TECHNICAL MANUAL

OPERATOR'S MANUAL ARMY MODEL AH-1G/TH-1G HELICOPTER

This manual supersedes TM 55-1520-221-10, 12 December 1975 including all changes.

HEADQUARTERS, DEPARTMENT OF THE ARMY

18 MARCH 1980

CHANGE
NO. 3

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C.,13 February 1984

Operator's Manual

ARMY MODEL
AH-1G/TH-1G HELICOPTERS

TM 55-1520-221-10, 18 March 1980, is changed as follows:

1. Remove and insert pages as indicated below.

	Remove pages	Insert Pages
Chapter 7	7-9 and 7-10	7-9 and 7-10
	7-15 and 7-16	7-15 and 7-16
	7-21 and 7-22	7-21 and 7-22
	7-49 and 7-50	7-49 and 7-50

2. New or changed text material is indicated by a vertical bar in the margin. An illustration change is indicated by a miniature pointing hand.

3. Retain this sheet in front of manual for reference purposes.

By Order of the Secretary of the Army:

JOHN A. WICKHAM, JR.
General, United States Army
Chief of Staff

Official:

ROBERT M. JOYCE
Major General, United States Army
The Adjutant General

DISTRIBUTION:
To be distributed in accordance with DA Form 12-31, Operator's Maintenance requirements for AH-1G aircraft.

CHANGE No. 2

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 5 February 1982

Operator's Manual

ARMY MODEL
AH-1G/TH-1G HELICOPTERS

TM 55-1520-221-10, 18 March 1980, is changed as follows:

1. Remove and insert pages as indicated below.

	Remove pages	Insert pages
Chapter 2	2-35 and 2-36	2-35 thru 2-36.1/2-36.2 2-38.1 and 2-38.2

2, New or changed text material is indicated by a vertical bar in the margin. An illustration change is indicated by a miniature pointing hand.

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By Order of the Secretary of the Army:

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General, United States Army
Chief of Staff

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ROBERT M. JOYCE
Brigadier General, United States Army
The Adjutant General

DISTRIBUTION:
To be distributed in accordance with DA Form 12-31, Operator Maintenance requirements for AH-1G aircraft.

WARNING

Personnel performing operations, procedures, and practices which are included or implied in this technical manual shall observe the following warnings. Disregard of these warnings and precautionary information can cause serious injury or loss of life.

STARTING ENGINE

Coordinate all cockpit actions with ground observer. Ensure that rotors and blast area are clear and fire guard is posted.

GROUND OPERATION

Engine will be started and helicopter operated only by authorized personnel. Reference AR95-1.

GROUNDING HELICOPTER

The helicopter should be electrically grounded when parked and during refueling operations.

HIGH VOLTAGE

Serious burns and/or electrical shock can result from contact with exposed electrical wires or connections.

FIRE EXTINGUISHER

Exposure to high concentrations of monobromotrifluoromethane (CF3Br) extinguishing agent or decomposition products should be avoided. The liquid should not be allowed to come into contact with the skin, as it may cause frostbite or low-temperature burns.

When helicopter is to be parked where ambient temperature equals or exceeds 90°F (32.2°C), the fire extinguisher shall be removed until the next mission.

Should an extinguisher be left in the helicopter inadvertently during a high temperature period, the extinguisher shall be weight checked prior to the next mission.

ARMAMENT

Loaded weapons, or weapons being loaded or unloaded, shall be pointed in a direction which offers the least exposure to personnel or property in the event of an accidental firing. Personnel should remain clear of a hazardous area (forward and aft) of all loaded weapons. Any rotation of the turret or wing gun pod machine gun barrels or pushing the turret grenade launcher aft may cause the weapon to fire.

CANOPY REMOVAL SYSTEM

Ground safety pins shall be installed in pilot and gunner canopy removal arming/firing mechanisms when the helicopter is on the ground. Safety pins shall be removed during preflight checks. Safety pins shall be installed during engine shutdown check. Debris may be expelled 50 feet outward when system is actuated. Pilot and gunner helmet visor should be down to prevent eye injury.

VERTIGO

The rotating beacon light should be turned off during flight through clouds to prevent sensations of vertigo as a result of reflections of the light on the clouds.

CARBON MONOXIDE

When smoke, suspected carbon monoxide fumes, or symptoms of anoxia exist, the crew should immediately ventilate cockpits.

FUEL, OIL, AND HYDRAULIC FLUIDS

Turbine fuels and lubricating oils contain additives which are poisonous and readily absorbed through the skin. Do not allow them to remain on skin longer than necessary. Prolonged contact may cause a skin rash. Prolonged contact with hydraulic fluid will cause burns. Refer to TM 10-1101 and FM 10-68 when handling fuel.

ELECTROLYTE

Battery electrolyte is harmful to the skin and clothing. If potassium hydroxide is spilled on clothing or other material, wash immediately with clean water. If spilled on personnel, immediately start flushing the affected area with clean water. Continue flushing until medical assistance arrives.

ROTOR BLADES

Personnel will stay clear of turning main and tail rotor blades. Wind gusts, coast down, or cyclic movement may cause the main rotor blade to flap down below the height of a person. Dangerous winds are created by the main rotor blades when blades are at operating RPM.

RADIOACTIVE MATERIALS

Self-luminous dials contain radioactive materials. If such an instrument is broken or becomes unsealed, avoid personal contact.

NOISE LEVEL

Sound pressure levels in the helicopter during some operating conditions exceed the Surgeon Generals hearing conservation criteria as defined in TM MED251. Hearing protective devices, such as the aviator helmet or ear plugs, are required to be worn by all personnel in and around the helicopter during its operation.

WING STORES JETTISON

All jettison safety pins shall be installed when the helicopter is on the ground. Serious injury can result from accidental ground jettison. Safety pins shall be removed prior to flight. Failure to do so will prevent emergency jettison of wing stores.

TECHNICAL MANUAL

No. 55-1520-221-10

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., *18 March 1980*

OPERATOR'S MANUAL

ARMY MODEL
AH-1G/TH-1G HELICOPTER

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistake or if you know of a way to improve the procedures, please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2 located in the back of this manual direct to: Commander, U. S. Army Troop Support & Aviation Materiel Readiness Command, ATTN: DRSTS-MTPS, 4300 Goodfellow Boulevard, St. Louis, MO 63120. A reply will be furnished directly to you.

TABLE OF CONTENTS

TABLE OF CONTENTS (Cont)

CHAPTER 1

INTRODUCTION

1-1. General.

These instructions are for use by the operator. They apply to the AH-1G and TH-1G helicopters.

1-2. Warnings, Cautions, and Notes.

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

WARNING

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

CAUTION

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

NOTE

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

1-3. Description.

The AH-1G helicopter is a tandem two-place, attack helicopter. The armament configuration of the AH-1G consists of the M28 nose turret and various wing stores arrangements described in Chapter 4. **T** The TH-1G helicopter is a modified AH-1G helicopter. The modifications allow the instructor pilot to fly in the gunners seat and have the same mechanical advantage of flight controls as the student pilot.

This manual contains the best operating instructions and procedures for the AH-1G and TH-1G helicopters under most circumstances. The observance of limitations, performance and weight/balance data provided is mandatory. Your flying experience is recognized, and therefore, basic flight principles are not included. **It is required that this manual be carried in the helicopter at all times.**

1-4. Appendix A, References.

Appendix A is a listing of official publications cited within the manual applicable to and available for flight crews.

1-5. Appendix B, Abbreviations.

Appendix B is a list of definitions for abbreviations used in this manual. The same abbreviation applies for either singular or plural application.

1-6. Index.

The index lists, in alphabetical order, every titled paragraph, figure, and table contained in this manual. Chapter 7 performance data shall have an additional index within the chapter.

1-7. Army Aviation Safety Program.

Reports necessary to comply with the safety program are prescribed in AR 385-40.

1-8. Destruction of Army Materiel to Prevent Enemy Use.

For information concerning destruction of Army materiel to prevent enemy use, refer to TM 750-244-1-5.

1-9. Equipment Serviceability Criteria.

Equipment serviceability criteria for the AH-1G helicopter are prescribed in TM 55-1520-221-ESC.

1-10. Forms and Records.

Army aviators flight record and helicopter maintenance records which are to be used by crewmembers are prescribed in AR 750-31, TM 38-750 and TM 55-405-9.

1-11. Explanation of Change Symbols.

Changes, except as noted below, to the text and tables, including new material on added pages, are indicated by a vertical line in the outer margin extending close to the entire area of the material affected; exception: pages with emergency markings, which consist of black diagonal lines around three edges, may have the vertical line or change symbol placed along the inner margins. Symbols show current changes only. A miniature pointing hand symbol is used to denote a change to an illustration. However, a vertical line in the outer margin, rather than miniature pointing hands, is utilized when there have been extensive changes made to an illustration. Change symbols are not utilized to indicate changes in the following:

a. Introductory material.

b. Indexes and tabular data where the change cannot be identified.

c. Blank space resulting from the deletion of text, an illustration, or a table.

d. Correction of minor inaccuracies, such as spelling, punctuation, relocation of material, etc., unless such correction changes the meaning of instructive information and procedures.

1-12. Helicopter Designation System.

The designation system prescribed by AR70-50 is used in helicopter designations as follows:

AH-1G

- Series Symbol
- Design Number
- Helicopter (Basic Mission)
- Attack (Modified Mission)

1-13. Designator Symbols.

The designator symbol T (TH-1G) is used in conjunction with text contents, text headings and illustration titles to show effectivity limited to TH-1G helicopters. The symbol T precedes a text heading or illustration title to indicate TH-1G effectivity only. If the material applies to all series and configurations, no designator symbols will be used. Where practical, descriptive information is condensed and combined for all series to avoid duplication.

1-14. Use of Word Shall, Should, and May.

Within this technical manual the word "shall" is used to indicate a mandatory requirement. The word "should" is used to indicate a nonmandatory but preferred method of accomplishment. The word "may" is used to indicate an acceptable method of accomplishment.

CHAPTER 2

HELICOPTER AND SYSTEMS DESCRIPTION AND OPERATION

SECTION I. HELICOPTER

2-1. General Description.

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. This helicopter is capable of operating from unprepared operational areas, day or night. The maximum gross weight is 9500 pounds. 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 T is the basic AH-1G modified to 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.

2-2. Fuselage.

Honeycomb panel skins and two main beams of one-half inch aluminum honeycomb sandwich construction, which extend from the nose attachment aft to the tailboom, provide the basic fuselage structure. The beams are twenty inches apart in the forward section, are canted outboard aft of the cockpit area, then become the contoured sides of the fuselage from the pylon support area to the tailboom. Flush riveting is employed through the fuselage and 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 to the main beam structure. The fuel cells are supported and protected by the beams in the area of the pylon.

2-3. Tailboom.

The tailboom is a tapered semi-monocoque structure with aluminum skins, longerons and stringers and attaches to the forward fuselage section with four bolts to allow easy removal for repair or replacement. The tailboom supports the tail rotor, vertical fin, synchronized elevator, and tail rotor driveshafts.

2-4. Wings.

The short swept back wing provides support for external stores. The airfoil is tapered and has a main root chord of thirty 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.

2-5. Armor Protection.

The armor protection is a combination of ceramic and fiberglass composite with a small amount of armor steel.

a. Crew Protection.

(1) Pilot. The pilot seat and fixed side panels are made of a ceramic-fiberglass composite material.

(2) Gunner. The gunner seat is made of a ceramic-fiberglass composite material.

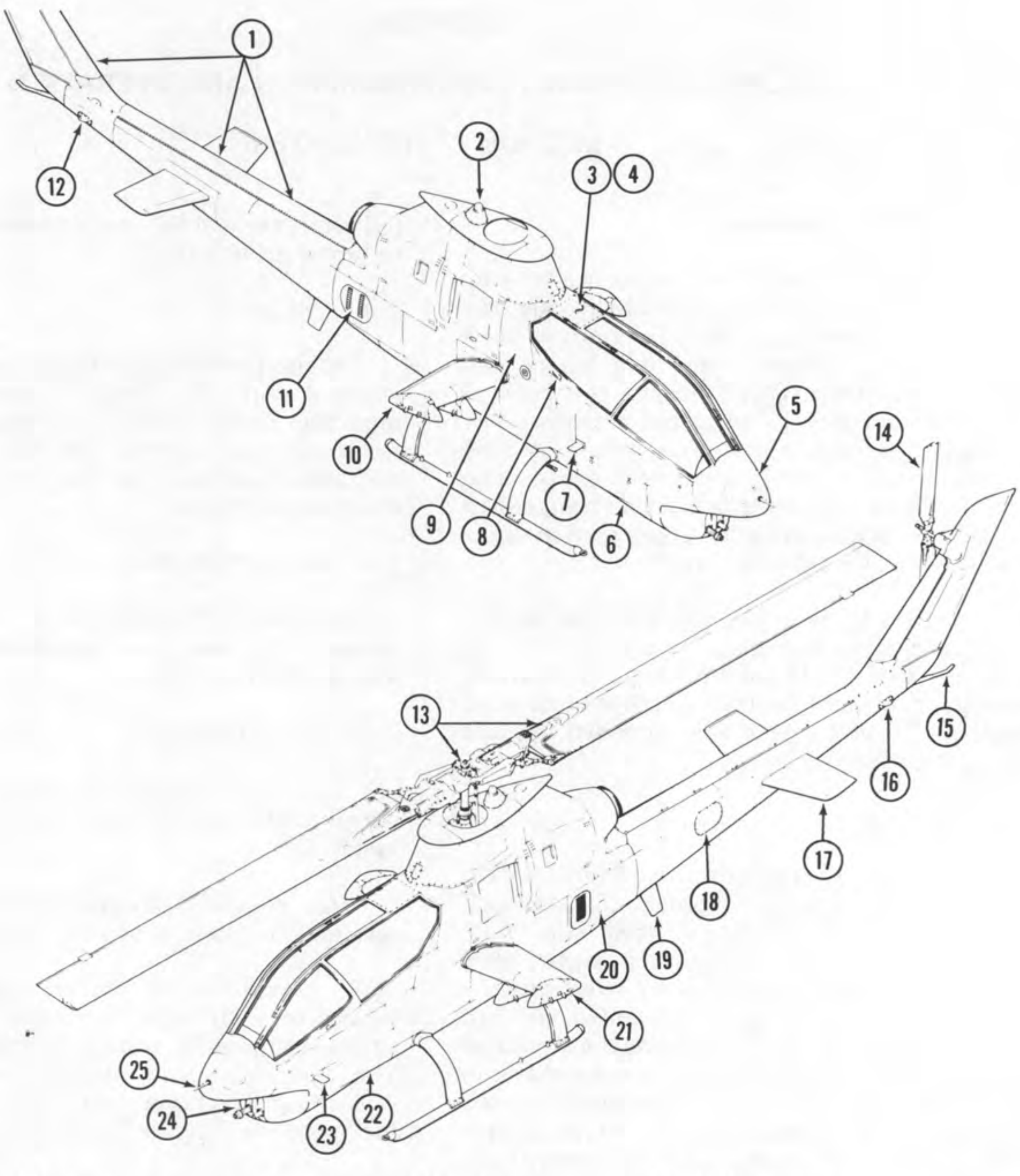
b. Component Protection. Armor plate is located on each side of the engine to protect the engine compressor section and the fuel control. The fuel cell lower and center sections are selfsealing. The top section is not selfsealing. The fuel crossover line is selfsealing.

2-6. Weight Class.

Army AH-1G/TH-1G helicopters are classified as Class IB. Additional directives governing weight of Class I helicopter forms and records are contained in AR 95-16, AR 750-31, and TM 55-405-9.

2-7. Crew Configuration.

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



1. Driveshaft cover
2. Anti-collision light
3. Loop antenna
4. FM homing antenna
5. Door battery access
6. Door, ammunition
7. Step
8. Pilots door
9. Hydraulic reservoir access
10. Position light (green)
11. Electrical door battery access
12. Position light (white)
13. Main rotor hub and blade
14. Tail rotor hub and blade
15. Tail skid
16. Position light (white)
17. Elevator
18. Door avionics access
19. VHF antenna
20. External power receptacle
21. Position light (red)
22. Door, ammunition
23. Step
24. Turret
25. Pitot tube

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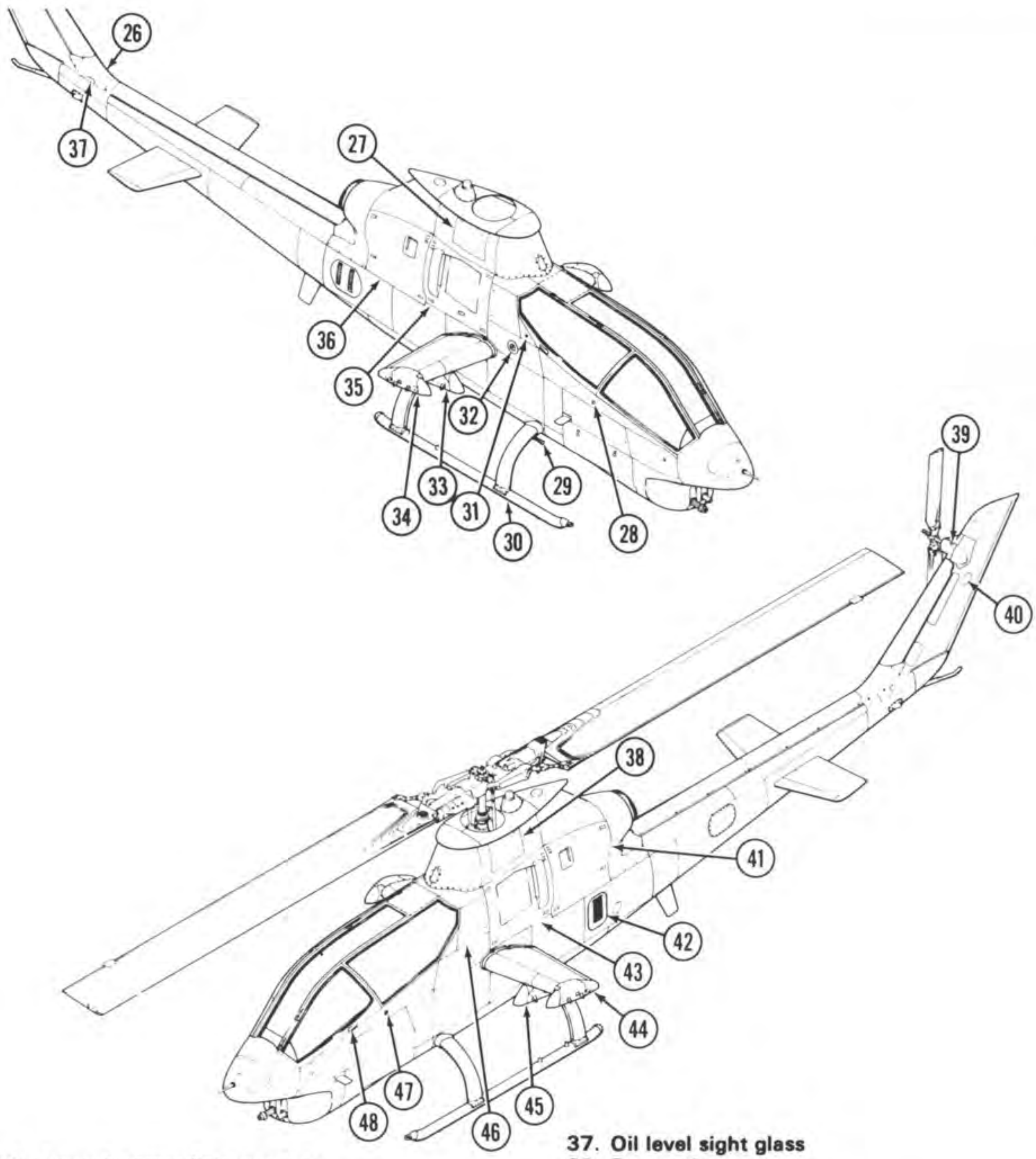
Figure 2-1. General arrangement (Sheet 1 of 2)



26. Cover intermediate gearbox
27. Door pylon access
28. Static port
29. Step
30. Landing gear
31. Grounding receptacle
32. Fuel filler cap
33. Pylon inboard
34. Pylon outboard
35. Door transmission access
36. Door engine access
37. Oil level sight glass
38. Door pylon access
39. Tail rotor gearbox
40. Tail rotor gearbox sight gage
41. Door engine access
42. Oil cooling duct
43. Door transmission access
44. Pylon outboard
45. Pylon inboard
46. Hydraulic access
47. Static port
48. Gunners door

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Figure 2-1. General arrangement (Sheet 2 of 2) sits forward in the single contour bubble enclosure to provide maximum visibility.

2-8. Controls and Indicators.

a. Pilot Instrument Panel. Refer to figure 2-6.

b. Gunner Instrument Panel. Refer to figure 2-7.

c. Other Instruments and Controls. These items are depicted on the pilot and gunner station diagrams (figures 2-4 and 2-5) or in the section which describes their related systems.

2-9. General Arrangement.

Figure 2-1 depicts the general arrangement.

2-10. Dimensions.

Figure 2-2 illustrates the principal dimensions of the helicopter to the nearest inch.

2-11. Turning Radius and Ground Clearance.

Figure 2-3 depicts the minimum turning radius on the ground handling wheels.

2-12. Compartments.

a. Pilot Station. Figure 2-4 illustrates the location of equipment in the pilot station.

b. Gunner Station. Figure 2-5 illustrates the location of equipment in the gunner station.

2-13. Landing Gear.

a. Main Landing Gear. The main landing gear consists of two aluminum lateral mounted crosstubes and two aluminum longitudinal skid tubes attached to the crosstubes. Each crosstube is enclosed in a kydex fairing for aerodynamic purposes. Each skid tube has replaceable steel skid shoes on the bottom to minimize skid wear.

b. Tail Skid. The steel tubular type tail skid is installed on the aft end of the tailboom to protect the tail rotor blades during tail-low landing.

2-14. Instruments and Controls. Refer to figures 2-6 and 2-7.

2-15. Canopy.

The canopy over the pilot and gunner stations consists of formed transparent acrylic plastic windows mounted in an aluminum alloy supporting framework. Crew doors are incorporated in the canopy; the forward left side panel is the gunner door, and the aft right side panel is the pilot door. On helicopters through Serial No. 71-15093 which have not been modified, the doors are equipped with separate mechanical cable-type jettison systems. On helicopters modified by MWO 55-1520-221-30/39 or subsequent to Serial No. 71-15093, both side windows and crew doors are equipped with linear explosive window cutting assemblies connected to arming/firing mechanisms at pilot and gunner stations for emergency removal of canopy windows.

2-16. Personnel Doors.

Both doors are hinged on top and swing outward and up to provide access. Both doors have supports incorporating locks to hold the door open.

2-17. Seats — Pilot and Gunner.

a. Construction. Both seats, side-shoulder panels, and head protective panels are of armor material which provides protection. Both seats are equipped with contoured seat cushions and back supports made of foam and open mesh for vibration attenuation and crew comfort.

*b. Pilot Seat.*The pilot seat (figure 2-8) is vertically adjustable nonreclining type. The vertical adjustment is reclined at 15 degrees. The vertical height adjustment handle is under the left side of the seat. The seat is equipped with a lap safety belt and inertia reel shoulder harness.

c. Gunner Seat. The gunner seat (figure 2-9) is a fixed seat (nonadjustable and nonreclining). The seat is equipped with a lap safety belt and inertia reel shoulder harness. The seat also has arm rests.

d. Inertia Reel Shoulder Harness. An inertia reel shoulder harness is incorporated in the pilot and gunner seats with a manual shoulder harness lock (figures 2-8 and 2-9). The handles are located to left front of each seat. With the handle in the unlocked (aft) position, the reel cable will extend allowing 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 position 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 then move handle aft to 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 shoulder harness. Manual locking of the reel (handle forward) should be accomplished for emergency landings.

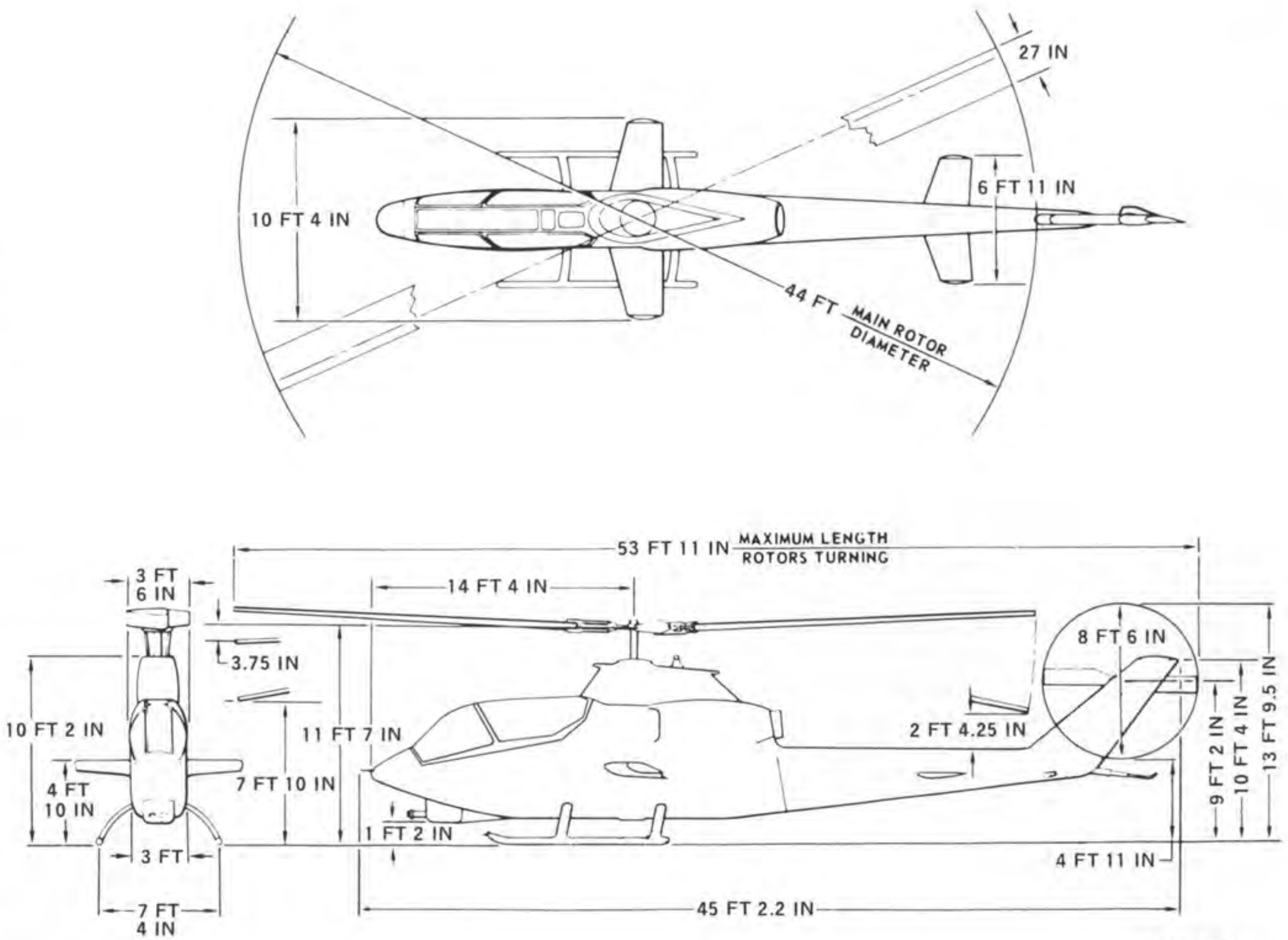


Figure 2-2. Principal dimensions

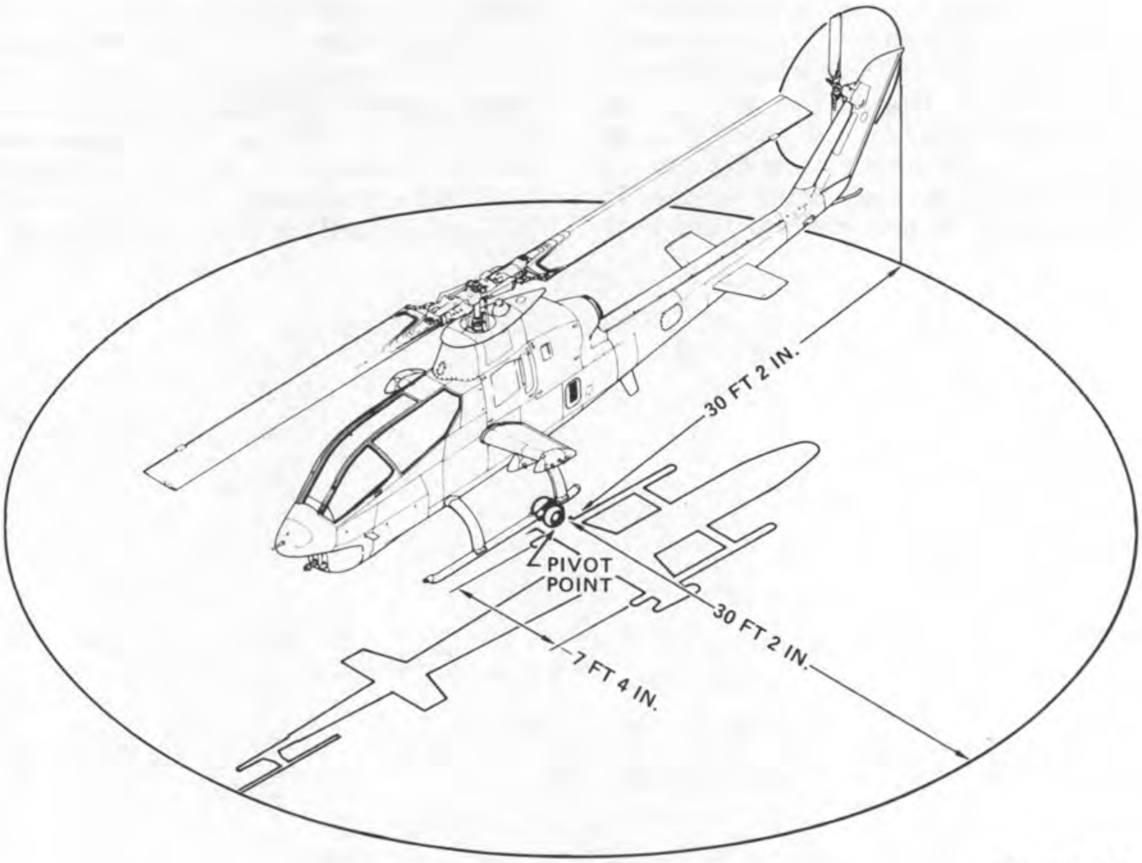


Figure 2-3. Turning radius

SECTION II. EMERGENCY EQUIPMENT

2-18. Emergency Equipment.

