OPERATOR'S MANUAL

ARMY MODEL

UH-1H/V HELICOPTERS

This manual supersedes TM 55-1520-210-10 dated 1 December 1986, including all changes.

HEADQUARTERS, DEPARTMENT OF THE ARMY

15 FEBRUARY 1988

TECHNICAL MANUAL

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 15 February 1988

OPERATOR'S MANUAL
UH-1H/V HELICOPTERS

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Placement of tables, figures, and appendixes. Full page tables, figures, and appendixes (in that order) included in this UPDATE printing are located following the chapters in which they were referenced.

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Chapter 1

Introduction

1-1. General These instructions are for use by the operator(s). They apply to UH-1H/V helicopter.

1-2. Warnings, Cautions, and Notes Warnings, Cautions, and Notes are used to emphasize important and critical instructions and are used for the following conditions.

WARNING

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

Caution

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

NOTE

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

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

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

1-5. Appendix B, Abbreviations and Terms Definitions of all abbreviations and terms used throughout the manual are included in appendix B.

1-6. Index The index lists every titled paragraph contained in this manual. Chapter 7 performance data has an additional index within the chapter.

1-7. Army Aviation Safety Program Reports necessary to comply with the safety program are prescribed in AR 385-40.

1-8. Destruction of Army Materiel to Prevent Enemy Use For information concerning destruction of Army materiel to prevent enemy use, refer to TM 750-244-1-5.

1-9. Forms and Records Army aviators flight records and helicopter maintenance records which are to be used by the operators and crew members are prescribed in DA PAM 738-751 and TM **55-1500-342-23**

1-10. Designator Symbols Designator Symbols **H** UH-1H and **V** UH-1V are used in conjunction with text contents, text headings and illustration titles to show limited effectivity of the material. One or more designator symbols may follow a text heading or illustration title to indicate proper effectivity, unless the material applies to all models and configurations within the manual. If the material applies to all models and configurations, no designator symbols will be used.

1-11. Use of Words Shall, Should, and May Within this technical manual, the word "shall" is used to indicate a mandatory requirement. The word "should" is used to indicate a non-mandatory but preferred method of accomplishment. The word "may" is used to indicate an acceptable method of accomplishment.

Chapter 2

Helicopter and Systems Description and Operation

Section I. HELICOPTER

2-1. General Description The UH-1H/V helicopters are thirteen-place single engine helicopters. The maximum gross weight is 9500 pounds.

2-2. General Arrangement Figure 2-1 depicts the general arrangement. Indexed items include access openings and most of the items referred to in the exterior check paragraph in section III of chapter 8.

2-3. Principal Dimensions Figure 2-2 depicts the principal dimensions.

2-4. Turning Radius Turning radius is about 35 feet when pivoted around the mast.

2-5. Fuselage The fuselage is the forward section of the airframe extending from the nose to the forward end of the tailboom. The fuselage consists primarily of two longitudinal beams with transverse bulkheads and metal covering. The main beams are the supporting structure for the cabin, landing gear, fuel tanks, transmission, engine, and tailboom. The external cargo suspension unit is attached to the main beams near the center of gravity of the helicopter.

2-6. Tailboom The tailboom section is bolted to the aft end of the fuselage and extends to the aft end of the helicopter. It is a tapered, semi-monocoque structure comprised of skins, longerons, and stringers. The tailboom supports the tail rotor, vertical fin, and synchronized elevator. It houses the tail rotor driveshaft and some electronic equipment.

2-7. Landing Gear System

a. Main Landing Gear. The main landing gear consists of two aluminum arched crosstubes mounted laterally on the fuselage with two longitudinal skid tubes attached to the crosstubes. The skid tubes are made of aluminum and have steel skid shoes attached to the bottom to minimize skid wear.

b. Tail Skid. A tubular steel tail skid is installed on the aft end of the tailboom. It acts as a warning to the pilot upon an inadvertent tail-low landing and aids in protecting the tail rotor from damage.

2-8. Crew Compartment Diagram The crew compartment is depicted in figure 2-5.

2-9. Cockpit and Cabin Doors

a. Cockpit Doors. The cockpit doors are formed aluminum frames with transparent plastic windows in the upper section (fig 2-1). Ventilation is supplied by the sliding panels in the windows. Cam-type door latches are used and doors are equipped with jettisonable door releases.

b. Cabin Doors. The two cabin doors are formed aluminum frames with transparent plastic windows in the upper section (fig 2-1). These doors are on rollers and slide aft to the open position allowing full access to the cargo area. Hinged doorpost panels are forward of the cabin doors. They provide a larger entrance to the cargo area. An open door lock is provided to hold the door in the aft position to prevent door separation in flight.

2-10. Pilot/Copilot Seats The pilot and copilot seats may be conventional seats or armored seats (fig 2-3). The armored seats have a release to recline the seats to aid in removal of injured personnel. The conventional seats do not have the reclining feature.

a. Pilot and Copilot Seats (Conventional). The pilot and copilot seats are vertical and fore-aft adjustable and the nonreclining type. The vertical height adjustment handle is under the right side of the seat. The fore and aft adjustment is under the left side of the seat. Webbing on the back of the seat can be removed to accept use of a back-pack parachute. The seats are equipped with lap safety belts and inertia reel shoulder harness.

b. Pilot and Copilot Seats (Armored). Armored seats can be installed in the helicopter for the pilot and copilot. They are equipped with lap safety belt and inertia-reel shoulder harness. They are adjustable fore and aft and vertically. The vertical adjustment handle is under the right side of the seat and the fore and aft handle on the left. The seats are equipped with a quick release, on each side at the back of the seat, for reclining the seat. The seat back, bottom, and sides are protected by ceramic and aluminum armor plate. Hip and shoulder areas are protected by ceramic type armor.

c. Inertia Reel Shoulder Harness. An inertia reel and shoulder harness is incorporated in the pilot and copilot seats with manual lock-unlock handle (fig 2-3). On the conventional seat, the control handles are located on the left front of the seat. On the armored seat, the control handles are located on the right front of the seat. With the control in the unlocked position (aft) and the shoulder straps properly adjusted, the reel strap will extend to allow the occupant to lean forward; however, the reel automatically locks when the helicopter encounters an impact force of 2 to 3 "G" deceleration. The reel can be locked (handle forward) from any position and will take up slack in the harness. To release the lock, it is necessary to lean back slightly to release tension on the lock and move the control handle to the unlock position. It is possible to have pressure against the seat back whereby no additional movement is possible and the lock cannot be released. If this condition occurs, it will be necessary to loosen the harness. The reel should be manually locked for emergency landing. Straps must be adjusted to fully retract within the inertia reels to prevent rebound overshoot in the event of impact. Seat belt must be securely fastened and firmly tightened prior to adjustment of shoulder harness to prevent submarining in event of impact.

2-11. Personnel Seats Various arrangements of personnel seats can be installed to accommodate from one to eleven personnel besides the pilot and copilot. The seats are constructed of tubular steel and reinforced canvas. Each seat is equipped with a lap safety belt. These same belts, with web extensions, are provided for litter patients when helicopter is used for rescue missions. For additional information on the personnel seats, refer to chapter 6.

2-12. Instruments and Controls

a. Instrument Panel. The location of all the controls, indicators, instruments, and data placards installed on the instrument panel is depicted in figure 2-4. V Some instruments may be relocated.

b. Pedestal Panel. The panels and controls installed in the pedestal are depicted in figure 2-5.

c. Overhead Console. The location of the controls and circuit breakers installed in the overhead console is depicted in figure 2-5.

d. External Stores Jettison Handle. The external stores jettison handle is located to the left of the pilot collective when installed. Pulling up on the handle will jettison external stores through mechanical linkage.

e. Other Instruments and Controls. Instruments, controls, or indicators not shown in figure 2-5 or figure 2-6 are shown in the chapter/section which describes their related systems.

2-12.1 Wire Strike Protection System (WSPS) The WSPS provides protection for 90% of the frontal area against impacts with horizontally strung mechanical and power transmission cables. The basic system consists of an upper cutter/deflector, a windshield protector/deflector/cutter, a lower cutter/deflector and a pair of windshield wiper deflectors (fig 2-1). The lower cutter assembly features a "Breakaway Tip" designed to shear when relatively large ground contact forces are experienced and before helicopter structural damage is incurred. However, the tip shear rivets are designed to withstand the smaller forces experienced during wire strikes and the tip will still effectively deflect wires/cables into the cutter blades.

Section II. EMERGENCY EQUIPMENT

2-13. Emergency Equipment The emergency equipment location, illustration, and emergency procedures are covered in chapter 9.

2-14. Portable Fire Extinguisher A portable hand-operated fire extinguisher is carried in a bracket located aft of the pedestal, or at the right side of the pilot seat.

2-15. First Aid Kits Four general purpose type first aid kits have been provided in the cabin area (fig 9-1). Two kits are secured to the right center doorpost. The other two kits are secured to the left doorpost. First aid kits can be easily removed for immediate use.

Section III. ENGINE AND RELATED SYSTEMS

2-16. Engine The UH-1H/V are equipped with a T53-L-13 engine.

2-17. Engine Compartment Cooling The engine compartment is cooled by natural convection through engine compartment screens.

2-18. Air Induction System Three different air induction systems are used on these helicopters. They are discussed in the following paragraphs:

a. *Non-Self-Purging Particle Separator.* The non-self-purging particle separator is an inertial type. A lip extending into the airstream deflects the particle-laden air into a large chamber. Large particles in the air settle in the chamber; fine particles are removed as the air is drawn through a filter assembly. Removed particles are held in porous foam box assemblies. The box assemblies can be removed and cleaned. Other components used with the particle separator are: ENG AIR FILTER CONT circuit breaker on the overhead console, an engine air differential pressure switch on the firewall, and an ENGINE INLET AIR caution light (fig 2-9) on the caution panel.

b. *Self-Purging Particle Separator.* Helicopters serial No. 68-15779 and subsequent are equipped with a self-purging particle separator. This is an inertial-type separator. Particle-laden air is directed through a large annular chamber and through an air cleaner. A constant supply of bleed air from the engine flows through the venturi-type ejector and carries particles overboard through airframe plumbing.

c. *Foreign Object Damage Screen.* Foreign Object Damage (FOD) screen prevents large particles from entering the engine inlet.

NOTE

The ice detector system is not applicable on helicopters equipped with the self-purging particle separator.

d. *DE-ICE.* Engine de-ice is a bleed air system activated by the DE-ICE switch on the ENGINE panel (fig 2-6). In the ON position bleed air is directed through the engine inlet to provide ice protection. Power losses caused when the system is on are shown in chapter 7. In the event of dc electrical failure or when the DE-ICE ENG circuit breaker is out, de-ice is automatically on. System power is provided by the dc essential bus and protected by the ANTI-ICE ENG circuit breaker.

e. *Improved Particle Separator.* Some UH-1s may be equipped with an Improved Particle Separator. This unit has a number of vortex tubes which are highly effective in removing sand and dust from the engine inlet air. The sand and dust are dumped overboard through outlets on each side of the Separator.

2-19. Engine Fuel Control System

a. *Engine Mounted Components.* The fuel control assembly is mounted on the engine. It consists of a metering section, a computer section and an overspeed governor.

(1) The metering section is driven at a speed proportional to N1 speed. It pumps fuel to the engine through the main metering valve or, if the main system fails, through the emergency metering valve which is positioned directly by the twist grip throttle.

(2) The computer section determines the rate of main fuel delivery by biasing main metering valve opening for N1 speed, inlet air temperature and pressure, and throttle position. It also controls the operation of the compressor air bleed and operation of the variable inlet guide vanes.

(3) The overspeed governor is driven at a speed proportional to N2 speed. It biases the main metering valve opening to maintain a constant selected N2 rpm.

b. Starting Fuel Flow. During engine start, energizing the start fuel switch opens the fuel solenoid valve, allowing fuel from the fuel regulator to flow through the starting fuel manifold and into the combustion chamber. When N1 reaches sufficient speed, the start switch is de-energized, causing the solenoid valve to close and stop-starting fuel flow.

Starting fuel nozzles are purged by air from the combustion chamber through a check filter valve. Engine starting fuel solenoid valve is controlled by the engine starter switch on helicopters which do not have a starting fuel switch. The engine solenoid valve (engine starting fuel solenoid valve) cannot be individually controlled during engine starts.

c. Power Controls (Throttles). Rotating the pilot or copilot twist grip-type throttle (fig 2-5) to the full open position allows the overspeed governor to maintain a constant rpm. Rotating the throttle toward the closed position will cause the rpm to be manually selected instead of automatically selected by the overspeed governor. Rotating the throttle to the fully closed position shuts off the fuel. An idle stop is incorporated in the throttle to prevent inadvertent throttle closure. To bypass the idle detent, press the IDLE REL switch and close the throttle. The IDLE REL switch is a momentary on, solenoid-operated switch. The IDLE REL switch is located on the pilot collective stick switch box. IDLE REL switch receives power from the 28 Vdc bus and is protected by a circuit breaker marked IDLE STOP REL. Friction can be induced in both throttles by rotating the pilot throttle friction ring counterclockwise (fig 2-5). The ring is located on the upper end of the pilot throttle.

d. Governor Switch. The GOV switch is located on the ENGINE control panel (fig 2-6). AUTO position permits the overspeed governor to automatically control the engine rpm with the throttle in the full open position. The EMER position permits the pilot or copilot to manually control the rpm. Because automatic acceleration, deceleration, and overspeed control are not provided with the GOV switch in the EMER position, control movements must be smooth to prevent compressor stall, overspeed, overtemperature or engine failure. The governor circuit receives power from the 28 Vdc essential bus and is protected by the GOV CONT circuit breaker.

2-20. Engine Oil Supply System

a. Description. The dry sump pressure type oil system is entirely automatic in its operation. The system consists of an engine oil tank with de-aeration provisions, thermostatically controlled oil cooler with by-pass valve, pressure transmitter and pressure indicator, low pressure warning switch and indicator, sight gages, and oil supply return vent, and breather lines. Drain valves have been provided for draining the oil tank and cooler. Pressure for engine lubrication and scavenging of return oil are provided by the engine-mounted and engine-driven oil pump. Oil specification and grade are specified in the Servicing Table 2-1.

b. Oil Cooler. Engine oil cooling is accomplished by an oil cooler. The cooler is housed within the fuselage area under the engine deck (fig 2-1). Air circulation for oil cooling is supplied by a turbine fan which operates from turbine bleed air. The fan is powered at all times when the engine is operating and no control is required except the bleed air limiting orifice.

2-21. Ignition—Starter System The starter-ignition switch is mounted on the underside of the pilot collective pitch control lever switch box. An additional switch may be installed on the copilot stick. The switch is a trigger switch, spring-loaded to the off position (fig. 2-5). The starter and ignition unit circuits are both connected to the trigger switches. The circuits receive power from the 28 Vdc essential bus and are protected by circuit breakers marked STARTER RELAY and IGNITION SYSTEM IGNITER SOL. The starter circuit is energized when the STARTER/GEN switch is in the START position and the trigger switch is pulled (fig 2-5). The ignition circuit is energized when the FUEL MAIN ON/OFF switch on the engine control panel is in the ON position and the trigger switch is pulled. The ignition keylock is located by the AC circuit breaker panel. The OFF position deactivates the igniters and start fuel to prevent engine starting. The ON position allows engine starting.

2-22. Governor RPM Switch The pilot and copilot GOV RPM INCR/DECR switches are mounted on a switch box attached to the end of the collective pitch control lever (fig 2-5). The switches are a three-position momentary type and are held in INCR (up) position to increase the power turbine (N2) speed or DECR (down) position to decrease the power turbine (N2) speed. Electrical power for the circuit is supplied from the 28 Vdc essential bus and is protected by a circuit breaker marked GOV CONT.

2-23. Droop Compensator A droop compensator maintains engine rpm (N2) as power demand is increased by the pilot. The compensator is a direct mechanical linkage between the collective stick and the speed selector lever on the N2 governor. No crew controls are provided or required. The compensator will hold N2 rpm to ±40 rpm when properly rigged. Droop is defined as the speed change in engine rpm (N2) as power is increased from a no-load condition. It is an inherent characteristic designed into the governor system. Without this characteristic, instability would develop as engine output is increased resulting in N1 speed overshooting or hunting the value necessary to satisfy the new power condition. If N2 power were allowed to droop, other than momentarily, the reduction in rotor speed could become critical.

2-24. Engine Instrument and Indicators All engine instruments and indicators are mounted in the instrument panel and the pedestal (figs 2-4 and 2-5).

a. Torquemeter Indicator. The torquemeter indicator is located in the center area of the instrument panel and is marked TORQUE PRESS (fig 2-4). The indicator is connected to a transmitter which is part of the engine oil system. The torquemeter indicates torque in pounds per square inch (psi) of torque imposed upon the engine output shaft. The torquemeter receives power from the 28 VAC bus and is protected by a circuit breaker marked TORQUE in the ac circuit breaker panel.

b. Exhaust Gas Temperature Indicator. The exhaust gas temperature indicator is located in the center area of the instrument panel and is marked EXH TEMP (fig 2-4). The indicator receives temperature indications from the thermocouple probes mounted in the engine exhaust diffuser section. The temperature indications are in degrees Celsius. The system is electrically self-generating.

c. Dual Tachometer. The dual tachometer is located in the center area of the instrument panel and indicates both the engine and main rotor rpm (fig 2-4). The tachometer inner scale is marked ROTOR and the outer scale is marked ENGINE. Synchronization of the ENGINE and ROTOR needles indicates normal operation of helicopter. The indicator receives power from the tachometer generators mounted on the engine and transmission. Connection to the helicopter electrical system is not required.

d. Gas Producer Tachometer. The gas producer indicator is located in the right center area of the instrument panel and is marked PERCENT (fig 2-4). The indicator displays the rpm of the gas producer turbine speed in percent. This system receives power from a tachometer generator which is geared to the engine compressor. A connection to the helicopter electrical system is not required.

e. Oil Temperature Indicator. The engine oil temperature indicator is located in the center area of the instrument panel and is marked OIL °C (fig 2-4). The indicator is connected to an electrical resistance-type thermocouple. The temperature of the engine oil at the engine oil inlet is indicated in degrees Celsius. Power to operate the circuit is supplied from the 28 Vdc essential bus. Circuit protection is provided by the TEMP IND ENG & XMSN circuit breaker.

f. Oil Pressure Indicator. The engine oil pressure indicator is located in the center area of the instrument panel and is marked OIL PRESS (fig 2-4). The indicator receives pressure indications from the engine oil pressure transmitter and provides readings in pounds per square inch (psi). The circuit receives electrical power from the 28 Vac bus and circuit protection is provided by the ENG circuit breaker in the ac circuit breaker panel.

g. Oil Pressure Caution Light. The ENGINE OIL PRESS caution light is located in the pedestal mounted CAUTION panel. The light is connected to a low pressure switch. When pressure drops below approximately 25 psi, the switch closes an electrical circuit, causing the caution light to illuminate. The circuit receives power from the 28 Vdc essential bus and is protected by the circuit breaker marked CAUTION LIGHTS.

h. Engine Chip Detector Caution Light. A magnetic plug is installed in the engine. When sufficient metal particles accumulate on the magnetic plug to complete the circuit, the ENGINE CHIP DET segment illuminates. The circuit receives power from the 28 Vdc essential bus and is protected by the circuit breaker marked CAUTION LIGHTS.

i. Engine Ice Detector. The ice detector system (ENGINE ICE DET caution light) is not connected.

j. Engine Icing Caution Light. The ENGINE ICING segment of the caution panel is not connected.

k. Engine Inlet Air Filter Clogged Warning Light. On helicopters prior to Serial No. 68-16066, the ENGINE INLET FILTER CLOGGED warning light is mounted on the upper area of the instrument panel (fig 2-4). When the inlet air filter becomes clogged, a differential pressure switch senses the condition and closes contacts to energize the filter caution light. Power is supplied from the 28 Vdc bus and circuit protection is provided by the CAUTION LIGHTS circuit breaker.

l. Engine Inlet Air Caution Light. The ENGINE INLET AIR segment of the caution panel will illuminate when the inlet air filter becomes clogged. Power is supplied from the 28 Vdc bus and protection is provided by the CAUTION LIGHT circuit breaker.

m. Engine Fuel Pump Caution Light. The ENGINE FUEL PUMP caution light is located in the pedestal-mounted panel. Failure of either fuel pump element will close an electrical circuit illuminating the caution light. The system receives power from the 28 Vdc essential bus and is protected by a circuit breaker marked CAUTION LIGHTS. One type of switch used on some aircraft will illuminate the caution light until normal operating pressure is reached. This momentary lighting does not indicate a pump element failure.

n. Emergency Fuel Control Caution Light. The emergency fuel control caution light is located in the pedestal-mounted caution panel. The illumination of the worded segment GOV EMER is a reminder to the pilot that the GOV switch is in the EMER position. Electrical power for the circuit is supplied from the 28 Vdc bus and is protected by a circuit breaker marked CAUTION LIGHTS.

o. Fuel Filter Caution Light. The FUEL FILTER caution light is located in the pedestal-mounted caution panel or a press to test light is located on the instrument panel. A differential pressure switch is mounted in the fuel line across the filter. When the filter becomes clogged, the pressure switch senses this and closes contacts to energize the caution light circuit. If clogging continues, the fuel bypass opens to allow fuel to flow around the filter. The circuit receives power from the 28 Vdc essential bus and is protected by a circuit breaker marked CAUTION LIGHTS.

Section IV. HELICOPTER FUEL SYSTEM

2-25. Fuel Supply System

a. Fuel System. The fuel system consists of five interconnected cells all filled from a single fitting on the right side of the helicopter. The two forward cells each contain a submerged boost pump. The boost pumps provide fuel pressure to prime the fuel line to the engine driven fuel pump. Each forward fuel cell is divided into two compartments by a lateral baffle fitted with a flapper valve to allow fuel flow from front to rear. The submerged boost pump is mounted on a sump assembly near the aft end of each forward cell and is connected by a hose to the pressure line outlet to the engine. Part of the pump output is diverted forward through a flow switch and hose to an ejector pump at front of cell. Induced flow of the ejector pump sends fuel through a hose over the baffle into the rear part of the cell, so that no significant quantity of fuel will be unusable in any flight attitude. The crashworthy system is designed to contain fuel during a severe, but survivable, crash impact to reduce the possibility of fire. Frangible fittings used to secure the fuel cells in the airframe are designed to fail and permit relative movement of the cells, without rupture, in event of a crash; self-sealing break-away valves are installed in the fuel lines at the fuel cell outlets and certain other locations. The break-away valves are designed to permit complete separation of components without loss of fuel. Rollover vent valves are installed on the aft fuel cells to provide protection in the event of a helicopter rollover during a crash. The system has .50 caliber ballistic protection in the lower two-thirds of the cell.

b. Closed Circuit Refueling System. Helicopter serial number 69-15292 and subsequent and modified helicopters provide a closed circuit refueling system when used with the mating nozzle. This system is capable of automatic shut-off of fuel flow when full.

c. Gravity Refueling. If helicopter is equipped with closed circuit refueling system and fuel servicing vehicle is not equipped with related nozzle for closed circuit refueling, a gravity system may be used.

2-26. Controls and Indicators

a. Fuel Switches. The fuel system switches consist of a main fuel switch, start fuel switch, and fuel transfer switches (fig 2-6) The FUEL START switch is not applicable on helicopters Serial No. 66-8574 through 66-8577, 66-16034 and subsequent, and earlier models so modified.

(1) Main Fuel Switch. The FUEL MAIN ON/OFF switch is located on the pedestal-mounted ENGINE panel (fig 2-6). The switch is protected from accidental operation by a spring-loaded toggle head that must be pulled up before switch movement can be accomplished. When the switch is in the ON position, the fuel valve opens, the electric boost pump(s) are energized and fuel flows to the engine. When the switch is in the OFF position the fuel valve closes and the electric boost pump(s) are de-energized. Electrical power for circuit operation is supplied by the 28 Vdc essential bus and is protected by circuit breakers FUEL VALVES, LH BOOST PUMP and RH BOOST PUMP.

(2) Fuel Start Switch. The FUEL START ON/OFF switch is located on the ENGINE panel. In the ON position the starting fuel solenoid valve is energized when the starter-ignition switch is pulled. When the START FUEL switch is in the OFF position the igniter

solenoid valve is de-energized. Electrical power for the circuit is supplied by the 28 Vdc essential bus and is protected by circuit breaker IGNITION SYSTEM IGNITER SOL.

(3) Fuel Control. Fuel flow and mode of operation is controlled by switches on the pedestal-mounted engine control panel (fig 2-6). The panel contains the MAIN FUEL ON/OFF or FUEL ON/OFF switch, START FUEL ON/OFF switch, two INT FUEL TRANS PUMP or INT AUX FUEL switches, and GOV AUTO/EMER switch. The switchover to emergency mode is accomplished by retarding the throttle to idle or off position and positioning the GOV AUTO/EMER switch to the EMER position. In the EMER position fuel is manually metered to the engine, with no automatic control features, by rotating the throttle twist grip.

b. Fuel Quantity Indicator. The fuel quantity indicator is located in the upper center area of the instrument panel (fig 2-4). This instrument is a transistorized electrical receiver which continuously indicates the quantity of fuel in pounds. The indicator is connected to three fuel transmitters mounted in the fuel cells. Two are mounted in the right forward cell and one in the center aft cell. Indicator readings shall be multiplied by 100 to obtain fuel quantity in pounds. Electrical power for operation is supplied from the 115 Vac system and is protected by circuit breaker FUEL QTY in the ac circuit breaker panel.

c. Fuel Gage Test Switch. The FUEL GAGE TEST switch is used to test the fuel quantity indicator operation (fig 2-4). Pressing the switch will cause the indicator pointer to move from the actual reading to a lesser reading. Releasing the switch will cause the pointer to return to the actual reading. The circuit receives power from the 115 Vac system and is protected by a circuit breaker marked FUEL QTY in the ac circuit breaker panel.

d. Fuel Pressure Indicator. The fuel pressure indicator displays the psi pressure of the fuel being delivered by the boost pumps from the fuel cells to the engine (fig 2-4). The circuit receives power from the 28 Vac bus and is protected by the FUEL PRESSURE circuit breaker in the ac circuit breaker panel.

e. Fuel Quantity Low Caution Light. The 20 MINUTE FUEL caution light will illuminate when there is approximately 185 pounds remaining. Electrical power is supplied from the 28 Vdc essential bus. The CAUTION LIGHTS circuit breaker protects the circuit.

f. Fuel Boost Pump Caution Lights. The LEFT FUEL BOOST and RIGHT FUEL BOOST caution lights will illuminate when the left/right fuel boost pumps fail to pump fuel. The circuits receive power from the 28 Vdc essential bus. Circuit protection is provided by the CAUTION LIGHTS, RH FUEL BOOST PUMP and LH FUEL BOOST PUMP circuit breakers. On helicopters prior to Serial No. 69-15292 a FUEL TANK SUMP PUMP circuit breaker is used instead of RH and LH BOOST PUMP circuit breakers.

2-27. Auxiliary Fuel System

Complete provisions have been made for installing an auxiliary fuel equipment kit in the helicopter cargo-passenger compartment. Two bladder type tanks can be installed on the aft bulkhead and transmission support structure. This allows the helicopter to be serviced with an additional 300 U.S. gallons of fuel (table 2-1).

a. Internal Fuel Transfer Switches. Two switches marked INT AUX FUEL LEFT/RIGHT are mounted in the ENGINE control panel (fig 2-6). Placing the switches to the forward position energizes the auxiliary fuel system. Fuel is transferred to the main fuel cells. An overfill limit switch is installed in the main fuel tank to prevent the auxiliary fuel pumps from overfilling the main fuel cells. Power is supplied by the dc essential bus and protected by the FUEL TRANS PUMP circuit breaker.

b. Auxiliary Fuel Low Caution Light. An AUX FUEL LOW caution light is provided to indicate when the auxiliary fuel tanks are empty. The light will illuminate only when the fuel transfer switches are in the forward position, and the auxiliary tanks are empty. The circuit receives power from the 28 Vdc essential bus and is protected by the CAUTION LIGHTS circuit breaker.

Section V. FLIGHT CONTROL SYSTEM

2-28. Description The flight control system is a hydraulic assisted positive mechanical type, actuated by conventional helicopter controls. Complete controls are provided for both pilot and copilot. The system includes a cyclic system, collective control system, tail rotor system, force trim system, synchronized elevator, and a stabilizer bar.

2-29. Cyclic Control System The system is operated by the cyclic stick movement (fig 2-5). Moving the stick in any direction will produce a corresponding movement of the helicopter which is a result of a change in the plane of rotation of the main rotor. The pilot cyclic contains the cargo release switch, radio ICS switch, armament fire control switch, hoist switch and force trim switch. Desired operating friction can be induced into the control stick by hand tightening the friction adjuster.

a. *Synchronized Elevator.* The synchronized elevator (fig 2-1) is located on the tailboom. It is connected by control tubes and mechanical linkage to the fore and aft cyclic system. Fore and aft movement of the cyclic control stick will produce a change in the synchronized elevator attitude. This improves controllability within the cg range.

b. *Stabilizer Bar.* The stabilizer bar is mounted on the main rotor hub trunnion assembly in a parallel plane, above and at 90 degrees to the main rotor blades. The gyroscopic and inertial effect of the stabilizer bar will produce a damping force in the rotor rotating control system and thus the rotor. When an angular displacement of the helicopter/mast occurs the bar tends to remain in its trim plane. The rate at which the bar rotational plane tends to return to a position perpendicular to the mast is controlled by the hydraulic dampers. By adjusting the dampers, positive dynamic stability can be achieved, and still allow the pilot complete responsive control of the helicopter.

2-30. Collective Control System The collective pitch control lever controls vertical flight (fig 2-5). When the lever is in full down position, the main rotor is at minimum pitch. When the lever is in the full up position, the main rotor is at maximum pitch. The amount of lever movement determines the angle of attack and lift developed by the main rotor, and results in ascent or descent of the helicopter. Desired operating friction can be induced into the control lever by handtightening the friction adjuster (fig 2-5). A grip-type throttle and a switch box assembly are located on the upper end of the collective pitch control lever. The pilot switch box contains the starter switch, governor rpm switch, engine idle stop release switch, and landing light/searchlight switches. A collective lever down lock is located on the floor below the collective lever. The copilot collective lever contains only the grip-type throttle, governor rpm switch, and starter switch when installed. The collective pitch control system has built-in breakaway (friction) force to move the stick up from the neutral (center of travel) position of eight to ten pounds with hydraulic boost ON.

2-31. Tail Rotor Control System The system is operated by pilot/copilot anti-torque pedals (fig 2-5). Pushing a pedal will change the pitch of the tail rotor blades resulting in directional control. Pedal adjusters are provided to adjust the pedal distance for individual comfort. A force trim system is connected to the directional controls.

2-32. Force Trim System Force centering devices are incorporated in the cyclic controls and directional pedal controls. These devices are installed between the cyclic stick and the hydraulic servo cylinders, and between the anti-torque pedals and the hydraulic servo cylinder. The devices furnish a force gradient or "feel" to the cyclic control stick and anti-torque pedals. A FORCE TRIM ON/OFF switch is installed on the miscellaneous control panel to turn the system on or off (fig 2-6). These forces can be reduced to zero by pressing and holding the force trim pushbutton switch on the cyclic stick grip or moving the force trim switch to off.

Section VI. HYDRAULIC SYSTEM

2-33. Description The hydraulic system is used to minimize the force required by the pilot to move the cyclic, collective and pedal controls. A hydraulic pump, mounted on and driven by the transmission supplies pressure to the hydraulic servos. The hydraulic servos are connected into the mechanical linkage of the helicopter flight control system. Movement of the controls in any direction causes a valve, in the appropriate system, to open and admit hydraulic pressure which actuates the cylinder, thereby reducing the force-load required for control movement. Irreversible valves are installed on the cyclic and collective hydraulic servo cylinders to prevent main rotor feedback to the cyclic and collective in the event of hydraulic system malfunction.

2-34. Control Switch The hydraulic control switch is located on the miscellaneous panel (fig 2-6). The switch is a two-position toggle type labeled HYD CONTROL ON/OFF. When the switch is in the ON position, pressure is supplied to the servo system. When switch is in the OFF position the solenoid valve is closed and no pressure is supplied to the system. The switch is a fail-safe type. Electrical power is required to turn the switch off.

2-35. Reservoir and Sight Glass The hydraulic reservoir is a gravity feed type and is located at the right aft edge of the cabin roof (fig 2-10). The reservoir and sight gage are visible for inspection through a plastic window in the transmission fairing.

2-36. Hydraulic Filter A line filter is installed on helicopters prior to Serial No. 68-16050. This filter has no indicator. Helicopters Serial No. 68-16050 and subsequent, or those modified by MWO have an improved filter system. When the filter is clogged it will give a visual warning by raising a red indicator button. The red button pops out when a set differential pressure across the element is exceeded. Once actuated, the indicator will remain extended until reset manually. When the indicator is in reset position, it will be hidden from view. An inspection window may be provided to permit ready visual access to the filter indicator. The transparent window is located on forward face of the transmission bulkhead.

2-37. Hydraulic Pressure Caution Light Low hydraulic system pressure will be indicated by the illumination of HYD PRESSURE segment on the CAUTION panel. Moderate feedback forces will be noticed in the controls when moved.

2-38. Electrical Circuit Electrical power for hydraulic system control is supplied by the 28 Vdc essential bus. The circuit is protected by the HYD CONT circuit breaker.

Section VII. POWER TRAIN SYSTEM

2-39. Transmission The transmission is mounted forward of the engine and coupled to the power turbine shaft at the cool end of the engine by the main driveshaft. The transmission is basically a reduction gearbox, used to transmit engine power at a reduced rpm to the rotor system. A freewheeling unit is incorporated in the transmission to provide a quick-disconnect from the engine if a power failure occurs. This permits the main rotor and tail rotor to rotate in order to accomplish a safe autorotational landing. The tail rotor drive is on the lower aft section of the transmission. Power is transmitted to the tail rotor through a series of driveshafts and gearboxes. The rotor tachometer generator, hydraulic pump, and main dc generator are mounted on and driven by the transmission. A self-contained pressure oil system is incorporated in the transmission. The oil is cooled by an oil cooler and turbine fan. The engine and transmission oil coolers use the same fan. The oil system has a thermal bypass capability. An oil level sight glass, filler cap, and magnetic chip detector are provided. A transmission oil filter is mounted in a pocket in upper right aft corner of sump case, with inlet and outlet ports through internal passages. The filter incorporates a bypass valve for continued oil flow if screens become clogged. The transmission external oil filter is located in the cargo-sling compartment on right side wall, and is connected into the external oil line. A bypass valve is incorporated, set to open at a set differential pressure to assure oil flow if filter element should become clogged. A bypass condition will be indicated by extension of a red indicator on the filter head.

2-40. Gearboxes

a. *Intermediate Gearbox—42 Degree*. The 42 degree gearbox is located at the base of the vertical fin. It provides 42 degree change of direction of the tail rotor driveshaft. The gearbox has a self-contained wet sump oil system. An oil level sight glass, filler cap, vent (fig 2-10) and magnetic chip detector are provided.

b. *Tail Rotor Gearbox—90 Degree*. The 90 degree gearbox is located at the top of the vertical fin. It provides a 90 degree change of direction and gear reduction of the tail rotor driveshaft. The gearbox has a self-contained wet sump oil system. An oil level sight glass, vented filler cap (fig 2-10) and magnetic chip detector are provided.

2-41. Driveshafts

a. *Main Driveshaft*. The main driveshaft connects the engine output shaft to the transmission input drive quill.

b. *Tail Rotor Driveshaft*. The tail rotor driveshaft consists of six driveshaft and four hanger bearing assemblies. The assemblies and the 42 degree and 90 degree gearboxes connect the transmission tail rotor drive quill to the tail rotor.

2-42. Indicators and Caution Lights

a. *Transmission Oil Pressure Indicator*. The TRANS OIL pressure indicator is located in the center area of the instrument panel (fig 2-4). It displays the transmission oil pressure in psi. Electrical power for the circuit is supplied from the 28 Vac bus and is protected by the XMSN circuit breaker in the ac circuit breaker panel.

b. Transmission Oil Pressure Low Caution Light. The XMSN OIL PRESS segment in the CAUTION panel will illuminate when the transmission oil pressure drops below about 30 psi. The circuit receives power from the essential bus. Circuit protection is supplied by the CAUTION LIGHTS circuit breaker.

c. *Transmission Oil Temperature Indicator.* The transmission oil temperature indicator is located in the center area of the instrument panel. (Fig 2-4). The indicator displays the temperature of the transmission oil in degrees Celsius. The electrical circuit receives power from the essential bus and is protected by the TEMP IND ENG — XMSN circuit breaker in the dc breaker panel. This is a wet bulb system dependent on fluid for valid indication.

d. Transmission Oil Hot Caution Light. The XMSN OIL HOT segment in the CAUTION panel will illuminate when the transmission oil temperature is above 110°C (230°F). The circuit receives power from the essential bus and is protected by the CAUTION LIGHTS circuit breaker. This is a wet bulb system dependent on fluid for valid indication.

e. Transmission and Gearbox Chip Detector.

(1) *Chip Detector Caution Light.* Magnetic inserts are installed in the drain plugs of the transmission sump, 42 degree gearbox, and the 90 degree gearbox. When sufficient metal particles collect on the plugs to close the electrical circuit the CHIP DETECTOR segment in the CAUTION panel will illuminate. A self-closing, spring-loaded valve in the drain plug permits the magnetic plugs to be removed without the loss of oil. The circuit is powered by essential bus and protected by the CAUTION LIGHTS circuit breaker.

(2) *Chip Detector Switch.* A CHIP DET switch (fig 2-6) is installed on a pedestal mounted panel. The switch is labeled BOTH, XMSN, and TAIL ROTOR and is spring loaded to the BOTH position. When the CHIP DETECTOR segment in the CAUTION panel lights up position the switch to XMSN, then TAIL ROTOR, to determine the trouble area. CHIP DET caution light will remain on when a contaminated component is selected. The light will go out if the noncontaminated component is selected.

Section VIII. ROTORS

2-43. Main Rotor

a. *Description.* The main rotor is a two blades, semi-rigid, seesaw type. The two all metal blades are connected to a common yoke by blade grips and pitch change bearing with tension straps to carry centrifugal forces. The rotor assembly is connected to the mast with a nut. The nut has provisions for hoisting the helicopter. A stabilizer bar is mounted on the trunnion 90 degrees to the main rotor. Blade pitch change is accomplished by movements of the collective and cyclic controls. The main rotor is driven by the transmission through the mast. The mast is tilted 5 degrees forward.

a1. *Hub Spring.* As an aid in controlling rotor flapping, a hub spring kit has been installed in the rotor system for those helicopters modified by MWO 55-1520-242-50-1. Two nonlinear elastomeric springs are attached to a support affixed to the mast. The hub springs provide an additional margin of safety in the event of an inadvertent excursion of the helicopter beyond the approved flight envelope.

b. *RPM Indicator.* The rpm indicator is part of the dual tachometer (fig 2-4). The tachometer inner scale displays the rotor rpm. The inner scale pointer is marked with an "R".

2-44. Tail Rotor The tail rotor is a two-bladed, semi-rigid delta-hinge type. Each blade is connected to a common yoke by a grip and pitch change bearings. The hub and blade assembly is mounted on the tail rotor shaft with a delta-hinge trunnion and a static stop to minimize rotor flapping. Blade pitch change is accomplished by movement of the anti-torque pedals which are connected to a pitch control system through the tail rotor (90 degree) gearbox. Blade pitch change serves to offset torque and provide heading control.

Section IX. UTILITY SYSTEMS

2-45. Pitot Heater The pitot tube is equipped with an electrical heater (fig 2-1). The PITOT HTR switch is on the overhead console panel (fig 2-5). ON position activates the heater in the tube and prevents ice from forming in the pitot tube. OFF position de-activates the heater. The electrical circuit for the system receives power from the essential bus and is protected by the PITOT TUBE HTR circuit breaker.

2-46. Heated Blanket Receptacles Two or six electrical receptacles are provided to supply 28 Vdc for heated blankets. They are mounted on the inside cabin roof structure aligned with the forward edge of the transmission support structure. The electrical circuit for the receptacles receive power from the nonessential bus. Circuit protection is provided by the HEATED BLANKET circuit breakers.

2-47. Data Case A data case for maps, flight reports, etc., has been provided and is located at the aft end of the pedestal.

2-48. Blackout Curtains Provisions have been made for installing blackout curtains behind pilot and copilot seats and between forward and aft cabin sections. Other blackout curtains may be installed over both cabin door windows and window in removable doorpost.

2-49. Blood Bottle Hangers Provisions have been made for six blood bottle hangers on the inside of the cabin roof structure within easy reach of the medical attendant station, for administration of blood to litter patients in flight.

2-50. External Cargo Rear View Mirror A mirror is installed under the right lower nose window to give the pilot clear visibility of the external cargo. This mirror may be removed and stowed in the heater compartment when provisions are installed.

2-51. Windshield Wiper

Caution

Do not operate the wiper on a dry or dirty windshield.

a. Two windshield wipers are provided, one for the right section of the windshield and one for the left section of the windshield.

b. The wipers are driven by electric motors with electric power supplied by the dc electrical system. Circuit protection is provided by WINDSHIELD WIPER PILOT and WINDSHIELD WIPER COPILOT circuit breakers on the dc circuit breaker panel.

c. The windshield wiper switches on the overhead console mounted MISC panel (fig 2-5) have five positions: HIGH, MED, LOW, OFF, and PARK.

d. The panel also has a selector which permits the operation of windshield wiper for pilot, copilot or both as desired.

Section X. HEATING AND VENTILATION

2-52. Ventilating System

a. Description. The ventilating system consists of four independently controlled exterior air scoop ventilators. Two single orifice air scoops are located on top of the cockpit section, and two double orifice air scoops are on top of cabin. The amount of air entering the cabin through the ventilators is regulated by the butterfly valve control.

b. Operation. Rotate butterfly valve control to desired position to provide outside air for flight.

2-53. Heating and Defrosting System Three different types of heating and defrosting systems may be used on these helicopters. They are the bleed air heater, combustion heater, and the auxiliary exhaust heat exchanger. Each system is described separately in the following paragraphs.

a. Bleed Air Heating and Defrosting System. There are some differences in the bleed air heating systems in use. These differences are shown in figure 2-7 with the following exception: helicopters prior to Serial No. 65-9565 have under-seat heater outlets; subsequent helicopters have aft pedestal outlets instead of the under-seat outlets. Heat is supplied to all bleed air heaters by the compressor bleed air system. Electric power for operation of the controls is supplied from the essential bus and is protected by the CABIN HEATER CONT circuit breaker. On helicopters Serial No. 66-16868 through 70-16518, temperature is controlled by a thermostat located on the right doorpost. Helicopters Serial No. 71-20000 and subsequent are protected by two circuit breakers marked CABIN HEATER OUTLET VALVE and CABIN HEATER AIR VALVE. Refer to figure 2-7 for controls and their function.

b. Combustion Heating and Defrosting System. With the combustion heater installed, a combination of bleed air heat and combustion heat is available for heating. Bleed air may be used for defrosting and combustion heat for heating, or combustion heat may be used for defrosting only with bleed air heat off. The MAIN FUEL switch must be ON, actuating the right boost pump, before fuel is available for combustion heater operation (fig 2-6). A purge switch keeps the blowers operating after shutdown to prevent residual heat buildup. If blower air pressure drops too low, the combustion heater will stop automatically. An overheat switch also automatically turns the heater off in the event of malfunction. The starting cycle has to be repeated to start the combustion heater. Electric power to operate the heater controls is supplied from the essential bus and is protected by the CABIN HEATER CONT circuit breaker. Refer to figure 2-7 for controls and their function.

c. *Auxiliary Exhaust Heater System.* The auxiliary exhaust heater system consists of an exhaust gas exchanger, and a bleed air driven fan for circulating ambient air through the heat exchanger. A mixing valve controls air to maintain the desired outlet temperature. The exhaust heater system controls consist of the cabin heating panel (fig 2-7), a thermostat dial on the right doorpost and the air directing lever on the pedestal.

Section XI. ELECTRICAL POWER SUPPLY AND DISTRIBUTION SYSTEM

2-54. DC and AC Power Distribution Figure 2-8 depicts the general schematic of the dc and ac power distribution system. The dc power is supplied by the battery, main generator, standby starter-generator, or the external power receptacle. The 115 Vac power is supplied by the main or spare inverters. The 28 Vac power is supplied by a transformer which is powered by the inverter.

2-55. DC Power Supply System The dc power supply system is a single conductor system with the negative leads of the generator grounded in the helicopter fuselage structure. The main generator voltage will vary from 27 to 28.5 depending on the average ambient temperature. In the event of a generator failure the nonessential bus is automatically de-energized. The pilot may override the automatic action by positioning the NON-ESS BUS switch on the DC POWER control panel to MANUAL ON.

2-56. External Power Receptacle The external power receptacle (fig 2-1) transmits the ground power unit 28 Vdc power to the power distribution system. A 7.5 KW GPU is recommended for external starts.

2-57. Battery

WARNING

If battery overheats, do not open battery compartment. Battery fluid will cause burns. An overheated battery may cause thermal burns and may explode.

The battery supplies approximately 24 Vdc power to the power distribution system when the generators and external power receptacle are not in operation (fig 2-1).

2-58. Main and Standby Starter-Generator The 30 volt 300 ampere main generator is mounted on and driven by the transmission. A standby starter-generator, rated at 300 amperes is mounted on the engine accessory drive section. The standby furnishes generator power in the event of main generator failure.

2-59. DC Power Indicators and Controls

a. *Main Generator Switch.* The MAIN GEN switch (fig 2-5) is on the overhead console DC POWER panel. In the ON position the main generator supplies power to the distribution system. The RESET position is spring-loaded to the OFF position. Momentarily holding the switch to RESET position will reset the main generator. The OFF position isolates the generator from the system. The circuit is protected by the GEN & BUS RESET in the dc circuit breaker panel.

b. *Battery Switch.* The BAT switch is located on the DC POWER control panel (fig 2-5). ON position permits the battery to supply power. ON position also permits the battery to be charged by the generator. The OFF position isolates the battery from the system.

c. *Starter-Generator Switch.* The STARTER GEN switch is located on the DC POWER control panel (fig 2-5). The START position permits the starter-generator to function as a starter. The STBY GEN position permits the starter-generator to function as a generator.

d. *Nonessential Bus Switch.* The NON-ESS BUS switch is located on the DC POWER control panel (fig 2-5). The NORMAL ON position permits the nonessential bus to receive dc from the main generator. The MANUAL ON position permits the nonessential bus to receive dc from the starter-generator when it has automatically been de-energized by a main generator failure.

e. *DC Voltmeter Selector Switch.* The VM switch is located on the DC POWER control panel (fig 2-5). The switch permits monitoring of voltage being delivered from any of the following; BAT, MAIN GEN, STBY GEN, ESS BUS, and NON-ESS BUS.

f. DC Voltmeter. The dc voltmeter is located in the center area of the instrument panel and is labeled VOLT DC (fig 2-4). Direct current voltage is indicated on the voltmeter as selected by the VM switch in the overhead console.

g. DC Loadmeters—Main and Standby. Two direct current loadmeters are mounted in the lower center area of the instrument panel (fig 2-4). The MAIN GEN loadmeter indicates the percentage of main generator rated capacity being used. The STBY GEN loadmeter indicates the percentage of standby generator rated capacity being used. The loadmeters will not indicate percentage when the generators are not operating.

2-60. Circuit Breaker Panel The dc circuit breaker panel is located in the overhead console (fig 2-5). In the "pushed in" position the circuit breakers provide circuit protection for dc equipment. In the "pulled out" position the circuit breakers de-energize the circuit. In the event of an overload the circuit breaker protecting that circuit will "pop out". Each breaker is labeled for the particular circuit it protects. Each applicable breaker is listed in the paragraph describing the equipment it protects.

2-61. AC Power Supply System Alternating current is supplied by two inverters (fig 2-8). They receive power from the essential bus and are controlled from the AC POWER control panel (fig 2-5).

2-62. Inverters Either the main or spare inverter (at the pilots option) will supply the necessary 115 Vac to the distribution system. The inverters also supply 115 Vac to the 28 volt ac transformer which in turn supplies 28 Vac to the necessary equipment. Circuit protection for the inverters is provided by the MAIN INVTR PWR and SPARE INVTR PWR circuit breakers.

2-63. AC Power Indicators and Controls

a. Inverter Switch. The INVTR switch is located on the AC POWER control panel in the overhead console (fig 2-5). The switch is normally in the MAIN ON position, to energize the main inverter. In the event of a main inverter failure the switch can be positioned to SPARE ON to energize the spare inverter. Electrical power to the INVTR switch is supplied from the essential bus. Circuit protection is provided by the INVTR CONT circuit breaker.

b. AC Failure Caution Light. The INST INVERTER caution light will illuminate when the inverter in use fails or when the INVTR switch is in the OFF position.

c. AC Voltmeter Selector Switch. The AC PHASE VM switch is located on the AC POWER control panel (fig 2-5). The switch is used to select any one of the three phases of the 115 Vac three-phase, current for monitoring on the ac voltmeter. The three positions on the switch are: AB, AC and BC. Each position indicates that respective phase of the 115 Vac on the ac voltmeter.

d. AC Voltmeter. The ac voltmeter is mounted on center area of the instrument panel (fig 2-4). The ac voltage output from the inverter (main or spare) is indicated on this instrument. The voltage indicated on any of the three selected positions should be 112 to 118 Vac.

2-64. AC Circuit Breaker Panel The ac circuit breaker panel is located on the right side of the pedestal panel (fig 2-5). The circuit breakers in the "pushed in" position provide circuit protection for the equipment. The breakers in the "pulled out" position de-energize the circuit. The breakers will "pop out" automatically in the event of a circuit overload. Each breaker is labeled for the particular circuit it protects. Each applicable breaker is listed in the paragraph describing the equipment it protects.

Section XII. LIGHTING

NOTE

Visible light means the light is visible to the unaided eye. NVG light means the light is visible only with the aid of the Night Vision Goggles.

2-65. Position Lights. The position lights consist of eight visible lights and five NVG lights (fig 2-1).

a. Visible Position Light Lights.

(1) *Configurations.* Two red lights are mounted on the left side of the fuselage, one above and one below the cabin door. Two green lights are mounted on the right side of the fuselage, one above and one below the cabin door. Two white lights are mounted on top of the fuselage just inboard of the red and green lights. One white light is mounted on the bot-

tom center of the fuselage,and one white light is mounted on the tailboom vertical fin. Electric power to operate the lights is supplied from the essential bus. Circuit protection is provided by the NAV LIGHTS circuit breaker in the dc circuit breaker panel.The position lights may be protected by the FUS LIGHTS circuit breakers.

(2) *Operation of Visible Position Lights.* The position lights are controlled by the POSITION switches on the EXT LTS panel on the overhead console (fig 2-5). A three-position switch permits selection of STEADY, OFF, or FLASH. Another two-position switch controls brilliance and is marked DIM and BRIGHT. When the three-position switch is in STEADY position, all eight navigation lights are illuminated. In FLASH position, on helicopters prior to Serial No.64-13901, the colored lights illuminate alternately with the white lights. On later models only the colored lights and the aft white light flash.

b. NVG Position Lights.

(1) *Configuration.* These lights are invisible to the unaided eye. They are designed to provide observed aircraft position, attitude, and distance during covert formation NVG flight and other covert multi-aircraft NVG operations. Lights are located on the top left and right side above the jump door of each side and one each under the pilot and copilot doors. The rear NVG position light is located on a mount under the visible position light.

(2) *Operation of the NVG Position Lights.* The control panel for the lights is located in the front-most panel of the left overhead console (fig 2-5). Five intensity positions are provided on the control panel; OFF, 1, 2, 3, 4, and BRT (BRIGHT). The lights are invisible to the unaided eye and must be checked or otherwise viewed with AN/PVS-5, AN/AVS-6, or AN/PVS-7 NVG. The visible position EXT LTS must be in the off position when the NVG lights are used. The NVG lights must be in the off position when not being used with NVG. The NVG lights do not flash.

2-66. Anti-Collision Light.

a. General. The anti-collision light is located on the top aft fuselage area(fig 2-1). Electric power to operate the light is supplied from the essential bus. Circuit protection is provided by the ANTI COLL LIGHT circuit breaker.

b. Operation. The ON position of the ANTI COLL light switch illuminates the anti-collision light and starts rotation of the light (fig 2-5). OFF position de-energizes the light.

NOTE

UH-1H and UH-1V differ in that the UH-1H has the IR band-pass filter on the searchlight, not on the landing light. The UH-1V has the IR band-pass filter on the landing light, not on the searchlight.

2-67. Landing Light.

a. UH-1H.

(1) *General.* The landing light is flush-mounted to the underside of the fuselage (fig 2-1). It may be extended or retracted to improve forward illumination. Electric power to operate the system is supplied from the essential bus. Circuit protection is provided by the LDG LIGHT PWR and LDG SEARCH LIGHT CONT circuit breakers.

(2) *Operation.* Landing light switches are on the pilot collective lever switch box (fig 2-5). The ON position of the LDG LT switch causes the landing light to illuminate; OFF turns the light off. The EXT position of the LDG LT EXT OFF RETR extend the landing light to the desired position; RETR position retracts the light. The OFF position stops the light during extension or retraction. The light automatically stops at the full extend/retract position.

b. UH-1V.

(1) *General.* The landing light on UH-1V aircraft has a filtering lens for assisting NVG flight. Other than the NVG infrared band pass filter, the UH-1V landing light is functionally the same as the UH-1H.

(2) *Operation.* The UH-1V landing light operates the same as the UH-1H landing light, except that NVG must be worn to use it.

2-68. Searchlight.

a. UH-1V.

(1) *General.* The searchlight is flush-mounted to the underside of the fuselage (fig 2-1). The light can be extended and retracted for search illumination. At any desired position in the extend or retract arc, the light may be stopped and rotated to the left or right. Electric power to operate the light is supplied from the essential bus. Circuit protection is

provided by the SEARCHLIGHT PWR and LDG & SEARCHLIGHT CONT circuit breakers.

(2) *Operation.*

a. Searchlight Switch. The pilot SL switch ON position illuminates the light (fig 2-5). The OFF position deactivates the light. The STOW position retracts the light into the fuselage well.

b. Searchlight Control Switch. The pilot SEARCH CONT switch EXT position extends the light from the fuselage well and moves it forward (fig 2-5). RETR position moves the light aft. The L and R position rotates the light left and right.

b. UH-1H.

(1) *General.* The searchlight differs functionally from the UH-1V searchlight only in that an infrared band pass filter is installed over the light to assist in NVG flight.

(2) *Operation.* The operation of the NVG searchlight is identical to the operation of the UH-1V searchlight, except that the NVG filter provides assistance for NVG flight.

2-69. Dome Lights.

a. General. The dome lights provide overhead lighting for the cabin area.The forward light is controlled by the FWD switch on the DOME LT panel when installed on the overhead console. When the DOME LT panel is not installed the FWD and AFT DOME LT are controlled by the aft switch in the roof. The aft dome lights are controlled by the switch on the AFT DOME LTS panel on the roof. Electric power to operate the dome light is supplied from the 28 Vdc essential bus. Circuit protection is provided by the DOME LIGHTS circuit breaker.

b. Operation. To operate the FWD dome light, position the FWD switch to WHITE for white light, NVG for green light and OFF to turn light off. The aft dome lights panel has two switches. The WHITE/OFF NVG switch functions are the same as the FWD switch. Rotation of the rheostat marked OFF/MED/BRT increases or decreases the brightness of the aft dome lights.

2-70. Cockpit Map Lights.

a. General. Two cockpit lights (NVG green) are provided, one above the pilot and one above the copilot (fig 2-5). Each light is controlled individually. The lights receive power from the essential bus and are protected by the COCKPIT LIGHTS circuit breaker.

b. Operation. Rheostat switches are part of each light assembly. Brightness is increased by turning the rheostat clockwise or dimmed by turning counterclockwise. These lights are for NVG or unaided eye use.

2-71. Instrument Lights. The instrument lights control panel is located in the overhead console (fig 2-5). The panel contains six switch/rheostats for activating and controlling the brightness of the various instrument lights. Each switch/rheostat functions the same. OFF position de-energizes the circuit, clockwise rotation increases brightness of the lights and counterclockwise rotation decreases brightness. The lights of all instruments receive electric power from the 28 Vdc essential bus, except the pilot attitude indicator, the pilot RMI, and the turn and bank indicators which receives 5 Vdc from the essential bus through resistor R24, which drops the voltage to 5 Vdc. On UH-1V aircraft, the pilot attitude indicator, the pilot RMI, and the turn and bank indicators receive the 5 Vdc from the pilot solid state device for providing 5 Vdc from the 28 Vdc essential bus. All other UH-1V instruments are illuminated by 28 Vdc from the 28 Vdc essential bus. On UH-1H aircraft the instrument lighting is protected by CONSOLE PEDLIGHTS, INST PANEL LIGHTS, and INST SEC LIGHTS circuit breakers. On UH-1V aircraft the instrument lights are protected by the same circuit breakers as the UH-1H aircraft, except the PILOT 5 VOLT LIGHTS circuit breaker is included in the protection. On UH-1V aircraft the "HI" and "LO" indicators and the digital readout illumination levels on the radar altimeter are jointly controlled by the independent altimeter rheostat.

a. Pilot Instrument Lights. The pilot instrument lights furnish illumination for the following instruments; gas producer tachometer, torquemeter, exhaust temperature indicator, dual tachometer, airspeed indicator, clock, vertical velocity indicator, turn and slip indicator, altimeter, attitude indicator, radio magnetic indicator, DME indicator, standby compass, pilot collective switch box and radar altimeter (if installed). These lights are all on one circuit and are controlled by the switch/rheostat marked PILOT on the INST LTG control panel.Circuit protection is provided by the INST PANEL LIGHTS and PILOT 5 VOLT LIGHTS(UH-1V) circuit breakers.

b. On UH-1V aircraft when the radar altimeter, AN/APN-209 is installed, turning the rheostat to OFF provides full illumination to the digital readout and HI-LO warning lights on the pilot and copilot height indicators. This feature enables the pilot and copilot to read the displays during daytime operations.

c. Copilot Instrument Lights. The copilot instrument lights furnish illumination for the instruments on the copilot section of the instrument panel. These instruments consist of an airspeed indicator, attitude indicator, radar altimeter (if installed on UH-1V), altimeter, vertical velocity indicator and radio magnetic indicator. The copilot instrument lights are all on one circuit, and are controlled by the switch/rheostat marked COPILOT on the INST LTG control panel. Circuit protection is provided by INST PANEL LIGHTS circuit breaker. Circuit protection is provided by INST PANEL LIGHTS and COPILOTS 5 VOLT LIGHTS circuit breaker.

d. Engine Instrument Lights. The engine instrument lights furnish illumination for the following instruments: transmission oil temperature, fuel quantity, transmission oil pressure, engine oil pressure, loadmeters, ac voltmeter, fuel pressure indicator, engine oil temperature gage, and dc voltmeter. Each instrument is individually iluminated and control is accomplished by the switch/rheostat marked ENGINE on the INST LTG control panel. Circuit protection is provided by the INST PANEL LIGHTS circuit breaker.

e. Secondary Instrument Lights.

(1) The four secondary instrument lights are spaced across the top of the instrument panel shield (fig 2-4). These lights furnish secondary illumination for the instrument panel face. The lights are activated and controlled by the switch/rheostat marked SEC on the INST LTG control panel. Circuit protection is provided by the INST SEC LIGHTS circuit breaker.

(2) *Pedestal Utility Light.* The pedestal utility light is provided for general use but also provides illumination for radio which are not illuminated. The light is operated by an OFF and ON switch on the panel on which it is mounted. The intensity of the light is controllable from full bright to dim or OFF, by the same control. The light is protected by the COCKPIT LTS circuit breaker in the overhead panel.

f. Emergency Lighting. Master Caution Fire Warning and Low RPM Indicators.The Master Caution, Fire, and Low RPM Warning Indicators are equipped with flip filters for use during NVG operations. The indicators must be uncovered for unaided operations during daylight and night.

2-72. Overhead Console Panel Lights The overhead console panel lights furnish illumination for all overhead panels (fig 2-5). Each panel is individually illuminated and control is accomplished by the switch/rheostat, marked CONSOLE on the INST LTG control panel. Circuit protection is provided by the CONSOLE PED LIGHTS circuit breaker.

NOTE

All "press-to-test" and cateye indicators are dimming type NVG green. Differentiation as to which indicator is illuminated must be determined by location since color coding is not used. In addition, the operator must return all indicators to the full bright position to assure visibility. On applicable indicators, dimming may be accomplished during pre-flight check to meet the operator's needs.

2-73. Pedestal Lights The pedestal lights provide illumination for the control panels on the pedestal (fig 2-5). Most panels are individually illuminated and intensity control is accomplished by the switch/rheostat marked PED on the INST LTG control panel overhead. On some panels, the internal lighting has been discontinued. These panels are illuminated by the goosenecked utility light mounted to the rear of the pedestal. The illumination can be placed on any area of the pedestal by adjusting the gooseneck postion. The intensity and ON-OFF function is controlled by the switch/rheostat mounted on the panel with the utility light. Circuit protection for the pedestal lighting is provided by the CONSOLE PED LIGHTS circuit breaker.

2-74. Transmission Oil Level Light A transmission oil level light is installed to provide illumination to check the transmission oil sight gage. The circuit is activated by a button-type switch marked XMSN OIL LEVEL LT SWITCH and is located on the right side of the transmission forward bulkhead. Electric power for the transmission oil level light circuit is supplied by the battery. Circuit protection is provided by the battery voltmeter circuit breaker located in the oil cooler compartment or forward radio compartment.

2-75. Spare Lamp Kit The spare lamp kit is located on the left side of the overhead console. The kit contains spare light bulb for the segment panel lights, the instrument lights, pedestal and overhead console lights, master caution and segment caution lights, all press to test lights, the rpm and fire warning lights, and the dome lights. All bulbs except the dome light bulbs may be replaced without the use of tools.

Section XIII. FLIGHT INSTRUMENTS

2-76. Airspeed Indicators The pilot and copilot airspeed indicators display the helicopter indicated airspeed (IAS) in knots (fig 2-4). The IAS is obtained by measuring the difference between impact air pressure from the pitot tube and the static air pressure from the static ports (fig 2-1).

NOTE

Indicated airspeeds are unreliable below 20 Knots due to rotor downwash.

2-77. Turn and Slip Indicator The turn and slip indicator displays the helicopter slip condition, direction of turn and rate of turn (fig 2-4). The ball displays the slip condition. The pointer displays the direction and rate of the turn. The circuit receives power from the essential bus and is protected by the TURN & SLIP IND circuit breaker.

2-78. Vertical Velocity Indicator The vertical velocity indicator displays the helicopter ascent and descent speed in feet per minute (fig 2-4). The indicator is actuated by the rate of atmospheric pressure change.

2-79. Pressure Altimeter The pressure altimeter (ALT) furnishes direct readings of height above sea level and is actuated by the pitot static system (fig 2-4). Two altimeters are provided, one for the pilot and one for the copilot. (Refer to chapter 3 for operation.)

2-80. Attitude Indicators

a. Pilot Attitude Indicator. The pilot attitude indicator is located on the pilot section of the instrument panel (fig 2-4). The indicator displays the pitch and roll attitude of the helicopter. An OFF warning flag in the indicator is exposed when electrical power to the system is removed. However, the OFF flag will not indicate internal system failure. The attitude indicator has an electrical trim in the roll axis in addition to the standard pitch trim. The attitude indicator is operated by 115 Vac power, supplied by the inverter. Circuit protection is provided by the PILOT ATTD circuit breakers in the ac circuit breaker panel.

Caution

The copilot attitude indicator shall be caged only in a straight and level attitude. The caging knob shall never be pulled violently.

b. Copilot Attitude Indicator. The copilot attitude indicator is located in the copilot section of the instrument panel (fig 2-4). It is operated by 115 Vac power supplied by the inverter. Circuit protection is provided by the COPILOT ATTD circuit breakers in the ac circuit breaker panel. In a climb or dive exceeding 27 degrees of pitch the horizontal bar will stop at the top or bottom of the case and the sphere then becomes the reference. The copilot attitude indicator may be caged manually by pulling the PULL TO CAGE knob smoothly away from the face of the instrument to the limit of its travel and then releasing quickly.

2-81. Free-Air Temperature Indicator (FAT) The free-air temperature indicator is located at the top center area of the windshield (fig 2-5). The indicator displays the free air temperature in degrees Celsius.

2-82. Standby Compass The standby (magnetic) compass is mounted in a bracket at the center right edge of the instrument panel (fig 2-4). A deviation in magnetic compass indications will occur when the landing light, searchlights or pitot heat are turned on.

2-83. Fire Detector Warning System A FIRE WARNING light is located in the upper right section of the instrument panel (fig 2-4). The press to test (FIRE DETECTOR TEST) test switch is located to the left of the fire warning light. Excessive heat in the engine compartment causes the FIRE light to illuminate. Pressing the press-to-test switch also causes the light to illuminate for testing. Electric power for the circuit is supplied from the 28 Vdc essential bus and is protected by the FIRE DET circuit breaker.

2-84. Master Caution System

NOTE

Aircraft are equipped with NVG compatibility devices, flip-filters for the "Master Caution," "Low RPM," and "Fire Warning" indicators. These filters must be flipped over away from the indicators during visual flight conditions. A slide drawer filter is also provided for the caution panel. This filter must be stowed in the pedestal stowing postion during visual flight conditions. To stow, lift the front end of the filter to the vertical position and allow the filter to gently slide into the vertical cavity in the pedestal above the caution panel.

a. *NVG Flight Conditions.*

(1) Follow all procedures used for visual flight conditions, except the "Master Caution," "Low RPM," and "Fire Warning" flip-filters and "Caution Panel" slide drawer filter must be placed over the indicators.

(2) Flip instrument panel indicator filters over indicators and press lightly in place to avoid light leakage around edges.

(3) Gently pull the slide drawer filter up from stowed position until it is at the top vertical position and place it over the caution panel.

b. *Master Caution Indicator.* The master caution indicator light on the instrument panel will illuminate when fault conditions occur (fig 2-4). This illumination alerts the pilot and copilot to check the caution panel for the specific fault condition.

c. *Caution Panel.* The CAUTION panel is located on the pilot side of the pedestal (fig 2-9). Worded segments illuminate to identify specific fault conditions. The worded segments are readable only when the light illuminates. When a light illuminates, indicating a fault condition, it will remain illuminated until the fault condition is corrected. Refer to figure 2-9 for explanation of the fault conditions.

(1) *Bright-Dim Switch.* The BRIGHT-DIM switch on the CAUTION panel permits the pilot to manually select a bright or dimmed condition for all the individual worded segments and the master caution indicator. The dimming switch position will work only when the pilot instrument lights are on. The master caution system lights will be in bright illumination after each initial application of electrical power; when the pilot instrument lights are turned OFF, or a loss of power from the dc essential bus occurs.

(2) *Reset-Test Switch.* The RESET-TEST switch on the CAUTION panel enables the pilot to manually reset and test the master caution system. Momentarily placing the switch in the RESET position, extinguishes and resets the master caution indicator light so it will again illuminate should another fault condition occur. Momentarily placing the switch in TEST position will cause the illumination of all the individually worded segments and the master caution indicator. Only the lamp circuitry is tested; the condition circuitry is not. Testing of the system will not change any particular combination of fault indications which might exist prior to testing. The worded segments will remain illuminated as long as fault condition or conditions exist, unless the segment is rotated.

d. *Electrical Power.* Electric power for the master caution system is supplied from the essential bus. Circuit protection is provided by the CAUTION LIGHTS circuit breakers.

2-85. RPM High-Low Limit Warning System The rpm high-low limit warning system provides the pilot with an immediate warning of high and low rotor or engine rpm. Main components of the system are a detector unit, warning light and audio signal circuit, low RPM AUDIO/OFF switch, and electrical wiring and connectors. The warning light and audio warning signal systems are activated when any one of the following rpm conditions exist:

a. Warning light only:

(1) For rotor rpm of 329-339 (High Warning).

(2) For rotor rpm of 300-310 (Low Warning).

(3) For engine rpm of 6100-6300 (Low Warning).

