RESTRICTED
SECURITY INFORMATION

AN 01-260HAA-1

Pilot's Handbook

NAVY MODEL
HTK-1
HELICOPTERS

THIS PUBLICATION SUPERSEDES AN 01-260HAA-1 DATED 1 DECEMBER 1951

Appendix I of this publication shall not be carried in aircraft on combat missions or when there is a reasonable chance of its falling into the hands of an unfriendly nation.

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1 September 1952

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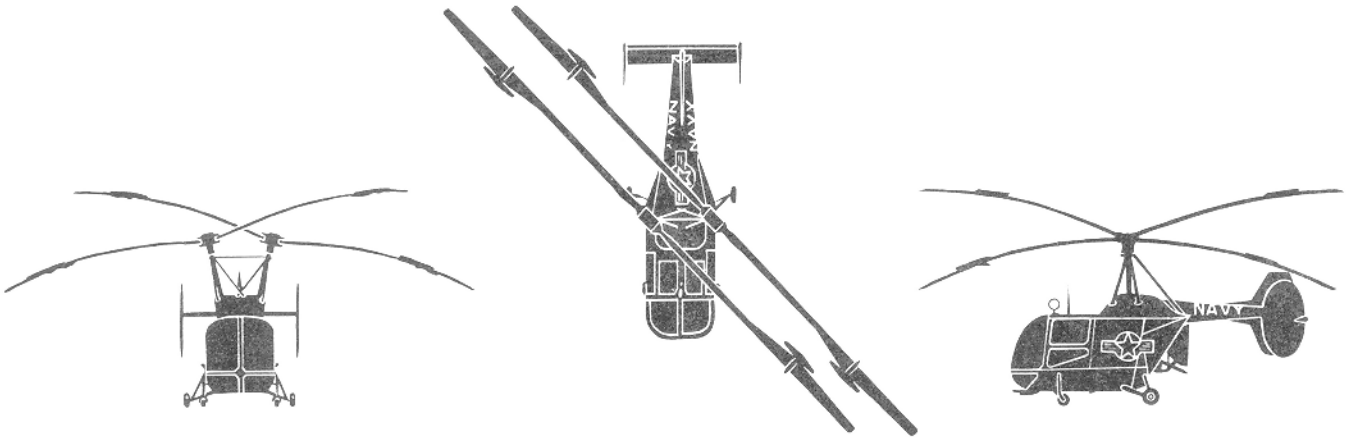


HTK-1

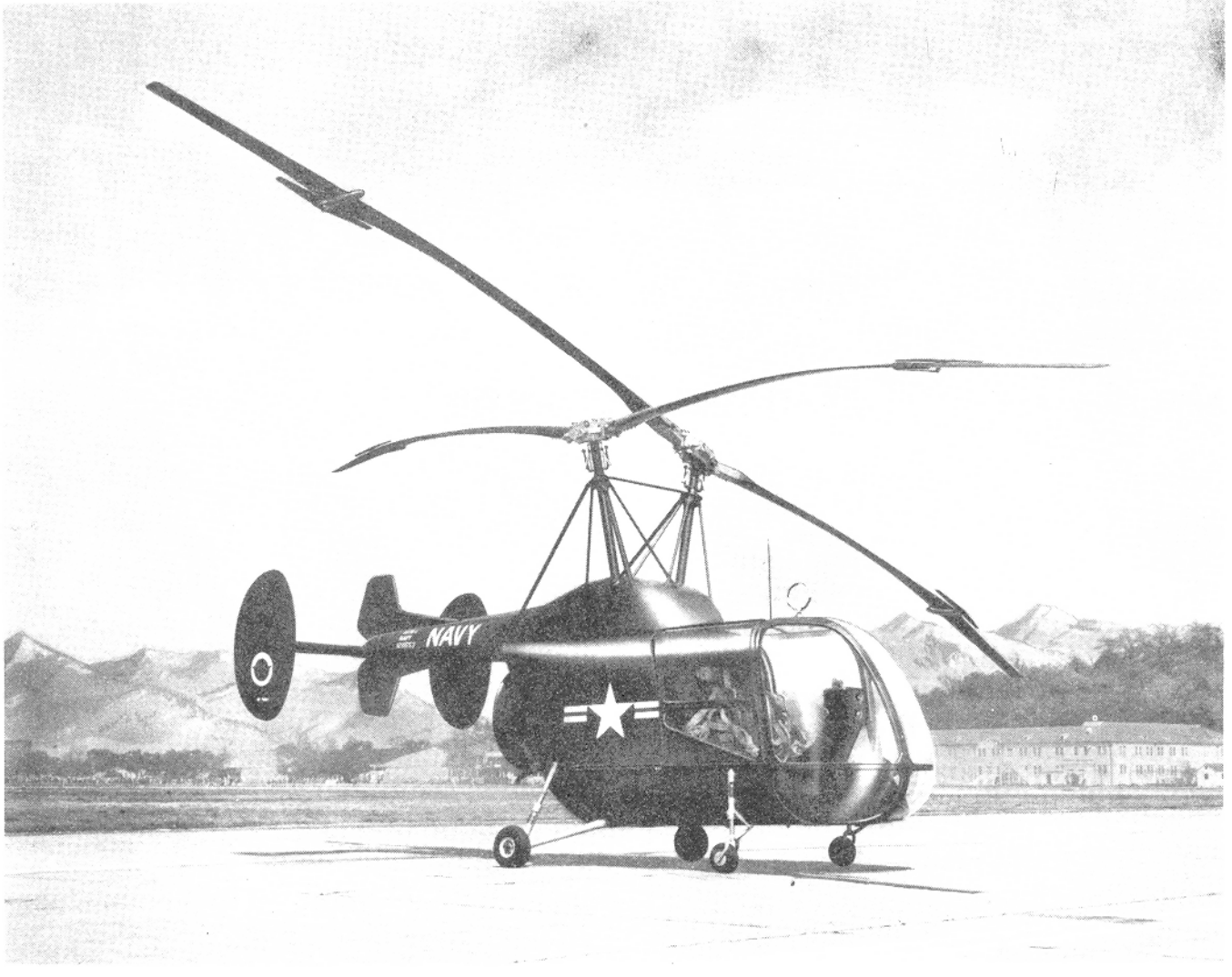


Figure 1-1. Navy Model HTK-1 Helicopter

SECTION 1

INTRODUCTION

THE HELICOPTER

DESCRIPTION. The Navy Model HTK-1 Helicopter is a three-place aircraft with twin intermeshing counter-rotating rotors controlled by servo flaps for both cyclic pitch and collective pitch change. The empennage consists of two fixed vertical fins rigidly attached to a floating horizontal surface which is controlled by a movable trim tab. Attached to the upper rear portion of the fuselage structure is the tail boom which supports the empennage. A center fin integral with the tail boom provides the helicopter with additional directional stability. The pilot's seat is located on the right side of the cabin and the co-pilot's seat on the left. A folding jump seat is provided for an additional passenger and is located aft of the pilot's seat. The nose bubble is made in two sections, the left one of which can be swung open for loading or removing a litter. The litter is installed within the cabin on the left side, after removing the co-pilot's seat and flight controls. Immediately behind the cabin and separated from it by a firewall is the main transmission and engine compartment. The aircraft is powered by a Lycoming Model O-435-4 aircraft engine mounted with the drive end facing aft in the fuselage. Mounted on the crank shaft end of the engine is a nose transmission which includes a cooling fan and a centrifugal clutch. Power is transmitted from the engine by means of the nose transmission and an intermediate drive shaft, to a free-wheeling unit in the rear of the main transmission housing. The main transmission distributes the power to each of the two rotors, and synchronizes them with each other. The fuel tank is located above the main transmission and between the rotor shafts. The non-retractable landing gear has two main rear wheels equipped with hydraulic brakes, and two swiveling and self-centering forward auxiliary wheels.

OVER-ALL DIMENSIONS

Length—fuselage	20 ft 6½ in.
Width—fuselage	4 ft 10 in.
Span—rotor blades	45 ft 0 in.
Length—rotor disk diameter	41 ft 0 in.
Height—over rotor hubs	12 ft 3 in.
Tread—main wheels, center to center of tires	7 ft 6 in.
Tread—nose wheels, center to center of tires	5 ft 2 in.
Wheelbase	6 ft 2 in.
Vertical tail—ground clearance	4 ft 2 in.

NORMAL GROSS WEIGHT

2-place with 40 gal fuel	2880 lb

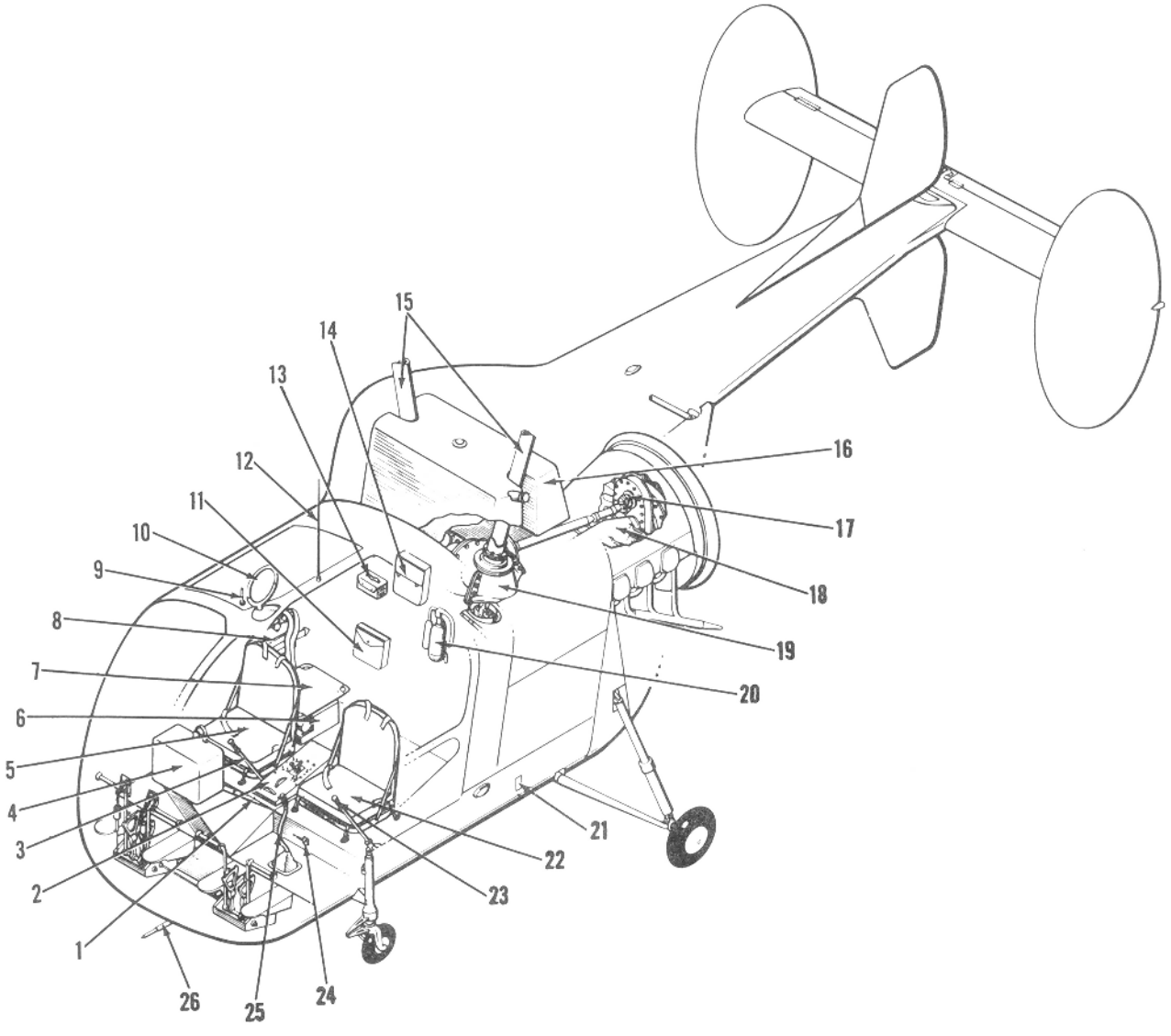
MAXIMUM GROSS WEIGHT

3-place with 28 gal fuel	3000 lb

FLIGHT CONTROLS

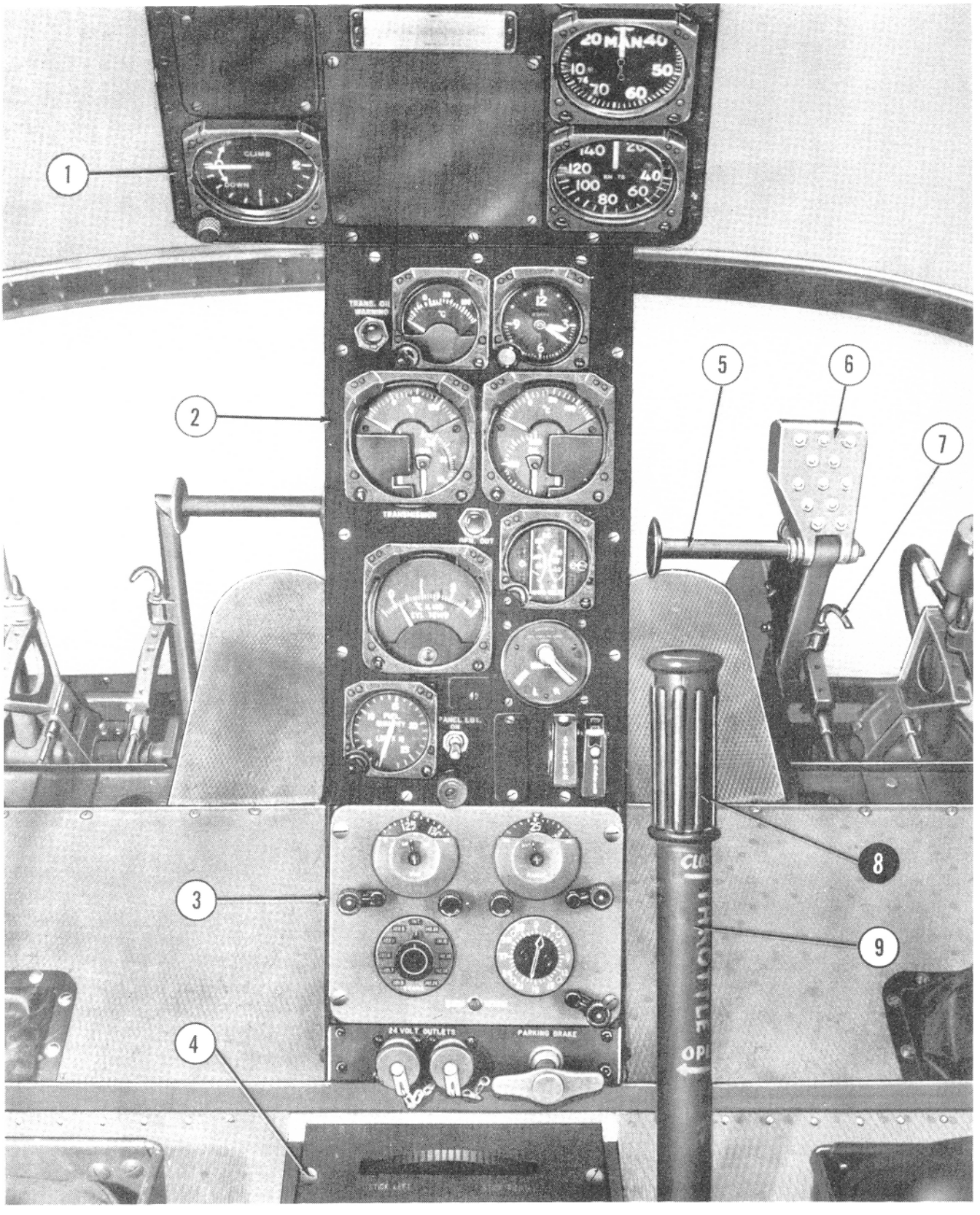
DESCRIPTION. The helicopter has a full servo-type control in the form of flaps mounted on the rotor blades. Both cyclic and collective pitch changes of the rotor blades are controlled by the flaps, which twist the blades about their spanwise axes. Additional control is provided by the use of a floating horizontal tail surface which is controlled by a servo tab mechanically linked to the collective pitch control sticks. Control of the servo flaps is obtained by push-pull rods from the cyclic and collective pitch control sticks to gimbal rings below the main transmission, through the rotor drive shafts, the rotor hubs, and the leading edge of the rotor blades. This type of design eliminates undesirable stick pressures because there is no direct linkage from the pilot to the lifting surfaces. Furthermore it allows cyclic and collective pitch control without changing the pitch of the blades relative to their hub. Droop stops are provided to keep the rotor blades at a safe height above ground objects. When the rotor blades are turning at 170 to 175 rpm, centrifugal force disengages the stops. The stops engage when the rotor blades are turning at 100 to 115 rpm.

DUAL FLIGHT CONTROLS. Dual flight controls are provided for the pilot and co-pilot except that no wheel brake controls are incorporated with the co-pilot's foot pedals.



1. Console panel
2. Auxiliary panel
3. Pilot's collective pitch control stick (collective stick)
4. Instrument panel
5. Pilot's seat
6. Radio equipment
7. Folding jump seat
8. Radio junction box
9. Free air thermometer
10. Loop antenna
11. Map case and flight report holder
12. Whip antenna
13. First aid kit
14. Files kit
15. Rotor drive shafts
16. Fuel tank
17. Engine nose transmission
18. Engine
19. Main transmission
20. Fire extinguisher
21. External power receptacle door
22. Co-pilot's seat
23. Co-pilot's collective pitch control stick (collective stick)
24. Co-pilot's microphone and headset jack box
25. Co-pilot's cyclic pitch control stick (cyclic stick)
26. Pitot tube

Figure 1-2. General Arrangement



1. Instrument panel
2. Console panel
3. Radio control unit
4. Auxiliary panel
5. Foot pedal
6. Wheel brake toe pedal
7. Pedal adjustment
8. Throttle control grip
9. Pilot's collective stick

