REVISION NOTICE

THESE ARE SUPERSEDING OR SUPPLEMENTARY PAGES TO SAME PUBLICATION OF PREVIOUS DATE
Insert these pages into basic publication
Destroy superseded pages

NAVWEPS 01-260HBA-1

# Flight Manual

*NAVY MODELS*
## HOK-1
## HUK-1
## HELICOPTERS




PUBLISHED BY DIRECTION OF
THE CHIEF OF THE BUREAU OF NAVAL WEAPONS

132

*1 January 1960*
*Revised 15 May 1962*

## LIST OF REVISED PAGES ISSUED

INSERT LATEST REVISED PAGES. DESTROY SUPERSEDED PAGES.

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

| *Page No.* | *Date of Latest Revision* |
|---|---|
| 6 | 15 May 1962 |
| 35 | 15 May 1962 |
| 38 | 15 May 1962 |
| 53 | 15 May 1962 |
| 54 | 15 May 1962 |
| 125 | 15 May 1962 |

*The asterisk indicates pages revised, added, or deleted by the curr ent revision.

ADDITIONAL COPIES OF THIS PUBLICATION MAY BE OBTAINED AS FOLLOWS: BuWeps

USAF ACTIVITIES.—In accordance with Technical Order No. 00-5-2.

NAVY ACTIVITIES.—Submit request to nearest supply point listed below, using form NavAer 140; NASD, Philadelphia, Pa.; NAS, Alameda, Calif.; NAS, Jacksonville, Fla.; NAS, Norfolk, Va.; NAS, San Diego, Calif.; NAS, Seattle, Wash.; ASD, NSC, Guam.

For listing of available material and details of distribution see Naval Aeronautics Publications Index NavWeps 00-500.

# INTERIM REVISION SUMMARY

The following Interim Revisions have been either canceled or incorporated in this Flight Manual:

| *Canceled or Previously Incorporated* | *Incorporated in This Revision on Pages Indicated* |
|---|---|
| No. 1 | No. 6, Page 87 |
| No. 2 | No. 7, Page 90 |
| No. 3 | |
| No. 4 | |
| No. 5 | |

INTERIM REVISIONS OUTSTANDING: (to be maintained by custodian of Flight Manual)

| *Number* | *Date* | *Purpose* |
|---|---|---|
| | None | |

# TABLE OF CONTENTS

## IMPORTANT

IN ORDER THAT YOU WILL GAIN MAXIMUM BENEFIT FROM THIS MANUAL IT IS IMPERATIVE THAT YOU READ THESE PAGES CAREFULLY.

## SCOPE

This manual contains the information required to enable assigned flight personnel to accomplish their missions safely and efficiently in the Model HOK-1 and the Model HUK-1 helicopters. Because of the basic similarity between the HOK-1 and the HUK-1, many paragraphs of this manual apply to both models. These paragraphs do not carry model designations. Where important differences exist between models, the paragraph heading is followed by the model designation of the helicopter covered in the text that follows. Revisions and interim revisions to this manual will be supplied when additional information is made available.

## DESCRIPTION OF SECTIONS

### SECTION 1, DESCRIPTION

Provides descriptive and functional data on the helicopter, its systems, controls, and related equipment.

### SECTION II, NORMAL PROCEDURES.

Sets forth procedural steps to be accomplished by the crew while completing a flight under normal conditions.

### SECTION III, EMERGENCY PROCEDURES.

Describes procedures to be effected by the flight crew in the event of emergencies which could be encountered.

### SECTION IV, AUXILIARY EQUIPMENT.

Contains the description and usage of various equipment, which contribute to the efficient operation of the helicopter under all conditions.

### SECTION V, OPERATING LIMITATIONS.

Pertains to limitations which must be observed during all phases of flight.

### SECTION VI, FLIGHT CHARACTERISTICS.

Points out items which will enable flight personnel to obtain the "feel" of this helicopter in the minimum period of time.

### SECTION VII, SYSTEMS OPERATION.

This section provides additional detailed information regarding the operation of various helicopter systems.

### SECTION VIII, CREW DUTIES.

Crew duties and responsibilities are discussed throughout other sections of the manual; therefore, this subject is not treated separately.

### SECTION IX, ALL WEATHER OPERATION.

Includes information and techniques which should be followed by the flight crew during cold weather or desert operations.

### APPENDIX I, PERFORMANCE DATA.

Presents tabular data which will assist flight personnel to complete mission planning prior to and during flight.

## WARNINGS, CAUTIONS AND NOTES

For your information, the following definitions apply to the "Warnings," "Cautions," and "Notes" found throughout this manual:

**WARNING**

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

**CAUTION**

Operating procedures, practices, etc., which if not strictly observed, will result in damage to or destruction of equipment.

**Note**

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

# The HOK-1 Helicopter

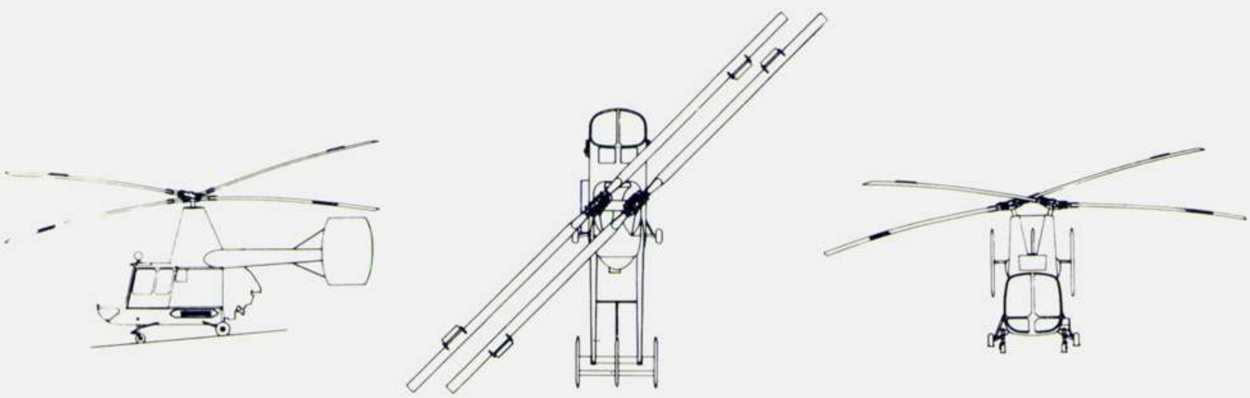



*Figure 1—1*

# The HUK-1 Helicopter

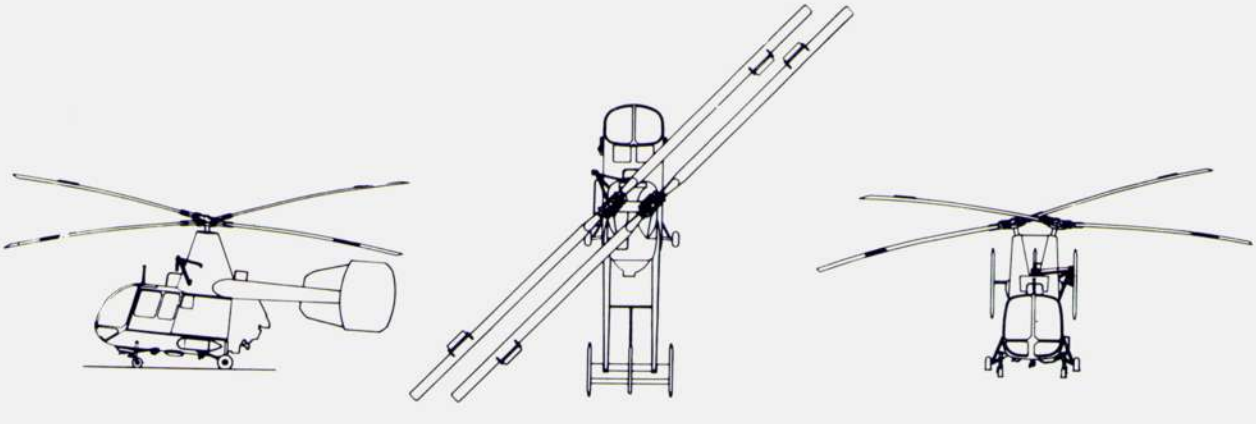



Figure 1—2

# section I

# Description

## THE HELICOPTER

The Navy Model HOK-1 observation helicopter (figure 1—1) is a 4-place helicopter powered by an air-cooled reciprocating engine, and is manufactured by the Kaman Aircraft Corporation, Bloomfield, Connecticut. The Navy Model HUK-1 utility helicopter (figure 1—2) is a 5-place helicopter, similar to the HOK-1 except for the differences shown in the Main Differences Table (figure 1—3).

### SPECIAL FEATURES.

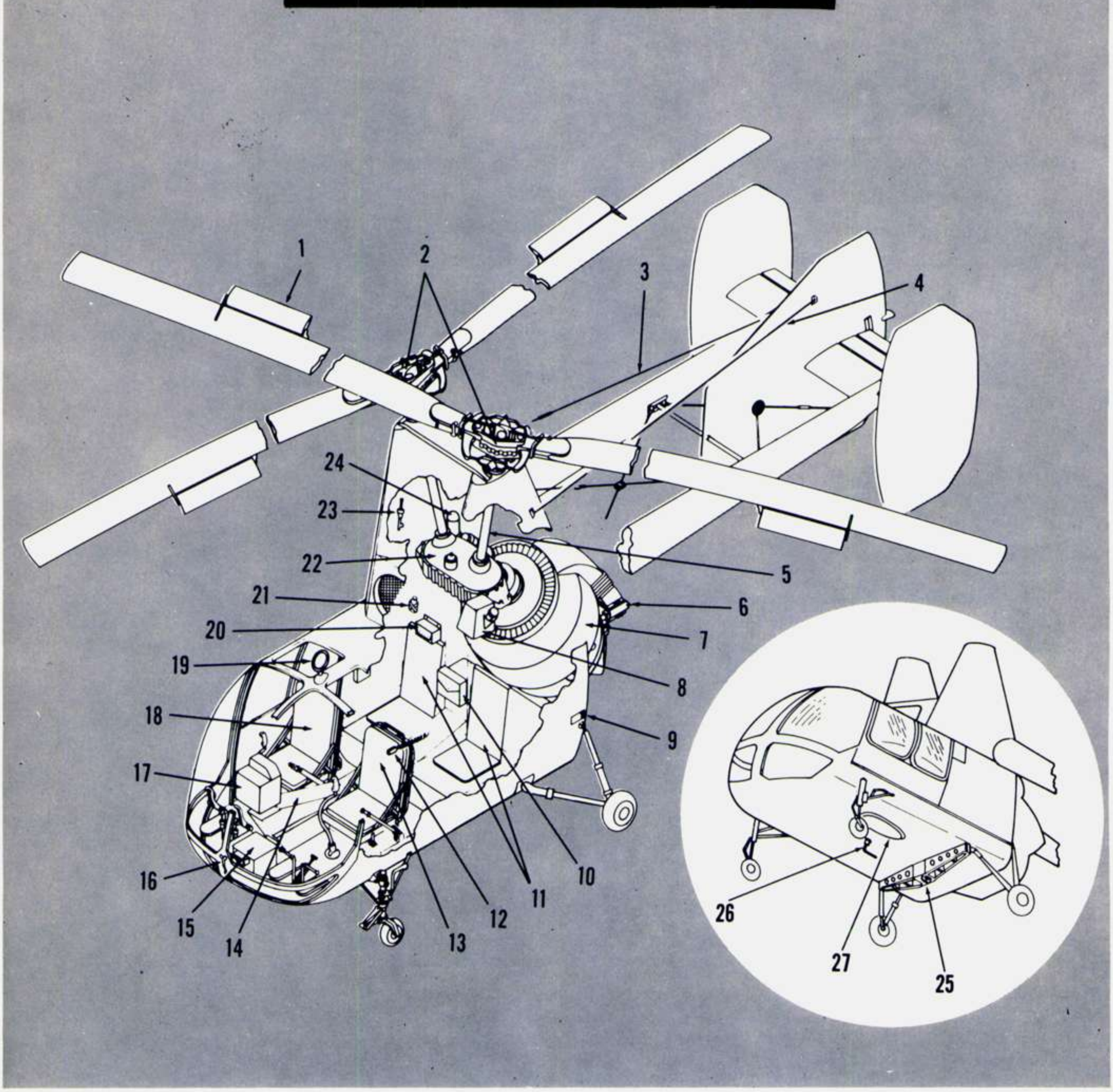
The engine is mounted at the rear of the fuselage, below the twin tailbooms. Twin, intermeshing, 2-blade type rotors are mounted side-by-side above twin pylons, forward of and above the engine. The rotors are driven in counter-rotation (eggbeater fashion) by the engine. Control of the rotors and, therefore, of the helicopter is obtained through servo flaps mounted on the rotor blades. Aerodynamic action of the flaps changes the angle of attack (pitch) of the rotors in response to the pilot's operation of conventional helicopter flight controls. Most of the energy required to accomplish rotor pitch changes is supplied by the aerodynamic action of the servo flaps, rather than by pilot applied force. Control forces are negligible, and trim springs are used to provide natural control feel. Additional stability and

## Main Differences Table

| ITEM | HOK-1 | HUK-1 |
|---|---|---|
| PASSENGER FACILITIES | TWO SEATS INSTALLED (4-PLACE AIRCRAFT) | THREE SEATS INSTALLED (5-PLACE AIRCRAFT) |
| ENGINE | PRATT & WHITNEY MODEL NO. R-1340-48 OR -48A (BLOWER RATIO 12-TO-1) | PRATT & WHITNEY MODEL NO. R-1340-52 (BLOWER RATIO 10-TO-1) |
| IN-FLIGHT ROTOR TRACKING | BUNOS 139996 THRU 140001 ONLY | ALL HUK-1 |
| AUXILIARY EQUIPMENT, COMMUNICATION AND ASSOCIATED ELECTRONIC EQUIPMENT | REFER TO SECTION IV | THREE FLOODLIGHTS MOUNTED UNDER FUSELAGE. INCREASED ELECTRONIC FACILITIES PROVIDED (REFER TO SECTION IV) |
| CIRCUIT BREAKER AND FUSE PANELS | RIGHT-HAND SIDE OF CONSOLE | RIGHT-HAND SIDE OF CONSOLE AND CABIN CEILING (POWER DISTRIBUTION FOR ADDITIONAL ELECTRONIC EQUIPMENT) |

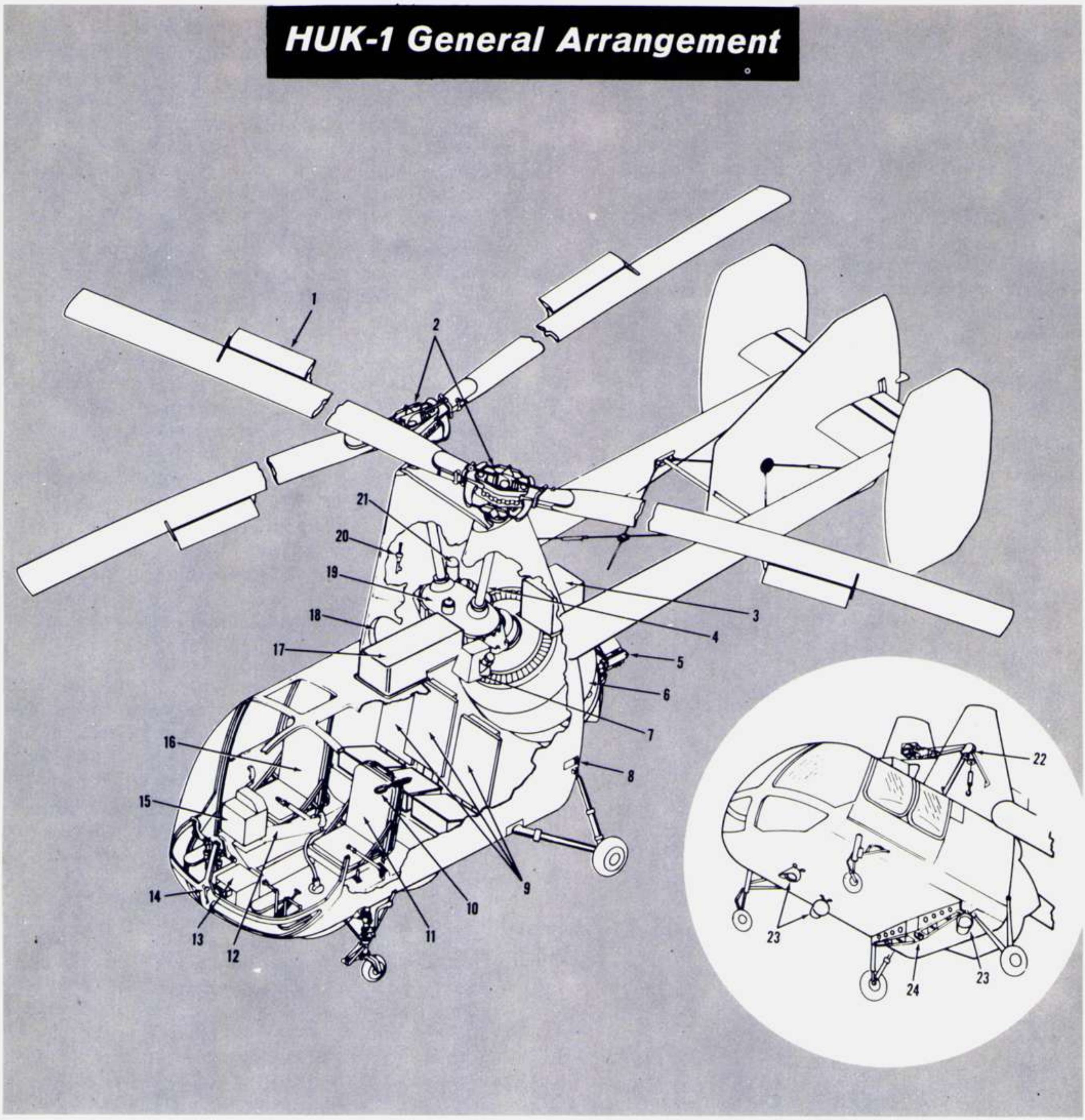
*Figure 1—3*

# HOK-1 General Arrangement




1. SERVO FLAPS
2. ROTOR HUB ASSEMBLIES
3. WIRE ANTENNA (AN/PRC SET)
4. WIRE ANTENNA (R-11A, OR AN/ARN-41A SET)
5. ROTOR SHAFTS
6. ENGINE OIL COOLER
7. ENGINE INSTALLATION
8. TRANSMISSION OIL TANK
9. EXTERNAL POWER RECEPTACLE
10. AIRCRAFT FILES KIT
11. PASSENGER SEATS
12. COPILOT'S CORD SET
13. COPILOT'S SEAT
14. CONSOLE PANEL
15. BATTERY
16. NOSE DOOR LATCH
17. PILOT'S INSTRUMENT PANEL
18. PILOT'S SEAT
19. LOOP ANTENNA (R-11A SET)
20. FIRST AID KIT
21. CANTEEN HOLDER
22. TRANSMISSION
23. ROTOR BRAKE MASTER CYLINDER
24. GENERATOR
25. CARGO HOOK
26. L-TYPE ANTENNA (A.R.C. TYPE 12 SET)
27. LOOP ANTENNA (AN/ARN-41A SET)

*Figure 1—4*




1. SERVO FLAPS
2. ROTOR HUB ASSEMBLIES
3. RADIO, IFF (WHEN INSTALLED)
4. ROTOR SHAFTS
5. ENGINE OIL COOLER
6. ENGINE INSTALLATION
7. TRANSMISSION OIL TANK
8. EXTERNAL POWER RECEPTACLE
9. PASSENGER SEATS (WHEN INSTALLED)
10. COPILOT'S CORD SET
11. COPILOT'S SEAT (WHEN INSTALLED)
12. CONSOLE PANEL
13. BATTERY
14. NOSE DOOR LATCH
15. PILOT'S INSTRUMENT PANEL
16. PILOT'S SEAT
17. RADIO, AN/ARC-55
18. COOLING AIR INTAKE
19. TRANSMISSION
20. ROTOR BRAKE MASTER CYLINDER
21. GENERATOR
22. RESCUE HOIST (WHEN INSTALLED)
23. FLOODLIGHTS
24. CARGO HOOK (WHEN INSTALLED)

*Figure 1—5*

control are supplied by the empennage, which consists of a fixed horizontal stabilizer, floating horizontal elevator and trim tab, and four vertical fins. The outer vertical fins are attached to the elevator.

### CREW AND MISSION PROVISIONS.

The pilot's seat and controls are located on the right side of the cabin. All controls and instruments are located for the pilot's convenience. A copilot's seat and controls can be installed at the left of the pilot's seat, and passenger seats may be installed in the rear of the cabin area. With the copilot's and passenger's seats removed, two litters may be installed on the left-hand side of the cabin area. Forward and aft cargo floors also may be installed on the left-hand side of the cabin area. A rescue hoist and an external cargo hook are also provided (refer to Section IV for details of auxiliary equipment).

### HELICOPTER DIMENSIONS.

Approximate overall dimensions of the helicopter are as follows:

| | | | | |
|---|---|---|---|---|
| Length — fuselage | | 25 ft | 0.0 | in. |
| Width | HOK-1 | 8 ft | 2.0 | in. |
| | HUK-1 | 9 ft | 0.0 | in. |
| Span — rotor blades | | 50 ft | 5.4 | in. |
| Diameter — rotor disc | | 47 ft | 0.0 | in. |
| Height — rotor hubs | | 12 ft | 8.0 | in. |
| Tread — main wheels center-to-center of tires | | 7 ft | 6.3 | in. |
| Tread — nose wheels center-to-center of tires | | 5 ft | 1.0 | in. |
| Wheelbase | | 7 ft | 5.63 | in. |
| Vertical tail ground clearance | | 2 ft | 11.0 | in. |

## ENGINE

The helicopter is powered by a 9-cylinder, air-cooled, reciprocating engine. See figure 1–3 for engine model designation. The engine is mounted at the rear of the fuselage with the output shaft facing forward and upward.

### CARBURETOR.

The engine is equipped with a float-type carburetor. Power and speed of the engine is controlled using the throttle, mixture lever, and carburetor air lever.

**Throttle.** The grip area of the pilot's collective pitch lever serves as a motorcycle-type throttle (3, figure 1–6). Rotation of the throttle regulates the throttle valve in the carburetor through a mechanical linkage. Rotating the throttle to the left opens the throttle valve and increases engine power. Rotating the throttle to the right shuts the throttle valve and decreases engine power. The throttle linkage is also mechanically connected with the collective pitch lever linkage so that any increase or decrease in the setting of the collective pitch lever is automatically accompanied by a corresponding change in throttle opening. In normal flight, therefore, the throttle is rotated only for minor adjustments in power requirements.

All engine starts must be made with the throttle closed, since there is no rotor loading of the engine, and a few degrees of throttle movement can cause overspeed damage to the engine.

**Mixture Lever.** The mixture lever (8, figure 1–8) is located on the console quadrant and is used to adjust the fuel-air ratio through a mechanical linkage. Rich mixture is obtained with the lever fully forward. Moving the mixture lever aft will lean the fuel-air ratio, with the amount of leaning dependent upon the amount of lever movement. The IDLE CUTOFF position is fully aft, and is used for stopping the engine. A ratchet prevents inadvertent movement of the lever toward the leaner mixture positions. The ratchet release button must be pressed before the lever can be moved aft. The mixture lever overrides the ratchet during forward movement.

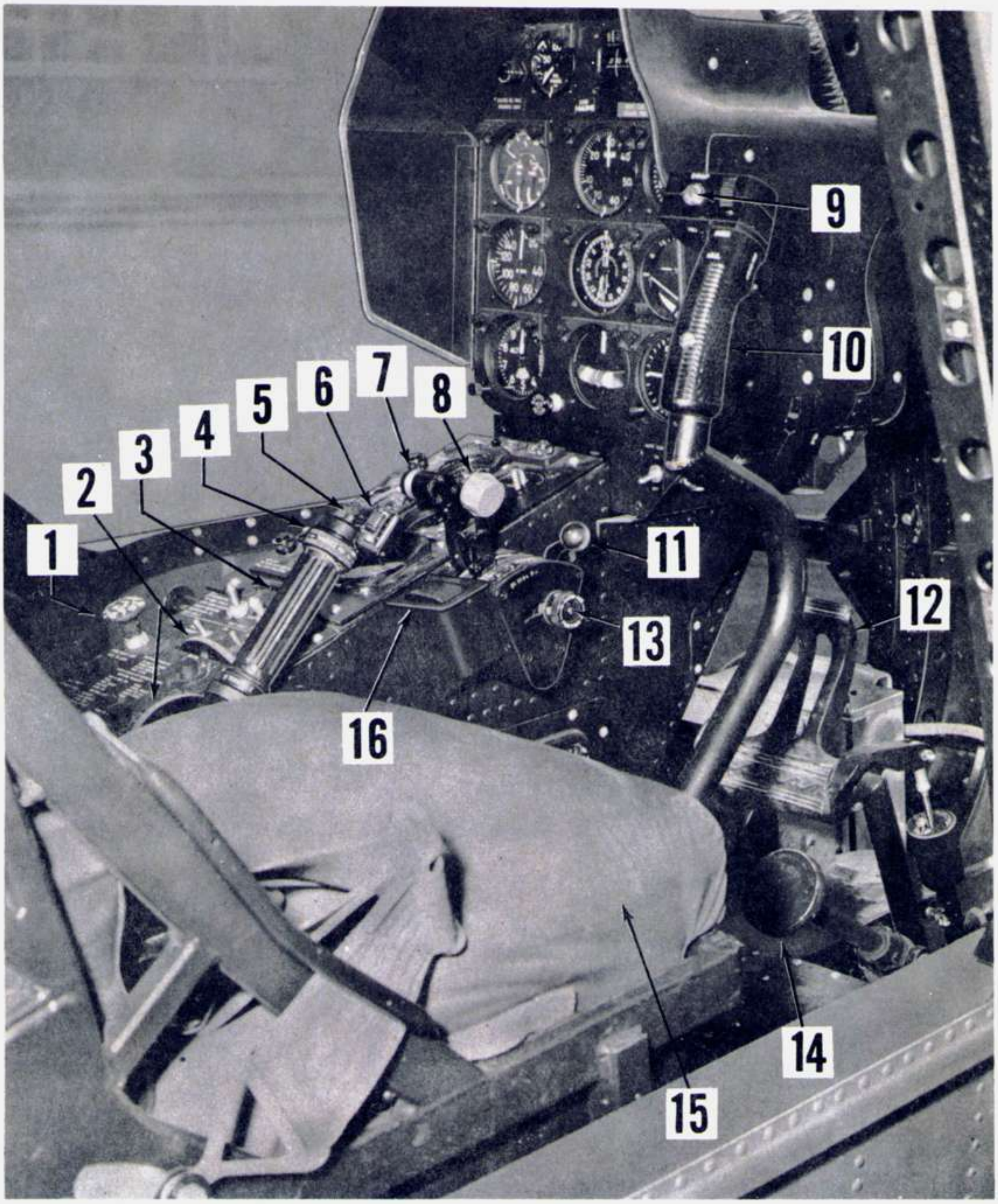
**Carburetor Air Lever.** The carburetor air (CARB AIR) lever (9, figure 1–8) is located on the console panel control quadrant to the right of the mixture lever. The air lever actuates dual butterfly valves (by mechanical linkage) that regulate the flow of air to the carburetor. The butterfly valves are located in an air mixing box below the carburetor and control mixing of hot and cold air. Cold air is supplied through an opening at the left of the air box and hot air is received from the engine exhaust collector. The air lever is used to maintain the carburetor mixture temperature within the desired range.

**Carburetor Mixture Temperature Gage.** The carburetor mixture (CARB MIX) temperature gage (5, figure 1–8) is located on the console instrument panel, and indicates the temperature of the fuel-air mixture in the blower housing of the engine. The temperature gage is powered from the 28-volt d-c bus (primary bus in HUK-1 helicopters) and from the carburetor air and transmission oil temperature circuit breaker (see figures 1–22 and 1–23). The indicator is actuated by a temperature sensing bulb located in the blower housing.

**WARNING**

Since the float-type carburetor used in this helicopter is subject to ice formation, the carburetor air lever must be positioned to maintain carburetor mixture temperature within the desired range.

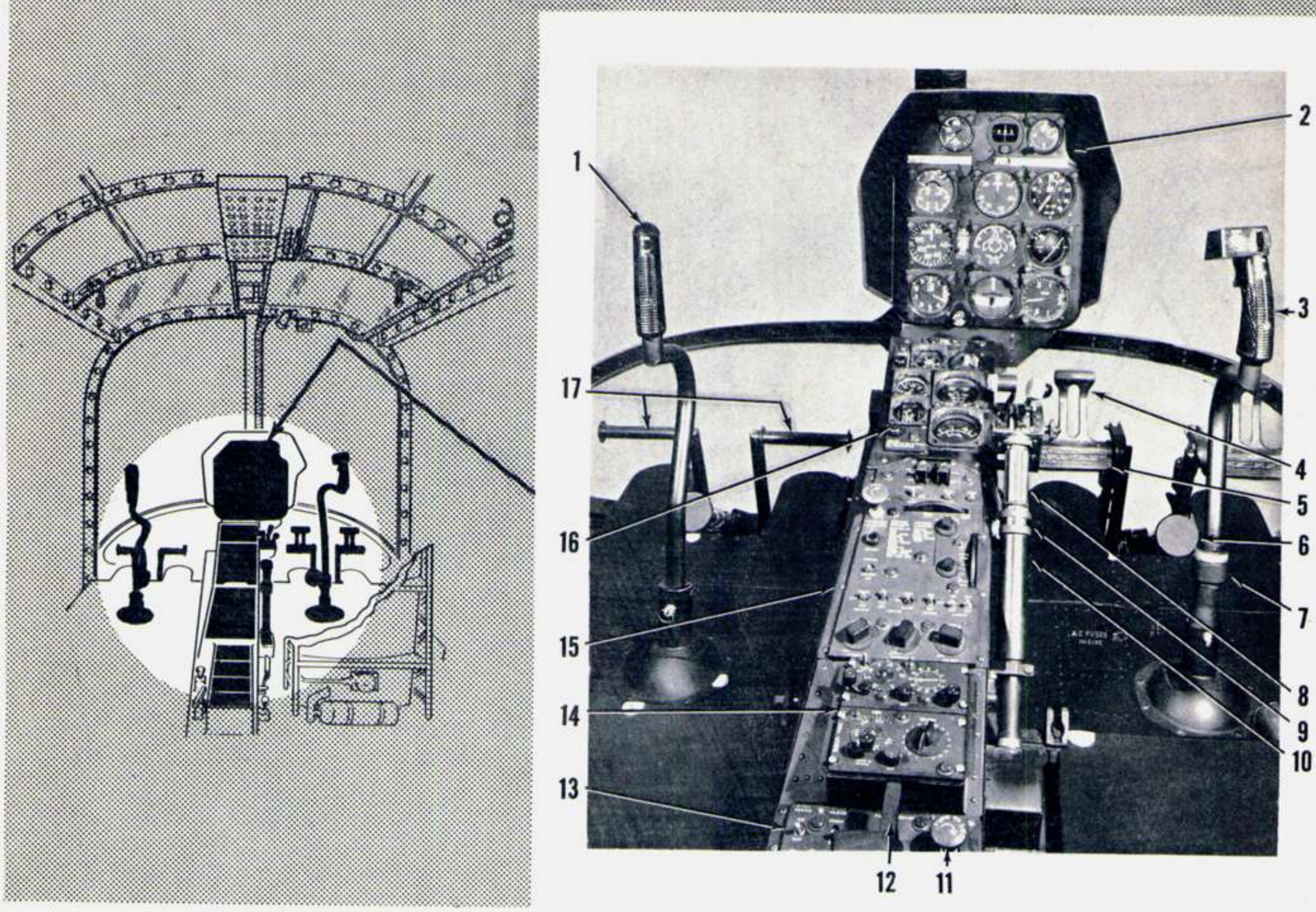
# Pilot's Station and Controls




1. NOSE WHEEL LOCK KNOB
2. CYCLIC TRIM CONTROLS
3. THROTTLE AND COLLECTIVE PITCH LEVER
4. THROTTLE FRICTION NUT
5. STARTER BUTTON
6. FLOODLIGHT SWITCH
7. CLUTCH CONTROL LEVER
8. CARBURETOR MIXTURE LEVER
9. RESCUE HOIST BUTTON
10. CYCLIC STICK
11. CARBURETOR AIR LEVER
12. DIRECTIONAL AND BRAKE PEDALS
13. CARBURETOR AIR LEVER FRICTION KNOB
14. PEDAL ADJUSTMENT KNOB
15. PILOT'S SEAT
16. ASHTRAY

*Figure 1–6*

## Console and Controls




1. COPILOT'S CYCLIC STICK
2. INSTRUMENT PANEL
3. PILOT'S CYCLIC STICK
4. BRAKE PEDALS
5. PILOT'S DIRECTIONAL PEDALS
6. PEDAL ADJUSTMENT KNOB
7. CYCLIC STICK FRICTION NUT
8. THROTTLE GRIP
9. COLLECTIVE PITCH LEVER FRICTION NUT
10. COLLECTIVE PITCH LEVER
11. NOSE WHEEL LOCK KNOB
12. PARKING BRAKE HANDLE
13. AUXILIARY CONTROL PANELS
14. RADIO CONTROL PANELS
15. CONSOLE CONTROL PANEL
16. CONSOLE INSTRUMENT PANEL
17. COPILOT'S DIRECTIONAL PEDALS

*Figure 1—7*

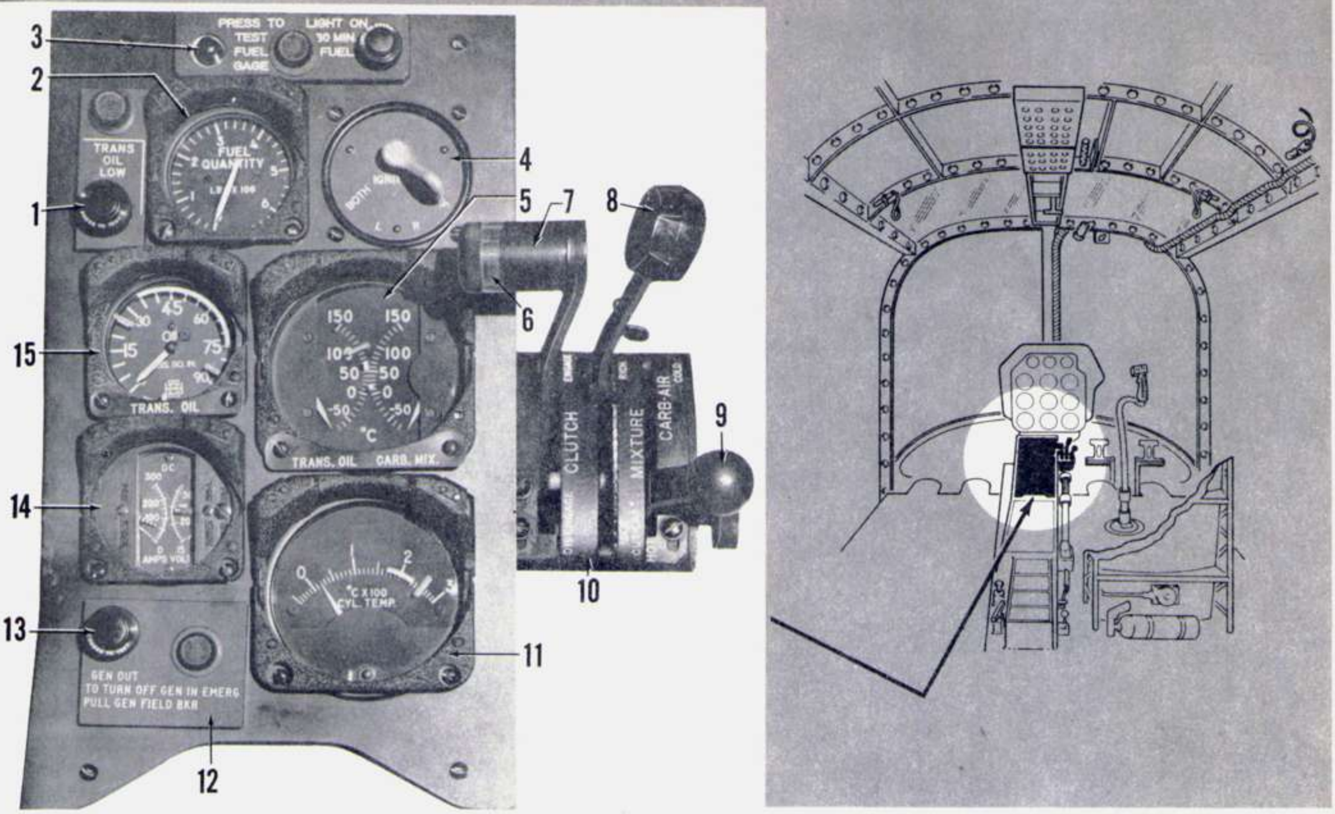
**Carburetor Air Filter Knob.**[1] The carburetor air (CARB AIR) filter knob is located on the aft end of the console at the rear of the radio control panel. Pulling the knob out closes off the outside air intake forcing air through the filter, located in the intake duct, and into the airbox and carburetor. Pushing the knob in opens the valve, allowing unfiltered air to enter the intake duct, airbox, and carburetor. Filtered air should be used during all operations on or close to the ground.

[1]HOK-1 helicopters only. In HUK-1 helicopters the carburetor air filter valve must be preset prior to flight. No cabin control is provided.

**ENGINE COOLING.**

The engine is cooled by means of a fan bolted to the clutch housing. The clutch and the fan rotate at the same speed as the engine output shaft. Cooling air flows whenever the engine is operating. No controls are required for operation of the engine cooling system. Air enters through the air intake in the lower area of the pylons. The fan draws the air from the intake and expels it directly to the cylinders. Baffles, located between the cylinders and a shroud around the cylinders, control movement of the air to ensure even cooling. After passing over the cylinders, the air is discharged downward and aft.

## Console Instrument Panel and Control Quadrant




1. TRANSMISSION OIL PRESSURE WARNING LIGHT
2. FUEL QUANTITY GAGE
3. FUEL QUANTITY GAGE TEST BUTTON
4. IGNITION SWITCH
5. TRANSMISSION OIL AND CARBURETOR MIXTURE TEMPERATURE GAGE
6. ROTOR BRAKE WARNING LIGHT
7. CLUTCH LEVER
8. MIXTURE LEVER
9. CARBURETOR AIR LEVER
10. CONTROL QUADRANT
11. CYLINDER HEAD TEMPERATURE GAGE
12. GENERATOR WARNING PLACARD
13. GENERATOR WARNING LIGHT
14. VOLTAMMETER GAGE
15. TRANSMISSION OIL PRESSURE GAGE

*Figure 1–8*

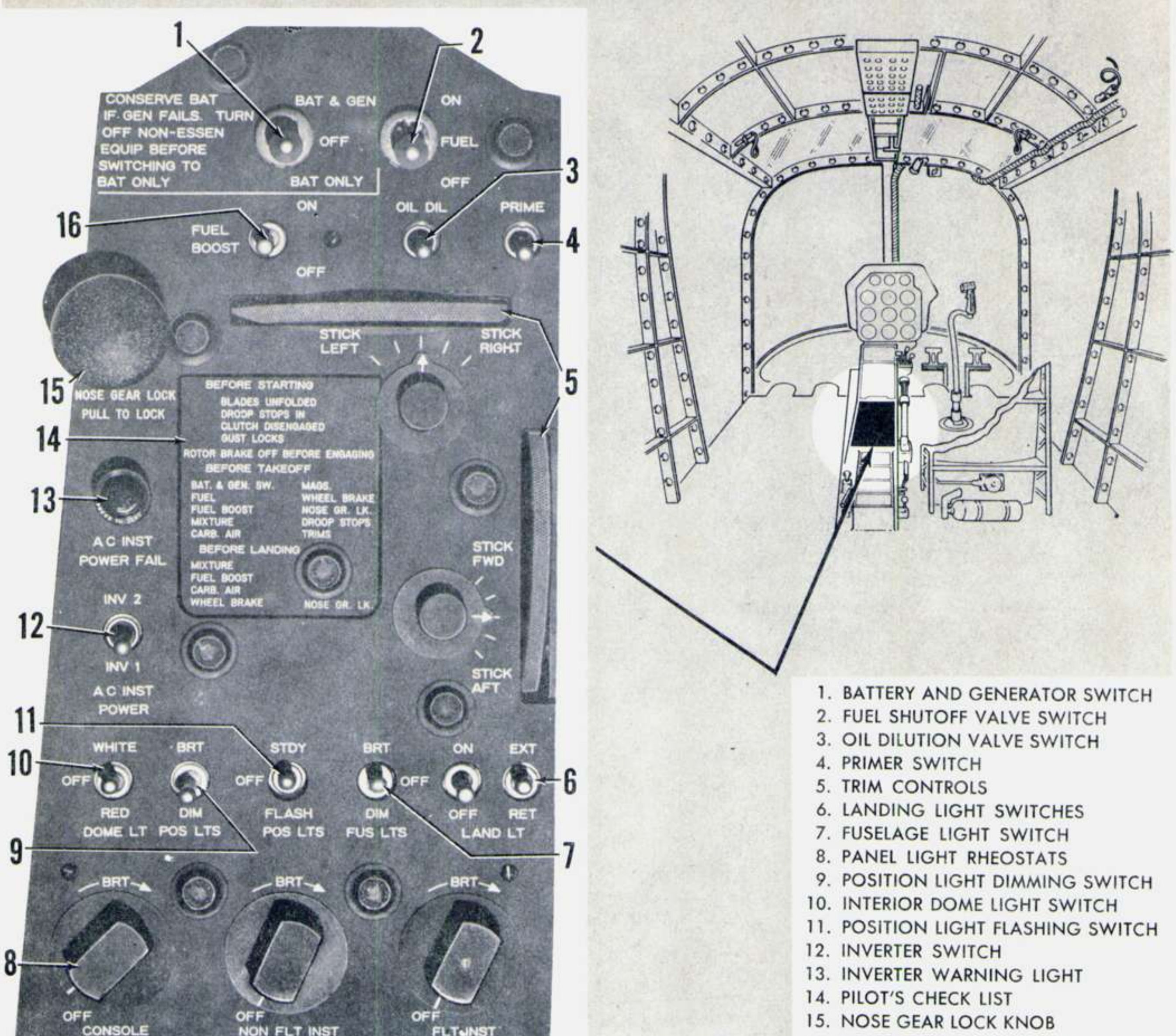
**IGNITION SWITCH.**

The ignition switch (4, figure 1–8) is located on the console instrument panel. The positions OFF, R, L, and BOTH are indicated on the switch face. When the switch is in the OFF position, both magnetos are electrically shorted to ground and do not supply voltage to the spark plugs. Placing the switch to L allows the left magneto to supply ignition voltage to the rear spark plugs. With the switch placed in the R position, the right magneto supplies ignition voltage to the front spark plugs. With the ignition switch set to BOTH, the left and right magnetos are both operating. Make all engine starts and flights with the ignition switch in the BOTH position. The L and R positions are used only for checking the operation of the magnetos.

**PRIME VALVE SWITCH.**

The prime valve switch (4, figure 1–9) is located on the console control panel. The switch is powered by the 28-volt d-c bus (primary bus in HUK-1 helicopters) and the fuel primer and oil dilution circuit breaker (see figures 1–22 and 1–23). When the switch is held in the forward (PRIME) position, a solenoid-operated valve on the engine mount opens and permits fuel to flow to the primer distributor attached to the top cylinder intake pipe. Five tubes carry fuel from the primer distributor to the intake ports of the five top cylinders. The primer switch is actuated, as necessary, during starting to avoid excessive cranking of the engine. When the switch is released, it automatically returns to the off position.

## Console Control Panel




1. BATTERY AND GENERATOR SWITCH
2. FUEL SHUTOFF VALVE SWITCH
3. OIL DILUTION VALVE SWITCH
4. PRIMER SWITCH
5. TRIM CONTROLS
6. LANDING LIGHT SWITCHES
7. FUSELAGE LIGHT SWITCH
8. PANEL LIGHT RHEOSTATS
9. POSITION LIGHT DIMMING SWITCH
10. INTERIOR DOME LIGHT SWITCH
11. POSITION LIGHT FLASHING SWITCH
12. INVERTER SWITCH
13. INVERTER WARNING LIGHT
14. PILOT'S CHECK LIST
15. NOSE GEAR LOCK KNOB
16. FUEL BOOST PUMP SWITCH

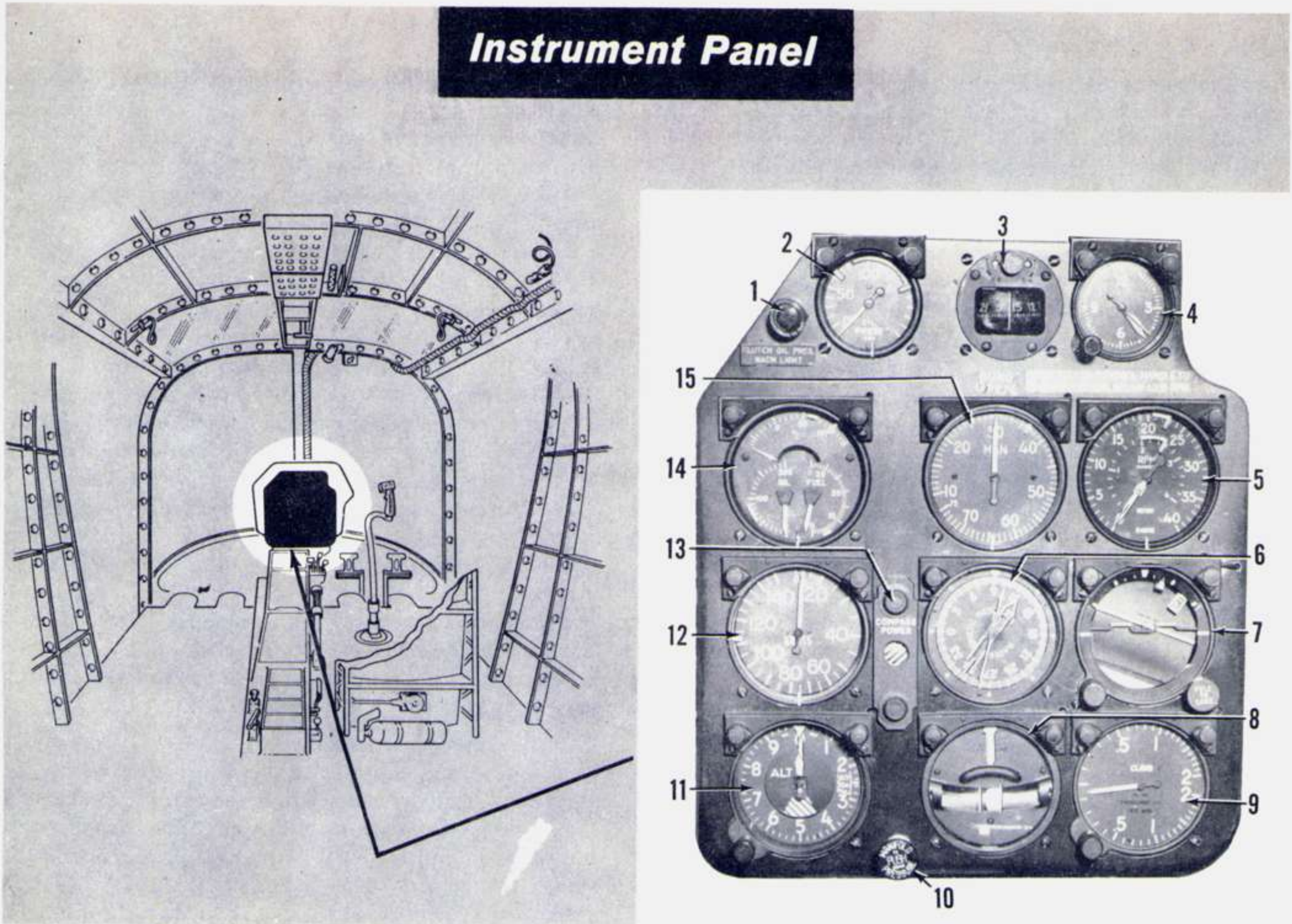
*Figure 1—9*

**STARTER BUTTON.**

The starter button (5, figure 1—6) is located at the top of the pilot's collective pitch lever. The switch, when pressed, energizes a relay that supplies electrical power to the starter motor. The motor, due to the high current it requires, receives power directly from the 28-volt d-c bus. The switch and relay receive power from the d-c bus (primary bus in HUK-1 helicopters) through the starter relay circuit breaker (see figures 1—22 and 1—23). The starter button also energizes an induction vibrator. This vibrator boosts the output of the right magneto to compensate for the low output of the magnetos during engine starting. The induction vibrator also receives d-c power from the starter relay circuit breaker (see figures 1—22 and 1—23). When the button is released, it automatically raises to the off position.

**ENGINE INSTRUMENTS.**

**Manifold Pressure Gage.** The manifold pressure gage (15, figure 1—10) is located approximately in the center of the pilot's instrument panel. The gage is connected, by means of tubing, to the engine intake manifold.




1. CLUTCH OIL PRESSURE WARNING LIGHT
2. CLUTCH OIL PRESSURE GAGE
3. MAGNETIC COMPASS
4. CLOCK
5. TACHOMETER
6. DIRECTIONAL COMPASS
7. GYRO HORIZON INDICATOR
8. TURN AND BANK INDICATOR
9. RATE-OF-CLIMB INDICATOR
10. MANIFOLD PRESSURE GAGE DRAIN VALVE KNOB
11. ALTIMETER
12. AIRSPEED INDICATOR
13. COMPASS POWER WARNING INDICATOR
14. ENGINE GAGE UNIT
15. MANIFOLD PRESSURE GAGE

***Figure 1—10***

Pressure variations in the intake manifold are sensed by the gage mechanism, which actuates the dial needle. Each calibration mark on the gage face represents 1 inch of mercury. Do not operate the engine in such a manner as to exceed the manifold pressure limits shown in Section V.

**Manifold Pressure Gage Drain Valve Knob.** The manifold pressure gage drain valve knob (10, figure 1—10) is located along the bottom edge of the pilot's instrument panel. Pressing the knob opens the drain valve to the atmosphere, and draws any moisture in the tubing into the engine when the manifold pressure is less than atmospheric pressure.

**WARNING**

Do not press the knob when the manifold pressure is greater than atmospheric pressure, as this will cause explosive fuel-air mixture to be blown into the cabin.

**Fuel Pressure Gage.** The fuel pressure is indicated on the right-hand scale of the engine gage unit (14, figure 1—10), located on the pilot's instrument panel. The fuel pressure line is connected to the main fuel supply line at the carburetor. The pressure indicated is the pressure at the carburetor and is a combination of the pressure supplied by the electrically driven boost pump and the engine-driven pump (see figure 1—18). Each reference mark on the gage represents 1 psi (pound per square inch).

**Engine Oil Pressure Gage.** The oil pressure is indicated on the left-hand scale of the engine gage unit (14, figure 1—10) located on the pilot's instrument panel. The oil pressure line is connected to the accessory section of the engine, and transmits the pressure of the oil, being delivered to the engine by the engine pump, to the pressure gage. Each reference mark on the scale represents 10 psi. Operating pressure limitations are shown in Section V.

**Engine Oil Temperature Gage.** The oil temperature is indicated on the upper scale of the engine gage unit (14, figure 1—10) located on the pilot's instrument panel. The gage receives electrical power from the d-c bus and the oil temperature circuit breaker (see figures 1—22 and 1—23). The temperature sensing bulb is located so as to indicate the temperature of the oil returning to the engine from the oil supply cooler. Each reference mark on the temperature scale represents 10° C. Refer to Section V for operating temperature limits. Refer to the paragraphs in this section on the oil supply system for a description of the oil cooler and oil temperature control thermostat.

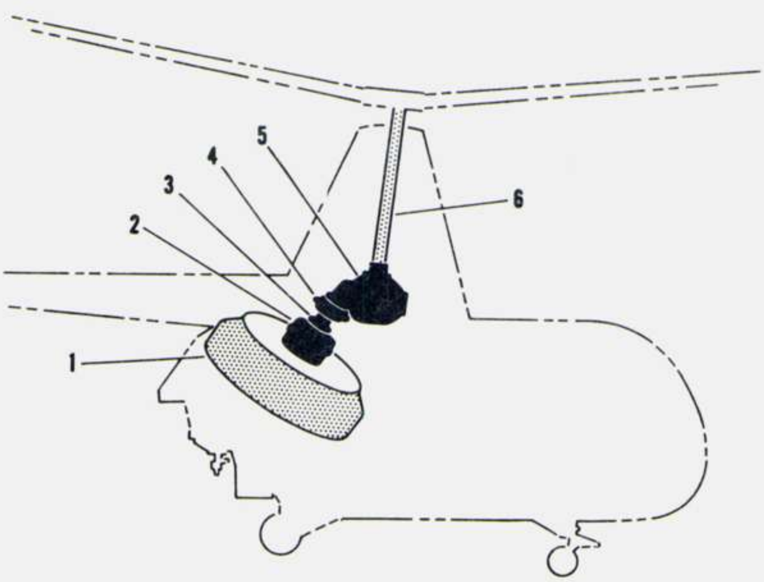
**Cylinder Head Temperature Gage.** The cylinder head temperature gage (11, figure 1—8) is located in the lower right-hand corner of the console instrument panel. The temperature indicated is that of the hottest running cylinder, and is obtained by means of a thermocouple installed under the spark plug. The thermocouple generates an electrical signal, which increases or decreases directly as the temperature. This change in the signal actuates the gage to indicate the temperature. Each reference mark on the scale represents 10° C. Refer to Section V for operating temperature limits.

**Dual Tachometer.** The dual tachometer (5, figure 1—10) is located on the pilot's instrument panel to the right of the manifold pressure gage, and indicates engine speed on the outer scale and rotor speed on the inner scale. Each reference mark on the outer scale represents 100 rpm. The tachometer receives electrical signals from an engine tachometer-generator on the engine accessory section and from a rotor tachometer-generator on the transmission. Procedures in this manual are described in terms of engine speed except for those where rotor speed is of primary importance, as in autorotation.

## TRANSMISSION SYSTEM

The transmission system (see figure 1—11) controls application of engine power to the rotors. The system consists of a clutch, transmission, and rotor brake. The clutch, when engaged, applies the engine power to the transmission and rotors. The transmission maintains the speed of the rotors at approximately 1/10th of the engine speed and synchronizes the counter-rotating rotors. The rotor brake is used to stop freewheeling of the rotors during ground operations.

**Transmission System**




1. ENGINE
2. CLUTCH
3. COUPLING
4. ROTOR BRAKE
5. TRANSMISSION
6. ROTOR SHAFTS

*Figure 1—11*

## CLUTCH

The clutch assembly is mounted directly on the engine output shaft and rotates at the same speed as the shaft. The clutch plates are engaged hydraulically by an oil pressure system completely enclosed within the clutch housing (see figure 1–12). As engine speed is increased, the clutch oil pressure increases, causing a piston to force the clutch plates into engagement. This provides a direct drive of engine power to the transmission and rotors. When engine speed is reduced to less than rotor speed, a torque sensing device relieves the oil pressure, which automatically disengages the clutch and permits autorotation of the rotors. When the clutch lever is in the DISENGAGE position, a control valve blocks the flow of oil, preventing clutch engagement when engine operation is desired without the rotors turning.

**Clutch Lever.** The clutch lever (7, figure 1–8) is located on the extreme left-hand side of control quadrant (10, figure 1–8). Operation of the clutch lever opens (ENGAGE) or closes (DISENGAGE) the manual control valve in the clutch by means of a mechanical linkage. When the lever is fully forward (ENGAGE), the clutch will engage when engine speed is increased to engagement speed. When the clutch lever is fully aft (DISENGAGE) and the rotor brake lever is in the ON position, the engine may be idled or run up without the rotors turning. The handle of the clutch lever contains the rotor brake warning light (6, figure 1–8). When the brake lever is in the ON position, the light will flash, and the clutch lever should be kept in the DISENGAGE position until the rotor brake handle is in the OFF position.

**Clutch Oil Pressure Gage.** The clutch oil pressure gage (2, figure 1–10) is located in the upper left-hand corner of the pilot's instrument panel. The oil pressure line is connected directly to the pressure gage, and transmits clutch oil pressure to the gage. The oil pressure line is connected to the clutch at the clutch control valve. Each reference mark on the gage face represents 10 psi. Refer to Section V for operating pressure limitations.

**Clutch Oil Pressure Warning Light.** The clutch oil pressure warning light (1, figure 1–10) is located in the upper left-hand corner of the pilot's instrument panel. The light receives electrical power from the d-c bus and the warning light circuit breaker (see figures 1–22 and 1–23). The light is controlled by a pressure-sensitive switch, which receives a pressure signal from the same source as the clutch oil pressure gage. When the light is energized, clutch oil pressure is at or below the minimum operating pressure. Refer to Section V for operating pressure limitations.

