rate (Clean). To obtain the maximum rate of descent in clean configuration, perform the following:

1. Cabin pressurization - Set. Adjust CABIN CONTROLLER dial as required and adjust RATE control knob so that cabin rate of descent equals one-third aircraft rate of descent.
2. CABIN SIGNS switch - As required.
3. POWER levers - IDLE.
4. PROP levers - HIGH RPM.
5. GEAR - UP.
6. FLAPS - UP.
7. Airspeed - Vmo.
8. ICE & RAIN switches - As required.
9. RECOG lights - As required.

b. DESCENT - Max Rate (Landing Configuration). If required to descend at a low airspeed (e.g. to conserve airspace or in turbulence), approach flaps and landing gear may be extended to increase the rate and angle of descent while maintaining the slower airspeed. To perform the maximum rate of descent in landing configuration, perform the following:

1. Cabin pressurization - Set. Adjust CABIN CONTROLLER dial as required and adjust RATE control knob so that cabin rate of descent equals one-third aircraft rate of descent.
2. CABIN SIGNS switch - As required.
3. POWER levers - IDLE.
4. PROP levers - HIGH RPM.
5. FLAPS - APPROACH.
6. GEAR - DN.
7. Airspeed - 181 KIAS maximum.
8. ICE AND RAIN switches - As required.
9. RECOG lights - As required.

8-38. DESCENT - ARRIVAL.

Perform the following checks prior to the final descent for landing:

1. Cabin pressurization - Set. Adjust CABIN CONTROLLER dial as required.
2. CABIN SIGNS switch - As required.
3. ICE AND RAIN switches - As required.
4. WINDSHIELD ANTI-ICE - As required.

NOTE

Set windshield anti-ice to normal or high as required well before descent into icing conditions or into warm moist air to aid in defogging. Turn off windshield anti-ice when descent is completed to lower altitudes and when heating is no longer required. This will preclude possible wind screen distortions.

5. RECOG lights - ON.
6. Radio altimeter (C-12 ***DF*** Aircraft (C-12D Aircraft Serials 84-24375 thru 84-24380) Set MDA/DH as required.
7. Altimeters - Set to current altimeter setting.

*8. Arrival briefing - Complete. Refer to Section VI for arrival briefing outline.

8-39. BEFORE LANDING.

1. CABIN SIGNS switch - BOTH.
2. PROP SYNC switch - OFF.
3. AUTOFEATHER switch - ARM.
4. PROP levers - As required.

NOTE

During approach, propellers should be set at 1900 RPM to prevent glideslope interference (IES approach), provide better power response during approach, and minimize attitude change when advancing propeller levers for landing.

5. FLAPS (below 199 KIAS) - APPROACH.
6. GEAR (below 181 KIAS ***CD*** , 182 KIAS ***F*** - DN.
7. Landing lights (***C*** below 150 KIAS) - As required.
8. BRAKE DEICE - As required.

8-40. OBSTACLE CLEARANCE APPROACH AND MINIMUM RUN LANDING.

When landing over obstacles that require a steeper than normal approach path, or when greater precision is required due to restricted runwav lengths, the "Power Approach/Precision Landing" technique should be employed as follows: Prior to intercepting the descent path, complete the LANDING check and stabilize airspeed (Vref) to 1.2 power-off stall speed in landing configuration (Vso). After intercepting the desired approach angle maintain a constant descent by controlling the descent with power and airspeed with elevator. Transition smoothly from approach to landing attitude. Touchdown should be made on the main gear with the nose slightly high, with power as required to control rate of descent for a smooth touchdown. Immediately after touchdown, allow the nosewheel to make ground contact and apply full reverse power and braking, as required. If possible, remove reverse thrust as the aircraft slows to 40 KIAS to minimize propeller blade erosion.

NOTE

Using 1.2 Vso for approach airspeed will provide increased performance and more responsive control; however, performance data is not available for approach at this slower airspeed.

8-41. LANDING.

Performance data charts for landing computations assume that the runway is paved, level and dry. Additional runway must be allowed when these conditions are not met. Refer to Chapter 7 for landing data. Do not consider headwind during landing computations; however, if landing must be downwind, include the tailwind in landing distance computations. Plan the final approach to arrive at 50 feet over the landing area at APPROACH SPEED (Vref) plus 1/2 wind gust speed. Perform the following procedures as the aircraft nears the runway.

1. AP & YD - Disengaged.
2. GEAR DOWN lights - Check.
3. PROP levers - HIGH RPM.

a. Normal Landing. As the aircraft nears the runway, flare slightly to break the rate of descent and reduce power smoothly to IDLE as the nose of the aircraft is rotated to landing attitude. Avoid the tendency to ride the ground effect cushion while waiting for the aircraft to slow down to a soft landing. As the aircraft touches down, gently lower the nosewheel to the runway and use reversing, brakes, or beta range, as required. If reversing is used, remove reverse power as the aircraft slows to 40 KIAS to minimize propeller blade erosion.

b. Crosswind Landing. When landing in very strong crosswinds, flaps extension should be limited to obtain a faster approach and landing speed. Refer to Chapter 7 for recommended touchdown speeds. Use the "crab-into-the-wind" method to correct for drift during final approach. The "crab" is changed to a slip (aileron into wind and top rudder) to correct for drift during flare and touchdown. After landing, position ailerons as required to correct for crosswind effect.

c. Soft Field Landing. When landing on a soft or unprepared surface such as mud, tall grass, or snow, plan a normal power approach with flaps fully extended. Decelerate to the slowest possible airspeed just prior to touchdown, using power to control the final rate of descent to as slow as possible. Do not stall prior to touchdown as the nose attitude and rate of descent will become unacceptable. On touchdown apply full back (aft) elevator and then reduce power slowly. Do not use brakes unless absolutely necessary. Every precaution must be taken to prevent the nose wheel from digging into the surface.

d. Touch-And-Go Landings. The instructor should select a point on the runway where all pre-takeoff procedures will have been completed prior to the pilot's initial application of power. In selecting this point, prime consideration shall be given to the required accelerate-stop distance pre-computed for the runway in use. The nosewheel should be on the runway and rolling straight before the touch-and-go procedures are initiated. After the pilot applies power to within 5 percent of target, the copilot's (instructor) actions are the same as during a normal takeoff. If training authorizing touch-and-go landings is approved, use the following procedure:

1. PROP levers - HIGH RPM.
2. Flaps - As required.
3. Trim - Set.
4. Power stabilized - Check 25% minimum.
5. Takeoff power - Set.

8-42. GO-AROUND.

When a go-around is commenced prior to the LANDING check, use power as required to climb to, or maintain, the desired altitude and airspeed. If the go-around is started after the LANDING check has been performed, apply maximum allowable power and simultaneously increase pitch attitude to stop the descent. Retract the landing gear after insuring that the aircraft will not touch the ground. Retract the flaps to TAKEOFF, adjusting pitch attitude simultaneously to avoid an altitude loss. Accelerate to best rate-of-climb airspeed (Vy), retracting flaps fully after attaining the Vref speed used for the approach. Perform the following checks:

1. Power - As required.
2. GEAR - UP.
3. FLAPS - UP.
4. LANDING LIGHTS - OFF.
5. Climb power - Set.
6. YAW DAMP - As required.
7. BRAKE DEICE - OFF.

8-43. AFTER LANDING.

Complete the following procedures after the aircraft has cleared the runway.

1. CONDITION levers - As required
2. Engine autoignition switch - OFF.
3. ICE AND RAIN switches - OFF.
4. FLAPS - UP.
5. XPNDR (transponder) - As required.
6. RADAR - As required.
7. LIGHTS - As required.

8-44. ENGINE SHUTDOWN.

NOTE

To prevent sustained loads on rudder shock links, the aircraft should be parked with the nose gear centered.

1. BRAKE DEICE - OFF.
2. Parking brake - Set.
3. LANDING/TAXI light - OFF.
4. Cabin air mode switch - OFF.
5. AUTOFEATHER switch - OFF.
6. VENT and AFT VENT blower switches - AUTO.
7. INVERTER switches - OFF.
8. Battery condition - Check as required. If BATTERY CHARGE light is illuminated during engine shutdown, turn BATT switch OFF momentarily and note loadmeter reading. After 90 seconds, momentarily turn switch OFF again and note loadmeter reading. Battery condition is unsatisfactory if BATTERY CHARGE light remains illuminated and charge current fails to decrease between checks.
9. TGT - Check TGT must be 6600C or below for one minute prior to shutdown.

CAUTION

Monitor TGT during shutdown. If sustained combustion is observed, proceed immediately to ABORT START procedure.

10. PROP levers - FEATHER.

11. CONDITION LEVERS - FUEL CUTOFF.

WARNING

Do not turn EXTERIOR LIGHTS OFF until propeller's rotation has stopped.

12. EXTERIOR LIGHTS - OFF.
13. MASTER PANEL LIGHTS - OFF.
14. AVIONICS MASTER switch - OFF.
15. MASTER SWITCH - OFF.
16. Key lock switch - OFF.
17. Oxygen system - OFF.

8-45. BEFORE LEAVING AIRCRAFT.

1. Wheels - Checked.
2. Parking brake - As required.

NOTE

Brakes should be released after chocks are in place (ramp conditions permitting).

3. Flight controls - Locked.

N 4. OVERHEAD FLOOD LIGHTS - OFF.

5. STANDBY PUMPS - OFF.
6. XPNDR (transponder) - OFF.
7. Windows - As required. Do not leave passenger windows in polarized (dark) position.
8. Emergency exit lock - As required.
9. Galley power switches - OFF.
10. Aft cabin light - OFF.
11. Door light - OFF.

CAUTION

If strong winds are anticipated while the aircraft is unattended, the propellers shall be secured to prevent their windmilling with zero engine oil pressure.

12. Walk-around inspection - Complete. Conduct a thorough walk-around inspection, checking for damage, fluid leaks, and levels. Check that covers, tiedowns, restraints, and chocks are installed as required.
13. Aircraft forms - Complete. In addition to established requirements for reporting any system defects, unusual and excessive operation such as hard landings, etc., the flight crew will also make entries on DA Form 2408-13 to indicate when limits in the Operator's Manual have been exceeded.
14. Aircraft secured - Check; lock cabin door as required.

NOTE

A cold oil check is unreliable. Oil should be checked within 10 minutes after stopping engines.

Section III. INSTRUMENT FLIGHT

8-46. GENERAL.

This aircraft is qualified for operation in instrument meterological conditions. Flight handling, stability characteristics and range are approximately the same during instrument flight conditions as when under visual flight conditions.

8-47. INSTRUMENT FLIGHT PROCEDURES.

Refer to FM 1-5, FM 1-230; FLIP; AR 95-1; FC 1-218; FAR 91 (sub parts A and B) or applicable foreign government regulations; and procedures described in this manual.

8-48. INSTRUMENT TAKEOFF.

Complete the BEFORE TAKEOFF check. Engage the heading (HDG) mode on the autopilot computer/control. (DO NOT ENGAGE AUTOPILOT.) Set heading marker (HDG) to runway heading and adjust pitch bar 9 to 16 degrees up (depending on weight). Align the aircraft with the runway centerline, insuring that nosewheel is straight before stopping aircraft. Hold brakes and complete the LINEUP check. Insure that the roll steering bar is centered. Power application and copilot duties are identical to those prescribed for a "visual" takeoff. After the brakes are released, initial directional control should be accomplished predominantly with the aid of outside visual references. As the takeoff progresses, the crosscheck should transition from outside references to the Flight Director and airspeed indicator. The rate of transition is directly proportional to the rate at which the outside references deteriorate. Approaching rotation speed (Vr), the crosscheck should be totally committed to the instruments so that erroneous sensory inputs can be ignored. At rotation speed, establish takeoff attitude on the Flight Director. Maintain this pitch attitude and wings-level attitude until the aircraft becomes airborne. When both the vertical velocity indicator and altimeter show positive climb indications, retract the landing gear. After the landing gear is retracted, adjust the pitch attitude as required to attain best rate-of-climb airspeed (Vy). Use PITCH-SYNC as required to reposition the Flight Director pitch steering bar. Retract flaps after attaining best single-engine rate-of-climb speed (Vyse), and readjust pitch as required. Control the bank attitudes to maintain the desired heading. Support Flight Director indications throughout the maneuver by cross-checking "raw data" information displayed on supporting instruments.

NOTE

Due to possible precession error, the pitch steering bar may slightly lower during acceleration, causing the pitch attitude to appear higher than actual pitch attitude. To avoid lowering the nose prematurely, crosscheck the vertical velocity and altimeter to insure proper climb performance. The erection system will automatically remove the error after the acceleration ceases.

8-49. INSTRUMENT CLIMB.

Instrument climb procedures are the same as those for visual climb. En route instrument climbs are normally performed at cruise climb airspeeds.

8-50. INSTRUMENT CRUISE.

There are no unusual flight characteristics during cruise in instrument meteorological conditions.

8-51. INSTRUMENT DESCENT.

When a descent at slower than recommended speed is desired, slow the aircraft to the desired speed before initiating the descent. Normal descent to approach altitude can be made using cruise airspeed. Normally, descent will be made with the aircraft in a cruise configuration, maintaining desired speed by reducing power as required. The aircraft is completely controllable in a high rate descent.

8-52. INSTRUMENT APPROACHES.

There are no unusual preparations or control techniques required for instrument approaches. The approaches are normally flown at an airspeed of Vref +20 until transitioning to visual flight.

8-53. AUTOPILOT COUPLED APPROACHES.

There are no special preparations required for placing the aircraft under autopilot control. Refer to Chapter3 for procedures to be followed for automatic approaches.

NOTE

The ILS localizer and glideslope warning flags indicate insufficient signal strength to the receiver. Certain electrical mechanical malfunctions between the receiver and indicators may result in erroneous localizer/glideslope information without a warning flag. It is recommended that ILS information be crosschecked with other flight instruments prior to and during final approach. Utilization of NAV TEST prior to the final approach fix may detect certain malfunctions not indicated by the warning flags.

Section IV. FLIGHT CHARACTERISTICS

8-54. STALLS.