Figure 1-3. Instruments and Controls

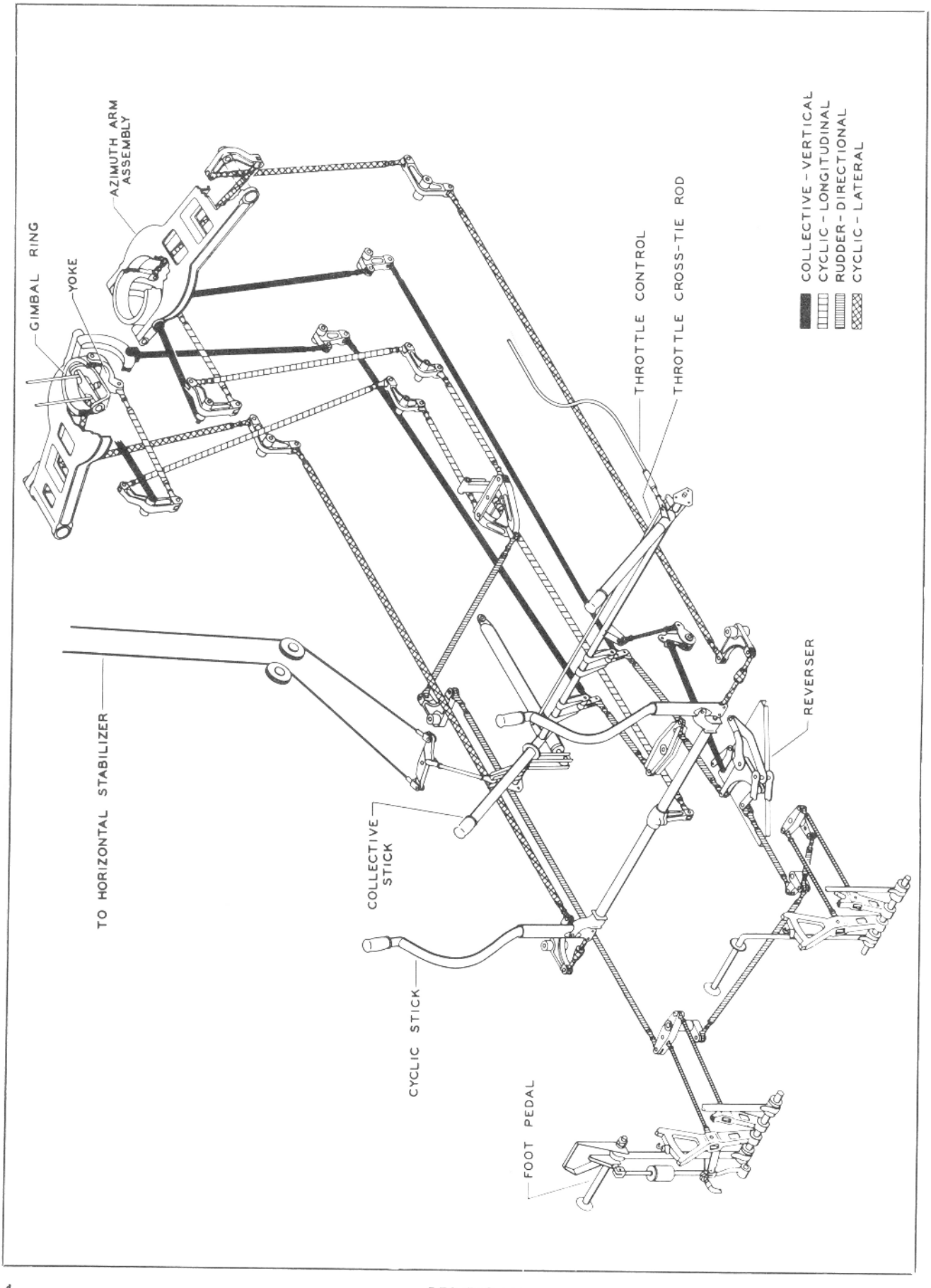


Figure 1-4. Flight Control System

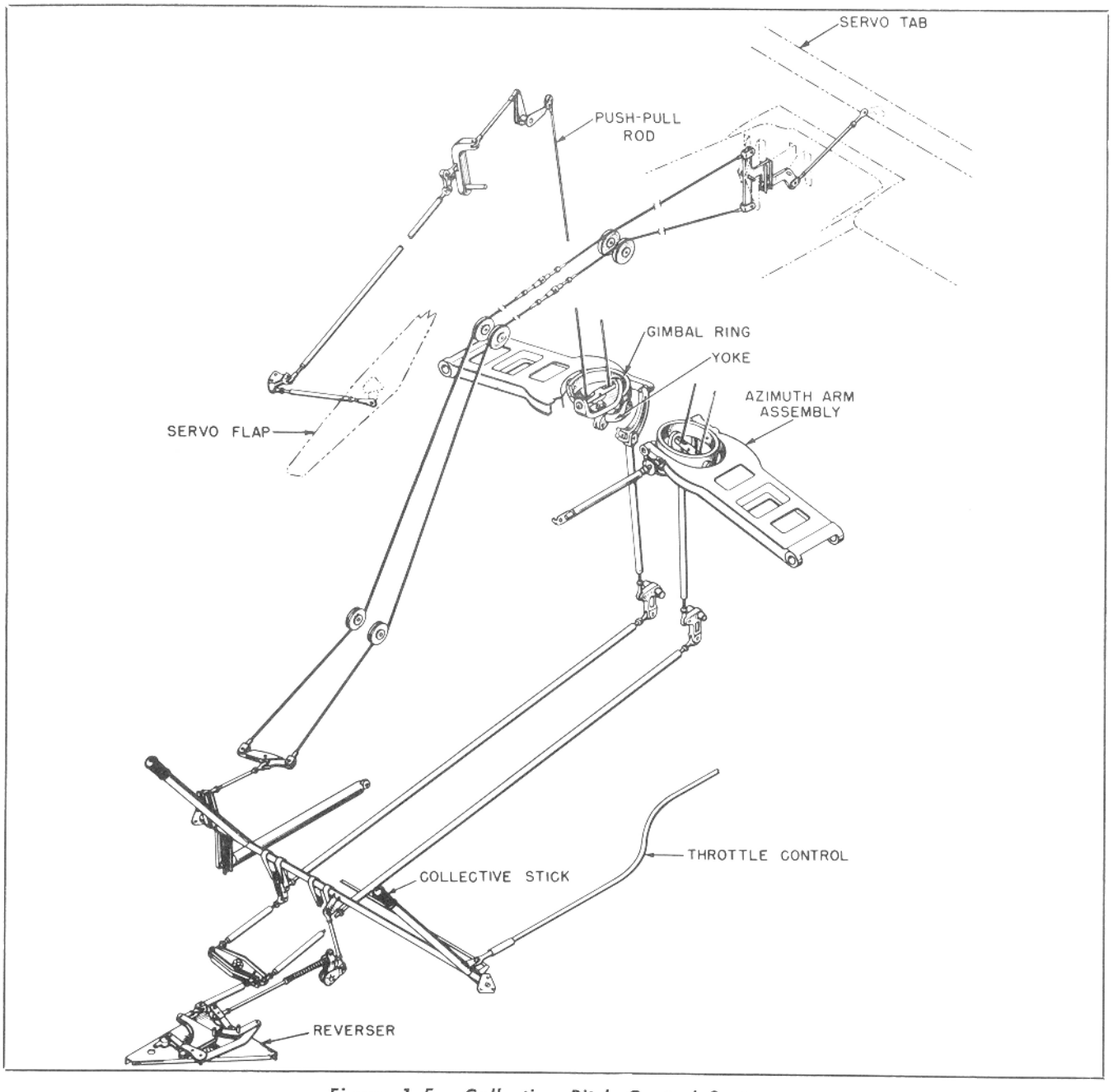


Figure 1-5. Collective Pitch Control System

COLLECTIVE PITCH CONTROL STICK. *(See figure 1-5.)* The collective pitch control sticks (3 and 23, figure 1-2), hereafter referred to as the "collective stick," are located to the left of the pilot's and co-pilot's seats and provide vertical control for ascent or descent. Pulling up on the collective stick increases the collective pitch of the rotor blades, thereby developing additional lift and causing the helicopter to ascend. Pushing down on the stick causes the reverse to occur. The collective stick is also linked to the servo tab on the movable horizontal tail surface. This tail surface improves longitudinal stability and provides controllability for a greater center of gravity range. An upward motion of the stick results in an increased angle of attack of the horizontal tail surface and a downward motion of the stick results in a decreased angle of attack. In addition, the collective stick is so interconnected with the throttle that an increase or decrease in rotor pitch is automatically accompanied by an increase or decrease in engine power output. A motorcycle-type grip mounted on the collective stick provides independent control of the throttle.

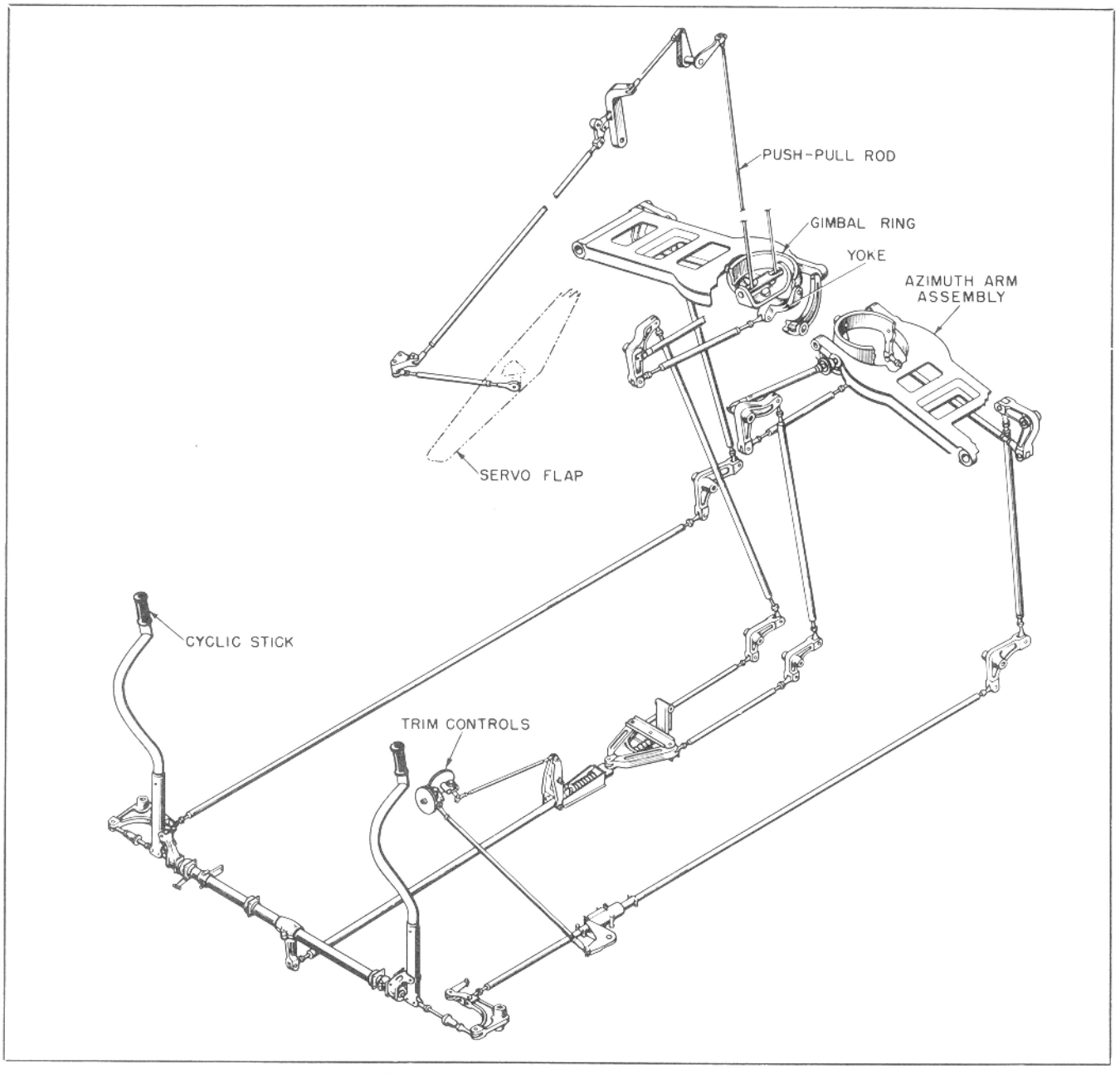


Figure 1-6. Cyclic Control System

CYCLIC PITCH CONTROL STICKS. *(See figure 1-6.)* The cyclic pitch control sticks, hereafter referred to as the "cyclic stick," are centrally located in front of the pilot's and co-pilot's seats. Operation of the cyclic stick is conventional; that is, displacement of the stick in a given direction results in the aircraft tilting, then moving, in that direction. However, because of the servo-flap control system, the force on the cyclic stick is at a minimum.

TRIM CONTROLS. The longitudinal trim control (7, figure 1-10) and the lateral trim control (6, figure 1-10) are located on the auxiliary panel and provide for the adjustment of the cyclic stick. When the trim controls are properly adjusted, the cyclic stick is trimmed for neutral pressure and can be released.

FOOT PEDALS. *(See figure 1-7.)* The foot pedals, located forward of the pilot's and co-pilot's seats, control the heading of the helicopter. When the right pedal is depressed, two things happen simultaneously.

1. The collective pitch of the right rotor is decreased, and the pitch of the left rotor is increased, resulting in:
   a. rolling the aircraft toward the right due to changes in lift between the two rotors, and
   b. turning the aircraft toward the right due to unbalanced torque between the two rotors.
2. The right rotor is tilted rearward and the left rotor is tilted forward, thus furnishing additional turning moment toward the right.

Thus, with the use of foot pedals alone, the aircraft tends to bank into the turn.

Conversely, depressing the left foot pedal will cause a left turn and bank. Pedal adjustments for positioning the pedals to suit leg length are located on the pedal shafts. The toe pedals mounted above the pilot's foot pedals are for wheel brake operation.

FLIGHT INSTRUMENTS. The following standard flight instruments are located on the instrument panel (figure 1-8) in the front of the cabin: rate of climb indicator (1), altimeter (3), compass (4), tachometer (5), manifold pressure gage (6), and airspeed indicator (7). In addition, space for the installation of a directional gyro indicator, a gyro horizon, and a turn and bank indicator is provided on the panel.

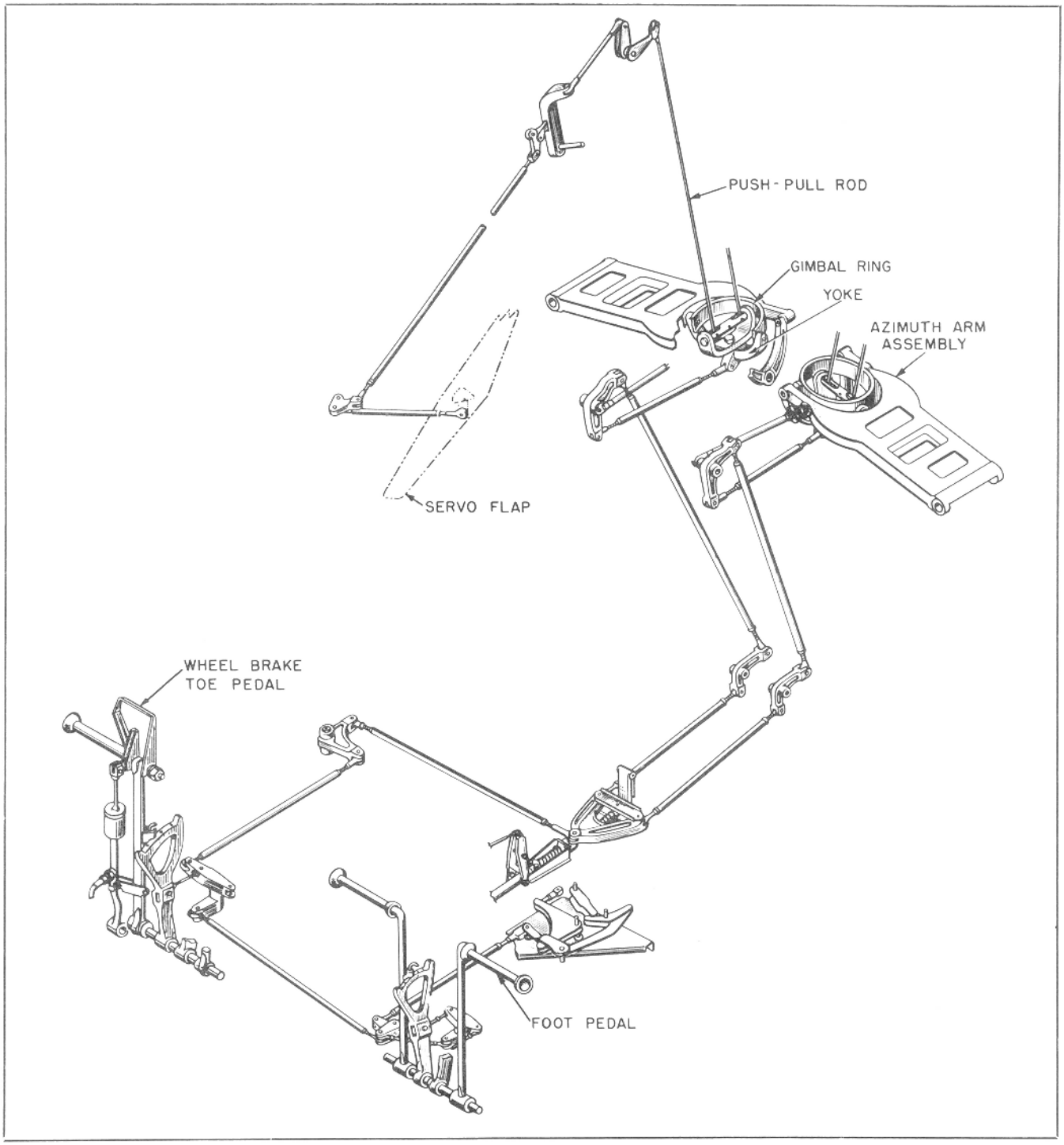
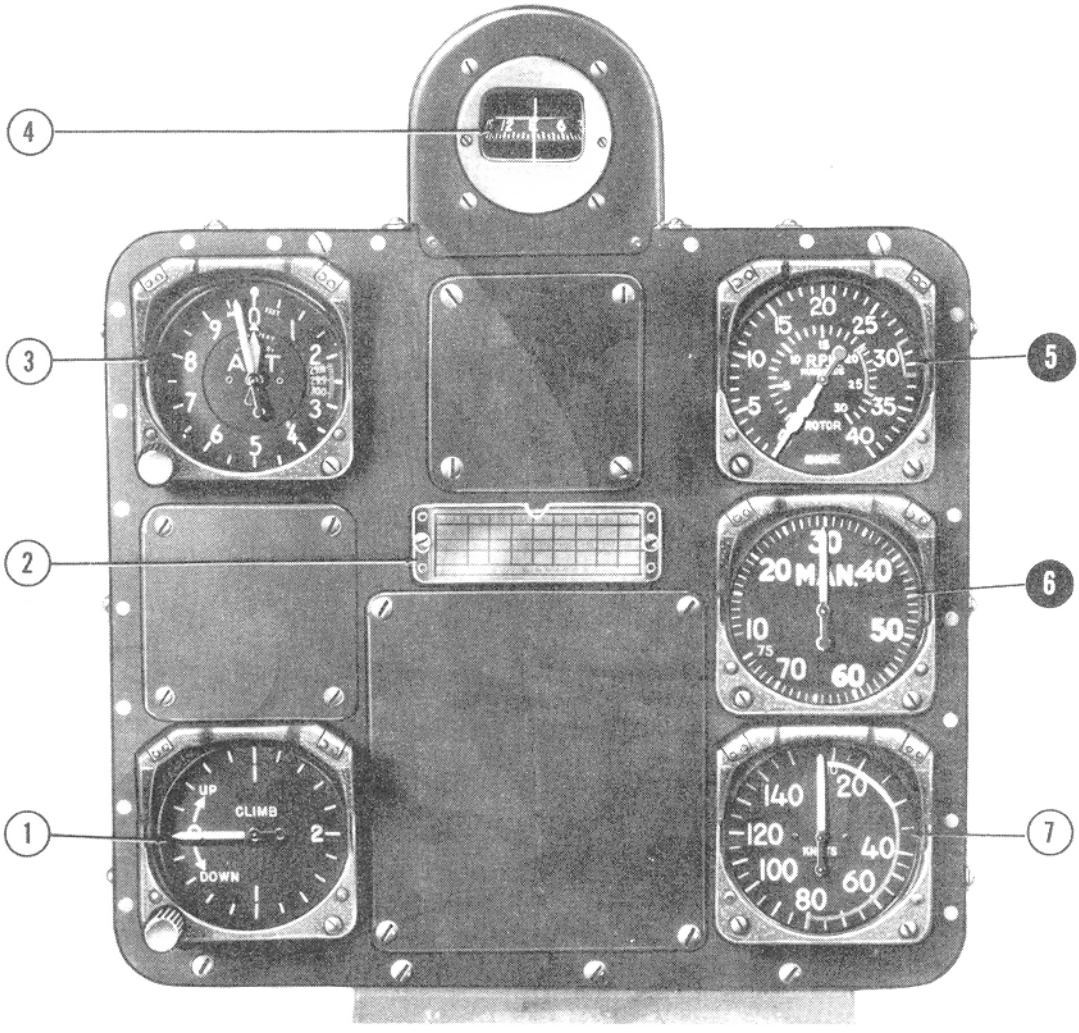


Figure 1-7. Foot Pedal Control System



1. Rate of climb indicator
2. Airspeed correction card
3. Altimeter
4. Compass
5. Tachometer
6. Manifold pressure gage
7. Airspeed indicator

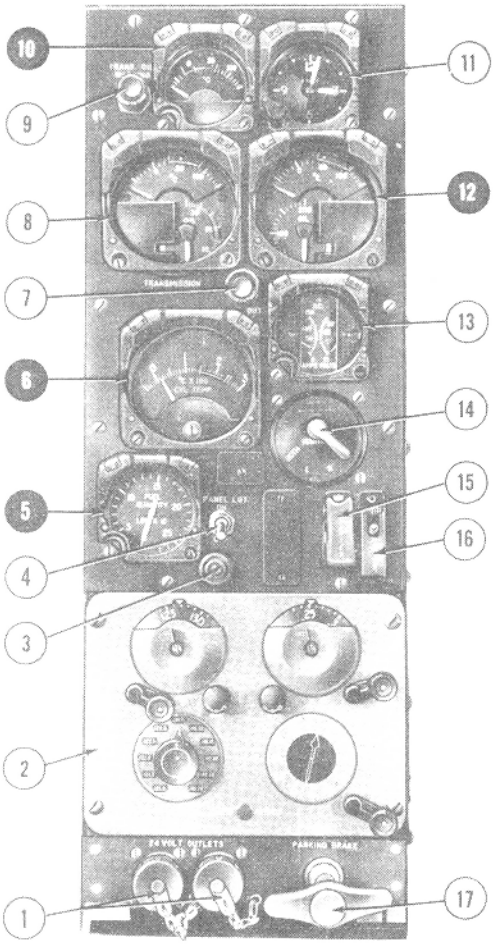
Figure 1-8. Instrument Panel

POWER PLANT CONTROLS

THROTTLE. The motorcycle-type throttle control grip (8, figure 1-3) is located at the end of each collective stick. Rotating the grip to the left will open the throttle and rotating it to the right will close the throttle. The mechanical linkage to the carburetor is so interconnected with the collective stick that an increase or decrease in rotor pitch is automatically accompanied by an increase or decrease in engine power output. In normal flight, the throttle grip is rotated only to make minor adjustments in power requirements.

