AMENDMENT NO. 12

THESE ARE SUPERSEDING OR SUPPLEMENTARY PAGES TO SAME PUBLICATION OF PREVIOUS DATE

Insert these pages into basic publication
Destroy superseded pages

CG-384-1
CGTO 1H-52A-1

FLIGHT HANDBOOK
and
STANDARDIZATION MANUAL

U.S. COAST GUARD
MODEL
HH-52A
HELICOPTERS

TCG-18319-A

PUBLISHED BY DIRECTION OF
THE COMMANDANT OF THE U.S. COAST GUARD

1 September 1963
Amended 15 August 1971

INTRODUCTION

This manual is divided into two parts. Part I contains seven sections which are as follows: Operating Limitations, Normal Procedures, Emergency Procedures, Performance Information, Loading Information, Description, and Flight Characteristics. Part II contains a training syllabus and standardized procedures for specific missions. Each of these parts has a list of revised pages to reflect the date and pages revised.

PART I

FLIGHT HANDBOOK

HH-52A FLIGHT HANDBOOK
LIST OF EFFECTIVE PAGES

Reproduction for non-military use of the information or illustrations contained in this publication is not permitted without specific approval of the issuing service.

Insert latest amended pages. Destroy superseded pages.

NOTE: The portion of the text affected by the current amendment is indicated by a vertical line in the outer margins of the page.

Page No.	Issue
*Title	15 August 1971
Introduction	Original
Part I	Original
*A	15 August 1971
Something New ...	15 February 1965
*Flyleaf	15 August 1971
Certification-1	15 August 1967
Certification-2	15 August 1967
Letter	Original
Blank	Original
*i	15 August 1971
ii	15 February 1967
*iii	15 August 1971
iv	Original
1 thru 2	15 May 1968
*2A	15 August 1971
2B	15 May 1968
*2C	15 August 1971
*2D Blank	15 August 1971
3	15 August 1967
4	Original
*5 thru 10	15 August 1971
*10A Added	15 August 1971
*10B Blank	15 August 1971
*11 thru 14	15 August 1971
*14A Added	15 August 1971
*14B Blank	15 August 1971
*15	15 August 1971
16	15 May 1968
16A Deleted	15 May 1968
*17 thru 18	15 August 1971
19	1 May 1969
*20 thru 20C	15 August 1971
*20D Blank	15 August 1971
*21 thru 22	15 August 1971
23 thru 26	Original
27 thru 33	1 November 1965
*34	15 August 1971
35 thru 36	Original
37	15 February 1965
*38	15 August 1971
39	15 February 1965
40 thru 42	Original
43 thru 52	1 November 1965
53	15 February 1965
54	Original
54A Added	15 February 1965
*54B thru 54E Added	15 August 1971
*54F Blank	15 August 1971
*55	15 August 1971
56 thru 57	15 May 1968
*58 thru 62	15 August 1971
*62A thru 62F Added	15 August 1971
*63	15 August 1971
64 thru 65	Original
66 thru 67	1 November 1965
68	Original
68A Added	1 November 1965
68B Blank	1 November 1965
69 thru 70	Original
70A Added	1 November 1965
70B Blank	1 November 1965
71	1 November 1965
72 thru 73	Original
*74 thru 75	15 August 1971
76	Original
77	1 November 1965
*78 thru 79	15 August 1971
80	15 February 1967
81 thru 82	15 February 1965
*83 thru 93	15 August 1971
94 thru 95	15 May 1968
96	1 November 1965
97	15 February 1965
98	Original
99	1 May 1969
*100 thru 101	15 August 1971
102	1 November 1965
103 thru 104	Original
*104A	15 August 1971
104B thru 104C	1 November 1965
104D Added	15 February 1965
*105 thru 106	15 August 1971
107	15 February 1965 < 110A/110B — 1 May 1969
*108 thru 112A	15 August 1971
*112B Blank	15 August 1971
*113 thru 114A	15 August 1971
*114B Blank	15 August 1971
*115	15 August 1971
116 thru 117 Deleted	15 February 1967
118	15 February 1965
119	1 November 1965
120	15 February 1965
Index-1 thru Index-5 Added	15 May 1968
Index-6 Blank	15 May 1968

*The asterisk indicates pages amended, added, or deleted by the current amendment.

SOMETHING NEW

A new system of publication changes is hereby started.

Commencing immediately essential and urgent changes to this technical handbook shall be issued by an Interim Change System. These changes shall be distributed to you on a non-scheduled, as needed basis to disseminate important information at the earliest possible date and eliminate much of your change page collation problems associated with large revisions.

Interim Changes shall consist of three types: (1) brief write-in instructions, (2) supplemental pages, paragraphs, and illustrations, and (3) replacement or additional pages. Write-in instructions indicated must be made directly on the affected page. Supplemental pages must be inserted next to the affected page of the handbook as instructed on the change. Replacement and additional pages must be collated into the handbook and superseded pages removed.

The changes shall be issued in message or printed form. All shall have a change number for control purposes which you must enter on the Interim Change Summary (flyleaf) in this handbook.

Periodically all Interim Changes will be considered to become a permanent part of the basic book and shall be incorporated as a formal, printed change or revision.

INTERIM HANDBOOK CHANGE SUMMARY

CANCELED OR PREVIOUSLY INCORPORATED IN THIS HANDBOOK	INCORPORATED IN THIS AMENDMENT ON PAGES INDICATED	
No. 1 Page 2 Part I	No. 3 Page 15	Part I
No. 2 Page 7 Part I	No. 4 Page 13	Part I
	No. 5 Page 18	Part I
	No. 6 Page 54C thru F	Part II

INTERIM HANDBOOK CHANGES OUTSTANDING
(to be maintained by handbook custodian)

No.	Date	Purpose

LIST OF U.S. COAST GUARD DIRECTIVES COMPLETELY INCORPORATED IN THIS MANUAL

H-52 Helicopter Change Nos. 6, 9, 16, 17, 24, 34, 37, 40, 44, 47A, 49, 53, 63, 65, 75, 75A, 84, 108

CERTIFICATION PAGE

This certification page must be used by any person who incorporates any change into this copy of the manual. A separate entry is required for each change. Each entry certifies that the person whose signature appears guarantees the accuracy and completeness of that change as it was made in this copy.

After the change has been incorporated, page check the manual. Be sure each instruction was followed accurately and completely. Before discarding superseded or deleted pages, check the date on each new page against the date listed for that page on the A page at the front of the manual or on the title page of the Interim Manual Change, whichever applies. Be sure write-in entries are accurate and placed correctly.

Make the required entry in the spaces below. Enter the date the check was made. List the official identification of the change. For printed revisions (changes) made by Sikorsky Aircraft use "Manual Revision dated _____ " or "Interim Manual Change No. _____ , "as applicable. Write the letters OK under Pages Checked to indicate page check compliance. Sign your name.

After incorporating the manual revision dated 15 August 1967 that contained this certification page, make a one-time check of the date on every page in this copy of the manual against the date listed for it on the newest A page. If all dates agree, complete the first entry in the spaces below, which is identified as "Complete manual dated 15 August 1967."

Date	Amendment/Change Incorporated	Pages Checked	Signature
	Complete manual dated 15 August 1967 Complete manual dated 15 August 1971		

Date	Amendment/Change Incorporated	Pages Checked	Signature

TREASURY DEPARTMENT
UNITED STATES COAST GUARD

Address reply to:
COMMANDANT
U.S. COAST GUARD
WASHINGTON, D.C. 20226

OAU

11 DEC 1964

LETTER OF PROMULGATION

FLIGHT HANDBOOK AND STANDARDIZATION MANUAL

U. S. COAST GUARD MODEL HH-52A HELICOPTERS (CG-384-1)

1. Purpose. This publication prescribes operating procedures and provides general information and performance data for the model HH-52A helicopter.

2. Scope. This publication contains all information and instructions required for safe operation of the model HH-52A helicopter.

3. Discussion. This publication has been previously prepared by the Sikorsky Aircraft Division at the direction of the Commandant. The Coast Guard is the sole military user of the model HH-52A helicopter and no Department of Defense publications exist for this helicopter. This publication is based upon, but by no means identical to the Flight Manual for the commercial S-62 helicopter. As an economy measure, the commercial format has been retained. This Letter of Promulgation is being distributed with Amendment 1 to the 1 September 1963 edition to establish it as a numbered Coast Guard publication and to establish that its content is directive rather than advisory in nature.

4. Distribution and Amendments. Distribution to Coast Guard units is intended to supply sufficient copies to permit individual issue to all helicopter pilots. However, custody will remain with the unit as will the responsibility for entering changes when issued. Changes will be made by serially numbered amendments. Safety of flight and other urgent changes will be promulgated by serially numbered "Interim Change Notices" distributed by the most rapid practical means. Where applicable, interim changes will be identified and included in the next succeeding published amendment.

5. Action. Operating commands and individual flight crews shall comply with the procedures and limitations established in this publication. This letter shall be bound as the first page within the front cover and remain as a permanent part of the publication.

W.W. Childress

W.W. CHILDRESS
Chief, Office of Operations

Dist:
Special Distribution List as
furnished to Sikorsky Aircraft Division

Keep Freedom in Your Future With U.S. Savings Bonds

TABLE OF CONTENTS

	Page
SECTION I. OPERATING LIMITATIONS	1
General	1
Operating Limits	1
Flight Limits	1
Instrument Markings	2
Flight Envelope For Safe Autorotative Landing After Power Failure	4
SECTION II. NORMAL PROCEDURES	5
Before Entering the Helicopter	5
Before Starting	5
Starting Engine	8
Rotor Engagement	9
Instrument Check	11
Taxiing	11
Pre-Take Off	12
Take Off	12
Cruise Checks	12
Pre-Landing Check	12
Landing	13
After Landing and Taxiing	13
Parking	13
Rotor and Engine Shutdown	13
Before Leaving the Helicopter	13
Post Flight	13
SECTION III. EMERGENCY PROCEDURES	14
Engine Emergencies - Ground	14
Engine Emergencies - Flight	14A
Overspeeding of the Rotor System	17
Flight Control Emergency Operation	17
Automatic Stabilization Equipment Failure	19
Main Rotor Blade Damper Malfunction	20
Rotor Blade Damage	20
Fire	20
Emergency Exits	20B
Main Gear Box Oil System Failure	20B
Fuel System Failure	20B
Electrical Power Supply System Malfunction	20C
Heater Failure	20C
Turbulence	20C
Hoist Emergency	21
Helicopter Handling on Water-Power Off	21
SECTION IV. PERFORMANCE INFORMATION	22
SECTION V. LOADING INFORMATION	56
SECTION VI. DESCRIPTION	73
The Model HH-52A Helicopters	73
Engine	73
Engine Fuel System	76
Engine Overspeed System	77
Ignition System	78
Starter System	78
Engine Oil System	78
Engine Anti-icing System	79
Fuel System	80
Transmission System	83
Rotor Brake	83
Transmission Oil Systems	84

TABLE OF CONTENTS (Cont)

	Page
Rotor Systems	85
Instruments	85
Electrical Power Supply Systems	90
Alternating Current Supply System	90
Direct Current Power Supply System	92
Flight Control System	96
Automatic Stabilization Equipment	98
Landing Gear System	99
Wheel Brake System	100
Lighting Equipment	100
Heating System	102
Ventilating System	103
Windshield Wipers	103
Emergency Equipment	104
Emergency Exits and Entrances	105
Pilot's and Copilot's Seats	105
Rescue Hoist	106
Cargo Sling	107
Communication and Associated Electronic Equipment	108
SECTION VII. FLIGHT CHARACTERISTICS	118
General	118
Climb	118
Stalls	118
Blade Stall	118
Spins	119
Flight Controls	119
Coordination of Flight Controls	119
Level Flight Characteristics Under Various Speed Conditions	120
Maneuvering Flight	120
Hovering Out of Ground Effect	120
Diving	120

LIST OF ILLUSTRATIONS

Figure		Page
1.	Helicopter Dimensions Diagram	iv
1A.	T_5 Limits Chart	2A
1B.	Incipient Blade Stall Chart (Sheet 1)	2B
1B.	Incipient Blade Stall Chart (Sheet 2)	2C/2D
2.	Flight Envelope for Safe Autorotative Landing After Power Failure	3
2A.	Exterior Inspection	6
3.	Emergency Exits	18
4.	Density Altitude Chart	23
5.	Airspeed System Calibration	24
6.	Hover Ceilings (5 FT Wheel Clearance)	25
7.	Hover Ceilings (OGE)	26
8.	Take-Off Distance (5 FT Hover to 50 FT, G W 7500 lbs)	27
9.	Take-Off Distance (5 FT Hover to 50 FT, G W 8300 lbs)	28
10.	Forward Climb Performance (M C Power, G W 6000 lbs)	29
11.	Forward Climb Performance (MC Power, G W 6500 lbs)	30
12.	Forward Climb Performance (MC Power, G W 7000 lbs)	31
13.	Forward Climb Performance (MC Power, G W 7500 lbs)	32
14.	Forward Climb Performance (MC Power, G W 8000 lbs)	33
15.	Forward Climb Performance (MC Power, G W 8300 lbs)	34
16.	Deleted.	
17.	Deleted.	
18.	Autorotative RPM vs Density Altitude (IAS 55 Knots, Full Low Pitch)	37
19.	Fuel Consumption vs Power	38
20.	Power Available	39
21.	Power vs Speed (Sea Level and 2000 FT)	40
22.	Power vs Speed (4000 and 6000 FT)	41
23.	Power vs Speed (8000 and 10,000 FT)	42
24.	Speed vs Altitude (G W 6500 lbs, 96%N_r)	43
25.	Speed vs Altitude (G W 7000 lbs, 96%N_r)	44
26.	Speed vs Altitude (G W 7500 lbs, 96%N_r)	45
27.	Speed vs Altitude (G W 8000 lbs, 96%N_r)	46
28.	Speed vs Altitude (G W 8300 lbs, 96%N_r)	47
29.	Speed vs Altitude (G W 6500 lbs, 100%N_r)	48
30.	Speed vs Altitude (G W 7000 lbs, 100%N_r)	49
31.	Speed vs Altitude (G W 7500 lbs, 100%N_r)	50
32.	Speed vs Altitude (G W 8000 lbs, 100%N_r)	51
33.	Speed vs Altitude (G W 8300 lbs, 100%N_r)	52
34.	Engine Input Horsepower vs Indicated Torque	53
35.	Power Check Chart	54
36.	Predicted Range Chart	54B
36A.	Example Problem for Range Chart	54C
36B.	Performance Chart - Sea Level	54D
36C.	Performance Chart - 2000 FT PRESS ALT	54E
36D.	Performance Chart - 4000 FT PRESS ALT	55
37.	Center of Gravity Graph	57
38.	Aircraft Diagram	66
39.	Jacking Points	67
40.	Pilot's Compartment	74
41.	Fuel System Schematic Diagram	81
42.	Instrument Panel and Control Sticks	86
43.	Overhead Switch Panel and Circuit Breaker Panels	91
44.	Electrical Power Supply Schematic Diagram - AC (Sheet 1)	94
44.	Electrical Power Supply Schematic Diagram - DC (Sheet 2)	95
44A.	Emergency Sea State Capabilities	104B
44B.	Sea State Capability vs Lateral Unbalance	104C
45.	Lower Radio Console and Channel Monitor Control Panel	109
46.	Communication and Associated Electronic Equipment	110
47.	Deleted.	

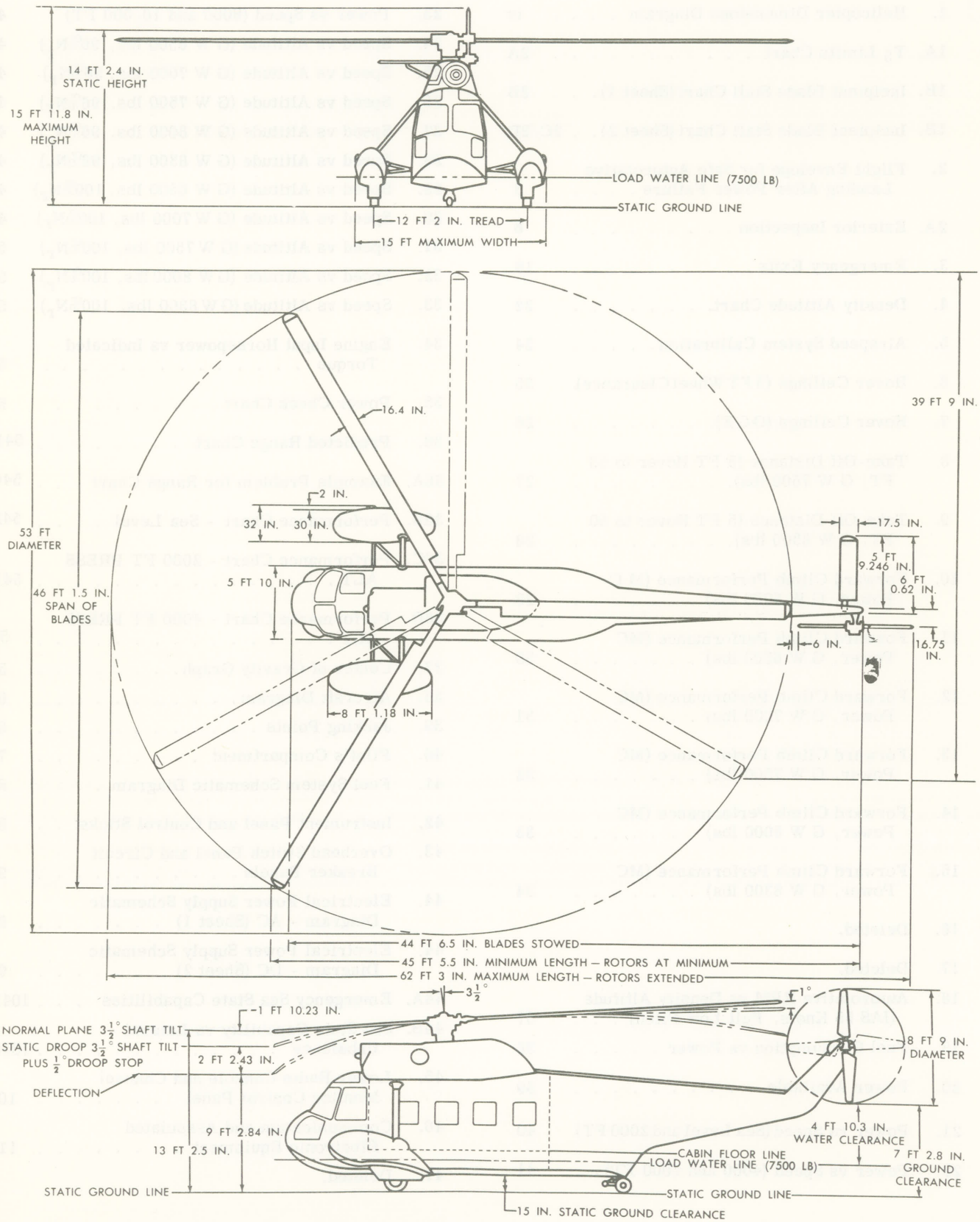

14 FT 2.4 IN.
STATIC HEIGHT
15 FT 11.8 IN.
MAXIMUM
HEIGHT
LOAD WATER LINE (7500 LB)
STATIC GROUND LINE
12 FT 2 IN. TREAD
15 FT MAXIMUM WIDTH
39 FT 9 IN.
16.4 IN.
2 IN.
32 IN.
30 IN.
53 FT
DIAMETER
5 FT 10 IN.
46 FT 1.5 IN.
SPAN OF
BLADES
17.5 IN.
5 FT
9.246 IN.
6 FT
0.62 IN.
6 IN.
16.75
IN.
8 FT 1.18 IN.
44 FT 6.5 IN. BLADES STOWED
45 FT 5.5 IN. MINIMUM LENGTH – ROTORS AT MINIMUM
62 FT 3 IN. MAXIMUM LENGTH – ROTORS EXTENDED
3½°
1° 1
1 FT 10.23 IN.
NORMAL PLANE 3½° SHAFT TILT
STATIC DROOP 3½° SHAFT TILT
PLUS ½° DROOP STOP
DEFLECTION
2 FT 2.43 IN.
9 FT 2.84 IN.
13 FT 2.5 IN.
8 FT 9 IN.
DIAMETER
4 FT 10.3 IN.
WATER CLEARANCE
CABIN FLOOR LINE
LOAD WATER LINE (7500 LB)
7 FT 2.8 IN.
GROUND
CLEARANCE
STATIC GROUND LINE
STATIC GROUND LINE
15 IN. STATIC GROUND CLEARANCE

Figure 1.

SECTION I

OPERATING LIMITATIONS

GENERAL.

These limitations insure your safety and help to obtain maximum utility from the helicopter and its equipment. The instruments are marked to serve as a constant reminder of limitations; however, additional limitations on operational procedures, maneuvers, and loading are given in the following paragraphs.

OPERATING LIMITS.

WEIGHT LIMITATIONS.

The maximum gross weight is 8300 pounds. Flights at gross weights above 8100 pounds shall be limited to operational situations which necessitate the higher gross weights, and whenever practicable, turbulent air shall be avoided and airspeed reduced in turbulence. (Refer to SECTION V, LOADING INFORMATION.)

CENTER OF GRAVITY LIMITATIONS.

Most forward cg: 249 inches aft of datum.
Most aft cg: 262 inches aft of datum.
Datum is located 252 inches forward of the main rotor centroid.

AMBIENT TEMPERATURE LIMITATIONS.

Minimum: -40°F (-40°C), with the winterization kit it is extended to -65°F (-53.9°C).
Maximum: 160°F (71.1°C).

ENGINE LIMITATIONS.

All normal engine limits are listed in the instrument markings in this section.

1. Shaft horsepower limits (limited by transmission life):
   a. Take-off: 730 SHP (100% torque) for 5 minutes at 100% N_f.
   b. Emergency: 845 SHP (116% torque) at 100% N_f.
   c. Maximum continuous: 670 SHP (96% torque) at 96% N_f.
2. Gas generator speed (N_g) limits:
   a. Maximum: 100% N_g.
   b. Maximum continuous: 97.5% N_g (within torque limits).
3. Power turbine inlet temperature (T_5) limits:
   a. Maximum 677°C (1250°F). Do not exceed 30 minutes
   b. Maximum continuous: 635°C (1175°F).

NOTE: The differences between stated T_5 limits and those depicted in Figure 1A are to permit latitude when setting N_g maximum topping. It is not intended that the maximum T_5 limit of of 677°C be exceeded during normal operations.

TRANSMISSION LIMITATIONS.

Operating limitations for the transmission system are governed by main gear box oil pressure and temperature which are designated in INSTRUMENT MARKINGS in this section.

TORQUE LIMITS.

1. Maximum: 100% (730 SHP). Over torque limited to 1 hour of recorded time on the elapsed time indicator.
2. Emergency: 116% (845 SHP). When this limit is exceeded for approximately 5 seconds, a red flag will appear in the window of the event indicator.

ROTOR LIMITS.

1. Power-off.
   a. Maximum: 110% (245 rpm) rotor speed.
   b. Minimum: 77% (170 rpm) rotor speed.
2. Power-on.
   a. Maximum: 103% (228 rpm) rotor speed at minimum pitch.

NOTE: During autorotation power recovery, a transient overshoot (with partial power) above 103% may be experienced and is acceptable.

100% (221 rpm) rotor speed at take-off power.

   b. Minimum: 94% (205 rpm) rotor speed.

MINIMUM FLIGHT CREW.

The minimum allowable crew for the operation of the helicopter is one pilot, but a copilot and crewman may also be carried.

FLIGHT LIMITS.

1. Hovering turns not to exceed a rate of 360 degrees in 10 seconds.
2. Limiting heights and corresponding airspeeds for safe landing following engine failure over land or water are as presented in figure 2.

3. Maximum, never exceed speed: at 6500 pounds gross weight is 109 knots IAS with 96% N_r and at 8300 pounds 88 knots IAS with 96% N_r.

NOTE: The preceding airspeeds differ slightly from those shown in the Speed vs Altitude curves in Section IV because the speeds used in the curves are true airspeeds and these are indicated airspeeds.

4. Maximum sideward flight speed: 25 knots.

5. Maximum rearward flight speed: 20 knots.

6. Maximum ground speed on a hard surface: 43 knots.

7. Maximum weight approved for the cargo sling is 3000 pounds.

NOTE: Extreme caution must be exercised to insure that loads carried and speeds attained do not adversely affect controllability characteristics of the helicopter.

8. Maximum weight approved for the hoist is 600 pounds.

9. Maximum forward flight speed with floats inflated: 70 knots.

CAUTION

Inflation of floats in flight not permitted.

10. Flight into known icing conditions is prohibited.

INSTRUMENT MARKINGS.

GENERAL.

1. Red radial lines - Maximum and minimum limits.
2. Yellow arc - Precautionary range.
3. Green arc - Normal operating range.

AIRSPEED INDICATOR.

1. Maximum: 109 Knots IAS - Red radial line.
2. Precautionary range: 88 to 109 knots IAS - Yellow arc.
3. Normal operating range: 45 to 88 knots IAS - Green arc.
4. Precautionary range: 0 to 45 knots IAS - Yellow arc.

DUAL TACHOMETER.

1. Engine power turbine speed (% N_f).
   a. Maximum: 110% - Red radial line.
   b. Normal operating range: 96 to 103% - Green arc.
   c. Minimum: 94% - Red radial line.
2. Rotor speed (% N_r).
   a. Maximum: 110% - Red radial line.
   b. Normal operating range: 96 to 103% - Green arc.
   c. Minimum: 77% - Red radial line.

POWER TURBINE INLET TEMPERATURE GAGE (T_5).

1. Maximum: 677°C - Red radial line.
2. Precautionary range: 635 to 677°C - Yellow arc.
3. Normal operating range: 300 to 635°C - Green arc.

GAS GENERATOR TACHOMETER (%N_g).

1. Maximum : 100% - Red radial line.
2. Precautionary range: 97.5 to 100% - Yellow arc.
3. Normal operating range: 50 to 97.5% - Green arc.

TORQUEMETER.

1. Maximum: 100% and 116% - Red radial lines.
2. Precautionary range: 96 to 100% - Yellow arc.
3. Normal operating range: 41 to 96% - Green arc.

FUEL PRESSURE GAGE.

1. Maximum: 995 psi - Red radial line.
2. Normal operating range: 190 to 450 psi - Green arc.
3. Minimum: 160 psi - Red radial line.

ENGINE OIL TEMPERATURE GAGE.

1. Maximum: 121°C - Red radial line.
2. Normal operating range: 0 to 121°C - Green arc.
3. Minimum: -54°C - Red radial line.

ENGINE OIL PRESSURE GAGE.

1. Maximum: 75 psi - Red radial line.

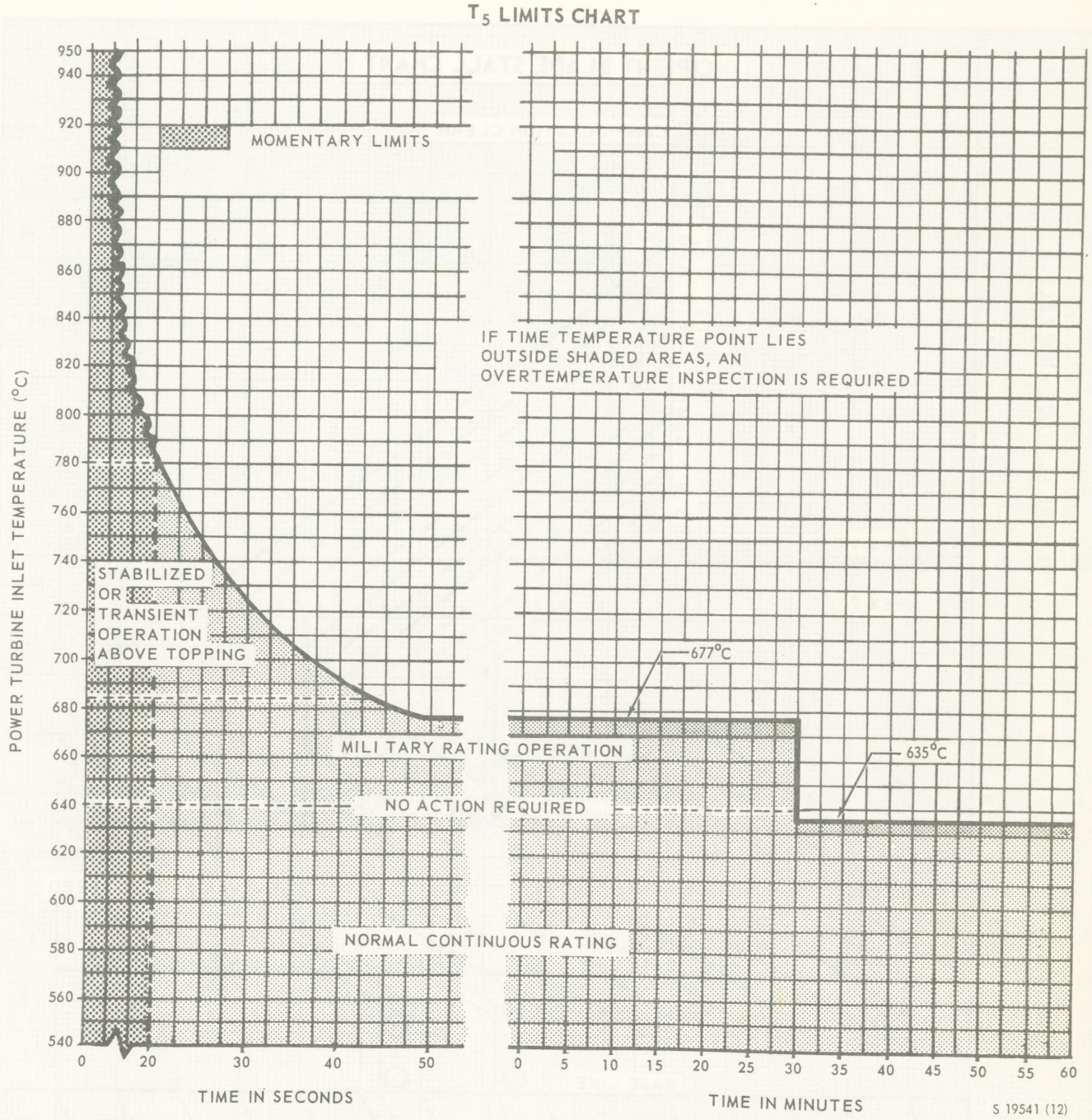

T5 LIMITS CHART
POWER TURBINE INLET TEMPERATURE (°C)
950
940
920
900
880
860
840
820
800
780
760
740
720
700
680
660
640
620
600
580
560
540
MOMENTARY LIMITS
IF TIME TEMPERATURE POINT LIES
OUTSIDE SHADED AREAS, AN
OVERTEMPERATURE INSPECTION IS REQUIRED
STABILIZED
OR
TRANSIENT
OPERATION
ABOVE TOPPING
677°C
MILI TARY RATING OPERATION
635°C
NO ACTION REQUIRED
NORMAL CONTINUOUS RATING
0
20
30
40
50
TIME IN SECONDS
0
5
10
15
20
25
30
35
40
45
50
55
60
TIME IN MINUTES
S 19541 (12)

Figure 1A.

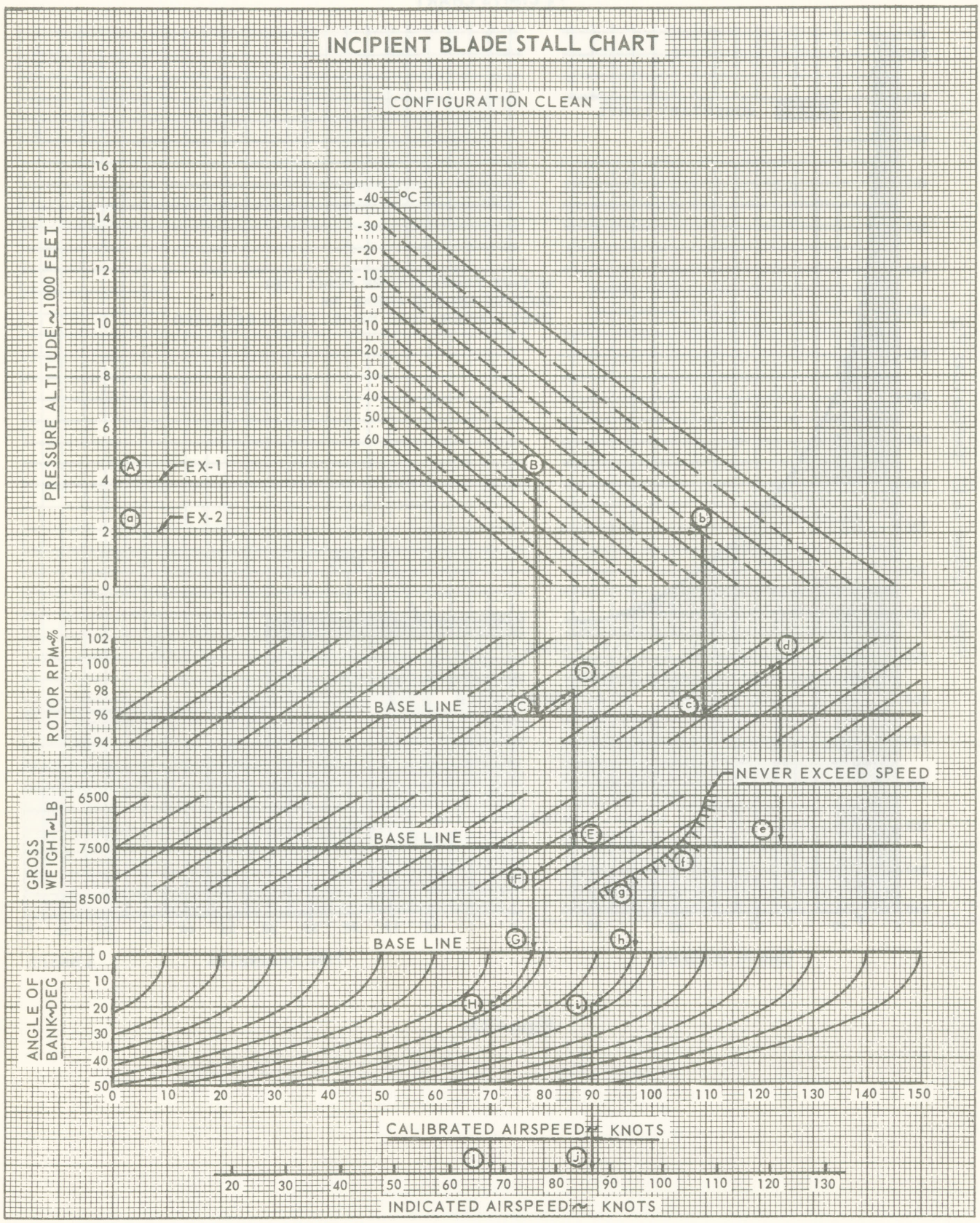


Figure 1B. (Sheet 1 of 2)

INCIPIENT BLADE STALL CHART

Example Problem 1.

Given:

Gross Weight	8000 lb
Angle of Bank	20°
Pressure Altitude	4000 feet
OAT	20°C
Main Rotor Speed	98%

Determine:
Incipient blade stall speed

Solution:

1. Enter chart at 4000 feet pressure altitude (point A).
2. From point A, move horizontally to 20°C (68°F) OAT. (point B).
3. From point B, move downward to base line, 96% N_r (point C).
4. From point C, move parallel to the rotor speed influence lines to 98% N_r (point D).
5. From point D, proceed downward to point E on the gross weight influence graph.
6. From point E, move parallel to the gross weight influence lines to 8000 pounds (point F).
7. From point F, proceed downward to zero degree angle of bank (point G).
8. From point G, move parallel to the angle of bank influence curves to a 20 degree angle of bank (point H).
9. From point H, move downward through the calibrated airspeed scale to the indicated airspeed scale (point I).
10. The indicated airspeed for the above conditions would be 68 knots.

Example Problem 2.

Given:

Gross Weight	8000 lb
Angle of Bank	20°
Pressure Altitude	2000 feet
OAT	-10°C
Main Rotor Speed	100%

Determine:
Incipient blade stall speed

Solution:

1. Enter chart at 2000 feet pressure altitude (point a).
2. From point a, move horizontally to -10°C (14°F) OAT (point b).
3. From point b, move downward to base line, 96% N_r (point c).
4. From point c, move parallel to the rotor speed influence lines to 100% N_r (point d).
5. From point d, proceed downward to point e on the gross weight influence graph.
6. Follow the gross weight base line back from point e to "never exceed speed" curve at point f.
7. From point f follow "never exceed speed" curve to desired gross weight 8000 lbs. (point g).
8. From point g, proceed downward to zero degree angle of bank (point h).
9. From point h, move parallel to the angle of bank influence curves to a 20 degree angle of bank (point i).
10. From point i, move downward through the calibrated airspeed scale to the indicated airspeed scale (point j).
11. The indicated airspeed for the above conditions would be 87 knots.

Figure 1B (Sheet 2 of 2)

2. Normal operating range: 20 to 60 psi - Green arc.
3. Minimum: 8 psi for MIL-L-23699 oil - Red radial line. 10 psi for MIL-L-7808 oil.

TRANSMISSION OIL TEMPERATURE GAGE.

1. Maximum: 140°C - Red radial line.
2. Normal operating range: 40 to 120°C - Green arc.
3. Minimum: -15°C - Red radial line.

TRANSMISSION OIL PRESSURE GAGE.

1. Maximum: 120 psi - Red radial line.
2. Normal operating range: 40 to 90 psi - Green arc.
3. Minimum: 25 psi - Red radial line.

PRIMARY SERVO HYDRAULIC PRESSURE GAGE.

Maximum: 1100 psi - Red radial line.

Normal operating range: 850 to 1100 psi - Green arc.

Minimum: 850 psi - Red radial line.

AUXILIARY SERVO HYDRAULIC PRESSURE GAGE.

Maximum: 1600 psi - Red radial line.

Normal operating range: 1300 to 1600 psi - Green arc.

Minimum: 1300 psi - Red radial line.

FLIGHT ENVELOPE FOR SAFE AUTOROTATIVE
LANDING AFTER POWER FAILURE

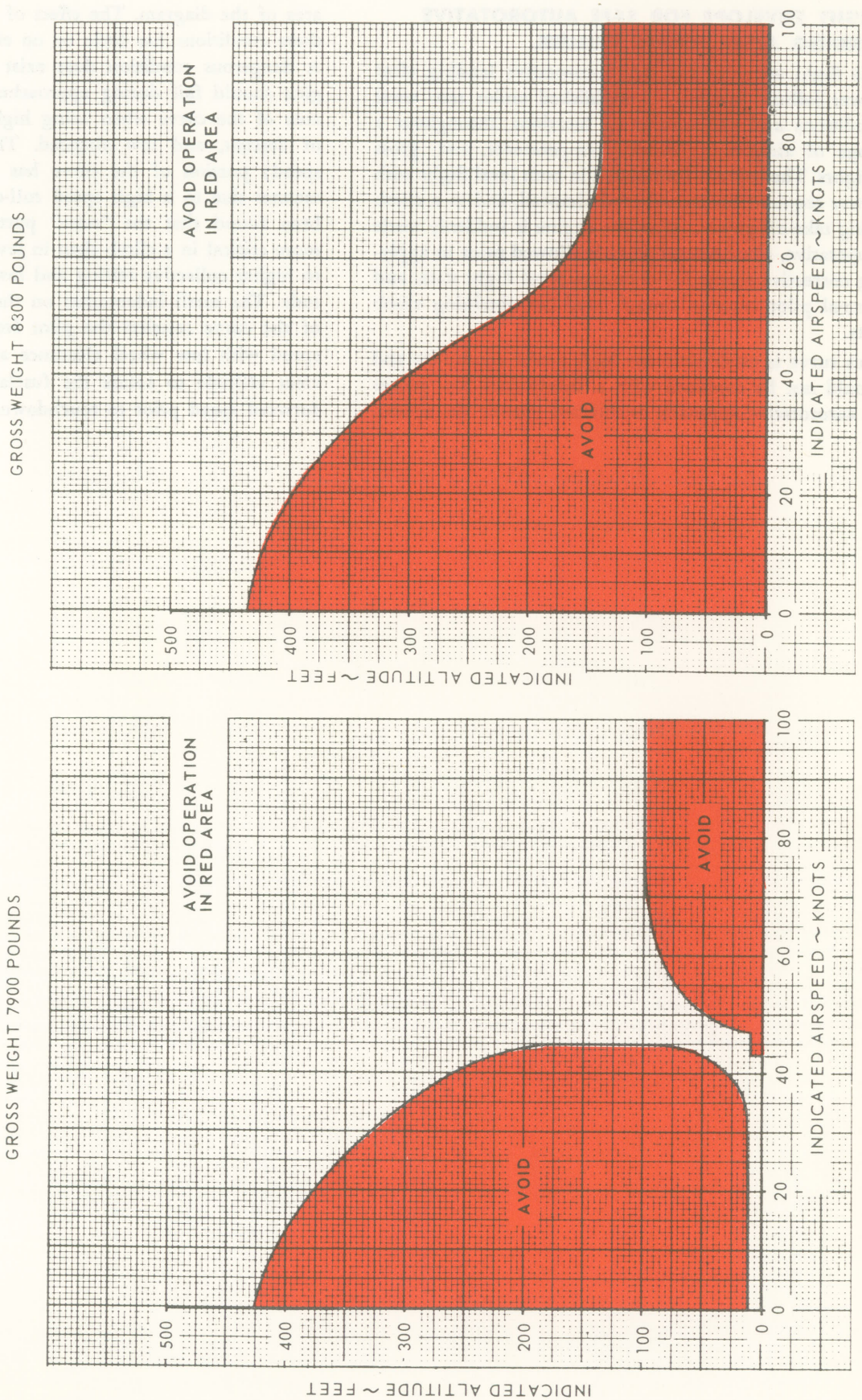


Figure 2.

FLIGHT ENVELOPE FOR SAFE AUTOROTATIVE LANDING AFTER POWER FAILURE.

The flight envelope for safe autorotative landing after power failure, figure 2, is established under zero wind conditions and per various cg locations, throughout a range of airspeeds, altitudes, temperatures, and, gross weights. The curve is formulated in both level flight with power required for the selected airspeed, and in a climb using take-off power. After the engine is suddenly made inoperative, a one second delay is allowed prior to applying corrective action for obtaining level flight data, and normal pilot reaction time is used for obtaining climb data.

This curve is established for high power conditions and should not be confused with a steady-state low power or autorotative approach established outside the shaded area of the diagram. The effect of engine failure under these conditions has little or no effect on the landing. A dangerous condition does exist however, if the engine should fail during approaches within the shaded area of the curve when using high power, a low rate of descent, and low airspeed. The right-hand (high speed) portion of the curve has been shaped in this manner due to a high speed roll-on restriction. It has been found that the "nose" portion of the curve is more critical in a climb than in level flight attitude due to higher collective setting and lower aircraft nose attitude. The small indentation on the high speed portion of the curve restricts the pilot from obtaining a high speed with low wheel clearance and allows him sufficient altitude to rotate the fuselage and decrease the forward speed prior to touchdown.

SECTION II

NORMAL PROCEDURES

Techniques for performing normal procedures are covered in Part II (Standardization Manual).

BEFORE ENTERING THE HELICOPTER.

LOADING INFORMATION. The take-off and anticipated landing gross weight and balance should be obtained before take-off and checked against the LOADING INFORMATION in Section V.

PILOT'S PRE-FLIGHT INSPECTION.

A pilot's pre-flight inspection will be accomplished prior to each flight. This will normally be performed by the assigned pilots but may be delegated to another qualified crewmember assigned to the flight. The purpose of this inspection is to visually inspect the aircraft prior to flight, to ensure removal of any protective covers/devices, and to detect damage or discrepancies which have developed since completion of the maintenance pre-flight inspection. The inspection will include, but is not limited to, the following items:

EXTERIOR INSPECTION.

1. GENERAL.
   a. Be alert for damage to any part of the aircraft that may have resulted from ground handling, careless operation of flight line vehicles, other aircraft, etc. -CHECKED.
   b. Be alert for any sign of fluid leakage - CHECKED.
2. BIM indicators for normal indication - CHECKED.
3. Bottom side and tip of main rotor blades for dents or scratches - CHECKED.
4. Tail wheel assembly for proper oleo extension and tire inflation. Lock pin in hole and shear point aligned - CHECKED.
5. Tail rotor blades for dents or scratches - CHECKED.
6. Fire extinguisher thermal discharge indicator - CHECKED.
7. Overboard drains for excessive discharge - CHECKED.
8. Left main landing gear for proper oleo extension and tire inflation - CHECKED.
9. Engine and transmission cowling for security - CHECKED.
10. Engine intake and exhaust protective covers removed - CHECKED.
11. Pitot cover removed - CHECKED.
12. Right main landing gear for proper oleo extension and tire inflation - CHECKED.

INTERIOR INSPECTION.

1. Circuit breakers (aft panel) - CHECKED.
2. Cargo for proper loading and security - CHECKED.
3. Circuit breakers; forward panel and radio panel - CHECKED.
4. Transmission overtorque clock and flag. (Note time on clock) - CHECKED AND NOTED.

BEFORE STARTING.

1. Safety belt and shoulder harness - FASTENED AND ADJUSTED.
2. Shoulder harness inertia reel lock handle - CHECK BOTH LOCKED AND UNLOCKED POSITION.
3. Seat - ADJUSTED.
4. Tail rotor pedals - ADJUST.
5. Gyro selector switch - PORT.
6. ASE hardover switches - GUARD COVERS CLOSED.
7. ASE channel disengage switches - ON.
8. Cockpit emergency window release handles - PROPER POSITION AND BREAKAWAY WIRE INTACT.
9. Flight controls - CHECK FOR COMPLETE FREEDOM OF MOVEMENT.
10. Collective friction - APPLY SLIGHT AMOUNT.

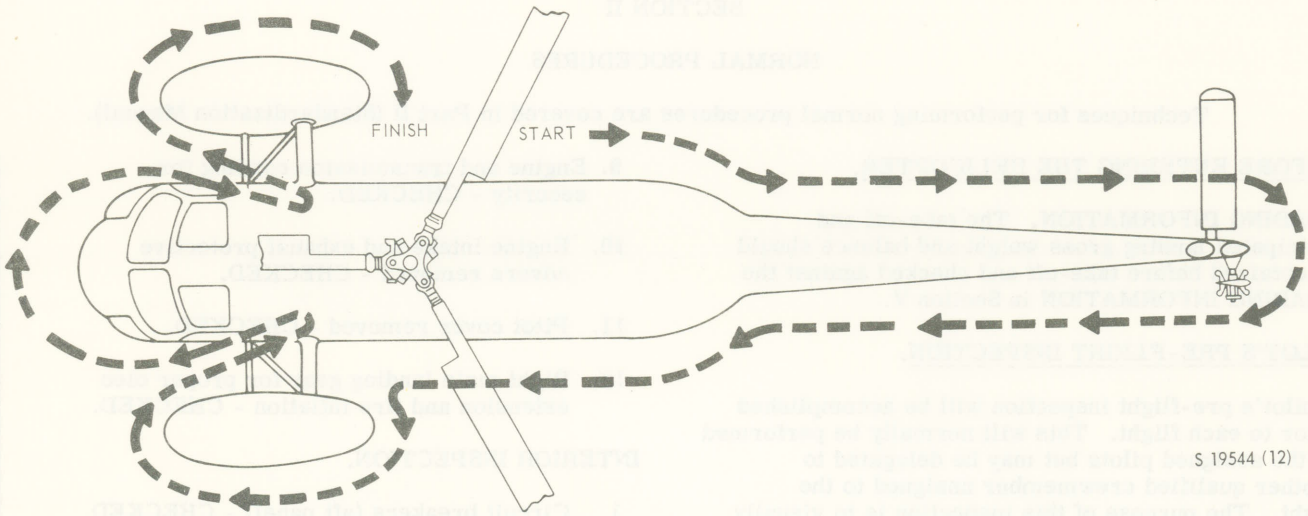


Figure 2A.

11. Emergency throttle - Operate through full travel to insure smooth and complete movements, then CLOSED.

12. Speed selector - Operate through full travel to insure smooth and complete movements, then STOPCOCKED.

13. Flight control servo shut-off switch - ON.

14. Hover and flood light switch - AS DESIRED.

15. Tail wheel - LOCKED.

16. Parking brake - RESET.

17. ASE CG trim index set ONE o'clock.

18. Lower console radios - AS DESIRED.

19. Radio transmit and receive switches - AS DESIRED.

20. Landing gear switch - DOWN.

21. Landing gear position indicator - BARBERPOLE.

22. Fuel quantity selector - TOTAL.

23. Rotor brake lever - ON.

24. Outside air temperature - CHECKED.

25. Fuel fire wall shut-off valve handle - FUEL ON.

26. P_3 valve - AS REQUIRED.

27. Pitot heater switch - AS DESIRED.

28. Windshield defroster switch - OFF.

29. Engine anti-ice switch - AS DESIRED (on below 10°C OAT).

30. Hoist master switch - OFF.

31. Hoist shear switch - OFF (Guard cover closed and breakaway wire intact).

32. DC non-essential bus override switch - OFF.

All data on this page deleted.

33. Heater master switch - OFF.
34. Heater start switch - OFF.
35. Heater HI-LO cycling switch - HI.
36. Vent blower switch - NORMAL.
37. Navigation lights master switch - ON.
38. Position lights master switch - AS DESIRED.
39. Rotating anti-collision light switch - ON.
40. Windshield wiper switch - OFF.
41. All lighting rheostats - AS DESIRED.
42. IFF - AS DESIRED.
43. Compass control - SLAVED.
44. Pilots compartment and cabin dome light switches - AS DESIRED.
45. Map light - AS DESIRED.
46. HF radio - AS DESIRED.
47. Cargo sling master switch - SAFE.
48. Release mode switch - TUGBIRD.
49. Radio master switch - ON.
50. Beeper trim switch - ON.
51. No. 1 and No. 2 fuel booster pump switches - ON.
52. Engine overspeed governor switch - AS REQUIRED.
53. Ignition switch - NORMAL.
54. No. 1 and No. 2 generator switches - ON.
55. Battery switch - OFF.
56. External power switch - OFF.

STARTING ENGINE.

BATTERY START.

This is the normal start procedure.

1. Fireguard - Posted left side forward.
2. Aircrewman (optional) - Posted forward with headset plugged in.
3. Speed selector - STOPCOCKED.
4. Battery switch - BAT START.
5. Starter button and clock - DEPRESS.

CAUTION

Do not operate starter continuously for more than 30 seconds at full engine load, except in emergency. Do not attempt more than three starts in any 30 minute period, allowing a minimum of 3 minutes between each attempt, or damage to the starter may result.

6. Motor the engine with the starter to remove fuel from the combustion chamber and until T_5 is less than 100°C. Then, advance the speed selector to GROUND IDLE when accelerating through 14% N_g. Do not tap gage.

NOTE: Failure to attain 17% N_g may result in a hot start. It is possible to get a hot start above 17% N_g if other unfavorable conditions exist, as listed in paragraph on ALTERNATE ENGINE STARTING PROCEDURE.

7. Release starter button at 45% N_g. The engine will accelerate to ground idle (56 ± 3% N_g).

CAUTION

If the engine lite-off does not occur within 15 seconds after the speed selector has been advanced to GROUND IDLE, return the speed selector to STOPCOCK and release the starter button. Before attempting another start, investigate and analyze the conditions requiring the abort. If the situation justifies another start, wait 3 minutes for fuel to drain from the manifolds, combustion chamber and exhaust hood before repeating the start procedure. It is then desirable to use an APU if available. If any doubt exists, or limits were exceeded during the start, do not attempt a second start. Record the discrepancies in the maintenance record listing all details. A hot start abort, cold hang-up or any other abnormal start should also be recorded in the aircraft maintenance record.

CAUTION

If the gas generator does not accelerate, monitor the power turbine inlet temperature indicator. If T_5 rises abnormally and/or appears it will exceed 700°C, a hot start is evident. Immediately shut down the engine by moving the speed selector to the STOP-COCK position and continue motoring the engine until it is certain that no fire remains. If the starter has been released and an engine fire remains (indicated by a 300°C or higher T_5), engage the starter below 20% N_g and motor until the fire is extinguished. For additional information on hot starts, refer to ENGINE STALL or HOT START in Section III.

CAUTION

If N_g ceases to accelerate and T_5 remains below 400°C, a cold hang-up has occurred. Advance emergency throttle slowly, monitoring T_5 and N_g, until N_g reaches ground idle (56 ± 3% N_g). Return emergency throttle to the closed position.

8. Battery switch - ON.
9. When gas generator speed has stabilized at ground idle, check engine instruments for normal indications.

ALTERNATE ENGINE STARTING PROCEDURE (P3 VALVE).

NOTE: The alternate engine starting procedure should be used any time conditions conducive to a hot start prevail or when starting at a remote area. Refer to HOT START in Section III.

CAUTION

Opening P3 valve may not prevent a hot start. It is not recommended that P3 valve be opened on all starts as this may mask malfunctions that would not otherwise be noted.

1. P_3 valve - OPEN.
2. Use BATTERY START procedures, items 1 thru 6. When T_5 has peaked close P_3 valve. Approximately 50 to 100°C T_5 increase can be expected.
3. Monitor gas generator speed until it reaches 45%, then release starter button.
4. Battery switch - ON.
5. When N_g stabilizes at ground idle - check engine instruments for normal indications.

STARTING WITH EXTERNAL POWER.

External power is recommended for the first start of the day.

1. When starting with AC external power, the entire electrical system is energized. When starting with DC external power, the dc essential and non-essential buses are energized. Accomplish the same BEFORE STARTING procedures as used for a normal battery start except for the following:
   a. External power switch - ON.
   b. Battery switch - ON.
   c. After engine is on SPEED, External power switch - OFF.
   d. Disconnect external power source.

ROTOR ENGAGEMENT.

1. Before rotor engagement, check that the APU (disconnected) and personnel are clear of main and tail rotor blades.
2. Collective pitch - MINIMUM.
3. Rotor brake - OFF and ROTOR BRAKE caution light out.
4. Transmission oil pressure gage and both servo pressure gages - CHECK indications for normal operation range and that caution lights are out.

   NOTE: High velocity or gusty winds can cause excessive blade flapping. The rotor should not be engaged in winds above 60 knots. When engaging or disengaging the rotor in high or gusty winds, the rotor should be accelerated or decelerated as rapidly as possible (without overtorque).

5. Flight controls - CHECK RESPONSE. As rotor speed accelerates to approximately 33% N_r, note that no unusual cyclic stick position is required to maintain a level tip path plane. Actuate the cyclic stick a slight amount in all directions and check for proper response by observing tip path plane of the main rotor blade. Activate rudder pedals and collective for freedom of movement. Note rise in tip path plane when collective is raised.

CAUTION

If flight controls do not respond correctly, shut down by applying rotor brake. Faulty response may be due to ice formation within the flight control servo unit boots (if boot is deteriorated and allows moisture to enter), rendering the servo pilot valve inoperative.

6. Primary and auxiliary servo systems - CHECK.

   a. Primary and auxiliary servo hydraulic pressure gages - CHECK.

CAUTION

When performing servo system check, keep finger on flight control servo shutoff switch and be prepared to return switch to ON (centered) position in event of erratic behavior or malfunction of flight control system when switch is placed in either PRI OFF or AUX OFF.

   b. Flight control servo shutoff switch - PRI OFF. Observe reaction of main rotor blades tip path plane. Normal indication is a slight movement of tip path plane as primary servos are allowed to move within sloppy link. If indication of tip path plane is normal when flight control servo shutoff switch is placed in PRI OFF position, continue flight control servo system check. Check all flight controls for proper operation on auxiliary servo system with TRIM RELEASE DEPRESSED. Check primary servo hydraulic pressure gage for decrease in pressure to zero. Primary hydraulic pressure caution light should illuminate.

NOTE: Fore and aft and lateral cyclic movement should be smooth.

CAUTION

Any abnormal movement of the tip path plane might indicate a primary servo malfunction.

If an excessive movement of the tip path plane is noted, do not continue servo check. Place flight control servo shutoff switch in the ON (centered) position, shut down engine and rotor and conduct a thorough ground investigation of primary servos.

   c. Flight control servo shutoff switch - ON (centered). Check primary servo hydraulic pressure gage for increase to normal operating pressure and caution light out.

   d. Raise collective pitch stick slightly. Flight Control servo shutoff switch - Aux OFF. Check for NO jump or kick in the flight controls; maximum allowed is 1/8" in cyclic, and 1/16" in collective and tail rotor pedals. Excessive jump is a grounding discrepancy. Check all flight controls with TRIM RELEASE DEPRESSED for proper operation on primary servo system. Check auxiliary servo hydraulic gage for decrease in pressure. Auxiliary hydraulic pressure caution light should illuminate.

NOTE: With auxiliary servo off, increased friction will be felt in 3 of the 4 servo channels when moving the controls. Pedal forces are less than normal due to pedal damper being off.

   e. Flight control servo shutoff switch - ON (centered). Check auxiliary servo hydraulic pressure gage for increase to normal operating pressure and caution light out.

CAUTION

Inability to secure either servo is a grounding discrepancy.

7. Engine overspeed switch - TEST NO. 1. Perform this test on the first flight of the day.

NOTE: The test will insure that the stator vane actuator primary switch is functioning properly.

8. Engine speed selector - ADVANCE TO OBTAIN TORQUE INCREASE. Note that at 72 $\pm$ 3% N_g, overspeed governor trips and N_g oscillates around 72%.

NOTE: Refer to NAVAIR 028-105AHB-2/ T.O. 2J-T58-2, Fig. 10-20 operating range of overspeed limiter system primary and accessory switch circuits. Variations in Test #1 greater than 72% PLUS 3 may be within allowable limits due to variations in outside air temperature.

CAUTION

Care should be exercised in advancing engine speed selector to preclude too rapid acceleration of rotor system which may cause slewing of helicopter.

9. Engine overspeed switch - TEST NO. 2. Perform this test on the first flight of the day.

10. Engine speed selector - ADVANCE TO OBTAIN 97% ± 1% N_r. Note that overspeed governor trips and N_f/N_r oscillates around 97%.

    NOTE: Gas generator should decrease until rotor speed and power turbine speed fall below 97% or until gas generator speed (N_g) falls below 72 ± 3% at which time N_g will increase again until the rotor speed (N_r) and power turbine speed (N_f) return to overspeed condition.

11. Engine overspeed switch - NORM.

12. Engine speed selector - Advance to check maximum N_f/N_r and return to 100% N_f/N_r.

13. Freewheel unit - CHECK. Rotate speed selector positively to FLT IDLE and when N_f/N_r needles split, increase speed selector to AUTO DETENT. Allow the initial N_g surge to peak and then increase speed selector to 100% N_f/N_r.

14. Chocks - REMOVED.

INSTRUMENT CHECK.

1. Fuel quantity selector switch - Rotate from TOT to AFT and obtain reading. Depress fuel gage test switch to minimum needle reading, release, and insure needle returns to same reading. Rotate switch to FWD.

2. Caution and advisory lights test switch - TEST. All panel lights should illuminate. Then RESET, to turn master caution light off.

3. Select DIM or BRIGHT as desired.

4. Engine and transmisssion system instruments - CHECK FOR NORMAL READINGS.

5. Emergency exit lights - ARM.

6. Engine fire warning light test switch - FIRE TEST. The T-handle lights and panel warning light should illuminate.

7. Dual tachometer - Pilot and copilot cross check.

8. Airspeed - Pilot and copilot cross check.

9. VGI - Check index arrows adjusted to index dots and pilot and copilot cross check.

10. RAD ALT - Both pilots adjust limit control bugs to 140 feet, check bug lights on, and check altimeter readings.

11. Torquemeter - Pilot and copilot cross check.

12. Flight director - Pilot select ASE.

13. MA-1 compass - SET. Pilot set as desired for compass controlled gyro or free gyro indications.

14. Compass acknowledge button - DEPRESS.

CAUTION

During shipboard operation, the MA-1 compass must be reset after becoming airborne when free of local magnetic disturbances created by the ship. Resetting will provide more accurate readouts sooner than if the system were allowed to slave by itself.

15. BAR ALT - Set in field elevation and pilot and copilot cross check.

16. Clock - CHECK.

17. Turn and Slip indicators - Pilot and copilot cross check.

18. RAWS - Pilot turn on if RAD ALT stabilized.

19. Marker beacon - ON. Volume and sensitivity as desired and press to test marker beacon light.

20. Vertical speed indicator - Pilot and copilot cross check.

21. Engine anti-icing system. Perform the following test if flight in icing conditions is possible.

    a. Engine anti-ice switch - TEST.

    b. Engine inlet anti-ice caution light - ON.

    NOTE: The light should illuminate when the switch is placed in TEST. At certain low ambient air temperatures the light may already be on. When system controller sense element detects a temperature of 54.4°C (130°F), the light should go out and then come on again when temperature reaches 48.9°C (120°F). The light will continue to cycle as the controller cycles. When the ambient temperature is below -28.9°C (-20°F), there is insufficient heat produced to raise duct temperature above the duct mounted thermal switch setting; therefore, the inlet anti-ice caution light will remain on.

    NOTE: Usually at very low temperatures, icing conditions are not encountered due to lack of moisture in the air.

    c. Engine anti-ice switch - AS DESIRED. (On below 10°C OAT.)

22. Hoist - CHECK AS REQUIRED.

23. Heater master switch - AS DESIRED.

TAXIING.

TAXIING PROCEDURE ON LAND.

1. Parking brake - OFF.

2. Speed selector - 100% N_f/N_r.

NOTE: Maintain a minimum of 100% N_f/N_r so that an immediate take-off can be accomplished if necessary.

3. Cyclic stick - AS REQUIRED. Regulate taxiing speed by use of wheel brakes.

NOTE: When taxiing crosswind, hold cyclic stick slightly into the wind. Avoid cyclic stick positions that cause main rotor blade to hit droop stops.

4. Collective pitch lever - Increase collective pitch until forward motion is obtained.

CAUTION

Use minimum collective pitch required for forward motion to prevent the main rotor from developing sufficient lift to cause extension of the landing gear oleo struts.

CAUTION

Caution should be observed when there are light planes within the immediate area as they may be upset by the turbulence from the rotor downwash.

5. Tail wheel - UNLOCKED.

6. Tail rotor pedals - AS REQUIRED. Maintain directional control by use of tail rotor pedals. If necessary, use wheel brakes.

TAXIING PROCEDURE ON WATER (FAMILIAR AREAS).

Taxiing on water in familiar areas may be accomplished with relative ease under ideal water conditions. The helicopter will respond to speed and directional controls in the conventional manner.

TAXIING PROCEDURE ON WATER (UNFAMILIAR AREAS).

When taxiing on water in unfamiliar areas, be alert to preclude striking floating surface objects or floating sub-surface objects which could seriously damage the hull or sponsons. Care should be exercised when taxiing in shallow water where contact with the bottom could cause damage to hull, sponsons, or tail wheel. If damage to the helicopter is suspected, an immediate take-off should be accomplished.

ASE CHECK.

1. Tail wheel - LOCKED.

2. Parking brake - ON.

3. ASE - CHECK.

   a. ASE ENG button (ASE control panel) - DEPRESS. Green light will illuminate when ASE is on. Check flight director OFF flags behind mask.

   b. Pilot move cyclic left and right then fore and aft slightly to check proper movement of mode bars.

   c. Pilot adjust CG control to place the pitch mode bar two units below center index while maintaining a center cyclic position. (Check CG setting in hover for fine adjustment.)

   d. Adjust yaw mode pointer one unit to right then center by depressing left rudder pedal. Reverse this procedure to the left.

   e. Pilot's AUTO STAB release button (cyclic) - DEPRESS. Check that engage light goes out.

   f. ASE ENG button - DEPRESS.

   g. Copilot's AUTO STAB release button (Cyclic) - DEPRESS Check that engage light goes out.

PRE-TAKEOFF.

1. Tail wheel - LOCKED.
2. Parking brake - OFF.
3. ASE - ENGAGED.

CAUTION

Aboard ship, ASE shall be disengaged anytime the ship is turning. If ASE is not disengaged, the turn will be resisted by the automatic stabilization directional channel and cause the helicopter to turn in relation to the deck of the ship.

4. Radios - AS DESIRED.
5. Caution panel lights - OUT.
6. Engine instruments - NORMAL.
7. Engine speed selector - 103% N_f/N_r.
8. Flight instruments - CHECKED.

TAKE-OFF.

1. Use procedures prescribed in Part 2 (Standardization Manual).

CRUISE CHECKS.

1. Landing gear switch - Check DOWN (over land), UP (over water).
2. Engine speed selector - 96% N_f.
3. Fuel quantity - Check at intervals during flight.

PRE-LANDING CHECK.

1. Tail wheel - LOCKED.
2. Parking brake - AS DESIRED.
3. Landing gear switch - DOWN (over land), UP (over water).
4. Caution panel - CHECKED.
5. Speed selector - 100% N_f/N_r (103% in low power descent).
6. Heater switch - AS DESIRED. (Secure 5 minutes prior to shutdown).

LANDING.

1. Use procedures prescribed in Part 2 (Standardization Manual).

CAUTION

The utmost caution is required to avoid contacting the water prematurely when darkness or glassy water makes it difficult to discern the surface. Under these conditions, depth perception is seriously impaired, and an abbreviated "beep to hover" technique should be used.

AFTER LANDING AND TAXIING.

1. Collective pitch - MINIMUM PITCH.
2. Speed selector - ADJUST TO 100% N_f/N_r.
3. ASE - DISENGAGE.
4. Tailwheel - UNLOCKED.

PARKING.

1. Head helicopter into wind.
2. Tailwheel - LOCKED.
3. Parking brake - SET.
4. Emergency exit lights - DISARM.
5. Air crewman - Disembark on signal and check droop stops in.

ROTOR AND ENGINE SHUTDOWN.

1. To provide engine cooling prior to shutdown, determine that the engine has been operated to meet one of the following conditions:
   a. A minimum of one minute of operation with the speed selector in the governing range and collective pitch lever set at minimum pitch.
   b. A minimum of one minute of operation with the speed selector set in FLIGHT IDLE and collective pitch lever set at minimum pitch.
   c. A minimum of one minute taxiing time.

   NOTE: If required by emergency conditions, the engine may be shut down from any normal power setting without regard to above conditions.

2. Speed selector - FLIGHT IDLE. (Check for N_f/N_r needle split.)
3. Droop stops - IN.
4. Rotor brake - Apply according to procedures below:
   a. Wind over 25 knots.
      (1) Speed selector - STOPCOCKED.
      (2) When N_r slows to 48 per cent apply full rotor brake using one steady motion. To preclude blade whip, as rotation nears complete deceleration rotor brake pressure should be reduced to ease rotor blades to a stop with one blade at the 12 o'clock position.
      (3) Battery switch - OFF.
   b. Wind 25 knots or less.
      (1) Speed selector - STOP COCKED.
      (2) Battery switch - OFF.
      (3) Allow the rotor to coast down until almost stopped then apply a slight amount of braking to slowly and smoothly bring the rotor to a stop with one blade at the 12 o'clock position.
   c. Any time when engine shutdown is not to be accomplished immediately.
      (1) Speed selector - FLIGHT IDLE.
      (2) Apply full rotor brake after rotor has stabilized at idle RPM using one steady motion.
      (3) Battery switch - OFF.

CAUTION

Whenever the rotor brake is applied, avoid pumping the rotor brake lever as this will result in premature wear of the rotor brake.

NOTE: In an emergency the rotor brake is capable of stopping the rotors from 96% NR in 20 seconds. Place speed selector in FLIGHT IDLE position, allow 5 second delay (NR will coast down to 85%) and apply brake.

5. Power turbine inlet temperature gage - MONITOR for indication of post shutdown fire indicated by continuous 300°C or higher T_5. Be prepared to motor engine with starter to extinguish flame.

BEFORE LEAVING THE HELICOPTER.

1. Switches - OFF. (Normal overhead wipeout sequence.)
2. Power turbine inlet temperature gage - RECHECK.

POST FLIGHT.

1. Overtorque clock and flag - Check and note on appropriate form if time increased and/or flag shows.
2. Perform brief EXTERIOR INSPECTION.

SECTION III

EMERGENCY PROCEDURES

ENGINE EMERGENCIES - GROUND.

These procedures describe the operation of the engine if an abnormal condition occurs. When safe operating limits are not attainable or are exceeded, they shall be recorded on the aircraft flight records. Hot starts and cold hangups are abnormal engine conditions. They provide an early indication that the engine and fuel control combination are not operating properly.

HOT START.

A hot start is defined as a temperature (T5) that rises abnormally fast, or above that normally expected, but below the overtemp range. An overtemp requires maintenance action. A hot start is more likely if the engine lights off after Ng has peaked and is decelerating. If a hot start is evident, abort the start before T5 rises above 700°C. Hot starts may be caused by one or a combination of the following:

1. Weak battery.
2. Malfunction of fuel control system.
3. Hot ambient temperatures.
4. Hot engine.
5. Fuel change/fuel control/flow divider set wrong.
6. High density altitude.
7. Malfunctioning starter.
8. Wind blowing up the exhaust.
9. Clogged combustion drain.
10. Improper starting procedure.

Following the hot start, the pilot should record the type start, the Ng speed when the speed selector was opened and the maximum T5.

COLD HANGUP.

A cold hangup is due to a lean fuel-air ratio. Indications of a cold hangup are N_g acceleration slowing down between 30-50%, and a lower than normal T_5 (350-400°C). A cold hangup can be corrected by opening the emergency throttle and accelerating the engine to the ground idle range. Possible causes of a cold hangup are:

1. Fuel boost pumps not on.
2. Fuel control malfunction.
3. Improper fuel density settings.
4. P_3 system leak or P_3 valve open.
5. Flow divider malfunction.

ENGINE STALL.

An engine stall is caused by an aerodynamic disturbance of the smooth air flow pattern through the compressor. A rapid rise in power turbine inlet temperature and a hangup of gas generator speed, accompanied by an audible rumble and vibration from the engine, are stall symptoms.

CAUTION

If an engine stall occurs, immediately stopcock the speed selector. During coast-down, listen for any unusual noise or for an indication of a possible mechanical failure. Note the maximum T_5.

ENGINE STALL ABOVE IDLE SPEED.

1. ACCELERATION STALL.

   Engine stall, occuring above the idle speed during acceleration, may be caused by incorrect operation of the variable stator vanes.

2. DECELERATION STALL.

   Engine stall, occuring above the idle speed during deceleration, may be caused by incorrect operation of the variable stator vanes.

3. FLAME-OUT.

   An engine flame-out will be indicated by a decrease in T_5, N_g, and fuel pressure. A flame-out due to water ingestion, gives similar indications.

CAUTION

Following a flame-out due to water ingestion, sea conditions will dictate whether a restart should be attempted. If adequate conditions and facilities exist, the helicopter should be towed to a suitable retrieving point and hoisted to land. Internal engine damage may preclude safe air taxi to land although a successful relight has been obtained.

4. OVERTEMPERATURE.

If the power turbine inlet temperature exceeds the temperature/time limitations of figure 1A, it is considered an overtemperature.

EMERGENCY SHUTDOWN.

If an abnormal engine condition occurs, such as engine stall, flame-out, or overtemperature, the engine shall be shut down immediately.

ENGINE EMERGENCIES - FLIGHT.

Engine malfunctions fall into two general categories. The first is a complete power loss. The audible symptoms normally associated with reciprocating engine failures are not characteristic of the T-58. Transmission noise makes engine deceleration difficult to detect. This is particularly true during a fuel control malfunction. There may be an audible warning of imminent engine failure if a forward accessory gear or engine bearing failure occurs. The most probable and common cause of a power loss is compressor stall. It could be caused by ingesting FOD, variable stator vane malfunction, inept application of emergency throttle or a fuel control malfunction. If a complete power failure occurs, an autorotative landing is necessary.

The second category is not a complete power loss but only an interruption, oscillation, decrease or increase from selected power. The fuel control system (fuel contamination), P_3 bleed, Test No. 1, Test No. 2, or N_f flexshaft malfunctions are the primary causes. This power change could be a slow or very rapid loss/increase. The rapid power loss situation requires an immediate entry into autorotation. Analyze the power instruments (N_g, fuel

pressure, T_5, N_f/N_r) and determine if the engine is still operating. This is difficult unless the pilot includes these instruments in his scan during practice autorotations. When in doubt, if the engine is still operating and T_5 is not overtemped, increase emergency throttle to 100% N_f/N_r and recover. If the engine has flamed out, emergency throttle will not correct the situation. It is important to analyze the situation as quickly as possible. If indicated, attempt a restart. In any case, if in autorotation, do not allow attention to be diverted to the detriment of the autorotative landing.

ENGINE MALFUNCTION CAUSING A POWER CHANGE FROM THAT SELECTED (ENGINE OPERATING).

POWER DECREASE CONDITION. (Example - P-3 bleed malfunction, fuel control malfunction or overspeed test N_r 1 switch malfunction).

1. Collective - Lower to maintain N_r.
2. Enter autorotation (if required).
3. Power instruments - analyze.
4. Emergency throttle - advance to regain power.
5. Collective - adjust as required.
6. Speed selector - retard to flight idle.
7. Alert appropriate facilities.
8. Land as soon as practicable.

POWER INCREASE CONDITION. (Example - N_f flex shaft failure).

1. Emergency throttle - advance to control N_r fluctuations.
2. Speed selector - retard to flight idle.
3. Emergency throttle - adjust to 100 percent N_r.
4. Collective - adjust as necessary.
5. Alert appropriate facilities.
6. Land as soon as practicable.

NOTE: An overspeed test N_r 2 malfunction will result in power fluctuations about 97 percent N_f/N_r. Recovery techniques are the same as for an N_f flex shaft failure.

CAUTION

When operating on emergency throttle, there is no automatic 110 percent N_r rotor overspeed protection.

CAUTION

In the event of an N_f flex shaft failure, there is no 122 percent N_f overspeed stopcock feature. (See ENGINE OVERSPEED SYSTEM, Section VI.)

CAUTION

Stopcock function is still controlled by the speed selector even when the engine is being controlled by emergency throttle.

Ice buildup on the windshield can result in engine failure due to FOD. Ice melting on the windshield will slide up and accumulate at the top of the windshield. The ice accumulation will break off and be ingested into the engine intake. If icing conditions are encountered, proceed as follows:

1. Fly helicopter from icing condition as soon as possible.
2. Heater - OFF.
3. Airspeed - 55 knots.
4. Land at first suitable site.

RAIN INGESTION.

Entry into a very heavy rain will cause a slight power loss in the engine. The characteristics of the T-58-8B engine are such that engine flameout is not probable. Engine instruments will indicate the loss of power; the most evident is torque. If the above conditions are experienced and power cannot be regained through use of speed selector, proceed as follows:

1. Emergency throttle - Increase as required to regain desired power.
2. Airspeed - 55 knots.
3. Conditions permitting - Secure emergency throttle and reestablish cruise flight. As rain intensity decreases, power will increase. This will be indicated by an increase in N_f/N_r and engine instruments.

NOTE: A power loss may be experienced utilizing emergency throttle if rain is extremely heavy.

ENGINE FAILURE IN HOVER.

Settling will be so rapid under these conditions that little can be done to avoid a relatively hard landing. Hovering should be accomplished at the lowest practical altitude and at 100% N_r. This will normally allow sufficient inertia to permit a safe landing. The landing can be cushioned somewhat by increasing collective pitch as the helicopter settles to the ground.

Do not reduce collective pitch as you normally would in the event of engine failure at higher altitudes. In this case, a reduction of pitch would cause the helicopter to settle more rapidly. The helicopter should be held in a level attitude, and when contact is made with the ground, the cyclic stick should be moved slightly forward of the neutral position. Regardless of the force with which the helicopter strikes the ground, damage will be much less if it strikes level.

Proceed as follows:

1. Collective - Increase to cushion landing.
2. Wheel brakes (land only) - APPLY.
3. Speed selector - CLOSED.
4. Secure cockpit.

CAUTION

Any displacement of the cyclic stick aft of neutral will decrease main rotor blade tail cone clearance and increase the possibility of striking the tail cone with a main rotor blade.

ENGINE FAILURE DURING TRANSITION TO FORWARD FLIGHT AND CLIMB.

CAUTION

Between 7900 and 8300 pounds gross weight, no safe area of the flight envelope exists below 140 feet for safe autorotative landing after power failure.

Surface conditions and altitude will dictate the autorotation flare and collective technique. Collective control will vary greatly. At low altitude, collective cannot be lowered. As altitude increases, collective can be lowered proportionately. If the surface is smooth and firm, vary flare to touchdown in a level attitude with 15 to 20 knots IAS. With rough surface condition, flare to touchdown with no forward ground speed. Depending on rotor energy available, use it to cushion touchdown. To prevent early collective pull, scan out far enough to see descent rate and flight path. Do not look down final descent angle to landing spot only.

CAUTION

Do not start collective pull as normally executed for a power recovery as this will result in a high recovery and a subsequent hard landing.

Attain maximum collective at touchdown - not before.

ENGINE FAILURE DURING FLIGHT.

Power-off autorotative landings can be safely accomplished to most any surface if operating in the proper flight envelope. When necessary to autorotate, plan to arrive at the desired landing area lined up into the wind. It is best to look as though you will overshoot rather than undershoot. Excessive altitude can be lost by turning as necessary. The flare and collective technique should be varied slightly for different surface conditions. When conditions permit, it is desirable to land with translational lift. However, it is mandatory to execute the flare so as to have no ground speed at touchdown when landing on water, rough or unprepared terrain. This is a demanding situation and it requires more precise collective use since translational lift normally is not present. When engine failure is experienced, proceed as follows:

1. Collective - Reduce pitch and establish autorotative glide.
2. Landing gear - DOWN (over land) UP (over water).
3. Shoulder harness - LOCKED.
4. Power instruments - ANALYZE.
5. Speed selector - STOPCOCK.
6. Cabin occupants - ALERT.
7. Transmit - MAYDAY.
8. If time and altitude permit - ATTEMPT RESTART IF INDICATED.
9. At 140 feet indicated on radar altimeter, execute a moderate rate of flare to 20 degrees nose up.
10. Maintain the flare until airspeed has slowed to 20 knots or less (landing on water or rough terrain).
11. Smoothly lower the nose to the proper attitude for conditions.
12. Apply collective to control rate-of-descent to cushion landing. Do not stop descent prematurely.
13. If possible, touchdown should be made in a level attitude.
14. Collective - Smoothly lower collective to minimum after positive ground contact and move cyclic slightly forward.
15. Wheel brakes (land only) - APPLY.

NOTE: An autorotation over trees should be planned to arrive at zero ground speed at tree-top level, allowing the trees to cushion the descent to ground contact.

RESTARTING ENGINE IN FLIGHT.

It will be left to the pilot's judgement whether to attempt a restart. In normal autorotation, rate-of-descent at 55 knots IAS is approximately 1800 feet-per-minute with 103% rotor speed. Consequently,

Page 16A deleted.

altitude will dictate whether an inflight engine restart should be attempted. The altitude at which air restart can be safely accomplished depends on pilot proficiency. An autorotative glide must be established immediately following engine failure. An in-flight engine restart may then be attempted. Proceed as follows:

1. Collective - LOWER and establish autorotative glide.
2. Speed selector - STOPCOCK.
3. Emergency throttle - CLOSED.
4. P_3 bleed valve - OPEN.
5. Starter switch - DEPRESS.
6. Speed selector (after N_g reaches 15% indicated) - GRD IDLE.
7. P_3 bleed valve - Closed (after T_5 peaks out).
8. Starter switch (after N_g reaches 45%) - RELEASE.
9. Re-establish level flight by use of emergency throttle.
10. If a restart attempt is unsuccessful, proceed as follows:
    a. Speed selector - STOPCOCK.
    b. Emergency throttle if used - CLOSED.
    c. Starter switch - RELEASE.
    d. Complete autorotation.

AUTOROTATION APPROACH SPEEDS.

1. Maximum glide distance airspeed: 82 knots IAS.
2. 82 knot autorotation rate of descent: approximately 2500 feet per minute.
3. Minimum rate of descent airspeed: 55 knots IAS.
4. 55 knot autorotation rate of descent: approximately 1800 feet per minute.

NOTE: Glide distance in the 82 knot autorotation will depend upon initial altitude, initial airspeed, and pilot technique utilized. A combination of varied airspeeds and/or approach turns may be required to land in the desired area. When possible, a steady state autorotation at 55 knots IAS should be attained prior to 140 feet radar altitude to allow recovery utilizing practiced techniques.

DUAL FAILURE OF ENGINE FUEL CONTROL AND OVERSPEED GOVERNOR.

Failure of fuel control will result in undesired engine output (loss of power or excess power). If N_r reaches 110% and the overspeed governor fails to trip, both power turbine and rotor will attain abnormally high speeds. If possible, simultaneously reduce engine speed selector to FLT IDLE, lower collective and control power with emergency throttle.

NOTE: At a high rate of acceleration, when power turbine speed reaches 122% N_f, fuel is cut off at the fuel control and engine stoppage results (provided N_f flexible shaft is not broken). See ENGINE OVERSPEED SYSTEM, Section VI.

OVERSPEEDING OF THE ROTOR SYSTEM.

Overspeeding of the rotor system imposes a severe overload on the rotor and transmission systems and requires immediate corrective action. Whenever an overspeed condition occurs, the immediate course of action should be determined from the following:

111 to 120 percent N_r - Urgent mission may be completed.

Over 120 per cent N_r - Continue to nearest suitable landing area and land. When an overspeed occurs, the pilot should write up a detailed description including the exact overspeed on the aircraft flight records. The helicopter should not be flown again until the special inspection requirements contained in the HH-52A Maintenance Manual are performed.

NOTE: The most common cause of N_r overspeed is misuse of the emergency throttle. After emergency throttle practice, pilots must ensure that it is fully closed prior to any manuevers. During the power recovery autorotation, pilots must be aware that increasing emergency throttle in lieu of the speed selector will result in a rotor overspeed.

FLIGHT CONTROL EMERGENCY OPERATION.

TAIL ROTOR AND CONTROL MALFUNCTION - GENERAL.

Loss of heading control could be the result of tail rotor blade loss or damage, failure of the tail rotor drive shaft between the transmission and the tail rotor, or a failure in the tail rotor control linkage. Tail rotor loss or failure of the drive shaft will result in a right yaw in powered flight. The amount of yaw being governed by the airspeed and the amount of power being applied to the main rotor. A failure in the control linkage may result in a loss of positive heading control. Direction and amount of yaw in this case will be determined by airspeed, torque, tail rotor rigging, and type of failure. A jammed control would result in a loss of positive heading control. The thrust produced by the tail rotor will be dependent upon the position of the control when it jams.

TAIL ROTOR CONTROL SYSTEM FAILURE.

