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LIST OF ILLUSTRATIONS

CHAPTER 1

INTRODUCTION

Section I. SCOPE

INPORTANT

In order to obtain complete information and derive maximum benefits from this manual, it is necessary to read this chapter carefully and thoroughly.

1-1. Purpose.

This manual, issued expressly for operators, is an official document for Army Models AH-1G and TH-1G helicopters, serial No. 66-15247 through 66-15357, 67-15450 through 67-15869, 68-15000 through 68-15213, 68-17020 through 68-17113, 69-16410 through 69-16447, 70-15936 through 70-16105, and 71-20983 through 71-21052.

The purpose of this manual is to supply you with the latest information and performance data derived from flight test programs and operational experiences. The study and use of this manual will enable you to perform the assigned missions and duties with maximum efficiency and safety. Your ability and experience are recognized. It is not the function of this manual to teach the pilot how to fly; basic flight principles and elementary instructions are not included. The contents of this manual will provide you with a general knowledge of Army Models AH-1G and TH-1G helicopters their flight characteristics and specific normal and emergency operating procedures.

a. Reports. Reports necessary to comply with the Army Safety Program are prescribed in detail in AR 385-40.

b. Forms. DA forms and procedures used for equipment maintenance will be only those prescribed by TM 38-750.

c. Equipment. Equipment serviceability criteria applicable to Army Model AH-1G aircraft are presented in TM 55-1520-221-ESC.

Section II. DISTRIBUTION, REVISION AND IMPROVEMENTS

1-2. Distribution and Revision System.

a. Distribution, revision, and mandatory requirements are accomplished in accordance with AR 310-1.

b. Authorization for issue is accomplished in accordance with AR 310-1.

1-3. Reporting of Improvements.

Report of errors, omissions, and recommendations for improving this publication by the individual user is encouraged. Reports should be submitted on DA Form 2028 (Recommended Changes to Publications and Blank Forms) and forwarded direct to: Commanding General, U.S. Army Aviation Systems Command, ATTN: AMSAV-FR, P.O. Box 209, St. Louis, Mo. 63166.

1-4. Definitions.

Warnings, cautions, and notes are used to emphasize important and critical instructions for the following conditions:

WARNING

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

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.

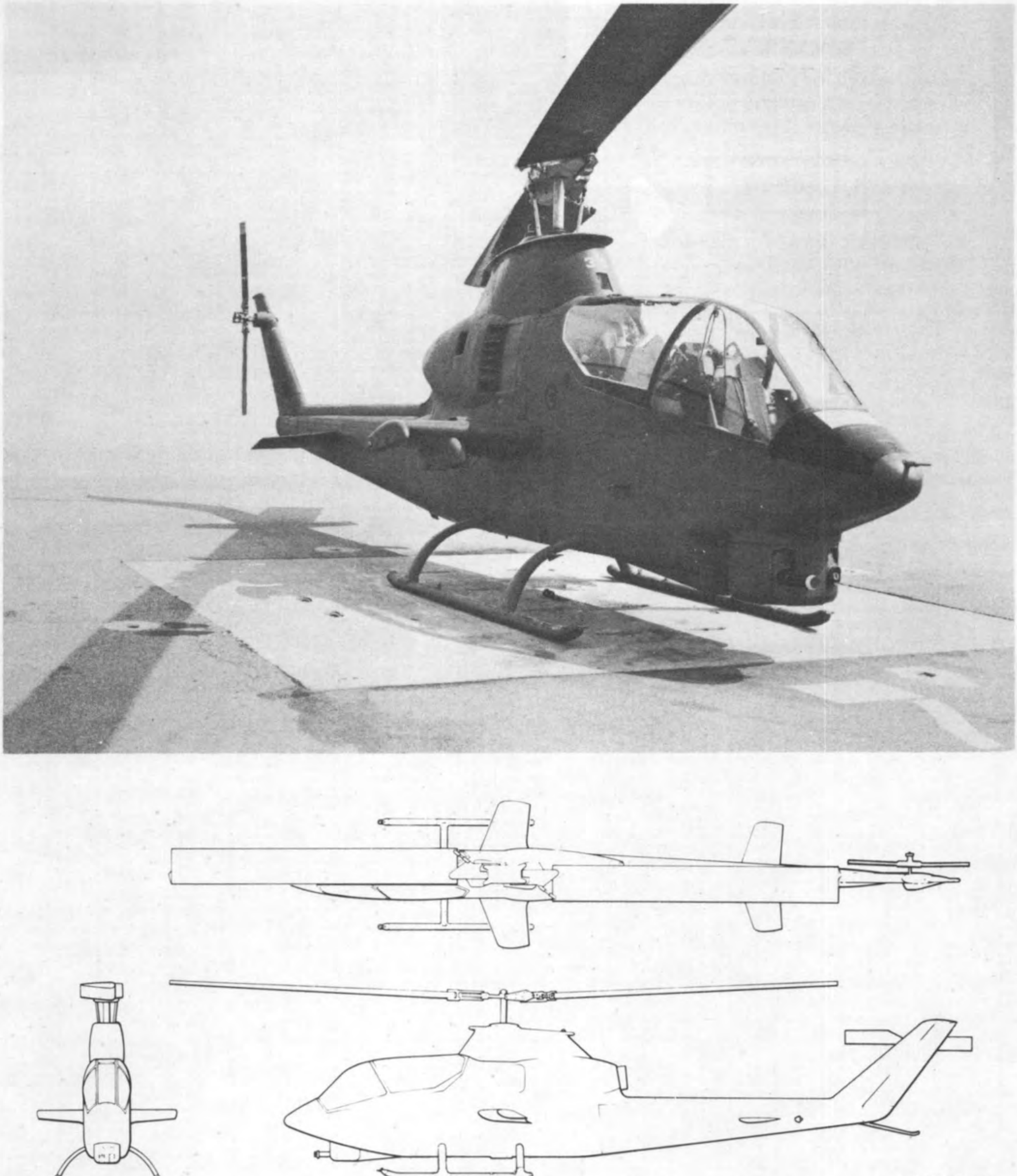


Figure 1-1. AH-1G Helicopter

CHAPTER 2

DESCRIPTION

Section I. INTRODUCTION

2-1. General.

The purpose of this chapter is to describe the helicopter, all its systems and controls which contribute to the physical act of flying the helicopter. Included in this chapter is all the emergency equipment that is not part of the auxiliary system. Operational procedures are covered in the applicable chapters of this manual. Data on the dual trainer is provided in paragraph 2-34.

Section II. AIRCRAFT SYSTEMS AND CONTROLS DESCRIPTION

2-2. General Configuration And Arrangement.

a. The AH-1G attack helicopter is a tandem, two-place, high speed conventional helicopter. The distinctive features are the very narrow sleek fuselage, small tapered swept mid-wings, and integral chin turret. The maximum fuselage width is 38.62 inches. This helicopter is capable of operating from unprepared operational areas, day or night. The gross weight for takeoff is 9500 pounds based on an International Congress of Aero Organization (ICAO) Standard day (29.92 inches of mercury 15°C at sea level). It can be navigated by the use of radio aids. Visibility is afforded by the large transparent plastic panels that cover the upper portion of the crew compartment (figure 2-1).

b. The TH-1G helicopter is the basic AH-1G with MWO 55-1520-221-30/6 and MWO 55-1520-221-30/7 incorporated. These modifications allow the instructor pilot to fly in the gunners seat and have the same mechanical advantage of flight controls as the student pilot. Additional instruments are provided on the gunners instrument panel (figure 2-30).

2-3. Typical Armament Configurations.

The armament configuration of the AH-1G consists of the M28 nose turret and various wing stores arrangements described in Chapter 12, Loading Data. Depending on weight and aerodynamic drag, the helicopter will conform to the loading configurations indicated in Chapter 6. Helicopters serial number 68-15000 and subsequent also have provisions for smoke grenade dispensers on the outboard wing stores.

2-4. Armor Protection.

The armor protection (figure 2-2) is a combination of ceramic and fiberglass composite with a small amount of armor steel.

a. Crew Protection.

(1) Pilot. The pilots seat is made of armor steel. The fixed side panels are made of a ceramic-fiberglass composite material.

(2) Gunner. The entire passive defense system for the gunner is made of a ceramic-fiberglass composite material.

b. Component Protection.

(1) Engine Compressor Section and Fuel Control. Armor plate is located on each side of the engine to protect the engine compressor and fuel control.

(2) Non-Crashworthy Fuel System.

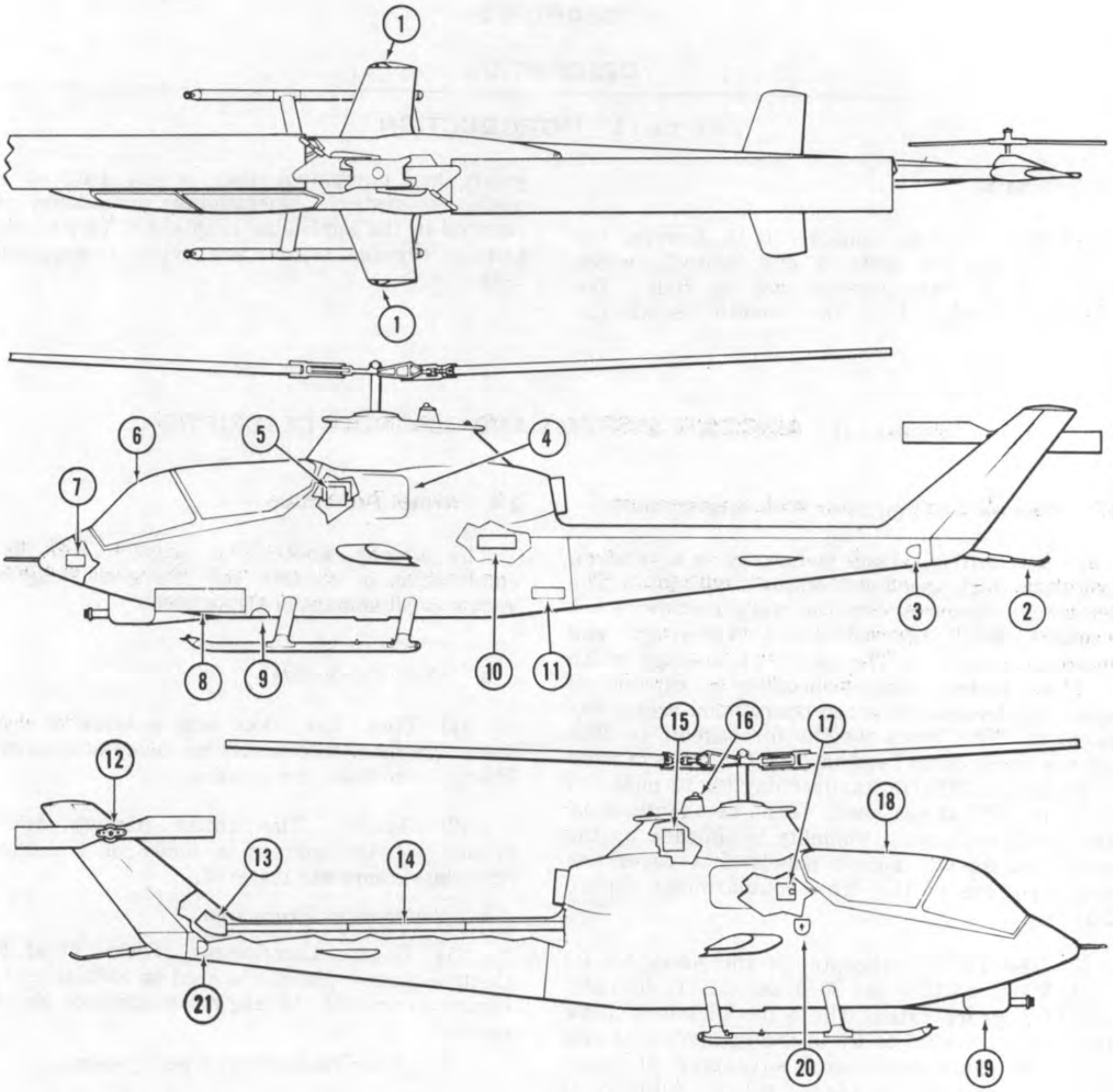
(*a*) Fuel Cells. The top sections are not self-sealing. The center section is self-sealing to a 30 caliber projectile. The lower section is self-sealing to a 50 caliber.

(*b*) Fuel Crossover Line. The line is self-sealing.

(3) Crashworthy Fuel System.

(*a*) Fuel cells. All sections are self-sealing to a 50 caliber.

(*b*) Fuel Crossover Line. The line is self-sealing.



1. Wing Tip Position Lights
2. Tail Skid
3. Tail Light
4. Engine Air Inlet & Inlet Screens
5. Hydraulic Reservoir
6. Gunners Canopy Door
7. Battery (Forward Position)
8. Ammunition Compartment
9. Searchlight
10. Engine and Transmission Oil Cooler
11. Battery (Aft Location)
12. 90 Degree Gearbox
13. 42 Degree Gearbox
14. Tail Rotor Driveshaft
15. Engine Oil Tank
16. Anti-Collision Light
17. Hydraulic Reservoir
18. Pilots Canopy Door
19. M-28 Turret
20. Fuel Filler Cap
21. Tail Light

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AV 089666

Figure 2-1. General configuration

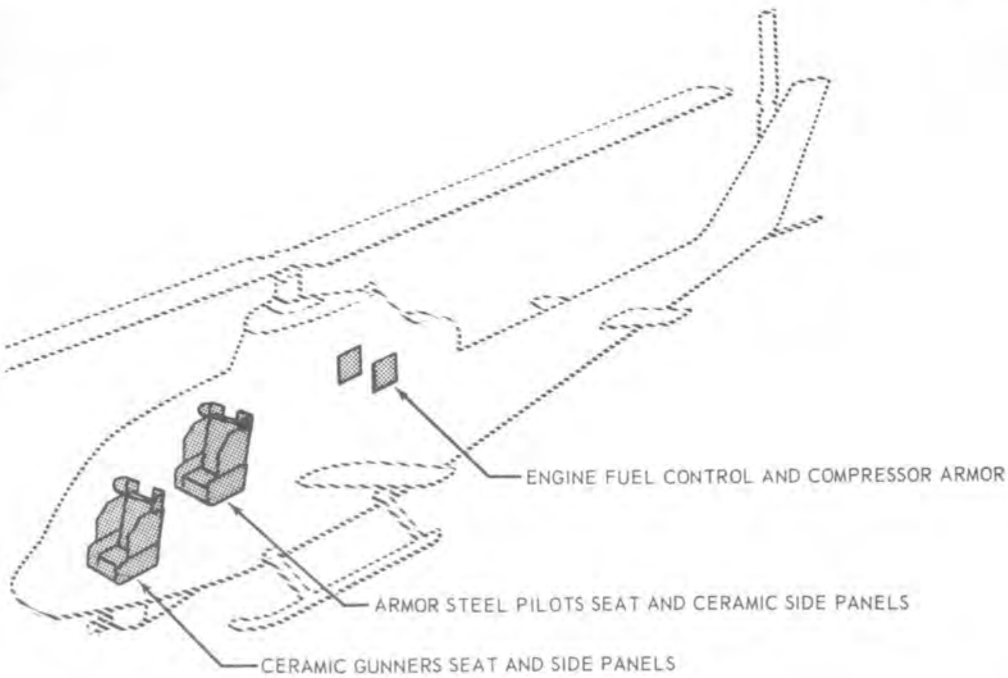


Figure 2-2. Armor protection

2-5. Airframe Configuration.

The airframe is an aerodynamically clean narrow structure that is configured around the armament mission, aircrew, and weapons to deliver firepower and consists of the fuselage and the tailboom. The forward section consists of two structural beams that are boxed to form a very stiff fuselage.

a. Fuselage. Honeycomb panel skins and two main beams of aluminum honeycomb sandwich construction, which extend from the nose attachment aft to the tailboom, provide the basic fuselage structure. The beams are 20 inches apart in the forward section, are canted outboard aft of the cockpit area, then become the slab-contoured sides of the fuselage from the pylon support area to the tailboom. Flush riveting is employed through the fuselage. The honeycomb panels are used to provide maximum inside space. All main load producing components (transmission, tailboom, landing gear, wings, and turreted weapons) are attached directly or indirectly to the main beam structure. The fuel cells are supported and protected by the beams in the area of the pylon.

b. Tailboom. The tailboom is a semi-monocoque structure with metal covering and attaches to the forward fuselage section with bolts to allow easy removal for repair or replacement. The rear of the tailboom supports the tail rotor, vertical fin, and synchronized elevator.

c. Landing Gear. The landing gear consists of cross tubes, skid tubes and skid shoes. The cross tubes are two lateral mounted arched tubes that are closed in fairings which are attached to two longitudinal skid tubes. The longitudinal skid tubes are provided with full length skid shoes. The landing gear structure members are made of formed aluminum alloy tubing.

NOTE

The helicopter can be flown without the fairings installed but limitations as specified in Chapter 7 must be observed.

d. Crew Compartment. The upper forward section of the fuselage is the crew compartment. Tandem seating is provided with the pilot elevated in the rear seat. The gunner sits forward in the single contour bubble enclosure to provide maximum visibility for observation and weapon direction. The pilots forward visibility is limited, but excellent in all other quadrants. The gunners cockpit has a 45° windshield which extends aft and contours over the pilots head. The center windshield panel is continuous from the nose, thus having no horizontal break line to distract the pilots vision. The windshield is stretched acrylic plastic.

2-6. Crew Configurations.

CAUTION

A minimum weight for each crew station is 170 pounds or equivalent loading.

The crew shall consist of the pilot and gunner or the pilot.

2-7. Wing Configuration.

The short swept back mid wing provides support for external stores. The airfoil is tapered and has a main root chord of 30 inches and a span of 10 feet 4 inches. The wing is cantilevered from the airframe. Each wing has two hard point locations for external stores. Each inboard hard point location is limited to 690 pounds and each outboard hard point location is limited to 550 pounds.

2-8. Principal Dimensions — Maximum.

Maximum dimensions of the helicopter are shown in figure 2-3.

2-9. Weights.

Refer to Chapter 12, Weight and Balance Computation.

2-10. Cooling System.

a. Engine Compartment. Engine compartment cooling is achieved by augmenting the air source through the compartment by an ejector on the tailpipe and by inducing and routing the flow of air to most efficiently cool the area. The engine compartment airflow is shown in figure 2-4. Air is introduced to the upper engine compartment through inlets located in the engine cowling. It is then routed down over the engine and aft to the ejector. The ejector draws compartment air around and beyond the tailpipe, thus enclosing the exhaust.

b. Transmission Compartment. Transmission compartment cooling (figure 2-4) is achieved by air from openings in and around the top of pylon fairing. The air is routed through the transmission compartment and through the tail rotor driveshaft cover (below the engine) to the outlet that is located in the lower aft area of the tailpipe fairing.

2-11. Propulsion System.

The propulsion system consists of the engine and drive system and is located aft of the cabin and mounted in the fuselage on a platform. The engine and drive system are enclosed by cowling that can be quickly opened or removed for easy access. This drive system with its independently mounted units and quick-disconnect couplings, allows rapid servicing and repair or replacement under combat conditions without use of special tools or ground equipment.

a. Engine. The turbine engine (figure 2-5) and its accessories are located aft of the transmission and mounted on a platform deck to provide maximum accessibility for servicing and maintenance. The complete engine and power transfer system is enclosed in an easily opened or quickly removable lightweight cowling. The engine consists of five major sections which are the inlet, compressor, diffuser, combustor, and exhaust. The compressor consists of five axial stages and one centrifugal impeller. The gas producer turbine drives the compressor and the power turbine drives the power shaft. The power shaft extends coaxially through the compressor rotor and drives the reduction gearing at the forward end of the engine. Power is extracted through an internally-splined output gear shaft driven by the reduction gearing. The through shaft arrangement permits mounting the accessory drives and power takeoffs on the inlet housing at the cool end of the engine, thus avoiding problems of a hot end drive. The acceleration airbleed system in conjunction with variable inlet guide vane system improves engine performance during starts and acceleration. Bleed air supply is extracted from the outlet side of the engine diffuser. The free-power turbine eliminates the need of a clutch and provides smooth and trouble-free engagement of the drive system. The T53-L-13 series engine's sea level static uninstalled military rated power equals 1400 shaft horsepower. However, in this installation, engine is torque-limited to 50 psi torque for military and normal power at 6600 rpm.

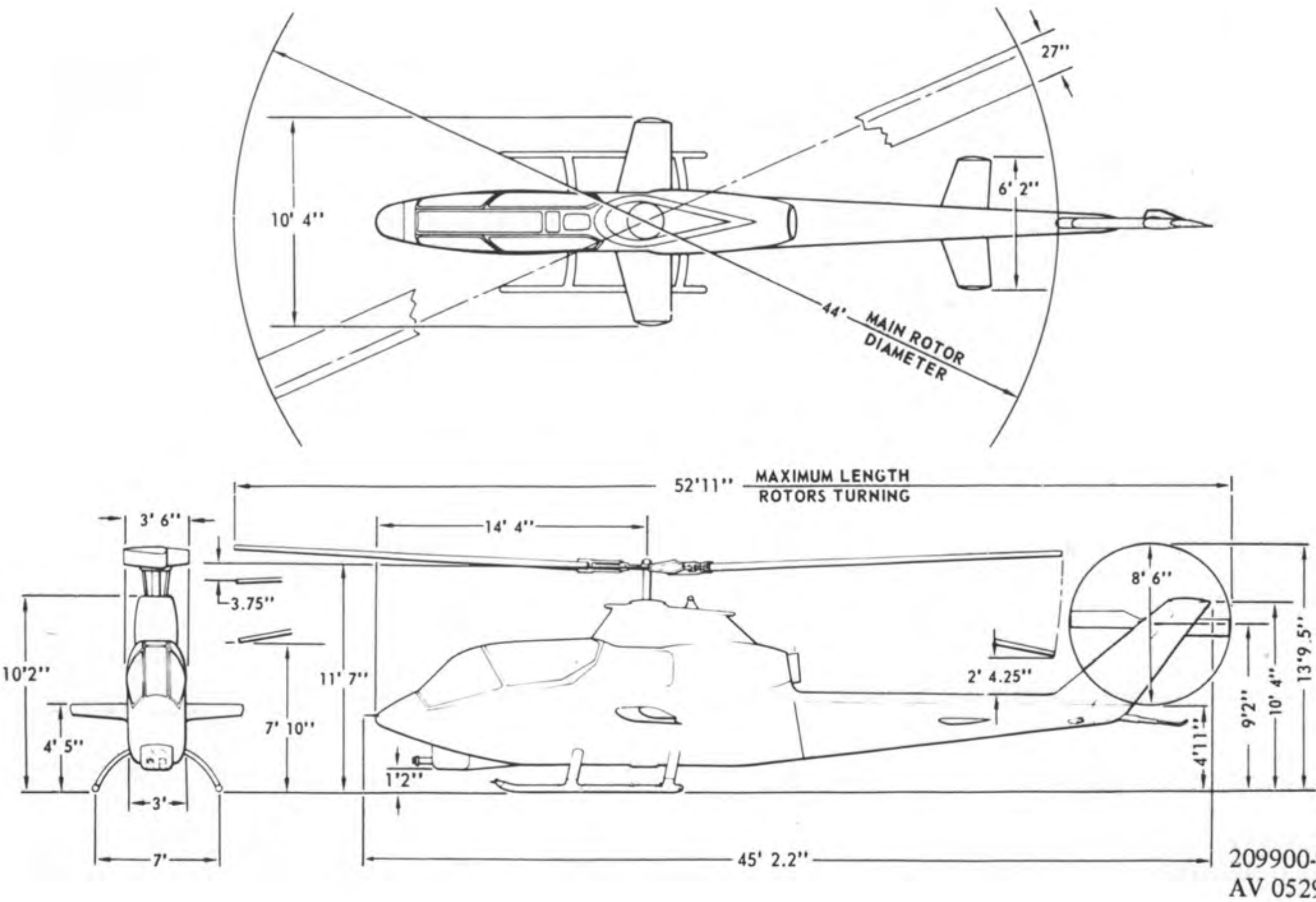


Figure 2-3. Principal dimensions

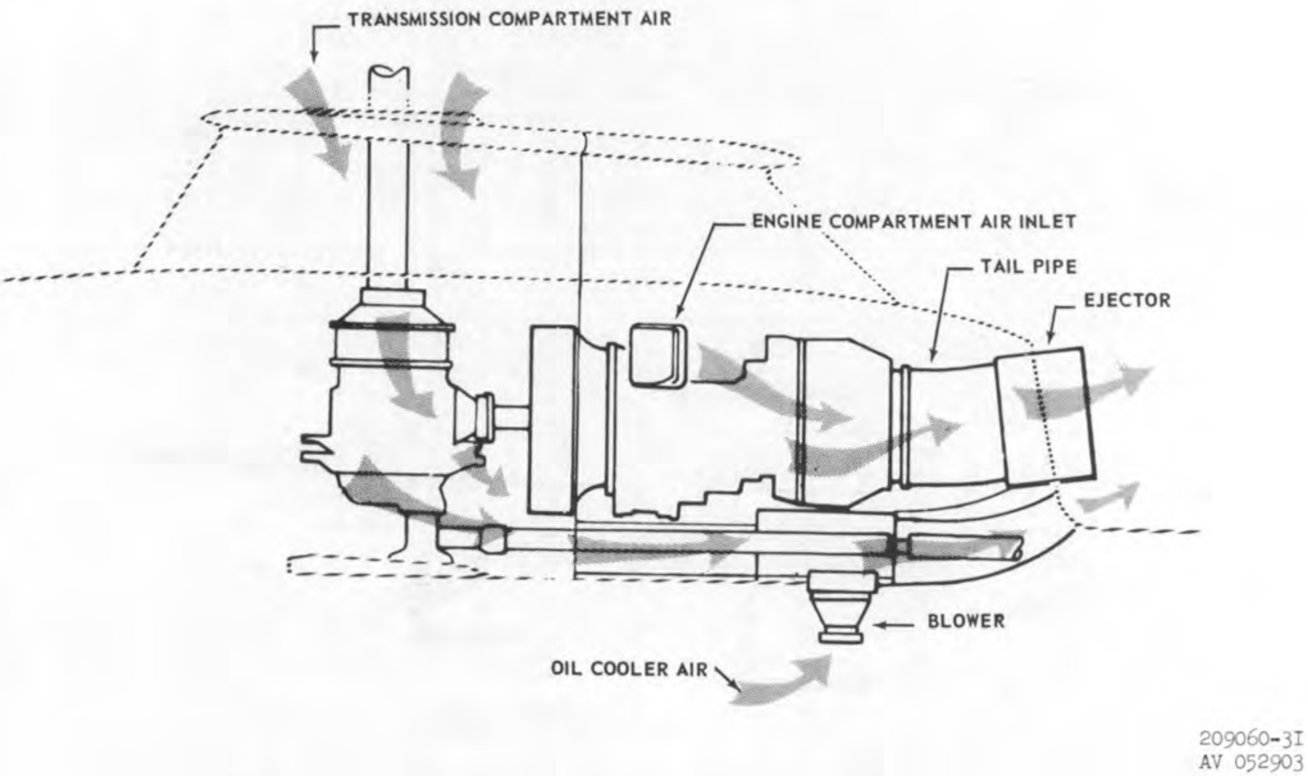


Figure 2-4. Engine and transmission compartment cooling

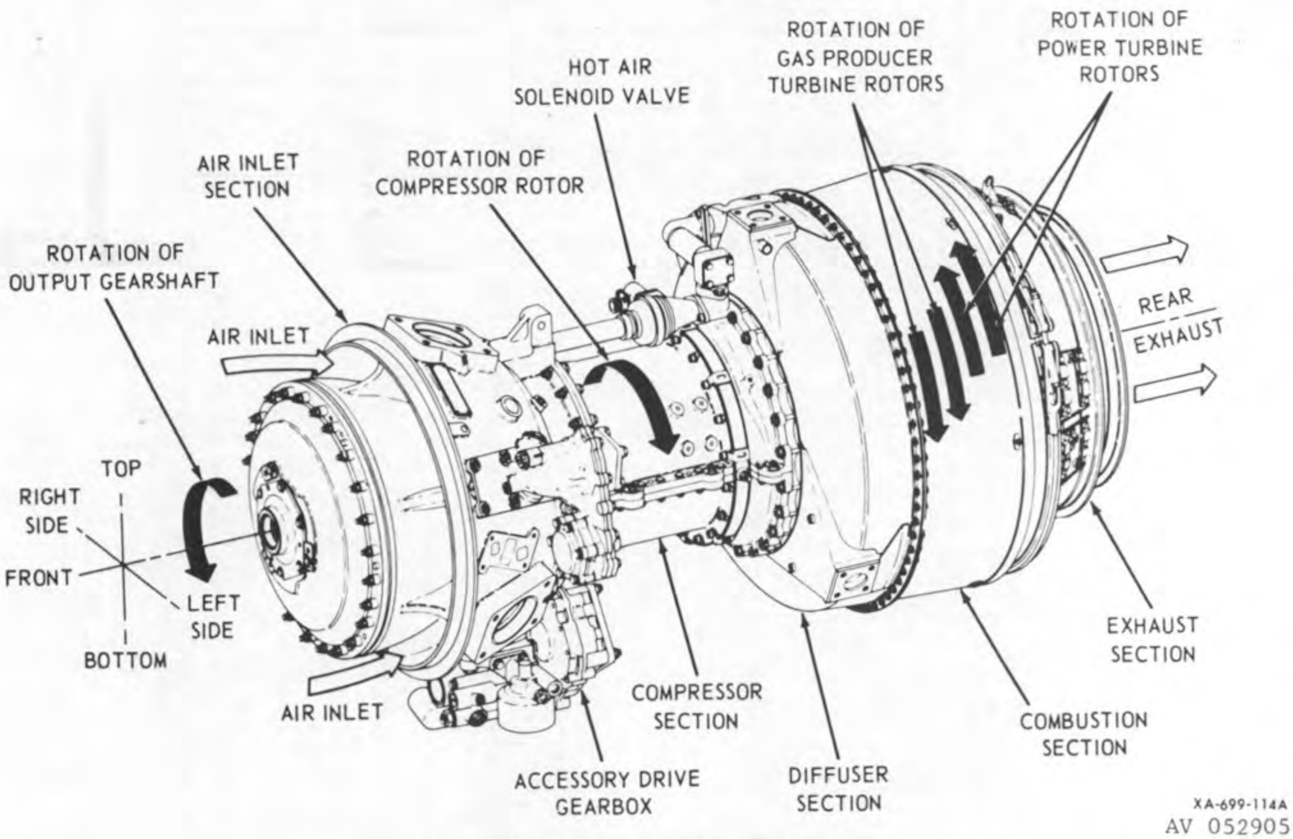


Figure 2-5. Engine assembly

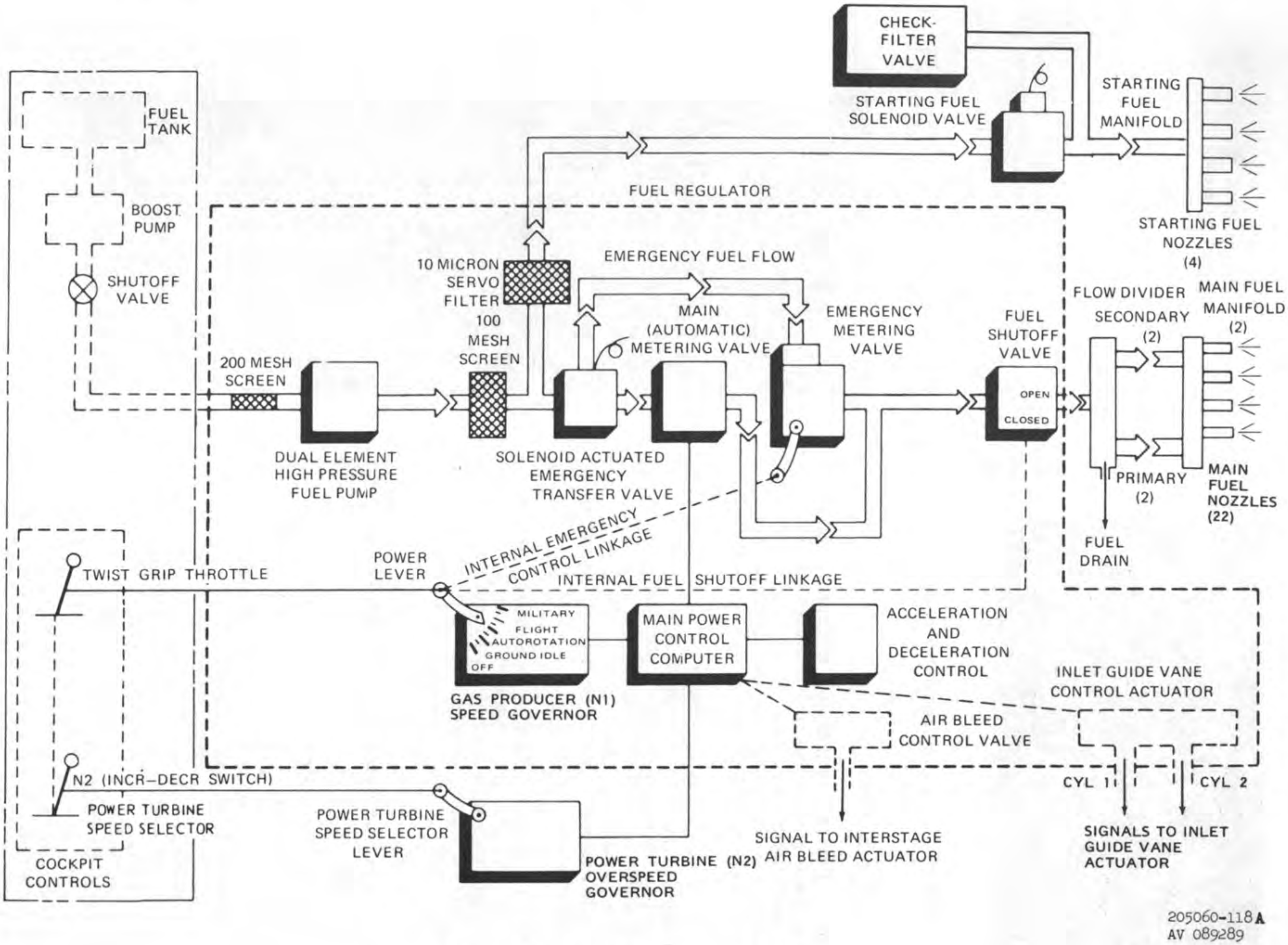


Figure 2-6. Engine fuel system diagram

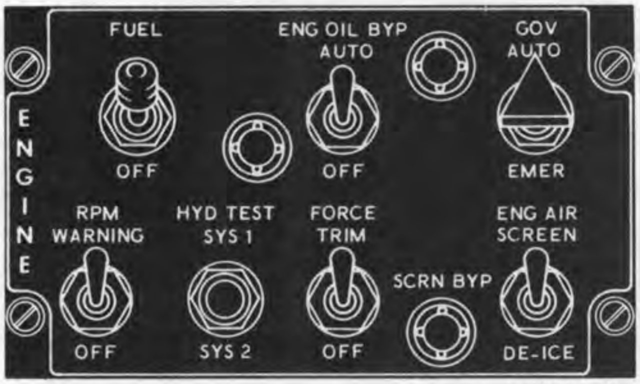


Figure 2-7. Pilots engine control panel

b. Particle Separator

The T53-L-13 series engines are equipped with a sand and dust particle separator to prevent erosion of engine parts. The particle separators are mounted on the engine inlet housing and are either self-purging or non-self-purging.

(1) Non-Self-Purging Particle Separators: Sand and dust particles are separated from the air flowing into the engine inlet by centrifugal action. The particles removed from the inlet air are held in box assemblies containing porous plastic foam inserts. The box assemblies are removed manually for inspection and cleaning.

(2) Self-Purging Particle Separators: Sand and dust particles are separated from the air flowing into the engine inlet by centrifugal action. The particles collect in the lower part of the particle separator and are ejected overboard through a tube by a flow of engine bleed air.

2-12. Engine Fuel System, Fuel Control Switches, And Throttle.

The engine fuel system (figure 2-6) consists of the fuel control (fuel regulator), starting fuel solenoid valve, flow divider assembly, main and starting fuel manifolds and hose assemblies, starting fuel nozzles, and fuel nozzles.

a. Fuel control consists of a primary control for N1 (gas producer) and an overspeed governor for the N2 (power turbine) (figure 2-6). A dual element engine driven fuel pump and emergency control systems are incorporated into the primary control unit. The automatic mode of the fuel control regulates ground and flight operations and maintains steady state N2 conditions through all power ranges.

WARNING

The gunners miscellaneous control panel switches will be repositioned as the pilot directs during emergency operations.

b. Fuel Control Switches. Switches located on the pilots engine control panel (figure 2-7) and the gunners miscellaneous control panel (figure 2-8) predicates the fuel system operation. The fuel switch energizes the fuel shutoff valve and boost pumps, and the GOV switch allows the pilot to select automatic or manual metering of the fuel control.

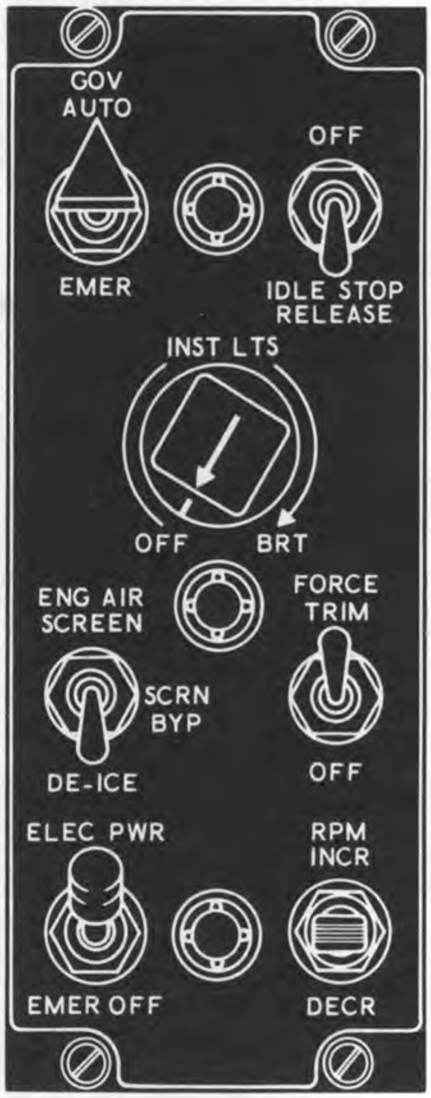


Figure 2-8. Gunners miscellaneous control panel

c. Fuel Starter Trigger. A solenoid shutoff valve is opened when the starter trigger (figure 2-9) is engaged allowing fuel to flow to four starting fuel nozzles. The circuit is de-energized and starting fuel flow ceases when the starter trigger is released. After engine start, any residual fuel that may be left in the system is purged by air from the combustion chamber through a check filter valve. Electrical power for the system is supplied through the main fuel switch and starter trigger from the essential bus. A pressure-operated drain valve at the bottom of combustion chamber housing automatically drains unburned fuel from combustion chamber after engine shutdown. (Refer to paragraph 2-22 for description of helicopter fuel supply system.)

d. Fuel Flow.

(1) Normal. During normal fuel flow, fuel enters the fuel control (fuel regulator) through an inlet screen and flows to an integral engine driven dual element fuel pump. It is then pumped through check valves and outlet screen to the transfer valve. With the transfer valve in normal position for automatic operation, fuel flows to the main metering valve and a pressure regulating valve. Position of the main metering valve and flow of fuel is automatically controlled by the computer section of the fuel regulator. Metered fuel flows through the open shutoff valve and discharge port to the engine flow divider, main fuel manifold, and fuel nozzles in combustion chamber.

(2) Emergency. The switchover to emergency fuel flow is accomplished by rotating the twist grip to flight idle, moving the GOV switch to EMER and then rotating the twist grip cautiously to desired power. The emergency control manually meters fuel to the engine without the incorporation of any automatic features. During emergency fuel flow, when the transfer valve is in EMER position, fuel flows through, and is metered by, the emergency (manual) metering valve. Fuel pressure is controlled by the emergency pressure regulating valve and fuel is delivered through the open shutoff valve to the fuel discharge port and to the engine flow divider, main fuel manifold, and nozzles in the combustion chamber. It is possible to fly the helicopter by utlizing smooth, coordinated use of the throttle.

e. Flow Divider and Dump Valves. Correct spray cone is maintained from main fuel nozzles by the flow divider directing fuel into the primary portion of the manifold for starting and directing fuel into the primary and secondary mainfolds for normal operation. Fuel then is drained from the manifolds and nozzles when fuel pressure drops on shutdown preventing carbon deposits from forming on the nozzles.

f. Power Turbine Overspeed Governor. The power turbine rotor speed is regulated by a power turbine overspeed governor at rpm selected. The governor is driven through gearing at a speed proportional to power turbine rotor speed. Limits for the governor are set by adjustable stops.

g. Throttle. The rotating grip-type throttles are located on the pilots and gunners collective assemblies (figures 2-9 and 2-10). The throttle, when rotated clockwise to the full open position, will allow the N2 overspeed governor to control fuel metering in order to maintain a pre-selected N2 rpm. When the throttle is rotated counterclockwise, manual metering is evidenced as rpm decreases. Rotating the throttle past the flight idle detent to the fully closed position cuts off the engine fuel flow. Friction can be induced into the throttle grips by rotating the ring at the upper end of the pilots grip counterclockwise. A solenoid operated idle detent is incorporated in the system to prevent inadvertent throttle closure. To bypass the idle detent, depress and hold the engine idle release switch and close throttle.

2-13. Starter-ignition System.

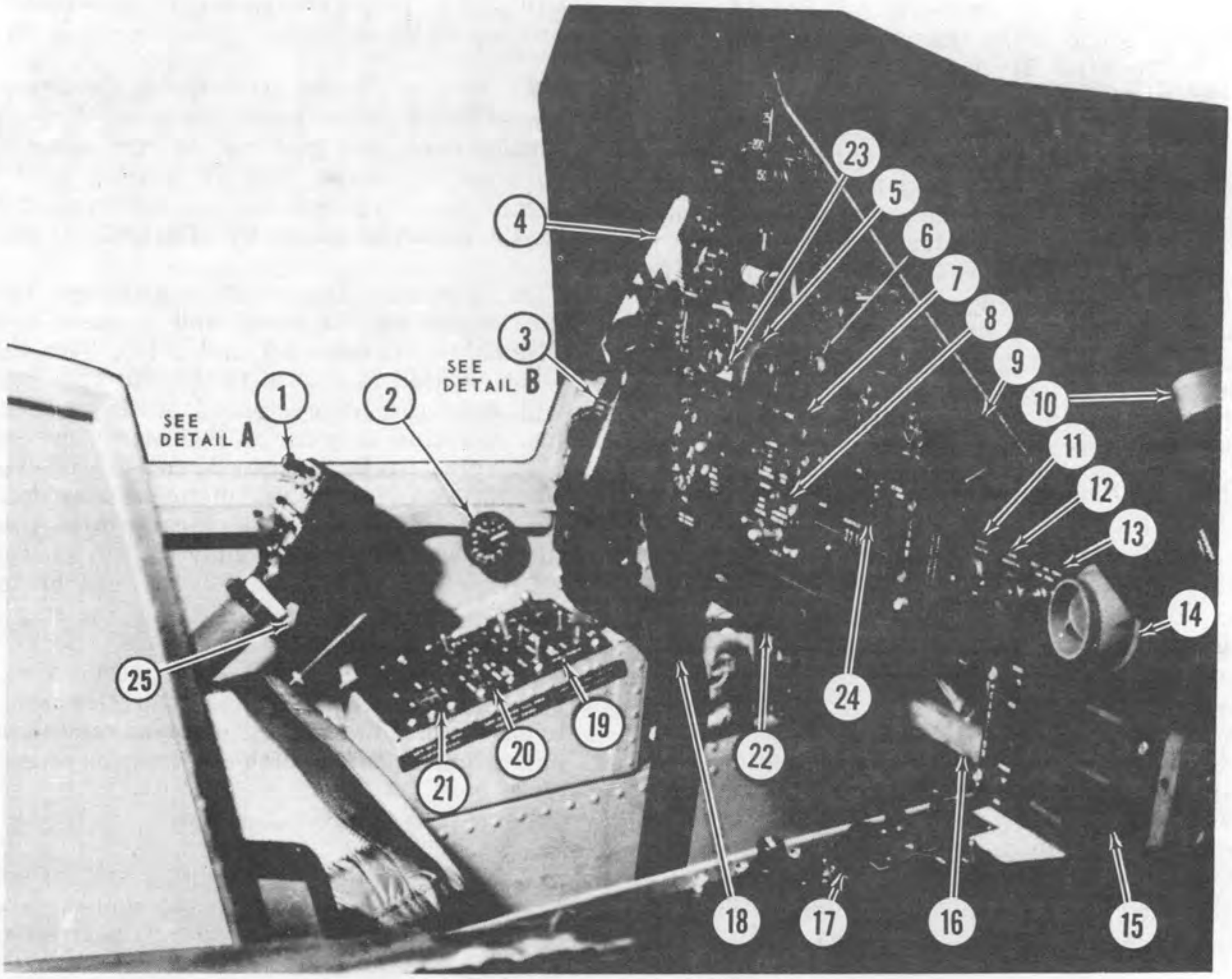
A combination starter-ignition trigger-actuated snap switch is mounted on the underside of the collective pitch control switch box. Both the starter and ignition unit circuits are wired to the trigger switch as the engine ignition will only be required while accomplishing engine starts.

2-14. Power Supply.

The circuits are supplied power from the 28 Vdc essential bus. The starter circuit is activated when the trigger switch, located on the pilots collective pitch control, is pulled. The ignition circuit and start fuel is activated when the FUEL switch (figure 2-7) is in the forward position (ON) and the trigger switch is pulled.

2-15. Governor RPM Switch.

The governor RPM switches (figures 2-8 and 2-9), are mounted in a switch box attached to the pilots collective pitch control lever and the gunners miscellaneous control panel. The switch is a three-position momentary type and is held (forward) to the INCR position to increase the power turbine (N2) speed or (aft) to DECR position to decrease the power turbine (N2) speed. Regulated power turbine speed may be adjusted in flight, through the operating range of 6000 to 6700 rpm, by



1. Collective Pitch Control
2. Free Air Temperature (Note 2)
3. Cyclic Stick
4. Go-No-Go Placard (Note 1)
5. Wing Stores Jettison Switch
6. Compass Switch
7. Turret Control Panel
8. Wing Stores Control Panel
9. Ash Tray
10. Breakout Knife (If Installed)
11. Pitot Heat Switch
12. Rain Removal — ENVR-CONT Switch
13. Vent Control
14. Air Nozzle
15. Caution Panel
16. Rudder Pedals
17. ARC-51 Control Panel
18. Turret Switch — Safety Flag
19. Engine Control Panel
20. Electrical Control Panel
21. Miscellaneous Control Panel
22. M35 Control Panel (When Installed)
23. Emergency Collective Hydraulic Switch
24. ARC54 Control Panel (Note 3)
25. Fuel Starter Trigger

NOTE 1: Refer to Chapter 3 for decal data.

NOTE 2: The Free Air Temperature gage is located in the pilots canopy door when M-35 is installed.

NOTE 3: Panel No. 24 is the proximity warning device control panel on helicopters with MWO 55-1520-221-30/49 incorporated. The ARC 54 control panel is located in the right-hand console on these helicopters.

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Figure 2-9. Pilots station typical (Sheet 1 of 3)

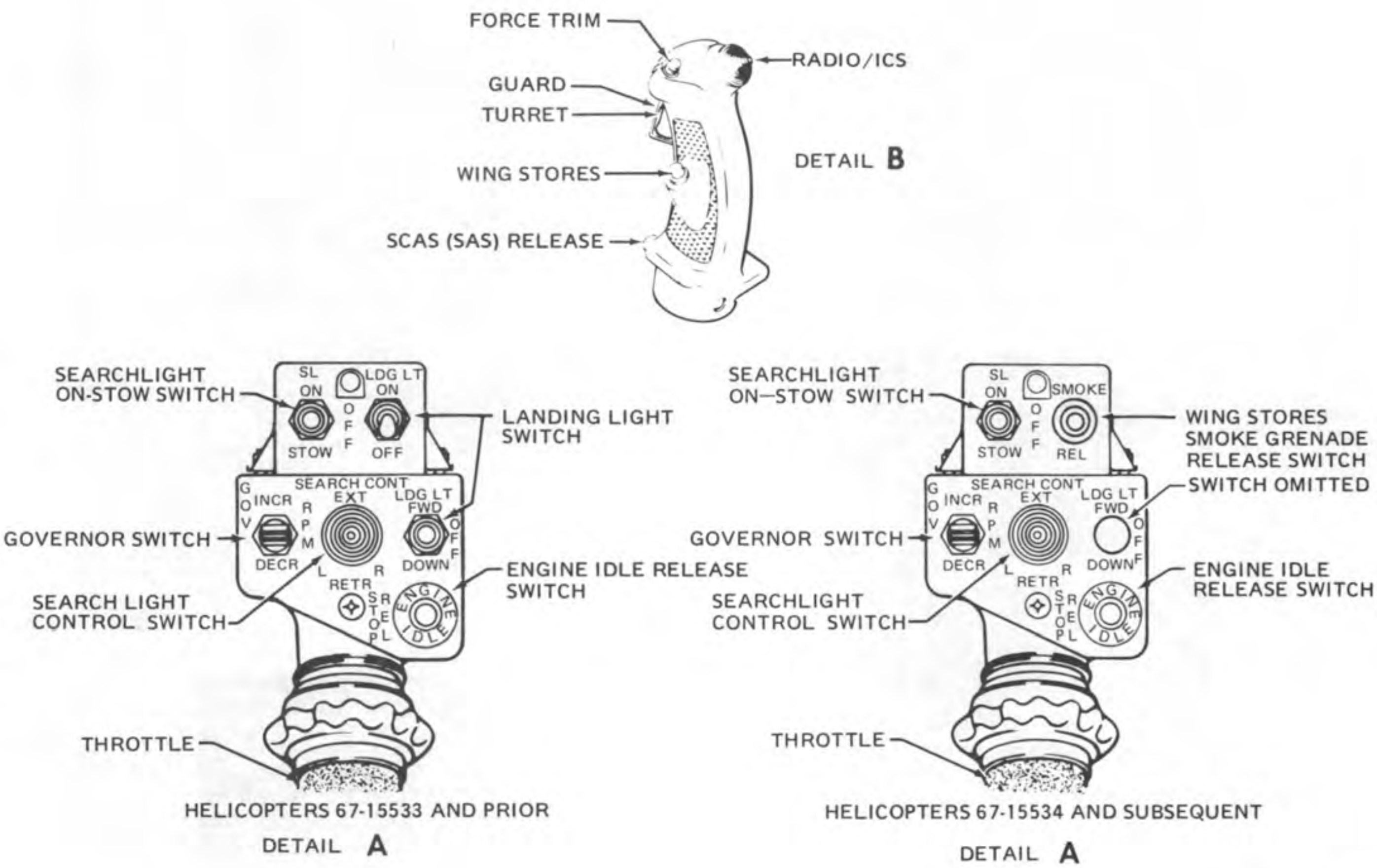

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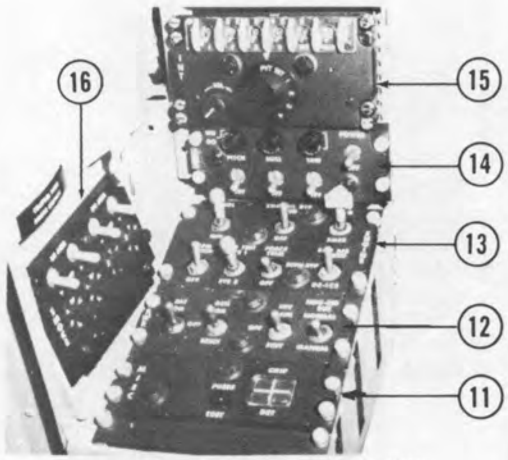
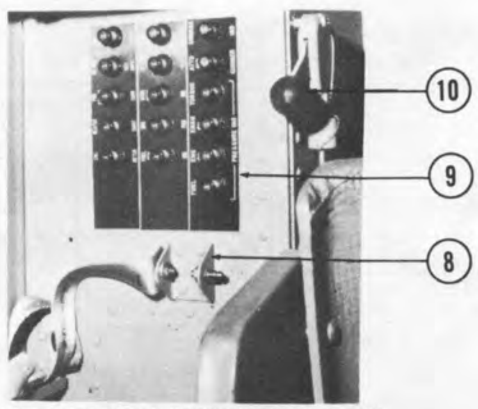
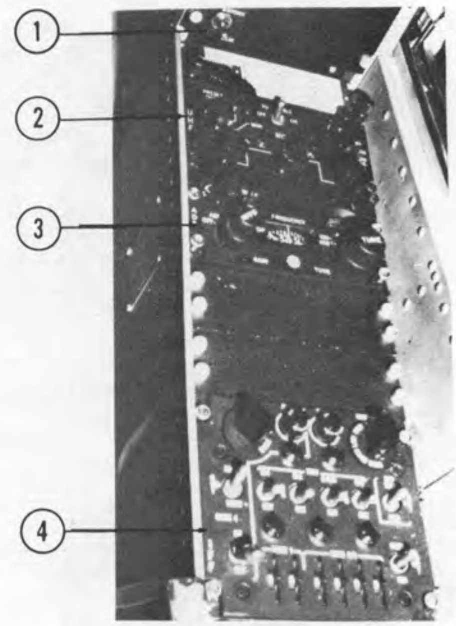
Figure 2-9. Pilots station typical (Sheet 2 of 3)



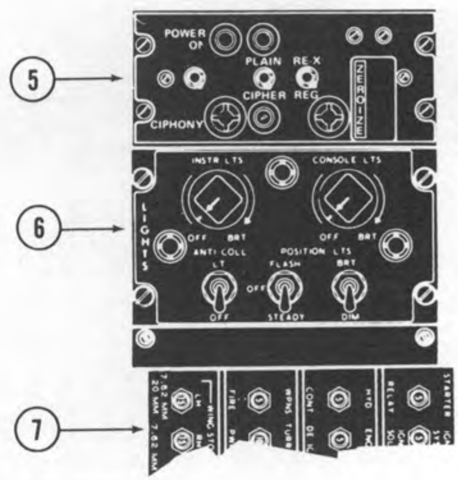
PILOT'S LEFT HAND CONSOLE FORWARD SECTION



PILOT'S LEFT HAND CONSOLE AFT SECTION



PILOT'S RIGHT HAND CONSOLE FORWARD SECTION



PILOT'S RIGHT HAND CONSOLE AFT SECTION

1. Caution Light Panel
2. UHF Control Panel
3. ADF Control Panel
4. Transponder Control Panel
5. Voice Security Control Indicator
6. Lights Control Panel
7. DC Circuit Breaker Panel
8. Collective Hold Down Strap
9. AC Circuit Breaker Panel
10. Inertia Reel Lock
11. Miscellaneous Control Panel
12. Electrical Power Control Panel
13. Engine Control Panel
14. SCAS Control Panel
15. Signal Distribution Panel
16. Wing Stores Smoke Grenade Control Panel

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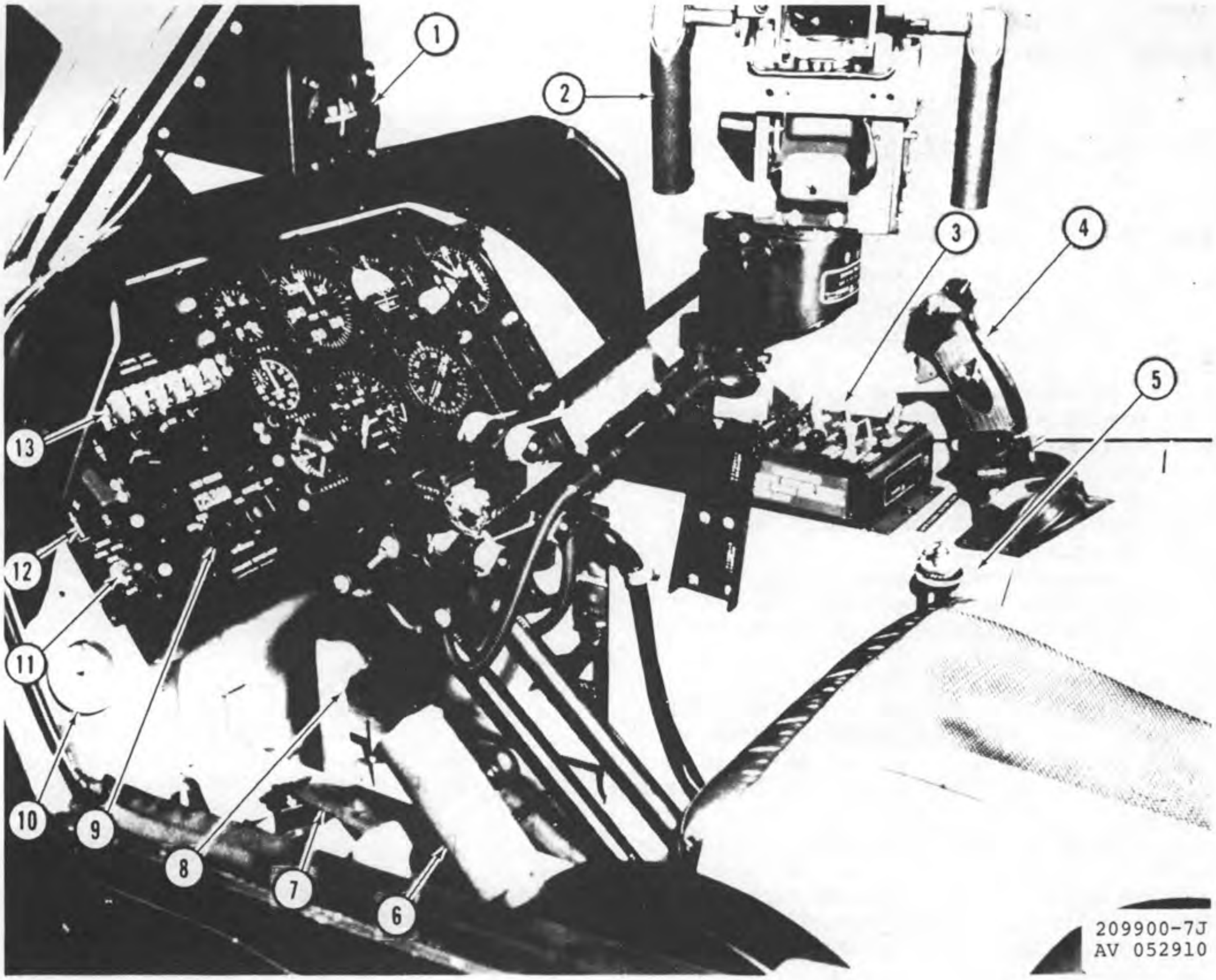
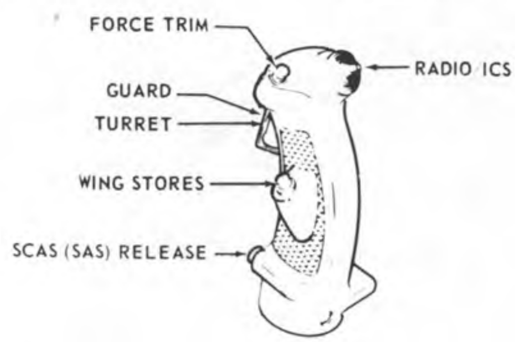
Figure 2-9. Pilots station - typical (Sheet 3 of 3)





Note

1. Knife (5) used only with cable-type door jettison systems. When equipped with explosive canopy removal system, arm/fire mechanism is at this location.

2. When M35 subsystem is installed VHF radio control panel (9), and signal distribution panel (13) are moved up. A 20mm armament panel is installed in the lower left side of the instrument panel.

1. Magnetic Compass
2. Sighting Station
3. Armament Control Panel
4. Cyclic Stick
5. Breakout Knife or Canopy Removal Arm/Fire Mechanism (Note 1)
6. Collective Pitch Control
7. Miscellaneous Control Panel
8. Rudder Pedals
9. VHF Radio (Note 2)
10. Air Vent
11. Emergency Hydraulic Control Switch
12. Wing Stores Jettison Switch
13. Signal Distribution Panel (Note 2)

Figure 2-10. Gunners station - typical

movement of the switch as required with the throttle in the full open position.

NOTE

Maximum N2 rpm allowable is 6640 above 91% N1.

2-16. Droop Compensator.

CAUTION

A shear pin is incorporated in the droop compensator linkage to permit collective control movement in the event of a bind occurring in the droop compensator linkage. When the pin is sheared, the droop compensator is inoperative and care must be taken to maneuver within power adjustment capabilities of the governor. Sheared pin shall be replaced before next flight.

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. Design droop of the engine governor system is as much as 300 to 400 rpm (flat pitch to full power). If N2 power were allowed to droop, other than momentarily, the reduction in rotor speed could become critical; therefore, a droop compensator is installed on the governor control to raise N2 speed as power is increased by the pilot. The compensator is a direct mechanical linkage between the collective control lever and the speed selector lever on the N2 governor. Properly rigged, the droop compensator will hold N2 rpm to ± 40 rpm.

2-17. Engine Idle Release Switch.

The ENGINE IDLE REL switch (figure 2-9) is a push button, momentary-on, type switch mounted in a switch box attached to the end of the pilots collective pitch control lever. The gunners idle release switch (IDLE STOP RELEASE) is located in the forward area of his miscellaneous control panel (figure 2-8). The ENGINE IDLE REL switch energizes an electrical solenoid with a retractable plunger. The solenoid is mounted so that the plunger acts as a stop in the system linkage. The stop prevents the pilot from accidentally retarding the throttle beyond the flight idle position. This acts as a safety feature by preventing inadvertent engine shutdown. When the throttle is opened the switch need not be depressed, however, the switch must be depressed when it is desired to retard the throttle below the engine idle position.

2-18. Engine Instruments and Indicators.

The pilots engine instruments and indicators are mounted in his instrument panel and consoles. The gunners instruments and indicators are all mounted in his instrument panel. The engine instruments and indicators consist of those listed and described in the following paragraphs.

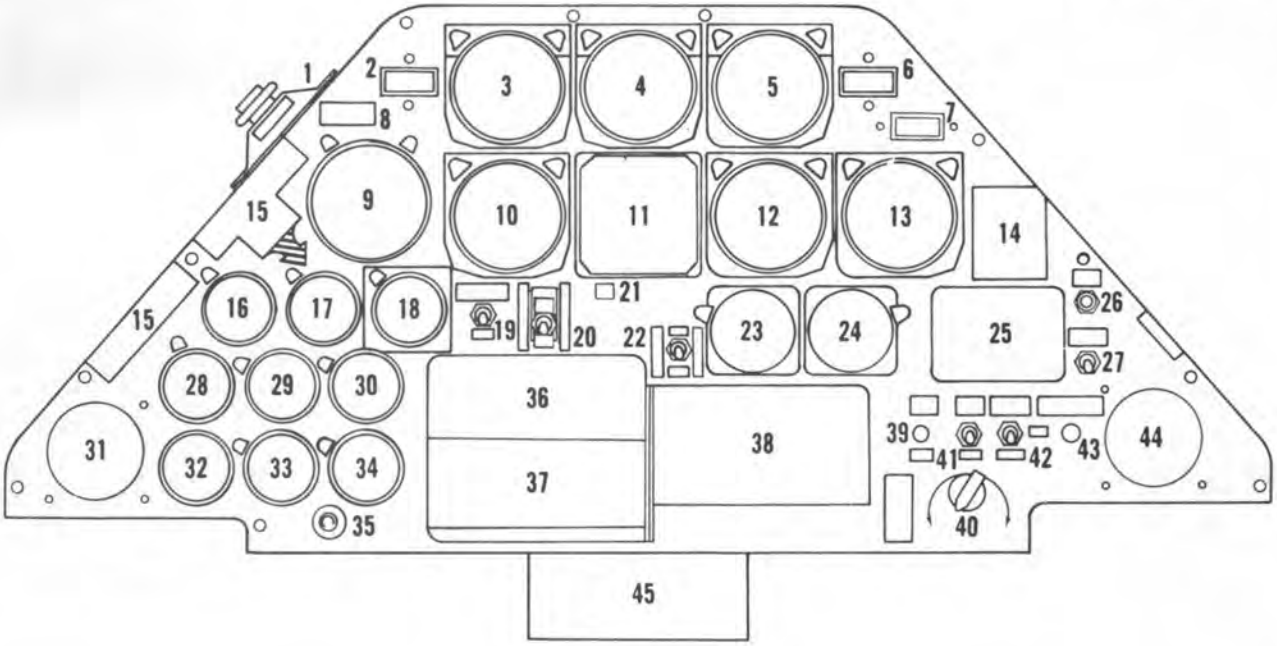
a. Torque Meter. A torque meter (figure 2-11) is located on the pilots instrument panel and is connected to a transmitter which is part of the engine oil system. The gunners torque meter is located on his instrument panel (figure 2-12) and is powered by a separate transmitter. The torque meter indicates pressure in psi corresponding to the torque imposed upon the engine output shaft.

NOTE

To convert torque meter pressure (psi) to horsepower multiply torque meter pressure x N2 rpm x 0.00352.

b. Exhaust Gas Temperature Indicator. An exhaust gas temperature indicator (figure 2-11) is located on the pilots instrument panel. Also an exhaust gas temperature indicator (figure 2-12) is located on the gunners instrument panel. The indicator receives temperature indications from the bayonet type thermocouples mounted in the engine exhaust diffuser section. The gage temperature indications are in degrees centigrade and electrical power is self generating.

c. Dual Tachometer. The dual tachometer (figure 2-11) is located on the pilots instrument panel. The gunners dual tachometer (figure 2-12) is located on his instrument panel. The indicator is for both the engine and main rotor. The outer scale of the indicator is for power turbine rpm (N2), and the smaller inner scale is for the main rotor rpm. Power for operation of the indicators is provided by two tachometer generators mounted one on the engine and one on the transmission. These systems are self-generating. A connection to the electrical system is not required. Normal operation of the helicopter is evident when the power turbine (engine) rpm and rotor rpm indicator needles are in synchronization.



1. Canopy Removal Arm/Fire Mechanism (Note 1)
2. RPM Warning Light
3. Airspeed Indicator
4. Attitude Indicator
5. Pressure Altimeter
6. Master Caution Light
7. Fire Warning Light
8. Radio Call Letters
9. Dual Tachometer
10. Turn and Slip Indicator
11. Radio Magnetic Indicator
12. Vertical Velocity Indicator
13. Course Indicator
14. Operating Limits Decal
15. GO NO GO Placard (Note 2)
16. Exhaust Gas Temperature
17. Gas Producer Tachometer
18. Torque Meter
19. Emergency Collective Hydraulic Switch
20. Wind Stores Jettison Switch — Emergency
21. Transmitter Selector Decal
22. Compass Slaving Switch
23. Clock
24. Volt-Ammeter Indicator
25. Ash Tray
26. IFF Mode 4 Indicator Light
27. Code Hold Switch
28. Fuel Pressure Indicator
29. Transmission Oil Temperature Indicator
30. Engine Oil Temperature Indicator
31. Air Vent
32. Fuel Quantity Indicator
33. Transmission Oil Pressure Indicator
34. Engine Oil Pressure Indicator
35. Fuel Gage Test Switch
36. Master Armament Control Panel
37. Wing Stores Control Panel
38. FM Control Panel (Note 3)
39. Fire Test Switch
40. Temperature Selector Control
41. Pitot Heat Switch
42. Rain Removal — ENVR CONT Switch
43. Vent Control
44. Air Vent
45. 20MM Control Panel

Notes:

1. With explosive canopy removal system.
2. Refer to Chapter 3 for decal data.
3. This will be the proximity warning device control panel on helicopters with MWO 55-1520-221-30/49 inoperated. The FM control panel will be located in the R.H. console on these helicopters.

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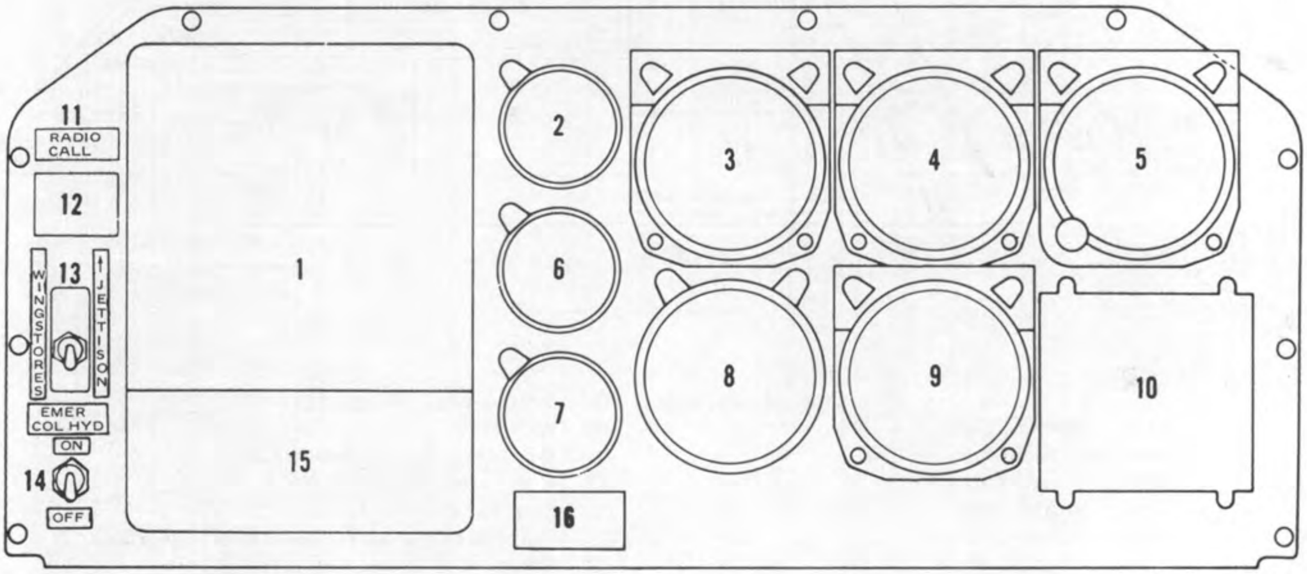
Figure 2-11. Pilots instrument panel - typical



1. VHF Radio and Signal Distribution Panel
2. Torque Meter
3. Airspeed Indicator
4. Attitude Indicator
5. Pressure Altimeter
6. Gas Producer Tachometer
7. Exhaust Gas Temperature Indicator
8. Dual Tachometer
9. Radio - Magnetic Indicator
10. Caution Panel
11. Radio Call Letters
12. Interphone Panel XMTR Select Data
13. Wing Stores Jettison Switch
14. Emergency Collective Hydraulic Switch
15. 20MM Control Panel When Installed
16. Fire Warning Light (When Installed)

209070-79

Figure 2-12. Gunners instrument panel - typical

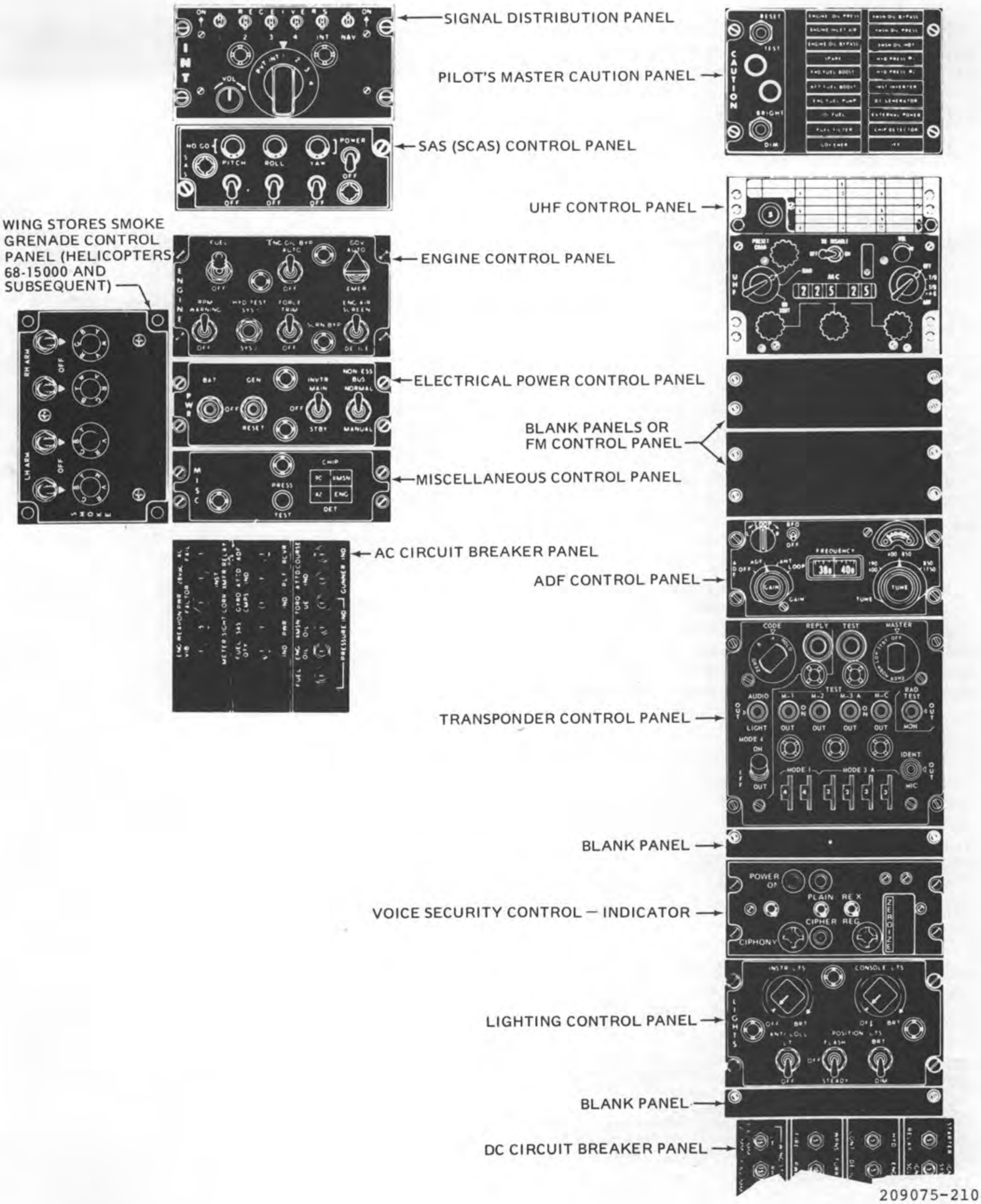


Figure 2-13. Pilots consoles

d. Gas Producer N1 Tachometer. The gas producer tachometers are located on the pilots and gunners instrument panels (figures 2-11 and 2-12). The indicator is powered by a tachometer generator geared to the N1 gearbox and does not depend on the helicopters electrical system. The indicator readings are in percent rpm of gas producer turbine speed.

e. Oil Pressure. The engine oil pressure indicator (figure 2-11) located on the pilots instrument panel, receives pressure indications from the pressure transmitter and provides readings in psi. The oil pressure indicator and transmitter are electrically powered by the 26 Vac system.

f. Oil Pressure Caution Light. The ENGINE OIL PRESS caution worded segments are located on the pilots and gunners caution panels (figures 2-27 and 2-28). The caution lights are connected to a low pressure switch which makes contact when pressure drops below safe limits, and illuminates the caution lights. The circuit is powered by 28 Vdc and is connected to the essential bus.

g. Oil Temperature. The engine oil temperature gage is located on the pilots instrument panel (figure 2-11). The gage is connected to an electrical resistance type thermocouple and indicates the temperature of the engine oil at the oil inlet. The oil temperature indicator is powered by 28 Vdc and is connected to the essential bus.

h. Chip Detector. A chip detector is located in the bottom of the engine accessory gearbox. The chip detector consists of a single pole of a permanent magnet. When the pole attracts sufficient metal chips to complete the circuit between the pole and ground the CHIP DETECTOR segment on caution panel will illuminate.

i. Chip Detector Panel. The pilots CHIP DET panel is located on his miscellaneous control panel (figure 2-14). Electrical power is supplied to the CHIP DET panel when the CHIP DETECTOR worded segments illuminate. The segments are located on the pilots caution panel (figure 2-27) and the gunners caution panel (figure 2-28). The pilots CHIP DET panel lights do not illuminate at this time. The illumination of the CHIP DETECTOR worded segments indicates that metal chips have contaminated one or more of the following components: 90° gearbox, transmission, 42° gearbox, engine. The contaminated component(s) can be identified by depressing the CHIP DET panel. The contaminated component light(s) in the CHIP DET panel will illuminate. The PRESS-TEST button on the pilots miscellaneous control panel is used to test the lights in the CHIP DET panel.

Figure 2-14. Miscellaneous control panel

j. Engine Fuel Pump Caution Light. A caution panel worded segment ENG FUEL PUMP is located on the pilots and gunners caution panels (figures 2-27 and 2-28). The light is connected to a fuel pressure switch at each element of the engine driven dual element fuel pump. A failure of either engine pump element will cause its respective pressure switch to close, thus closing the electrical circuit and illuminating the caution light. The caution light and pressure switches are powered by 28 Vdc from the essential bus. Sufficient fuel for engine operation is delivered by either element.

k. Engine Inlet Air. The engine is equipped with an automatic engine inlet air system, made up of a detection system, inlet screen actuator, and bleed air valve system. The detector, negative pressure switch, located in the induction area, senses an obstruction of the engines air induction system and closes the electrical contact points in the pressure switch. The closing of the contacts illuminates the ENGINE INLET AIR caution light. When the ENGINE INLET AIR caution light is illuminated the ENG AIR switch (figure 2-7) shall be moved to the DE-ICE or SCRN BYP (screen bypass) position. The switch shall not be actuated with an indicated airspeed in excess of 100 KIAS. When the ENG AIR switch is in the DE-ICE position the intake screen is actuated open and the bleed air anti-ice valve is opened. The bleed air is collected in a manifold, passes through the hot air valve and enters the port on top of the engine inlet housing. From this point the air is circulated through five of the six hollow inlet housing support struts to prevent ice formation in the inlet housing area. The air also flows into the annulus in the rear of the inlet housing to prevent ice formation on the inlet guide vanes. Hot scavenge oil, draining through the lower strut into the accessory drive gearbox, prevents ice formation in the bottom of the inlet housing area. The detector system and actuator are powered by the 28 Vdc essential bus.

When the ENG AIR switch is in the SCRN BYP position the induction screens are actuated open and the anti-icing system is non-functioning.

2-19. Power Train.

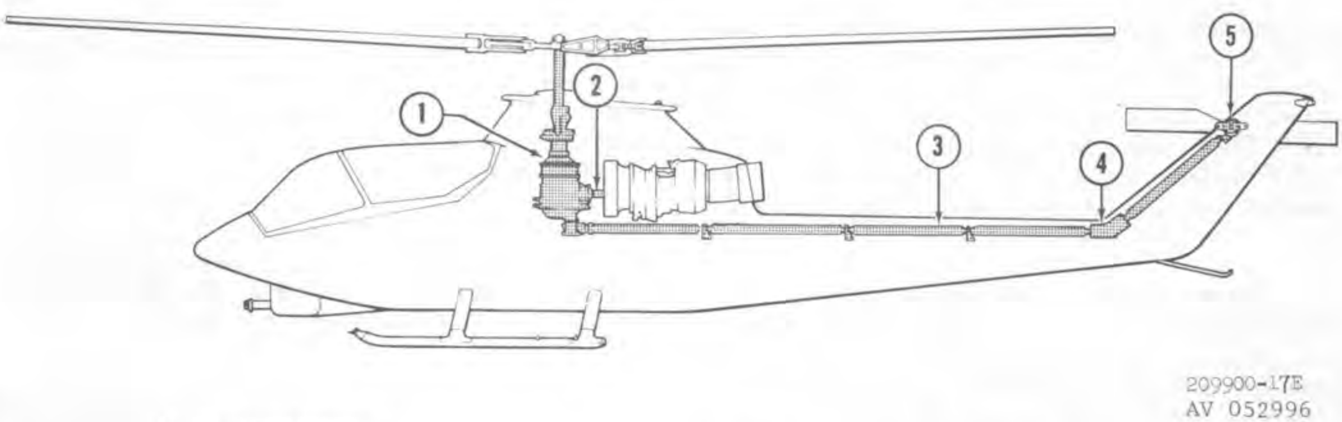
The system consists of a main driveshaft, a main transmission which includes input and output drives and the main rotor mast; and a series of driveshafts with two gearboxes through which the tail rotor is driven. The forward tail rotor driveshaft is located below the engine and the remaining four driveshafts are routed aft of the engine along the top of the tailboom to the intermediate gearbox, (42°), then along the forward edge of the vertical fin to the tail rotor gearbox (90°). The tail rotor is mounted on the output shaft of the tail rotor 90° gearbox (figure 2-15).

a. Transmission. The transmission is located directly ahead of the engine and is suspended by pylon isolating mounts on structural supports extending above the service deck. The unit is coupled to the engine through a short driveshaft and provides drive angle change and speed reduction (20.38 to 1). The transmission is basically a reduction gearbox functioning to transmit engine power to the rotor at the desired rpm. A three stage gear reduction is attained from the input spiral bevel gear set and the two stage planetary. A freewheeling clutch in the input drive quill disengages to allow main rotor and gear train to turn freely when engine is stopped or is idling below rotor driving speed. A secondary gear train drives the tail rotor shaft, ventilation fan, rotor tachometer generator, hydraulic pumps, and transmission oil pump. The transmission support case incorporates four mounting provisions and a lift link attachment for support of the transmission and an oil filler cap which is located on the right aft side. The sump case incorporates oil level sight gages, magnetic plug, oil screens, and drive quills for the tail rotor driveshafts, hydraulic pumps and rotor tachometer generator. The transmission indicators consist of oil pressure indicator, oil pressure caution light, oil temperature indicator, oil temperature caution light, and chip detector caution light.

(1) Oil Pressure Indicator. The transmission oil pressure indicator (figure 2-11) is located on the pilots instrument panel. The indicator receives pressure indications from the transmission oil pressure transmitter and indicates pressure in psi. The oil pressure indicator and transmitter are electrically powered by the helicopters 26 Vac circuit.

(2) Oil Pressure Caution Light. The caution panel worded segment XMSN OIL PRESS is located on the pilots and gunners caution panels (figures 2-27 and 2-28). The lights are connected to a transmission mounted pressure switch. A drop in oil pressure, below safe operating limits, closes the electrical circuit and illuminates the caution light. The circuit is powered by the 28 Vdc essential bus.

(3) Oil Temperature Indicator. The transmission oil temperature indicator (figure 2-11)



1. Transmission
2. Main Drive Shaft
3. Tail Rotor Drive Shafts
4. Intermediate Gearbox
5. Tail Rotor Gearbox

Figure 2-15. Power train

is located on the pilots instrument panel. An electrical resistance type thermobulb transmits the oil temperature reading to the indicator unit. The indicator circuit is powered by the 28 Vdc essential bus.

(4) Oil Temperature Caution Light. The transmission is equipped with an oil temperature thermoswitch that is installed in the oil manifold assembly. The thermoswitch is a normally open switch and is temperature actuated to the closed position when the oil temperature reaches or exceeds 110°C. This will cause the XMSN OIL HOT caution panel segment to illuminate. The caution panel worded segment is located on the pilots and gunners caution panels (figures 2-27 and 2-28). Electrical power is supplied to this system by the 28 Vdc essential bus.

(5) Chip Detector Caution Light. The chip detector is located in the bottom of the transmission sump. The chip detector consists of a single pole of a permanent magnet. When the pole attracts sufficient metal chips to complete the circuit between the pole and ground the CHIP DETECTOR segment on the caution panel will illuminate.

(6) Chip Detector Panel. The pilots CHIP DET panel is located on his miscellaneous control panel (figure 2-14). Electrical power is supplied to the CHIP DET panel when the CHIP DETECTOR worded segments illuminate. The segments are located on the pilots caution panel (figure 2-27) and the gunners caution panel (figure 2-28). The pilots CHIP DET panel lights do not illuminate at this time. The illumination of the CHIP DETECTOR worded segments indicates that metal chips have contaminated one or more of the following components: 90° gearbox, transmission, 42° gearbox, engine. The contaminated component(s) can be identified by depressing the CHIP DET panel. The contaminated component light(s) in the CHIP DET panel will illuminate. The PRESS-TEST button on the pilots miscellaneous control panel is used to test the lights in the CHIP DET panel.

b. *Intermediate Gearbox - 42°.* The intermediate gearbox is located on tailboom, at base of vertical fin. This gearbox provides a 42° change in direction of tail rotor driveshaft, with no change of speed. Gearbox assembly consists of a case with a gear quill in each end. The case is fitted with an oil filler cap, a vent breather, an oil level sight gage, and a drain plug equipped with a magnetic chip detector. Input and output quills have flexible couplings for attachment of driveshafts.

(1) Intermediate Gearbox - Chip Detector. The chip detector is located on the right side of the gearbox. The chip detector consists of a single pole of a permanent magnet. When the pole attracts sufficient metal chips to complete the circuit between the pole and ground the CHIP DETECTOR segment on the caution panels will illuminate.

c. *Tail Rotor Gearbox - 90°.* The 90° gearbox is mounted near the top of the tailboom vertical fin. The gearbox provides a 90° change in the direction of drive and speed a reduction of 2.6 to 1 between the input shaft and the output shaft, on which the tail rotor is mounted. The gearbox consists of mating input and output gear quill assemblies set into a gear case which is provided with a breather type oil filler cap, oil level sight gage, and a drain plug with a chip detector plug. The input quill has a flexible coupling for attachment to the driveshaft.

(1) Tail Rotor Gearbox - Chip Detector. The chip detector is located in the lower area of the gearbox. The chip detector consists of a single pole of a permanent magnet. When the pole attracts sufficient metal chips to complete the circuit between the pole and the ground the CHIP DETECTOR segment on the caution panels will illuminate.

d. *Tail Rotor Driveshafts.* Five driveshaft sections are incorporated in the tail rotor drive system between the transmission tail rotor drive quill, three bearing hanger assemblies and gearbox (42°) on tailboom, and a tail rotor gearbox (90°) on the vertical fin. Each shaft section is an anodized aluminum alloy tube with a curvic coupling riveted to each end. It is statically balanced by metal strips bonded near middle on tube surface, with an identification plate showing part and serial numbers. Forward shaft section extends through a tunnel between engine firewalls, with ends connected by V-band clamps to mating curvic couplings on transmission tail rotor drive quill and on forward bearing hanger. Other shaft sections are mounted in similar manner along tailboom and vertical fin between hangers and gearboxes.

e. *Main Driveshaft.* A main driveshaft with flexible couplings is installed between an adapter on the engine output shaft and transmission input drive quill. Flexibility of couplings is provided by crowned gear toothed coupling sliding in splined teeth of outer coupling to accommodate movement of transmission on pylon mounts.

2-20. Rotor System.

The rotor system consists of the main rotor, tail rotor (anti-torque) and rotor tachometer.

a. *Main Rotor.*

The main rotor is a two bladed, semi-rigid, see-saw type employing preconing and underslinging. Each blade is connected to a common flat plate yoke by means of a grip and extension, consisting of teflon bearings to permit blade pitch change and a tension torsion strap to carry blade centrifugal force. The hub is underslung on a trunnion through elastomeric flapping bearings mounted in the yoke. The elastomeric trunnion bearings are used on helicopters serial numbers 71-21040 and subsequent and helicopters equipped with hub assemblies with MWO 55-1615-201/1 incorporated.

The rotating control system consists of a swashplate and support, scissors and sleeve, and connecting linkage to transmit control movements to the rotor.

b. *Main Rotor RPM Indicator.* The rotor rpm indicator is part of the dual tachometer (figure 2-11) and is located on the pilots instrument panel. The gunners dual tachometer (figure 2-12) is located on his instrument panel. The rotor rpm reading is indicated on the inner scale and the pointer needle is marked with an R. The indicator is powered by a tachometer generator mounted on and driven by the transmission. The indicator and generator operate independent of the helicopters electrical system. The tachometer generator is a variable output type, and as rpm changes, the current output of the generator varies. The variable output power from the generator operates the motor in the indicator thus providing a direct reading of the rotor rpm.

c. *Tail Rotor.* The 8.41 inch chord tail rotor is a two bladed, delta hinged type employing preconing and underslinging. Each blade is connected to a common yoke by means of a grip and pitch change bearings. The hub and blade assembly is mounted on the tail rotor shaft by means of delta-hinge trunnion. Blade pitch is altered by movement of the rudder pedals. This blade pitch change provides both anti-torque and directional control. Power to drive the tail rotor is supplied from a takeoff on the lower section of the main transmission.

d. *Tail Rotor.* Helicopters with MWO 55-1520-221-30/45 incorporated have the 11.5 inch chord tail rotor assembly. The tail rotor is a two bladed, semi-rigid, delta hinged, flex beam type employing both preconing and underslinging. Each blade is attached to the flat plate yoke by means of spherical pitch change bearings. Spherical bearings are used to permit flapping about the delta hinge. Blade pitch is controlled by the use of the rudder pedals.

2-21. Oil Supply Systems.

The oil supply system consists of engine, transmission, 42° gearbox and 90° gearbox oil systems.

a. *Engine.* The engine oil system is a dry sump, pressure type and completely automatic (figure 2-16). The oil tank is located in the upper pylon fairing, is self sealing to a 30 caliber projectile, and is equipped with de-aeration provisions. Oil is gravity fed from tank to engine driven oil pump which provides pressure and scavenging for the system. The tank capacity and oil specification are shown on the servicing diagram.

NOTE

Maximum permissible oil consumption is 0.14 gallon (1.1 pints) per hour.

(1) Cooling. Engine oil cooling is accomplished by an oil cooler with thermostatic valves and bypass provisions. The cooler is located in the engine support deck below the engine combustor. The engine oil cooling air is supplied by the engine bleed air turbine fan. No control for the bleed air fan is required or provided.

(2) Bypass Control. The emergency oil bypass system is controlled by the low level switch in the oil tank and the ENG OIL BYP switch on the pilots engine control panel (figure 2-7). When the ENG OIL BYP switch is in AUTO position, the low level switch in the oil tank will automatically energize the two position bypass valve circuit when the engine oil tank supply is approximately 3.8 quarts low from spillover. When the bypass valve is activated, the oil bypasses the oil cooler. When the ENG OIL BYPASS switch is in the OFF position, the bypass circuit is deactivated, however, the ENGINE OIL BYPASS light will still illuminate when the float switch is activated.

b. *Transmission.* Transmission lubrication is accomplished by a self contained pressure oil system with the oil pump immersed in oil contained in the sump case of the transmission. Visual sight glasses are provided on the right side of the accessory case for checking oil level. Quick-disconnect couplings are used on the driveshaft

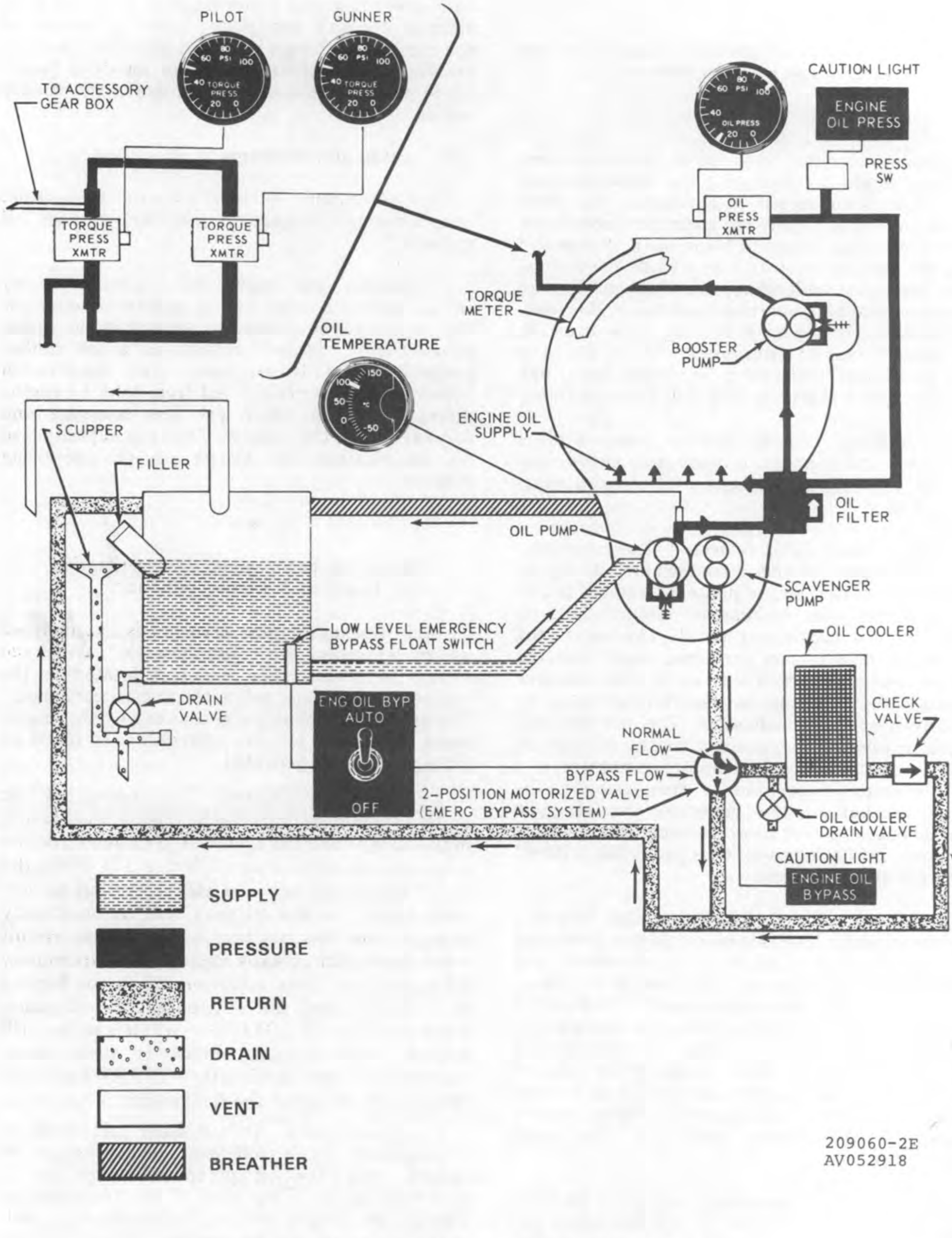


Figure 2-16. Engine oil system schematic

and electrical connections which permit rapid removal or replacement of the transmission as an assembly. Oil specification and capacity of the transmission are shown on the servicing diagram.

(1) Cooler. A transmission oil cooler, (figure 2-17) attached to the engine oil cooler, is incorporated in the transmission oil system. Transmission oil is cooled by the same fan that cools the engine oil. No manual control has been provided as it is a self contained system with independent thermostatic valves and bypass provisions as a part of the transmission oil cooling system. The oil system has an automatic emergency oil cooler bypass system that routes the oil around the oil cooler if the oil cooler is ruptured.

(2) Bypass Caution Light. Illumination of the XMSN OIL BYPASS segment light is caused by low oil pressure on the cooler side of the emergency bypass valve. Unless transmission oil pressure is below approximately 32 psi the light would indicate oil is being routed around the cooler (figure 2-17). The emergency bypass valve closes automatically when there is a differential flow between the pump and cooler outlet.

c. Intermediate Gearbox - 42°. The 42° gearbox lubrication is accomplished by a self contained wet sump located in lower area of gearbox assembly. A visual sight glass is provided on the right side of the gearbox for checking oil level. Oil specification and capacity of the 42° gearbox are shown on the servicing diagram.

d. Tail Rotor Gearbox - 90°. The 90° gearbox lubrication is accomplished by a self contained wet sump. A visual sight glass is provided on the lower right side of the gearbox for checking oil level. Oil specification and capacity of the gearbox are shown on the servicing diagram.

2-22. Fuel Supply System.

The fuel supply system consists of two fuel cells, two boost pumps, filter, quantity and boost pump pressure indicator systems, and malfunction caution lights.

CAUTION

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 providing the servicing nozzle does not exceed 1.75 inches outside diameter. To refuel utilizing the gravity nozzle, it is necessary to position the intersleeve of receiver until slot is lined up with fuel port in bottom of receiver. Position nozzle into port in order to bypass closed circuit valve. Damage could result to the closed circuit refueling system if caution is not used when fueling with the gravity servicing nozzle. Nozzle must be supported to prevent a twisting moment on the refueling receiver.

a. Helicopters serial number 70-15936 and subsequent and helicopters with MWO 55-1500-206-20/3 accomplished provide a closed circuit refueling system when used with the mating nozzle. This system is capable of automatic shutoff of fuel flow at a predetermined level. A total of 270 gallons is stored in two bladder type cells connected by a single crossover line. Servicing is accomplished from the right side of the helicopter into the forward cell (figure 2-18).

b. Helicopters serial number 70-15936 and subsequent and helicopters with MWO 55-1520-221-50/2 accomplished have the crashworthy fuel supply system. The crashworthy fuel supply system is designed with the potential of containing fuel during severe but survivable impacts, to reduce the possibility of fire, and to increase the ballistic protection level of the cells. Frangible fittings are used to secure the fuel cells in the airframe. They are designed to fail and permit relative movement of the cells without rupture. This allows the cells to contain the fuel in the crash impact sequence. Fuel capacity of this system is 262 gallons.

c. Operation. Fuel free - flows through the crossover line into the aft cell but is restricted flowing forward by a flapper check valve which prevents cg shift when the helicopter nose is lowered for flight. Low pressure fuel is supplied to the engine fuel regulator by an electrically operated submerged boost pump located on the floor of each cell. Individual boost pump lines are connected at a check valve manifold located at the top forward side of the aft fuel cell. The fuel is then filtered as it passes up through the left side of the engine compartment by an electric indicator type filter. Total pressure being maintained by the boost pumps is monitored by the fuel pressure gage. Low boost pump pressure caution lights are provided on pilots caution panel. Continuous monitoring of pounds of fuel contained in the cells is indicated by the fuel quantity gage and

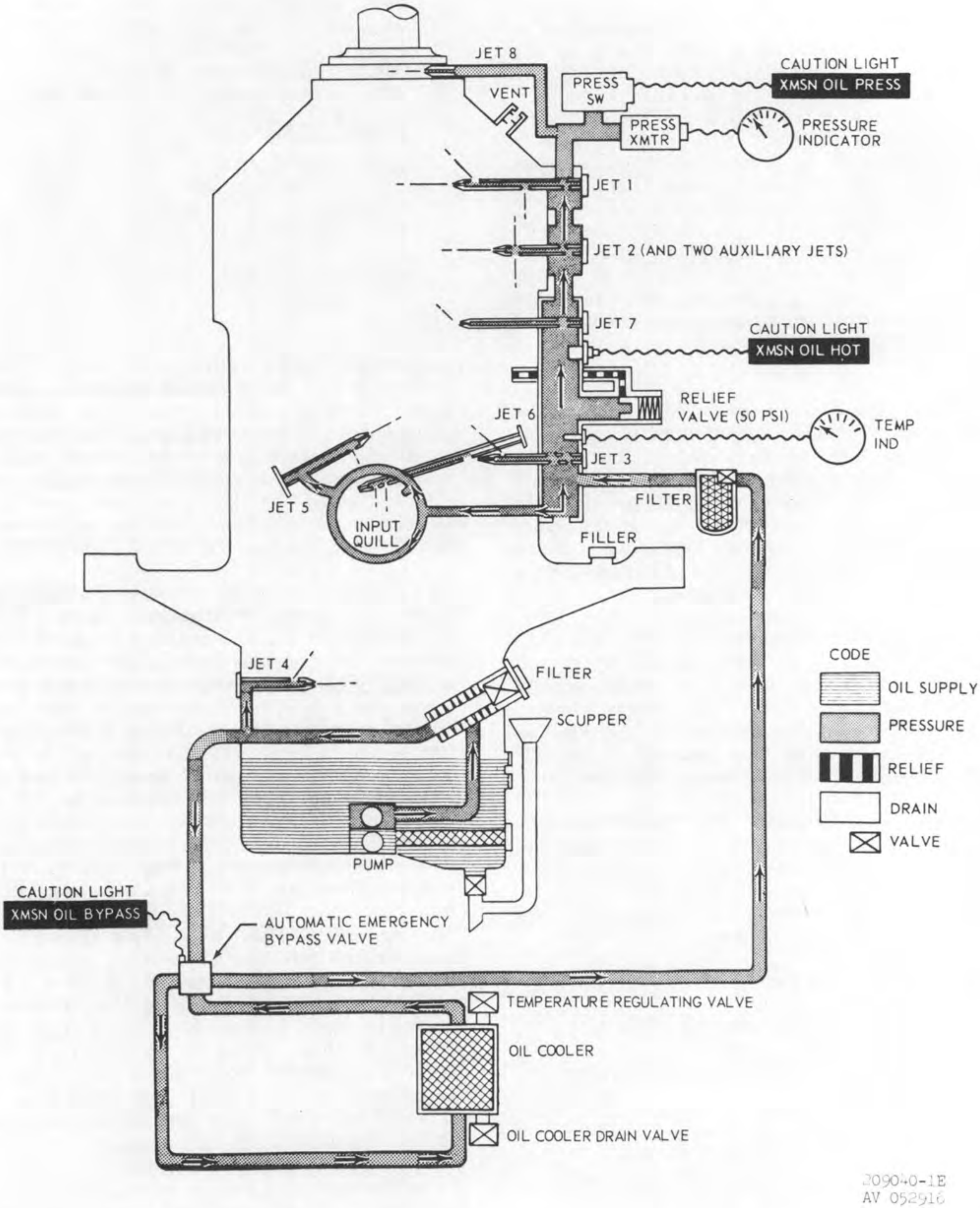


Figure 2-17. Transmission oil system schematic

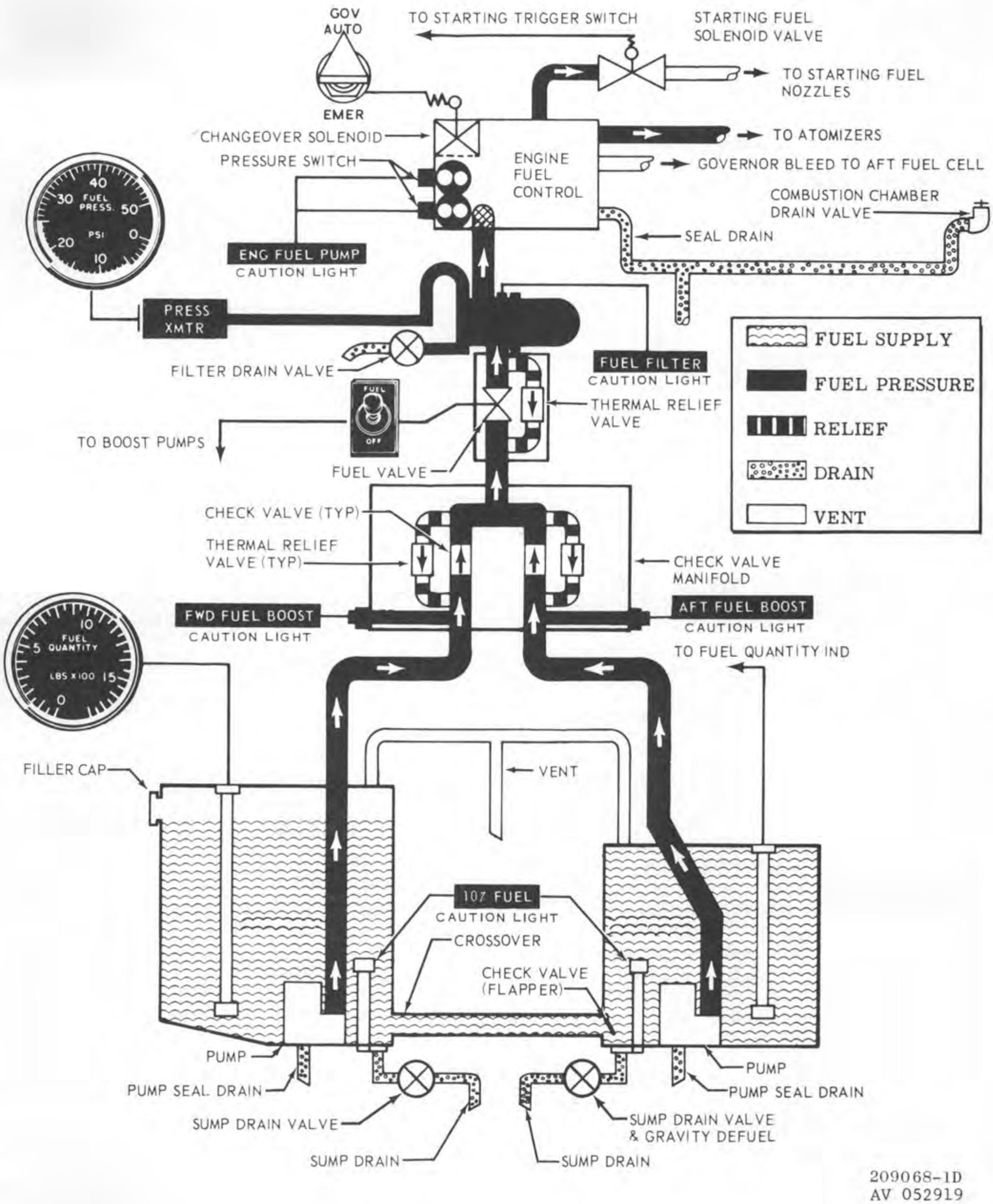


Figure 2-18. Fuel system schematic

approximately 20 minutes of usable fuel by the 10% FUEL light located on each segment caution panel.