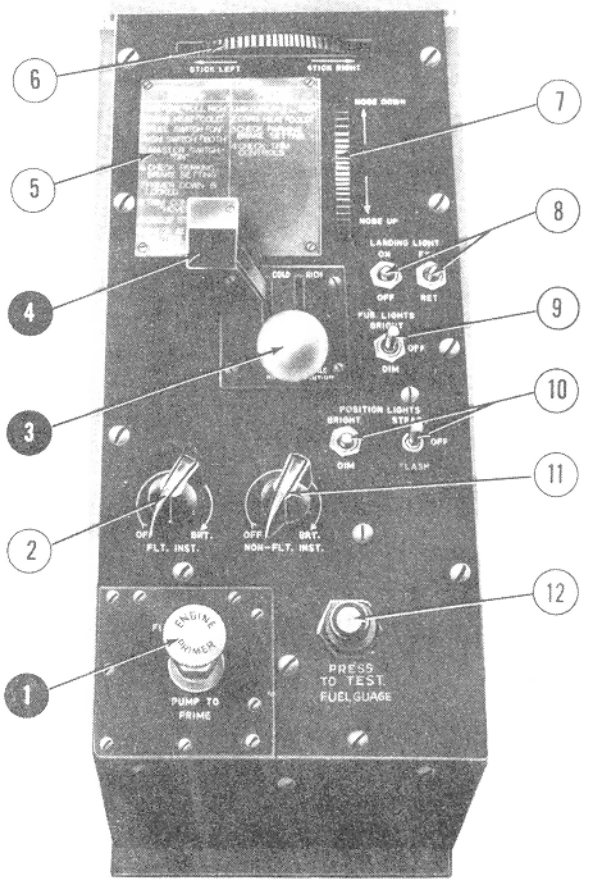
MIXTURE CONTROL LEVER. This control lever (3, figure 1-10), located on the auxiliary panel, adjusts the carburetor fuel-air mixture. Rich mixture setting is forward and leaner mixtures are obtained at intermediate settings toward the rear. Idle cut-off is full aft. Full rich is used on all flights under 5000 feet altitude. The thumb lock on the lever must be depressed before the mixture control can be moved aft. The thumb lock need not be depressed when moving toward full rich, since it operates on a spring-loaded ratchet in that direction.

CARBURETOR HEAT LEVER. The carburetor heat lever (4, figure 1-10) on the auxiliary panel is located to the left of the mixture control lever. The desired carburetor air temperature is obtained by moving the lever to the proper position between "HOT" and "COLD." Cold position is full forward and hot is full aft. With



1. 24-volt receptacles
2. Radio control unit
3. Panel light
4. Panel light switch
5. Fuel quantity indicator
6. Cylinder head temperature indicator
7. Generator warning light
8. Transmission gage unit
9. Transmission oil warning light
10. Carburetor air temperature gage
11. Clock
12. Engine gage unit
13. Voltammeter
14. Ignition switch
15. Starter switch
16. Master switch
17. Parking brake handle

Figure 1-9. Console Panel



1. Fuel primer
2. Flight instruments lights rheostat
3. Mixture control lever
4. Carburetor heat lever
5. Pilot's check list
6. Lateral trim control
7. Longitudinal trim control
8. Landing light switches
9. Fuselage lights switch
10. Position lights switches
11. Non-flight instruments lights rheostat
12. Fuel gage test switch

Figure 1-10. Auxiliary Panel

the carburetor heat lever in the "COLD" position, cold air enters the air intake and passes through ducting to the carburetor. Heated air is obtained by passing air through the heat exchanger on the exhaust manifold. The carburetor heat lever is mechanically connected to a gate at the junction of the cold air duct and the duct from the heat exchanger. When the lever is moved, it changes the relative openings of the two ducts, thus varying the mixture of heated and cold air entering the carburetor.

FUEL PRIMER. The fuel primer (1, figure 1-10), located on the auxiliary panel, is marked "FUEL PRIMER" and "PUMP TO PRIME." The primer is manually operated and pumps fuel directly from the strainer to the engine cylinders. After the engine has started, the primer should be in the full down position and locked by turning the knob one-quarter turn to the right.

STARTER SWITCH. The starter switch (15, figure 1-9) is located on the console panel. To engage the starter, the switch guard must be raised, and the switch held to the "ON" position. This switch will automatically return to "OFF" position when released.

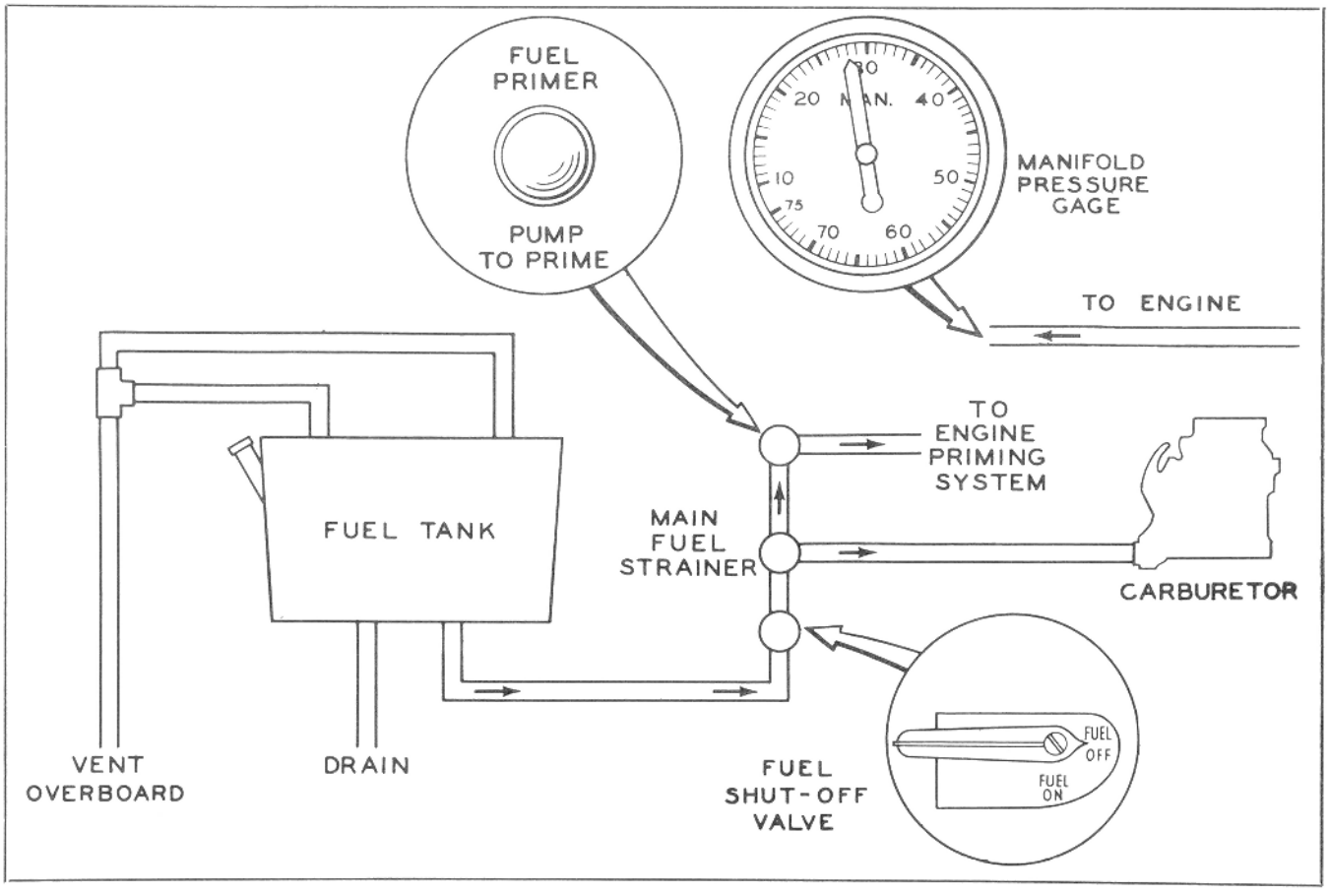


Figure 1-11. Fuel System Diagram

IGNITION SWITCH. The ignition switch (14, figure 1-9) is located on the console panel. The positions "OFF," "R," "L," and "BOTH" are indicated on the switch face. Since the engine is mounted with the crankshaft rearward, the right magneto is on the left side of the aircraft and the left magneto is on the right side. The impulse coupling is on the left engine magneto.

POWER PLANT INDICATORS. The following indicators are located on the console panel (figure 1-9): carburetor air temperature gage (10), transmission gage unit (8), engine gage unit (12), and cylinder head temperature indicator (6). The manifold pressure gage (6, figure 1-8) is located on the instrument panel.

FUEL SYSTEM CONTROLS

DESCRIPTION. The fuel system (figure 1-11) is of the gravity-feed type. The fuel tank is located above the main transmission between the rotor shafts. Fuel flows from the tank to the electrically controlled shut-off valve, through the valve and strainer to the carburetor.

FUEL SPECIFICATION AND GRADE. The fuel used in the helicopter should conform to Specification MIL-F-5572, Grade 91/96.

FUEL QUANTITY DATA

Tanks	1
Number of cells	1
Usable fuel—forward flight (U. S. gallons)	40
Total volume (U. S. gallons)	42

FUEL SHUT-OFF SWITCH. Fuel flow to the carburetor is controlled by a shut-off valve located directly under the fuel tank. The shut-off valve is actuated by a manually operated fuel shut-off switch located in the upper cabin enclosure directly over the pilot's seat. The "FUEL ON" and "FUEL OFF" switch positions are indicated on the switch handle bracket quadrant.

FUEL QUANTITY INDICATOR. The fuel quantity indicator (5, figure 1-9) located on the console panel indicates the fuel quantity in pounds. A capacitance-type fuel quantity indicating system is installed in this helicopter and is practically unresponsive to volumetric changes due to temperature variations. Moving parts are not required in the fuel tank because the conducting properties of the fuel are utilized as a measurement of quantity. The voltage drop between two electrodes in the tank unit is measured and the resistance between these two electrodes varies as the fuel quantity varies. The system is calibrated so that the quantity indicator will show pounds of fuel as measured from voltage drop.

ENGINE OIL SYSTEM

DESCRIPTION. The engine oil system (figure 1-12) is a conventional wet sump pressure system having a capacity of three gallons. The filler neck for the system is located on the side of the engine case and can be reached through an access door on the forward right-hand side of the engine cooling hood. An oil level measuring stick is located inside the filler neck.

OIL SPECIFICATION AND GRADE. The oil used in the engine should conform to Specification MIL-O-6082, Grade 1100, for summer, and Grade 1065 for winter.

OIL COOLERS. The engine oil cooling system (figure 1-12) includes two series connected oil coolers that are located forward of the engine cooling fan inside the fan shrouding; one on the left hand and one on the right hand side of the helicopter. The right hand cooler is mounted immediately forward of the main transmission oil cooler and mounts on the same brackets. The engine oil temperature is automatically controlled by thermostats in the oil coolers. When the oil temperature is high, the thermostatic valves in the coolers direct the engine oil through the coolers, where it is cooled by the air from the fan. The cooled oil is then returned to the engine oil sump. When the engine oil temperature is low, the thermostatic valves by-pass the flow of oil around the coolers to the engine oil sump.

OIL TEMPERATURE GAGE. The engine oil temperature gage is part of the engine gage unit (12, figure 1-9) located on the console panel. The engine oil temperature thermometer bulb is installed in the engine and is electrically wired to the engine gage unit.

OIL PRESSURE GAGE. The engine oil pressure gage is part of the engine gage unit (12, figure 1-9), on the console panel.

MAIN TRANSMISSION OIL SYSTEM

DESCRIPTION. The main transmission oil system (figure 1-12) consists of a six-quart oil tank, oil pump, oil cooler, oil filter, and oil pressure and oil quantity warning switches. Oil is drawn from the tank by an oil pump geared to the main transmission, circulated through the oil filter and transmission oil cooler and supplied to the transmission. The transmission oil cooler is located forward of the engine cooling fan inside the fan shrouding on the right side of the ship. The cooler contains a thermostatically controlled valve which by-passes the oil when the oil temperature is low or normal.

OIL SPECIFICATION AND GRADE. The oil used in the main transmission should conform to Specification MIL-O-6082, Grade 1100 for summer, and Grade 1065 for winter.

OIL TEMPERATURE GAGE. The transmission oil temperature gage is part of the transmission gage unit (8, figure 1-9) on the console panel. The transmission oil temperature thermometer bulb is installed in the oil

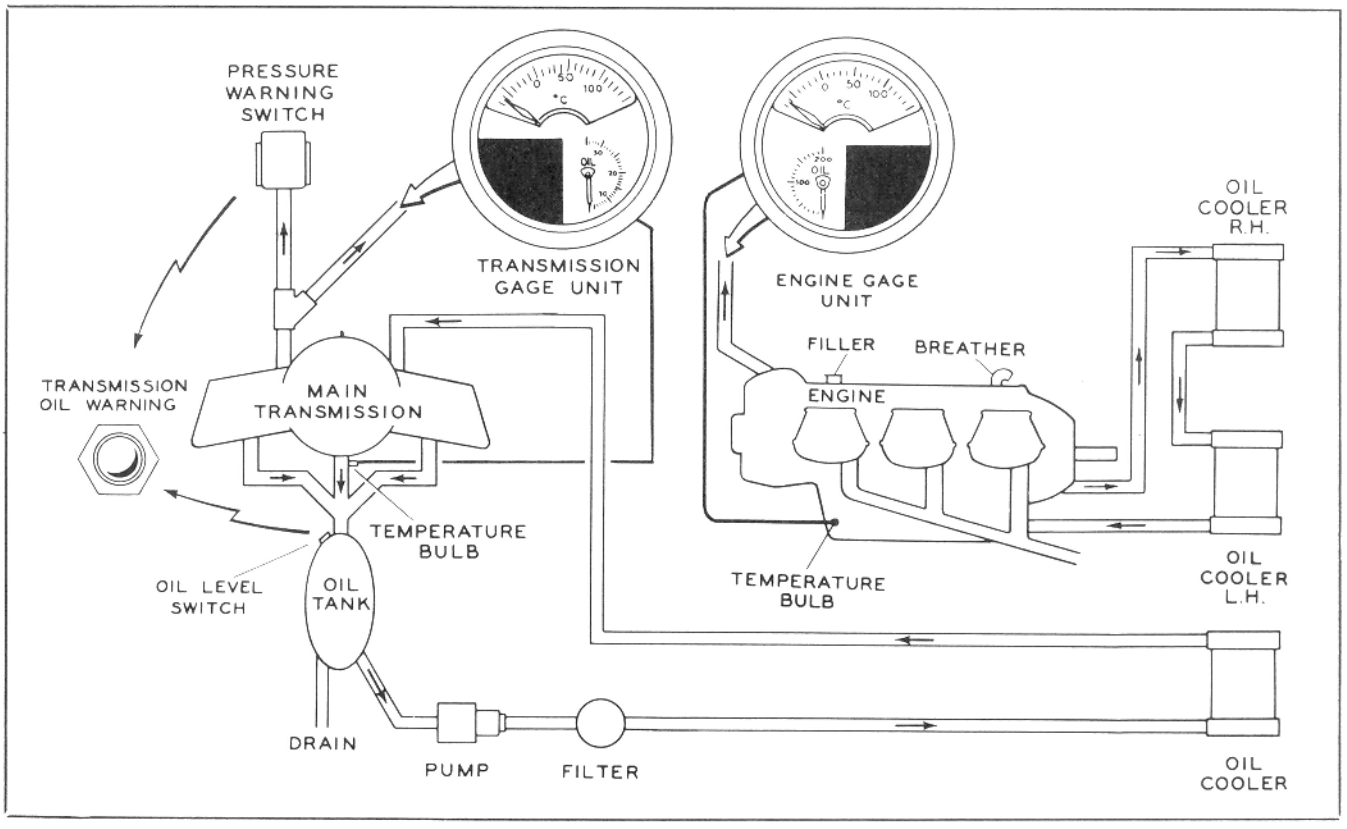


Figure 1-12. Oil System Diagram

return line between the transmission and the oil tank. The bulb is electrically connected to the transmission gage unit.

OIL PRESSURE GAGE. The transmission oil pressure gage is part of the transmission gage unit (8, figure 1-9) on the console panel.

OIL WARNING LIGHT. The transmission oil warning light (9, figure 1-9) located on the console panel will light when the transmission oil pressure drops to 15 psi or when the oil quantity in the transmission oil tank drops to approximately 3 quarts. The light is operated by a pressure warning switch connected to the transmission and by a float switch located in the transmission oil tank.

ENGINE NOSE TRANSMISSION OIL SYSTEM

DESCRIPTION. The engine nose transmission oil system is a conventional wet sump system with a capacity of one pint. The oil filler is located on the forward right side of the transmission. An oil-level measuring stick is attached to the filler cap.

OIL SPECIFICATION AND GRADE. The oil used in the engine nose transmission should be Kendall 140 manufactured by Kendall Refining Company, Bradford, Penn., or equivalent.

LANDING GEAR CONTROLS

BRAKES. A self-contained master cylinder system provides control of the hydraulic brakes on the two main landing gear wheels. The brakes are operated by toe pedals incorporated with the pilot's foot pedals. The parking brake handle (17, figure 1-9) is mounted on the lower portion of the console panel. The parking brake is locked by depressing both toe brake pedals and pulling up the parking brake handle.

ELECTRICAL SYSTEM CONTROLS

DESCRIPTION. The electrical system is a 28-volt d-c system and power may be obtained from the 24-volt 24-ampere-hour battery, the 28-volt 50-ampere generator, or from an external power source.

Note

The generator is driven by the main transmission and therefore is inoperative when the rotors are not rotating. To prevent excessive draining of the battery, keep the electrical load to a minimum when the rotors are stopped or when operating at low rpm.

MASTER SWITCH. The two-position master switch (16, figure 1-9) covered with a switch guard, is located on the console panel. This switch controls the power for the complete electrical system.

GENERATOR FIELD CIRCUIT BREAKER. This circuit breaker (figure 1-13) is mounted on the right side of the console panel. In case of generator malfunction, the generator can be isolated from the electrical system by pulling up on the generator field circuit breaker.

GENERATOR WARNING LIGHT. The generator warning light (7, figure 1-9) is mounted on the console panel. When the light is on, the generator is not charging and the electrical system is being operated from the battery.

VOLTAMMETER. The voltammeter (13, figure 1-9) is mounted on the console panel and incorporates a voltmeter and ammeter within the case.

CIRCUIT BREAKER AND FUSE PANEL. The circuit breaker panel (figure 1-13) is mounted on the right hand side of the console panel. Each circuit breaker button is clearly marked to indicate the circuit that it protects. The button will snap out when the circuit is overloaded and the circuit can be reset by pushing the button in. The fuse panel is located on the right side of the console inside the door marked "FUSES INSIDE" and the fuses are marked to indicate the circuits which they protect. Spare fuses are supplied in the upper half of the rubber holder for each fuse. To change fuses, use the rubber holder as a handle to pull the blown fuse out, invert it, and press the spare fuse into the clip.

EXTERNAL POWER RECEPTACLE. The external power receptacle (21, figure 1-2), which is used to connect the 28-volt external power supply to the electrical system, is located on the left hand side of the helicopter just aft of and below the red position light. When the external power is supplied, all electrical instruments and equipment are in an operational condition.