(4) Loss of signal (circuit failure) from either rotor tachometer generator or power turbine tachometer generator.

b. Warning light and audio warning signal combination:

(1) For rotor rpm of 300-310 and engine rpm of 6100-6300 (Low Warning).

(2) Loss of signal (circuit failure) from both rotor tachometer generator and power turbine tachometer generator.

NOTE

It is possible to have an unmodified warning system in the aircraft. On unmodified warning systems, an audio signal will be heard if either rotor or engine RPM drops below low limits.

c. Rotor Tachometer Generator and Power Turbine Tachometer Generator. The rotor tachometer generator and power turbine tachometer generator both send signals to the high-low rpm warning light and audio warning circuits. When the warning light only is energized, determine the cause of indication by checking the torquemeter and cross referencing other engine instruments. A normal indication signifies that the engine is functioning properly, and that there is a tachometer generator failure or an open circuit to the warning system rather than an actual engine failure. Electrical power for system operation is supplied by the 28 vdc essential bus.

d. Light—High Low Limit RPM Warning. The high low warning light (fig 2-4) is located on the instrument panel. This light illuminates to provide a visual warning of low rotor rpm, low engine rpm, or high rotor rpm.

e. Switch—Low RPM Audio/Off. The LOW RPM AUDIO/OFF switch is on the engine control panel (fig 2-6). When in OFF position, the switch prevents the audio warning signal from functioning during engine starting. Current production helicopters use a spring-loaded switch. When the switch has been manually turned off for engine starting, it will automatically return to the AUDIO position when normal operating range is reached.

Section XIV. SERVICING PARKING AND MOORING

2-86. Servicing

a. Servicing Diagram. Refer to figure 2-10.

b. Approved Military Fuels, Oils and Fluids. Refer to table 2-1.

c. Fuel Sample. Settling time for AVGAS is 15 minutes per foot of tank depth and one hour per foot depth for Jet (JP) fuels. Allow the fuel to settle for the prescribed period before any fuel samples are taken. Tank depth is about 29 inches.

2-87. Fuel System Servicing

WARNING

Servicing personnel shall comply with all safety precautions and procedures specified in FM 10-68, Aircraft Refueling Field Manual.

a. Refer to table 2-1 for fuel tank capacities.

b. Refer to table 2-1 for approved fuel.

c. The helicopter is serviced as follows:

(1) Refer to figure 2-10 for fuel filler location.

(2) Assure that fire guard is in position with fire extinguisher.

(3) Ground servicing unit to ground stake.

(4) Ground servicing unit to helicopter.

(5) Ground fuel nozzle to ground receptacle located adjacent to fuel receptacle on helicopter.

Caution

Ensure that servicing unit pressure is not above 125 psi while refueling.

(6) Closed circuit.

(a) Remove fuel filler cap, and assure that refueling module is in locked position. Refer to figure 2-10.

(b) Remove nozzle cap and insert nozzle into fuel receptacle and lock into position.

(c) Activate flow control handle to ON or FLOW position. Fuel flow will automatically shut off when fuel cell is full. Just prior to normal shut off, fuel flow may cycle several times as maximum fuel level is reached.

(d) Assure that flow control handle is in OFF or NO FLOW position and remove nozzle.

(7) Gravity or open port:

(a) Remove fuel filler cap.

(b) Using latch tool, attached to filler cap cable, open refueling module.

(c) Remove nozzle cap and insert nozzle into fuel receptacle.

(d) Fill to specified level.

(e) Remove nozzle.

(f) Close refueling module by pulling cable until latch is in locked position. Refer to figure 2-10.

(8) Replace fuel nozzle cap.

(9) Replace fuel filler cap.

(10) Disconnect fuel nozzle ground.

(11) Disconnect ground from helicopter to servicing unit.

(12) Disconnect servicing unit ground from ground stake.

(13) Return fire extinguisher to designated location.

d. Rapid (Hot) Refueling.

(1) Before rapid refueling.

(a) Throttle—Idle.

(b) FORCE TRIM—ON or controls frictioned.

(c) Refuel as described in paragraph c above.

WARNING

In case of helicopter fire, observe fire emergency procedures in chapter 9.

(2) During rapid refueling. A crewmember should observe the refueling operation (performed by authorized refueling personnel) and stand fire guard as required. One crewmember shall remain in the helicopter to monitor controls. Only emergency radio transmission should be made during RAPID refueling.

(3) After rapid refueling, the pilot shall be advised by the refueling crew that fuel cap is secure and grounding cables have been removed.

2-88. Approved Commercial Fuel, Oils, and Fluids

a. Fuels. Refer to table 2-1.

b. Oils. Refer to table 2-1.

c. Fluids. Refer to table 2-1.

2-89. Use of Fuels

a. There are no special limitations on the use of Army standard or alternate fuels but certain limitations are imposed when emergency fuels are used. A fuel mixture which contains over 10 percent leaded gasoline shall be recorded as all leaded gasoline. The use of emergency fuels shall be recorded in the FAULT/ REMARKS column of DA Form 2408-13, Aircraft Maintenance and Inspection Record noting the type of fuel, additives, and duration of operation.

b. When mixing of fuel in helicopter tanks or changing from one type of authorized fuel to another, for example JP-4 to JP-5, it is not necessary to drain the helicopter fuel system before adding the new fuel.

Table 2-1
Servicing Table of Approved Fuels, Oils, and Fluids

System	Specification
Fuel	MIL-T-5624 (JP-4)[1]
Crashworthy System—	
Total: 208.5 U.S. gallons (789.2 liters).	
Usable: 206.5 U.S. gallons (781.6 liters)...	
Internal Auxiliary Tanks—	
Usable: 300 U.S. gallons (1135.5 liters)...	
Oil:	
Engine	MIL-L-23699[3] [4]
	*MIL-L-7808[2] [4]
Transmission	MIL-L-23699[3] [4]
	*MIL-L-7808[2] [4]
42° Gearbox	MIL-L-23699[3] [4]
	*MIL-L-7808[2] [4]
90° Gearbox	MIL-L-23699[3] [4]
	*MIL-L-7808[2] [4]
Hydraulic System	MIL-H-5606[6] [7]
	MIL-H-83282[8] [7]
Main Rotor Grip	MIL-L-46152[8] [9]
	MIL-L-23699[3] [4] [9]
	*MIL-L-7808[2] [4]
	MIL-L-2104[8] [9]
	MIL-L-46167[8] [9]
Pillow Block Oil	MIL-L-23699[3] [4]
	*MIL-L-7808[2] [4] [9]
	MIL-L-2104[8] [9]
	MIL-L-46152[8] [9]
	MIL-L-46167[8] [9]

FOOTNOTES

[1] Army Standard fuel is MIL-T-5624 (JP-4) NATO code is F-40 Alternate fuels are MIL-T-5624 (JP-5) (NATO F-44) and MIL-T-83133 (JP-8) (NATO F-34). Emergency fuel is MIL-G-5572 (any AV gas) (NATO F-12, F-18, F-22). Refer to TM 55-9150-200-24.

The helicopter shall not be flown when emergency fuel has been used for a total cumulative time of 50 hours. (25 hours when TCP is used in fuel.)

CAUTION

*Lubrication oil made to MIL-L-7808 by Shell Oil Company under their part number 307, qualification number 7D-1 shall not be used in the engine or aircraft systems. It contains additives which are harmful to seals in the systems.

[2] *MIL-L-7808 NATO code is 0-148. For use in ambient temperatures below minus 32°C/25°F. May be used when MIL-L-23699 oil is not available. Not for use in main rotor hub P/N 204-012-101-31.

CAUTION

Under no circumstances shall MIL-L-23699 oil be used in ambient temperatures below minus 32°C/25°F.

[3] MIL-L-23699 NATO code is 0-156. For use in ambient temperatures above minus 32°C/25°F. Not for use in main rotor hub P/N 204-012-101-31.

[4] Do not mix MIL-L-2104, MIL-L-46152, MIL-L-46167, MIL-L-23699, and or MIL-L-7808 oils, except during an emergency. If the oils are mixed the system shall be flushed within six hours and filled with the proper oil. An entry on DA Form 2408-13 is required when the oils are mixed.

[5] MIL-H-5606 NATO code is H-515. For use in ambient temperatures below minus 35°C/30°F. (Refer to TB 55-1500-344-25.)

[6] For use in ambient temperatures above minus 35°C/30°F.

CAUTION

Prolonged contact with hydraulic fluid or its mist can irritate eyes and skin. After any prolonged contact with skin, immediately wash contacted area with soap and water. If liquid contacts eyes, flush immediately with clear water. If liquid is swallowed, do not induce vomiting; get immediate medical attention. When fluid is decomposed by heating, toxic gases are released.

[7] It is not advisable to mix MIL-H-5606 and MIL-83282 fluids, except during an emergency. An entry on DA Form 2408-13 is required when the fluids are mixed. When changing from MIL-H-5606 to MIL-H-83282, not more than two percent of MIL-H-5606 may be present in the system.

[8] Refer to stencil on grip assembly to determine proper lubrication requirements.

[9] MIL-L-2104, MIL-L-46152, and MIL-L-46167, must be used in hub P/N 204-012-101-31 as follows:

Average Temp Range	Specifications
+5°C and above	MIL-L-2104, Grade 40, NATO Code 0-230
−18°C to +5°C	MIL-L-2104, Grade 30, NATO Code 0-230 or MIL-L-46152, Grade 30
−29°C to −18°C	MIL-L-2104, Grade 10, NATO Code 0-230 or MIL-L-46152, Grade 10W30
−54°C to −20°C	MIL-L-46167, DEXRON II Automatic transmission fluid.

Approved domestic commercial fuels (spec. ASTM-D-1655-70: Manufacturer's designation—

Jet B-JP4 Type	Jet A—JP5 Type	Jet A-1—JP8 Type
American JP-4	American Type A	
Aerojet B	Aerojet A	Aerojet A-1
		Richfield A
B.P.A.T.G.		B.P.A.T.K.
Caltex Jet B		Caltex Jet A-1
	CITGO A	
Conoco JP-4	Conoco Jet-50	Conoco Jet-60
Gulf Jet B	Gulf Jet A	Gulf Jet A-1
EXXON Turbo Fuel B	EXXON A	EXXON A-1
Mobil Jet B	Mobil Jet A	Mobil Jet A-1
Philjet JP-4	Philjet A-50	
Aeroshell JP-4	Aeroshell 640	Aeroshell 650
	Superjet A	Superjet A-1
	Jet A Kerosine	Jet A-1 Kerosine
Chevron B	Chevron A-50	Chevron A-1
Texaco Avjet B	Avjet A	Avjet A-1
Union JP-4	76 Turbine Fuel	

Approved foreign commercial fuels:

Country	F-40	F-44
Belgium	BA-PF-2B	
Canada	3GP-22F	3-6P-24e
Denmark	JP-4 MIL-T-5624	
France	Air 3407A	
Germany (West)	VTL-9130-006	UTL 9130-007/UTL 9130-010
Greece	JP-4 MIL-T-5624	
Italy	AA-M-C-1421	AMC-143
Netherlands	JP-4 MIL-T-5624	D. Eng Rd 2493
Norway	JP-4 MIL-T-5624	
Portugal	JP-4 MIL-T-5624	
Turkey	JP-4 MIL-T-5624	
United Kingdom (Britain)	D. Eng Rd 2454	E. Eng Rd 2498

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

Approved domestic commercial oils for MIL-L-7808: Manufacturers designation—
PQ Turbine Oil 8365
ESSO/ENCO Turbo Oil 2389
RM-184A/RM-201AI51

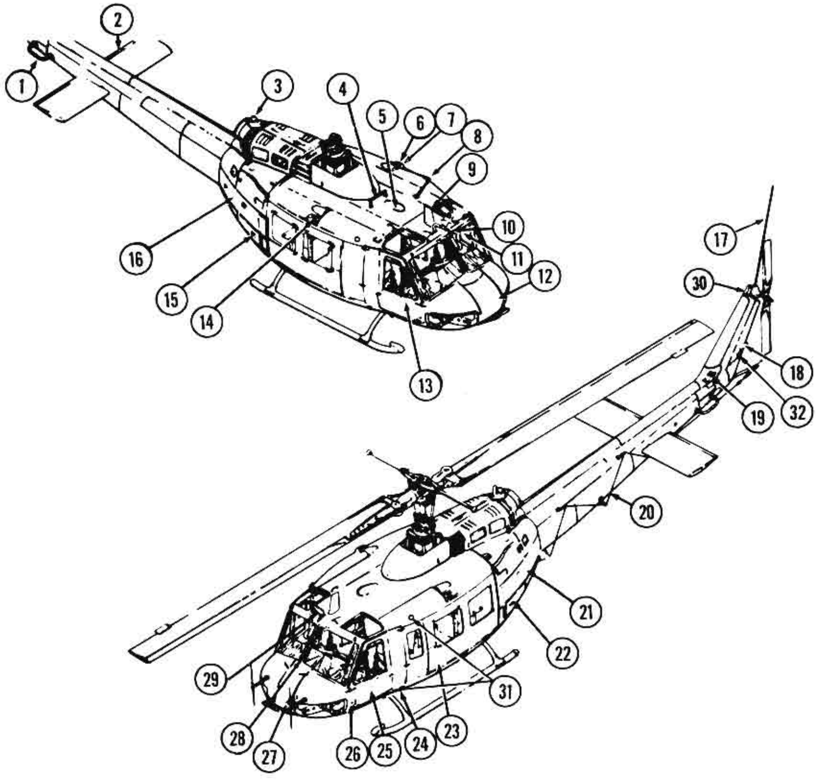
CAUTION

Do not use Shell Oil Co., part No. 307, qualification No. 7D-1 oil (MIL-L-7808). It can be harmful to seals made of silicone.

Approved domestic commercial oils for MIL-L-23699: Manufacturers designation—
PQ Turbine Lubricant 5247/ 6423/6700/7731/8878/9595
Brayco 899/899-G/899-S
Castrol 205
Jet Engine Oil 5
STO-21919/STO-21919A/STD-6530
HATCOL 3211/3611
Turbo Oil 2380 (WS-6000)/2395 (WS-6459)/2392/2393
Mobil Jet II RM-139A/Mobil Jet II RM-147A/Avrex S
Turbo260/Avrex S
Turbo 265
Royco 899 (C-915)/899SC/Stauffer Jet II
Aeroshell Turbine Oil 500
Aeroshell Turbine Oil 550

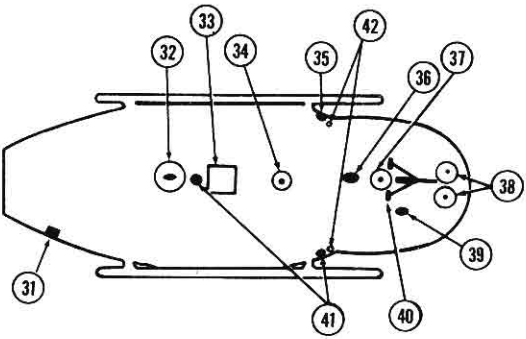
Chevron Jet Engine Oil 5
Stauffer 6924/Jet II
SATO 7377/7730, TL-8090

Approved domestic commercial fluids for MIL-H-5606:
Manufacturers designation—
''PO'' 4226
Brayco 757B
Brayco 756C
Brayco 7561D
Hyspin A
Univis J41
Aero HFB
Petrofluid 5606B
Petrofluid 4607
Royco 756C/D
Royco 782
XSL 7828
PED 3565
PED 3337
TL-5874
Aero Hydroil 500
YT-283
FP-221
Approved domestic commercial fluids for MIL-H-83282:
Brayco Micronic 882
Hanover R-2
HF 832
XRM 230A
XRM 231A



1. VHF navigation (Omni) antenna
2. Synchronized elevator
3. Anti-collision light
4. FM homing antenna No.1
5. Loop (ADF) antenna
6. Position light (White)
7. Position light (Red)
8. FM communications antenna No.2
9. VHF/UHF antenna
10. Pitot tube
11. WSPS Windshield Wiper Deflector
12. Radio compartment and fwd battery location access door
13. Pilot door
14. Position lights (Green upper and lower)
15. Heater compartment access door
16. Oil cooler fan access door
17. FM communications antenna No.1
18. Aft position light (White)
19. 42 degree gearbox
20. HF long wire antenna
21. Electrical compartment access door
22. Aft radio compartment access doors
23. Cabin door
24. Position light (Red)
25. Copilot door
26. Static port
27. Pitot tube.
28. WSPS Windshield Deflector
29. WSPS Upper Cutter
30. 90 degree gearbox
31. Position light (NVG)
32. Aft position light (NVG)

Figure 2-1. General Arrangement Diagram—Typical (Sheet 1 of 2)



31. External power receptacle
32. Cargo suspension hook
33. Sense antenna
34. Landing light (V NVG)
35. Position light
36. Marker beacon antenna
37. Searchlight (H NVG)
38. Radar altimeter antenna V
39. IFF Antenna
40. WSPS Lower Cutter
41. Position light
42. Position light (NVG)

Figure 2-1. General Arrangement Diagram—Typical (Sheet 2 of 2)

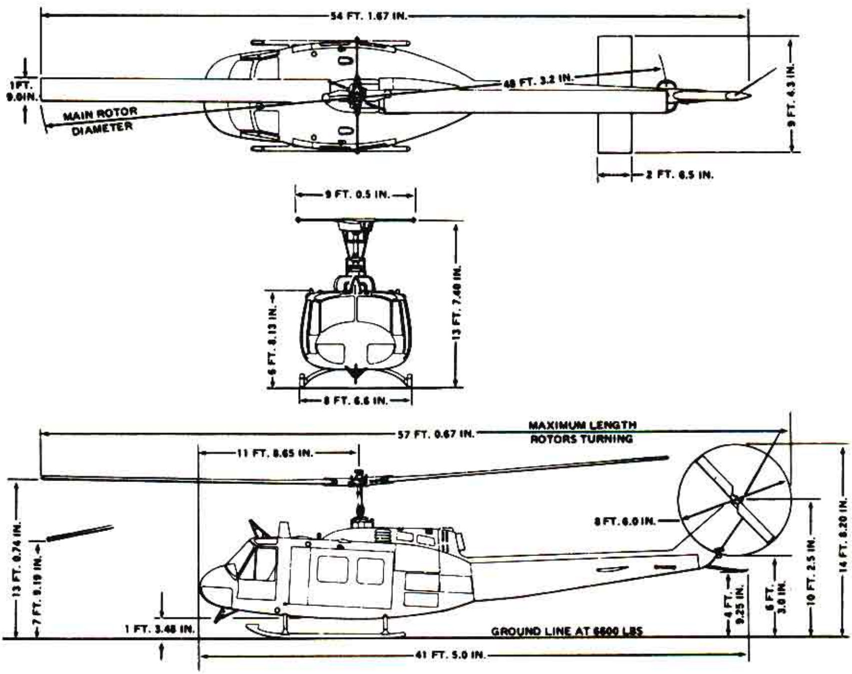
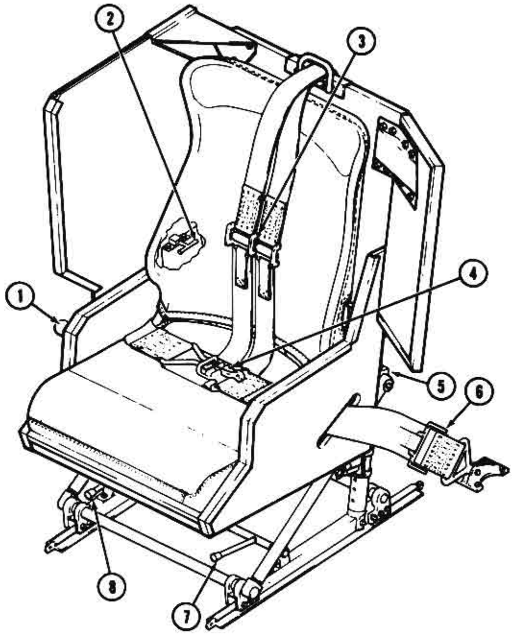
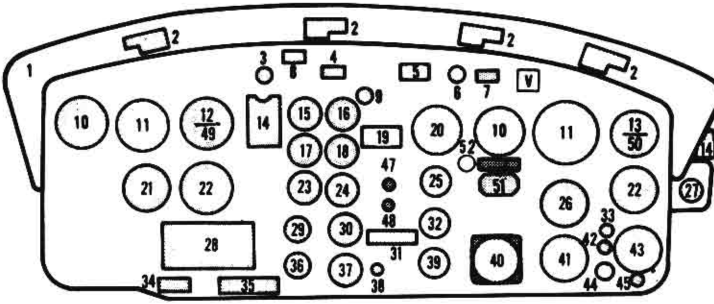


Figure 2-2. Principal Dimensions Diagram—Typical



1. Shoulder harness lock — unlock control
2. Armor plate adjustment lock
3. Shoulder harness adjuster
4. Seat belt latch
5. Quick release
6. Seat belt adjuster
7. Seat adjustment fore and aft
8. Seat adjustment vertical

Figure 2-3. Pilot/Copilot Seat—Typical



1. Glareshield
2. Secondary Lights
3. Engine INlet Filter Clogged Warning Light
4. Master Caution
5. RPM Warning Light
6. Fire Detector Test Switch
7. Fire Warning Indicator Light
8. Radio Call Designator
9. Fuel Gage Test Switch
10. Airspeed Indicator
11. Attitude Indicator
12. Altimeter Indicator (AAU-32/A)
13. Altimeter Indicator (AAU-31/A)
14. Compass Correction Card Holder
15. Fuel Pressure Indicator
16. Fuel Quantity Indicator
17. Engine Oil Pressure Indicator
18. Engine Oil Temperature Indicator
19. Cargo Caution Decal
20. Dual Tachometer
21. Radio Compass Indicator
22. Vertical Velocity Indicator
23. Transmission Oil Pressure Indicator
24. Transmission Oil Temperature Indicator
25. Torquemeter Indicator
26. Radio Compass Indicator
27. Magnetic Compass
28. Operating Limits Decal
29. Main Generator Loadmeter
30. DC Voltmeter
31. Engine Caution Decal
32. Gas Producer Tachometer Indicator
33. Marker Beacon Light
34. Engine Installation Decal
35. Transmitter Selector Decal
36. Standby Generator Loadmeter
37. AC Voltmeter
38. Compass Slaving Switch
39. Exhaust Gas Temperature Indicator
40. Turn and Slip Indicator
41. Omni Indicator
42. Marker Beacon Sensing Switch
43. Clock
44. Marker Beacon Volume Control
45. Cargo Release Armed Light
46. IFF Code Hold Light
47. IFF Code Hold Switch
49. V Height Indicator Remote
50. V Receiver-Transmitter, Height Indicator
51. V DME Indicator
52. V DME Hold Light

Figure 2-4. Instrument Panel (Typical)

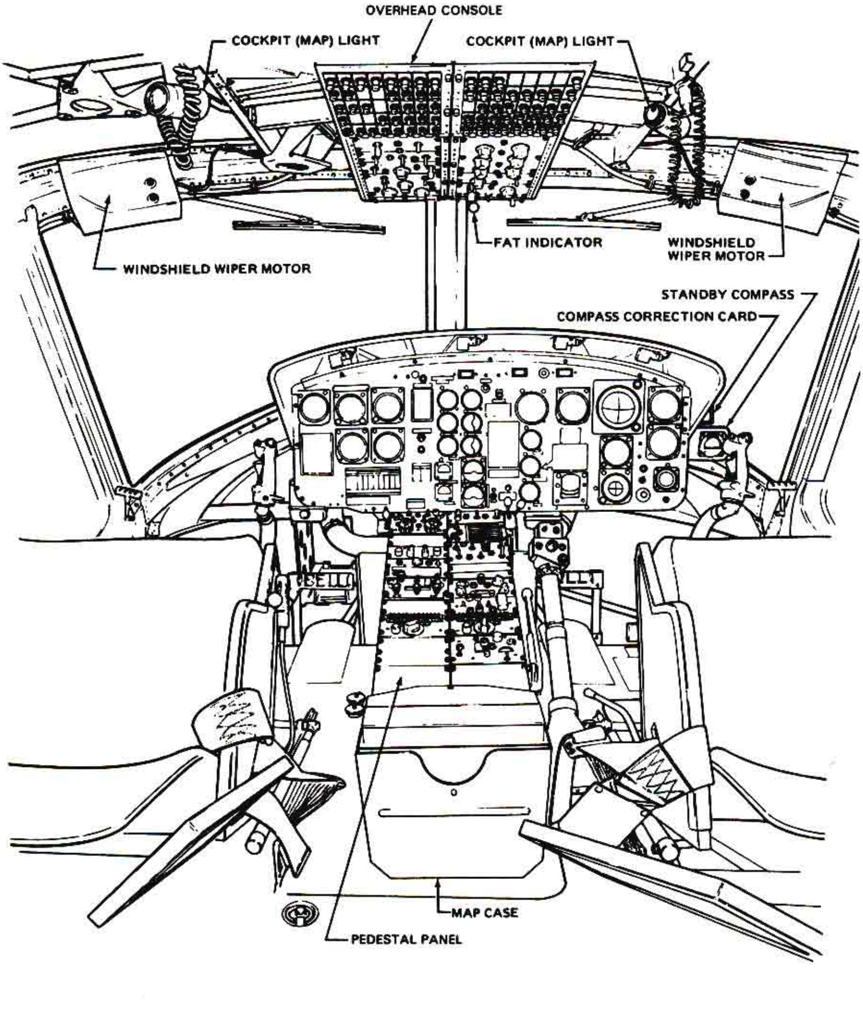


Figure 2-5. Crew Compartment—Typical (Sheet 1 of 3)

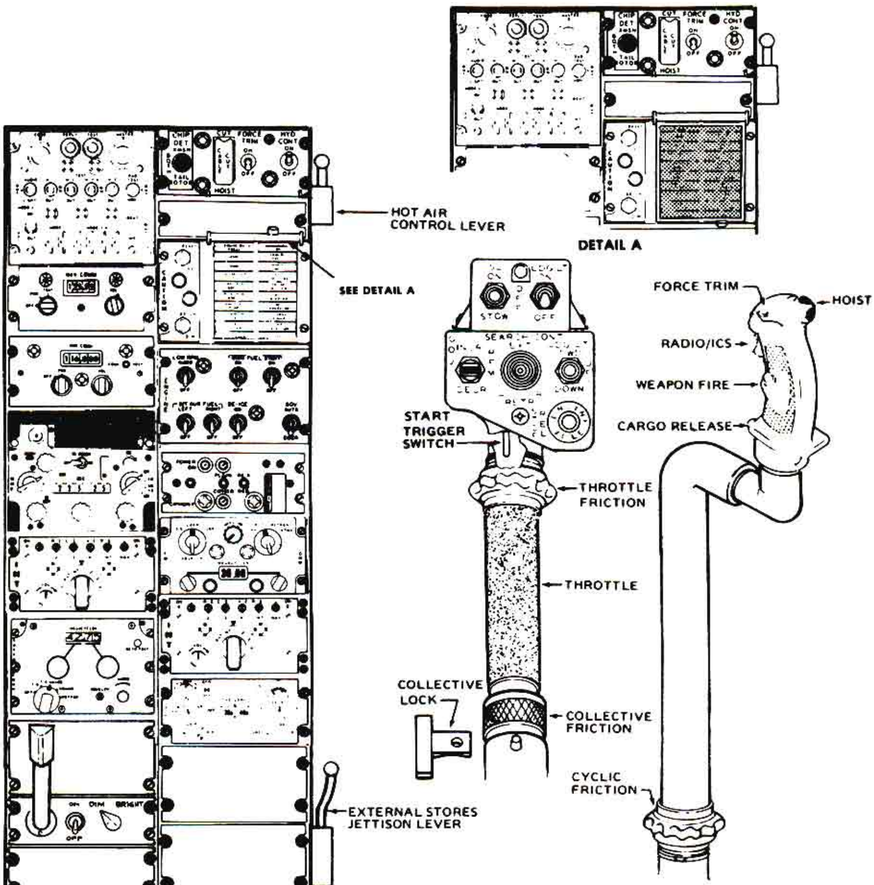


Figure 2-5. Crew Compartment—Typical (Sheet 2 of 3)

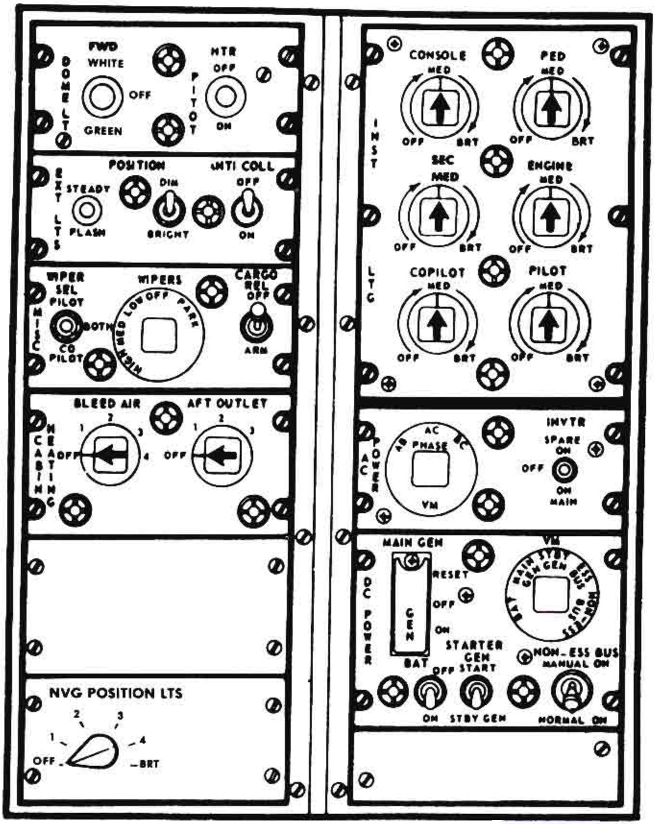


Figure 2-5. Overhead Console—Typical (Sheet 3 of 3)

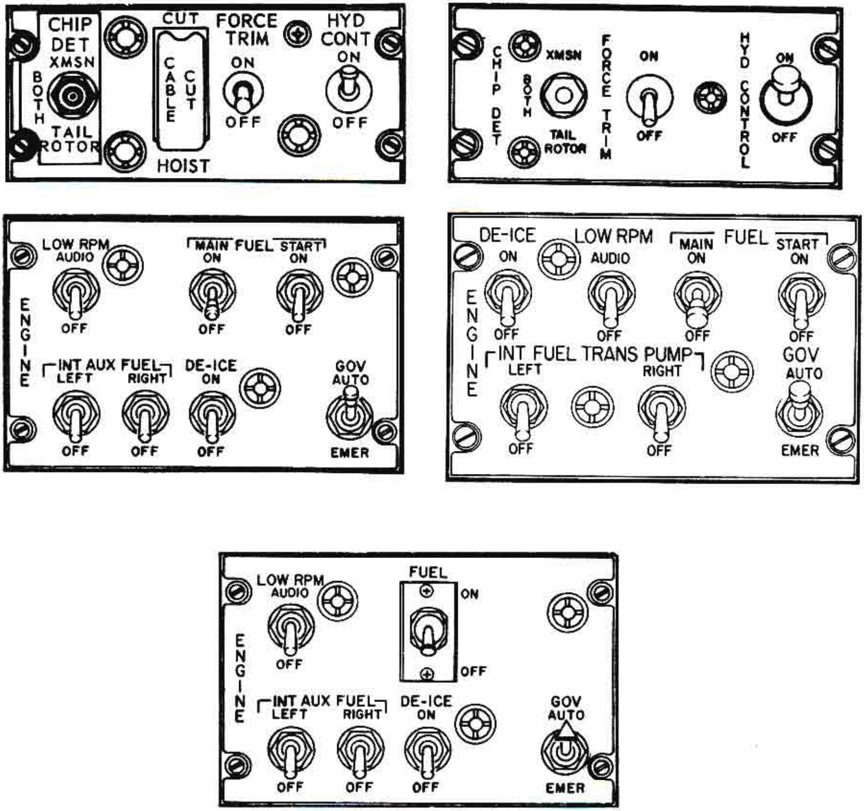
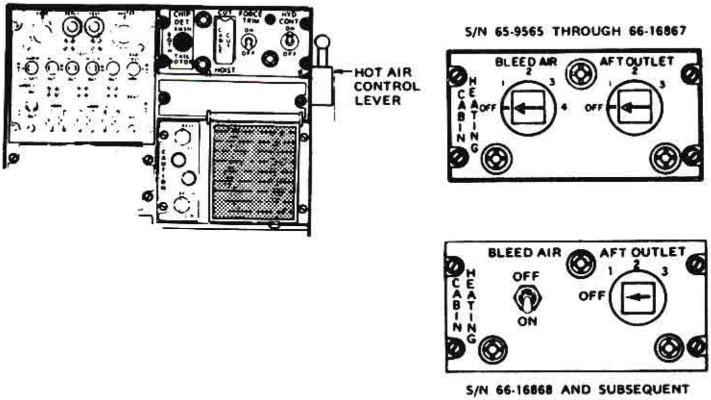
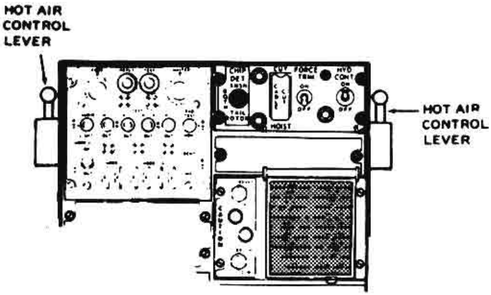


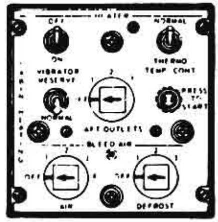
Figure 2-6. Engine and Miscellaneous Control Panel—Typical



SWITCH/CONTROL	POSITION	FUNCTION
BLEED AIR (Rotary)	Clockwise Rotation	Increases amount of heated air.
	OFF	Turns bleed air off.
AFT OUTLET	Clockwise Rotation	Increases amount of air to doorpost outlets.
	OFF	Doorpost are closed, all air is direct to pedestal outlets.
Pedestal Lever	Full Forward	All heated air to defrost nozzles.
	Full Aft	All heated air to cockpit and cabin.
	Intermediate	Partial defrost and partial cockpit and cabin heat.
BLEED AIR (ON/OFF)	ON	Turns bleed air heat on.
	OFF	Turns bleed air heat off.

Figure 2-7. Heating and Defrosting System—Typical (Sheet 1 of 2)





HEATER PANEL AND CONTROLS (PRIOR TO S/N 65-9565)

SWITCH/CONTROL	POSITION	FUNCTION
ON/OFF	ON	Energizes the blower.
	OFF	Stops combustion heater operation.
VIBRATOR	NORMAL	Builds up electrical charge for starting.
	RESERVE	Builds up reserve charge, used only if combustion does not occur in NORMAL.
	OFF	Turns vibrator off.
PRESS TO START	Press	Closes ignition circuit. VIBRATOR
NORMAL/THERMO	THERMO TEMP. CONT.	Actuates thermostatic control.
	NORMAL	Thermostat is not actuated.
		must be in NORMAL or RESERVE.
AFT OUTLETS	1 — 2 — 3	Clockwise rotation increases heat.
AIR	1 — 2 — 3 — 4	Clockwise rotation increases air volume.
DEFROST	OFF	100% of air to underseat outlets.
	1	33% defrost — 67% underseat outlets.
	2	67% defrost — 33% underseat outlets.
	3	100% of air to defrost nozzles
Pedestal Lever	AFT	Actuates bleed air system.
Right Inboard	FORWARD	Shuts off bleed air.
Pedestal Levers	AFT	Admits air to underseat outlets.
Outboard	FORWARD	Closes valve to underseat outlets.

Figure 2-7. Heating and Defrosting System—Typical (Sheet 2 of 2)

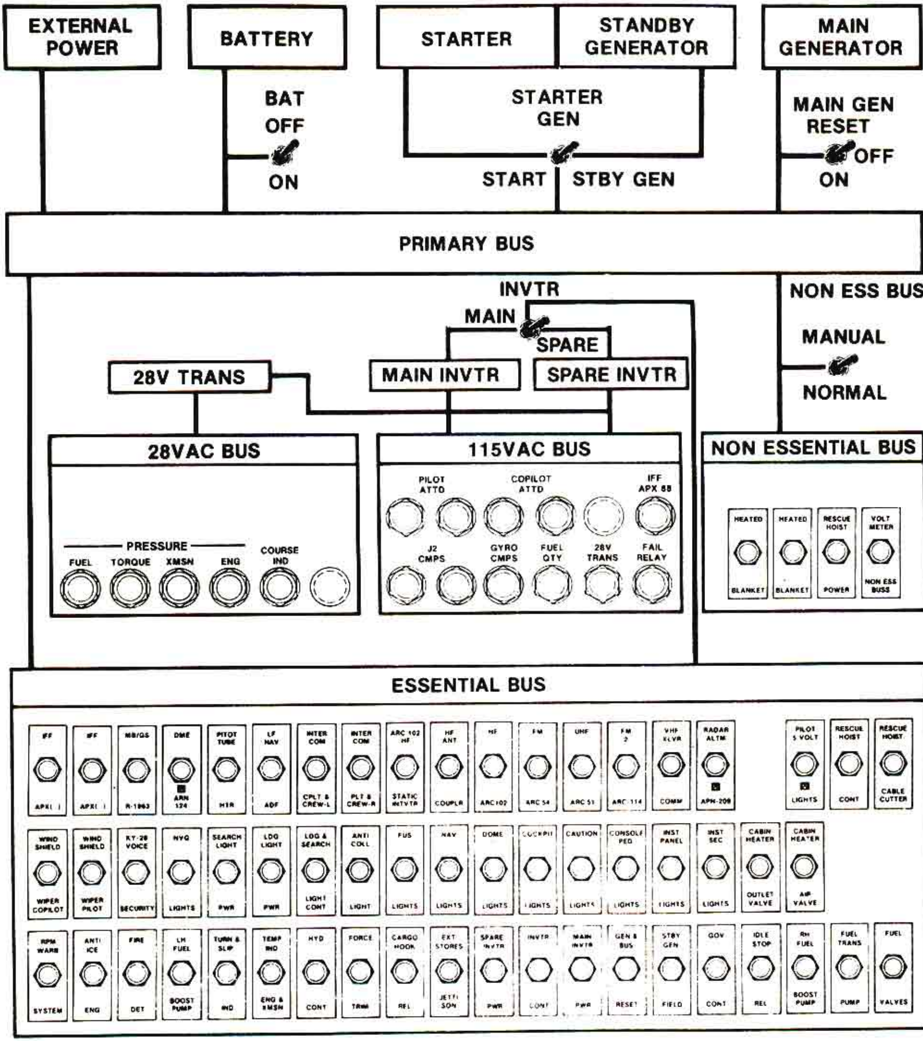
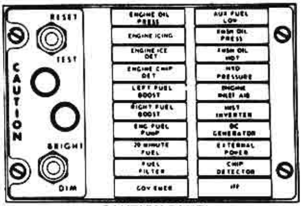


Figure 2-8. Electrical System (Typical)



CAUTION PANEL

CAUTION PANEL WORDING	FAULT CONDITION
ENGINE OIL PRESS	Engine oil pressure below 25 psi
*ENGINE ICING	Engine icing detected
*ENGINE ICE DET.	Not connected
ENGINE CHIP DET	Metal particles in engine oil
LEFT FUEL BOOST	Left fuel boost pump inoperative
RIGHT FUEL BOOST	Right fuel boost pump inoperative
ENG FUEL PUMP	Engine fuel pump malfunction
20 MINUTE FUEL	Fuel quantity about 185 lb
FUEL FILTER	Fuel filter impending bypass
*GOV EMER	Governor switch in emergency position
AUX FUEL LOW	Auxiliary fuel tank empty
XMSN OIL PRESS	Transmission oil pressure below 30 psi
XMSN OIL HOT	Transmission oil temperature above 110° C
HYD PRESSURE	Hydraulic pressure low
*ENGINE INLET AIR	Engine air filter clogged
INST INVERTER	Failure of inverter
DC GENERATOR	DC Generator failure
EXTERNAL POWER	External power access door open
CHIP DETECTOR	Metal particles present in 42° or 90° gearbox or main transmission
*IFF	IFF System inoperative

*May not be installed on all configurations.

Figure 2-9. Caution Panel—Typical

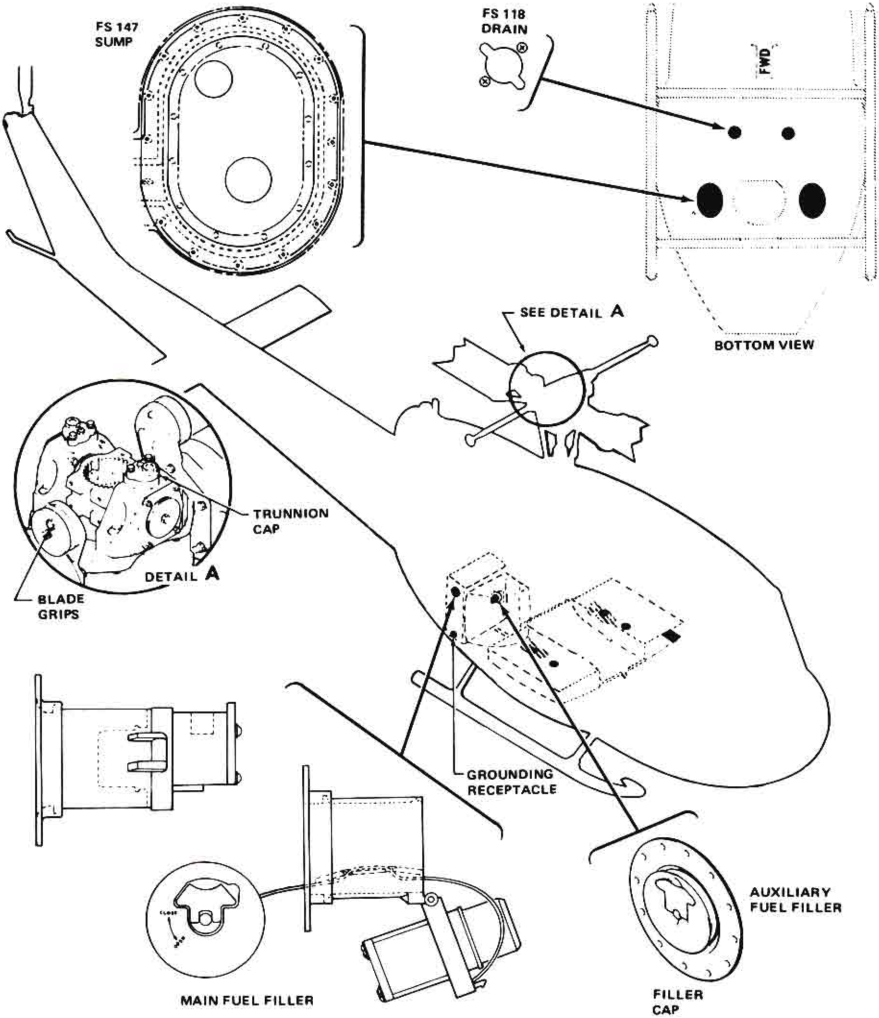


Figure 2-10. Servicing Diagram—Typical (Sheet 1 of 2)

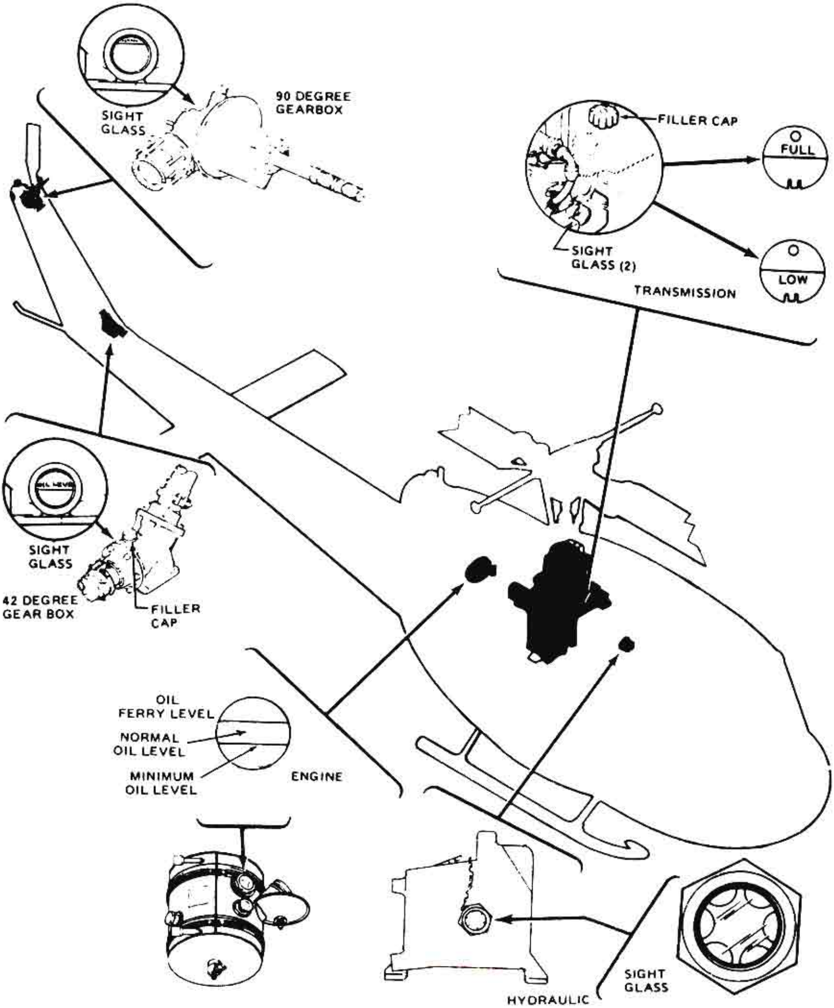


Figure 2-10. Servicing Diagram—Typical (Sheet 2 of 2)

Chapter 3

Avionics

Section I. GENERAL

3-1. General This chapter covers the avionics equipment configuration. It includes a brief description of the avionics equipment, its technical characteristics, capabilities, and location. The chapter also contains complete operating instructions for all avionics equipment installed. For mission avionics equipment, refer to chapter 4, Mission Equipment.

3-2. Avionics Equipment Configuration The configuration consists of the following:

a. Headset Cordage. The pilot and copilot cordage connectors are located at their respective sides near the aft portion of the overhead console. The crew cordage connectors are located near the overhead mounted signal distribution panel (figs 3-1, 3-2, and 3-3) at each crew station.

b. Keying Switches. A trigger type keying switch is located on each (pilot and copilot) cyclic control stick grip. The half depressed (first detent) position of the trigger switch is used for keying the interphone. The fully depressed (second detent) position of the trigger switch keys the radio selected with the transmit-interphone selector switch on the signal distribution panel. A foot-operated type keying switch (pilot and copilot) is located at each side of the center console, between the center console and cyclic control stick, and on the cabin floor at each crew station. The depressed position of the foot-operated switch keys the radio or interphone selected with the rotary selector switch at the appropriate signal distribution panel.

c. Power Supply and Circuit Breakers. Refer to figure 2-8.

d. Operation. The operation of the avionics equipment in this helicopter is dependent on the operation of the interphone system (figs 3-1, 3-2, and 3-3). Do not turn interphone system off until the end of flight day.

Section II. COMMUNICATIONS

3-3. Signal Distribution Panel—SB-329/AR

a. Description. The Signal Distribution Panel, located at each crewmember station, amplifies and controls the distribution of audio signals between each headset-microphone, to and from radio transmitters and receivers, and from navigation receivers. The system is used for intercommunications between crewmembers and for monitoring communication and navigation receivers singly or in combination.

b. Controls and Functions. Refer to figure 3-1.

c. Operation.

(1) FM Switch panel AN/ARC-44 number 3ICS switch-up.

(2) RECEIVERS switches—As desired.

(3) TRANS selector switch—As desired.

(4) VOL control—Adjust.

3-4. Signal Distribution Panel C-1611/AIC

a. Description. The Signal Distribution Panel amplifies and controls the distribution of audio signals applied to or from each headset-microphone, to or from communication receivers and transmitters, from navigation receivers, intercommunication between crewmembers, and for monitoring the communication and navigation receivers singly or in combination. In addition the C-1611/AIC panel permits the operator to control four receiver-transmitters. A private interphone line is also provided.

When the selector switch is in the PVT position it provides a hot line (no external switch is used) to any station in the helicopter which also has PVT selected. A HOT MIC switch is also provide on the C-1611/AIC control panel at the medical attendants station. Four C-1611/AIC units may be installed in serial no. 63-8739 and subsequent. One each of the units are installed for the pilot and copilot, and two are installed in the crew/passenger compartment of the crew. All four of the C-1611/AIC units are wired to provide interphone operations for the crew, and full transmit and receive facilities for all communication and navigation equipment.

b. Controls and Functions. Refer to figure 3-2.

c. Operation.

(1) Transmit interphone selector switch—As desired.

(2) RECEIVERS switches—As desired.

(3) Microphone switches—As desired.

(4) VOL control—Adjust.

3-5. Signal Distribution Panel C-6533/ARC

a. Description. Two panels are installed in the pedestal for the pilot and copilot and two panels are installed in the cabin roof aft of the overhead console for the right and left crewmembers. The system is used for intercommunications and radio control. The system has three modes of operation; two way radio communications, radio monitoring, and interphone.

b. Controls and Functions. Refer to figure 3-3.

c. Operation.

(1) NAV receiver switch—As desired.

(2) AUX receiver switch—As desired.

(3) Transmit-interphone selector switch—As desired.

(4) Receiver switches—As desired.

(5) HOT MIKE switch—As desired.

(6) VOL control—Adjust.

3-6. UHF Radio Set AN/ARC-51BX

a. Description. The Radio Set provides two way communications in the UHF (225.0 to 399.9 MHz) band. The set located at the left side of the pedestal, tunes in 0.05 MHz increments and provides 3500 channels. The set also permits 20 preset channels and monitoring of the guard channel. Transmission and reception are conducted on the same frequency.

b. Controls and Functions. Refer to figure 3-4.

c. Operation.

(1) UHF function select switch—T/R (T/R+G as desired).

(2) UHF mode selector switch—PRESET CHAN.

(3) RECEIVERS switch No. 2—ON

(4) Channel—Select.

NOTE

An 800-cps audio tone should be heard during channel changing cycle.

(5) SQ DISABLE switch—OFF.

(6) VOL—Adjust.

(7) Transmit-interphone selector switch—No. 2 position.

d. Emergency Operation.

(1) UHF mode switch—GD XMIT.

(2) UHF function switch—T/R+G.

3-7. UHF Radio Set AN/ARC-51X

a. Description. The radio set provides two way communications in the UHF (225.0 to 399.9 MHz) band. The set located at the left side of the pedestal, tunes in 0.1 MHz increments and provides 1750 channels. The set also permits monitoring of the guard channel. Transmission and reception are conducted on the same frequency.

b. Controls and Functions. Refer to figure 3-5.

c. Operation.

(1) UHF function selector switch—T/R (T/R+G as desired). Allow five minute warmup.

(2) Frequency—Select.

(3) RECEIVERS switch No. 2—ON.

(4) SENS and VOL controls—Adjust.

(5) Transmit-interphone selector switch—No. 2 position.

d. Emergency Operation. Select guard frequency 243.0 MHz.

3-8. UHF Radio Set AN/ARC-55B

a. Description. The UHF command set provides two way, amplitude-modulated communications on any of 1750 channels within 225.0 to 399.9 MHz. Channel selection is manual and the guard channel may be monitored.

b. Controls and Functions. Refer to figure 3-6.

c. Operation.

(1) UHF function selector switch—As desired.

(2) Frequency—Select.

(3) RECEIVERS switch No. 2—ON.

(4) UHF VOL-SENS controls—Adjust.

(5) Transmit-interphone selector switch—No. 2 position.

d. Emergency Operation. Select guard frequency 243.0 MHz.

3-9. VHF Radio Set AN/ARC-115

a. Description. The VHF Radio Set provides amplitude-modulated, narrow band voice communications within the frequency range of 116.000 to 149.975 MHz on 1360 channels for a distance of approximately 50 miles line of sight. A guard receiver is incorporated and fixed tuned to 121.50 MHz. The panel is labeled VHF AM COMM and mounted on the left side of the pedestal.

b. Controls and Functions. Refer to figure 3-7.

c. Operation.

(1) Function selector—As desired.

(2) Frequency—Select.

(3) RCVR TEST—Press to test.

(4) AUDIO—Adjust.

(5) Transmit-interphone selector switch—No. 3 position.

(6) RADIO transmit switch—Press.

d. Emergency Operation. Select guard frequency 121.50 MHz.

3-10. VHF Radio Set—AN/ARC-134

a. Description. The set transmits and receives the same frequency. The panel (VHF COMM) is located on the left side of the pedestal. The set provides voice communications in the VHF range of 116.000 through 149.975 MHz on 1360 channels spaced 25 kHz apart.

b. Controls and Functions Refer to figure 3-8.

c. Operation.

(1) OFF/PWR switch—PWR. Allow set to warm up.

(2) Frequency—Select.

(3) RECEIVERS switch No. 3—ON.

(4) Volume—Adjust. If signal is not audible with VOL control fully clockwise, press COMM TEST switch to unsquelch circuits.

(5) Transmit-interphone selector switch—No. 3 position.

(6) OFF/PWR switch—OFF.

d. Emergency Operation. Select guard frequency 121.500 MHz.

3-11. VHF Radio Set—AN/ARC-73

a. Description. The VHF Command Set is an alternate set for the UHF radio. The set provides transmission and reception of AM radio signals in the VHF range. The receiver may be tuned within its frequency range of 116.00 to 151.95 MHz in 50 kHz increments to any of the 720 available channels. The transmitter may be tuned within its frequency range of 116.00 to 149.95 MHz in 50 kHz increments to any one of its 680 available channels. The distance range is limited to line of sight or a distance of approximately 50 miles.

b. Controls and Functions. Refer to figure 3-9.

c. Operation.

(1) POWER switch—ON.

(2) Frequency—Select.

(3) RECEIVERS switch No. 3—ON.

(4) SQ and VOL controls—Adjust.

(5) Transmit-interphone selector switch—No. 3 position.

d. Emergency Operation. Select guard frequency 121.500 MHz.

3-12. FM Radio Set—AN/ARC-114 and -114A

a. Description. The FM Radio Set provides two way frequency modulated (FM) narrow band voice communications and homing capability within the frequency range of 30.00 to 75.95 MHz on 920 channels for a distance range limited to line of sight. A guard receiver is incorporated in the set and is fixed tuned to 40.50 MHz. It has the additional capability for retransmission of voice, or X-mode communications in conjunction with radio set AN/ARC-131. The radio set is marked VHF FM COMM and is mounted on the center console, on helicopter serial Nos. 71-20000 and subsequent.

b. Controls and Functions. Refer to figure 3-10.

c. Operation.

(1) *Two Way Voice Communication.*

(*a*) Function selector—As desired.

(*b*) Frequency—Select.

(*c*) RCVR TEST—Press to test.

(*d*) AUDIO—Adjust.

(*e*) Transmit-interphone selector—No. 5 position.

(2) *Retransmission.*

NOTE

For transmission both FM circuit breakers must be in.

(*a*) Frequencies—Select (both FM sets).

(*b*) Communications—Establish with each facility by selecting number 1 position and then number 5 position on the transmit-interphone selector.

(*c*) Function selectors—RETRAN (both FM sets).

(*d*) Receivers switches—Number 1 and number 5 positions as desired for monitoring.

d. Emergency Operation. Select guard frequency 40.50 MHz.

3-13. FM Radio Set—AN/ARC-131

a. Description. The FM Radio Set consists of a receiver-transmitter, remote control panel unit, communication antenna and a homing antenna. The radio set provides 920 channels spaced 50 kHz apart within the frequency range of 30.00 to 75.95 MHz. Circuits are included to provide transmission sidetone monitoring. The control panel is located on the pedestal. Homing data is displayed by the course indicator (fig 3-21) on the instrument panel. A channel changing tone should be heard in the headset while radio set is tuning. When the tone stops, the radio set is tuned. Operation in DIS position is possible; however flags on course indicator will be inoperative. When the first FM radio set is in the homing mode, the homing indicator may deflect left or right of on course indication while the second FM radio set is keyed.

b. Controls and Functions. Refer to figure 3-11.

c. Operation. Depending on the settings of the control panel controls, the radio set can be used for the following types of operation: Two way voice communication and homing (fig 3-12).

(1) *Two Way Voice Communication.*

(*a*) Mode control switch—T/R (allow two minute warm up).

(*b*) Frequency—Select.

(*c*) RECEIVERS No. 1 switch—ON.

(*d*) VOL control—Adjust.

(*e*) SQUELCH control—Set for desired squelch mode.

(*f*) TRANS selector switch—No. 1.

(2) *Homing Operation.*

(*a*) Mode control switch—HOME.

(*b*) Frequency—Adjust to frequency of selected homing station.

(*c*) SQUELCH control may be set to CARR or TONE, however, the carrier squelch is automatically selected by an internal contact arrangement on HOME position.

(*d*) Fly helicopter toward the homing station by heading in direction that causes homing indicator right-left vertical pointer to position itself in the center of indicator scale. To ensure that helicopter is not heading away from homing station, change the heading slightly and note that the homing indicator vertical pointer deflects in direction opposite that of the turn.

(3) *Retransmit Operation.* Start the equipment and proceed as follows for retransmit operation:

(*a*) Mode controls (both control units)—RETRAN.

(*b*) SQUELCH controls (both control units)—Set as required. Do not attempt retransmit operation with the SQUELCH controls set to DIS. Both controls must be set to CARR or TONE. To operate satisfactorily, the two radio sets must be tuned to frequencies at least 3 MHz apart.

(*c*) Frequency adjust (both control units) for the desired operation.

(*4*) Stopping Procedure. Mode control switch—OFF.

3-14. FM Radio Set AN/ARC-54

a. Description. The FM Radio Set provides the helicopter with two way communications within the frequency range of 30.00 to 69.95 MHz. Also, voice communication permits selective calling (TONE) and, when used with the homing antenna and course indicator, the pilot is provided with a homing facility. A channel changing tone should be heard in the headset while radio set is tuning. When the tone stops, the radio set is tuned. Voice reception is possible in HOME position. With two or more FM radio sets installed and the first FM radio set is in the homing mode, the homing indicator may deflect left or right of on course indication while the second FM radio set is keyed.

b. Controls and Functions. Refer to figure 3-12.

c. Operation.

(1) *Two Way Voice Communications.*

(*a*) FM mode selector switch—PTT (allow three minute warmup).

(*b*) Frequency—Select.

(*c*) FM VOL control—Adjust.

(*d*) FM SQUELCH control—CARR (or as desired).

(*e*) RECEIVERS switch No. 1—ON.

(*f*) TRANS selector switch—No. 1.

(*g*) Microphone switch—Press.

(2) *Homing Operation.* FM mode selector switch—HOME.

(3) *Retransmit Operation.* Start the equipment and perform the following for retransmit operation:

(*a*) Mode controls (both control units)—RETRAN.

(*b*) SQUELCH controls (both control units) set as desired.

NOTE

Do not attempt retransmit operation with the SQUELCH controls set to DIS. Both controls must be set to CARR or TONE.

(*c*) Adjust frequency (both control units) desired operation. To operate satisfactorily, the two radio sets must be tuned to frequencies at least 5 MHz apart.

(4) *Stopping Procedure.* FM mode selector switch—OFF.

3-15. FM Radio Set AN/ARC-44

a. Description. The FM Radio Set provides two way communications within the frequency range of 24.0 to 51.9 MHz on 280 preset channels. Signal distribution panel SB-329 and control panel assembly 204-075-219 (FM switch assembly), to provide squelch control and power to the antenna group, are used in conjunction with the FM Liaison Radio Set (fig 3-2 and fig 3-14). The set provides a homing facility on signals between 24.0 and 49.0 MHz. Cycling may take place in the receiver-transmitter. This will be indicated by a 400-cycle-per-second signal heard in the headset.

b. Controls and Functions. Refer to figure 3-13.

c. Operation.

(1) *Preliminary Setup.*

(*a*) FM power switch—ON.

(*b*) FM home switch—Down.

(*c*) TRANS selector switch—No. 1 position.

(*d*) REM-LOCAL switch—LOCAL.

(*e*) Frequency—Select.

(2) *Starting Procedures.*

(*a*) BAT switch—ON (OFF for APU).

(*b*) INT and FM circuit breakers—In.

(*c*) ICS switch—Up (allow three minute warm up).

(3) *Interphone Operation.*

(*a*) Microphone switch—Press.

(*b*) Speak into the microphone—Adjust interphone volume.

(4) *FM Receive-Transmit Operation.*

(*a*) ICS switch—Up.

(*b*) FM ON-OFF power switch—ON.

(*c*) FM VOL control—As desired.

(*d*) TRANS selector switch—No. 1 position.

(*e*) Microphone switch—Press to transmit

(5) *FM Home Operation.* FM HOME switch—Up.

(6) *Stopping Procedures.*

(*a*) FM HOME switch—Down.

(*b*) FM POWER switch—OFF.

(*c*) ICS switch—Down.

3-16. Voice Security Equipment

a. Description. The Voice Security Equipment is used with the FM Command Radio to provide secure two way communication (figs 3-11 through 3-14). The equipment is controlled by the control-indicator mounted in the pilot right console. The POWER switch must be in the ON position, regardless of the mode of operation, whenever the equipment is installed.

b. Controls and Functions. Refer to figure 3-14.

c. Operation. Normal operation will exist without its encoder/decoder and control indication being installed in the helicopter. However, two operation modes are available when they are installed. PLAIN mode for unciphered radio transmission or reception and CIPHER mode for ciphered radio transmission or reception. Both modes may be operated with or without retransmission units.

(1) *Preliminary.*

(*a*) Set the control indicator POWER switch to ON.

(*b*) Apply power to FM radio set.

(*c*) When power is initially applied, an automatic alarm procedure is initiated.

1 A constant tone is heard in the headset and after approximately two seconds the constant tone will change to an interrupted tone.

2 To clear the interrupted tone, press and release the press to talk switch, the interrupted tone will no longer be heard, and the circuit will be in a standby condition ready for either transmission or reception. No traffic will be passed if the interrupted tone is still heard after pressing and releasing the press to talk switch.

(*d*) Set control unit function switch for desired type of operation (2 and 3 below).

(2) *Plain Mode.*

(*a*) Set the control indicator POWER switch to ON.

(*b*) Set the PLAIN-CIPHER switch to PLAIN (indicated by red light).

(*c*) Set the RE-X-REG switch to REG; except when operating with retransmission units, at which time switch will be placed in the RE-X position.

(*d*) Press the press to talk switch and speak into the microphone to transmit. Release the press to talk switch for reception.

(3) *Cipher Mode.*

(*a*) Set the PLAIN-CIPHER switch to CIPHER (indicated by a green light).

(*b*) Place the RE-X-REG switch to REG, except when operating with retransmission units, at which time the switch will be placed in RE-X position.

(*c*) To transmit, press the press to talk switch. NO NOT TALK; in approximately one-half second, a beep will be heard. This indicates the receiving station is now capable of receiving your message. Transmission can now commence. Only one voice security system can transmit on a given frequency. Always listen before attempting to transmit to assure that no one else is transmitting.

(*d*) When transmission is completed, release the press to talk switch. This will return equipment to the standby condition.

(*e*) To receive, it is necessary for another station to send you a signal first. Upon receipt of a signal the cipher equipment will be switched automatically to the receive condition, which will be indicated by a short beep heard in the headset. Reception will then be possible. Upon loss of the signal, the cipher equipment will be automatically returned to the standby condition.

3-16.1 Voice Security Equipment TSEC/KY-58

a. Description. The voice security equipment is used with the FM Command Radio to provide secure two way communication. The equipment is controlled by the control-indicator (Z-AHP) mounted in the right pedestal panel. The POWER switch must be in the ON position, regardless of the mode of operation, whenever the equipment is installed.

b. Controls and Functions. Refer to Figure 3-14.

c. Operating Procedures.

(1) Operating procedures for secure voice.

NOTE

To talk in secure voice, the KY-58 must be ''Loading'' with any number of desired variables.

(*a*) Set to MODE switch to OP.

(*b*) Set the FILL switch to the storage register which contains the crypto-net variable (CNV) you desire.

(*c*) Set the POWER switch to ON.

(*d*) Set the PLAIN C/RAD switch to C/RAD.

(*e*) If the signal is to be retransmitted, set the DELAY switch to (ON).

(*f*) At this time a crypto alarm, and background noise, in the aircraft audio intercom system should be heard. To clear this alarm, press and release PTT in the aircraft audio/intercom system. Secure voice communication is now possible.

NOTE

When operating in either secure or clear (plain) voice operations the VOLUME must be adjusted on the aircraft radio and intercom equipment to a comfortable operating level.

(2) Clear Voice Procedures:

(*a*) To operate in clear voice (plain text) simply:

1 Set the Z-AHP(RCU) PLAIN-C/RAD switch to PLAIN.

2 Operate the equipment

(3) Zeroing Procedures

NOTE

Instructions should originate from the Net Controller or Commander as to when to zeroize the equipment

(*a*) To zeroize the KY-58: (Power must be on).

1 Lift the red ZEROIZE switch cover on the RCU.

2 Lift the spring-loaded ZEROIZE switch. This will zeroize positions 1-6.

3 Close the red cover.

The equipment is now zeroized and secure voice communications are no longer possible.

(4) Automatic Remote Keying Procedures

NOTE

Automatic Remote Keying (AK) causes an ''old'' crypto-net variable (CNV) to be replaced by a ''new'' CNV. Net Controller simply transmits the ''new'' CNV to your KY-58.

(*a*) The Net Controller will use a secure voice channel, with directions to stand by for an AK transmission. Calls should not be made during this standby action.

(*b*) Several beeps should now be heard in your headset. This means that the ''old'' CNV is being replaced by a ''new'' CNV.

(*c*) Using this ''new'' CNV, the Net Controller will ask you for a ''radio check.''

(*d*) After the ''radio check'' is completed, the Net Controller instructions will be to resume normal communications. No action should be taken until the net controller requests a ''radio check.''

(5) Manual Remote Keying Procedures.

(*a*) The Net Controller will make contact on a secure voice channel with instructions to stand by for a new crypto-net variable (CNV) by a Manual Remote Keying (MK) action. Upon instructions from the Net Controller:

1 Set the Z-AHP FILL switch to position 6. Notify the Net Controller by radio, and stand by.

2 When notified by the Net Controller, set the Z-AHP MODE switch to RV (receive variable). Notify the Net Controller, and stand by.

3 When notified by the Net Controller, set the Z-AHP FILL switch to any storage position selected to receive the new CNV (May be unused or may contain the variable being replaced). Notify the Net Controller, and stand by.

NOTE

When performing Step 3, the storage position (1 through 6) selected to receive the new CNV may be unused, or it may contain the variable which is being replaced.

(*b*) Upon instructions from the Net Controller:

1 Listen for a beep on your headset.

2 Wait two seconds

3 Set the the RCU MDOE switch to OP

4 Confirm

(*c*) If the MK operation was successful, the Net Controller will now contact you via the new CNV.

(*d*) If the MK operation was not successful, the Net Controller will contact you via clear voice (plain) transmission; with instructions to set your Z-AHP FILL selector switch to position 6, and stand by while the MK operation is repeated.

(6) It is important to be familiar with certain KY-58 audio tones. Some tones indicate normal operation, while other indicate equipment malfunction. These tones are:

(*a*) Continuous beeping, with background noise, is cryptoalarm. This occurs when power is first applied to the KY-58, or when the KY-58 is zeroized. This beeping is part of normal KY-58 operation. To clear this tone, press and release the PTT button on the Z-AHQ (after the Z-AHQ LOCAL switch has been pressed. Also the PTT can be pressed in the cockpit.

(*b*) Background noise indicates that the KY-58 is working properly. This noise should occur at TURN ON of the KY-58, and also when the KY-58 is generating a cryptovariable. If the background noise is not heard at TURN ON, the equipment must be checked out by maintenance personnel.

(*c*) Continuous tone, could indicate a ''parity alarm.'' This will occur whenever an empty storage register is selected while holding the PTT button in. This tone can mean any of three conditions:

1 Selection of any empty storage register.

2 A ''bad'' cryptovariable is present.

3 Equipment failure has occurred. To clear this tone, follow the ''Loading Procedures'' in TM 11-5810-262-OP. If this tone continues, have the equipment checked out by maintenance personnel.