A prestall warning in the form of very light buffeting can be felt when a stall is approached. A mechanical warning is also provided by a warning horn. The warning horn starts to alarm approximately five to ten knots above stall speed with the aircraft in any configuration. If correct stall recovery technique is used, very little altitude will be lost during the stall recovery. For the purpose of this section, the term "power-on" means that both engines and propellers of the aircraft are operating normally and are responsive to pilot control. The term "power-off" means that both engines are operating at idle power. Landing gear position has no effect on stall speed. During practice, enter power-off stalls from normal glides. Enter power-on stalls by smoothly increasing pitch attitude to a climb attitude obviously impossible for the aircraft to maintain (do not exceed 200), and hold that attitude until the stall occurs.

a. Power-On Stalls. The power-on stall attitude is very steep and unless this high-pitch attitude is maintained, the aircraft will generally "settle" or "mush" instead of stall. It is difficult to stall the aircraft inadvertently in any normal maneuver. A light buffet precedes most stalls, and the first indication of approaching stall is generally a decrease in control effectiveness, accompanied by a "chirping" tone from the stall warning horn. The stall itself is characterized by a rolling tendency if the aircraft is allowed to yaw. The proper use of rudder will prevent the tendency to roll. A slight pitching tendency will develop if the aircraft is held in the stall, resulting in the nose dropping sharply, then pitching up toward the horizon; this cycle is repeated until recovery is made. Control is regained very quickly with little altitude loss, providing the nose is not lowered excessively. Begin recovery with forward movement of the control wheel and a gradual return to level flight. The roll tendency caused by yaw is more pronounced in power-on stalls, as is the pitching tendency; however, both are easily controlled after the initial entry. Power-on stall characteristics are not greatly affected by wing flap position, except that stalling speed is reduced in proportion to the degree of wing flap extension.

b. Power-Off Stalls. The roll tendency is considerably less pronounced in power-off stalls (in any configuration) and is more easily prevented or corrected by adequate rudder and aileron control, respectively. The nose will generally drop straight through with some tendency to pitch up again if recovery is not made immediately. With wing flaps down, there is little or no roll tendency and stalling speed is much slower than with wing flaps up. The Stall Speed Chart (Fig. 8-2) shows the indicated power-off stall speeds with aircraft in various configurations. Altitude loss during a full stall will be approximately 800 feet.

c. Accelerated Stalls. The aircraft gives noticeable stall warning in the form of buffeting when the stall occurs. The stall warning and buffet can be demonstrated in turns by applying excessive back pressure on the control wheel.

8-55. SPINS.

Intentional spins are prohibited. If a spin is inadvertently entered use the following recovery procedure:

NOTE

Spin demonstrations have not been conducted. The recovery technique is based on the best available information.

The first three actions should be as nearly simultaneously as possible.

1. Power levers IDLE.
2. Apply full rudder opposite the direction of spin rotation.
3. Simultaneously with rudder application, push the control wheel forward and neutralize ailerons.
4. When rotation stops, neutralize rudder.

CAUTION

Do not pull out of the resulting dive too abruptly as this could cause excessive wing loads and a possible secondary stall.

5. Pull out of dive by exerting a smooth, steady back pressure on the control wheel, avoiding an accelerated stall and excessive aircraft stresses.

STALL SPEED
POWER IDLE

C-12
PT6A

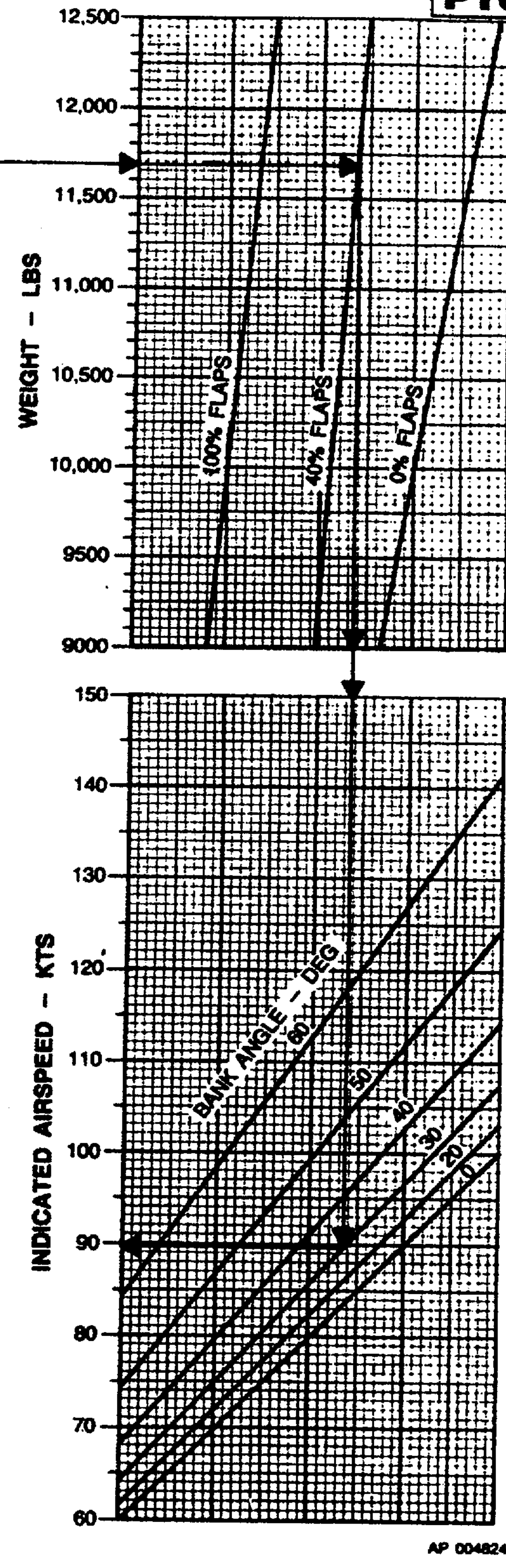
EXAMPLE

WANTED
STALL SPEED.

KNOWN
WEIGHT = 11,700 LBS.
FLAPS = 40%.
BANK ANGLE = 30 DEG.

METHOD
ENTER WEIGHT HERE.
MOVE RIGHT TO FLAP SETTING.
MOVE DOWN TO BANK ANGLE.
MOVE LEFT AND READ STALL SPEED = 90 KTS.

NOTE
LANDING GEAR POSITION HAS NO EFFECT ON STALL SPEED.



DATA BASIS: DERIVED FROM FLIGHT TEST

AP 004824

Figure 8-2. Stall Speed

8-56. DIVING.

Maximum diving airspeed (red line) VMO/MMO is: **A** 270 KIAS or .48 Mach; **CDF** 260 KIAS or .52 Mach. Flight characteristics are conventional throughout a dive maneuver, however, caution should be used if rough air is encountered after maximum allowable dive speed has been reached, since it is difficult to reduce speed in dive configuration. Dive recovery should be very gentle to avoid excessive aircraft stresses.

8-57. MANEUVERING FLIGHT.

The maximum speed (Va) of which abrupt full control inputs can be applied without exceeding the design load factor of the aircraft is shown in Chapter 5. The data is based on 12,500 pounds and there are no restrictions below this weight. There are no unusual characteristic under accelerated flight.

8-58. FLIGHT CONTROLS.

The aircraft is stable under all normal flight conditions. Aileron, elevator, rudder and trim tab controls function effectively throughout all normal flight conditions. Elevator control forces are relatively light in the extreme aft CG (center of gravity) condition, progressing to moderately high with CG at the forward limit. Extending and retracting the landing gear causes only slight changes in control pressure. Control pressures, resulting from changes in power settings or the repositioning of the wing flaps are not excessive in the landing configuration at the most forward CG. The minimum speed at which the aircraft can be fully trimmed is 92 KIAS (gear and flaps down, propellers at high RPM). Control forces produced by changes in speed, power setting, wing flap position and landing gear position are light and can be overcome with one hand on the control wheel. Trim tabs permit the pilot to reduce these forces to zero. During single engine operation, the rudder boost system aids in relieving the relatively high rudder pressures resulting from the large variation in power.

8-59. LEVEL FLIGHT CHARACTERISTICS.

All fight characteristics are conventional throughout the level flight speed range.

Section V. ADVERSE ENVIRONMENTAL CONDITIONS

8-60. INTRODUCTION.

The purpose of this part is to inform the pilot of the special precautions and procedures to be followed during the various weather conditions that maybe encountered in flight. This part is primarily narrative, only those checklists that cover specific procedures characteristic of weather operations are included. The checklist in Section II provides for adverse environmental operations.

8-61. COLD WEATHER OPERATIONS.

Operational difficulties may be encountered during extremely cold weather, unless proper steps are taken prior to or immediately after flight. All personnel should understand and be fully aware of the necessary procedures and precautions involved.

a. Preparation For Flight.

CAUTION

For ground operations conducive to ice accumulation on landing gear structure, use undiluted defrosting fluid on brakes and tires to reduce the tendency of ice accumulation during taxi, takeoff and subsequent landing.

Accumulations of snow, ice, or frost on aircraft surfaces will adversely affect takeoff distance, climb performance and stall speed to a dangerous degree. Such accumulations must be removed before flight. In addition to the normal exterior checks, following the removal of ice, snow, or frost, inspect wing and empennage surfaces to verify that these remain sufficiently cleared. Also, move all control surfaces to confirm full freedom of movement. Assure that tires are not frozen to wheel chocks or to the ground. Use ground heaters, anti-ice solution, or brake deice, to free frozen tires. When heat is applied to release tires, the temperature should not exceed 71°C (160°F). Refer to Chapter 2 for anti-icing, deicing, and defrosting treatment.

b. Engine Starting. When starting engines on ramps covered with ice, propeller levers should be in the FEATHER position to prevent the tires from sliding. To prevent exceeding torque limits when advancing CONDITION levers to HIGH IDLE during the starting procedure, place the power lever in BETA and the propeller lever in HIGH RPM before advancing the condition lever to HIGH IDLE.

c. Warm-Up and Ground Test. Warm-up procedures and ground test are the same as those outlines in Section II.

d. Taxiing. Whenever possible, taxiing in deep snow, light weight dry snow or slush should be avoided, particularly in colder FAT conditions. If it is necessary to taxi through snow or slush, do not set the parking brake when stopped. If possible, do not park the aircraft in snow or slush deep enough to reach the brake assemblies. Chocks or sand bags should be used to prevent the aircraft from rolling while parked. Before attempting to taxi, activate the brake deice system, insuring that the bleed air valves are OPEN and that the condition levers are in HIGH IDLE. An outside observer should visually check wheel rotation to insure brake assemblies have been deiced. The condition levers may be returned to LOW IDLE as soon as the brakes are free of ice.

e. Before Takeoff.

1. If icing conditions are expected, activate all anti-ice systems before takeoff, allowing sufficient time for the equipment to become effective.
2. If the possibility of ice accumulation on the horizontal stabilizer or elevator exists, takeoff will not be attempted.

f. Takeoff.

NOTE

Following takeoff from runways covered with snow or slush, it is advisable to delay gear retraction, and to cycle the gear a few times to dislodge ice accumulated from the spray of slush and water.

Takeoff procedures for cold weather operations are the same as for normal takeoff. Taking off with temperature at or below freezing, with water, slush or snow on the runway, can cause ice to accumulate on the landing gear and can throw ice into the wheel well areas. Such takeoffs shall be made with brake deice on and with the ice vanes extended to preclude the possibility of ice build-up on engine air inlets. Monitor oil temperature to insure operation within limits. Before flight into icing conditions, the pilot and copilot WSHLD, ANTIICE switches should be set at NORMAL position.

g. During Flight.

1. After take off from a runway covered with snow or slush, it may be advisable to leave brake deice ON to dislodge ice accumulated from the spray of slush or water. Monitor BRAKE DEICE annunciator for automatic termination of system operation and then turn the switch OFF. During flight, trim tabs and controls should also be exercised periodically to prevent freezing. Insure that anti-icing systems are activated before entering icing conditions. Do not activate the surface deice system until ice accumulated one-half to one inch. The propeller deice system operates effectively as an anti-ice system and it may be operated continously in flight. If propeller imbalance due to ice does occur, it may be relieved by increasing RPM briefly, then returning to desired setting.
2. Ice vanes must be extended when operating in visible moisture or when freedom from visible moisture cannot be assured, at +5°C FAT or less. Ice vanes are designed as an anti-ice system, not a deice system. After the engine air inlet screens are blocked, lowering the ice vanes will not rectify the condition. Ice vanes should be retracted at +15°C FAT and above to assure adequate engine oil cooling.
3. Stalling airspeeds should be expected to increase when ice has accumulated on the aircraft causing distortion of the wing airfoil. For the same reason, stall warning devices are not accurate and should not be relied upon. Keep a comfortable margin of airspeed above the normal stall airspeed. Maintain a minimum of 140 knots during sustained icing conditions to prevent ice accumulation on unprotected surfaces of the wing. In the event of windshield icing, reduce airspeed to 226 knots or below.

h. Descent. Use normal procedures in Section II. Brake icing should be considered if moisture was encountered during previous ground operations or in flight in icing conditions with gear extended.

i. Landing.

Landing on an icy runway should be attempted only when absolutely necessary and should not be attempted unless the wind is within 10 degrees of runway heading. Application of brakes without skidding the tires on ice is very difficult, due to the sensitive brakes. In order not to impair pilot visibility, reverse thrust should be used with caution when landing on a runway covered with snow or standing water. Use procedures in Section II for normal landing.

j. Engine Shutdown. Use normal procedures in Section II.

k. Before Leaving the Aircraft. When the aircraft is parked outside on ice or in a fluctuating freeze-thaw temperature condition the following procedures should be followed in addition to the normal procedures in Section II. After wheel chocks are in place, release the brakes to prevent freezing. Fill fuel tanks to minimize condensation, remove any accumulation of dirt and ice from the landing gear shock struts, and install protective covers to guard against possible collection of snow and ice.

8-62. DESERT OPERATION AND HOT WEATHER OPERATION.