ELECTRICAL RECEPTACLES. Two electrical receptacles for 24-volt direct current are located on the console panel. If these receptacles are used to operate equipment, turn off all nonessential electrical equipment and check the voltammeter in order to prevent the overloading of the generator.

MISCELLANEOUS EQUIPMENT

SEATS. *(See figure 1-2.)* The pilot's and co-pilot's seats are non-adjustable and each is equipped with a standard safety belt and shoulder harness. The folding jump seat, located behind the pilot's seat, is also equipped with a safety belt and shoulder harness. The pilot's

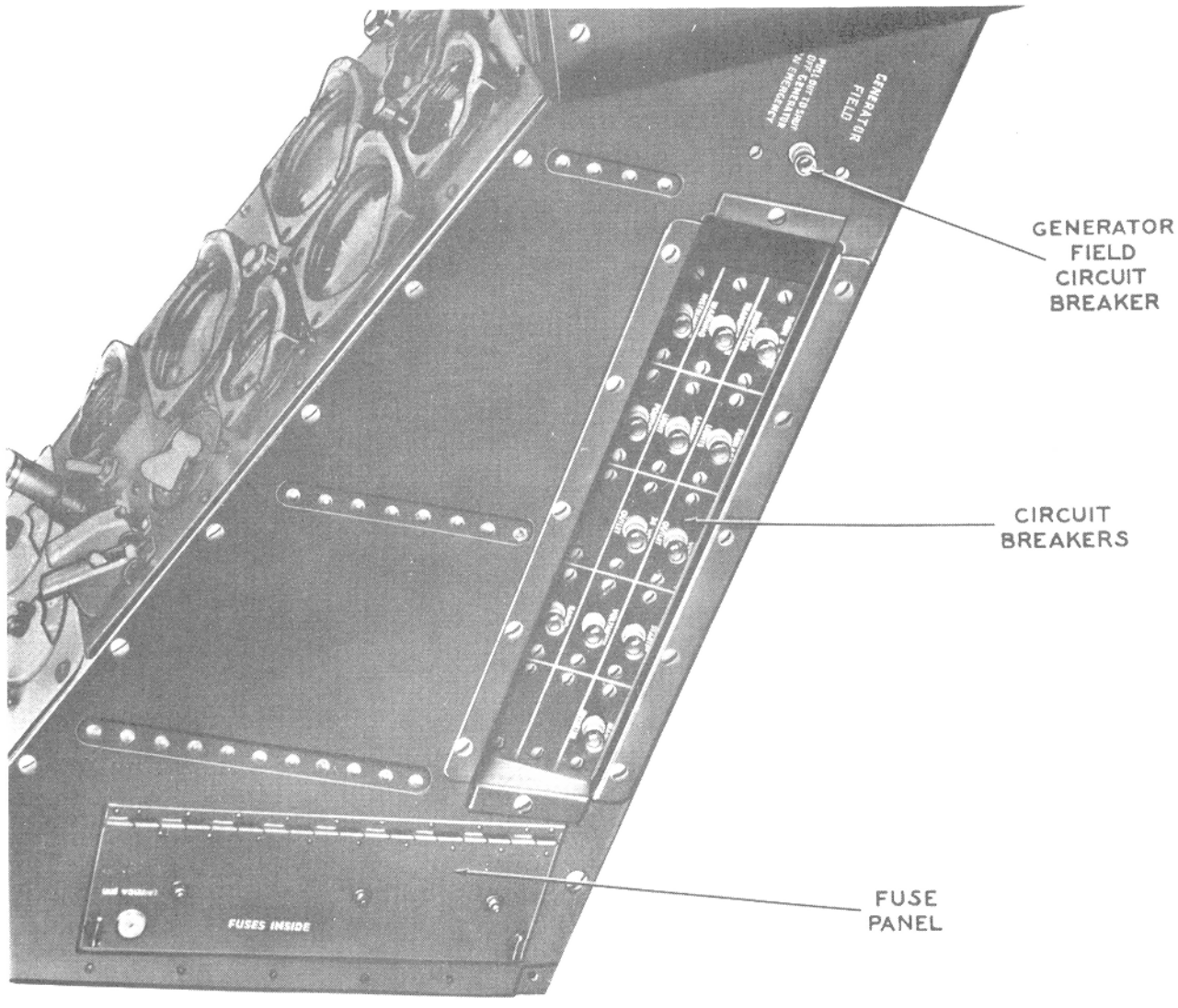


Figure 1-13. Circuit Breakers and Fuse Panel

and co-pilot's seats can be removed easily by pulling up on the spring-loaded lock pins at the rear of the seat, pushing the seat to the rear and lifting it up.

MAP CASE AND FLIGHT REPORT HOLDER. The map case and flight report holder is located on the firewall.

PILOT'S CHECK LIST. A pilot's check list is located on the face of the auxiliary panel.

FILES KIT. A files kit is located on the firewall.

CLOCK. An elapsed-time, 8-day clock (11, figure 1-9) is mounted on the console panel.

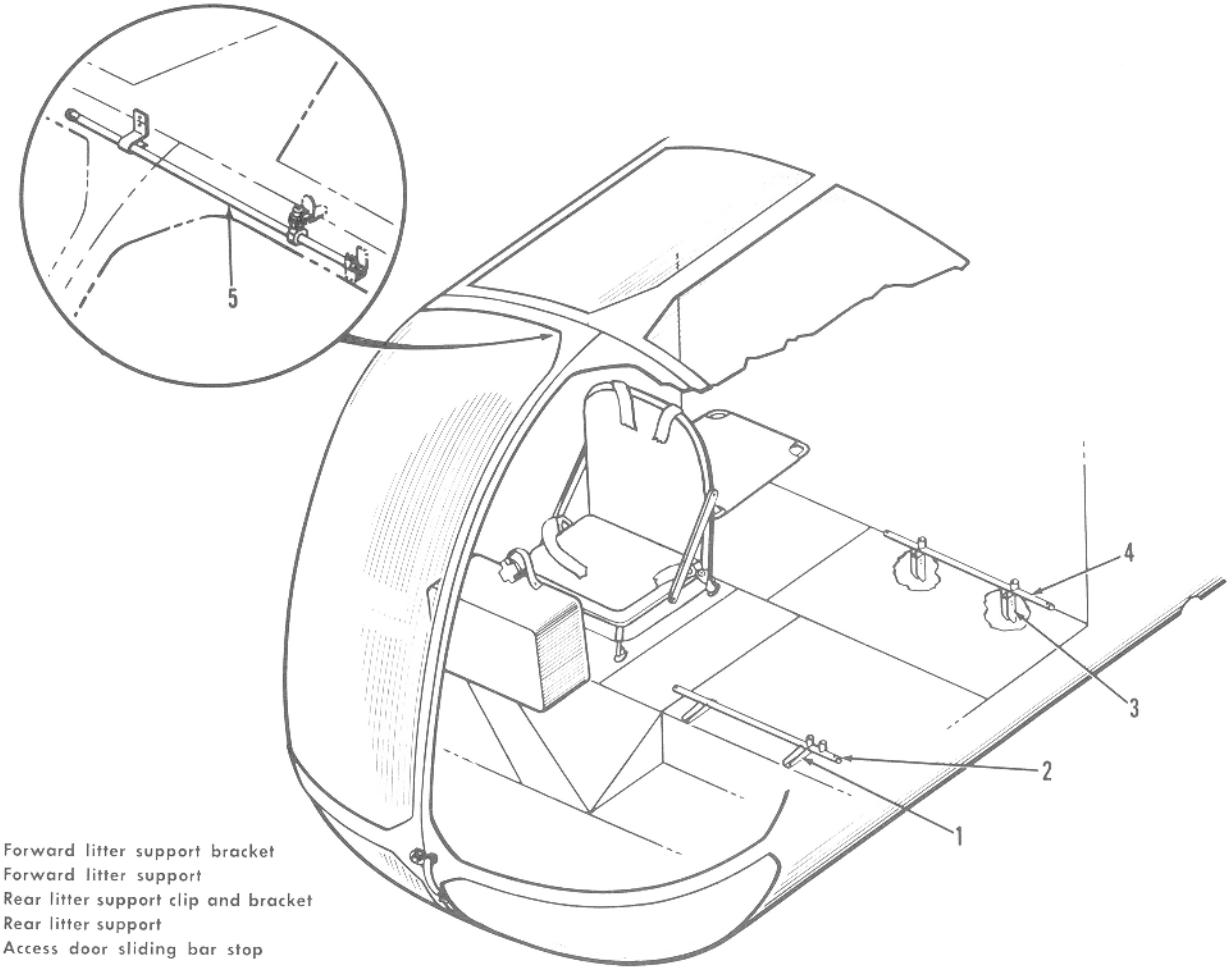
FREE AIR THERMOMETER. A bulb-type free-air thermometer is located in the top of the cabin to the right of the loop antenna.

NOSE BUBBLE ACCESS DOOR CONTROL. The nose bubble access door can be opened only from outside the helicopter and it is latched or unlatched by means of the exterior door handle part way up on the nose bubble and an internal safety latch at the top of the nose bubble. Hold-open provisions in the form of a sliding bar stop (figure 1-14) locks the access door in the open position.

LITTER INSTALLATION. In order to install the litter, the co-pilot's seat, collective stick, and cyclic stick must be removed. Litter supports (see figure 1-14) must be installed for accommodating the Stokes litter. After these installation modifications are completed, the litter may be loaded through the left-hand half of the nose bubble. After loading, disengage the sliding bar stop and close and latch the nose bubble access door, both inside and out.

OPERATIONAL EQUIPMENT

Information concerning Radio Set ARC Type 12 and the lighting system is presented in Section IV.



1. Forward litter support bracket
2. Forward litter support
3. Rear litter support clip and bracket
4. Rear litter support
5. Access door sliding bar stop

Figure 1-14. Litter Installation

SECTION 2

NORMAL OPERATING INSTRUCTIONS

BEFORE ENTERING THE PILOT'S COMPARTMENT

FLIGHT LIMITATIONS AND RESTRICTIONS

This model helicopter is restricted to normal flying and a maximum speed of 80 knots.

The maximum gross weight for operating at sea level under standard atmospheric conditions is 3000 pounds. The maximum gross weights for hovering out of ground effect under various conditions of temperature and winds are shown in Appendix 1.

Hovering operations at zero airspeed and at altitudes between 10 and 300 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. The upper and lower limits of altitude between which a safe power-off landing is difficult to perform are shown in figure 2-1. Intentional autorotation should not be entered from a speed-altitude condition represented by a point within the shaded areas of figure 2-1.

Do not hover or maneuver in such a manner that the relative cross wind exceeds 30 knots or the relative tail wind exceeds 20 knots.

The rotor operating speeds are 260 rpm maximum and 200 rpm minimum with power off. The operating speeds with power on are 240 rpm maximum and 217 rpm minimum based on engine settings of 3200 and 2900 rpm.

THESE LIMITATIONS AND RESTRICTIONS ARE SUBJECT TO CHANGE AND LATEST SERVICE DIRECTIVES AND ORDERS MUST BE CONSULTED.

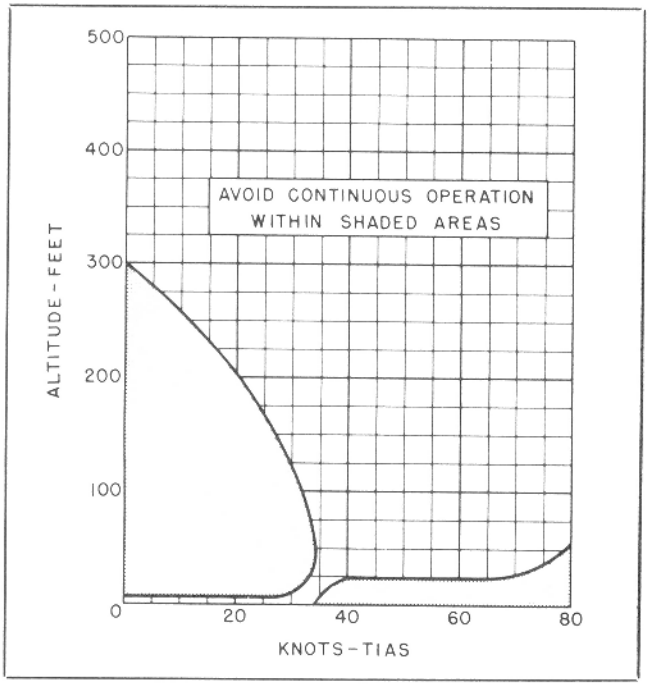


Figure 2-1. Caution Areas

TAKE-OFF GROSS WEIGHT AND BALANCE. Check the gross weight and balance for take-off and anticipated loading for landing. Loading data are furnished in the "Handbook of Weight and Balance AN 01-1B-40."

PREFLIGHT INSPECTION. Refer to figure 2-2 for servicing locations and to figure 2-3 for the inspection procedure.

ENTRANCE TO THE HELICOPTER

Access to the cabin is attained through sliding doors on each side of the fuselage, one on the pilot's side and the other on the co-pilot's side.

ON ENTERING THE PILOT'S COMPARTMENT

STANDARD CHECK FOR ALL FLIGHTS

Inspect cabin interior, and make certain that all items are secured.

Adjust foot pedals for proper length.

Adjust safety belt and shoulder harness.

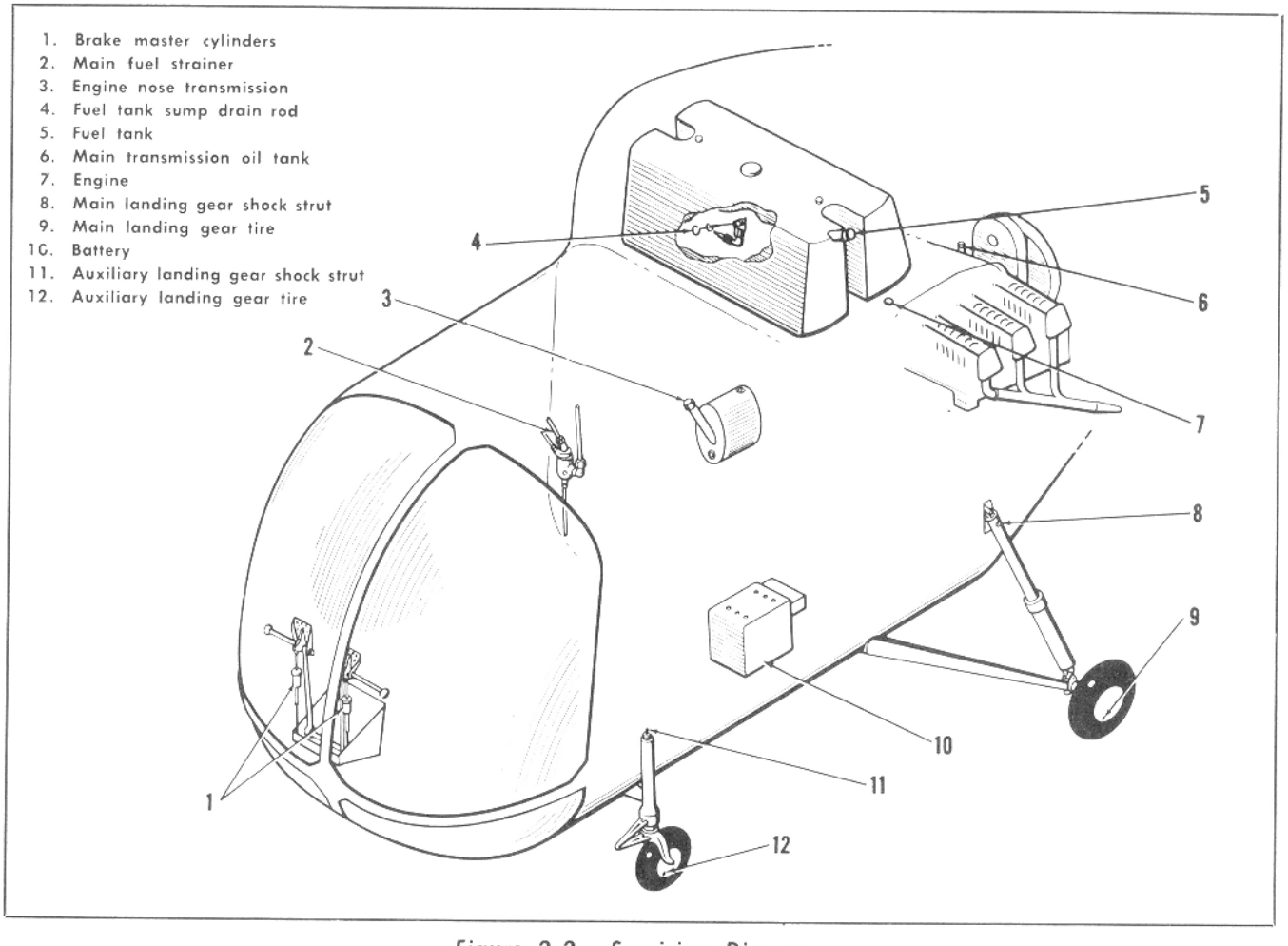
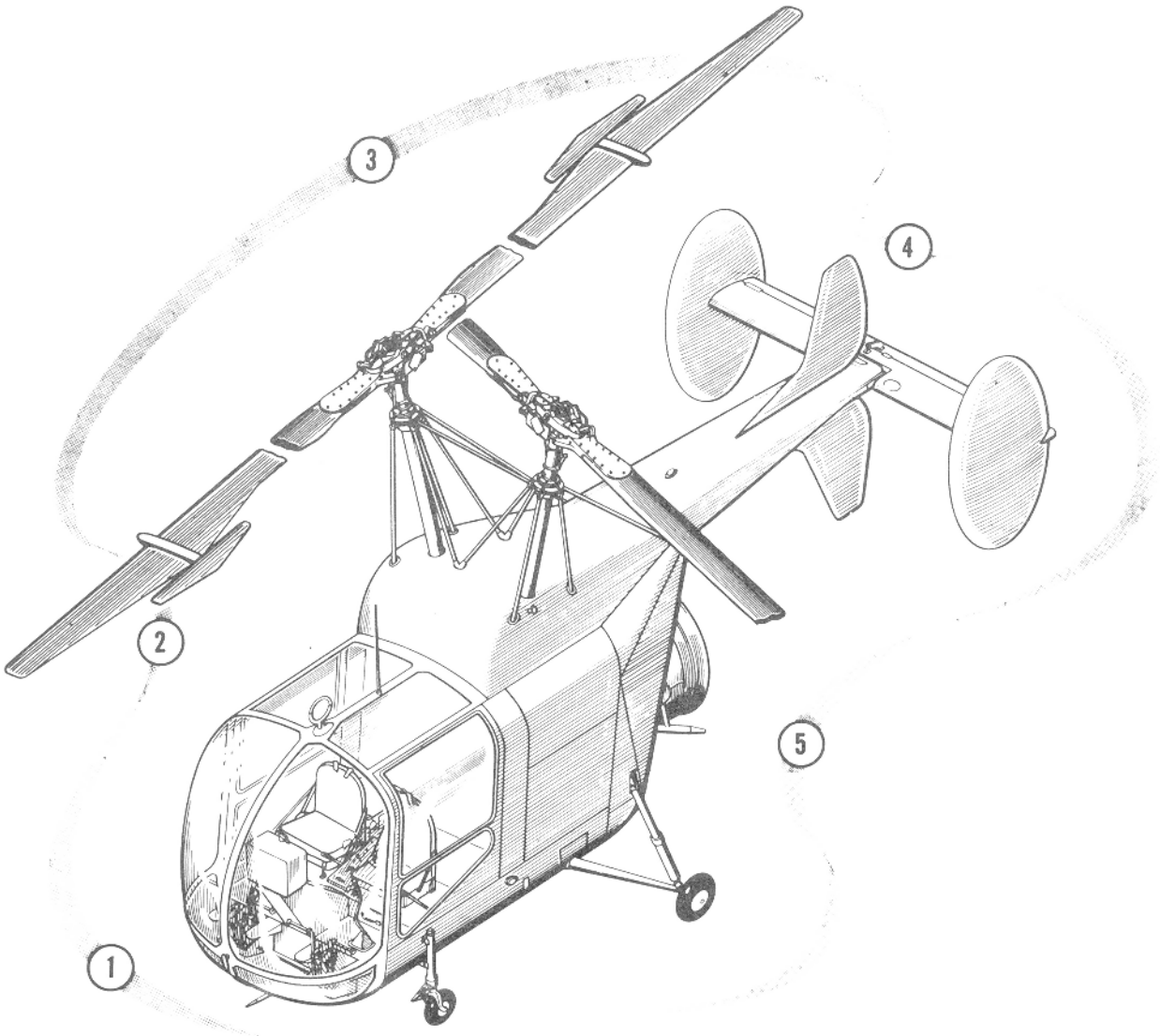


Figure 2-2. Servicing Diagram



1 NOSE

Check the auxiliary landing gear struts for proper inflation and the tires for cracks and proper inflation.
Check that pitot tube cover is removed.
Check that nose bubble access door is securely fastened.
Inspect windows for cleanliness.