Tail rotor control system failures will likely fall into two categories: those resulting in loss of tail rotor pedal response and those resulting in a lock-up of tail rotor control linkage. Loss of pedal response could probably result from separation of the control linkage. If the control linkage separates between the pedals and the AUX servo, the ASE yaw channel (with ASE engaged) will continue to maintain heading. In this situation heading can be controlled with the ASE yaw trim knob. If the control linkage separates between the AUX servo and the tail rotor, the tail rotor blade pitch will be controlled by the pre-set counterweights. This will result in a left, neutral or right yaw depending on airspeed, torque, and tail rotor rigging. Controlled flight is normally possible using cyclic for directional control while adjusting torque for minimum yaw. Evaluation of the airspeed, torque and yaw relationship is recommended prior to attempting approach and landing. During this evaluation, which should be conducted at altitude if possible, the following yaw angle limits should be observed to prevent structural damage:

15 degrees at 85 kts
33 degrees at 56 kts

Tail rotor rigging balance will require a low airspeed high power approach, and may permit a vertical landing. Tail rotor control system failures resulting in a lock-up of the mechanical linkage must also be evaluated to determine the airspeed, torque and yaw relationship. Select the optimum airspeed/torque combination for approach and the landing technique best suited to the situation.

TAIL ROTOR AUXILIARY YAW SERVO SYSTEM MALFUNCTION.

A tail rotor control system malfunction of the auxiliary yaw servo could result in a possible hydraulic hardover. This type malfunction can be determined by the displacement of the pedals and/or a "locked" condition. This does not preclude the possibility of a jammed control as a result of FOD, etc. Turning the AUX servo OFF should eliminate the hardover condition. Tail rotor response will be as in a normal flight condition with the exception of slightly increased pedal pressures due to the auxiliary servo system being secured.

TAIL ROTOR ASSEMBLY LOSS.

A complete loss of the tail rotor assembly would result in an excessive yaw right flight condition. Controlled flight may be accomplished by maintaining 60-90 knots airspeed. Final approach should be made in full autorotation with the engine shut down.

APPROACH AND LANDING PROCEDURES - GENERAL.

The varied conditions under which rotor control system failure may occur preclude dictating a technique to be followed under all circumstances. Careful consideration must be given the malfunction/failure to determine the most logical and safest procedure to use.

TAIL ROTOR FAILURE DURING TAKE-OFF, LANDING OR HOVERING (LOW ALTITUDE, SLOW AIRSPEED).

In the event of a tail rotor failure during take-off, landing or while hovering, main rotor torque will cause an immediate clockwise rotation of the fuselage. The following procedure should be followed to minimize further damage to the helicopter:

1. Speed selector - FLIGHT IDLE (STOPCOCK, time permitting).
2. Cyclic
   a. Hover - Maintain level attitude.
   b. Forward speed - Attempt to align flight direction with helicopter heading by use of lateral cyclic.
3. Collective - INCREASE.
4. Wheel brakes (land only) - APPLY.
5. Secure engine and cockpit.

CAUTION

An increase in torque at a slow airspeed will cause the helicopter to rotate more rapidly to the right thus aggravating the situation.

TAIL ROTOR FAILURE DURING FLIGHT.

Tail rotor failure during flight will be indicated by a loss of directional control (yaw right). The first and most important step is to regain directional control by an immediate reduction of power to the main rotor. If immediate landing cannot be accomplished proceed as follows:

1. Reduce power to the main rotor and establish a glide at 60 to 90 knots IAS to regain directional control.
2. Slowly bring in power to reduce rate-of-descent while compensating for yaw with left cyclic.
3. Maintain altitude and an airspeed of 60 to 90 knots IAS until suitable landing site is selected.
4. Alert crew and lock shoulder harness.
5. Alert crash facilities and burn off excess fuel.

APPROACH WITH TAIL ROTOR INOPERATIVE (AUTOROTATION).

1. Complete pre-landing check.
2. Reduce collective pitch to minimum, retard the speed selector to AUTO DETENT and enter autorotation into the wind. Autorotation will be accomplished by a change in yaw from nose right to nose aligned nearly with the runway.
3. Establish a glide at 55 knots IAS.
4. Maintain directional control by lateral movement of cyclic control.
5. When satisfied approach will permit landing in desired area, stopcock the speed selector.

NOTE: If approach is not satisfactory and the decision is made to abort the approach, maintain 55-60 knots and slowly increase torque to that required to permit a controllable wave-off.

LANDING WITH TAIL ROTOR INOPERATIVE (AUTOROTATION TO RUNWAY).

1. At 140 feet indicated on radar altimeter, execute a moderate rate of flare to 20 degrees nose up.
2. Maintain the flare until airspeed has slowed to 20 knots.
3. Smoothly and positively initiate recovery to level the helicopter by application of forward cyclic and simultaneously make a slow, smooth application of the collective pitch lever to control the rate of descent.
4. Use cyclic as necessary to align the helicopter in the direction of flight path.

NOTE: When collective pitch is applied, the helicopter, due to reduced torque and increased transmission drag, will tend to turn to the left. It is at this point cyclic should be used in a positive manner to keep the aircraft aligned in the direction it is traveling over the ground so as to eliminate skid at touchdown.

5. Ground contact speed should be held to a minimum.
6. Collective pitch - Reduce to minimum pitch.
7. Wheel brakes - Apply.
8. Secure cockpit.

RUNNING LANDING (RUNWAY ONLY).

If the tail rotor malfunction results in partial loss of tail rotor control or an uncontrollable yaw to the left is experienced, then a running landing will be more advantageous than the autorotative approach. If the situation warrants this type landing, proceed as follows:

1. Complete pre-landing check.
2. Determine at altitude, the amount of control available and the airspeed, collective power, and speed selector setting required.
3. Make sufficient number of low passes over the selected runway to determine the effectiveness of findings in step (2) with adequate airspeed to maintain aircraft controllability.
4. When satisfied that this type approach can be executed, complete landing.

CAUTION

Maximum touchdown speed is 43 knots in a balanced condition (main landing gear limitation).

5. Wheel brakes - APPLY.
6. Secure engine and cockpit.

AUTOMATIC STABILIZATION EQUIPMENT FAILURE.

In the event that automatic stabilization signals cause the helicopter to oscillate in pitch, roll, or yaw, automatic stabilization equipment (ASE) should be disengaged by depressing button marked AUTO STABE RELEASE, on either cyclic grip. One or more channels may be disengaged by placing the respective channel disengage switch, located on the channel monitor control panel, to OFF. Pressing AUTO STABE RELEASE button on either cyclic stick grip will disengage all three channels of the ASE system. Placing the flight control servo switch in AUX OFF will render the system inoperative. Due to the design authority of ASE, any electrical malfunction can be overridden by the pilot. However, if the malfunction is not corrected by depressing an AUTO STABE RELEASE button, the equipment may be eliminated from the flight control system entirely by turning off the auxiliary servo unit. Cyclic stick forces should be no greater although a slight drag from the auxiliary servos will be detected. The possibility of a failure, which would not be entirely eliminated by depressing an AUTO STABE RELEASE button, is extremely remote. When the automatic stabilization equipment is nulled mechanically, by using the AUTO STABE RELEASE button on either cyclic stick, all valves will be centered immediately. Pushing the engage button will again supply power.

FLIGHT CONTROL MALFUNCTION.

NOTE: On helicopter CG Nos 1449 and subsequent an ASE OFF warning capsule has been added to the caution advisory panel. The capsule illuminates when the essential dc bus is energized and the ASE is disengaged.

ELECTRICAL (ASE).

An electrical malfunction allows the pilot to continue controllable flight by overriding the malfunction. An electrical hardover signal input will cause the helicopter to react adversely without cyclic displacement. A yaw hardover will cause rudder displacement requiring 15 to 25 pounds of pedal pressure to override the condition.

1. With ASE engaged, oscillations in pitch and/or roll:
   a. ASE - Disengage, Light On.
   b. Shift gyros.
   c. ASE - Reengage, Light Off.
2. Hardover associated with an ASE malfunction:
   a. Override hardover. Roll and pitch should require no abnormal force with stick trim released.
   b. If defective channel can be readily determined, disengage affected channel. If defective channel cannot be determined, disengage ASE.

CAUTION

An ASE hardover may occur with ASE disengaged (channel monitor panel malfunction) which will be indicated on the flight director in addition to rotor disc/pedal displacement.

HYDRAULIC.

Normally, a hydraulic hardover malfunction will position the affected control to an extreme position; however, an intermediate control position is possible. Apparent control movement of one quarter total travel in the opposite direction is allowed by the sloppy link and control linkage. The severity of the malfunction will be determined by the amount of associated control displacement. Failure of either servo system may preclude a controlled flight condition. The nature of a hydraulic servo hardover may mask the exact identity of the cause. The pilot must analyze the symptoms and isolate the problem as rapidly as possible.

1. Hydraulic hardover affecting only one control (cyclic, collective, pedals):

   a. Servo switch - AUX OFF.

   NOTE: A malfunction of the auxiliary servo system will be more pronounced in only one channel of the system. A malfunction of the primary servo system might transmit a coupling effect to the cyclic and collective due to the mechanical forces being transmitted through the mixing unit.

2. Hydraulic malfunction affecting two controls (cyclic and collective):

   a. Servo switch - PRI OFF.

3. Increase in control friction accompanied by loss of servo pressure:

   a. Affected servo system - OFF.

4. In addition to above procedures for hydraulic malfunctions, proceed as follows:

   a. Reduce airspeed to 60 knots.

   b. Land as soon as practicable.

CAUTION

When the auxiliary servo system fails, the automatic stabilization equipment is disabled.

MAIN ROTOR BLADE DAMPER MALFUNCTION.

Main rotor blade damper malfunctions, such as loss of hydraulic fluid, damper reservoir or complete loss of the damper will result in a noticeable rough head indication with associated fuselage vibrations. They will be more evident in a high power flight condition. Reduce airspeed to 55 knots and land at the nearest suitable landing site.

CAUTION

Ground resonance could be encountered during or after landing.

ROTOR BLADE DAMAGE

If the main/tail rotor blades have been damaged by a foreign object, the helicopter should not be flown until a thorough inspection has been accomplished by qualified maintenance personnel. Further flight of helicopters with blade damage exceeding negligible and repairable as defined by CGTO-1H-52A-3 shall not be attempted. If the damage was incurred in flight, the helicopter should be landed as soon as practicable at the nearest safe landing site. Possible loss of the aircraft subsequent to a safe landing is not sufficient cause to continue flight.

FIRE.

ENGINE COMPARTMENT FIRE DURING OR AFTER STARTING.

If engine compartment fire should develop during or after starting it may be detected visually or by the fire detector warning light (except with battery switch at BAT START). If fire is detected proceed as follows:

1. Speed selector - STOPCOCK.
2. Fuel fire wall shut-off handle - FIRE EXT ARMED.
3. Battery switch - ON.

   NOTE: Steps 2 and 3 close the engine compartment shutter doors, the fuel shut-off valve, and arm the engine compartment fire extinguisher.

4. Engine compartment fire extinguisher - DISCHARGE.
5. EXT PWR switch - OFF.
6. Battery switch - OFF.
7. Exit aircraft.
8. Fight fire externally.

ENGINE COMPARTMENT FIRE IN FLIGHT.

An engine compartment fire in flight may be the result of an engine malfunction or failure of one of its component systems. Ruptured fuel or oil lines will usually be detected by engine instrument indications.

NOTE: The engine compartment fire warning light may illuminate if the shutter doors are closed or if there is excessive engine blow-by.

NOTE: Severity of the fire, actual flight conditions, and terrain conditions will dictate the immediate procedure to be followed. If it is determined that a fire does exist:

1. Establish autorotative glide.
2. Speed selector - STOPCOCK.
3. Fuel fire wall shut-off handle - FIRE EXT ARMED.
4. Engine compartment fire extinguisher - DISCHARGE.
5. Alert cabin occupants.
6. Complete autorotative landing.
7. Secure cockpit.
8. Exit aircraft.

POST SHUTDOWN FIRE.

Post shutdown fires generally fall into two categories. The first is an internal fire (T_5 - 300°C or greater) and the second a compartment fire (Fire warning light and/or line crew indications). In the event of post shutdown fire, proceed as follows:

1. Speed selector - STOPCOCK.
2. Fuel fire wall shut-off handle - FIRE EXT ARMED.
3. Battery switch-ON.
4. Analyze.
   a. Internal fire (T_5 - 300°C or greater).
      (1) Starter - ENGAGE and motor until fire is extinguished.
      (2) Battery switch - OFF.
      (3) Exit aircraft.
   b. Engine compartment fire.
      (1) Engine compartment fire extinguisher - DISCHARGE.
      (2) Battery switch - OFF.
      (3) Exit aircraft.
5. Fight fire externally.

CABIN FIRE.

1. Cockpit windows - CLOSED.
2. Cabin door - CLOSED.
3. Ventilation switch - OFF.
4. Portable fire extinguisher - USE.

CAUTION

CO_2 is not toxic, however, it does reduce the oxygen content of the air.

5. Ventilate as soon as practicable.

ELECTRICAL FIRE.

Possibilities of electrical fires are very slight because the generator is prevented from generating excessive voltage by the field control relay and each electrical circuit is protected from over load by circuit breakers. However, in event of electrical fire in flight, land as soon as practicable. Comply immediately with the following procedures:

1. Circuit breaker (for affected circuits) - PULL.

If fire persists:

2. Battery switch - OFF.
3. Generator switches - OFF.
4. Portable fire estinguisher - USE.

CAUTION

Severity of the fire and actual flight conditions (night or instrument) will dictate the immediate procedure to be followed. It may be advisable to let the fire burn, if it is isolated, than to secure all electrical power and lose ASE and flight instruments prior to achieving VFR conditions.

SMOKE ELIMINATION.

1. Cockpit windows - OPEN.
2. Cabin door - OPEN.
3. Ventilating blower switch - ON.

FUEL FUME REMOVAL PROCEDURE.

1. Open cockpit windows and cabin door.
2. Complete pre-landing check.
3. Land at first suitable site.
4. Battery switch - OFF.
5. Secure engine and cockpit.

CAUTION

Do not use radios if at all possible. The severity of the situation will determine the necessity for securing all electrical power sources and whether an immediate landing is necessary.

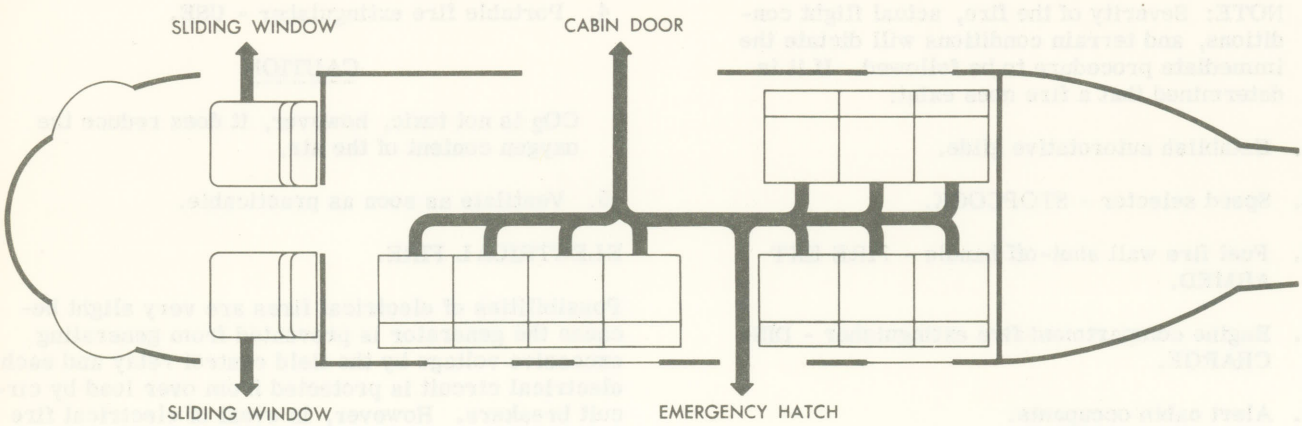


Figure 3.

EMERGENCY EXITS.

(See figure 3.)

COCKPIT EMERGENCY EXITS.

The windows on each side of the cockpit can be jettisoned to provide emergency exits. The windows are jettisoned by turning the release handles, marked EMERGENCY EXIT-PULL forward which are located on the forward lower corner of the window. The windows may also be removed from the outside by depressing the release handle marked EMERGENCY RESCUE-PRESS BUTTON-TWIST HANDLE-PULL OUT WINDOW located at the aft lower corner of the window and allowing the EXIT-TURN handle to pop out.

CABIN EMERGENCY HATCH.

A cabin emergency hatch, containing the third (forward to aft) window on the left side of the cabin, may be jettisoned to provide cabin emergency exit. The emergency release handle, marked EMERGENCY EXIT-TURN HANDLE-PUSH WINDOW is located on the forward lower corner of the hatch. To jettison the cabin emergency hatch, turn the handle forward and push the hatch out. A handle marked EMERGENCY RESCUE-TURN HANDLE-PULL OUT HATCH is also provided to open the hatch from the outside of the helicopter.

POP-OUT WINDOW EXITS.

All remaining cabin windows are of the pop-out type. To release these windows, apply pressure to the window and it will jettison. EMERGENCY EXIT-PUSH OUT WINDOW is stenciled above each window.

CABIN DOOR EMERGENCY EXIT.

The cabin door can be jettisoned by pulling down on the handle marked EMERGENCY EXIT-PULL GUARD LEFT-PULL HANDLE DOWN-PUSH DOOR OUT, located on the forward upper corner of the cabin door. A similar handle marked EMERGENCY RESCUE-TURN HANDLE AND PULL OUT is located on the outside of the door.

CAUTION

Do not jettison windows, hatches, or door in flight.

MAIN GEAR BOX OIL SYSTEM FAILURE.

If main gear box oil pressure should drop below 25 psi, or if main gear box oil temperature should go above 140°C in flight, an immediate landing is advisable as the gear box may not be receiving proper lubrication. Flight should not be resumed until the cause has been determined and corrected. If a landing is not feasible due to terrain or sea conditions proceed as follows:

1. Airspeed - 55 knots.
2. Altitude - 150 feet.

NOTE: Flight at this altitude and airspeed allows a low torque application and safe altitude in event of engine failure.

FUEL SYSTEM FAILURE.

ENGINE DRIVEN FUEL PUMP.

Failure of the engine driven fuel pump will result in immediate flameout. Refer to procedures for Engine Failure in this section.

SINGLE FUEL BOOSTER PUMP FAILURE.

Failure of either fuel booster pump will be indicated by illumination of its warning light on the caution panel. The respective fuel booster pump should then be turned off to prevent fuel system contamination. The remaining fuel booster pump will provide sufficient fuel pressure for normal operation. In the event of failure of either fuel booster pump:

1. Failed booster pump switch - OFF.
2. Abort mission.

DUAL FUEL BOOSTER PUMP FAILURE.

Failure of both fuel booster pumps will be indicated by illumination of their warning lights on the caution panel. The engine driven fuel pump now must draw the fuel from the tanks up to the engine. The possibility of "loss of suction" and flameout must be considered. Plan the flight path to allow for an autorotation in the event of flameout. Maintaining a high power setting will lessen the chance of flameout. In the event of dual pump failure:

1. Booster pump switches - OFF.
2. Abort mission and land at the first suitable site.
3. Plan the approach to avoid rapid power changes.

NOTE: Fuel in the aft tank is not available to the engine with dual fuel booster pump failure.

ELECTRICAL POWER SUPPLY SYSTEM MALFUNCTION.

AC SYSTEM FAILURE.

Indications of generator malfunction are the illumination of either or both generator failure caution lights. The electrical system is designed to function on one generator. If the No. 1 or No. 2 generator caution light should illuminate, proceed as follows:

1. Move the corresponding GEN switch to OFF-RESET then ON.

NOTE: This will restore generator service if the failure was caused by momentary overvoltage or undervoltage.

NOTE: The loss of either generator will result in the loss of the No. 2 T/R and as a result, the nonessential DC bus which powers the No. 2 fuel pump. Should the reset procedure fail to restore power:

1. DC NON ESS BUS OVRD switch - ON.
2. Monitor ammeter.
3. Abort mission (Unless urgent SAR)

DUAL GENERATOR FAILURE.

Dual generator failure is remote, but if it occurs, proceed as in step 1. of AC System Failure for each generator. If either generator's output is not restored - ABORT MISSION.

Proceed as follows:

1. Generator switches - OFF.
2. Battery switch - ON.
3. DC NON ESS BUS OVRD switch - OFF.
4. Turn off all unnecessary electrical equipment (heater, lighting, etc.). Give highest priority to the #1 fuel booster pump.
5. Land at first suitable site.

CAUTION

The #1 fuel booster pump light will illuminate if landing is not possible within the life of the battery. If this occurs, proceed under Dual Booster Pump Failure.

NOTE: In the event of dual generator failure with the battery switch ON, the ground inverter will power the engine, transmission, hydraulic instruments, torquemeter, fuel quantity, and fire detection system for the start and essential DC buses. However, in this condition ASE will be inoperative, and all flight instruments except needle ball, standby compass, and pressure instruments will be lost. If at night or under IFR conditions, this will produce an extremely critical condition.

DC SYSTEM FAILURE.

Failure of either the No. 1 T/R or the No. 2 T/R will result in the loss of the DC non-essential bus due to the automatic switching feature incorporated in the system. Should a T/R fail:

1. Check and reset circuit breaker.
2. Move the associated generator switch to OFF-RESET then ON.

If this fails to restore power:

1. DC NON ESS BUS OVRD switch - ON.
2. Monitor ammeter.

HEATER FAILURE.

An overheat thermal switch will limit the temperature of heated air in the plenum duct to a maximum of 350°F if a master fuel valve or cycling switch fails. If an overheat condition occurs, an overheat relay will shut off the ignition unit, the master fuel valve, heater fuel pump, and turn on the caution light, marked HEATER HOT, located on the caution panel. The heater blower will continue to operate during an overheat condition and cool the temperature in the plenum duct. The master and heater starter switches will not energize the heating circuit if heater blower fails to operate.

NOTE: If "HEATER HOT" caution light illuminates, do not restart heater until cause of overheat has been determined.

TURBULENCE.

Turbulence can cause blade stall due to sudden high blade loading. If turbulence is encountered, proceed as follows:

1. Airspeed - 55 knots.
2. N_f/N_r - 100%
3. Reverse course if possible.

HOIST EMERGENCY.

If the hoist cable or hook become entangled and cannot be released, endangering the helicopter, actuate the pilot's or the cabin hoist cable shear switch.

HELICOPTER HANDLING ON WATER - POWER OFF.

The helicopter's inherent stability limits may be exceeded in excessively rough water in a power off condition. Use of auxiliary floatation equipment will aid materially in maintaining stability and should be employed as soon as possible after a power off landing. Although the power off helicopter can right itself from a roll up to approximately 16 degrees without aid of auxiliary floatation, a wind of 15 knots or more (creating waves of 2 feet or higher) will probably drive it into the trough of a wave and possibly cause excessive roll. The helicopter is equipped with a sea drogue and a Danforth anchor. Either one should be utilized in maintaining heading in relation to waves. These help to keep the helicopter near the point of descent and also reduces the possibility of drifting.

AUXILIARY FLOAT ACTUATION.

CAUTION

Do not inflate the auxiliary floats until helicopter has settled on water. Power off landing with auxiliary floats inflated may cause damage to the floats.

1. Helicopter on water and no forward motion.
2. Manual release handle - Pull firmly to extended position.

DEPLOYING SEA DROGUE.

1. Cyclic control neutral (stick trim on).
2. Use remaining tail rotor control to hold heading in direction from which wind and waves are coming.
3. Open pilot's window (or copilot's window).
4. Remove sea drogue from stowed position.
5. Pull red hook on end of rip cord line and attach hook around pedal adjuster flexible cable.
6. Unhook bungee outside aircraft below window and attach snap hook to thimble on tow line.

CAUTION

Do not attach snap hook on end of sea drogue line to small hook on end of bungee cord or round ring attached to thimble.

7. Throw sea drogue overboard and forward - Pull ripcord.

CAUTION

Detach sea drogue line before flight.

NOTE: Normally do not use rotor brake. Tail rotor provides directional control and stability while slowing down.

DEPLOYING DANFORTH ANCHOR.

1. Cyclic control neutral (stick trim on).
2. Use of remaining tail rotor control to hold heading in direction from which wind and waves are coming.
3. Open pilot's sliding window (or copilot's window).
4. Remove Danforth anchor from stowed position.
5. Unhook bungee on outside below window and attach snapring in end of anchor line to tow line thimble.

CAUTION

Do not attach snap hook on end of anchor line to small hook on end of bungee.

6. Cast anchor line bundle overboard.
7. Cast Danforth anchor overboard.

CAUTION

Detach anchor from tow line before flight.

TOWING OF HELICOPTER ON WATER.

If the helicopter is on water without power it will usually be desirable to take it in tow. Boat coxswain should be carefully briefed. The recommended attachment point for the tow line is the bow eye on the nose fitting. Use fifty to sixty feet of tow line to prevent surging up on the tow boat. Tow speeds up to 5 knots may be attained depending on sea condition.

CAUTION

Avoid heading parallel to troughs of waves as this may cause excessive roll.

CAUTION

Exercise care to avoid damage to helicopter when tow boat comes alongside to pass a line, as boat handling personnel may not be experienced in towing operations.

Since the helicopter will drift downwind more rapidly than a boat, the boat should stay to windward. If a sea drogue (or Danforth anchor) is or can be streamed, one recommended procedure is run the boat across the line where it is deeply enough submerged and fish it out with a boat hook, using anchor line as a tow line. Additional lengths of line may be required.

SECTION IV
PERFORMANCE INFORMATION
TABLE OF CONTENTS

CHART	PAGE	FIG
DENSITY ALTITUDE	23	4
AIRSPEED SYSTEM CALIBRATION	24	5
HOVER CEILINGS IGE	25	6
HOVER CEILINGS OGE	26	7
TAKE OFF DISTANCE G.W. 7500 LBS	27	8
TAKE OFF DISTANCE G.W. 8300 LBS	28	9
FORWARD CLIMB PERFORMANCE G.W. 6000 LBS	29	10
FORWARD CLIMB PERFORMANCE G.W. 6500 LBS	30	11
FORWARD CLIMB PERFORMANCE G.W. 7000 LBS	31	12
FORWARD CLIMB PERFORMANCE G.W. 7500 LBS	32	13
FORWARD CLIMB PERFORMANCE G.W. 8000 LBS	33	14
FORWARD CLIMB PERFORMANCE G.W. 8300 LBS	34	15
AUTOROTATIVE RPM V, DENSITY ALT	37	18
FUEL CONSUMPTION V, POWER AND INDICATED TORQUE	38	19
POWER AVAILABLE	39	20
POWER vs SPEED S.L. AND 2000 FT	40	21
POWER vs SPEED 4000 FT AND 6000 FT	41	22
POWER vs SPEED 8000 FT AND 10,000 FT	42	23
SPEED vs ALTITUDE G.W. 6500 LBS 96% Nf/Nr	43	24
SPEED vs ALTITUDE G.W. 7000 LBS 96% Nf/Nr	44	25
SPEED vs ALTITUDE G.W. 7500 LBS 96% Nf/Nr	45	26
SPEED vs ALTITUDE G.W. 8000 LBS 96% Nf/Nr	46	27
SPEED vs ALTITUDE G.W. 8300 LBS 96% Nf/Nr	47	28
SPEED vs ALTITUDE G.W. 6500 LBS 100% Nf/Nr	48	29
SPEED vs ALTITUDE G.W. 7000 LBS 100% Nf/Nr	49	30
SPEED vs ALTITUDE G.W. 7500 LBS 100% Nf/Nr	50	31
SPEED vs ALTITUDE G.W. 8000 LBS 100% Nf/Nr	51	32
SPEED vs ALTITUDE G.W. 8300 LBS 100% Nf/Nr	52	33
ENGINE HORSEPOWER vs INDICATED TORQUE	53	34
POWER CHECK	54	35
INSTRUCTIONS FOR POWER CHECK	54A	
PREDICTED RANGE	54B	36
INSTRUCTIONS FOR S.R./MAX RANGE A.S. CHART	54C	36A
S.R./MAX RANGE A.S.S.L.	54D	36B
S.R./MAX RANGE A.S. 2000 FT	54E	36C
S.R./MAX RANGE A.S. 4000 FT	55	36D

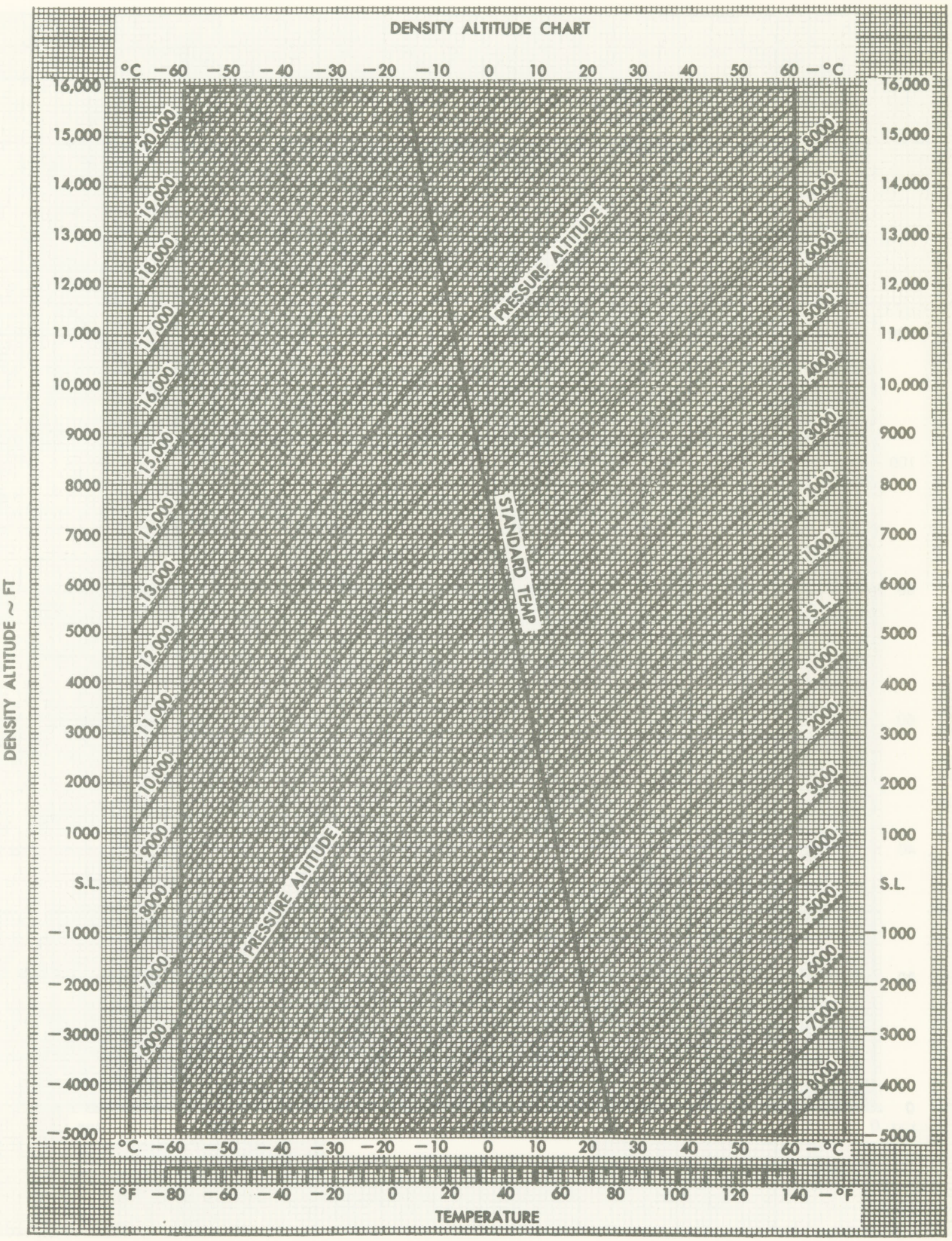

DENSITY ALTITUDE CHART
°C −60 −50 −40 −30 −20 −10 0 10 20 30 40 50 60 −°C
16,000
15,000
14,000
13,000
12,000
11,000
10,000
9000
8000
7000
6000
5000
4000
3000
2000
1000
S.L.
−1000
−2000
−3000
−4000
−5000
DENSITY ALTITUDE ~ FT
PRESSURE ALTITUDE
STANDARD TEMP
20,000
19,000
18,000
17,000
16,000
15,000
14,000
13,000
12,000
11,000
10,000
9000
8000
7000
6000
8000
7000
6000
5000
4000
3000
2000
1000
S.L.
−1000
−2000
−3000
−4000
−5000
−6000
−7000
−8000
°F −80 −60 −40 −20 0 20 40 60 80 100 120 140 −°F
TEMPERATURE

Figure 4.

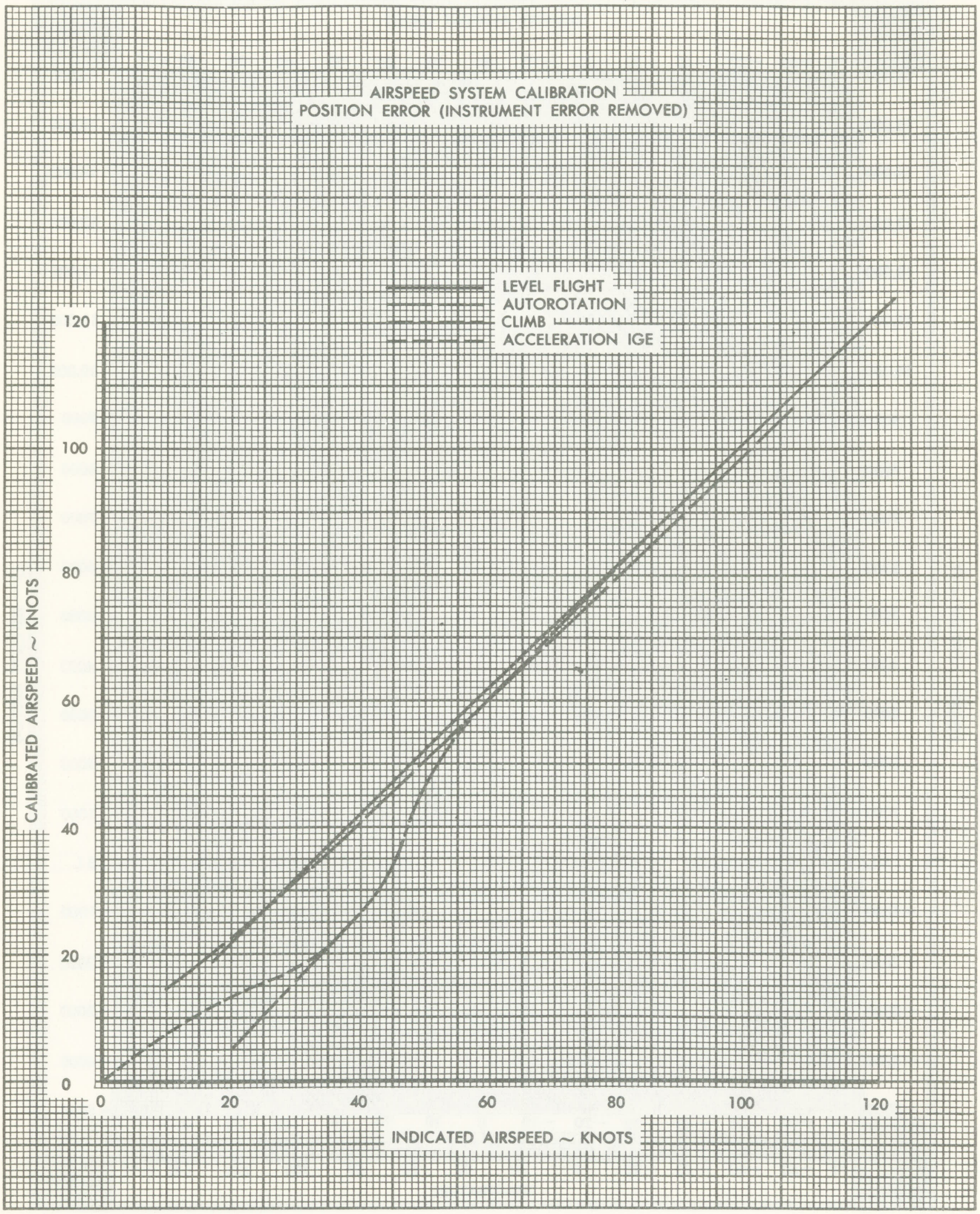

AIRSPEED SYSTEM CALIBRATION
POSITION ERROR (INSTRUMENT ERROR REMOVED)
LEVEL FLIGHT
AUTOROTATION
CLIMB
ACCELERATION IGE
CALIBRATED AIRSPEED ~ KNOTS
0
20
40
60
80
100
120
INDICATED AIRSPEED ~ KNOTS

Figure 5.

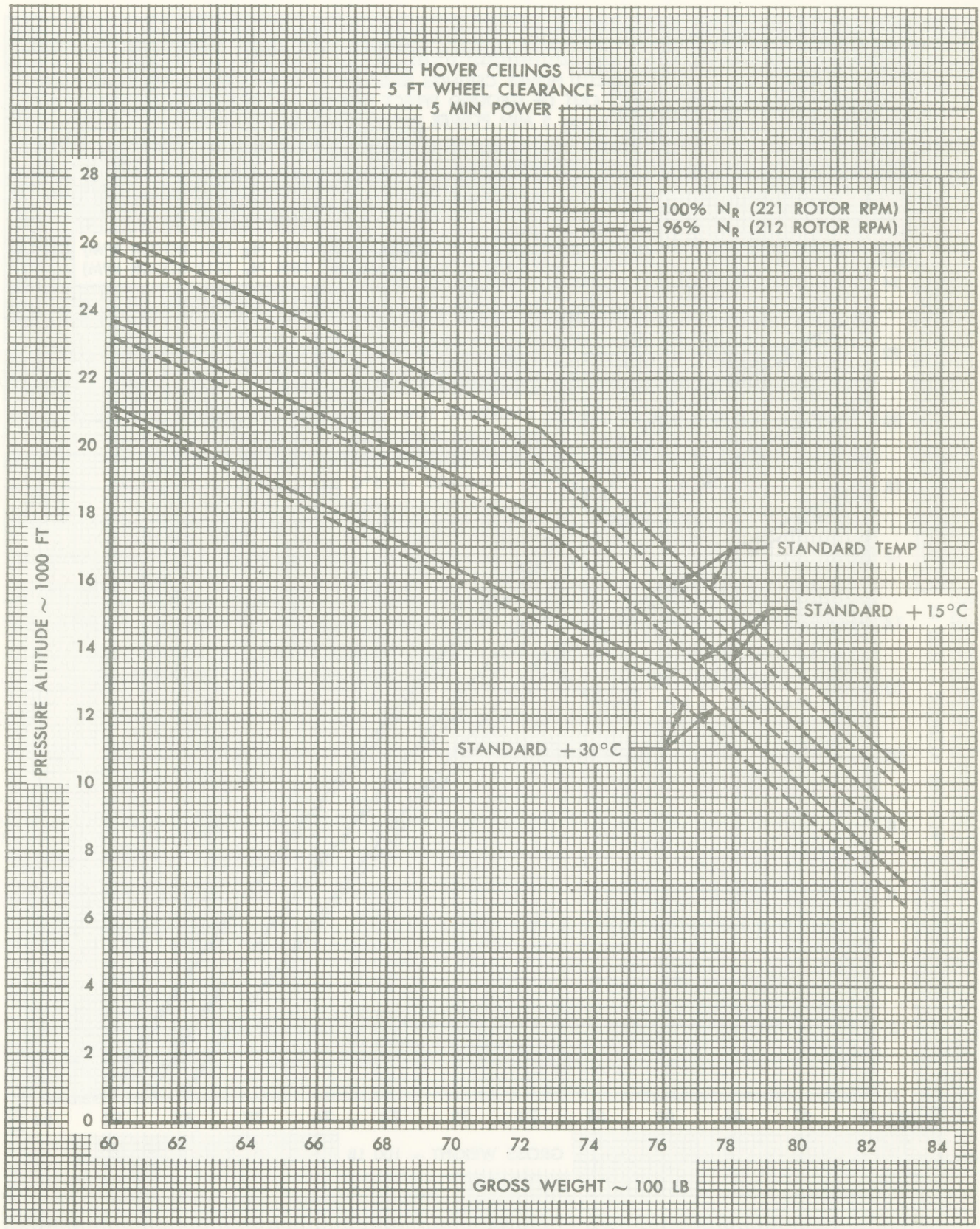

HOVER CEILINGS
5 FT WHEEL CLEARANCE
5 MIN POWER
100% N_R (221 ROTOR RPM)
96% N_R (212 ROTOR RPM)
STANDARD TEMP
STANDARD +15°C
STANDARD +30°C
PRESSURE ALTITUDE ~ 1000 FT
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
60
62
64
66
68
70
72
74
76
78
80
82
84
GROSS WEIGHT ~ 100 LB

Figure 6.

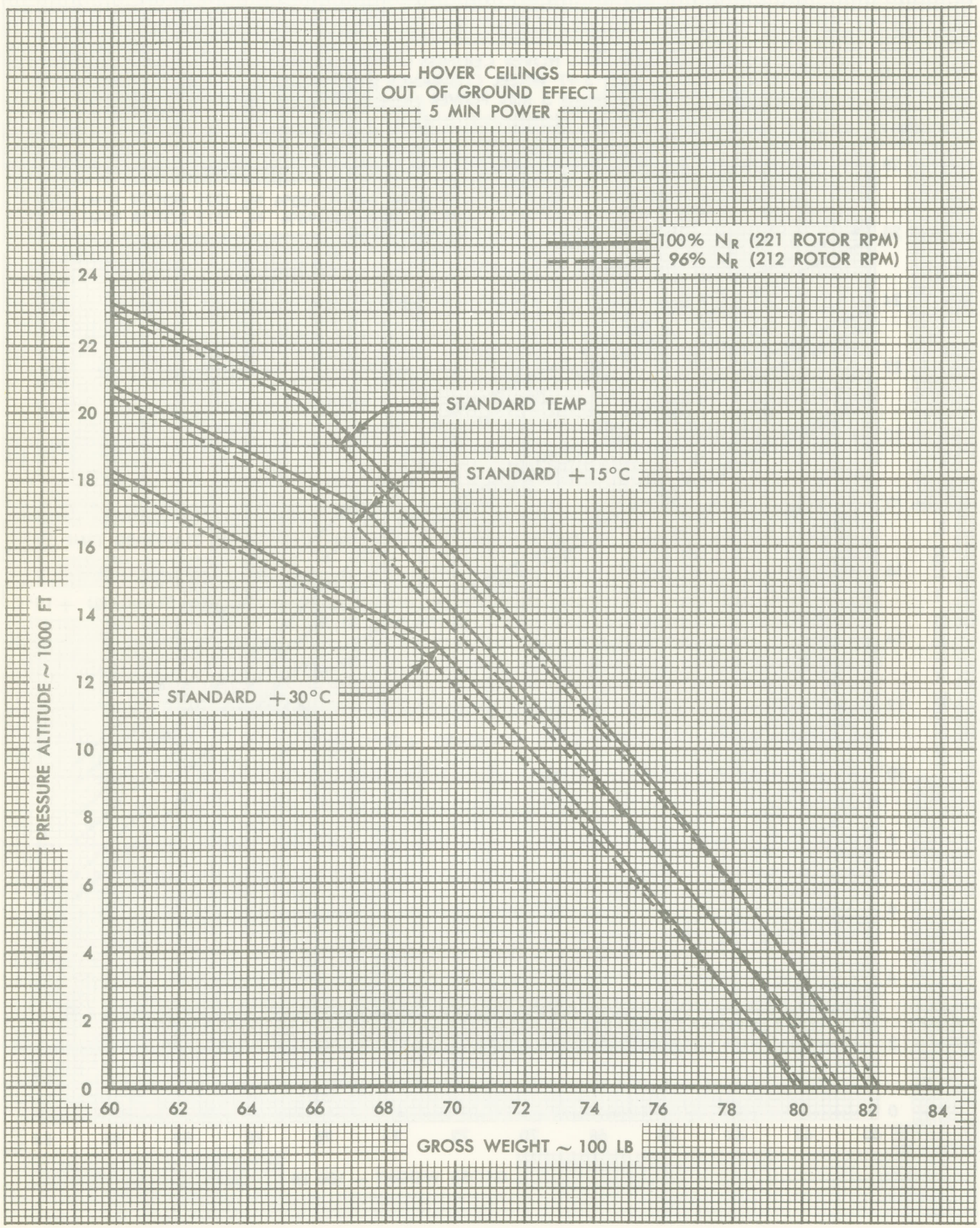

HOVER CEILINGS
OUT OF GROUND EFFECT
5 MIN POWER
100% N_R (221 ROTOR RPM)
96% N_R (212 ROTOR RPM)
STANDARD TEMP
STANDARD +15°C
STANDARD +30°C
PRESSURE ALTITUDE ~ 1000 FT
0
2
4
6
8
10
12
14
16
18
20
22
24
60
62
64
66
68
70
72
74
76
78
80
82
84
GROSS WEIGHT ~ 100 LB

Figure 7.

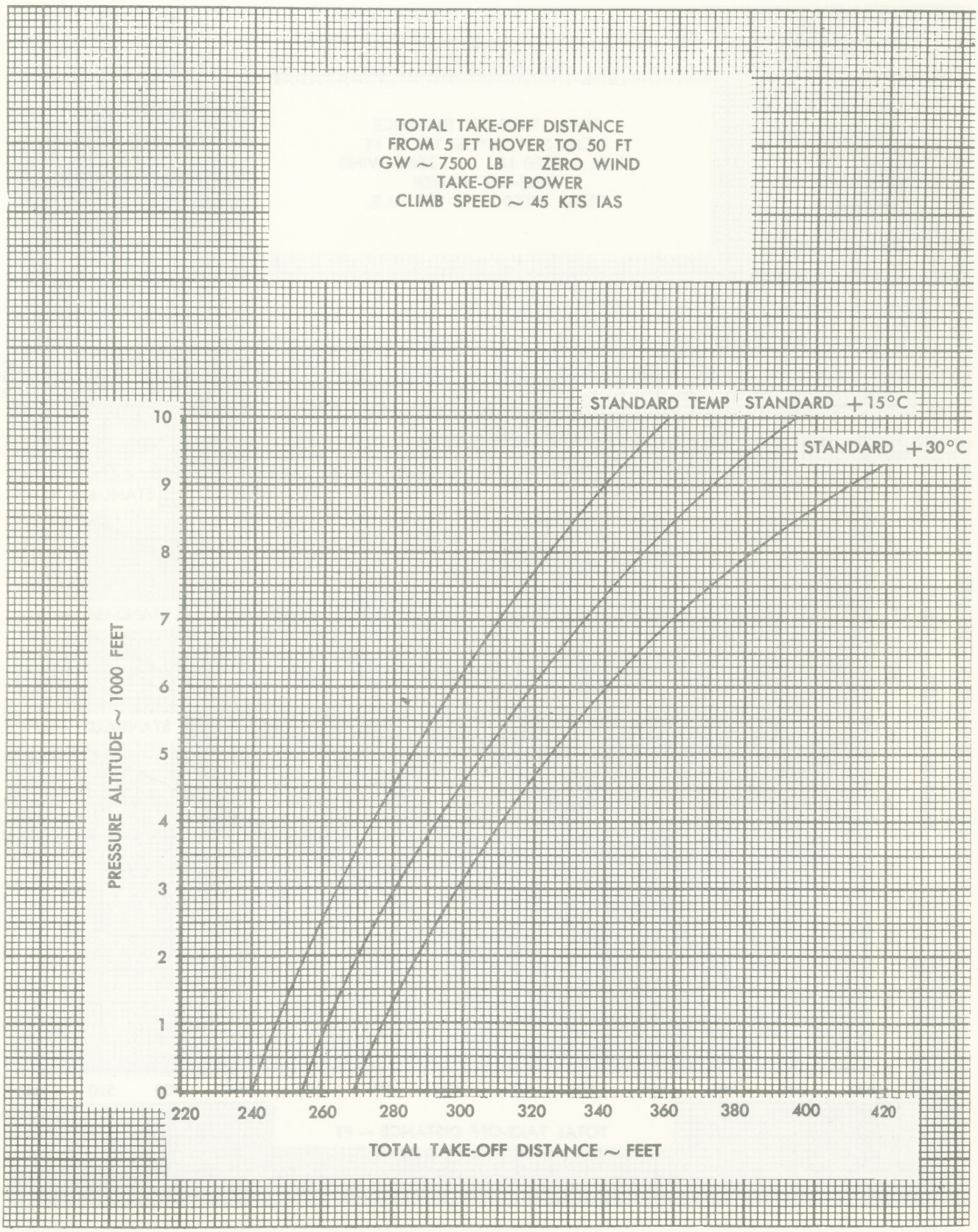

TOTAL TAKE-OFF DISTANCE
FROM 5 FT HOVER TO 50 FT
GW ~ 7500 LB ZERO WIND
TAKE-OFF POWER
CLIMB SPEED ~ 45 KTS IAS
STANDARD TEMP
STANDARD +15°C
STANDARD +30°C
PRESSURE ALTITUDE ~ 1000 FEET
0
1
2
3
4
5
6
7
8
9
10
220
240
260
280
300
320
340
360
380
400
420
TOTAL TAKE-OFF DISTANCE ~ FEET

Figure 8.

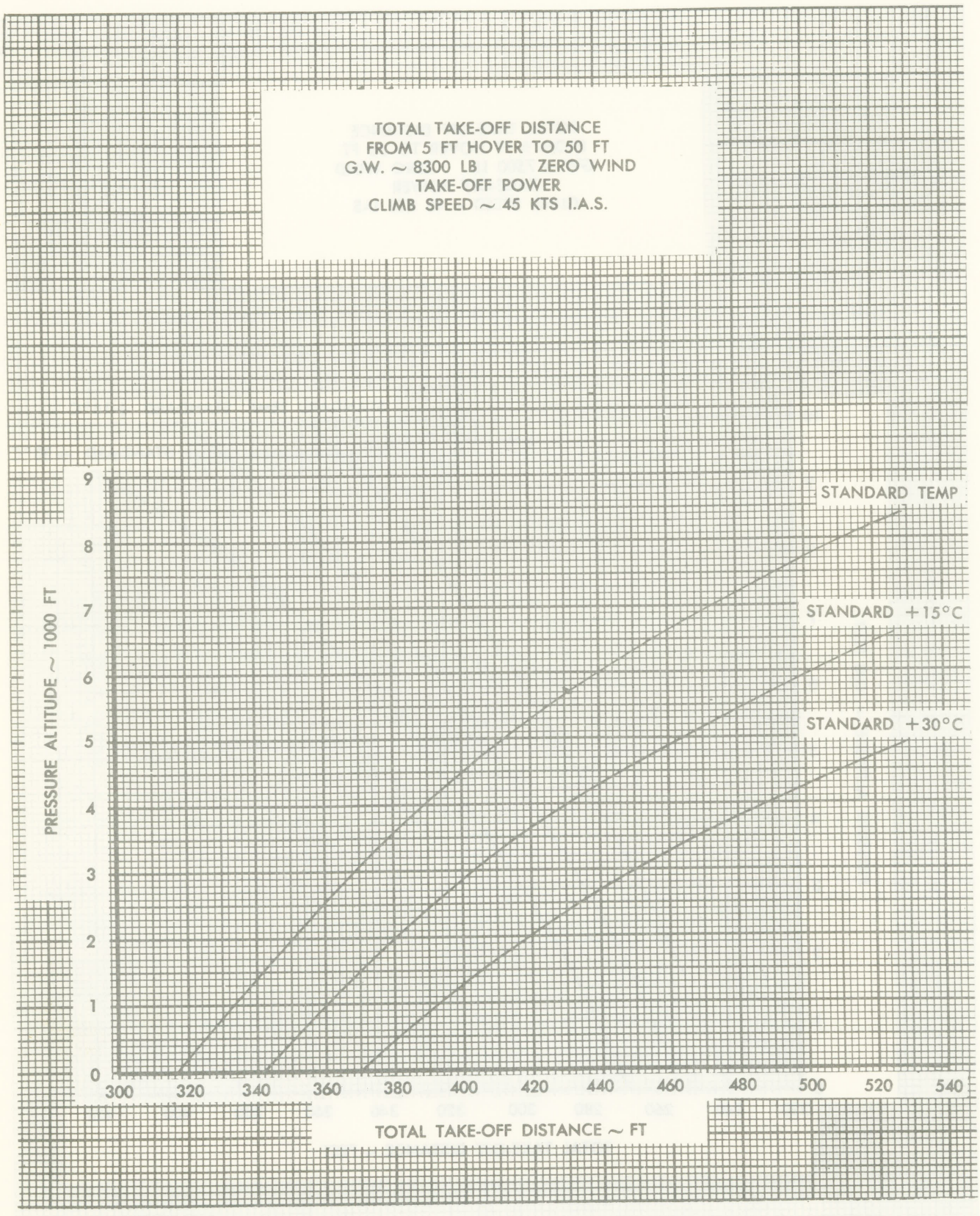

TOTAL TAKE-OFF DISTANCE
FROM 5 FT HOVER TO 50 FT
G.W. ~ 8300 LB ZERO WIND
TAKE-OFF POWER
CLIMB SPEED ~ 45 KTS I.A.S.
PRESSURE ALTITUDE ~ 1000 FT
0
1
2
3
4
5
6
7
8
9
STANDARD TEMP
STANDARD +15°C
STANDARD +30°C
300
320
340
360
380
400
420
440
460
480
500
520
540
TOTAL TAKE-OFF DISTANCE ~ FT

Figure 9.

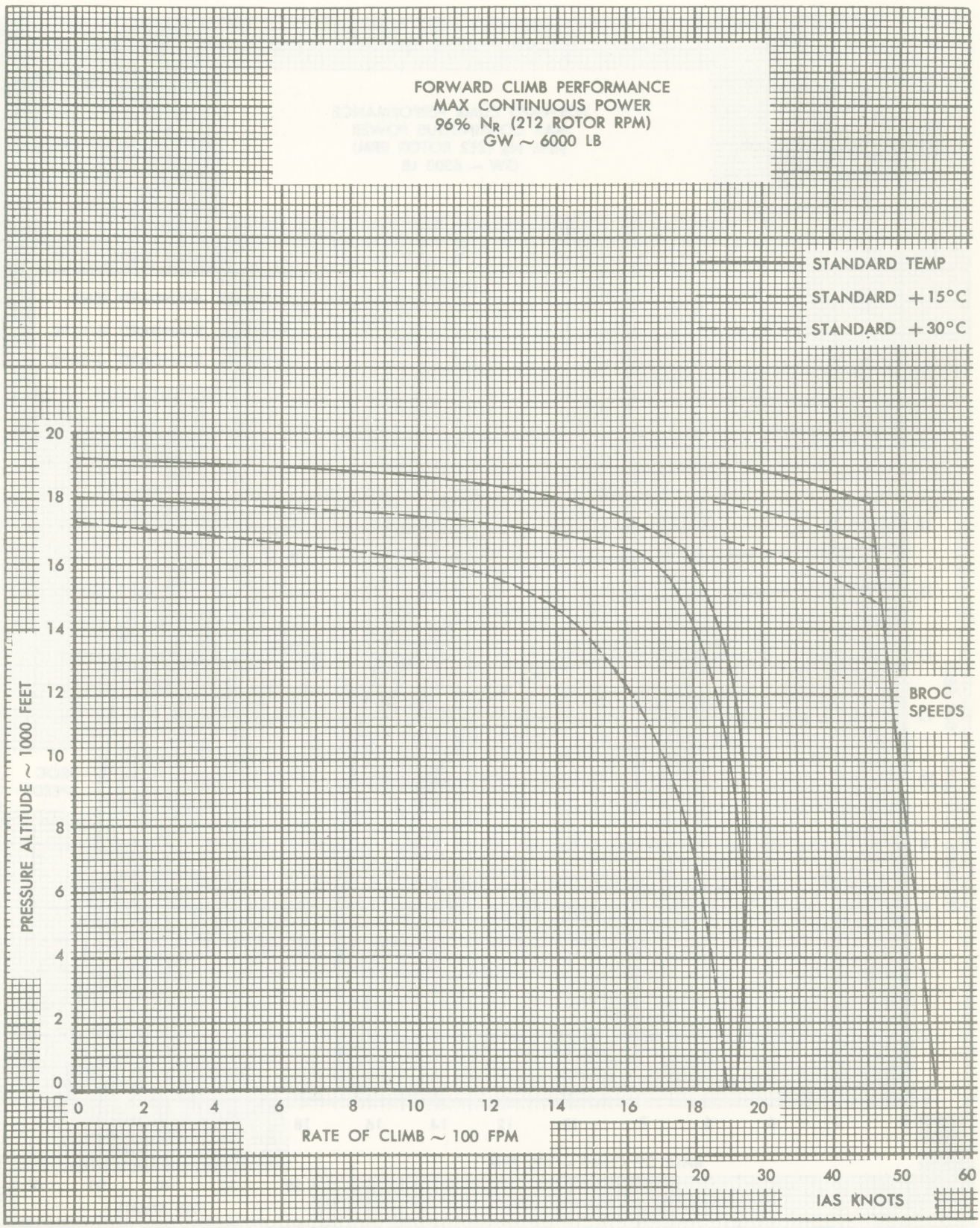

FORWARD CLIMB PERFORMANCE
MAX CONTINUOUS POWER
96% N_R (212 ROTOR RPM)
GW ~ 6000 LB
STANDARD TEMP
STANDARD +15°C
STANDARD +30°C
BROC SPEEDS
PRESSURE ALTITUDE ~ 1000 FEET
0
2
4
6
8
10
12
14
16
18
20
RATE OF CLIMB ~ 100 FPM
20
30
40
50
60
IAS KNOTS

Figure 10.

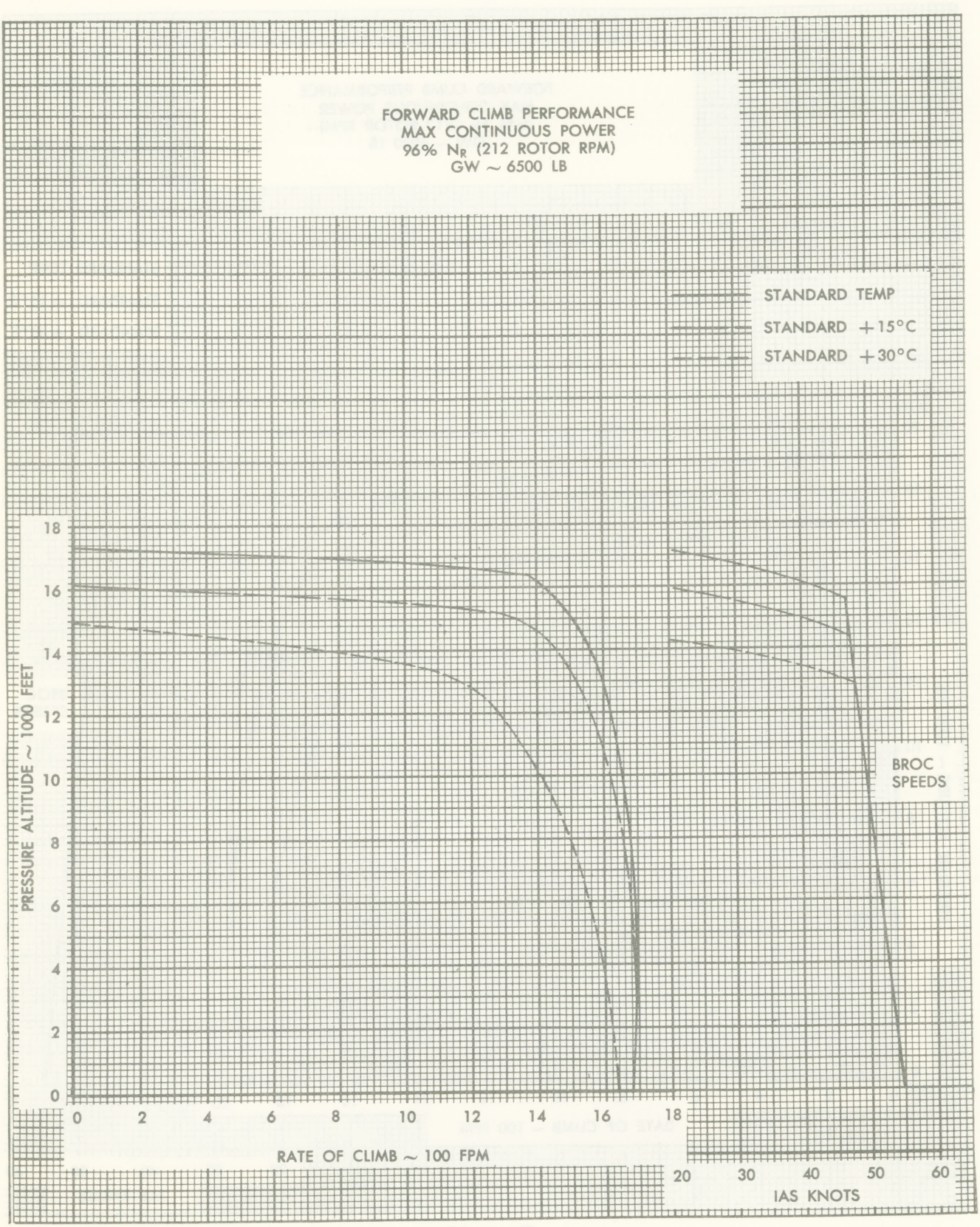

FORWARD CLIMB PERFORMANCE
MAX CONTINUOUS POWER
96% N_R (212 ROTOR RPM)
GW ~ 6500 LB
STANDARD TEMP
STANDARD +15°C
STANDARD +30°C
BROC SPEEDS
PRESSURE ALTITUDE ~ 1000 FEET
0
2
4
6
8
10
12
14
16
18
RATE OF CLIMB ~ 100 FPM
20
30
40
50
60
IAS KNOTS

Figure 11.

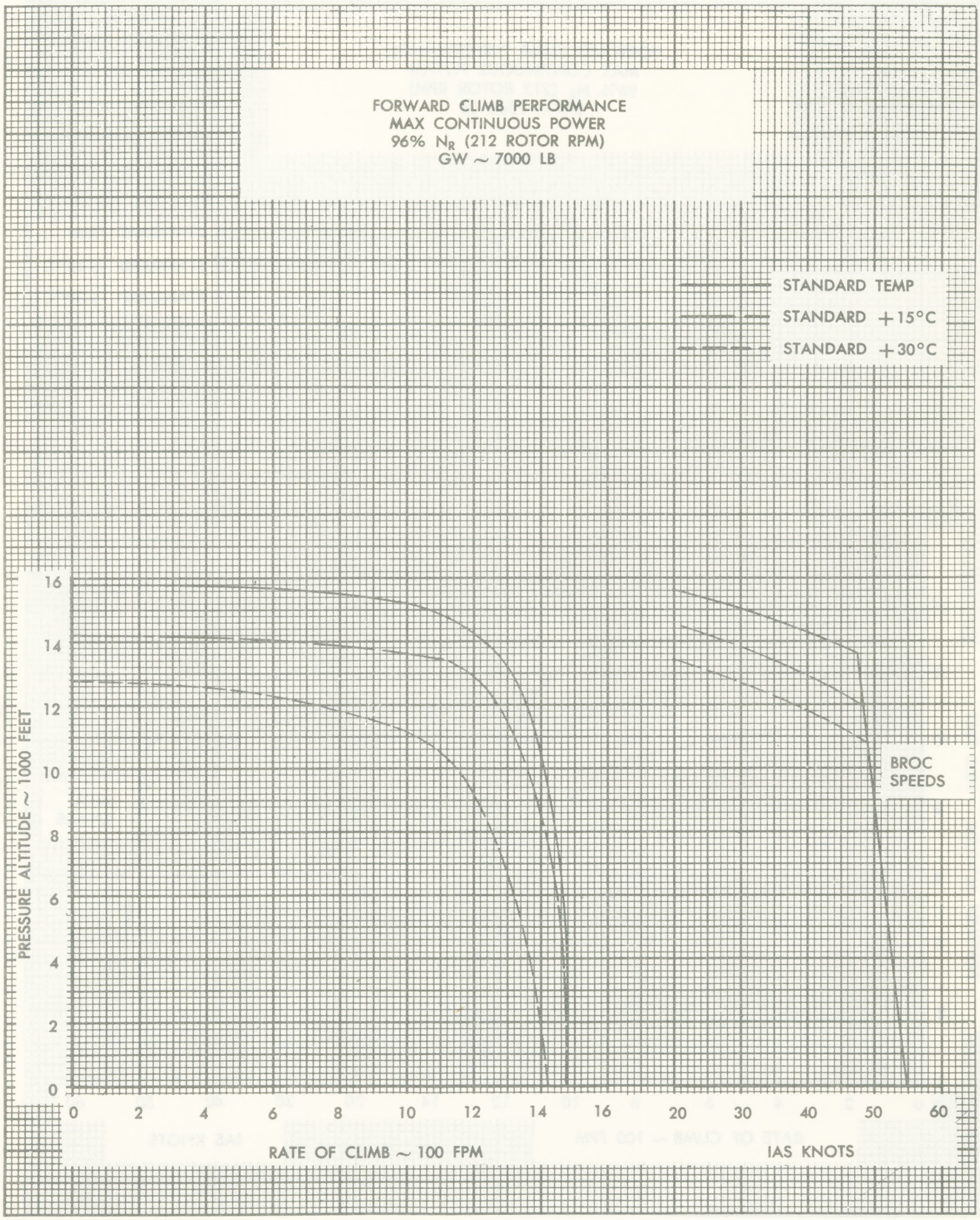

FORWARD CLIMB PERFORMANCE
MAX CONTINUOUS POWER
96% N_R (212 ROTOR RPM)
GW ~ 7000 LB
STANDARD TEMP
STANDARD +15°C
STANDARD +30°C
BROC SPEEDS
PRESSURE ALTITUDE ~ 1000 FEET
0
2
4
6
8
10
12
14
16
RATE OF CLIMB ~ 100 FPM
0
2
4
6
8
10
12
14
16
20
30
40
50
60
IAS KNOTS

Figure 12.

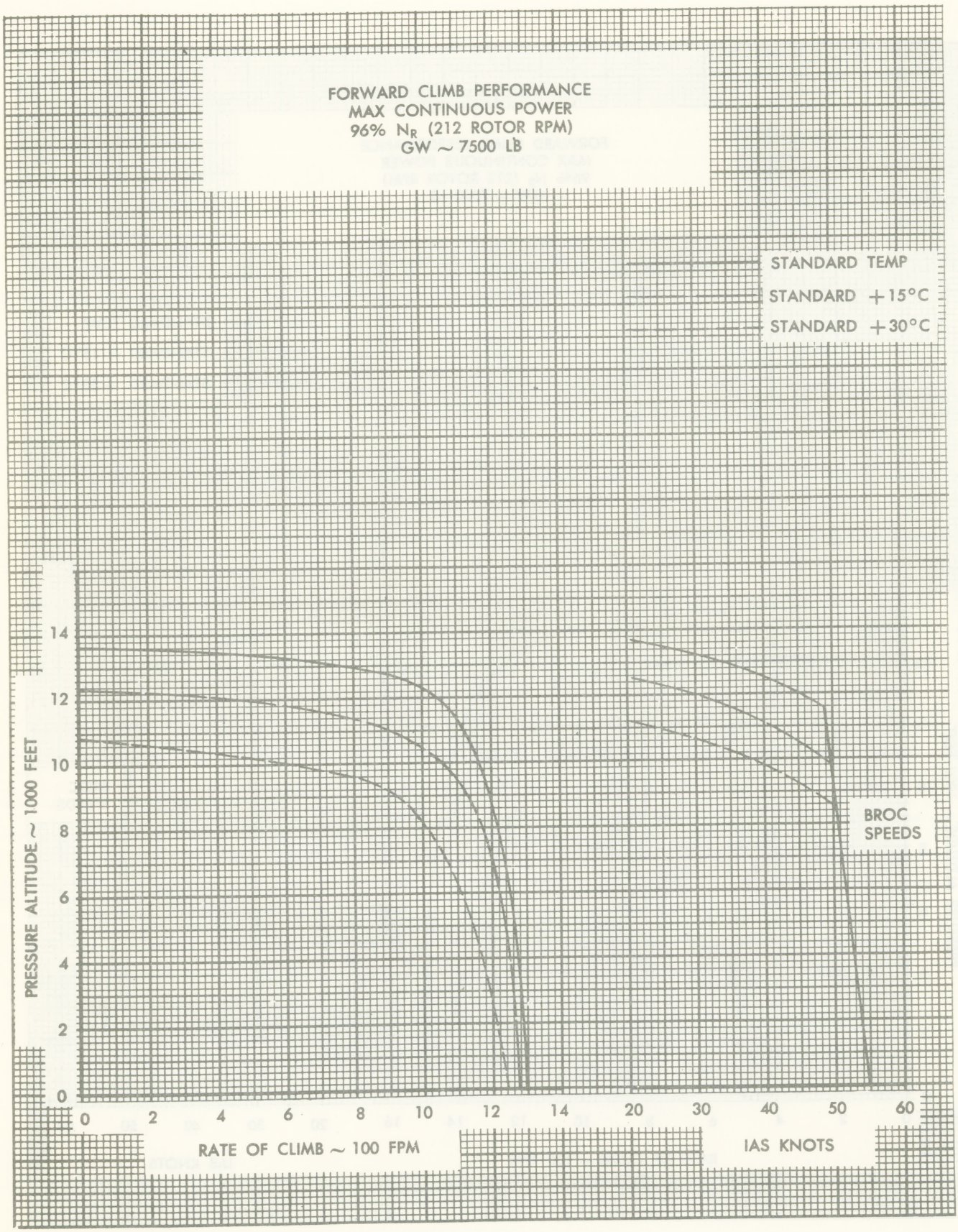

FORWARD CLIMB PERFORMANCE
MAX CONTINUOUS POWER
96% N_R (212 ROTOR RPM)
GW ~ 7500 LB
STANDARD TEMP
STANDARD +15°C
STANDARD +30°C
BROC SPEEDS
PRESSURE ALTITUDE ~ 1000 FEET
0
2
4
6
8
10
12
14
0
2
4
6
8
10
12
14
20
30
40
50
60
RATE OF CLIMB ~ 100 FPM
IAS KNOTS

Figure 13.

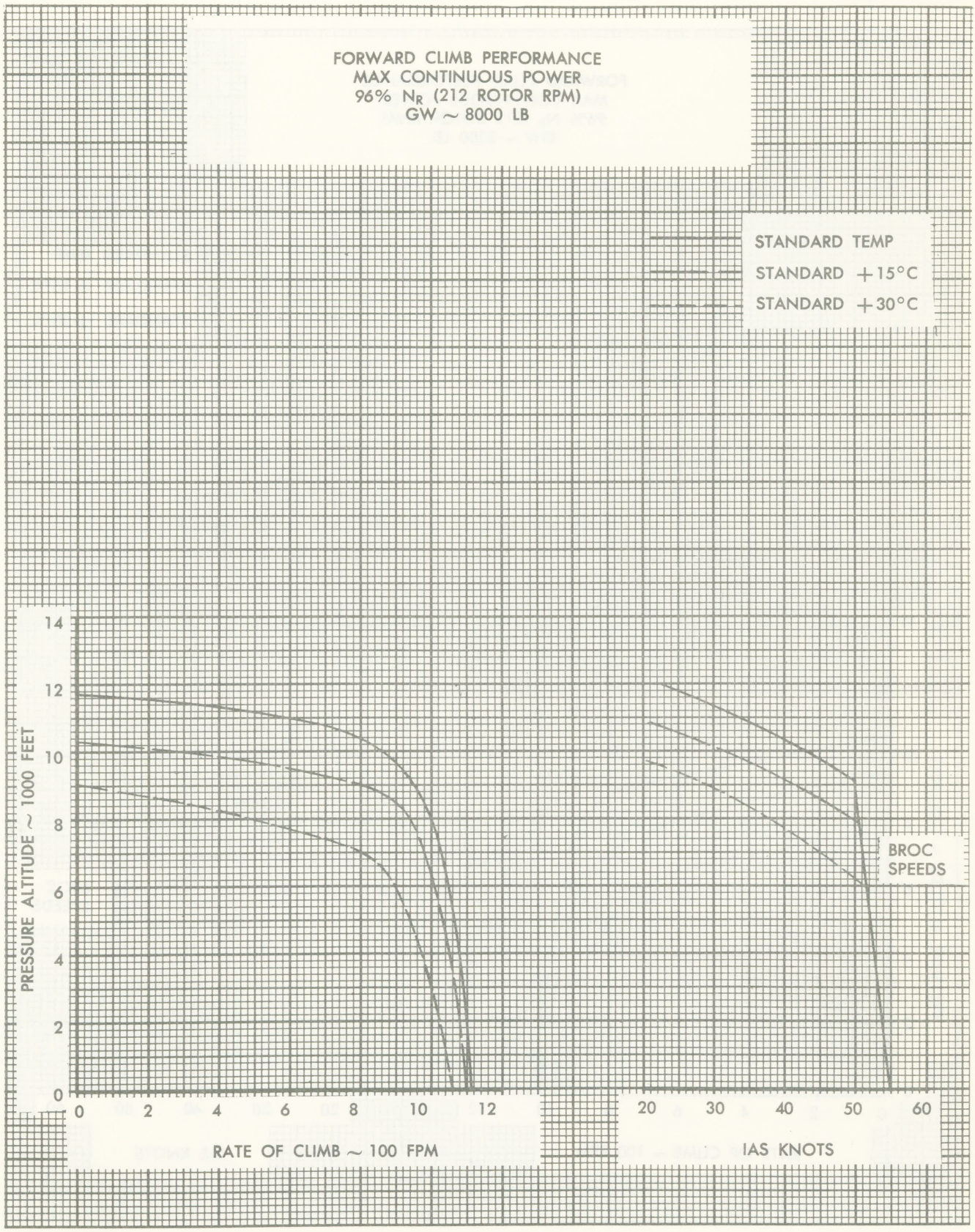

FORWARD CLIMB PERFORMANCE
MAX CONTINUOUS POWER
96% N_R (212 ROTOR RPM)
GW ~ 8000 LB
STANDARD TEMP
STANDARD +15°C
STANDARD +30°C
BROC SPEEDS
PRESSURE ALTITUDE ~ 1000 FEET
0
2
4
6
8
10
12
14
RATE OF CLIMB ~ 100 FPM
0
2
4
6
8
10
12
IAS KNOTS
20
30
40
50
60

Figure 14.

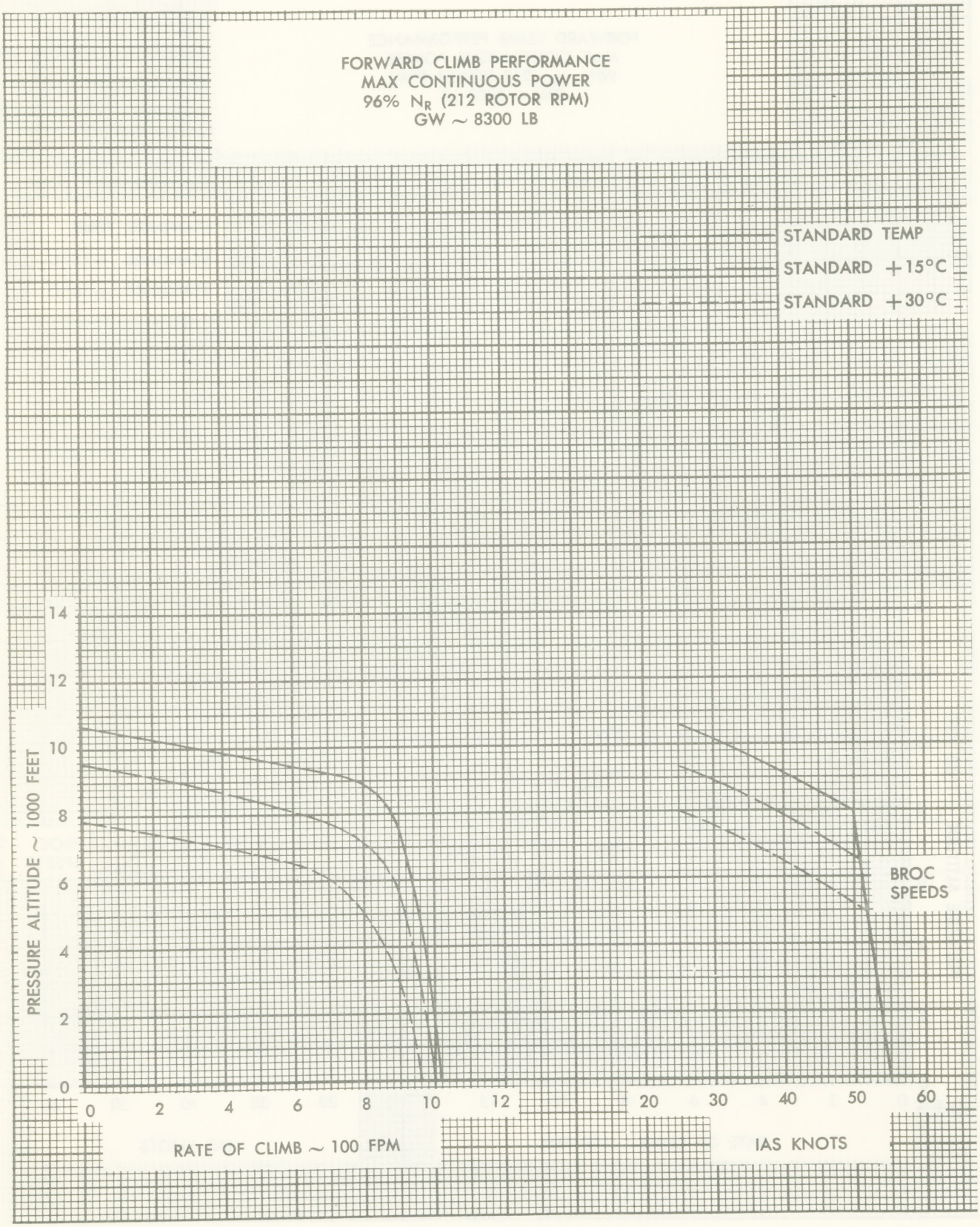


Figure 15.

Amended 15 August 1971

Pages 35, 36 and figures 16 and 17 deleted.

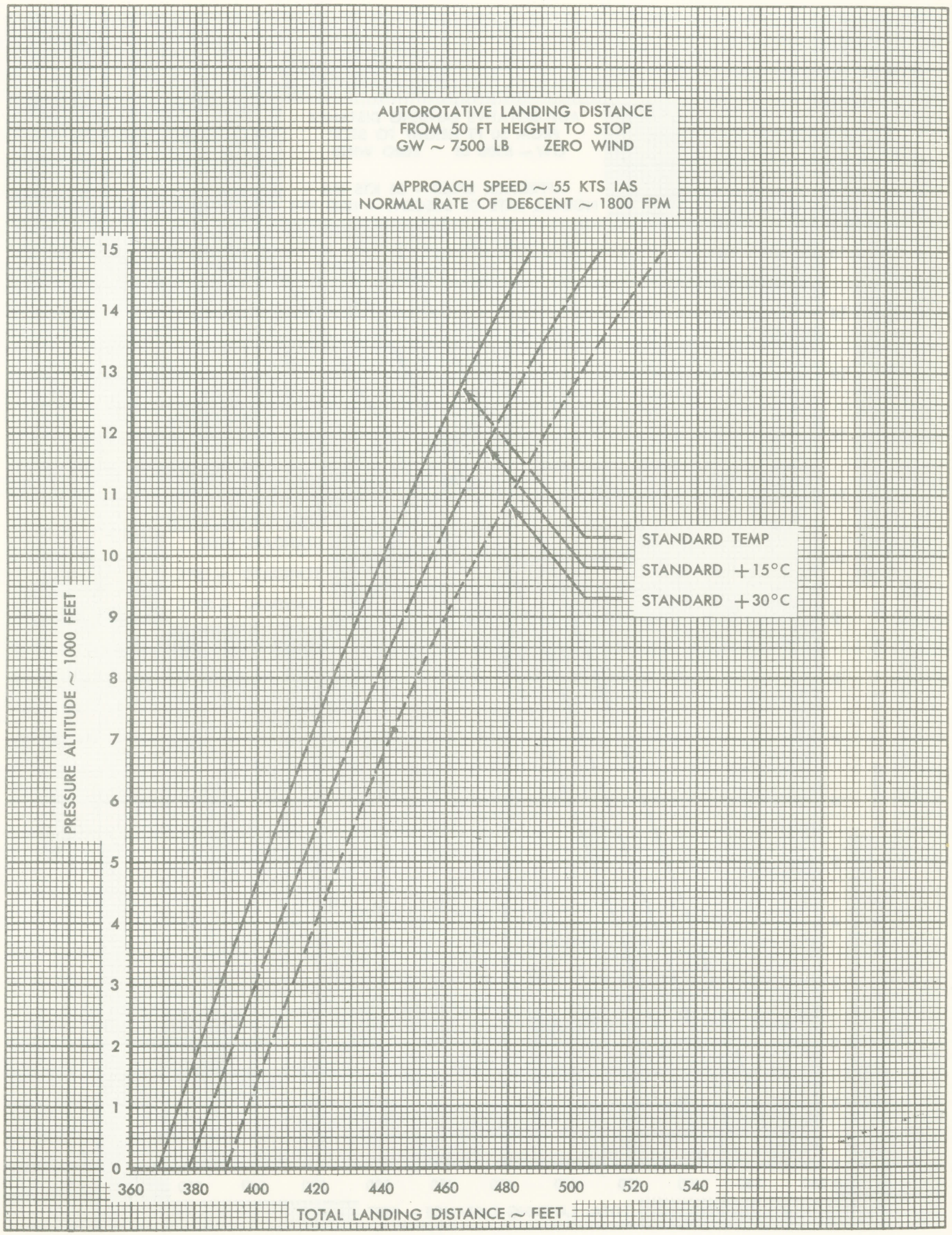

AUTOROTATIVE LANDING DISTANCE
FROM 50 FT HEIGHT TO STOP
GW ~ 7500 LB ZERO WIND
APPROACH SPEED ~ 55 KTS IAS
NORMAL RATE OF DESCENT ~ 1800 FPM
STANDARD TEMP
STANDARD +15°C
STANDARD +30°C
PRESSURE ALTITUDE ~ 1000 FEET
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
360
380
400
420
440
460
480
500
520
540
TOTAL LANDING DISTANCE ~ FEET

Figure 16.