Dust, sand, and high temperatures encountered during desert operation can sharply reduce the operational life of the aircraft and its equipment. The abrasive qualities of dust and sand upon turbine blades and moving parts of the aircraft and the destructive effect of heat upon the aircraft instruments will necessitate hours of maintenance if basic preventive measures are not followed. In flight, the hazards of dust and sand will be difficult to escape, since dust clouds over a desert may be found at altitudes up to 10,000 feet. During hot weather operations, the principle difficulties encountered are high turbine gas temperature (TGT) during engine starting, over-heating of brakes, and longer takeoff and landing rolls due to the higher density altitudes. In areas where high humidity is encountered, electrical equipment (such as communication equipment and instruments) will be subject to malfunction by corrosion, fungi and moisture absorption by nonmetallic materials.

a. Preparation For Flight. Check the position of the aircraft in relation to other aircraft. Propeller sand blast can damage closely parked aircraft. Check that the landing gear shock struts are free of dust and sand. Check instrument panel and general interior for dust and sand accumulation. Open main entrance door and cockpit vent storm windows to ventilate the aircraft.

CAUTION

N1 speeds of 70% or higher may be required to keep oil temperature within limits.

b. Engine Starting. Use normal procedures in Section II. Engine starting under conditions of high ambient temperatures may produce a higher than normal TGT during the start. The TGT should be closely monitored when the condition lever is moved to the LOW IDLE position. If over temperature tendencies are encountered, the condition lever should be moved to IDLE CUTOFF position periodically during acceleration of gas generator RPM (N1). Be prepared to abort the start before temperature limitations are exceeded.

c. Warm-Up Ground Tests. Use normal procedures in Section II. To minimize the possibility of damage to the engines during dusty/sandy conditions; activate ICE VANES if the temperature is below +15°C.

d. Taxiing. Use normal procedures in Section II. When practical, avoid taxiing over sandy terrain to minimize propeller damage and engine deterioration that results from impingement of sand and gravel. During hot weather operation, use minimum braking action to prevent overheating.

e. Takeoff. Use normal procedures in Section II. Avoid taking off in the wake of another aircraft if The runway surface is sandy or dusty.

f. During Flight. Use normal procedures in Section II.

g. Descent. Use normal procedures in Section II.

h. Landing. Use normal procedures in Section II.

i. Engine Shutdown. Use normal procedures in Section II.

CAUTION

During hot weather, if fuel tanks are completely filled, fuel expansion may cause overflow, thereby creating a fire hazard.

j. Before Leaving Aircraft. Use normal procedures in Section II. Take extreme care to prevent sand or dust from entering the fuel and oil system during servicing. During hot weather, release the brake immediately after installing wheel chocks to prevent brake disc warpage.

8-63. TURBULENCE AND THUNDERSTORM OPERATION.

CAUTION

Due to the comparatively light wing loading, control in severe turbulence and thunderstorms is critical. Since turbulence imposes heavy loads on the aircraft structure, make all necessary changes in aircraft attitude with the least amount of control pressures to avoid excessive loads on the aircraft' s structure.

Thunderstorms and areas of severe turbulence should be avoided. If such areas are to he penetrated it will be necessary to counter rapid changes in attitude and accept major indicated altitude variations. Penetration should be of an altitude which provides adequate maneuvering margins as a loss or gain of several thousand feet of altitude may be expected. The recommended penetration speed in severe turbulence is 170 KIAS. Pitch attitude and constant power settings are vital to proper flight technique. Establish recommended penetration speed and proper attitude prior to entering turbulent air to minimize most difficulties. False indications by the pressure instruments due to barometric pressure variations within the storm make them unreliable. Maintaining a preestablished attitude will result in a fairly constant airspeed. Turn cockpit and cabin lights on to minimize the blinding effects of lighting. Do not use autopilot altitude hold. Maintain constant power settings and pitch attitude regardless of airspeed or altitude indications. Concentrate on maintaining a level attitude by reference to the Flight Director/Attitude Indicator. Maintain original heading. Maker no turns unless absolutely necessary.

8-64. ICE AND RAIN (TYPICAL).

WARNING

While in icing conditions, if there is an unexplained 30% increase of torque needed to maintain airspeed in level flight, a cumulative total of two or more inches of ice accumulation on the wing, an unexplained decrease of 15 knots IAS, or an unexplained deviation between pilot's and copilot's airspeed indicators, the icing environment should be exited as soon as practicable. Ice accumulation on the pitot tube assemblies could cause a complete loss of airspeed indication.

The following conditions indicate a possible accumulation of ice on the pitot tube assemblies and unprotected airplane surfaces. If any of these conditions are observed, the icing environment should be exited as soon as practicable.

(1) Total ice accumulation of two inches or more on the wing surfaces. Determination of ice thickness can be accomplished by summing the estimated ice thickness on the wing prior to each pneumatic boot deice cycle (e.g. four cycles of minimum recommended %-inch accumulation.

(2) A 30 percent increase in torque per engine required to maintain an desired airspeed in level flight (not to exceed 85 percent torque) when operating at recommended holding/loiter speed.

(3) A decrease in indicated airspeed of 15 knots after entering the icing condition (not slower than 1.4 power off stall speed) if maintaining original power setting in level flight. This can be determined by comparing pre-icing condition entry speed to the indicated speed after a surface and antenna deice cycle is completed.

(4) Any variations from normal indicated airspeed between the pilot' s and copilot' s airspeed indicators.

a. Typical Icing. Typical icing occurs because of supercooled water vapor such as fog, clouds or rain. The most severe icing occurs on aircraft surfaces in visible moisture or precipitation with a true outside air temperature between -5° C and +1° C; however, under some circumstances, dangerous icing conditions may be encountered with temperatures below -10° C. The surface of the aircraft must he at a temperature of freezing or below for it to stick. If severe icing conditions are encountered, ascend or descend to altitudes where these conditions do not prevail. If flight into icing conditions is unavoidable, proper use of aircraft anti-icing and deicing systems may minimize the problems encountered. Approximately 15 minutes prior to flight into temperature conditions which could produce frost or icing conditions, the pilot and co-pilot windshield anti-ice switches should be set at normal or high temperature position (after preheating) as necessary to eliminate windshield ice. Stalling airspeeds should be expected to increase when ice has accumulated on the aircraft causing distortion of the wing airfoil. For the same reason, stall warning devices are not accurate and should not be relied upon. Keep a comfortable margin of airspeed above the normal stall airspeed with ice on the aircraft. Maintain a minimum of 140 knots during sustained icing conditions to prevent ice accumulation on unprotected surfaces of the wing. In the event of windshield icing, reduce airspeed to 226 knots or below.

b. Rain. Rain presents no particular problems other than restricted visibility and occasional incorrect airspeed indications.

c. Timing. Extreme care must be exercised when taxiing on ice or slippery runways. Excessive use of either brakes or Rower may result in an uncontrollable skid.

d. Takeoff Extreme care must be exercised during takeoff from ice or slippery runways. Excessive use of either brakes or Rower may result in an uncontrollable skid.

e. Climb. Keep aircraft attitude as flat as possible and climb with higher airspeed than usual, so that the lower surfaces of the aircraft will not be iced by flight at a high angle of attack.

f. Cruise Flight. Prevention of ice formation is far more effective and satisfactory than attempts to dislodge the ice after it has formed. If icing conditions are inadvertently encountered turn on the anti-icing systems prior to the first sign of ice formation.

Do not operate deicer boots continuously. Allow at least one-half inch of ice on the boots before activating the deicer boots to remove the ice. Continued flight in severe icing conditions should not be attempted. If ice forms on the wing area aft of the deicer boots, climb or descend to an altitude where conditions are less severe.

g. Landing. Extreme care must be exercised when landing on ice or slippery runways. Excessive use of either brakes or power may result in an uncontrollable skid. Ice accumulation on the aircraft will result in higher stalling airspeeds due to the change in aerodynamic characteristics and increased weight of the aircraft due to ice buildup. Approach and landing airspeeds must be increased accordingly.

NOTE

When operating on wet or icy runways, refer to stopping distance factors (RCR) shown in Chapter 7.

8-64A. ICING (SEVERE).

a. The following weather conditions may be conducive to severe in-flight icing:

(1) Visible rain at temperatures below zero degrees Celsius ambient air temperature.

(2) Droplets that splash or splatter on impact at temperatures below zero degrees Celsius ambient air temperature.

b. The following procedures for exiting a severe icing environment are applicable to all flight phases from takeoff to landing.

(1) 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.

(2) Upon observing the visual cues specified in the limitations section of the airplane flight manual (Military Operations Manual) for the identification of severe icing conditions (reference paragraph 5-33B.), accomplish the following:

(a) 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.

(b) Avoid abrupt and excessive maneuvering that may exacerbate control difficulties.

(c) Do not engage the autopilot.

(d) If the autopilot is engaged, hold the control wheel firmly and disengage the autopilot.

(e) If an unusual roll response or uncommanded roll control movement is observed, reduce the angle-of-attack.

(f) Do not extend flaps during extended operation in icing conditions. Operations with flaps extended can result in a reduced 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.

(g) If the flaps are extended, do not retract them until the airframe is clear of ice.

(h) Report these weather conditions to air traffic control.

Section VI. CREW DUTIES

★8-65. CREW/PASSENGER BRIEFING.

The following guide should be used in accomplishing required passenger briefings. Items that do not pertain to a specific mission may be omitted.

1. Crew introduction.

2. Equipment.

   a Personnel, to include ID tags.

   b. Professional (medical equipment, etc.).

   c. Survival.

3. Flight data.

   a. Route.

b. Altitude
c. Time enroute.
d. Weather.

4. Normal procedures.

a. Entry and exit of aircraft.
b. Seating and seat position.
c. Seat belts.
d. Movement in aircraft.
e. Internal communications.
f. Security of equipment.
g. Smoking.
h. Oxygen.
i. Refueling.
j. Weapons and prohibited items.
k. Protective masks.
l. Toilet.
m. Polarized windows.

5. Emergency procedures.

a. Emergency exits.
b. Emergency equipment.
c. Emergency landing/ditching procedures.

★8-66. DEPARTURE BRIEFING.

The following is a guide that should be used as applicable in accomplishing the required crew briefing prior to takeoff however, if the crew has operated together previously (thru-flight) and the pilot is certain that the copilot understands all items of the briefing, he may omit the briefing by stating "standard briefing," when the briefing is called for during the BEFORE TAKEOFF CHECK.

1. ATC clearance Review.

a. Routing.
b. Initial altitude.

2. Departure procedure Review.

a. SID.
b. Noise abatement procedure.
c. VFR departure route.

3. Copilot duties Review.

a. Adjust takeoff power.
b. Monitor engine instruments.
c. Power check at 65 knots.
d. Call out engine malfunctions.
e. Tune/ident all Nav/Com radios.
f. Make all radio calls.
g. Adjust transponder and radar as required.
h. Complete flight log during flight (note altitudes and headings).
i. Note departure time.

4. PPC Review.

a. Takeoff power.
b. Vr.
c. Vy (climb to 500' AGL).
d. Vyse.

★8-67. ARRIVAL BRIEFING.

The following is a guide that should be used as applicable in accomplishing the required crew briefing prior to landing; however, if the crew has operated together previously (thru flight) and the pilot is certain that the copilot understands all items of the briefing, he may omit the briefing by stating "standard briefing," when the briefing is called for during the DESCENT-ARRIVAL CHECK.

1. Weather/altimeter setting.
2. Airfield/facilities Review.
    a. Field elevation.
    b. Runway length.
    c. Runway condition.
3. Approach procedure Review.
    a. Approach plan/profile.
    b. Altitude restrictions
    c. Missed approach.
        (1) Point.
        (2) Time.
        (3) Intention.
    d. Decision hight or MDA
    e. Lost communications.
4. Backup approach/frequencies.
5. Cockpit duties Review.
    a. Nav/Com set up.
    b. Monitor altitude and airspeed.
    c. Monitor approach.
    d. Call out visual/field in sight.
6. Landing performance data Review.
    a. Approach speed.
    b. Runway required.
7. Passenger briefing - As required.

CHAPTER 9
EMERGENCY PROCEDURES

Section I. AIRCRAFT SYSTEMS

9-1. AIRCRAFT SYSTEMS.

This section describes the aircraft systems emergencies that may reasonably be expected to occur and presents the procedures to be followed. Emergency procedures are given in checklist form when applicable. A condensed version of these procedures is in the Operator's and Crew member's Checklist, TM 55-1510-218-CL. Emergency operations of avionics equipment are covered when appropriate in Chapter 3, Avionics, and are repeated in this section only as safety of flight is affected.

9-2. IMMEDIATE ACTION EMERGENCY CHECKS.

Immediate action emergency items are underlined for your reference and shall be committed to memory. During an emergency, the checklist will be called for to verify the memory steps performed and to assist in completing any additional emergency procedures.

NOTE

The urgency of certain emergencies requires immediate action by the pilot. The most important single consideration is aircraft control. All procedures are subordinate to this requirement. Reset MASTER CAUTION after each malfunction to allow systems to respond to subsequent malfunctions.

9-3. DEFINITION OF LANDING TERMS.

The term LANDING IMMEDIATELY is defined as executing a landing without delay. (The primary consideration is to assure the survival of occupants.) The term LAND AS SOON AS POSSIBLE is defined as executing a landing to the nearest suitable landing area without delay. The term LAND AS SOON AS PRACTICABLE is defined as executing a landing to the nearest suitable airfield.

9-4. AFTER EMERGENCY ACTION.

After a malfunction has occurred, appropriate emergency actions have been taken and the aircraft is on the ground, an entry shall be made in the remarks section of DA Form 2408-13 describing the malfunction.

9-5. EMERGENCY EXITS AND EQUIPMENT.

Emergency exits and equipment are shown in figure 9-1.

9-6. EMERGENCY ENTRANCE.

Entry may be made through the cabin emergency hatch. The hatch may be released by pulling on its flush-mounted, pull-out handle, placarded EMERGENCY EXIT-PULL HANDLE TO RELEASE. The hatch is of the nonhinged plug type which removes completely from the frame when the latches are released. After the latches are released, the hatch may be pushed in.