The emergency equipment includes a fire extinguisher, a first aid kit, and stowage provisions for two survival kits. 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. Refer to Chapter 9 for Emergency Procedures and location diagram.

2-19. Fire Extinguisher.

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

2-20. Survival Kit.

Survival kit provisions are located behind the pilot seat.

2-21. First Aid Kit.

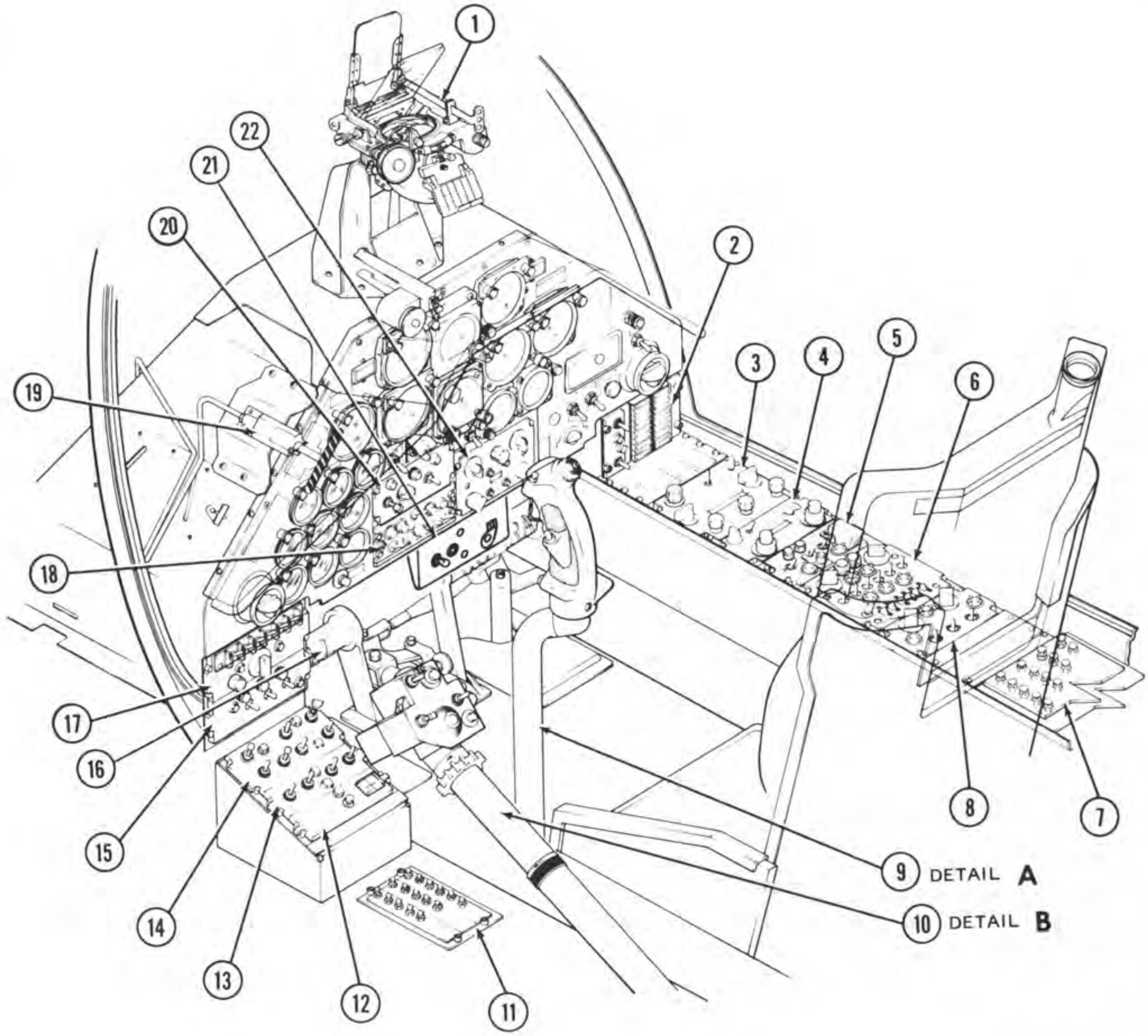
An aeronautical type first aid kit is located on the bulkhead behind the pilot seat.

2-22. Door Jettison Systems.

Through Serial No. 71-15093 helicopters not modified by retrofit have pilot and gunner 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 pilot and gunner stations.

2-23. Canopy Removal System.

Window cutting assemblies are mounted in the pilot and gunner doors and window frames. The linear explosive is contained with the cutting assemblies. The cutting assemblies are controlled by the pilot or gunner arming/firing mechanisms.



1. Sight station
2. Caution light panel
3. UHF control panel
4. ADF control panel
5. Voice security control indicator
6. Transponder control panel
7. DC circuit breaker panel
8. Lights control panel
9. Cyclic stick
10. Collective stick
11. AC circuit breaker panel
12. Miscellaneous control panel
13. Electrical control panel
14. Engine control panel
15. SCAS control panel
16. Tail rotor pedals
17. Signal distribution panel
18. Wing stores jettison panel
19. Arm fire mechanism
20. Turret control panel
21. 20MM panel
22. ARC-54 control panel

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Figure 2-4. Pilot station diagram (Typical) (Sheet 1 of 2)

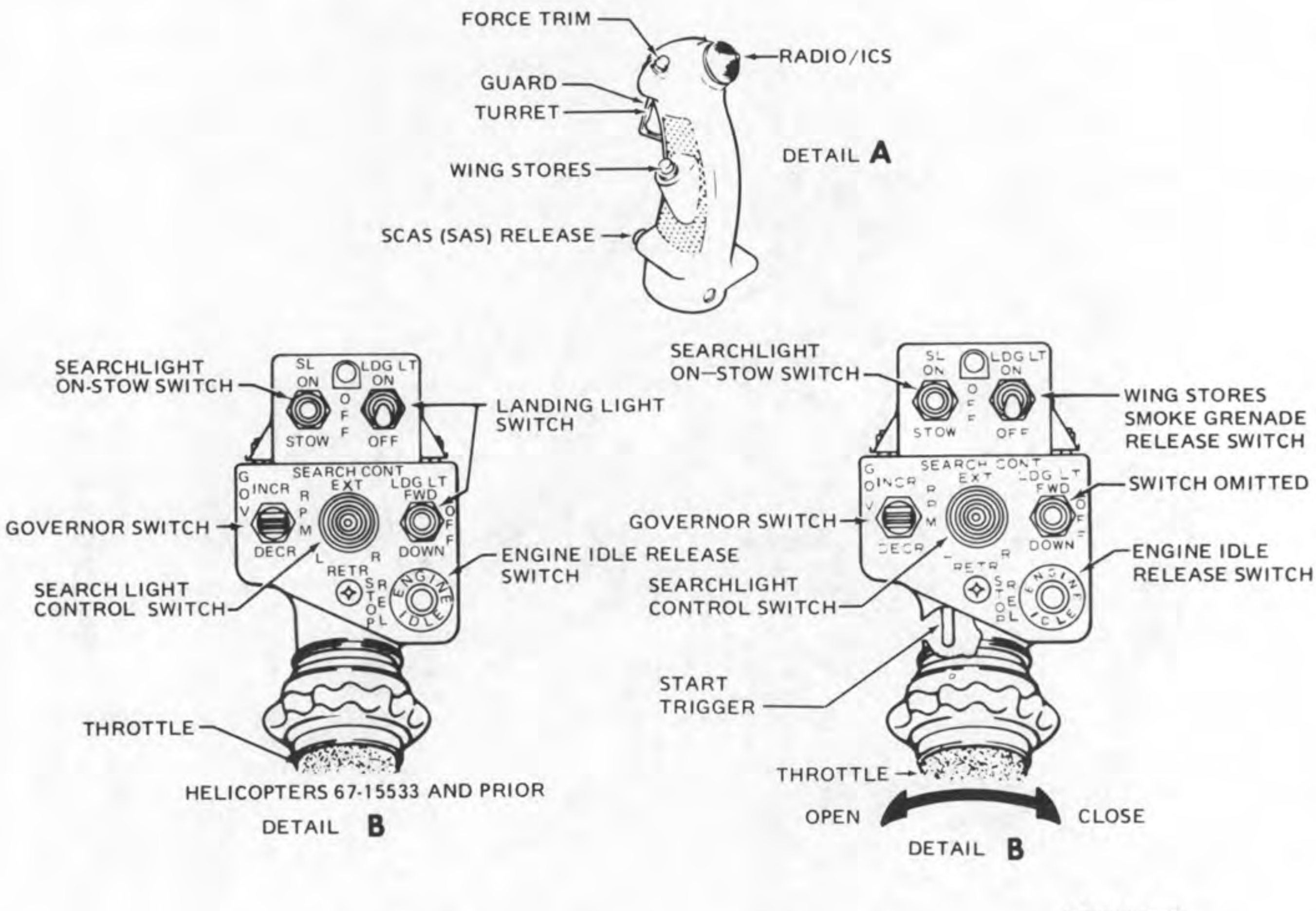


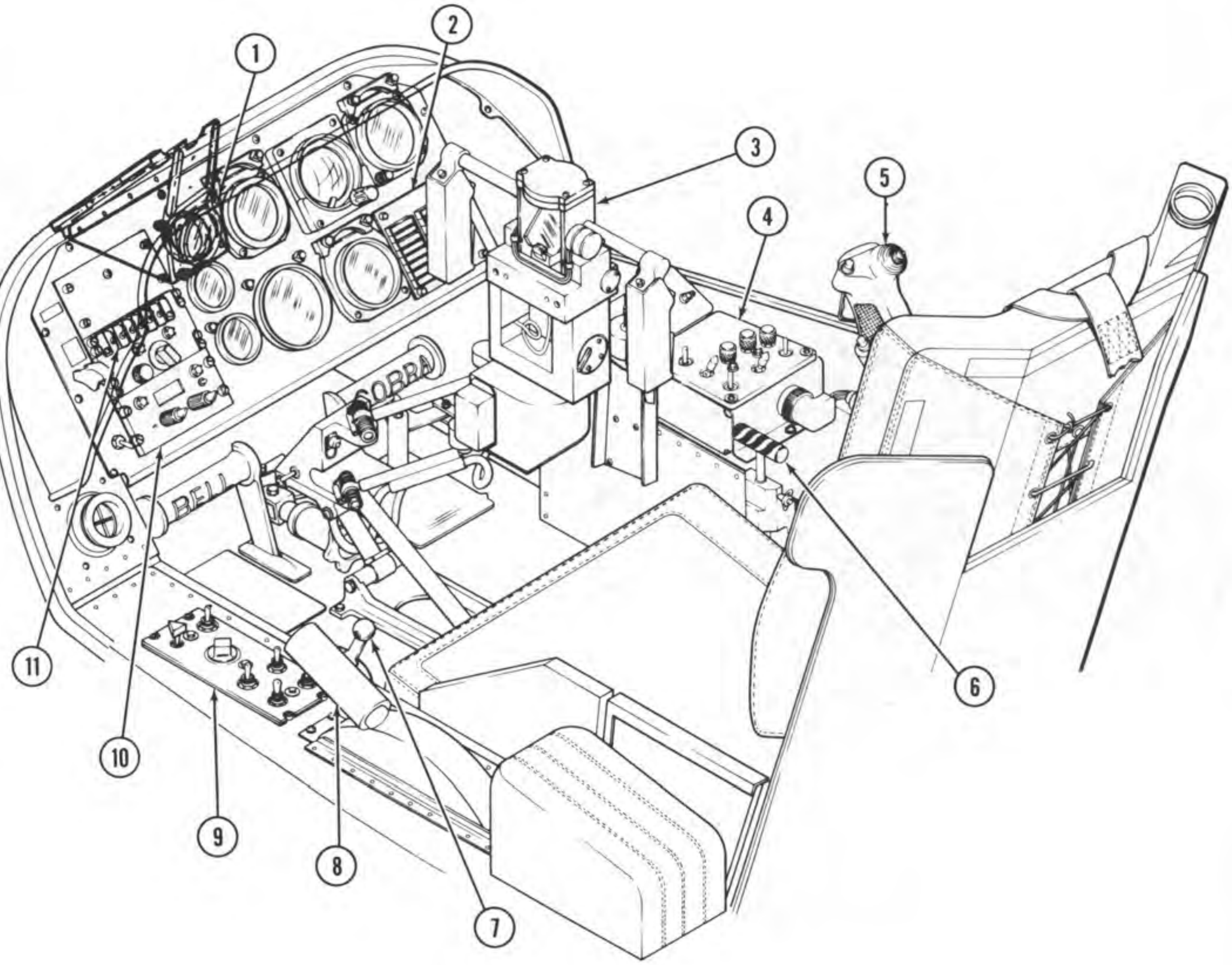
Figure 2-4. Pilot station diagram (typical) (Sheet 2 of 2)

Rotating the arming/firing mechanism handle 90° counterclockwise (torque required 6 to 12 inch-pounds) will arm the cutting assemblies. Pulling the handle (20 to 30 pounds tension) will fire the percussion primer causing the cutting assemblies to be detonated. The explosive force will be outward and cut the four transparent panels out of their frames simultaneously. If handle has been rotated but not pulled, the handle can be rotated and the safety pin installed. DA Form 2408-13 entry required.

SECTION III. ENGINE AND RELATED SYSTEMS

2-24. Engine.

The helicopter is equipped with a model T53-L-13 engine. The T53-L-13 series engine's sea level static uninstalled military rated power equals 1400 shaft horsepower. However, in the AH-1G and TH-1G, the engine is torque-limited to 50 psi torque for military and normal power at 6600 rpm.



1. Magnetic compass
2. Master caution panel
3. Sighting station
4. Armament control panel
5. Cyclic stick
6. Arm/fire mechanism
7. Shoulder harness lock
8. Collective pitch control
9. Miscellaneous control panel
10. VHF radio panel
11. Signal distribution panel

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Figure 2-5. Gunner station diagram (Typical)

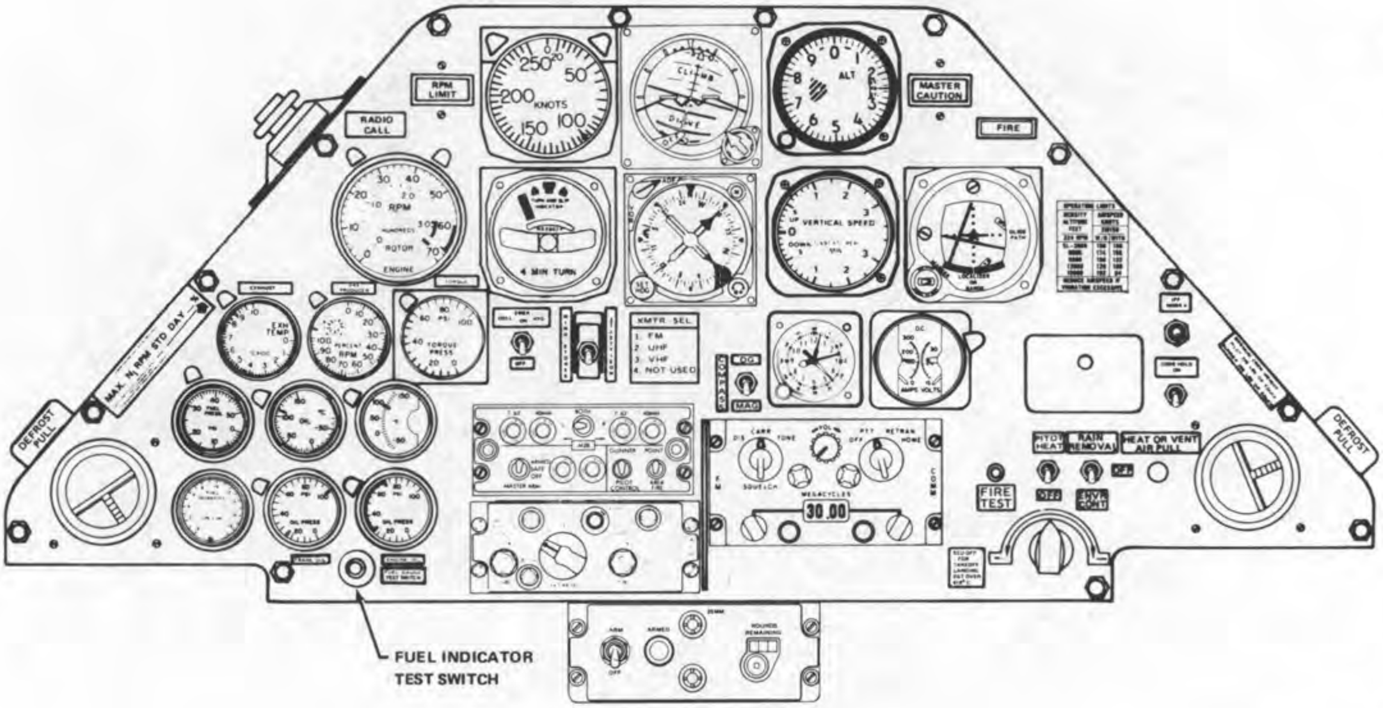

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Figure 2-6. Pilot instrument panel (typical)

2-25. Engine Protection.

Armor material is located on the left and right engine compartment doors to provide armor protection for the engine compressor, fuel control, oil filter, and fuel filter. (figure 2-1)

2-26. Air Induction System.

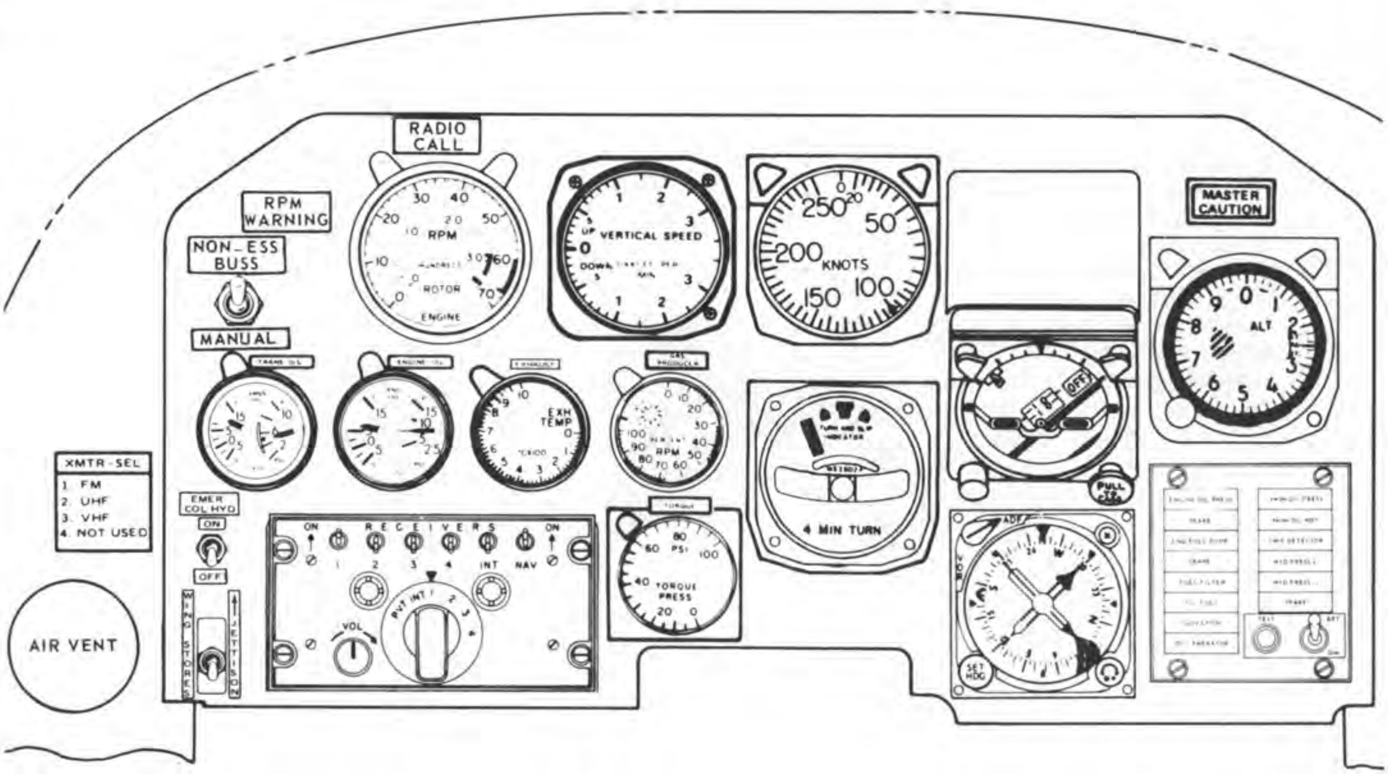
Ambient air enters the transmission compartment door air inlet, then is routed through the foreign object damage (FOD) screen, and the particle separator to the engine air inlet.

a. Foreign Object Damage (FOD) Screen. The FOD screen is mounted around the particle separator on the forward end of the engine in the transmission compartment. The purpose of the screen is to prevent debris from entering the particle separator.

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 selfpurging or nonselfpurging.

(1) Nonselfpurging Particle Separators: Sand and dust particles are separted 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) Selfpurging Particle Separators: Sand and dust particles are separated from the air flowing into the engine inlet by centrifugal action.



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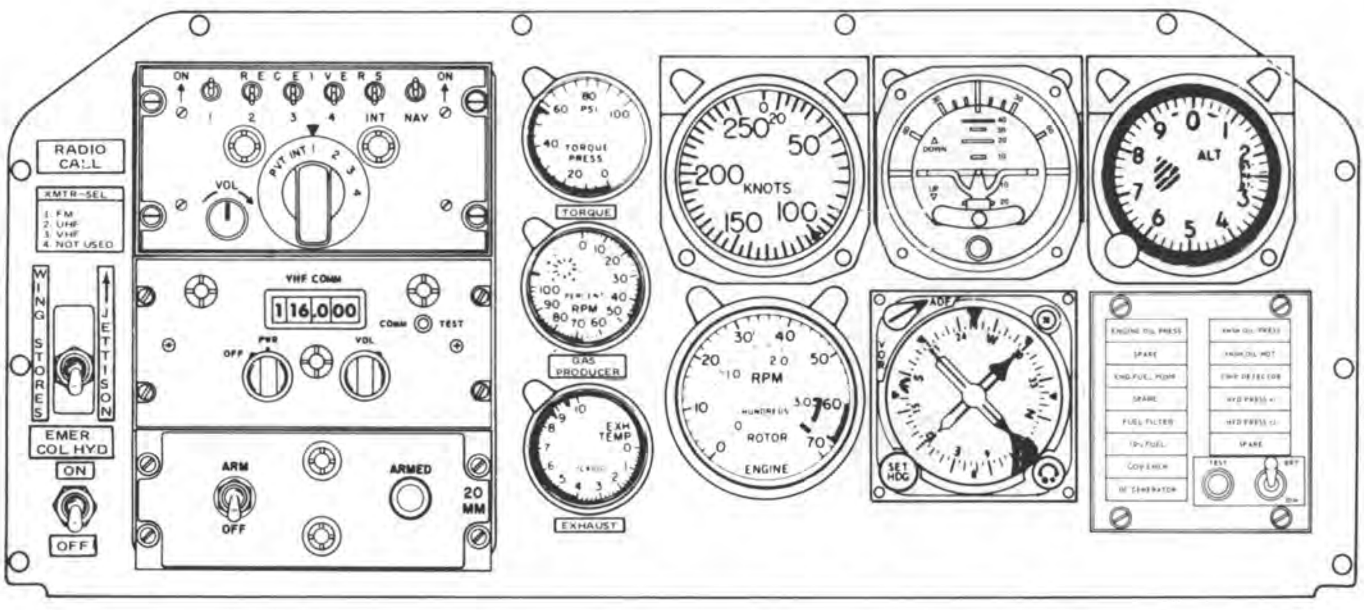

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Figure 2-7. Gunner instrument panels (Typical)

1. Shoulder harness lock
2. Seat cushion
3. Side armor panels
4. Seat back cushion
5. Seat assembly
6. Shoulder harness
7. Inertia reel
8. Seat lap belt
9. Height adjustment handle

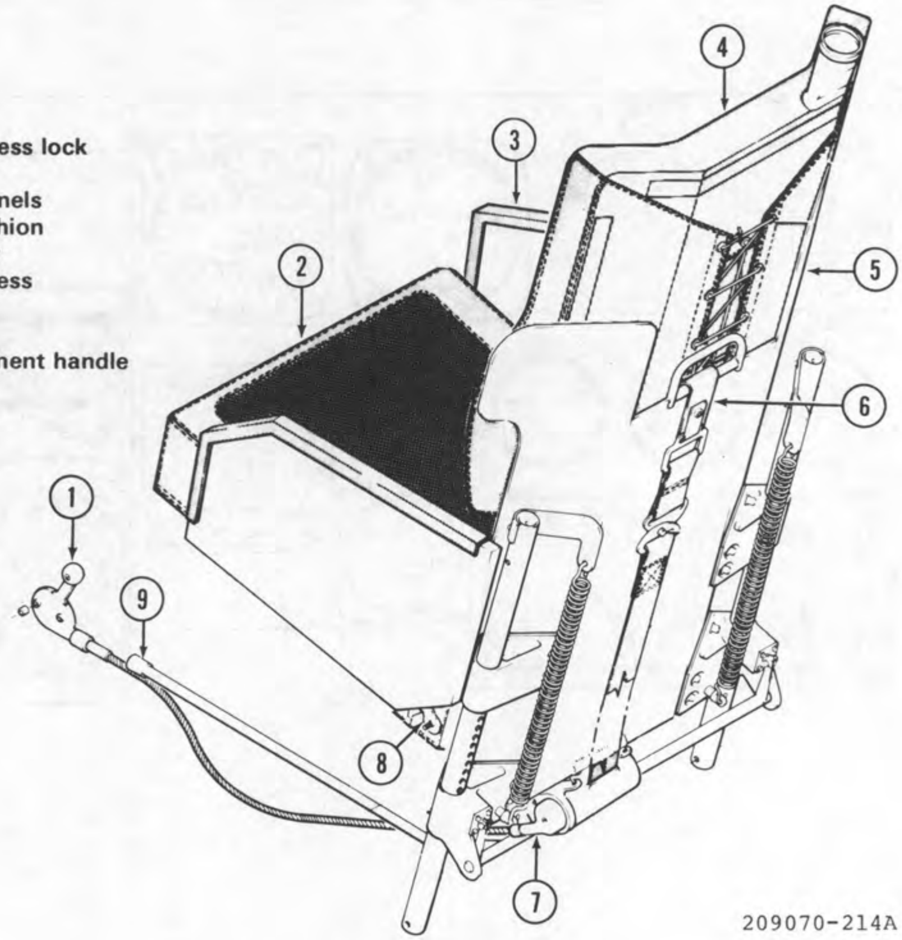

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Figure 2-8. Pilot seat

1. Shoulder harness lock
2. Side armor panels
3. Seat
4. Shoulder harness
5. Inertia reel

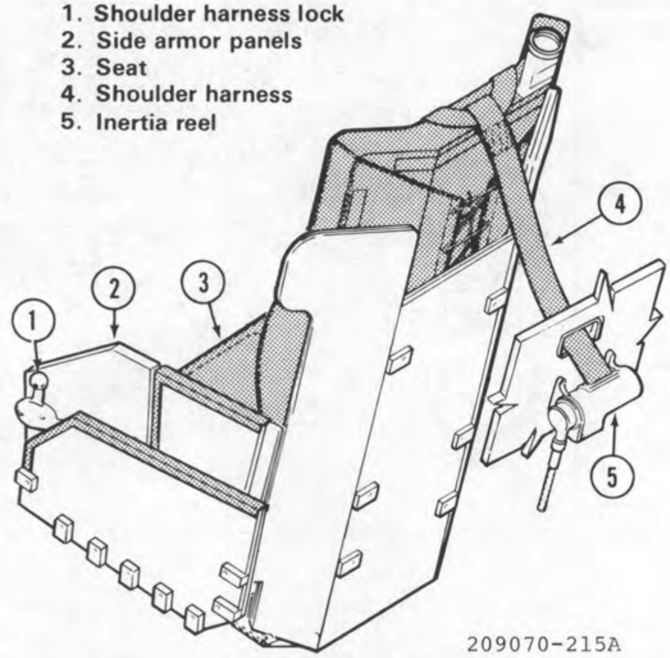

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Figure 2-9. Gunner seat

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.

c. Engine Cooling. 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. 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.

d. Transmission Compartment. Transmission compartment cooling 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.