NOTE

The 10% FUEL caution segment will illuminate, regardless of an inoperative boost pump, when ten percent of usable fuel remains.

When the helicopter is in forward flight it will assume a nose down attitude varying in degrees with airspeed, gross weight, c.g., and drag. When this attitude is maintained, fuel will level and a larger quantity will be maintained in the forward cell. When both boost pumps are operational, the 10% FUEL caution light will illuminate with low level total in both cells (approx. 160 lb). When either boost pump is inoperative the 10% FUEL caution light will illuminate when low level is reached in the opposite cell; therefore, with a forward boost pump inoperative the fuel contained in the forward cell is not usable and is disregarded by the 10% FUEL caution light. This amount could be as high as 320 lb. depending on the nose down attitude of the helicopter. When either boost pump is inoperative the 10% FUEL caution light is valid, and unnecessary flight maneuvers should be avoided.

d. Controls and Indicators. Fuel system controls and indicators are composed of the following: fuel switch, fuel gage test switch, fuel quantity indicator, fuel quantity caution light, fuel pressure indicator, forward and aft fuel boost pump caution lights and fuel filter caution light.

(1) Switch. The fuel switch (figure 2-7), is a two-position switch and is located on the pilots left console just forward of the collective stick. The switch is protected against accidental operation by a spring-loaded toggle lever which must be pulled up before switch movement can be accomplished. Movement of the switch to the forward position (ON) activates the forward and the aft boost pumps, opens the fuel shutoff valve and completes the circuit for starting fuel to the starting trigger. When the toggle head is lifted and the switch is moved to aft position, the fuel shutoff valve is closed and the forward and aft fuel boost pumps cease operation. The electrical power for the valve and forward boost pump is supplied from the 28 Vdc essential bus. Electrical power for the aft boost pump is supplied by the non-essential bus.

(2) Quantity. The fuel quantity indicator is located on the pilots instrument panel (figure 2-11). This instrument is a transistorized electrical receiver which continuously indicates the quantity of fuel in pounds and is powered by the 115 Vac system and circuit protection is provided by a circuit breaker on the circuit breaker panel. The fuel quantity indicator is connected to capacitor-type fuel quantity transmitters in the forward and aft fuel cells. The indicator readings shall be multiplied by 100 to obtain fuel quantity in pounds.

(3) Gage Test Switch. A pushbutton momentary ON switch (figure 2-11) is located on the pilots instrument panel. The switch functions to provide a means of testing the indicator and circuit for operation. When the switch button is depressed and held in, the fuel quantity indicator pointer moves from the actual quantity reading toward a less quantity reading. Upon release of the test button the indicator needle will return to the actual fuel reading.

(4) Quantity Caution Light. A caution panel segment worded 10% FUEL is located on the pilots and gunners caution panels (figures 2-27 and 2-28). The light switch assembly is located in each fuel cell through a low fuel level relay. With both pumps operating the low level switches are connected in series and with either pump inoperative the low level switches are connected in parallel. The switches function to close the circuit and illuminate the caution light when there is enough fuel remaining for approximately 20 minutes of fuel at cruise power. Electrical power for circuit operation is supplied by the 28 Vdc essential bus.

(5) Fuel Pressure. The fuel pressure indicator (figure 2-11) is located on the pilots instrument panel. This indicator provides psi readings of the fuel as delivered from the tank mounted fuel boost pumps to the engine driven pump. The indicator is connected to a pressure transmitter, powered by 26 Vac which electrically transmits the fuel pressure reading to the fuel pressure indicator.

(6) Boost Pump Caution Lights. The caution panel worded segment FWD FUEL BOOST and AFT FUEL BOOST is located on the pilots caution panel. A failure of a fuel boost pump is sensed by a pressure switch which then illuminates the caution light for the particular boost pump (FWD or AFT) that failed. The caution lights and pressure switches are powered by the 28 Vdc essential bus.

(7) Filter Caution Light. The caution panel worded segments FUEL FILTER are located in the pilots and gunners caution panels (figures 2-27 and 2-28). A differential pressure switch is mounted in the fuel line across the filter. When the

filter becomes partially obstructed, the pressure switch senses this and closes contacts, to energize the circuit. The caution light illuminates, alerting the pilot to a partially clogged fuel filter condition. If clogging increases, the fuel bypass valve opens to permit fuel to flow around the filter.

e. Approved Fuels. (Table 2-1).

(1) Standard Fuel - JP-4 (MIL-T-5624) (NATO Code No. F-40).

(*a*) JP-4 is designated as Army Standard Fuel for aircraft turbine engines and is the primary fuel to be used in this helicopter.

(*b*) Commercial Jet B fuels should be used when JP-4 is not available.

(2) Alternate Fuel - JP-5 (MIL-T-5624) (NATO Code No. F-44).

(*a*) Commercial Jet A or Jet A-1 fuels should be used when JP-5 is not available.

(*b*) Alternate fuels can be used continuously without reduction of power outputs.

(3) Emergency Fuel - Gasoline of all types may be used only when aircraft turbine engine fuels are not available.

NOTE

T53 series engines require a hot end inspection after 50 hours operation on emergency fuel. An entry shall be made on DA Form 2408-13 if emergency fuel is used.

Table 2-1. Approved Fuels

SOURCE	PRIMARY OR STANDARD FUEL	ALTERNATE FUEL	
U.S. MILITARY FUEL NATO CODE NO.	JP-4(MIL-T-5624) F-40 (WIDE CUT TYPE)	JP-5 (MIL-T-5624) F-44 (HIGH FLASH TYPE)	
COMMERCIAL FUEL (ASTM-D-1655)	JET B	JET A	JET A-1 NATO F-34
American Oil Co.	American JP-4	American Type A	
Atlantic Richfield	Arcojet B	Arcojet A	Arcojet A-1
Richfield Div.		Richfield A	Richfield A-1
B.P. Trading	B.P.A.T.G.		B.P.A.T.K.
Caltex Petroleum Corp.	Caltex Jet B		Caltex Jet A
Cities Service Co.		CITCO A	
Continental Oil Co.	Conoco JP-4	Conoco Jet-50	Conoco Jet-60
Gulf Oil	Gulf Jet B	Gulf Jet A	Gulf Jet A-1
EXXON Co. USA	EXXON Turbo Fuel B	EXXON A	EXXON A-1
Mobil Oil	Mobil Jet B	Mobil Jet A	Mobil Jet A-1
Phillips Petroleum	Philjet JP-4	Philjet A-50	
Shell Oil	Aeroshell JP-4	Aeroshell 640	Aeroshell 650
Sinclair		Superjet A	Superjet A-1
Standard Oil Co.		Jet A Kerosine	Jet A-1 Kerosine
Chevron	Chevron B	Chevron A-50	Chevron A-1
Texaco	Texaco Avjet B	Avjet A	Avjet A-1
Union Oil	Union JP-4	76 Turbine Fuel	

Table 2-1. Approved Fuels (Cont)

SOURCE	PRIMARY OR STANDARD FUEL	ALTERNATE FUEL
U.S. MILITARY FUEL NATO CODE NO.	JP-4 (MIL-T-5624) F-40 (WIDE CUT TYPE)	JP-5 (MIL-T-5624) F-44 (HIGH FLASH TYPE)
FOREIGN FUEL	NATO F-40	NATO F-44
Belgium	BA-PF-2B	
Canada	3GP-22F	3-6P-24e
Denmark	JP-4 MIL-T-5624	
France	Air 3407A	
Germany (West)	VTL-9130-006	UTL-9130-007/UTL 9130-010
Greece	JP-4 MIL-T-5624	
Italy	AA-M-C-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	D. Eng RD 2498

NOTE

Anti-icing and Biocidal Additive for Commercial Turbine Engine Fuel — The fuel system icing inhibitor shall conform to MIL-I-27686. The additive provides anti-icing protection and also functions as a biocide to kill microbial growths in aircraft fuel systems. Icing inhibitor conforming to MIL-I-27686 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.

2-23. Electrical Power Supply Systems.

The electrical power supply system consists of the dc and ac electrical systems.

a. DC Power Supply. The 28 Vdc supply system (figure 2-19) is a single conductor system with the negative lead of the generator grounded to the helicopter structure. Direct current power is supplied by the starter-generator, battery, or external power. The power supply incorporates a primary bus, essential bus, non-essential bus, generator voltage regulator, generator field relay, generator reverse current relay, bus control relay, battery relay, non-essential bus relay, starter relay, external power relay, control panel, and circuit breakers to furnish protection for the system and equipment operating from the system. In the event of a generator failure, the non-essential bus, is automatically dropped. The circuit is opened by means of the bus control relay and the non-essential bus relay actions; however, a switch has been provided (NON-ESS BUS) to override the automatic action.

b. Battery. The battery is located in the aft section of the fuselage. The battery is either a 22 or 34 ampere hour 24 volt nickel cadmium battery which has a high discharge rate for starting turbine engines. The primary use of the 34 amp-hour battery is for cold weather operations.

c. Starter - Generator. The 28 volt starter-generator is rated at 300 ampere output and is mounted on and driven by the engine accessory drive section. DC power control is accomplished through the pilots electrical power control panel (figure 2-20).

d. DC Power Supply Controls and Indicators. The dc power supply controls and indicators are composed of the following: control panel, battery switch, generator switch, non-essential bus switch, and dc volt-ammeter indicator.

(1) Control panel. This panel is located on the pilots left console. The panel contains the following dc control switches; BAT, GEN, and NON-ESS BUS. Panel illumination is provided by

two panel lights that are controllable from the CONSOLE LTS rheostat switch.

(2) Battery switch. This switch is located on the pilots electrical power control panel and is a two-position toggle switch, labeled BAT. When the switch is placed in the BAT position, it closes the circuit to the actuating coil of the battery relay and dc voltage is then being delivered from the battery to the primary bus. When the switch is placed in the OFF position it opens the circuit to the actuating coil of the battery relay and no current is delivered from the battery to the primary bus. The gunner is provided an ELEC PWR-EMER OFF switch on his miscellaneous control panel to provide the gunner a means of de-energizing the electrical system and the generator circuit.

(3) Generator switch. This switch is located on the pilots electrical power control panel and is a three position switch. This switch is labeled GEN, OFF and RESET. The RESET position is spring loaded to return to OFF position when released. To reset generator, the switch must be held in the RESET position momentarily and then moved to the GEN position.

(4) Non-Essential Bus Switch. This switch is located on the pilots electrical power control panel. This switch is a two-position switch labeled NON-ESS BUS. When the switch is in NORMAL position (forward), power is supplied to the non-essential bus provided the generator is operating and charging. When the switch is in MANUAL position (aft) power is supplied to the non-essential bus regardless of the generator operation.

(5) Volt-Ammeter. The dc volt-ammeter (figure 2-11) is located on the instrument panel and is a dual purpose instrument. The right scale on the face of the instrument is calibrated in volts and the left scale on the instrument dial is calibrated in amps. The instrument has dual hands and amperage and voltage are displayed simultaneously.

(6) DC Circuit Breaker Panel. The dc circuit breaker panel (figure 2-21) is located on the pilots right console and is in easy reach of the pilot. Each individual circuit breaker is clearly labeled for the particular electrical circuit protected. In event a circuit is overloaded the circuit breaker protecting that particular circuit will pop out. The circuit is reactivated by resetting the circuit breaker.

e. External Power Receptacle.

CAUTION

A 650 amp (minimum) APU is required for external start.

The external power receptacle is located on the aft left side of the fuselage. When a 28 Vdc auxiliary power unit plug is securely inserted in the receptacle the external power relay in the helicopters electrical system is energized and 28 Vdc electrical power is supplied to the primary bus for distribution. When the external door is opened the EXTERNAL POWER worded segment in the pilots caution panel will be illuminated.

2-24. AC Power Supply.

The 115 Vac is supplied to the helicopter instruments and systems shown in figure 2-19 by either of two inverters; the main inverter or the standby inverter. Either inverter may be selected by the pilot with the INVTR switch located on the electrical power control panel (figure 2-20). Alternating current is supplied to those instruments requiring 26 Vac by the 26 Vac transformer.

a. AC Power Control. The ac power is controlled by the inverter switch and ac circuit breakers.

b. Inverter switch. The three position inverter switch is located in the pilots electrical power control panel. The forward or INVTR MAIN position selects the main inverter which is powered by the non-essential bus. The rear or STBY position selects the standby inverter which is powered by the essential bus. The center or OFF position opens the circuit to the actuating coil of the inverter relay and illuminates the INST INVERTER caution light.

c. AC Circuit Breakers. The ac circuit breakers are located in the ac circuit breaker panel (figure 2-22) on the pilots left console. In the event of a circuit overload, the circuit breaker protecting that particular circuit will pop out. The circuit is reactivated by resetting the circuit breaker.

d. AC System Indicator. The caution panel worded segment INST INVERTER is located in the pilots caution panel. The caution panel segment is illuminated if ac power to the system is lost.

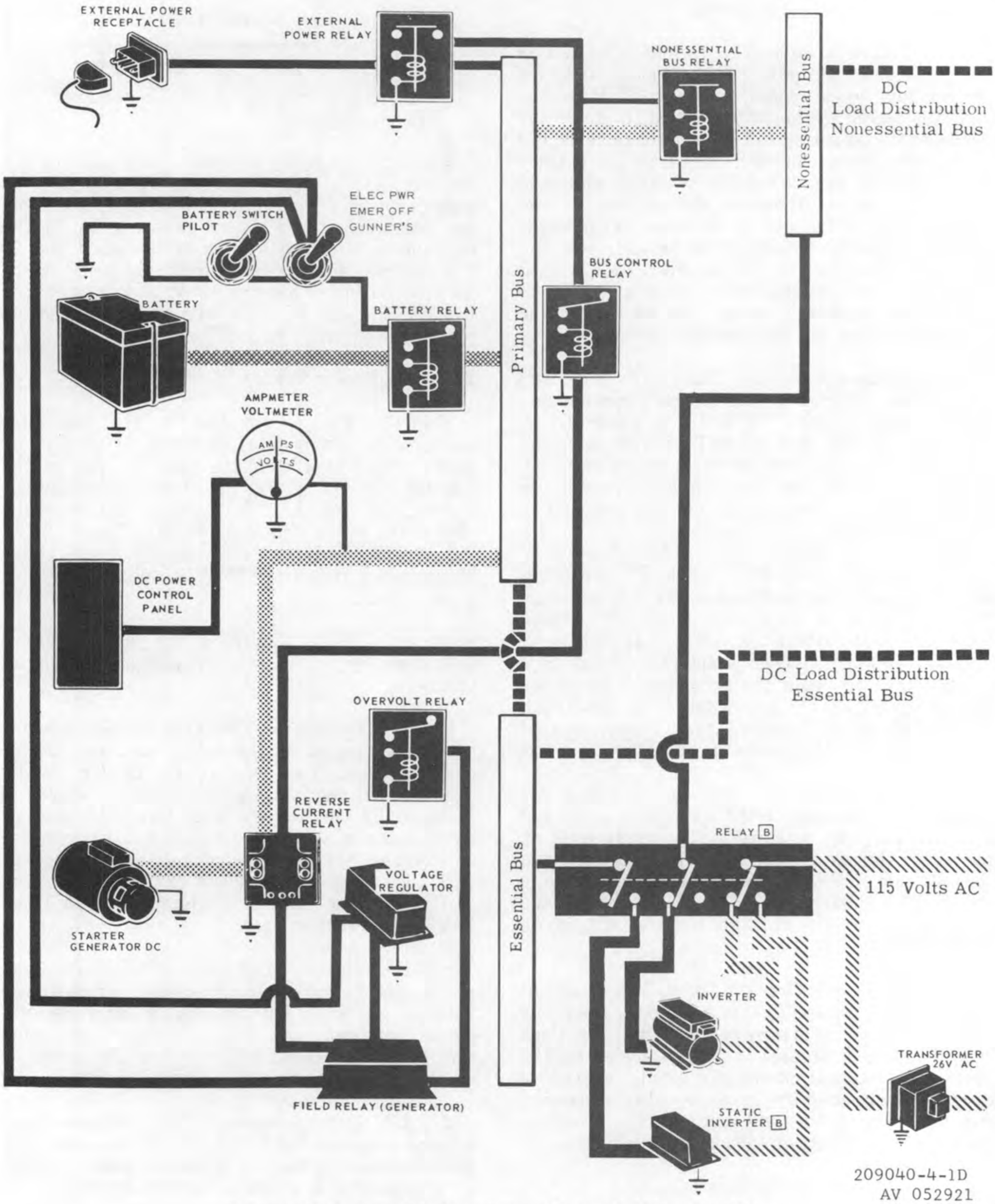


Figure 2-19. Electrical system schematic (Sheet 1 of 2)

NON-ESSENTIAL BUS

Inverter — Main
Fuel Boost Aft
Postion Lights
Anti-Collision Lights
Searchlight Control
Pitot Tube Heater
KY 28 Coder
VHF Radio
FM Radio
ADF
Weapons Fire
Turret Power
LH Mini Gun
RH Mini Gun
Wing Stores Rockets
Environmental Control Unit (ECU)

ESSENTIAL BUS

Proximity Warning
DC Voltmeter
Generator and Bus Reset
Inverter Standby
Starter Relay
Ignition System and Start Fuel
Governor Control
Fuel Valve
Oil Bypass Valve
Fuel Boost Forward
Idle Stop
Engine Air Screen
Engine Deice
Cockpit Lights
Force Trim
Hydraulic Control
SCAS Power
Turn and Slip Indicator
Engine and Transmission Oil Temperature Indicator
Instrument Lights
RPM Warning
Searchlight Power
Caution Lights
ICS
UHF Transceiver
IFF Transponder
IFF Test Set
Wing Stores Jettison
RH Smoke Grenade
LH Smoke Grenade
Engine Fire Warning

AC 115 VOLT

Engine VIB Meter
Weapons Sight
AC Fail Relay
SCAS Power
Pilot Attitude Indicator
Gunner Attitude Indicator
Gyro Compass Indicator
Fuel Quantity Indicator
26V Transformer

AC 26 VOLT

ADF Receiver
Fuel Pressure
Engine Oil Pressure
Transmission Oil Pressure
Torque Pressure
Power Factor Correction
Course Indicator

Power from Generator
DC Load Distribution
Power from Battery
DC Control
AC Load Distribution

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Figure 2-19. Electrical system schematic (Sheet 2 of 2)

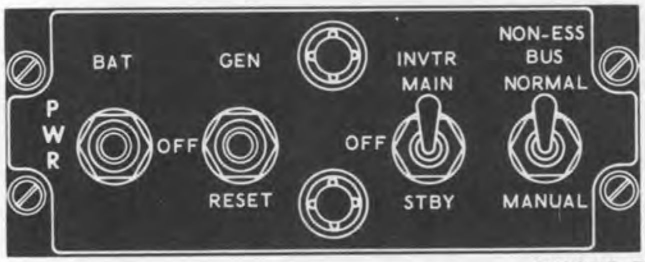

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Figure 2-20. Electrical power control panel

2-25. Hydraulic Systems.

Hydraulic power is supplied by a dual hydraulic system, (No. 1 and No. 2) which minimizes the force required by the pilot to move the cyclic, collective and directional control systems (figure 2-23). Basically, the two systems are identical excluding the portion of system No. 1, which supplies pressure to the directional control system SCAS and emergency system; and the portion of system No. 2, which supplies pressure to the armament system and SCAS. The systems contain the following major components common to both systems: reservoirs, pumps (transmission driven), modules, and three dual actuating cylinders (two for cyclic and one for collective controls) with dual servo valves. Each system module is comprised of

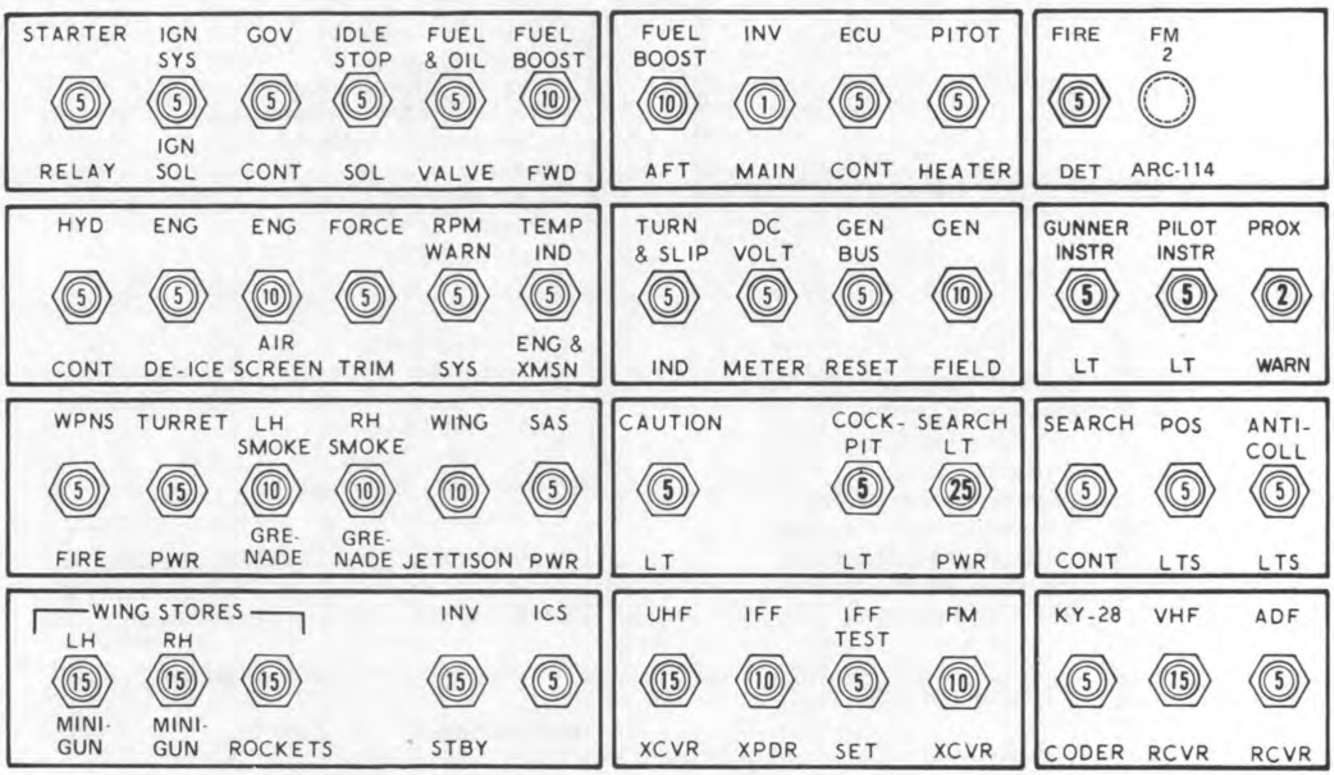

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Figure 2-21. DC circuit breaker panel 8 typical

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AV089660

Figure 2-22. AC circuit breaker panel

the following units; pressure line filter, pressure line filter indicator, pressure switch, system ON-OFF solenoid valve, system relief valve, return line filter, return line filter indicator, and two ground test connections. This dual system with pressure going into dual actuators offers the pilot a greater safety factor. The hydraulic cylinders incorporate closed center four-way manual servo valves with irreversible features and are provided in the lateral fore-and-aft cyclic and collective control systems. A single power cylinder incorporating a closed center four-way manual servo valve is provided in the directional control system. The cylinders contain a straight-through mechanical linkage. Refer to servicing diagram for hydraulic fluid specifications and quantity.

a. System No. 1. Hydraulic fluid from the reservoir passes through the constant pressure, variable delivery pump, delivering fluid at 1500 psi to the No. 1 module system. This module has, on the pressure side, a filter element, a magnetic indicator, and solenoid valve which when de-energized, the system is "ON" and energized, the system is "OFF". The module also incorporates, a pressure switch which warns the pilot of "Hydraulic Low Pressure" and on the hydraulic fluid return a filter element with a magnetic indicator. On the module two quick disconnect couplings for the auxiliary hydraulic system are also incorporated. From the module the fluid flows to the three servo actuating valves which are dual acting, directing the pressurized fluid to the dual servo actuating cylinders at a minimum 1500 psi. The No. 1 system also supplies pressure to the directional control system, directional control (YAW) SCAS system and charges the emergency hydraulic accumulator system.

b. System No. 2. Hydraulic fluid from the reservoir passes through the constant pressure, variable delivery pump, delivering fluid at 1500 psi to the No. 2 module. This module has, on the pressure side, a filter element, a magnetic indicator, and solenoid valve which when de-energized, the system is "ON" and energized, the system is "OFF". The module also incorporates a pressure switch which warns the pilot of hydraulic low pressure and on the hydraulic fluid return a filter element with a magnetic indicator. On the module two quick disconnect couplings for the auxiliary hydraulic system are also incorporated. From the module the fluid flows to the three servo actuating valves which are dual acting, directing the pressurized fluid to the dual servo actuating cylinders at a minimum 1500 psi. The No. 2 system also supplies pressure to the turret, and pitch and roll SCAS actuators.

c. Test Switch. The hydraulic system test switch is located on the pilots engine control panel. The switch is a three-position toggle type switch labeled HYD TEST SYS 1 and SYS 2 and is spring loaded to the center position. When the switch is held in SYS 1 position, system 1 is the only system that is supplied with hydraulic pressure. Similar action occurs when the switch is held in the SYS 2 position.

d. Indicators. The hydraulic indicators consist of fluid level gages and low pressure caution lights.

e. Fluid Level Gages. The hydraulic reservoirs are mounted just aft of the crew compartment and have a capacity of 3.2 pints. A sight gage is mounted on each reservoir and both gages are visible from the left hydraulic compartment access door. System number 1 reservoir is located on the left side and system number 2 is located on the right side.

f. Caution Lights. The caution panel worded segment HYD PRESS NO. 1 and HYD PRESS NO. 2 are located in the pilots and gunners caution panel. The panels illuminate when the hydraulic system pressure is low. Electrical power for the hydraulic pressure caution light is supplied from the 28 Vdc essential bus and circuit protection is provided by a circuit breaker on the circuit breaker panel.

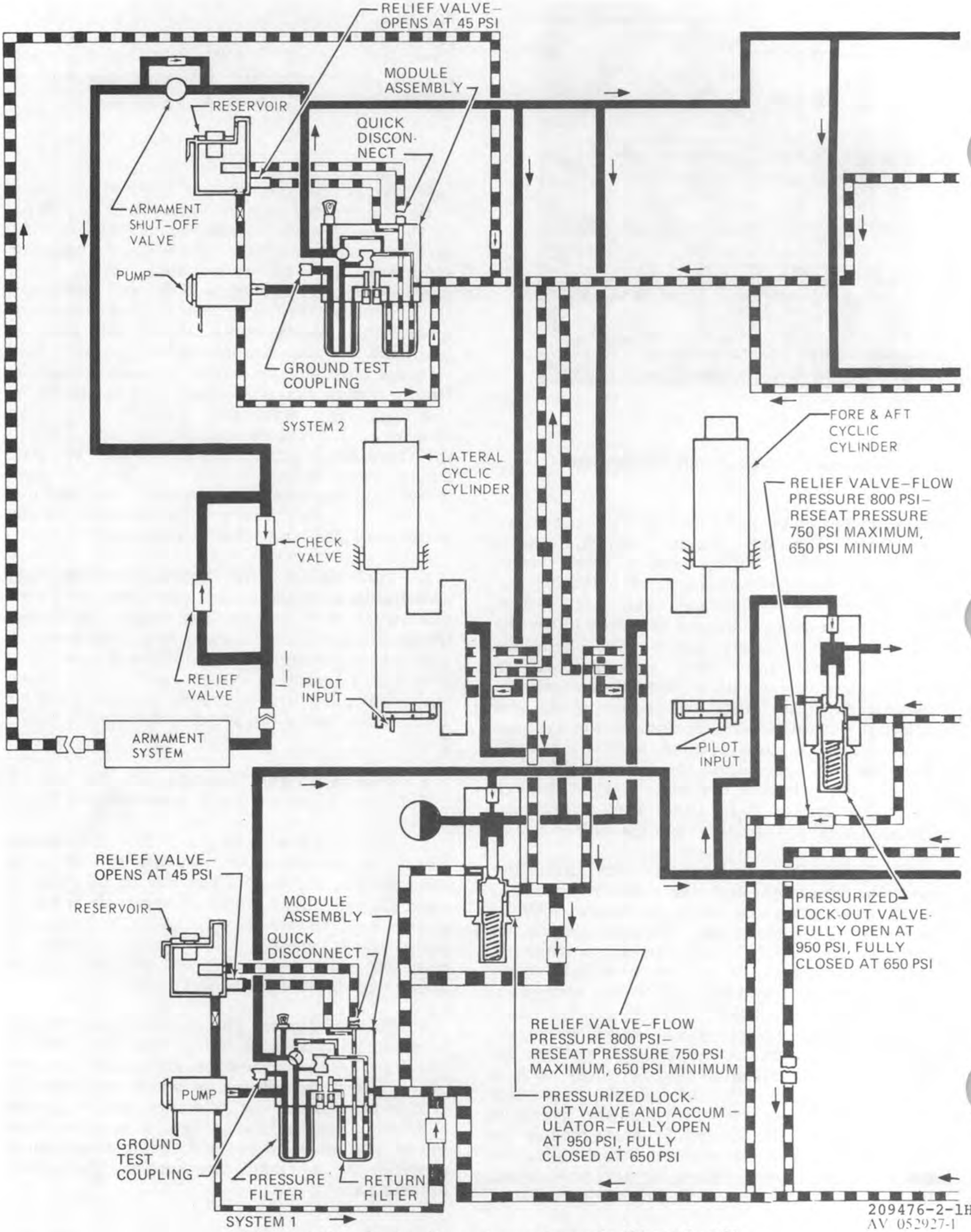


Figure 2-23. Hydraulic system schematic (Sheet 1 of 2)

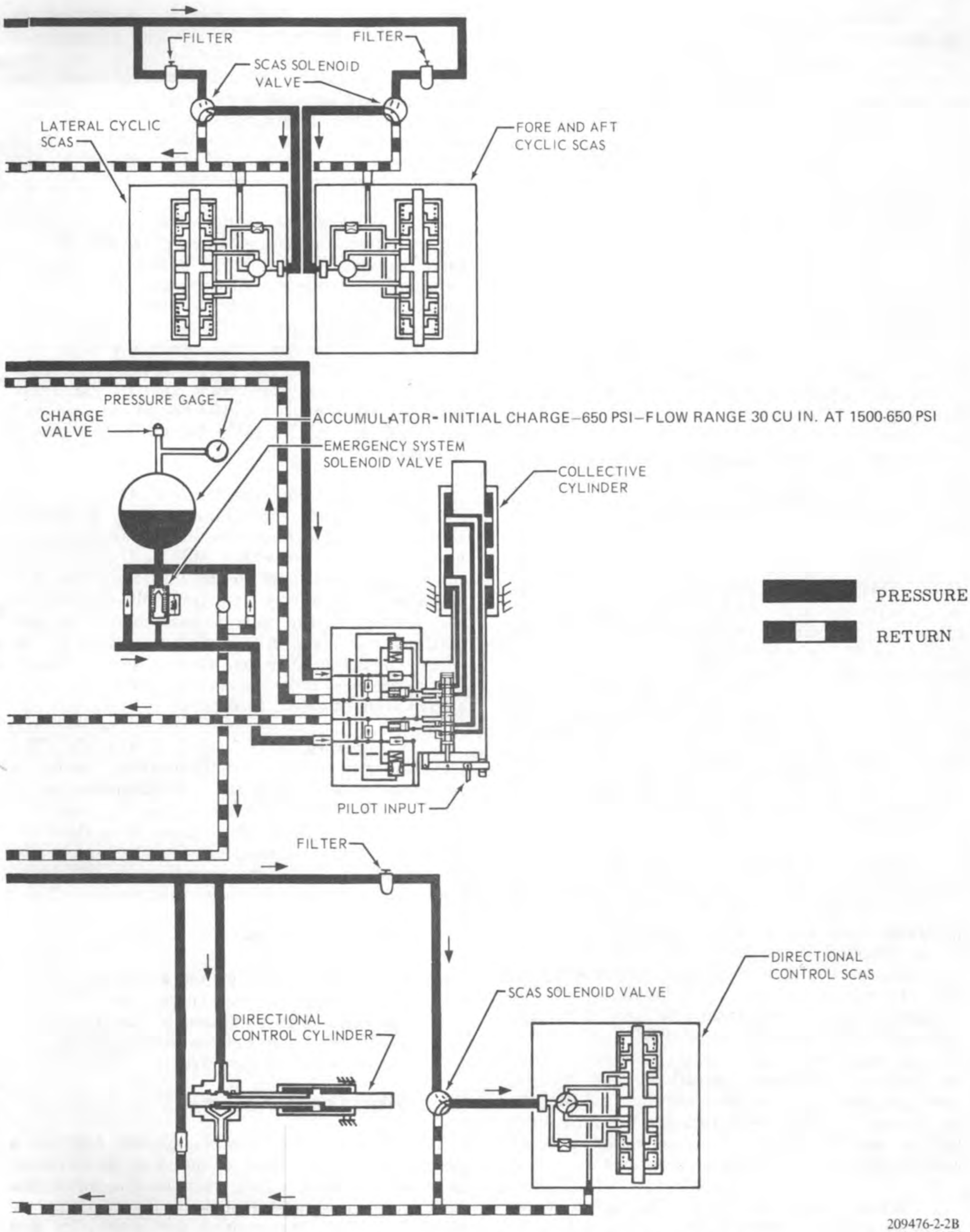


Figure 2-23. Hydraulic system schematic (Sheet 2 of 2)

g. Emergency Hydraulic System. (Accumulator System). This equipment is intended to provide emergency capability for operating the collective pitch hydraulic cylinder when neither hydraulic system provides normal operating pressure. The circuit includes, a pressurized lockout valve, a hydraulic accumulator precharged with compressed nitrogen, and a solenoid valve controlled by the EMER COLL HYD switch on the instrument panels. The accumulator becomes hydraulically charged during normal operation in either switch position. The solenoid valve is spring-loaded to be open when electrically de-energized (switch ON, or without electrical power), but can be electrically energized (switch OFF) to be closed and holding stored fluid in pressure accumulator. If system pressure drops, the lockout valve becomes fully closed, at not lower than 650 psi, to isolate the cylinder and accumulator circuit from the system. When EMER COLL HYD switch is positioned to ON, the solenoid valve de-energizes and opens, allowing the accumulator to be used to operate the collective control power cylinder for at least four full strokes of the control. A stroke is maximum movement in one direction.

h. Cyclic Controls Accumulator and Lockout Valve. This equipment provides a small reserve of oil for cylinder seal leakage. When fluid is lost other than at cylinder, a valve locks fluid in the cylinder at 650 psi which compresses oil and air in cylinder resulting in stiffness when flying with hydraulic power OFF. This system differs from provisions in collective system in capacity of accumulator and in being automatic. The lockout valve is identical to the one used in the collective system. The accumulator is a small unit, using spring pressure instead of compressed gas, and has no external means of control.

i. Turret. The M28 turret assembly hydraulic system enables the gunner to traverse the gun through varied positions in elevation and azimuth. Hydraulic fluid and pressure, regulated at 1500 psi, is supplied to the M28 system by the No. 2 hydraulic system at a maximum flow rate of 5.5 gpm. Flexible lines and quick-disconnect fittings are used to connect helicopter and turret hydraulic systems. Power requirements of 28 Vdc and 115 Vac are both required to supply electrical power for hydraulic system operation. The system consists of six major components (figure 2-24): the servo valve manifold, elevation and azimuth servo valves, azimuth drive motor, elevation position control actuator, and elevation stow lock assembly.

j. Servo Valve Manifold. The servo valve manifold directs hydraulic flow to all hydraulic components of the M28 turret and is mounted in the center of the turret.

k. Servo Valves - Elevation and Azimuth. The elevation and azimuth servo valves are identical except that the oil flow releases to their dependent components is adjusted to different rates. In an emergency, they can be used interchangeably, and are always replaced as a complete unit.

l. Azimuth Drive motor. The azimuth drive motor drives the turret through a full 215° of turret travel. When a signal is applied from the weapons controllers, the azimuth servo valve schedules a given flow rate of fluid through one of two ports (dependent on the desired direction of turret travel) into the motor, while the other port serves as a return. The port through which fluid enters determines the motor speed. The motor output shaft is geared to the turret azimuth ring gear and drives the table to which the gun is mounted.

m. Elevation Position Control Actuator. The elevation position control actuator is a double-acting hydraulic cylinder permitting application of hydraulic power on either side of the piston to control gun movement in the vertical plane. The actuator is stationary and vertically mounted in the center of the turret assembly. The gun platform can pivot in elevation according to the side of the actuator piston that pressure is applied. The direction of pressure is controlled by command signals from the sight resolvers.

n. Elevation Stow Lock Assembly. The elevation stow lock assembly locks the turret in zero degree elevation when hydraulic power is not applied to the turret. When hydraulic pressure is applied to the system, it releases the detent pin from the elevation cradle, allowing the turret to be positioned in elevation according to the servo valve.

NOTE

When the system is not activated or when desired, the turret can be repositioned in elevation by manually retracting the detent pin located in the bottom center of the turret.

2-26. Flight Control System.

The flight control system (figure 2-25) is a positive mechanical type, actuated by conventional helicopter controls which when moved, direct the helicopter in various modes of flight. Complete flight controls are provided for both pilot and

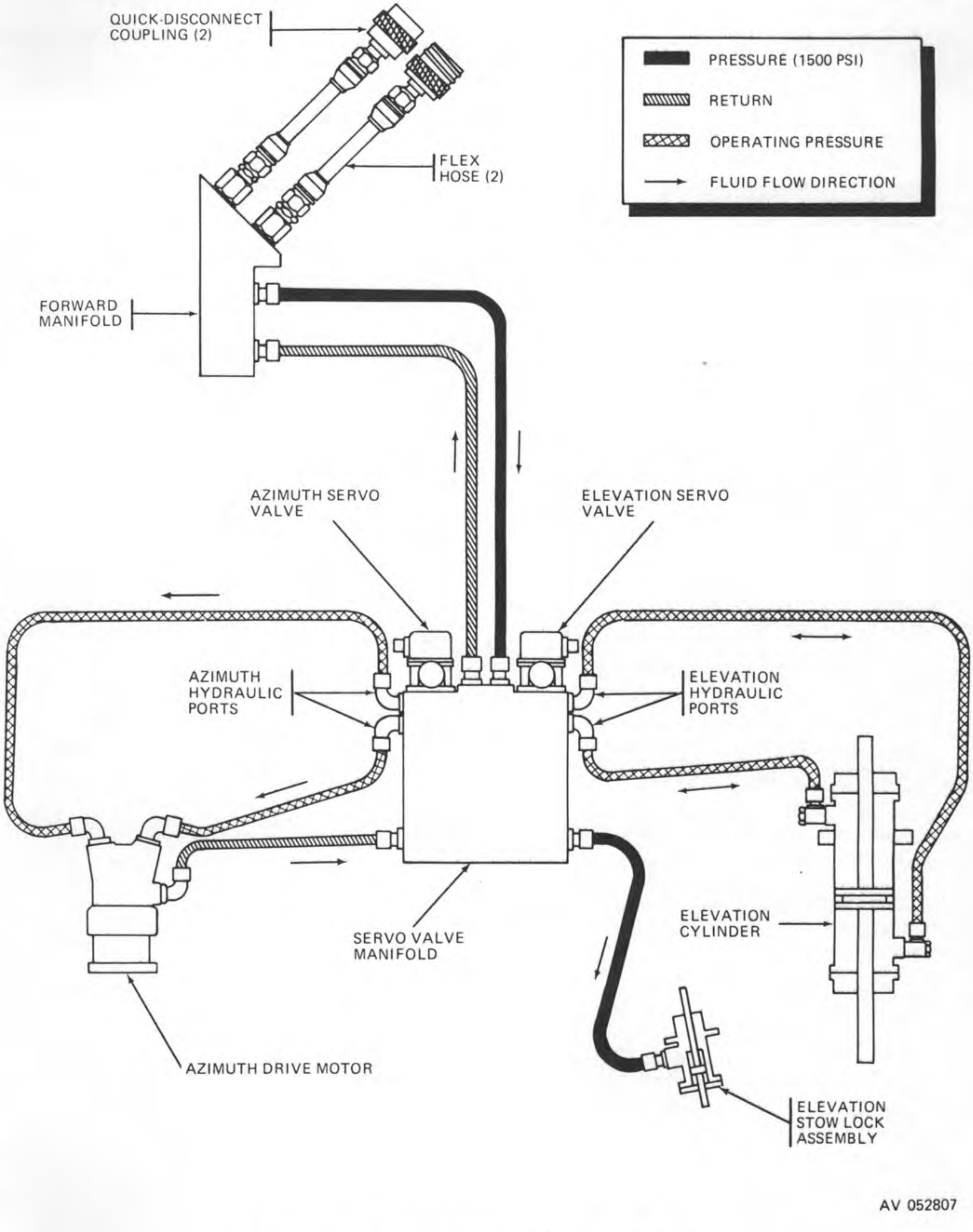
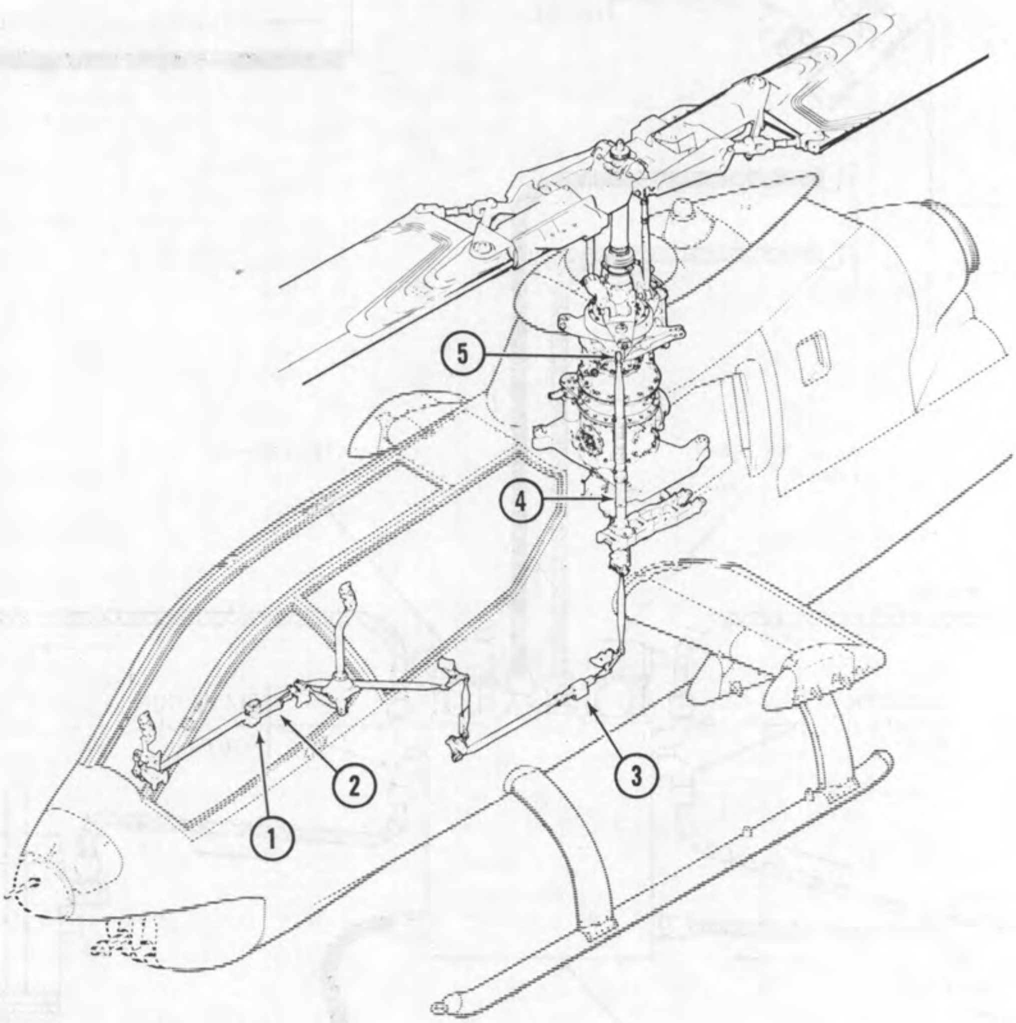


Figure 2-24. Turret hydraulic schematic M28



1. Magnetic Brake
2. Force Gradient
3. SCAS Actuator Unit
4. Hydraulic Cylinder
5. Swashplate

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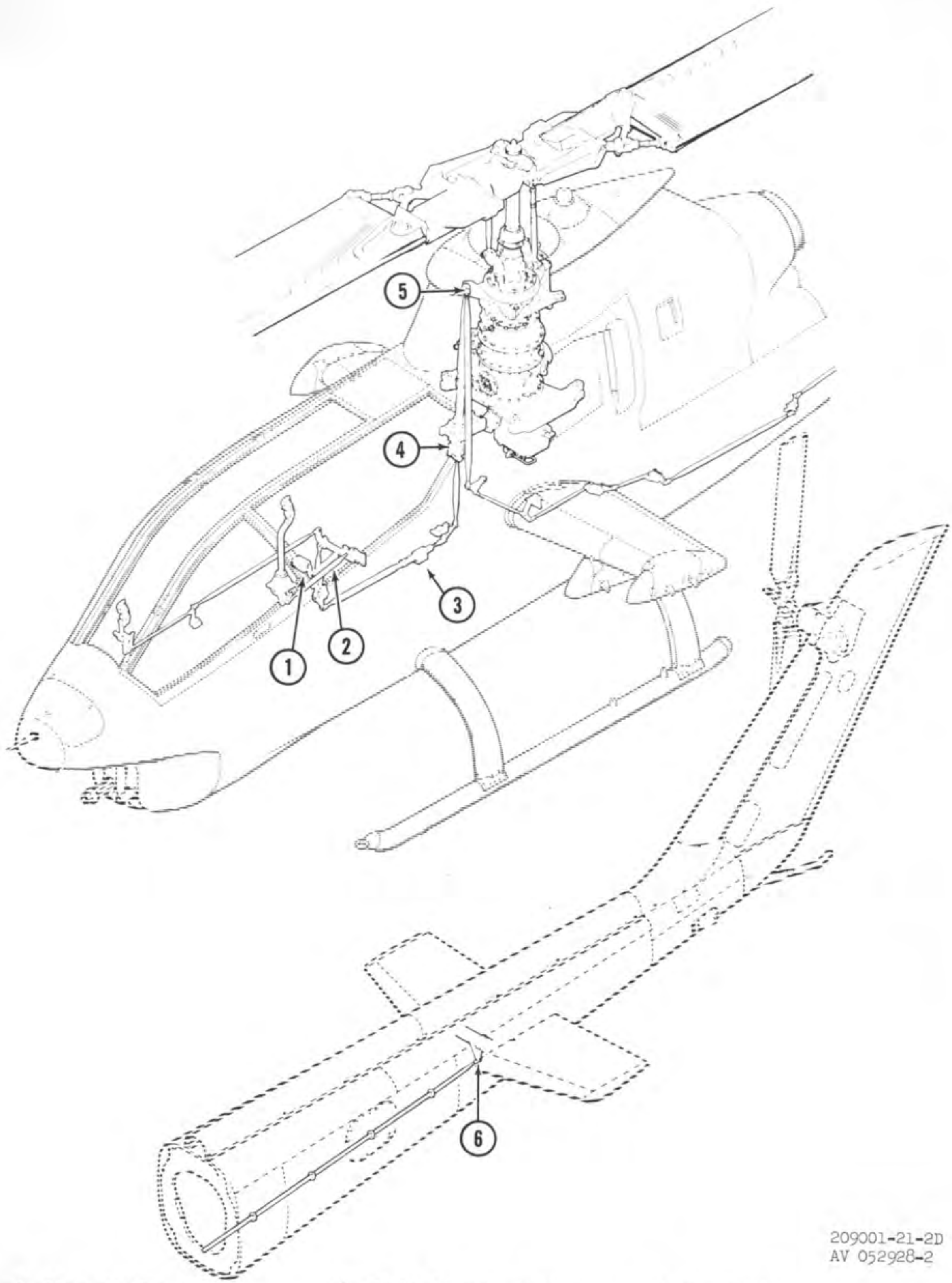
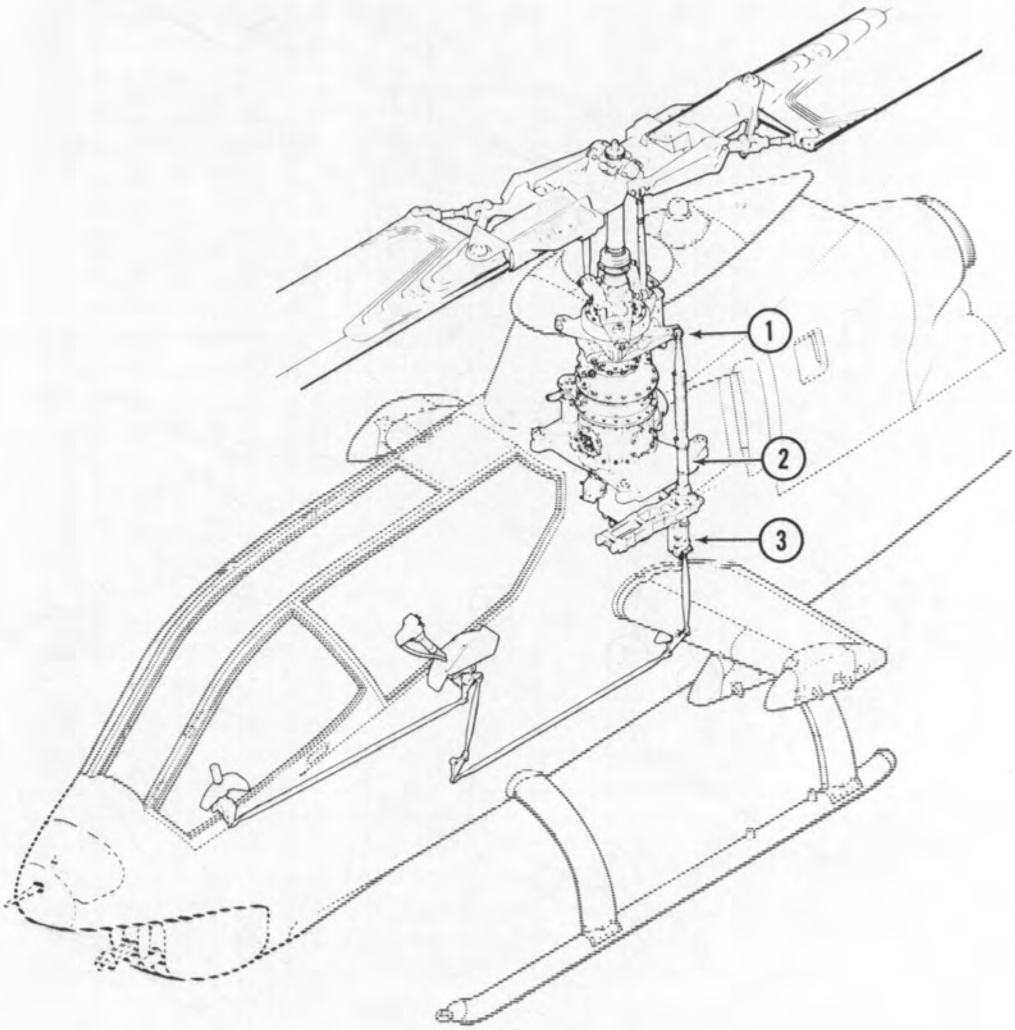
Figure 2-25. Flight control system (Sheet 1 of 4)



1. Magnetic Brake
2. Force Gradient
3. SCAS Actuator Unit
4. Hydraulic Cylinder
5. Swashplate
6. Elevator Horn

Figure 2-25. Flight control system (Sheet 1 of 4)



1. Collective Lever
2. Hydraulic Cylinder
3. Hydraulic Cylinder Valve

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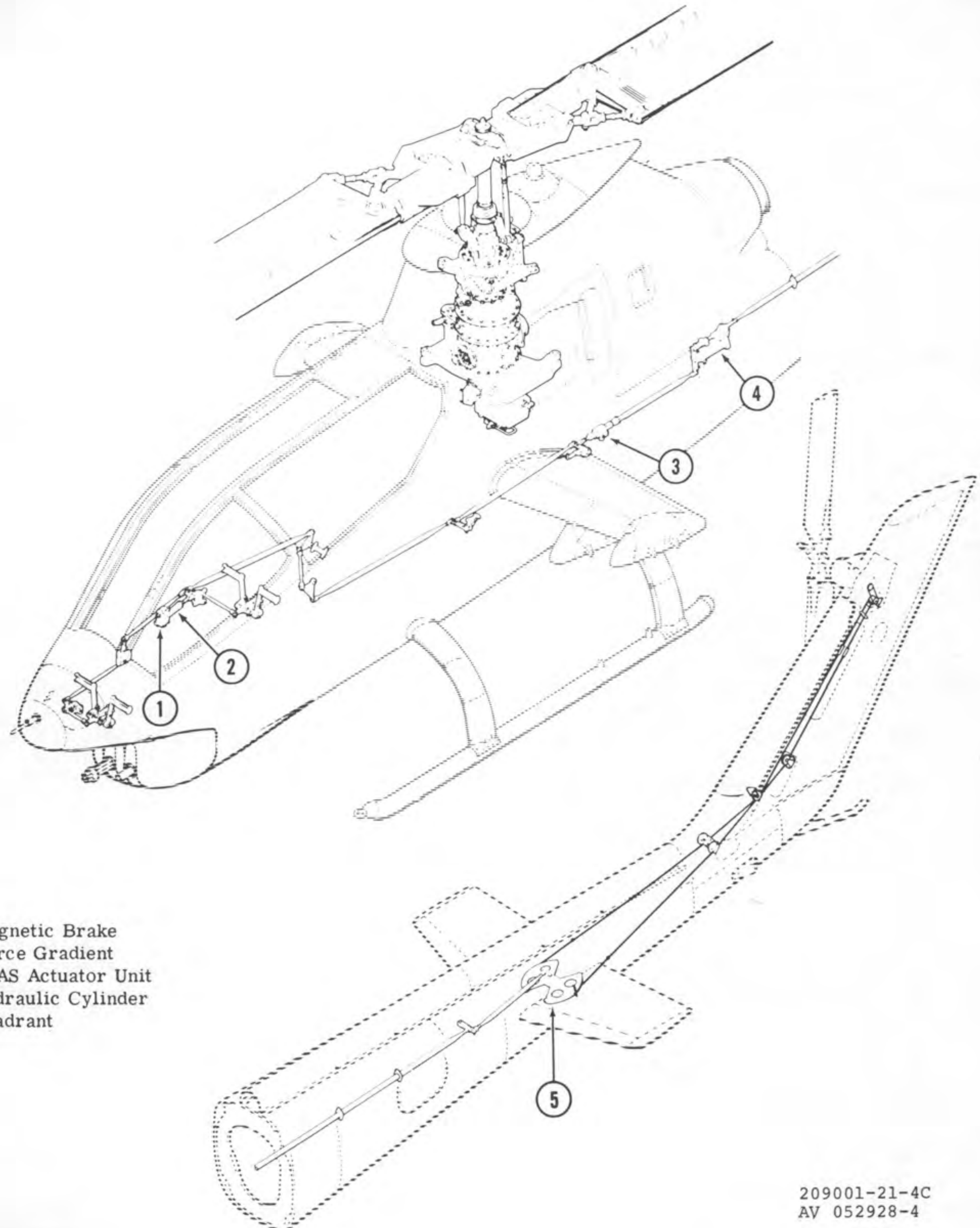
Figure 2-25. Flight control system (Sheet 3 of 4)



1. Magnetic Brake
2. Force Gradient
3. SCAS Actuator Unit
4. Hydraulic Cylinder
5. Quadrant

Figure 2-25. Flight control system (Sheet 4 of 4)

gunner. The system includes; the cyclic control stick, used for fore and aft and lateral control; the collective pitch (main rotor) control stick, used for vertical control; rudder (directional) pedals, used for heading control; and a synchronized elevator, to increase controllability and to stabilize the cg through the speed range of the helicopter. The control forces of the flight control system are reduced to a near zero pounds force, to lessen pilot fatigue, by hydraulic servo cylinders connected to the control system mechanical linkage and powered by the transmission driven pumps. Force trims (force trim system) connected to the cyclic and direction controls are electrically operated mechanical units; used to induce artificial control feeling into the cyclic and directional controls and to prevent the cyclic stick and directional controls from moving of their own accord.

a. Force Trim. A magnetic brake and force gradient are installed in the longitudinal lateral cyclic and the directional controls. A magnetic brake is attached to the airframe and when the force trim is turned "ON" the arm attached to the force gradient will lock in a fixed position. When the control is moved in either direction the force gradient spring will be compressing, inducing artificial feel to the control system. The magnetic brake is energized from the 28 Vdc essential bus. When either force trim switch is moved to the OFF position or power to the bus is interrupted, the system is inoperative. OFF-ON switches are contained on the gunners miscellaneous control panel (figure 2-8) and the pilots engine control panel (figure 2-7). A momentary interrupt force trim switch is contained on both cyclic controls which allows the pilot or gunner to de-energize the magnetic brake circuit temporarily and trim the controls to the flight attitude desired.

b. Controls - Crew Compartment. The pilots controls are of the conventional helicopter controls. The gunners cyclic and collective controls are side arm controls that are operated with less motion than the pilots controls.

(1) Cyclic. The pilots and gunners cyclic stick grip contains a two-position trigger switch for the turreted gun, radio two-position switch, force trim switch, SCAS release switch, and a switch for firing the wing mounted weapons (figures 2-9 and 2-10). The pilots cyclic stick has a built-in operating friction. The cyclic control movements are not mixed, but are transmitted directly to the swashplate. The longitudinal cyclic control linkage is routed from the cyclic stick through the SCAS actuator, the dual boost hydraulic actuator to the right horn of the fixed swashplate ring. The lateral is similarly routed to the left horn. Control "feel" is provided by the force trim units.

(2) The pilots collective pitch control (figure 2-9) is located to the left of the pilots seat and controls the vertical mode of flight. The collective assembly consists of collective stick, with adjustable friction system, twist grip-type throttle with friction adjusters, and switch box assembly. The switch box assembly incorporates the starter, governor increase-decrease, smoke release switch, engine idle release, searchlight and landing light switch (when installed). A pitch lever down lock is provided for the pilots collective. The gunners collective assembly is located to the left of the gunners seat and incorporates collective pitch and throttle control.

(3) Tail rotor. Rudder pedals alter the pitch of the tail rotor blades and provide the means of directional control. Pedal adjusters are located at the base of the pedals at the floor level. Adjuster knobs enable adjustment of pedal distance for individual comfort. The force trim system is connected to the directional controls. Heel rests are provided for the gunner to preclude inadvertent operation of the rudder pedals during maneuvering flight when the pilot is in control of the helicopter.

c. Stability and Control Augmentation System (SCAS). The SCAS system consists of a control panel, sensor-amplifier, three electro-hydraulic actuators, three control motion transducers, and a pylon compensation system. The SCAS is a three-axis, limited-authority, rate-referenced stability augmentation system. In addition, it includes an electrical pilot input which augments the pilots mechanical control input to provide a continuous fly-through capability. This arrangement permits separate consideration of airframe displacements caused by external disturbances from those caused by pilot input. Because the system can distinguish between the two, it is possible to provide a wide variety of gain adjustments to tailor the helicopter responses to best fit operational requirements.

(1) Control Panel. The control panel (figure 2-26) contains a POWER switch for applying necessary 28 Vdc and 115 Vac operating voltages to the system. It also contains three magnetic latching channel engage switches which energize electric solenoid valve controlling hydraulic pressure to the system. The panel has three NO-GO lights; one associated with each channel engage switch. These lights are illuminated during the warmup to indicate the presence of current in each associated channel actuators. Should an

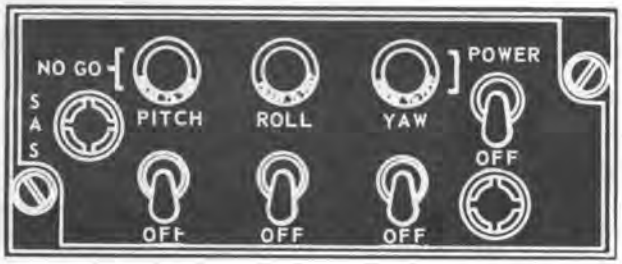


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Figure 2-26. SCAS control panel

engagement be attempted during this warmup period, the actuator will make an abrupt input to the flight controls at the moment of engagement. When engagement is made, the NO-GO lights are locked out of the circuit and do not operate as malfunction indicators. Disengaging a channel, however, restores the associated light to operation. The NO-GO lights have a built-in press-to-test feature for ensuring that the indicator is operational, but this feature works only prior to channel engagement.

(2) Sensor-Amplifier. The sensor-amplifier unit is the decision-making center of the SCAS. A rate gyro for each stabilized axis detects and measures rate of displacement of the airframe and this data is provided to the compensating network. The compensating network also receives inputs from the pilots control motion transducer and acts to prevent rate gyro signals from overriding the pilot commands. The actual magnitude of movements of the pilots control is measured and summed with rate outputs of the gyro. The resultant output from the network is a rate command that is based on the amount of physical movement of the pilots control. The valve driver amplifier in each channel provides driving signals to the SCAS actuator valve, determining by polarity and amplitude the direction and amount to move the valve.

(3) Electro-Hydraulic Actuators. Each stabilized axis has an electro-hydraulic actuator which extends or retracts the control linkage in which it is installed to move the swashplate or change the pitch of the tail rotor. Each actuator contains a motion feedback transducer which informs the compensation network of the actuators position. Extension or retraction of the actuator is not felt in flight controls, providing proper control friction is present. In the non-energized position actuator is mechanically locked in a centered position. Applying hydraulic pressure by engaging channel, retracts locking mechanism and readies the actuator for valve driver commands.

(4) Control Motion Transducer. The control motion transducer is a linear potentiometer. The transducer is installed with its case attached to the airframe and a movable arm is attached to a bellcrank of the pilots pitch, roll, or yaw flight control. The movable arm travels along the resistance element as the pilots control is moved, picking off a linearly changing voltage from the transducers resistance element. This voltage is provided as an input to a compensation network of the sensor-amplifier unit, representing physical movement of the pilots control in a definite direction and amount.

(5) Pylon Compensation. The pylon compensation system electrically detects motion of the pylon with respect to the airframe, and operates in conjunction with the SCAS to provide automatic damping. The pylon suspension system of the AH-1G has been deliberately designed to be rather soft, as this characteristic affords a smoother flying weapon delivery platform. Under certain conditions of power loading, g-loading, and velocity, it is possible to set up a low frequency oscillation which causes the pylon to lean or rock in a circular pattern opposite to the direction of rotor rotation. The pylon compensation unit consists of a compensation network and pylon motion transducer. The pylon transducer measures fore and aft pylon motion relative to the airframe. The compensation network provides necessary signal shaping and phasing to apply corrective signals to the roll channel of the SCAS, effectively damping the pylon suspension system to cancel undesired motion.

d. Synchronized Elevator. The synchronized elevator is located near the aft end of the tailboom and is connected by mechanical linkage to the fore and aft cyclic control system. Fore and aft movements of the cyclic control stick produces a change in the synchronized elevator attitude, thus increasing controllability.

2-27. Landing Gear System.

a. Landing Gear. The landing gear system is a skid type, consisting of two lateral mounted arched crosstubes attached to two formed longitudinal skid tubes. The landing gear structural members are made from formed aluminum alloy tubing with full length steel skid shoes to minimize skid wear. The gear assembly is attached with clamps at four points to the fuselage structure. The manually retractable and quickly removable wheel assemblies have been provided to facilitate helicopter ground handling operations. The cross tubes are enclosed in fairings to reduce drag.

NOTE

The helicopter can be flown without fairings installed. Refer to Chapter 7 for airspeed limitations.

b. Tail Skid. A tubular steel tail skid is attached to the lower aft section of the tailboom assembly and acts as a warning to the pilot upon an inadvertent tail low landing.

2-28. Instruments.

a. Flight Instruments and Indicators. The pilots flight instruments consist of airspeed indicator, turn and slip indicator, vertical velocity indicator, altimeter, free air temperature, and attitude indicator. The gunners flight instruments consist of an airspeed indicator, attitude indicator, and altimeter.

(1) Airspeed. The single scale airspeed indicator (figure 2-11 and 2-12) is calibrated in knots and provides an indicated airspeed of the helicopter at any time during flight, by measuring the difference between impact air pressure from the pitot tube and static vents. The pitot tube is mounted on the nose section, and the static vents are located in the side cabin skins near the bottom edge of the canopy and just aft of the gunners compartment.

NOTE

Indicated airspeeds are inaccurate below approximately 25 KIAS due to rotor downwash.

(2) Turn and Slip. The turn and slip indicator (4 MIN TURN) (figure 2-11) is controlled by an electrically activated gyro which is dc powered from the essential bus. The instrument has a needle (turn indicator) and a ball (slip indicator). Although the needle and ball are combined in the one instrument and are normally read and interpreted together, each has its own specific function and operates independently of the other. The ball indicates when the helicopter is in a condition of zero slip, either in a turn or in straight and level flight. The needle indicates in which direction and what rate the helicopter is turning. The electrical circuit is protected by a circuit breaker on the dc circuit breaker panel.

(3) Vertical Velocity. The vertical velocity indicator (Rate of Climb) (figure 2-11) registers ascent and descent of the helicopter in feet per minute. The instrument is actuated by the rate of atmospheric pressure change and is vented to the static air system.

(4) Pressure Altimeter. The pressure altimeter (ALT) furnishes direct readings of height above sea level.

(5) Free Air Temperature. The bi-metal free air temperature indicator is located in the left side of the pilots compartment just below the plexiglass canopy attachment edge. The indicator provides a direct reading of the outside air temperature.

NOTE

The free air temperature indicator is installed in the pilots canopy door when the M35 subsystem is installed.

(6) Attitude Indicator - Pilot and Gunner. This is a dual remote indicating system. It includes a pilots and gunners attitude indicator (figures 2-11 and 2-12) a rate switch and separately mounted attitude gyro. The system is supplied power from the 115 Vac bus and is protected by circuit breakers on the ac circuit breaker panel (figure 2-22). The pilots and gunners attitude indicators mounted in the respective instrument panels display flight attitude of the helicopter relative to the earth. Pitch attitude is indicated by the motion of the sphere with respect to the minature airplane. Roll attitude is indicated by motion of the roll pointer with respect to the fixed roll scale located at the top of the display. The indicator sphere can be adjusted to zero indication by the pitch trim knob located on the face of the instrument on the lower right corner and a roll trim control located at the rear of the instrument. The power OFF flag located in the lower hand portion of the display is energized (out of view) by a tap on the power transformer. Any interruption of indicator power will indicate a failure and the flag will be exposed.

b. Navigation Instruments.

(1) Standby Compass. A standard magnetic type compass (figure 2-10) is mounted on the left windshield support. The compass is utilized by both the pilot and gunner.

(2) Avionics System Instruments. Instruments with avionics systems are covered in Chapter 5.

2-29. Caution-Warning Systems.

a. Master Caution System. The system consists of a master caution light and caution panels.

(1) Master Caution Light. The pilots master CAUTION light is located on his instrument panel (figures 2-11). The light will illuminate (aviation yellow) when caution fault conditions occur. This illumination alerts the pilot to check his caution panel for the specific fault condition.

(2) Caution Panels. The pilots caution panel (figure 2-27) is located in his right console. The gunners caution panel (figure 2-28) is located on his instrument panel.

(*a*) Caution Panel Lights. The caution panel has individual caution lights to identify fault conditions. The applicable caution light will illuminate (aviation yellow) when the fault condition occurs. The caution light lettering is readable only when the light illuminates. The caution light will remain illuminated until the fault condition is corrected or light panel is rotated in the caution panel. Table 2-2 relates the caution light lettering to the fault condition.

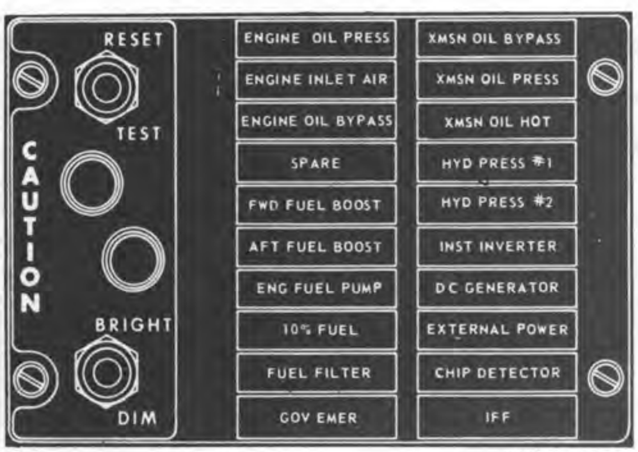

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Figure 2-27. Pilots caution panel

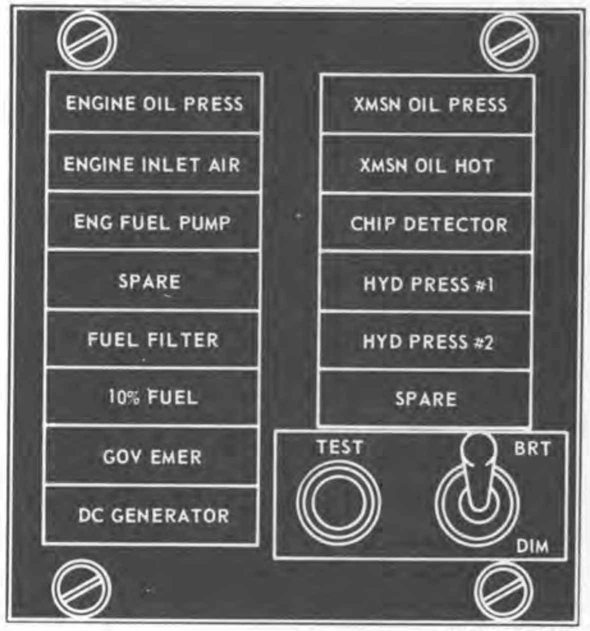

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Figure 2-28. Gunners caution panel

(*b*) Test/Reset and Test Switches. The pilots caution panel has a TEST/RESET spring loaded toggle switch. The gunners caution panel has a TEST press-to-test switch. Momentarily placing the pilots or gunners switch in the TEST position will cause all caution lights and the master CAUTION light to illuminate. Testing of the system will not change fault condition indications which existed prior to testing. Momentarily placing the pilots switch in the RESET position will extinguish and reset the pilots master CAUTION light so it will illuminate again should another fault conditon occur.

(*c*) Bright-Dim Switches. The caution panel has a BRIGHT-DIM (pilot), BRT-DIM (gunner) switch to control the brightness of the panel caution lights and the master CAUTION light. This switch will not function if the pilots CONSOLE LTS rheostat on his light panel (figure 6-4) or the gunners INST LTS rheostat on his miscellaneous control panel (figure 2-8) is in the OFF Position. The caution panel lights and the master CAUTION light will be at full brightness when the pilots/gunners rheostats are in the OFF position.

Table 2-2. Caution Panel Segment

CAUTION PANEL SEGMENT WORDING	FAULT CONDITIONS
ENGINE OIL PRESS.	Engine oil pressure below operating minimum (25 psi)
ENGINE INLET AIR	Negative air pressure in engine induction system.
*ENGINE OIL BYPASS	Engine oil bypass switch OFF - oil system level down 3.8 quarts from full. Engine oil bypass switch AUTOMATIC - oil system level down 3.8 quarts from full and bypassing cooler.
*FWD FUEL BOOST	Forward fuel boost pump pressure low (below 5 psi)
*AFT FUEL BOOST	Aft fuel boost pump pressure low (below 5 psi)
ENG FUEL PUMP	One side and/or both sides of engine fuel producing low pressure
10% FUEL	Low fuel quantity
FUEL FILTER	Fuel filter is partially obstructed
GOV EMER	Governor switch in emergency position
*XMSN OIL BYPASS	Transmission oil bypassing oil cooler
XMSN OIL PRESS.	Transmission oil pressure is below minimum (below 30 psi)
XMSN OIL HOT	Transmission oil temperature is at or above red line.
HYD PRESS 1	System 1 hydraulic pressure is low
HYD PRESS 2	System 2 hydraulic pressure is low
*INST INVERTER	AC power lost
DC GENERATOR	DC generator has failed
*EXTERNAL POWER	External power receptacle door open
CHIP DETECTOR	Metal particles in transmission, engine, 42° or 90° gearboxes
*IFF Identification – friend or foe	IFF system inoperative
*incorporated on pilots caution panel only.	

(3) The master caution system is powered by the 28 Vdc essential bus and is protected by the CAUTION LTS circuit breaker (figure 2-21).

b. RPM High-Low Limit Warning System. The system provides an immediate warning of high or low rotor rpm or low engine rpm. Main components are a detector unit, warning light, and an audio switch. The light warning and audio warning functions when the following rpm conditions exist:

Light Warning and Audio Warning in Combination	For rotor rpm at 300 ±5 rpm or below (corresponds to engine rpm of 6100 ±100 rpm or below) (low warning).
Light Warning Only	For rotor rpm of 334 ±5 (corresponds to engine rpm of 6800 ±100) (High warning).

NOTE

The audio warning will be heard in the pilots and gunners headsets. The audio is a varying oscillating frequency starting low and building up to a high pitch, on for 0.85 second interval, then off for 1.25 second, then repeating cycle.

(1) RPM Warning Light. The pilots RPM light is located on his instrument panel (figure 2-11). The light illuminates (red) to provide a visual warning of high or low rotor rpm or low engine rpm.

NOTE

For low rpm warning the audio warning functions in conjunction with the light.

(2) RPM Switch-Low RPM Audio. The pilots RPM switch is located on his engine control panel (figure 2-7). The switch in OFF position prevents audio warning from functioning for engine starting when the audio might be objectionable. The switch automatically resets to WARNING position when the engine and rotor reach normal operating rpm.

(3) The system circuit is powered by the 28 Vdc essential bus and is protected by the RPM WARN SYS circuit breaker (figure 2-21).

c. Fire Detector Warning System

NOTE

Helicopters with MWO 55-1520-221-30/43 incorporated will have the Fire detection system.

(1) The fire detection warning system consists of fire detection elements, fire detection control unit, fire detection test switch, and two fire warning lights.

(2) The fire detector elements are attached to the engine cowling.

(3) Excessive heat from the engine compartment will illuminate the fire lights located on the pilots and gunners instrument panel.

(4) Fire detector warning system units are supplied power by the 28 Vdc essential bus.

(5) The press-to-test (Fire Detector Test) test switch is located on the pilot instrument panel (figure 2-11). When the test switch is depressed, the fire detector elements are connected in series causing the fire light to illuminate.

2-30. Proximity Warning System.

The proximity warning system described in the following paragraphs is installed in helicopters which have had MWO 55-1520-221-30/49 incorporated. Refer to Chapter 3 for operating instructions and illustrations.

a. Description. The proximity warning system warns the pilot by visual and aural means whenever one or more similarly equipped aircraft are within a selectable range and within an altitude of 300 feet of the protected helicopter. The proximity warning system has selectable ranges of 1000, 2000 and 3000 feet. The system differentiates between aircraft which are above his helicopter, at the same altitude, and those that are below. It, accordingly, issues a visual warning to the pilot and informs him that an intruder is above, below, or at the same altitude as his "protected" helicopter. The system operates on a cooperative basis with other aircraft having like equipment. The system is in effect a modified C-band pulse beacon ranging system with electronic comparison of relative altitude. The system includes two "stub" antennas. The units weight is approximately 5.2 pounds and it requires 28 Vdc power and pitot-static system inputs. Warning outputs are lights (3) blinking at 3 Hz and a single 1600 Hz audio tone. Volume control is provided.

NOTE

A later configuration proximity warning device has a range selectability of 1000, 3000, and 5000 feet and is totally interchangeable within the system.

b. Modes of Operation. The proximity warning system has three modes of operation: the interrogation, response, and test modes. The interrogation and response modes are automatic, while the test mode is a manually initiated mode. The interrogation mode operates approximately 50 times per second, but the response mode is ready to operate any time an interrogation is received from an intruding aircraft.

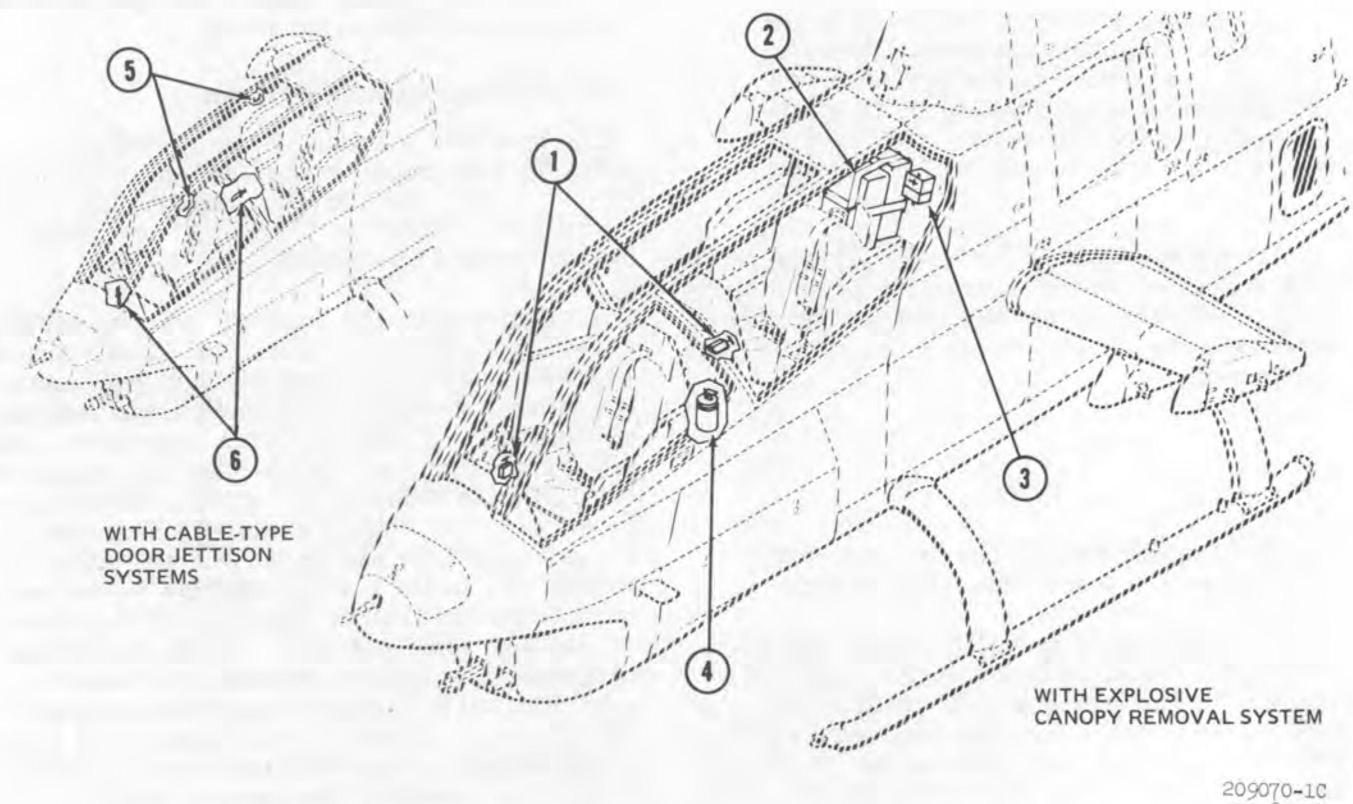
2-31. Emergency Equipment.

The emergency equipment includes a fire extinguisher, a first aid kit, and stowage provisions for two survival kits. (figure 2-29.) In addition, the cockpit area is equipped either with manually operated canopy door jettison systems and two canopy breakout knives, or with a canopy removal system of the linear explosive type.

a. Fire Extinguisher. A portable fire extinguisher is carried in a bracket located on the bulkhead at left of the gunners seat.

b. Crew Compartment Access. The pilots door on the right side and the gunners door on the left side of the canopy are each hinged at the top to swing outward and up. Each door has adjustable hold-open struts which will lock at full open and in intermediate position when handle is rotated to the lock position.

(1) Door Jettison Systems. Through Serial No. 71-20093, helicopters not modified by retrofit have pilots and gunners doors equipped with manual jettison handles and actuating cables which can pull pins from door hinges and struts. Each door can be separately jettisoned. Breakout knives are provided at pilots and gunners stations.



1. Arming Firing Mechanisms
2. Survival Kit Stowage
3. First Aid Kit
4. Fire Extinguisher
5. Door Jettison Handles
6. BreakOut Knives

Figure 2-29. Emergency equipment

(2) Explosive Canopy Removal System. On helicopters Serial No. 71-20984 and subsequent, and on prior serial numbers when MWO 55-1520-221-30/39 is accomplished, linear explosive window cutting assemblies are mounted around frames of both canopy doors and both side windows of the canopy, with interconnecting lines to two arming/firing (A/F) mechanisms at pilots and gunners stations. If the T-handle of either A/F unit is rotated 90° to arm, then pulled to fire the percussion primer, all four window cutting assemblies will be detonated. Explosive force will be outward and will cut the four transparent plastic side panels out of the canopy frame simultaneously.

2-32. Seats — Pilots and Gunners.

The pilots and gunners seats are positioned in a tandem arrangement. The gunners seat is in the forward position and the pilots seat is in the aft position.

a. Pilot. The pilots seat is vertically adjustable non-reclining type. The vertical adjustment is reclined at 15°. The vertical height adjustment handle is on the right side of the seat. The seat back and bottom is made of three-sixteenth inch armor plate. The sides are of one-fourth inch steel. The hip and shoulder areas are covered with ceramic panels that are five-eighths inch thick. The seat is equipped with a lap safety belt and inertia reel shoulder harness.

b. Gunner. The gunners seat is a fixed seat (non-adjustable and non-reclining). The gunners seat is made of ceramic type armor plate. The seat is equipped with a lap safety belt and inertia reel shoulder harness. The seat also has arm rests on each side that utilize urethane foam as the cushion material.

c. Shoulder Harness. An inertia reel and shoulder harness is incorporated in the pilots and gunners seats with a manual lock-unlock control handle. With the control in the unlocked position, the reel cable will extend to allow the occupant to lean forward; however, the reel will automatically lock when helicopter encounters an impact force of two to three g deceleration. Locking of the reel can be accomplished from any positon and the reel will automatically take up the 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 lock and then unlock position. It is possible to have pressure against the seat back whereby no additional movement can be accomplished and the lock cannot be released; if this condition occurs, it will be necessary to loosen the shoulder harness. Manual locking of the reel should be accomplished for emergency landings.

2-33. Equipment — Auxiliary.

The following auxiliary equipment is described in Chapter 6.

Environmental Control System

Engine Anti-Icing

Pitot Heater

Rain Removal

Lighting Equipment

Armament Systems

Data Case

Mooring Fittings

Rotor Tie Down

Tow Rings

Tailpipe Cover

Pitot Tube Cover

Canopy Cover

Electrical External Stores Jettison

2-34. Trainer — Pilot (TH-1G).

The trainer has a new instrument panel that provides the instructor (forward station) with a full set of flight instruments. The cyclic system provides the instructor with mechanical leverage equal to the pilot. The instructors collective also has equal mechanical leverage.

a. Instrument Panel. The trainer instrument panel (figure 2-30) provides the instructor with the following instruments and indicator lights which are in addition to the helicopters basic configuration: clock, turn and slip indicator, vertical velocity indicator, engine oil pressure indicator, transmission oil pressure indicator, rpm warning light, and master caution light. These additional instruments provide means for the instructor to monitor the helicopters and students actions.

b. Cyclic System. The trainers cyclic control system (figure 2-31) is provided with two

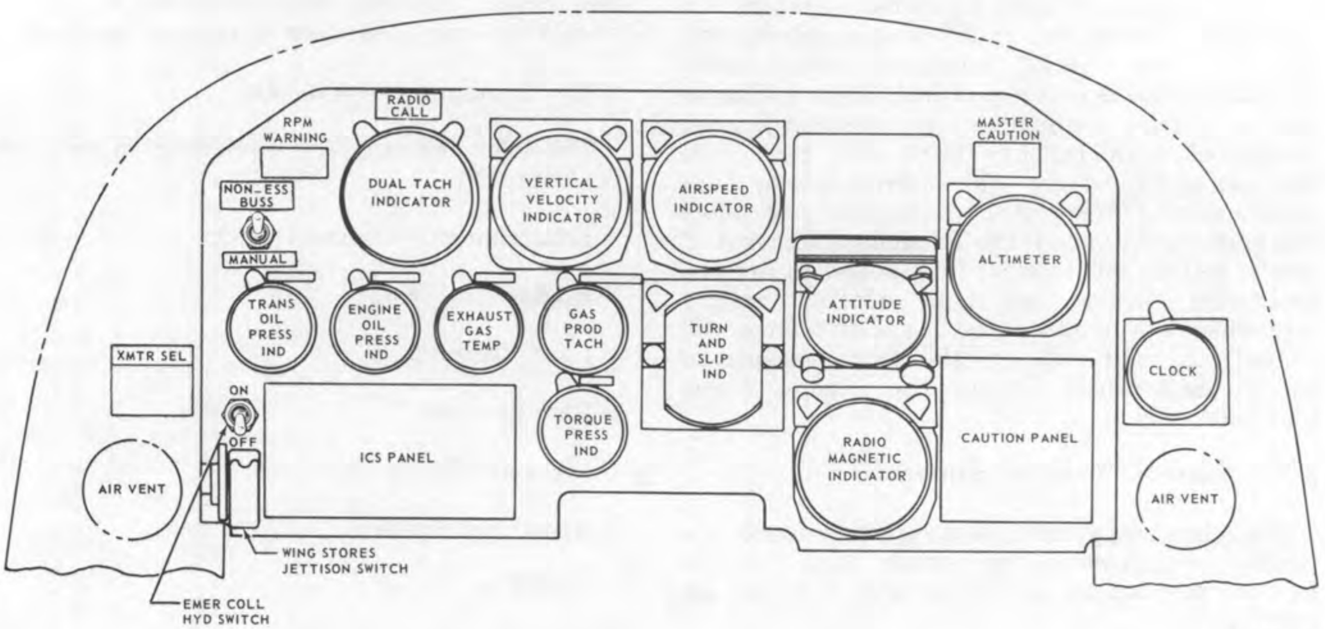
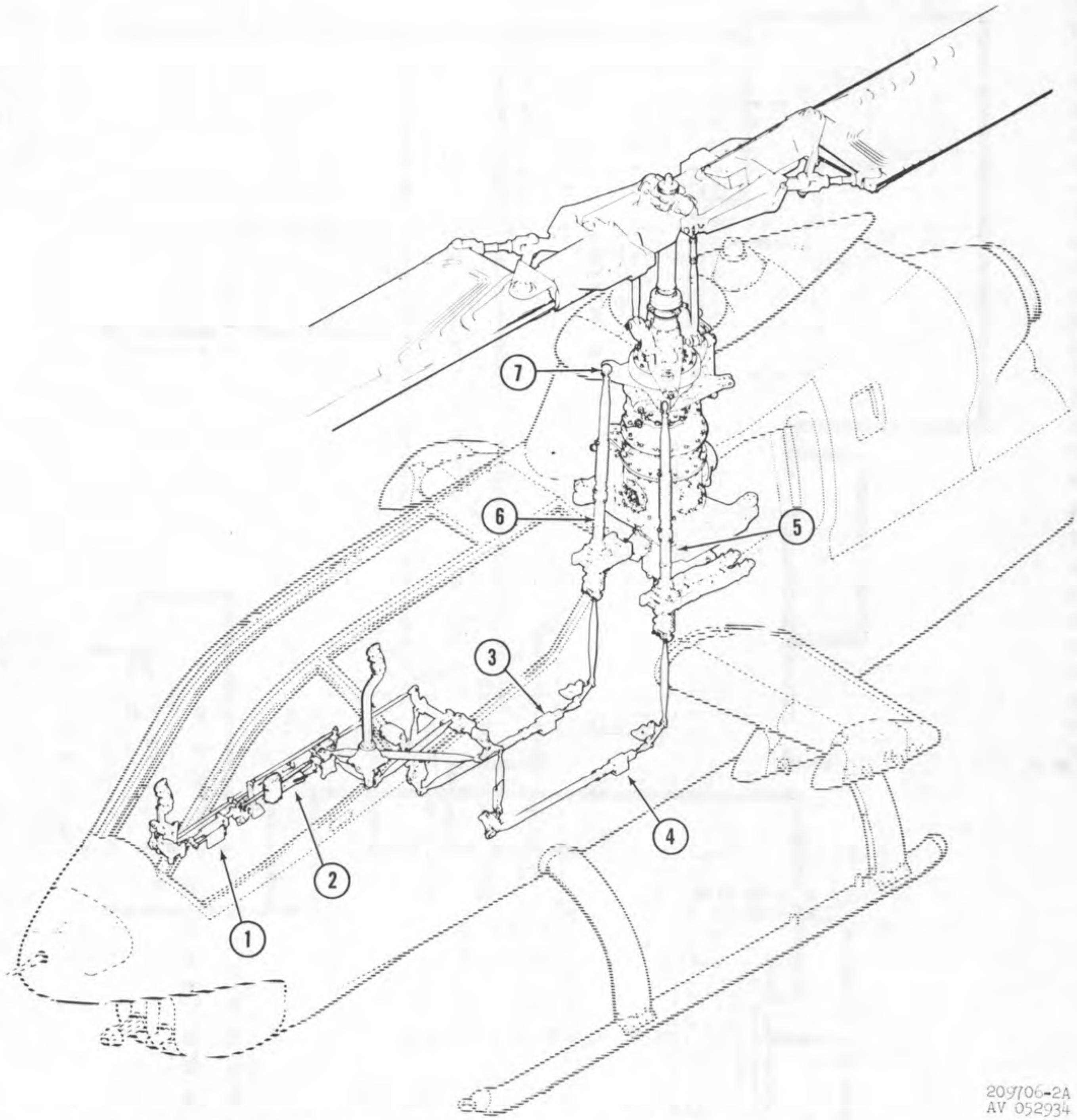


Figure 2-30. Trainer instrument panel

additional hydraulic cylinders located between the instructors cyclic controls and the students cyclic control. The added cylinders increase the mechanical leverage that the instructor can apply into the control system without changing the normal control travel. This provides both the student and instructor with equal systems. The hydraulic control cylinders are connected to the No. 2 system.

c. Collective System. The trainers collective control length has been increased 2.4 inches. This increased length provides the instructor and student with equal collective control systems.

d. Hydraulic System. The trainer hydraulic system is identical to the basic hydraulic system, except that an additional fore and aft cyclic cylinder, and an additional lateral cyclic cylinder, have been installed between the front and rear cyclic linkage. The two additional cylinders are powered by the No. 2 hydraulic system and provide the front cyclic with a mechanical advantage equal to the rear cyclic (figure 2-32).



1. Instructors Fore and Aft Hydraulic Cylinder
2. Instructors Lateral Hydraulic Cylinder
3. Fore and Aft SCAS Actuator Unit
4. Lateral SCAS Actuator Unit
5. Lateral Hydraulic Cylinder
6. Fore and Aft Hydraulic Cylinder
7. Swashplate

Figure 2-31. Trainer flight control system

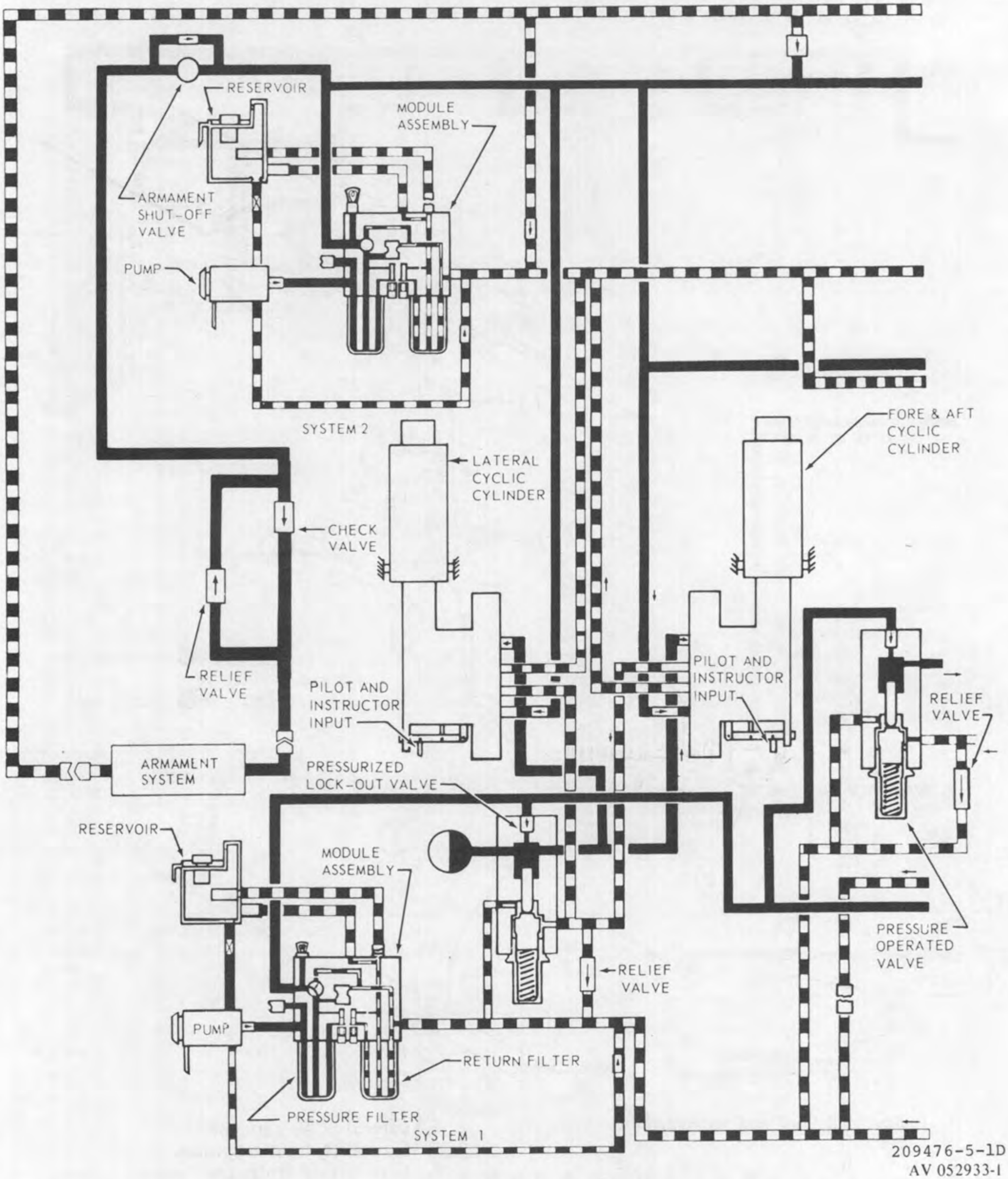


Figure 2-32. Trainer hydraulic system (Sheet 1 of 2)

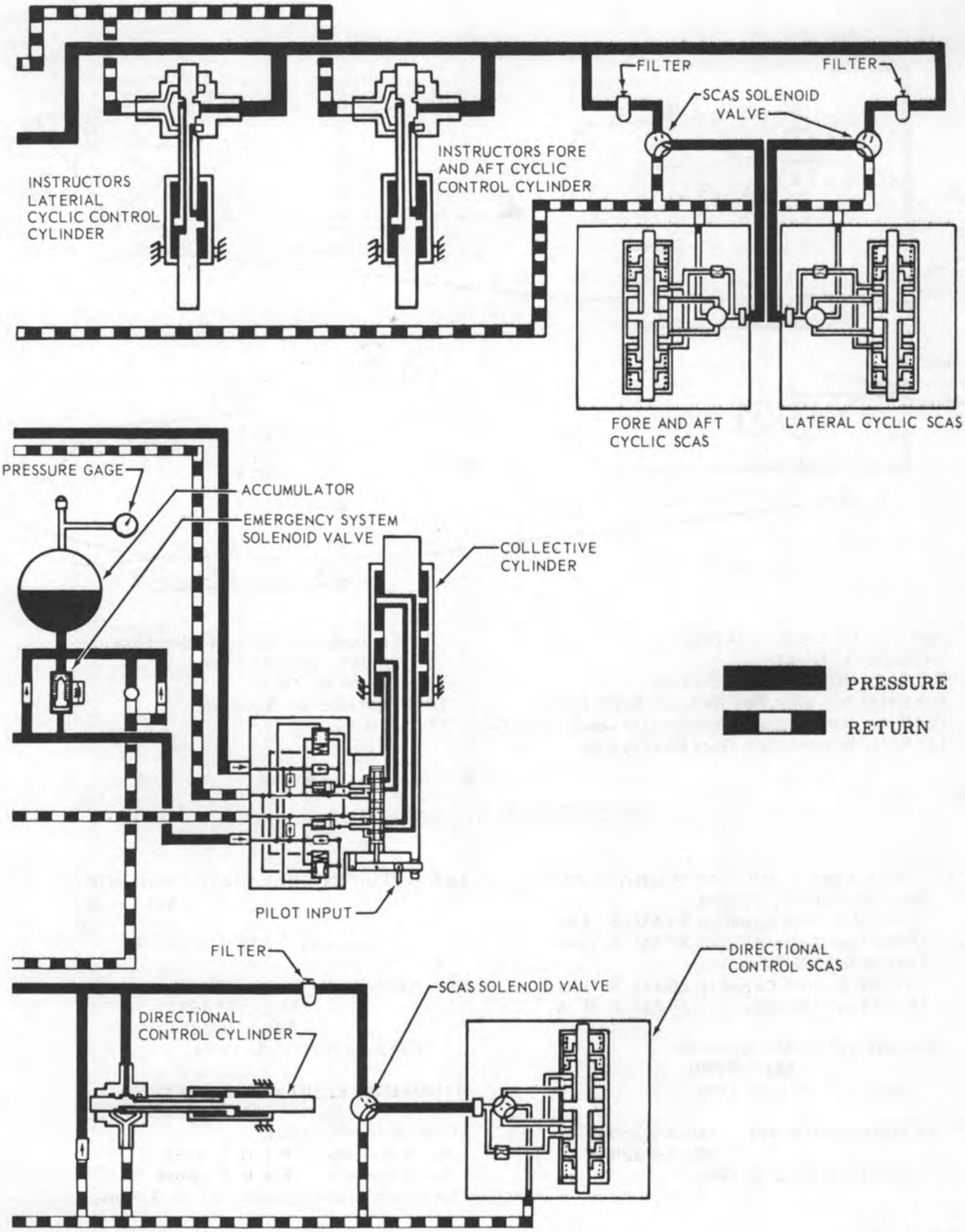


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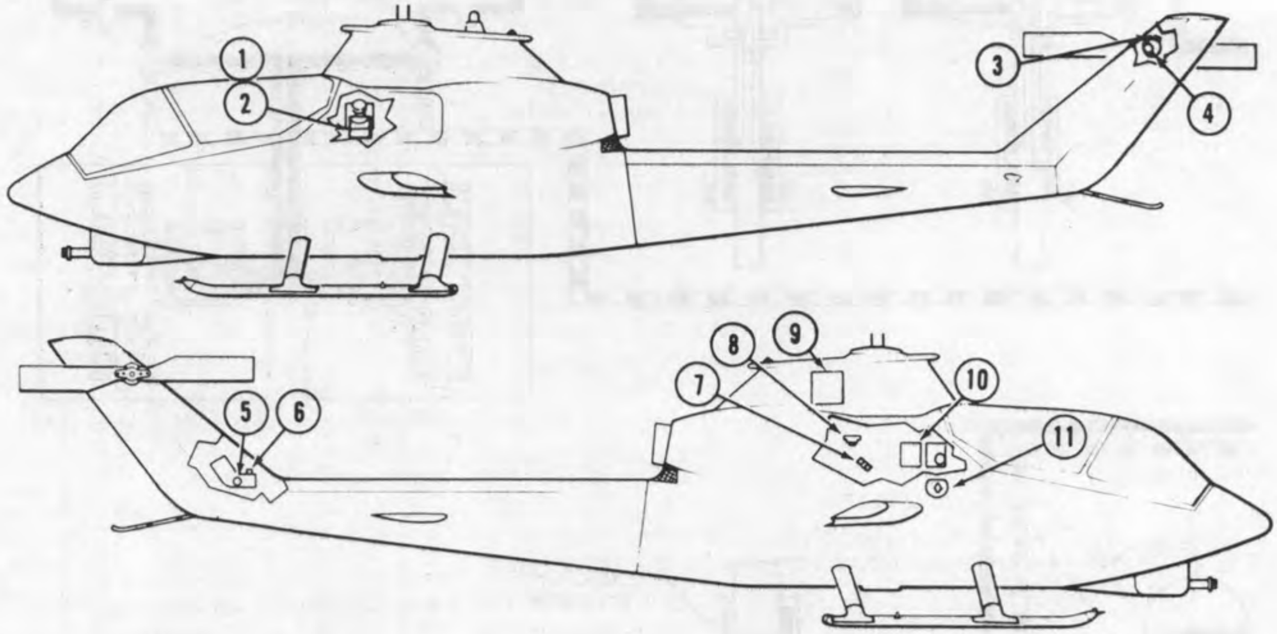
Figure 2-32. Trainer hydraulic system (Sheet 2 of 2)



1. Hydraulic Oil Level Sight Gages
2. Hydraulic Oil Reservoir
3. Tail Rotor 90° Gear Box Oil Filler
4. Tail Rotor 90° Gear Box Oil Level Sight Gage
5. Tail Rotor Intermediate Gear Box Oil Level Sight Gage
6. Tail Rotor Intermediate Gear Box Oil Filler
7. Transmission Oil Level Sight Gage
8. Transmission Oil Filler
9. Engine Oil Tank
10. Hydraulic Oil Reservoir
11. Fuel Filler

SPECIFICATION AND CAPACITIES

ENGINE FUEL — MIL-T-5624 GRADE JP-4
Non-Crashworthy System
Normal Service Capacity 247 U. S. Gals.
Total Tank Capacity 270 U. S. Gals.
Crashworthy System
Normal Service Capacity 260 U. S. Gals.
Total Tank Capacity 262 U. S. Gals.