9-7. ENGINE MALFUNCTION.

a. Flight Characteristics Under Partial Power Conditions. There are no unusual flight characteristics during single-engine operation as long as airspeed is maintained at or above minimum control speed (Vmc) and power-off stall speeds. The capability of the aircraft to climb or maintain level flight depends on configuration, gross weight, altitude, and free air temperature. Performance and contr6o will improve by feathering the propeller of the inoperative engine, retracting the landing gear and flaps, and establishing the appropriate single-engine best rate-of-climb speed (Vyse). Minimum control speed (Vmc) with flaps retracted is approximately 1 knot higher than with flaps at takeoff (40%) position.

b. Engine Malfunction During And After Takeoff. The action to be taken in the event of an engine malfunction during takeoff depends on whether or not

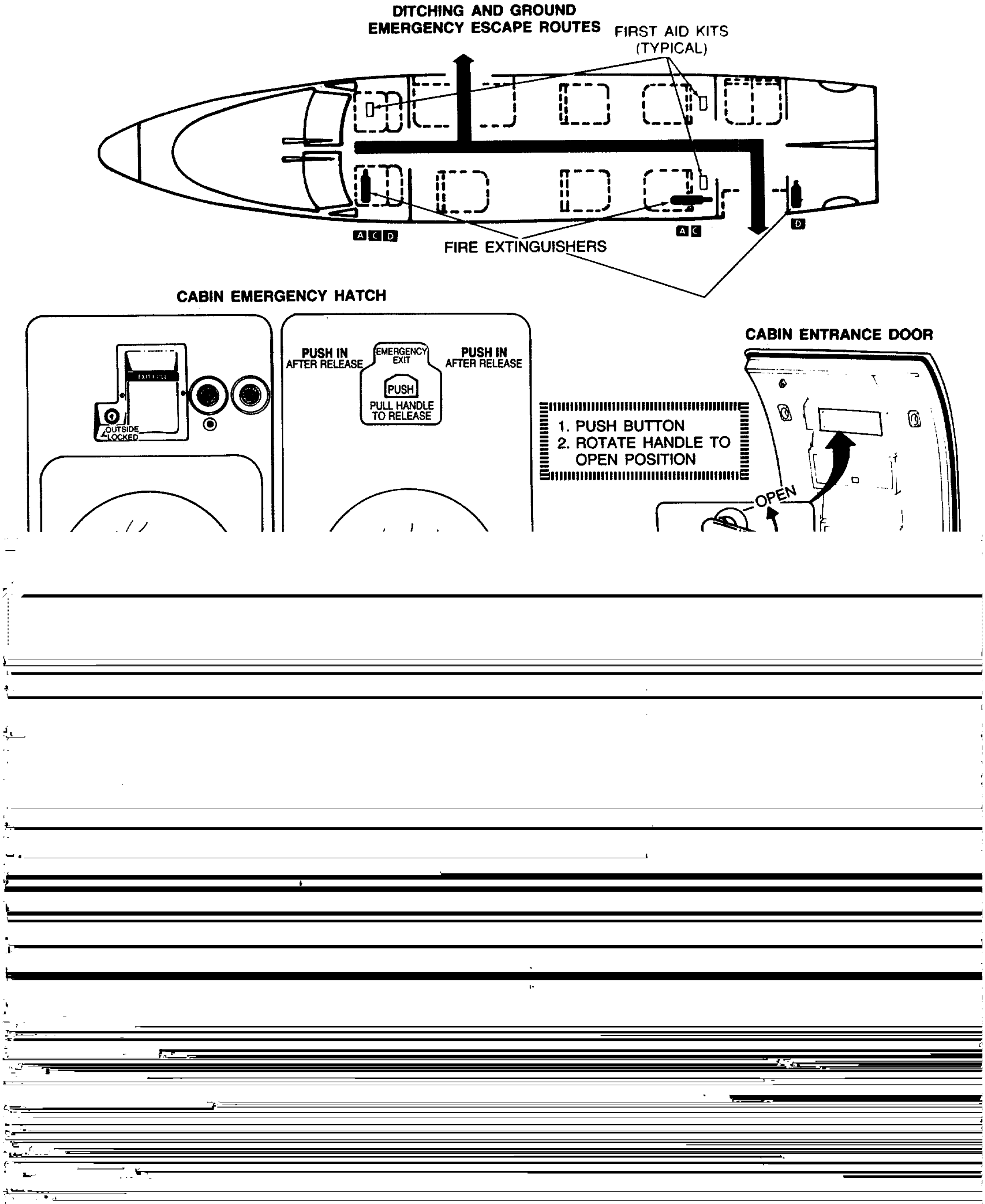


Figure 9-1. Emergency Exits and Equipment.

liftoff speed (Vlof) has been attained. If an engine fails immediately after liftoff, many variables such as airspeed, runway remaining, aircraft weight, altitude at time of engine failure, and single-engine performance must be considered in deciding whether it is safer to land or continue flight.

c. Engine Malfunction Before Liftoff (Abort). If an engine fails and the aircraft has not accelerated to recommended liftoff speed (Vlof), retard power levers immediately to IDLE and stop the aircraft with brakes and reverse thrust. Perform the following:

1. POWER levers IDLE.
2. Braking As required. NOTE

If insufficient runway remains for stopping perform steps 3 thru 5.

3. CONDITION levers FUEL CUTOFF.
4. FIRE PULL handles Pull.
5. MASTER SWITCHOFF.

d. Engine Malfunction After Liftoff. If an engine fails after becoming airbome, maintain single-engine best rate-of climb speed (Vyse) or, if airspeed is below (Vyse), maintain whatever airspeed is attained between liftoff (Vlof) and (Vyse) until sufficient altitude is attained to trade altitude for airspeed and accelerate to (Vyse). Engine malfunction after liftoff (abort), perform the following and land in a wings level attitude:

1. POWER levers REDUCE
2. Gear DOWN.
3. Complete normal landing.

NOTE

If able to land on remaining runway check gear down; use brakes and reverse thrust as required. If insufficient runway remains for stopping, perform the following:

4. CONDITION levers FUEL CUTOFF.
5. FIRE PULL handles Pull.
6. MASTER SWITCH OFF.

e. Engine malfunction after liftoff (fight continued without auto feather), perform the following:

1. Power Maximum controllable.

NOTE

If airspeed is below Vyse, maintain whatever airspeed has been attained (between Vlof and Vyse) until sufficient altitude can be obtained to trade off altitude for airspeed to assist in acceleration to Vyse.

2. Dead engine Identify.
3. POWER lever (dead engine) IDLE.
4. PROP lever (dead engine) FEATHER.
5. GEAR-UP.
6. FLAPS UP.

NOTE

If takeoff was made with flaps extended, insure that airspeed is above computed approach speed (Vref) before retracting flaps.

7. LANDING LIGIHTS OFF.
8. BRAKE DEICE OFF.
9. Engine cleanup Perform.

NOTE

Holding three to five degrees bank (half ball width) towards the operating engine will assist in maintaining directional control and improving aircraft performance.

f. Engine malfunction after liftoff (fight continued with autofeather), perform the following:

1. Power Maximum controllable.

NOTE

If airspeed is below Vyse, maintain whatever airspeed has been attained (between Vlof and Vyse) until sufficient altitude can be obtained to trade off altitude for airspeed to assist in acceleration to Vyse.

NOTE

Do not retard the malfunctioning engine power lever, or turn the autofeather system OFF, until propeller rotation is completely stopped. To do so will deactivate the autofeather circuit and prevent automatic leathering.

2. GEAR UP.
3. FLAPS-UP.

NOTE

If takeoff was made with flaps extended, insure that airspeed is above computed approach speed (Vref) before retracting flaps. 4. LANDING LIGHTS OFF.

5. BRAKE DEICE OFF.
6. Engine cleanup Perform.

NOTE

Holding three to five degrees bank (half ball width) towards the operating engine will assist in maintaining directional control and improving aircraft performance.

g. Engine Malfunction During Flight. If an engine malfunctions during cruise flight, maintain control of the aircraft while maintaining heading or turn as required. Add power as required to keep airspeed from decaying excessively and to maintain altitude. Identify the failed engine by feel (if holding rudder pressure to keep the aircraft from yawing; the rudder being pressed indicates the good engine) and engine instruments, then confirm identification by retarding the power lever of the suspected failed engine. Refer to Chapter 7 for single-engine cruise information. If one engine malfunctions during flight, perform the following:

1. Autopilot/yaw damp Disengage.
2. Power As required.
3. Dead engine Identify.
4. POWER lever (dead engine) IDLE.
5. PROP lever (dead engine) FEATHER.
6. GEAR As required.
7. FLAPS As required.
8. Power Set for single-engine cruise.
9. Engine cleanup Perform.

NOTE

At Vyse speeds, holding three to five degrees bank (half ball width) towards the operating engine will assist in maintaining directional control and improving aircraft performance.

h. Engine Malfunction During Final Approach. If an engine malfunctions during final approach (after LANDING CHECK) the propeller should not be feathered unless time and altitude permit or conditions require it. Continue approach using the following procedure:

1. Power As required.
2. GEAR DN.

i. Engine Malfunction (Second Engine). If the second engine fails, do not feather the propeller if an engine restart is to be attempted. Engine restart without starter assist can not be accomplished with a feathered propeller, and the propeller will not unfeather without the engine operating. 140 KIAS is recommended as the best all around glide speed (considering engine restart, distance covered, transition to landing configuration, etc.), although it does not necessarily result in the minimum rate of descent. Perform the following procedure if the second engine fails during cruise flight.

1. Airspeed 140 KIAS.
2. POWER lever IDLE.
3. PROP lever - Do not FEATHER.
4. Conduct engine restart procedure.

9-8. ENGINE SHUTDOWN IN FLIGHT.

If it becomes necessary to shut an engine down during flight, perform the following:

1. POWER lever - IDLE.
2. PROP lever FEATHER.
3. CONDITION lever FUEL CUTOFF.
4. Engine cleanup - Perform.

9-9. ENGINE CLEANUP.

The cleanup procedure to be used after engine malfunction, shutdown, or an unsuccessful restart is as follows:

1. CONDITION lever FUEL CUTOFF.
2. Engine autoignition switch OFF.
3. AUTOFEATHER switch OFF.
4. Generator switch OFF.
5. PROP SYNC switch OFF.

9-10. ENGINE RESTART DURING FLIGHT (USING STARTER).

Engine restarts may be attempted at all altitudes. If a restart is attempted, perform the following:

1. Cabin air mode switch OFF.
2. Electrical load Reduce to minimum.
3. FIRE PULL handle In.
4. POWER lever IDLE.
5. PROP lever FEATHER.
6. CONDITION lever FUEL CUTOFF.
7. TGT (operating engine) **700°C OR LESS**.
8. Ignition and engine starter switch ON.
9. CONDITION lever LOW IDLE.

NOTE

If a rise in TGT does not occur within 10 seconds after moving the condition lever to LOW IDLE, abort the start.

10. TGT 10000C 5 SECONDS MAXIMUM.

NOTE

If N_1 is below 12%, starting temperatures tend to be higher than normal. To preclude over-temperature (1000°C or above) during engine acceleration to idle speed, periodically move the condition lever into FUEL CUTOFF position as necessary. TM 55-1510-218-10

11. Oil pressure - Check.
12. Ignition and engine starter switch OFF at 50% N1.
13. Generator switch RESET, then ON.
14. Engine cleanup - Perform if engine restart unsuccessful.
15. Cabin air mode switch As required.
16. Electrical equipment As required.
17. Auto ignition switch ARMED.
18. Propellers Synchronized.
19. Power - As required.

9-11. ENGINE RESTART DURING FLIGHT (NOT USING STARTER).

A restart without starter assist may be accomplished provided airspeed is at or above 140 KIAS, altitude is below 20,000 feet, and the propeller is not feathered. If altitude permits, diving the aircraft will increase N I1 and assist in restart. If a start is attempted, perform following:

1. Cabin air mode switch - OFF.
2. Electrical load Reduce to minimum.
3. Generator switch (affected engine) - OFF.
4. FIRE PULL handle Check in.
5. POWER lever IDLE.
6. PROP lever - HIGH RPM.
7. CONDITION lever - FUEL CUTOFF.
8. Airspeed 140 KIAS minimum Check.
9. Altitude below 20,000 feet Check.
10. Engine autoignition switch ARM.
11. CONDITION lever LOW IDLE.

NOTE

If a rise in TGT does not occur in 10 seconds after moving the condition lever to LOW IDLE, abort the start.

12. TGT 10000C 5 SECONDS MAXIMUM.
13. Oil pressure Check.
14. Generator switch RESET then ON.
15. Engine Cleanup - Perform if engine restart unsuccessful.
16. Cabin air mode switch - As required.

17. Electrical equipment As required.
18. Auto ignition switch ARMED.
19. Propellers Synchronized.
20. Power As required.

NOTE

When N_1 is below 12%, starting temperatures tend to be higher than normal. To preclude over-temperature (1000°C or above) during engine acceleration to idle speed, periodically move the condition lever into the FUEL CUTOFF position as necessary.

9-12. MAXIMUM GLIDE.

In the event of failure of both engines, maximum gliding distance can be obtained by feathering both propellers to reduce propeller drag and by maintaining the appropriate airspeed with the gear and flaps up. Figure 9-2 gives the approximate gliding distances in relation to altitude.

9-13. LANDING WITH TWO ENGINES INOPERATIVE.

Maintain best glide speed (figure 9-2). If sufficient altitude remains after reaching a suitable landing area, a circular pattern will provide best observation of surface conditions, wind velocity, and direction. When the condition of the terrain has been noted and the landing area selected, set up a rectangular pattern. Extending APPROACH flaps and landing gear early in the pattern will give an indication of glide performance sooner and will allow more time to make adjustments for the added drag. Fly the base leg as necessary to control point of touchdown. Plan to overshoot rather than undershoot, then use flaps as necessary to arrive at the selected landing point. Keep in mind that, with both propellers feathered the normal tendency is to overshoot due to less drag. In the event a positive geardown indication cannot be determined, prepare for a gear-up landing; also, unless the surface of the landing area is hard and smooth, the landing should be made with the landing gear up. If landing on a rough terrain, land in a slightly tail-low attitude to keep nacelles from possibly digging in. If possible, land with flaps fully extended.

9-14. LOW OIL PRESSURE.

In the event of a low oil pressure indication, perform procedures as applicable:

1. Oil pressure below 105 **CD** 100**F** PSI below 21,000 feet or 85 PSI 21,000 feet and above: Torque -**49% MAXIMUM.**
2. Oil pressure below 60 PSI Perform engine shutdown, or land as soon as practicable using minimum power to insure safe arrival.