2 FORWARD FUSELAGE

Check that all access doors and removable panels are securely fastened.
Inspect windows for cleanliness.
Check that all loose equipment is properly stowed and secured.
Check antenna mountings.

3 ROTORS

Check that covers and blade blocks are removed.
Inspect the rotor hubs, blades, and servo flaps for evidence of damage and security of mounting.
Inspect the rotor blade dampers and the lag stops for damage and security of mounting.

4 EMPENNAGE

Check for damage and cleanliness.
Check the attachment of the vertical surfaces to the horizontal surface.
Check stabilizer gust lock removed.

5 AFT FUSELAGE

Check the condition of the engine cooling fan blades and the exhaust stacks.
Check the main landing gear struts for proper inflation and the tires for cracks and proper inflation.
Check for brake system leaks.
Check engine and nose transmission sumps and the main transmission tank for proper servicing and security of filler caps.
Check fuel tank for proper servicing and security of filler cap.
Check that all access doors and removable panels are securely fastened.
Inspect the exterior of helicopter for evidence of oil leakage.

Figure 2-3. Exterior Inspection

Set parking brake to locked position.

Check foot pedals for freedom of movement.

Check cyclic stick for freedom of movement.

Check collective stick for freedom of movement.

Check throttle for freedom of movement.

Check that ignition switch is in the "OFF" position.

Check clock for proper time setting.

Check altimeter setting.

Check that master switch is in the "OFF" position if external power source is to be used.

WARNING

To avoid the danger of electrical fire if the poles of the external power source are accidentally reversed, the master switch should be in the "OFF" position at all times while the external power source is connected.

Have the external power source connected.

Note

Except in case of emergency, an external power supply of 28 volts should be used for pre-flight checks and for engine starting. All electrical equipment is in a functional condition when the external power source is connected.

SPECIAL CHECK FOR NIGHT FLIGHTS. In addition to the standard check for all flights, make the following checks for night flights:

Check the operation of the cabin and radio panel lights.

Check the operation of the fuselage light switch.

Check the operation of the position light switches.

Check the flight instrument rheostat through its full range from "OFF" to "BRIGHT."

Check the non-flight instrument rheostat through its full range from "OFF" to "BRIGHT."

Check the operation of the landing light extending and retracting switch and the "ON-OFF" switch.

Note

The landing light will not go on until it is slightly extended. Avoid a prolonged check in order to conserve battery.

STARTING ENGINE

If an external power source is not used, turn the master switch to "ON."

Check fuel quantity.

Set carburetor heat control lever to "COLD" position.

Check that the collective stick bungee has moved the collective stick to the full low position.

Set mixture control lever to "FULL RICH."

Set the fuel shut-off switch to "FUEL ON."

Prime engine with two or three strokes of primer plunger. Then lock plunger by pushing down on the knob and turning one-quarter turn to the right. Open and close the throttle control two or three times.

Set the throttle control to the closed position. A very small amount of throttle opening may be required for cold weather starting, but it must be kept to a minimum.

Make sure that personnel and ground objects are clear of the rotors and fan blades.

Make certain that the droop stops are up in position.

Engage the starter by means of the starter switch.

Turn the ignition switch to "L" in order to utilize the impulse magneto for starting.

After the engine starts, turn the ignition switch to "BOTH" and adjust the engine speed to between 900 and 1100 rpm with the throttle.

CAUTION

If the engine oil pressure does not register a minimum of 30 psi within 30 seconds, stop the engine and investigate.

If an external power source was used for starting, have it disconnected and place the master switch in the "ON" position. If the inverter switch is installed, place it in the "NORMAL" position.

Note

The generator is operative only when the rotors are turning.

FAILURE OF ENGINE TO START. If the engine fails to start because of over-priming, turn the ignition switch "OFF," set the mixture control to "IDLE CUT-OFF," open the throttle control, and turn the engine over several revolutions with the starter to clear the flooded condition. Repeat the starting procedure.

ENGINE FIRES. Refer to Section III for instructions on handling engine fires.

WARM-UP

Idle engine betwen 900 and 1100 rpm until the engine oil pressure reaches 30 psi, and until a rise in engine oil temperature begins to be indicated.

Increase engine rpm to 1500-1600 until the automatic clutch is fully engaged. This is apparent when the dual tachometer needles are synchronized.

CAUTION

If transmission oil pressure does not register within the green line limits (15 psi minimum) within 15 seconds after the rotors first begin to turn, stop the engine and investigate.

Adjust carburetor heat lever as necessary to maintain carburetor air temperature between 32°C (90°F) and 50°C (122°F) or –30°C (–22°F) and –2°C (28°F).

Set engine rpm at 1800 to 2000 and run until cylinder head temperature and engine and transmission oil temperatures and pressures are within limits.

Note

The droop stops do not disengage until the rotor rpm reaches 170-180 (2180-2300 engine rpm). In rough or gusty conditions, running the rotors with the droop stops engaged may cause undue roughness. Therefore, it may be necessary to increase the warm-up rpm until the stops are disengaged. Extreme caution should then be used to avoid inadvertent flight.

GROUND TEST

Check that the fuel and oil pressures are within range at 1800 to 2000 rpm.

Check all instruments for desired range.

With a cylinder head temperature reading of at least 100°C (212°F), check the magnetos at 2500 rpm. The drop on either "L" or "R" position should not exceed 125 rpm and there should be no engine roughness on either magneto.

Check generator output.

Check that droop stops are disengaged at 2500 rpm.

With collective stick in full low pitch position and engine rpm at 3000, check the cyclic stick for correct response at the rotors, using only slight stick movement. Check the foot pedals for correct response at the rotors by moving the left and right pedals slightly.

Check operation of free-wheeling unit by retarding throttle quickly. Tachometer indicator needles should separate considerably when the rpm drops below 1800 rpm, with the drop-off occurring in the engine rpm needle.

TAXIING INSTRUCTIONS

Release parking brake.

Taxi at 2900 to 3200 rpm by applying throttle and slightly increasing the collective pitch to obtain approximately 17 inches manifold pressure.

Move the cyclic stick forward to obtain forward motion.

Govern ground speed by the fore and aft movement of the cyclic stick. Do not close the throttle in an effort to stop.

Maintain directional control by use of the foot pedals and lateral cyclic stick, using the brakes to assist in slow sharp turns.

Note

Keep taxi speed under 10 knots ground speed at all times.

When taxiing cross wind, hold the cyclic stick into the wind. The amount of stick displacement will vary with the velocity of the cross wind.

CAUTION

While it is possible for this helicopter to taxi rearward, this maneuver requires a thorough understanding of the helicopter because of the methods employed for swiveling the auxiliary landing gear wheels, and for avoiding problems incident to sudden stoppage of the main landing gear in rough and soft ground. It is recommended that this maneuver be avoided until the pilot is thoroughly acquainted with the helicopter's flight characteristics.

BEFORE TAKE-OFF

The check to be made before take-off is similar to the ground check in this section. Perform the before take-off check by referring to the cockpit check list.

TAKE-OFF

Refer to figure A-3, "Take-Off Chart."

This helicopter is normally flown in accordance with accepted helicopter practice. However, due to the

CHECK LIST	
BEFORE TAKEOFF	BEFORE LANDING
1. MIXTURE-"FULL RICH"	1. MIXTURE-"FULL RICH"
2. CARB. HEAT-"COLD"	2. CHECK CARB. HEAT
3. FUEL SWITCH-"ON"	3. CHECK PARKING BRAKE SETTING
4. IGN. SWITCH-"BOTH"	4. CHECK TRIM CONTROLS
5. CHECK TRIM CONTROLS	
6. CHECK PARKING BRAKE SETTING	
7. PRIMER DOWN & LOCKED	
8. CHECK ALL CONTROLS FOR FREEDOM OF MOVEMENT	
9. CHECK FREE WHEELING UNIT	

Figure 2-4. Pilot's Check-Off List

equalization of torque between the two rotors, rudder control is required only for minor correction of heading. Due to the availability of toe brakes, the aircraft may be held for shipboard operation or for operation from rough or rolling terrain without having to set the parking brakes. The longitudinal and lateral trim controls may be adjusted to neutralize the cyclic stick pressures for varying conditions of flight.

Refer to Section III for the procedure to be followed if engine failure should occur during take-off.

RUNNING TAKE-OFF

As a training maneuver, running take-offs may be made at sea level under simulated overload conditions.

Fly the helicopter into the wind at about 35 knots level flight at a safe altitude and note the manifold pressure reading and engine rpm. Set the helicopter down and proceed as follows:

Note

In order not to defeat the purpose of the simulated conditions during take-off, do not exceed a manifold pressure reading of approximately 1 to 2 inches Hg higher than that required for 35 knots level flight.

The take-off must be made into the wind using 1 or 2 inches Hg above that required at 35 knots level flight and a collective pitch setting to obtain the predetermined rpm. Apply forward cyclic as required, maintaining heading until best climb speed (34 knots) is reached or until helicopter is airborne. If the helicopter becomes airborne prior to reaching a speed of 34 knots, assume level flight till that speed is attained.

Maintain power and continue climb at this speed to a safe altitude.

Note

There are various procedures within standard practice for running take-offs which may be utilized, depending upon the particular conditions. Therefore, the procedure given above should not be construed as restrictive to this helicopter.

CLIMB

Refer to figure A-5, "Climb Chart."

Refer to figure 2-1, "Caution Areas," which indicates the safe operating altitudes versus airspeeds.

A climb in this helicopter is performed in accordance with accepted helicopter practice. It is recommended that 3200 engine rpm be maintained at all times during the climb.

DURING FLIGHT

FLIGHT OPERATION. Refer to figure A-4, "Hovering Data," and figures A-7 and A-8, "Flight Operation Instruction Charts."

FLIGHT CHARACTERISTICS

Because this helicopter utilizes intermeshing counter-rotating rotors, torque is equalized, thus eliminating much of the pilot's co-ordination usually associated with changes in power. Torque is unbalanced between the two rotors only for purposes of changing directional heading by use of the foot pedals. Cyclic stick pressure is greatly reduced by the use of servo flaps, and for this reason artificial feel is introduced into the stick to provide some stick pressure. This artificial feel can be adjusted to suit the pilot by utilization of the trim controls (figure 1-10).

The use of counter-rotating rotors permits a greater angle of rearward flare due to the relatively short tail structure. The lack of a rotating control surface at the tail eliminates the danger attendant upon striking a surface on the ground or having it come in contact with ground obstacles. Should the fins of the helicopter contact the ground or other objects in a flare or during other maneuvers, the possibility of losing control of the helicopter is extremely remote.

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

MIXTURE CONTROL SETTINGS. The mixture control is usually kept in the "FULL RICH" position during all flight below 5000 feet altitude. Above 5000 feet altitude, move the mixture control slowly towards "LEAN" until engine runs smoothly.

CARBURETOR ICING. The engine with which this helicopter is powered is not abnormally subject to formation of carburetor ice. However, when the aircraft is being flown in potential icing conditions during certain flight operations when carburetor icing is a potential

hazard, or during all operations under severe icing conditions, carburetor heat should be adjusted to keep the indicated carburetor mixture temperature below or slightly above the yellow "CAUTION" range.

TRIM CONTROL SETTINGS. The trim controls will adjust the cyclic stick to neutral pressure positions laterally and longitudinally during flight.

TRANSMISSION OIL WARNING LIGHT. If the transmission oil warning light is on, land the helicopter as quickly as possible. If at high altitudes, autorotate in order to reduce the load on the transmission, but maintain engine rpm at approximately 2500 in order to keep the cooling fan turning at a high rate, thereby keeping the transmission oil cooler temperature at a minimum. The warning light will go on if transmission oil level is low or if pressure is lost.

STALLS

This helicopter will not stall at slow speeds. 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.

SPINS

Spins should not be attempted in this helicopter.

ZERO AIRSPEED SETTLING

As is true in other helicopters, it is possible with this helicopter to settle vertically into the downwash of the rotors, with resultant extreme roughness and reduction of control. Therefore 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.

PERMISSIBLE ACROBATICS

Acrobatics are prohibited.

DIVING

Diving speed is limited to an IAS of 80 knots.

NIGHT FLIGHT

The helicopter is completely equipped for night flights. The brilliancy of the rim type instrument lights is controlled by means of rheostats. To enable the pilot to observe and correct for drift and to stay clear of ground obstacles, night landings should be made in lighted areas or by the use of the landing light.

APPROACH

Set mixture control to "FULL RICH."

Apply carburetor heat if necessary to keep the indicator out of the yellow area, during partial power or autorotative glide.

Immediately before establishing hovering for a landing, move carburetor heat lever to full "COLD" position.

Approach with this helicopter conforms to accepted helicopter practice.

LANDING

NORMAL LANDING. Refer to figure A-6, "Landing Chart." Landing is made in accordance with accepted helicopter practice, but, because of the equalization of torque between the two rotors, excessive corrective foot pedal action is not required upon normal contact with the ground. Use of the toe brakes is recommended to avoid subsequent ground motion on shipboard or rough or rolling terrain.

CROSS WIND LANDINGS. Avoid side drift by holding the cyclic stick into the wind when landing from a hovering position in a cross wind.

RUNNING LANDING. As a training maneuver, running landings may be made under simulated overload conditions, using a predetermined manifold pressure limit as outlined under "RUNNING TAKE-OFF."

Make a power-on landing approach into the wind at 50 knots. Apply cyclic stick as required to slow helicopter to 34 knots (best climb speed in the event of a required go-around) at about 10 feet. Upon ground contact, lower collective stick and bring the helicopter to a stop by applying rearward cyclic stick and brakes.

Note

The procedure given above is one of several which may be utilized for making running landings within standard practice. Therefore, the procedure given should not be construed as restrictive to this helicopter.

EMERGENCY LANDING. Refer to Section IV for the procedure to be followed when making landings after power failure.

GO-AROUND. Apply full power while maintaining rpm and acquire forward speed and altitude.

STOPPING OF ENGINE

Reduce engine speed to 1700 rpm until cylinder head temperature drops to 150°C (302°F).

When engine has cooled sufficiently, idle down to 1000 rpm. Check that droop stops on both rotors are "in."

Set mixture control to "IDLE CUT-OFF."

After the engine has stopped, turn ignition switch "OFF."

Turn master switch "OFF."

Close throttle.

BEFORE LEAVING HELICOPTER

Turn fuel shut-off switch "FUEL OFF."

Turn all electrical switches "OFF."

Check that throttle is closed.

Set parking brake to the locked position.

Stay in helicopter until rotors have stopped.

SECTION 3

EMERGENCY OPERATING INSTRUCTIONS

FIRE

ENGINE FIRE ON STARTING

Leave ignition switch set to "BOTH."

Keep starter engaged.

Open the throttle slightly.

If the fire is not drawn into the engine, move the mixture control to "IDLE CUT-OFF," turn the fuel shut-off switch to "FUEL OFF," and turn the ignition switch "OFF."

Extinguish the fire.

ENGINE FIRE DURING FLIGHT

Make an emergency landing as quickly as possible.

Move the mixture control to "IDLE CUT-OFF" position.

Turn the fuel shut-off switch to "FUEL OFF."

Turn the ignition switch "OFF."

Extinguish the fire.

ELECTRICAL FIRE ON THE GROUND

Disconnect the external power source.

Turn the master switch "OFF."

Extinguish the fire.

ELECTRICAL FIRE DURING FLIGHT

Land as quickly as possible.

If a landing cannot be made, proceed as follows:

Turn off all electrical equipment that is not required for flight.

Extinguish the fire.

Open the cabin doors slightly to disperse the fumes.

Keep all nonessential electrical equipment turned off.

CABIN FIRE

Land as soon as possible and extinguish the fire.

Open the cabin doors slightly to disperse the fumes.

ENGINE FAILURE

DURING TAKE-OFF. Should the engine fail during take-off or when the helicopter is hovering at an altitude of less than 10 feet, the resultant landing may be cushioned by moving the collective stick toward the full up position as required in order to utilize the inertia in the rotor system. Due to the equalization of torque between the two rotors, there will be no excessive yawing introduced by sudden engine stoppage.

BETWEEN 10 AND 300 FEET ALTITUDE. The actions of the pilot in case of engine failure between 10 and 300 feet altitude will depend upon many variable factors, including airspeed and the helicopter's heading relative to the direction of the wind. This helicopter should be flown in accordance with standard accepted procedures in this regard. The collective pitch should not be increased until the helicopter is less than 15 feet

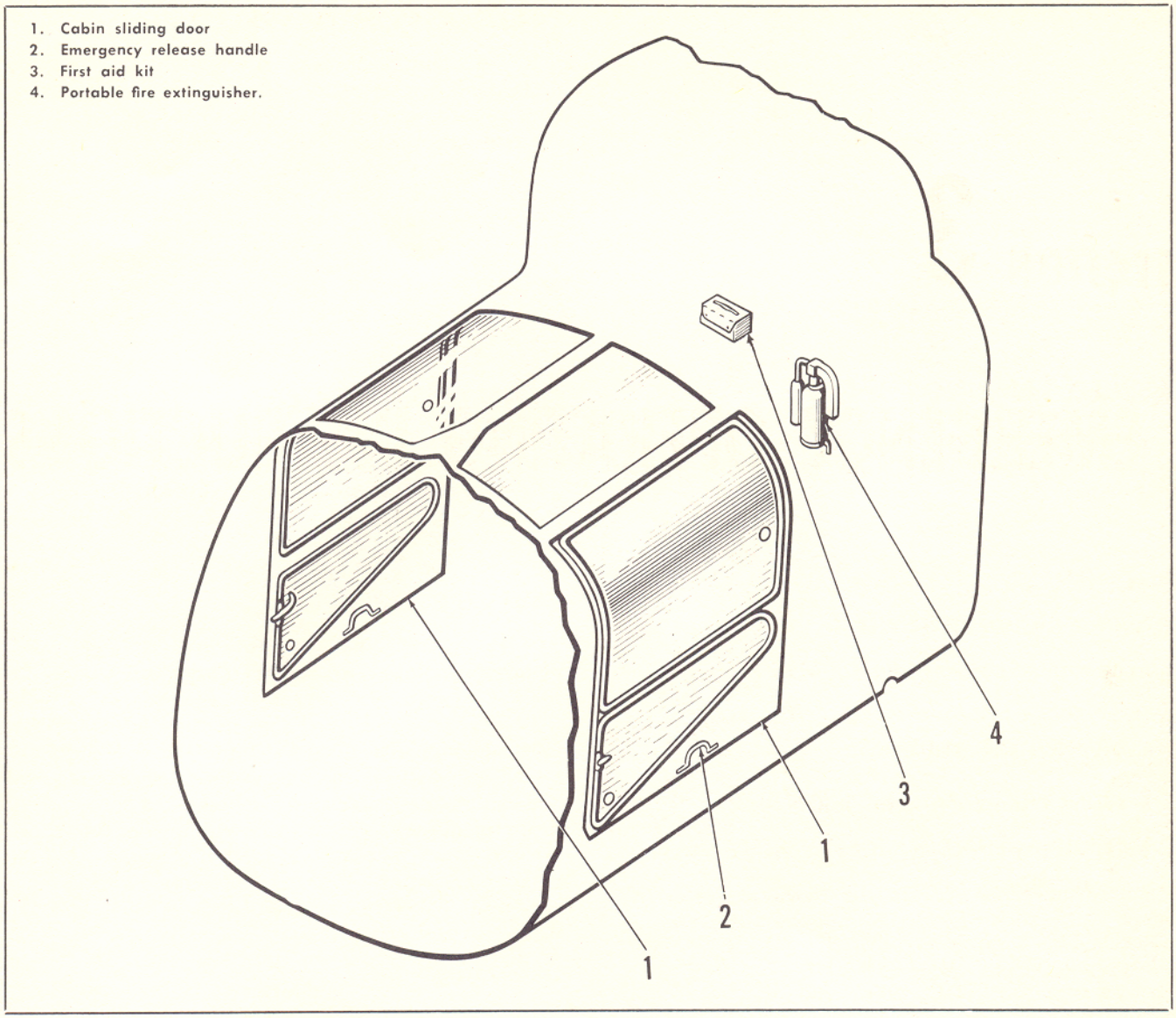


Figure 3-1. Emergency Equipment and Exits

above the ground. Due to the high angle of flare that can be made with this helicopter, some rearward inclination of the craft may be maintained even up to the point of contact with the ground.