ENGINE OIL — MIL-L-23699*
— MIL-L-7808*
Capacity 2.75 U. S. Gals.**

TRANSMISSION OIL — MIL-L-23699*
— MIL-L-7808*
Capacity 2.25 U. S. Gals.

TAIL ROTOR INTERMEDIATE GEAR BOX OIL
— MIL-L-23699*
— MIL-L-7808*
Capacity 0.375 U. S. Pints

TAIL ROTOR 90° GEAR BOX OIL
— MIL-L-23669*
— MIL-L-7808*
Capacity 0.50 U. S. Pints

HYDRAULIC FLUID — MIL-H-5606***
— MIL-H-83282***
Total System Capacity
No. 1 System 6.0 U. S. Pints
No. 2 System 6.6 U. S. Pints
Reservoir Capacity (each) 3.2 U. S. Pints

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Figure 2-33. Servicing diagram (Sheet 1 of 2)

Notes

*It is not advisable to mix MIL-L-23699 oil with MIL-L-7808 oil except in cases of emergency. If it becomes necessary to mix the oils it is recommended that the system be flushed within six hours. MIL-L-23699 is authorized as the principle lubricant. MIL-L-7808 is to be used when ambient temperatures are below -25°F (-32°C).

**Though an oil level sight gage is provided for the purpose of determining a low oil condition, it is not always accurate. The oil level should be checked by removing the filler cap and inspecting visually for proper level. When servicing oil tank, fill completely to a spillover condition.

***Although MIL-H-5606 and MIL-H-83282 are fully compatible to one another, it is not advisable to mix the fluids except in an emergency. MIL-H-83282 is a flame retardant fluid fully operable in temperatures to -40°F. To mix MIL-H-5606 with MIL-H-83282 will void the flame retardant properties of MIL-H-83282. When changing from MIL-H-5606 to MIL-H-83282, not more than 2 percent of MIL-H-5606 may be present in the system if flame retardant properties of MIL-H-83282 are to be observed. System must be thoroughly flushed with MIL-H-83282 when changing to MIL-H-83282. In temperatures below -40°F use MIL-H-5606.

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Figure 2-23. Servicing diagram (Sheet 2 of 2)

CHAPTER 3

NORMAL PROCEDURES

Section I. INTRODUCTION

3-1. General.

This chapter contains the procedures that are required to ensure safe and efficient operation of the helicopter. Steps are included in checklist form covering the flight from the time it is planned until it is completed and the helicopter is left properly parked and secure. Normal and standard conditions are assumed in these procedures. Pertinent data in other chapters is referenced when applicable.

Normal procedures are given in checklist form when applicable. To provide for easier cross referencing, the procedural steps in this chapter are numbered to coincide with the corresponding numbered steps in the abbreviated pilots checklist (TM 55-1520-221-CL).

The instructions and procedures contained herein are written for the purpose of standardization and are not applicable to all field situations.

Section II. FLIGHT PROCEDURES

3-2. Preparation For Flight.

This period should be devoted to general mission planning and to a study of special problems involved in operating the helicopter for mission completion.

3-3. Flight Restrictions.

The minimum, normal, maximum, and caution operation ranges for the helicopter and the engine are indicated by instrument markings and placards. These instrument markings and placards represent careful aerodynamic calculations, substantiated by flight test data. Refer to Chapter 7, Operating Limitations, for a detailed description of helicopter and engine restrictions.

3-4. Flight Planning.

The safe and efficient planning of the mission to be accomplished will provide the pilot with the data to be used during flight. The information to be used can be compiled from the following sources.

1. Check type of mission to be performed, and destination.

2. Select performance charts to be used from Chapter 14.

3. Record for inflight use, the information concerning fuel quantity required, airspeed, power settings, takeoff, climb, cruise and hovering condition, landing and fuel consumption for operating gross weight, and climatic condition.

3-5. Takeoff and Landing Data.

Refer to Chapter 14, Performance Data, for detailed operating information when planning various types of missions that require use of the data.

3-6. Weight and Balance.

Ascertain proper weight and balance of the helicopter as follows:

1. Refer to applicable weight and balance instructions given in Chapter 12, and ensure DD Form 365F has been completed properly.

2. Compute takeoff and anticipated landing gross weight, checking helicopter cg location, weight of fuel, oil, payload, etc.

3. Check that loading limitations, described in Chapter 7, have not been exceeded.

3-7. Preflight Check.

The amplified prefight check includes the exterior and interior checks as outlined.

NOTE

(I) Indicates check required for instrument flights only.

(N) Indicates checks required for night flights only.

(O) Indicates check required if item installed.

NOTE

When the helicopter is flown by the same flight crew during tactical or administrative missions requiring intermediate stops, the flight crew need not perform all preflight checks required by the amplified or condensed checklists for beginning flights. Under these conditions the asterisked (*) items in these lists are required checks to assure safe operation.

3-8. Before Exterior Check.

WARNING

Preflight should not be initiated until the armament subsystem is determined to be safe.

*1. Armament systems — safe (ground safety pins in), safeing devices — installed, gun and launches — clear.

*2. BAT switch — OFF.

*3. INVTR — OFF.

*4. NON-ESS BUS — NORMAL.

*5. AC WEAPON SIGHT circuit breaker — OUT.

*6. WG ST ARM switch — OFF.

*7. MASTER ARM — OFF.

*8. Publications — check DA Form 2408-12, -13, -14, and -18. DD Form 365F, locally required forms and availability of operators manual.

*9. Fuel quantity — Check. BAT switch — ON. INVTR switch — STBY. Check fuel quantity. INVTR switch — OFF, BAT switch — OFF.

(N)*10. Searchlight, position lights — Check. BAT switch — ON. NON--ESS BUS to MANUAL. Check Lights. BAT switch — OFF.

*11. Canopy and hatch jettison — condition and security — safety pins in canopy removal system — installed. (the window cutting assembly should not have any cracks in the retainer)

*12. FM Homing and ADF antennas — condition and security.

*13. Area behind pilot seat — check condition and security of first aid kit, sensor-amplifier unit. Pylon compensator unit and survival kit, if required.

3-9. Fuselage and Main Rotor — Right Side Area 1 (figure 3-1).

1. Forward main rotor blade — skin penetrations, corrosion and tip cap for security.

2. Fuselage — condition.

3. Canopy removal system window cutting assembly — linear explosive substance should not have any breaks.

4. Static port — condition and cleanliness.

*5. Ammunition bay — check condition and security of right door, check loading security, electrical connection and internal hydraulic lines, secure door.

*6. Hydraulic compartment — condition; module filter indicator buttons — IN; utility hydraulic connections locked; lines — secure; reservoir caps — secure; ECU — condition.

*7. Fuel — quantity. Secure cap with lock to rear.

*8. Landing gear — condition and security of fairings, cross tubes secure to skid, skid shoe condition, and handling wheels removed.

*9. Wing bottom — condition and security (retention bolts).

10. Wing Stores — condition and security.

11. Position light — condition.

12. Fuel sumps and pump (two) — drain and check for contamination (first flight of day). Secure doors.

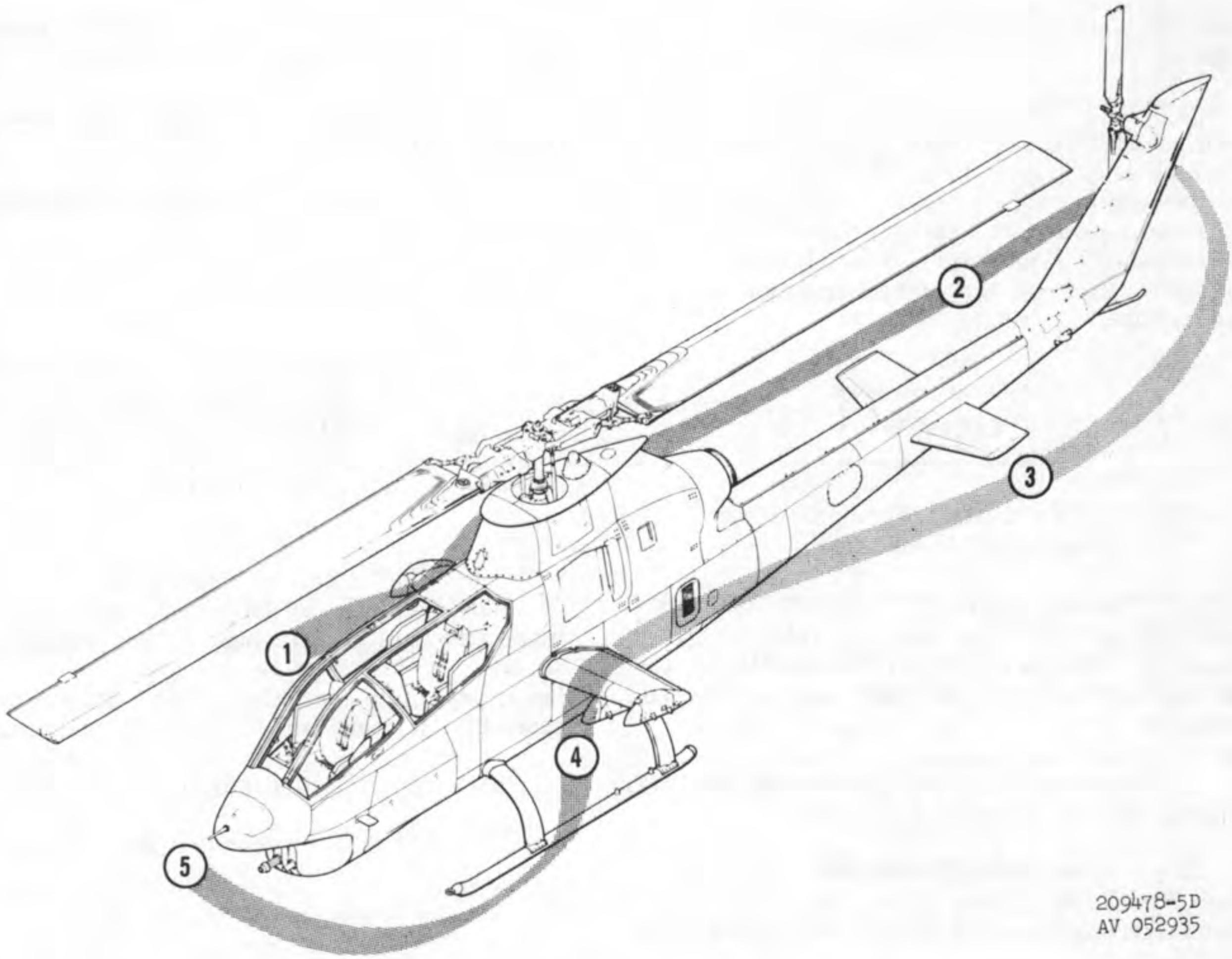

Figure 3-1. Exterior check diagram

13. Area beneath transmission (hellhole) — leaks, condition and security of hydraulic, oil, and fuel lines, controls for security, safeties, and no excessive play, accumulator condition and proper charge.

14. Wing top — condition and security (retention bolts).

15. Engine air intake shield — removed.

16. Engine air intake — condition, screens closed.

17. Engine and transmission cowlings — open, condition and security.

18. Hydraulic pump and lines — condition, security, and leaks

19. Servo and mount — condition, security, and leaks.

*20. Transmission and mounts — condition, oil level, security, and safeties.

*21. Pylon access — FM antenna — condition; engine oil reservoir — condition and security; remove cap and check oil level; then secure cap.

NOTE

Do not depend on sight gage when check oil level; remove oil cap and check visually.

*22. Swashplate and support — check the collective lever, anti-drive link, swashplate drive links, scissors levers, and friction collet —

condition, security, excessive play, safeties, and spacing.

*23. Main rotor control tubes and head — pitch change tubes, mast, split cones, rotor retaining nut, grip and dust deflectors, trunnion, dust covers, feathering bearings, drag braces, and top of rotor blades for damage, corrosion, safeties, and clearance. Trunnion bolts for slippage marks, retainer in place on elastomeric trunnion bearing, if so equipped.

CAUTION

Check for FOD (Foreign Object Damage) potential hazards.

*24. Plenum chamber components, lines, electrical leads and particle separator — check latches for security, pressure differential switch, and area beneath the separator for security and clearance.

25. Engine, right side — condition, security, safeties, fuel and oil leaks, and mounts.

26. Engine and transmission cowlings — close. A definite physical check must be made to ensure the engine and transmission cowling doors are secure.

27. Fuselage stress/inspection panels — damage, missing rivets, screws and condition.

28. Tailpipe — remove cover and store; check for cracked supports and security.

3-10. Tail Section — Right Side Area 2.

1. Air ejector area — condition and cleanliness. No. 1 tail rotor driveshaft hanger bearing condition and security.

2. Electronic compartment — electrical equipment and lines, tail rotor servo, circuit breakers — IN. Battery and vent (if installed), tailboom attaching bolts for slippage marks and security, rivets and rivet plates — condition.

3. Tailboom — condition.

4. Synchornized elevator — condition, security, and movement.

5. Position light — condition.

*6. Intermediate (42°) gearbox — condition, security, oil level, non-vented cap secure.

7. Vertical fin — condition and security of outer fairings.

*8. 90° gearbox — condition, security, oil level, vented cap secure.

*9. Tail Rotor.

a. Tail rotor assembly with blade chord of 8.41 inches. Check condition, security, trunnion retaining nut, safeties, flapping axis, pitch change links, castellated nuts, cotter pins, condition and security of yoke, grips, and blades.

b. Tail rotor — helicopters with MWO 55-1520-221-30/45 incorporated (assembly with blade chord of 11.5 inches). Check condition and security of: trunnion retaining nut, shield, cross head, counter weights, pitch links, retainer assembly, safeties, cotter pins, hub, and blades.

10. Upper fin — condition.

11. Tail skid — security and condition.

3-11. Tail Section — Left Side Area 3.

*1. Vertical fin — condition and security of fairing and panels.

2. Position light — condition

*3. Main rotor tiedown — remove and stow.

4. Rotate main rotor 90° — condition of aft blade; freewheeling unit.

5. Tail rotor driveshaft — open covers and inspect driveshaft sections for condition and security (first flight of the day only), close covers and secure.

6. Synchronized elevator — condition, security, and movement.

7. Tailboom — condition.

8. UHF - VHF Antennas — check.

9. Air ejector area — condition and cleanliness.

3-12. Fuselage and Main Rotor – Left Side Area 4.

1. Oil cooler — condition and cleanliness; screen.

2. Fuselage — condition.

3. Engine air intake shield — removed.

4. Engine air intake — condition, screens closed.

5. Engine and transmission cowlings — open, condition, and security.

6. Fuel filter — drain (battery and fuel ON-OFF when completed).

7. Engine, left side — condition, security, safeties, and leaks.

8. Plenum chamber and particle separator — cleanliness, condition, and security.

CAUTION

Check for FOD (Foreign Object Damage) potential hazards.

9. Area beneath plenum chamber — condition, safeties, fuel leaks, and tail rotor driveshaft.

10. Wing top — condition and security (retention bolts).

11. Lift Link — condition and security.

12. Rotor tachometer generator — condition and security.

13. Transmission and mounts — condition, security, safeties and, leaks.

14. Servo, mount, and lines — condition, security, and leaks.

15. Main driveshaft — check installation, freewheeling (rotate counterclockwise, no friction).

*16. Pylon access — engine oil reservoir condition.

*17. Swashplate and support — collective lever, anti-drive link, swashplate drive links, scissors levers, and friction collet — condition, security excessive play safeties and spacing.

*18. Main rotor head and control tubes — condition, security, movement, and safeties; retainer in place on elastomeric trunnion bearing, if so equipped.

19. Top of pylon — condition and security.

20. Anti-collision light — condition and security.

*21. Engine and transmission cowling — close. A definite physical check must be made to ensure that the engine and transmission cowling doors are secure.

22. Wing bottom — condition and security (retention bolts).

(O)23. Wing Stores — condition and security.

24. Position light — condition.

*25. Landing gear — condition and security of fairings, cross tubes and skid shoes; handling wheels removed.

*26. Hydraulic compartment — condition; module filter indicator buttons — in; utility hydraulic connections — locked; secure; reservoir caps — secure; fluid level — check both reservoirs and ECU for condition.

27. Static port — condition and cleanliness.

28. Canopy — condition and cleanliness.

29. Canopy removal system window cutting assembly — linear explosive substance should not have any breaks.

30. Fire extinguisher — condition and security.

*31. Ammunition bay — condition, security of left door; interior, check loading, security, electrical connection, and internal hydraulic lines. Secure door.

32. Searchlight — condition, position, and cleanliness.

3-13. Nose Section – Area 5.

1. Turret — condition, security, weapons and fairings.

2. Nose fuselage panels — condition and security.

3. Pitot tube — condition; remove and stow cover.

4. Forward battery compartment — battery (if installed); condition, security and connection. Circuit breakers — IN; secure door for flight.

5. Rain removal nozzle — clear.

6. Windshield — condition and cleanliness.

*(O)7. When no fireguard available, remove and stow wing stores ground safety pins at this time. If fireguard available, this step not applicable.

WARNING

Loose doors or covers may separate from the helicopter in flight and cause damage to the helicopter and possible loss of life.

8. Final walk around — engine/transmission cowling doors, all access panels, tail rotor driveshaft covers, all ammo doors to be physically checked — closed.

3-14. Single Pilot Operation.

If single pilot operation is to be conducted, the following items must be checked in the gunners cockpit at this time.

1. Secure gunners safety belts, and shoulder harness.

2. Stow and secure or remove loose equipment in the gunners cockpit.

(O)3. Door jettison handle — secured and safetied.

(O) 4. Canopy removal arming/firing mechanism — safety pin installed.

5. ELEC PWR EMER OFF switch — ELEC PWR.

6. ENG AIR switch — SCREEN.

7. FORCE TRIM switch — FORCE TRIM

(N) 8. INST LTS — as desired.

9. Governor switch — AUTO.

10. IDLE STOP RELEASE — OFF.

11. Miscellaneous control panel cover — as desired.

12. Magnetic compass — check.

13. EMER COL HYD switch — OFF.

14. WINGSTORES JETTISON switch — cover closed and safetied.

15. VHF radio — as desired.

16. Sight — stowed, gimbal locks secure.

17. Ground safety lever — engaged.

18. OVERRIDE PILOT switch — OFF.

19. WEAPON CLEAR / WEAPON UNCLEAR switch — as desired.

20. WING STORES SELECT switch — OFF.

21. AMMO FIREOUT switch — as desired.

22. Cyclic firing trigger cover — closed.

23. Cockpit light — OFF.

24. Ballast — install.

*25. Canopy hatch — secure.

3-15. Interior Check (Gunner).

CAUTION

An open canopy is susceptible to possible damage from helicopters operating nearby.

*1. Canopy hatch — as desired.

*2. Loose equipment — stowed and secure.

3. Pedals — adjust.

*4. Safety belt and shoulder harness — fastened.

5. Shoulder harness lock — operation of inertia reel.

(O) 6. Door jettison handle — secure and safetied.

*7. ELEC PWR EMER OFF switch — ELEC PWR

*8. ENG AIR switch — SCREEN.

*9. FORCE TRIM switch — FORCE TRIM

10. INST LTS — OFF (BRT for night).

*11. GOV switch — AUTO.

12. IDLE STOP RELEASE — OFF.

13. Miscellaneous control panel cover — as desired.

14. Vents — as desired.

*15. Standby compass — condition, fluid, and calibration card.

*16. EMER COLL HYD switch — OFF.

17. WING STORES JETTISON switch — Cover closed and safetied.

18. Signal distribution panel — as desired.

19. VHF Radio — OFF; set frequency.

20. Instruments — check static indications, condition, and markings.

*21. Altimeter — set.

22. Mirror — cleanliness and adjust.

23. Sight — stowed, gimbal locks, secured.

24. Ground safety lever — horizontal.

25. Sun shield — conditions and security.

26. Weapons select switch — as desired.

27. Range control knob —adjust.

28. Filament select switch — as desired.

29. Reticle intensity control (rheostat switch) — as desired.

30. Compensation switch — as desired.

*31. AMMO RESERVE PERCENT — set.

32. OVERRIDE PILOT switch — OFF.

33. WEAPON CLEAR / WEAPON UNCLEAR switch — clear.

34. WING STORES SELECT switch —OFF.

35. POINT/AREA FIRE switch — as desired.

36. AMMO FIREOUT switch — as desired.

37. Cyclic firing trigger cover — closed.

*(O)38. Breakout knife — check.

*(O)39. Canopy removal arm/fire unit safety pin — remove and stow.

*40. Cockpit lights — condition, as desired.

3-16. Interior Check (Pilot).

CAUTION

An open canopy is susceptible to possible damage from helicopters operating nearby.

*1. Canopy hatch — as desired.

*(O)2. Knife and loose equipment — stowed and secure.

3. Seat and pedals — adjust.

*4. Safety belt and shoulder harness — fastened.

5. Shoulder harness lock — operation of inertia reel.

(O)6. Door jettison handle — secure and safetied.

*7. Cyclic — position and trigger guard down.

*8. Collective — position, friction — OFF, downlock removed.

NOTE

The collective may be in a position other than full down.

*9. Throttle friction — OFF.

10. SL, searchlight, switch — STOW

*11. AC circuit breakers — In (except WEAPON SIGHT).

12. BAT switch — OFF.

13. GEN switch — OFF.

14. INVTR switch — OFF.

15. NON-ESS BUS — MANUAL

*16. ENG AIR switch — SCREEN.

17. FORCE TRIM switch — FORCE TRIM

18. FUEL switch — OFF.

19. ENG OIL BYP switch — as desired.

20. GOV switch — AUTO.

21. Free air temperature — check.

22. SCAS power — OFF.

(O)23. Canopy removal arm/fire unit safety pin — remove and stow.

24. Signal distribution panel — as desired.

25. Instruments — check static indications, condition, and markings.

*26. Altimeter — set.

27. VIS/IVSI — note indication.

28. RMI — set to ADF position.

*29. EMER COL HYD switch — OFF.

30. WING STORES JETTISON switch — Cover closed and safetied.

31. Compass slaving switch — as desired.

32. Clock — wound, running, and set.

33. Weapons select switch — as desired.

*34. MASTER ARM switch — OFF.

35. GUNNER/PILOT CONTROL switch — as desired.

*36. POINT/AREA FIRE switch — as desired.

37. WG ST JETTISON SELECT — BOTH.

38. RKT PR SEL — set to 1.

39. WG ST ARM switch — OFF.

(O)40. SMOKE grenade switches — OFF.

41. FM radio — OFF and set.

(O)42. PROXIMITY WARNING — OFF.

43. PITOT HEAT switch — OFF.

44. RAIN REMOVAL — ENVR CONT switch — OFF.

45. HEAT OR VENT control — PULL.

NOTE

Set heat vent control prior to flight as operation in flight is often impossible.

46. Vents — as desired.

47. UHF Radio — OFF and set.

(O)48. VHF Radio — OFF and set.

49. Navigation aids — OFF and set

*(O)50. XPDR, transponder — OFF and set.

51. INSTR and CONSOLE LTS — as desired.

*52. ANTI-COLL LT — ON.

(N)53. POSITION LTS switch — as required.

54. DC circuit breakers — IN.

55. Cockpit light — OFF, condition and security.

3-17. Starting Engine.

*1. Helmets and gloves — on.

*2. Helmet Visors — down.

*3. BAT switch — ON, OFF for APU start.

WARNING

When helicopter is armed with rockets, make start with battery only, because it is hazardous to place an APU (or any electrical generating equipment) in same revetment or parking area due to danger of accidental firing of rockets.

*4. APU — Give signal for APU connection.

*5. Intercom — as desired.

*6. RPM WARNING — OFF.

7. CHIP DET — Test.

*8. GOV RPM INCR/DECR switch — decrease 10 seconds.

*9. Throttle — Check full travel and operation of flight idle stop, and idle release switch.

NOTE

Slight twist grip friction may be required to assure that flight idle position will be maintained with hands off the controls. This condition will vary due to variations within fuel controls but should never require sufficient friction as to be objectionable during normal operation.

*10. Throttle —Set — rotate to flight idle and position just to the abort side of the stop.

*11. FUEL switch — FUEL.

*12. MASTER CAUTION and RPM WARNING lights — ON.

*13. CAUTION panel and MASTER CAUTION lights — TEST and RESET.

*14. Fireguard — posted.

*15. Main rotor — clear and displaced.

*16. Voltmeter — minimum 22 Vdc.

CAUTION

Limit starter energize time to 40 seconds. If engine does not start, a three-minute cooling period is required before beginning another starting cycle. Only three 40-second starting attempts are permissible in any one-hour period.

*17. INVTR switch — MAIN.

*18. Starter trigger — energize, start clock.

*19. Engine oil pressure — note indication after ignition.

*20. Collective — full down during start.

21. Cyclic — centered.

CAUTION

During starting or acceleration, the maximum allowable EGT is 760°C for any period of time. If EGT exceeds 675°C for more than 5 seconds, an entry in DA form 2408-13 is required. If during starting or acceleration it becomes apparent that EGT will exceed 675°C, abort the start.

*22. EGT and gas producer gage — monitor.

*23. Starter trigger — release at 40 percent N1.

*24. GEN switch — ON.

CAUTION

If no oil pressure is evident at this time, shut engine down immediately and record in DA Form 2408-13.

*25. Engine and transmission oil pressure — proper indication.

NOTE

Oil pressure may exceed maximum on low ambient temperature starts. Do not exceed flight idle until engine oil pressure is below 100 psi.

*26. Throttle — slowly advance past the flight idle stop to flight idle position. Manually check stop by attempting to roll throttle off.

*27. APU start — APU disconnected, battery ON.

28. Wing stores ground safety pins — removed.

(N) 29. Instruments and console lights — as desired.

3-18. Engine Runup.

CAUTION

Minimize movement of the cyclic during ground runup, to preclude damage to the input quill seal and the main driveshaft.

NOTE

For extended ground running (exceeding two minutes) N2 speed should be maintained at a minimum of 5500 rpm.

*1. Gas producer (N1) — 68 to 72 percent.

NOTE

This check should be made while holding throttle lightly against flight idle stop.

2. Throttle friction — as desired.

*3. Engine oil pressure — 25 psi minimum at flight idle.

*4. Transmission oil pressure — check.

*5. Fuel pressure — check.

*6. MASTER CAUTION light — OFF.

*7. SCAS POWER switch — POWER (check No-Go lights illuminated).

8. Force Trim switch — FORCE TRIM. Check force gradients operational. Press cyclic momentary interrupt switch (pilot then gunner) ensuring magnetic brakes release.

9. Force trim switch — OFF; check pedals and cyclic for freedom of movement and tip-path plane correlation.

10. Hydraulic system number 1 — Hold switch to hydraulic system 1 (system 2 out). Check master caution and HYD PRESS #2 caution lights ON. All controls free.

NOTE

The cyclic will be stiff on all TH-1G and any AH-1G with the modification. However, slight cyclic movement before stiffness occurs should be evident.

11. Hydraulic system number 2 — Hold switch to system 2 (system 1 out). Check master caution and HYD PRESS # 1 caution lights ON. Pedals stiff, cyclic and collective free.

12. Hydraulic test switch — release, lights out.

13. Force trim switch — FORCE TRIM.

*14. Throttle — slowly advance until rpm is 6000 ±50. Check throttle full open. Do not exceed engine limitations.

WARNING

If fuel quantity gage does not coincide with the visual inspection of fuel quantity, the possibility exists that fuel is restricted from flowing to the aft cell by malfunction or improper installation of the flapper check valve. If this condition does exist, it presents a serious cg hazard and should be thoroughly investigated by maintenance before flight.

*15. Fuel quantity — press to test.

NOTE

Do not hold test switch after a zero reading has been reached.

*16. Radios and nabigation aids — ON.

*(O) 17. XPDR, Transponder — STBY.

CAUTION

Do not exceed 6640 rpm with N1 above 91%. Refer to Chapter 7.

*18. GOV INCR-DECR switch — actuate through full range slowly to 6700 rpm ±50. Set rpm at 6600. During increase-decrease check observe low rpm audio and rpm warning light out at 300 rotor rpm 5 rpm.

*19. Instruments — normal.

NOTE

Generator voltage will be dependent upon the average ambient temperature.

*20. Check for voltage indication as follows:
27.0 Volts 80°F (27°C) and above
28.0 Volts 32°F to 80°F (0°C to 27°C)
28.5 volts 32°F (0°C) and below.

21. Pitot heat switch — ON, note ammeter increase, then OFF.

22. GEN switch — OFF. Master CAUTION light and DC GENERATOR CAUTION lights ON.

23. NON-ESS BUS switch — NORMAL. Check pressure instrument fluctuation. Check for illumination of the AFT FUEL BOOST caution light.

NOTE

Because of the difference in output of the main and standby inverters, a noticeable fluctuation in the pressure instruments will occur when the non-essential bus is switched from MANUAL to NORMAL.

24. GEN switch — ON, caution lights out.

*25. NON-ESS BUS switch — As required. NORMAL for day; MANUAL for night or weather operation. The MANUAL position should be used at any time it would not be desirable to lose cockpit lights and weapon firing capability in the event of generator failure.

26. INVTR switch — Move to OFF, check pressures and caution light, then standby position; note normal operation of standby inverter, return switch to MAIN position.

27. ENG AIR switch — SCRN BYP, visually check screens open; switch to DE-ICE position check EGT rise.

*28. ENG AIR switch — SCREEN, visually check screens closed, EGT decrease.

*29. SCAS — Check NO-GO lights out. Engage PITCH, ROLL and YAW channels one at a time.

CAUTION

When engaging the SCAS channels the pilot must be prepared to immediately press the SCAS cyclic disengage button if any abnormal tip path plane/control fluctuations are noted.

30. SCAS — Gunner press SCAS cyclic disengage button (Pilot notes channels off).

31. SCAS — Pilot re-engage SCAS channels press SCAS cyclic disengage button (note channels off).

32. SCAS — Pilot check NO-GO lights out re-rengage channels.

33. AFT FUEL BOOST pump — FWD FUEL BOOST pump dc circuit breaker — out, fuel pressure normal; minimum 5 psi. Caution and warning lights on.

34. Engine fuel pump — AFT FUEL BOOST pump DC circuit breaker — out, check fuel pressure zero; AFT FUEL BOOST pump caution light — ON; reset master caution, allow engine to operate without boost pumps for one minute.

*35. Magnetic compass — check with known heading.

*36. Radio magnetic indicator — check heading with magnetic compass.

*37. Altimeter — set.

*38. Attitude indicator — set.

*39. Canopy hatches — secured for flight.

40. Forward fuel boost pump — Check FWD FUEL BOOST circuit breaker — in; check light out; pressure normal (minimum five psi).

41. AFT FUEL BOOST pump circuit breaker — in; check all lights out; pressure normal.

42. Signal distribution panel — as desired.

43. Radios — check.

*44. Force trim — as desired.

3-19. Before Takeoff.

*1. RPM — 6600.

*2. Caution and warning Lights — check.

*3. Instruments — normal.

*4. Fuel quantity — note.

*5. Armament panel — check.

*6. RAIN REMOVAL — ENVR CONT switch — OFF.

NOTE

The RAIN Removal — ENVR CONT switch should be in the off position during takeoff, landing and other flight conditions requiring maximum engine power available.

3-20. Health Indicator Test (HIT).

The HIT Provides the aviator with a go-no-go check for engine condition prior to takeoff. By logging EGT deviations from the HIT EGT baseline, the aviator provides the maintenance officer with the information to monitor EGT

ACFT S/N	UH-1H, M, AH-1G, TH-1G EGT LOG																					ENGINE S/N									
OAT °C	-10	-8	-6	-4	-2	0	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50
N1%	86.0	86.3	86.7	87.0	87.4	87.7	88.0	88.3	88.7	89.0	89.3	89.6	89.9	90.1	90.4	90.7	91.0	91.4	91.7	92.1	92.4	92.7	93.0	93.3	93.6	93.9	94.2	94.5	94.9	95.2	95.5
Baseline EGT																															

Instructions:

1. Maintain N_2 at 6600 RPM.
2. Turn off all bleed air.
3. With rotor turning, read free air temperature from OAT gauge.
4. Enter OAT line at value nearest to free air temperature in chart above.
5. Set N_1 at value indicated in $N_1\%$ line.
6. Read EGT from indicator.
7. Compare EGT with value indicated in line labeled "Baseline EGT"
8. Record aircraft hours and difference (±) between indicated EGT and Baseline EGT in EGT Trend Log below.

EXHAUST GAS TEMPERATURE TREND LOG

Acft or Eng Hrs (-13)	Diff. from Base line EGT (±)	Acft or Eng Hrs (-13)	Diff. from Base line EGT (±)	Acft or Eng Hrs (-13)	Diff. from Base line EGT (±)	Acft or Eng Hrs (-13)	Diff. from Base line EGT (±)	Acft or Eng Hrs (-13)	Diff. from Base line EGT (±)

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Figure 3-2. Engine health indicator test exhaust gas temperature log

trends. This can aid the maintenance officer in optimizing the maintenance effort and ensure that engines receive attention as soon as performance degradation is noted. The HIT is accomplished as follows:

NOTE

The HIT should not be performed until completion of all other pre-takeoff procedures. This assures that the engine is warmed and the instruments stabilized.

1. Maintain N2 at 6600 rpm.

2. Turn off all bleed air.

3. Turn helicopter into the wind and read free air temperature on cockpit OAT gage.

4. Utilizing the HIT EGT log (figure 3-2) with baseline EGT data entered, locate the OAT in the first column nearest the free air temperature read on the cockpit OAT gage.

5. Set N1% at the value indicated opposite this OAT. Allow EGT to stabilize.

6. Read EGT from indicator.

7. Compare this EGT with the baseline EGT adjacent to the OAT and N1% utilized.

8. Record helicopter hours and difference (±) between indicated EGT and baseline EGT.

NOTE

The EGT baseline values are established by the Maintenance officer in accordance with TM 55-2840-229-24.

9. If difference between indicated EGT and baseline EGT is:

a. 20°C or greater, notify Maintenance office with entry on DA Form 2408-13.

b. 30°C or greater, do not fly helicopter until troubleshooting determines cause for excessive EGT, entry on DA Form 2408-13.

3-21. Hover Check (Prior to Instrument Takeoff).

*(I) 1. Turn needle, heading indicator, and magnetic compass indicator turns right and left.

*(I) 2. Slip indicator — ball free in race.

*(I) 3. Vertical velocity indicator and altimeter indicates climb and descent.

*(I) 4. Attitude indicator — indicates nose high and low, bank left and right.

*(I) 5. Airspeed indicator — note indication.

*(I) 6. Torque meter — note psi required to hover.

*(I) 7. RMI — set takeoff heading.

*(I) 8. Pitot Heat — as required.

3-22. Before Landing.

1. RPM — 6600.

2. Caution and warning lights — check.

3. Instruments — normal

4. Fuel quantity — Note.

5. Armament panel — Check.

6. RAIN REMOVAL — ENVR CONT switch — OFF.

7. Searchlight — As required.

3-23. After Landing Check (Shutdown Anticipated).

1. Collective — full down.

2. Cyclic — centered.

3. Force trim — ON.

4. SCAS power switch — OFF.

5. Throttle — reduce to flight idle. Check gas producer (N1) rpm 68 to 72 percent.

6. Low RPM audio switch — OFF.

7. Non-essential bus — MANUAL.

8. EGT — allow to stabilize (minimum of two minutes).

9. Engine and transmission instruments — normal.

10. Navigation aids — OFF.

11. Searchlight — off.

3-24. Engine Shutdown.

1. Throttle — full OFF.

2. FUEL switch — OFF.

3. INVTR switch — OFF.

4. GEN switch — OFF.

CAUTION

If a rapid rise in exhaust temperature is noted, with throttle closed and FUEL SWITCH OFF, energize starter to allow temperature to stabilize within limits. Normal purging of the fuel system of the engine allows approximately two ounces of fuel to flow overboard on shutdown. This creates a fire hazard in certain areas as well as damage to macadam surfaces. Extreme care should be utilized to prohibit the possibility of fire.

5. EGT — monitor (If EGT rises energize starter).

6. Radios — off.

NOTE

After stopping the engine a fuel pressure indication in excess of 30 psi may be observed, due to the expansion of fuel trapped between the fuel control and the fuel shutoff valve. This expansion is caused by heat radiation from the engine resulting in fuel pressure indication. Check valves located in the fuel system relieve pressure exceeding 40 to 45 psi and permit fuel to bleed into the fuel cells.

7. EMER COL HYD switch — ON when main rotor stops.

8. Accumulator — BLEED.

NOTE

When bleeding the emergency hydraulic collective accumulator, a minimum of four complete strokes (two UP and two DOWN), are required. After four full strokes complete the bleed-off with short strokes to preclude the collective from freezing in an up position. In the event the collective becomes frozen in other than full down position, the blade should be turned in the direction of rotation and the collective fully lowered.

9. EMER COL HYD switch — OFF.

10. Canopy removal system safety pins — install.

3-25. Before Leaving Helicopter.

1. Battery switch — OFF.

2. Main rotor blade — tiedown.

3. Conduct a thorough walkaround inspection of the helicopter. (oil levels and leaks.)

NOTE

An accurate reading of the transmission oil level can not be obtained until approximately 30 minutes after shutdown.

4. DA Forms 2408 Series — complete.

NOTE

In addition to the established requirements for reporting any system defects, unusual and excessive operations, the pilot will also make entires in DA Form 2408-13 to indicate when any limits in the Operator's Manual have been exceeded.

3-26. Takeoff and Climb Procedures.

Takeoff and climb procedures are accomplished in accordance with the following paragraphs.

3-27. GO-NO-GO Procedure.

CAUTION

High gross weight and high density altitude may result in limited or inadequate directional control authority during crosswind operation. Refer to chapter 7 for crosswind, sideward and rearward airspeed limitations which shall not be exceeded.

Prolonged use of left pedal or rapid left pedal inputs to start or arrest hovering turns may damage the tail rotor drive system and should be avoided.

Pre-takeoff check will include determining if power is available for takeoff by utilizing the GO-NO-GO takeoff data placard (figure 3-3) and checking the area for other aircraft.

3-28. Normal Takeoff to Hover.

Normal takeoff to a hover can be accomplished at moderate altitude and with normal gross weights as shown in the takeoff distance chart, chapter 14. The safety factor is high as the helicopter is lifted from the ground vertically to a height of approximately three feet where the flight controls and engine may be checked for normal operation. A normal vertical takeoff is made in the following manner. Place cyclic control in neutral position. Increase collective pitch control slowly and smoothly until hovering altitude of three feet is reached. Apply rudder pedal to maintain heading as collective is increased. As the helicopter breaks ground, make minor corrections with cyclic control to ensure vertical ascent, and adjust rudder pedals to maintain heading.

3-29. Normal Takeoff from Hover.

Hover briefly to determine if engine and flight controls are operating properly. From a normal hover at three feet altitude, apply forward cyclic to accelerate smoothly into effective translational lift; maintain hovering altitude with collective pitch and maintain heading with rudder pedals, until effective translational lift has been obtained and the ascent has begun. Then smoothly lower nose of helicopter to an attitude tht will result in an increase of airspeed to 80 KIAS. Adjust power as required to establish the desired rate of climb. Stabilize airspeed and torque pressure as soon as a smooth rate of acceleration will permit.

3-30. Maximum Performance Takeoff.

Place the cyclic control and rudder pedals in a neutral position, then slowly increase collective pitch and apply pedal as necessary, as the helicopter leaves the ground. Continue to increase the collective pitch at a constant rate until the power setting requirement to clear the obstacles is obtained. Once obstacle clearance is obtained adjust power and attitude to establish a normal climbout.

NOTE

The bleed air heater (RAIN REMOVAL-ENVR CONT switch) should be in the OFF position during takeoff, landing and other flight conditions requiring maximum engine power available.

3-31. Crosswind Takeoff and Landing.

CAUTION

Suspected overtorque of the tail rotor drive system shall be entered in DA Form 2408-13.

In the event a crosswind takeoff is required, normal takeoff procedures are used. As the helicopter leaves the ground, there will be a definite tendency to drift downwind. This tendency can be corrected by holding the cyclic stick into the wind a sufficient amount to prevent downwind drift. When a crosswind takeoff is accomplished, it is advisable to turn the helicopter into the wind for climb as soon as obstacles are cleared and terrain permits. Crosswind landings can generally be avoided in helicopter operations. Occasionally, plowed, furrowed or eroded fields, and narrow mountain ridges may require that crosswind landings be made. The crosswind landing, in such instances where terrain features dictate, is utilized to prevent landing at a high tipping angle or dangerous tail low attitude. Crosswind landing may also be accomplished on smooth terrain when deemed advisable by pilot.

3-32. After Takeoff.

CAUTION

Monitor EGT to prevent overtemp.

As the helicopter accelerates from hovering flight to flight in any direction, it passes through a transitional period. If engine power, rpm, and collective pitch are held constant in calm air, a momentary settling will be noted when the cyclic control stick is moved forward to obtain forward speed. This momentary settling condition is a result of the helicopter moving from the ground cushion and the tilting of the tippath plane of rotation of the main rotor blades to obtain forward airspeed. Wind velocity at the time of takeoff will partially eliminate this settling due to the increased airflow over the main rotor blades. As wind velocity increases, this settling will be less pronounced. After the helicoptr accelerates forward to 10 to 15 knots airspeed, less power is required to sustain flight due to increase in aerodynamic efficiency as airspeed is increased to

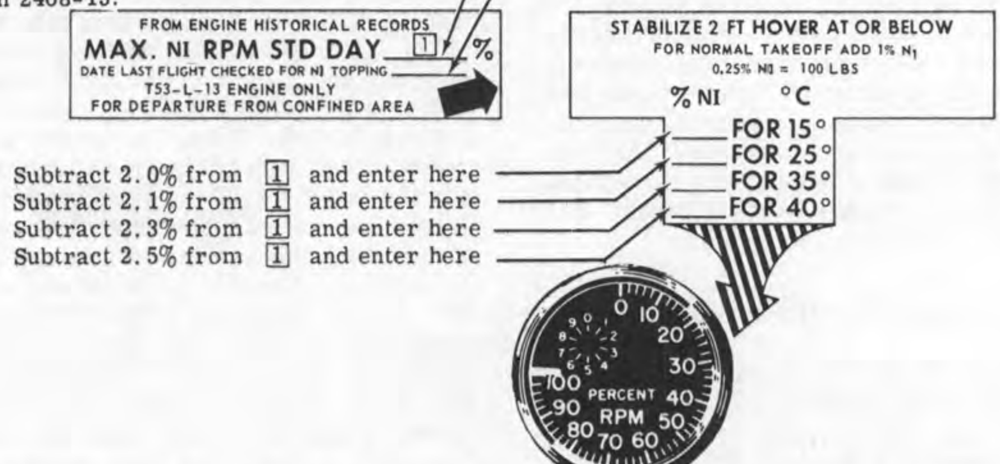
1. The following diagram of the GO-NO-GO placard and related instructions are established in order to standardize instruction and utilization of the GO-NO-GO placard.

WARNING

Maximum NI may not be possible to obtain due to dynamic component limitations. Care must be exercised not to exceed operating limitations.

CAUTION

Do not EXCEED 50 PSI torque. If 50 PSI torque is exceeded, record maximum torque and duration on DA form 2408-13.



2. Takeoff From a Confined Area. To determine if sufficient power is available to safely execute a takeoff from a confined area, the following procedures apply:

a. Check the percent of NI required to maintain a stabilized two foot hover.

b. Check the outside air temperature (OAT).

c. Relate hover power and OAT to the GO-NO-GO placard.

d. If the percent NI required to hover at two feet does not exceed that listed on the placard for that OAT, and 50 PSI torque will not be exceeded, the aircraft has sufficient power for exiting a confined area. (NOTE below applies.)

3. Normal Takeoff. To determine if sufficient power is available for a normal takeoff, the procedures are as follows:

a. Check the percent NI required to maintain a stabilized two foot hover.

b. Check the outside air temperature (OAT).

c. Relate hover power and OAT to the GO-NO-GO placard.

d. If the percent NI required to hover does not exceed that listed on the placard for the appropriate OAT by more than 1% the aircraft has sufficient power to execute a normal takeoff. (NOTE below applies.)

Note

If the OAT falls between the OAT'S listed on the GO-NO-GO placard, read the percent NI corresponding to the next higher temperature. DO NOT INTERPOLATE. If the percent NI required to hover at two feet does not meet the criteria established in paragraphs 2d. and 3d. above, the load must be reduced (.25% NI = 100 lbs.).

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Figure 3-3. Go-no-go takeoff data

best climbing speed. Takeoff power should be maintained until a safe autorotative airspeed is attained, then power may be adjusted to establish the desired rate of climb. Turn instrument panel mounted COOL/WARM selector to desired temperature. Position RAIN REMOVAL ENVR CONT switch to ENVR CONT position.

3-33. Climb.

During climbs at low altitude a safe autorotative airspeed should be maintained so that in the event of engine failure, sufficient but not excessive airspeed is available to accomplish a safe autorotative landing. Airspeeds to avoid at low altitudes are shown on figure 7-6. If necessary to clear ground obstructions after takeoff, vertical climbs can be accomplished; however, operation within the shaded area on figure 7-6, should be kept to a minimum. Accelerating the helicopter to the optimum climbing airspeed, in a shallow climb, eliminates critical settling and the possibility of the helicopter striking the ground on takeoff.

3-34. Cruise Checks.

These checks consist of constantly monitoring instruments, to be cognizant of any change in performance of condition.

3-35. Flight Characteristics.

Chapter 8 describes the flight characteristics of the helicopter. The capabilities of the helicopter in stabilized flight conditions are clearly and accurately defined in Chapter 7 and 14.

3-36. Approach and Landing Procedures.

CAUTION

If 50 psi torque is exceeded, record maximum torque and duration on DA Form 2408-13.

Before approaching and landing are accomplished, the pilot should evaluate the landing site for suitability of usable area by making a low speed pass into the wind over the intended landing site. Evaluate terrain, check wind direciton, velocity, and consistency. The gross weight of the helicopter must be considered; the final step in evaluation of a landing is the anticipated helicopter performance during landing and subsequent takeoff.

NOTE

The RAIN REMOVAL — ENVR CONT switch should be in the OFF position during takeoff, landing, and other flight conditions requiring maximum power available.

3-37. Normal Approach.

The objective of a normal approach and landing is to bring the helicopter to a hover over the spot of intended landing (figure 3-4). The airspeed is decreased gradually and a constant approach angle of 8 to 10° established at an engine speed of 6600 rpm. In case of undershooting or overshooting, the approach angle is corrected by increasing or decreasing the power.

3-38. Steep Approach.

WARNING

Due to a lag in acceleration, which in inherent in turbine engines, a need for power should be anticipated in time to allow for the acceleration lag. As much as a four second delay may be encountered for low power (bottom pitch) to full power.

CAUTION

Never reduce forward airspeed to zero before reaching hovering altitude. If the landing spot has been overshot, execute a go-around immediately.

The steep approach procedure is a precision, power-controlled approach used to clear obstacles and to accomplish a landing in confined areas. The constant approach angle is 12° to 15° maintained at all times. Since a reasonable amount of power will be required to control the rate of descent (power required is governed by the gross weight and atmospheric conditions) a minimum amount of additional power will remain to accomplish a hover. The airspeed is decreased by holding the cyclic stick aft. The rate of descent is controlled by proper application of power. In the final stages of approach, the collective pitch is increased gradually and the cyclic stick is adjusted to maintain the originally established glide angle in a way which will reduce the rate of descent to zero the moment the hovering altitude is reached.

Figure 3-4. Normal approach and landing - power ON

3-39. Normal Landing.

With an engine rpm at 6600; decrease collective pitch to effect a constant smooth rate of descent until touchdown, making necessary corrections with pedals and cyclic control to maintain level attitude and constant heading and to prevent movement over the ground. Upon contact with the ground, continue to decrease collective pitch smoothly and steadily until the entire weight of the helicopter is resting on the ground. When loaded, the helicopter will touchdown nose low (forward tips of skids) and caution should be exercised during touchdown.

3-40. Slope Landing.

WARNING

A slope of 5 degrees is the maximum which should be attempted because of high vertical cg and narrow landing gear.

Make the slope landing by heading the helicopter generally cross-slope. Slope landing should be made cross-slope with skid type gear. Descend slowly, placing the up-slope skid on the ground first. Coordinate reduction of collective pitch with lateral cyclic (into the slope) until the down-slope skid touches the ground. Continue coordinating reduction of collective pitch and application of cyclic into the slope until all the weight of the helicopter is resting firmly on the slope. If the cyclic control contacts the stop before the down-slope skid is resting firmly on the ground, return to hover and select an area where the degree of slope is not so great. After completion of a slope landing, and after determining that the helicopter will maintain its position on the slope, place the cyclic stick in neutral position.

3-41. Operating Instructions For Proximity Warning System (figure 3-5).

NOTE

The proximity warning device is on helicopters that have had MWO 55-1520-221-30-49 incorporated.

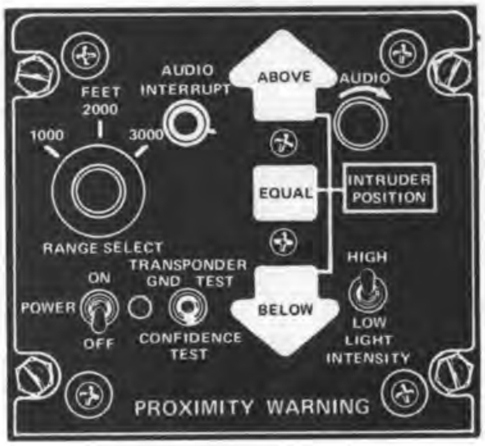

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Figure 3-5. Proximity warning control panel

The operating instructions are of two types: system engagement and system test. To engage the system:

1. Push the proximity warning circuit breaker in.

2. Position the proximity warning panel power switch to ON.

3. Position the proximity warning panel range select switch to the desired range position.

To test the system:

1. Engage the system as outlined in the preceeding paragraph.

2. Position the proximity warning panel GND TEST/CONFIDENCE TEST switch to desired test position. Refer to table 3-1 for the functions of all proximity warning panel controls.

Table 3-1. Proximity Warning System Control Panel Functions

CONTROL	FUNCTION	
POWER ON/OFF switch	Controls 28 Vdc power to system	
POWER lamp	Indicates when 28 Vdc 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 GND TEST/CONFIDENCE TEST switch	In TRANSPONDER GND TEST position, permits unit to accept signals from ground transponder. In CONFIDENCE TEST position, switch indicates confidence test.	

CHAPTER 4

EMERGENCY

Section I. INTRODUCTION

4-1. General.

This chapter sets forth the procedures to be followed in meeting any emergency (except those concerning avionics and auxiliary equipment) that may be expected to happen.

4.2. Scope of Emergency Procedures.

Emergency operation of auxiliary equipment is contained in this chapter insofar as its use affects safety of flight. All other emergency operation of auxiliary equipment is covered in Chapter 6.

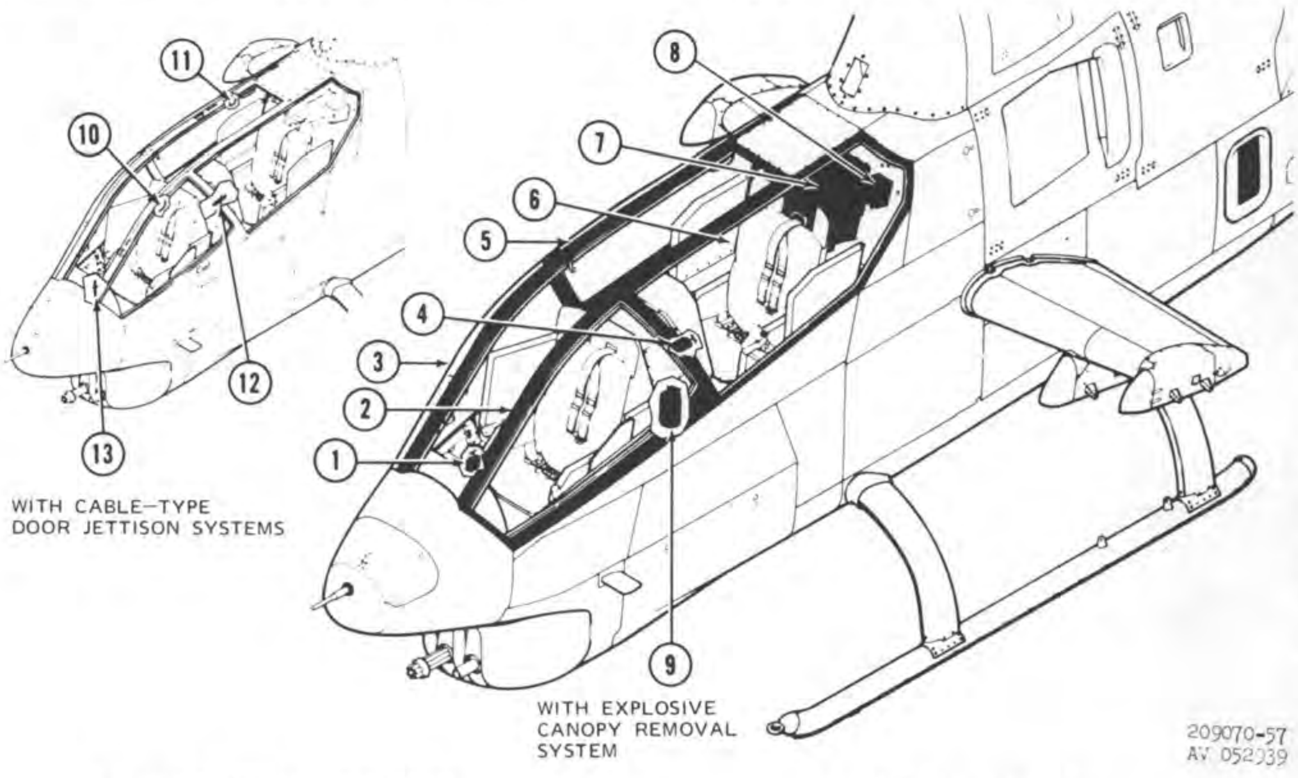
Emergency procedures are given in the checklist form when applicable. A condensed version of these procedures is contained in the condensed checklist Technical Manual TM 55-1520-221-CL.

NOTE

The urgency of certain emergencies requires immediate and instinctive action by the pilot. The most important single consideration is helicopter control. All procedures are subordinate to this requirements.

4-3. Emergency Exits and Equipment.

See Figure 4-1 for location of emergency exits and equipment. The helicopter may have either



1. Gunner's Arming/Firing Unit
2. Gunner's Door
3. Gunner's Window
4. Pilot's Arming/Firing Unit
5. Pilot's Door
6. Pilot's Window
7. Survival Kits Stowage
8. First Aid Kit
9. Fire Extinguishers
10. Gunner's Door Jettison Handle
11. Pilot's Door Jettison Handle
12. Pilot's Breakout Knife
13. Gunner's Breakout Knife

Figure 4-1. Emergency exits and equipment — typical

manually operated cable-type jettison systems on pilots and gunners doors, or a linear explosive canopy removal system actuated by pilots or gunners arming/firing mechanism to cut away four side windows of canopy. Refer to paragraph 4-47 for emergency exit procedure.

Section II. ENGINE

4-4. Engine Ground Operations.

Use the following procedures as required.

4-5. Use of Fuel Control (Emergency Position) for Starting.

When mission dictates and starting the helicopter takes precedence, start attempt may be made using the emergency fuel system. Proceed as for a normal start except as follows:

CAUTION

When operating in the emergency fuel control mode, always advance and retard throttle slowly and monitor EGT in order to avoid over-temperature or flameout.

a. Throttle — closed.

b. Engine fuel control/governor switch — EMER.

CAUTION

If engine will not accelerate without exceeding EGT limits, abort start.

c. Energize starter and start clock.

d. When N1 speed passes through eight percent advance throttle slowly to flight idle maintaining EGT below 675°C.

e. Release starter at 40 percent N1 speed.

f. Advance throttle to 80 percent N1 speed then decrease to flight idle.

g. As engine is decelerating, position GOV switch to AUTO.

NOTE

Temporary engine surge may occur as the governor switch is placed in the automatic position, however, unless EGT limits are exceeded, progress normally.

4-6. Hot Start — Abort Procedure.

If an engine hot start is imminent, proceed as follows:

CAUTION

During starting or acceleration, the maximum allowable EGT is 760°C. If EGT exceeds 760°C at any time or 675°C for more than five seconds, an entry in Form 2408-13 is required. If, during starting or acceleration, it becomes apparent that EGT will exceed 675°C abort the start as follows:

a. Throttle — closed.

CAUTION

Do not place governor switch to the EMER position, as this may increase fuel flow.

b. FUEL switch — OFF.

c. Starter — continue to energize until EGT decreases.

d. Complete engine shutdown.

4-7. Flight Characteristics.

The handling characteristics of the helicopter without power are similar to those of a normal power descent. Full control is maintained by autorotative action of the main rotor and ground contact force is reduced by increasing main rotor pitch prior to landing.

4-8. Engine Failure and Autorotation.

The two conditions most likely to affect successful autorotational landings in the event of power loss or engine failure are the altitude and airspeed at which the helicopter is operating at the time of failure. The main symptoms of either a partial power loss or complete engine failure are a sudden reduction in engine noise, a sudden drop in engine and rotor rpm, a left yaw resulting from the reduction in engine torque, and the total or partial lack of response to throttle movements. When a loss of engine power is detected,it is necessary to decrease the collective pitch and apply right pedal immediately in order to avoid a reduction in rotor rpm and to maintain a constant heading. (An exception to this statement occurs during engine failures above 120 KIAS.) Under partial power conditions the engine may operate relatively smooth at reduced power or it may operate roughly and erratically with intermittent surges of power. In instances where a power loss is experienced without accompanying engine roughness or surging, the helicopter may sometimes be flown in a gradual descent at reduced power to a favorable landing area; however, under these conditions the pilot should always be prepared for a complete power failure and an immediate autorotative landing. In the event that a partial power condition is accompanied by engine roughness, erratic operation or power surging, take immediate action by closing the throttle immediately and accomplish an autorotational landing to the nearest possible landing area (figure 4-2). In the event of an engine failure with non-essential bus switch in NORMAL position, the only operational radios are the UHF and transponder.

4-9. Minimum Ratio of Descent.

The Power Off minimum rate of descent is obtained by maintaining a forward speed of:

a. 70 KIAS at 324 rotor rpm — Clean configuration.

b. 65 KIAS at 324 rotor rpm — Heavy hog configuration.

4-10. Maximum Glide.

Maximum glide distance will be obtained by maintaining a forward speed of:

a. 100 KIAS at 324 rotor rpm — Clean configuration.

b. 90 KIAS at 324 rotor rpm — Heavy hog configuration.

4-11. Engine Failure — Autorotation.

NOTE

Refer to figure 4-2 for typical autorotation.

a. Lower collective as required to establish autorotation rpm.

b. Cyclic — Adjust as necessary to establish desired airspeed.

c. Following all engine failures:

(1) Wing stores — jettison as appropriate.

(2) Fuel switch — off.

(3) Shoulder harness — locked.

d. Maintain 65 to 100 KIAS until reaching an altitude of approximately 100 feet.

e. Execute a cyclic deceleration to a nose-up pitch attitude.

f. Terminate the deceleration by applying collective and touching down in slightly nose-high attitude to achieve minimum ground run distances. Following touchdown, gradually allow full skid ground contact.

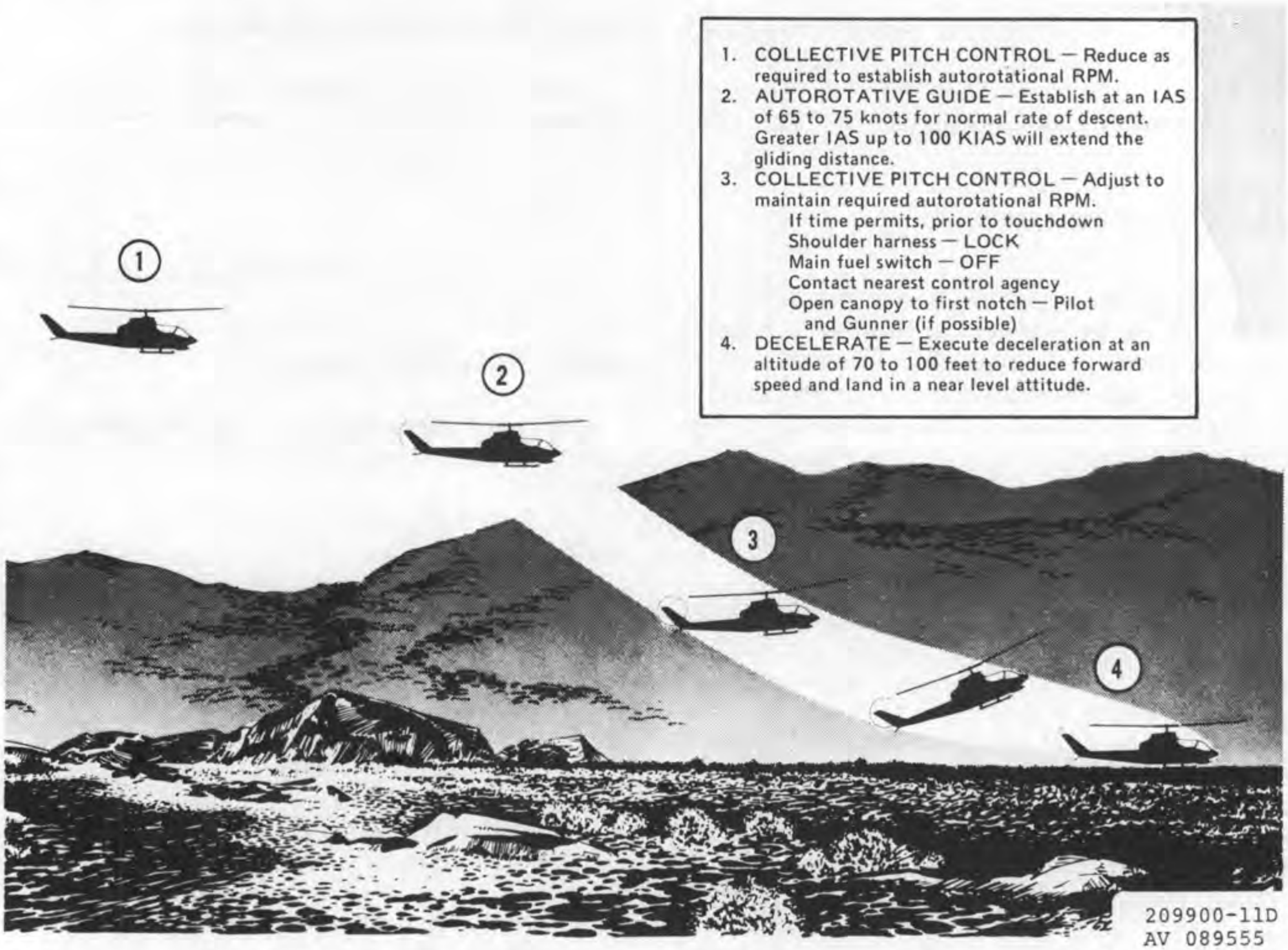


Figure 4-2. Typical autorotative approach and landing — power off

4-12. Height-Velocity Envelope.

The height-velocity envelope depicts combinations of airspeed and height above the ground where a successful straight-ahead landing to a suitable landing area may be made from level or hovering flight in the event of an engine failure. It is imperative that the techniques described in the subparagraphs herein be adhered to to achieve the capability shown by the height-velocity envelope. Delay in recognition of the failure, improper technique or excessive maneuvering to reach a suitable landing area reduces the probability of a safe touchdown. Flight conducted within the caution area of the height-velocity envelope exposes the aircraft to a high probability of damage despite the best efforts of the pilot. The following procedures must be observed when an engine failure occurs within the caution areas shown in Figure 4-4.

a. *Area A.* Forward cyclic should be applied in conjunction with lowering of collective to establish a nose-down pitch attitude of 25 degrees in order to reach and stabilize on a descent airspeed of 70 KIAS (65 KIAS in the HOG Configuration).

b. *Area B.* Forward cyclic should be applied as necessary in conjunction with lowering of collective to establish a nose-down pitch attitude of 20 degrees at 40 KIAS varying to no forward cyclic at 70 KIAS, in order to reach and stabilize on a descent airspeed of 70 KIAS (65 KIAS in the HOG Configuration).

NOTE

Additional airspeed above the recommended dive speed increases rate of descent and should only be used as necessary to extend glide distance (see figure 4-3).

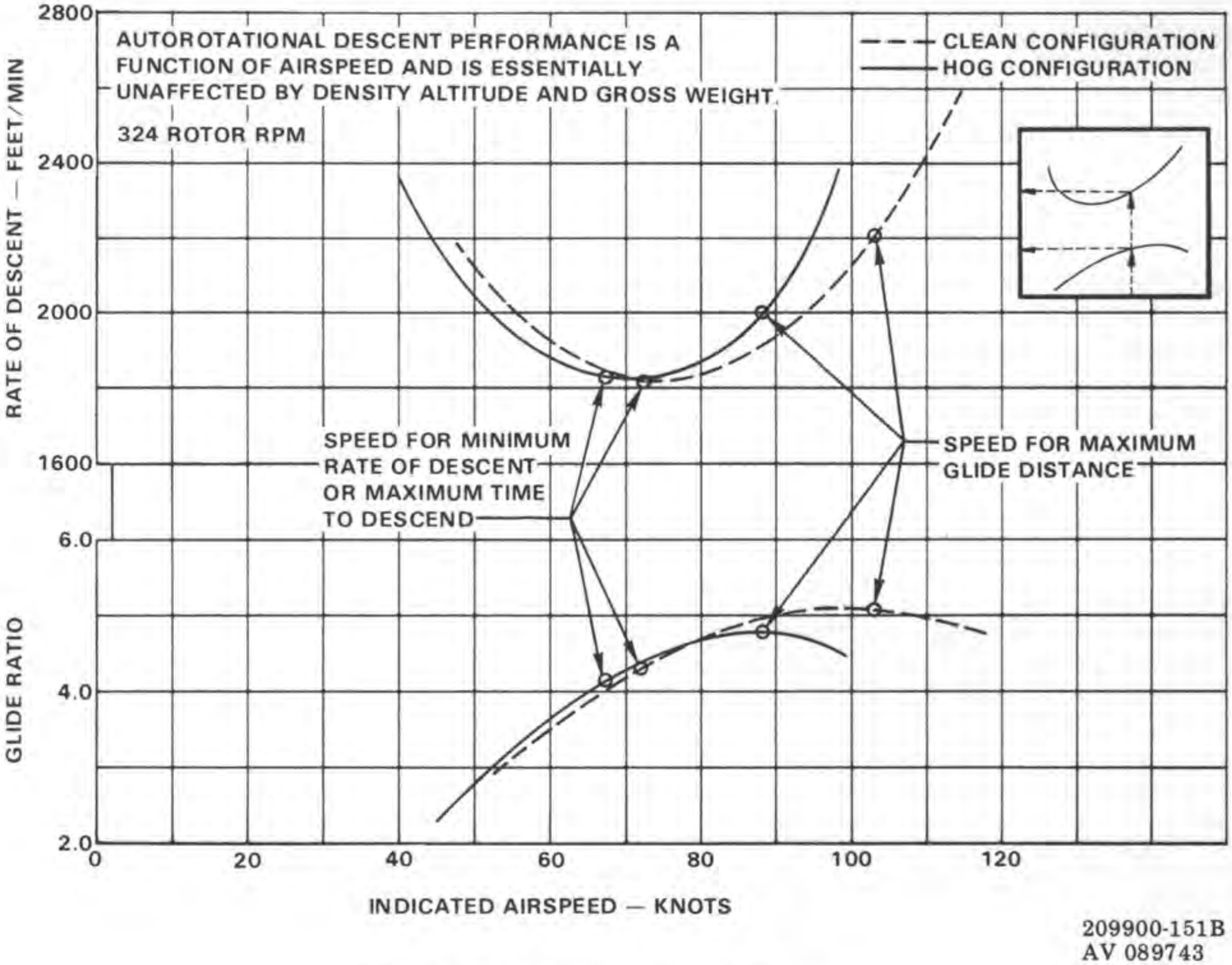


Figure 4-3. Autorotational descent

c. *Area C.* From conditions of low airspeed and low height, the deceleration capability is limited, and caution should be used to avoid striking the ground with the tail rotor. Initial collective reduction will vary from no reduction at zero airspeed and 15 feet to full down at 70 KIAS and 125 feet. Intermediate altitudes and airspeeds will require a partial reduction of collective in order to reach the termination prior to excessive rotor speed decay. Touchdown should be made in a slightly nose-high attitude to reduce the ground run as much as possible.

4-13. Engine Failure — 120 to 190 KIAS.

CAUTION

Engine failure at indicated airspeeds greater than 150 KIAS with indicated engine torque pressure greater than 35 psi require pilot recognition and reaction time of less than 1 second to preclude undesirable left roll rates (roll rate greater than 28 degrees/sec.).

Through a speed range of 120 to 190 KIAS, an engine failure will cause the nose of the helicopter to pitch up as a result of its aerodynamic qualities. The SCAS system detects this airframe movement and will attempt to correct by dipping the rotor tip path plane, thereby causing serious rotor flapping and, possibly, mast bumping. To prevent SCAS from making this correction there must be pilot input. In a nose-low attitude or level flight the input should be an aft cyclic movement. In a nose high attitude the input should be a forward cyclic movement. During the recovery from a high-speed engine failure, the important point to remember is to maintain the necessary rotor rpm and movement to keep the rotor system loaded. Speed should be reduced to successfully reach the intended landing area (figure 4-3). After entering autorotation, follow procedures outlined in paragraph 4-11. Do not exceed 120 KIAS in sustained autorotation.

NOTE

Should an engine failure occur at high speed low level it will require aft cyclic to establish a slight climb to attain sufficient altitude to execute a full deceleration termination.

4-14. Engine Restart.

WARNING

Due to the increased electrical load on the battery, a SCAS transient will occur when the starter is energized. Be prepared for a helicopter trim change.

The conditions which would warrant an attempt to restart the engine would be fuel starvation or an unknown stoppage other than

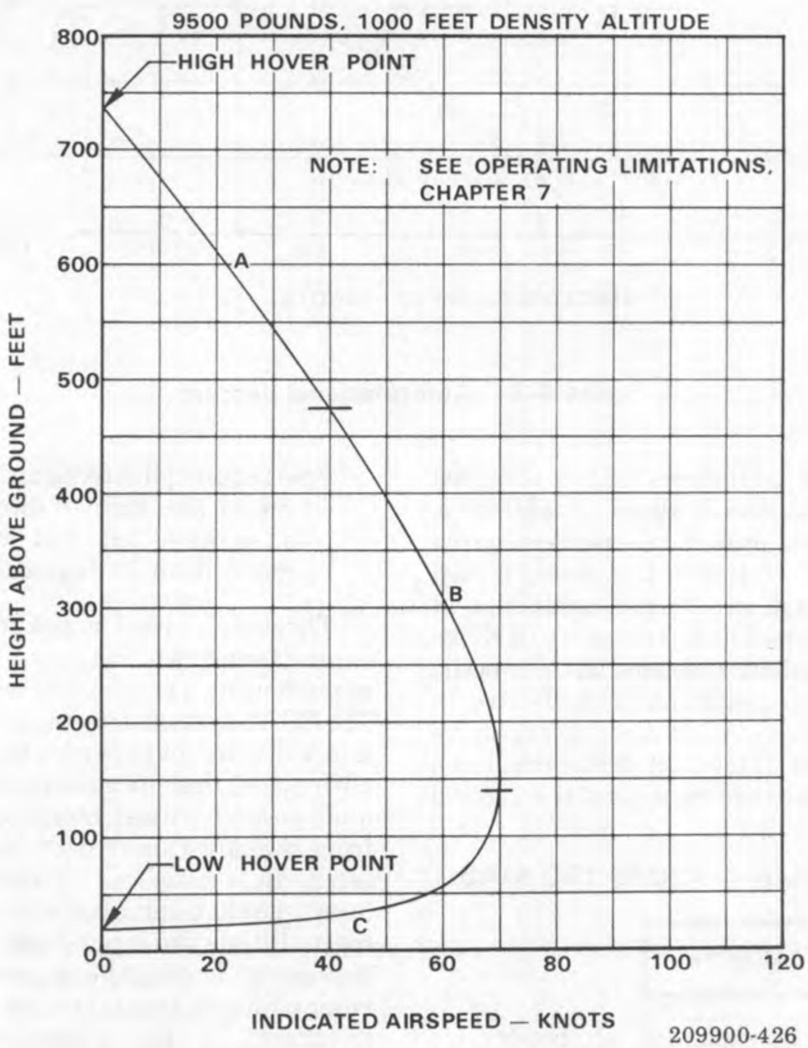


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Figure 4-4. Height velocity envelope

mechanical. The decision to attempt an engine restart during flight is the pilots responsibility and is dependent upon analysis of the cause of failure, the altitude and time available, the potential landing condition sites, and the crew assistance available. Tests have shown that 45 to 60 seconds will be required to regain powered flight from the time the starter switch is depressed. Depending on the helicopters weight, speed, and flight path at the time of failure, altitude loss during restart will vary between 1500 and 2000 feet. Before making a decision, the pilot should analyze the following variables: the time and altitude required following the engine failure to regain helicopter control, the cause of failure, and whether or not to set the controls and switches for restart. If an engine restart is to be attempted, proceed as follows:

a. Establish autorotation and select a landing area.

b. BAT switch — ON.

c. FUEL switch — FUEL.

d. Fuel boost circuit breakers — IN.

e. Starter and IGN SYS circuit breakers — IN.

f. Throttle — full off.

g. GOV switch — EMER.

h. Starter — energize.

i. Throttle — Open slowly when N1 reaches eight percent, control rate of opening to keep EGT below start limits while maintaining a smooth increase of N1.

j. Starter — Release when engine is self-sustaining (40 percent N1).

k. Throttle — Open slowly until operating rpm is reached. Monitor N2 closely as powered flight is re-established to prevent engine and rotor overspeed or underspeed. Continue flight with manual throttle control.

4-15. Engine Air Induction System.

4-16. Engine Icing.

NOTE

Possible engine icing is indicated by the ENGINE INLET AIR light on the caution panel and a rise in EGT. If this condition exists while in visible moisture with an OAT below 4.4°C proceed as follows.

a. Airspeed — 100 KIAS or less.

b. ENG AIR switch — De-ice.

CAUTION

Continue to monitor EGT, and should an apparent rise be evidenced, land immediately. The non-heating capability of the particle separator limits the de-icing.

4-17. Air Screen Obstruction.

CAUTION

Do not exceed 100 KIAS with the engine air switch in either the screen bypass or de-ice position.

a. Establish IAS — 100 KIAS or less.

b. ENG AIR switch — SCRN BYP.

c. Ensure inlet screens clear — ENG AIR switch — SCREEN.

4-18. Engine Fuel Control Malfunction.

Malfunction or failure of the engine fuel control unit or N2 governor will be evidenced by overspeeding N2 rpm, compressor stall, or flameout.

a. Overspeeding N2 Governor (High RPM).

CAUTION

Acceleration, deceleration, and overspeed control are not provided in the emergency system. Do not move collective rapidly. Engine overspeed, overtemperature, compressor stall, or flameout could result.

(1) Increase collective to load rotor and sustain engine/rotor rpm below the redline.

(2) Reduce throttle until normal operating rpm is obtained.

(3) When conditions permit, reduce throttle to flight idle and place governor switch in the emergency position.

(4) Advance throttle slowly until operating rpm is obtained and control engine rpm manually by coordinating throttle and collective controls.

b. Understanding N2 Governor (Loss of rpm).

CAUTION

Acceleration, deceleration and overspeed control are not provided in the emergency system. Do not move collective rapidly. Engine overspeed, overtemperature, compressor stall, or flameout could result.

(1) Enter autorotation and select forced landing area.

(2) Gas Producer — Check to ensure engine has not failed.

(3) Reduce throttle to flight idle and place governor switch in emergency position.

(4) Advance throttle slowly until operating rpm is obtained and control engine rpm manually by coordinating throttle and collective.

4-19. 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. In the event of failure of the droop compensator, proceed as follows:

a. Establish autorotational glide.

b. Throttle — flight idle.

c. GOV switch — EMER.

d. Throttle — open slowly to maintain desired rpm.

e. Landing — accomplish at the nearest available safe landing area.

4-20. Engine Compressor Stall.

Engine compressor stall (surge) is characterized by a sharp rumble or a series of loud, sharp reports, severe engine vibration, and a rapid rise in exhaust gas temperature (EGT) depending on the severity of the surge. Should this occur the following steps should be accomplished.

a. Reduce power.

b. RAIN REMOVAL — ECU switch — OFF.

CAUTION

Maneuvers requiring rapid or maximum power applications should be avoided.

c. If stall progresses, land at the nearest available landing area.

d. Record duration of stall, gas producer rpm, engine rpm, and torque meter indications on the DA Form 2408-13.

4-21. Inlet Guide Vane Actuator Failure.

a. If the guide vanes fail in the closed position a maximum of 20-25 psi of torque will be available. Although N1 may indicate normally, power applications above 20-25 psi will result in deterioration of N2 and rotor rpm while increasing N1. Placing the governor switch in the emergency position will not provide any increased power capability and increases the possibility of an N1 overspeed and an engine overtemperature.

(1) Collective — Maintain N2 rpm.

(2) Wing stores — Jettison as appropriate to maintain altitude.

(3) Land — Plan for a minimum power approach.

b. 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, acceleration times will correspondingly increase.

Section III. ROTORS TRANSMISSIONS, AND DRIVE SYSTEMS

4-22. Tail Rotor Failure.

A common tendency among helicopter pilots is to attempt to lump all types of tail rotor malfunctions and the corrective actions into a single category with a single solution. This is definitely not correct and any attempt to propose a single solution (emergency procedure) for all types of anti-torque malfunction could prove disastrous. The key to pilots successful handling of a tail rotor emergency lies in his ability to quickly recognize the type of malfunction that has occurred and to select the proper emergency procedure. Following is a discussion of some types of tail rotor malfunction and their probable effects.

4-23. Complete Loss of Thrust Components.

a. Complete loss of tail rotor thrust. This is a situation involving a break in the drive system, such as a severed driveshaft, wherein the tail rotor stops turning and no thrust is delivered by the tail rotor. A failure of this type in powered flight will usually result in the nose of the helicopter swinging to the right (left side slip) and usually a roll of the fuselage. Nose down tucking will also be present. The most advisable procedure is to immediately enter autorotation and coordinate the resulting maneuver with cyclic control. Control of heading will probably not be regained in autorotative flight. The pilot should expect that some rotation will be present until touchdown. Touchdown should be executed in as level an attitude as can be achieved. Ground speed should be as low as possible to minimize the possibility of turnover.

b. Loss of Tail Rotor Components. Except for a greater forward cg shift this situation would be quite similar to a complete loss of thrust as discussed above. When a loss of components is suspected enter autorotation immediately.

4-24. Fixed Pitch Failures.

a. Failures of this type (broken cable, jammed slider, etc.) are characterized by either a lack of directional response when a pedal is pushed or the pedals will be in a locked position. If the pedals cannot be moved with a moderate amount of force, do not attempt to apply a maximum effort since a more serious malfunction and set of circumstances could result. If the helicopter is in a trimmed condition when the malfunction is discovered, the engine power and airspeed should be noted and the helicopter flown to a suitable landing area. Combinations of engine torque, rotor rpm, and airspeed will correct or aggravate a yaw attitude and these are what will be used to land the helicopter.

b. If the tail rotor pitch becomes fixed during a high power condition (left pedal applied), the helicopter will yaw to the left when power is reduced. Under these conditions, power should be maintained at a setting where a controllable side slip angle can be maintained.

NOTE

At airspeeds above approximately 100 KIAS, the cambered vertical fin will begin to become increasingly more effective and as a result, the left yaw condition will be aggravated.

(1) To accomplish a landing, establish a powered approach with an airspeed that will allow a desirable rate of descent without producing an uncomfortable left yaw attitude.

NOTE

To aid in directional control, the rpm may be decreased with the throttle until rpm is controlled manually. Increasing the throttle and collective will move the nose to the right, decreasing the throttle and collective will move the nose to the left.

(2) Just prior to landing, an increase in throttle and collective will assist in reducing the left yaw attitude.

c. If the pilot has determined that the tail rotor pitch is fixed in a "left pedal applied position," an autorotative landing should not be attempted. The pilot should use only that power necessary to produce a controllable degree of side slip and continue to the nearest suitable landing area. An approach should then be established at an airspeed and rate of descent which will not produce uncontrollable side slip. During the approach, a right side slip condition will most probably prevail. When power is applied just prior to landing, the helicopter will yaw to the right, reducing the side slip condition.

d. If the tail rotor pitch becomes fixed during cruise flight or a reduced power situation (right pedal applied) the helicopter will yaw to the right when power is increased. For either of these situations, a running type landing can be performed. If the right yaw becomes excessive when adding power at touchdown, roll-off the throttle and cushion the landing with collective. The greatest problem is the compromise that may have to be made between rate of descent and yaw attitude since the collective (power) is the primary control for both of these parameters. Within reasonable limits, it is probably preferable to land hard with a zero yaw attitude than to make a soft landing while in a severe yaw attitude.

4-25. Tail Rotor Failure at a Hover.

a. In the event of complete loss of tail rotor thrust or loss of tail rotor components, close throttle and perform hovering autorotation.

b. In the event of loss of tail rotor pitch control, proceed as follows:

(1) If no yaw rotation of helicopter occurs reduce collective pitch and accomplish a power touchdown.

(2) If right yaw rotation of helicopter occurs, close throttle and accomplish a hovering autorotation.

(3) If left yaw rotation of the helicopter occurs, gradually reduce the throttle and increase collective to stop the yaw rotation and allow the helicopter to settle to the ground.

4-26. Transmission/Engine Oil Bypass.

a. Transmission Oil Bypass. Transmission oil bypass is indicated by the illumination of the transmission oil bypass caution light. This condition will occur when a flow differential develops between the oil pump outlet and the oil cooler outlet and will result in the transmission oil bypassing the oil cooler. If a bypass condition occurs, a rise in transmission oil temperature should be anticipated. Upon illumination of the transmission oil bypass caution light, proceed as follows:

(1) Monitor transmission oil temperature and pressure to confirm an actual failure.

WARNING

Engine power should be maintained throughout approach and landing to aid in preventing seizure of gears within the transmission.

(2) Should an abnormal indication occur, land as soon as possible.

(3) Do not continue until the cause has been determined and corrective action taken.

b. Engine Oil Bypass. With the engine oil bypass in the AUTO position, illumination of the engine oil bypass caution light will indicate that the engine oil is bypassing the oil cooler. This occurs when the oil level in the engine oil system is down 3.8 quarts from full. Should a bypass condition occur, a rise in engine oil temperature should be anticipated. If the engine oil bypass is in the OFF position, the illumination of the engine oil bypass light will indicate only that the oil level in the engine oil system is down 3.8 quarts from full and no bypass will occur. If illumination of the engine oil bypass caution light occurs, proceed as follows:

(1) Monitor engine oil temperature and pressure.

(2) If an abnormal indication occurs, land at the nearest available safe landing area.

(3) Do not continue until the cause has been determined and corrective action taken.

4-27. Loss of Engine/Transmission Oil Pressure or Excessive Engine/Transmission Oil Temperature.

WARNING

Should transmission oil pressure drop to zero psi, a valid cross reference can be made with the XMSN OIL PRESS caution light, but not with oil temperature indicators. The oil temperature gage and XMSN OIL HOT caution lights are dependent on fluid for valid indications.

The loss of engine/transmission oil pressure will be indicated by a drop or loss of pressure on the engine or transmission oil gage and/or the illumination of the caution light marked XMSN OIL PRESS and/or ENG OIL PRESS. Excessive transmission oil temperature will be indicated on the transmission oil temperature gage and/or the illumination of the caution light marked XMSN OIL HOT. Excessive engine oil temperature will be indicated on the engine oil temperature gage. Total loss of oil or complete pressure drop in either system will not normally produce a temperature increase. Should any of these indications occur, proceed as follows:

WARNING

If loss of transmission oil pressure or excessive temperature occurs, power should be maintained throughout approach and landing to aid in preventing seizure of gears within the transmission.

a. Accomplish a normal landing at the nearest safe landing area (open field, etc.).

b. Do not continue until the cause has been determined and corrective action taken.

4-28. Main Driveshaft Failure.

A main driveshaft failure is the loss of the drive train between the engine and transmission. This will result in the helicopter yawing to the left with a rapid increase of engine rpm and a decay of rotor rpm. Proceed as follows:

Close throttle immediately and accomplish an autorotational landing.

Section IV. FIRE

4-29. Engine Fire During Starting.

An engine fire during starting may be caused by an overloading of fuel in the combustion chamber and a delayed ignition of the fuel resulting in flame emitting from the tailpipe. To extinguish fire, proceed as follows:

a. Internal fire and/or torching.

NOTE

The pilots first attempt should be to complete the start within EGT limits. The fire will go out of its own accord once excess fuel is consumed. If, however, the EGT indicates rapid rise and hot start is eminent, proceed as stated in paragraph 4-6. If the fire is not extinguished by this procedure, abort start and exit helicopter.

(1) Starter — Continue to energize starter — release at 40 percent N1.

(2) Monitor EGT.

CAUTION

If fire is not extinguished prior to reaching engine idle, abort the start.

(3) Throttle increase to flight idle (68 to 72 percent).

(4) Continue normal procedures.

b. External fire — if external fire is evidenced in the engine compartment proceed as follows.

(1) Throttle — close.

(2) FUEL switch — OFF.

(3) Exit helicopter.

4-30. Fire During Flight.

CAUTION

A lower than normal fuel or oil pressure may be an indication of a broken or ruptured line which could be feeding the fire. This and other prevailing circumstances (e.g., altitude, forced landing areas available), must be considered by the pilot in order to determine whether to execute a powered approach or a power off autorotative descent to the ground.

CAUTION

After landing, do not attempt to restart engine until cause of fire has been determined and corrected.

a. Upon discovery of an aircraft fire, execute an immediate landing.

b. If a power off autorotative descent is made, proceed as follows:

(1) Select forced landing area and enter autorotation.

(2) Throttle — full off.

(3) Fuel switch — OFF.

(4) Wing stores — Jettison (if appropriate).

(5) Shoulder harness — Lock (time permitting.)

4-31. Electrical Fire.

WARNING

In the event of any electrical fire or smoke in the cockpit whose cause cannot be quickly and positively located and eliminated, the pilot should land at the nearest possible landing area.

The electrical circuits are individually protected by circuit breakers that automatically interrupt power to aid in the prevention of fire when a short circuit or malfunction occurs. To identify and isolate the defective system, if necessary, proceed as follows:

a. Instruments — check for correct reading.

b. BATT and GEN switches — OFF.

c. Eliminate existing smoke and fumes.

d. Circuit breakers — Out.

e. GEN FIELD circuit breaker — IN.

f. GEN switch — forward (ON) if generator circuit is shorted, return generator switch to OFF, GEN FIELD circuit breaker OUT, and BAT swtich ON.

g. GEN BUS reset circuit breaker — IN.

h. Circuit breakers — IN one at a time, and allow a short period of time to identify defective circuit.

NOTE

Flight operation can be maintained without battery and generator; however, most instruments will not function, as they are electrically powered.

4-32. Wing Stores Fire.

a. WG ST JETTISON SELECT switch — OUTBD, BOTH, or INBD position as appropriate.

b. WING STORES JETTISON switch — UP position.

4-33. Smoke and Fume Elimination.

Smoke or toxic fumes entering the cabin can be exhausted by the following procedure.

a. Reduce airspeed to 40 to 45 KIAS.

b. Open pilots and gunners canopy door to an intermediate position.

NOTE

If smoke or fumes are caused by an electrical fire, isolate the defective circuit as outlined under ELECTRICAL FIRE.

Section V. FUEL SYSTEM

4-34. Fuel Boost Pump Failure.

The helicopters fuel boost system has two separate fuel boost pumps located on the floor of each cell. Either of the pumps is capable of sustaining normal flight. In the event of boost pump failure proceed as follows:

a. Single Boost Pump Failure.

(1) Fuel switch — FUEL.

(2) If flight conditions and terrain permit descend to a pressure altitude of 4600 feet or less.

(3) Pull circuit breaker of inoperable fuel boost pump.

CAUTION

With the forward fuel boost pump inoperable, as indicated by illumination of the fuel boost caution light and less than 320 pounds of fuel remaining, nose down attitude greater than 15° should be avoided as possible engine failure may occur due to fuel starvation.

(4) Upon landing, both boost pumps must be operational before next flight.

b. Dual Boost Pump Failure.

(1) Fuel switch — ON.

(2) If conditions and terrain permit descend to pressure altitude of 4600 feet.

NOTE

The engine fuel pump is capable of supplying engine fuel requirements at pressure altitude of less than 4600 feet.

(3) Fuel boost FWD and fuel boost AFT circuit breakers — pull.

(4) Land at the nearest available safe landing area.

(5) Do not continue until cause has been determined and corrective action taken.

4-35. Fuel Filter Caution Light.

The FUEL FILTER caution light is designed to give an early indication of contaminated fuel being pumped from the fuel cells. If segment light illuminates.

a. Land at the nearest available safe landing area to prevent possible flameout or malfunction.

b. Before flight is attempted, determine cause and take corrective action.

4-36. Engine Driven Fuel Pump Failure.

Illumination of the ENG FUEL PUMP segment is an indication of one or both elements of the pump failing. If both elements fail, the engine will flameout and a power off autorotation should be accomplished per paragraph 4-11. If engine is operating normally and ENG FUEL PUMP segment illuminates, procees as follows:

a. Land at the nearest available safe landing area.

b. Do not continue until cause has been determined and corrective action taken.

4-37. Apparent Unusual Over or Under Fuel Consumption.

Condition could be an indication of fuel cell deterioration and possible increase in amount of fuel usable.

a. Do not continue flight to the point that the low fuel warning light illuminates.

b. Report condition for maintenance action prior to next flight.

Section VI. ELECTRICAL SYSTEM

4-38. DC Generator Failure.

Complete failure of the electrical system is improbable because the primary dc power normally supplied by the generator will be furnished by the battery in the event of a generator failure. Evidence of generator failure will be provided by illumination of the DC GENERATOR caution light. If the generator has not failed and the circuit has opened, reset as follows:

NOTE

As battery voltage is depleted, there is a possibility of activation of the rpm warning light and rpm audio systems.

a. GEN BUS RESET circuit breaker — IN.

b. GEN FIELD circuit breaker — IN.

c. GEN switch — move to RESET then to GEN position.

d. SCAS — re-engage.

NOTE

In the event of a generator failure, the inverter power will be automatically drawn from the static "Standby" inverter to reduce drain on the battery. Extended battery life may be obtained by the following procedures.

e. If generator is not restored, proceed as follows:

f. GEN switch — OFF.

g. GEN FIELD circuit breaker — OUT.

h. Turn off switches and/or pull circuit breaker to unnecessary equipment as desired.

i. INVTR switch — STANDBY.

j. SCAS — as desired.

k. NON-ESS BUS-MANUAL (if desired).

4-39. Engine Shutdown With Complete Electrical Failure.

a. Remove oil cooling compartment screen.

b. Press engine idle release solenoid plunger.

c. Pull control linkage down to the throttle closed position.

4-40. AC Inverter Failure.

Failure of the main inverter will be evident by illumination of the master caution light and the INST INVTR fault light on the caution panel.

NOTE

With the inverter switch in MAIN, if the main inverter fails because of loss of the dc power to the inverter relay, switchover to the standby inverter will be automatic. However, if the main inverter fails and dc power is still applied, the MASTER CAUTION and INST INVTR fault lights will illuminate, and automatic switchover will not occur.

a. Main inverter circuit breaker — IN.

b. Standby inverter circuit breaker — IN.

c. INVTR switch — STBY.

d. SCAS — re-engage.

e. Main inverter circuit breaker — OUT.

NOTE

Failure of the spare inverter will again illuminate the MASTER CAUTION and INST-INVTR light, then ac power is lost completely.

Section VII. HYDRAULIC SYSTEM

4-41. Hydraulic System.

Procedures for the three combinations of hydraulic failure are described in the following paragraphs.

CAUTION

Before further flight, the cause of hydraulic failure shall be determined and corrected.

WARNING

During a single system failure, do not move hydraulic test switch to the failed system position. Hydraulic pressure to the good system will be interrupted.

4-42. System No. 1 Failure.

a. EMER COL HYD switches — OFF, pilot and gunner, to prevent depletion of the accumulator.

b. HYD CONT circuit breaker — IN.

c. SCAS — disengage YAW channel.

d. AC WEAPON SIGHT circuit breaker — OUT.

e. Land at the nearest available safe landing area.

f. EMER COL HYD switch — ON (final approach).

NOTE

Loss of system No.1 will result in loss of tail rotor boost, the directional control SCAS actuator, and the ability to charge the accumulator. Cyclic and collective control feedback may be evident during abrupt maneuvers.

NOTE

Due to a possible failure of the operating system caused by fluid seepage into the inoperative system, a running landing is recommended with a touchdown speed of 50 KIAS, terrain permitting.

4-43. System No. 2 Failure.

a. EMER COLL HYD switches – OFF pilot and gunner, to prevent depletion of the accumulator.

b. HYD CONT circuit breaker — IN.

c. SCAS — Disengage PITCH and ROLL channels.

d. AC WEAPON SIGHT circuit breaker — OUT.

e. Land at the nearest available safe landing area.

f. EMER COL HYD switch — ON (final approach).

NOTE

Due to a possible failure of the operating system caused by fluid seepage into the inoperative system, a running landing is recommended with a touchdown speed of 50 KIAS, terrain permitting.

NOTE

Prior loss of the No. 2 hydraulic system will result in loss of pitch and roll SCAS actuators. The M28 turret will return to the stow position in elevation; however, it will not stow in azimuth. Cyclic and collective control feedback may be evident during abrupt maneuvers.

NOTE

In TH-1G helicopters, a failure of the No. 2 hydraulic system will cause the cyclic control to become somewhat stiff.

4-44. System No. 1 and No. 2 Failure.

a. EMER COL HYD switches — OFF, pilot and gunner, to prevent depletion of the accumulator.

b. HYD CONT circuit breaker — IN.

c. SCAS — disengage all channels.

d. AC WEAPON SIGHT circuit breaker — OUT.

WARNING

Below 20 KIAS cyclic feedback forces becomes uncontrollable.

e. Airspeed — maintain speed where control forces are manageable.

CAUTION

With the emergency collective hydraulic switch in the ON position, collective motion must be kept to a minimum until touchdown so that sufficient collective control remains to accomplish a landing.

f. Land at the nearest available safe landing area.

NOTE

A running landing is recommended with a touchdown speed of 50 KIAS, terrain permitting.

g. EMER COL HYD switch — ON (final approach).

NOTE

Loss of both hydraulic systems will result in loss of the SCAS actuators, cyclic, collective, and tail rotor boost and loss of directional control of the M28 turret. The turret will return to the stow position in elevation; however, it will not stow in azimuth.

Section VIII. LANDING AND DITCHING

4-45. Emergency Descent.

a. Power Off. A power off emergency descent should be conducted at the maximum permissible autorotative airspeed (120 KIAS) and at the maximum permissible power off rotor rpm. The use of turns will increase the rate of descent substantially.

b. Power On. A power on emergency descent should be conducted at as high an airspeed as conditions will permit and at 6600 engine rpm with minimum power. The use of turns will increase the rate of descent substantially.

4-46. Emergency Landing — Power Off.

Emergency landings can be accomplished without undue difficulty. They are executed in near the same manner as a power on landing. The portion of the procedure which is different is the final touchdown which will be easier to perform with a slight forward speed at time of contact. It should be remembered that landing distance (ground roll) is limited by the skid type landing gear and ground surface condition. Refer to engine failure procedures contained in this Chapter.

NOTE

When anticipating a crash landing or ditching and time permitting — jettison wing stores as appropriate; locking of the shoulder harness provides an added safety precaution over that of the automatic lock.

4-47. Landing In Trees.

a. Execute a normal autorotative descent.

b. Inform gunner of intentions.

c. Distress message — transmit, set transponder.

d. Wing stores — jettison as appropriate.

e. FUEL switch — OFF.

f. BAT switch — OFF.

g. GEN switch — OFF.

h. Shoulder harness — locked.

i. Helmet visor — down.

j. Decelerate and reach a zero rate of descent and zero ground speed at tree tops.

k. As helicopter settles, increase collective pitch to maximum.

4-48. Emergency Exit.

NOTE

If canopy doors are to be jettisoned or glasses removed by linear explosive system in flight, reduce airspeed to 20 KIAS and jettison while in level flight or slight climb.

(O)*a. Cable-Actuated Canopy Door Jettison.* Pilots canopy door on right side and gunners canopy door on left side are each attached at hinges and hold-open struts by pins on cables connected to a jettison handle. When jettison handle is pulled inboard, pins are withdrawn from the door hinges and struts, allowing the canopy door to be jettisoned.

(1) Rotate door handle up; unlatching the door.

(2) Rotate jettison handle inboard.

(3) Push canopy door out.

(4) Exit helicopter through door opening.

(O)*b. Explosive Canopy Removal System.* Both side windows and crew doors are equipped with linear explosive window cutting assemblies, installed around their frames and connected to two arming/firing mechanisms at pilots and gunners stations. When the striped handle of either arming/firing unit is turned 90° to arm, then pulled, all window cutting assemblies will be fired. Explosive force is directed outboard, cutting each transparent window and door panel free from the frame and pushing it out to allow exit through either side of pilots and gunners cockpits.

(1) Turn handle of arming/firing mechanism 90° to ARM.

(2) Pull handle to fire all four window cutting assemblies.

(3) Exit helicopter through either side of canopy.

4-49. Ditching With Power On.

The pilots decision to ditch having been made, the following steps will be accomplished.

a. Inform gunner of intentions.

b. Distress message — transmit, set XPDR to emergency.

(O)c. Wing Stores — Jettison as appropriate.

d. Airspeed — hover.

e. Helmet visor — down.

f. Canopy — jettison pilots and gunners doors, or actuate either arming/firing mechanism to remove canopy windows.

g. Gunner — Exit helicopter.

NOTE

Loss of 200 pound gunner will result in a cg shift of 2.5 to 4.0 inches.

h. Hover clear of gunner.

i. MASTER ARM switch — OFF.

j. Shoulder Harness — locked.

k. Accomplish a hovering autorotation, and as helicopter settles into the water, dissipate rotor rpm, by holding helicopter up and level as long as possible; if helicopter starts to roll, assist with cyclic in direction the helicopter tends to roll.

WARNING

Do not inflate life preserver until clear of helicopter.

l. Exit helicopter when main rotor stops.

4-50. Ditching with Power Off.

a. Inform gunner of intentions.

b. Distress message — transmit, set XPDR to emergency.

(O)*c.* Wing stores — jettison as appropriate.

d. Shoulder harness — locked.

e. Helmet visor — down.

f. Canopy — prepare as applicable:

(O) (1) For cable-type jettison — open pilots and gunners doors to first notch.

(O) (2) For explosive-type removal — turn handle of arming/firing mechanism to ARM position.

g. Execute zero groundspeed autorotation. After leveling helicopter, jettison canopy doors or pull arming/firing handle to remove windows.

h. As helicopter settles into the water, dissipate rotor rpm by holding helicopter up and level as long as possible; if helicopter starts to roll, assist with cyclic in the direction of roll.

i. Exit helicopter when rotor stops.

Section IX. FLIGHT CONTROLS

4-51. Flight Control Failure.

See hydraulic system, (Section VII) for hydraulic system failure data. See stability and control augmentation system failure (Section XII) for SCAS system failure data.

Section X. BAILOUT

4-52. Bailout.

Helicopter design, flight characteristics and autorotation qualities reduce the necessity for bailout, however, if a decision is made to bailout, accomplish as follows:

a. Warn gunner of intent.

b. Distress message — transmit and set transponder to emergency.

c. Reduce airspeed to approximately 20 KIAS, if canopy hatches are to be jettisoned.

(O)*d.* Wing stores — jettison if appropriate.

e. Force trim — FORCE TRIM.

f. Jettison canopy doors or actuate canopy removal system:

(O) (1) For door jettison system — rotate door handle up and jettison handle inboard, push out door.

(O) (2) For explosive removal system — rotate arming/firing handle 90° to arm, then pull handle to fire.

g. Set controls to establish cruise forward speed, nose slightly down, flight attitude.

WARNING

Delay opening of parachute until well clear of helicopter.

h. Bailout when ready.

Section XI. EMERGENCY JETTISONING (WING STORES)

4-53. Wing Stores Emergency Jettison.

a. Pilots wing stores jettison procedures.

(1) WG ST JETTISON SELECT switch — as required.

(2) WING STORES JETTISON switch cover — UP.

(3) WING STORES JETTISON switch — UP.

NOTE

Power for the pilots salvo jettison capability is supplied directly by the battery and is not dependent upon the battery switch position. Power for the individual INBD or OUTBD jettison capability is supplied by the essential bus. With the exterior wing stores jettison circuit breaker out or with a loss of battery power, the pilot has no salvo jettison capability and must manually position the select switch to the INBD and OUTBD positions to accomplish a complete jettison. With a loss of dc power to the essential bus or the pilots interior WING STORES JETTISON circuit breaker out, the pilot has no selective capability, and will receive a salvo jettison regardless of select switch position. With both circuit breakers pulled, the pilot has no jettison capability.

b. Gunners Wing Stores Jettison Procedures.

(1) WING STORES JETTISON switch cover — UP.

(2) WING STORES JETTISON switch — UP.

NOTE

The gunners WING STORES JETTISON switch has a salvo jettison capability only and receives power directly from the battery and is not dependent upon the battery switch position. With a loss of battery power or the exterior wing stores jettison circuit breaker out, the gunner has no jettison capability.

Section XII. STABILITY AND CONTROL AUGMENTATION SYSTEM

4-54. Stability and Control Augmentation System (SCAS) Failure.

A hardover failure of a SCAS Actuator will be evident by an abrupt change in pitch, roll, or yaw attitude which, when corrected by the pilot will result in an abnormal cyclic or pedal position. If a hardover failure occurs, proceed as follows:

a. Disengage by depressing SCAS release button.

b. If condition persists, turn SCAS power switch OFF.

c. After helicopter attitude and airspeed control has been re-established, the pilot may re-engage the unaffected SCAS channels, if desired.

CHAPTER 5

AVIONICS

Section I. INTRODUCTION

5-1. General.

This Chapter describes the electronic equipment configuration installed in Army model AH-1G helicopter. It includes a brief description of the electronic equipment, their technical characteristics, capabilities, and location. This Chapter also contains complete operating instructions for all signal equipment installed in the helicopter.

5-2. Electronic Equipment Configuration.

The avionic configuration consists of two signal distribution panels, UHF radio set, FM radio set, VHF radio set, automatic direction finder, IFF transponder, voice security set, a gyrosyn compass, and appropriate headset cordages and keying switches. The keying switch is the hat switch on top of the cyclic control grips in both stations. Placing the hat switch in aft position keys the interphone. The forward position of the switch keys the transmitter selected with transmit-interphone selector switch on the interphone panel. In addition to the hat switch the gunner has a foot switch. The foot switch has only one position. It keys the radio or interphone that is selected with the transmit-interphone selector switch on the gunners signal distribution panel. The gunners headset cordage connector is aft of the cyclic stick and just forward of the canted bulkhead. The pilots headset cordage connector is on his left, outboard from the collective control stick. UHF and ADF control panels are located on the pilots right console. The FM radio control panel is in the pilots instrument panel. The helicopter has the FM homing facility. External interphone receptacles are located in each wing tip. Access to the wing tip receptacles is provided by a hinged access door. Headset cordages (within-the-line keying switches) are provided for adapting the headset to the wing tip receptacles. The transponder control panel and security set indicator assembly are in the pilots right console. The voice security set is utilized with the FM radio set for the purpose of providing secure, two-way voice communication. The VHF radio control panel is in the gunners instrument control panel.