9-15. CHIP DETECTOR WARNING LIGHT ILLUMINATED.

If a CHIP DET warning light illuminates, and safe single-engine flight can be maintained; perform engine shutdown.

9-16. DUCT OVERTEMP CAUTION LIGHT ILLUMINATED.

Insure the cabin floor outlets are open and unobstructed, then perform the following steps in sequence until the light is extinguished. Allow approximately 30 seconds after each adjustment for the system temperature to stabilize. The over temperature condition is considered corrected at any point during the procedure that the light goes out.

1. CABIN AIR control In.
2. Cabin air mode switch AUTO.
3. Cabin temperature switch Decrease.
4. VENT BLOWER switch - HI.
5. Cabin air mode switch MAN COOL.
6. MANUAL TEMP switch DECREASE (hold).
7. Left bleed air valve switch ENVIRO OFF/PNEU ONLY.
8. Light still illuminated (30 seconds) Left bleed air valve switch OPEN/BOTH.
9. Right bleed air valve switch ENVIRO OFF/PNEU ONLY.
10. Light still illuminated (30 seconds) Right bleed air valve switch OPEN/BOTH.

NOTE

If the over temperature light has not extinguished after completing the above procedure, the warning system has malfunctioned.

9-17. ICE VANE FAILURE.

Ice vane failure is indicated by VANE FAIL caution light illumination. If an ice vane fails to operate electrically, perform the following:

MAXIMUM GLIDE DISTANCE

C-12
PT6A

ASSOCIATE CONDITIONS:
1. POWER OFF (PROPELLERS FEATHERED).
2. GEAR AND FLAPS UP.
3. ZERO WIND, STANDARD DAY.
4. AIRSPEED AND WEIGHT COMBINATIONS SHOWN PRODUCE MAXIMUM GLIDE DISTANCE.

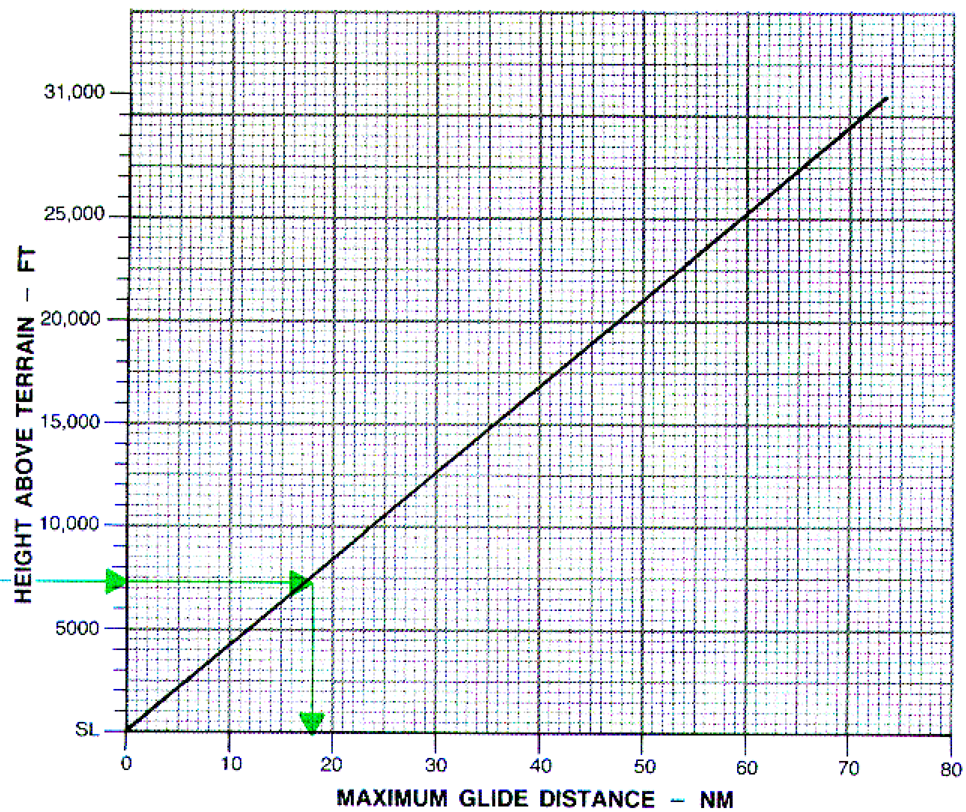
WEIGHT – LBS	BEST GLIDE SPEED – KIAS
12,500	124
11,000	119
10,000	112
9000	105

EXAMPLE

WANTED
MAXIMUM GLIDE DISTANCE.

KNOWN
HEIGHT ABOVE TERRAIN = 7500 FT.

METHOD
ENTER HEIGHT ABOVE TERRAIN HERE.
MOVE RIGHT TO REFERENCE LINE.
MOVE DOWN, READ MAXIMUM GLIDE DISTANCE = 18 NM.



DATA BASIS: CALCULATED

G
AP 005578

Figure 9-2. Maximum Glide Distance.

1. Airspeed - 160 KIAS or below.
2. ICE VANE CONTR circuit breaker - Pull.
3. Ice Vane - Operate manually.
4. Airspeed - Resume normal airspeed.

CAUTION

Do not operate vanes electrically after manual extension.

9-18. ENGINE BLEED AIR SYSTEM MALFUNCTION.

a. Bleed Air Failure Light Illuminated. Steady illumination of the warning light in flight indicates a possible ruptured bleed air line aft of the engine firewall. The light will remain illuminated for the remainder of flight. Perform the following:

NOTE

BLEED AIR FAIL lights may momentarily illuminate during simultaneous surface deice and brake deice operation at low N1 speed.

1. BRAKE DEICE switch OFF.
2. TGT and torque Monitor (note readings).
3. Bleed air valve switch OFF.

NOTE

Brake deice on the affected side, and rudder boost, will not be available with BLEED AIR VALVE switch OFF.

4. Cabin pressurization Check.

b. Excessive Differential Pressure. If cabin differential pressure exceeds 6.1 PSI**ACD**, 6.5 **F**, perform the following:

1. CABIN CONTROLLER Select higher setting. If condition persists:
2. Left bleed air valve switch ENVIRO OFF/PNEU ONLY (light illuminated).

If condition still persists:

3. Right bleed air valve switch ENVIRO OFF/PNEU ONLY (light illuminated).

If condition still persists:

4. Descend immediately. If unable to descend:
5. CABIN PRESS switch DUMP.
6. Bleed air valve switches OPEN/BOTH, if cabin heating is required.

9-19. LOSS OF PRESSURIZATION (ABOVE 10,000 FEET).

If cabin pressurization is lost when operating above 10,000 feet or the ALTITUDE warning light illuminates, perform the following:

1. Crew oxygen masks 100% and on.
2. Passenger oxygen ON and checked to insure all passengers have oxygen masks on and are receiving supplemental oxygen if required.

9-20. CABIN DOOR CAUTION LIGHT ILLUMINATED.

Remain clear of cabin door and perform the following:

1. CABIN SIGNS switch BOTH.
2. Bleed air valve switches ENVIRO OFF/PNEU ONLY.
3. Descend below 14,000 feet as soon as practicable.
4. Oxygen As required.

9-21. SINGLE-ENGINE DESCENT/ARRIVAL.

NOTE

Approximately 85% N1 is required to maintain pressurization schedule.

Perform the following procedure prior to the final descent for landing:

1. CABIN CONTROLLER Set.
2. CABIN SIGNS switch - As required.
3. ICE AND RAIN switches - As required.

4. Altimeters Set.

5. RECOG lights ON.

★*6. Arrival briefing - Complete (refer to Chapter 8, Section VI).

9-22. SINGLE-ENGINE BEFORE LANDING.

1. CABIN SIGNS BOTH.

2. PROP lever As required.

NOTE

During approach, propeller should be set at 1900 RPM to prevent glideslope interference (ILS approach), provide better power response during approach, and to minimize attitude change when advancing propeller levers for landing.

3. FLAPS APPROACH.
4. GEAR - DN.
5. LANDING LIGHTS As required.
6. YAW DAMP - OFF.
7. BRAKE DEICE OFF.

9-23. SINGLE-ENGINE LANDING CHECK.

Perform the following procedure during final approach to runway.

1. AP/YD Disengaged.
2. GEAR DOWN lights Check.
3. PROP lever (live engine) HIGH RPM.

NOTE

To insure constant reversing characteristics, the propeller control must be in the HIGH RPM position.

9-24. SINGLE-ENGINE GO-AROUND.

The decision to go around must be made as early as possible. Elevator forces at the start of a go around are very high and a considerable amount of rudder control will also be required at low airspeeds. Retrim as required. If rudder application is insufficient, or applied too slowly, directional control can not be maintained. If control difficulties are experienced, reduce power on the operating engine immediately. Insure that the aircraft will not touch the ground before retracting the landing gear Retract the flaps only as safe airspeed permits (TAKEOFF position until Vyse) then up. Perform single-engine go-around as follows:

NOTE

Once flaps are fully extended, a single-engine go-around may not be possible when close to ground under conditions of high gross weights and/or high density altitude.

1. Power Maximum controllable.
2. GEAR-UP.
3. FLAPS As required.
4. LANDING LIGHTS OFF.
5. Power As required.
6. YAW DAMP As required.

9-25. PROPELLER FAILURE (OVER 2080 RPM).

If an overspeed condition occurs that cannot be controlled with the propeller lever, or by reducing power, perform the following:

1. POWER lever (affected engine IDLE
2. PROP lever FEATHER.
3. CONDITION lever As required.
4. Engine cleanup As required.

9-26. FIRE.

The safety of aircraft occupants is the primary consideration when a fire occurs; therefore, it is imperative that every effort be made by the flight crew to put the fire out. On the ground it is essential that the engines be shut down, crew and passengers evacuated, and fire fighting begun immediately. If the aircraft is airborne when a fire occurs, the most important single action that can be taken by the pilot is to land safely as soon as possible.

a. Engine Fire. The following procedures shall be taken in case of engine fire:

(1) Engine/Nacelle Fire During Start or Ground Operations. If engine/nacelle fire is identified during start or ground operation, perform the following:

1. PROP levers - FEATHER.
2. CONDITION levers FUEL CUTOFF.
3. FIRE PULL handle Pull,

CAUTION

If fire extinguisher has been used to extinguish an engine fire, do not attempt to restart, until maintenance personnel have inspected the aircraft and released it for flight.

4. PUSH TO EXTINGUISH switch Push.
5. MASTER SWITCH OFF.

(2) Engine Fire In Flight (Fire Pull Handle Light Illuminated). If an engine fire is suspected in flight, perform the following:

1. POWER lever IDLE.
2. FIRE PULL handle light out Advance power.
3. FIRE PULL handle light illuminated - Perform engine fire inflight procedures (identified).

NOTE

Flight into the sun at high aircraft pitch attitude may actuate the fire warning system. Lowering the nose and/or changing headings will confirm a warning system failure caused by sun rays.

(3) Engine Fire In Flight (Identified). If an engine fire is confirmed in flight, perform the following:

CAUTION

Due to the possibilities of fire warning system malfunctions, the fire should be visually identified before the engine is secured and the extinguisher actuated.

1. POWER lever - IDLE.
2. PROP lever - FEATHER.
3. CONDITION lever - FUEL CUTOFF.

4. FIRE PULL handle-Pull.
5. Fire extinguisher-Actuate as required.
6. Engine cleanup-Perform.

b. Fuselage Fire. If a fuselage fire occurs, perform the following:

WARNING

The extinguisher agent (Bromochlorodifluoromethane) in the fire extinguisher can produce toxic effects if inhaled.

1. Fight the fire.
2. Land immediately if fire continues.

c. Wing Fire. There is little that can be done to control a wing fire except to shut off fuel and electrical systems that may be contributing to the fire, or which could aggravate it. Diving and slipping the aircraft away from the burning wing may help. If a wing fire occurs, perform the following:

1. Perform engine shutdown on affected side.
2. Land immediately if fire continues.

d Electrical Fire. Upon noting the existence or indications of an electrical fire, turn off all affected electrical circuits, if known. If electrical fire source is unknown, perform the following:

1. Crew oxygen masks-As required.
2. Passenger oxygen-As required.
3. MASTER SWITCH-OFF. (Visual Conditions Only).
4. All nonessential electrical equipment-OFF.

NOTE

With the loss of DC electrical power, the aircraft will depressurize. All electrical instruments, with the exception of the Prop RPM, N1 RPM, and TGT gages will be inoperative.

5. Battery switch-ON.
6. Generator switches (individually)-RESET, then ON.
7. Circuit breakers-Check for indication of defective circuit.

CAUTION

As each electrical switch is returned to ON (note load meter reading) and check for evidence of fire.

8. Essential electrical equipment-ON (individually until fire source is isolated).
9. Land as soon as practicable.

e. Smoke and Fume Elimination. To eliminate smoke and fumes from the aircraft, perform the following:

1. Crew oxygen masks 100% and ON.
2. Passenger oxygen-ON.
3. Bleed air valve switches-ENVIRO-OFF/PNEU ONLY.
4. VENT BLOWER switch-AUTO.
5. AFT VENT BLOWER switch-OFF.
6. Cabin air mode switch-OFF.
7. If smoke and fumes are not eliminated, CABIN PRESS switch-DUMP.

NOTE

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

8. Passenger oxygen masks-Check. -Confirm that all passengers are receiving supplemental oxygen.
9. Engine oil pressure-Monitor.