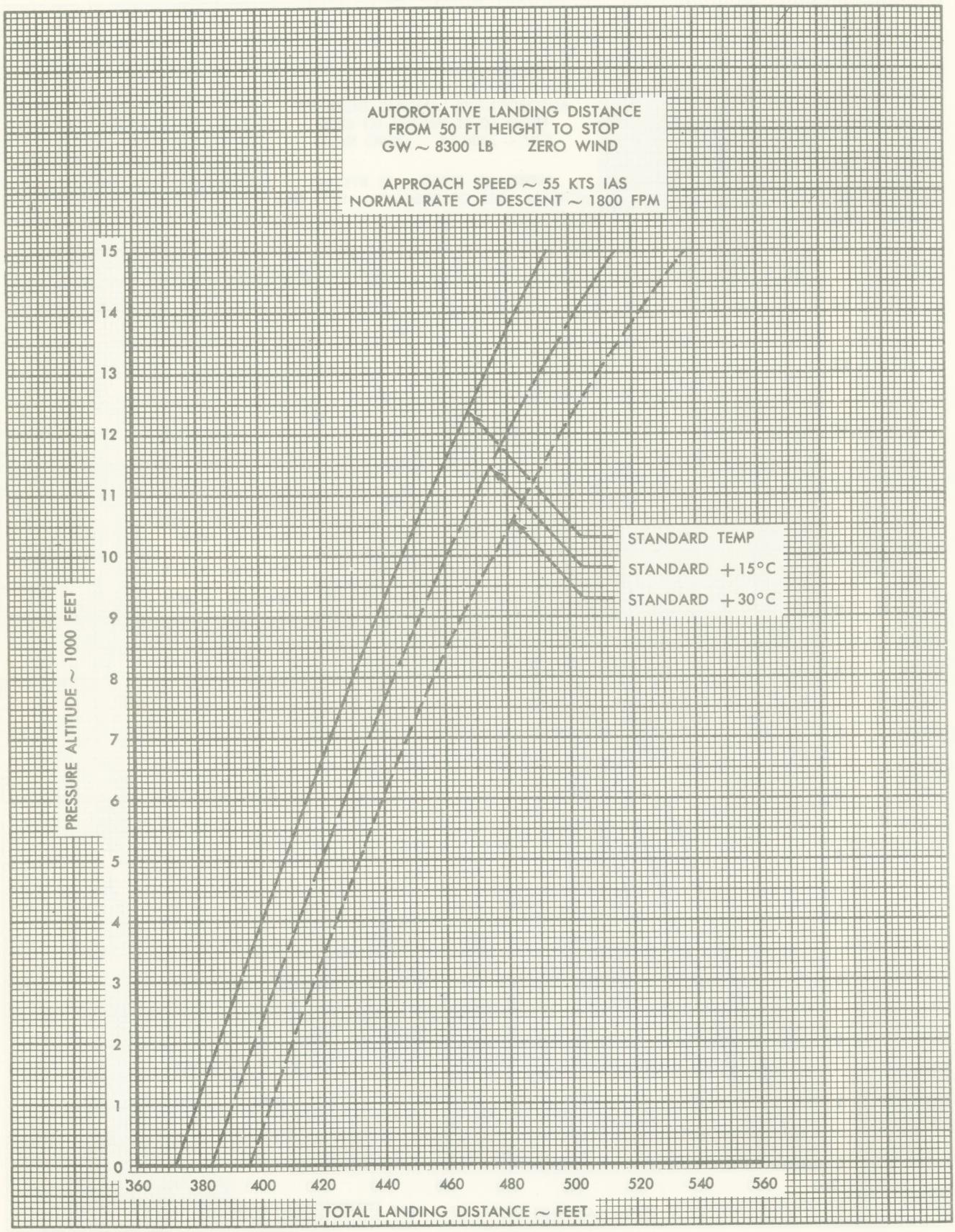

AUTOROTATIVE LANDING DISTANCE
FROM 50 FT HEIGHT TO STOP
GW ~ 8300 LB ZERO WIND
APPROACH SPEED ~ 55 KTS IAS
NORMAL RATE OF DESCENT ~ 1800 FPM
STANDARD TEMP
STANDARD +15°C
STANDARD +30°C
PRESSURE ALTITUDE ~ 1000 FEET
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
360
380
400
420
440
460
480
500
520
540
560
TOTAL LANDING DISTANCE ~ FEET

Figure 17.

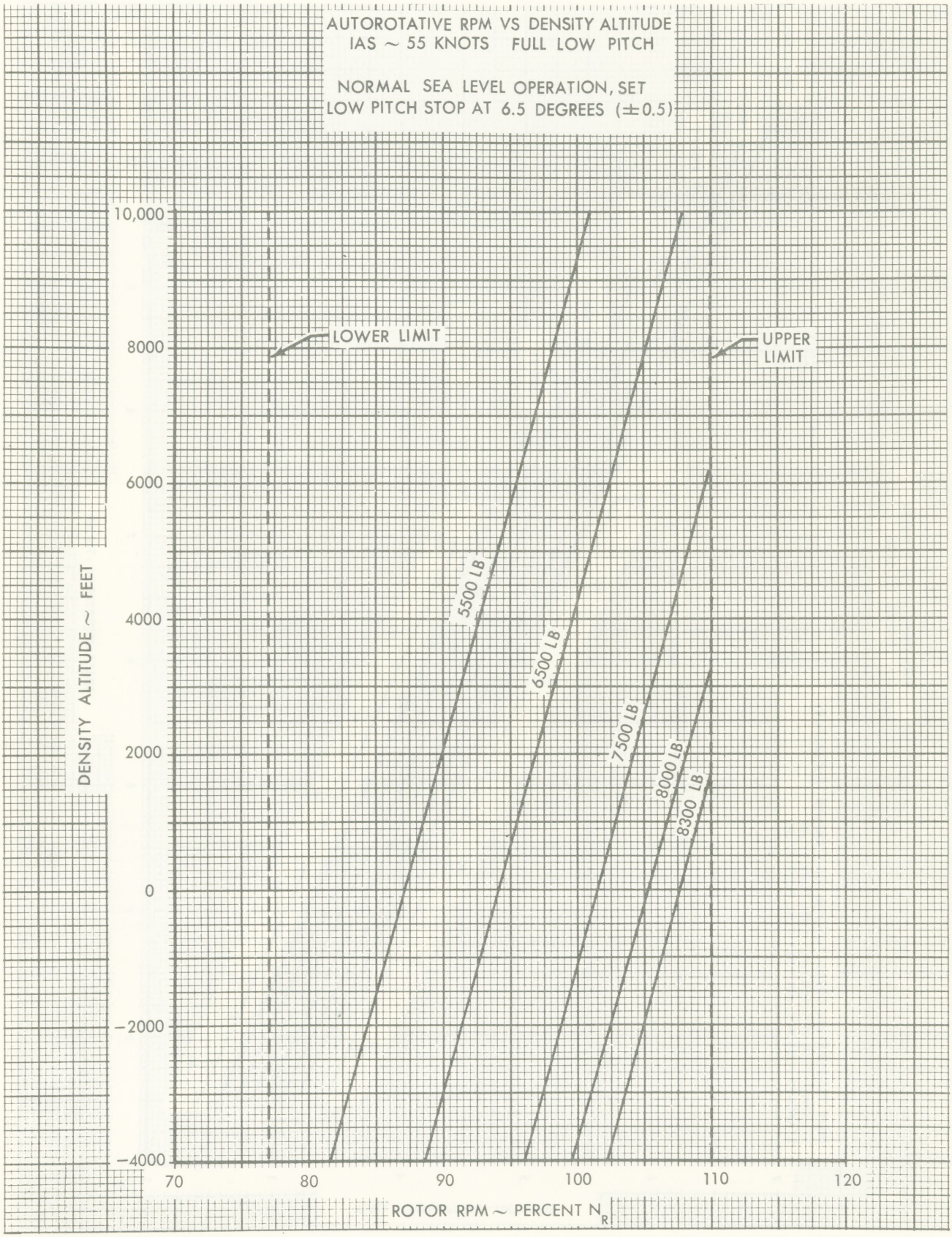

AUTOROTATIVE RPM VS DENSITY ALTITUDE
IAS ~ 55 KNOTS FULL LOW PITCH
NORMAL SEA LEVEL OPERATION, SET
LOW PITCH STOP AT 6.5 DEGREES (±0.5)
LOWER LIMIT
UPPER LIMIT
5500 LB
6500 LB
7500 LB
8000 LB
8300 LB
DENSITY ALTITUDE ~ FEET
10,000
8000
6000
4000
2000
0
−2000
−4000
70
80
90
100
110
120
ROTOR RPM ~ PERCENT N_R

Figure 18.

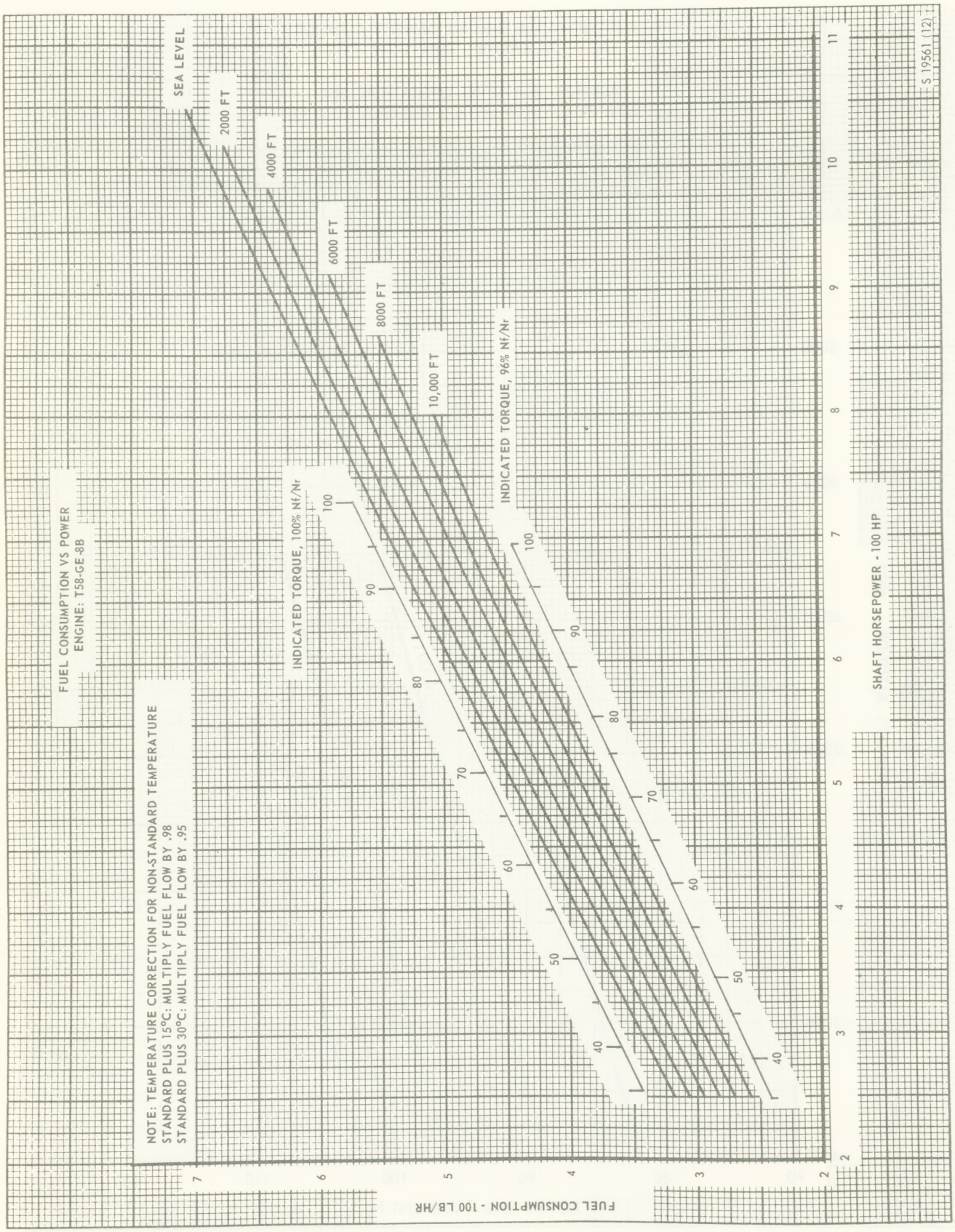

FUEL CONSUMPTION VS POWER
ENGINE: T58-GE-8B
NOTE: TEMPERATURE CORRECTION FOR NON-STANDARD TEMPERATURE
STANDARD PLUS 15°C: MULTIPLY FUEL FLOW BY .98
STANDARD PLUS 30°C: MULTIPLY FUEL FLOW BY .95
SEA LEVEL
2000 FT
4000 FT
6000 FT
8000 FT
10,000 FT
INDICATED TORQUE, 100% Nf/Nr
INDICATED TORQUE, 96% Nf/Nr
SHAFT HORSEPOWER - 100 HP
FUEL CONSUMPTION - 100 LB/HR
S 1956 (12)

Figure 19.

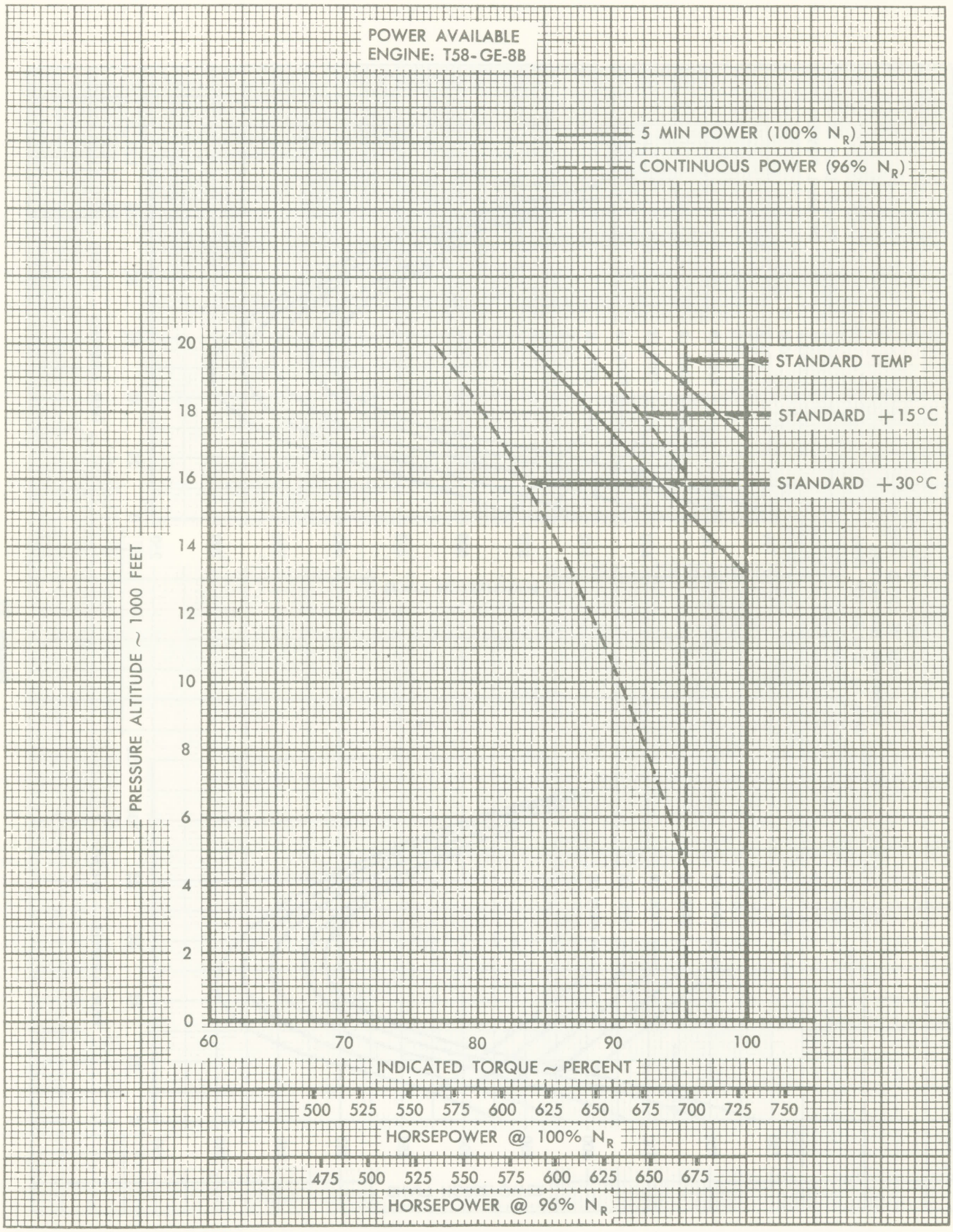

POWER AVAILABLE
ENGINE: T58-GE-8B
5 MIN POWER (100% N_R)
CONTINUOUS POWER (96% N_R)
STANDARD TEMP
STANDARD +15°C
STANDARD +30°C
PRESSURE ALTITUDE ~ 1000 FEET
20
18
16
14
12
10
8
6
4
2
0
60
70
80
90
100
INDICATED TORQUE ~ PERCENT
500 525 550 575 600 625 650 675 700 725 750
HORSEPOWER @ 100% N_R
475 500 525 550 575 600 625 650 675
HORSEPOWER @ 96% N_R

Figure 20.

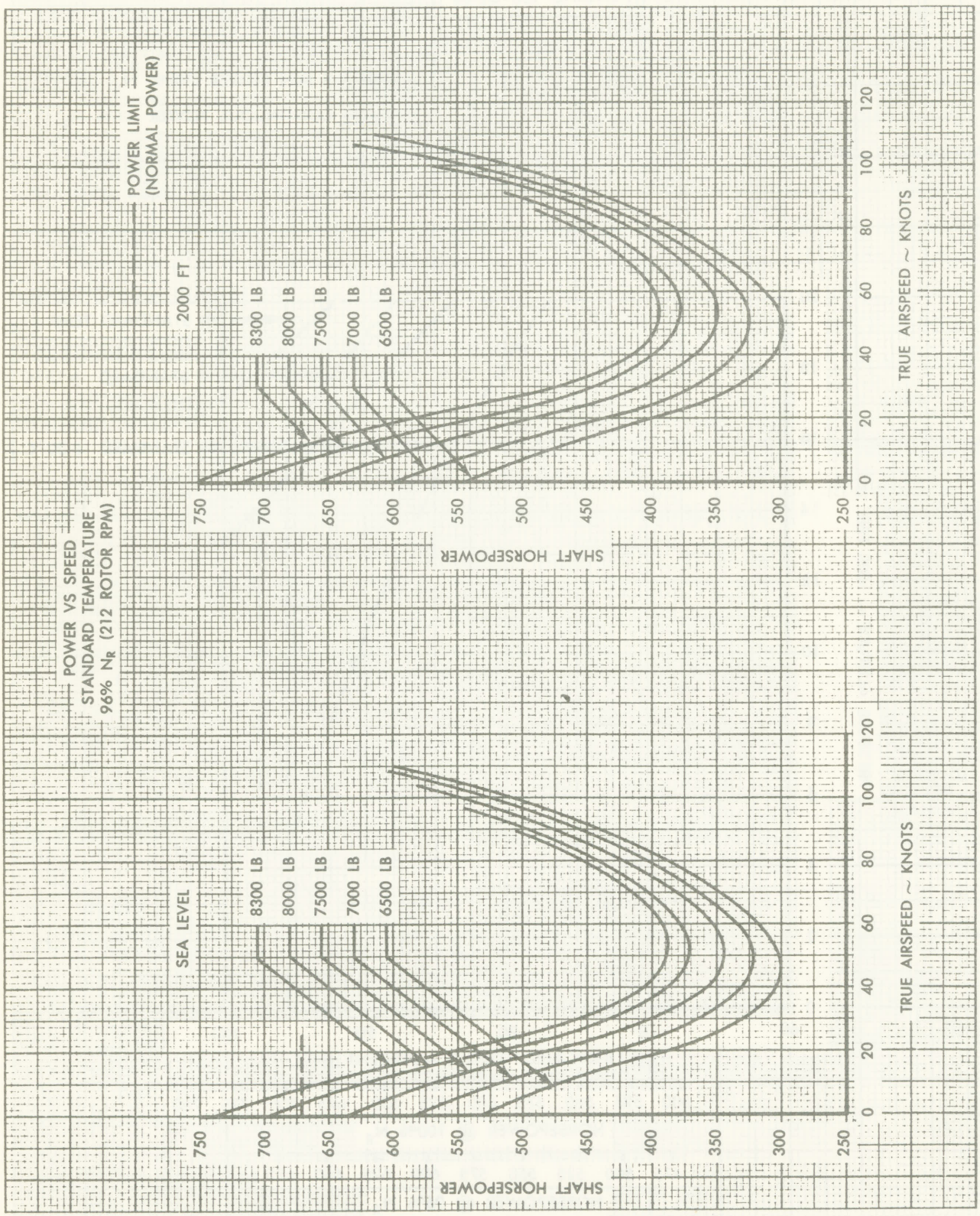

POWER VS SPEED
STANDARD TEMPERATURE
96% N_R (212 ROTOR RPM)
POWER LIMIT
(NORMAL POWER)
SEA LEVEL
2000 FT
8300 LB
8000 LB
7500 LB
7000 LB
6500 LB
SHAFT HORSEPOWER
750
700
650
600
550
500
450
400
350
300
250
TRUE AIRSPEED ~ KNOTS
0
20
40
60
80
100
120

Figure 21.

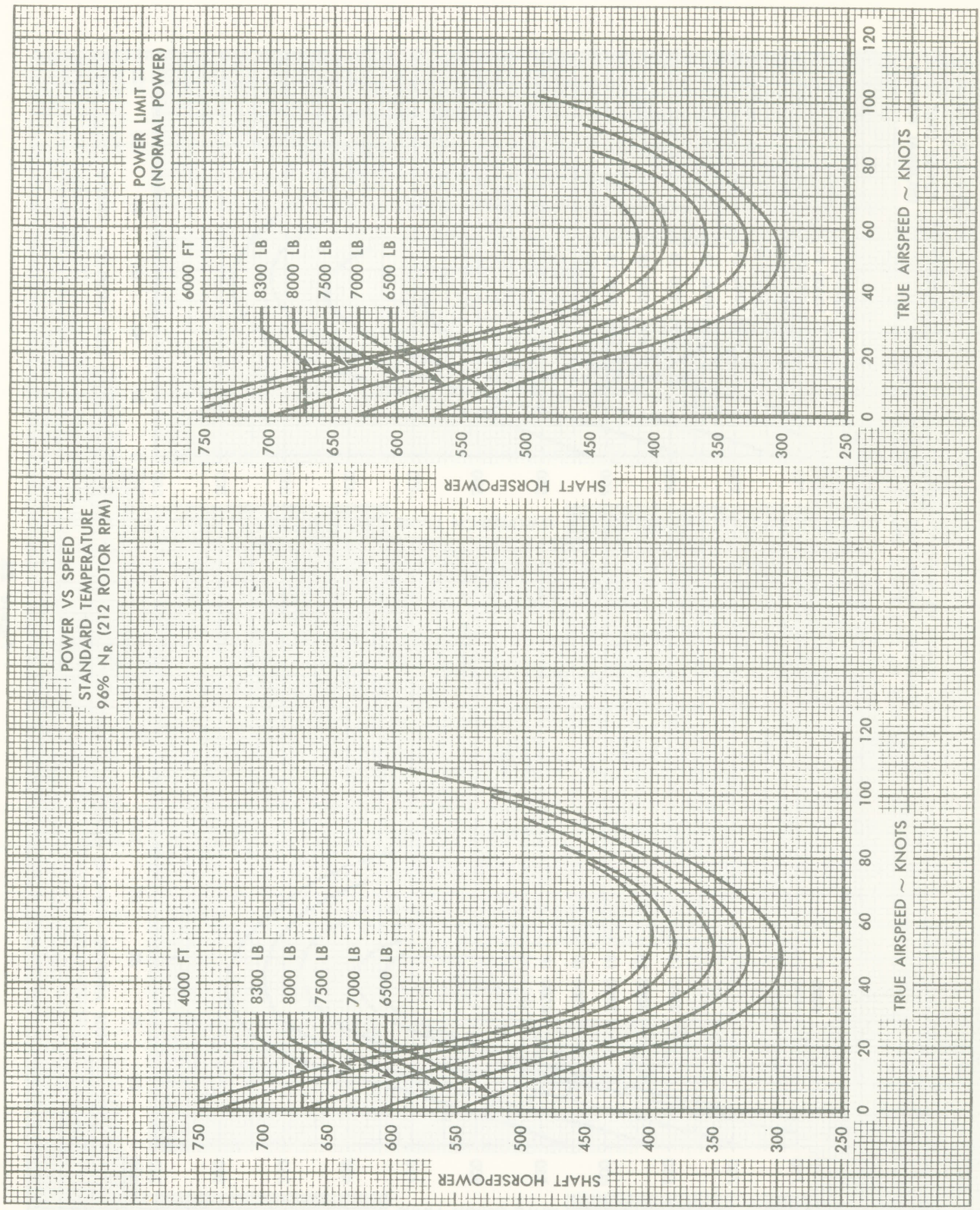

POWER VS SPEED
STANDARD TEMPERATURE
96% N_R (212 ROTOR RPM)
POWER LIMIT
(NORMAL POWER)
4000 FT
6000 FT
8300 LB
8000 LB
7500 LB
7000 LB
6500 LB
SHAFT HORSEPOWER
TRUE AIRSPEED ~ KNOTS
750
700
650
600
550
500
450
400
350
300
250
0
20
40
60
80
100
120

Figure 22.

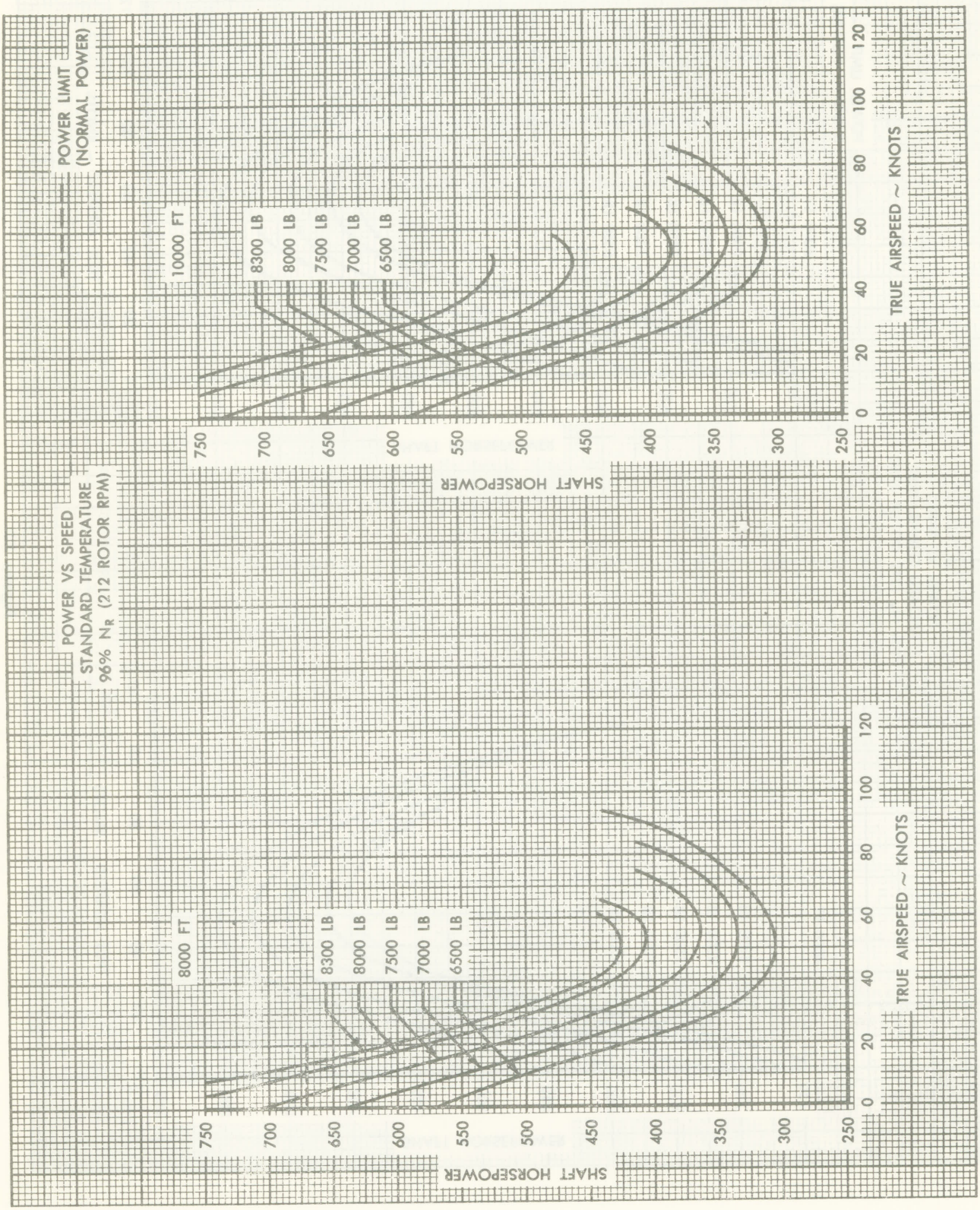

POWER VS SPEED
STANDARD TEMPERATURE
96% N_R (212 ROTOR RPM)
POWER LIMIT
(NORMAL POWER)
8000 FT
10000 FT
8300 LB
8000 LB
7500 LB
7000 LB
6500 LB
SHAFT HORSEPOWER
750
700
650
600
550
500
450
400
350
300
250
TRUE AIRSPEED ~ KNOTS
0
20
40
60
80
100
120

Figure 23.

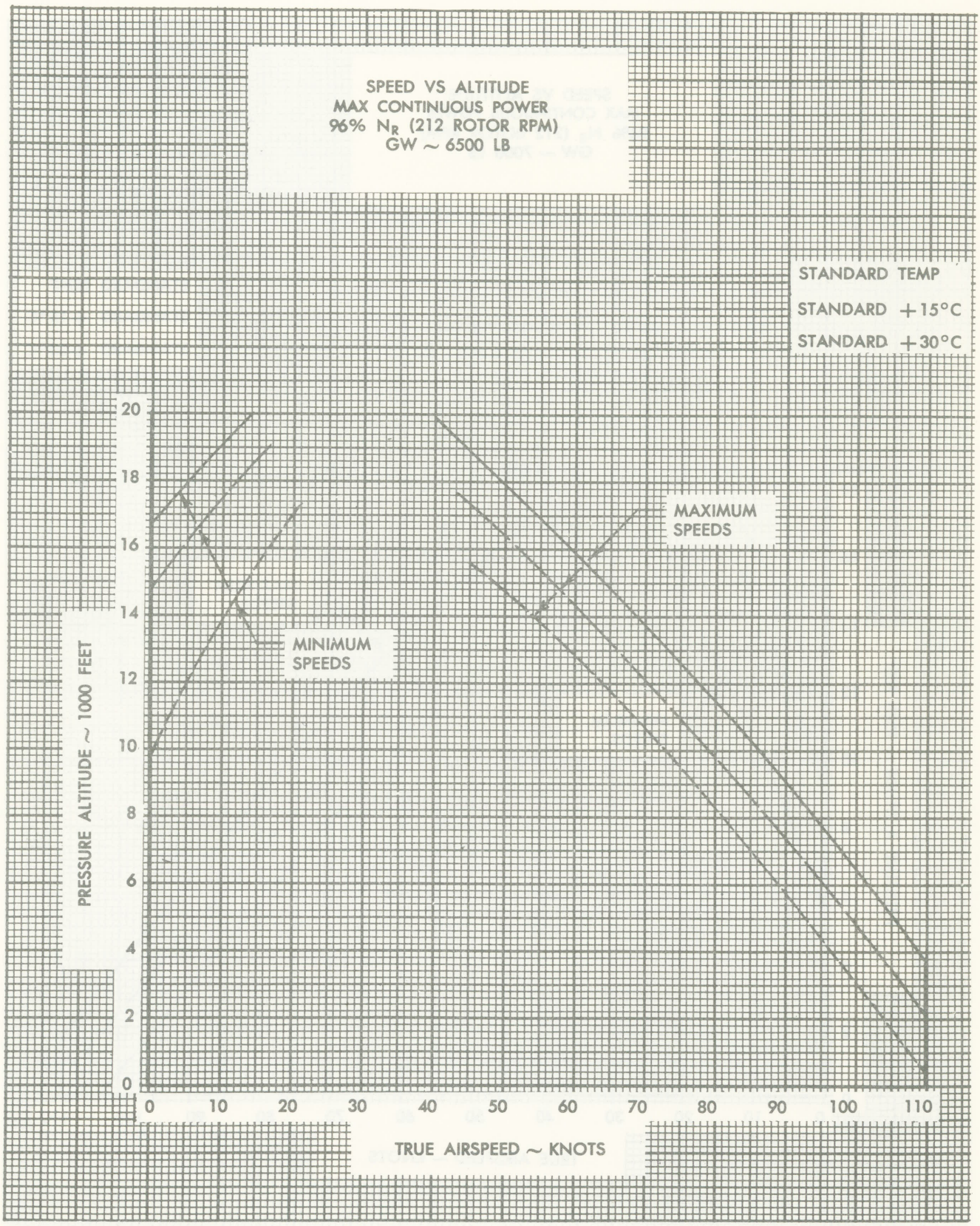

SPEED VS ALTITUDE
MAX CONTINUOUS POWER
96% N_R (212 ROTOR RPM)
GW ~ 6500 LB
STANDARD TEMP
STANDARD +15°C
STANDARD +30°C
MAXIMUM SPEEDS
MINIMUM SPEEDS
PRESSURE ALTITUDE ~ 1000 FEET
0
2
4
6
8
10
12
14
16
18
20
0
10
20
30
40
50
60
70
80
90
100
110
TRUE AIRSPEED ~ KNOTS

Figure 24.

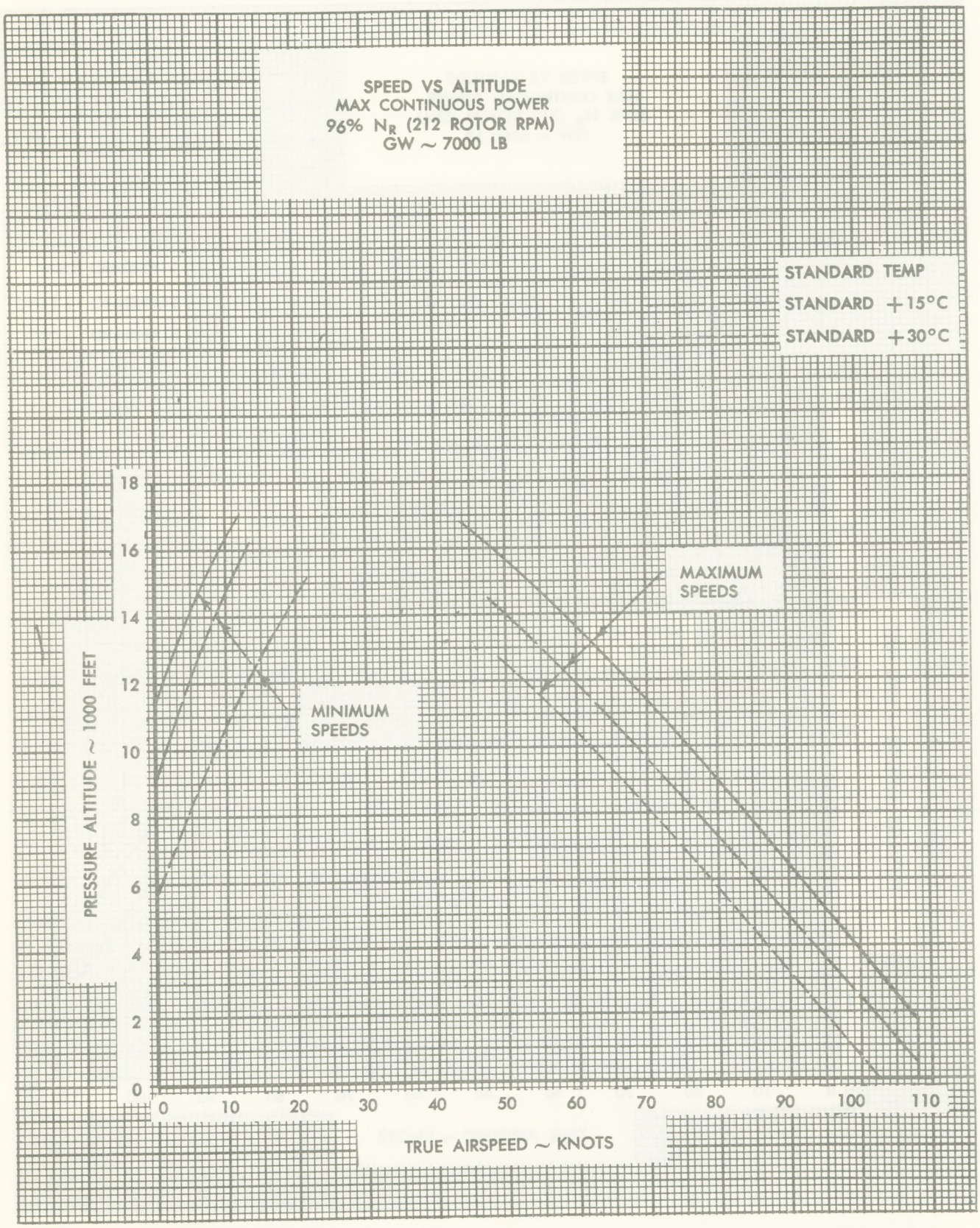

SPEED VS ALTITUDE
MAX CONTINUOUS POWER
96% N_R (212 ROTOR RPM)
GW ~ 7000 LB
STANDARD TEMP
STANDARD +15°C
STANDARD +30°C
MAXIMUM SPEEDS
MINIMUM SPEEDS
PRESSURE ALTITUDE ~ 1000 FEET
0
2
4
6
8
10
12
14
16
18
0
10
20
30
40
50
60
70
80
90
100
110
TRUE AIRSPEED ~ KNOTS

Figure 25.

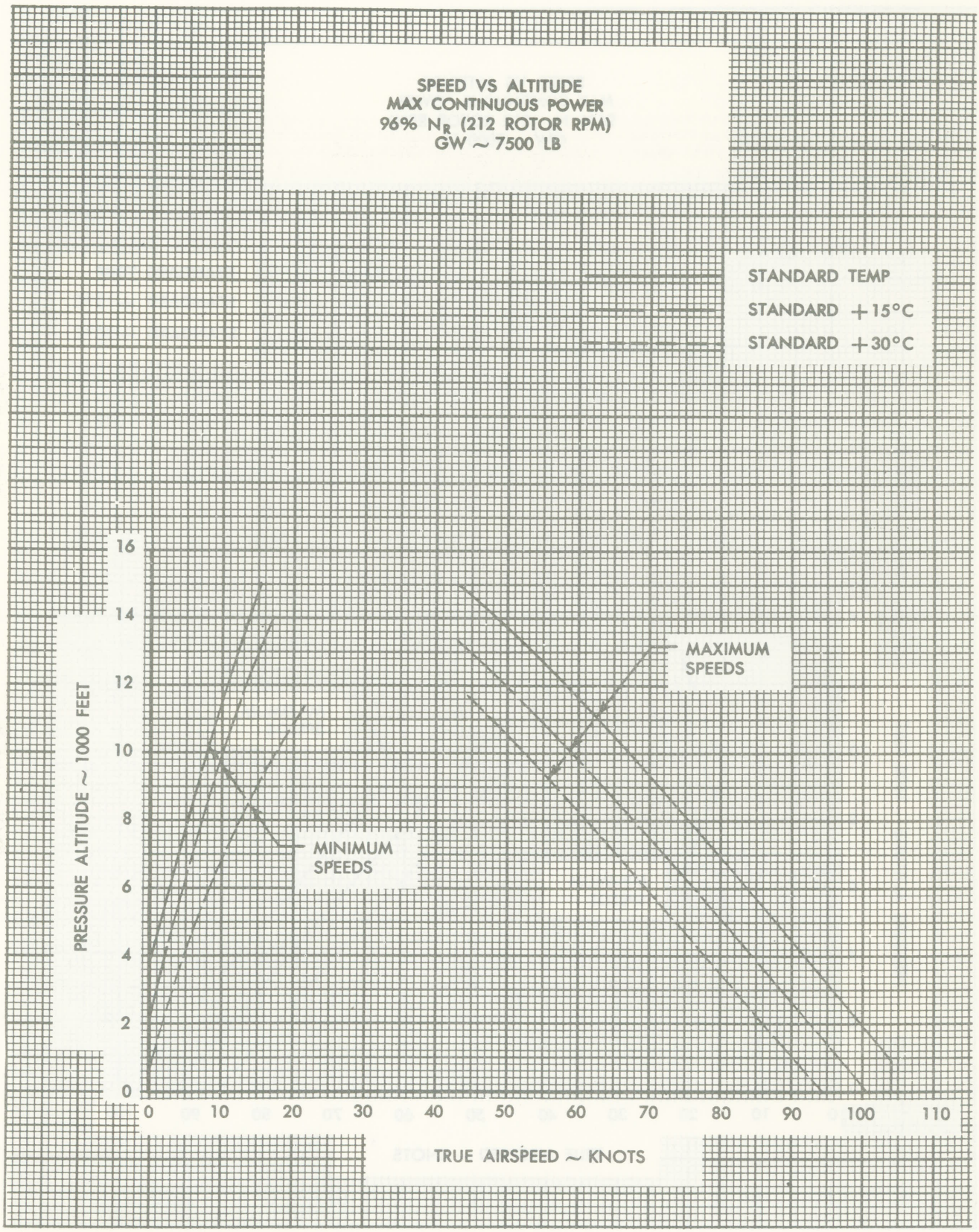

SPEED VS ALTITUDE
MAX CONTINUOUS POWER
96% N_R (212 ROTOR RPM)
GW ~ 7500 LB
STANDARD TEMP
STANDARD +15°C
STANDARD +30°C
MAXIMUM SPEEDS
MINIMUM SPEEDS
PRESSURE ALTITUDE ~ 1000 FEET
0
2
4
6
8
10
12
14
16
0
10
20
30
40
50
60
70
80
90
100
110
TRUE AIRSPEED ~ KNOTS

Figure 26.

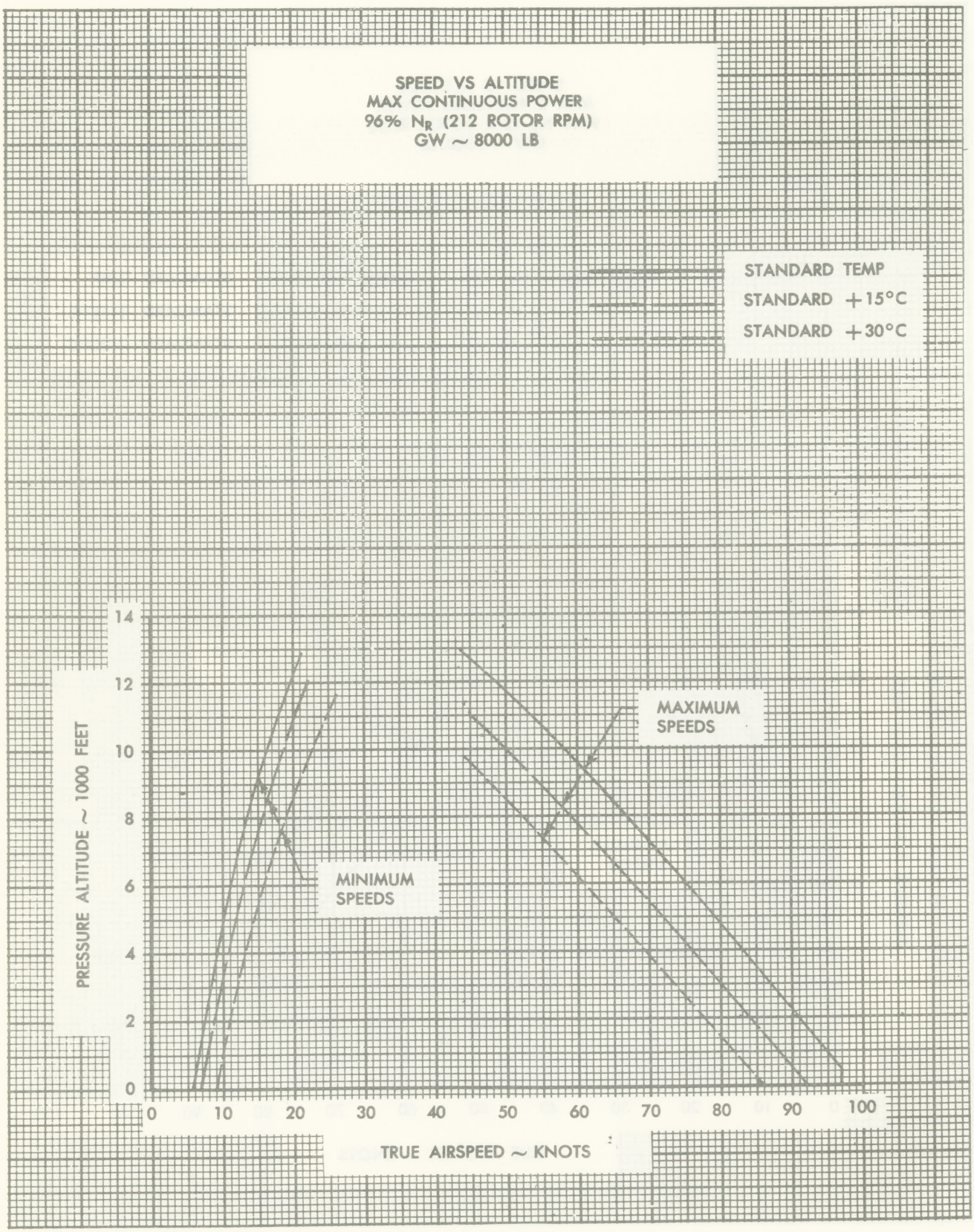

SPEED VS ALTITUDE
MAX CONTINUOUS POWER
96% N_R (212 ROTOR RPM)
GW ~ 8000 LB
STANDARD TEMP
STANDARD +15°C
STANDARD +30°C
MAXIMUM SPEEDS
MINIMUM SPEEDS
PRESSURE ALTITUDE ~ 1000 FEET
0
2
4
6
8
10
12
14
0
10
20
30
40
50
60
70
80
90
100
TRUE AIRSPEED ~ KNOTS

Figure 27.

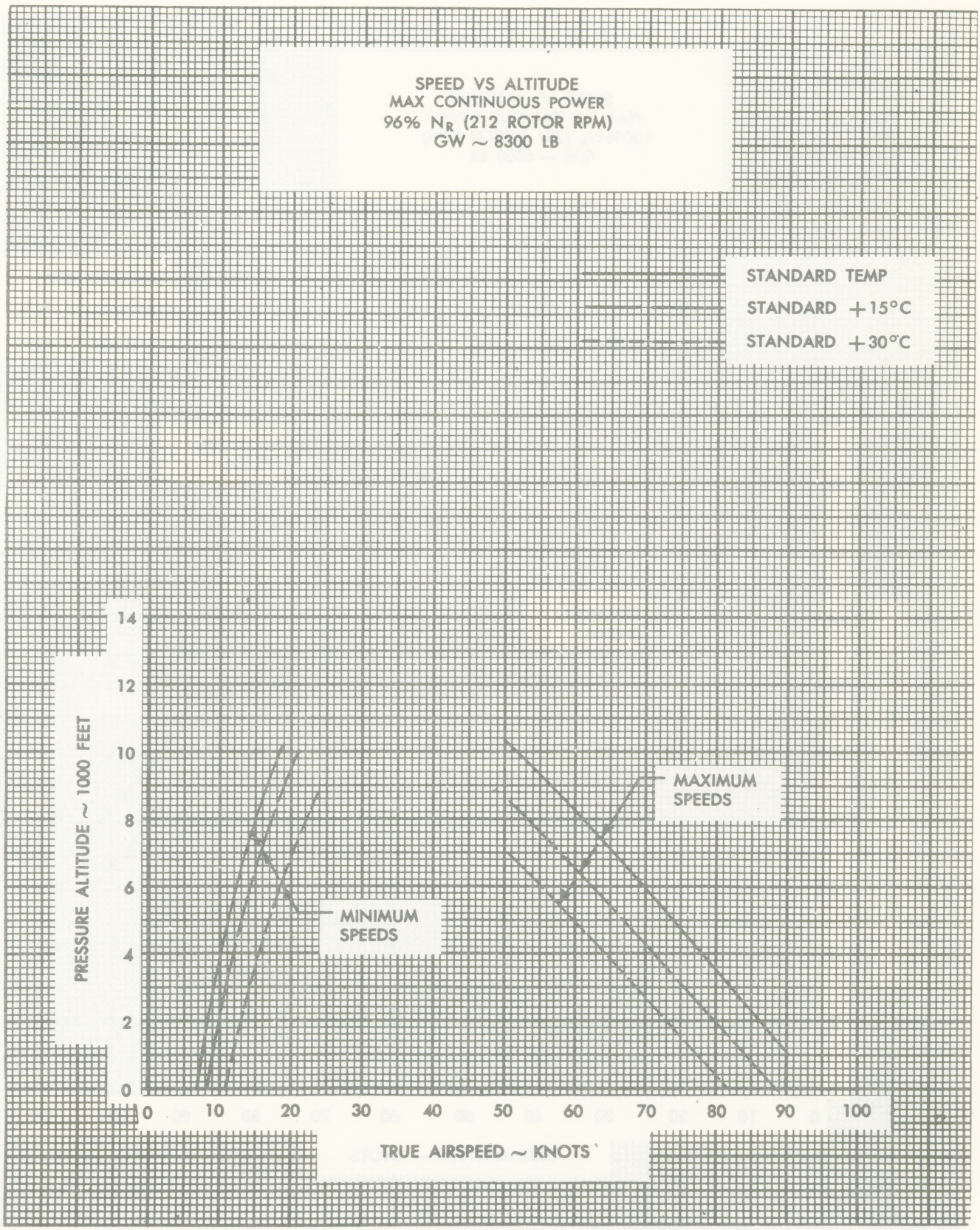

SPEED VS ALTITUDE
MAX CONTINUOUS POWER
96% N_R (212 ROTOR RPM)
GW ~ 8300 LB
STANDARD TEMP
STANDARD +15°C
STANDARD +30°C
PRESSURE ALTITUDE ~ 1000 FEET
0
2
4
6
8
10
12
14
MAXIMUM SPEEDS
MINIMUM SPEEDS
0
10
20
30
40
50
60
70
80
90
100
TRUE AIRSPEED ~ KNOTS

Figure 28.

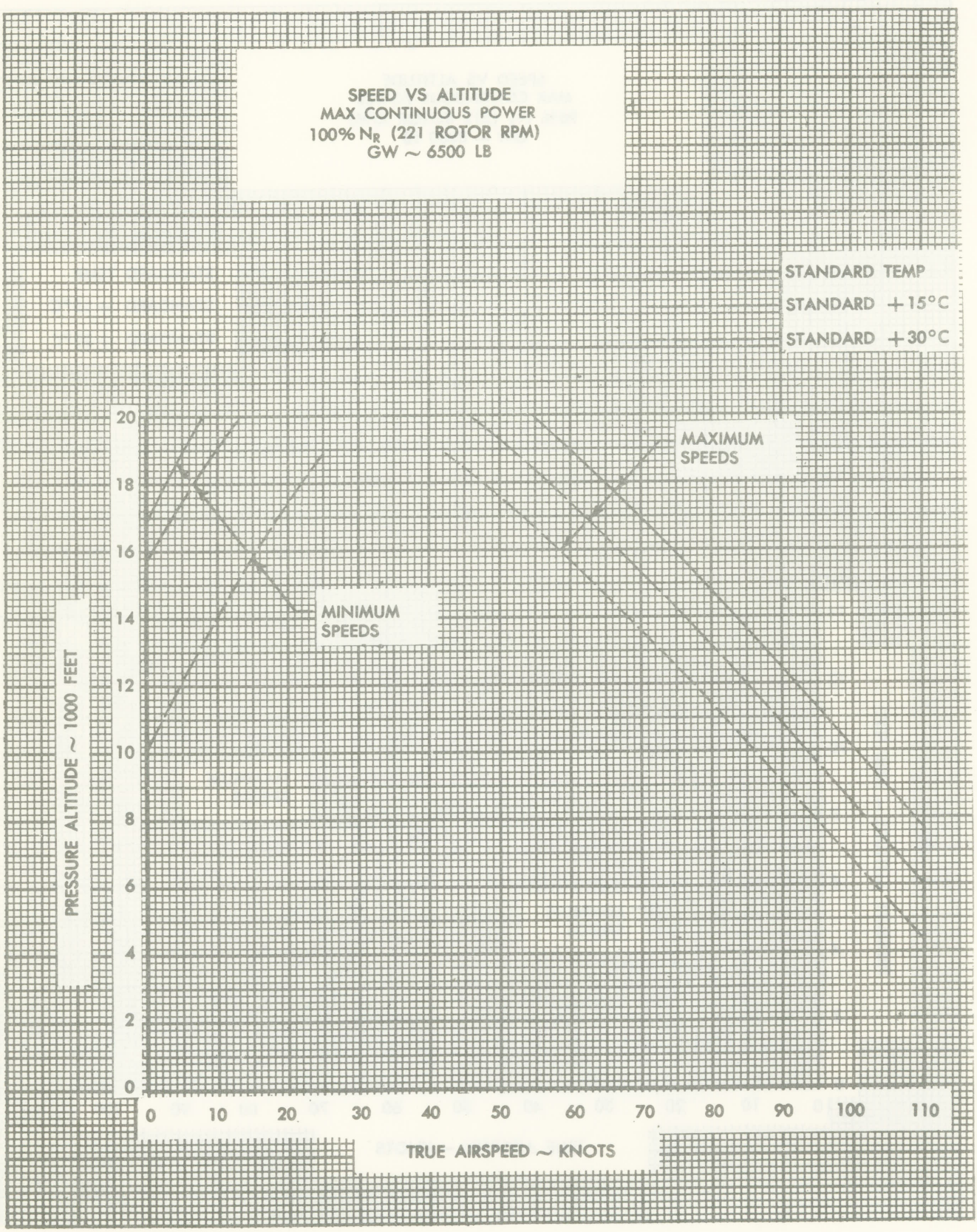

SPEED VS ALTITUDE
MAX CONTINUOUS POWER
100% N_R (221 ROTOR RPM)
GW ~ 6500 LB
STANDARD TEMP
STANDARD +15°C
STANDARD +30°C
MAXIMUM SPEEDS
MINIMUM SPEEDS
PRESSURE ALTITUDE ~ 1000 FEET
0
2
4
6
8
10
12
14
16
18
20
0 10 20 30 40 50 60 70 80 90 100 110
TRUE AIRSPEED ~ KNOTS

Figure 29.

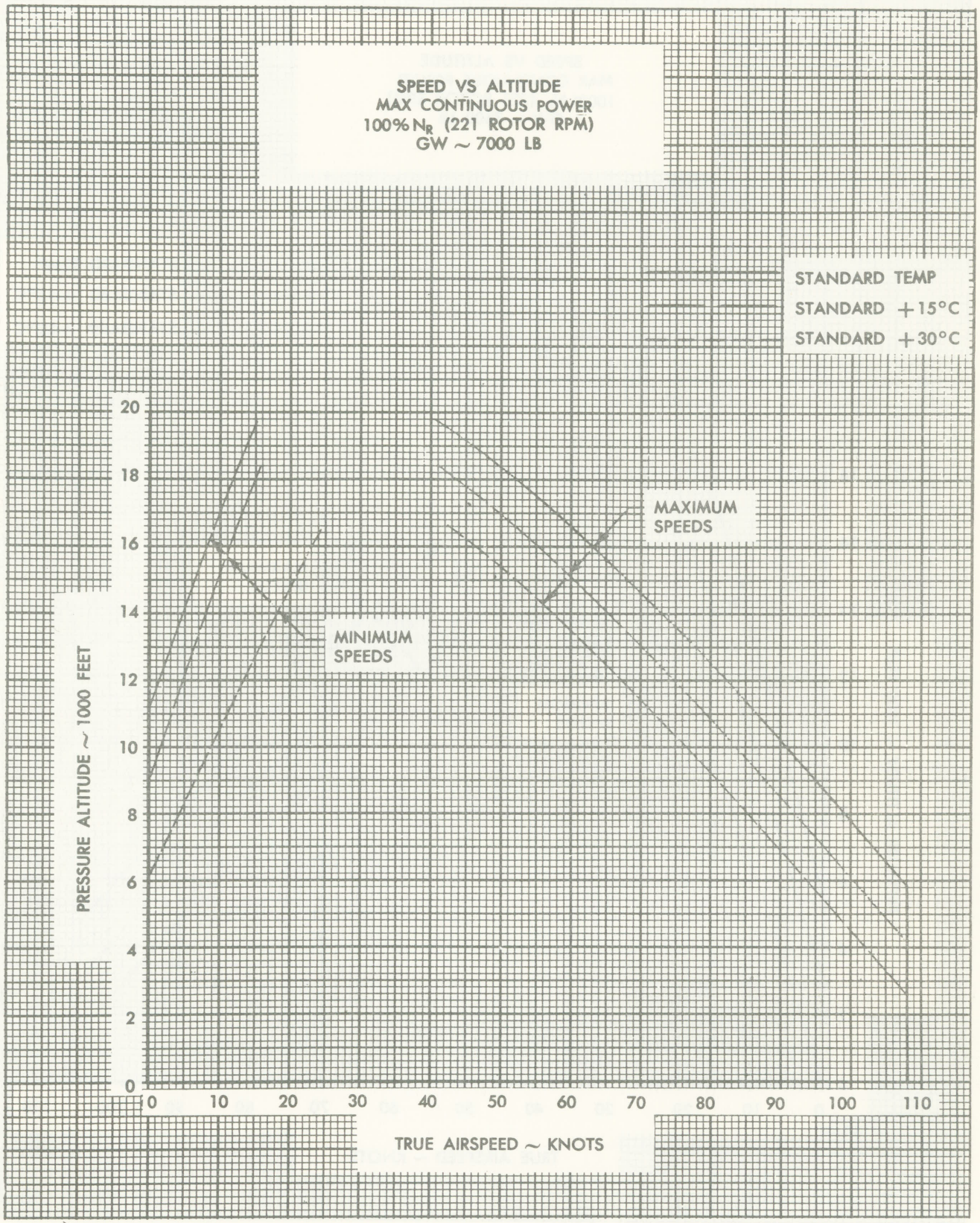

SPEED VS ALTITUDE
MAX CONTINUOUS POWER
100% N_R (221 ROTOR RPM)
GW ~ 7000 LB
STANDARD TEMP
STANDARD +15°C
STANDARD +30°C
MAXIMUM SPEEDS
MINIMUM SPEEDS
PRESSURE ALTITUDE ~ 1000 FEET
0
2
4
6
8
10
12
14
16
18
20
0
10
20
30
40
50
60
70
80
90
100
110
TRUE AIRSPEED ~ KNOTS

Figure 30.

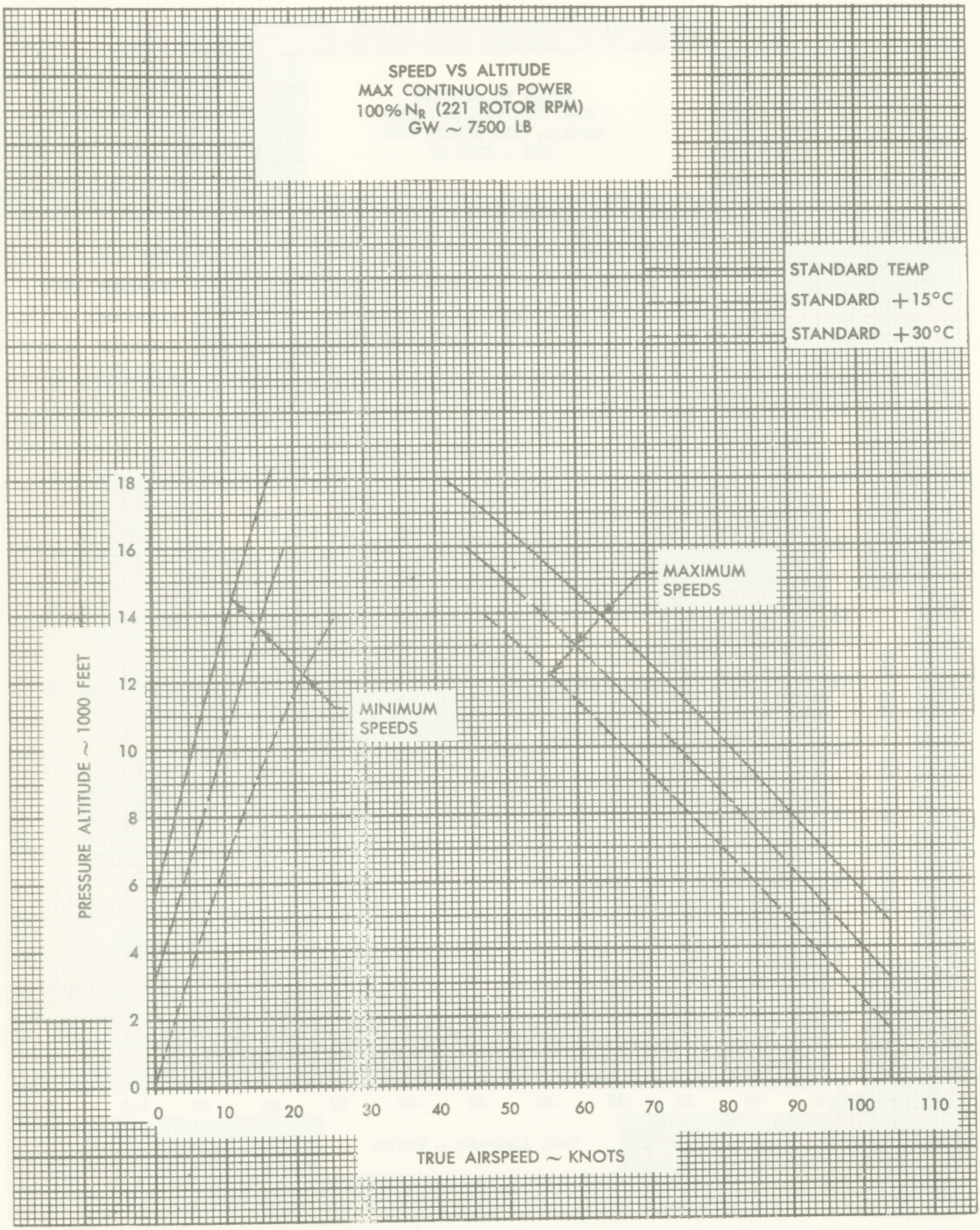

SPEED VS ALTITUDE
MAX CONTINUOUS POWER
100% N_R (221 ROTOR RPM)
GW ~ 7500 LB
STANDARD TEMP
STANDARD +15°C
STANDARD +30°C
MAXIMUM SPEEDS
MINIMUM SPEEDS
PRESSURE ALTITUDE ~ 1000 FEET
0
2
4
6
8
10
12
14
16
18
0
10
20
30
40
50
60
70
80
90
100
110
TRUE AIRSPEED ~ KNOTS

Figure 31.

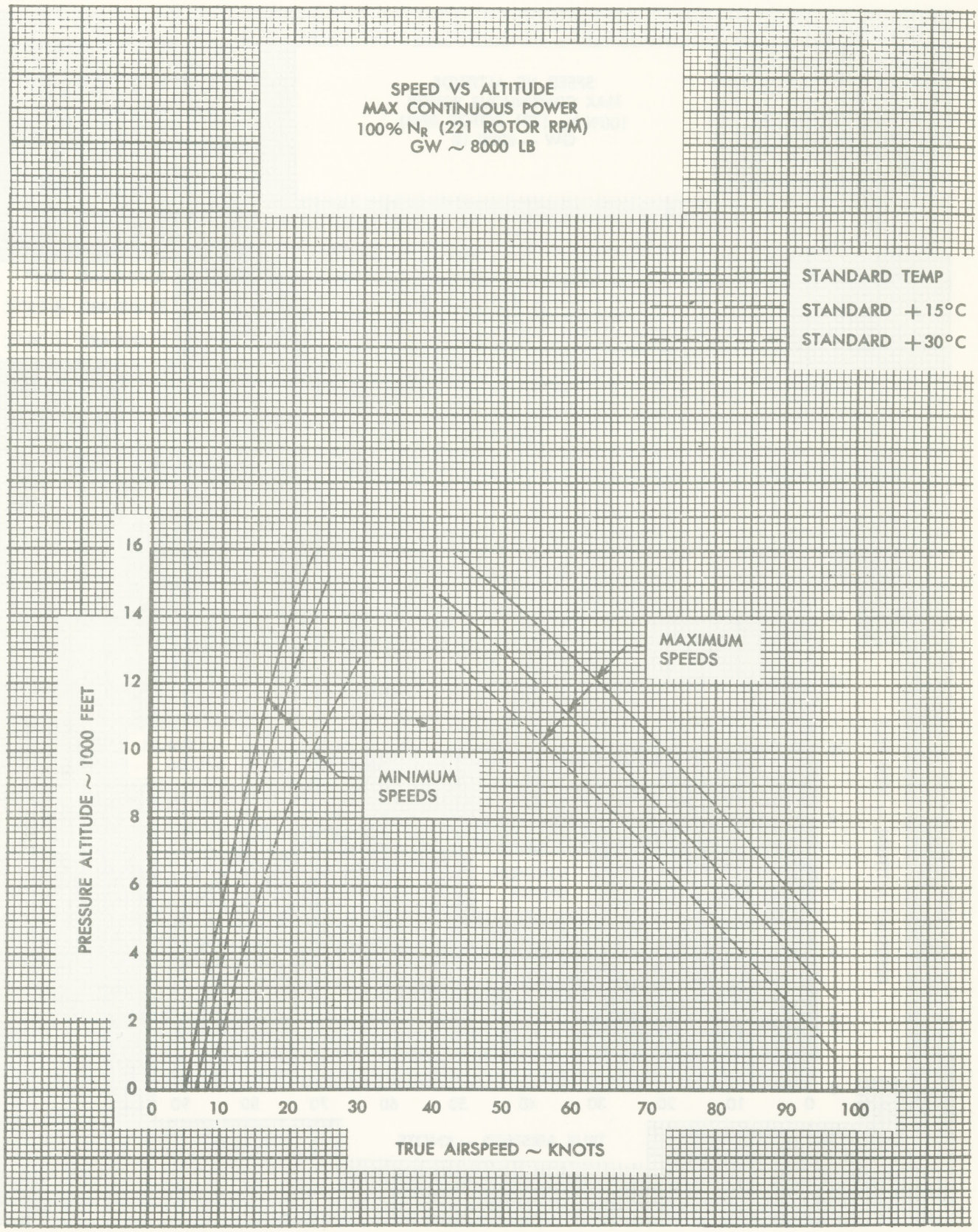

SPEED VS ALTITUDE
MAX CONTINUOUS POWER
100% N_R (221 ROTOR RPM)
GW ~ 8000 LB
STANDARD TEMP
STANDARD +15°C
STANDARD +30°C
MAXIMUM SPEEDS
MINIMUM SPEEDS
PRESSURE ALTITUDE ~ 1000 FEET
0
2
4
6
8
10
12
14
16
0
10
20
30
40
50
60
70
80
90
100
TRUE AIRSPEED ~ KNOTS

Figure 32.

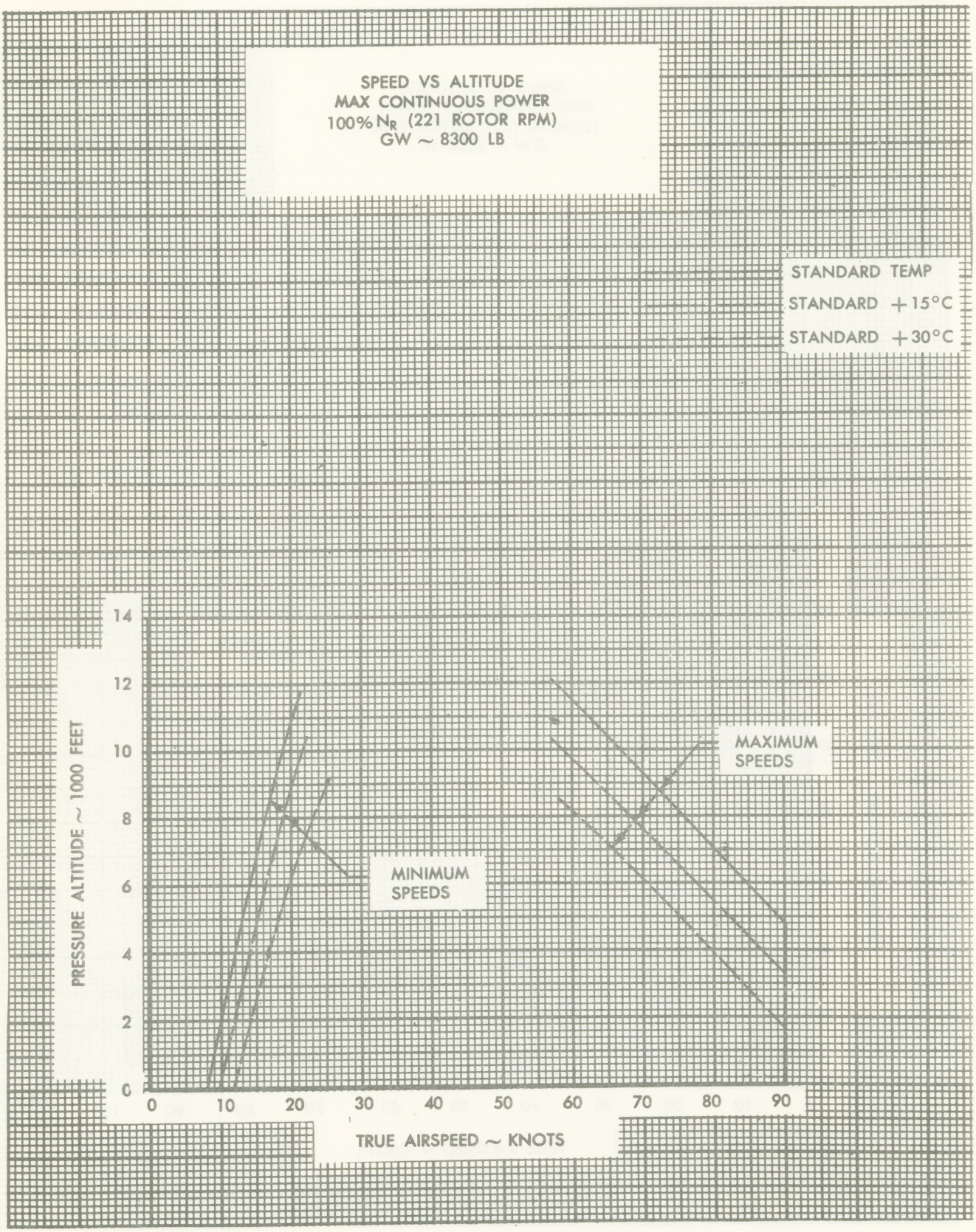

SPEED VS ALTITUDE
MAX CONTINUOUS POWER
100% N_R (221 ROTOR RPM)
GW ~ 8300 LB
STANDARD TEMP
STANDARD +15°C
STANDARD +30°C
MAXIMUM SPEEDS
MINIMUM SPEEDS
PRESSURE ALTITUDE ~ 1000 FEET
0
2
4
6
8
10
12
14
0
10
20
30
40
50
60
70
80
90
TRUE AIRSPEED ~ KNOTS

Figure 33.

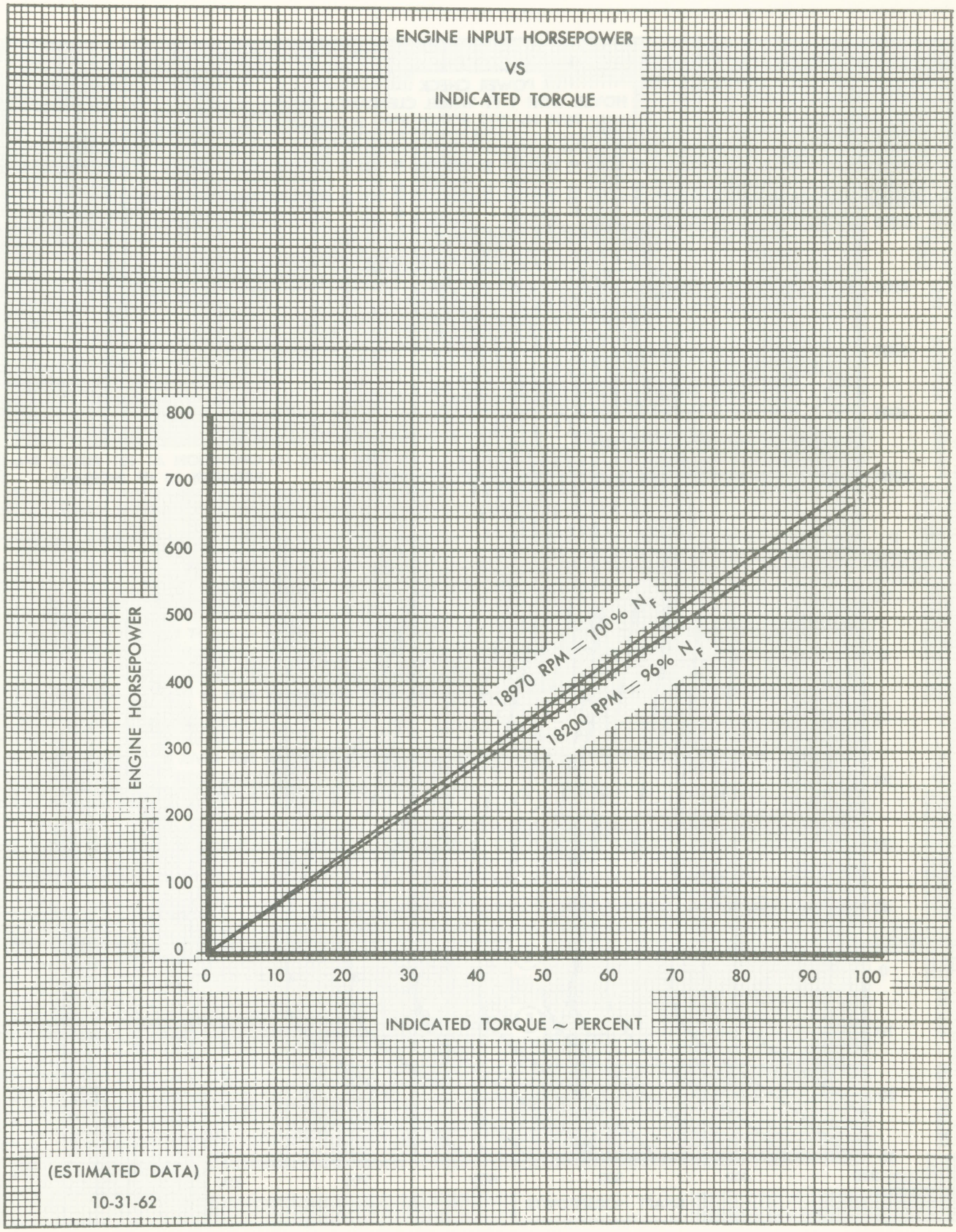

ENGINE INPUT HORSEPOWER
VS
INDICATED TORQUE
ENGINE HORSEPOWER
800
700
600
500
400
300
200
100
0
18970 RPM = 100% N_F
18200 RPM = 96% N_F
0
10
20
30
40
50
60
70
80
90
100
INDICATED TORQUE ~ PERCENT
(ESTIMATED DATA)
10-31-62

Figure 34.

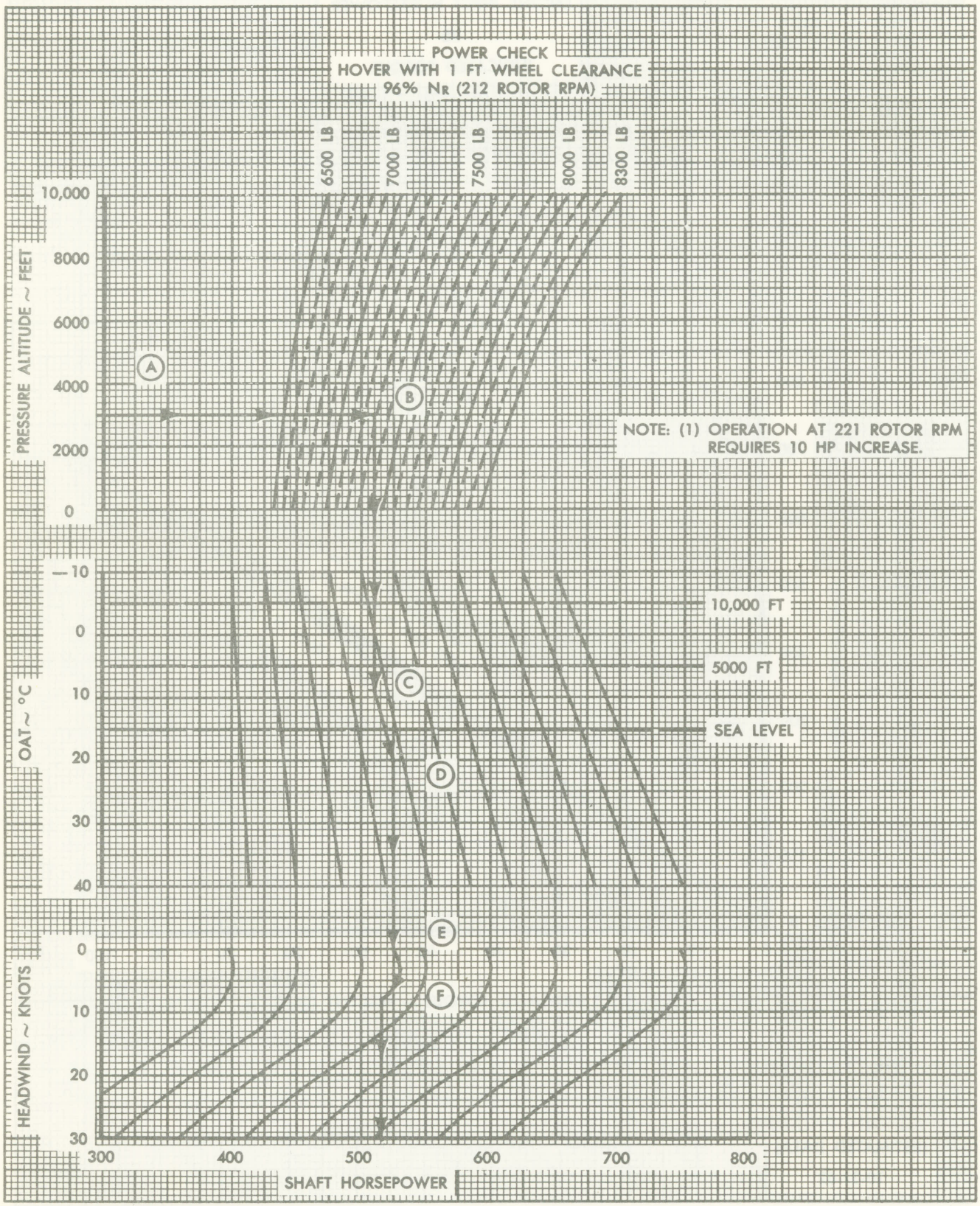

POWER CHECK
HOVER WITH 1 FT WHEEL CLEARANCE
96% NR (212 ROTOR RPM)
6500 LB
7000 LB
7500 LB
8000 LB
8300 LB
PRESSURE ALTITUDE ~ FEET
10,000
8000
6000
4000
2000
0
A
B
NOTE: (1) OPERATION AT 221 ROTOR RPM REQUIRES 10 HP INCREASE.
OAT ~ °C
—10
0
10
20
30
40
10,000 FT
5000 FT
SEA LEVEL
C
D
E
F
HEADWIND ~ KNOTS
0
10
20
30
300
400
500
600
700
800
SHAFT HORSEPOWER

Figure 35.

USE OF POWER CHECK CHART

Problem: Determine the power required to hover at 3000 feet pressure altitude, 20°C OAT., 7300 pounds gross weight, and 8 knot headwind, at a one (1) foot wheel clearance and 96% (212 rpm) rotor speed.

Solution:

1. Enter the chart at 3000 feet, (A).
2. From (A), proceed horizontally to 7300 pounds, (B).
3. From (B), move vertically down to 3000 feet, (C).
4. From (C), follow the temperature influence lines to 20°C (D).
5. From point (D), proceed vertically down to zero headwind, (E).
6. From (E), follow the wind influence curve to 8 knots, (F).
7. From (F), move vertically down to read 518 SHP at (G). To determine corresponding torque, refer to Figure 34, Engine Input Horsepower vs Indicated Torque, using the 96% N_f scale.