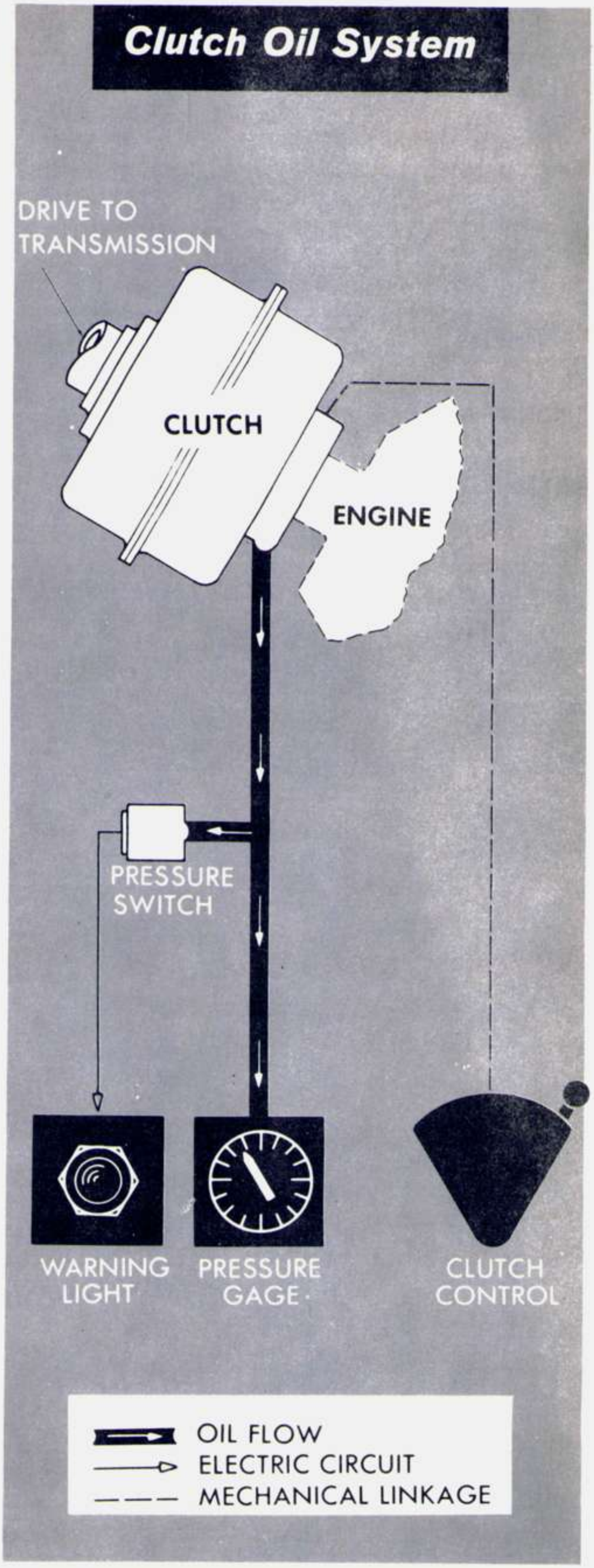



*Figure 1–12*

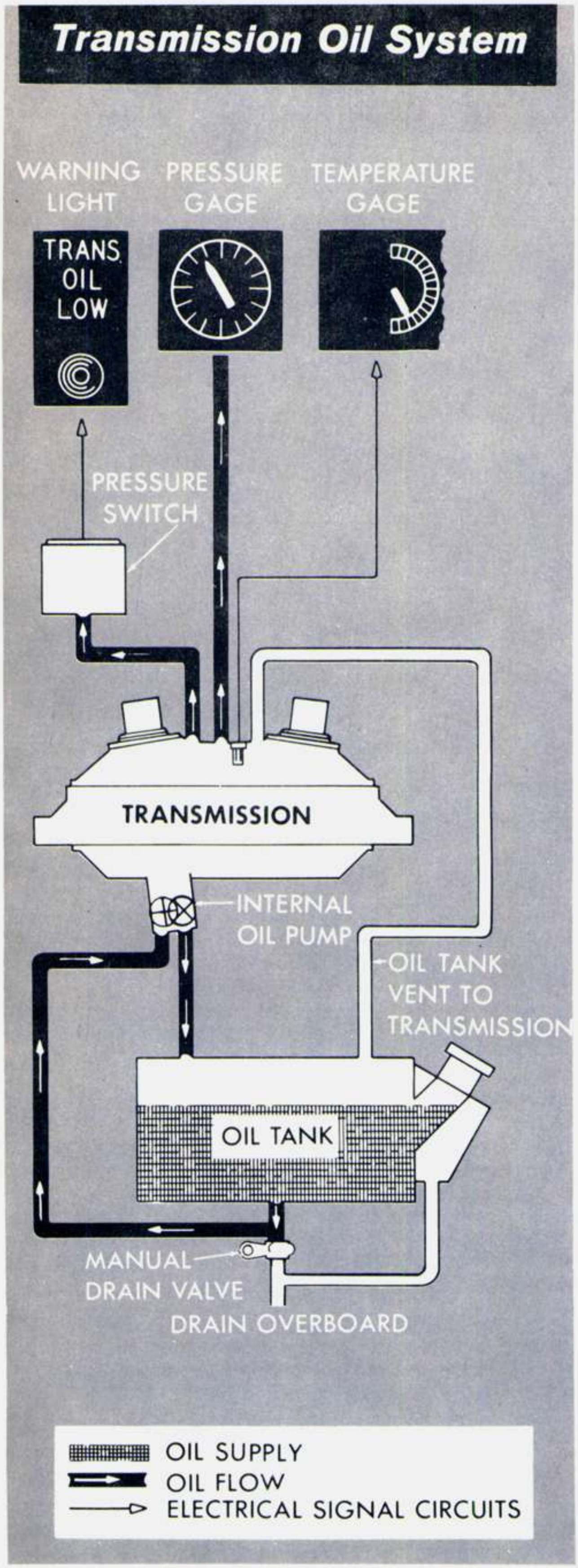



*Figure 1—13*

**TRANSMISSION.**

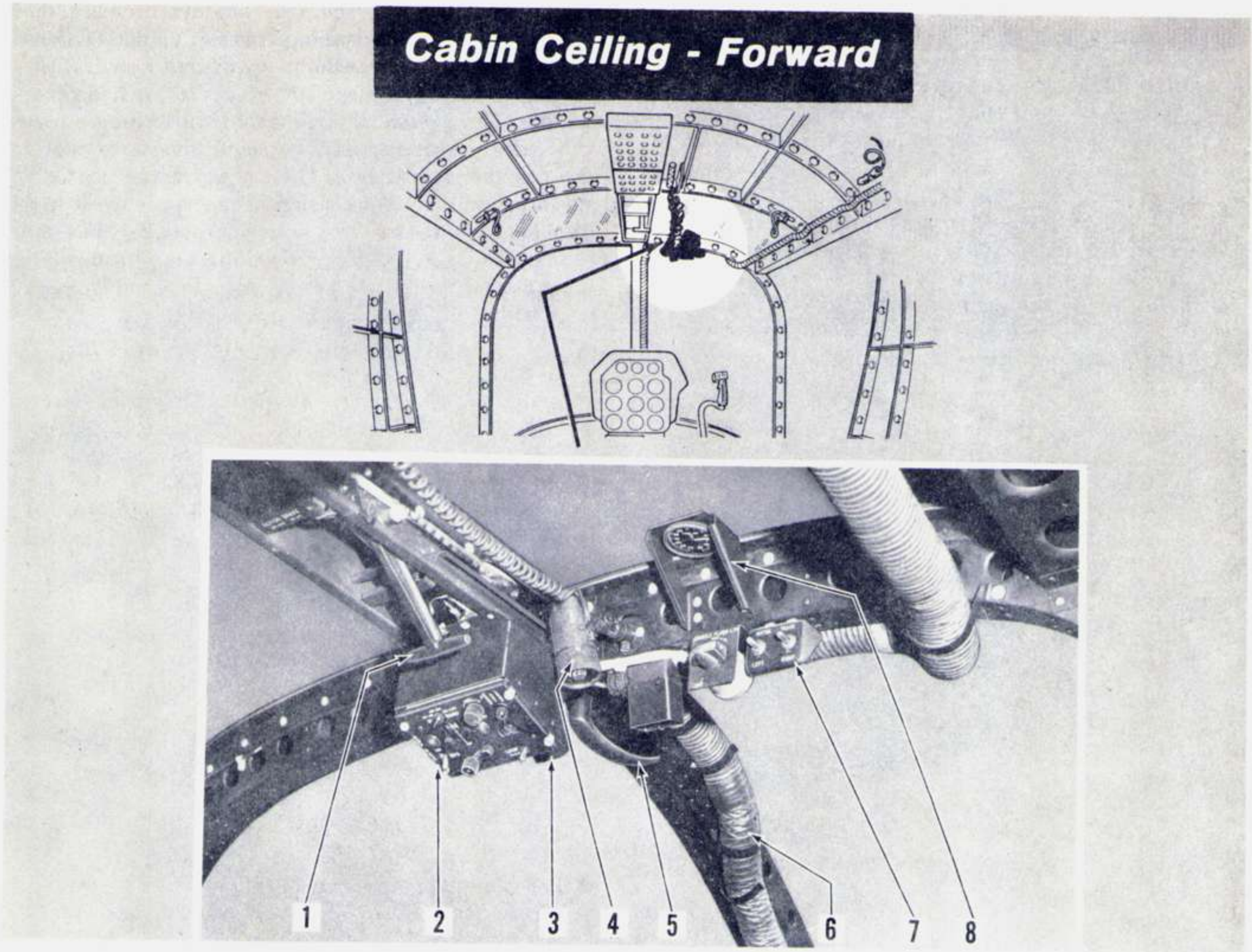
The transmission (5, figure 1—11) synchronizes the counter-rotating, intermeshing rotors, applies engine power to the rotors at reduced speed and transfers the resulting lifting forces from the rotors to the helicopter structure. The d-c generator, used for furnishing power to the helicopter's electrical system, is mounted on and driven by the transmission. The transmission is centrally located below the pylons, where it can apply the lifting forces from the rotors directly to the fuselage. Since the transmission has fixed gear ratios, no operating controls are necessary; however, pressure and temperature gages are provided for the transmission oil system.

**Transmission Oil System.** The transmission oil system (see figure 1—13) consists of an oil tank, with connecting hoses, and an oil pump which is contained within the transmission housing. The oil tank is mounted in the leading edge of the left pylon, and has a usable capacity of seven quarts. Refer to figure 1—24 for the specification and grade of oil.

**Transmission Oil Pressure Gage.** The transmission oil pressure gage (15, figure 1—8) is located on the console instrument panel. The transmission oil pressure is transmitted to the transmission. Each reference mark on the scale represents 5 psi. Refer to Section V for operating pressure limitations.

**Transmission Oil Temperature Gage.** The transmission oil temperature gage (5, figure 1—8) is located on the console instrument panel and is on the same instrument with the carburetor mixture temperature scale. The gage receives electrical power from the 28-volt d-c bus (primary bus in HUK-1 helicopters) and from the carburetor air and transmission oil temperature circuit breaker (see figures 1—22 and 1—23). A temperature sensing bulb is located at the transmission oil inlet, and transmits to the gage the temperature of the oil flowing from the oil tank to the transmission. Each reference mark on the scale represents 10° C. Refer to Section V for operating temperature limitations.

**Transmission Oil Pressure Warning Light.** The transmission oil pressure warning light (1, figure 1—8) is located in the upper left-hand corner of the console instrument panel. The light receives electrical power from the 28-volt d-c bus (primary bus in HUK-1 helicopters) and from the transmission oil warning light circuit breaker (see figures 1—22 and 1—23). A pressure-sensitive switch, connected to the same pressure transmitter as the oil pressure gage, energizes the light when the oil pressure falls to the minimum safe operating pressure. Refer to Section V for the operating pressure limitations.




1. ROTOR BRAKE LEVER
2. AN/ARN-59 CONTROL PANEL (WHEN INSTALLED)
3. CONSOLE FLOODLIGHTS
4. LIGHT, TYPE C4
5. NOSE DOOR LOCK HANDLE
6. DEFOGGING DUCT
7. ROTOR TRACK SWITCHES
8. OUTSIDE AIR THERMOMETER

*Figure 1—14*

## ROTOR BRAKE.

The rotor brake (4, figure 1—11) is a single-disc, mechanical friction unit, which is used to stop the rotors from freewheeling during ground operations such as engine shutdown. The brake acts on the input shaft of the transmission, thereby utilizing the mechanical advantage of the transmission reduction gearing. The brake is controlled by a brake lever located on the cabin ceiling. A flexible cable connects the lever to a hydraulic master cylinder located in the right-hand pylon. Movement of the brake lever actuates the hydraulic cylinder. The resulting hydraulic pressure is applied to the rotor brake friction unit.

**Rotor Brake Lever.** The rotor brake lever (1, figure 1—11) is located in the center of the cabin ceiling. The ON position of the lever is fully aft and the OFF position is forward. Pulling down and aft on the lever applies the force of the brake to the rotors with a controlled amount of pressure. When the lever is in the fully aft position, the brake is locked on. The brake is released by pulling the lever down and forward.

**Rotor Brake Warning Light.** The rotor brake warning light (6, figure 1—8) is located in the translucent handle of the clutch lever. The light receives electrical power from the 28-volt d-c bus (primary bus in HUK-1 helicopters) and from the rotor brake warning light circuit breaker (see figures 1—22 and 1—23). The light is controlled by a switch, which is actuated by movement of the rotor brake lever. When brake lever is in the ON position, the warning light flashes.

## ROTOR SYSTEM

The rotor system (see figure 1—15) consists of two counter-rotating intermeshing rotors. Each rotor consists of two wooden blades mounted on a common hub. A hollow drive shaft, secured at one end to its rotor hub by means of a horizontal teeter pin and at the opposite end to one of the transmission output shafts, transmits the output of the transmission to each rotor. Bearings at the top of the pylon provide radial support for the drive shafts. The rotor blades are attached to their hubs with vertical lag pins. Mechanical friction dampers between the blades on each rotor prevent excessive lead-lag oscillation of the blades. The lifting forces from the rotors are applied to the transmission by the drive shafts, and to the helicopter structure at the transmission mounts.

Droop stops (14, figure 1—16) prevent excessive teetering of the blades during starting and stopping of the rotors. When rotor speed reaches 100 to 130 rpm, the droop stops are disengaged automatically by the increased centrifugal force acting on their flyweights. A rotor blade flap (2, figure 1—15) is attached to the outboard trailing edge of each blade. Changes in the attack angle of these flaps are accomplished by means of the collective pitch lever, the cyclic stick, and the directional pedals, all of which are connected by mechanical linkages to the flaps. Aerodynamic action of the flaps twists the rotor blades to obtain changes in blade pitch. There is no rotational pivoting of the blade at its hub. Refer to the Flight Control System paragraphs in this section for a detailed description of the flight controls.

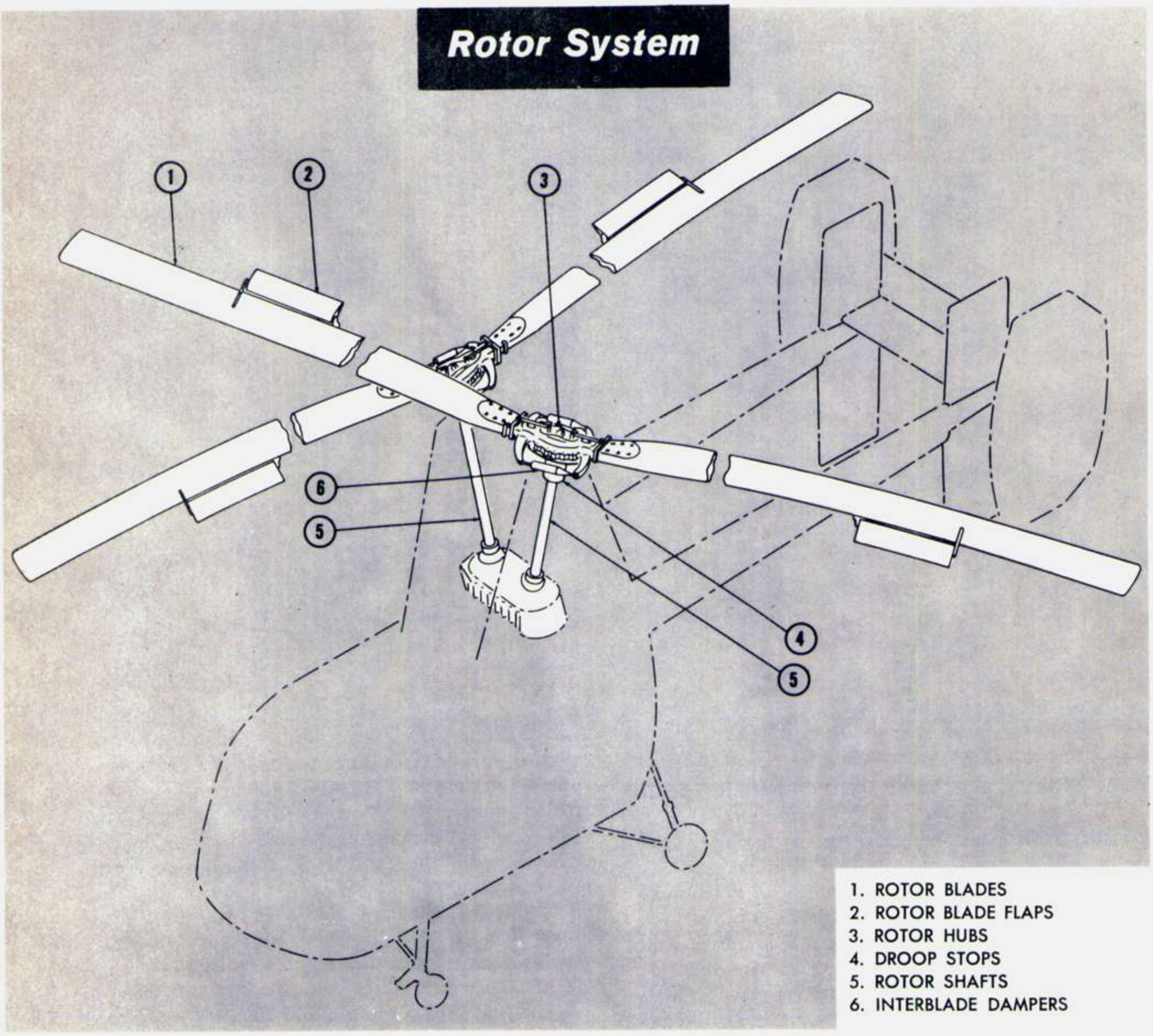
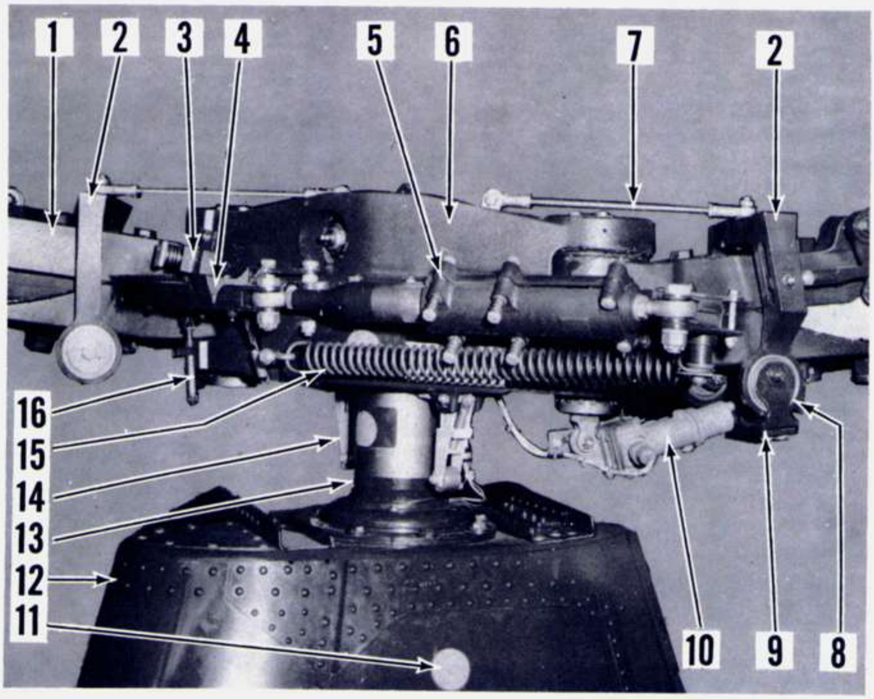



*Figure 1—15*

## Rotor Installation




1. ROTOR BLADE GRIP
2. U-CRANK
3. LEAD STOP ASSEMBLY
4. BLADE FOLDING LOCK ASSEMBLY (BLADES SHOWN IN FOLDED POSITION)
5. DAMPER ASSEMBLY
6. HUB ASSEMBLY
7. HUB-TO-BLADE CONTROL ROD
8. ROCKER
9. TIE BAR
10. IN-FLIGHT TRACKING ACTUATOR
11. COLOR CODE (ORANGE CIRCLE—LEFT ROTOR, CREAM SQUARE—RIGHT ROTOR)
12. UPPER PYLON
13. ROTOR SHAFT
14. DROOP STOP ASSEMBLY
15. LAG SPRING
16. LOCK ASSEMBLY (RETAINS LEAD STOP WHEN BLADE EXTENDED)

*Figure 1—16*

## ENGINE OIL SUPPLY SYSTEM

The engine oil supply system (see figure 1—17) is a dry sump pressure system with a capacity of 9.1 gallons; 7 gallons in the oil tank and 2.1 gallons circulating throughout the system. There are 1.1 gallons of trapped oil that cannot be drained through the drain fitting in the bottom of the tank. Oil flows by gravity from the tank to the engine. The engine oil pump then circulates the oil through the engine to the sump, and returns the oil to the tank through an oil cooler. Refer to figure 1—24 for oil specification and grade.

### OIL COOLER.

The oil cooler is located aft of the engine on the engine cooling shroud duct. The cooler is a completely automatic unit and, therefore, requires no controls. A portion of the air from the cooling fan is circulated through the oil cooler dissipating the oil heat. The temperature of the oil is thermostatically controlled. When the oil temperature is high, the thermostatic valve causes all oil from the engine to flow through the cooler. When the oil temperature is low, the valve causes a portion of the oil to bypass the cooler and flow directly to the tank.

### OIL DILUTION VALVE SWITCH.

The oil dilution (OIL DIL) valve switch (3, figure 1—9) is located on the console control panel. The switch and valve receive electrical power from the d-c bus and from the fuel prime-oil dilution circuit breaker (see figures 1—22 and 1—23). When the switch is in the on position, the fuel boost pump and the oil dilution solenoid are energized. The solenoid opens a valve, which permits fuel to mix with the oil flowing from the tank to the engine. When the switch is released, it

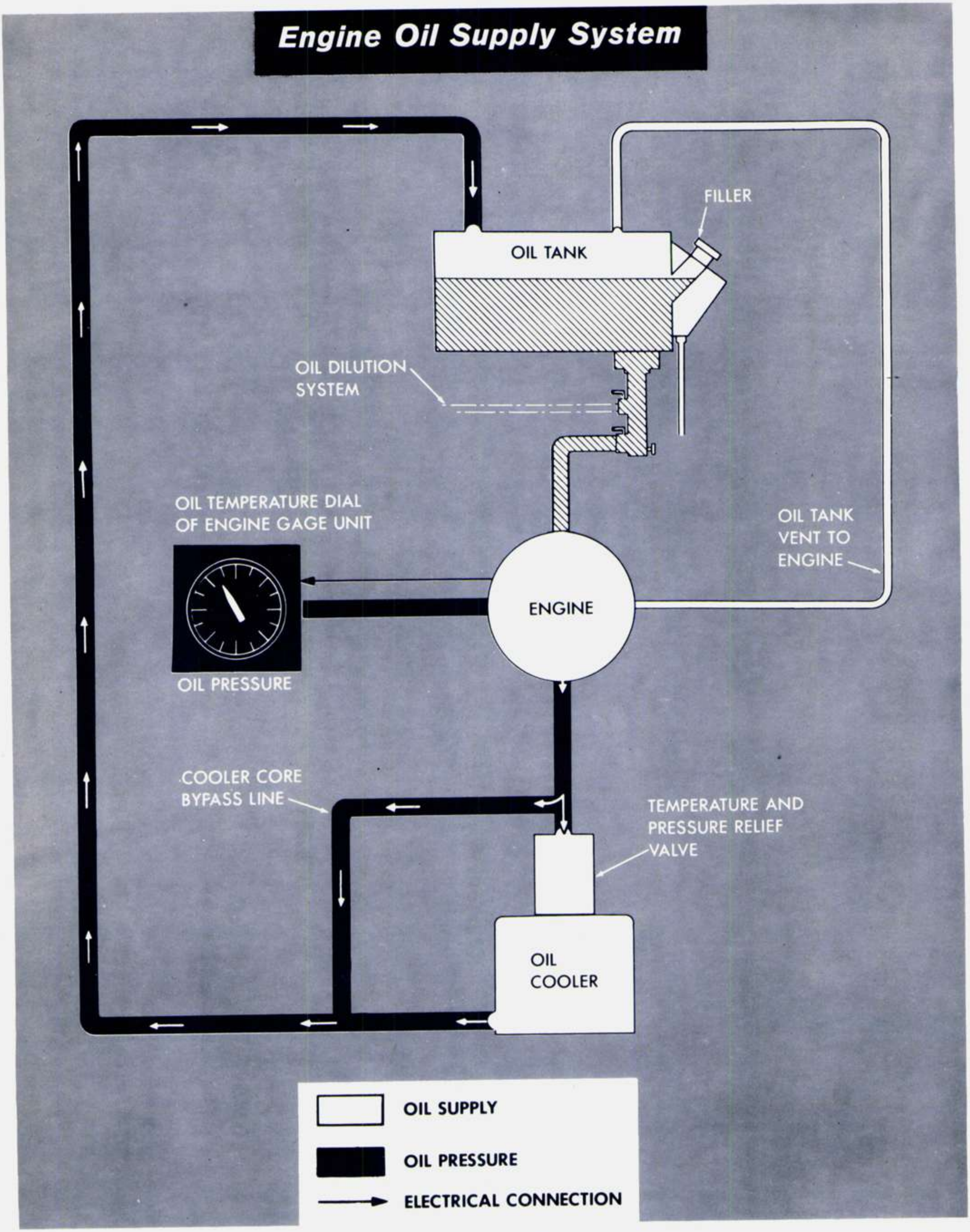
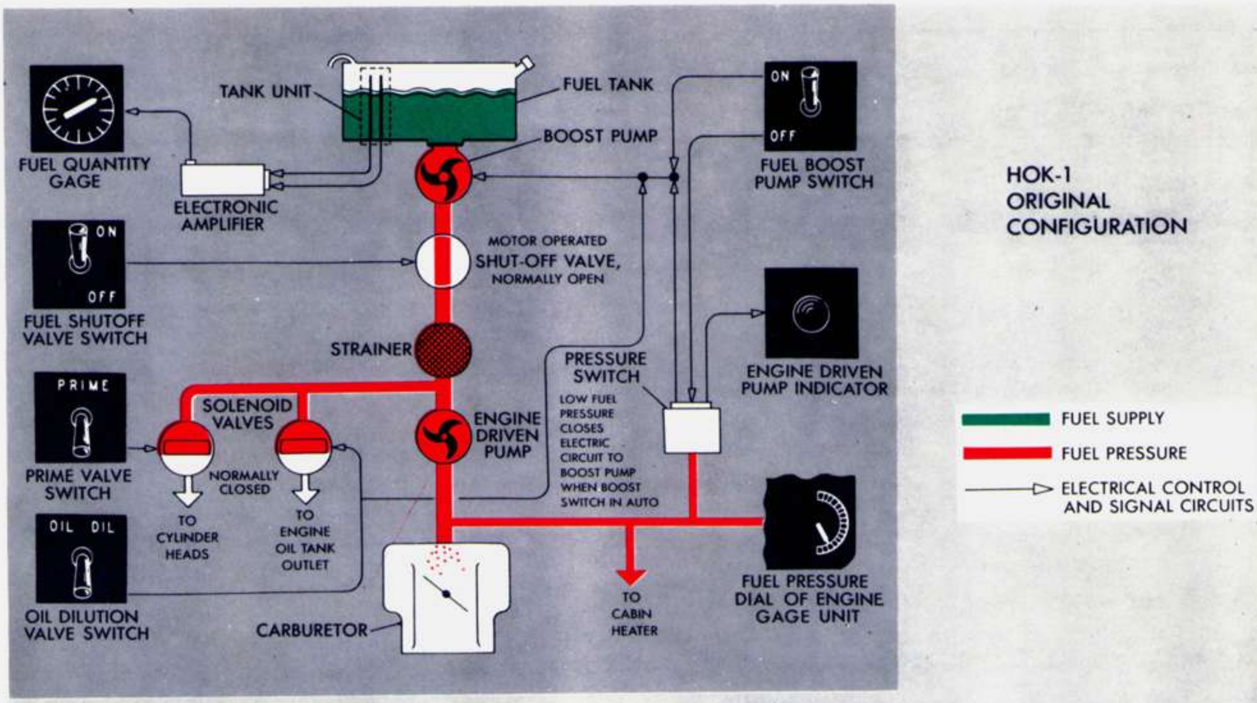

Engine Oil Supply System
FILLER
OIL TANK
OIL DILUTION SYSTEM
OIL TEMPERATURE DIAL OF ENGINE GAGE UNIT
OIL TANK VENT TO ENGINE
ENGINE
OIL PRESSURE
COOLER CORE BYPASS LINE
TEMPERATURE AND PRESSURE RELIEF VALVE
OIL COOLER
OIL SUPPLY
OIL PRESSURE
ELECTRICAL CONNECTION

*Figure 1—17*

# Fuel Supply System



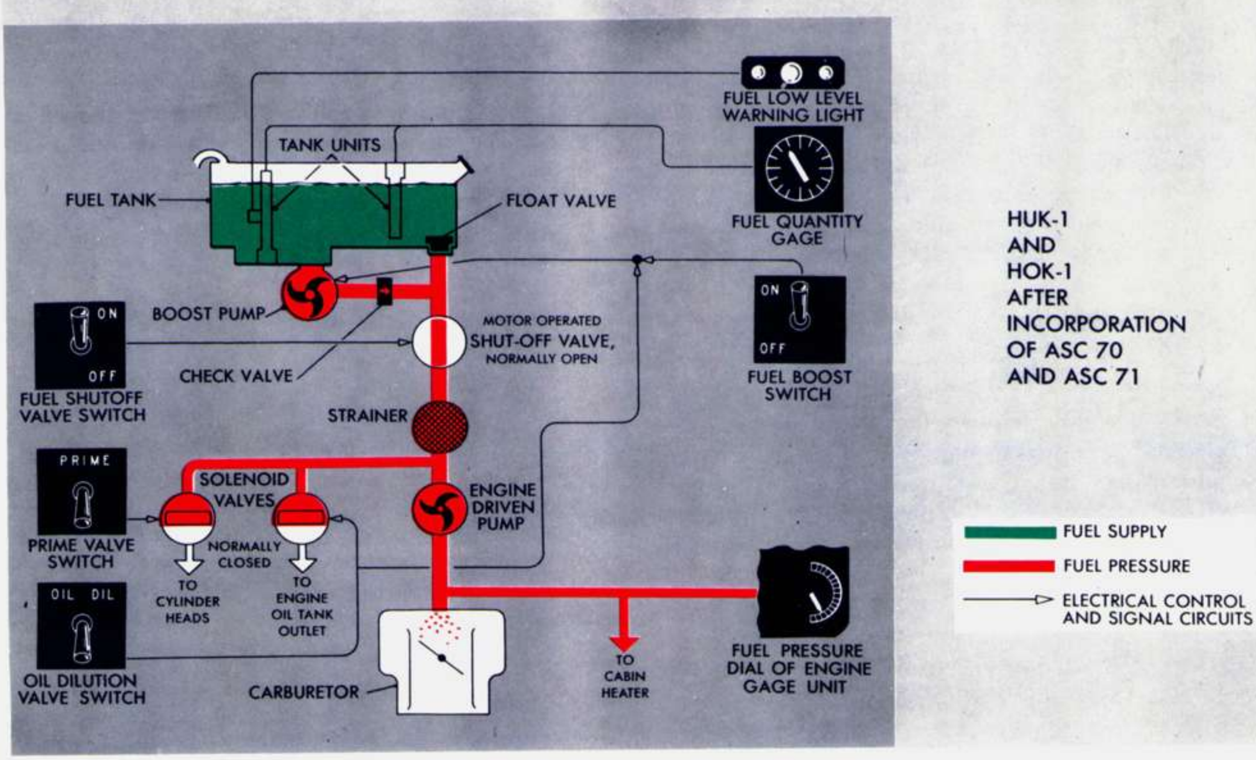




*Figure 1—18*

# Nonusable Fuel

| HELICOPTER ATTITUDE | | HOK-1 — Original Configuration | | HUK-1 AND HOK-1 (HOK-1 after incorporation of ASC 70 & 71) | |
|---|---|---|---|---|---|
| | | Pounds* | Gallons | Pounds* | Gallons |
| NOSE UP | 21-1/2° | 152 | 25.3 | 2 | 0.3 |
| NOSE UP | 9° | 57 | 9.5 | 2 | 0.3 |
| NOSE UP | 6° | 25 | 4.2 | 2 | 0.3 |
| NOSE DOWN | 8-1/2° | 12 | 2.0 | 4 | 0.7 |
| NOSE DOWN | 4° | 2 | 0.3 | 4 | 0.7 |
| BANKED | 15° | 31 | 5.1 | 31 | 5.1 |

* 1 GALLON WEIGHS 6 POUNDS ON STANDARD DAY.

*Figure 1—19*

will automatically return to the off position, stopping the oil dilution process. This procedure is used prior to stopping the engine during cold weather operation, thus simplifying cold weather starting. A manual shutoff valve at the base of the tank prevents oil dilution during flight. This valve must be opened by the ground crew prior to shutdown if it is desired to dilute the oil. Refer to Section IX for oil dilution procedures.

## FUEL SUPPLY SYSTEM

The fuel supply system (see figure 1—18) consists of a fuel tank, a boost pump, a fuel shutoff valve, and the associated controls. The fuel system is considered to end at the strainer. The body of the strainer serves as a manifold for distributing fuel to the cylinder heads during priming, to the oil tank lines for oil dilution, to the carburetor for engine operation, and to the cabin heating system. Engine system fuel controls and indicators are described earlier in this section. The cabin heating system is described in Section IV. Refer to figure 1—24 for fuel specification and grade.

### FUEL TANK — HOK-1 ORIGINAL CONFIGURATION.[1]

The fuel tank is located in the lower aft fuselage under the engine compartment and passenger area. The tank is a self-sealing unit and has a filler neck and cap on the fuselage directly above the right main landing gear. Fuel flows from the tank through a single sump (which contains a fuel boost pump, an electrically operated fuel shutoff valve, a strainer, and an engine-driven fuel pump) and then flows into the carburetor. The amount of nonusable fuel is shown in figure 1—19.

[1] HOK-1 Original configuration references throughout the section apply to BUNOS 125528 thru 140001 prior to incorporation of ASC 70 and ASC 71.

### FUEL TANK — HOK-1 (AFTER INCORPORATION OF ASC 70 AND ASC 71) AND HUK-1.

The fuel tank is located in the lower aft fuselage under the engine compartment and passenger area. The unit is not self-sealing. The tank has a filler neck and cap on the fuselage directly above the right main landing gear. Fuel flows from the tank through dual sumps. The forward sump is located in the lowest part of the tank and contains a fuel boost pump, which discharges the fuel at 4 to 6 psi. Fuel is drawn from the aft sump during nose-up maneuvers. The fuel lines from both sumps join upstream of a motor-operated fuel shutoff valve. The fuel then flows through the valve, a strainer, an engine-driven fuel pump, and into the carburetor. The amount of nonusable fuel is shown in figure 1—19.

### FUEL QUANTITY GAGE — HOK-1 ORIGINAL CONFIGURATION.

The fuel quantity gage (2, figure 1—8) is located on the console instrument panel. The capacitance-type fuel quantity gaging system consists of the gage and a single tank unit. The capacitance of the tank unit varies as the quantity of fuel varies and this capacitance is transmitted to an electronic amplifier. The amplifier, in turn, positions the gage needle in response to the capacitance values. Since the capacitance value of the tank unit is determined by both the fuel level and fuel density, the position of the gage needle is determined by fuel weight. Each reference mark on the gage represents 20 pounds of fuel (6 pounds per gallon on a standard day). Electrical power is received from the 115-volt a-c bus through a fuse in the fuse panel in the right-hand cabin floor (see figure 1—22).

FUEL QUANTITY GAGE — HOK-1 (AFTER INCORPORATION OF ASC 70 AND ASC 71) AND HUK-1.

The fuel quantity gage (2, figure 1—8) is located on the console instrument panel. The capacitance-type fuel quantity gaging system consists of the gage and two tank units. Electrical power is obtained from the 115-volt a-c bus and the fuel quantity indicator fuse (fuel gage fuse on HUK-1 helicopters) (see figures 1—22 and 1—23). The rear of the gage case contains an amplifier that positions the gage needle in response to the capacitance value of the tank units. Since the capacitance value of the tank units is determined by both the fuel level and fuel density, the position of the gage needle is determined by fuel weight. Each reference mark on the gage represents 20 pounds of fuel (6 pounds per gallon on a standard day).

FUEL QUANTITY GAGE TEST BUTTON.

The fuel quantity gage test button (3, figure 1—8) is located in the top center portion of the console instrument panel. When the button is pressed, the capacitance signal from the tank is cancelled and the indicating needle should move toward the zero mark at a steady rate. After the needle has traveled a few degrees, release the button and check that the needle returns to the original quantity indicated.

FUEL LOW WARNING LIGHT.[1]

The fuel low warning light is located to the right of the fuel quantity gage test button on the console instrument panel. The light receives electrical power from the 28-volt d-c bus (primary bus on HUK-1 helicopters) and from the fuel level warning light circuit breaker on the console circuit breaker panel (see figures 1—22 and 1—23). The light is actuated by a transistor-type fuel level sensing unit located on the tank unit. The warning light panel is labeled to indicate, for each of the basic flight attitudes that affects the level of the fuel in the tank, the quantity of fuel remaining when the light begins to glow. The light calls your attention to the fact that your fuel quantity is low, and that you should check the fuel quantity gage to determine the actual quantity of fuel remaining. When operating with a partially full fuel tank, the light may be off in forward or level flight, but will glow during uncoordinated nose-up maneuvers, which cause fuel to flow to the rear of the tank.

**Note**

Warning light panel labels are not the same in all helicopters. Label differences are required to compensate for fuel system differences which depend on aircraft service change incorporation.

FUEL SHUTOFF VALVE SWITCH.

The fuel shutoff valve switch (2, figure 1—9) is located in the upper right-hand corner of the console control panel, and controls the motor-operated fuel shutoff valve (see figure 1—18). The switch receives electrical power from the 28-volt d-c bus (primary bus on HUK-1 helicopters) and from the fuel shutoff valve circuit breaker (see figures 1—22 and 1—23). When the fuel valve switch is in the ON position, the valve opens and permits fuel to flow from the supply tank to the engine-driven pump, the oil dilution valve, the primer valve, and the cabin heater system. Limit switches in the valve automatically stop operation of the motor when the valve reaches the fully open or fully closed position.

FUEL BOOST PUMP SWITCH — HOK-1 ORIGINAL CONFIGURATION.

The fuel boost pump switch (16, figure 1—9) is located on the console control panel, and controls the electrically operated fuel boost pump. The switch receives electrical power from the 28-volt d-c bus and from the fuel boost pump circuit breaker (see figure 1—22). When the switch is in the ON position, the pump delivers fuel at a pressure of 4 to 6 psi. When the switch is in the AUTO position, a pressure switch opens and closes the electrical circuit to the boost pump as necessary, thus energizing and de-energizing the boost pump to maintain correct fuel pressure.

ENGINE DRIVEN FUEL PUMP INDICATOR — HOK-1 ORIGINAL CONFIGURATION.

The fuel pump indicator is located on the console control panel. When the fuel boost pump switch is in the AUTO position, the indicator shows whether the engine-driven fuel pump is delivering proper fuel pressure to the carburetor. When the fuel boost pump switch is in the OFF position, the indicator will show diagonal lines.

FUEL BOOST PUMP SWITCH — HOK-1 (AFTER INCORPORATION OF ASC 70 AND ASC 71) AND HUK-1.

The fuel boost pump switch (16, figure 1—9) is located on the console control panel, and controls the electrically operated fuel boost pump. The switch receives electrical power from the 28-volt d-c bus (primary bus on HUK-1 helicopters) and the fuel boost pump circuit breaker (see figures 1—22 and 1—23). When the switch is in the ON position, the pump delivers fuel at a pressure of 4 to 6 psi. Automatic relief valves within the pump body prevent buildup of excessive pressures.

## ELECTRICAL POWER SUPPLY SYSTEM

The electrical power supply system (see figures 1—20 and 1—21) provides 28-volt direct current and 115-volt, 3 phase, 400-cycle alternating current to operate the electrical and electronic equipment installed in the helicopter. The power supply system is considered to terminate at the distribution busses in the circuit breaker and fuse panels. The circuit breakers and fuses are considered to be a part of the system served.

[1] HOK-1 subsequent to incorporation of ASC 66 or ASC 70 and ASC 71, and all HUK-1.

## Electric Power Supply - HOK-1

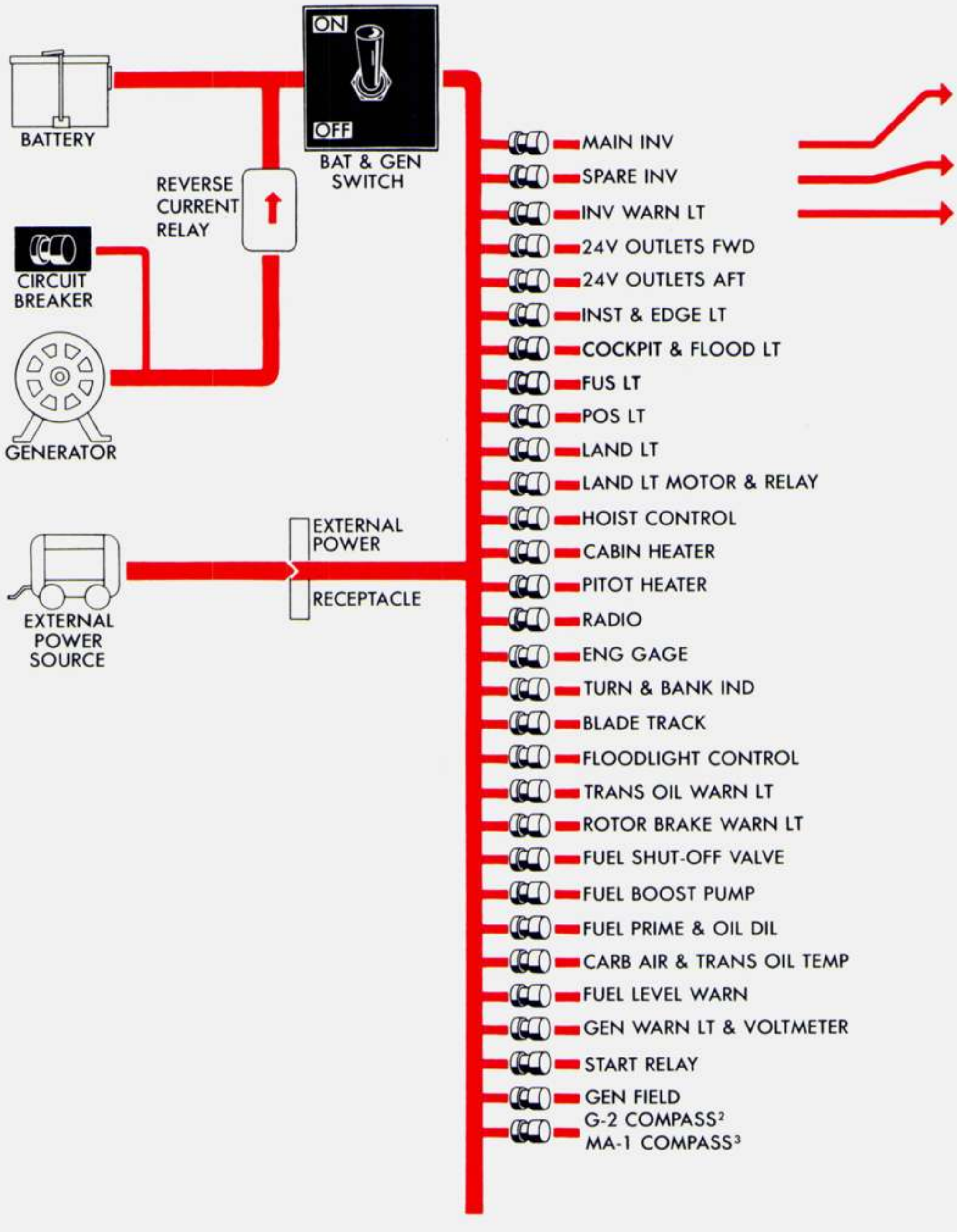
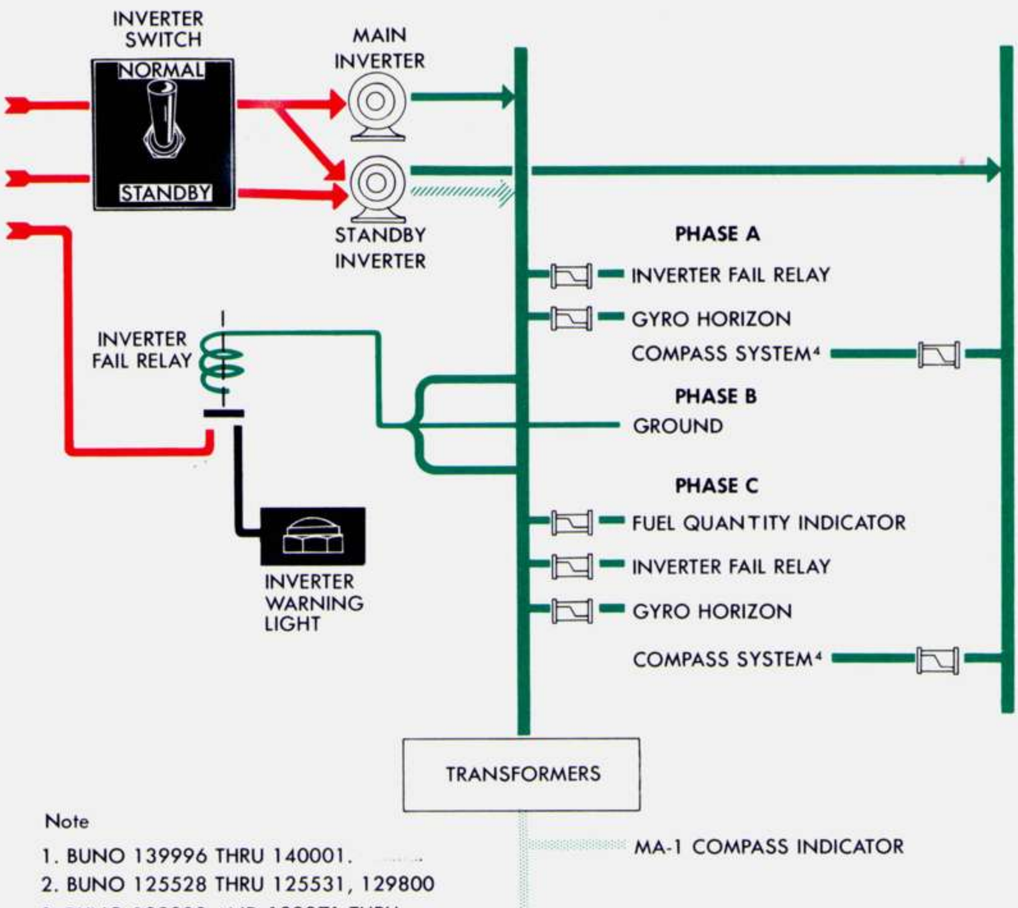



*Figure 1—20 (Sheet 1)*



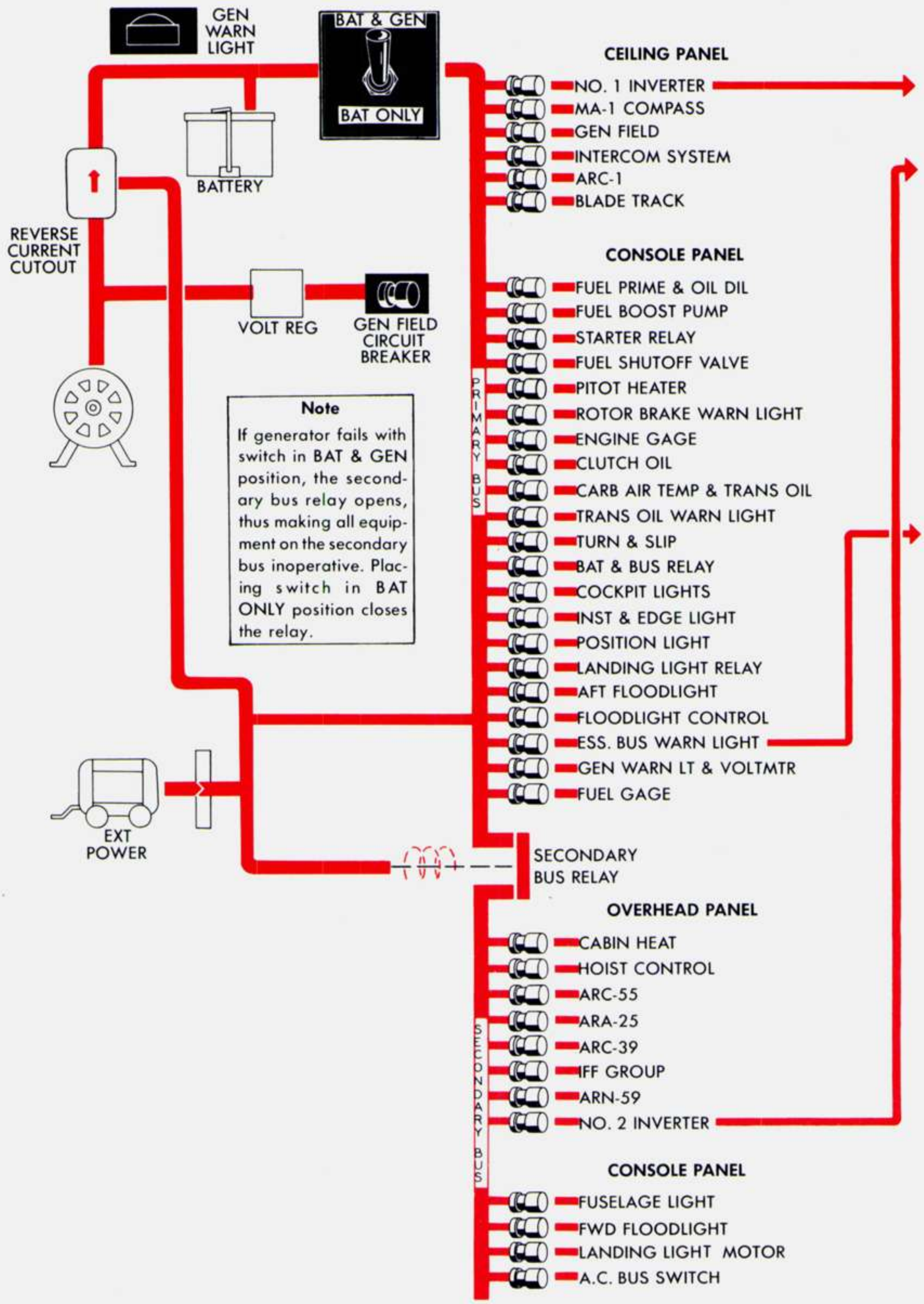

Note

1. BUNO 139996 THRU 140001.
2. BUNO 125528 THRU 125531, 129800
3. BUNO 129809 AND 139971 THRU 140001.
4. IN BUNO'S LISTED IN NOTE 2, THE GYRO HORIZON RECEIVES POWER FROM THE STANDBY INVERTER IN NORMAL OPERATION, AND THE COMPASS SYSTEM RECEIVES POWER FROM THE MAIN INVERTER.

28 VOLT, DC POWER
115 VOLT, 3 PHASE, 400 CYCLE AC POWER NORMAL OPERATION
115 VOLT, 3 PHASE, 400 CYCLE AC POWER STANDBY OPERATION
26 VOLT, 1 PHASE AC POWER
CIRCUIT BREAKER
FUSE

*Figure 1—20 (Sheet 2)*

# Electric Power Supply - HUK-1




**Note**

If generator fails with switch in BAT & GEN position, the secondary bus relay opens, thus making all equipment on the secondary bus inoperative. Placing switch in BAT ONLY position closes the relay.

*Figure 1—21 (Sheet 1)*

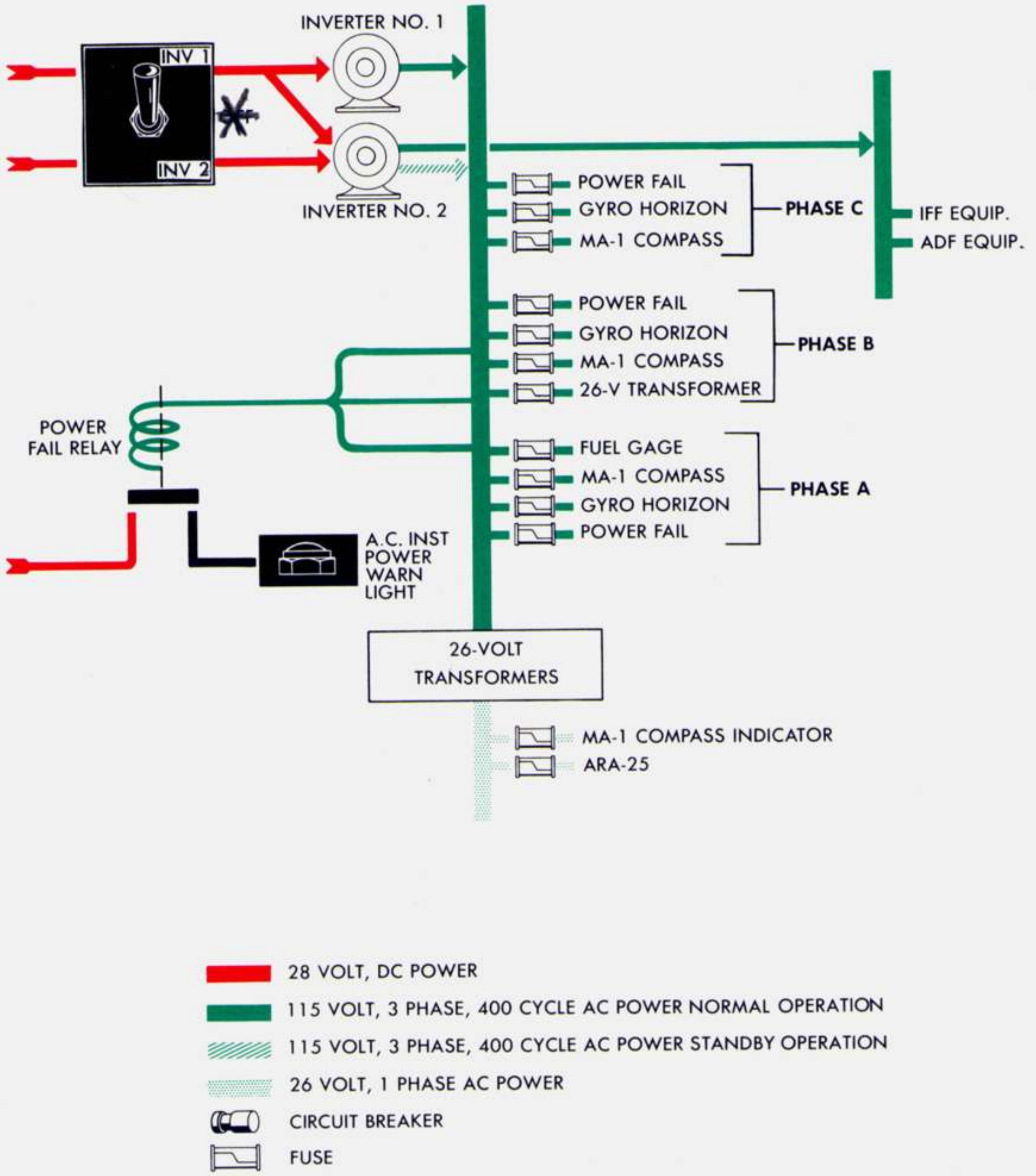



*Figure 1—21 (Sheet 2)*

## DIRECT CURRENT POWER SUPPLY.

The primary source of 28-volt d-c power is the 200-ampere generator. The generator is mounted on the transmission and delivers maximum electrical power throughout the entire rotor rpm range. An external power receptacle provides a means of connecting an external 28-volt d-c power source for engine starting or ground testing of electrical equipment. A 24-volt, 36 ampere-hour battery provides a means of starting the engine when external power is not available, and of operating the electrical equipment if the generator fails.

**Battery.** The battery (15, figure 1—4) is located in the center of the cabin floor forward of the pilot's instrument panel. The battery is accessible through the nose bubble door. The battery is completely contained within a case, and is equipped with hose lines which vent all explosive battery gases overboard.

**Battery and Generator Switch — HOK-1.** The battery and generator switch is a 2-position (ON-OFF) toggle switch, located on the console control panel. When the switch is in the ON position, internal electrical power (generator or battery voltage) is supplied to the d-c bus. If the generator fails when the switch is in the ON position, the generator can be isolated from the electric system by pulling out the generator field (GEN FIELD) circuit breaker located on the console circuit breaker panel. When an external power supply is used, the battery and generator switch must be in the OFF position.