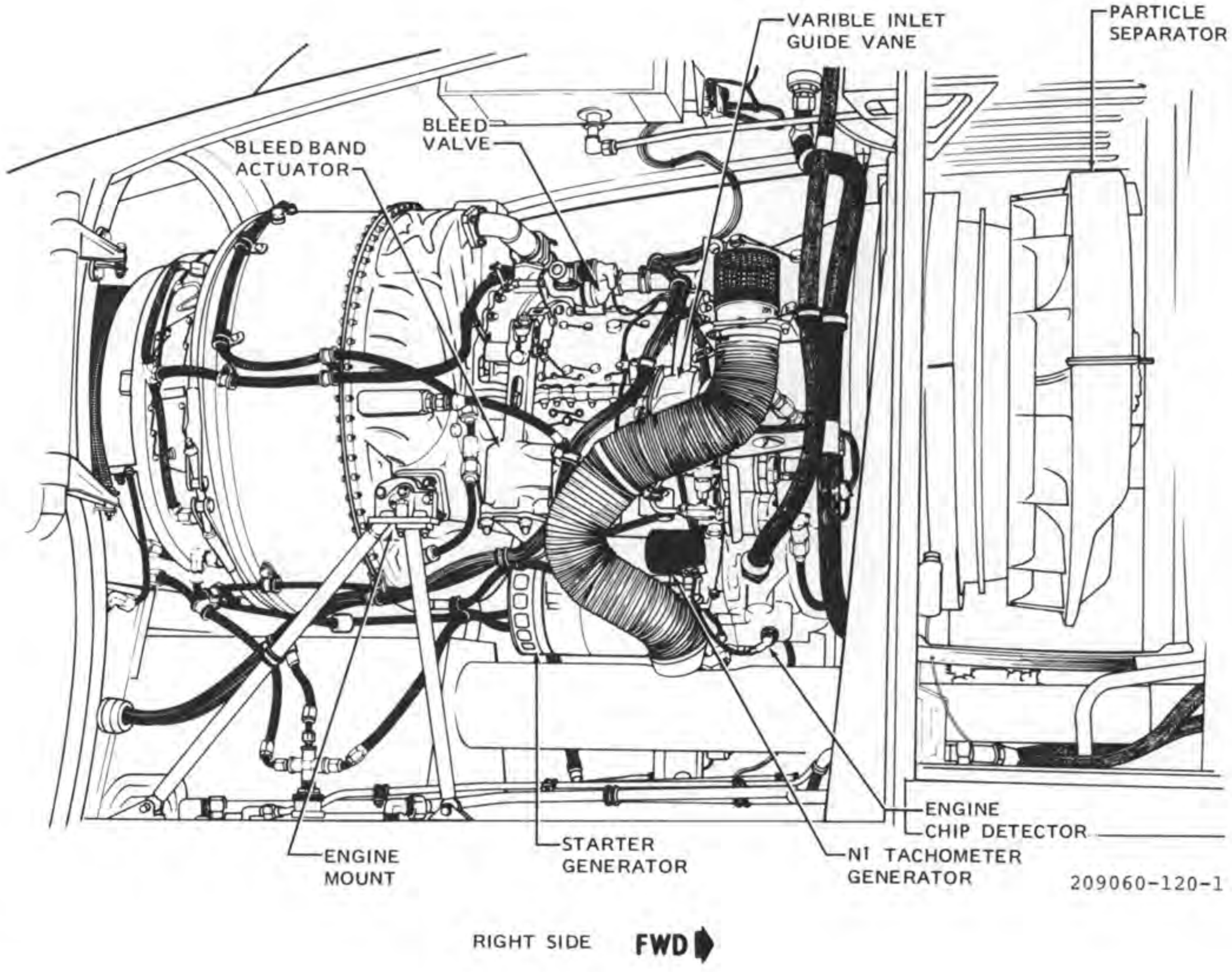

Figure 2-10. Engine assembly (Sheet 1 of 2)

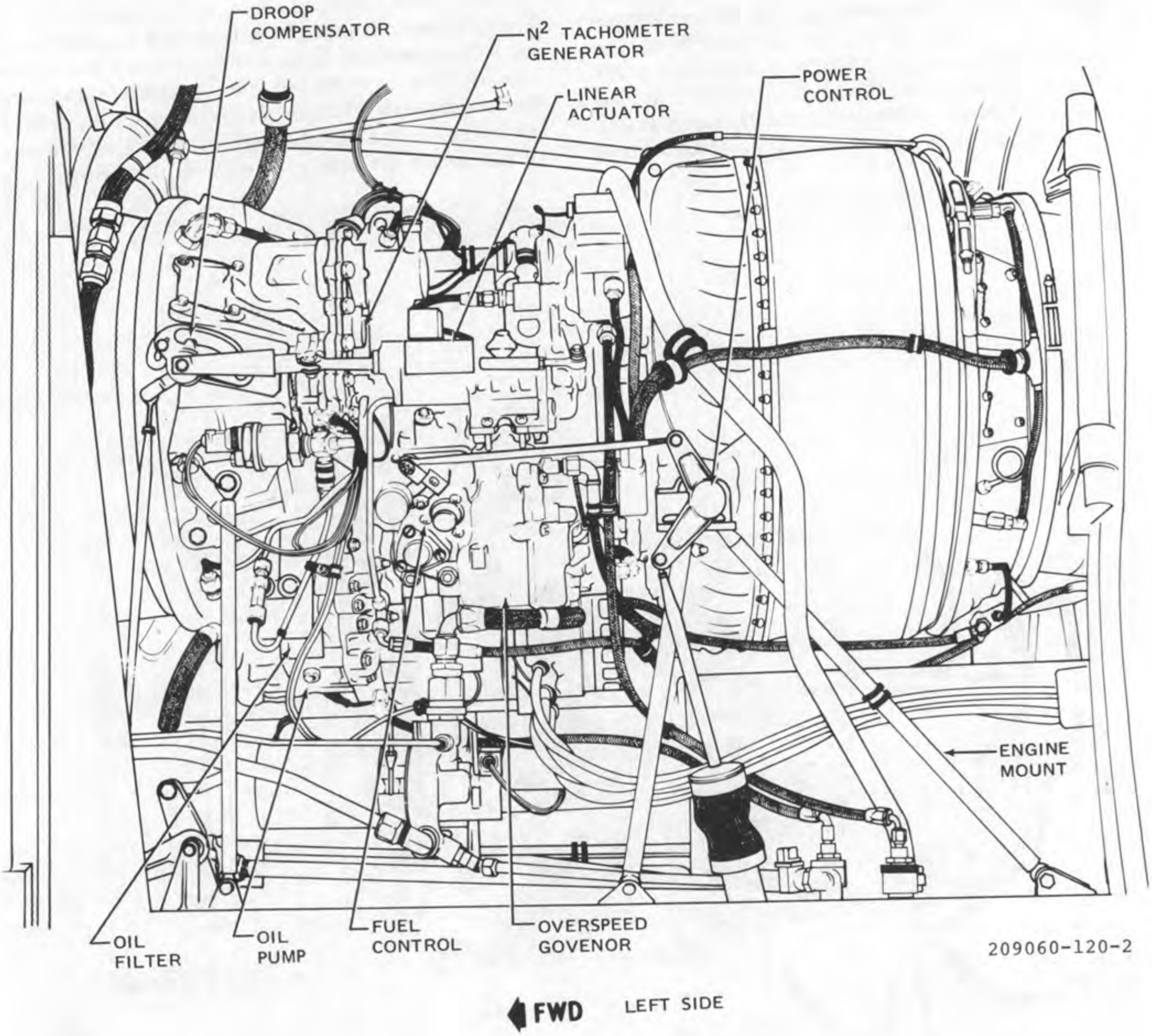

Figure 2-10. Engine assembly (Sheet 2 of 2)

2-27. Engine Inlet Anti-Icing/Deicing System.

WARNING

The system will not deice or prevent icing of the FOD screen or particle separator. A power loss will occur if the formation of ice in the FOD screen or particle separator obstructs the flow of ambient air to the engine.

a. Description. The system prevents ice from forming in the engine air inlet. The system consists of a hot air solenoid valve on the engine, controlled by the pilot or gunner DE-ICE switch (figures 2-11 and 2-12), powered by the essential bus, and protected by the ENG DE-ICE circuit breaker.

b. Operation. If ice accumulation is suspected, the pilot or gunner DE-ICE switch is placed in the DE-ICE position. This action causes the hot air solenoid valve to route engine bleed air to the engine air inlet.

NOTE

A rise in the turbine gas temperature (TGT) will occur when the pilot or gunner ENGINE DE-ICE switch is in the DE-ICE position. De-ice operation will become continuous if the hot air solenoid valve (ENGINE DE-ICE) circuit fails or if ENG DE-ICE circuit breaker is out (extended).

2-28. Engine Fuel Control System.

a. Engine Mounted Component. The fuel control assembly is mounted on the left side of the engine. The assembly is controlled by the pilot or gunner throttle and GOV switch. The assembly consists of a metering section, a computer section, and an overspeed governor. The metering section pumps fuel to the engine. The computer section determines the rate of fuel delivery. The overspeed governor maintains a constant rpm.

b. Crew Controls.

(1) Throttle. Rotating the pilot or gunner grip type throttle (figure 2-4 and 2-5) to the full open position allows the overspeed governor to maintain a constant rpm. Rotating the throttle toward the closed position will cause the rpm to be manually selected instead of automatically selected by the overspeed governor. Rotating the throttle past the engine idle stop to the fully closed position shuts off fuel flow. A solenoid operated idle stop is incorporated to prevent inadvertent throttle closure. The idle stop is controlled by the pilot IDLE STOP REL switch (figure 2-4) or the gunner IDLE STOP RELEASE switch (figure 2-12). The engine idle stop release circuit is powered by the essential bus and protected by the IDLE STOP SOL circuit breaker. Friction can be induced into both throttles by rotating the pilot throttle friction (figure 2-4) counterclockwise.

(2) Governor Switches. The pilot or gunner GOV switches (figure 2-11 and 2-12) AUTO position permits the overspeed governor to automatically control the engine rpm. The EMER position permits the pilot and gunner to manually control the engine rpm. The governor circuit is powered by essential bus and protected by the GOV CONT circuit breaker.

NOTE

A maximum of approximately 78% torque is available in the EMER position.

2-29. Engine Oil Supply System.

a. Description. The engine oil system is a dry sump, pressure type, and is completely automatic. The oil tank is located in the upper pylon fairing. It will self-seal a 30 caliber projectile hole and is equipped with deaeration provisions. Oil is gravity fed from tank to engine driven oil pump which provides pressure and scavenging for the system.

b. Cooling. Engine oil cooling is accomplished by an oil cooler and a turbine fan. The engine and transmission oil coolers use the same fan.

c. Switching Action. The pilot ENG OIL BYP switch (figure 2-11) AUTO position permits the oil to automatically bypass the oil cooler when the oil tank is approximately 3.8 quarts low. The OFF position deactivates the automatic bypass feature causing the oil to pass through the oil cooler regardless of the oil tank level. The switch circuit is powered by the essential bus and protected by the FUEL OIL VALVE circuit breaker.

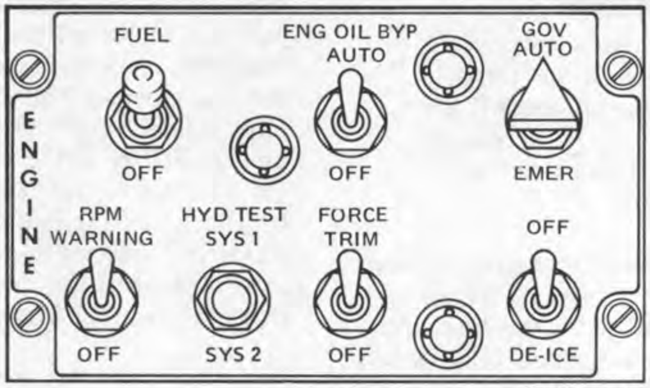

Figure 2-11. Pilot engine control panel

2-30. Ignition — Starter System.

The switch must be released manually when the engine starts or the time limit expires. The pilot FUEL switch (figure 2-11) must be in the FUEL position and the pilot ignition keylock switch in the ON position to complete the ignition and start fuel circuit. Then GEN switch must be in OFF position for normal starting. The circuits are powered by the essential bus and protected by the STARTER RELAY and IGN SOL circuit breakers.

2-31. RPM Increase-Decrease (INCR DECR) Switches.

The GOV RPM INCR-DECR switch (figure 2-4) is a three-position, momentary-type switch located in the pilot collective switch box and gunner miscellaneous control panel. The switch is held forward to increase, and aft to decrease the power turbine speed. The circuit is powered by the essential bus and protected by the GOV CONT circuit breaker.

2-32. Droop Compensator.

A droop compensator maintains engine rpm (N2) as power demand is increased by the pilot. The compensator is a direct mechanical linkage between the collective stick and the speed selector lever on the N2 governor. No crew controls are provided or required. The compensator will hold N2 rpm to ± 0.6% when properly rigged. Droop is defined as the speed change in engine rpm (N2) as power is increased from a no-load condition and is an inherent characteristic of the governor system. Without this characteristic, instability would develop as engine output is increased, resulting in N2 speed overshooting or hunting the value necessary to satisfy the new power condition. Design droop of the engine governor system is as much as 4.5 to 6% (flat pitch to full power). If N2 power were allowed to droop, other than momentarily, the reduction in rotor speed could become critical.

2-33. Engine Instruments and Indicators.

a. Torquemeters. The pilot and gunner torquemeters (figure 2-6) display percent of torque imposed upon the engine output shaft. Each torquemeter is powered by a separate transmitter. The circuit is powered by the essential bus and protected by the TORQUE circuit breaker.

b. Exhaust Gas Temperature (EGT) Indicators. The pilot and gunner indicators (figure

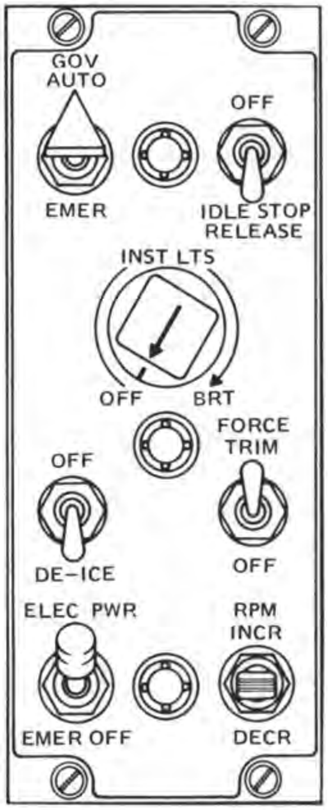

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Figure 2-12. Gunner miscellaneous control panel

2-6) display the temperature in degrees celsius of the air in the power turbine inlet area.

c. Dual Tachometers. The pilot and gunner tachometers (figures 2-6 and 2-7) display the rpm of the engine and main rotor speed in percent. The tachometer outer scale is marked ENGINE and the inner scale is marked ROTOR. The ENGINE and ROTOR needles are synchronized during normal helicopter operation.

d. Gas Producer N1 Tachometers. The pilot and gunner tachometers (figures 2-6 and 2-7) display the rpm of the gas producer turbine speed in percent.

e. Oil Pressure and Oil Temperature Indicators. The ENGINE OIL indicators (figure 2-6) displays the psi pressure of the oil at the pressure side of the oil pump and the temperature as degrees celsius of the oil at the engine oil inlet. The circuit is powered by the essential oil inlet. The circuit is powered by the essential bus and protected by the TEMP IND ENG XMSN circuit breaker.

f. Oil Pressure Caution Light. The pilot ENGINE OIL PRESS and gunner ENGINE OIL PRESS caution lights (figure 2-19) will illuminate when the engine oil pressure is below safe limits.

g. Oil Bypass Caution Light. The pilot ENGINE OIL BYPASS caution light (figure 2-19) illuminates when oil tank level is approximately 3.8 quarts low.

h. Engine Oil Chip Detector Caution Light. The ENG CHIP caution lights (figure 2-13) in pilot miscellaneous control panel and CHIP DETECTOR in gunner caution panel (figure 2-19) illuminate when sufficient metal chips to complete the electrical circuit are collected from the engine oil.

i. Fuel Pump Caution Lights. The pilot and gunner ENG FUEL PUMP caution lights (figure 2-19) illuminate when either element of the engine driven fuel pump fails.

j. Governor Caution Lights. The pilot and gunner GOV EMER caution lights (figure 2-19) illuminates when the pilot or gunner GOV switch (figures 2-11 and 2-12) is in the EMER position.

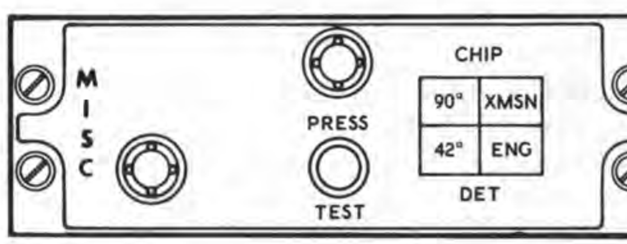

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Figure 2-13. Pilot miscellaneous control panel

SECTION IV. FUEL SYSTEM

2-34. Fuel Supply System.

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.

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.

2-35. Controls and Indicators.

a. Fuel Switch. A two-position fuel switch (figure 2-11) is located on the pilot left console forward of the collective stick. The switch is protected against accidental operation by a spring-loaded toggle lever which must be pulled before switch movement can be accomplished. Movement of the switch to FUEL position activates the forward and aft boost pumps, opens 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 the OFF position, the fuel shutoff valve is closed and the forward and aft boost pumps cease operation. Electrical power for the valve and forward boost pump is supplied from the essential bus and for the aft boost pump by the nonessential bus.

b. Fuel Quantity Indicator. The fuel quantity indicator is located on the pilot instrument panel (figure 2-6). 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 protected by the FUEL QTY IND circuit breaker. The indicator is connected to capacitor-type fuel quantity transmitters in the forward and aft fuel cells. Multiply indicator readings by 100 to obtain fuel quantity in pounds.

c. Test Switch. Fuel gauge test switch is a pushbutton momentary on switch (figure 2-6) located on the pilot instrument panel. The switch provides a means of testing the indicator and circuit operation. When the switch button is pressed and held in, the fuel quantity indicator pointer moves from the actual quantity reading to a lesser quantity reading. Upon release of the test button the indicator needle will return to the actual fuel reading.

d. Low Fuel Quantity Caution Light. A caution panel segment worded 10% FUEL is located on the pilot and gunner caution panels (figure 2-19).

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 essential bus.

e. Fuel Pressure Indicator. The fuel pressure indicator (figure 2-6) is located on the pilot 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.

f. Boost Pump Caution Lights. The caution panel worded segments FWD FUEL BOOST and AFT FUEL BOOST are located on the pilot 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 essential bus.

g. Fuel Filter Caution Light. The caution panel worded segments FUEL FILTER are located in the pilot and gunner caution panels (figure 2-19). 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 filter bypass valve opens to permit fuel to flow around the filter.

SECTION V. FLIGHT CONTROLS

2-36. Flight Controls.

2-37. Description.

The flight control system 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 gunner. The gunner controls are slaved to the pilot controls. The system includes a cyclic system, collective control system, tail rotor system, force trim system and stability and control augmentation system (SCAS).

2-38. Cyclic Control System.

The system is operated by the cyclic stick (figures 2-4 and 2-5) movement. Moving the stick in any direction will produce a corresponding movement of the helicopter which is the result of a change in the plane of rotation of the main rotor. The stick fore and aft movement also changes the synchronized elevator (figure 2-1) attitude to assist controllability and lengthen cg range.

2-39. Collective Control System.

The system is operated by the collective stick (figures 2-4 and 2-5). Moving the stick up or down changes the angle of attack and lift developed by the main rotor resulting in the ascent or descent of the helicopter.

2-40. Tail Rotor Control System.

The system is operated by the pedals (figures 2-4 and 2-5). Pushing a pedal changes the pitch of the tail rotor resulting in directional control and may be used to pivot the helicopter on its own vertical axis. A pedal adjuster (figures 2-4 and 2-5) is provided to adjust the pedal distance for individual comfort. Heel rests are provided for the gunner to prevent inadvertent pedal operation.

2-41. Force Trim System.

The system incorporates a magnetic brake and gradient in the cyclic and directional control systems to provide artifical feel into the systems. Also, it provides a means to trim the controls. Placing the FORCE TRIM switch (figures 2-11 and 2-12) in the FORCE TRIM position will induce artificial feel into the systems. Depressing the cyclic stick force trim switch (figure 2-4 and 2-5) will cause the magnetic brake and force gradient to be repositioned to correspond to the positions of the cyclic stick and pedals thus providing trim. The system is powered by the essential bus and protected by the FORCE TRIM circuit breaker.

2-42. Stability and Control Augmentation System (SCAS).

a. Description. The SCAS is a three-axis, limited authority rate reference augmentation system. The SCAS cancels undesired motion of the helicopter during flight. This is accomplished by inducing a pilot electrical input into the flight control system to augment the pilot mechanical input.

b. Control Panel. The SCAS control panel (figure 2-14) contains a POWER switch for applying essential bus and 115 vac operating voltages to the system. The circuits are protected by the SAS PWR dc and SAS PWR ac circuit breakers. The panel also contains three channel engage switches which energize electric solenoid valves controlling hydraulic pressure to the system. The panel has three amber colored, mechanically dimmable NO GO lights; one associated with each PITCH, ROLL, and YAW channel engage switch. These lights are illuminated during the warmup to indicate the presence of current in each associated channel actuators. Should an engagement be attempted during this warmup period, the actuator will make an abrupt input to the fight 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.

c. SCAS (SAS) Release Switch. The cyclic grip mounted switch (figures 2-4 and 2-5) is used to disengage the pitch, roll, and yaw channels simultaneously. The channels are re-engaged by the PITCH, ROLL, and YAW switches on the SCAS control panel.

d. 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. 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.

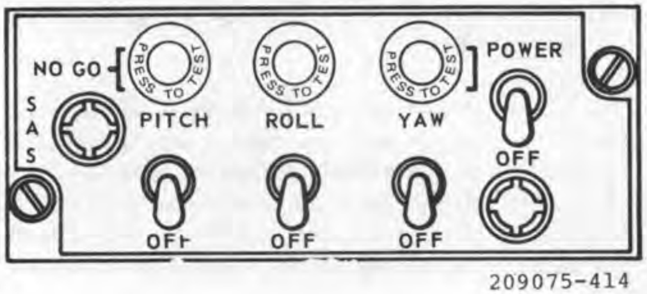


Figure 2-14. Pilot SCAS control panel

2-43. Trainer — Pilot (TH-1G).

The cyclic system provides the instructor with mechanical leverage equal to the pilot. The instructors collective also has equal mechanical leverage.

a. Cyclic System. The trainers cyclic control system is provided with two 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.

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

c. 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.

SECTION VI. HYDRAULIC AND PNEUMATIC SYSTEMS

2-44. Hydraulic and Pneumatic Systems.

2-45. Description.

The hydraulic system is a dual system (No. 1 and No. 2 system) used to minimize the force required by the pilot to move the cyclic, collective, and foot pedal controls. The No. 1 and No. 2 systems are installed to provide maximum separation to reduce the probability of a single projectile incapacitating both systems

2-46. Hydraulic System No. 1.

The No. 1 system provides hydraulic power to the cyclic controls, collective controls, SCAS yaw controls and charges emergency collective control system. The No. 1 system is located on the left side of the helicopter.

2-47. Hydraulic System No. 2.

The No. 2 system provides hydraulic power to the cyclic controls, collective controls, turret system, SCAS pitch and roll controls and articulated wing pylons. The No. 2 system is located on the right side of the helicopter.

2-48. Test Switch.

The pilot HYD TEST switch (figure 2-11) is used to test the No. 1 and No. 2 hydraulic systems. Holding the switch in the SYS 1 position will cause the No. 1 system to be the only system supplying hydraulic pressure. Similar action occurs when the switch is held in the SYS 2 position.

2-49. Reservoir Fluid Sight Glasses.

The No. 1 and No. 2 reservoirs are provided with a fluid sight glass. Both sight glasses can only be seen from the left hydraulic compartment door.

2-50. Filter Indicators.

The No. 1 and No. 2 pressure and return filters are provided with a differential pressure indicator. The red indicator pops out when the filter needs changing or during cold weather operation.

2-51. Low Pressure Caution Lights.

The pilot and gunner HYD PRESS #1 and HYD PRESS #2 caution lights (figure 2-19) will illuminate when the hydraulic pressure is below safe limits.

2-52. Electrical Circuit.

The hydraulic electrical circuit is powered by the essential bus and protected by the HYD CONT circuit breaker.

2-53. Emergency Hydraulic Control System.

a. Emergency Collective Control System. The system provides limited collective control operations if the No. 1 and No. 2 system fail. The pilot and gunner EMER COLL HYD switches (figures 2-6 and 2-7) control the emergency system. The switch is in the OFF position during normal operations. With the switch in the OFF position when the No. 1 and No. 2 systems fail will cause sufficient fluid to be retained in an accumulator for an emergency landing. Placing the switch in the ON position will allow four full strokes of the collective stick: A stroke is a maximum movement in one direction. The nitrogen accumulator pressure gage displays the amount of charge in the accumulator. It is normally charged to 650 to 850 psi. (Figure 2-15.)

b. Emergency Cyclic Control System. The system provides limited cyclic and control operations if the No. 1 and No. 2 systems fail. The system is automatic, using spring pressure in a small accumulator, and has no external controls.

2-54. Armament Hydraulic System.

a. Turret System. The M28 system is powered by the No. 2 system and enables the turret to be traversed through varied positions in elevation and azimuth. The system is controlled by the turret controls. The system electrical circuit is powered by the essential and nonessential busses and the 115 vac system. The circuit is protected by the dc HYD CONT, dc TURRET POWER, and ac WEAPON SIGHT circuit breakers.