(*d*) Continuous tone could also indicate a cryptoalarm. If this tone occurs at any time other than in (c) above, equipment failure may have occurred. To clear this tone, repeat the ''Loading Procedures'' in TM 11-5810-262-OP. If this tone continues, have the equipment checked out by maintenance personnel.

(*e*) Single beep, when RCU is not in TD (Time Delay), can indicate any of three normal conditions:

1 Each time the PTT button is pressed when the KY-58 is in C (cipher) and a filled storage register is selected, this tone will be heard. Normal use (speaking) of the KY-58 is possible.

2 When the KY-58 has successfully received a cryptovariable, this tone indicates that a ''good'' cryptovariable is present in the selected register.

3 When you begin to receive a ciphered message, this tone indicates that the cryptovariable has passed the "parity" check, and that it is a good variable.

(f) A single beep, when the RCU is in TD (Time Delay) occurring after the "preamble" is sent, indicates that you may begin speaking.

(g) A single beep, followed by a burst of noise after which exists a seemingly "dead" condition indicates that your receiver is on a different variable than the distant transmitter. If this tone occurs when in cipher text mode: Turn RCU FILL switch to the CNV and contact the transmitter in PLAIN text and agree to meet on a particular variable.

3-17. HF Radio Set AN/ARC-102

a. Description. HF AM/SSB Radio Set AN/ARC-102 is a long range, high frequency (hf), single side band (ssb), transceiver that transmits and receives in the 2.0 to 30.0 MHz range. The control panel is located on the right side of the pedestal and tunes in one MHz stops to any of 28,000 manually selected frequencies. The primary mode of operation is ssb. However, it can also transmit and receive compatible amplitude modulated (am) signals.

b. Controls and Functions. Refer to figure 3-15.

c. Operation.

WARNING

When ground testing ARC-102 equipment, be sure that personnel are clear of antenna. Serious burns can result if body contact is made with the antenna during ground testing.

(1) Function selector switch—As desired.

(2) Frequency controls—Desired frequency. If the function selector is moved from the OFF position to an operating mode and the desired operating frequency is already set up on the control panel, rotate the first selector knob one digit off frequency and then back to the operating frequency. This will allow the system to return to the frequency.

(3) RF-SENS—Adjust.

(4) Intercommunications HF switch—As desired.

d. Emergency Operation. The AN/ARC-102 HF radio has two built-in protective devices that could cause the set to stop operating. The condition and corrective steps are as follows:

(1) A protective circuit is designed to turn the receiver-transmitter off, when a short exists in the output circuit. To restore the receiver-transmitter to operation, move the function selector to OFF position and then back to the desired operating mode.

(2) When the associated antenna coupler is required to complete several consecutive tuning cycles it may become overheated. In this event a thermal relay in the coupler unit is designed to turn off the receiver-transmitter. If the receiver-transmitter stops operating after a series of tuning cycles, position the function selector switch to OFF position, allow the thermal relay to cool for two minutes, and return the function selector to the desired operating mode.

(3) If the above procedure does not return the HF radio set to normal operation, place the function selector in the OFF position and report the failure to the maintenance personnel.

Section III. NAVIGATION

3-18. ADF Set AN/ARN-83

a. Description. The Automatic Direction Finder set provides radio aid to navigation, on helicopter serial Nos. 66-746 and subsequent, within the 190 to 1750 kHz frequency range. In automatic operation, the set presents continuous bearing information to any selected radio station and simultaneously provides aural reception of the stations transmission. In manual operation, the operator determines the bearing to any selected radio station by controlling the aural null of the directional antenna. The set may also be operated as a receiver.

b. Controls and Functions. Refer to figure 3-16.

c. Operation.

(1) *Automatic Operation.*

(a) RECEIVERS NAV switch—ON.

(b) Mode selector switch—ADF.

(c) Frequency—Select.

(d) Volume—Adjust.

(2) *Manual Operation.*

(a) Mode selector switch—LOOP.

(b) BFO switch—ON.

(c) LOOP L/R switch—Press right or left and rotate loop for null.

3-19. ADF Set AN/ARN-59

a. Description. The Direction Finder Set is a radio compass system to provide continuous automatic visual indication of the direction from which an incoming selected radio signal is received. It may also be used for homing and position fixing, or as a manually operated direction finder. The control panel, located in the pedestal, provides control for aural reception of AM signals in the 190 to 1750 kHz range.

b. Controls and Functions. Refer to figure 3-17.

c. Operation.

(1) *Automatic Operation.*

(a) ADF VOL control—ON.

(b) RECEIVERS NAV switch—ON.

(c) Frequency—Select.

(d) Function switch—COMP.

(2) *Manual Operation.*

(a) Function switch—LOOP.

(b) BFO switch—ON.

(c) LOOP switch—Press right or left and rotate loop for null.

3-20. VHF Navigation Set AN/ARN-82

a. Description. The Navigation Receiver set provides reception on 200 channels, with 50 kHz spacing between 108.0 and 126.95 MHz. This permits reception of the VHF omnidirectional range (VOR) between 108.0 and 117.95 MHz. The localizers are received on odd-tenth MHz, between 108.0 and 112.0 MHz and energized as selected. Both VOR and localizer are received aurally through the interphone system. The VOR is presented visually by the course indicator and the number 2 pointer on the bearing indicator and the localizer is presented visually by the vertical needle on the course deviation indicator (CDI) (fig 3-20). When the R-1963/ARN Glideslope/Marker Beacon Receiver is installed, the glideslope frequency is selected by tuning an associated localizer frequency on the control panel.

b. Controls and Functions. Refer to figure 3-18.

c. Operation.

(1) Function switch—PWR.

(2) RECEIVERS NAV switch—ON.

(3) Frequency—Select.

(4) VOL—Adjust.

3-21. VHF Navigation Set—AN/ARN-30E

a. Description. The VHF Navigation Receiver Set provides reception of 190 channels at 0.1 MHz intervals between 108.0 and 126.95 MHz. The VOR ILS control panel is located on the pedestal and permits reception and interpretation of VHF omnidirectional range and localizer signals broadcast by ground stations. Line of sight operation varies from 12 nautical miles at 100 feet altitude to 160 nautical miles at 20,000 feet altitude.

b. Controls and Functions. Refer to figure 3-19.

c. Operation.

(1) VOL-OFF switch—On and adjust.

(2) SQUELCH control—Counterclockwise.

(3) Frequency selectors—Select.

The warning flag for the vertical pointer is an indication of signal strength and reliability. Under no circumstances should navigation be attempted if the flag is visible. If the TO-FROM indicator remains blank, do not attempt VOR navigation.

(4) Vertical pointer and TO-FROM indicators (fig 3-20)—Masked.

(5) SQUELCH control—Adjust.

3-22. Course Deviation Indicators ID-453 and ID-1347/

a. Description. The Course Deviation Indicator, used with the VHF Navigation Receiver system, is installed in the instrument panel (figs 3-18 and 3-19). The purpose of the indicator is to depict bearing and deviation of the helicopter from the selected station. Also, information is presented from the FM Receiver when the mode selector switch is in HOME position (figs 3-10, 3-11, 3-12, and 3-13). When the R-1963/ARN Marker Beacon/Glideslope

Receiver is installed, data is presented by the horizontal pointer and GS warning flag.

b. Controls and Functions. Refer to figure 3-20.

c. Operation. Refer to the applicable VHF Navigation Receiver and/or FM Radio set operating procedures.

3-23. Gyromagnetic Compass Set

a. Description.

(1) The Gyromagnetic Compass Set is a direction sensing system which provides a visual indication of the magnetic heading (MAG) of the helicopter. The information which the system supplies may be used for navigation and to control flight path of the helicopter. The system may also be used as a free gyro (DG) in areas where the magnetic reference is unreliable.

(2) A radio magnetic indicator is installed in the pilot instrument panel. A second radio magnetic indicator (not shown) is installed in the copilots instrument panel. The copilot indicator is a repeater type instrument similar to the pilot indicator except that it has no control knobs. The moving compass card on both indicators displays the gyromagnetic compass heading. The number 1 pointer on the indicators indicate the bearing to the NDB or course to the VOR station. The number 2 pointer indicates the VOR course to station.

(3) The system does not have a "fast—slewing" feature. If the compass is 180° off the correct helicopter heading when the system is energized it will take approximately 1 hour and 30 minutes (2° per minute) for the compass to slave to the correct headings.

b. Controls and Functions. Refer to figure 3-21.

c. Operation.

(1) INV switch—MAIN or STBY.

(2) Radio magnetic indicator (pilot only)—Check power failure indicator is not in view.

(a) Slaved gyro mode.

1 COMPASS switch—MAG.

2 Synchronizing knob—Center (Null) annunciator.

3 Magnetic heading—Check.

(b) Free gyro mode.

1 COMPASS switch—DG.

2 Synchronizing knob—Set heading.

3 Annunciator—Center position and then does not change (annunciator is de-energized in the free gyro (DG) mode).

(c) Inflight operation.

1 Set the COMPASS switch to DG or MAG as desired for magnetically slaved or free gyro mode of operation. Free gyro (DG) mode is recommended when flying in latitudes higher than 70°.

2 When operated in the slaved (MAG) mode, the system will remain synchronized during normal flight maneuvers. During violent maneuvers the system may become unsynchronized, as indicated by the annunciator moving off center. The system will slowly remove all errors in synchronization however, if fast synchronization is desired turn the synchronizing knob in the direction indicated by the annunciator until the annunciator is centered again.

3 When operating in the free gyro (DG) mode, periodically update the heading to a known reference by rotating the synchronizing knob.

3-24. Marker Beacon Receiver

a. Description. The Marker Beacon Receiver set is a radio aid to navigation. It receives 75 MHz marker beacon signals from a ground transmitter to provide the pilot with aural and visual information. The marker beacon controls and indicator are located on the instrument panel to aid in determining helicopter position for navigation or instrument approach.

b. Controls and Functions. Refer to figure 3-22.

c. Operation.

(1) VOLUME OFF/INCR control—ON.

(2) Receiver NAV switch (MB switch if SB-329/AR panel is used)—On.

(3) Volume—Adjust.

(4) SENSING HIGH/LOW switch—As desired.

d. Stopping Procedures. VOLUME OFF/INCR control—OFF.

3-24.1 Distance Measuring Equipment (DME) AN/ARN-124.

a. Description.

The AN/ARN-124 DME consists of a receiver-transmitter (interrogator), antenna, indicator and hold light.

The interrogator is installed in the aft left radio-electronics compartment. The indicator and hold light are installed on the pilot's instrument panel.

The indicator displays distance in nautical miles from the helicopter to the DME ground station and controls power to the interrogator.The interrogator contains 200 channels covering a frequency range of 962 MHz through 1213 MHz. Signals from the interrogator are responded to by a DME ground station, resulting in a readout on the indicator. DME frequency selection is controlled by the VOR control panel, C-6873B/ARN-82. VOR-DME frequencies are automatically paired. The hold light is controlled by the indicator. Illumination of the hold light indicates a DME frequency is in the hold mode. ILS glideslope indications are not possible with the switch in the hold position. Use of the hold mode permits a change of VOR frequency without changing the DME frequency. DME station identification is accomplished by a continuous 1350 Hz tone in the ICS. Power to operate the DME is from the dc essential bus, through the DME ARN-124 circuit breaker.

b. Controls and Functions. Refer to figure 3-23.

Section IV. TRANSPONDER AND RADAR

3-25. Transponder Set AN/APX-72

a. Description. The APX-72 provides radar identification capability. Five independent coding modes are available. The first three modes may be used independently or in combination. Mode 1 provides 32 possible code combinations, any one of which may be selected in flight. Mode 2 provides 4,096 possible code combinations but only one is available since the selection dial is not available in flight and must be preset before flight. Mode 3/A provides 4,096 possible codes, any of which may be selected in flight. Mode C is used with the AAU-32/A Encoding Altimeter (AIMS). Mode 4, which is connected to an external computer, can be programmed prior to flight to display any one of many classified operational codes for security identification. The effective range depends on the capability of interrogating radar and line of sight. The transponder set is mounted on the center pedestal. The IFF CODE HOLD switch on the instrument panel interfaces with MODE 4 (fig 2-4). This allows the crew to hold the classified operational code that has been programmed. The IFF CODE HOLD switch must be momentarily held in the ON position prior to turning the CODE switch to HOLD. The CODE switch must be in HOLD a minimum of 20 seconds prior to turning MASTER control OFF.

b. Controls and Functions. Refer to figure 3-24.

c. Operation.

(1) MASTER control—STBY. Allow approximately 2 minutes for warmup.

(2) MODE and CODE—Select as required.

(3) TEST M-1, 2, 3/A and C - As required.

(4) MASTER control—NORM or LOW as required.

(5) IDENT—As required.

(6) STOPPING procedure. MASTER control—OFF.

d. Emergency Operation. MASTER control—EMER.

3-26. Transponder Set AN/APX-100.

a. Description. The transponder set AN/APX-100 enables the helicopter to identify itself automatically when properly challenged by friendly surface and airborne radar equipment. The control panel enables the set to operate in modes 1, 2, 3A, 4 and test. Mode 4 is operational when computer KIT-1/A/TSCE (classified) is installed, properly code keyed, and IFF caution advisory light is not on. The range of the receiver-transmitter is limited to line of sight transmission since its frequency of operation is in the UHF band making range dependent on altitude.

b. Controls and functions—Transponder Set. Refer to figure 3-25.

c. Operation—Transponder Set.

(1) MASTER control—STBY. Allow approximately 2 minutes for warmup.

(2) MODE and CODE—As required.

(3) MASTER control—NORM.

(4) TEST—As required.

(5) ANT—As desired.

(6) IDENT—As required.

(7) Stopping procedure. MASTER control—OFF.

d. Emergency Operation—Transponder Set. MASTER control—EMERG.

3-27. Mode 4 Operation (APX-72 and APX-100)

a. Before Exterior Check.

(1) MASTER switch—OFF.

(2) IFF CODE HOLD switch (on the instrument panel)—HOLD. If the IFF CODE HOLD switch is OFF and the MASTER switch is in any position other than OFF, MODE 4 codes will zeroize when the battery switch is turned off during the BEFORE EXTERIOR check.

b. Aircraft Runup—Test.

(1) MASTER switch—STBY for 2 minutes.

(2) CODE switch—A.

(3) MODE 4 TEST/ON/OUT switch—ON.

(4) MODE 4 AUDIO/LIGHT/OUT switch—AUDIO.

(5) MODE 4 TEST/ON/OUT switch—TEST momentarily. The REPLY light should be on. If the REPLY light is not on or the IFF caution light goes on when the switch is at TEST, a malfunction is indicated and MODE 4 shall not be used. Release the switch to the ON position. Further testing to check for correct coding responses is done with ground test equipment by a qualified technician when ground test is used to interface with the mode 4 systems the following indications should be observed;

(6) APX-72.

(a) REPLY light should go on.

(b) Audio tone should be heard.

(c) If the above indications do not occur, select the opposite code (A or B) and repeat the check.

(7) APX-100.

(a) REPLY light should go on.

(b) If the REPLY light does not illuminate and/or the audio tone is heard, select the opposite code (A or B) and repeat check.

(8) If the aircraft transponder does not respond correctly to ground test interrogation, the IFF caution light should illuminate. If there is any indication of an unsatisfactory test, MODE 4 shall not be used.

c. Zeroizing. Mode 4 codes may be zeroized by either of the following methods:

(1) CODE switch—ZERO.

(2) MASTER switch—OFF. If the switch is returned to NORMAL within about 20 seconds, zeroizing may not occur.

(3) Aircraft electrical power—OFF. If the IFF CODE HOLD switch (on the instrument panel) is at HOLD and the CODE switch has been moved to HOLD 20 seconds prior to removing electrical power, zeroizing will not occur in (1) and (2) above.

d. Before Takeoff. IFF CODE HOLD switch (on the instrument panel)—OFF.

e. Engine Shutdown.

(1) If MODE 4 codes are to be held (not zeroized):

(a) IFF CODE HOLD switch (on the instrument panel)—HOLD.

(b) CODE switch—HOLD and release at least 20 seconds prior to moving MASTER switch to OFF or removing all electrical power.

(2) If MODE 4 codes are to be zeroized, use any of the zeroizing methods.

3-28. Altitude Encoder/Pneumatic Altimeter AAU-32/A

a. Description. The AAU-32/A pneumatic counter-drum-pointer altimeter is a self-contained unit which consists of a precision pressure altimeter combined with an altitude encoder (fig. 3-26). The display indicates and the encoder transmits, simultaneously, pressure altitude reporting. Altitude is displayed on the altimeter by a 10,000 foot counter, a 1,000 foot counter and a 100 foot drum. A single pointer indicates hundreds of feet on a circular scale, with 50 foot center markings. Below an altitude of 10,000 foot a diagonal warning system will appear on the 10,000 foot counter. A barometric pressure setting knob is provided to insert the desired altimeter setting in inches of Hg. A dc powered vibrator operates inside the altimeter whenever the aircraft power is on. If dc power to the altitude encoder is lost, a warning flag placarded CODE OFF will appear in the upper left portion of the instrument face indicating that the altitude encoder is inoperative and that the system is not reporting altitude to ground stations. The CODE OFF flag monitors only the encoder function of the altimeter. It does not indicate transponder condition. The AIMS altitude reporting function may be inoperative without the AAU-32/A CODE OFF flag showing, in case of transponder failure or improper control settings. It is also possible to get a ''good'' MODE C test on the transponder control with the CODE OFF flag showing. Display of the CODE OFF flag only indicates an encoder power failure or a CODE OFF flag failure. In this event, check that dc power is available and that the circuit breakers are in. If the flag is still visible, radio contact should be made with a ground radar site to determine whether the AIMS altitude reporting function is operative, and the remainder of the flight should be conducted accordingly.

b. Operation.

(1) *Normal Operation.* The AIMS altimeter circuit breaker should be closed prior to flight. the Mode C switch (M-C) on the transponder control should be switched to ON for altitude reporting during flight. The AAU-32/A altimeter indicates pneumatic altitude reference to the barometric pressure level as selected by the pilot. At ambient pressure, altimeters should agree with ±70 feet of the field elevation when the proper barometric pressure setting is set in the altimeter. If there is an error of greater than ±70 feet, do not use the altimeter for IFR flight. A red flag marked CODE OFF is located in the upper left portion of the altimeters face. In order to supply Mode C information to the IFF transponder, the CODE OFF flag must not be visible. A vibrator, powered by the dc essential bus, is contained in the altimeter and requires a minimum of one minute warmup prior to checking or setting the altimeter.

(2) *Abnormal Operation.*

(a) If the altimeters internal vibrator becomes inoperative due to internal failure or dc power failure, the pointer and drum may momentarily hang up when passing from 9 through 0 (climbing) or from 0 through 9 (descending). This hang-up will cause lag, the magnitude of which will depend on the vertical velocity of the aircraft and the friction in the altimeter. Pilots should be especially watchful for this type failure when the minimum approach altitude lies within the 8—1 part of the scale (800 to 1100, 1800 to 2100, etc).

(b) If the CODE OFF flag is visible, the dc power is not available, the circuit breaker is not in, or there is an internal altimeter encoder failure.

(c) If the altimeter indicator does not correspond within 70 feet of the field elevation (with proper local barometric setting) the altimeter needs rezeroing or there has been an internal failure.

(d) If the baroset knob binds or sticks, abnormal force should not be used to make the setting as this may cause internal gear failure resulting in altitude errors. Settings can sometimes be made by backing off and turning at a slower rate.

3-29. Proximity Warning System YG-1054

a. Description. The proximity warning transponder, control panel located at the forward left side of the pedestal, operates at frequency 5.08 GHz. The system provides audio and visual intruder indications of similarly equipped aircraft within 5,000 feet laterally and 300 feet vertically. Vertical operation is influenced by barometric pressure from the helicopters pitot static tube.

b. Controls and Functions. Refer to figure 3-27.

c. Operation.

(1) POWER switch—ON.

(2) Test—CONFIDENCE TEST.

(3) RANGE SELECT—As desired.

(4) LIGHT INTENSITY—As desired.

(5) AUDIO—Adjust.

(6) POWER—OFF.

3-30. Radar Warning Set

a. Description. The radar warning set AN/APR-39 provides the pilot with visual and audible warning when a hostile fire-control threat is encountered. The equipment responds to hostile fire-control radars but nonthreat radars are generally excluded. The equipment also receives missile guidance radar signals and, when the signals are time-coincident with a radar tracking signal, the equipment identifies the combination as an activated hostile surface to air (SAM) radar system. The visual and aural displays warn the pilot of potential threat so that evasive maneuvers can be initiated.

Caution

To prevent damage to equipment, do not operate the AN/APR-39 within 60 yards of a ground based radar antenna.

b. Controls and Functions. Refer to figure 3-29.

c. Operation.

(1) *System Operation.*

(a) PWR switch—ON

(b) AUDIO control—Adjust.

(c) Intensity control—Adjust.

(d) NIGHT—DAY control—Adjust.

(2) *Self-Test Operation.*

(a) DSCRM switch—ON.

(b) Press SELF TEST switch, verify that within approximately three seconds the indicator displays a forward (0 degrees) or aft (180 degrees) strobe and an audio tone is heard.

(c) Approximately three seconds later, the opposite strobe should appear and the audio tone becomes stronger.

(3) *Stopping Procedure. PWR switch—OFF.*

3-31. V Radar Altimeter—AN/APN-209

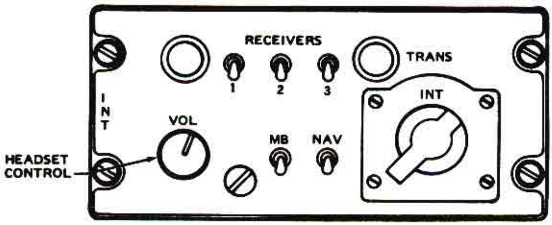
a. Description. The radar altimeter set is a high resolution pulse radar that provides an indication of absolute clearance over all types of terrain. The set consists of the following: a panel mounted height indicator receiver transmitter (located on copilot instrument panel); a panel mounted remote height indicator (located on pilot instrument panel) and two flush mounted antennas on the underside of the helicopter. The controls and displays of the height indicator receiver-transmitter (IRT) and the remote height indicator (RI) are identical (see fig 3-27). Absolute altitude is displayed by a pointer and a digital readout. The pointer operates against a fixed dial and indicates tens of feet between 0 to 200 feet, and hundreds of feet between 200 to 1500 feet. Above 1500 feet the pointer is driven behind a mask. The digital display has a four digit readout. The readout is displayed in one foot increments up to 255 feet. At 256 feet the display is rounded up to 260 feet. Between 260 and 1500 feet the readout is displayed in tens of feet. The LO SET control knob functions as the on-off switch and is the low altitude trip point adjustment. Clockwise rotation turns the set on. Continuing a clockwise rotation provides for the setting of the low altitude bug. The HI SET control knob provides for the setting of the high altitude bug. Depressing the HI SET control knob places the altimeter set in the self-test mode. The IRT sends a simulated signal of 1000 feet to both indicators. The indicators display the information via the pointer and digital readout. Whenever the indicated altitude drops below the low altitude bug setting the LO altitude warning lamp is activated. Whenever the indicated altitude goes above the high altitude bug setting, the HI altitude warning lamp is activated. When the LO SET control knob is turned to OFF, or during periods of unreliable operation, the OFF flag comes into view.

(b) Operation. The following procedures apply to both indicators (IRT on copilot instrument panel, and RI on pilot instrument panel). Accomplish procedures using controls on each indicator.

(1) *Initial Operation.* Turn the IRT and RI on by turning the LO SET control knob clockwise. Set the low altitude warning bug to 80 feet by turning LO SET control knob clockwise. Set the high altitude warning bug to 800 feet by turning the HI SET control knob clockwise. The indicators should display a track condition within two minutes from the time indicator was turned on. The OFF flag should disappear from view; the pointer read 0 to 3 feet; the digital display -0 to +3 feet; and the LO warning lamp illuminate. Press and hold the HI SET control knob (push to test operation). The indicator pointer should read 1000 ±175 feet; the digital display 1,000 ±100 feet; the LO warning lamp should be off and the HI warning lamp on.

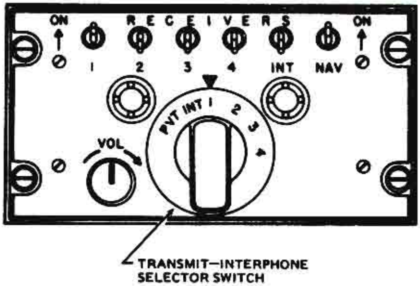
(2) *Normal Operation.* Adjust LO SET control knob to desired setting for low altitude warning bug. The LO warning lamp will illuminate when indicated altitude drops below this setting. Adjust HI SET control knob to desired setting for high altitude warning bug. The HI warning lamp will illuminate when indicated altitude goes above the high altitude warning bug setting. For daylight operations, set the pilot instrument lighting control (overhead console) to OFF. This setting provides lighting at full brightness to the warning lamps and digital displays on both indicators. Turning the instrument lighting controls (pilot and copilot) controls clockwise dims the indicator lighting. In the event of loss of track due to helicopter attitude (30 degrees pitch or 45 roll) or to operation beyond the range of the altimeter, the altitude pointer swings behind the no-track mask and the digital readout is totally blanked. In addition, the OFF flag comes into view.

(3) *Stopping Procedure.* Turn LO SET control knob (on each indicator) fully counterclockwise.



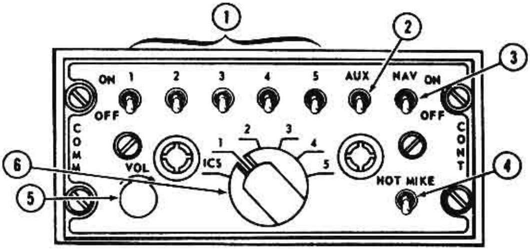
CONTROL/INDICATOR	FUNCTION
Receive switches	The switches marked 1, 2, 3 MB and NAV are for connecting or disconnecting receiver audio signals to the associated headset. The up position is on and connects the receiver. The down position is off and disconnects the receiver. The number 1 switch is for the FM receiver, number 2 switch is for the UHF receiver and switch number 3 is for the VHF receiver when installed. The switch marked MB connects audio from the marker beacon receiver, and the switch marked NAV connects audio from the ADF or VHF navigation receivers.
TRANS selector switch	This is a rotary type switch with indicator window at the top. The switch has four positions, INT, 1 (FM), 2 (UHF), and 3 (VHF). Positions 1, 2, and 3 select the receiver-transmitter to be used to receive or transmit regardless of the position of the RECEIVERS 1, 2, 3 switches. The INT position connects signal distribution panels for interphone operation. The operator will hear side tone when transmitting. The other crewmember will hear the interphone message regardless of the position of their TRANS selector switch.
VOL control	Adjusts the volume level of the audio applied to the headset associated with the INT signal distribution panel.

Figure 3-1. Signal Distribution Panel SB-329/AR



CONTROL	FUNCTION
RECEIVERS switches 1 (FM), 2 (UHF), 3 (VHF), and 4 (#2 FM/HF)	Turns audio from associated receiver ON or OFF.
INT switch	ON position enables operator to hear audio from the interphone.
NAV switch	ON position enables operator to monitor audio from the navigation receiver.
VOL control	Adjusts audio on receivers except NAV receivers.
Transmit-interphone selector switch	Positions 1 (FM), 2 (UHF), 3 (VHF), 4 (#2 FM/HF) and INT permits INT or selected receiver-transmitter to transmit and receive. The cyclic stick switch or foot switch must be used to transmit. PVT position keys interphone for transmission.

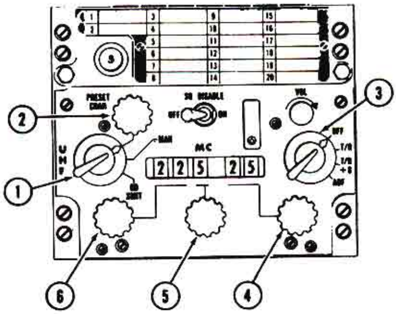
Figure 3-2. Signal Distribution Panel C-1611/AIC



CONTROL/INDICATOR	FUNCTION
1. Receiver Switches	Connect (ON) or disconnect OFF) communications receivers from the headsets.
1 — FM No. 1 ARC-54 or ARC-131	
2 — UHF ARC-51BX	
3 — VHF ARC-115	
4 — HF ARC-102	
5 — FM No. 2 ARC-114	
2. AUX Receiver Switch	Connects (ON) or disconnects (OFF) VOR omni receiver ARN-82 from the headset.
3. NAV Receiver Switch	Connects (ON) or disconnects (OFF) ADF navigation receiver ARN-83 from the headset.
4. HOT MIKE Switch	Permits hand-free intercommunications with transmit-interphone selector in any position.
5. VOL Control	Adjusts volume from receivers. Adjusts intercommunications volume.
6. Transmit-Interphone Selector	Selects transmitter to be keyed and connects microphone to tranmitters.
1 — FM No. 1 ARC-54 or ARC-131	
2 — UHF ARC-51BX	
3 — VHF ARC-115	
4 — HF ARC-102	
5 — FM No. 2 ARC-114	
ICS	Connects the microphone to the intercommunications system only, disconnecting microphone from transmitters.

Figure 3-3. Signal Distribution Control Panel (C-6533/ARC)

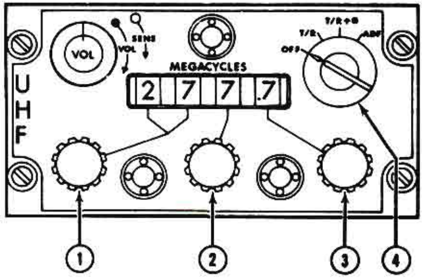
1. Mode selector
2. Preset channel control
3. Function select switch
4. 0.05 megahertz control
5. 1 megahertz control
6. 10 megahertz control



CONTROL/INDICATOR	FUNCTION
Function select switch	Applies power to radio set and selects type of operation as follows: OFF position — Removes operating power from the set. T/R position — Transmitter and main receiver ON. T/R + G position — Transmitter, main receiver and guard receiver ON. ADF position — Energizes, UHF-DF system when installed.
VOL control	Controls the receiver audio volume.
SQ DISABLE switch	In the ON position squelch is disabled. In the OFF position, the squelch is operative.
Mode selector	Determines the manner in which the frequencies are selected as follows: PRESET CHAN position — Permits selection of one of 20 preset channels by means of preset channel control. MAN position — Permits frequency selection by means of megacycle controls. GD XMIT position — Receiver-transmitter automatically tunes to guard channel frequency (243.00 MHz).
PRESET CHANnel	Permits selection of any one of 20 preset channels.
Preset channel indicator	Indicates the preset channel selected by the preset channel control.
Ten megahertz control	Selects the first two digits (or ten-megahertz number).
One megahertz control	Selects the third digit (or one-megahertz number).
Five-hundredths megahertz control	Selects the fourth and fifth digits (or 0.05 megahertz number).

Figure 3-4. UHF Control Panel C-6287/ARC-51BX

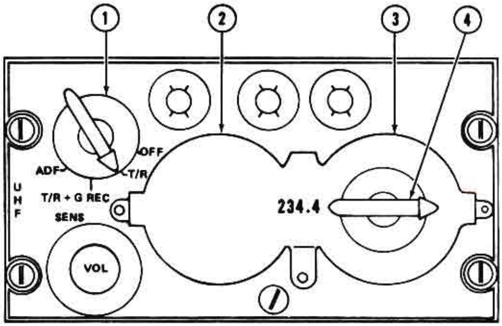
1. Frequency selector (first two digits)
2. Frequency selector (third digit)
3. Frequency selector (fourth digit)
4. Function selector switch



CONTROL/INDICATOR	FUNCTION
Function select switch	Applies power to the radio and selects type of operation as follows: OFF position — Removes operating power from radio set. T/R position — Applies power to the set and permits transmission and reception; guard receiver is not operative. T/R + G position — Permits transmission and reception; guard receiver is operative. ADF position — Not used.
VOL control	Controls the receiver audio volume.
SENS control	Adjusts main receiver sensitivity. When rotated fully clockwise the control disables the squelch.
Ten-megahertz control	Selects the first two digits (or ten-megahertz number).
One-megahertz control	Selects the third digit (or one-megahertz number).
One-tenth megahertz control	Selects the fourth digit (or tenth-megahertz number).

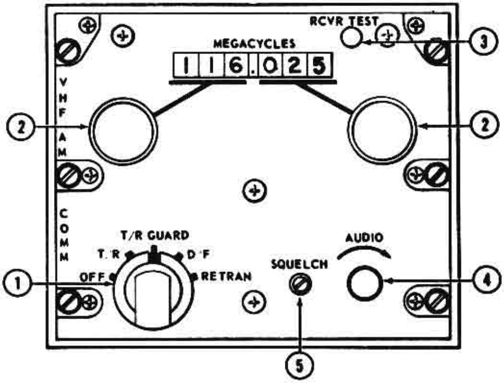
Figure 3-5. UHF Control Panel C-4677/ARC-51X

1. Function selector switch
2. Frequency selector (first two digits)
3. Frequency selector (third digit)
4. Frequency selector (fourth digit)



CONTROL/INDICATOR	FUNCTION
Selector switch	Applies power to the radio set and selects the mode of operation. OFF position — turns off primary power. T/R position — transmitter and main receiver are on. T/R + G REC position — transmitter, main receiver and guard receiver are on. ADF position — not used.
Volume sensitivity control	This is a dual purpose rotary control. The larger or outer knob is marked SENS, and controls receiver sensitivity. The smaller or inner knob is marked VOL, and controls receiver volume.
Tuning controls	The tuning controls consist of two large control knobs, an inner control knob, and an indicator window. The large knob on the left side selects the first two digits (or ten megahertz number). The large knob on the right side selects the third digit (or one megahertz number). The inner knob selects the fractional (or tenth megahertz number).

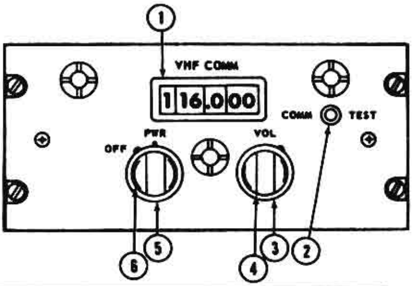
Figure 3-6. UHF Control Panel C-1827/ARC-55B



CONTROL/ INDICATOR	FUNCTION
1. Function Selector	
OFF	Power off.
T/R	Receiver — On; Transmitter — Standby.
T/R GUARD	Receiver — On; Transmitter — Standby; Guard Receiver — On. NOTE Reception on guard frequency is unaffected by frequencies selected for normal communications.
D/F	Not used.
RETRAN	Not used.
2. Frequency Selectors	
Left	Selects first three digits of desired frequency.
Right	Selects fourth, fifth and sixth digits of desired frequency.
3. RCVR TEST switch	When pressed, audible signal indicates proper receiver performance.
4. AUDIO control	Adjusts receiver volume.
5. SQUELCH control	Squelch control adjusted by maintenance personnel only.

Figure 3-7. Control Panel AN/ARC-115

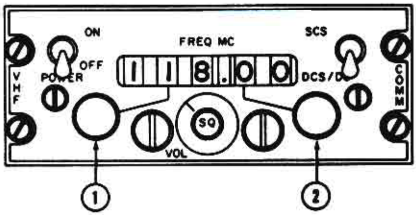
1. Frequency indicator
2. Communication test switch
3. Volume control
4. Kilohertz selector
5. Off/power switch
6. Megahertz selector



CONTROL/INDICATOR	FUNCTION
OFF-PWR switch	Turns power to the set ON-OFF.
VOL control	Controls the receiver audio volume.
COMM-TEST switch	Turns squelch on or off.
Megahertz control	Selects whole number part of operating frequency.
Kilohertz control	Selects the decimal number part of the operating frequency

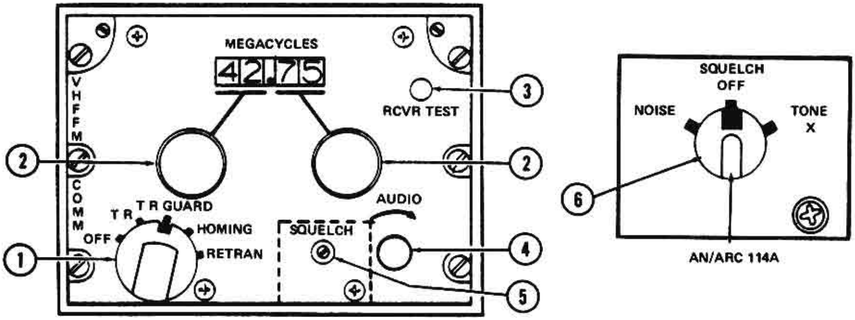
Figure 3-8. VHF Control Panel C-7197/ARC-134

1. Megahertz control knob
2. Kilohertz control knob



CONTROL/INDICATOR	FUNCTION
POWER switch	Turns primary power to the radio set ON or OFF
VOL control knob	Controls the receiver audio volume.
SQ control knob	Adjusts the squelch threshold level of the receiver output.
Megahertz control knob	Selects receiver and transmitter frequency in 1-mhz steps.
Kilohertz control knob	Selects receiver and transmitter frequency in 50-khz steps.
FREQ MC indicator window	Indicates receiver and transmitter frequency selected.
SCS-DCS/DCD switch	Not used.

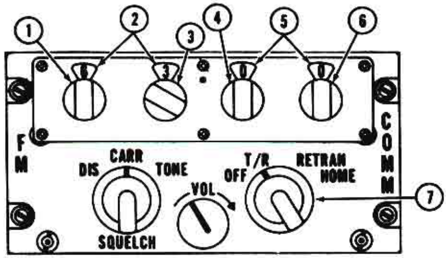
Figure 3-9. VHF Control Panel 614U-6/ARC-73



CONTROL/INDICATOR	FUNCTION
1. Function Selector	
OFF	Power Off
T/R	Receiver — On; Transmitter — Standby.
T/R GUARD	Receiver — On; Transmitter — Standby; Guard Receiver — On. NOTE Reception on guard frequency is unaffected by frequencies selected for normal communications.
HOMING	Not Used.
RETRAN	Activates the Retransmission Mode in Conjunction with Radio Set ARC-54 or ARC-131.
2. Frequency Selectors	
Left Selector	Selects first two digits of desired frequency
Right Selector	Selects third and fourth digits of desired frequency.
3. RCVR TEST	When pressed audible signal indicates proper receiver performance.
4. AUDIO	Adjusts receiver volume.
5. SQUELCH (ARC 114)	Squelch control adjusted by maintenance personnel only.
6. SQUELCH (ARC 114A)	
OFF	Disables squelch.
NOISE	Enables noise squelch.
TONE X	Enables tone squelch.

Figure 3-10. Control Panel AN/ARC-114 and AN/ARC-114A

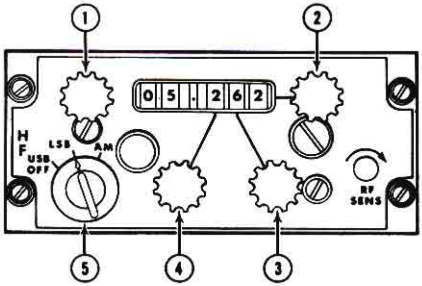
1. Tens megahertz digit frequency selector
2. Frequency indicators
3. Units megahertz digit frequency selector
4. Tenths megahertz digit frequency selector
5. Frequency indicators
6. Hundredths megahertz digit frequency selector
7. Mode control switch



CONTROL/INDICATOR	FUNCTION
Mode control switch (four-position switch)	
OFF	Turns off primary power.
T/R (transmit/receive)	Radio set operates in normal communication mode (reception). (Aircraft transmit switch must be depressed to transmit.)
RETRAN (retransmit)	Radio set operates as a two-way relay station. (Two radio sets are rquired set at least 3 MHz apart.)
HOME	Radio set operates as a homing facility. (Requires a homing antenna and indicator.)
VOL control	Adjusts the audio output level of the radio set.
SQUELCH switch (three-position rotary switch)	
DIS (disable)	Squelch circuits are disabled.
CARR (carrier)	Squelch circuits operate normally in presence of any carrier.
TONE	Squelch opens (unsquelches) only on selected signals (signals containing a 150-cps tone modulation).
Frequency indicator	
Tens megahertz frequency selector	Selects the tens megahertz digit of the operating frequency.
Units megahertz frequency selector	Selects the units megahertz digit of the operating frequency.
Tenths megahertz frequency selector	Selects the tenths megahertz digit of the operating frequency.
Hundredths megahertz frequency selector	Selects the hundredths megahertz digit of the operating frequency.
Frequency indicator	Displays the operating frequency of the radio set.

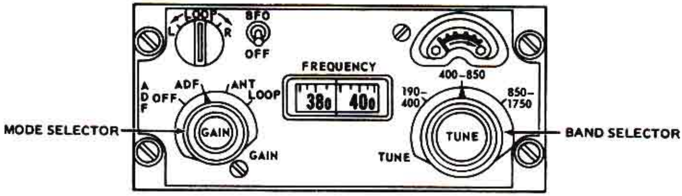
Figure 3-11. FM Radio Set Control Panel AN/ARC-131

1. Frequency selector (first two digits)
2. Frequency selector (fifth digit)
3. Frequency selector (fourth digit)
4. Frequency selector (third digit)
5. Function selector switch



CONTROL/ INDICATOR	FUNCTION
Function selector switch (4-position rotary switch)	OFF position — Turns off primary power to the radio set. USB position — Energizes radio set for upper sideband mode of operation. LSB position — Energizes radio set for lower sideband mode of operation. AM posi*ion — Energizes radio set for amplitude modulation mode of operation.
Megahertz select knobs	Four knobs used to select the desired frequency as follows: Upper left knob selects the first two digits of the desired frequency. Left center knob selects the third digit. Right center knob selects the fourth digit. Upper right knob selects the last digit of the operating frequency.
RF SENS knob	Controls the receiver audio volume.

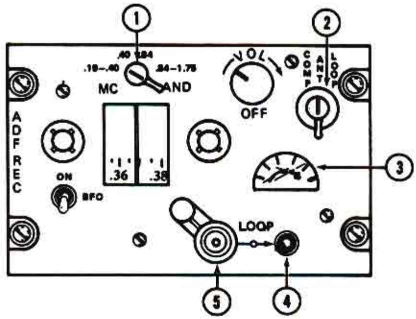
Figure 3-15. HF Radio Control Panel



CONTROL/ INDICATOR	FUNCTION
Band selector switch	Selects the desired frequency band.
TUNE control	Selects the desired frequency.
Tuning meter	Facilitates accurate tuning of the receiver.
GAIN control	Controls receiver audio volume.
Mode selector switch	Turns set OFF and selects ADF, ANT and LOOP modes of operation.
LOOP L-R switch	Controls rotation of loop left or right.
BFO switch	Turns BFO, on or off.

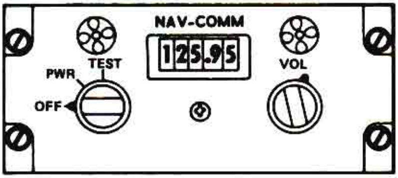
Figure 3-16. Direction Finder Control Panel ARN-83

1. Band switch
2. Function switch
3. Tuning meter
4. Loop switch
5. Tuning crank



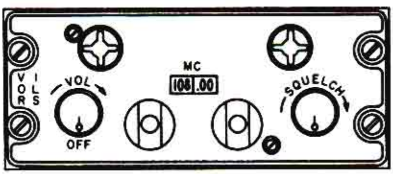
CONTROL/ INDICATOR	FUNCTION
MC BAND switch	Selects the desired frequency band.
VOL-OFF control	Turns direction finder set on or off and adjusts receiver audio volume.
Function switch	COMP position — Receiver operates on combined loop and sense antennas as a radio compass. ANT position — receiver operates with sense antenna. Loop position — receiver operates with loop antenna.
LOOP switch	Positions the loop antenna when the function switch is in either COMP or LOOP position.
Tuning crank	Tunes the receiver to the frequency of the received signal.
Tuning meter	Facilitates accurate tuning of the receiver.
BFO switch	Turns BFO ON or OFF.

Figure 3-17. ADF Control Panel ARN-59



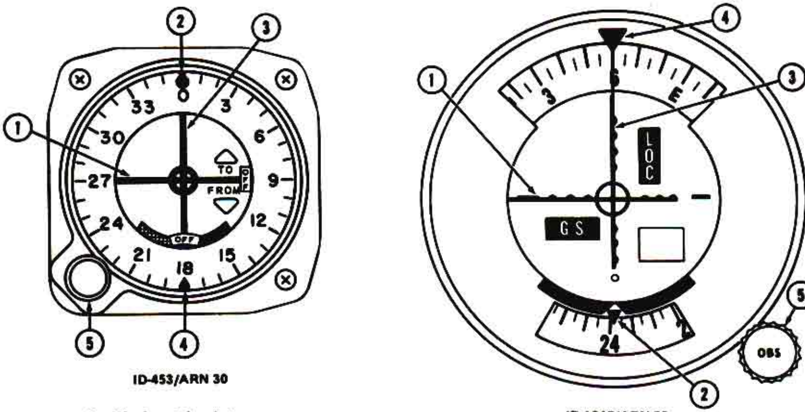
CONTROL/INDICATOR	FUNCTION
VOL control	Controls receiver audio volume.
Power switch	Turns primary power to the radio set and to the R-1963/ARN Marker Beacon/Glideslope Receiver ON or OFF. Allows for accuracy of Course Deviation Indicators and Marker Beacon indicator lamp in the TEST position.
Whole megahertz channel selector knob	This is the control knob on the left side. It is used to select the whole megahertz number of the desired frequency.
Fractional megahertz channel selector knob	This is the control knob on the right side. It is used to select the fractional megahertz number of the desired frequency.

Figure 3-18. Navigation Control Panel ARN-82



CONTROL/INDICATOR	FUNCTION
VOL-OFF switch	Turns primary power to the radio set ON or OFF and controls the receiver audio volume.
SQUELCH control	Controls receiver squelch circuit.
Whole megahertz control	Selects receiver and transmitter frequency in 1 MHz steps.
Fractional megahertz control	Selects receiver and transmitter frequency in 0.1 MHz steps

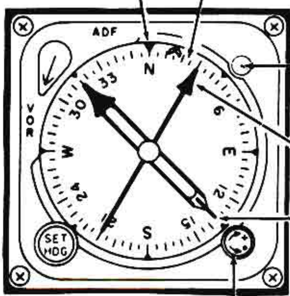
Figure 3-19. VHF Navigation Receiver Control Panel ARN-30E



1. Horizontal pointer
2. Reciprocal pointer
3. Vertical pointer
4. Course pointer
5. Course selector knob

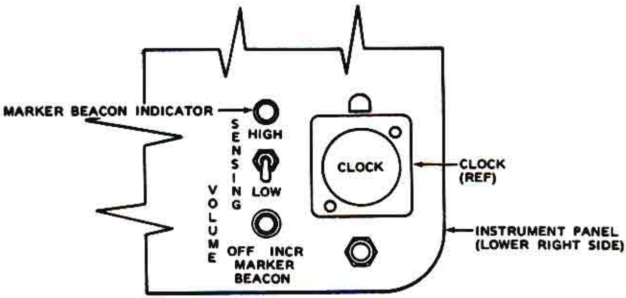
INDICATOR	FUNCTION
OFF vertical	Disappears when FM homing circuits are functioning properly. Remains in view when FM homing circuits are not functioning properly.
OFF horizontal flag	Disappears when homing circuits are functioning properly. Remains in view when FM homing circuits are not functioning properly. NOTE: Do not use if either OFF flag is in view.
Horizontal pointer	Indicate strength of FM homing signal being received. Deflects downward as signal strength decreases.
Vertical (reciprocal) pointer	Indicates when pointer is centered that helicopter is flying directly toward or away from the station. Deflection of the pointer indicates the direction (right or left) to turn to fly to the station.

Figure 3-20. Course Deviation Indicators ID-43/ARN-30 and ID-1347/ARN-82



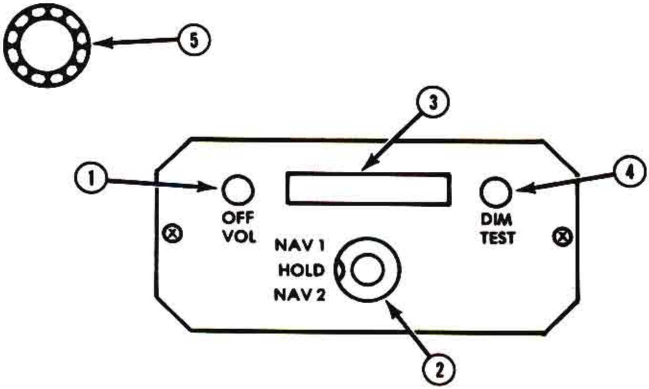
CONTROL/INDICATOR	FUNCTION
Pointer No. 1	Indicates course to ADF or VOR radio station.
Pointer No. 2	Indicates course to VOR station.
Synchronizing control	Is manually rotated to null annunciator and synchronize compass system.
SET HDG control	Moves the heading select cursor to desired heading.
Heading select cursor	Indicates desired heading.
ADF/VOR control	Selects ADF or VOR for pointer No. 1
Fixed index	Provides reference mark for rotating compass card.
Rotating compass card	Rotates under fixed index to indicate helicopter magnetic heading.
Annunciator	Show dot (●) or cross (+) to indicate misalignment (nonsynchronization) of compass system.
Power failure indicator (OFF) (flag)	Shows to indications loss of power to compass system.
Compass switch (located on pilots instrument panel)	MAG position slaved gyro mode DG position free gyro mode.

Figure 3-21. Gyromagnetic Compass Indicator (RMI)



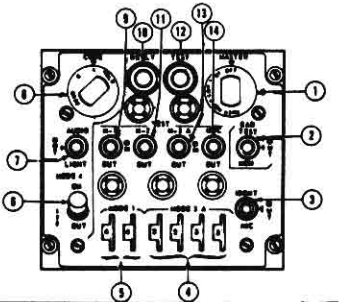
CONTROL/INDICATOR	FUNCTION
VOLUME OFF-INCR control	Turns set ON or OFF and adjusts volume.
SENSING switch	HIGH position — Increases sensitivity.
	LOW position — Decreases sensitivity.
Marker beacon indicator	Flashes when marker beacon receiver is operating and aircraft is passing over the ground transmitter.

Figure 3-22. Marker Beacon Controls



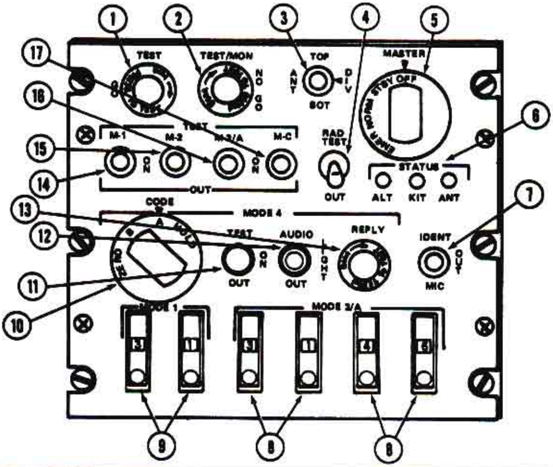
CONTROL	FUNCTION
1. OFF/VOL switch.	Controls powers to indicator and interrogator. Adjusts volume of audio identification (1350 Hz continuous tone).
2. NAV 1/HOLD/NAV 2 switch	
NAV 1	Selects DME frequency controlled by VOR control panel C-6873B/ARN-82.
NAV 2	When two VOR sets are installed, selects DME frequency controlled by No. 2 VOR.
HOLD	Holds DME frequency last selected by VOR control panel. Change of VOR frequency does not change DME frequency.
3. Distance Display	Digital readout indicating distance to DME station in hundreds, tens, units, and tenths of nautical miles.
4. DIM/TEST switch	
DIM	Controls brightness of display lighting.
TEST	Push test function provides digital readout of 0.0 or 0.1 in display window.
5. Hold light.	Lamp illumination indicates a DME frequency is in the hold mode.

Figure 3-23. DME Indicator ID-2192/ARN-124



CONTROL/INDICATOR	FUNCTION
1. MASTER Control	
OFF	Turns set off.
STBY	Places in warmup (standby) condition.
LOW	Set operates at reduced receiver sensitivity.
NORM	Set operates at normal receiver sensitivity.
EMER	Transmits emergency reply signals to MODE 1, 2, or 3/A interrogations regardless of mode control settings.
2. RAD TEST – MON Switch	
RAD TEST	Enables set to reply to TEST mode interrogations. Other functions of this switch position are classified.
MON	Enables the monitor test circuits.
OUT	Disables the RAD TEST and MON features.
3. IDENT-MIC Switch	
IDENT	Initiates identification reply for approximately 25 seconds.
OUT	Prevents triggering of identification reply. Spring loaded to OUT.
MIC	Not used.
4. MODE 3/A Code Select Switches	Selects and indicates the MODE 3/A four-digit reply code number.
5. MODE 1 Code Select Switches	Selects and indicates the MODE 1 two-digit reply code number.
6. MODE 4 Switch	
ON	Enables the set to reply to MODE 4 interrogations.
OUT	Disables the reply to MODE 4 interrogations.
7. AUDIO-LIGHT Switch	
AUDIO	Enables aural and REPLY light monitoring of valid MODE 4 interrogations and replies.
LIGHT	Enables REPLY light only monitoring of valid MODE 4 interrogations and replies.
OUT	Disables aural and REPLY light monitoring of valid MODE 4 interrogations and replies.
8. CODE Control	Holds, zeroizes or changes mode 4 code.
9. M-1 Switch	
ON	Enables the set to reply to MODE 1 interrogations.
OUT	Disables the reply to MODE 1 interrogations.
TEST	Provides test of MODE 1 interrogation by indication on TEST light.
10. REPLY Indicator	Lights when valid MODE 4 replies are present, or when pressed.
11. M-2 Switch	
ON	Enables the set to reply to MODE 2 interrogations.
OUT	Disables the reply to MODE 2 interrogations.
TEST	Provides test of MODE 2 interrogation by indication on TEST light.
12. TEST Indicator	Lights when the set responds properly to a M-1, M-2, M-3/A or M-C test, or when pressed. Note Computer, transponder must be installed before set will reply to a MODE 4 interrogation.
13. M-3/A Switch	
ON	Enables the set to reply to MODE 3/A interrogations.
OUT	Disables the reply to MODE 3/A interrogations.
TEST	Provides test of MODE 3/A interrogation by indication on TEST light.
14. M-C Switch	Used with AIMS altimeter.
ON	Enables set to reply to MODE C interrogation.
OUT	Disables reply to MODE C interrogation.
TEST	Enables TS-1843/APX to locally interrogate set.

Figure 3-24. Transponder Set AN/APX-72



CONTROL/INDICATOR	FUNCTION
1. TEST GO	Indicates successful built in test (BIT).
2. TEST/MON NO GO	Indicates unit malfunction.
3. ANT	
TOP	Selects antenna located on top of helicopter.
BOT	Selects antenna located on bottom of helicopter.
DIV	Monitor received signals from both antennas and allows transmission via antenna receiving the strongest signal.
4. RAD TEST switch	
RAD TEST	Enables set to reply to TEST mode interrogations.
OUT	Disables to RAD TEST features.
5. MASTER control	
OFF	Turns set off.
STBY	Places in warmup (standby) condition.
NORM	Set operates at normal receiver sensitivity.
EMER	Transmits emergency replay signal to MODE 1, 2, or 3/A interrogations regardless of mode control settings.
6. STATUS indicators	
ANT	Indicates that built in test (BIT) or monitor (MON) failure is due to high voltage standing wave ratio (VSWR) in antenna.
KIT	Indicates that built in test (BIT) or monitor (MON) failure is due to external computer.
ALT	Indicates that built in test (BIT) or monitor (MON) failure is due to altitude digitizer.

Figure 3-25. Transponder Set (AN/APX-100) Control Panel (Sheet 1 of 2)

CONTROL/INDICATOR	FUNCTION
7. IDENT-MIC switch	
IDENT	Initiates identification reply for approximately 25 seconds.
OUT	Prevents triggering of identification reply. Spring loaded to OUT.
MIC	Not used.
8. MODE 3/A code select switches	Selects and indicates the MODE 3/A four-digit reply code number.
9. MODE 1 code select switches	Selects and indicates the MODE 1 two-digit reply code number.
10. MODE 4/CODE control HOLD/A/B/ZERO	Selects condition of code changer in remote computer
11. MODE 4 TEST switch	
TEST	Selects MODE 4 BIT operation.
ON	Selects MODE 4 ON operation.
OUT	Disables MODE 4 operation.
12. MODE 4 AUDIO/LIGHT control	
AUDIO	MODE 4 is monitored by audio.
LIGHT	MODE 4 is monitored by a light.
OUT	MODE 4 not monitored.
13. MODE 4/REPLY	Indicates that a MODE 4 reply is generated.
14. TEST/M-1 TEST/ON/OUT	Selects ON, OFF or BIT of MODE 1 operation.
15. TEST/M-2 TEST/ON/OUT	Selects ON, OFF, or BIT of MODE 2 operation.
16. TEST/M-3/A TEST/ON/OUT	Selects ON, OFF, or BIT of MODE 3/A operation.
17. TEST/M-C TEST/ON/OUT	Selects ON, OFF, or BIT of MODE C operation.

Figure 3-25. Transponder Set (AN/APX-100) Control Panel (Sheet 2 of 2)

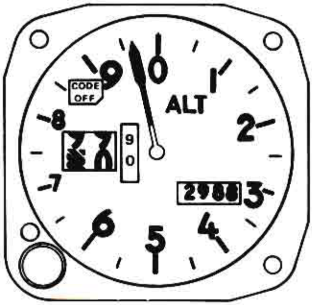


Figure 3-26. AAU-32/A Altitude Encode/Pneumatic Altimeter

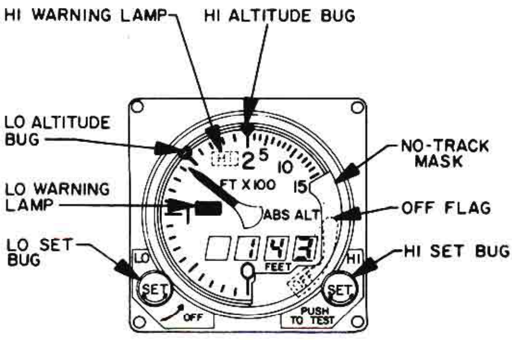
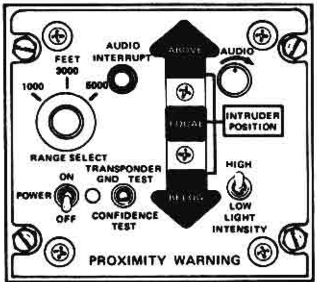
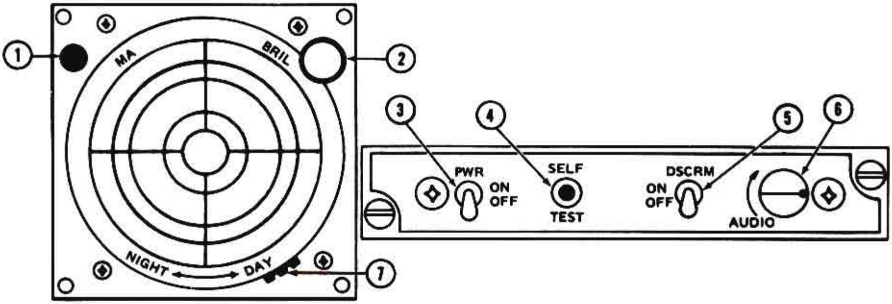


Figure 3-27. AN/APN-209 Radar Altimeter (V)



CONTROL/INDICATOR	FUNCTION
POWER ON/OFF switch	Controls 28Vdc power to system
POWER lamp	Indicates when 28Vdc power is applied to system
RANGE SELECT switch	Sets range gate circuitry to accept a reply signal within selected distances
AUDIO INTERRUPT push button switch	Silences audio alarm signal for approximately one minute
INTRUDER POSITION indicator lamps	Flash singly or in combination to indicate position of intruder as follows:
	FLASHING LAMP(S) — RELATIVE INTRUDER POSITION
	ABOVE — Between 110 and 300 feet above
	ABOVE and EQUAL — Between 80 and 110 feet above
	EQUAL — Between 80 feet above and 80 feet below
	EQUAL and BELOW — Between 80 and 110 feet below
	BELOW — Between 110 and 300 feet below
AUDIO control	Varies the volume of the audio tone
LIGHT INTENSITY switch	Switches INTRUDER POSITION and POWER indicator lamps to LOW or HIGH intensity
TRANSPONDER TEST switch	In TRANSPONDER GND TEST position, permits unit to accept signals from ground transponder. In CONFIDENCE TEST position, switch initiates confidence test

Figure 3-28. Proximity Warning Panel



CONTROL/INDICATOR	FUNCTION
1. MA Indicator	Flashing indicates high radar missile threat with DSCRM switch in ON.
2. BRIL Control	Adjusts indicator illumination.
3. PWR Switch:	
ON	Applies power to radar set.
OFF	De-energizes radar set.
4. SELF-TEST Switch:	
With DSCRM Switch OFF	No indications.
With DSCRM Switch ON	One strobe appears at the top or bottom and primary (normal) audio tone is heard. After short delay, a second strobe will appear 180 degrees from the initial strobe. After another short delay, MA light will start flashing and audio warning (wailing) tone is heard.
5. DSCRM Switch:	
OFF	Without missile activity — Provides strobe lines for ground radar and normal audio indications.
	With missile activity — Provides strobe lines for ground radar, flashing strobe line(s) for missile activity, and flashing MA (missile alert) light.
ON	Without missile activity — No indications.
	With missile activity — Flashing strobe lines for missile activity (no strobe lines for ground radar), flashing MA light, and audio warning (wailing) tone.
6. AUDIO Control	Adjusts radar warning audio volume.
7. NIGHT-DAY Control	Adjust indicator intensity.

Figure 3-29. Radar Warning System

Chapter 4

Mission Equipment

Section I. ARMAMENT

4-1. Armament Subsystem M23 The armament subsystem M23 is attached to external stores hard point fittings on both sides of the helicopter. The two flexible 7.62 millimeter machine guns M60D are free pointing but limited in traverse, elevation, and depression by cam surfaces and stops on pointless and pintle post assemblies of the two mount assemblies on which the M60D machine guns are mounted. An ejection control bag is latched to the right side of each M60D machine gun to hold the spent cases, unfired rounds and links. Cartridges travel from ammunition box and cover assemblies to M60D machine gun through flexible chute and brace assemblies. The following paragraphs describe machine gun M60D components.

a. Cover Latch. The cover latch is located at the right rear of the cover assembly. In the vertical position it secures cover assembly in closed position. Turning to horizontal position unlocks cover assembly.

b. Barrel Lock Lever. The barrel lock lever, located at right front of receiver, is secured to barrel locking shaft and rotates shaft to lock or unlock barrel assembly.

WARNING

Cocking handle assembly shall be returned to the forward or locked position before firing to prevent injury to personnel.

c. Cocking Handle Assembly. The cocking handle assembly, at right front of receiver, is used for manually charging the weapon.

d. Safety. The safety, located at lower front of receiver, consists of a cylindrical pin with a sear clearance cut which slides across receiver to block the sear and prevent accidental firing. Ends of pin are marked for pushing to ''S'' safe and ''F'' firing positions.

WARNING

Pressing the trigger to release the bolt assembly also accomplishes feeding and releases the firing mechanism. Weapon shall be cleared of cartridges before pressing trigger assembly, unless firing is intended.

e. Grip and Trigger Assembly. The grip and trigger assembly includes the spade grips and is located at rear of receiver. The U-shaped design permits firing of weapon by index finger of either hand.

Caution

When ammunition is not present in machine gun M60D, retard forward force of released bolt assembly by manually restraining forward movement of cocking handle assembly to prevent damage to cartridge tray.

f. Magazine Release Latch. The magazine release latch, located on left side of receiver, locks adapter of the ammunition chute when it is seated in magazine bracket.

g. Ammunition Chute Adapter. The ammunition chute adapter is required for flexible chute installation.

4-2. Preflight Procedures—Machine Gun M60D

1. Gun—Secure—Stowed position.
2. Barrel—Free of obstruction.
3. Gas cylinder—Plug tight, safety-wired.
4. Cover—Free movement, latch secure.
5. Ejection control bag—Latched.
6. Ammunition box—Latches and cover—Secure. Check cartridges for proper position in links.

7. Chute and brace—Secure.

8. Safety—Safe.

9. Mount—Check free pintle movement.

10. Ammunition boxes—Stowed.

4-3. Before Takeoff/Before Landing Procedure—Machine Gun M60D

1. Bolt—Retract, push handle forward.

2. Safety—Check safe.

3. Cover—Open.

4. Ammunition—Load.

5. Cover—Close, latch secure.

WARNING

Safety harness shall be worn by gunner and attached to helicopter during flight operations.

4-4. Before Leaving Helicopter Procedures—Machine Gun M60D Remove gun. Refer to TM 9-1005-224-10.

4-5. Emergency Procedures—Machine Gun M60D

WARNING

If a stoppage occurs, never retract bolt assembly and allow it to go forward again without inspecting chamber to see it is clear. Such an action strips another cartridge from the belt. If an unfired cartridge remains in the chamber, a second cartridge can fire the first and cause injury to personnel and/or weapon damage. One hundred fifty cartridges fired in a 2 minute period will make a barrel hot enough to produce a cookoff.

a. *Misfire*. A misfire is a complete failure to fire. It must be treated as a hangfire until possibility of a hangfire is eliminated.

b. *Hangfire*. A hangfire is a delay in functioning of the propelling charge. If a stoppage occurs, wait five seconds. Pull handle assembly to rear, ensuring operating rod assembly is held back.

c. *Double Feeding*. When a stoppage occurs with bolt assembly in forward position, assume there is an unfired cartridge in the chamber. Treat this as a hangfire.

d. *Runaway Gun*. If gun continues to fire after trigger has been released, open cover and permit bolt to go underneath cartridge and stop in the forward position.

e. *Cookoff*. A cookoff is a functioning of any or all of the explosive components of a cartridge chambered in a very hot machine gun. If the primer or propelling charge should cookoff, the projectile may be propelled from the machine gun with normal velocity, even though no attempt was made to fire the primer, by actuating firing mechanism. In such a case, although there may be uncertainty as to whether or when the cartridge will fire, the precautions to be observed are the same as those prescribed for a "hangfire". To prevent a cookoff, a cartridge, which has been loaded into a very hot machine gun, should be fired immediately or removed within 5 seconds to 10 seconds.

4-6. Armament Subsystem M56 and M132 Mine Dispersing

a. The M56 mine dispersing subsystem is attached to external stores hardpoint fittings on both sides of the helicopter and is electrically or manually jettisonable in an emergency. The mine dispenser is designed to provide release of mines from the 40 canisters with application of current through the intervalometer, which is part of the disperser electrical circuit. Total release of mines in all canisters is accomplished within a variable time span between each canister release, which is set by the pilot. A quick-release safe pin with an attached REMOVE BEFORE FLIGHT red flag is installed in the intervalometer to prevent accidental activation of the intervalometer before flight. A quick-release safe pin with an attached REMOVE BEFORE FLIGHT red flag is also installed in the pylon ejector rack to prevent the accidental dropping of the mines from the pylon. The subsystem consists of a bomb (mine) dispenser SUU-13D/A loaded with 40 mine canisters, each of which contains two anti-tank/anti-vehicle (AT/AV) mines and one mine ejection charge M198. The subsystem is used in conjunction with a dispenser control panel and a helicopter cable (harness) assembly (fig 4-1). A pallet, which is used for safety and handling purposes, attaches to the underside of the subsystem. The dispenser control panel allows the pilot to initiate mine dispersing, stop mine dispersing, control quantity of mines dispersed, set the time interval between the ejection of mines, and electrically jettison the subsystems in an emergency. The dispenser is fired by pressing the FIRE button of the DISP control. The firing sequence will continue until the quantity of mines selected have been ejected from the dispenser. Anytime after FIRE button is pressed, the firing sequence may be terminated by resetting the SAFE-ARM switch to the center STBY (standby) position. When the switch is again set in the ARM position and the FIRE button is again pressed, a new firing sequence is initiated. The helicopter cable (harness) assembly provides connection of the dispenser control panel to the heated blanket receptacle and to the subsystem firing and jettison circuitry.

b. The subsystem M132 is used by helicopter crews for gaining experience in dispersing mines which simulate those in the M56 subsystem. The M132 consists of a dispenser SUU-13D/A containing three practice mine canisters. Dispenser loading for a practice mining mission consists of three practice mine canisters loaded into each dispenser in firing locations 1, 20, and 40. The remaining 37 positions will be left empty. With the dispenser control panel mode selector switch set to PAIRS and the QUANTITY selector switch set to ALL, the dummy mines will be dispersed to land at the beginning, in the middle and at the end of the target area.