**Battery and Generator Switch — HUK-1.** The battery and generator switch (1, figure 1—9) is a 3-position (BAT & GEN-OFF-BAT ONLY) switch, and is located on the console control panel. When the switch is in the BAT & GEN position, the generator supplies power to both the primary and secondary d-c busses (see figure 1—21). If the generator fails during this mode of operation, the secondary bus is automatically de-energized, and the battery supplies power to the primary bus only. Placing the switch in the BAT ONLY position restores power to the equipment on the secondary bus. When an external power source is used, the switch must be in the OFF position.

**Battery Reverse Current Relay.** When the generator is operating, this relay controls the rate at which the battery is charged. The reverse current relay remains closed when generator voltage is greater than battery voltage. Generator voltage is then supplied to the battery for charging and to the d-c bus for operation of all electrical equipment. When battery voltage is greater than generator voltage, the relay opens to prevent discharge of the battery through the generator and the battery supplies electrical power for operation of all electrical and electronic equipment.

**Generator.** The generator (24, figure 1—4) is mounted on the transmission in the lower right-hand pylon, and is driven by the transmission gearing. The generator maintains a fully charged battery and supplies the necessary power for operation of all electrical and electronic equipment.

**Generator Warning Light.** The generator warning light (13, figure 1—8) is located in the lower left-hand corner of the console instrument panel. The light receives electrical power from the 28-volt d-c bus (primary bus in HUK-1 helicopter) and from the generator warning light and voltmeter circuit breaker. (see figures 1—22 and 1—23). When the light is on, the generator voltage is less than the battery voltage, and the electrical equipment is operating on battery power.

**Voltage Regulator.** The voltage regulator controls the generator field current to maintain the desired generator output voltage regardless of generator speed or electrical load.

**Generator Field Circuit Breaker.** The generator field circuit breaker (GEN FIELD) is located in the circuit breaker panel on the right-hand side of the console (see figures 1—22 and 1—23). Pulling out on the circuit breaker will isolate the generator from the electric system. When the generator is overloaded or fails, the button will snap out and the generator will become inoperative. The circuit can be re-energized by pressing the button.

**Voltammeter Gage.** The voltammeter gage (14, figure 1—8) is located on the console instrument panel. This gage indicates the voltage and current of the d-c circuits. Since the current indication is for the generator, the gage becomes inoperative when the power is received entirely from the battery.

**External Power Receptacle.** The external power receptacle (9, figure 1—4) is located on the left-hand side of the fuselage directly above the aft landing gear. The receptacle provides a means for connecting an external power source for ground testing electrical and electronic equipment or for starting procedures.

**CAUTION**

The battery and generator switch must be in the OFF position when external power is used. Reversed polarity between the external power source and helicopter power can cause serious damage to the electrical equipment and may result in a fire.

**Circuit Breaker Panels.** A circuit breaker panel is located on the right-hand side of the console. In addition, the HUK-1 has a second circuit breaker panel located in the center of the cabin ceiling. Refer to figures 1—22 and 1—23 for the circuits protected by each circuit breaker panel. The circuit breaker button will automatically pop out, thus de-energizing the circuit, if the circuit should become overloaded.

**ALTERNATING CURRENT POWER SUPPLY.**

Alternating current for operation of various instruments is produced by inverters. The inverters receive electrical power from the d-c power supply system. The current produced by the inverters is distributed through a fuse panel located in the floor to the right of the console (HOK-1 only) or on the cabin ceiling (HUK-1 only).

**Inverters — HOK-1.** There are two inverters, located in the upper left-hand pylon. When the inverter switch is in the NORMAL position, both inverters are operating. The main inverter supplies power to the fuel quantity gage, the inverter fail relay, and the gyro horizon indicator. The standby inverter supplies power only to the gyro magnetic compass system. If the main inverter fails, the switch should be placed in the STANDBY position so that only the standby inverter is operating. During STANDBY operation the gyro magnetic compass is inoperative.[1] Each inverter receives 28-volt d-c bus power through the inverter circuit breakers (see figure 1—22) and converts this electrical power to 115-volt, 400-cycle, 3 phase, a-c power. In addition, stepdown transformers convert some of this a-c power to 26-volt, 400-cycle, single phase, a-c power for operation of the MA-1 compass indicator (rotating compass card of the dual radio-magnetic indicator).

**Inverter Switch — HOK-1.** The inverter (INV) switch is located on the console control panel and is a 2-position (NORMAL-STANDBY) toggle switch.

**Note**

Upon incorporation of Aircraft Service Change 77, the inverter switch is a 3-position (NORMAL-OFF-STANDBY) toggle switch.

The switch controls the d-c input and a-c output of the inverters.[2] When the inverter switch is placed in the STANDBY position, the main inverter is disconnected from the circuitry, and a-c power is received from the standby inverter.

**Inverter Out Warning Light — HOK-1.** The warning light is located on the console control panel directly above the inverter switch. If the light glows with the inverter switch in the NORMAL position, the main inverter is not operating. If the light continues to glow after the inverter switch is placed in the STANDBY position, the spare inverter is also inoperative. The light receives electrical power through the INV WARN LT circuit breaker on the console circuit breaker panel.

**Fuse Panel — HOK-1.** The fuse panel is located in the floor of the helicopter directly to the right of the console. All instruments using a-c power are wired to the fuse panel, and each fuse is marked to indicate the circuit protected. The fuses are easily removed for inspection and replacement. Replacement fuses are contained in the holders marked SPARE.

**Inverters — HUK-1.** Two inverters are mounted inside the left-hand pylon. The inverters convert 28-volt d-c power to 115/200-volt, 3 phase, a-c power to be supplied to equipment requiring a-c power for operation. When the a-c instrument power switch is in the INV 1 position, both inverters are operating. Inverter No. 1 supplies power to the power fail relays, gyro horizon, MA-1 compass system, fuel gage, and the stepdown transformers. The stepdown transformers reduce some of the inverter output to 26-volt, single-phase power for operation of the MA-1 compass indicator and the AN/ARA-25 direction finder. Inverter No. 2 supplies power to the IFF and ADF equipment. If inverter No. 1 fails when the instrument power switch is in the INV 1 position, the switch should be placed in the INV 2 position. The IFF and ADF equipment is inoperative when only the No. 2 inverter is operating.

**A-C Instrument Power Switch — HUK-1.** The instrument power switch (12, figure 1—9) is located on the console control panel and is a 3-position (INV 1-OFF-INV 2) toggle switch. When the switch is in the INV 1 position, both inverters are operating. Upon failure of inverter No. 1, the switch should be placed in the INV 2 position.

**A-C Instrument Power Warning Light — HUK-1.** The warning light is located on the console control panel directly above the instrument power switch. If the light glows when the inverter switch is in the INV 1 position, the No. 1 inverter is not operating, and the switch should be placed in the INV 2 position. If the light continues to glow, the No. 2 inverter is also inoperative. The light receives electrical power through the essential bus warning light circuit breaker on the console circuit breaker panel (see figure 1—23).

**Fuse Panel — HUK-1.** A fuse panel is located on the ceiling next to the ceiling circuit breaker panel (see figure 1—23). The fuses are clearly marked as to the equipment they protect and are readily removed for inspection and replacement. Replacement fuses are contained in the fuse holders marked SPARE.

[1] BUNOS 129809, 139971 through 140001, and all HOK-1 helicopters incorporating ASC 72. In all other HOK-1 helicopters, the gyro horizon indicator operates off the standby inverter during NORMAL operation, and is inoperative during STANDBY operation.

[2] BUNOS 139981 thru 140001 only. On all other HOK-1 helicopters, the switch controls the a-c output only.

# Circuit Breakers and Fuses - HOK-1

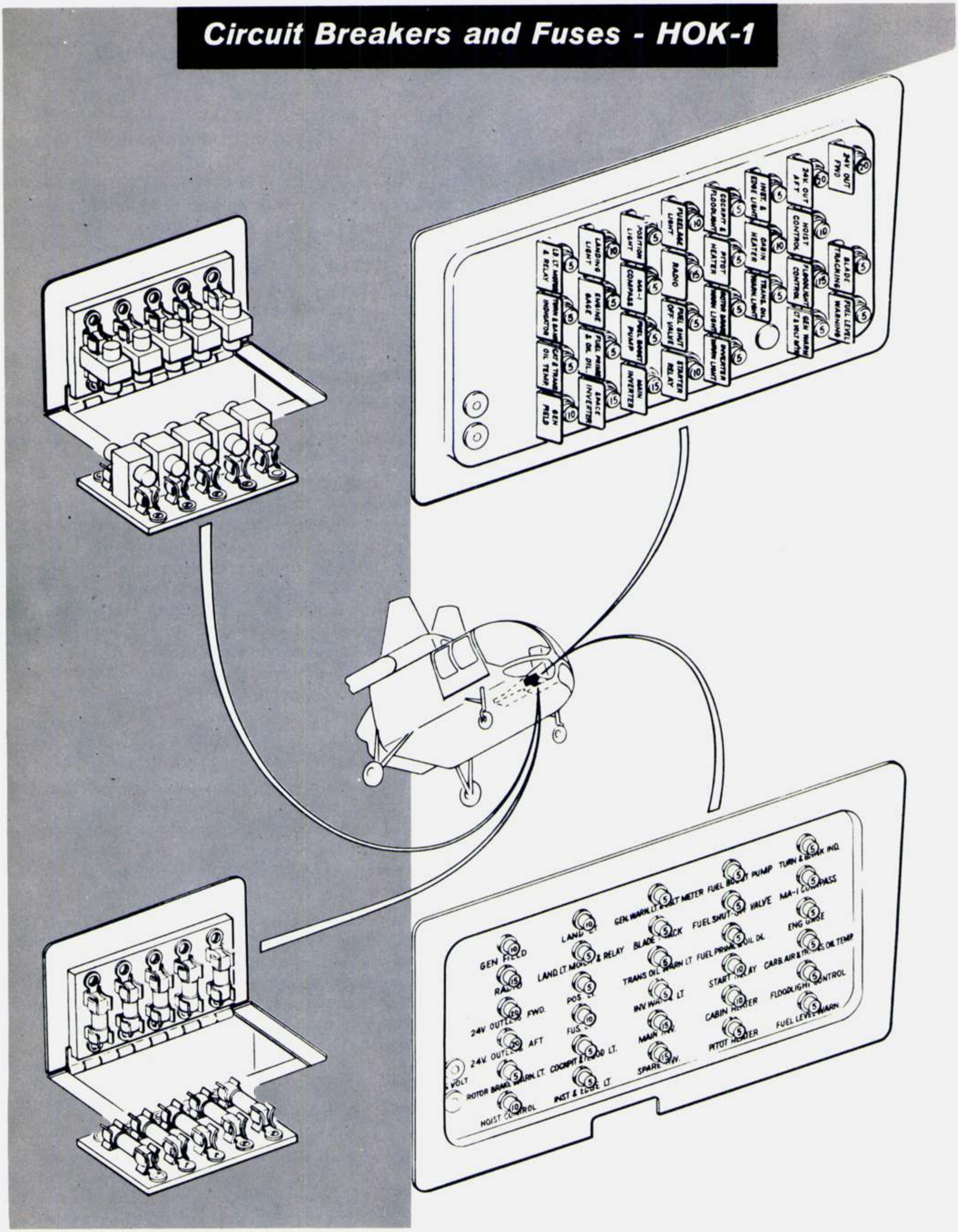



Figure 1—22

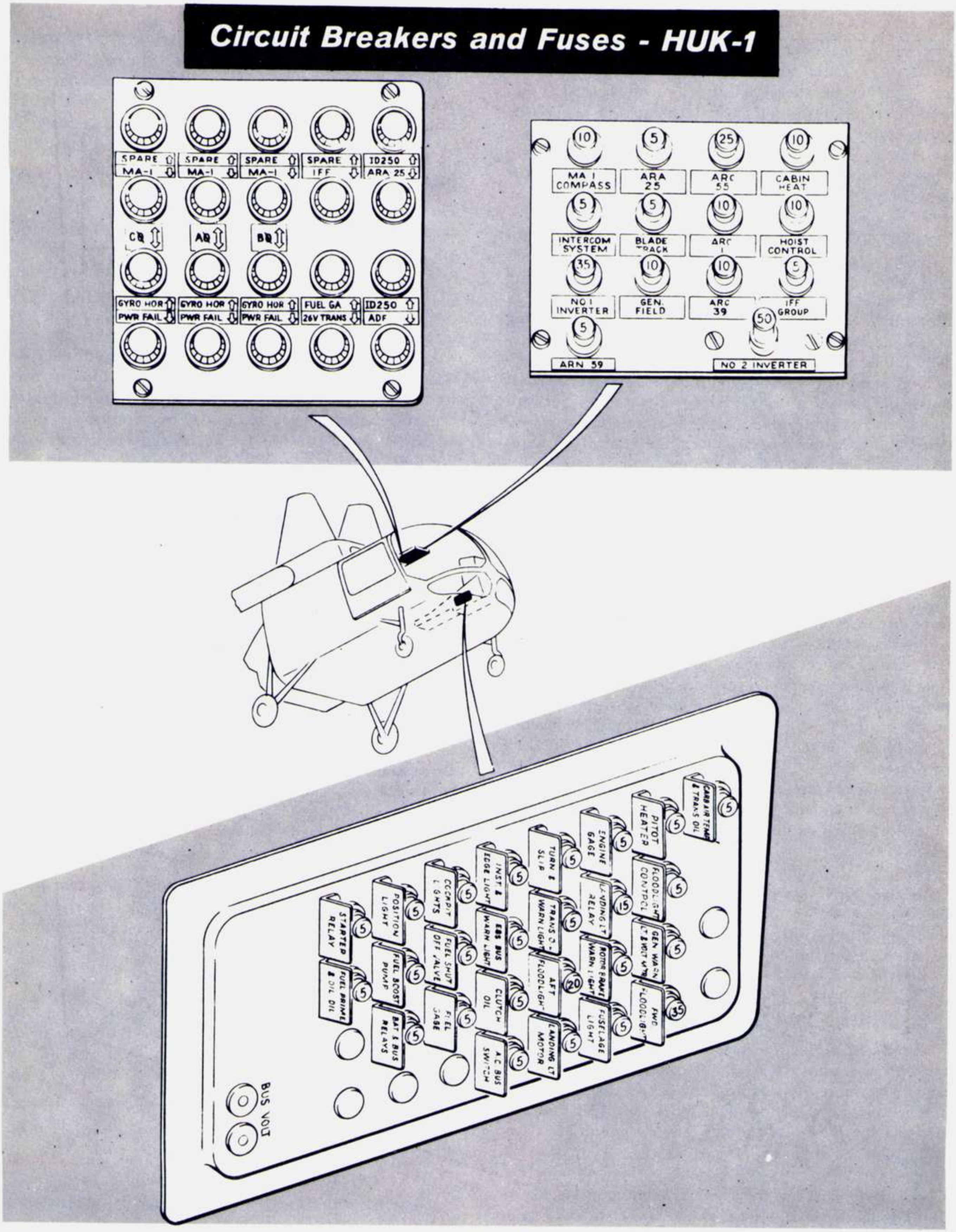

Circuit Breakers and Fuses - HUK-1
SPARE
MA-1
SPARE
MA-1
SPARE
MA-1
SPARE
IFF
ID250
ARA 25
CB
AB
BB
GYRO HOR
PWR FAIL
GYRO HOR
PWR FAIL
GYRO HOR
PWR FAIL
FUEL GA
26V TRANS
ID250
ADF
10
MA 1 COMPASS
5
ARA 25
25
ARC 55
10
CABIN HEAT
5
INTERCOM SYSTEM
5
BLADE TRACK
10
ARC 1
10
HOIST CONTROL
35
NO 1 INVERTER
10
GEN. FIELD
10
ARC 39
5
IFF GROUP
5
ARN 59
50
NO 2 INVERTER
STARTER RELAY
FUEL PRIME & OIL DIL
POSITION LIGHT
FUEL BOOST PUMP
BAT & BUS RELAYS
COCKPIT LIGHTS
FUEL SHUT OFF VALVE
FUEL GAGE
INST & EDGE LIGHT
CLUTCH OIL
A.C. BUS SWITCH
TURN & SLIP
AFT FLOODLIGHT
LANDING LT MOTOR
ENGINE GAGE
LANDING LT RELAY
FUSELAGE LIGHT
PITOT HEATER
FLOODLIGHT CONTROL
FWD FLOODLIGHT
BUS VOLT

Figure 1—23

## FLIGHT CONTROL SYSTEM

The helicopter is controlled by changing the pitch (angle of attack) of the rotor blades. The collective pitch lever, the cyclic stick and the directional pedals are used to accomplish the desired changes in the attack angle of the rotor blades. These flight controls actuate blade flaps, which are mounted on the outboard trailing edge of each blade. The aerodynamic action of the flaps twists the blades along their respective spanwise axes. The action of the flight controls is transmitted, through mechanical push-pull rods, to azimuth control rings mounted below the transmission. Additional push-pull rods, connected to the azimuths and running through the rotor shafts, rotor hubs, and rotor blades, transmit this motion to the blade flaps. A floating horizontal elevator, controlled by a servo tab mechanically linked to the collective pitch lever, increases longitudinal stability by compensating for the tendency of the helicopter nose to pitch upward at high forward speeds and engine power outputs. Although the system permits relative ease of handling the controls, control forces and control feel are maintained at a comfortable level.

### COLLECTIVE PITCH LEVER.

The collective pitch lever (10, figure 1—7) is located at the left of the pilot's seat. The lever controls the vertical ascent and descent of the helicopter. Pulling up on the lever increases the blade pitch, developing additional lift forces to raise the helicopter. Pushing down on the lever causes the reverse action to occur. The lever is also linked to the servo tab on the horizontal tail. An upward motion of the lever results in an increase in the angle of attack of the floating horizontal elevator. The lever is mechanically linked to the throttle so that an increase or decrease in the collective pitch lever setting is accompanied by a corresponding increase or decrease in engine power. Independent control of engine power is made possible by the motorcycle-type throttle on the lever grip.

**Collective Pitch Lever Friction Nut.** The friction nut (9, figure 1—7) is located below the motorcycle-type throttle on the collective pitch lever. The nut can be adjusted to set the control force and feel of the lever as desired.

### CYCLIC STICK.

The cyclic stick (3, figure 1—7) is located directly forward of the pilot's seat. Displacement of the stick in any direction results in the helicopter's tilting and the moving in that direction. The cyclic stick grip contains controls for the hoist and the intercommunication system (refer to Section IV).

**Cyclic Stick Friction Nut.** The friction nut (7, figure 1—7) is located at the base of the cyclic stick. The nut may be adjusted to increase or decrease the stick's resistance to movement (control feel) as desired.

### TRIM CONTROLS.

The longitudinal and lateral trim controls (5, figure 1—9) are located on the console control panel. The controls are used to adjust the spring force of struts that determine the neutral position of the cyclic stick. After adjustment for neutral pressure, the stick may be released for hands-off flying.

### DIRECTIONAL PEDALS.

The directional pedals (5 and 17, figure 1—7) are located forward of the pilot's and copilot's seats, and are used to control the heading of the helicopter. pressing the right pedal decreases the collective pitch of the right rotor and increases the collective pitch of the left rotor. This action causes the helicopter to roll and turn to the right due to the difference in lift and the unbalanced torque between the rotors. In addition, the right rotor tilts to the rear and the left rotor tilts forward thus furnishing added turning force to the right. Pressing the left pedal will cause the opposite action to occur. No other controls are necessary to bank and turn the helicopter.

Directional control during autorotation is maintained by means of a reverser and shifter included in the control linkages from the foot pedals. The reverser is actuated when the collective stick is in the down position. The reverser crosses the differential collective controls from the directional pedals, thus compensating for the reversal in torque application relative to helicopter heading which occurs when the blades drive the rotor shafts rather than being driven by shafts. The shifter is also actuated by movement of the collective pitch lever. The shifter varies the amount of fore-and-aft differential cyclic control applied to the rotors for a given amount of pedal movement.

**Directional Pedal Friction Nut.** A wing nut, located below the pilot's left pedal, may be used to adjust the friction on both pairs of pedals. Pedal friction adjustments must be made prior to flight, since the nut is inaccessible during flight.

**Directional Pedals Positioning Knob.** The pedal positioning knob (6, figure 1—7) is located to the right and in front of the pilot's seat. The knob is used to adjust the pedals to suit the pilot's legs.

### DUAL CONTROLS.

A collective pitch lever, a cyclic stick, and directional pedals may be installed in their respective positions around the copilot's seat. The copilot's controls do not include friction nuts on the cyclic stick or collective pitch lever.

### ROTOR TRACK SWITCHES.[1]

The rotor track switches (7, figure 1—14) are located on the forward portion of the cabin ceiling. Each switch is a 3-position (up-off-down; spring return to off)

[1] BUNOS 139996 through 140001 and 146304 through 146327 only.

toggle switch. Electrical power is supplied from the 28-volt d-c bus (primary bus in HUK-1 helicopters) and the blade track circuit breaker (see figures 1—22 and 1—23). Refer to Section VII for additional description and operational procedures.

## LANDING GEAR SYSTEM

The landing gear system consists of four nonretractable wheels equipped with individual shock struts. The two rear wheels are fixed in a fore-and-aft position. The two nose wheels have castering mounts which allow them to swivel, but they can be locked in fore-and-aft trailing alignment with the rear wheels. The nose wheels are equipped with shimmy dampers.

### NOSE WHEEL LOCK KNOB.

The nose wheel lock knob (11, figure 1—7) is located at the left of the console and is connected, by means of a mechanical linkage, to locking pins in the nose wheel struts. The knob has two positions; LOCKED (pull up and rotate clockwise) and UNLOCKED (rotate counter-clockwise and press). The wheels must be in a fore-and-aft position before they can be locked. The locked position is normally used only for shipboard operation, or when operating on rough or sloping terrain.

## WHEEL BRAKE SYSTEM

The rear wheels are equipped with disc-type hydraulic brakes. The brakes are applied by using the brake pedals, which are located directly above the directional pedals. The wheel brakes can be locked on during parking.

### WHEEL BRAKE PEDALS.

The wheel brake pedals (4, figure 1—7) are located at the top of the pilot's directional pedals. The left and right wheel brakes are applied by pressing the corresponding brake pedal. The wheel brakes are actuated by hydraulic pressure transmitted from master cylinders located directly below the pedals.

### PARKING BRAKE HANDLE.

The parking brake handle (12, figure 1—7) is located at the left of the console. The handle is connected by mechanical linkage to valves in the wheel brake hydraulic lines. To apply the parking brakes the wheel brakes are applied by toe pressure on the wheel brake pedals, and the toe pressure is continued while the parking brake handle is pulled ON. Hold the parking brake handle on until the wheel brake pedals are released. This closes the valves and traps the hydraulic pressure against the wheel brake friction units. The wheel brakes will remain ON, acting as parking brakes until the brake pedals are again applied, automatically releasing the parking brake handle.

## INSTRUMENTS

Instruments that are a part of a particular system are described in the paragraphs pertaining to that system. The G-2 and MA-2 magnetic gyro compass systems are described in Section IV.

### FLIGHT INSTRUMENTS.

The following instruments are located on the pilot's instrument panel (see figure 1—10):

- Magnetic compass (3)
- Manual wind clock (4)
- Gyro horizon indicator (7)
- Turn and bank indicator (8)
- Rate-of-climb indicator (9)
- Altimeter (11)
- Airspeed indicator (12)

An outside air thermometer (8, figure 1—14) is located in the forward area of the cabin ceiling. Airspeed and compass correction cards are located in a holder assembly on the ceiling above the pilot's seat.

**Gyro Horizon Indicator.** The gyro horizon indicator is supplied with 115-volt, 3 phase, a-c power through a fuse in the a-c fuse panel. The indicator provides the pilot with a visual check of the pitch and roll attitude of the helicopter. The gyro must be caged immediately after power is supplied to the indicator. This is done by pulling out the caging knob on the panel just below the indicator and holding it until the horizon bar and bank index cease to oscillate. After all oscillation stops, the bar and bank index should indicate zero roll within 3 degrees. The caging time will depend upon the position of the gyro.

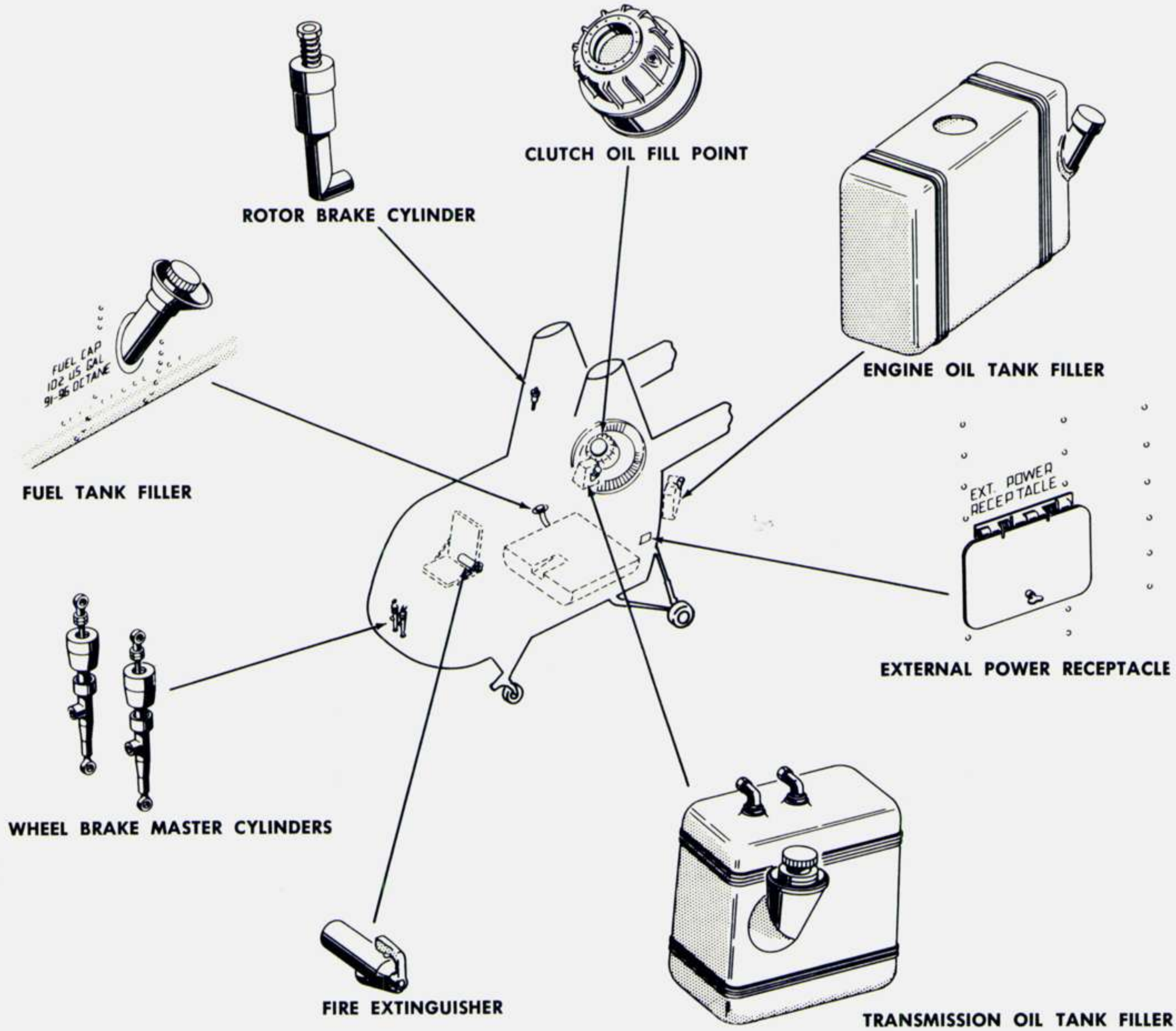
**WARNING**

When the instrument is caged, the position shown is the helicopter attitude and not the true vertical; therefore, the indicator should not be caged in flight unless the aircraft is known to be in level flight. Do not rely on the indicator if the power warning flag is visible.

A figure, which represents the helicopter attitude, is attached on the face of the instrument. The amount of variation of the helicopter attitude from the horizontal will show as the angular variation between the aircraft figure and the gyro horizon line. Flight control corrections can be made to bring the aircraft figure in line with the horizon line in order to maintain level flight.

**Airspeed Pitot System.** The pitot tube, which delivers the impact of the oncoming air to the diaphragm of the airspeed indicator, is located externally on the under-

# Servicing Diagram




**TIRE PRESSURES:** REAR — 100 PSI
FRONT — 70 PSI

**FUEL:** MIL-F-5572 — ASHORE, USE GRADES 91/96, 100/130, 115/145; AFLOAT, USE GRADE 115/145.

**ENGINE OIL:** MIL-O-6082 — WHEN STARTING TEMPERATURES ARE PREDICTED TO BE ABOVE 1.7° C (35° F) USE GRADE 1100; BELOW 1.7° C USE GRADE 1065.

**TRANSMISSION OIL:** MIL-L-6086 — WHEN STARTING TEMPERATURES ARE PREDICTED TO BE ABOVE −6.7° C (20° F) USE GRADE M; BELOW −6.7° C USE GRADE L.

**CLUTCH OIL:** TYPE A AUTOMATIC TRANSMISSION OIL, COMMERCIAL BRANDS. MIL-L-2104 GRADE 10 MAY BE USED AS AN ALTERNATE, AND MAY BE MIXED WITH TYPE A OIL.

**WHEEL BRAKE, AND ROTOR BRAKE HYDRAULIC OIL:** MIL-O-5606.

*Figure 1—24*

side of the fuselage. The tube is protected from icing by a self-contained electrical heating element. Refer to Section IV for a description of the pitot tube heater control.

**Static Vent System — HOK-1.** The static vent system consists of vents in the airspeed, altimeter, and rate-of-climb indicator cases connected with tubing leading to a common static head in the pitot tube.

**Static Vent System — HUK-1.** A tubing system leads from the rear of the instrument panel to ports in the right-hand tailboom and provides venting for the airspeed indicator, altimeter, and rate-of-climb indicator.

**Turn and Bank Indicator.** The turn and bank indicator (8, figure 1—10) receives electrical power from the 28-volt d-c bus and from the turn and bank circuit breaker on the circuit breaker panel (see figures 1—22 and 1—23).

## EMERGENCY EQUIPMENT

The fire extinguisher, pyrotechnic pistol, and first aid kit are discussed in Section III.

## ENTRANCE DOORS

The helicopter may be entered through sliding doors on either side of the cabin, or through the left half of the nose bubble, which is hinged at the outboard edge. The side doors have self-locking handles, located at the lower forward edge both inside and outside. Pulling either handle disengages the lock, and releasing the handle locks the door in any position. In an emergency, the side doors may be jettisoned by pulling down on either of two handles located at the top inside edge of the door and pushing the door outward. The nose bubble door is secured inside and outside with latches. The interior latch should be unlocked first, and locked last. A strut holds the door in the fully open position.

## SEATS

The pilot's and copilot's seats (15, figure 1—6) are nonadjustable and are equipped with lap belts and inertia reel-type shoulder harnesses. Passenger seats are described in Section IV.

### SHOULDER HARNESS INERTIA REEL LOCK HANDLE.

The handle is located on the left side of the seat back and has LOCKED (up) and UNLOCKED (down) positions. When the handle is placed in the LOCKED position, a mechanical linkage is actuated, which locks the inertia reel and restrains the user's shoulders against the seat back. When the handle is in the UNLOCKED position, the inertia-reel cable, which restrains the shoulder harness, will extend and allow freedom of movement. With the handle in the UNLOCKED position, a force of 2g from any direction will automatically lock the reel. When the reel is locked in this manner, the handle must be moved to the LOCKED position and then returned to the UNLOCKED position before any movement is again possible.

## AUXILIARY EQUIPMENT

The following systems and equipment are described in Section IV:

- Heating, Ventilating, and Anti-Fogging System
- Pitot Heater
- Communication and Associated Electronic Equipment
- Navigation Equipment
- Cargo Hook Equipment
- Rescue Hoist Equipment
- Lighting System
- Passenger Carrying Equipment
- Casualty Carrying Equipment
- Miscellaneous Equipment

# section II

# Normal Procedures

## PREPARATION FOR FLIGHT

### FLIGHT RESTRICTIONS.

Refer to Section V for flight restrictions and operating limitations.

### FLIGHT PLANNING.

Use the operating data in Appendix I to determine fuel quantity, airspeed, power settings, etc., for the mission.

### WEIGHT AND BALANCE

Obtain takeoff and anticipated landing gross weights and balance. Refer to weight limitations contained in Section V, and the Handbook of Weights and Balance, AN01-1B-40, for loading data. Check that Form "F" has been completed.

## PREFLIGHT CHECK

### BEFORE EXTERIOR INSPECTION.

Check the yellow sheet to determine helicopter status.

### EXTERIOR INSPECTION.

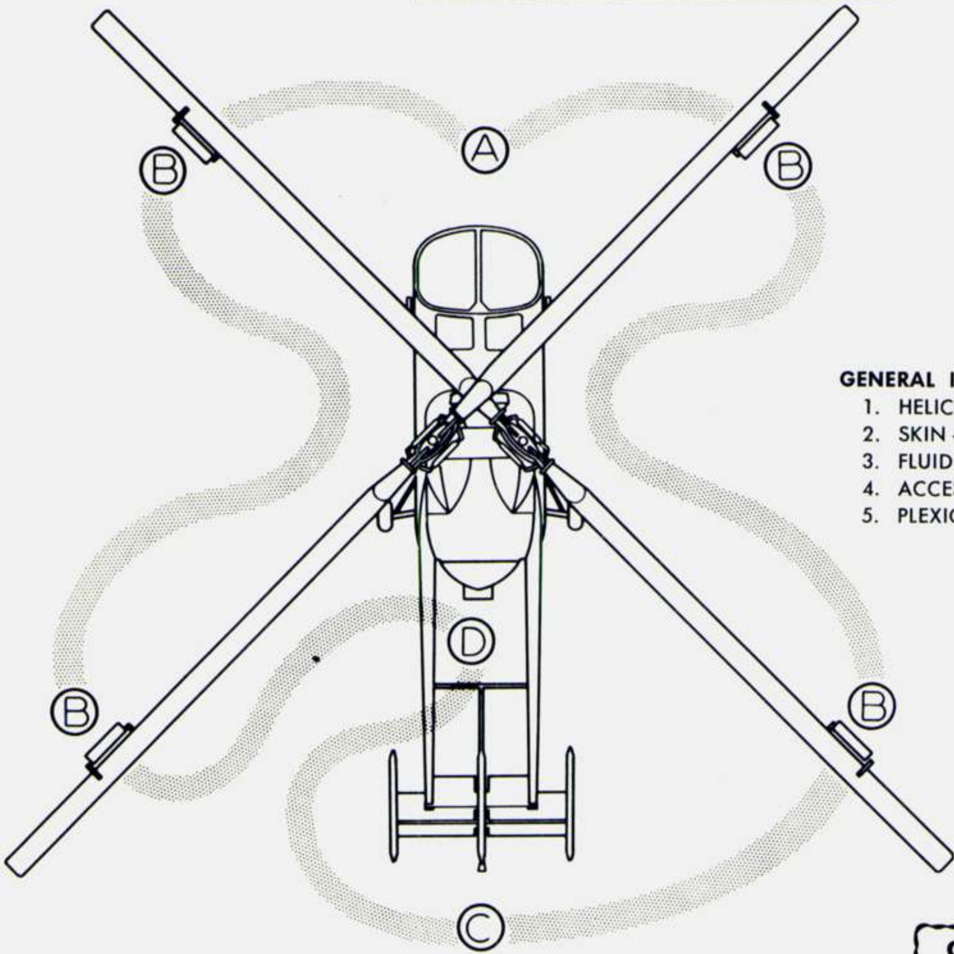
Accomplish the exterior inspection as shown in figure 2–1.

### INTERIOR INSPECTION (ALL FLIGHTS).

1. Cargo and loose equipment – Secured.
2. Left sliding door – Climatic.
   On solo flights open or close door as desired, depending on anticipated weather. The left door cannot be reached from the pilot's seat.

CONTINUED ON NEXT PAGE

# Exterior Inspection




**GENERAL ITEMS — ALL AREAS**

1. HELICOPTER — CLEAN.
2. SKIN — NOT CRACKED.
3. FLUID LEAKS — NO INDICATION.
4. ACCESS DOOR AND PANELS — SECURED.
5. PLEXIGLAS — CLEAN AND NOT CRACKED.

**A. NOSE**

1. FORWARD LANDING GEAR STRUTS — INFLATED AND NOT DAMAGED.
2. TIRES — INFLATED.
3. PITOT TUBE COVER — REMOVED.
4. BATTERY — CONNECTED.
5. NOSE DOOR LATCH — SECURED.
6. (HOK-1 ONLY) AIR INTAKE COVER — CLIMATIC
   - INSTALLED WHEN ICING CONDITIONS OR TEMPERATURES BELOW —9.4°C (15°F) ARE ANTICIPATED
   - REMOVED WHEN ANTICIPATED OAT ABOVE 10°C (50°F)

**B. ROTORS**

1. COVERS — REMOVED.
2. BLOCKS — REMOVED.
3. HUBS, BLADES AND FLAPS — SECURE AND NOT DAMAGED.
4. DROOP STOPS — IN.
5. BLADES — NOT FOLDED AND PROPERLY EXTENDED FROM FOLDED POSITION.

**CAUTION**

TO AVOID EXCESSIVE STRESSES ON THE BLADES, DISENGAGE THE DROOP STOPS BEFORE ANY BLADE HANDLING, AND DO NOT FLEX THE BLADES MORE THAN 12 INCHES AT THE BLADE TIPS. DO NOT ROTATE THE BLADES WHEN THE DROOP STOPS ARE DISENGAGED. BE CERTAIN THAT DROOP STOPS ARE IN AT THE COMPLETION OF INSPECTION.

**C. TAIL**

1. STABILIZER GUST LOCK — REMOVED.
2. TAIL SURFACES — SECURE AND NOT DAMAGED.
3. FRICTION DAMPER — SET.
4. ANTENNA MOUNTING — SECURE.

**D. AFT FUSELAGE**

1. FUEL CELL FILLER — SERVICED AND CAP SECURED.
2. AFT LANDING GEAR STRUTS — INFLATED AND NOT DAMAGED.
3. WHEEL BRAKES — NO LEAKS.
4. ENGINE OIL TANK — SERVICED AND CAP SECURE.
5. TRANSMISSION OIL TANK — SERVICED AND CAP SECURE.

*Figure 2—1*

## *PREFLIGHT CHECK* CONTINUED

3. First aid kit — Complete and secured.
4. Fire extinguisher — Serviced and secured.
5. Pilot's seat retaining pins — Installed.
6. Circuit breaker buttons — In.
7. Fuse covers — Tight.
8. Directional pedals positioning knob — Adjust.
   Position pedals to suit your leg length.
9. Directional pedals — Full and free travel.
10. Nose door interior latch — Latched.
11. Lap belt and shoulder harness — Secured.
12. All electric switches — OFF.
13. Collective stick — Full and free travel, then DOWN.
14. Cyclic stick — Full and free travel, then NEUTRAL.
15. Wheel brakes — OFF.
    Except for shipboard operation, or operation from rough or sloping terrain.
16. Nose wheel lock — UNLOCKED.
    Except for shipboard operation, or operation from rough or sloping terrain.
17. Throttle — Full and free travel, then CLOSED.
18. Throttle friction nut — Adjust.
    Apply sufficient friction to prevent creeping.
19. Mixture control lever — Full and free travel, then IDLE CUTOFF.
20. Carburetor air control lever — COLD.
21. Carburetor filter control — FILTERED.
22. Clutch control lever — DISENGAGE.
23. Rotor brake control handle — ON.
24. Clock — Set.
25. Altimeter — Set.

### INTERIOR INSPECTION (NIGHT FLIGHTS).

The items listed below must be checked in addition to those listed in the Interior Inspection (All Flights).

**Note**

Have external power connected before starting inspection. Be certain that the battery and generator switch is OFF when external power is connected. If external power is not available, avoid prolonged checks to conserve battery power.

1. Cabin dome light — Check.
2. Console light rheostat — Check.
   Check through full range from OFF to BRIGHT.
3. Flight instrument rheostat — Check.
   Check through full range from OFF to BRIGHT.
4. Console floodlight — Check.
   Check through full range with flight instrument rheostat on.

CONTINUED ON NEXT PAGE

## PREFLIGHT CHECK CONTINUED

5. Map light – Check.
   Removable map light is located on cabin ceiling.
6. Non-flight instrument rheostat – Check.
   Check through full range from OFF to BRIGHT.
7. Position light switches – Check.
   Check BRIGHT, DIM, STEADY and FLASH positions.
8. Fuselage lights switch – Check.
   Check BRIGHT and DIM positions.
9. Landing lights – Check.
   Check operation of extending and retracting switch and the ON-OFF switch.

**Note**

The landing light will not go on until it is slightly extended.

10. Flashlight – Aboard.

# BEFORE STARTING ENGINE

1. External d-c power – Have connected.

**CAUTION**

To avoid the danger of fire caused by accidental reversal of external power polarity, keep the battery and generator switch OFF whenever external power is connected.

**Note**

To conserve battery power, use external power, if available, for all pre-flight checks and for engine starting. All electrical equipment will operate when the external power source is connected.

2. Inverter switch – NORMAL.
3. Gyro horizon – Cage.

**CAUTION**

The gyro must be caged immediately after power is supplied to the indicator. Pull out the caging knob, and hold the knob in the extended position until the horizon bar and bank index cease to oscillate.

4. Fuel quantity gage test switch – Press.

**WARNING**

If the pointer moves unevenly or sticks during the test of the fuel quantity indicator, do not proceed with the flight. Shut down, and report deficiency to appropriate maintenance personnel.

CONTINUED ON NEXT PAGE

## BEFORE STARTING ENGINE CONTINUED

5. Fuel quantity gage – Check fuel quantity.
   Sufficient for planned mission.
6. Fuel shutoff switch – ON.
7. Fuel boost pump switch – ON.[1]
8. Engine gage unit – Check fuel pressure.
   Should be in desired range (refer to Section V). Steady fluctuation is normal.

**Note**

The alternate grades of fuel shown in the servicing diagram (figure 1–24) are equal alternates. The engine operating limits in Section V apply to operation with any of the alternate grades.

## STARTING ENGINE

**CAUTION**

If the helicopter is moored, do not start engine or engage clutch and rotors with the fuselage and landing gear tiedown lines secured so tightly that no shock strut action is possible.

1. Throttle – Closed.
   Recheck.
2. Throttle friction nut – Applied.
   Recheck.
3. Starter switch – Press for 5 seconds
   This will clear engine lower cylinders of any accumulated fuel or oil.

**CAUTION**

Any sign of hesitation or stopping may indicate hydraulic lock. Have ground crew remove spark plugs and check for excessive accumulation of fuel or oil.

4. Mixture control lever – FULL RICH.
5. Ignition switch – BOTH.
6. Starter switch – Press.

**CAUTION**

To prevent overheat damage to the starter, do not press starter switch continuously for more than 30 seconds. Wait 3 to 5 minutes before actuating starter switch again.

7. Fuel prime switch – PRIME.

   Use simultaneously with starter switch as necessary. Less priming is needed if engine is hot from previous operation. Refer to Section IX for cold weather starting.

   If the engine fails to start because of overpriming, use the following procedure to clear the engine:

   a. Ignition switch – OFF.
   b. Fuel shutoff switch – OFF.

[1] On BUNOS 125528 thru 139998 prior to the incorporation of ASC 70, the fuel boost pump switch has ON, AUTO and OFF positions.

CONTINUED ON NEXT PAGE

## STARTING ENGINE CONTINUED

c. Fuel boost pump switch – OFF.
d. Mixture control lever – IDLE CUTOFF.
e. Throttle – OPEN.
f. Starter switch – ON.
As necessary to clear flooded condition.
g. Repeat starting procedure.

8. Throttle – 1000 to 1100 rpm.
Maintain this engine speed until engine oil pressure becomes stabilized within the desired operating range, and until engine oil has reached minimum temperature (refer to Section V).

**CAUTION**

The engine is extremely sensitive to throttle movement when the clutch is disengaged. A few degrees of throttle movement can cause overspeed damage to the engine. Do not exceed 1800 rpm with clutch disengaged.

9. Engine oil pressure gage – Check.

**CAUTION**

If oil pressure does not register within 30 seconds, shut down and report the deficiency to appropriate maintenance personnel.

10. Fuel boost pump switch – OFF, then ON.
Place switch in OFF long enough to check the pressure gage and make certain that the engine-driven fuel pump is maintaining desired operating pressure (refer to Section V).
11. Manifold pressure gage drain valve – Press.
Press for 5 to 10 seconds.

# ENGINE GROUND OPERATION

### ENGAGING CLUTCH AND ROTORS.

1. Shoulder harness inertia lock control – DOWN.
2. Helicopter heading – Check.
Refer to Section V for limitations on maximum wind for engaging clutch and rotors.
3. Engine oil temperature gage – Recheck.
Refer to Section V for minimum oil temperature for engaging clutch and rotors.
4. Area – Cleared.
5. Throttle – 1400 to 1500 rpm.
6. Rotor brake control – OFF.
7. Clutch control lever – ENGAGE.
Wait momentarily for initial engagement to occur.

CONTINUED ON NEXT PAGE

## ENGINE GROUND OPERATION CONTINUED

**Note**

Because of normal clutch plate slippage, engagement takes place in two stages. Initial engagement is the first stage, and is indicated by decreased engine speed and increased rotor acceleration. Full engagement is the second stage, and is indicated by synchronization of the dual tachometer needles.

If initial engagement does not occur within 5-10 seconds, increase engine speed slowly until initial engagement occurs. Refer to Section V for maximum permissible engine speed for initial engagement.

**Note**

Initial engagement under increasing engine speed should cause engine speed to drop below the maximum permissible engine speed for full engagement as listed in Section V.

**CAUTION**

If clutch plate drag causes the rotors to exceed 20 rpm without obtaining initial engagement, place the clutch control lever to DISENGAGE, and apply the rotor brake to stop the rotors. Repeat engaging process. Continued operation without initial engagement may cause overheat damage to the clutch plates.

After initial engagement occurs, increase power until the clutch has reached full engagement. Check tachometer to make certain that the clutch has reached full engagement within the permissible rpm limit (refer to Section V).

8. Clutch oil pressure gage – Check.
9. Transmission oil pressure gage – Check.
10. External d-c power – Have disconnected.
11. Battery and generator switch – ON.[1]

**WARMUP.**

1. Carburetor air lever – Climatic.
   Keep mixture temperature in desired range.
2. Throttle – Increase.
   Operate engine at speed slightly above the speed at which full engagement occurred. Operate at this speed until engine oil, cylinder head and transmission oil temperature gages are in the desired operating range.

**Note**

The droop stops do not disengage until rotor reaches 100-130 rpm. In rough or gusty winds, running the rotors with the droop stops engaged may cause roughness. Reduce roughness by increasing rpm until the droop stops disengage.

**CAUTION**

Use care to avoid inadvertent flight during warmup.

[1] On HOK-1 helicopters, the battery and generator switch has ON and OFF positions only. On HUK-1 helicopters, the battery and generator switch has three positions: BAT & GEN, OFF, and BAT ONLY. When operating HUK-1 helicopters, place the switch to BAT & GEN position whenever the ON position is called for in this manual. Use of the BAT ONLY position is covered in Section I and Section III.

CONTINUED ON NEXT PAGE

## ENGINE GROUND OPERATION CONTINUED

### BEFORE TAXIING.

1. Throttle – 2000 rpm.
2. Engine, clutch, and transmission gages – Check.
3. Droop stops – Check.
   Should be out. Droop stops can be seen through cabin ceiling windows.
4. Cyclic stick – Correct response at rotors.
5. Directional pedals – Correct response at rotors.

**Note**

Use only slight stick and foot pedal movement to avoid inadvertent flights.

6. Rotor tip paths – Check track.
7. Ignition system – Check.
   Place ignition switch to L, and return to BOTH. Place switch to R, and return to BOTH. The dropoff on either L or R switch position should not exceed 100 rpm, and there should be no roughness on either magneto. The difference in the left or right magneto drop should not be greater than 40 rpm.

**Note**

If dropoff exceeds 100 rpm, recheck the magneto at 2200 rpm. If dropoff still exceeds 100 rpm, shut down and investigate.

**CAUTION**

Use collective stick as necessary when checking magnetos at higher rpm to avoid inadvertent flight.

8. Voltammeter – Check.
   Check generator output (28 volts). Place a load on the electrical system and note rise in ammeter reading.
9. Carburetor air lever – Check response.
   Place lever to HOT, engine rpm should drop. Return lever to cold, previous rpm should be restored.
10. Clutch system – Check freewheeling.
    Retard the throttle quickly. Tachometer needles should separate quickly when the throttle is retarded, with the dropoff occurring in the engine rpm needle.

**CAUTION**

Do not idle engine with clutch engaged. Clutch internal oil pressure will be low and may result in slippage and damage to the clutch.

11. Radios and intercom – Check operation.
    Refer to Section IV.
12. If taxiing or takeoff is to be delayed, refer to procedures for disengaging clutch and rotors.

## TAXIING

1. Area – Clear.
2. Parking brake handle – OFF.
3. a. Throttle – 1900 to 2000 rpm.
   b. Collective pitch lever – INCREASE.
   Perform simultaneously with step a to obtain 20 to 21 inches of manifold pressure. (20 to 21 inches is normal, but may be varied as necessary.)

**Note**

At these power settings the helicopter is stable on the wheels, yet can be lifted off the ground should the need arise, and the collective pitch lever is positioned so as to permit adequate directional control.

4. Cyclic stick – As required.

   Govern ground speed by fore-and-aft movement of the cyclic stick, using brakes if required. Maintain directional control by use of the brakes and directional pedals. Use lateral cyclic as necessary to assist in turn.

   When taxiing crosswind, apply cyclic stick into the wind. The amount of stick displacement will vary with the velocity of the crosswind. Avoid excessive displacement of the cyclic stick.

**CAUTION**

- Keep taxi speed under 10 knots ground speed in confined areas and on rough surfaces to avoid possibility of collision.
- Use extreme caution when taxiing in crosswinds in excess of 10 knots, as directional control may be difficult to maintain.
- While it is possible for this helicopter to taxi rearward, the maneuver requires a thorough understanding of the helicopter because of the methods employed for swiveling the forward landing gear wheels and for avoiding problems caused by sudden stoppage of the rear landing gear wheels in soft terrain. It is recommended that this maneuver be avoided until you are thoroughly acquainted with the helicopter's flight characteristics.

5. Instruments – Check operation.
   a. Magnetic compass.
   b. Gyro-magnetic compass.
   c. Turn and bank indicator.

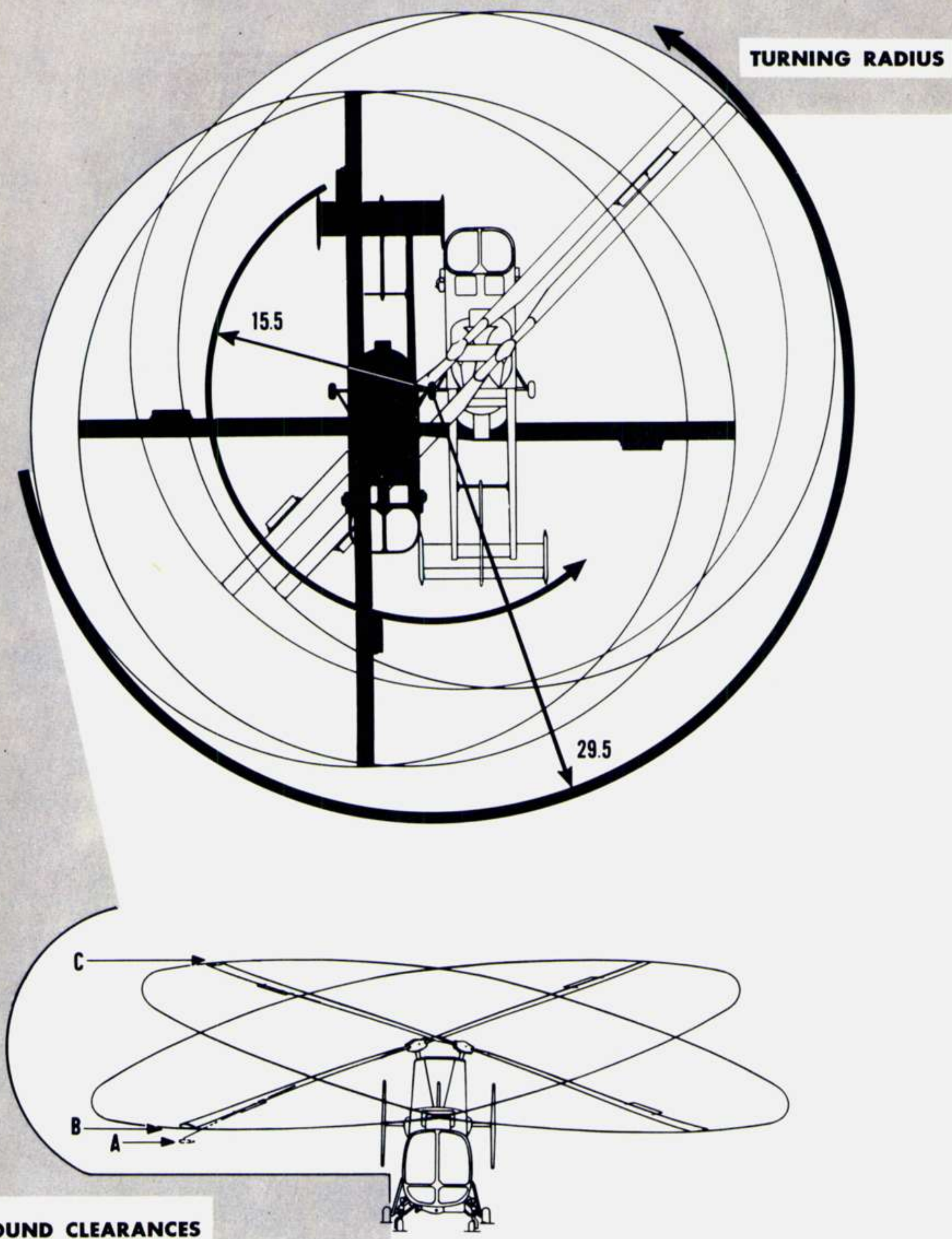
## BEFORE TAKEOFF

1. Pilot's check list – Check.

   Check all items as shown in figure 2–2 for proper control position, etc., as described in earlier paragraphs of this section.
2. Pitot heater switch – Climatic.

   ON if icing conditions exist.
3. Area – Clear.
4. Crew and passengers – Ready.
   Check each person.

## Turning Radius and Ground Clearances




**GROUND CLEARANCES**

A. 6 FEET 11 INCHES (AGAINST DROOP STOP)
B. 8 FEET 4 INCHES (NEUTRAL)
C. 16 FEET 11 INCHES (NEUTRAL)

*Figure 2—2*

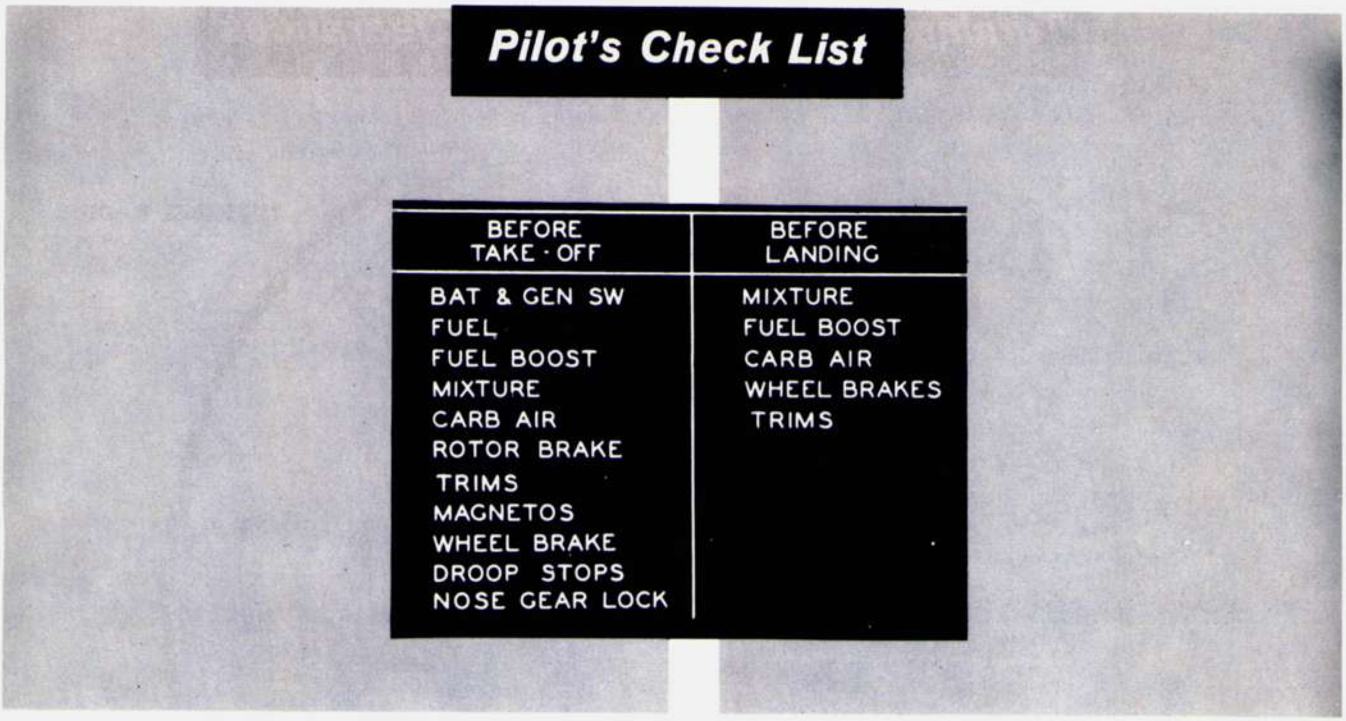



*Figure 2—3*

## TAKEOFF

The following procedures will produce the results indicated in Appendix I.