9-27. -FUEL SYSTEM.

a. Fuel Press Warning Light Illuminated. Illumination of the No. 1 or No. 2-FUEL PRESS warning light usually indicates failure of the respective engine driven boost pump. -Perform the following:

1. STANDBY PUMP switch-ON.
2. FUEL PRESS light out-Check.
3. FUEL PRESS light still on-Record unboosted time.

b. NO-FUEL XFR Caution Light Illuminated. Illumination of a No. 1 or No. 2. NO-FUEL XFR light with fuel remaining in the respective auxiliary fuel tank indicates a failure of that automatic fuel transfer system. Proceed as follows:

1. Auxiliary transfer switch (affected side)-OVERRIDE/OVRD.
2. Auxiliary fuel quantity-Monitor.
3. Auxiliary transfer switch (after respective auxiliary fuel has completely transferred)-AUTO.

c. Nacelle Fuel Leak. If nacelle fuel leaks are evident, perform following:

1. Perform engine shutdown.
2. FIRE PULL handle-Pull.
3. Land as soon as practicable.

d. Fuel Crossfeed. Fuel crossfeed is normally used only during single-engine operation. The fuel from the dead engine side may be used to supply the live engine by routing the fuel through the crossfeed system. During extended flights, this method of fuel usage will provide a more balanced lateral load condition in the aircraft. For fuel crossfeed, use the following procedure:

1. Auxiliary transfer switches-AUTO.

NOTE

With the FIRE PULL handle pulled, the fuel in the auxiliary tank for that side will not be available (usable) for crossfeed.

2. STANDBY PUMPS-OFF.
3. CROSSFEED switch-As required.
4. FUEL CROSSFEED light illuminated-Check.

NOTE

With the FIRE PULL handle pulled, the-FUEL PRESS light will remain illuminated on the side supplying fuel.

5. FUEL PRESS light extinguished-Check.
6. Fuel quantity-Monitor.

e. NAC LOW Light Illuminated. Illumination of the #1 and #2 NAC LOW caution light indicates that the affected tank has 20 ***C*** 30 ***DF*** minutes of usable fuel remaining at sea level, at normal cruise power consumption rate. Proceed as follows:

WARNING

Failure of the fuel tank venting system will prevent the fuel in the wing tanks from gravity feeding into the nacelle tank. Fuel vent system failure may be indicated by illumination of the #1 or #2 NAC LOW caution light with greater than 20 C 30 D F minutes of usable fuel indicated in the main tank fuel system. The total usable fuel remaining in the main fuel supply system with the LOW-FUEL caution light illuminated may be as little as 114 pounds, regardless of the total fuel quantity indicated. Continued flight may result in engine flameout due to fuel starvation.

1. Usable fuel remaining-Confirm.
2. Land as soon as possible.

9-28. ELECTRICAL SYSTEM EMERGENCIES.

a. DC GEN Light Illuminated. Illumination of a #1 or #2 DC GEN caution light indicates failure of a generator or one of its associated circuits (generator control unit). If one generator system becomes inoperative, all nonessential electrical equipment should be used judiciously to avoid overloading the remaining generator. The use of accessories which create a very high drain should be avoided. If both generators are shut off due to either generator system failure or engine failure, all nonessential equipment should be turned off to preserve battery power for extending the landing gear and wing flaps. When a DC GEN light illuminates, perform the following:

1. Generator switch-OFF, RESET, then ON.
2. Generator switch-(no reset)-OFF
3. Operating loadmeter-100% maximum.

b. Both DC GEN Lights Illuminated.

1. All nonessential equipment-OFF.
2. Land as soon as practicable.

c. Excessive Loadmeter Indication (Over 100%). If either loadmeter indicates over 100%, perform the following:

1. Battery switch-OFF (monitor loadmeter).
2. Loadmeter over 100%-Nonessential electrical equipmentOFF.
3. Loadmeter under 100%-Battery switch ON.

d. INVERTER Light Illuminated. Illumination of the #1 or #2 INVERTER caution light indicates failure of the affected inverter. When either inverter fails, the total AC load is automatically switched to the remaining inverter. When a # 1 or #2 INVERTER light illuminates, perform the following:

1. Affected INVERTER switch-OFF.

e. INST AC Light Illuminated. Illumination of the INST AC warning light indicates that both 26 VAC transformer circuits are inoperative. The primary power indicating instruments torque and fuel flow, will be inoperative. Under these conditions, power must be controlled by indications of the NSUB1 and TGT gages. -Perform the following:

1. N_1 and TGT indications-Check.
2. Other engine instruments-Monitor.

f. Circuit Breaker Tripped. If the circuit breaker is for a nonessential item, do not reset in flight. If the circuit breaker is for an essential item, the circuit breaker may be reset once. If a bus feeder circuit breaker (on the overhead circuit breaker panel) trips, a short is indicated. Do not reset in flight. If a circuit breaker trips, perform as follows:

1. BUS FEEDER breaker tripped-Do not reset.
2. Nonessential Circuit-Do not reset.
3. Essential circuit-Reset once.

NOTE

Circuit breakers should not be reset more than once until the cause of circuit malfunction has been determined and corrected. Do not reset dual fed bus feeder circuit breakers.

g. BATTERY CHARGE Light Illuminated. If the BATTERY CHARGE caution light illuminates during normal cruise flight, perform the following:

1. Loadmeter-Check; note indication.
2. Battery switch-OFF.
3. Loadmeter-Check. If loadmeter indicates less than 2.5% change (one needle width), turn battery switch ON and monitor for increasing load. If load continues to increase, turn battery switch-OFF.

NOTE

The battery may be turned back ON only for gear and flap extension and approach to landing. Battery may be usable after a 15 to 20 minute cool down period.

4. Battery switch (landing gear/flap extension only)-ON.

h. AVIONICS MASTER POWER Switch Failure. If the AVIONICS MASTER POWER switch fails to operate in the ON position, perform the following:

1. AVIONICS MASTER CONTR circuit breaker-Pull.

NOTE

The avionics power relay is normally hot. -Pulling the AVIONICS MASTER CONTR circuit breaker will remove power to the relay, thus allowing electrical power to the associated busses.

9-23. EMERGENCY DESCENT. Emergency descent is a maximum effort in which damage to the aircraft must be considered secondary to getting the aircraft down. The following procedure assumes the structural integrity of the aircraft and smooth flight conditions. If structural integrity is in doubt, limit speed as much as possible, reduce rate of descent if necessary, and avoid high maneuvering loads. For emergency descent, perform the following:

1. <u>POWER levers-IDLE</u>.
2. <u>PROP levers HIGH RPM.</u>
3. <u>FLAPS APPROACH</u>.
4. <u>GEAR-DN</u>.
5. <u>Airspeed-**181 KIAS maximum**</u>.

NOTE

Windshield defogging may be required.

9-30. LANDING EMERGENCIES.

WARNING

Structural damage may exist after landing with brake, tire, or landing gear malfunctions. Under no circumstances shall an attempt be made to inspect the aircraft until jacks have been installed.

*a. Landing Gear Unsafe indication **CD** Aircraft Prior to C-12D Serial 84-24375).* Should one or more of the landing gear fail to indicate a safe condition, the following steps should be taken before proceeding manually to extend the gear.

1. LDG GEAR CONTR switch-DN.
2. LANDING GEAR RELAY and gear indicator circuit breakers-Check in.
3. GEAR DOWN lights-Check.
   IF INDICATOR REMAINS UNSAFE:
4. Landing gear emergency extension-Perform.

NOTE

If gear continues to indicate unsafe, attempt to verify position visually.

*b. Landing Gear Unsafe Indication (C-12 **CD** Aircraft (C-12D Aircraft Serials 84-24375 thru 8424380*). Should one or more of the landing gear fail to indicate a safe condition, the following steps should be taken before proceeding manually to extend the gear.

1. LDG GEAR CONTR switch-Check-DN.
2. LANDING GEAR CONTROL and gear indicator circuit breakers-Check in.
3. GEAR DOWN lights illuminated-Check.
   IF INDICATOR REMAINS UNSAFE:
4. Landing gear emergency extension-Perform.

NOTE

If gear continues to indicate unsafe, attempt to verify position visually.

c. Landing Gear Emergency Extension (*C-12 **CD** Aircraft Prior to C-12D Serial 84-24375).*

CAUTION

Continued pumping of the handle after GEAR DOWN position indicator lights (3) are illuminated could damage the drive mechanism, and prevent subsequent gear retraction.

CAUTION

After an emergency landing gear extension has been made, do not stow the gear ratchet handle or move any landing gear controls or reset any switches or circuit breakers until the cause of the malfunction has been corrected.

1. Airspeed130 KIAS.
2. LANDING GEAR RELAY circuit breaker-Out.
3. LDG GEAR CONTR switch-DN.
4. Landing gear alternate engage handle-Lift and turn clockwise to the stop.
5. Alternate landing gear extension handle-Pump.,
6. GEAR DOWN lights illuminated-Check.

*d. Landing Gear Emergency Extension (C-12 **DF** Aircraft C-12DAircraftSerials 84-243 75 thru 84-24380).*

NOTE

If the HYD FLUID LOW annunciator illuminates during flight attempt to extend the landing gear normally upon reaching destination. If landing gear fails to extend follow these procedures.

CAUTION

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. Do not stow the extension lever, but leave it in the full up position.

CAUTION

After an emergency landing gear extension has been made, do not move any landing gear controls or reset any switches or circuit breakers until the cause of the malfunction has been corrected, as failure may be in the gear up circuit and the gear might retract on the ground.

1. Airspeed-Below 181 KIAS **CD**;-Below 182 KIAS J.
2. LANDING GEAR CONTROL circuit breaker-Pull.
3. LDG GEAR CONTR switch-DN.
4. Alternate extension lever-Unstow.
5. Alternate extension lever-Pump up and down until the three GREEN GEAR DOWN lights illuminate or resistance is felt.

NOTE

It could require up to 80 strokes or more to achieve full extension. Allow additional time during the approach phase to assure gear extension prior to landing.

6. Alternate extension lever-Stow (secure in clip).

e. Gear-up Landing (All Gears Up or Unlocked) (C-121 Aircraft Prior to C-12D Serial 84-24375). Due to decreased drag with the gear up, the tendency will be to overshoot the approach. The center-of-gravity with the gear retracted is aft of the main wheels. This condition will allow the aircraft to be landed with the gear retracted and should result in a minimum amount of structural damage to the aircraft, providing the wings are kept level. It is recommended that the fuel load be reduced and the landing made with flaps fully extended on a hard surface runway. Landing on soft ground or dirt is not recommended as sod has a tendency to roll up into chunks, damaging the underside of the aircraft's structure. When fuel load has been reduced, prepare for a gear-up landing as follows:

1. Personnel emergency briefing-Completed.
2. Loose equipment-Stowed.
3. BLEED AIR VALVES ENVIRO-OFF.
4. CABIN PRESS switch-DUMP.
5. CABIN SIGNS-BOTH.
6. Cabin emergency hatch-Remove and stow.
7. Seat belts and harnesses-Secured.
8. Landing gear alternate engage handle-Disengaged.
9. Alternate landing gear extension handle-Stowed.
10. LANDING GEAR RELAY circuit breaker-In.
11. GEAR UP.
12. Nonessential electrical equipment-OFF.
13. Flaps-As required (DOWN for landing).

NOTE

Fly a normal approach to touchdown. Avoid touching down in a nose-high attitude.

14. POWER levers (runway assured)-IDLE.
15. CONDITION levers-FUEL CUTOFF.
16. FIRE PULL handles-Pull.
17. MASTER SWITCH-OFF..

f Gear-up Landing (All Gears Up or Unlocked) (C-12 ***DF*** *Aircraft C-12D Aircraft Serials 84-24375 thru 84-24380*). Due to decreased drag with the gear up, the tendency will be to overshoot the approach. The center-of-gravity with the gear retracted is aft of the main wheels. This condition will allow the aircraft to be landed with the gear retracted and should result in a minimum amount of A structural damage to the aircraft, providing the wings are kept level. It is recommended that the fuel load be reduced and the landing made with flaps fully extended on a hard surface runway. Landing on soft ground or dirt is not recommended as sod has a tendency to roll up into chunks, damaging the underside of the aircraft's structure. When fuel load has been reduced, prepare for a gear-up landing as follows:

1. Personnel emergency briefing-Completed.
2. Loose equipment-Stowed.
3. Bleed air valves ENVIRO-OFF/PNEU ONLY.
4. CABIN PRESS switch-DUMP.

5. CABIN SIGNS-BOTH.
6. Cabin emergency hatch-Remove and stow.
7. Seat belts and harnesses-Secured.
8. Alternate landing gear extension handle-Stowed.
9. LANDING GEAR CONTROL circuit breaker In.
10. GEAR-UP.
11. Nonessential electrical equipment-OFF.
12. Flaps-As required (DOWN for landing).

NOTE

Fly a normal approach to touchdown. Avoid touching down in a nose-high attitude.

13. POWER levers (runway assured)-IDLE.
14. CONDITION levers-FUEL CUTOFF.
15. FIRE PULL handles-Pull.
16. MASTER SWITCH-OFF.

g. Landing With Nose Gear Unsafe. If the LDG GEAR CONTROL warning light is illuminated and the nose GEAR DOWN LIGHT shows an unsafe condition, the nose gear is probably not locked down, and the gear position should be checked visually by another aircraft, if possible. If all attempts to lock the nose gear fail, retract the main gear, complete GEAR-UP

LANDING procedure and execute a gear-up landing. If the main gear cannot be retracted, adjust passenger cargo load to obtain maximum aft CG, then touchdown gently on a smooth, hard surface. Hold the nose up as long as possible and do not use brakes. Use the following procedures:

1. Personnel emergency briefing-Completed.
2. Loose equipment-Stowed.
3. Bleed air valves ENVIRO-OFF/PNEU ONLY.
4. CABIN PRESS switch-DUMP.
5. CABIN SIGNS-BOTH.
6. Cabin emergency hatch-Remove and stow.
7. Seat belts and harnesses-Secured.
8. Nonessential electrical equipment-OFF.

NOTE

Fly a normal approach to touchdown. After landing, accomplish the following:

9. POWER levers (runway assured)-IDLE.
10. CONDITION levers-FUEL CUTOFF.
11. FIRE PULL handles-Pull.
12. MASTER SWITCH-OFF.

h. Landing With One Main Gear Unsafe. If one main landing gear fails to extend, retract the other gear and make a gear-up landing. If all efforts to retract the extended gear fail, land the aircraft on a hard runway surface, touching down on the same edge of the runway as the extended gear. Roll on the down and locked gear, holding the opposite wing up and the nose gear straight as long as possible. If the gear has extended, but is unsafe, apply brakes lightly on the unsafe side to assist in locking the gear. If the gear has not extended or does not lock, allow the wing to lower slowly to the runway. Use the following procedures:

1. Personnel emergency briefing-Completed.
2. Loose equipment-Stowed.
3. Bleed air valves ENVIRO-OFF/PNEU ONLY.
4. CABIN PRESS switch-DUMP.
5. CABIN SIGNS-BOTH.
6. Cabin emergency hatch-Remove and stow.
7. Seat belts and harnesses-Secured.
8. Nonessential electrical equipment-OFF.
9. Touchdown On safe main gear first.