ABOVE 300 FEET ALTITUDE

Decrease collective pitch to full low, collective stick down, and adjust the cyclic stick to obtain forward flight along a glide path at an indicated air speed of 45 knots.

Turn the fuel shut-off switch to "FUEL OFF."

Turn ignition switch "OFF."

Flare out at approximately 10 to 15 feet above the ground by moving the cyclic stick aft. This will slow the helicopter to zero or nearly zero ground speed.

When 3 to 4 feet above the ground, gradually apply collective pitch to cushion the landing.

BAIL OUT

If possible, set the controls for forward flight.

Open the cabin sliding doors. Although this helicopter is provided with means for jettisoning the cabin sliding doors by pulling the emergency release handle (2, figure 3-1) and pushing outward on the lower section of the doors, most circumstances will not require this procedure.

CAUTION

In order to avoid the possibility of the doors flying into the rotor system, especially in vertical autorotation, do not jettison the cabin doors in flight.

Unfasten safety belt, automatically releasing the shoulder harness.

Dive out as far as possible to clear the helicopter.

FORCED LANDINGS

The procedures to be followed for forced landings are outlined in the paragraphs in this section covering engine failure.

DITCHING

DITCHING WITHOUT POWER

Autorotate at 45 knots into the wind.

Open cabin doors, or jettison them if necessary.

Unbuckle parachute.

Flare the helicopter to zero ground speed.

Apply collective pitch in order to cushion the landing.

Immediately upon contact with the water, apply full lateral cyclic stick in order to roll the aircraft on its side and cause the rotor blades to strike the water. This will stop the blades rotating.

Unfasten the safety belt which automatically releases the shoulder harness.

Climb out and immediately clear the helicopter.

DITCHING WITH POWER

Descend close to the water.

Unbuckle the parachute.

Open the cabin doors, or jettison them if necessary.

Make a normal landing by hovering slightly above the water and settling vertically into it. Follow the procedure outlined above for ditching without power.

TRANSMISSION OIL PRESSURE

If the transmission oil warning light is on during flight, land the helicopter as quickly as possible. If at high altitude, autorotate in order to reduce the load on the transmission, but maintain engine rpm at approximately 2500 in order to keep the cooling fan turning at a high rate, thereby keeping the transmission oil cooler temperature at a minimum.

If rotor rpm begins to drop, and if application of power fails to keep it turning, bail out. For the greatest rate of descent from altitude in case of emergency, autorotate at zero air speed.

GENERATOR FAILURE

If generator failure occurs, pull out on the generator field circuit breaker, mounted on the right-hand side of the console. Locate and turn off all non-essential electrical equipment in order to minimize the drain on the battery.

INVERTER FAILURE

With the single inverter installation the only evidence of inverter failure is a constant fuel quantity reading on the fuel quantity indicator during operation.

If the fuel quantity reading remains constant when checked at regular intervals, press the fuel gage test switch (12, figure 1-10) on the auxiliary control panel and observe the fuel quantity indicator. If the indicator drops off toward the zero mark and remains there after the test switch button is released, it is evident that the inverter has failed. If the indicator returns to its original position after the test switch button is released, the inverter is still operative.

Note

In the event that inverter failure has been ascertained, bear in mind that the fuel quantity shown on the indicator prior to depressing the test switch button, indicated the fuel quantity at the time of inverter failure.

MISCELLANEOUS EMERGENCY EQUIPMENT

FIRE EXTINGUISHER. A hand-type portable carbon dioxide fire extinguisher (4, figure 3-1) is mounted on the left side of the firewall behind the co-pilot.

FIRST AID KIT. The first aid kit (3, figure 3-1) is mounted to the right of the fire extinguisher.

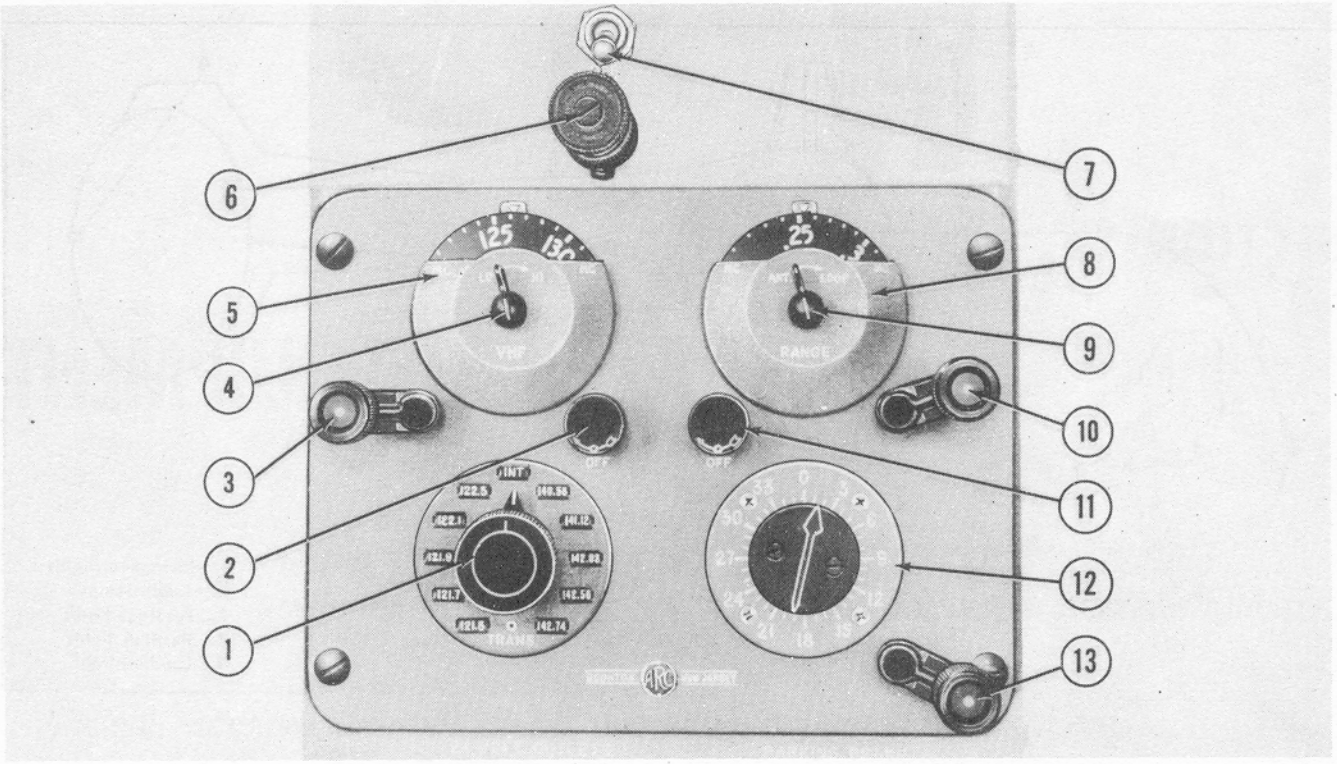
SECTION 4

OPERATIONAL EQUIPMENT

COMMUNICATION EQUIPMENT

TABLE OF COMMUNICATION EQUIPMENT, RADIO SET ARC TYPE 12

Type	Designation	Use	Range	Primary Operator	Illustration	Remarks
VHF Transmitter	ARC Type T-11A	Voice Transmitter	30 miles at 3000 ft alt 60 miles at 6000 ft alt	Pilot and Co-pilot	Figure 1-2	116-132 mc
VHF Transmitter	ARC Type T-13	Voice Transmitter	30 miles at 3000 ft alt 60 miles at 6000 ft alt	Pilot and Co-pilot	Figure 1-2	132-148 mc
VHF Receiver	ARC Type R-19	Voice Receiver	30 miles at 3000 ft alt 60 miles at 6000 ft alt	Pilot and Co-pilot	Figure 1-2	118-148 mc
Range Receiver	ARC Type R-11A	Low Frequency Range Receiver	200 miles	Pilot and Co-pilot	Figure 1-2	190-550 kc
Control Unit	ARC Type C-39	Controls ARC Type 12 Equipment		Pilot and Co-pilot	Figure 4-1	
Junction Box	ARC Type J-13	Interconnects ARC Type 12 Equipment			Figure 1-2	



1. Transmitter selector switch
2. VHF "OFF" control
3. VHF tuning crank
4. "LO-HI" switch
5. VHF control unit
6. Panel light
7. Panel light switch
8. Range control unit
9. "ANT.-LOOP" switch
10. Range tuning crank
11. Range "OFF" switch
12. Loop azimuth indicator dial
13. Loop tuning crank

Figure 4-1. Type C-39 Radio Control Unit

UPON ENTRANCE TO THE CABIN

Connect the pilot's headset and microphone to the jack box plug located on the vertical bulkhead just below the pilot's knees.

Connect the co-pilot's headset and microphone to the jack box plug (23, figure 1-2) located on the vertical bulkhead just below the co-pilot's knees.

Check that the cables and mechanical linkage are securely and properly connected and that all locking rings are hand tight.

Check that the tuning cranks and "TRANS" selector switch on the control unit (figure 4-1) turn easily and without binding at any point.

Turn master switch on.

Turn the "OFF" controls of control unit on. Feel the dynamotors and check that they are running.

Turn the "OFF" control of the control units "OFF."

Turn the master switch "OFF."

OPERATION OF VHF RECEIVER ARC TYPE R-19

Check that the master switch is turned "ON."

Turn the "OFF" control on the left side of the C-39 control unit (figure 4-1) clockwise.

Allow the receiver to warm up for two or three minutes.

Rotate the "OFF" control clockwise to maximum tolerable noise.

Set the "LO-HI" switch on the control unit to "LO."

Note

Ordinarily the "LO" position will provide a sufficiently strong signal. For outputs which cannot be increased through the use of the sensitivity control, use the "HI" position.

Turn the VHF tuning crank to tune in the desired station and reduce the sensitivity by means of the "OFF" control so that the signal is weak.

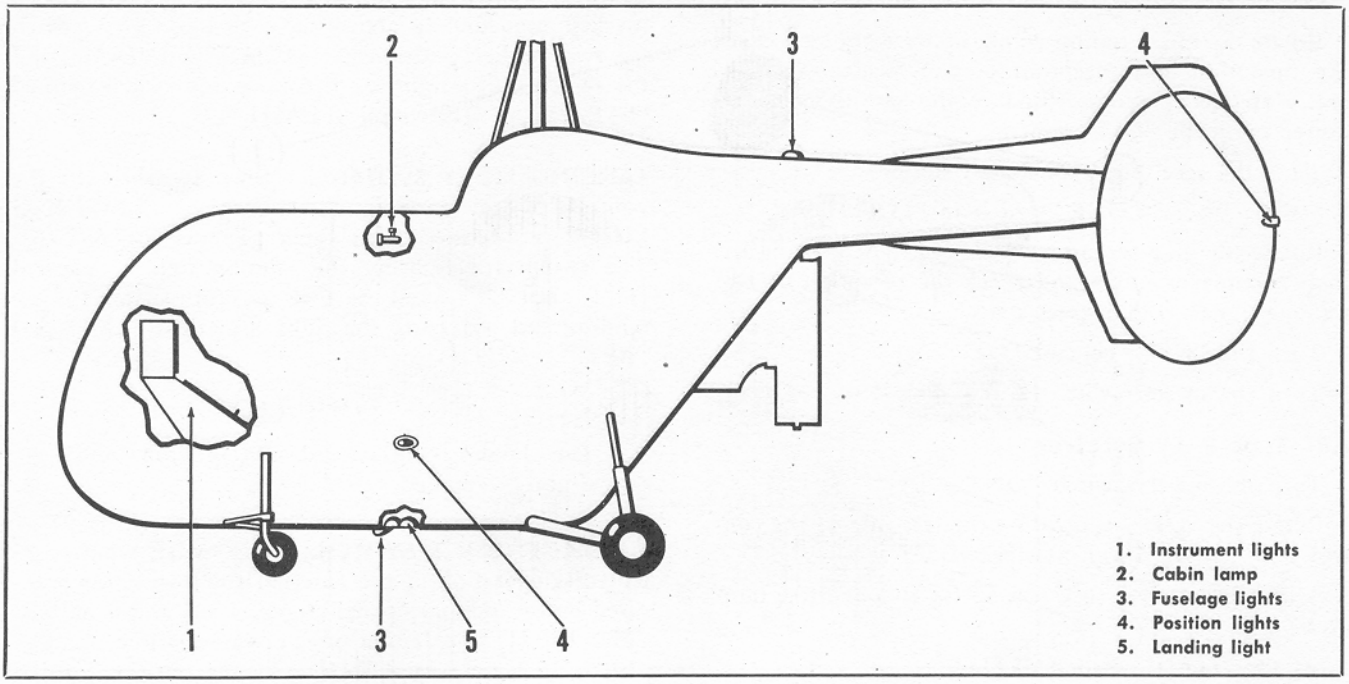


Figure 4-2. Lighting System

When the signal is accurately tuned in, increase the sensitivity to maximum.

OPERATION OF LF RANGE RECEIVER ARC TYPE R-11A

Check that the master switch is "ON."

Rotate the "OFF" control on the right side of the control unit (figure 4-1) to its full clockwise position.

Allow the equipment to warm up for two or three minutes.

Set the "ANT.-LOOP" switch of the "RANGE" control to "LOOP."

Rotate the loop tuning crank which rotates the L-10 loop antenna, and tune the receiver to the desired tower or range frequency.

Turn the loop tuning crank, lower right, on the control box and adjust the sensitivity for the sharpest minimum signal.

Read the bearing from the loop azimuth indicator dial. This is the bearing from the heading of the helicopter.

SIMULTANEOUS OPERATION OF RECEIVERS. The helicopter is equipped with two receivers: the VHF receiver and the range receiver. Both the pilot and co-pilot have the control of these receivers by the use of the tuning cranks and switches on the control unit. The two receivers may be operated simultaneously but both the pilot and co-pilot will hear both signals.

TRANSMISSION

THESE INSTRUCTIONS ARE SUBJECT TO LOCAL LIMITATIONS REGARDING RADIO SILENCE.

Check that the master switch is "ON."

Rotate the "OFF" control on the left side of the control unit (figure 4-1) clockwise.

If the R-11A receiver is to be used for reply reception, turn the "OFF" control on the right side of the control unit clockwise. Otherwise do not touch this control.

Tune the receiver on which a reply is expected to the desired frequency.

Set the "TRANS" switch to the desired channel.

Press the microphone button on the cyclic stick, listen for sidetone, and check the operation of the T-11A or T-13 transmitter by calling the selected station.

State the frequency upon which reply is awaited.

Release the microphone button as soon as transmission is completed.

BEFORE TAKE-OFF RADIO CHECK LIST

ARC Type R-11A Receiver

Turn the master switch "ON."

Rotate the "OFF" control, top right on the control unit (figure 4-1) full clockwise.

Allow the equipment to warm up for two or three minutes.

Set the "ANT.-LOOP" switch to "ANT."

Rotate the range tuning crank, upper right, and check the operation and reception of the receiver over its entire frequency range. Reduce the sensitivity as required, with the "OFF" control.

Tune the receiver to a selected station.

Set the "ANT.-LOOP" switch to "LOOP."

Rotate the loop tuning crank, lower right, causing the loop antenna to rotate and check the reception of two minima signals, 180 degrees apart.

Turn the "OFF" control "OFF."

Turn the master switch "OFF."

ARC Type R-19 Receiver

Turn the master switch "ON."

Rotate the "OFF" control on the left side of the control unit (figure 4-1) full clockwise.

Allow the receiver to warm up for two or three minutes.

Set the "LO-HI" switch to "LO."

Rotate VHF tuning crank and check the reception and operation of the receiver over its entire range.

With the "LO-HI" switch in "HI" position, check the operation and reception of the receiver, reducing the sensitivity as required, with the "OFF" control.

Turn the "OFF" control "OFF."

Turn the master switch "OFF."

ARC Types T-11A and T-13 Transmitters. The before take-off radio check list for the transmitters is the same as the operating procedures for this equipment. Refer to the paragraph in this section that covers their operation.

AFTER-LANDING RADIO CHECK LIST

Check that both "OFF" controls on the control unit (figure 4-1) are "OFF."

Check that master switch is "OFF."

LIGHTING EQUIPMENT

POSITION LIGHT SWITCHES. Two switches for the operation of the position lights are located on the auxiliary panel (figure 1-10) and "POS LIGHTS" is marked immediately above the switches. One switch has two marked positions, "BRIGHT" and "DIM," and the switch on its right is a three-position switch marked "STEADY," "OFF," and "FLASH."

LANDING LIGHT SWITCHES. Two switches for the control of the landing light, marked "LANDING LIGHT" are located in the auxiliary panel (figure 1-10). The switch for lighting the landing light is marked "ON" and "OFF" and the three-position switch for extending and retracting the light is marked "EXT" and "RET."

Note

The landing light will not go on until slightly extended.

FUSELAGE LIGHTS SWITCH. This switch which controls the operation of the external fuselage lights is located on the auxiliary panel (figure 1-10) and is marked "FUS LIGHTS." It is a three-position switch, marked "BRIGHT" and "DIM." The center position of the switch is the "OFF" position.

INSTRUMENT LIGHTS. Two rheostats are located on the auxiliary panel for the operation and control of the instrument lights. The light intensity can be regulated by rotating the rheostat between the two positions "OFF" and "BRT." One rheostat marked "FLT INST" is for the instrument panel and the second marked "NON FLT INST" is for the console panel.

PANEL LIGHT. A panel light (3, figure 1-9) is provided on the console panel to illuminate the face of the radio control unit. The light is controlled by an on-off switch (4, figure 1-9).

CABIN LAMP. *(See figure 4-2.)* The cabin lamp is connected to a coil-type cord which is clipped in position on the cockpit ceiling centerline behind the pilot and co-pilot. The lamp housing is equipped with a rheostat for brilliancy control and a push button which provides instantaneous full-intensity lighting. The lamp can be focused to provide either spot or flood lighting. A built-in filter in the cap provides red light when the cap is on and white light when the cap is removed.

SECTION 5

EXTREME WEATHER OPERATION

COLD WEATHER OPERATION

Care must be taken while operating in extreme cold weather as the helicopter is not equipped with rotor blade de-icing equipment, windshield defogging equipment, or a cabin heating system. In addition the pitot tube heating element is not connected and is inoperative. The normal operating procedures outlined in Section II should be adhered to during cold weather operation, with the following exceptions.

BEFORE ENTERING THE HELICOPTER

Remove all covers.

Drain moisture from the fuel system drains.

Check transmission oil tank sump drain.

Inspect fuel tank, oil tank, and oil sump vents and the engine breather for ice stoppages.

Clean dirt and ice from landing gear shock struts; check for proper inflation.

WARNING

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

Carefully inspect all openings in the helicopter for the accumulation of snow.

Use a ground heater to preheat the engine, transmissions, and cabin.

Connect the external power source.

STARTING ENGINE

Use the normal starting procedure outlined in Section II.

Apply carburetor heat if necessary, after the engine is running.

WARM-UP

Follow the procedures outlined in Section II.

If engine and transmission oil temperatures do not register within a reasonable time after desirable pressures are reached, hover the helicopter at a height of 2 to 5 feet until temperatures begin to rise.

BEFORE TAKE-OFF

Follow the procedures outlined in Section II.

TAKE-OFF

Follow the procedures outlined in Section II.

DURING FLIGHT

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

APPROACH AND LANDING

Follow the procedures outlined in Section II.

STOPPING ENGINE

Follow the procedures outlined in Section II.

BEFORE LEAVING HELICOPTER

Release the brakes to avoid freezing.

Install the protective covers.

Clean dirt and ice from the shock struts.

Inspect fuel and oil tank vents and breather and remove ice.

Drain oil sumps and fuel sump and strainer of condensate approximately 30 minutes after stopping the engine.

Remove the battery if the temperature is below −29°C (−20°F) and the helicopter is to be idle for more than four hours.