### NORMAL TAKEOFF.

1. Throttle — 2200 rpm.
2. a. Collective pitch lever — Increase.
   Increase setting until helicopter becomes light on landing gear; perform simultaneously with step 1.
   b. Cyclic stick — As necessary.
   Keep helicopter laterally and longitudinally level.
   c. Directional pedals — As necessary.
   Maintain heading into wind.
3. Collective pitch lever — Increase.
   Increase setting until helicopter is approximately 10 feet above ground.
4. Throttle — 2200 rpm.
   Perform simultaneously with step 3.

**WARNING**

Carbon monoxide concentration in cabin may increase rapidly when hovering with right side to windward with cabin doors either open or closed.

### MAXIMUM PERFORMANCE TAKEOFF.

Maximum takeoff performance is obtained by following normal takeoff procedure, but using maximum power (see Section V), with an increased rate of collective stick up movement and forward cyclic stick application to obtain vertical rise and forward airspeed as quickly as possible.

CONTINUED ON NEXT PAGE

## TAKEOFF CONTINUED

### ROLLING-TYPE TAKEOFF.

When operating at high gross weights, pressure altitudes or outside air temperatures, running take-offs, may be required. The takeoff should be made into the wind when practicable.

**CAUTION**

Surface irregularities may cause excessive helicopter vibration or landing gear damage during ground run.

1. Wheel brakes – OFF.
2. Nose wheel lock knob – UNLOCKED.
3. Runway – Clear.
4. Throttle – 2250 rpm.
5. Collective pitch lever – Increase.
   Increase setting to obtain maximum manifold pressure (or maximum attainable). Perform simultaneously with step 4.

CONTINUED ON NEXT PAGE

## Normal Takeoff Procedure

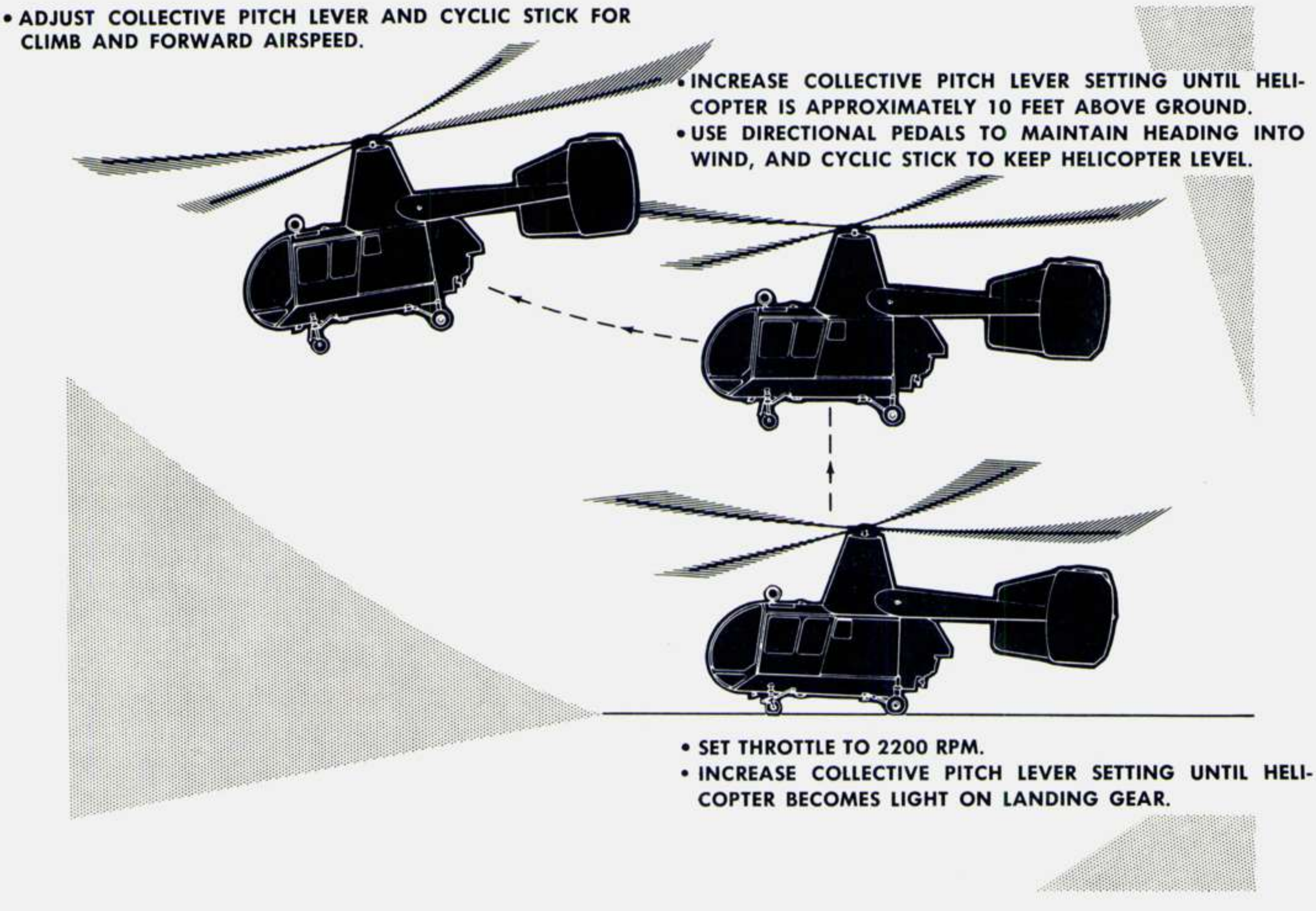



Figure 2–4

## TAKEOFF CONTINUED

6. Cyclic stick – FORWARD.
   As required to start ground run, and then to obtain desired takeoff speed.
7. Directional pedals – As necessary.
   Maintain heading; perform simultaneously with step 6.
8. Cyclic stick – AFT.
   When desired takeoff speed is reached, move cyclic stick aft as necessary to become airborne.

**Note**

If helicopter becomes airborne prior to reaching best climb airspeed, maintain level flight, if conditions such as terrain permit, until that speed is reached.

See Appendix I for takeoff distances and maximum gross weight for rolling-type takeoff.

## AFTER TAKEOFF CLIMB

Refer to the climb data in Appendix I, and to figure 5–3, which indicates safe operating altitudes for various airspeeds. The following procedure will produce the results indicated in Appendix I.

1. Throttle – 2200 rpm.
   Coordinate with step 2.
2. Collective pitch lever – Adjust.
   Maintain 33.0 manifold pressure; coordinate with step 1.

**Note**

The above settings are for normal climb. For maximum climb, use 2250 rpm and 36.5 manifold pressure for 5 minutes, and then reduce to 2200 rpm and 35.0 manifold pressure for remainder of climb.[1]

3. Cyclic stick – As necessary.
   Maintain approximately 45 knots IAS.

## CLIMB

Continue the after takeoff climb until the desired altitude is reached.

## CRUISE CHECKS

Refer to Section VII.

## FLIGHT CHARACTERISTICS

Refer to Section VI.

[1] HOK-1 helicopter only. In HUK-1 helicopters maximum climb is accomplished using 2250 rpm and 36.0 manifold pressure for 5 minutes, and then using 2200 rpm and 34.6 manifold pressure for remainder of climb. Refer to Section V.

# DESCENTS

Descent is accomplished by reducing the collective pitch lever setting, while maintaining 2050 to 2150 rpm with the throttle. Maintain desired heading at 50 to 55 knots IAS by using cyclic stick and directional pedals.

# BEFORE LANDING

1. Carburetor air lever – Climatic.
   Use as necessary to keep mixture temperature out of icing range.
2. Pitot heater switch – Climatic.
   ON as necessary to prevent icing of the pitot tube.
3. Mixture lever – Adjust.
   FULL RICH, or MANUAL LEAN if landing at altitude.
4. Wheel brakes – OFF.
5. Nose gear lock – OFF.
6. Trim controls – As necessary.
   Trim requirements will vary with weight and center of gravity location.

**WARNING**

To prevent fuel exhaustion when operating with minimum available fuel, avoid uncoordinated flight.

# LANDING

## NORMAL LANDING.

1. Helicopter – Zero ground speed.
   Use aft movement of cyclic stick to reduce ground speed to zero at 3 to 10 feet altitude.

**CAUTION**

Avoid excessive angles of flare, which can cause tail surfaces to strike ground.

2. Helicopter – Establish hover.
   Establish hover by use of collective pitch lever, while maintaining 2200 rpm with the throttle. Use cyclic stick and directional pedals to maintain heading into wind.
3. Helicopter – Establish vertical descent.
   Reduce collective pitch lever setting for desired rate of vertical descent until ground is contacted. Maintain 2200 rpm during vertical descent.
4. Collective pitch lever – DOWN.
5. Throttle – Reduce.

CONTINUED ON NEXT PAGE

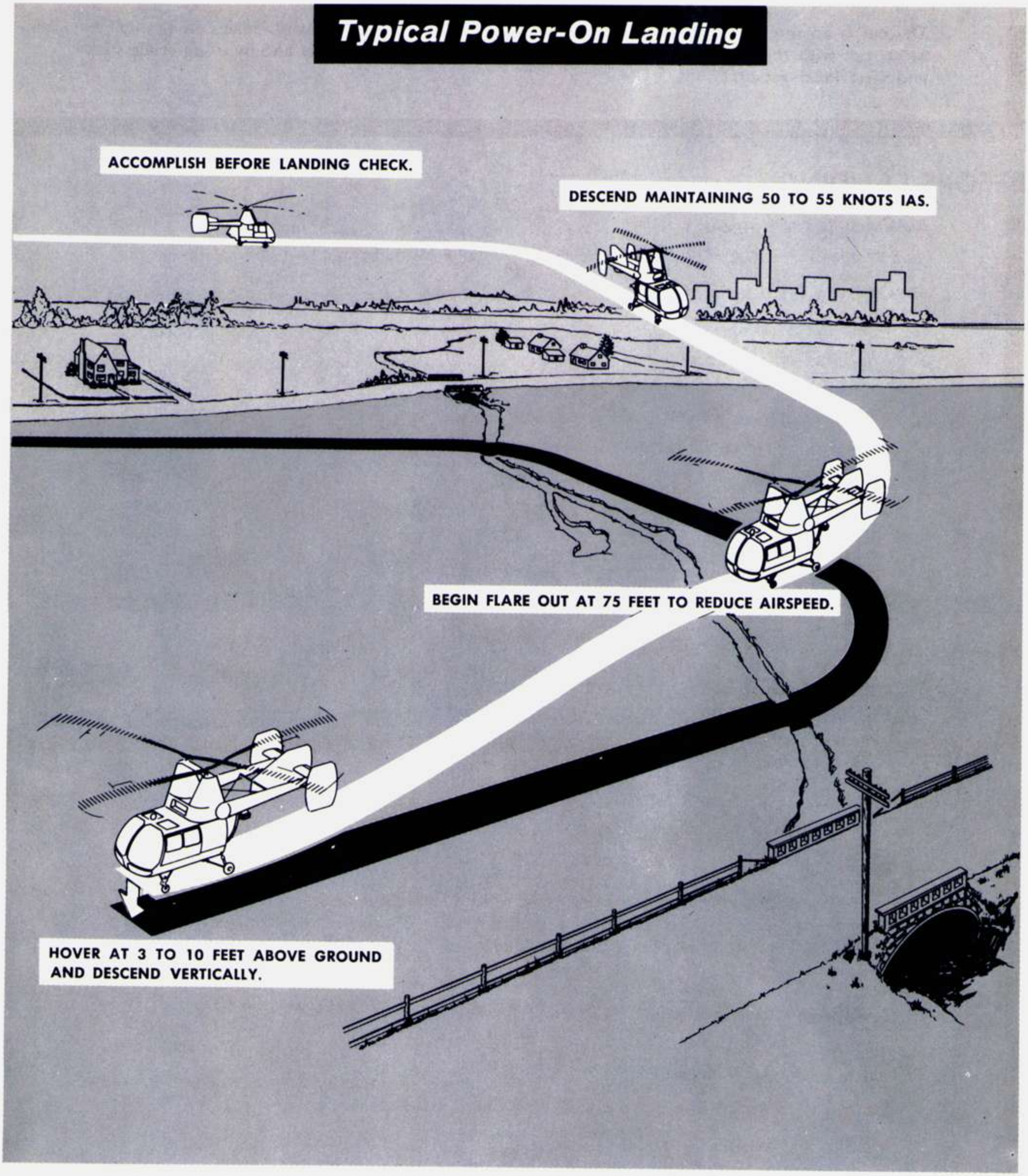

Typical Power-On Landing
ACCOMPLISH BEFORE LANDING CHECK.
DESCEND MAINTAINING 50 TO 55 KNOTS IAS.
BEGIN FLARE OUT AT 75 FEET TO REDUCE AIRSPEED.
HOVER AT 3 TO 10 FEET ABOVE GROUND
AND DESCEND VERTICALLY.

Figure 2—5

## LANDING CONTINUED

**CROSSWIND LANDING.**
Refer to Section VI.

**LANDING IN TURBULENT AIR.**
Refer to Section VI.

**RUNNING LANDING.**

**CAUTION**

Make running landings only on runways known to be free of obstructions and surface irregularities that may damage the landing gear and the helicopter.

1. Parking brake control – OFF.
2. Wheel brake pedals – OFF.
3. Nose gear lock – OFF.
4. Cyclic stick – Maintain 45 knots IAS.
5. Collective pitch lever – Establish glide path.
6. Cyclic stick – AFT for 15 to 20 knots IAS at about 10 feet altitude.
7. Wheel brake pedals – ON.
   Use wheel brakes to control direction after ground contact, and to stop forward movement.
8. Collective pitch lever – DOWN.
9. Throttle – Reduce.

## GO-AROUND

Apply maximum power while maintaining rpm and acquire forward airspeed and altitude.

## AFTER LANDING

**DISENGAGING CLUTCH AND ROTORS.**

**CAUTION**

Do not idle engine with clutch in ENGAGE position, since clutch drag may cause overheat damage to the clutch plates. If extended ground running is necessary with clutch engaged and rotors turning, make certain that enough throttle is applied to keep clutch engaged (needles synchronized).

1. Helicopter – Head into wind.
2. Throttle – CLOSED.
3. Clutch lever – DISENGAGE.
   After needles split.

**CAUTION**

Severe damage may result, especially during windy conditions, if droop stops are not IN at low rpm. If droop stops do not come in by 85 rpm, re-engage clutch then repeat disengaging procedure after requesting ground crew to hit droop stops in if necessary (droop stops can be hit in by using a stick of suitable length).

CONTINUED ON NEXT PAGE

## AFTER LANDING CONTINUED

4. Droop stops — Check.
   Should be in.
5. Rotor brake control — ON.
   Apply rotor brake after rotor speed is reduced to 100 rpm.

**Note**

- If excessive rocking, usually caused by wind, soft struts and tires, or loose blade dampers, is encountered at low rotor speed while the rotor is decelerating, release wheel brakes. If necessary, as an additional corrective measure, release and re-engage rotor brake.
- If clutch re-engagement is required, do not re-engage when rotor speed is between 30 and 70 rpm as re-engagement may cause lag stops to hit hard during the engaging cycle. Re-engagement can be accomplished above or below these limits.
- Do not place clutch control lever to ENGAGE with rotor brake ON.

## ENGINE SHUTDOWN

1. Cabin heater switch — OFF.

**WARNING**

To prevent fire in cabin heater ducts, place switch to OFF at least 2 minutes before completing engine shutdown. Refer to Section IV.

**Note**

Refer to Section IX for engine shutdown when oil dilution is required.

2. Cylinder head temperature — Below 200° C (400° F).
   Run engine at 1000 to 1100 rpm until cylinder head temperature is reduced.
3. Mixture lever — IDLE CUTOFF.
4. Fuel boost pump switch — OFF.
5. Fuel shutoff switch — OFF.
6. Ignition switch — OFF.

## BEFORE LEAVING THE HELICOPTER

1. Battery and generator switch — OFF.
2. All other electric switches — OFF.
3. Wheel brakes — As desired.
4. Nose gear lock — As desired.
5. Tiedown gear — Climatic.
   Secure helicopter if high wind conditions are anticipated.

# section III

# Emergency Procedures

## ENGINE FAILURE

Due to the equalization of torque between the two rotors, there will be no excessive yawing introduced by sudden engine failure.

### PARTIAL POWER LOSS.

**CAUTION**

Be prepared for complete engine failure.

Land as soon as practicable, unless the roughness necessitates an immediate autorotational landing.

### ENGINE SHUTDOWN PROCEDURE.

1. Fuel shutoff valve switch — OFF.
2. Battery and generator switch — OFF.
3. Ignition switch — OFF.
4. Mixture lever — IDLE CUTOFF.

### FAILURE BELOW 10 FEET ALTITUDE AND UNDER 26 KNOTS IAS.

1. Collective pitch lever — Increase setting.
   To cushion ground impact.
2. Engine — Shut down.

### FAILURE BELOW 10 FEET ALTITUDE AND OVER 26 KNOTS IAS.

1. Cyclic stick — Aft.
   To control altitude.
2. Collective pitch lever — As necessary.
   To control altitude.
3. a. Cyclic stick — Aft.
   As necessary to complete flare, coordinate with step b.

   b. Collective pitch lever — Increase.
   To cushion ground contact.
4. Engine — Shut down.

### FAILURE ABOVE 10 FEET ALTITUDE AND OVER 26 KNOTS IAS.

1. Engine — Shut down.
   Altitude permitting.
2. Helicopter — Autorotational landing into wind.

### ENGINE RESTART IN FLIGHT.

If the engine fails under normal flight conditions, it is unlikely that a restart can be accomplished in flight. It is usually better to make a safe landing rather than use precious time attempting a restart. Howevevr, if engine failure occurs at sufficient altitude to warrant an attempt at restarting the engine, the following procedure should be used:

1. Throttle — Barely open.
   Use minimum throttle in order to avoid engine surges and shock loads to the rotors.
2. Mixture lever — RICH.
3. Starter button — Press.
4. Prime switch — As required.

**Note**

After the engine starts, increase throttle gradually to obtain synchronization of the dual tachometer needles.

# Maximum Glide Distance

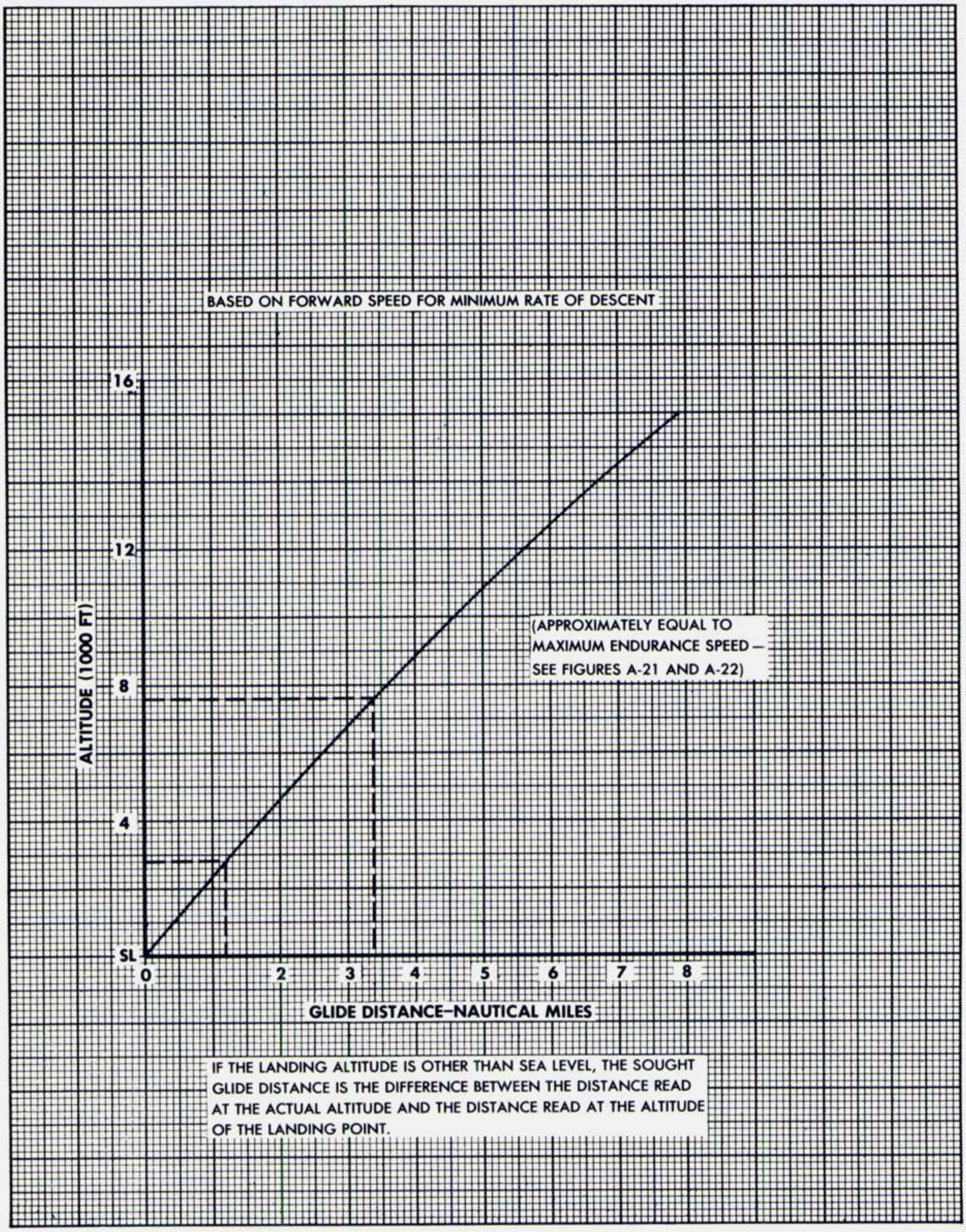



*Figure 3—1*

### MAXIMUM GLIDE DISTANCE.

Figure 3–1 shows the maximum distance which the helicopter will glide from a given altitude without power.

## PRACTICE AUTOROTATION

1. Collective pitch lever – Full down.
2. Throttle – Reduce for 1100 to 1200 rpm.

**Note**

It is characteristic of this helicopter that the nose will automatically pitch down when entering autorotation. It is not necessary, therefore, to apply forward cyclic. Apply a slight aft cyclic motion, which will help maintain rotor speed, and will reduce the possibility of excessive airspeed.

3. Cyclic stick – Maintain 55 to 60 knots IAS.
4. Cyclic stick – Aft.
   At approximately 75 feet, commence a mild flare to lose altitude and airspeed in order to reach 10 feet of altitude at zero knots ground speed (avoid extreme tail low attitudes.)
5. Throttle – Increase smoothly.
   The power recovery is made in the flare by smoothly marrying the needles at the start of the transition to avoid engine surge and excessive wear of the clutch.
6. Simultaneously:
   a. Cyclic stick – Forward.
   b. Collective pitch lever – Up.
   c. Throttle – Increase.

   Level the helicopter by easing the cyclic forward into a four-point attitude, and use throttle and collective to establish hover.

**Note**

The above procedure applies when a minimum wind condition exists. The procedure will vary slightly with changes in surface wind velocity.

## FIRE

### ENGINE FIRE ON STARTING – ENGINE NOT STARTED.

1. Ignition switch – BOTH.
2. Starter button – Continue to press.
3. Throttle – Open slightly.
   If fire is not drawn into the engine, release starter and follow emergency engine shutdown procedure.
4. Fire extinguisher – Discharge at fire.

### ENGINE FIRE ON STARTING – ENGINE STARTED.

1. Engine – Shut down.
2. Fire extinguisher – Discharge at fire.

### ENGINE FIRE DURING FLIGHT.

1. Engine – Shut down.
2. Helicopter – Land as soon as possible.
3. Fire extinguisher – Discharge at fire.

### ELECTRICAL FIRE – ON GROUND.

1. External power – Disconnect.
2. Battery and generator switch – OFF.
3. Fire Extinguisher – Discharge at fire.

### ELECTRICAL FIRE – DURING FLIGHT.

1. Battery and generator switch – OFF.
2. Helicopter – Land.
   As quickly as possible.
3. Cabin doors – Open.
   To disperse fumes.
4. Fire extinguisher – Discharge at fire.

### CABIN FIRE.

Follow the same procedure as for an electrical fire during flight.

## SMOKE AND FUME ELIMINATION

Open cabin doors for best ventilation.

## BAILOUT

Bailout is recommended only if uncontrollable fire, damage to the rotor system, or other circumstances make it impossible to ditch or to make an emergency landing.

1. Flight controls – Set for forward flight.
2. Passengers and Crew – Warn.
3. Cabin doors – Open.
   If doors will not slide open, they may be jettisoned by pulling the emergency release handles and pushing doors out.
4. Lap belt – Unfasten.
   This will also release the shoulder harness.
5. Passengers and crew – Dive out.
6. Pilot – Dive out.
   Dive as far as possible to clear helicopter.

**Note**

Free-fall clear of the helicopter before opening parachute.

## EMERGENCY LANDINGS

The procedures to be followed for emergency landings are outlined in the paragraphs on engine failure.

## DITCHING

### DITCHING WITHOUT POWER.

1. Helicopter – Autorotate at 60 knots IAS into the wind.
2. Passengers and Crew – Warn.
3. Radio – Distress procedure.
4. Cabin doors – Open.

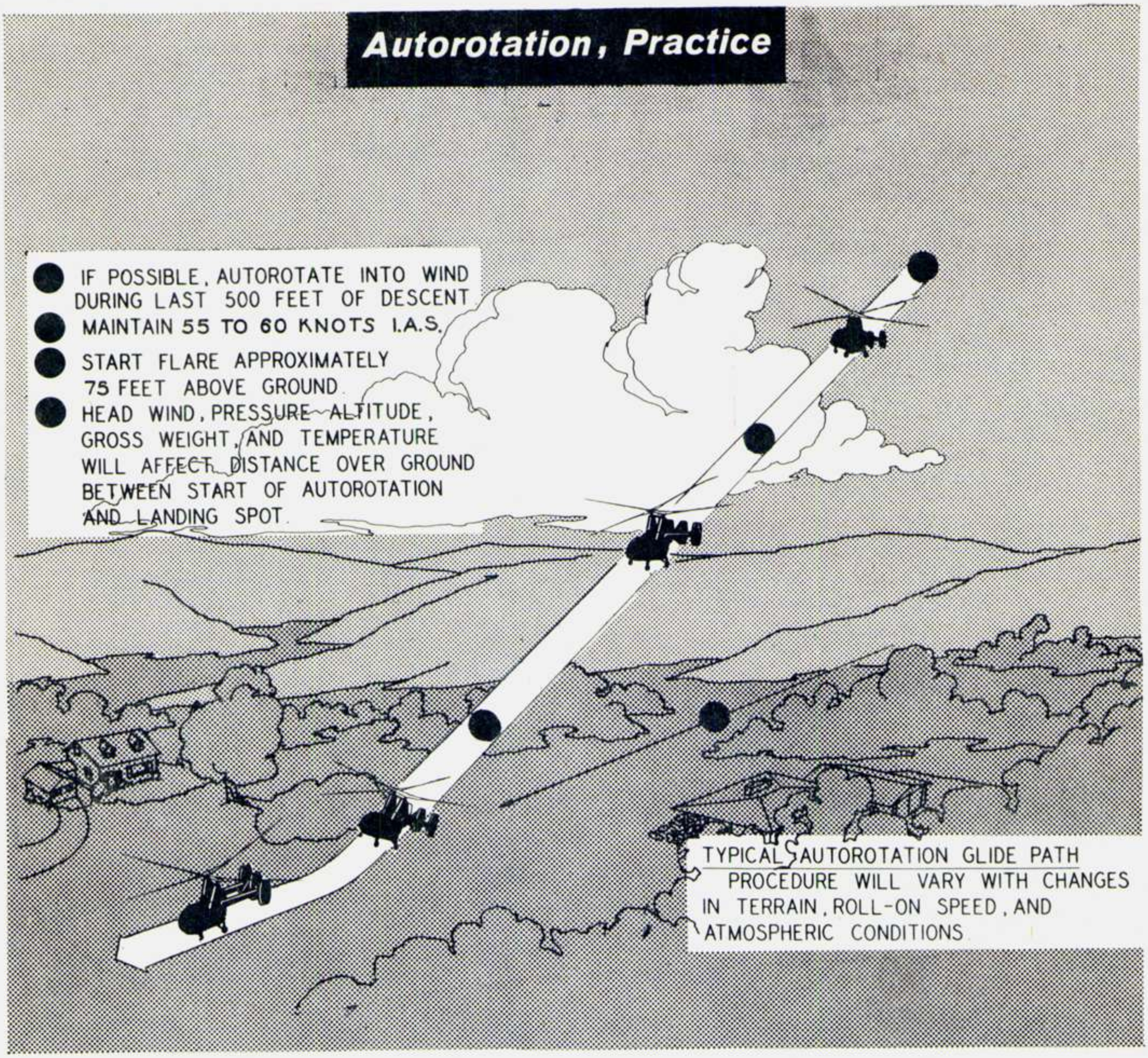



*Figure 3—2*

5. Survival gear — Prepare for jettison if time permits.
6. Inertia reel — Lock.
7. Parachute — Unbuckle if time permits.
8. Engine — Shut down.
9. a. Cyclic stick — As necessary.
   When 10 to 30 feet above water, apply aft cyclic to flare to zero water speed and to hold the helicopter laterally level. Coordinate with use of collective pitch lever.
   b. Collective pitch lever — Increase setting.
   To cushion water contact.
10. Rotor brake lever — ON (copilot).

**Note**

- Do not remove left hand from collective pitch lever to operate the rotor brake if copilot is not available, as collective pitch lever will creep to down position, even with full lever friction.
- Application of AFT cyclic pitch control will also stop rotors, by causing them to contact the water.

11. Flight controls — Maintain level attitude.
Maintain level attitude as long as possible, after which the helicopter will automatically roll and blades will be stopped by striking the water. This procedure will reduce rotor inertia and cause less violent reaction when blades strike water, stopping blades in shortest possible time.
12. Lap belt — Unfastened.
After rotors have stopped.
13. Survival gear — Jettison.
14. Personnel — Ditch.

**DITCHING WITH POWER.**

1. Passengers and crew — Warn.
2. Radio — Distress procedure.
3. Cabin doors — Open.
4. Survival gear — Prepare for jettison.
5. Inertia reel — Lock.
6. Parachute — Unbuckle.
7. Helicopter — Hover.
8. Survival gear (except pilot's) — Jettison.
If time permits, hover slightly over the water to disembark passengers and their survival gear; then proceed downwind at least 50 yards before ditching the helicopter.
9. Helicopter — Ditch.
Hover slightly above the water and settle into it, using UP collective pitch to ease the landing, and cyclic pitch control to hold the helicopter level.
10. Ignition switch — OFF.
11. Battery and generator switch — OFF.
12. Rotor brake lever — ON.
13. Flight controls — Maintain level attitude.
14. Lap belt — Unfasten.
After rotors have stopped.
15. Pilot survival gear — Jettison.
16. Pilot — Ditch.

## TRANSMISSION OIL PRESSURE LIGHT ON

1. Transmission oil pressure indicator — Check.
Confirm that oil pressure is low.
2. Helicopter — Land.
Land as quickly as possible. If altitude permits, autorotate at 90 knots IAS for fast rate of descent.

**Note**

Controlled turns during high speed autorotation will increase rate of descent.

3. If rotor rpm drops — Apply power.
4. If rotor rpm continues to drop — Bail out.

## CLUTCH OIL PRESSURE LIGHT ON

1. Clutch oil pressure indicator — Check.
Confirm that oil pressure is low.
2. Helicopter — Land as soon as possible.
If terrain does not permit immediate landing, use the following procedure to continue flight.
3. Dual tachometers — Check.
If the clutch oil pressure drops below the minimum red line, *further flight will be dependent upon the relationship of engine speed to rotor speed, as indicated on the tachometer.* If no separation of the needles is evident, flight may be continued taking all emergency precautions necessary to execute an immediate landing in a safe area.
4. Collective pitch lever — Gradually reduce to minimum for flight.
If the flight must be continued, make certain to maintain POWER-ON as any sudden reduction in engine power will separate the engine and rotor tachometer needles, indicating clutch disengagement. With low oil pressure, re-engagement cannot be assured and a forced autorotation landing may be required.
Gradually reduce engine power to the minimum required for flight. This will reduce the tendency for the clutch plates to slip due to the reduction in torque applied. Do not reduce rpm or split the tachometer needles when reducing power.
5. Airspeed — Maintain 50 knots IAS minimum.
This will simplify establishing autorotation, if required. Avoid flight conditions which may demand sudden power application.
6. Helicopter — Land as soon as possible.

## CLUTCH OIL PRESSURE HIGH

Clutch oil pressure in excess of the maximum red line limit may be attributed to a sticking oil pressure relief valve. Higher clutch pressures reduce the capability of the clutch to slip when excessive torque loads occur in the drive system due to engine surging or sudden power application. It is recommended that all unusual maneuvers and recoveries from autorotation be avoided under the above circumstances to eliminate the possible transmission of high torque loads to one rotor shaft rather than both. Keeping the foregoing restriction in mind, the flight may be continued if necessary to reach a safe emergency landing area, using care in the management of the engine and helicopter flight attitude.

1. Maneuvers — Avoid.
2. Autorotation — Avoid recovery.
3. Helicopter — Land as soon as possible.

# Emergency Equipment

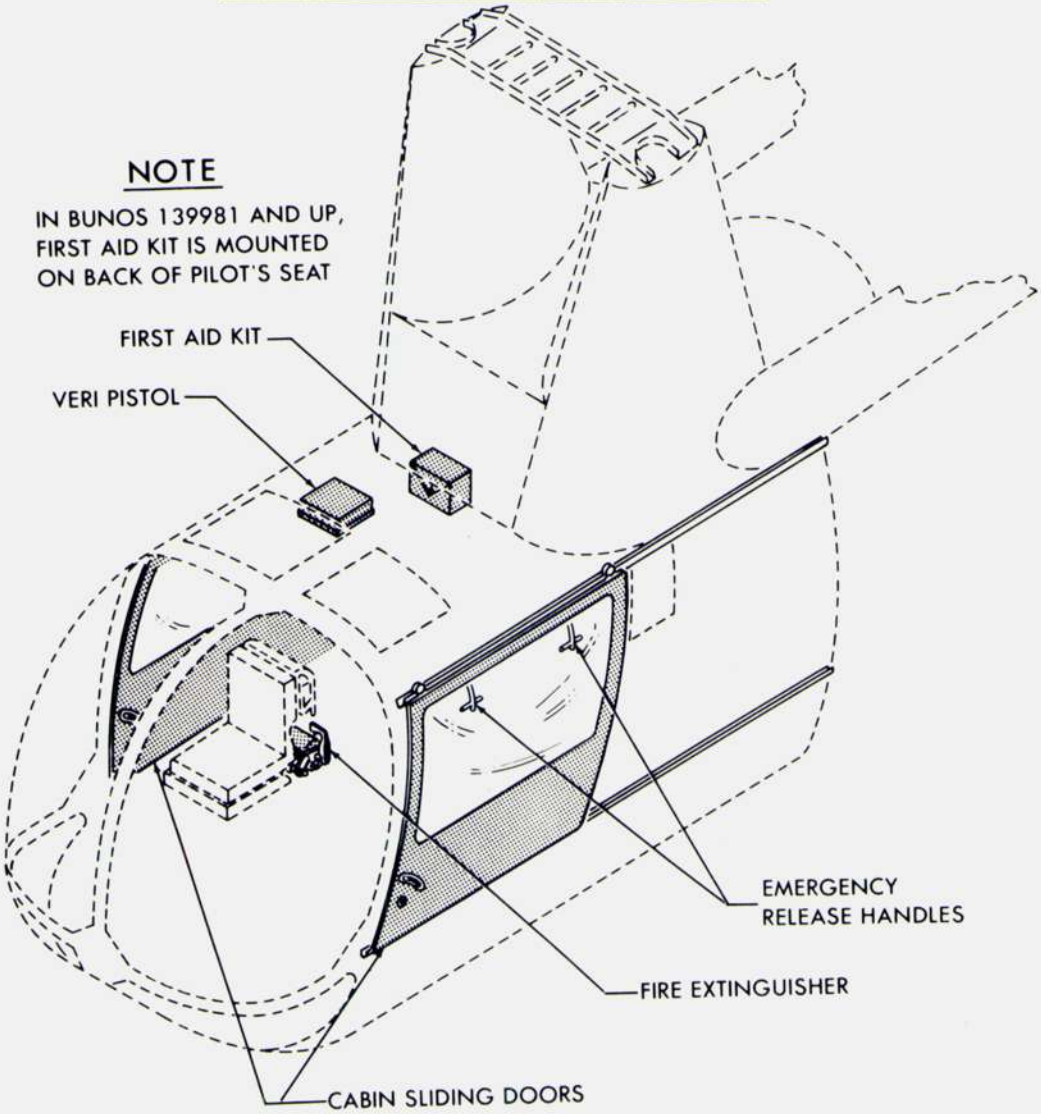



*Figure 3—3*

## D-C GENERATOR WARNING LIGHT ON

1. Generator field circuit breaker – Pull.
2. Nonessential electrical equipment – Off.[1]
   To conserve battery power.

## A-C INSTRUMENT POWER FAIL LIGHT ON

1. Inverter switch – STANDBY.
2. Light remains on – Pull inverter circuit breakers.

[1] In HUK-1 helicopters the secondary bus is automatically disconnected when the generator fails and the battery and generator switch is in the BAT & GEN position (see figure 1–21 for equipment operated off secondary bus). If it is necessary to operate any of the auxiliary equipment which receives its power from the secondary bus, place the switch in the BAT ONLY position.

## FUEL LOW LEVEL WARNING LIGHT ON

1. Pilot – Avoid uncoordinated flight.
2. Fuel quantity indicator – Check.
   Confirm fuel quantity.

**Note**

If indicator reading is high, check indicator operation using the press-to-test switch.

3. Flight plan – Check.
4. Helicopter – Land before fuel is exhausted.

# section IV
# Auxiliary Equipment

## HEATING, VENTILATING, AND ANTI-FOGGING SYSTEM

Ventilation air is supplied by the engine fan whenever the helicopter engine is operating (see figure 4—1). The air flows through a combustion chamber located in the lower right-hand side of the engine compartment. The heater is controlled by a 3-position (OFF-RUN-START) switch located on the console control panel (2, figure 4—2) aft of the radio control panel. Electrical power to operate the equipment is supplied from the 28-volt d-c bus (secondary bus on the HUK-1) and the cabin heat circuit breaker (see figures 1—22 and 1—23). The heated air is ducted through the firewall into the cabin and to the nose bubble for defogging. Air flow is controlled by the ventilation air knob (5, figure 4—2), which is located aft and to the right of the heater switch. When the knob is in the OPEN position, air is permitted to flow into the cabin and also to the nose bubble. When the knob is in the CLOSED position, the air flows to the nose bubble only.

The heater fuel supply originates at the pressure plug of the carburetor and passes through a filter, a solenoid-operated shutoff valve, a fuel metering valve located in the fuel control box, and feeds directly into the fuel vaporizer head of the heater (see figure 4—1). A portion of the incoming air flows into the combustion chamber, while the remaining air passes over or outside the chamber. The fuel-air mixture in the chamber is ignited by a glow plug, burns, and exhausts through the exhaust port in the right-hand side of the fuselage. The heat produced by this burning mixture is transmitted to the air flowing around the chamber. This air is then directed to the cabin and nose bubble. A ram air pressure switch, located on the fuselage shelf above and forward of the fuel control box, prevents the shutoff valve from opening when the air supply is not sufficient for continuous operation. When the heater is turned on, power is supplied to the glow plug and to the solenoid-operated fuel shutoff valve. Control of cabin temperature is maintained by two thermal cycling switches, mounted in the air duct, which cycle the temperature between 49° C (120° F) and 79° C (175° F). An additional overheat switch, mounted in the duct, shuts off the fuel supply if the air temperature exceeds 177° C (350° F).

### NORMAL OPERATION.

1. Engine speed — Operating range.
2. Cabin thermostat — As desired.
3. Heater control switch — START then RUN.
4. Ventilation air knob — As desired.

**WARNING**

To prevent overheating while residual fuel burns, turn off heater system at least 2 minutes prior to engine shutdown.

## PITOT HEATER

The pitot heater is an electrical resistance unit operating from the helicopter d-c supply. The unit is incorporated into the structure of the pitot tube and is used as necessary to deice the pitot tube.

# Heating, Ventilating, and Anti-Fogging System

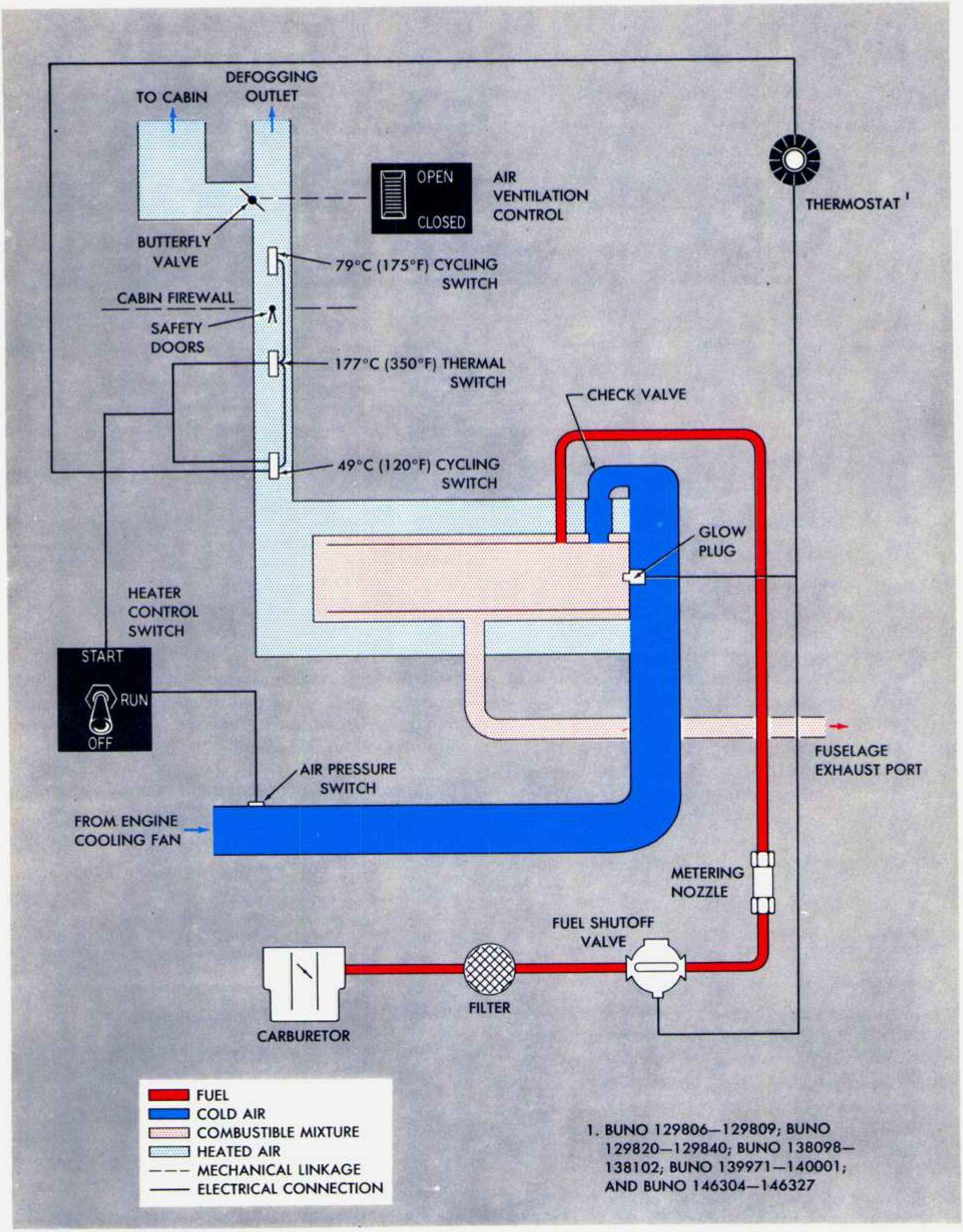
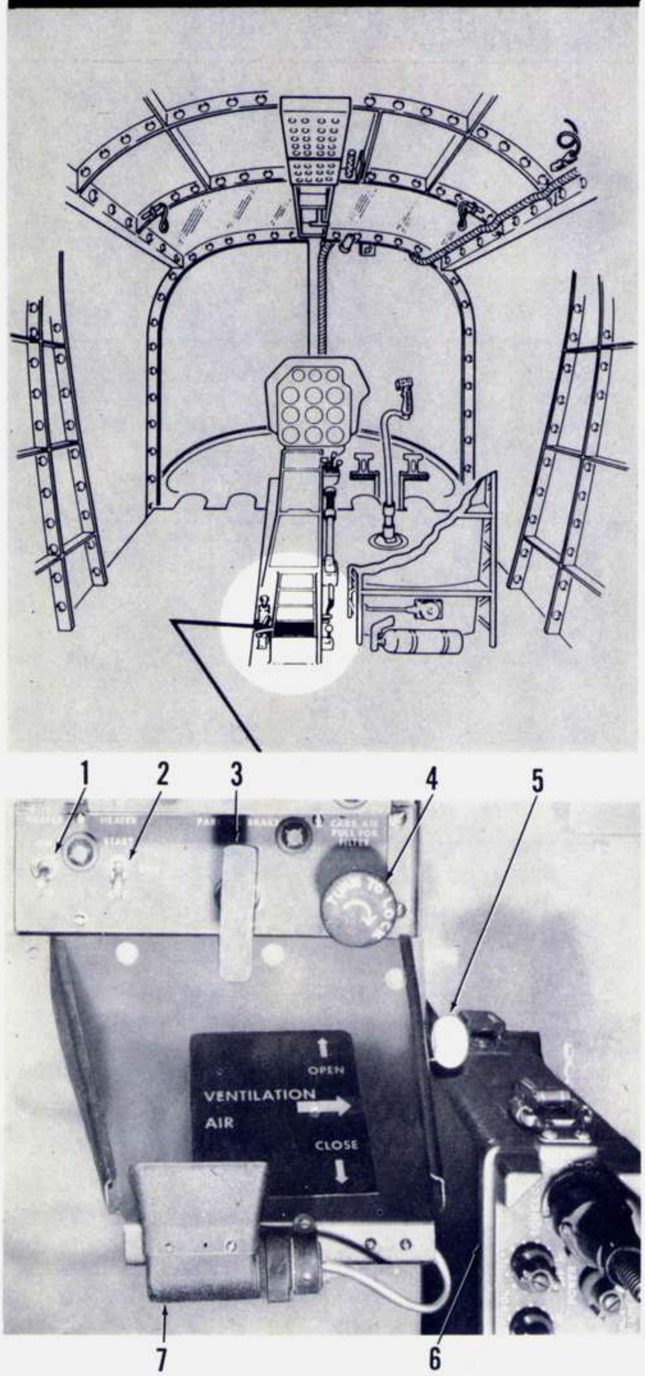



*Figure 4—1*

## Auxiliary Control Panels




1. PITOT HEATER SWITCH
2. CABIN HEATER SWITCH
3. PARKING BRAKE HANDLE
4. CARBURETOR AIR FILTER KNOB
5. AIR KNOB
6. AN/PRC RADIO SET (WHEN INSTALLED)
7. CONSOLE FLOODLIGHT

*Figure 4—2*

### PITOT HEATER SWITCH.

The pitot heater switch (1, figure 4—2) is located on the console panel and is a 2-position (ON-OFF) toggle switch. Electrical power to energize the switch and hence the heating unit is received from the 28-volt d-c bus (primary bus on HUK-1 helicopters) through the pitot heater circuit breaker (figures 1—22 and 1—23).

## COMMUNICATIONS AND ASSOCIATED ELECTRONIC EQUIPMENT.

This equipment provides radio reception and transmission of voice communication signals, radio reception of navigational information, and intercommunication between crew members. The equipment is located below the cabin floor, and is remotely controlled from the radio console. Figure 4—3 lists the equipment installed in the Model HOK-1 helicopter, and gives the basic characteristics of the installed equipment. Figure 4—4 lists and gives the basic characteristics of the equipment installed in the Model HUK-1 helicopter. Antennas are installed for all radio equipment, and are shown on figure 4—5.

Headsets and microphones for the pilot, copilot, and hoist operator are plugged into cord sets located on the cabin ceiling above their respective stations. Passengers' headsets and hand-held microphones are plugged into outlets (5, figure 4—6) in a control panel on the aft cabin ceiling. A rear observer's headset is connected to a receptacle located aft of the pilot's seat, near the console.[1]

The pilot's and copilot's sets are connected to the system by RADIO-ICS buttons on their cyclic stick grips. The ICS position of the buttons connects the microphones to the ICS circuits; the RADIO position connects the microphones to the radio circuits. The hoist operator's headset and microphone are connected to ICS by the ICS button on the hoist control grip; no provisions are made for connecting the hoist operator's set to the radio circuits. Passenger's and rear seat observer's sets are connected to either ICS or radio circuits by the RADIO-ICS switch (6, figure 4—6) on the aft cabin ceiling. Press-to-talk buttons on their microphones must be pressed to enable the passengers and observer to transmit over either radio or ICS.

### ICS (INTERCOMMUNICATION SYSTEM) EQUIPMENT — HOK-1.

**Description.** The intercommunication system provides for speech communication between all crew members and passengers. The system is turned on by the OFF-VOL knob on the UHF control panel (see figures 4—8 and 4—14). ICS volume is not adjustable by the flight crew; if volume is not satisfactory, notify maintenance personnel. Electrical power to operate the system is received from the 28-volt d-c bus through the radio circuit breaker on the circuit breaker panel (figure 1—22).

[1] Observer's receptacle is provided in HOK-1 aircraft only.

# Communications and Associated Electronic Equipment - HOK-1

| TYPE | DESIGNATION | FUNCTION | OPER-ATOR | RANGE | LOCATION OF CONTROLS | EFFEC-TIVITY |
|---|---|---|---|---|---|---|
| INTERCOM-MUNICATION SYSTEM (ICS) | 44100 (TEXAS IN-STRUMENTS INC.) OR AW-86-2 (PER-MOFLUX, INC.) | COMMUNICA-TION BETWEEN CREW | PILOT AND COPILOT | INTERIOR OF HELICOPTER | OFF-VOL CONTROL ON UHF COMM PANEL (ENERGIZES ICS; VOLUME NOT CONTROLLABLE) | ALL HOK-1 |
| UHF COMMUNI-CATION | A.R.C. TYPE 12 (TV-10 TRANSVERT-ER, R10 RE-CEIVER) | VOICE COM-MUNICATION | PILOT OR COPILOT | LINE OF SIGHT | CONSOLE | ALL HOK-1[1] |
| | AN/ARC-55 | VOICE COM-MUNICATION | PILOT | LINE OF SIGHT | CONSOLE | ALL HOK-1[1] |
| LF NAVIGA-TION | A.R.C. TYPE 12 (R-11A RECEIVER) | DIRECTION FINDING | PILOT OR COPILOT | 200 MILES | CONSOLE | BUNOS 125528 THRU 138102 |
| RADIO COM-PASS (LF AND MF NAVIGA-TION) | AN/ARN-41A | AUTOMATIC DIRECTION FINDING | PILOT OR COPILOT | 200 MILES | CONSOLE | BUNOS 139971 THRU 140001 |
| FM COMMUNI-CATIONS | AN/PRC-8, -9 OR -10 (PROVISION ONLY) | VOICE COM-MUNICATION | OBSERVER | 3 TO 12 MILES DEPENDING ON ALTITUDE | LEFT REAR OF PILOT'S SEAT (WHEN INSTALLED) | BUNOS 125528 THRU 139997[2] |
| | AN/ARC-44 | VOICE COM-MUNICATION | PILOT OR COPILOT | LINE OF SIGHT | CONSOLE | BUNOS 139998[2] THRU 140001 |

[1] AN/ARC-55 replaces A.R.C. Type 12 upon compliance with ASC-84.
[2] AN/ARC-44 replaces AN/PRC-8, -9, or -10 upon compliance with ASC-39.

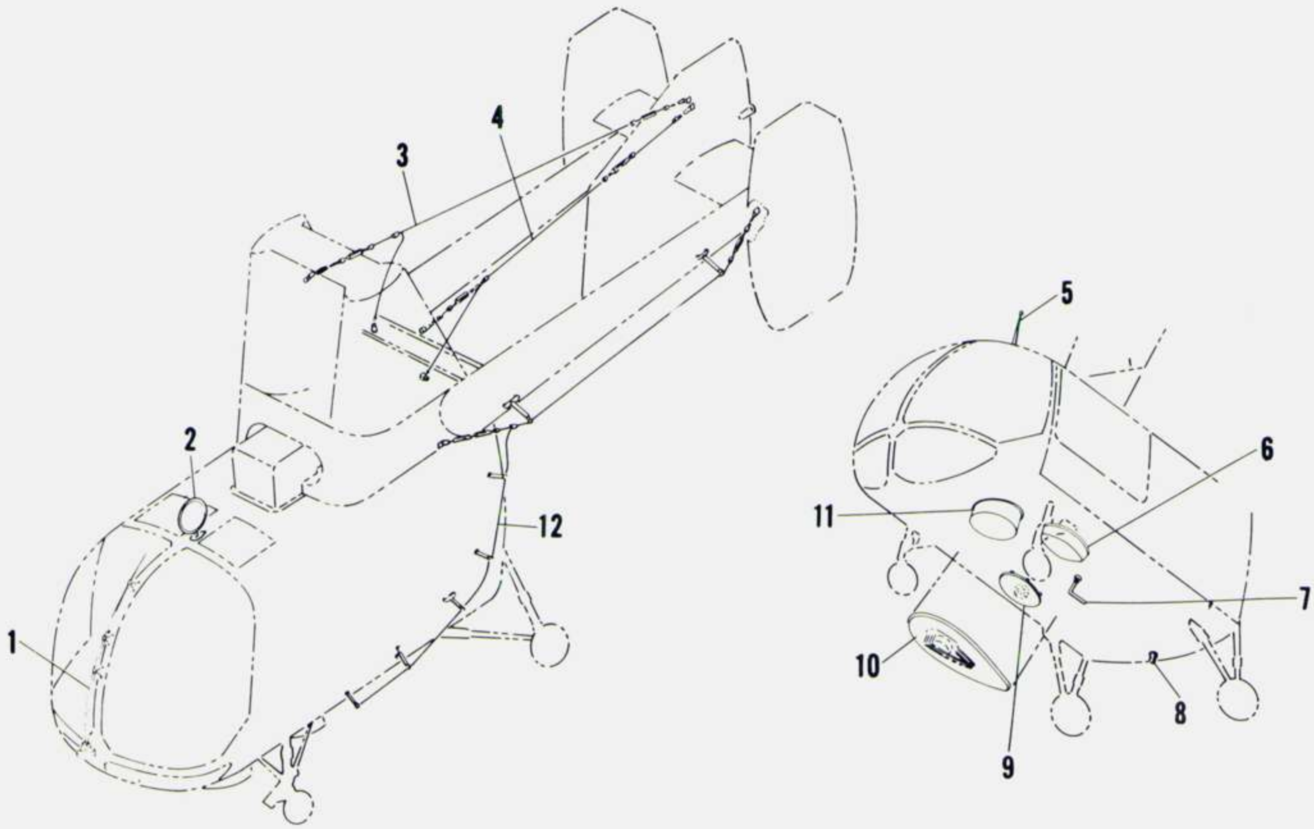
*Figure 4—3*

# Communications and Associated Electronic Equipment - HUK-1

| TYPE | DESIGNATION | FUNCTION | PRIMARY OPERATOR | RANGE | LOCATION OF CONTROLS | EFFECTIVITY |
|---|---|---|---|---|---|---|
| INTERCOMMUNICATION SYSTEM (ICS) | CB-1005C (ELECTRO SOLIDS CORP.) | INTERCOM BETWEEN CREW | PILOT | INTERIOR OF HELICOPTER | ON CONSOLE | ALL HUK-1 |
| UHF COMMUNICATION | AN/ARC-55 | VOICE COMMUNICATION | PILOT | LINE OF SIGHT | ON CONSOLE | ALL HUK-1 |
| VHF COMMUNICATION | AN/ARC-1 | VOICE COMMUNICATION | PILOT | LINE OF SIGHT | ON CONSOLE | ALL HUK-1 (PROVISION ONLY) |
| HF COMMUNICATION | AN/ARC-39 | VOICE COMMUNICATION | PILOT | LINE OF SIGHT | ON CONSOLE | ALL HUK-1 (PROVISION ONLY) |
| DIRECTION FINDER | AN/ARA-25 | AUTOMATIC DIRECTION FINDING (ADF) | PILOT | LINE OF SIGHT | CONTROLLED THRU AN/ARC-55 CONTROL ON CONSOLE | ALL HUK-1 |
| DIRECTION FINDER | AN/ARN-59 | AUTOMATIC DIRECTION FINDING (ADF) | PILOT | DEPENDS ON FREQUENCY | FORWARD CENTER CEILING | ALL HUK-1 (PROVISION ONLY) |
| IFF AND SIF | AN/APX-6B<br>AN/APA-89 | IDENTIFICATION | PILOT | ........ | ON CONSOLE | ALL HUK-1 (PROVISION ONLY) |

Figure 4—4

# Antennas




1. AT-454/ARC (AN/ARC-44)
2. L-10A (TYPE 12, LF)
3. SENSING ANTENNA (AN/ARN-59)
4. WIRE ANTENNA (TYPE 12, LF)
5. AT-8/AR (AN/ARC-1)
6. DM-C-3 (AN/ARC-55)
7. A-16 (TYPE 12, UHF)
8. DM-NI-3 (AN/APX-6B)
9. AT-780/ARN (AN/ARN-59)
10. AT-556A (AN/ARN-41A)
11. AS-578/ARA-25 (AN/ARA-25)
12. WIRE ANTENNA (AN/ARC-39)

*Figure 4—5*

**Normal Operation.** To operate the equipment, proceed as follows:

1. UHF set OFF-VOL knob — Rotate clockwise. Allow sufficient time for the equipment to warm up.
2. RADIO-ICS switch — ICS. To connect passengers and observer to ICS.