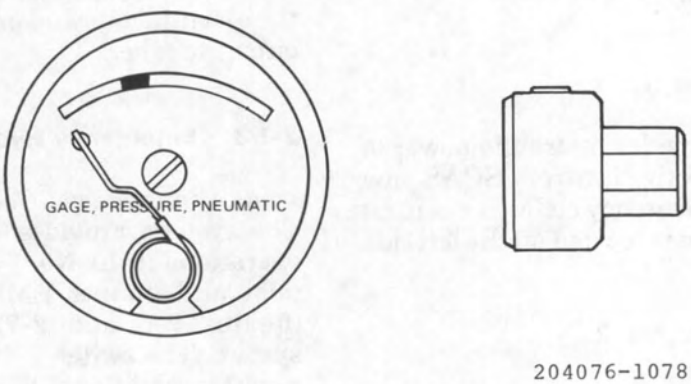


Figure 2-15. Nitrogen pressure gage

SECTION VII. POWER TRAIN SYSTEM

2-55. Transmission.

The transmission transfers engine power to the main rotor through the mast assembly and to the tail rotor through a series of driveshafts and gearboxes. The transmission has a self-contained pressure oil system. The oil is cooled by an oil cooler and turbine fan. The transmission and engine oil coolers use the same fan. The oil system has an automatic bypass system which causes the oil to bypass the cooler when the oil pressure is below safe limits. Two oil level sight glasses, an oil filler cap, and a magnetic chip detector are provided.

2-56. Gearboxes.

a. Intermediate Gearbox — 42 Degree. The gearbox is located at the base of the vertical fin (figure 2-1). It provides a 42 degree change of direction of the tail rotor driveshaft. The gearbox has a self-contained wet sump oil system. An oil level sight glass, a filler cap, and a magnetic chip detector are provided.

b. Tail Rotor Gearbox — 90 Degree. The gearbox is located near the top of the vertical fin (figure 2-1). It provides a 90 degree change of direction of the tail rotor driveshaft. The gearbox has a self-contained wet sump oil system. An oil level sight glass, a filler cap, and a magnetic chip detector are provided.

2-57. Driveshafts.

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

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

2-58. Indicators and Caution Lights.

a. Transmission Oil Pressure and Oil Temperature Indicators. The TRANS OIL indicators (figure 2-6) displays the pressure in psi and temperature in degrees celsius of the transmission oil. The electrical circuit is powered by the essential bus and protected by the TEMP IND ENG/XMSN circuit breaker.

b. Transmission Oil Low Pressure Caution Lights. The pilot and gunner XMSN OIL PRESS caution lights (figure 2-19) illuminate when the transmission oil pressure drops below safe limits.

c. Transmission Oil Hot Caution Lights. The pilot and gunner XMSN OIL HOT caution lights (figure 2-19) illuminate when the transmission oil temperature exceeds the safe limits.

d. Transmission Oil Cooler Bypass Caution Lights. The XMSN OIL BYPASS caution light (figure 2-19) will illuminate when the automatic oil bypass system is activated causing the oil to bypass the oil cooler.

e. Transmission and Gearboxes Chip Detectors.

(1) *Chip Detector Caution Lights.* The CHIP DETECTOR caution lights (figure 2-19) illuminate when metal chips are detected in the engine, 42° gearbox, 90° gearbox, or transmission. The miscellaneous control panel (figure 2-13) identifies which unit is contaminated.

(2) *Miscellaneous Control Panel.* The MISC CHIP DET panel (figure 2-13) is used to identify the contaminated component. When the pilot and gunner CHIP DETECTOR caution light illuminates, pressing the CHIP DET panel will cause the word ENG, 42°, 90°, or XMSN to illuminate. This illumination identifies the contaminated unit. The PRESS TEST switch is used to check the CHIP DET panel lights. The CHIP DET panel receives electrical power from the CHIP DETECTOR caution lights.

SECTION VIII. MAIN AND TAIL ROTORS

2-59. Main Rotor.

a. Description. The main rotor is driven by the mast which is connected to the transmission. The rotor rpm is governed by the engine rpm during powered flight. The rotor tip path plane is controlled by the cyclic stick. The rotor pitch is controlled by the collective stick.

b. RPM Indicators. The pilot and gunner indicators are part of the dual tachometers (figures 2-6 and 2-7). The tachometer inner scale displays percent rotor rpm.

2-60. Tail Rotor.

The tail rotor is driven by the 90 degree gearbox which is connected to the transmission by the tail rotor driveshaft assemblies and the 42 degree gearbox. The rotor rpm is governed by the transmission rpm. The rotor blade pitch is controlled by the pedals. Helicopters with MWO 55-1520-221-30/45 incorporated have a 11.5 inch chord tail rotor assembly.

SECTION IX. UTILITY SYSTEMS

2-61. Pitot Heater System.

The pitot heater is installed in the pitot head and functions to prevent ice forming in the pitot tube. Electric power for the pitot heater operation is supplied from the non-essential bus. Circuit protection is provided by a circuit breaker, marked PITOT HEATER.

a. Switch. The PITOT HEAT switch is located on the instrument panel (figure 2-6). The switch is two-position with up position ON and down position OFF.

b. Switch Operation. The PITOT HEAT switch should be in the up position to prevent ice from forming in the pitot tube. To shutoff pitot heater, position switch to OFF (down).

2-62. Defrosting, Deicing and Rain Removal Systems.

These systems are considered to be part of the environmental control system. Refer to Section X of this chapter.

SECTION X. HEATING, VENTILATION, COOLING, ENVIRONMENTAL CONTROL UNIT

2-63. Environmental Control Unit (ECU).

a. ECU Functions.

(1) Heats/cools the crew compartment.

(2) Removes moisture from the air supplied to the crew compartment.

(3) Defrosts, defogs, and deices the canopy.

(4) Removes rain from the canopy.

(5) Provides ambient air ventilation to the crew compartment.

b. ECU Power Source. The ECU is electrically controlled and engine bleed air operated. The circuit is powered by the dc nonessential bus and protected by the ECU CONT circuit breaker.

c. ECU Controls.

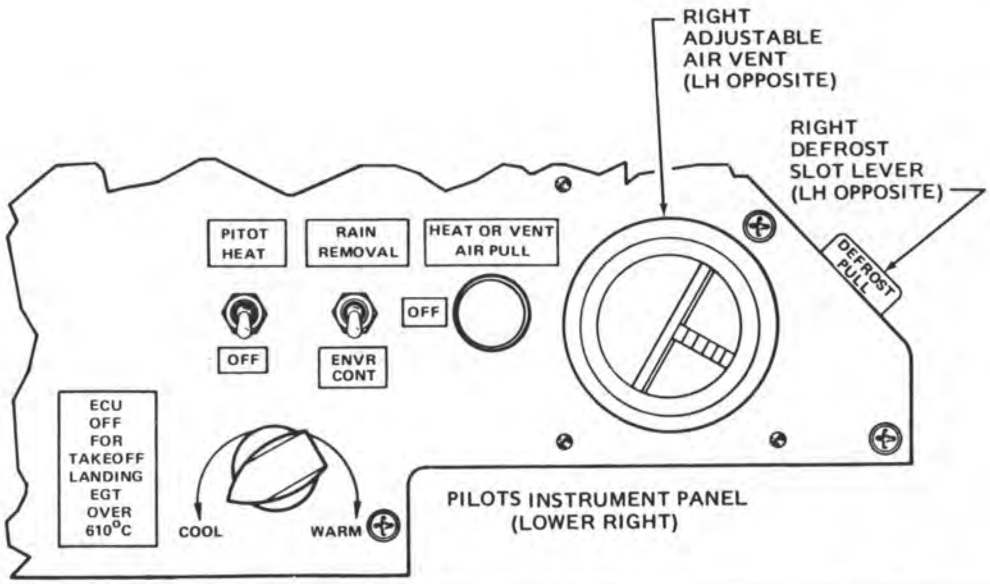
NOTE

Under certain conditions a plume may be observed at the air vents in the crew compartment. The plume may appear to be smoke, but is actually condensation.

(1) The pilot ECU controls and their functions are shown on figure 2-17.

(2) The pilot and gunner controls the volume and direction of the air entering the crew compartment using the adjustable air vents in their instrument panels.

(3) The pilot and gunner controls the volume of air entering their seat cushions using the valve at the top of each seat.



SWITCH/CONTROL	POSITION	FUNCTION
COOL/WARM	COOL to WARM	Controls temperature between 35°F (2°C) and 180°F (82°C) in the crew compartment when the RAIN REMOVAL/ENVR CONT switch is in the ENVR CONT position.
RAIN REMOVAL/ ENVR CONT	RAIN REMOVAL	Removes rain from canopy. Only ambient air ventilation enters the crew compartment. May be used to defrost, defog, or deice the forward area of the canopy. CAUTION A dry canopy will melt if rain removal system is operated for a lengthy period.
	ENVR CONT	Heats or cools the crew compartment.
	OFF	Ambient air ventilation enters the crew compartment.
HEAT OR VENT AIR PULL	OUT	Directs maximum air to crew compartment.
	IN	Air flow to crew compartment is shut off, except to pilot seat cushion.
Air Vent	Open/Closed	Controls the volume/direction of air to the crew compartment.
Defrost Slot Lever	Aft (Open)/ forward (closed)	Controls the volume of air directed to the inner surfaces of the canopy for defogging, defrosting, and deicing.

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Figure 2-17. ECS controls

SECTION XI. ELECTRICAL POWER SUPPLY AND DISTRIBUTION SYSTEM

2-64. DC and AC Power Disbribution.

Figure 2-18 depicts the general schematic of the dc and ac power distribution system. The dc power is supplied by the battery, starter-generator, or an external power source through the external power receptacle. The 115 vac power is supplied by the main or standby inverters. Power is supplied by the 26 vac transformer.

2-65. Battery.

The battery (figure 2-1) supplies 24 vdc power to the power distribution system when the starter-generator and the external power receptacle are not in operation.

2-66. Starter-Generator.

The starter-generator is mounted on and driven by the engine. The starter-generator supplies 28 vdc power to the power distribution system and recharges the battery.

2-67. External Power Receptacle.

The external power receptacle (figure 2-1) transmits the ground power unit 28 vdc power to the power distribution system.

2-68. Gunner Electrical Power Control.

The gunner ELEC PWR EMER OFF switch (figure 2-12) in the ELEC PWR position permits the pilot to control the electrical system. The switch in the EMER OFF position deactivates the electrical system and negates the pilot controls.

2-69. Pilot DC Power Indicators and Controls.

a. Battery Switch. The pilot BAT switch (figure 2-21) ON position permits the battery to supply 24 vdc to the primary bus or permits the battery to be charged. The OFF position isolates the battery from the system.

b. Generator Switch. The pilot GEN switch (figure 2-21) ON position permits the starter-generator to supply power to the primary bus. The RESET position will reset the starter-generator. When the switch is released, it will return to OFF. The OFF position isolates the generator from the system and allows the starter-generator to function as a starter. The circuit is protected by the GEN BUS RESET and GEN FIELD circuit breakers.

c. Nonessential Bus Switch. The pilot NON-ESS BUS switch (figure 2-21) NORMAL position permits the nonessential bus to receive power from the starter-generator only. The MANUAL position permits the nonessential bus to receive dc power.

d. DC Circuit Breaker Panel. The pilot dc circuit breakers (figure 2-20) in the "pushed-in" position provide circuit protection for the 28 vdc operated equipment. The breakers in the "pulled-out" position deactivate the circuit. The breakers will "pop out" automatically in the event of a circuit overload. Each breaker is labeled for the particular circuit it protects. Each applicable breaker is listed in the paragraph describing the equipment it protects.

e. Armament DC Circuit Breakers. The armament dc circuit breakers (figure 2-20) in the in/on position provide circuit protection for the 28 vdc operated equipment. The breakers in the out/off position deactivate the circuit. The breakers will "pop" automatically in the event of a circuit overload.

Each breaker is labeled for the particular circuit it protects. Each applicable breaker is listed in the paragraph describing the equipment it protects.

f. Volt-Ammeter Indicator. The pilot indicator (figure 2-6) simultaneously displays the voltage and amperage of dc power being supplied to the power distribution system. The indicator right scale displays the volts. The left scale displays the amps. The circuit is powered by the essential bus and protected by the DC VM circuit breaker.

g. Generator Caution Lights. The pilot and gunner DC GENERATOR caution lights (figure 2-19) illuminate when the dc generator fails, or when the GEN switch is off.

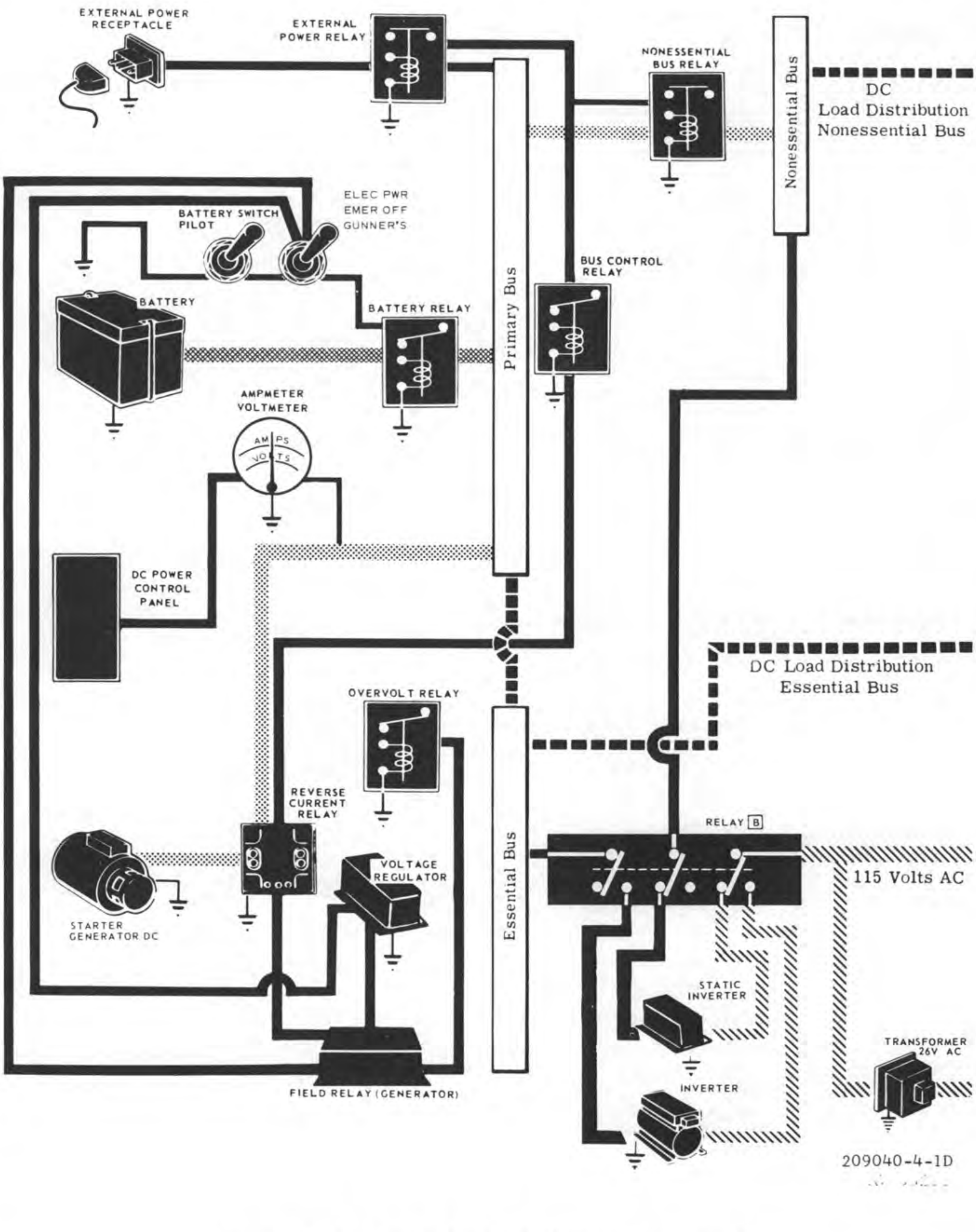
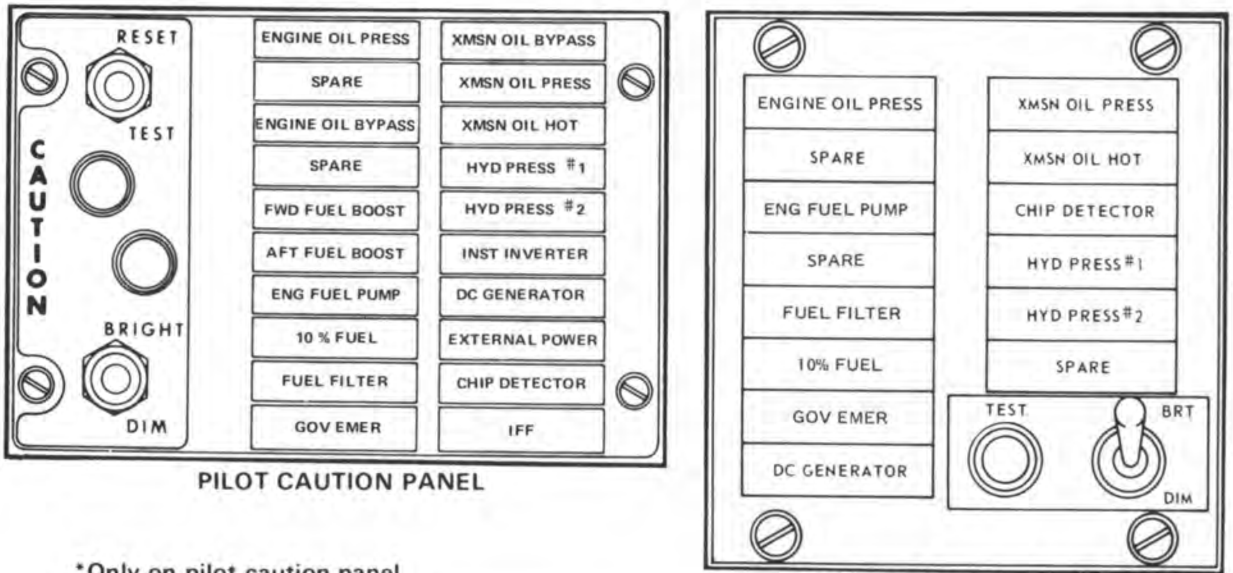


Figure 2-18. Electrical system schematic (Sheet 1 of 2)

Figure 2-18. Electrical system schematic (Sheet 2 of 2)



*Only on pilot caution panel

CAUTION PANEL WORDING	FAULT CONDITIONS
ENGINE OIL PRESS	Engine oil pressure below operating minimum (25 psi).
* 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 pump 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 degree gearbox, or 90 degree gearbox.
* IFF	IFF system inoperative.

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Figure 2-19. Pilot and gunner caution panels (typical)

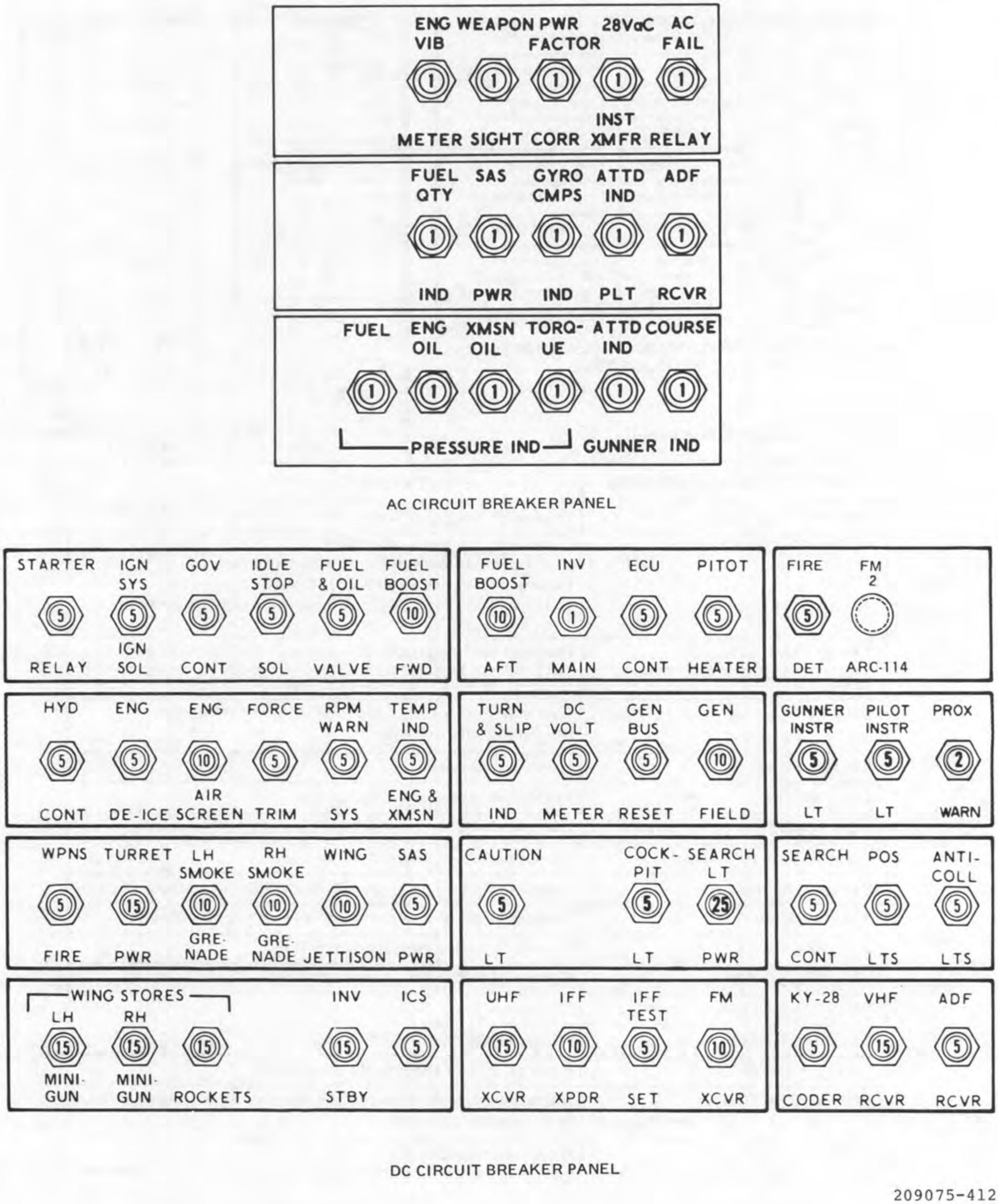


Figure 2-20. Circuit breaker panels (typical)

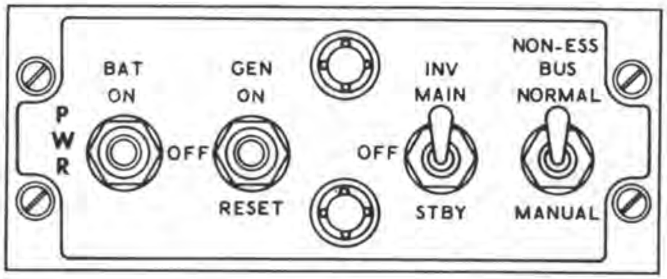


Figure 2-21. Pilot electrical power control panel

h. External Power Receptacle Caution Light. The pilot EXTERNAL POWER caution light (figure 2-19) illuminates when the external power receptacle door is open.

2-70. AC Power Indicators and Controls.

a. Inverter Switch. The pilot INV switch (figure 2-21) MAIN position selects the main inverter. It is powered by the essential bus and protected by the INV MAIN circuit breaker. The STBY position selects the standby inverter. It is powered by the nonessential bus and protected by the INV STBY circuit breaker. The OFF position deactivates the MAIN and STANDBY inverter circuits. In the event of a main inverter failure, the standby inverter automatically assumes the ac load.

b. AC Circuit Breaker Panel. The pilot ac circuit breakers (figure 2-20) in the "push-in" position provides circuit protection for the 26 Vac and 115 Vac operated equipment. The breakers in the "pulled-out" position deactivate the circuit. The breakers will "pop out" automatically in the event of a circuit overload. Each breaker is labeled for the particular circuit it protects. Each applicable breaker is listed in the paragraph describing the equipment it protects.

c. Inverter Caution Lights. The pilot INST INVERTER caution light (figure 2-19) illuminates when the inverter in use fails or when the INV switch is in the OFF position.

SECTION XII. LIGHTING

2-71. Position Lights.

a. Description. The position lights consist of the right wing green light, left wing red light, and the two tailboom white lights (figure 2-1). The lights are powered by the nonessential bus and protected by the POS LTS circuit breaker.

b. Operation. The pilot POSITION LTS (FLASH/OFF/STEADY) switch (figure 2-22) FLASH position flashes the four lights off and on. The STEADY position illuminates the four lights continuous. The OFF position deactivates the four lights. The pilot POSITION LTS BRT/DIM switch (figure 2-22) controls the four lights brightness.

2-72. Anti-Collision Light.

a. Description. The anti-collision light (figure 2-1) is powered by the nonessential bus and protected by the ANTI-COLL LTS circuit breaker.

b. Operation. The pilot ANTI-COLL LT switch (figure 2-22) ON position illuminates the anti-collision light. The OFF position deactivates the light.

2-73. Searchlight.

a. Description. The searchlight (figure 2-1) is powered by the essential bus and protected by the SEARCH LT PWR circuit breaker. The

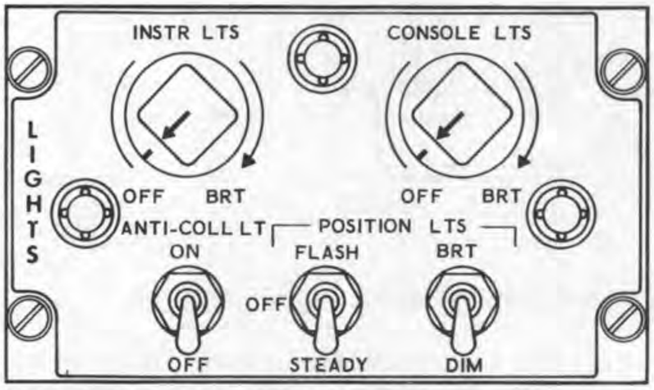


Figure 2-22. Pilot lights control panel (Typical)

searchlight control is nonessential bus powered and protected by the SEARCH CONT circuit breaker.

b. Operation.

(1) Searchlight Switch. The pilot SL switch (figure 2-4) ON position illuminates the light. The OFF position deactivates the light. The STOW position retracts the light into the fuselage well.

(2) Searchlight Control Switch. The pilot SEARCH CONT switch (figure 2-4) EXT position extends the light from the fuselage well and moves it forward. RETR position moves the light aft. The L/R position moves the light left and right.

2-74. Cockpit (Map) Lights.

a. Description. The pilot (two) and the gunner (one) lights are powered by the essential bus and protected by the COCKPIT LT circuit breaker. The lights are supplied in various configurations. All configurations have on-off, bright/dim and red/white light capabilities.

b. Operation. The pilot/gunner determines the configuration of his light and operates it accordingly.

2-75. Pilot Station Lighting.

a. Pilot Instrument Panel Lighting.

(1) Description. The panel is illuminated by hooded type and instrument built-in lights. The lights are powered by the essential bus and protected by the PILOT INSTR LT circuit breaker.

(2) Operation. The pilot INSTR LTS rheostat knob (figure 2-22) OFF position deactivates the lights. The between OFF and BRT positions controls the brightness of the instrument built-in lights. The hooded lights brightness is controlled by the INST LTS rheostat.

b. Pilot Consoles and Collective Stick Switchbox Lighting.

(1) Description. The console is illuminated by edgelight panels and equipment built-in lights. The switchbox is illuminated by one hooded type light. The lights are powered by the essential bus and protected by the PILOT INSTR LT circuit breaker.

(2) Operation. The pilot CONSOLE LTS rheostat knob (figure 2-22) OFF position deactivates the light. The between OFF and BRT positions controls the brightness of the console edge-light panels and equipment built-in lights. The switchbox hooded light has no brightness control.