5-3. Nomenclature and Common Names.

A list of the avionic equipment installed in the helicopter, with a common name assignment for each piece of equipment, is presented in table 5-1.

NOTE

The terms "Megahertz" and Kilohertz" have replaced the terms "Megacycle" and "Kilocycle". This chapter will use the terms "Megahertz" and "Kilohertz" regardless of the equipment markings.

Section II. DESCRIPTION

5-4. Signal Distribution Panel.

The signal distribution panel is a transistorized unit used for intercommunication between the pilot and gunner. The set also amplifies all received or transmitted audio signals to or from other communication and navigation receivers and transmitters. It is used to monitor the communications and navigation receivers singly or in combination. Both intercom stations are connected for full transmit and receive facilities for all communication and navigation equipment. A hot mic is also provided at each station for intercom operation without the use of an external key.

5-5. UHF Command Set.

The UHF Radio Set provides two-way amplitude modulated voice communications in the UHF (Ultra High Frequency) band of 225.0 to 399.95 MHz. It tunes in 0.05 MHz increments and provides 3500 channels. A preset channel selector and 20 preset channels are provided. The set provides monitoring of the guard channel. Transmission and reception are conducted on the same frequency with the use of a common antenna.

a. The UHF Command Set includes a receiver-transmitter installed in the tailboom section, a remote control unit installed in the pilots compartment and a UHF antenna (figure 5-1).

Table 5-1. Communications And Associated Electronic Equipment

NOMENCLATURE	COMMON NAME	USE	RANGE	LOCATION OF CONTROLS	REMARKS
Intercommunication Set Control C-1611/A1C	Interphone Panel	Interphone for Pilot and Gunner; Integrates all Communication Equipment	Stations Within Helicopter	Pilots and Gunners Left Instrument Panel	Press to talk switches located on cyclic sticks and gunners foot switch.
Radio Set AN/ARC-51BX Receiver-Transmitter Radio RT 742/ARC-51BX Control Radio Set C-6287()/ARC-51BX Antenna AT-1108/ARC	UHF Command Set Receiver-Transmitter UHF Control Panel UHF Antenna	Two-way Voice Communications in the frequency range of 225.0 to 399.95 MHz	Line of sight of 50 miles	Pilots Console	
Radio Set AN/ARC-54 Receiver-Transmitter Radio RT-348()/ARC-54 Control Radio Set C-3835()/ARC-54 FM Homing Antenna FM Communications Antenna-Collins 437S-1 Indicator ID-48()/ARN	FM Radio Set Receiver-Transmitter FM Control Panel Homing Antenna FM Antenna Course Indicator	Two-way Voice Communications and homing in the frequency range of 30.00 to 69.95 MHz	Line of Sight or 80 miles average	Pilots instrument panel	

NOTE

Signal frequencies at 62 MHz and above produce false on-course indications. Final home destination will be achieved but route covered may not be the most direct.

or

Radio Set AN/ARC-131 Receiver-Transmitter RT-823()/ARC-131 Control Radio Set	FM Radio Set Receiver-Transmitter FM Control	Two-Way Voice Communications and homing in the frequency range of of 30.00 to 75.95 MHz	Line of sight or 80 miles average	Pilots instrument panel.	

Table 5-1. Communications And Associated Electronic Equipment (Cont)

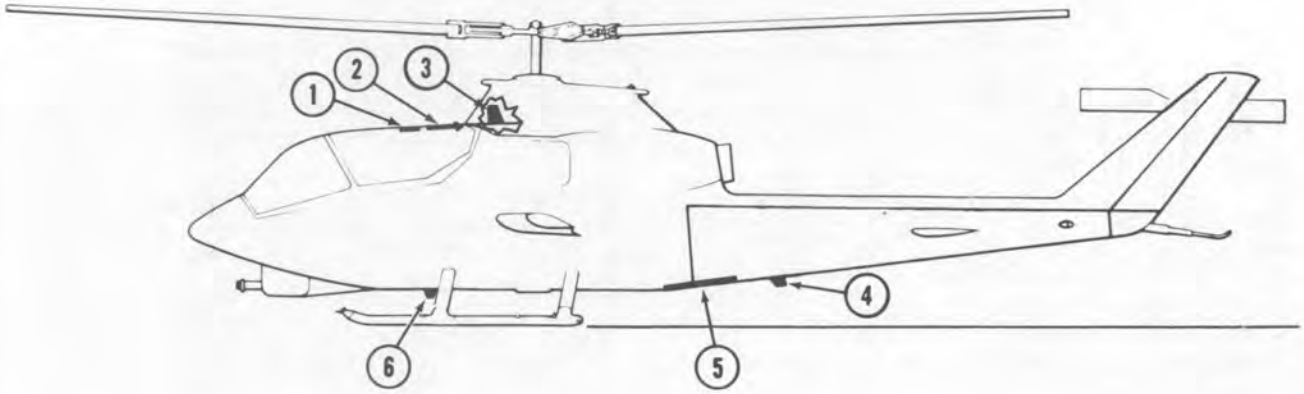
NOMENCLATURE	COMMON NAME	USE	RANGE	LOCATION OF CONTROLS	REMARKS
C-7088()/ARC-131 FM Homing Antenna FM Communications Antenna-Collins 437S-1 Indicator ID-48()/ARN	Panel Homing Antenna FM Antenna Course Indicator				
Computer Voice Security TSEC/KY-28 Control Indicator Voice Security C-8157/ARC Discriminator, Discrete Signal MD-736/A	Secure-Voice encoder/decoder Secure-Voice control indicator Discrete Signal discriminator	In conjunction with FM radio set to provide secure two-way voice communication		Pilots console.	
Radio Set Wilcox 807A AN/ARC-134 Receiver-Transmitter RT-857/ARC-134 Control Radio Set C-7197/ARC-134 Antenna AT-1108/ARC	VHF Radio Set Receiver-Transmitter VHF Control Panel VHF Antenna	Two-way Voice Communications in the frequency range of 116.00 to 149.975 MHz	Line of Sight or 50 miles average condition	Gunners instrument Panel	
Direction Finder Set AN/ARN-83 Radio Receiver R-1391/ARN-83 Control Direction Finder C-6899/ARN-83 Antenna AS-1863/ARN-83 Antenna 209-030-133	Direction Finder Set ADF Receiver ADF Control Panel Loop Antenna Sense Antenna	Radio Range Navigation and Position fixing; Automatic Direction and Homing in the Frequency Range of 190 to 400 KHz in Band 1, 400 to 850 KHz in Band 2 and 850 to 1750 KHz in Band 3	150 to 200 mile average, depending on terrain interference and noise	Pilots Console	

Table 5-1. Communications And Associated Electronic Equipment (Cont)

NOMENCLATURE	COMMON NAME	USE	RANGE	LOCATION OF CONTROLS	REMARKS
Transponder Set AN/APX-44 Receiver-Transmitter, Radar RT-494/APX-44 Transponder Set Control C-2714/APX-44 Antenna AT-844()/APX-44	Transponder Set Receiver-Transmitter Control Panel Antenna	Receives on 1030 MHz. Transmits a Special Coded Reply on 1090 MHz to Ground Based IFF Radar Interrogator System. Transmits and Receives Pulsated Radio Frequency.	Line of Sight	Pilots Console	
or					
Transponder Set AN/APX-72 Receiver-Transmitter RT-859/APX-72 Transponder Set Control C-6280(P)/APX Antenna AT-884()/APX	Transponder Set Receiver Transmitter Control Panel System which it Receives Antenna	Receives on 1030 MHz. Transmit a Special Coded Reply on 1090 MHz to Ground Based IFF Radar Interrogator. Transmits and Receives Pulsated Radio Frequency.	Line of Sight	Pilots Console	
Transponder Test Set TS-1843()/APX	Test Set	Provides Built in Test (BIT) features for transponder functions			

Table 5-1. Communications And Associated Electronic Equipment (Cont)

NOMENCLATURE	COMMON NAME	USE	RANGE	LOCATION OF CONTROLS	REMARKS
AN/ASN-43 Compass Gyro magnetic	Gyromagnetic Compass	Navigational Aid; provides accurate heading information	Pilots Instrument Panel		
Transmitter Induction Compass T-611/ASN	Flux Valve				
Compensator, Magnetic Flux CN-405/ASN	Compensator				
Directional Gyro CN-998/ASN-43	Directional Gyro				
Amplifier Electronic Control AM-3209/ASN	Amplifier, Servo				
Indicator Radio-Magnetic Compass ID-998/ASN	RMI				
Indicator Course ID-250/ARN	RMI				



1. FM Homing Antenna
2. ARN-83 Loop Antenna
3. FM Communication Antenna
4. AT-1108)ARC UHF — VHF Communications Antenna
5. AN/ARN ADF SENSE Antenna
6. AT-884/APX Antenna

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Figure 5-1. Antenna location

b. The receiver is a pressurized unit. Internal air is cooled by heat exchangers and an externally mounted blower. The blower operates only when the internal temperature of the receiver-transmitter exceeds 95°F. Primary power to operate the set is supplied from the 28 Vdc essential bus. Circuit protection is provided by a circuit breaker marked UHF COMM. The receiver-transmitter is controlled from the UHF remote control panel mounted in the pilots right console.

c. The UHF/VHF antenna is a dual antenna contained in a single housing. Both UHF and VHF antenna elements and connectors are provided which permits the antenna to be used for either UHF or VHF.

5-6. FM Radio Set — AN/ARC-54.

NOTE

Electrical connectings and mounting are the same for the AN/ARC-54 and AN/ARC-131 set.

The FM radio provides two-way voice communications within the tactical frequency modulation (FM) range of 30.00 to 69.95 MHz. In addition to voice communication, the FM radio permits selective calling (TONE) operation. Also when used with the homing antenna and course indicator, the pilot is provided with a homing facility. This permits homing on any station within the 30.00 to 69.95 MHz frequency range.

a. The FM radio set includes a receiver-transmitter, FM control panel, communications antenna, homing antenna, and homing (Course) indicator.

b. The FM receiver-transmitter is installed in the tailboom section and is controlled from the FM control panel at the pilots station. Primary power to the radio set is supplied from the helicopters 28 Vdc non-essential bus. Circuit protection is provided by a circuit breaker marked FM RCVR.

c. The FM communication antenna (figure 5-1) consists of an antenna element, mounting base, and coupler, which are installed inside the pylon fairing.

d. The homing antenna (figure 5-1) is installed in the cabin roof plexiglass panel. Data provided by the homing facility is displayed visually on the course indicator in the pilots instrument panel.

5-7. FM Radio Set – AN/ARC-131.

NOTE

Electrical connectings and mounting are the same for the AN/ARC-54 and AN/ARC-131 set.

The FM radio provides two-way voice communications within the tactical frequency modulation (FM) range of 30.00 to 75.95 MHz. In addition to voice communication, the FM radio permits selective calling (TONE) operation. Also, when used with the homing antenna and course indicator, the pilot is provided with a homing facility. This permits homing on any station within the 30.00 to 75.95 MHz frequency range.

a. The FM radio set includes a receiver-transmitter, FM control panel, communications antenna, homing antenna, and homing (Course) indicator.

b. The FM receiver-transmitter is installed in the tailboom section and is controlled from the FM control panel. Primary power to the radio set is supplied from the 28 Vdc non-essential bus. Circuit protection is provided by a circuit breaker marked FM RCVR.

c. The FM communication antenna (figure 5-1) consists of an antenna element, mounting base, and coupler, which are installed inside the pylon fairing.

d. The homing antenna (figure 5-1) is installed in the cabin roof plexiglass panel. Data provided by the homing facility is displayed visually on the course indicator in the pilots instrument panel.

5-8. Voice Security System.

The secure-voice encoder/decoder (TSEC/KY-28) and secure-voice control-indicator (C-8157/ARC), MD-736/A's discrete signal discriminators are used in conjunction with the FM radio set to provide secure, two-way voice communications. The encoder portion of the secure-voice encoder/decoder translates the microphone audio to coded voice for application to the FM radio transmitter. Secure audio signal from the FM radio receiver is applied to the secure-voice encoder/decoder for translation to clear-voice audio.

a. The TSEC/KY-28 computer, is installed in the tailboom section. The system is controlled by the C-8157/ARC Control-indicator installed in the pilots right console. For description of the control-indicator see Section III. The two MD-736/A's discrete signal discriminators are a portion of the inter-connected wiring and are located behind an external access panel below the pilots right console. Primary power to operate the system is supplied from the 28 Vdc non-essential bus.

b. The MD-736/A's performs two functions during operation. One function is to disable the FM radio receiver circuits while the VHF or UHF radio transmitter is being used by the pilot, or gunner. The other function is to discriminate between high and low audio levels between the C-1611/AIC and the VHF and UHF radio transmitters.

5-9. VHF Radio Set.

The VHF radio set provides voice communication in the very high-frequency (VHF) range of 116.000 through 149.975 MHz. This provides 1360 channels spaced 25 KHz apart. The set transmits and receives amplitude modulated signals on the same frequency with the use of a common antenna.

The VHF radio set consists of a receiver-transmitter, remote control panel, and VHF antenna. The receiver-transmitter is installed in the tailboom section. The control panel for the receiver-transmitter is installed in the gunners instrument panel. The VHF antenna is contained in the same housing with the UHF antenna (figure 5-1). Primary power to operate the radio set is supplied from the 28 Vdc non-essential bus. Circuit protection is provided by a circuit breaker marked VHF COMM.

5-10. Direction Finder Set.

The direction finder set provides radio aid to navigation. It operates in the frequency range of 190 to 1750 KHz. When operating as an automatic direction finder, the system presents a continuous indication of the bearing to any selected radio station. It also provides aural reception of audio from the station. When the loop mode of operation is selected, the system enables the operator to find the bearing to any selected radio station by manually controlling the null direction of the directional antenna. The system also operates as a conventional low-frequency aural receiver to receive voice and continuous wave (CW) transmissions.

a. The direction finder set consists of a receiver, control panel, loop antenna, sense antenna, and two indicators.

b. The receiver is a three-band transistorized unit, mounted in the aft fuselage electrical compartment, forward of the tailboom. Primary power to operate the receiver is supplied from the 28 Vdc non-essential bus. The receiver is controlled from a remote control panel mounted in the pilots right console.

c. The loop antenna and sense antenna are part of the direction finder system. The loop antenna is installed above the cabin roof (figure 5-1). The sense antenna is in one section and is an integral part of the bottom fuselage skin.

d. Information received via the direction finder set is presented visually on the pilots and gunners radio magnetic indicators and aurally through the intercom system.

5-11. Gyro Magnetic Compass.

The gyro magnetic compass is a direction sensing system which provides a visual indication of the magnetic heading of a 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 in areas where the magnetic reference is unreliable.

a. The gyro magnetic compass system consists of a flux valve, gyro and amplifier, and two radio magnetic indicators.

b. The compass transmitter or flux-valve is installed in the tailboom. It is the direction sensing unit of the compass system. The unit consists of a hemispherical bowl, which houses the functioning assemblies, and is attached to a mounting flange and compensator.

c. A sealed directional gyroscope and electronic amplifier are mounted on the same base and installed in the aft electrical compartment. The gyro contains automatic leveling circuits and precession coils for slaving the gyro to the magnetic reference in the slaved mode. The precession coils are used in the free gyro mode to provide latitude corrected drift. Primary 115 Vac power is supplied from the ac circuit breaker panel to a power supply in the base. The power supply provides necessary voltages to operate the gyro and amplifier and to excite the transmitter. The base also contains a relay operated by the COMPASS SLAVING switch to switch operation from the free gyro mode to the slaved mode.

5-12. Transponder Set — APX-44.

The transponder set receives, decodes and responds to interrogations of the Mark X identification friend or foe (IFF) system supplemented by selected identification features (SIF), and to the interrogation of civil secondary ground radar systems. The transponder set can also be used to transmit specially coded emergency signals or position-identifying signals.

a. Interrogating signals, consisting of pairs of pulses spaced to form a code, are transmitted to the transponder, which decodes the interrogation and transmits a coded reply to the question source. The form of coded reply, which can be preset by the transponder set controls, presents positive identification of the nationality and position of the helicopter.

b. The operational facilities of the transponder set are divided into five categories each of which may be selected by the pilot. These categories are as follows:

Normal Operation

Modified (SIF) Operation

Civil Operation

Identification of Position

Emergency Operation

c. Three independent coding modes, or combinations of the three, are available to the pilot. Mode 1 provides 32 possible code combinations, any one of which may be selected while in flight. Mode 2 provides one code combination which is preset prior to flight and may consist of any one of 4096 possible code combinations. Mode 3 provides 64 additional code combinations, any one of which may be selected by the pilot while in flight.

d. The transponder set consists of a receiver-transmitter and mounting, a remote control, and antenna.

e. The receiver-transmitter is installed in the tailboom section. The set is controlled from the transponder control panel installed in the pilots right console. For description of the control panel refer to Section III. Primary power to operate the set is supplied from the 28 Vdc essential bus.

f. The receiver-transmitter is a separately housed unit containing the receiver and transmitter circuits of the transponder set. The front panel has an air intake, two fuse holders, and four coaxial connector jacks. Two hold-down hooks, located at the bottom lip of the front panel mate with the hold-down clamps on the mounting. Holes are provided on the rear panel that mate with the index pins of the mounting.

g. The antenna (figure 5-1) used with the transponder set is a light weight blade type. It is installed beneath the pilots station on the fuselage.

5-13. Transponder Set — APX-72.

The transponder set provides automatic radar identification of aircraft or surface vessel to all suitably equipped challenging aircraft, surface ships, and ground facilities within the operational range of the system. The set receives, decodes, and responds to the characteristic interrogations of operational modes 1, 2, 3/A, C, and 4. The receiver section operates on a frequency of 1030 Megahertz (MHz) and the transmitter section operates on a frequency of 1090 MHz. Specially coded identification of position (IP) and emergency signals may be transmitted to interrogating stations when conditions warrant.

a. Interrogation signals, consisting of pairs of pulses spaced to form a code, are transmitted to the APX-72 which receives the coded signal and transfers it to the decoder. The decoder checks the incoming signal for valid code and proper mode (except for mode 4 interrogations which are sent directly to the mode 4 board). If valid, the decoder signal is sent to the encoder board which prepares the coded replay. The coder reply is sent through the transmitter and antenna to the interrogating source.

b. The operational facilities of the APX-72 set are divided into four categories, each of which may be selected by the pilot. These categories are as follows:

Low (sensitivity) operation

Normal (sensitivity) operation.

Identification of position (IDENT-MIC)

Emergency

c. Five independent coding modes are available to the pilot. The first three modes may be used independently or in combination. Mode 1 provides 32 possible code combinations, any of which may be selected in flight. Mode 2 provides 4096 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 4096 possible codes any one of which may be selected in flight. Mode C, in this installation is not utilized. Mode 4, which is connected to an external computer, can be selected to display any one of many classified operational codes for security identification.

d. The range of the APX-72 is limited to line-of-sight transmission since its frequency of operation is in the UHF band making range dependent on altitude of helicopter.

e. The transponder set consists of a receiver transmitter and mounting, remote control panel, and antenna.

f. The receiver-transmitter is installed in the tailboom. The set is controlled from the transponder control panel which is installed in the pilots right console. For description of the control panel refer to Section III, Operating Controls. Primary power to operate the set is supplied from the 28 Vdc essential bus.

g. The APX-72 is encased in a two-sectional housing suitable for pressurizing. A silicon rubber packing serves as a pressure seal between the two sections which are joined together by an encircling flange coupler with clamp. The upper section of the housing contains a chassis with compartments for seven digital circuitry printed circuit board and a plug-in power supply. A frontal panel (containing three fuse holders, an elapsed time meter, the MODE 2 switch assembly, the power control connector, and a folding handle) is fastened to the upper section of the case. The lower section of the housing contains the rf and video circuit components, the antenna connector, and the pressurization valve.

h. The APX-72 set includes a test set, installed in the helicopter, used for built in test (BIT).

Section III. OPERATING CONTROLS

5-14. Signal Distribution Panel.

This panel (figure 5-2) is marked INT (interphone). Two of the panels are installed in the helicopter. The pilots panel is in the left console and gunners panel is in the instrument panel. The system is used for intercommunication and radio control. It may be used in any one of three different modes as determined by the setting of the switches and controls on the panel. The three modes of operation are: Two-way radio communication; radio receiver monitoring; and intercommunication between the pilot, gunner, and ground crew. The switches and controls and their functions are as follows:

CONTROL	FUNCTION
RECEIVERS switches 1 (FM), 2 (UHF), 3 (VHF), and 4 (not used)	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 output to headset.
Transmit-interphone selector switch	Posiitons 1 (FM), 2 (UHF), 3 (VHF), and INT connect INT or associated receiver-transmitter for transmit and receive function. Hat switch or foot switch must be used to transmit. PVT position keys interphone for transmission.

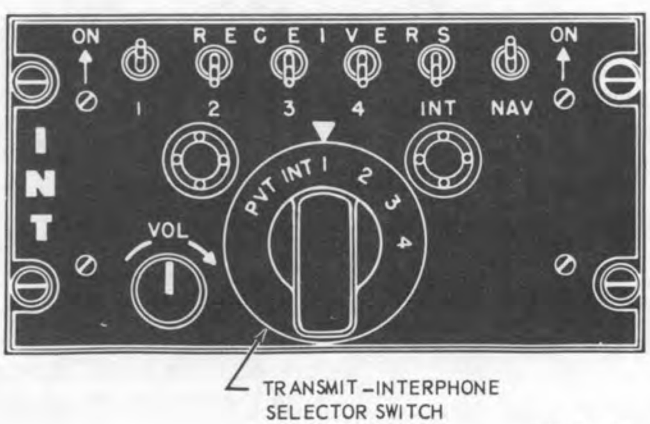
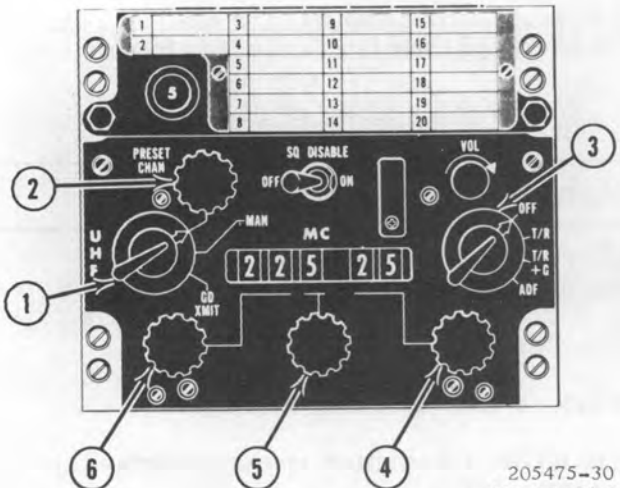


Figure 5-2. Signal distribution panel

5-15. UHF Control Panel.

This control panel (figure 5-3) is marked UHF and is installed in the pilots station. It is used to control the UHF radio set. The controls located on the panel and their functions are as follows:

CONTROL	FUNCTION
Function select switch	Applies power to the set and selects type of operation as follows:
	OFF — Removes power from the set.
	T/R Transmitter and main receiver ON.
	T/R plus G — Transmitter, main receiver and guard receiver ON.
	ADF — Not used.
VOL control	Controls receiver audio volume.
SQ DISABLE switch	ON — Squelch is disable.
	OFF — Squelch is operative.
Mode selector switch	Determines the manner in which the frequencies are selected as follows:
	PRESET CHAN — Permits selection of one of 20 preset channels by means of preset channel control
	MAN — Permits frequency selection by means of Megahertz controls.
	GD XMIT — Receiver-transmitter — automatically tunes to guard channel.
PRESET CHAN	Permits selection of one of 20 preset channels.
Preset channel indicator	Indicates preset channel selected.
Ten megahertz control	Selects first two digits of operating frequency.
One megahertz control	Selects the third digit of operating frequency.
Five-hundredths megahertz control	Selects fourth and fifth digits of operating frequency.



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1. Mode Selector
2. Preset Channel Control
3. Function Select Switch
4. 0.05 Megacycle Control
5. 1 Megacycle Control
6. 10 Megacycle Control

Figure 5-3. UHF control panel

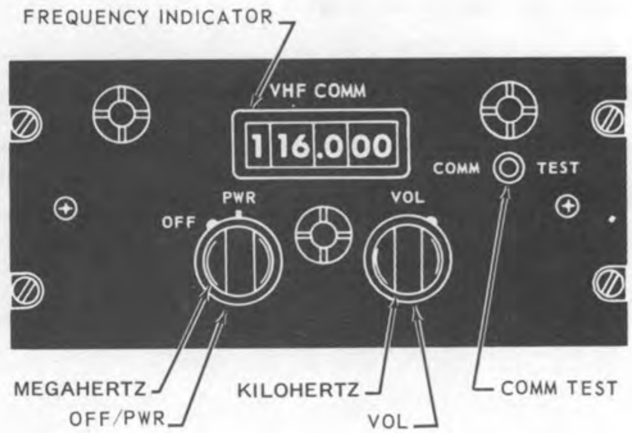

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Figure 5-4. VHF Control panel

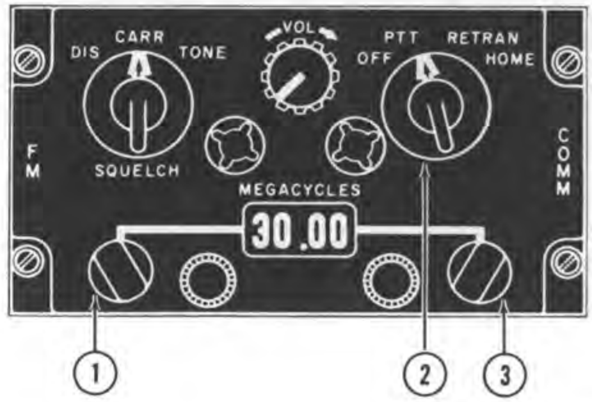
5-16. VHF Control Panel .

This control panel (figure 5-4) is marked VHF COMM and installed in the gunners insrument panel. It is used to control the VHF radio. The controls located on the panel and their functions are as follows:

CONTROL	FUNCTION
OFF-PWR switch	Turns power to the set ON-OFF.
VOL control	Controls 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 parts of operating frequency.

5-17. FM Control Panel — AN/ARC-54.

The FM panel (figure 5-5) is marked FM COMM. The panel is installed in the pilots instrument panel. It is used to control the AN/ARC-54 FM transceiver. The controls located on the panel and their functions are as follows:



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1. Frequency Control Whole - Megacycle
2. Mode Selector Switch
3. Frequency Control Decimal - Megacycle

Figure 5-5. AN/ARC-54 - FM control panel

CONTROL	FUNCTION
Mode selector	Selects mode of operation as follows:
	OFF — Turns off power.
	PTT — applies power.
	RETRAN — Not applicable.
	HOME — Connects set to homing antenna and course indicator for homing.
VOL control	Adjust audio level.
SQUELCH control	Selects squelch mode as follows:
	DIS — Squelch disabled.
	CARR — Squelch operative.
	TONE — Squelch opens only on signals containing 150 cps tone modulation.
Whole megahertz control	Selects the whole megahertz digits of the operating frequency.
Decimal megahertz control	Selects the decimal hegahertz digits of the operating frequency.

NOTE

Signal frequencies at 62 MHz and above produce false on-course indications. Final home destination will be achieved but route covered may not be the most direct.

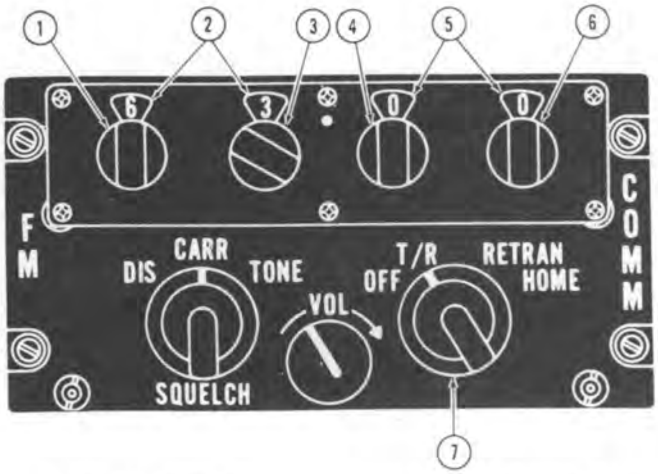
5-18. FM Control Panel — AN/ARC-131.

The FM panel (figure 5-6) is marked FM COMM. The panel is installed in the pilots instrument panel. It is used to control the AN/ARC-131 FM transceiver. The controls located on the panel and their functions are as follows:

CONTROL	FUNCTION
Mode selector	Selects mode of operation as follows: OFF — Turns off power. T/R — Applies power. RETRAN — Not applicable. HOME — Connects set to homing antenna and course indicator for homing.
VOL control	Adjust audio level.
SQUELCH control	Selects squelch mode as follows: DIS — Squelch disabled. CARR — Squelch operative. TONE — Squelch opens only on signal containing 150 cps tone modulation.
Tens and ones megahertz controls	Selects the tens and ones megahertz digits of the operating frequency.
Decimal megahertz controls	Selects the decimal megahertz digits of the operating frequency.

NOTE

Signal frequencies at 62 MHz and above produce false on-course indications. Final home destination will be achieved but route covered may not be the most direct.



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

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Figure 5-6. Radio control panel - AN/ARC-131

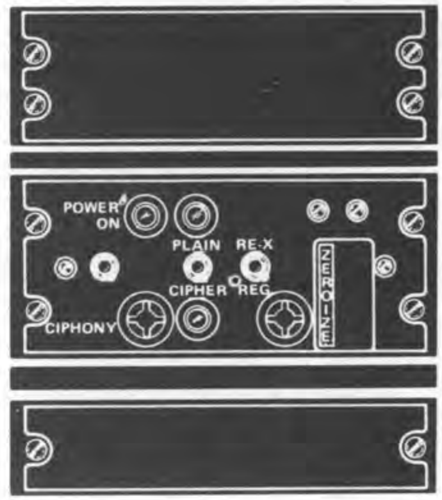

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Figure 5-7. Voice security control - indicator

5-19. Voice Security Control — Indicator.

The control-indicator panel (figure 5-7) is installed in the pilots right console. It is used to control and monitor the TSEC/KY-28 system. The controls and indicators located on the unit and their functions are as follows:

CONTROL	FUNCTION
POWER ON switch (two-poistion circuit breaker)	Connects power to the associated TSEC/KY-28 cipher equipment in the (up) position, and disconnects power from the equipment in the off (down) position. NOTE: Switch must be in the on (up) position for operation in the plain or cipher mode.
POWER ON (amber) indicator (with dimmer switch)	Lights when the associated POWER ON switch is placed in the on (up) position.
PLAIN CIPHER switch (two-position locking toggle)	In the PLAIN position, permits normal (unciphered) communications on the associated AN/ARC-131. In the CIPHER position, permits ciphered communications on the associated radio set.
PLAIN (red) indicator with dimmer switch	Lights when the associated PLAIN-CIPHER switch is in the PLAIN position.
CIPHER (green) indicator (with dimmer switch)	Lights when the associated PLAIN-CIPHER switch is in the CIPHER position.

CONTROL	FUNCTION
RE-X-REG switch (two-position locking toggle)	In the RE-X position, permits ciphered communications through a retransmission unit (at a distant location). In the REG position, permits normal ciphered communicatins or clear test.
ZEROIZE switch (two-position locking toggle, under spring-loaded cover)	CAUTION: Do not place the ZEROIZE switch in the on (up) position unless a crash or capture is imminent. Normally in off (down) position. Placed in on (up) position during emergency situations to neutralize amd make inoperative the associated TSEC/KY-28 cipher equipment.
Panel lights	Illuminate the control-indicator (controlled by helicopter panel lights).

5-20. Course Indicator.

The course indicator (figure 5-8) is located in the pilots instrument panel. This indicator is used only when the FM radio is operating in the homing mode. The indicating element in the indicator and their functions are as follows:

INDICATOR	FUNCTION
OFF vertical flag	Disappears from view when FM homing circuits are functioning properly. Remains in view when FM homing circuits are not functioning properly.
OFF horizontal flag	Disappears from view when homing circuits are functioning properly. Remains in view when FM homing circuits are not functioning properly.
Horizontal pointer	Indicates strength of FM homing signal being received. Deflects downward when flying over station being received, when flying away from station or when signal is unreliable.
Vertical 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.
Marker beacon light	Not used.

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Figure 5-8. Course Indicator

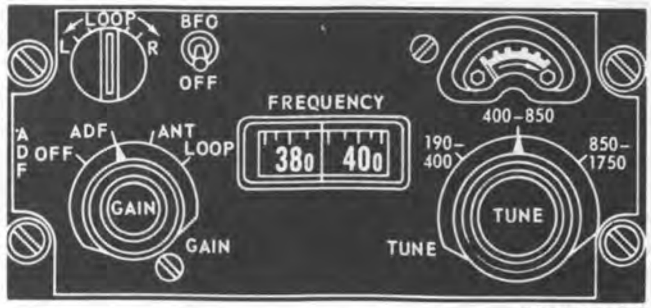

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Figure 5-9. ADF control panel

5-21. ADF Control Panel.

This panel (figure 5-9) is marked ADF and is located in the pilots right console. The panel is used to control the direction finder set and associated loop antenna and to select the sense antenna. The controls and indicators located on the panel and their functions are as follows:

CONTROL OR INDICATOR	FUNCTION
Band selector switch	Selects desired frequency band.
Tune control	Selects the desired frequency.
Tuning meter	Facilitates accurate tuning of the receiver.
GAIN control	Controls receiver audio volume.
LOOP L-R switch	Rotates loop antenna to the right or left.
BFO switch	Turns BFO on or off.
MODE selector switch	Selects the operating mode as follows:
	ADF — automatic direction finding showing to a station and position fixing.
	ANT — low frequency radio station receiver.
	LOOP — Manual direction finding or aural null operation.
	OFF — Removes power from set.

5-22. Radio Magnetic Indicator.

A radio magnetic indicator (figure 5-10) is installed in the pilots instrument panel. A second radio magnetic indicator (not shown) is installed in the gunners instrument panel. The gunners indicator is a repeater type instrument similar to the pilots indicator except that it has no control knobs. The moving dial on both indicators displays the gyro magnetic compass heading. Both pointers on the indicators indicate the bearing to the station selected on the ADF receiver.

a. Controls and Their Functions.

b. Compass Slaving Switch. The compass controls with the exception of the COMPASS switch, are incorporated in the radio magnetic indicator in this configuration. The compass switch is located in the center area of the pilots instrument panel. When the switch is in the MAG position, the system is operating in the slaved gyro mode. When the switch is in the D.G. position the system is operating in the free gyro mode.

Figure 5-10. Radio magnetic indicator

CONTROL OR INDICATOR	FUNCTION
ADF/VOR knob	Selects ADF or VOR, however, only ADF is used on this installation, switch should remain in ADF position.
Fixed Index	Provides reference mark for rotating dial.
Rotating scale dial	Rotates under fixed index to indicate aircraft heading.
Annunciator	Shows dot (•) or cross (+) to indicate misalignment (non-synchronization of compass system).
Pointer No. 1	Indicates bearing of ADF radio signal.
Pointer No. 2	Not used.
Synchronizing knob	Is manually rotated to null annunciator and synchronize (Electrically and mechanical align) compass system.
SET HDG KNOB	Moves the heading select cursor to desired heading.
Heading select cursor	Indicates desired heading.
Power failure indicator (OFF flag)	Shows to indicate loss of power to compass system.

5-23. Transponder Control Panel — APX-44.

This control panel is marked XPDR (transponder) and is installed in the pilots right console. It provides remote control of the AN/APX-44 transponder set (figure 5-11). The controls and indicators on the panel and their functions are as follows:

CONTROL OR INDICATOR	FUNCTION
Master control	Each position functions as follows: OFF — Removes power from the set. STBY — Set is in warmup (standby) condition. LOW — Selects low receiver sensitivity. NORM — selects normal receiver sensitivity. EMER — Transmitter ready for emergency automatic operation.
Function control	Selects operational mode as follows: NORMAL — Permits set to reply with normal pulse codes, representing, modes 1, 2, and 3. MOD — Permits set to reply with SIF pulse codes, representing modes 1, 2, and 3. CIVIL — Permits set to reply with civil pulse codes, representing modes 1, 2, and 3.
I/P switch	Enables I/P reply operation as follows: MIC — Connects I/P energizing circuits to helicopter microphone key circuits and permits aural I/P for 30 seconds when speaking into the microphone. OFF — Disconnects microphone keying and I/P initiating circuits. I/P — When momentarily actuated initiates I/P operation for 30 seconds.
Audio switch	ON position permits monitoring transmitted reply pulses.
MODE 2 switch	Provides mode 2 replies for mode 2 interrogations.
MODE 3 switch	Provides mode 3 replies for mode 3 interrogations.
MODE 1 Code control	Selects and indicates the two-digit, mode 1 code number.
MODE 3 Code control	Selects and indicates the two-digit, mode 3 code number.

CONTROL OR INDICATOR	FUNCTION
Emergency barrier	Prevents accidental placement of master control to to the EMER Position.
Pilot light	Lights when power is applied to the transponder.
Lens Shutter	Controls brilliance of pilot light.
Test button	Permits test of pilot light.

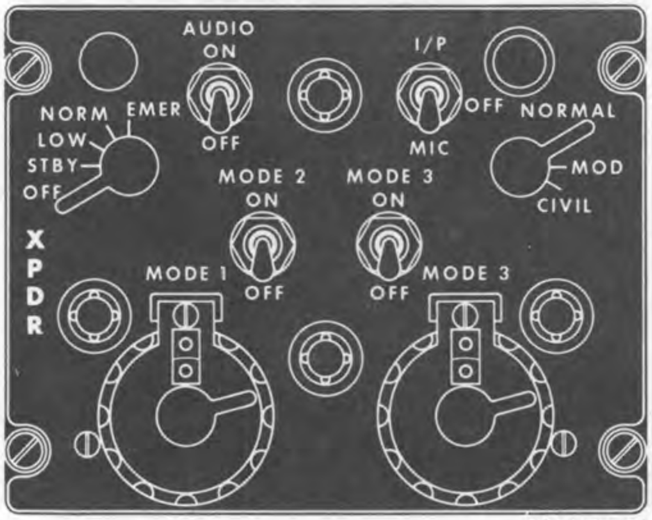

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Figure 5-11. Transponder control panel - APX-44

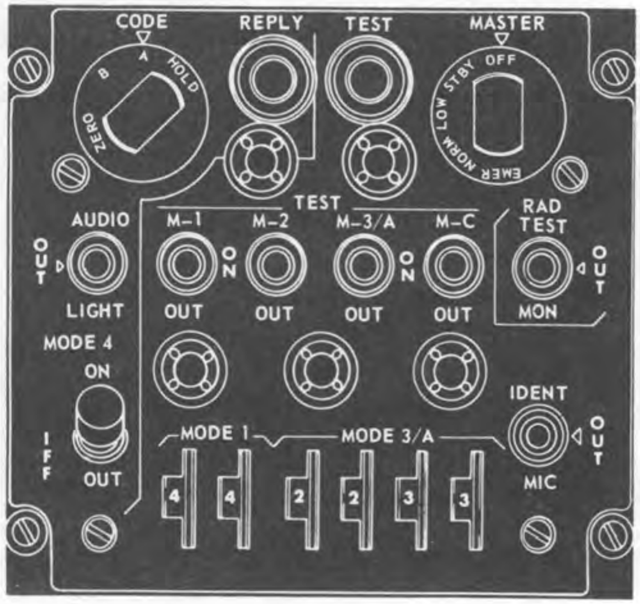

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Figure 5-12. Transponder control panel - APX-72

5-24. Transponder Control Panel — APX-72.

This control panel is located in the pilots right console. It provides remote control of the APX-72 transponder set (figure 5-12). Mode 2 code select switch is on the front panel of the receiver-transmitter radio. The controls and indicators on the panel and their functions are as follows:

CONTROL OR INDICATOR	FUNCTION
MASTER control	OFF — Turns set off.
	STBY — Places in warmup (standby) condition.
	LOW — Applies power to operate set, but at reduced receiver sensitivity.
	NORM — Applies power to operate set at normal receiver sensitivity.
	EMER — Transmits emergency reply signals to mode 1, 2, or 3/A interrogations regardless of mode control settings.

CONTROL OR INDICATOR	FUNCTION
IDENT — MIC switch	IDENT — When momentarily actuated (switch has spring-loaded return) initiates identification of position reply for a period of 15 to 30 seconds.
	OUT — Prevents triggering of identification of position reply.
	MIC — Not used.
M-1 switch	ON — Enables the set to reply to mode 1 interrogations.
	OUT — Disables the reply to mode 1 interrogations.
	TEST — Enables the TS-1843/APX to locally interrogate the set in mode 1.
M-2 switch	ON — Enables the set to reply to mode 2 interrogations.
	OUT — Disables the reply to mode 2 interrogations.
	TEST — Enables the TS-1843/APX to locally interrogate the set in mode 2.
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 — Enables the TS-1843/APX to locally interrogate the set in mode 3/A.
M-C switch	ON — Non-functional.
	OUT — Non-functional.
	TEST — Non-functional.
Mode 1 code select switches	Selects and indicates the mode 1 two-digit reply code number.
Mode 3/A code select switches	Selects and indicates the mode 3/A four-digit reply code number.
TEST Light	Lights when the set is interrogated by the TS-1843/APX in modes 1, 2, 3/A, or C, or when depressed.

CONTROL OR INDICATOR	FUNCTION
MODE 4 switch	ON — Enables the set to reply to mode 4 interrogations.
	OUT — Disables the reply to mode 4 interrogations.
CODE control	Functions of this switch are operationally classified
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.
REPLY light	Lights when valid mode 4 replies are present, or when depressed if AUDIO-LIGHT switch is in AUDIO or LIGHT position.
RAD TEST - switch	RAD TEST — Enables set to reply to TEST mode interrogations from an AN/APM-123A(B), or equivalent. Other functions of this switch position are classified.
	MON — Enables the monitor circuits of the TS-1843/APX.
	OUT — Disables the RAD TEST and MON features of the control panel.

Section IV. OPERATING PROCEDURES

5-25. Interphone Operation.

a. Battery switch — ON (OFF for APU).

b. ICS circuit breaker — in.

c. Transmit interphone selector switch — as desired.

d. Receiver switches — as desired.

e. Microphone switch — as desired.

f. Volume control — Adjust.

5-26. UHF Command Set Operation.

a. *Starting Procedure.*

(1) Battery switch — ON (OFF for APU).

(2) UHF XCVR and ICS circuit breakers — In.

(3) Function selector switch — T/R (T/R plus G as required).

(4) Mode selector switch — PRESET CHAN. Allow set to warmup.

(5) RECEIVERS switch No. 2 — forward position.

(6) Frequency — select.

(7) SQ DISABLE switch — OFF.

(8) VOL control — adjust.

(9) Transmit interphone selector switch — position 2.

(10) Microphone switch — press.

b. *UHF Guard Frequency Operation.* To transmit and receive on the guard frequency, set up the equipment as outlined in paragraph 5-26.a.

steps (1), (2), and (3). Set the mode selector switch to GD XMIT to tune automatically to the guard frequency. Complete steps (5), (7), (8), (9), and (10), in paragraph 5-26.a.

c. Stopping Procedure. Function selector switch — OFF.

5-27. FM Radio Operation — AN/ARC-54.

a. Starting Procedure.

(1) Battery switch — ON (OFF forAPU).

(2) FM XCVR, nd ICS circuit breakers — In.

(3) Mode selector switch — PTT.

(4) Frequency — Select.

NOTE

A channel changing tone should be heard in the headset while the radio set in tuning. When the tone stops the radio set is tuned.

(5) FM VOL control — Adjust.

(6) SQUELCH control — CARR or as required.

(7) Receiver switch No. 1 — Forward position.

(8) Transmit-interphone selector switch — position No. 1.

(9) Microphone switch — press.

b. FM Homing Operation. Mode selector switch — HOME.

NOTE

Signal frequencies at 62 MHz and above produce false on-course indications. Final home destination will be achieved but route covered may not be the most direct.

c. Stopping Procedure. Mode selector switch — OFF.

5-28. FM Radio Operation — AN/ARC-131.

a. Starting Procedure.

(1) Battery switch — ON (OFF for APU).

(2) FM XCVR and ICS circuit breakers — IN.

(3) Mode selector switch — T/R.

(4) Frequency — select.

NOTE

A channel changing tone should be heard in the headset while the radio is tuning. When the tone stops the radio set is tuned.

(5) FM VOL control — adjust.

(6) SQUELCH control — CARR or as required.

(7) Receiver Switch No. 1 — forward position.

(8) Transmit — interphone selector switch — position No. 1.

(9) Microphone switch — press.

b. FM Homing Operation Mode selector switch — HOME.

NOTE

Signal frequencies at 62 MHz and above produce false on-course indications. Final home destination will be achieved but route covered may not be the most direct.

*c. Stopping Procedure.*Mode selector switch — OFF.

5-29. Voice Security System Operation.

Normal operation will exist without the TSEC/KY-28 and the C-8157-ARC being installed in the helicopter; however, two operating mdoes are available when the TSEC/KY-28 and the control indicator C-8157/ARC are installed in the helicopter. PLAIN mode for unciphered radio transmission or reception and CIPHERED mode for ciphered radio transmission or reception. Both modes may be operated with or without retransmission units. Refer to the following to operate the equipment in any particular mode:

a. Preliminary Operating Procedure.

CAUTION

The POWER ON switch must be in the ON position, regardless of the mode of operation, whenever the C-8157/ARC is installed in the helicopters.

(1) Set the control indicator C-8157/ARC POWER ON switch to ON.

(2) Apply power to radio set AN/ARC-54 or AN/ARC-131.

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

(*a*) A constant tone is heard in the headset and after approximately two seconds the constant tone will change to an interrupted tone.

CAUTION

No traffic will be passed if the interrupted tone is still heard after depressing and releasing the push-to-talk switch.

(*b*) To clear the interrupted tone, depress and release the push-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.

(4) Set control unit function switch for desired type of operation (b. and c. below).

b. Plain Mode.

(1) Set the control indicator C-8157/ARC POWER ON switch to ON.

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

(3) 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.

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

c. Cipher Mode.

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

(2) 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.

(3) To transmit, press the press-to-talk switch. DO 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.

NOTE

Only one TSEC/KY-28 can transmit on a given frequency. Always listen before attempting to transmit to assure that no one else is transmitting.

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

(5) 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.

5-30. VHF Radio Operation.

a. Starting Procedure.

(1) Battery switch — ON (OFF for APU).

(2) VHF XCVR and ICS circuit breakers — in.

(3) OFF/PWR switch — PWR. Allow set to warmup.

(4) Frequency — select.

(5) RECEIVERS switch No. 3 — forward position.

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

(7) Transmit interphone selector switch — position 3.

(8) Microphone switch — press.

b. Stopping Procedure — OFF/PWR switch — OFF.

5-31. Direction Finder Set Operation.

a. Starting Procedure. To operate the direction finder set in any particular mode, perform the following preliminary steps.

(1) Battery switch — ON (OFF for APU).

(2) ADF RCVR and ICS circuit breakers — In.

(3) Receiver switch (NAV) — ON.

(4) Mode selector switch — As desired. Allow set to warmup.

(5) Frequency — select.

b. ADF Operation.

(1) To operate the direction finder set in the ADF mode, perform the following steps:

(*a*) Mode selector switch — ADF.

(*b*) BFO-OFF switch — OFF.

(*c*) Tuning meter — Tune for maximum deflection.

(*d*) Volume — adjust.

c. Antenna Operation.

(1) In this mode, the ADF pointer of radio magnetic indicator is inoperative. To operate the direction finder set in the ANT mode, perform the following:

(*a*) Mode selector switch — ANT.

(*b*) Volume — adjust.

d. Manual Loop Operation.

(1) Mode selector switch — LOOP.

(2) BFO-OFF switch — BFO.

(3) Volume — adjust.

(4) Loop switch — Move left or right for null.

e. Stopping Procedure. Mode selector switch — OFF.

5-32. Gyro Magnetic Compass — AN/ASN-43.

a. Starting Procedure.

NOTE

This compass may be operated magnetically slaved (MAG) or free gyro (D.G.). To operate the equipment in either mode perform the following procedures.

(1) Battery switch — ON (OFF for APU).

(2) GYRO CMPS circuit breakers — In.

(3) INVERTER switch — MAIN (or STBY).

(4) Radio magnetic indicator (pilots only) — check power failure indicator is not in view.

b. Slaved Gyro Mode Preflight Operation.

(1) COMPASS switch — MAG.

(2) Synchronizing knob — Center (Null) annunciator.

NOTE

The AN/ASN-43 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 30 minutes for the compass to slave to the correct headings.

(3) Magnetic heading — check.

c. Free Gyro Mode Preflight Operation.

(1) COMPASS switch — D.G.

(2) LATITUDE knob (located on the gyro base, in aft fuselage electrical compartment) — local latitude.

(3) LATITUDE switch (beside the latitude knob) — N position for northern hemisphere operation, or S position for southern hemisphere operation.

(4) Synchronizing knob — set heading.

(5) Annunciator — center position and then does not change (annunciator is de-energized in the free gyro (D.G.) mode).

d. Inflight Operation.

(1) Set the COMPASS switch to D.G. or MAG as desired for magnetically slaved or free gyro mode of operation. Free gyro (D.G.) 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 (D.G.) mode, periodically update the heading to a known reference by rotating the synchronizing knob.

e. Stopping Procedure. The compass system is turned off when helicopter electrical power is turned off.

5-33. Transponder — APX-44.

a. Starting Procedure.

(1) Battery switch — ON (OFF for APU).

(2) IFF XPDR circuit breaker — In.

(3) Master control — STBY position. The pilot light should light.

NOTE

If the pilot light does not light, press the test button. If the light does not light when the test button is pressed, either light is burned out or operating power is not reaching the transponder set.

(4) Pilot light — adjust.

(5) Allow transponder set to warmup.

b. Normal Operation.

(1) For Mode 1 operation.

(*a*) Function control — NORMAL.

(*b*) Master control — LOW or NORM as required.

(*c*) MODE 2 switch — OFF.

(*d*) MODE 3 switch — OFF.

(*e*) I/P switch — OFF or MIC as required.

(*f*) AUDIO switch — OFF.

(2) Combined modes 1 and 2.

(*a*) Function control — NORMAL.

(*b*) Master control — LOW or NORM as rquired.

(*c*) MODE 2 switch — ON.

(*d*) MODE 3 switch — OFF.

(*e*) I/P switch — OFF or MIC as required.

(*f*) AUDIO switch — OFF.

(3) Combined modes 1 and 3.

(*a*) Function control — NORMAL.

(*b*) Master control — LOW or NORM as required.

(*c*) MODE 3 switch — ON.

(*d*) MODE 2 switch — OFF.

(*e*) I/P switch — OFF or MIC as required.

(*f*) AUDIO switch — OFF.

(4) Combined modes 1, 2, and 3.

(*a*) Function control — NORMAL.

(*b*) MODE 2 switch — ON.

(*c*) MODE 3 switch — ON.

(*d*) Master control — LOW or NORM as required.

(*e*) I/P switch — OFF or MIC as required.

(*f*) AUDIO switch — OFF.

c. *Modified Operation.*

(1) MODE 1.

(*a*) Function control — MOD.

(*b*) MODE 1 code control — Assigned two digit code number.

(*c*) Master control — LOW or NORM as required.

(*d*) MODE 2 switch — OFF.

(*e*) MODE 3 switch — OFF.

(*f*) I/P switch — OFF or MIC as required.

(*g*) AUDIO switch — OFF.

(2) Combined Modes 1 and 2.

(*a*) Function control — MOD.

(*b*) MODE 1 code control — Assigned two digit code number.

(*c*) MODE 2 switch — ON.

(*d*) Master control — LOW or NORM as required.

(*e*) MODE 3 switch — OFF.

(*f*) I/P switch — OFF or MIC as required.

(*g*) AUDIO switch — OFF.

(3) Combined Modes 1 and 3.

(*a*) Function control — MODE.

(*b*) MODE 2 switch — OFF.

(*c*) MODE 3 switch — ON.

(*d*) MODE 1 code control — Assigned two digit code number.

(*e*) MODE 3 code control — Assigned two digit code number.

(*f*) Master control — LOW or NORM as required.

(*g*) I/P switch — OFF or MIC as required.

(*h*) AUDIO switch — OFF.

(4) Combined Modes 1, 2, and 3.

(*a*) Function control — MOD.

(*b*) Mode 1 code control — Assigned two digit code number.

(*c*) MODE 2 switch — ON.

(*d*) MODE 3 switch — ON.

(*e*) MODE 3 code control — Assigned two digit code number.

(*f*) Master control — LOW or NORM as required.

(*g*) I/P switch — OFF or MIC as required.

(*h*) AUDIO switch — OFF.

d. *Civil Operation.*

(1) Combined Civil and Military Mode 1.

(*a*) Function control — CIVIL.

(*b*) MODE 3 code control —Assigned two digit code number.

(*c*) MODE 3 switch — ON.

(*d*) MODE 2 switch — OFF.

(*e*) MODE 1 code control — Assigned two digit code number.

(*f*) Master control — LOW or NORM as required.

(*g*) I/P switch — OFF or MIC as required.

(*h*) AUDIO switch — OFF.

(2) Combined Civil and Military Mode 1 and 2.

(*a*) Function control — CIVIL

(*b*) MODE 3 code control — Assigned two digit code number.

(*c*) MODE 3 switch — ON.

(*d*) MODE 2 switch — ON.

(*e*) MODE 1 code control — Assigned two digit code number.

(*f*) Master control — LOW or NORM as required.

(*g*) I/P switch — OFF or MIC as required.

(*h*) AUDIO switch — OFF.

e. I/P Operation. The pilot may identify the position of his helicopter when being interrogated by a ground based IFF system. This type of operation is initiated by the pilot upon receipt of request via communications set, or unpon arrival at the pre-established check points. The transponder set will transmit position identifying signals when either of the following procedures are used.

(1) Procedure No. 1. To transmit position-identifying signals, momentarily hold the I/P switch in the I/P position.

(2) Procedure No. 2.

(*a*) Place the I/P switch in MIC Position.

(*b*) Momentarily press the switch on the microphone; the transponder set is now transmitting position identifying signals.

(*c*) Place the I/P switch in the OFF position.

f. Monitoring.

(1) Place the AUDIO switch in the ON position. Transmitted reply pulses, following interrogation, will be audible in the pilots headset.

(2) Immediately following completion of the monitoring procedure, place the AUDIO switch in the OFF position.

g. Emergency Operation. In the event of an emergency or distress condition, the transponder set may be used to transmit specially coded emergency signals. These emergency signals are automatically set up and will be transmitted as long as the master control of the transponder set remains in the EMER position. When the transponder set is interrogated by a ground-based IFF system, these signals will continue to be transmitted automatically, regardless of any mode and function combination previously set up, and will provide indications to the ground-based IFF system that the helicopter is in an emergency or distress condition. For emergency operation, set the controls as follows:

(1) Depress and hold the emergency barrier button.

(2) Turn the master control to the EMER position.

(3) Release the barrier button.

(4) Permit the master control to remain in the EMER position for the duration of the emergency.

(5) When the emergency is over, return the master control to the NORM or LOW positon.

h. Stopping Procedure.

(1) Master control — OFF.

(2) AUDIO switch — OFF.

(3) I/P switch — OFF.

(4) MODE 2 switch — OFF.

(5) MODE 3 switch — OFF.

(6) MODE 1 code control — to read 00.

(7) MODE 3 code control — to read 00.

(8) Function control — NORMAL.

5-34. Transponder — APX-72.

The APX-72 receiver-transmitter operates as an active receiver-transmitter unit which will respond only to an interrogating signal from an external source corresponding to the modes and codes preset in the C-6280 control panel and the APX-72.

The APX-72 is capable of responding in nine coded modes of operation to six coded modes of interrogation. The coded interrogation inputs are classified as modes 1, 2, 3/A, C, 4, and test. The normal coded output responses are classified as modes 1, 2, 3/A, C, and 4. Modes 1, 2, and 3/A can be modified for special responses, designated identification of position, emergency, and X pulse. Mode C can be modified for special pulse indication.

An IFF MODE 4 indicator light and CODE HOLD switch is installed on the pilots instrument panel. The switch, when in the ON position, allows the IFF MODE 4 preset code to be retained. The indicator light serves as a reminder of the switch's position.

a. Starting Procedure.

(1) Battery switch — ON (OFF for APU).

(2) IFF XPDR circuit breakers — IN.

(3) MASTER control:

STBY — one minute for standard temperature conditions and two minutes under extreme ranges of operating temperature.

LOW — low receiver sensitivity for receiving high energy signals.

NORM — normal receiver sensitivity.

EMER — refer to paragraph 5-34.d.

(4) M-1, M-2, M-3/A, M-C, and MODE 4 switches — ON, as required.

(5) AUDIO LIGHT switch — LIGHT.

(6) IDENT-MIC switch — OUT.

(7) RAD TEST -MON switch — MON.

b. Normal Operation.

(1) MASTER control — LOW or NORM, as required.

(2) M-1, M-2, M-3/A, M-C, and MODE 4 switches — ON, unless operational requirements indicate that only specific modes are to be used, then all other mode switches will be OUT.

(3) AUDIO-LIGHT switch — LIGHT.

(4) IDENT-MIC switch — OUT.

(5) RAD TEST-MON switch — OUT.

c. I/P Operation. The APX-72 will transmit position identifying signals to all interrogating stations on modes 1, 2, and 3/A when the IDENT-MIC switch on the control panel is set to IDENT. Transmission of the I/P signal will occur in these modes even if the mode enable switches are in the OUT position. The I/P operation is as follows:

Momentarily hold the IDENT-MIC switch in the IDENT position (spring-load return) and then release it. This action will cause the APX-72 to transmit the I/P signal for a period of 15 to 30 seconds to all interrogating stations on modes 1, 2, and 3/A. Repeat as required.

d. Emergency Operation. During a helicopter emergency or distress condition, the APX-72 may be used to transmit specially coded emergency signals on modes 1, 2, and 3/A to all interrogating stations. These emergency signals will be transmitted as long as the master control on the control panel remains in the EMER position. For emergency operation, set the controls as follows:

(1) Master control — EMER, leave in this position for the duration of the emergency.

(2) Master control — NORM or LOW, after emergency is over.

e. Monitoring Operation. Valid mode 4 interrogations and replies can be monitored either aurally and visually or visually by placement of the AUDIO-LIGHT switch on the control panel as follows:

(1) AUDIO-LIGHT switch — AUDIO - Mode 4 interrogating and reply pulses will be audible in the pilots headset and visible on the RELAY light.

(2) AUDIO-LIGHT switch — LIGHT - Indication of mode 4 interrogating and reply pulses will be visible on the REPLY light.

f. Stopping Procedure.

(1) Master control — OFF.

(2) IDENT-MIC switch — OUT.

(3) M-1, M-2, M-3/A, M-C, and MODE 4 switches — OUT.

(4) AUDIO-LIGHT switch — OUT.

CHAPTER 6

AUXILIARY EQUIPMENT

Section I. INTRODUCTION

6-1. General.

This chapter includes the description, normal operating, and emergency operation of all equipment not directly contributing to flight, but which enables the helicopter to perform certain specialized functions.

Much of the equipment discussed in this chapter is highly specialized or interchangeably used in many aircraft. Coverage for specialized or interchangeable equipment of this type will be brief, since complete coverage is available in publications devoted entirely to that equipment.

Section II. HEATING AND VENTILATION SYSTEM

6-2. Environmental Control System.

The environmental control system heats, cools, and removes moisture from the air supplied to the crew compartment. It is composed of the environmental control unit, control valves, ducting, and controls for the pilot to operate the system. The ambient air ventilation system and rain removal system are described with the environmental control system theory of operation.

a. Theory of Operation.

(1) When the COOL/WARM selector (figure 6-1) is rotated to full cool, and the RAIN REMOVAL ENVR CONT switch is positioned to ENVR CONT, the pressure regulator valve (figure 6-2) opens. Bleed air from the engine at approximately 460°F is directed into the environmental control unit where it is cooled to 35°F and forced through ducting to outlets in the crew compartment. Moisture is removed from the air as it passes through the water separator portion of the environmental control unit. This condensed moisture is sprayed into the ram air inlet of the heat exchanger, where the liquid evaporates and adds to the cooling effectiveness of the heat exchanger.

(2) When the COOL/WARM selector (figure 6-1) is positioned anywhere between cool and warm, hot bleed air is mixed with cold air from the environmental control unit to obtain the temperature selected by the pilot. The control/sensor (figure 6-2) consists of a sensor probe and an electronic control package as an integral unit. The sensor probe is immersed in the cold air duct. Signals from the probe and the pilots COOL/WARM selector are fed into the control/sensor control section. The control section output is supplied to a torque motor on the temperature control valve (figure 6-2). The valve responds to torque motor signals, and controls the amount of hot bleed air allowed to mix with the cold air to furnish air to the crew compartment at the temperature selected by the pilot. Maximum temperature is 180°F.

(3) When the environmental control unit is in operation, the air distribution valve (figure 6-2) is automatically positioned to prevent flow of ventilation air from the transmission blower to the crew compartment. When the environmental control unit is not in operation, the air distribution valve is automatically positioned to direct the flow of ventilation air from the transmission blower to the crew compartment. This ventilation air is at ambient temperature.

(4) In the event of a malfunction permitting excessive hot engine bleed air to enter the ducting, the probe thermal switch/overheat switch (figure 6-2) will automatically turn the environmental control unit off when conditioned air temperature increases to 260°F. When the conditioned air temperature decreases to 225°F, the

environmental control unit will come on. Cycling will continue until the environmental control unit is turned off and the malfunction is corrected.

(5) When the RAIN REMOVAL-ENVR CONT switch is positioned to RAIN REMOVAL, the environmental control unit is OFF and the rain removal valve (figure 6-2) is open to direct engine bleed air to the rain removal nozzle/slot at the lower front external surface of the windshield.

b. System Operation.

CAUTION

The RAIN REMOVAL-ENVR CONT switch must be OFF under the following conditions:
Takeoff and landing.
Flight conditions requiring maximum power. When exhaust gas temperature (EGT) exceeds 610°C continuously.
Engine normal starts.
Engine inflight restarts.

NOTE

Under certain conditions a plume may be observed at air outlets in the crew compartment. The plume may appear to be smoke, but is actually condensation.

(1) Ventilation air at ambient temperature is delivered to the crew compartment vents by the transmission driven blower when the engine is running and the RAIN REMOVAL - ENVR CONT switch is OFF. Refer to step (3) for description of crew compartment vents.

(2) When ambient air is cooler or warmer than desired, position RAIN REMOVAL-ENVR CONT switch (figure 6-1) to ENVR CONT and turn COOL/WARM switch to obtain air at comfortable temperature. The temperature of the air entering the ducting from the environmental control unit is adjustable in the range of 35°F to 180°F. Refer to step (3) for description of crew compartment vents.

NOTE

When the RAIN REMOVAL-ENVR CONT switch is positioned to ENVR CONT, the environmental control unit turbine should be heard to come up to speed.

(3) Air from the environmental control unit or the transmission driven blower enters the crew compartment at two nozzles on the pilots instrument panel, two nozzles on the gunners instrument panel, and at the back pack of each seat. The nozzles in the instrument panel are adjustable from closed to full open. Valves are located at the top of each seat to control the flow of air into the back pack. Maximum air flow may be directed to the pilots back pack by pulling HEAT OR VENT knob out, (figure 6-1).

(4) Windshield and canopy defrosting or defogging may be accomplished with ambient ventilation air or with air from the environmental control unit. Pull the two defrost levers on the pilots instrument panel aft to open the defrost slots. If maximum air flow to the defrost slots is desired, push the HEAT OR VENT knob in and close the nozzles on the instrument panels and the valves to the seat back packs.

Section III. ANTI-ICING, DEICING AND DEFROSTING SYSTEMS

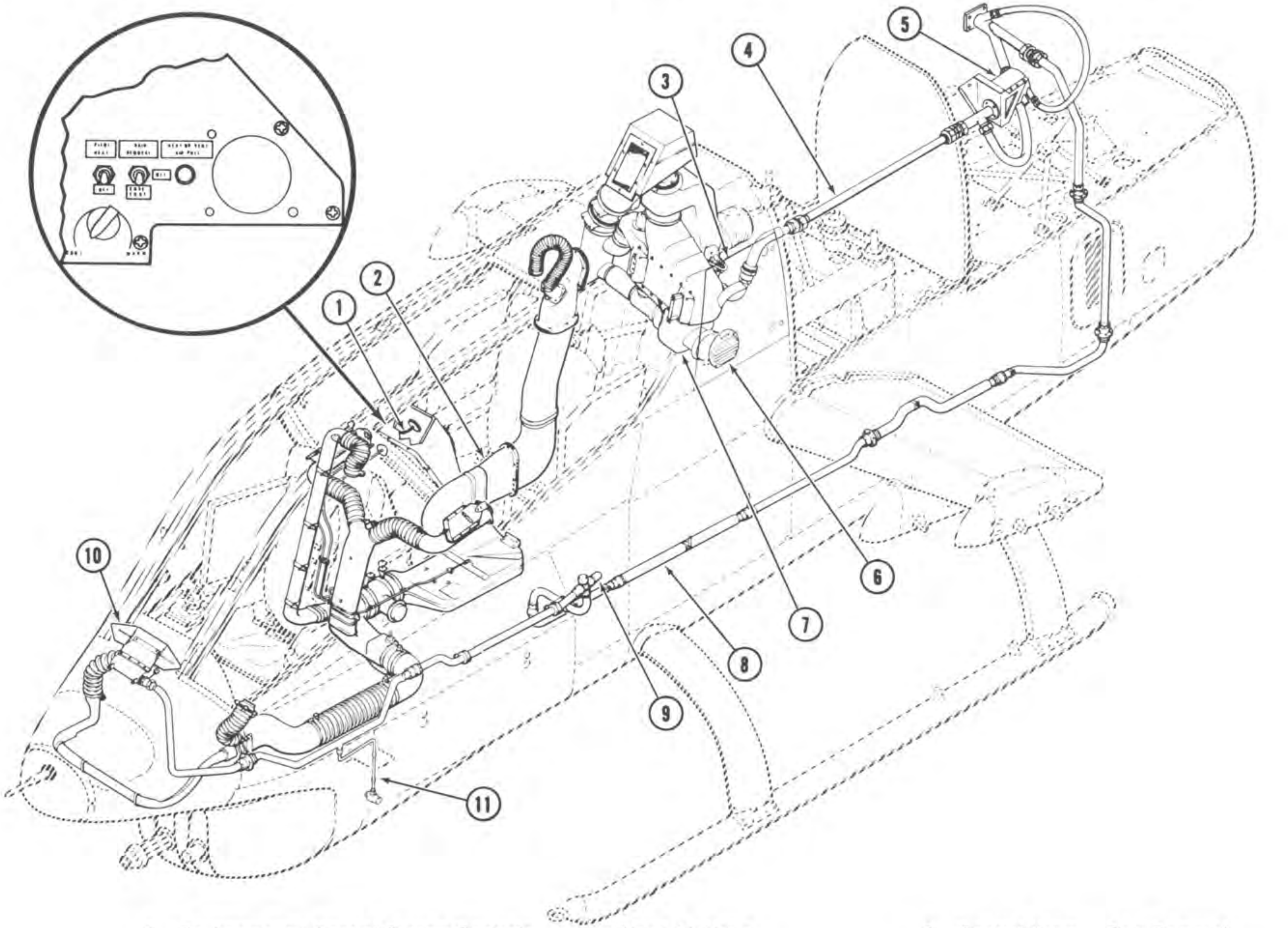
NOTE

The defrosting system is combined with the environmental control system. Refer to Chapter 6, Section II.

6-3. Engine Anti-Icing System.

The anti-icing system for the engine functions to prevent icing of the air inlet areas when engine is operating at freezing temperatures. The system consists of an electrically operated hot air valve which is controlled by the DE-ICE position of the ENG AIR switch. The system is electrically operated and powered by the 28 Vdc essential bus.

a. Caution Light. The caution light is illuminated when its pressure switch senses a negative pressure in the engine induction system. The illumination of this caution light notifies the pilot and gunner that the engine induction system



1. Environmental Control System Controls
2. Ducting
3. Hydraulic Compartment
4. Bleed Air Line
5. Bleed Air Valve
6. Door and Nozzle
7. Environmental Control Unit
8. Engine Bleed Air Line
9. Control Valve — Rain Removal
10. Rain Removal
11. Drain Line — Rain Removal

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Figure 6-1. Environmental control system

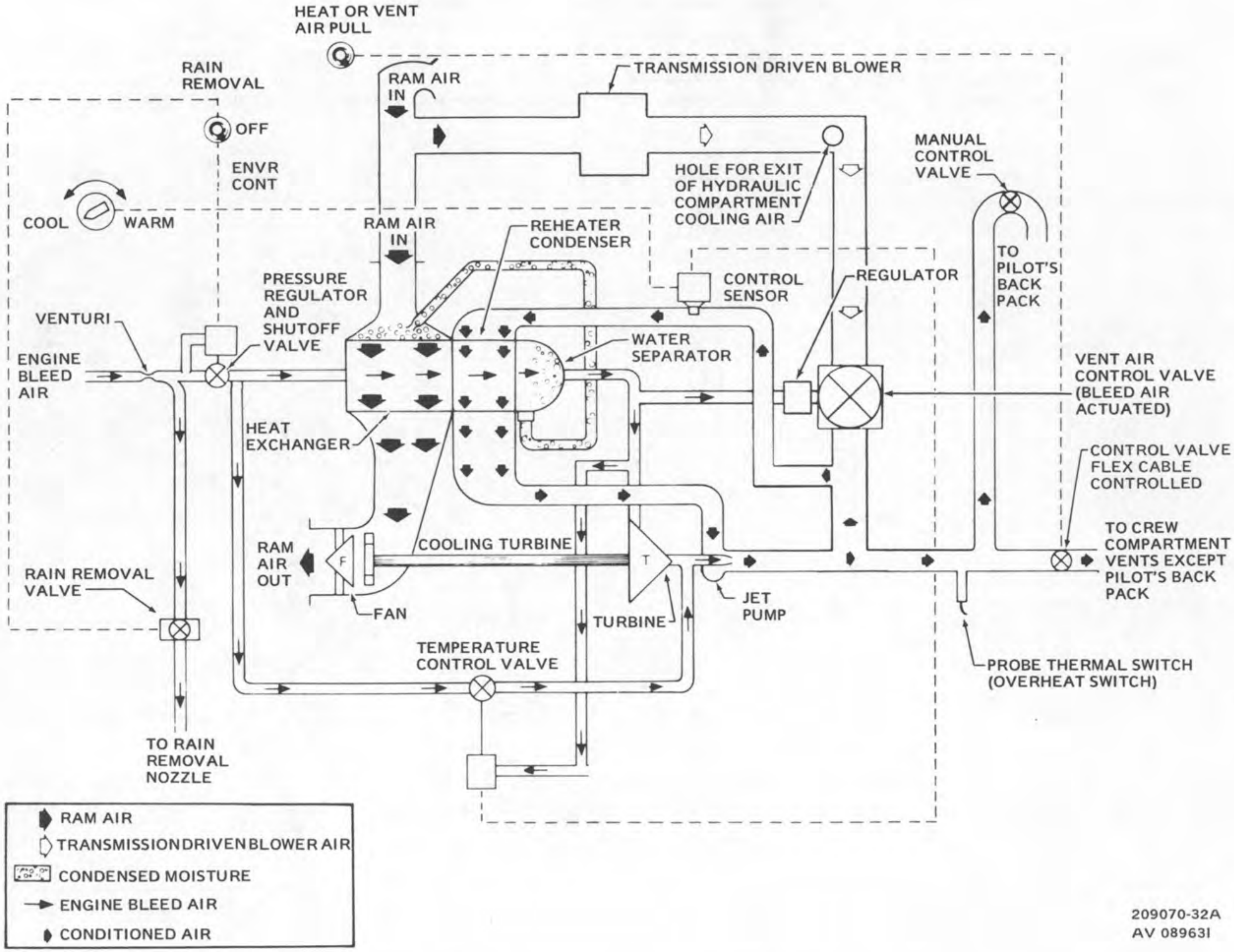

Figure 6-2. Environmental control system schematic

screen is restricting the flow of engine air. This condition may result from foreign material or ice accumulation on the screen. The bypass should be opened when the ENGINE AIR caution light is illuminated.

b. ENG AIR Switch. If ice accumulation is suspected the ENG AIR switch should be actuated from the SCREEN position aft to the DE-ICE position. Refer to Chapter 7, Section II, for limitations on opening of bypass door. With the ENG AIR switch in the SCRN BYP position, screen bypass door circuit is energized and bypass door will open. With ENG AIR switch in DE-ICE position the bypass door circuit is energized and the hot air valve circuit is de-energized allowing hot air to be extracted from the annular manifold within the diffuser housing. This hot air is then directed through five of the six hollow inlet housing support struts to de-ice the air inlet area. Hot scavenge oil draining through the lower strut into the accessory drive gearbox, de-ices the bottom of the air inlet area. Hot air is also directed into the inlet guide vane area and through the annulus around the reigon of the temperature sensing element of the main fuel control to prevent ice formation in the area of the ambient temperature sensing bulb. Small openings in the bottom of the inlet guide vanes allow hot air to bleed back into the compressor area. In the event of electrical failure, anti-icing becomes continuous.

NOTE

The particle separator in the engine induction system has no anti-icing capability. EGT should be monitored closely if icing is encountered.

6-4. Pitot Heater System.

The pitot heater is installed on the pitot head and functions to prevent ice forming in the pitot tube. Electric power for the pitot heater operation is supplied from the 28 Vdc non-essential bus. Circuit protection is provided by a circuit breaker, marked PITOT TUBE HTR.

a. Switch. The pitot heater switch is located on the instrument panel (figure 6-1). The switch is two-position with up position ON and down position OFF.

b, Switch Operation. The pitot heater switch should be in the up position to prevent ice forming in pitot tube. To shutoff pitot heater, position switch to OFF position (down).

6-5. Rain Removal System.

Rain removal is accomplished by the bleed air system. The bleed air is directed at the base of the windshield and removes the rain. The electrical power for the operation of the rain removal system is provided by the 28 Vdc non-essential bus.

a. Switch. The rain removal switch is located on the instrument panel (figure 6-1). The switch is three position with center position OFF.

CAUTION

Bleed air rain removal system should be turned OFF as soon as cleared vision will permit. Heat may melt windshield if operated for a lengthy period on a dry windshield.

b. Switch Operation. The rain removal system is controlled by the RAIN REMOVAL — ENVR CONT switch. Place switch in RAIN REMOVAL position and bleed air is directed to base of windshield. The switch should be in the OFF position during takeoff and landing and other flight conditions requiring maximum engine power available. When RAIN REMOVAL is being utilized the ENVR CONT system will be non-functional.

Section IV. LIGHTING EQUIPMENT

6-6. Position Lights.

a. The position lights consist of four lights. A green light is located on the right wing tip and a red light on the left wing tip and two white lights are located on the aft section of the tailboom (figure 6-3). Electrical power is supplied from the 28 Vdc system. Circuit protection is provided by the POS LTS circuit breaker.

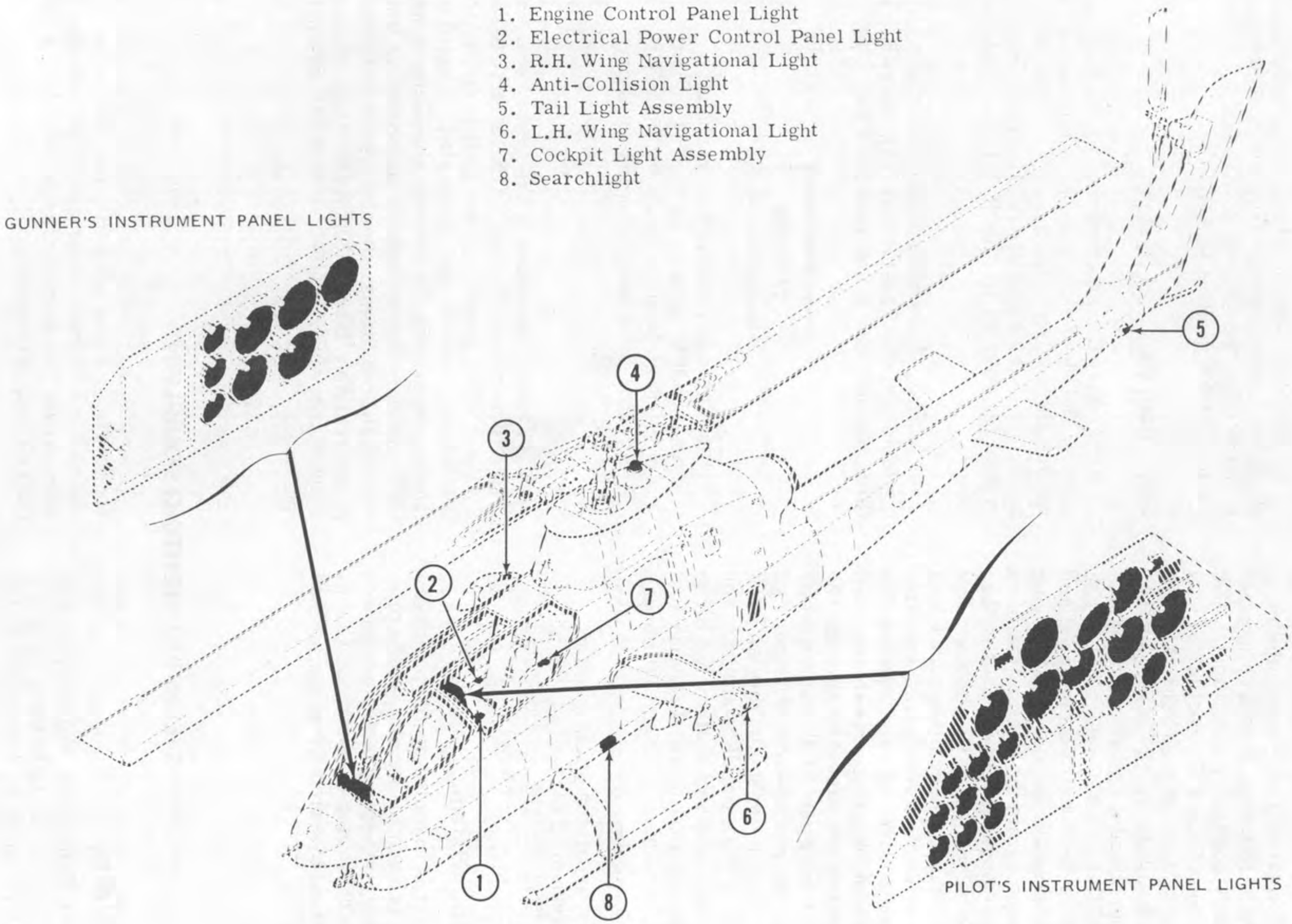

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Figure 6-3. Lighting diagram

b. The position lights are controlled from the lights control panel (figure 6-4). Two switches are provided for the control of the position lights FLASH-STEADY and BRT-DIM. The Flash-steady switch is a three position switch with the circuit de-energized when the switch is in the center position (OFF). The BRT-DIM switch is a two position switch and when in forward position the bright circuit of the position lights is energized. The aft position energizes the dim circuit.

6-7. Anti-Collision Light.

WARNING

Under instrument conditions, particularly at night, through conditions of reduced visibility, unnecessary operation of the anti-collision light should be avoided. Uncommon reflections on the helicopters windows, caused by rotating light being reflected back from the clouds through the whirling blades, may cause vertigo.

a. The anti-collision light is mounted on the top of the pylon fairing (figure 6-3). Electrical power for the anti-collision light is provided by the 28 Vdc non-essential bus.

b. The anti-collision light switch is located in the lights control panel (figure 6-4). The switch is a two position toggle switch marked ANTI-COLL LT and OFF. The forward position energizes the anti-collision light circuit.

6-8. Searchlight.

CAUTION

Do not operate searchlight after landing in areas of combustible material, such as tall grass, etc.

The controllable searchlight is located in the lower section of the fuselage just aft of the ammunition compartment (figure 6-3). At any desired position in the lights extend or retract position, it may be stopped and moved in a horizontal plane to the left or right. Electrical power for the search light is supplied by 28 Vdc non-essential bus. Circuit protection is provided by SEARCH LT PWR and SEARCH CONT circuit breaker on the dc circuit breaker panel. The light is controlled by two switches on the switchbox assembly on the pilots collective stick. The upper switch is marked SL ON/OFF/STOW. The lower switch is a four position switch marked SEARCH CONT EXT/RETR/L/R and is used to control searchlight movement.

6-9. Crew Compartment Lights.

The pilots and gunners cockpit lights are located on the side armored seat panels (figure 6-3). Rheostat operating switches for each light are mounted on the light assembly body. Brightness is controlled by operation of the rheostat. Rotation of the lens clockwise provides white lighting, counterclockwise, red lighting. The rheostat is also the ON-OFF switch for the light assembly. Electrical power for the light circuit is supplied from the 28 Vdc non-essential bus.

6-10. Pilots Instrument Lights Control Panel.

The pilots instrument light control (figure 6-4) is located in the pilots right console. This panel contains two switch type rheostats for activating and dimming various instrument lights. The switch type rheostats are marked INSTR LTS and CONSOLE LTS. Electrical power for the instrument lights is supplied by the 28 Vdc non-essential bus.

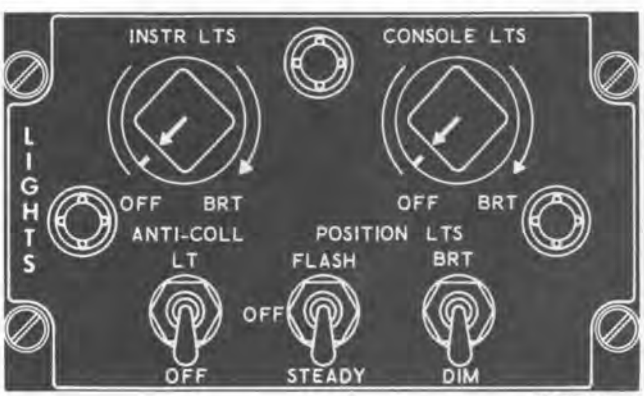

Figure 6-4. Lights control panel

6-11. Pilots Instrument Lights.

The pilots instrument lights are all provided with a hooded type light. These lights are all on one circuit and are controlled by the switch type rheostat labeled INSTR LTS. Clockwise rotation of rheostat knob turns on the lights and increases brilliance. Counterclockwise rotation of the knob dims lights and the final motion (OFF) deactivates the electrical circuit to the instrument lights.

6-12. Pilots Console Panel Lights.

The console panel lights furnish the illumination for both the right and left side console panels. Each panel is individually illuminated and brilliance control is accomplished by means of a rotary type rheostat located in the right console. Clockwise rotation of the rheostat knob activates the console panels circuits and increases the brilliance. Counterclockwise rotation of the knob dims, with final movement (OFF) deactivating the electrical circuit. The pilots console panel lights control must be on to supply electrical power for actuation of the pilots master caution system BRIGHT-DIM switch.

6-13. Gunners Instrument and Panel Lights.

The gunners instrument and panel lights are controlled by the switch type rheostat located in the gunners miscellaneous control panel in the gunners left console. The gunners lights are activated and brilliance controlled by means of a rotary type rheostat. Counterclockwise rotation of the knob dims with final movement deactivating the circuit. Electrical power for the gunners instrument and panel lights circuit is supplied from the 28 Vdc non-essential bus. The magnetic compass light is controlled by the gunners instrument lights rheostat.

Section V. OXYGEN SYSTEM

(Not Applicable)

Section VI. AUXILIARY POWER UNIT

(Not Applicable)

Section VII. ARMAMENT SYSTEMS

6-14. M28 and M28A1 Armament Subsystems.

M28 and M28A1 armament subsystems (figure 6-5, 6-6 and 6-7) are dual weapons, hydraulically and electrically operated. The two configurations, M28 and M28A1, have the same capabilities and functions. The M28A1 subsystem (serial numbers 0397 and subsequent) uses an improved two-speed gun drive assembly and different weapons controllers. The subsystems are gunner controlled as fully flexible weapons systems and pilot controlled as fixed systems (in a forward, stowed position). Any one of the following combination of weapons may be used: one left M134 machinegun, and one right M129 grenade launcher; one left M129 grenade launcher, and one right M134 machinegun (figure 6-5); two M134 machineguns (figure 6-6); or two M129 grenade launchers (figure 6-7).

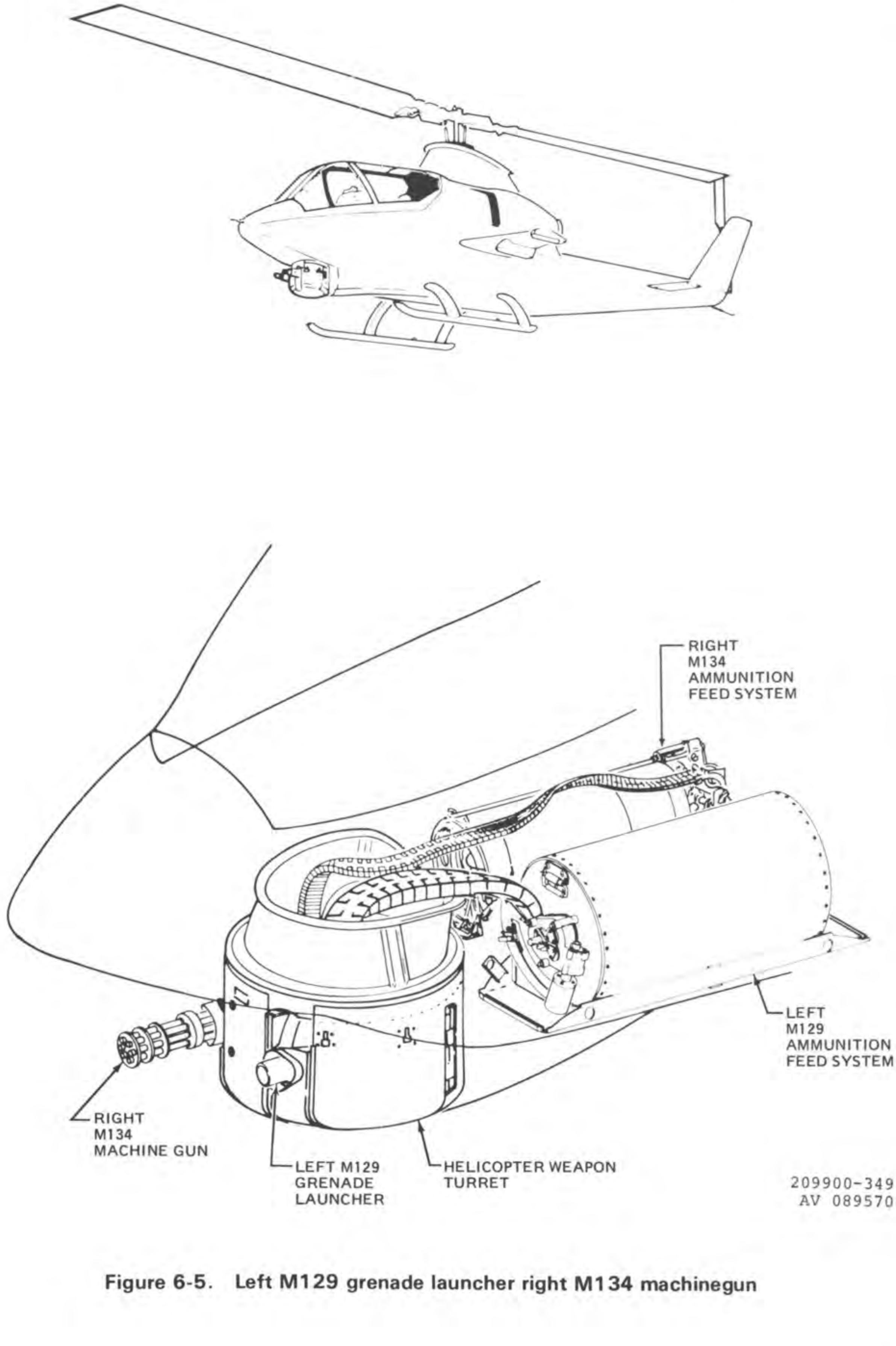

Figure 6-5. Left M129 grenade launcher right M134 machinegun

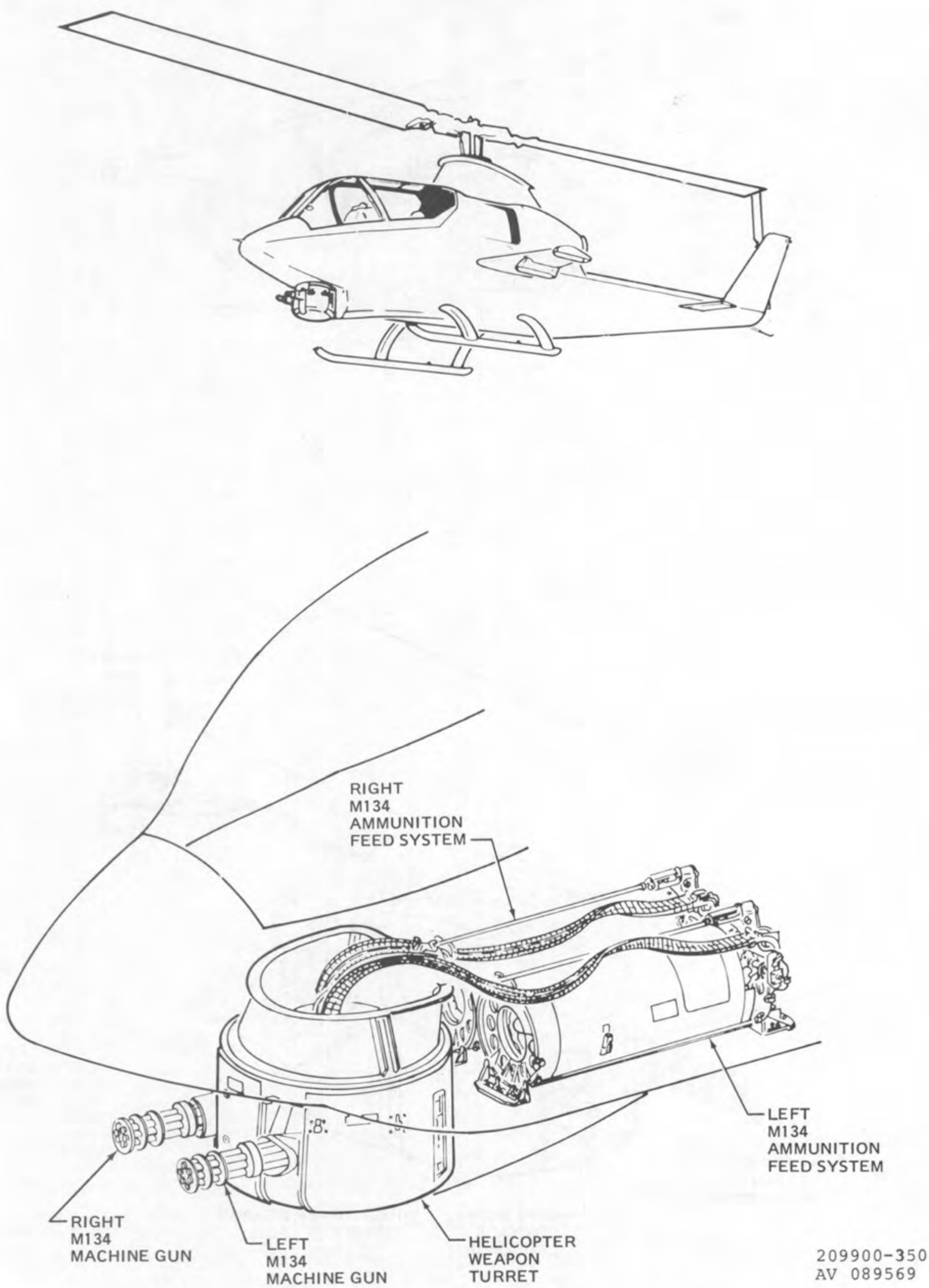

Figure 6-6. Two M134 machineguns with ammunition magazine assembly

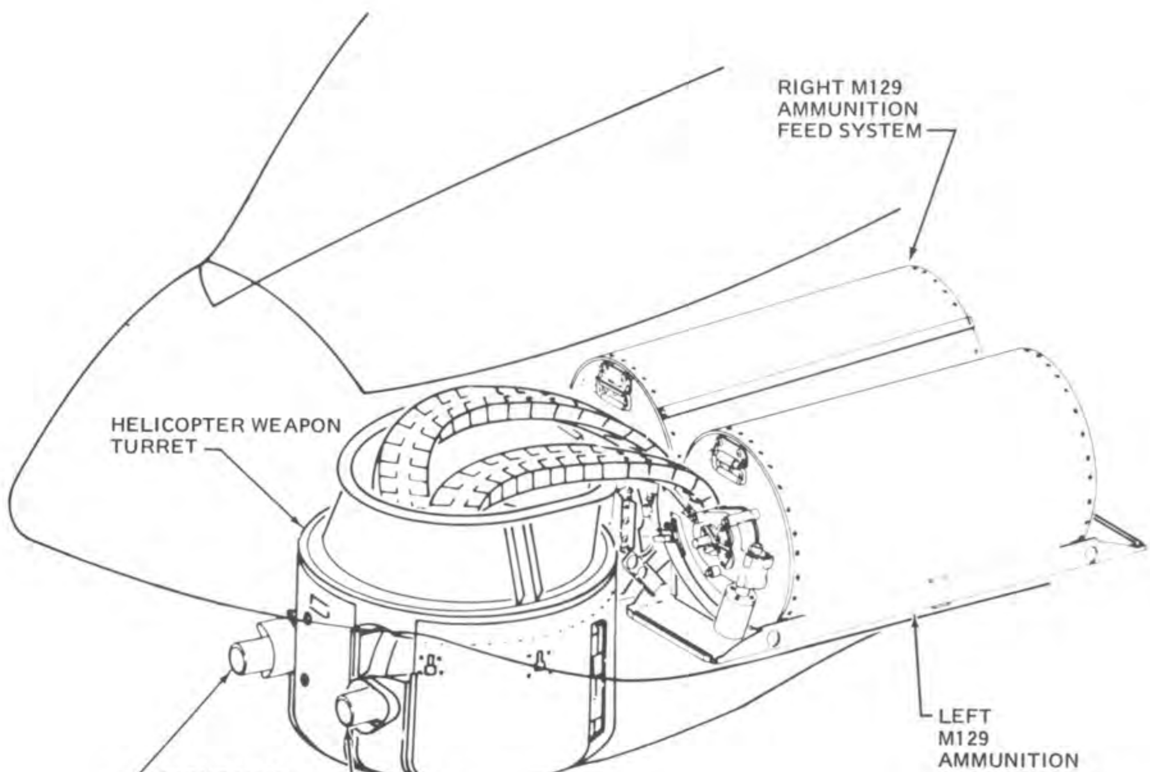

Figure 6-7. Two M129 grenade launchers

Each subsystem consists essentially of the following major components: M134 machinegun accessory assemblies, M129 grenade launcher accessory assemblies, helicopter weapon turret, chute separator assembly, weapons gun speed and launcher brake controllers (left and right), intervalometers, electronic components assembly, differential pressure transducer, helicopter turret sighting station, stow bracket assembly, gunners control panel, pilots wing stores control panel, pilots control panel, flex sight M37, and flex sight support assembly.

a. M134 Machinegun Accessory Assembly. The M134 machinegun accessory assembly (figures 6-8) stores and transports the ammunition from the ammunition compartment to the gun rotor, fires the rounds, and ejects the links and cartridge cases. The accessory consists primarily of the machinegun, the machinegun drive, delinking feeder (MAU-56/A) ammunition chute, flexible shaft, and ammunition storage containers.

(1) The M134 machinegun is an electrically-driven, automatic, air-cooled multibarrel gun incorporating six barrels and six bolt assemblies which revolve around the longitudinal axis of the weapon. The M134 machinegun is capable of firing six-second bursts of rates of 2000 rounds per minute or 4000 rounds per minute.

(2) The machinegun drive assembly (M28 only) includes the electric motor, machinegun drive assembly, and gear reduction housing assembly. A 28 Vdc, three horsepower motor is used to drive the machinegun drive assembly. The machinegun drive assembly is mounted forward of the electric motor and provides the necessary gearing to drive the flexible shaft assembly which in turn operates either the crossover assembly or the ammunition magazine assembly. Power to drive the machinegun is tranferred from the machinegun drive assembly to the machinegun by the gear reduction housing assembly. The gear reduction housing, mounted forward of the machinegun drive assembly, also serves as a mounting point for the machinegun drive assemblies.

(3) The machinegun drive assembly (M28A1 only) includes the electric motor, gear reduction housing assembly, and feed drive gearbox. The electric motor is a two-speed, 24 Vdc motor. The motor provides 1.7 horsepower at high speed and 0.75 horsepower at low speed to operate the gear reduction housing assembly and feed drive gearbox. The gear reduction housing assembly, mounted on the forward side of the electric motor, is used to drive the machinegun and provide a mounting point for the drive assembly. The feed drive gearbox, mounted on the rear of the electric motor, provides the necessary gearing to drive the flexible shaft assembly which in turn operates the ammunition magazine assembly.

(4) The delinking Feeder MAU-56/A is gear driven through the machinegun. The feeder removes the cartridges from the links and feeds them to the bolt and track assemblies in the machinegun rotor. The links are discarded through the link ejector chute attached to the feeder.

(5) The ammunition chute is a flexible link channel which guides the ammunition from the ammunition magazine assembly to the feeder mounted on the machinegun. The left and right ammunition chutes are functionally the same, but physically different, and are not interchangeable.

(6) The flexible shaft assembly mechanically connects the machinegun drive assembly to the ammunition magazine assembly.

(7) The ammunition magazine assembly is located aft of the turret, in the ammunition compartment. The ammunition magazine assembly is used as improved replacement for the ammunition boxes and crossover assembly. The cylindrical drum stores 4000 rounds of linked ammunition in a folded fan arrangement. The capacity may be decreased to 3000 rounds by inserting the pin located on the side of the drum. The ammunition drum is driven by the machinegun drive through the flexible shaft assembly.

b. M129 Grenade Launcher Accessory Assembly. The M129 grenade launcher accessory assembly (figure 6-9) consists primarily of the grenade launcher, gun cradle assembly, turret assembly gun drive, gun driveshaft assembly, ammunition chute, and ammunition magazine assembly.

(1) The M129 grenade launcher is an electrically driven, rapid firing, air-cooled weapon. It is used to launch antipersonnel fragmentation type projectiles. The single barrel grenade launcher is cam operated, capable of firing ten-second bursts of 400 rounds per minute.

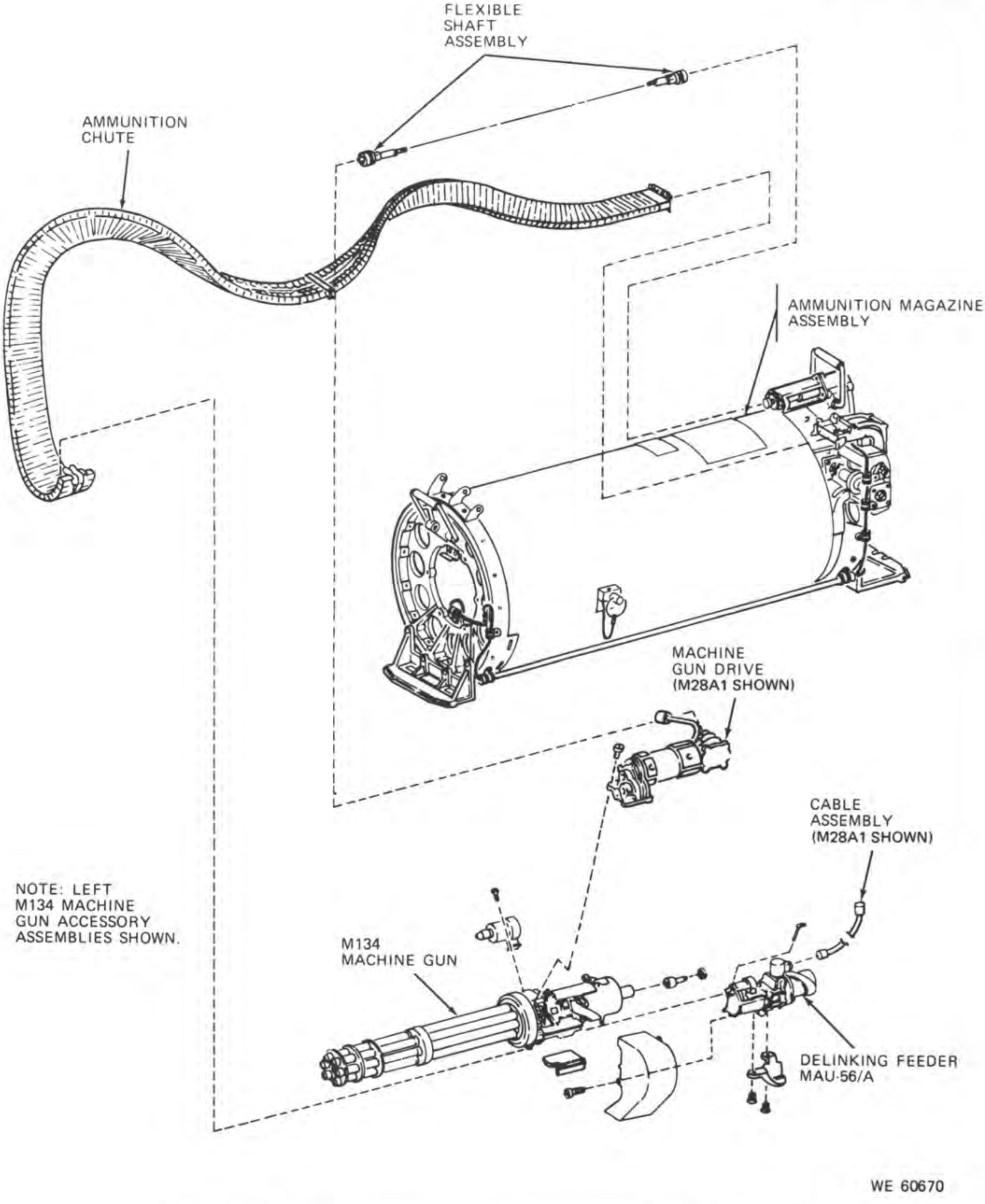

Figure 6-8. M134 machinegun accessory assembly with ammunition magazine assembly

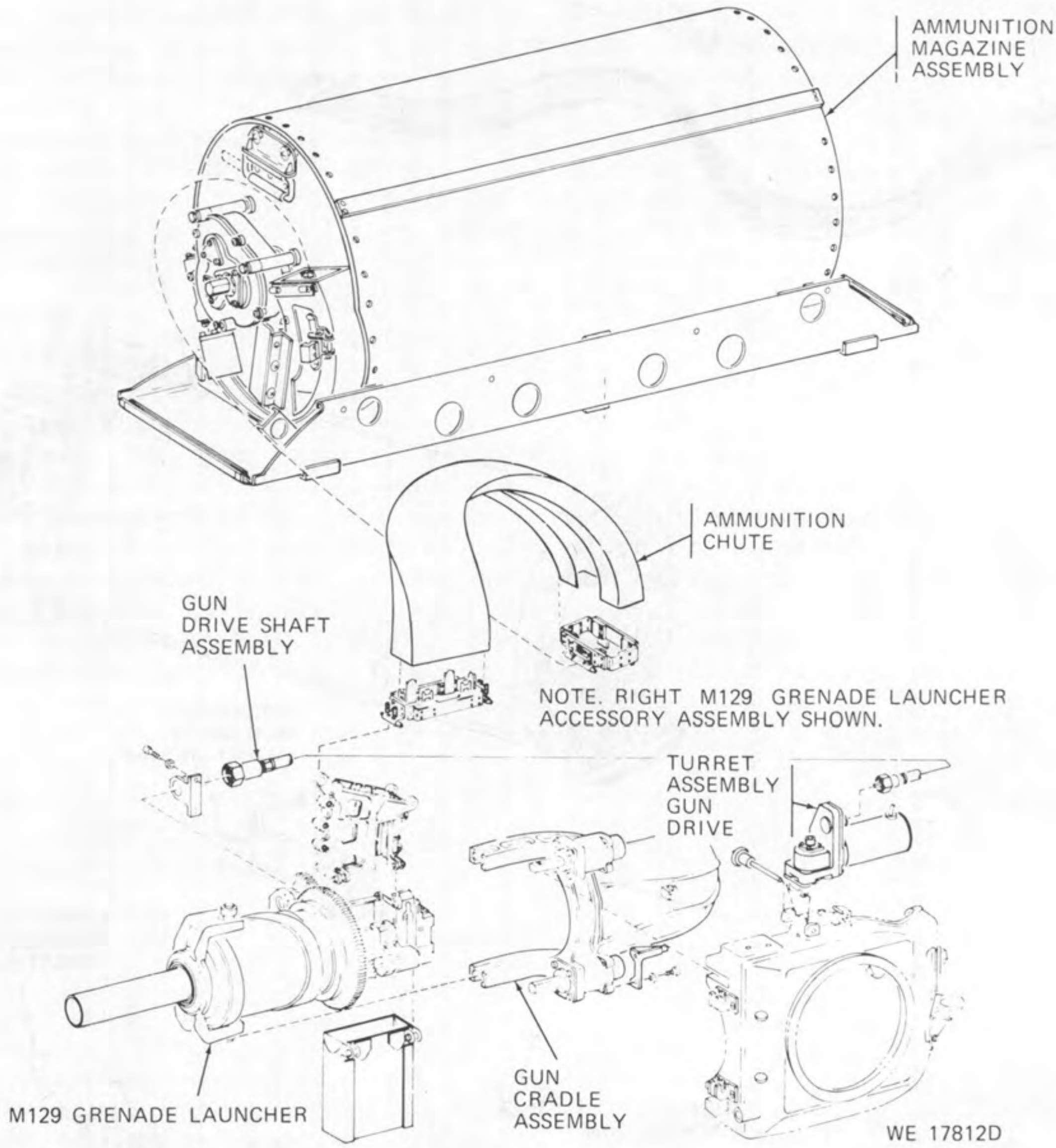

Figure 6-9. M129 grenade luncher accessory assembly

(2) The gun cradle assembly supports the grenade launcher in the turret. The cradle assembly, which is mounted on the grenade launcher before installation, is equipped with two recoil adapter assemblies which provide recoil compensation for the grenade launcher. The left and right gun cradles are functionally the same, but physically different and are not interchangeable.