**Note**

- To speak over ICS, pilot and copilot press RADIO-ICS button to ICS and speak into microphone. Hoist operator press ICS button on hoist control grip. Rear seat passenger and observer press button on respective microphone and speak. Release buttons when not speaking.
- When any ICS button is depressed, all microphones and headsets are immediately disconnected from all *radio* equipment.

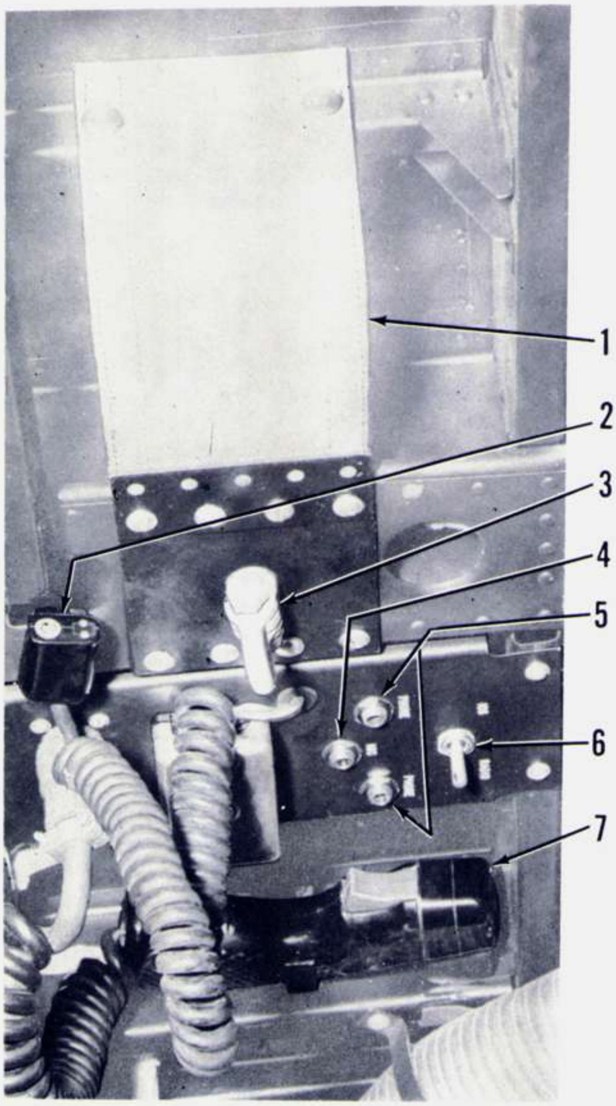
To turn the equipment off, proceed as follows:

1. UHF set OFF-VOL knob — Rotate fully counterclockwise.

## ICS (INTERCOMMUNICATION SYSTEM) EQUIPMENT — HUK-1.

**Description.** The intercommunication system provides for speech communication between all crew members and passengers. The system is turned on (power is supplied to the ICS amplifier) whenever the BAT & GEN switch is in the BAT or BAT & GEN position. Electrical power is provided from the secondary d-c bus through the intercom system circuit breaker on the

## Cabin Ceiling Aft




1. STOWAGE BELT FOR HOIST OPERATOR'S SAFETY HARNESS
2. HOIST OPERATOR'S CORD SET
3. SHACKLE FOR SAFETY HARNESS
4. MICROPHONE OUTLET
5. HEADSET (PHONE) OUTLETS
6. ICS-RADIO SWITCH
7. HOIST OPERATOR'S CONTROL

*Figure 4–6*

overhead circuit breaker panel (see figure 1–23). The ICS VOL knob on the control panel (see figure 4–7) adjusts headset listening level. The ADF, REC, and TRANS knobs are used to connect the headsets to the radio equipment. Use of these knobs is described in the paragraphs covering the applicable radio equipment.

**Normal Operation.** To operate the equipment, proceed as follows:

1. Allow the equipment to warm up.
2. ICS VOL knob – Adjust.
   Adjust to desired headset listening level.

**Note**

- To speak over ICS, pilot and copilot press RADIO-ICS button to ICS and speak into microphone. Hoist operator press ICS button on hoist control grip. Rear seat passenger press button on hand-held microphone and speak. Release buttons when not speaking.
- When any ICS button is depressed, all microphones and headsets are immediately disconnected from all *radio* equipment.

## ICS Control Panel - HUK-1

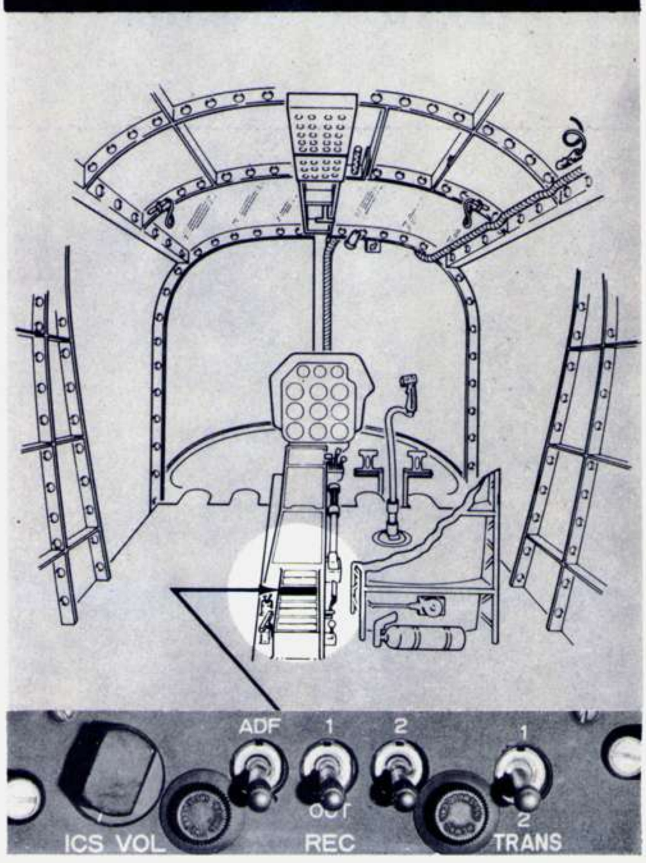



*Figure 4–7*

## A.R.C. TYPE 12 UHF (ULTRA HIGH FREQUENCY) COMMUNICATIONS EQUIPMENT — HOK-1.

**Description.** The A.R.C. Type 12 UHF equipment provides crystal-controlled, amplitude-modulated voice transmission and continuously tunable reception in the frequency range of 228 to 258 megacycles. Transmitting channels are selected using the TRANS knob on the control panel (figure 4–8). See figure 4–9 for UHF channelization. Receiving frequencies are shown on the REC dial, and are tuned using the tuning crank at the lower left-hand corner of the panel. Electrical power for operation of the equipment is supplied from the 28-volt d-c bus through the radio circuit breaker on the circuit breaker panel (figure 1–22).

**Normal Operation.** To operate the equipment, proceed as follows:

1. OFF-VOL knob — Rotate fully clockwise.
   Allow 2 to 3 minutes for the equipment to warm up.
2. TRANS knob — As desired.
   Select transmitting channel.
3. REC dial — As desired.
   Select receiving frequency using tuning crank. If reception is desired on one of the transmitting channels, press in on the crank while tuning for maximum "whistle".
4. RADIO-ICS button — Press to RADIO position.
   To enable pilot and copilot to transmit over TRANS channel.
   To enable passengers to transmit, the RADIO-ICS switch must be in RADIO position, and the press-to-talk button on the hand-held microphone must be pressed. All buttons must be released to receive.

To turn the equipment off, proceed as follows:

1. OFF-VOL knob — Rotate fully counterclockwise.

**Note**

Do not turn the equipment off if ICS or FM facilities are to remain in use.

**A.R.C. Type 12 UHF Radio Control Panel**

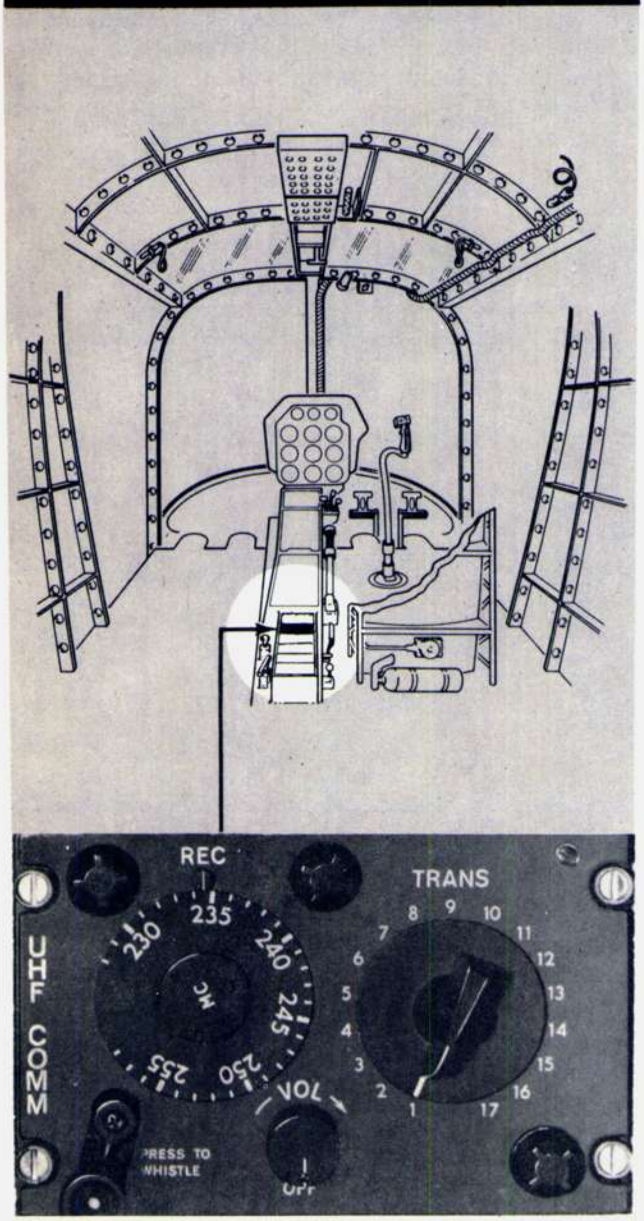



*Figure 4–8*

**UHF Channelization**

| Channel (TRANS knob) | Frequency (mc) | Service |
|---|---|---|
| 1 | 233.8 | NAVY TOWER |
| 2 | 235.6 | |
| 3 | 236.2 | APPROACH CONTROL |
| 4 | 236.6 | AIR FORCE TOWER |
| 5 | 254.0 | |
| 6 | 255.4 | CAA AIRWAYS |
| 7 | 256.0 | |
| 8 | 257.8 | CIVIL TOWER |
| 9 | CONNECTS MICROPHONES TO AN/PRC SET | |
| 10-17 | BLANK | |

*Figure 4–9*

## A.R.C. TYPE 12 LF NAV (LOW FREQUENCY NAVIGA-TION) EQUIPMENT — HOK-1.

**Description.** The A.R.C. Type 12 LF NAV equipment provides continuously tunable facilities over the frequency range of 190 to 550 kilocycles, and is used for reception of low frequency radio range stations, homing or direction finding. A loop antenna (2, figure 4—5) is used for direction finding; a wire antenna (4, figure 4—5) is used for range reception. The equipment is turned on and volume is adjusted using the OFF-SENS knob on the control panel (figure 4—10). Receiving frequencies are tuned using the tuning cranks, and are shown on the MC dial. The bearing of the tuned station with respect to the helicopter heading is displayed in degrees on the bearing dial. Electrical power to operate the equipment is supplied from the 28-volt d-c bus through the radio circuit breaker on the circuit breaker panel (figure 1—22).

**A.R.C. Type 12 LF NAV Radio Control Panel**

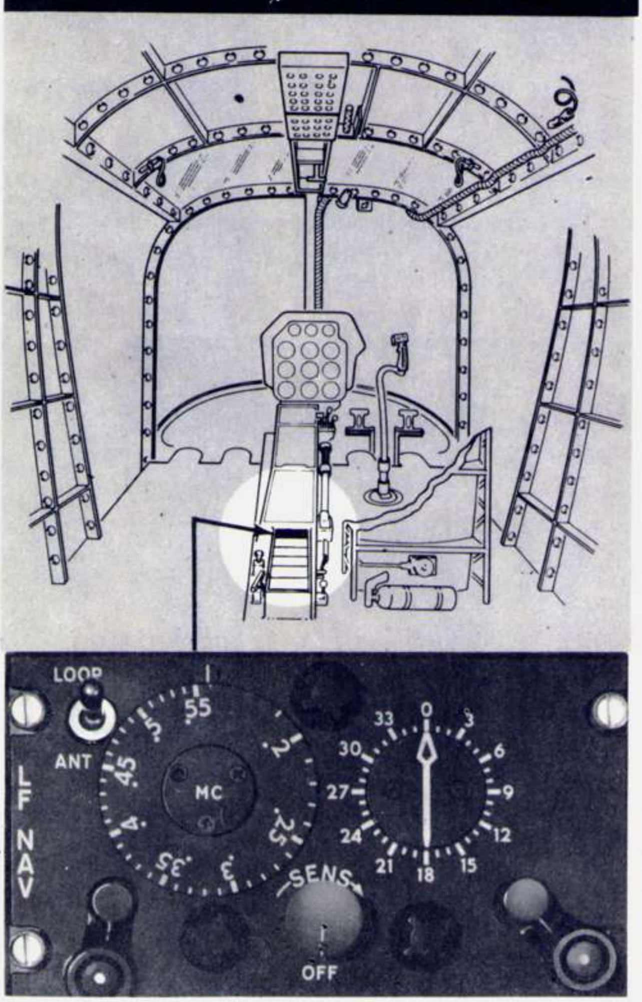



*Figure 4—10*

**Normal Operation.** To operate the equipment as a range receiver, proceed as follows:

1. OFF-SENS knob — Rotate fully clockwise.
   Allow 2 to 3 minutes for the equipment to warm up.
2. ANT-LOOP switch — ANT.
3. Tuning crank — Rotate.
   Rotate the left-hand crank until the desired frequency is indicated on the MC dial.
4. OFF-SENS knob — Adjust.
   Adjust knob until audio decreases sharply and substantially.
5. Station identification — Check.

**Note**

Do not operate with the OFF-SENS knob at the maximum setting unless the signal of the desired station is weak. Operating at the maximum setting may cause course broadening.

To operate the equipment as a direction finder receiver, proceed as follows:

1. OFF-SENS knob — Rotate fully clockwise.
   Allow 2 to 3 minutes for the equipment to warm up.
2. ANT-LOOP switch — LOOP.
3. Tuning crank — Rotate.
   Rotate the left-hand crank until the desired frequency is indicated on the MC dial.
4. OFF-SENS knob — Adjust.
   Adjust knob until audio volume decreases sharply and substantially.
5. Station identification — Check.
6. Tuning crank and OFF-SENS knob — Adjust.
   Alternately rotate right-hand crank and OFF-SENS knob until the sharpest minimum signal is obtained.
7. Bearing dial — Read.
   Dial indicates bearing of the station with respect to the helicopter heading.

**Note**

Two bearings, 180 degrees apart, will be found. Knowledge of the helicopter's general position with respect to the transmitting station will resolve the ambiguity. If this position is not known, fly in the direction indicated by one of the bearings. An increase or decrease on the signal indicates that the helicopter is heading toward or away from the station.

To turn the equipment off, proceed as follows:

1. OFF-SENS knob — Rotate fully counterclockwise.

## AN/ARN-41A RADIO COMPASS EQUIPMENT — HOK-1.

**Description.** The AN/ARN-41A radio compass equipment provides amplitude-modulated voice or CW (continuous wave) signals within the frequency ranges of 190 to 430 kilocycles, 480 to 1025 kilocycles, and 1025 to 1725 kilocycles. The equipment may be operated as a conventional receiver or as an automatic direction finder (ADF). The equipment is turned on, and the mode of operation chosen using the OFF-COMP-ANT-CW switch on the control panel (figure 4—11). Electrical power to operate the equipment is supplied from the 28-volt d-c bus through the radio circuit breaker (figure 1—22). The band knob, located below the window on the control panel, is used to choose the operating frequency range, and the tuning crank is used to adjust to the desired frequency. The VOLUME knob allows continuous volume control. The tuning meter in the upper right-hand corner of the panel is used in ADF operation. When the equipment is used for ADF, the helicopter heading is indicated on the needle of the dual radio magnetic indicator (figure 4—12). (There are actually two needles on the direction indicator, but they are synchronized and used as a single needle in this aircraft.) The loop antenna (10, figure 4—5) and the dual radio magnetic indicator operate off the a-c power supply; no fuses or circuit breakers installed for this equipment.

**Normal Operation.** To operate the equipment, proceed as follows:

1. OFF-COMP-ANT-CW switch — As desired.
   Rotate switch to COMP position for ADF operation, to ANT position for use as conventional receiver, or to CW position for inspection of continuous wave signals. Allow 2 to 3 minutes for equipment to warm up.
2. Band knob — Rotate to desired frequency range.
3. Tuning crank — Rotate as desired.
   Rotate crank to obtain desired frequency within the chosen frequency range.

**Note**

- For ADF operation, adjust tuning crank for maximum indication on meter.
- For CW operation, turn switch to CW position to locate the station and then switch to the COMP position, and tune for maximum meter indication.

**WARNING**

Always tune for maximum indication on tuning meter to avoid erroneous bearing indications.

4. Dual radio magnetic indicator — Check.
   The needle will indicate the bearing of the transmitting station.
5. VOLUME knob — Adjust as desired.

To turn the equipment off, proceed as follows:

1. OFF-COMP-ANT-CW switch — OFF.

**AN/ARN-41A Radio Compass Control Panel**

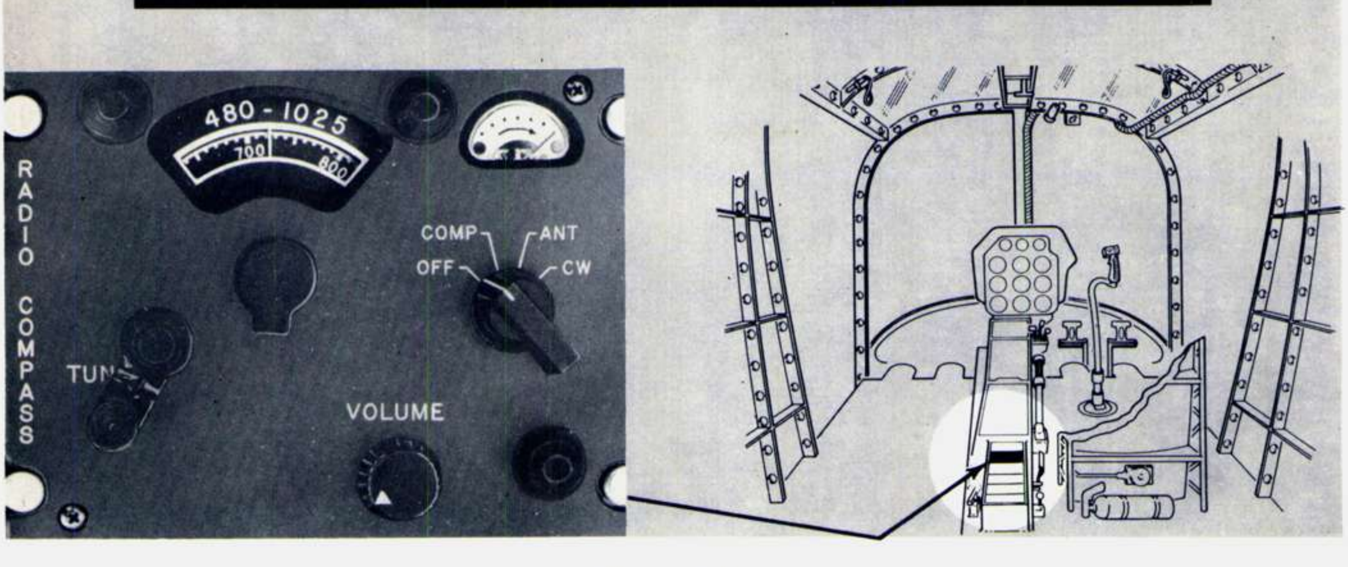
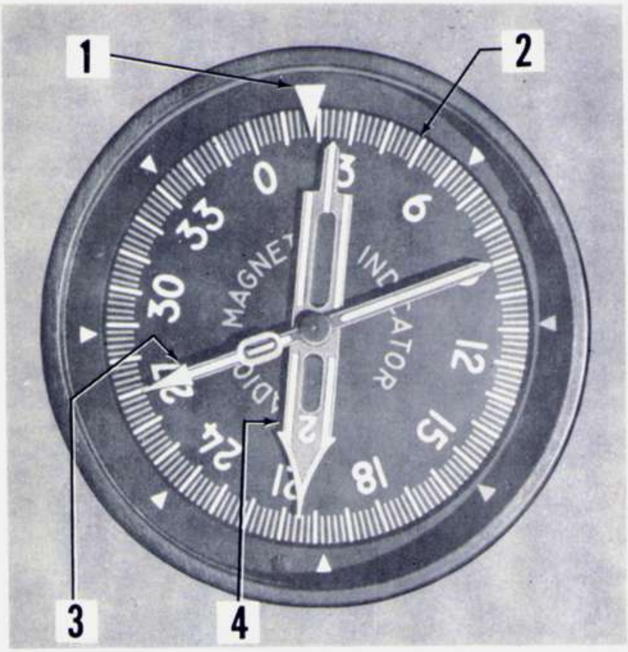
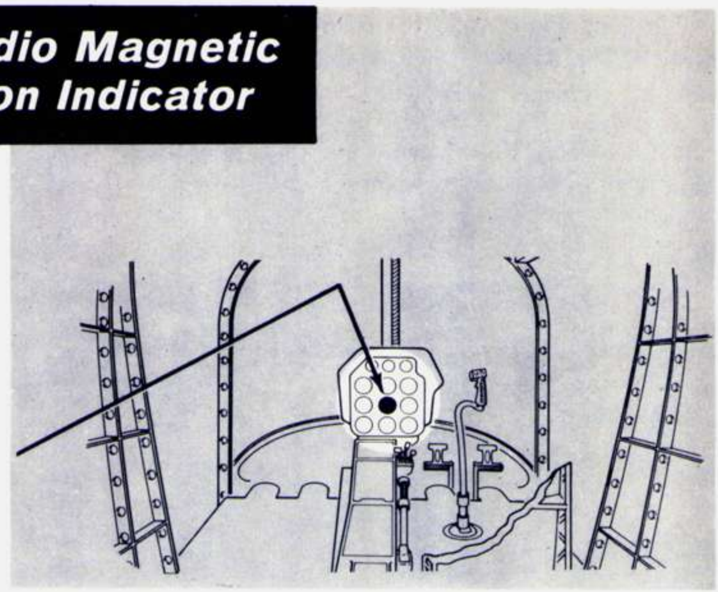



*Figure 4—11*

## Dual Radio Magnetic Direction Indicator



1. FIXED INDEX MARKS. LARGE MARK AT TOP OF INSTRUMENT REPRESENTS FORWARD END OF HELICOPTER FORE-AND-AFT AXIS.
2. ROTATING COMPASS CARD, WHICH INDICATES HEADING OF AIRCRAFT AND IS CONTROLLED BY MA-1 GYRO MAGNETIC COMPASS SYSTEM.
3. INDICATES DIRECTION OF STATION RECEIVED ON UHF RADIO SET AN/ARC-55 WITH ADF EQUIPMENT AN/ARA-25 (HUK-1 ONLY).
4. INDICATES DIRECTION OF STATION RECEIVED ON ADF RADIO AN/ARN-59 (HUK-1 ONLY).

3. and 4. NEEDLES NO. 1 and 2 OPERATE AS SINGLE NEEDLE TO INDICATE DIRECTION OF STATION RECEIVED ON RADIO SET AN/ARN-41A (HOK-1 ONLY).

*Figure 4—12*

**AN/PRC-8, -9, OR -10 VHF FM (VERY HIGH FREQUENCY, FREQUENCY MODULATED) EQUIPMENT — HOK-1.**

**Description.** Provisions have been made for installing this equipment (6, figure 4—2) at the right side of the console. When the set is installed, the associated amplifier and power supply, AM-598/U, is installed below the floor aft of the pilot's seat. Electrical power to operate the equipment is supplied from the 28-volt d-c bus through the radio circuit breaker (figure 1—22).

**Note**

This equipment is replaced by the AN/ARC-44 equipment upon incorporation of ASC-39.

**Normal Operation.** To operate the equipment, proceed as follows:

1. OFF-VOL knob — Rotate fully clockwise.
   Knob is located on UHF control panel.
2. TRANS knob — Rotate to Channel No. 9.
   Knob is located on UHF control panel.
3. ICS-RADIO switch — RADIO.
4. POWER knob — ON.
5. SQUELCH knob — OFF.
   Allow 2 to 3 minutes for equipment to warm up.
6. TUNING knob — Rotate to desired frequency.
7. VOL knob — Adjust for comfortable listening level.
8. SQUELCH knob — Rotate as necessary.
   If no signals are received, rotate the knob until all background noise disappears. Do not go beyond this point as weak signals may be lost.
9. RADIO-ICS button — Press to RADIO position.
   To enable pilot and copilot to transmit. For passengers to transmit, the RADIO-ICS switch must be in the RADIO position, and the press-to-talk button on the hand-held microphone must be pressed. All buttons must be released to receive.

To turn the equipment off, proceed as follows:

1. POWER knob — OFF.

**Note**

Turn the UHF set OFF-VOL knob fully counterclockwise only if ICS or UHF facilities are not to remain in use.

**AN/ARC-44 FM Radio Control Panel**

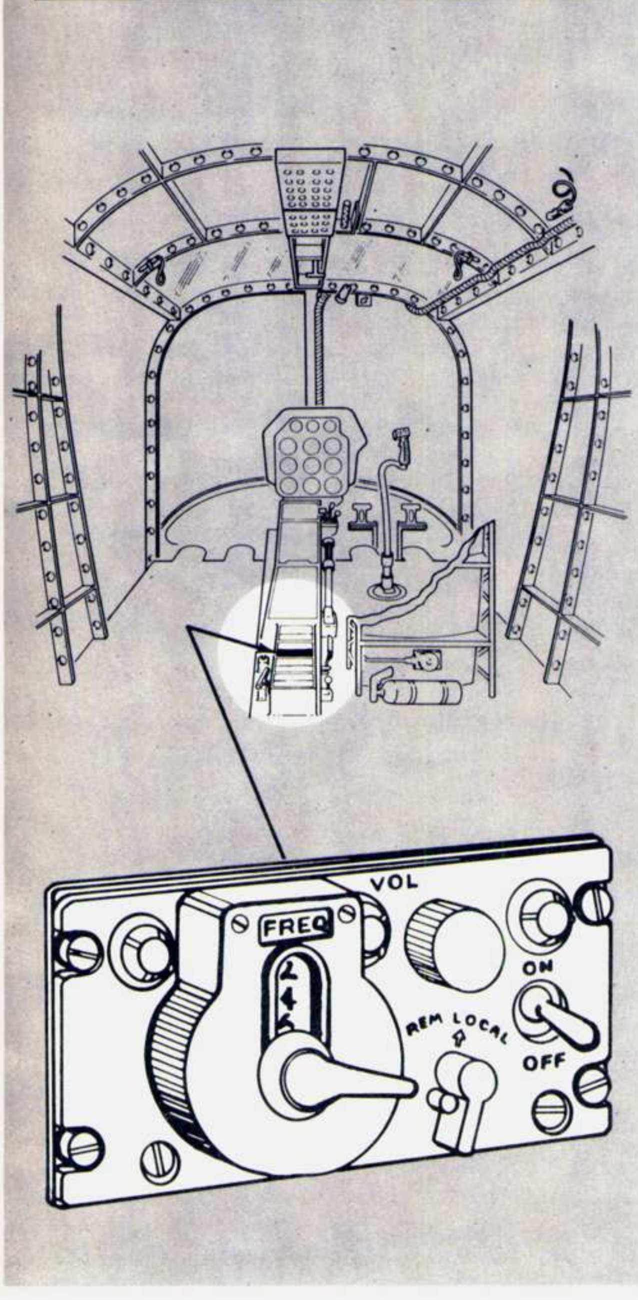



*Figure 4—13*

**AN/ARC-44 FM (FREQUENCY MODULATED) EQUIPMENT — HOK-1.**

**Description.** The AN/ARC-44 FM equipment provides reception and transmission of frequency-modulated voice signals within the frequency range of 24.0 to 51.9 megacycles. The control panel (figure 4—13) is located on the console to the left of the pilot's seat. When the equipment is energized, electrical power is received from the 28-volt d-c supply through the radio circuit breaker on the circuit breaker panel (figure 1—22). A REM-LOCAL switch ordinarily permits choice of remote or local operation. In this installation, however, only local operation is used. A frequency (FREQ) selector knob permits adjustment for the desired operating frequency.

**Normal Operation.** To operate the equipment, proceed as follows:

1. REM-LOCAL switch — LOCAL.
2. ON-OFF switch — ON.
   Allow at least 1 minute for the equipment to warm up.
3. FREQ selector knob — Adjust.
   Adjust the knob until the desired frequency appears in the window above the knob. Allow 6 seconds for the equipment to change frequency.
4. VOL knob — Adjust as desired.
5. TRANS knob — Channel No. 9.
   Knob is located on UHF control panel.
6. RADIO-ICS button — Press to RADIO position.
   To allow pilot and copilot to transmit. For passengers to transmit, the RADIO-ICS switch must be in the RADIO position, and the press-to-talk button on the hand-held microphone must be pressed. All buttons must be released to receive.

To turn the equipment off, proceed as follows:

1. ON-OFF switch — OFF.

**AN/ARC-55 UHF (ULTRA HIGH FREQUENCY) EQUIPMENT WITH AN/ARA-25 DIRECTION FINDER EQUIPMENT[1] — HOK-1 AND HUK-1.**

**Description.** The AN/ARC-55 UHF radio equipment provides reception and transmission of amplitude-modulated voice signals within the frequency range of 225.0 to 399.9 megacycles. One predetermined frequency, known as the guard channel, also may be monitored in addition to the twenty that may be preset on the CHAN knob. This frequency is within the 238.0 to 248.0 megacycle band. All components are controlled from the UHF control panel (see figure 4—14). In HOK-1 helicopters, when the OFF-T/R-T/R+G-ADF switch is in any position other than OFF, electrical power is received from the 28-volt d-c bus through the radio circuit breaker on the circuit breaker panel (see figure 1—22).

[1] AN/ARA-25 Automatic Direction Finder is provided on Model HUK-1 only.

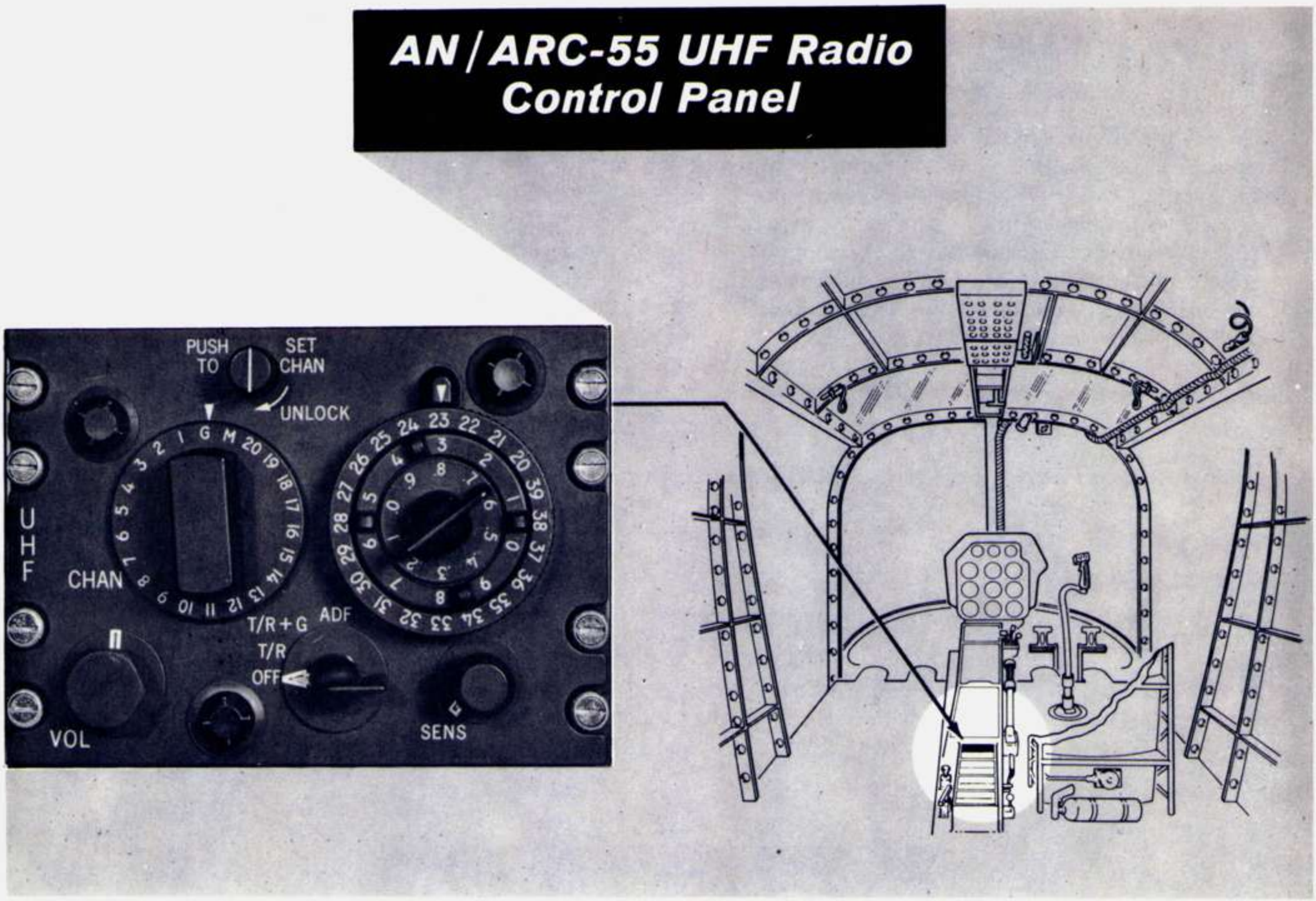



*Figure 4—14*

In HUK-1 helicopters, power is supplied from the secondary d-c bus and the ARC-55 circuit breaker on the overhead circuit breaker panel (see figure 1—23).

The AN/ARA-25 equipment is used in conjunction with the AN/ARC-55 radio set, and provides ADF facilities. Power to operate the equipment is supplied from the secondary d-c bus and the ARA-25 circuit breaker on the overhead circuit breaker panel (see figure 1—23).

**Normal Operation.** To operate the equipment as a UHF transmitter-receiver, proceed as follows:

1. OFF-T/R-T/R+G-ADF switch — T/R.

   Allow 1 minute for the equipment to warm up.

2. CHAN knob — Adjust.

   Rotate knob until the desired channel is indicated on the dial.

**Note**

To receive on the guard (G) channel and another channel simultaneously, set the OFF-T/R-T/R+G-ADF switch to T/R +G and the CHAN knob to the desired channel.

3. VOL knob — Adjust as desired.
4. SENS knob — Adjust as desired.

   Adjust the SENS knob as necessary to reduce undesirable background noises or to increase the strength of weak signals.

5. TRANS knob — Channel No. 9.
6. RADIO-ICS button — Press to RADIO position.

   To enable pilot and copilot to transmit. For passenger to transmit, the RADIO-ICS switch must be in the RADIO position, and the press-to-talk button on the hand-held microphone must be pressed. All buttons must be released to receive.

To operate the equipment as an ADF receiver, proceed as follows:

1. OFF-T/R-T/R+G-ADF switch — ADF.
2. CHAN knob — Adjust.

   Select the channel desired and allow 3 minutes for the equipment to warm up.

3. Signal direction — Check.

   Observe the relative bearing of signal reception on needle 1 of the dual radio magnetic indicator (figure 4—12) on the pilot's instrument panel.

**WARNING**

Do not use the AN/ARA-25 to make bearing readings. Multiple reflections of the radio signal by the landing gear etc., cause unpredictable errors in the bearing indication. However, the AN/ARA-25 is adequate for homing on ground or air transmitters. During the homing run, check compass heading frequently to avoid circling the transmitting station.

To turn the equipment off, proceed as follows:

1. OFF-T/R-T/R+G-ADF switch – OFF.

To preset frequencies for tuning with the CHAN knob, proceed as follows:

1. OFF-T/R-T/R+G-ADF switch – OFF.
2. CHAN knob – Adjust.

   Set CHAN knob to the channel to be preset or changed.
3. Frequency selector dials – Adjust.

   Set the dials to the desired frequency within the range of 225.0 to 399.9 megacycles.
4. PUSH TO SET CHAN button – Turn and depress. Rotate the button 90 degrees clockwise and depress firmly. Release the button and check to ensure that the white line on the button returns to a vertical position.

**CAUTION**

If the button does not return to a vertical position, the channel is not properly set and the procedure should be repeated.

Set each of the 20 channels and the guard (G) channel in the same manner.

**AN/ARC-1 VHF (VERY HIGH FREQUENCY) EQUIPMENT – HUK-1.**

**Description.** The AN/ARC-1 equipment provides transmission and reception of amplitude-modulated voice signals within the VHF band. Provisions are made for monitoring a guard channel while receiving and transmitting on other frequencies. Electrical power to operate the equipment is supplied from the primary 28-volt d-c bus through the ARC-1 circuit breaker on the overhead circuit breaker panel (see figure 1–23). The equipment is controlled from the VHF control panel (figure 4–15).

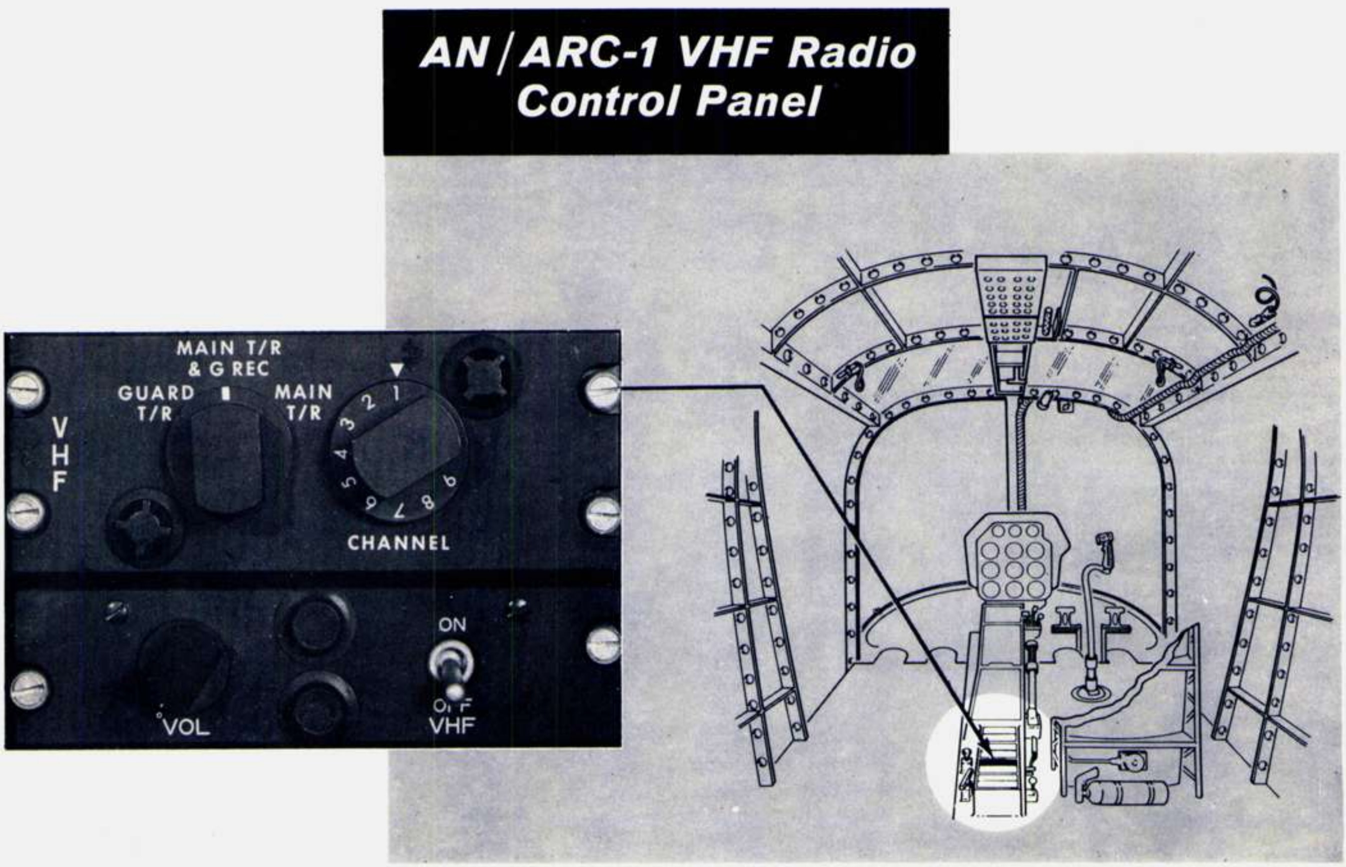



*Figure 4–15*

**Normal Operation.** To operate the equipment, proceed as follows:

1. ON-OFF switch – ON.
   Allow at least 20 seconds for the equipment to warm up.
2. CHANNEL knob – As desired.
3. Function selector knob – MAIN T/R + G REC.
4. REC 2 switch – 2.
   Switch is located on the ICS control panel.
5. VOL knob – Adjust.

**Note**

- If the main and guard channels cause interference with each other, rotate the function selector to GUARD T/R or MAIN T/R to clarify the desired signals.
- The equipment is inoperative for 5 seconds after the function selector is rotated to GUARD T/R.

6. TRANS switch – 2.
   Switch is located on the ICS control panel.
7. RADIO-ICS button – Press to RADIO position.
   To enable pilot and copilot to transmit. For passengers to transmit, the RADIO-ICS switch must be in the RADIO position, and the press-to-talk button on the hand-held microphone must be pressed. All buttons must be released to receive.

To turn the equipment off, proceed as follows:

1. ON-OFF switch – OFF.

**AN/ARC-39 HF (HIGH FREQUENCY) RADIO EQUIPMENT – HUK-1.**

**Description.** Provision is made for installing this equipment, which will transmit and receive amplitude-modulated voice signals on any of 12 preset channels within the frequency range of 2.0 to 9.1 megacycles. Channels 1 through 6 are allocated to a low band (2.0 to 4.27 megacycles) and channels 7 through 12 are allocated to a high band (4.27 to 9.1 megacycles). Any frequency within a given band may be assigned to any channel allocated to that band. If installed, the receiver-transmitter is located beneath the copilot's seat, and is equipped with the necessary controls to change the preset channels. Electrical power to operate the equipment is supplied from the secondary d-c bus and the ARC-39 circuit breaker (see figure 1–23). The equipment is controlled by the HF control panel (figure 4–16), located on the console.

**Normal Operation.** To operate the equipment, proceed as follows:

1. VOL-OFF knob – Adjust.
   Rotate the knob 1/2-turn clockwise. Allow the equipment 1 minute to warm up.
2. CHANNEL selector knob – As desired.
   Adjust the knob to the desired channel. Be sure that the bar in the center of the knob is down flush with the control handle.
3. REC 2 switches – 2.
   Switch is located on the ICS control panel.
4. VOL knob – Adjust.
5. TRANS switch – 2.
   Switch is located on the ICS control panel.
6. RADIO-ICS button – Press to RADIO position.
   To enable pilot and copilot to transmit. For passengers to transmit, the RADIO-ICS switch must be in the RADIO position, and the press-to-talk button on the hand-held microphone must be pressed. All buttons must be released to receive.

To turn the equipment off, proceed as follows:

1. VOL-OFF knob – OFF.

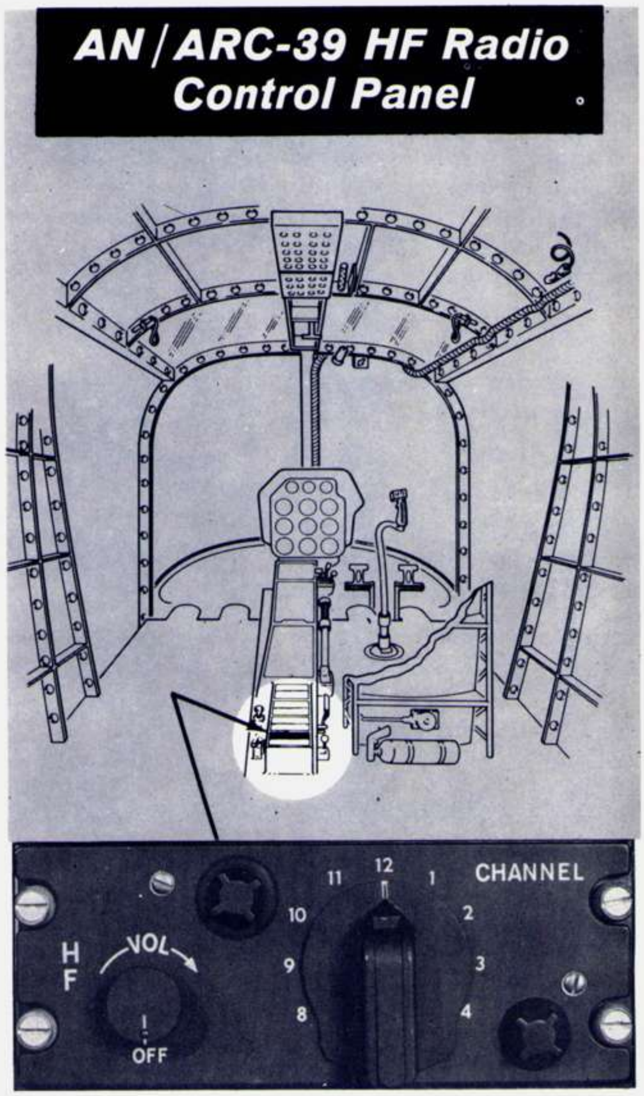



*Figure 4–16*

## AN/APX-6B RADAR IDENTIFICATION SET (IFF) AND AN/APA-89 CODER GROUP (SIF) — HUK-1.

Provision is made for installing Radar Identification Set AN/APX-6B in a removable pod near the forward inboard end of the left tailboom, and for installing Coder Group AN/APA-89 below the cabin floor. When installed, remote control of both sets of equipment is provided by control panels mounted on the console. Refer to publications AN16-30APX6-51 and NAVAER 16-30APA89-503 for operating instructions.

## AN/ARN-59 ADF REC (AUTOMATIC DIRECTION FINDER RECEIVER) EQUIPMENT — HUK-1.

**Description.** Provisions are made for installing this equipment, which provides automatic visual bearing indication of an incoming signal and aural reception of amplitude-modulated signal. The equipment operates within the frequency range of 190 to 1750 kilocycles. This frequency range is divided into the following three frequency bands; 190 to 400, 400 to 840, and 840 to 1750 kilocycles. Remote control of this equipment is provided by a control panel (see figure 4—17) mounted approximately in the center of the cabin ceiling. When the OFF-VOL knob is turned clockwise, power to operate the equipment is supplied from the secondary d-c bus through the ARN-59 circuit breaker on the overhead circuit breaker panel (see figure 1—23). The MC BAND switch is used to select the frequency band, and the tuning crank selects the operating frequency within that band. The COMP-ANT-LOOP switch is used to select the desired mode of operation. The COMP position is used for ADF operation and the ANT position is used for low frequency navigation and communication reception. The LOOP position is used to provide reception over the loop antenna only. A loop switch, located below the tuning meter, is used to check the reliability of course indications during ADF operation, and to rotate the loop antenna during LF navigation and communications reception operations. The BFO (beat frequency oscillator) switch is used for identification of CW (continuous wave) stations.

**Normal Operation.** To operate the equipment as an automatic direction finder, proceed as follows:

1. OFF-VOL knob — Fully clockwise.
2. COMP-ANT-LOOP switch — COMP.
3. MC BAND knob — Adjust to desired band.
4. ADF switch — Up.
   This permits reception of incoming signals.
5. Tuning crank — Adjust.
   Adjust crank to the desired frequency within the chosen band and to obtain the maximum indication on the tuning meter.
6. VOL knob — Adjust as desired.
7. Station identification — Check.
   Check that the proper station is being received. If the signal is too weak, set COMP-ANT-LOOP switch temporarily to ANT to reduce background noise.

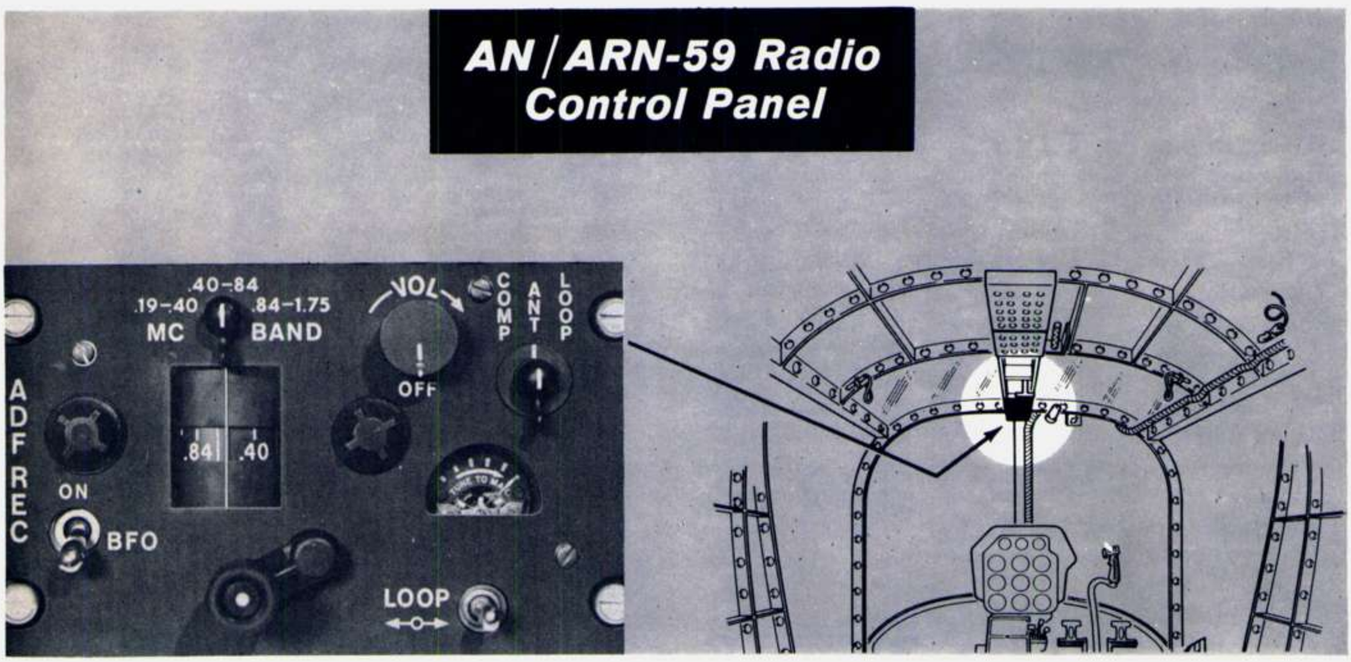



Figure 4—17

**Note**

To identify CW (continuous wave) stations, place the function control to ANT and the BFO switch to ON (up). As the tuning crank is rotated with a rocking motion while listening to a CW signal, notice that the tone heard in the headset changes from high pitch, to zero pitch, and back to high pitch. Tune to the lower frequency of the two closely adjacent dial readings at which the high pitch tone is heard.

**WARNING**

Do not place the BFO switch ON when the function control is set to COMP as this will cause incorrect direction and frequency indications.

8. Dual radio magnetic indicator – Check.
   Needle 2 indicates the bearing of the transmitting station. Check reliability of the indication by holding the LOOP switch to the right, and observing that the needle rotates clockwise. Allow the needle to travel between 10 and 20 degrees and then release the switch. If the needle returns to the original indication, the bearing indicated for the transmitting station is reliable.

**Note**

Maintain straight and level flight while checking reliability of indication.

To operate the equipment as an LF NAV receiver or conventional broadcast receiver, proceed as follows:

1. OFF-VOL knob – Adjust.

**WARNING**

Keep VOL control at lowest setting possible for good listening, thus eliminating the possibility of course broadening.

2. COMP-ANT-LOOP switch – ANT.
3. MC BAND knob – Adjust to desired band.
4. ADF switch – Up.
5. Tuning crank – Adjust.
   Adjust tuning crank for the clearest reception possible of the desired station. If heavy static conditions exist, set the function selector switch in the LOOP position. Hold LOOP switch to the left or right to obtain the best reception.

**Note**

As the loop rotates, the headset volume will decrease to a minimum (null). Observe this position of needle 2 on the direction indicator and test for best reception 90° or 270° from the null position.

To turn the equipment off, proceed as follows:

1. OFF-VOL knob – OFF.

## LIGHTING SYSTEM

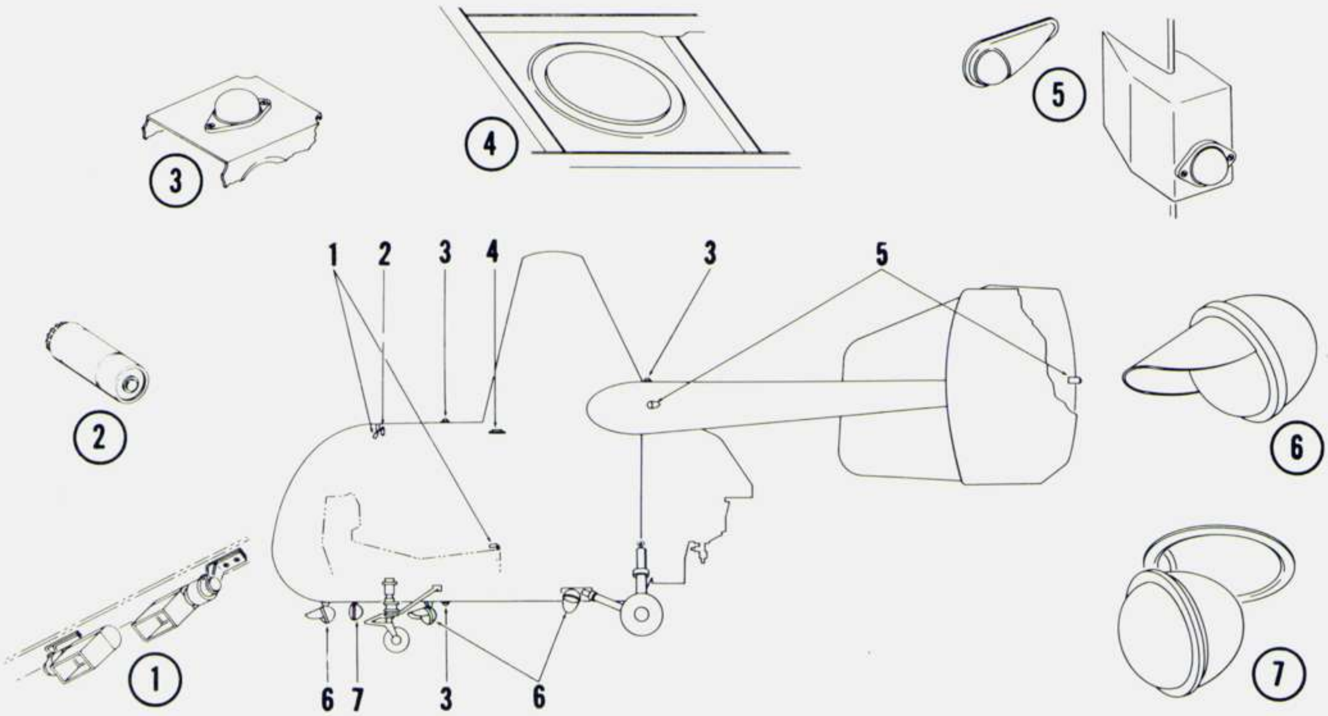
### NAVIGATION LIGHTS.