Slightly open the cabin doors to prevent the cracking of the transparent areas due to differential contraction. Air circulation will also retard the formation of frost.

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.

The helicopter is equipped with a filter for the carburetor air which is 90 per cent efficient. When operating under extreme sandy conditions, it is necessary to frequently check and clean the carburetor air filter and reduce the time between oil changes and engine top overhaul.

APPENDIX 1

OPERATING CHARTS

FLIGHT OPERATION INSTRUCTION CHARTS

The charts on the following pages are provided to aid in selecting the proper power settings and altitude for obtaining the optimum performance of the helicopter under various given flight conditions. All fuel quantities in the charts are given in pounds.

POWER PLANT CHART

The power plant chart (figure A-2) provides information concerning the amount of fuel consumed at various altitudes during normal and maximum continuous power operations.

TAKE-OFF CHART

The take-off chart (figure A-3) shows the take-off ground roll and 50-foot obstacle clearance distances vs. pressure altitude and temperatures for various gross weights. The take-off conditions are based on firm, dry sod runways.

HOVERING DATA

The hovering data in figure A-4 show the maximum permissible gross weight of the helicopter for hovering with maximum power outside of ground effect for various conditions, such as altitude, head winds, specific humidity, and temperatures. A nomogram is included in the data for determining the specific humidity from wet and dry bulb temperatures.

CLIMB CHART

The climb data in figure A-5 provide information on the best rate of climb, indicated airspeed, and fuel consumed during climbing operations at various temperatures. The data are based on the best climb speeds in forward flight. A fuel allowance for warm-up and take-off is listed in the data supplied for sea level. Fuel requirements at other altitudes include this allowance plus the fuel required to climb from sea level. The time for climb does not include the time for warm-up and take-off.

LANDING CHART

The landing chart (figure A-6) provides data showing the best approach airspeeds for power-on landings vs. ground roll and 50-foot obstacle clearance distances for various gross weights, pressure altitudes, and temperatures. These data are based on the use of a firm, dry sod runway.

FLIGHT OPERATION INSTRUCTION CHARTS

The flight operation instruction charts (figures A-7 and A-8) are provided to facilitate flight planning. The charts show the range in miles and the endurance in hours of the helicopter at various gross weights, altitudes, and airspeeds, and the procedures required to obtain these results. In these charts five columns are provided for the tabulation of operating data. Columns I through III contain data for range planning and columns

A and B contain data for endurance. Columns I, II, and III provide the power setting required at various altitudes and each column shows a progressive increase in range with a corresponding sacrifice of speed. Column A provides power setting data for hovering (minimum airspeed) at various altitudes and column B provides power setting data for maximum endurance flight. The charted ranges do not include the fuel consumed during warm-up, take-off, and climb during the flight. The operating data in any one chart can be used only when the gross weight of the helicopter during flight is within the limits specified in the title block. If a weight change, during flight, necessitates the use of the second chart, the operating data included in the corresponding column of that chart should be used. This procedure is essential as the ranges are computed on that basis.

ENGINE OPERATING LIMITS CURVE

The engine operating limits curve (figure A-9) is a plot of engine brake horsepower versus altitude for constant rpm with dashed lines representing manifold pressures.

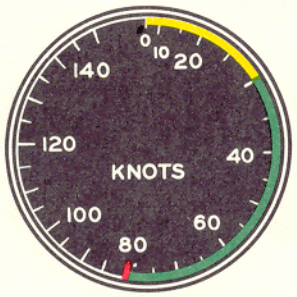
AIRSPEED INSTALLATION CORRECTION TABLE

In the Navy Model HTK-1 Helicopter there is no airspeed installation error, therefore, indicated airspeed (IAS) equals true indicated airspeed (TIAS).

USE OF THE CHARTS

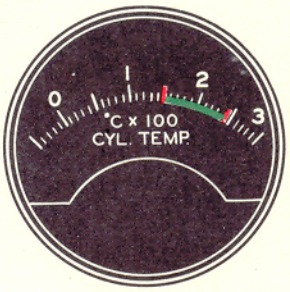
The amount of fuel available for flight planning purposes depends upon the amount required for starting and warm-up, climb, hovering, and reserve. Refer to figure A-5 for starting, warm-up, and climb figures. The amount of fuel consumed during hovering operations at various altitudes is tabulated in column A of figures A-7 and A-8. The amount of fuel remaining after subtracting the reserve, warm-up, take-off, climb, and hovering fuel from the total available is the amount to be used for flight planning.

For instructions in and examples of the use of the flight operation instruction charts, refer to figures A-7 and A-8.



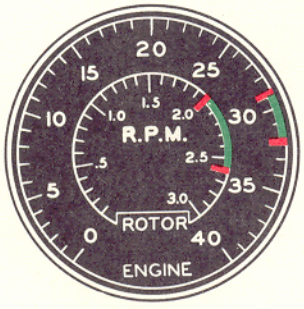
AIR SPEED INDICATOR

- 0 TO 30 KNOTS CAUTION
- 30 TO 80 KNOTS DESIRED
- ABOVE 80 KNOTS DANGER



CYLINDER HEAD TEMPERATURE

- 150° C MINIMUM
- 150° C TO 246° C DESIRED
- 246° C MAXIMUM



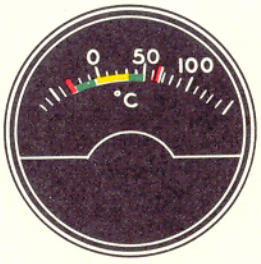
TACHOMETER

ROTOR

- 200 RPM MINIMUM
- 200 TO 260 RPM DESIRED
- 260 RPM MAXIMUM

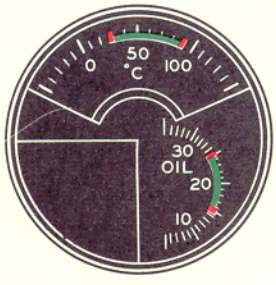
ENGINE

- 2900 RPM MINIMUM OPERATING
- 2900 TO 3200 RPM DESIRED
- 3200 RPM MAXIMUM OPERATING



CARBURETOR AIR TEMPERATURE

- -30° C MINIMUM
- -30° C TO -2° C DESIRED
- -2° C TO 32° C CAUTION
- 32° C TO 50° C DESIRED
- 65° C MAXIMUM



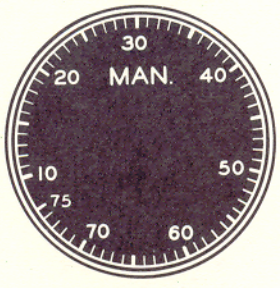
TRANSMISSION GAGE UNIT

TEMPERATURE

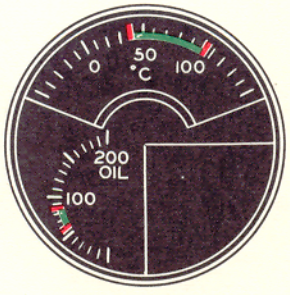
- 30° C MINIMUM
- 30° C TO 90° C DESIRED
- 90° C MAXIMUM

PRESSURE

- 15 PSI MINIMUM
- 15 TO 25 PSI DESIRED
- 25 PSI MAXIMUM



MANIFOLD PRESSURE



ENGINE GAGE UNIT

TEMPERATURE

- 40° C MINIMUM
- 40° C TO 104° C DESIRED
- 104° C MAXIMUM

PRESSURE

- 55 PSI MINIMUM
- 55 TO 85 PSI DESIRED
- 85 PSI MAXIMUM

Figure A-1. Power Plant and Instrument Limits

POWER PLANT CHART

AIRCRAFT MODEL(S): HTK-1

PROPELLER(S):

ENGINE MODEL(S): LYCOMING O-435-4

GAUGE READING	FUEL PRESS.	OIL PRESS.	OIL TEMP.	COOLANT TEMP.		OIL[1] CONS.
DESIRED MAXIMUM	GRAVITY FUEL SYSTEM	65 TO 85	75°C TO 80°C	AIR COOLED		0.5
MINIMUM IDLING	GRAVITY FUEL SYSTEM	50				

MAXIMUM PERMISSABLE DIVING RPM: 3400
MINIMUM RECOMMENDED CRUISE RPM: 2900
MAXIMUM RECOMMENDED ENGINE RPM: 3200

OIL GRADE: (S) 1100 (W) 1065
FUEL GRADE: MIL-F-5572 91/96

WAR EMERGENCY (COMBAT EMERGENCY)			MILITARY POWER (NON-COMBAT EMERGENCY)			OPERATING CONDITION			NORMAL RATED (MAXIMUM CONTINUOUS)			MAXIMUM CRUISE (NORMAL OPERATION)		
MINUTES			MINUTES			TIME LIMIT			UNLIMITED			UNLIMITED		
						MAX. CYL. HD. TEMP.			246°C			246°C		
						MIXTURE			F.R.			F.R.		
						R. P. M.			3200			3000		
MANIF. PRESS.	SUPER-CHARGER	FUEL[2] Gal/Min	MANIF. PRESS.	SUPER-CHARGER	FUEL[2] Gal/Min	STD. TEMP. °C	PRESSURE ALTITUDE	STD. TEMP. °F	MANIF. PRESS.	SUPER-CHARGER	FUEL PH	MANIF. PRESS.	SUPER-CHARGER	FUEL PH
						-55.0	40,000 FT.	-67.0						
						-55.0	38,000 FT.	-67.0						
						-55.0	36,000 FT.	-67.0						
						-52.4	34,000 FT.	-62.3						
						-48.4	32,000 FT.	-55.1						
						-44.4	30,000 FT.	-48.0						
	NOT			NOT		-40.5	28,000 FT.	-40.9						
						-36.5	26,000 FT.	-33.7						
						-32.5	24,000 FT.	-26.5						
APPLICABLE			APPLICABLE			-28.6	22,000 FT.	-19.4						
						-24.6	20,000 FT.	-12.3						
						-20.7	18,000 FT.	- 5.2						
						-16.7	16,000 FT.	2.0						
						-12.7	14,000 FT.	9.1						
						- 8.8	12,000 FT.	16.2	F.T.	—	85	F.T.	—	78
						- 4.8	10,000 FT.	23.4	F.T.	—	87	F.T.	—	84
						- 0.8	8,000 FT.	30.5	F.T.	—	97	F.T.	—	90
						3.1	6,000 FT.	37.6	F.T.	—	109	F.T.	—	102
						7.1	4,000 FT.	44.7	F.T.	—	122	F.T.	—	108
						11.0	2,000 FT.	51.8	F.T.	—	137	F.T.	—	126
						15.0	SEA LEVEL	59.0	27.9	—	147	F.T.	—	139

GENERAL NOTES

[1] OIL CONSUMPTION: MAXIMUM U.S. QUART PER HOUR PER ENGINE.
[2] *Gal/Min:* APPROXIMATE U.S. GALLON PER *MINUTE* PER ENGINE
[3] PH: APPROXIMATE POUNDS PER HOUR PER ENGINE.
F.T.: MEANS FULL THROTTLE OPERATION.
VALUES ARE FOR FLIGHT WITH RAM.

FOR COMPLETE CRUISING DATA SEE FIGURES A-8 & A-9

TAKE-OFF CONDITIONS: 3200 RPM 27.9 Hg. M.P. FULL THROTTLE

CONDITIONS TO AVOID: DO NOT IDLE ENGINE BELOW 900 RPM. DO NOT OPERATE CRAFT BELOW 2900 ENGINE RPM. DO NOT LEAN OUT MIXTURE BELOW 5000 FEET ALT.

SPECIAL NOTES

NOTE: RED FIGURES ARE ESTIMATED DATA

DATA AS OF 4-23-51 BASED ON CALCULATIONS AND ESTIMATES

Figure A-2. Power Plant Chart

AIRCRAFT MODEL(S): HTK - 1

TAKE - OFF CHART

CONFIGURATION Clean

ENGINE MODEL(S): Lycoming O - 435 - 4

TAKE - OFF DISTANCE - FEET

FIRM DRY SOD

GROSS WEIGHT LB	PRESSURE ALTITUDE 1000 FEET	−25 DEG. CENT		−5 DEG. CENT		+15 DEG. CENT		+35 DEG. CENT		+55 DEG. CENT	
		GROUND RUN	CLEAR 50'	GROUND RUN	CLEAR 50'	GROUND RUN	CLEAR 50'	GROUND RUN	CLEAR 50'	GROUND RUN	CLEAR 50'
3,000	S.L.	0	0	0	0	0	0	0	135	0	260
	2	0	0	0	0	0	190	0	280	45	465
	4	0	0	0	285	25	440	60	620	110	820
	6	15	395	41	570	90	795	160	1050	250	1585
	8	70	710	120	995	240	1430	410	2480		
	10	205	1380	360	2320	725	6500				
	12	595	4730								
2,900	S.L.	0	0	0	0	0	0	0	0	0	175
	2	0	0	0	0	0	0	0	215	0	315
	4	0	0	0	185	0	310	30	455	65	645
	6	0	285	20	445	60	650	100	810	165	1120
	8	40	575	85	800	165	1120	250	1610	410	2960
	10	110	985	235	1545	410	2845				
	12	345	2360	735	7745						
2,600	S.L.	0	0	0	0	0	0	0	0	0	0
	2	0	0	0	0	0	0	0	0	0	0
	4	0	0	0	0	0	0	0	0	0	205
	6	0	0	0	0	0	200	0	310	30	490
	8	0	180	0	305	30	480	60	685	110	875
	10	25	440	60	660	110	745	175	1210	305	1880
	12	100	805	185	1205	320	1990	535	4015		

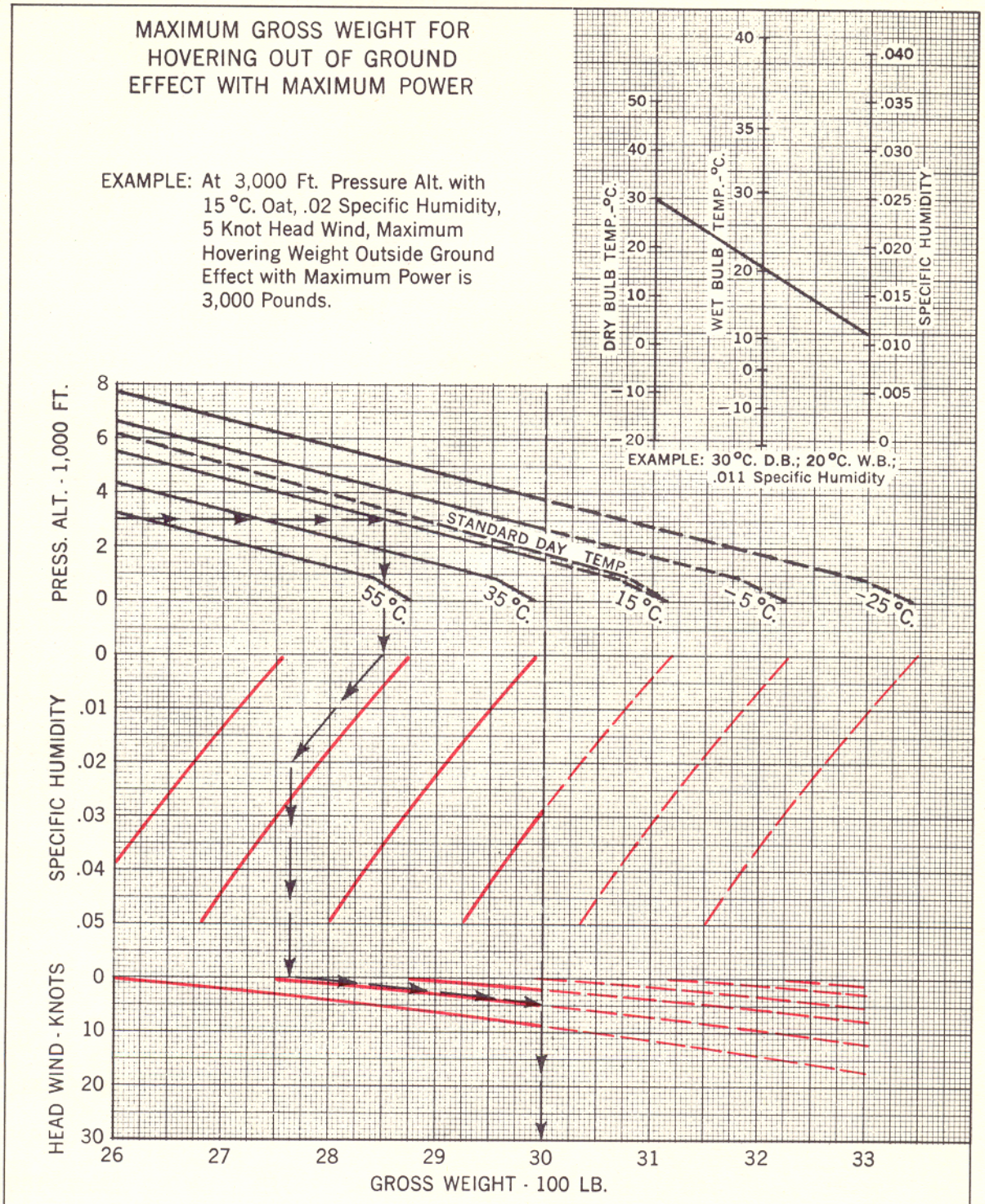
REMARKS:

BASED ON: Calculated
DATA AS OF: 9/28/51

FUEL GRADE: 91/96
FUEL DENSITY: 6.0 Lb/Gal.

Figure A-3. Take-Off Chart

HOVERING DATA



REMARKS: Maximum Overload Gross Weight is 3,000 Pounds

BASED ON: Calculated
DATA AS OF: 9/28/51

FUEL GRADE: 91/96
FUEL DENSITY: 6.0 Lb./Gal.

Figure A-4. Hovering Data

AIRCRAFT MODEL(S)
HTK - 1

CLIMB CHART

ENGINE MODEL(S)
Lycoming 0-435-4

CONFIGURATION: Clean

GROSS WEIGHT - LB.

TEMP. DEG. CENT.	PRESSURE ALTITUDE	2600					2900					3000				
		BEST IAS		RATE OF CLIMB FPM	FROM S.L.		BEST IAS		RATE OF CLIMB FPM	FROM S.L.		BEST IAS		RATE OF CLIMB FPM	FROM S.L.	
		MPH	KTS		TIME MIN.	FUEL USED LB.	MPH	KTS		TIME MIN.	FUEL USED LB.	MPH	KTS		TIME MIN.	FUEL USED LB.
−25	S.L.		33	1055	0	25		34	862	0	25		35	808	0	25
	2,000		33	982	2.0	31		34	777	2.4	32		35	722	2.6	32
	4,000		33	835	4.2	36		34	640	5.2	39		35	581	5.7	40
	6,000		33	698	6.8	41		34	514	8.7	46		35	454	9.6	48
	8,000		33	553	10.0	47		34	385	13.1	54		35	329	14.7	57
	10,000		33	412	14.1	54		34	248	19.4	65		35	204	22.2	70
	12,000		33	276	19.9	63		34	104	30.7	82		35	68	36.9	93
−5	S.L.		33	993	0	25		34	803	0	25		35	740	0	25
	2,000		33	898	2.1	31		34	707	2.6	32		35	651	2.9	32
	4,000		33	752	4.5	36		34	570	5.7	39		35	518	6.3	40
	6,000		33	615	7.4	42		34	436	9.7	46		35	386	10.7	49
	8,000		33	487	11.0	48		34	307	15.1	56		35	254	17.0	60
	10,000		33	350	15.8	56		34	174	23.4	69		35	118	27.7	77
	12,000		33	200	23.1	67		34	30	43.0	99					
+15	S.L.		33	938	0	25		34	732	0	25		35	661	0	25
	2,000		33	835	2.3	31		34	636	2.9	32		35	573	3.2	33
	4,000		33	692	4.9	36		34	496	6.4	39		35	443	7.1	41
	6,000		33	558	8.1	42		34	370	11.0	48		35	322	12.3	50
	8,000		33	416	12.2	49		34	226	17.7	59		35	186	20.2	64
	10,000		33	272	18.0	58		34	89	30.3	79		35	46	37.4	91
	12,000		33	125	28.0	73										
+35	S.L.		33	870	0	25		34	662	0	25		35	611	0	25
	2,000		33	775	2.4	30		34	577	3.2	32		35	519	3.5	33
	4,000		33	631	5.2	36		34	433	7.2	40		35	383	7.9	42
	6,000		33	503	8.7	42		34	300	12.7	50		35	249	14.2	53
	8,000		33	370	13.3	50		34	163	21.3	64		35	114	25.2	70
	10,000		33	208	20.0	60		34	15	44.3	99					
	12,000		33	72	34.3	81										
+55	S.L.		33	802	0	25		34	599	0	25		35	551	0	25
	2,000		33	704	2.7	31		34	518	3.6	33		35	454	4.0	33
	4,000		33	563	5.9	37		34	380	8.1	41		35	315	9.2	43
	6,000		33	425	9.9	43		34	240	14.6	52		35	176	17.3	57
	8,000		33	285	15.5	52		34	92	26.6	71		35	36	36.1	87
	10,000		33	134	25.0	67										
	12,000															

REMARKS: Climbs Based on 28 Inches Manifold Pressure & 3200 RPM at S.L.
2,000 to 12,000 Ft. Use Full Throttle and 3200 RPM

BASED ON: Calculated
DATA AS OF: 9/28/51

FUEL GRADE: 91/96
FUEL DENSITY: 6.0 Lb Gal.