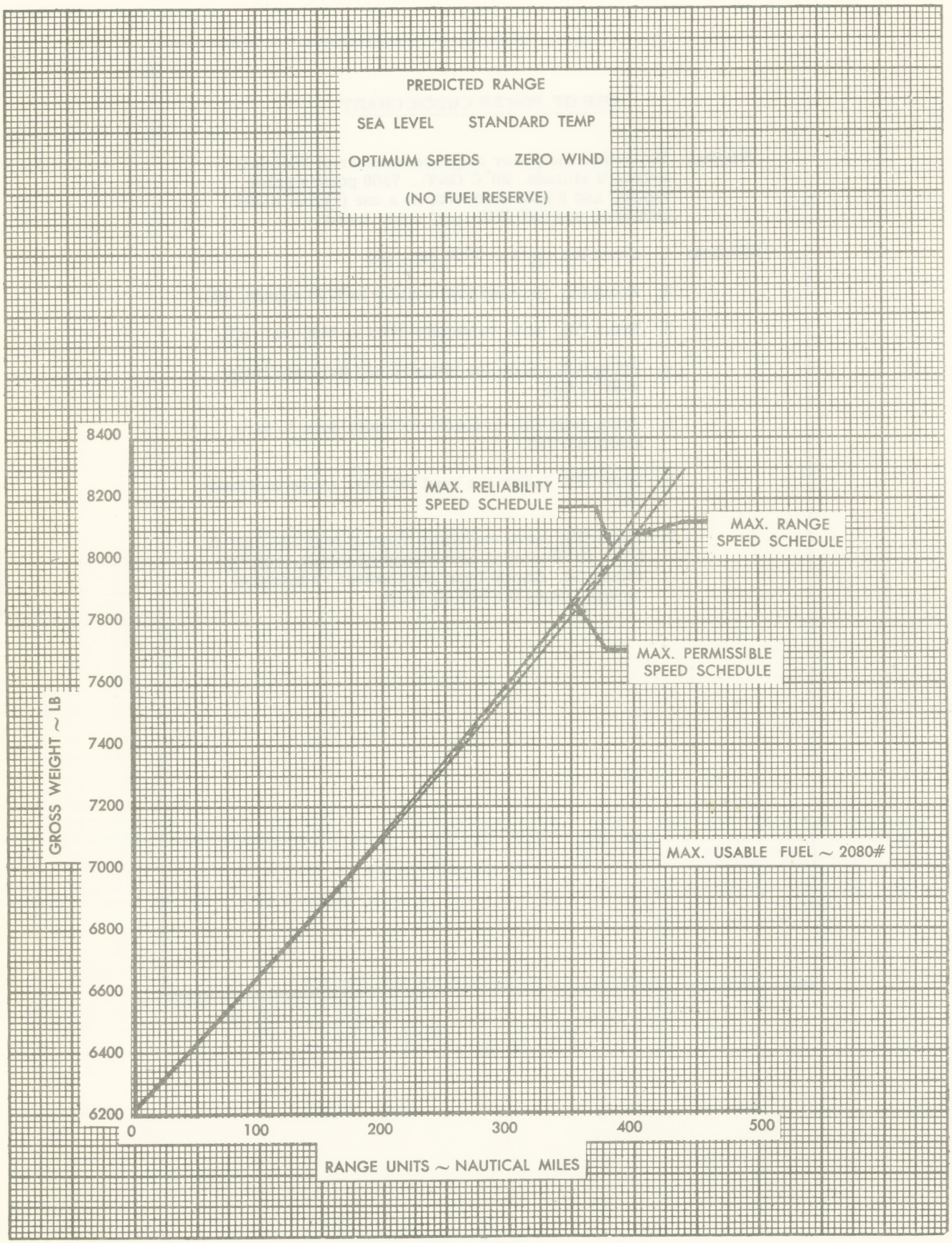

PREDICTED RANGE
SEA LEVEL STANDARD TEMP
OPTIMUM SPEEDS ZERO WIND
(NO FUEL RESERVE)
MAX. RELIABILITY SPEED SCHEDULE
MAX. RANGE SPEED SCHEDULE
MAX. PERMISSIBLE SPEED SCHEDULE
MAX. USABLE FUEL ~ 2080#
GROSS WEIGHT ~ LB
8400
8200
8000
7800
7600
7400
7200
7000
6800
6600
6400
6200
0
100
200
300
400
500
RANGE UNITS ~ NAUTICAL MILES

Figure 36.

RANGE CHARTS

The Range Charts graphically illustrate the cruise performance of the helicopter. The charts present specific range (nautical miles per pound of fuel), approximate torque required and, if desired, fuel flow in pounds per hour. Maximum range and maximum airspeeds are also depicted. Maximum component life airspeeds as stated in Part II (Standardization Manual) should be used when maximum range is not required.

EXAMPLE PROBLEM FOR RANGE CHARTS. (See Figure 36C).

Given:

Gross Weight	8000 lbs
Temperature	Standard
Pressure altitude	2000 feet and flight altitude
Fuel quantity	1000 lbs available for cruise

Determine:

Maximum range.

Solution:

This sample problem is based upon the average gross weight for cruise. 8000 lbs - (1000 ÷ 2) = 7500 lbs. Average gross weight for cruise.

1. Determine maximum specific range by referring to specific range section of chart. Locate curve for average gross weight for cruise (7500 lbs). Follow gross weight curve to the desired airspeed (V max range), point A. Move horizontally to the left and read specific range, .215 nautical miles per pound of fuel.

2. Determine approximate torque by moving vertically from point A up to approximate torque curve for 7500 lbs, point B. Move horizontally to left and read approximate torque required, 74%.

3. Determine fuel flow (optional procedure) by moving vertically down from point A to fuel flow curve for 7500 lbs, point C. Move horizontally to the left and read fuel flow 440 lbs/hr.

4. Determine maximum range by multiplying specific range by useable fuel. Specific range X pounds of fuel available = no wind range .215 X 1000 = 215 NM.

Figure 36A.

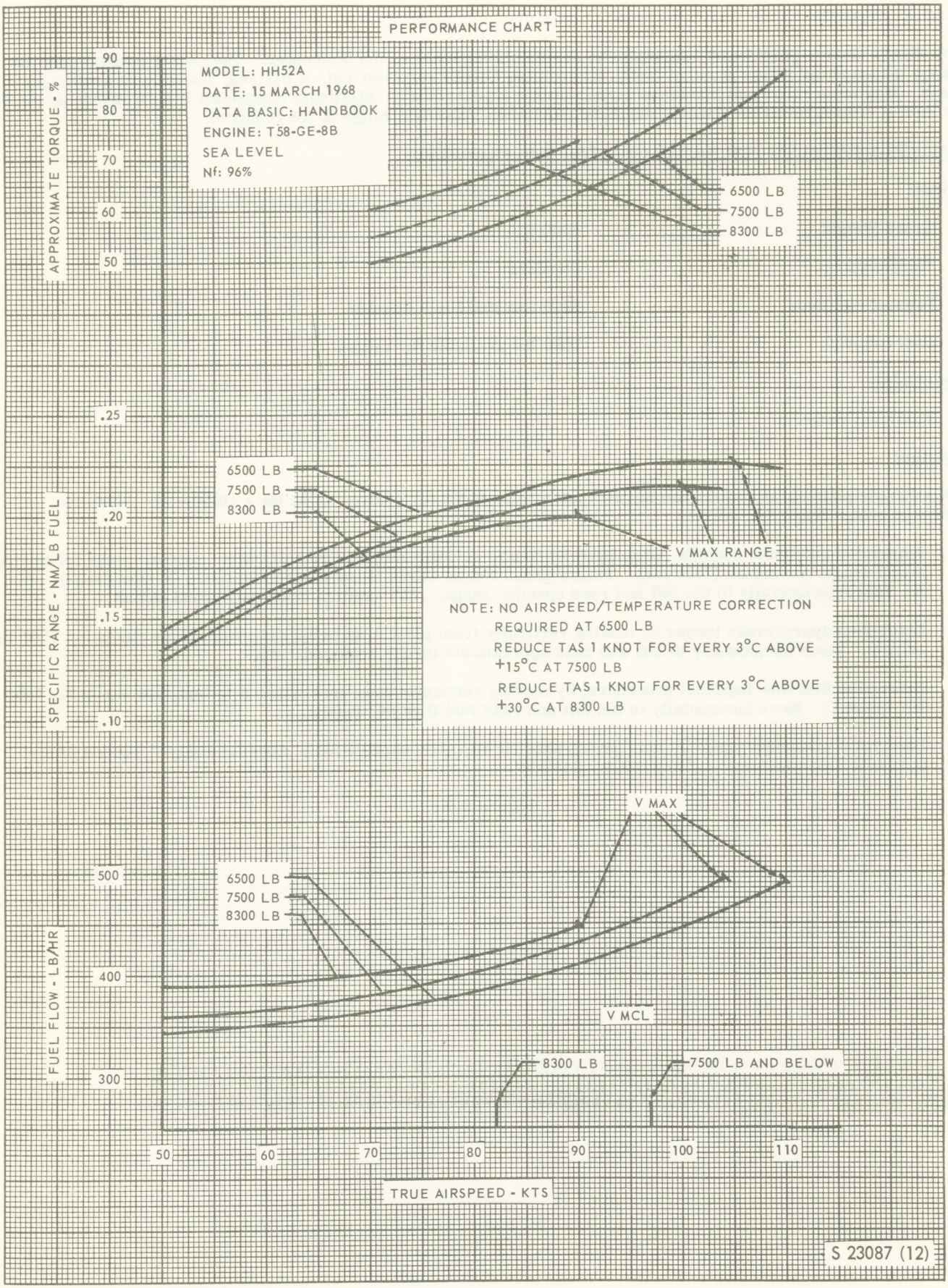

PERFORMANCE CHART
MODEL: HH52A
DATE: 15 MARCH 1968
DATA BASIC: HANDBOOK
ENGINE: T58-GE-8B
SEA LEVEL
Nf: 96%
APPROXIMATE TORQUE - %
90
80
70
60
50
6500 LB
7500 LB
8300 LB
SPECIFIC RANGE - NM/LB FUEL
.25
.20
.15
.10
6500 LB
7500 LB
8300 LB
V MAX RANGE
NOTE: NO AIRSPEED/TEMPERATURE CORRECTION REQUIRED AT 6500 LB
REDUCE TAS 1 KNOT FOR EVERY 3°C ABOVE +15°C AT 7500 LB
REDUCE TAS 1 KNOT FOR EVERY 3°C ABOVE +30°C AT 8300 LB
V MAX
FUEL FLOW - LB/HR
500
400
300
6500 LB
7500 LB
8300 LB
V MCL
8300 LB
7500 LB AND BELOW
50
60
70
80
90
100
110
TRUE AIRSPEED - KTS
S 23087 (12)

Figure 36B.

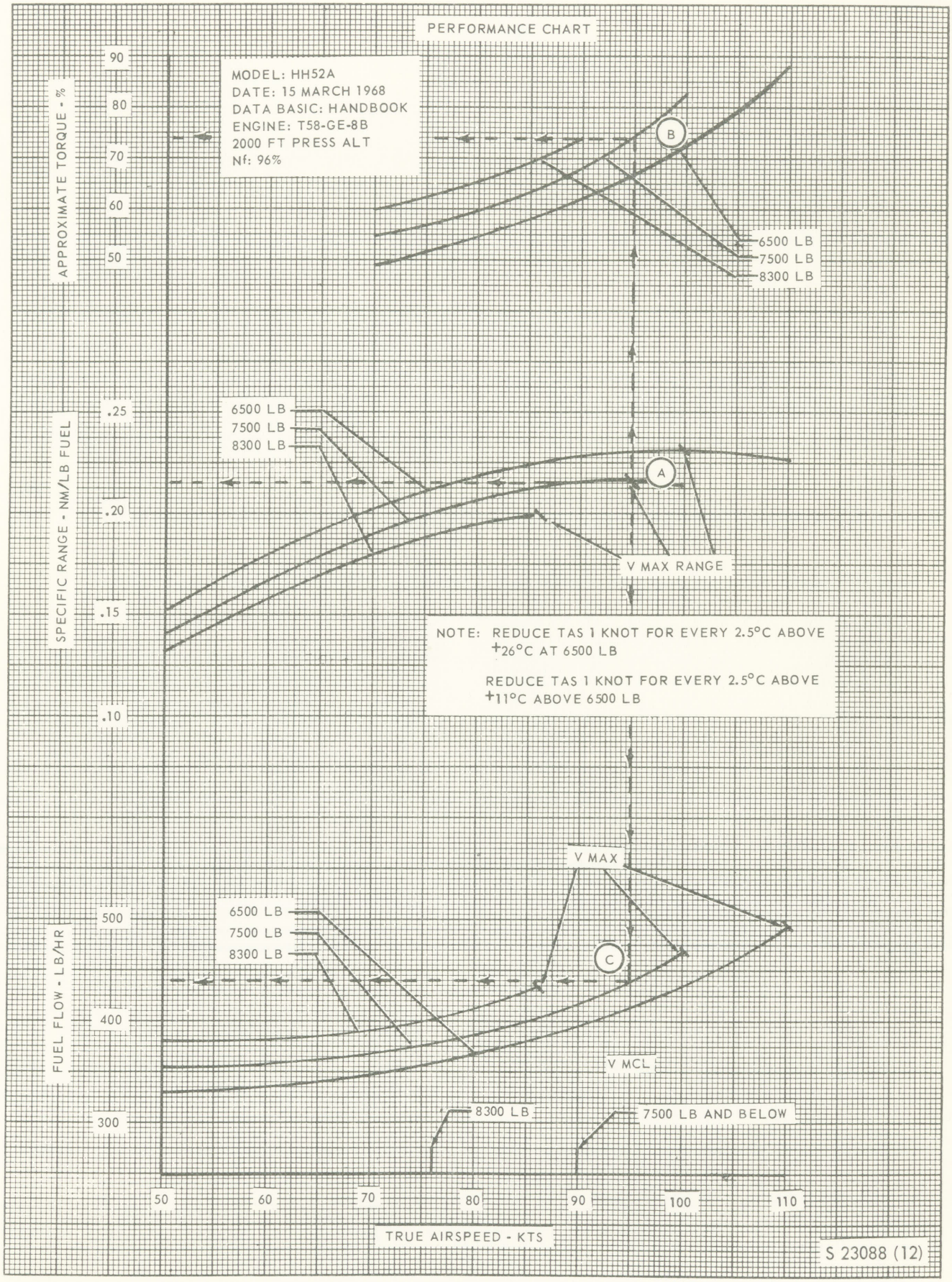

PERFORMANCE CHART
MODEL: HH52A
DATE: 15 MARCH 1968
DATA BASIC: HANDBOOK
ENGINE: T58-GE-8B
2000 FT PRESS ALT
Nf: 96%
APPROXIMATE TORQUE - %
90
80
70
60
50
B
6500 LB
7500 LB
8300 LB
SPECIFIC RANGE - NM/LB FUEL
.25
.20
.15
.10
6500 LB
7500 LB
8300 LB
A
V MAX RANGE
NOTE: REDUCE TAS 1 KNOT FOR EVERY 2.5°C ABOVE +26°C AT 6500 LB
REDUCE TAS 1 KNOT FOR EVERY 2.5°C ABOVE +11°C ABOVE 6500 LB
V MAX
FUEL FLOW - LB/HR
500
400
300
6500 LB
7500 LB
8300 LB
C
V MCL
8300 LB
7500 LB AND BELOW
50
60
70
80
90
100
110
TRUE AIRSPEED - KTS
S 23088 (12)

Figure 36C.

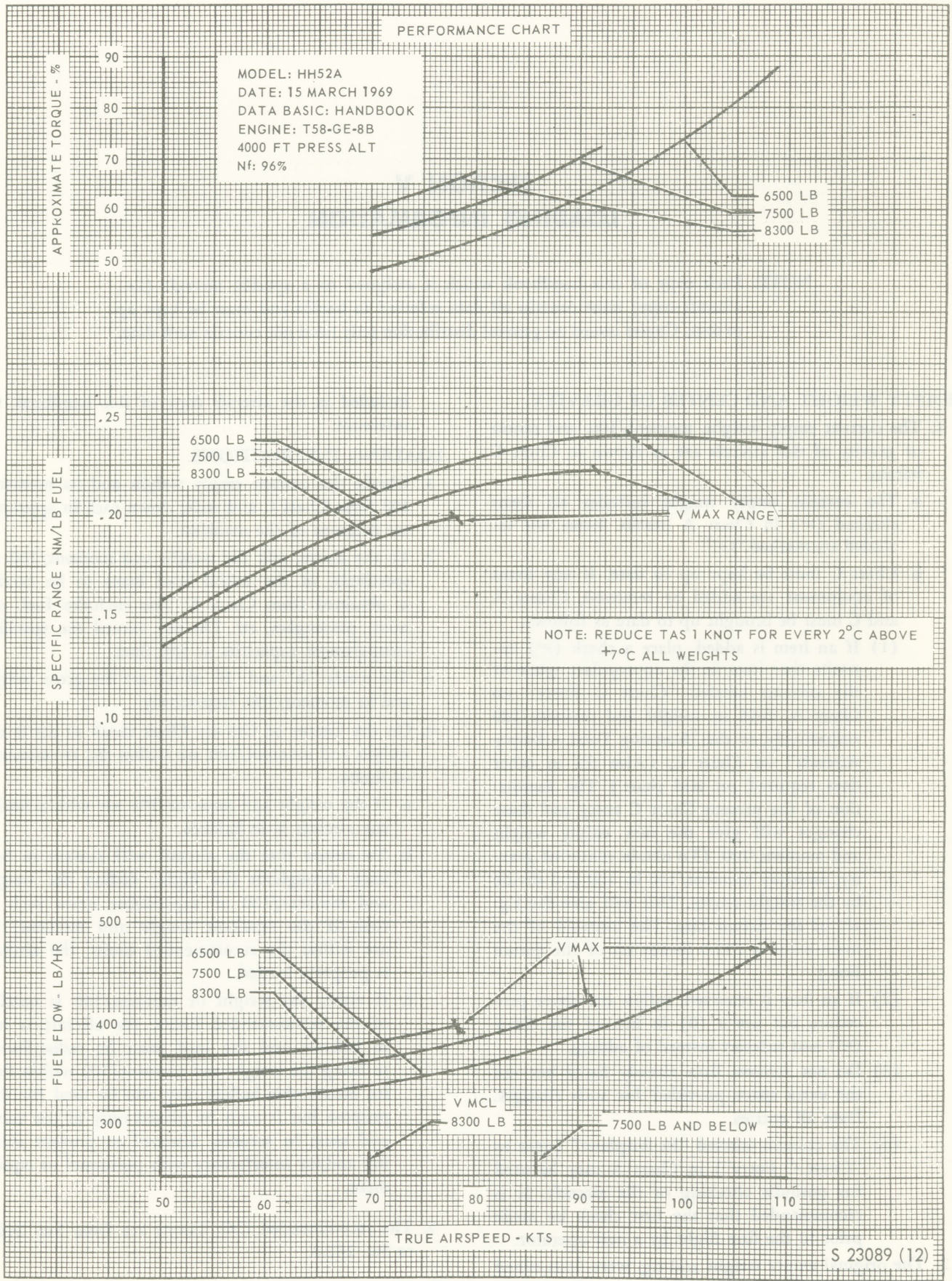

PERFORMANCE CHART
MODEL: HH52A
DATE: 15 MARCH 1969
DATA BASIC: HANDBOOK
ENGINE: T58-GE-8B
4000 FT PRESS ALT
Nf: 96%
APPROXIMATE TORQUE - %
90
80
70
60
50
6500 LB
7500 LB
8300 LB
SPECIFIC RANGE - NM/LB FUEL
.25
.20
.15
.10
6500 LB
7500 LB
8300 LB
V MAX RANGE
NOTE: REDUCE TAS 1 KNOT FOR EVERY 2°C ABOVE
+7°C ALL WEIGHTS
FUEL FLOW - LB/HR
500
400
300
6500 LB
7500 LB
8300 LB
V MAX
V MCL
8300 LB
7500 LB AND BELOW
50
60
70
80
90
100
110
TRUE AIRSPEED - KTS
S 23089 (12)

Figure 36D.

SECTION V
LOADING INFORMATION

NOTE: Each copy of this handbook which is assigned to a specific aircraft (i.e., aircraft copy) must contain all data referred to herein and must be kept up to date. Copies issued on general distribution only need not contain such data.

EMPTY WEIGHT AND CENTER OF GRAVITY.

1. The current empty weight, moment/100, and center of gravity of this aircraft are as shown in Chart C herein.
   a. The current empty weight includes all items checked (✓) in Chart A herein. Items not included are marked "O."
   b. Chart C must be kept up to date. If any items of equipment are added or removed, Charts A and C must be brought up to date as follows:
      (1) If an item is added, place a check (✓) opposite that item in the appropriate space of the column labeled "Chart C Entry" on Chart A. Add its weight and moment/100 respectively, to the "Running Total – Empty Aircraft" on Chart C. (Also fill in other data required on said chart.) The summation of the present Chart C entry and these changes will give the new empty weight and moment/100. (To obtain center of gravity, multiply moment/100 by 100 and divide by the weight empty. This will give the c.g. aft of the datum line. The centroid of the main rotor is 252.0 inches aft of the datum line.)
      (2) If an item is removed, follow the above procedure but use a (0) in lieu of the check (✓) and subtract instead of adding.
      (3) Do not remove data already listed but use the extra space provided for such changes. Date all entries.
      (4) The column labeled "In Airplane" (next to "Chart C Entry") in Chart A may be used for periodic checking of the aircraft. It is recommended that the first check be made prior to the first flight by a new operator.
2. The original empty weight and c.g. were determined by Sikorsky Aircraft as shown in Chart B which is included in the aircraft copy of this handbook for reference.

LOADING INSTRUCTIONS.

1. Obtain the current empty weight and its moment/100 from Chart C and write down each in appropriate columns of the manifest.
2. To the above, add the weight and moment/100 respectively, of the useful load items to be carried as obtained from Chart E. This includes fuel, oil, pilot, passengers, etc. Do not exceed the specified compartment capacities at any time.
3. The totals "A" and "B" above are the gross weight and its moment/100, respectively.
4. On the Center of Gravity Chart check to see if the weight and moment/100 are within the recommended limits.
   a. If the weight and moment/100 are within limits, the aircraft is in balance.
   b. To ensure that the aircraft will remain in balance throughout the flight, deduct the weight and moment/100 of expendable items such as fuel. If the resultant weight and moment/100 are within the recommended limits, the aircraft is properly loaded.
   c. If either the weight or moment/100 is outside of the recommended limits, the aircraft is not in balance and the load must be redistributed to bring the weight and moment/100 within limits. Removable ballast may also be used for this purpose but it must be placed only in the cabin and must be securely fastened to prevent shifting and/or interference with personnel or equipment.
5. The recommended C.G. Limits are from Sta. 249.0 to Sta. 262.0.
6. The maximum gross weight is 8300 pounds.

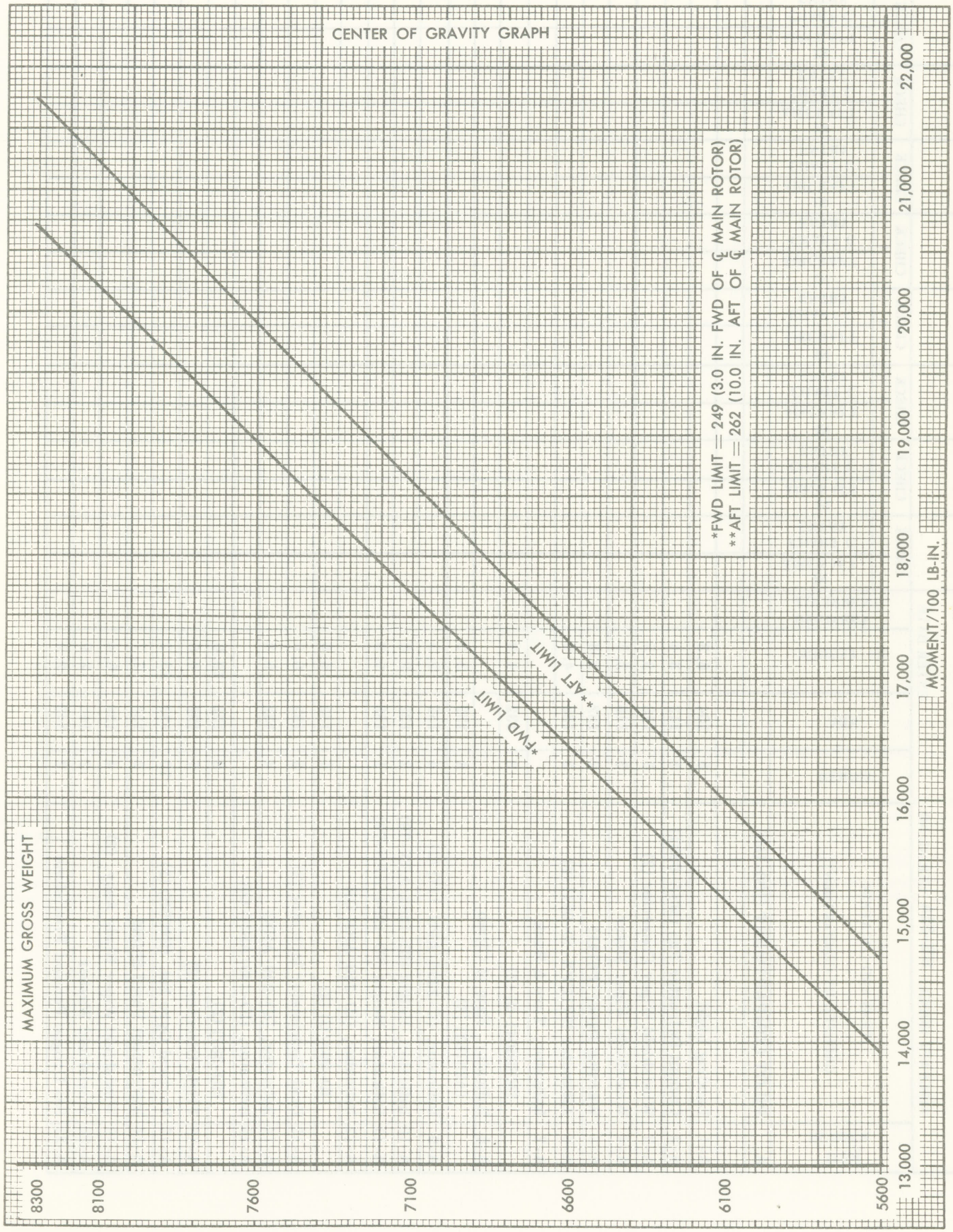

CENTER OF GRAVITY GRAPH
*FWD LIMIT = 249 (3.0 IN. FWD OF ℄ MAIN ROTOR)
**AFT LIMIT = 262 (10.0 IN. AFT OF ℄ MAIN ROTOR)
*FWD LIMIT
**AFT LIMIT
MAXIMUM GROSS WEIGHT
8300
8100
7600
7100
6600
6100
5600
13,000
14,000
15,000
16,000
17,000
18,000
19,000
20,000
21,000
22,000
MOMENT/100 LB-IN.

Figure 37.

CHART A – EMPTY WEIGHT CHECK LIST

AIRCRAFT MODEL **HH-52A** SERIAL NO. ENTER DATE

ITEM NUMBER	ITEMS AND LOCATION GROUPED BY COMPARTMENT	WEIGHT	ARM	MOMENT/100	DELIVERY EQUIPMENT	CHECK 1		CHECK 2		CHECK 3		CHECK 4		CHECK 5		CHECK 6		CHECK 7		CHECK 8	
						IN AIRCRAFT	CHART C ENTRY	IN AIRCRAFT	CHART C ENTRY	IN AIRCRAFT	CHART C ENTRY	IN AIRCRAFT	CHART C ENTRY	IN AIRCRAFT	CHART C ENTRY	IN AIRCRAFT	CHART C ENTRY	IN AIRCRAFT	CHART C ENTRY	IN AIRCRAFT	CHART C ENTRY
A	PILOT COMPARTMENT (100-180)																				
A-1	Landing Light	8	104	8.3																	
A-2	Cockpit Defroster Fan (MSA-9631)	3	113	3.4																	
A-3	Windshield Wiper Converter (2)	3	118	3.5																	
A-4	Windshield Wiper Motor	3	118	3.5																	
A-5	Warning Panel (F6141)	2	132	2.6																	
A-6	Altimeter (671CPX-10-051) (2)	3	132	4.0																	
A-7	Indicator, Turn & Bank																				
	(MS28041-2) (2)	3	132	4.0																	
A-8	Indicator, Rate of Climb																				
	(A25753) (2)	4	132	5.3																	
A-9	Indicator, (C-2236/APN-117) (2)	4	132	5.3																	
A-10	Indicator, Height (ID-1263/ARN-79)	2	132	2.6																	
A-11	Indicator, Height (ID-1264/ARN-79)	1	132	1.3																	
A-12	Indicator, (ID-250/ARN OR																				
	ID-663/U) (2)	5	132	6.6																	
A-13	Dual Tachometer Indicator (2)	5	132	6.6																	
A-14	Indicator, (ID-249/ARN)	4	132	5.3																	
A-15	Indicator, (ID-249/ARN) OR																				
	(ID-387) (2)	8	132	10.6																	
A-16	Flight Director (2)	5	132	6.6																	
A-17	Vertical Gyro Ind. (H005H) (2)	10	132	13.2																	
A-18	Instrument Panel Shield	2	133	2.7																	
A-19	Windshield Wiper Blade Assy. (2)	4	134	5.4																	
A-20	Windshield Washer	2	143	2.9																	
A-21	Sea Drogue Pennant Provisions	2	143	2.9																	

CHART A – EMPTY WEIGHT CHECK LIST

AIRCRAFT MODEL HH-52A SERIAL NO. ENTER DATE

ITEM NUMBER	ITEMS AND LOCATION GROUPED BY COMPARTMENT	WEIGHT	ARM	MOMENT 100	DELIVERY EQUIPMENT	CHECK 1		CHECK 2		CHECK 3		CHECK 4		CHECK 5		CHECK 6		CHECK 7		CHECK 8	
						IN AIRCRAFT	CHART C ENTRY	IN AIRCRAFT	CHART C ENTRY	IN AIRCRAFT	CHART C ENTRY	IN AIRCRAFT	CHART C ENTRY	IN AIRCRAFT	CHART C ENTRY	IN AIRCRAFT	CHART C ENTRY	IN AIRCRAFT	CHART C ENTRY	IN AIRCRAFT	CHART C ENTRY
A-	PILOT COMPARTMENT (100-180) (Cont.)																				
A-22	Rotor Brake Valve	3	145	4.4																	
A-23	Rearview Mirror & Bracket	2	146	2.9																	
A-24	Control Panel (C1611A/AIC) (2)	6	146	8.8																	
A-25	Receiver (R-1106/ARN-73)	7	146	10.2																	
A-26	Control Panel - ASE Engage	2	153	3.1																	
A-27	Miscellaneous Instruments:	17	156	26.5																	
	Airspeed Indicator (1296U-4D197) (2)																				
	Fuel Quantity (393004-01166)																				
	Fuel Selector (385335-006)																				
	Indicator, Inlet Temp.																				
	Gas Generator Tach. (MU-1)																				
	Torque Meter (6200C64A881) (2)																				
	Clock (A-134) (2)																				
	Indicator, Hyd. Press. (SR-151A)																				
	Indicator, Eng. Oil Press. (SR-151A)																				
	Indicator, Trans. Oil Press.																				
	Indicator, Eng. Oil Temp.																				
	Standby Compass (AN5766T4)																				
	Indicator, Fuel Pressure (SR-151A)																				
	Remote Air Thermometer (162B2)																				
A-28	Belts, (MS-22033-1) (Pilot & Copilot)	6	158	9.5																	
A-29	Control Panel (C-2174/APX-44)	2	163	3.3																	
A-30	Control Panel (C-3044A/ARC-84)	2	163	3.3																	

CHART A – EMPTY WEIGHT CHECK LIST

AIRCRAFT MODEL HH-52A SERIAL NO. ENTER DATE

ITEM NUMBER	ITEMS AND LOCATION GROUPED BY COMPARTMENT	WEIGHT	ARM	MOMENT/100	DELIVERY EQUIPMENT	CHECK 1		CHECK 2		CHECK 3		CHECK 4		CHECK 5		CHECK 6		CHECK 7		CHECK 8	
						IN AIRCRAFT	CHART C ENTRY	IN AIRCRAFT	CHART C ENTRY	IN AIRCRAFT	CHART C ENTRY	IN AIRCRAFT	CHART C ENTRY	IN AIRCRAFT	CHART C ENTRY	IN AIRCRAFT	CHART C ENTRY	IN AIRCRAFT	CHART C ENTRY	IN AIRCRAFT	CHART C ENTRY
A-	PILOT COMPARTMENT (100-180) (Cont.)																				
A-31	Control Panel (C-6476/ARC-51A)	4	163	6.5																	
A-32	Control Panel (C-2010/ARN-52V)	2	163	3.3																	
A-33	Control Panel (714E-2)	2	165	3.3																	
A-34	Shoulder Harness, (Pilot & Copilot)	6	165	9.9																	
	(2)																				
A-35	Seat Cushion - (Pilot & Copilot) (2)	6	165	9.9																	
A-36	Pilot Seat (667)	23	165	38.0																	
A-37	Copilot Seat (667)	23	165	38.0																	
A-38	Back Cushion (Pilot & Copilot) (2)	6	170	10.2																	
A-39	Back Cushion (Cut-Out AMC 10) (2)	9	170	15.3																	
A-40	PK-2 Life Raft Pack (Pilot & CP.)																				
	(2)	16	170	27.2																	
A-41	Fire Extinguisher (891083)	7	178	12.5																	
A-42	Windshield Washer Fluid	4	179	7.2																	
A-43	First Aid Kit	2	179	3.6																	
A-44	Cords for Headsets (2)	1	179	1.8																	
A-45	Sea Drogue (S6150-62573-2)	10	179	17.9																	

CHART A – EMPTY WEIGHT CHECK LIST

AIRCRAFT MODEL HH-52A SERIAL NO. ENTER DATE

ITEM NUMBER	ITEMS AND LOCATION GROUPED BY COMPARTMENT	WEIGHT	ARM	MOMENT / 100	DELIVERY EQUIPMENT	CHECK 1		CHECK 2		CHECK 3		CHECK 4		CHECK 5		CHECK 6		CHECK 7		CHECK 8	
						IN AIRCRAFT	CHART C ENTRY	IN AIRCRAFT	CHART C ENTRY	IN AIRCRAFT	CHART C ENTRY	IN AIRCRAFT	CHART C ENTRY	IN AIRCRAFT	CHART C ENTRY	IN AIRCRAFT	CHART C ENTRY	IN AIRCRAFT	CHART C ENTRY	IN AIRCRAFT	CHART C ENTRY
B	ENGINE & TRANSMISSION COMP. (170-336)																				
B-1	Starter & Cover	19	171	32.5																	
B-2	Plug, Air Intake - Installed	3	171	5.1																	
B-3	Oil Tank (S6130-80205)	4	174	7.0																	
B-4	Inlet Anti-Icing Boot (S6230-80108)	2	180	3.6																	
** B-5	Trapped Engine Oil (.4 Gal.)	3	189	5.7																	
B-6	Turbine Engine (T-58-GE-8B)		199																		
B-7	Plug, Engine Exhaust - Installed	3	227	6.8																	
B-8	Rotor Brake Assy.	5	232	11.6																	
B-9	Rotor Brake Disc	9	232	20.9																	
B-10	Airframe Fuel Filter Assy.	2	246	4.9																	
B-11	Primary Servos (S14-40-5000)	13	250	32.5																	
B-12	Main Transmission Oil (3.3 Gal.)	25	254	63.5																	
B-13	Aux. Hyd. Panel Assy. (HP610100-																				
	2C10)	3	255	7.7																	
B-14	Rotor Tach., Generator & Speed																				
	Switch	2	264	5.3																	
B-15	Pri. Hyd. Panel Assy. (HP610100-																				
	1N10)	4	264	10.6																	
B-16	Primary Systems Pump (65W0-																				
	1011)	5	266	13.3																	
B-17	Utility Systems Pump (66WAP-200)	9	266	23.9																	
B-18	Generator (28B139) 10 KVA (2)	67	271	181.6																	
**	Undrainable Oil Obtained by Draining																				
	at Station 174 In Level Attitude.																				

CHART A – EMPTY WEIGHT CHECK LIST

AIRCRAFT MODEL **HH-52A** SERIAL NO. ENTER DATE

ITEM NUMBER	ITEMS AND LOCATION GROUPED BY COMPARTMENT	WEIGHT	ARM	MOMENT / 100	DELIVERY EQUIPMENT	CHECK 1		CHECK 2		CHECK 3		CHECK 4		CHECK 5		CHECK 6		CHECK 7		CHECK 8	
						IN AIRCRAFT	CHART C ENTRY	IN AIRCRAFT	CHART C ENTRY	IN AIRCRAFT	CHART C ENTRY	IN AIRCRAFT	CHART C ENTRY	IN AIRCRAFT	CHART C ENTRY	IN AIRCRAFT	CHART C ENTRY	IN AIRCRAFT	CHART C ENTRY	IN AIRCRAFT	CHART C ENTRY
B-	ENGINE & TRANSMISSION COMP.																				
	(170-336) (Cont.)																				
B-19	Engine Fire Bottle (891119)	8	282	22.6																	
B-20	Transmission Oil Cooler Fan Assy.	12	294	35.3																	
B-21	Transmission Oil Cooler (85233534)	15	308	46.2																	
C	PASSENGER OR CARGO COMPARTMENT																				
	(180-348)																				
C-1	Directional Gyro (R88U0191-200)																				
	MA-1	5	184	9.2																	
C-2	Aux. Servo Cylinder Assy.																				
	(S6265-62551)	41	185	75.9																	

CHART A – EMPTY WEIGHT CHECK LIST

AIRCRAFT MODEL HH-52A SERIAL NO. ENTER DATE

ITEM NUMBER	ITEMS AND LOCATION GROUPED BY COMPARTMENT	WEIGHT	ARM	MOMENT/100	DELIVERY EQUIPMENT	CHECK 1		CHECK 2		CHECK 3		CHECK 4		CHECK 5		CHECK 6		CHECK 7		CHECK 8	
						IN AIRCRAFT	CHART C ENTRY	IN AIRCRAFT	CHART C ENTRY	IN AIRCRAFT	CHART C ENTRY	IN AIRCRAFT	CHART C ENTRY	IN AIRCRAFT	CHART C ENTRY	IN AIRCRAFT	CHART C ENTRY	IN AIRCRAFT	CHART C ENTRY	IN AIRCRAFT	CHART C ENTRY
C-	PASSENGER OR CARGO COMPARTMENT																				
	(180-348) (Cont.)																				
C-3	Log Amplifier (S6190-61123-1)	2	187	3.7																	
C-4	Mount, Antenna Coupler	2	188	3.8																	
C-5	Antenna Coupler (CU-351/AR)	20	188	37.6																	
C-6	Antenna Coupler (490T-1)	20	188	37.6																	
C-7	Mounting Tray (S6190-61022)	3	188	5.6																	
C-8	Tilt Table	4	188	7.5																	
C-9	ASE Shelves & Relay	4	188	7.5																	
C-10	Vertical Gyros (2)	9	188	16.9																	
C-11	ASE Amplifier (566359)	16	188	30.1																	
C-12	Elec. Rack (88380-4) With Mts. &																				
	Wiring	70	210	147.0																	
C-13	Amplifier (AM-3223/ARN-73)	5	205	10.3																	
C-14	Compass Adapter (8KE28EH2)	7	206	14.4																	
C-15	Mount & Shelf (For AN/PRC-59A)	2	209	4.2																	
C-16	Receiver-Transmitter (AN/PRC-59A)	14	209	29.3																	
C-17	Receiver-Transmitter (RT-743/ARC-																				
	51A)	31	213	66.0																	
C-18	Marker Beacon (MKA-23A)	2	213	4.3																	
C-19	Receiver, Glidescope (GSA-8A)	8	216	17.3																	
C-20	Receiver-Transmitter (RT-																				
	494/APX-44)	23	216	49.7																	
C-21	Receiver-Transmitter (618T-2)																				
	(HF-102)	52	216	112.3																	
C-22	OMNI Converter (NVA-22A)																				
	(AN/ARN-87V)	9	218	19.6																	

CHART A – EMPTY WEIGHT CHECK LIST

AIRCRAFT MODEL HH-52A SERIAL NO. ENTER DATE

ITEM NUMBER	ITEMS AND LOCATION GROUPED BY COMPARTMENT	WEIGHT	ARM	MOMENT / 100	DELIVERY EQUIPMENT	CHECK 1		CHECK 2		CHECK 3		CHECK 4		CHECK 5		CHECK 6		CHECK 7		CHECK 8	
						IN AIRCRAFT	CHART C ENTRY	IN AIRCRAFT	CHART C ENTRY	IN AIRCRAFT	CHART C ENTRY	IN AIRCRAFT	CHART C ENTRY	IN AIRCRAFT	CHART C ENTRY	IN AIRCRAFT	CHART C ENTRY	IN AIRCRAFT	CHART C ENTRY	IN AIRCRAFT	CHART C ENTRY
C-	PASSENGER OR CARGO COMPARTMENT																				
	(180-348) (Cont.)																				
C-23	Receiver-Transmitter (RT-760/ARN-																				
	79)	13	218	28.3																	
C-24	Amplifier (AM-1717/APN-117)	19	218	41.4																	
C-25	Compass Amplifier (8KE8AA2) MA-1	7	221	15.5																	
C-26	Receiver-Transmitter (RT-384/																				
	ARN-52V)	43	221	95.0																	
C-27	Transmitter (T-744/ARC-84) &																				
	Pwr. Sup.	13	221	28.7																	
C-28	Receiver (R-955/ARC-84) &																				
	Pwr. Sup.	11	225	24.8																	
C-29	Receiver-Transmitter (RT-160/																				
	APN-22) With Housing and																				
	Antenna (In Bilge)	8	222	17.8																	
C-30	Air Bottles - Aux. Floats (TAVCO)																				
	(2)	20	188	37.6																	
C-31	PK-2 Life Raft Pack (Crewmans)	8	230	18.4																	
C-32	Belts, Safety (FDC-1650-27MI) (3)	3	230	6.9																	
C-33	Seat (Troop Type) 3-Man (30-S-1)	7	230	16.1																	
C-34	Control, Intercom (C1611A) Stbd.	3	234	7.0																	
C-35	Light, Emergency Exit - Stbd.	1	231	2.3																	
C-36	Cabin Step - Installed	4	252	10.1																	
C-37	Safety Harness (NAF 501234)	6	252	15.1																	
C-38	Fuel Pumps (RG12640T2) (2)	9	252	22.7																	
C-39	Trapped Fuel, Fwd. Tank	9	252	22.7																	
C-40	Rescue Platform - Installed	25	252	63.0																	

CHART A – EMPTY WEIGHT CHECK LIST

AIRCRAFT MODEL **HH-52A** SERIAL NO. ENTER DATE

ITEM NUMBER	ITEMS AND LOCATION GROUPED BY COMPARTMENT	WEIGHT	ARM	MOMENT/100	DELIVERY EQUIPMENT	CHECK 1		CHECK 2		CHECK 3		CHECK 4		CHECK 5		CHECK 6		CHECK 7		CHECK 8	
						IN AIRCRAFT	CHART C ENTRY	IN AIRCRAFT	CHART C ENTRY	IN AIRCRAFT	CHART C ENTRY	IN AIRCRAFT	CHART C ENTRY	IN AIRCRAFT	CHART C ENTRY	IN AIRCRAFT	CHART C ENTRY	IN AIRCRAFT	CHART C ENTRY	IN AIRCRAFT	CHART C ENTRY
C-	PASSENGER OR CARGO COMPARTMENT																				
	(180-348) (Cont.)																				
C-41	Control, Intercom (C1611A) Port	3	258	7.7																	
C-42	Cabin Soundproofing	40	264	105.6																	
C-43	Seat, Troop Type, 1 Man & Belt	4	269	10.8																	
C-44	Light, Emergency Exit - Port	1	280	2.8																	
C-45	Trapped Fuel Aft. Tank	1	294	2.9																	
C-46	Fire Extinguisher (891083)	7	294	20.6																	
C-47	SAR Package	100	298	298.0																	
C-48	Belts (FDC-1650-27MI) (5)	5	317	15.9																	
C-49	Seat (Troop Type) 3 Man (30-8-1)	7	317	22.2																	
C-50	Seat (Troop Type) 2 Man (S6250-62302-2)	4	326	13.0																	
C-51	Litter Straps (Stowed) Stbd.	4	327	13.1																	
C-52	Litter Straps (Stowed) Port	4	327	13.1																	
C-53	Danforth Anchor (Stowed) With Line	10	346	34.6																	
C-54	First Aid Kit	2	347	6.9																	

CHART A – EMPTY WEIGHT CHECK LIST

AIRCRAFT MODEL HH-52A SERIAL NO. ENTER DATE

ITEM NUMBER	ITEMS AND LOCATION GROUPED BY COMPARTMENT	WEIGHT	ARM	MOMENT/100	DELIVERY EQUIPMENT	CHECK 1		CHECK 2		CHECK 3		CHECK 4		CHECK 5		CHECK 6		CHECK 7		CHECK 8	
						IN AIRCRAFT	CHART C ENTRY	IN AIRCRAFT	CHART C ENTRY	IN AIRCRAFT	CHART C ENTRY	IN AIRCRAFT	CHART C ENTRY	IN AIRCRAFT	CHART C ENTRY	IN AIRCRAFT	CHART C ENTRY	IN AIRCRAFT	CHART C ENTRY	IN AIRCRAFT	CHART C ENTRY
D	TRANSITION SECTION COMPARTMENT																				
	(348-408)																				
D-1	Heater Ignition Unit (A11C30)	5	350	17.5																	
D-2	Tail Drive Shaft Fairing	2	351	7.0																	
D-3	Main Line Contactor (DH-7B) (2)	2	352	5.0																	
D-4	Pressure Switch (75017)	2	351	7.0																	
D-5	Relays, (R. C.) 200 Amps (2)	9	351	31.6																	
D-6	Relay, Battery (A770N)	2	352	7.0																	
D-7	Relay, Bus Tie, 300 Amps	2	352	7.0																	
D-8	Relay, External Power, 300 Amps	2	352	7.0																	
D-9	Heater Blower (MS 5862X-1A)	1	354	42.5																	
D-10	Heater, (52689)	16	354	56.6																	
D-11	Battery Disconnect	2	356	7.1																	
D-12	Battery Support	2	356	7.1																	
D-13	Battery, (24V, 24AH, NI-CAD)	49	356	174.4																	
D-14	Supervisory Panel (24E12) (2)	17	361	61.4																	
D-15	Electrical Shelves and Supports	11	364	40.0																	
D-16	Convertors, 200 Amps (2)	43	364	156.5																	
D-17	Heater, Fuel Control, (54C00)	8	366	29.3																	
D-18	Voltage Regulator (20B56-1) (2)	7	374	26.2																	
D-19	Regulator Panel Assy. (34B26-9-A)																				
	(2)	17	361	61.4																	
D-20	Supervisory/Regulator Panel	6	374	22.4																	
	(21B17-22A) (2) (Ref. AMC #26)																				
D-21	Regulator Base (1B40-2-A) (2)	6	374	22.4																	
	(Ref. AMC #26)																				

CHART A – EMPTY WEIGHT CHECK LIST

AIRCRAFT MODEL HH-52A SERIAL NO. ENTER DATE

ITEM NUMBER	ITEMS AND LOCATION GROUPED BY COMPARTMENT	WEIGHT	ARM	MOMENT / 100	DELIVERY EQUIPMENT	CHECK 1		CHECK 2		CHECK 3		CHECK 4		CHECK 5		CHECK 6		CHECK 7		CHECK 8	
						IN AIRCRAFT	CHART C ENTRY	IN AIRCRAFT	CHART C ENTRY	IN AIRCRAFT	CHART C ENTRY	IN AIRCRAFT	CHART C ENTRY	IN AIRCRAFT	CHART C ENTRY	IN AIRCRAFT	CHART C ENTRY	IN AIRCRAFT	CHART C ENTRY	IN AIRCRAFT	CHART C ENTRY
D-	TRANSITION SECTION COMPARTMENT																				
	(348-408) (Cont.)																				
D-22	Inverter (MS16057-1) (100 VA)	8	378	30.2																	
D-23	Datum Beacon Holder	2	378	7.6																	
D-24	Beacon (T981/SRT)	25	378	94.5																	
D-25	Flux Valve & Compensator MA-1	2	387	7.7																	
D-26	De-icing Control	3	404	12.1																	
E	TAIL CONE AND PYLON (403-637)																				
E-1	Tail Wheel Fairing	6	418	25.1																	
E-2	Tail Drive Shaft Fairing	7	476	33.3																	
E-3	Pylon Fairing	7	601	42.1																	
E-4	Oil, Intermediate & Tail Gear Box	3	618	18.5																	
E-5	Stabilizer	19	618	117.4																	
E-6	Tail Rotor Assy. (105")	62	629	390.0																	

CHART A – EMPTY WEIGHT CHECK LIST

AIRCRAFT MODEL HH-52A SERIAL NO. ENTER DATE

ITEM NUMBER	ITEMS AND LOCATION GROUPED BY COMPARTMENT	WEIGHT	ARM	MOMENT / 100	DELIVERY EQUIPMENT	CHECK 1		CHECK 2		CHECK 3		CHECK 4		CHECK 5		CHECK 6		CHECK 7		CHECK 8	
						IN AIRCRAFT	CHART C ENTRY	IN AIRCRAFT	CHART C ENTRY	IN AIRCRAFT	CHART C ENTRY	IN AIRCRAFT	CHART C ENTRY	IN AIRCRAFT	CHART C ENTRY	IN AIRCRAFT	CHART C ENTRY	IN AIRCRAFT	CHART C ENTRY	IN AIRCRAFT	CHART C ENTRY
F	ALIGHTING GEAR & SPONSONS																				
F-1	Landing Lights - Stbd. (42275) (2)	4	180	7.2																	
F-2	Landing Light - Port (42275)	2	180	3.6																	
F-3	Rotating Beacon - Stbd. (42700)	2	193	3.9																	
F-4	Rotating Beacon - Port (42700)	2	193	3.9																	
F-5	Sponsons (2)	162	195	315.9																	
F-6	Auxiliary Float - Inflatable Bags (2)	18	196	35.3																	
F-7	Auxiliary Float Bag Covers (2)	4	196	7.8																	
F-8	Main Strut Assembly (2)	86	206	177.2																	
F-9	Main Wheel Assembly (9531925) (2)	27	206	55.6																	
F-10	Brake Assembly (9531926) (2)	13	206	26.8																	
F-11	Main Tires (6.50 x 10) Tubeless (2)	18	206	37.1																	
F-12	Tail Strut Assembly	44	412	181.3																	
F-13	Tail Wheel (9531952)	5	422	21.1																	
F-14	Tail Wheel Tire & Tube (5.00 x 5)	5	422	21.1																	

CHART A – EMPTY WEIGHT CHECK LIST

AIRCRAFT MODEL HH-52A SERIAL NO. ENTER DATE

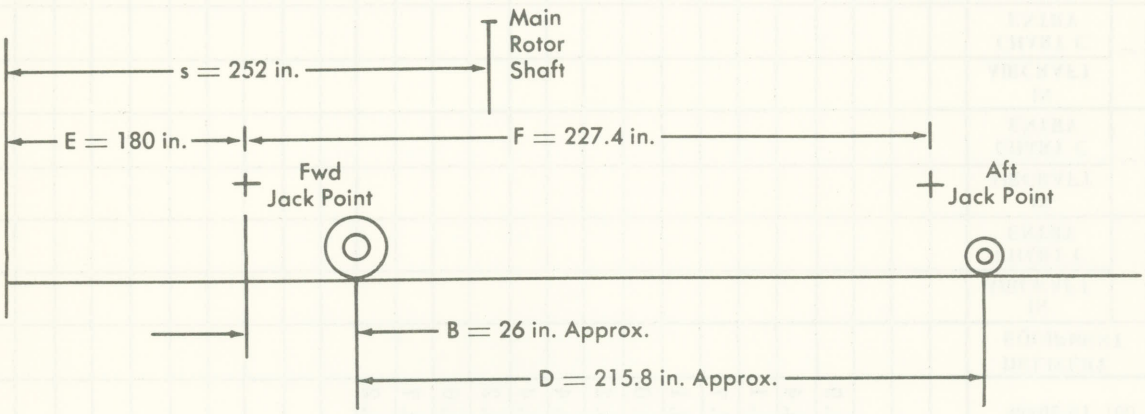
ITEM NUMBER	ITEMS AND LOCATION GROUPED BY COMPARTMENT	WEIGHT	ARM	MOMENT/100	DELIVERY EQUIPMENT	CHECK 1		CHECK 2		CHECK 3		CHECK 4		CHECK 5		CHECK 6		CHECK 7		CHECK 8	
						IN AIRCRAFT	CHART C ENTRY	IN AIRCRAFT	CHART C ENTRY	IN AIRCRAFT	CHART C ENTRY	IN AIRCRAFT	CHART C ENTRY	IN AIRCRAFT	CHART C ENTRY	IN AIRCRAFT	CHART C ENTRY	IN AIRCRAFT	CHART C ENTRY	IN AIRCRAFT	CHART C ENTRY
G	MISCELLANEOUS EXTERNAL EQUIPMENT																				
G-1	Antenna (AT-740/APX)	1	186	1.9																	
G-2	Antenna (AS-1728/ARN-79) (2)	2	221	4.4																	
G-3	Hoist Assy. (BL-2330-3)	56	252	141.1																	
G-4	Hoist Support Assy.	11	252	27.7																	
G-5	Hoist Fairing	4	252	10.1																	
G-6	Main Rotor Blades (3)	425	252	1071.0																	
G-7	Antenna (AT-740/ARN)	1	321	3.2																	
G-8	Antenna (WS-25V)	2	420	8.4																	
G-9	Antenna (AT/209/ARR-26)	1	444	4.4																	
G-10	Antenna, Tension (HF-102)	5	463	23.2																	
G-11	Antenna, (ANT-37R2U)	3	488	14.6																	
G-12	Antenna (AT-1094/ARN-73)	4	493	19.7																	
G-13	Antenna (DMN-4-4)	2	558	11.2																	

Load Condition: Aircraft Actual Weight and Horizontal Balance

PREPARED BY: _____
DATE: _____

MODEL: _____ REG. NO. _____ SERIAL NO. _____

SCALE POSITION	SCALE NO.	SCALE READING (LB)	TARE	SCALE ERROR	SYMBOL	NET WEIGHT
Left Fwd Jack Point					W_L	
Right Fwd Jack Point					W_R	
Aft Jack Point					W_T	
Total Weight					W	



CENTER OF GRAVITY TO FORWARD DATUM (HORIZ. DIST. – AS WEIGHED)

Weighing on Wheels $E + \frac{B + W_T \times D}{W}$

Weighing on Jack Points $E + \frac{W_T \times F}{W}$

CORRECTED WEIGHT AND HORIZONTAL BALANCE

ITEMS ADDED & SUBTRACTED	WEIGHT (LB)	HORIZONTAL DIST. (in) C. G. TO FWD DATUM	MOMENT (lb in.)
Aircraft as Weighed			
Plus –			
Minus –			
EMPTY TOTAL GROSS WEIGHT			
BALANCE (Corrected) Horizontal Dist. – s		in. Fwd / Aft of Main Rotor Centroid	

Witnessed By _____

• BASIC WEIGHT and BALANCE RECORD •

CONTINUOUS HISTORY OF CHANGES IN STRUCTURE OR EQUIPMENT AFFECTING WEIGHT & BALANCE

CHART C SHEET

AIRPLANE MODEL ____________ SERIAL NO. ____________

DATE	ITEM NO.		DESCRIPTION OF ARTICLE OR MODIFICATION	WEIGHT CHANGE				RUNNING TOTAL BASIC AIRPLANE		
				ADDED (+)		REMOVED (−)				
	IN	OUT		WEIGHT	MOMENT 100	WEIGHT	MOMENT 100	WEIGHT	MOMENT 100	INDEX

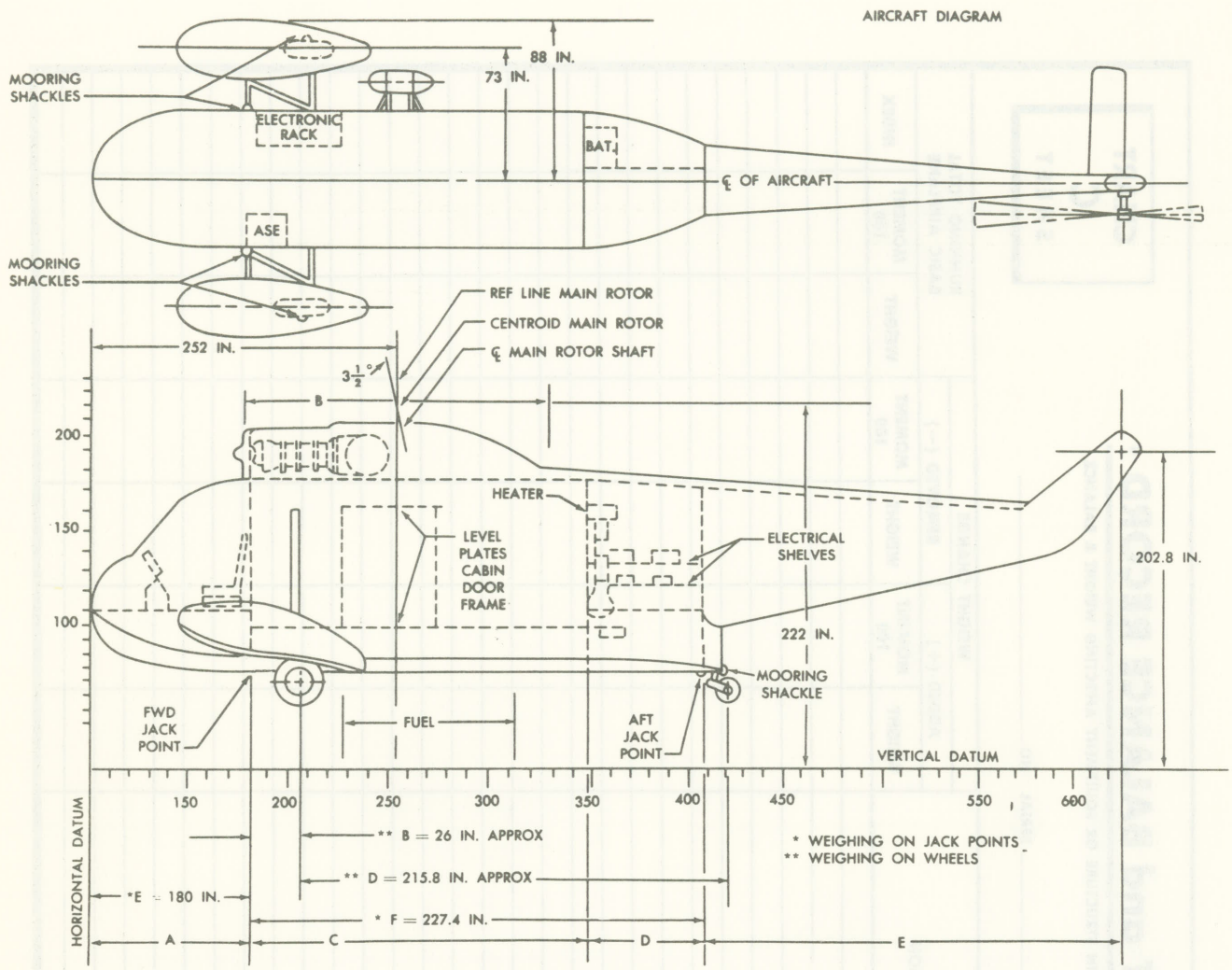
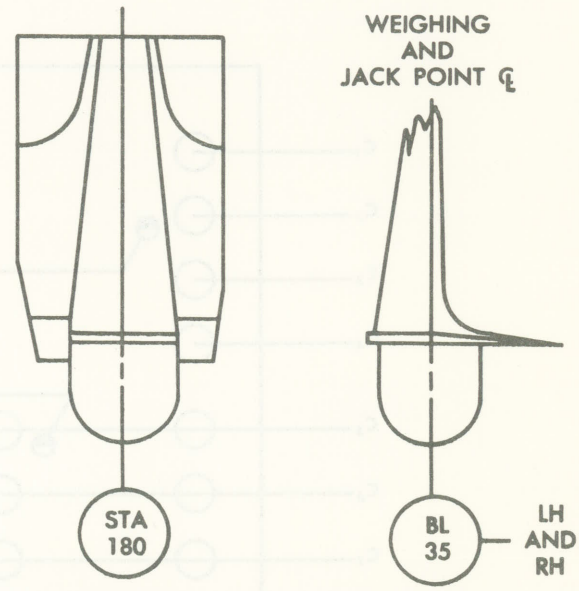

AIRCRAFT DIAGRAM
88 IN.
73 IN.
MOORING SHACKLES
ELECTRONIC RACK
BAT.
℄ OF AIRCRAFT
ASE
MOORING SHACKLES
REF LINE MAIN ROTOR
CENTROID MAIN ROTOR
℄ MAIN ROTOR SHAFT
252 IN.
3 1/2°
B
200
150
100
HEATER
LEVEL PLATES CABIN DOOR FRAME
ELECTRICAL SHELVES
202.8 IN.
222 IN.
MOORING SHACKLE
FWD JACK POINT
FUEL
AFT JACK POINT
VERTICAL DATUM
HORIZONTAL DATUM
150
200
250
300
350
400
450
550
600
** B = 26 IN. APPROX
** D = 215.8 IN. APPROX
*E = 180 IN.
* F = 227.4 IN.
A
C
D
E
* WEIGHING ON JACK POINTS
** WEIGHING ON WHEELS

Figure 38.

DETAIL FWD. FUSELAGE JACK POINT



WEIGHING PROCEDURE

NOTE: (1) IT IS ADVISABLE TO WEIGH ON JACK POINTS BECAUSE OF EASE IN LEVELING.

(2) USE PLUMB BOB SUSPENDED FROM TOP LEVEL PLATE (ON UPPER CABIN DOOR FRAME) FOR CHECKING THE LEVELING OF THE AIRCRAFT DURING WEIGHING.

(3) WHEN WEIGHING ON JACK POINTS USE DIMENSIONS *E AND *F RESPECTIVELY.

(4) WHEN WEIGHING ON WHEELS USE DIMENSIONS **B AND **D RESPECTIVELY.

(5) FOR ACCURACY IN WEIGHING, THE MAIN ROTOR BLADES SHOULD BE REMOVED, OR EVENLY SPACED IF REMOVAL IS IMPRACTICAL.

DATUM LINE TO ℄ OF FORWARD WHEELS = 206 IN. APPROX

DATUM LINE TO ℄ OF AFT WHEEL = 421.8 IN. APPROX

DATUM LINE TO ℄ OF FORWARD JACK POINT = 180 IN. APPROX

DATUM LINE TO ℄ OF AFT JACK POINT = 407.4 IN. APPROX

DETAIL AFT. FUSELAGE JACK POINT

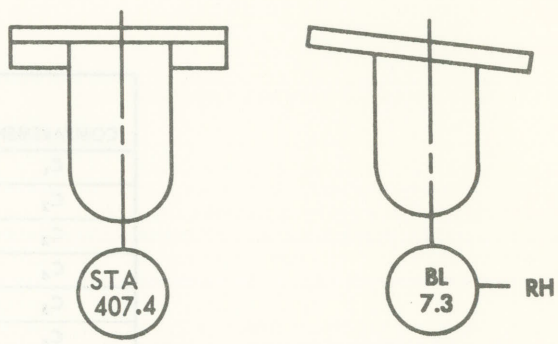
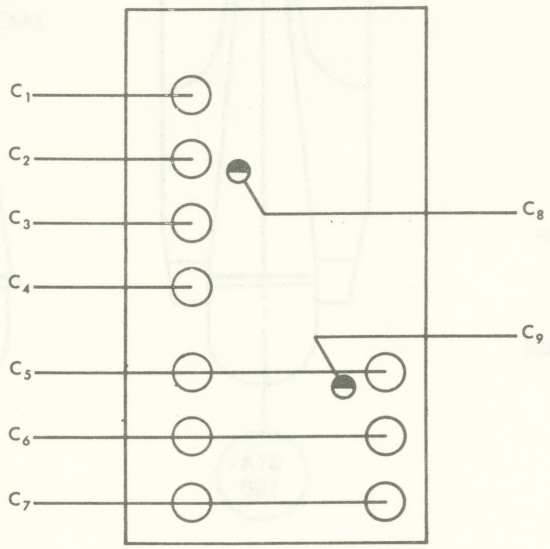


Figure 39.



PASSENGER AND CARGO LOADING DATA

PASSENGER CENTROID (TROOP-TYPE SEATS)

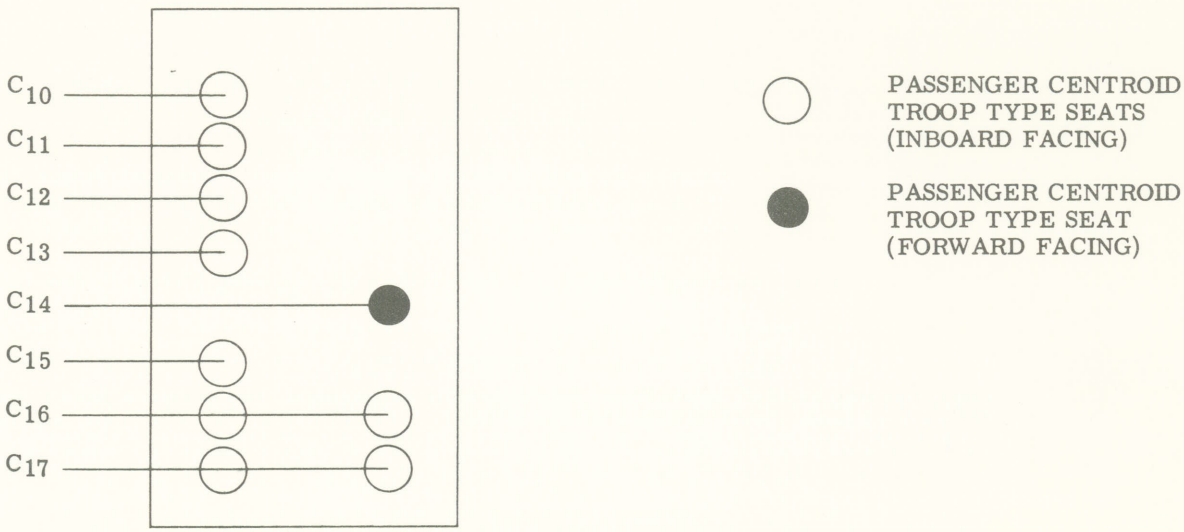
LITTER CENTROID

COMPARTMENT	CENTROID	MAXIMUM WEIGHT (POUNDS)
C_1	209.8	200
C_2	229.8	200
C_3	249.8	200
C_4	268.8	200
C_5	296.8	400
C_6	316.8	400
C_7	336.8	400
C_8	233	380
C_9	297	380
CARGO	*SEE NOTE 1 BELOW	

* Note 1: The cabin floor area between stations 180 and 348 is structurally satisfactory for a uniformly distributed loading of 175 lb/sq ft when used for cargo purposes with the following limitations: the areas between stations 276 to 312 and stations 312 to 348 are each limited to a maximum of 1200 lb; the maximum total floor load permitted is 2400 lb.

Note 2: Care should be taken to ensure that passenger or cargo loadings do not move the c.g. outside the approved limits as fuel is used.

PASSENGER LOADING DATA
(ALTERNATE SEATING ARRANGEMENT)



COMPARTMENT	CENTROID	MAXIMUM WEIGHT (POUNDS)
C_{10}	209.8	200
C_{11}	229.8	200
C_{12}	249.8	200
C_{13}	268.8	200
C_{14}	291.0	200
C_{15}	296.8	200
C_{16}	316.8	400
C_{17}	336.8	400

NOTE 1: Care should be taken to ensure that passenger or cargo loadings do not move the C.G. outside the approved limits as fuel is used.

NOTE 2: Use compartment loading data C_1 for C_{10}.

CREW TABLE		
WEIGHT (POUNDS)	PILOT AND CO-PILOT ARM = 158.5 MOMENT/100	C_1 CREW ARM = 209.8 MOMENT/100
100	159	210
110	174	231
120	190	252
130	206	273
140	222	294
150	238	315
160	254	336
170	270	357
180	285	378
190	301	399
200	317	420
210	333	
220	349	
230	365	
240	380	
250	396	
260	412	
270	428	
280	444	
290	460	
300	476	
310	491	
320	507	
330	523	
340	539	
350	555	
360	571	
370	586	
380	602	
390	618	
400	634	

FUEL TABLE

WEIGHT (POUNDS)	MAIN FUEL TANK CAPACITY = 187 GALLONS ARM = 252 MOMENT/100	REAR FUEL TANK CAPACITY = 138 GALLONS ARM = 294 MOMENT/100
50	130	150
100	250	290
150	380	440
200	500	590
250	630	740
300	760	880
350	880	1030
400	1010	1180
450	1130	1320
500	1260	1470
550	1390	1620
600	1510	1760
650	1640	1910
700	1760	2060
750	1890	2210
800	2020	2350
850	2140	2500
*(JP-4) 897		2640
*(JP-1) 932		2740
*(JP-5) 938		2760
1050	2650	
1100	2770	
1150	2900	
1200	3020	
*(JP-4) 1216	3060	
1250	3150	
*(JP-1) 1262	3180	
*(JP-5) 1272	3210	

*Approximate weight and moment for full fuel tank, under standard conditions (60°F) and based on 6.5#/gal. for JP-4, 6.75#/gal. for JP-1 and 6.8#/gal. for JP-5 is indicated by an asterisk (*).

CAUTION

This helicopter is equipped with capacitor type fuel quantity gages which are calibrated in pounds. Aircraft fuel varies in weight per gallon dependent upon the specific gravity and the temperature of the fuel, therefore, the notation "FULL" does not appear on the instrument dial and the pilot should anticipate variations in the instrument readings when tanks are full.

PASSENGER COMPARTMENT TABLE TROOP TYPE SEATS						
WEIGHT (POUNDS)	C_2 ARM = 229.8 MOMENT/100	C_3 ARM = 249.8 MOMENT/100	C_4 ARM = 268.8 MOMENT/100	C_5 ARM = 296.8 MOMENT/100	C_6 ARM = 316.8 MOMENT/100	C_7 ARM = 336.8 MOMENT/100
10	23	25	27	30	32	34
20	46	50	54	59	63	67
30	69	75	81	89	95	101
40	92	100	108	119	127	135
50	115	125	134	148	158	168
60	138	150	161	178	190	202
70	161	175	188	208	222	236
80	184	200	215	237	253	269
90	207	225	242	267	285	303
100	230	250	269	297	317	337
110	253	275	296	327	349	371
120	276	300	323	356	380	404
130	299	325	349	386	412	438
140	322	350	376	416	444	472
150	345	375	403	445	475	505
160	368	400	430	475	507	539
170	391	425	457	505	539	573
180	414	450	484	534	570	606
190	437	475	511	564	602	640
200	460	500	538	594	634	674
210				623	665	707
220				653	697	741
230				683	729	775
240				712	760	808
250				742	792	842
260				772	824	875
270				801	855	909
280				831	887	943
290				861	919	977
300				890	950	1010
310				920	982	1044
320				950	1014	1078
330				979	1045	1111
340				1009	1077	1145
350				1039	1109	1179
360				1068	1140	1212
370				1098	1172	1246
380				1128	1204	1280
390				1158	1236	1314
400				1187	1267	1347

PASSENGER COMPARTMENT TABLE
TROOP TYPE SEATS
(ALTERNATE SEATING ARRANGEMENT)

WEIGHT (POUNDS)	C_{11} ARM = 229.8	C_{12} ARM = 249.8	C_{13} ARM = 268.8	C_{14} ARM = 291	C_{15} ARM = 296.8	C_{16} ARM = 316.8	C_{17} ARM = 336.8
10	23	25	27	29	30	32	34
20	46	50	54	58	59	63	67
30	69	75	81	87	89	95	101
40	92	100	108	116	119	127	135
50	115	125	134	146	148	158	168
60	138	150	161	175	178	190	202
70	161	175	188	204	208	222	236
80	184	200	215	233	237	253	269
90	207	225	242	262	267	285	303
100	230	250	269	291	297	317	337
110	253	275	296	320	327	349	371
120	276	300	323	349	356	380	404
130	299	325	349	378	386	412	438
140	322	350	376	407	416	444	472
150	345	375	403	437	445	475	505
160	368	400	430	466	475	507	539
170	391	425	457	495	505	539	573
180	414	450	484	524	534	570	606
190	437	475	511	553	564	602	640
200	460	500	538	582	594	634	674
210						665	707
220						697	741
230						729	775
240						760	808
250						792	842
260						824	875
270						855	909
280						887	943
290						919	977
300						950	1010
310						982	1044
320						1014	1078
330						1045	1111
340						1077	1145
350						1109	1179
360						1140	1212
370						1172	1246
380						1204	1280
390						1236	1314
400						1267	1347

LITTER PATIENT TABLE					
WEIGHT (POUNDS)	STARBOARD SIDE ARM = 297 MOMENT/100	PORT SIDE ARM = 233 MOMENT/100	WEIGHT (POUNDS)	STARBOARD SIDE ARM = 297 MOMENT/100	PORT SIDE ARM = 233 MOMENT/100
120	356	280	460	1366	1072
140	416	326	480	1426	1118
160	475	373	500	1485	1165
180	535	419	520	1544	1212
200	594	466	540	1604	1258
220	653	513	560	1663	1305
240	713	559	580	1723	1351
260	772	606	600	1782	1398
280	832	652	620	1841	1445
300	891	699	640	1901	1491
320	950	746	660	1960	1538
340	1010	792	680	2020	1584
360	1069	839	700	2079	1631
380	1129	885	720	2138	1678
400	1188	932	740	2198	1724
420	1247	979	760	2257	1771
440	1307	1025			

OIL TABLE		
CAPACITY = 2.5 GALLONS ARM = 174		
U.S. GAL.	WEIGHT (POUNDS)	MOMENT/100
0.5	3.8	7
1.0	7.5	13
1.5	11.3	20
2.0	15.0	26
2.5	18.8	33

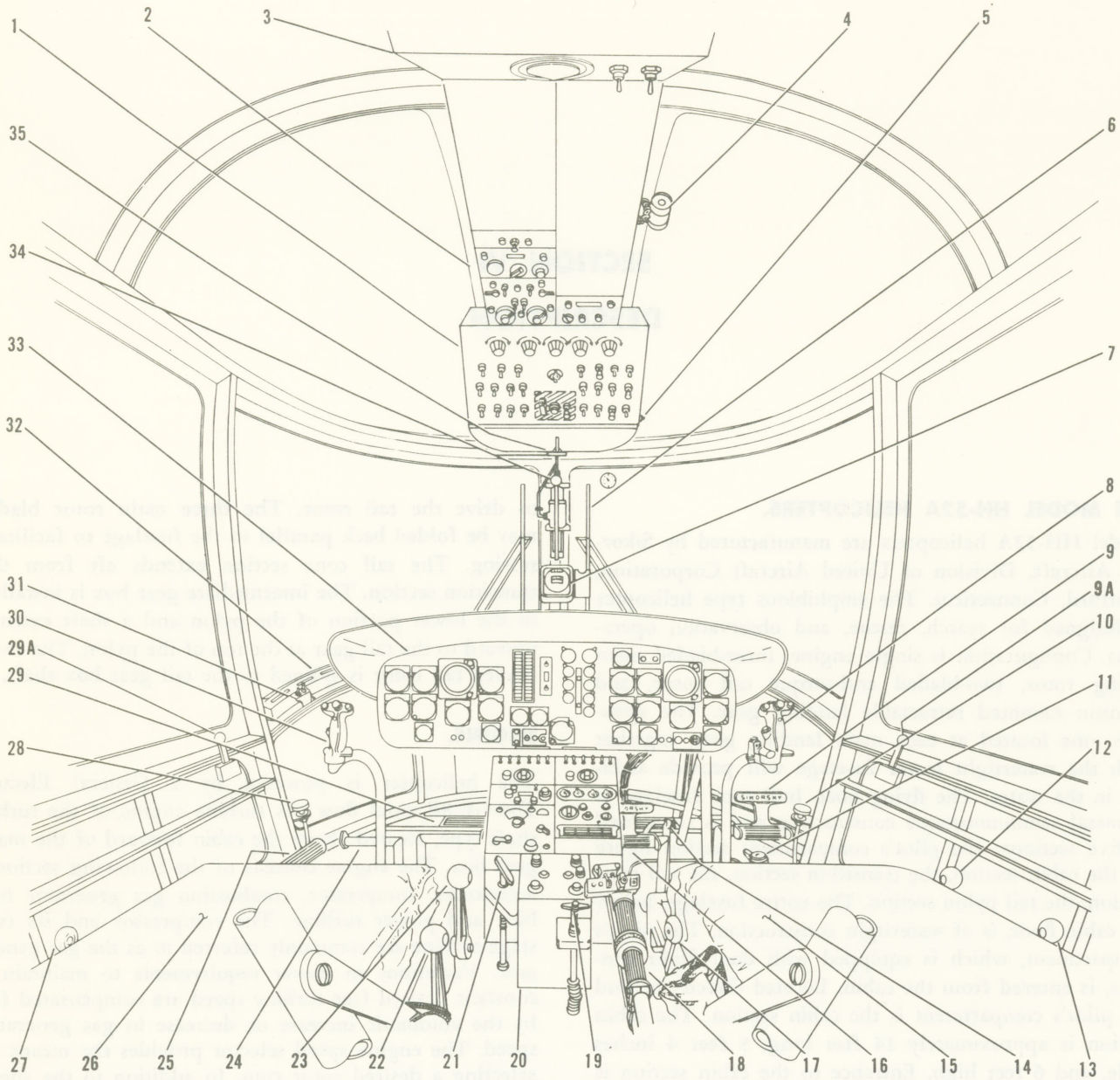
SECTION VI
DESCRIPTION

THE MODEL HH-52A HELICOPTERS.

Model HH-52A helicopters are manufactured by Sikorsky Aircraft, Division of United Aircraft Corporation, Stratford, Connecticut. The amphibious type helicopter is designed for search, rescue, and observation operations. Configuration is single engine, three-bladed main lifting rotor, two-bladed anti-torque tail rotor, and sponson mounted retractable landing gear. The sponsons, one located at each main landing gear, together with the watertight lower fuselage will provide stability in the water. The flying boat, hull type fuselage is of metal semimonocoque construction and is comprised of five sections: the pilot's compartment section figure 40, the cabin section, the transition section, the tail cone section, the tail pylon section. The entire fuselage, below the cabin floor, is of watertight construction. The pilot's compartment, which is equipped with dual flight controls, is entered from the cabin. Located directly behind the pilot's compartment is the cabin section. The cabin section is approximately 14 feet long, 5 feet 4 inches wide, and 6 feet high. Entrance to the cabin section is through a 4 foot wide, 5 foot high, sliding door. The cabin section may be equipped with 10 troop seats for passenger accommodations, or 6 litters, and 3 troop seats. Two single cell fuel tanks are installed below the cabin floor in the watertight lower fuselage section. Aft of the cabin is the transition section which contains the cabin heater and electrical equipment. The engine compartment is located above the cabin. The engine is installed with the drive shaft pointed rearward and connected to the main gear box. The transmission compartment housing the main gear box is on the top of the fuselage directly behind the engine compartment. The main rotor drive shaft extends vertically from the top of the main gear box. The main rotor hub assembly, to which the main rotor blades are attached, is splined to the top of the main rotor drive shaft. The tail rotor drive shaft extends rearward from the main gear box lower housing to drive the tail rotor. The three main rotor blades may be folded back parallel to the fuselage to facilitate storing. The tail cone section extends aft from the transition section. The intermediate gear box is installed in the lower portion of the pylon and a shaft extends upward to the tail gear at the top of the pylon. The two-bladed tail rotor is splined to the tail gear box shaft.

ENGINE.

The helicopter is powered by a General Electric T58-GE-8B axial flow gas turbine engine of the turboshaft type, located above the cabin forward of the main gear box. The engine consists of the following sections: accessories, compressor, combustion gas generator turbine and power turbine. The compressor and its two stage turbine are commonly referred to as the gas generator. Variations in power requirements to maintain a constant desired free turbine speed are compensated for by the automatic increase or decrease in gas generator speed. The engine speed selector provides the means of selecting a desired rotor rpm. In addition to the speed selector, an emergency throttle is used to manually control fuel flow through the main metering valve in the event of fuel control unit malfunction. The fuel control system delivers fuel in controlled amounts to the combustion chamber in order to maintain a constant desired free turbine speed resulting in a constant desired rotor speed. The accessory drive section, mounted on the front frame and extending beneath the compressor, transmits the necessary power to drive the lube scavenge pump, fuel pump, main fuel control, and N_g tachometer-generator. Engine exhaust gases are dissipated through the exhaust casing extending through an opening on the left side of the fairing that surrounds the engine and main gear box. Small openings, located in the fairing on both sides of the engine, also aid in dissipating engine heat. The openings on the right side are provided with normally open shutters which are a part of the engine fire extinguisher system.



1. Overhead Switch Panel
2. Overhead Radio Panel
3. Overhead Domelight Panel
4. Pilot's Compartment Spotlight
5. P3 Valve
6. Windshield Wiper
7. Magnetic Standby Compass
8. Pilot's Cyclic Stick
9. Pilot's Brake Pedal

9A. Pilot's Window Emergency Release Handle in Released Position

10. Pilot's Tail Rotor Pedal Adjustment Knob
11. Windshield Washer Foot Pedal
12. Seat Forward or Aft Adjustment Lever
13. Seat Height Adjustment Lever
14. Heater Register
15. Pilot's Seat
16. Pilot's Tail Rotor Pedal
17. Pilot's Shoulder Harness Inertia Reel Lock Lever
18. Pilot's Collective Pitch Lever
19. Tail Wheel Lock Handle
20. Console
21. Parking Brake Handle
22. Copilot's Seat Height Adjustment Lever
23. Copilot's Seat Forward or Aft Adjustment Lever
24. Copilot's Tail Rotor Pedal
25. Copilot's Collective Pitch Lever
26. Copilot's Seat
27. Copilot's Shoulder Harness Inertia Reel Lock Lever
28. Copilot's Tail Rotor Pedal Adjustment Knob
29. Heater Register

29A. Copilot's Window Emergency Release Handle in Released Position

30. Copilot's Cyclic Stick
31. Copilot's Remote ICS Switch and Landing Light Control Switch
32. Windshield Defroster Vents
33. Instrument Panel
34. Rotor Brake Lever
35. Fire Wall Valve Shut-Off Handle

Figure 40.

ENGINE SPEED SELECTORS. Twist-grip type speed selectors are located on the forward end of the pilot's and copilot's collective pitch levers. Power turbine speed is controlled with the speed selector. When starting engine, both the speed selector and emergency throttle must be in the CLOSED (fully clockwise) position. Two pulley limit switches are closed when both twist-grips are in the CLOSED position, permitting the starter to be energized when the starter switch is actuated. The speed selector is mechanically linked to the fuel control stopcock to assure positive shut-off of all fuel flow to the engine in the CLOSED position. The stopcock is open when the speed selector is rotated in the increase direction to the ground idle stop. Subsequent to rotor engagement desired rotor speed is selected by positioning the speed selector. Design of the speed selector provides two ranges of operation, a starting range which extends from CLOSED (fully clockwise) to GRD IDLE (ground idle stop) position and an operating range which extends from the ground idle stop to maximum speed. When the speed selector is rotated (counterclockwise) to the upper limit of the starting range at the GRD IDLE position a stop is encountered that prevents continued increase. The selector must be pushed forward from GRD IDLE position to FLT IDLE position and then rotated in the increase direction (counterclockwise) to the operating range. When the speed selector is rotated (clockwise) from a normal operating rotor speed toward FLT IDLE position, an autorotative detent will be felt before reaching the FLT IDLE stop. The selector must be pulled rearward from FLT IDLE to GRD IDLE position and then rotated (clockwise) to stopcock the engine. The pilot's speed selector has full authority from the stopcock position to the maximum position and is not limited like the copilot's speed selector. The copilot's selector is restricted to full authority within GRD IDLE range or within the operating range depending on which range the pilot has selected.