(3) The turret assembly gun drive is mounted on the left or right saddle (turret) when the grenade launcher is installed. The gun drive assembly consists of a direct current motor and gun drive adapter which operates the grenade launcher by means of a flexible driveshaft.

(4) The gun driveshaft assembly is a flexible driveshaft connecting the turret assembly gun drive to the launcher drive assembly.

(5) The ammunition chute is a flexible link channel, which guides the ammunition from the ammunition magazine assembly to the feed tray on the grenade launcher. The left and right ammunition chutes are functionally the same, but physically different, and are not interchangeable.

(6) The ammunition magazine assembly, located aft of the turret in the ammunition compartment, has a capacity of 265 rounds of linked ammunition. The ammunition magazine assembly is electrically driven by a motor mounted on the front of the magazine assembly.

c. Helicopter Weapon Turret and Chute Separator.

(1) The hydraulically-driven turret assembly (figure 6-10) is mounted forward and below the gunners station inside an aerodynamically designed fairing. The turret can position the weapons 107.5° left or right of the forward position. Weapon elevation beyond 57° left or right of forward position is variable from 18.0° to 10.6°. The azimuth and elevation travel has electrical and mechanical stop limitations. Weapon depression is 50° in all azimuth positions.

(2) The turret assembly traverses in azimuth and elevation in response to electrical signals transmitted from the sighting station to the turret servo valves. The polarity and magnitude of the signals determine the direction and rate of turret and weapons movement. Mechanical stops and electrical limits prevent the turret from being driven beyond its limits.

(3) Access to the weapons and internal parts of the turret may be gained by disengaging the two latches and turnlock fastener and opening the access doors on each side of the turret fairing.

(4) The chute separator assembly (figure 6-10) provides separation of the ammunition chute assemblies and support for the hydraulic lines and electrical cables which pass through the helicopter bulkhead (between ammunition compartment and turret assembly).

d. Weapons Gun Speed and Launcher Brake Controllers (Left and Right). The left and right weapons controllers are mounted on the bulkhead aft of the turret assembly. The left weapons controller contains the required circuitry to control firing speed of the left machinegun or the drive and brake of the left grenade launcher. The right weapons controller performs the same function for the right machinegun or grenade launcher. The M28 and M28A1 armament subsystems uses two different sets of weapons controllers. The M28 subsystem uses weapons controllers 11688509 (left) and 11688510 (right). The M28A1 subsystem uses weapons controllers 11690242 (left) and 11690243 (right). Although both sets perform basically the same function they are not interchangeable between armament subsystems.

e. Intervalometers. Intervalometers exist in two basic configurations. Helicopters with armament subsystems M28 or M28A1 were originally equipped with intervalometers located beneath the helicopters rotor transmission and accessible through access panels under the right and left wings. The right intervalometer controls the inboard and the left controls the outboard wing stores rocket pod installations. The intervalometer is designed to control group or ripple firing of a preselected number of pairs of rockets.

f. Electronic Components. The electronic components assembly (figure 6-11) is located below the gunners control panel in the gunners station and is accessible from outside the helicopter. The electronic components assembly contains amplifiers, relays and electronic components used by the control circuit, firing circuit, and master arm bus. Located in the electronic components assembly are six removable plug-in printed circuit

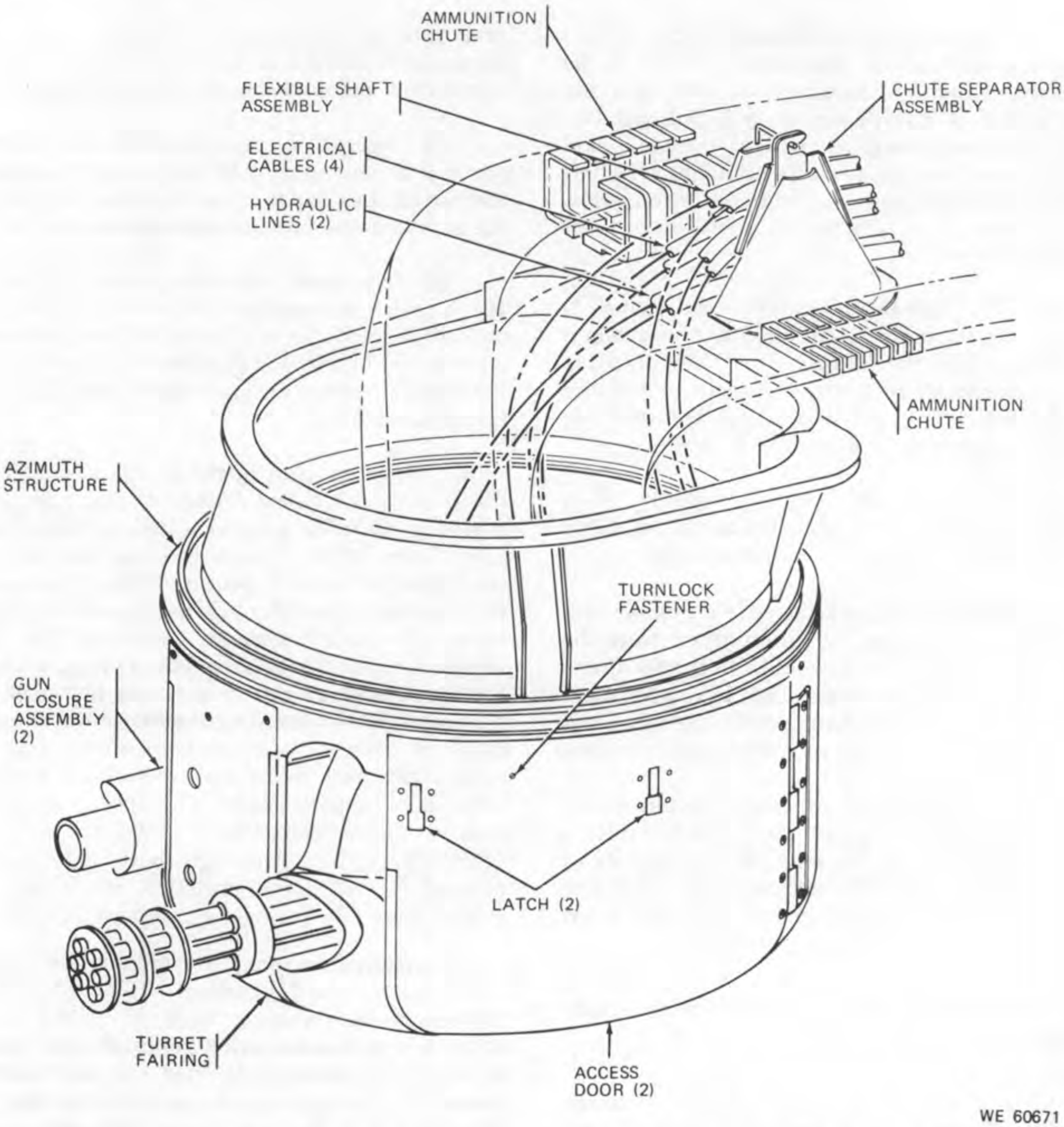

Figure 6-10. Helicopter weapon turret and chute separator assembly

card assemblies; azimuth and elevation equalizer amplifiers; azimuth and elevation demodulator detector amplifiers; dithercoincidence amplifier; tachometer amplifier.

g. Differential Pressure Transducer. The differential pressure transducer is located above and aft of the left ammunition bay door, and is connected to the helicopters pitot-static system. Using the pitot-static pressure differential, the transducer feeds airspeed data to the electronic components assembly.

h. Helicopter Turret Sighting Station and Stow Bracket. The sighting station (figure 6-12) provides the means for the gunner to aim and fire the weapons. The sighting station is located in the gunners station and is mounted on the floor of the helicopter, forward of the gunner. When not in use,

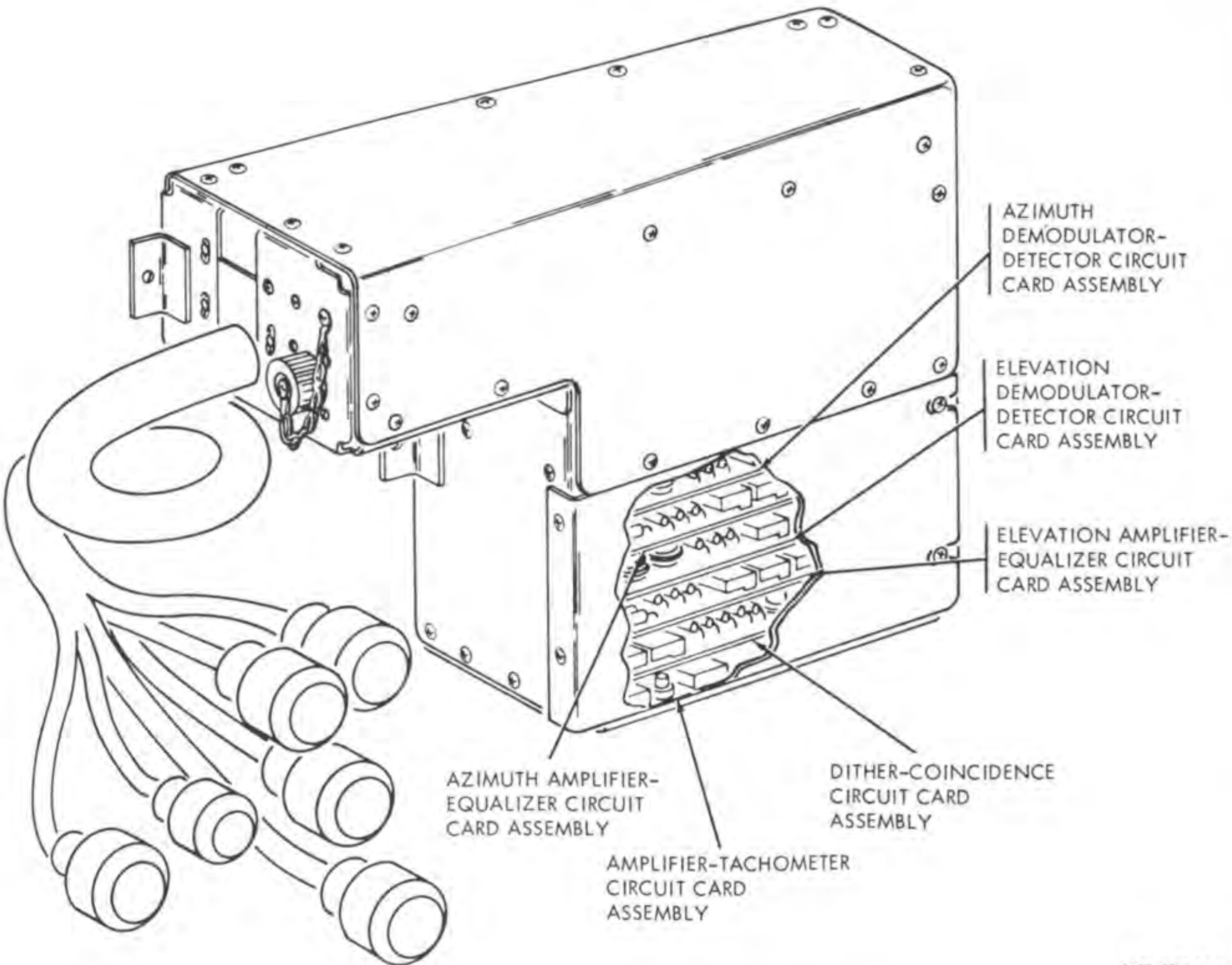

Figure 6-11. Electronic components assembly

the sighting station may be stowed by engaging the sight stowlock with the stow bracket assembly adjacent to the gunners control panel. An off-angle stow bracket jacks the sighting station azimuth gimbal in position so that, when the sighting station is stowed, the sight will not interfere with the canopy. The purpose of the sighting station is to provide a line of sight for accurate firing of the weapons. Aiming the weapons is accomplished by superimposing a reticle image (projected by the reflex sight) on the target. The projected reticle image (sheet 2, figure 6-12) has red and yellow numerals indicating range in hundreds of meters. The red numerals are used when aiming the machinegun; the yellow numerals are used when aiming the grenade launcher. The sighting station consists of a reflex sight mounted in a gimbal assembly. Two hand grips, which allow the gunner to position the turret assembly and fire the weapons, are also attached to the gimbal assembly. Movement of the sight generates electrical signals which position the turret assembly.

(1) *Controls.* The following is a list of sighting station (figure 6-12) controls and their functions.

(a) The action switches are located on the lower forward side of the hand grips. Pressing either, or both of the action switches applies voltage to the trigger switches, energizes the gunners action relay, removes the stow signals from the azimuth and elevation stow potentiometers, and applies turret positioning signals to the azimuth and elevation servo valves.

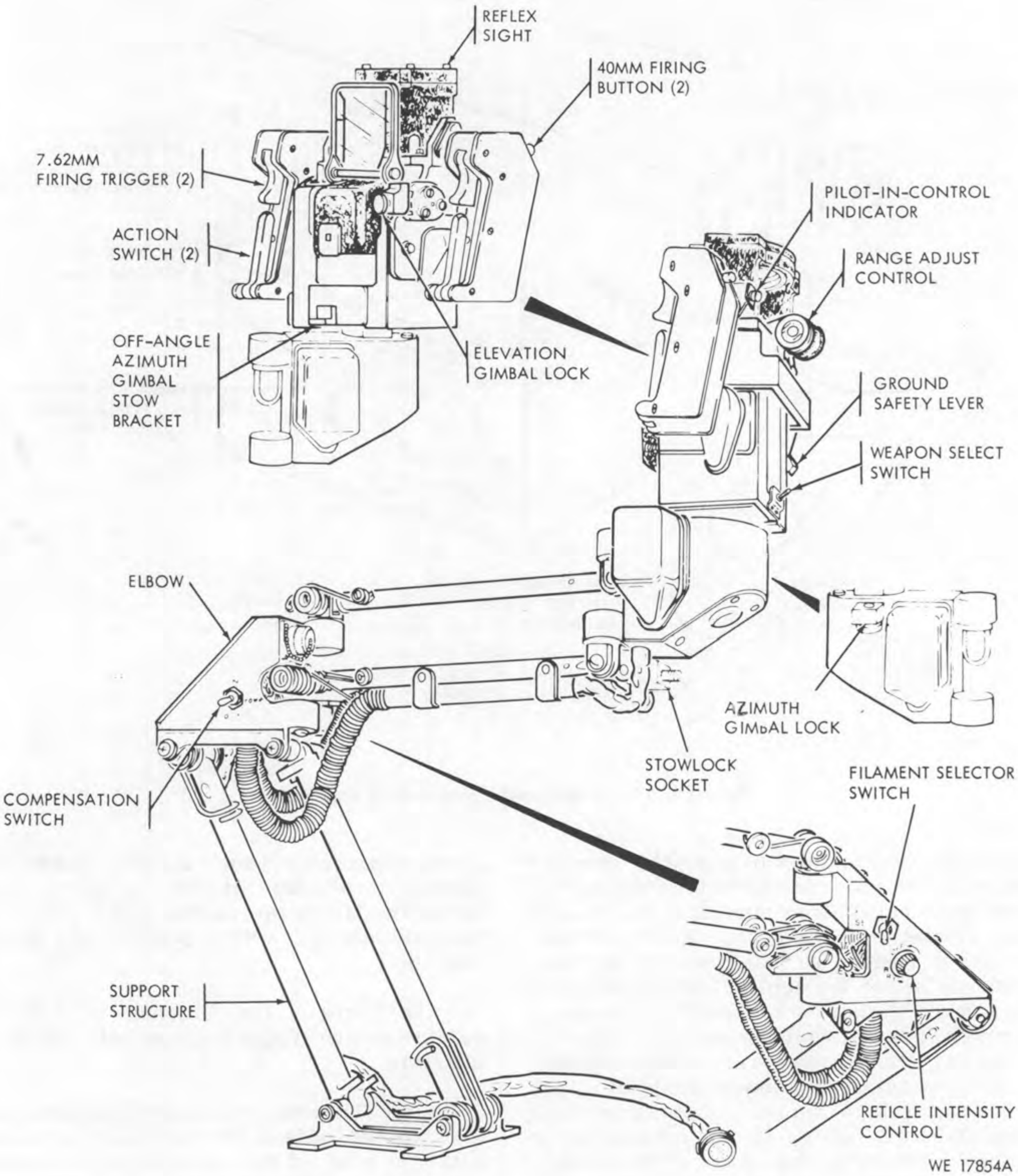

Figure 6-12. Helicopters turret sighting station (Sheet 1 of 2)

M134 MACHINE GUN

NOTE

Range markings are in red.

M129 GRENADE LAUNCHER

NOTE

Range markings are in yellow.

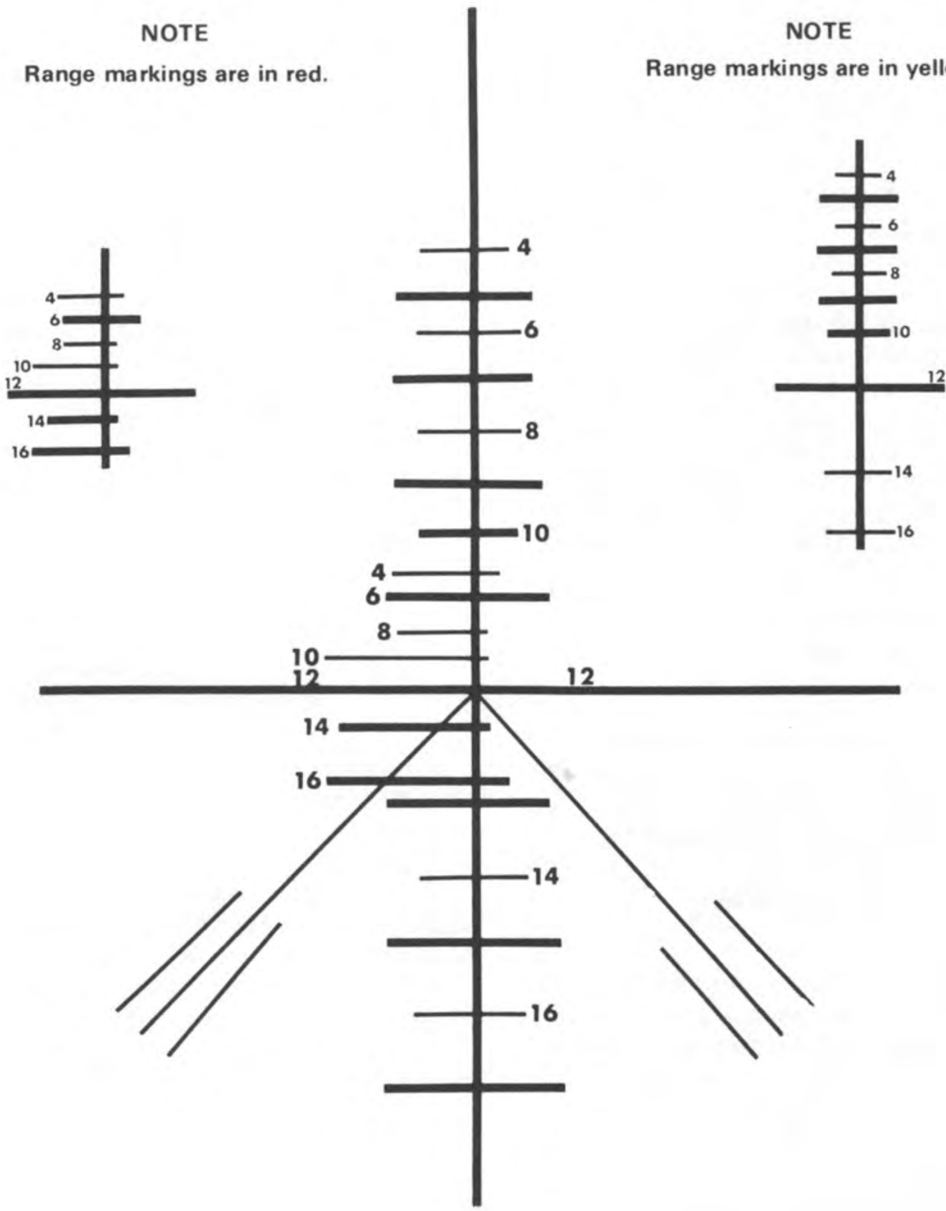

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Figure 6-12. Helicopter turret sighting station (Sheet 2 of 2)

Releasing the action switches de-energizes the gunners action relay and applies stow signals to the azimuth and elevation servo valves.

CAUTION

If a machinegun firing stoppage occurs, immediately release the trigger switches or extensive damage to the equipment may occur. Do not attempt to fire the machinegun until stoppage corrective action has been taken.

(b) The M134 machinegun firing trigger switches are located on the upper forward side of the hand grips. Prior to firing the machinegun, the action switch(es) must be pressed. Partially depressing either, or both trigger switches fires the machinegun at the low rate of approximately 2000 rounds per minute. Fully depressing either, or both trigger switches fires the machinegun at the high rate of approximately 4000 rounds per minute.

CAUTION

If a grenade launcher firing stoppage occurs, immediately release the firing buttons or extensive damage to the equipment may occur. Do not attempt to fire the grenade launcher until stoppage corrective action has been taken.

(c) The M129 grenade launcher firing buttons are located on the upper aft side of the hand grips. Before firing the grenade launcher, the action switch(es) must be pressed. Pressing either, or both firing buttons fire the grenade launcher at the rate of approximately 400 rounds per minute.

(d) The compensation (COMP) switch is located on the left side of the support structure elbow. When the compensation switch is placed in the IN position, the compensation relay is energized and airspeed and range data are fed to the turret positioning circuits to provide gun line correction. When the compensation switch is in the OUT position, gun line correction is achieved manually by observing the impact area and positioning the sight to compensate for range and airspeed.

(e) The filament (FIL SEL) selector switch is located on the right side of the support structure elbow. The filament selector switch is used to select one of the two filaments of the reticle incandescent lamp.

(f) The reticle intensity control is a variable resistor mounted on the right side of the support structure elbow. This control adjusts the intensity of the sight reticle image.

(g) The range adjust control is a variable resistor mounted above the right grip. The range adjust control knob is calibrated in meters. When the compensation (COMP) switch is in the IN position, the control allows the gunner to supply a range correction input to the turret positioning circuits.

NOTE

The sighting station is provided with a graduated reticle which may be used for ranging, in lieu of the range adjust control. To range, using the graduated reticle, first position the range adjust control to 1200 meters, then use the reticle graduations to aim the weapons. If the range adjust control is to be used for ranging, index the estimated target range on the range adjust control and aim the weapons, using the reticle center dot.

(h) The ground safety lever, when placed in the horizontal position, prevents the sight head from being depressed more than 35° below horizontal. During ground firing, this lever prevents the sight head from being accidentally fully depressed, thereby preventing rounds from ricocheting into the helicopter.

(i) The azimuth and elevation gimbal locks mechanically lock the sight gimbals at zero degree azimuth and elevation for boresighting and harmonization.

(j) The weapon select switch selects the left or right mounted weapon for firing. When in the BOTH position, both weapons will fire if they are identical weapons. If the turret contains one of each weapon, depression of the appropriate trigger will fire that weapon. The other weapon firing circuit is interrupted to prevent simultaneous firing of unlike weapons.

(2) *Indicator.* The PILOT-IN-CONT. indicator (figure 6-12) is located adjacent to the left grip. The indicator illuminates (amber) when the GUNNER/PILOT CONTROL switch on the pilots control panel is in the PILOT position, indicating that the pilot has control of the subsystem.

(3) *Positioning the Turret.* Azimuth and elevation movement of the turret is accomplished by using either, or both, of the sighting station hand grips. Pressing the action switches on the hand grip and positioning the sight horizontally will rotate the turret about its azimuth axis; positioning the sight vertically will move the weapons about their elevation axis. When the hand grips are released, the action switches open and the turret returns to its stowed position.

(4) *Turret Coincidence.* If the action switch is depressed and the sight rotated at a speed greater then the turret maximum angular velocity, the firing circuit is interrupted and the sight reticle blinks until the gun line is coincident within five degrees to the line of sight.

(5) *Firing the M134 Machinegun.* Firing the machinegun is accomplished by placing the weapon select switch to the LEFT GUN, RIGHT GUN, or BOTH position (depending upon which position(s) the machinegun is mounted) and using either, or both of the hand grips. Pressing the action switch and partially depressing the firing trigger switch(es) on front of the grips will fire the machinegun at the low rate of approximately 2000 rounds per minute; then fully depressing the machinegun firing trigger switch(es) will fire the machinegun at the high rate of approximately 4000 rounds per minute.

NOTE

When firing in the stowed mode with one of each type weapon mounted in the turret assembly, only the machinegun will fire with the weapon select switch in the BOTH position. The other weapon firing circuit is interrupted to prevent simultaneous firing of unlike weapons. When firing in the FLEX mode whichever weapon receives the signal first will fire.

WARNING

At a hover below 125 feet, do not fire the grenade launcher when the weapon is in the fully depressed position.

CAUTION

If a launcher firing stoppage occurs, immediately release the firing buttons or extensive damage to the equipment may occur. Do not attempt to fire the launcher until stoppage corrective action has been taken.

(6) *Firing the M129 Grenade Launcher.* Firing the grenade launcher is accomplished by placing the weapon select switch to the LEFT GUN, RIGHT GUN or BOTH position (depending upon which position(s) the grenade launcher is mounted) and using either, or both, of the hand grips. Pressing the action switch and the grenade launcher (firing button(s) on the hand grips will fire the grenade launcher at a rate of approximately 400 rounds per minute. When the trigger button is released, the grenade launcher stops firing.

i. Gunners Control Panel. The gunners control panel (figure 6-13) contains the controls and indicators required by the gunner to operate and monitor the M28 and M28A1 armament subsystems. Emergency provisions on panel are available for the gunner to take command and fire the system in case the pilot is disabled. The gunners control panel is located in the gunners station on the right console forward of the flight controls.

(1) *Controls.* The following is a list of gunners control panel controls and their functions:

WARNING

With OVERRIDE PILOT switch in ON position, the system is armed and may be fired. Before landing place OVERRIDE PILOT switch in OFF position.

(a) The OVERRIDE PILOT switch is an emergency switch which permits the gunner to

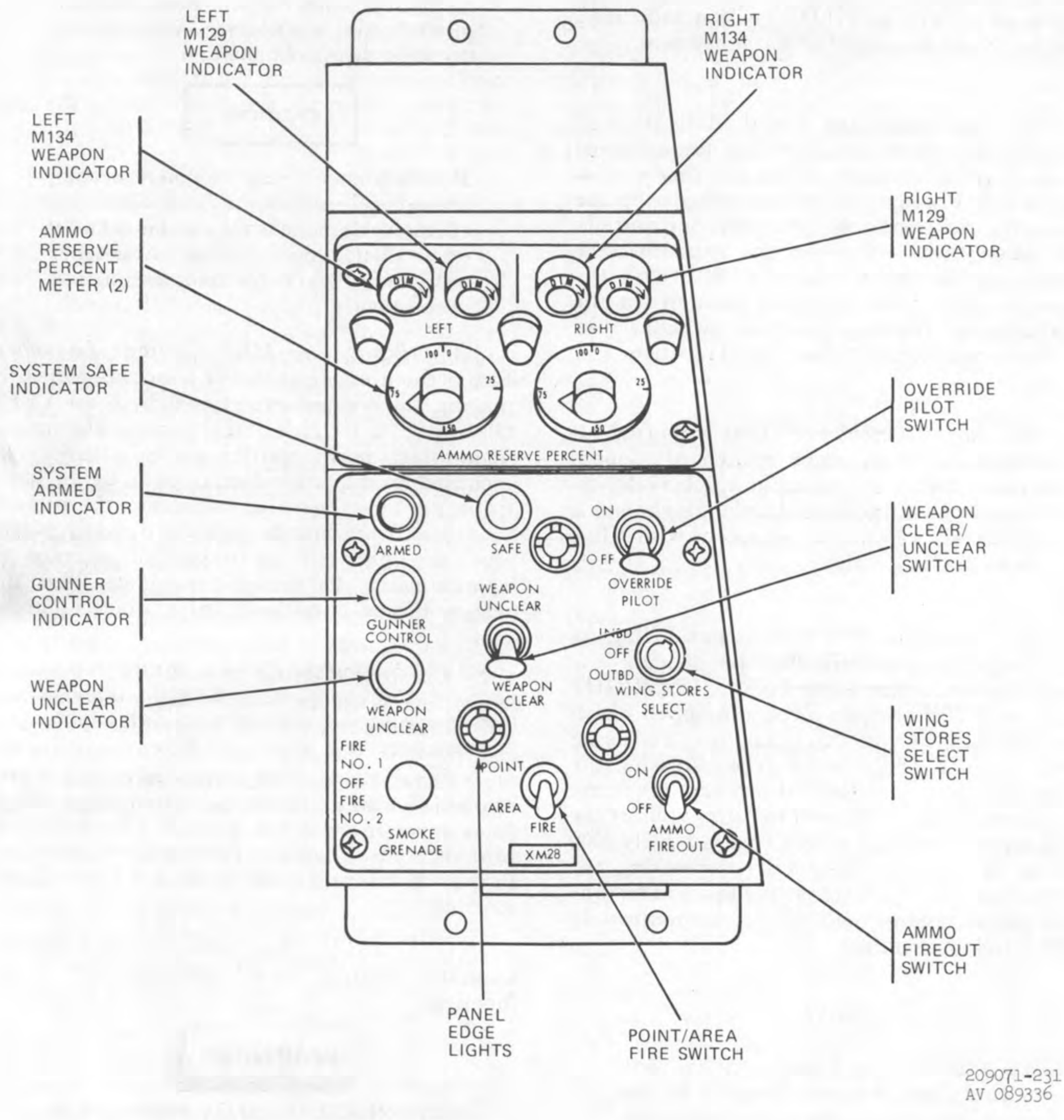


Figure 6-13. Gunners turret control panel

take command of the armament subsystem when the pilot is incapacitated. Placing the OVERRIDE PILOT switch in the ON position energizes the pilot override relay and transfers control of the armament subsystem and the pods to the gunner. In this mode the subsystem is fired in the stowed position, using the trigger switches on the gunners cyclic control. However, due to a feedback condition, it is possible for the pilot to also fire the wing stores, even through the gunners override pilot switch is ON, if both the pilot and gunners wing stores switches are in same position.

NOTE

When OVERRIDE PILOT switch is ON, number of rockets fired will be determined by the position selected on the RKT PR SEL in the pilots station.

WARNING

Use of the UNCLEAR mode of fire for the machinegun presents the hazard of live round cook-off in the weapon from barrel heat. Proper precautions must be taken to protect personnel and property when using this mode.

CAUTION

Use of the UNCLEAR mode of fire for the machinegun may result in more frequent stoppage.

(b) The WEAPON CLEAR/UNCLEAR switch (M134 only) selects the mode of firing. When the WEAPON CLEAR/UNCLEAR switch is in the WEAPON CLEAR position at the end of the firing cycle, the machinegun rotates one full revolution after the delinking feeder gate is closed, thus assuring that the machinegun(s) is clear of live ammunition. With the WEAPON CLEAR/UNCLEAR switch in the WEAPON UNCLEAR position, the delinking feeder gate remains open during the last revolution of the machinegun. Since there will be live ammunition chambered in the machinegun, this mode is incorporated only to conserve ammunition and should be used only during combat.

NOTE

Placing the WEAPON CLEAR/UNCLEAR switch in the CLEAR position does not affect normal clearing or jam clearing of the machine gun M134 but merely selects the next mode for firing.

(c) The WING STORES SELECT switch functions only when the OVERRIDE PILOT switch is in the ON position. This switch may be used to select either inboard or outboard wing pods for firing. Pod stores are fired by using the wing arm fire button on the gunners cyclic control.

(d) The AMMO FIREOUT or last round switch in the ammunition box crossover assembly and the magazine assembly opens when the last round of ammunition passes over the switch, thereby interrupting the electrical signal to the gun drive. The rounds of ammunition remaining in the flexible chutes facilitate the reloading of ammunition. In an emergency, the ammunition remaining in the flexible chutes may be fired by placing the AMMO FIREOUT switch in the ON position. This permits the electrical signal to bypass the last round switch and allows the remaining rounds of ammunition to be fired.

(e) The POINT/AREA FIRE switch, when placed in the AREA position, energizes the dither circuit and applies a dither voltage to the azimuth servo valve causing the weapons to oscillate 60 mils in azimuth about their trained position. Placing the switch in the POINT position removes the dither voltage from the azimuth servo valve and allows the gun to remain stable in its trained position.

(2) *Indicators.* The following is a list of gunners control panel (figure 6-13) indicators and their functions:

NOTE

The incandescent lamps in the indicators on the gunners control panel may be tested by pressing the indicator lens. The lamp intensity may be varied by rotating the indicator lens.

(a) The system ARMED indicator illuminates (amber) when the pilots MASTER ARM switch is placed in the ARMED position or when the gunners OVERRIDE PILOT switch is placed in the ON position, indicating that the turret control system is energized.

(b) The GUNNER CONTROL indicator illuminates (blue) when the pilot places the GUNNER/PILOT CONTROL switch on the pilots control panel in the GUNNER position or when

the gunner places the OVERRIDE PILOT switch in the ON position, indicating the gunner has control of the subsystem.

(c) The SAFE indicator illuminates (green), indicating the subsystem (except the firing circuits) is energized, when the pilot places the GUNNER/PILOT CONTROL switch in the GUNNER or PILOT position and the MASTER ARM switch in the SAFE position.

(d) The WEAPON UNCLEAR indicator (M134 only) is based on the mode of the previous firing while the WEAPON UNCLEAR/CLEAR switch selects the mode of the next firing. When the last firing was in the UNCLEAR mode, the WEAPON UNCLEAR indicator will illuminate and remain illuminated until the weapon is fired in the CLEAR mode.

(e) When the left weapon indicator light is illuminated, it indicates the type of weapon mounted in the left side of turret assembly.

(f) When the right weapon indicator is illuminated, it indicates the type of weapon mounted in right side of turret assembly.

(g) The AMMO RESERVE PERCENT meters indicate the percentage of 4000 rounds of ammunition remaining in the M134 machinegun ammunition box assemblies or magazine assembly, or the percentage of 270 (±5) rounds of ammunition remaining in the M129 grenade launcher magazine assembly.

NOTE

The ammo reserve percent meters depend on correct resetting procedures for accuracy in indicating the percent of rounds remaining in each system.

(h) The panel edge lights provide panel lighting and are controlled from the gunners miscellaneous control panel.

j. Pilots Control Panel. The pilots turret control panel (figure 6-14) contains the controls and indicators required by the pilot to arm and fire the M28 and M28A1 armament subsystem with the weapons in stowed position. The following is a list of the pilots control panel (figure 6-14) controls, indicators, and their functions.

(1) The MASTER ARM switch is a three position switch which permits the pilot to energize and de-energize the armament circuits. Placing the switch in the ARMED position, arms the basic weapon system. Placing the switch in the SAFE position energizes only the control circuits. Placing the switch in the OFF position de-energizes the armament and control circuits.

(2) The GUNNER/PILOT CONTROL switch is a two position switch which designates control of the firing circuits. When placed in the

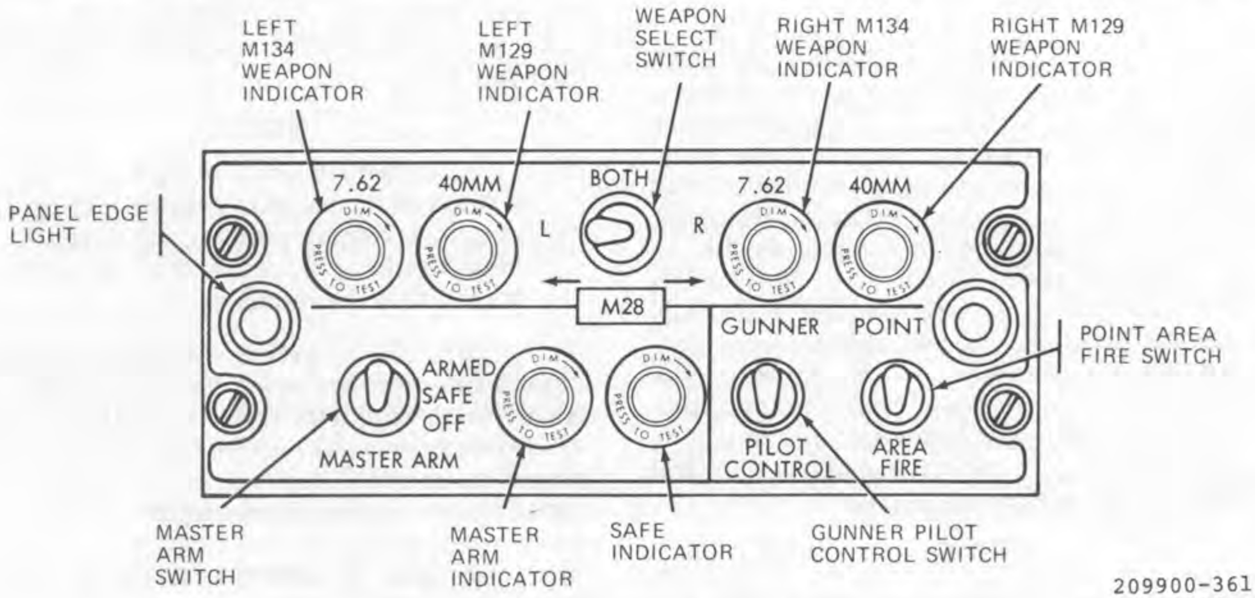


Figure 6-14. Pilots turret control panel

GUNNER position, it permits gunners control of the subsystem firing circuits. When placed in the PILOT position, it permits pilots control of the subsystem firing circuits.

(3) The POINT/AREA FIRE switch is a two position switch which allows the guns to oscillate or remain in a stable position. When placed in the POINT position the guns remain stable in the trained position. When placed in the AREA position, the guns will oscillate 60 mils in azimuth about their trained positions.

(4) The WEAPON SELECT switch is a three position switch which allows selection of the left and right weapons for firing simultaneously or individually. When placed in the L (left) position, the left position is selected for firing. When placed in the R (right) position, the right weapon is selected for firing. When placed in the BOTH position, both weapons will fire simultaneously if they are identical (two machineguns or two grenade launchers). If one of each weapon is installed in the turret assembly, only the machinegun will fire when the weapon select switch is placed in the BOTH position.

NOTE

The incandescent lamps in the indicators on the pilots control panel may be tested by pressing the indicator lens. The lamp intensity may be varied by rotating the indicator lens.

(5) When the left weapon indicators are illuminated, it indicates the type of weapon mounted in left side of turret assembly.

(6) When the right weapon indicators are illuminated, it indicates type of weapon mounted in right side of turret assembly.

(7) When the SAFE indicator is illuminated (green), it indicates MASTER ARM switch is in the SAFE position.

(8) When the ARMED indicator is illuminated (amber) it indicates MASTER ARM switch is in the ARMED position.

(9) The panel edge lights provide panel lighting and are controlled from the pilots light control panel.

k. Reflex Sight M73. The reflex sight (figure 6-15) is located above the pilots instrument panel. It provides a projected reticle image for the pilots use when firing the wing stores or turret weaponry from a target collision course. For the wing stores, the pilot uses the elevation/depression knob to set in correction per the ballistic data cards. For turret weaponry, the range potentiometer is used for superelevation. The reflex sight contains the following controls and items.

(1) *Elevation depress knob.* The elevation/depression knob allows the pilot to vary the angle of the beamsplittor to adjust for range and airspeed when firing the wing stores.

(2) *Reticle intensity control.* The reticle intensity control allows the pilot to adjust the illumination intensity of the sight reticle image.

(3) *Inclinometer.* The inclinometer indicates helicopter yaw attitude (trim) to the pilot and is for use when firing the wing stores and turret.

(4) *Range potentiometer control. The range potentiometer control allows the pilot to apply an elevation correctional signal to the turret weapons.*

(5) Reticle light filament selector switch. The reticle light filament selector switch allows the pilot to select one of two filaments of the sight reticle lamp.

(6) *Panel lights.* The panel lights are used to light the panel on the sight during operation.

(7) *Panel light intensity control.* The panel light intensity control allows the pilot to adjust the illumination intensity of the panel lights.

(8) *Reflex sight support assembly.* The reflex sight support assembly is secured to the top of the pilots instrument panel and provides hard point mounting of the reflex sight reticle intensity control (rheostat) and filament selector switch.

(l) Pilots Wing Stores Control Panel. The pilots wing stores control panel (figure 6-16) is located in the pilots instrument panel. Following is a list of pilots wing stores control panel (figure 6-16) control/indicators and their functions.

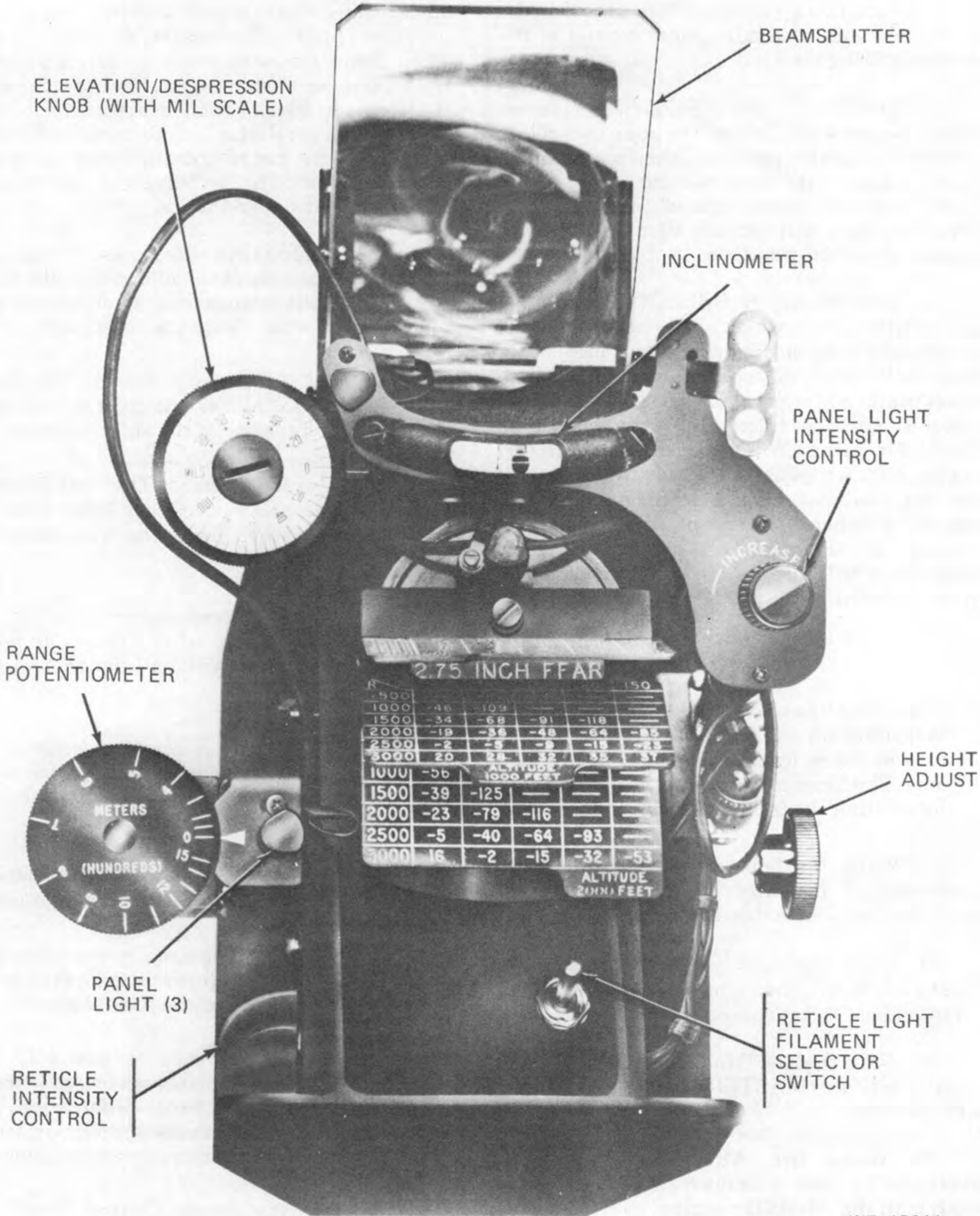


Figure 6-15. Reflex sight M73 (Sheet 1 of 2)

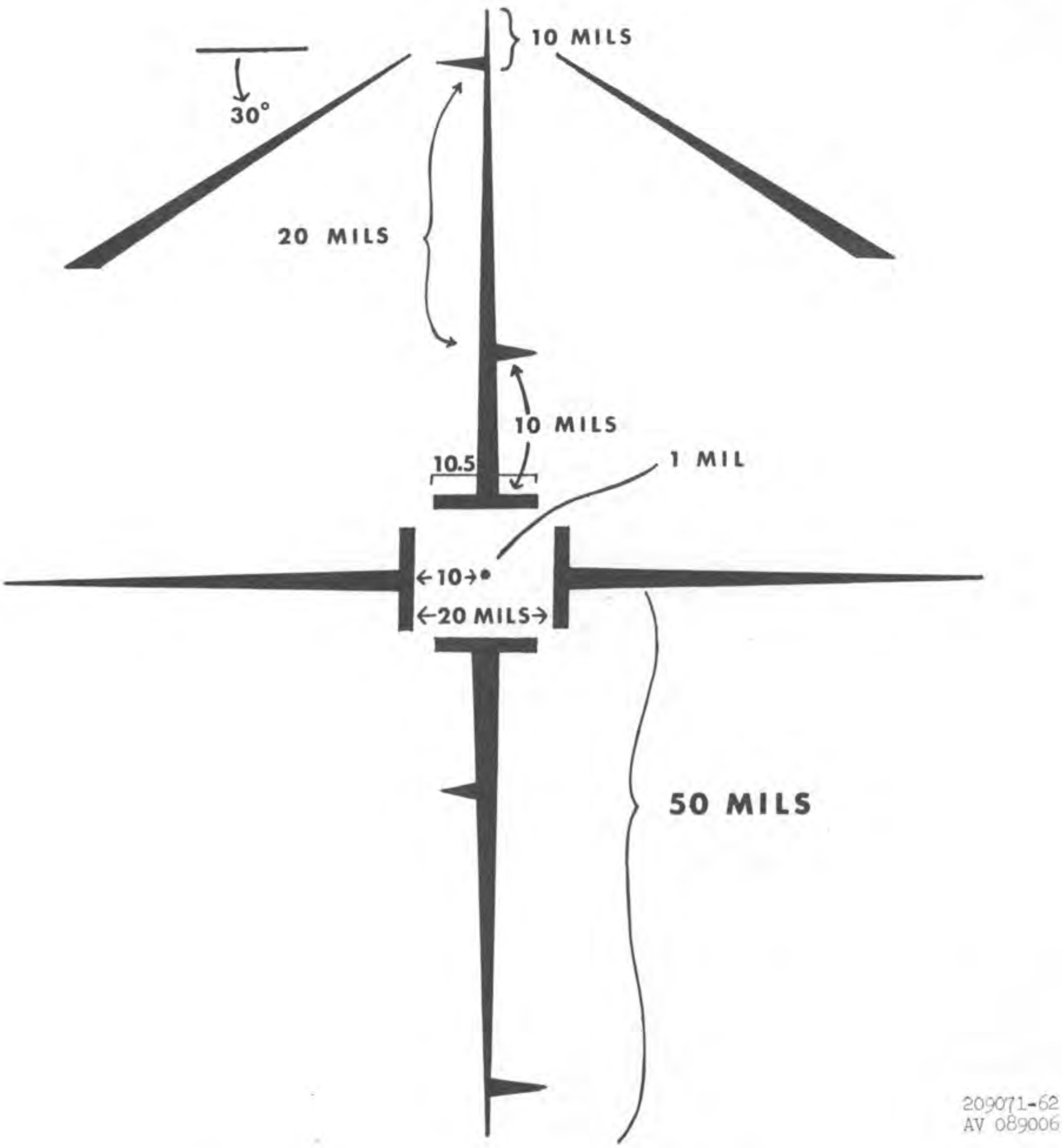


Figure 6-15. Reflex sight M73 (Sheet 2 of 2)

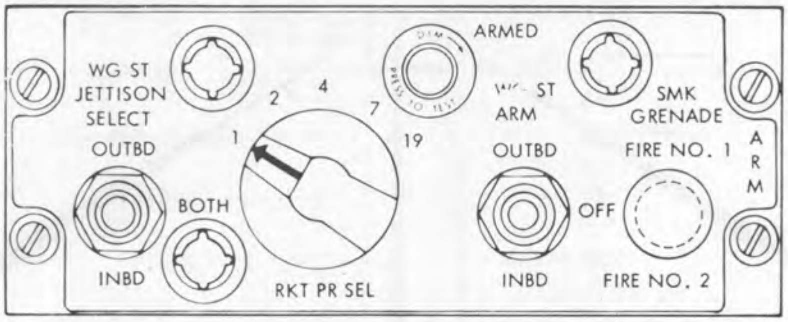
(1) The WG ST JETTISON SELECT switch permits the pilot to jettison outboard wing stores (OUTBD position) or inboard wing stores (INBD position).

(2) A five position rotary RKT PR SEL switch is for selecting rocket pairs. Position 1 selects one pair of rockets for firing. Positions 2, 4, 7, and 19 select a quantity of rocket pairs for firing, according to the preselected position of the switch.

(3) The WG ST ARM switch permits the pilot to select either inboard (INBD) or outboard (OUTBD) wing stores for firing.

(4) The ARMED indicator illuminates (amber) when the WG ST ARM switch is in the INBD or OUTBD position.

(5) The panel edge lights provide panel lighting and are controlled from the pilots light control panel.



HELICOPTERS S/N 68-15052 AND PRIOR

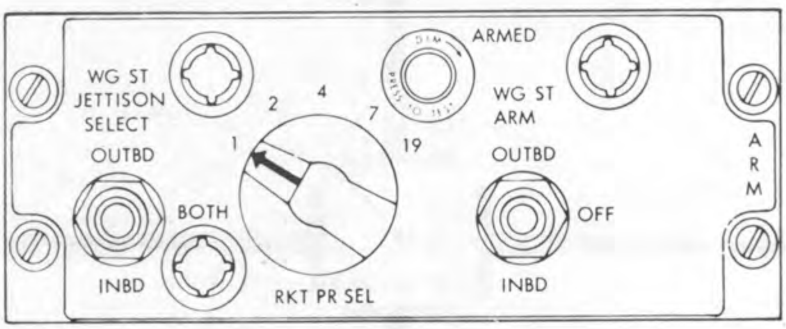


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Figure 6-16. Pilots wing stores control panel

m. Armament Subsystem Leading Particulars.

POWER REQUIREMENTS PER GUN

Electrical	28 Vdc at 20 amps 24 Vdc at 100 amps 115 volts 400 cycles Maximum Requirements — 200 hertz
Hydraulic	1500 psi at 5.5 gpm (MIL-H-5606 fluid)

WEIGHTS

M129 Grenade Launcher

Empty	28.3 lbs
Loaded (400 rounds)	288.3 lbs

M134 Ammo Magazine Assembly

Empty	63.0 lbs
Loaded (4000 rounds)	323.0 lbs

M129 Ammo Magazine Assembly (Pallet & Drum)

Empty	75.0 lbs
Loaded (250 rounds)	265.0 lbs

WEAPON TURRET

MOVEMENT

Azimuth	107.5° left, 107.5° right of forward
Elevation	Variable, dependent on azimuth position

Azimuth Position	Elevation
0°	18.0°
57°	18.0°
80°	14.6°
90°	13.1°
100°	11.7°
107.5°	10.6°

Depression .... 50° in all azimuth positions

ANGULAR VELOCITY

Azimuth .... 72°per second (approx.)

Elevation .... 60° per second (approx.)

WEAPONS

M134 Machinegun

Caliber .... 7.62 millimeter

Firing Rate

Low .... 2000 rounds per minute (approx.)

High.................. 4000 rounds per minute (approx.)

Operation .... fixed or flexible

M129 Grenade Launcher

Caliber .... 40 millimeter

Rounds .... 400 rounds per minute (approx.)

Operation .... fixed or flexible

AMMUNITION

M134 Machinegun

Cartridge, 7.26MM:	NATO, AP, M61
Cartridge, 7.62MM:	NATO, ball, M59
Cartridge, 7.62MM:	NATO, ball, M80
Cartridge, 7.62MM:	NATO, tracer M62
Cartridge, 7.62MM:	DUMMY: NATO, M172

M129 Grenade Launcher

Cartridge, 40MM:	HE: M384
Cartridge, 40MM:	Practice: M385

n. Cyclic Stick Armament Switches. The cyclic stick provides two armament switches; wing stores and turret (figure 6-17).

(1) *Wing stores.* The lower thumb button on the cyclic stick is used to fire the wing stores. After presetting the wing stores selection switch, the wing stores may be fired. Wing stores may be fired by either the pilot or gunner even though the gunners OVERRIDE PILOT switch is ON, if the pilot and gunners wing stores switches are in the same position.

(2) *Turret.* The cyclic turret firing trigger will fire the turret mounted weapons. The pilot may fire the turret mounted weapons by placing the PILOT/GUNNER select switch in the PILOT position. At this time the turret will return to or remain in the fixed (stowed) position. The pilot may now fire the turret mounted weapons by depressing the cyclic firing trigger. The gunner may fire the turret from the cyclic by placing the OVERRIDE PILOT switch in the ON position. His cyclic then functions the same as the pilots. The cyclic stick trigger has a guard that must be lifted to provide access to the cyclic trigger. This guard is provided to prevent inadvertent firing of the turret gun.

o. Bullet Trap Assembly. The bullet trap assembly is a special tool used to prevent injury to personnel or damage to materiel through accidental firing of machine gun M134. It is a steel cylinder, closed at one end, which contains a deflector designed to contain and dissipate the energy of a bullet inadvertently fired. The bullet trap assembly fits over the gun barrels and is secured in place by two quick release pins.

p. Preflight Checklist.

WARNING

Personnel should remain clear of hazardous area of loaded weapons.

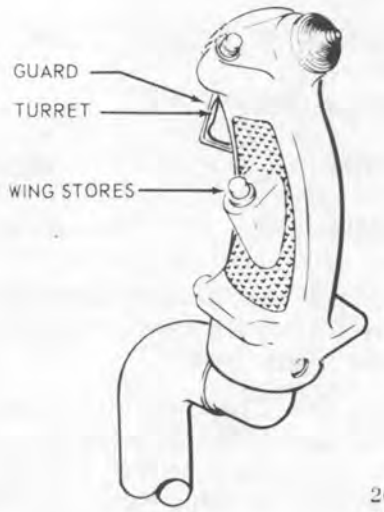


Figure 6-17. Cyclic stick armament swtiches

CAUTION

Helicopters with loaded weapons should be pointed toward clear area.

q. Exterior Checks.

(1) Ensure the M134 ammunition magazine assembly is fully loaded and that one round of play (fore and aft) is present in the ammunition belt in the ammunition chute. Ensure the flexible shaft assembly and the electrical cable are connected. Ensure the bullet trap assembly has been removed from machinegun M134.

(2) Check the M129 ammunition magazine assembly to ensure a full complement of ammunition.

(3) Ensure the ammunition compartment access doors are closed and secure.

(4) Ensure the turret fairings and access doors are installed and secure.

r. Interior Checks.

NOTE

Before turning on the armament subsystem, the helicopter armament (WEAPON FIRE and TURRET POWER) circuit breakers must be closed (depressed) and INVERTER switch must be in the on (MAIN or STANDBY) position.

(1) Ensure MASTER ARM switch is in the OFF position.

(2) Ensure ground safety lever on sighting station is in the horizontal position.

(3) Place the MASTER ARM switch in the SAFE position. Ensure SAFE indicator illuminates.

(4) Depress action switches and rotate the hand grips in azimuth and elevation. Check that the turret is operational.

(5) Depress action switches and apply a rapid rotational movement to the hand grips. Observe that sight reticle image momentarily flashes on and off.

(6) Range Adjustment Check.

(a) Engage compensation switch.

(b) Depress action lever.

(c) Rotate range adjustment knob from 0 to 1600 and back to 0.

(d) Visually assure that rangement is being applied to turret.

(7) Depress control panel press-to-test indicator lenses. Observe that indicators illuminate.

(8) Place the MASTER ARM switch in the OFF position.

(9) Set both AMMO RESERVE PERCENT meter dials and ensure OVERRIDE PILOT switch is in OFF position.

s. In-Flight Operation.

(1) *Pilots Preliminary Operating Procedures.*

(a) Place the GUNNER/PILOT CONTROL switch in the PILOT position.

(b) Place the MASTER ARM switch to the SAFE position.

(c) Adjust the reflex sight reticle illumination and panel lights to the desired intensity.

(d) Check both pilots and gunners sights for parallax.

(2) *Pilots Operating Procedures.*

WARNING

Do not engage a cyclic stick armament switch during any switching action on the armament control panels.

(a) Place the MASTER ARM switch to the ARMED position.

(b) Place the POINT/AREA FIRE switch to either the POINT or AREA FIRE position. Position of the switch is dependent on intended use.

(c) To fire the machinegun, the weapon select switch must either be in the position that selects the machinegun for firing or in BOTH position.

CAUTION

If a machinegun firing stoppage occurs, immediately release the trigger switch or extensive damage to the equipment may occur. Do not attempt to fire the machinegun until stoppage corrective action has been taken.

CAUTION

Do not attempt to fire machinegun M134 if bullet trap assembly was not removed before flight. Gun will be damaged.

(d) To fire the machinegun, depress trigger switch on cyclic control stick.

NOTE

Partially depressing trigger switch will fire the machinegun at a low rate of speed (approximately 2000 rounds per minute). Complete depressing the trigger switch will fire the machinegun at a high rate of speed (approximately 4000 rounds per minute).

(e) To fire the grenade launcher, the weapon select switch must be in a position that selects the grenade launcher for firing.

CAUTION

If a grenade launcher firing stoppage occurs, immediately release the trigger switch or extensive damage to the equipment may occur. Do not attempt to fire the grenade launcher until stoppage corrective action has been taken.

WARNING

After firing rockets in OUTBD position, failure to release trigger when switching to INBD position for purpose of firing M18/M18A1 or M35 may result in detonation of inflight rocket in proximity of helicopter.

(f) To fire grenade launcher, M129, completely depress trigger switch on cyclic control stick.

(g) To fire wing stores, select inboard or outboard stores, using WG ST ARM switch and depress thumb button on cyclic stick.

NOTE

If the wing stores selected are rockets, position the RKT PR SEL switch to the desired position.

WARNING

Before returning to base, ensure machinegun(s) has been cleared (ie., machinegun(s) last fired with WEAPONS CLEAR/UNCLEAR switch in CLEAR position).

(h) Before returning to base, place the GUNNER/PILOT CONTROL switch to the PILOT position, and the MASTER ARM switch to the OFF position.

NOTE

After landing, place the circuit breakers (WEAPON FIRE and TURRET POWER) to the OFF position.

(3) Gunners preliminary operating procedures.

NOTE

The pilots MASTER ARM switch must be in the SAFE position. The pilots GUNNER/PILOT CONTROL switch must be in the GUNNER position. Observe that GUNNER CONTROL and SAFE indicators are illuminated.

(a) Remove sighting station from stow bracket assembly.

(b) Disengage sighting station gimbal locks.

(c) Place sighting station ground safety lever in down position.

(4) *Gunners operating procedures.*

(a) Place POINT/AREA FIRE switch in either POINT or AREA position. Position of switch is dependent upon intended use.

(b) Place compensation (COMP) switch to IN position if gun line correction for airspeed and range is desired.

(c) Index estimated range on RANGE ADJUST knob (applicable only if compensation switch is at IN position).

(d) To fire the machinegun, the weapon select switch must be either in the position that selects the machinegun for firing or in BOTH position.

(e) Depress action switches and move sight to position target in reticle image.

CAUTION

If a machinegun firing stoppage occurs, immediately release the trigger switches or extensive damage to the equipment may occur. Do not initiate further attempts to fire the machinegun until stoppage corrective action has been taken.

CAUTION

Do not attempt to fire machinegun M134 if bullet trap assembly was not removed before flight. Gun will be damaged.

(f) To fire machinegun at low rate, partially depress firing trigger; to fire the machinegun at high rate fully depress firing trigger.

(g) To fire the grenade launcher, the weapon select switch must either be in the position that selects the grenade launcher for firing or in BOTH position.

(h) Depress action switches and move sight to position target in reticle image.

CAUTION

If grenade launcher firing stoppage occurs, immediately release the trigger switches or extensive damage to the equipment may occur. Do not attempt to fire the grenade launcher until stoppage corrective action has been taken.

(i) To fire the grenade launcher, depress firing button.

NOTE

If weapon ceases firing due to ammunition being expended from the M134 ammo box assembly or the M134 ammunition magazine assembly, or the M129 ammunition magazine assembly, place the AMMO FIRE OUT switch in the ON position. This will allow the remaining ammunition to be fired. Do not attempt to fire weapon if any other type stoppage occurs.

(j) Rotate the RANGE ADJUST knob as required to bring rounds on target (applicable only if compensation switch is at IN position).

t. Emergency Procedures.

(1) *Gunners emergency procedures (pilot disabled).*

(a) Stow sighting station on stow bracket assembly.

(b) Place OVERRIDE PILOT switch in ON position.

CAUTION

If a weapon firing stoppage occurs, immediately release the trigger switch or extensive damage to the equipment may occur. Do not attempt to fire the weapon until stoppage corrective action has been taken.

(c) To fire the machinegun or grenade launcher, place the weapon select switch on the sighting station in the position that selects the desired weapon for firing. Then depress the trigger switch on cyclic control switch.

NOTE

Partially depressing trigger switch will fire the machinegun at low rate of fire (approximately 2000 rounds per minute). Completely depressing the trigger switch will fire the machinegun at high rate of fire (approximately 4000 rounds per minute). The grenade launcher is fired by fully depressing the cyclic firing trigger, but only at one speed (approximately 400 rounds per minute). If the turret assembly contains one of each type of weapon, only the machinegun will fire when the weapon select switch is in BOTH position.

(d) To fire wing stores pod, select inboard or outboard wing stores, using WING STORES SELECT switch and depress thumb button on cyclic control stick.

WARNING

Before returning to base, ensure machinegun(s) has been cleared (i.e. machinegun(s) last fired with WEAPONS CLEAR/UNCLEAR switch in CLEAR position).

(e) Before returning to base, place OVERRIDE PILOT switch to OFF position.

(2) Pilots Emergency Procedure (Runaway Gun). In the event of a runaway gun, place MASTER ARM switch in the OFF position.

(3) *Pilots Emergency Procedure (Hydraulic System Failure).* Should a hydraulic failure occur, weapons will not return to the azimuth stow position. Gunner should visually check azimuth position of gun weapons and advise pilot, as weapons may not be cleared and the necessary precautions must be taken.

u. Pilots Postflight Checklist.

(1) Ensure MASTER ARM switch is in the OFF position.

(2) Ensure armament circuit breakers are in th OFF position.

v. Gunners Postflight Checklist.

(1) Ensure weapons have been cleared.

(2) Ensure WING STORES and OVERRIDE PILOT switches are in the OFF position.

(3) Ensure ground safety lever on sighting station is in the horizontal position.

w. Demolition To Prevent Enemy Use.

NOTE

The information contained in the following paragraphs is in accordance with demolition information contained in International Standardization Agreement STANAG 2113.

(1) *Priorities for Destruction.* The priority for destruction of equipment components shall be as follows:

(a) Breech mechanism (gun rotor assembly) (Launcher receiver assembly).

(b) Gun barrels and launcher barrel assemblies.

(c) Helicopter turret sighting station and reflex sight MT3.

(d) Control panels.

(2) *Authorization.* The authority for ordering the destruction of equipment is to be vested in divisional and higher commanders, who may delegate authority to subordinate commanders when the situation requires.

(3) *Methods.* Ordinarily the armament should be destroyed in conjunction with the destruction of the helicopter. If the material is off the helicopter, the armament can be destroyed by using one of the following methods:

(a) Mechanical: Requires axe, pick mattock, sledge, crowbar, or similar implement.

(b) Burning: Requires gasoline, oil incendiary grenades, or other flammables, or welding or cutting torch.

(c) Demolition: Requires suitable explosives or ammunition.

(d) Gunfire: Includes artillery, machineguns, rifles using rifle grenades, and launchers using antitank rockets.

(e) Disposal: Required burying in the ground, dumping in streams or marshes, or scattering so widely as to preclude recovery of essential parts.

x. Operators Checklist—Exterior Inspection.

WARNING

Exercise extreme care when preflighting the M134 machinegun. If ammunition is present in the system, the gun will fire if rotated by hand or otherwise. If operation of the weapon is in doubt, contact qualified armament personnel for safe clearing procedures.

(1) Turret, right side, M134, machinegun mounted.

(a) Bullet trap assembly — install.

(b) Barrel clamp and retaining bolt — secure.

(c) Access door — open/remove.

(d) M134 securely mounted with release pins in outboard mounting holes, check recoil adapters and rear mount.

(e) Feeder, delinker — condition and security.

(f) Cartridge ejector chute — condition and security.

WARNING

Ensure that clearing solenoid plunger is in fully extended position prior to flight.

(g) Clearing gate solenoid cannon plug — condition and security.

(h) Gate solenoid movement — solenoid plunger should return to extended position.

(i) Flex drive cable — routing and condition.

(j) Turret hydraulic lines and connections — check.

(k) Link ejector chute — condition and security.

(l) Drive motor cannon plug(s) — condition and connected.

(m) Gun timing pin — set.

(n) Feeder delinker timing pin — set.

(o) Ammo feed system — check.

(p) Access door — replace, hinge properly engaged, latches latched.

(q) Bullet trap assembly — remove.

(2) Ammunition bay, right side.

(a) Ammo bay door — retaining cables, teflon runners, and hinge for condition and security.

NOTE

Disconnect rounds counter/ammo fireout cannon plug and flex drive cable if ammo container is to be moved outboard.

(b) Turret hydraulic/electrical lines and connections — check.

(c) Chuting — condition, routed properly, and secure.

(d) Torque limiter — condition, security, and ammo fireout switch connected.

(e) Flex drive cable — condition, routed, and connected properly.

(f) Ammo container quick release pins — properly inserted.

(g) Ammo bay door — close and secure.

(3) Ammunition bay, left side 40mm drum.

(a) Ammo bay door — retaining cables, teflon runners, and hinge for condition and security.

(b) Drum — condition, visually check ammunition and rounds counter/ammo fireout cannon plug.

(c) Drive cable 7.62 — check routing and connection by looking behind ammo container.

(d) 40mm drum and drive motor — secure, electrical connections, condition, and security.

(e) Ammo fireout switch — check.

(f) Chuting — condition, routed properly, and secure.

(g) Ammo container quick release pins — properly inserted.

(h) Turret hydraulic/electrical lines and connections — check.

(i) Ammo bay door — close and secure.

(4) Turret left side, M129 grenade launcher mounted.

(a) Access door — open/remove.

(b) M-129 — securely mounted with cradle assembly release pins in inboard mounting holes, recoil adapters and rear mount.

(c) Turret hydraulic lines and connections — check.

(d) Ammo chute and feed tray — condition and securely mounted.

(e) Drive cable — condition, connected, and routed properly.

(f) Ejector chute — security.

(g) Access door — replace, hinge properly engaged, latches latched.

y. Operators Checklist. Interior Inspection.

(1) Sighting station filament selector switch (both positions) .... Lamp illuminates

(2) Reflex sight M73 filament selector switch (both positions) .... Lamp illuminates

(3) MASTER ARM switch .... OFF

(4) OVERRIDE PILOT switch .... OFF

(5) Sighting station .... Stowed

(6) Sighting station ground safety level .... Up

(7) AMMO RESERVE PERCENT indicators .... Set

z. Pilots Firing Procedures.

(1) Armament circuit breakers .... Closed (depressed)

(2) MASTER ARM switch .... ARMED

(3) GUNNER/PILOT CONTROL switch .... PILOT

(4) POINT/AREA FIRE switch .... POINT OR AREA

(5) Reticle lamp switch .... ON

(6) Reticle intensity control .... Adjust as desired

(7) Elevation/depression knob .... Position per range card data

(8) Reflex sight .... On target

(9) To fire wing stores:

(a) WG ST ARM switch .... OUTBD

(b) RKT PR SEL switch .... Desired position

(c) Cyclic control thumb button ..... Depress

(10) To fire the machine gun:

(a) Weapon select switch .... As applicable for desired weapon(s)

(b) Cyclic control trigger switch

Low rate .... Partially depress

High rate .... Fully depress

(11) To fire the grenade launcher:

(a) Weapon select switch .... As applicable for desired weapon(s)

(b) Cyclic control trigger switch . Fully depress

aa. Gunners Firing Procedures.

NOTE

Pilots armament circuit breakers must be closed, MASTER ARM switch at ARMED, and GUNNER/PILOT CONTROL switch at GUNNER.

(1) Sighting station .... Unstow

(2) Sighting station gimbal locks .... Disengage

(3) Sighting station ground safety lever .... Down

(4) POINT/AREA FIRE switch .... POINT or AREA

(5) COMP switch .... IN (if desired)

(6) Range adjust knob Set to estimated range (only if COMP switch at IN position)

(7) WEAPON SELECT switch .... As applicable for desired weapon(s)

(8) Action switches .... Depress

(9) Sighting station .... On target

(10) To fire the machinegun:

Low rate .... Partially depress firing trigger(s)

High rate .... Fully depress firing trigger(s)

(11) To fire the grenade launcher .... Depress firing button(s)

ab. After Firing Weapons

(1) MASTER ARM switch . OFF

(2) Sighting station ground safety lever .... Horizontal

(3) Sighting station gimbal locks................... Engage

(4) Sighting station .... Stow

ac. Before Leaving Helicopter.

(1) MASTER ARM switch . OFF

(2) OVERRIDE PILOT switch .... OFF

(3) Armament circuit breakers .... Open (pulled out)

6-15. External (Wing) Stores Armament Sub-systems — Smoke Dispensers.

Four attachment points are provided, two under each wing panel. These are located 42.5 inches and 59.7 inches from the centerline of the helicopter.

a. Pylons. The pylon assemblies include special 14 inch external store racks, sway braces, and standard electrical connections for the external stores. The entire assembly is enclosed in a fairing that matches the lower contour of the wing. The ejector rack of each pylon is equipped with an electrically operated ballistic emergency jettison device. The jettison system consists of a breech block that utilizes two cartridges. Activation of a jettison switch (pilots or gunners) fires the cartridges and gas pressure actuates a piston, opening hooks and separates the stores simultaneously. The breech block holds two cartridges and each cartridge is provided with a firing circuit. However, if one cartridge should fail to fire, the fired cartridge will fire the unignited cartridge through interconnecting ports. Gas pressure from the beech also actuates a slave piston that contacts a striker block attached to the bellcrank. The piston force overcomes the existing closing moment at the link load and opens the hook (releases pod). The pilot has jettison select switch located in the pilots wing stores control panel and a jettison switch on the instrument panel. The gunner has a jettison switch located on the left side of this instrument panel.

WARNING

Normally, the jettison system is hot at all times. If the battery switch is off and the pilots dc circuit breaker is pulled, the system still may be activated even if the engine is not running. The only positive method to deactivate the system electrically is to pull the pilots and battery compartment jettison circuit breaker. Serious injuries may result due to inadvertent ground jettisons.

b. Stores Jettison. (Table 6-1) An electrical jettison assembly is attached to both of the right and left wings store supports. The electrical release assemblies are activated by either the pilots jettison select switch in conjunction with the instrument panel mounted wing stores jettison switch or by the gunners wing stores jettison switch. The pilots jettison circuit is supplied power from two sources: Direct from the battery through the nose compartment circuit breaker and from the essential bus. The gunners wing stores jettison switch is located on the left side of this instrument panel. The gunners jettison system, with an aft electrical compartment circuit breaker, is wired directly to the battery bypassing the battery switch. The inboard pylon incorporates an electrically primed cartridge used to force eject the stores under a 6g force for a loaded M159 pod. The inboard stores eject at a 34° angle outboard to clear the skid gear. The outboard stores eject a fully loaded M159 with a 2g force in a vertical plane. The wing stores can be jettisoned with jettison select switch, jettison switches, and circuit breakers in various positions.

Table 6-1. Jettison Switch Positions and Actions

PILOTS JETTISON SELECT SWITCH	PILOTS JETTISON SWITCH	PILOTS JETTISON CIRCUIT BREAKER	AFT ELECTRICAL COMPARTMENT JETTISON CIRCUIT BREAKER	ACTION
INBD	ON	IN	IN	Inbds Jettison
OUTBD	ON	IN	IN	Outbd Jettison
BOTH	ON	IN	IN	Both Jettison
INBD	ON	OUT	IN	Both Jettison
OUTBD	ON	OUT	IN	Both Jettison
BOTH	ON	OUT	IN	Both Jettison
INBD	ON	IN	OUT	Inbd Jettison
OUTBD	ON	IN	OUT	Outbd Jettison
BOTH	ON	IN	OUT	No Jettison
INBD	ON	OUT	OUT	No Jettison
OUTBD	ON	OUT	OUT	No Jettison
BOTH	ON	OUT	OUT	No Jettison

NOTE

The gunners guarded jettison switch is inactive if the aft electrical compartment circuit breaker is pulled.

c. Controls. The pilot and gunner are provided with controls for operation of the wing stores armament. The primary controls are located in the pilots wing stores control panel. The pilots stores control panel is located on the instrument panel. The gunners primary controls are located on his armament control panel. The pilots control panel has a MASTER ARM switch, WING STORE ARM switch and a ROCKET PAIR SELECT switch. The gunners panel has a WING STORE ARM switch and a OVERRIDE PILOT switch.

d. Pods. Provisions are included by the M18 or M18A1 aircraft armament pod at each inboard station. The pod houses a 7.62mm machinegun, carries its own electrical system and space for 1500 rounds of ammunition. The pod is a self contained unit with a battery recharging system.

e. Launchers. Provisions are included for rocket launchers at four attachment points, two are under each wing panel. These launchers carry the 2.75 inch folding fin aerial rockets (FFAR).

f. Rockets. The 2.75 inch folding fin aerial rockets (FFAR) are carried in either a 19 tube rocket launcher or a 7 tube rocket launcher. The wing stores will provide for a maximum of four 19 tube launchers 76 rockets.

NOTE

Refer to Chapter 12 for rocket loading limitations.

(1) *Rocket launcher — M157B.* (Figure 6-18) The M157B launcher is reusable and holds seven 2.75 inch FFARS. (Figure 6-19 for rocket firing order.)

(2) *Rocket launcher — M158A1.* (Figure 6-18). The M158A1 is a seven tube reparable launcher and holds seven 2.75 inch FFARS. (Figure 6-20 for rocket firing order.)

(3) *Rocket Launcher—M200.* (Figure 6-18). The M200 is a nineteen tube reparable launcher and holds nineteen 2.75 inch FFARS. Refer to the following cautions and to Chapter 12 for loading limitations (figure 6-21) for rocket firing order.

(4) *Rocket Launcher — M159C.* (Figure 6-18). Two configurations of the M159C may be used. The launchers may be identified by serial number and by weight. Launchers S/N 004178 and subsequent weigh 152 pounds. Both configurations are reusable and hold nineteen 2.75-inch FFAR's. Launchers may be mounted on either of two hard point locations on either wing. Refer to the following caution and to Chapter 12 for loading limitations (figure 6-21 for rocket firing order).

CAUTION

When the M159C or M200 launcher is mounted on the outboard external wing stores, the launcher is restricted to a maximum of 12 rockets (with M229 warhead) in each launcher.

WARNING

Failure to comply with the above restrictions may result in premature failure of the wing attach lugs, lift beam, and carry through structure.

CAUTION

Do to structural limitations of the launcher all M159C launchers (serial number prior to 004178) when mounted on the inboard wing stores are restricted to a maximum of 14 rockets (with M229 warhead) in each launcher.

NOTE

M159C launchers (serial number 004178 and subsequent) or the M200 when mounted on the inboard external wing stores may carry a full load of 19 rockets (with M229 warhead) in each launcher. All M159C launchers (serial number 004178 and subsequent) are marked as follows "LOAD PER APPLICABLE AIRCRAFT INSTRUCTIONS".

CAUTION

Before loading inspect each M-157B and M-159C launcher for broken detents, tube burn-out, tube burning, or distortion in the vicinity of detents. Discard launchers with such defects.

NOTE

Due to safe jettison considerations, the M157B or M158A cannot be carried inboard in combination with the M159C or M200 outboard.

WARNING

Personnel should remain clear of hazardous area of loaded weapons.

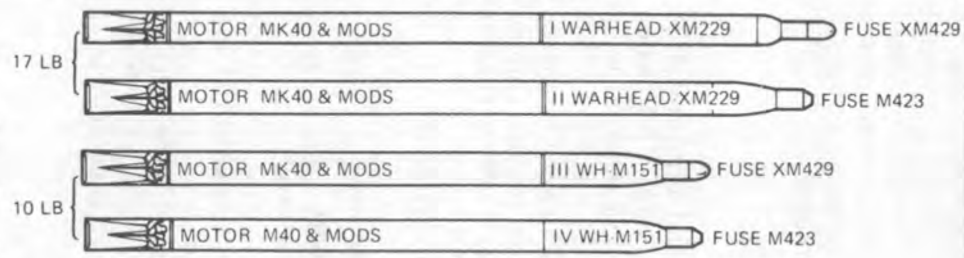
2.75 INCH ROCKETS

I 2.75 INCH FFAR
WT 28.22 LB LGTH 64.72 IN.
CG 26.90 IN.

II 2.75 INCH FFAR
WT 27.94 LB LGTH 62.81 IN.
CG 25.35 IN.

III 2.75 INCH FFAR
WT 20.82 LB LGTH 54.72 IN.
CG 23.10 IN.

IV 2.75 INCH FFAR
WT 20.54 LB LGTH 52.81 IN.
CG 21.60 IN.

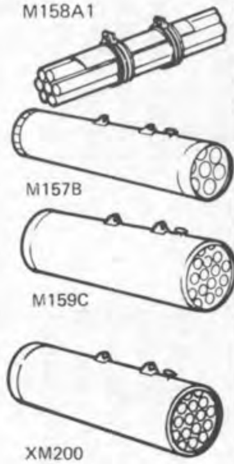


ITEM	WT	LGTH
Motor MK 40 & Mods	11.22 LB	39.30 IN.
Warhead M151	8.70 LB	10.40 IN.
Warhead XM229	16.10 LB	20.40 IN.
FUSE M423	.62 LB	3.11 IN.
XM429	.90 LB	5.02 IN.

ROCKET LAUNCHERS

EMPTY

LAUNCHER	WEIGHT	LENGTH	DIA.	C.G.	DISTANCE FROM END OF LAUNCHER TO CENTER LINE OF FRONT LUG
	LB	IN.	IN.	IN.	IN.
M158A1	48.00	58.00	9.86	30.07	18.17
M157B	67.00	59.87	9.80	31.00	18.50
M159C	130.00	59.87	15.50	31.00	18.50
M159C	152.00	59.87	15.50	30.50	18.50
XM200	139.00	60.60	15.72	31.38	19.49



LOADED

LAUNCHER	M151 XM429 WT/CG		M151 M423 WT/CG		XM229 XM429 WT/CG		XM229 M423 WT/CG	
	LB	IN.	LB	IN.	LB	IN.	LB	IN.
M158A1	193.74	27.31	191.78	27.61	245.54	22.11	243.58	22.41
M157B	212.74	28.06	210.78	28.35	264.54	23.16	262.58	23.45
M159C	525.58	27.77	520.26	28.09	468.64	23.40	465.28	23.70
M159C	547.58	27.76	542.26	28.06	490.64 688.18	23.76 22.82	487.28 682.86	24.03 23.20
XM200	534.58	28.84	529.26	29.21	476.64 674.18	23.50 23.78	473.28 668.86	23.78 24.07

1. Weight limitations and rocket loading restrictions are given elsewhere in Chapter 6 and Chapter 12.

2. M159C Serial No. 004178 and subsequent weight 152.00 pounds as shown. Identify launchers by serial number.

3. CG and front lug measurements are taken from forward end of launchers or rockets.

4. When using M229 warheads, these launchers (Serial No. 004040 and below) are limited to 14 rockets on inboard external stores stations LH and RH due to launcher limitation, and 12 rockets on outboard external stores stations LH and RH due to aircraft limitation.

5. When using M229 warheads these launchers are limited to 12 rockets on outboard external stores stations LH and RH due to aircraft limitation. Launchers (Serial No. 004041 and subsequent for XM159C) are authorized full load of rockets with M229 warheads. Weights and C.G. measurements are shown for 12 and 19 rockets with M229 warheads.

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Figure 6-18. Rocket and rocket launcher tabulated data

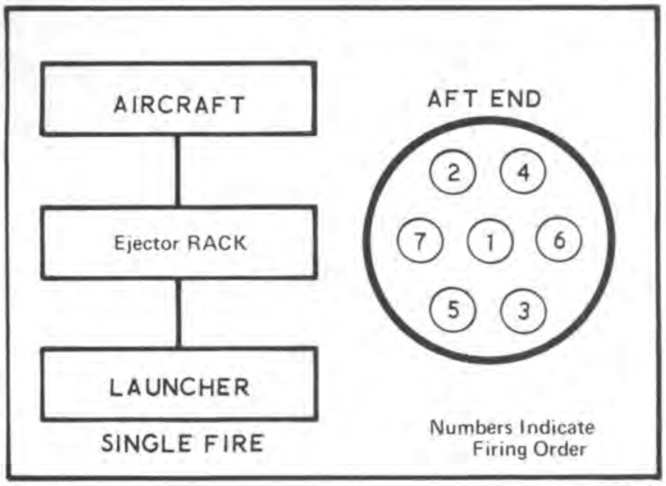

Figure 6-19. M157 Rocket launcher firing order

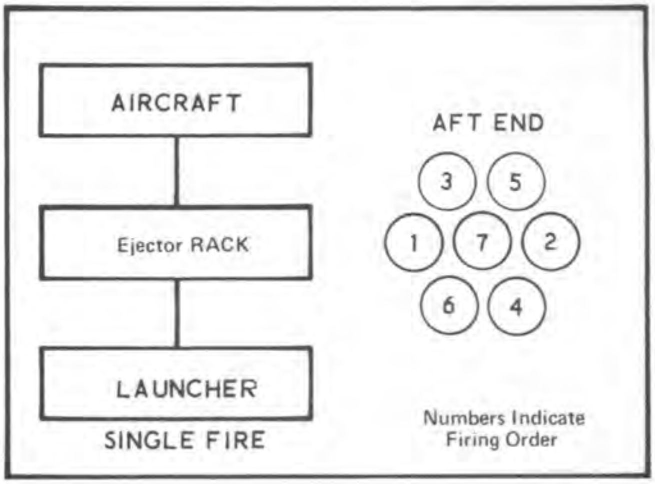

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Figure 6-20. M158A1 Rocket launcher firing order

CAUTION

Helicopter with loaded weapons should be pointed toward clear area.

g. Preflight.

(1) *Interior — gunner.*

(a) Clear area in front of helicopter.

(b) WING STORES switch — OFF.

(c) Pilot override switch — OFF.

NOTE

Consult Chapter 3 for complete interior check.

(2) *Interior — pilot.*

(a) Clear area in front of helicopter.

(b) WG ST JETTISON SELECT switch — Both.

(c) RKT PR SEL switch — one pair.

(d) WG ST ARM switch — OFF.

(e) MASTER ARM switch — OFF.

NOTE

Consult Chapter 3 for complete interior check.

(3) *Exterior — FFAR launcher.*

(a) Mounting lugs — properly engaged.

(b) Swaybraces — condition, firmly against pod but not denting exterior of launcher.

(c) Cannon plug — connected properly and jettison quick disconnect cable secure.

(d) Exterior of launcher — condition of launcher for damage and corrosion.

(e) Interior of launcher tubes — damage and corrosion.

(f) Firing contact points — condition and corrosion.

h. Inflight Operations.

WARNING

After firing rockets in OUTBD position, failure to release trigger when switching to INBD position for purpose of firing M18/M18A1 or M35 may result in detonation of inflight rocket in proximity of helicopter.

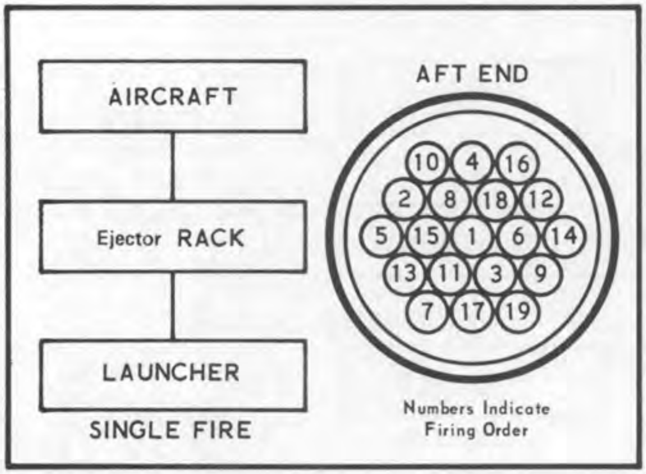

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Figure 6-21. M159 and XM200 Rocket launcher firing order

(1) WING STORES circuit breaker — IN.

(2) MASTER ARM switch — ON.

(3) RKT PR SEL switch — as desired.

(4) WG ST ARM switch — OUTBD or INBD.

(5) Align reflex sight on target.

(6) Press cyclic firing button.

NOTE

Failure to fire may result if the firing switch is not closed for at least one-tenth of a second.

i. Before Leaving The Helicopter.

(1) WG ST ARM switch — OFF.

(2) MASTER ARM switch — OFF.

j. Automatic Gun. The M18/M18E1 pod houses a 7.62mm machinegun. The automatic gun pod carries its own electrical system and space for 1500 rounds of ammunition. The pod is a self contained unit with a battery recharging system. The rate of fire of the M18 is 4000 rounds per minute, while the rate of fire of the M18E1 can be either 2000 rounds or 4000 rounds per minute. Rate of fire selection on the M18E1 is accomplished by switch positioning on the rear of the gun pod. The batteries for the two systems are not interchangeable. The pilot may deactivate either or both M18 pods from the cockpit by use of dc circuit breakers. With the M18A1 installed, this capability is not present.

TABULATED DATA

Weight	245 pounds
Weight Loaded (each)	328 pounds
Length	85 inches
Diameter	12 inches
Maximum Burst Length	Full Complement
Capacity	1500 rounds
Gun and Feed System	Electric

k. Preflight Check.

NOTE

For detailed interior check see Chapter 3.

(1) Interior — Gunner.

(a) Clear area in front of helicopter.

(b) WING STORES switch — OFF.

(c) OVERRIDE PILOT switch — OFF.

(2) Interior — Pilot.

NOTE

See Chapter 3 for detailed interior check.

(a) Clear area in front of helicopter.

(b) WG ST JETTISON SELECT switch — BOTH.

(c) WG ST ARM switch — OFF.

(3) Exterior.

(a) Forward fairing — remove. Install bullet trap assembly.

(b) Forward fairing — condition.

(c) Barrel clamp and retaining bolt — secure.

(d) Mounting lugs — properly engaged.

(e) Swaybraces — condition and security against pod.

(f) Cannon plug (external) — connected properly and jettison quick disconnect cable secure.

(g) M134 securely mounted — recoil adapters, release pins, and rear mount.

(h) Gate solenoid cannon plug — condition and security.

(i) Gate solenoid movement — solenoid plunger should return to extended position.

(j) Exit unit — condition and security.

(k) Feeder wheel — condition and security.

(l) Rounds counters (2) — check.

(m) Safing sector and pins — check.

(n) Gun timing pin — set.

(o) Feeder wheel timing pin — set.

(p) Exit unit timing pin — set.

(q) Drive motor and electrical connections check.

(r) Bullet trap assembly — remove.

(s) Forward fairing — replace, 12 o'clock barrel position clears fairing, fairing secure.

(t) Rear fairing — remove.

(u) Battery switch — charge.

(v) Heater switch — as required (on below zero degrees F).

(w) High/low rate fairing switch — as desired (M18A1 only).

(x) Aircraft field switch — as desired (M18A1 only).

(y) Battery — check.

(z) Rear fairing — replace/secure.

l. Inflight Operation.

WARNING

After firing rocket in OUTBD position, failure to release trigger when switching to INBD position for purpose of firing M18/M18A1 or M35 may result in detonation of inflight rocket in proximity of helicopter.

(1) MASTER ARM switch — On.

(2) WG ST ARM switch — INBD.

(3) ARMED light — Illuminated.

(4) Align reflex sight on target.

(5) Press cyclic firing thumb button.

m. Before Leaving Helicopter.

(1) WG ST ARM switch — OFF.

(2) MASTER ARM switch — OFF.

(3) Rocket pair selector switch to one (1) pair.

n. Pilots Wing Stores Smoke Grenade Launcher Control Panel. The pilots wing stores smoke grenade launcher control panel (figure 6-22) is on the left console. The panel contains two switches for the left wing stores (LH ARM) and two switches for the right wing stores (RH ARM). The switches, when in the forward position, arm their respective smoke grenade launcher. The rotary controls, marked G, B, Y, W, V and R, are present at the time the launchers are loaded. The rotary controls are manually set and provide a reminder as to the color of smoke grenade that is in each respective launcher. Control of the launcher is provided by this control panel in conjunction with the control button mounted on the collective control head. When the collective control head switch (SMOKE REL) is pressed, a 400-cycle audio tone is introduced into the pilot headset.

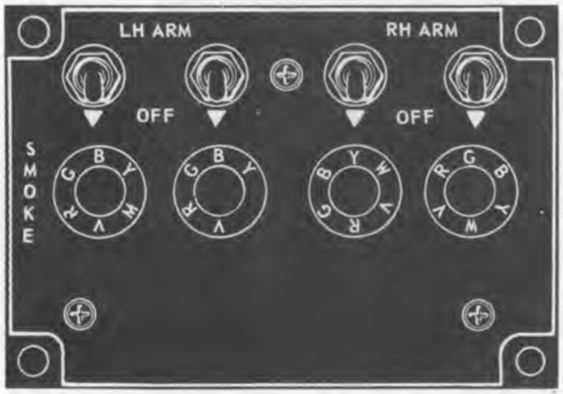

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Figure 6-22. Pilots wing stores smoke grenade launcher control panel

o. Smoke Grenade Dispenser (M118) (Externally Mounted). The externally mounted smoke grenade dispenser may be attached directly to the outboard store ejector rack or it may be strapped upon M157B, M159C, M158, or M200 rocket launcher, which is attached to the outboard store ejector rack. Two dispensers are mounted on the helicopter; one on each side. Each dispenser consists of two racks of six smoke grenades each, or a total of 24 smoke grenades. Each of the four racks can be loaded with a different color smoke grenade. The pilot can fire one grenade at a time or up to four grenades of different colors simultaneously. The color of smoke grenade in each rack is set on a color indicating dial which is located below the arming switch to each rack. To select a grenade of a desired color, the pilot turns ON the grenade arming switch which is directly above the color indicating dial which is set to the desired color. When the pilot presses the SMOKE REL button, actuation of a dispenser is indicated by a 400-cycle audio tone in the pilots headset. The pilot will hear the same audio tone regardless of how many grenades he is firing simultaneously, and the tone will be heard as long as the firing button remains depressed. When the last grenade from a rack has been fired, the tone will continue to be heard until the arming switch for the particular rack is turned OFF.

p. Preflight Check — Smoke Greande.

(1) . *Interior-pilot.*

(a) WG ST JETTISON SELECT switch — BOTH.

(b) LH ARM and RH ARM switches on grenade control panel — OFF (total of four switches).

(c) MASTER ARM SWITCH — OFF.

(d) Color indicating dials on grenade control panel set to indicate color of smoke grenade loaded in each rack.

(2) *Exterior.*

(a) Smoke grenades of desired colors are loaded.

(b) Smoke grenade safety pins — removed.

(c) Ejector safety pin — remove (each rack).

(d) Electrical connection between helicopter and dispenser is connected.

(e) Quick-disconnect lanyard is more taut than dispenser electrical cable.

(f) Smoke grenade dispensers are cocked.

q. Inflight Operation.

(1) LH SMOKE GRENADE and RH SMOKE GRENADE circuit breakers — IN.

(2) MASTER ARM switch — ON or SAFE.

(3) LH ARM and RH ARM switches on grenade control panel — as desired.

(4) Press SMOKE REL button.

r. Before Leaving Helicopter.

(1) LH ARM and RH ARM switches on grenade control panel — OFF (total of four switches).

(2) MASTER ARM switch — OFF.

s. 20MM Weapons Subsystem (M35). Weapons subsystem M35 (figure 6-23) consists of a crossover gun feed chute assembly, cross chute fairing assembly, two wire rope assemblies, ammunition booster assembly, gun firing control unit, right (RH) ammunition box assembly, feeder

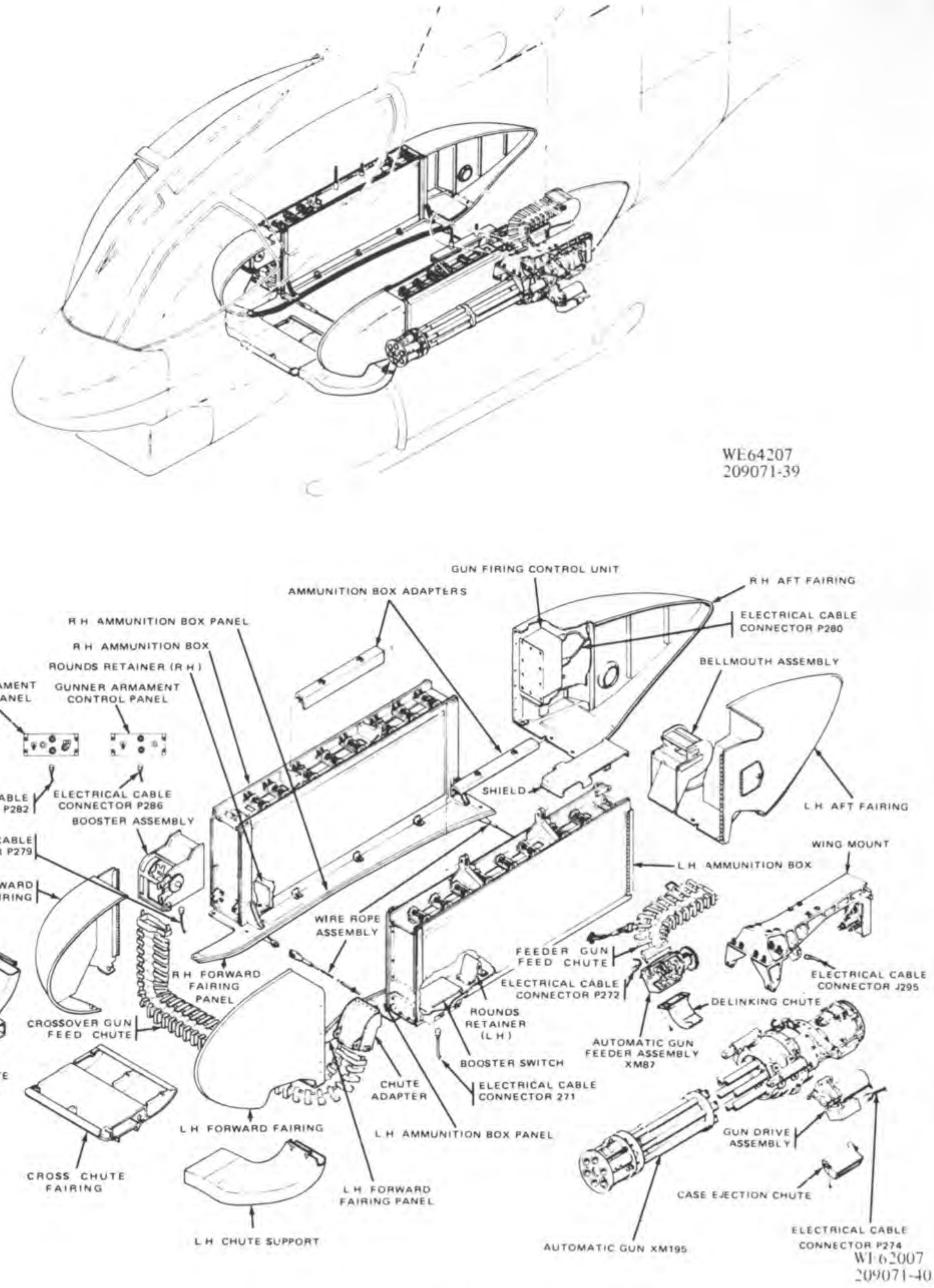

Figure 6-23. M35 20MM Weapons subsystem

gun feed chute assembly, bellmouth assembly, left (LH) ammunition box assembly, booster switch, ammunition box adapters, electrical cable assemblies, gun drive assembly, automatic gun feeder assembly M87, automatic gun M195, wing mount, pilots armament control panel (pilots control panel), and gunners armament control panel (gunners control panel). The gun M195 is fix-mounted on the left stub wing of the helicopter. The two ammunition box assemblies are secured to either side of the helicopter exterior, and are connected to the gun by flexible ammunition chuting.

(1) *Crossover Gun Feed Chute (figure 6-24).* The crossover gun feed chute permits the transfer of linked ammunition from the RH ammunition box to the LH ammunition box after ammunition in the LH ammunition box is exhausted. A cross chute fairing protects the chute and provides reduced drag for the helicopter.

(2) *Booster (figure 6-25).* The booster assembly is located on the forward end of the gun feed RH ammunition box. It assists the feeder by pushing ammunition from the right box through the crossover gun feed chute into the LH ammunition box when the box is empty. The booster is actuated by the booster switch, located in the bottom of the LH ammunition box.

(3) *M35 Gun Firing Control Unit (figure 6-26).* The gun firing control unit is located on the aft end of the RH ammunition box. When the ARM/OFF switch on the pilots control panel is placed in the ARM position, the gun firing control unit is energized. When the trigger switch on the cyclic stick is pressed, the gun firing control unit controls the application of power to the gun firing contact assembly, gun drive assembly, declutching/delinking feeder, rounds counter, and gun drive assembly. The gun drive motor series field and booster motor are powered from the helicopter 24 Vdc battery while all other circuits operate off the 28 Vdc bus.

(4) *RH Ammunition Box.* The RH ammunition box is attached beneath the right sponson (stub wing) by the adapter assembly. The box is held in position against the helicopter skin by two wire rope assemblies connected between the RH and LH ammunition boxes. The RH ammunition box stores approximately 450 rounds of linked ammunition. Attached to the front and

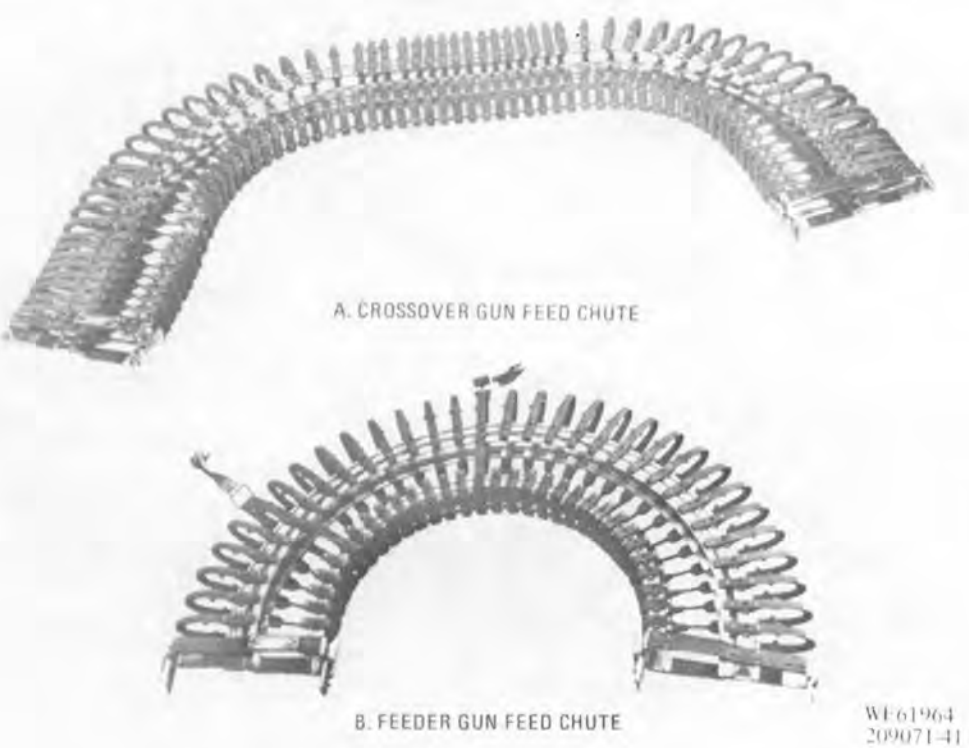

Figure 6-24. M35 gun feed chute assemblies

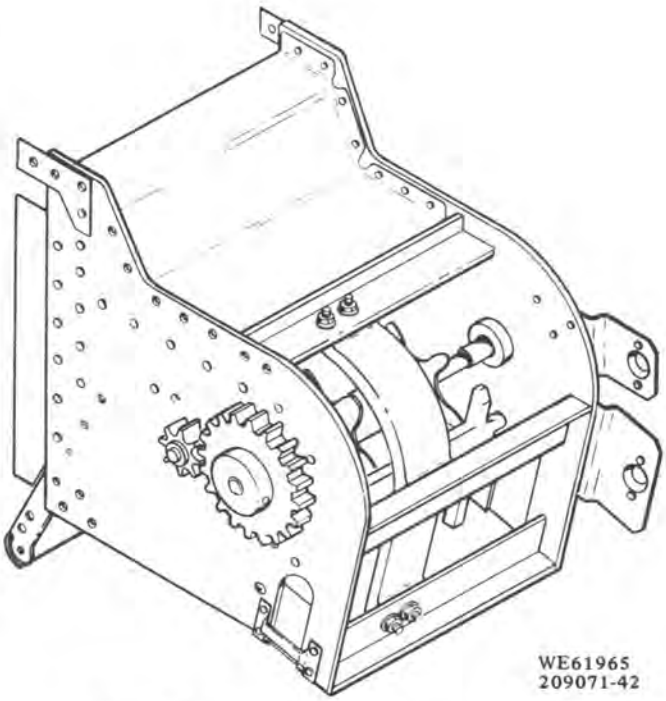

Figure 6-25. M35 Booster assembly

rear ends of the box are aerodynamic fairing sections designed to reduce drag. The front fairing section houses the booster assembly and is hinged for easy access. The rear fairing section houses the gun control unit.