2-76. Gunner Station Lighting.

a. Description. The gunner instrument panel is illuminated by hooded type and instrument built-in lights. The miscellaneous control panel (figure 2-12) and the armament control panel are illuminated by edgelight panels. The magnetic compass (figure 2-7) is illuminated by one hooded type light. The lights are powered by the essential bus and protected by the GUNNER INSTR LT circuit breaker (figure 2-20).

b. Operation. The gunner INST LTS rheostat knob (figure 2-12) OFF position deactivates the lights. The between OFF and BRT positions controls the brightness of the instrument built-in lights and the edgelight panels. The hooded lights have no brightness control.

SECTION XIII. FLIGHT INSTRUMENTS

2-77. Instruments and Indicators.

The pilot flight instruments consist of airspeed indicator, turn and slip indicator, vertical velocity indicator, altimeter, free air temperature and attitude indicator. The gunner flight instruments consist of an airspeed indicator, attitude indicator and altimeter.

2-78. Airspeed Indicators.

The pilot and gunner airspeed indicators (figure 2-6 and 2-7) display the helicopter indicated airspeed (IAS) in knots.

NOTE

IAS below approximately 25 KIAS is inaccurate due to rotor downwash.

2-79. Pressure Altimeters.

The pilot and gunner altimeters (figures 2-6 and 2-7) display the helicopter height above sea level in feet.

2-80. Attitude Indicators.

The pilot and gunner attitude indicators (figures 2-6 and 2-7) display the helicopter pitch and roll attitudes in relation to the earth. Pitch attitude is displayed by the motion of the sphere with respect to the miniature airplane. Roll attitude is displayed by the motion of the roll pointer with respect to the fixed roll scale. The sphere can be adjusted to level indication by the pitch trim knob. The power OFF flag is out of view when the indicator is energized. A power failure will cause the OFF flag to appear. The circuit is powered by the 115 vac system and protected by the ATTD IND PLT and ATTD IND GUNNER circuit breakers.

2-81. Turn and Slip Indicator.

The pilot turn and slip indicator (4 MIN TURN) (figure 2-6) displays the helicopter slip condition, direction of turn and rate of turn. The ball displays the slip condition. The pointer displays the direction and rate of the turn. The circuit is powered by the essential bus and protected by the TURN — SLIP IND circuit breaker.

2-82. Vertical Velocity Indicator.

The pilot vertical velocity indicator (figure 2-6) displays the helicopter ascent and descent speed in feet per minute. The indicator is actuated by the rate of atmospheric pressure change.

2-83. Free Air Temperature (FAT) Indicator.

The pilot FAT indicator displays the outside air temperature in Celsius degrees.

2-84. Magnetic (Standby) Compass.

The gunner magnetic compass (figure 2-5) displays the magnetic heading of the helicopter. A compass correction card is attached to the compass.

2-85. Radio Aids to Navigation.

The FM radio, automatic directional finder, course indicator, and radio magnetic indicator are radio aids to navigation and are covered in Chapter 3.

2-86. Master Caution System.

a. Master Caution Lights. The pilot and **T** gunner master CAUTION lights (figures 2-6 and 2-7) illuminate when fault conditions occur. This illumination alerts the pilot and **T** gunner to check the caution panels for the specific fault condition.

b. Caution Panels (figure 2-19).

(1) Caution Panel Lights. The pilot and gunner caution panel lights illuminate to identify specific fault conditions. The caution light lettering is readable only when the light illuminates. The light will remain illuminated until the fault condition is corrected or the light panel is rotated in the caution panel.

(2) Test/Reset and Test Switches. The pilot caution panel has a TEST/RESET switch. The gunner caution panel has a TEST switch. Momentarily placing the pilot or gunner switch in the TEST position will cause all caution lights and the MASTER caution light to illuminate. Testing of the system will not change the existing fault

condition indications. Momentarily placing the pilot switch in the RESET position will extinguish and reset the pilot and T gunner MASTER caution lights so they will illuminate again should another fault condition occur.

(3) Bright-Dim Switches. The caution panels have a BRIGHT-DIM (pilot), BRT-DIM (gunner) switch to control the brightness of the panel caution light and the MASTER caution lights. This switch will not function if the pilot CONSOLE LTS rheostat (figure 2-22) or the gunner INST LTS rheostat (figure 2-12) is in the OFF position. The caution panel lights and the MASTER caution light will be at full brightness when the pilot/gunner rheostats are in the OFF position.

c. Electrical Circuit. The master caution system is powered by the essential bus and protected by the CAUTION LT circuit breaker.

2-87. 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 low rotor rpm 305 ± 5 rpm or below and engine rpm 6200 ± 100 rpm or below.
Light Warning Only	For rotor rpm 334 ± 5 (corresponds to engine rpm of 6800 ± 100) (High warning).

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.

a. RPM Warning Light. The pilots RPM LIMIT light is located on the instrument panel (figure 2-6). 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.

b. RPM Switch — Low RPM Audio. The pilots RPM switch is located on the engine control panel (figure 2-11). The switch in OFF position prevents audio warning from functioning when the audio might be objectionable. The switch automatically resets to RPM WARNING position when the engine and rotor reach normal operating rpm.

c. The rotor tachometer generator and power turbine tachometer both send signals to the high-low rpm warning light and audio warning circuits. When the combination warning light and audio signals are energized, determine the cause of indication by checking the torquemeter and cross referencing other engine instruments or other indications.

d. Other normal engine indications signify the engine is functioning properly, and there is a tachometer generator failure or an open circuit to the warning system rather than an actual engine failure.

e. The system circuit is powered by the essential bus and is protected by the RPM WARN SYS circuit breaker (figure 2-20).

2-88. Fire Detector Warning System.

a. On modified helicopters the fire detection warning system consists of fire detection elements, fire detection control unit, fire detection test switch, and two FIRE warning lights.

b. The fire detector elements are attached to the engine cowling and tail rotor drive heat shield.

c. Excessive heat from the engine compartment will illuminate the fire lights located on the pilot and gunner instrument panel.

d. Fire detector warning system units are supplied power by the essential bus and is protected by the FIRE DET circuit breaker.

e. The FIRE TEST switch is located on the pilot instrument panel (figure 2-6). When the test switch is moved to test, the fire detector elements are connected in series causing the FIRE light to illuminate.

SECTION XIV. SERVICING, PARKING, AND MOORING

2-89. Fuel System Servicing.

WARNING

Servicing personnel shall comply with all safety precautions and procedures specified in FM10-68 Aircraft Refueling field manual.

a. Refer to figure 2-24 for fuel tank capacities.

b. Refer to figure 2-25 for approved fuel.

c. The helicopter may be serviced by any of the methods described as follows:

(1) Closed Circuit Refueling (Power Off)

(a) Refer to figure 2-23 for fuel filler location.

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

(c) Ground servicing unit to ground stake.

(d) Ground servicing unit to helicopter.

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

(f) Remove fuel filler cap, and assure that refueling module is in locked position. Refer to figure 2-25.1.

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

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

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

(j) Replace fuel nozzle cap.

(k) Replace fuel filler cap.

(l) Disconnect fuel nozzle ground.

(m) Disconnect ground from helicopter to servicing unit.

(n) Disconnect servicing unit ground from ground stake.

(o) Return fire extinguisher to designated location.

(2) Gravity or Open-Port Refueling (Power Off)

(a) Refer to figure 2-23 for fuel filler location.

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

(c) Ground servicing unit to ground stake.

(d) Ground servicing unit to helicopter.

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

(f) Remove fuel filler cap.

(g) Using latch tool, attached to filler cap cable open refueling module if equipped with closed circuit receptacle. Refer to figures 2-25.1 and 2-25.2.

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

(i) Activate flow control handle to ON or FLOW position. Fuel flow will automatically shut off when fuel cell is full.

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

(k) Replace fuel nozzle cap.

(l) Close refueling module by pulling cable until latch is in locked position, if equipped with closed circuit receptacle. Refer to figure 2-25.1.

(m) Replace fuel filler cap.

(n) Disconnect fuel nozzle ground.

(o) Disconnect ground from helicopter to servicing unit.

(p) Disconnect servicing unit ground from ground stake.

(q) Return fire extinquisher to designated location.

(3) RAPID (HOT) Refueling (Closed Circuit)

(a) Before RAPID Refueling.

(1) Throttle - Idle.

(2) FORCE TRIM switch - FORCE TRIM.

WARNING

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

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

(c) Refer to figure 2-23 for fuel filler location.

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

(e) Ground servicing unit to ground stake.

(f) Ground servicing unit to helicopter.

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

(h) Remove fuel filler cap, and assure that refueling module is in closed position. Refer to figure 2-25.1.

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

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

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

(l) Replace fuel nozzle cap.

(m) Replace fuel filler cap.

(n) Disconnect fuel nozzle ground.

(o) Disconnect ground from helicopter to servicing unit. AFTER RAPID REFUELING. The pilot shall be advised by the refueling crew that fuel cap is secure and grounding cables have been removed.

(p) Disconnect servicing unit ground from ground stake.

(q) Return fire extinguisher to designated location.

(4) RAPID (HOT) GRAVITY Refueling

(a) Before RAPID Refueling.

(1) Throttle - Idle.

(2) FORCE TRIM switch - FORCE TRIM.

WARNING

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

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

(c) Refer to figure 2-23 for fuel filler location.

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

(e) Ground servicing unit to ground stake.

(f) Ground servicing unit to helicopter.

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

(h) Remove fuel filler cap.

(i) Using latch tool, attached to filler cap cable open refueling module if equipped with closed circuit rapid refueling receptacle. Refer to figures 2-25.1 and 2-25.2.

WARNING

During RAPID GRAVITY refueling, exercise extreme caution to prevent fuel splashing from fuel cell or fuel nozzle. Any fuel leakage could be extremely hazardous if ingested into engine air intake.

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

(k) Activate flow control handle to ON or FLOW position. Fuel flow will automatically shut off when cell is full.

(l) Assure that flow control handle is in OFF or NO FLOW position and remove nozzle. Close refueling module by pulling cable until latch is in locked position, if equipped with closed circuit receptacle. Refer to figure 2-25.1.

(m) Replace fuel nozzle cap.

(n) Replace fuel filler cap.

(o) Disconnect fuel nozzle ground.

(p) Disconnect ground from helicopter to servicing unit. AFTER RAPID REFUELING. The pilot shall be advised by the refueling crew that fuel cap is secure and grounding cables have been removed.

(q) Disconnect servicing unit ground from ground stake.

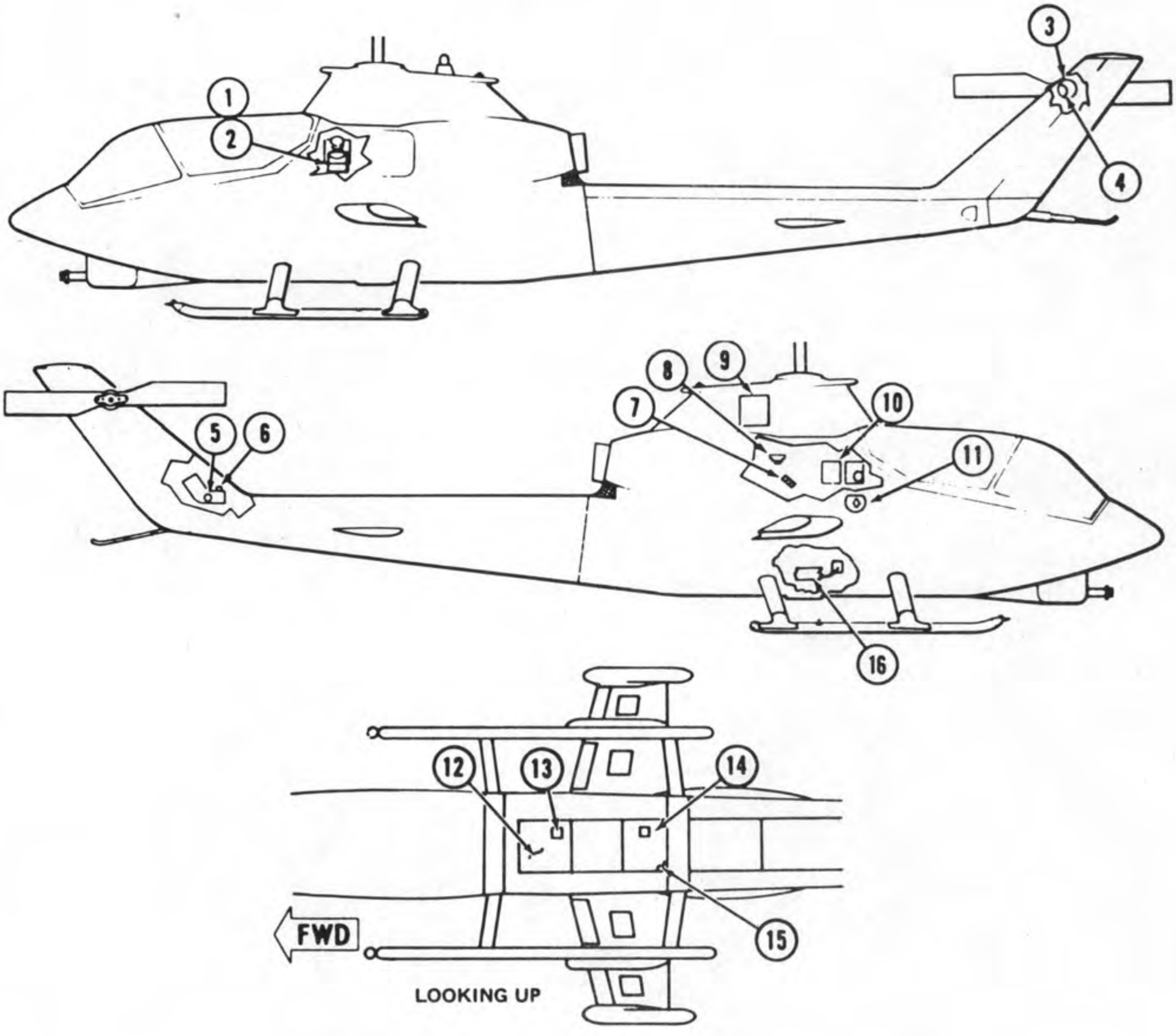
(r) Return fire extinguisher to designated location.

2-92. Ground Handling Equipment, Covers, Rotor Tiedowns, and Mooring Diagram.

Refer to figure 2-26.

NOTE

All tiedowns shall be tight.



1. Hydraulic fluid level sight gages
2. Hydraulic fluid reservoir
3. Tail rotor 90 degree gearbox oil filler
4. Tail rotor 90 degree gearbox oil level sight gage
5. Tail rotor intermediate gearbox oil level sight gage
6. Tail rotor intermediate gearbox oil filler
7. Transmission oil level sight gage
8. Transmission oil filler
9. Engine oil tank
10. Hydraulic fluid reservoir
11. Fuel filler
12. Forward fuel cell sump panel
13. Forward fuel cell drain
14. Aft fuel cell drain
15. Aft fuel cell sump panel
16. Emergency collective accumulator

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Figure 2-23. Servicing diagram

SYSTEM	SPECIFICATION	NOTE	CAPACITY
			Crashworthy
Fuel	MIL-5624 (JP-4)	1	260 U. S. Gals. Usable 262 U. S. Gals. Total Non-Crashworthy
Oil			270 U. S. Gals. Total
Engine	MIL-L-7808 MIL-L-23699	2, 4 3, 4	2.9 U. S. Gals. Spillover 2.2 U. S. Gals. Sight Glass
Transmission	MIL-L-7808 MIL-L-23699	2, 4 3, 4	2.3 U. S. Gals.
42° Gearbox	MIL-L-7808 MIL-L-23699	2, 4 3, 4	0.4 U. S. Pint
90° Gearbox	MIL-L-7808 MIL-L-23699	2, 4	0.5 U. S. Pint
Hydraulic			
System No. 1	MIL-H-5606 MIL-H-83282	5. 7 6, 7	6.0 U. S. Pints
System No. 2	MIL-H-5606 MIL-H-83282	5, 7 6, 7	6.6 U. S. Pints
Reservoir No. 1 & 2	MIL-H-5606 MIL-H-83282	5, 6, 7	3.2 U. S. Pints

NOTE:

1. MIL-T-5624 (JP-4) NATO code is F-40.
   Alternate fuel is MIL-T-5624 (JP-5) (NATO F-44).
   Emergency fuel is MIL-G-5572 (Any AV gas) (NATO F-12, F-18, F-22). The use of emergency fuel for a maximum operating time of 50 hours will require a scheduled internal (hot end) inspection.
2. MIL-L-7808 NATO code is 0-148.
   For use in ambient temperatures below minus 32°C/25°F.
   May be used when MIL-L-23699 oil is not available.
3. MIL-L-23699 NATO code is 0-156.
   For use in ambient temperatures above minus 32°C/25°F.

CAUTION

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

4. It is not advisable to mix MIL-L-7808 and MIL-L-23699 oils, except during an emergency. If the oils are mixed, the system shall be flushed within six hours and filled with the proper oil. An entry on DA Form 2408-13 is required when the oils are mixed.
5. MIL-H-5606 NATO code is H-515, alternate MIL-H-83282.
   For use in ambient temperatures below minus 40°C/40°F.
6. MIL-H-83282 for use in ambient temperatures above minus 40°C/40°F.
7. It is not advisable to mix MIL-H-5606 and MIL-H-83282 fluids, except during an emergency. An entry on DA Form 2408-13 is required when the fluids are mixed. When changing from MIL-H-5606 to MIL-H-83282, not more than two percent of MIL-H-5606 may be present in the system.

Figure 2-24. Approved military fuels, oils, fluids, and unit capacities

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 Kerosene	Jet A-1 Kerosene
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	
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 (commercial name PRIST) 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.

Figure 2-25. Approved fuels chart

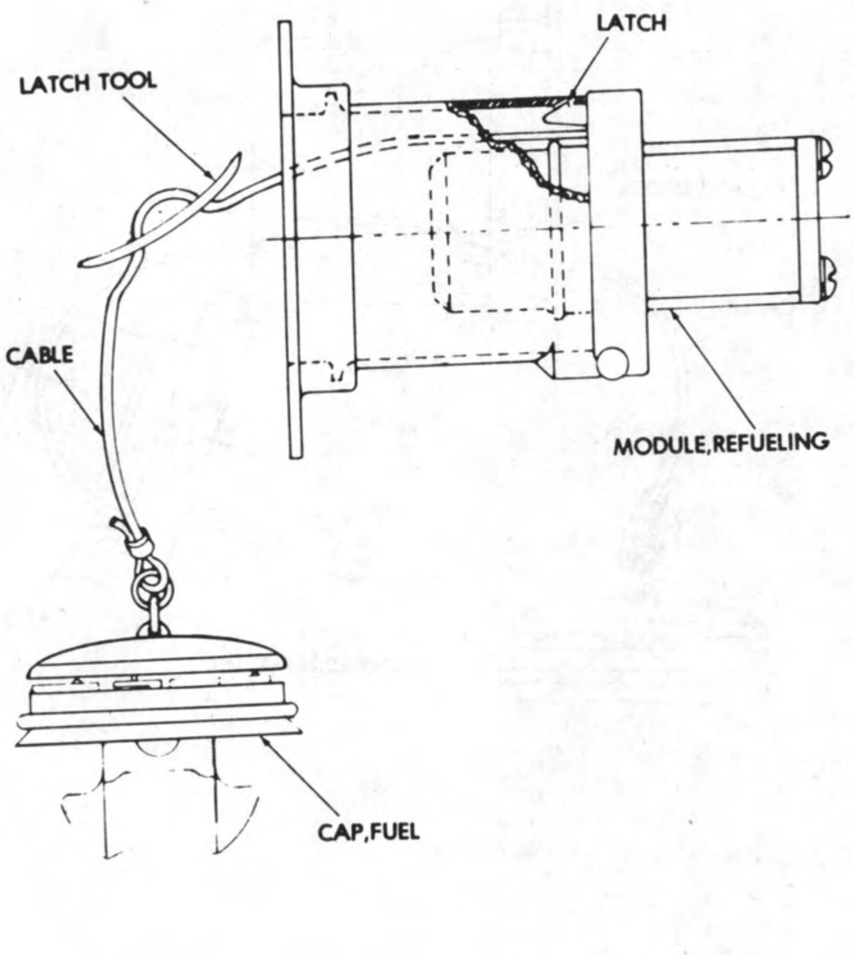

Figure 2-25.1. Receiver and Cap Assembly (View in closed and locked position)

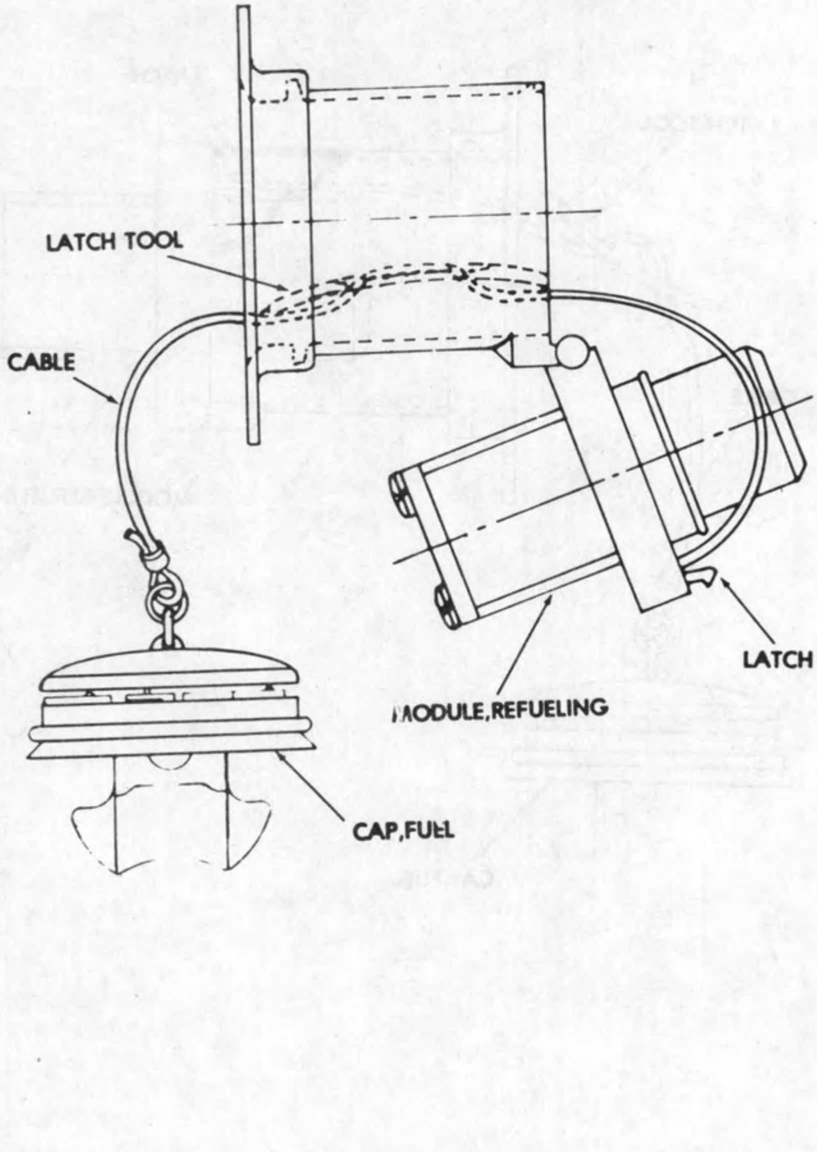

Figure 2-25.2. Receiver and Cap Assembly (View in open position)

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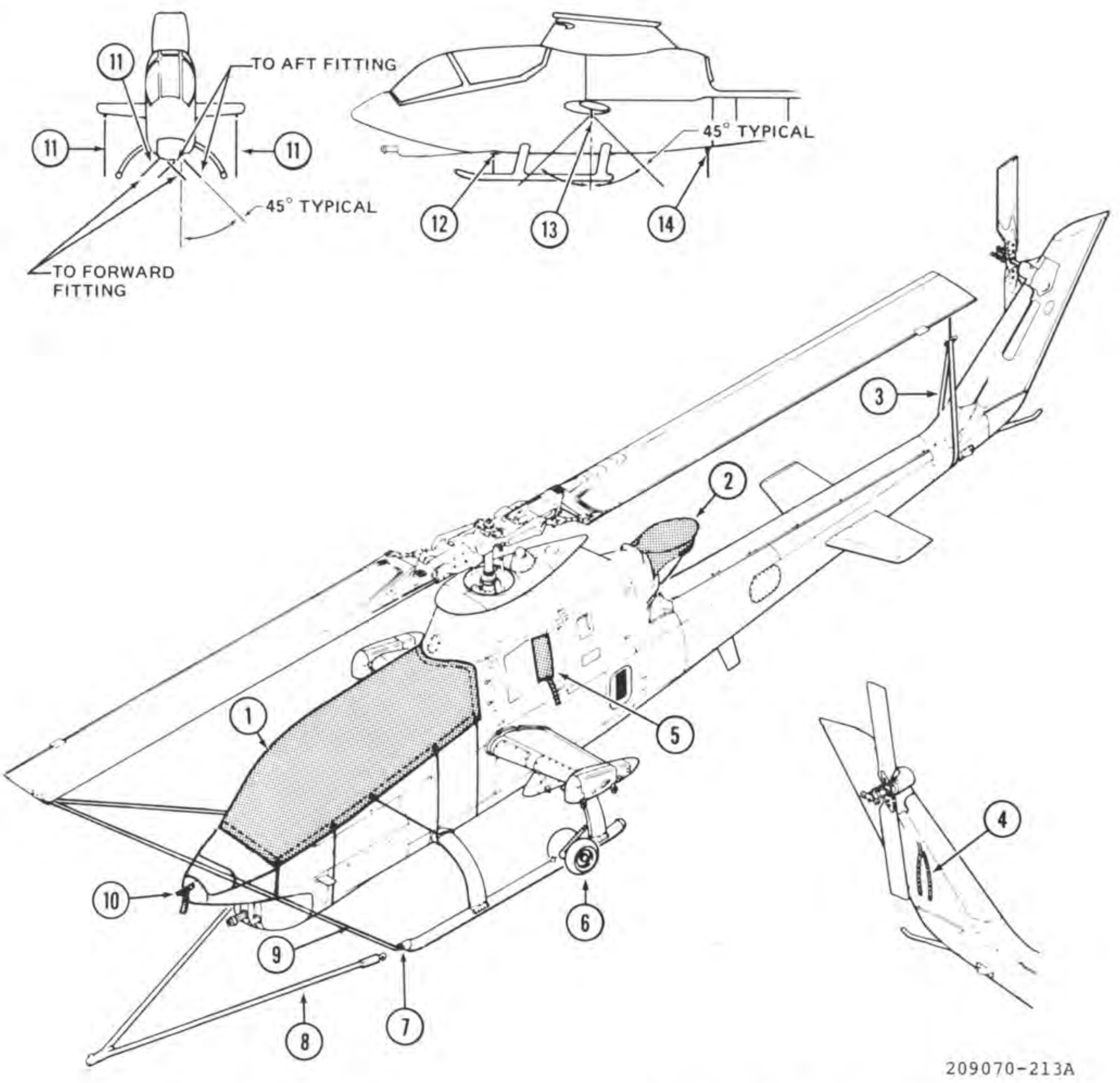


1. Canopy cover
2. Exhaust cover/IR duct cover
3. Aft main rotor tiedown
4. Tail rotor tiedown
5. Engine air inlet shield
6. Ground handling gear
7. Tow ring
8. Tow bar
9. Forward main rotor tiedown
10. Pitot tube cover
11. One inch rope or one-fourth inch cable
12. Forward mooring fitting
13. Outboard pylon mooring fitting (LH/RH)
14. Aft mooring fitting

Figure 2-26. Ground handling equipment, covers, rotor tiedowns, and mooring diagram

CHAPTER 3

AVIONICS

SECTION I. GENERAL

3-1. Description.

This chapter describes the avionics equipment configuration installed in Army model AH-1G helicopter. It includes a brief description of the avionics equipment, its technical characteristics, capabilities, and location. This chapter also contains complete operating instructions for all signal equipment installed in the helicopter. For mission avionics equipment refer to Chapter 4, Mission Equipment.

3-2. Avionics Equipment Configuration.