EMERGENCY THROTTLES. Twist-grip type emergency throttles are located aft of the speed selectors on the pilot's and copilot's collective pitch levers. Normally, the emergency throttle is in the CLOSED (fully-clockwise) position. The throttle is rotated counterclockwise from CLOSED to OPEN position. The emergency throttle may be used to manually position the main metering valve of the fuel control in event of a malfunction of the fuel control unit. The emergency throttle meters fuel to maintain a speed at or above the speed setting of the speed selector. Therefore, if a lower speed is desired after failure of the fuel control, the speed selector must be returned to FLT IDLE before actuating emergency throttle.

CAUTION

Stopcock function is still controlled by engine speed selector when power turbine speed is controlled by emergency throttle.

ENGINE INSTRUMENTS.

The following instruments are those directly associated with monitoring engine operation. The instrumentation related to other systems is described under the specific system.

DUAL TACHOMETER (POWER TURBINE AND ROTOR). Two electrically operated dual tachometers (power turbine speed N_f and rotor speed N_r) are mounted on the instrument panel in front of pilot and copilot. The power turbine and rotor tachometer-generators, one driven by the engine power turbine and the other driven by the main gear box, are synchronized to line up the tachometer needles when the engine is driving main gear box. The tachometer dial, marked ROTOR PERCENT RPM scale, is calibrated in 2 percent increments from 0 to 140 percent of power turbine speed (N_f), while the short needle, marked "R," indicates percent of rotor speed (N_r).

GAS GENERATOR TACHOMETER. The gas generator tachometer, mounted on the instrument panel, operates on current developed by a tachometer-generator, which senses gas generator speed (Ng). The tachometer has two scales and two needles. The large needle and outer scale indicate gas generator speed from 0 to 100 percent in increments of 2 percent each. The small needle and inner scale, calibrated from 0 to 10 percent in increments of 1 percent each, provide a means of accurately reading gas generator speed within one percent. The tachometer will indicate up to 110 percent gas generator speed.

POWER TURBINE INLET TEMPERATURE GAGE. A power turbine inlet temperature gage, located on the instrument panel, is wired to eight thermocouples projecting into the hot-gas stream immediately ahead of power turbine. The thermocouples, connected with a balance-resistance harness, are wired to a thermocouple spool resistor that varies the current flowing to the gage. The dial, marked °C x 100, is numerically calibrated from 0 to 10° with linear increments of 20°C each representing 0 to 1000°C of power turbine inlet temperature (T_5).

ENGINE OIL PRESSURE GAGE. An engine oil pressure gage, located on the instrument panel, is wired to an oil pressure transmitter installed on the discharge side of engine oil pump. The dial, marked PSI, is calibrated numerically from 0 to 10 psi in linear increments of 5 psi each representing 0 to 100 psi of engine oil pressure. The gage operates on 26 volts from the ac essential bus and is protected by a circuit breaker, marked ENG OIL PRESS, located on forward circuit breaker panel.

ENGINE OIL TEMPERATURE GAGE. An engine oil temperature gage, located on the instrument panel, is wired to a temperature bulb installed on bottom of the oil tank. The dial, numerically marked from -50 to 150°C, is calibrated in linear increments of 10°C each representing -70 to 150°C of engine oil temperature.

The gage operates on 28 volts from the dc essential bus and is protected by a circuit breaker, marked OIL TEMP, under the general heading ENGINE, located on the forward circuit breaker panel.

FUEL PRESSURE GAGE. The fuel pressure gage installed on the instrument panel, indicates fuel pressure in pounds per square inch as measured at the fuel inlet of the No. 1 manifold. The dial, numerically marked from 0 to 100 is calibrated in linear increments of 50 psi each representing 0 to 1000 psi of fuel pressure. The system operates on 26 volts from the ac essential bus and is protected by a circuit breaker, marked FUEL PRESS, located on the forward circuit breaker panel.

TORQUE SENSING SYSTEM.

The torque sensing system determines input torque at the main gear box and transmits this information to the torquemeter indicators which are located on the instrument panel. Components of the system include the main pressure transmitter, a high pressure oil pump, and two torquemeter indicators. The system is designed to measure the oil pressure generated by the forward displacement of the main gear box second stage helical gear as a result of the input shaft torque of the engine. These oil pressures are sensed by the main pressure transmitter which converts the oil pressure into an electrical signal and sends this signal to the torquemeter indicators.

TORQUEMETER INDICATOR. Two torquemeter indicators, one for the pilot and one for the copilot, are located on the instrument panel. Each indicator, marked PERCENT TORQUE, contains a single needle which indicates torque input to the main gear box in percent. The indicator dials are calibrated in increments of 5 percent each from 0 to 135 percent. The indicators operate on 26-volts alternating current and are protected by a circuit breaker, marked TORQUE SENSOR, located on the forward circuit breaker panel.

MAXIMUM AND OVERTORQUE SENSING SYSTEM.

The maximum and overtorque sensing system provides a visual indication of elapsed time occuring while the main gear box is operating over 100 percent torque; it also indicates a 116 percent overtorque condition. Components of the system include two pressure switches, a time delay relay, an elapsed time indicator, and a flag indicator. This system operates on the principle that the developed oil pressure at the main gear box second stage helical gear is proportional to the applied torque at the engine input shaft making this system identical to the torque sensing system, except for the pressure switches which will not develop an electrical impulse until their respective activating limits are reached. Within the overtorque circuitry, a time delay relay has been incorporated and preset to a fixed time so that during transient maneuvers a flag indication will not appear until the preset time has been exceeded.

ELAPSED-TIME INDICATOR. An elapsed-time indicator is located on the forward circuit breaker panel. The indicator, marked HOURS AND HUNDREDTHS, provides a digital indication of the amount of time the main gear box has been operated above 100 percent torque. The indicator operates on 28 volts from the dc essential bus and is protected by a circuit breaker, marked TORQUE SENSOR, located on the forward circuit breaker panel.

FLAG INDICATOR. A flag indicator is located on the forward circuit breaker panel adjacent to the elapsed time indicator. The indicator can be identified by its circular, normally dull black face. When a sustained overtorque condition has existed, a rectangular fluorescent red flag appears. The indicator operates on 28 volts from the dc essential bus and is protected by a circuit breaker, marked TORQUE SENSOR, located on the forward circuit breaker panel.

ENGINE FUEL SYSTEM.

The engine fuel system components include a dynamic filter, the engine driven fuel pump, the fuel control and flow divider, and fuel manifold and nozzles. Fuel, supplied by the fuel tank booster pumps, flows through the fire wall shut-off valve and the airframe filter, enters the dynamic filter, and then passes to the engine driven fuel pump inlet. From the engine pump discharge, the fuel passes into the fuel control where it is filtered and metered. Fuel from the pressure-regulating relief valve returns to the fuel pump inlet, while metered fuel passes through the oil cooler and the in-line fuel filter before entering the flow divider. The fuel passes from the flow divider into the internal fuel manifolds. Fuel at pump-discharge pressures is throttled and metered through a pilot valve to operate the stator vane actuator.

FUEL CONTROL SYSTEM. The fuel control system regulates fuel flow to maintain a constant desired rotor speed, as determined by the position of the engine speed selector. The speed selector can be repositioned occasionally during major changes in flight conditions but can be ignored during minor flight condition changes. During normal flight, whenever the collective pitch is varied, a change in fuel flow occurs, which regulates gas generator speed to compensate for the change in load demand. Accordingly gas generator speed is regulated from no load at minimum collective pitch to full load at maximum collective pitch. If the fuel control fails, the emergency throttle can be used to manually meter fuel to maintain a speed at or above the setting of the speed selector.

FUEL CONTROL. The fuel control is mounted on and receives fuel from the engine driven fuel pump which is located on the accessory drive section of the engine. The fuel control consists of a single housing that contains elements which perform the two basic functions that are necessary for control of the engine. The fuel conrol senses five parameters of engine operation and positions the main metering valve to provide the necessary fuel flow. The parameters are compressor inlet temperature, gas generator speed (N_g), speed selector position, compressor discharge pressure (P3), and power turbine speed (N_f). The control also provides for filtering of fuel and prevents damage to fuel system components by limiting pressure to approximately 900 psi (fuel discharge pressure.)

STATOR VANE ACTUATING SYSTEM. The stator vane actuating system controls the flow of compressor air intake by directing the inlet air to insure maximum compressor efficiency. The system functions by regulating the angle of the inlet guide vanes and the vanes of the first three compressor stator stages. The actuating system is operated automatically by fuel pressure from a component of the fuel control. The system components are the pilot valve assembly, the actuator assembly, and the feedback cable assembly. The actuating system components are mounted externally on the compressor casing.

ENGINE OVERSPEED SYSTEM.

The purpose of the overspeed system is to prevent power turbine speeds in excess of maximum continuous speed and from obtaining destructive overspeed RPM's. Components of the system include an overspeed switch that is mounted on the main gear box, a compressor discharge pressure signal line solenoid valve (P3) that is mounted on the engine, and a primary microswitch which is mounted on the engine stator vane actuator. An overspeed condition test switch is located in the pilot's compartment. The overspeed system is designed for operation whenever the engine is driving the rotor system. During such operation, should a power turbine speed signal failure to the fuel control occur, the engine will accelerate to maximum power. The resulting rotor response will depend upon numerous factors. The overspeed system operates on current from the dc essential bus and is protected by a circuit breakers, marked ENG OVSPD, located on the forward circuit breaker panel.

POWER TURBINE SPEED SIGNAL FAILURE WITH LOW POWER. During engine operation with minimum collective pitch and low power output from the engine (less than 700 SHP), a power turbine speed (N_f) signal failure would result in sudden acceleration of the engine to maximum power. The load absorption capabilities of the main rotor during such operation is small and an overspeed of the rotor system would result. To prevent a rotor overspeed, an overspeed switch, consisting of an overspeed circuit and two test circuits is located on the main gear box. When an overspeed condition, 110 percent rotor speed (110% N_r) occurs, the switch is triggered and an electrical signal is transmitted to the P3 solenoid valve, bleeding the compressor discharge pressure (P3) signal from the fuel control. Loss of the P3 signal will result in a reduction of fuel flow to the engine, thus containing the overspeed. Because of the low drag characteristics of the rotor while in minimum collective pitch, once the rotor has accelerated into the overspeed region, deceleration out of this region will take considerable amount of time. During such a time delay, the overspeed signal from the main gear box overspeed switch, closed above 110 percent rotor speed (110% N_r), will continue to bleed the P3 signal. As a result, the gas generator will continue to decelerate. To prevent gas generator speed (N_g) from decelerating below ground idle into a region of low stall margins, the stator vane actuator primary switch, normally closed above 72 ± 3 percent N_g, will open and return the P3 signal to the fuel control when gas generator speed (N_g) drops below 72 ± 3 percent. At this point, the gas generator will begin to accelerate and continue to accelerate until the stator vane actuator primary switch closes when N_g rises above 72 ± 3 percent, and once again bleeds the P3 signal from the fuel control. Gas generator speed will oscillate until such time as the rotor has decelerated out of the overspeed region. A rotor overspeed due to a power turbine speed (N_f) signal failure to the fuel control will be denoted by gas generator speed oscillations with a zero power turbine speed indication and a rotor speed indication of 110 percent. The overspeed can be corrected by retarding the speed selector from the governing region to the GRD IDLE position and using the emergency throttle, if required.

POWER TURBINE SPEED SIGNAL FAILURE WITH INTERMEDIATE POWER. With low collective pitch, less than 700 SHP output from the engine, an overspeed of the rotor system can result from a power turbine speed (N_f) signal failure. Such an overspeed will result in an immediate response of the overspeed system, bleeding the P3 signal from the fuel control. Rotor drag characteristics are now such that deceleration out of the overspeed region will occur quite rapidly. The gas generator will now oscillate as the rotor passes in and out of the overspeed region, with the main gear box overspeed switch controlling the P3 signal to the fuel control. At no time will the stator vane actuator primary speed switch effect operation since gas generator speed will be above the switch's cut-in point.

POWER TURBINE SPEED SIGNAL FAILURE WITH HIGH POWER. With an engine power output of more than 700 SHP, an overspeed cannot occur without a change in rotor collective pitch (power demand from the engine.) Engine response to a power turbine speed signal failure is independent of load, but the increase in power level is not sufficient to produce a destructive overspeed of the power turbine. Should collective pitch be decreased following such failure, Nf/Nr will accelerate to 110% causing the overspeed system to actuate. Increasing the collective after the overspeed system has actuated to a point where the engine output is again above 700 SHP will cause Nf/Nr to stabilize.

OVERSPEED SWITCH SYSTEM TEST SWITCH. An overspeed test switch, marked ENG-OVSP-TEST, is located on the overhead switch panel. The switch, having positions NO. 1, NORM, and NO. 2 is used to test the operation of the test overspeed switch and the primary switch. When checking the system during engine ground operation, with minimum collective pitch, placing the switch in NO. 1 position and advancing the engine speed selector to approximately 72 ±3 percent N_g will cause gas generator speed to oscillate around 72 ±3 percent. Use of the switch in the NO. 1 position bypasses the main rotor test circuit which is an integral part of the main gear box overspeed switch. With minimum collective pitch, placing the switch in the NO. 2 position and advancing the engine speed selector to obtain 100 percent rotor speed (100% N_r) causes the overspeed test switch to actuate the overspeed system at 97%. At this time it should be noted that gas generator speed (N_g), power turbine inlet temperature (T_5), rotor speed (N_r), and power turbine speed (N_f) will decrease until rotor speed drops below 97 percent, at which time the overspeed test switch will deactivate the system. After rotor speed drops below 97 percent, it should be noted that N_g will begin to increase until the rotor speed rises above 97 percent. Except for testing the system, the overspeed switch system test switch is kept in the NORM position.

IGNITION SYSTEM.

During engine start, the ignition system furnishes a spark to ignitor plugs which ignites the fuel-air mixture in the combustion chamber of the engine. The capacitor discharge type ignition unit, which operates on 28 volts dc from the start bus, fires the two ignitor plugs. The system is protected by a circuit breaker, marked START & IGN, under the general heading START BUS, which is located on the forward circuit breaker panel.

IGNITION SWITCH. The lever lock type ignition switch, marked IGN, with positions TEST, OFF, and NORM, is located on the overhead switch panel. When the ignition switch is placed in the NORM position, the starter switch is depressed, and the throttle limit switches are opened; current from the start bus will flow to the ignition unit. The TEST position is used to test the ignitors if an ignition malfunction is suspected or occurs. When the ignition switch is placed in the TEST position, current from the start bus flows directly to the ignition unit.

STARTER SYSTEM.

The starter system consists of a starter motor mounted on the front frame of the engine, a starter relay, and a starter switch. The starter motor is protected by a bulletnose cover. Two pulley limit switches must be closed by placing the engine speed selector (pilot's) and emergency throttle (pilot's) in the (CLOSED) position before the starter motor can be energized. When energized by current from the start bus, the starter relay closes, allowing current from the start bus to activate the starter motor. Once the starter relay is energized it remains energized until the starter button is released.

STARTER SWITCH. The starter switch is a push-button type momentary switch, located on the pilot's cyclic stick below the grip. When the starter switch is depressed, the starter motor is energized. Releasing the starter switch breaks the circuit to the starter motor.

ENGINE OIL SYSTEM.

The engine oil system is of the positive-displacement recirculating type system. The main points that are lubricated within the engine are as follows: The compressor rotor front bearing and the engine accessory drive gear components, the compressor rotor rear bearing, the gas generator turbine bearing, and the power turbine rotor bearings and the power turbine accessory drive gear components. The engine oil system components include an oil tank, located around the front frame, a combined oil and scavenge pump, an oil filter, a relief valve, a check valve, and an oil cooler.

ENGINE OIL TANK. A circular, oil tank, installed around the engine front frame, has a capacity of 2.5 gallons. An oil level dipstick gage, connected to the filler cap, located on the top-left side of the tank will indicate 2.5 gallons as FULL.

ENGINE OIL COOLER. Operation of the oil cooler is entirely automatic. The oil cooler is an oil-to-fuel heat exchanger with an associated oil bypass valve. The oil flow through the cooler depends upon oil temperature. At lower temperatures, the pressure differential across the cooler causes most of the oil to bypass the core of the cooler. At higher temperatures, the lower viscosity reduces the pressure differential, which closes the bypass valve and causes all of the oil to flow through the cooler.

ENGINE OIL SPECIFICATIONS AND GRADES. The useable types of oil for the engine are Specification MIL-L-7808D which is limited to use in temperatures above (–53.9°C) –65°F, and Esso Turbo oil 35, Texaco synthetic aircraft turbine oil 35, and MIL-L-23699 oil which are limited to use in temperatures above (-40°C) –40°F.

ENGINE ANTI-ICING SYSTEM.

The engine anti-icing system provides two methods of anti-icing. The engine air inlet duct anti-icing system protects the engine air inlet duct, and the engine component anti-icing system protects the starter fairing, inlet guide vanes, and two of the engine front frame struts.

ENGINE AIR-INLET ANTI-ICING SYSTEM. The engine air-inlet anti-icing system utilizes ac powered electrical heating elements, embedded within the duct material, to heat the engine air-inlet duct. A sensing element, also embedded in the duct material, senses the duct temperature for the automatic controller, which regulates the duct temperature within a specific range. The heating elements are cycled by the automatic controller at temperatures of (48.9°C) 120°F to (54.4°C) 130°F. The engine air-inlet anti-icing system should be turned on below 10°C (50°F) OAT. The engine air-inlet anti-icing system is powered by current from the ac essential bus, and is protected by a circuit breaker, marked ENG-INLET ANTI-ICE, located on the aft circuit breaker panel. The automatic controller utilizes both current from the ac essential bus, and current from the dc essential bus. The alternating current circuits of the automatic controller are protected by a circuit breaker, marked ANTI-ICE CONT, located on the forward circuit breaker panel. The direct current circuits of the automatic controller are protected by a circuit breaker, marked INLET, under the general heading ANTI-ICE, also located on the forward circuit breaker panel.

ENGINE COMPONENT ANTI-ICING SYSTEM. The engine component anti-icing system utilizes tenth stage compressor air to anti-ice the starter fairing, inlet guide vanes, and top and right struts of the front frame. The left and bottom struts of the front frame are continually heated by normally operating engine systems and do not require further anti-icing provisions. The compressor bleed air is controlled by a solenoid valve that is energized and de-energized through a relay. This relay is controlled by the engine anti-ice switch. In the event an electrical power failure occurs, the engine solenoid valve will be de-energized and opened, to provide continuous anti-icing. Since both the engine air-inlet and engine component anti-icing systems are actuated by the same switch, a caution light for indicating system failure has been provided only for the engine air-inlet anti-icing system. However, an additional advisory light is provided for the engine component anti-icing system that illuminates when the system is turned on or if the valve opens due to a failure resulting in an open circuit. The light will stay on until the system is turned off or the open circuit discrepancy is corrected. The engine component anti-icing system operates on current from the dc essential bus, and is protected by a circuit breaker, marked IGV, under the general heading ANTI-ICE, located on the forward circuit breaker panel.

Note

Continued operations at ground idle under known icing conditions should be avoided due to lack of sufficient air flow that is needed to maintain the engine components at the desired anti-icing temperatures.

ENGINE ANTI-ICE SWITCH. The engine anti-ice switch, marked ENG ANTI-ICE, with marked positions TEST, OFF, and ON, is located on the overhead switch panel. When the engine anti-ice switch is placed in the TEST position, the engine air-inlet anti-icing system caution light will come on, and remain on, until the automatic controller cycles the system. The caution light will then go out to indicate the system is operating properly. When the engine anti-ice switch is placed in the ON position, the automatic controller will be actuated to energize the engine air-inlet anti-icing system, and the engine solenoid valve will be de-energized to provide compressor bleed air for the engine component anti-icing system. The solenoid sensing relay will also be de-energized and cause the ENG IGV ANTI-ICE light, located on the advisory panel, to illuminate. When the engine anti-ice switch is placed in the OFF position, the engine air-inlet anti-icing system is de-energized. However, the engine solenoid valve of the component anti-icing system will be energized to the closed position, and the solenoid sensing relay will be energized causing the ENG IGV ANTI-ICE light on the caution panel to go out.

ENGINE AIR-INLET ANTI-ICING SYSTEM CAUTION LIGHT. The engine air-inlet anti-icing system caution light, marked ENG INLET ANTI-ICE, is located on the caution panel. The caution light will come on whenever the engine air-inlet anti-icing system has failed and/or the capability of the engine air inlet anti-icing system has been exceeded. The light is controlled by the actuation of the duct mounted thermal switch.

When the engine anti-ice switch is placed in the TEST position, the engine air-inlet anti-icing caution light will come on, until the automatic controller cycles the system, then go out to indicate the system is functioning properly. The engine air-inlet anti-icing system caution light operates on current from the dc essential bus and is protected by a circuit breaker, marked ANTI-ICE INLET, under the general heading ENGINE, located on the forward circuit breaker panel.

ENGINE COMPONENT ANTI-ICING SYSTEM ADVISORY LIGHT. A light, marked ENG IGV ANTI-ICE, located on the advisory panel, is illuminated as long as the engine anti-ice switch is in the ON position. When the engine anti-ice switch is placed in the OFF position, the advisory light will go out. The engine component anti-icing system advisory light operates on current from the dc essential bus and is protected by a circuit breaker, marked ANTI-ICE IGV, under the general heading ENGINE, located on the forward circuit breaker panel.

FUEL SYSTEM.

The fuel supply is carried in two single cell fuel tanks which are located below the cabin floor. Fuel is supplied to the engine from the forward tank only and an ejector type fuel transfer system automatically transfers fuel from the aft tank to the forward tank whenever the fuel booster pumps are operating. A collector unit in the forward tank contains two electrically operated fuel booster pumps which supply fuel under continuous pressure through the main fuel line to the engine driven fuel pump. A fuel ejector supply line connected to the main fuel line diverts fuel at booster pump pressure to two fuel ejector units in the forward tank. Fuel from the forward tank is drawn into the ejector units as a result of a pressure differential (venturi action) and is transferred into the collector unit to keep it full. An overflow valve on the collector unit permits excess fuel to flow back into the forward tank. A second fuel ejector supply line connected to the main fuel line diverts fuel to an ejector unit in the aft tank. Fuel from the aft tank is drawn into the ejector unit and transferred into the forward tank. Fuel transfer from the aft tank to the forward tank is at a rate which permits maximum fuel consumption. A float in the forward tank closes a valve in the transfer line when the forward tank is full to prevent overfilling the forward tank. When the fuel level in the forward tank is lowered, due to fuel consumption, the float valve will open and transfer of fuel will be resumed automatically. A check valve is installed in the line from the fuel pumps to the aft tank ejector. This check valve provides protection against flame-out due to dual fuel pump shut-off with the aft tank empty. As soon as pressure is negative in the fuel line due to suction by the engine pump, the check valve will move to its closed position, preventing suction of air from the aft tank.

FUEL SPECIFICATIONS AND GRADES.

The fuel system is compatible with the following fuels, which are acceptable for use in the T58-GE-8B engine:

CAUTION

JP-4 is the only fuel approved for operation at or below —20°F (—29°C).

MIL-H-5161E Grade I (JP-4 Referee)
MIL-J-5624E (JP-4 Regular)
Esso Referee Turbo Fuel 4
ASTM Type B Aircraft Turbine Fuel
Esso Turbo Fuel 4
Texaco JP-4
MIL-J-5161E Grade II (JP-5 Referee)
Mobil JP-5 (Referee)
MIL-J-5624E (JP-5 Regular)
Esso Turbo Fuel (Type 1A)
ASTM Type A Aircraft Turbine Fuel
Humble Oil Company Commercial Type A-1
Texaco K-40 Kerosene
Phillips Company Type T.F. Kerosene
Gulflite Turbo A
Texaco K-58 Kerosene
Aeroshell Turbine Fluid Type 640K
Aeroshell Turbine Fluid Type 650K
JP-1 Narrow Cut Kerosene
British Fuel D ENG.
Canadian Fuel 3-GP-23C (Type 1)
Canadian Fuel 3-GP-22C (Type 2)

WARNING

Insure that both engine fuel control and engine fuel flow divider have been adjusted properly for the fuel type in use. Adjustment procedure is described in HANDBOOK SERVICE INSTRUCTIONS T58-GE-8B, NAVAIR 02B-105AHB-2. When changing from JP-5 to JP-4 fuel and with the fuel control and flow divider not properly adjusted for the change in fuel, hot starts will occur. However, when changing from JP-4 to JP-5 fuel under the same conditions, cold hangups or slow acceleration will be encountered.

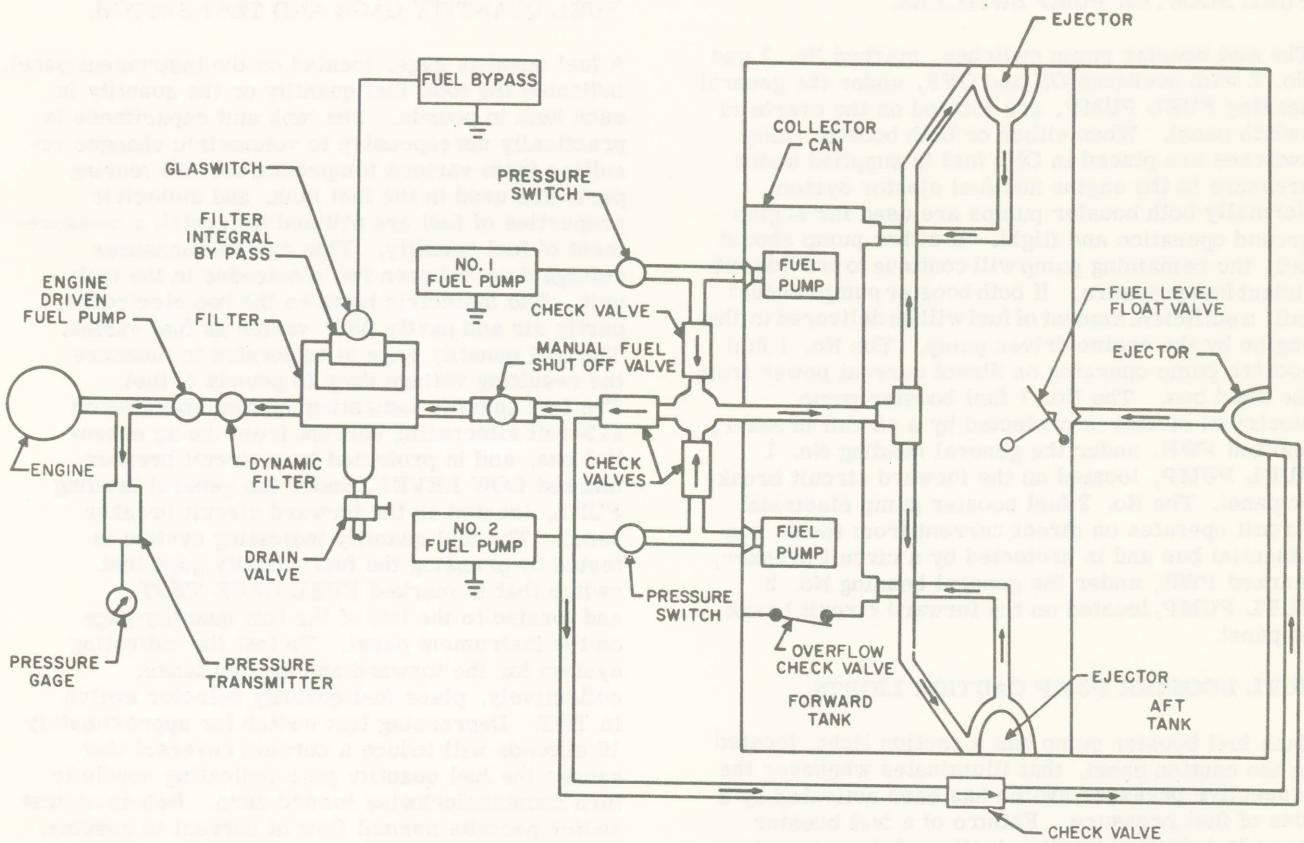


Figure 41.

FUEL QUANTITY DATA - U.S. GALLONS

TANK	TOTAL CAPACITY	UNUSABLE FUEL
Forward Tank and Collector Unit	187.0 GAL. 1193.0 LB	0.40 GAL. 2.50 LB
Aft Fuel Tank	138.0 GAL. 880.0 LB	0.67 GAL. 4.27 LB
TOTAL	325.0 GAL. 2073.0 LB	1.07 GAL. 6.77 LB

5 DEGREES NOSE-DOWN ATTITUDE, FUEL JP-4 6.38 LB/GAL. AT STANDARD TEMPERATURE.

FUEL TANKS.

The forward and aft, non-self-sealing bladder type fuel tanks are installed below the cabin floor in the water-tight lower fuselage section. The forward fuel tank components consist of a three U.S. gallon collector unit, containing No. 1 and No. 2 fuel booster pumps, and two fuel ejector units. The aft fuel tank has one ejector unit. Each tank has a filler unit, located on the left side of fuselage, and the forward fuel tank has an additional filler unit, located on the cabin floor, to enable the helicopter to be refueled while at rest on the water or from suitable containers during flight. A drain cock is located in the sump of the forward and aft tanks to permit individual draining of the tank on the ground. Each tank sump also is equipped with a poppet-drain cock to be used to drain any water that may have accumulated in fuel tank sump. Both tanks are vented by lines that extend through the side of the fuselage.

FUEL FIRE WALL SHUT-OFF VALVE AND HANDLE.

A manually operated fuel shut-off valve is located aft of engine fire wall and controls the flow of fuel through main fuel line from the tank to the engine. The valve is actuated by a T-shaped handle with marked positions, FUEL-ON (forward), FUEL-OFF (mid-position), and FIRE EXT ARMED (aft), located forward of the overhead switch panel. When T-handle is in FUEL ON, fuel is permitted to flow from the fuel tank to the engine. When the T-handle is in FUEL-OFF, the fuel fire wall shut-off valve is closed. When the T-handle is in FIRE EXT ARMED, the fuel fire wall shut-off valve is closed shutting off the flow of fuel to the engine. A microswitch in the FIRE EXT ARMED position arms the fire extinguisher circuit and energizes a solenoid with direct current from the dc essential bus which closes the engine shutters.

NOTE: The engine shut-down time is between 35 seconds and 60 seconds, if FUEL SHUT-OFF position is used to shut-down engine in lieu of the engine speed selector lever.

FUEL BOOSTER PUMP SWITCHES.

The fuel booster pump switches, marked No. 1 and No. 2 with positions ON and OFF, under the general heading FUEL PUMP, are located on the overhead switch panel. When either or both booster pump switches are placed in ON, fuel is supplied under pressure to the engine and fuel ejector system. Normally both booster pumps are used for engine ground operation and flight. If either pump should fail, the remaining pump will continue to provide sufficient fuel pressure. If both booster pumps should fail, a sufficient amount of fuel will be delivered to the engine by the engine driven pump. The No. 1 fuel booster pump operates on direct current power from the start bus. The No. 1 fuel booster pump electrical circuit is protected by a circuit breaker, marked PWR, under the general heading No. 1 FUEL PUMP, located on the forward circuit breaker panel. The No. 2 fuel booster pump electrical circuit operates on direct current from the dc non-essential bus and is protected by a circuit breaker, marked PWR, under the general heading No. 2 FUEL PUMP, located on the forward circuit breaker panel.

FUEL BOOSTER PUMP CAUTION LIGHTS.

Each fuel booster pump has a caution light, located on the caution panel, that illuminates whenever the respective pressure switch has been activated by a loss of fuel pressure. Failure of a fuel booster pump is indicated by illumination of its respective booster pump caution light. The No. 1 fuel booster pump caution light operates on direct current from the start bus and is protected by a circuit breaker, marked WARN LT, under the general heading NO. 1 FUEL PUMP, located on the forward circuit breaker panel. The No. 2 fuel booster pump caution light operates from the dc non-essential bus and is protected by a circuit breaker, marked WARN LT, under the general heading No. 2 FUEL PUMP, located on the forward circuit breaker panel.

FUEL FILTER BYPASS CAUTION LIGHT.

A fuel filter bypass caution light, located on the caution panel, illuminates whenever the airframe fuel filter has been clogged by foreign particles. In event the filter becomes clogged, a self-contained filter bypass valve will open and allow fuel to bypass the filter internally. A clogged or restricted filter is sensed by a differential pressure switch between the inlet and outlet ports of the filter and illuminates the caution light, indicating fuel is bypassing the filter. The fuel filter bypass circuit operates on direct current from the dc essential bus and is protected by a circuit breaker, marked FILTER BYPASS, under the general heading FUEL, located on the forward circuit breaker panel.

FUEL QUANTITY GAGE AND TEST SWITCH.

A fuel quantity gage, located on the instrument panel, indicates the total fuel quantity or the quantity in each tank in pounds. The tank unit capacitance is practically unresponsive to volumetric changes resulting from various temperatures. No moving parts are used in the fuel tank, and dielectric properties of fuel are utilized to furnish a measurement of fuel quantity. This system measures voltage drop between two electrodes in the tank unit. The dielectric between the two electrodes, partly air and partly fuel, varies as fuel varies, The fuel quantity gage is calibrated to measure the resulting voltage drop in pounds of fuel. The fuel quantity indicating system operates on 115-volt alternating current from the ac essential bus, and is protected by a circuit breaker, marked LOW LEVEL, under the general heading FUEL, located on the forward circuit breaker panel. The fuel quantity indicating system is tested by pressing the fuel quantity gage test switch that is marked FUEL GAGE TEST, and located to the left of the fuel quantity gage on the instrument panel. To test the indicating system for the forward and aft fuel tanks, collectively, place fuel quantity selector switch in TOT. Depressing test switch for approximately 10 seconds will induce a current reversal that causes the fuel quantity gage indicating needle to turn counterclockwise toward zero. Releasing test switch permits normal flow of current to resume, and should cause indicating needle to return to previous reading. Procedure for testing the indicating system of forward or aft fuel tank, individually, is the same, except that the fuel quantity selector switch is placed in FWD or AFT position respectively.

FUEL QUANTITY SELECTOR SWITCH.

A fuel quantity selector switch is located on the instrument panel. The switch is marked FUEL QTY SEL, and has positions, TOT, FWD, and AFT. When the selector switch is placed in TOT, and the fuel quantity gage will indicate total amount of fuel in both forward and aft fuel tanks. When the switch is placed in either FWD or AFT, the gage will indicate only amount of fuel in that specific tank. Upon completion of a fuel check, leave the switch in FWD.

FUEL LOW LEVEL CAUTION LIGHT.

A fuel low level caution light, marked FUEL LOW, is located on caution panel. The light is connected through a control unit to a sensing element, located in aft tank unit in forward fuel tank. The light goes on during flight at the normal attitude (5 degrees down) when approximately 237 to 269 pounds of JP-4 or 255 to 289 pounds of JP-5 (37 to 42

gallons) of fuel remaining. This remaining fuel is sufficient for approximately 30 minutes of flight at cruising power. The caution light operates on dc curent from the dc essential bus and is protected by a circuit breaker, marked LOW LEVEL, under the general heading FUEL, located on the forward circuit breaker panel.

TRANSMISSION SYSTEM.

The transmission system consists of three gear boxes (main, intermediate, and tail) and interconnecting shafting for the transmission of engine power to the rotor systems. The main gear box reduces engine rpm, supports and drives the main rotor, and furnishes a means of driving the tail rotor. An intermediate gear box changes the direction of the drive and shafting from the main gear box to the tail gear box. The tail gear box, in turn, drives the tail rotor.

MAIN GEAR BOX.

The main gear box, mounted above the cabin aft of the engine, reduces engine rpm to the main rotor through a five-stage reduction gear system at a ratio of 85.839 to 1. The main gear box also reduces engine rpm at a ratio of 12.274 to 1 for driving the tail rotor. A freewheeling unit, located at the engine input to the gear box, permits the main rotor to autorotate without engine drag, in event of engine failure or when rotor speed (N_r) increases above power turbine speed (N_f). When the engine is driving the main rotor shaft, the rollers in the freewheeling unit are forced by cam action to lock the freewheeling cam and the output gear. Power is then transmitted from the freewheeling output gear into the main gear box. When the engine is not driving the main rotor shaft, the rollers in the freewheeling unit remain in the roller retainer, disengaged from the freewheeling cam. This allows the main rotor shaft to rotate independently from the main drive shaft. An accessory section, located at the rear of the main gear box, drives the two alternating current generators, the primary and auxiliary hydraulic pumps, the main gear box oil pump, the torquemeter oil pump, and the rotor tachometer-generator.

MAXIMUM AND OVER TORQUE SENSING SYSTEM. The maximum and over torque sensing system provides a means of measuring an over 100 percent torque and maximum torque condition on the gear box. For a detailed description, refer to MAXIMUM AND OVER TORQUE SYSTEM in this section.

MAIN GEAR BOX CHIP DETECTOR CAUTION LIGHT. A transmission chip detector caution light, marked CHIP DETECTED, is located on the instrument panel. The light is connected to a magnetic chip detector in the main gear box. The caution light will give a visual indication that the chip detector has picked up and retained metallic particles or chips present in the oil. This could result in excessive wear and premature gear box failure. The light operates on 28 volts dc from the essential bus and is protected by a circuit breaker, marked CHIP DET, located on the forward circuit breaker panel.

INTERMEDIATE GEAR BOX.

The intermediate gear box, located at the junction of the tail cone and pylon, contains a bevel gear direct-drive system to transmit engine torque, received from the main gear box through the tail rotor drive shaft, to the pylon drive shaft.

TAIL ROTOR GEAR BOX.

The tail rotor gear box, located at the upper end of the tail rotor pylon, contains a bevel gear reduction-drive system to transmit engine torque to the tail rotor. The tail gear box also contains part of the tail rotor pitch change linkage which extends through the hollow horizontal output shaft to the tail rotor hub.

ROTOR BRAKE.

A rotor brake, mounted on the flange of the main gear box bevel gear input shaft, stops the rotation of the rotor system and prevents its rotation when the helicopter is parked. The rotor brake will bring the rotors to a dead stop from 96 percent (212 rpm) rotor speed in 20 seconds after setting the speed selector at the FLIGHT IDLE position. Unless emergency conditions prevail however, the rotor brake should not be applied until the rotor speed has decreased to approximately 48%.

CAUTION

Under normal conditions, the rotor should be allowed to coast down until almost stopped before the rotor brake is applied. Repeated application of the rotor brake at high rotor speeds may unduly stress the rotor brake disc and lead to its failure.

The rotor brake consists of a hydraulic cylinder and lever, an advisory light, hydraulic brake cylinders, and brake disc. The rotor brake hydraulic cylinder and lever, located on the windshield frame in the pilot's compartment, supplies the operating pressure (460 to 580 psi) for the system, making the system independently operated from the other hydraulic systems. A spring-loaded accumulator is charged with approximately 435 psi to prevent erratic hydraulic pressure surges during application of the brake, assuring evenly sustained pressure. The hydraulic cylinder is gravity fed from the auxiliary hydraulic reservoir. In the event of a hydraulic supply line break, the cylinder contains sufficient hydraulic fluid for operation of the system. The hydraulic brake cylinder is located on a support which is attached to the main gear box. The function of the cylinder is to force the brake pucks against the brake disc for decleration and restraint of rotor head. The brake disc, mounted on the flange of the input bevel gear, rotates between the brake cylinder pucks and receives the applied force of the pucks for containing the rotor head while it is not rotating and also for creating deceleration drag during rotation.

CAUTION

Since the helicopter is not equipped with a rotor clutch, the rotor brake prevents the rotor system from accelerating, prior to rotor engagement, during ground operations. Therefore, when operating the engine, with the rotor brake engaged, avoid advancing gas generator speed above 65 percent to avoid damage to the rotor brake.

ROTOR BRAKE LEVER. The rotor brake lever is connected directly to the rotor brake hydraulic cylinder on the pilot's compartment forward of the overhead switch panel. The rotor brake is applied by pulling down and forward on the lever. A spring-loaded lockpin, located on the forward outboard side of the cylinder, automatically locks the lever in the applied (forward) position after the pilot has positioned the lockpin handle in the horizontal position. The lockpin handle may be positioned before or after application of the rotor brake. To release the rotor brake, position the lockpin handle 90 degrees from the horizontal position into its slot and swing the lever aft and up against the bottom of the cylinder until it snaps into the off position detent. The lockpin may be rendered inoperative by leaving the handle in the 90 degree position. For normal shutdown, the rotor brake should be applied firmly by moving the rotor brake lever forward, toward the full on position. A rotor brake caution light, located on the caution panel, will illuminate when pressure is applied to the rotor brake.

ROTOR BRAKE CAUTION LIGHT. A rotor brake caution light, marked ROTOR BRAKE ON, is located on the instrument panel caution panel. When the lever is applied, a pressure switch energizes the electrical circuit and illuminates the light. The light operates on 28 volts dc from the essential bus and is protected by a circuit breaker, marked ROTOR BRAKE, located on the forward circuit breaker panel.

TRANSMISSION OIL SYSTEMS.

Each of the three transmission systems has its individual oil lubrication system. The main gear box is pressure-lubricated and the intermediate and tail gear boxes are splash-lubricated.

MAIN GEAR BOX OIL SYSTEM.

Pressure for lubricating the main gear box is supplied by a pump mounted on the gear box lower housing. Oil is pumped from the gear box sump through a strainer and filter to an oil cooler located aft of the main gear box. Cooling air enters the fairing through a screened intake and is forced through the oil cooler by a blower driven by belts and pulleys from the tail drive shaft. After passing through the oil cooler, the oil returns to the main gear box where it is sprayed onto the gears and bearings through jets built into the gear box castings. An oil filler tube is located on the left side of the main gear box and is accessible through the respective fairing. The oil level may be checked by a sight gage, located below the oil filler tube.

MAIN GEAR BOX OIL PRESSURE INDICATOR. The main gear box oil pressure indicator, marked XMSN OIL PRESS, is located in the center of the instrument panel. The dial is divided into 25 increments with each division representing 10 psi. The function of the indicator is to display the main gear box inlet oil pressure in pounds per square inch. The indicator is electrically connected to a pressure transmitter which senses a pressure, and converts the pressure to an electrical impulse to the indicator. The indicator operates on 26 volts ac from the essential bus and is protected by a circuit breaker, marked XMSN OIL PRESS, located on the forward circuit breaker panel.

MAIN GEAR BOX OIL PRESSURE CAUTION LIGHT. The main gear box oil pressure caution light, marked TRANS OIL PRESS, is located on the instrument panel caution panel. The light is connected to a pressure switch which receives pressure from a jet in the main gear box. When the oil pressure at the switch drops to approximately seven psi, the caution light illuminates. The light operates on 28 volts dc from the essential bus and is protected by a circuit breaker, marked XMSN LOW OIL PRESS, located on the forward circuit breaker panel.

MAIN GEAR BOX OIL TEMPERATURE INDICATOR. The main gear box oil temperature indicator, marked XMSN OIL TEMP, is located in the center of the instrument panel. The indicator dial has a range of —50 to 150°C and is graduated in increments of 10 °C each. The indicator operates on 28 volts dc from the essential bus and is protected by a circuit breaker, marked XMSN OIL TEMP, located on the forward circuit breaker panel.

MAIN GEAR BOX OIL SPECIFICATIONS AND GRADES. The useable types of lubricating oils are Texaco SATO oil 35 and Esso Turbo oil 35 for temperatures of (−34.4°C) −30°F to (121.1°C) 250°F, and MIL-L-23699 oil limited to use above (−34°C) −30°F.

INTERMEDIATE GEAR BOX OIL SYSTEM.

The intermediate gear box is splash-lubricated from a sump system. Internal spiral channels insure oil lubrication to all bearings. The oil filler plug is installed in the top of the output housing assembly. An oil level sight gage is located on the right side of the intermediate gear box.

TAIL GEAR BOX OIL SYSTEM.

The tail gear box is splash-lubricated from a sump system. Internal spiral channels insure oil lubrication to all bearings. A filler cap is located on top of the gear box, and an oil level sight gage is located on the aft side of the gear box.

ROTOR SYSTEMS.

The rotor systems consist of a main lifting main rotor system and an anti-torque tail rotor system. Both systems are driven by the engine through the transmission system and are controlled by the flight controls.

MAIN ROTOR SYSTEM.

The main rotor system consists of main rotor blades, main rotor assembly, and the linkage necessary to transmit control movement by the pilot to the blades. The main rotor assembly is mounted directly above the main gear box and is splined to main rotor drive shaft. The three aluminum alloy main rotor blades are hinged to the main rotor hub in such a manner that each blade is free to flap vertically, hunt horizontally, and change angle of attack. Each blade is equipped with a pressure integrity indicator located at the root end of each spar. The blades can be folded back from the attachment points at the sleeves of the main rotor hub. This is usually done when moving or parking in a small area. Anti-flapping restrainers limit upward movement of the blades about the flapping hinges, caused by wind when blades are stopped or turning at low rpm. When rotor rpm is increased to approximately 20 percent, centrifugal force automatically releases the anti-flapping restrainers. Droop stops attached to the vertical hinge limit the downward movement of the blades about the flapping hinges when blades are stopped or turning at low rpm. At rotor speeds of approximately 65 to 88 percent rotor speed, centrifugal force extends spring-loaded cams which release droop stops and allow increased downward flapping of the blades. When rotor rpm is increased, the blades are supported by the combination of centrifugal force and lift developed by the rotating blades. At rotor speeds of approximately 56 percent rotor speed and below, spring-loaded cams resist the centrifugal force developed and remain in the retracted position holding the droop stops in place. Dampers connected to each blade control movement of the blades about the vertical hinges as they rotate, to prevent shock to the blades when the rotor is started or stopped, and aid in prevention of ground resonance. The angle of attack of the blades is controlled by the main rotor flight control system which connects to the lower section of main rotor assembly. Control of main blades is accomplished through a star assembly consisting of a rotating star and a stationary star. The two stars are installed so that the upper star is rotated by the main rotor drive shaft and the lower star is held stationary. Both stars are tilted, raised, or lowered by a ball-ring and socket assembly which slides on the main rotor shaft by action of the flight control system. Arms on lower (stationary) star assembly are connected to the main rotor flight control system. A hydraulic flight control servo system, incorporated into the linkage of the main rotor control system, relieves pilot of flight loads.

PRESSURIZED MAIN ROTOR BLADES (BIM).

The helicopter may be equipped with main rotor blades of pressurized-spar type (BIM) blade inspection method. These blades can be readily identified by the presence of an air valve in the root end plate of blade and a cylindrical pressure indicator in back wall of the spar. The spar, which is hollow, is pressurized with nitrogen to approximately 10 psi at an ambient temperature of 18.3° to 23.9°C (65° to 75°F). If an unforeseen combination of events should occur, impairing the structural integrity of the spar, or if a seal should leak, nitrogen will escape. The cylinder will show red or black (depending on type indicator installed) when the pressure in the spar drops below the minimum allowable service pressure. On a serviceable blade, red or black (depending on type of indicator installed) will not be visible.

WARNING

If indicator shows any red or black color (depending on type indicator installed), blade must be checked immediately to determine the cause. This may be an indication of blade damage that is a flight hazard.

MAIN ROTOR BLADE FOLDING.

The main rotor blades are folded back parallel to the fuselage when mooring helicopter or parking it in a small area. The main rotor blades are positioned for folding by centering one blade over the tail cone. This blade is stowed by releasing the top hinge pin and lowering blade to a blade support installed on the tail cone. After loosening the sleeve lock and removing the upper hinge pin, the right blade is rotated 90 degrees (trailing edge up) and is folded down to the side of tail cone. The left blade sleeve lock is loosened, and the left blade rotated 180 degrees so that lower hinge pin is on top. Then the lower hinge pin is removed, the blade is rotated 90 degrees (trailing edge up), and folded down to the side of tail cone. The blades are secured in the folded position by blade folding pockets which are hooked to each side of the tail cone.

TAIL ROTOR SYSTEM.

The tail rotor system consists of two variable pitch, all-metal blades and tail rotor hub. The tail rotor hub is splined to the tail gear box drive shaft which transmits engine torque to the tail rotor hub and blades. The blade pitch-changing mechanism is contained inside tail rotor drive shaft and is connected to the tail rotor flight control system.

NOTE: The tail rotor counterweight is rigged to provide a stable heading in a hover with auxiliary servo off and feet off pedals.

INSTRUMENTS.

All instruments shown in figure 42 except the power turbine tachometer, the gas generator tachometer,

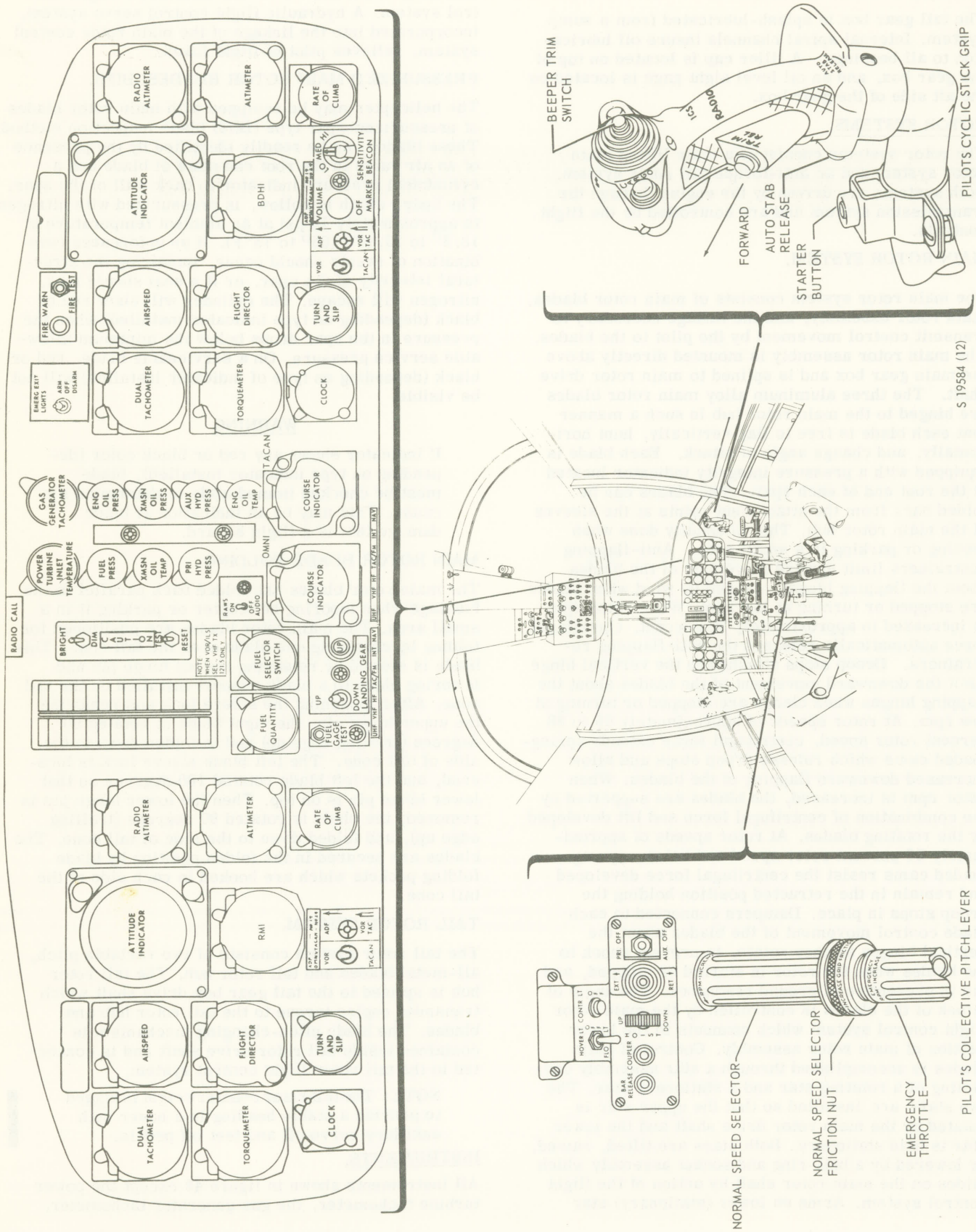

RADIO ALTIMETER
ALTIMETER
RATE OF CLIMB
ATTITUDE INDICATOR
BDHI
AIRSPEED
FLIGHT DIRECTOR
TURN AND SLIP
DUAL TACHOMETER
TORQUEMETER
CLOCK
FIRE WARN
FIRE TEST
EMERG EXIT LIGHTS
ARM OFF DISARM
TACAN
COURSE INDICATOR
GAS GENERATOR TACHOMETER
ENG OIL PRESS
XMSN OIL PRESS
AUX HYD PRESS
ENG OIL TEMP
POWER TURBINE INLET TEMPERATURE
FUEL PRESS
XMSN OIL TEMP
PRI HYD PRESS
OMNI
COURSE INDICATOR
RADIO CALL
BRIGHT
DIM
CAUTION
TEST
RESET
RMI
FUEL SELECTOR SWITCH
FUEL QUANTITY
UP
DOWN
LANDING GEAR
BEEPER TRIM SWITCH
RADIO
TRIM REL
FORWARD
AUTO STAB RELEASE
STARTER BUTTON
PILOTS CYCLIC STICK GRIP
S 19584 (12)
PRI OFF
AUX OFF
EXT
RET
NORMAL SPEED SELECTOR
NORMAL SPEED SELECTOR FRICTION NUT
EMERGENCY THROTTLE
PILOT'S COLLECTIVE PITCH LEVER

Figure 42.

power turbine inlet temperature gage, standby compass, free-air temperature gage, clock, and instruments included in pilot-static system are electrically operated by ac and dc power and protected by circuit breakers, located on forward circuit breaker panel.

STANDBY COMPASS.

A magnetic standby compass is mounted on the windshield center support. The compass indicates helicopter heading in relation to magnetic north pole. Its dial is graduated with cardinal headings indicated by enlarged letters with subordinate headings numerically indicated in 30-degree increments each, with finer linear graduations of 5 degrees each. A compass correction card is provided so that accurate compensated compass readings may be utilized.

FREE-AIR TEMPERATURE GAGE.

A bimetallic free-air temperature gage is located in the center of the windshield. It indicates temperatures from -70° to $+50^{O}$C in increments of 2 degrees each.

CLOCK.

An eight-day, elapsed-time, 12-hour clock is installed on pilot's side of instrument panel. On helicopters CGNOS 1421 and subsequent and on helicopters modified by HH-52A Helicopter Change No. 40, a second eight day, elapsed-time clock is installed on the copilot's side of the instrument panel. The control knob for the elapsed-time mechanism is located in upper right corner. Successive depressions of this knob start and stop the sweep second and totalizer hands. The hands will return to starting position when the knob is depressed to stop elapsed-time operation.

PITOT STATIC SYSTEM.

An electrically heated pitot tube is located on the right side of fuselage above pilot's compartment. The static ports, located on the left and right-hand sides of fuselage, are connected through tubing to the pilot's and copilot's vertical velocity indicators and the altimeters. The pitot and static ports are connected through tubing to airspeed indicators. A switch, marked PITOT HEAT, with positions ON and OFF, is located on the overhead switch panel. When the switch is placed in ON, the pitot head is electrically heated to prevent formation of ice on or within tube. Turning the heater on also illuminates a PITOT HEAT ON light on caution panel to indicate that head is being heated. The pitot heater operates on 28-volts dc from the essential bus and is protected by a circuit breaker, marked PITOT HEAT, located on forward circuit breaker panel.

TURN-AND-SLIP INDICATORS.

Two turn-and-slip indicators are installed on the instrument panel, one in front of the pilot and one in front of copilot. The indicators give a visual indication of helicopters rate-of-turn and balanced flight. The gyros of the indicators operate on 28-volts dc from essential bus and are protected by circuit breakers, marked TURN & SLIP, PILOT - COPILOT, located on forward circuit breaker panel.

ATTITUDE INDICATORS.

Two attitude indicators installed on instrument panel, one in front of the pilot and one in front of copilot, give a visual indication of helicopter's flight attitude. The indicator face consists of a stationary miniature airplane representing the helicopter, a bank angle scale, bank index, and a moving two-colored sphere with a distinct white horizon line dividing the two colors, white above, black below. A power warning flag, marked OFF, appears in the face of the indicator when the indicator is inoperative. If indicator becomes unreliable due to line voltage difference or drop, the failure detector also causes OFF signal to appear from behind the drop-out mask. In addition to this signal appearing, a GYRO ERECT light, located on caution panel, illuminates simultaneously with OFF signal of the pilot's indicator only, providing a duplicate indication. A circuit breaker, located on forward circuit breaker panel, marked GYRO ERECT, protects the light circuitry. Two trim adjustment knobs are located on the front of the attitude indicators, one at upper right of panel for adjusting roll, and the other at the lower right of panel for adjusting pitch. The roll trim knob adjusts the bank index position from 0 to 20 degrees, right and left bank. The pitch trim knob rotates the sphere to deflect the horizon line upward when pitch trim knob is rotated clockwise from the zero pitch trim adjustment white dot, to indicate between 0 and 20-degrees dive. The sphere may be rotated downward when pitch trim knob is rotated counterclockwise from the zero pitch trim adjustment white dot, to indicate between 0 to 10 degrees climb. The pilot's attitude indicator operates on ac current supplied by the No. 2 generator through circuit breakers, marked PILOTS VGI, NO. 1 GEN, and NO. 2 GEN, located on forward circuit breaker panel. The copilot's attitude indicator operates on ac current supplied by the No. 1 generator through circuit breakers marked COPILOTS VGI, also located on forward circuit breaker panel. Should No. 2 generator fail, the pilot's attitude indicator is automatically transferred to No. 1 generator.

MA-1 DIRECTIONAL GYRO COMPASS SYSTEM.

The MA-1 directional gyro compass system provides stabilized compass indications by combining the advantages of the remote indicating magnetic compass with the gyro compass. The oscillations of the magnetic compass and the drift error of directional gyro are eliminated when operating as a gyro-magnetic compass and an accurate stabilized magnetic heading is indicated. In magnetically unreliable regions, such as encountered in northern latitudes, the gyro may be unslaved from the compass system to act as a free directional gyro. The system consists of a magnetic flux valve, located in the tail cone, a directional gyro, a directional gyro amplifier, located on the integrated radio rack, and a control panel and ACKNOWLEDGE switch on the overhead radio console. Compass headings are indicated by the rotating azimuth card on the radio magnetic indicators, located on instrument panel. The system operates on alternating and direct current, and is protected by circuit breakers, COMPASS

and COMP SLAVE, located on the forward circuit breaker panel. In addition to providing stabilized magnetic headings, the system supplies directional signals to the automatic stabilization system.

MA-1 DIRECTIONAL GYRO COMPASS CONTROL PANEL. The MA-1 directional gyro compass control panel, located on the overhead radio console, contains all the controls for operation of the directional gyro compass system. The mode-of-operation switch on the compass control panel has three marked positions: FREE N. LAT, SLAVED, and FREE S. LAT. When the switch is placed in either of the FREE positions, the system will function as a free directional gyro with either north or south latitude corrections for the drift effect of the rotation of the earth. When the switch is placed in the SLAVED position, the directional gyro is slaved to the magnetic compass heading and the rotating azimuth card on the course indicators indicate stabilized magnetic headings. To insure slaving of the compass system, a caution light ACKNOWLEDGE switch is incorporated so that the caution light, marked SLAVE COMPASS, may be turned off when the system is slaved. This switch is located on a panel, marked SLAVE COMPASS CAUTION LT, above the compass control panel on the overhead radio panel. The synchronizing indicator is a white pointer visible through a window, located directly forward of the mode-of-operation switch. When the pointer is in line with the white arrow on the control panel, the system is in synchronization. A red flag on the synchronizing indicator appears whenever electrical power to the system is turned off or has failed. Synchronization is obtained by pulling out the heading set knob, marked PULL TO SET, and rotating it until the pointer of the synchronizing indicator is in line with the arrow.

CAUTION

Two settings of the heading-set knob will cause the synchronizing indicator to line up with the arrow. One is correct and the other will result in an unstable 180-degree ambiguity. The correct setting can be recognized by the relationship between the direction that the heading-set knob is turned and the direction of movement of the synchronizing indicator. When the heading-set knob is turned in a clockwise direction, the synchronizing indicator should approach the arrow from left to right, and when the heading-set knob is turned counterclockwise, the synchronizing indicator approaches the arrow from right to left.

One method of insuring correct synchronization and preventing any possibility of the unstable 180-degree ambiguity is to rotate the heading-set knob in a clockwise direction until the synchronizing indicator moves from left to right. After the indicator moves from left to right, the system is synchronized by turning the heading-set knob until the synchronizing indicator lines up with the arrow. The synchronizing indicator continues to provide a check on the slaving operation during flight; however, the pointer oscillates about the arrow. When the system is being used as a free gyro, the mode-of-operation switch is set to either FREE N. LAT or FREE S. LAT, and the latitude is set on the latitude compensation control, marked SET TO LAT, to compensate for the drift of the gyro due to the rotation of the earth. The heading-set knob is rotated to set up any desired heading on the rotating azimuth card on the course indicators. When the helicopter is being flown in a northerly or southerly direction, the latitude compensation control should be set periodically to the latitude at which the helicopter is flying.

SLAVED GYRO OPERATION.

1. Mode-of-operation switch – SLAVED.
2. Heading-set knob – Synchronize gyro and magnetic heading by pulling knob and rotating until synchronizing indicator is centered.

FREE GYRO OPERATION.

1. Mode-of-operation switch – FREE N. LAT or FREE S. LAT, as required.
2. Latitude compensator control – Set to degree of latitude.
3. Heading control knob – Set to desired heading.

NAVIGATION FLIGHT DIRECTOR INDICATOR. The navigation flight director indicator allows the pilot and/or copilot to visually monitor composite information from ASE and radio sets, GSA-8A and NVA-22A. The navigation flight director indicator has four modes of operation that are determined by the position of the mode selector knob. The mode selector knob is marked with the letters A, T, V, and G to identify modes. The pilot and copilot can monitor the same mode or any combinaton of modes by placing their respective mode selector knobs in either the A, T, V, or G position. A mode indicator window in the upper right quadrant of the face indicates the mode selected by displaying the letters ASE, TAC, VOR, or GVR. With ASE engaged and the mode selector knob in the A position (ASE visible in mode indicator window), the navigation flight director indicator monitors the output signals from the pitch, roll, and yaw ASE channels. Each output signal represents the amount of differential current flow to the servo valve in a particular channel. The warning flags, marked OFF, disappear when ASE is engaged. During the ASE mode of operation, all meter

movements are used except the vertical pointer for the collective channel, which is not installed in the HH-52A. The horizontal bar monitors the signal output from the pitch channel and indicates forward or aft displacement from the helicopter's selected attitude. The vertical bar monitors the signal output from the roll channel and indicates left or right displacement from the helicopter's selected attitude. The yaw pointer monitors the signal output from the yaw channel, and indicates left or right displacement from the helicopter's selected direction. All ASE signal inputs to the navigation flight director indicator are routed through the channel monitor control panel. Power for warning flag operation is supplied from the AUTO STAB circuit breaker through the ASE ENG button. The warning flags are at the top and right center of the face and indicate in black letters when the navigation flight director indicator is operating or is turned off for a particular mode of operation. The navigation flight director indicator has four meter movements, consisting of two bars and two pointers. The horizontal bar deflects up and down along reference marks on the vertical axis. The vertical bar deflects left and right along reference marks on the horizontal axis. The horizontal and vertical reference marks intersect and form a cross within a circle. This intersection point is the center or null of the horizontal and vertical bars. The vertical pointer remains stationary in all modes. The yaw pointer deflects left and right along reference marks which are perpendicular to the horizontal reference edge. The bar reference marks (divisions) are spaced to equal zero, 25, 50, 75, and 100 percent of full scale deflection in either direction. The pointer reference marks (divisions) are spaced to equal zero, 25, 50, 75, and 100 percent of full scale deflection in either direction. The T (TAC) and G (GVR) modes are not utilized in this particular installation, but for future helicopters may be used for TACAN and doppler monitoring. With radio set, AN/ARC-84, turned to a VOR frequency and the mode selector knob in the V (VOR) position, the navigation flight director indicator monitors the lateral deviation from the course selected on the course indicator (ID-387/ARN) relative to an omni-directional range source. The warning flag disappears when the radio is turned on and the bearing signal received is reliable. During the VOR mode of operation, only the vertical bar is used for monitoring purposes. The navigation flight director indicator will not indicate if the lateral position deviation from a selected course is a bearing to or from an omni-directional range source. This information is received from the course indicator. Power for the vertical bar warning flag during VOR operations is supplied through the AN/ARC-84 radio set. Exact bearing information is available on the course indicator, ID-387/ARN, which is connected in parallel with the navigation flight director indicator. When the AN/ARC-84 radio set is used in the localizer mode and the selector knob is in the V position, the horizontal bar on the indicator provides a monitoring capability of vertical deviation from the selected glide slope. Exact glide slope information can be obtained from the course indicator. Power for the horizontal bar warning flag is supplied through the same radio set as for the vertical bar.

COURSE INDICATOR (ID-387/ARN)

The course indicator, ID-387/ARN, located in the center of the instrument panel, consists of a knob marked SET in the lower left corner; a marker beacon light marked PRESS-TO-TEST and DIM in the upper right corner; a digital course selector and vertical bar marked COURSE; a horizontal bar marked GLIDE SLOPE; a TO-FROM indicator in the upper left corner; and a drift angle pointer and scales in the center of the instrument. The set knob is used to set a desired omni course in the course window. This knob has no effect on vertical bar movement when operating in the localizer mode. The TO-FROM indicator will show whether the selected course will take the helicopter to or from the station. The TO-FROM indicator is inoperative when operating in the localizer mode. The vertical bar indicates lateral deviation from a selected omni or localizer course. The horizontal bar indicates vertical deviation from a glide slope. The drift angle pointer and scales will show the drift angle on the nose or tail of the helicopter relative to a selected omni course. This feature may also be used during localizer tracking by placing the inbound course on the course selector. The marker beacon light will illuminate where an appropriate signal is received by the MKA-23A marker beacon system. The light may be dimmed as desired by rotating the housing. Two red warning flags, marked OFF, will appear in the face of the instrument whenever signals are unreliable or the equipment malfunctions.

RADIO MAGNETIC INDICATOR (ID-250/ARN).

The radio magnetic indicator, ID-250/ARN, marked RADIO MAGNETIC INDICATOR, consists of a rotating compass card numerically marked in 30-degree increments and linear markings in 2-degree increments, a fixed index for the compass card at the top of the indicator, a single-barred pointer, numbered 1, and a double-barred pointer, numbered 2. The compass card, coupled to the MA-1 compass system, indicates the magnetic heading of the helicopter under the fixed index. The single-barred pointer indicates the magnetic bearing to the LF transmitting station. The double-barred pointer

indicates the magnetic bearing to a VOR station. Two indicators are located on the instrument panel, one in front of the pilot and the other in front of the copilot.

CAUTION PANEL.

The caution panel, located to the left center of the instrument panel, provides a visual indication of failure or unsafe conditions of certain critical equipment in the helicopter. The caution panel contains placard-type amber caution lights, each having its own operating circuit, to indicate that a particular failure or unsafe condition is present in the helicopter. If either of these conditions occur in any of the systems, the caution light for that particular condition remains on until corrective action has been taken to rectify the fault. A master light, marked CAUTION, is located on a switch panel adjacent to the caution panel. The switches, located on this panel, are marked BRIGHT - DIM and TEST - RESET. This master light illuminates when any of the caution panel lights are energized by a malfunction and remains on until the malfunction is corrected, or until de-energized by the pilot. Placing the switch in the RESET position de-energizes the master light, permitting the indication of a second malfunction if one should occur while the first is still present. Actuating the switch, marked TEST, simultaneously tests all the caution and advisory panel lights. This test circuit is protected by a circuit breaker, marked WARN LIGHTS TEST, located on the forward circuit breaker panel. The circuit receives its power from the dc essential bus. An additional circuit breaker, marked CAUTION PANEL, protects the panel circuitry and is located on the forward circuit breaker panel.

NOTE: Bright dim switch also dims indicator light in controllable landing light master switch.

CAUTION PANEL LIGHTS. The following placard type lights are contained on the caution panel: NO. 1 GENERATOR, NO. 2 GENERATOR, NO. 1 RECTIFIER, NO. 2 RECTIFIER, FUEL LOW, FUEL BYPASS, PRI HYD PRESS, AUX HYD PRESS, XMSN OIL PRESS, ENG INLET ANTI-ICE, CHIP DETECTED, NO. 1 FUEL PUMP, NO. 2 FUEL PUMP, ROTOR BRAKE, GYRO EREC, IFF, ASE OFF, SLING OPEN SLAVE COMPASS, HEATER HOT, and RAWS OFF on helicopters equipped with audio warning systems.

ADVISORY PANEL.

The advisory panel is located immediately below the caution panel. The advisory panel provides a visual indication of certain operating conditions that exist in flight or while on the ground. The advisory panel contains placard-type green advisory lights, each having its own operating circuit, to indicate that a particular system is in operation or an unsafe flight condition exists. When a system is operating or an unsafe flight condition exists, the advisory light for that particular system or condition lights and remains on until the system is turned off or the unsafe flight condition is corrected.

ADVISORY PANEL LIGHTS. The following placard type lights are contained on the advisory panel: EXT POWER, ENG IGV ANTI-ICE, PARKING BRAKE, PITOT HEAT, and MONITOR AMMETER.

ELECTRICAL POWER SUPPLY SYSTEMS.

Electrical power is supplied by a 115/200-volt alternating current system and a 28-volt direct current power supply system. The primary system is the ac system. Direct current is obtained by rectifying alternating current or from the battery.

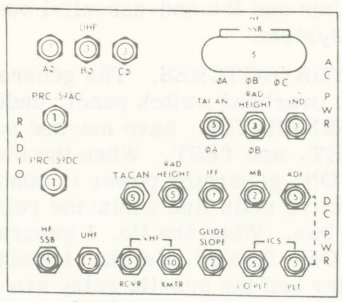
ALTERNATING CURRENT SUPPLY SYSTEM.

Two ac generators are the primary source of power for the electrical supply system. Other sources are the dc driven ground inverter and an ac external power receptacle. (See figures 43 and 44.)

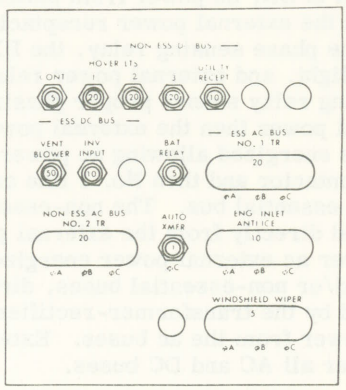
GENERATORS. The two brushless 10KVA, 115/200-volt, 400 cycle three-phase generators are mounted on, and driven by, the accessory drive section of the main gear box. Each generator has its own supervisory voltage regulator panel and each generator maintains separate loads. The supervisory-voltage regulator panels provide voltage regulation, as well as over voltage, undervoltage, ground or line-to-line faults and under frequency protection. The NO. 1 generator supplies power to the AC essential bus through a line contactor, and the NO. 2 generator supplies power to the AC non-essential bus through a line contactor. The operation of each generator is controlled by a switch in the pilot's compartment. Failure of either generator is indicated by warning lights, marked NO. 1 GENERATOR and NO. 2 GENERATOR, on the caution panel. Both generators will continue to generate power during autorotation.

AC EXTERNAL POWER RECEPTACLE. The 115-volt external power receptacle is located on the right side of the fuselage aft of the cabin door. External power is

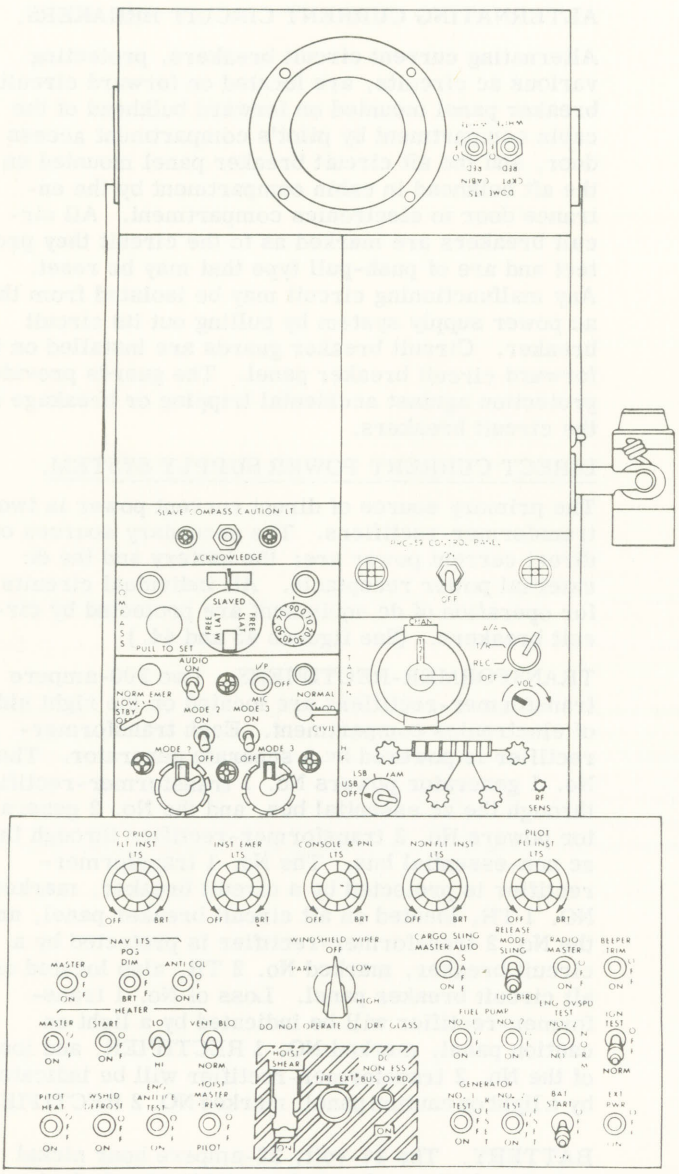
GROUND INVERTER. The 100 VA ground inverter, located in the electronics compartment, is powered by the 28-volt dc essential bus, and supplies power to the autotransformer. The autotransformer steps the inverter voltage down to 26 volts for operation of the engine oil, transmission oil, and hydraulic servo pressure gages, fuel pressure and torque sensor. The ground inverter is automatically energized whenever the dc essential bus is energized and the ac essential bus is not energized. Whenever the ac essential bus is energized, a relay is actuated that disconnects the ground inverter from the dc power source and connects the autotransformer to the ac essential bus. The ground inverter is protected by a circuit breaker, marked INV INPUT, located on the aft circuit breaker panel. The autotransformer is protected by a circuit breaker, marked AUTO XFMR, located on the forward circuit breaker panel.



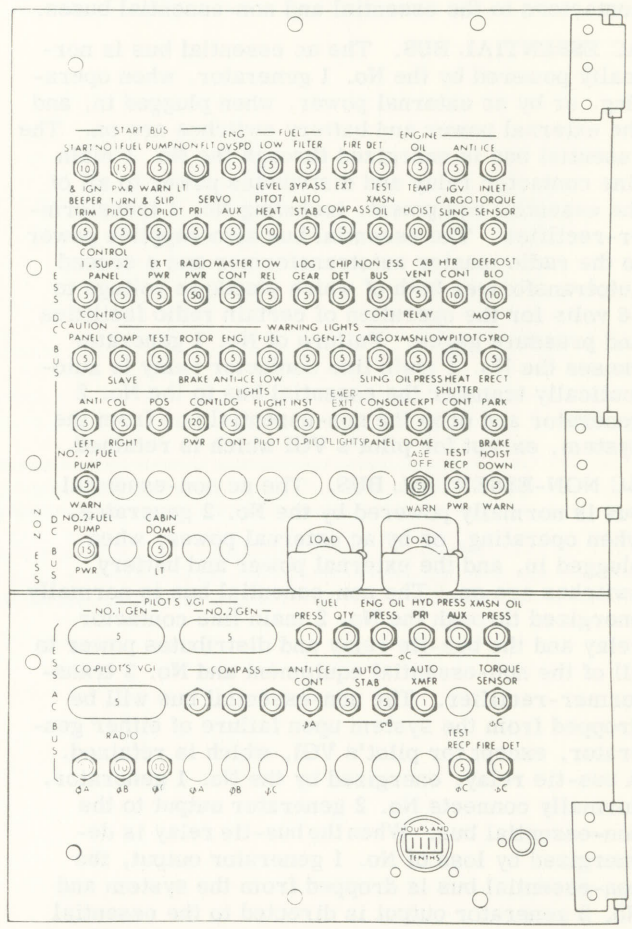
RADIO CIRCUIT BREAKER PANEL



AFT CIRCUIT BREAKER PANEL



OVERHEAD SWITCH, RADIO, AND DOME LIGHT PANEL



FORWARD CIRCUIT BREAKER PANEL

S 19585 (12)

Figure 43.

controlled by a switch, located on overhead switch panel with marked positions, ON and OFF, under general heading EXT PWR, and through a circuit breaker, marked EXT PWR, located on forward circuit breaker panel. When the external power switch is placed in ON, dc power from battery is applied through the external power receptacle (if connected) to the phase sensing relay, the EXT PWR advisory light, and external power relay. If the phase sensing relay senses proper phasing of applied external power then the external power relay will become energized allowing ac power through to No. 2 line contactor and then No. 1 line contactor to energize the essential bus. The non-essential bus is energized directly from the external power relay. Whenever ac external power energizes the ac essential and/or non-essential buses, direct current is supplied by the transformer-rectifiers which also receive power from the ac buses. External AC power will power all AC and DC buses.

ALTERNATING CURRENT DISTRIBUTION.

Power for operation of the alternating current electrical equipment is distributed through voltage regulators and supervisory panels that provide control and protection of the system, then through line contactors to the essential and non-essential buses.

AC ESSENTIAL BUS. The ac essential bus is normally powered by the No. 1 generator, when operating, or by ac external power, when plugged in, and the external power and battery switches are on. The essential bus is energized through the No. 1 main line contactor relay and distributes power to all of the essential equipment, including No. 1 transformer-rectifier. The essential bus also supplies power to the radio master autotransformer and a second autotransformer both of which stepdown voltage to 26 volts for the operation of certain radio facilities and pressure gages. Failure of No. 1 generator causes the No. 1 main line contactor relay to automatically transfer the essential bus to the No. 2 generator and drop the non-essential bus from the system, except for pilot's VGI which is retained.

AC NON-ESSENTIAL BUS. The ac non-essential bus is normally powered by the No. 2 generator, when operating, or by ac external power, when plugged in, and the external power and battery switches are on. The non-essential bus is normally energized through the No. 2 main line contactor relay and the bus-tie relay and distributes power to all of the non-essential equipment and No. 2 transformer-rectifier. The non-essential bus will be dropped from the system upon failure of either generator, except for pilot's VGI, which is retained. A bus-tie relay, energized by the No. 1 generator, normally connects No. 2 generator output to the non-essential bus. When the bus-tie relay is de-energized by loss of No. 1 generator output, the non-essential bus is dropped from the system and No. 2 generator output is directed to the essential bus. When the bus-tie relay is energized by No. 1 generator output, and the No. 2 generator is inoperative, No. 1 main line contactor relay insures that No. 1 generator output is directed only to the essential bus and the non-essential bus is dropped from the system.

GENERATOR SWITCHES. The generator switches, located on overhead switch panel, under general heading GENERATOR, have marked positions ON, OFF RESET, and TEST. When the switches are placed in ON, generator power is connected through the respective main line contactor relay to the appropriate bus. When the No. 1 generator switch is placed in OFF RESET, the No. 1 main line contactor relay and the bus-tie relay are de-energized. When the No. 2 generator switch is placed in OFF RESET, only the No. 2 main line contactor relay is de-energized. The TEST position of the switches is to be utilized by ground personnel when performing maintenance checks.

ALTERNATING CURRENT CIRCUIT BREAKERS.

Alternating current circuit breakers, protecting various ac circuits, are located on forward circuit breaker panel mounted on forward bulkhead of the cabin compartment by pilot's compartment access door, and the aft circuit breaker panel mounted on the aft bulkhead in cabin compartment by the entrance door to electronics compartment. All circuit breakers are marked as to the circuit they protect and are of push-pull type that may be reset. Any malfunctioning circuit may be isolated from the ac power supply system by pulling out its circuit breaker. Circuit breaker guards are installed on the forward circuit breaker panel. The guards provide protection against accidental tripping or breakage of the circuit breakers.

DIRECT CURRENT POWER SUPPLY SYSTEM.

The primary source of direct current power is two transformer-rectifiers. The secondary sources of direct current power are: the battery and the dc external power receptacle. All individual circuits for operation of dc equipment are protected by circuit breakers. (See figures 43 and 44.)

TRANSFORMER-RECTIFIERS. Two 200-ampere transformer-rectifiers are located on the right side of electronics compartment. Each transformer-rectifier is powered by a separate generator. The No. 1 generator powers No. 1 transformer-rectifier through the ac essential bus, and the No. 2 generator powers No. 2 transformer-rectifier through the ac non-essential bus. The No. 1 transformer-rectifier is protected by a circuit breaker, marked NO. 1 TR, located on aft circuit breaker panel, and the No. 2 transformer-rectifier is protected by a circuit breaker, marked No. 2 TR, also located on aft circuit breaker panel. Loss of No. 1 transformer-rectifier will be indicated by a light on caution panel, marked NO. 1 RECTIFIER, and loss of the No. 2 transformer-rectifier will be indicated by a light on caution panel, marked NO. 2 RECTIFIER.

BATTERY. The 24-volt, 22-ampere hour nickel cadmium battery, located on right side of electronics compartment floor, is accessible from inside helicopter for maintenance. Battery power is used for limited ground operations, including starting of the

engine, when no external power is available; and as an emergency source of power in event of failure of both generators and/or transformer-rectifiers.

DC EXTERNAL POWER RECEPTACLE. The 28-volt external power receptacle is located on right side of fuselage aft of cabin door. External power is controlled by a switch, located on overhead switch panel, with marked positions ON and OFF, under general heading EXT PWR, and through a circuit breaker, marked EXT PWR, located on forward circuit breaker panel by the pilot's compartment entrance door. The external power switch must be in ON to utilize an external power source connected to the external power receptacle. When external power energizes the external power relay, a light marked EXT PWR, located on caution panel, illuminates. The external power relay also serves to keep the external power receptacle from being energized when it is not in use. External power is supplied through the start bus to the essential and non-essential buses. In other words, external DC power will energize all DC buses.

NOTE: External power will not be supplied to the dc non-essential bus unless non-essential bus recovery switch is in ON.

DIRECT CURRENT DISTRIBUTION.

Power for operation of direct current electrical equipment is distributed through reverse current cut-out relays to the dc essential, non-essential, and start buses.

DC ESSENTIAL BUS. The dc essential bus supplies power for operation of all equipment necessary for safety of flight and limited mission accomplishment. The dc essential bus is powered by the transformer-rectifiers by external power when external power switch is in ON or by battery when battery switch is in ON. The dc essential bus will be energized regardless of the failure of any one transformer-rectifier. An essential bus relay is provided to disconnect essential bus loads from the dc system, when battery switch is placed in START, to insure maximum utilization of available battery power. The essential bus relay connects the essential bus loads to the dc system whenever battery switch is out of the start position. During normal operation, the start bus becomes a part of the dc essential bus load.