(5) *M35, Feeder Gun Feed Chute (Figure 6-24).* The feeder gun feed chute guides linked ammunition from the bellmouth assembly to the declutching/delinking feeder.

(6) *LH Ammunition Box.* The LH ammunition box is attached beneath the left sponson (stub wing) by the adapter assembly. The LH ammunition box is held in position against the helicopter skin by two wire rope asemblies connected between the RH and LH ammunition boxes. The LH ammunition box stores approximately 450 rounds of linked ammunition. Attached to the front and rear ends of the box are aerodynamic fairing sections designed to reduce drag. The aft fairing section houses the bellmouth assembly and is hinged for easy access. The shield is attached to the top rear section of the LH ammunition box. The booster switch is located on the access door in the bottom front portion of the LH ammunition box.

(7) *Bellmouth.* The bellmouth assembly is mounted on the aft end of the LH ammunition box. This assembly incorporates a single turnaround hub. The hub, located within the bellmouth, changes the direction of ammunition flow 180°.

(8) *Shield.* The shield is located on the top aft portion of the LH ammunition box and is held in place by the top mounting pin of the bellmouth assembly. The shield supports the flexible feed chute so that ammunition flow will not be restricted during firing.

(9) *Booster Swtich.* The booster switch is mounted on the inside of the access door, located on the forward bottom of the LH ammunition box. The booster swtich is held in an off position by the weight of stored ammunition. When the ammunition supply in the LH ammunition box is exhausted, the booster switch actuates, energizing the booster motor and causing ammunition to be transferred from the RH ammunition box to the LH ammunition box.

(10) *Rounds Retainer.* The rounds retainer is located to the rear of the booster switch in the bottom of the LH ammunition box. When ammunition is being transferred from the RH ammunition box, and the firing cycle terminates, the rounds retainer causes ammunition to pile up and turn off the booster switch.

(11) *Electrical Cable.* The right and left electrical cable assemblies provide the electrical connections between the helicopters wiring and armament subsystem M35. A quick-disconnect firing lead cable is connected between the firing contact assembly on the gun and the ring mount.

(12) *M35 Gun Drive (Figure 6-27).* The gun drive assembly, which is mounted on the housing of gun M195, drives the gun motor assembly. It consists of a split-field series dc electric motor and a gear assembly.

(13) *M35 Automatic Gun Feeder M87 (Figure 6-28).* The feeder gun feed chute is attached to the automatic gun feeder which is mounted on gun M195. As linked ammunition passes through the feeder, each round is stripped from its link and fed into the gun. The links follow a "T" rail and are ejected through the declutching/delinking chute assembly. Upon trigger release, the feeder declutches and stops feeding rounds into the gun. A time delay allows the gun to continue firing rounds already fed.

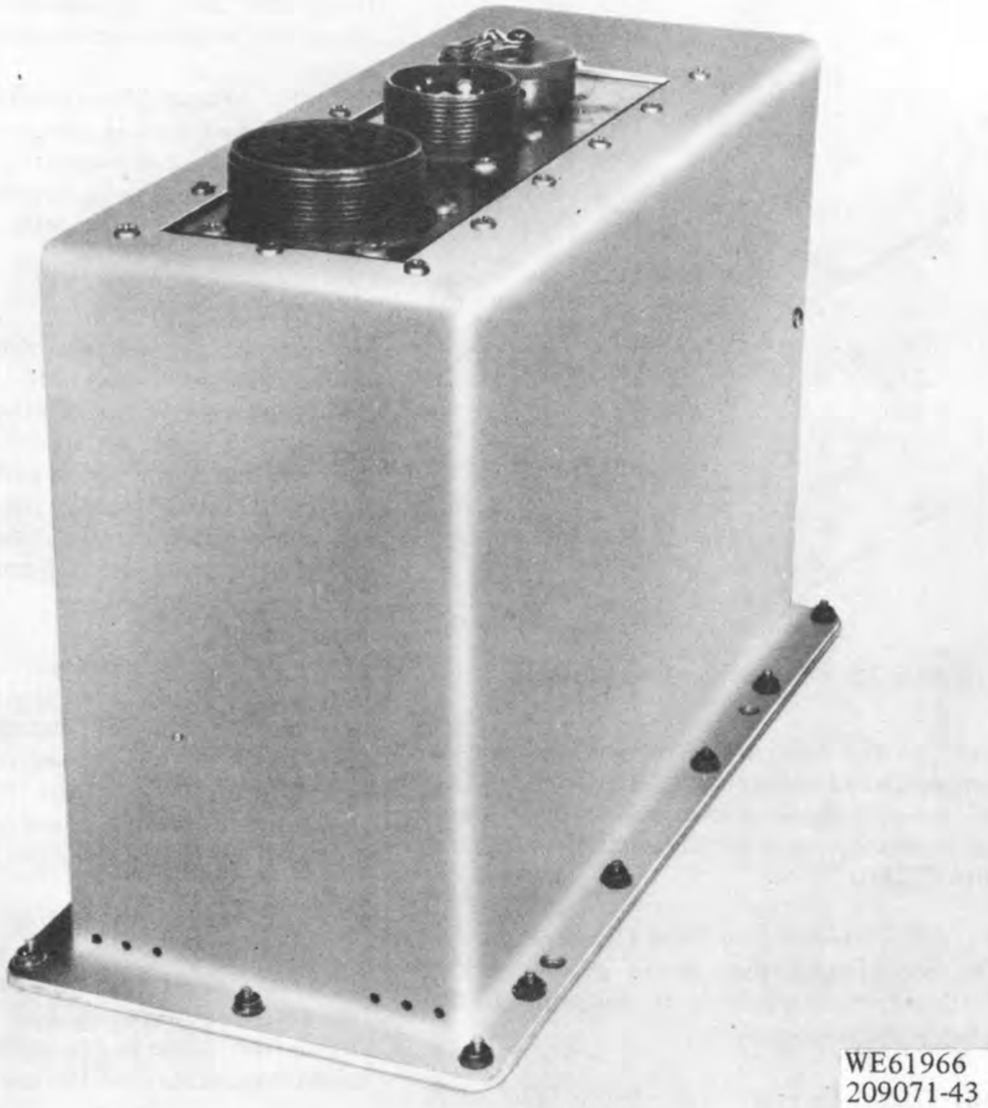

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Figure 6-26. M35 Gun firing control unit

(14) *Delinking Chute.* The delinking chute assembly is attached to the declutching/delinking feeder and separates the links as they drop through the chute. This prevents the possibility of a long loop of links hanging beneath the helicopter or damaging the tail rotor.

(15) *20 Multimeter Automatic Gun. M195 (Figure 6-29).* Gun M195 is an electrically-driven, air cooled weapon using electrically-fired ammunition. It is of the Gatling type, and has a total of six barrels arranged in a cluster and retained in a rotor assembly which revolves on bearings within a stationary housing. The major subassemblies of the gun are the housing assembly, the rotor assembly, and the gun drive assembly. The firing cycle begins when power is applied simultaneously to the firing contact assembly and the gun drive assembly. The gun drive assembly turns the rotor assembly, and interaction between the bolt assemblies and the main cam path on the inside of the housing assembly causes the gun to feed, chamber, lock, fire, extract, and eject ammunition. Rotation of the barrel cluster is in a counterclockwise direction, as viewed from the rear. The position of the firing barrel is at approximately 12 o'clock while the feed/eject position is at approximately 6 o'clock.

Figure 6-27. M35 Gun drive assembly

(16) *Wing Mount.* The wing mount is located under the left sponson (stub wing) and is secured by eight bolts. The wing mount supports the gun and makes provision for boresight adjustment up to 1.5° in azimuth or elevation.

(17) *Pilots Armament Control Panel (Figure 6-30).* The pilots control panel is located in the pilots cockpit. Normally, the pilot fires gun M195 and other wing stores. Operation of the subsystem is accomplished by means of the ARM/OFF and trigger switches located on the control panel and cyclic stick respectively. A rounds counter located on the control panel provides a digital indication of the number of rounds remaining in the system (± 9 rounds).

(18) *Gunners Armament Control Panel (Figure 6-31).* The gunners control panel is located in the gunners cockpit. Operation of the subsystem by the gunner is permitted by use of the PILOT OVERRIDE switch located in the gunners cockpit and the ARM/OFF switch on the control panel. An indicator light on the panel lights when the subsystem is armed and under the control of the gunner.

(19) *Tabulated Data.*

(a) Armament subsystem M35 tabulated data is listed in table 6-2.

Table 6-2. Characteristics — Armament Subsystem M35

System	1186.5 lb (loaded), 550 lb. (empty)
Ammunition capacity	Approximately 1000 rounds
Gun	M195
Ammunition	M51A1B1, M52E1, M53, M54A1, M55A2, M56A3
Gun drive	Electrical
Basic life	100,000 rounds
Links	M14A1

Table 6-2. Characteristics — Armament Subsystem M35 (Cont)

Accuracy	6 mils radial, std. deviation
Turn-around and reload time	15 minutes
Reliability	15,000 mean rounds between failures (MRBF)
Crash load requirement	6 g's maximum
Ammunition feed	Linked
Type of ammunition storage	Box
Boresight adjustment	± 1/2 degrees in azimuth and elevation

(b) Gun M195 tabulated data is listed in table 6-3.

Table 6-3. Characteristics — Gun M195

Caliber	20mm
Overall length	Approximately 60 inches
Reliability	25,000 mean rounds between failure (MRBF)
Number of barrels	6
Length	40 inches
Lands	9
Twist	Gain twist
Rotation or barrel cluster	Counterclockwise, viewed from rear of gun

Table 6-3. Characteristics — Gun M195 (Cont)

Firing rate	
Maximum	850 spm
Minimum	650 spm
Burst limits	Unlimited (100-200 rounds — 7 to 14 sec recommended for maximum barrel life).

(20) *Controls.* The pilot and gunner are each provided with a control panel for operation of gun M195. During normal operation, the pilot controls the wing stores armament. The primary controls are located on the pilots left console, and include a MASTER ARM switch, and a WG ST ARM switch. The pilots control panel has an ARM/OFF switch, an ARMED indicator light, and a rounds remaining counter. The gunners control panel is located in his right console and includes a PILOT OVERRIDE switch and a WING STORES switch. The gunners control panel has an ARM/OFF switch, and an ARMED light.

(a) Pilots Wing Stores Control Panel. Refer to paragraph 6-15.c.

(b) Cyclic stick armanment switches. The cyclic sticks wing stores fires switch is used to fire gun M195.

t. Preflight Checks — Exterior.

WARNING

Do not walk in front of gun. Safety gun before servicing. Observe all standard safety precautions governing handling of weapons and live ammunition.

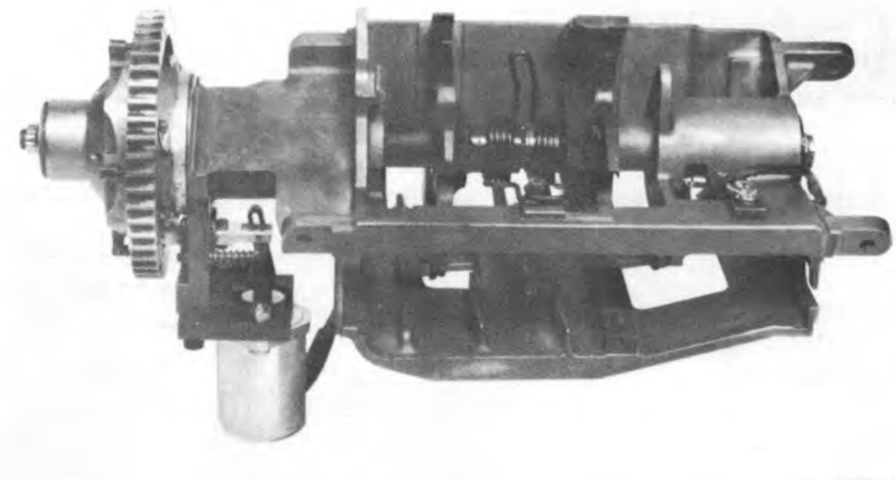

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Figure 6-28. M35 Automatic gun feeder assembly M87

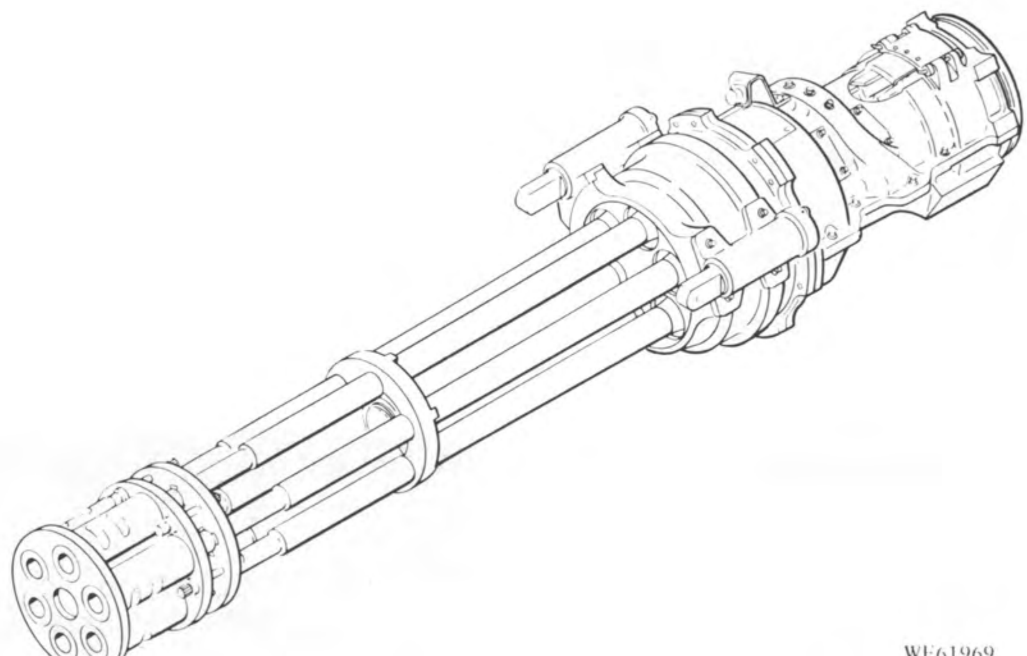

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Figure 6-29. M35 20MM Automatic gun M195

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Figure 6-30. M35 Pilots armament control panel

WARNING

When preflighting the M35 20mm automatic gun, if ammunition is present in the system the gun may fire if rotated by hand. Do not attempt to perform operational checks with ammunition present in the system. If operation of the weapon is in doubt contact qualified armament personnel for safe clearing procedures.

u. Safety Checks.

(1) Ensure MASTER ARM switch is in OFF position.

(2) Remove firing lead quick-disconnect and install shorting plug.

(3) Release gun drive brake.

(4) Depress the declutching solenoid linkage.

WARNING

To ensure the feeder delinker assembly is clear of rounds, the declutching solenoid linkage must be fully depressed to engage the feeder delinker assembly when rotating the gun to clear rounds.

(5) With the declutching solenoid linkage fully depressed, rotate the gun a minimum of two full revolutions to clear rounds.

v. General Checks.

(1) Check total rounds fired to determine if parts replacement is required.

(2) Review loading procedure.

(a) Correct number of rounds per loop.

(3) Check that proper ammunition has been loaded, and that it is correctly linked.

CAUTION

If partial load of ammunition is to be carried, the right ammunition can is to be loaded first.

w. RH Ammunition Box Check.

(1) Ensure nine round retainer spring doors are latched.

(2) Ensure rounds are aft of forward-most retainer spring.

(3) Ensure aft ammunition box cable is taut.

(4) Ensure two booster mounting pins are installed.

(5) Ensure ammunition is free at booster.

(6) Ensure booster motor connector is secure.

(7) Ensure two flexible chuting clips are secure at booster.

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Figure 6-31. M35 Gunners armament control panel

(8) Ensure six RH forward fairing and panel latches are secure.

(9) Ensure forward ammunition box cable is taut.

x. Crossover Gun Feed Chute Check.

(1) Ensure four RH and LH chute support pins are secure.

(2) Ensure three cross-chute fairing door latches are secure.

y. LH Ammunition Box Check.

(1) Ensure two flexible chute clips are secure at adapter chute.

(2) Ensure there are two short ammunition loops (18 rounds each), over booster switch.

(3) Ensure booster switch connector is secure.

(4) Ensure booster switch is actuated.

(5) Ensure nine round retainer spring doors are latched.

(6) Ensure chute shield and bellmouth are secure.

(7) Ensure two flexible chute clips are secured to bellmouth.

(8) Ensure ammunition is free in bellmouth.

(9) Ensure nine LH aft fairing and panel latches are secure.

z. Weapon Check.

(1) Ensure two flexible chute "D" rings are secure.

(2) Ensure two flexible chute clips are secured to feeder.

(3) Ensure feeder is timed to gun.

(4) Ensure link chute is secured to feeder.

(5) Ensure feeder solenoid and linkage is free.

(6) Ensure feeder connector is secure.

(7) Ensure two feeder mounting pins are secure (safety wire).

(8) Ensure gun is lubricated.

(9) Ensure four gun drive motor bolts are secure.

(10) Ensure four case chute bolts are secure.

(11) Ensure firing lead connector is secure at gun firing contact assembly.

(12) Check boresight of gun.

(13) Ensure gun fore and aft mounts are secure.

(14) Ensure wing mount is secure.

(15) Ensure center barrel clamp is secure and that cotter pin is installed.

(16) Ensure seven blast suppressor bolts are secure.

aa. Final Arming Check.

(1) Ensure cockpit rounds counter is reset to correct ammunition load.

WARNING

Check with pilot and gunner before proceeding further.

(2) Remove holdback tool.

(3) Feed ammunition belt into feeder and strip one round.

(4) Set gun drive brake lever to ON position.

(5) Remove shorting plug assembly, connect firing lead.

WARNING

Weapon system is ready to fire when MASTER ARM switch is turned on.

ab. Preflight Checks — Interior.

(1) Gunners checks.

(a) Ensure area in front of helicopter is clear.

(b) Ensure WING STORES switch is in OFF position.

(c) Ensure OVERRIDE PILOT switch is in OFF position.

(2) Pilots checks.

(a) Ensure area in front of helicopter is clear.

(b) Ensure WG ST ARM switch is in OFF position.

(c) Ensure WING STORES circuit breakers are out.

(d) Ensure MASTER ARM switch is in OFF position.

ac. Inflight Operation.

WARNING

After firing rockets in OUTBD position, failure to release trigger when switching to INBD position for purpose of firing M18/M18A1 or M35 may result in detonation of inflight rocket in proximity of helicopter.

(1) Push WING STORES circuit breakers in.

(2) Place MASTER ARM switch in ON position.

(3) Place WG ST ARM switch in INBD position.

(4) Ensure ARM light on pilots control panel illuminated.

(5) Place ARM/OFF switch on M35 control panel in ARM position.

(6) Ensure ARM light on M35 control panel is illuminated.

(7) Aim gun M195 by flying helicopter directly at target.

(8) Fire weapon by depressing wing stores firing switch on pilots cyclic stick. If gunner has control of system, fire weapon by depressing wing stores firing switch on gunners cyclic stick.

ad. Emergency Procedures.

(1) Gun Fails to Fire.

(a) Ensure WING STORES circuit breakers are in.

(b) Ensure MASTER ARM switch is in ON position.

(c) Ensure WG ST ARM switch is in INBD position.

(d) Ensure ARM/OFF switch on M35 control panel is in ARM position.

(e) On cyclic stick, depress wing stores firing switch.

(2) Runaway Gun.

(a) Place MASTER ARM switch in OFF position.

(b) Pull out WING STORES circuit breakers.

ae. Postflight Checks.

(1) Interior.

(a) Ensure M35 control panel ARM switch is in OFF position.

(b) Ensure WG ST ARM switch is in OFF position.

(c) Ensure MASTER ARM switch is in OFF position.

(d) Ensure WING STORES circuit breakers are out.

(2) Exterior.

WARNING

Do not walk in front of gun. Safety gun before servicing. Observe all standard safety precautions governing the handling of weapons and ammunition.

(a) Remove firing lead quick-disconnect and install shorting plug assembly.

(b) Release gun drive motor brake.

(c) Depress the declutching solenoid linkage.

WARNING

To ensure the feeder delinker assembly is clear of rounds, the declutching solenoid linkage must be fully depressed to engage the feeder delinker assembly when rotating the gun to clear rounds.

(d) With the declutching solenoid linkage fully depressed, rotate the gun a minimum of two full revolutions to clear rounds.

(e) Check ammunition boxes and chuting for remaining ammunition.

(f) Make an overall visual check for damaged, loose, or missing parts.

af. Ammunition. The 20mm ammunition used in subsystem M35 is electric-primed. Stamped on the head of each round is the manufacturer's mark and lot number. Also, each projectile is painted and marked for purposes of identification. Ammunition authorized for use in the M35 armament subsystem is listed in table 6-4.

WARNING

Do not load, store, or handle 20MM electric primer ammunition near operating radio frequency (RF) energy transmitting equipment. When loading HE1 rounds into links, use extreme caution to prevent impacts to the round which would damage the fuse.

Table 6-4. Ammunition — M35 Armament Subsystem

Cartridge, 20 Millimeter	Electric, Armor-Piercing Incendiary, M53
Cartridge, 20 Millimeter	Electric Target Practice, M55A2
Cartridge, 20 Millimeter	Electric, High Explosive Incendiary, M56A3
Cartridge, 20 Millimeter	Dummy M51A2

ag. Destruction of Material To Prevent Enemy Use.

NOTE

The information contained in the following paragraphs is in accordance with demolition information contained in International Standardization Agreement — STANAG 2113. It is essential to destroy to the maximum degree possible, military technical equipment, abandoned in wartime operations, to prevent its eventual repair and use by the enemy.

ah. Degree of Damage. Methods of destruction should achieve such damage to material that it will not be possible to restore the material to a useable condition in the combat zone either by repair or cannibalization.

ai. Priorities For Destruction. When lack of time prevents complete destruction of the material, priority is to be given to the destruction of essential parts, and the same parts are to be destroyed on all like equipment.

(1) The priority for destruction of equipment components shall be as follows:

(a) Breech mechanism (gun rotor assembly).

(b) Gun barrels.

(c) Declutching/delinking feeder assembly.

(d) Gun firing control unit.

(2) Equipment installed on helicopter shall be destroyed in accordance with the priorities for the equipment itself.

aj. Authorization And Reporting.

(1) The authority for ordering the destruction of equipment is vested in the divisional and higher commanders, who may delegate authority to subordinate commanders when the situation requires.

(2) The reporting of the destruction of equipment is done through command channels.

ak. Methods.

(1) Ordinarily armament subsystem M35 is destroyed in conjunction with the destruction of the helicopter itself.

(2) If armament subsystem M35 is separated from the helicopter, the subsystem can be destroyed by using one of the following methods:

(a) Mechanical: Require use of axe, pick, mattock, sledge, crowbar, or similar implement.

(b) Burning: Requires use of gasoline, oil, incendiary grenades or other flammables, or welding or cutting torch.

(c) Demolition: Requires use of suitable explosives or ammunition.

(d) Gunfire: Requires use of artillery, machineguns, rifles firing rifle grenades, or launchers firing antitank rockets.

(e) Disposal: Requires burial of equipment in ground, dumping in streams or marshes, or scattering so widely as to preclude recovery of essential parts.

6-16. Authorized Armament Configurations. See figure 6-32 for authorized armament loading configurations.

Section VIII. PHOTOGRAPHIC EQUIPMENT

(Not Applicable)

Section IX. AUTOMATIC STABILIZATION EQUIPMENT

(Refer to Chapter II)

Section X. MISCELLANEOUS EQUIPMENT

6-17. Data Case.

A data case for maps, flight reports, and similar items has been provided. The data case is beneath the pilots seat.

NOTE

Helicopters serial number 67-15495 and subsequent are not provided with a data case.

6-18. Mooring Fittings.

The mooring fittings are provided on the helicopter fuselage and at each outboard wing stores. One fitting is on the fuselage just forward of the tailboom attachment fittings and one fitting is aft of the chin turret. These fittings are accessible when their access plate has been removed. The wing stores fitting is installed in the outboard racks discharge cartridge location. All mooring fittings are of the dual purpose jackpoint and mooring fitting.

6-19. Tow Rings.

To facilitate towing the helicopter, with ground handling wheels lowered, a tow ring has been provided at the forward end of each landing gear skid tube. These rings will receive a standard tow bar.

6-20. Rotor Tiedown.

Rotor tiedown is provided for use in mooring the aft blade of the main rotor which prevents the rotor from see-sawing when the helicopter is parked. The tiedown can be stowed in the gunners compartment.

6-21. Pitot Tube Cover.

A cover for the pitot tube is supplied. This cover is made of olive drab duck material. The cover has streamer to warn personnel. The streamer is painted with REMOVE BEFORE FLIGHT.

6-22. Tailpipe Cover and Engine Inlet Shield.

Covers are provided of olive drab duck material to cover the engine inlet and tailpipe during storage or tiedown. Streamers are sewed on to warn personnel to remove before flight. On helicopters serial numbers 66-15249 through 66-15292 the engine inlet shield is of polyurethane foam covered with duck material. The shield is held in palce by compressing the shield into the engine inlet openings. On helicopters serial number 66-15293 and subsequent the engine inlet shield (cover) is of duck material about 12 inches by 24 inches with flaps along the forward, top, and bottom edges. The cover is held over the engine intake screen by insetting the three flaps under the corresponding edges of the inlet screen.

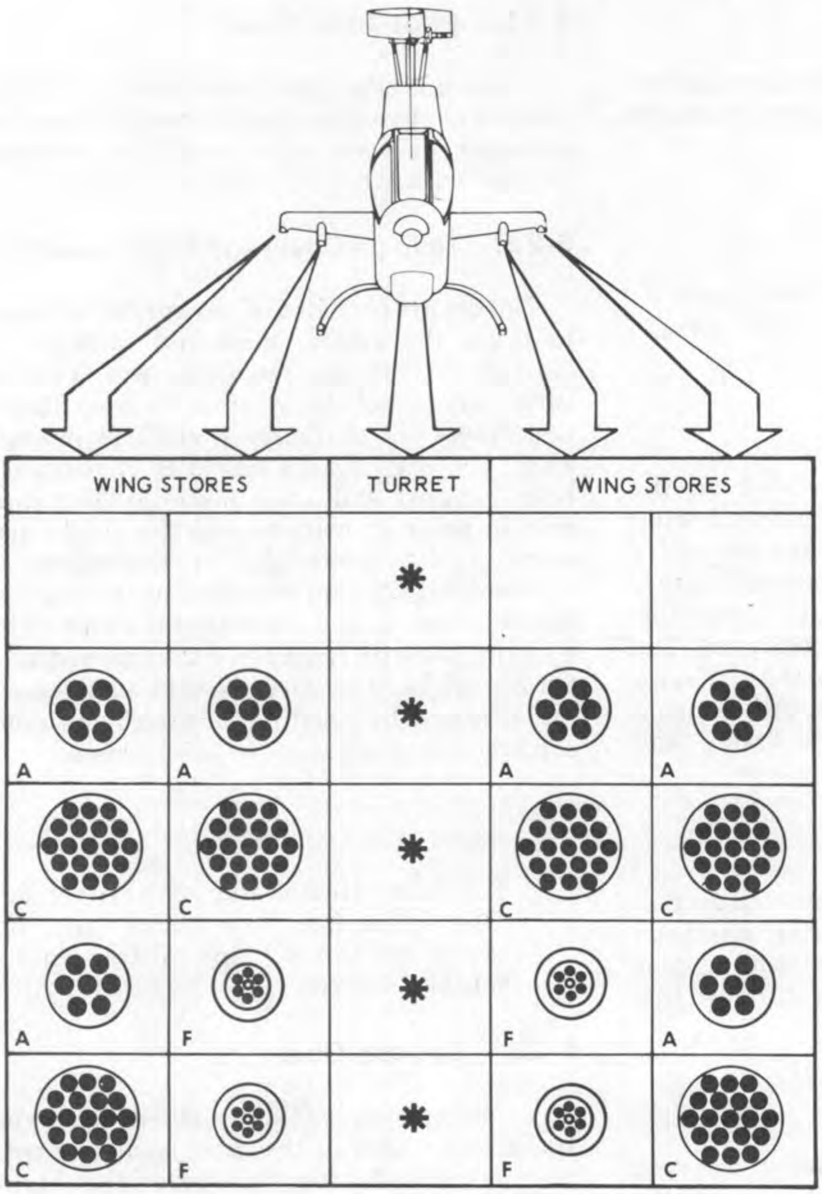
NOTE

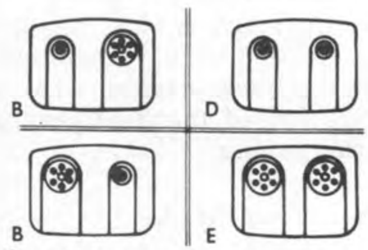
To facilitate installation of the cover, the filter screen may be actuated open, the cover installed, and filter screen actuated closed.

6-23. Canopy Cover.

A canopy cover is provided to cover the transparent area of the crew compartment. The cover is made of cotton twill material and is held in place by four nylon cords. Stencils are located at the forward outside edges to indicate the forward edge of cover.

AH-1G AUTHORIZED ARMAMENT CONFIGURATIONS





* M 28A1 turret subsystems are interchangeable and may be used in conjunction with all approved wing store configurations.

A	M157B or M159A1:	Seven-Tube, 2.75 Inch Rocket Launcher
B	M28 Subsystem:	7.62MM High Rate Automatic Gun and 40MM Grenade Launcher
C	M159C or XM200:	19-Tube, 2.75-Inch Rocket Launcher
D	M28 Subsystem:	Two 40MM Grenade Launchers
E	M28 Subsystem:	Two 7.62MM High Rate Automatic Guns
F	M18A1 Armament:	Pod, 7.62MM High Rate Automatic Gun
G	M35 Subsystem:	20MM High Rate Automatic Gun

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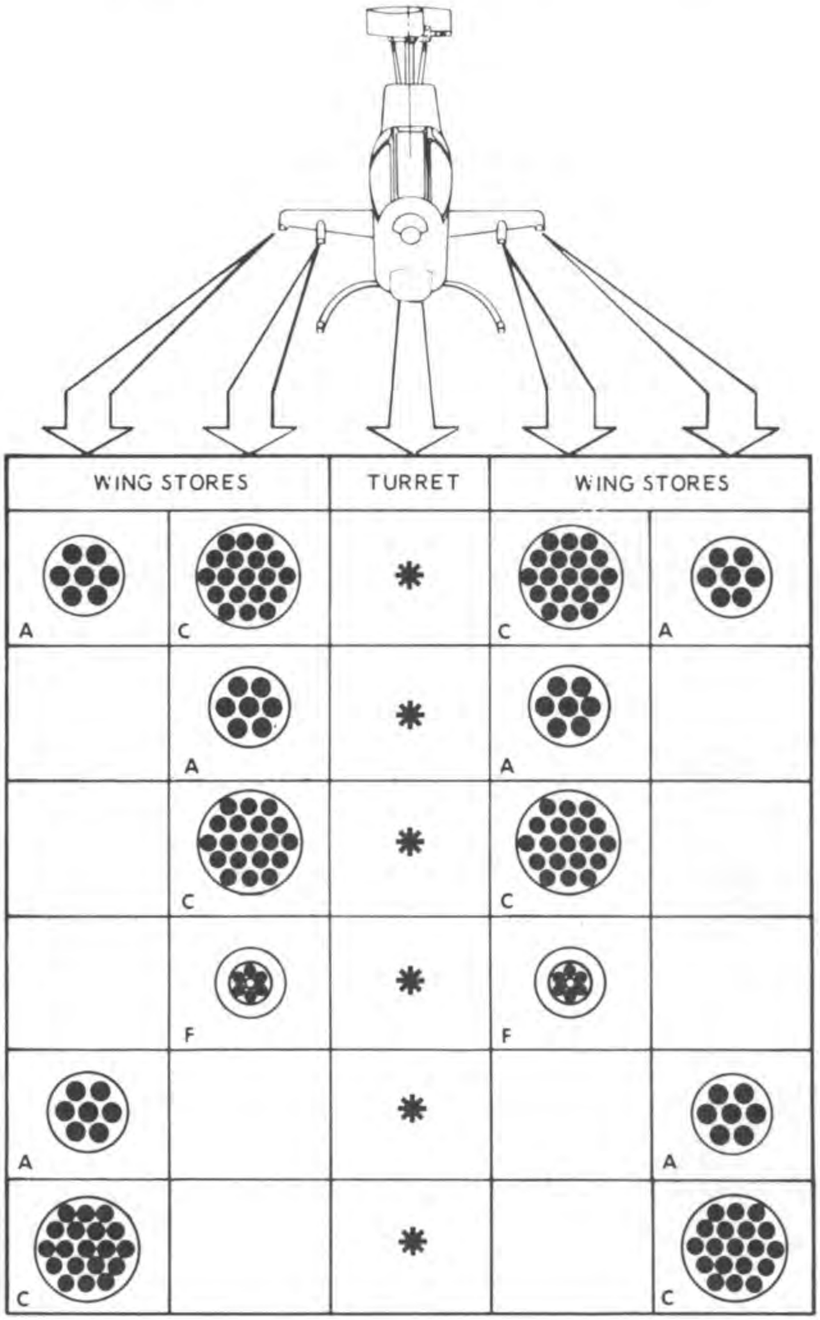
AV 089025.1

Figure 6-32. Authorized armament configuration (Sheet 1 of 4)

AH-1G AUTHORIZED ARMAMENT CONFIGURATIONS



Note

XM 118 grenade launcher may be used on outboard pylons or in conjunction with outboard stores in all configurations

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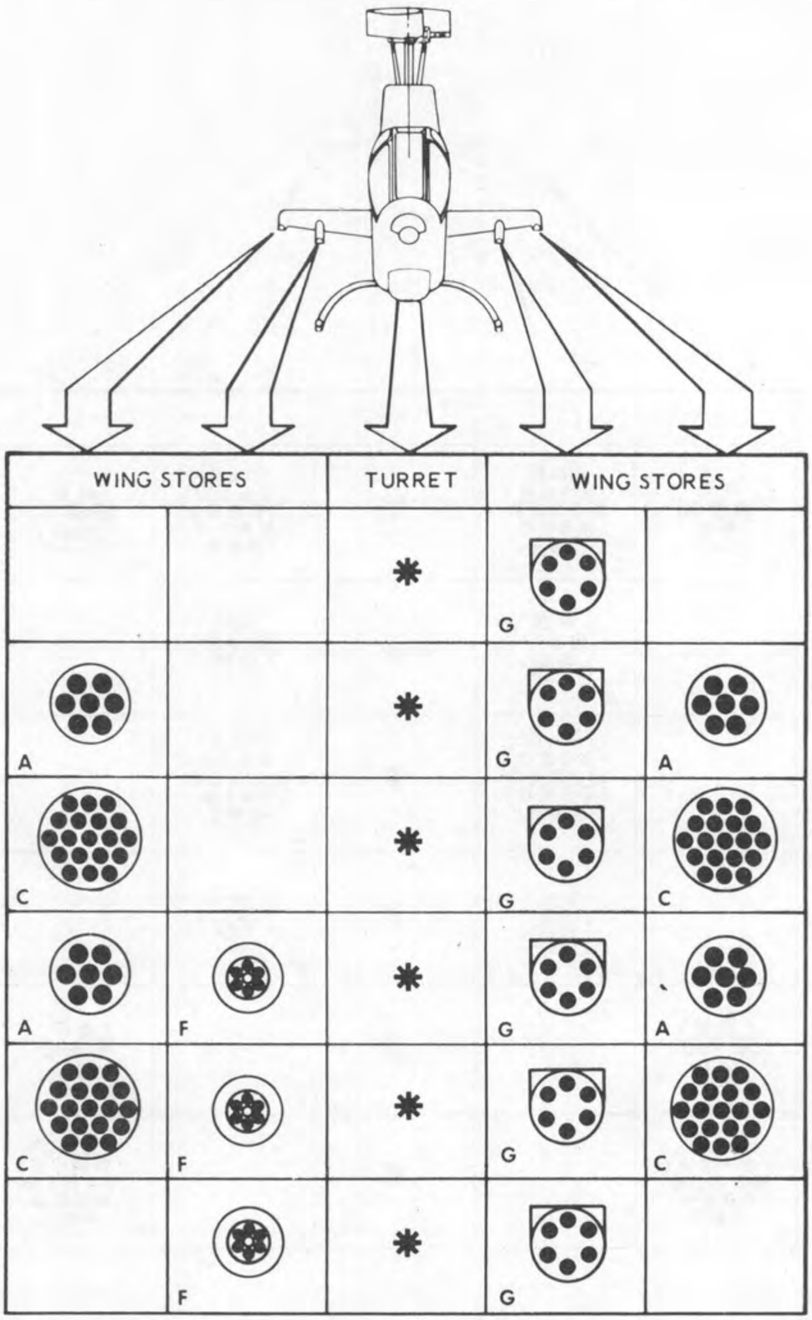
AV 089025.2

Figure 6-32. Authorized armament configuration (Sheet 2 of 4)

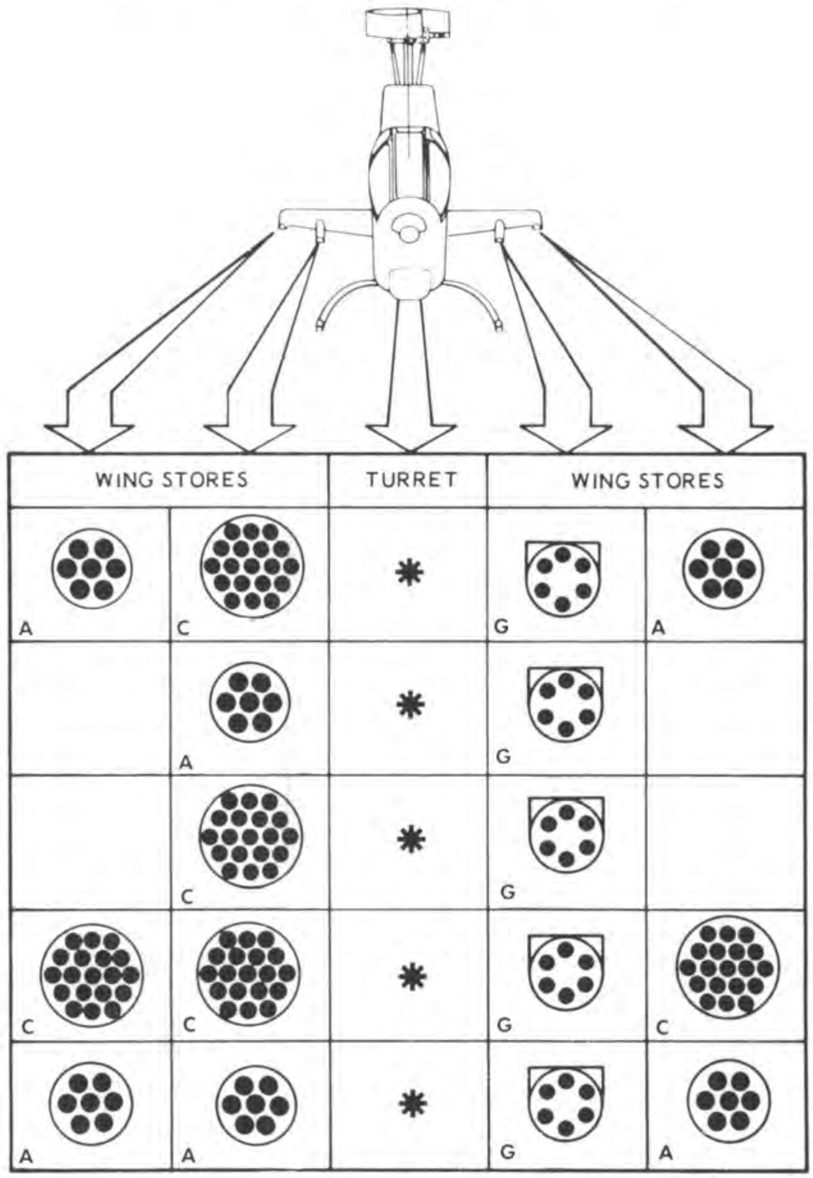
AH-1G AUTHORIZED ARMAMENT CONFIGURATIONS



209071-229-3A
AV 089025.3

Figure 6-32. Authorized armament configuration (Sheet 3 of 4)

AH-1G AUTHORIZED ARMAMENT CONFIGURATIONS



Note

XM-118 grenade launcher may be used on outboard pylons or in conjunction with outboard stores in all configurations.

209071-229-4
AV089025.4

Figure 6-32. Authorized armament configuration (Sheet 4 of 4)

CHAPTER 7

OPERATING LIMITATIONS

Section I. INTRODUCTION

7-1. General Operating Limitations Data.

All important limitations that must be observed during normal operations of the helicopter are provided in this Chapter. Limitations that are characteristic only to a specialized phase of operation are not repeated here.

Section II. LIMITATIONS

7-2. Introduction.

The flight and engine limitations set forth in this Chapter are the direct result of numerous flight test programs and actual operation experience. Compliance with these limits will allow YOU, THE PII OT, to safely perform the assigned missions and permit YOU to derive maximum utility from the helicopter, when used for intended purpose. Limits concerning maneuvers and cg limitations are also covered in this Chapter. Close attention must be given to the instrument markings, since they represent limitations that are not necessarily repeated in the text. The operating limits decal (figure 7-1) will serve as a constant reminder during operation.

7-3. Minimum Crew Requirements.

CAUTION

The minimum weight for each crew station is 170 pounds or equivalent loading.

The minimum crew requirements for the tactical helicopter consists of only the pilot. The pilot can control all fire power from the aft cockpit. For better fire power coverage and control however, the mission should carry a gunner and a pilot. With a gunner the flexible capability of the turret gun can be employed.

OPERATING LIMITS

DENSITY ALTITUDE FEET 324 RPM	AIRSPEED KNOTS XM159 W/O	AIRSPEED KNOTS XM159 WITH
SL–3000	190	180
6000	174	156
9000	150	132
12000	126	108
15000	102	84

REDUCE AIRSPEED IF VIBRATION EXCESSIVE

209070-11A
AV 052980

Figure 7-1. Operating limits decal

7-4. Instrument Markings.

The operating ranges for both the helicopter and engine are shown on figure 7-2.

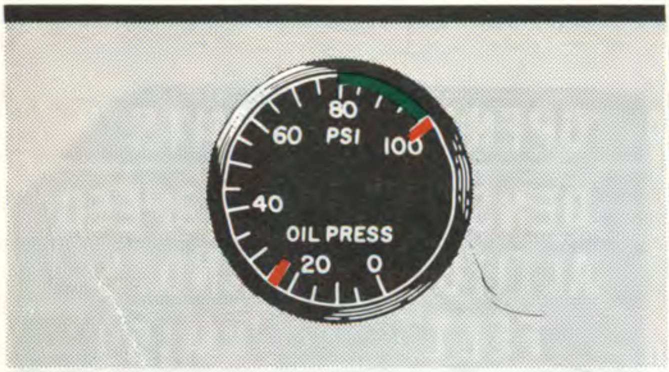
INSTRUMENT MARKINGS

TRANSMISSION OIL TEMPERATURE

110 C Maximum

FUEL PRESSURE

5 to 30 PSI Continuous Operation

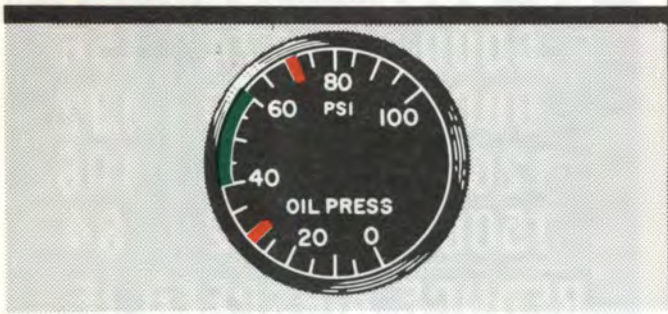


ENGINE OIL PRESSURE

25 PSI Minimum

80 to 100 PSI Continous Operation

100 PSI Maximum



TRANSMISSION OIL PRESSURE

30 PSI Minimum

40 to 60 PSI Continuous Operation

70 PSI Maximum

ENGINE OIL TEMPERATURE

93°C Maximum below 30°C Ambient

100°C Maximum above 30°C Ambient

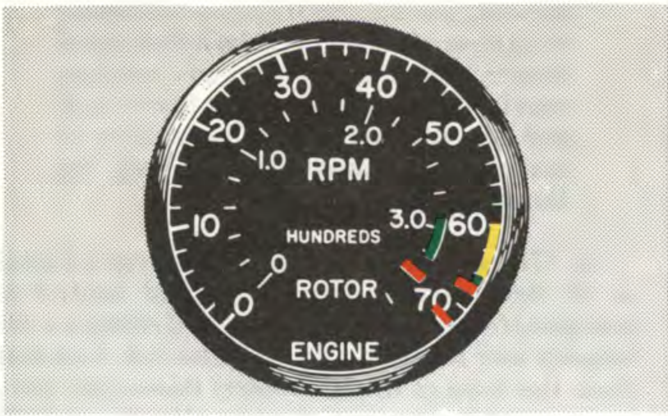
NOTE

When operating in a steady state engine oil-in temperature of 100°C, above 30°C ambient, the temperature and time shall be logged on DA Form 2408-13. Inspections for "OIL OVER TEMPERATURE LIMITS" shall be accomplished in accordance with TM 55-2840-229-24.

FUEL GRADE
JP-4 or JP-5

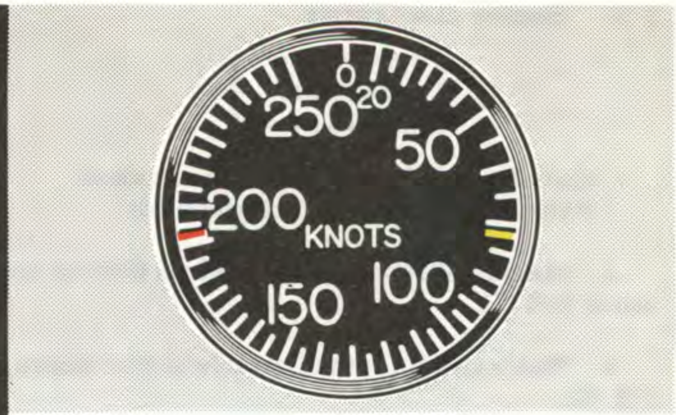
209078-12-1G
AV 052981.1

Figure 7-2. Instruments markings (Sheet 1 of 2)

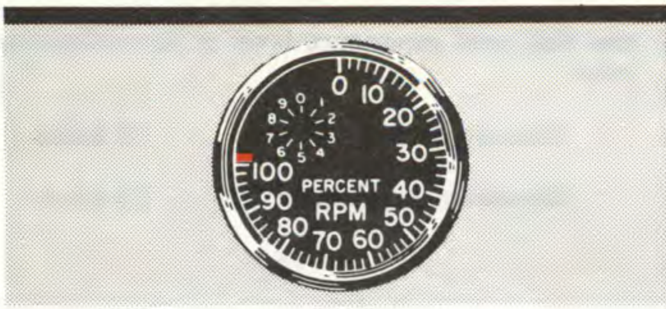


ROTOR TACHOMETER
- 294 to 324 RPM Continuous Operation
- 339 RPM Maximum for Autorotation

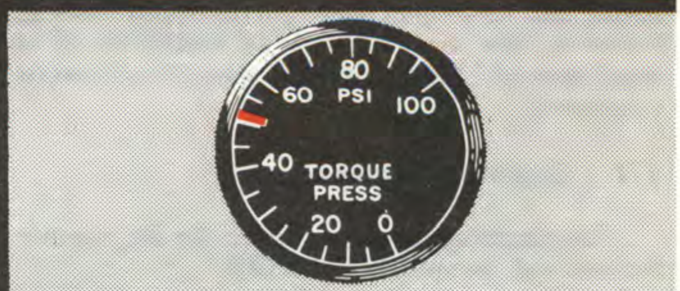
ENGINE TACHOMETER
- 6000 to 6400 RPM 0 - 70 Knots
- 6400 to 6600 RPM Continuous Operation
- 6600 RPM Maximum



AIRSPEED
- Above 70 Knots - 6400 RPM Minimum
- 190 Knots Maximum



GAS PRODUCER TACHOMETER
- 101.5 Percent Maximum



TORQUE PRESSURE
- 50 PSI Maximum

EXHAUST TEMPERATURE
(6 probe Thermocouple)
- 400°C to 610°C Continuous Operation (normal power)
- 610°C to 625°C 30 Minute Limit (military power)
- 675°C 5 Second Limit for Starting and Acceleration.
- 760°C Maximum for Starting and Acceleration

209078-12-2K
AV 052981.2

Figure 7-2. Instruments markings (Sheet 2 of 2)

7-5. Engine Limitations.

CAUTION

An entry in DA Form 2408-13 is required if the following limits are exceeded:

a. Maximum N2 rpm allowable is 6840 at or below 91% N1.

b. Maximum N2 rpm allowable is 6640 above 91% N1.

c. Maximum transient N2 rpm allowable is 6910 for a maximum of three seconds.

7-6. Engine Rating.

The T53-L-13 gas turbine power plant in this installation is rated to an output torque value equivalent to 1400 hp at 6600 rpm for military rating and 1250 hp at 6600 rpm for normal rating; however, the transmission is restricted to a maximum of 1100 hp at 6600 rpm (50 psi torque pressure).

7-7. Engine Air Screens.

The maximum speed at which the Engine Air Screens can be open is 100 KIAS.

7-8. Rotor Limitations.

The normal operating range of the main rotor is 294 to 324 rpm and is marked on the dual tachometer as a green arc on the face of the instrument. Autorotation main rotor speed shall not exceed 339 rpm. Main rotor speeds in excess of 339 rpm shall be recorded in DA form 2408-13.

7-9. Airspeed Limitations.

a. The maximum forward indicated airspeeds are shown on figure 7-3.

b. The maximum permissible airspeed in steady state autorotation is 120 KIAS.

CAUTION

With relative wind velocities between 10 and 18 knots at relative azimuth angles between 210 and 330 degrees (clockwise from nose of helicopter), the helicopter is directionally unstable and requires rapid and sometimes large directional and longitudinal control excursions to maintain heading and correct for disturbances.

c. The sideward and rearward airspeed limit is 30 knots except that directional control is marginal for certain combinations of relative wind velocity and azimuth angles (measured clockwise from the nose of the helicopter) dependent upon gross weight, rotor rpm, density altitude, and tail rotor configuration. Figure 7-5 shows the in-ground effect translational flight envelope. This figure shows that value of relative wind velocity, which if exceeded, will result in marginal directional control if the relative wind is from the region of critical azimuth angles.

d. Wind guides. These are designed to serve as a guide only. Prime consideration must be given to the skill and experience level of the individual pilot.

Maximum wind velocity	30 knots
Maximum gust spread	15 knots

NOTE

Gust spreads are not normally reported. To obtain spread, compare minimum and maximum wind velocities.

e. It is recommended that SCAS OFF flight be limited to 100 KIAS and that no operations other than return-to-base or ferry flights be conducted with either lateral or directional SCAS channels inoperative. Additionally, high power settings should be avoided when operating at airspeeds between 60 and 100 KIAS with inoperative lateral and directional SCAS channel because of instability.

7-10. Canopy Doors Limitations.

The canopy doors shall not be opened in winds above 45 knots, or in flight as outlined in emergency procedures in Chapter 4.

7-11. Prohibited Maneuvers.

a. No acrobatic maneuvers permitted.

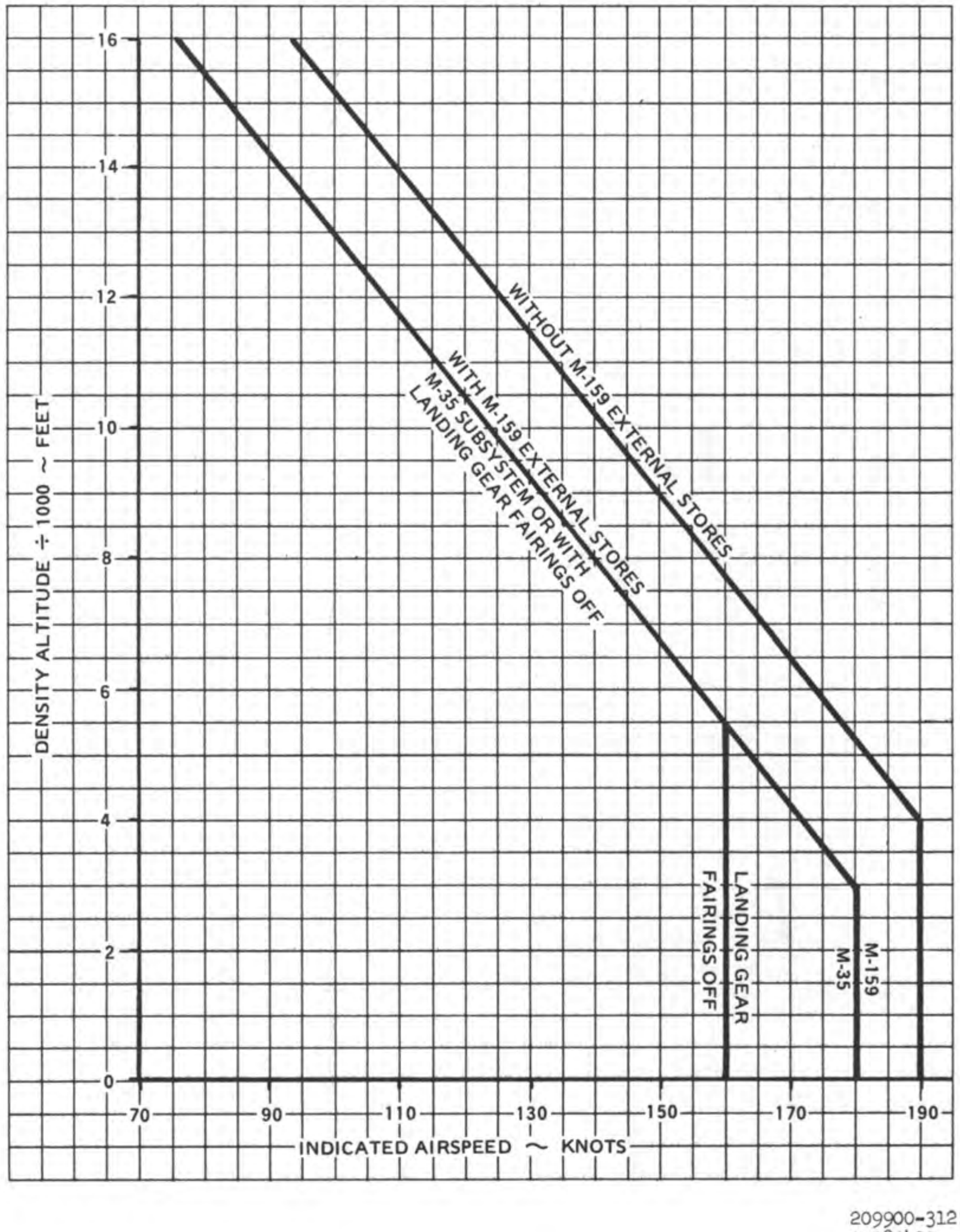


Figure 7-3. Airspeed limitations

b. Excessive rearward flight and downwind hovering are prohibited.

c. The speed for any and all maneuvers shall not exceed the speeds as stated in operating limits decal.

d. Flight near or below zero "g's" is prohibited.

e. Practice autorotations and/or rapid throttle-setting reductions at airspeeds greater than 150 KIAS are prohibited when indicated engine torque pressure is greater than 35 psi.

7-12. Hovering Limitations.

Hovering performance limits for the helicopter are shown in Chapter 14.

7-13. Center of Gravity Limitations.

The maximum center of gravity limitations are: Station 190.0 to Station 201.0 (figure 7-4).

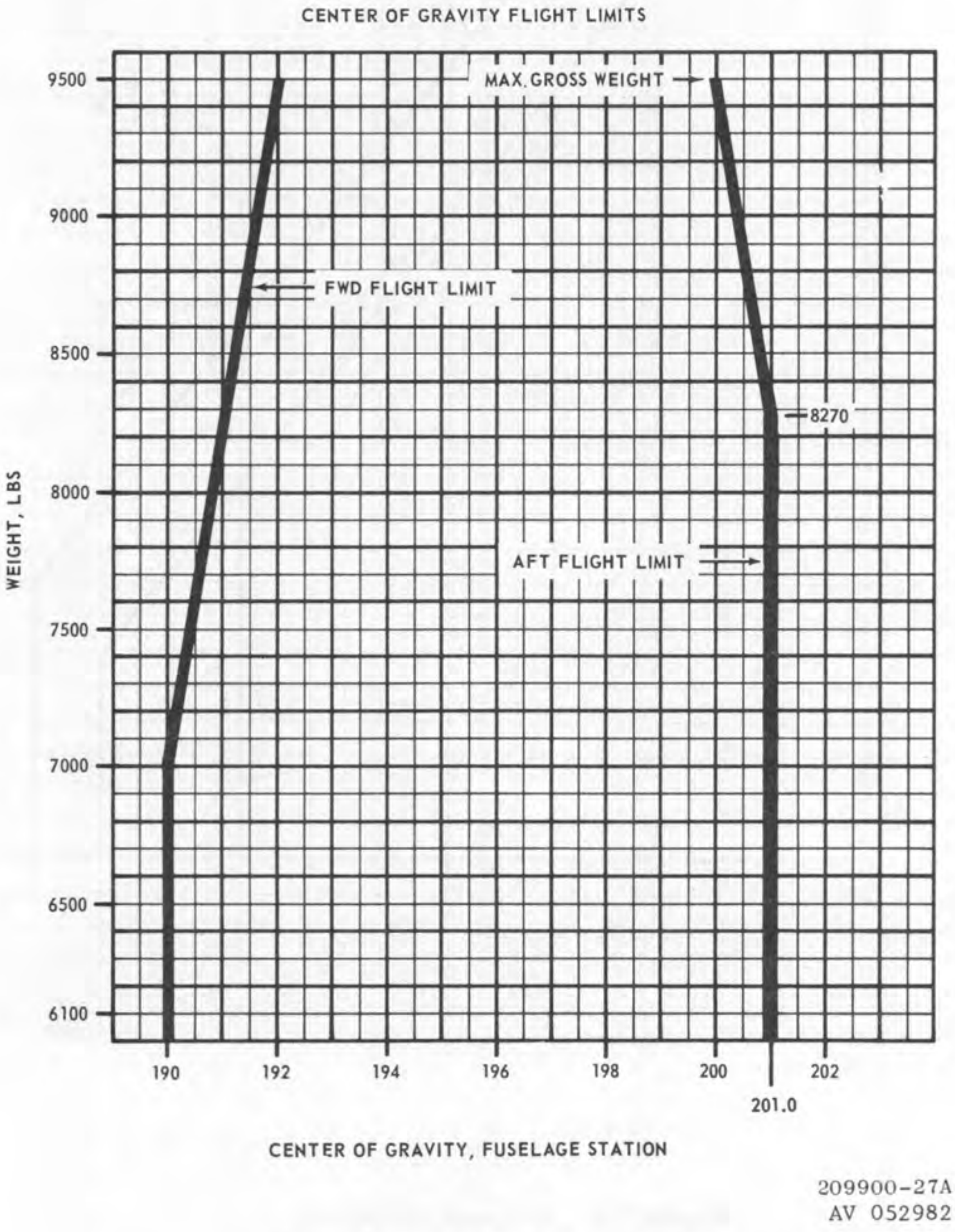


Figure 7-4. Center of gravity limits

7-14. Height Velocity Diagram.

The height velocity diagram (figure 7-6) is based on an extrapolation of test data collected by ASTA on the AH-1G helicopter. The diagram is applicable for all gross weights up to and including 9500 pounds. If an engine failure should occur during operation within the shaded areas, the emergency procedures relating to engine failures in Chapter 4 should be observed.

7-15. Towing Limitations.

Towing the helicopter on the ground handling wheels on unprepared surfaces at gross weight in excess of 9000 pounds will cause permanent set in the aft cross tube.

7-16. Jettisonable Stores with M35.

CAUTION

Pilot should anticipate making a lateral control input after jettison of external stores.

Any AH-1G authorized inboard jettisonable wing store may be carried on inboard right wing station with M35 subsystem. Refer to figure 6-32 for authorized configurations.

7-17. Limitations for Flight Without Wings.

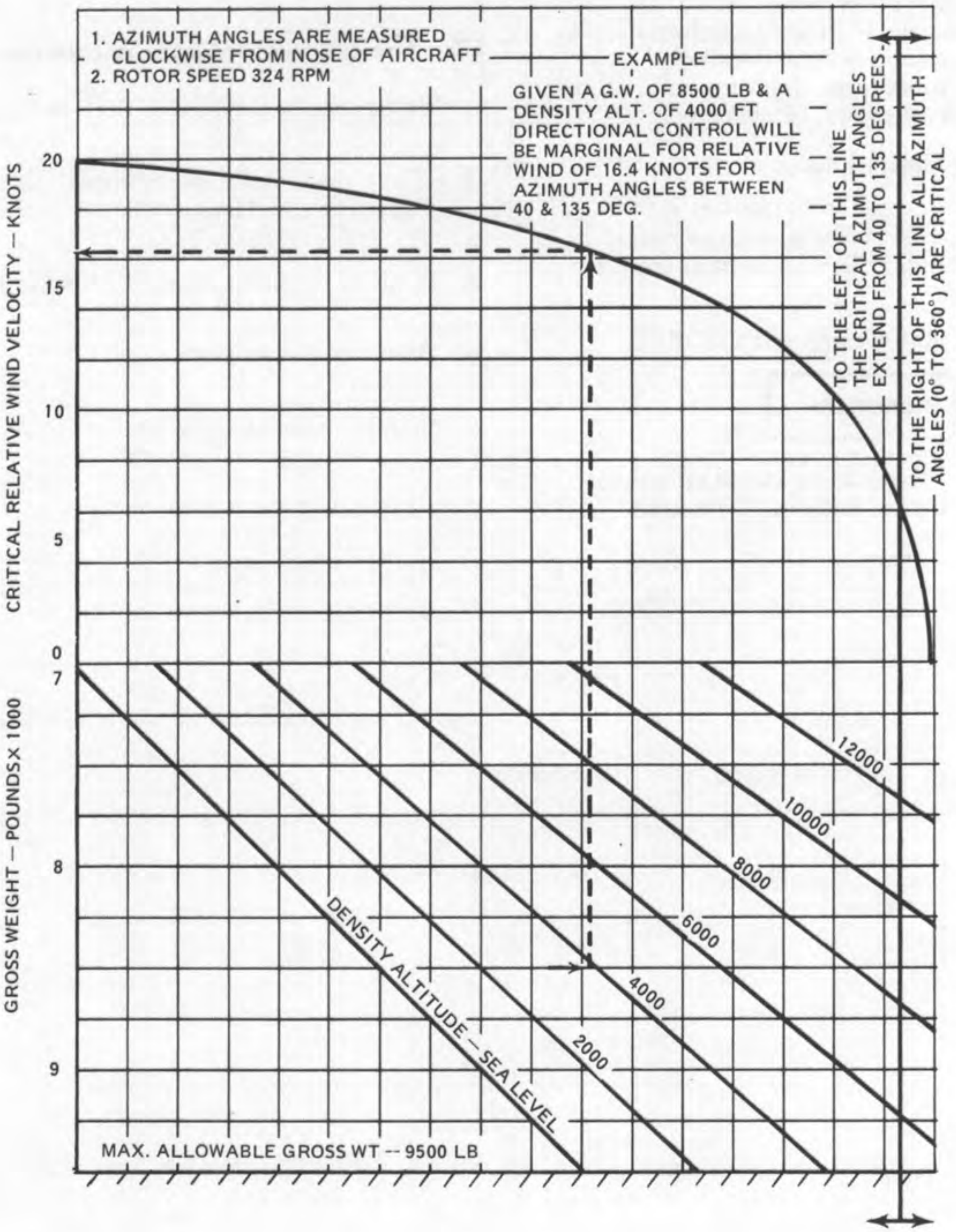
a. CG should be forward to Station 197.0.

b. The maximum permissible indicated forward speed is 130 KIAS.

c. Limit of 30° bank should be held in turns.

d. Avoid excessive yaw.

e. SCAS — should all be on.



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AV 089572

Figure 7-5. In-ground effect translational flight envelope — tail rotor

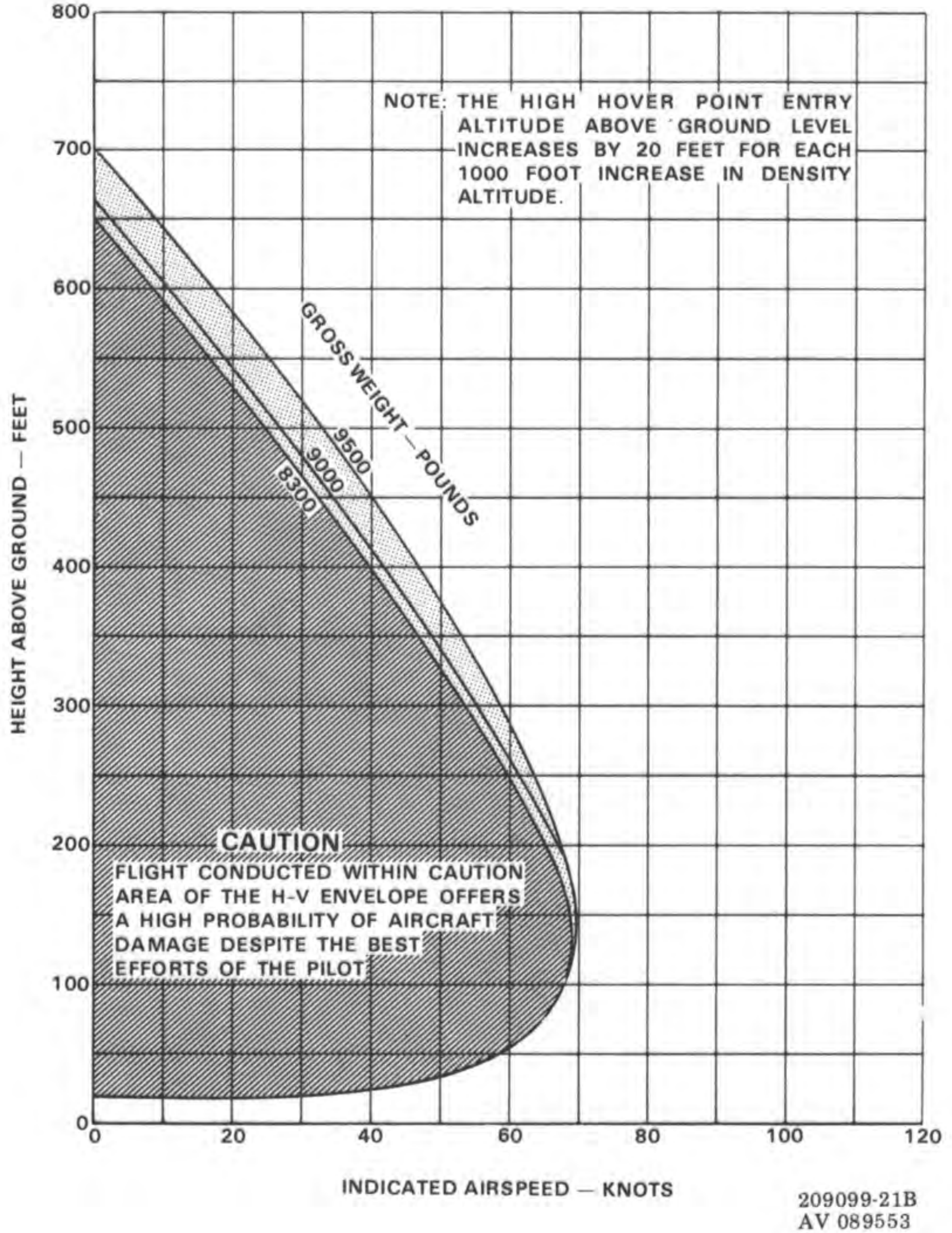


Figure 7-6. Height velocity diagram

CHAPTER 8

FLIGHT CHARACTERISTICS

Section I. INTRODUCTION

8-1. General.

The purpose of this Chapter is to describe the flight characteristics of the helicopter.

Section II. GENERAL FLIGHT CHARACTERISTICS

8-2. Operating Characteristics.

The flight characteristics of this helicopter in general are similar to other single rotor helicopters. The particular noticeable difference is the additional stability in all flight conditions. This stable condition is the result of the stability and control augmentation system (SCAS). The control system, with hydraulic servo assist, provides the pilot with a light force required for control movements. Control feel is induced into the cyclic stick and rudder pedals by means of a force trim system.

8-3. Rotor Blade Stall.

In forward flight some portions of the rotor disk swept by the retreating blade are always stalled. How this stalled area affects the flying qualities depends on the size of the stalled area and the type of rotor system. The size of the installed area increases with increase in gross weight, airspeed, density altitude, "g" loading, or with a decrease in rpm.

For the two-bladed, semi-rigid rotor, the advancing blade minimizes the flapping of the retreating blade as it passes through the stalled region since the blades are rigidly attached to each other through the hub. Since the hub is attached to the mast by see-saw hinge bearings, the rotor cannot transmit hub moments to the fuselage. Therefore, the rolling and pitching motions which are often associated with rotor stall will not occur.

8-4. Rotor Stall — Recognition.

The pilot will notice a progressive increase in vertical vibration level, mostly at 2/rev, as more of the rotor disk is stalled. An increase in any of the above stall inducing factors will result in more 2/rev vibration and eventually the onset of control force feedback. Both the 2/rev vibration and feedback forces will be progressively increased as blade stall affects more of the rotor area. Because of the progressive nature of blade stall with this rotor system, there is no abrupt threshold or onset or rotor stall and no meaningful "stall limit" exists.

The pilot maintains positive control of the rotor as stall progresses and rapid, uncommanded rolling or pitching motions will not be encountered.

8-5. Rotor Stall — Reduction.

The amount of stall and associated vibration encountered may be reduced by reducing the g-level of the maneuver by:

1. reducing collective pitch
2. applying forward cyclic

or by reducing the severity of the rotor operating state by:

1. reducing airspeed
2. increasing operating rpm
3. reducing altitude

Altitude may be gained or lost, depending on the flight condition and technique chosen.

8-6. Control Feedback.

WARNING

The gunners station side arm flight controls are designed for emergency conditions and have a reduced mechanical advantage. Because of this reduced mechanical advantage of the gunners cyclic and collective controls, severe maneuvers should be avoided while flying from the gunners station. If the pilot-in-command elects to allow maneuvers to be flown from the gunners station, he should be sure that the rear seat pilot monitors the flight controls and is capable of recovering if feedback is encountered.

Feedback in the cyclic stick or collective stick is caused by high loads in the control system. These loads are generated during severe maneuvers and can be of sufficient magnitude to overpower or feed through the main boost cylinders and into the cyclic and/or collective stick. The pilot will feel this feedback as an oscillatory "shaking" of the controls even though he may not be making control inputs after the maneuver is established. This type of feedback will normally vary with the severity of the maneuver. The pilot should regard it as a cue that high control system loads are occurring and should immediately reduce the severity of the maneuver.

8-7. Pitch — Cone Coupling.

Pitch cone coupling is the characteristic of the 540 rotor to inherently reduce pitch under loading which aids to maintain rpm and retard blade stall. With severe rotor loading, the rotor rpm may overspeed above the red line unless the pilot adds collective pitch. With the increased speed range and maneuverability of the AH-1G, the pilot should have an increased awareness of this aerodynamic characteristic.

When "g" load is placed upon the rotor system through steep turns, dive recoveries, or other high stress maneuvers, the rotor blades cone upward. Most of the inherent bending action is absorbed by the 540's flexible yoke assembly. As the hub bends, the pitch change horns exert a downward pressure on the pitch control tubes. The control tubes, however, are fixed through the control system and are unable to move. As pressure continues to be applied, the leading edge of the blade begins to rotate downward via the feather bearing. This directly reduces pitch in the blades which in turn acts to increase rotor rpm. As the rotor rpm begins to increase, the N2 governor senses the change and begins to decrease engine power resulting in a corresponding decrease in torque and N1. When performing "g" maneuvers maintaining a constant torque setting is of prime importance in preventing overspeeding of the rotor.

8-8. Rotor Capabilities.

Helicopters are capable of delivering a maximum thrust commensurate with rotor transmission engine limitations and the density of the atmosphere in which they are operating. Maximum thrust can be utilized to obtain maximum airspeed, optimum rate of climb, or,at some reduced airspeed, the maximum maneuver potential. The pilot may employ the capabilities of the helicopter within maximum limitations and in accordance with the environment under which he is operating.

8-9. Turn Versus "G Load.

During maneuvering turns, an increased "g" load which varies with the angle of bank, is exerted on the helicopter. For instance, at a constant airspeed, a 30° bank will produce 1.15 "g's", a 45° bank 1.4 "g's, a 60° bank 2.0 "g's". This means that during a 60° bank at a constant airspeed, the rotor must furnish 2 "g's" or a lift equal to twice the weight of the helicopter in order to maintain that angle of bank.

8-10. Transient Torque.

Transient torque, although evident in all semirigid single rotor system helicopters, is a phenomenon which is quite pronounced in the AH-1G. With a rapid application of left lateral cyclic a rapid torque increase followed by a decrease will be evidenced. This condition occurs as a result of temporary increased induced drag being placed on the rotor system by the additional pitch in the advancing blade.

With a rapid application of right lateral cyclic a rapid torque decrease followed by an increase will be evidenced. This condition occurs as a result of drag being reduced in the rotor system due to the reduction of pitch in the advancing blade, which temporarily decreases the blades resistance to the air flow. Increasing and decreasing rotor system drag will produce corresponding torque changes due to the fact that the rotor systems requirement for an increase or decrease in power is sensed and subsequently supplied by the fuel control system. As airspeed and severity of the maneuver are increased the transient torque effect is also increased. The pilot should become familiar with this characteristic and form a natural tendency to compensate with collective control to avoid exceeding the helicopter torque and rotor rpm limitations.

8-11. Maneuvering Flight.

CAUTION

During left rolling maneuvers or high power dives, torque increases occur. To prevent main transmission over torque, care must be exercised in monitoring torque pressure to enable the pilot to reduce power as required to prevent over torque conditions.

When performing maneuvers above 120 KIAS, it is necessary to devote more attention to flying and to planning maneuvers due to the increased distance needed to perform pull outs and turns. The increased distance required for pull outs and turns is a direct result of the higher airspeed.

8-12. Radius of Turn.

At airspeeds above 130 KIAS the radius of turn and rate of closure increases rapidly due primarily to the AH-1G's higher airspeeds. The turn radius is a function of the bank angle ("g" loading) and the square of the airspeed. For any given condition of altitude and weight, where the "g" capability is defined by rotor characteristics the turn radius can be markedly affected by airspeed. The effect of speed can be ascertained by an inspection of figure 8-1. From the examples A and B, it can be seen that for a bank angle of 30° (1.15 "g") the radius of turn is increased by a factor of four when the airspeed is increased form 80 KIAS to 160 KIAS. The same is also true in a dive recovery. Figure 8-2 provides a graphic chart of the turning radius in relationship to airspeed.

8-13. Low G Maneuvers.

WARNING

Flight near or below zero "g's" is prohibited.

Because of mission requirements, it may be necessary to rapidly lower the nose of the helicopter in order to (1) acquire a target (2) stay on a target; or (3) to recover from a pullup. At moderate to high airspeeds, it becomes increasingly easier to approach zero or negative load factors by abrupt forward cyclic inputs. The AH-1G may exhibit a tendency to roll to the right simultaneously with the forward cyclic input; this characteristic being most pronounced when the roll SCAS is disengaged.

WARNING

If an abrupt right roll should occur when rapidly lowering the nose, PULL IN AFT CYCLIC to stop the rate and effect recovery. Left lateral cyclic WILL NOT effect recovery from a well developed right roll during flight at less than one "g" and it may cause severe main rotor flapping. DO NOT move collective or directional controls or disengage the SCAS during recovery.

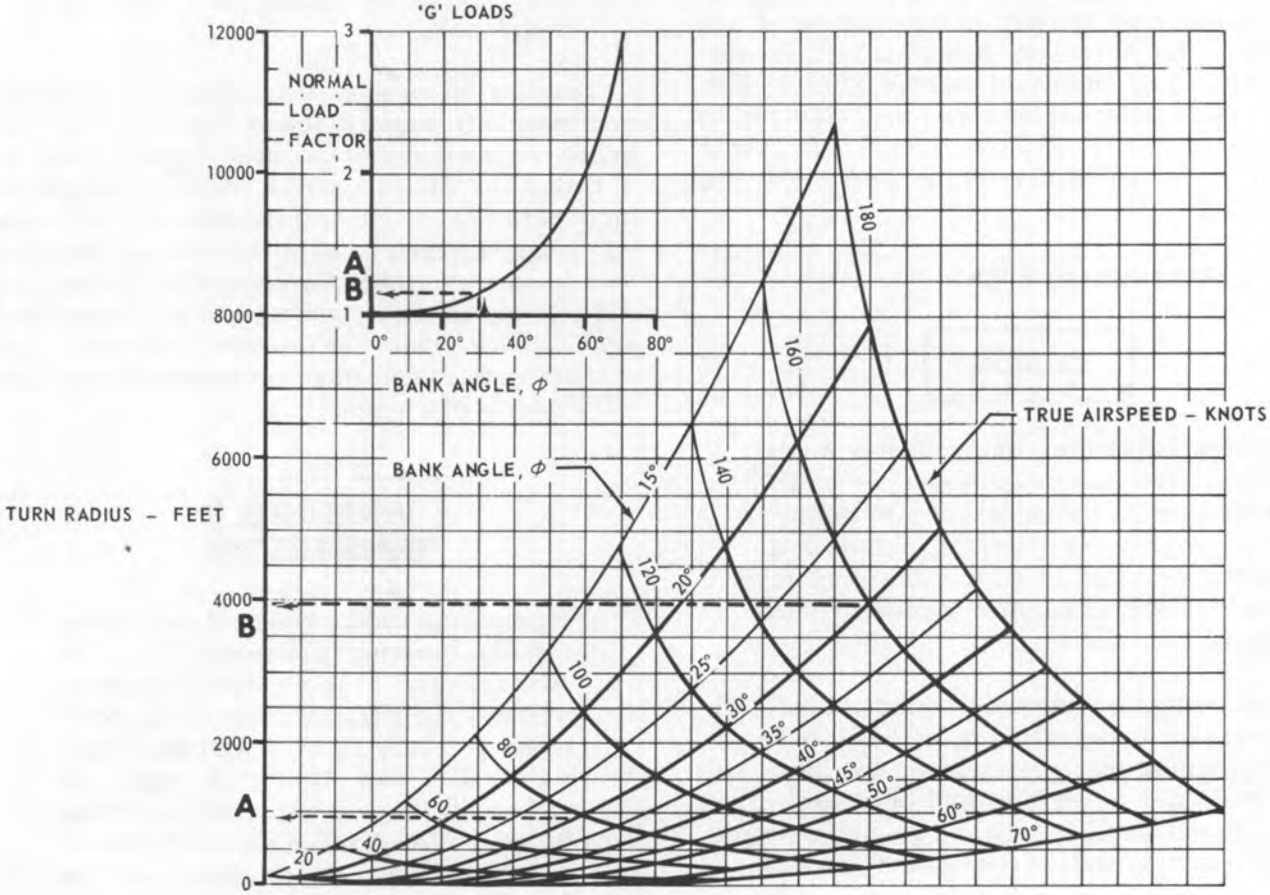
Such things as sideslip, weight and location of wing stores and airspeed will affect the severity of the right roll. Variances in gross weight, longitudinal cg, and rotor rpm may affect the roll characteristics. The right roll occurs throughout the normal operating airspeed range and becomes more violent at progressively lower load factors.

NOTE

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.

TURN RADIUS = $\frac{V^2}{g \tan \phi}$ NORMAL LOAD FACTOR = $\frac{1}{\cos \phi}$

Note This chart gives the turn radius in feet as a function of airspeed and either bank angle or normal load factor. The capability of the aircraft is not inferred by this chart, but trade-off of bank angle versus turn radius are valid.



EXAMPLE **A**

AIRSPEED – 80 KTAS
BANK ANGLE – 30 DEGREES
SOLUTION:
TURN RADIUS – 981 FEET
'G' LOAD – 1.15

EXAMPLE **B**

AIRSPEED – 160 KTAS
BANK ANGLE – 30 DEGREES
SOLUTION:
TURN RADIUS – 3925 FEET
'G' LOAD – 1.15

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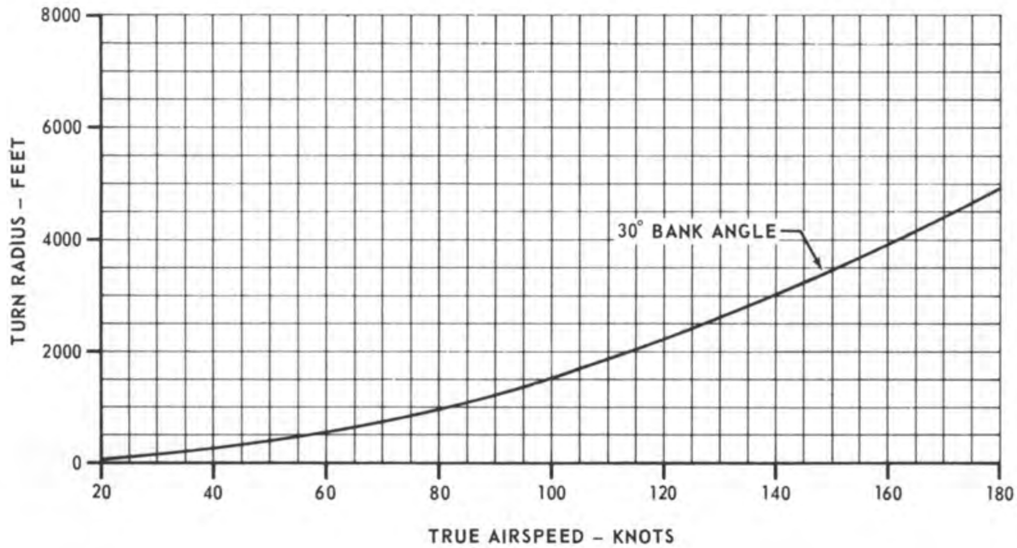
Figure 8-1. Radius of turn

Note

This chart gives the turn radius in feet as a function of airspeed and either bank angle or normal load factor. The capability of the aircraft is not inferred by this chart, but trade-off of bank angle versus turn radius are valid.



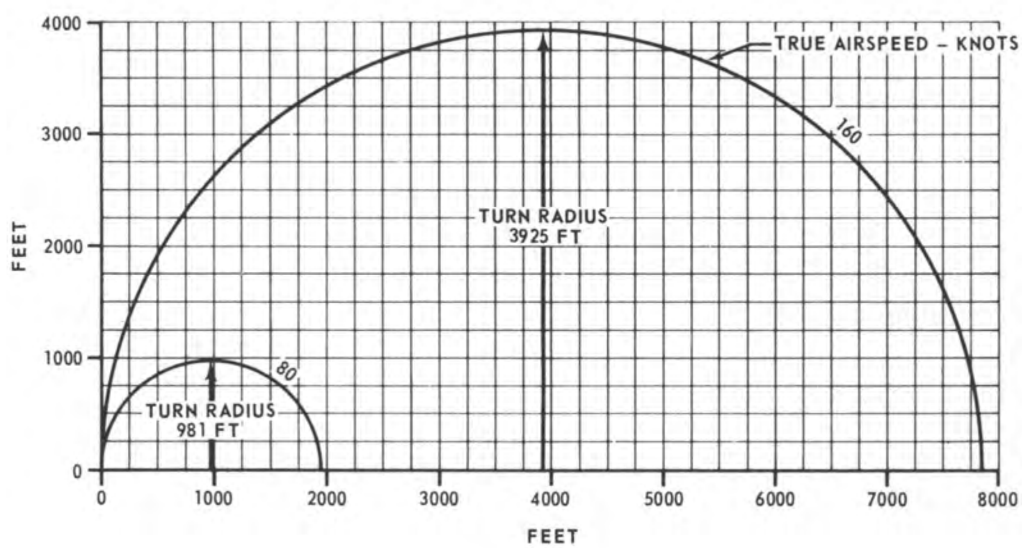


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Figure 8-2. Radius of turn — 30 degree bank

8-14. Diving Flight.

Diving flight presents no particular problems in the AH-1G; however, the pilot should have a good understanding of such things as rates of descent versus airspeed, rate of closure and rates of descent versus power. Because of relatively low drag, the helicopter gains airspeed quite rapidly in a dive and it is fairly easy to exceed the redline. Rates of descent of 3500 ft./min. to 4800 ft./min. are not uncommon during high speed dives. These high rates of descent coupled with the high flight path speeds (320 ft./sec. at 190 KIAS) require that the pilot monitor both rate of closure and terrain features very closely and plan his dive recovery in time to avoid having to make an abrupt recovery. If an abrupt recovery is attempted at speeds near redline airspeed, "mushing" of the helicopter can occur. If mushing is experienced, do not increase collective. Application of increased collective will aggravate condition. Figure 8-3 dipicts the altitude lost during a pull out versus rate of descent for various "g" loadings.

EXAMPLE:

At a rate of descent of 2000 fpm and a "g" loading of 1.2, 125 ft. of altitude is lost in the pull out. (Example A on figure 8-3.)

At a rate of descent of 3750 fpm and a "g" loading of 1.2, 375 ft. of altitude is lost in the pull out. (Example B on figure 8-3.)

In other words, if the dive speed were increased to effect a 1750 fpm increase in rate of descent the altitude lost during the pull out at 1.2 "g" increased by a factor of three.

8-15. Power Dives.

At speeds above the maximum level flight speed, the rate of descent will increase approximately 1000 ft./min. for every 10 knots increase in airspeed for the full power condition. At redline airspeed, the rate of descent will not change appreciably for any torque pressure between 40 and 50 psi.

8-16. Hovering Capability.

Hovering capability is affected by in-ground-effect (IGE), out-of-ground effect (OGE), outside air temperature (OAT), density and pressure altitude, wind speed, engine torque (power available), and gross weight of the helicopter. Hovering IGE performance is better than OGE because during IGE the rotor sets up a current flow between the helicopter and the ground, providing a cushion of air to partially support the helicopter weight. Temperature variations affect engine and rotor performance. Hovering with heavier gross weights or at higher altitudes is possible with lower temperatures and higher wind velocities. Lower temperatures increase engine efficiency and wind represents airspeed; therefore, either condition or both will increase hovering performance due to the ability of the main rotor to provide more lift.

Section III. CONTROL CHARACTERISTICS

8-17. Level Flight Characteristics.

The level flight characteristics of this helicopter are normal throughout the operating limits range. All control response is immediate and gives positive results.

8-18. Autorotation Characteristics.

Due to the wide speed range capability of the AH-1G, it is felt that some discussion of the POWER OFF characteristics of the rotor system is essential.

8-19. Main Rotor.

The following steps explain the necessity of maintaining rotor rpm in its normal range (294 to 339).

a. Normal Rotor Speed. The normal rotor speed assures the pilot that he will retain adequate control effectiveness. Low rpm (underspeed) causes a proportional loss of response to control inputs. High rpm (overspeed) can cause structural damage to the rotor system.

b. Rotor Flapping. The angle between the tip path plane and the mast increases at low rpm. By maintaining rotor rpm in the normal range, the pilot assures safe clearance between the rotor and the tailboom.

c. Rotor Inertia. Rotor inertia is a characteristic which tends to prolong the effectiveness of collective control in the autorotation landing. This effectiveness decreases

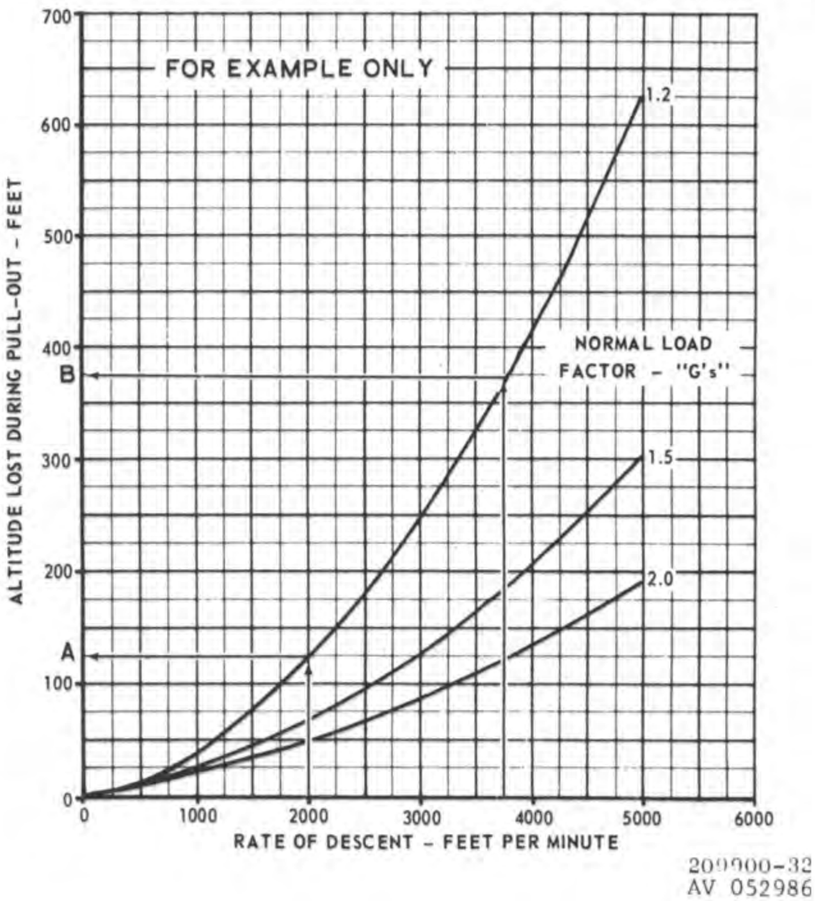

Figure 8-3. Dive recovery distance

with rpm. Normal rotor rpm assures the pilot that he will have normal inertia and normal collective control response with which to arrest the sink rate in the autorotation landing.

8-20. Rotor RPM.

The following steps list the factors which affect power-off rotor rpm.

a. Airspeed. In autorotation, rotor rpm varies with airspeed. Maximum rotor rpm is achieved at a steady state of 60 to 80 KIAS. (Figure 8-4) Rotor rpm decreases at stabilized airspeeds above or below 60 to 80 KIAS range. When changing airspeeds cyclic movement will produce a rotor rpm other than that produced under steady state conditions as follows:

(1) From Low Airspeed. Example: From a stabilized 30 KIAS autorotative condition, a positive forward cyclic movement to increase airspeed will cause the rotor rpm to decrease initially and then increase when the helicopter is stabilized at the higher speed.

(2) From High Airspeed. Example: From a stabilized 120 KIAS autorotative condition, a positive aft cyclic movement to decrease airspeed will cause the rotor rpm to increase initially and then decrease when the helicopter is stabilized at the lower speed.

NOTE

The maximum permissible steady state autorotation airspeed is 120 KIAS.

b. Gross Weight. The power-off rpm varies significantly with gross weight. A low gross

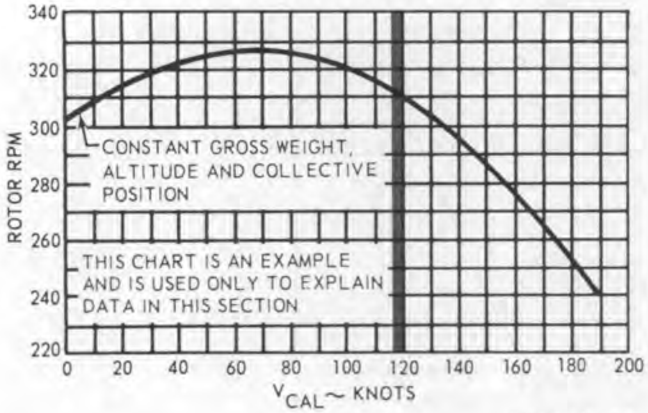

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Figure 8-4. Main rotor RPM versus airspeed

weight will produce a low rotor rpm. A high gross weight will produce a high rotor rpm. With the collective system correctly rigged to a minimum blade angle (full down collective stick) of approximately 8.5° the pilot must manually control rpm with collective stick in order to prevent overspeeding of the rotor when at high gross weight.

NOTE

The minimum blade angle rigging is dictated by the minimum autorotation rpm requirement (295) when at light gross weight and low altitude (figure 8-5).

c. Density Altitude. The power-off rotor rpm varies with altitude; low altitude — low rpm; high altitude — high rpm (figure 8-6). For the same flight conditions as in paragraph b. above, the pilot will find that the higher the altitude — the higher the collective stick position required to prevent overspeed of the rotor.

d. Cyclic Flare. Aft cyclic control application (nose up pitching) produces an increase in rotor rpm proportional to the flare and entry speed. The higher the speed — greater the flare effectiveness. From a high speed entry condition, a steep flare can produce an overspeed unless limited by collective pitch control.

8-21. Pilots Technique.

It can be readily seen from the information, that the pilots technique must vary in accordance with the actual conditions of airspeed, altitude, and gross weight at the time of engine failure.

8-22. Rollover Characteristics.

WARNING

If the helicopter exceeds a bank angle which requires full lateral cyclic control to maintain roll attitude with one skid on the ground, lateral skidding and loss of control may occur.

CAUTION

When landing or taking off, with thrust (lift) approximately equal to the weight and one skid on the ground, keep the helicopter trimmed and do not allow helicopter rates to build up. Fly the helicopter smoothly off (or onto) the ground carefully maintaining trim.

During normal or slope takeoffs and landings with some bank angle or side drift and with one skid on the ground, the helicopter may pivot about this skid. Depending on the helicopter vertical and lateral center of gravity location, crosswinds, pedal inputs, and direction of roll, a critical bank angle may be reached which requires full lateral cyclic control to maintain roll attitude. This critical bank angle will be reduced if roll rate and acceleration are opposed.

Beyond this critical angle, marginal roll control may be maintained with collective and/or pedal inputs. However lateral skidding due to insufficient friction between the skid and the ground will limit the effectiveness of this means of control.

When performing maneuvers with one skid on the ground, care must be taken to keep the helicopter trimmed, especially laterally. For example, if a slow takeoff is attempted and the tail rotor thrust contribution to rolling moment is not

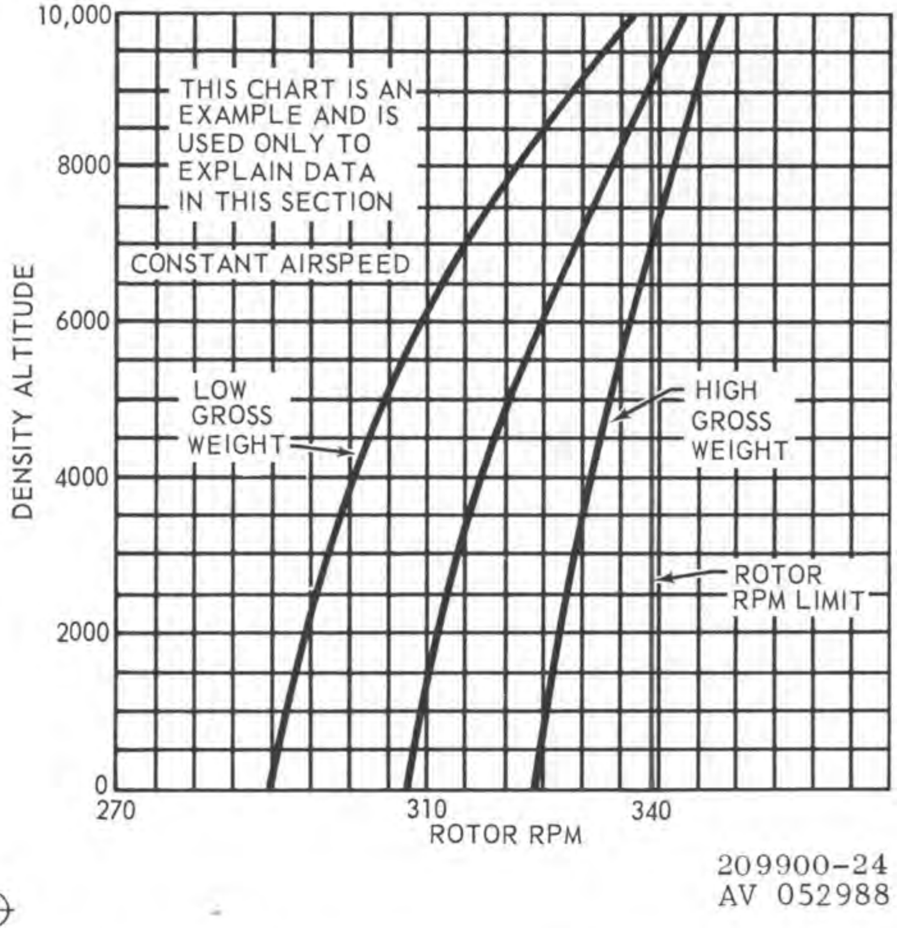

Figure 8-5. Main rotor rpm versus gross weight and altitude

trimmed out with cyclic, the critical recovery angle will be exceeded in less than two seconds. Control can be maintained if the pilot maintains trim, does not allow helicopter rates to become large, and keeps the bank angle from getting too large. The pilot must fly the helicopter into the air smoothly keeping excursions in pitch, roll, and yaw low and not allowing any untrimmed moments.

When performing normal takeoffs, and landings on relatively level ground with one skid on the ground and thrust (lift) approximately equal to the weight, carefully maintain the helicopter position relative to the ground with the flight controls. Perform maneuvers smoothly and keep the helicopter trimmed so that no helicopter rates build up, especially roll rate. If the bank angle starts to increase to a large angle (5° to 8°) and full corrective cyclic does not reduce the angle, reduce collective to reduce the unstable rolling moment caused by the thrust (lift) vector.

When performing slope takeoff and landing maneuvers, follow the published procedures, being careful to keep roll rates small. Slowly raise the down slope skid to bring the helicopter level and then lift off. (If landing, land on one skid and slowly lower the down slope skid.) If the helicopter rolls to the up slope side (5° to 8°), reduce collective to correct the bank angle and return to level attitude and then start the takeoff procedure again.

Collective is much more effective in controlling the rolling motion than lateral cyclic because it reduces the main rotor thrust. A smooth, moderate collective reduction of less than approximately 40% (at a rate less than approximately full up to full down in two seconds) is adequate to stop the rolling motion with about two degrees bank angle overshoot from where down collective is applied. Care must be taken to not dump collective at too high a rate as to cause fuselage-rotor blade

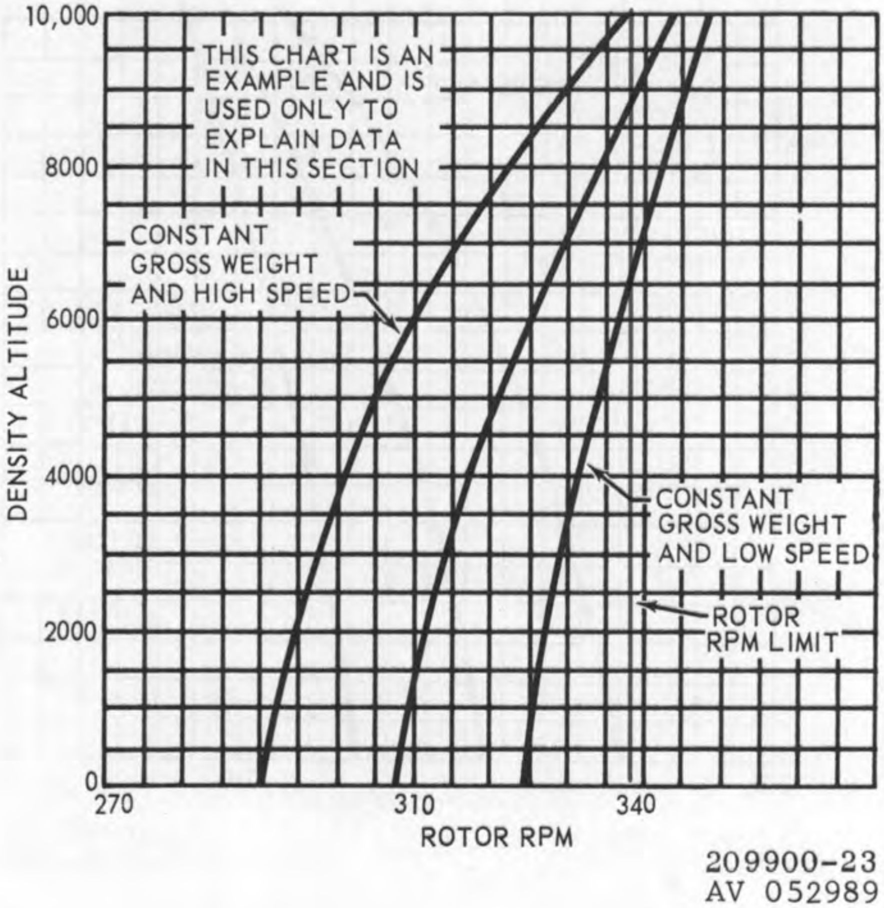

Figure 8-6. Main rotor autorotative rpm versus altitude and airspeed

contact. Additionally, if the helicopter is on a slope and the roll starts to the up slope side, reducing collective too fast creates a high rate in the opposite direction. When the down slope skid hits the ground, the dynamics of the motion can cause the helicopter to roll about down-slope skid and over on its side. Do not pull collective suddently to get airborne as a large and abrupt rolling moment in the opposite direction will result. This moment may be uncontrollable.

CHAPTER 9

SYSTEM OPERATION

(Not Applicable)

CHAPTER 10

WEATHER OPERATIONS

Section I. INTRODUCTION

10-1. General Weather Operation Instructions.