Figure A-5. Climb Chart

AIRCRAFT MODEL(S)
HTK - 1
CONFIGURATION Clean

LANDING CHART

POWER ON
LANDING DISTANCE - FEET

ENGINE MODEL(S)
Lycoming 0-435-4
FIRM DRY SOD

GROSS WEIGHT LB	PRESSURE ALTITUDE	BEST IAS APPROACH		−25 DEG. CENT		−5 DEG. CENT		+15 DEG. CENT		+35 DEG. CENT		+55 DEG. CENT		
				GROUND ROLL	CLEAR 50'	GROUND ROLL	CLEAR 50'	GROUND ROLL	CLEAR 50'	GROUND ROLL	CLEAR 50'	GROUND ROLL	CLEAR 50'	
2,500	S.L.		35	0	0	0	0	0	0	0	0	0	0	
	2,000		35	0	0	0	0	0	0	0	0	0	0	
	4,000		35	0	0	0	0	0	0	0	0	0	0	
	6,000		35	0	0	0	0	0	0	0	10	0	15	
	8,000		35	0	0	0	10	0	15	0	20	0	30	
	10,000		35	0	15	0	20	0	30	0	40	10	55	
	12,000		35	0	30	0	40	15	60	25	80	110	190	
3,000	S.L.		37	0	0	0	0	0	0	0	0	0	15	
	2,000		37	0	0	0	0	0	0	0	15	0	25	
	4,000		37	0	0	0	10	0	20	0	30	0	40	
	6,000		37	0	15	0	25	0	35	10	50	20	70	
	8,000		37	0	30	0	40	20	65	45	105	100	170	
	10,000		37	15	60	50	110	120	205					
	12,000		37	70	145									

REMARKS: Normal Landing (final phase) is as Near Vertical Descent as Possible with Power On

BASED ON: Calculated
DATA AS OF: 9/28/51

FUEL GRADE: 91/96
FUEL DENSITY: 6.0 Lb/Gal.

Figure A-6. Landing Chart

AIRCRAFT MODEL(S) HTK - 1	FLIGHT OPERATION INSTRUCTION CHART	EXTERNAL LOAD ITEMS None
ENGINE(S): Lycoming 0 - 435 - 4	CHART WEIGHT LIMITS: 3,000 to 2,800 Pounds	NUMBER OF ENGINES OPERATING: 1

INSTRUCTIONS—RANGE: Select figure in fuel column equal to or less than amount of fuel to be used for cruising (1). Move horizontally to right or left and select range value equal to or greater than the statute or nautical air miles to be flown. Vertically below and opposite value nearest desired cruising altitude (alt.) read rpm, manifold pressure (m.p.) and mixture setting required. Pounds per hour (p.h.) and indicated airspeed (i.a.s.) are approximate. Columns I, II, and III give progressive increase in range at a sacrifice in speed. Range values are for an average airplane flying alone (no wind).

INSTRUCTIONS—ENDURANCE: Select figure in fuel column equal to or less than amount of fuel to be used for endurance. Move horizontally to right or left (column A for hovering—column B for max. endurance) and under the desired pressure alt. read hours endurance available. Vertically below and opposite value nearest desired altitude (alt.) read rpm, manifold pressure (m.p.) mixture setting and approximate i.a.s.

RANGE - AIR MILES

COLUMN I		FUEL U.S. LB.	COLUMN II		COLUMN III	
STATUTE	NAUTICAL		STATUTE	NAUTICAL	STATUTE	NAUTICAL
			SUBTRACT FUEL ALLOWANCE NOT AVAILABLE FOR FLIGHT			
107	93	195	118	103	123	107
83	72	150	91	79	96	83
58	50	105	65	56	67	58
35	31	65	41	35	41	36

MAXIMUM CONTINUOUS						PRESS. ALT. FEET	MEDIUM CRUISE						MAXIMUM AIR RANGE					
RPM	M.P. INCHES	MIX-TURE	APPROXIMATE TOT. P.H.	APPROXIMATE IAS. MPH	APPROXIMATE IAS. KTS.		RPM	M.P. INCHES	MIX-TURE	APPROXIMATE TOT. P.H.	APPROXIMATE IAS. MPH	APPROXIMATE IAS. KTS.	RPM	M.P. INCHES	MIX-TURE	APPROXIMATE TOT. P.H.	APPROXIMATE IAS. MPH	APPROXIMATE IAS. KTS.
						16,000 14,000 12,000												
3,200	F.T.	M.L.	94	60	52	10,000	3,200	F.T.	M.L.	94	60	52	3,200	F.T.	M.L.	94	60	52
3,200	F.T.	M.L.	99	67	58	8,000	3,200	F.T.	M.L.	99	67	58	3,200	F.T.	M.L.	99	67	58
3,200	F.T.	M.L.	106	71	62	6,000	3,200	22.2	M.L.	103	70	61	3,200	22.1	M.L.	102	69	60
3,200	F.T.	M.L.	121	76	66	4,000	3,200	23.6	M.L.	111	74	64	3,200	22.2	M.L.	103	70	61
3,200	F.T.	M.L.	138	79	69	2,000	3,200	24.7	M.L.	118	76	66	3,200	22.4	M.L.	102	69	60
3,200	F.T.	F.R.	149	82	71	S.L.	3,200	25.7	M.L.	129	78	68	3,200	22.5	M.L.	100	68	59

ENDURANCE - HOURS

COLUMN A					FUEL U.S. LB.	COLUMN B				
SEA LEVEL	2,000	4,000	6,000	8,000		SEA LEVEL	2,000	4,000	6,000	8,000
1.42	1.41	1.62	1.83	1.96	195	2.28	2.27	2.26	2.25	2.23
1.10	1.08	1.25	1.41	1.51	150	1.76	1.74	1.74	1.73	1.71
.77	.77	.88	.99	1.05	105	1.23	1.22	1.22	1.21	1.20
.47	.47	.54	.61	.66	65	.76	.76	.75	.75	.74

HOVERING - MINIMUM IAS.						PRESS. ALT. FEET	MAXIMUM ENDURANCE					
RPM	M.P. INCHES	MIX-TURE	APPROXIMATE TOT. P.H.	APPROXIMATE IAS. MPH	APPROXIMATE IAS. KTS.		RPM	M.P. INCHES	MIX-TURE	APPROXIMATE TOT. P.H.	APPROXIMATE IAS. MPH	APPROXIMATE IAS. KTS.
						16,000 14,000 12,000						
						10,000						
3,200	F.T.	M.L.	100	20	17	8,000	3,200	18.1	M.L.	88	40	35
3,200	F.T.	M.L.	107	14	12	6,000	3,200	18.2	M.L.	87	40	35
3,200	F.T.	M.L.	121	9	8	4,000	3,200	18.3	M.L.	86	40	35
3,200	F.T.	M.L.	138	2	2	2,000	3,200	18.4	M.L.	86	39	34
3,200	26.4	F.R.	137	0	0	S.L.	3,200	19.0	M.L.	85	38	33

SPECIAL NOTES

(1) Make allowance for warm-up, take-off and climb (see figure A-6) plus allowance for wind, reserve and combat as required.

RED FIGURES ARE CALCULATED DATA

EXAMPLE—RANGE

At 3000 lb gross weight with 150 lb of fuel (after deducting total allowances of 65 lb) to fly 83 nautical air miles at 4000 ft altitude maintain 3200 rpm and 22.2 in. manifold pressure with mixture set: M.L.

EXAMPLE—ENDURANCE

At 3000 lb gross weight with 150 lb of fuel (after deducting total allowances of 65 lb) to stay in the air 1.7 hours at 4000 ft altitude maintain 3200 rpm and 18.3 in. manifold pressure with mixture set: M.L. and approximate i.a.s. of 35 knots.

LEGEND

Alt.: Pressure altitude
M.P.: Manifold pressure
P.H.: Lb of fuel per hour
IAS.: Indicated airspeed
KTS.: Knots
S.L.: Sea level
M.L.: Manual lean
F.T.: Full throttle

Figure A-7. Flight Operation Instruction Chart, 3000 to 2800 Pounds Gross Weight

AIRCRAFT MODEL(S) HTK - 1	FLIGHT OPERATION INSTRUCTION CHART	EXTERNAL LOAD ITEMS None
ENGINE(S): Lycoming 0 - 435 - 4	CHART WEIGHT LIMITS: 2,800 to 2,600 Pounds	NUMBER OF ENGINES OPERATING: 1

INSTRUCTIONS—RANGE: Select figure in fuel column equal to or less than amount of fuel to be used for cruising (1). Move horizontally to right or left and select range value equal to or greater than the statute or nautical air miles to be flown. Vertically below and opposite value nearest desired cruising altitude (alt.) read rpm, manifold pressure (m.p.) and mixture setting required. Pounds per hour (p.h.) and indicated airspeed (i.a.s.) are approximate. Columns I, II, and III give progressive increase in range at a sacrifice in speed. Range values are for an average airplane flying alone (no wind).

INSTRUCTIONS—ENDURANCE: Select figure in fuel column equal to or less than amount of fuel to be used for endurance. Move horizontally to right or left (column A for hovering—column B for max. endurance) and under the desired pressure altitude read hours endurance available. Vertically below and opposite value nearest desired altitude (alt.) read rpm, manifold pressure (m.p.), mixture setting and approximate i.a.s.

RANGE - AIR MILES

COLUMN I		FUEL U.S. LB.	COLUMN II		COLUMN III	
STATUTE	NAUTICAL		STATUTE	NAUTICAL	STATUTE	NAUTICAL
108	94	195	SUBTRACT FUEL ALLOWANCE NOT AVAILABLE FOR FLIGHT			
			125	108	134	116
83	72	150	96	83	102	89
58	50	105	67	58	71	62
36	32	65	42	36	45	39

MAXIMUM CONTINUOUS						PRESS. ALT. FEET	MEDIUM CRUISE						MAXIMUM AIR RANGE					
RPM	M.P. INCHES	MIX-TURE	APPROXIMATE TOT. P.H.	APPROXIMATE IAS. MPH	APPROXIMATE IAS. KTS.		RPM	M.P. INCHES	MIX-TURE	APPROXIMATE TOT. P.H.	APPROXIMATE IAS. MPH	APPROXIMATE IAS. KTS.	RPM	M.P. INCHES	MIX-TURE	APPROXIMATE TOT. P.H.	APPROXIMATE IAS. MPH	APPROXIMATE IAS. KTS.
						16,000 14,000 12,000												
3,200	F.T.	M.L.	94	65	56	10,000	3,200	F.T.	M.L.	94	65	56	3,200	F.T.	M.L.	94	65	56
3,200	F.T.	M.L.	100	70	61	8,000	3,200	F.T.	M.L.	100	70	61	3,200	20.9	M.L.	99	69	60
3,200	F.T.	M.L.	106	75	65	6,000	3,200	21.7	M.L.	103	73	63	3,200	21.3	M.L.	100	70	61
3,200	F.T.	M.L.	121	79	69	4,000	3,200	23.3	M.L.	108	75	65	3,200	21.9	M.L.	101	71	62
3,200	F.T.	M.L.	138	82	71	2,000	3,200	24.0	M.L.	112	76	66	3,200	22.1	M.L.	100	70	61
3,200	F.T.	F.R.	149	83	72	S.L.	3,200	25.0	M.L.	121	77	67	3,200	22.7	M.L.	100	70	61

ENDURANCE - HOURS

COLUMN A					FUEL U.S. LB.	COLUMN B				
SEA LEVEL	2,000	4,000	6,000	8,000		SEA LEVEL	2,000	4,000	6,000	8,000
1.65	1.63	1.59	1.83	1.96	195	2.40	2.39	2.38	2.37	2.35
1.27	1.25	1.23	1.40	1.50	150	1.84	1.83	1.83	1.82	1.81
.89	.88	.85	.99	1.05	105	1.29	1.29	1.28	1.28	1.27
.55	.55	.53	.61	.66	65	.80	.80	.79	.79	.78

HOVERING - MINIMUM IAS.						PRESS. ALT. FEET	MAXIMUM ENDURANCE					
RPM	M.P. INCHES	MIX-TURE	APPROXIMATE TOT. P.H.	APPROXIMATE IAS. MPH	APPROXIMATE IAS. KTS.		RPM	M.P. INCHES	MIX-TURE	APPROXIMATE TOT. P.H.	APPROXIMATE IAS. MPH	APPROXIMATE IAS. KTS.
						16,000 14,000 12,000						
						10,000						
3,200	F.T.	M.L.	100	9	8.0	8,000	3,200	17.2	M.L.	83	39	34
3,200	F.T.	M.L.	107	6	5.0	6,000	3,200	17.3	M.L.	82	38	33
3,200	24.6	M.L.	122	0	0	4,000	3,200	17.5	M.L.	82	38	33
3,200	26.5	M.L.	120	0	0	2,000	3,200	17.6	M.L.	82	38	33
3,200	27.4	F.R.	118	0	0	S.L.	3,200	17.9	M.L.	81	37	32

SPECIAL NOTES

(1) Make allowance for warm-up, take-off, and climb (see figure A-6) plus allowance for wind, reserve and combat as required.

RED FIGURES ARE CALCULATED DATA

EXAMPLE—RANGE

At 2800 lb gross weight with 150 lb of fuel (after deducting total allowances of 62 lb) to fly 89 nautical air miles at 4000 ft altitude maintain 3200 rpm and 21.9 in. manifold pressure with mixture set: M.L.

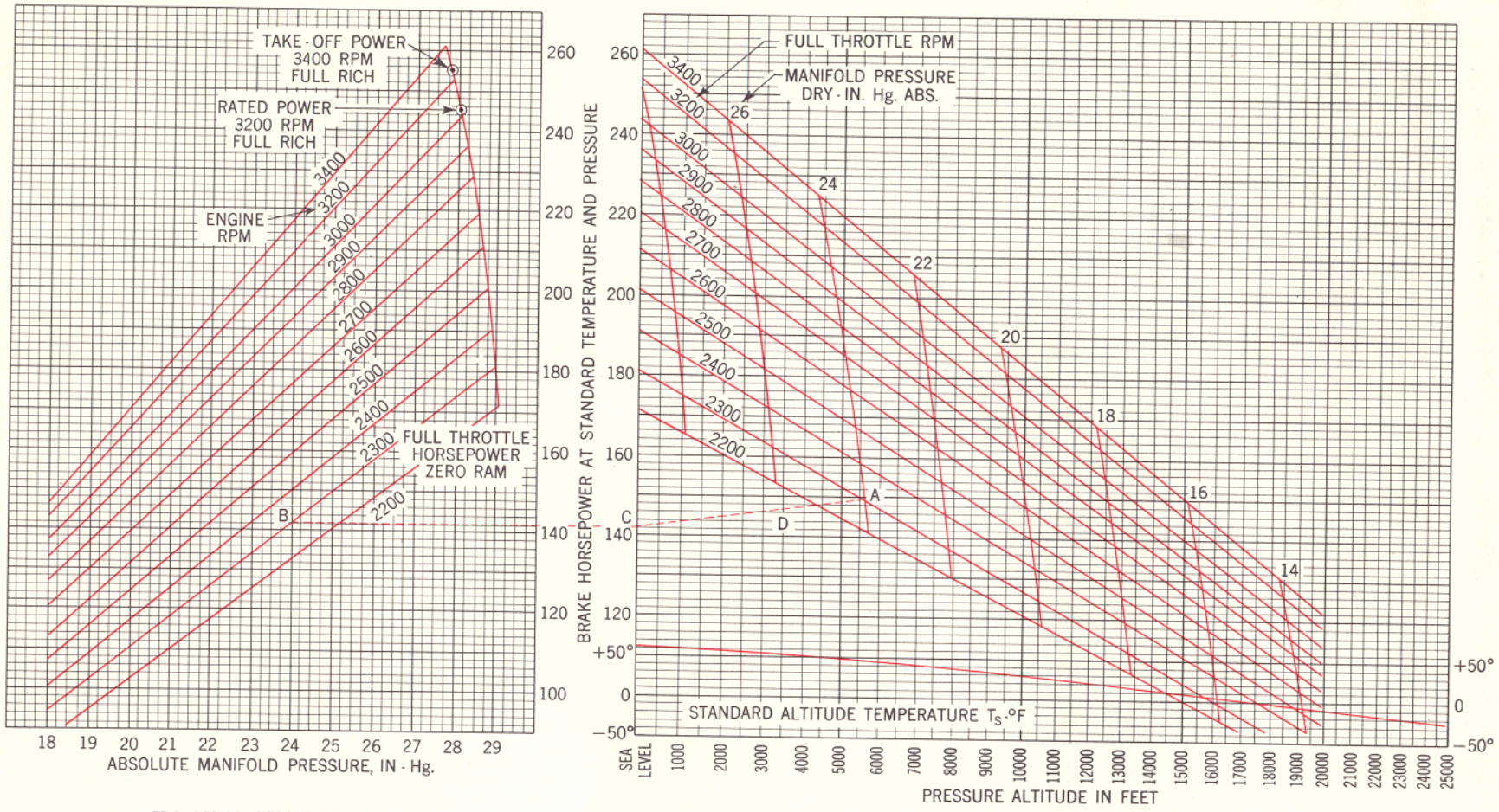
EXAMPLE—ENDURANCE

At 2800 lb gross weight with 150 lb of fuel (after deducting total allowances of 62 lb) to stay in the air 1.8 hours at 4000 ft altitude maintain 3200 rpm and 17.5 in. manifold pressure with mixture set: M.L. and approximate i.a.s. of 33 knots.

LEGEND

Alt.: Pressure altitude
M.P.: Manifold pressure
P.H.: Lb of fuel per hour
IAS.: Indicated airspeed
KTS.: Knots
S.L.: Sea level
F.R.: Full rich
M.L.: Manual lean
F.T.: Full throttle

Figure A-8. Flight Operation Instruction Chart, 2800 to 2600 Pounds Gross Weight



SEA LEVEL PERFORMANCE

ESTIMATED ALTITUDE PERFORMANCE

LYCOMING
AIRCRAFT ENGINE
PERFORMANCE DATA

MIXTURE CONTROL AT MAXIMUM POWER UNLESS OTHERWISE NOTED
ENGINE MODEL 0-435-4
PROP. DRIVE RATIO 1:1
COMPRESSION RATIO 7.30:1
CARB; MARVEL-SCHEBLER MA-4-5
FUEL MINIMUM GRADE 80/87
NO EXTERNAL MIXTURE HEATER USED

TO FIND ACTUAL HORSEPOWER FROM ALTITUDE, RPM, MANIFOLD PRESSURE AND AIR INLET TEMPERATURE

1. LOCATE A ON FULL THROTTLE ALTITUDE CURVE FOR GIVEN RPM & MANIFOLD PRESSURE
2. LOCATE B ON SEA LEVEL CURVE FOR RPM & MANIFOLD PRESSURE & TRANSFER TO C
3. CONNECT A & C BY STRAIGHT LINE & READ H.P. AT GIVEN ALTITUDE "D"
4. MODIFY HORSEPOWER AT D FOR VARIATION OF AIR INLET TEMPERATURE T FROM STANDARD ALTITUDE TEMPERATURE T_S BY FORMULA:

$$[\text{H.P. AT D}] \times \sqrt{\frac{460+T_S}{460+T}} = \text{ACTUAL H.P.}$$

APPROXIMATELY 1% CORRECTION FOR EACH 10°F VARIATION FROM T_S

Figure A-9. Engine Operating Limits Curve

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