DC NON-ESSENTIAL BUS. The dc non-essential bus supplies power for operation of equipment not essential for safety of flight or limited mission accomplishment. The non-essential bus is powered by the transformer-rectifiers, when both are operating. Loss of power from either TR will cause the non-essential DC bus loads to be dropped. The non-essential DC bus may be recovered in this event by use of the non-essential bus override switch. When this switch is utilized, a green light on the caution panel marked Monitor Ammeter will illuminate. The DC non-essential bus is also energized when using external AC or DC power. It may also be powered by the battery alone if both Battery and non-essential bus override switches are in the ON position.

START BUS. The start bus supplies power to the No. 1 fuel pump, No. 1 fuel pump caution light, transformer-rectifier caution lights, non-flight instrument lights, starter and ignition systems when battery switch is in START. During normal operation, the start bus becomes a part of the essential bus load. The start bus is powered by both or either transformer-rectifier, by external power when plugged in and the external power switch is in ON, and by the battery, when the battery switch is in either START or ON.

BATTERY SWITCH. The battery switch, located on overhead switch console, has marked positions

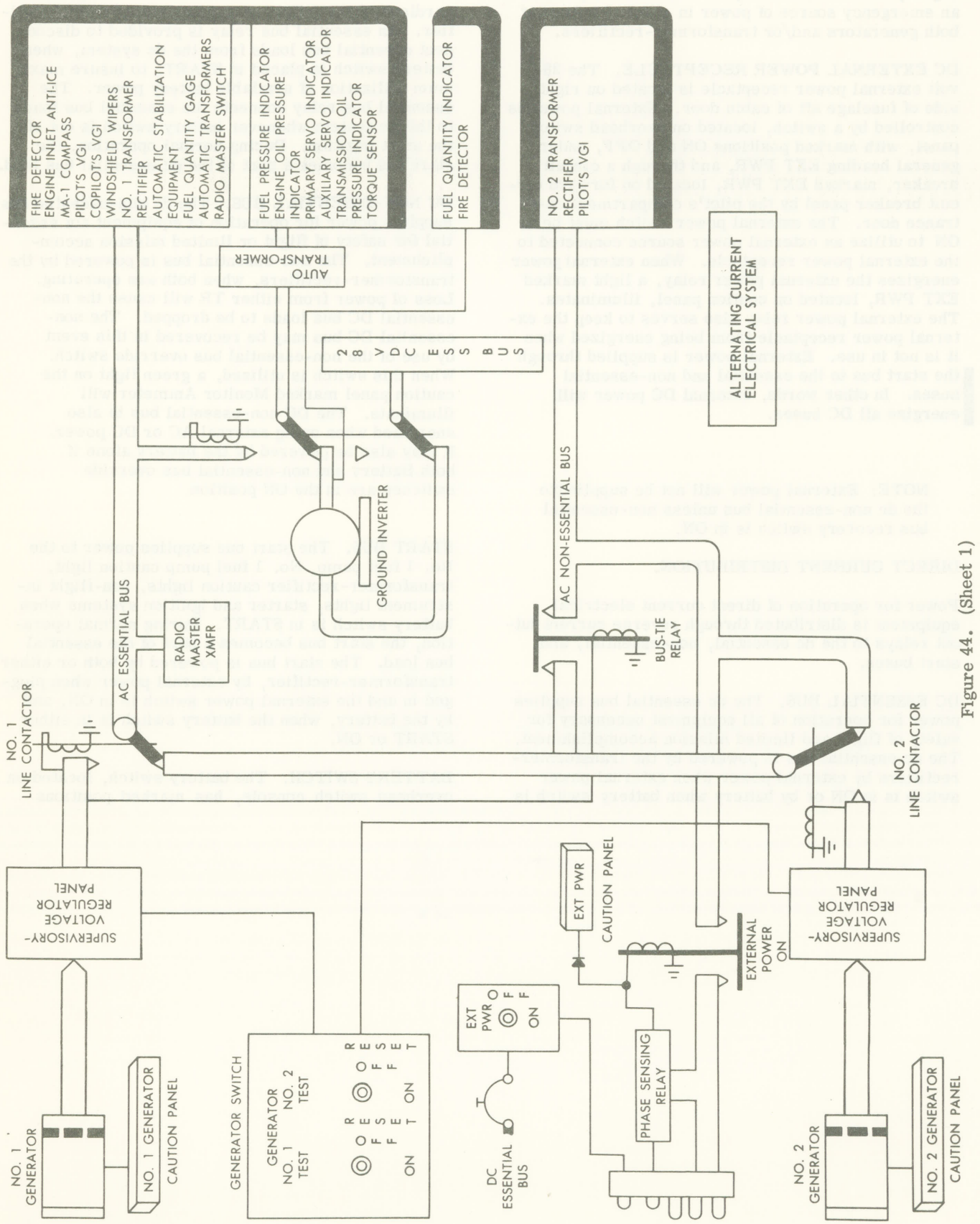


Figure 44. (Sheet 1)

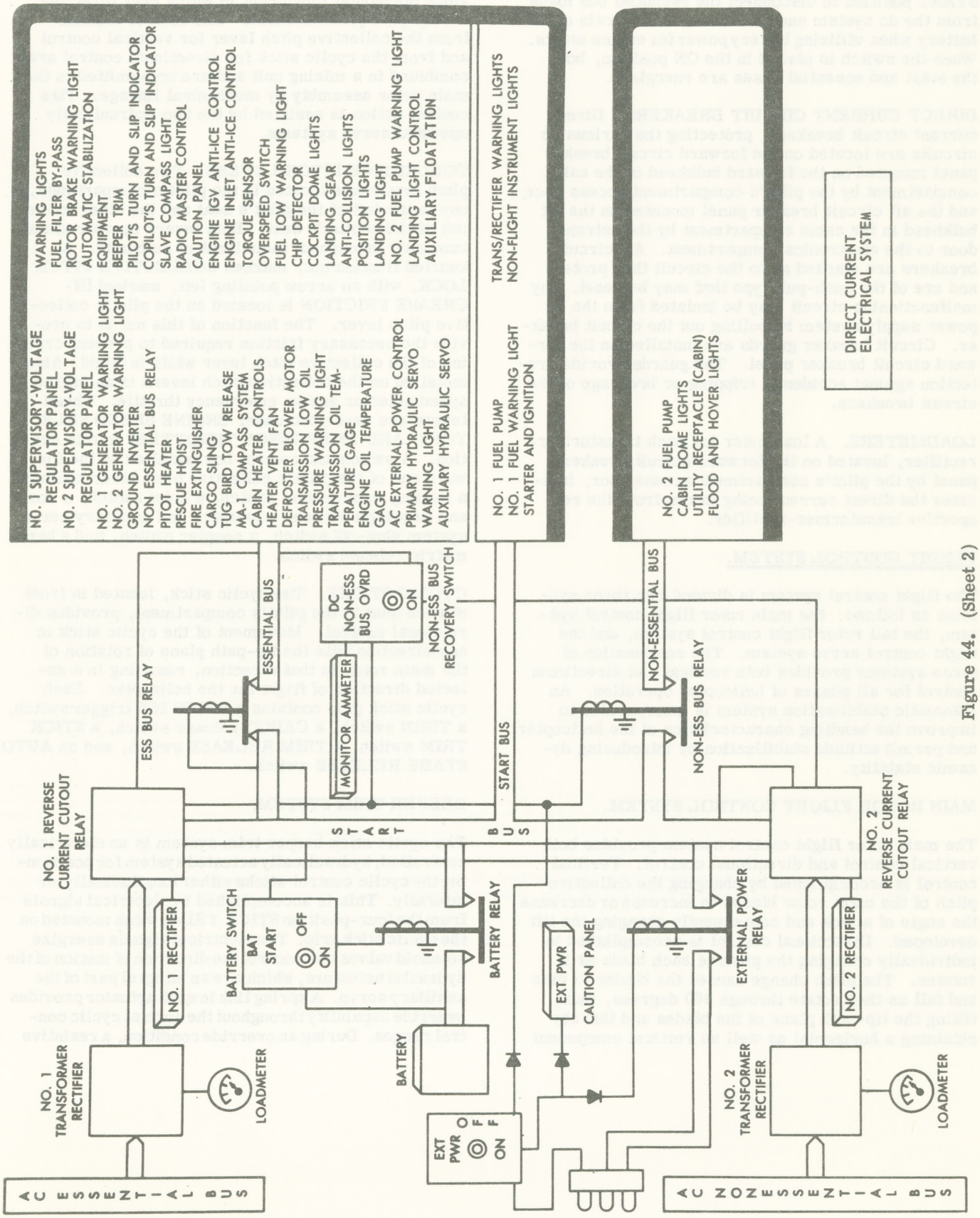


Figure 44. (Sheet 2)

START, OFF and ON. The switch is placed in the START position to disconnect the essential bus loads from the dc system and limit the current drain on the battery when utilizing battery power for engine starts. When the switch is placed in the ON position, both the start and essential buses are energized.

DIRECT CURRENT CIRCUIT BREAKERS. Direct current circuit breakers, protecting the various dc circuits are located on the forward circuit breaker panel mounted on the forward bulkhead of the cabin compartment by the pilot's compartment access door, and the aft circuit breaker panel mounted on the aft bulkhead in the cabin compartment by the entrance door to the electronics compartment. All circuit breakers are marked as to the circuit they protect and are of the push-pull type that may be reset. Any malfunctioning circuit may be isolated from the dc power supply system by pulling out the circuit breaker. Circuit breaker guards are installed on the forward circuit breaker panel. The guards provide protection against accidental tripping or breakage of the circuit breakers.

LOADMETERS. A loadmeter for each transformer-rectifier, located on the forward circuit breaker panel by the pilot's compartment access door, indicates the direct current being drawn from the respective transformer-rectifier.

FLIGHT CONTROL SYSTEM.

The flight control system is divided into three systems as follows: the main rotor flight control system, the tail rotor flight control system, and the flight control servo system. The combination of these systems provides both vertical and directional control for all phases of helicopter operation. An automatic stabilization system is incorporated to improve the handling characteristics of the helicopter and permit attitude stabilization by introducing dynamic stability.

MAIN ROTOR FLIGHT CONTROL SYSTEM.

The main rotor flight control system provides both vertical control and directional control. Vertical control is accomplished by changing the collective pitch of the main rotor blades to increase or decrease the angle of attack and consequently changing the lift developed. Directional control is accomplished by individually changing the pitch of each blade as it rotates. The pitch change causes the blades to rise and fall as they rotate through 360 degrees, thus, tilting the tip-path plane of the blades and thereby obtaining a horizontal as well as vertical component of thrust. The horizontal component of thrust provides horizontal movement in which ever direction the tip-path plane is tilted. The control motions from the collective pitch lever for vertical control and from the cyclic stick for directional control are combined in a mixing unit and are transmitted to the main rotor assembly by mechanical linkage. This control action is assisted by the two hydraulically operated servo systems.

COLLECTIVE PITCH LEVERS. Two collective pitch levers are located in the pilot's compartment, one to the left of the pilot's seat and the other to the left of the copilot's seat. Both levers operate simultaneously throughout their limit of authority. A knurled friction nut, marked COLLECTIVE PITCH LOCK, with an arrow pointing left, marked INCREASE FRICTION is located on the pilot's collective pitch lever. The function of this nut is to provide the necessary friction required to prevent creeping of the collective pitch lever while in flight. Also installed on the collective pitch levers is an engine speed selector and an emergency throttle. These levers are described under ENGINE SPEED SELECTORS, AND EMERGENCY THROTTLES in this section. A switch and control box installed on the forward end of the pilot's collective pitch lever contains a landing light control switch, a hoist switch, a hover and floodlight switch, a primary and auxiliary servo system shut-off switch, a coupler switch, and a barometric release switch.

CYCLIC STICKS. The cyclic stick, located in front of each seat in the pilot's compartment, provides directional control. Movement of the cyclic stick in any direction tilts the tip-path plane of rotation of the main rotor in that direction, resulting in a selected direction of flight for the helicopter. Each cyclic stick grip contains a RADIO ICS trigger switch, a TURN switch, a CARGO release switch, a STICK TRIM switch, a TRIM RELEASE switch, and an AUTO STABE RELEASE switch.

BEEPER TRIM SYSTEM.

The cyclic stick beeper trim system is an electrically controlled, hydraulically actuated system for positioning the cyclic control sticks either longitudinally or laterally. This is accomplished by electrical signals from the four-position STICK TRIM switch mounted on the cyclic stick grip. The electrical signals energize solenoid valves that control the direction of motion of the hydraulic actuators, which are an integral part of the auxiliary servo. A spring link in each actuator provides override capability throughout the normal cyclic control ranges. During an override condition, a resistive

force caused by spring tension is increased progressively as the stick is displaced. This condition will be relieved and the stick returned to the originally trimmed position as soon as the stick is released. However, the beeper trim system may be momentarily deenergized by actuation of the TRIM REL switch, eliminating any resistive force. A master switch, located on overhead switch panel, marked BEEPER TRIM, ON, and OFF, must be placed in ON before the system is operable. To trim the cyclic stick, place the four-position switch in the desired direction and release it as soon as trim attitude is attained. The system will operate as long as there is 28 volts dc power to the essential bus and hydraulic pressure to the actuators.

MASTER TRIM SWITCH. A master trim switch, marked BEEPER TRIM ON and OFF, is located on overhead switch panel. The switch is the master control for the beeper trim system. When switch is placed in ON, hydraulic pressure is applied to the actuators holding the cyclic stick in position. If the cyclic stick is moved from this position, the actuators spring action resists this movement and attempts to return cyclic stick to its original position. The spring tension provides cyclic stick "feel," mounting to approximately 1 1/2 pounds initial force and 1/2 pound for each one inch of cyclic stick movement. When the switch is placed in OFF, the beeper trim system is rendered inoperative.

BEEPER TRIM SWITCH. The beeper trim switches, located on pilot's and copilot's cyclic stick grips, have four positions marked FWD, AFT, L, and R. The four-way thumb operated switch is spring-loaded to center (off) position. Whenever the switch is placed in any of the four positions, hydraulic pressure will drive the cyclic stick in the same direction. When the desired cyclic stick position is obtained, the switch should be released to keep this position constant.

TRIM RELEASE SWITCH. The push-button switches, located on pilot's and copilot's cyclic stick grips, are marked TRIM REL. The switch provides an override capability that permits an established trim position to be changed. To perform this function, depress trim release button, move cyclic stick to a new position, and release the button.

TAIL ROTOR FLIGHT CONTROL SYSTEM.

The function of the tail rotor flight control system is to provide a means of controlling heading of the helicopter. The torque of the main rotor system, turning counterclockwise, tends to rotate fuselage in a clockwise direction. Power settings and collective pitch will vary the amount of torque developed by the main rotor system. The tail rotor pedals increase or decrease the pitch of tail rotor blades which results in an increase or decrease in thrust to compensate for changes in main rotor torque. This compensation stabilizes the tendency of the fuselage to turn and also results in the ability to control change of heading.

TAIL ROTOR PEDALS. The tail rotor pedals, one set in front of pilot and other in front of copilot, change the pitch of the tail rotor and consequently the heading of the helicopter. Pressing the left pedal increases tail rotor pitch which increases thrust, and turns the helicopter to the left. Pressing the right pedal decreases tail rotor blade pitch decreasing thrust and allowing helicopter to turn to right. Tail rotor adjustment knobs are provided to adjust pedals for leg length. Electrical switches mounted on the force link cancel directional signals of the automatic stabilization equipment when approximately 8 pounds of pressure is exerted on a pedal. Toe brake pedals for the main landing gear brake system are mounted on pilot's tail rotor pedals.

TAIL ROTOR PEDAL ADJUSTMENT KNOBS. Tail rotor pedal adjustment knobs are located on each side of cockpit forward of pilot's and copilot's seats. The adjustment knobs are connected to mechanical linkage that provides fore-and-aft adjustment of tail rotor pedals. The knobs, marked PEDAL ADJUSTOR, FORWARD, and AFT, are rotated to the right, as indicated by the arrows, for forward adjustment and to the left for aft adjustment. The pilot's and copilot's pedals are adjusted by their respective adjustors.

FLIGHT CONTROL HYDRAULIC POWER SUPPLY SYSTEM.

The flight control hydraulic power supply system consists of a primary and an auxiliary servo system. The servo systems are required by the pilot and copilot for a power boost to operate the flight controls. The servos also prevent feedback of main rotor vibratory loads to the control sticks. Each servo system is independent. Each servo unit consists of a bypass valve and sloppy link, power piston, pilot valve, and ASE valve in the auxiliary servo unit only. The flight control system actuates the pilot valve which admits hydraulic oil into the servo unit. The servo unit output is connected to the flight control linkage, thus providing the necessary power boost. The continuity of the direct linkage is maintained throughout the flight control system except for a slight amount of end play at each primary servo unit permitting the pilot valves to move before the direct control linkage. Normally, both servo systems operate at all times.

PRIMARY SERVO SYSTEM. The primary servo system consists of three hydraulic servo units which connect the flight control linkage to the stationary star of the main rotor. The servos provide the power necessary for the pilot to operate of the main rotor flight control system only. The system utilizes 1000 psi hydraulic pressure from the primary servo hydraulic pump, located on the accessory section of the main gear box. The system has a 0.45 gallon capacity reservoir which is mounted left of the main gear box. A light, marked PRI HYD PRESS, located on the caution panel, will illuminate when the pressure drops below 750 psi in the primary flight control servo system.

AUXILIARY SERVO SYSTEM. The auxiliary servo system consisting of a bank of four hydraulic servo packages, located below the main rotor flight control mixing unit, introduces automatic stabilization equipment signals into the flight control system and also resists flight loads in the event of primary servo failure. The system utilizes 1500 psi hydraulic pressure from the auxiliary hydraulic pump, located on the accessory section of the main gear box. Hydraulic oil for the system is supplied by a 1.03 gallon capacity reservoir, located right of the main gear box. The light, marked AUX HYD PRESS, located on the caution panel, illuminates when the pressure drops below 1000 psi in the auxiliary flight control system.

FLIGHT CONTROL SERVO SHUT-OFF SWITCH.

The flight control servo shut-off switch, has positions PRI OFF, ON (centered), and AUX OFF, and is located on a switch and control box on the forward end of the pilot's collective pitch lever. Hydraulic pressure to either the primary or auxiliary servo system is controlled by solenoid valves which are actuated by the flight control servo shut-off switch. Both hydraulic flight control servo systems are normally in operation with the switch in the ON (center) position. To turn off the primary servo system, the switch is placed in the PRI OFF position. To turn off the auxiliary servo system, the switch is placed in the AUX OFF position. The solenoid valve actuating circuit operates on direct current and is protected by circuit breakers, marked PRI and AUX, under the general heading SERVO, located on the overhead circuit breaker and fuse panel. If pressure in the primary servo system drops below 750 psi, a pressure switch prevents the auxiliary servo system from being shut-off, regardless of the position of the flight control servo shut-off switch. If pressure in the auxiliary servo system drops below 1000 psi, a pressure switch prevents the primary servo system from being shut-off, regardless of the position of the flight control servo shut-off switch. The warning lights, marked PRI HYD PRESS and AUX HYD PRESS, located on the caution panel, will illuminate when the respective system pressure drops below the pressure switch setting.

PRIMARY SERVO HYDRAULIC SYSTEM PRESSURE INDICATOR. The primary servo hydraulic system pressure indicator, marked PRI HYDR PRESS, is located on the instrument panel. The indicator dial has a range from 0 to 2500 psi in increments of 100 psi. The indicator provides a visual indication of pressure within the primary servo system. The indicator operates on 26 volts ac from the essential bus and is protected by a circuit breaker, marked HYD PRESS PRI, located on the forward circuit breaker panel.

AUXILIARY SERVO HYDRAULIC SYSTEM PRESSURE INDICATOR. The auxiliary servo hydraulic system pressure indicator, marked AUX HYD PRESS, is located on the instrument panel. The indicator dial has a range of 0 to 5000 in increments of 200 psi. The indicator provides a visual indication of the pressure within the auxiliary servo system. The indicator operates on 26 volts ac from the essential bus and is protected by a circuit breaker, marked HYD PRESS AUX, located on the forward circuit breaker panel.

AUTOMATIC STABILIZATION EQUIPMENT.

The automatic stabilization equipment provides the helicopter with an automatic stability feature. The automatic stabilization equipment provides pitch, roll, and yaw stabilization, and has provisions for the installation of barometric altitude stablization and coupler mode. The automatic stabilization equipment may be engaged at all times with the stability corrections being introduced into the flight control system in such a way that the pilot still maintains full authority of the helicopter. Because of the limited authority of the ASE system, the pilot, through normal use of the flight controls, is able to override any malfunction in the ASE system that would cause a full ASE authority input to the flight control system. Pitch and roll attitudes are held constant by means of signals received from a vertical gyro reference, and yaw (heading) is maintained by signals received from the MA-1 compass system. Changes in pitch, roll, and yaw made by the pilot, will be maintained by the automatic stabilization equipment. Small pitch and roll stabilization corrections are constantly added, even though the pilot moves or holds the cyclic stick, but directional stabilization occurs only when the pilot's feet are removed from the tail rotor control pedals. A microswitch on the force link assembly in the broom closet will disengage directional stabilization when the pilot applies 6-8 pounds of pressure on either tail rotor control pedal. A yaw rate gyro senses the turning rate and causes an opposing force on the tail rotor control pedals, which increases as the rate-of-turn increases.

Small heading corrections may be made with the yaw trim knob without using the rotor pedals.

NOTE: On helicopter CG Nos 1449 and subsequent an ASE OFF warning capsule has been added to the caution advisory panel. The capsule illuminates when the essential dc bus is energized and the ASE is disengaged.

AUTOMATIC STABILIZATION CONTROL PANEL.

The automatic stabilization control panel, located on the cockpit console between pilot and copilot, is marked ASE CONTROL. The controls consist of two engage buttons at the top of the panel, an OFF button directly below the BAR ALT engage button, a center-of-gravity trim control, and a yaw trim control. The two engage buttons are marked ASE ENG and BAR ALT ENG. When ASE ENG button is depressed, the pitch, roll, and yaw channels are operating. The BAR ALT ENG button and OFF button are inoperative as provisions only are made for the installation of a barometric altitude controller. The ASE is disengaged by depressing the button, marked AUTO STABE RELEASE, located on pilot's and copilot's cyclic stick grip. The YAW TRIM and CG TRIM knobs, located at bottom of the panel, are designed with characteristic shapes to enable pilot to easily identify them. The yaw trim knob is triangular-shaped and CG trim knob is clover leaf-shaped. The yaw trim knob enables pilot to accurately trim the heading of helicopter with his feet off the tail rotor control pedals. One rotation of the knob will turn helicopter 72 degrees. The CG trim knob is used to trim the automatic stabilization pitch channel for actual CG location. The CG trim could be adjusted while in flight or a hover. To perform this adjustment, coordinate the control knob and cyclic stick and monitor flight director indicator horizontal bar until bar is centered. The CG trim is now properly adjusted. The ASE control panel operates on direct current from dc essential bus, through a circuit breaker, marked AUTO STAB, located on forward circuit breaker panel.

NOTE: The CG trim adjustment is limited to the authority of ASE.

CHANNEL MONITOR PANEL. The channel monitor panel, marked CHANNEL MONITOR, is mounted to right of pilot's seat. The controls consist of four toggle switches across top of the panel, marked PITCH, ROLL, COLL, and YAW, under general heading CHANNEL DISENGAGE, with marked positions ON and OFF. They permit individual disengagement of pitch, roll, and yaw channels of ASE. The toggle switch, marked COLL, is inoperative as provisions only are installed for a barometric altitude controller. They are normally left in ON except when the pilot wishes to disengage a malfunctioning channel. Directly below the four toggle switches are four guarded three-position switches, under general heading HARDOVER, that are used to check system authority. The switch, marked PITCH, has marked positions FWD and AFT. The switch, marked ROLL, has marked positions LEFT and RIGHT, and the switch, marked YAW, has marked positions LEFT and RIGHT. Each switch may be placed in a position to check corresponding PITCH ROLL, or YAW channels of ASE. When the switch guards are closed, the switches are held in ON. The switch guards must be lifted before override checks can be made. The toggle switch on the bottom of the panel is marked GYRO SELECT, with marked positions, PORT and STBD. Pitch and roll references for ASE are selected from either the starboard or port gyro; however, the normal position is PORT. In event of failure of either gyro, the other gyro may be selected, permitting continued use of ASE. The channel monitor panel receives power from dc essential bus, through a circuit breaker, marked AUTO STAB, located on forward circuit breaker panel.

LANDING GEAR SYSTEM.

The landing gear system consists of two partially retractable main landing gear assemblies and a non-retractable full swiveling tail wheel.

MAIN LANDING GEAR.

The two main landing gear assemblies are attached to the sponsons by oleo struts and support struts, and may be partially retracted into the sponsons for water landings. The main landing gear retracting system utilizes pressure from the auxiliary hydraulic system. When landing gear is to be extended, hydraulic pressure is released, and normal air charge in inner cylinder of each main landing gear oleo strut assembly forces the struts to extended position. Circular inspection windows made of transparent acrylic sheet are located on the outboard surface of each sponson strut fairing panel. The inspection windows facilitate inspection of the strut shear bolts.

MAIN LANDING GEAR SWITCH. The main landing gear switch, marked LANDING GEAR, with marked positions UP and DOWN, is located on instrument panel. When the main landing gear switch is placed in UP, a control valve is energized and allows auxiliary hydraulic system to retract the main landing gear. When the main landing gear switch is placed in DOWN, the control valve is de-energized and hydraulic pressure released. The normal air charge in the oleo strut of each main landing gear, plus weight of the wheels, forces the struts to move to the extended position. The landing gear circuit operates on direct current from dc essential bus and is protected by a circuit breaker, marked LDG GEAR, located on forward circuit breaker panel.

MAIN LANDING GEAR POSITION INDICATOR.

The main landing gear position indicator is located on instrument panel by main landing gear switch.

When the main landing gear is in the retracted position, the indicator shows an UP indication. When the main landing gear is in the extended position, the indicator shows a DOWN indication. Although the DOWN indication is not visible until the helicopter is airborne; while on the ground a barber pole type indication will be visible. The main landing gear indicator operates on direct current from the dc essential bus through a circuit breaker, marked LDG GEAR, located on the forward circuit breaker panel.

TAIL WHEEL.

The non-retractable tail wheel is located underneath the aft section of the hull. The tail wheel is the full-swiveling and self-centering type, and may be mechanically locked in the center position.

TAIL WHEEL LOCK HANDLE.

The tail wheel lock handle, marked PULL UP TO LOCK, is located at the aft end of the lower radio console. When the handle is pulled up to the LOCKED position, the control cable slackens, allowing the spring-loaded lockpin to engage after the tail wheel centers. When the handle is pushed down to the UNLOCKED position, the control cable pulls the lockpin from the swivel joint, permitting the tail wheel to swivel through 360 degrees. A button in the center of the handle must be pressed to release a ratchet-type lock, before the tail wheel lock handle can be pushed down to the UNLOCKED position.

WHEEL BRAKE SYSTEM.

The main landing gear wheels are equipped with hydraulic brakes. The self-contained brake system is operated by toe pedals on the pilot's tail rotor pedals. A parking brake valve and handle permits locking the brakes when the helicopter is parked.

BRAKE PEDALS. Each main landing gear wheel is individually braked by depressing the corresponding brake pedal, mounted on the pilot's tail rotor pedals. The copilot's tail rotor pedals are not equipped with brake pedals.

PARKING BRAKE HANDLE. The parking brake handle is located on the left side of the control console. The brakes are locked by depressing the brake pedals, pulling the parking brake handle out, and releasing the brake pedals before releasing the parking brake handle. Pressing the right brake pedal releases the parking brakes, causing the parking brake handle to return to the unlocked position.

PARKING BRAKE LIGHT.

A light, marked PARKING BRAKE, located on the advisory panel, will illuminate when parking brake handle is engaged. The light will go out when the parking brakes are released and the parking brake handle returns to the unlocked position. The light receives electrical power from the dc essential but through a circuit breaker, marked PARK BRAKE, located on the forward circuit breaker panel.

LIGHTING EQUIPMENT.

All lights operate on direct current and are protected by circuit breakers. The cabin dome lights and the flood and hover lights operate from the non-essential bus. All other lights operate from the essential bus.

NAVIGATION LIGHTS MASTER SWITCH.

A navigation lights master switch, marked MASTER, under the general heading NAV LTS, is located on the overhead switch panel in the pilot's compartment. The switch has marked positions, ON and OFF, and controls the power source to the position and anti-collision lights. The switch must be in the ON position before the position and anti-collision lights can be operated.

POSITION LIGHT SWITCH.

A position light switch, marked POSITION, under the general heading NAV LTS, is located on the overhead switch panel in the pilot's compartment. The switch has marked positions, DIM, OFF, and BRT, and controls the operation of the three position lights. The position lights consist of a green light, located on the right sponson, a red light, located on the left sponson, and a white light, located on the top aft end of the pylon. When the position light switch is placed in the ON position, the three position lights are illuminated. When the switch is placed in the OFF position, the three position lights are turned off. The DIM position of the switch controls the intensity of the position lights. The position lights operate on current from the dc essential bus and are protected by a circuit breaker, marked POS, under the general heading LIGHTS, located on the forward circuit breaker.

ANTI-COLLISION LIGHT SWITCH.

An anti-collision light switch, marked ANTI-COL, under the general heading NAV LTS, is located on the overhead switch panel in the pilot's compartment. The switch has marked positions, ON and OFF, and controls the operation of the two anti-collision lights. A red, rotating anti-collision light is located on the outboard side of each sponson. When the anti-collision light switch is placed in the ON position both anti-collision lights are illuminated. When the switch is placed in the OFF position, the two anti-collision lights are turned off. The anti-collision lights operate on current from the dc essential bus and are protected by circuit breakers, marked ANTI-COL, LEFT and RIGHT, under the general heading LIGHTS, located on the forward circuit breaker panel.

CONTROLLABLE LANDING LIGHT.

A controllable landing light, located in the nose of the helicopter, may be pivoted downward through an arc of 125 degrees and rotated to the left or right of any point within 360 degrees by actuation of the landing light switch on the collective pitch lever control box. The controllable landing light circuit operates on direct current from the dc essential bus and is protected by two circuit breakers, marked PWR and CONT, under the general heading CONT LDG, located on the forward circuit breaker panel.

CONTROLLABLE LANDING LIGHT MASTER SWITCH.

A push type, controllable landing light master switch, marked CONTR LT, is located on the forward end of the pilot's collective pitch lever. When the switch is pushed in, power is supplied to the landing light and the landing light control switches, located on the pilot's collective pitch stick and the copilot's remote control panel and bulb, located in the center of the master switch, illuminates. The indicator bulb intensity is controlled by the caution panel bright/dim switch.

PILOT'S LANDING LIGHT CONTROL SWITCH.

The pilot's landing light control switch is located on the forward end of the pilot's collective pitch stick. The control switch is a spring-loaded, four-position thumb switch, marked EXT, RET, L, and R, with a center OFF position. Pushing the switch forward to the EXT position causes the landing light to extend. Pushing the switch aft to the RET position causes the landing light to retract, but the light may be stopped at any vertical angle between 125 degrees and the stowed position. Before the landing light has fully retracted and seated, the light if in other than normal position, automatically rotates back to the normal position. Moving the control switch to the L or R position causes the landing light to rotate to the left or right of any point within 360 degrees provided the light is fully extended. If the light is not fully extended, it only rotates within a 45-degree arc to the left.

COPILOT'S LANDING LIGHT CONTROL SWITCH.

The copilot's landing light control switch is located on the copilot's remote control panel. The control switch is a spring-loaded, four-position toggle switch, marked EXTEND, RETRACT, L, and R, with a center OFF position. The switch provides the same type of operation as the pilot's landing light control switch.

FLOOD AND HOVER LIGHTS SWITCH.

The flood and hover light switch is located on the forward end of the pilot's collective pitch stick, and has marked positions HOVER LT, OFF, and FLOOD LT. The flood and hover lights switch controls the flood and hover lights mounted below the forward strut assemblies of each sponson, through four circuit breakers, marked CONT, 1, 2, and 3, under the general heading HOVER LTS, located on the aft circuit breaker panel. The circuit breaker, marked 1, protects the floodlight mounted by the right sponson that provides illumination directly below the helicopter. The circuit breaker, marked 2, protects the hover light mounted by the left sponson that provides forward illumination, and the circuit breaker, marked 3, protects the hover light mounted by the right sponson, that also provides forward illumination. When the flood and hover lights switch is placed in the HOVER LT position, all three lights are operated. When the switch is placed in the FLOOD LT position, the light by each sponson that provides forward illumination will be operated.

CAUTION

Do not operate the lights for more than 10 minutes at a time. Bulb life is sharply decreased by longer operating periods.

PILOT'S COMPARTMENT DOME LIGHT SWITCH.

The pilot's compartment dome light switch, marked CKPT, under the general heading DOME LTS, is located on the dome light panel in the pilot's compartment. The dome light switch has marked positions, RED, OFF, and WHITE, and controls the dome light, located in the panel. The dome light contains a red lamp and a white lamp, either of which may be selected by placing the dome light switch in the RED or WHITE position.

PILOT'S COMPARTMENT SPOTLIGHT.

The pilot's compartment spotlight is located on the right side of the overhead console in an adjustable bracket. The light is controlled by a rotary ON-OFF switch, located on the end of the spotlight, through the circuit breaker, marked CKPT DOME, located on the forward circuit breaker panel. The intensity and color of the light may be varied by rotating the casing.

CABIN DOME LIGHT SWITCH.

The cabin dome light switch, marked CABIN, under the general heading DOME LTS, is located on the pilot's compartment dome light panel in the pilot's compartment. The cabin dome light switch has marked positions RED, OFF, and WHITE, and controls the two cabin dome lights, located in the cabin ceiling, through a circuit breaker, marked CABIN DOME LT, located on the forward circuit breaker panel. The two cabin dome lights each contain a red lamp and a white lamp, either of which may be selected by placing the cabin dome light switch in the RED or WHITE position.

INSTRUMENT EMERGENCY LIGHT RHEOSTAT.

A rheostat, marked INST EMER LTS, with positions OFF and BRT, is located on the overhead switch panel.

The instrument emergency light rheostat controls the red lamp of the pilot's compartment dome light in the event an emergency source of instrument lighting is desired. To turn on the red lamp and increase its intensity, rotate the rheostat from the OFF to the BRT position.

CONSOLE AND PANEL LIGHTS RHEOSTAT.

A rheostat, marked CONSOLE & PNL LTS, with positions OFF and BRT, is located on the overhead switch panel. The console and panel light rheostat controls the lights on the overhead switch panel, radio control console, forward circuit breaker panel, and the hoist operator's and observer's radio control panels, through a circuit breaker, marked CONSOLE PANEL, located on the forward circuit breaker panel. To turn on the console and panel lights and increase their intensity rotate the rheostat from the OFF to the BRT position.

NON-FLIGHT INSTRUMENT LIGHT RHEOSTAT.

A rheostat, marked NON FLT INST LTS, with positions OFF and BRT, is located on the overhead switch panel. The non-flight instrument light rheostat controls the engine, transmission, and fuel system lights on the instrument panel, through a circuit breaker, marked NON FLT, located on the forward circuit breaker panel. To turn on the non-flight instrument lights and increase their intensity, rotate the rheostat from the OFF to the BRT position.

PILOT'S FLIGHT INSTRUMENT LIGHT RHEOSTAT.

A rheostat, marked PILOT FLT INST LTS, with positions OFF and BRT, is located on the overhead switch panel. The pilot's flight instrument light rheostat controls the flight instrument lights, plus the lights for the towmeter, dual tachometers, torquemeter, and clock on the pilot's side of the instrument panel. The pilot's flight instrument light circuit is protected by a circuit breaker, marked PILOT, under the general heading, FLIGHT INST, located on the forward circuit breaker panel.

COPILOT'S FLIGHT INSTRUMENT LIGHT RHEOSTAT.

A rheostat, marked COPILOT'S FLT INST LTS, with positions OFF and BRT, is located on the overhead switch panel. The copilot's flight instrument light rheostat controls the flight instrument lights, plus the lights for the dual tachometer and torquemeter on the copilot's side of the instrument panel. The copilot's flight instrument light circuit is protected by a circuit breaker, marked CO-PILOT, under the general heading, FLIGHT INST, located on the forward circuit breaker panel.

HEATING SYSTEM.

The heating system consists of a blower, an internal combustion chamber, a plenum chamber, and ducting that runs along the left cabin wall to the pilot's compartment where it divides into three ducts. One duct supplies heated air to the copilot's registers. A second duct supplies heated air to the pilots registers and the third duct is connected to the windshield defroster diffusers. The 50,000 BTU heater unit, located in the transition compartment, operates on fuel pumped from the forward fuel tank to the heater unit where it is ignited by the ignition unit. A heater blower draws air into the system through an outside air intake vent, located on the upper right side of the fuselage and forces it through a heat exchanger unit surrounding the combustion heater unit where it is heated. The heated air is then forced through a plenum chamber into the ducting through the cabin to the pilot's compartment. The windshield defroster is automatically operated whenever the heating system is in operation. However, a defroster blower is provided to expedite the flow of heated air for windshield defrosting. The heater blower may be operated separately from the heating system to provide ventilation. (Refer to VENTILATING SYSTEM in this section.) The heating system is actuated by a master switch, a heater start switch, and a high-low cycling switch, located on the overhead switch console. The heating system operates on direct current from the essential bus and is protected by circuit breakers, marked VENT RELAY, and CONT, under the general heading CAB HTR, located on the forward circuit breaker panel.

HEATER MASTER SWITCH. The heater master switch, marked MASTER, with marked positions, ON and OFF, is located on the overhead switch console under the general heading HEATER. The heater master switch must be in the ON position before the START switch can be energized.

Note

Whenever the heater master switch is placed in the ON position, the HEATER HOT caution light will come on.

HEATER START SWITCH AND FAN SWITCH. The heater start switch, marked START, with marked positions, ON and OFF, is located on the overhead switch console under the general heading HEATER. The fan switch, with marked positions, NORM and VENT BLO, is also located on the overhead switch console under the general heading HEATER. When the fan switch is in the NORM position, and the heater master switch is in the ON position, a blower relay is energized and the heater blower is turned on. When the starter switch

is placed in the on position, and adequate air pressure from the heater blower is available, a ram air switch closes and energizes the master fuel valve, ignition unit, fuel pump, and cycle valve starting the heater. An overheat thermal switch limits the temperature of the heated air in the plenum chamber to a maximum of 350°F. When an overheat condition occurs, an overheat relay shuts off the ignition unit, the master fuel valve, and the fuel pump and cycling valve, and turns on the caution light, marked HEATER HOT, located on the caution panel. However, the heater blower continues to operate and cools the temperature in the plenum chamber.

Note

Do not restart heater after caution light actuation until cause of overheat has been determined.

The heater start and fan switches will not energize the master fuel valve, ignition unit, and fuel pump and cycling valve if the heater blower fails to operate. A thermal overrun switch keeps the blower in operation until the temperature in the plenum chamber drops to 48.9°C (120°F), after the heater master switch has been placed in the OFF position, and the heater is shut off.

HIGH-LOW CYCLING SWITCH. The high-low cycling switch, with marked positions LO and HI, under the general heading HEATER, is located on the overhead switch console. When the cycling switch is in the LO position, a low cycling thermal switch enables the heater to automatically maintain a temperature of 65.6°C (150°F) in the plenum chamber. A high cycling thermal switch enables the heater to automatically maintain a temperature of 140.6°C (285°F) in the plenum chamber.

HEATER REGISTERS. Four heater registers (diffusers) are located in the pilot's compartment. One register is located on the wall panel just above the floor to the right of the pilot, and another register is located on the wall panel just above the floor to the left of the copilot. Each of these registers are equipped with a knob, marked OPEN and CLOSE; turning the knob regulates the flow of heated air into the pilot's compartment. One non-regulating register is located on the floor approximately under the pilot's tail rotor pedals, and one is located similarily for the copilot. Five registers are located in the cabin on the left side panel just above the floor. Each register has a knob that operates in the same manner as the knob on the pilot's and copilot's registers to regulate the flow of heated air into the cabin.

WINDSHIELD DEFROSTER SWITCH. A windshield defroster switch, marked WSHLD DEFROST, with marked positions ON and OFF, is located on the overhead switch console. The windshield defroster switch controls a blower motor, located in the main duct of the windshield defroster. When the windshield defroster switch is placed in the ON position and the heater is operating, the blower motor provides a rapid flow of heated air against the windshield. The blower may also be utilized for defogging the windshield without turning the heater on. The blower motor operates on direct current from the dc essential bus, and is protected by a circuit breaker, marked DEFROST BLO MOTOR, located on the forward circuit breaker panel.

VENTILATING SYSTEM.

The ventilating system utilizes the heater blower, ducts, and registers to draw in cooling air from outside the helicopter and circulate it throughout the helicopter. The ventilating system may also be used as an aid to dissipate smoke or fumes from the helicopter interior. The ventilating system can also be used in conjunction with the windshield defroster ducts and blower motor to defog the windshield. The ventilating system operates on dc current from the essential bus, and is protected by a circuit breaker, marked VENT BLOWER, located on the aft circuit breaker panel.

VENTILATING SWITCH. The ventilating switch, with marked positions VENT BLO and NORM, is located on the overhead switch panel under the general heading HEATER. When the ventilating switch is placed in the VENT BLO position, the heater blower draws outside air into the helicopter and circulates it for ventilating purposes. When the ventilating switch is in the NORM position, the heater blower supplies air for the heating system.

WINDSHIELD WIPERS.

Electrically operated windshield wipers are located on the pilot's and copilot's windshields. The windshield wiper system is controlled by a rotary switch, with marked positions PARK, OFF, LOW, and HIGH, located on the overhead switch panel. The windshield wiper switch is placed in the LOW or HIGH positions to turn the system on and regulate the wiper blade speed. The PARK position is used to move the wiper blades from the line of vision before placing the switch in the OFF position. The windshield wiper system operates on ac current from the essential bus, and is protected by a circuit breaker, marked WINDSHIELD WIPER, located on the aft circuit breaker panel.

Note

To prevent scratching the windshield, do not operate wipers on dry glass.

WINDSHIELD WASHER SYSTEM.

The windshield washer system is operated by depressing a foot pedal, located on the floor to the right of the pilot's seat. Water from the reservoir, installed aft of the pilot's seat, is then pumped to the windshield through jets to the center of the wiped area. The pedal must be depressed several times to prime the system and then pumped continuously, as required to clean the windshield.

UTILITY RECEPTACLE.

A 28-volt dc electrical utility receptacle, marked UT RECP, is located aft of the cabin door. The circuit is protected by a circuit breaker, marked UTILITY RECEPT, located on the aft circuit breaker panel.

EMERGENCY EQUIPMENT.

ENGINE COMPARTMENT FIRE DETECTOR SYSTEM.

An engine compartment fire detector system consists of four fire detector sensing elements, located in the engine compartment. The sensing elements are wired in a closed series loop and connected to a control unit. The control unit illuminates the engine fire warning light on the instrument panel and the two engine fire warning lights in the fire emergency shut-off selector handle. The sensing elements are continuously responsive to flame, but not sensitive to normal engine temperatures. The engine fire detector system operates on alternating current from the ac essential bus, and is protected by a circuit breaker, marked FIRE DET TEST, located on the forward circuit breaker panel.

ENGINE COMPARTMENT FIRE WARNING LIGHTS AND TEST SWITCH. A red, press-to-test, engine compartment fire warning light, marked FIRE WARN, is located on the instrument panel. Two additional engine fire warning lights are installed in the fire emergency shut-off selector handle, located overhead in the pilot's compartment. In the event of a fire in the engine compartment the fire warning lights are illuminated by the engine compartment fire detector system. An engine fire warning light test switch, marked FIRE TEST, is located beside the fire warning light on the instrument panel. When the spring-loaded test switch is actuated, the engine compartment fire warning lights are actuated by direct current from the dc essential bus. When the test switch is released, the lights go out. The engine compartment fire warning lights test circuit is protected by a circuit breaker, marked DET, under the general heading FIRE, located on the forward circuit breaker panel.

ENGINE COMPARTMENT FIRE EXTINGUISHER SYSTEM.

A liquid monobromotrifluoromethane (CF3BR), one-shot engine compartment fire extinguisher system, is installed to enable the pilot to extinguish an engine compartment fire during flight. The liquid is stored in a spherical container, located on the left side and forward of the main gear box oil cooler blower. A discharge valve on the container contains a disc which is broken by an explosive cartridge when the fire extinguisher switch is depressed. The fire extinguisher circuit operates on direct current from the essential bus and is protected by a circuit breaker marked EXT, under the general heading FIRE, located on the forward circuit breaker panel. Tubing extends from the discharge valve to the engine compartment where it branches into four discharge tubes, located over the gas generator and power turbine sections of the engine. When the extinguishing liquid is released through the discharge tubes, it turns to a vapor which smothers the fire. The spherical container is equipped with a pressure gage and a thermal discharge valve which discharges the contents of the container overboard out of the left side of the helicopter if the sphere overheats. When the sphere is properly charged, the pressure gage should indicate a value within the range shown on a decal adjacent to the gage.

CAUTION

CF3BR is very volatile, but is not easily detected by odor. It is not toxic and can be considered to be about the same as other freons and carbon dioxide, causing danger primarily by reduction of oxygen. The liquid should not be allowed to contact the skin, as it may cause frostbite or low temperature burns because of its very low boiling point.

Note

Although designed primarily for combating an engine fire during flight, the engine compartment fire extinguishing system may be used on the ground if other fire fighting equipment is ineffectual or not available. Check that ground personnel are clear before using the system.

FUEL FIRE WALL SHUT-OFF HANDLE. A T-shaped, fire emergency shut-off selector handle, is located forward of the overhead switch panel. When the handle is actuated to the FIRE EXT ARMED (FULLY AFT) position, the fuel shut-off valve is manually closed. Microswitches, located adjacent to the emergency shut-off selector handle assembly, are also closed to permit power from the dc essential bus to close the solenoid-operated shutters, located in the right side only of the engine compartment fairing, and close the circuit between the fire extinguisher and the fire extinguisher switch.

NOTE: The fuel fire wall shut-off handle must be pulled aft prior to operation of fire extinguisher switch.

ENGINE COMPARTMENT FIRE EXTINGUISHER SWITCH. The engine compartment fire extinguisher switch is a push-button-type switch encircled with a ring guard. The switch, marked FIRE EXT, is located on overhead switch panel. Before the engine compartment fire extinguisher switch becomes operative, the fire emergency shut-off selector handle must be pulled aft to close the circuit between the fire extinguisher and fire extinguisher switch. When the fire extinguisher switch is depressed, the content of the spherical container is discharged into engine compartment.

PORTABLE FIRE EXTINGUISHERS.

One hand-operated portable fire extinguisher is mounted on a bracket, located on brace behind co-pilot's seat, and a second hand-operated portable fire extinguisher is mounted on a bracket attached to frame just aft of cabin door. Both extinguishers are filled with carbon dioxide (CO_2).

FIRST AID KITS.

One first aid kit is located in the cockpit, mounted on bulkhead behind copilot. A second first aid kit is located in the cabin, mounted on cabin aft bulkhead above door.

EMERGENCY EXIT LIGHTS.

The Emergency Exit Light System comprises two light assemblies, a control panel with a three position switch marked ARM-OFF-DISARM and a relay, and associated wiring and circuit breakers. The control panel is mounted on the pilot's instrument panel to the left of the fire warning light. One light is located below the left emergency exit hatch and the other is located at the upper forward corner of the cabin entrance. By placing the switch in the ARM position during ground run-up, the batteries in the light assemblies receive a trickle charge current from the DC ESS BUS through the de-energized relay in the control unit. Two small lights glow within the lens of the light when the batteries are charging. In this mode, activation of the lights is dependent upon momentary interruption of the charging current by either a drop in the main transmission oil pressure to 6-8 psi, or by water immersion. Prior to shut-down, disarm the system to avoid unintentional activation of the system and discharge of the batteries by momentarily moving the switch to DISARM, then release to OFF. If the lights have not been disarmed prior to shut-down, they may be extinguished by placing the switch in DISARM, then releasing to OFF. The lights may be removed from their retainers for use as an emergency flashlight by pulling the red PULL - EMERGENCY LIGHT handle. A fully charged battery will provide sufficient power to operate the light for 30 minutes.

EMERGENCY EXIT SIGNS.

On some helicopters a radio active luminescent sign, marked EMERGENCY EXIT, is located above cabin emergency hatch and cabin door.

AUXILIARY FLOTATION SYSTEM.

Auxiliary flotation pop-out bags are provided to give the helicopter additional stability while on water with the rotor system stopped. For sea state capabilities, see figures 44A and 44B.

AUXILIARY FLOATATION INSTALLATION - MECHANICAL RELEASE SYSTEM. The mechanical release system consists of two inflatable bags, two air cylinders and a manual release.

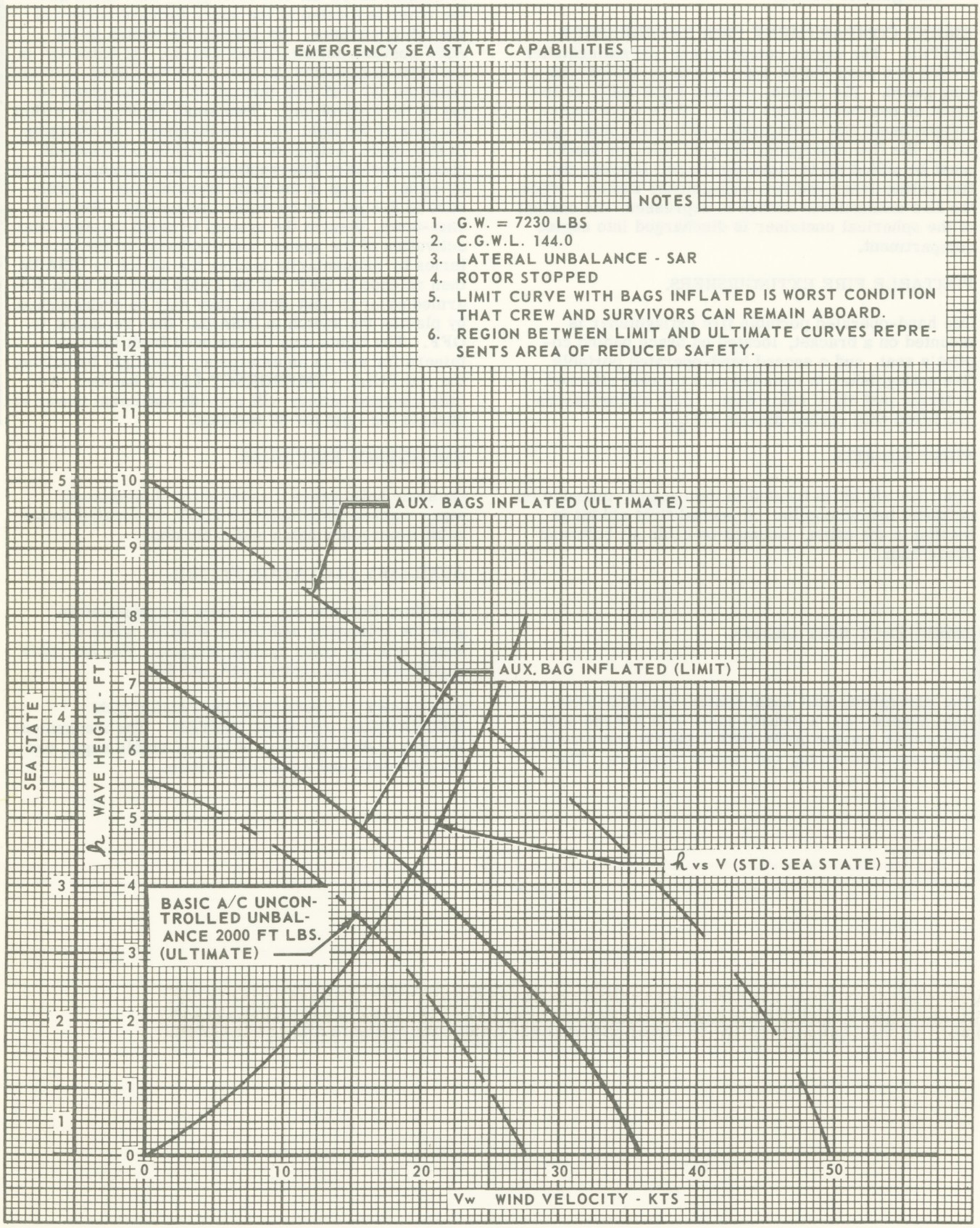

EMERGENCY SEA STATE CAPABILITIES
NOTES
1. G.W. = 7230 LBS
2. C.G.W.L. 144.0
3. LATERAL UNBALANCE - SAR
4. ROTOR STOPPED
5. LIMIT CURVE WITH BAGS INFLATED IS WORST CONDITION THAT CREW AND SURVIVORS CAN REMAIN ABOARD.
6. REGION BETWEEN LIMIT AND ULTIMATE CURVES REPRESENTS AREA OF REDUCED SAFETY.
AUX. BAGS INFLATED (ULTIMATE)
AUX. BAG INFLATED (LIMIT)
h vs V (STD. SEA STATE)
BASIC A/C UNCONTROLLED UNBALANCE 2000 FT LBS. (ULTIMATE)
SEA STATE
h WAVE HEIGHT - FT
Vw WIND VELOCITY - KTS
0
10
20
30
40
50
1
2
3
4
5
6
7
8
9
10
11
12

Figure 44A.

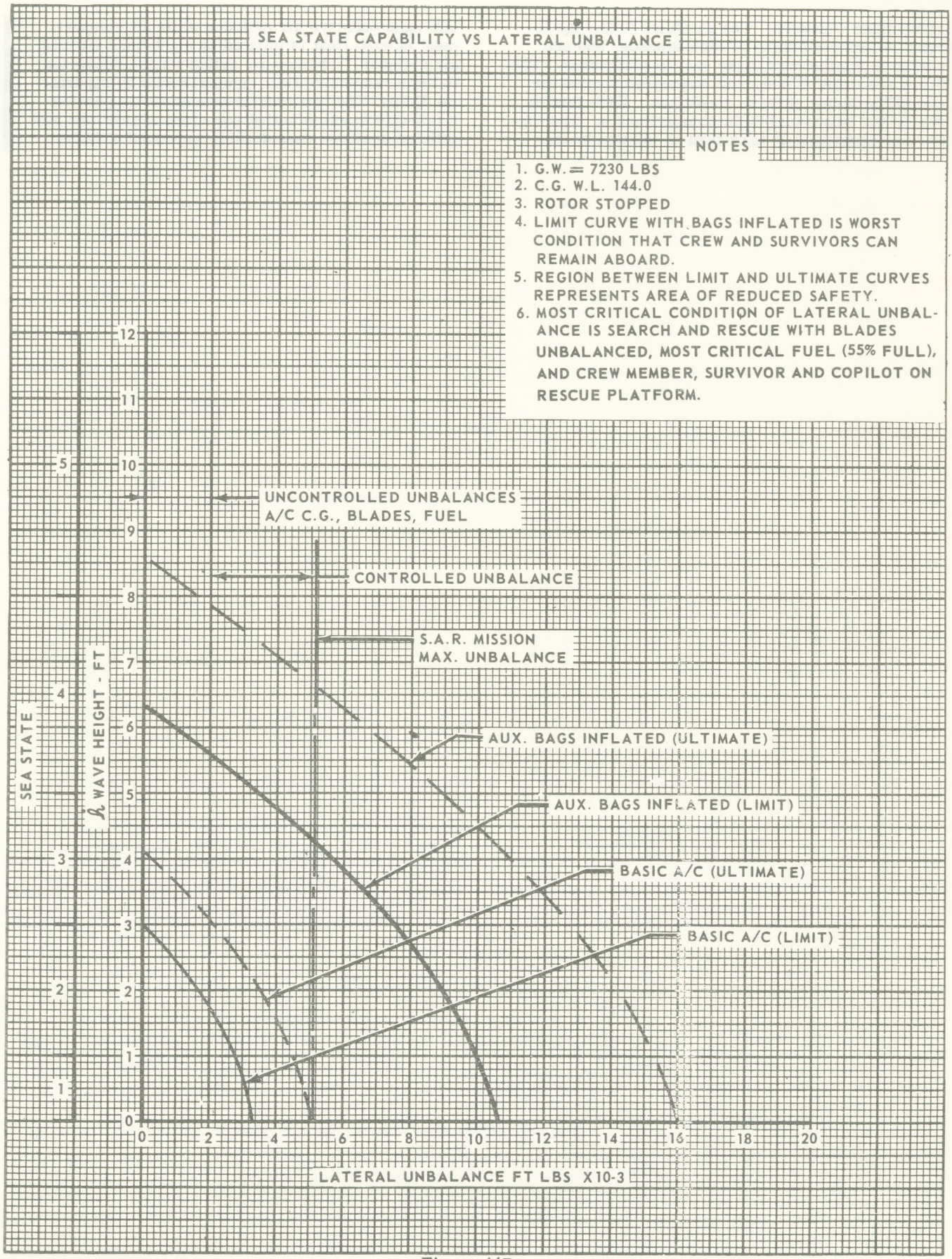

SEA STATE CAPABILITY VS LATERAL UNBALANCE
NOTES
1. G.W. = 7230 LBS
2. C.G. W.L. 144.0
3. ROTOR STOPPED
4. LIMIT CURVE WITH BAGS INFLATED IS WORST CONDITION THAT CREW AND SURVIVORS CAN REMAIN ABOARD.
5. REGION BETWEEN LIMIT AND ULTIMATE CURVES REPRESENTS AREA OF REDUCED SAFETY.
6. MOST CRITICAL CONDITION OF LATERAL UNBALANCE IS SEARCH AND RESCUE WITH BLADES UNBALANCED, MOST CRITICAL FUEL (55% FULL), AND CREW MEMBER, SURVIVOR AND COPILOT ON RESCUE PLATFORM.
UNCONTROLLED UNBALANCES A/C C.G., BLADES, FUEL
CONTROLLED UNBALANCE
S.A.R. MISSION MAX. UNBALANCE
AUX. BAGS INFLATED (ULTIMATE)
AUX. BAGS INFLATED (LIMIT)
BASIC A/C (ULTIMATE)
BASIC A/C (LIMIT)
SEA STATE
WAVE HEIGHT - FT
LATERAL UNBALANCE FT LBS X10-3
0
1
2
3
4
5
6
7
8
9
10
11
12
0
2
4
6
8
10
12
14
16
18
20

Figure 44B.

AUXILIARY FLOATS. The auxiliary floats are located on outboard chine of each sponson, and are stowed in bungee cord laced canvas enclosures. The floats are made of neoprene impregnated nylon for durability during adverse conditions. Each float is subdivided into two airtight compartments. The forward compartment of each float is inflated by the left-hand outboard air cylinder while aft compartment of each float is inflated by right-hand inboard air cylinder. The two air cylinders are connected to their respective float compartments by separate air lines. The two compartmented floats provide a fail-safe function in that one compartment per side inflated provides considerably improved stability.

AUXILIARY FLOAT AIR CYLINDERS. The two spherical 330 cubic inch compressed air cylinders are mounted on a honeycomb panel support in the cabin on left-hand side under ASE tilt table between fuselage stations 180 and 192. The cylinders are mechanically discharged through a valve located on each cylinder. A pressure gage is also mounted on each cylinder and is graduated from 0 to 3500 psi in 100 psi increments. The gage is green lined for 2650 to 3000 psi.

AUXILIARY FLOAT MANUAL RELEASE HANDLE. The manual release handle is located on the left hand side of the cockpit entrance fastened to a bracket aft of the copilot. The handle is connected by cables to each auxiliary float air cylinder mechanical release valve. Pulling the handle actuates both floats simultaneously. Normally the floats will take 6 to 7 seconds to inflate.

PARACHUTE TYPE SEA DROGUE.

The water-borne capability of the helicopter creates a need of anchoring or stabilizing in both deep and shallow water. The helicopter with power-off reacts to forces of wind, waves, swell and current and may therefore be damaged by excessive roll, or by drifting ashore or out to sea into conditions beyond its survival capabilities. The parachute type sea drogue is generally effective in any depth of water when wind force is 10 knots or more. (If it is less than 10 knots, there probably will not be enough wave action to cause dangerous rolling.) Because drift of helicopter, under influence of wind, is greater than movement of sea drogue in water, the drag of sea drogue will tend to keep nose of helicopter into wind and waves under most sea conditions. When direction and speed of current coincide with wind drift, sea drogue will be ineffective. A second effect of parachute type sea drogue is to reduce rate of drift to a minimum keeping helicopter near point of descent. The parachute type sea drogue is stowed behind copilot's seat and should be deployed as soon as possible after power-off landing.

DANFORTH ANCHOR.

The helicopter may be equipped with a shallow water anchor of Danforth design. Use of Danforth anchor in water depth exceeding length of anchor line makes anchor ineffective. Should anchor drag, its effect will be similar to that of sea drogue and should tend to hold helicopter into wind and waves. To be effective in stopping all drift, anchor line should be at least 6 times depth of water. The anchor should be deployed as soon as possible after power-off landing.

EMERGENCY EXITS AND ENTRANCES.

PILOT'S COMPARTMENT EMERGENCY EXITS.

The sliding windows on each side of pilot's compartment can be jettisoned in any position from OPEN to CLOSED, to provide emergency exits or entrances. A release handle, marked EMERGENCY EXIT-TURN, is located inside and outside of each pilot's compartment sliding window. The sliding windows may be released from inside or outside the helicopter by turning the release handle and pushing or pulling sliding window out.

CABIN EMERGENCY HATCH.

The panel surrounding last window on left side of cabin can be jettisoned to provide a cabin emergency exit or entrance. An emergency release handle, marked EMERGENCY EXIT-TURN, is located on forward lower corner of panel. To jettison cabin emergency hatch, the release handle is turned in direction of the arrow and hatch is pushed out. A similar release handle is provided to open the hatch from outside of helicopter.

CABIN DOOR EMERGENCY EXIT.

The cabin door can be jettisoned to provide cabin door emergency exit by pulling down on a handle, marked EXIT RELEASE-TURN, which is located on forward upper corner of cabin door. A similar handle is provided to open cabin door from outside of helicopter. An orange-yellow stripe is painted on the guard assembly of the inside door handle to indicate when the emergency handle is aligned and locked. The guard lever is safety wired with break way copper wire to prevent accidental release of the cabin door.

PILOT'S AND COPILOT'S SEATS.

Pilot's and copilot's seats are located side by side in pilot's compartment. The pilot's seat is on right side. The seats are adjustable and were designed to accommodate a back-type parachute and a pararaft. Each seat is equipped with a safety belt and shoulder harness.

SEAT HEIGHT ADJUSTMENT LEVER

A seat height adjustment lever, located on right rear side of each seat, is pulled back to release seat lock. The pilot may then adjust bungee suspended seat by varying the weight upon it. When desired position is obtained the adjustment lever is released and seat is locked in place. Both seats have a four-inch range-of-height adjustment.

SEAT FORWARD OR AFT ADJUSTMENT LEVER.

A seat forward or aft adjustment lever, located on forward right side of pilot's seat and copilot's seat, is pulled back to release fore-and-aft lockpin. The lever must be held back while seat is moved forward or aft on tracks to desired position. When desired position is obtained, adjustment lever is released and seat is locked in place. The seats have a four-inch forward-and-aft range of adjustment.

SHOULDER HARNESS INERTIA REEL LOCK LEVER

A two-position shoulder harness inertia reel lock lever, located on forward left side of pilot's seat and copilot's seat, has a dual function. It permits pilot to manually lock the inertia reel, and it enables him to release the harness restraint after reel has locked automatically in an emergency. Normally, the lever is left in UNLOCKED (aft) position permitting normal duties to be performed without apparent restraint. The reel will lock instantly should an emergency occur that would tend to throw pilot

from his seat, in any direction. When the multi-directional reel is locked in this manner it will remain locked until the lever is moved to the LOCKED (forward) position. The lever is then returned to the automatic or UNLOCKED (aft) position. If the pilot anticipates severe conditions, such as during a crash landing, the inertia reel may be manually locked by placing the lever in the LOCKED (forward) position to prevent further extension of the harness reel cable.

NOTE: The LOCKED (forward) position of the lever is used only when a crash landing (land or water) is anticipated. This position provides an added safety precaution over that of the automatic safety lock.

RESCUE HOIST.

A 600 pound capacity hydraulic hoist winch, with approximately 100 feet of cable, is suspended on a fixed truss over the cabin door. The winch motor is powered by a hydraulic pump mounted on and driven by the accessory drive section of the main gear box. Hydraulic fluid for the hoist is supplied from the auxiliary hydraulic reservoir. The hoist winch incorporates a load-holding brake which locks automatically whenever the winch stops, and a level-wind mechanism which prevents snarling if the cable is wound in rapidly with no load attached to it. Travel limit switches will de-energize the hoist solenoid valve and stop operation of the winch, either when the cable is reeled completely in or when it is pulled completely out. An electrically-operated cartridge-type guillotine, actuated by a switch, located both in the pilot's compartment and cabin, will cut the hoist cable at the winch in case the hook becomes entangled in an obstruction on the ground and cannot be released. The guillotine circuit may be tested by use of a hoist shear circuit test panel, located in the cabin. The hoist hook is manually opened by pulling down on the spring-loaded lever. The hook incorporates a ring type handhold as an aid to rescued personnel and is self-stowing when the cable is reeled completely in. The hoist winch may be controlled either from the pilot's compartment or from the cabin by switches which utilize dc power from the primary bus to operate solenoid valves in the hydraulic lines. Since the hoist hydraulic pump is driven by the main gear box, the hoist may be operated only when the main rotor is turning. The hydraulic hoist actuating shearing and testing circuits are protected by a circuit breaker, marked HOIST, DOWN, and WARN, located on the forward circuit breaker panel.

HOIST MASTER SWITCH. The hoist master switch, marked HOIST MASTER, with the marked positions CREW, OFF, and PILOT, is located on the overhead switch panel. When the switch is placed in the CREW position, the hoist winch is operated up or down by the hoist switch, located forward of the door in the cabin. When the switch is placed in the PILOT position, the hoist is controlled only by the pilot with a switch on the collective pitch lever control box. When the switch is left in the OFF position, both winch switches are inoperative, but the pilot's emergency cable cut-off switch is operable. Both hoist winch switches are inoperative while either the pilot's or the cabin emergency cable cut-off switch is in operation.

PILOT'S HOIST SWITCH. The thumb switch, marked HOIST with the positions UP, OFF (Center), and DOWN, located on the pilot's collective pitch lever control box, controls the hydraulic hoist winch. The switch is pushed to either position, UP or DOWN, to operate the hoist. When released, the switch returns to the center (OFF) position and the hoist winch stops and locks. The switch is inoperative unless the hoist master switch is placed in the PILOT position.

CABIN HOIST SWITCH. A momentary-type switch, marked UP, OFF, DOWN, on a small panel marked HOIST, located above and forward of the door on the right side of the cabin, enables a crew member to control the hoist. The switch is pushed to either extreme position to operate the hoist winch. When released, the switch returns to the center (OFF) position, and the hoist winch stops and locks automatically. The switch is operative only if the hoist master switch on the pilot's overhead switch panel is placed in the CREW position.

CABIN PORTABLE HOIST CONTROL SWITCH.

A momentary-type thumb operated portable hoist control switch, marked DOWN and UP, is stowed on a bracket on the cabin frame forward of the cargo door. The switch will provide the hoist operator with greater mobility during hoist operations. The switch is wired in parallel with the cabin hoist control switch and is operative when the hoist master switch is positioned in CREW.

HYDRAULIC HOIST CABLE SHEAR SWITCHES. Two guarded hydraulic hoist cable shear switches, marked HOIST, with positions ON (guarded) and SHEAR, are provided to cut the hoist cable at the winch in an emergency should the cable become entangled and cannot be released from an obstruction on the ground. One switch is located on the overhead switch panel in the pilot's compartment; the other switch is located on the panel, marked HOIST, located on the cabin wall above the cabin door. To cut the cable, lift the guard and place the switch in the SHEAR position. An electrically-fired cartridge will fire a guillotine and cut the hoist cable at the winch. Hoist master switch must be placed in the crew position to permit shearing from the CREW position. The pilot's shear switch is operable with the hoist master switch in any position.

HYDRAULIC HOIST SHEAR CIRCUIT TEST PANEL. A hydraulic hoist shear circuit test panel, marked HOIST SHEAR CIRCUIT, is mounted on the cabin wall above the cabin door. A light, marked TEST, is located on the top center of the panel and a guarded switch with marked positions, TEST and FIRE, is located on the bottom center of the panel.

HYDRAULIC HOIST MANUAL OVERRIDE VALVE.

A hydraulic hoist manual override valve, installed above cabin door, is provided to lower or raise hoist in event of electrical failure. The three-position four-way valve operates on power from the auxiliary hydraulic system.

HYDRAULIC HOIST MANUAL OVERRIDE VALVE BUTTONS. Two hydraulic hoist manual override valve buttons, located on hydraulic hoist manual override valve, can be used to operate the hydraulic hoist if electrical failure occurs. Depressing either of the spring-loaded buttons, marked HOIST DOWN and HOIST UP, opens the override valve and actuates the hoist winch. Releasing the button closes the override valve and stops operation of hoist winch.

HYDRAULIC HOIST OPERATION.

1. Hoist master switch - PILOT or CREW.
2. Pilot's hoist switch (on collective pitch lever grip) or cabin hoist switch - DOWN, UP.

   NOTE: When operating hoist from the cabin with cabin door open, secure a safety strap across door opening or use a gunner's type safety belt.
3. At completion of hoist operation, hold either hoist switch in up position until winch stops. When hoist is in full up position, the hoist hook is automatically stowed.

CAUTION

The hoist should not be fully raised until the oscillations of hoist cable have stopped. This will prevent injury to anyone, or damage to hoist or anything on hoist cable at the time.

HYDRAULIC HOIST SHEAR CIRCUIT TEST.

1. Break safety wire and lift guard on hoist shear circuit test panel and move switch to TEST.
2. Actuate the pilot's or hoist operator's hoist cable shear switch.

CAUTION

When testing hoist cable shear circuit, the test switch must be in TEST before actuating the pilot's or hoist operator's hoist cable shear switch.

3. The light on the hoist shear circuit test panel goes on indicating that the system is functioning properly.
4. Upon completion of the test, return test switch to FIRE position and safety wire the guard.

RESCUE PLATFORM.

A detachable rescue platform is provided to aid in recovery of personnel or objects from the sea when helicopter is afloat. The platform is secured to fittings, located in the deck just inboard of cabin door, and supported by two cable assemblies attached to studs, located on upper cabin cargo door frame. The cabin cargo door must be fully opened to lower rescue platform into position. The attachment fittings on the rescue platform are quick detachable Norco locks. The same deck fittings are used for cabin door step.

CARGO SLING.

A cargo sling of 3000 pounds capacity may be attached externally to four brackets, of which two each are installed on right and left chines of lower fuselage. Operating controls for the cargo sling are a three-position master switch and caution light, two electrical release switches, all of which are located in pilot's compartment. The cargo hook may be opened electrically to release an external load, either automatically through a touchdown release circuit when the load touches the ground and tension on the cargo hook is lowered, or by depressing either pilot's or copilot's cargo release switch, located on cyclic stick grip. The cargo release circuit operates on direct current from the essential bus and is protected by circuit breaker, marked CARGO SLING, located on forward circuit breaker panel. A manual release handle, located on the cargo hook, permits mechanical opening of cargo hook by ground personnel. On some helicopters crewman may open cargo hook during flight or while on ground by actuating the nylon release line attached to the manual release mechanism on the hook. The nylon line is secured to the cabin door handle. When cargo hook is in stowed position, the line is passed over a hook at station 221 to clear doorway. Cargo is attached to the hook by ground personnel who must manually close hook. When the cargo sling is attached but not in use, the cargo hook should be drawn up securely, and as high as possible, against the frame into stowed position by means of a cargo sling stowage line which enters cabin through a side panel and is secured to a cleat.

CAUTION

The cargo hook should be stowed before landing to prevent striking cargo hook on the ground. Striking or dragging hook on the ground may cause damage which could result in subsequent failure of hook assembly.

CAUTION

Be sure to stow cargo sling hook as securely as possible to prevent damage during water landings. It should be noted on the appropriate form if cargo hook had made water contacts so that preventive action can be taken against corrosion.

CARGO SLING MASTER AND MODE SWITCHES.

A switch, marked RELEASE MODE, SLING, and TUG-BIRD, is provided to enable selection of either the sling or towing mode of operation. The cargo sling master switch, marked CARGO SLING MASTER, located on the overhead switch panel, controls the electrical actuation of the cargo hook. The switch has three positions, ON, SAFE, and AUTO. When preparing to release cargo electrically, the master switch should be in either the ON or AUTO position. With the switch in the ON position, cargo may be released by actuating either cyclic stick cargo release switch. With the switch in the AUTO position, cargo is released by the automatic touchdown release circuit when the cargo sling load contacts the ground and the load on the cargo hook is reduced. If the switch is in the AUTO position and the load on the cargo hook is reduced to 100 ±20 pounds or less, the cargo hook opens. The cargo hook cannot be closed by ground personnel if the master switch is in the AUTO position.

WARNING

To assure suitable margin for safe operation, automatic touchdown should be made only with loads greater than 500 pounds. The master switch should only be placed in the AUTO position on final approach to prepare the circuit for automatic release upon touchdown of load. Keep the master switch in the SAFE position during flight to prevent accidental opening of the cargo hook.

The cargo release switch on the grip of each cyclic stick may also be used to release a load when the master switch is in the AUTO position. Cargo may be attached to the cargo hook with the master switch in the SAFE or ON position only because the cargo hook does not close when the master switch is in the AUTO position. The master switch should be placed in the SAFE position and the cargo sling stowed after cargo operations have been completed. A light, marked HOOK OPEN, located on the caution panel, lights whenever the cargo hook is open, indicating, during cargo sling operations, that the cargo load has been released. The light circuitry is protected by a circuit breaker, marked CARGO SLING, located on the forward circuit breaker panel.

CARGO RELEASE SWITCH. A push-button, momentary-contact type cargo release switch is located on the grip of both cyclic sticks. Either thumb-operated switch, marked CARGO, is depressed to open the cargo hook when the cargo sling master switch is in the ON or AUTO position.

COMMUNICATION AND ASSOCIATED ELECTRONIC EQUIPMENT.

The communication control panels, figures 43 and 45, provided in the pilot's compartment, are divided between the lower console and the upper console. The lower console is also equipped with interphone control panels for both pilot and copilot. All panels may be operated by either the pilot or copilot. In addition, two communication control panels are provided in the cabin for crewmen, one above the cargo door, and the other is on the left side of the cabin. All radio equipment is installed on the integrated electronic rack, located in the right forward area of the cabin, and is easily accessible in flight. The radio equipment utilizes both direct and alternating current. Master control for the radio equipment is provided by a radio master switch, located on the overhead switch panel in the pilot's compartment. Indicators, used in conjunction with the navigation sets, are located on the instrument panel in front of the pilot and copilot.

RADIO CIRCUIT BREAKER PANEL.

The radio circuit breaker panel is located on the forward end of the integrated electronics rack by the pilot's compartment access door. The circuit breakers may be reset by pushing them in. The direct current operation circuits, each protected by an appropriately marked circuit breaker, are connected to the helicopter's direct current power supply system through the radio master switch. The alternating current operating circuits, each protected by an appropriately marked circuit breaker, are connected directly to the helicopter's alternating current power supply system and are continuously energized as long as the generators are operating. Both power sources must be operative for the communication and associated electronics equipment to be fully operative.

RADIO MASTER SWITCH.

The switch, marked RADIO MASTER, OFF and ON, located on the overhead switch panel, controls the 28-volt direct current power supply to the radios. The

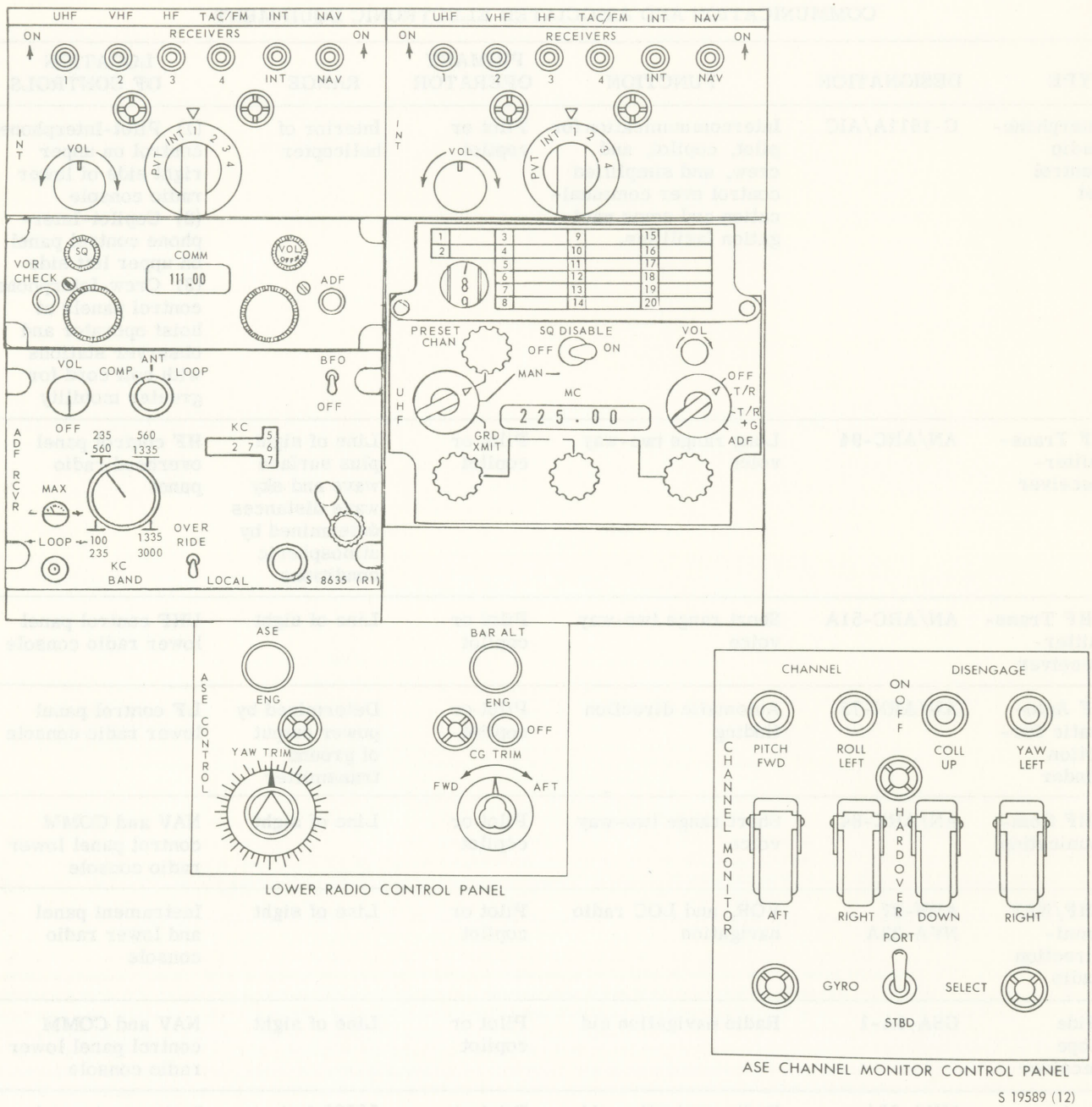

UHF VHF HF TAC/FM INT NAV
ON
RECEIVERS
1 2 3 4 INT NAV
INT
VOL
PVT INT 1 2 3 4
VOR CHECK
SQ
COMM
111.00
VOL OFF
ADF
VOL COMP ANT LOOP
BFO OFF
ADF RCVR
OFF
235 560 .560 1335
KC
MAX
LOOP
100 235 1335 3000
OVER RIDE
KC BAND
LOCAL
S 8635 (R1)
PRESET CHAN
SQ DISABLE
OFF ON
VOL
MAN
MC
225.00
GRD XMIT
OFF T/R T/R+G ADF
ASE CONTROL
ASE
ENG
YAW TRIM
BAR ALT
ENG
OFF
CG TRIM
FWD AFT
LOWER RADIO CONTROL PANEL
CHANNEL
DISENGAGE
ON
OFF
PITCH FWD
ROLL LEFT
COLL UP
YAW LEFT
CHANNEL MONITOR
HARDOVER
AFT
RIGHT
DOWN
RIGHT
PORT
GYRO
SELECT
STBD
ASE CHANNEL MONITOR CONTROL PANEL
S 19589 (12)

Figure 45.

COMMUNICATION AND ASSOCIATED ELECTRONIC EQUIPMENT

TYPE	DESIGNATION	FUNCTION	PRIMARY OPERATOR	RANGE	LOCATION OF CONTROLS
Interphone-Radio Control Set	C-1611A/AIC	Intercommunication for pilot, copilot, and crew, and simplified control over communication and some navigation facilities.	Pilot or copilot	Interior of helicopter	(1) Pilot-Interphone control on upper right side of lower radio console (2) Copilot-Interphone control panel on upper left side (3) Crew-Interphone control panels at hoist operator and observer stations with coil cord for greater mobility
HF Transmitter-Receiver	AN/ARC-94	Long range two-way voice	Pilot or copilot	Line of sight plus surface wave and sky wave distances determined by atmospheric conditions	HF control panel overhead radio panel
UHF Transmitter-Receiver	AN/ARC-51A	Short range two-way voice	Pilot or copilot	Line of sight	UHF control panel lower radio console
LF Automatic Direction Finder	AN/ARN-73	Automatic direction finding	Pilot or copilot	Determined by power output of ground transmitter	LF control panel lower radio console
VHF Communication	AN/ARC-84	Short range two-way voice	Pilot or copilot	Line of sight	NAV and COMM control panel lower radio console
VHF/NAV Omni-Direction Radio	ARN-87 NVA-22A	VOR, and LOC radio navigation	Pilot or copilot	Line of sight	Instrument panel and lower radio console
Glide Slope Receiver	GSA-8A-1	Radio navigation aid	Pilot or copilot	Line of sight	NAV and COMM control panel lower radio console
Marker Beacon	MKA-23A	Radio navigation aid	Pilot or copilot	50000 feet vertical	Instrument panel
TACAN	AN/ARN-52(V)	Tactical air navigation	Pilot or copilot	Line of sight	Overhead radio control panel
PORTABLE FM TRANSCEIVER	AN/PRC59	Temporary installation for special communication	Pilot or copilot	Line of sight	Overhead radio control panel and on equipment
Radio Altimeter	AN/ARN-79	Low altitude terrain clearance	Pilot or copilot	1000 feet vertical	Instrument panel
IFF Transponder	AN/APX-44	Identification and tracking	Pilot or copilot	Line of sight	XPDR control panel overhead radio panel

Figure 46.

radio master circuit is energized from the dc essential bus through two circuit breakers, marked PWR and CONT, under the general heading RADIO MASTER, located on the forward circuit breaker panel.