4-7. Preflight Procedures—M56 and M132 Mine Dispersing Subsystem

1. Pylons and supports—Secure.
2. Sway braces—Secure to disperser pads.
3. Electrical connectors—Secure.
4. Wiring harness—Taped to pylon support.
5. Pallet—In place.

Caution

Connector marked with a plus (+) sign must be placed in the heater blanket receptacle properly.

6. Wiring harness—Connected to heater blanket receptacle.
7. HEATED BLANKET circuit breakers—In.
8. Wiring harness—Secure to cabin deck.
9. Press to test lights—Check.
10. HEATED BLANKET circuit breakers—Out.

4-8. Before Takeoff Procedures—M56 and M132 Mine Dispersing Subsystem

1. SAFE/STBY/ARM switch—SAFE.
2. Safety pallets—Remove.
3. Intervalometer safety pins—Remove.
4. Pylon safety pins—Remove.

4-9. Inflight Procedures—M56 and M132 Mine Dispersing Subsystem

1. HEATED BLANKET circuit breakers—In.
2. SAFE-STBY-ARM switch—STBY.
3. Mode selector switch—As desired.
4. QUANTITY selector switch—As desired.
5. INTERVAL selector switch—As desired. Switch shall be position 1 through 10.
6. SAFE-STBY-ARM switch—ARM.
7. FIRE button—Press.

4-10. Before Landing Procedures—M56 and M132 Mine Dispersing Subsystem

1. SAFE-STBY-ARM switch—SAFE.
2. HEATED BLANKET circuit breakers—Out.

4-11. Before Leaving Helicopter Procedures—M56 and M132 Mine Dispersing Subsystem

1. Subsystem—Check for unfired canisters.
2. Maintenance checks—Refer to TM 9-1345-201-12.

4-12. Emergency Procedures—Electrical—M56 and M132 Mine Dispersing Subsystem

1. HEATED BLANKET circuit breakers—Check in.
2. NON-ESS BUS switch—MANUAL ON.
3. FIRE button—Press.

4-13. Emergency Procedures—Fire—M56 and M132 Mine Dispersing Subsystem

1. JETTISON switch cover—Up.

2. JETTISON switch—Up.

4-14. Safety—M56 and M132 Mine Dispersing Subsystem

WARNING

Unfired canisters and mines accidentally released from subsystem will not be handled or moved.

1. Failure to fire—After completion of mission and a check of the subsystem reveals unfired canisters, install safety pallets and notify explosive ordnance disposal or other authorized personnel.

2. If dangerous explosive item is encountered, all operation in the immediate vicinity will be shut down, personnel evacuated to a safe location (800 foot radius) and explosive ordnance disposal or other authorized personnel notified to render assistance in elimination of the hazard.

3. Refer to TM 9-1345-201-12 for minimum safety standards and requirements.

4-15. M52 Smoke Generator Subsystem

WARNING

Never operate the smoke generating subsystem when the helicopter is on the ground and engine is operating.

The smoke generating subsystem basically consists of the oil tank assembly, pump and motor assembly, nozzle ring assembly, operating switch and fog oil level gage. The smoke generating subsystem discharges atomized fog oil into the hot exhaust gases of a helicopter jet engine. A dense white smoke is formed which settles rapidly to the ground when fog oil is released at altitudes less than 50 feet and airspeeds less than 90 knots. The tank capacity is 50 gallons (approximately) and provide approximately three minutes of smoke generator operation. The length of time the smoke screen will obscure enemy vision depends on wind conditions and the altitude at which the smoke is released. The operating switch is a hand-held push button switch, attached to the end of a six foot cable, suspended from the cabin roof and held by a clip near the center line of the roof structure. Its location is accessible to the pilot, copilot, or crewmembers. The tank level fog oil circuit breaker is located in the overhead panel. The circuit breaker protects the pump and motor assembly. An oil level gage is mounted on the center post in the cockpit. The gage is marked from E (empty) to F (full) in \1/4\ tank increments, to indicate the quantity of oil remaining in the oil tank. The prescribed fog oil is type SFG2 (Military Specification MIL-F-12070).

WARNING

Alternate fluids shall not be used in the oil tank.

Caution

Do not operate the smoke generating subsystem when there is no fog oil in the oil tank.

4-16. Preflight Procedures—M52 Smoke Generator Subsystem

1. Fluid—Check.

2. Pump and motor—Secure.

3. Hoses and connections—Leaks—Security.

4. Exhaust ring—Secure.

5. Electrical connections—Secure.

4-17. Before Takeoff—M52 Smoke Generator Subsystem

1. SMOKE GENERATOR circuit breaker—OUT.

2. The circuit breaker must be in to provide operating power to the pump and motor when the operating switch is activated.

4-18. Inflight Procedures—M52 Smoke Generator Subsystem

1. SMOKE GENERATOR circuit breaker—In.

2. Operating switch—Push—As desired. Smoke can be generated either continuously or in short bursts. Smoke generation will stop when the operating switch push button is released.

4-19. Before Landing—M52 Smoke Generator Subsystem SMOKE GENERATOR circuit breaker—Out.

4-20. Before Leaving Helicopter—M52 Smoke Generator Subsystem

1. System—check for leaks.
2. Ring—Condition and security.

Section II. CARGO HANDLING

4-21. Hoist Systems Two hoist systems are available for use with the helicopter. The hoists are similar in function but the operating characteristics for the rescue hoist and the high performance hoist must be addressed separately.

4-22. Rescue Hoist

WARNING

Rescue hoist is totally restricted from any live rescues, noncritical training and demonstrations. Pick up of dummy loads over uninhabited areas is authorized for training.

a. Description. Provisions have been made for the installation of an internal rescue hoist (fig 4-2). The hoist may be installed in any one of four positions in the helicopter cabin. The hoist installation consists of a vertical column extending from the floor structure to the cabin roof, a boom with an electrically powered traction sheave, and an electrically operated winch. Two electrical control stations for the operation of the rescue hoist are provided, one for the pilot, and one for the hoist operator. A control switch is located on the cyclic control stick and provides up and down operation of the hoist as well as positioning the boom (fig 2-5). A pendant control is provided for the hoist operator and contains a boom positioning switch and a toggle switch for hoist operation (fig 4-3). The pilot control will override the hoist operators control. A pressure cartridge cable cutter is provided with two guarded cable cutter switches. The pilots cable cutter switch is mounted on the pedestal and the hoist operators cable cutter switch is mounted on the top of the hoist control box (fig 4-4 and fig 4-5). The hoist has 256 feet of usable cable. The hoist cable is color coded as follows: The first 25 feet at the hook end is yellow, the next 175 feet is unpainted, the next 40 feet is yellow and the last 16 feet is red. Two limiting switches provide automatic stoppage to protect reel-in and reel-out limits of usable cable. The hoist operators intercom speaker is controlled by switch on the pendant and gives the hoist operator interphone communications with the flight crew.

NOTE

When an internal auxiliary fuel tank is installed, it shall be on the opposite side of the helicopter from the hoist. If a pair of auxiliary fuel tanks are installed, the fuel shall be used evenly from both tanks or used first from the tank that is on the same side as the hoist.

b. Rescue Hoist Operations.

(1) The rescue hoist is used to accomplish the lifting of 600 pounds of personnel when a landing cannot be made. The types of lifts usually required in the use of the rescue hoist are:

(a) Pickups from wooded or obstructed areas.

(b) Pickups from water.

(c) Pickups from boats or ships where landings could not be accomplished.

Caution

The hoist should be operated in the full speed condition as slow speed operation will cause the motor to heat excessively.

(2) The hoist operator has variable speed controls for raising or lowering the cable. The further the down/up toggle is pushed from its neutral position, the faster the hoist will run.

c. Operating Data. The following general information is provided for use when operating rescue hoist.

(1) Maximum load: 600 pounds for raising or lowering.

(2) Usable cable length: 256 feet.

(3) Limits: boom in and boom out—Preset limit switches in the actuator.

Up Limit—Trigger at end of boom (contacted by rubber bumper on the hook handwheel).

Down Limit—Switch (actuated when three wraps of cable remain on storage drum).

(4) Override—The pilot control will override the operator control.

d. Weight and Balance Information. Refer to Chapter 6.

4-23. Preflight Procedures—Rescue Hoist

The rescue hoist operator may be any certified crewmember designated that position as the mission dictates. Therefore, this duty should be thoroughly understood by all crewmembers.

1. BAT switch/external power—OFF.

2. Base of the hoist assembly positioned on the cabin floor stud.

Caution

Tighten the locknut only by hand. Excessive force may result in damage to the cabin roof.

3. Top of the hoist assembly aligned to the roof stud and locknut tightened.

4. Stud adapters—Installed on actuator plate and secured.

5. Actuator lever—Positioned and secured.

6. Actuator—Installed and secured.

7. Power cable—Connected.

8. Hoist boom retaining pin—Removed.

WARNING

Failure to install the hoist boom retaining pin properly (in center hole) could result in boom failure.

9. Hoist boom—Positioned and retaining pin installed.

10. Pressure cartridge—Installed.

11. Pilot CABLE CUT switch guard—Down and safetied.

12. Hoist operator CABLE CUT switch guard—Down and safetied.

13. RESCUE HOIST CABLE CUTTER circuit breaker—In.

14. RESCUE HOIST CONT circuit breaker—In.

15. RESCUE HOIST POWER circuit breaker—In.

16. BAT switch or external power—ON.

17. NON-ESS bus switch—MANUAL.

18. Cabin door by rescue hoist—Full open.

19. Pilot rescue hoist switch—Check.

20. Right—Boom pivots outward to the fully etended position. Should just clear upper doorframe.

21. Neutral—Boom remains in the fully extended position.

WARNING

Rescue hoist traction sheave will be operational prior to usage of the rescue hoist.

22. Operation of the traction sheave can be effectively determined during the required daily check (or preflight check) by the following: Lower the hook one or two feet from the boom. Support the weight of the hook to prevent any tension or pull on the cable. Activate the DOWN switch while observing the cable action. If the traction sheave is not working properly, slack will be indicated in the cable between the cable pulleys and the base of the boom along the hoist post. If the traction sheave is operational, slack will be indicated between the supported hook end and the end of the boom. The cable between the pulleys along the post should always remain under tension. If the traction sheave is not working, the hoist shall not be used until it is repaired and the cable condition and routing verified as serviceable.

23. DOWN—Cable extends.

24. Neutral—Cable holds position.

25. UP—Cable retracts.

26. IN—Boom pivots inward to the stowed position.

27. Hoist operator pendant—Check.

28. BOOM switch—OUT (boom pivots outward to the fully extended position).

Caution

Operate hoist normally at full speed to avoid excessive heating of motor and gearbox. Use slow speed near either end of travel. Switch boot—Check condition and centers switch when pressure is released. Wear gloves while handling cable. The Hoist Operator Pendant check requires an additional crewmember to maintain cable tension and prevent damage to the hoist cable. Do not drag, kink, or crush cable.

29. Pendant cable control switch—Right and DOWN. (Cable extends.)

30. Hoist oil level sight gauge—Check.

31. Down limit switch—Check.

WARNING

Cable condition is critical; no broken strands allowed.

32. Hoist cable—Check condition and drum attachment.

33. Pendant cable control switch—Up and left (cable retracts).

WARNING

Up limit switch must function and be adjusted properly or hoist cable failure may result.

34. Up limit switch—Check.

35. BOOM switch—IN (boom pivots inward to the stowed position).

36. Audio control panel—Check.

37. ICS position—Check.

38. Hot mike position—Check.

39. RESCUE HOIST CABLE CUTTER circuit breaker—Out.

40. RESCUE HOIST CONT circuit breaker—Out.

41. RESCUE HOIST POWER circuit breaker—Out.

42. Battery switch/external power—OFF.

43. Gunner harness—Check condition.

44. Forest penetrator and other equipment—Off.

4-24. Before Takeoff—Rescue Hoist

1. RESCUE HOIST CABLE CUTTER circuit breaker—Out.

2. RESCUE HOIST CONT circuit breaker—Out.

3. RESCUE HOIST POWER circuit breaker—Out.

4-25. Inflight Procedures—Pilot—Rescue Hoist

1. Check RESCUE HOIST CABLE CUTTER, RESCUE HOIST CONT, and RESCUE HOIST POWER circuit breakers are in.

2. Pilot CABLE CUT switchguard—Down and safetied.

3. Establish zero ground speed over pick-up location.

4. Move hoist control, on cyclic stick, to right to swing boom outboard. Pilot controls will override the hoist operator control inputs; however, the pilot has only a single speed capability.

5. Move hoist control switch down to lower hook and handwheel assembly. Hoist cable is painted at each end to provide visual indication of cable footage that is extended. The hoist cable is lowered approximately 150 feet per minute and is retracted approximately 120 feet per minute (table 4-1).

Table 4-1
Operation Limitations-Hoist

256 Foot Cable

Weight	Cycles	Notes
Lower 250 lbs. Raise 250 lbs.	8	1, 3, and 4
Lower 0 lbs. Raise 250 lbs.	4	1, 2, and 3
Lower 0 lbs. Raise 400 lbs.		
Lower 400 lbs. Raise 0 lbs.	4	1 and 3
Lower 0 lbs. Raise 600 lbs.	3	1 and 3
Lower 600 lbs. Raise 0 lbs	3	1 and 3

NOTES:

1. One cycle equals one complete lowering and raising of the 250 foot usable cable.

2. Equivalent to lowering a medical attendant and raising nine patients with the attendant.

3. Thirty-second rest period at the end of each raise or lower cycle. A 2.5 hour rest period at completion of listed cycled.

4. Thirty-second rest period at the end of each raise. A 2.5 rest period at the end of four cycles.

WARNING

When a load is attached on the hoist hook (and if conditions permit), it is advisable not to make abrupt changes in helicopter attitude until load is aboard or raised as close as possible. G-forces on hoist could become excessive if hoist load is being raised during abrupt movements of helicopter. These G-forces could result in the yield or failure of the hoist cable.

6. Move hoist control switch to up to raise hoist load.

7. Move hoist control switch to left to swing hoist boom inboard.

8. Bring hoist load into cabin and hoist to stowed position (fully inboard).

9. RESCUE HOIST CABLE CUTTER circuit breaker—Out.

10. RESCUE HOIST CONT circuit breaker—Out.

11. RESCUE HOIST POWER circuit breaker—Out.

4-26. Inflight Procedures—Hoist Operator—Rescue Hoist

WARNING

When any crewmember is not in his seat and is in the vicinity of the open cargo door, he shall be secured with a gunner harness.

1. Door—Full open and locked.

2. Hoist operator CABLE CUT switch guard—Down and safetied.

3. Hoist operator ICS panel—HOT MIC/PRIVATE.

WARNING

All hoist operation will be coordinated with the pilot. Continuous status reports.

4. After pilot has established zero airspeed over the desired location, move BOOM control switch—OUT to swing hoist boom outboard.

WARNING

Attempt to discharge electrostatic charge on hook before letting it touch person to be hoisted.

5. HOIST control switch—DOWN to lower cable hook (right and forward).

6. HOIST control switch—UP to raise hoist load (left and rearward).

7. BOOM control switch—IN to swing hoist boom inboard.

8. Bring hoist load into cabin and swing hoist boom to stowed position (fully inboard).

4-27. High Performance Hoist Provisions have been made for the installation of an internal rescue hoist (fig 4-2). The hoist may be installed in any one of four positions in the helicopter cabin. The hoist installation consists of a vertical column extending from the floor structure to the cabin roof, a boom with an electrically powered traction sheave, and an electrically operated winch. Two electrical control stations for the operation of the rescue hoist are provided, one for the pilot, and one for the hoist operator. A control switch is located on the cyclic control stick and provides up and down operation of the hoist as well as positioning the boom (fig 2-5). A pendant control is provided for the hoist operator and contains a boom positioning switch and a toggle switch for hoist operation (fig 4-6). The pilot control will override the hoist operators control. A pressure cartridge cable cutter is provided with two guarded cable cutter switches. The pilot cable cutter switch is mounted on the pedestal and the hoist operators cable cutter switch is mounted on the back of the hoist control box (fig 4-4 and fig 4-5). The high performance hoist is an electronically speed controlled unit. Speed varies from 125 fpm at 600 pounds to 250 fpm at 300 pounds. The winch has four positive action switches. Number One is an all-stop switch that opens when three wraps of cable remain on drum. Number Two is a deceleration switch that opens when five wraps of cable remain on drum. Number Three switch has two functions, operates caution indicator light on control pendant (when caution light is on, a cable deceleration should occur) and limits cable speed when hook is 8 to 10 feet from up-stow position. Number Four switch further limits cable speed when hook is 12 to 18 inches from the up-stow position. The first and last 20 feet of the cable are painted red. An elapsed time meter and power-on indicator are located on the control panel. A pistol grip control (fig 4-6) is provided for the hoist operator and contains a boom in/out switch, a variable speed control, cable limit and overtemperature indicator (when hoist operating temperature limit has been exceeded the over temp light will come on). (Secure hoist as soon as operations permit), and an intercommunication switch. The hoist has 250 feet of usable cable. Power is provided by the nonessential bus. Circuit protection is provided by the RESCUE HOIST POWER, RESCUE HOIST CONT, and RESCUE HOIST CABLE CUTTER circuit breakers. RESCUE HOIST CABLE CUTTER circuit breaker controls only the pilot's cable cutter switch.

WARNING

All hoist operators must, prior to any "LIVE" hoist mission, have at least five (5) practice hoist lifts of 100 feet or more using a dummy load of 200 pounds or more. The practice lifts must have been within the last 6 months. The rescue hoist operator may be any certified crewmember designated that position as the mission dictates. Therefore, this duty should be thoroughly understood by all crewmembers.

4-28. Preflight Procedures

1. Check that vertical shaft for ceiling attaching point is raised vertically to prevent the ceiling attaching device from disconnecting.

2. Oil level—Check in hoist and boom head.

3. RESCUE HOIST CONT, RESCUE HOIST POWER AND RESCUE HOIST CABLE CUTTER circuit breakers—Check out.

4. CABLE CUT switches (pilot and hoist operator) guard—Down and safetied.

5. Cable cutter connector—Check connected.

6. Boom sheave—Check that no foreign matter is entrapped at sheave.

7. GPU—Connect to helicopter.

8. RESCUE HOIST CONT and RESCUE HOIST POWER circuit breakers—In. Blue POWER ON light and yellow CAUTION light should be on and fan should be operating.

9. BOOM switch—Rotate boom out and in, and then out to test boom operation.

10. HOIST switch (pilot)—Rotate boom in, and then out.

WARNING

A crewmember must reel cable out from the boom head in line with the boom axis during the following test procedures. Care must be taken not to pull the cable taut around the cable guide/roller since kinking of the cable might result. Avoid damaging cable on rough surfaces including the ground. No broken strands are allowed.

NOTE

After multiple and consecutive cable extensions (four or more) at one time under no load, apply 200 pound load with cable extended 250 feet to again properly seat cable elements.

11. SPEED MODE switch—HIGH.

12. HOIST switch (pilot)—Down. Reel cable out until caution light is out on pendant (approximately 10 feet).

13. HOIST control switch (pilot)—Reel in cable and observe that cable speed slows when caution light comes ON (approximately 10 feet).

14. Boom up limit switch actuator arm—Push up on arm during reeling in to check that hoist stops running when up limit switches are actuated. Observe that cable speed slows when hook is 12 to 18 inches from the full up position when cable is reeled in with no load on hook.

15. SPEED MODE switch—LOW SPEED and repeat steps 9 through 11.

16. Repeat steps 9 through 11 using the control pendant assembly. Check that cable speed can be regulated by the control from 0 to 250

fpm when cable is reeled out beyond 10 foot caution limit (caution light is out).

17. BOOM switch—Rotate boom in to stowed position.

18. RESCUE HOIST CONT, RESCUE HOIST POWER and RESCUE HOIST CABLE CUTTER circuit breakers—Out upon completion of preflight check.

4-29. Operating Procedures

1. RESCUE HOIST CONT, RESCUE HOIST POWER and CABLE CUTTER breakers—In.

2. Blue POWER ON and yellow CAUTION indicator lights should be on.

WARNING

Hands must be kept off hoist boom during operation to prevent hand entrapment and injury.

3. BOOM switch—Rotate boom out.

4. SPEED MODE switch—As required.

5. HOIST switch—DOWN. Adjust cable—reel-out speed as required. CAUTION light should be out when 8 to 10 feet of cable is reeled out.

6. HOIST control switch—UP and adjust cable reel-in speed as required. CAUTION light should be ON when rescue hook is 8 to 10 feet from up stow position. Reel cable completely up.

Caution

When hoist is installed in positions 1 or 4, the boom head assembly and hook assembly could bump the pilot/copilot helmets if stowed behind seat back.

7. BOOM OUT/IN switch—Rotate boom in.

8. RESCUE HOIST POWER, RESCUE CONT and CABLE CUTTER circuit breakers—Out.

4-30. Before Takeoff RESCUE HOIST CABLE CUTTER, RESCUE HOIST CONT and RESCUE HOIST POWER circuit breakers—Out.

4-31. Inflight Procedures

WARNING

Operations during gusty or turbulent wind conditions may result in contracting the lateral cyclic control stops. During hoisting operations the helicopter should be positioned to maximize the control margins.

1. Hover over pick-up location.

2. Use operating procedures as required.

3. Pilot should lift load off ground by increasing collective to ensure helicopter control with the load.

WARNING

When a load is attached on the hoist hook (and if conditions permit), it is advisable not to make abrupt changes in helicopter attitude until load is aboard or raised as close as possible. G-forces on hoist could become excessive if hoist load is being raised during abrupt movements of helicopter. These G-forces could result in the yield or failure of the hoist cable.

4-32. Inflight Procedures—Hoist Operator

WARNING

When any crewmember is not in his seat and is in the vicinity of open cargo door, he shall be secured with a gunner harness. All hoist operations will be coordinated with the pilot. Continuous status reports required.

1. Doors—Open as required.

2. Hoist operator ICS panel—HOT MIC/PRIVATE

WARNING

Attempt to discharge electrostatic charge on hook before letting it touch person to be hoisted. With personnel suspended on the hoist cable, adjust cable sway and speed as needed in order to avoid catching personnel under the aircraft or bumping personnel against the aircraft.

3. When helicopter is hovered over pickup location use operational procedures as required.

4. Pull out RESCUE HOIST CONT, RESCUE HOIST POWER and RESCUE HOIST CABLE CUTTER circuit breakers upon completion of hoist operations.

4-33. Engine Shutdown Procedures

1. RESCUE HOIST CONT circuit breaker—In.

2. Hoist—Stowed position.

3. RESCUE HOIST CONT circuit breaker—Out.

4. Enter the length of cable and number of lifts used in the remarks section of DA Form 2408-13.

4-34. Cargo Hook

Caution

Helicopters equipped with a nonrotating cargo suspension unit, which maintains the hook in a fixed position (facing forward), should be used only with a cargo sling having a swivel attachment ring. A device which may be used for this application is: Sling, Endless, Nylon Webbing, Type 1, 10 inch, NSN 3940-00-675-5001.

a. Description. External cargo can be carried by means of a short single cable suspension unit, secured to the primary structure and located at the approximate center of gravity. This method of attachment and location has proved to be the most satisfactory for carrying external cargo. Pitching and rolling due to cargo swinging is minimized, and good stability and control characteristics are maintained under load. A MANUAL CARGO RELEASE PUSH pedal is located between the pilot tail rotor control pedals, and an electrical release pushbutton switch is on the cyclic control stick. Before the electrical release switch on the cyclic control stick can be actuated, the CARGO RELEASE switch on the overhead panel must be positioned to ARM MISC. When not in use, the cargo suspension unit need not be removed, nor does it require stowing. Three cable and spring attachments keep the unit centralized, and the hook protrudes only slightly below the lower surface of the helicopter. A rear view mirror enables the pilot to visually check operation of the external cargo suspension hook.

b. Preflight Procedure.

1. Hook assembly—Check as follows:

(a) Condition and installation.

(b) Freedom of movement: fore, aft, and lateral.

(c) Centering springs (3)—Check for centering of the hook.

(d) Shear pin installation—The hook should not rotate.

(e) Electrical wiring—Condition and installation.

(f) Manual release cable—Condition and installation.

(g) Cargo hook—Closed.

2. Hook operation—Check as follows:

(a) BAT switch—ON.

(b) CARGO RELEASE switch—ARM. The CARGO RELEASE light should illuminate.

(c) Pilot electrical release switch—Press and hold. The cargo hook should open with slight pressure applied to the hook.

(d) Cargo hook—Close. Release the pilot electrical release switch.

(e) Copilot electrical release switch—Press and hold. The cargo hook should open with slight pressure applied to the hook.

(f) Cargo hook—Close. Release the copilot electrical release switch.

(g) Manual release—Press. The cargo hook should open with 20 to 30 pounds pressure applied to the hook.

(h) Cargo hook—Close.

(i) CARGO RELEASE switch—OFF The CARGO RELEASE light should go off.

(j) Apply approximately 20 to 30 pounds pressure to the hook—The cargo hook should not open.

(k) Pilot and copilot electrical release switches—Press. The cargo hook should not open. Release the switches.

(l) BAT switch—OFF.

c. Hookup Procedures.

1. CARGO RELEASE switch—ARM.

2. Approach the object to be picked up with caution. A ground handler or crewmember will direct the helicopter movement.

3. Maintain a constant altitude and position over the ground while the object is being placed on the cargo hook. Normally, the helicopter will be hovered into the wind.

WARNING

Attempt to discharge electrostatic charge on the hook before being touched by a person.

4. After the object is secured to the cargo hook, raise the helicopter until sling is taut and lift the load off the ground. Takeoff will be accomplished to allow adequate clearance over all obstacles.

5. A minimum amount of control movement (to prevent oscillation of the cargo load) is desired.

d. In Flight Procedures. CARGO RELEASE switch—OFF when cruise altitude and airspeed are reached. The switch should remain in the ON position at low altitude and airspeed.

e. Before Landing. CARGO RELEASE switch—ARM.

f. Release Procedures.

1. The landing approach angle will be determined by load weight and wind conditions, usually shallower than a normal approach. Do not allow the load to touch the ground until the helicopter is in a stable hover.

2. To deliver the load, lower the helicopter to relieve the tension on the sling, then use the electrical release button or mechanical release pedal to release the load. In order to release the cargo load safelyusing the cargo hook release button, the button must be pressed continually while at least 20 to 30 pounds of tension is put on the cargo hook. After the load is released, the cargo hook release button must be depressed again to close the hook. The crewman does not have the capability to release the cargoload from the aft cabin.

4-35. Parachute Operations

a. Crewmembers must become familiar with procedures outlines in TM 57-220 prior to parachute operations.

Caution

At no time during flight will the static line, snap hook or safety pins be disconnected from the aircraft static line anchor cable.

b. After the last chutist has exited the aircraft, the crew chief will pull in the static lines and will hold them secured until the aircraft has landed.

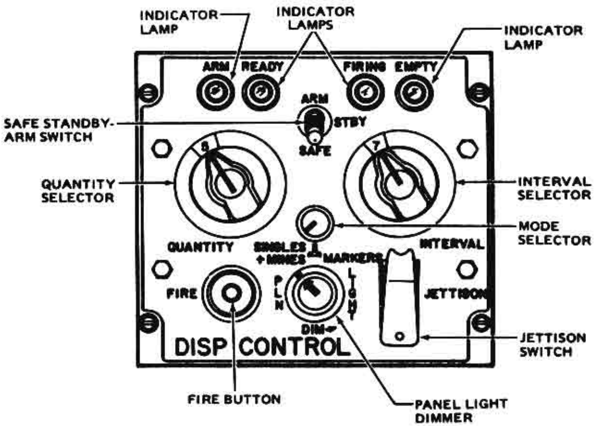


Figure 4-1. Mine Dispenser Control Panel—Typical

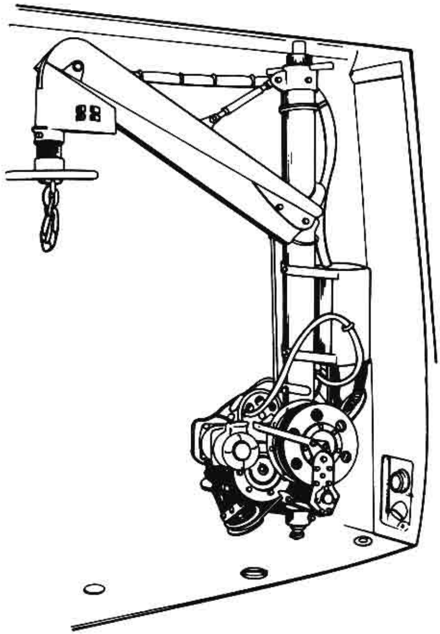


Figure 4-2. Hoist Installation—Typical

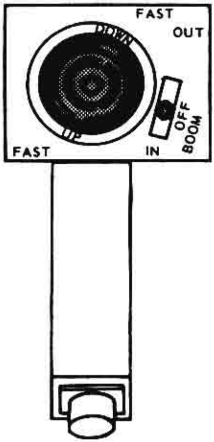


Figure 4-3. Pendant Control—Rescue Hoist

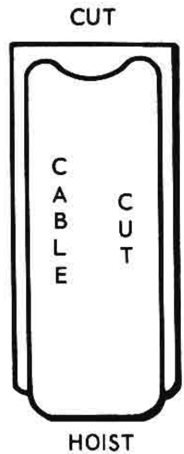


Figure 4-5. Hoist Cable Cut Switch—Hoist Operator—Typical

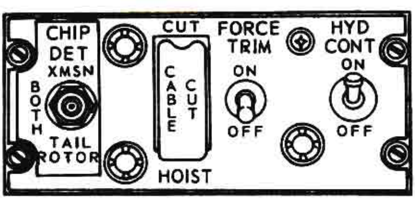


Figure 4-4. Hoist Cable Cutter Switch—Pilot—Typical

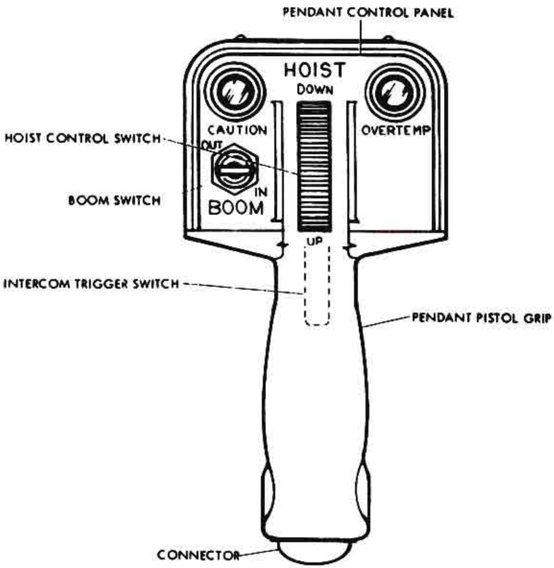


Figure 4-6. Control Pendant Assembly, High Performance Hoist

Chapter 5

Operating Limits and Restrictions

Section I. GENERAL

5-1. Purpose This chapter identifies or refers to all important operating limits and restrictions that shall be observed during ground and flight operations.

5-2. General The operating limitations set forth in this chapter are the direct results of design analysis, tests, and operating experiences. Compliance with these limits will allow the pilot to safely perform the assigned missions and to derive maximum utility from the helicopter.

5-3. Exceeding Operational Limits Anytime an operational limit is exceeded an appropriate entry shall be made on DA Form 2408-13. Entry shall state what limit or limits were exceeded, range, time beyond limits, and any additional data that would aid maintenance personnel in the maintenance action that may be required.

5-4. Minimum Crew Requirements The minimum crew required to fly the helicopter is one pilot whose station is in the right seat. Additional crewmembers as required will be added at the discretion of the commander, in accordance with pertinent Department of the Army regulations.

Section II. SYSTEM LIMITS

5-5. Instrument Markings (Fig 5-1)

a. Instrument Marking Color Codes. Operating limits and ranges color markings which appear on the dial faces of engine, flight, and utility system instruments are illustrated with the following symbols:

R=Red, G=Green, Y=Yellow,

RED markings on the dial faces of these instruments indicate the limit above or below which continued operation is likely to cause damage or shorten life. The GREEN markings on instruments indicate the safe or normal range of operation. The YELLOW markings on instruments indicate the range when special attention should be given to the operation covered by the instrument.

b. Instrument Glass Alignment Marks. Limitation markings consist of strips of semitransparent color tape which adhere to the glass outside of an indicator dial. Each tape strip aligns to increment marks on the dial face so correct operating limits are portrayed. The pilot should occasionally verify alignment of the glass to the dial face. For this purpose, all instruments that have range markings have short, vertical white alignment marks extending from the dial glass onto the fixed base of the indicator. These slippage marks appear as a single vertical line when limitation markings on the glass properly align with reading increments on the dial face. However, the slippage marks appear as separate radial lines when a dial glass has rotated.

5-6. Rotor Limitations.

a. Refer to figure 5-1.

b. Restrict rotor speed to 319 to 324 RPM (6500 to 6600 Engine RPM) during cruise flight.

Section III. POWER LIMITS

5-7. Engine Limitations

a. Refer to figure 5-1.

b. Maximum starter energize time is 40 seconds with a three-minute cooling time between start attempts with three attempts in any one hour.

c. Health Indicator Test. When a difference between a recorded EGT and the baseline EGT is plus or minus 20°C, make an entry on DA Form 2408-13; ±30°C or greater make an entry on DA Form 2408-13 and do not fly the aircraft.

Section IV. LOADING LIMITS

5-8. Center of Gravity Limitations

a. Center of gravity limits for the helicopter to which this manual applies and instructions for computation of the center of gravity are contained in chapter 6.

b. Do not carry external loads if the cg is aft of station 142 prior to lifting external load.

c. When flying at an aft cg (station 140 to 144) terminate an approach at a minimum of five-foot hover prior to landing to prevent striking the tail on the ground. Practice touchdown autorotations shall not be attempted with the cg aft of 140 because termination at 5 feet is not possible.

5-9. Weight Limitations

a. Maximum Gross Weight. The maximum gross weight for the helicopter is 9500 pounds. The maximum gross weights for varying conditions of temperature, altitude, wind velocity, and skid height are shown in chapter 7.

b. Maximum Gross Weight for Towing. The maximum gross weight for towing is 9500 pounds.

c. Cargo Hook Weight Limitations. Maximum allowable weight for the cargo hook is 4000 pounds.

d. Weight Distribution Limitations. Cargo distribution over the cargo floor area shall not exceed 100 pounds per square foot. For information pertaining to weight distribution, refer to chapter 6.

e. Mine Disperser Jettisoning Limits. Except in an emergency, the mine dispersing subsystem M56 shall not be jettisoned above 60 KIAS with roof mounted pitot tube or 50 KIAS with nose mounted pitot tube.

5-10. Turbulance Limitations

a. Intentional flight into severe or extreme turbulance.

b. Intentional flight into moderate turbulance is not recommended when the report or forecast is based on aircraft above 12,500 pounds gross weight.

c. Intentional flight into thunder storms are prohibited.

Section V. AIRSPEED LIMITS

5-11. Airspeed Limitations

a. Refer to figure 5-2 for forward airspeed limits.

b. Sideward flight limits are 30 knots.

c. Rearward flight limit is 30 knots.

d. The helicopter can be flown up to VNE with the cabin doors locked in either the closed position or the fully open position. Flight above 50 KIAS with the cabin doors in the unlocked position is prohibited.

e. The helicopter can be flown up to an IAS of 50 knots with one door open and one door closed. This will allow .for missions such as rappeling, paradrop, and use of rescue hoist. If a door comes open, speed should be reduced to 50 KIAS or below the door secured. Crewmembers should ensure that they are fastened to the helicopter by seat belts or other safety devices while securing the cabin doors inflight.

f. Flight above 60 KIAS with roof mounted pitot tube or 50 KIAS with nose mounted pitot tube with one M56 mine disperser installed and the other disperser subsystem removed is prohibited.

Section VI. MANEUVERING LIMITS

5-12. Prohibited Maneuvers

a. Abrupt inputs of flight controls cause excessive main rotor flapping, which may result in mast bumping and must be avoided.

b. No aerobatic maneuvers permitted. Aerobatic flight is defined to be any intentional maneuver involving an abrupt change in the aircraft's attitude, an abnormal attitude pitch angle greater than ±30° or roll angles greater than 60°, or abnormal acceleration not necessary for normal flight.

c. Intentional flight below *+0.5G is prohibited. Refer to low G maneuvers, paragraph 8-53.*

d. The speed for any and all maneuvers shall not exceed the level flight velocities as stated on the airspeed operating limits chart (fig 5-2).

Section VII. ENVIRONMENTAL RESTRICTIONS

5-13. Environmental Restrictions

a. This helicopter is qualified for flight under instrument meteorological conditions.

b. Intentional flight into known moderate icing condition is prohibited.

c. Wind Limitation.

(1) Maximum cross wind for hover is 30 knots.

(2) Maximum tail wind for hover is 30 knots.

*d. Wind Limitation for Starting.*Helicopter can be started in a maximum wind velocity of 30 knots or a maximum gust spread of 15 knots. Gust spreads are not normally reported. To obtain spread, compare minimum and maximum wind velocity.

Section VIII. HEIGHT VELOCITY

5-14. Height Velocity The Height Velocity diagram (fig 9-3) is based on an extrapolation of test data. The chart is applicable for all gross weights up to and including 9500 pounds.

Section IX. INTERNAL RESCUE HOIST (BREEZE ONLY)

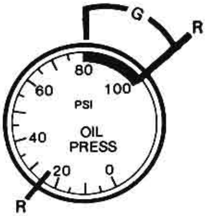
5-15. Hoist Restrictions Rescue hoist (breeze hoist only) is totally restricted from any live rescues, non-critical training and demonstrations. Dummy load pickups over uninhabited areas are authorized for training.

Section X. OTHER LIMITATIONS

5-16. Towing The helicopter should not be towed for 25 minutes after the battery and inverter switches have been turned off to prevent damage to attitude and directional gyros. If the helicopter must be towed prior to the 25 minute limit, the battery and inverter switches shall be turned on. Wait five minutes after the switches are on before moving the helicopter.

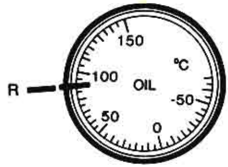
COLOR MARKING CODES

R - Red
G - Green



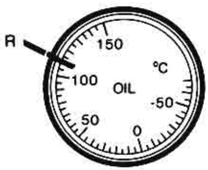
ENGINE OIL PRESSURE

R 25 PSI Minimum—Engine Idle
G 80 to 100 PSI Continuous
R 100 PSI Maximum



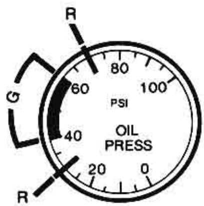
ENGINE OIL TEMPERATURE

R 93°C Maximum Below 30°C FAT
100°C Maximum At 30°C FAT and Above
(Write Up Required Anytime 93°C Exceeded.)



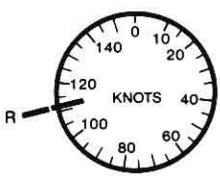
TRANSMISSION OIL TEMPERATURE

R 110°C Maximum



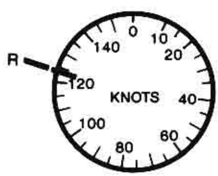
TRANSMISSION OIL PRESSURE

R 30 PSI Minimum
G 40 to 60 PSI Continuous
R 70 PSI Maximum



AIRSPEED
NOSE MOUNTED PITOT TUBE

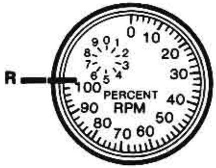
R 112 Knots Maximum
Refer to Figure 5-2, Airspeed Operating Limits for Additional Limitations.



AIRSPEED
ROOF MOUNTED PITOT TUBE

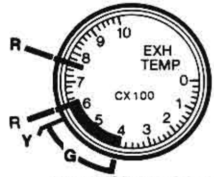
R 124 Knots Maximum
Refer to Figure 5-2, Airspeed Operating Limits for Additional Limitations.

Figure 5-1. Instrument Markings (Sheet 1 of 3)



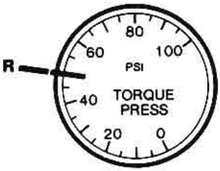
GAS PRODUCER TACHOMETER (N1)

R 101.5 Percent Maximum



EXHAUST TEMPERATURE

G 400°C to 610°C Continuous
Y 610°C to 625°C 30 Minutes
R 625°C Maximum 30 Minutes
625°C to 675°C 10 Second Limit for Starting and Acceleration
675°C to 760°C 5 Second Limit for Starting and Acceleration
R 760°C Maximum



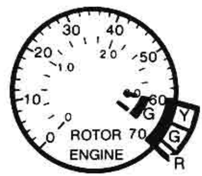
TORQUE PRESSURE

Meter is marked with the maximum torque limit for each engine as reflected by the individual engine Data Plate Torque. Refer to Torque Available Chart, Chapter 7.

NOTE

Line at 50 PSI shown on dial face is for illustration only. Actual location will vary.

R



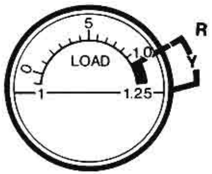
ROTOR TACHOMETER

G 294 to 324 Continuous
R 339 RPM Maximum

ENGINE TACHOMETER (N2)

Y 6000 to 6400 RPM Transient
G 6400 to 6600 RPM Continuous
R 6700 RPM Maximum Continuous above 15 PSI Torque
6900 RPM Maximum Continuous at 15 PSI Torque or Less
6900 RPM Maximum Transient (3 second) above 15 PSI Torque
R 6900 RPM Maximum

Figure 5-1. Instrument Markings (Sheet 2 of 3)



LOADMETER MAIN GENERATOR

Y ■ 1.0 to 1.25 Transient

STANDBY GENERATOR

R ■ 1.0 Maximum

FUEL PRESSURE

G ■ 5 to 35 PSI Continuous

Figure 5-1. Instrument Markings (Sheet 3 of 3)

AIRSPEED OPERATING LIMITS

EXAMPLE

WANTED

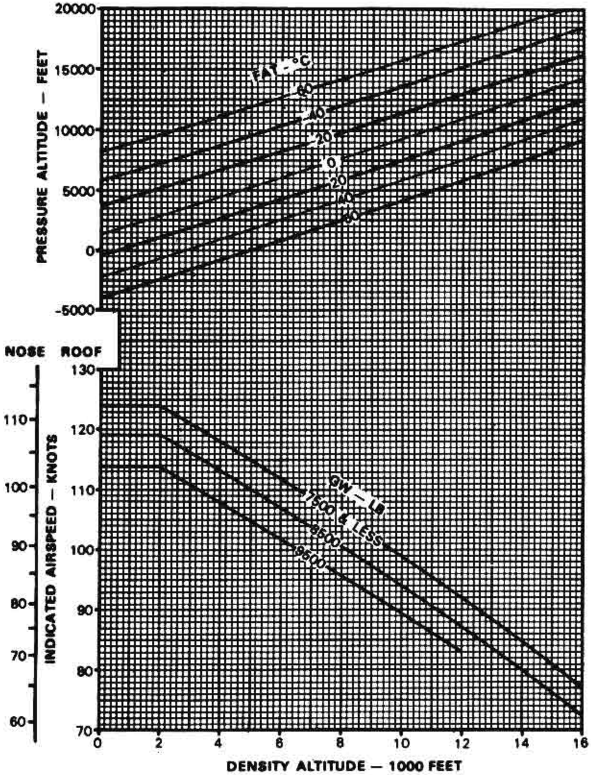
INDICATED AIRSPEED
AND DENSITY ALTITUDE

KNOWN

GROSS WEIGHT = 8500 LB
PRESSURE ALTITUDE = 7500 FEET
FAT = -20°C
ROOF MOUNTED SYSTEM

METHOD

ENTER PRESSURE ALTITUDE
MOVE RIGHT TO FAT
MOVE DOWN TO GROSS WEIGHT
MOVE LEFT, READ INDICATED
AIRSPEED = 110 KNOTS
REENTER PRESSURE ALTITUDE
MOVE RIGHT TO FAT
MOVE DOWN, READ DENSITY
ALTITUDE = 5000 FEET



DATA BASIS: DERIVED FROM FLIGHT TEST

Figure 5-2. Airspeed operating limits chart

Chapter 6

Weight/Balance and Loading

Section I. GENERAL

6-1. General Chapter 6 contains sufficient instructions and data so that an aviator knowing the basic weight and moment of the helicopter can compute any combination of weight and balance.

6-2. Classification of Helicopter. Army UH-1H/V helicopters are in class 2. Additional directives governing weight and balance of class 2 aircraft forms and records are contained in AR 95-16, TM 55-1500-342-23 and DA PAM 738-751.

6-3. Helicopter Station Diagram Figure 6-1 show the helicopter reference datum lines, fuselage stations, butt lines, water lines and jack pad locations. The primary purposes of the figure is to aid personnel in the computation of helicopter weight/balance and loading.

Section II. WEIGHT AND BALANCE

6-4. Loading Charts

a. Information. The loading data contained in this chapter is intended to provide information necessary to work a loading problem for the helicopters to which this manual is applicable.

b. Use. From the figures contained in this chapter, weight and moment are obtained for all variable load items and are added to the current basic weight and moment (DD Form 365-3) to obtain the gross weight and moment.

(1) The gross weight and moment are checked on DD Form 365-3 to determine the approximate center of gravity (cg).

(2) The effect on cg by the expenditures in flight of such items as fuel, ammunition, etc., may be checked by subtracting the weights and moments of such items from the takeoff weight and moments and checking the new weight and moment on the CG limits Chart.

6-5. DD Form 365-1—Basic Weight Checklist. The form is initially prepared by the manufacturer before the helicopter is delivered. The form is a tabulation of equipment that is, or may be, installed and for which provision for fixed stowage has been made in a definite location. The form gives the weight, arm, and moment/100 of individual items for use in correcting the basic weight and moment on DD Form 365-3 as changes are made in this equipment.

6-6. DD Form 365-3—Basic Weight and Balance Records The form is initially prepared by the manufacturer at time of delivery of the helicopter. The form is a continuous history of the basic weight and moment resulting from structural and equipment changes. At all times the last entry is considered current weight and balance status of the basic helicopter.

6-7. DD Form 365-4—Weight and Balance Clearance Form F

a. General. The form is a summary of actual disposition of the load in the helicopter. It records the balance status of the helicopter, step-by-step. It serves as a worksheet on which to record weight and balance calculations, and any corrections that must be made to ensure that the helicopter will be within weight and cg limits.

b. Form Preparation. Specific instructions for filling out the form are given in TM 55-1500-342-23. Figure 6-3 shows the results of the instructions.

NOTE

Allowable gross weight for take off and landing is 9500 pounds.

Section III. FUEL/OIL

6-8. Fuel Refer to figure 6-2.

6-9. Oil For weight and balance purposes, engine oil is a part of basic weight.

Section IV. PERSONNEL

6-10. Personnel Compartment and Litter Provisions

a. The personnel compartment provides seating for eleven combat equipped troops (fig 6-3). Seat belts are provided for restraint.

b. Provisions and hardware are provided for up to six patients. Refer to figure 6-3.

6-11. Personnel Loading and Unloading When helicopter is operated at critical gross weights, the exact weight of each individual occupant plus equipment should be used. If weighing facilities are not available, or if the tactical situation dictates otherwise, loads shall be computed as follows:

a. Combat equipped soldiers: 240 pounds per individual.

b. Combat equipped paratroopers: 260 pounds per individual.

c. Crew and passengers with no equipment: compute weight according to each individual's estimate.

d. *Litter Weight and Balance Data*. Refer to figure 6-3. Litter loads shall be computed at 265 pounds (litter and patient's weight combined).

6-12. Personnel Moments Refer to figure 6-3.

Section V. MISSION EQUIPMENT

6-13. Weight and Balance Loading Data

a. *System Weight and Balance Data*. Refer to figure 6-6.

b. *Hoist Loading Data*. Use Hoist Loading Limitations charts for hoist in forward right or forward left positions only (figs 6-4 and 6-5).

WARNING

Longitudinal or lateral cg limits may not permit maximum hoist loading capability. The lesser of the two loads derived from lateral and longitudinal charts shall be used.

NOTE

If additional internal load is carried during hoisting operations this load should be positioned on opposite side from hoist.

c. Positions Hoist May Occupy in Cabin. Refer to figure 6-7 .

Section VI. CARGO LOADING

6-14. Cargo Loading The large cargo doors, open loading area and low floor level preclude the need for special loading aids. Through loading may be accomplished by securing cargo doors in the fully open position. Cargo tiedown fittings (figs 6-8 and 6-9) are located on the cabin floor for securing cargo to prevent cargo shift during flight.

6-15. Preparation of General Cargo

a. The loading crew shall assemble the cargo and baggage to be transported. At time of assembly and prior to loading, the loading crew shall compile data covering weight, dimensions, center of gravity location and contact areas for each item.

b. Heavier packages to be loaded shall be loaded first and placed in the aft section against the bulkhead for cg range purposes.

c. Calculation of the allowable load and loading distribution shall be accomplished by determining the final cg location and remain within the allowable limits for safe operating conditions.

6-16. Cargo Center of Gravity Planning

a. Planning. The items to be transported should be assembled for loading after the weight and dimensions have been recorded.

(1) Loading time will be gained if the packages are positioned as they are to be located in the helicopter.

(2) To assist in determining the locations of the various items, the individual weights and total weight must be known.

(3) When these factors are known the cargo loading charts (fig 6-10 and 6-11 can be used as a guide to determine the helicopter station at which the package cg shall be located and the moment for each item.

(4) The information presented on the loading chart will not be affected by fuel quantity, as full to empty fuel load as been considered during data computation.

(5) Final analysis of helicopter cg location for loading shall be computed from the data presented in this chapter.

b. Computation of Cargo Center of Gravity.

(1) The loading data in this chapter will provide information to work a loading problem. From the loading charts, weight and moment/100 are obtained for all variable load items and are added mathematically to the current basic weight and moment/100 obtained from chart C to arrive at the gross weight and moment.

(2) The cg of the loaded helicopter is represented by a moment figure in the center of gravity table. If the helicopter is loaded within the forward and aft cg limits, the figure will fall numerically between the limiting moments.

(3) The effect on the cg of the usable inflight items of fuel may be checked by subtracting the weights and moments of such items from the takeoff gross weight and moment and checking the landing weight new moment with the cg limits chart.

(4) This check will be made to determine whether or not the cg will remain within limtis during the entire flight.

6-17. Loading Procedures The helicopter requires no special loading preparation.

a. The loading procedure consists of placing the heaviest items to be loaded as far aft as possible. Such placement locates the cargo nearer the helicopter cg and allows maximum cargo load to be transported, as well as maintaining the helicopter within the safe operating cg limits for flight.

b. The mission to be performed should be known to determine the weight and moment of cargo, troop transport, or litter patients to be carried on the return trip.

c. If troops or litter patients are to be carried, troop seats and litter racks shall be loaded aboard and stowed.

d. High density cargo distributed over floor area shall not exceed 100 pounds per square foot.

6-18. Loading and Unloading of Other Than General Cargo

WARNING

Before transporting nuclear weapons, the pilot shall be familiar with AR 95-27, AR 50-4 and AR 50-5.

The helicopter is capable of transporting nuclear weapons, if required.

6-19. Tiedown Devices Refer to figures 6-8 and 6-9.

Section VII. CENTER OF GRAVITY LIMITS

6-20. Center of Gravity Limits Refer to figure 6-2 for longitudinal limits. The lateral C.G. limits are 5 inches (5 inches to the right and left of the helicopter centerline). The lateral C.G. limits will not be exceeded if external store loadings are symmetrical, the hoist loading limits (fig 6-4) are observed, and a reasonable effort is made to evenly distribute internal loads from left to right.

HELICOPTER DIAGRAM

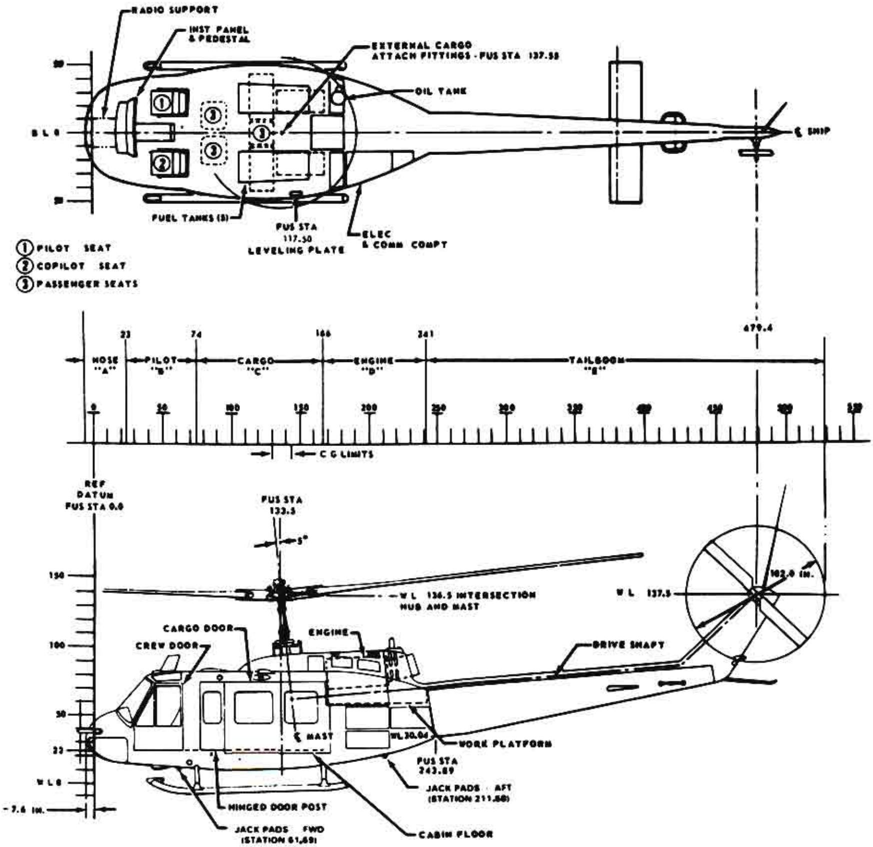


Figure 6-1. Helicopter Station Diagram

FUEL LOADING

FUEL MOMENT

CRASHWORTHY SYSTEM TANKS

EXAMPLE

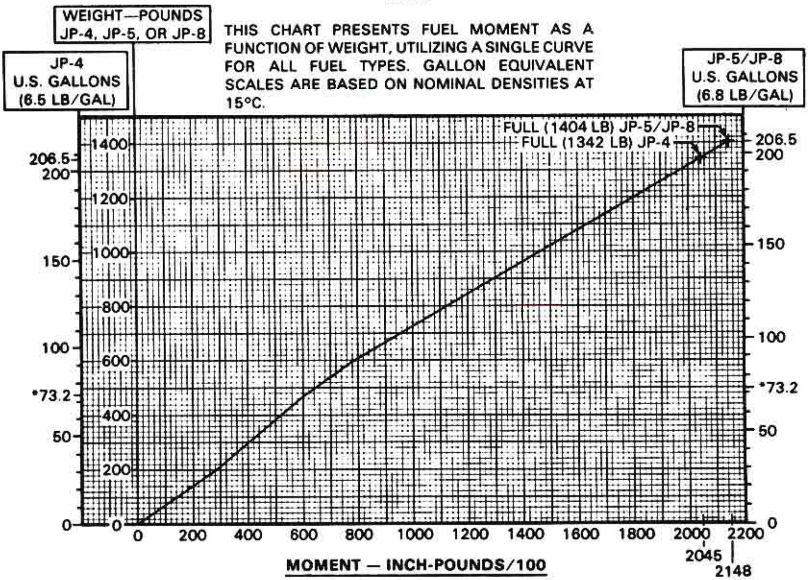
WANTED
WEIGHT AND MOMENT FOR A GIVEN QUANTITY OF USABLE FUEL IN CRASHWORTHY FUEL SYSTEM.

KNOWN
U.S. GALLONS OF JP-4 FUEL.

METHOD
ENTER AT GALLONS ON JP-4 SCALE.
MOVE RIGHT TO READ WEIGHT
CONTINUE RIGHT TO INTERSECT DIAGONAL LINE, THEN PROJECT DOWN TO READ MOMENT/100 SCALE.

NOTE

THIS CHART PRESENTS FUEL MOMENT AS A FUNCTION OF WEIGHT, UTILIZING A SINGLE CURVE FOR ALL FUEL TYPES. GALLON EQUIVALENT SCALES ARE BASED ON NOMINAL DENSITIES AT 15°C.



*MOST FORWARD FUEL CG AT 73.2 GALLONS

Figure 6-2. Fuel Loading (Sheet 1 of 2)

FUEL LOADING

FUEL MOMENT

AUXILIARY FUEL
300 GALLONS INTERNAL
(F.S. 151.0)

EXAMPLE

WANTED
WEIGHT AND MOMENT FOR A GIVEN QUANTITY OF FUEL IN AUXILIARY FUEL TANKS.

KNOWN
300 U.S. GALLONS OF JP-4 FUEL (IN AUXILIARY TANKS ONLY).

METHOD
ENTER AT GALLONS ON JP-4 SCALE.
MOVE RIGHT TO READ WEIGHT.
CONTINUE RIGHT TO INTERSECT DIAGONAL LINE, THEN PROJECT DOWN TO READ MOMENT/100 SCALE.

NOTE

THIS CHART PRESENTS FUEL MOMENT AS A FUNCTION OF WEIGHT, UTILIZING A SINGLE CURVE FOR ALL FUEL TYPES. GALLON EQUIVALENT SCALES ARE BASED ON NOMINAL DENSITIES AT 15°C.

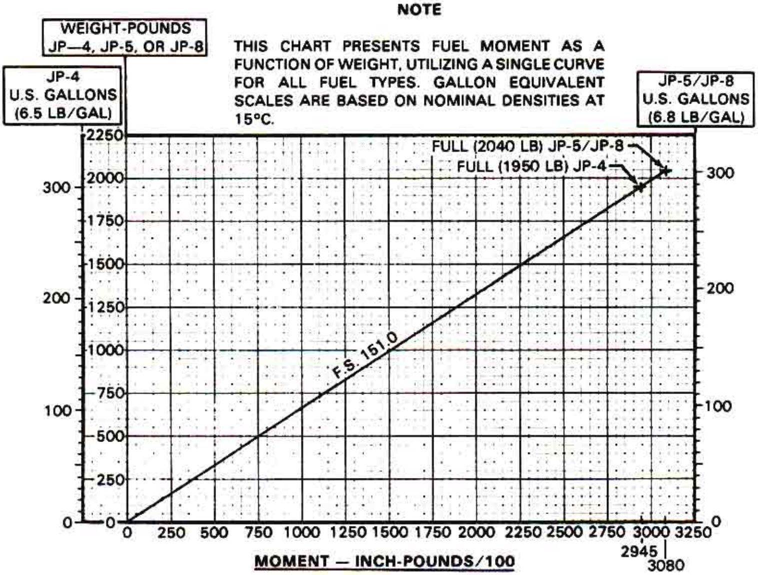


Figure 6-2. Fuel Loading (Sheet 2 of 2)

PERSONNEL LOADING CHART

MOMENT FOR PERSONNEL

EXAMPLE

WANTED

PERSONNEL MOMENT FOR A GIVEN WEIGHT AND LOCATION

KNOWN

PERSONNEL WEIGHT OF 200 POUNDS AT F.S.117.0 (Row 4)

METHOD

MOVE RIGHT FROM 200 LBS TO THE LINE CONNECTING WITH SEAT ROW 4. PROJECT DOWN TO READ 234 ON THE MOMENT/100 SCALE.

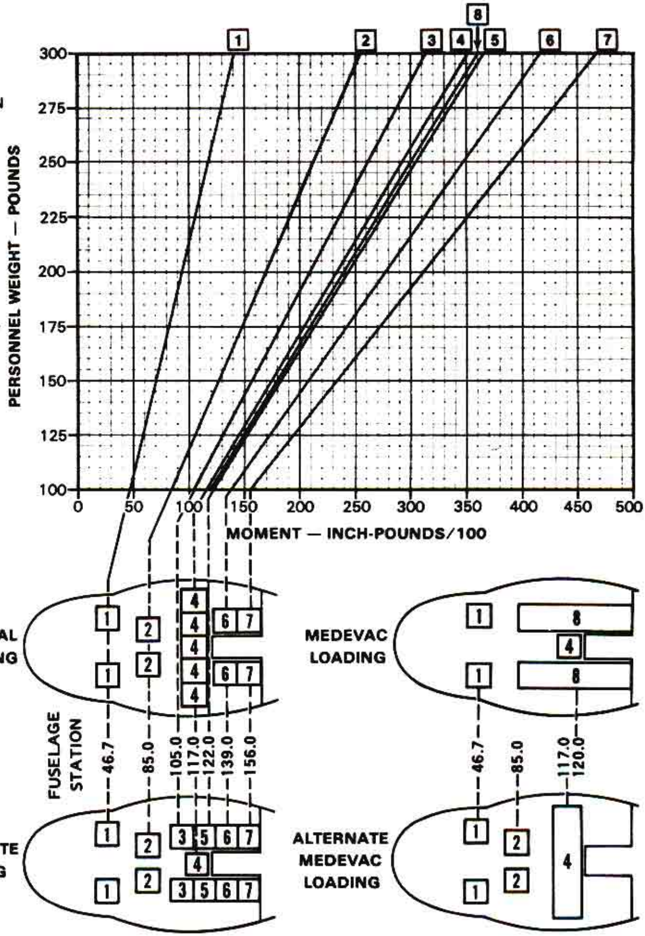


Figure 6-3. Personnel Loading

HOIST LOADING LIMITATIONS DUE TO LATERAL C .G. LIMITS

HOIST IN FORWARD RIGHT POSITION

EXAMPLE

WANTED

MAXIMUM ALLOWABLE
HOIST LOAD

KNOWN

GROSS WEIGHT 8600 LBS
LONGITUDINAL C. G. 133.5,
CREW — PILOT & HOIST OPERATOR.

METHOD

ENTER GROSS WEIGHT
MOVE RIGHT TO INTERSECT
PILOT & HOIST OPERATOR CURVE.
MOVE DOWN TO READ
ALLOWABLE HOIST LOAD 550 LBS

NOTE

THE LESSER OF THE TWO WEIGHTS DERIVED FROM LATERAL AND LONGITUDINAL CHARTS SHALL BE USED (EXAMPLE 335 POUNDS).

GROSS WEIGHT TO BE THE LIGHTEST WEIGHT OF THE HELICOPTER DURING HOISTING OPERATIONS, BUT NOT INCLUDING THE WEIGHT OF THE HOIST LOAD. FUEL BURNED PRIOR TO HOISTING OPERATION MUST BE DEDUCTED FROM TAKEOFF GROSS WEIGHT BEFORE COMPUTING ALLOWABLE HOIST LOAD.

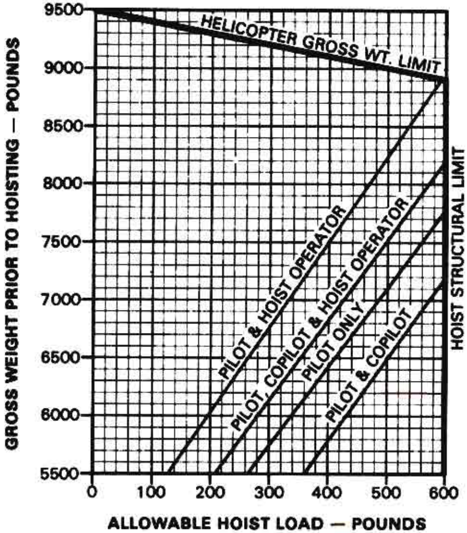


Figure 6-4. Hoist Loading Limitations (Lateral CG)

HOIST LOADING LIMITATIONS DUE TO LONGITUDINAL C .G. LIMITS

HOIST IN FORWARD RIGHT OR FORWARD LEFT POSITION

EXAMPLE

WANTED

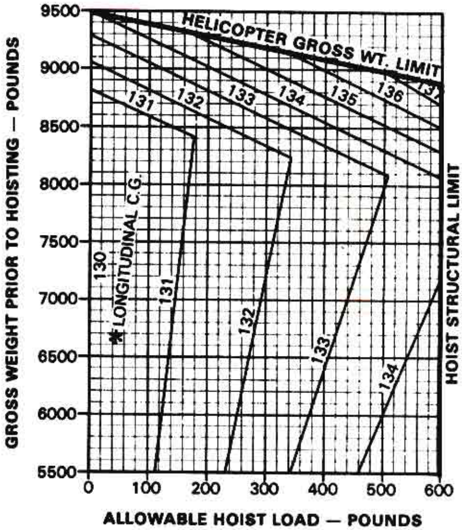
MAXIMUM ALLOWABLE
HOIST LOAD

KNOWN

GROSS WEIGHT 8600 LBS
LONGITUDINAL C.G. 133.5
PRIOR TO HOISTING.

METHOD

ENTER GROSS WT.
MOVE RIGHT TO C.G.
MOVE DOWN TO READ
ALLOWABLE HOIST LOAD 335 LBS



*GROSS WEIGHT AND C.G.
DO NOT INCLUDE HOIST LOAD

Figure 6-5. Hoist Loading Limitations (Longitudinal CG)

100,000 BTU HEATER

WINTERIZATION KIT

ITEM	WEIGHT	ARM	MOMENT/ 100
Complete Heater Instl. (205-706-001)	73.2	197.0	144.2
Winterization Kit (Muff Heater)	61.0	212.0	129.3

AFT BATTERY INSTALLATION

ITEM	WEIGHT	ARM	MOMENT/ 100
Battery (Fwd)	80.0	5.0	4.0
Battery (Aft)	80.0	233.0	186.4
Aft Battery Provisions (205-1682-1)	15.0	224.8	33.8

300 GALLON INTERNAL AUXILIARY FUEL TANK

ITEM	WEIGHT	ARM	MOMENT/ 100
Tank, LH, Non-Crashworthy	50.8	151.3	76.9
Tank, RH, Non-Crashworthy	50.8	151.3	76.9
Tank, LH, Crashworthy	(*)	151.3	(**)
Tank, RH, Crashworthy	(*)	151.3	(**)

*Tank weight varies; use weight stamped on tank (use fuel loading chart for fuel weight).
**Depends on tank weight.