Three position lights (5, figure 4–18) are located on the empennage. A white light is located on the trailing edge of the center fin; a green light is located in the forward portion of the starboard tailboom; and a red light is located in a corresponding position on the port tailboom. White fuselage lights (3, figure 4–18) are mounted on the upper and lower center fuselage and between the aft edges of the pylons. A 2-position (BRT-DIM) POS LTS switch (9, figure 1–9) permits control of the brilliancy of the position lights. A 2-position (STDY-FLASH) POS LTS switch (11, figure 1–9) permits choice of mode of operation for the position lights. A 2-position (BRT-DIM) FUS LTS switch (7, figure 1–9) permits control of fuselage light brilliancy. In HOK-1 helicopters, power to operate the navigation lights is supplied from the 28-volt d-c bus through circuit breakers marked fuselage lights and position lights on the console circuit breaker panel (see figure 1–22). In HUK-1 helicopters, power is supplied from the primary d-c bus through the position lights circuit breaker on the console circuit breaker panel (see figure 1–23).

### LANDING LIGHT.

The retractable landing light (7, figure 4–18) is recessed in the lower forward portion of the fuselage. The light is controlled by 2-position (ON-OFF and EXT-RET) LAND LT switches (6, figure 1–9), which provide for extending and retracting the light. The light will not go on until it is partially extended. In HOK-1 helicopters, power to operate the light is supplied from the 28-volt d-c bus through circuit breakers marked landing light on the console circuit breaker panel (see figure 1–22). In HUK-1 helicopters, power to operate the light is supplied from the primary d-c bus through the landing light relay circuit breaker; operating power to extend and retract the light is supplied from the secondary d-c bus through the landing light motor circuit breaker (see figure 1–23).

# Lighting System




1. CONSOLE FLOODLIGHTS
2. COCKPIT LIGHT
3. FUSELAGE LIGHTS
4. DOME LIGHT
5. POSITION LIGHTS
6. FLOODLIGHTS
7. LANDING LIGHT

***Figure 4—18***

### FLOODLIGHTS.[1]

Three fixed floodlights (6, figure 4—18) are mounted externally on the fuselage belly. The lights are controlled by an on-off switch located on the top of the pilot's collective stick (see figure 4—19). Power to operate the aft floodlight is supplied from the primary 28-volt d-c bus through a circuit breaker marked floodlight control on the console circuit breaker panel. The forward floodlights are powered from the secondary d-c bus through the forward floodlight circuit breaker on the console circuit breaker panel (see figure 1—23).

### INSTRUMENT LIGHTS.

All instruments and console control labels are illuminated by red edge lights. The brilliancy of these edge lights is controlled by three rheostats (8, figure 1—9) labeled CONSOLE, NON FLT INST located on the console control panel. Power to operate these lights is supplied from the 28-volt d-c bus (primary bus in HUK-1 helicopters) through the instrument and edge light circuit breaker on the console circuit breaker panel (see figures 1—22 and 1—23).

### CONSOLE FLOODLIGHTS.

Three red console floodlights (1, figure 4—18) are provided to illuminate all instruments and console controls. Two of these lights (3, figure 1—14) are located on the cabin ceiling directly over the console. A CONSOLE FLOOD LT rheostat, mounted between the lights, controls their brilliancy and has positions of OFF-BRT; however, the FLT INST rheostat (8, figure 1—9) must

[1] HUK-1 only.

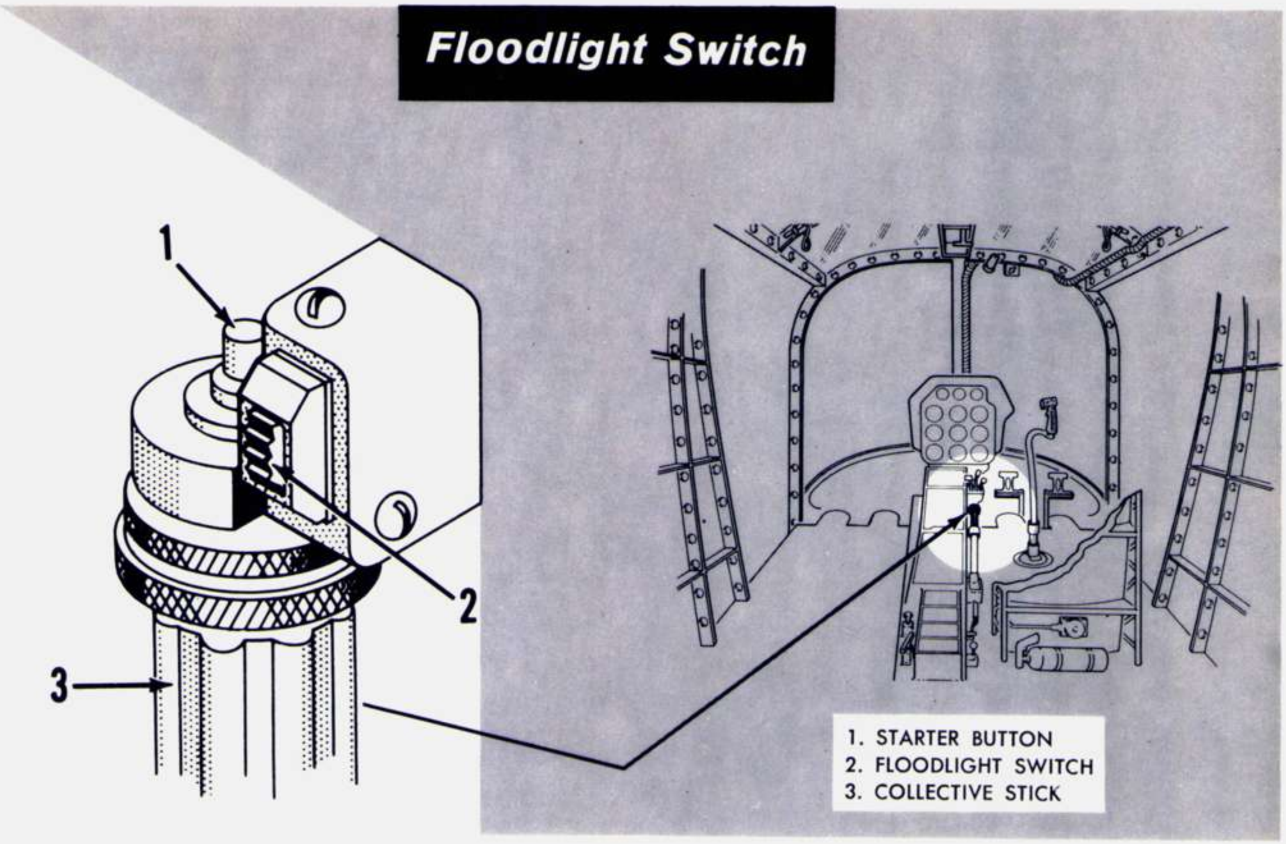



*Figure 4—19*

be on before the lights will be illuminated. The remaining console floodlight is mounted at the aft end of the console and is controlled by the CONSOLE rheostat (8, figure 1—9). In HOK-1 helicopters, power to operate the lights is supplied from the 28-volt d-c bus through a circuit breaker labeled cockpit and floodlight on the console circuit breaker panel (see figure 1—22). In HUK-1 helicopters, power is supplied from the primary d-c bus through the cockpit lights circuit breaker on the console circuit breaker panel (see figure 1—23).

#### DOME LIGHT.

The dome light (4, figure 4—18) is mounted on the center of the cabin ceiling and provides red or white illumination of the cabin interior. The light is controlled by a DOME LT WHITE-OFF-RED switch (10, figure 1—9) located on the console control panel. Power to operate this light is supplied from the 28-volt d-c bus (primary bus in HUK-1 helicopters) through the same circuit breaker used for the console floodlights (see figures 1—22 and 1—23).

#### COCKPIT LIGHT.

The cockpit light (2, figure 4—18) is connected to a flexible cord and is mounted in a retaining socket directly above the pilot's seat. All controls for operating the lights are on the light case. Power to operate the light is supplied from the 28-volt d-c bus (primary in HUK-1 helicopters) through the same circuit breaker used for the console floodlights (see figures 1—22 and 1—23).

## NAVIGATION EQUIPMENT

In addition to the radio and radar equipment described earlier in this section, the helicopter is also equipped with a compass controlled gyro system to provide indications of aircraft heading.

#### G-2 COMPASS SYSTEM.[1]

**Description.** The compass system may be operated as a free gyro or as a compass controlled gyro. In either mode of operation, the gyro reading is obtained on the outer scale of the rotating compass card of the dual radio magnetic indicator (see figure 4—12). In compass controlled gyro operation, the remote compass transmitter detects changes in the helicopter's line of flight and transmits corresponding signals to an amplifier. The amplifier compares this signal and a signal from the gyro, and generates a corrected signal to precess the gyro so that it agrees with the magnetic compass. In free gyro operation, the compass transmitter is disconnected

[1] Used on all HOK-1 except BUNOS 129809 and 139971 thru 140001.

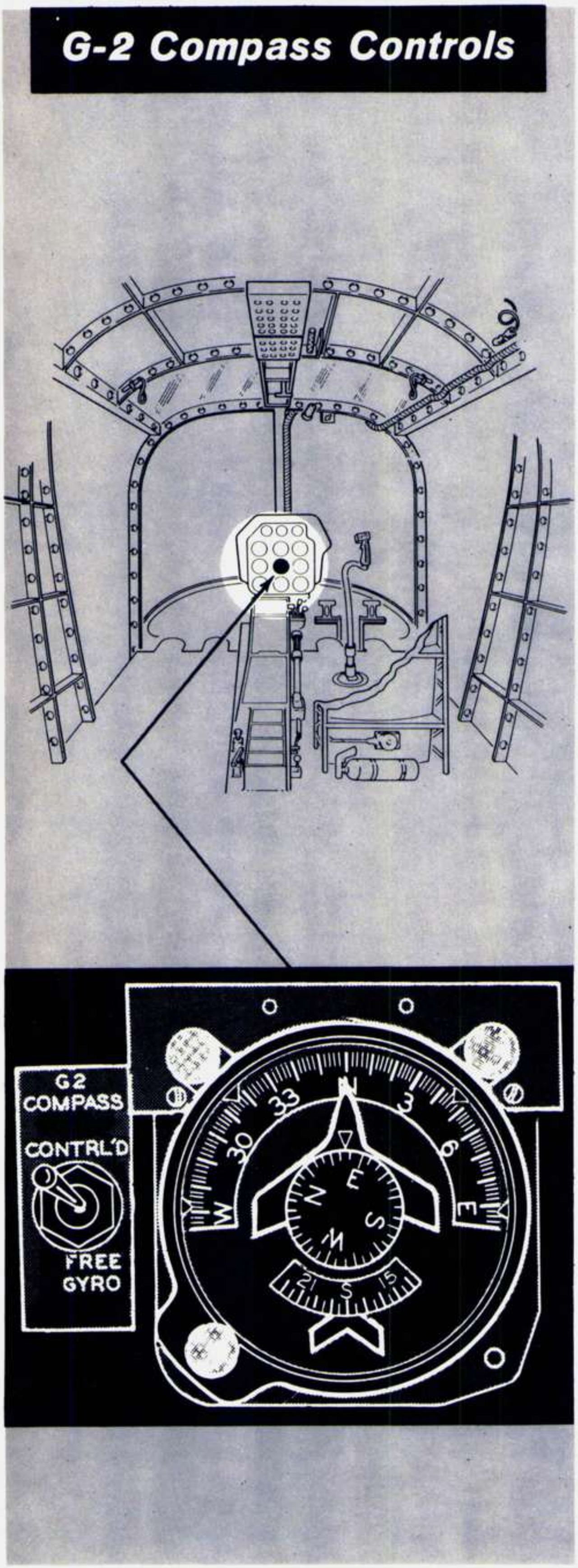



Figure 4—20

from the gyro, which is then subject to a greater amount of drift. The gyro indicator must be adjusted manually, and must be corrected for gyro precession as necessary. All controls (see figure 4—20) for operating this compass system are located on the pilot's instrument panel. Power to operate the system is received from the 28-volt d-c bus through the G-2 compass circuit breaker on the console circuit breaker panel (see figure 1—22), and is supplied whenever the BAT & GEN switch is ON.

**Normal Operation.** To operate the system as a compass controlled directional gyro, proceed as follows:

1. Gyro Indicator – Adjust.
   Depress and rotate the knob, located at the rim of the indicator, to the desired reading. Avoid twisting the knob when releasing.
2. CONTRL'D-FREE GYRO switch – CONTRL'D.

**Note**

This switch should be in the CONTRL'D position except when geographical location prohibits this mode of operation due to high magnetic disturbance, for example magnetic poles of the earth or large masses of iron.

To operate the system as a free directional gyro, proceed as follows:

1. CONTRL'D-FREE GYRO switch – FREE GYRO.
2. Gyro indicator – Adjust.
   Adjust the gyro indicator to the desired reading.

**Note**

In this mode of operation, the system is subject to drift errors and therefore it is necessary to maintain a constant check with the magnetic compass and reset as necessary.

## MA-1 COMPASS SYSTEM.[1]

**Description.** The system may be operated as a free gyro or as a compass controlled (slaved) gyro. In compass controlled operation the remote compass transmitter detects changes in the helicopter's line of flight and transmits these changes to an amplifier. The amplifier, in turn, transmits corresponding correction signals to the gyro, which produces the helicopter's heading on the indicator (6, figure 1—10). In free gyro operation the compass transmitter is disconnected from the gyro. The dial should be adjusted manually to coincide with the magnetic compass reading and must be corrected for gyro precession as necessary. The system is controlled by a panel (see figure 4—21) located on the pilot's console. Power to operate the system is received from the 28-volt d-c bus through the MA-1 compass circuit breaker (see figures 1—22 and 1—23). This power is being supplied to the system whenever the BAT & GEN switch is ON.

[1] Used on BUNOS 129809, 139971-140001, and all HUK-1.

## MA-1 Compass Controls

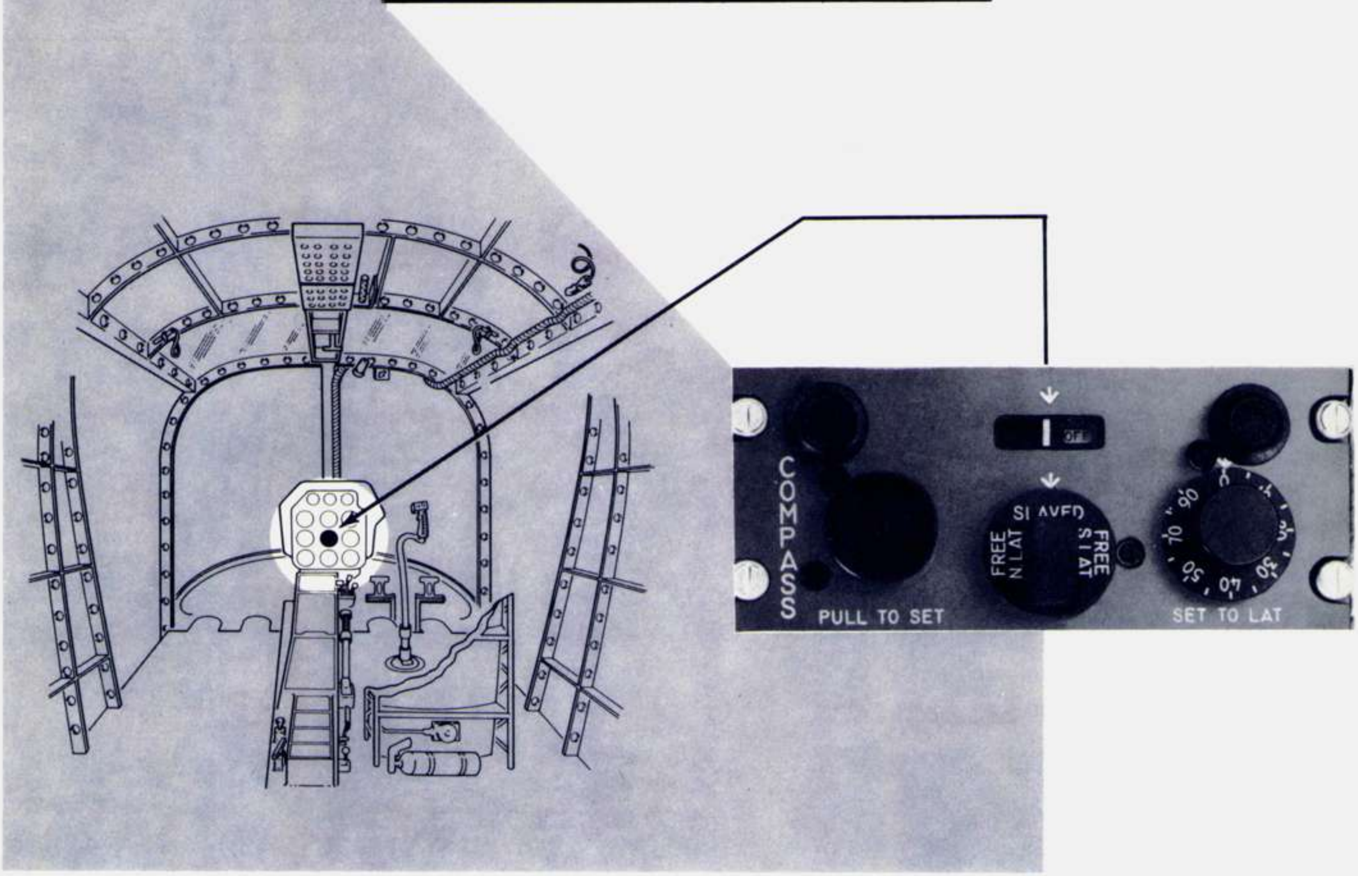



*Figure 4–21*

**Normal Operation.** To operate the system as a compass controlled directional gyro, proceed as follows:

1. FREE N. LAT-SLAVED-FREE S. LAT knob – SLAVED.
2. PULL TO SET knob – Adjust.

   Pull the knob out and rotate it until the indicator is set approximately on the desired heading. Release the knob to allow the indicator to align itself with the exact magnetic heading of the aircraft. Alignment is ensured when the white bar, located in the window above the selector switch, is directly below the arrow. Slight oscillation of the white bar is a normal condition.

**CAUTION**

There are two null positions for the knob, which are 180° apart. To ensure that the proper null position is obtained, check that the white bar moves in the same direction as the knob.

To operate the system as a free directional gyro, proceed as follows:

1. FREE N. LAT-SLAVED-FREE S. LAT knob – As required.

   Rotate the knob to the FREE N. LAT or FREE S. LAT position depending upon location with respect to the equator.
2. PULL TO SET knob – Adjust.

   Pull out the knob and rotate it until the indicator is set to the desired heading.
3. SET TO LAT knob – Adjust.

   Position the knob to the degree of latitude in which the helicopter is flying to compensate for gyro drift due to the earth's rotation.

**Note**

In free gyro operation, the gyro is subject to a drift rate of up to 4 degrees per hour; therefore, the gyro should be reset as required.

# Cargo Hook and Rescue Hoist System

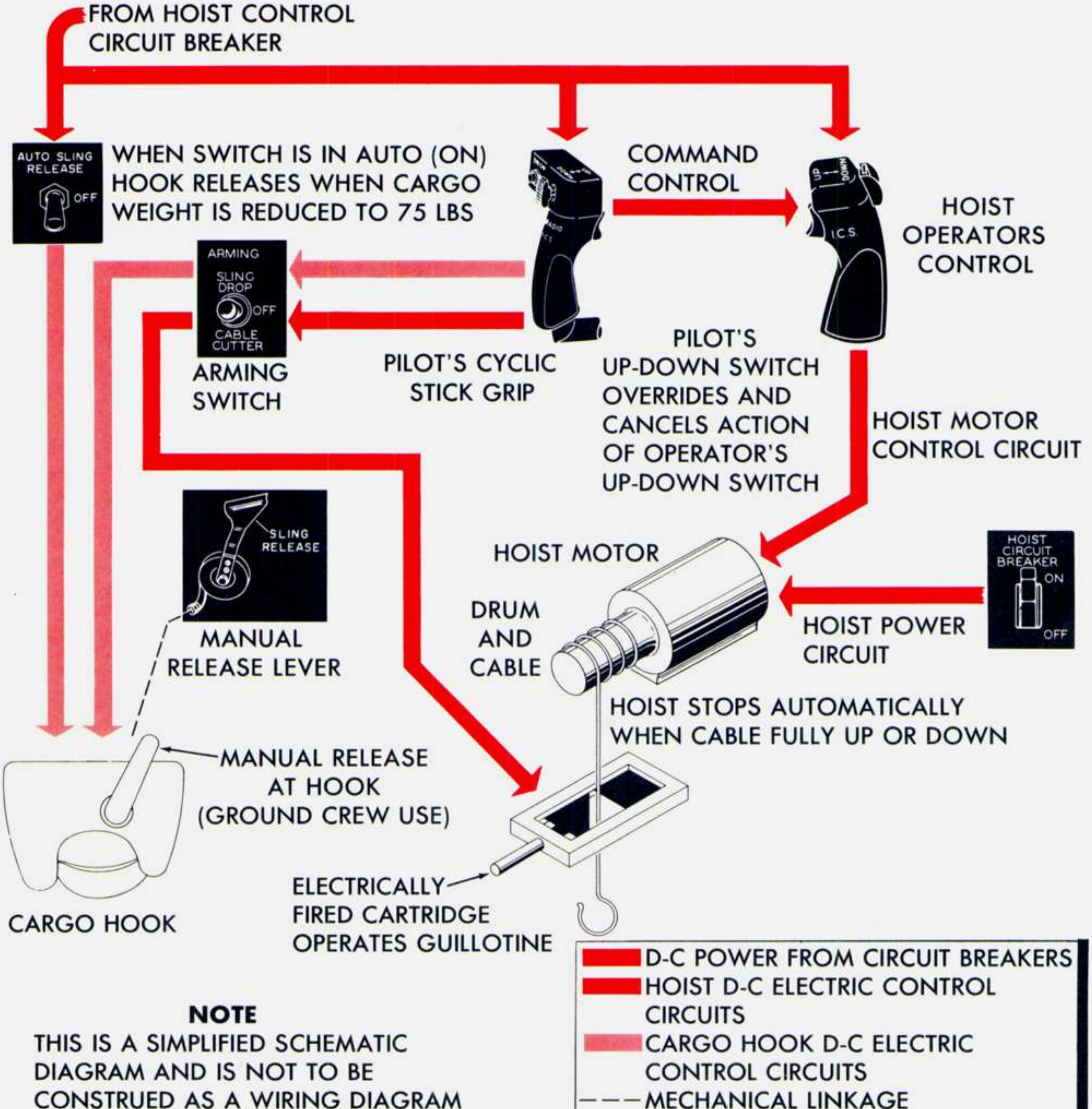



*Figure 4—22*

## CARGO HOOK EQUIPMENT

### DESCRIPTION.

The cargo hook assembly (5, figure 4—23) is mounted on the fuselage belly between the landing gear forward fittings. The cargo hook system (see figure 4—22) provides for carrying external cargo suspended from a cargo hook by means of a suitable sling. An external manual hook allows ground crews to attach the sling to the hook. When the AUTO SLING RELEASE switch (3, figure 4—22) is in the ON position, the sling can be released automatically by means of a weight sensing switch, which releases the hook when the load is reduced to 75 pounds. The load can also be released manually by depressing the release lever to the left of the pilot's seat or electrically by depressing the DROP button on the pilot's cyclic stick, when the arming switch (1, figure 4—23) is in the SLING DROP position. Power for electrical sling release is supplied from the 28-volt d-c bus (secondary bus on HUK-1 helicopters) through the hoist control circuit breaker mounted on the console circuit breaker panel (see figures 1—22 and 1—23).

### NORMAL OPERATION.

To pick up and carry external cargo, proceed as follows:

1. ARMING switch — SLING DROP.

   Hover over the pickup area for attachment of the load by ground crew (refer to Section V for limitations on cargo hook load). Upon receiving a signal that the load is attached, slowly raise collective pitch lever until restraint from the load is felt. Continue raising collective pitch lever and increase power settings as necessary. Apply forward cyclic stick movement to gain forward airspeed as soon as possible.

2. ARMING switch — Off.

   Turn switch off to avoid inadvertent release of load during flight.

**WARNING**

To avoid inadvertent release of load, AUTO SLING RELEASE switch should be in the OFF position when the load weighs less than 300 pounds.

**CAUTION**

When flying with loads attached to the hook, do not make uncoordinated turns.

To release external cargo, proceed as follows:

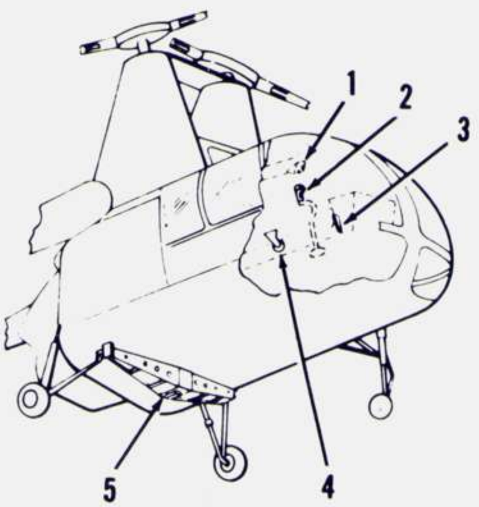
1. ARMING switch — SLING DROP.
2. DROP button — Depress.

### EMERGENCY OPERATION.

1. MANUAL SLING RELEASE lever — Press.

   When DROP switch does not release load, press release lever at left of pilot's seat.

## Cargo Hook and Cargo Hook Controls




1. ARMING SWITCH
2. DROP SWITCH
3. AUTO RELEASE SWITCH
4. MANUAL RELEASE LEVER
5. CARGO HOOK

*Figure 4—23*

## PASSENGER CARRYING EQUIPMENT

Backrests and seat cushions with lap-type safety belts are installed in the aft cabin area (two in HOK-1, three in HUK-1). When the casualty carrying equipment is to be used, the seat directly behind the pilot's seat remains installed for use by a medical attendant.

## CASUALTY CARRYING EQUIPMENT

Two channel-type litter supports (see figure 4–24) and stokes or pole-type litters may be installed, one above the other, on the left-hand side of the cabin. When the litter equipment is to be installed, all seats are removed, except the pilot's seat and the attendant's seat directly to the rear, together with the copilot's flight controls. The litter supports are stowed on the left and right-hand cabin walls and are secured to the fuselage structure when in use.

### NORMAL PROCEDURES.

Litter loading and unloading are normally accomplished by ground crew personnel except for pilot operation of the support lock handle (3, figure 4–24).

**WARNING**

When rotors are turning, be sure to approach and leave the helicopter from the nose.

To load litters, proceed as follows:

1. Nose door – Open.
2. Left-hand cabin door – Open.

**Casualty Carrying Equipment**

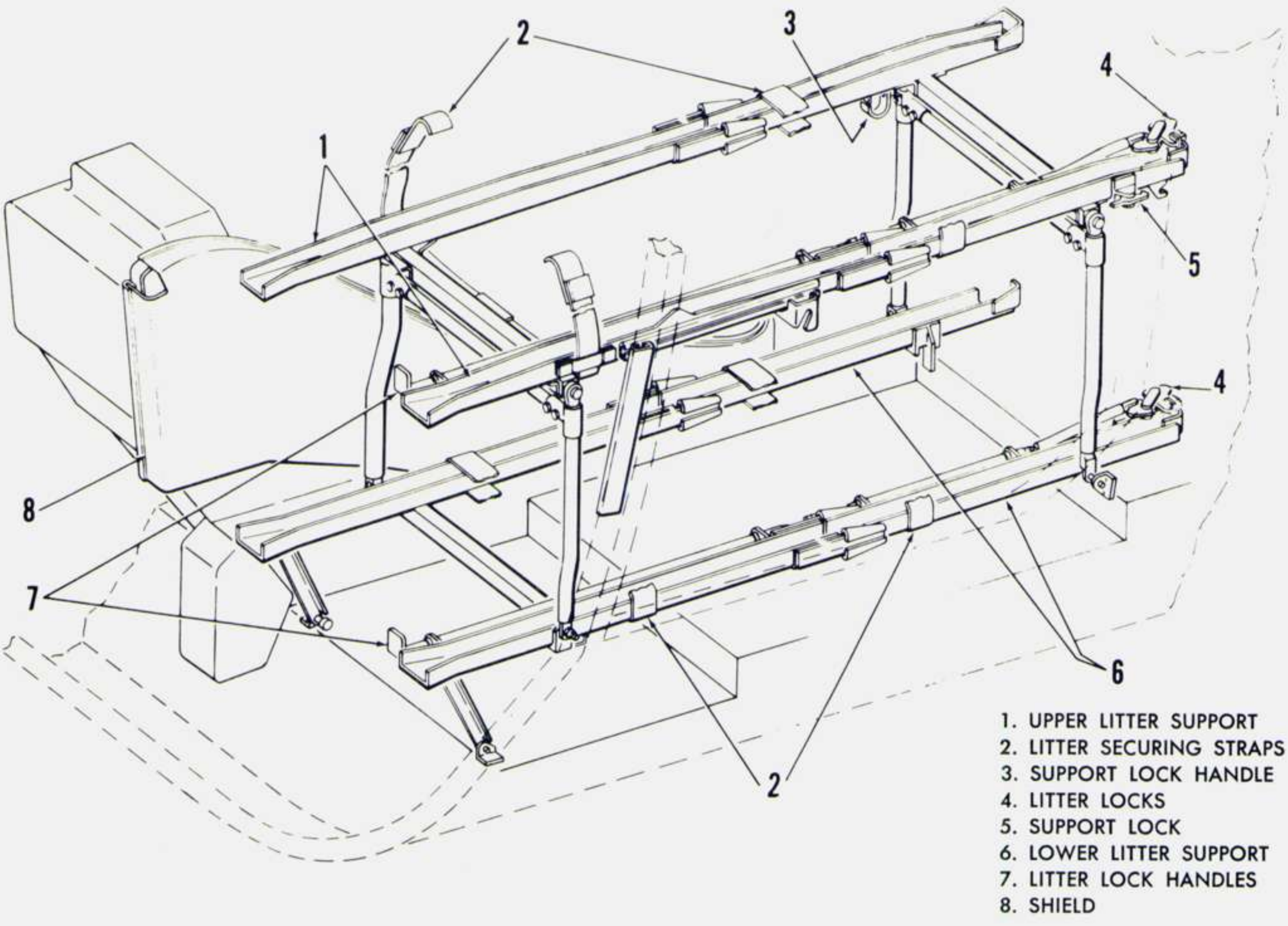



*Figure 4–24*

3. Litter support lock handle — Pull.
4. Upper litter support — Pull forward and down.
5. Upper litter securing straps — Loosen.
6. Upper litter lock handle — Fully forward.
   Position litter on upper support and secure with straps.
7. Upper litter lock handle — Fully aft.
   Check to ensure that the litter is secured with the handle in the fully aft position.
8. Litter support and litter — Push up and aft.

**WARNING**

Check to ensure that support lock (5, figure 4—24) is locked to fuselage pin.

9. Lower litter securing straps — Loosen.
10. Lower litter lock handle — Fully forward.
    Position litter on lower support and secure with straps.
11. Lower litter lock handle — Fully aft.
    Check to ensure that the litter is secured with the handle in the fully aft position.
12. Left-hand cabin door — Closed and locked.
13. Nose — Closed and locked.

To unload litters, proceed as follows:

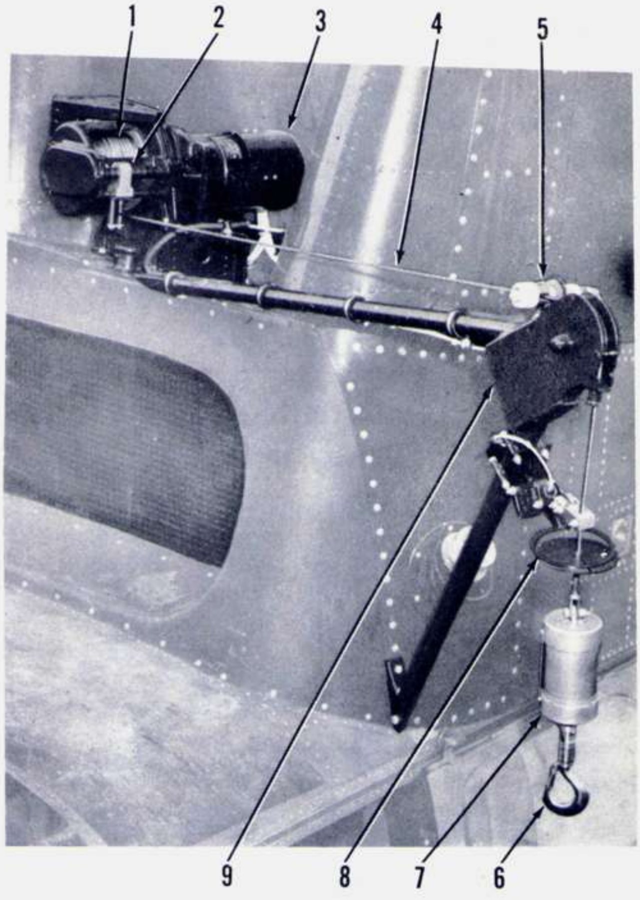
1. Nose door — Open.
2. Left-hand cabin door — Open.
3. Lower litter securing straps — Loosen.
4. Lower litter lock handle — Fully forward.
   Remove the lower litter from the helicopter.
5. Upper support lock handle — Pull.
   Pull upper support and litter unit until it rests against the stops.
6. Upper litter securing straps — Loosen.
7. Upper litter lock handle — Fully forward.
   Remove the upper litter from the helicopter.

## RESCUE HOIST EQUIPMENT

### DESCRIPTION.

The rescue hoist system (see figure 4—22) is electrically operated and has 100 feet of cable. The cable drum (1, figure 4—25) and hoist motor (3, figure 4—25) are mounted between the pylons. The cable feeds off the drum and over a pulley, which is held rigid by means of a tripod. The tripod and pulley positions the cable in such a way that rescued personnel may enter the helicopter through the left-hand cabin door. A safety latch hook is attached to the cable by means of a damper assembly. The damper reduces shock loads to both the helicopter and personnel being rescued. Limit switches stop the hoist automatically when in the fully raised or lowered position. An automatic brake holds the cable at any position, and a guillotine-type cable cutter, controlled by the pilot, can be used to cut the cable if it becomes entangled with ground objects and cannot be released.

**Rescue Hoist**




1. HOIST DRUM
2. LEVEL WIND DEVICE
3. HOIST MOTOR
4. HOIST CABLE
5. CABLE CUTTER
6. HOOK AND SAFETY LATCH
7. DAMPER ASSEMBLY
8. UP-LIMIT SWITCH AND TRIP MECHANISM
9. TRIPOD ASSEMBLY

*Figure 4—25*

The hoist circuit breaker switch and an arming switch are located on a small panel in the center of the cabin ceiling. The circuit breaker switch must be in the ON position for hoist operation. Up-down switches are provided for the pilot on the cyclic stick and for the hoist operator on the hoist operator's grip, which is connected to a flexible cable and stowed on the cabin ceiling aft of the arming switch. The pilot's UP-DOWN switch overrides the hoist operator's switch, giving the pilot complete control of the system in case of an emergency. A DROP button, also on the pilot's cyclic stick, actuates the cable cutter when the arming switch is in the CABLE CUTTER position. Power to operate the hoist is received from the 28-volt d-c bus (secondary bus in HUK-1 helicopters) through the hoist control circuit breaker located on the console circuit breaker panel. Refer to Section V for hoist load and operating cycle limitations.

#### NORMAL OPERATION.

To operate the equipment, proceed as follows:

1. All non-essential electrical equipment – Off.
2. HOIST CIRCUIT BREAKER switch – ON.
3. ARMING switch – CABLE CUTTER.
4. UP-DOWN switch – Actuate as necessary.
   Either the pilot or the hoist operator may operate the system.

**WARNING**

It is possible for rescue seat rings or horsecollar rings to slip from the hook during rescue operations if they are not set properly in the hook. When hauling in, exercise caution until it is determined that rings are set properly in the hook.

#### EMERGENCY PROCEDURES.

The pilot may operate his up-down switch as necessary, thus overriding the hoist operator's controls, and may, in case of an emergency, depress the DROP button to sever the cable.

## MISCELLANEOUS EQUIPMENT

#### HEATED SUIT PROVISIONS.

Four 28-volt d-c electrical outlets are provided for operation of heated suits for the pilot, copilot, and two passengers.

#### AIRCRAFT FILES KIT.[1]

The aircraft files kit is mounted on the rear cabin wall above the heater diffuser.

#### FLIGHT DATA.

A MK-16A Chart Plotting Board is contained in a rack above the back of the copilot's seat. Clips on the side of the instrument panel support provide for retaining miscellaneous flight data.

#### CORRECTION CARD HOLDER.

A card holder, with airspeed and compass correction cards, is located on the cabin ceiling above the pilot's seat.

#### CHECK LIST.

The pilot's check list (14, figure 1–9) is located on the console control panel.

#### RELIEF EQUIPMENT.

The pilot (HOK-1 and HUK-1) and copilot (HOK-1 only) are provided with relief tubes located directly below the forward edges of their seats.

#### WATER CONTAINERS.

Strap assemblies are provided for carrying standard size canteens on the left-hand (HOK-1 only) and right-hand (HOK-1 and HUK-1) sides of the rear cabin wall. The canteens are not part of the helicopter equipment.

[1] BUNOS 125528-125631, 129800-129840, and 138098-138102 only.

# section V

# Operating Limitations

## MINIMUM CREW

A pilot is the minimum crew required for a normal nontactical flight in this helicopter. Additional crew members may be assigned at the discretion of the commanding officer.

## INSTRUMENT MARKINGS

Each instrument that has operating limit markings is shown on figure 5–1. Special attention should be given the instrument markings, since they represent limitations not necessarily repeated in the text. When necessary, additional explanation of instrument markings is covered in the text under the appropriate heading.

## ENGINE LIMITATIONS

### ENGINE SPEED.

Maximum engine speed is 2250 rpm. Higher engine speeds will reduce engine life, and will reduce the lifting efficiency of the rotors. Refer to Section VI for a discussion of rotor speed.

### MANIFOLD PRESSURE.

The following limitations have been established to distribute the effect of any overloads evenly over the period between overhauls.

**Maximum Allowable Power.** Maximum allowable power (at sea level and 0.0 inches atmospheric vapor pressure) is obtained at 36.5 inches Hg manifold pressure for the HOK-1, and at 36.0 inches Hg manifold pressure for the HUK-1. Refer to figures A–4 and A–5 to determine maximum power manifold pressure for any specific atmospheric condition. The use of maximum power is limited to 5 minutes duration.

**Maximum Continuous Power.** Maximum continuous power (at sea level and 0.0 inches atmospheric vapor pressure) is obtained at 35 inches Hg manifold pressure for the HOK-1, and at 34.6 inches Hg manifold pressure for the HUK-1.

## ENGAGING CLUTCH AND ROTORS

The recommended maximum wind velocities for engaging and disengaging the clutch and rotors are shown in figure 5–2. Exceeding these limits may cause damage to the droop stops and the lag stops.

Do not move the clutch control lever to ENGAGE when engine oil temperature is below 30° C.

Do not move the clutch control lever to ENGAGE when the engine is operating above 1500 rpm, or when the rotors are operating between 20 and 80 rpm.

Do not increase engine speed above 1800 rpm while attempting to accomplish initial engagement of the clutch.

The maximum permissible speed for full engagement of the clutch, indicated by synchronization of the tachometer, is 1600 rpm.

A series of surges in engine speed to above 1600 rpm during engagement is an indication of possible malfunction. Shut down, and report surges to appropriate maintenance personnel.

## Instrument Markings


PILOT'S INSTRUMENT PANEL

**CLUTCH OIL PRESSURE**

- 45 PSI MINIMUM (red)
- 60 TO 75 PSI DESIRED (white)
- 75 PSI MAXIMUM (red)

**ENGINE GAGE UNIT**

ENGINE OIL TEMPERATURE

| | GRADE 1100 | GRADE 1065 |
|---|---|---|
| (red) | 40°C MIN | 40°C MIN |
| (white) | 75 TO 80°C DESIRED | 65 TO 75°C DESIRED |
| (red) | 95°C MAX | 75°C MAX |

ENGINE OIL PRESSURE

- 60 TO 91 PSI DESIRED (white)

ENGINE FUEL PRESSURE

- 4 TO 6 PSI DESIRED (white)

**AIRSPEED INDICATOR**

- 113 KNOTS MAXIMUM (red)

**MANIFOLD PRESSURE**

- HOK-1 36.5 (red)
- HUK-1 36.0 (red)

INCHES of MERCURY MAXIMUM

Refer to figures 5-2 and 5-3, and to text for additional information on manifold pressure.

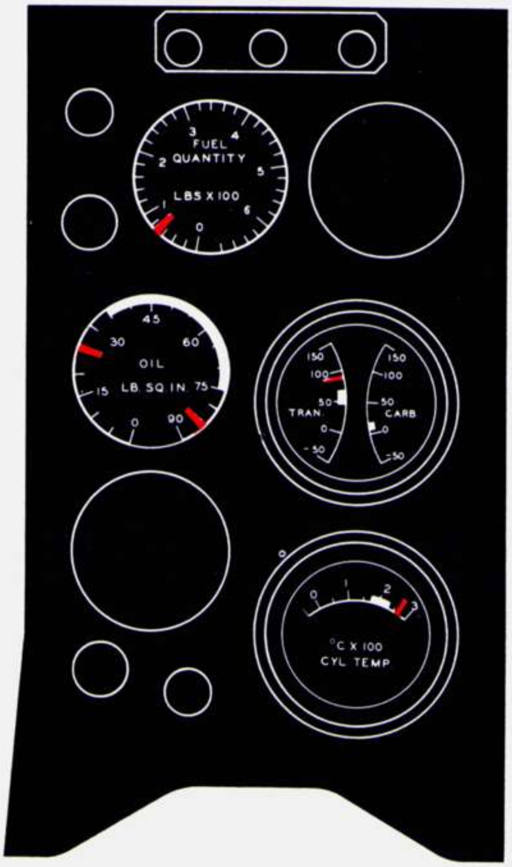
**TACHOMETER**

- 200 TO 250 ROTOR RPM (white)
- 2050 TO 2250 ENGINE RPM (white)

**FUEL GRADES**

91/96
100/130
115/145

*Figure 5—1 (Sheet 1)*




CONSOLE INSTRUMENT PANEL

**FUEL QUANTITY**

- (red) 70 POUNDS, MINIMUM FUEL FOR SAFE OPERATION

**TRANSMISSION OIL PRESSURE**

- (red) 25 PSI MINIMUM
- (white) 35 TO 75 PSI DESIRED
- (red) 85 PSI MAXIMUM

**TRANSMISSION OIL TEMPERATURE**

- (white) 49 TO 65°C DESIRED
- (red) 93°C MAXIMUM

**CARBURETOR MIXTURE TEMPERATURE**

- (white) 5 TO 15°C DESIRED

**CYLINDER HEAD TEMPERATURE**

- (white) 176 TO 232°C DESIRED
- (red) 260°C MAXIMUM

**FUEL GRADES**

91/96
100/130
115/145

*Figure 5—1 (Sheet 2)*

## Maximum Wind Velocity For Engaging Rotors

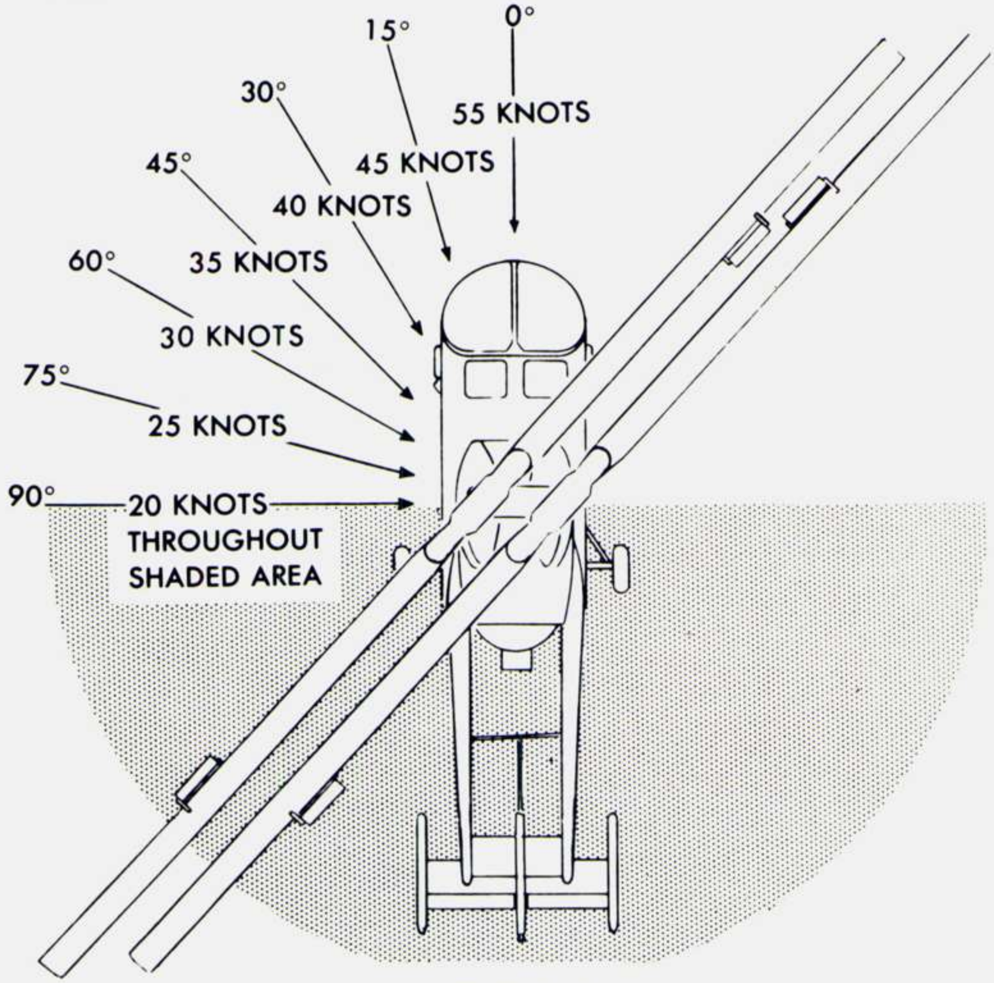



*Figure 5—2*

## PROHIBITED MANEUVERS

In-flight maneuvers with these helicopters are restricted as follows:

1. Abrupt movement of the flight controls should be avoided, to prevent unnecessary stresses in the rotor system.
2. Do not hover in such a manner that the relative tail-wind exceeds 20 knots, as abrupt directional pedal movement may be required to maintain heading.
3. The angle of bank shall not exceed 45 degrees.
4. Acrobatic flight is prohibited, because of inherent helicopter structural limitations.

## HOVERING LIMITATIONS

Hovering at zero airspeed at altitudes between 10 and 360 feet above the ground should be avoided whenever possible, since a power failure under these conditions is likely to result in an extremely severe landing.

## MINIMUM HEIGHT FOR SAFE LANDING AFTER ENGINE FAILURE

Figure 5—3 indicates the altitudes and airspeeds from which a safe power-off landing is difficult to perform. Intentional autorotations should not be entered from any speed-altitude condition within the shaded areas of figure 5—3.

## CENTER OF GRAVITY LIMITATIONS

To ensure adequate control, the helicopter shall be loaded so that the center of gravity is between stations 116.0 and 123.0 (the firewall between the cabin and the engine is located at station 120). For information on how to determine the center of gravity for any load condition, refer to the Handbook of Weight and Balance, AN 01-18-40.

## Minimum Height For Safe Landing After Engine Failure

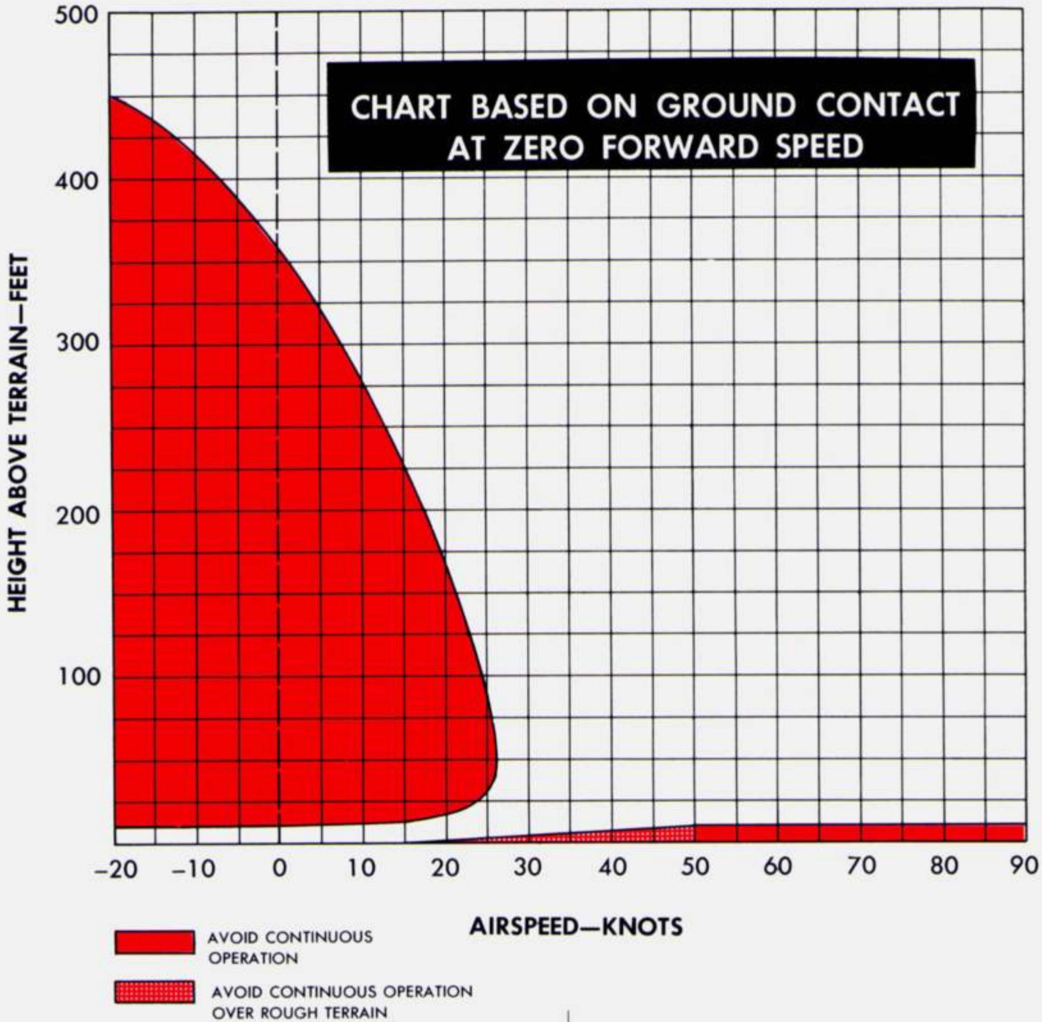



*Figure 5—3*

## WEIGHT LIMITATIONS

It is not the purpose of the following data to establish maximums. It is to provide information with which you can evaluate the importance of a mission against the degree of risk being assumed by exceeding the gross weights recommended for normal conditions. The weight limitations are imposed by structural characteristics.

### HELICOPTER GROSS WEIGHT.

The maximum recommended gross weight for operation under normal conditions is 5924 pounds for the HOK-1, and 6203 pounds for the HUK-1. Under emergency or combat conditions, this weight may be exceeded to the limit of horsepower available for flight.

Operational limitations on gross weight and accelerations are defined by figure 5—4. The maximum gross weight for hovering out of ground effect under various atmospheric conditions are shown in the takeoff gross weight limitations charts in Appendix 1.

## Gross Weight and Acceleration Limitations

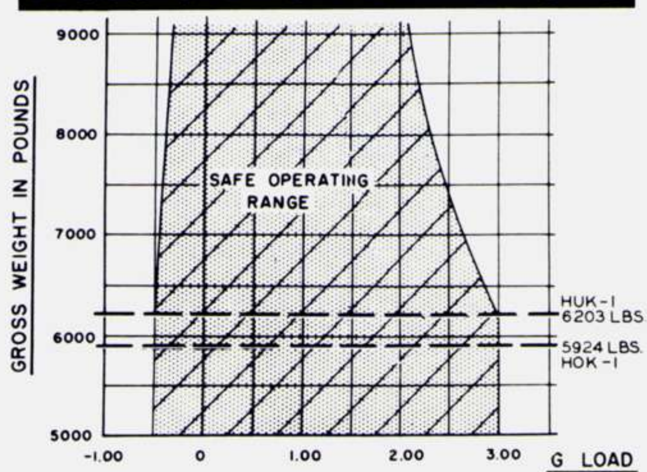



*Figure 5—4*

### CARGO HOOK LOADS.

The maximum recommended weight for loads attached to the cargo hook is 2000 pounds at accelerations of not over 2g, or 1300 pounds at accelerations of not over 3g.

## RESCUE HOIST LOADS

Loads attached to the rescue hoist shall not exceed 600 pounds. Since rescue operations are generally performed at hover, with helicopter movement kept at a minimum to avoid possible injury to personnel being rescued, acceleration limits have not been established for rescue hoist loads.

## RESCUE HOIST OPERATION

Do not unnecessarily stop and start the hoist during up or down travel. Whenever possible, allow at least 20 seconds motor rest before lowering or raising the hoist cable. These limitations are imposed to reduce the possibility of overheat damage to the hoist motor.

## AVAILABLE FUEL

To prevent fuel exhaustion when operating helicopter with minimum available fuel, avoid uncoordinated flight.

# section VI

# Flight Characteristics

## GENERAL CHARACTERISTICS

The intermeshing, counter-rotating rotors in this helicopter are so arranged that the unbalanced torque, normally found in a single main rotor, is equalized. With a minimum amount of unbalanced torque in the rotor system, much of the requirement for pilot coordination, usually associated with changes in power is eliminated. Torque is unbalanced between the two rotors only for changing directional heading by use of the foot pedals. Cyclic stick pressure is greatly reduced by the use of servo flaps.

**CAUTION**

Care should be used when making sharp flare-outs near the ground to avoid unnecessary damage to the tail surfaces.

In forward flight, the control of the helicopter conforms to accepted helicopter practice and in addition, it may be trimmed for hands-off flying. Minor corrections in heading can be made by use of foot pedals alone, with a coordination of bank automatically resulting.

**Note**

Improved performance may be obtained by holding neutral foot pedal control when flight heading is crosswind.

## STALLS

The helicopter will not stall at slow speed. However, in downwind flares, the helicopter will go through a condition of zero airspeed accompanied by settling inertia, which may make it difficult or impossible to avoid inadvertent contact with the ground. As in other helicopters, therefore, it is recommended that downwind flares be avoided.

## ROTOR BLADE STALL

Because of the blade flap control system, the counter-rotating rotors, and the relatively light rotor disc loading of this helicopter, rotor stall will not occur if the operating limitations of Section V are observed. If the operating limitations are exceeded during flights at high airspeed and altitude with low rotor rpm, minor roughness of a noncritical nature may occur. It is caused by the increased control input and the resultant increased blade angles required at higher speeds and altitude. The helicopter may be flown with the roughness occurring, or roughness can be reduced by decreasing airspeed and increasing rotor rpm, or by descending to a lower altitude.

## SPINS

Spins are strictly prohibited.

## FLIGHT CONTROLS

The configuration of the helicopter permits all flight control movements to be based on a neutral control position producing a true neutral flight condition, i.e., hovering in a fixed position. When the controls are moved for a desired flight condition, the resulting flight attitude will be responsive in accordance with the control movement. It is characteristic of the helicopter that when the flight control system has been properly rigged and maintained, little or no foot pedal displacement should be required to hold directional heading with zero wind, or when heading directly into the wind.

**WARNING**

If excessive foot pedal displacement (approximately 1 inch) is required to hold directional heading with zero wind, or directly into the wind, it may be an indication that an azimuth collective thrust bearing is abnormally worn and an inspection is required.

## LEVEL FLIGHT

The stability of the helicopter is such that the collective stick position and throttle may be locked during sustained level flight, and all flight variations may be corrected or altered with the cyclic stick and foot pedals. Periodic resetting of the collective stick and throttle may be required to account for the change in gross weight as fuel is consumed.

## POWER SETTLING

Vertical settling at zero airspeed should be avoided where possible, and extreme caution should be used when settling in this manner at altitudes from 20 to 500 feet above the ground.

## ROTOR SPEEDS

The rotor speeds during all phases of flight should be kept within the limits shown on the tachometer markings, figure 5—1. If rotor rpm is allowed to drop below the minimum operating range, excessive coning and corresponding loss of lift will occur.

## DIVING

See Section V for maximum permissible airspeed.

## HOVERING

The stability of the helicopter permits exact hovering flight, although as in any helicopter, hovering at zero airspeed between 10 and 360 feet above the ground should be avoided. A power failure at this point would likely result in a severe landing. Figure 5—5 shows the caution areas based on indicated airspeed and altitude above the ground.

# section VII

# Systems Operation

## CRUISE CHECKS

### CARBURETOR MIXTURE TEMPERATURE.

The engine with which this helicopter is powered is subject to formation of carburetor ice. When the aircraft is being flown in potential icing conditions and during certain flight operations when carburetor icing is a potential hazard, or during all operations under severe icing conditions the carburetor air lever should be adjusted to keep the indicated carburetor mixture temperature within the desired range (white line).

### MIXTURE LEVER.

Move the mixture lever aft until engine roughness or a dropoff in power is noted, then move the lever forward until the engine becomes smooth and maximum power is restored.

**Note**

Observe cylinder head temperature readings when operating above 5000 feet with mixture control lever in a lean position.

### ENGINE BACKFIRING, SURGING, ETC.

If the engine backfires, surges, misses, or exhibits abnormal roughness so as to introduce intermittent sharp power impacts into the drive system while the clutch is engaged and rotor speed is below 190 rpm, shut down the engine as soon as practicable. Shut down in accordance with normal procedure. Prior to further flight, report the condition to appropriate maintenance personnel for inspection of the rotor system and the engine.