The avionics configuration (figure 3-1) consists of two interphone (signal distribution) panels, UHF command (radio) set, FM radio set, VHF radio set, direction finder set, transponder test set, transponder set, voice security set, a gyromagnetic compass, proximity warning system, radar warning and appropriate headset cordages and (microphone) keying switches. One type of microphone switch is the radio/ICS switch on top of the cylic control grips in both stations. Placing the microphone switch in aft position keys the interphone independently of the intercom transmitter selector. The forward position of the microphone switch keys the radio transmitter selected with transmitter-interphone selector switch on the interphone panel. In addition to the radio/ICS switch the gunner has a foot switch. The foot switch has only one position. It keys the radio or interphone selector switch on the gunners interphone 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 the left, outboard from the collective control stick. UHF and ADF control panels are located on the pilots right console. The FM control panel is in the pilots instrument panel. The helicopter has FM homing capability. 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. If switch is left in the ON position the respective head set is hot. The transponder control panel and voice security control indicator 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 control panel is in the gunners instrument panel.

3-3. Power Source.

Refer to figure 2-26 and figure 2-27 for circuit breaker panels.

NOMENCLATURE	COMMON NAME	USE	RANGE
Intercommunication Set Control C-1611/AIC	Interphone panel	Interphone for pilot and gunner; integrates all communication equipment	Stations within helicopter
Radio Set AN/ARC-51BX Receiver-Transmitter Radio RT 742/ARC-51 BX Control Radio Set C-6287( )/ARC-51BX Antenna AT-1108/ARC	UHF Command Set Receiver-Transmitter UHF Control Panel UHF Antenna	Two-way voice communication in the frequency range of 225.0 to 399.95 MHz from UHF radio broad-casting station	Line of sight for 50 miles

Figure 3-1. Avionics equipment configuration (Sheet 1 of 4)

NOMENCLATURE	COMMON NAME	USE	RANGE
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 from FM radio broadcasting station	Line of sight or 80 miles average
or Radio Set AN/ARC-131 Receiver-Transmitter RT-823( )/ARC-131 Control Radio Set C-7088( )/ARC-131 FM Homing Antenna FM Communications Antenna-Collins 437S-1 Indicator ID-48( )/ARM	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 75.95 MHz from FM radio broadcasting station.	Line of sight or 80 miles average
Computer Voice Security TSEC/KY-28 Control Indicator Voice Security C-8157/ARC Discriminator, Discrete Signal MD-736/A	Voice Security Set encoder/decoder Voice Security control indicator Discrete Signal discriminator	In conjunction with FM radio set to provide secure two-way voice communication.	
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 from VHF radio broadcasting station.	Line of sight or 50 miles average condition

Figure 3-1. Avionics equipment configuration (Sheet 2 of 4)

NOMENCLATURE	COMMON NAME	USE	RANGE
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 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
Transponder Set AN/APX-44 Receiver-Transmitter, Radar RT-494/APX-44 Transponder Set Control C-2714/APX-44 Antenna AT-844( )/APX	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
or Transponder Set AN/APX-72 Receiver-Transmitter RT-859/APX-72 Transponder Set Control C-6280(P)/APX Antenna AT-884( )/APX Transponder Test Set TS-1843( )/APX	Transponder Set Receiver-Transmitter Control Panel System which it Receives Antenna Test Set	Receives on 1030 MHz. Transmits a special coded reply on 1090 MHz to ground based IFF radar interrogator. Transmits and receives pulsated radio frequency. Provides Built in Test (BIT) features for transponder functions.	Line of sight
Proximity Warning System YG-1054	Proximity Warning Device	Provides proximity warning of others so equipped aircraft to avoid mid-air collision.	Line of sight

Figure 3-1. Avionics equipment configuration (Sheet 3 of 4)

NOMENCLATURE	COMMON NAME	USE	RANGE
AN/ASN-43 Compass Gyro Magnetic	Gyromagnetic Compass	Navigational aid; provides accurate heading information.	Gyromagnetically from zero latitude to 70 degree north or south latitude. Gyro will operate at any latitude as a standard type gyro.
Transmitter Induction Compass T-611/ASN	Flux Valve		
Compensator, Magnetic Flux CH-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	Course Indicator		

Figure 3-1. Avionics equipment configuration (Sheet 4 of 4)

SECTION II. COMMUNICATIONS

3-4. Interphone Panel.

a. Description. The interphone panel (figure 3-2) 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 PVT position is also provided at each station for intercom operation without the use of an external key.

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

c. Operation.

1. BAT switch — BAT (OFF if GPU is used).

2. ICS circuit breaker — In.

3. Transmit interphone selector switch — As desired.

4. RECEIVERS switches — As desired.

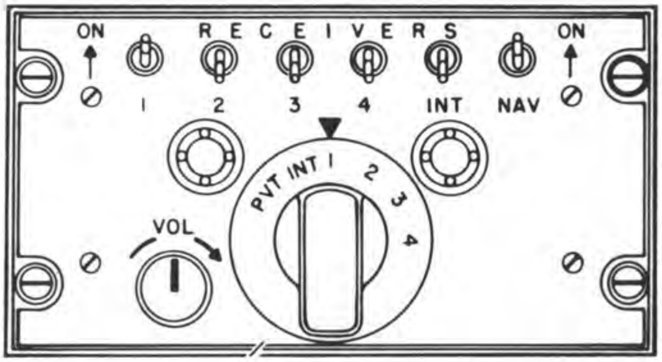
5. Microphone switch — As desired.

6. VOL control — Adjust.

3-5. UHF Command Set.

a. Description. The UHF command set provides two-way amplitude modulated voice communications in the UHF (Ultra High Frequency) band of 225.0 to 399.95 MHz. It turns 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. The UHF command set consists of a receiver-transmitter installed in the tailboom section, a control panel (figure 3-3) installed in the pilots console and a UHF antenna (figure 3-4).

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 (35°C). Primary power to operate the set is supplied from the essential bus. Circuit protection is provided by a circuit breaker marked UHF COMM. The receiver-transmitter is



CONTROL	FUNCTION
RECEIVERS switches 1 (FM), 2 (UHF), 3 (VHF), and 4 (not used)	Turn audio from associated receiver ON or OFF.
INT switch	ON position enables operator to hear audio from the interphone.
NAV switch	ON position enables operator to monitor audio from the navigation receiver.
VOL control	Adjusts audio on receivers except NAV receivers.
Transmit-interphone selector switch	Positions 1 (FM), 2 (UHF), 3 (VHF), 4 (not used) and INT permits INT or selected receiver-transmitter to transmit and receive. The cyclic stick switch or foot switch must be used to transmit. PVT position keys interphone for transmission HOT MIC condition.

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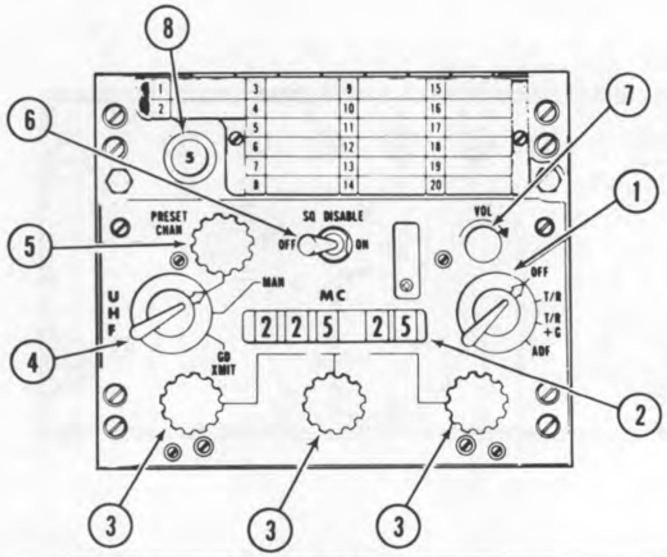
Figure 3-2. Interphone panel



CONTROL	FUNCTION
1. Function Selector	Applies power to radio and selects type of operation.
OFF position	Removes operating power from the set.
T/R position	Transmitter and main receiver ON.
T/R + G position	Transmitter, main receiver and guard receiver ON.
ADF position	Not used.
2. Channel Indicator	Indicates the frequency selected by the frequency controls.
3. Frequency Controls	
Left-hand control	Selects the first two digits of desired frequency.
Center control	Selects the third digit of desired frequency.
Right-hand control	Selects the fourth and fifth digits of the desired frequency.
4. Mode Selector	Determines the manner in which the frequencies are selected as follows:
PRESET CHAN position	Permits selection of one of 20 preset channels by means of preset channel control.
MAN position	Permits frequency selection by means of frequency controls.
GD XMIT position	Receiver-transmitter automatically tunes to guard channel frequency.
5. PRESET CHAN	Permits selection of any of 20 preset channels.
6. SQ DISABLE switch	In the ON position squelch is disabled. In the OFF position the squelch is operative.
7. VOL Control	Controls the receiver audio volume.
8. Preset Channel Indicator	Indicates the preset channel selected by preset channel control.

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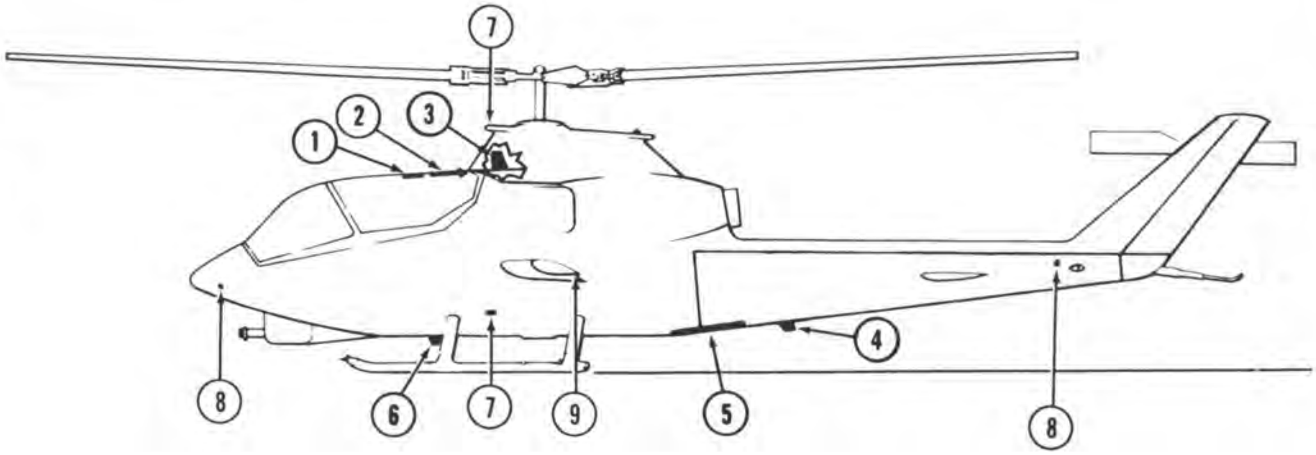
Figure 3-3. UHF control panel



1. FM homing antenna
2. ARN-83 loop antenna
3. FM communication antenna
4. AT-1108ARC/UHF—VHF communications antenna
5. AN/ARN—ADF SENSE antenna
6. AT-884/APX antenna
7. Proximity warning
8. Radar warning (typical)
9. Interphone jack

209078-25A

Figure 3-4. Antenna location

controlled from the UHF control panel and mounted in the pilots right console. The UHF/VHF antenna elements and connectors are provided and contained in a single housing which permits the antenna to be used for either or both UHF and VHF. UHF guard transmits or receives on a frequency 243.0 MHz.

NOTE

Do not transmit on emergency (GUARD) frequency except when under actual emergency conditions.

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

c. Operation.

1. BAT switch — BAT (OFF if GPU is used).

2. UHF XCVR and ICS circuit breakers — In.

3. Function selector — As desired. Allow set to warmup.

4. Mode selector — As desired.

5. Interphone panel RECEIVERS switch No. 2 — ON.

6. Frequency — Select.

7. SQ DISABLE switch — OFF.

8. VOL control — Adjust.

9. Interphone panel transmit-interphone selector switch — Position 2.

10. Microphone switch — Press to transmit.

11. Function selector — OFF.

3-6. VHF Radio Set.

a. Description. 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 UHF/VHF antenna elements and connectors are provided and contained in a single housing which permits the antenna to be used for either or both UHF and VHF (figure 3-4). The VHF radio set consists of a receiver-transmitter, control panel, and VHF antenna. The receiver-transmitter is installed in the tailboom section. The control panel is installed in the gunners instrument panel. 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 RCVR.

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

c. Operation.

1. BAT switch — BAT (OFF if GPU is used).

2. VHF XCVR and ICS circuit breakers — In.

3. OFF/PWR switch — PWR. Allow set to warmup.

4. Frequency — Select.

5. Interphone panel RECEIVERS switch No. 3 — ON.

6. VOL control — Adjust. If signal is not audible with VOL control full clockwise, press COMM TEST switch to unsequelch circuits.

7. Interphone panel transmit-interphone selector switch — Position 3.

8. Microphone switch — Press to transmit.

9. OFF/PWR switch — OFF.

3-7. FM Radio Set.

a. Description. The FM radio set consists of; a FM control panel AN/ARC-54 or AN/ARC-131 mounted in the pilot instrument panel, a receiver-transmitter, a communication antenna, a homing antenna, and a course indicator. Frequency range for the AN/ARC-54 is from 30.00 to 69.95 MHz. Frequency range for the AN/ARC-131 is from 30.00 to 75.95 MHz. The set is used for two-way communication. Homing to a known station can be accomplished using the course indicator with this radio (figure 3-7).

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

c. Operation.

1. BAT switch — BAT (OFF if GPU is used).

2. FM XCVR and ICS circuit breakers — In.

3. Mode selector switch — PTT or T/R.

4. Frequency — Select.

5. VOL control — Adjust.

6. SQUELCH control — CARR or as required.

7. Interphone panel RECEIVERS switch No. 1 — ON.

8. Interphone panel transmit-interphone selector switch — Position No. 1.

9. Microphone switch — Press to transmit.

10. Homing — 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.

11. Mode selector switch — OFF.

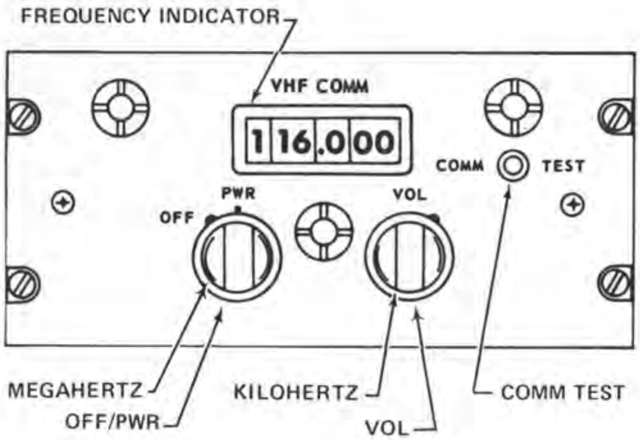
3-8. Course Indicator. The course indicator (figure 3-7) is located in the pilot instrument panel. This indicator is used only when the FM radio is operating in the homing mode.

3-9. Voice Security Equipment.

a. Description. The voice security set is used with the FM radio set to provide secure two-way communication. The equipment is controlled by the voice security control indicator mounted in the pilot right console.

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

c. Operation. Normal operation will exist without its encoder/decoder and control indication being installed in the helicopter. However, two operating modes are available when



CONTROL	FUNCTION
OFF-PWR switch	Turns power to the set ON-OFF.
VOL control	Controls receiver audio volume.
COMM — TEST switch	Disables squelch circuits when pressed.
Megahertz control	Selects whole number part of operating frequency.
Kilohertz control	Selects the decimal number part of operating frequency.

209078-17G

Figure 3-5. VHF control panel

they are installed. PLAIN mode for unciphered radio transmission or reception and CIPHER mode for ciphered radio transmission or reception. Both modes may be operated with or without retransmission units. Refer to the following to operate the equipment in any particular mode:

1. Preliminary operation.

(a) BAT switch — BAT (OFF if GPU is used).

(b) KY-28 CODER, FM XCVR, and ICS circuit breakers — In.

(c) Place the FM radio set in operation.

(d) Set the control indicator POWER switch to ON. The POWER switch must be in the ON position, regardless of the mode of operation, whenever the control indicator is installed.

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

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

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

(f) Set control indicator PLAIN or CIPHER switch for desired type of operation (2 and 3 below).

2. Plain mode.

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

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

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

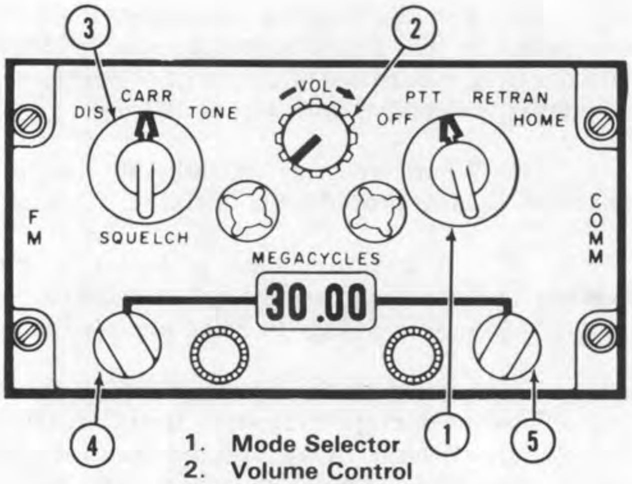
(d) Press the microphone switch and speak into the microphone to transmit. Release the microphone switch for reception.

3. Cipher mode.

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

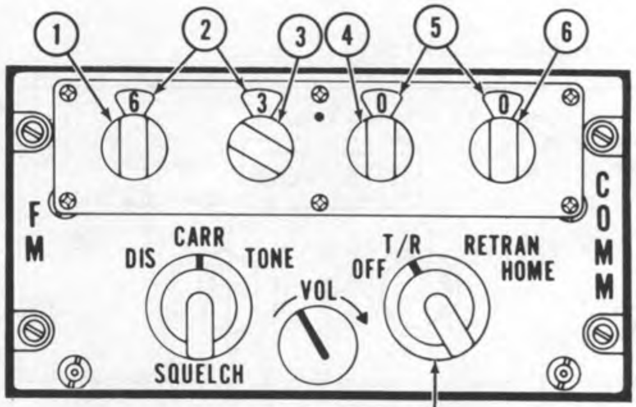
(b) Place the RE-X-REG switch to REG, except when operating with re-transmission units, at which time the switch will be placed in RE-X position.

(c) To transmit, press the microphone switch. DO NOT TALK; in approximately one-half second, a beep will be heard. This indicates the



1. Mode Selector
2. Volume Control
3. Squelch Control
4. Whole Megahertz Control
5. Decimal Megahertz Control

FM control panel — AN/ARC-54



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 Selector Switch

FM control panel AN/ARC-131

CONTROL	FUNCTION
Mode selector	OFF — Turns off power.
	PTT or 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	DIS — Squelch disabled.
	CARR — Squelch closed.
	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 megahertz digits of the operating frequency.

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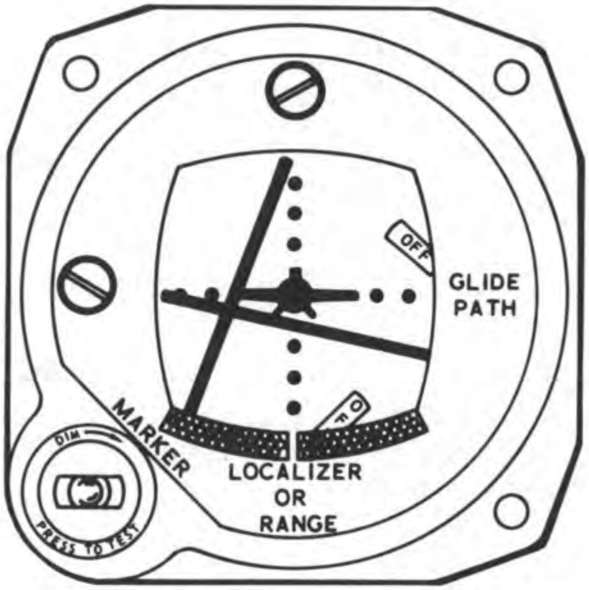
Figure 3-6. FM control panels



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	Indicate strength of FM homing signal being received. Deflects downward as signal strength increases.
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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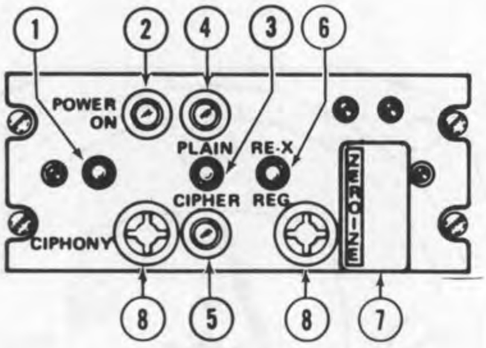
Figure 3-7. Course indicator



CONTROL	FUNCTION
1. POWER ON Switch (Two-Position Circuit Breaker)	Connects power to the associated TSEC/KY-28 cipher equipment in the ON (forward) position, and disconnects power from the equipment in the OFF (aft) position. NOTE Switch must be in the ON (forward) position for operation in the PLAIN or CIPHER mode.
2. POWER ON (Amber) Indicator (With Dimmer Switch)	Lights when the associated POWER ON switch is placed in the ON (forward) position.
3. PLAIN CIPHER Switch (Two-Position Locking Toggle)	In the PLAIN position, permits normal (unciphered) communications on the associated FM radio set. In the CIPHER position, permits ciphered communications on the associated radio set.
4. PLAIN (Red) Indicator (with Dimmer Switch)	Lights when the associated PLAIN-CIPHER switch is in the PLAIN position
5. CIPHER (Green) Indicator (with Dimmer Switch)	Lights when the associated PLAIN-CIPHER switch is in the CIPHER position.
6. 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 communications or clear text.
7. ZEROIZE Switch (Two-Position Locking Toggle, Under Spring-Loaded Cover)	CAUTION Do not place the ZEROIZE switch in the ON (forward) position unless a crash or capture is imminent. Normally in OFF (aft) position. Placed in ON (forward) position during emergency situations to neutralize and make inoperative the associated TSEC/KY-28 cipher equipment.
8. Panel Lights	Illuminate the control-indicator (controlled by aircraft panel lights).

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Figure 3-8. Voice security equipment

receiving station is now capable of receiving your message. Transmission can now commence.

NOTE

Only one voice security system can transmit on a given frequency. Always listen before attempting to transmit to assure that no one else is transmitting.

(d) When transmisison is completed, release the microphone switch. This will return equipment to the standby condition.

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

d. Emergency Operation. Place ZEROIZE switch in the forward position during a crash or if capture is imminent. This will neutralize and make the associated TSEC/KY-28 cipher equipment inoperative.

e. Stopping Procedures. Control Indicator POWER Switch — OFF.

SECTION III. NAVIGATION

3-10. Direction Finder Set (ADF).

a. Description. 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 set presents a continuous indication of the bearing to the station by the number 1 pointer of the pilot radio magnetic indicator and the gunner course indicator. The loop mode enables the operator to find the bearing to the station by manually controlling the null direction of the directional antenna. The system also operates as a radio receiver to receive voice and CW transmission in all modes. The control panel is marked ADF and is located in the pilot right console.

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

c. Operation.

1. BAT switch — BAT (OFF if GPU is used).

2. ADF RCVR and ICS circuit breakers — In.

3. Interphone panel RECEIVERS switch (NAV) — ON.

4. ADF mode selector switch — As desired. Allow set to warmup.

5. FREQUENCY — Select.

6. ADF mode.

(a) Mode selector switch — ADF.

(b) BFO switch — OFF. (BFO for CW)

(c) TUNE meter — Tune for maximum deflection. ADF pointer indicator bearing to station.

(d) Volume — Adjust.

7. ANT mode. 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) BFO switch — BFO, tune.

(c) BFO switch — OFF.

(d) Volume — Adjust.

8. Manual LOOP mode.

(a) Mode selector switch — LOOP.

(b) BFO-OFF switch — BFO, tune.

(c) BFO-OFF switch — OFF.

(d) Volume — Adjust.

(e) Loop switch — Move left or right for null.

9. Mode selector switch — OFF.

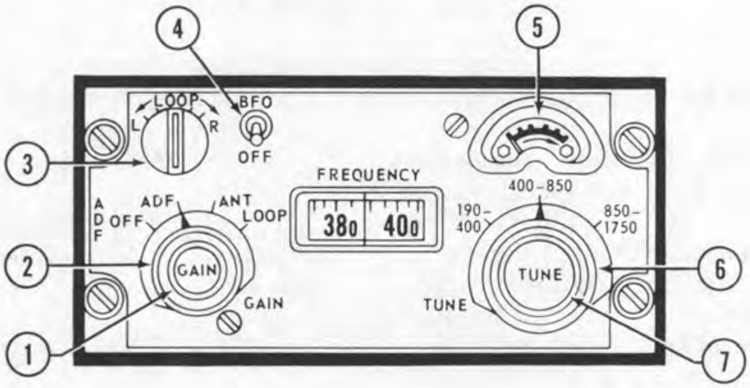
3-11. Gyromagnetic Compass Set.

a. Description.

1. The gyromagnetic compass set is a direction sensing system which provides a visual indication of the magnetic heading (MAG) of the helicopter. The information which the system supplies may be used for navigation and to indicate flight path of the helicopter. The system may also be used as a free gyro (DG) in areas where the magnetic reference is unreliable. The COMPASS switch on the pilots instrument panel controls the set in MAG or DG mode.

2. A radio magnetic indicator (figure 3-10) is installed in the pilot instrument panel. A course indicator (not shown) is installed in the gunner instrument panel. The gunner course indicator is a repeater type instrument similar to the pilot indicator except that it has no control knobs. The moving compass card on both indicators displays the gyromagnetic compass heading. The number 1 pointer on the indicators indicate the bearing to the station selected by the ADF control panel.

3. The gyromagnetic compass deviation card is normally attached with the standby compass card.

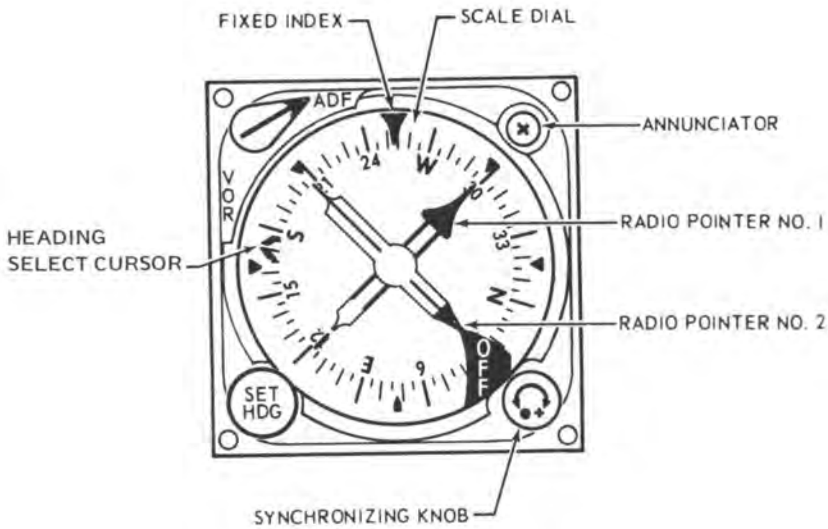


CONTROL OR INDICATOR	FUNCTION
1. GAIN control	Controls receiver audio volume.
2. MODE selector switch	ADF — Automatic direction finding showing station direction.
	ANT — Low frequency radio station receiver.
	LOOP — Manual direction finding or aural null operation.
	OFF — Removes power from set.

CONTROL OR INDICATOR	FUNCTION
3. LOOP L-R switch	Rotates loop antenna to the right or left when in LOOP mode.
4. BFO switch	Turns beat frequency oscillator on or off for station tuning or continuous wave (CW) reception.
5. Tuning meter	Facilitates accurate tuning of the receiver.
6. Band selector switch	Selects desired frequency band.
7. Tune control	Selects the desired frequency.

205475-1004C

Figure 3-9. ADF control panel



CONTROL	FUNCTION
Pointer No. 1	Indicates bearing of ADF radio signal.
Pointer No. 2	Not used.
Synchronizing knob	Is manually rotated to null annunciator and synchronize compass system.
SET HDG	Moves the heading select cursor to desired heading.
Heading select cursor	Indicates desired heading selected.
ADF/VOR knob	Selects ADF or VOR, however, only ADF is used on this installation. Leave knob in ADF position.
Fixed Index	Provides reference mark for scale dial.
Scale dial	Rotates under fixed index to indicate helicopter magnetic heading.
Annunciator	Shows dot (•) or cross (+) to indicate misalignment (non-synchronization of compass system.
Power failure indicator (OFF) (flag)	Shows to indicate loss of power to compass system.
Compass Switch (located on pilots instrument panel)	MAG position slaves gyro mode DG position free gyro mode

204475-2F

Figure 3-10. Radio magnetic indicator

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

c. Operation.