RESCUE HOIST (BREEZE)

ITEM	WEIGHT	ARM	MOMENT/ 100
Hoist—Forward Position (Arm Inside)	151.3	87.3	132.1
Hoist—Aft Position (Arm Inside)	151.3	125.1	189.3

Figure 6-6. System Weight and Balance Data Sheet (Sheet 1 of 3)

RESCUE HOIST (HIGH PERFORMANCE)

ITEM	WEIGHT	ARM	MOMENT/ 100
Hoist—Forward RH Position (Arm Stowed Forward)	174.0	80.0	139.2
Hoist—Forward RH Position (Arm Stowed Aft)	174.0	84.0	146.2
Hoist—Forward LH Position (Arm Stowed Forward)	174.0	82.0	142.7
Hoist—Forward LH Position (Arm Stowed Aft)	174.0	84.0	146.2
Hoist—Aft Position (Arm Stowed Forward)	174.0	129.0	224.5
Hoist—Aft Position (Arm Stowed Aft)	174.0	133.0	231.4

GLASS WINDSHIELD INSTALLATION

ITEM	WEIGHT	ARM	MOMENT/ 100
Glass Windshield—Pilot/Copilot (Both)	30.0	27.0	8.1
Glass Windshield—Pilot Only or Copilot Only	15.0	27.0	4.1

M-23 DOOR MOUNTED M-60

ITEM	WEIGHT	ARM	MOMENT/ 100
Armament Subsystem W/O Ammunition	128.0	142.6	182.5
Ammunition 7.62 MM (1200 Rounds)	78.0	142.6	111.2
Total Armament Subsystem W/Ammunition (1200 Rounds)	206.0	142.6	293.8
Ammunition Box (2 each) W/Cover Assembly	8.5	142.6	12.1
Machine Guns W/Ejection Control Bags (2 each) and Chute Assembly (2 each)	66.5	142.0	94.4
Mount Assembly (2 each) W/Hardware	53.0	142.6	75.6

EXTERNAL STORES SUPPORT

ITEM	WEIGHT	ARM	MOMENT/ 100
Stores Rack			
Cross Beam Assys.	29.5	142.5	42.1
Fwd. Beam Assys.	11.5	129.0	14.8
Aft Beam Assys.	11.9	155.1	18.4
Fwd. Sway Brace Assys.	1.1	135.3	1.5
Aft Sway Brace Assys.	1.2	149.7	1.9
Hardware	3.1	142.9	4.4
Total Aft Stores Instl.	58.3	142.5	83.1

Figure 6-6. System Weight and Balance Data Sheet (Sheet 2 of 3)

Stores Rack (205-706-013-11)			
Cross Beam Assys.	31.1	73.9	23.0
Fwd. Beam Assys.	11.7	63.0	....
Aft Beam Assys.	13.6	84.5	11.5
Fwd. Sway Brace Assys.	1.9	68.4	1.3
Aft Sway Brace Assys.	1.5	79.7	1.2
Hardware	3.2	74.0	2.4
Total Fwd. Stores Instl.	63.0	74.2	46.8

M52 SMOKE GENERATOR SUBSYSTEM

ITEM	WEIGHT	ARM	MOMENT/ 100
A Kit	16.7	161.67	27.0
B Kit	39.64	120.08	47.6
	−20.62	122.21	−25.2
C Kit Without Oil in Tank	117.5	127.57	149.9
C Kit With Oil in Tank (50 Gal)	492.5	121.81	599.9

MULTIARMAMENT STRUCTURAL SUPPORT KIT

ITEM	WEIGHT	ARM	MOMENT/ 100
A Kit (Roof Hardpoints)	5.83	146.71	8.6
B Kit	205.87	141.87	292.1

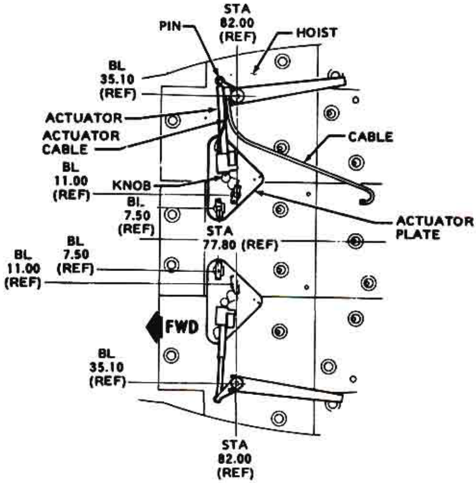
M56 MINE DISPENSER (SUN-13D/A)

ITEM	WEIGHT	ARM	MOMENT/ 100
Each Dispenser Empty, Without Pallet	117	145.83	170.6
Each Dispenser with Canisters Only	188	145.83	274.2
Each Dispenser—Loaded as Flown	640	143.79	920.3

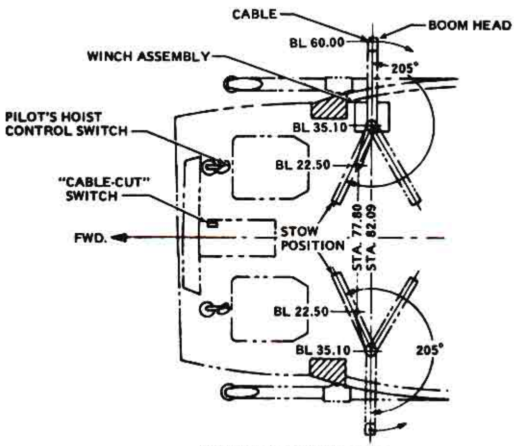
AUXILIARY SUPPRESSOR KIT, EXHAUST SUPPRESSOR

ITEM	WEIGHT	ARM	MOMENT/ 100
A Kit	4.0	228.0	9.1
B Kit	47	230.2	108.2

Figure 6-6. System Weight and Balance Data Sheet (Sheet 3 of 3)

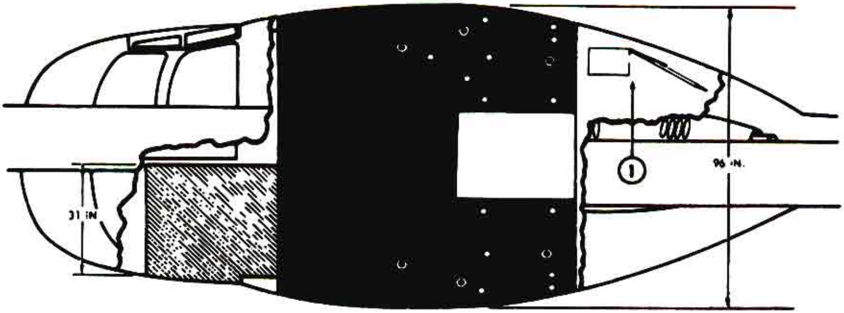


BREEZE HOIST



HIGH PERFORMANCE HOIST

Figure 6-7. Hoist Installation Positions



CODE

1. Tie-down Fittings
2. Stanchion Fittings
3. Cargo Area, Maximum Loading Dimensions
4. Optional Loading Area, Left Seat Removed
5. Interior Clearance Above Maximum Package at Centerline of Cabin

(1) Mirror Stowage

NOTES:

1. Floor tie-down fittings, strength 1250 pounds vertical, 500 pounds horizontal load per fitting. Each aft bulkhead tiedown fitting is capable of the following loads: 1250 lbs, parallel to the bulkhead, 2195 lbs at a 45° angle.
2. Bulkhead tie-down fittings are good for 2500 pounds ultimate per fitting perpendicular to the bulkhead.
3. Tie-down fittings on the side of the beams are good for 1250 pounds ultimate per fitting perpendicular to the beams.
4. Two fittings at station 129.0 are good for 1250 pounds ultimate per fitting perpendicular to bulkhead.

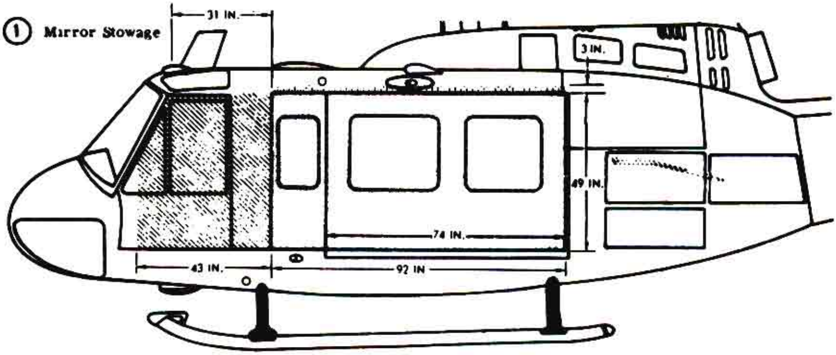


Figure 6-8. Cargo Compartment

CARGO TIE DOWN FITTING DATA

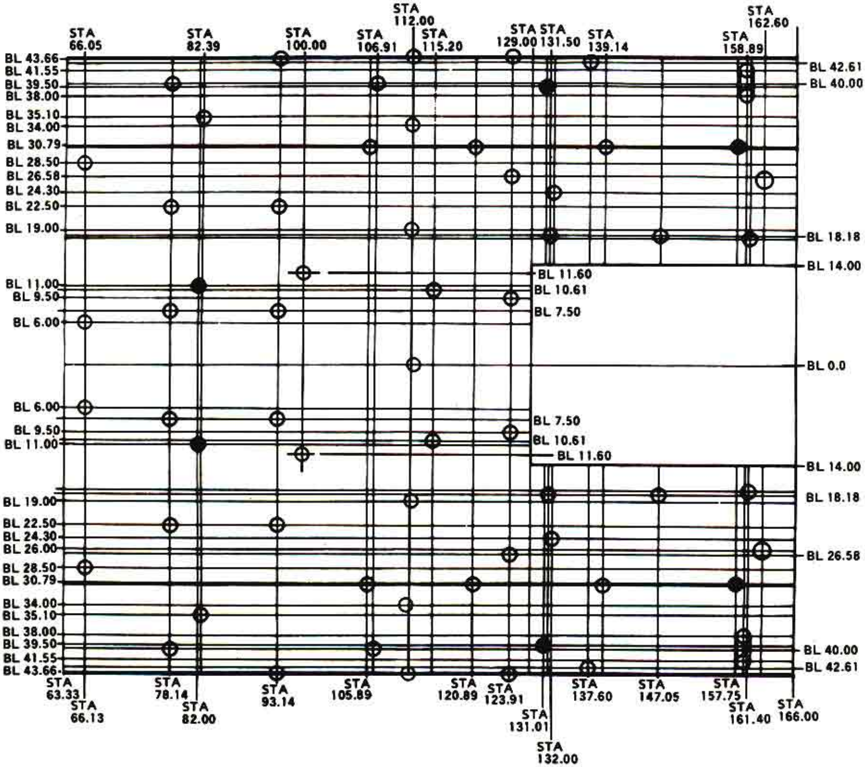


Figure 6-9. Cargo Tiedown Fitting Data

INTERNAL CARGO WEIGHT AND MOMENT

EXAMPLE

WANTED

CARGO MOMENT FOR A GIVEN CARGO WEIGHT AND FUSELAGE STATION

KNOWN

CARGO WEIGHT 1000 LBS
LOCATION FS105

METHOD

ENTER INTERNAL CARGO WEIGHT
MOVE RIGHT TO FS105
MOVE DOWN TO BASE-LINE AND READ 1050 INCH POUNDS/100

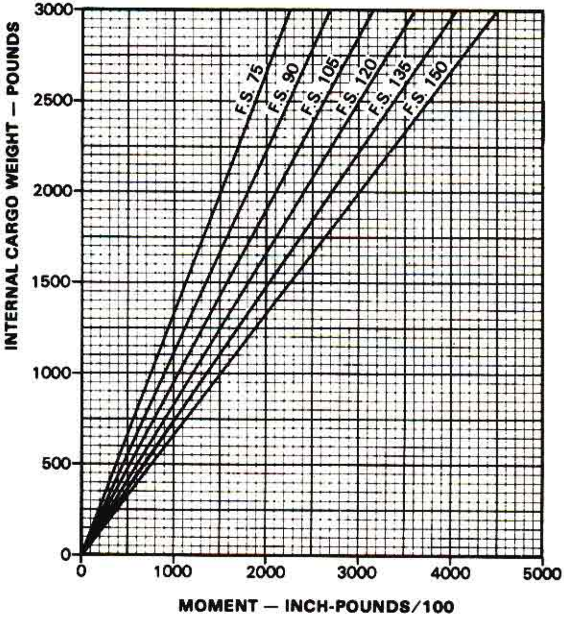


Figure 6-10. Internal Cargo Weight and Moment

EXTERNAL CARGO WEIGHT AND MOMENT

F.S. 137.55

EXAMPLE

WANTED

CARGO MOMENT/100 FOR A GIVEN CARGO WEIGHT.

KNOWN

CARGO WEIGHT 3000 LBS

METHOD

ENTER EXTERNAL CARGO WEIGHT MOVE RIGHT TO DIAGONAL LINE MOVE DOWN TO BASELINE AND READ 4127 ON MOMENT/100 SCALE.

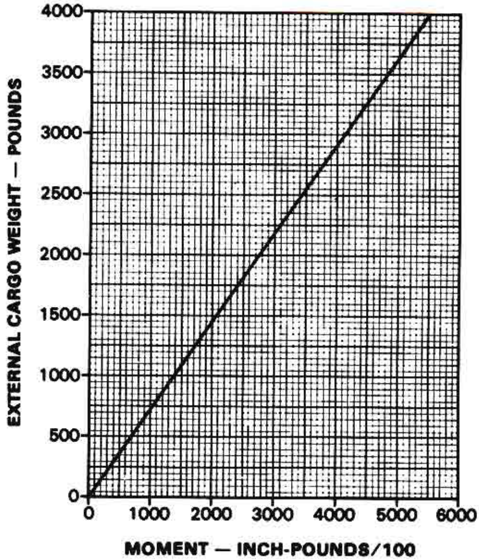


Figure 6-11. External Cargo Weight and Moment

CENTER OF GRAVITY LIMITS

C.G. LIMITS

EXAMPLE

WANTED

DETERMINE CENTER OF GRAVITY FOR KNOWN WEIGHT AND MOMENT.

KNOWN

GROSS WEIGHT EQUALS 8460 POUNDS, MOMENT/100 EQUALS 11,900 INCH-POUNDS

METHOD

MOVE RIGHT FROM 8460 POUNDS TO A POINT APPROXIMATELY 1/2 OF THE DISTANCE BETWEEN 11,800 AND 12,000 INCH-POUND DIAGONAL LINES. FROM THIS POINT PROJECT DOWN TO READ 140.6 ON THE CENTER OF GRAVITY SCALE (FUSELAGE STATION IN INCHES).

NOTE

WHEN CG IS WITHIN SHADED AREA AFT OF STATION 140.0, APPROACHES SHOULD BE TERMINATED TO A 5-FOOT HOVER FOR ADEQUATE TAIL ROTOR CLEARANCE.

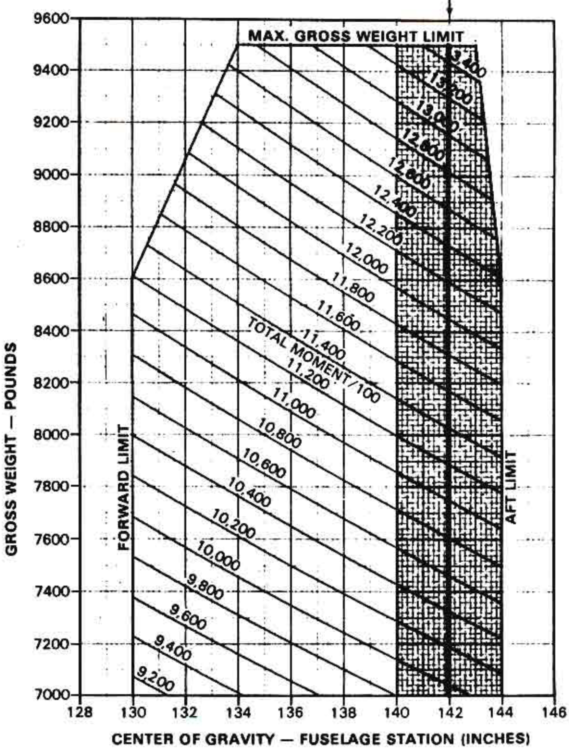


Figure 6-12. Center of Gravity Limits (Sheet 1 of 2)

CENTER OF GRAVITY LIMITS

C.G. LIMITS

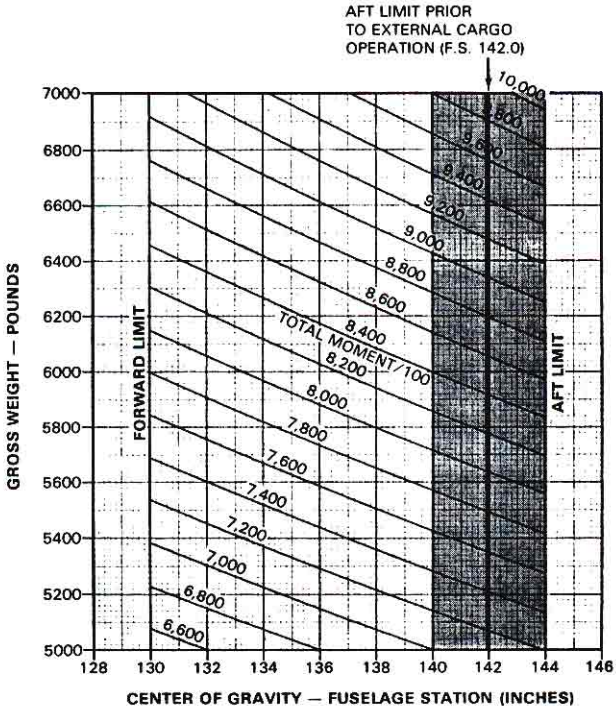


Figure 6-12. Center of Gravity Limits (Sheet 2 of 2)

Chapter 7

Performance Data

Section I. INTRODUCTION

7-1. Purpose The purpose of this chapter is to provide performance data. Regular use of this information will enable you to receive maximum safe utilization from the helicopter. Although maximum performance is not always required, regular use of this chapter is recommended for the following reasons:

a. Knowledge of your performance margin will allow you to make better decisions when unexpected conditions or alternate missions are encountered.

b. Situations requiring maximum performance will be more readily recognized.

c. Familiarity with the data will allow performance to be computed more easily and quickly.

d. Experience will be gained in accurately estimating the effects of variables for which data are not presented.

NOTE

The information provided in this chapter is primarily intended for mission planning and is most useful when planning operations in unfamiliar areas or at extreme conditions. The data may also be used inflight, to establish unit or area standing operating procedures, and to inform ground commanders of performance/risk tradeoffs.

7-2. Chapter 7 Index The following index contains a list of the sections and their titles, the figure numbers, subjects of each performance data chart contained in this chapter.

INDEX

Altitude Sea Level to 2000 Ft
18, 4000 Ft to 6000 Ft
19, 8000 Ft to 10000 Ft
20, 12000 Ft 14000 Ft
21, FAT =45°C, Pressure
Altitude Sea Level to 2000 Ft
22, 4000 Ft to 6000 Ft
23, 8000 Ft to 10000 Ft
24, 12000 Ft to 14000 Ft

VI Drag
Figure 7-7. Drag Chart
Sheet 1, Drag (Authorized Configurations) Chart
Sheet 2, Drag Chart

VII Climb-Descent
Figure 7-8. Climb-Descent Chart

VIII Fuel Flow
Figure 7-9. Fuel Flow
Sheet 1, Idle Fuel Flow Chart
Sheet 2, Fuel Flow vs. Torque

7-3. General The data presented covers the maximum range of conditions and performance that can reasonably be expected. In each area of performance, the effects of altitude, temperature, gross weight, and other parameters relating to that phase of flight are presented. In addition to the presented data, your judgment and experience will be necessary to accurately obtain performance under a given set of circumstances. The conditions for the data are listed under the title of each chart. The effects of different conditions are discussed in the text. Where practical, data are presented at conservative conditions. However NO GENERAL CONSERVATISM HAS BEEN APPLIED. All performance data presented are within the applicable limits of the helicopter.

7-4. Limits Applicable limits are shown on the charts. Performance generally deteriorates rapidly beyond limits. If limits are exceeded, minimize the amount and time. Enter the maximum value and time above limits on DA Form 2408-13 so proper maintenance action can be taken.

7-5. Use of Charts

a. *Chart Explanation*. The first page of each section describes the chart(s) and explains its uses.

b. *Shading*. Shaded areas on charts indicate precautionary or time limited operation.

c. *Reading the Charts*. The primary use of each chart is given in an example to help you follow the route through the chart. The use of a straight edge (ruler or page edge) and a hard fine point pencil is recommended to avoid cumulative errors. The majority of the charts provide a standard pattern for use as follows: enter first variable on top left scale, move right to the second variable, reflect down at right angles to the third variable, reflects left at right angles to the fourth variable, reflect down, etc. until the final variable is read out at the final scale.

NOTE

An example of an auxiliary use of the charts referenced above is as follows: Although the hover chart is primarily arranged to find torque required to hover, by entering torque available as required, maximum skid height for hover can also be found. In general, any single variable can be found if all others are known. Also, the tradeoffs between two variables can be found. For example, at a given pressure altitude, you can find the maximum gross weight capability as free air temperature changes.

d. *Dashed Line Data*. Data beyond conditions for which tests were conducted are shown as dashed lines.

7-6. Data Basis The type of data used is indicated at the bottom of each performance chart under DATA BASIS. The applicable report and date are also given. The data provided generally is based on one of four categories:

a. *Flight Test Data*. Data obtained by flight test of the aircraft by experienced flight test personnel at precise conditions using sensitive calibrated instruments.

b. *Derived From Flight Test*. Flight test data obtained on a similar rather than the same aircraft and series. Generally small corrections will have been made.

c. *Calculated Data*. Data based on tests, but not on flight test of the complete aircraft.

d. *Estimated Data*. Data based on estimates using aerodynamic theory or other means but not verified by flight test.

7-7. Specific Conditions The data presented are accurate only for specific conditions listed under the title of each chart. Variables for which data are not presented, but which may affect that phase of performance, are discussed in the text. Where data are available or reasonable estimates can be made, the amount that each variable affects performance will be given.

7-8. General Conditions In addition to the specific conditions, the following general conditions are applicable to the performance data.

a. Rigging. All airframe and engine controls are assumed to be rigged within allowable tolerances.

b. Pilot Technique. Normal pilot technique is assumed. Control movements should be smooth and continuous.

c. Helicopter Variation. Variation in performance between individual helicopters are known to exist; however, they are considered to be small and cannot be individually accounted for.

d. Instrument Variation. The data shown in the performance charts do not account for instrument inaccuracies or malfunctions.

7-9. Performance Discrepancies Regular use of this chapter will allow you to monitor instruments and other helicopter systems for malfunction, by comparing actual performance with planned performance. Knowledge will also be gained concerning the effects of variables for which data are not provided, thereby increasing the accuracy of performance predictions.

7-10. Definitions of Abbreviations

a. Unless otherwise indicated abbreviations and symbols used in this manual conform to those established in Military Standard MIL-STD-12, which is periodically revised to reflect current changes in abbreviations usage.

b. Capitalization and punctuation of abbreviations varies, depending upon the context in which they are used. In general, lower case abbreviations are used in text material, whereas abbreviations used in charts and illustrations appears in full capital letters. Periods do not usually follow abbreviations; however, periods are used with abbreviations that could be mistaken for whole words if the period were omitted.

7-11. Temperature Conversion The temperature conversion chart figure 7-1 is arranged so that degrees celsius can be converted quickly and easily by reading celsius and looking directly across the charts for fahrenheit equivalence and vice versa.

Section II. TORQUE AVAILABLE

7-12. Description The torque available charts show the effects of altitude and temperature on engine torque.

7-13. Chart Differences Both pressure altitude and FAT affect engine power production. Figure 7-2 shows power available data at 30 minute power ratings in terms of the allowable torque as recorded by the torquemeter (psi). Note that the power output capability of the T53-L-13 engine can exceed the transmission structural limit (50 psi calibrated) under certain conditions.

a. Figure 7-2 is applicable for maximum power, 30 minute operation at 324 rotor/6600 engine rpm.

b. If the hot metal plus plume tailpipe is installed on the aircraft, subtract 1 psi from the torque values obtained from figure 7-2.

7-14. Use of Chart The primary use of the chart is illustrated by the examples. In general, to determine the maximum power available, it is necessary to know the pressure altitude and temperature. The calibration factor (Data Plate Torque), obtained from the engine data plate or from the engine acceptance records, is the indicated torque pressure at 1125 ft-lbs actual output shaft torque, and is used to correct the error of individual engine torque indicating system.

NOTE

Torque available values determined are not limits. Any torque which can be achieved, without exceeding engine, transmission, or other limits, may be used.

7-15. Conditions Chart (fig 7-2) is based upon speeds of 324 rotor/6600 engine rpm grade J-4 fuel. The use of aviation gasoline will not influence engine power. All torque availables are presented for bleed air heater and deice off. Decrease power available 1.4 psi for heater on and 2.1 psi for deice on; decrease torque available 3.5 psi if both bleed air heater and deice are operating.

Section III. HOVER

7-16. Description The hover charts (fig 7-3, sheets 1 and 2) shows the hover ceiling and the torque required to hover respectively at various pressure altitudes, ambient temperatures, gross weights, and skid heights. Maximum skid height for hover can also be obtained by using the torque available from figure 7-2.

7-17. Use of Chart The primary use of the hover charts is illustrated by the charts examples. In general, to determine the hover ceiling or the torque required to hover, it is necessary to know the pressure altitude, temperature, gross weight and the desired skid height. In addition to its primary use, the hover chart (sheet 2) can also be used to determine the predicted maximum hover height, which is needed for use of the takeoff chart (fig 7-5).

7-18. Control Margin

a. Sheet 1 of the control margin charts (fig 7-4) shows the maximum right crosswind which one can achieve and still maintain directional control as a function of pressure altitude, temperature, and gross weight. Sheet 2 of the control margin chart (fig 7-4) shows the combinations of relative wind velocity and azimuth which may result in marginal directional or longitudinal control.

b. Use of the control margin charts is illustrated by the example on sheet 1. Ten percent pedal margin (full right to full left) is considered adequate for directional control when hovering. The shaded area on sheet 1 indicates conditions where the directional control margin may be less than ten percent in zero wind hover. The shaded area on sheet 2 labeled DIRECTIONAL indicates conditions where the directional control margin may be less than ten percent for crosswind components in excess of those determined from sheet 1. The shaded area on sheet 2 labeled LONGITUDINAL indicates wind conditions where longitudinal control may be less than 10 percent. These charts are based on control margin only.

7-19. Conditions

a. The hover charts are based upon calm wind conditions, a level ground surface, and the use of 324 rotor rpm.

b. The control margin charts are based on test of in-ground effect (IGE) translation flight over a level surface at 324 rotor rpm. Use of these charts is to determine if adequate control margin will be available for IGE and OGE hover in winds or low speed translation.

Section IV. TAKEOFF

7-20. Description The takeoff chart (fig 7-5) shows the distances to clear various obstacle heights, based upon several hover height capabilities. The upper chart grid presents data for climbout at a constant INDICATED airspeed. The two lower grids present data for climbouts at various TRUE airspeeds. Figure 7-5, sheet 1, is based upon level acceleration technique, sheet 2 is based upon a climb and acceleration from a 3 foot skid height and sheet 3 is based upon a level acceleration from a 15 foot skid height.

NOTE

The hover heights shown on the chart are only a measure of the aircraft's climb capability and do not imply that a higher than normal hover height should be used during the actual takeoff.

7-21. Use of Charts The primary use of these charts is illustrated by the charts examples. The main consideration for takeoff performance is the hovering skid height capability, which includes the effects of pressure altitude, free air temperature, gross weight, and torque. Hover height capability is determined by use of the hover chart, figure 7-3. A hover check can be made to verify the hover capability. If winds are present, the hover check may disclose that the helicopter can actually hover at a greater skid height than the calculated value, since the hover chart is based upon calm wind conditions.

7-22. Conditions

a. Wind. The takeoff chart is based upon calm wind conditions. Since surface wind velocity and direction cannot be accurately predicted, all takeoff planning should be based upon calm wind conditions. Takeoff into any prevailing wind will improve the takeoff performance.

WARNING

A tailwind during takeoff and climbout will increase the obstacle clearance distance and could prevent a successful takeoff.

b. Power Settings. All takeoff performance data are based upon the torque used in determining the hover capabilities in figure 7-3.

Section V. CRUISE

7-23. Description The cruise charts (fig 7-6, sheets 1 through 24) show the torque pressure and engine rpm required for level flight at various pressure altitudes, airspeeds, gross weights and fuel flows.

NOTE

The cruise charts are basically arranged by FAT groupings. Figure 7-6, sheets 1 through 24, are based upon operation with clean configuration. Each chart has a dashed line that represents a ten square foot equivalent flat plate drag area. This allows quick determination of Delta PSI for other than clean configurations.

7-24. Use of Charts

CAUTION

Cruise flight is restricted to 319 to 324 Rotor RPM (6500 to 6600 Engine RPM.). Cruise at 324 Rotor/6600 Engine RPM is recommended. The cruise chart data for true airspeeds above 40 KTAS is based on 314 Rotor/6400 Engine RPM. Until the cruise charts are revised performance planning shall be accomplished using the procedures and torque corrections from Table 7-1.

The primary use of the charts is illustrated by the examples provided in figure 7-6. The first step for chart use is to select the proper chart, based upon the planned drags configuration, pressure altitude and anticipated free air temperature; refer to chapter 7 index (para 7-2). Normally, sufficient accuracy can be obtained by selecting the chart nearest to the planned cruising altitude and FAT, or the next higher altitude and FAT. If greater accuracy is required, interpolation between altitudes and/or temperatures will be required. You may enter the charts on any side: TAS, IAS, torque pressure, or fuel flow, and then move vertically or horizontally to the gross weight, then to the other three parameters. Maximum performance conditions are determined by entering the chart where the maximum range or maximum endurance and rate of climb lines intersect the appropriate gross weight; then read airspeed, fuel flow and PSI torque pressure. For conservatism, use the gross weight at the beginning of cruise flight. For greater accuracy on long flights it is preferable to determine cruise information for several flight segments in order to allow for decreasing fuel weights (reduced gross weight). Estimated performance data is presented for hover (KTAS=0) in figure 7-6, however, the hover performance data presented in figure 7-3 is more accurate and should be used in planning critical hover performance. The following parameters contained in each chart are further explaned as follows:

a. Airspeed. True and indicated airspeeds are presented at opposite sides of each chart. On any chart, indicated airspeed can be directly converted to true airspeed (or vice versa) by reading directly across the chart without regard for other chart information. Maximum permissible airspeed (VNE) limits appear on some charts. If no line appears, VNE is above the limits of the chart.

b. Torque Pressure (PSI). Since pressure altitude and temperature are fixed for each chart, torque pressures vary according to gross weight, airspeed and bleed air on or off. See paragraph 7-15 for effect of bleed air heater and deice.

NOTE

Torque available values determined are not limits. Any torque which can be achieved, without exceeding engine, transmission, or other limits, may be used.

c. Fuel Flow. Fuel flow scales are provided opposite the torque pressure scales. On any chart, torque pressure may be converted directly to fuel flow without regard for other chart information. All fuel flows are presented for bleed air heater and deice off. Add two percent fuel flow (about 14 lb/hr) for heater on and increase fuel flow three percent (approximately 21 lb/hr) for deice on. If both are operating, add five percent fuel flow (about 35 lb/hr) to chart values.

d. Maximum Range. The maximum range lines indicate the combinations of weight and airspeed that will produce the greatest flight range per gallon of fuel under zero wind conditions. When a maximum range condition does not appear on a chart it is because the maximum range speed is beyond the maximum permissible speed (VNE); in such cases, use VNE cruising speed to obtain maximum range.

e. Maximum Endurance and Rate of Climb. The maximum endurance and rate of climb lines indicate the airspeed for minimum torque pressure required to maintain level flight for each gross weight, FAT and pressure altitude. Since minimum torque pressure will provide minimum fuel flow, maximum flight endurance will be obtained at the airpeeds indicated.

7-25. Conditions The cruise charts are based upon operations at 324 rotor/6600 engine rpm below 40 KTAS and 314 rotor/6400 engine rpm for true airspeeds above 40 knots.

Section VI. DRAG

7-26. Description The drag chart (fig 7-7, sheet 1 of 2) shows the authorized configuration or the equivalent flat plate drag area changes for additional aircraft modifications. There is no increase in drag with cargo doors fully open. The upper left portion of figure 7-7, sheet 2 of 2, presents drag areas of typical external loads as a function of the load frontal area. The balance of the charts shows the additional torque required in level flight due to the increase in drag caused by external loads, aircraft modifications or authorized configurations.

7-27. Use of Chart The primary use of the chart is illustrated by the example. To determine the change in torque it is necessary to know the drag area change, the true airspeed, the pressure altitude and the free air temperature. Enter at the known drag area change, move right to TAS, move down to pressure altitude, move left to FAT, then move down and read change in torque. In addition, by entering the chart in the opposite direction, drag area change may be found from a known torque change. This chart is used to adjust cruise charts for appropriate torque and fuel flow due to equivalent flat plate drag area change (ΔF). For frontal areas exceeding values shown on figure 7-7 (sheet 2 of 2) use a smaller value and multiply, e.g. 36 sq. ft.=9 sq. ft.x4.

7-28. Conditions The drag chart is based upon 314 rotor/6400 engine rpm.

Section VII. CLIMB-DESCENT

7-29. Description

The climb descent chart fig 7-8, shows the change in torque (above or below torque required for level flight under the same gross weight and atmospheric conditions) to obtain a given rate of climb or descent.

7-30. Use of Chart

Climb-Descent. The primary uses of the chart are illustrated by the chart examples.

a. The torque change obtained from the grid scale must be added to the torque required for level flight (for climb)—or subtracted from the torque required for level fight (for descent)—obtained from the appropriate cruise chart in order to obtain a total climb or descent torque.

b. By entering the bottom of the grid with a known torque change, moving upward to the gross weight, and left to the corresponding rate of climb or descent may also be obtained.

7-31. Conditions

Climb-Descent. The climb-descent chart is based on the use of constant rotor or engine rpm. The rate of climb (descent) presented is for steady state conditions and rpm bleed could increase (decrease) the rate of climb (descent) shown.

Section VIII. FUEL FLOW

7-32. Description

a. The fuel flow chart (fig 7-9) shows the fuel flow at engine idle and 324 rotor/6600 engine rpm with flat pitch.

b. Fuel flow vs torque, shows fuel flow in pound-per-hour versus torquemeter psi for pressure altitudes from sea level to 14000 feet and for 0°C free air temperature.

7-33. Use of Chart

a. The primary use of the idle fuel flow chart is illustrated by the example. To determine the idle fuel flow, it is necessary to know the idle condition, pressure altitude, and free air temperature. Enter at the pressure altitude, move right to FAT in appropriate grid, then move down and read fuel flow on the scale corresponding to the condition. Refer to the cruise charts to obtain fuel flow for cruise power conditions.

b. Fuel flow will increase about two percent with the bleed air heater on and three percent with deice on. When both systems are on, increase fuel flow five percent. Also a range or endurance penalty should be accounted for when working cruise chart data. A fairly accurate rule-of-thumb to correct fuel flow for temperatures other than 0°C FAT is to increase (decrease) fuel flow 1 percent for each 10°C increase (decrease) in FAT.

7-34. Conditions

These charts are based upon the use of JP-4 fuel. The change in fuel flow when using other jet fuels is insignificant.

Table 7-1 Torque Correction (Sheet 1 of 4)

To determine cruise performance data for 324 Rotor/6600 Engine RPM at speeds above 40 KTAS, follow the instructions in paragraph 7-24 except:

a. Add appropriate torque correction from this table to the calibrated torque required values determined from the intersection of the airspeed and gross weight lines on the upper (6400 Engine RPM) portion of the cruise chart.

b. Determine fuel flow corresponding to the corrected torque required from the lower (6600 Engine RPM) portion of the cruise chart.

c. Determine continuous torque available (CONT TRQ AVAIL) and 30 minute torque available (30 MIN TRQ AVAIL) from the lower (6600 Engine RPM) portion of the cruise chart.

EXAMPLE

WANTED

Speed for Maximum Range
Calibrate Torque Required and Fuel Flow at Maximum Range

KNOWN

324 Rotor/6600 Engine RPM
Clean Configuration
FAT = -30°C
Pressure Altitude = 8000 feet
Gross Weight = 8500 pounds
Roof Mounted System

METHOD

Locate (-30°C FAT, 8000 Feet) Chart (figure 7-6 Sheet 3 of 24)
Find Intersection of 8500 LB Gr Wt Line With the Max Range Line
To Read Speed for Maximum Range:
Move Right, Read TAS = 105.3 Knot
Move Left, Read IAS = 102.3
To Read Calibrated Torque Required @ 314 Rotor/6400 Engine RPM
Move Down, Read Torque = 41.2 PSI
To Correct Torque Required for 6600 Engine RPM
From Table for Sheet 3 (8000 Ft -30°C) @ 8500 Lb Gross Weight
For 90 KTAS, Torque Correction = 3.5 PSI
For 110 KTAS, Torque Correction = 5.7 PSI
Interpolate for 105.3 KTAS Torque Correction = 5.2 PSI
Corrected Torque Required = 41.2 PSI + 5.2 PSI = 46.4 PSI
To Determine Fuel Flow
Enter Figure 7-6, Sheet 3 of 24 At 46.4 PSI Torque:
Move Down Read Fuel Flow = 614 Lb/Hr

TABLE 7-1 TORQUE CORRECTION (Sheet 2 of 4)

		TORQUE CORRECTION - PSI							
(-30°C FAT)		SHEET 1		SHEET 2		SHEET 3		SHEET 4	
GW-LB	KTAS	SL	2000	4000	6000	8000	10000	12000	14000
5500	50	NA	NA	NA	2.4	2.2	2.1	1.9	1.8
	70	NA	NA	NA	2.8	2.6	2.4	2.2	2.2
	90	NA	NA	NA	3.5	3.4	3.2	3.0	2.9
	110	NA	NA	NA	5.9	5.5	5.2	4.9	4.5
6500	50	3.0	2.8	2.6	2.4	2.2	2.2	2.1	1.9
	70	3.3	3.2	3.1	2.9	2.6	2.5	2.4	2.3
	90	4.3	4.1	3.9	3.7	3.5	3.4	2.9	2.9
	110	7.3	6.9	6.4	6.1	5.6	5.3	4.5	4.6
7500	50	3.1	2.9	2.6	2.5	2.3	2.3	1.7	1.4
	70	3.5	3.3	3.0	3.0	2.8	2.7	2.2	2.2
	90	4.5	4.3	4.1	3.9	3.4	3.3	2.9	2.7
	110	7.4	7.0	6.5	6.2	5.3	5.3	4.7	4.7
8500	50	3.0	2.9	2.7	2.6	2.3	1.8	1.1	0.8
	70	3.5	3.4	3.3	3.1	2.8	2.6	1.8	1.1
	90	4.6	4.4	4.0	3.7	3.5	3.2	1.9	0.8
	110	7.5	7.1	6.4	6.0	5.7	5.5	2.6	0.6
9500	50	3.1	3.0	2.9	2.1	1.7	1.1	0.1	-1.8
	70	3.8	3.5	3.4	2.8	2.8	1.9	-0.6	-2.3
	90	4.9	4.2	4.2	3.5	3.5	2.0	-2.4	-1.5
	110	7.7	6.6	6.7	6.0	5.9	2.5	-4.8	1.4
[-15°C FAT]		SHEET 5		SHEET 6		SHEET 7		SHEET 8	
GW-LB	KTAS	SL	2000	4000	6000	8000	10000	12000	14000
5500	50	NA	NA	1.3	1.2	1.1	1.0	1.0	1.0
	70	NA	NA	1.9	1.7	1.7	1.5	1.5	1.3
	90	NA	NA	2.6	2.5	2.3	2.2	2.1	1.9
	110	NA	NA	3.0	2.9	2.6	2.4	2.3	2.0
6500	50	1.5	1.4	1.3	1.2	1.1	1.1	1.0	0.5
	70	2.2	2.1	1.9	1.7	1.7	1.6	1.5	1.3
	90	3.0	2.9	2.7	2.5	2.4	2.2	2.1	1.8
	110	3.5	3.3	3.1	2.8	2.7	2.3	2.2	1.8
7500	50	1.6	1.4	1.3	1.3	1.2	0.7	0.7	0.3
	70	2.2	2.0	2.0	1.9	1.8	1.6	1.6	0.6
	90	3.2	2.9	2.8	2.6	2.4	2.1	2.0	0.9
	110	3.6	3.3	3.2	2.7	2.5	2.2	2.1	-0.5
8500	50	1.6	1.5	1.4	1.1	0.7	0.5	0.5	-0.9
	70	2.3	2.2	2.1	1.9	1.7	1.2	0.8	-1.4
	90	3.3	3.1	2.8	2.6	2.2	1.6	1.3	-3.2
	110	3.6	3.3	2.8	2.7	2.3	0.8	-0.2	-7.5
9500	50	1.6	1.4	0.8	0.9	0.4	-0.1	-0.8	-7.5
	70	2.3	2.3	2.0	2.0	0.8	-0.2	-1.2	-6.6
	90	3.2	3.1	2.6	2.6	1.2	-0.8	-2.9	-6.8
	110	3.2	3.1	2.7	2.7	-0.7	-3.8	-7.2	-6.9

TABLE 7-1 TORQUE CORRECTION (Sheet 3 of 4)

		TORQUE CORRECTION - PSI							
[0°C FAT]		SHEET 9		SHEET 10		SHEET 11		SHEET 12	
GW-LB	KTAS	SL	2000	4000	6000	8000	10000	12000	14000
5500	50	NA	NA	1.1	1.1	1.0	0.9	0.9	0.8
	70	NA	NA	1.2	1.1	1.1	1.0	0.9	0.8
	90	NA	NA	1.4	1.3	1.2	1.1	1.1	1.0
	110	NA	NA	2.5	2.3	2.1	2.0	1.9	1.6
6500	50	1.4	1.3	1.1	1.2	1.1	0.9	0.7	0.6
	70	1.4	1.3	1.2	1.2	1.1	0.9	0.8	0.8
	90	1.6	1.5	1.4	1.4	1.2	1.2	0.9	0.9
	110	2.9	2.7	2.5	2.4	2.1	2.0	1.8	1.6
7500	50	1.3	1.3	1.2	1.1	0.9	0.7	0.4	0.4
	70	1.4	1.4	1.3	1.1	1.0	0.8	0.2	0.0
	90	1.6	1.6	1.4	1.3	1.2	0.9	0.3	0.0
	110	3.0	2.7	2.5	2.3	2.1	1.9	0.5	-0.1
8500	50	1.4	1.3	1.1	0.7	0.7	0.4	-0.5	-3.0
	70	1.5	1.3	1.2	0.9	0.8	0.1	-1.5	-3.8
	90	1.7	1.5	1.5	1.0	0.8	0.1	-3.8	-5.9
	110	3.0	2.5	2.5	2.1	1.8	0.0	-4.9	-8.8
9500	50	1.3	1.0	0.8	0.5	0.4	-0.8	-6.9	NA
	70	1.4	1.2	1.1	0.3	0.0	-2.0	-7.3	NA
	90	1.6	1.3	1.2	0.3	-0.3	-5.3	-8.5	NA
	110	2.8	2.6	2.4	0.4	-0.4	-6.3	-15.4	NA
(15°C FAT)		SHEET 13		SHEET 14		SHEET 15		SHEET 16	
GW-LB	KTAS	SL	2000	4000	6000	8000	10000	12000	14000
5500	50	NA	0.7	0.7	0.6	0.6	0.7	0.6	0.5
	70	NA	0.9	0.9	0.8	0.7	0.7	0.6	0.5
	90	NA	1.0	1.1	0.9	0.9	0.8	0.8	0.7
	110	NA	0.9	0.9	0.9	0.8	0.8	0.8	0.8
6500	50	0.8	0.7	0.7	0.8	0.7	0.6	0.4	0.2
	70	1.0	1.0	0.9	0.9	0.6	0.5	0.4	0.1
	90	1.2	1.1	1.0	0.9	0.9	0.8	0.6	0.3
	110	1.1	1.0	1.0	0.9	0.8	0.8	0.6	-0.3
7500	50	0.9	0.9	0.8	0.7	0.4	0.4	0.1	-1.0
	70	1.1	1.0	0.7	0.7	0.5	0.2	-0.2	-1.7
	90	1.2	1.1	1.0	1.0	0.6	0.5	-0.1	-4.2
	110	1.1	1.0	0.9	1.1	0.7	0.1	-1.2	-6.7
8500	50	0.9	0.8	0.6	0.5	0.0	-0.5	-1.3	-7.3
	70	0.9	0.8	0.6	0.5	-0.3	-0.9	-2.0	-7.1
	90	1.1	1.2	0.8	0.8	-0.1	-2.0	-5.0	-7.9
	110	1.0	1.1	0.8	0.8	-1.5	-4.0	-8.2	-19.6
9500	50	0.8	0.6	0.4	0.0	-1.4	-4.9	NA	NA
	70	0.7	0.6	0.2	-0.2	-2.2	-5.2	NA	NA
	90	1.2	0.8	0.4	0.0	-5.4	-7.3	NA	NA
	110	1.2	0.9	-0.2	-1.5	-8.7	-15.2	NA	NA

TABLE 7-1 TORQUE CORRECTION (Sheet 4 of 4)

		TORQUE CORRECTION - PSI							
[30°C FAT]		SHEET 17		SHEET 18		SHEET 19		SHEET 20	
GW-LB	KTAS	SL	2000	4000	6000	8000	10000	12000	14000
5500	50	0.5	0.5	0.5	0.5	0.6	0.5	0.5	0.3
	70	0.8	0.7	0.7	0.6	0.6	0.5	0.3	0.3
	90	0.5	0.5	0.4	0.3	0.3	0.2	0.3	0.1
	110	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.6
6500	50	0.6	0.6	0.7	0.5	0.5	0.3	0.4	0.0
	70	0.7	0.7	0.6	0.5	0.4	0.4	0.3	-0.2
	90	0.6	0.4	0.3	0.3	0.4	0.1	0.1	-0.6
	110	1.0	0.9	0.8	0.8	1.0	0.6	0.5	-0.9
7500	50	0.9	0.7	0.6	0.5	0.4	-0.1	-0.6	-1.6
	70	0.8	0.5	0.5	0.4	0.3	-0.3	-0.9	-2.0
	90	0.3	0.3	0.4	0.1	0.2	-0.7	-2.7	-5.1
	110	0.9	1.0	1.0	0.8	0.7	-1.1	-2.8	-7.4
8500	50	0.7	0.6	0.5	0.1	0.0	-1.6	-6.3	NA
	70	0.5	0.4	0.4	0.0	-0.1	-2.1	-6.0	NA
	90	0.4	0.3	0.2	-0.4	-0.7	-5.7	-7.9	NA
	110	1.2	1.0	0.7	-0.6	-1.1	-8.0	-16.3	NA
9500	50	0.5	0.5	-0.1	-1.0	-2.2	-8.3	NA	NA
	70	0.4	0.5	-0.3	-1.3	-2.7	-7.7	NA	NA
	90	0.1	0.2	-0.8	-3.9	-6.6	-9.3	NA	NA
	110	0.8	0.8	-1.3	-5.4	-9.7	-21.5	NA	NA
[45°C FAT]		SHEET 21		SHEET 22		SHEET 23		SHEET 24	
GW-LB	KTAS	SL	2000	4000	6000	8000	10000	12000	14000
5500	50	0.5	0.5	0.5	0.6	0.5	0.4	0.3	0.2
	70	0.4	0.5	0.4	0.3	0.3	0.1	0.2	0.1
	90	0.5	0.5	0.3	0.2	0.2	0.3	0.3	0.1
	110	0.3	0.3	0.3	0.3	0.4	0.4	0.3	0.0
6500	50	0.6	0.6	0.5	0.4	0.3	0.2	-0.1	-0.3
	70	0.5	0.4	0.3	0.2	0.2	0.1	-0.3	-0.6
	90	0.3	0.2	0.2	0.4	0.3	0.1	-0.4	-1.3
	110	0.3	0.4	0.4	0.4	0.3	0.0	-1.1	-2.5
7500	50	0.6	0.4	0.4	0.3	0.0	-0.1	-1.5	-5.9
	70	0.3	0.2	0.3	0.2	-0.2	-0.2	-2.1	-5.7
	90	0.3	0.4	0.4	0.1	-0.4	-0.6	-5.0	-6.9
	110	0.4	0.5	0.3	0.0	-0.9	-1.5	-7.9	-14.7
8500	50	0.5	0.3	0.2	-0.2	-1.4	-3.6	7.2	NA
	70	0.3	0.2	0.1	-0.3	-1.9	-3.9	8.0	NA
	90	0.5	0.1	0.0	-0.8	-4.4	-6.4	11.0	NA
	110	0.6	0.0	-0.3	-1.8	-7.2	-11.7	NA	NA
9500	50	0.4	-0.1	-0.4	-1.9	-7.7	NA	NA	NA
	70	0.2	-0.4	-0.6	-2.6	-7.5	NA	NA	NA
	90	0.3	-0.7	-1.4	-6.3	-8.8	NA	NA	NA
	110	0.1	-1.6	-2.8	-10.0	-18.8	NA	NA	NA

TEMPERATURE CONVERSION CHART

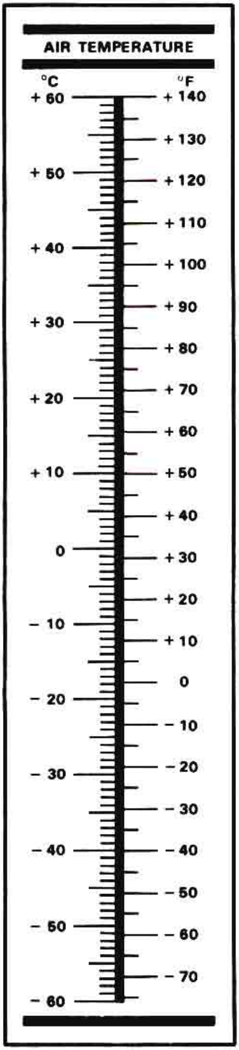


Figure 7–1. Temperature Conversion Chart

MAXIMUM TORQUE AVAILABLE (30 MINUTE OPERATION)

ANTI-ICE OFF BLEED AIR HEATER OFF

324 ROTOR/6600 ENGINE RPM

EXAMPLE

WANTED

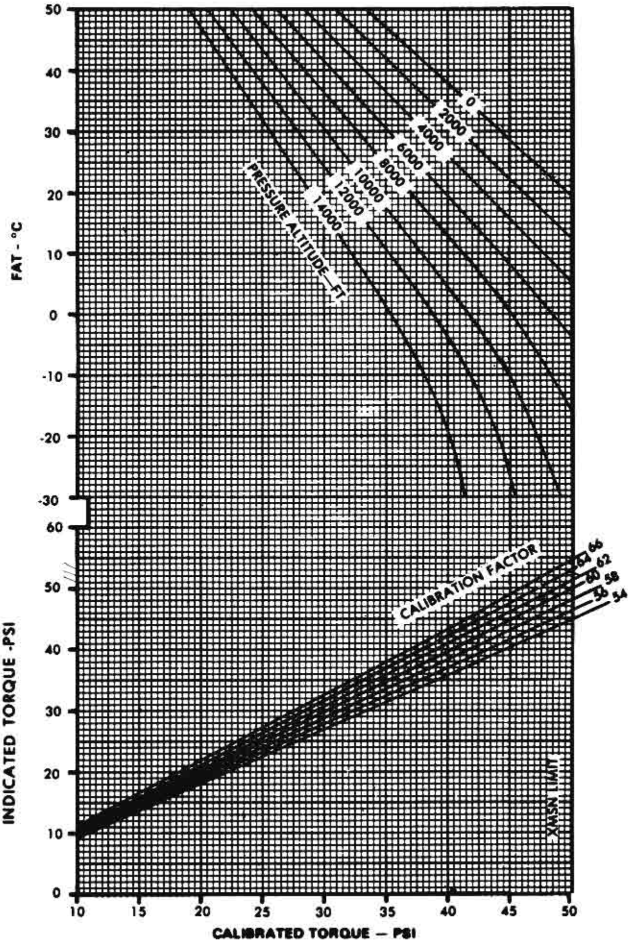
INDICATED TORQUE
CALIBRATED TORQUE

KNOWN

PRESSURE ALTITUDE = 10,000 FT.
OAT = 15°C
CALIBRATION FACTOR = 66.0

METHOD

ENTER FAT
MOVE RIGHT TO PRESSURE ALTITUDE
MOVE DOWN TO CALIBRATION FACTOR
MOVE LEFT, READ INDICATED TORQUE = 39 PSI
FOR CALIBRATED TORQUE CONTINUE DOWN THRU CALIBRATION FACTOR, READ CALIBRATED TORQUE = 36.0 PSI



DATA BASIS: CALCULATED FROM T53-L-13B ENGINE PROGRAM 19.28.25.03 CORRECTED FOR INSTALLATION LOSSES BASED ON FLIGHT TEST, ASTA 66-04, NOVEMBER 1970. AND LOSS DUE TO PARTICLE SEPARATOR

Figure 7-2. Maximum Torque Available (30 Minute Operation) Chart

HOVER POWER REQUIRED
LEVEL SURFACE CALM WIND
324 ROTOR/6600 ENGINE RPM

EXAMPLE

WANTED

TORQUE REQUIRED TO HOVER

KNOWN

PRESSURE ALTITUDE = 2000 FEET
FAT = −40°C
GROSS WEIGHT = 8500 LB
DESIRED SKID HEIGHT = 2 FEET

METHOD

ENTER PRESSURE ALTITUDE
MOVE RIGHT TO FAT
MOVE DOWN TO GROSS WEIGHT
MOVE LEFT TO SKID HEIGHT
MOVE DOWN, READ CALIBRATED TORQUE = 31.5 PSI
FROM THE TABLE FOR FAT = −40°C AND 31.5 PSI TORQUE
DETERMINE TORQUE CORRECTION OF 2.2 PSI

TORQUE REQUIRED TO HOVER IS
31.5 +2.2 = 33.7 PSI

DATA BASIS: DERIVED FROM YUH-1H FLIGHT TEST, ASTA -TDR 66-04, NOVEMBER 1970

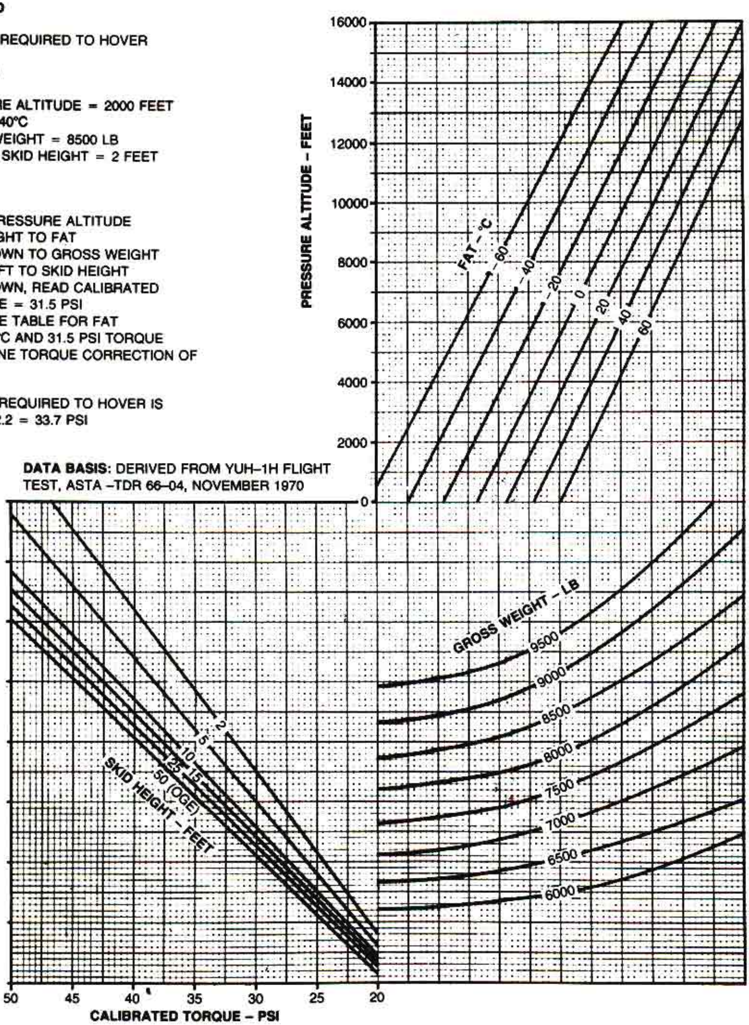


Figure 7-3. Hover (Power Required) Chart (Sheet 1 of 2)

HOVER CEILING
MAXIMUM TORQUE AVAILABLE (30 MINUTE OPERATION)
324 ROTOR/6600 ENGINE RPM

EXAMPLE

WANTED

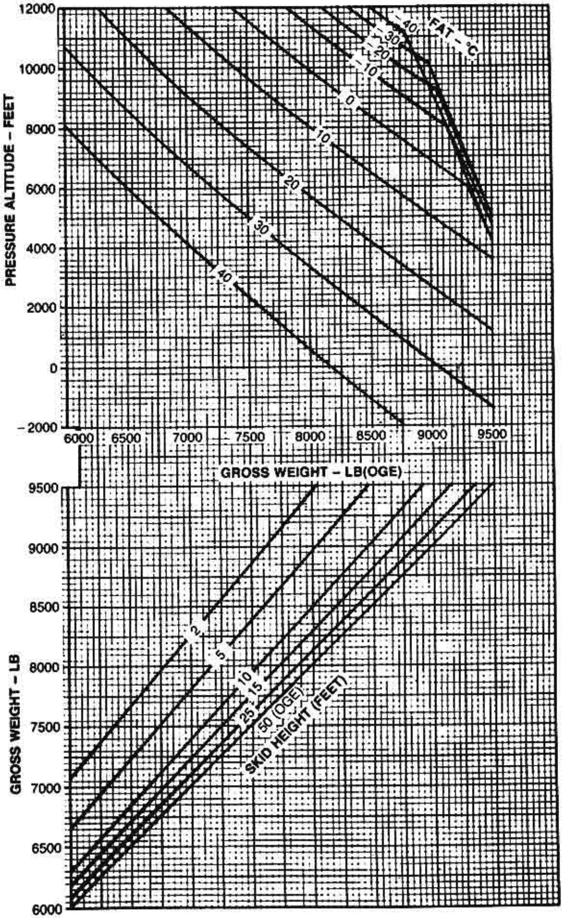
GROSS WEIGHT TO HOVER

KNOWN

PRESSURE ALTITUDE = 10600 FEET
FAT = 10°C
SKID HEIGHT = 2 FEET

METHOD

ENTER PRESSURE ALTITUDE
MOVE RIGHT TO FAT
MOVE DOWN TO SKID HEIGHT
MOVE LEFT, READ GROSS WEIGHT
TO HOVER = 8500 POUNDS



CORRECTION TABLE:

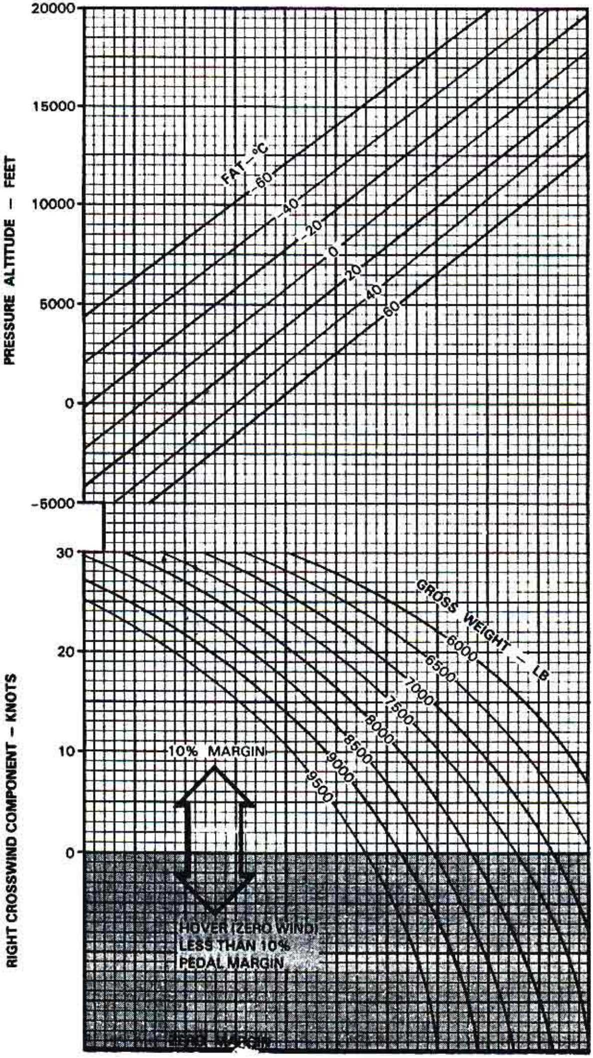
NOTE: WHEN OPERATING BELOW 20°C INCREASE TORQUE REQ'D BY:				
PSI / FAT	20	30	40	50
0°C	.2	.3	.4	.5
−20°C	.4	.6	.8	1.0
−40°C	1.4	2.1	2.8	3.5
−50°C	2.4	3.6	4.8	6.0
−60°C	4.0	6.0	8.0	10.0

DATA BASIS: DERIVED FROM YUH-1H FLIGHT TEST, ASTA-TDR 66-04 NOVEMBER 1970

Figure 7-3. Hover (Ceiling) Chart (Sheet 2 of 2)

CONTROL MARGIN

TRANSLATIONAL FLIGHT 324 ROTOR/6600 ENGINE RPM



EXAMPLE

WANTED

MAXIMUM RIGHT CROSSWIND COMPONENT WITH 10% SAFE PEDAL MARGIN

KNOWN

PRESSURE ALTITUDE = 5000 FEET
FAT = 0°C
GROSS WEIGHT = 8500 POUNDS

METHOD

ENTER PRESSURE ALTITUDE
MOVE RIGHT TO FAT
MOVE DOWN TO KNOWN GROSS WEIGHT
MOVE LEFT AND READ 18.8
RIGHT CROSSWIND COMPONENT
REFER TO SHEET 2. SAFE PEDAL MARGIN MAY BE LESS THAN 10% FOR CROSSWIND COMPONENTS GREATER THAN 18.8 KNOTS IN THE SHADED AREA LABELED DIRECTIONAL.