The purpose of this Chapter is to provide information relative to operations during various weather conditions, including instrument flight, night flying, cold weather operation, high altitude operation, flight through ice and rain, hot weather operation, and turbulence and thunderstorm operation.

Section II. INSTRUMENT FLIGHT PROCEDURES

10-2. General.

This helicopter is not IFR qualified.

NOTE

Instrument flight is prohibited except when warranted by the tactical situation. The following procedures may be used for tactical mission instrument flight.

Instrument flights should be carefully planned, keeping in mind that icing conditions, turbulent air, and thunderstorms will greatly affect the flight. Except for some repetition which is necessary for continuity of thought, the instrument flight procedures contain only the procedures that differ or are in addition to normal procedures covered in other sections.

10-3. Preflight and Ground Checks.

Perform the normal preflight inspections, including the night flight checks, as outlined in the normal operating instructions in Chapter 3. Particular attention should be paid toward proper operation of flight instruments, navigation equipment, external and internal lighting, defrosters, pitot heat, generator, inverters, and engine ice protection.

NOTE

Ground check of the engine ice protection system is accomplished by pulling the anti-ice (engine) circuit breaker and determining a rise in the engine EGT. If possible, set and check altimeters for error before engine start. After engine start, note the decrease in altimeter reading induced by rotor downwash effect. This decrease will be approximately 20 feet with a collective pitch setting of 15 pounds torque.

10-4. Instrument Takeoff.

The attitude indicator, heading indicator, and torque meter are primary for instrument takeoffs. By use of these instruments, along with the following procedures, ITO's are easily accomplished.

a. After positioning the helicopter on a level or near level surface and into the wind, set helicopter heading selector marker to top of the heading indicator and adjust the horizon bar of the attitude indicator so that the miniature airplane will appear approximately two bar widths above the horizon bar.

WARNING

The airspeed and vertical speed indicators and altimeter are unreliable below 25 knots KIAS because of rotor downwash effect on the pitot static system. During takeoff, do not rely on these instruments until the airspeed indicator reads at least 25 KIAS. The time required to reach this speed will be approximately seven seconds.

b. With a steady, smooth motion apply collective pitch until five pounds of torque more than that required for hovering is obtained. As the helicopter leaves the ground, position the cyclic so that the miniature airplane will appear one to two bar widths below the horizon bar with the wings level.

c. The takeoff attitude (miniature airplane one to two bars below horizon) and power setting (five psi plus hovering power) is to be maintained until the airspeed approaches the desired climbing airspeed, then adjust the climbing attitude (miniature airplane on the horizon bar and in a wing level attitude). As climbing airspeed and attitude are attained, the power (collective pitch) should be adjusted to result in a 500 fpm rate of climb. Higher rates of climb may be used for extended climbs.

10-5. Instrument Climb.

These helicopters handle well in climbs and climbing turns. After desired rate of climb and IAS are reached no change should be made to collective pitch setting unless the airspeed changes more than five KIAS or vertical velocity more than 100 fpm. Turns should be made utilizing the attitude indicator to obtain the recommended 15° angle of bank which approximates a standard rate turn of three degrees per second. Any pitch attitude corrections should not exceed one bar width. The angle of bank should never exceed 20°.

10-6. Instrument Cruising Flight.

Upon establishing the desired cruise speed, the attitude indicator should be set for a nose level indicaiton. Thereafter, any pitch or bank corrections should be made utilizing the attitude indicator. Pitch corrections should not exceed one bar width. The recommended angle of bank for cruising turns is 15° and should not exceed 20°.

NOTE

The attitude indicator should never be reset in flight except to align the miniature airplane with the horizon bar. The adjustment is to be always made in straight and level flight at recommended cruise speed.

The range chart (long range-cruise speed) airspeeds are recommended for IFR cruise except when penetrating turbulence.

10-7. Communications and Navigation Equipment.

There are no unusual transmitting or reception characteristics that render this equipment unreliable for instrument flight.

10-8. Normal Descents.

Enroute descent to traffic altitude can be initiated and maintained without difficulty using the following procedures.

a. Before commencing the descent, check and reset if necessary, the attitude indicator for a nose level indication with the helicopter in straight and level flight at the recommended cruise speed.

b. To establish the descent, reduce the torque to set up a 500 fpm rate of descent and maintain recommended cruise airspeed, angle of bank, and pitch attitude. During the descent the miniature airplane will remain on the horizon bar. Higher rates of descent may be used for extended descents and approaches.

NOTE

In general, below 7000 feet density altitude, a reduction of one pound of torque will increase the rate of descent approximately 100 fpm.

10-9. Autorotative Descent.

Autorotations are used for emergencies (loss of engine, etc.) only. The following procedures are for establishing and conducting autorotations on instruments.

a. Reduce collective pitch to maintain desired rotor rpm.

b. Assume a one-bar-width,nose-high attitude, and maintain directional control. Approximately a one-bar-width, nose-high attitude will give 70 KIAS, which should be maintained until visual ground contact is made. As soon as the autorotation is established and the helicopter under positive control, complete the Engine Failure During Flight, Chapter 4, checklist. During the descent limit the angle of bank in turns to 15 degrees.

10-10. Holding.

100 KIAS is recommended for holding. Maximum endurance airspeeds of 55 to 65 KIAS to achieve minimum fuel flow are not recommended due to the poor instrument handling qualities at these airspeed.

For all pitch and bank corrections, utilize the attitude indicator. Do not exceed a one bar width pitch correction for minor altitude changes and limit the angle of bank in turns of 15°. It is best not to make a collective pitch change unless the airspeed varies more than ± 10 knots indicated.

10-11. Instrument Approaches.

Before commencing the approach have the attitude indicator properly set (i.e., miniature airplane on horizon bar at a straight and level cruise speed).

For all pitch and bank corrections, utilize the attitude indicator. Do not exceed a one bar width pitch correction for minor altitude changes and limit the angle of bank in turns to 15°.

During the descent phase of an approach, make rate of descent corrections with the cyclic pitch by reference to the attitude indicator. Allow the airspeed to vary ± 10 knots during these corrections before making a collective pitch adjustment.

AIRSPEED

Pattern	100 KIAS
Descent	100 KIAS

10-12. Missed Approach.

A missed approach is executed at the missed approach point by applying power and establishing a normal climb.

10-13. Night Flying.

Night flying presents many of the same problems as instrument flying, plus additional problems introduced by illumination of the instruments and crew compartment and exterior reflections.

For night takeoffs and approaches, set searchlight approximately 15° "down" from horizontal. This will give the pilot a reference point during takeoff and also light the approximate touchdown area following a normal approach. During takeoffs, climbs, and approaches, use the searchlight as desired to check the intended flight path for obstructions.

NOTE

Night landings can be made with the navigation lights on steady if the searchlight is inoperative. However, exercise extreme caution, since the navigation lights do not furnish sufficient illumination for depth perception until just before touchdown.

Section III. COLD WEATHER OPERATIONS

10-14. Cold Weather.

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 walk-around inspection when temperatures have been at or below 0°C (32°F). Water and snow may have entered many parts during operation 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. Protection covers afford majority 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 a blowing snow or freezing rain. Accumulation of snow and ice should be removed 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 system. The pilot should be particularly attentive to the main and tail rotor systems and their exposed control linkages.

CAUTION

If temperatures are -44°C (-47°F) or below, the pilot must be particularly careful to monitor his engine instruments for too high oil pressure.

NOTE

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. If found frozen, apply heat to thaw the couplings before attempting to start the engine. Indication of proper operation is obtained by turning the main rotor blade opposite to the direction of rotation while observer watches the driveshaft to see that there is no tendency for the transmission to "wobble" while the driveshaft is turning.

b. Electronic Equipment. The proper functioning of radio equipment in the Arctic is of primary importance because of the large areas of unmapped territory and the poor check points, even in mapped areas. Although in general, radio equipment gives little additional trouble at low temperature, pilots and maintenance personnel should be aware of a few conditions and phenomena which at some time may affect their safe passage over rugged, uninhabited terrain. Radio fadeouts occur periodically in the Arctic and are caused by solar explosions and sun spot activity. The accepted theory is that the sun emits electrified particles which produce heavy ionization on reaching the earths atmosphere. The ionized blanket disrupts radio ceilings everywhere, but particularly in the polar regions. Fadeouts may last for several weeks. As these are referable to sun spots activity, they may be forecast. Short term fadeouts caused by solar explosions, similar to the detonation of atom bombs, may occur in the Arctic during both daylight and darkness. The atmospheric disturbance is revealed about eight minutes after a solar explosion. The fadeout conditions last for 15 minutes to several hours and cannot be forecast. Radios are unserviceable and communication leading to rescue may be delayed. Do not interpret these fadeouts as faulty equipment. At temperatures below 0°C (+32°F), the efficiency of the equipment is affected by decreasing temperatures.

c. Checks.

(1) Before Exterior Check — 0°C (+32°F) and lower. Perform check as specified in Chapter 3.

(2) Exterior Check — 0°C (+32°F) to -54°C (-65°F). Perform exterior check as outlined in Chapter 3, plus the following checks.

CAUTION

Check that all surfaces and controls are free of ice and snow.

NOTE

Contraction of the fluids in the helicopter systems at extreme low temperature 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 upper surface free of ice, frost, and snow.

(b) Engine Air Inlet — Remove all loose snow that could be pulled intoandblock the engine intake during starting.

(3) Interior Check — all flights — 0°C (+32°F) to -54°C (-65°F). Peform check as outlined in Chapter 3.

(4) Interior Check — Night Flights — 0°C (+32°F) to -54°C (-65°F). External Power Connected. Perform check as specified in Chapter 3.

(5) 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 inelt housing will free a frozen rotor. Perform check as outlined in Chapter 3.

NOTE

During cold weather starting the engine oil pressure gage will indicate maximum (100 psi). The engine should be warmed up at flight 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.

(6) Engine Runup Check. Perform the check as outlined in Chapter 3.

WARNING

Controls 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. Improved Capability. The cold weather capability has been improved in this helicopter with the installation of a nickel-cadmium battery which, because of its partial immunity to low temperatures, can be used to start engine at temperatures down to -30°C (-22°F). The operator is cautioned that a battery start should only be attempted if the battery is fully charged and that the safety margin for starting is increased if the battery has been warmed.

e. Emergency Engine Starting Without External Power Supply. If a battery start must be attempted when the helicopter and battery has been cold-soaked at temperatures between -26°C to -37°C (-15°F to -35°F), 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 in reaching a self-sustaining speed (40 percent N1) in the least possible time.

10-15. Snow.

a. Takeoff. Snow takeoff from an airbase may be considered normal except for the following precautions that should be observed.

WARNING

Under cold weather conditions, make sure all instruments have been warmed up sufficiently to ensure normal operation. Check for sluggish instruments before takeoff.

(1) Select an area that is free of loose or powdery snow to minimize the restriction to visibility from blowing snow.

WARNING

Pilots of helicopter with barrier filter or fine mesh screen installed will exercise extreme caution during ground operation in loose snow. Snow and ice accumulation during ground operation may be detrimental to the engine and hazardous to the helicopter and operation. Ground operation time should be minimized and filter assemblies should be inspected prior to takeoff.

(2) Before attempting to takeoff make sure the landing gear skids are free and not frozen to the surface.

(3) The first takeoff after a cold start should include a visual check of the ground surface for evidence of hydraulic leaks. This should be done under hovering power conditions. If hydraulic leaks are present further flight should be aborted.

b. Landing — Snow — Airbase. Snow landing at an air base may be considered normal except for the following precautions that should be observed:

(1) Select an area free of loose or powdery snow so that visibility will not be restricted by blowing snow.

(2) Accomplish a normal landing with a minimum hover before touchdown. Limited visibility will result from swirling snow, when hovering is attempted before making a touchdown.

c. Landing — Snow — Strange Area.

(1) Anticipate loose powdery snow and crusts on all landings on snow.

(2) Landings should always be made when visual ground reference can be maintained. The reference point should be kept forward and to the right so that it will be visible to the pilot at all times.

NOTE

When making an approach and landing on snow it should be one continuous operation without extended hover in order to reduce the white-out condition that results from extended hovering over snow. This white-out will usually occur on loose snow and can cause the pilot to lose all reference with the ground or any object he is approaching. If the object being used as reference should become completely obscured, accomplish a go-round.

d. Evaluation of Strange Area Snow Landing Site. Landing may often be necessary in areas other than operational airbases. In addition to the basic factors in landing site evaluation, factors pertinent to snow landings are outlined in this paragraph.

(1) The pilot should have knowledge of the type of terrain under the snow(bush, marsh land, tundra, etc.).

(2) The snow depth is usually less in clear areas where there is little drifting snow effect. Clean areas normally form gentle swells with the crests of these swells usually crusted. The heaviest crust will generally be found on the upwind side of the crests.

(3) Deep snow is usually found in the valleys and to the 'lee'. These areas are suitable for landing and takeoffs if caution is exercised.

10-16. High Altitude.

a. Determine the density altitude for the area into which the flight is intended and compute maximum gross weight at which a hover may be possible.

b. Determine the existing and forecast wind conditions whenever possible.

c. Insofar as practicable, plan the flight to avoid known and probable areas of turbulence.

d. Engine Starting. (Refer to Chapter 3.)

e. Takeoff. The takeoff should be made to obtain airspeed and altitude simultaneously. The takeoff should begin with a slow acceleration to obtain translational lift, followed by a gradual increase in power and airspeed until a normal climb is attained.

f. Inflight Operations.

(1) All turns should be shallow. Avoid turns close to the ground.

(2) Control movements should be gentle.

(3) Sufficient altitude should be maintained to allow for any emergency keeping in mind the high rate of autorotational descent associated with high altitudes.

(4) Forward airspeed should be limited to prevent blade stall, which is preceded by blade "buffeting".

(5) Avoid areas of known turbulence such as the base of clouds, the 'lee' side of mountains, and steep canyons.

g. Descent.

(1) All descents should be gradual. Under no circumstances should a high rate of descent be allowed to develop.

(2) Caution should be used during descents to maintain a safe airspeed. Increasing the airspeed above normal approach speed can cause the rate of descent to increase very rapidly. Low airspeed may also result in a high rate of descent, and when the nose is lowered in recovery the condition is aggravated.

(3) Power applications should be anticipated because the gas turbine engine does not respond at high altitudes as rapidly as at lower elevation.

h. Landing. All approaches to landings should be planned and performed in an area of suitable level ground.

CAUTION

Practice autorotations at high altitudes should be made only to prepared landing areas, even when a power recovery is anticipated. Power recoveries should not be initiated below 400 to 500 feet altitude depending upon helicopter weight and field elevation, due to a combination of slow engine acceleration characteristics, high rotor blade angle of attack and accompanying drag, and the probability of encountering a high rate of descent. The presence of these factors make a quick power recovery impossible. The altitude at which safe power recovery should be initiated increases with helicopter gross weight and/or field elevation.

i. Autorotation. Autorotations at high altitudes are characterized by higher rates of descent and less effective collective pitch control available to cushion the landings.

NOTE

Approximately 70 KIAS should be maintained during autorotation. At an altitude of 75 to 85 feet, decelerate to decrease airspeed and rate of descent. At approximately 10 to 15 feet, a small amount of pitch should be applied with the helicopter still in a deceleration attitude. Maintain approximately 20 to 25 KIAS forward speed to further decrease the rate of descent. The helicopter should then be leveled and sufficient collective pitch should be used to cushion the landing.

Section IV. DESERT AND HOT WEATHER OPERATION

10-17. Hot Weather.

Operations when outside air temperatures are above standard conditions, do not require any special handling technique or procedures, other than closer monitoring of oil temperatures and EGT.

10-18. High Ambient Temperatures.

At very high ambient temperatures, the helicopter loses efficiency with high gross weights

Section V. TURBULENCE AND THUNDERSTORMS OPERATION

10-19. Turbulence And Thunderstorms.

Flight in thunderstorms and heavy rain which accompanies thunderstorms should be avoided. If turbulence and thunderstorms are encountered inadvertently, use the following procedures.

a. Check that safety belts and harnesses are tightened.

b. Pitot heat — ON.

c. Power — Adjust to maintain a penetration speed of 100 KIAS.

d. Radios — Turn volume down on any radio equipment badly affected by static.

e. At night — Turn interior lights to full bright to minimize blinding effect of lightning.

10-20. In the Storm.

a. Maintain a level attitude and constant power setting. Airspeed fluctuations should be expected and disregarded.

b. Maintain the original heading, turning only when necessary.

c. 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.

NOTE

The turbulence penetration speed is 100 KIAS.

Section VI. ICE AND RAIN OPERATION

10-21. Icing Conditions.

CAUTION

To preclude the possibility of icing, it is recommended that the engine particle separators be removed when it is anticipated that the helicopter will be flown under atmospheric conditions conducive to icing.

CAUTION

Continuous flight in light icing conditions is not recommended because the ice shedding induces rotor blade vibrations, adding greatly to the pilots work load.

a. During flight in icing conditions, the pilot can expect one or all of the following to occur.

(1) At any temperature below freezing, a low frequency main blade vibration, caused by asymmetric self-shedding ice.

(2) To maintain airspeed, the torque must be increased.

(3) An increase in engine egt.

CAUTION

When operating within visible moisture and outside air temperatures of 4.4° C or below, icing of the engine air inlet screens can be expected. Ice accumulation on the inlet screens is indicated 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 sand and dust separator or on the FOD screen.

10-22. Rain.

Maintenance personnel are required to perform special inspections of the tail rotor and sand and dust separator after the helicopter has been operated in rain. The pilot must make an entry on DA Form 2408-13 after a flight has been conducted in rain.

CHAPTER 11

CREW DUTIES

Crew duties are listed in Chapters 3 and 6.

CHAPTER 12

WEIGHT AND BALANCE COMPUTATIONS

Section I. INTRODUCTION

12-1. General.

This chapter contains sufficient instructions and data so that the pilot, knowing the basic weight and moment of the helicopter, can compute any combinations of weight and balance.

No computers are provided for the helicopter, hence no computer instruction is included.

Section II. GENERAL

12-2. Introduction.

This chapter contains explanations of Chart C — Basic Weight and Balance record DD Form 365C (the source of the basic weight and moment); Chart E — Loading Data, Charts and Graphs; and a practical example of a loading problem using weight and balance clearance form, DD Form 365F.

NOTE

For the purpose of clarity, Model AH-1G helicopters are in Class I category. Additional directives governing weight and balance of Class I aircraft are contained in Army Regulations 95-16.

Section III. CHART EXPLANATIONS

12-3. Chart C — Basic Weight and Balance Record.

a. History. Chart C (DD Form 365C) is a continuous history of the basic weight and moment resulting from structural and equipment changes. At all times the last weight and moment/constant entry is considered current weight and balance status of the basic helicopter.

b. Use. At time of delivery of a new helicopter, the manufacturer entered the basic weight and moment/constant of the individual helicopter. This chart becomes a part of the "G" file of the helicopter. Subsequent additions or subtractions to the basic weight and moment/constant on Chart C are made by the weight and balance technician. Refer to figure 12-1 for a sample of DD Form 365C.

12-4. Chart E — Loading Data.

a. Information. The loading data on Chart E are intended to provide information necessary to work a loading problem for the helicopters to which this manual is applicable.

b. Use. From the loading table contained in Chart E (figure 12-2) weight and moment/constant are obtained for all variable load items are added to the current basic weight and moment/constant (from Chart C) to obtain the gross weight and moment.

(1) The cg of the loaded helicopter is represented by a moment figure opposite the gross weight of the table.

(2) If the helicopter is loaded within the forward and aft cg limits, the moment figure will fall numerically between the limiting moments.

(3) 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 gross weight and moment and checking the new moment with the cg table.

NOTE

This check should be made to determine whether or not the cg will remain within limits during the entire flight.

CHART C—BASIC WEIGHT AND BALANCE RECORD
(CONTINUOUS HISTORY OF CHANGES IN STRUCTURE OR EQUIPMENT AFFECTING WEIGHT AND BALANCE)

FOR USE IN T.O. 1-1B-40, NAVWEPS 01-1B-40 & TM 55-405-9

AIRCRAFT MODEL: AH-1G | SERIAL NO: SAMPLE | PAGE NO:

DATE	ITEM NO. IN	ITEM NO. OUT	DESCRIPTION OF ARTICLE OR MODIFICATION	WEIGHT CHANGE ADDED (+) WEIGHT	ADDED (+) ARM	ADDED (+) MOMENT[1] /100	REMOVED (−) WEIGHT	REMOVED (−) ARM	REMOVED (−) MOMENT[1] /100	RUNNING TOTAL BASIC AIRCRAFT WEIGHT	MOMENT[1] /100	INDEX[2] CG
10-25-61	✓		BASIC HELICOPTER							4722.0	6876.0	145.6
CAMPBELL												
11-15-61	✓		HEATER KIT (CHART A ITEM D-B)	73.0	197	143.1				4795.0	7019.1	146.4
12-29-61		✓	ENGINE L-E06010				480.0	187	897.6			
RUCKER	✓		ENGINE L-E06089	478.0	187	893.9				4820.0	7064.4	146.6

EXAMPLE ONLY

[1] Enter constant used below line
[2] Balance computer index.

DD FORM 1 SEP 54 365C   PREVIOUS EDITIONS OF THIS FORM MAY BE USED UNTIL STOCKS ARE EXHAUSTED   U.S. GOVERNMENT PRINTING OFFICE 1959—O-526970

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Figure 12-1. Sample DD form 365C

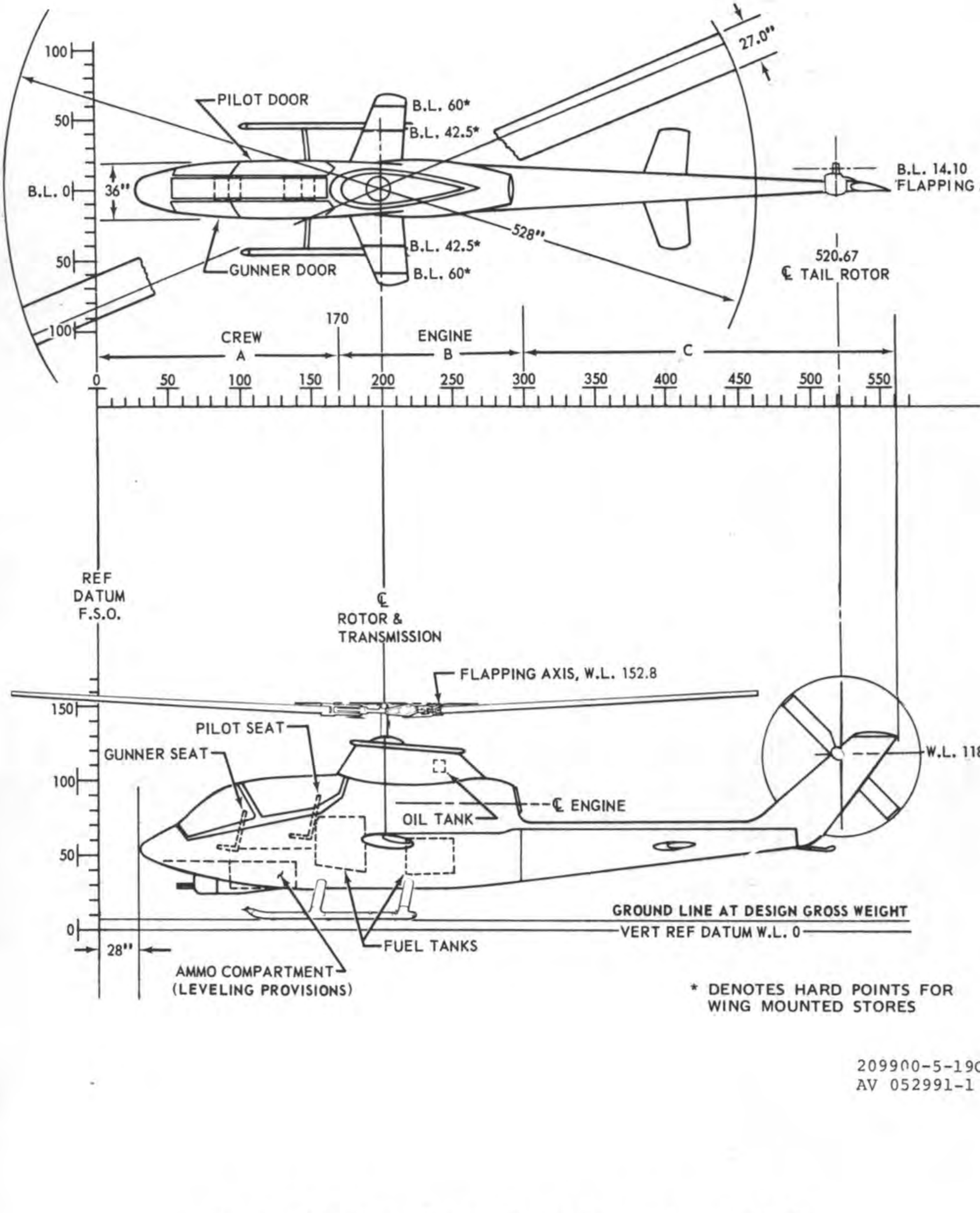
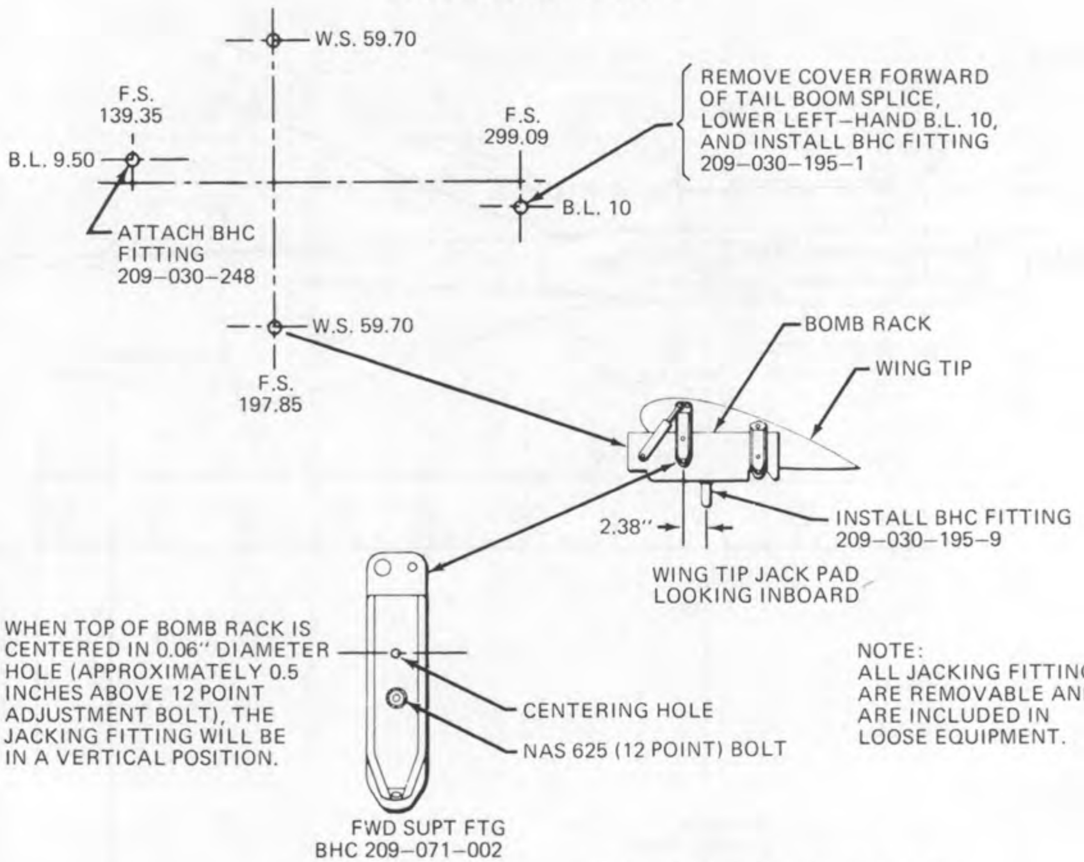


Figure 12-2. Chart E — loading data sheet (Sheet 1 of 18)

JACK PAD LOCATION DATA

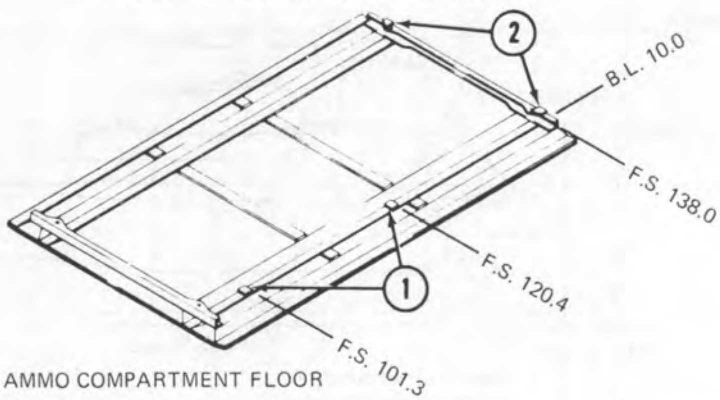


NOTE:
ALL JACKING FITTINGS ARE REMOVABLE AND ARE INCLUDED IN LOOSE EQUIPMENT.

NOTE

USE SCALES ONLY ON THREE JACK PAD LOCATIONS. TWO ON THE WING JACK POINTS AND ONE ON EITHER THE FORE OR AFT JACK POINT, DEPENDING, UPON EMPTY WEIGHT C.G. LOCATION (E.G. IF EMPTY WEIGHT C.G. IS AFT OF F.S. 197.85, USE THE AFT JACK POINT). ALWAYS USE A FOURTH JACK ON THE REMAINING JACK POINT, HOWEVER, ADJUST IT TO CARRY NO LOAD AND AS A PRECAUTION TO PREVENT HELICOPTER FROM FALLING.

HELICOPTER LEVELING PROVISIONS



AMMO COMPARTMENT FLOOR

(1) PADS FOR HORIZONTAL LEVELING LOCATED IN DEPRESSION NEAR LEFT SIDE OF FLOOR. PALLET MUST BE REMOVED

(2) PADS FOR LATERAL LEVELING LOCATED ON TOP OF AFT AMMO PALLET TRACK

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Figure 12-2. Chart E — loading data sheet (Sheet 2 of 18)

STANDARD FUEL LOADING TABLE INTERCONNECTED FUSELAGE TANKS

	JP-4 (6.5 LBS./GAL.)			JP-5 (6.8 LBS./GAL.)		
GAL.	WEIGHT	FUSELAGE STATION	MOMENT/100 ARM VARIES	WEIGHT	FUSELAGE STATION	MOMENT/100 ARM VARIES
10	65	209.0	136	68	209.0	142
20	130	207.7	270	136	207.7	282
30	195	206.5	403	204	206.5	421
40	260	205.5	534	272	205.5	559
50	325	205.0	666	340	205.0	697
60	390	204.6	798	408	204.6	835
70	455	204.4	930	476	204.4	973
80	520	204.2	1062	544	204.2	1111
90	585	204.1	1194	612	204.1	1249
100	650	204.0	1326	680	204.0	1387
110	715	203.9	1458	748	203.9	1525
120	780	203.8	1590	816	203.8	1663
130	845	203.8	1722	884	203.8	1802
140	910	203.7	1854	952	203.7	1939
150	975	203.7	1986	1020	203.7	2078
160	1040	203.6	2117	1088	203.6	2215
170	1105	203.6	2250	1156	203.6	2354
180	1170	203.6	2382	1224	203.6	2492
190	1235	203.5	2513	1292	203.5	2629
200	1300	203.5	2646	1360	203.5	2768
210	1365	203.5	2778	1428	203.5	2906
220	1430	203.4	2909	1496	203.4	3043
230	1495	203.2	3038	1564	203.2	3178
240	1560	201.8	3148	1632	201.8	3293
250	1625	200.5	3258	1700	200.5	3409
260	1690	199.3	3368	1768	199.3	3524
270	1755	198.1	3477	1836	198.1	3637

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Figure 12-2. Chart E — loading data sheet (Sheet 3 of 18)

CRASHWORTHY FUEL LOADING TABLE INTERCONNECTED FUSELAGE TANKS

	JP-4 (6.5 LBS./GAL.)			JP-5 (6.8 LBS./GAL.)		
GAL.	WEIGHT	FUSELAGE STATION	MOMENT/100 ARM VARIES	WEIGHT	FUSELAGE STATION	MOMENT/100 ARM VARIES
10	65	207.8	135	68	207.8	141
20	130	208.1	271	136	208.1	283
30	195	207.0	404	204	207.0	422
40	260	206.2	536	272	206.2	561
50	325	205.6	668	340	205.6	699
60	390	205.3	801	408	205.3	838
70	455	205.0	933	476	205.0	976
80	520	204.8	1065	544	204.8	1114
90	585	204.6	1197	612	204.6	1252
100	650	204.5	1329	680	204.5	1391
110	715	204.4	1461	748	204.4	1529
120	780	204.4	1594	816	204.4	1668
130	845	204.3	1726	884	204.3	1806
140	910	204.3	1859	952	204.3	1945
150	975	204.2	1991	1020	204.2	2083
160	1040	204.2	2124	1088	204.2	2222
170	1105	204.1	2255	1156	204.1	2359
180	1170	204.1	2388	1224	204.1	2493
190	1235	204.1	2521	1292	204.1	2637
200	1300	204.0	2652	1360	204.0	2774
210	1365	204.0	2785	1428	204.0	2913
220	1430	204.0	2917	1496	204.0	3052
230	1495	203.2	3038	1564	203.2	3178
240	1560	201.8	3148	1632	201.8	3293
250	1625	200.4	3257	1700	200.4	3407
260	1690	199.2	3366	1768	199.2	3522
264	1716	198.7	3410	1795	198.7	3567

TANK OIL LOADING TABLE

Gal.	Weight (Lbs)	Moment/100 Sta. 234.1	Gal.	Weight (Lbs)	Moment/100 Sta. 234.1
.5	4	9	2.5	19	45
1.0	8	19	3.0	23	54
1.5	11	26	3.5	26	61
2.0	15	35			

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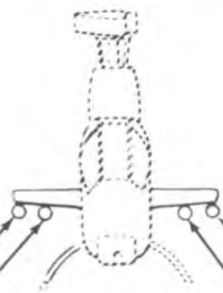
Figure 12-2. Chart E — loading data sheet (Sheet 4 of 18)

TABLE OF MOMENTS FOR PERSONNEL

GUNNER, F.S. 83.0				PILOT, F.S. 135.0			
Weight (Lbs)	Moment / 100	Weight (Lbs)	Moment / 100	Weight (Lbs)	Moment / 100	Weight (Lbs)	Moment / 100
150	125	210	174	150	203	210	284
160	133	220	183	160	216	220	297
170	141	230	191	170	230	230	311
180	149	240	199	180	243	240	324
190	158	250	208	190	257	250	338
200	166			200	270		



NOTES:

1. M157B FULL LAUNCHERS (SEVEN ROCKETS) MAY BE CARRIED ON INBOARD OR OUTBOARD EXTERNAL STORES STATIONS LH AND RH.

2. M158A1 FULL LAUNCHERS (SEVEN ROCKETS) MAY BE CARRIED ON INBOARD OR OUTBOARD EXTERNAL STORES STATIONS LH AND RH.

3. M159C WITH XM229 WARHEAD ROCKETS.

A. LAUNCHERS SER. NO. 004178 AND SUBSEQUENT MAY BE CARRIED ON THE INBOARD EXTERNAL STORES STATIONS LH AND RH WITH A FULL LOAD OF NINETEEN ROCKETS.

B. LAUNCHERS PRIOR TO SER. NO. 004178 ARE RESTRICTED TO A MAXIMUM OF FOURTEEN ROCKETS WHEN CARRIED ON THE INBOARD EXTERNAL STORES STATIONS RH AND LH.

C. ALL LAUNCHERS ARE RESTRICTED TO A MAXIMUM OF TWELVE ROCKETS WHEN CARRIED ON THE OUTBOARD EXTERNAL STORES STATIONS LH AND RH.

D. LAUNCHERS SER. NO. 004178 AND SUBSEQUENT ARE MARKED ON BOTH SIDES WITH 3/4 INCH LETTERS AS FOLLOWS.

LOAD PER APPLICABLE AIRCRAFT INSTRUCTIONS

4. THE M157B OR M158A1 CANNOT BE CARRIED ON INBOARD EXTERNAL STORES STATIONS IN COMBINATION WITH THE M159C OUTBOARD DUE TO SAFE JETTISON CONSIDERATIONS.

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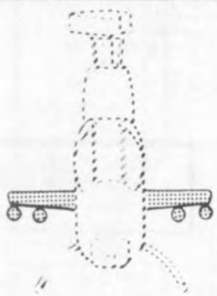
Figure 12-2. Chart E — loading data sheet (Sheet 5 of 18)

INFORMATION PRESENTED IN ARMAMENT TABLES IS BASED ON THE FOLLOWING WEIGHTS:

20MM, LINKED		0.67 LBS./ROUND
7.62MM AMMO, LINKED		0.065 LBS./ROUND
7.62MM AMMO, LINKLESS		0.055 LBS./ROUND
40MM GRENADES, LINKED		0.76 LBS./ROUND
SMOKE GRENADES, WHITE		1.75 LBS. EACH
SMOKE GRENADES, COLORED		1.00 LBS. EACH
2.75 INCH FFAR ROCKETS		
M151 WARHEAD/M423 FUSE	10 LB WARHEAD POINT DETONATING FUSE	20.5 LBS. EACH
M151 WARHEAD/XM429 FUSE	10 LB WARHEAD PROXIMITY FUSE	20.8 LBS. EACH
M229 WARHEAD/M423 FUSE	17 LB WARHEAD POINT DETONATING FUSE	27.9 LBS. EACH
M229 WARHEAD/XM429 FUSE	17 LB WARHEAD PROXIMITY FUSE	28.2 LBS. EACH
WDU-4A/A	FLECHETTE	20.2 LBS. EACH

ARMAMENT TABLES

WING MOUNTED STORES



POD	WEIGHT (LBS)	LOCATION ON WING	
		INBOARD MOM/100	OUTBOARD MOM/100
M157B	67	134	136
M158A1	48	95	97
*M159C	130	259	264
**M159C	152	302	308
M200/A1	139	277	282
M18A1	245	481	NA
M118	17	NA	33

* PRIOR TO S/N 004178
** S/N 004178 AND SUBSEQUENT

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AV 089029

Figure 12-2. Chart E — loading data sheet (Sheet 6 of 18)

CAUTION: SEE WEIGHT LIMITATIONS

M151 WARHEAD/M423 FUSE
10 lb. WARHEAD POINT DETONATING FUSE

ROCKETS (NUMBER)	WEIGHT (LBS)	LOCATION ON WING	
		INBOARD MOM/100	OUTBOARD MOM/100
1	21	41	41
2	41	81	82
3	62	121	123
4	82	161	164
5	103	201	205
6	123	241	246
7	144	281	287
8	164	321	328
9	185	361	368
10	205	401	409
11	226	442	450
12	246	482	491
13	267	522	532
14	287	562	573
15	308	602	614
16	328	642	655
17	349	682	696
18	369	722	737
19	390	762	777

M151 WARHEAD/XM429 FUSE
10 lb. WARHEAD PROXIMITY FUSE

ROCKETS (NUMBER)	WEIGHT (LBS)	LOCATION ON WING	
		INBOARD MOM/100	OUTBOARD MOM/100
1	21	41	42
2	42	82	83
3	62	122	125
4	83	163	166
5	104	203	207
6	125	244	249
7	146	285	290
8	166	325	332
9	187	365	373
10	208	406	415
11	229	447	456
12	250	488	497
13	270	528	539
14	291	569	580
15	312	610	622
16	333	650	663
17	354	691	704
18	374	731	746
19	395	772	787

XM 229 WARHEAD/M423 FUSE
17 lb. WARHEAD POINT DETONATING FUSE

ROCKETS (NUMBER)	WEIGHT (LBS)	LOCATION ON WING	
		INBOARD MOM/100	OUTBOARD MOM/100
1	28	53	54
2	56	106	108
3	84	159	162
4	112	212	216
5	140	265	270
6	167	318	344
7	195	370	378
8	223	423	432
9	251	476	486
10	279	529	539
11	307	582	593
12	335	635	647
13	363	687	701
14	391	740	755
15	419	793	809
16	446	846	863
17	474	899	917
18	502	952	971
19	530	1004	1025

XM 229 WARHEAD/XM429 FUSE
17 lb. WARHEAD PROXIMITY FUSE

ROCKETS (NUMBER)	WEIGHT (LBS)	LOCATION ON WING	
		INBOARD MOM/100	OUTBOARD MOM/100
1	28	54	55
2	56	107	109
3	85	160	164
4	113	214	218
5	141	267	272
6	169	320	327
7	197	374	381
8	226	427	436
9	254	480	490
10	282	533	544
11	310	587	599
12	338	640	653
13	367	693	708
14	395	747	762
15	423	800	816
16	451	853	871
17	479	907	925
18	508	960	980
19	536	1013	1034

*SEE RESTRICTIONS, SHEET 4

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AV 089030

Figure 12-2. Chart E — loading data sheet (Sheet 7 of 18)

WDU-4A/A (FLECHETTE)

ROCKETS (NUMBER)	WEIGHT (LBS)	LOCATION ON WING	
		INBOARD MOM/100	OUTBOARD MOM/100
1	20	40	41
2	40	79	82
3	61	118	122
4	81	158	163
5	101	198	204
6	121	238	245
7	141	277	287
8	162	316	326
9	182	356	367
10	202	396	408
11	222	436	449
12	242	475	490
13	263	515	530
14	283	554	571
15	303	594	612
16	323	633	653
17	343	673	694
18	364	713	734
19	384	752	775

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AV 089031

Figure 12-2. Chart E — loading data sheet (Sheet 8 of 18)

TARGET MARKING SMOKE GRENADE DISPENSER SYSTEM

WHITE SMOKE			COLORED SMOKE		
SMOKE GRENADES (NUMBER)	WEIGHT (LBS)	OUTBOARD POSITION ONLY *MOMENT/100	SMOKE GRENADES (NUMBER)	WEIGHT (LBS)	OUTBOARD POSITION ONLY *MOMENT/100
1	2	4	1	1	2
2	3	7	2	2	4
3	5	10	3	3	6
4	7	14	4	4	8
5	9	17	5	5	10
6	10	21	6	6	12
7	12	24	7	7	14
8	14	28	8	8	16
9	16	32	9	9	18
10	17	36	10	10	21
11	19	39	11	11	23
12	21	43	12	12	25

*MOMENT IS FOR GRENADES LOADED FROM FORWARD POSITION AFT.

7.62MM AMMUNITION FOR M18 GUN POD

7.62MM AMMO. LINKLESS (ROUNDS)	WEIGHT (LBS)	INBOARD WING POSITION ONLY MOM/100	7.62MM AMMO. LINKLESS (ROUNDS)	WEIGHT (LBS)	INBOARD WING POSITION ONLY MOM/100
100	6	11	800	44	89
200	11	22	900	50	100
300	17	33	1000	55	111
400	22	45	1100	61	122
500	28	56	1200	66	134
600	33	67	1300	72	145
700	39	78	1400	77	156
			1500	83	167

209900-5-8B
AV 08y032

Figure 12-2. Chart E — loading data sheet (Sheet 9 of 18)

M35 AMMO (20 MM)
EXTERNALLY MOUNTED

ROUNDS	WEIGHT (POUNDS)	FUSELAGE STATION	MOMENT/100	ROUNDS	WEIGHT (POUNDS)	FUSELAGE STATION	MOMENT/100
28	19	214.5	40	506	339	192.4	652
40	27	213.4	57	530	355	191.3	679
52	35	208.3	73	542	363	190.7	693
62	42	202.6	84	554	371	190.2	706
100	67	183.4	123	578	387	189.3	733
112	75	182.5	137	602	403	188.6	761
134	90	185.7	167	626	419	188.0	789
146	98	188.5	184	650	436	187.7	817
170	114	192.5	219	674	452	187.4	846
194	130	195.2	254	698	468	187.3	876
218	146	196.9	288	722	484	187.4	906
242	162	197.9	321	746	500	187.5	937
266	178	198.4	354	770	516	187.7	968
290	194	198.6	386	794	532	188.0	1000
314	210	198.5	418	818	548	188.4	1033
338	226	198.2	449	842	564	188.8	1065
362	243	197.7	480	866	580	189.4	1099
386	259	197.1	510	890	596	190.0	1133
410	275	196.3	539	914	612	190.6	1167
434	291	195.5	568	938	628	191.3	1202
458	307	194.5	597	950	637	191.7	1220
482	323	193.5	625				

M35 GUN SUBSYSTEM

	WEIGHT (POUNDS)	FUSELAGE STATION	MOMENT/100
TOTAL SUBSYSTEM	550.85	190.84	1051.2
ITEMS ON L.H. INBOARD STORE	310.00	192.4	596.44

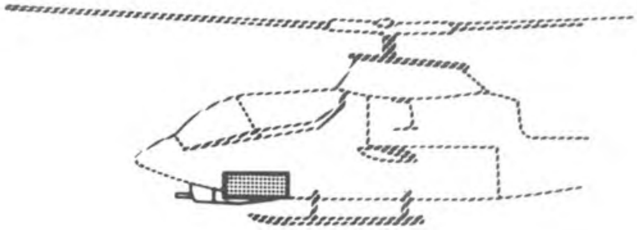
Note

Items on L.H. Inboard Store include the following:

(1) M35 Gun Pod
(2) Delinking Feeder
(3) Gun Drive Assembly
(4) Delinking Chute
(5) Ejection Chute
(6) Wing Mount
(7) ½ Weight of Feed Chute

Figure 12-2. Chart E — loading data sheet (Sheet 10 of 18)

AMMO COMPARTMENT



40MM GRENADES

ROUNDS	WEIGHT (LBS)	MOMENT/100 F.S. 113.0	ROUNDS	WEIGHT (LBS)	MOMENT/100 F.S. 113.0
25	19	21	275	209	236
50	38	43	300	228	258
75	57	64	325	247	279
100	76	86	350	266	301
125	95	107	375	285	322
150	114	129	400	304	344
175	133	150	425	323	365
200	152	172	450	342	386
225	171	193	475	361	408
250	190	215	500	380	429

7.62 MM AMMUNITION LINKED

ROUNDS	WEIGHT (LBS)	FWD BOX F.S. 108.4 MOMENT/100	AFT BOX F.S. 125.9 MOMENT/100	DRUM	
				FUSELAGE STATION	MOMENT/100
250	16	18	20	131.1	21.3
500	33	35	41	130.1	42.3
750	49	53	61	129.0	62.9
1000	65	70	82	127.9	83.1
1250	81	88	102	126.8	103.0
1500	98	106	123	125.7	122.6
1750	114	123	143	124.6	141.7
2000	130	141	164	123.5	160.6
2250	146	159	184	122.4	179.0
2500	163	176	205	121.4	197.3
2750	179	194	225	120.3	215.0
3000	195	211	246	119.2	232.4
3250	211	229	266	118.1	249.5
3500	228	247	286	117.1	266.4
3750	244	264	307	116.0	282.8
4000	260	282	327	114.9	298.7

209900-5-23
AV 052828

Figure 12-2. Chart E — loading data sheet (Sheet 11 of 18)

CENTER OF GRAVITY TABLE

Moment/100

GROSS WEIGHT (POUNDS)	← Forward Limit 190.0	191.0	192.0	194.0	196.0	198.0	200.0	201.0 Aft Limit →
5200	9880	9932	9984	10088	10192	10296	10400	10452
5225	9928	9980	10032	10137	10241	10346	10450	10502
5250	9975	10028	10080	10185	10290	10395	10500	10553
5275	10023	10075	10128	10234	10339	10445	10550	10603
5300	10070	10123	10176	10282	10388	10494	10600	10653
5325	10118	10171	10224	10331	10437	10544	10650	10703
5350	10165	10219	10272	10379	10486	10593	10700	10754
5375	10213	10266	10320	10428	10535	10643	10750	10804
5400	10260	10314	10368	10476	10584	10692	10800	10854
5425	10308	10362	10416	10525	10633	10742	10850	10904
5450	10355	10410	10464	10573	10682	10791	10900	10955
5475	10403	10457	10512	10622	10731	10841	10950	11005
5500	10450	10505	10560	10670	10780	10890	11000	11055
5525	10498	10553	10608	10719	10829	10940	11050	11105
5550	10545	10601	10656	10767	10878	10989	11100	11156
5575	10593	10648	10704	10816	10927	11039	11150	11206
5600	10640	10696	10752	10864	10976	11088	11200	11256
5625	10688	10744	10800	10913	11025	11138	11250	11306
5650	10735	10792	10848	10961	11074	11187	11300	11357
5675	10783	10839	10896	11010	11123	11237	11350	11407
5700	10830	10887	10944	11058	11172	11286	11400	11457
5725	10878	10935	10992	11107	11221	11336	11450	11507
5750	10925	10983	11040	11155	11270	11385	11500	11558
5775	10973	11030	11088	11204	11319	11435	11550	11608
5800	11020	11078	11136	11252	11368	11484	11600	11658
5825	11068	11126	11184	11301	11417	11534	11650	11708
5850	11115	11174	11232	11349	11466	11583	11700	11759
5875	11163	11221	11280	11398	11515	11633	11750	11809
5900	11210	11269	11328	11446	11564	11682	11800	11859
5925	11258	11317	11376	11495	11613	11732	11850	11909
5950	11305	11365	11424	11543	11662	11781	11900	11960
5975	11353	11412	11472	11592	11711	11831	11950	12010
6000	11400	11460	11520	11640	11760	11880	12000	12060
6025	11448	11508	11568	11689	11809	11930	12050	12110
6050	11495	11556	11616	11737	11858	11979	12100	12161
6075	11543	11603	11664	11786	11907	12029	12150	12211
6100	11590	11651	11712	11834	11956	12078	12200	12261
6125	11638	11699	11760	11883	12005	12128	12250	12311

209900-5-24
AV 089374

Figure 12-2. Chart E — loading data sheet (Sheet 12 of 18)

CENTER OF GRAVITY TABLE

Moment/100

Approximate flight limits shown by heavy vertical line. Numbers in **bold face** are actual moment limits for weights indicated but not for stations shown in column head. See Chapter 7, for **exact** gross weight - C.G. limits.

GROSS WEIGHT (POUNDS)	190.0	191.0	192.0	194.0	196.0	198.0	200.0	201.0	
6150	11685	11747	11808	11931	12054	12177	12300	12362	
6175	11733	11794	11856	11980	12103	12227	12350	12412	
6200	11780	11842	11904	12028	12152	12276	12400	12462	
6225	11828	11890	11952	12077	12201	12326	12450	12512	
6250	11875	11938	12000	12125	12250	12375	12500	12563	
6275	11923	11985	12048	12174	12299	12425	12550	12613	
6300	11970	12033	12096	12222	12348	12474	12600	12663	
6325	12018	12081	12144	12271	12397	12524	12650	12713	
6350	12065	12129	12192	12319	12446	12573	12700	12764	
6375	12113	12176	12240	12368	12495	12623	12750	12814	
6400	12160	12224	12288	12416	12544	12672	12800	12864	
6425	12208	12272	12336	12465	12593	12721	12850	12914	
6450	12255	12320	12384	12513	12642	12771	12900	12965	
6475	12303	12367	12432	12562	12691	12821	12950	13015	
6500	12350	12415	12480	12610	12740	12870	13000	13065	
6525	12398	12463	12528	12659	12789	12920	13050	13115	
6550	12445	12511	12576	12707	12838	12969	13100	13166	
6575	12493	12558	12624	12756	12887	13019	13150	13216	
6600	12540	12606	12672	12804	12936	13068	13200	13266	
6625	12588	12654	12720	12853	12985	13118	13250	13316	
6650	12635	12702	12768	12901	13034	13167	13300	13367	
6675	12683	12749	12816	12950	13083	13217	13350	13417	
6700	12730	12797	12864	12998	13132	13266	13400	13467	
6725	12778	12845	12912	13047	13181	13316	13450	13517	
6750	12825	12893	12960	13095	13230	13365	13500	13568	
6775	12873	12940	13008	13144	13279	13415	13550	13618	
6800	12920	12988	13056	13192	13328	13464	13600	13668	
6825	12968	13036	13104	13241	13377	13514	13650	13718	
6850	13015	13084	13152	13289	13426	13563	13700	13769	
6875	13063	13131	13200	13338	13475	13613	13750	13819	
6900	13110	13179	13248	13386	13524	13662	13800	13869	
6925	13158	13227	13296	13435	13573	13712	13850	13919	
6950	13205	13275	13344	13483	13622	13761	13900	13970	
6975	13253	13322	13392	13532	13671	13811	13950	14020	
7000	13300	13370	13440	13580	13720	13860	14000	14070	
7025		13418	13488	13629	13769	13910	14050	14120	
7050	**13398**	13466	13536	13677	13818	13959	14100	14171	
7075		13513	13584	13726	13867	14009	14150	14221	

209900-5-25A
AV089375

Figure 12-2. Chart E — loading data sheet (Sheet 13 of 18)

CENTER OF GRAVITY TABLE

Moment/100

Approximate flight limits shown by heavy vertical line. Numbers in **bold face** are actual moment limits for weights indicated but not for stations shown in column head. See Chapter 7, for **exact** gross weight - C.G. limits.

GROSS WEIGHT (POUNDS)	190.0	191.0	192.0	194.0	196.0	198.0	200.0	201.0
7100	**13496**	13561	13632	13774	13916	14058	14200	14271
7125		13609	13680	13823	13965	14108	14250	14321
7150	**13594**	13657	13728	13871	14014	14157	14300	14372
7175		13704	13776	13920	14063	14207	14350	14422
7200	**13692**	13752	13824	13968	14112	14256	14400	14472
7225		13800	13872	14017	14161	14306	14450	14522
7250	**13790**	13848	13920	14065	14210	14355	14500	14573
7275		13895	13968	14114	14259	14405	14550	14623
7300	**13888**	13943	14016	14162	14308	14454	14600	14673
7325		13991	14064	14211	14357	14504	14650	14723
7350	**13986**	14039	14112	14259	14406	14553	14700	14774
7375		14086	14160	14308	14455	14603	14750	14824
7400	**14084**	14134	14208	14356	14504	14652	14800	14874
7425		14182	14256	14405	14553	14702	14850	14924
7450	**14182**	14230	14304	14453	14602	14751	14900	14975
7475		14277	14352	14502	14651	14801	14950	15025
7500	**14280**	14325	14400	14550	14700	14850	15000	15075
7525		14373	14448	14599	14749	14900	15050	15125
7550	**14378**	14421	14496	14647	14798	14949	15100	15176
7575		14468	14544	14696	14847	14999	15150	15226
7600	**14476**	14516	14592	14744	14896	15048	15200	15276
7625		14564	14640	14793	14945	15098	15250	15326
7650	**14575**	14612	14688	14841	14994	15147	15300	15377
7675		14659	14736	14890	15043	15197	15350	15427
7700	**13673**	14707	14784	14938	15092	15246	15400	15477
7725		14755	14832	14987	15141	15296	15450	15527
7750	**14772**	14803	14880	15035	15190	15345	15500	15578
7775		14850	14928	15084	15239	15395	15550	15628
7800	**14870**	14898	14976	15132	15288	15444	15600	15678
7825		14946	15024	15181	15337	15494	15650	15728
7850	**14968**	14994	15072	15229	15386	15543	15700	15779
7875		15041	15120	15278	15435	15593	15750	15829
7900	**15067**	15089	15168	15326	15484	15642	15800	15879
7925		15137	15216	15375	15533	15692	15850	15929
7950	**15165**	15185	15264	15423	15582	15741	15900	15980
7975		15232	15312	15472	15631	15791	15950	16030
8000	**15264**	15280	15360	15520	15680	15840	16000	16080
8025		15328	15408	15569	15729	15890	16050	16130

209900-5-26A
AV089376

Figure 12-2. Chart E — loading data sheet (Sheet 14 of 18)

CENTER OF GRAVITY TABLE

Moment/100

Approximate flight limits shown by heavy vertical line. Numbers in **bold face** are actual moment limits for weights indicated but not for stations shown in column head. See Chapter 7, for **exact** gross weight - C.G. limits.

GROSS WEIGHT (POUNDS)	190.0	191.0	192.0	194.0	196.0	198.0	200.0	201.0
8050	**15363**	15376	15456	15617	15778	15939	16100	16181
8075		15423	15504	15666	15827	15989	16150	16231
8100	**15461**	15471	15552	15714	15876	16038	16200	16281
8125		15519	15600	15763	15925	16088	16250	16331
8150	**15560**	15567	15648	15811	15974	16137	16300	16382
8175		15614	15696	15860	16023	16187	16350	16432
8200	**15659**	15662	15744	15908	16072	16236	16400	16482
8225		15710	15792	15957	16121	16286	16450	16532
8250		15758	15840	16005	16170	16335	16500	16583
8275			15888	16054	16219	16385	16550	16633
8300		**15856**	15936	16102	16268	16434	16600	**16681**
8325			15984	16151	16317	16484	16650	
8350		**15955**	16032	16199	16366	16533	16700	**16778**
8375			16080	16248	16415	16583	16750	
8400		**16054**	16128	16296	16464	16632	16800	**16875**
8425			16176	16345	16513	16682	16850	
8450		**16153**	16224	16393	16562	16731	16900	**16972**
8475			16272	16442	16611	16781	16950	
8500		**16252**	16320	16490	16660	16830	17000	**17069**
8525			16368	16539	16709	16880	17050	
8550		**16351**	16416	16587	16758	16929	17100	**17166**
8575			16464	16636	16807	16979	17150	
8600		**16450**	16512	16684	16856	17028	17200	**17263**
8625			16560	16733	16905	17078	17250	
8650		**16549**	16608	16781	16954	17127	17300	**17360**
8675			16656	16830	17003	17177	17350	
8700		**16648**	16704	16878	17052	17226	17400	**17457**
8725			16752	16927	17101	17276	17450	
8750		**16748**	16800	16975	17150	17325	17500	**17553**
8775			16848	17024	17199	17375	17550	
8800		**16847**	16896	17072	17248	17424	17600	**17650**
8825			16944	17121	17297	17474	17650	
8850		**16946**	16992	17169	17346	17523	17700	**17747**
8875			17040	17218	17395	17573	17750	
8900		**17045**	17088	17266	17444	17622	17800	**17843**
8925			17136	17315	17493	17672	17850	
8950		**17145**	17184	17363	17542	17721	17900	**17940**
8975			17232	17412	17591	17771	17950	

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Figure 12-2. Chart E — loading data sheet (Sheet 15 of 18)

CENTER OF GRAVITY TABLE

Moment/100

Approximate flight limits shown by heavy vertical line. Numbers in **bold face** are actual moment limits for weights indicated but not for stations shown in column head. See Chapter 7, for **exact** gross weight - C.G. limits.

GROSS WEIGHT (POUNDS)	190.0	191.0	192.0	194.0	196.0	198.0	200.0	201.0	
9000		**17244**	17280	17460	17640	17820	18000	**18037**	
9025			17328	17509	17689	17870	18050		
9050		**17343**	17376	17557	17738	17919	18100	**18133**	
9075			17424	17606	17787	17969	18150		
9100		**17443**	17472	17655	17836	18018	18200	**18230**	
9125			17520	17703	17885	18068	18250		
9150		**17542**	17568	17751	17934	18117	18300	**18326**	
9175			17616	17800	17983	18167	18350		
9200		**17642**	17664	17848	18032	18216	18400	**18422**	
9225			17712	17897	18081	18266	18450		
9250		**17742**	17760	17945	18130	18315	18500	**18519**	
9275			17808	17994	18179	18365	18550		
9300		**17841**	17856	18042	18228	18414	18600	**18615**	
9325			17904	18091	18277	18464	18650		
9350		**17941**	17952	18139	18326	18513	18700	**18711**	
9375			18000	18188	18375	18563	18750		
9400		**18040**	18048	18236	18424	18612	18800	**18808**	
9425			18096	18285	18473	18662	18850		
9450		**18140**	18144	18333	18522	18711	18900	**18904**	
9475			18192	18382	18571	18761	18950		
9500			18240	18430	18620	18810	19000		

GROSS WEIGHT LIMITATIONS:

Takeoff ______________________________ *

Landing ______________________________ *

*NOTE: Service activities shall insert, or substitute, current figures from latest applicable Technical Manual covering operating restrictions.

209900-5-28A
AV089378

Figure 12-2. Chart E — loading data sheet (Sheet 16 of 18)

MISCELLANEOUS DATA

PERSONNEL CENTROIDS

COMPARTMENT	CREW MEMBER	ARM
A	Gunner	83.0
A	Pilot	135.0

DIMENSIONAL DATA

CONDITION	DIMENSION (INCHES)
Overall Length - Blades Extended or Rotating	635.7
Length - Blades Removed	535.1
Maximum Height - Tail Rotor Blades Vertical	165.5
Maximum Height - Blades Removed	147.3
Span - Blades Rotating	528.0
Span - Blades Removed	123.9

209900-5-29
AV 089379

Figure 12-2. Chart E — loading data sheet (Sheet 17 of 18)

TYPICAL SERVICE LOADING CONDITIONS

ITEM	BASIC		HOG		SCOUT	
	WEIGHT	MOMENT/100	WEIGHT	MOMENT/100	WEIGHT	MOMENT/100
Gunner	200	166	200	166	200	166
Pilot	200	270	200	270	200	270
Oil	23	54	23	54	23	54
Fuel	1625	3258	845	1722	1625	3258
7.62mm Ammo - 8000 Rnds	520	609				
- 4000 Rnds					260	305
- 2000 Rnds			130	141		
- 1000 Rnds			65	82		
40mm Ammo - 250 Rnds			190	215	190	215
M157B Pod (2) O/B	134	136			134	136
XM229/XM429 Rockets (14)	395	762			395	762
M18A1 Pods (2)					490	962
7.62mm Ammo - 3000 Rnds.					166	334
M118 Grenade Dispenser (2)	34	66				
Target Marking Grenades (24)	33	68				
M159C Pod (2) I/B			304	604		
XM229/XM429 Rockets (38)			1072	2026		
M159C Pod (2) O/B			304	616		
XM229/XM429 Rockets (24)			676	1306		
	3164	5389	4009	7202	3683	6462

Note

Above loading conditions are typical of items to be added to basic helicopter weight (Chart C) to represent missions indicated. This is an example only - for accurate weight and balance, complete form F using current basic weight.

Figure 12-2. Chart E — loading data sheet (Sheet 18 of 18)

Section IV. WEIGHT AND BALANCE CLEARANCE FORM F AND DD FORM 365F

12-5. General.

a. Load Disposition Summary. This 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 work sheet on which the record weight and balance calculations, and any corrections that must be made to ensure that the helicopter will be within weight and cg limits. Form F is required only when the loading is such as to seriously affect the flying characteristics and safety of the helicopter and in all cases where alternate loading is employed.

b. Use. Form F is furnished in expendable pads, or as separate sheets, which can be replenished when exhausted. An original and carbon are prepared for each loading, as applicable. The original sheets, carrying the signature of responsibility, can be removed and placed in the helicopter "G" files to serve as certificates of proper weight and balance as required by AR 95-16. The duplicate copy must be retained in the helicopter for the duration of the flight. On a cross country flight, this form aids the weight and balance technician at refueling bases and stopover stations. There are two versions of this form: "TRANSPORT" and 'TACTICAL". These two versions were designed to provide for the respective loading arrangements of two types of helicopters. However, the general use or fulfillment of either version is the same: Specific instructions for filling out the "TACTICAL" is given in the following paragraphs.

(1) Insert the necessary identifying information at the top of the form. In the blank spaces of the "Limitation" table, enter the gross weight and cg restrictions obtained from Chapter 7.

NOTE

Enter moment/constant values from Chart E throughout the form.

(2) Reference 1 — Enter the helicopter basic weight and moment/constant (figure 12-3). Obtain these figures from the last entry on Chart C — Basic Weight and Balance Record.

(3) Reference 2 — Enter the amount and weight of oil.

(4) Reference 3 — Using the compartment letter designations as shown on Chart E (helicopter diagram) enter the number and weight of the crew at their "Takeoff Stations". Use actual crew weights if available.

(5) Reference 4 — Enter the sum of the weight for reference 1 through reference 3 to obtain "Operating Weight".

(6) Reference 5 — Enter by compartment the number of rounds, caliber and weight of all ammunition.

(7) Reference 6 — Enter the size, distribution (forward, aft, external, etc.) and weight of all rockets, etc.

(8) Reference 7 — Enter the number of gallons and weight of fuel.

(9) Reference 8 — Not applicable.

(10) Reference 9 — Not applicable.

(11) Reference 10 — Enter the sum of the weights for reference 4 through reference 9 opposite "Takeoff Condition" (uncorrected). At this point, if not already done, calculate and enter the moment/constant for reference 1 through reference 10, inclusive.

(12) Check the weight figure opposite reference 10 against the "Gross Weight Takeoff" in the "Limitations" table. Check the moment/constant figure opposite reference 10 by means of Chart E to ascertain that the indicated cg is within allowable limits.

(13) Reference 11 — If changes in amount or distribution of load are required, indicate necessary adjustments by proper entries in the "Corrections" table in lower left corner of the form as follows:

(a) Enter a brief description of the adjustment made in the column marked "Item".

(b) Add all the weight and moment decreases and insert the totals in the space opposite "Total Weight Removed".

(c) Add all the weight and moment increases and insert the totals in the space opposite "Total Weight Added".

WEIGHT AND BALANCE CLEARANCE FORM F
TACTICAL
(USE REVERSE FOR TRANSPORT MISSIONS)

FOR USE IN T. O. 1-1B-40 & AN 01-1B-40

DATE	AIRPLANE TYPE	FROM	HOME STATION
5-4-67	AH-1G		
MISSION/TRIP/FLIGHT/NO.	**SERIAL NO.**	**TO**	**PILOT**
SUPPORT	SAMPLE		

REMARKS
✱ SEE CENTER OF GRAVITY TABLE "CHART E"

COMPUTER PLATE NO. *(If used)*

REF	ITEM	WEIGHT	[1] INDEX OR MOM/
1	BASIC AIRPLANE *(From Chart C)*	5611	11469
2	OIL (3.0 *Gal.*)	23	54
3	DISTRIBUTION OF LOAD		

COMPT.	CREW NO.	CREW WEIGHT	BAGGAGE	CARGO AND MISC	WEIGHT	[1] INDEX OR MOM/
A	1	190	PILOT		190	257
A	1	180	GUNNER		180	149

REF	ITEM			WEIGHT	[1] INDEX OR MOM/
4	OPERATING WEIGHT			6004	11929
5 (AMMUNITION)	COMPT.	ROUNDS	CALIBER		
	A	4000		260	282
	A	4000		260	327
6 (BOMBS, ROCKETS, ETC.)	FORWARD				
	AFT				
	EXTERNAL				
	ROCKETS				
7 (FUEL)	BUILT IN (240 *Gal.*)			1560	3148
	BOMB BAY (*Gal.*)				
	EXTERNAL (*Gal.*)				
8	WATER INJ. FLUID (*Gal.*)				
9	JATO OR RATO				
10	TAKEOFF CONDITION *(Uncorrected)*			8084	15686
11	CORRECTIONS *(If required)*				
12	TAKEOFF CONDITION *(Corrected)*			8084	15686
13	TAKEOFF C. G. IN % M. A. C. OR IN.			194.0	
14 (LESS EXPENDABLES)	JATO OR RATO				
	BOMBS				
	AMMUNITION			520	609
	FUEL 150 GAL.			975	1954
15	ESTIMATED LANDING CONDITION			6589	13123
16	ESTIMATED LANDING C. G. IN % M. A. C. OR IN.			199.2	

Pertinent instructions to the pilot for shifting load and crew during takeoff and landing should be noted above.

CORRECTIONS *(Ref. 11)*

COMPT.	ITEM	CHANGES (+ or −) WEIGHT	[1] INDEX OR MOM/
	TOTAL WEIGHT REMOVED	−	−
	TOTAL WEIGHT ADDED	+	+
	NET DIFFERENCE *(Ref. 11)*		

EXAMPLE ONLY

LIMITATIONS

[2] GROSS WT. TAKEOFF *(lb.)*	[2] GROSS WT. LANDING *(lb.)*
9500	9500

	FROM	TO
[3] PERMISSIBLE C. G. TAKEOFF	✱	(% M. A. C. or IN.)
[4] PERMISSIBLE C. G. LANDING	✱	(% M. A. C. or IN.)

[1] Enter constant used.
[2] Enter values from current applicable T. O.
[3] Applicable to gross weight (Ref. 12).
[4] Applicable to gross weight (Ref. 15).

COMPUTED BY *(Signature)*
WEIGHT AND BALANCE AUTHORITY *(Signature)*
PILOT *(Signature)*

DD FORM SEPT 54 365F

209900-4B
AV 052992

Figure 12-3. Sample DD form 365F

(d) Subtract the smaller from the larger of the two totals and enter the difference (with applicable ± sign) opposite "Net Difference".

(e) Transfer these net difference figures to the spaces opposite reference 11.

(14) Reference 12 — Enter the sum of, or the difference between, reference 10 and reference 11. Recheck to ascertain that these figures do not exceed allowable limits.

(15) Reference 13 — By referring to the cg table on Chart E determine the takeoff cg position. Enter this figure in the space provided opposite "Takeoff CG".

(16) Reference 14 — Estimate the weight of ammunition (not including weight of cases and links if retained), fuel, and any other items which may be expended before landing. Enter figures together with moment/constant in the spaces provided. To estimate the amount of fuel expended, perform the following calculation:

(a) Subtract the weight and moment of the fuel estimated to remain at landing from the weight and moment of the fuel loaded at takeoff.

(b) Enter the above result in Section 14 of Form 365F.

EXAMPLE	GAL	WEIGHT	MOMENT
Fuel at takeoff (See sheet 3 of Chart E)	240	1560	3148
Fuel estimated to remain at landing (See sheet 3 of Chart E)	90	585	1194
Fuel expended (Enter in Section 14 of Form 365F)	150	975	1954

NOTE

Do not consider reserve fuel as expended when determining ESTIMATED LANDING CONDITION.

(17) Reference 14 — Enter the difference in weights and moment/constant between reference 12 and the total of reference 14.

(18) Reference 16 — By again referring to the cg table on Chart E, determine the estimated landing cg position. Enter the figure opposite "ESTIMATED LANDING CG".

(19) The necessary signatures must appear at the bottom of the form.

CHAPTER 13

AIRCRAFT LOADING

NOTE

Refer to figure 12-2 for typical service load conditions.

CHAPTER 14

PERFORMANCE DATA

Section I. INTRODUCTION

14.1 General.

The charts contained in this chapter reflect the necessary data required for preflight and inflight mission planning. Explanatory text and examples for use of the charts is presented in Section II. The performance charts are presented in graphic form with a blocked example chase around located at the top of the chart. Charts are based on flight test data or calculated data as indicated on the chart. Some of the charts are based on different armament configurations, as indicated on the chart i.e., Basic, Heavy Scout, Heavy Hog, etc. The different armament configurations as they effect performance charts are described in the following paragraphs:

a. Basic Configuration – This configuration has an M28 or TAT102A turret installed with one M157 rocket launcher installed on each outboard wing hard point.

pod installed on each inboard wing hard point and one M159 rocket launcher installed on each outboard wing hard point.

b. Heavy Scout Configuration – This configuration has an M28 turret installed, with one M18 gun.

c. Light Scout Configuration – This configuration has an M28 turret installed, with one M18 gun pod installed on each inboard wing hard point and one M157 rocket launcher installed on each outboard wing hard point.

d. Heavy Hog Configuration – This configuration has an M28 turret installed, with two M159 rocket launchers installed on each wing.

e. Light Hog Configuration – This configuration has an M28 turret installed, with two M157 rocket launchers installed on each wing.

Section II. CHARTS

14-2. Airspeed Calibration Chart.

The Airspeed Calibration chart (figure 14-1) is used to convert calibrated to indicated airspeed and vice versa. Calibrated airspeed (CAS) is indicated airspeed (IAS) as read from the instrument corrected for instrument error, plus the installation correction.

14-3. Density Altitude Chart.

Density altitude is an expression of the density of the air in terms of height above sea level; hence, the less dense the air, the higher the density altitude. For standard conditions of temperature and pressure, density altitude is the same as pressure altitude. As temperature increases above standard for any altitude, the density altitude will also increase to values higher than pressure altitude. Figure 14-2 expresses density altitude as a function of pressure altitude and temperature.

EXAMPLE:

Pressure Altitude	7000 feet
OAT	-10°C

a. Enter the bottom of the chart at -10°C.

b. Move vertically up until the 7000 feet pressure altitude curve is intersected.

c. Move horizontally to the left and read a density altitude of 5700 feet.

14-4. Temperature Conversion Chart.

The temperature conversion chart (see figure 14-3) provides a list of temperatures from -54°C (-85°F) to + 793°C (+2660°F) and is grouped in columns of three. These columns allow the direct conversion of a temperature reading to either centigrade or fahrenheit.

14-5. Component Life Maximum Speed Chart.

Component life maximum speed, Vne, is presented in figures 14-4 and 14-5 in indicated airspeed as a function of pressure altitude for temperatures from -40 to +40 °C. Figure 14-4 is used for the Basic configuration while figure 14-5 is used for Heavy Scout and Heavy Hog configurations. For a given set of atmospheric conditions, the component life maximum speed is the speed beyond which the fatigue life of the helicopters critical components can be seriously impaired. It should be noted that pressure altitude must be converted to density altitude before the component life maximum speed chart may be properly used.

EXAMPLE:

Configuration	Basic
Pressure Altitude	7000 feet
OAT	-10°C

a. Enter the density altitude chart (figure 14-2) at -10°C, move vertically to a pressure altitude of 7000 feet, and project horizontally to read a density altitude of 5700 feet.

b. Enter the component lift maximum speed chart (figure 14-4) at a density altitude of 5700 feet, move to -10°C line and project vertically to read 184 KIAS.

14-6. Power Available Charts.

Atmospheric conditions of OAT and pressure altitude have an effect on the capability of the engine to produce power. Data for power available at two power settings is shown: Military power available with 0 and 70 knots loss (figure 14-6), normal rated power available with 0 and 70 knots losses (figure 14-7), and normal rated power available with 140 knot losses (figure 14-8). OAT and pressure altitude effects on power available are shown on the charts. Power available is presented in terms of torque and shaft horsepower.

It should be noted that the power output capability of the engine can exceed the structural limit of the transmission under certain conditions. The limits shown on the charts (1134 shp for both military and normal power) should be observed to prevent exceeding the power limitations imposed by the transmission.

EXAMPLE:

OAT	15°C
Pressure Altitude	9000 feet
Power Setting	Military rated power (0 and 70 knot losses)

a. Enter the pressure altitude scale of figure 14-6 at 9000 feet.

b. Move horizontally to intersection of 15°C temperature line.

c. Project vertically to either the shaft horsepower or torquemeter pressure scale and read 920 shp or 39.8 psi power available.

14-7. Fuel Flow Chart.

The fuel flow chart (figure 14-9) shows the engine fuel flow for a given altitude and power setting under standard day conditions.

EXAMPLE:

Pressure Altitude	9000 feet
Torquemeter Pressure	30 psi

a. Move along the 30 psi line to an altitude of 9000 feet.

b. Project horizontally to the fuel flow scale and read 483 pounds per hour.

14-8. Torque and Power Required To Hover.

Torque and power required to hover at various skid heights is presented in figures 14-10 through 14-13 for all configurations. The skid heights presented are, in ground effect for two, ten, and fifteen foot and out of ground effect. Power required in terms of torque and shaft horsepower is presented as a function of density altitude and gross weight for each skid height.

EXAMPLE:

Pressure Altitude	6000 feet
OAT	20°C
Skid height	OGE
Gross weight	8750 pounds.

a. Determine density altitude for the given conditions by referring to the density altitude chart (figure 14-2). For a pressure altitude of 6000 feet and OAT of 20°C the density altitude is 8000 feet.

b. Enter the gross weight scale of figure 14-13 at 8750 pounds and move horizontally to the 8000 foot density altitude line.

c. Move vertically to the appropriate scale to read a shaft horsepower of 1130 or a torque pressure of 48.5 psi.

14-9. Hover Ceiling Charts.

The hovering ceiling charts show for all configurations the maximum pressure altitudes for which hover is possible, as a function of gross weight and OAT. Figures 14-14, 14-15, and 14-16 show in ground effect hovering ceilings at two-foot, ten-foot, and fifteen-foot skid heights. Figure 14-17 shows hovering ceiling out of ground effect with headwind and vertical rate of climb corrections.

These charts are used to determine the maximum gross weight at which hovering is possible for the given conditions of pressure altitude and OAT when operating at military rated power.

EXAMPLE:

Pressure Altitude	8000 feet
OAT	20°C
Skid height	OGE
Headwind	5 knots
Vertical rate of climb	100 feet per minute

a. Enter the ceiling grid of figure 14-17 at a pressure altitude of 8000 feet and move horizontally to an OAT of 20°C.

b. The maximum gross weight is then read as 7400 pounds.

c. A headwind correction is applied by entering the headwind grid at 7400 pounds and moving vertically down to the zero baseline. Move down, paralleling the flow lines to the 5 knot line. By projecting vertically to the gross weight scale, the corrected gross weight of 7480 pounds is read.

d. A vertical rate of climb correction is applied by entering the grid at 7480 pounds and moving vertically down to the zero baseline. Move down, paralleling the flow lines to the 100 foot per minute line. By projecting vertically to the gross weight scale, the corrected gross weight of 7400 pounds is read.

14-10. Takeoff Distance.

The takeoff distance chart (figure 14-18) presents the distance required to clear a 50-foot obstacle for takeoff speeds from 10 to 70 knots, pressure altitudes from sea level to 20,000 feet, and air temperatures from -40°C to +40°C, when operating at military rated power. The chart also incorporates a headwind tradeoff correction from 0 to 30 knots.

The level acceleration technique from a three-foot hover yields successful takeoffs when the power available is sufficient to hover at skid heights above three feet. The takeoff is accomplished by applying full power while accelerating through translational lift at a skid height of three feet. Climbout airspeed is maintained at 5 to 10 knots above translational lift speed when the minimum distance over a 50-foot obstacle is required. This takeoff technique is recommended for normal heavy weight takeoffs when excess power available is limited.

EXAMPLE:

Pressure Altitude	5000 feet
Temperature	20°C
Gross weight	8000 pounds
Takeoff airspeed	30 knots
Headwind	10 knots

a. Enter the upper portion of the chart (figure 14-18) on the left side at 5000 feet pressure altitude.

b. Move horizontally to the right and intersect the 20°C solid line.

c. Proceed vertically down to the baseline.

d. Since the solid line was encountered first, no transmission limit was reached. Thus, follow the trend of the solid lines until 8000 pounds is reached.

e. Drop vertically down to the 30 knot line.

f. Move horizontally to the right and intersect the baseline.

g. Follow the trend of the lines to the 10-knot headwind point.

h. Proceed horizontally to the right to the edge of the chart. Read a takeoff distance of 375 feet.

14-11. Climb Performance Charts.

The climb performance chart is used to determine time, distance and fuel used in climb at military rated power (figure 14-19). For each climb parameter various curves are shown for temperatures from -45°C to +35°C.

Figure 14-19 does not include the fuel used for warmup and takeoff, which is 25 pounds (2 minutes at normal rated power). This amount must be added to the climb fuel to determine the total fuel required to reach cruise altitude.

EXAMPLE: (See figure 14-19)

Problem	Conditions
Takeoff pressure altitude	4000 feet
Cruise pressure altitude	8000 feet
Gross weight	8000 pounds
Power setting	Military rated power
OAT	+35°C

a. Enter the gross weight scale of figure 14-19 at 7500 pounds. Move horizontally to the right and intersect the

4000 foot pressure altitude curve. Move vertically upward to intersect the +35°C line of the time plot. Move horizontally to the time scale and read 2.8 minutes.

b. Enter the gross weight scale of Figure 14-19 again at 8000 pounds. Move horizontally to the right and intersect 8000 feet pressure altitude. Move vertically upward to intersect the +35°C line of the time plot. Move horizontally to the time scale and read 7.0 minutes.

c. To obtain the time to climb from 4000 feet to 8000 feet, subtract the time to climb from 4000 feet from the time to climb to 8000 feet. For this example the time to climb would be (7.0 – 2.8) = 4.2 minutes.

d. Distance and climb fuel are obtained by entering the gross weight scale at 8000 pounds and moving horizontally to the applicable grid area of the chart and the following procedure described above. Using the same conditions as above, distance in climb from 4000 to 8000 feet would be (7.3 – 2.7) = 4.6 nautical miles and climb fuel (including fuel from warmup and takeoff) from 4000 to 8000 feet would be (72 – 28) +25 = 69 pounds.

14-12. Maximum Rate Of Climb.

The maximum rate of climb chart (figure 14-20) presents the maximum rate of climb at any combination of ambient temperature and altitude at military power.

A separate section, shown with dashed lines, gives the rate of climb from ambient conditions where the power available is limited by the transmission.

The best climb speed is approximately 69 KTAS. Faster or slower speeds will reduce the rate of climb.

Three examples are given to demonstrate the various options of the chart.

EXAMPLE 1: (No transmission limit encountered)

Pressure Altitude	8000 feet
Gross weight	8000 pounds
Temperature	20°C

a. At the lower left hand corner, enter the chart (figure 14-20) at 8000 feet pressure altitude.

b. Move vertically to the 20°C line. Note the point is above the TRANS LIMIT DERATE BORDER.

c. From the 20°C point, proceed horizontally to the 8000-pound gross weight line.

d. Move vertically up to the reflector line.

e. Slide horizontally across to the baseline.

f. Follow the trend of the curves to 20°C.

g. Move straight across to the RATE OF CLIMB scale and read 1025 feet per minute.

EXAMPLE 2: (Transmission limit encountered)

Pressure Altitude	7500 feet
Gross weight	8000 pounds
Temperature	0°C

a. At the lower left corner, enter the chart (figure 14-20) at 7500 feet pressure altitude.

b. Move vertically to the 0°C line. Note the point is below the TRANS LIMIT DERATE BORDER.

c. Since the power is transmission limited, leave the chart and re-enter the top right portion at 8000 pounds gross weight.

d. Drop vertically down to the 0°C line.

e. From the 0°C point, move horizontally to the right to the RATE OF CLIMB scale and read 1090 feet per minute.

14-13. Service Ceiling Charts.

The service ceiling charts present the altitude at which the rate of climb of the helicopter is 100 feet per minute when operating at normal rated power. Service ceiling at a 69 KIAS. is presented in figure 14-21.

EXAMPLE:

Gross weight	8000 pounds
Temperature	10°C

a. Enter the bottom of the chart (figure 14-21) at a gross weight of 8000 pounds.

b. Move up vertically and intersect the 10°C temperature curve.

c. From this point move horizontally to the left and read a pressure altitude of 14,000 feet.

14-14. Specific Range And Maximum Cruise Speed Charts.

The specific range charts (figures 14-22 through 14-24) and the maximum cruise speed charts (figures 14-25 through 14-27) are used in conjunction to present nautical miles per pound of fuel, fuel flow, and maximum cruise speed as a function of gross weight, pressure altitude, outside air temperature, and airspeed for the basic heavy scout, and heavy hog configurations.

Two examples of the use of these charts are shown. The first involves determining specific range at long range cruise (LRC) airspeed and at maximum endurance airspeed at a given cruise altitude. The second example involves determining long range cruise at an optimum cruise altitude.

EXAMPLE 1:

Gross weight at start of cruise	8000 pounds
OAT during cruise	20°C
Cruise pressure altitude	10,000 feet
Cruise airspeed condition	LRC and maximum endurance
Configuration	Basic

a. Enter the gross weight scale of the cruise chart (figure 14-22) at 8000 pounds and move horizontally to an altitude of 10,000 feet.

b. Project vertically up to the nautical miles per pound scale and read 0.247. This is for long range cruise.

NOTE

The long range cruise is 99 percent of the maximum range on the high speed side.

c. The LRC airspeed is determined by projecting vertically along the 0.274 nautical miles per pound line to the baseline of the airspeed curve and moving horizontally to read 134 knots on the true airspeed scale.

d. To determine if the LRC airspeed exceeds limits, enter the maximum permissible speed curves for 20°C and 8000 pounds gross weight for the basic configuration (figure 14-25). Move along the gross weight to the given altitude then project vertically to read a maximum speed of 115 KTAS.

e. In this case the LRC speed must be decreased to 115 KTAS to stay within limits. This is accomplished by moving vertically from the 0.274 intersection with the baseline and paralleling the flow lines until 115 KTAS is reached. The new range is then read as 0.246 nautical miles per pound.

f. Fuel flow is determined by projecting vertically to 115 KTAS on the fuel flow grid and moving horizontally to read 465 pounds per hour.

g. Maximum endurance airspeed is determined by projecting vertically from 0.246 nautical miles per pound intersection with 115 KTAS, paralleling the flow lines until the maximum endurance line is reached. The maximum endurance airspeed is read as 69 KTAS and the corresponding range as 0.180 nautical miles per pound.

h. Fuel flow is determined by projecting vertically to the 69 KTAS line of the fuel flow pilot, moving horizontally and reading 380 pounds per hour.

EXAMPLE 2:

Gross weight at start of cruise	8500 pounds
OAT	-20°C
Cruise altitude	Optimum
Cruise airspeed condition	LRC
Configuration	Heavy Scout

a. Enter the gross weight scale of the cruise chart (figure 14-23) at 8500 pounds and move to the highest altitude line on the grid. This altitude is the optimum altitude and in this case the interpolation between the 8000 feet and 10,000 feet curves yields 9300 feet.

NOTE

Since the optimum cruise altitude increases with decreasing gross weight, it may not always be possible to cruise at the optimum altitude due to lack of oxygen or other limitations.

b. Project vertically to the range scale and read 0.228 nautical miles per pound.

c. LRC airspeed is determined by moving vertically to the baseline and projecting horizontally to read 132 KTAS. By referring to the maximum permissible speed plot, figure 14-26, for an OAT of -20°C, this airspeed is seen to be within the limit of 132 KTAS.

d. Fuel flow is determined by projecting vertically to 132 KTAS on the fuel flow grid and moving horizontally to read 580 pounds per hour.

14-15. Power Chart.

The power chart (figure 14-28) is a versatile aid to the experienced pilot. Proper use will allow the replacement of several separate charts provided in this manual.

With this chart, the pilot can determine military rated power available, torque required to hover at a gross weight, the gross weight capability to hover at a torque setting, and hover ceilings for any ambient conditions. Density altitude and corresponding combinations of pressure altitude and outside air temperature are also readily determined.

Any OAT and pressure altitude condition which produces a torque pressure greater than 49.0 psi is limited to 49.0 psi due to the transmission limit.

The following set of examples demonstrates various applications of the POWER chart.

EXAMPLE 1:

Find military rated power available.

Temperature	20°C
Pressure Altitude	8000 feet

a. Enter the upper chart of figure 14-28 on the left side at 20°C.

b. Move horizontally to the right to the 8000-foot pressure altitude line.

c. Interpolate between the TORQUE lines to read 40.8 psi. This is the maximum torque the engine is capable of producing at these ambient conditions.

EXAMPLE 2:

Find the torque required to hover at at 10-foot skid height under the assumed conditions. Can the helicopter hover there?

Temperature	20°C
Pressure Altitude	8000 feet
Gross weight	8000 pounds

a. Enter the upper chart of figure 14-28 on the left side at 20°C.

b. Move horizontally to the right to the 8000-foot pressure altitude line.

c. Drop vertically down to the density altitude scale and read 10,400 feet density altitude. Retain this number.

d. Enter the lower chart on the left side at the gross weight of 8000 pounds.

e. Move horizontally to the right to the density altitude retained from step 6 (10,400 feet).

f. Drop vertically to the baseline of the skid height trade-off portion. Then follow the trend of the lines to the 10-foot skid height.

g. Drop vertically from the 10-foot skid height point to read 40.5 psi indicated torque required to hover.

h. Recall for Example 1 the value of torque available, 40.8 psi. Thus, the ship can hover at these conditions.

EXAMPLE 3:

What is the maximum hover gross weight capability at a 10-foot skid height under the assumed conditions?

Temperature	20°C
Pressure Altitude	8000 feet

a. Enter the upper chart of figure 14-28 on the left side at 20°C.

b. Move horizontally to the right to the 8000-foot pressure altitude line.

c. Drop vertically down to the density altitude scale and read 10,400 feet density altitude. Retain this number.

d. Refer to Example 1 to obtain the torque available of 40.8 psi.

e. Enter the bottom of the chart at 40.8 psi.

f. Move vertically up to the 10-foot skid height point.

g. Follow the trend of the lines to the baseline (OGE).

h. Proceed vertically up to the density altitude of 10,400 feet which was retained from step c.

i. Move horizontally to the left to the gross weight scale and read 8100 pounds. This is the maximum gross weight capability at 8000 feet and 20°C at a skid height of 10 feet when operating at military power.

14-16. Power Check Chart.

The purpose of this chart (figure 14-29) is to compare the actual power output of a given engine to that of a "spec" engine.

The following example illustrates the use of the power check chart.

EXAMPLE: Find percent gas producer speed (% N_I)

Torque pressure	20 psi
N_{II}	100%
Pressure altitude	12000 feet
OAT	0°C

a. Enter the chart at a pressure altitude of 12000 feet, proceed horizontally to the right to the 0°C line Move vertically downward to read 87.3% gas producer speed.

b. If the actual gas producer speed of a given engine under the above conditions is equal to or less than 87.3%, the engine is capable of the performance shown in this Operator's Manual. If the actual gas producer speed is greater than 87.3%, the engine is incapable of the performance shown in this Operator's Manual.

AIRSPEED CALIBRATION

Model(s): AH-1G
Data as of: JUNE 1971
DATA BASIS: ARMY PHASE D FLIGHT TEST (66-06)

Engine(s): T53-L-13
Fuel Grade: JP-4
Fuel Density: 6.5 LB/GAL

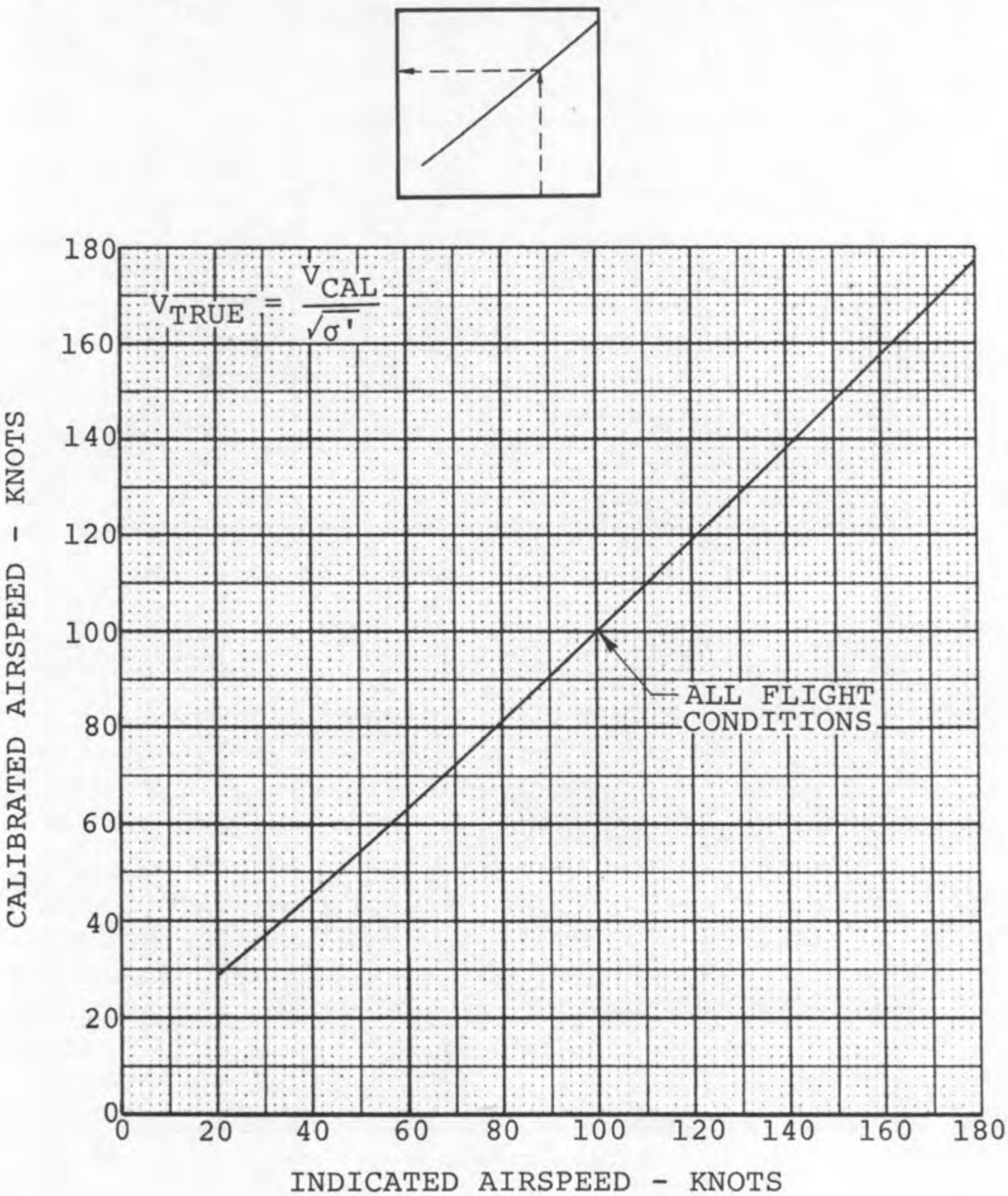


Figure 14-1. Airspeed calibration

DENSITY ALTITUDE

Model(s): AH-1G
Data as of: JUNE 1971
DATA BASIS: ARMY PHASE D
FLIGHT TEST (66-06)

Engine(s): T53-L-13
Fuel Grade: JP-4
Fuel Density: 6.5 LB/GAL

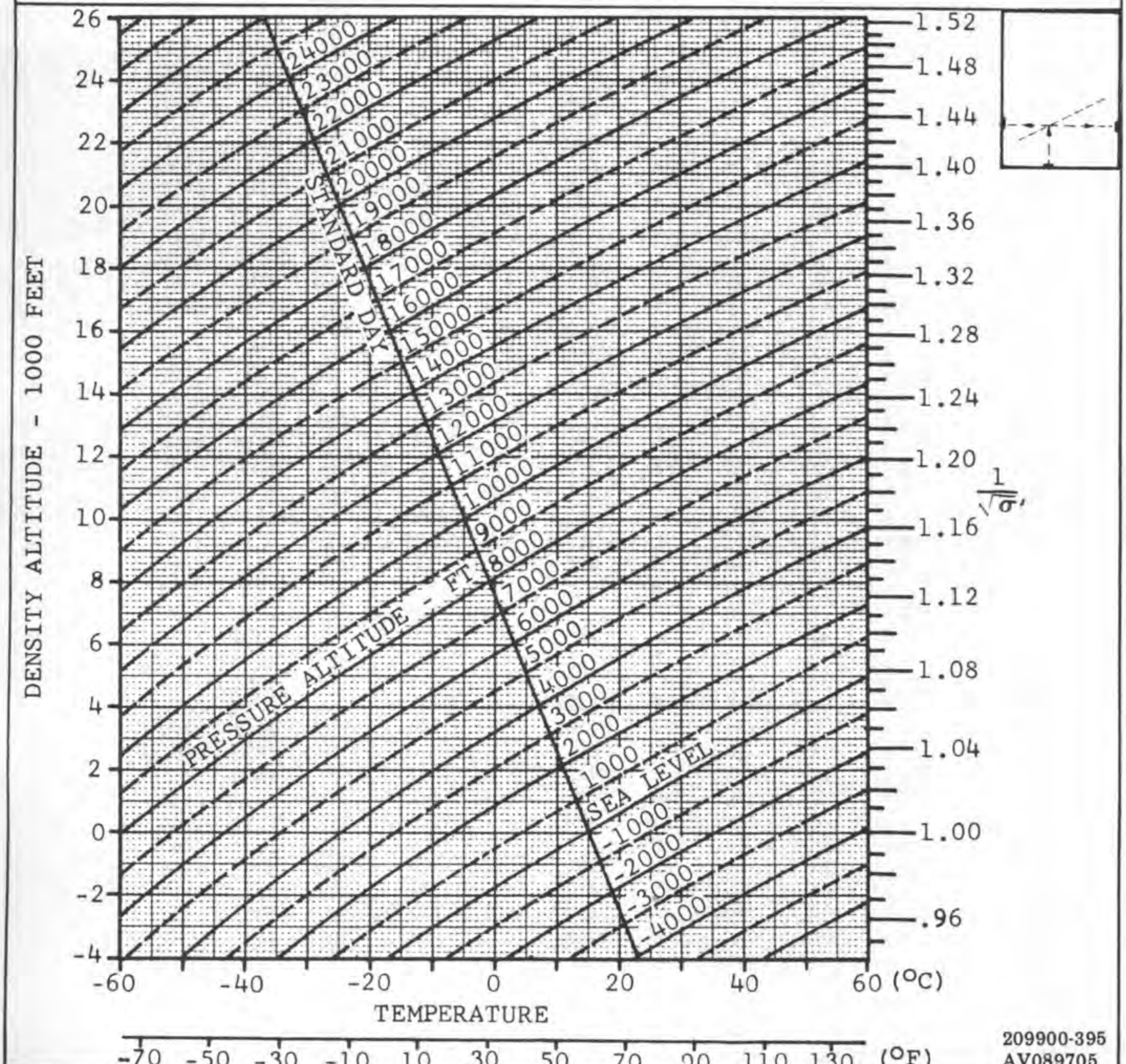


Figure 14-2. Density altitude chart

TEMPERATURE CONVERSION CHART

Look up reading in middle column; if in degrees Centrigrade, read Fahrenheit equivalent in right-hand column; if in degrees Fahrenheit, read Centigrade equivalent in left-hand column.