OPERATING CONTROLS.

A spring-loaded three-position microphone trigger switch, marked ICS and RADIO, is located on the pilot's and copilot's cyclic stick grips. When the upper portion of the switch is held in the ICS position, the respective microphones are connected to the interphone transmission circuit and to the radio transmission circuit when the lower portion of the switch is held in the RADIO position. When the pilot wishes to talk to the hoist operator and/or the crewmen, he must use the trigger switch, but the copilot may use either the trigger switch or the remote switch. The remote switch should be placed in ICS MAINTAINED position before intercommunications are conducted.

INTERPHONE-RADIO CONTROL SYSTEM (C-1611A/AIC).

The interphone system, C-1611A/AIC, provides three modes of operation; radio communication, radio receiver monitoring, and intercommunications. The specific mode of operation is determined by the setting of the transmit-interphone switch and the receiver switches on the interphone control panel. Components of the system are four interphone control panels, two coil cord assemblies, cyclic trigger switches, a junction box, a hoist position remote switch, the copilots remote switch, and headsets. The system operates on 28 volts dc from the radio bus and is protected by circuits breakers, marked CO-PLT and PLT, under the general heading ICS, located on the radio circuit breaker panel.

INTERPHONE CONTROL PANELS. The interphone control panels provide complete control circuits for the pilot and copilot and limited control circuits for the hoist operator and crewmen. There are four panels throughout the helicopter. Two panels are located on the forward portion of the lower radio console. The remaining two panels are located in the cabin, one above the cargo door and the other on the opposite bulkhead. A coil cord assembly and jack is attached to each of the cabin interphone panels to provide mobility for the crewman or observer. Each panel is equipped with a volume control knob, a rotatble six-position transmit-interphone selector switch, and six receiver switches. The volume control knob, marked VOL, provides a means of regulating the level of received audio signals to the headsets. The transmit-interphone selector switch, marked PVT, INT, 1, 2, 3, and 4, enables selection of one of four transmitters except for the PVT position which is provisional. The INT, 1, 2, 3, and 4 positions on the selector switch couple the interphone, UHF, VHF, HF and the TAC/FM radio set transmitters and receivers, respectively, to the control panels. The transmit-interphone switch is inoperative in the hoist operator's and crewmen's interphone control panels except for the INT position. The switches, marked RECEIVERS, 1, 2, 3, 4, INT, and NAV, provide a means of selecting any of six receivers, in addition to the receiver selected by the transmit selector switch. The number 1, 2, and 3 switches select the UHF, the VHF, and the HF receivers, respectively. The number 4 switch is for TACAN and FM. The switch marked INT provides intercommunication reception. The INT receiver switch is inoperative on all interphone control panels except the copilot's. This permits only the copilot to disconnect from the interphone system by placing his INT receiver switch in the INT position. The NAV switch enables selection of the LF automatic direction finder and marker beacon receivers, except for the hoist and observer position panels which may only select the LF automatic direction finder receiver. VOR audio is received through the VHF receiver on the number 3 switch. The panels operate on direct current from the radio bus.

COPILOT'S REMOTE ICS SWITCH. The copilot's remote ICS switch, marked ICS MAINTAINED, OFF, and RADIO MOMENTARY, is located in the pilot's compartment to the left and forward of the copilot's seat. The switch is connected in parallel to the cyclic stick trigger switch permitting operation of the interphone and radio systems. When the switch is placed in the ICS MAINTAINED position, intercommunications may be conducted. When the switch is placed in the OFF position, normal radio operation through the cycle stick switch is maintained. The RADIO MOMENTARY position allows the copilot to conduct radio communications. When the switch is released, it will return to the OFF position.

HOIST OPERATOR'S INTERPHONE SWITCH. The hoist operator's interphone switch, marked HOT MIKE, with positions MOMENTARY, OFF, and MAINTAINED, is located above the cargo door on the hoist control panel to the left of the interphone control panel. Intercommunications may be conducted in either the MOMENTARY or MAINTAINED positions. When the switch is placed in the MAINTAINED position, hands-off operation of the interphone system is provided during rescue or hoist operations. From the MOMENTARY position the switch is spring-loaded to the OFF (centered) position. A warning light, located on the HOT MIKE switch, is used as a safety precaution to indicate that power is applied to the HOT MIKE switch, which prevents radio communications for the pilot and copilot.

INTERPHONE OPERATION.

To turn the set on:

1. Radio master circuit breaker - Set (Forward circuit breaker panel).
2. Interphone circuit breakers - Set (Radio circuit breaker panel).
3. Radio master switch - ON (Overhead switch panel).
4. (ALL STATIONS) RECEIVERS INT switch - ON (Interphone control panel) or transmit-interphone selector switch - INT (Interphone control panel).

To transmit:

1. (ALL STATIONS) Transmit-interphone selector switch - INT (Interphone control panel).
2. Pilot or copilot cyclic stick trigger switch - Depress.
3. Copilot override ICS switch - ICS MAINTAINED (For copilot hands-off operation).
4. Hoist operator or observer microphone switch - Depress.
5. Hoist operator HOT MIKE - MOMENTARY or MAINTAINED.

To turn the set off:

1. Radio master switch - OFF (Overhead switch panel).

UHF/COMM RADIO SET AN/ARC-51A.

The UHF/COMM system AN/ARC-51A is composed of a receiver-transmitter, and a control

panel. The set provides two-way voice communication between land based, seaborne or airborne stations. This can be accomplished on any one of 20 preset frequencies or by manually selecting any one of 3500 channels spaced at 50 kHz intervals within the equipment's frequency range of 225.0 through 399.95 MHz. The radio set includes a guard receiver which permits continuous monitoring of the Guard frequency at the same time the main transmitter receiver is tuned to a tactical frequency. The circuit is protected by a circuit breaker on the radio circuit breaker panel marked UHF.

UHF/COMM Control Panel.

The operating controls located on the AN/ARC-51A radio control panel (figure 45) are the function selector, the mode selector, the preset channel control, the preset channel indicator, the frequency selectors, the frequency display window, the volume control, and the squelch disable switch.

Function Selector.

The function selector switch has 4 positions.

In the OFF position, all power is removed from the equipment.

The T/R position energizes the receiver-transmitter.

T/R+G energizes the receiver-transmitter and guard receiver.

The ADF position is inoperative.

UHF TRANSMITTER-RECEIVER OPERATION.

To turn the set on:

1. Radio master switch - ON.
2. Function switch (UHF panel) - T/R or T/R+G.
3. RECEIVERS No. 1 switch (Interphone control panel) - ON.
4. Volume knob (UHF panel) - As desired.
5. Channel selector switch - Rotate to desired operating frequency.

To Transmit:

1. Transmit - interphone selector switch (Interphone control panel) - No. 1.

To turn the set off:

1. Function switch (UHF panel) - OFF.

VHF COMMUNICATION SYSTEM (AN/ARC-84).

The VHF communication system, AN/ARC-84, provides amplitude modulated voice communication between aircraft and ground stations over a frequency range of 118.0 to 135.95 megacycles. Control for the system is provided by a control panel, marked NAV-COMM, located on the lower radio console. The panel consists of two frequency selector knobs, a volume, on and off knob, a squelch knob, and double and single channel selector switches. This panel also contains the controls for the glide slope system, GSA-8A, and the navigation system, NVA-22A which are described under their respective systems in this section. The frequency knobs enable selection of the normal operating frequency. The volume knob, marked VOL and OFF, applies the primary power to the system and adjusts the headset volume. The knob, marked SQ, enables squelch level adjustment. The switch, marked DC and SC, provides, in the SC position, reception and transmission on the same frequency. The DC position is inoperative in this installation. The system operates on 28 volts dc from the radio bus and is protected by circuit breakers, marked VHF RCVR, and XMTR, located on the radio circuit breaker panel.

VHF COMMUNICATION SYSTEM OPERATION.

To turn the set on:

1. Radio master switch - ON (Overhead switch panel).
2. VOL - OFF knob - ON (NAV and COMM control panel).
3. RECEIVER NO. 2 switch - ON (Interphone control panel).
4. Frequency knobs - 118.0 to 135.95 as desired (NAV and COMM control panel).

To transmit:

1. Transmit-interphone selector switch - NO. 2 (Interphone control panel).

To turn the set off:

1. VOL - OFF knob - OFF (NAV and COMM control panel).

HF RADIO SET (AN/ARC-94).

The HF radio set provides reliable, preset multichannel two-way radio communication using transmission in the "USB" (upper side band) and "AM" (amplitude modulation) in frequency from two to thirty megacycles selected by the function selector switch. The desired change of frequency is selected by rotation of the four line referenced control knobs, located on the face of the control panel. An "R-F SENSITIVITY" control knob through rotation varies the R-F gain of the set. The components of the HF radio set are the control unit, transceiver, antenna coupler, and wire antenna. The helicopter's ac and dc system supplies the voltages for normal operation of the HF radio set, through three 5 ampere ac circuit breakers, marked "HF-SSB-ØA, "HF-SSB-ØB, "

"HF-SSB-ØC," and a 5 ampere dc circuit breaker, marked "HF-SSB," located on the electronics circuit breaker panel, which supplies 28 VDC to the LF-ADF sense antenna relay K4 which energizes when the ARC-94 transmitter is keyed to prevent R-F damage to the interior components of the LF-ADF receiver.

CONTROL UNIT.

The control unit (figure 43), located on the forward right-hand side of the overhead control panel, provides remote control of the transceiver. The control unit is marked "HF" and has six control knobs. The function selector switch selects the "USB" (upper side band), "AM" (amplitude modulation), or "OFF" position. The "LSB" (lower side band) position is not used. The "R-F SENSITIVITY" control knob regulates the R-F gain of the HF radio set. The four line referenced control knobs through rotation change the frequency of the HF radio set numerically indicated on the window area on the face of the control unit.

WARNING

During ground operation of the AN/ARC-94, insure that personnel are clear of the antenna. Serious burns may result if bodily contact is made with the antenna during ground operation.

HF TRANSMITTER-RECEIVER OPERATION.

To turn the set on:

1. Radio master switch - ON (Overhead switch panel).
2. Mode selector switch - ON (HF control panel).
3. RECEIVER switch No. 3 - ON (Interphone control panel).
4. RF SENS (HF control panel) - Minimum setting for reception.
5. Interphone audio control - As desired.

To transmit:

1. Transmit-interphone selector switch - NO. 3 (Interphone control panel).

To turn the set off:

1. Mode selector switch - OFF (HF control panel).

AUTOMATIC DIRECTION FINDER SET (AN/ARN-73.)

The automatic direction finder set is an airborne, transistorized, radio direction finder that provides automatic or manual compass bearings on any radio signal between 100 and 3000 kilocycles. The tuning range is divided into four bands as follows: 100 to 235 kc, 235 to 560 kc, 560 to 1335 kc, and 1335 to 3000 kc. The AN/ARN-73 also functions as a low-frequency radio range and communications receiver. A beat frequency oscillator permits identification of keyed cw stations and may be used to obtain improved indications of an aural null during loop operation. The set is controlled from a paenl marked ADF RCV located on the radio console. Controls include a volume control knob marked VOL-OFF, a function switch marked COMP-ANT-LOOP, a maximum tuning indicator marked MAX, a local light

marked LOCAL, a loop slew switch marked LOOP, a KC band selector knob marked KC BAND, an override-local switch marked OVERRIDE LOCAL: a KC frequency dial window, a BFO selector switch, marked BFO-OFF, and an unmarked crank type tuning handle. When the function switch is in COMP the AN/ARN-73 functions as an automatic direction finder. When function switch is in ANT, VOL-OFF volume control knob functions as an r-f sensitivity control. When the control is adjusted to a normal listening level, the automatic gain control is inactive due to the agc delay. These conditions, plus the sensitivity and selectivity of this radio set permits it to be used as a low-frequency range receiver.

NOTE: The AN/ARN-73 should always be operated with VOL-OFF control backed off to a comfortable audio level during low-frequency range operation because course broadening may result at high audio levels. In ANT operation the audio output is adjusted by manually varying r-f gain of the receiver. This method is used so that the incoming signal level may be kept below the range of agc action, thereby providing an indication of relative signal strength. The control circuit of the COMP-ANT-LOOP switch automatically switches the VOL-OFF control for this purpose.

For accurate reception of low-frequency radio range signals, use the ANT position of function switch. In the COMP position, agc action causes course-broadening of the signals. If an interphone is used when receiving A-N radio range signals, set the interphone volume at maximum and control audio level with the VOL-OFF control. When function switch is in LOOP, the AN/ARN-73 may be used for manual direction finding (MDF) procedures. The LOOP skewing switch may be used with function switch in LOOP or COMP. With function switch in COMP, reliability of incoming signals may be checked by skewing No. 1 needle and noting return to station bearing. BFO is used principally to identify cw transmission occuring within frequency range of the AN/ARN-73 such as those employed in areas outside United States, but may also be used to aid in determining aural nulls. For cw identification COMP-ANT-LOOP function switch is placed in ANT; for aural-null procedures, the switch is set to LOOP. The OVERRIDE - LOCAL switch is not used in AN/ARN-73 installation on this helicopter. The DIM-BRIGHT lamp will come on when VOL-OFF control switch is rotated with system power applied.

LF AUTOMATIC DIRECTION FINDER OPERATION.

To turn set on for use as a conventional radio receiver:

1. Radio master switch - ON (Overhead switch panel).
2. RECEIVER NAV switch - ON (Interphone control panel).
3. VOL OFF switch - ON and adjust as desired.
4. Function switch - ANT.
5. KC BAND switch - Set to desired operating band.
6. Tuning control - Tune to desired station.

To turn set on for use as an automatic direction finder:

1. Radio master switch - ON.
2. RECEIVER NAV switch - ON.
3. VOL-OFF switch - ON and adjust as desired.
4. Function switch - ANT.
5. KC BAND switch - Set to desired operating band.
6. Tuning control - Tune to desired station.
7. Function switch - COMP.
8. Tuning meter - Adjust to MAX.

To turn set on for use as a manual direction finder:

1. Radio master switch - ON.
2. RECEIVER NAV switch - ON.
3. VOL-OFF switch - ON and adjust as desired.
4. Function switch - ANT.
5. KC BAND switch - Set to desired band.
6. Tuning control - Tune to desired station.
7. Function switch - LOOP.
8. LOOP control - Operate for aural null.
9. VOL-OFF switch - Adjust for null width.

NOTE: BFO and/or tuning meter may be used to aid in determining aural null.

For navigation with an unmodulated continuous wave (CW) station:

10. Function switch - ANT.
11. BFO switch - BFO.

Tune to desired station; a properly tuned cw signal will produce a 1000-cycle beat note. To obtain proper cw indentification, detune slightly until frequency of beat note changes, tune receiver from one side of signal to other. Tone will decrease from high pitch to zero and increase again on other side of zero beat.

12. Volume control - Adjust as desired.

To turn set off:

1. VOL-OFF switch - OFF.

NAVIGATION SYSTEM (NVA-22A) (ARN-87).

The navigation system, NVA-22A, is a fully transistorized airborne navigation unit that is to be used in conjunction with VHF radio set receiver (AN/ARC-84) to provide VOR (VHF omni-directional range) and LOC (Localizer) modes of operation. Controls for system are contained within AN/ARC-84 control

panel. When a frequency of from 108.1 to 111.9 megacycles (odd tenths only) is selected, the LOC mode of operation is automatically obtained, and this frequency selection also provides a corresponding glide slope (GSA-8A) frequency. When a frequency of 108.0 to 111.8 megacycles (even tenths only) is selected or a 112.0 to 117.9 megacycle frequency is selected, the VOR mode of operation is obtained and the glide slope, GSA-8A, receiver is returned to a standby condition. The VHF transmitter is automatically tuned to 121.5 MCS in both LOC and VOR modes. The course information obtained from these modes of operation are fed to the flight director, course, and radio magnetic indicators, for presentation to the pilot or copilot. The system operates on 26 volts ac power and 28 volts dc power. The ac power is protected by a circuit breaker, marked IND, located on the radio circuit breaker panel. The dc power is protected by the compass system circuit breakers which are described under that system.

NAVIGATION SYSTEM OPERATION.

To turn the set on:

1. Radio master switch - ON (Overhead switch panel).
2. VOL - OFF knob - ON (NAV and COMM control panel).
3. Frequency selector knob - 108.0 to 117.9 as desired for VOR or LOC operation (NAV and COMM control panel).
4. RCVR switch (ICS panel) - No. 2

To turn the set off:

1. VOL - OFF knob - OFF (NAV and COMM control panel).

GLIDE SLOPE SYSTEM (GSA-8A-1).

The GSA-8A glide slope system is an airborne UHF receiver designed to receive glide slope transmission within the frequency range of 329.3 to 335.0 megacycles and to provide vertical guidance during instrument landings. The receiver is controlled by the VHF navigation set control and can be modified to provide either ten or twenty channel operation. Information is provided through the flight director indicators and the ID-387/ARN course indicator, located on the instrument panel in front of the pilot and copilot. When a localizer frequency of 108.1 to 111.9 mc (odd tenths only) is selected on the control unit, the corresponding glide slope frequency is automatically selected. When the horizontal bar on the flight director indicator is up, the glide path is above the helicopter; if the bar is down, the glide path is below the helicopter; if the bar is centered in a horizontal position, the helicopter is directly on the glide path. The glide slope system operates on direct current from the dc radio bus through a circuit breaker, marked GLIDE SLOPE, located on the radio circuit breaker panel.

MARKER BEACON SYSTEM (MKA-23A).

The marker beacon system, MKA-23A, detects 75 megacycle signals modulated by either a 400, 1300, or 3000 cycle-per-second tone. Accordingly, it identifies airway fan markers, station locator Z markers, and approach markers of an instrument landing system. The system provides aural and visual indications by way of the interphone system and light indication on the ID-387/ARN course indicator. Controls for the system consist of a volume and on-off knob and a sensitivity switch, located on the instrument panel, under the heading MARKER BEACON. The volume control knob, marked VOLUME OFF, enables regulation of audio volume in the headsets. The sensitivity switch, marked SENSITIVITY, LO, MED, and HI, provides a means of selecting three sensitivity settings, for the marker beacon receiver. In this installation, the LO and MED positions provide the same sensitivity. The system operates on 28-volts dc from the radio bus and is protected by a circuit breaker, marked MB, located on the radio circuit breaker panel.

MARKER BEACON SYSTEM OPERATION.

To turn the set on:

1. Radio master switch - ON (Overhead switch panel).
2. Volume control knob - ON (Marker beacon control panel).
3. RECEIVER NAV switch - ON (Interphone control panel).
4. Sensitivity switch - As required (Marker beacon control panel).

To turn the set off:

1. Volume control knob - OFF (Marker beacon control panel).

IFF RADAR IDENTIFICATION SET (AN/APX-44).

The radar identification set, AN/APX-44, provides functions to receive, decode, and reply to characteristic interrogations from IFF, MOD, and CIVIL secondary ground radar systems over a frequency band of 1010 to 1110 megacycles. The radar set will only transmit after proper interrogation. The set is controlled by a panel, marked XPDR, located on the overhead radio panel. Its basic function is divided into two catagories, functional controls, and operation controls. The functional controls include the master control, marked OFF, STBY, LOW, NORM, and EMER; the function control, marked NORMAL, MOD, and CIVIL; the position identification switch, marked I/P, OFF, and MIC; the audio switch, marked AUDIO, ON, and OFF; the mode two switch, marked MODE 2, ON, and OFF; the mode three switch, marked MODE 3, ON, and OFF; and a press-to-test type panel light. The master control operates the receiver-transmitter power relay to apply primary power to the

transponder set, selects either low or normal IF sensitivity, and operates the receiver-transmitter relay for emergency replies. The function control operates the receiver-transmitter relays to determine the reply category, and supplies the ground connection for enabling the MODE 1 and MODE 3 code controls to select their reply trains for selective identification feature replies (MOD or CIVIL). The position identification switch provides two means of energizing the I/P relay either directly at the radar control panel or from the helicopter microphone (MIC) switch circuits. When the I/P relay is energized, it operates through the function control to provide repeated replies required for position identification. An I/P time-delay relay will keep the I/P relay energized for 30 seconds. The audio switch applies audio (relay pulses) to the aircraft audio system for monitoring of the transmitted replies, but in this installation the switch is inoperative. The MODE 2 and 3 switches enable or disable their reply code switching cards. The panel light indicates when the set is operating. The operational controls consist of the MODE 1 and MODE 3 code controls. When these controls are actuated by the function control, they control the switching diodes in the MODE 1 and MODE 3 reply code switching cards to determine the composition of their respective coded reply trains. The set operates on 28-volts dc from the radio bus and is protected by a circuit breaker, marked IFF, located on the radio circuit breaker panel.

IFF RADAR IDENTIFICATION SET OPERATION.

To turn the set on:

1. Radio master switch - ON (Overhead switch panel).
2. Master control switch - STBY (XPDR control panel).

To turn the set off:

1. Master control switch - OFF (XPDR control panel).

PORTABLE FM TRANSCEIVER (AN/PRC59).

Provisions have been made for the temporary installation of a portable FM transceiver (AN/PRC59). The PRC59 audio and the TACAN IDENT TONE are both received on the No. 4 position of the AIC C-1611A. When the PRC-59 is turned ON the Tacan Audio will be automatically disconnected. If TACAN identification is required, while the PRC-59 is ON, the PRC-59 must be momentarily turned off to receive the identification signal.

TACAN RADIO SET AN/ARN-52(V) (TACTICAL AIR NAVIGATION).

The TACAN system AN/ARN-52(V), an airborne navigation set consisting of a receiver-transmitter and control panel, supplies inputs to the BDHI, RMI and a course indicator marked TACAN on the instrument panel. It operates in conjunction with a selected fixed ground station or with another cooperating aircraft equipped with air-to-air TACAN. In the receive mode of operation, the AN/ARN-52(V) provides continuous information of the bearing (azimuth angle) from the helicopter to a selected ground station. In the receiver-transmit mode of operation, the AN/ARN-52(V) provides continuous information on the line of sight distance from the aircraft to a selected ground station in addition to bearing information. In the receive-transmit and receive modes of operation the selected ground station is identified by the identity tone signal. In the air-to-air mode of operation, the AN/ARN-52(V) provides continuous information of the line of sight distance between two cooperating aircraft that are each equipped with air-to-air TACAN. Although the maximum range of the equipment is governed by line of sight considerations, the maximum indicated range is 300 miles.

NOTE: Operation in the air-to-air mode requires prearrangement with a cooperating aircraft. The second aircraft must be equipped with an air-to-air TACAN which is set to the air-to air mode of operation and is set to a channel 63 channels away from the channel setting of the AN/ARN-52(V) in the first aircraft. One aircraft may reply to as many as five others, but it will only display the distance to the nearest aircraft. Bearing information is not provided in the air-to-air mode.

Visual presentation of the TACAN course is made on the pilot's course indicator (figure 42) and the RMI's. Ambiguity in TACAN bearing information of a TACAN (manual) course is resolved by the to/from

arrow. Visual presentation of (automatic) TACAN bearing is presented with the No. 2 pointer of both RMI's. The distance to a TACAN or VORTAC station is displayed by the miles counter on the course indicator. The distance is read in nautical miles.

CAUTION

It is possible that improperly adjusted or malfunctioning ground or airborne TACAN equipment may "lock-on" to a false bearing. The error will probably be plus or minus 40 degrees, but can be of any value to either side of the correct bearing in multiples of 40 degrees. This possibility is inherent in the TACAN system and, therefore, the TACAN should be cross-checked with ground radar, airborne radar, VOR, or LF-ADF.

The TACAN is protected by one circuit breaker on the radio circuit breaker panel.

TACAN Operating Controls.

The control panel located on the center console (figure 4-43), contains the channel selector, the volume control and the function selector switch.

CHAN Selector Knob. The channel selector knob is a rotary switch that provides for selection of 126 TACAN channels.

VOL Control. The control allows for adjustment in volume of beacon identity tone signal.

Function Selector. The function selector switch is a 4 position rotary switch that determines the mode of equipment operation.
OFF removes power from the set.
REC turns the receiver on.
T/R turns the transmitter and receiver on.
A/A enables air-to-air distance measuring.
The equipment requires a three minute warmup period regardless of the mode selected. The No. 2 navaid selector switch with the marked positions VOR and TAC is located on the instrument panel. This switch selects the navaid that will control the No. 2 pointer on the RMI's.

TACAN Operation.

To turn set on:

1. Function selector switch (TACAN control panel) - AS REQUIRED.
2. ICS monitor selector - TAC/FM.
3. VOR-TACAN selector switch (Instrument panel) - TACAN.
4. Channel selector knob (TACAN control panel) - AS REQUIRED.
5. Tone level control - AS REQUIRED.

To secure set:

1. Function selector switch (TACAN control panel) - OFF.

RADIO ALTIMETER (AN/ARN-79).

The AN/APN-117 low altitude altimeter is replaced by the AN/ARN-79. Radio altimeter AN/ARN-79, provides visual indications of altitude (terrain clearance) from 0 to 1000 feet and three distinctive headset audio warning tones set at predetermined altitudes. Altitude is indicated by two altimeter indicators marked RADIO ALTIMETER FEET located on the instrument panel. Each indicator contains a LIMIT control knob, a limit control bug, and a red, press-to-test, low limit light. The LIMIT control knob is the power switch for the set and is also used to set the limit control bug to any desired altitude between 0 and 1000 feet. The low limit light illuminates whenever the helicopter is at or below the altitude set with the bug. Low limit setting of each indicator is independent of the low limit setting of the other indicator. In case of power failure or an unreliable signal, OFF flags appear on the indicators and the altitude pointers are driven behind their masks. The audio warnings are controlled by a switch marked RAWS AUDIO, ON, and OFF located on the instrument panel. When the switch is placed in the ON position the audio warning signals are received in the headset. The audio warnings are; a 3 second duration, 120 pulse-per-minute signal when the helicopter descends through 140 feet, a 3 second duration 240 pulse-per-minute signal when the helicopter descends through 40 feet, and a continuous signal above 2500 feet. As the aircraft goes above the pre-set altitude, no tone is heard. Tones are only heard on descent through pre-set altitudes. When the continuous signal is heard the limits of the set are exceeded and the RAWS AUDIO switch should be turned off. When the RAWS AUDIO switch is placed in the OFF position, audio signals are cut off and the RAWS OFF light on the caution panel illuminates.

RADIO ALTIMETER SET OPERATION.

To turn set on:

1. Radio master switch - ON.
2. Limit switch - ON.

To operate set:

1. Limit switch - Set BUG to desired altitude (visual).
2. Raws audio switch - ON for 40, 140, and 2500 foot audio warnings, - OFF for no audio warnings.

To turn set off:

1. Limit switch - OFF.

Pages 116, 117 and figure 47 deleted.

This page intentionally left blank.

This page intentionally left blank.

SECTION VII

FLIGHT CHARACTERISTICS

GENERAL.

Unlike a conventional fixed-wing aircraft, this helicopter, like most helicopters, has no absolute minimum speed limited by such a definite characteristic as a stall. The safe operating speed range extends from a rearward speed of 20 knots to a forward speed of 109 knots, and also includes lateral speeds either to left or right of 25 knots. They are limited by the amount of control available with various center of gravity loadings and rotor speeds. While there may be no need for flight other than in the forward direction, it is frequently necessary to hover in crosswinds and tailwinds of the same velocities, as those mentioned above, for sideward and rearward flight. The helicopter is directionally stable in forward flight, but in sideward and rearward flight, directional control is more difficult to maintain, as the nose of the helicopter has a tendency to turn in direction of flight. This is due to the large flat plate area aft of the main rotor shaft.

CLIMB.

CAUTION

During climbs at low altitude, a safe autorotative speed should be maintained, so that in event of engine failure, sufficient but not excessive speed is available to accomplish a safe autorotative landing. Accelerating the helicopter to the best climbing speed in a shallow climb, eliminates critical settling and possibility of the helicopter striking the ground on take-off.

STALLS.

Stalling, as applied to a fixed-wing aircraft, will not occur in a helicopter; however, a power settling may occur in low speed flight and blade tip stall may occur at high speed flight. Refer to POWER SETTLING, Section III.

BLADE STALL.

BLADE STALL IN LEVEL FLIGHT.

Blade stall is one of the contributing factors to erratic stick forces. However, blade stall is often of a nature which conforms to the following pattern. Whenever, the airspeed of the tip of the retreating blade falls below a predetermined speed blade stall will be experienced. During accelerated flight conditions or when operating with high values of forward speed, gross weight, load factor, power, altitude, or with low rotor speed, a stall may occur at the outer portion of the retreating blade on the left side of helicopter. At the threshold of blade stall, the pilot will feel an increase in the general vibration level of the helicopter and occasional "kicks" in the flight controls. A further increase in forward speed, a reduction in rotor speed, or abrupt maneuvers can so aggravate the stall that rotor blade pitching moments become strong enough to overpower flight control servos and permit strong steady or strong vibratory loads in the control system. Also, the controllability of the helicopter will deteriorate. If such vibrations and control kicks should be noticed, the stall may be easily eliminated by accomplishing any one or a combination of the following:

1. Reduce collective pitch.
2. Increase rotor speed.
3. Decrease severity of the maneuver.
4. Gradually decrease airspeed.

SEVERE BLADE STALL - PITCH-UP.

Blade stall, as experienced in level flight without turbulence, does not present any undue hazard as the

vibratory forces in the helicopter provide ample warning. During maneuvers that increase the G load such as sharp turns or high speed flares from diving descents, where rapid application of collective pitch lever is involved, and especially when using aft cyclic stick, severe blade stall may be encountered. Severe blade stall may also be encountered in turbulent air when the pilot attempts to counteract induced porpoising with rapid or sharp forward applications of the cyclic stick, and during normal turn recoveries at high altitude when forward cyclic stick is applied to lower the nose of the helicopter. Severe blade stall can be recognized by an abrupt pitch-up of the nose of the helicopter. The pitch-up is caused by the retreating blade having a greater stalled area than the stalled area encountered during the fringe of blade stall and is due to excessive angle of attack. This greater area of blade stall results in a loss of lift of the retreating blade, which causes the blade to drop downward instead of climbing upward as it approaches the tail cone of the helicopter. The retreating blade reaches its lowest point 90 degrees from the point at which lift decreases, thereby, causing the tip-path plane of rotation of the main rotor blades to tilt downward toward the rear and causing the nose of the helicopter to pitch upward. This change in attitude results in an extremely high G loading, and an increase of the in-flow of air to the rotor which greatly increases the angle of attack and accentuates blade stall. The normal control response to overcome pitching, forward application of the cyclic stick without decreasing the collective pitch lever, may be ineffective. A strong steady feedback may force the cyclic stick left rear momentarily during the severe stall. The uncontrolled pitch-up lasts only for a very short period. Then, full control is restored as airspeed decreases in the nose-high attitude and the excessively high angle of attack no longer exists. To stop the nose pitch-up, especially during turns at critical airspeeds and attitudes, gradually reduce collective pitch and/or rapidly increase rotor speed and gently ease the nose of the helicopter down with a smooth forward application of the cyclic stick.

NOTE: Do not shut off the flight control servo system when pitch-up is experienced.

Avoid operation in thunderstorms and associated turbulent areas. When in turbulent air, reduce airspeed to minimize the porpoising as, these conditions may cause severe blade stall.

SPINS.

Spins are not a flight characteristic of helicopters.

FLIGHT CONTROLS.

FLIGHT CONTROL SERVOS.

Pilot fatigue is reduced considerably by the installation of two main rotor flight control servo systems. The primary servos at the main rotor assembly and the auxiliary servos at the main rotor control mixing unit are both in operation at all times. Because of the servo units, the control forces are virtually eliminated and are constant throughout their full range. If either servo system should fail or malfunction, it may be turned off, provided there is sufficient hydraulic pressure in the other system. The primary servo system cannot be shut off if hydraulic pressure in the auxiliary servo system drops below 1000 psi. The auxiliary servo system cannot be shut off if hydraulic pressure in the primary servo system drops below 750 psi. If the primary flight control servo system fails or is shut off, the auxiliary flight control servo system provides power to prevent any substantial increase in cyclic control forces. If during flight the primary servo system is shut off, the helicopter assumes a slight bank to the left. Upon returning the system to operation this bank is cancelled by an equal roll to the right.

PILOT INDUCED COLLECTIVE BOUNCE

Since the flight control servo systems provide "force free" operation of the flight controls, a condition of collective bounce can occur if collective friction is not used. Collective bounce can occur in flight as well as on the ground. Rapid vertical displacement of the helicopter may cause a neutrally balanced, friction free collective pitch lever to move out of phase with the helicopter's vertical motion. The pilot, in an attempt to correct the condition by holding the collective, may inadvertently increase the amplitude of the collective bounce with a possibility of the helicopter's motion becoming divergent. This condition is sometimes referred to as "collective resonance." To preclude collective bounce, some collective friction should be used at all times.

COORDINATION OF FLIGHT CONTROLS.

The climb or descent of this helicopter is controlled by increasing or decreasing the collective pitch lever; however, coordinated movements of the tail rotor pedals and cyclic stick are necessary to maintain a constant heading. When the collective pitch lever is increased to ascend, additional torque is developed by the main rotor. This torque must be compensated for by depressing the left tail rotor pedal to increase the pitch and thrust of the tail rotor to the right. Sideward flight during a hover is accomplished primarily by lateral displacement of the cyclic stick; however, it is necessary to use tail rotor pedals to prevent the nose from swinging toward the direction of flight. When flying to the right the cyclic stick is displaced to the right, and the left tail rotor pedal is used to keep the nose of the helicopter on the original heading. For flight to the left, the cyclic stick is displaced to the left, and the right tail rotor pedal is used to keep the nose of the helicopter on the original heading. Turns are accomplished, primarily, by depressing the right tail rotor pedal for a right turn and the left tail rotor pedal for a left turn. In hovering, with no wind, no appreciable movements of the cyclic stick are necessary. During forward flight at slow speeds, coordinated movements of the cyclic stick and tail rotor pedals are necessary to accomplish turns. In high speed flight, less tail rotor pedal displacement is necessary.

LEVEL FLIGHT CHARACTERISTICS UNDER VARIOUS SPEED CONDITIONS.

For hovering or slow speed flight, maximum rotor speed may be required becuase of the increased collective pitch needed to produce sufficient lift. When, from hovering or slow speed flight, forward speed is desired, the cyclic stick is moved forward. A momentary settling will occur with rapid accelerations, and then the helicopter climbs due to the increase in efficiency of the main rotor as helicopter moves forward.

MANEUVERING FLIGHT.

No acrobatic maneuvers are permitted with the helicopter although the high degree of maneuvarability makes it possible to execute many maneuvers and flight conditions which permit efficient and safe operations from extremely small or remote areas.

HOVERING OUT OF GROUND EFFECT.

Careful evaluation of wind direction is of great importance prior to this maneuver. Hover into the wind and gradually reduce airspeed, maintaining altitude. Control manipulation and power turbine speed changes must be smooth and precise or the helicopter may inadvertently enter power settling. Do not allow helicopter to enter a descent while establishing hover. Recovery is affected by increasing rotor speed and slowly lowering the nose to attain translation. Some yaw may be experienced; however, this tendency is easily overcome by use of tail rotor pedals. The pilot must be thoroughly familiar with power settling and its recovery procedure prior to attempting this maneuver.

DIVING.

Maximum diving speed is limited at sea level to 109 knots IAS. During recovery from a dive, however, increased G load may cause blade stall. Therefore, recovery should be made very shallow to prevent the occurence of excessive G loads and the subsequent blade stall.

U.S. COAST GUARD—General Offset Ptg. Co. Springfield, Mass. - 250

ALPHABETICAL INDEX

A

AC Essential Bus 92
AC External Power Receptacle 90
AC Non-Essential Bus 92
AC System Failure 20C
Advisory Panel 90
Advisory Panel Lights 90
After Landing and Taxiing 13
Airspeed Indicator 2
Airspeed System Calibration *24
Alternate Engine Starting Procedure (P_3 Valve) 9
Alternating Current Circuit Breakers 92
Alternating Current Distribution 92
Alternating Current Supply System 90
Ambient Temperature Limitations 1
Anti-Collision Light Switch 100
Approach and Landing Procedures - General ... 18
Approach with Tail Rotor Inoperative (Autorotation) 18
Attitude Indicators 87
Automatic Direction Finder Set (AN/ARN-73) ... 112A
Automatic Stabilization Control Panel 99
Automatic Stabilization Equipment 98
Automatic Stabilization Equipment Failure 19
Autorotation Approach Speeds 17
Autorotative Landing Distance (50 FT Height to Stop, GW 7500 lbs) *35
Autorotative Landing Distance (50 FT Height to Stop, GW 8300 lbs) *36
Autorotative RPM vs Density Altitude (IAS 55 Knots, Full Low Pitch) *37
Auxiliary Float Actuation 21
Auxiliary Float Air Cylinders 104A, 105
Auxiliary Float Electrical Release Switch Panel 104A
Auxiliary Float Manual Release Handle 105
Auxiliary Floats 104A, 104D
Auxiliary Flotation Installation - Electrical Release System 104A
Auxiliary Flotation Installation - Mechanical Release System 104A
Auxiliary Flotation System 104A
Auxiliary Servo Hydraulic Pressure Gage 2C
Auxiliary Servo Hydraulic System Pressure Indicator 98
Auxiliary Servo System 98

B

Battery 92
Battery Start 8
Battery Switch 93
Beeper Trim Switch 97
Beeper Trim System 96
Before Entering The Helicopter 5
Before Leaving The Helicopter 13
Before Starting 5
Blade Stall 118
Blade Stall in Level Flight 118
Brake Pedals 100

C

Cabin Dome Light Switch 101
Cabin Door Emergency Exit 20B, 105
Cabin Emergency Hatch 20B, 105
Cabin Fire 20A
Cabin Hoist Switch 106
Cabin Portable Hoist Control Switch 106
Cargo Release Switch 108
Cargo Sling 107
Cargo Sling Master and Mode Switches 108
Caution Panel 90
Caution Panel Lights 90
Center of Gravity Graph *57
Center of Gravity Limitations 1
Channel Monitor Panel 99
Climb 118
Clock 87
Cockpit Emergency Exits 20B
Cold Hangup 14
Collective Pitch Levers 96
Communication and Associated Electronic Equipment 108, *110
Console and Panel Lights Rheostat 102
Controllable Landing Light 101
Controllable Landing Light Master Switch 101
Coordination of Flight Controls 119
Copilot's Flight Instrument Light Rheostat 102
Copilot's Landing Light Control Switch 101
Copilot's Remote ICS Switch 111
Course Indicator (ID-387/ARN) 89
Cruise Checks 12
Cyclic Sticks 96

D

Danforth Anchor 105
DC Essential Bus 93
DC External Power Receptacle 93
DC Non-Essential Bus 93
DC System Failure 20C
Density Altitude Chart *23
Deploying Danforth Anchor 21
Deploying Sea Drogue 21
Direct Current Circuit Breakers 96
Direct Current Distribution 93
Direct Current Power Supply System 92
Directional Gyro Compass Control Panel, MA-1 88

(Asterisks before page numbers denote illustrations)

Directional Gyro Compass System, MA-1 87
Diving 120
Dual Failure of Engine Fuel Control and Overspeed Governor 17
Dual Generator Failure 20C
Dual Tachometer 2
Dual Tachometer (Power Turbine and Rotor) .. 75

E

Elapsed-Time Indicator 76
Electrical (ASE) 19
Electrical Fire 20A
Electrical Power Supply Schematic Diagram -
AC (Sheet 1) *94
DC (Sheet 2) *95
Electrical Power Supply System Malfunction... 20C
Electrical Power Supply Systems 90
Emergency Crash Lights 104A
Emergency Equipment 104
Emergency Exits *18, 20B
Emergency Exits and Entrances 105
Emergency Exit Signs 104A
Emergency Sea State Capabilities *104B
Emergency Shutdown 15
Emergency Throttles 75
Empty Weight and Center of Gravity 56
Engine 73
Engine Air-Inlet Anti-Icing System 79
Engine Air-Inlet Anti-Icing System Caution Light 79
Engine Anti-Ice Switch 79
Engine Anti-Icing System 79
Engine Compartment Fire Detector System.... 104
Engine Compartment Fire Extinguisher Switch 104A
Engine Compartment Fire Extinguisher System 104
Engine Compartment Fire Warning Lights and Test Switch 104
Engine Component Anti-Icing System 79
Engine Component Anti-Icing System Advisory Light 80
Engine Compartment Fire During or After Starting 20
Engine Compartment Fire in Flight 20
Engine Driven Fuel Pump 20B
Engine Emergencies - Flight 15
Engine Emergencies - Ground 14
Engine Failure During Flight 16
Engine Failure During Flight 16
Engine Failure During Transition to Forward Flight and Climb 16
Engine Failure in Hover 15
Engine Fuel System 76
Engine Input Horsepower vs Indicated Torque .. *53
Engine Instruments 75
Engine Limitations 1
Engine Malfunction Causing a Power Change from that Selected (Engine Operating) 15
Engine Oil Cooler 78
Engine Oil Pressure Gage 2, 75
Engine Oil System 78
Engine Oil Tank 78
Engine Oil Temperature Gage 2, 75
Engine Overspeed System 77
Engine Speed Selectors 75
Engine Stall 14
Engine Stall Above Idle Speed 14
Exterior Inspection 5, *6

F

Fire 20
First Aid Kits 104A
Flag Indicator 76
Flight Control Emergency Operation 17
Flight Control Hydraulic Power Supply System. 97
Flight Control Malfunction 19
Flight Controls 119
Flight Control Servos 119
Flight Control Servo Shut-off Switch 98
Flight Control System 96
Flight Envelope for Safe Autorotative Landing After Power Failure *3, 4
Flight Limits 1
Flood and Hover Lights Switch 101
Forward Climb Performance (MC Power, GW 6000 lbs) *29
Forward Climb Performance (MC Power, GW 6500 lbs) *30
Forward Climb Performance (MC Power, GW 7000 lbs) *31
Forward Climb Performance (MC Power, GW 7500 lbs) *32
Forward Climb Performance (MC Power, GW 8000 lbs) *33
Forward Climb Performance (MC Power, GW 8300 lbs) *34
Free-Air Temperature Gage 87
Free Gyro Operation 88
Fuel Booster Pump Caution Lights 82
Fuel Booster Pump Failure 20B
Fuel Booster Pump Switches 82
Fuel Consumption vs Power *38
Fuel Control 77
Fuel Control System 76
Fuel Filter Bypass Caution Light 82
Fuel Fire Wall Shut-off Handle 104
Fuel Fire Wall Shut-off Valve and Handle 81
Fuel Fume Removal Procedure 20A
Fuel Low Level Caution Light 82
Fuel Pressure Gage 2, 76
Fuel Quantity Gage and Test Switch 82
Fuel Quantity Selector Switch 82
Fuel Specification and Grades 80
Fuel System 80
Fuel System Failure 20B
Fuel System Schematic Diagram *81
Fuel Tanks 81

G

Gas Generator Tachometer 75
Gas Generator Tachometer ($\%N_g$) 2
Generators 90
Generator Switches 92
Glide Slope System (GSA-8A) 114
Ground Inverter 90

(Asterisks before page numbers denote illustrations)

H

Heater Failure 20C
Heater Master Switch 102
Heater Registers 103
Heater Start Switch and Fan Switch 102
Heating System 102
Helicopter Dimensions Diagram ..... *IV
Helicopter Handling on Water - Power Off 20C
HF Transmitter-Receiver (HF-102) 112
HF Transmitter-Receiver Operation 112
High-Low Cycling Switch 103
Hoist Emergency 20C
Hoist Master Switch 106
Hoist Operator's Interphone Switch 111
Hot Start 14
Hover Ceilings (5 Ft. Wheel Clearance) *25
Hover Ceilings (OGE) *26
Hovering Out of Ground Effect 120
Hydraulic 20
Hydraulic Hoist Cable Shear Switches 106
Hydraulic Hoist Manual Override Valve 107
Hydraulic Hoist Manual Override Valve Buttons. 107
Hydraulic Hoist Operation 107
Hydraulic Hoist Shear Circuit Test 107
Hydraulic Hoist Shear Circuit Test Panel 106

I

Ice/Snow Accumulation 15
IFF/Radar Identification Set Operation 115
IFF Radar Identification Set (AN/APX-44) 114
Ignition Switch 78
Ignition System 78
Incipient Blade Stall Chart *2B
Instrument Check 11
Instrument Emergency Light Rheostat 101
Instrument Markings 2
Instrument Panel and Control Sticks *86
Instruments 85
Interior Check 5
Intermediate Gear Box 83
Intermediate Gear Box Oil System 84
Interphone Control Panels 111
Interphone Operation 111
Interphone-Radio Control System (C-1611A/AIC) 110

L

Landing 13
Landing Gear System 99
Landing with Tail Rotor Inoperative (Autorotation to Runway) 19
Level Flight Characteristics Under Various Speed Conditions 120
LF Automatic Direction Finder (AN/ARC-41C) 112A
LF Automatic Direction Finder Operation 112A, 113
Lighting Equipment 100
Loading Information 5
Chart A - Empty Weight Checklist 58
Chart B - Aircraft Actual Weight and Horizontal Balance 64
Chart C - Basic Weight and Balance Record 65
Chart D - Aircraft Diagram *66
Chart E - Crew Table 69
Chart E - Fuel Table 70
Chart E - Jacking Points 68
Chart E - Passenger and Cargo Loading Data. 68A
Chart E - Litter Patient Table Oil Table 72
Chart E - Passenger Compartment Table Troop Type Seats 70A
Loading Instructions 56
Loadmeters 96
Low Altitude Radar Set (AN/APN-117) 115
Low Altitude Radar Set Operation 115
Lower Radio Console and Channel Monitor Control Panel *109

M

Main Gear Box 83
Main Gear Box Chip Detector Caution Light 83
Main Gear Box Oil Pressure Caution Light 84
Main Gear Box Oil Pressure Indicator 84
Main Gear Box Oil Specifications and Grades 84
Main Gear Box Oil System 84
Main Gear Box Oil System Failure 20B
Main Gear Box Oil Temperature Indicator 84
Main Landing Gear 99
Main Landing Gear Position Indicator 99
Main Landing Gear Switch 99
Main Rotor Blade Damper Malfunction 20
Main Rotor Blade Folding 85
Main Rotor Flight Control System 96
Main Rotor System 85
Maneuvering Flight 120
Marker Beacon System (MKA-23A) 114
Marker Beacon System Operation 114
Master Trim Switch 97
Maximum and Overtorque Sensing System 83
Maximum and Torque Sensing System 76
Minimum Flight Crew 1
Model HH-52A Helicopter 73

N

Navigation Flight Director Indicator 88
Navigation Lights Master Switch 100
Navigation System (NVA-22A) 113
Navigation System Operation 114
Non-Flight Instrument Light Rheostat 102

O

On Entering The Helicopter 5
Operating Controls 110
Operating Limits 1
Overhead Switch Panel and Circuit Breaker Panels *91
Overspeeding of the Rotor System 17
Overspeed Switch System Test Switch 78

(Asterisks before page numbers denote illustrations)

P

Parachute Type Sea Drogue 105
Parking 13
Parking Brake Handle 100
Parking Brake Light 100
Pilot Induced Collective Bounce 119
Pilot's and Copilot's Seats 105
Pilot's Compartment *74
Pilot's Compartment Dome Light Switch 101
Pilot's Compartment Emergency Exits 105
Pilot's Compartment Spotlight 101
Pilot's Flight Instrument Light Rheostat 102
Pilot's Hoist Switch 106
Pilot's Landing Light Control Switch 101
Pitot Static System 87
Pop-Out Window Exits 20B
Portable Fire Extinguishers 104A
Position Light Switch 100
Post Flight 13
Post Shutdown Fire 20A
Power Available *39
Power Check Chart *54
Power Turbine Inlet Temperature Gage 75
Power Turbine Inlet Temperature Gage (T_5) ... 2
Power Turbine Speed Signal Failure with High Power 78
Power Turbine Speed Signal Failure with Intermediate Power 77
Power Turbine Speed Signal Failure with Low Power 77
Power vs Speed (Sea Level and 2000 FT) *40
Power vs Speed (4000 and 6000 FT) *41
Power vs Speed (8000 and 10,000 FT) *42
Predicted Range Chart *55
Pre-Landing Check 12
Pressurized Main Rotor Blades (BIM) 85
Pre-Takeoff 12
Primary Servo Hydraulic Pressure Gage 2C
Primary Servo Hydraulic System Pressure Indicator 98
Primary Servo System 98

R

Radio Altimeter (AN/ARN-79) 115
Radio Altimeter Set Operation 115
Radio Circuit Breaker Panel 109
Radio Magnetic Indicator (ID-250/ARN) 89
Radio Master Switch 109
Rain Ingestion 15
Rescue Hoist 106
Rescue Platform 107
Restarting Engine in Flight 16
Rotor and Engine Shutdown 13
Rotor Blade Damage 20
Rotor Brake 83
Rotor Brake Caution Light 84
Rotor Brake Lever 84
Rotor Engagement 9
Rotor Limits 1
Rotor Systems 85
Running Landing (Runway only) 19

S

Sea State Capability vs Lateral Unbalance ... *104C
Seat Forward or Aft Adjustment Lever 105
Seat Height Adjustment Lever 105
Severe Blade Stall - Pitch-up 118
Shoulder Harness Inertia Reel Lock Lever .. 105
Slaved Gyro Operation 88
Smoke Elimination 20A
Speed vs Altitude
(GW 6500 lbs, 96% N_r) *43
(GW 6500 lbs, 100% N_r) *48
(GW 7000 lbs, 96% N_r) *44
(GW 7000 lbs, 100% N_r) *49
(GW 7500 lbs, 96% N_r) *45
(GW 7500 lbs, 100% N_r) *50
(GW 8000 lbs, 96% N_r) *46
(GW 8000 lbs, 100% N_r) *51
(GW 8300 lbs, 96% N_r) *47
(GW 8300 lbs, 100% N_r) *52
Spins 119
Stalls 118
Standby Compass 87
Start Bus 93
Starter Switch 78
Starter System 78
Starting Engine 8
Starting with External Power 9
Stator Vane Actuating System 77

T

Take-Off 12
Take-Off Distance (5 FT. Hover to 50 FT, GW 7500 lbs) *27
Take-Off Distance (5 FT Hover to 50 FT, GW 8300 lbs) *28
Tail Gear Box Oil System 85
Tail Rotor and Control Malfunction - General 17
Tail Rotor Assembly Loss 18
Tail Rotor Auxiliary Tow Servo System Malfunction 18
Tail Rotor Control System Failure 18
Tail Rotor Failure During Flight 18
Tail Rotor Failure During Take-Off, Landing or Hovering (Low Altitude, Slow Airspeed). 18
Tail Rotor Flight Control System 97
Tail Rotor Gear Box 83
Tail Rotor Pedal Adjustment Knobs 97
Tail Rotor Pedals 97
Tail Rotor System 85
Tail Wheel 100
Tail Wheel Lock Handle 100
Taxiing 11
Taxiing Procedure on Land 11
Taxiing Procedure on Water (Familiar Areas) 12
Taxiing Procedure on Water (Unfamiliar Areas) 1 12
Torque Limits 1
Torquemeter 2
Torquemeter Indicator 76

(Asterisks before page numbers denote illustrations)

Torque Sensing System 76
Towing of Helicopter on Water..... 21
Transformer-Rectifiers..... 92
Transmission Limitations..... 1
Transmission Oil Pressure Gage 2C
Transmission Oil Systems..... 84
Transmission Oil Temperature Gage 2C
Transmission System..... 83
Trim Release Switch..... 97
Turbulence 20C
Turn-and-Slip Indicators..... 87
T_5 Limits Chart *2A

U

UHF Transmitter (AN/ARC-52X)..... 111
UHF Transmitter-Receiver Operation 112
Use of Power Check Chart..... 54A
Utility Receptacle 104

V

Ventilating Switch 103
Ventilating System 103
VHF Communication System (AN/ARC-84) .. 112
VHF Communication System Operation 112

W

Weight Limitations 1
Wheel Brake System..... 100
Windshield Defroster Switch..... 103
Windshield Washer System..... 104
Windshield Wipers 103

(Asterisks before page numbers denote illustrations)

PART II
STANDARDIZATION MANUAL

INTRODUCTION

This manual is issued to standardize flight crew procedures and techniques for operation of the HH-52A helicopter. It must be used in conjunction with the flight handbook, and is not intended to replace it. Procedures prescribed in this manual are mandatory but it is expected that they will be executed with sound professional judgment. Nothing in this manual shall be construed to relieve personnel of responsibility for using initiative in prosecuting a mission or taking such emergency action as the situation warrants.

There are numerous ways to accomplish a maneuver but there is only one best way. The procedures herein described are recognized as the best at the present time. Standardization is only one of many tools available to the professional SAR pilot. It is imperative that dual standards be avoided, i.e., where standard procedures are utilized only when flying with standardization pilots and personalized procedures are employed at other times. Senior and experienced pilots must set the example for the junior and inexperienced pilots to follow. Standardization is not intended to eliminate a pilot's individuality nor force him to "fly by the numbers". Its primary purpose is to assist him to efficiently and safely accomplish the mission using the approved procedures.

The procedures and techniques have evolved through the logical processes of Sikorsky test and Coast Guard HH-19 and HH-52A training and operational experience. The Basic Operational Training Unit, Rotary Wing, BOTU (RW), is established at Mobile, Alabama to transition and qualify pilots in the HH-52A. BOTU (RW) will also provide instructors to visit air stations to re-standardize pilots. During these visits, BOTU instructors are authorized to instruct in all the maneuvers that are authorized at BOTU (RW). Maneuvers described in this section followed by (BOTU ONLY) will be performed only under the direct supervision of currently assigned BOTU instructors.

BOTU (RW) has been designated the unit responsible for changes to this manual. All units are encouraged to submit timely recommendations direct to BOTU (RW).

LIST OF EFFECTIVE PAGES

Reproduction for non-military use of the information or illustrations contained in this publication is not permitted without specific approval of the issuing service.

Insert latest amended pages. Destroy superseded pages.

Page No.	Issue
A	1 March 1967
*B	15 August 1971
*i	15 August 1971
ii	1 March 1967
*iii	15 August 1971
*iv	15 August 1971
1	15 May 1968
*2	15 August 1971
2A	15 May 1968
2B	15 May 1968
*3	15 August 1971
*4	15 August 1971
*5	15 August 1971
*6	15 August 1971
*6A	15 August 1971
*6B	15 August 1971
*6C	15 August 1971
*6D Blank	15 August 1971
7	1 March 1967
8	1 March 1967
9	1 March 1967
10	1 March 1967
*11	15 August 1971
12	1 March 1967
13	1 March 1967
14	1 March 1967
15	1 March 1967
16	1 March 1967
*17	15 August 1971
18	1 March 1967
*19	15 August 1971
*20	15 August 1971
*20A	15 August 1971
*20B Blank	15 August 1971
21	1 March 1967
22	1 March 1967
23	1 March 1967
24	1 March 1967
*25	15 August 1971
*26	15 August 1971
*27 Deleted	15 August 1971
*28 Deleted	15 August 1971
*29	15 August 1971
30	1 March 1967
31	1 March 1967
32	1 March 1967

TABLE OF CONTENTS

PARAGRAPH	STANDARDIZATION PROCEDURES	PAGE
1	COCKPIT TECHNIQUE	1
	(A) Wiping Technique	1
	(B) Cocked Helicopter	1
2	STARTING PROCEDURE	1
3	GROUND CHECK OF ALL SYSTEMS	1
4	TAXIING	1
	(A) Land	1
	(B) Water	1
	(C) Rough Water	2
5	VERTICAL TAKE OFF	2
6	HOVERING	2
	(A) Into Wind	2
	(B) Crosswind	3
	(C) Downwind	3
	(D) Turns-On-Spot	3
	(E) Air Taxiing	3
	(F) Sideward and Rearward Flight	3
7	TRANSITION TO FORWARD FLIGHT	3
	(A) From Hover Over Land or Water	3
	(B) No Hover	4
	(C) Rough Area	4
	(D) Running Take-Off, Land	4
	(E) Running Take-Off, Water	4
8	TRAFFIC PATTERN FLYING	4
9	NORMAL APPROACH TO HOVER	5
10	ROUGH AREA APPROACH	5
11	VERTICAL LANDING	6
	(A) From Hover, Land	6
	(B) From Hover, Water	6
	(C) Crosswind and Downwind From Hover	6
	(D) No Hover	6
12	RUNNING LANDING, LAND	6
13	RUNNING LANDING, WATER	6
14	GO AROUND - WAVE OFF	7

PARAGRAPH	STANDARDIZATION PROCEDURES	PAGE
15	AUTOROTATIONS	7
	(A) General	7
	(B) Procedure, Power Recovery	7
	(C) Procedure, Practice Full Autorotation	8
	(D) Engine Failure in a Hover	9
16	WATER MANEUVERING	10
	(A) Turn On Spot	10
	(B) Sideward Maneuvering	10
	(C) Rearward Maneuvering	10
	(D) Rotor Shutdown and Engagement	10
17	WATER RESCUE PROCEDURES	11
	(A) Rescue Platform, Calm Water	11
	(B) Rescue Platform, Rough Water	12
	(C) Rescue Platform Recovery Phraseology	13
18	HOIST PROCEDURES	13
	(A) From Boat	13
	(B) Lowering Salvage Pumps	14
	(C) From Water	14
	(D) Hoist Phraseology	15
19	FORMATION	15
	(A) General	15
	(B) Basic	15
	(C) Maneuvering	16
20	TOWING	16
21	INSTRUMENT FLIGHT PROCEDURES	16
	(A) General	16
	(B) Basic	17
	(C) Instrument Take-Off	18
	(D) Instrument Climb	18
	(E) Instrument Cruise	18
	(F) Holding	19
	(G) Instrument Descent	19
	(H) Instrument Approaches	19
	(I) Instrument Autorotations	19
	(J) Instrument Wave Off	19
	(K) Beep to A Hover Approach	19
	(1) General	19
	(2) Procedure and Crew Duties	20
	(3) Attitude Limitations	23

PARAGRAPH	STANDARDIZATION PROCEDURES	PAGE
22	EMERGENCY OPERATIONS	23
	(A) General	23
	(B) Emergency Throttle Operations	24
	(1) General	24
	(2) Normal Procedure	24
	(3) Simulated Emergencies	24
23	CARGO OPERATIONS	29
	INDEX	31

LIST OF ILLUSTRATIONS

Figure Page

1. Vertical Take-Off and Transition to Forward Flight 2A
2. Running Take-Off (Land) 2B
3. Normal Approach to Hover 6A
3A. Normal Approach–Sight Picture 6B
4. Practice Autorotation 6C

1. COCKPIT TECHNIQUE

(A) Wiping Technique.

(1) Cockpit check will be accomplished in accordance with the Flight Handbook using the wiping technique.

(2) A check list is not considered necessary or desirable for qualified HH-52A pilots. The Caution/Advisory Panel with the wiping technique is sufficient. It is suggested that proficiency, transition and student pilots make a knee board list from the handbook NORMAL PROCEDURES Section, if desired.

(B) Cocked Helicopter.

A cocked aircraft is one on which certain portions of the check list have been previously performed in anticipation of an emergency launch. Because the wiping technique is used in lieu of a checklist, the HH-52A will not be cocked. Early preflight inspection by the ready flight crew is recommended.

2. STARTING PROCEDURE

Starting Procedure will be accomplished in accordance with the Flight Handbook. It should be emphasized that the BAT START is the normal start. It is necessary to make BAT STARTS often to insure the battery, automatic fuel control, flow divider, and engine are operating correctly. It is difficult to observe a weak battery or a malfunction in the fuel control system when making an APU start. It is recommended that the first start of the day and engineering ground maintenance operation use an APU start and normally all others use the BAT START procedure.

3. GROUND CHECK OF ALL SYSTEMS

Ground check of systems will be accomplished as outlined in the Flight Handbook.

4. TAXIING

(A) Land

All ground taxiing will be accomplished at 100% Nf/Nr and with ASE disengaged. When ready to taxi release the parking brake while holding the parking brake handle. Allow the parking brake handle to slide in gently. Push the cyclic slightly forward and increase collective to start forward motion. Unlock the tail wheel by depressing the tail wheel lock handle and exerting an easy left and right tail rotor pedal pressure as necessary to unload the side pressure and allow the locking pin to retract. It is difficult to ascertain positively when the tail wheel is unlocked. It is very easy to turn, particularly on wet surfaces or with strong or gusty winds, with the pin still locked. Normally, the locking handle will go completely down and with ASE disengaged, the helicopter will turn easily with slight tail rotor pedal pressure. The only positive way to tell if the pin is retracted is by observing from the outside. Taxi speed should be slow enough to maintain positive control for the situation. Use wheel brakes to control speed, since aft cyclic with low collective will cause main rotor blades to hit the droop stops. Monitor the tip path plane to prevent endangering personnel. Taxiing in a cross wind requires the cyclic to be displaced into the wind to maintain level condition, particularly with sticky, or high or low oleos. During the last few degrees of the turn prior to lining up on the desired heading, pull the tail wheel locking handle up and leave hand on the handle. Depress opposite pedal to roll out and as the pin seats, a slight force is transmitted to the pilot's hand. When this force is felt, exert an easy left and right tail rotor pedal pressure to allow the pin to fully seat. The tail wheel should be locked for most conditions since it affords a more stable configuration. Embarking or disembarking personnel, the tail wheel should be locked. When taxiing in a confined area, use a signalman to ensure safe clearance.

(B) Water

Due to forward tilt of the main rotor shaft, the HH-52A will tend to taxi forward at a very slow speed if collective is full down and the cyclic is placed in neutral. To maintain a position in the water, it is necessary to use aft cyclic and sufficient collective to keep main rotor blades from hitting the droop stops. The pilot must observe any debris, sea weed, foam, and sponson and hull wake for movement control. Since the sponsons offer less support in the water than the wheels do on land, it is necessary for the pilot to use cyclic to control roll attitude in the water. Taxiing is accomplished by adding forward cyclic and raising collective. Taxi speed is regulated by cyclic control. High speed taxiing will result in a nose low attitude and build-up of bow wave which will tend to cause nose of the helicopter to tuck. Taxi speed should be kept

to a minimum to prevent the nose from tucking and to prevent hull damage in event of striking a floating or sunken object. Caution should be used when taxiing in shallow water where damage to hull or sponsons might be incurred. The helicopter will respond to speed and directional controls in the conventional manner. Since there is less positive roll stability from the sponsons in the water, application of tail rotor control will cause the helicopter to roll in direction opposite the direction of the turn, and it will be necessary to maintain a level roll attitude by application of cyclic in direction of turn. This is primarily due to the roll-lateral coupling caused by the location of the tail rotor above the roll axis of the helicopter, and in part due to centrifugal force tending to roll helicopter to the outside of the turn.

(C) Rough Water

Rough water taxiing should be kept to a minimum. Due to wave action and effect of wind, the helicopter will pitch and roll excessively if collective is lowered to the full down position. This pitching and rolling results in the tail rotor coming into close proximity to the water and may result in damage to the tail rotor. Rough water taxiing should be accomplished by utilizing enough collective to keep the aircraft in light contact with the water and using cyclic to resist pitching and rolling tendencies.

CAUTION

Extreme care should be used when taxiing crosswind or downwind in high winds. Downwind taxiing in high winds can result in an excessively high taxi speed. Under this condition the nose will start to tuck and sufficient aft cyclic is not available to slow the taxi speed. Collective application will only increase the taxi speed and the tendency of the nose to tuck. The proper corrective action is to turn the helicopter into the wind, which can be accomplished best when riding the crest of a wave.

CAUTION

Do not allow the sea to break on helicopter and/or come up the windshield and go into the engine. It does not take very much water with the collective full down to flame out the engine.

5. VERTICAL TAKE OFF

In a vertical takeoff, the helicopter is raised from the ground to a hover with no turning, fore and aft, nor lateral movement. ASE is normally engaged prior to takeoff. Set 103% Nf/Nr at minimum collective pitch. With the cyclic in a neutral position, smoothly increase collective. With ASE engaged, the pilot has the option of maintaining heading with the tail rotor pedals or ASE. If ASE is used for heading control, the pilot's feet should be flat on the deck. If ASE is disengaged, the pilot should use the tail rotor pedals to maintain heading. Continue increasing collective slowly until the helicopter is airborne using cyclic inputs to avoid drift. Establish a hover appropriate for gross weight and surface.

CAUTION

Although it is permissible to use the beeper trim release button during day VFR, continued and indiscriminate use of the button can develop habit patterns which will be impossible to overcome when flying on instruments or at night.

When taking off from shipboard or near obstacles, feet should be on pedals.

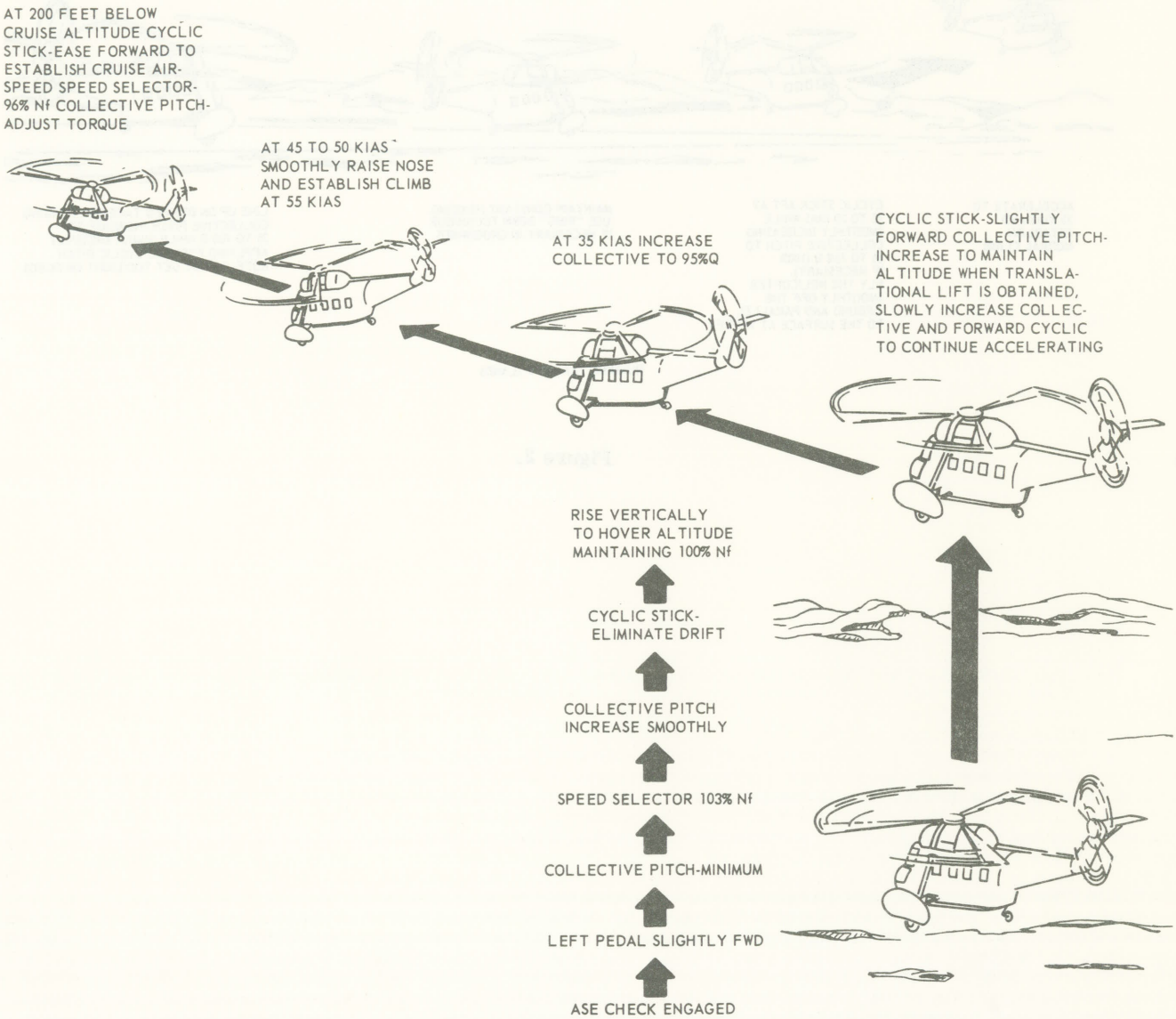
6. HOVERING

Use 100% Nf/Nr for all hovering. Avoid prolonged hovering for training purposes.

(A) Into Wind.

(1) Over land up to 7900 lbs. Maintain position by displacing cyclic as necessary into wind. The altitude should be 10 feet or less. Five feet is desirable for an experienced pilot since the lower altitude is better in event of engine failure.

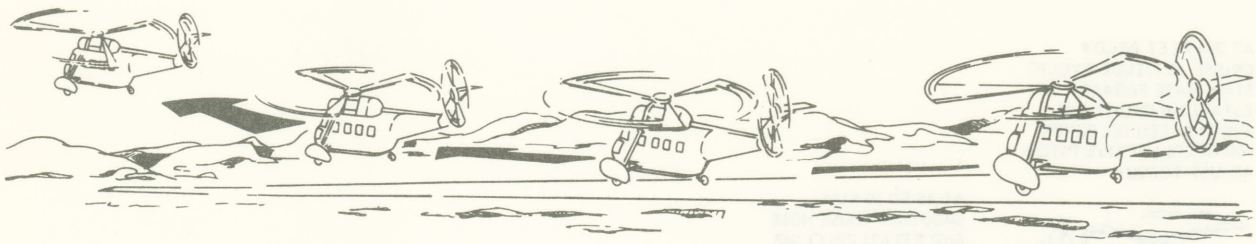
(2) Over land 7900 to 8300 lbs. The altitude should be 5 feet or less. One to 3 feet is desirable for an experienced pilot. However, limited maneuvering should be performed at this low altitude and high weight. The torque must be scanned often. As a rule of thumb power check on a standard no wind day, 1% torque is required for each 100 pounds of weight to maintain a 1 foot hover.



NOTE: IF OVER WATER, AFTER OBTAINING 15 KIAS, BEGIN A SHALLOW CLIMB TO APPROXIMATELY 20 FEET WHILE INCREASING AIRSPEED TO 35 KIAS.

VERTICAL TAKE-OFF AND TRANSITION TO FORWARD FLIGHT

Figure 1.



ACCELERATE TO 35 KIAS AND ESTABLISH NORMAL CLIMB

CYCLIC STICK-AFT AT 15 TO 20 KIAS WHILE SMOOTHLY INCREASING COLLECTIVE PITCH TO 65 TO 75% Q (100% IF NECESSARY). FLY THE HELICOPTER SMOOTHLY OFF THE GROUND AND PARALLEL TO THE SURFACE AT 10 FEET

MAINTAIN CONSTANT HEADING. USE "WING" DOWN TECHNIQUE IF NECESSARY IN CROSSWINDS

LINE UP ON DESIRED TAKE-OFF HEADING COLLECTIVE PITCH-INCREASE TO 35 TO 40% Q WHILE SIMULTANEOUSLY APPLYING FORWARD CYCLIC PITCH NOTE: DO NOT GET TOO LIGHT ON OLEOS.

RUNNING TAKE-OFF (LAND)

Figure 2.

CAUTION

During night and/or low visibility operations (dirty windshield, blowing sand, dirt, snow or rain) hovering should be minimal and the altitude should be high enough to prevent inadvertent ground contact. The possibility of flying into the surface during conditions of reduced visibility is much greater than the possibility of an engine malfunction.

(3) Over water

The altitude should be 10 feet or higher above the wave tops, particularly at night or with poor visibility. However, during day operations over sheltered water, when a positive clearance can be maintained, 5 feet is desirable. Maintaining position over open water is difficult and aids must be used, such as debris, seaweed, foam, rotor downwash, and smoke float signals. Pilots must become familiar with and use the rotor wash patterns. Transitioning into a hover with no wind, the rotor wash will be equal around the helicopter and as the speed of the helicopter or wind increases, the wash pattern retreats downwind.

(B) Crosswind

The altitude should be 10 feet. For training purposes, do not hover crosswind in winds exceeding 25 knots.

(C) Downwind

The altitude should be 10 feet. For training purposes, do not hover in winds exceeding 20 knots. During extended downwind hovering, close cabin and cockpit hatches and windows and turn on the ventilating fan to prevent excessive exhaust gas concentrations in the cockpit and cabin.

(D) Turns on spot

Turns on the spot will be accomplished at 10 feet. Rotation of the helicopter should be about the vertical axis extending through the cockpit center. The rate of turn should be maintained at approximately 10 degrees per second.

(E) Air Taxiing

Air taxiing will be performed by turning the helicopter in the direction of motion whenever practical. Air taxi altitude will be 10 feet or the minimum required to clear obstacles. Avoid air taxiing downwind if possible as translational lift is easily lost and the helicopter could settle onto the surface. It is easy to overtorque during this situation.

(F) Sideward and Rearward Flight

A constant rate of movement over the ground equal to the speed of a walking man will be maintained at a constant altitude of 10 feet and a constant heading.

7. TRANSITION TO FORWARD FLIGHT

(A) From Hover Over Land or Water.

This maneuver enables the pilot to safely transition from a hover to a cruise altitude and airspeed over land or water, day or night under VFR conditions. Transition to forward flight by smoothly applying forward cyclic to accelerate, adding collective necessary to prevent settling. Nose down attitudes in excess of 6° are not normally required. As translational lift is encountered, apply forward cyclic to maintain the nose attitude. Upon attaining 35 knots, at approximately 20 feet altitude or less, smoothly increase collective until 95% torque is reached. The torque instrument must be scanned continually to prevent an overtorque, particularly if hovering torque requirements are high. Maintain the nosedown attitude until reaching 50 knots; then rotate the nose and trim for a 55 knot climb. When within 200 feet of the desired altitude, ease the cyclic forward to accelerate to the desired airspeed (normally the maximum component lift airspeed or 55 knots if remaining in the pattern). Decrease Nf/Nr to 96% and adjust the collective for cruise torque.

(B) No Hover
This is a practical manever where the vertical take off and transition to forward flight are combined. It is normally used by experienced pilots. However, it is not a jump take off. Increase collective smoothly, coordinating cyclic and tail rotor pedals to lift vertically. As the helicopter leaves the surface apply forward cyclic to parallel the surface at 10 feet. Continue the transition to forward flight in accordance with standard transition procedures.

(C) From Rough Area
The pilot must know that the helicopter performance for the existing conditions will be adequate to clear the obstacles before the take off. See handbook performance charts. The pilot should brief the crew to keep a close watch so as to maintain proper clearance. Position the helicopter to have the most clear area downwind from the obstacle. Hover and note the maximum torque required, and then land. Increase collective smoothly and positively to 95 to 100% torque and as the helicopter leaves the ground, apply forward cyclic to gain translational lift, if possible. The amount of airspeed will vary depending on the size of the area. Apply aft cyclic and establish a safe climb angle to clear the obstacle, then accelerate to a 55 knot climb. If the area is confined, requiring a steep climb angle, climb performance is greatly reduced without translational list. Of course, the worst condition is a vertical climbout. In areas of thick trees, do not depend on the wind until above the trees.

(D) Running Take Off (Land)
Line the helicopter up on the desired takeoff heading. Increase collective to 35 to 45% torque, depending on weight, (do not get too light on oleos) and simultaneously apply forward cyclic. Keep the tip path plane just above the droop stops. It is necessary to use left tail rotor pedal pressure until climb torque is established. Use the wing down technique with a crosswind. When airspeed (use ground speed when practicing in a wind condition to simulate ground movement controllability) increases to 15 to 20 knots, move cyclic slightly aft of neutral position (observe the tip path plane) and smoothly increase collective to 65 to 75% torque (or to 100% if necessary). Fly the helicopter smoothly airborne and parallel the surface at 10 feet. Accelerate to 35 KIAS, then use normal climb procedures.

CAUTION

Avoid increasing collective prior to moving cyclic aft to prevent lift off in a nose low attitude and possible bow contact with the runway.

(E) Running Take off, Water (BOTU ONLY)
This maneuver is impractical and can be hazardous if not carefully performed. It is introduced primarily to show pilots the water handling characteristics with speed. Due to the water resistance on the hull, little or no power reduction can be realized and there is a strong tendency to tuck. Tucking can cause large amounts of water to enter the engine air intake and will result in engine flame out. Extreme tucking can cause the rotor blades to strike the water.

To practice this maneuver the water must have no swell and be free of obstacles. Increase collective to 60 to 70 percent and simultaneously apply forward cyclic. When water speed increases to about 10 knots apply aft cyclic and increase torque as necessary to smoothly become airborne. Use the standard procedure for transition to forward flight over water.

CAUTION

If the nose begins to tuck, the only recovery is to lower the collective. Raising the collective will aggravate the tuck and will probably result in water entering the intake.

8. TRAFFIC PATTERN FLYING

Normal traffic patterns will be flown at 1000 feet above field elevation (use barometric altimeter above 500 feet and radar altimeter below 500 feet as the primary instrument, cross checking one with the other), 55 knots and 100% Nf/Nr. The 1000 foot pattern is a change from the 500 foot pattern used prior to the HH-52A. Experience has shown that a 200 to 300 foot altitude loss can occur analyzing a power malfunction with this quiet jet engine. The rate-of-descent in an autorotation is greater. It is a good procedure to remain within

autorotational distance of the airport boundaries.

9. NORMAL APPROACH

General. This maneuver is used to transition from level flight to a hover or to a landing. The prescribed procedure will enable the pilot to execute an approach to a specific spot over land, water, mountainous terrain, or to elevated structures. This approach can be commenced at any point from the 180 degree position to a straight in position. The technique used after aligning the helicopter on straight away, regardless of initial altitude, is to fly a constant angle (straight line) descent to the desired spot by maintaining a proper windshield sight picture. It is this technique which imparts precision and operational usefulness to this approach.

Procedure. When making approaches to a runway, a spot 1/3 the distance upwind from the approach end of the runway should be used. This will permit an autorotation to within the airport boundary in the event of engine failure. Complete the PRELANDING check prior to commencing the approach. The desired normal approach begins abeam the intended spot, heading downwind at 1000 feet AGL and 55 knots airspeed. The downwind abeam distance will vary slightly with wind direction and velocity. Commence the approach by reducing collective, normally abeam the spot. In no wind conditions, when abeam the straight away position (an imaginary point on the centerline, 1000 to 1500 feet downwind from the selected spot), commence a turn towards that position. The flight path should intercept the 90 degree position at 700 to 600 feet AGL at 55 knots and the straight away position at 400 to 300 feet AGL and 55 knots. This abeam turn must be made earlier as wind velocity increases. When commencing an approach from between the 180 and the 90 degree positions, use the 90 degree position checkpoint. When commencing an approach from between the 90 degree position and a straight in position, use the straight away position as a checkpoint. In all approaches, use the proper windshield sight picture to assist in intercepting the straight away at the proper altitude. Fly the desired approach angle using collective to control the angle of descent and cyclic to maintain a comfortable closure rate, while monitoring progress through use of appropriate windshield sight pictures. Use the crab method of crosswind correction through 200 feet AGL; then shift to the wingdown method. Continue decreasing groundspeed and rate of descent to terminate the approach in a hover or a landing, as desired, at the selected spot.

CAUTION

Make corrections early to avoid a high rate of descent and/or a fast closure rate. If the approach becomes uncomfortable, wave off.

10. ROUGH AREA APPROACH

The pilot must exercise mature judgment. Do not jeopardize personnel unless saving lives. The same procedure for a NORMAL APPROACH is used except for the following:

(A) Make a low and slow pass (maintaining translational lift) and observe the area closely to determine the wind condition, obstacles in the approach path, the landing spot and estimate the maximum torque that may be required to land. Obstacles in the approach path will dictate the angle of descent. Avoid steep descents, if possible, as a greater amount of torque will be required to land safely.

Note

Pilots must be conversant with the information presented in the hover ceiling data in the performance chart section of the handbook.

(B) Brief the copilot and crewman to keep the pilot advised of obstacles.

(C) Fly the helicopter into the straightaway downwind of the landing area at 200 to 300 feet above obstacles, maintaining 55 knots. At 140 feet above the highest obstacle increase the nose attitude as required to arrive over the obstacle just short of the landing area with translational lift, if possible, and proper clearance. As helicopter passes obstacle, adjust collective and flight controls to establish the required descent angle for situation and transition into a hover or use a no hover landing if terrain permits.

CAUTION

If rotor blades or the helicopter are damaged, land as soon as safely practical and have maintenance personnel inspect prior to further flight.

11. VERTICAL LANDING

(A) From Hover, Land
Lower collective smoothly and set up a slow and constant downward movement, coordinating cyclic to avoid any sideward drift. With ASE engaged, the pilot has the option of maintaining heading with the tail rotor pedals or ASE. If ASE is used to maintain heading, the pilot's feet should be flat on the deck. Under normal conditions the HH-52A will touch down tail wheel first, followed by the left main gear and then the right main gear. Upon firm contact with the surface decrease collective slowly and smoothly, simultaneously applying neutral cyclic. Stop any forward motion with brakes, not aft cyclic. Occasionally one oleo will hang up, which requires cyclic to level the helicopter. When conditions permit, a smoother landing is accomplished by moving forward at 1 to 2 knots at touchdown. As the tail wheel touches down avoid over controlling lateral and aft cyclic. This helicopter does not have a history of ground resonance; however, avoid a half on and half off (oleos extended) condition. If any unusual vibration or unbalanced condition is experienced during touchdown, execute an immediate take off.

(B) From Hover, Water
Landings will be accomplished in the same manner as on land. Altitude and movement, particularly at night, are difficult to see and judge properly, and it is very easy to contact the water prematurely. The radar altimeter should be used to cross check the altitude.

(C) Crosswind and Downwind From Hover
Crosswind and downwind landings from a hover will be accomplished in the same manner as into the wind vertical landings with the exception of the required cyclic displacement into the wind. Crosswind landings are prohibited in winds exceeding 25 knots. Downwind landings are prohibited in winds exceeding 20 knots. Cyclic control could be less than is required to safely control the helicopter as collective is lowered, if these velocities are exceeded.

(D) No Hover Landing
This is the most practical technique of landing on most surfaces, particularly with high density altitudes and heavy loads. A safe landing using 5 to 10% less torque than that required to hover can be accomplished. Less snow, sand, and other debris are blown up. The NORMAL or ROUGH AREA APPROACH procedures are used with the following exception:

(1) At approximately 50 feet increase collective smoothly and continue coordinating flight controls to settle softly onto the surface in a landing attitude with 0 to 5 knots ground speed depending on surface. Avoid applying late collective (hard touchdown), too much collective (stopping rate-of-descent), or touching down in a nose high attitude.