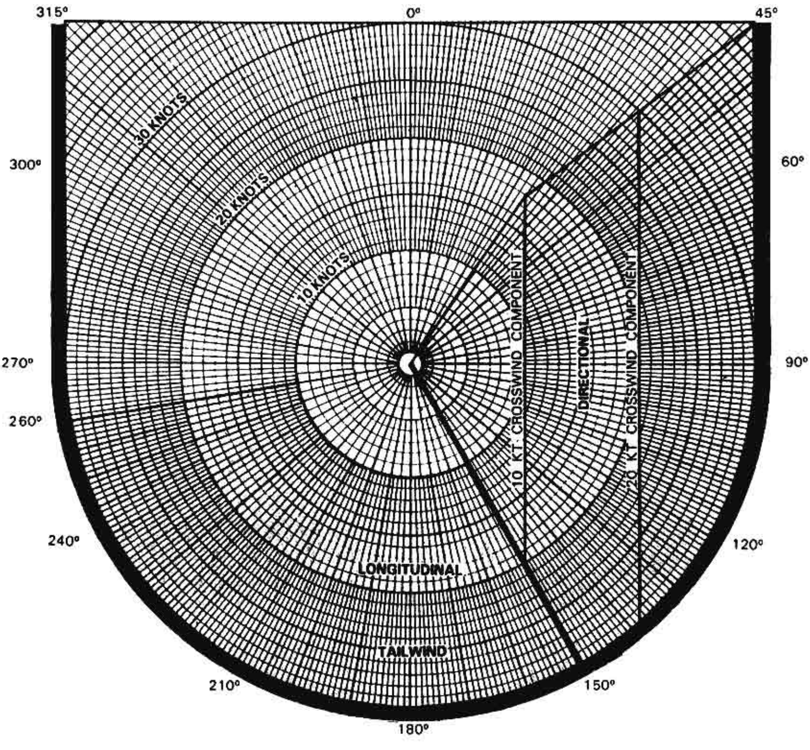
DATA BASIS: DERIVED FROM FLIGHT TEST

Figure 7-4. Control margin (Sheet 1 of 2)

CONTROL MARGIN

TRANSLATIONAL FLIGHT 324 ROTOR/6600 ENGINE RPM

CONDITIONS WHERE THE CONTROL MARGIN MAY BE LESS THAN 10% ARE SHOWN IN SHADED AREA



DATA BASIS: DERIVED FROM FLIGHT TEST USA ASTA 68-37, JUNE 1969

Figure 7-4. Control margin (Sheet 2 of 2)

TAKEOFF

LEVEL ACCELERATION, 3 FT SKID HEIGHT
324 ROTOR/6600 ENGINE RPM MAXIMUM TORQUE AVAILABLE
CALM WIND LEVEL SURFACE ALL CONFIGURATIONS

EXAMPLE A

WANTED

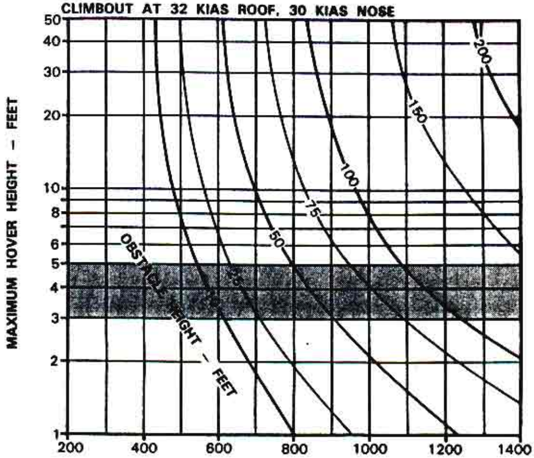
DISTANCE TO CLEAR OBSTACLE

KNOWN

MAXIMUM HOVER HEIGHT = 10 FEET
OBSTACLE HEIGHT = 50 FEET

METHOD

ENTER MAX HOVER HEIGHT
MOVE RIGHT TO OBSTACLE HEIGHT
MOVE DOWN, READ DISTANCE
TO CLEAR OBSTACLE = 700 FEET



EXAMPLE B

WANTED

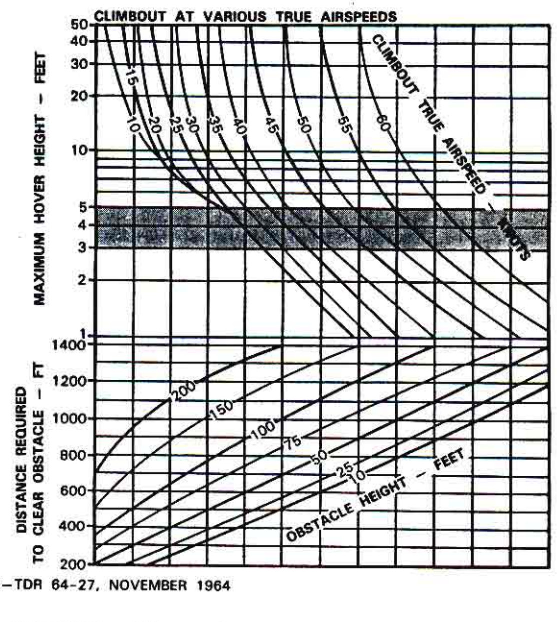
DISTANCE TO CLEAR OBSTACLE

KNOWN

MAX HOVER HEIGHT = 8 FEET
OBSTACLE HEIGHT = 50 FEET
CLIMBOUT AIRSPEED = 40 KNOTS

METHOD

ENTER MAX HOVER HEIGHT
MOVE RIGHT TO CLIMBOUT TRUE AIRSPEED
MOVE DOWN TO OBSTACLE HEIGHT
MOVE LEFT READ DISTANCE
TO CLEAR OBSTACLE = 630 FEET



DATA BASIS: DERIVED FROM FLIGHT TEST FTC-TDR 64-27, NOVEMBER 1964

Figure 7-5. Takeoff chart (Sheet 1 of 3)

TAKEOFF

CLIMB AND ACCELERATION, 3 FT SKID HEIGHT
324 ROTOR/6600 ENGINE RPM MAXIMUM TORQUE AVAILABLE
CALM WIND LEVEL SURFACE ALL CONFIGURATIONS

EXAMPLE A

WANTED

DISTANCE TO CLEAR OBSTACLE

KNOWN

MAX HOVER HEIGHT = 17 FEET
OBSTACLE HEIGHT = 120 FEET

METHOD

ENTER MAX HOVER HEIGHT
MOVE RIGHT TO OBSTACLE HEIGHT
MOVE DOWN, READ DISTANCE
TO CLEAR OBSTACLE = 1420 FEET

EXAMPLE B

WANTED

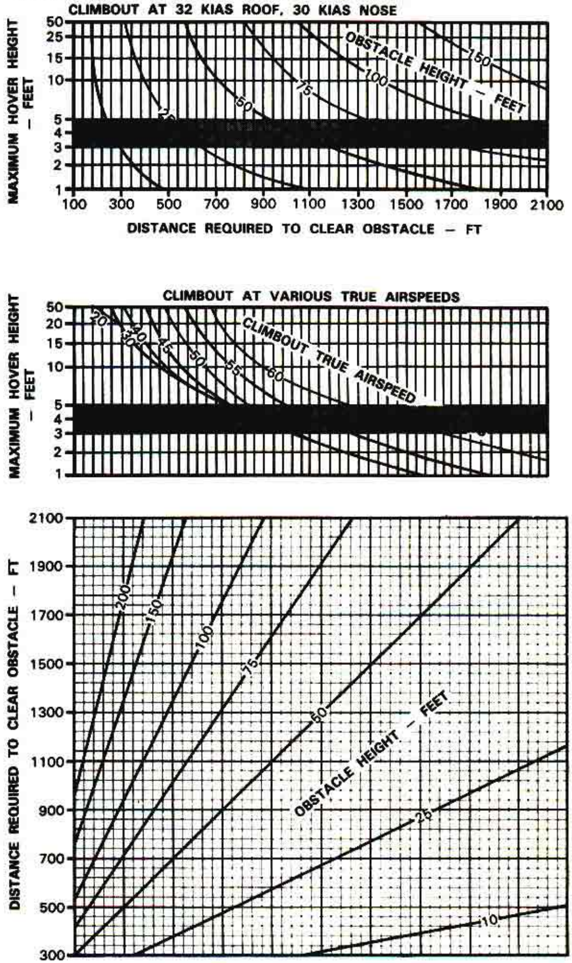
DISTANCE TO CLEAR OBSTACLE

KNOWN

MAX HOVER HEIGHT = 17 FEET
OBSTACLE HEIGHT = 120 FEET
CLIMBOUT AIRSPEED = 50 KTAS

METHOD

ENTER MAX HOVER HEIGHT
MORE RIGHT TO AIRSPEED
MOVE DOWN TO OBSTACLE HEIGHT
MOVE LEFT, READ DISTANCE
TO CLEAR OBSTACLE = 1610 FEET



DATA BASIS: DERIVED FROM YUH-1H FLIGHT TEST, ASTA-TDR 66-04, NOVEMBER 1970

Figure 7-5. Takeoff Chart (Sheet 2 of 3)

TAKEOFF

LEVEL ACCELERATION, 15 FT SKID HEIGHT
324 ROTOR/6600 ENGINE RPM MAXIMUM TORQUE AVAILABLE
CALM WIND LEVEL SURFACE ALL CONFIGURATIONS

EXAMPLE A

WANTED

DISTANCE TO CLEAR OBSTACLE

KNOWN

MAX HOVER HEIGHT = 17 FEET
OBSTACLE HEIGHT = 120 FEET

METHOD

ENTER MAX HOVER HEIGHT
MOVE RIGHT TO OBSTACLE HEIGHT
MOVE DOWN, READ DISTANCE
TO CLEAR OBSTACLE = 1125 FEET

EXAMPLE B

WANTED

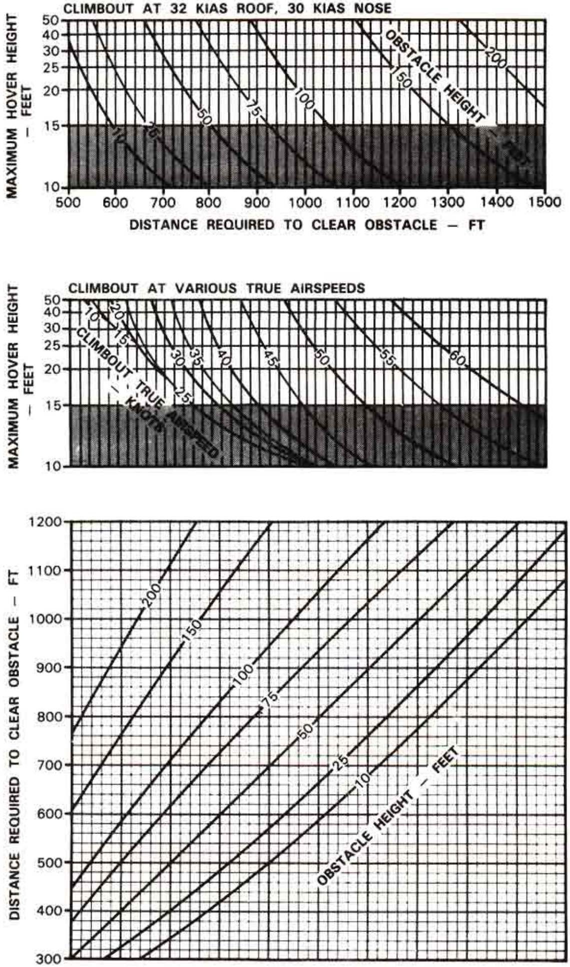
DISTANCE TO CLEAR OBSTACLE

KNOWN

MAX HOVER HEIGHT = 17 FEET
OBSTACLE HEIGHT = 120 FEET
CLIMBOUT AIRSPEED = 40 KTAS

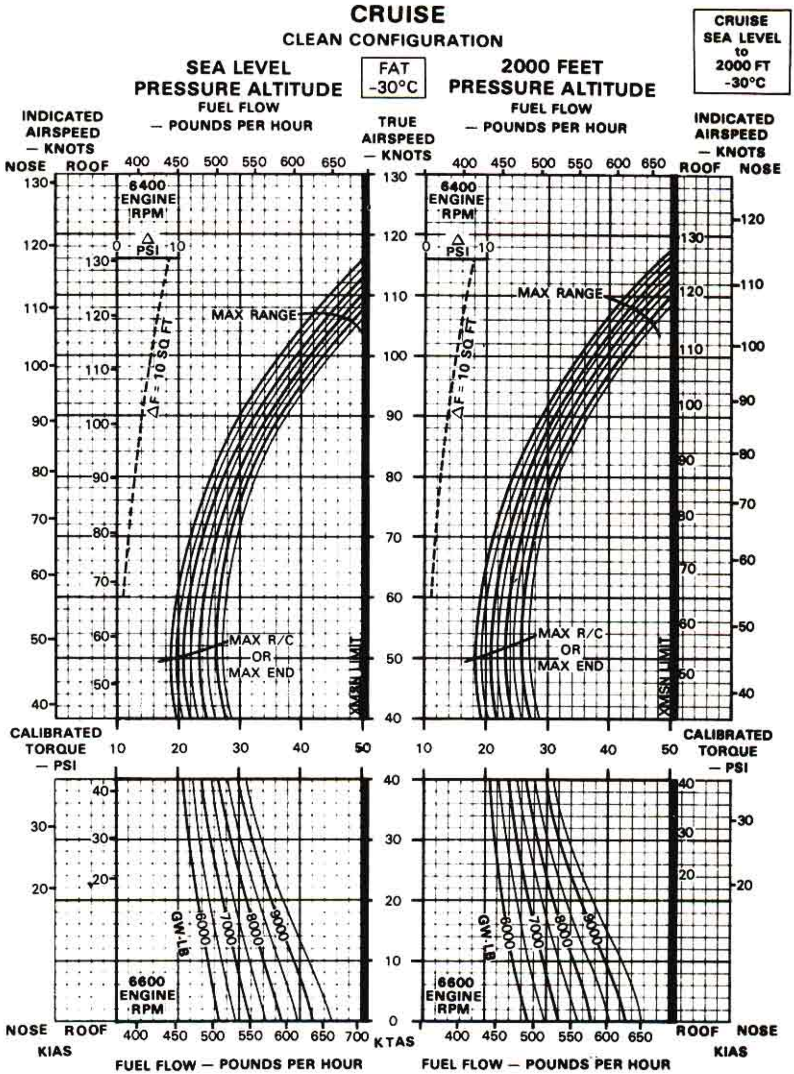
METHOD

ENTER MAX HOVER HEIGHT
MOVE RIGHT TO CLIMBOUT
TRUE AIRSPEED
MOVE DOWN TO OBSTACLE HEIGHT
MOVE LEFT, READ DISTANCE
TO CLEAR OBSTACLE = 1000 FEET



DATA BASIS: DERIVED FROM YUH-1H FLIGHT TEST, ASTA–TDR 66-04, NOVEMBER 1970

Figure 7-5. Takeoff Chart (Sheet 3 of 3)



DATA BASIS: DERIVED FROM YUH-1H FLIGHT TEST, ASTA-TDR 66-04, NOVEMBER 1970

Figure 7-6. Cruise Chart (Sheet 1 of 24)

EXAMPLE

WANTED

CALIBRATED TORQUE REQUIRED FOR LEVEL FLIGHT, FUEL FLOW, INDICATED AIRSPEED

KNOWN

CLEAN CONFIGURATION
GROSS WEIGHT = 9000 LB
PRESSURE ALTITUDE = 5000 FEET
FAT = -30°C
DESIRED TRUE AIRSPEED = 100 KNOTS ROOF MOUNTED SYSTEM

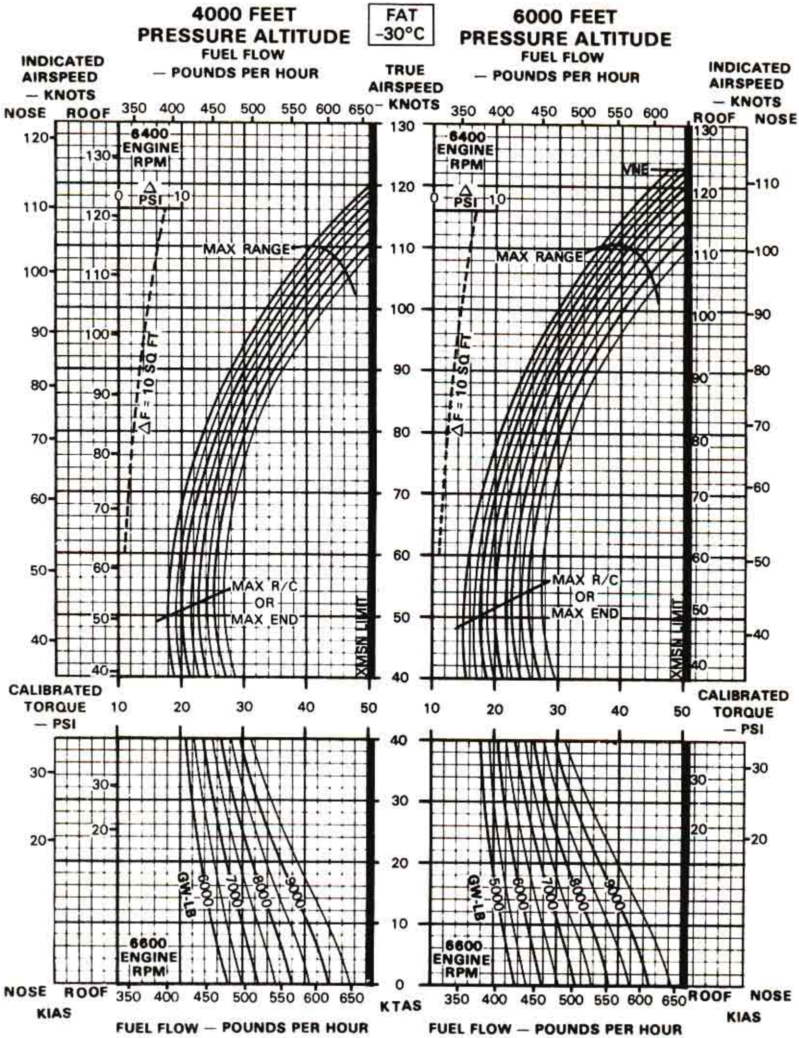
METHOD (INTERPOLATE)

ENTER TRUE AIRSPEED
READ CALIBRATED TORQUE, FUEL FLOW, AND IAS ON EACH ADJACENT ALTITUDE AND/OR FAT, THEN INTERPOLATE BETWEEN ALTITUDE AND/OR FAT.

ALTITUDE, FEET	4000 FT	6000 FEET	5000 FEET
FAT, C	-30	-30	-30
CALIBRATED TORQUE, PSI	41.2	40.2	40.7
FUEL FLOW, LB/HR	582	558	570
IAS, KNOTS	104.5	100.7	102.6

CRUISE

CLEAN CONFIGURATION



DATA BASIS: DERIVED FROM YUH-1H FLIGHT TEST, ASTA-TDR 66-04, NOVEMBER 1970

Figure 7-6. Cruise Chart (2 of 24)

EXAMPLE

WANTED

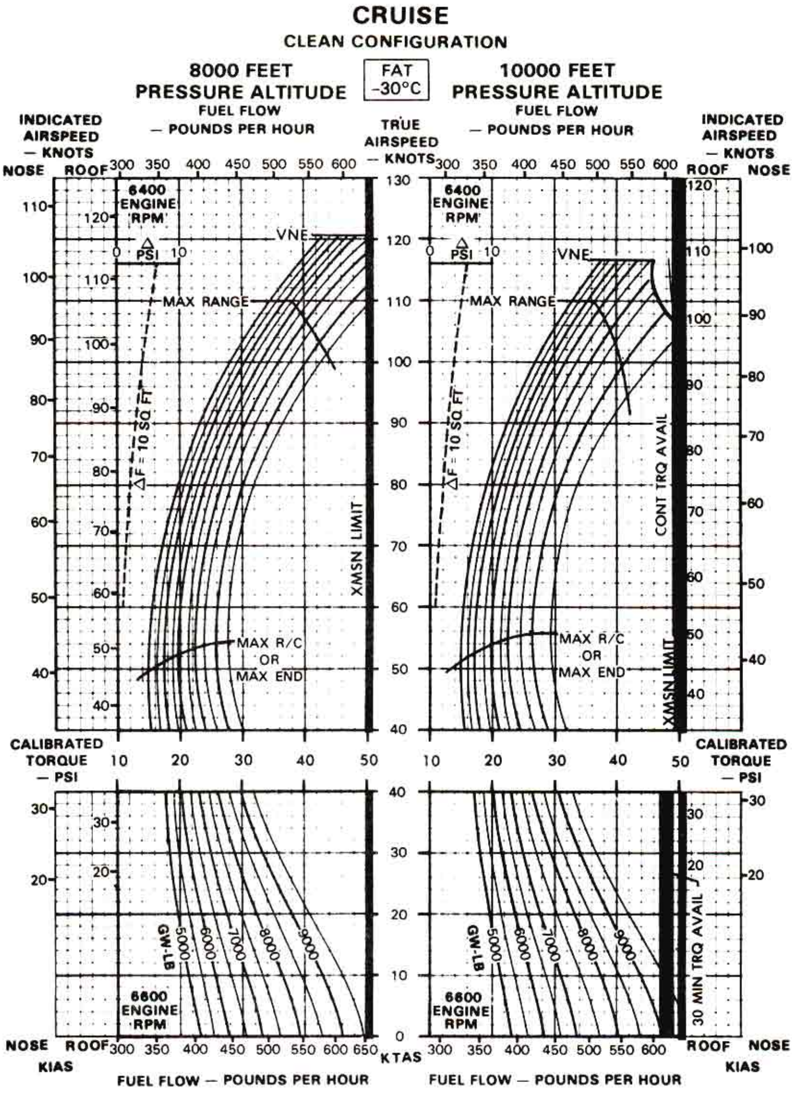
SPEED FOR MAXIMUM RANGE
CALIBRATE TORQUE REQUIRED AND FUEL FLOW AT MAXIMUM RANGE
SPEED FOR MAXIMUM ENDURANCE

KNOWN

CLEAN CONFIGURATION, FAT = -30°C
PRESSURE ALTITUDE = 8000 FEET,
AND GROSS WEIGHT = 8500 POUNDS
ROOF MOUNTED SYSTEM

METHOD

LOCATE (-30°C FAT, 8000 FEET) CHART
FIND INTERSECTION OF 8500 GROSS WEIGHT LINE
WITH THE MAXIMUM RANGE LINE
TO READ SPEED FOR MAXIMUM RANGE:
    MOVE RIGHT, READ TAS = 105.3 KNOT AND MOVE LEFT,
    READ IAS = 102.3
TO READ FUEL FLOW REQUIRED:
    MOVE UP, READ FUEL FLOW = 554 LB/HR
TO READ CALIBRATED TORQUE REQUIRED:
    MOVE DOWN, READ TORQUE = 41.2 PSI
FIND INTERSECTION OF 8500 LB GROSS WEIGHT LINE
WITH THE MAXIMUM ENDURANCE LINE
TO READ SPEED FOR MAXIMUM ENDURANCE
    MOVE RIGHT, READ TAS = 53.9 KNOTS AND MOVE LEFT,
    READ IAS = 50.5 KNOTS



DATA BASIS: DERIVED FROM YUH-1H FLIGHT TEST, ASTA-TDR 66-04, NOVEMBER 1970

Figure 7-6. Cruise Chart (Sheet 3 of 24)

EXAMPLE

WANTED

ADDITIONAL CALIBRATED TORQUE REQUIRED AND FUEL FLOW FOR EXTERNAL DRAG CONFIGURATION

KNOWN

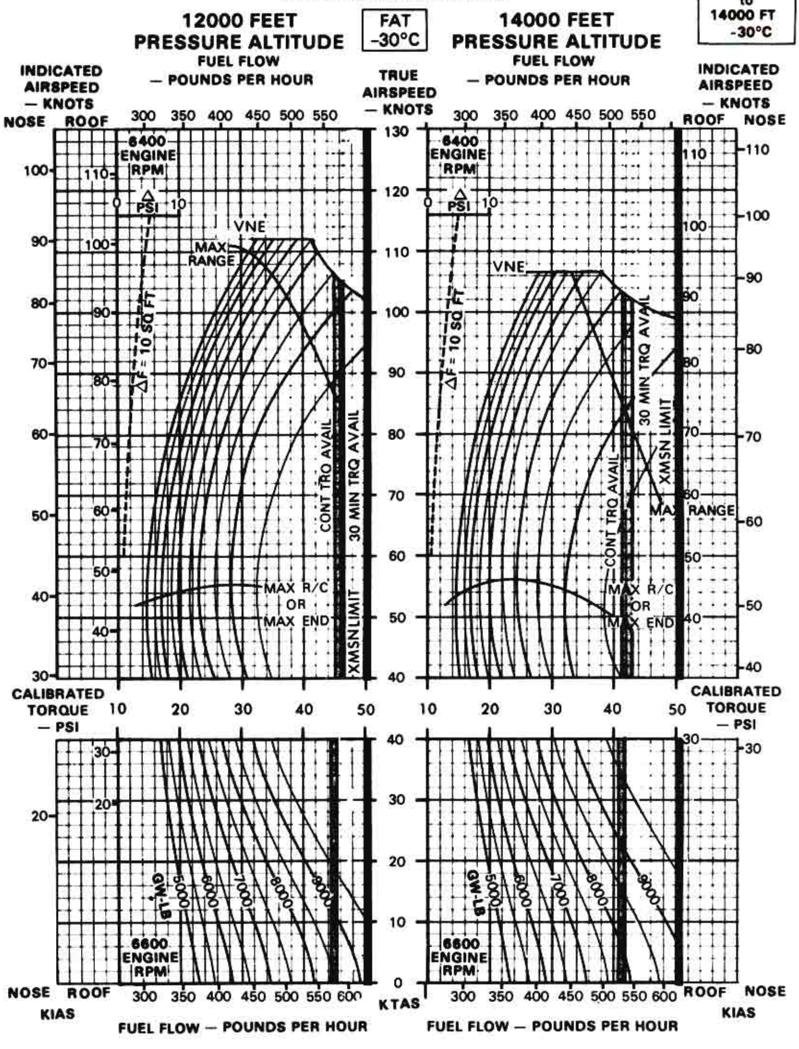
DF FOR EXTERNAL DRAG CONFIGURATION (FROM FIGURE 7-7, EXAMPLE B) = 4 SQUARE FEET
GROSS WEIGHT = 8000 POUNDS
FAT = -30°C
PRESSURE ALTITUDE = 12000 FEET
TRUE AIRSPEED = 105 KNOTS

METHOD

ENTER TRUE AIRSPEED AT 105 KNOTS AND MOVE LEFT TO 8000 POUND GROSS WEIGHT LINE. MOVE UP TO FUEL FLOW SCALE AND READ 510 LB/HR. MOVE DOWN TO CALIBRATED TORQUE SCALE AND READ 39.0 PSI. MOVE LEFT (AT 105 KNOTS) TO 10 SQ FEET DF LINE. MIOVE UP AND READ 4.0 DPSI. DIVIDE 4 SQ FEET BY 10 SQ FEET = 40%. 40% OF 4.0 DPSI = 1.6 DPSI. ADD 1.6 AND 39.0 = 40.6 PSI. MOVE UP FROM TORQUE SCALE AT THIS POINT TO FUEL FLOW SCALE AND READ 537 LB/HR.

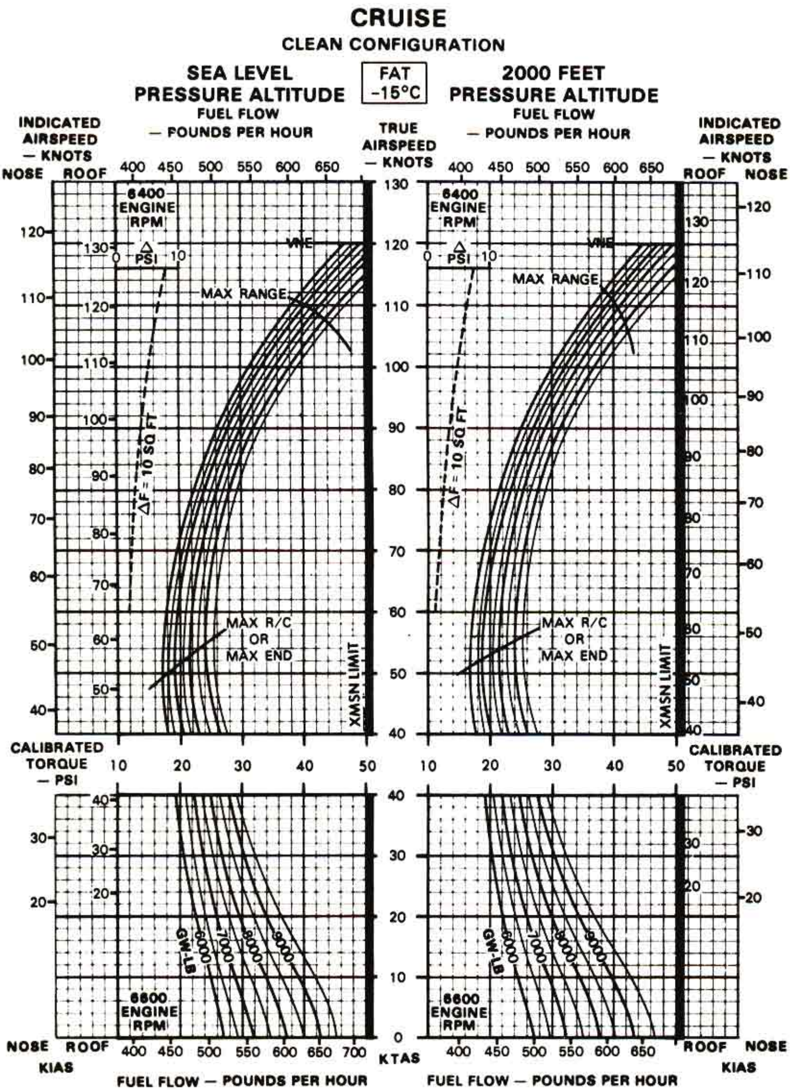
CRUISE

CLEAN CONFIGURATION



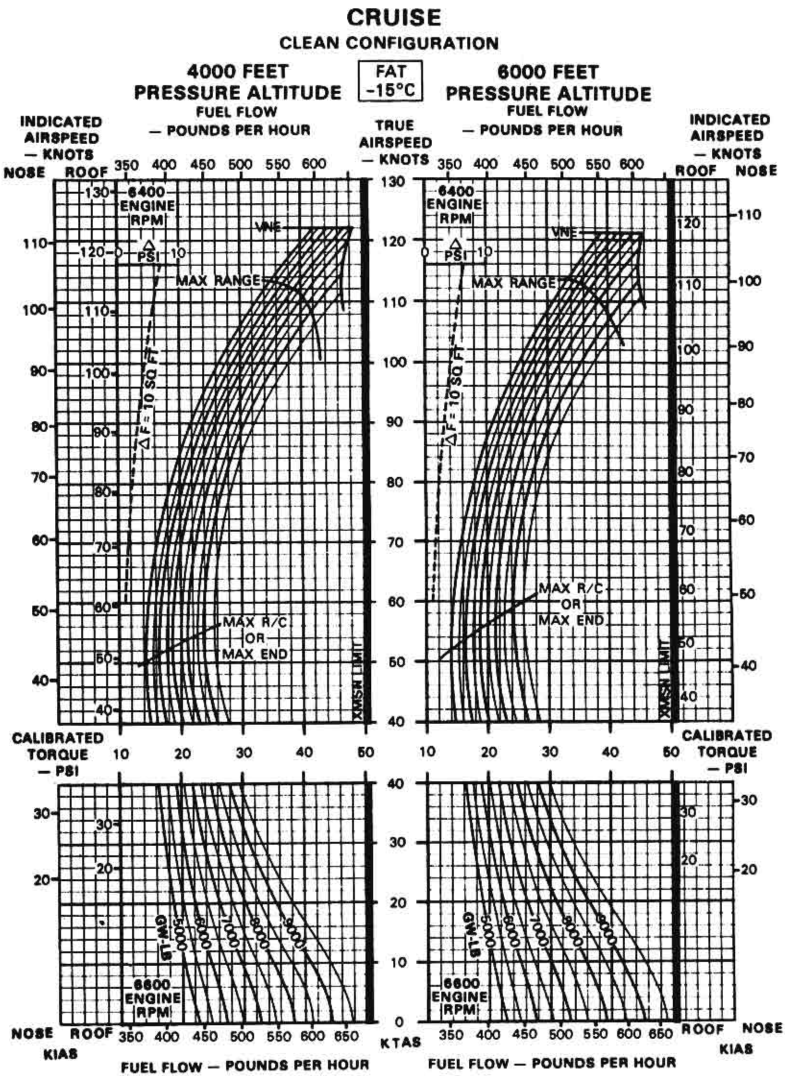
DATA BASIS: DERIVED FROM YUH-1H FLIGHT TEST, ASTA-TDR 66-04, NOVEMBER 1970

Figure 7-6. Cruise Chart (Sheet 4 of 24)



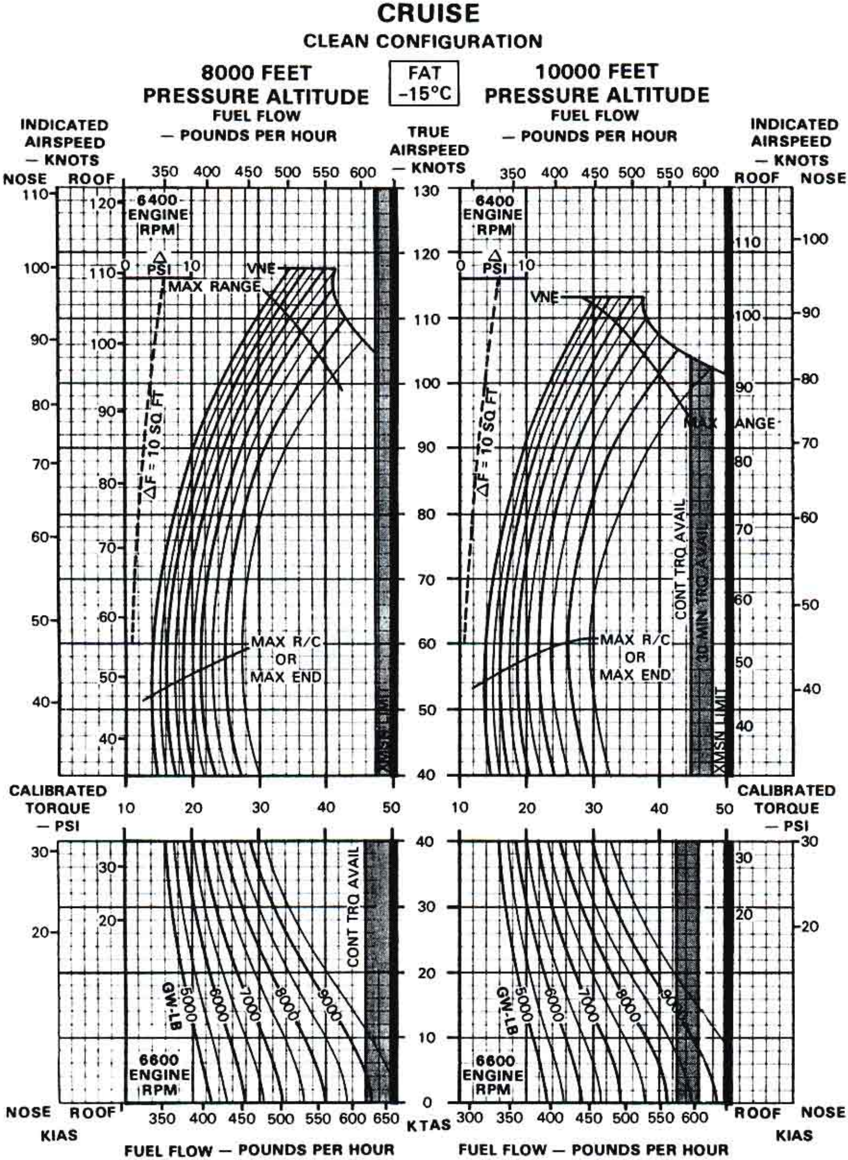
DATA BASIS: DERIVED FROM YUH-1H FLIGHT TEST, ASTA-TDR 66-04, NOVEMBER 1970

Figure 7-6. Cruise Chart (Sheet 5 of 24)



DATA BASIS: DERIVED FROM YUH-1H FLIGHT TEST, ASTA-TDR 66-04, NOVEMBER 1970

Figure 7-6. Cruise Chart (Sheet 6 of 24)

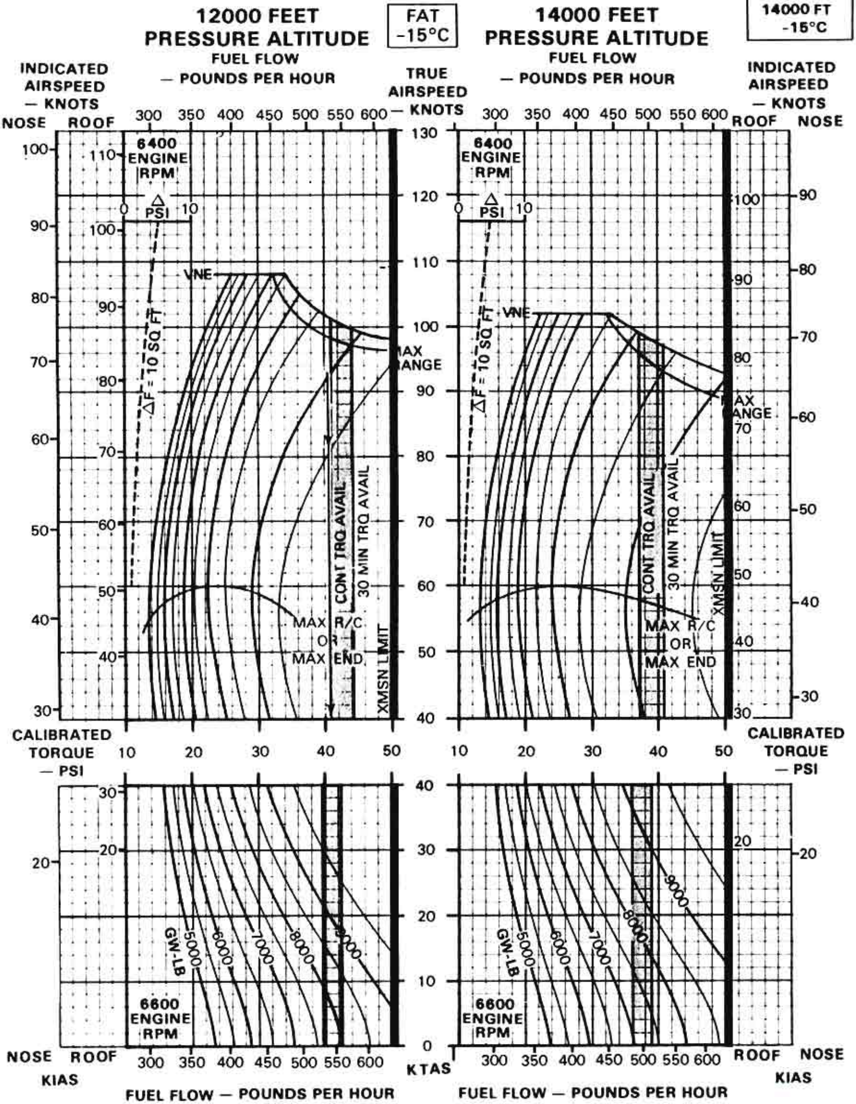


DATA BASIS: DERIVED FROM YUH-1H FLIGHT TEST, ASTA-TDR 66-04, NOVEMBER 1970

Figure 7-6. Cruise chart (Sheet 7 of 24)

CRUISE

CLEAN CONFIGURATION

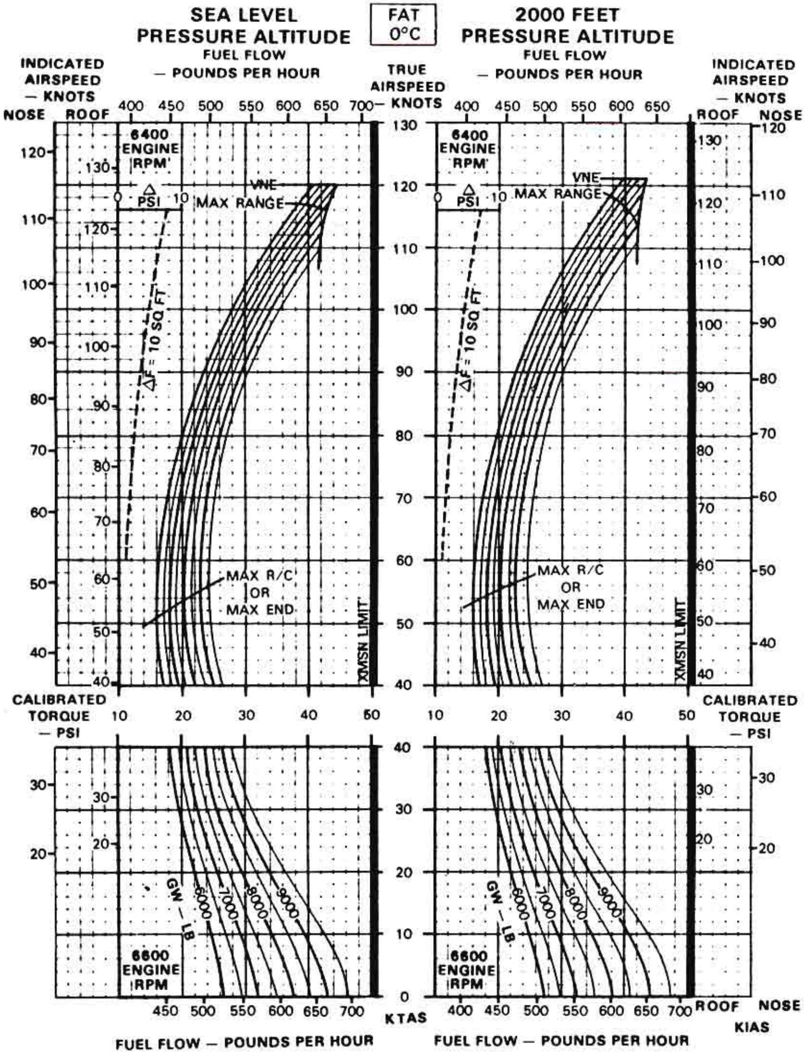


DATA BASIS: DERIVED FROM YUH-1H FLIGHT TEST, ASTA-TDR 66-04, NOVEMBER 1970

Figure 7-6. Cruise chart (Sheet 8 of 24)

CRUISE

CLEAN CONFIGURATION

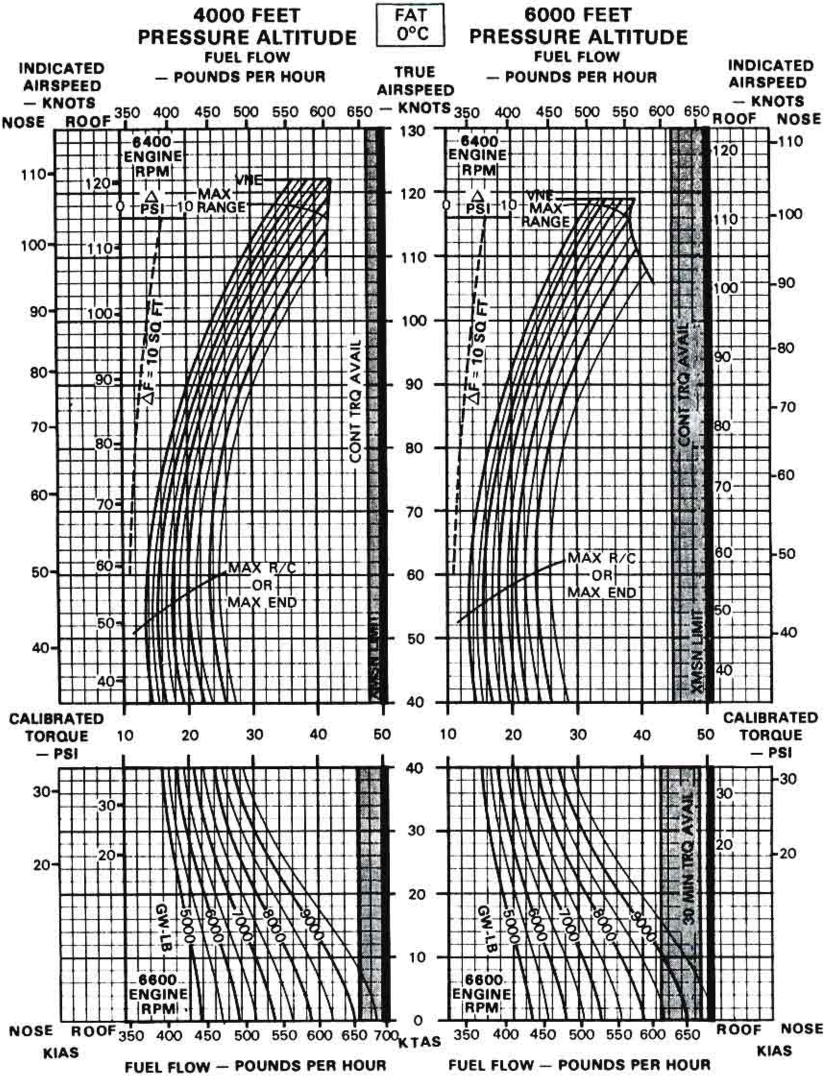


DATA BASIS: DERIVED FROM YUH-1H FLIGHT TEST, ASTA-TDR 66-04, NOVEMBER 1970

Figure 7-6. Cruise Chart (Sheet 9 of 24)

CRUISE

CLEAN CONFIGURATION



DATA BASIS: DERIVED FROM YUH-1H FLIGHT TEST, ASTA-TDR 66-04, NOVEMBER 1970

Figure 7-6. Cruise chart (Sheet 10 of 24)

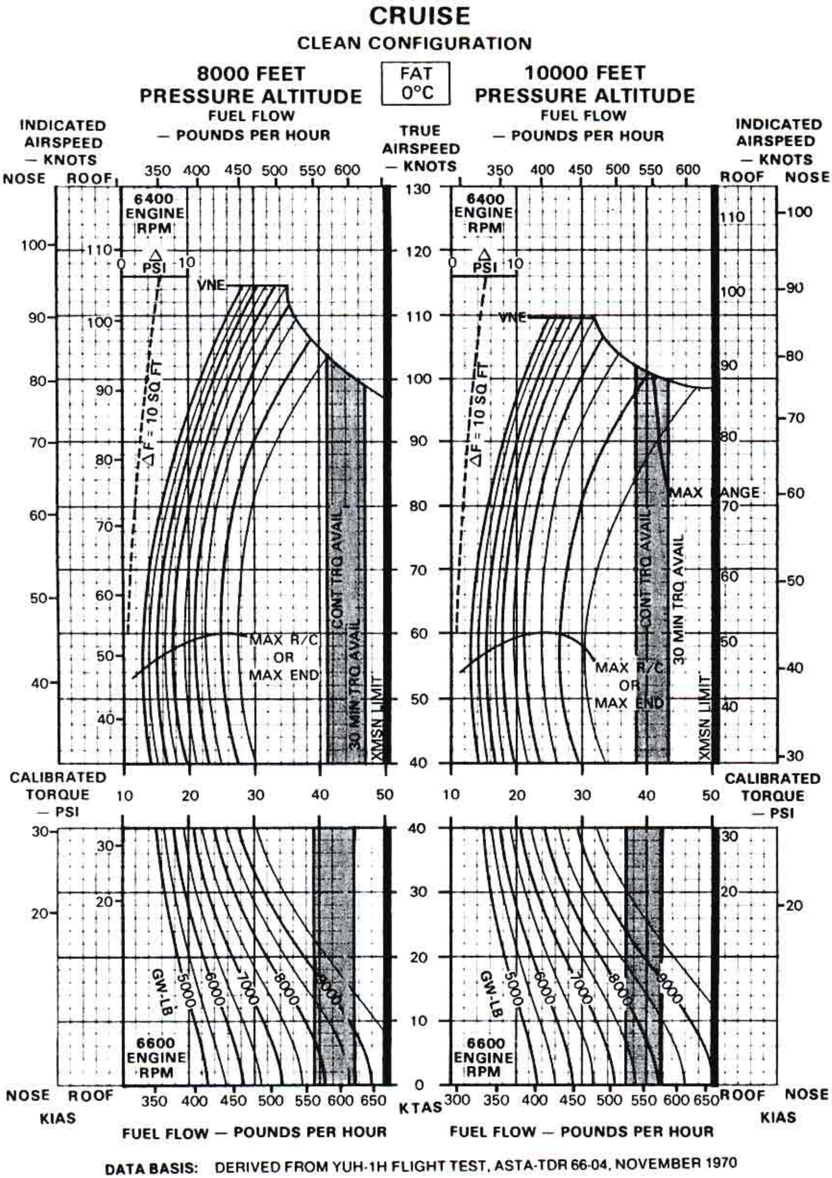
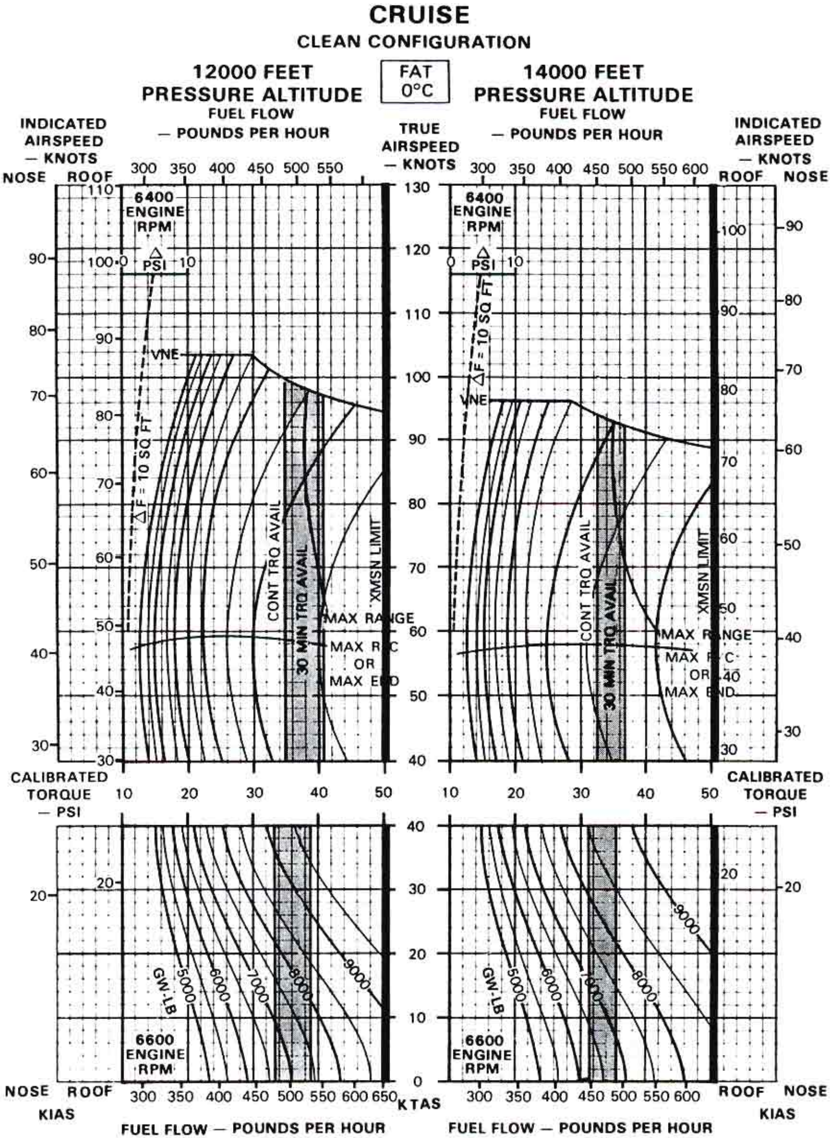
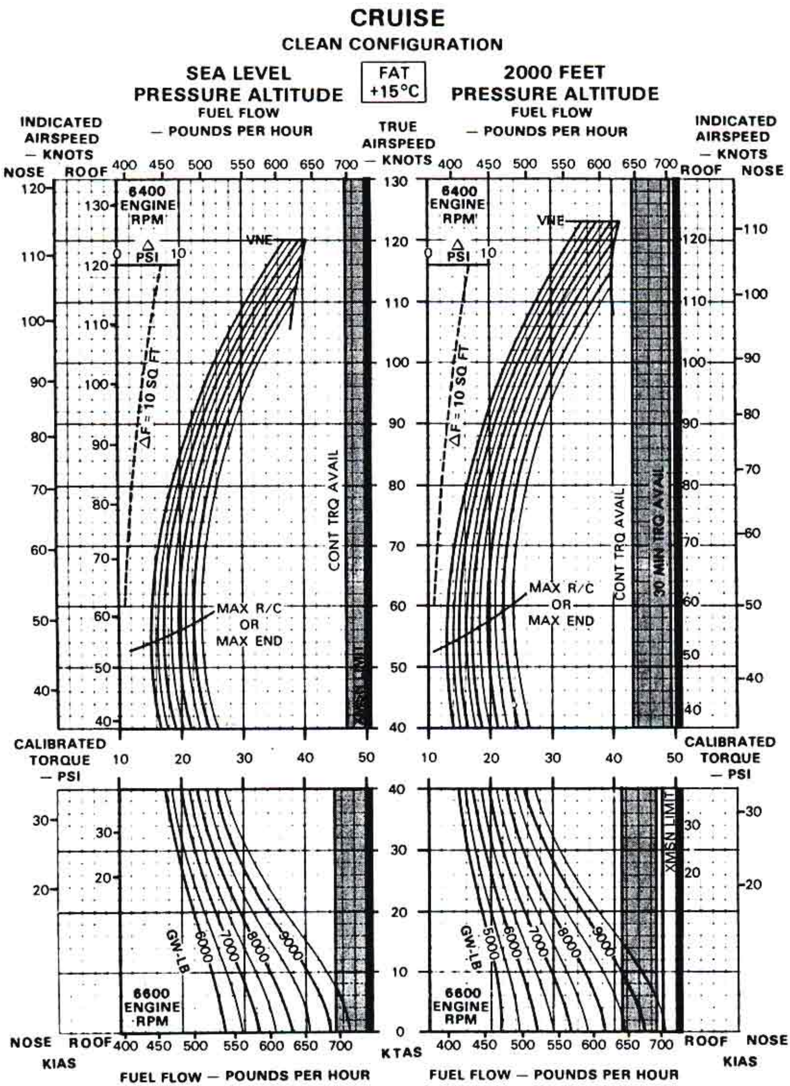


Figure 7-6. Cruise chart (Sheet 11 of 24)



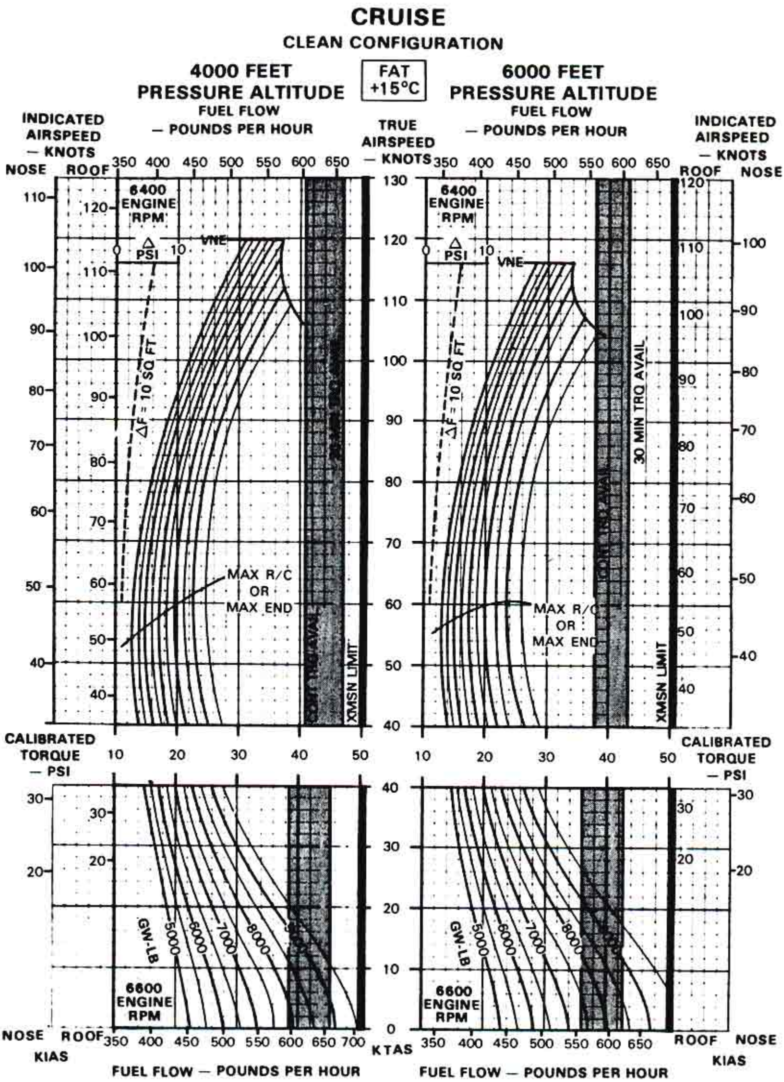
DATA BASIS: DERIVED FROM YUH-1H FLIGHT TEST, ASTA-TDR 66-04, NOVEMBER 1970

Figure 7-6. Cruise chart (Sheet 12 of 24)



DATA BASIS: DERIVED FROM YUH-1H FLIGHT TEST, ASTA-TDR 66-04, NOVEMBER 1970

Figure 7-6. Cruise Chart (Sheet 13 of 24)



DATA BASIS: DERIVED FROM YUH-1H FLIGHT TEST, ASTA-TDR 66-04, NOVEMBER 1970

Figure 7-6. Cruise Chart (Sheet 14 of 24)

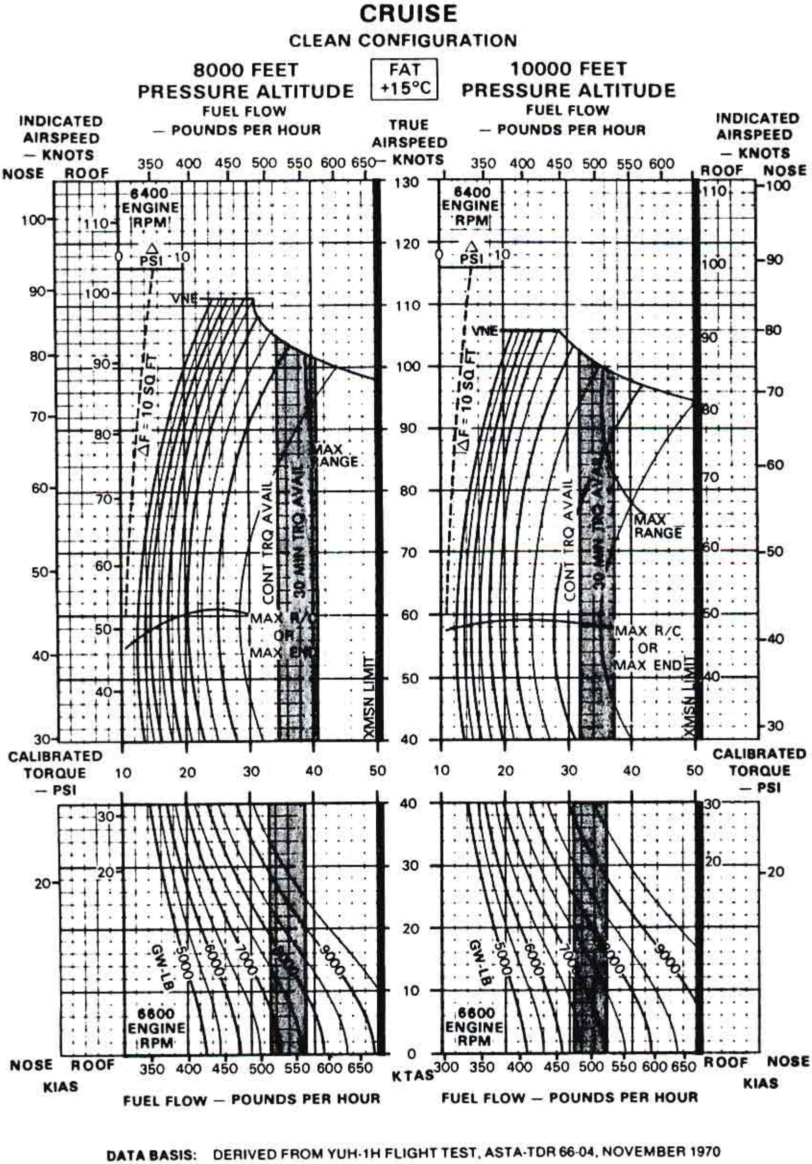
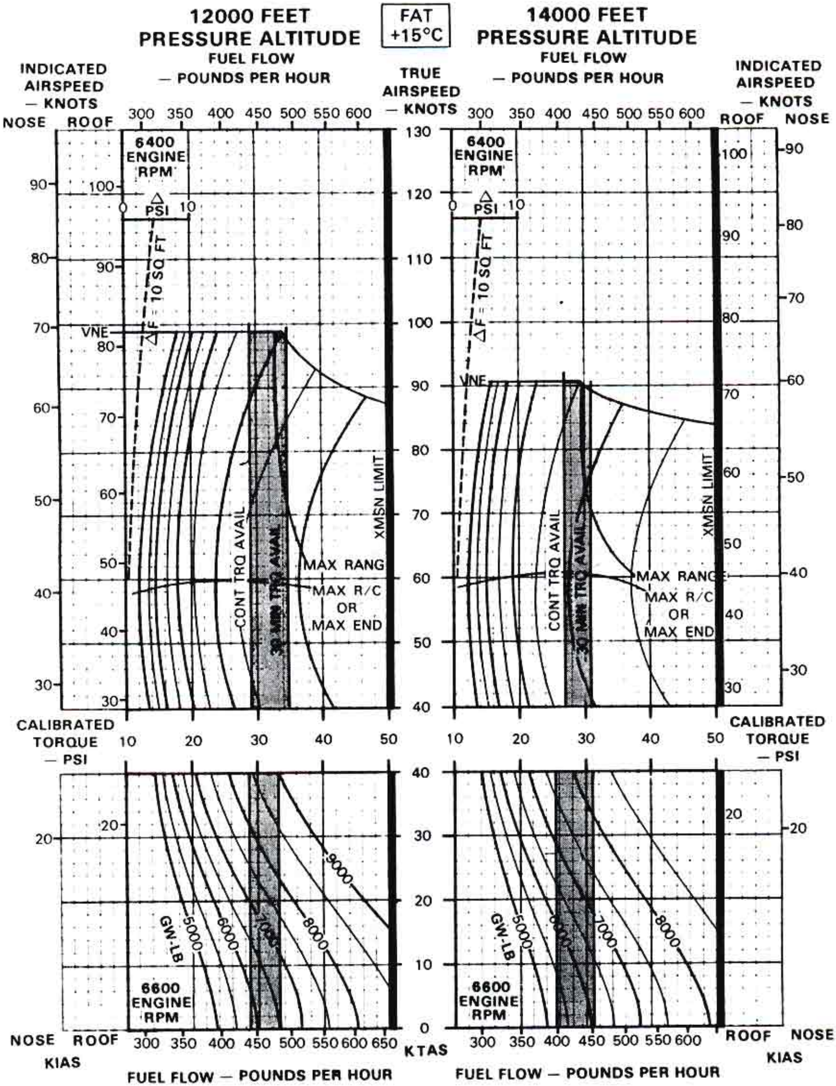


Figure 7-6. Cruise Chart (Sheet 15 of 24)

CRUISE

CLEAN CONFIGURATION



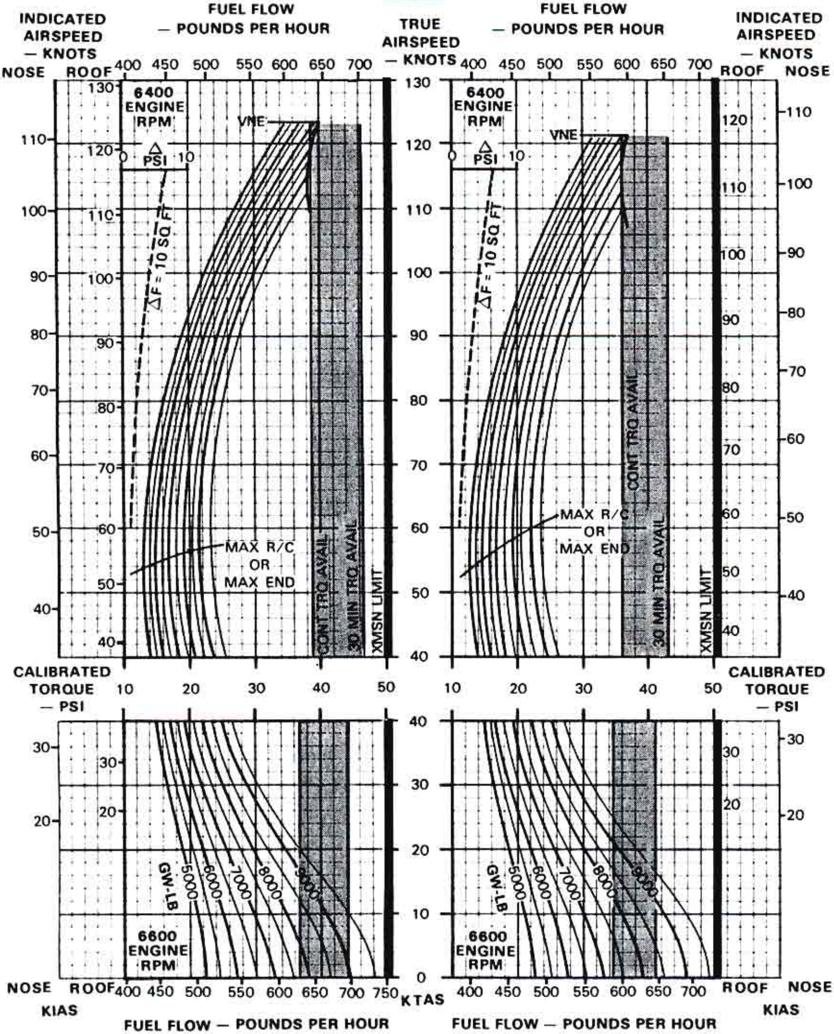
DATA BASIS: DERIVED FROM YUH-1H FLIGHT TEST, ASTA-TDR 66-04, NOVEMBER 1970

Figure 7-6. Cruise chart (Sheet 16 of 24)

CRUISE

CLEAN CONFIGURATION

SEA LEVEL PRESSURE ALTITUDE | **FAT +30°C** | **2000 FEET PRESSURE ALTITUDE**

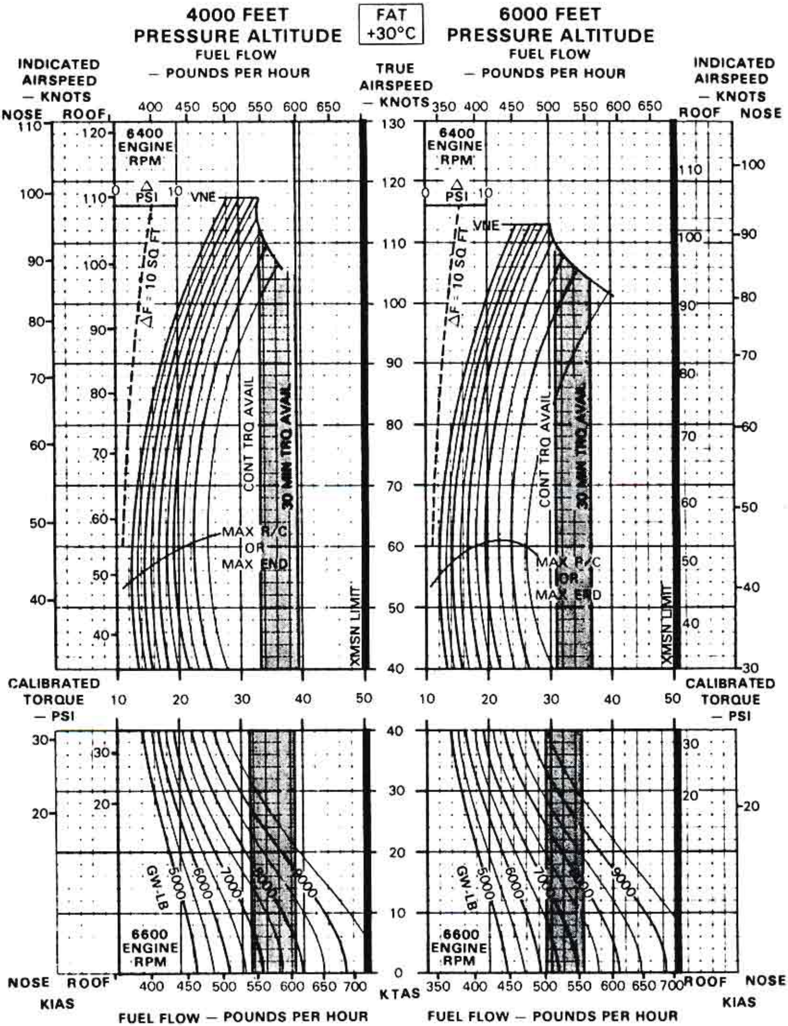


DATA BASIS: DERIVED FROM YUH-1H FLIGHT TEST, ASTA-TDR 66-04, NOVEMBER 1970

Figure 7-6. Cruise chart (Sheet 17 of 24)

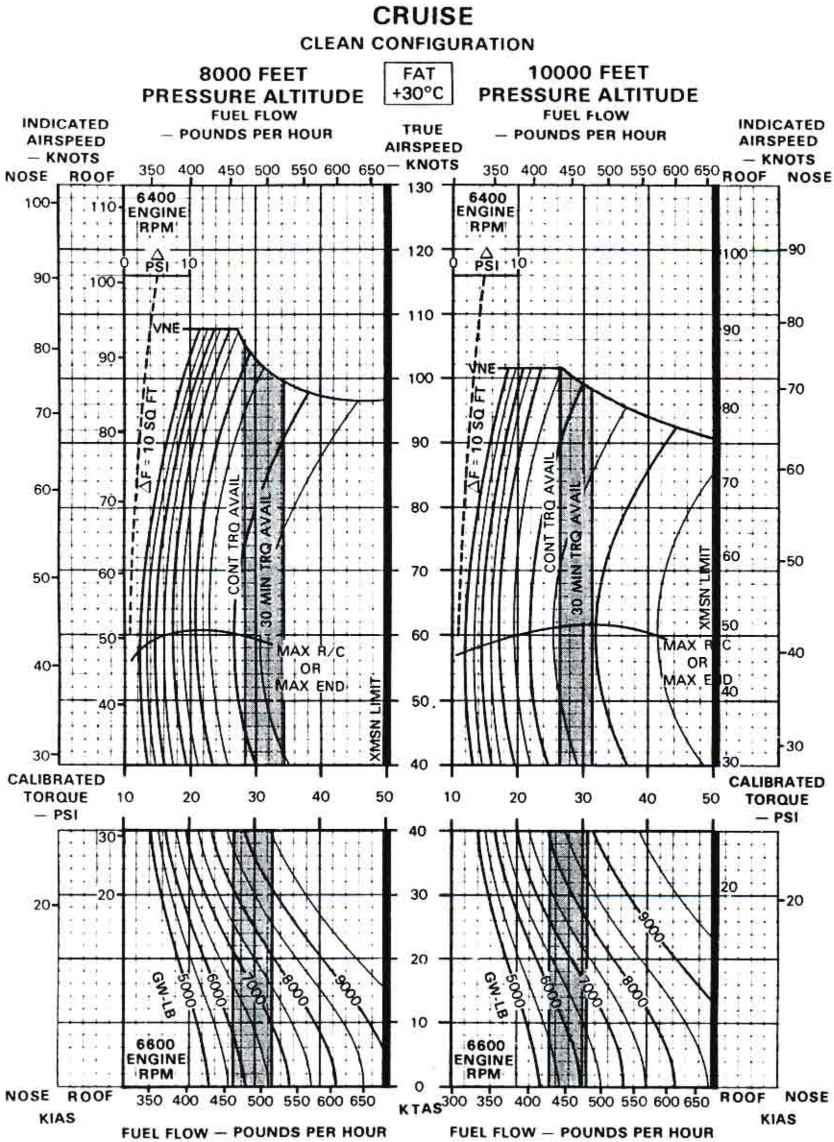
CRUISE

CLEAN CONFIGURATION



DATA BASIS: DERIVED FROM YUH-1H FLIGHT TEST, ASTA-TDR 66-04, NOVEMBER 1970

Figure 7-6. Cruise Chart (Sheet 18 of 24)

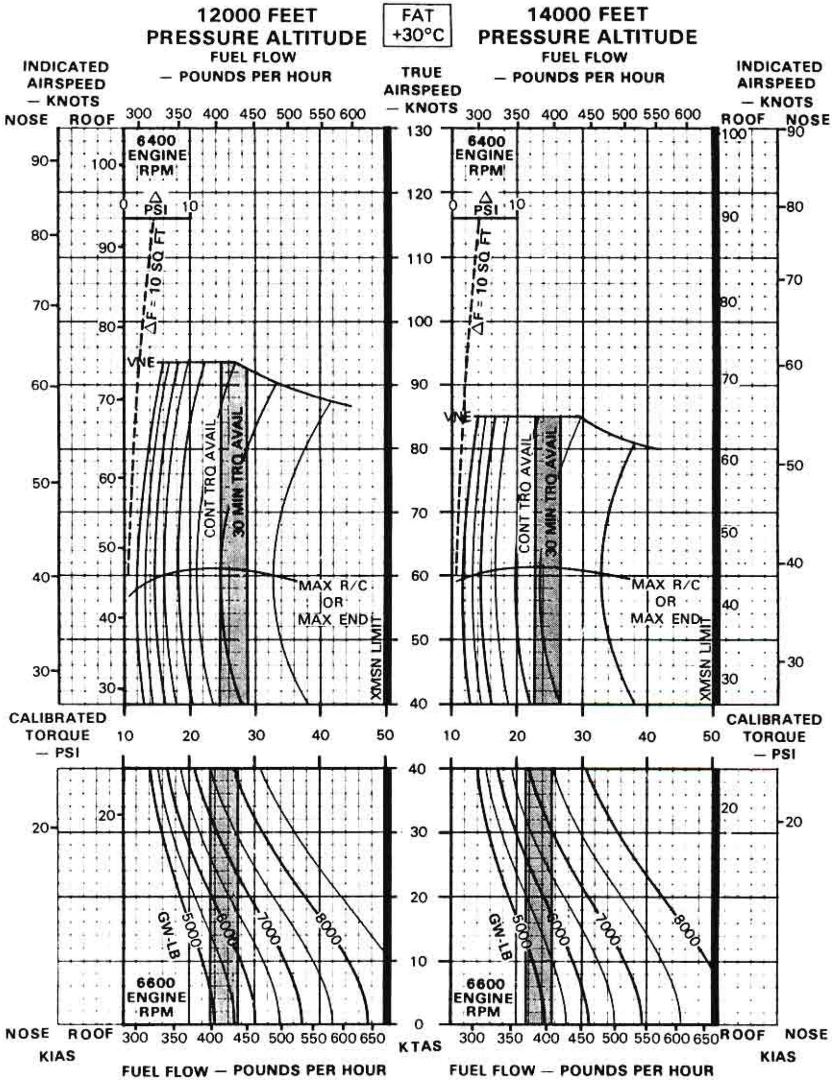


DATA BASIS: DERIVED FROM YUH-1H FLIGHT TEST, ASTA-TDR 66-04, NOVEMBER 1970

Figure 7-6. Cruise chart (Sheet 19 of 24)