**Note**

The rotor system can be damaged whenever the above conditions occur. However, the probability of damage is greatest at rotor speeds from 20 to 80 rpm.

## IN-FLIGHT ROTOR TRACKING SYSTEM[1]

### DESCRIPTION.

This equipment enables the pilot to adjust rotor blade tip-path track during flight. Adjustment of track is accomplished by electrically operated actuators, connected between the bottom of the lag pin and the U-crank of one blade of each rotor. Each actuator operates an eccentric linkage (tie bar, rockers, and bearings) that moves the pivot point of the U-crank inboard or outboard. This increases or decreases the range of the angle of attack of the rotor blade flap. These changes in flap-angle raise or lower the tip-path track of that blade. The actuators are controlled by switches (7, figure 1–16) located on the upper forward cabin ceiling. Slip-ring assemblies in each pylon, complete the electrical circuits between the switches and the actuators.

The primary purpose of the in-flight tracking device is to permit the pilot to make track adjustments during basic rigging and tracking of the helicopter (following major maintenance, rotor changes, etc.) and during

[1] Installed in HOK-1 helicopters BUNOS 13996 thru 140001, and all HUK-1 helicopters

normal flight operations. It is suggested that in-track condition at hover be obtained by normal ground tracking procedures. For forward flight tracking the in-flight tracking controls should be used, after which the in-flight tracking device should be neutralized and properly compensated by normal ground adjustments.

Visually, follow the tip-path of the right rotor downward and to the right, so that the right rotor disc can be seen without interference from the left rotor.

If the tip-paths of the two right rotor blades appear as a single line at the edge of the rotor disc, the rotor is in track. No adjustment is required.

However, if the two blades of the rotor appear to describe separate paths, one above the other, the rotor is out of track. To adjust, press up or down on the ROTOR TRACK, RIGHT switch. A beeping action rather than a steady holding action is recommended to avoid overshooting. The tip-paths should appear to move vertically toward each other.

**Note**

If the tip-paths appear to move vertically away from each other, press the switch in the opposite direction. This will reverse the direction of movement, and cause the tip-paths to move toward each other.

Release the switch when the tip-paths of the right rotor blades appear as a single line.

Repeat the above procedure, but sight to the left to see the tip-paths of the left rotor. Use the ROTOR TRACK, LEFT switch to track the left rotor. It is suggested that the in-flight tracking controls not be used at speeds in excess of 80 knots IAS.

**Note**

If actuating a ROTOR TRACK switch causes increased helicopter vibration, actuate the switch to the opposite position to decrease vibration and visually check that rotor track is being improved.

**CAUTION**

If during normal operational use of the helicopter (excludes rigging and tracking operations) it is found that maximum available adjustment is not enough to maintain track, an inspection should be made to determine whether malfunctions exist or whether the tracking actuators require static rigging.

# section VIII

# Crew Duties

CREW DUTIES, OTHER THAN THOSE COVERED IN OTHER SECTIONS OF THIS MANUAL, ARE OF A MINOR NATURE AND DO NOT WARRANT COVERAGE AT THIS TIME.

# section IX

# All-Weather Operation

## INSTRUMENT FLIGHT PROCEDURES

Information pertaining to instrument flight procedures is not available at this time.

## COLD WEATHER OPERATION

The normal operating procedures outlined in Section II should be followed during cold weather operation, with the following exceptions:

### EXTERIOR INSPECTION

Perform the following checks in addition to those listed in Section II.

1. Protective covers — Remove.
2. Moisture accumulations — Drain.
   a. Fuel cell sump.
   b. Fuel strainer.
   c. Transmission oil tank sump.
   d. Engine oil tank sump.
3. Vents — No ice stoppage.
   a. Fuel cell vent.
   b. Fuel pump drain line.
   c. Engine crankcase breather.
   d. Transmission oil tank vent.
   e. Battery vent.
4. Tires — Not frozen to ground.
5. All openings — Remove snow.
6. Exterior surfaces — Remove ice and snow.

**WARNING**

Thoroughly remove snow and ice from all rotor blade and flap surfaces. Do not attempt takeoff if ice is accumulating.

7. Preheat — Apply.
   a. Engine.
   b. Transmission and clutch.
   c. Cabin.

### INTERIOR INSPECTION

Snow accumulations — Remove.

### STARTING ENGINE

Use the normal starting procedure described in Section II. Apply carburetor heat if necessary after the engine is running.

If oil dilution was used after the last flight of the previous day, proceed as follows before the first flight of the day:

Run the engine at 1000 to 1100 rpm for 15 minutes. Shut down, and have the oil drained and checked for sludge, and the engine oil screen and sump drain magnetic plug cleaned. Repeat this procedure until excessive sludge is eliminated.

Make a short test flight, and again have the screens checked for sludge. If sludge is excessive, have oil changed and the screens and sump plug checked again before releasing the helicopter for service operation.

**WARNING**

All fire prevention precautions must be taken throughout the above procedures. Do not handle drained oil in confined spaces.

## CRUISE CHECKS

To detect carburetor ice if suspected, apply carburetor heat. Ice is present if manifold pressure remains the same or decreases slightly and then rises.

Prevent carburetor ice by using carburetor heat prior to entering icing conditions.

If extreme icing conditions are encountered during flight, land as quickly as possible.

## ENGINE SHUTDOWN

Stop the engine following the procedures outlined in Section II except when oil dilution is used to prepare for cold weather starting. Oil dilution is used only if oil preheat equipment is not available.

If oil preheat equipment is not available, refer to figure 9—1 to determine the oil grade to be used, and to determine whether oil dilution is required. If preheat equipment is available, use Grade 1100 oil under all conditions.

**Note**

Unless practiced on a regular, periodic basis, oil dilution will loosen engine sludge deposits which can plug critical oil passages or collapse oil screens. Once oil dilution has been used, it is best to dilute regularly.

If oil dilution is required, proceed as follows:

1. a. Cylinder head temperature — Below 148° C (298° F).
   b. Engine oil temperature — Below 50° C (122° F).
   Idle at 900 rpm, or if necessary, stop engine to reduce engine temperature.
2. Engine oil tank — Service (ground crew).
3. Oil dilution manual shutoff valve — Open (ground crew).
4. Throttle — Adjust for 900 rpm.
5. Oil dilution switch — Press.
   Refer to figure 9—1 for oil dilution times. Continue to press switch during step 6, until engine stops.

**WARNING**

Dilution increases the inflammability of crankcase breather vapors. Oil diluted 20 percent or more can be ignited at temperatures of 15° C (60° F) and will burn readily. Station personnel with fire extinguishers in the immediate vicinity of the engine during oil dilution procedures. Do not dilute oil for more than 3 minutes.

## Oil Grade and Oil Dilution Limits

| FORECAST OF TEMPERATURE PRIOR TO NEXT START | OIL GRADE TO BE USED | DILUTION TIME (MINUTES) | | PERCENT OF DILUTION (APPROXIMATE) | |
|---|---|---|---|---|---|
| | | GRADE 1065 | GRADE 1100 | GRADE 1065 | GRADE 1100 |
| −4° C (25° F) | 1100 | — | NONE | — | NONE |
| −12° C (10° F) | USE 1065, IF AVAILABLE, FOR ALL TEMPERATURES BELOW −6° C (25° F); USE 1100 IF THE 1065 IS NOT AVAILABLE | NONE | 1.0 | NONE | 12 |
| −21° C (−5° F) | | 0.5 | 1.5 | 6 | 18 |
| −29° C (−20° F) | | 1.0 | 2.0 | 12 | 24 |
| −37° C (−35° F) | | 1.5 | 2.5 | 18 | 30 |
| −46° C (−50° F) | | 2.0 | 3.0 | 24 | 36 |

*Figure 9—1*

6. Mixture lever — IDLE CUTOFF.
7. Fuel boost pump switch — OFF.
8. Fuel shutoff switch — OFF.
9. Ignition switch — OFF.

## BEFORE LEAVING THE HELICOPTER

Perform the following checks in addition to those listed in Section II.

1. Wheels — Protect.
   Place wheels on insulation such as planks or sandbags to prevent freezing.
2. Wheel brakes parking lock — OFF.
3. Tiedown equipment — Install.
4. Protective covers — Install.
5. Battery — Protect.
   Remove battery and place in warm area if temperature is below −29° C (−20° F) and helicopter is to remain idle for more than 4 hours.
6. Cabin doors — Open slightly.
   Air circulation will retard frost formation, and will prevent cracking of the transparent areas due to differential contraction.
7. Moisture accumulations — Drain.
   a. Fuel cell sump.
   b. Fuel strainer.
   c. Transmission oil tank sump.
   d. Engine oil tank.
   Drain moisture accumulations as soon as possible after engine shutdown, to prevent ice formation.
8. Vents — No ice stoppage.
   a. Fuel cell vents.
   b. Fuel pump drain line.
   c. Engine crankcase breather.
   d. Transmission oil tank vent.

# DESERT OPERATION

Extreme caution should be used when operating in hot weather because the performance of the helicopter drops as the outside air temperature increases.

When operating under extreme sandy conditions, it is necessary to reduce the time between lubrication and oil change periods. The time between engine top overhaul will also be reduced.

Use filtered carburetor air at all times when operating in dusty or sandy conditions. Place the carburetor air filter knob, located on the control panel aft of the radio, to the FILTERED AIR position.

# TURBULENT AIR OPERATION

When operating in turbulent air or at altitude, such as encountered in mountain areas, use the following techniques to compensate for extremes of atmosphere. The helicopter has been flight-tested under conditions that imposed peak loads far in excess of the limit of pilot discomfort. If desired, pilot discomfort may be used as a guide to determine the extent of roughness that is acceptable. See figure 5—4 for g-load limits.

## ENGAGING ROTORS

Make certain that the helicopter is heading into the wind. Warm up engine sufficiently before engaging rotors. Engage clutch, and while holding cyclic into the wind, increase rotor rpm immediately to prevent excessive bumping of the droop stops. Continue warmup at a reasonable rpm where control is possible (approximately 1700 to 1800 rpm). The rpm required for warmup can best be judged by the amount of wind velocity present. Make a thorough check of engine operation. Maximum recommended headwind velocity for engaging rotors is 50 knots. This limitation may be exceeded when essential emergency missions must be accomplished.

**CAUTION**

If the helicopter is moored, do not engage clutch and rotors with the fuselage and landing gear tiedown lines secured so tightly that no shock strut action is possible.

## TAKEOFF

Heading directly into the wind, apply power and collective stick in a manner that provides a clean positive "lift-off". If takeoff is critical, make certain that clear area exists ahead and move into forward flight immediately to obtain best climb speed as soon as possible.

## CLIMB

Variations in atmospheric conditions, engine performance and gross loading will require pilot judgment to determine best IAS for climb.

## STRAIGHT AND LEVEL FLIGHT

Sharp gusts may cause pilot discomfort which may be reduced in severity by avoiding high airspeeds. However, directional stability is obtained from the fixed tail fins, which become less effective below 50 knots airspeed. Therefore, to maintain good directional stability, airspeed should not be reduced below 50 knots.

Rotor rpm may tend to increase or decrease in gusty conditions and should be controlled by a coordinated adjustment of throttle and collective stick setting. To retain the most effective directional control, however, the collective pitch lever should not be reduced below the halfway mark. Best engine operating speed in turbulence is between 2150 and 2200 rpm.

Vertical winds, especially when operating at low gross weights, may cause the helicopter to ascend or descend due to the relatively low rotor disc loading. Coordinated adjustment of throttle and collective pitch lever, as discussed above, should be used to correct these altitude changes. In more violent cases, these altitude changes should be counteracted by large changes of power settings to either high power, or power-off autorotation. This will ensure best positive control by keeping the collective pitch lever out of the partial power setting (approximately 1/4 UP). During partial power operation, with the collective pitch lever in the 1/4 UP position, the effectiveness of the directional pedals is at a minimum.

The inherent stability of the helicopter is such that it will return to its normal flight attitude without fighting the controls when turbulence causes pitching or rolling. If control corrections become necessary, make positive cyclic stick corrective movements to provide desired attitude.

## TURNS

Less pilot fatigue will be experienced if foot pedal corrections are introduced as soon as the need is apparent. The need and direction of foot pedal corrections can be readily ascertained by using ground reference points in lieu of other heading indications, which may be inaccurate.

Flight handling characteristics regarding turns are particularly favorable for maneuvering in tight places. No limit other than that imposed by good pilot judgment is required. Sharp turns may be executed, using plenty of power and coordinated collective stick movement.

## CROSSWIND

Permit the helicopter to crab as it will, with the helicopter disposed laterally level. Do not cross controls as this will cause skidding and result in roughness. keep engine speed between 2150 and 2200 rpm.

## DESCENDING

When approach is determined and started, preferably into the wind, keep engine speed slightly below cruising rpm, keep rate of descent low and maintain a comfortable amount of indicated airspeed, preferably over 50 knots.

A long, fairly flat approach with the collective stick above the 50 percent setting will afford better handling characteristics than will a steep slow approach. This will also keep the helicopter out of the AVOID CONTINUOUS OPERATION area shown in figure 5–5.

## PRE-LANDING CHECK

Due to reduced available horsepower above 6000 feet and reduced air density, determine if power available at landing altitude is sufficient to permit hovering with the gross loading, and atmospheric conditions prevailing at time of landing. This may best be accomplished by establishing straight and level flight at 35 to 45 knots IAS, out of ground effect, and noting the minimum manifold pressure required to maintain this flight condition. When manifold pressure has been determined, apply full power available up to operating limitations, in climbing attitude, and note manifold pressure.

The difference between the two readings will be the basis for estimating whether or not the helicopter will hover under existing conditions. For example: With a no-wind condition, flying at 35 to 45 knots might require 24 inches Hg manifold pressure and a full power check might show that only 29 inches Hg is available, giving an actual difference in manifold pressure of 5 inches Hg. Under these conditions it is doubtful that the helicopter will hover in ground effect, and a non-hovering-type landing should be planned. Experimentation under local conditions will reveal the correct difference in manifold pressure required to hover. As surface winds increase, the difference in manifold pressure required for hovering will reduce to a minimum.

If, during any phase of turbulent air operation, normal maximum power (see Section V) is insufficient to avoid excessive loss of altitude, additional power should be obtained by increasing manifold pressure, rather than by increasing engine speed. Increasing engine speed over normal maximum will decrease rotor efficiency and lift. The R-1340 Engine has been test run at 42 inches Hg manifold pressure without detonation.

## HOVERING

Maintain helicopter heading directly into the wind and hover as low as possible to obtain maximum ground effect.

## DISENGAGING ROTORS

Use the normal procedure for disengaging rotors making certain that the helicopter is heading into the wind. Continue to control rotor attitude with the cyclic stick by holding cyclic into the wind, as necessary, to reduce tendency of hubs to bump against droop stops. Make certain to use normal procedure of applying rotor brake when rotor speed is reduced to 100 rpm.

# appendix I

# Performance Data

## INTRODUCTION

The performance charts and airspeed correction data on the following pages are provided to aid the pilot in flight planning for any mission normally performed with the HOK-1 and HUK-1 helicopters. Through the use of the charts, the pilot is able to select the best power setting, altitude, airspeed, etc., for safe and efficient performance of the mission. With the exception of the landing chart (figure A—24), which is applicable to both helicopters, separate charts are provided for the HOK-1 and HUK-1. Each performance chart indicates whether the information in the chart is based on flight tests or estimates. All performance information shown is conservative, and actual performance can be expected to at least equal that shown in the charts. The use of the charts and related data is explained in the following text.

## SYMBOLS USED IN CHARTS

The symbols and abbreviations used in the charts and the explanatory text are listed in alphabetical order and defined in figure A—1.

## Symbols Used In Charts

| SYMBOL | DEFINITION | SYMBOL | DEFINITION |
|---|---|---|---|
| ALT | ALTITUDE | KTS | KNOTS |
| BP | MIXTURE LEVER MANUALLY LEANED FOR BEST ENGINE PERFORMANCE | LB | POUNDS |
| °C | DEGREES CENTIGRADE | LB/HR | POUNDS PER HOUR |
| CAS | CALIBRATED AIRSPEED | MAN. PRESS. | MANIFOLD PRESSURE |
| °F | DEGREES FAHRENHEIT | MAX | MAXIMUM |
| FPM | FEET PER MINUTE | MIN | MINUTES |
| FT | FULL THROTTLE (USED TO INDICATE MANIFOLD PRESSURE WHEN AVAILABLE PRESSURE IS LIMITED BY ALTITUDE) | OAT | OUTSIDE AIR TEMPERATURE |
| GAL | GALLONS | PRESS. ALT | PRESSURE ALTITUDE |
| IAS | INDICATED AIRSPEED | R | FULL RICH SETTING OF MIXTURE LEVER |
| IN. Hg | INCHES OF MERCURY (PRESSURE) | R/C | RATE OF CLIMB |
| | | RPM | REVOLUTIONS PER MINUTE |
| | | SL | SEA LEVEL |
| | | TAS | TRUE AIRSPEED |

*Figure A—1*

# AIRSPEED CORRECTIONS

## AIRSPEED INDICATOR CORRECTION.

The airspeed indicator correction card, located on the cabin ceiling above the pilot's seat, corrects for slight errors in the calibration of the airspeed indicator installed in the helicopter. To obtain the correct IAS, add or subtract, as indicated on the card, the card values from the airspeed indicator reading.

## CALIBRATED AIRSPEED CORRECTION.

The information for determining CAS from IAS is provided in figure A–2 (HOK-1) and figure A–3 (HUK-1). The correction factors are added to the IAS to compensate for errors introduced by the position of the airspeed-sensing pitot tube.

# DENSITY ALTITUDE DATA

Density altitude is an expression of the density of the air in terms of height above sea level. The less dense the air, the higher the density altitude. At standard day conditions, density altitude is the same as pressure altitude. As temperature increases above standard for any altitude, density altitude increases to values above pressure altitude. When density altitude increases above pressure altitude, helicopter performance is reduced in two basic ways: the power output of the engine is decreased, and the rotors develop less lift for any given power output. Each performance chart that requires the use of density altitude contains curves for obtaining density altitude from pressure altitude and OAT.

# ENGINE OPERATING LIMITS

These charts (figures A–4 and A–5) indicate maximum allowable manifold pressure at various altitudes and temperatures. Two OAT versus manifold pressure plots are provided, one for cold temperature operation at 0° F (–17.8° C), and one for all temperature between 32° F (0° C) and 120° F (48.9° C). (32° F [0° C] OAT represents standard day sea level temperature of 59° F [15° C] at the engine inlet, because of the 27° F [–2.8° C] carburetor air temperature rise.) Maximum allowable manifold pressure at temperature between 0° F (–17.8° C) and 32° F (0° C) are determined by interpolation between the two plots. The full throttle operation plots indicate maximum available rather than maximum allowable manifold pressure. The charts are based on operation in dry air, and correction curves are provided for vapor pressure at dewpoint temperatures between 0° F to 100° F and –20° C to 40° C.

## EXAMPLE PROBLEM USING ENGINE OPERATING LIMITS CHART.

Since the charts for both the HOK-1 and HUK-1 are used in the same way, only one example is shown, using figure A–4. At a pressure altitude of 1750 feet, an OAT of 48° F, and a dewpoint temperature of 70° F, the maximum allowable manifold pressure is 37.0 in. Hg. The result is obtained by the following procedure:

1. Enter the chart at 1750 feet pressure altitude and move horizontally to the right to intersect the OAT plot at 32° F (0° C) to 120° F (48.9° C), since 48° F is within these limits.
2. Move down vertically to intersect the manifold pressure scale at 36.25 in. Hg.
3. Determine the vapor pressure correction by entering the correction chart at the dewpoint temperature of 70° F and moving horizontally to the right to intersect the correction curve. Move down vertically to intersect the vapor pressure scale at 0.75 in. Hg.
4. Add the vapor pressure correction of 0.75 in. Hg to the manifold pressure of 36.25 in. Hg to obtain 37.0 in. Hg maximum allowable manifold pressure.

**Calibrated Airspeed Correction - HOK-1**

| INDICATED AIRSPEED IN KNOTS | CORRECTION IN KNOTS | CALIBRATED AIRSPEED IN KNOTS |
|---|---|---|
| 30.0 | –3.5 | 26.5 |
| 50.0 | –1.0 | 49.0 |
| 70.0 | –4.0 | 66.0 |
| 90.0 | –8.0 | 82.0 |

*Figure A–2*

**Calibrated Airspeed Correction - HUK-1**

| INDICATED AIRSPEED IN KNOTS | CORRECTION IN KNOTS | CALIBRATED AIRSPEED IN KNOTS |
|---|---|---|
| 30.0 | 4.0 | 34.0 |
| 50.0 | 3.5 | 53.5 |
| 70.0 | 0.0 | 70.0 |
| 90.0 | 0.0 | 90.0 |

*Figure A–3*

## TAKEOFF

These charts (figures A—6 and A—7) present the length of ground run required for a running-type takeoff, the minimum takeoff speed, and the total distance (ground run and in-flight) required to clear an obstacle 50 feet high. The information is provided for various conditions of altitude and temperature, and various gross weights. The charts are based upon the use of maximum allowable power for takeoff. Correction plots are included for headwinds up to 30 knots.

### EXAMPLE PROBLEM USING TAKEOFF CHART.

Since the charts for both the HOK-1 and HUK-1 are used in the same way, only one example will be shown, using figure A—6. At an OAT of 70° F, pressure altitude of 4000 feet and headwinds of 10 knots, the chart indicates that at 7000 pounds gross weight, the takeoff distance is 25 feet, the takeoff speed is 11 knots, and the distance required to clear a 50-foot obstacle is 820 feet. These results are obtained by the following procedure:

1. Enter the chart at 70° F OAT and proceed up vertically to intersect the pressure altitude at 4000 feet.
2. Move horizontally to the right to intersect 7000 pounds gross weight on the takeoff distance curve.
3. Descend vertically to intersect the base line of the headwind correction curve.
4. Follow the correction curve until it intersects the line representing 10 knots.
5. Descend vertically to the takeoff distance scale, and read 80 feet.
6. The takeoff speed is read in the same manner as the takeoff distance, except that no headwind correction is required.
7. The distance to clear a 50-foot obstacle is read in the same manner as the takeoff distance.

## TAKEOFF GROSS WEIGHT LIMITATION

These charts (figures A—8 and A—9) present the maximum vertical takeoff weight as limited by the ability to hover out of ground effect and the desired vertical rate-of-climb. The charts are based upon the use of maximum allowable power.

### EXAMPLE PROBLEM USING TAKEOFF GROSS WEIGHT LIMITATION CHART.

Since the charts for both the HOK-1 and HUK-1 are used in the same way, only one example will be shown, using figure A—8. Assume the following conditions:

pressure altitude — 2200 feet
OAT — 80° F (26.7° C)
dewpoint temperature — 50° F (10° C)
desired vertical rate-of-climb — 100 FPM
wind velocity — 10 knots

The chart indicates that the maximum gross weight for a vertical takeoff and climb at 100 FPM is 5975 pounds. The result is obtained using the following procedure:

1. Enter the chart at 2200 feet pressure altitude and move horizontally to the right to intersect the 26.7° C OAT curve.
2. Move down vertically until the base line of the dewpoint correction curve is intersected. Follow the correction curve until it intersects the horizontal line representing 50° C dewpoint temperature.

**Note**

This chart is based on the use of 36.5 inches manifold pressure. If manifold pressure is increased in accordance with figure A—4 or A—5 the dewpoint correction should be reduced to 1/2 of that shown. (After using the correction curve as in step 2, note the total length of horizontal movement to the left that occurred in step 2, then move 1/2 this distance to the right before proceeding with step 3.)

3. Move down vertically until the base line of vertical rate-of-climb correction curve is intersected. Follow the correction curve until it intersects the horizontal line representing 100 FPM rate of vertical climb.
4. Move down vertically until the base line of the wind velocity correction curve is intersected. Follow that curve until it intersects the horizontal line representing 10 knots wind velocity.
5. Move down vertically to gross weight scale, and read 5975 pounds. Note that, under the same conditions of atmosphere, the gross weight limitation can be increased by reducing the rate-of-climb.

### MAXIMUM GROSS WEIGHT FOR ROLLING-TYPE TAKEOFF.

This chart (figure A—10) presents the maximum takeoff gross weight as limited by the ability of the helicopter to make a rolling takeoff and then to climb at 500 FPM with maximum continuous power. The chart provides curves for adjusting for any desired forward rate-of-climb, between zero and 1000 FPM. The chart is based on zero wind conditions.

### EXAMPLE PROBLEM USING MAXIMUM GROSS WEIGHT FOR ROLLING-TYPE TAKEOFF CHART.

Since the charts for both the HOK-1 and HUK-1 are used in the same way, only one example is shown, using figure A—10. With the following conditions:

pressure altitude — 2250
outside air temperature — 80° F (26.7° C)
dewpoint temperature — 50° F (10° C)
desired rate-of-climb — 600 FPM

The chart shows that 6550 pounds is the maximum gross weight for a rolling takeoff. This result is obtained by the following procedure:

1. Enter the chart at 2250 feet on the pressure altitude scale and move horizontally to the right to intersect the 26.7° C curve.
2. Move down vertically until the base line of the dewpoint curve is intersected. Follow the curve until it intersects the horizontal line representing 10° C dewpoint temperature.
3. Move down vertically until the base line of the rate-of-climb curve is intersected. Follow that curve until it intersects the horizontal line representing 600 FPM forward rate-of-climb.
4. Move down vertically to the gross weight scale, and read 6550 pounds.

## HOVERING

These charts (figures A–12 and A–13) present the maximum gross weights at which it is possible to hover in ground effect (wheels 5 feet off the ground) using maximum allowable power at various pressure altitudes and temperatures. Correction curves are provided for vapor pressure at dewpoint temperatures between 0° F to 100° F and –20° C to 40° C, and headwinds up to 30 knots.

### EXAMPLE PROBLEM USING HOVERING CHART.

Since the charts for both the HOK-1 and HUK-1 are used in the same way, only one example is shown, using figure A–12. At a pressure altitude of 1200 feet, OAT of 80° F (26.7° C), dewpoint temperature of 50° F, and headwinds of 10 knots, the maximum gross weight at which it is possible to hover in ground effect is 6850 pounds. The result is obtained as follows:

1. Enter the chart at 1200 feet pressure altitude and proceed horizontally to the right to intersect the OAT scale at 80° F.
2. Descend vertically to intersect the base line of the dewpoint correction curve. Follow the correction curve until it intersects the horizontal line representing 50° F dewpoint temperature.

**Note**

This chart is based on the use of 36.5 inches manifold pressure. If manifold pressure is increased in accordance with figure A–4 or A–5, the dewpoint correction should be reduced to 1/2 of that shown. (After using the correction curve as in step 2, note the total length of horizontal movement to the left that occurred in step 2, then move 1/2 this distance to the right before proceeding to step 3.)

3. Move down vertically until the base line of the headwind correction curve is intersected. Follow the headwind correction curve until it intersects the horizontal line representing 10 knots wind velocity.
4. Move down vertically to the gross weight scale, and read 6850 pounds.

## CLIMB CHART FOR MAXIMUM CONTINUOUS POWER

These charts (figures A–14 and A–15) give the best indicated airspeed, rate-of-climb, and manifold pressure for accomplishing maximum continuous power climbs. The charts also indicate the total time required to complete a climb, and the fuel needed. The information is shown for gross weights of 5000, 6000, and 7000 pounds. For intermediate gross weights, use the next higher weight shown.

### EXAMPLE PROBLEM USING CLIMB CHART FOR MAXIMUM CONTINUOUS POWER.

Since the charts for both the HOK-1 and HUK-1 are used in the same way, only one example is shown, using figure A–14. A climb from pressure altitudes of 2000 feet to 8000 feet is contemplated on a standard day. Helicopter gross weight is 5750 pounds. The values on the chart indicate such a climb can be accomplished in 7 minutes at 41 to 42 knots CAS, using 43 pounds of fuel for the climb. Best manifold pressure ranges from 35 in. Hg at 2000 feet to full throttle at 8000 feet. (During full throttle operation, manifold pressure is not used to indicate engine power. The engine is operated with wide open throttle, and the collective pitch lever setting is adjusted to maintain 2200 rpm rotor speed. At the altitudes at which full throttle operation is indicated, manifold pressure will be less than the maximum, as indicated by gage red line.) Use the following procedure to obtain the results shown in this example.

1. Select the desired gross weight column on the chart. Since the helicopter gross weight of 5750 pounds is not shown, weight of 6000 pounds is used.
2. Read across the 2000-foot line to determine that 3 minutes is required to climb from sea level to 2000 feet. Then, read across the 8000-foot line to determine that 10 minutes is required to climb from sea level to 8000 feet. Since the climb is to be started at 2000 feet, subtract 3 minutes from 10 minutes to obtain 7 minutes as the time required to climb from 2000 to 8000 feet.
3. Note that the best climb CAS varies from 41 knots at 2000 feet to 42 knots at 8000 feet.
4. Note that 45 pounds of fuel is required to climb from sea level to 2000 feet, and that 88 pounds is needed to climb from sea level to 8000 feet. Subtract 45 pounds from 88 pounds to obtain 43 pounds as the fuel required to climb from 2000 to 8000 feet. Add the 30 pounds of fuel required for takeoff and warmup to the 43 pounds required for climb, to obtain 73 pounds total.

**WARNING**

It is important to realize that the base of the fuel column is 30 pounds rather than zero. Therefore, when the fuel quantity for the lower altitude is subtracted from the fuel quantity for the higher altitude, the 30-pound allowance for takeoff and warmup is also subtracted.

**Note**

In planning climbs from sea level, it is not necessary to perform computations as the results can be read directly from the chart. Merely read across the chart at the altitude at which the climb will end.

5. Note that best manifold pressure ranges from 35 in. Hg to FT.

### RANGE CHARTS.

These charts (figures A–16, A–17, A–18 and A–19) are provided to show the air mile distances that can be flown with various quantities of fuel and at various altitudes. The charts also show the best power settings and airspeeds for flying the desired distance. The Best Range Chart (figures A–16 and A–17) gives maximum range attainable for a given gross weight and altitude. The Maximum Continuous Power Range Chart (figures A–18 and A–19) shows the range that can be expected for cruising at maximum continuous power. Since all three charts are read in the same manner, and are extremely simple to read, a specific example is not provided. Enter the charts at the correct gross weight column (use the next higher weight if desired weight is not shown). Select the altitude line at which cruise will be flown, and read across to obtain power settings, airspeeds, and ranges.

### ENDURANCE CHARTS.

These charts (figures A–20, A–21, A–22 and A–23) are similar to the range charts, but present the helicopter performance information in terms of endurance in hours. The Maximum Endurance Charts (figures A–20 and A–21) present the power settings and airspeeds for obtaining maximum endurance with various quantities of fuel. The Hovering Endurance Charts (figures A–22 and A–23) present the endurance time that can be expected in hovering flight for various quantities of fuel. The endurance charts are read in the same manner as the range charts.

## POWER OFF LANDING CHART

This chart (figure A–24) shows both the ground roll distance and the total landing distance needed to clear a 50-foot obstacle, and touchdown speed. Correction plots are provided for headwinds of zero to 30 knots.

### EXAMPLE PROBLEM USING POWER OFF LANDING CHART.

With the following condition:

outside air temperature – 60° F (15.6° C)
pressure altitude – 4000 feet
gross weight – 6000 pounds
headwind – 15 knots

The chart shows a ground roll distance of 160 feet, and a total distance of 256 feet to clear a 50-foot obstacle. Touchdown speed is 29.4 knots CAS. These results are obtained by the following procedure:

1. Enter the chart at 60° F OAT, and move vertically to intersect the curve of 4000 feet pressure altitude.
2. Move horizontally to the right to intersect the 6000-pound gross weight curve for ground roll.
3. Move down vertically until the base line of the headwind correction curve is intersected, and follow the curve until it intersects the horizontal line representing 15 knots.
4. Move down vertically to the ground roll scale, and read 160 feet.
5. From the point established in step 1, move horizontally to the right to intersect the 6000-pound gross weight curve for distance to clear 50 feet.
6. Move down vertically until the base line of the headwind correction curve is intersected, and follow the curve until it intersects the horizontal line representing 15 knots.
7. Move down vertically to the distance scale, and read 350 feet.
8. From the point established in step 1, move horizontally to the right to intersect the 6000-pound gross weight curve for touchdown speed.
9. Move down vertically to the touchdown speed scale, and read 29.4 knots CAS.

# ENGINE LIMITATIONS

## STANDARD DAY

MODEL: HOK-1
DATE: 16 SEPTEMBER 1959
DATA BASIS: FLIGHT TEST

ENGINE: R-1340-48
FUEL GRADE: 91/96
FUEL DENSITY: 6.0 LB/GAL

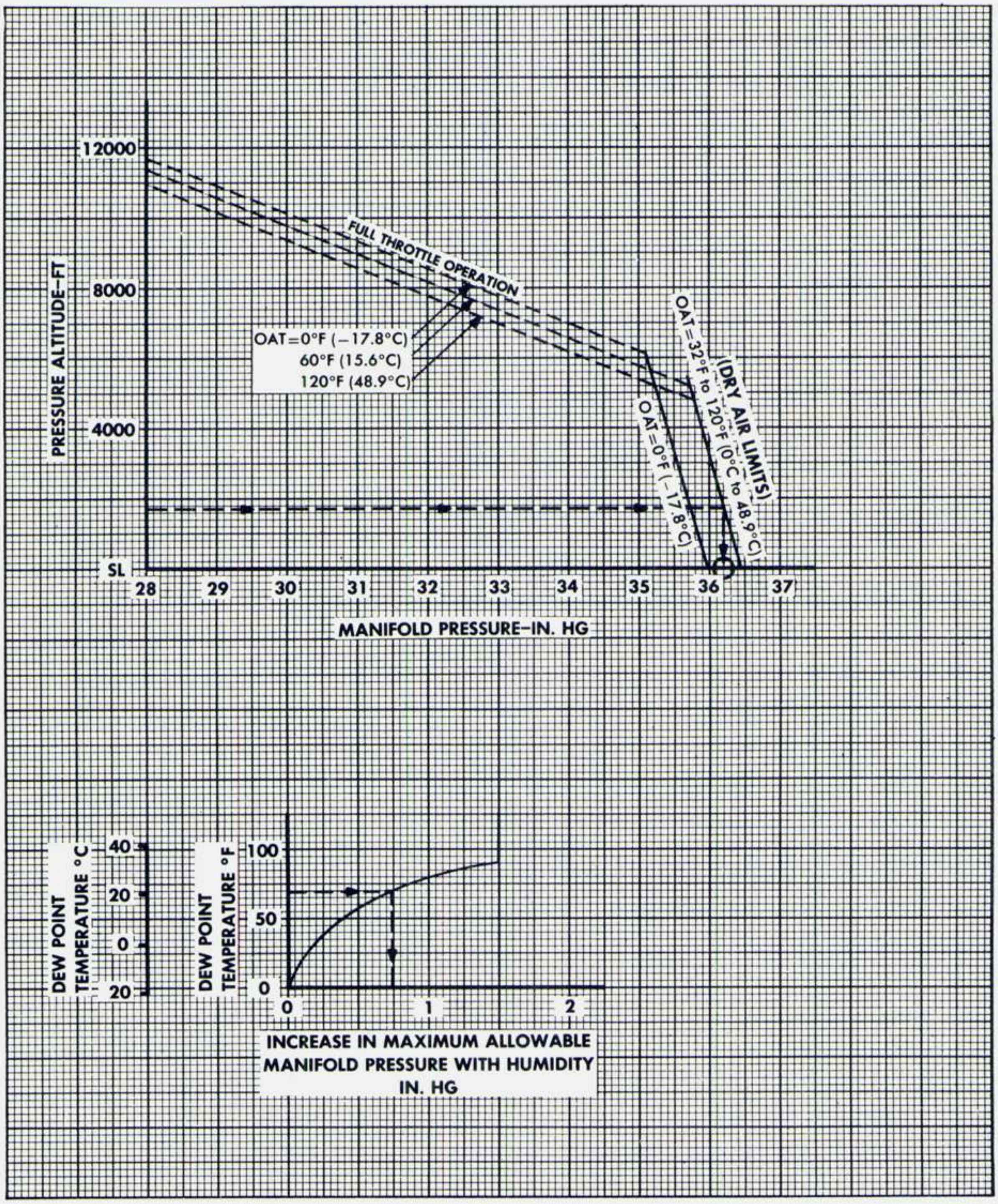



*Figure A-4*

# ENGINE LIMITATIONS

## STANDARD DAY

MODEL: HUK-1
DATE: 10 SEPTEMBER 1959
DATA BASIS: FLIGHT TEST

ENGINE: R-1340-52
FUEL GRADE: 91/96
FUEL DENSITY: 6.0 LB/GAL

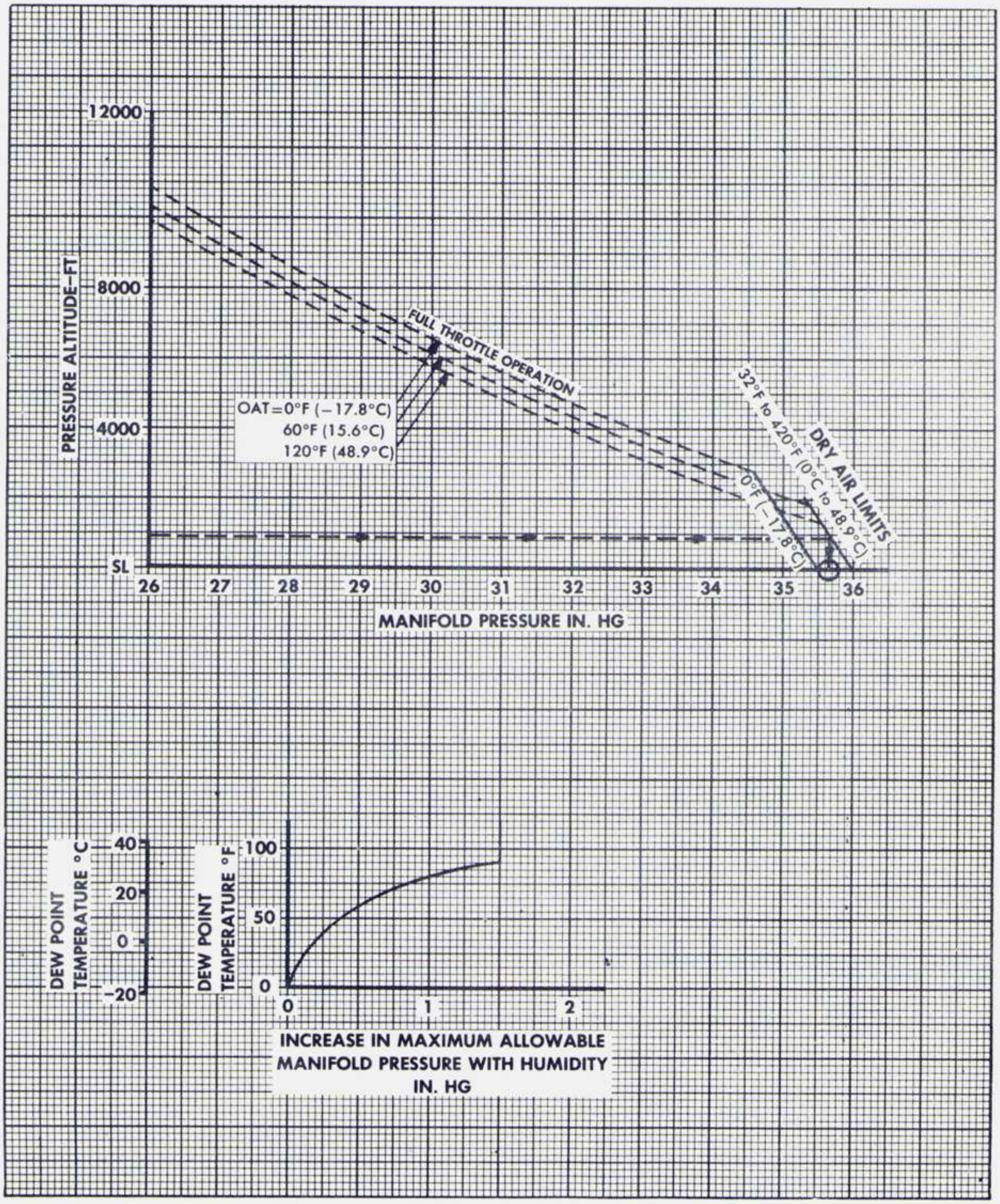



*Figure A-5*

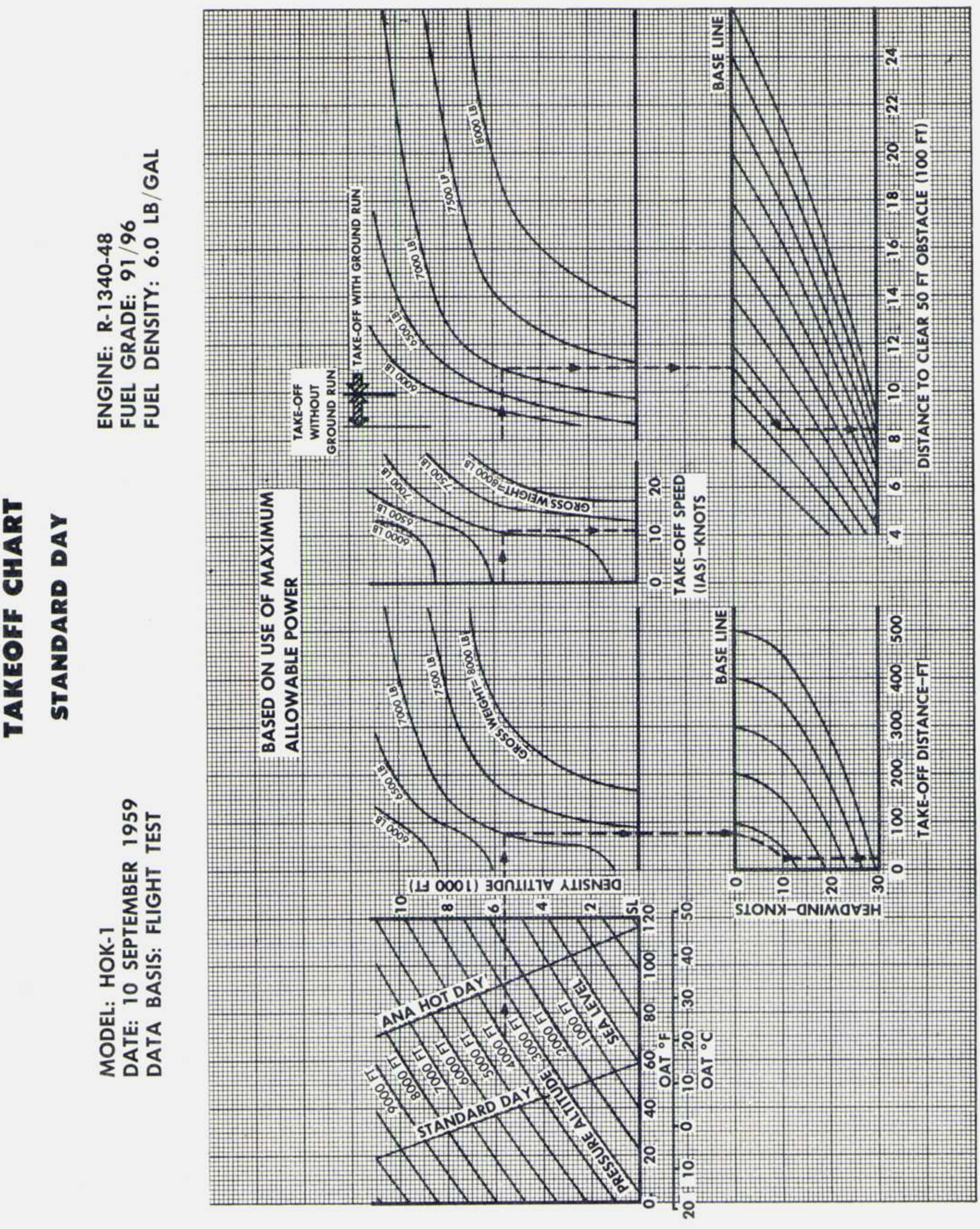

TAKEOFF CHART
STANDARD DAY
MODEL: HOK-1
DATE: 10 SEPTEMBER 1959
DATA BASIS: FLIGHT TEST
ENGINE: R-1340-48
FUEL GRADE: 91/96
FUEL DENSITY: 6.0 LB/GAL
BASED ON USE OF MAXIMUM ALLOWABLE POWER
TAKE-OFF WITHOUT GROUND RUN
TAKE-OFF WITH GROUND RUN
ANA HOT DAY
STANDARD DAY
PRESSURE ALTITUDE
SEA LEVEL
1000 FT
2000 FT
3000 FT
4000 FT
5000 FT
6000 FT
7000 FT
8000 FT
9000 FT
OAT °F
OAT °C
DENSITY ALTITUDE (1000 FT)
GROSS WEIGHT=8000 LB
7500 LB
7000 LB
6500 LB
6000 LB
TAKE-OFF SPEED (IAS)—KNOTS
BASE LINE
HEADWIND—KNOTS
TAKE-OFF DISTANCE—FT
DISTANCE TO CLEAR 50 FT OBSTACLE (100 FT)