1. BAT switch — BAT (OFF if GPU is used).

2. GYRO CMPS IND, INV MAIN and STBY, and course IND circuit breakers — In.

3. INVTR switch — MAIN or STBY.

4. Radio magnetic indicator. Check power failure indicator is not in view.

(a) Slaved gyro mode.

(1) COMPASS switch — MAG.

(2) Synchronizing knob — Center (Null) annunciator. When neither dot nor cross appears in annunciator, or if they alternate rapidly, the indicated heading is the magnetic heading. The system does have a "fast-slewing" feature. If the compass is 180° off the correct helicopter heading when the system is energized it will take approximately four seconds for the compass to slave to the correct headings using the synchronizing knob.

(3) Magnetic heading — Check.

(b) Free gyro mode.

(1) COMPASS switch — DG.

(2) Synchronizing knob — Set heading.

(3) Annunciator — Center position with no change (annunciator is de-energized in the DG mode).

(c) Inflight operation.

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

(2) When operated in the 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 DG mode, periodically update the heading to a known reference by rotating the synchronizing knob.

5. INVTR switch — OFF.

SECTION IV. TRANSPONDER AND RADAR

3-12. Proximity Warning System.

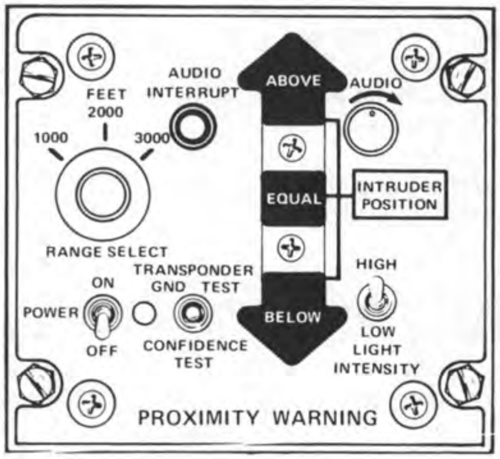
a. Description. The proximity warning system warns the pilot by visual and aural means whenever one or more similarly equipped aircraft are within a selectable range and within an altitude of 300 feet of the protected helicopter. The proximity warning system has selectable ranges of 1000, 2000 and 3000 feet. The later configuration proximity warning device has a range selectability of 1000, 3000, and 5000 feet and is totally interchangeable within the system. 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 unit is powered by the essential bus and requires pitot static system inputs. Warning outputs are lights (3) blinking at 3 Hz and a single 1600 Hz audio tone. Volume control is provided.

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

c. 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.

3-13. Transponder Set — APX-44.

a. Description. 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



CONTROL/INDICATOR	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 Pushbutton 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 initiates confidence test.

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Figure 3-11. Proximity warning device

ground radar systems. The transponder set can also be used to transmit specially coded emergency signals or position-identifying signals. 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. Controls and Functions. Refer to figure 3-12.

c. Operation.

1. BAT switch — BAT (OFF if GPU is used).

2. IFF XPDR circuit breakers — In.

3. Master control — STBY position. The pilot light should illuminate.

NOTE

If pilot light does not illuminate press the test button. If the light does not illuminate 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.

6. Normal operation.

(a) Mode 1.

(1) Function control — NORMAL.

(2) Master control — LOW or NORM as required.

(3) MODE 2 switch — OFF.

(4) MODE 3 switch — OFF.

(5) I/P switch — OFF or MIC as required.

(6) AUDIO switch — OFF.

(b) Combined mode 1 and 2.

(1) Function control — NORMAL.

(2) Master control — LOW or NORM as required.

(3) MODE 2 switch — ON.

(4) MODE 3 switch — OFF.

(5) I/P switch — OFF.

(6) AUDIO switch — OFF.

(c) Combined modes 1 and 3.

(1) Function control — NORMAL.

(2) Master control — LOW or NORM as required.

(3) MODE 3 switch — ON.

(4) MODE 2 switch — OFF.

(5) I/P switch — OFF or MIC as required.

(6) AUDIO switch — OFF.

(d) Combined modes 1, 2 and 3.

(1) Function control — NORMAL.

(2) MODE 2 switch — ON.

(3) MODE 3 switch — ON.

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

(5) I/P switch — OFF or MIC as required.

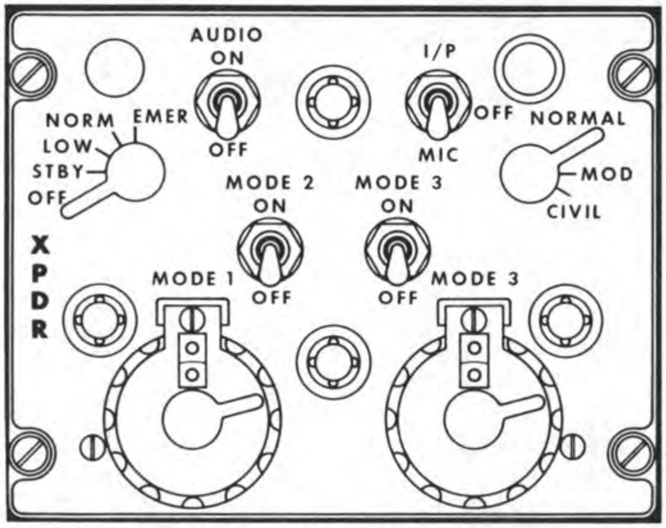
(6) AUDIO switch — OFF.

7. Modified operation.

(a) Mode 1.

(1) Function control — MOD.

(2) MODE 1 code control — Assigned two digit code number.



LOCATION: PILOT RIGHT CONSOLE

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.

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Figure 3-12. Transponder control panel — APX-44 (Sheet 1 of 2)

CONTROL OR INDICATOR	FUNCTION
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.
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Figure 3-12. Transponder control panel — APX-44 (Sheet 2 of 2)

(3) Master control — LOW or NORM as required.

(4) MODE 2 switch — OFF.

(5) MODE 3 switch — OFF.

(6) I/P switch — OFF or MIC as required.

(7) AUDIO switch — OFF.

(b) Combined Modes 1 and 2.

(1) Function control — MOD.

(2) MODE 1 code control — Assigned two digit code number.

(3) MODE 2 switch — ON.

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

(5) MODE 3 switch — OFF.

(6) I/P switch — OFF or MIC as required.

(7) AUDIO switch — OFF.

(c) Combined Modes 1 and 3.

(1) Function control — MODE.

(2) MODE 2 switch — OFF.

(3) MODE 3 switch — ON.

(4) MODE 1 code control — Assigned two digit code number.

(5) MODE 3 code control — Assigned two digit code number.

(6) Master control — LOW or NORM as required.

(7) I/P switch — OFF or MIC as required.

(8) AUDIO switch — OFF.

(d) Combined Modes 1, 2 and 3.

(1) Function control — MOD.

(2) MODE 1 code control — Assigned two digit code number.

(3) MODE 2 switch — ON.

(4) MODE 3 switch — ON.

(5) MODE 3 code control — Assigned two digit code number.

(6) Master control — LOW or NORM as required.

(7) I/P switch — OFF or MIC as required.

(8) AUDIO switch — OFF.

8. Civil Operation.

(a) Combined Civil and Military Mode 1.

(1) Function control — CIVIL.

(2) MODE 3 code control — Assigned two digit code number.

(3) MODE 3 switch — ON.

(4) MODE 2 switch — OFF.

(5) MODE 1 code control — Assigned two digit code number.

(6) Master control — LOW or NORM as required.

(7) I/P switch — OFF or MIC as requried.

(8) AUDIO switch — OFF.

(b) Combined Civil and Military Mode 1 and 2.

(1) Function control — CIVIL.

(2) MODE 3 code control — Assigned two digit code number.

(3) MODE 3 switch — ON.

(4) MODE 2 switch — ON.

(5) MODE 1 code control — Assigned two digit code number.

9. Stopping Procedures.

(a) Master control — OFF.

(b) AUDIO switch — OFF.

(c) I/P switch — OFF.

(d) MODE 2 switch — OFF.

(e) MODE 3 switch — OFF.

(f) MODE 1 code control — to read 00.

(g) MODE 3 code control — to read 00.

(h) Function control — NORMAL.

d. 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. Press 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 position.

3-14. Transponder Set AN/APX-72.

a. Description. The AN/APX-72 provides radar identification capability. Five independent coding modes are available. Mode 1 provides 32 possible codes which may be selected in flight. Mode 2 provides 4,096 possible codes, but must be preset before flight. Mode 3/A provides 4,096 possible codes which may be selected in flight. Mode C is used with the AAU-32/A Encoding Altimeter to provide the transponder with an altitude reporting capability. Mode 4 provides IFF capability when coupled with an external computer and must be preset prior to flight.

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

c. Operation.

1. BAT SWITCH — BAT (OFF if GPU is used).

2. IFF XPDR and ICS circuit breakers — In.

3. MASTER control:

STBY — two minutes.
LOW — low receiver sensitivity for receiving high energy signals.
NORM — normal receiver sensitivity.

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.

8. Normal Operation.

(a) MASTER control — LOW or NORM, as required.

(b) 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.

9. 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.

10. 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:

(a) AUDIO-LIGHT switch — AUDIO. Mode 4 interrogating and reply pulses will be audible in the pilots headset and visually on the RELAY light.

(b) AUDIO-LIGHT switch — LIGHT. Indication of mode 4 interrogating and reply pulses will be visible on the REPLY light.

11. Master control — OFF.

12. IDENT-MIC switch — OUT.

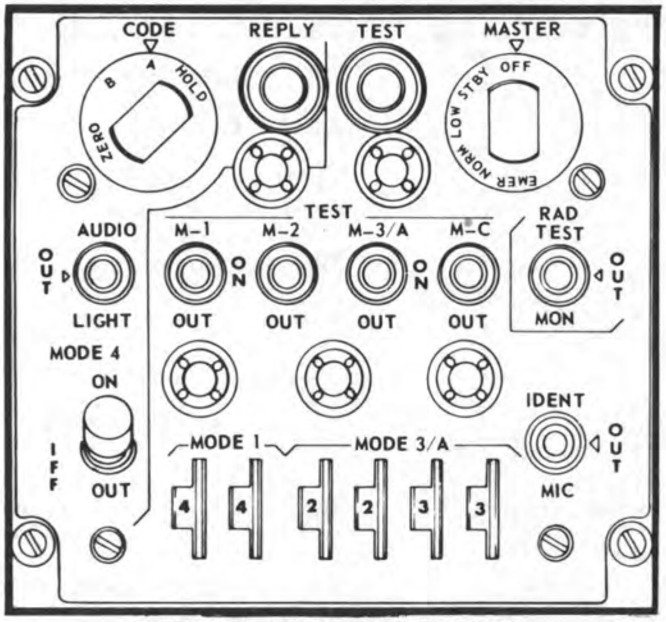
13. M-1, M-2, M-3/A, M-C, and MODE 4 switches — OUT.

14. AUDIO-LIGHT switch — OUT.

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.



LOCATION: PILOT RIGHT CONSOLE

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.
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.

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Figure 3-13. Transponder control panel — APX-72 (Sheet 1 of 2)

CONTROL OR INDICATOR	FUNCTION
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 — Nonfunctional. OUT — Nonfunctional. TEST — Nonfunctional.
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.
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.
OUT	Turns function off.
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.

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Figure 3-13. Transponder control panel — APX-72 (Sheet 2 of 2)

CHAPTER 4

MISSION EQUIPMENT

SECTION I. MISSION AVIONICS

(Not Applicable)

SECTION II. ARMAMENT

4-1. Armament Configuration.

a. Authorized Armament Configuration. Refer to figure 4-1 for authorized armament loading configuration.

b. Interrelation of Armament. The armament subsystems are interfaced with one another. Figure 4-2 shows the pilot and gunner control components in relationship to each armament subsystem.

4-2. Armament System Description.

a. M28 and M28A1 Armament Subsystems. The M28 series turret (figure 4-3) (TM 9-1090-203-12) contains a 7.62 MM M134 machine gun and a 40 MM M129 grenade launcher. The ammunition drums (figure 4-4) are located in the ammunition bay. The turret is hydraulically and electrically operated. It can be fired in the fixed or flexible mode by the gunner; fixed mode by the pilot. The turret can travel 107.5 degrees left or right in azimuth and 10.6 to 18 degrees up and 50 degrees down in elevation.

(1) Machine Gun. The gun is an electrically driven, automatic, air-cooled, six barrel, and six bolt weapon. The gun is capable of firing six-second bursts at 2000 or 4000 rounds per minute. The ammunition drum stores a maximum of 4000 rounds of linked ammunition in a folding fan arrangement. The drum is driven by the machine gun drive motor through the flexible shaft.

(2) Grenade Launcher. The launcher is an electrically driven, rapid-firing, air-cooled weapon. The launcher is capable of firing 10-second burst at 400 grenades per minute. The launcher is cam operated by the gun drive through the flexible shaft. The ammunition drum stores a maximum of 265 linked anti-personnel fragmentation grenades. The drum is electrically driven by a motor mounted on the drum.

(3) Turret Sighting Station. The sighting station (figure 4-5) 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 forward of the gunner. The sighting station provides a line of sight for accurate weapon firing. Aiming weapons is accomplished by superimposing a reticle image (projected by the reflex sight) on the target.

b. Smoke Grenade Dispenser Subsystem (figure 4-6). Externally mounted smoke grenade dispensers (M118) may be attached directly to the outboard store ejector rack or it may be strapped to a 7 or 19 tube rocket pod, 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 (figure 4-14). 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 are being fired simultaneously, and the tone will be heard as long as the firing button remains pressed. When the last grenade from a

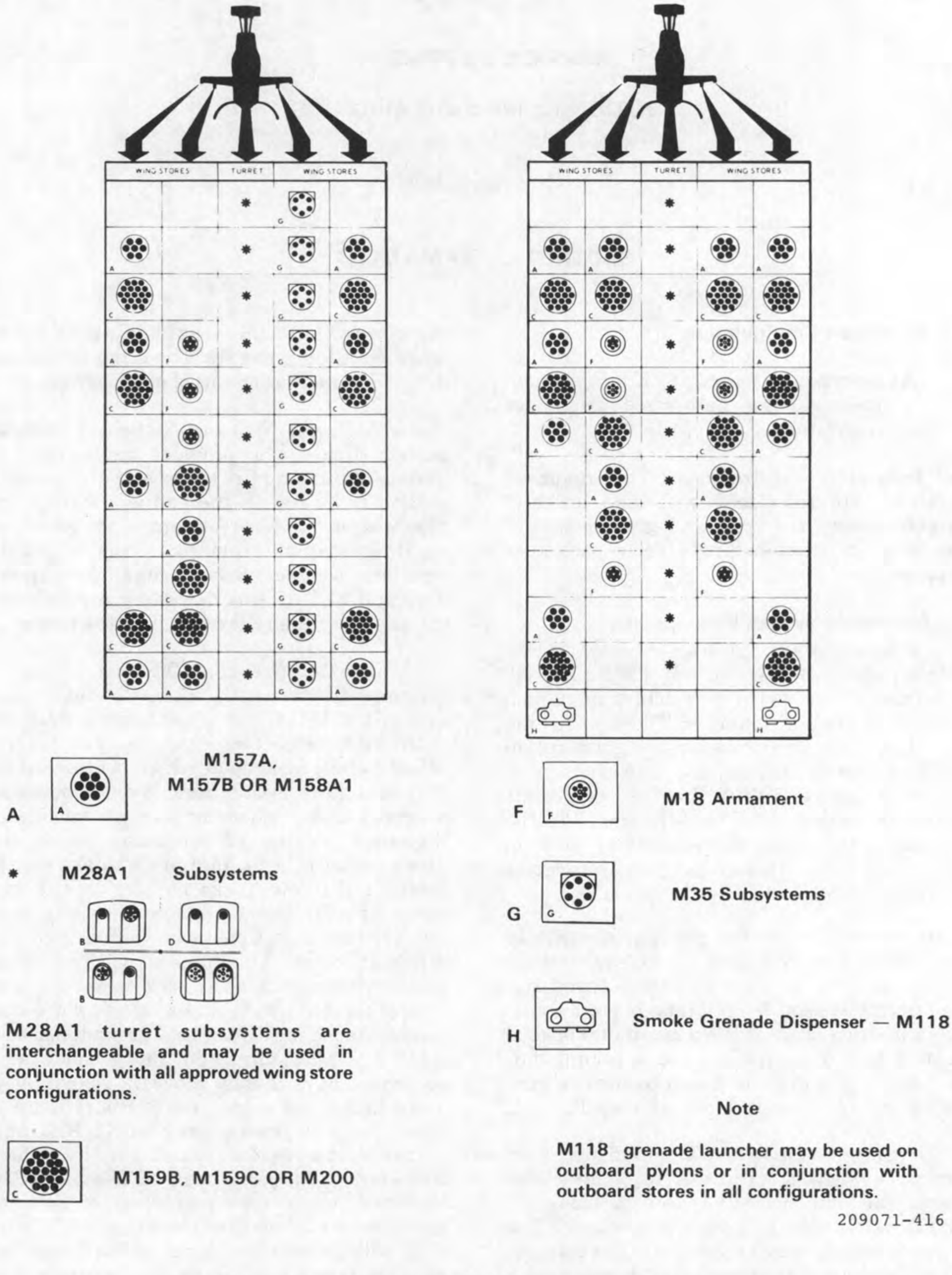
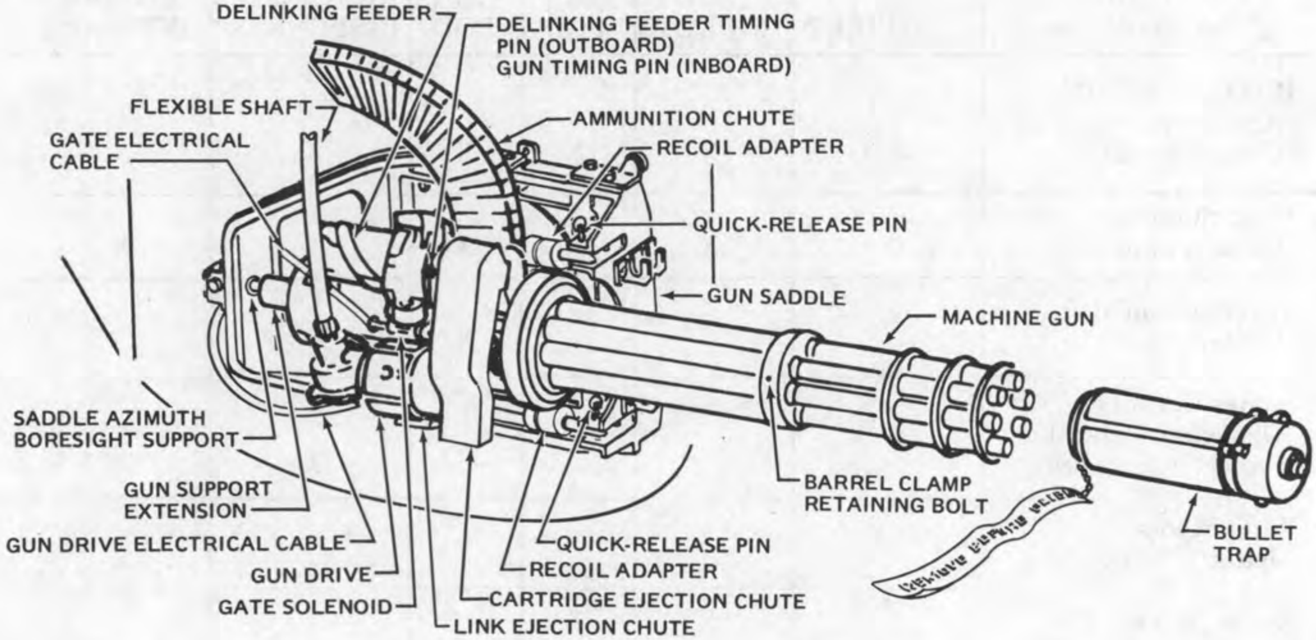


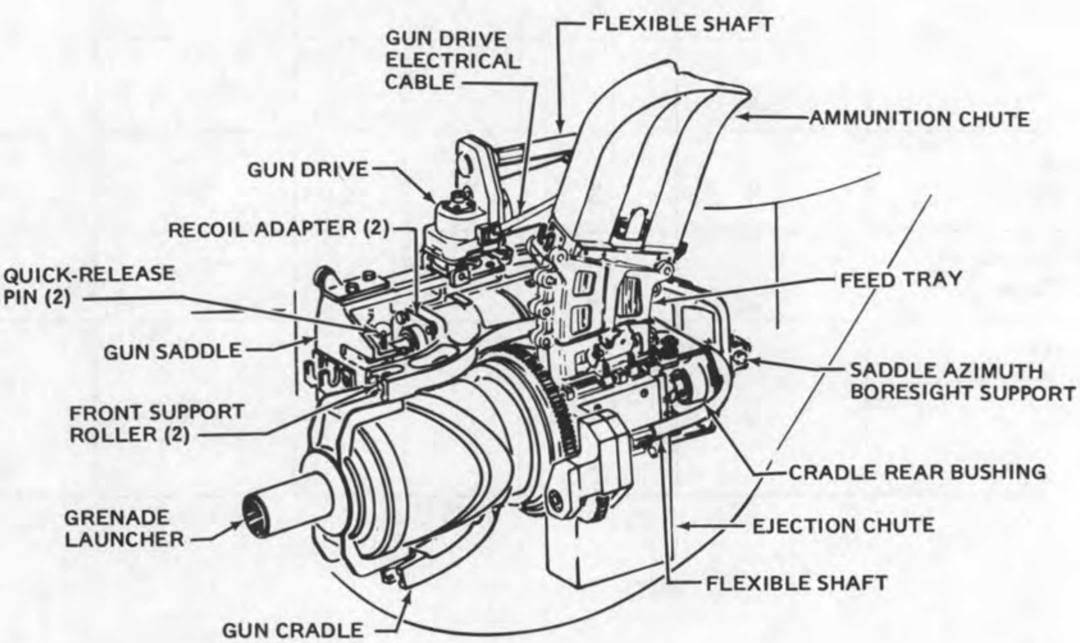
Figure 4-1. Authorized armament configuration

CONTROL COMPONENTS	TURRET	WING STORES M18 ROCKETS	WING STORES GUN POD	M35 GUN POD	SMOKE GRENADE DISPENSER	WING STORES JETTISON
PILOT STATION Armament Control Panel	X	X	X	X	X	X
Wing Stores Control Panel		X	X	X		X
M35 Armament Control Panel				X		
Smoke Grenade Dispenser Control Panel (If Installed)					X	
Wing Stores Jettison Switch						X
Reflex Sight	X	X	X			
Cyclic Switches	X	X	X	X		
GUNNER STATION						
Cyclic Switches	X	X	X	X		
Turret Sighting Station	X					
Armament Control Panel	X	X	X	X	X	
M35 Armament Control Panel				X		
Wing Stores Jettison Switch						X

Figure 4-2. Control components in relationship to armament subsystems



RIGHT SIDE OF TURRET -- MACHINE GUN



LEFT SIDE OF TURRET — GRENADE LAUNCHER

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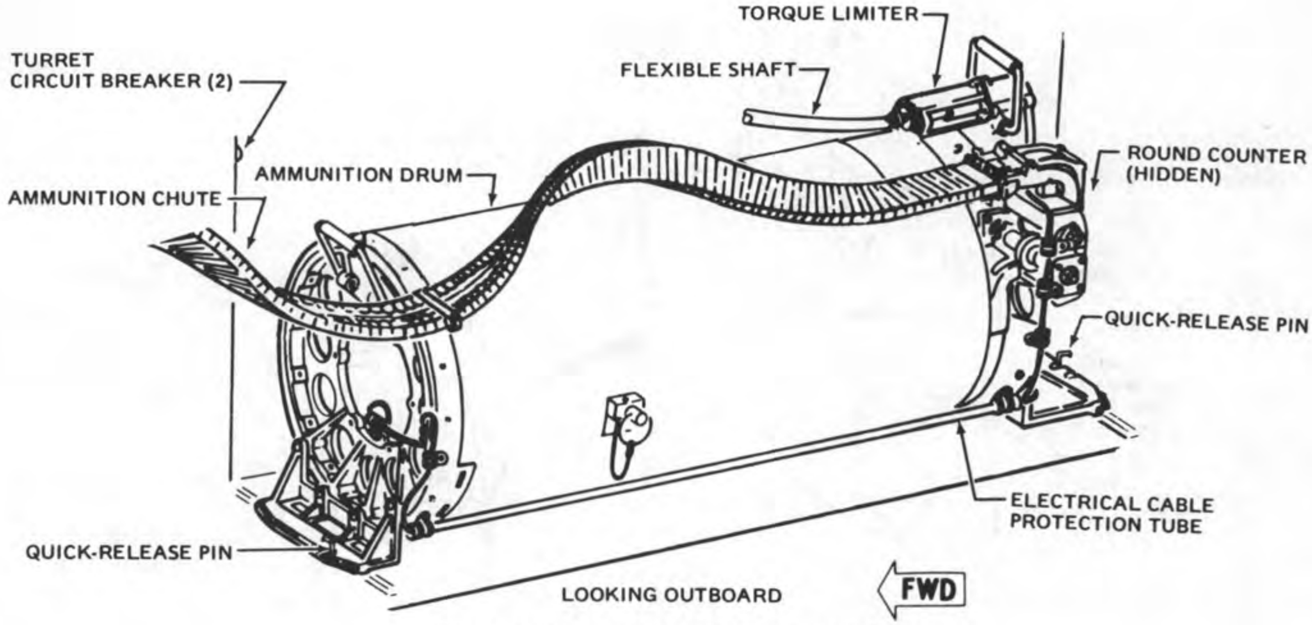
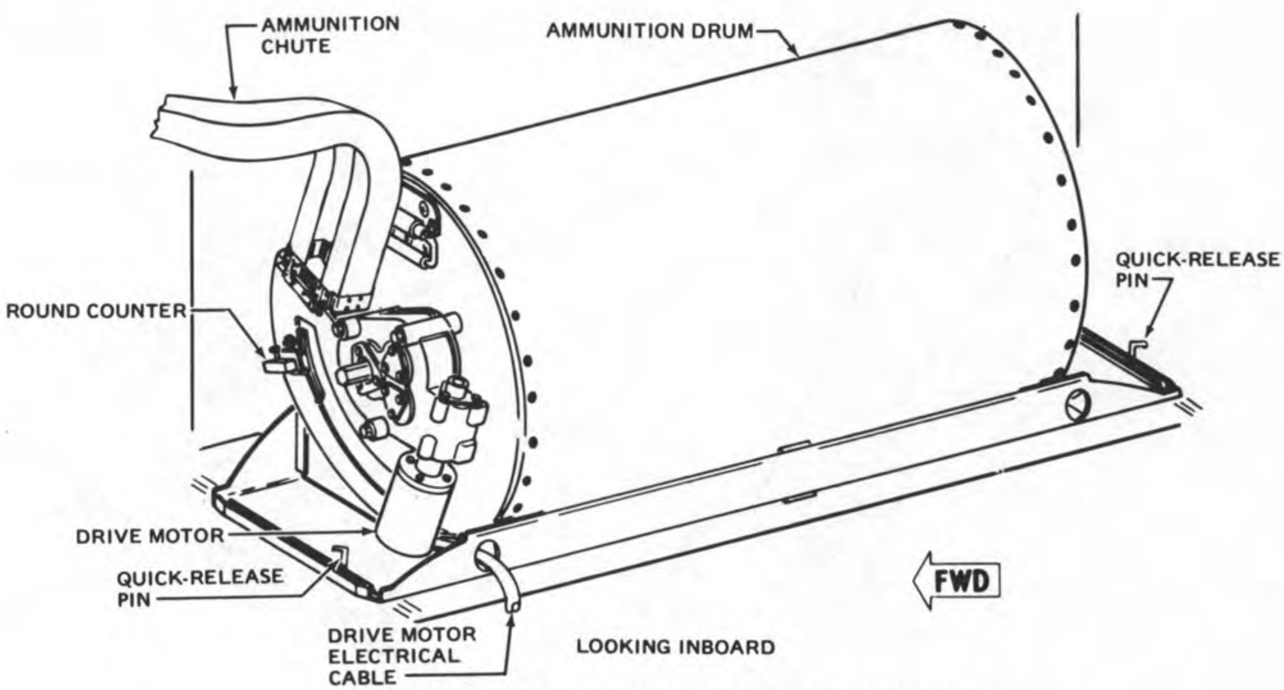
Figure 4-3. Turret