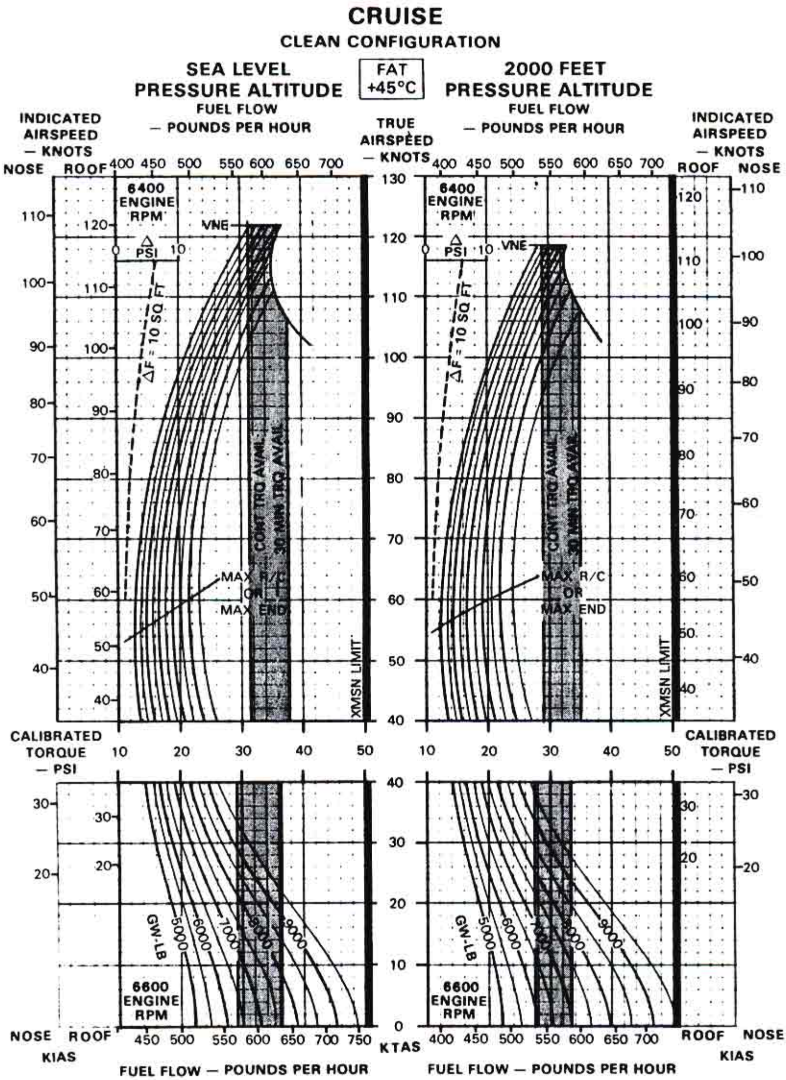
CRUISE

CLEAN CONFIGURATION



DATA BASIS: DERIVED FROM YUH-1H FLIGHT TEST, ASTA-TDR 66-04, NOVEMBER 1970

Figure 7-6. Cruise chart (Sheet 20 of 24)

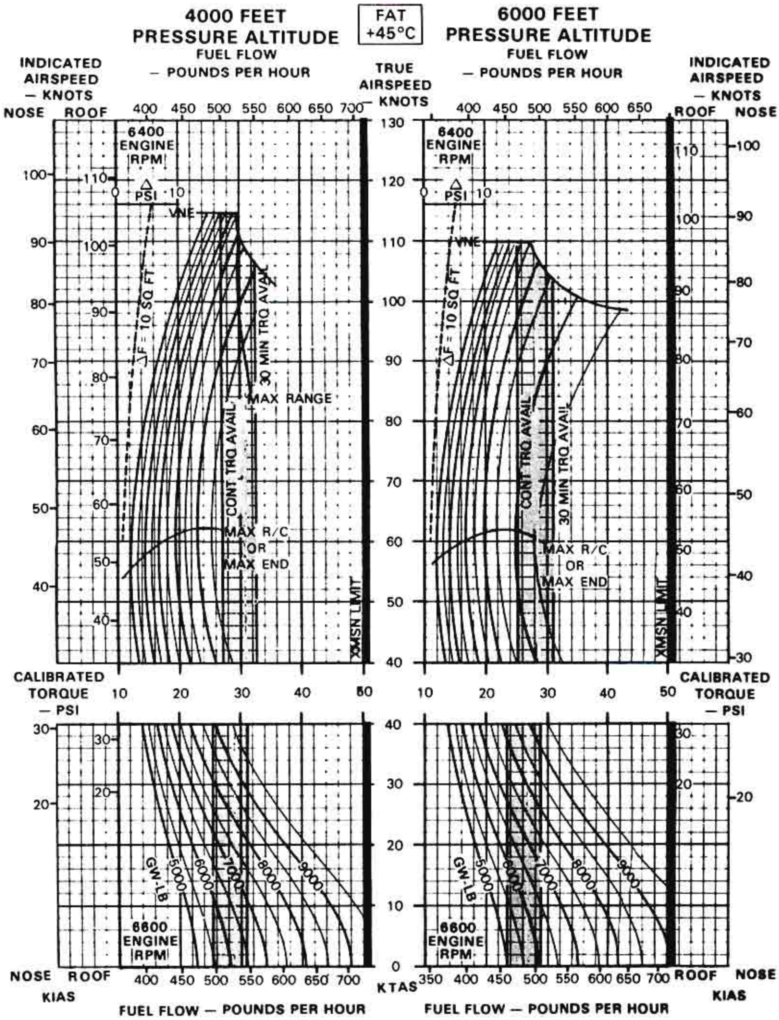


DATA BASIS: DERIVED FROM YUH-1H FLIGHT TEST, ASTA-TDR 66-04, NOVEMBER 1970

Figure 7-6. Cruise Chart (Sheet 21 of 24)

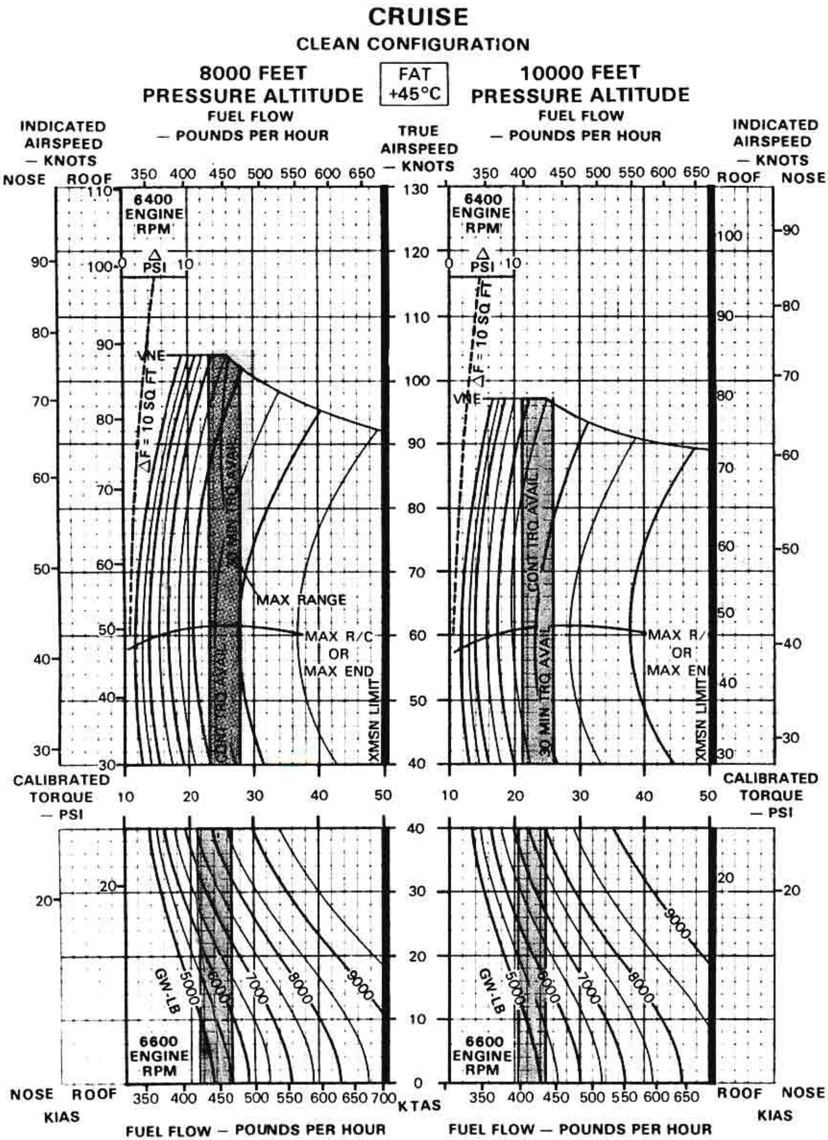
CRUISE

CLEAN CONFIGURATION



DATA BASIS: DERIVED FROM YUH-1H FLIGHT TEST, ASTA-TDR 66-04, NOVEMBER 1970

Figure 7-6. Cruise Chart (Sheet 22 of 24)

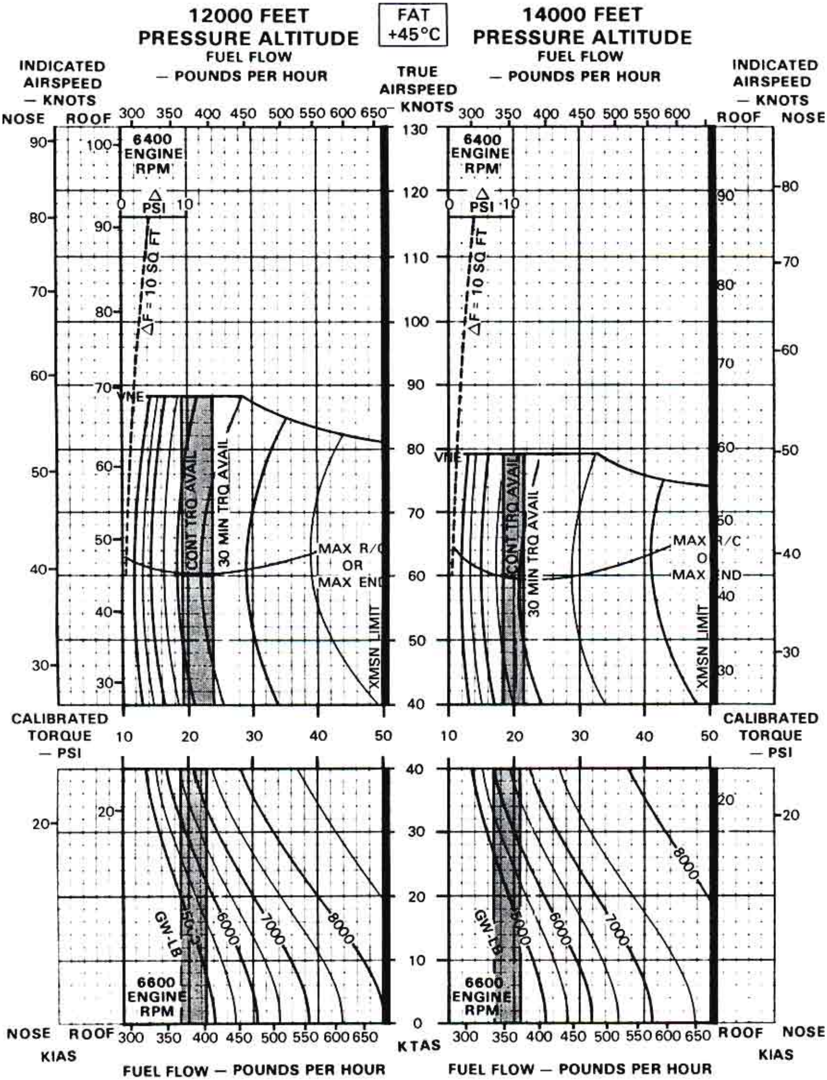


DATA BASIS: DERIVED FROM YUH-1H FLIGHT TEST, ASTA-TDR 66-04, NOVEMBER 1970

Figure 7-6. Cruise chart (Sheet 23 of 24)

CRUISE

CLEAN CONFIGURATION



DATA BASIS: DERIVED FROM YUH-1H FLIGHT TEST, ASTA-TDR 66-04, NOVEMBER 1970

Figure 7-6. Cruise chart (Sheet 24 of 24)

DRAG

ΔF—SQ FT			
0	CLEAN CONFIGURATION (BASE LINE)		
6		CARGO MIRROR	
11	M-23		M-23
12	M-59		M-59
15	M-56		M-56

EXAMPLE A

WANTED

CHANGE IN TORQUE REQUIRED DUE TO EQUIVALENT FLAT PLATE DRAG AREA CHANGE (ΔF) FROM CLEAN (BASELINE) CONFIGURATION TO AN M-56 SUBSYSTEM CONFIGURATION

ΔF DRAG AREA CHANGE = 15 SQ FT
TRUE AIRSPEED = 120 KNOTS
PRESSURE ALTITUDE = SEA LEVEL
FAT = 0°C

METHOD

ENTER DRAG AREA CHANGE
MOVE RIGHT TO TRUE AIRSPEED
MOVE DOWN TO PRESSURE ALTITUDE
MOVE LEFT TO FREE AIR TEMPERATURE
MOVE DOWN, READ CHANGE IN TORQUE = 12.2 PSI

EXAMPLE B

WANTED

INCREASE IN DRAG AREA DUE TO EXTERNAL CARGO

KNOWN

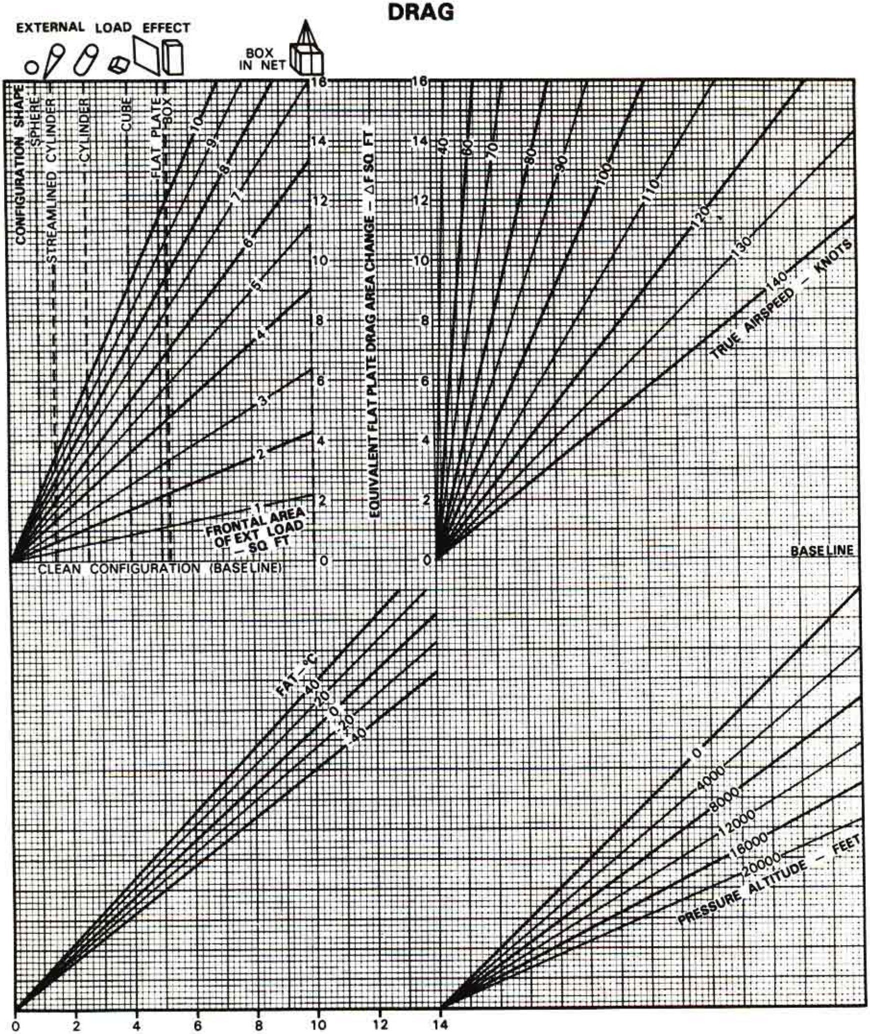
SHAPE OF EXTERNAL LOAD = CYLINDER
FRONTAL AREA OF EXTERNAL LOAD = 6.8 SQ FT

METHOD

ENTER CHART AT SYMBOL FOR CYLINDER
MOVE DOWN TO 6.8 SQ FT
MOVE RIGHT AND READ INCREASED DRAG AREA = 4.0 SQ FT

Figure 7-7. Drag Chart (Sheet 1 of 2)

DRAG



DATA BASIS: CALCULATED DATA

Figure 7-7. Drag Chart (Sheet 2 of 2)

CLIMB—DESCENT

314 ROTOR/6400 ENGINE RPM

EXAMPLE

WANTED

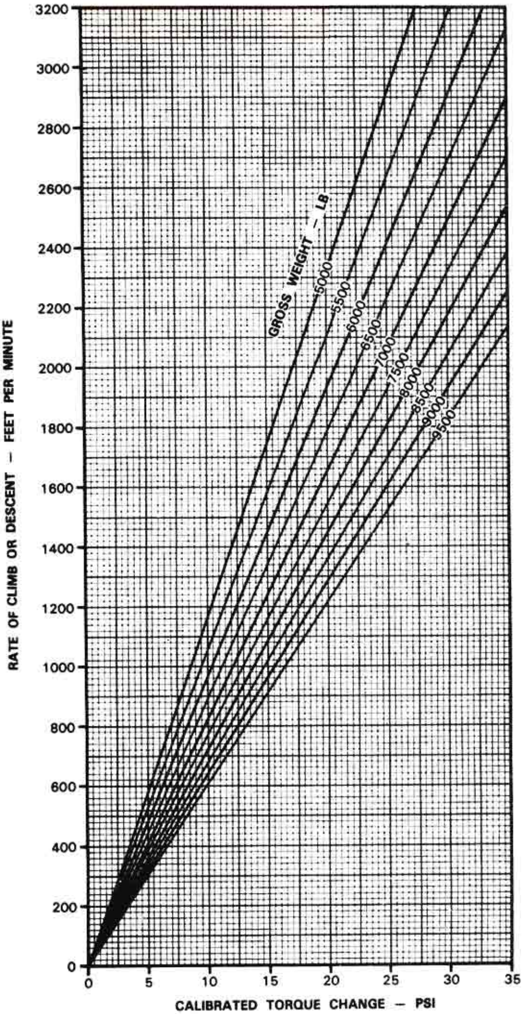
CALIBRATED TORQUE CHANGE
FOR DESIRED R/C OR R/D

KNOWN

GROSS WEIGHT = 6000 LB
DESIRED R/C = 1200 FT/MIN

METHOD

ENTER R/C
MOVE RIGHT TO GROSS WEIGHT
MOVE DOWN, READ CALIBRATED
TORQUE CHANGE = 12.5 PSI



DATA BASIS: DERIVED FROM FLIGHT TEST FTC-TDR 62-21, DECEMBER 1962, AND CALCULATED DATA.

Figure 7-8. Climb-Descent Chart

FUEL FLOW

JP-4 FUEL

EXAMPLE B

WANTED

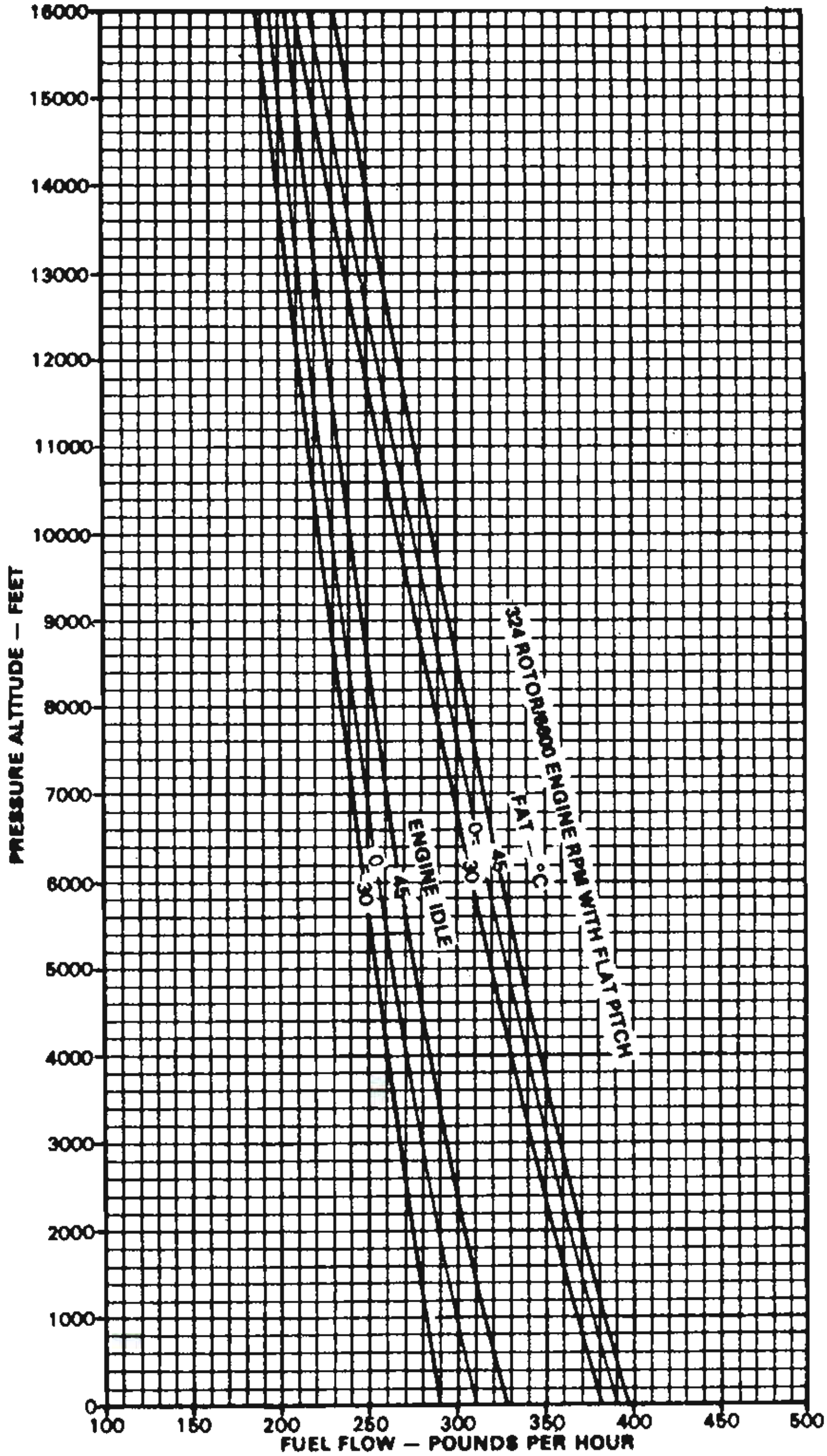
FUEL FLOW AT ENGINE IDLE AND AT 324 ROTOR/6600 ENGINE RPM WITH FLAT PITCH

KNOWN

PRESSURE ALTITUDE = 11000 FEET, FAT = 0°

METHOD

ENTER PRESSURE ALTITUDE
MOVE RIGHT TO (ENGINE IDLE) FAT
MOVE DOWN, READ ENGINE IDLE
FUEL FLOW = 223 LB/HR
REENTER PRESSURE ALTITUDE
MOVE RIGHT TO (FLAT PITCH) FAT
MOVE DOWN, READ FLAT PITCH
FUEL FLOW = 265 LB/HR



DATA BASIS: CALCULATED FROM MODEL SPEC 104.33, SEPTEMBER 1964; CORRECTED FOR INSTALLATION LOSSES BASED ON FLIGHT TEST FTC-TDR 64-27, NOVEMBER 1964

Figure 7-9. Idle Fuel Flow Chart

ALL DATA ON PAGE 7-52 INCLUDING FIGURE 7-9 (SHEET 2) DELETED.

Chapter 8
Normal Procedures

Section I. MISSION PLANNING

8–1. Mission Planning Mission planning begins when the mission is assigned and extends to the preflight check of the helicopter. It includes, but is not limited to checks of operating limits and restrictions; weight balance and loading; performance; publication; flight plan and crew and passenger briefings. The pilot in command shall ensure compliance with the contents of this manual that are applicable to the mission.

8–2. Operating Limits and Restrictions The minimum, maximum, normal and cautionary operational ranges represent careful aerodynamic and structural calculation, substantiated by flight test data. These limitations shall be adhered to during all phases of the mission. Refer to chapter 5, OPERATING LIMITS AND RESTRICTIONS, for detailed information.

8–3. Weight Balance and Loading The helicopter shall be loaded, cargo and passengers secured, and weight and balance verified in accordance with chapter 6, WEIGHT, BALANCE AND LOADING. This helicopter requires a weight and balance clearance, in accordance with AR 95–16. The helicopter weight and center–of–gravity conditions shall be within the limits prescribed in Chaper 5, OPERATING LIMITS AND RESTRICTIONS.

8–4. Performance Refer to chapter 7, PERFORMANCE DATA, to determine the capability of the helicopter for the entire mission. Consideration shall be given to changes in performance resulting from variation in loads, temperatures, and pressure altitudes. Record the data on the Performance Planning Card for use in completing the flight plan and for reference throughout the mission.

8–5. Crew and Passenger Briefings A crew briefing shall be conducted to ensure a thorough understanding of individual and team responsibilies. The briefing should include, but not be limited to, copilot, crew chief, mission equipment operator, and ground crew responsibilites and the coordination necessary to complete the mission in the most efficient manner. A review of visual signals is desirable when ground guides do not have direct voice communications link with the crew.

Section II. CREW DUTIES

8–6. Crew Duties

a. *Responsibilities*. The minimum crew required to fly the helicopter is a pilot. Additional crewmembers, as required, may be added at the discretion of the commander. The manner in which each crewmember performs his related duties is the responsibility of the pilot in command.

b. *Pilot*. The pilot in command is responsible for all aspects of mission planning, preflight, and operation of the helicopter. He will assign duties and functions to all other crewmembers as required. Prior to or during preflight the pilot will brief the crew on the mission, performance data, monitoring of instruments, communications, emergency procedures, taxi, and load operations.

c. *Copilot (when assigned)*. The copilot must be familiar with the pilots duties and the duties of the other crew positions. The copilot will assist the pilot as directed.

d. *Crew Chief (when assigned)*. The crew chief will perform all duties as assigned by the pilot.

e. *Passenger Briefing*. The following is a guide that should be used in accomplishing required passenger briefings. Items that do not pertain to a specific mission may be omitted.

(1) Crew Introduction.

(2) Equipment.

(a) Personal to include ID tags.

(b) Professional.

(c) Survival.

(3) Flight Data.

(a) Route.

(b) Altitude.

(c) Time enroute.

(d) Weather.

(4) Normal Procedures.

(a) Entry and exit of helicopter.

(b) Seating.

(c) Seat belts.

(d) Movement in helicopter.

(e) Internal communications.

(f) Security of equipment.

(g) Smoking.

(h) Oxygen.

(i) Refueling.

(j) Weapons.

(k) Protective masks.

(l) Parachutes.

(m) Ear protection.

(n) ALSE

(5) Emergency Procedures.

(a) Emergency exits.

(b) Emergency equipment.

(c) Emergency landing/ditching procedures.

8-7. Danger Areas Refer to figure 8-1.

Section III. OPERATING PROCEDURES AND MANEUVERS

8-8. Operating Procedures and Maneuvers This section deals with normal procedures, and includes all steps necessary to ensure safe and efficient operating of the helicopter from the time a preflight begins until the flight is completed and the helicopter is parked and secured. Unique feel, characteristics and reaction of the helicopter during various phases of operation and the techniques and procedures used for taxiing, takeoff, climb, etc., are described including precautions to be observed. Your flying experience is recognized; therefore, basic flight principles are avoided. Only the duties of the minimum crew necessary for the actual operation of the helicopter are included.

8-9. Additional Crew Additional crew duties are covered as necessary in section II, CREW DUTIES. Mission equipment checks are contained in chapter 4, MISSION EQUIPMENT. Procedures specifically related to instrument flight that are different from normal procedures are covered in this section following normal procedures. Descriptions of functions, operations, and effects of controls are covered in section V, FLIGHT CHARACTERISTICS, and are repeated in this section only when required for emphasis. Checks that must be performed under adverse environmental conditions, such as desert and cold weather operations, supplement normal procedures checks in this section and are covered in section VI, ADVERSE ENVIRONMENTAL CONDITIONS.

8-10. Checklist Normal procedures are given primarily in checklist form, and amplified as necessary in accompanying paragraph form, when a detailed description of a procedure or maneuver is required. A condensed version of the amplified checklist, omitting all explanatory text, is contained in the Operators Checklist, TM 55-1520-210-CL. To provide for easier cross-referencing, the procedural steps in CL are numbered to coincide with the corresponding numbered steps in this manual.

8-11. Checks The checklist includes items for day, night, and instrument flight with annotative indicators immediately preceding the check to which they are pertinent; N for night operation only; I for instrument operations only; and O to indicate a requirement if the equipment is installed. The symbol star ★ indicates that a detailed procedure for the step is located in the performance section of the condensed checklist. When a helicopter is flown on a mission requiring intermediate stops it is not necessary to perform all of the normal checks. The steps that are essential for safe helicopter operations on intermediate stops are designated as "thru-flight" checks. An asterisk indicates that performance of steps is mandatory for all "thru-flights". The asterisk applies only to checks performed prior to takeoff.

WARNING

Do not preflight until armament systems are safe.

8-12. Before Exterior Checks

*1. Covers, locking devices, tiedowns, and cables—Removed, except aft main rotor tiedown.

2. Publications—Check DA Forms 2408-12, -13, -14, and -18; DD Form 1896; DD Form 365F; locally required forms and publications, and availability of Operators Manual (-10), and Checklist (-CL).

3. AC circuit breakers—IN.

4. BAT switch—ON. Check battery voltage. A minimum of 24 volts should be indicated on the DC voltmeter for a battery start.

5. Lights—On. Check landing, search, anti-collision, position, interior lights and NVG lighting as required for condition and operation as required; position landing and searchlights as desired; then off.

*6. Fuel—Check quantity. Caps secure.

7. Fuel sample—Check for contamination before first flight of the day. If the fuel sumps, and filter have not been drained by maintenance personnel, drain a sample as follows:

a. Sumps—Drain sample and check.

b. MAIN FUEL switch—ON.

c. Filter—Drain sample and check.

O *d.* Auxiliary fuel tanks—Drain sample and check.

e. MAIN FUEL switch—OFF.

O 8. Cargo hook—Check as required, if use is anticipated, refer to Chapter 4, MISSION EQUIPMENT, for checks of the system.

9. BAT switch—OFF.

8-13. Exterior Check (Fig 8-2)

8-14. Area 1

*1. Main rotor blade—Check condition.

2. Fuselage—Check as follows:

a. Cabin top-Check windshields, wipers, FAT probe, WSPS, for condition.

b. Radio compartment—Check security of all equipment. Check battery if installed. Secure door.

c. Antennas—Check condition and security.

O *d.* Pitot tube—Check security and unobstructed.

e. Cabin lower area-Check condition of windshield, antennas, WSPS and fuselage. Check for loose objects inside which might jam controls.

O *f.* Cargo suspension mirror—Check security and cover installed. Uncover and adjust if cargo operations are anticipated.

8-15. Area 2

1. Fuselage—Check as follows:

O *a.* Static port—Check unobstructed.

b. Copilot seat, seat belt and shoulder harness—Check condition and security; secure belt and harness if seat is not used during flight.

c. Copilot door—Check condition and security.

d. Cabin doors—Check condition and security.

e. Landing gear—Check condition and security; ground handling wheels removed.

f. Radio and electrical compartments—Check condition, circuit breakers in and components secure. Secure access doors.

O *g.* Armament systems—Check weapon(s) safe. Check condition and security. Refer to Chapter 4, MISSION EQUIPMENT, for checks of the system.

2. Engine compartment—Check fluid lines and connections for condition and security. Check general condition. Cowling secure.

8-16. Area 3

1. Tailboom—Check as follows:

a. Skin—Check condition.

b. Driveshaft cover—Check secure.

c. Synchronized elevator—Check condition and security.

d. Antennas—Check condition and security.

e. Tail skid—Check condition and security.

*2. Main rotor blade—Check condition, rotate in normal direction 90 degrees to fuselage, tiedown removed.

*3. Tail rotor—Check condition and free movement on flapping axis. The tail rotor blades should be checked as the main rotor blade is rotated. Visually check all components for security.

8–17. Area 4

*1. Tail rotor gearboxes (90 and 42 degrees)—Check general condition, oil levels, filler caps secure.

2. Tailboom—Check as follows;

a. Skin—Check condition.

b. Antennas—Check condition and security.

c. Synchronized elevator—Check condition and security.

3. Engine exhaust/smoke generator—Check condition. Refer to chapter 4 MISSION EQUIPMENT, for systems check.

4. Oil cooling fan and heater compartments—Check condition of fan, flight control and cables, tail rotor servo for leaks and security and battery if installed; check for installation of structural support; check tailboom attachment bolts; check heater for condition and security if installed; check area clear of obstructions; secure doors.

8–18. Area 5

*1. Engine compartment—Check fluid lines and connections for condition and security. Check fluid levels and general condition; cowling secure.

*2. Hydraulic fluid sight gage—Check.

*3. Fuselage—Check as follows:

O **a.* Armament systems—Check weapon(s) safe. Check condition and security. Refer to Chapter 4, MISSION EQUIPMENT, for systems check.

b. Cabin doors—Check condition and security.

c. Landing gear—Check condition and security; ground handling wheels removed.

O *d.* Static port—Check unobstructed.

e. Pilot door—Check condition and security.

f. Pilot seat, seat belt and shoulder harness—Check condition and security.

O *g.* Fire extinguisher—Check secure.

8–19. Area 6

*1. Main rotor system—Check condition and security; check level of fluid in dampers, blade grips, and pillow blocks.

2. Transmission area—Check as follows:

a. Transmission and hydraulic filler caps—Secure.

b. Main driveshaft—Check condition and security.

c. Engine air intake—Check unobstructed.

d. Engine and transmission cowling—Check condition and security.

e. Antennas—Check condition and security.

O *f.* Pitot static tube—Check security and unobstructed.

8–20. Interior Check—Cabin

*1. Transmission oil level—Check.

*2. Cabin area—Check as follows:

O *a.* Cargo—Check as required for proper loading and security.

b. Loose equipment—Stow rotor blade, tiedown, pitot tube cover, tailpipe cover and other equipment.

O *c.* Mission equipment—Check condition and security. Refer to Chapter 4, MISSION EQUIPMENT, for equipment checks.

d. Passenger seats and belts—Check condition and security.

e. First aid kits—Check secure.

O *f.* Fire extinguisher—Check secure.

*3. Crew and passenger briefing—Complete as required.

8–21. Before Starting Engine

1. Overhead switches and circuit breakers—Set as follows:

O *a.* Smoke generator operating switch—Check condition and security. Refer to chapter 4, MISSION EQUIPMENT, for systems check.

b. DC circuit breakers—In, except for armament and special equipment.

O *c.* DOME LT switch—As required.

d. PITOT HTR switch—OFF.

**e.* EXT LTS switches—Set as follows:

(1) ANTI COLL switch—ON.

(2) POSITION lights switches—As required: STEADY or FLASH for night; OFF for day.

f. MISC switches—Set as follows:

(1) CARGO REL switch—OFF.

(2) WIPERS switch—OFF.

g. CABIN HEATING switches—OFF.

h. INST LTG switches—As required.

i. AC POWER switches—Set as follows:

(1) PHASE switch—AC.

(2) INVTR switch—OFF.

j. DC POWER switches—Set as follows:

(1) MAIN GEN switch—ON and cover down.

(2) VM selector—ESS BUS.

(3) NON-ESS BUS switch—As required.

(4) STARTER GEN switch—START.

*(5) BAT switch—ON.

*2. Ground power unit—Connect for GPU start.

O 3. Smoke gage—Check.

4. FIRE warning indicator light—Test.

5. Press to test caution/warning lights—Check as required.

6. Systems instruments—Check engine and transmission systems for static indications, slippage marks, and ranges.

7. Center pedestal switches—Set as follows:

a. Avionics equipment—Off; set as desired.

b. External stores jettison handle—Check safetied.

O *c.* DISP CONTROL panel—Check ARM/STBY/SAFE switch is SAFE; check that JETTISON switch is down and covered.

d. GOV switch—AUTO.

e. DE-ICE switch—OFF.

**f.* FUEL switches—Set as follows:

(1) MAIN FUEL switch—ON.

O (2) START FUEL switch—ON.

(3) All other switches—OFF.

g. CAUTION panel lights—TEST and RESET.

h. HYD CONT switch—ON.

i. FORCE TRIM switch—ON.

j. CHIP DET switch—BOTH.

8. Flight controls—Check freedom of movement through full travel: center cyclic and pedals; collective pitch full down.

9. Altimeters—Set to field elevation.

***8-22. Starting Engine**

1. Fireguard—Posted if avaliable.

2. Rotor blades—Check clear and untied.

3. Ignition key lock switch—On.

4. Throttle—Set for start. Position the throttle as near as possible (on decrease side) to the engine idle stop.

5. Engine—Start as follows:

a. Start switch—Press and hold; start time. Note DC voltmeter indication. Battery starts can be made when voltages less than 24 volts are indicated, provided the voltage is not below 14 volts when cranking through 10 percent N1 speed.

b. Main rotor—Check that the main rotor is turning as N1 reaches 15 percent. If the rotor is not turning, abort the start.

O *c.* START FUEL switch—OFF at 40 percent N1.

d. Start switch—Release at 40 percent N1 or after 40 seconds, whichever occurs first. Refer to chapter 5 for starter limitations.

e. Throttle—Slowly advance past the engine idle stop to the engine idle position. Manually check the engine idle stop by attempting to close the throttle.

f. N1—68 to 72 percent. Hold a very slight pressure against the engine idle stop during the check. A slight rise in N1 may be anticipated after releasing pressure on throttle.

NOTE

The copilot attitude indicator should be caged and held momentarily as inverter power is applied.

6. INVTR switch—MAIN ON.

7. Engine and transmission oil pressures—Check

8. GPU—Disconnect.

8-23. Engine Runup

*1. Avionics—On. Check as required.

*2. STARTER GEN switch—STBY GEN.

*3. Systems—Check as follows:

a. FUEL.

b. Engine.

c. Transmission.

d. Electrical.

(1) AC—112 to 118 volts.

(2) DC—27 volts at 26°C and above. 28 volts from 0°C to 26°C. 28.5 volts below 0°C.

*4. RPM—6600. As throttle is increased, the low rpm audio and warning light should be off at 6100 to 6300 rpm.

5. Fuel control—Check as required (for helicopters without modified fuel control) before first flight of the day as follows:

a. GOV RPM INCR/DECR switch—DECR to 6000 rpm.

b. Collective pitch—Increase slowly until the helicopter is light on the skids. Do not exceed 94 percent N1 or torque limit.

c. RPM—Check for the following:

(1) If rpm remains at 6000 (no bleed-off) or if bleed-off occurs but returns to 6000 within 4 seconds, the fuel control is acceptable.

(2) If rpm bleed-off occurs but does not return to 6000, the fuel control is not acceptable and the helicopter shall not be flown. An entry on DA Form 2408-13 is required.

d. Collective pitch—Decrease to full down.

e. GOV RPM INCR/DECR switch—Increase to 6600 rpm.

6. Health Indicator Tests (HIT) check—Perform as required on first flight of the day. Refer to HIT EGT log in helicopter log book.

8-24. Takeoff to Hover Refer to FM 1-203, Fundamentals of Flight.

8-25. Hovering Turns Refer to FM 1-203, Fundamentals of Flight.

8-26. Sideward and rearward hovering Flight Refer to FM 1-203, Fundamentals of Flight.

8-27. Hover/Taxi Refer to FM 1-203, Fundamentals of Flight.

8-28. Hover/Taxi Check Perform the following checks at a hover:

* 1. Engine and transmission instruments—Check.

2. Flight instruments—Check as required.

a. VSI and altimeter—Check for indication of climb and descent.

b. Slip indicator—Check ball free in race.

c. Turn needle, heading indicator, and magnetic compass—Check for turn indication left and right.

d. Attitude indicator—Check for indication of nose high and low and banks left and right.

e. Airspeed indictor—Check airspeed.

*3. Power check as required. The power check is performed by comparing the indicated torque required to hover with the predicted values from performance charts .

8-29. Landing From a Hover Refer to FM 1-203, Fundamentals of Flight.

***8-30. Before Takeoff** Immediately prior to takeoff, the following checks shall be accomplished.

1. RPM—6600.

2. Systems—Check engine, transmission, electrical and fuel systems indications.

3. Avionics—As required.

4. Crew, passengers, and mission equipment—Check.

8-31. Takeoff

Caution

During take-off and at any time the helicopter skids are close to the ground, negative pitch attitudes (nose low) of 10° or more can result in ground contact of the WSPS lower cutter tip. Forward c.g., high gross weight, high density altitude, transitional lift settling, and a tail wind increases the probability of ground contact.

8-32. Normal Refer to FM 1-203, Fundamentals of Flight.

8-33. Maximum Performance A takeoff that demands maximum peformance from the helicopter is necessary because of various combinations of heavy helicopter loads, limited power and restricted performance due to high density altitudes, barriers that must be cleared and other terrain features. The decision to use either of the following takeoff techniques must be based on an evaluation of the conditions and helicopter performance. The copilot (when available) can assist the pilot in maintaining proper rpm by calling out rpm and torque as power changes are made, thereby allowing the pilot more attention outside the cockpit.

a. *Coordinated Climb.* Align the helicopter with the desired takeoff course at a stabilized hover of approximately three feet (skid height). Apply forward cyclic pressure smoothly and gradually while simultaneously increasing collective pitch to begin a coordinated acceleration and climb. Adjust pedal pressure as necessary to maintain the desired heading. Maximum torque available should be applied (without exceeding helicopter limits) as the helicopter attitude is established that will permit safe obstacle clearance. The climbout is continued at that attitude and power setting until the obstacle is cleared. After the obstacle is cleared, adjust helicopter attitude and collective pitch as required to establish a climb at the desired rate and airspeed. Continous coordinated application of control pressures is necessary to maintain trim, heading, flight path, airspeed, and rate of climb. This technique is desirable when OGE hover capability exists. Takeoff may be made from the ground by positioning the cyclic control slightly forward of neutral prior to increasing collective pitch.

b. *Level—Acceleration.* Align the helicopter with the desired takeoff course at a stabilized hover of approximately three feet (skid height). Apply forward cyclic pressure smoothly and gradually while simultaneously increasing collective pitch to begin an acceleration at approximately 3 to 5 feet skid height. Adjust pedal pressure as necessary to maintain the desired heading. Maximum torque available should be applied (without exceeding helicopter limits) prior to accelerating through effective translational lift. Additional forward cyclic pressure will be necessary to allow for level acceleration to the desired climb airspeed. Approximately five knots prior to reaching the desired climb airspeed, gradually release forward cyclic pressure and allow the helicopter to begin a constant airspeed climb to clear the obstacle. Care must be taken not to decrease airspeed during the climbout since this may result in the helicopter descending. After the obstacle is cleared adjust helicopter attitude and collective pitch as required to establish a climb at the desired rate and airspeed. Continuous coordinated application of control pressures is necessary to maintain trim, heading, flight path, airspeed, and rate of climb. Takeoff may be made from the ground by positioning the cyclic control slightly forward of neutral prior to increasing collective pitch.

c. *Power Application.*

During takeoffs where maximum engine performance is demanded and the maximum torque limit cannot be reached it will be necessary to press the GOV INCR switch (increase "beep") to prevent drooping the engine rpm below 6600. As the GOV INCR switch is pressed, collective pitch must be increased simultaneously to prevent engine overspeed. As the takeoff is completed and power requirements are reduced, a coordinated reduction is collective pitch and GOV DECR (decrease "beep") are required to maintain 6600 rpm. The copilot (when available) can assist the pilot in maintaining proper rpm by calling out rpm and torque as power changes are made, thereby allowing the pilot more attention outside the cockpit.

d. *Comparison of Techniques.* Refer to chapter 7, Performance Data, for a comparison of takeoff distances. Where the two techniques yield the same distance over a fifty-foot obstacle, the coordinated climb technique will give a shorter distance over lower obstacles and the level acceleration technique will give a shorter distance over obstacles higher than fifty feet. The two techniques give approximately the same distance over a fifty-foot obstacle when the helicopter can barely hover OGE. As hover capability is decreased the level acceleration technique gives increasingly shorter distances than the coordinated climb technique. In addition to the distance comparison, the main advantages of the level acceleration technique are: (1) it requires less or no time in the avoid area of the height velocity diagram; (2) performance is more repeatable since reference to attitude which changes with loading and airspeed is not required; (3) at the higher climbout airspeeds (30 knots or greater), reliable indicated airspeeds are available for accurate airspeed reference from the beginning of the climbout, therefore minimizing the possibility of descent. The main advantage of the coordinated climb technique is that the climb angle is established early in the takeoff and more distance and time are available to abort the takeoff if the obstacle cannot be cleared. Additionally, large attitude changes are not required to establish climb airspeed.

8-34. Slingload The slingload takeoff requiring the maximum performance (when OGE hover is not possible) is similar to the level acceleration technique except the takeoff is begun and the acceleration made above 15 feet. Obstacle heights include the additional height necessary for a 15-foot sling load.

8-35. Climb After takeoff, select the airspeed necessary to clear obstacles. When obstacles are cleared, adjust the airspeed as desired at or above the maximum rate of climb airspeed. Refer to chapter 7 for recommended airspeeds.

8-36. Cruise When the desired cruise altitude is reached, adjust power as necessary to maintain the required airspeed. Refer to chapter 7 for recommended airspeeds, power settings, and fuel flow.

8-37. Descent Adjust power and attitude as necessary to attain and maintain the desired speed and rate during descent. Refer to chapter 7 for power requirements at selected airspeeds and rates of descent. All checks of mission equipment that must be made in preparation for landing should be accomplished during descent.

8-38. Before Landing Prior to landing the following checks shall be accomplished:

1. RPM-6600.

2. Crew, passengers, and mission equipment—Check.

8-39. Landing

a. Approach. Refer to the Height Velocity Diagram. Figure 9-3, for avoid area during the approach.

b. Run-on Landing. A run-on landing is used during emergency conditions of hydraulic power failure and some flight control malfunctions. The approach is shallow and flown at an airspeed that provides safe helicopter control. Airspeed is maintained as for a normal approach except that touchdown is made at an airspeed above effective translational lift. After ground contact is made, slowly decrease collective pitch to minimize forward speed. If braking action is necessary, the collective pitch may be lowered as required for quicker stopping.

c. Landing from a Hover. Refer to FM 1-203, Fundamentals of Flight.

8-40. Engine Shutdown

Caution

If throttle is inadvertently rolled to the OFF position, do not attempt to roll it back on.

1. Throttle—Engine idle for two minutes.

2. FORCE TRIM switch—ON.

NOTE

Steps 3 through 8 are to be completed after the last flight of the day if the system operation was not verified during the mission.

3. PITOT HTR—Check. Place the PITOT HTR switch in the ON position. Note loadmeter increase—then OFF.

4. INVTR switch—OFF. Check for INST INVERTER caution light illumination. Switch to SPARE check caution light OFF.

5. AC voltmeter—Check 112 to 118 volts.

6. MAIN GEN switch—OFF. Check DC voltmeter for 26 volts at 26°C and above 27 volts from 0°C to plus 26°C; and 27.5 volts below 0°C. The DC GENERATOR caution light should illuminate and the standby generator loadmeter should indicate a load.

7. NON-ESS BUS—Check as required. If equipment powered by the nonessential bus is installed, accomplish the following:

a. VM switch—NON-ESS BUS.

b. NON-ESS BUS switch—MANUAL ON. Check DC voltmeter for the same DC volts as in step 7 above.

c. VM switch—ESS BUS.

8. MAIN GEN switch—ON and guard closed. The DC GENERATOR caution light should be out and the main generator loadmeter should indicate a load.

9. STARTER GEN switch—START.

10. Throttle—Off.

11. Center Pedestal switches—Off.

a. FUEL.

b. Avionics.

12. Overhead switches—Off.

a. INVTR.

b. PITOT HTR.

c. EXT LTS.

d. MISC.

e. CABIN HEATING.

f. INST LTG.

g. BAT.

13. Ignition keylock switch—Remove key as required.

8-41. Before Leaving The Helicopter

1. Walk-around—complete, checking for damage, fluid leaks and levels.

2. Mission equipment—Secure.

3. Complete DA Forms 2408-12 and -13. An entry in DA Form 2408-13 is required if any of the following conditions were experienced:

a. Flown in a loose grass environment.

b. Operated within 10 miles of saltwater.

c. Exposed to radioactivity.

d. Operated in rain, ice, or snow.

e. Operated within 200 miles of volcanic area.

4. Secure helicopter.

Section IV. INSTRUMENT FLIGHT

8-42. Instrument Flight—General This helicopter is qualified for operation in instrument meteorological conditions. Flight handling qualities, stability characteristics, and range are the same during instrument flight as for visual flight. Navigation and communication equipment are adequate for instrument flight. Refer to FM 1-240, Instrument Flying and Navigation for Army Aviators.

Section V. FLIGHT CHARACTERISTICS

8-43. Flight Characteristics

8-44. Operating Characteristics The flight characteristics of this helicopter in general are similar to other single rotor helicopters.

8-45. Mast Bumping

WARNING

Abrupt inputs of flight controls cause excessive main rotor flapping, which may result in mast bumping and must be avoided.

Mast bumping (flapping-stop contact) is the main yoke contacting the mast. It may occur during slope landings, rotor startup/coastdown, or when the flight envelope is exceeded. If mast bumping is encountered in flight, land as soon as possible. Because of mission requirements, it may be necessary to rapidly lower the nose of the helicopter with cyclic input or make a rapid collective reduction. At moderate to high airspeeds it becomes increasingly easy to approach less than +0.5G by abrupt forward cyclic inputs. Variance, in such things as sideslip, airspeed, gross weight, density altitude, center of gravity and rotor speed, may increase main rotor flapping and increase the probability of mast bumping. Rotor flapping is a normal part of maneuvering and excessive flapping can occur at greater than one G flight; but, flapping becomes more excessive for any given maneuver at progressively lower load factors.

a. If bumping occurs during a slope landing, reposition the cyclic to stop the bumping and re-establish a hover.

b. If bumping occurs during startup or shutdown, move cyclic to minimize or eliminate bumping.

c. As collective pitch is reduced after engine failure or loss of tail rotor thrust, cyclic must be positioned to maintain positive "G" forces during autorotation. Touchdown should be accomplished prior to excessive rotor rpm decay.

8-45.1. **Hub Spring Contact**

a. With the addition of the Hub Spring the likelihood that mast bumping will occur is reduced. A 2 per rev. vibration will be noticed when the hub spring makes contact with the plate assembly on the hub. With the hub spring modification, contact is made at rotor flapping angles greater than 4 degrees and becomes more pronounced as the angle increases. Without the Hub Spring, contact is made at 11 degrees (contact between yolk and mast, i.e., mast bumping).

b. Due to the difference in contact limitations (4 degrees compared to 11 degrees) it is likely that this vibration (2 per rev.) will be felt while flying within the flight envelope. Gusting winds, landings with slope angles, greater than 4 degrees and hoisting operations are several situations that increase main rotor flapping angles, thus increasing the possibility of hub spring contact. While the hub spring will not prohibit mast bumping, it will aid in controlling rotor flapping angles, and provide an extra margin of safety. Installation of the hub spring does not change in any way the approved flight envelope. Should hub spring contact occur during normal operations, no special inspections or maintenance actions are required. Anytime operating limitations or the flight envelope is exceeded and hub spring contact is encountered, a mast bump inspection will be performed.

8-46. Collective Bounce Collective bounce is a pilot induced vertical oscillation of the collective control system when an absolute friction (either pilot applied or control rigged) is less than seven pounds. It may be encountered in any flight condition by a rapid buildup of vertical bounce at approximately three cycles per second. The severity of the oscillation is such that effective control of the helicopter may become difficult to maintain. The pilot should apply and maintain adequate collective friction in all flight conditions.

8-47. Blade Stall Refer to FM 1-203, Fundamentals of Flight.

8-48. Settling with Power Refer to FM 1-203, Fundamentals of Flight.

8-49. Maneuvering Flight Action and response of the controls during maneuvering flight are normal at all times when the helicopter is operated within the limitations set forth in this manual.

8-50. Hovering Capabilities Refer to chapter 7.

8-51. Flight With External Loads The airspeed with external cargo is limited by controllability.

8-52. Types of Vibration

a. The source of vibrations of various frequencies are the rotating and moving components on the helicopter; other components vibrate in response to an existing vibration.

b. Rotor vibrations felt during in-flight or ground operations are divided in general frequencies as follows:

(1) Extreme low frequency—Less than one per revolution (pylon rock).

(2) Low frequency—One or two per revolution.

(3) Medium frequency—Generally, four, five, or six per revolution.

(4) High frequency—Tail rotor frequency or higher.

c. Most vibrations are always present at low magnitudes. The main problem is deciding when a vibration level has reached the point of being excessive.

d. Extreme low, and most medium frequency vibrations are caused by the rotor or dynamic controls. Various malfunctions in stationary components can affect the absorption or damping of the existing vibrations and increase the overall level.

e. A number of vibrations are present which are considered a normal characteristic. Two per revolution is the most prominent of these, with four or six per revolution the next most prominent. There is always a small amount of high-frequency vibration present that may be detectable. Experience is necessary to learn the normal vibration levels. Sometimes the mistake is made of concentrating on feeling one specific vibration and concluding that the level is higher than normal.

8-53. Low G Maneuvers

WARNING

Intentional flight below +0.5G is prohibited.

WARNING

Abrupt inputs of flight controls cause excessive main rotor flapping, which may result in mast bumping and must be avoided.

a. Because of mission requirements, it may be necessary to rapidly lower the nose of the helicopter. At moderate to high airspeeds, it becomes increasingly easier to approach zero or negative load factors by abrupt forward cyclic inputs. The helicopter may exhibit a tendency to roll to the right simultaneously with the forward cyclic input.

b. Such things as sideslip, weight and location of external stores and airspeed will affect the severity of the right roll. Variances in gross weight, longitudinal cg, and rotor rpm may affect the roll characteristics. The right roll occurs throughout the normal operating airspeed range and becomes more violent at progressively lower load factors. When it is necessary to rapidly lower the nose of the helicopter, it is essential that the pilot monitor changes in roll attitude as the cyclic is moved forward.

c. If the flight envelope is inadvertently exceeded, causing a low ''G'' condition and right roll, move cyclic aft to return rotor to positive thrust condition, then roll level, continuing flight if mast bumping has not occurred.

8-54. Rollover Characteristics Refer to FM 1-203, Fundamentals of Flight.

*U.S.Government Printing Office;1988-654-047/81068

Section VI. ADVERSE ENVIRONMENTAL CONDITIONS

8-55. General This section provides information relative to operation under adverse environmental conditions (snow, ice and rain, turbulent air, extreme cold and hot weather, desert operations, mountainous and altitude operation) at maximum gross weight. Section II check list provides for operational requirements of this section.

Caution

Extreme care should be exercised under adverse environmental conditions when using NVG. Such conditions induce backscatter and could significantly decrease or destroy the effectiveness of NVG to the extent of creating unsafe flight conditions. Use of NVG should be discontinued under such conditions and assure that the NVG searchlight and/or landing light and NVG position lights are extinguished.

8-56. Cold Weather Operations Operation of the helicopter in cold weather or an arctic environment presents no unusual problems if the operators are aware of those changes that do take place and conditions that may exist because of the lower temperatures and freezing moisture.

a. Inspection. The pilot must be more thorough in the preflight check when temperatures have been at or below 0°C (32°F). Water and snow may have entered many parts during operations or in periods when the helicopter was parked unsheltered. This moisture often remains to form ice which will immobilize moving parts or damage structure by expansion and will occasionally foul electric circuitry. Protective covers afford protection against rain, freezing rain, sleet, and snow when installed on a dry helicopter prior to the precipitation. Since it is not practicable to completely cover an unsheltered helicopter, those parts not protected by covers and those adjacent to cover overlap and joints require closer attention, especially after blowing snow or freezing rain. Remove accumulation of snow and ice prior to flight. Failure to do so can result in hazardous flight, due to aerodynamic and center of gravity disturbances as well as the introduction of snow, water and ice into internal moving parts and electrical systems. The pilot should be particularly attentive to the main and tail rotor systems and their exposed control linkages.

Caution

At temperatures of -35°C (-31°F) and lower, the grease in the spherical couplings of the main transmission driveshaft may congeal to a point that the couplings cannot operate properly.

b. Transmission. Check for proper operation by turning the main rotor opposite to the direction of rotation while observer watches the driveshaft to see there is no tendency for the transmission to "wobble" while the driveshaft is turning. If found frozen, apply heat (do not use open flame, avoid overheating boot) to thaw the spherical couplings before attempting to start engine.

c. Checks.

(1) Before exterior check 0°C (32°F) and lower. Perform check as specified in Section III.

(2) Exterior check 0°C (32°F) to -54°C (-65°F). Perform the following checks. Check that all surfaces and controls are free of ice and snow. Contraction of the fluids in the helicopter system at exteme low temperatures causes indication of low levels. A check made just after the previous shutdown and carried forward to the walk around check is satisfactory if no leaks are in evidence. Filling when the system is cold-soaked will reveal an over-full condition immediately after flight, with the possibility of forced leaks at seals.

(a) Main rotor—Check free of ice, frost, and snow.

(b) Main driveshaft—Check for freedom of movement.

(c) Engine air inlet and screens—Remove all loose snow that could be pulled into and block the engine intake during starting.

(d) Oil cooling fan compartment—Check oil cooling fan blades for ice.

(3) Interior check—All flights 0°C (32°F) to -54°C (-65°F). Perform check as specified in section III.

(4) Engine starting check 0°C (32°F) to -54°C (-65°F). Determine that the compressor rotor turns freely. As the engine cools to an ambient temperature below 0°C (32°F) after engine shutdown condensed moisture may freeze engine seals. Ducting hot air from an external source through the air inlet housing will free a frozen rotor. Perform check as

outlined in section II. If temperature is -44°C (-47°F) or below the pilot must be particularly careful to monitor engine and transmission instruments for high oil pressure. During cold weather starting the engine oil pressure gage will indicate maximum (100 psi). The engine should be warmed up at engine idle until the engine oil pressure indication is below 100 psi. The time required for warmup is entirely dependent on the starting temperature of the engine and lubrication system.

(5) Engine runup check. Perform the check as outlined in section II.

WARNING

Control system checks should be performed with extreme caution when helicopter is parked on snow and ice. There is reduction in ground friction holding the helicopter stationary, controls are sensitive and response is immediate.

d. Engine Starting Without External Power Supply. If a battery start must be attempted when the helicopter and battery have been cold-soaked, preheat the engine and battery if equipment is available and time permits. Preheating will result in a faster starter cranking speed which tends to reduce the hot start hazard by assisting the engine to reach a self-sustaining speed (40 percent N1) in the least possible time. Electrical load may be reduced by leaving inverter lights and other electrical equipment off during start.

8-57. Before Leaving the Helicopter Open vents to permit free circulation of air. Install protective covers as required.

8-58. Snow Refer to FM 1-202, Environmental Flight.

8-59. Desert and Hot Weather Operations Refer to FM 1-202, Environmental Flight.

8-60. Turbulence and Thunderstorms

8-61. Turbulence

a. In turbulence, check that all occupants are seated with seat belts and harnesses tightened.

b. Helicopter controllability is the primary consideration; therefore, if control becomes marginal, exit the turbulence as soon as possible.

c. To minimize the effects of turbulence encountered in flight the helicopter should be flown at an airspeed corresponding to minimum torque required; maximum endurance airspeed. There will be a corresponding increase in control movements at the reduced airspeed.

8-62. Thunderstorms

a. To minimize the effects of thunderstorms encountered in flight perform the following:

(1) Adjust torque to maintain maximum endurance airspeed.

(2) Check that all occupants are seated with seat belts and harnesses tightened.

(3) PITOT HTR switch—ON.

(4) Avionics—Reduce volume on any equipment affected by static.

(5) Interior lights—Adjust to full bright at night to minimize blinding effect of lightning.

b. In The Storm.

(1) Maintain a level attitude and constant power setting. Airspeed fluctuations should be expected and disregarded.

(2) Maintain original heading, turning only when necessary.

(3) The altimeter is unreliable due to differential barometric pressures within the storm. An indicated gain or loss of several hundred feet is not uncommon and should be allowed for in determining minimum safe altitude.

8-63. Lightning Strikes

a. Although the possiblity of a lightning strike is remote, with increasing use of all-weather capabilities the helicopter could inadvertently be exposed to lightning damage. Therefore static tests have been conducted to detemine lightning strike effects on rotors.

b. Simulated lightning tests indicate that lightning strikes may damage helicopter rotors. The degree of damage will depend on the magnitude of the charge and the point of contact. Catastrophic structural failure is not anticipated. However, lightning damage to hub bearings, blade aft section, trim tabs, and blade tips was demonstrated. Also, adhesive bond separations occurred between the blade spar and aft section between the spar and leading edge abrasion strip. Some portions of blade aft sections deformed to the extent that partial or complete separation of the damaged section could be expected. Such damage can aerodynamically produce severe structural vibration and serious control problems which, if prolonged, could endanger the helicopter and crew.

WARNING

Avoid flight in or near thunderstorms especially in areas of observed or anticipated lightning discharges.

c. If lightning damage occurs, indications such as control problems or vibration changes, especially abnormal noise may or may not be evident.

NOTE

Abnormal operating noises almost always accompany rotor damage, but loudness or pitch are not valid indications of the degree of damage sustained.

d. If lightning strike occurs or is suspected, the following precautions are recommended to minimize further risk.

(1) Reduce airspeed as much as practical to maintain safe flight.

(2) Avoid abrupt control inputs.

8-64. Ice and Rain

a. In heavy rain, a properly adjusted wiper can be expected to clear the windshield adequately throughout the entire speed range. However, when poor visibility is encountered while cruising in rain, it is recommended that the pilot fly by reference to the flight instruments and the copilot attempt to maintain visual reference. Rain has no noticeable effect on handling or performance of the helicopter. Maintenance personnel are required to perform a special inspection after the helicopter has been operated in rain.

NOTE

If the windshield wiper does not start in LOW or MED position, turn the control to HIGH. After the wiper starts, the control may be set at the desired position.

b. Continuous flight in light icing conditions is not recommended because the ice shedding induces rotor blade vibrations, adding greatly to the pilots work load. If icing conditions are encountered during flight every effort should be made to vacate the icing environment.

Caution

When operating at outside air temperatures of 40°F (5°C) or below, icing of the engine air inlet screens can be expected. Ice accumulation on inlet screens can be detected by illumination of the ENGINE INLET AIR caution light. Continued accumulation of ice will result in partial or complete power loss. It should be noted that illumination of the ENGINE INLET AIR caution light indicates blockage at the inlet screen only and does not reveal icing conditions in the particle separator or on the FOD screen. To preclude the possibility of icing, it is recommended that the right and left engine air inlet filters be removed from the cowling when it is anticipated that the helicopter will be flown under atmospheric conditions conductive to icing. (Do not remove the top filter.)

c. If icing conditions become unavoidable the pilot should actuate the pitot heat, windshield defroster and de-icer switches.

d. Flight tests in closely controlled icing conditions have indicated that the pilot can expect one or all of the following to occur:

(1) Obscured forward field of view due to ice accumulation on the windscreens and chin bubbles. If the windshield defrosters fail to keep the windshield clear of ice, the side windows may be used for visual reference during landing.

(2) One-per-rotor-revolution vibrations ranging from mild to severe caused by asymmetrical ice shedding from the main rotor system. The severity of the vibration will depend upon the temperatures and the amount of ice accumulation on the blades when the ice shed occurs. Flight test experience has shown that the possiblity of an asymmetric ice shed occurring increases as the outside air temperature decreases.

(3) An increase in torque required to maintain a constant airspeed and altitude due to ice accumulation on the rotor system.

(4) Possible degradation of the ability to maintain autorotational rotor speed within operating limits.

e. Severe vibrations may occur as a result of main rotor asymmetrical ice shedding. If icing conditions are encountered while in flight, land as soon as practical. All ice should be removed from the rotor system before attempting further flight.

f. Control activity cannot be depended upon to remove ice from the main rotor system. Vigorous control movements should not be made in an attempt to reduce low frequency vibrations caused by asymmetrical shedding of ice from the main rotor blades. These movements may induce a more asymmetrical shedding of ice, further aggravating helicopter vibration levels.

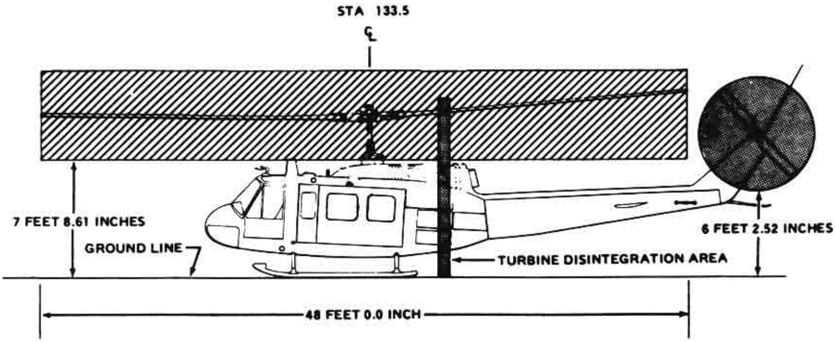
g. If a 5 psi (or greater) torque pressure increases is required above the cruise torque setting used prior to entering icing conditions it may not be possible to maintain autorotational rotor speed within operational limits, should an engine failure occur.

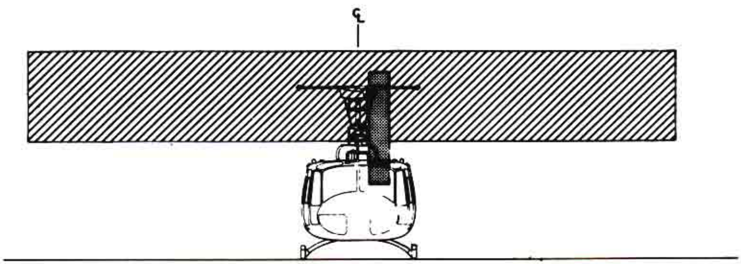
h. Ice shed from the rotor blades and/or other rotating components presents a hazard to personnel during landing and shutdown. Ground personnel should remain well clear of the helicopter during landing and shutdown, and passengers and crewmembers should not exit the helicopter until the rotor has stopped turning.

8-65. High or Gusty Wind

a. High or gusty wind operations require no special procedures or techniques while in flight however, special parking precautions are necessary to ensure that the main rotor blades do not flex downward contacting the tail rotor driveshaft during rotor coast down.

b. To reduce the possibility of main rotor/tailboom contact during engine shutdown, land the helicopter on an upwind heading. During engine shutdown, displace cyclic into the wind, adding cyclic as necessary as rotor rpm decreases.