NOTE

Fly a normal approach to touchdown. After landing, accomplish steps 10 thru 13.

10. POWER levers-IDLE.
11. CONDITION levers-FUEL CUTOFF.
12. FIRE PULL handle-Pull.
13. MASTER SWITCH-OFF.

i. Landing With Flat Tire(s). If aware that 0 a main gear tire(s) is flat, a landing close to the edge of the runway opposite the flat tire will help avoid veering off the runway. If the nose wheel tire is flat, use minimum braking.

9-31. LANDING WITH INOPERATIVE WING FLAPS (UP). The aircraft does not exhibit any unusual characteristics when landing with the wings flaps up. The approach angle will be shallow and the touchdown speed will be higher resulting in a longer landing roll.

9-32. CRACKED WINDSHIELD.

a. External Crack. If an external windshield 0 crack is noted, no action is required in flight.

NOTE

Heating elements may be inoperative in areas of crack.

b. Internal Crack. If an internal crack occurs, perform the following:

1. Descend-Below 25,000 feet.
2. Cabin Pressure Reset pressure differential to 4 PSI or less within 10 minutes.

9-33. CRACKED CABIN WINDOW.

If crack(s) in a cabin window ply(s) occurs, perform the following:

1. Crew oxygen masks 100% and on (if above 10,000 feet).
2. Cabin signs switch-BOTH.
3. Passenger oxygen ON and checked (if above 10,000 feet). The copilot should confirm that all passengers have oxygen masks on and are receiving supplemental oxygen if required.
4. Cabin pressure Depressure.
5. Land as soon as practicable. If both plys of a cabin window has developed cracks the aircraft shall not be flown, once landed, without proper ferry flight authorization.

NOTE

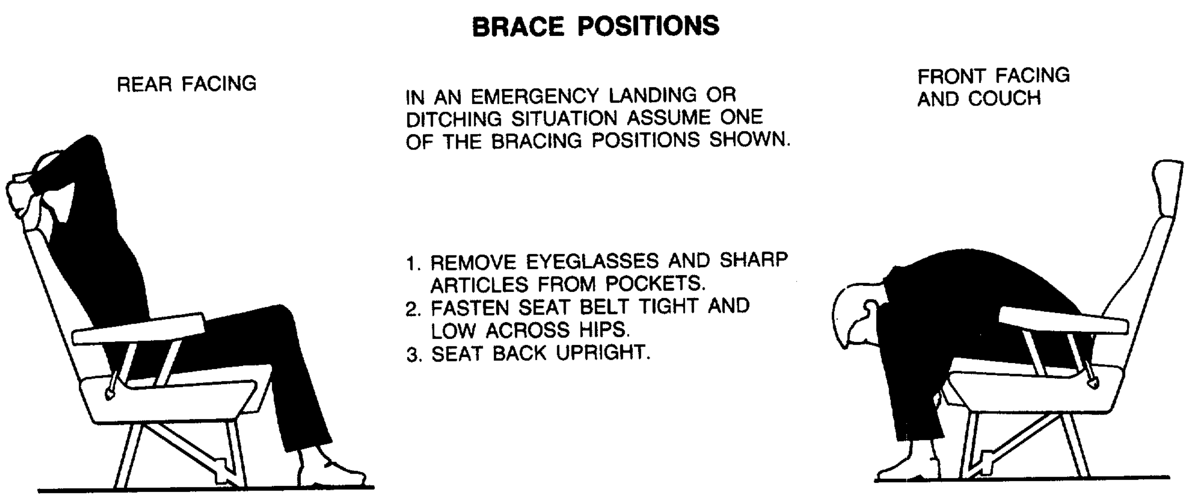
Treat outer ply cracks which are linear (not circular) or cracks that touch the frame as an inner ply crack.

9-34. CRACKED CABIN WINDOW (INNER PANEL).

Deleted.

9-35. DITCHING.

If a decision to ditch is made, immediately alert all personnel to prepare for ditching. Plan the approach into the wind if the wind is high and the seas are heavy. If the swells are heavy but the wind is light, land parallel to the swells. Set up a minimum rate descent (power on or off, as the situation dictates airspeed 110-120 KIAS). Do not try to flare as in a normal landing, as it is very difficult to judge altitude over water, particularly in a slick sea. Leveling off too high may cause a nose low "drop in", while having the tail too low in impact may result in the aircraft pitching forward and "digging in". Expect more than one impact shock and several skips before the final hard shock. There may be nothing but spray visible for several seconds while the aircraft is decelerating. To prevent cartwheeling, it is important that the wings be level when the aircraft hits the water. After the aircraft is at rest, supervise evacuation of passengers and exit the aircraft as quickly as possible. In a planned ditching, the life raft and first-aid kits should be secured close to the cabin emergency hatch for easy access when evacuating; however, do not remove the raft from its carrying case inside the aircraft. After exiting the aircraft, keep the raft from any damaged surfaces which might tear or puncture the fabric. The length of time that the aircraft will float depends on the fuel level and the extent of aircraft damage caused by the ditching.



Refer to Figure 9-3 for body positions during ditching and Figure 9-4 for procedure. Figure 9-5 shows wind swell information. -Perform the following procedures:

WARNING

Do not unstrap from the seat until all motion stops. The possibility of injury and disorientation requires that evacuation not be attempted until the aircraft comes to a complete stop.

1. Radio calls/transponder-As required.
2. Personnel emergency briefing-As required.
3. Bleed air valves ENVIRO-OFF/PNEU ONLY.
4. CABIN PRESS switch-DUMP.
5. CABIN SIGNS-BOTH.
6. Cabin emergency hatch-Remove and stow.
7. Seat belts and harnesses-Secured.
8. GEAR UP.
9. FLAPS-DN.
10. Nonessential electrical equipment-OFF.
11. Approach-Normal, power on.
12. Emergency lights-As required.

9-36. FLIGHT CONTROLS MALFUNCTION.

Use the following procedures, as applicable, for flight control malfunctions.

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

Perform the following:

1. RUDDER BOOST-OFF.

NOTE

The rudder boost system may not operate when the brake deice system is in use. Availability of the rudder boost system will be restored to normal when the BRAKE DEICE switch is turned-OFF.

IF CONDITION PERSISTS:

2. Bleed air valve-OFF (Below 10,000 feet).

1. Rudder trim Adjust.

b. Unscheduled Electric Elevator Trim. In the event of unscheduled electric elevator trim, perform the

1. ELEV TRIM switch-OFF.
2. ELEC TRIM circuit breaker OUT.

PLANNED DITCHING		IMMEDIATE DITCHING
PILOT	**PILOT SEAT**	**PILOT**
A. ALERT OCCUPANTS		A. WARN OCCUPANTS
B. ORDER TO PREPARE SURVIVAL GEAR FOR AERIAL DROP		B. TRANSMIT DISTRESS MESSAGE
C. TRANSMIT DISTRESS MESSAGE		C. LIFE VEST - CHECK (DO NOT INFLATE)
D. LIFE VEST - CHECK (DO NOT INFLATE)		D. APPROACH - NORMAL
E. DISCHARGE MARKER		E. NOTIFY OCCUPANTS TO BRACE FOR DITCHING
F. LAND AND DITCH AIRCRAFT		F. LAND AND DITCH AIRCRAFT
G. ABANDON AIRCRAFT		G. ABANDON AIRCRAFT AFTER COPILOT THROUGH CABIN EMERGENCY HATCH
COPILOT	**COPILOT SEAT**	**COPILOT**
A. REMOVE CABIN EMERGENCY HATCH		A. REMOVE CABIN EMERGENCY HATCH
B. LIFE VEST - CHECK (DO NOT INFLATE)		B. LIFE VEST - CHECK (DO NOT INFLATE)
C. ABANDON AIRCRAFT (TAKE LIFE RAFT AND FIRST AID KIT).		C. ABANDON AIRCRAFT (TAKE LIFE RAFT AND FIRST AID KIT).
PASSENGERS		**PASSENGERS**
A. SEAT BELTS - FASTEN		A. SEAT BELTS - FASTEN
B. LIFE VEST - CHECK (DO NOT INFLATE)		B. LIFE VEST - CHECK (DO NOT INFLATE)
C. ON PILOTS SIGNAL - BRACE FOR DITCHING		C. ON PILOTS SIGNAL - BRACE FOR DITCHING
D. ABANDON AIRCRAFT THROUGH CABIN DOOR (TAKE LIFE RAFT AND FIRST AID KIT)		D. ABANDON AIRCRAFT THROUGH CABIN DOOR (TAKE LIFE RAFT AND FIRST AID KIT)

Figure 9-4. Ditching Chart

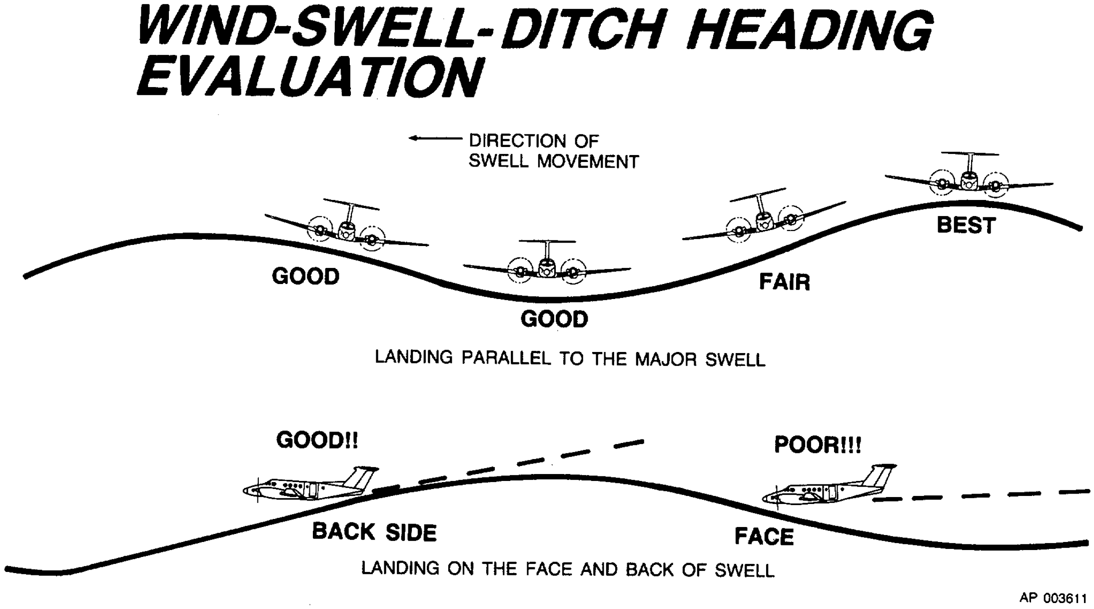


Figure 9-5. Wind Swell Ditch Heading Evaluation

APPENDIX A

REFERENCES

Reference information for the subject material contained in this manual can be found in the following publications.

AR 95-1	Army Aviation-General Provisions and Flight Regulations
AR 95-3	General Provisions, Training, Standardization, and Resource Management
AR 385-40	Accident Reporting and Records
AR 70-50	Design and Name of Military Aircraft
DA PAM 738-751.	Functional User's Manual for the Army Maintenance Management System-Aviation-(TAMMS-A)
TM 55-1500-314-25	Handling, Storage, and Disposal of Army Aircraft Components Containing Radioactive Materials
TM 55-1500-342-23	Army Aviation Maintenance Manual-Weight and Balance
TB MED 501	Noise and Conservation of Hearing Radar Warning System, AN/APR-44(V) I
TM 55-410	Aircraft Maintenance, Servicing and Ground Handling Under Extreme Environmental Conditions
TM 55-1500-204-25/1	General Aircraft Maintenance Manual
TM 750-244-1-5	Procedures for the Destruction of Aircraft and-Associated Equipment to Prevent Enemy Use

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APPENDIX B

ABBREVIATIONS AND TERMS

For the purpose of this manual, the following abbreviations and terms apply. See appropriate technical manuals for additional terms and abbreviations.

AIRSPEED TERMINOLOGY.

CAS	Calibrated airspeed is indicated airspeed corrected for position and instrument error.
FT/MIN	Feet per minute.
GS	Ground speed, though not an airspeed, is directly calculable from true airspeed if the true wind speed and direction are known.
IAS	Indicated airspeed is the speed as shown on the airspeed indicator and assumes no error.
KT	Knots.
M_{mo}	Maximum operating Mach number.
TAS	True airspeed is calibrated airspeed corrected for temperature, pressure, and compressability effects.
V_a	Maneuvering speed is the maximum speed at which application of full available aerodynamic control will not overstress the aircraft.
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 aircraft can be safely flown with the landing gear extended.
V_{l0}	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 (takeoff airspeed).
V_{mca}	The minimum flight speed at which the aircraft is directionally controllable as determined in accordance with Federal Aviation Regulations. Aircraft Certification conditions include one engine becoming inoperative and windmilling; a 5' bank towards the operative engine; takeoff power on operative engine; landing gear up; flaps up; and most rearward CG. This speed has been demonstrated to provide satisfactory control above power off stall speed (which varies with weight, configuration, and flight attitude).
V_{mo}	Maximum operating limit speed.
V_{ne}	Never exceed speed.
V_r	Rotation speed.

Vs	Power off stalling speed or the minimum steady flight speed at which the aircraft is controllable.
Vso	Stalling speed or the minimum steady flight speed in the landing configuration.
Vsse	The safe one-engine inoperative speed selected to provide a reasonable margin against the occurrence of an unintentional stall when making intentional engine cuts.
Vx	Best angle of climb speed.
Vxse	Best single-engine angle of climb speed.
Vy	Best rate of climb speed.
Vyse	The best single engine rate of climb speed.
Vref	The indicated airspeed the aircraft should be at when 50 feet above the runway in landing configuration.

B-2. METEOROLOGICAL TERMINOLOGY.