*Figure A-6*

# TAKEOFF CHART

## STANDARD DAY

MODEL: HUK-1
DATE: 22 SEPTEMBER 1959
DATA BASIS: FLIGHT TEST

ENGINE: R-1340-52
FUEL GRADE: 91/96
FUEL DENSITY: 6.0 LB/GAL

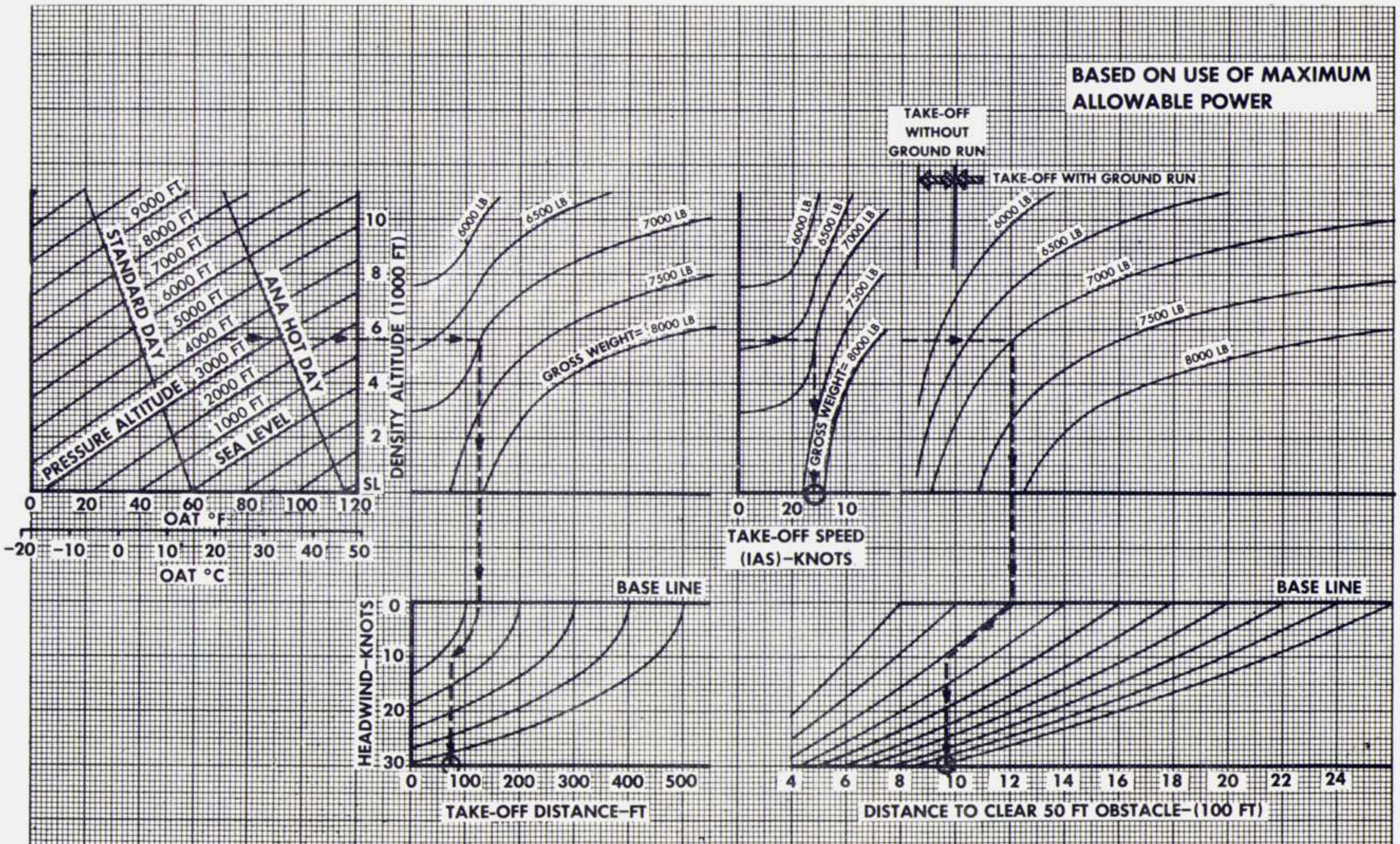



Figure A-7

# TAKEOFF GROSS WEIGHT LIMITATIONS

## STANDARD DAY

MODEL: HOK-1
DATE: 15 SEPTEMBER 1959
DATA BASIS: FLIGHT TEST

ENGINE: R-1340-48
FUEL GRADE: 91/96
FUEL DENSITY: 6.0 LB/GAL

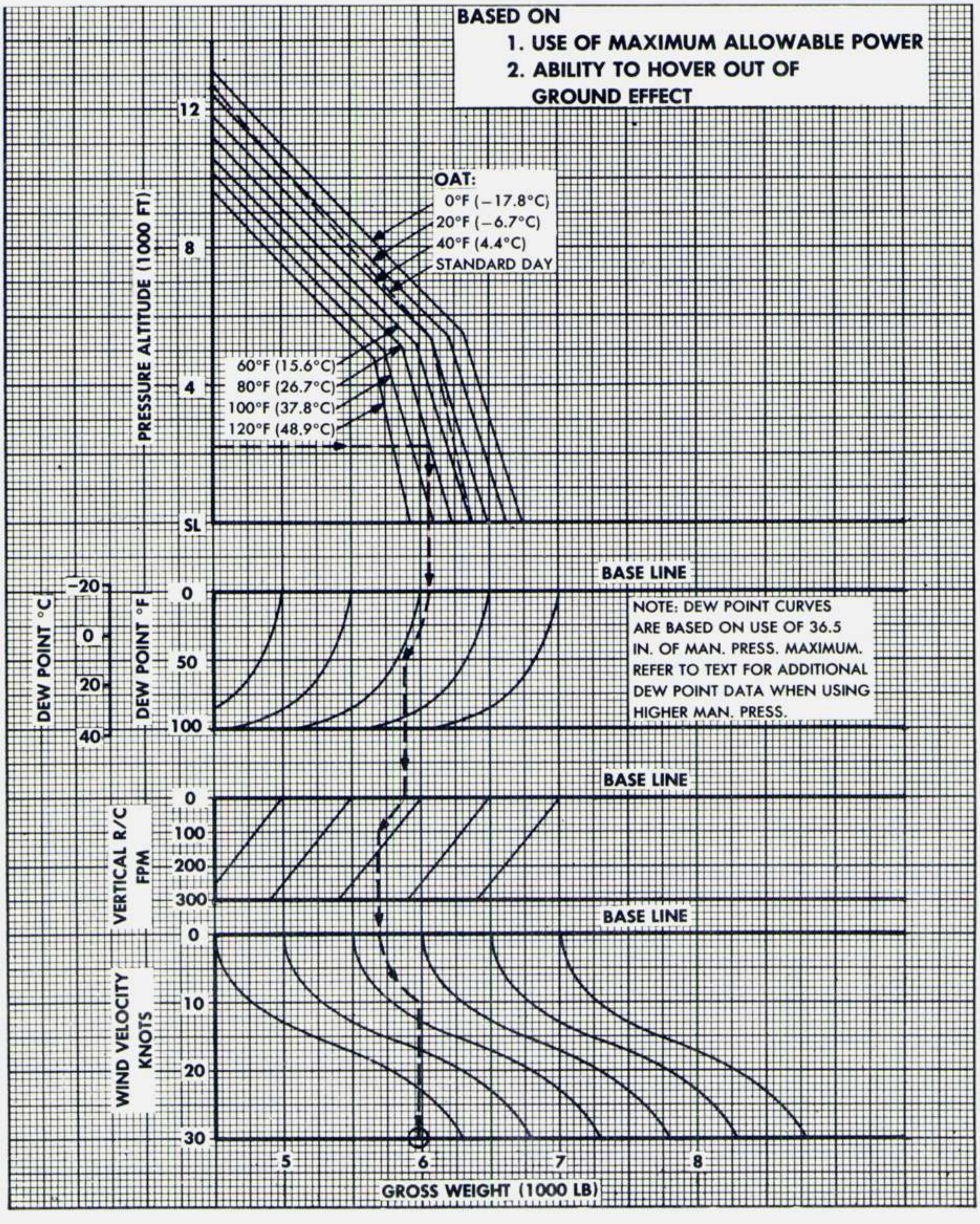



*Figure A-8*

# TAKEOFF GROSS WEIGHT LIMITATIONS
## STANDARD DAY

MODEL: HUK-1
DATE: 15 SEPTEMBER 1959
DATA BASIS: FLIGHT TEST

ENGINE: R-1340-52
FUEL GRADE: 91/96
FUEL DENSITY: 6.0 LB/GAL

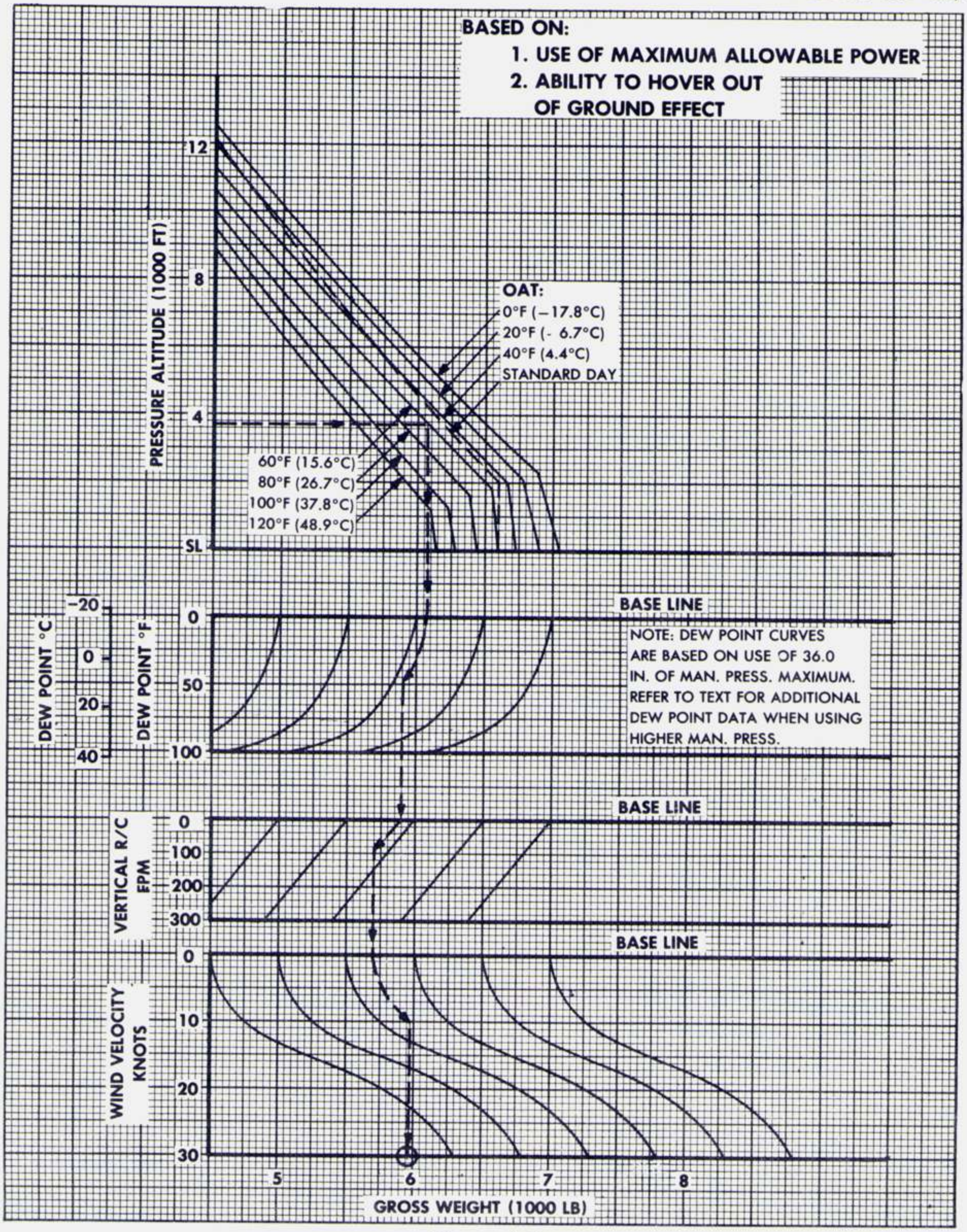



*Figure A-9*

# MAXIMUM GROSS WEIGHT FOR ROLLING-TYPE TAKEOFF

## STANDARD DAY

MODEL: HOK-1
DATE: 16 SEPTEMBER 1959
DATA BASIS: FLIGHT TEST

ENGINE: R-1340-48
FUEL GRADE: 91/96
FUEL DENSITY: 6.0 LB/GAL

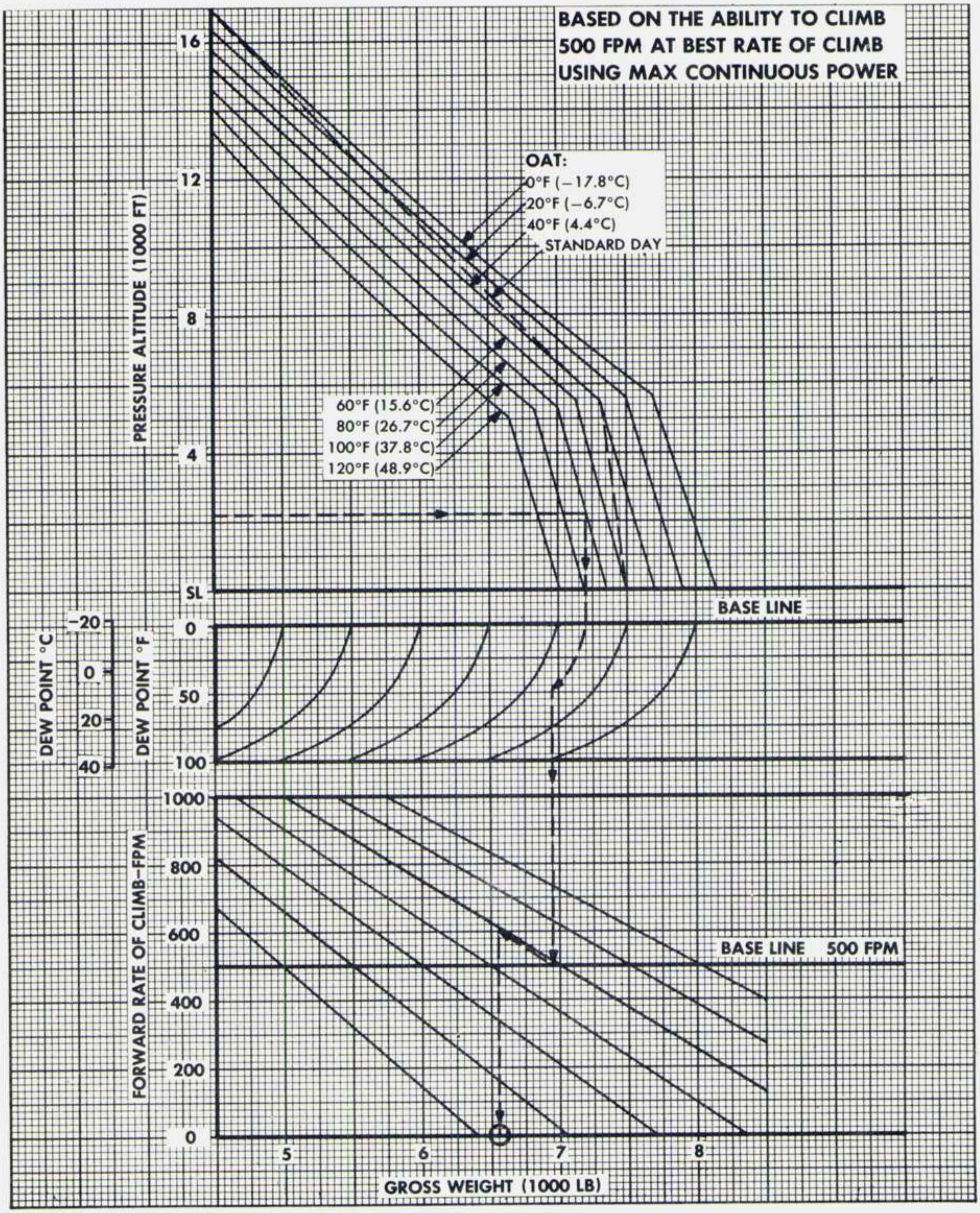



*Figure A-10*

# MAXIMUM GROSS WEIGHT FOR ROLLING-TYPE TAKEOFF

## STANDARD DAY

MODEL: HUK-1
DATE: 18 SEPTEMBER 1959
DATA BASIS: FLIGHT TEST

ENGINE: R-1340-52
FUEL GRADE: 91/96
FUEL DENSITY: 6.0 LB/GAL

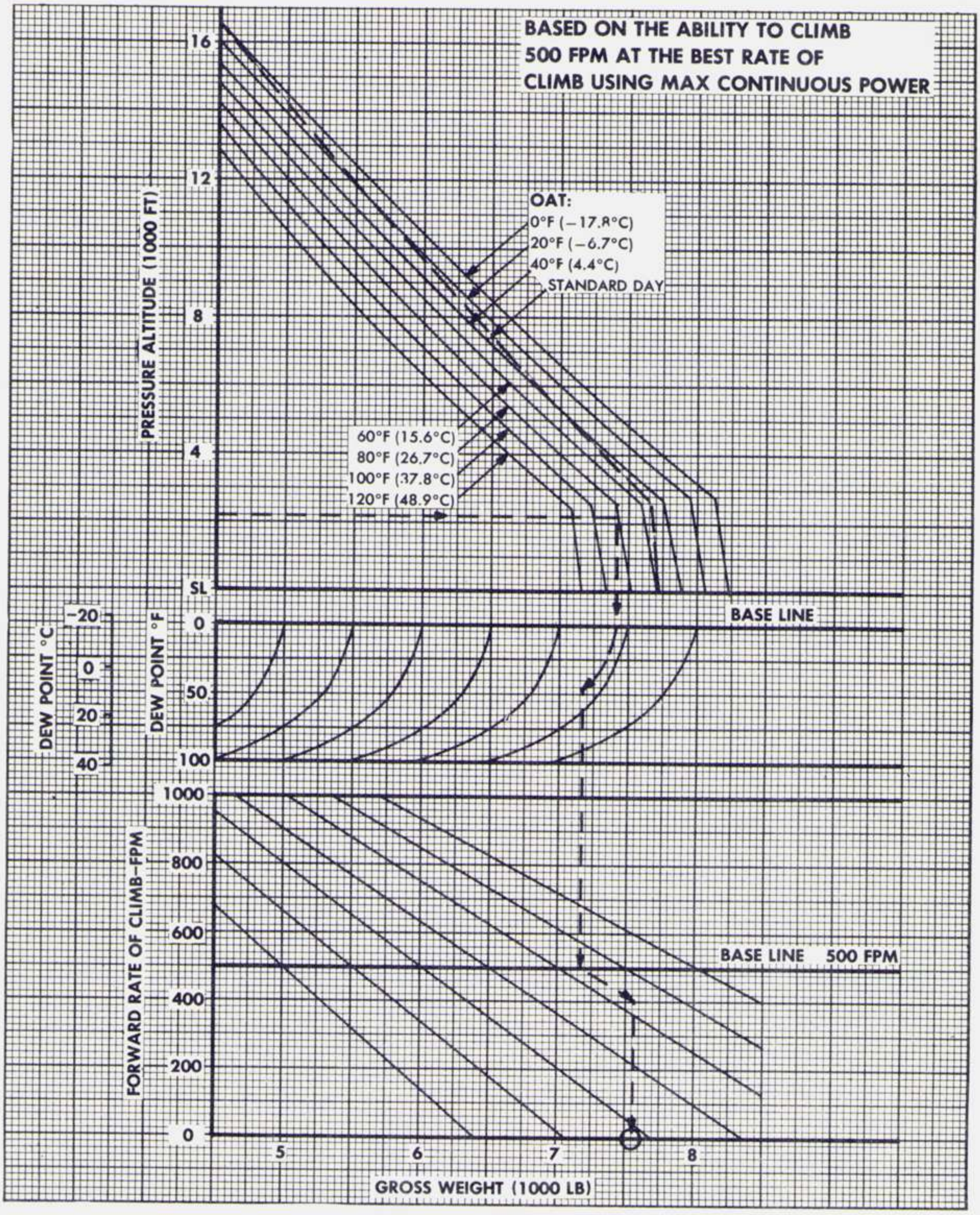



Figure A-11

# HOVERING

## STANDARD DAY

MODEL: HOK-1
DATE: 23 SEPTEMBER 1959
DATA BASIS: FLIGHT TEST

ENGINE: R-1340-48
FUEL GRADE: 91/96
FUEL DENSITY: 6.0 LB/GAL

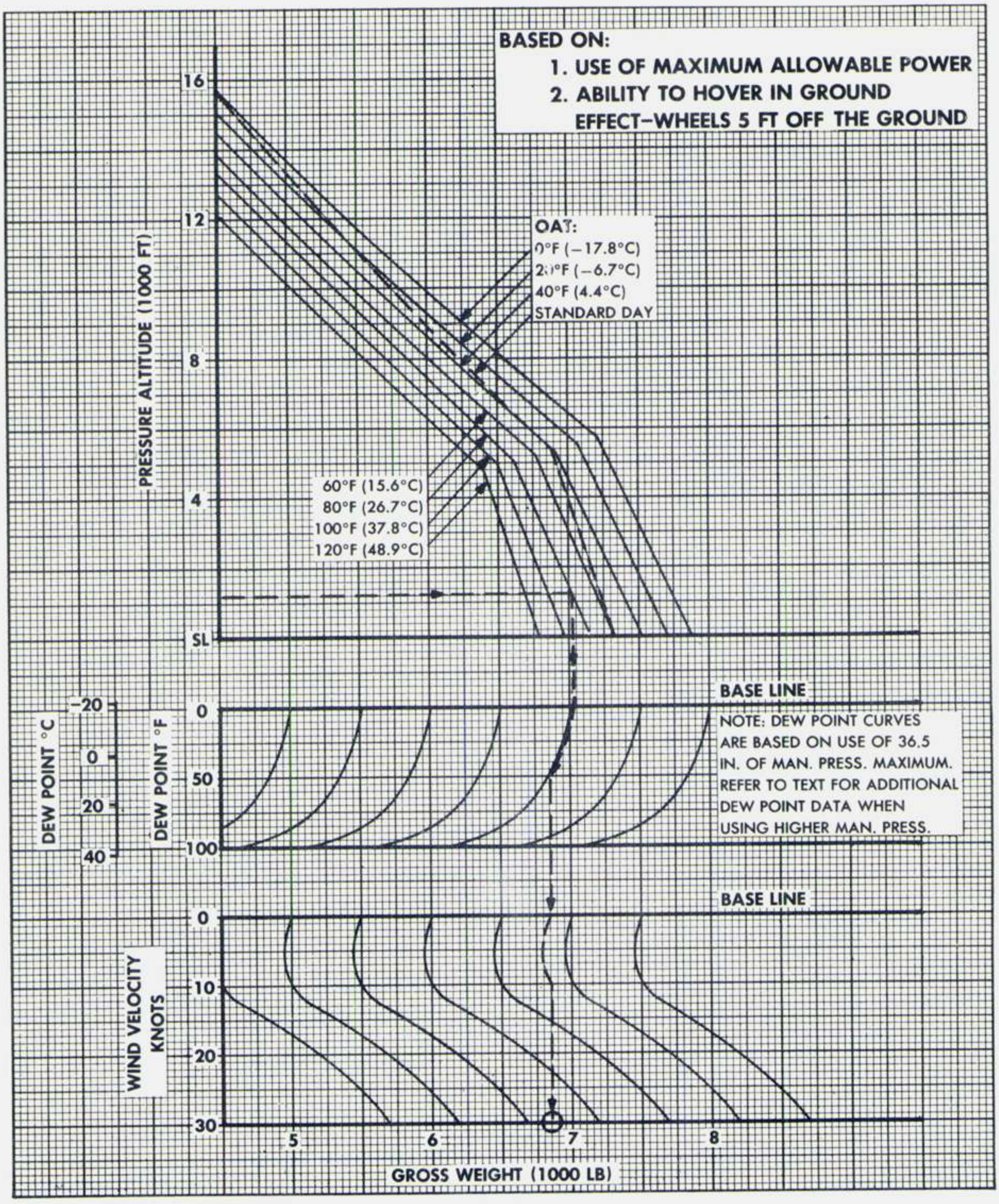



*Figure A-12*

# HOVERING

## STANDARD DAY

MODEL: HUK-1
DATE: 17 SEPTEMBER 1959
DATA BASIS: FLIGHT TEST

ENGINE: R-1340-52
FUEL GRADE: 91/96
FUEL DENSITY: 6.0 LB/GAL

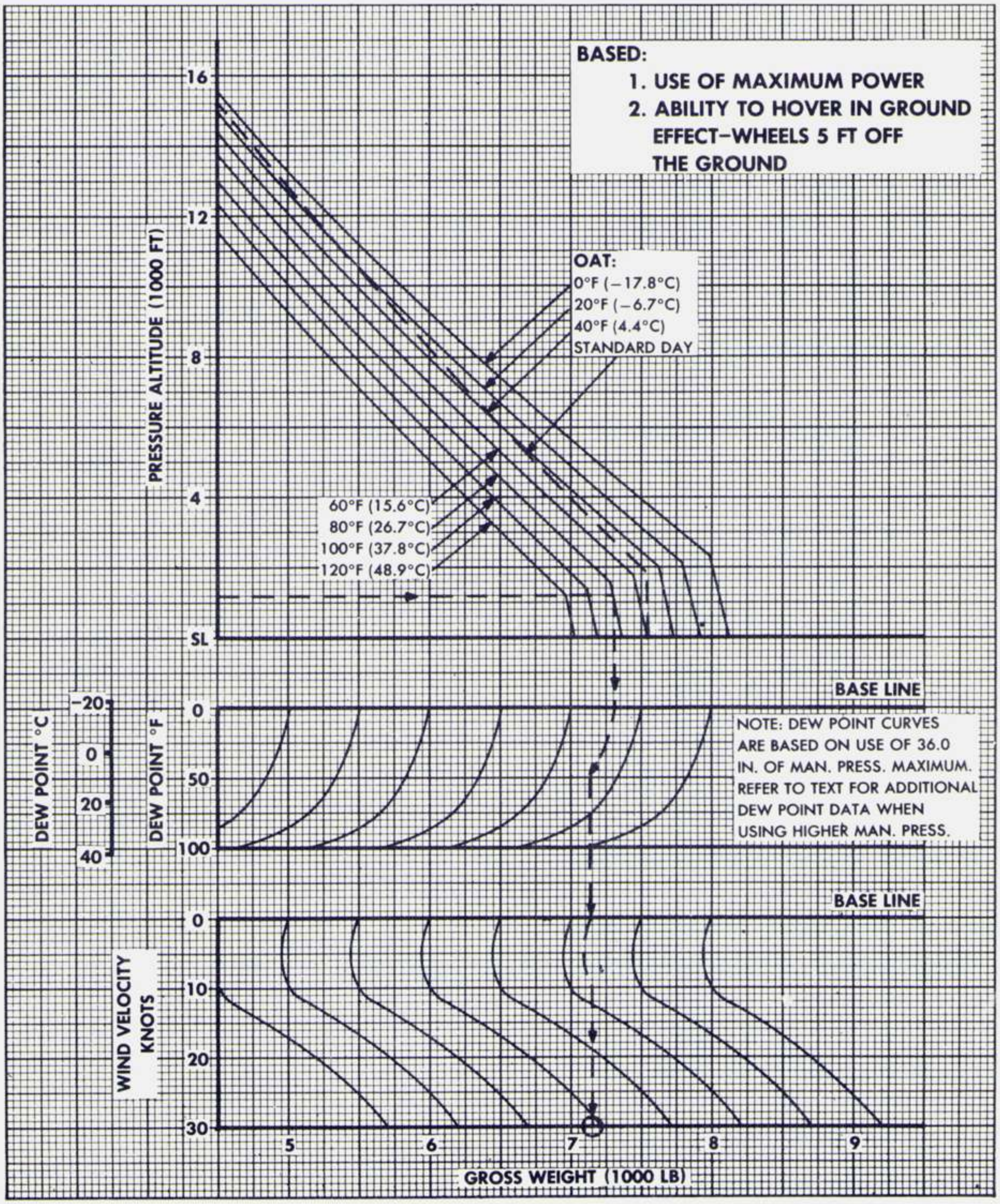



*Figure A-13*

# CLIMB CHART FOR MAXIMUM CONTINUOUS POWER

## STANDARD DAY

MODEL: HOK-1
DATE: 15 SEPTEMBER 1959
DATA BASIS: FLIGHT TEST

ENGINE: R-1340-48
FUEL GRADE: 91/96
FUEL DENSITY: 6.0 LB/GAL

GROSS WEIGHT: 7000 LB.

| PRESS. ALT. 1000 FT. | CAS KNOTS | MAN. PRESS. IN. HG. | APPROXIMATE CLIMB RATE FPM | APPROXIMATE FROM SL TIME MIN. | APPROXIMATE FROM SL FUEL LB. |
|---|---|---|---|---|---|
| 14 | | | | | |
| 12 | 48 | FT | 140 | 28 | 175 |
| 10 | 47 | FT | 300 | 19 | 133 |
| 8 | 46 | FT | 450 | 14 | 110 |
| 6 | 45 | FT | 580 | 10 | 88 |
| 4 | 45 | 35.0 | 610 | 7 | 68 |
| 2 | 45 | 35.0 | 615 | 4 | 50 |
| SL | 45 | 35.0 | 620 | 0 | 30 |

GROSS WEIGHT: 6000 LB.

| PRESS. ALT. 1000 FT. | CAS KNOTS | MAN. PRESS. IN. HG. | APPROXIMATE CLIMB RATE FPM | APPROXIMATE FROM SL TIME MIN. | APPROXIMATE FROM SL FUEL LB. |
|---|---|---|---|---|---|
| 14 | 43 | FT | 270 | 23 | 145 |
| 12 | 42 | FT | 430 | 18 | 122 |
| 10 | 42 | FT | 570 | 14 | 102 |
| 8 | 42 | FT | 690 | 10 | 88 |
| 6 | 41 | FT | 800 | 7 | 74 |
| 4 | 41 | 35.0 | 835 | 5 | 60 |
| 2 | 41 | 35.0 | 840 | 3 | 45 |
| SL | 40 | 35.0 | 845 | 0 | 30 |

GROSS WEIGHT: 5000 LB.

| PRESS. ALT. 1000 FT. | CAS KNOTS | MAN. PRESS. IN. HG. | APPROXIMATE CLIMB RATE FPM | APPROXIMATE FROM SL TIME MIN. | APPROXIMATE FROM SL FUEL LB. |
|---|---|---|---|---|---|
| 14 | 38 | FT | 600 | 16 | 108 |
| 12 | 37 | FT | 730 | 13 | 97 |
| 10 | 37 | FT | 840 | 10 | 86 |
| 8 | 37 | FT | 940 | 8 | 75 |
| 6 | 37 | FT | 1030 | 6 | 65 |
| 4 | 37 | 35.0 | 1055 | 4 | 53 |
| 2 | 37 | 35.0 | 1060 | 2 | 43 |
| SL | 37 | 35.0 | 1065 | 0 | 30 |

REMARKS:
1. Use 2200 rpm engine speed throughout.
2. Fuel used includes 30 pounds for warmup and takeoff.
3. Subtract 40 FPM per 10°F increase in OAT above standard.

*Figure A-14*

# CLIMB CHART FOR MAXIMUM CONTINUOUS POWER

## STANDARD DAY

**MODEL: HUK-1**
**DATE: 15 SEPTEMBER 1959**
**DATA BASIS: FLIGHT TEST**

**ENGINE: R-1340-52**
**FUEL GRADE: 91/96**
**FUEL DENSITY: 6.0 LB/GAL**

| GROSS WEIGHT: 7000 LB. | | | | | | GROSS WEIGHT: 6000 LB. | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| PRESS. ALT. 1000 FT. | CAS KNOTS | MAN. PRESS. IN. HG. | APPROXIMATE | | | PRESS. ALT. 1000 FT. | CAS KNOTS | MAN. PRESS. IN. HG. | APPROXIMATE | | |
| | | | CLIMB RATE FPM | FROM SL | | | | | CLIMB RATE FPM | FROM SL | |
| | | | | TIME MIN. | FUEL LB. | | | | | TIME MIN. | FUEL LB. |
| 14 | | | | | | 14 | 43 | FT | 210 | 25 | 145 |
| 12 | | | | | | 12 | 42 | FT | 360 | 19 | 120 |
| 10 | 47 | FT | 200 | 23 | 143 | 10 | 42 | FT | 490 | 14 | 102 |
| 8 | 46 | FT | 335 | 15 | 112 | 8 | 42 | FT | 610 | 10 | 87 |
| 6 | 45 | FT | 460 | 10 | 90 | 6 | 41 | FT | 710 | 7 | 72 |
| 4 | 45 | FT | 575 | 7 | 69 | 4 | 41 | FT | 810 | 5 | 58 |
| 2 | 45 | 34.6 | 650 | 3 | 49 | 2 | 41 | 34.6 | 880 | 3 | 44 |
| SL | 45 | 34.6 | 660 | 0 | 30 | SL | 40 | 34.6 | 885 | 0 | 30 |

| GROSS WEIGHT: 5000 LB. | | | | | |
|---|---|---|---|---|---|
| PRESS. ALT. 1000 FT. | CAS KNOTS | MAN. PRESS. IN. HG. | APPROXIMATE | | |
| | | | CLIMB RATE FPM | FROM SL | |
| | | | | TIME MIN. | FUEL LB. |
| 14 | 38 | FT | 550 | 17 | 107 |
| 12 | 38 | FT | 670 | 13 | 95 |
| 10 | 37 | FT | 775 | 10 | 84 |
| 8 | 37 | FT | 875 | 8 | 73 |
| 6 | 37 | FT | 970 | 6 | 63 |
| 4 | 37 | FT | 1050 | 4 | 52 |
| 2 | 37 | 34.6 | 1095 | 2 | 42 |
| SL | 37 | 34.6 | 1100 | 0 | 30 |

REMARKS:
1. Use 2200 rpm engine speed throughout.
2. Fuel used includes 30 pounds for warmup and takeoff.
3. Subtract 40 FPM per 10°F increase in OAT above standard.

*Figure A-15*

# BEST RANGE CHART

## STANDARD DAY

MODEL: HOK-1
DATE: 18 SEPTEMBER 1959
DATA BASIS: FLIGHT TEST

ENGINE: R-1340-48
FUEL GRADE: 91/96
FUEL DENSITY: 6.0 LB/GAL

| GROSS WEIGHT LB | PRESS. ALT. 1000 FT. | POWER SETTINGS: ENGINE SPEED RPM | MAN. PRESS. IN. HG | MIX-TURE | APPROXIMATE TOTAL LB/HR | SPEED/KNOTS TAS | CAS | RANGE — NAUTICAL AIR MILES: 600 LB FUEL | 500 LB FUEL | 400 LB FUEL | 300 LB FUEL | 200 LB FUEL | 100 LB FUEL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 7000 | 8 | 2200 | 30.7 | BP | 277 | 84 | 74 | 181 | 151 | 120 | 90 | 60 | 30 |
| | 6 | 2200 | 30.7 | BP | 274 | 81 | 74 | 177 | 146 | 118 | 88 | 59 | 29 |
| | 4 | 2200 | 30.8 | R | 314 | 79 | 74 | 151 | 126 | 101 | 75 | 50 | 25 |
| | 2 | 2200 | 30.9 | R | 311 | 77 | 75 | 148 | 123 | 99 | 74 | 49 | 24 |
| | SL | 2200 | 31.1 | R | 309 | 75 | 75 | 146 | 122 | 97 | 73 | 48 | 24 |
| 6000 | 12 | 2200 | 26.9 | BP | 241 | 83 | 69 | 206 | 172 | 137 | 103 | 69 | 34 |
| | 10 | 2200 | 27.1 | BP | 240 | 81 | 70 | 202 | 168 | 135 | 101 | 67 | 34 |
| | 8 | 2200 | 27.2 | BP | 239 | 79 | 70 | 199 | 166 | 133 | 100 | 66 | 33 |
| | 6 | 2200 | 27.5 | BP | 239 | 77 | 71 | 194 | 162 | 130 | 97 | 65 | 33 |
| | 4 | 2200 | 27.7 | R | 275 | 76 | 71 | 165 | 137 | 100 | 82 | 54 | 27 |
| | 2 | 2200 | 28.1 | R | 274 | 74 | 72 | 162 | 135 | 108 | 81 | 54 | 27 |
| | SL | 2200 | 28.4 | R | 273 | 72 | 72 | 159 | 132 | 106 | 79 | 52 | 26 |
| 5000 | 14 | 2200 | 23.3 | BP | 202 | 79 | 64 | 235 | 196 | 157 | 117 | 78 | 39 |
| | 12 | 2200 | 23.6 | BP | 202 | 78 | 65 | 230 | 191 | 153 | 115 | 77 | 38 |
| | 10 | 2200 | 23.9 | BP | 203 | 76 | 66 | 226 | 188 | 151 | 113 | 75 | 38 |
| | 8 | 2200 | 24.3 | BP | 204 | 75 | 66 | 222 | 185 | 148 | 111 | 74 | 37 |
| | 6 | 2200 | 24.7 | BP | 205 | 74 | 67 | 218 | 181 | 145 | 109 | 73 | 36 |
| | 4 | 2200 | 25.1 | BP | 206 | 73 | 68 | 212 | 177 | 141 | 106 | 71 | 35 |
| | 2 | 2200 | 25.6 | BP | 207 | 71 | 69 | 206 | 172 | 138 | 103 | 69 | 34 |
| | SL | 2200 | 26.2 | BP | 208 | 70 | 70 | 199 | 166 | 133 | 100 | 66 | 33 |

*Figure A-16*

# BEST RANGE CHART

## STANDARD DAY

MODEL: HUK-1
DATE: 17 SEPTEMBER 1959
DATA BASIS: FLIGHT TEST

ENGINE: R-1340-52
FUEL GRADE: 91/96
FUEL DENSITY: 6.0 LB/GAL

| GROSS WEIGHT LB | PRESS. ALT. 1000 FT. | POWER SETTINGS | | | | | | RANGE — NAUTICAL AIR MILES | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ENGINE SPEED RPM | MAN. PRESS. IN. HG | MIX-TURE | APPROXIMATE TOTAL LB/HR | SPEED/KNOTS TAS | SPEED/KNOTS CAS | 600 LB FUEL | 500 LB FUEL | 400 LB FUEL | 300 LB FUEL | 200 LB FUEL | 100 LB FUEL |
| | 8 | 2200 | 29.5 | BP | 271 | 84 | 74 | 184 | 153 | 122 | 92 | 61 | 31 |
| | 6 | 2200 | 29.6 | BP | 265 | 81 | 74 | 182 | 151 | 121 | 91 | 61 | 30 |
| 7000 | 4 | 2200 | 29.7 | R | 307 | 79 | 74 | 165 | 128 | 103 | 77 | 51 | 26 |
| | 2 | 2200 | 29.8 | R | 305 | 77 | 75 | 152 | 126 | 101 | 76 | 50 | 25 |
| | SL | 2200 | 30.1 | R | 303 | 75 | 75 | 148 | 123 | 99 | 74 | 49 | 25 |
| | 10 | 2200 | 26.0 | BP | 234 | 81 | 70 | 208 | 173 | 143 | 104 | 69 | 35 |
| | 8 | 2200 | 26.2 | BP | 233 | 79 | 70 | 206 | 171 | 137 | 103 | 69 | 34 |
| 6000 | 6 | 2200 | 26.5 | BP | 232 | 77 | 71 | 204 | 169 | 135 | 102 | 68 | 34 |
| | 4 | 2200 | 26.8 | BP | 231 | 76 | 71 | 200 | 166 | 133 | 100 | 67 | 33 |
| | 2 | 2200 | 27.1 | BP | 231 | 73 | 72 | 195 | 162 | 130 | 97 | 65 | 32 |
| | SL | 2200 | 27.4 | BP | 230 | 72 | 72 | 190 | 158 | 126 | 95 | 63 | 32 |
| | 14 | 2200 | 22.3 | BP | 197 | 79 | 64 | 242 | 202 | 162 | 121 | 81 | 40 |
| | 12 | 2200 | 22.6 | BP | 197 | 78 | 65 | 238 | 198 | 158 | 119 | 79 | 40 |
| | 10 | 2200 | 22.9 | BP | 197 | 76 | 66 | 232 | 194 | 155 | 116 | 78 | 39 |
| 5000 | 8 | 2200 | 23.3 | BP | 198 | 75 | 66 | 229 | 191 | 153 | 115 | 76 | 38 |
| | 6 | 2200 | 23.7 | BP | 198 | 74 | 67 | 225 | 187 | 150 | 113 | 75 | 37 |
| | 4 | 2200 | 24.2 | BP | 199 | 73 | 68 | 220 | 183 | 147 | 110 | 73 | 37 |
| | 2 | 2200 | 24.7 | BP | 200 | 71 | 69 | 214 | 178 | 143 | 107 | 71 | 35 |
| | SL | 2200 | 25.2 | BP | 202 | 70 | 70 | 207 | 172 | 142 | 103 | 69 | 34 |

*Figure A-17*

# MAXIMUM CONTINUOUS POWER CHART

## STANDARD DAY

MODEL: HOK-1
DATE: 23 SEPTEMBER 1959
DATA BASIS: FLIGHT TEST

ENGINE: R-1340-48
FUEL GRADE: 91/96
FUEL DENSITY: 6.0 LB/GAL

| GROSS WEIGHT LB | PRESS. ALT. 1000 FT. | POWER SETTINGS | | | | | | RANGE — NAUTICAL AIR MILES | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ENGINE SPEED RPM | MAN. PRESS. IN. HG | MIX-TURE | APPROXIMATE | | | 600 LB FUEL | 500 LB FUEL | 400 LB FUEL | 300 LB FUEL | 200 LB FUEL | 100 LB FUEL |
| | | | | | TOTAL LB/HR | SPEED/KNOTS TAS | CAS | | | | | | |
| | 12 | 2200 | FT | BP | 250 | 77 | 64 | 186 | 155 | 124 | 93 | 62 | 31 |
| | 10 | 2200 | FT | BP | 270 | 82 | 70 | 182 | 151 | 121 | 91 | 61 | 30 |
| | 8 | 2200 | FT | BP | 290 | 84 | 75 | 173 | 145 | 116 | 87 | 58 | 29 |
| 7000 | 6 | 2200 | FT | BP | 311 | 85 | 78 | 165 | 137 | 110 | 82 | 55 | 27 |
| | 4 | 2200 | 35.0 | R | 370 | 85 | 80 | 137 | 114 | 92 | 69 | 46 | 23 |
| | 2 | 2200 | 35.0 | R | 366 | 85 | 82 | 139 | 116 | 93 | 70 | 46 | 23 |
| | SL | 2200 | 35.0 | R | 362 | 84 | 84 | 141 | 122 | 94 | 70 | 47 | 23 |
| | 14 | 2200 | FT | BP | 230 | 84 | 68 | 219 | 182 | 146 | 109 | 73 | 36 |
| | 12 | 2200 | FT | BP | 250 | 89 | 73 | 212 | 177 | 141 | 106 | 71 | 35 |
| | 10 | 2200 | FT | BP | 270 | 90 | 77 | 200 | 166 | 133 | 100 | 67 | 33 |
| 6000 | 8 | 2200 | FT | BP | 290 | 90 | 80 | 185 | 154 | 123 | 92 | 61 | 31 |
| | 6 | 2200 | FT | BP | 311 | 89 | 82 | 166 | 143 | 115 | 86 | 57 | 29 |
| | 4 | 2200 | 35.0 | R | 370 | 88 | 83 | 143 | 119 | 95 | 72 | 48 | 24 |
| | 2 | 2200 | 35.0 | R | 366 | 88 | 85 | 144 | 120 | 96 | 72 | 48 | 24 |
| | SL | 2200 | 35.0 | R | 362 | 87 | 87 | 145 | 121 | 97 | 73 | 48 | 24 |
| | 14 | 2200 | FT | BP | 230 | 90 | 73 | 229 | 191 | 153 | 114 | 76 | 38 |
| | 12 | 2200 | FT | BP | 250 | 92 | 77 | 220 | 183 | 147 | 110 | 73 | 37 |
| | 10 | 2200 | FT | BP | 270 | 93 | 80 | 207 | 173 | 138 | 104 | 69 | 35 |
| 5000 | 8 | 2200 | FT | BP | 290 | 93 | 83 | 192 | 160 | 128 | 96 | 64 | 32 |
| | 6 | 2200 | FT | BP | 311 | 92 | 84 | 178 | 148 | 118 | 89 | 59 | 29 |
| | 4 | 2200 | 35.0 | R | 370 | 91 | 86 | 148 | 123 | 99 | 74 | 49 | 25 |
| | 2 | 2200 | 35.0 | R | 366 | 91 | 88 | 149 | 124 | 99 | 74 | 50 | 25 |
| | SL | 2200 | 35.0 | R | 362 | 91 | 90 | 150 | 125 | 100 | 75 | 50 | 25 |

*Figure A-18*

# MAXIMUM CONTINUOUS POWER CHART

## STANDARD DAY

MODEL: HUK-1
DATE: 22 SEPTEMBER 1959
DATA BASIS: FLIGHT TEST

ENGINE: R-1340-52
FUEL GRADE: 91/96
FUEL DENSITY: 6.0 LB/GAL

| GROSS WEIGHT LB | PRESS. ALT. 1000 FT. | POWER SETTINGS | | | APPROXIMATE | | | RANGE — NAUTICAL AIR MILES | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ENGINE SPEED RPM | MAN. PRESS. IN. HG | MIX-TURE | TOTAL LB/HR | SPEED/KNOTS TAS | SPEED/KNOTS CAS | 600 LB FUEL | 500 LB FUEL | 400 LB FUEL | 300 LB FUEL | 200 LB FUEL | 100 LB FUEL |
| | 10 | 2200 | FT | BP | 249 | 77 | 66 | 186 | 155 | 124 | 93 | 62 | 31 |
| | 8 | 2200 | FT | BP | 269 | 84 | 76 | 185 | 154 | 123 | 92 | 62 | 31 |
| 7000 | 6 | 2200 | FT | BP | 287 | 87 | 80 | 181 | 151 | 121 | 91 | 60 | 30 |
| | 4 | 2200 | FT | R | 375 | 88 | 83 | 149 | 124 | 99 | 74 | 50 | 25 |
| | 2 | 2200 | 34.6 | R | 370 | 88 | 85 | 143 | 119 | 95 | 71 | 48 | 24 |
| | SL | 2200 | 34.6 | R | 365 | 87 | 87 | 144 | 120 | 96 | 72 | 48 | 24 |
| | 14 | 2200 | FT | BP | 218 | 77 | 62 | 213 | 177 | 142 | 106 | 71 | 35 |
| | 12 | 2200 | FT | BP | 235 | 82 | 68 | 211 | 176 | 141 | 106 | 70 | 35 |
| | 10 | 2200 | FT | BP | 249 | 86 | 74 | 207 | 172 | 138 | 103 | 69 | 34 |
| 6000 | 8 | 2200 | FT | BP | 269 | 89 | 79 | 198 | 165 | 132 | 99 | 66 | 33 |
| | 6 | 2200 | FT | BP | 287 | 91 | 83 | 191 | 159 | 127 | 95 | 64 | 32 |
| | 4 | 2200 | FT | R | 375 | 91 | 85 | 153 | 128 | 102 | 77 | 51 | 26 |
| | 2 | 2200 | 34.6 | R | 370 | 90 | 87 | 147 | 122 | 98 | 73 | 49 | 24 |
| | SL | 2200 | 34.6 | R | 365 | 90 | 90 | 147 | 123 | 98 | 74 | 49 | 25 |
| | 14 | 2200 | FT | BP | 218 | 86 | 69 | 238 | 198 | 159 | 119 | 79 | 40 |
| | 12 | 2200 | FT | BP | 235 | 88 | 73 | 227 | 189 | 152 | 114 | 76 | 38 |
| | 10 | 2200 | FT | BP | 249 | 90 | 77 | 216 | 180 | 144 | 108 | 72 | 36 |
| 5000 | 8 | 2200 | FT | BP | 269 | 92 | 81 | 206 | 171 | 137 | 103 | 69 | 34 |
| | 6 | 2200 | FT | BP | 287 | 93 | 85 | 196 | 163 | 130 | 98 | 65 | 33 |
| | 4 | 2200 | FT | R | 375 | 94 | 88 | 158 | 132 | 106 | 79 | 53 | 26 |
| | 2 | 2200 | 34.6 | R | 370 | 92 | 90 | 150 | 125 | 100 | 75 | 50 | 25 |
| | SL | 2200 | 34.6 | R | 365 | 92 | 92 | 151 | 126 | 101 | 76 | 50 | 25 |

*Figure A-19*

# MAXIMUM ENDURANCE

## STANDARD DAY

MODEL: HOK-1
DATE: 10 SEPTEMBER 1959
DATA BASIS: FLIGHT TEST

ENGINE: R-1340-48
FUEL GRADE: 91/96
FUEL DENSITY: 6.0 LB/GAL

| GROSS WEIGHT LB | PRESS. ALT. 1000 FT. | POWER SETTINGS | | | | | | ENDURANCE — HOURS | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ENGINE SPEED RPM | MAN. PRESS. IN. HG. | MIX-TURE | APPROXIMATE | | | 600 LB FUEL | 500 LB FUEL | 400 LB FUEL | 300 LB FUEL | 200 LB FUEL | 100 LB FUEL |
| | | | | | TOTAL LB/HR | SPEED/KNOTS TAS | SPEED/KNOTS CAS | | | | | | |
| | 12 | 2060 | 26.4 | BP | 231 | 56 | 48 | 2.6 | 2.1 | 1.7 | 1.3 | .9 | .4 |
| | 10 | 2060 | 26.3 | BP | 226 | 54 | 47 | 2.6 | 2.2 | 1.8 | 1.3 | .9 | .4 |
| | 8 | 2060 | 26.2 | BP | 219 | 52 | 46 | 2.7 | 2.3 | 1.8 | 1.4 | .9 | .4 |
| 7000 | 6 | 2060 | 26.2 | BP | 214 | 50 | 45 | 2.8 | 2.3 | 1.8 | 1.4 | .9 | .4 |
| | 4 | 2060 | 26.1 | BP | 208 | 48 | 45 | 2.9 | 2.4 | 1.9 | 1.4 | .9 | .5 |
| | 2 | 2060 | 26.0 | BP | 201 | 46 | 45 | 3.0 | 2.5 | 2.0 | 1.5 | 1.0 | .5 |
| | SL | 2060 | 26.1 | BP | 196 | 45 | 45 | 3.0 | 2.5 | 2.0 | 1.5 | 1.0 | .5 |
| | 14 | 2060 | 22.8 | BP | 195 | 53 | 43 | 3.1 | 2.5 | 2.0 | 1.5 | 1.0 | .5 |
| | 12 | 2060 | 22.7 | BP | 189 | 51 | 42 | 3.2 | 2.6 | 2.1 | 1.6 | 1.0 | .5 |
| | 10 | 2060 | 22.6 | BP | 183 | 49 | 42 | 3.3 | 2.7 | 2.2 | 1.6 | 1.1 | .5 |
| 6000 | 8 | 2060 | 22.6 | BP | 178 | 47 | 42 | 3.3 | 2.8 | 2.2 | 1.7 | 1.1 | .5 |
| | 6 | 2060 | 22.6 | BP | 174 | 45 | 41 | 3.4 | 2.9 | 2.3 | 1.7 | 1.1 | .6 |
| | 4 | 2060 | 22.7 | BP | 170 | 44 | 41 | 3.5 | 2.9 | 2.3 | 1.7 | 1.2 | .6 |
| | 2 | 2060 | 22.9 | BP | 167 | 42 | 41 | 3.6 | 3.0 | 2.4 | 1.8 | 1.2 | .6 |
| | SL | 2060 | 23.2 | BP | 164 | 40 | 40 | 3.6 | 3.0 | 2.4 | 1.8 | 1.2 | .6 |
| | 14 | 2060 | 19.0 | BP | 153 | 47 | 38 | 3.9 | 3.3 | 2.6 | 1.9 | 1.3 | .6 |
| | 12 | 2060 | 19.1 | BP | 148 | 45 | 38 | 4.0 | 3.4 | 2.7 | 2.0 | 1.3 | .7 |
| | 10 | 2060 | 19.2 | BP | 144 | 43 | 37 | 4.1 | 3.5 | 2.8 | 2.0 | 1.4 | .7 |
| 5000 | 8 | 2060 | 19.3 | BP | 141 | 42 | 37 | 4.2 | 3.5 | 2.8 | 2.1 | 1.4 | .7 |
| | 6 | 2060 | 19.6 | BP | 139 | 40 | 37 | 4.3 | 3.6 | 2.9 | 2.1 | 1.4 | .7 |
| | 4 | 2060 | 19.8 | BP | 137 | 39 | 37 | 4.4 | 3.6 | 2.9 | 2.2 | 1.4 | .7 |
| | 2 | 2060 | 20.2 | BP | 136 | 38 | 37 | 4.4 | 3.7 | 2.9 | 2.2 | 1.4 | .7 |
| | SL | 2060 | 20.8 | BP | 137 | 37 | 37 | 4.4 | 3.6 | 2.9 | 2.2 | 1.4 | .7 |

*Figure A-20*

# MAXIMUM ENDURANCE

## STANDARD DAY

MODEL: HUK-1
DATE: 10 SEPTEMBER 1959
DATA BASIS: FLIGHT TEST

ENGINE: R-1340-52
FUEL GRADE: 91/96
FUEL DENSITY: 6.0 LB/GAL

| GROSS WEIGHT LB | PRESS. ALT. 1000 FT. | POWER SETTINGS | | | APPROXIMATE | | | ENDURANCE — HOURS | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ENGINE SPEED RPM | MAN. PRESS. IN. HG. | MIX-TURE | TOTAL LB/HR | SPEED/KNOTS TAS | SPEED/KNOTS CAS | 600 LB FUEL | 500 LB FUEL | 400 LB FUEL | 300 LB FUEL | 200 LB FUEL | 100 LB FUEL |
| 7000 | 10 | 2060 | 25.9 | BP | 220 | 54 | 47 | 2.7 | 2.3 | 1.8 | 1.3 | .9 | .4 |
| | 8 | 2060 | 25.8 | BP | 214 | 52 | 46 | 2.8 | 2.3 | 1.8 | 1.4 | .9 | .4 |
| | 6 | 2060 | 25.6 | BP | 208 | 50 | 45 | 2.9 | 2.4 | 1.9 | 1.4 | 1.0 | .5 |
| | 4 | 2060 | 25.5 | BP | 203 | 48 | 45 | 3.0 | 2.4 | 2.0 | 1.5 | 1.0 | .5 |
| | 2 | 2060 | 25.4 | BP | 197 | 46 | 45 | 3.0 | 2.5 | 2.0 | 1.5 | 1.0 | .5 |
| | SL | 2060 | 25.3 | BP | 192 | 45 | 45 | 3.1 | 2.6 | 2.1 | 1.5 | 1.0 | .5 |
| 6000 | 14 | 2060 | 22.5 | BP | 190 | 53 | 43 | 3.1 | 2.6 | 2.1 | 1.6 | 1.0 | .5 |
| | 12 | 2060 | 22.4 | BP | 183 | 51 | 42 | 3.3 | 2.7 | 2.2 | 1.6 | 1.1 | .5 |
| | 10 | 2060 | 22.3 | BP | 177 | 49 | 42 | 3.4 | 2.8 | 2.2 | 1.7 | 1.1 | .5 |
| | 8 | 2060 | 22.2 | BP | 172 | 47 | 42 | 3.5 | 2.9 | 2.3 | 1.7 | 1.1 | .6 |
| | 6 | 2060 | 22.2 | BP | 168 | 45 | 41 | 3.6 | 3.0 | 2.4 | 1.8 | 1.2 | .6 |
| | 4 | 2060 | 22.3 | BP | 164 | 44 | 41 | 3.6 | 3.0 | 2.4 | 1.8 | 1.2 | .6 |
| | 2 | 2060 | 22.4 | BP | 161 | 42 | 41 | 3.7 | 3.1 | 2.5 | 1.8 | 1.2 | .6 |
| | SL | 2060 | 22.4 | BP | 159 | 40 | 40 | 3.8 | 3.1 | 2.5 | 1.9 | 1.2 | .6 |
| 5000 | 14 | 2060 | 19.2 | BP | 147 | 47 | 38 | 4.1 | 3.4 | 2.7 | 2.0 | 1.3 | .7 |
| | 12 | 2060 | 19.2 | BP | 143 | 45 | 38 | 4.2 | 3.5 | 2.8 | 2.1 | 1.4 | .7 |
| | 10 | 2060 | 19.2 | BP | 139 | 43 | 37 | 4.3 | 3.6 | 2.9 | 2.1 | 1.4 | .7 |
| | 8 | 2060 | 19.2 | BP | 136 | 42 | 37 | 4.4 | 3.7 | 2.9 | 2.2 | 1.5 | .7 |
| | 6 | 2060 | 19.2 | BP | 133 | 40 | 37 | 4.5 | 3.7 | 3.0 | 2.2 | 1.5 | .7 |
| | 4 | 2060 | 19.4 | BP | 131 | 39 | 37 | 4.6 | 3.8 | 3.0 | 2.3 | 1.5 | .7 |
| | 2 | 2060 | 19.7 | BP | 131 | 38 | 37 | 4.6 | 3.8 | 3.0 | 2.3 | 1.5 | .7 |
| | SL | 2060 | 20.2 | BP | 132 | 37 | 37 | 4.5 | 3.8 | 3.0 | 2.3 | 1.5 | .7 |

*Figure A-21*

# HOVERING ENDURANCE

## STANDARD DAY

MODEL: HOK-1
DATE: 16 SEPTEMBER 1959
DATA BASIS: FLIGHT TEST

ENGINE: R-1340-48
FUEL GRADE: 91/96
FUEL DENSITY: 6.0 LB/GAL

| GROSS WEIGHT LB | PRESS. ALT. 1000 FT. | POWER SETTINGS | | | APPROXIMATE | | | ENDURANCE — HOURS | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ENGINE SPEED RPM | MAN. PRESS. IN. HG. | MIX-TURE | TOTAL LB/HR | SPEED/KNOTS TAS | SPEED/KNOTS CAS | 600 LB FUEL | 500 LB FUEL | 400 LB FUEL | 300 LB FUEL | 200 LB FUEL | 100 LB FUEL |
| 7000 | 8 | 2060 | FT | BP | 271 | 20 | 18 | 2.2 | 1.8 | 1.5 | 1.1 | .7 | .4 |
| | 6 | 2060 | FT | BP | 291 | 16 | 14 | 2.1 | 1.7 | 1.4 | 1.0 | .7 | .3 |
| | 4 | 2060 | 35.0 | R | 357 | 13 | 12 | 1.7 | 1.4 | 1.1 | .8 | .6 | .3 |
| | 2 | 2060 | 35.0 | R | 350 | 13 | 13 | 1.7 | 1.4 | 1.1 | .8 | .6 | .3 |
| | SL | 2060 | 35.0 | R | 346 | 13 | 13 | 1.7 | 1.4 | 1.1 | .8 | .6 | .3 |
| 6000 | 12 | 2060 | FT | BP | 232 | 20 | 17 | 2.6 | 2.1 | 1.7 | 1.3 | .9 | .4 |
| | 10 | 2060 | FT | BP | 252 | 15 | 13 | 2.4 | 2.0 | 1.6 | 1.2 | .8 | .4 |
| | 8 | 2060 | FT | BP | 271 | 12 | 10 | 2.2 | 1.8 | 1.5 | 1.1 | .7 | .4 |
| | 6 | 2060 | FT | BP | 291 | 7 | 6 | 2.0 | 1.7 | 1.4 | 1.0 | .7 | .3 |
| | 4 | 2060 | 33.9 | R | 346 | 0 | 0 | 1.7 | 1.4 | 1.1 | .8 | .6 | .3 |
| | 2 | 2060 | 34.1 | R | 341 | 0 | 0 | 1.7 | 1.4 | 1.2 | .9 | .6 | .3 |
| | SL | 2060 | 34.4 | R | 337 | 0 | 0 | 1.8 | 1.5 | 1.2 | .9 | .6 | .3 |
| 5000 | 14 | 2060 | FT | BP | 213 | 14 | 11 | 2.8 | 2.3 | 1.9 | 1.4 | .9 | .5 |
| | 12 | 2060 | FT | BP | 232 | 11 | 9 | 2.6 | 2.1 | 1.7 | 1.3 | .8 | .4 |
| | 10 | 2060 | 28.2 | BP | 252 | 0 | 0 | 2.4 | 1.9 | 1.6 | 1.2 | .8 | .4 |
| | 8 | 2060 | 28.5 | BP | 248 | 0 | 0 | 2.4 | 2.0 | 1.6 | 1.2 | .8 | .4 |
| | 6 | 2060 | 28.7 | BP | 245 | 0 | 0 | 2.4 | 2.0 | 1.6 | 1.2 | .8 | .4 |
| | 4 | 2060 | 29.0 | R | 281 | 0 | 0 | 2.1 | 1.8 | 1.4 | 1.0 | .7 | .3 |
| | 2 | 2060 | 29.3 | R | 278 | 0 | 0 | 2.1 | 1.8 | 1.4 | 1.1 | .7 | .3 |
| | SL | 2060 | 29.6 | R | 275 | 0 | 0 | 2.2 | 1.8 | 1.4 | 1.1 | .7 | .3 |

*Figure A-22*

# HOVERING ENDURANCE

## STANDARD DAY

MODEL: HUK-1
DATE: 16 SEPTEMBER 1959
DATA BASIS: FLIGHT TEST

ENGINE: R-1340-52
FUEL GRADE: 91/96
FUEL DENSITY: 6.0 LB/GAL

| GROSS WEIGHT LB | PRESS. ALT. 1000 FT. | POWER SETTINGS | | | APPROXIMATE | | | ENDURANCE — HOURS | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ENGINE SPEED RPM | MAN. PRESS. IN. HG. | MIX-TURE | TOTAL LB/HR | SPEED/KNOTS TAS | SPEED/KNOTS CAS | 600 LB FUEL | 500 LB FUEL | 400 LB FUEL | 300 LB FUEL | 200 LB FUEL | 100 LB FUEL |
| | 8 | 2060 | FT | BP | 256 | 23 | 21 | 2.3 | 1.9 | 1.5 | 1.2 | .8 | .4 |
| | 6 | 2060 | FT | BP | 275 | 18 | 16 | 2.2 | 1.8 | 1.4 | 1.1 | .7 | .3 |
| 7000 | 4 | 2060 | FT | R | 334 | 14 | 13 | 1.8 | 1.5 | 1.2 | .9 | .6 | .3 |
| | 2 | 2060 | 34.6 | R | 345 | 12 | 12 | 1.7 | 1.4 | 1.2 | .9 | .6 | .3 |
| | SL | 2060 | 34.6 | R | 340 | 12 | 12 | 1.7 | 1.4 | 1.2 | .9 | .6 | .3 |
| | 12 | 2060 | FT | BP | 222 | 22 | 18 | 2.7 | 2.2 | 1.8 | 1.3 | .9 | .4 |
| | 10 | 2060 | FT | BP | 239 | 17 | 14 | 2.5 | 2.1 | 1.7 | 1.2 | .8 | .4 |
| | 8 | 2060 | FT | BP | 256 | 13 | 11 | 2.3 | 1.9 | 1.5 | 1.2 | .8 | .4 |
| 6000 | 6 | 2060 | FT | BP | 275 | 10 | 9 | 2.2 | 1.8 | 1.4 | 1.1 | .7 | .4 |
| | 4 | 2060 | 33.1 | R | 340 | 0 | 0 | 1.7 | 1.5 | 1.2 | .9 | .6 | .3 |
| | 2 | 2060 | 33.1 | R | 336 | 0 | 0 | 1.8 | 1.5 | 1.2 | .9 | .6 | .3 |
| | SL | 2060 | 33.2 | R | 331 | 0 | 0 | 1.8 | 1.5 | 1.2 | .9 | .6 | .3 |
| | 14 | 2060 | FT | BP | 207 | 15 | 12 | 2.9 | 2.4 | 1.9 | 1.4 | 1.0 | .5 |
| | 12 | 2060 | FT | BP | 222 | 12 | 10 | 2.7 | 2.2 | 1.8 | 1.3 | .9 | .4 |
| | 10 | 2060 | FT | BP | 239 | 6 | 5 | 2.5 | 2.1 | 1.7 | 1.2 | .8 | .4 |
| 5000 | 8 | 2060 | 28.2 | BP | 243 | 0 | 0 | 2.5 | 2.0 | 1.6 | 1.2 | .8 | .4 |
| | 6 | 2060 | 28.2 | BP | 240 | 0 | 0 | 2.5 | 2.1 | 1.6 | 1.2 | .8 | .4 |
| | 4 | 2060 | 28.3 | R | 275 | 0 | 0 | 2.2 | 1.8 | 1.4 | 1.1 | .7 | .3 |
| | 2 | 2060 | 28.5 | R | 272 | 0 | 0 | 2.2 | 1.8 | 1.5 | 1.1 | .7 | .3 |
| | SL | 2060 | 28.7 | R | 269 | 0 | 0 | 2.2 | 1.8 | 1.5 | 1.1 | .7 | .4 |

*Figure A-23*

# LANDING

## STANDARD DAY

MODEL: HOK-1/HUK-1
DATE: 16 SEPTEMBER 1959
DATA BASIS: FLIGHT TEST

ENGINE: R-1340-48, OR-52
FUEL GRADE: 91/96
FUEL DENSITY: 6.0 LB/GAL

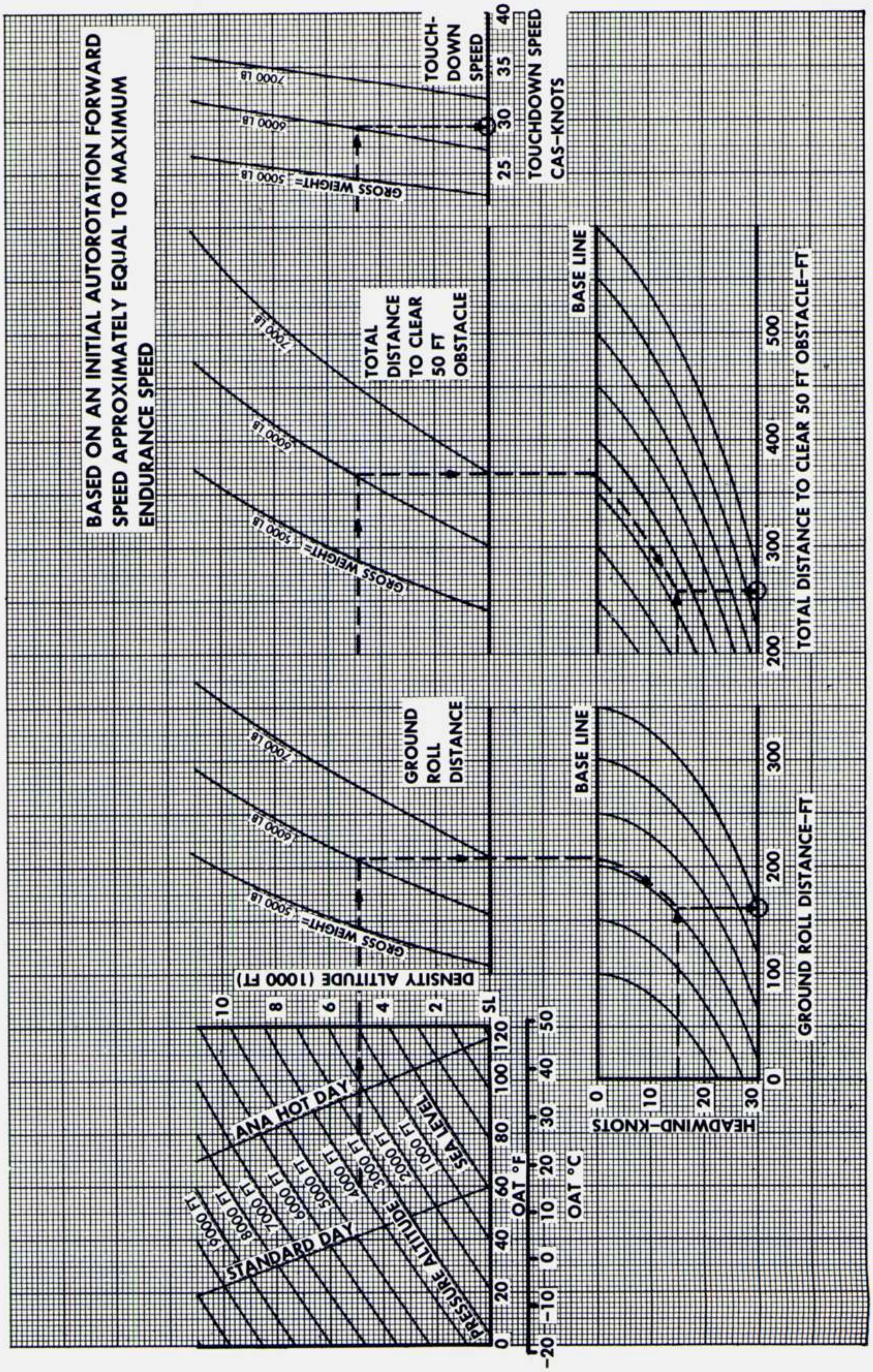



Figure A-24

# Index



**(Page numbers in *italics* denote illustrations)**

**(Page numbers in *italics* denote illustrations)**

**(Page numbers in *italics* denote illustrations)**