C		F	C		F	C		F	C		F
-54	- 65	- 85	28.9	84	183.2	266	510	950	538	1000	1832
-51	- 60	- 76	30.0	86	186.8	271	520	968	543	1010	1850
-46	- 50	- 58	31.1	88	190.4	277	530	986	549	1021	1868
-40	- 40	- 40	32.2	90	194.0	282	540	1004	554	1031	1886
-34	- 30	- 22	33.3	92	197.6	288	550	1022	560	1040	1904
-29	- 20	- 4	34.4	94	201.2	293	560	1040	566	1050	1922
-23	- 10	14	35.6	96	204.8	299	570	1058	571	1060	1940
-17.8	0	32	36.7	98	208.4	304	580	1076	577	1070	1958
-16.7	2	35.6	37.8	100	212.0	310	590	1094	582	1080	1976
-15.6	4	39.2	43	110	230	316	600	1112	588	1090	1994
-14.4	6	42.8	49	120	248	321	610	1130	593	1100	2012
-13.3	8	46.4	54	130	266	327	620	1148	599	1110	2030
-12.2	10	50.0	60	140	284	332	630	1166	604	1120	2048
-11.1	12	53.6	66	150	302	338	640	1184	610	1130	2066
-10.0	14	57.2	71	160	320	343	650	1202	616	1140	2084
- 8.9	16	60.8	77	170	338	349	660	1220	621	1150	2102
- 7.8	18	64.4	82	180	356	354	670	1238	627	1160	2120
- 6.7	20	68.0	88	190	374	360	680	1256	632	1170	2138
- 5.6	22	71.6	93	200	392	366	690	1274	638	1180	2156
- 4.4	24	75.2	99	210	410	371	700	1292	643	1190	2174
- 3.3	26	78.8	104	220	428	377	710	1310	649	1200	2192
- 2.3	28	82.4	110	230	446	382	720	1328	654	1210	2210
- 1.1	30	86.0	116	240	464	388	730	1346	660	1220	2228
0.0	32	89.6	121	250	482	393	740	1364	666	1230	2246
1.1	34	93.2	127	260	500	399	750	1382	671	1240	2264
2.2	36	96.8	132	270	518	404	760	1400	677	1250	2282
3.3	38	100.4	138	280	536	410	770	1418	682	1260	2300
4.4	40	104.0	143	290	554	416	780	1436	688	1270	2318
5.6	42	107.6	149	300	572	421	790	1454	693	1280	2336
6.7	44	111.2	154	310	590	427	800	1472	699	1290	2354
7.8	46	114.3	160	320	608	432	810	1490	704	1300	2372
8.9	48	118.4	166	330	626	438	820	1508	710	1310	2390
10.0	50	122.0	171	340	644	443	830	1526	716	1320	2408
11.1	52	125.6	177	350	662	449	840	1544	721	1330	2426
12.2	54	129.2	182	360	680	454	850	1562	727	1340	2444
13.3	56	132.8	188	370	698	460	860	1580	732	1350	2462
14.4	58	136.4	193	380	716	466	870	1598	738	1360	2480
15.6	60	140.0	199	390	734	471	880	1616	743	1370	2498
16.7	62	143.6	204	400	752	477	890	1634	749	1380	2516
17.8	64	147.2	210	410	770	482	900	1652	754	1390	2534
18.9	66	150.8	216	420	788	488	910	1670	760	1400	2552
20.0	68	154.4	221	430	806	493	920	1688	766	1410	2570
21.1	70	158.0	227	440	824	499	930	1706	771	1420	2588
22.2	72	161.6	232	450	842	504	940	1724	777	1430	2606
23.3	74	165.2	238	460	860	510	950	1742	782	1440	2624
24.4	76	168.8	243	470	878	516	960	1760	788	1450	2642
25.6	78	172.4	249	480	896	521	970	1778	793	1460	2660
26.7	80	176.0	254	490	914	527	980	1796			
27.8	82	179.6	260	500	932	532	990	1814			

209900-396
AV089706

Figure 14-3. Temperature conversion table

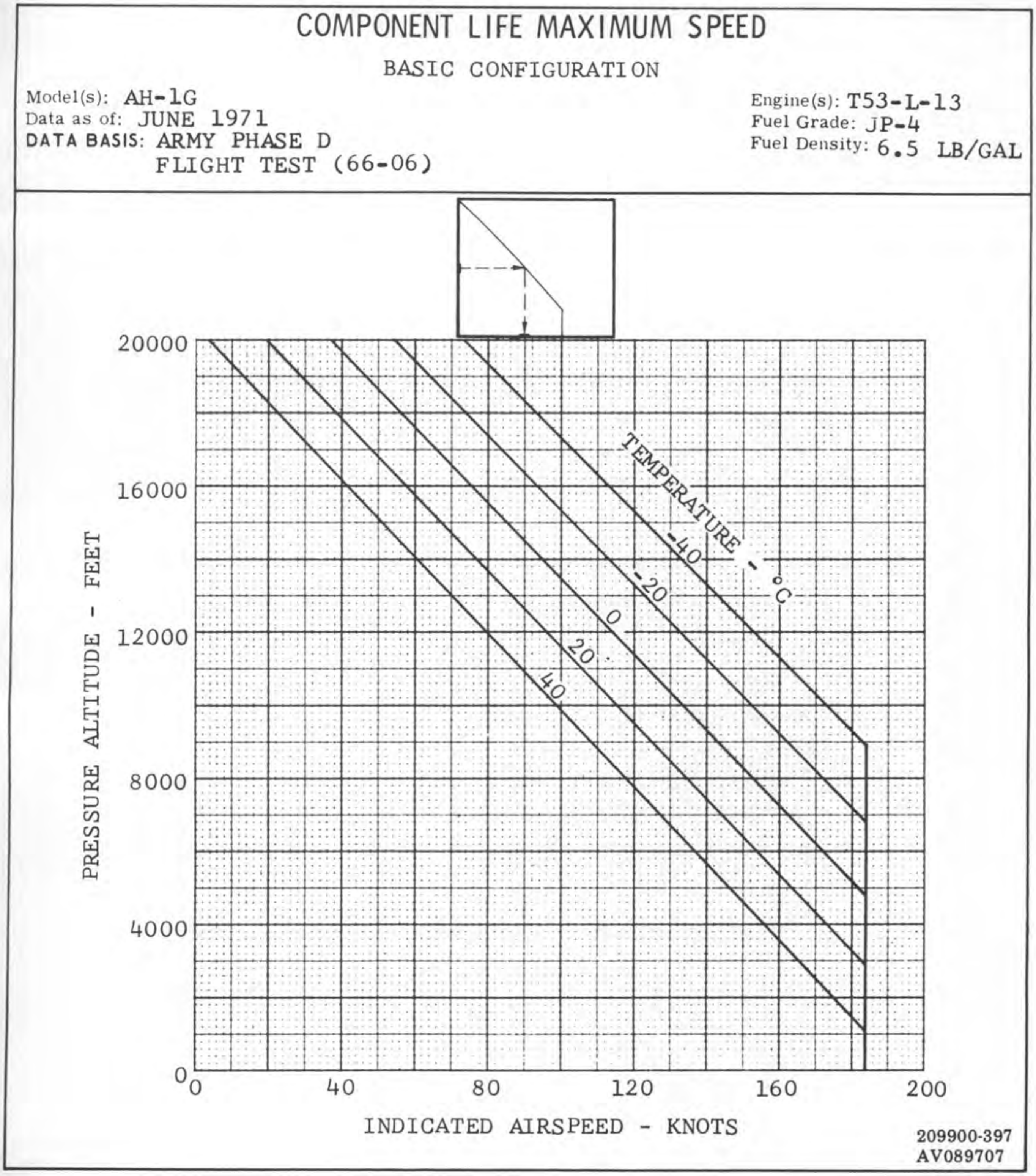


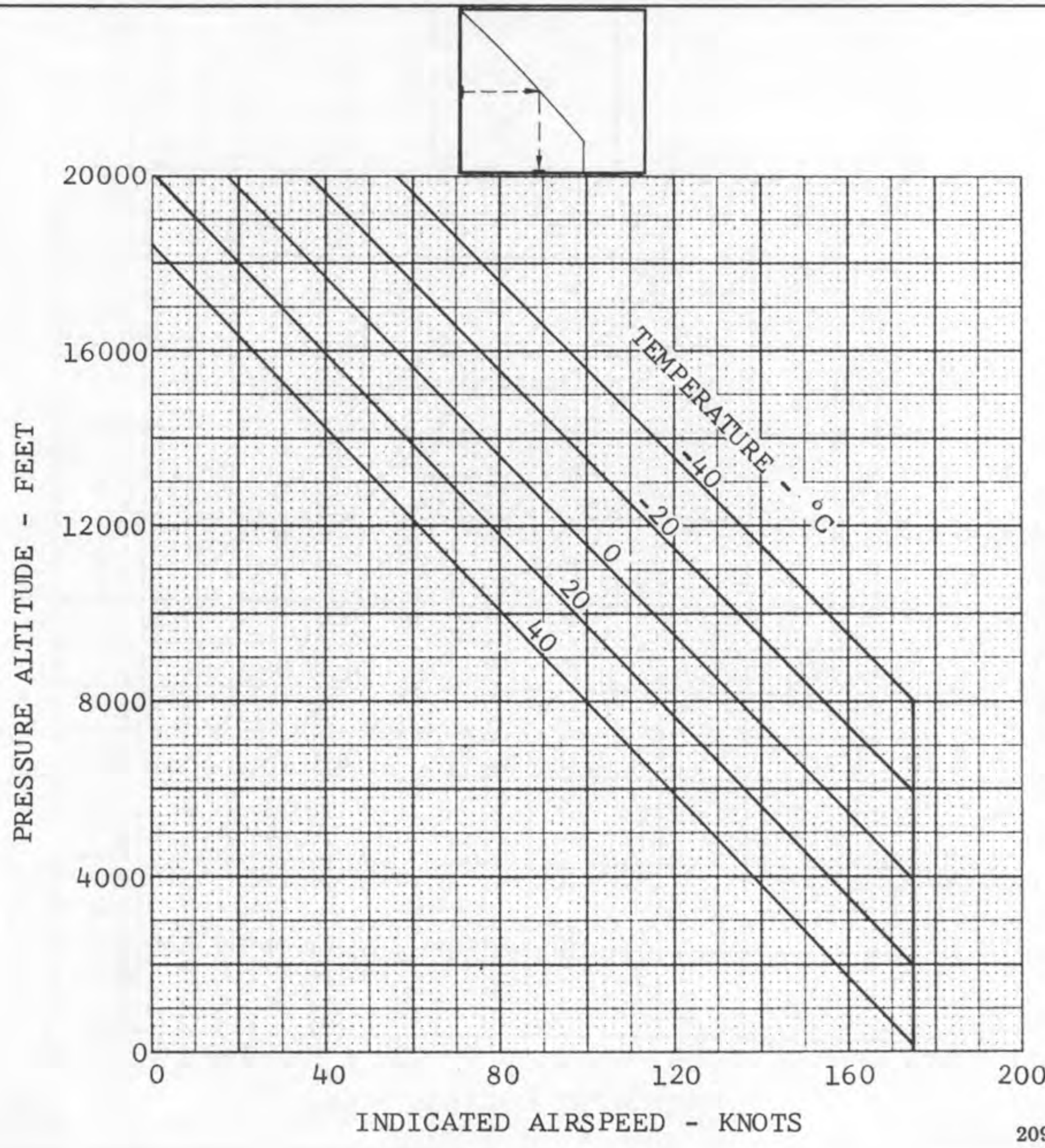
Figure 14-4. Component lift maximum speed chart

COMPONENT LIFE MAXIMUM SPEED

HEAVY SCOUT AND HEAVY HOG CONFIGURATIONS

Model(s): AH-1G
Data as of: JUNE 1971
DATA BASIS: ARMY PHASE D FLIGHT TEST (66-06)

Engine(s): T53-L-13
Fuel Grade: JP-4
Fuel Density: 6.5 LB/GAL



209900-398
AV089708

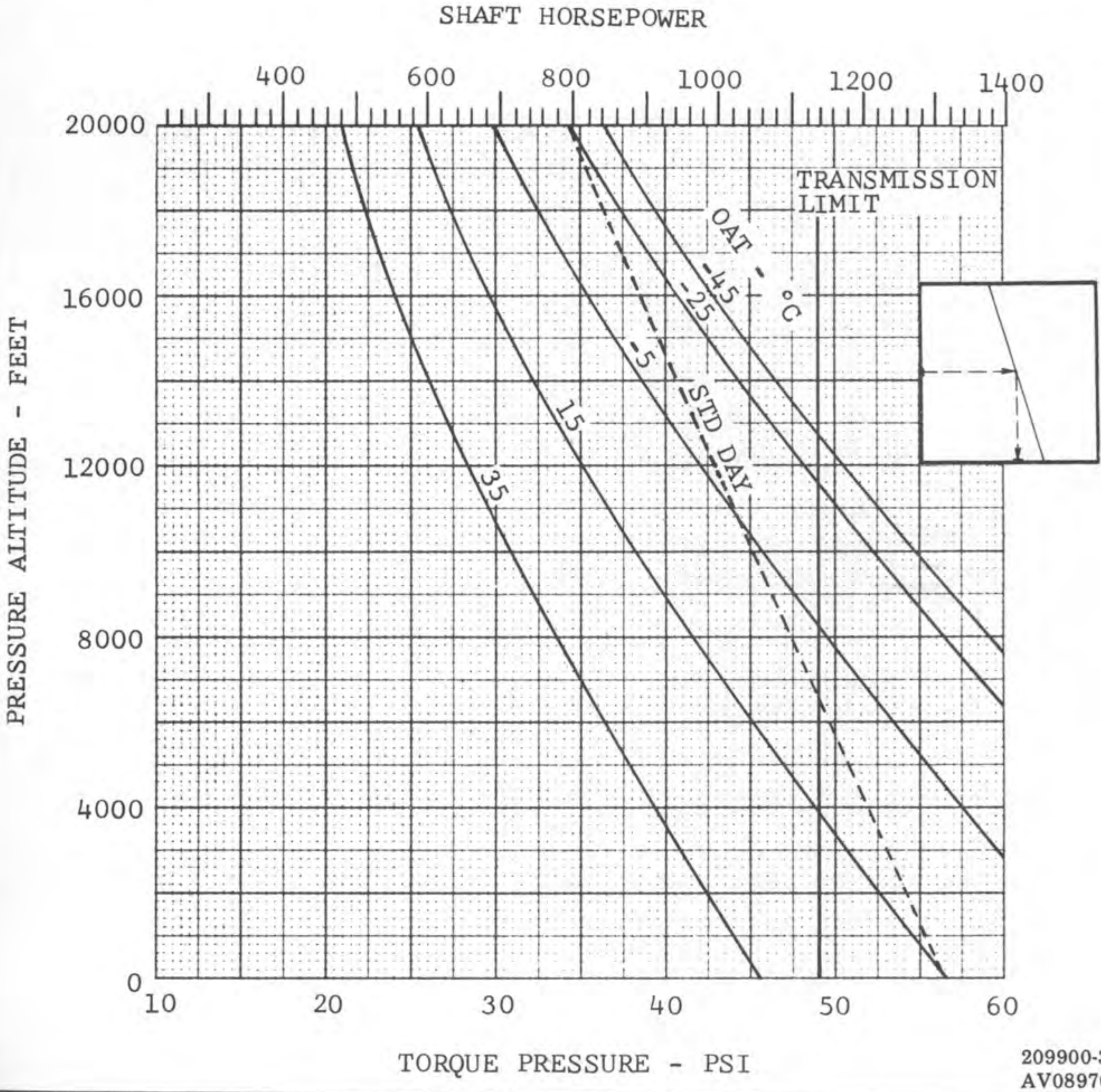
Figure 14-5. Component life maximum speed chart

MILITARY RATED POWER AVAILABLE

0 AND 70 KNOTS

Model(s): AH-1G
Data as of: JUNE 1971
DATA BASIS: ARMY PHASE D
FLIGHT TEST (66-06)

Engine(s): T53-L-13
Fuel Grade: JP-4
Fuel Density: 6.5 LB/GAL



209900-399
AV089709

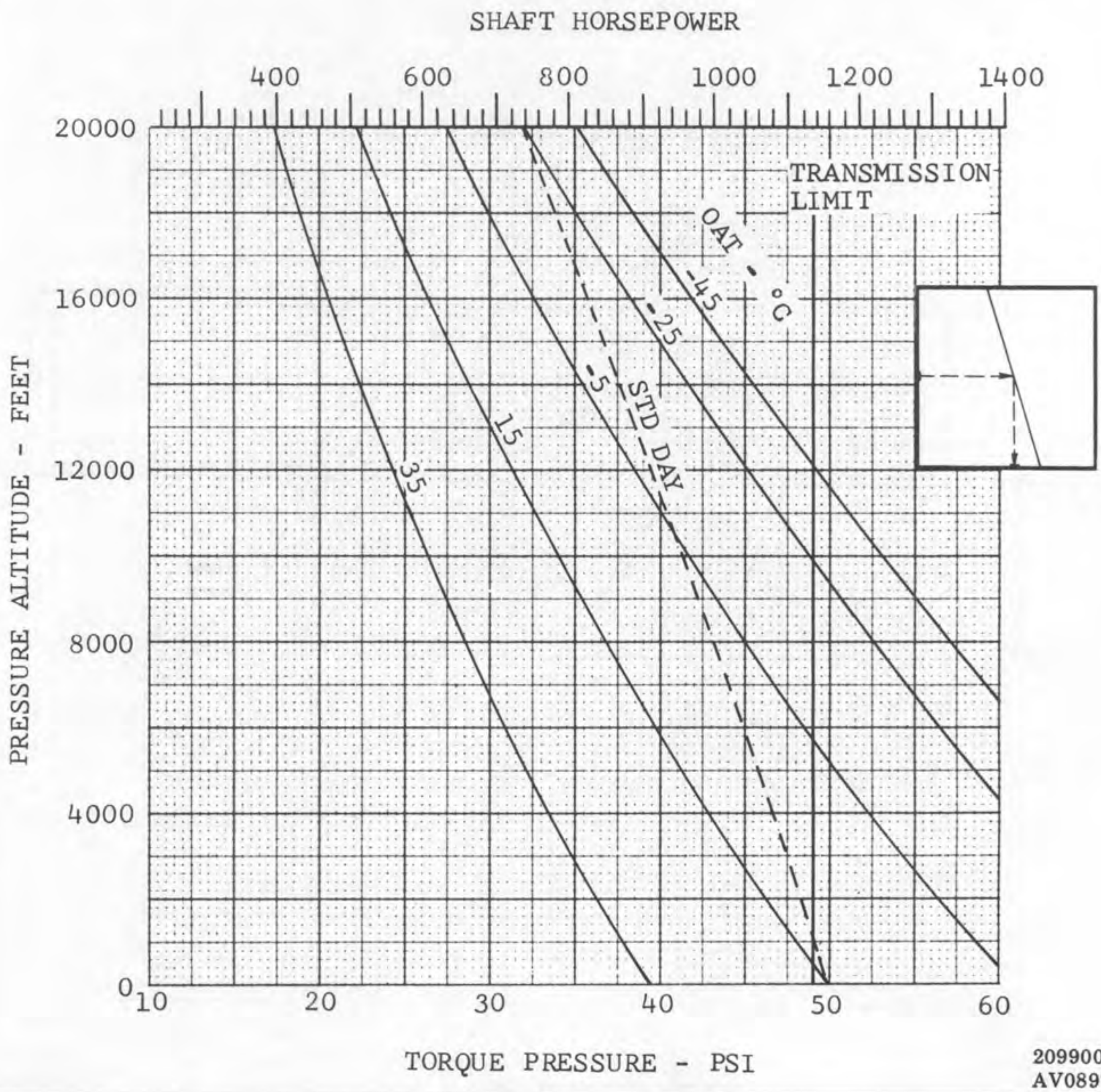
Figure 14-6. Power available chart

NORMAL RATED POWER AVAILABLE

0 AND 70 KNOTS

Model(s): AH-1G
Data as of: JUNE 1971
DATA BASIS: ARMY PHASE D
FLIGHT TEST (66-06)

Engine(s): T53-L-13
Fuel Grade: JP-4
Fuel Density: 6.5 LB/GAL



209900-400
AV089710

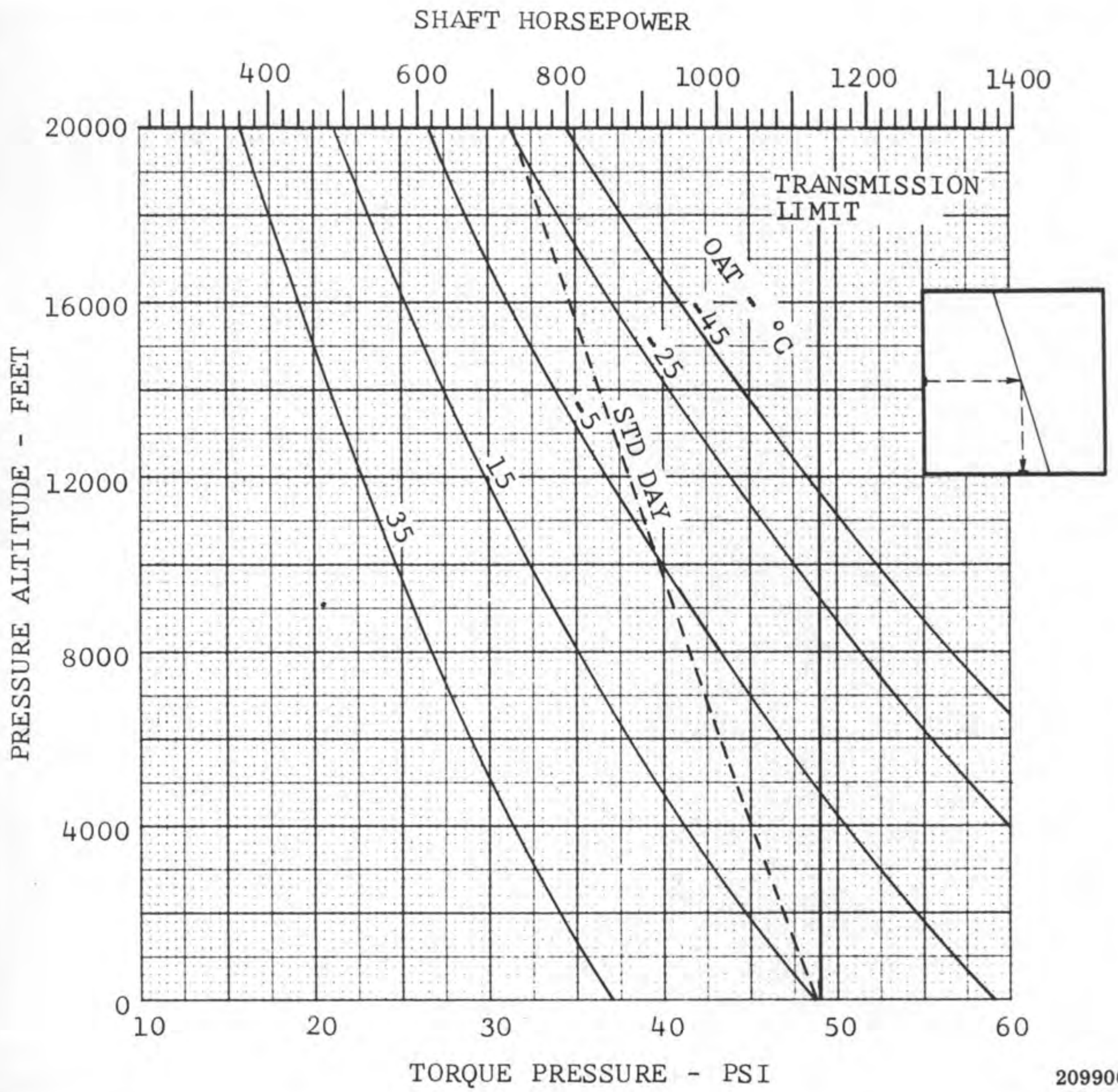
Figure 14-7. Power available chart

NORMAL RATED POWER AVAILABLE

140 KNOTS

Model(s): AH-1G
Data as of: JUNE 1971
DATA BASIS: ARMY PHASE D FLIGHT TEST (66-06)

Engine(s): T53-L-13
Fuel Grade: JP-4
Fuel Density: 6.5 LB/GAL



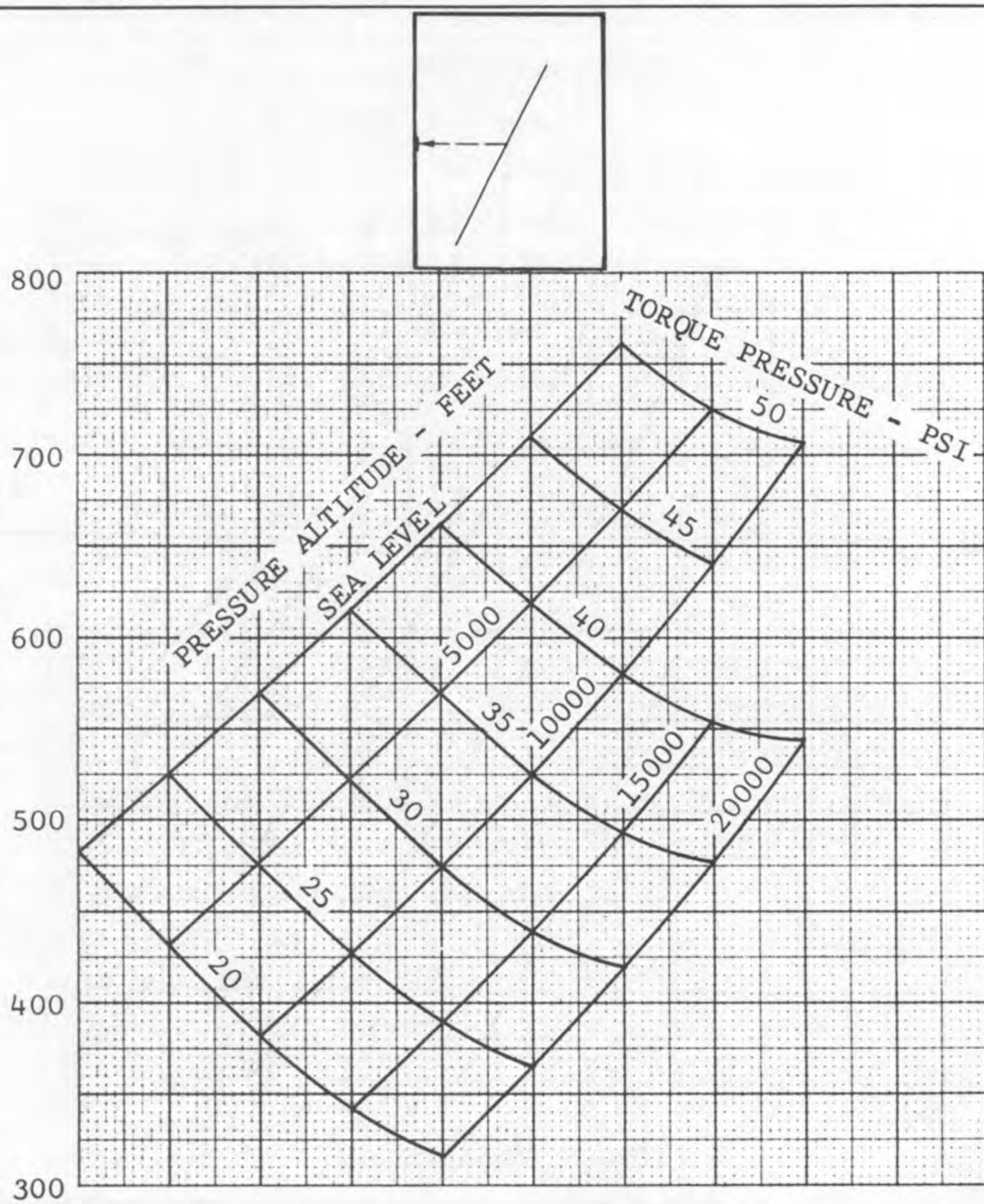
209900-401
AV089711

Figure 14-8. Power available chart

FUEL FLOW

Model(s): AH-1G
Data as of: JUNE 1971
DATA BASIS: ARMY PHASE D
FLIGHT TEST (66-06)

Engine(s): T53-L-13
Fuel Grade: JP-4
Fuel Density: 6.5 LB/GAL



209900-402
AV089712

Figure 14-9. Fuel flow chart

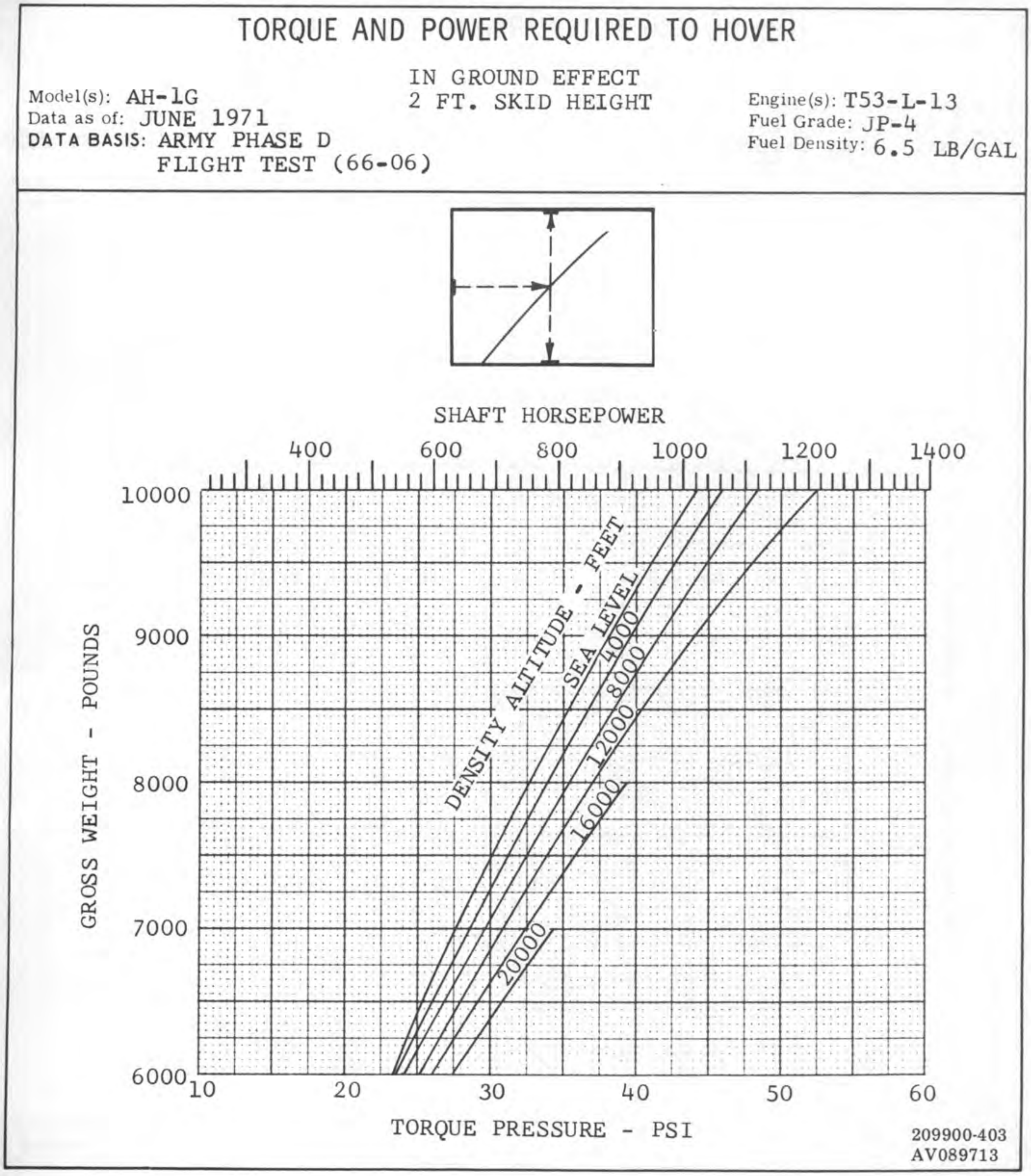


Figure 14-10. Torque and power required to hover chart

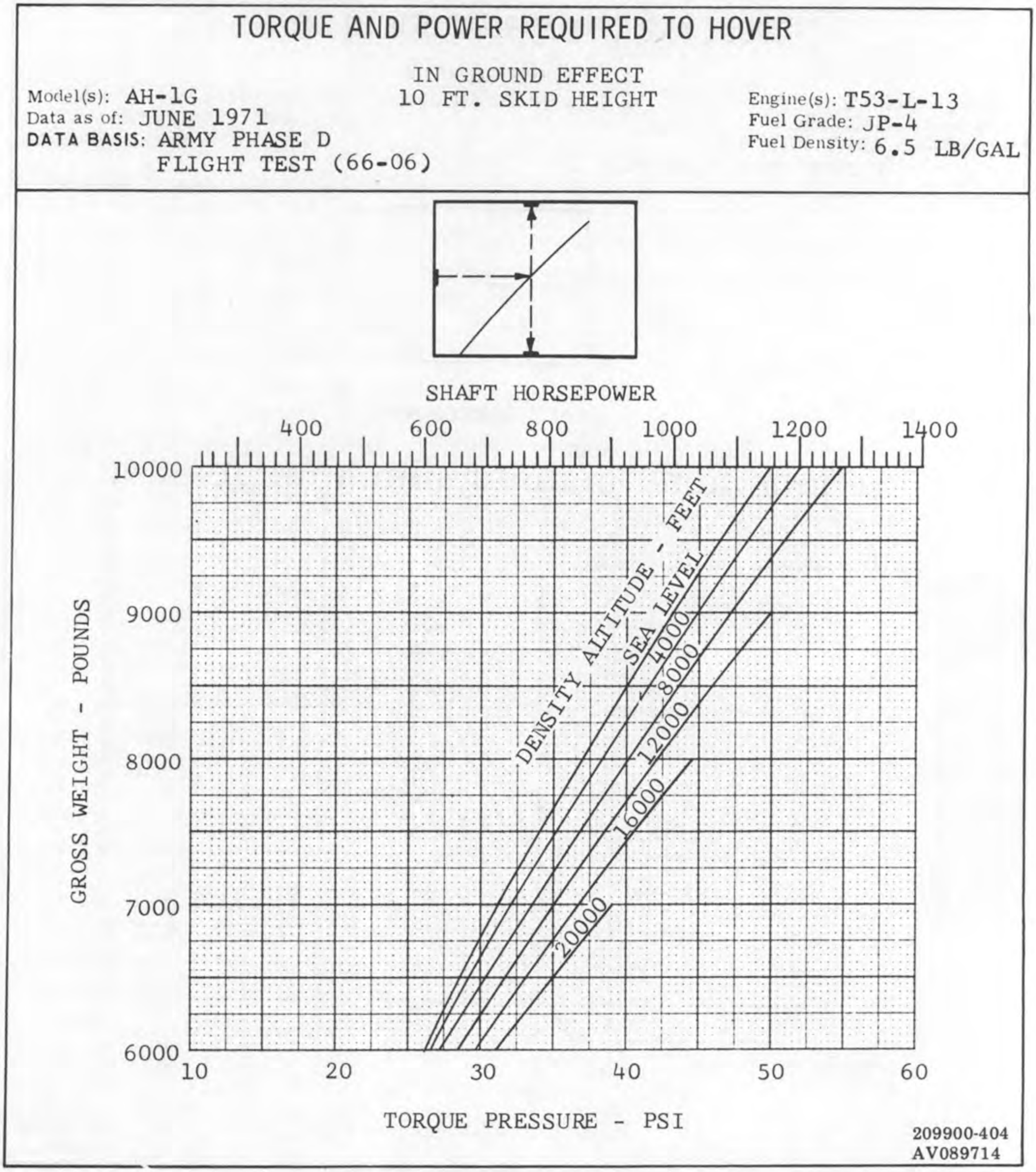


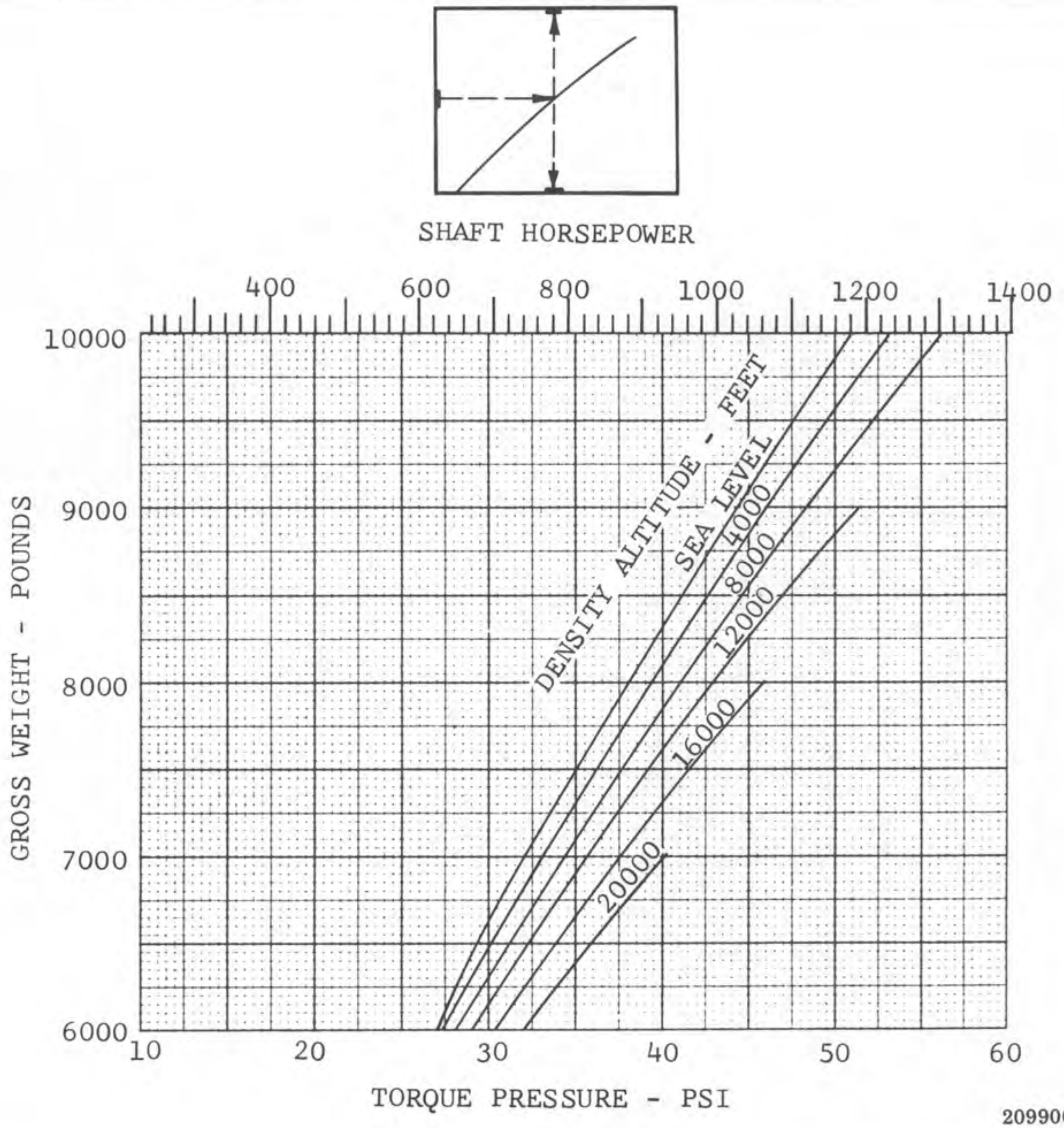
Figure 14-11. Torque and power required to hover chart.

TORQUE AND POWER REQUIRED TO HOVER

IN GROUND EFFECT
15 FT. SKID HEIGHT

Model(s): AH-1G
Data as of: JUNE 1971
DATA BASIS: ARMY PHASE D
FLIGHT TEST (66-06)

Engine(s): T53-L-13
Fuel Grade: JP-4
Fuel Density: 6.5 LB/GAL



209900-405
AV089715

Figure 14-12. Torque and power required to hover chart

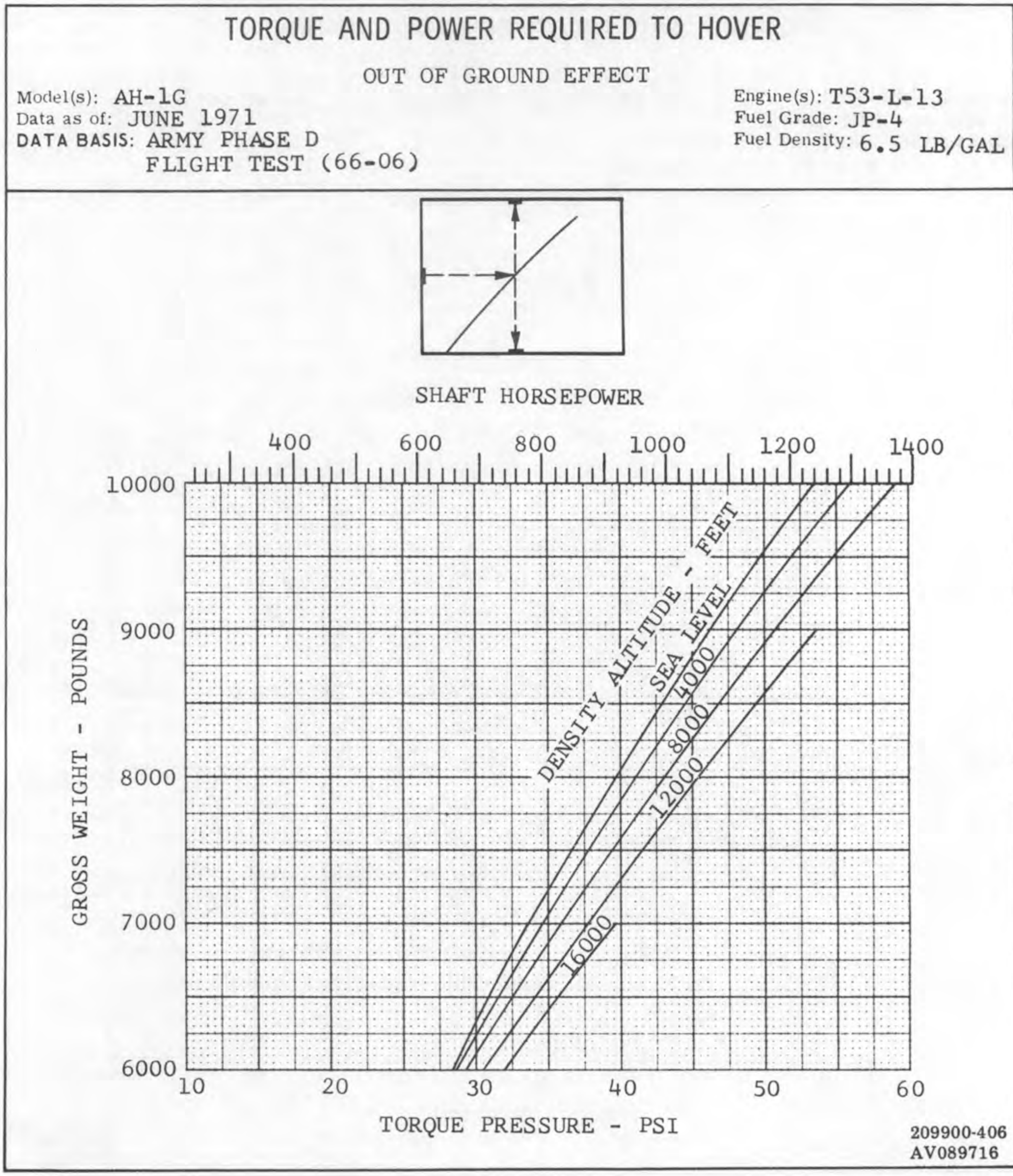


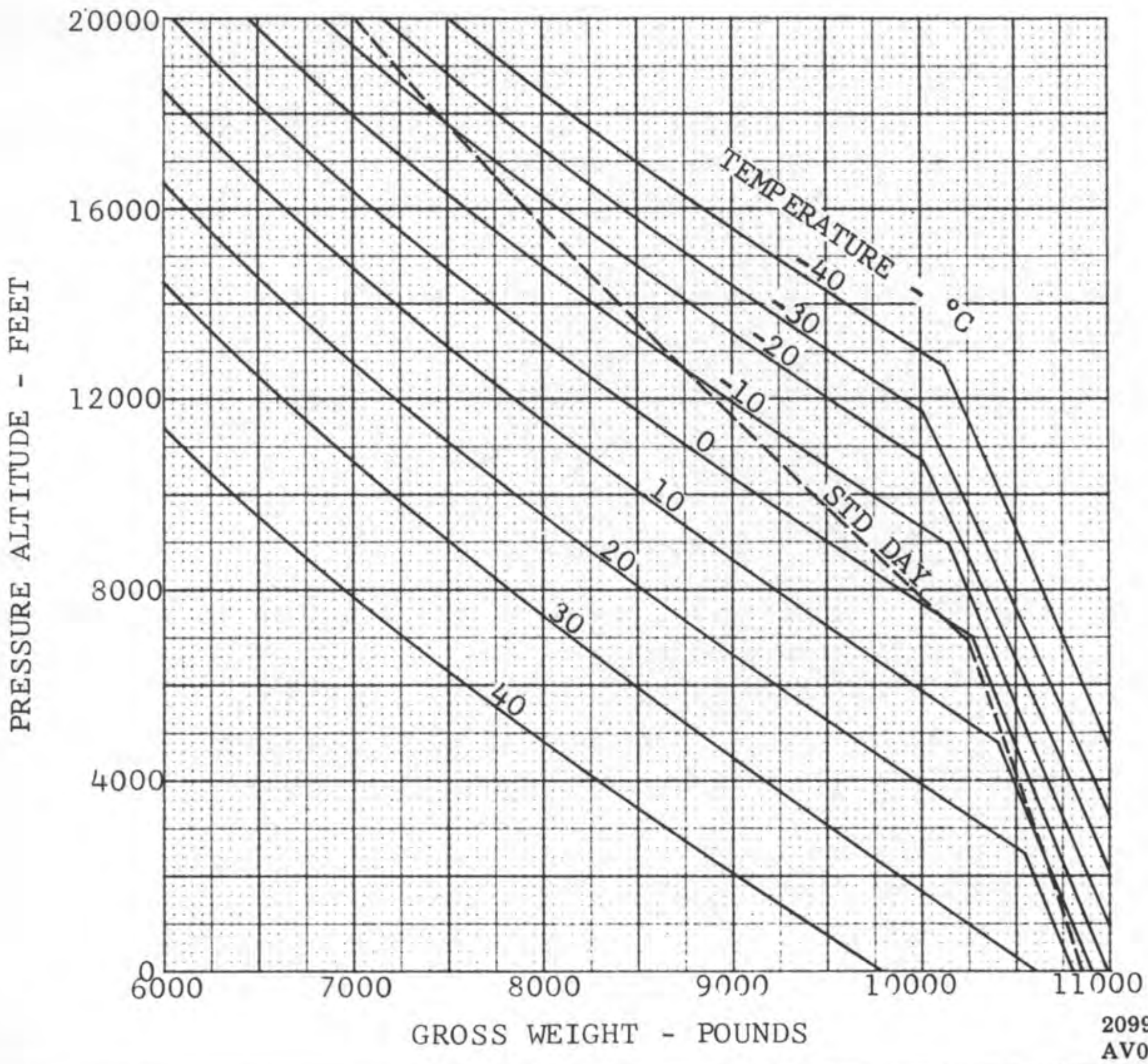
Figure 14-13. Torque and power required to hover chart

HOVER CEILING

IN GROUND EFFECT
2 FT. SKID HEIGHT
MILITARY RATED POWER

Model(s): AH-1G
Data as of: JUNE 1971
DATA BASIS: ARMY PHASE D
FLIGHT TEST (66-06)

Engine(s): T53-L-13
Fuel Grade: JP-4
Fuel Density: 6.5 LB/GAL



209900-407
AV089717

Figure 14-14. Hover ceiling chart

HOVER CEILING

IN GROUND EFFECT
10 FT. SKID HEIGHT
MILITARY RATED POWER

Model(s): AH-1G
Data as of: JUNE 1971
DATA BASIS: ARMY PHASE D
FLIGHT TEST (66-06)

Engine(s): T53-L-13
Fuel Grade: JP-4
Fuel Density: 6.5 LB/GAL

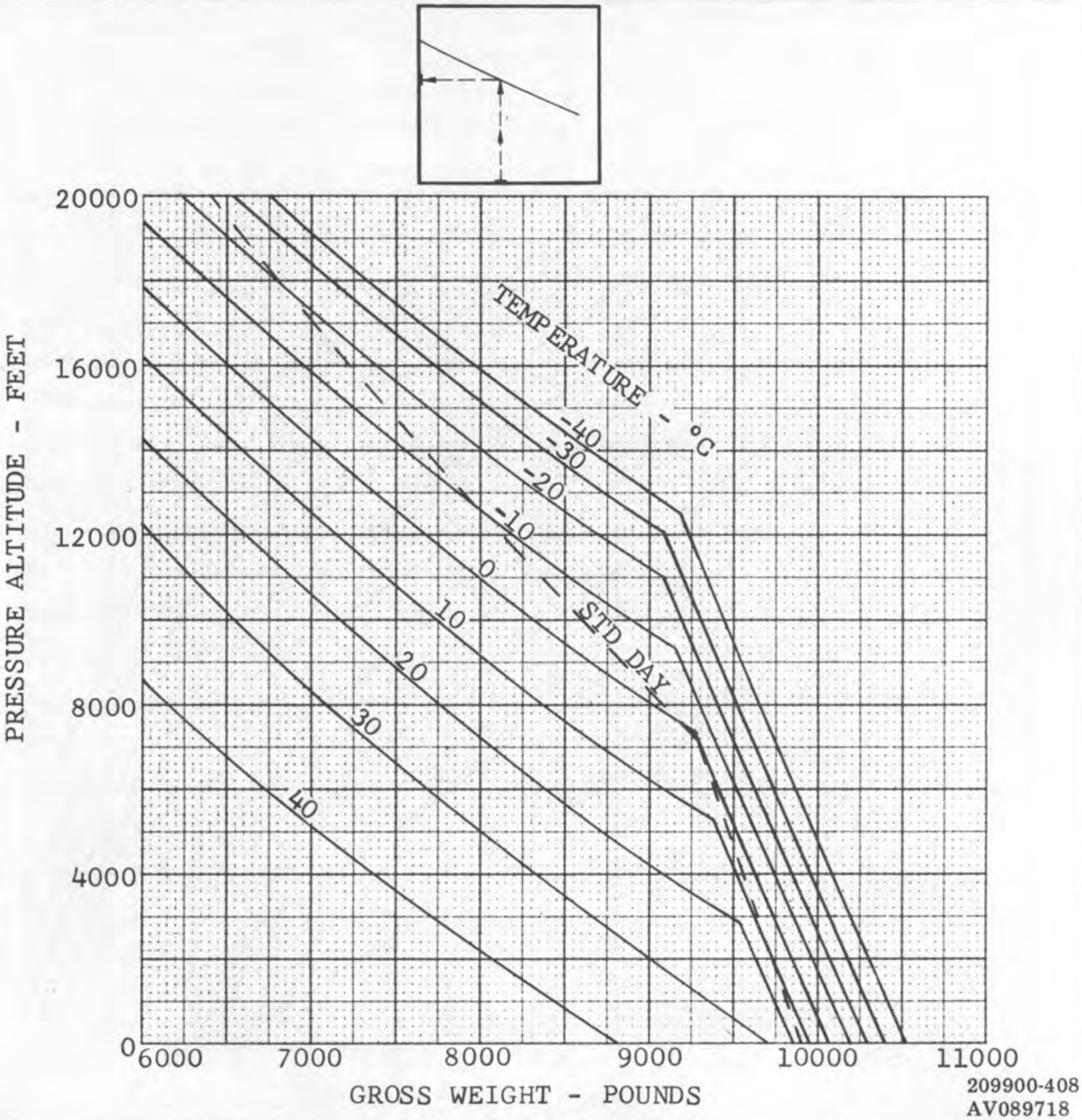


Figure 14-15. Hover ceiling chart

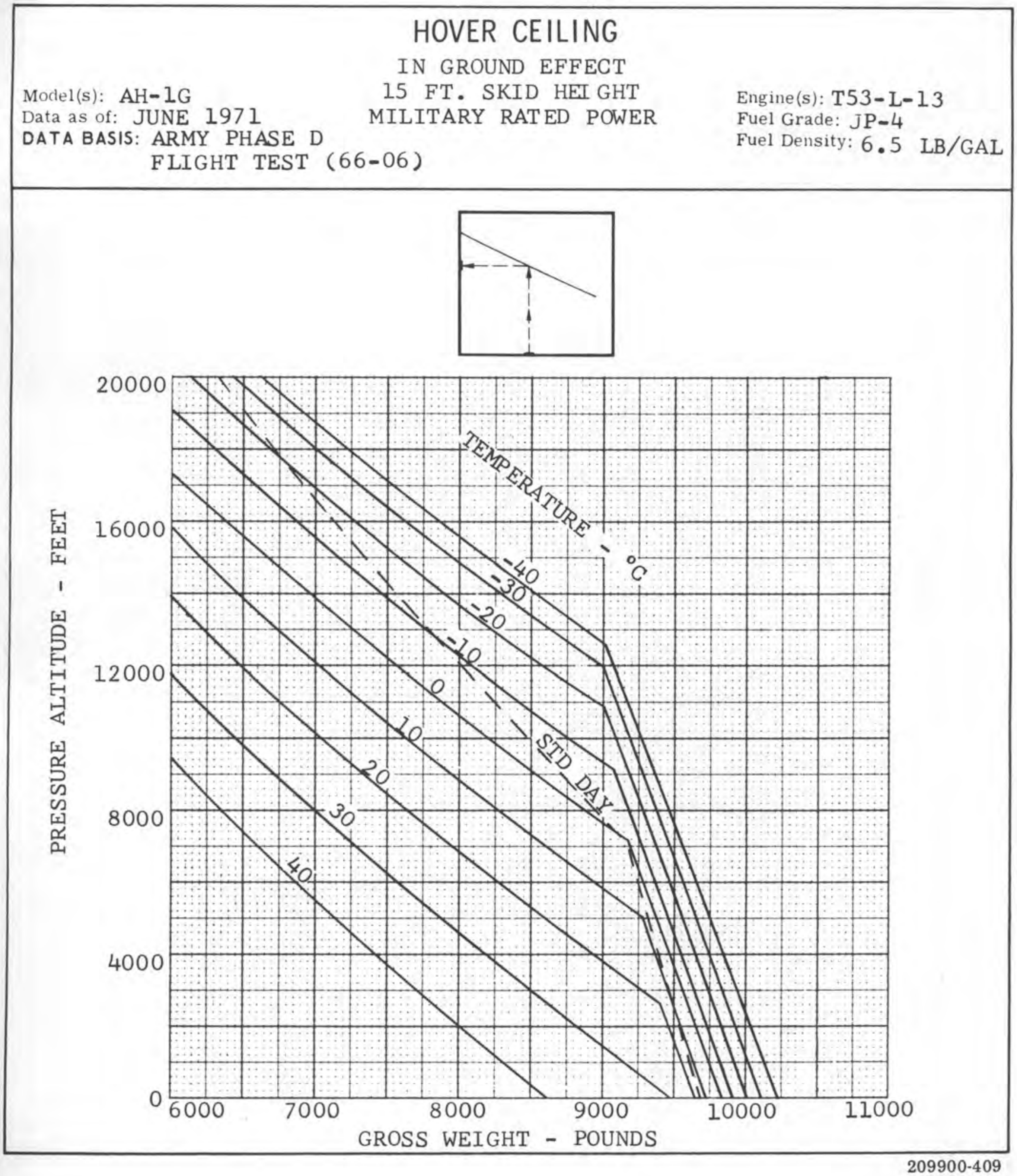


Figure 14-16. Hover ceiling chart

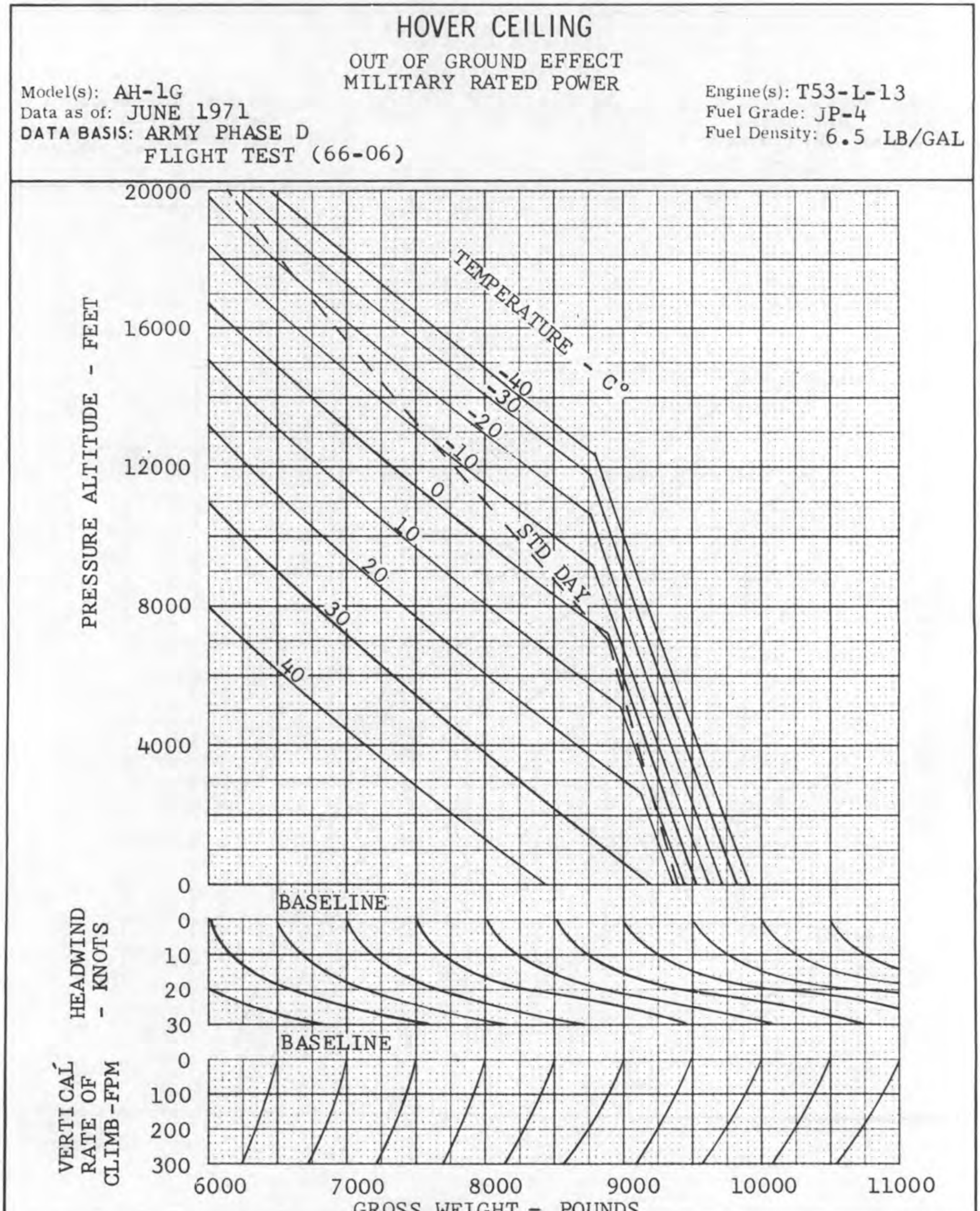


Figure 14-17. Hover ceiling chart

209900-410
AV089720

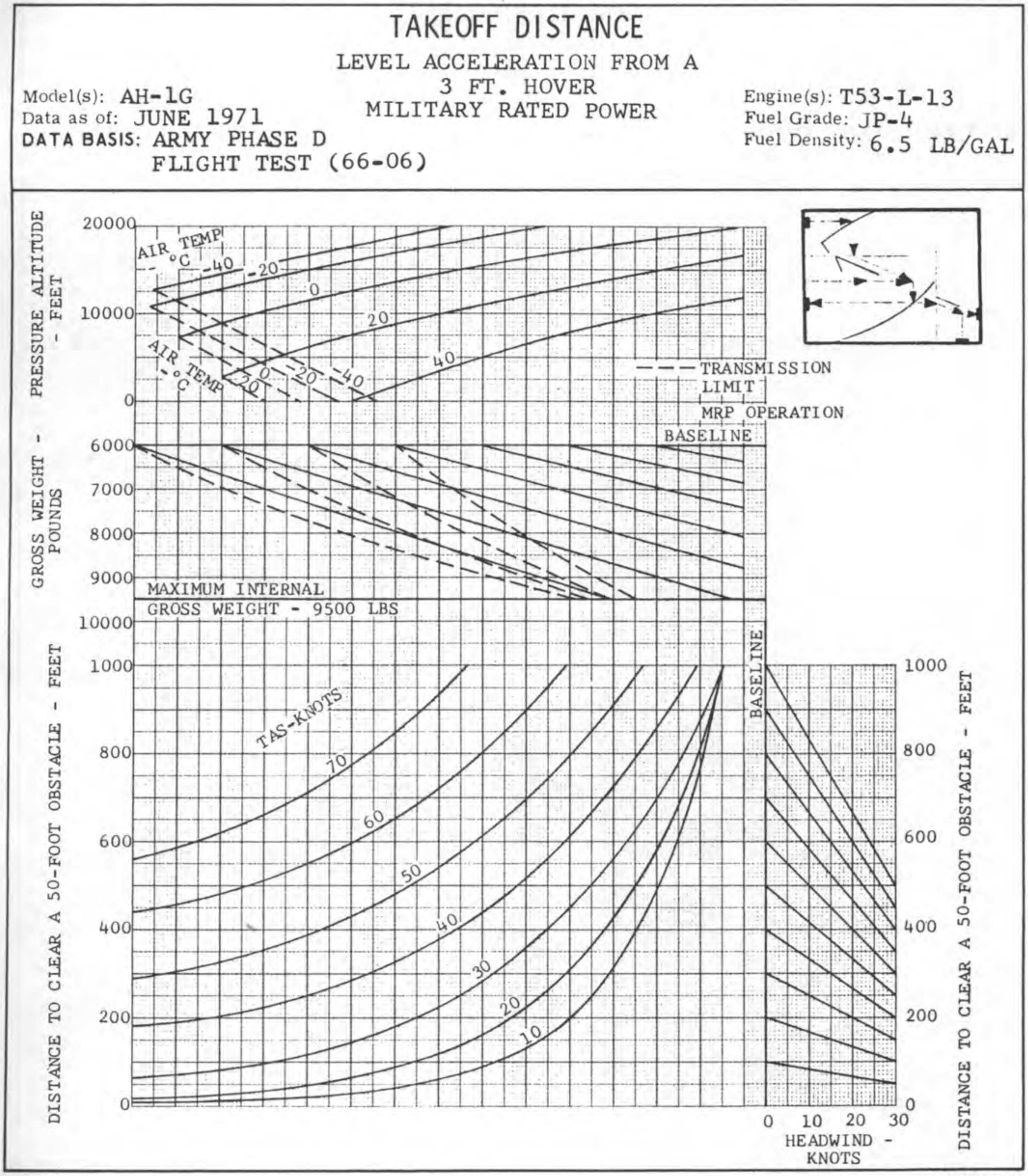


Figure 14-18. Take-off distance chart

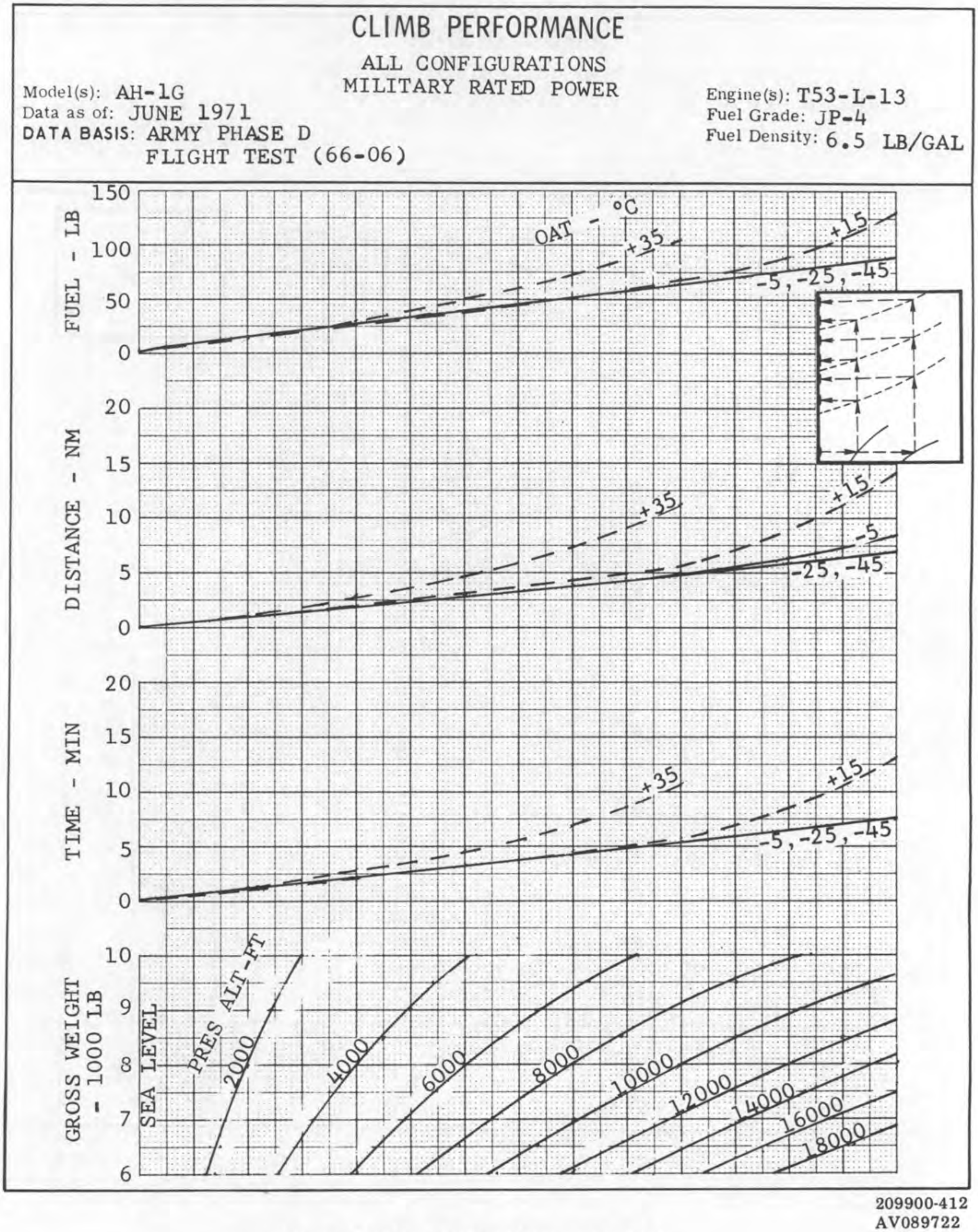


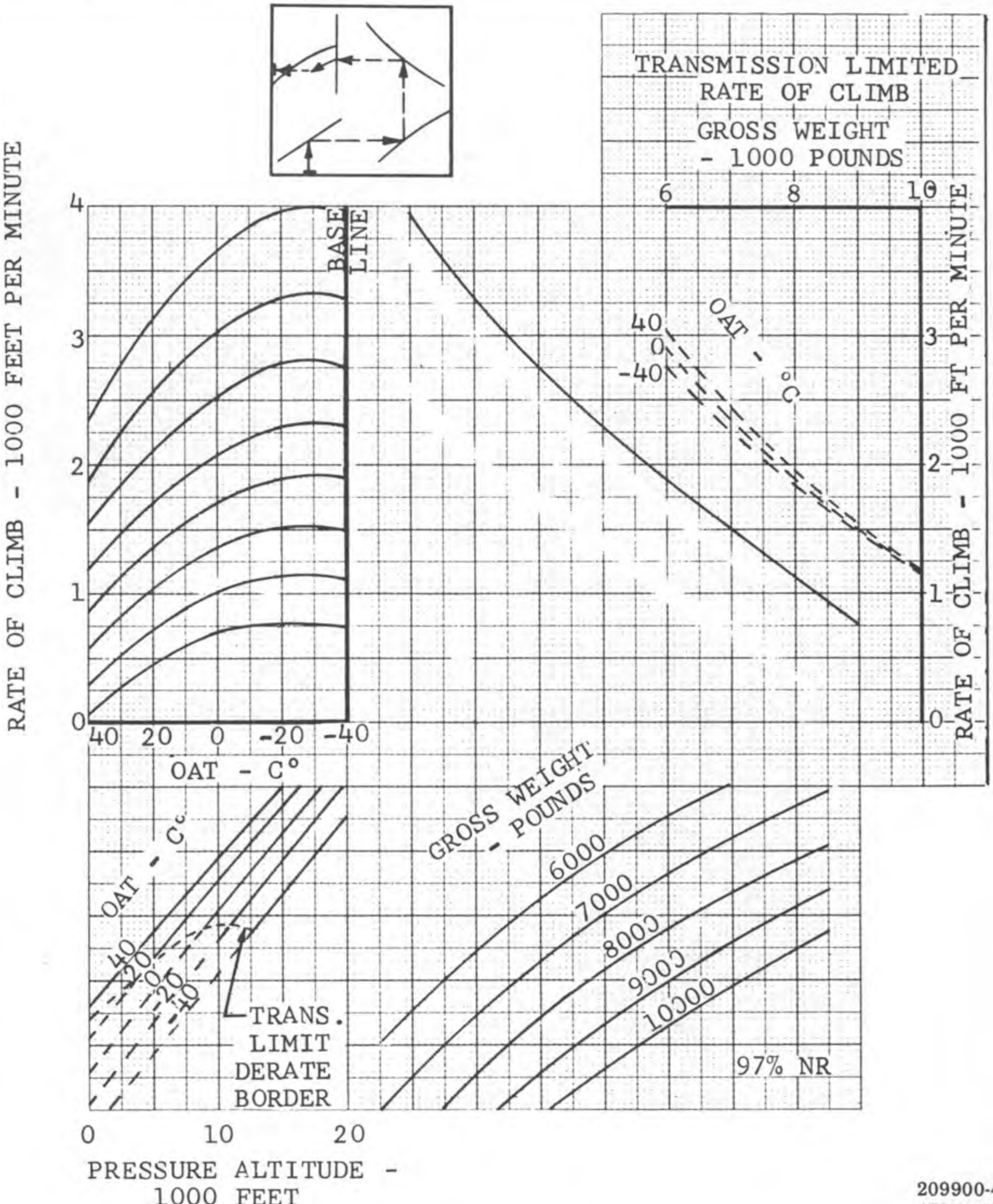
Figure 14-19. Climb performance chart

RATE OF CLIMB

ALL CONFIGURATIONS
MILITARY RATED POWER

Model(s): AH-1G
Data as of: JUNE 1971
DATA BASIS: ARMY PHASE D FLIGHT TEST (66-06)

Engine(s): T53-L-13
Fuel Grade: JP-4
Fuel Density: 6.5 LB/GAL



209900-413
AV089723

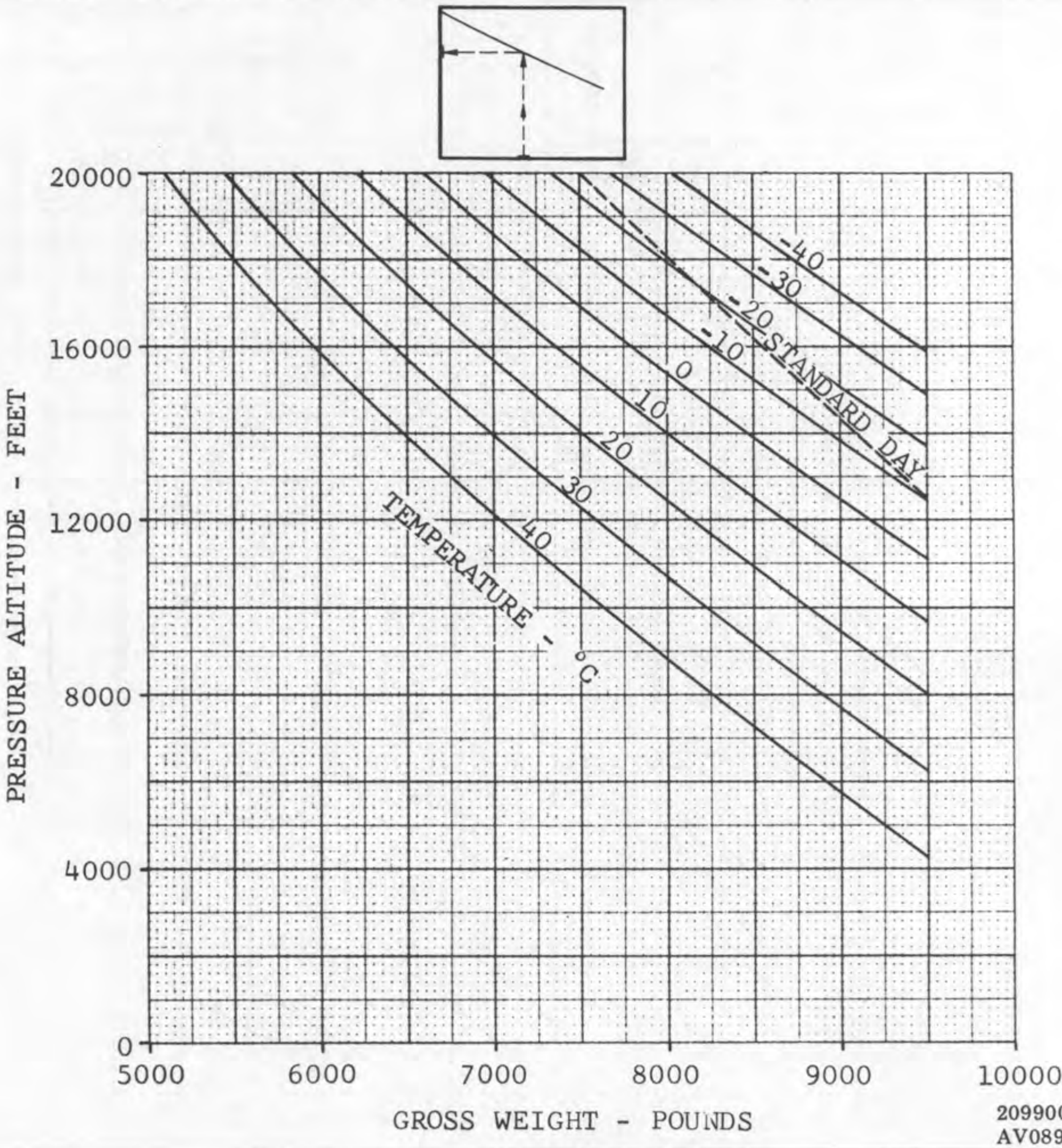
Figure 14-20. Maximum rate of climb chart

SERVICE CEILING

ALL CONFIGURATIONS
NORMAL RATED POWER

Model(s): AH-1G
Data as of: JUNE 1971
DATA BASIS: ARMY PHASE D
FLIGHT TEST (66-06)

Engine(s): T53-L-13
Fuel Grade: JP-4
Fuel Density: 6.5 LB/GAL



209900-414
AV089724

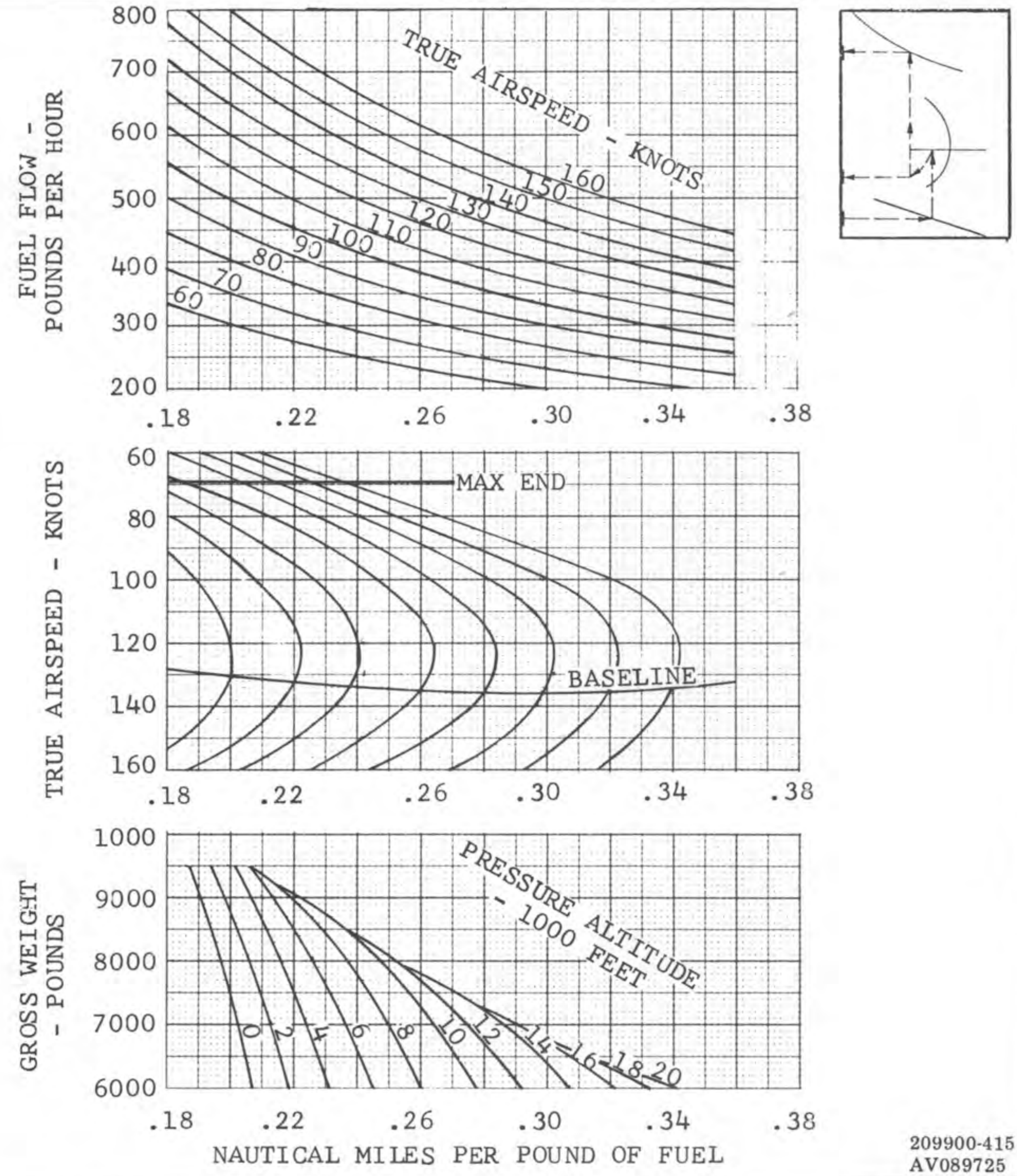
Figure 14-21. Service ceiling chart

SPECIFIC RANGE

BASIC CONFIGURATION

Model(s): AH-1G
Data as of: JUNE 1971
DATA BASIS: ARMY PHASE D
FLIGHT TEST (66-06)

Engine(s): T53-L-13
Fuel Grade: JP-4
Fuel Density: 6.5 LB/GAL



209900-415
AV089725

Figure 14-22. Specific range chart

SPECIFIC RANGE

HEAVY SCOUT CONFIGURATION

Model(s): AH-1G
Data as of: JUNE 1971
DATA BASIS: ARMY PHASE D
FLIGHT TEST (66-06)

Engine(s): T53-L-13
Fuel Grade: JP-4
Fuel Density: 6.5 LB/GAL

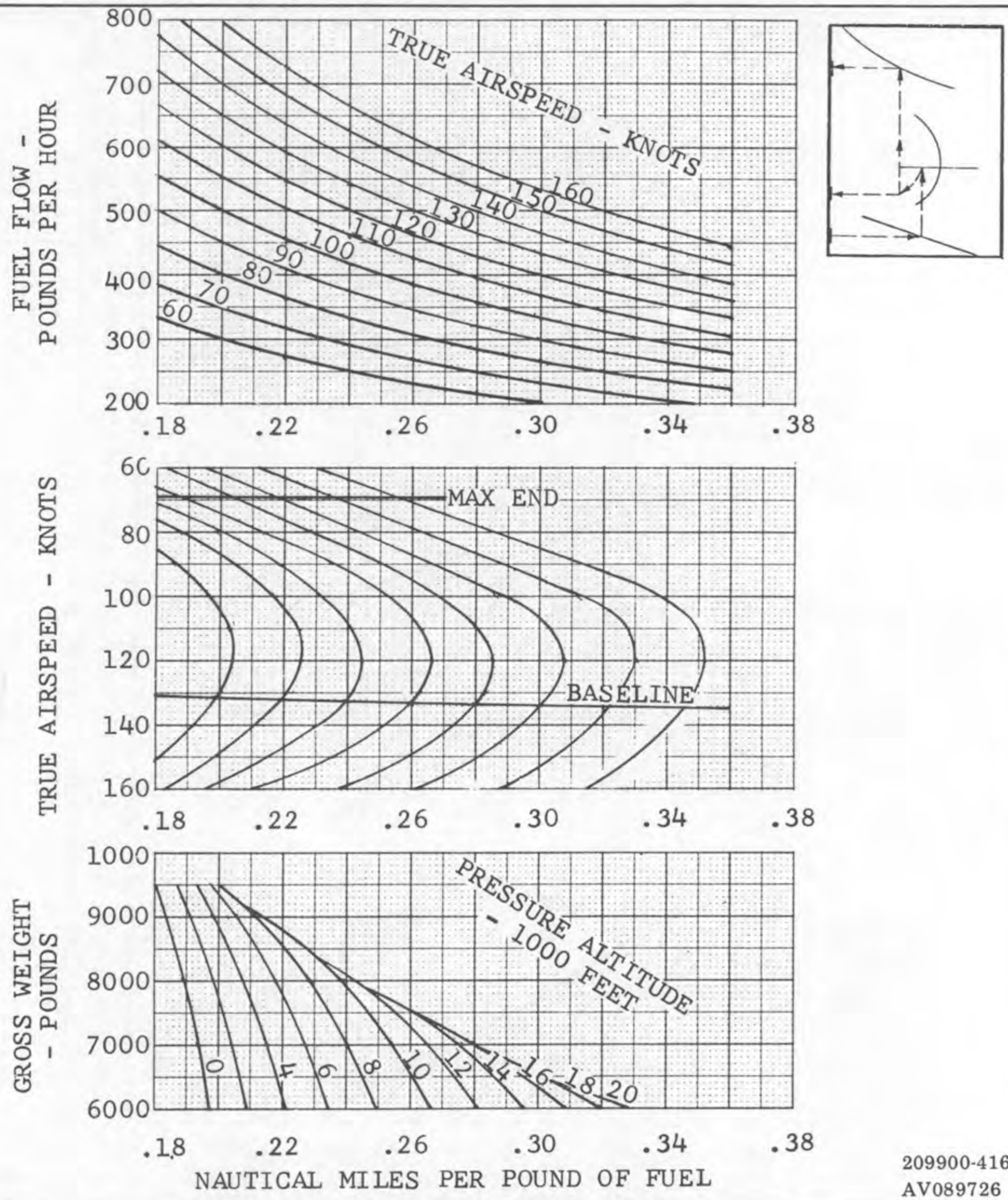


Figure 14-23. Specific range chart

SPECIFIC RANGE

HEAVY HOG CONFIGURATION

Model(s): AH-1G
Data as of: JUNE 1971
DATA BASIS: ARMY PHASE D
FLIGHT TEST (66-06)

Engine(s): T53-L-13
Fuel Grade: JP-4
Fuel Density: 6.5 LB/GAL

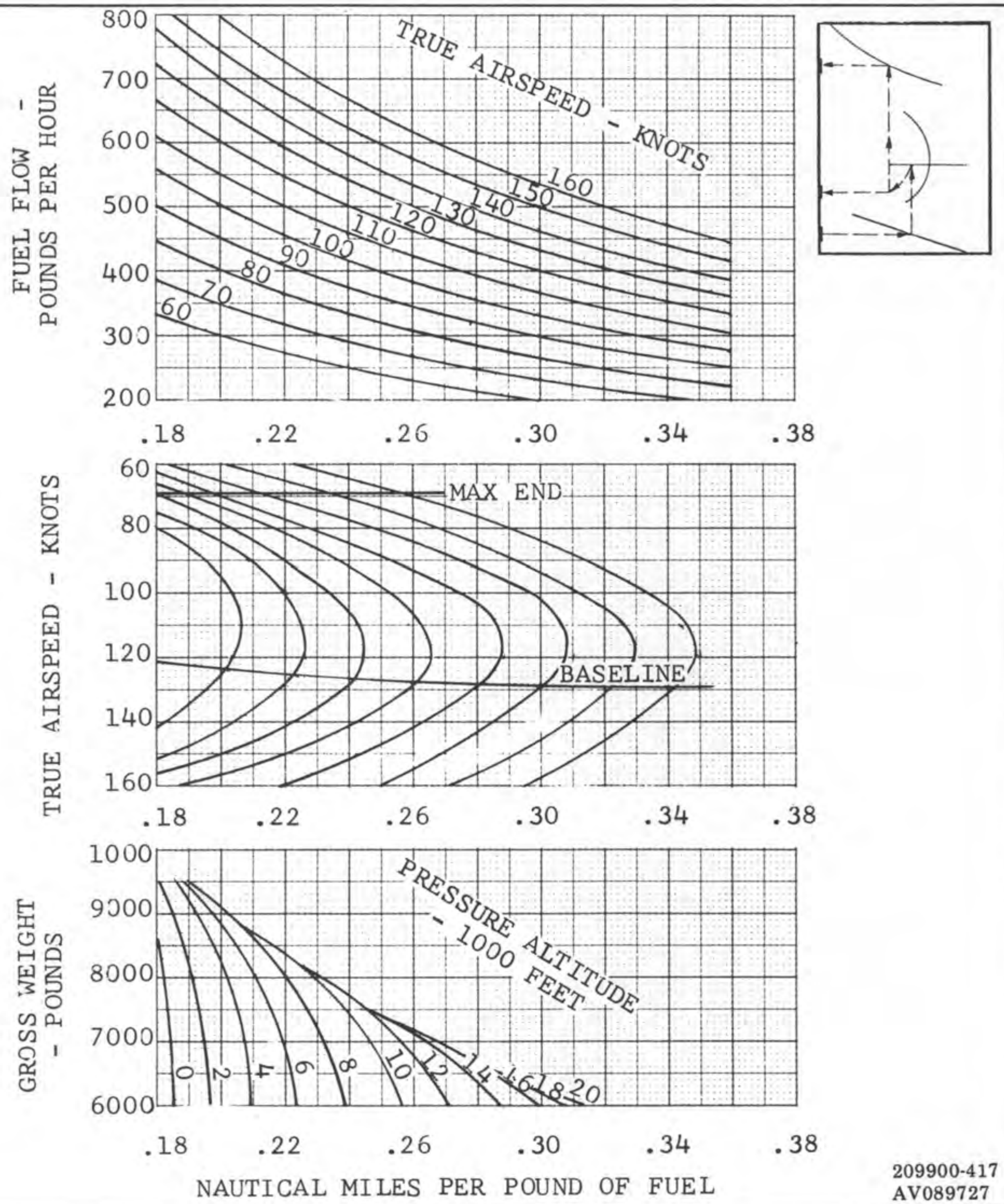


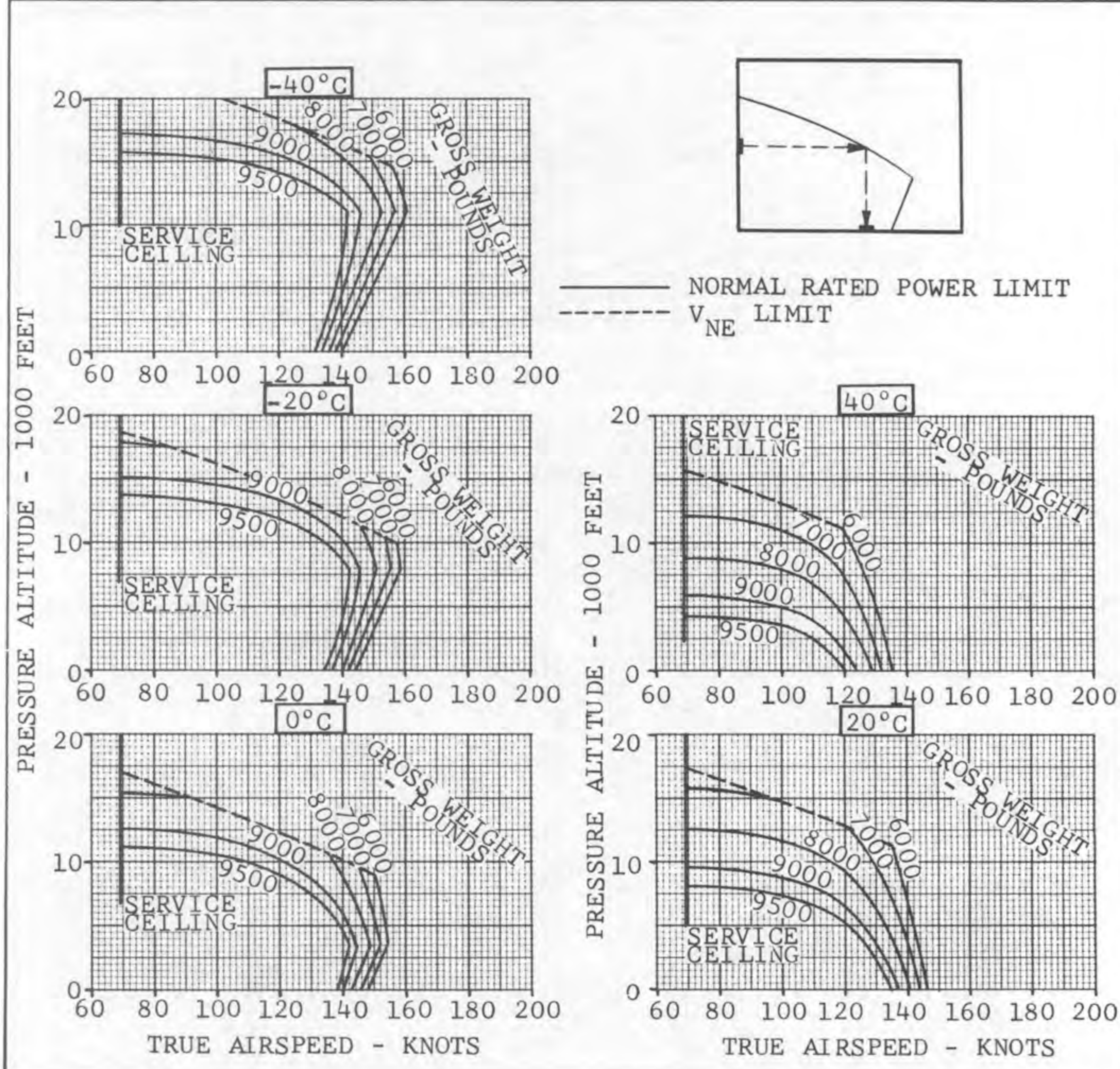
Figure 14-24. Specific range chart

MAXIMUM CRUISE SPEED

BASIC CONFIGURATION

Model(s): AH-1G
Data as of: JUNE 1971
DATA BASIS: ARMY PHASE D
FLIGHT TEST (66-06)

Engine(s): T53-L-13
Fuel Grade: JP-4
Fuel Density: 6.5 LB/GAL



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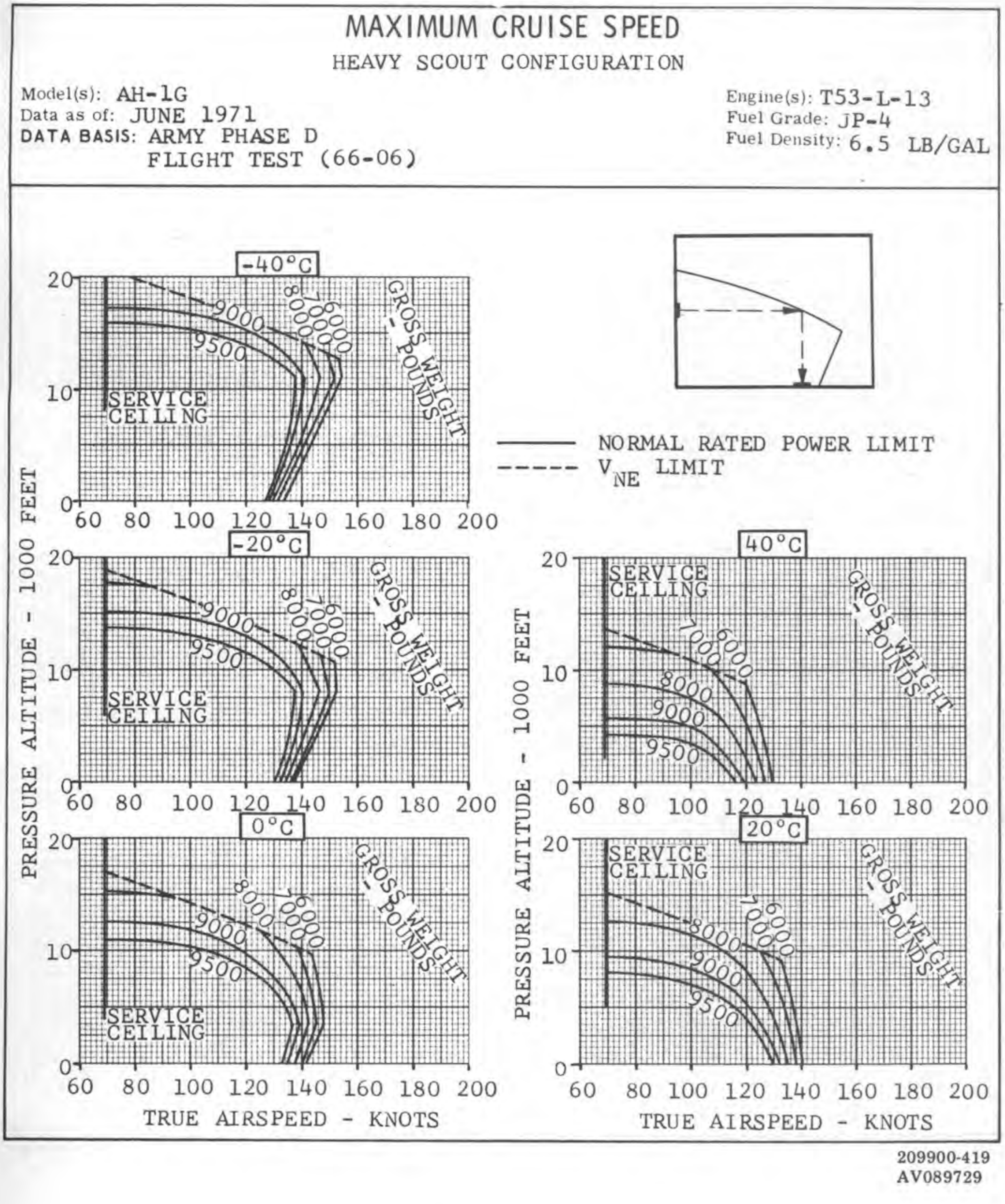
AV089728

Figure 14-25. Maximum cruise speed chart



209900-419
AV089729

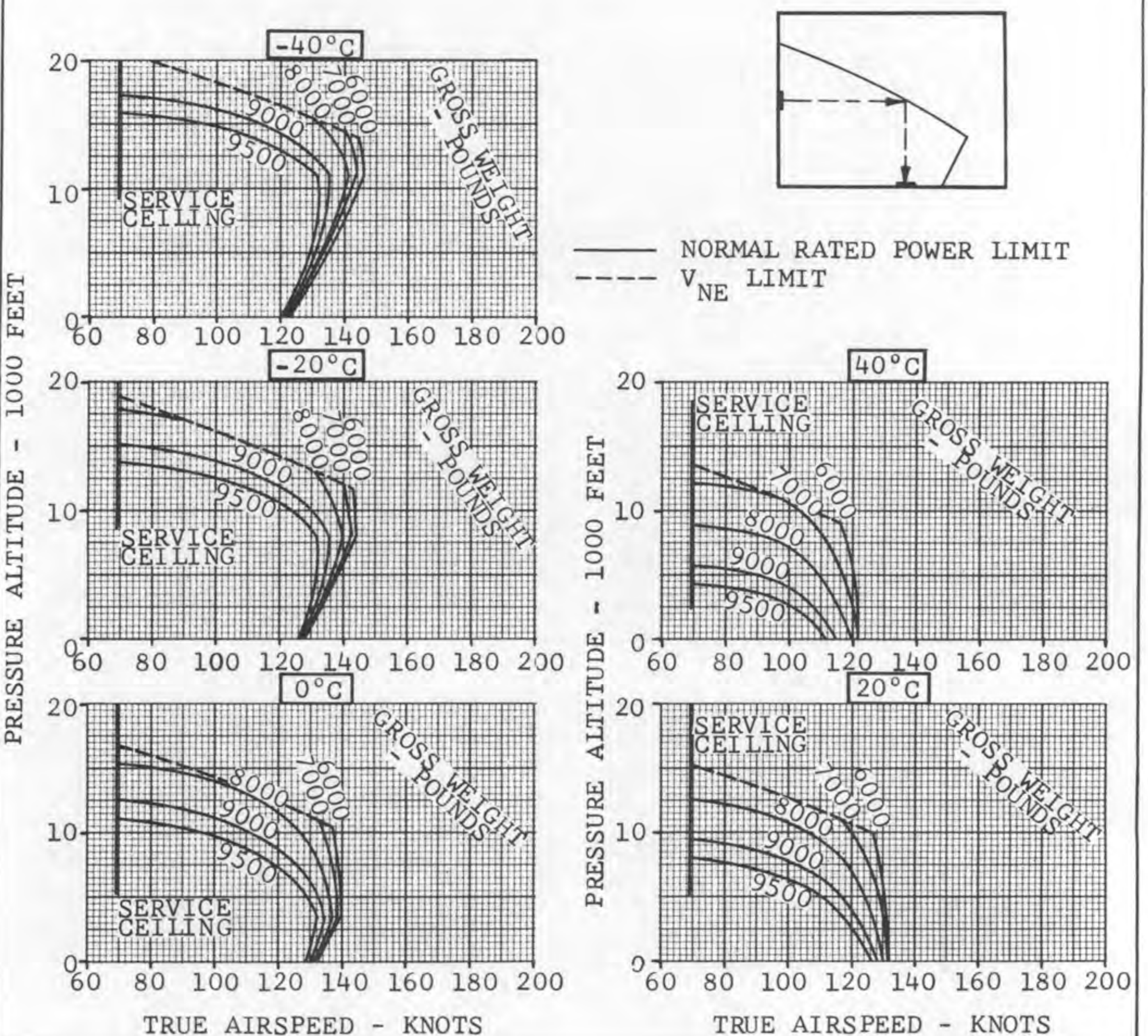
Figure 14-26. Maximum cruise speed chart

MAXIMUM CRUISE SPEED

HEAVY HOG CONFIGURATION

Model(s): AH-1G
Data as of: JUNE 1971
DATA BASIS: ARMY PHASE D FLIGHT TEST (66-06)

Engine(s): T53-L-13
Fuel Grade: JP-4
Fuel Density: 6.5 LB/GAL



209900-420
AV089730

Figure 14-27. Maximum cruise speed chart

POWER CHART

Model(s): AH-1G
Data as of: JUNE 1971
DATA BASIS: ARMY PHASE D FLIGHT TEST (66-06)

Engine(s): T53-L-13
Fuel Grade: JP-4
Fuel Density: 6.5 LB/GAL

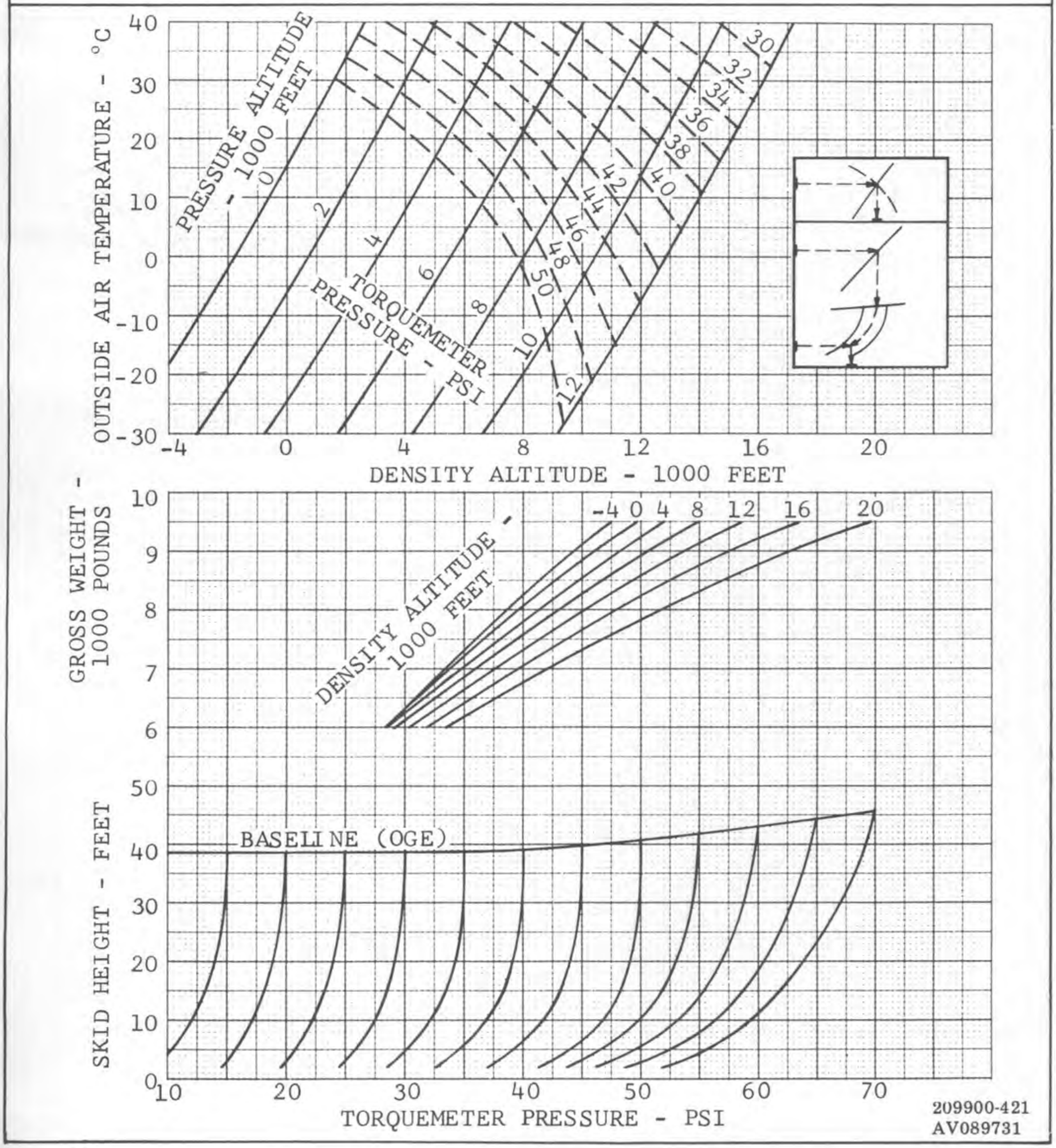


Figure 14-28. Power chart

POWER CHECK CHART

Model(s): AH-1G
Data as of: JUNE 1971
DATA BASIS: ARMY PHASE D FLIGHT TEST (66-06)

Engine(s): T53-L-13
Fuel Grade: JP-4
Fuel Density: 6.5 LB/GAL

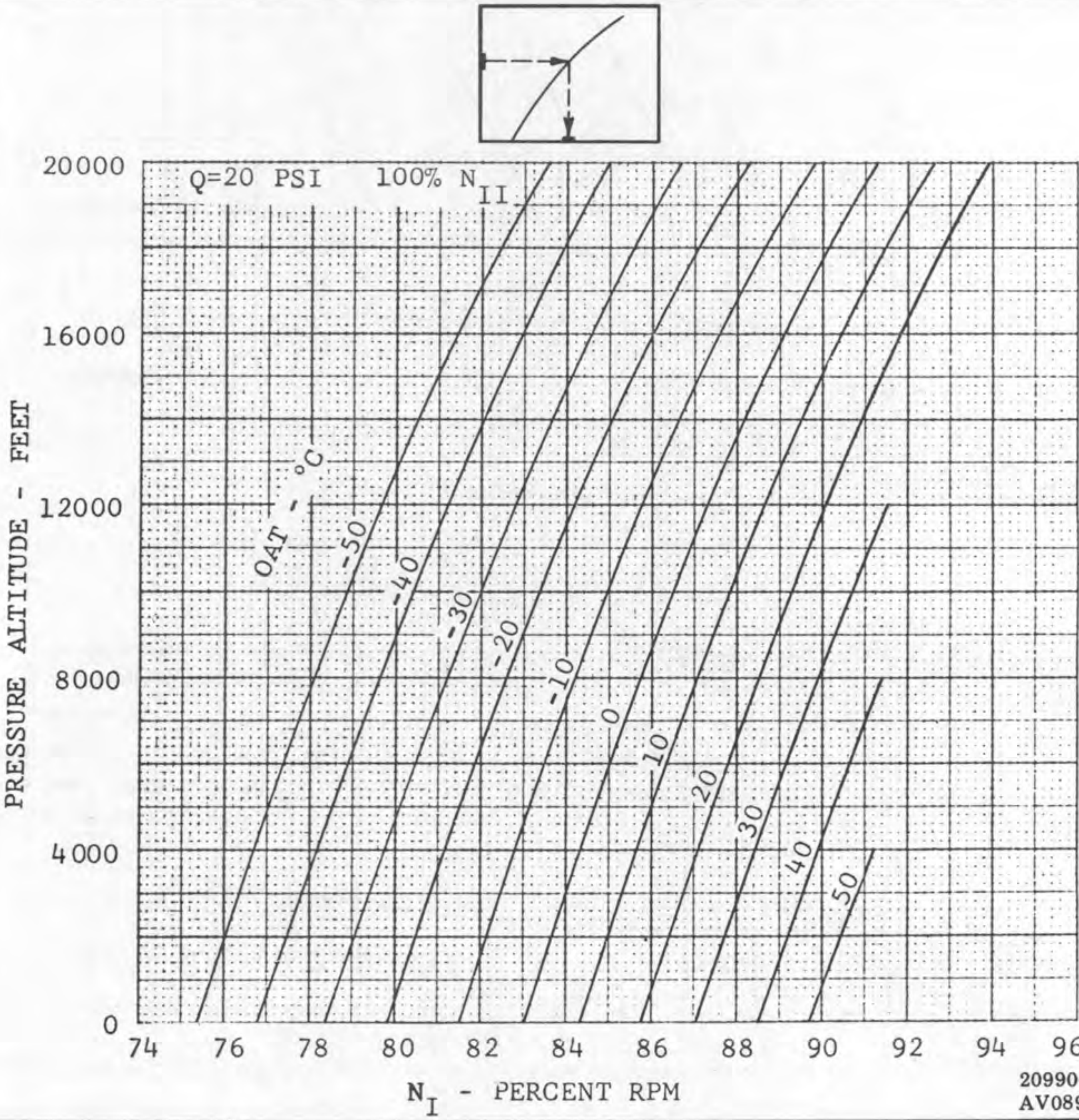


Figure 14-29. Power check chart

APPENDIX A

RTFERENCES

AR 95-1	Army Aviation — General Provisions and Flight Regulations
AR 95-5	Aircraft Accident Prevention, Investigation, and Reporting
AR 95-16	Weight and Balance Army Aircraft
AR385-40	Accident Reporting and Records
AR385-63	Regulations for Firing Ammunition
TB 55-1500-314-25	Handling, Storage and Disposal of Self-luminous Aircraft Instruments, Markers and Aircraft Engine Ignition Exciter Units Containing Radioactive Material
TB 55-9150-200-25	Engine and Transmission Oils and Additives for Army Aircraft
TM 1-225	Navigation for Army Aviation
TB 3-220	Chemical, Biological, and Radiological Decontamination
TM 3-261	Handling and Disposal and Unwanted Radioactive Material
TM 9-1005-257-12	Operator and Organizational Maintenance Manual: Armament Pod, Aircraft, 7.62 Millimeter Machine Gun, M18 (1005-930-5597) and Armament Pod, Aircraft, 7.62 Millimeter Machine Gun, M18A1 (1005-832-7498)
TM 9-1005-299-12	Operator and Organizational Maintenance Manual: Armament Subsystem, Helicopter, 20 Milimeter Automatic Gun, M35 (1005-133-8193)
TM 9-1090-203-12	Operator and Organizational Maintenance Manual for Armament Subsystem, Helicopter, 7.62 Millimeter Machine Gun — 40 Millimeter Grenade Launcher: M28 (1090-933-6701) and Armament Subsystem, Helicopter, 7.62 Millimeter Machine Gun — 40 Millimeter Grenade Launcher, M28A1 (1090-134-3071)
TM 38-750	The Army Maintenance Management System (TAMMS)
TM 55-405-9	Armament Aviation Maintenance Engineering Manual: Weight and Balance
TM 55-1500-328-25	Aeronautical Equipment Maintenance Management Policies and Procedures
TM 55-1520-221-CL	Operator's and Crewmember's Checklist, for Army Model AH-1G Helicopter

ALPHABETICAL INDEX