DANGER AREA

Figure 8-1. Danger Area

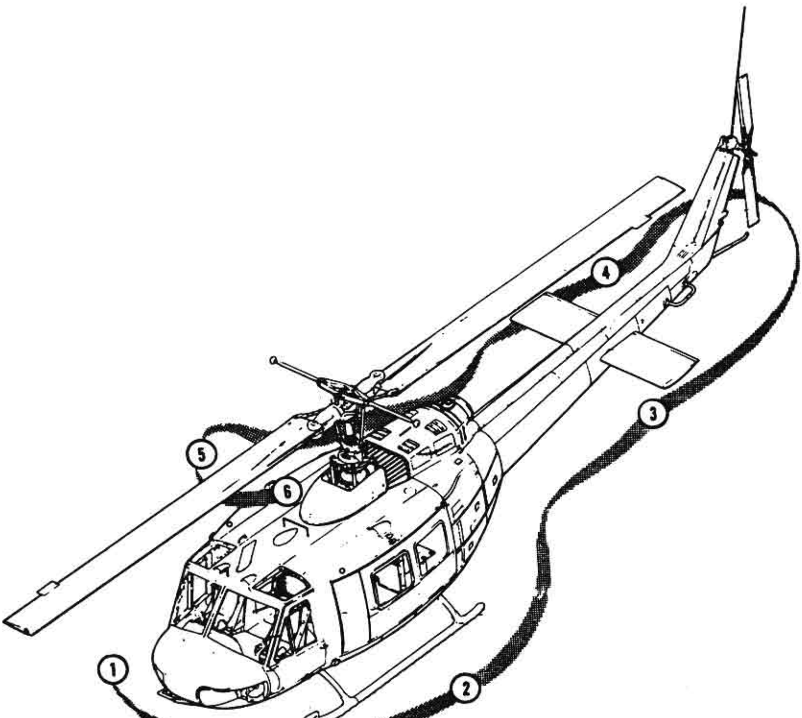


Figure 8-2. Exterior Check Diagram

Chapter 9

Emergency Procedures

Section I. HELICOPTER SYSTEMS

9-1. Helicopter Systems This section describes the helicopter systems emergencies that may reasonably be expected to occur and presents the procedures to be followed. Emergency operation of mission equipment is contained in this chapter insofar as its use affects safety of flight. Emergency procedures are given in checklist form when applicable. A condensed version of these procedures is contained in the condensed checklist TM 55-1520-210-CL.

9-2. Immediate Action Emergency Steps Those steps that must be performed immediately in an emergency situation are underlined. These steps must be performed without reference to the checklist. When the situation permits, non-underlined steps will be accomplished with use of the checklist.

NOTE

The urgency of certain emergencies requires immediate and instinctive action by the pilot. The most important single consideration is aircraft control. All procedures are subordinate to this requirement.

9-3. Definition Of Emergency Terms For the purpose of standardization the following definitions shall apply:

a. The term LAND AS SOON AS POSSIBLE is defined as executing a landing to the nearest suitable landing area without delay. The primary consideration is to assure the survival of occupants.

b. The term LAND AS SOON AS PRACTICABLE is defined as executing a landing to a suitable airfield, heliport, or other landing area as the situation dictates.

c. The term AUTOROTATE is defined as adjusting the flight controls as necessary to establish an autorotational descent. See figure 9-2, FM 1-203, Fundamentals of Flight.

1. Collective adjust as required to maintain rotor rpm.

2. Pedals adjust as required.

3. Throttle adjust as required.

4. Airspeed adjust as required.

d. The term EMER SHUTDOWN is defined as engine stoppage without delay.

1. Throttle—Off.

2 FUEL switches—OFF.

3. BAT switch—OFF.

e. The term EMER GOV OPNS is defined as manual control of the engine RPM with the GOV AUTO/EMER switch in the EMER position. Because automatic acceleration, deceleration, and overspeed control are not provided with the GOV switch in the EMER position, throttle and collective coordinated control movements must be smooth to prevent compressor stall, overspeed, overtemperature, or engine failure.

1. GOV switch—EMER.

2. Throttle-Adjust as necessary to control RPM.

3. Land as soon as possible.

9-4. Emergency Exits Emergency exits are shown in figure 9-1. Emergency exit release handles are yellow and black striped.

a. Cockpit Doors.

(1) Pull handle.

(2) Push door out.

b. Cabin Door Windows.

(1) Pull handle.

(2) Lift window inward.

9-5. Emergency Equipment

WARNING

Toxic fumes of the extinguishing agent may cause injury, and liquid agent may cause frost bite or low-temperature burns.

Refer to figure 9-1 for fire extinguisher and first aid kit locations.

9-6. Minimum Rate of Descent See figure 9-2

9-7. Maximum Glide Distance See figure 9-2

9-8. Engine

9-9. Engine Malfunction-Partial or Complete Power Loss

a. The indications of an engine malfunction, either a partial or a complete power loss are left yaw, drop in engine rpm, drop in rotor rpm, low rpm audio alarm, illumination of the rpm warning light, change in engine noise.

b. Flight characteristics:

(1)—Control response with an engine inoperable is similar to a descent with power.

(2)—Airspeed above the minimum rate of descent values (figures 9-2) will result in greater rates of descent and should only be used as necessary to extend glide distance.

(3)—Airspeeds below minimum rate of descent airspeeds will increase rate of descent and decrease glide distance.

(4)—Should the engine malfunction during a left bank maneuver, right cyclic input to level the aircraft must be made simultaneously with collective pitch adjustment. If the collective pitch is decreased without a corresponding right cyclic input, the helicopter will pitch down and the roll rate will increase rapidly, resulting in a significant loss of altitude.

WARNING

Do not close the throttle. Do not respond to the rpm audio and/or warning light illumination without first confirming engine malfunction by one or more of the other indications. Normal indications signify the engine is functioning properly and that there is a tachometer generator failure or an open circuit to the warning system, rather than an actual engine malfunction.

c. Partial power condition:

Under partial power conditions, the engine may operate relatively smoothly at reduced power or it may operate erratically with intermittent surges of power. In instances where a power loss is experienced without accompanying power surging, the helicopter may sometimes be flown at reduced power to a favorable landing area. Under these conditions, the pilot should always be prepared for a complete power loss. In the event a partial power condition is accompanied by erratic engine operation or power surging, and flight is to be continued, the GOV switch may be moved to the EMER position and throttle adjusted in an attempt to correct the surging condition. If flight is not possible, close the throttle completely and complete an autorotational landing.

d. Complete power loss:

(1) Under a complete power loss condition, delay in recognition of the malfunction, improper technique or excessive maneuvering to reach a suitable landing area reduces the probability of a safe autorotational landing. Flight conducted within the caution area of the height-velocity chart (fig 9-3) exposes the helicopter to a high probability of damage despite the best efforts of the pilot.

(2) From conditions of low airspeed and low altitude, the deceleration capability is limited, and caution should be used to avoid striking the ground with the tail rotor. Initial collective reduction will vary after an engine malfunction dependent upon the altitude and airspeed at the time of the occurrence. For example, collective pitch must not be decreased when an engine failure occurs at a hover in ground effect; whereas, during cruise flight conditions, altitude and airspeed are sufficient for a significant reduction in collective pitch, thereby, allowing rotor rpm to be maintained in the safe operating range during autorotational descent. At high gross weights, the rotor may tend to overspeed and require collective pitch application to maintain the rpm below the upper limit. Collective pitch should never be applied to reduce rpm below normal limits for extending glide distance because of the reduction in rpm available for use during autorotational landing.

NOTE

If time permits, during the autorotative descent, transmit a "May Day" call, set transponder to emergency, jettison external stores, and lock shoulder harness.

9-10. Deleted

9-11. Engine Malfunction—Hover

Autorotate.

9-12. Engine Malfunction—Low Altitude/Low Airspeed or Cruise

1. Autorotate.
2. EMER GOV OPNS

9-13. Engine Restart—During Flight After an engine failure in flight, resulting from a malfunction of fuel control unit, an engine start may be attempted. Because the exact cause of engine failure cannot be determined in flight, the decision to attempt the start will depend on the altitude and time available, rate of descent, potential landing areas, and crew assistance available. Under ideal conditions approximately one minute is required to regain powered flight from time the attempt start is begun. If the decision is made to attempt an in-flight start:

1. Throttle—Off.
2. STARTER GEN switch—START.
3. FUEL switches—ON.
4. GOV switch—EMER.
5. Attempt start.

a. Starter switch—Press.

b. Throttle—Open slowly to 6400 to 6600 rpm as N1 passes through 8 percent. Control rate of throttle application as necessary to prevent exceeding EGT limits.

c. Starter switch—Release as N1 passes through 40 percent. After the engine is started and powered flight is reestablished, continue with manual control. Turn the START FUEL switch OFF and return the STARTER GEN switch to STANDBY.

6. Land as soon as possible.

9-14. Droop Compensator Failure Droop compensator failure will be indicated when engine rpm is no longer controlled by application of collective pitch. The engine will tend to overspeed as collective pitch is decreased and will underspeed as collective pitch is increased. If the droop compensator fails, make minimum collective movements and execute a shallow approach to the landing area. If unable to maintain the operating rpm within limits:

EMER GOV OPNS

9-15. Engine Compressor Stall Engine compressor stall (surge) is characterized by a sharp rumble or loud sharp reports, severe engine vibration and a rapid rise in exhaust gas temperature (EGT) depending on the severity of the surge. Maneuvers requiring rapid or maximum power applications should be avoided. Should this occur:

1. Collective—Reduce.
2. DE-ICE and BLEED AIR switches—OFF.
3. Land as soon as possible.

9-16. Inlet Guide Vane Actuator Failure-Closed or Open

a. *Closed*. If the guide vanes fail in the closed position, a maximum of 20 to 25 psi of torque will be available although N1 may indicate normal. Power applications above 20 to 25 psi will result in deterioration of N2 and rotor rpm while increasing N1. Placing the GOV switch in the EMER position will not provide any increase power capability and increases the possibility of an N1 overspeed and an engine overtemperature. Should a failure occur, accomplish an approach and landing to the ground with torque not exceeding the maximum available. If possible, a running landing is recommended.

b. *Open*. If the inlet guide vanes fail in the open position during normal flight, it is likely that no indications will be evidenced. In this situation, increased acceleration times will be experienced. As power applications are made from increasingly lower N1 settings, acceleration times will correspondingly increase.

9-17. Engine Overspeed Engine overspeed will be indicated by a right yaw, rapid increase in both rotor and engine rpm, rpm warning light illuminated, and an increase in engine noise. An engine overspeed may be caused by a malfunctioning N2 governor or fuel control. Although the initial indications of high N2 rpm and rotor rpm are the same in each case, actions that must be taken to control rpm are distinctly different. If the N2 governor malfunctions, throttle reduction will result in a corresponding decrease in N2 rpm. In the event of a fuel control malfunction, throttle reduction will have no effect on N2 rpm. If an overspeed is experienced:

1. Collective—Increase to load the rotor in an attempt to maintain rpm below the maximum operating limit.

2. Throttle—Reduce until normal operating rpm is attained. Continue with manual throttle control.

If reduction of throttle does not reduce rpm as required:

3. EMER GOV OPNS

9-18. Transmissions, and Drive Systems

9-19. Transmission Oil-Hot or Low Pressure If the transmission oil temperature XMSN OIL HOT caution light illuminates, limits on the transmission oil temperature gage are exceeded; XMSN OIL PRESS caution light illuminates, or limits on the transmission oil pressure gage are exceeded (low or high)—

1. Land as soon as possible.

2. EMER SHUTDOWN— After landing.

WARNING

Engine power must be maintained throughout the approach and landing to aid in preventing seizure of gears in the transmission.

Should transmission oil pressure drop to zero psi, a valid cross reference cannot be made with the oil temperature indicators. The oil temperature gage and transmission oil hot warning lights are dependent on fluid for valid indications.

9-20. Tail Rotor Malfunctions Because the many different malfunctions that can occur, it is not possible to provide a solution for every emergency. The success in coping with the emergency depends on quick analysis of the condition.

9-21. Complete Loss of Tail Rotor Thrust. This situation involves a break in the drive system, such as a severed driveshaft, wherein the tail rotor stops turning or tail rotor controls fail with zero thrust.

a. Indications.

(1) Pedal input has no effect on helicopter trim.

(2) Nose of the helicopter turns to the right (left sideslip).

(3) Roll of fuselage along with the horizontal axis.

(4) Nose down tucking will also be present.

WARNING

At airspeeds below 30 to 40 knots, the sideslip may become uncontrollable, and the helicopter will begin to revolve on the vertical axis.

b. Procedures.

(1) If safe landing area is not immediately available and powered flight is possible, continue flight to a suitable landing area at above minimum rate of descent airspeed. Degree of roll and sideslip may be varied by varying throttle and/or collective.

(2) When landing area is reached, AUTOROTATE using an airspeed above minimum rate of descent airspeed.

(3) If landing area is suitable, touchdown above effective translational lift utilizing throttle as necessary to maintain directional control.

(4) If run-on landing is not possible, start to decelerate at about 75 feet altitude so that forward groundspeed is at a minimum when the helicopter reaches 10 to 20 feet; execute the touchdown with a rapid collective pull just prior to touchdown in a level attitude with minimum groundspeed.

9-22. Fixed Pitch Settings This is a malfunction involving a loss of control resulting in a fixed-pitch

*U.S.Government Printing Office;1989-654-047/81107

setting. Whether the nose of the helicopter yaws left or right is dependent upon the amount of pedal applied at the time of the malfunction. Regardless of pedal setting at the time of malfunction, a varying amount of tail rotor thrust will be delivered at all times during flight.

a. Reduced power (low torque).

(1) Indications: The nose of the helicopter will turn right when power is applied.

(2) Procedure: Reduced power situations:

(a) If helicopter control can be maintained in powered flight, the best solution is to maintain control with power and accomplish a run-on landing as soon as practicable.

(b) If helicopter control cannot be maintained, close the throttle immediately and accomplish an autorotational landing.

b. Increased power (high torque).

(1) Indications: The nose of the helicopter will turn left when power is reduced.

(2) Procedure.

(a) Less than hover power. Maintain control with power and accomplish a run-on landing with greater than normal speed and land as soon as practicable.

(b) Greater than hover power.

1. Maintain control with power and airspeed between 40 and 70 knots.

2. If needed, reduce rpm (not below 6000) to control sideslip.

3. Continue powered flight to a suitable landing area where a run-on landing can be accomplished.

4. On final, reduce rpm to 6000 and accomplish a run-on landing.

c. Hover.

(1) Indication. Helicopter heading cannot be controlled with pedals.

(2) Procedure. Simultaneously reduce throttle and increase collective pitch to land the helicopter.

9-23. Loss of Tail Rotor Components The gravity of this situation is dependent upon the amount of weight lost. Any loss of this nature will result in a forward center of gravity shift, requiring aft cyclic control correction.

a. Indications:

(1) Varying degrees of right yaw depending on power applied and airspeed at time of failure.

(2) Forward CG shift.

b. Procedure:

(1) Enter autorotative descent (power off).

(2) Maintain airspeed above minimum rate of descent airspeed.

(3) If run-on landing is possible, complete autorotation with a touchdown airspeed of between 15 and 25 knots.

(4) If run-on landing is not possible, start to decelerate from about 75 feet altitude, so that forward groundspeed is at a minimum when the helicopter reaches 10 to 20 feet; execute the touchdown with a rapid collective pull just prior to touchdown in a level attitude with minimum ground roll.

9-24. Loss of Tail Rotor Effectiveness This is a situation involving a loss of effective tail rotor thrust without a break in the drive system. The condition is most likely to occur at a hover as a result of two or more of the following:

a. Out-of-ground effect hover.

b. High pressure altitude/high temperature.

c. Adverse wind conditions.

d. Engine/rotor rpm below 6600/324.

e. Improperly rigged tail rotor.

(1) Indications: The first indication of this condition will be a slow starting right turn of the nose of the helicopter which cannot be stopped with full left pedal application. This turn rate will gradually increase until it becomes uncontrollable or, depending upon conditions, the aircraft aligns itself with the wind.

(2) Procedures. Lower collective to regain control and allow the aircraft to touchdown with little if any forward movement.

9-25. Main Driveshaft Failure A failure of the main driveshaft will be indicated by a left yaw (this is caused by the drop in torque applied to the main rotor), increase in engine rpm, decrease in rotor rpm, low rpm audio alarm (unmodified system), and illumination of the rpm warning light. This condition will result in complete loss of power to the rotor and a possible engine overspeed. If a failure occurs:

1. Autorotate.

2. Throttle—Off.

9-26. Clutch Fails to Disengage A clutch failing to disengage in flight will be indicated by the rotor rpm decaying with engine rpm as the throttle is reduced to the engine idle position when entering autorotational descent. This condition results in total loss of autorotational capability. If a failure occurs, do the following:

1. Throttle—On.

2. Land as soon as possible.

9-27. Clutch Fails to Re-engage During recovery from autorotational descent clutch malfunction may occur and will be indicated by a reverse needle split (engine rpm higher than rotor rpm):

1. Autorotate.

2. Throttle—Off.

9-28. Collective Bounce If collective bounce occurs.

1. Relax pressure on collective. (Do not "stiff arm" the collective.)

2. Make a significant collective application either up or down.

3. Increase collective friction.

9-29. Fire The safety of helicopter occupants is the primary consideration when a fire occurs; therefore, it is imperative that every effort be made by the flight crew to put the fire out. On the ground it is essential that the engine be shut down, crew and passengers evacuated and fire fighting begun immediately. If time permits, a "May Day" radio call should be made before the electrical power is OFF to expedite assistance from fire fighting equipment and personnel. If the helicopter is airborne when a fire occurs, the most important single action that can be taken by the pilot is to land the helicopter. Consideration must be given to jettison external stores prior to landing.

9-30. Fire-Engine Start The following procedure is applicable during engine starting if EGT limits are exceeded, or if it becomes apparent that they will be exceeded. Flames emitting from the tailpipe are acceptable if the EGT limits are not exceeded.

1. Start switch—Press. The starter switch must be held until EGT is in the normal operating range.

2. Throttle—Off. The throttle must be closed immediately as the starter switch is pressed.

3. FUEL switches—OFF.

9-31. Fire-Ground

EMER SHUTDOWN

9-32. Fire-Flight If the fire light illuminates and/or fire is observed during flight, prevailing circumstances (such as VFR, IMC, night, altitude, and landing areas available), must be considered in order to determine whether to execute a power-on, or a power-off landing.

a. *Power-On.*

1. Land as soon as possible.

2. EMER SHUTDOWN after landing.

b. *Power-Off.*

1. Autorotate.

2. EMER SHUTDOWN.

9-33. Electrical Fire-Flight Prior to shutting off all electrical power, the pilot must consider the equipment that is essential to a particular flight environment that will be encountered, e.g., flight instruments, and fuel boost pumps. In the event of electrical fire or suspected electrical fire in flight:

1. BAT, STBY, and MAIN GEN switches—OFF

2. Land as soon as possible.

If landing cannot be made soon as possible and flight must be continued, the defective circuits may be identified and isolated as follows:

3. Circuit breakers—Out. As each of the following steps is accomplished, check for indications of the source of the fire.

4. MAIN GEN switch-ON.

5. STARTER GEN switch—STBY GEN.

6. BAT switch-ON.

7. Circuit breakers—In one at a time in the priority required, GEN BUS RESET first. When malfunctioning circuit is identified, pull the applicable circuit breaker out.

9-34. Overheated Battery.

WARNING

Do not open battery compartment or attempt to disconnect or remove overheated battery. Battery fluid will cause burns and overheated battery will cause thermal burns and may explode.

If an overheated battery is suspected or detected:

1. BAT switch—OFF.

2. Land as soon as possible. If condition is corrected, flight may be resumed with battery switch off.

3. EMER SHUTDOWN.

9-35. Smoke and Fume Elimination Smoke and/or toxic fumes entering the cockpit and cabin can be exhausted as follows:

Doors, windows, and vents—Open.

Caution

Do not jettison doors in flight.

9-36. Hydraulic

WARNING

During actual or simulated hydraulic failure, do not pull or push circuit breakers or move the HYD CONT switch during takeoff, nap of the earth flying, approach and landing or while the aircraft is not in level flight. This prevents any possibility of a surge in hydraulic pressure and the resulting loss of control.

9-37. Hydraulic Power Failure Hydraulic power failure will be evident when the force required for control movement increases; a moderate feedback in the controls when moved is felt, and the HYD PRESSURE caution light illuminates. Control movements will result in normal helicopter response in every respect. In the event of hydraulic power failure:

1. Airspeed—Adjust as necessary to attain the most comfortable level of control movements.

2. HYD CONT circuit breaker—Out.

If hydraulic power is not restored:

3. HYD CONT circuit breaker—In.

4. HYD CONT switch—OFF.

5. Land as soon as practicable at an area that will permit a run-on landing with power. Maintain airspeed at or above effective translational lift until touchdown.

9-38. Control Stiffness A failure within the hydraulic irreversible valve may cause stiffness in the flight controls to the extent that controls are extremely hard to move. Should control stiffness occur:

1. HYD CONT switch—OFF then ON.

Check for restoration of normal flight control movements.

Repeat as necessary.

If control response is not restored:

2. HYD CONT switch—Off if normal operation is not restored.

3. Land as soon as practicable at an area that will permit a run-on landing with power. Maintain airspeed at or above effective translational lift until touchdown.

9-39. Cyclic Hardover Cyclic hardover is any erratic movement of the cyclic stick not induced by turbulence or by crew input. During a hydraulics OFF check on the ground, in the event of an irreversible valve failure (hardover), the cyclic stick will move either left rear, right rear, left forward, or right forward, depending on which irreversible fails. In flight with hydraulics ON when a hardover occurs, the cyclic will move left rear, right rear, left forward, or right forward. In flight, with hydraulics OFF (when a hardover occurs), the cyclic will tend to move either right rear or left rear. The cyclic moves toward the rear quadrants due to the main rotor exerting extension forces on the hydraulic servos. A failure in either mode may render the helicopter uncontrollable unless the following corrective action is taken:

1. HYD CONT switch—Select opposite position.

2. Land as soon as practicable at an area that will permit a run-on landing with power. Maintain airspeed at or above effective translational lift at touchdown.

9-40. Fuel System

9-41. Fuel Boost Caution Light Illuminated

a. One Boost Pump. If the fuel pressure gage indicates a drop in pressure and/or one FUEL BOOST caution light illuminates:

Land as soon as practicable.

b. Two Boost Pumps. If the fuel pressure gage indicates zero pressure and/or both FUEL BOOST caution lights illuminate, proceed as follows:

1. FUEL switch – Check ON.

2. Decend to a pressure altitude of 4600 feet or less if possible.

3. Land as soon as practicable.

No attempt should be made to troubleshoot the system while in flight.

9-42. Electrical System

9-43. Main Generator Malfunction A malfunction of the main generator will be indicated by zero indication on the Main Generator Loadmeter and DC GENERATOR caution light illumination. An attempt may be made to put the generator back on line as follows:

1. GEN and BUS RESET circuit breaker—In.

2. MAIN GEN switch—RESET then ON. Do not hold the switch in the RESET POSITION. If the main generator is not restored or if it goes off again:

3. MAIN GEN switch—OFF.

NOTE

Check that the standby generator load-meter is indicating a load. Flight may be continued using the standby generator.

9-44. Landing and Ditching

9-45. Landing in Trees A landing in trees should be made when no other landing area is available. Select a landing area containing the least number of trees of minimum height. Decelerate to a zero ground speed at tree-top level and descend into the trees vertically, applying collective pitch as necessary for minimum rate of descent. Prior to the main rotor blades entering the tree, apply all of the remaining collective pitch.

9-46. Ditching—Power on If it becomes necessary to ditch the helicopter, accomplish an approach to an approximate 3-foot hover above the water and proceed as follows:

1. Cockpit doors—Jettison at a hover.

2. Cabin doors—Open.

3. Crew (except pilot) and passengers—Exit.

4. Hover a safe distance away from personnel.

5. Throttle—Off and autorotate. Apply full collective pitch prior to the main rotor blades entering the water. Maintain a level attitude as the helicopter sinks and until it begins to roll, then apply cyclic in direction of the roll.

6. Pilot—Exit when the main rotor is stopped.

9-47. Ditching-Power Off If ditching is imminent, accomplish engine malfunction emergency procedures. Decelerate to zero forward speed as the helicopter nears the water. Apply all of the collective pitch as the helicopter enters the water. Maintain a level attitude as the helicopter sinks and until it begins to roll, then apply cyclic in the direction of the roll. Exit when the main rotor is stopped.

1. Cockpit and cabin doors—Jettison.

2. Exit when main rotor has stopped.

9-48. Flight Control/Main Rotor System Malfunctions

a. Failure of components within the flight control system may be indicated through varying degrees of feedback, binding, resistance, or sloppiness. These conditions should not be mistaken for hydraulic power failure.

b. Imminent failure of main rotor components may be indicated by a sudden increase in main rotor vibration and/or unusual noise. Severe changes in lift characteristics and/or balance condition can occur due to blade strikes, skin separation, shift or loss of balance weights or other material. Malfunctions may result in severe main rotor flapping. In the even of a main rotor system malfunction, proceed as follows:

WARNING

Danger exists that the main rotor system could collapse or separate from the aircraft after landing. A decision must be made whether occupant egress occurs before or after the rotor has stopped.

1. Land as soon as possible.

2. EMER SHUTDOWN.

9-49. Mast Bumping

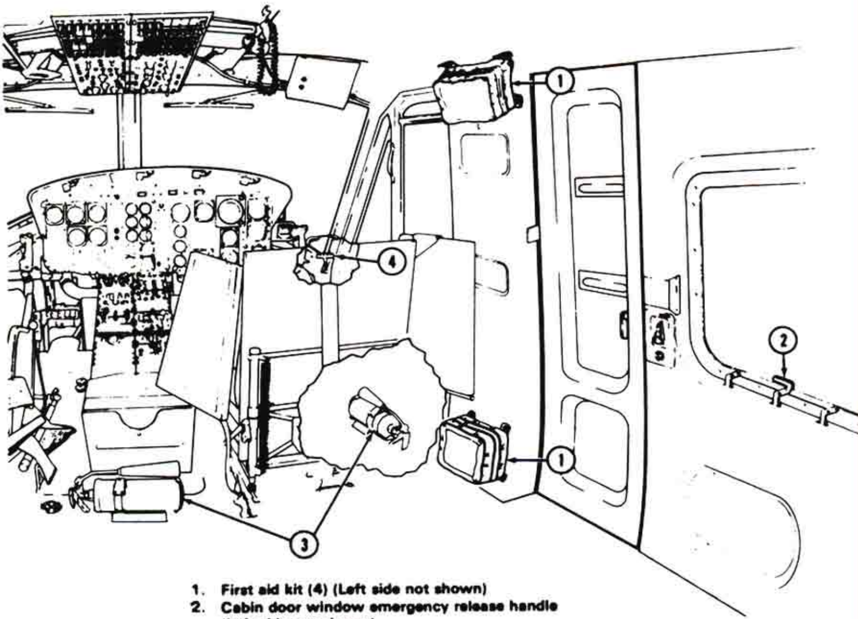
If mast bumping occurs:

1. Reduce severity of maneuver.

2. Land as soon as possible.

Table 9-1 Emergency Procedures for Caution Segments

Light	Corrective Action
MASTER CAUTION	Check the CAUTION panel for the condition. If master caution only (no segment light), land as soon as possible.
AUX FUEL LOW	INT AUX FUEL transfer switches-OFF.
DC GENERATOR	Check GEN AND BUS RESET circuit breaker in MAIN GEN switch RESET then ON. Switch to STBY GEN.
INST INVERTER	Switch to other inverter.
EXTERNAL POWER	Close door.
XMSM OIL PRESS	Land as soon as possible.
XMSM OIL HOT	Land as soon as possible.
ENGINE INLET AIR	Land as soon as practicable.
CHIP DETECTOR	Land as soon as possible.
LEFT FUEL BOOST	Land as soon as practicable.
RIGHT FUEL BOOST	Land as soon as practicable.
20 MINUTE FUEL	Information/System Status
IFF	Information/System Status
ENGINE OIL PRESS	Land as soon as possible.
ENGINE CHIP DET	Land as soon as possible.
GOV EMER	Information/System Status
ENGINE ICE DET	Land as soon as possible.
ENGINE FUEL PUMP	Land as soon as possible.
ENGINE ICING	Land as soon as possible.
FUEL FILTER	Land as soon as practicable.
HYD PRESSURE	Land as soon as practicable.
SPARE	Land as soon as possible.



1. First aid kit (4) (Left side not shown)
2. Cabin door window emergency release handle (Left side not shown)
3. Fire extinguisher (1)
4. Crew door jettison handle (Left side not shown)

Figure 9-1. Emergency Exits and Equipment

AUTOROTATIONAL GLIDE CHARACTERISTICS

POWER OFF

EXAMPLE

WANTED

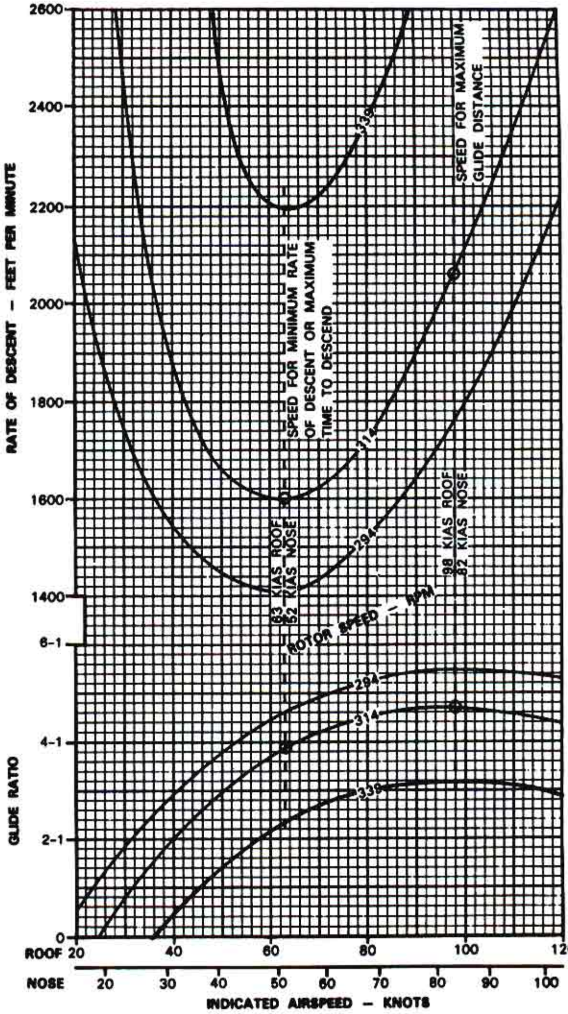
GLIDE RATIO AND RATE OF DESCENT

KNOWN

AIRSPEED = 80 KIAS ROOF
ROTOR RPM = 314

METHOD

ENTER INDICATED AIRSPEED
MOVE UP TO 314 ROTOR RPM LINE
MOVE LEFT, READ GLIDE RATIO.
CONTINUE UP 80 KIAS TO 314 ROTOR RPM LINE ON UPPER GRAPH. MOVE LEFT. READ RATE OF DESCENT.



TED DATA

Figure 9-2. Autorotational Glide Characteristics Chart

*U.S.Government Printing Office;1988-654-047/81046

HEIGHT VELOCITY DIAGRAM

324 ROTOR RPM

EXAMPLE A

WANTED

INDICATED AIRSPEED

KNOWN

GROSS WEIGHT = 8700 LB
SKID HEIGHT ABOVE GROUND = 370 FEET
ROOF MOUNTED SYSTEM

METHOD

ENTER SKID HEIGHT HERE
MOVE RIGHT TO GROSS WEIGHT
MOVE DOWN, READ INDICATED
AIRSPEED = 18 KNOTS

EXAMPLE B

WANTED

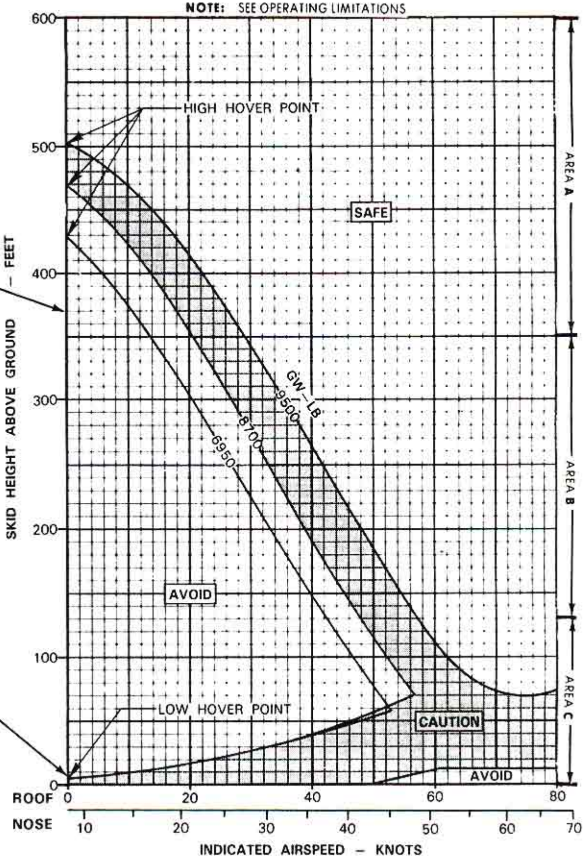
MINIMUM INDICATED AIRSPEED
FOR CLIMBOUT TO AVOID
HEIGHT VELOCITY RESTRICTIONS

KNOWN

GROSS WEIGHT = 8700 LB
LOW HOVER POINT = 5 FEET
SKID HEIGHT ABOVE GROUND
ROOF MOUNTED SYSTEM

METHOD

ENTER SKID HEIGHT HERE
(AT LOW HOVER POINT)
MOVE RIGHT ALONG THE
GROSS WEIGHT LINE
TO THE FASTEST AIRSPEED
MOVE DOWN, READ INDICATED
AIRSPEED = 56.5 KNOTS



DATA BASIS: DERIVED FROM FLIGHT TEST FTC-TDR 67-27, NOVEMBER 1964

Figure 9-3. Height Velocity Diagram

Appendix A
References

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Safety Studies and Reviews of Nuclear Weapon Systems

AR 50-5
Nuclear Surety

AR 70-50
Designating and Naming Military Aircraft, Rockets, and Guided Missiles

AR 95-1
Army Aviation General Provisions and Flight Regulations

AR 95-16
Weight and Balance—Army Aircraft

AR 95-27
Operational Procedures for Aircraft Carrying Dangerous Materials

AR 385-40
Accident Reporting and Records

TB 55-9150-200-24
Engine and Transmission Oils, Fuels and Additives for Army Aircraft

TB MED 501
Noise and Conservation of Hearing

TM 9-1005-224-10
Operators Manual for M60, 7.62-MM Machine Gun (NSN 1005-00-605-7710)

TM 9-1005-224-12
Operator and Organizational Maintenance Manual Including Repair Parts and Special Tool Lists: Machine Gun 7.62-MM M60, and Mount, Tripod, Machine Gun M122

TM 9-1345-201-12
Operators and Organizational Maintenance Manual: Mine Dispersing Subsystem, Aircraft: M56 and M132

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TM 55-1500-342-23
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Functional Users Manual for the Army Maintenance Management System-Aviation (TAMMS-A)

DOD FLIP
DOD Flight Information Publication (Enroute)

FM-1-202
Environmental Flight

FM-1-203
Fundamentals of Flight

FM-1-204
Night Flight Techniques and Procedures

FM-1-240
Instrument Flying and Navigation for Army Aviators

FM 10-68
Aircraft Refueling

FM 10-1101
Petroleum Handling Equipment and Operation

AC
Alternating Current

ADF
Automatic Direction Finder

AGL
Above Ground Level

AI
Attack Imminent

ALT
Alternator

ALT
Altitude/Altimeter

ALTM
Altimeter

AM
Amplitude Modulation

AMP
Ampere

ANT
Antenna

ATTD
Attitude

AUTO
Automatic

AUX
Auxiliary

AVGAS
Aviation Gasoline

BAT
Battery

BDHI
Bearing Distance Heading Indicator

BFO
Beat Frequency Oscillator

BL
Butt Line

BRIL
Brilliance

BRT
Bright

C
Celsius

CARR
Carrier

CAS
Calibrated Airspeed

CCW
Counter Clockwise

CDI
Course Deviation Indicator

CG
Center of Gravity

CL
Centerline

CMPS
Compass

CNVTR
Converter

COLL
Collision

COMM
Communication

COMPT
Compartment

CONT
Control

CONT
Continuous

CONV
Converter

CW
Clockwise

DC
Direct Current

DCP
Dispenser Control Panel

DF
Direction Finding

DECR
Decrease

DELTA Δ
Incremental Change

DET
Detector

DG
Directional Gyro

DIS
Disable

DISP
Dispense

DSCRM
Discriminator

ECM
Electronic Countermeasures

EGT
Exhaust Gas Temperature

ELEC
Electrical

EMER
Emergency

END
Endurance

ENG
Engine

ESS
Essential

EXH
Exhaust

EXT
Extend

EXT
Exterior

F
Fahrenheit

FAT
Free Air Temperature

FITG
Fitting

FM
Frequency Modulation

FOD
Foreign Object Damage

FPS
Feet Per Second

FREQ
Frequency

FS
Fuselage Station

FT
Foot

FT/MIN
Feet Per Minute

FUS
Fuselage

FWD
Forward

ΔF
Increment of Equivalent Flat Plate Drag Area

G
Gravity

G
Guard

GAL
Gallon

GD
Guard

GEN
Generator

GND
Ground

GOV
Governor

GPU
Ground Power Unit

GRWT
Gross Weight

GW
Gross Weight

HDG
Heading

HF
High Frequency

HIT
Health Indicator Test

HTR
Heater

HYD
Hydraulic

IAS
Indicated Airspeed

ICS
Interphone Control Station

IDENT
Identification

IFF
Identification Friend or Foe

IGE
In Ground Effect

IN
Inch

INCR
Increase

IND
Indication/Indicator

INHG
Inches of Mercury

INOP
Inoperative

INST
Instrument

INT
Internal

INT
Interphone

INV
Inverter

INVTR
Inverter

IR
Infrared

IRT
Indicator Receiver Transmitter

ISA
International Standard Atmosphere

KCAS
Knots Calibrated Airspeed

kHz
Kilohertz

KIAS
Knots Indicated Airspeed

km
Kilometer

KTAS
Knots True Airspeed

KN
Knots

kva
Kilovolt-Ampere

kw
Kilowatt

L
Left

LB
Pounds

LDG
Landing

LH
Left Hand

LSB
Lower Sideband

LT
Lights

LTG
Lighting

LTS
Lights

MAG
Magnetic

MAN
Manual

MAX
Maximum

MED
Medium

MHF
Medium-High Frequency

MHz
Megahertz

MIC
Microphone

MIN
Minimum

MIN
Minute

MISC
Miscellaneous

mm
Millimeter

MON
Monitor

MWO
Modification Work Order

NAV
Navigation

NET
Network

NO
Number

NM
Nautical Mile

NON-ESS
Non-Essential

NON-SEC
Non-Secure

NORM
Normal

NVG
Night Vision Goggles

N1
Gas Turbine Speed

N2
Power Turbine Speed

OGE
Out of Ground Effect

PED
Pedestal

PLT
Pilot

PRESS
Pressure

PRGM
Program

PSI
Pounds Per Square Inch

PVT
Private

PWR
Power

QTY
Quantity

% Q
Percent Torque

R
Right

RCVR
Receiver

R/C
Rate of Climb

R/D
Rate of Descent

RDR
Radar

RDS
Rounds

REL
Release

REM
Remote

RETR
Retract

RETRAN
Retransmission

RF
Radio Frequency

RH
Right Hand

RI
Remote Height Indicator

RPM
Revolutions Per Minute

SAM
Surface to Air Missile

SEC
Secondary

SEC
Secure

SEL
Select

SENS
Sensitivity

SL
Searchlight

SOL
Solenoid

SQ
Squelch

SSB
Single Sideband

STA
Station

STBY
Standby

SQ FT
Square Feet

TAS
True Airspeed

TEMP
Temperature

TGT
Turbine Gas Temperature

T/R
Transmit-Receive

TRANS
Transfer

TRANS
Transformer

TRANS
Transmitter

TRQ
Torque

UHF
Ultra-High Frequency

USB
Upper Sideband

VAC
Volts, Alternating Current

VDC
Volts, Direct Current

VHF
Very high Frequency

VM
Volt Meter

VOL
Volume

VOR
Visual Omni Range

VNE
Velocity, Never Exceed (Airspeed Limitation)

WL
Water line

WPN
Weapon

XCVR
Transceiver

XMIT
Transmit

XMTR
Transmitter

XMSN
Transmission

APPENDIX C
TABULAR PERFORMANCE DATA

MAXIMUM HOVER WEIGHT AND TORQUE REQUIRED
LEVEL SURFACE CALM WIND TEMPERATURE
324 ROTOR/6600 ENGINE RPM

PRES ALT FT		FREE AIR TEMPERATURE °C							
		-60	-55	-50	-45	-40	-35	-30	-25
	GW-10LB	915	942	950	950	950	950	950	950
0	Q OGE-PSI	50	50	49	48	47	46	46	46
	Q IGE-PSI	43	43	42	41	40	39	39	38
	GW-10LB	912	939	950	950	950	950	950	950
500	Q OGE-PSI	50	50	49	48	47	47	46	46
	Q IGE-PSI	43	43	42	41	40	39	39	38
	GW-10LB	909	936	950	950	950	950	950	950
1000	Q OGE-PSI	50	50	49	48	47	47	47	46
	Q IGE-PSI	43	43	42	41	40	39	39	39
	GW-10LB	906	934	950	950	950	950	950	950
1500	Q OGE-PSI	50	50	50	48	48	47	47	47
	Q IGE-PSI	43	43	42	41	40	39	39	39
	GW-10LB	903	931	950	950	950	950	950	950
2000	Q OGE-PSI	50	50	50	49	48	47	47	47
	Q IGE-PSI	43	43	42	41	40	40	39	39
	GW-10LB	901	928	950	950	950	950	950	950
2500	Q OGE-PSI	50	50	50	49	48	48	47	47
	Q IGE-PSI	43	43	42	41	40	40	39	39
	GW-10LB	899	926	948	950	950	950	950	950
3000	Q OGE-PSI	50	50	50	49	48	48	48	47
	Q IGE-PSI	43	43	42	41	40	40	39	39
	GW-10LB	896	923	944	950	950	950	950	950
3500	Q OGE-PSI	50	50	50	49	49	48	48	48
	Q IGE-PSI	43	43	42	42	41	40	40	39
	GW-10LB	894	920	941	950	950	950	950	950
4000	Q OGE-PSI	50	50	50	50	49	48	48	48
	Q IGE-PSI	43	43	42	42	41	40	40	40
	GW-10LB	892	918	937	950	950	950	950	950
4500	Q OGE-PSI	50	50	50	50	49	49	49	48
	Q IGE-PSI	43	43	42	42	41	40	40	40
	GW-10LB	890	915	933	946	950	950	950	950
5000	Q OGE-PSI	50	50	50	50	50	49	49	49
	Q IGE-PSI	43	43	42	42	41	41	40	40
	GW-10LB	888	911	928	942	950	950	950	950
5500	Q OGE-PSI	50	50	50	50	50	49	49	49
	Q IGE-PSI	43	43	42	42	41	41	40	40
	GW-10LB	886	908	924	937	946	950	950	950
6000	Q OGE-PSI	50	50	50	50	50	50	50	50
	Q IGE-PSI	43	42	42	42	41	41	41	40
	GW-10LB	883	904	919	932	941	947	950	950
6500	Q OGE-PSI	50	50	50	50	50	50	50	50
	Q IGE-PSI	43	42	42	42	41	41	41	41
	GW-10LB	880	899	915	927	936	942	945	945
7000	Q OGE-PSI	50	50	50	50	50	50	50	50
	Q IGE-PSI	43	42	42	42	41	41	41	40
	GW-10LB	877	895	910	922	931	937	940	940
7500	Q OGE-PSI	50	50	50	50	50	50	50	50
	Q IGE-PSI	43	42	42	42	41	41	41	40
	GW-10LB	873	890	905	917	926	932	935	935
8000	Q OGE-PSI	50	50	50	50	50	50	50	50
	Q IGE-PSI	43	42	42	41	41	41	41	40
	GW-10LB	869	885	900	912	921	927	929	929
8500	Q OGE-PSI	50	50	50	50	50	50	50	50
	Q IGE-PSI	43	42	42	41	41	41	40	40
	GW-10LB	864	880	895	907	916	922	924	921
9000	Q OGE-PSI	50	50	50	50	50	50	50	50
	Q IGE-PSI	43	42	42	41	41	41	40	40
	GW-10LB	860	875	890	902	911	917	917	904
9500	Q OGE-PSI	50	50	50	50	50	50	50	49
	Q IGE-PSI	43	42	42	41	41	41	40	39
	GW-10LB	855	870	884	897	906	910	899	886
10000	Q OGE-PSI	50	50	50	50	50	50	49	48
	Q IGE-PSI	42	42	42	41	41	40	39	39
	GW-10LB	850	865	879	892	900	893	882	869
10500	Q OGE-PSI	50	50	50	50	50	49	48	47
	Q IGE-PSI	42	42	42	41	41	40	39	38
	GW-10LB	845	860	874	886	883	876	865	853
11000	Q OGE-PSI	50	50	50	50	49	48	47	46
	Q IGE-PSI	42	42	41	41	40	39	38	37
	GW-10LB	839	855	869	870	866	859	849	836
11500	Q OGE-PSI	50	50	50	49	48	47	46	45
	Q IGE-PSI	42	42	41	40	39	38	37	36

PRES ALT FT		FREE AIR TEMPERATURE °C							
		-20	-15	-10	-5	0	5	10	15
	GW-10LB	950	950	950	950	950	950	950	950
0	Q OGE-PSI	46	46	46	46	46	46	47	47
	Q IGE-PSI	38	38	38	38	38	38	38	38
	GW-10LB	950	950	950	950	950	950	950	950
500	Q OGE-PSI	46	46	46	46	47	47	47	47
	Q IGE-PSI	38	38	38	38	38	38	38	38
	GW-10LB	950	950	950	950	950	950	950	950
1000	Q OGE-PSI	46	46	46	47	47	47	47	47
	Q IGE-PSI	38	38	38	38	38	38	38	39
	GW-10LB	950	950	950	950	950	950	950	950
1500	Q OGE-PSI	47	47	47	47	47	47	48	48
	Q IGE-PSI	39	39	38	38	39	39	39	39
	GW-10LB	950	950	950	950	950	950	950	950
2000	Q OGE-PSI	47	47	47	47	47	48	48	48
	Q IGE-PSI	39	39	39	39	39	39	39	39
	GW-10LB	950	950	950	950	950	950	950	944
2500	Q OGE-PSI	47	47	47	48	48	48	48	48
	Q IGE-PSI	39	39	39	39	39	39	39	39
	GW-10LB	950	950	950	950	950	950	950	927
3000	Q OGE-PSI	47	48	48	48	48	48	49	47
	Q IGE-PSI	39	39	39	39	39	39	39	38
	GW-10LB	950	950	950	950	950	950	950	910
3500	Q OGE-PSI	48	48	48	48	48	49	49	46
	Q IGE-PSI	39	39	39	39	39	39	39	37
	GW-10LB	950	950	950	950	950	950	932	893
4000	Q OGE-PSI	48	48	48	49	49	49	48	45
	Q IGE-PSI	39	39	39	39	39	39	39	37
	GW-10LB	950	950	950	950	950	950	915	876
4500	Q OGE-PSI	49	49	49	49	49	49	47	45
	Q IGE-PSI	40	40	40	40	40	40	38	36
	GW-10LB	950	950	950	950	950	935	898	859
5000	Q OGE-PSI	49	49	49	49	50	49	46	44
	Q IGE-PSI	40	40	40	40	40	39	37	35
	GW-10LB	950	950	950	950	950	917	881	843
5500	Q OGE-PSI	49	49	50	50	50	48	45	43
	Q IGE-PSI	40	40	40	40	40	38	36	35
	GW-10LB	950	950	950	948	934	900	864	827
6000	Q OGE-PSI	50	50	50	50	49	47	45	42
	Q IGE-PSI	40	40	40	40	39	38	36	34
	GW-10LB	949	947	945	942	916	883	848	811
6500	Q OGE-PSI	50	50	50	50	48	46	44	41
	Q IGE-PSI	40	40	40	40	39	37	35	33
	GW-10LB	944	942	940	927	899	866	831	796
7000	Q OGE-PSI	50	50	50	49	47	45	43	40
	Q IGE-PSI	40	40	40	39	38	36	34	33
	GW-10LB	939	937	932	910	882	850	816	781
7500	Q OGE-PSI	50	50	50	48	46	44	42	40
	Q IGE-PSI	40	40	40	39	37	36	34	32
	GW-10LB	933	931	915	892	865	834	800	766
8000	Q OGE-PSI	50	50	49	47	46	43	41	39
	Q IGE-PSI	40	40	39	38	36	35	33	31
	GW-10LB	928	915	897	875	848	818	785	751
8500	Q OGE-PSI	50	49	48	46	45	43	40	38
	Q IGE-PSI	40	39	38	37	36	34	32	31
	GW-10LB	911	898	880	859	832	802	769	736
9000	Q OGE-PSI	49	48	47	46	44	42	40	37
	Q IGE-PSI	39	39	38	36	35	34	32	30
	GW-10LB	894	880	863	842	816	786	755	722
9500	Q OGE-PSI	48	47	46	45	43	41	39	37
	Q IGE-PSI	39	38	37	36	34	33	31	30
	GW-10LB	877	864	847	826	800	771	740	708
10000	Q OGE-PSI	47	46	45	44	42	40	38	36
	Q IGE-PSI	38	37	36	35	34	32	31	29
	GW-10LB	860	847	830	810	785	756	725	694
10500	Q OGE-PSI	46	46	44	43	41	39	37	35
	Q IGE-PSI	37	36	36	34	33	32	30	28
	GW-10LB	843	831	814	794	769	741	711	681
11000	Q OGE-PSI	45	45	44	42	40	39	37	35
	Q IGE-PSI	36	36	35	34	32	31	29	28
	GW-10LB	827	814	798	778	754	727	697	667
11500	Q OGE-PSI	45	44	43	41	40	39	36	34
	Q IGE-PSI	36	35	34	33	32	30	29	27

PRES ALT FT		FREE AIR TEMPERATURE °C							
		20	25	30	35	40	45	50	55
	GW-10LB	950	946	903	859	816	765	715	663
0	Q OGE-PSI	47	47	44	41	38	35	33	31
	Q IGE-PSI	38	38	36	34	32	30	28	26
	GW-10LB	950	929	886	844	801	751	702	651
500	Q OGE-PSI	47	46	44	41	38	35	33	30
	Q IGE-PSI	38	38	36	34	32	29	27	25
	GW-10LB	950	912	870	828	787	737	689	639
1000	Q OGE-PSI	48	45	43	40	38	35	32	29
	Q IGE-PSI	39	37	35	33	31	29	27	25
	GW-10LB	937	895	854	813	772	724	676	627
1500	Q OGE-PSI	47	44	42	39	37	34	32	29
	Q IGE-PSI	38	36	34	32	30	28	26	24
	GW-10LB	920	879	838	798	758	710	664	615
2000	Q OGE-PSI	46	44	41	39	36	34	31	28
	Q IGE-PSI	37	36	34	32	30	28	26	24
	GW-10LB	903	863	823	783	744	697	651	604
2500	Q OGE-PSI	45	43	40	38	36	33	30	28
	Q IGE-PSI	37	35	33	31	29	27	25	23
	GW-10LB	886	847	807	769	730	684	639	592
3000	Q OGE-PSI	45	42	40	37	35	32	30	27
	Q IGE-PSI	36	34	32	31	29	27	25	23
	GW-10LB	870	831	792	754	716	671	627	581
3500	Q OGE-PSI	44	41	39	37	34	32	29	27
	Q IGE-PSI	35	34	32	30	28	26	24	22
	GW-10LB	853	815	777	740	703	659	615	570
4000	Q OGE-PSI	43	40	38	36	34	31	29	26
	Q IGE-PSI	35	33	31	29	28	26	24	22
	GW-10LB	837	800	763	726	690	646	604	559
4500	Q OGE-PSI	42	40	37	35	33	31	28	26
	Q IGE-PSI	34	32	31	29	27	25	23	22
	GW-10LB	822	785	748	712	677	634	592	549
5000	Q OGE-PSI	41	39	37	35	32	30	28	25
	Q IGE-PSI	33	32	30	28	27	25	23	21
	GW-10LB	806	770	734	699	664	622	581	538
5500	Q OGE-PSI	41	38	36	34	32	29	27	25
	Q IGE-PSI	33	31	29	28	26	24	23	21
	GW-10LB	791	755	720	686	651	610	570	528
6000	Q OGE-PSI	40	37	35	33	31	29	27	24
	Q IGE-PSI	32	30	29	27	26	24	22	20
	GW-10LB	776	741	707	673	639	599	559	518
6500	Q OGE-PSI	39	37	35	33	31	28	26	24
	Q IGE-PSI	32	30	28	27	25	23	22	20
	GW-10LB	761	727	693	660	627	587	549	508
7000	Q OGE-PSI	38	36	34	32	30	28	26	23
	Q IGE-PSI	31	29	28	26	25	23	21	20
	GW-10LB	746	713	680	647	615	576	538	
7500	Q OGE-PSI	37	35	33	31	29	27	25	
	Q IGE-PSI	30	29	27	26	24	22	21	
	GW-10LB	732	699	667	635	603	565	528	
8000	Q OGE-PSI	37	35	33	31	29	27	25	
	Q IGE-PSI	30	28	27	25	24	22	20	
	GW-10LB	718	686	654	623	592	554	518	
8500	Q OGE-PSI	36	34	32	30	28	26	24	
	Q IGE-PSI	29	28	26	25	23	22	20	
	GW-10LB	704	672	641	611	581	544	508	
9000	Q OGE-PSI	35	33	31	30	28	26	24	
	Q IGE-PSI	29	27	26	24	23	21	20	
	GW-10LB	690	659	629	599	569	533		
9500	Q OGE-PSI	35	33	31	29	27	25		
	Q IGE-PSI	28	27	25	24	22	21		
	GW-10LB	677	647	617	588	558	523		
10000	Q OGE-PSI	34	32	30	28	27	25		
	Q IGE-PSI	28	26	25	23	22	20		
	GW-10LB	664	634	605	576	548	513		
10500	Q OGE-PSI	33	31	30	28	26	24		
	Q IGE-PSI	27	26	24	23	22	20		
	GW-10LB	651	621	593	565	537	503		
11000	Q OGE-PSI	33	31	29	27	26	24		
	Q IGE-PSI	26	25	24	22	21	20		
	GW-10LB	638	609	581	554	527			
11500	Q OGE-PSI	32	30	28	27	25			
	Q IGE-PSI	26	25	23	22	21			

- GW-10LB = GW DIVIDED BY 10 LB
Q = TORQUE PSI
IGE = 2 FOOT SKID HEIGH

MAXIMUM HOVER WEIGHT AND TORQUE REQUIRED
LEVEL SURFACE CALM WIND TEMPERATURE
324 ROTOR/6400 ENGINE RPM

PRESS ALT FT		FREE AIR TEMPERATURE °C							
		-60	-55	-50	-45	-40	-35	-30	-25
12000	GW–10LB	804	850	853	853	849	842	832	820
	Q OGE–PSI	50	50	49	48	47	48	45	44
	Q IGE–PSI	43	42	41	39	38	37	37	36
12500	GW–10LB	828	833	836	836	833	826	816	804
	Q OGE–PSI	50	49	48	47	46	45	44	43
	Q IGE–PSI	43	41	40	39	38	37	36	35
13000	GW–10LB	812	817	819	820	816	809	800	788
	Q OGE–PSI	49	48	47	46	45	44	43	43
	Q IGE–PSI	41	40	39	38	37	36	35	34
13500	GW–10LB	796	801	803	803	800	793	784	772
	Q OGE–PSI	48	47	46	45	44	43	43	42
	Q IGE–PSI	41	40	38	37	36	35	34	34
14000	GW–10LB	778	782	785	785	781	775	765	753
	Q OGE–PSI	47	46	45	44	43	42	43	41
	Q IGE–PSI	40	39	37	36	35	34	34	33
14500	GW–10LB	761	765	768	768	764	758	748	737
	Q OGE–PSI	46	45	44	43	42	41	41	40
	Q IGE–PSI	38	38	37	35	35	34	33	32
15000	GW–10LB	745	749	751	751	748	741	732	721
	Q OGE–PSI	45	44	43	42	41	41	40	39
	Q IGE–PSI	38	37	36	35	34	33	32	31

PRESS ALT FT		FREE AIR TEMPERATURE °C							
		-20	-15	-10	-5	0	5	10	15
12000	GW–10LB	811	798	783	762	739	712	683	654
	Q OGE–PSI	44	43	42	41	39	37	35	33
	Q IGE–PSI	35	34	33	32	31	30	28	27
12500	GW–10LB	795	783	767	748	724	698	669	641
	Q OGE–PSI	43	42	41	40	38	36	34	33
	Q IGE–PSI	34	34	33	32	31	29	28	26
13000	GW–10LB	779	767	752	733	710	684	656	628
	Q OGE–PSI	42	41	40	39	37	36	34	32
	Q IGE–PSI	34	33	32	31	30	29	27	26
13500	GW–10LB	762	751	736	718	695	670	642	615
	Q OGE–PSI	41	40	39	38	37	35	33	31
	Q IGE–PSI	33	32	31	30	29	28	27	25
14000	GW–10LB	745	733	718	700	678	653	626	599
	Q OGE–PSI	40	39	38	37	36	34	32	30
	Q IGE–PSI	32	31	31	30	29	27	26	25
14500	GW–10LB	728	717	703	685	663	639	612	586
	Q OGE–PSI	39	38	37	36	35	33	31	30
	Q IGE–PSI	31	31	30	29	28	27	25	24
15000	GW–10LB	712	701	687	669	648	624	598	572
	Q OGE–PSI	38	37	37	35	34	32	31	29
	Q IGE–PSI	31	30	29	28	27	26	25	23

PRESS ALT FT		FREE AIR TEMPERATURE °C							
		20	25	30	35	40	45	50	55
12000	GW–10LB	625	597	570	543	516			
	Q OGE–PSI	31	30	28	26	25			
	Q IGE–PSI	25	24	23	22	20			
12500	GW–10LB	612	585	558	532	506			
	Q OGE–PSI	31	29	27	26	24			
	Q IGE–PSI	25	24	22	21	20			
13000	GW–10LB	600	573	547	521				
	Q OGE–PSI	30	28	27	25				
	Q IGE–PSI	24	23	22	21				
13500	GW–10LB	588	561	536	511				
	Q OGE–PSI	29	28	26	25				
	Q IGE–PSI	24	23	21	20				
14000	GW–10LB	573	547	522					
	Q OGE–PSI	29	27	26					
	Q IGE–PSI	23	22	21					
14500	GW–10LB	560	535	510					
	Q OGE–PSI	28	26	25					
	Q IGE–PSI	23	22	20					
15000	GW–10LB	547	523						
	Q OGE–PSI	27	26						
	Q IGE–PSI	22	21						

MAXIMUM TORQUE AVAILABLE — 30 MINUTE LIMIT
ANTI-ICE OFF BLEED AIR HEATER OFF
324 ROTOR/6400 ENGINE RPM

PRESS ALT FT	FREE AIR TEMPERATURE C					
	0.0	+10	+20	+30	+40	+50
0	50.0	50.0	49.8	44.3	39.1	33.4
500	50.0	50.0	48.9	43.5	38.4	32.8
1000	50.0	50.0	48.0	42.7	37.7	32.2
1500	50.0	50.0	47.2	41.9	37.0	31.6
2000	50.0	50.0	46.3	41.1	36.3	31.0
2500	50.0	50.0	45.4	40.4	35.6	30.4
3000	50.0	49.9	44.6	39.6	35.0	29.8
3500	50.0	49.0	43.7	38.9	34.3	29.3
4000	50.0	48.0	42.9	38.1	33.7	28.7
4500	50.0	47.1	42.1	37.4	33.0	28.2
5000	50.0	46.2	41.3	36.7	32.4	27.6
5500	50.0	45.4	40.5	36.0	31.8	27.1
6000	49.2	44.5	39.7	35.3	31.2	26.6
6500	48.2	43.7	39.0	34.6	30.6	26.1
7000	47.3	42.8	38.2	34.0	30.0	25.6
7500	46.4	42.0	37.5	33.3	29.4	25.1

PRESS ALT FT	FREE AIR TEMPERATURE °C					
	0.0	+10	+20	+30	+40	+50
8000	45.5	41.2	36.8	32.7	28.9	24.6
8500	44.7	40.4	36.0	32.1	28.3	24.2
9000	43.8	39.6	35.3	31.4	27.8	23.7
9500	43.0	38.8	34.7	30.8	27.2	23.2
10000	42.1	38.1	34.0	30.2	26.7	22.8
10500	41.3	37.3	33.3	29.6	26.2	22.4
11000	40.5	36.6	32.7	29.1	25.7	21.9
11500	39.7	35.9	32.0	28.5	25.2	21.5
12000	38.9	35.1	31.4	27.9	24.7	21.1
12500	38.1	34.4	30.7	27.3	24.2	20.7
13000	37.3	33.7	30.1	26.8	23.7	20.3
13500	36.6	33.0	29.5	26.2	23.2	19.9
14000	35.6	32.1	28.7	25.5	22.6	19.3
14500	34.8	31.4	28.0	24.9	22.1	18.9
15000	33.9	30.6	27.3	24.3	21.6	18.4

PRESS ALT FT	FREE AIR TEMPERATURE C					
	-50	-40	-30	-20	-10	0.0
0	50.0	50.0	50.0	50.0	50.0	50.0
500	50.0	50.0	50.0	50.0	50.0	50.0
1000	50.0	50.0	50.0	50.0	50.0	50.0
1500	50.0	50.0	50.0	50.0	50.0	50.0
2000	50.0	50.0	50.0	50.0	50.0	50.0
2500	50.0	50.0	50.0	50.0	50.0	50.0
3000	50.0	50.0	50.0	50.0	50.0	50.0
3500	50.0	50.0	50.0	50.0	50.0	50.0
4000	50.0	50.0	50.0	50.0	50.0	50.0
4500	50.0	50.0	50.0	50.0	50.0	50.0
5000	50.0	50.0	50.0	50.0	50.0	50.0
5500	50.0	50.0	50.0	50.0	50.0	50.0
6000	50.0	50.0	50.0	50.0	50.0	49.2
6500	50.0	50.0	50.0	50.0	50.0	48.2
7000	50.0	50.0	50.0	50.0	50.0	47.3
7500	50.0	50.0	50.0	50.0	49.9	46.4

PRESS ALT FT	FREE AIR TEMPERATURE °C					
	-50	-40	-30	-20	-10	0.0
8000	50.0	50.0	50.0	50.0	48.9	45.5
8500	50.0	50.0	50.0	50.0	48.0	44.7
9000	50.0	50.0	50.0	49.1	47.1	43.8
9500	50.0	50.0	49.8	48.2	46.2	43.0
10000	50.0	50.0	48.9	47.3	45.3	42.1
10500	50.0	50.0	48.0	46.6	44.4	41.3
11000	50.0	49.0	47.1	45.5	43.5	40.5
11500	50.0	48.1	46.2	44.6	42.7	39.7
12000	49.0	47.1	45.3	43.7	41.8	38.9
12500	48.1	46.2	44.4	42.8	41.0	38.1
13000	47.1	45.3	43.5	42.0	40.2	37.3
13500	46.2	44.4	42.6	41.1	39.3	36.6
14000	45.1	43.3	41.5	40.0	38.3	35.6
14500	44.1	42.3	40.6	39.1	37.4	34.8
15000	43.1	41.4	39.6	38.2	36.5	33.9

This index is organized alphabetically by paragraph number topics.

The Metric System and Equivalents

Linear Measure

1 centimeter = 10 millimeters = .39 inch
1 decimeter = 10 centimeters = 3.94 inches
1 meter = 10 decimeters = 39.37 inches
1 dekameter = 10 meters = 32.8 feet
1 hectometer = 10 dekameters = 328.08 feet
1 kilometer = 10 hectometers = 3,280.8 feet

Weights

1 centigram = 10 milligrams = .15 grain
1 decigram = 10 centigrams = 1.54 grains
1 gram = 10 decigram = .035 ounce
1 dekagram = 10 grams = .35 ounce
1 hectogram = 10 dekagrams = 3.52 ounces
1 kilogram = 10 hectograms = 2.2 pounds
1 quintal = 100 kilograms = 220.46 pounds
1 metric ton = 10 quintals = 1.1 short tons

Liquid Measure

1 centiliter = 10 milliters = .34 fl. ounce
1 deciliter = 10 centiliters = 3.38 fl. ounces
1 liter = 10 deciliters = 33.81 fl. ounces
1 dekaliter = 10 liters = 2.64 gallons
1 hectoliter = 10 dekaliters = 26.42 gallons
1 kiloliter = 10 hectoliters = 264.18 gallons

Square Measure

1 sq. centimeter = 100 sq. millimeters = .155 sq. inch
1 sq. decimeter = 100 sq. centimeters = 15.5 sq. inches
1 sq. meter (centare) = 100 sq. decimeters = 10.76 sq. feet
1 sq. dekameter (are) = 100 sq. meters = 1,076.4 sq. feet
1 sq. hectometer (hectare) = 100 sq. dekameters = 2.47 acres
1 sq. kilometer = 100 sq. hectometers = .386 sq. mile

Cubic Measure

1 cu. centimeter = 1000 cu. millimeters = .06 cu. inch
1 cu. decimeter = 1000 cu. centimeters = 61.02 cu. inches
1 cu. meter = 1000 cu. decimeters = 35.31 cu. feet

Approximate Conversion Factors

To change	*To*	*Multiply by*
inches	centimeters	2.540
feet	meters	.305
yards	meters	.914
miles	kilometers	1.609
square inches	square centimeters	6.451
square feet	square meters	.093
square yards	square meters	.836
square miles	square kilometers	2.590
acres	square hectometers	.405
cubic feet	cubic meters	.028
cubic yards	cubic meters	.765
fluid ounces	milliliters	29,573
pints	liters	.473
quarts	liters	.946
gallons	liters	3.785
ounces	grams	28.349
pounds	kilograms	.454
short tons	metric tons	.907
pound-feet	newton-meters	1.356
pound-inches	newton-meters	.11296

To change	*To*	*Multiply by*
ounce-inches	newton-meters	.007062
centimeters	inches	.394
meters	feet	3.280
meters	yards	1.094
kilometers	miles	.621
square centimeters	square inches	.155
square meters	square feet	10.764
square meters	square yards	1.196
square kilometers	square miles	.386
square hectometers	acres	2.471
cubic meters	cubic feet	35.315
cubic meters	cubic yards	1.308
milliliters	fluid ounces	.034
liters	pints	2.113
liters	quarts	1.057
liters	gallons	.264
grams	ounces	.035
kilograms	pounds	2.205
metric tons	short tons	1.102

Temperature (Exact)

°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

By Order of the Secretary of the Army:

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

Official:

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

DISTRIBUTION:

To be distributed in accordance with DA Form 12-31, -10 & CL Maintenance requirements for UH-1H Helicopter, Utility and UH-1V Helicopter, Utility.

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TEAR ALONG PERFORATED LINE

RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL PUBLICATIONS

SOMETHING WRONG WITH THIS PUBLICATION?

FROM: (PRINT YOUR UNIT'S COMPLETE ADDRESS)
PFC JOHN DOE
COA, 3d ENGINEER BN
FT. LEONARDWOOD, MO 63108

DATE SENT

PUBLICATION NUMBER	PUBLICATION DATE	PUBLICATION TITLE
TM 55-1520-210-10	15 Feb 88	Operator's Manual UH-1H/V Helicopter

BE EXACT. . PIN-POINT WHERE IT IS

PAGE NO	PARA-GRAPH	FIGURE NO	TABLE NO	IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:
6	2-1 a			In line 6 of paragraph 2-1a the manual states the engine has 6 cylinders. The engine on my set only has 4 cylinders. Change the manual to show 4 Cylinders.
81		4-3		Callout 16 on figure 4-3 is pointing at a bolt. In key to figure 4-3, item 16 is called a shim - Please correct one or the other.
125	line 20			I ordered a gasket, item 19 on figure B-16 by NSN 2910-00-762-3001. I got a gasket but it doesn't fit. Supply says I got what I ordered, so the NSN is wrong. Please give me a good NSN

PRINTED NAME, GRADE OR TITLE, AND TELEPHONE NUMBER
JOHN DOE, PFC (268) 317-7111

SIGN HERE John Doe
JOHN DOE

DA FORM 1 JUL 79 2028-2

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DRSTS-M Overprint 1, 1 Nov 80

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