12. RUNNING LANDING, LAND

The purpose of this maneuver is to touchdown with translational lift and to demonstrate flight control feel of the helicopter as wind velocity increases. Touchdown will be accomplished at 15 to 20 KIAS. The NORMAL APPROACH procedure is used except for the following:

(A) When the airspeed decreases to 20 to 25 knots, slowly lower nose attitude to 0 to 5 degrees nose up, adjusting collective to round out flight path and parallel runway momentarily.

(B) Touch down smoothly, maintaining translational lift (15 to 20 knots ground speed when demonstrating).

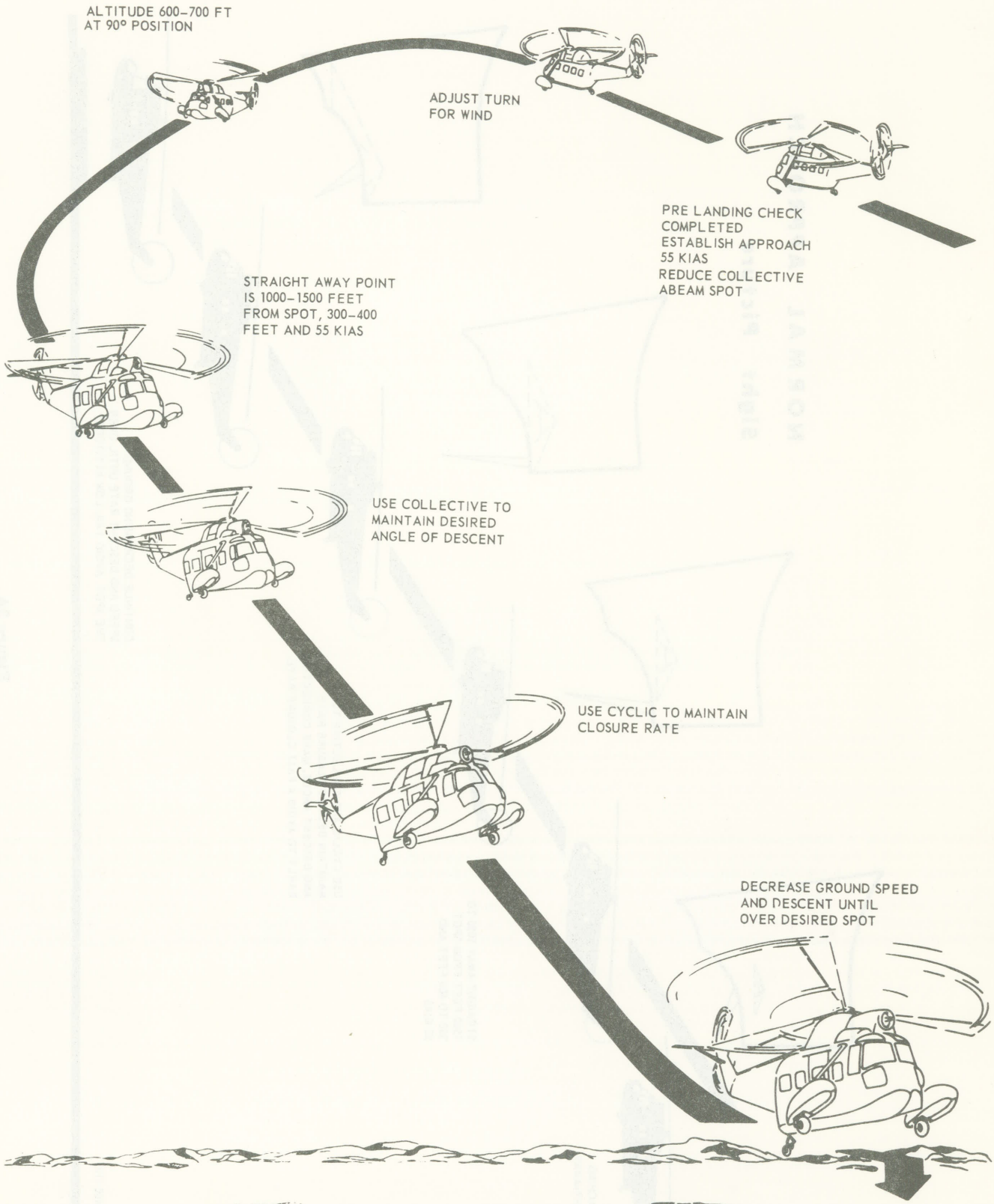
(C) Lower collective gently and move cyclic to neutral.

(D) Apply brakes to slow ground speed.

13. RUNNING LANDING, WATER (BOTU ONLY)

This maneuver involves hazards similar to the water running takeoff. The primary purpose of the running landing is to demonstrate attitude and helicopter feel when touch down occurs with 10 to 15 knots forward speed. This would be most likely to occur in a full autorotation. NORMAL APPROACH procedures are used with the exception of the following:

(A) The water must have no swell condition and be free of debris.



NORMAL APPROACH

Figure 3.

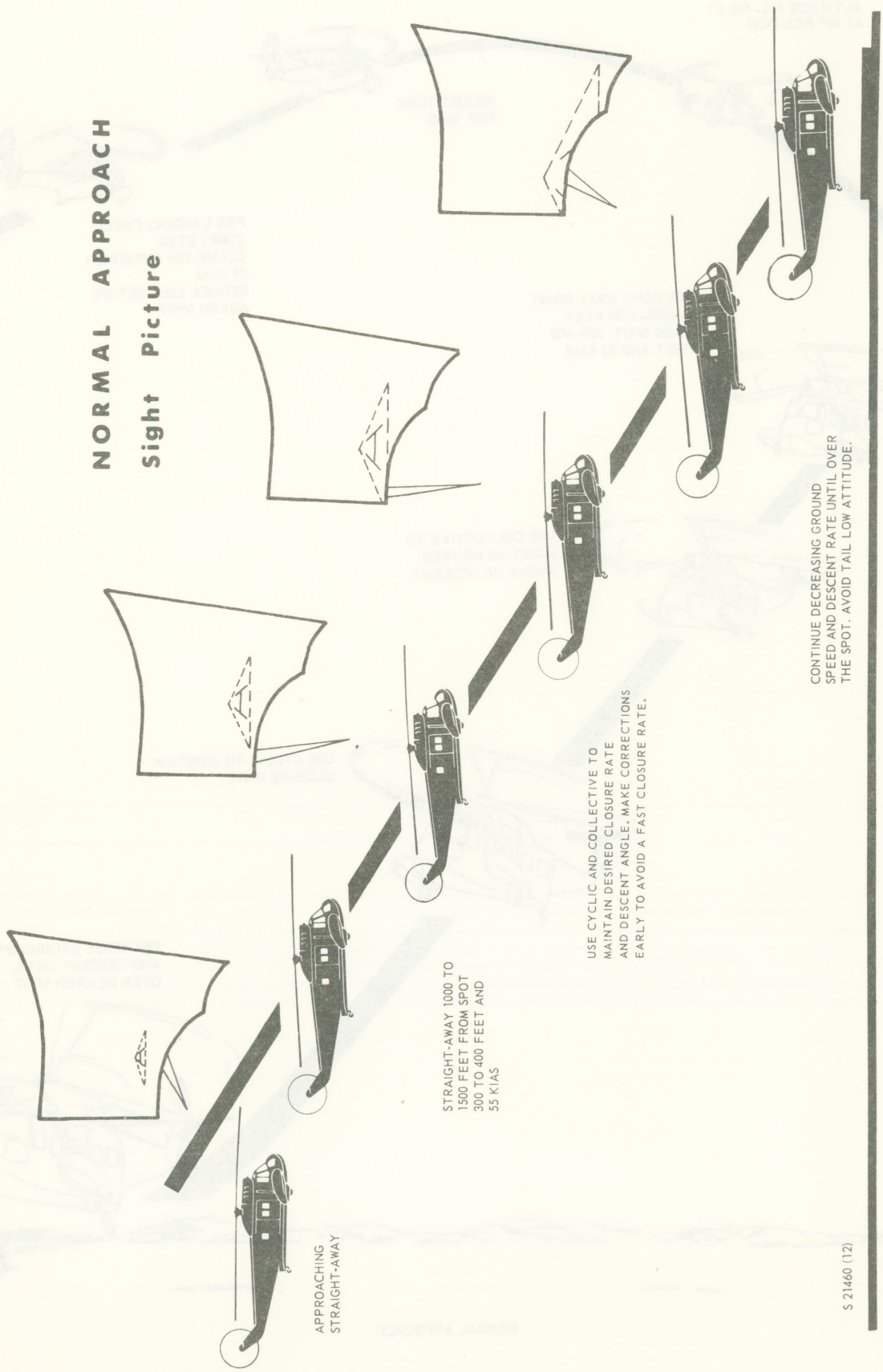

NORMAL APPROACH
Sight Picture
APPROACHING STRAIGHT-AWAY
STRAIGHT-AWAY 1000 TO 1500 FEET FROM SPOT 300 TO 400 FEET AND 55 KIAS
USE CYCLIC AND COLLECTIVE TO MAINTAIN DESIRED CLOSURE RATE AND DESCENT ANGLE. MAKE CORRECTIONS EARLY TO AVOID A FAST CLOSURE RATE.
CONTINUE DECREASING GROUND SPEED AND DESCENT RATE UNTIL OVER THE SPOT. AVOID TAIL LOW ATTITUDE.
S 21460 (12)

Figure 3A.

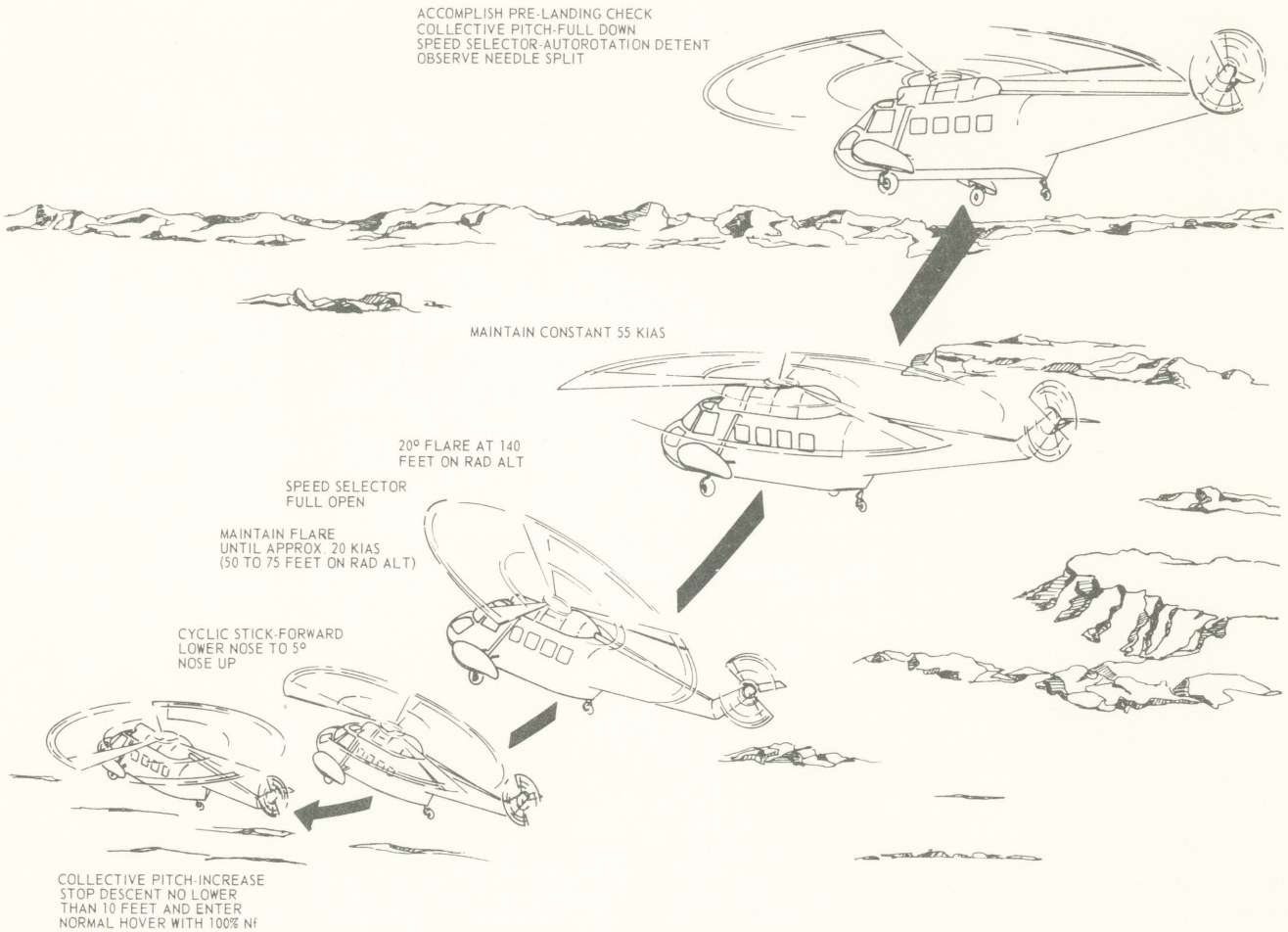

ACCOMPLISH PRE-LANDING CHECK
COLLECTIVE PITCH-FULL DOWN
SPEED SELECTOR-AUTOROTATION DETENT
OBSERVE NEEDLE SPLIT
MAINTAIN CONSTANT 55 KIAS
20° FLARE AT 140
FEET ON RAD ALT
SPEED SELECTOR
FULL OPEN
MAINTAIN FLARE
UNTIL APPROX. 20 KIAS
(50 TO 75 FEET ON RAD ALT)
CYCLIC STICK-FORWARD
LOWER NOSE TO 5°
NOSE UP
COLLECTIVE PITCH-INCREASE
STOP DESCENT NO LOWER
THAN 10 FEET AND ENTER
NORMAL HOVER WITH 100% Nf
PRACTICE AUTOROTATION

Figure 4.

(B) When the airspeed decreases to 15 to 20 knots, lower nose attitude to 5 degrees nose up, adjusting collective to round out flight path and parallel water until ground speed decreases to 0 to 10 knots.

(C) Touch down smoothly, maintaining a nose up attitude of 5 degrees. As the tail wheel contacts the water, the nose will pitch down (more pronounced with faster ground speeds), which must be corrected by applying aft cyclic and maintaining the proper touchdown attitude to prevent the nose from tucking. As the hull and sponsons settle into the water, drag is increased. As the water speed approaches zero, lower collective smoothly and move the cyclic to the neutral position.

CAUTION

If the helicopter starts to tuck severely, the collective must be lowered in a positive manner.

14. GO AROUND - WAVE OFF

When any normal approach gets out of a safe envelope for an autorotation, the pilot should execute a wave off. If Nf/Nr is set properly, it will be 103% when using an approach torque. Increase collective to 95 to 100% torque and establish a 55 knot climb. In an emergency situation, more than 100% torque is available. Remember that a transmission overhaul is cheaper than overhauling the entire helicopter.

15. AUTOROTATIONS

(A) General. Proficiency in autorotations is necessary if the helicopter and its occupants are to survive an engine failure in flight. Continuous practice in power recoveries at the unit, coupled with practice full autorotations at BOTU and when BOTU standardization instructors visit the air stations, will assure that an engine failure will be followed by a successful autorotation. Generally water presents the best surface for an autorotative landing. Missions that can be flown over relatively protected water will be safer than those flown over buildings, wooded land, rough terrain or other poorly prepared surfaces. The mission may dictate flying over surfaces unsuitable for autorotative landing but if it does not, the pilot should make an effort to stay within autorotative distance of a safe landing area.

CAUTION

Do not overestimate your ability to autorotate to a small landing area.

If there is a choice of making a water autorotative landing versus a marginal or unknown land surface area, generally the water is more desirable. There are occasions when an autorotation into the surf would be far more disastrous than autorotation to poor terrain. If the choice is land rather than water, the extent of damage, if any, will be dependent upon the condition of the surface and pilot technique. Touchdown speed to a runway should be at 15 to 20 knots with translational lift. Touchdown speed must be kept to a minimum if the surface conditions are poor or unknown. It is mandatory to have zero ground speed going into trees. If surface conditions are poor, hold the flare until a speed slower than 20 knots exists (wind must be considered). After touchdown, smoothly lower the collective so as not to compound the impact force, and neutralize the cyclic. Apply wheel brakes as necessary.

CAUTION

DO NOT PRACTICE AUTOROTATIONS AT NIGHT EXCEPT TO A LIGHTED AIRPORT WITH CRASH EQUIPMENT IMMEDIATELY AVAILABLE.

Full practice autorotations are prohibited except under the direct supervision of BOTU instructor pilots. Practice autorotations with a power recovery, if properly executed, closely simulates an actual autorotation. Practice autorotations will not be conducted at gross weights above 7600 lbs. Practice autorotations will not be conducted without proper fire and crash facilities immediately available.

(B) Procedure, Power recovery. A practice autorotation may be straight in, 90 degree or 180 degree. A practice 180 degree autorotation will be entered at a minimum of 1000 feet and 55 knots. To enter the autorotation lower the collective with a positive, steady movement to the full down position. Split the needles (Nf/Nr) by decreasing the speed selector to the AUTOROTATION DETENT immediately after the collective reaches the full down position. Maintain heading by use of the tail rotor and then make a smooth, coordinated turn into the wind maintaining 55 knots. Make small collective adjustments as nec-

essary to limit the rotor RPM to no more than 104%.

Note

Under certain conditions, NR will be less than 100% due to weight and density altitude. Pilots should be familiar with the Autorotative VS Density Altitude Chart in the performance chart section of the handbook.

Stabilize into the wind in balanced flight maintaining a steady state descent at 55 knots. At 140 feet on the radar altimeter, execute a flare to 20 degrees nose up attitude by application of aft cyclic. The rate of flare execution will be determined primarily by the wind velocity, temperature, and helicopter weight. The greater the wind velocity, the lower the temperature, or the lighter the weight, the slower will be the rate of flare to 20 degrees nose up. It should be remembered, however, that the flare should always be commenced at 140 feet. During the flare, increase the speed selector to the FULL ON position. Maintain the flare until the airspeed has slowed to 20 knots. (The 20 knots is the other variable in the autorotation. In lighter winds, holding the flare until slightly slower than 20 knots may be desirable.)

As the airspeed approaches 20 knots, the altitude should be 50 to 70 feet on the radar altimeter. Smoothly and positively lower the nose to 5 degrees nose up by applying forward cyclic. Apply collective to stop descent at no lower than 10 feet altitude.

Note

Application of collective will cause the nose and right wing to pitch up. Hold the level attitude and maintain directional control with the tail rotor.

Enter a normal hover at 10 feet. Readjust the speed selector to 100% Nf/Nr.

Wave Off During Autorotation. During any practice autorotation, if the pilot is not satisfied with the progress of the maneuver, the surface conditions, or any adverse situation, EXECUTE A WAVE OFF. Increase the speed selector to FULL ON, if not already accomplished, and increase collective positively to 95% to 100% torque (closely scan torque indicator), and establish a 55 knot climb. In an emergency situation, more than 100% torque is available.

(C) Procedure, Practice Full Autorotation. (BOTU ONLY.)

The practice of full autorotation is of great value in developing a pilot's confidence in the helicopter and in assuring successful landing following power loss. Practice full autorotations will only be conducted under ideal conditions. The wind will be less than 15 knots (5-15 knots desirable) and if being accomplished over water, the surface must be calm but not slick. The pilot in command must be an instructor pilot assigned to BOTU (RW). A crash boat, another helicopter or, if over land, manned crash equipment must be immediately available to the landing area. The gross weight shall be 7600 pounds or less.

The full autorotation will be entered in the same manner as the power recovery autorotation. The student will follow exactly the same procedure including increasing the speed selector to FULL ON in the flare. If the instructor pilot feels conditions are satisfactory, he will decrease the speed selector to FLIGHT IDLE. Lower the nose to 5 degrees nose up over water (0-3 degrees up over land). Slowly and smoothly apply collective to control rate of descent. Collective should not be used to stop the rate of descent, but to establish a very low sink rate at surface contact.

CAUTION

Never exceed 20 knots water speed at touchdown. Ten knots or less is desirable. Speed of touchdown on land will be dictated by surface conditions.

CAUTION

It must be remembered that the use of collective for a full autorotation must be at a lower altitude than for a power recovery.

Touchdown attitude on the water should be 5 degrees nose up to prevent the nose from tucking, especially when touchdown speed exceeds 10 knots. After surface contact and the helicopter has settled and stabilized, lower the collective to the full down position and place the cyclic in neutral.

CAUTION

Do not attempt to use aft cyclic as the main rotor blades will hit the droop stops and possibly cause tail cone damage.

Tail rotor should be used to maintain a straight path after touchdown. After the helicopter and rotor RPM have fully stabilized, re-establish Nf/Nr at 103%. Increase speed selector to the AUTOROTATION DETENT while monitoring Ng. When Ng peaks (approximately 80%), increase RPM to 103% Nf/Nr. Occasionally Ng will not respond and it is necessary to move the speed selector within the AUTOROTATION DETENT until a rise in Ng is realized.

CAUTION

If the speed selector is increased from the FLIGHT IDLE position to beyond the AUTOROTATION DETENT, before Ng rises, the rapid acceleration of Ng will cause a momentary overtorque and the helicopter will swerve abruptly to the right.

Cautions to the instructor for full autorotations. Do not move the speed selector to FLIGHT IDLE until:

(1) The touchdown area is clear of obstructions and debris.

(2) The maneuver is progressing satisfactorily.

CAUTION

When accomplishing a full autorotation, the instructor will positively ensure speed selector is decreased to the FLIGHT IDLE. If collective is increased with the speed selector in AUTO DETENT, an unexpected power surge will slew the helicopter dangerously to the right and an overtorque may result.

CAUTION

Exercise great care in practicing autorotations while climbing after take-off.

The greatest dangers encountered and which must be carefully avoided are:

(1) Autorotation to water which is smooth, glassy, calm, or near calm, or which reflects the sun. Neither full nor power recovery autorotations should be practiced under such conditions.

(2) Flaring low (below 140 feet on the radar altimeter) or too slow a rate of flare causing a low recovery altitude and fast ground speed on touchdown. This could result in tail rotor contact or severe nose tuck on water contact.

(3) Flaring high (above 140 feet on the radar altimeter) or too fast a rate of flare causing a high altitude and low airspeed coming out of the flare followed by a high sink rate. If this occurs, it is very difficult to use collective properly. Probably a hard landing will result, which could cause dishing of the hull or structural damage.

(4) Not rotating the nose over to the 5 degree nose up attitude prior to getting close to the water. If the nose is approximately 12 degrees or higher, over level water condition, the tail rotor will contact the water. This will very likely result in tail rotor system damage and loss of directional control.

(5) Forgetting to advance the speed selector to FULL ON position during the flare and then having the conditions unfavorable for completing a full autorotation. The speed selector must be advanced prior to collective application or an overtorque will result. Also, this could cause a dangerous slewing of the helicopter to the right as the engine rapidly accelerates just about at touchdown.

(6) Using and relying on a radar altimeter that is lagging or reading in error. It is sometimes difficult to determine this. The radar altimeter should be suspected to read erroneously if, after several autorotations using proper procedures and techniques, the recoveries are consistently low or high. If this occurs, discontinue practice autorotations until the equipment is thoroughly checked.

(D) Engine failure in a hover (simulated by BOTU only)

If the engine fails in a hover, follow the

engine failure in a hover procedure as set forth in the Emergency Procedures Section of the handbook.

Practice throttle chops in a hover are authorized under the direct supervision of a BOTU instructor pilot. With the helicopter established in a low hover, 3 to 5 feet above the surface, and heading into the wind, the instructor pilot will decrease the speed selector to the FLIGHT IDLE position. Hold the collective initially, and as the rotor RPM decays, the helicopter will start to settle. Smoothly apply collective to control the sink rate. Collective should not be used to stop the rate of descent. The helicopter will drift to the left. Use lateral cyclic to control drift. As the helicopter settles, the nose will swing to the left because power is removed from the rotor system. Use tail rotor to maintain heading. After the helicopter has landed, smoothly lower collective to the full down position. Once the helicopter and rotor RPM have fully stabilized, re-establish Nf/Nr at 103% using the technique described in paragraph (C) above.

CAUTION

The collective must not be lowered nor raised when the throttle chop is initiated. Lowering the collective, a common tendency after practicing autorotations from altitude, compounds the forces, driving the helicopter into the surface, resulting in possible structural damage. Raising the collective abruptly could cause the helicopter to climb resulting in rapid loss of rotor RPM, insufficient remaining collective, and a hard landing.

Note

The lighter the wind condition, or the heavier the weight, the lower the helicopter should be hovered prior to commencing the maneuver.

16. WATER MANEUVERING

The HH-52A enjoys a freedom not available to the fixed wing flying boat since it is capable of hovering and maneuvering at slow speeds, and it is capable of selecting the degree that it will be either airborne or waterborne. It is possible to maneuver the helicopter on the water much as it can be maneuvered in a hover.

(A) Turn on Spot

From a position into the wind, apply a small amount of tail rotor and cyclic in the direction of turn. As the nose begins to swing, use lateral cyclic to maintain a level attitude in roll, and fore and aft cyclic to cause the helicopter to rotate about the vertical axis extending through the cockpit. A slight amount of collective may be necessary to keep the blades from hitting the droop stops, depending on the rate of turn and the amount of lateral cyclic that is used. To stop the turn, use opposite tail rotor and return the cyclic to a neutral lateral position.

(B) Sideward Maneuvering

The helicopter may be moved laterally in the water, in the same manner that it may be flown sidewards in a hover. From a position into the wind, apply cyclic in the direction movement is desired. Tail rotor should be used to maintain heading. Sideward maneuvering speed will be limited to 2 to 3 knots water speed as the helicopter will assume a high degree of roll due to the resistance of the hull in the water.

(C) Rearward Maneuvering

It is possible to move the helicopter through the water in a rearward direction. Because of the forward tilt of the main rotor shaft, it will be necessary to use collective when using aft cyclic to prevent the main rotor blades from hitting the droop stops. Rearward maneuvering should only be performed when absolutely necessary as rearward vision is limited and the possibility of taxiing into a floating or sunken object is greater.

(D) Rotor Shutdown and Engagement

In the event of a water landing as a result of an engine failure, rotor shutdown should be accomplished by letting the rotor coast down to a stop. If there is any danger of the main rotor blades striking the water due to wind or wave action, the rotor brake should be applied at as low an RPM as conditions will permit. This will minimize the tendency of the helicopter to swing away from the desired heading on shutdown.

When shutting down the rotor with the engine in FLIGHT IDLE, application of the

rotor brake will cause the helicopter to turn to the left. The amount of turn will be somewhat influenced by the strength of the wind.

NOTE: This maneuver should be practiced at TRASEC only to demonstrate helicopter performance to student pilots. Shutting down the rotor with the engine at flight idle produces high loads on the rotor brake disc and may lead to its failure. This note does not restrict pilots from shutting down the rotor with the engine running when there is an operational necessity to do so.

While heading into the wind, decrease the speed selector to the FLIGHT IDLE position. Turn the helicopter approximately 100 to 150 degrees to the right of the windline. Once the N_f/N_r has stabilized (45 to 50%), commence a smooth application of rotor brake, simultaneously applying right rudder until directional control is lost (15 to 35% N_r). When directional control is lost, apply rotor brake full on. The helicopter will then swing left to the approximate desired shutdown heading. When engaging the rotor (engine in FLIGHT IDLE), the helicopter will have a tendency to turn to the right as torque is applied to the rotor system. To minimize turning of the helicopter and to gain control as soon as possible, apply full left tail rotor pedal and left cyclic prior to releasing the rotor brake. As the blades start to turn, the pilot should monitor the tip path plane to keep the blades from striking the water as cyclic control becomes effective. Tail rotor control will start to become effective at approximately 20% N_r. As soon as the turning of the helicopter is controlled, a slight amount of right tail rotor pedal is necessary to keep the tail rotor blades from striking the flapping stops. Tail rotor control will be effective for slow turns while at FLIGHT IDLE (45 to 50% N_f/N_r).

17. WATER RESCUE PROCEDURES

The amphibious capability of the HH-52A affords the pilot a wider latitude of water rescue potential than any previous helicopter. The Aircraft Commander, through training and experience, will have a thorough understanding of the capabilities and the limitations of the helicopter and the rescue equipment. As his experience increases, he will be able to draw upon this knowledge in his decision to either attempt a water landing with a rescue platform recovery or to perform a hoist. This decision should be made as soon as practicable to allow for sufficient briefing of the crewman. The equipment required for a rescue platform recovery or hoist should be rigged just prior to commencing the approach. The rescue platform should normally be rigged in the lower position for actual pickups. A check list shall be posted in the cabin and shall be completed by the crewman at the direction of the pilot. The list below is a minimum check list and may be supplemented as necessary.

a. Gunners safety belt on and adjusted.

b. Check rescue rig (basket, sling, platform) for proper rigging and condition.

c. Check Hot Mike.

d. Request permission to open up.

e. Rig rescue gear.

f. Report ready to pilot.

(A) Rescue Platform Recovery in Calm Water

The rescue platform normally will be used to effect the rescue of survivors from sheltered water or smooth, calm, open sea conditions. The platform is designed to permit the crewman to work at the outboard side of the right sponson to assist mobile survivors or to rescue immobile survivors with a minimum of time and maneuvering of the helicopter. The rescue platform is particularly effective to recover personnel from the water or from a small boat or raft where hoisting, without good visual reference points, would involve considerable time and maneuvering.

The approach to a hover will be accomplished in the same manner as described in paragraph 9. Approaching the straightaway, instruct the crewman to open the door and lower the rescue platform; then go on HOT MIC and establish ICS communications. The crewman should supplement the pilot's picture with continuous advisories until the rescue is complete. Immediately after touchdown, the crewman should position himself on the platform with the gunner's belt adjusted to permit complete freedom of movement on the platform. Normally the crewman will use the boathook to help retrieve the survivor. To prevent rotor blade contact, the boathook must not be raised above the shoulders. Water touchdown, utilizing no hover landing technique, should be accomplished with the survivor in the approximate 2 o'clock position just outboard of the rotor wash. Maneuver the helicopter to bring the survivor alongside the rescue platform, insuring that closure rate is such that the pilot can normally see the entire recovery and that the survivor is not endangered. The helicopter should be brought to a stop in the water as the survivor is alongside the platform.

CAUTION

As the platform approaches the survivor, the closure rate must be near zero to insure that the helicopter does not overrun the survivor. Making practice pickups using a dummy may cause the pilot to lose the proper respect for the dangers to the survivor in an actual rescue.

Use of the side mirror will assist the pilot in keeping the recovery in view at all times. Under unusual circumstances the use of right cyclic to lower the rescue platform may assist the crewman in recovering an immobile survivor. Forward flight should not be commenced until the crewman and the survivor are in the cabin. After administering necessary first aid, the crewman should pull in the platform, close the door, and stow the platform.

CAUTION

Do not air taxi close to a small raft as the downwash could capsize the raft and possibly cause contact with the blades. It is best to land short, as in a survivor recovery from the water, and using minimum collective for the situation, water taxi for the recovery.

CAUTION

Extreme care must be used in approaching parachutes in the water. When recovering an immobile survivor attached to a parachute, it is safest to land clear to one side and have the crewman use a raft or swim to the aid of the survivor and free him of the parachute.

CAUTION

When being approached by a small boat the pilot must be ready to take corrective action if it appears that persons in the boat may stand up, raise oars or in any way jeopardize themselves or the helicopter.

(B) Rescue Platform Recovery in Rough Water

CAUTION

Some sea conditions preclude a safe landing and rescue platform recovery. Therefore, a hoist will be required. WHEN IN DOUBT, HOIST!

If the pilot has elected to make a platform recovery, the approach and preparation for landing will be the same as in (A) above. While transitioning to the hover, turn the helicopter to place the major swell on the port bow to the port beam, holding the survivor in about the 2 o'clock position. While maintaining this general relationship, evaluate the sea, close on the survivor, and when sea conditions permit, land with the survivor just inside the rotor disc (to reduce water taxiing). Landing parallel or near parellel to the swell affords safer handling characteristics (greater tail rotor clearance). A greater sea state will require a greater degree of turn up to a maximum of 90 degrees. The slighter the sea state, the lesser the amount of turn until approaching the optimum situation of calm water and a landing directly into the wind.

CAUTION

Never turn the helicopter so far that the tail rotor is presented to swell condition, for obvious reasons. This may occur inadvertently when the pilot has his feet on the rudder pedals, concentrating on the recovery and not constantly scanning the swell condition.

CAUTION

Do not allow the swells to break on the bow of the helicopter as an engine flameout could occur due to the funneling tendency of water up the windshield and into the intake. Occasionally, it becomes necessary to momentarily break off the rescue, lift off, and await passage of a large swell.

Once touchdown on the water is made, maintain desired stability by use of cyclic and collective. The rougher the sea condition, the more collective is required. Carefully control closure rate to stop all drift as the platform approaches the survivor on the leeward side of the helicopter. During this phase, the pilot and particularly the copilot must alertly scan the sea to port. When the survivor is on the platform, establish a safe hover and as the helicopter clears the water turn into the wind. Maintain the hover until ready for forward flight.

(C) Rescue Platform Recovery Phaseology

As mentioned in paragraph (A) above, use of the side mirror will assist the pilot in keeping the recovery in view at all times. However, unless all conditions, including weather, visibility, sea, etc., are extremely favorable, ICS communications are required during rescue platform operations.

The pilot and crewman must perform as a team to effect a safe recovery. To preclude confusion and misunderstanding, the ing voice reports are to be used by the crewman in directing the pilot to position the helicopter:

"FORWARD" "RIGHT" "HOLD"
"BACK" "LEFT"

The following reports advise the pilot of the progress:

(1) "MAN APPROACHING THE PLATFORM"
(2) "MAN AT THE PLATFORM"
(3) "MAN ON PLATFORM, CLEARED TO HOVER"
(4) "DOOR SECURED AND READY FOR FORWARD FLIGHT"
(5) "MAN DRIFTING AFT (or UNDER TAIL PYLON) PICKUP INTO HOVER" (It is essential to hover clear of survivor if the aircraft drift is not controlled and is endangering him.)

The above reports should be supplemented by other simple, clearly understood advisories, as necessary. The crewman, to avoid unnecessary external noises whenever on HOT MIC, should keep the lip mike as close as possible to his lips.

18. HOIST PROCEDURES

Most SAR hoists will be made from a boat or ship. Communications should be established with the vessel as early as possible, prior to arriving on scene. This will aid in making an expeditious rendezvous and hoist. The ship's personnel should be briefed to be prepared for the hoist prior to the rendezvous. The briefing should include the securing of loose items, lowering antennas (rigging, booms, etc.) around the most desirable hoist area on deck and to have the patient ready. If voice communications cannot be established, the pilot, upon arriving on scene, may have to drop message blocks, use hand signals, blackboards, or may just have to move into position and commence the hoist.

Hoist pickups present no particular problems. It is virtually impossible to prescribe procedures that are practicable for every case. The Aircraft Commander must frequently rely on his judgment and experience in adapting general principles to meet the conditions encountered. When the pilot has made the final decision to hoist, he must complete the hoist check list as set forth in paragraph 17. Normally the checklist should be completed prior to commencing the approach. The approach should be accomplished as described in paragraph 9. During the straightaway, the crewman, when having the survivor or boat in sight, will be directed to go on HOT MIC, open the cabin door, and stand by to put the hoisting rig over the side.

(A) Hoists From Boat

As the helicopter approaches a hover, the the crewman should be directed to put the hoisting rig over the side. The helicopter should be brought to a near hover about 15 to 20 yards short of the boat to allow dipping of the hoist rig in the water to discharge static build up.

CAUTION

If any possibility exists of fuel spillage on the water surface, a dip of the hoisting rig must be made clear of the spill to preclude sparking a fire.

Through the crewman's advisories, the helicopter will then be positioned over the boat at as low an altitude as safely practicable. It is usually desirable to have the boat underway or maintaining steerageway with the wind over her port bow. This enables the pilot, while closing on the boat, to ease the helicopter heading 35 to 45 degrees to the left of the boat's longitudinal axis. This heading relationship is maintained using ASE and is normally used when hoisting from the boat's stern. It affords the pilot the maximum view of the boat.

CAUTION

Great care must be used to maintain positive clearance from any portion of the boat (whip antenna, masts, rigging, etc.).

The crewman must maintain a steady, calm voiced, running commentary of advisories as described in paragraph (D) below. It is very important for the crewman to keep the pilot informed at all times of the progress.

CAUTION

The crewman must never allow the hoist cable or hook to be secured to any portion of the boat. If this should happen, the crewman should run out slack cable, advise the pilot and attempt to have the boat personnel release it. If the attempt to free it is unsuccessful, the HOIST SHEAR may have to be used.

After the basket, litter or sling is on the boat, the pilot must hold a steady position. Cyclic TRIM RELEASE may be depressed while maintaining position and yaw heading retention feature utilized by keeping the feet on the deck. When the patient is safely in the hoisting rig, the crewman will raise the hoist. If the sea conditions are rough, with the boat deck pitching, it is desirable to have the pilot take a strain on the hoist cable by lifting the helicopter while the crewman simultaneously raises the rig with the hoist. This expedites clearing the rig from the boat deck.

CAUTION

If at any time during the hoist the crewman loses complete sight of the boat, he will inform the pilot, the hoisting will be abandoned, and the helicopter will maneuver for another approach.

During some situations, the pilot will not be able to see the boat due to its small size. In this case, he must rely upon the crewman's advisories for position holding. Once the basket is clear of the deck and obstructions, the pilot must be advised so he can move the helicopter clear of the boat. This is done to prevent serious injury to personnel or damage to the boat should an engine failure occur. When clear of the boat, the pilot may slowly lower the helicopter to a safe hovering altitude as the hoisting rig is raised. The helicopter should not be transitioned to forward flight until the hoisting rig is inside the cabin.

When sea conditions or rigging prevent "plumbing the deck", a heaving line attached to the basket may help. Pass the heaving line to the vessel so that personnel on deck can steady the basket while the helicopter is hovered slightly to one side.

CAUTION

The crewman must use extreme care in tossing the heaving line to prevent getting it fouled in the helicopter rotor system. With the line coiled loosely, the crewman should toss it downward to the boat, never letting it get above his shoulder level.

This procedure may be used even when the receiving unit presents a steady, uncluttered receiving platform. In all cases, an approximate 300 pound weak link should be provided where the heaving line is attached to the basket.

(B) Lowering Salvage Pumps

A heaving line or tending line should be used when passing salvage pumps or other heavy equipment in waterproof containers to a surface unit. The line should be fitted with a 300 pound weak link and tossed as explained in paragraph (A) above. Lowering such heavy equipment directly to the deck can be extremely hazardous to personnel on deck due to the possibility of the load swinging on the end of the hoist cable. Where there are sufficient personnel on the receiving unit to lift the payload out of the water, it may be desirable for the helicopter to put the payload in the water, normally downwind, as close as possible to the vessel, after having passed a recovery line.

(C) Hoists From Water

As the helicopter approaches a hover, the crewman should be directed to put the hoisting rig over the side. The helicopter should be brought to a low hover over the survivor through the crewman's advisories. Hovering into the wind at the lowest altitude that is safely practical makes the hoist operation easier and more expeditious. It is usually very difficult to maintain a steady hover over a spot on the open water, particularly at night. The pilot's task of position holding will be made easier by following the crewman's advisor-

ies, making smooth control corrections, and by scanning the water around the helicopter for any drift indications. Utilizing techniques described in paragraph 6(A)(3) will aid the pilot in controlling drift. It may be desirable to toss out charts, floats, smoke markers, etc., upwind to give the pilot some reference points during the hoist.

(D) Hoisting Phraseology

The effectiveness of a hoist operation depends upon the ability of the pilot and crewman to perform as a team. Normally, crewman to pilot ICS communications are mandatory. If communications are lost, hoisting will be discontinued unless all conditions, including pilot visual references are extremely favorable permitting a safe continuation of the hoist operation. If time permits, the ICS communications control boxes are interchangeable. In an emergency one way communications (pilot to crewman) could be conducted on a VHF or UHF frequency. There must be a clear understanding of procedures and phraseology to be used to complete the operation safely and successfully. To avoid confusion and misunderstanding, the following voice reports should be used by the crewman in directing the pilot to position the helicopter:

"FORWARD"	"RIGHT"
"BACK"	"LEFT"
"UP"	"HOLD"
"DOWN"	"___ EASY" (used for small corrections in any direction)

The crewman may use "LEFT 20 FEET", "RIGHT 25 FEET", etc.

The following reports from the crewman are mandatory. They advise the pilot of the hoisting progress:

(1) "BASKET (SLING) GOING DOWN"
(2) "BASKET ON THE DECK" or "BASKET IN THE WATER"
(3) "MAN GETTING IN THE BASKET"
(4) "MAN IN THE BASKET"
(5) "PREPARE TO TAKE THE LOAD" (commencing to raise hoist)
(6) "TAKE A STRAIN WITH THE HELICOPTER" (used if circumstances dictate)
(7) "BASKET CLEAR OF BOAT (WATER)"
(8) "BASKET OUTSIDE OF DOOR"
(9) "MAN IS ABOARD"
(10) "DOOR SECURED AND READY FOR FORWARD FLIGHT"
(11) "CABLE (BASKET) FOULED" (If encountered. Anytime hoisting rig becomes fouled, attempt to free rig. If unsuccessful, use HOIST SHEAR).
(12) "CABLE (BASKET) FREE"

The above required reports should be supplemented by advisories on basket relationship to the water, deck, sponson, etc., while raising or lowering the hoist. In addition, other simple, clearly understood advisories should be given to the pilot as necessary.

19. FORMATION FLIGHT

(A) General

The occasion may arise when Coast Guard pilots will find it necessary to fly formation. Previous knowledge and practice may determine the success or failure of the mission. The Air Operations Manual (CG-333) outlines the circumstances under which formation flying may be conducted. When flying formation it is imperative that the flight leader fly as smoothly as possible with a minimum of attitude and power changes. The flight leader must allow his wingman 10% torque and airspeed for maneuvering. Communications between units of the formation are very desirable since hand signals are virtually impossible to use when flying a helicopter in intricate flight maneuvers. The normal distance between adjacent helicopters in a two helicopter section will be one rotor disc diameter. The wingman will fly a step-up position 10 feet above the lead helicopter. It will be noted after a little practice that it is easier to maintain a good position in the formation if the formation is kept "tight" and very close to one rotor disc distance.

(B) Basic Formations

(1) Column—When the wingman flies directly astern of the flight leader the flight is in column.

(2) Parade—When the wingman flies on a bearing of 45 degrees left or right of the astern position of the flight leader then the flight is in parade formation. This is a "show or flyover" formation.

The wingman is not free to maneuver except to maintain this position.

(3) Tactical—When the wingman flies on a bearing of 35 degrees left or right of the astern position of the flight leader then the flight is in tactical formation. The wingman is free to maneuver from side to side as he desires.

(4) Cross country cruise—When the wingman flies on a bearing of 35 degrees left or right of the astern position of the flight leader at a distance of 3 to 4 rotor disc diameters then the flight is in cross country cruise formation.

(C) Maneuvering

When the formation is maneuvering the flight leader should advise the wingman by radio of the expected evolution. When the wingman is maneuvering within the formation he should use extreme care and avoid approaching the flight leader too closely. To change his position in a flight the wingman generally will have to adjust his power in addition to maneuvering his helicopter. For example, when directed to move from parade left to parade right, the wingman initially will need to reduce power slightly so that he can drop back and then add power as he commences the cross over, maintaining the desired 1 rotor disc distance and the 10 foot step-up throughout the maneuver. As the wingman arrives in the position of parade right, a slight power reduction is required to prevent over running the flight leader.

(1) Breaks—When helicopters are in formation they may need to break apart for landing separation, or other purposes. When breaking left the formation should be formed in parade right or tactical right. The flight leader, when breaking, will bank his helicopter smartly to 10 to 15 degrees (angle of bank for standard rate turn for the airspeed) so that the wingman will be aware of the maneuver and, if communications will permit, the flight should be advised of the break. Three seconds after the flight leader breaks the next helicopter shall break, etc.

(2) Join-up—The maneuver in which the wingman joins up on the flight leader is one of the most difficult maneuvers in formation flying. The wingman is attempting to position his helicopter on a bearing 45 degrees aft of the flight leader's beam and then fly in on this bearing. To commence this maneuver it is necessary for the two helicopters to be relatively close to each other. (During the normal rendezvous, the wingman should position himself within the turning circle of the flight leader when the flight leader is circling at a standard rate turn.) If the flight leader is in a right turn, the wingman should establish a right turn also and turn such that the flight leader bears 45 degrees off the wingman's port bow (to the wingman the flight leader's relative bearing is 315 degrees). If the wingman keeps turning right so as to keep this bearing constant, he should be able to rendezvous with, or join-up with the flight leader without difficulty. As the helicopters close in range, the wingman must be alert to ensure that he does not fly into the flight leader. Too fast a closure rate close in is very dangerous and should be avoided by the wingman by shallowing his turn. Do not reduce closure rate by increasing bank to such a degree that the flight leader goes out of sight and avoid getting ahead of the 45 degree bearing, particularly close in.

20. TOWING

Towing with the helicopter is prohibited except with a line hand held by the crewman. Towing in this manner should be undertaken with great caution. Under no circumstances should the line be wrapped around any part of the aircraft or the crewman. The pilot shall ensure that the line is firmly secured to the vessel and that the bitter end is hand held by the crewman.

21. INSTRUMENT FLIGHT PROCEDURES

(A) General

This section covers basic instrument flight procedures peculiar to the HH-52A. Pilots should consult current instrument flight manuals for specific approach procedures using various aids. Two instrument qualified pilots (one an Aircraft Commander) are required for instrument or night flights (other than local night training flights). The copilot's (the pilot not actually actuating the flight controls) duties are similar to those in any two pilot air-

craft. He should act as a safety pilot, maintaining a good visual lookout in marginal conditions. He should normally maintain all communications, tune and monitor navigation aids, start and stop the clock at the pilot's command, and continually monitor the pilot's actions. He should question anything he feels may endanger the aircraft or that he fails to understand. He should particularly pay close attention to cross checking the pilot's instruments with his own, for failures can occur without warning (i.e., loss of VGI without OFF flag).

The HH-52A exhibits excellent basic instrument flight characteristics with ASE operating. However, back-up capability in the communications-navigation equipment is lacking, and only engine anti-icing equipment is provided. Compliance with the following rules is therefore mandatory:

(1) An operative ASE system is required for night and instrument flight. Only in matters of life or death may Commanding Officers waive this provision. Under VFR conditions at night, ASE off training is permissible provided sufficient visual reference exists.

(2) Flight into known icing conditions is prohibited.

(3) Actual instrument and local approach training flights are encouraged provided stable air is forecast and the ceiling and visibility will permit the final phase of an autorotation to be visual in the event of engine failure.

(B) Basic Instruments

The best stability characteristics for maneuvering the helicopter are obtained at cruise airspeeds. The HH-52A exhibits good stability with ASE operating throughout the speed spectrum. Seventy (70) knots is recommended as a good compromise, for it is fast enough to provide reasonable rates-of-descent on GCA and ILS glideslopes, and yet permits easy transition to approach speeds through the height/velocity "corridor" after breakout.

The pilot will find he depends on the VGI as his primary instrument, cross checking with the remaining instruments. The horizon bar is adjusted by placing the pitch and roll knobs at the centering indices during the NORMAL PROCEDURES check, and they are not readjusted during flight. Proper pitch attitude for a given airspeed and CG position is established by cross reference to secondary instruments, and the pilot should trim for straight and level flight (wings level), and "feet on the deck".

CAUTION

TRIM RELEASE will not be used during:
(1) Instrument flight or,
(2) Night flight over water or poorly defined terrain, except when operating without ASE.
Thus, the helicopter will assume a "wings level" attitude should the pilot suffer vertigo and turn loose of the cyclic.

For turns greater than 5 degrees, coordinated tail rotor and lateral cyclic should be used. For turns of 5 degrees or less, yaw trim should be used. The pilot should momentarily press in a slight amount of lateral cyclic as he applies yaw trim in order that the helicopter assumes the new flight path in balanced flight.

In order to determine the torque required to maintain level flight at a given airspeed, the pilot should consult the power vs. speed and engine horsepower vs. torque performance charts. Entering with aircraft weight, desired altitude and airspeed, he determines horsepower. Entering the engine horsepower vs. torque chart with this horsepower, indicated torque may be obtained. The change in torque required to produce a given climb or descent at constant airspeed is based on the following solution:

$$\frac{\text{A/C WT (lbs)} \times \text{ROC or Descent (Ft/min}}{33{,}000} : \text{HP CHANGE}$$

Obviously this is a little clumsy for everyday use so for convenience, a table of typical values is presented following this paragraph. Because glideslopes are fixed paths in space, rates-of-descent on the glideslope are a function of ground speed, not airspeed. Weight varies continually, but the approximate values presented provide the pilot with an easy to remember "rule of thumb".

TORQUE SETTING (%) for 70 KNOTS IAS, 96% Nr, 0-2000 FT ALTITUDE, 7500 LBS

Level Flight	55%
500 Ft/Min Descent	40%
500 Ft/Min Climb	70%
No Wind Glideslope	45%

Or, in other words, reduce torque approximately 15% for a standard rate descent; increase torque approximately 15% for a standard rate climb; and decrease torque approximately 10% on the glideslope. Though these are approximate figures, they will not be more than 5% in error in the normal flight regime of the HH-52A.

(C) Instrument Take-Off

Prior to commencing an instrument take-off, accomplish the following:
(1) 103% Nf/Nr
(2) ASE engaged
(3) Feet on deck, yaw pointer centered

Initiate a smooth application of collective to 95% torque. Maintain "wings level" and "nose level" attitude on lift-off by overriding cyclic trim. The pilot cannot "beep" fast enough in this phase of the maneuver. Once a positive rate-of-climb has been established and when passing through 40 to 60 feet on the radar altimeter, override pitch and lateral trim to attain an attitude of 5 degrees nose down and "wings level". Approaching 55 knots, relax this pressure and "beep" the nose attitude to maintain a 55 knot climb, "wings level".

CAUTION

The yaw heading retention feature of the ASE may not hold. Close monitoring of the heading during the initial phase of the take-off is required.

The technique is the same from the land, water or from a hover. The following advantages gained in performing this maneuver from a hover make this action advisable when conditions permit. A much smaller torque change is required, resulting in less aerodynamic coupling forces and therefore fewer and smaller control movements during the critical portion of the maneuver. The oleos do not give the pilot false indications of what the helicopter is actually doing, and less monitoring of the heading is necessary. The chances of not using enough torque are considerably lessened, decreasing the chances of flying back into the surface.

CAUTION

The following tendencies are common in the ITO and should be avoided:

(1) Abruptly increasing collective, which may result in exceeding yaw channel capability with appreciable heading change and/or overtorque.

(2) Use of inadequate collective, resulting in becoming airborne momentarily and then settling back to the surface.

(3) The nose and the right "wing" will pitch up. Overcontrolling the cyclic often results in a nose low takeoff and excessive right drift.

(4) Lowering the nose too early increases the possibility of flying back into the surface.

(5) If the feet are on the pedals or cocked, inadvertant heading change can easily result.

(D) Instrument Climb

Climb from take-off to 1000 feet above the terrain will be at 100% Nf/Nr, 95% torque and 55 knots. Above 1000 feet, increase climb speed to 70 knots. If the time to climb to altitude exceeds 5 minutes, climb as indicated for the first 5 minutes and then reduce rpm to 96% Nf/Nr and power to 90% torque. Continue climb at 70 knots or the speed for maximum component life, whichever is less.

(E) Instrument Cruise

Cruising speed will be the speed for maximum component life and will be accom-plished at 96% Nf/Nr regardless of weight.

CRUISE SPEED FOR MAXIMUM COMPONENT LIFE-VCL

Vmax(TAS)	Weight	Vcl(IAS at MSL)
90	8300	80
92	8200	80
95	8100	85
97	8000	85
98	7900	90
100	7800	90
102	7700	90
103	7600	90
104	7500 below	95

Note

Reduce Vcl 4 knots per 1000 feet.

(F) Holding

Holding for short periods will be at 96% N_f/N_r and 70 knots or the speed for maximum component life (Vcl), whichever is less. Holding for long periods or when fuel is critical will be at 96% N_f/N_r and 55 knots.

(G) Instrument Descent

Enroute cruising descent normally will be accomplished at 96% N_f/N_r and the speed for maximum component life (Vcl). Descent in a shuttle or during the initial phases of an approach will be at 96% N_f/N_r and 70 knots.

(H) Instrument Approaches

Instrument approaches are accomplished in the same manner as in other helicopters. The PRE-LANDING CHECK, consisting of

(1) Tail Wheel - Locked
(2) Parking Brake - As desired
(3) Landing Gear - As desired
(4) Caution Panel - Checked
(5) Speed Selector - 100% N_f/N_r
(6) Air speed - 70 knots
(7) RAWS - On
(8) Radar Altimeter - Set for approach minimums
(9) Heater - As required

will be accomplished as follows:

(1) On GCA and ASR - when directed to "PERFORM COCKPIT CHECK"

(2) On ILS, VOR, ADF and LF - at HIGH STATION OUTBOUND (prior to OUTER MARKER or LOW STATION INBOUND on a straight in approach). At any time the approach appears unsafe or if the field is not in sight at approach minimums, execute a waveoff on instruments, complying with missed approach instructions.

(I) Instrument Autorotations

The instrument autorotation is performed in the same manner as the visual autorotation with the following exceptions:

(1) After entering autorotation and stabilized into the wind, place feet on the deck.

(2) Do not depress stick trim release.

(3) Collective is increased on the radar altimeter rather than by visual interpretation.

Note

An instrument autorotation will normally be required if the engine should fail over water at night. Proficiency in the instrument autorotation is therefore mandatory for all Coast Guard pilots.

Practice power recovery autorotations are authorized under the following conditions:

(1) The safety pilot must be an Aircraft Commander.

(2) The recovery must be complete at 1000 feet and IAS should not drop below 35 knots.

(J) Instrument Wave Off

Smoothly and positively increase collective to 95 to 100% torque. Simultaneously adjust attitude to check descent and transition into a 55 knot climb. Instrument scan should include the torque indicator to insure 95 to 100% torque, radar altimeter, and the VGI cross checked with the airspeed indicator for transition into the climb.

(K) Beep to a Hover Approach

(1) General

This maneuver is one of the most demanding types of flying a pilot will be called upon to perform and it is also one of the most useful "tools" an operational SAR pilot can have. These, of course, are both excellent reasons for attaining and maintaining a high degree of proficiency in the maneuver and it is highly recommended as a training exercise. Whether used for training or operationally, it is mandatory that two pilots be in the cockpit.

The basic purpose and design of the complete maneuver is to transition the helicopter down to an exact position for a water landing or hoist at night when some indication of a small target in the water has been received (lifevest light, distress signal, etc.). It is emphasized however that the maneuver should be used either day or night whenever good visual contact with the surface cannot be expected and it is necessary to transition the helicopter from above the 300 foot level down to hover altitude (night, IFR conditions, "glassy" water conditions, etc.). If it is desired to position the helicopter to a hover at an exact reference, the complete maneuver should be used. If it is only necessary to arrive at a hover in a general area, the tear-drop portion of the pattern may be eliminated and only the straight-in portion flown, provided all of the prerequisites are accomplished prior to entry at the "gate". The maneuver provides a positive control of the descent (altitude/airspeed relationship) and will preclude flying into the water.

CAUTION

Other than eliminating the tear-drop portion of the pattern, no other modification of the maneuver should be made and no attempt should be made for a half beep/half visual approach.

CAUTION

The controllable light must be used with caution. The spot light characteristic of this light can cause vertigo. During its use the pilot controlling the helicopter must carefully monitor the flight instruments.

(2) Procedure and Crew Duties

Note

For convenience, the pilot actually in control is called "the pilot" regardless of the seat he occupies. The other pilot is the "safety pilot."

Note

If time permits, the following adjustments should be made prior to crossing datum:

(A) Conduct PRE-LANDING CHECK

(B) When stabilized at 55 knots set CG trim (horizontal bar is on the first index mark below the center "doughnut").

(C) BARALT and RADALT cross checked.

(D) Cross check pilot's and co-pilot's VGI.

(E) "Bug" lights set to 40 feet.

BEEP PATTERN

a. Turn and adjust pattern to pass datum on a downwind heading at 300 feet and 55 knots, at 100% N_f/N_r.

b. Passing over datum, punch the clock and hold heading for 15 seconds.

c. After 15 seconds, make a standard rate turn of 40 degrees toward the side on which the pilot is sitting (i.e., pilot in left seat, left turn; right seat, right turn). Required bank angle is approximately 10 degrees.

d. Safety pilot, with the acquiescence of the pilot, positions the controllable landing light so that the beam is approximately 30 degrees below the horizontal and at the 11 o'clock

position (safety pilot on right, 1 o'clock position) and then normally turns the light off again. Placing the beam in this position reduces light reflection in the cockpit and affords the safety pilot the best lighting condition.

Note

If the pilot desires, he may carry his instrument lights in the full bright position. This minimizes distraction from outside lights and helps resist the temptation to fly semi-visual flight.

e. Fifty-five seconds after datum start a level, standard rate turn in the opposite direction from the initial turn.

f. The safety pilot scans quickly to the inside of the turn and attempts to regain sight of datum. He continues scanning rapidly in and out of the cockpit, warning the pilot if he descends below 300 feet.

g. When the safety pilot regains sight of datum he calls "datum" over the interphone.

h. At approximately 30 degrees short of the original wind line, the safety

pilot estimates the heading to bring the helicopter back to datum. He tells the pilot in control "wind line okay" or "roll out heading ----".

i. Five degrees prior to roll out heading initiate recovery to wings level attitude. Three degrees prior to the heading remove feet from the rudder pedals to utilize the heading retention feature.

j. After roll out restart the clock.

k. Turn on controllable landing light at pilot's discretion.

l. Start immediate descent to 140 feet altitude (approximately 10% less torque than that required for 55 knot cruise).

CAUTION

Do not let rate-of-descent increase to more than 400 feet per minute.

m. Safety pilot monitors descent and warns pilot when passing 180 feet radar altitude. It must be accepted that datum may be lost during this phase.

n. Level off and stabilize at 140 feet. The power required to maintain 140 feet will be the same as that required to maintain 300 feet.

o. Safety pilot continues to monitor radar altitude and scans rapidly outside to regain datum.

p. The "gate" for commencing the beep to hover is arrived at 30 seconds after starting the clock under a no wind condition. Add an additional 15 seconds of each 5 knots of wind.

Note

Under a no wind condition, arrival at the gate and completion of the descent will be nearly simultaneous. It is better to overrun the gate slightly if necessary rather than commencing the beep before heading, altitude and airspeed are stabilized.

q. Arriving at the gate, commence the beep to a hover. Decrease torque approximately 15% less than that required for 55 knot cruise, and beep the nose to 6 degrees nose up. This attitude/power combination will cause a gradual deceleration and a descent of 100-150 feet per minute. As speed decreases, the nose attitude must be monitored to maintain the 6 degree nose up position and a wings level attitude.

r. Both pilots monitor check points.

ALTITUDE	AIRSPEED (KIAS)
140	55
100	40
70	30

The safety pilot must continue scanning between radar altitude, airspeed and datum.

CAUTION

A good beep to a hover depends on correctly beeping while simultaneously decreasing power. A steady beep, beeping too rapidly, or completing the beep prior to decreasing power will cause a rapid decrease in airspeed with little or no decrease in altitude initially. A rapid descent will follow which is difficult to break or stop at 40 feet; the tendency being to descend below 40 feet or start to climb. Conversely, if power is first reduced and then a beep commenced, the altitude loss will get ahead of the airspeed decrease.

s. After commencing the beep to a hover from the gate, control inputs are made only with the BEEPER TRIM button using short beeps and very small collective (torque) changes. Heading control is left entirely with the ASE heading retention feature.

Note

This differs from the usual fixed wing practice of applying a control force and then trim for neutral pressure. Under no circumstances should steady

beeper trim or trim release be used.

t. Approaching 40 feet, increase collective to check the rate-of-descent and attain hovering power. Monitor power addition to prevent climbing. The power required should be 5 to 10% more than that required to hover in ground effect, at the same weight. Do not make any additional beeper trim corrections after starting to increase collective.

u. If the pilot has maintained the 6 degree nose up, wings level attitude and kept airspeed within limits, the natural aerodynamic characteristics of the helicopter with ASE will transition the helicopter to an approximate hover without further pilot effort.

v. As power is increased the nose of the helicopter will first pitch up to about 10 degrees, vibration will increase as airspeed decreases and airspeed indications will fluctuate rapidly between 0 to 20 knots.

CAUTION

Avoid hovering in a nose high attitude. This results in zero IAS, backing and settling which may require an overtorque to prevent water contact.

The helicopter will then pitch downward and assume a hovering attitude with the VGI indicating about 3 degrees nose up and 3 degrees left "wing" down. Minor beeper adjustments may be necessary to attain this hovering attitude.

w. The safety pilot puts his hand on the exterior light switches and turns on the hover lights at the direction of the pilot.

x. Immediately after turning on the lights, the safety pilot should look outside the cockpit and attempt to gain visual reference for hovering. If he can get sufficient visual reference for hovering he calls "I'm visual" over the interphone.

y. The pilot relinquishes control to the safety pilot by saying "you have it" and getting the response "I have it". (The pilot monitors controls.)

z. As soon as the safety pilot acknowledges control, the pilot shifts scan outside the cockpit and gets visual reference.

aa. When he has visual reference well established the pilot calls "I'm visual" and control is again shifted as in step y.

CAUTION

Before transitioning to visual flight, pilots must be absolutely sure that they do not merely see the surface, but rather that they see enough to give them good reference for control of the helicopter.

ab. In event the safety pilot does not get satisfactory visual contact within 10 seconds of establishing a hover, the pilot may start a very gradual descent to 30 feet radar altitude (after advising the safety pilot of his intention).

ac. Do not decrease hovering torque more than 5%.

ad. Keep some indicated airspeed greater than zero but less than 20 knots (needle will be fluctuating). If the wind is greater than 20 knots, maintain approximately the same airspeed as the wind speed. If it is necessary to remain in a hover over water at night, the recommended scan pattern is VGI, radar altimeter, airspeed. The airspeed is important as it will help to indicate drift. For example, with a 10 knot wind and the airspeed indicating zero, the helicopter is drifting aft. If the vibration level increases and the airspeed indicates more than the wind, the helicopter is drifting forward.

ae. If visual reference is not established at 30 feet, commence an instrument take off as described in paragraph 2 (C).

af. If a hovering or air taxi operation is indicated, the pilot should

expect to fly slightly higher than he would in the day time. A very fine spray, usually not visible in daylight, turns the light beam into a "bowl of milk" at altitudes of 20 feet or below. Provided visual contact with the surface can be maintained, altitudes closer to 40 feet will be more satisfactory.

ag. If a water landing is required, commence a slow descent with a very slight forward speed (less than 10 knots). Attitude for landing is maintained by overriding the stick trim forces in order to retain the cyclic trim position for the hover. Maintain attitude and rate of descent until solidly on the water. Proceed as in normal water operations.

CAUTION

Tests have shown that pilots have a strong tendency to attemp to follow along with a line of advancing whitecaps. In shallow water during maximum ebbing or flooding, the tendency to hold a hover in the direction of current flow creates a similar problem. This is especially true when the pilot's view is limited as for example, by the extent of the controllable landing light beam. If the pilot permits the helicopter to drift aft with the whitecaps, or with the current, there is great danger that he will back into the water damaging the tail rotor.

(3) Attitude Limitations

If during the beep to a hover the helicopter attitude exceeds 12 degrees nose up, 5 degrees nose down, or 6 degrees right or left roll, level the helicopter and increase power to 95% torque. Transition to an instrument take-off.

CAUTION

If at any time the pilots are dissatisfied with the progress of the maneuver, execute an instrument wave off.

22. EMERGENCY OPERATIONS

(A) General

Success in handling an actual emergency will depend not only on a pilot's experience level but more so on his current proficiency in handling the simulated emergency. Proper ground and flight scheduling will ensure that the pilot's knowledge and ability to cope with ground and inflight emergencies will progress towards attaining and maintaining the desired proficiency level. Initial checkout and recurrent training should include practicing the following simulated emergencies:

(1) Inflight

Autorotations (refer section 15)

Primary servo off operations (BOTU only)

Auxiliary servo off operations (BOTU only)

Emergency throttle operations

Generator failure

(2) Ground

Cold hang-up

Actuation of TEST No. 1

Actuation of TEST No. 2

P3 system leak

The following criteria are strongly recommended to provide for maximum safety when practicing simulated emergency operations:

(1) Two pilots in the cockpit, one of which is an Aircraft Commander currently proficient in the maneuver to be practiced.

(2) Do not practice dual emergencies.

(3) Operating conditions should be ideal. Operations should be conducted on or to a prepared hard surface area with crash equipment available and which is clear of obstacles.

(4) Simulated emergencies should be realistically accomplished. For example, turns on the spot and squares should not be practiced on emergency throttle.

(B) Emergency Throttle Operation

(1) General

Flight utilizing emergency throttle requires a great degree of coordination. It is very similar to flying a reciprocating engine helicopter with a poorly adjusted throttle compensating cam. Smooth operation on emergency throttle depends on the pilot's ability to anticipate the emergency throttle movements required to maintain a desired rpm. As collective is increased, emergency throttle must be increased. Conversely, when collective is decreased, emergency throttle must be decreased. The more rapid the collective application, the quicker the pilot must be to lead with the rpm change. For example, the most rapid collective change occurs during a vertical landing. The pilot must steadily lower the collective to minimize the time the helicopter is "light on the oleos" (subjected to ground resonance). The emergency throttle must be simultaneously decreased as the blade pitch decreases to prevent rpm from increasing and possibly overspeeding the rotor system. Pilots are encouraged to thoroughly familiarize themselves with the proper use of emergency throttle. Frequent practice will engender a continuing high degree of proficiency as well as a thorough knowledge of emergency throttle operation.

(2) Normal Procedure

With the helicopter on the ground, adjust the speed selector to 96% Nf/Nr. Slowly bring the emergency throttle up to 103% Nf/Nr. Perform all maneuvers maintaining the same rpm as obtained when using the speed selector. When terminating maneuvers with the emergency throttle, again with the helicopter on the ground, close the emergency throttle and increase the speed selector to the desired rpm.

CAUTION

If the pilot permits Nf/Nr to droop down to 92 to 93%, the governor may actually be maintaining RPM presenting a false picture of the degree of difficulty involved. It must be remembered that in the actual emergency condition, the pilot will not have the RPM protection established in the simulated emergency condition by setting the speed selector to 96% Nf/Nr on the ground. Hence, excessive RPM droop (below 92%) can lead to loss of helicopter control.

CAUTION

Pilots must strive for smooth control movements on emergency throttle. Abrupt or erratic movements can result in engine overspeeding or overtemperatures.

(3) Simulated Emergencies

There are several simulated emergencies which pilots can and should practice. Proficiency in handling the following simulated emergencies will ensure a better understanding of emergency throttle operation.

(a) Ground Emergencies.

1. Simulated Cold Hang Up. Although not considered an emergent condition, a cold hang up can be simulated by commencing the alternate engine start procedure (P3 valve and speed selector). Following light off, do not close P3 when T5 peaks. Gas generator speed will slow down and normally stop between 30 - 50 Ng, establishing cold hang up. Increase rpm slowly with the emergency throttle, monitoring Ng and T5, until Ng reaches the ground idle range. Close P3 and then the emergency throttle.

2. Stabilizing Engine Conditions Under TEST No. 1 and TEST No. 2 Conditions

Perform electrical ground check of the overspeed protection system. When the primary over-

speed switch trips at 72% (plus or minus 3%) Ng, increase rpm with the emergency throttle to stabilize the engine/power relationship. Note the amount of emergency throttle movement required for stabilization. Place the engine overspeed switch to TEST No. 2 position. Close the emergency throttle. Increase rpm with the speed selector until actuating the transmission overspeed switch at 97-98% Nr. Increase rpm with the emergency throttle until stabilizing the engine/power relationship. Note the amount of emergency throttle movement required for stabilization. This closely approximates the amount of emergency throttle required in flight for 100% Nf/Nr with minimum collective.

3. Simulated Actuation of Overspeed System during Ground Taxi.

During taxi, initiate the simulated emergency by placing the engine overspeed switch in either the TEST No. 1 or TEST No. 2 position. Analyzing the primary engine (T5, Ng, and fuel pressure) and power instruments (torque and Nf/Nr) would indicate actuation of the overspeed system, characterized by the fluctuations. The TEST No. 1 condition creates a larger power loss with lesser gage fluctuations than the TEST No. 2 condition. A minor yaw tendency in the TEST No. 2 condition will be noted due to the wide range of torque fluctuation. Stabilize the engine/power relationship by increasing the rpm with the emergency throttle. Place the engine overspeed switch in the NORMAL position and close the emergency throttle. More realism may be incorporated by having the second pilot initiate this simulated emergency.

4. P3 System Leak (BOTU only)

With 100% Nf/Nr (helicopter chocked or during ground taxi), a realistic emergency condition can be simulated by having the second pilot open the P3 valve. The pilot in control of the helicopter should immediately analyze his primary engine instruments. Noting the engine power loss, specifically gas generator deceleration, increase the emergency throttle and stabilize Nf/Nr at 100%. To terminate the simulated emergency, close P3 valve and then the emergency throttle.

Note

With a P3 system leak, the engine rapidly loses power and gas generator speed, if allowed to decelerate, would eventually stabilize between 30-50% Ng. A steady decrease of Ng below 70% with a lack of gage fluctuations (power fluctuation) would differentiate a P3 leak from the TEST No. 1 or No. 2 trip condition.

CAUTION

Pilots must exercise care when terminating this simulated emergency. If, after stabilizing Nf/Nr at 100%, the emergency throttle is closed prior to closing P3, the gas generator speed will decrease considerably. Then, closing P3 with the speed selector set at 100% Nf/Nr will cause the gas generator to rapidly accelerate resulting in an overtorque.

Pages 27 and 28 deleted.

All data on this page deleted.

Note

Turbulence due to the ship's superstructure on 210' class cutters is negligible and approaches may be made from any position into any relative wind which is forward of the ship's beam. Turbulence caused by icebreaker superstructure may be moderate and turbulence caused by superstructure on other type vessels in unknown; therefore, approaches should be made with caution.

CAUTION

During the approach to a hover and when close aboard the ship, it is possible for the pilot to lose sight of the LSO due to the altitude of the helicopter. The pilot should maneuver the helicopter so as to keep the LSO in sight.

(3) THE HOVER

Utilizing the LSO's signals the helicopter will be brought to a hover at minimum permissible height above the deck, aligned fore and aft with the ship. The pilot should evaluate the deck conditions for landing noting the period of pitch and roll and the dampening characteristics of the ship. At this time the pilot must decide to abort the approach or follow the LSO's signals for landing. Exact positioning of the helicopter on the flight deck is desirable. However, prolonged hovering for minute corrections in position over a moving deck is not recommended. The pilot will tend to overcontrol the aircraft in attempting to attain and hold the optimum position. Use the minimum hover time required for safe landing.

(4) THE LANDING

(a) With the Grid Deck—(BRAKES UNLOCKED AND TAILWHEEL LOCKED) At anytime the "cleared to land" is received from the LSO, the pilot, having previously noted the ship's movement cycle, will land at the most favorable moment. The landing should be made with a positive down collective movement. When the pilot feels the wheels are on the deck, he should "bottom" the collective. Should the helicopter land atop the grid a slight roll forward should position it within the square. The pilot should allow the helicopter to chock itself into the grid before applying the brakes.

Note

Cyclic movement on deck attempting to counteract for the movement of the ship has little effect on the stability of the helicopter. The pilot should place the cyclic in the neutral position and hold down collective.

(b) Without the grid deck—(BRAKES LOCKED AND TAILWHEEL LOCKED) Landing technique remains the same. A decided snubbing effect is felt on contact with the deck.

CAUTION

Landing without the Grid Deck on 210' class cutters shall only be attempted under emergency conditions due to the tendency of the helicopter to slide on a rolling wet deck.

(5) SECURING THE HELICOPTER

(a) THE QUICK TIE-DOWN—Once the helicopter is solidly on the deck, and when directed by the pilot the tie-down crews will attach the Quick Tie-Down straps at the high tie-down points on either side of the helicopter and at the tail wheel tie-down point.

CAUTION

Once the pilot signals to accept the Quick Tie-Downs, the pilot should consider himself a part the ship and further flight is prohibited. This is necessary to avoid the danger of becoming airborne with a strap attached. The time to abort the landing is prior to or in the hover.

The pilot and the LSO should be aware of the importance of positioning the helicopter in the center of the flight deck to permit rapid, coordinated tie-down. COLLECTIVE PITCH MUST NOT BE APPLIED ONCE TIE-DOWNS HAVE BEEN SIGNALED.

Should a ship's course change become necessary while the helicopter is on the flight deck with power on the pilot should either override the controls or release the ASE to avoid inducing a full throw rudder pedal movement through the heading hold feature. However, insure that ASE is reengaged prior to take-off.

(b) SECURING THE HELICOPTER FOR SEA—The above Quick Tie-Down procedure should be followed. When the helicopter is firmly tied down, the engine and rotors may be shut down. The helicopter should be fueled as desired at this time to provide lower center of gravity. The chain tie-downs, the blade crutches, and the blade tip boots should now be installed to secure the helicopter for sea.

(6) STARTING THE ENGINE. Remove blade tie-down equipment. Procedures and signals should be in accordance with the ship's Helicopter Operations Instructions, NWIP 41-6 series, and the Flight Handbook.

(7) ENGAGING THE ROTORS. Procedures and signals should be in accordance with the ship's Helicopter Operations Instruction, NWIP 41-6 series, and with Flight Handbook.

CAUTION

A positive indication must be received from the LSO that all tie-down equipment has been removed prior to attempting flight. Tie-down crews hold tie-downs in full view of pilot.

(8) CLEARANCE AND TAKE-OFF. Clearance signals and take-off procedures will be in accordance with existing instructions and the Flight Handbook. The pilot, upon receiving the proper signal from the LSO and observing KILO two-blocked, will execute a vertical take-off when the ship's riding characteristics are favorable. Riding characteristics will determine the type of departure. Under rough conditions, the pilot should expedite his departure to either side to avoid the grey area in event of power loss.

CAUTION

Extreme caution should be exercised when landing or departing a vessel working in the ice. Should the ice suddenly stop the vessel, the pilot can easily overrun the ship.

CAUTION

The pilot should exercise extreme caution while hovering to avoid any forward movement across the flight deck. The pilot's position should be aft of the yellow athwartship safety lines (on the forward end of the flight deck outline) in order to assure adequate rotor clearances.

(9) NIGHT OPERATIONS (Emergency Only). Night operations are not authorized except for emergency operations until approved flight deck lighting has been installed. Night take-offs require extreme caution on the part of both pilots to insure that the helicopter executes positive abeam departure from the vessel and still maintains adequate clearance with the water. Once the helicopter is clear of the ship the pilot should execute a standard instrument take-off. The co-pilot should monitor the instruments making sure of a positive climb. In the pattern the pilot may find it difficult to judge his distance from the ship due to the illusions created by the outline lighting of the ship. Approach and landing procedures are as described above. The lack of permanently installed flight deck lights makes it difficult for the pilot to discern the flight deck and judge his altitude. Distinguishing the LSO's signals is diffucult; they are not as easily understood as in daylight operations with the flags.

(10) FUELING. Fueling from the ship's aviation stores should be accomplished in accordance with existing fueling and safety instructions. Prior to fueling, the pilot should assure himself that the fuel is "clean" and that proper procedures for recirculating and testing have been observed.

U.S. COAST GUARD—General Offset Ptg. Co. Springfield, Mass. - 500

23. CARGO SLING OPERATIONS

(A) The mechanical and electrical operation of the cargo sling is explained in detail in the flight handbook.

(B) Pre-Flight.

(1) Planning. Using the existing atmospheric conditions compute the maximum gross weight for hovering out of ground effect. Compute, using fuel weight, the cargo carrying capacity. Training loads will not exceed 1000 pounds.

(2) Equipment Inspection. Preflight will be conducted in accordance with the flight handbook exterior inspection. The following items will be inspected prior to to a cargo flight.

a. Cargo sling and attachments for security.

b. Manual release for proper rigging.

c. Manual release line for adequate slack.

d. Cargo hook for security and condition.

(3) In Flight.

a. Equipment preparation.

(1) Ensure sling is fully extended and all cables and lines are clear.

(2) HOT MIC - ON

(3) Cargo Master Switch - ON (hook cannot be closed in AUTO)

(4) Release Mode Switch - SLING

b. Approach and Hook-up.

(1) Crewman con pilot into position directly over cargo using hoisting voice procedures.

(2) Touch hook to ground or cargo if practicable to discharge static electricity.

(3) Crewman monitor hook-up and ground personnel clear of cargo.

(4) Crewman report hook-up and ready for lift off.

(5) Pilot smoothly increase power until the cable is under tension. Slowly increase power to lift off.

(6) Crewman report cargo clear of deck.

Note

For training, a 10-15 foot cable should be attached to the selected load. The length of cable will vary in actual operations, but in general, the greater the weight, the shorter the cable should be.

(C) Transition to forward flight.

Transition to forward flight and establish a positive rate of climb as soon as translational lift has been obtained. Do not descend during transition. Acceleration and maximum air speed to prevent oscillation will be dependent on the type of load carried but should be at least 55 knots if practical. Some loads will require air speeds as low as 10 knots to maintain stability. Turns should be coordinated and shallow (5-10 degree bank). Do not exceed a 30 degree bank.

CAUTION

Tight turns will tend to cause the load to oscillate. Rapid acceleration may cause the load to swing aft putting all the weight on the forward cables overstressing the sling assembly.

Note

The crewman should monitor the load for oscillation and other unsatisfactory indications. Be ready to manually release load.

(D) Cruise.

Cargo Master Switch - SAFE (after 1000 feet terrain clearance).

Note

Control of oscillating loads is a major factor in external load. Light, bulky, and odd shaped objects swing and spin easier than heavy, compact loads. Spin alone is usually not objectionable. Oscillations are usually initiated by too much air speed and abrupt control movements. Control swing by reducing airspeed and applying smooth, slight lateral cyclic as necessary. Do not exceed 70 knots.

CAUTION

Release uncontrollable loads.

CAUTION

Do not fly over populated areas, buildings or other surface conditions that would be damaged by inadvertant cargo release. Gusty wind conditions, action of the load or aircraft equipment malfunction can cause or require unplanned load release.

(E) Approach

(1) Use a NORMAL APPROACH with a maximum rate of descent of 300 feet per minute in the straightaway. Reduce airspeed in the approach so that hover is attained over the intended landing spot.

(2) HOT MIC - On

(3) Cargo Master Switch - As required

(4) Crew Report - "CARGO ON DECK"

(5) Cargo - Released

(6) Sling - Stowed prior to landing

Note

Cargo operation without ASE should be undertaken with caution. Without the stabilization, oscillation of the helicopter and load can endanger ground personnel.

Note

If the cargo release line does not have sufficient slack, small gusts may cause the load to release prematurely.

CAUTION

AUTO position is not to be used with loads of less than 500 pounds.

CAUTION

The Radar Altimeter is unreliable with a load attached.

☆ U. S. GOVERNMENT PRINTING OFFICE: 1971 — 704-027/121

INDEX

PAGE

approaches
beep to a hover 19
cargo sling 30
instrument 19
normal 9
rough area 5
shipboard 26

autorotations
full 8
general discussion of 7
instrument 19
limitations 7, 8
power recovery 7
wave off 8

battery start 1

beep to a hover 19

brakes
rotor 10
wheel 1

cargo sling operations 29

checks
cockpit 1
ground 1
pre-landing, normal approach 5
pre-landing, shipboard 26

cocked helicopter 1

cockpit technique (wipeout) 1

crosswind
hovering 3
landing 6
taxi, air 3
taxi, ground 1

cruise
cargo sling 30
formation 16
instrument 18
maximum component life 19

damage to rotor system 6

descent, instrument 19

downwind landing 6

emergency
operations 23
simulated 24
throttle 24

PAGE

engagement, rotor
shipboard 28
water 10

formation
breaks 16
column 15
cross country cruise 16
general discussion of 15
join-ups 16
maneuvering 16
parade 15
tactical 16

full autorotations 8

go around - wave off 7

helicopter, cocked 1

hoisting
boat/ship 13
phraseology 15
water 14

holding, instrument 19

hovering
crosswind 3
downwind 3
into wind, land 2
into wind, water 3
shipboard 27

instrument
approaches 19
autorotation 19
basic 17
climb 18
cruise 18
descent 19
flight procedures 16
holding 19
take-off 18
wave off 19

landing
no hover 6
running, land 24
running, water 6
shipboard 27
vertical, land 6
vertical, water 6

limitations
actual instruments 16, 17
autorotations, land 7, 8
autorotations, water 7, 8, 9

PAGE

limitations, cont'd.
beep to hover attitude 23
crosswind landing 6
downwind landing 6
dual emergencies 23
hovering 6, 7
practice emergencies 23
shipboard operations 29

maneuvering
formation 16
water 10

no hover
landing 6
take-off 4

normal
approach 5
traffic pattern 4

parachute, approach technique for 12

phraseology
hoist 15
rescue platform recovery 13

power recovery autorotations 7

pump drops 14

rescue platform recovery
calm water 11
phraseology 13
rough water 12

rotor
engagement, water 10
shutdown, water 10
system damage 6

rough area approach 5

rough area, transition to forward flight from . . 4

running landing
land 6
water 6

running take-off
land 4
water 4

salvage pump, lowering of 14

shipboard operations 25

sling, cargo, operation 29

shutdown, rotor, water 10

PAGE

simulated emergencies
cold hang up 24
P3 system leak 25
Test No. 1 trip 25
Test No. 2 trip 25

starting procedure 1

take-off
instrument 18
rough area 4
running, land 4
running, water 4
vertical 2

tail wheel locking pin 1, 2

taxi
air 3
land 1
rearward, air 3
rough water 2
sideward 3
water 1

throttle
chops 9
emergency 24

towing 16

traffic pattern, normal 4

transition to forward flight
cargo operation 30
hover, land 3
hover, water 3
no hover 4
rough area 4

tuck, during water
autorotation 8
running landing 7
running take-off 4
taxi 1, 2

turn on spot
hover 3
water 10

vertical landing
land 6
water 6

vertical take-off 2

wave off
autorotation 8
instrument 19
normal approach 7

wipeout (cockpit) 1