Altimeter Setting	Barometric pressure corrected to sea level.
°C	Degrees Celsius.
°F	Degrees Fahrenheit.
FAT	Free air temperature is the free air static temperature, obtained either from ground meteorological sources or from inflight temperature indications adjusted for compressibility effects.
Indicated Pressure	The number actually read from an altimeter when, the barometric scale Altitude (PA) (Kollsman window) has been set to 29.92 inches of mercury (1013 millibars).
IN. HG.	Inches of Mercury.
ISA	International Standard Atmosphere in which: a. The air is a dry perfect gas; b. The temperature at sea level is 59 degrees Fahrenheit, 15 degrees Centigrade; c. The pressure at sea level is 29.92 inches Hg; d. The temperature gradient from sea level to the altitude at which the temperature is -69.7 degrees Fahrenheit is -0.003566 Fahrenheit per foot and zero above that altitude.
Pressure Altitude (press alt)	Indicated pressure altitude corrected for altimeter error.
SL	Sea level.
Wind	The wind velocities recorded as variables on the charts of this manual are to be understood as the headwind or tailwind components of the actual winds at 50 feet above runway surface (tower winds).

B-3. 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 N1 RPM.
SHP	Shaft horsepower. That horsepower imparted to the propeller shaft.
Low Idle	Obtained by placing the Condition Lever in the LO-IDLE position. This limits the power operation to a minimum of 52% of N1 RPM.
Maximum Cruise Power	Is the highest power rating for cruise and is not time limited.
Maximum Power	The maximum power available from an engine for use during an emergency operation.
Normal Rated Climb Power	The maximum power available from an engine for continuous normal climb operations.
Normal Rated Power	The maximum power available from an engine for continuous operation in cruise (with lower ITT limit than normal rated climb power).
Reverse Thrust	Obtained by lifting the power levers and moving them aft of the beta range.
RPM	Revolutions Per Minute.
Takeoff Power	The maximum power available from an engine for takeoff, limited to periods of five minutes duration.

B-4. 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 LO to HIGH.
N1 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 N1 RPM)	This lever serves to modulate engine power from full reverse thrust to takeoff. The position for idle represents the lowest recommended level of power for flight operation.
Propeller Control Lever (N2 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 propeller speed requested by the propeller control lever.
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.

Turbine Gas Temperature (TGT)	Eight probes wired in parallel indicate the temperature between the compressor and power turbines.

B-5. GRAPH AND TABULAR TERMINOLOGY.

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.
Clean Configuration	Gear and flaps up.
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 aircraft during takeoff and landing was actually demonstrated during certification tests.
Landing Weight	The weight of the aircraft at landing touchdown.
Maximum Zero Fuel Weight	Any weight above the value given must be loaded as fuel.
MEA	Minimum En route Altitude.
Obstacle Clearance Speed	Obstacle clearance speed is a speed near Vx and Vy, 1.1 times power off stall speed, or 1.2 times minimum single-engine stall speed, whichever is higher.
Ramp Weight	The gross weight of the aircraft before engine start. Included is the takeoff 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: a. A geographic location; or b. A point at which a definite radio fix can be established.
Service Ceiling	The altitude at which the maximum rate of climb of 100 feet per minute can be attained for existing aircraft weight.
Takeoff Weight	The weight of the aircraft at lift-off from the runway.

B-6. WEIGHT AND BALANCE TERMINOLOGY.

Arm	The distance from the center of gravity of an object to a line about which moments are to be computed.
Approved Loading Envelope	Those combinations of aircraft weight and center of gravity which define the limits beyond which loading is not approved.

Center-of-Gravity	A point at which the weight of an object may be considered concentrated for weight and balance purposes.
CG Limits	CG limits are the extremes of movement which the CG can have without making the aircraft unsafe to fly. The CG of the loaded aircraft must be within these limits at takeoff, in the air, and on landing.
Datum	A vertical plane perpendicular to the aircraft longitudinal axis from which fore and aft (usually aft) measurements are made for weight and balance purposes.
Engine Oil	That portion of the engine oil which can be drained fom the engine.
Empty Weight	The aircraft weight with fixed ballast, unusable fuel, engine oil, engine coolant, hydraulic fluid, and in other respects as required by applicable regulatory standards.
Landing Weight	The weight of the aircraft at landing touchdown.
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.
Standard	Weights corresponding to the aircraft as offered with seating and interior, avionics, accessories, fixed ballast and other equipment specified by the manufacturer as composing a standard aircraft.
Station	The longitudinal distance from some point to the zero datum or zero fuselage station.
Takeoff Weight	The weight of the aircraft at liftoff.
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 aircraft ramp weight and basic empty weight.

B-7. MISCELLANEOUS ABBREVIATIONS.

DEG	Degrees	MAX	Maximum
DN	Down	MHz	Megahertz
FT	Foot or feet	MIN	Minimum or minutes
FT-LB	Foot-pounds	NAUT	Nautical
GAL	Gallons	NM	Nautical miles
HR	Hours	PSI	Pounds per square inch
kHz	Kilohertz	R/C	Rate of climb
LB	Pounds	TEMP	Temperature

THE METRIC SYSTEM AND EQUIVALENTS

Linear Measure

1 centimeter = 10 millimeters = .39 inch

1 decimeter = 10 centimeters = 3.94 inches

1 meter = 10 decimeters = 39.37 inches

1 dekameter = 10 meters = 32.8 feet

1 hectometer = 10 dekameters = 328.08 feet

1 kilometer = 10 hectometers = 3280.8 feet

Weights

1 centigram = 10 milligrams = .15 grain

1 decigram = 10 centigrams = 1.54 grains

1 gram = 10 decigrams = .035 ounce

1 dekagram = 10 grams = .35 ounce

1 hectogram = 10 dekagrams = 3.52 ounces

1 kilogram = 10 hectograms = 2.2 pounds

1 quintal = 100 kilograms = 220.46 pounds

1 metric ton = 10 quintals = 1.1 short tons

Liquid Measure

1 centiliter = 10 milliliters = .34 fl. ounces

1 deciliter = 10 centiliters = 3.38 fl. ounces

1 liter = 10 deciliters = 33.81 fl. ounces

1 dekaliter = 10 liters = 2.64 gallons

1 hectoliter = 10 dekaliters = 26.42 gallons

1 kiloliter = 10 hectoliters = 264.18 gallons

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Subject	Paragraph, Figure, Table Number
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By Order of the Secretary of the Army:

JOHN A. WICKHAM, JR.
General, United States Army
Chief of Staff

Official:

DONALD J. DELANDRO
Brigadier General, United States Army
The Adjutant General

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The following format must be used if submitting an electronic 2028. The subject line must be exactly the same and all fields must be included; however, Only the following fields are mandatory: 1, 3, 4, 5, 6, 7, 8, 9, 10, 13, 15, 16, 17, and 27.

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To: ls-lp@redstone.army.mil

Subject: DA Form 2028

1. ***From:*** Joe Smith
2. *Unit:* home
3. ***Address:*** 4300 Park
4. ***City:*** Hometown
5. ***St:*** AL
6. ***Zip:*** 77777
7. ***Date Sent:*** 19-OCT-93
8. ***Pub No:*** 552840-229-23
9. ***Pub Title:*** TM
10. ***Publication Date:*** 04-JUL-85
11. Change Number: 7
12. Submitter Rank: MSG
13. ***Submitter Fname:*** Joe
14. Submitter Mname: T
15. ***Submitter Lname:*** Smith
16. ***Submitter Phone:*** 123-123-1234
17. ***Probrem:*** 1
18. Page: 2
19. Paragraph: 3
20. Line: 4
21. NSN: 5
22. Reference: 6
23. Figure: 7
24. Table: 8
25. Item: 9
26. Total: 123
27. ***Text:***

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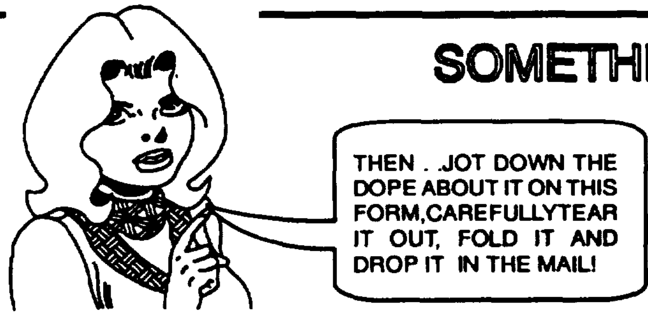

SOMETHING WRONG WITH THIS PUBLICATION?

FROM: (PRINT YOUR UNIT'S COMPLETE ADDRESS)
PFC John DOE
CO A 3rd Engineer Bn
Ft. Leonardwood, MO 63108

DATE SENT 22 August 1992

PUBLICATION NUMBER	PUBLICATION DATE	PUBLICATION TITLE
TM 1-1520-250-10	15 June 1992	Operator's manual MH60K Helicopter

BE EXACT PIN-POINT WHERE IT IS

PAGE NO	PARA-GRAPH	FIGURE NO	TABLE NO	IN THIS SPACE, TELL WHAT IS WONG AND WHAT SHOULD BE DONE ABOUT IT:
6	2-1 a			In line 6 of paragraph 2-1a the manual states the engine has 6 cylinders. The engine on my set only has 4 cylinders. Change the manual to show 4 cylinders.
81		4-3		Callout 16 on figure 4-3 is pointed at a bolt. In key to figure 4-3, item 16 is calle a shim. Please correct one or the other

EXAMPLE

PRINTED NAME, GRADE OR TITLE, AND TELEPHONE NUMBER	SIGN HERE
JOHN DOE, PFC (268) 317-7111	JOHN DOE *John Doe*

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COMMANDER
US ARMY AVIATION AND MISSILE COMMAND
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REDSTONE ARSENAL AL 35898-5230

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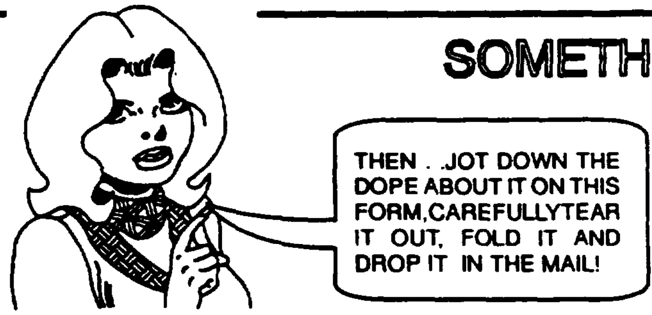

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TM 55-1510-218-10	15 April 1985	Operator's Manual, C-12A/C/D

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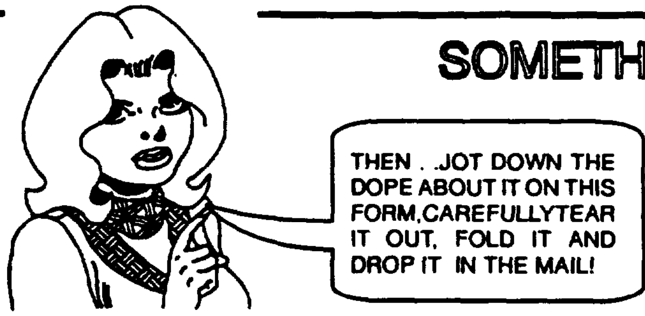

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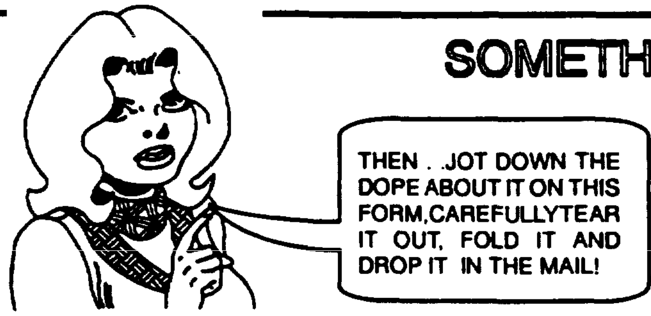

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TEAR ALONG PERFORATED LINE

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1 dekaliter = 10 liters = 2.64 gallons
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Square Measure

1 sq. centimeter = 100 sq. millimeters = .155 sq. inch
1 sq. decimeter = 100 sq. centimeters = 15.5 sq. inches
1 sq. meter (centare) = 100 sq. decimeters = 10.76 sq. feet
1 sq. dekameter (are) = 100 sq. meters = 1,076.4 sq. feet
1 sq. hectometer (hectare) = 100 sq. dekameters = 2.47 acres
1 sq. kilometer = 100 sq. hectometers = .386 sq. mile

Cubic Measure

1 cu. centimeter = 1000 cu. millimeters = .06 cu. inch
1 cu. decimeter = 1000 cu. centimeters = 61.02 cu. inches
1 cu. meter = 1000 cu. decimeters = 35.31 cu. feet

Approximate Conversion Factors

To change	*To*	*Multiply by*	*To change*	*To*	*Multiply by*
inches	centimeters	2.540	ounce-inches	newton-meters	.007062
feet	meters	.305	centimeters	inches	.394
yards	meters	.914	meters	feet	3.280
miles	kilometers	1.609	meters	yards	1.094
square inches	square centimeters	6.451	kilometers	miles	.621
square feet	square meters	.093	square centimeters	square inches	.155
square yards	square meters	.836	square meters	square feet	10.764
square miles	square kilometers	2.590	square meters	square yards	1.196
acres	square hectometers	.405	square kilometers	square miles	.386
cubic feet	cubic meters	.028	square hectometers	acres	2.471
cubic yards	cubic meters	.765	cubic meters	cubic feet	35.315
fluid ounces	milliliters	29,573	cubic meters	cubic yards	1.308
pints	liters	.473	milliliters	fluid ounces	.034
quarts	liters	.946	liters	pints	2.113
gallons	liters	3.785	liters	quarts	1.057
ounces	grams	28.349	liters	gallons	.264
pounds	kilograms	.454	grams	ounces	.035
short tons	metric tons	.907	kilograms	pounds	2.205
pound-feet	newton-meters	1.356	metric tons	short tons	1.102
pound-inches	newton-meters	.11296			

Temperature (Exact)

°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

PIN : 051657-000