RIGHT AMMUNITION BAY — MACHINE GUN DRUM



LEFT AMMUNITION BAY -- GRENADE LAUNCHER DRUM

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Figure 4-4. Ammunition drums

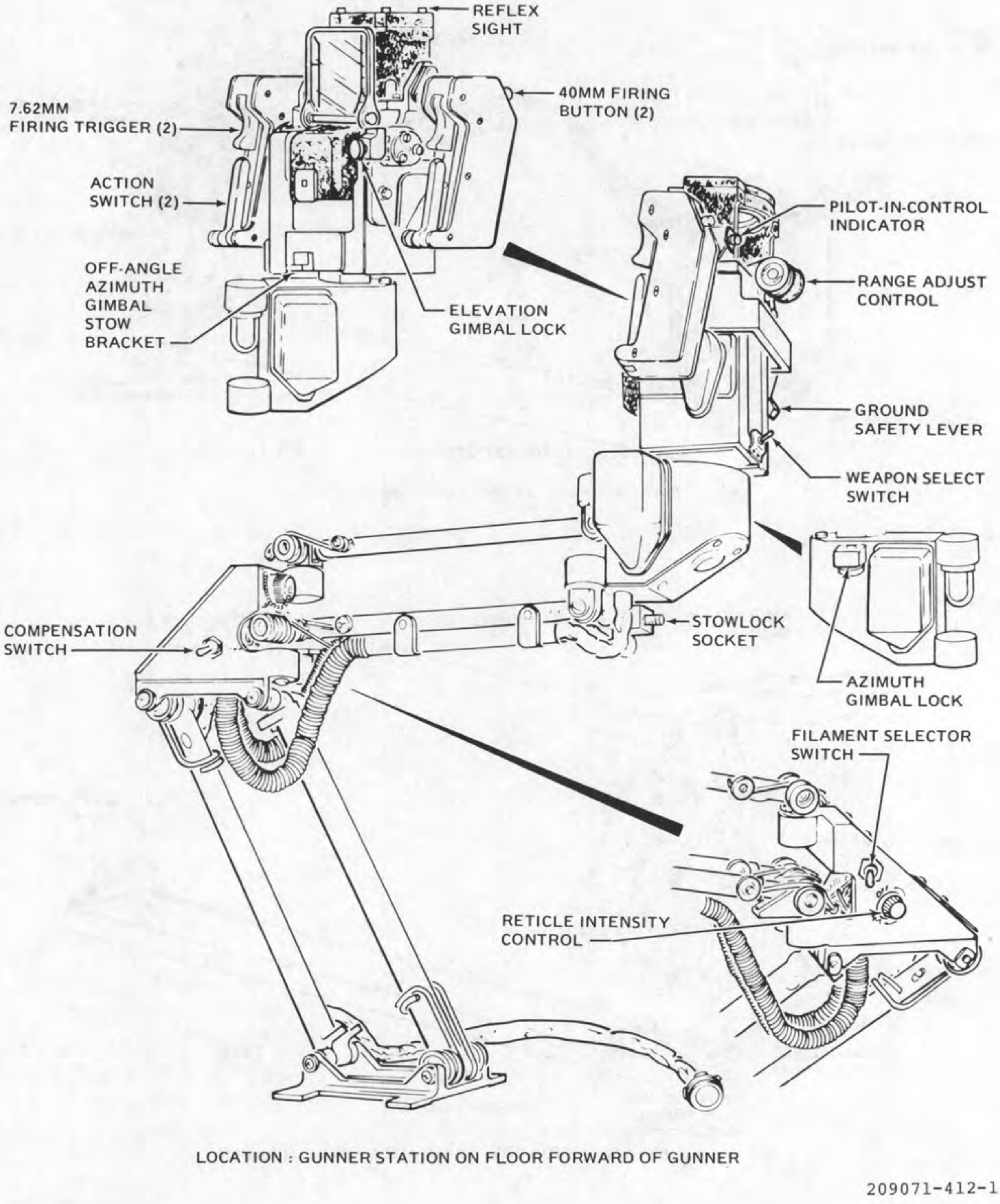

Figure 4-5. Turret sighting station (Sheet 1 of 3)

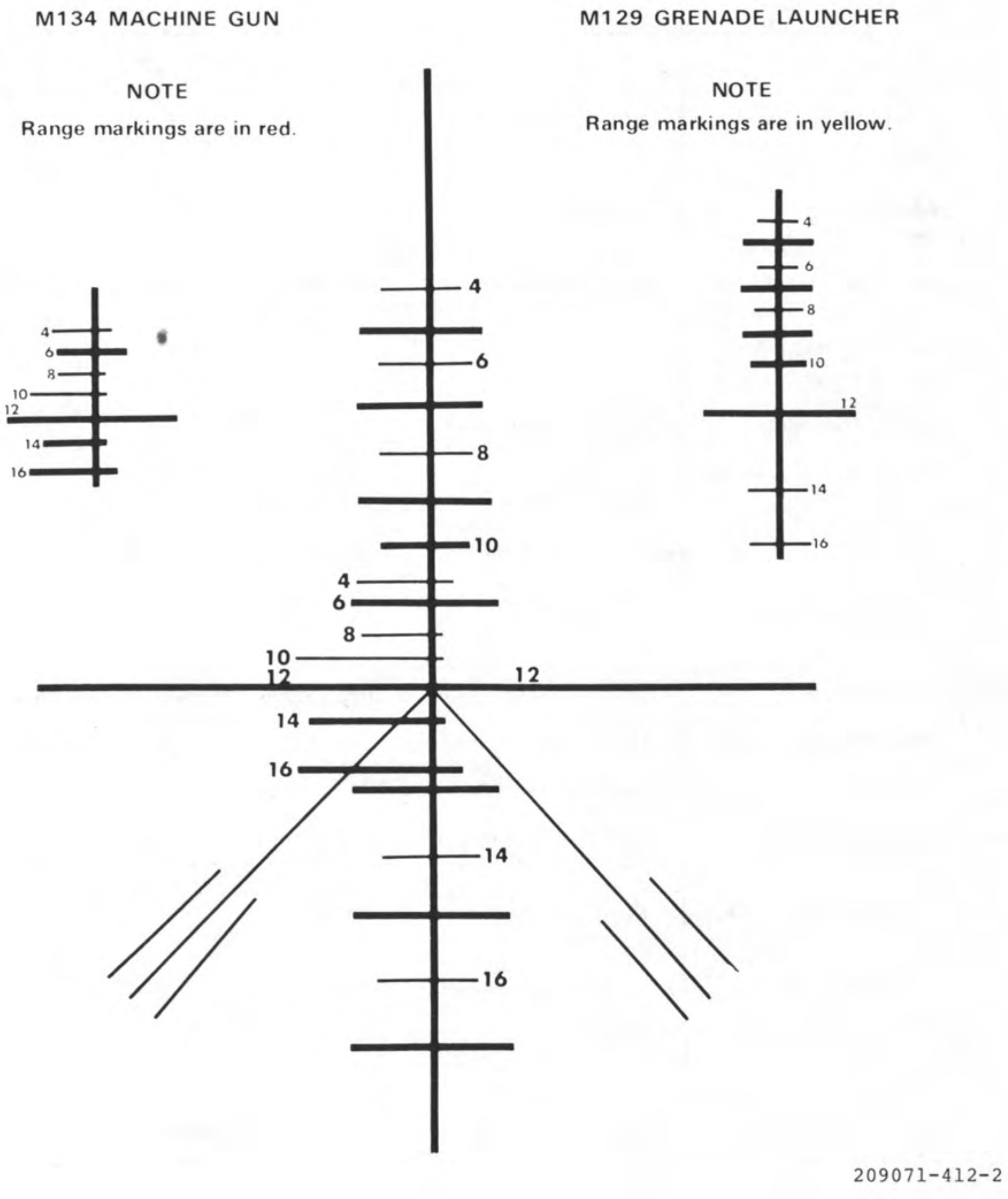

Figure 4-5. Turret sighting station (Sheet 2 of 3)

ITEM	FUNCTION
7.62MM Firing Trigger (2)	Partially pressing switches fires gun at low rate. Fully pressing switches fires gun at high rate.
Reflex Sight	
40MM Firing Button (2)	Fires grenade launchers.
Elevation Gimbal Lock	Mechanically lock sight gimbals at zero degrees azimuth and elevation for boresighting and harmonization.
Off-Angle Azimuth Gimbal Stow Bracket	
Action Switch (2)	Pressing applies voltage to trigger switches.
Compensation Switch (COMP)	IN — Compensation relay energized, provides gun line correction. OUT — Gun line corrected manually.
Pilot in Control Indicator (PILOT-IN-CONT)	Indicates pilot in control of subsystem.
Range Adjust Control	IN — Allows gunner to supply range correction input to turret.
Ground Safety Lever	Horizontal — Prevents sight head from being depressed 35° below horizontal. Ground Fire — Prevents sight head from being fully depressed.
Weapon Select Switch	Selects left or right weapon for firing. BOTH — Both weapons will fire, if they are identical weapons.
Azimuth Gimbal Lock	Mechanically locks sight gimbals at zero degree azimuth and elevation.
Stowlock Socket	Stows subsystem.
Reticle Intensity Control	Adjusts intensity of sight reticle image.
Filament Selector Switch (FIL SEL)	Selects one of two filaments of reticle incandescent lamp.

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Figure 4-5. Turret sighting station (Sheet 3 of 3)

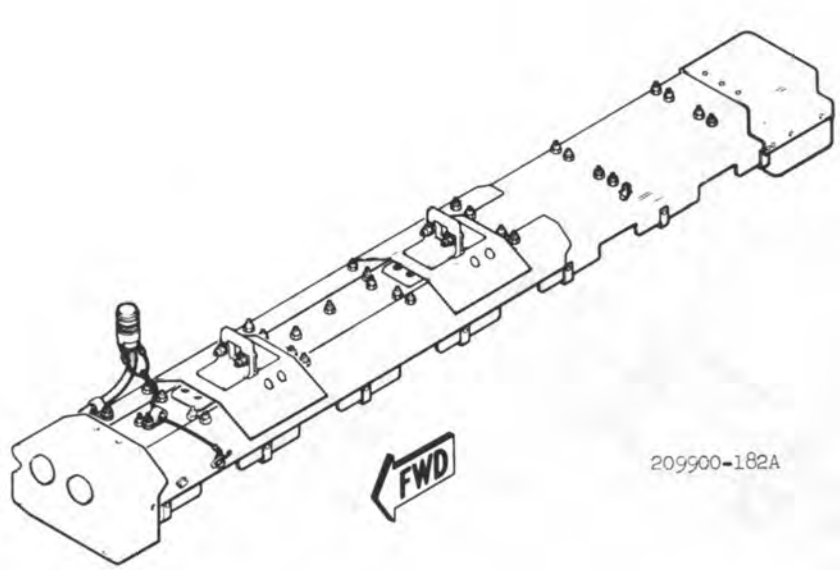


Figure 4-6. Smoke grenade dispenser (M118)

rack has been fired, the tone will continue to be heard until the arming switch for the particular rack is turned OFF. Pilot can still fire grenades with gunner OVERRIDE PILOT switch in ON position.

c. External Wing Stores Armament Subsystem.

(1) External Store Ejector Racks. The pylon assemblies include 14 inch external store ejector racks, sway braces, and electrical connections. The assembly is enclosed in a fairing matching the lower contour of the wing. The ejector rack of each pylon is equipped with an electrically operated ballistic emergency jettison device.

(2) Wing Stores Jettison. Each of the four ejector racks are equipped with an electrically operated ballistic device to jettison the attached weapon.

(3) Rockets and Launchers.

(a) Rockets. The 2.75 inch folding fin aerial rocket (figure 4-7) (FFAR) (TM 9-1055-460-14) subsystem is a light anti-personnel/assault weapon.

(b) Launchers.

WARNING

Failure to comply with the loading restrictions may result in premature failure of the wing attach lugs, lift beam, and carry-through structure. Refer to Chapter 6 for loading restrictions.

Personnel should remain clear of hazardous area of loaded weapons.

CAUTION

Before loading, inspect each launcher for broken detents, tube burn-out, tube burning, or distortion in the vicinity of detents. Discard launchers with such defects.

1 Rocket Launcher — M157A, M157B and M158A1. The M157 series and M158A1 launchers hold seven 2.75 inch FFARS.

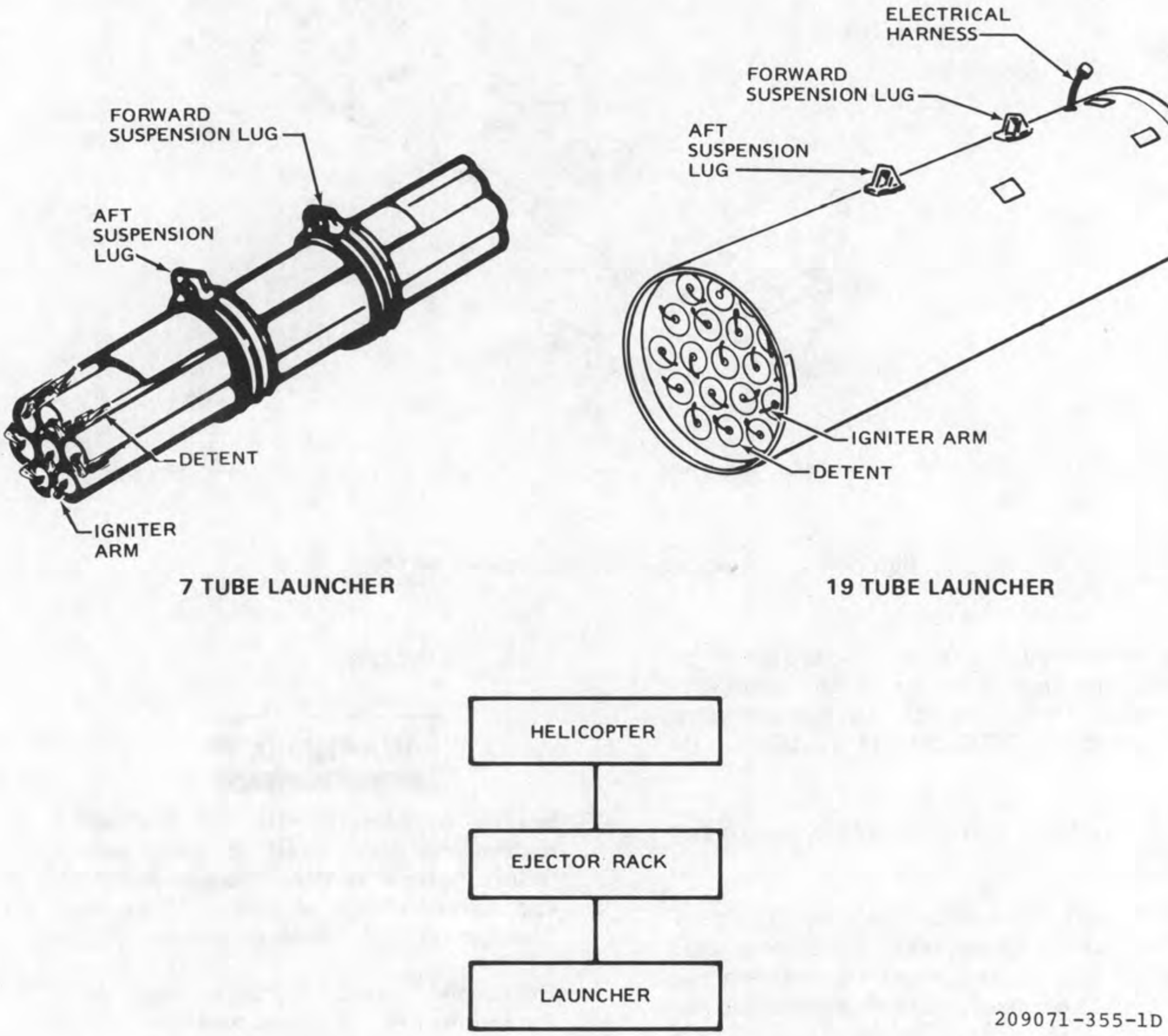


Figure 4-7. Folding fin aerial rocket (2.75 inch) launcher

2 *Rocket Launcher — M159B, M159C, and M200.* The launchers are reusable and hold nineteen 2.75-inch FFARS. Launchers may be mounted on either of two hard point locations on either wing. Refer to Chapter 6 for loading limitations.

(4) Wing Gun Pod (M18 and M18A1). The pod (figure 4-8) (TM 9-1005-257-12) is self-contained unit housing a 7.62 MM machine gun, its own electrical system, a battery recharging system, and a maximum of 1500 rounds of ammunition. The gun is capable of firing six second bursts at 2000 or 4000 (M18A1) or 4000 (M18) rounds per minute. The pod configuration can be determined by the firing rate and heater switches on the rear of the pod.

(5) M35 20MM Subsystem. The M35 subsystem (figure 4-9) includes a gun drive

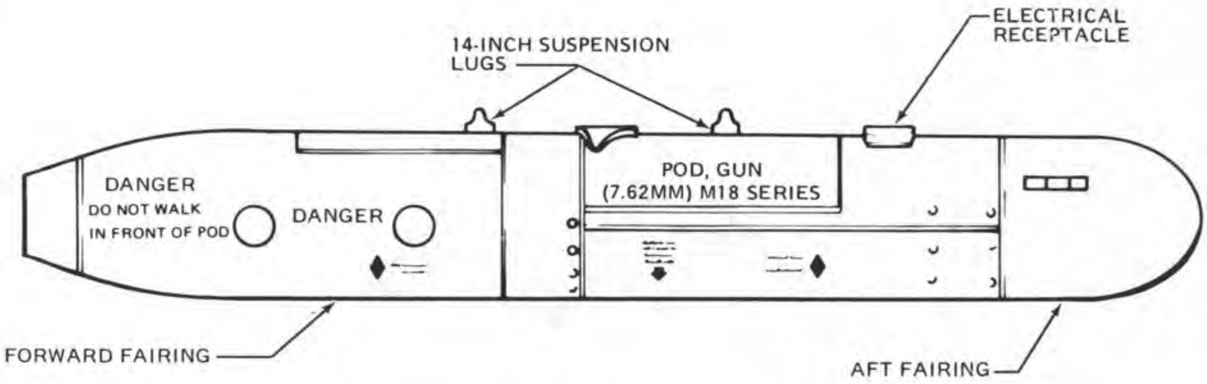


Figure 4-8. Wing gun pod (M18 series)

assembly, automatic gun feeder assembly, gun firing unit, pilot armament control panel (pilots control panel), and gunner armament control panel (gunners control panel). The M195 gun is an electrically-driven, six barrel, air cooled weapon using electrically-fired ammunition. The position of the firing barrel is at approximately 12 o'clock while the feed/eject position is at approximately 6 o'clock. The gun is capable of firing at a rate of 650 to 850 rounds per minute.

4-3. Armament Control Systems.

a. Pilot Switches and Indicators. Pilot panels and switches are interfaced with other pilot/gunner panels and switches for weapon operations and wing stores jettison. Refer to figure 4-2.

(1) Pilot Armament Control Panel. Refer to figure 4-10.

(2) Pilot Wing Stores Control Panel. Refer to figure 4-11.

(3) Pilot M35 Armament Control Panel. Refer to figure 4-12

(4) Pilot Reflex Sight. Refer to figure 4-13.

(5) Pilot Cyclic Armament Switches. Refer to figure 2-4.

(6) Pilot Smoke Grenade Dispenser Control Panel. Refer to figure 4-14.

b. Gunner Switches and Indicators. Gunner panels and switches are interfaced with other gunner/pilot panels and switches for weapon operations and wing stores jettison. Refer to figure 4-2.

(1) Gunner Cyclic Armament Switches. Refer to figure 2-7.

(2) Gunner M35 Armament Control Panel. Refer to figure 4-15.

(3) Gunner Wing Stores Jettison Switch. Refer to figure 2-5.

(4) Turret Sighting Station. Refer to figure 4-5.

(5) Gunner Armament Control Panel. Refer to figure 4-16.

4-4. BEFORE EXTERIOR CHECK — ALL ARMAMENT — PREFLIGHT.

WARNING

The machine gun in the turret and wing gun pods will fire when rotated by hand or otherwise. The grenade launcher in the turret will fire when the barrel is pushed in.

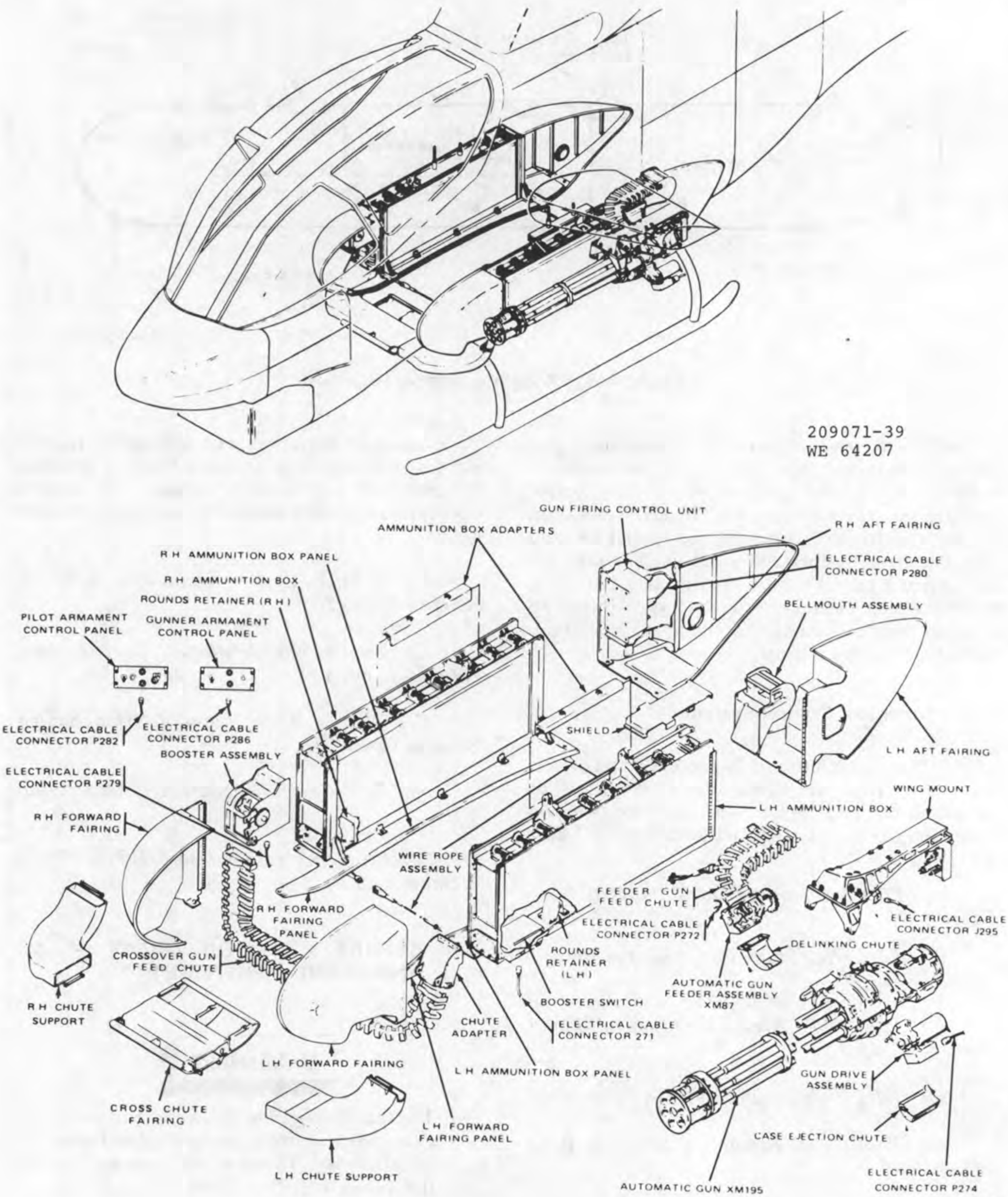
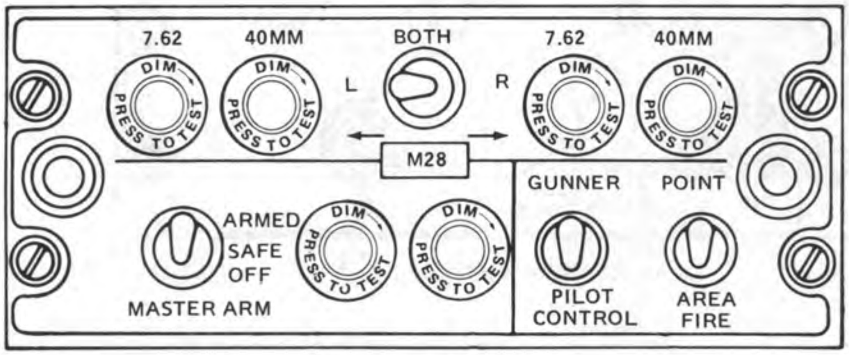


Figure 4-9. M35 20MM weapons subsystem

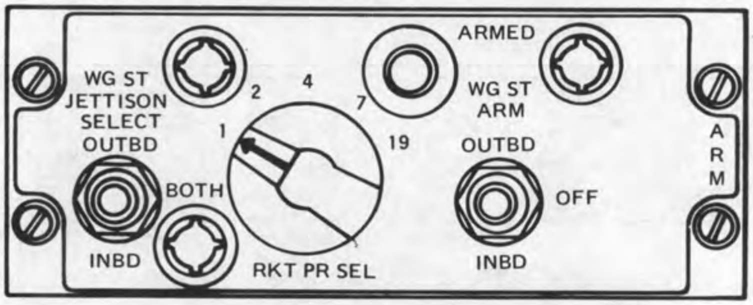


LOCATION: PILOT INSTRUMENT PANEL

ITEM	FUNCTION
MASTER ARM Switch	ARMED — Arms weapon system. SAFE — Energizes only control and smoke grenade firing circuits. OFF — De-energizes armament and control circuits.
GUNNER/PILOT CONTROL Switch	GUNNER — Permits gunner control of turret firing circuits. PILOT — Permits pilot control of turret firing circuits.
POINT/AREA FIRE Switch	POINT — Guns remain stable in trained position. AREA — Guns will oscillate 60 mils in azimuth about trained positions.
Weapon Select Switch	L Position — Left position selected for firing. R Position — Right position selected for firing. BOTH — Both weapons will fire simultaneously if identical. If one of each weapon installed only machinegun will fire.
Left Weapon Indicators	Illuminated indicates type of weapon mounted on left side of turret.
Right Weapon Indicators	Illuminated indicates type of weapon mounted on right side of turret.
SAFE Indicator	Illuminated (green) indicates MASTER ARM switch in SAFE position.
ARMED Indicator	Illuminated (amber) indicates MASTER ARM switch is in ARMED position or gunner OVERRIDE PILOT switch in ON position.

209071-410A

Figure 4-10. Pilot armament control panel



LOCATION: PILOT INSTRUMENT PANEL

ITEM	FUNCTION		
WG ST ARM Switch	OFF	—	Deactivates rocket and wing gun pod circuits.
	INBD	—	Permits pilot to fire rockets/gun pods mounted on wing inboard ejector racks.
	OUTBD	—	Permits pilot to fire rockets mounted on wing outboard ejector racks.
ARMED Indicator	OFF	—	Indicates WG ST ARM switch is in the OFF position.
	ON	—	Indicates WG ST ARM switch is in the INBD or OUTBD position.
	Turn	—	Varies intensity of indicator light.
RKT PR SEL Switch	Turn	—	Selects quantity of rocket pairs for firing.
WG ST JETTISON SELECT Switch	OUTBD	—	Selects outboard wing stores to be jettisoned.
	BOTH	—	Selects both outboard and inboard wing stores to be jettisoned.
	INBD	—	Select inboard wing stores for jettison.

209071-403A

Figure 4-11. Pilots wing stores control panel (typical)

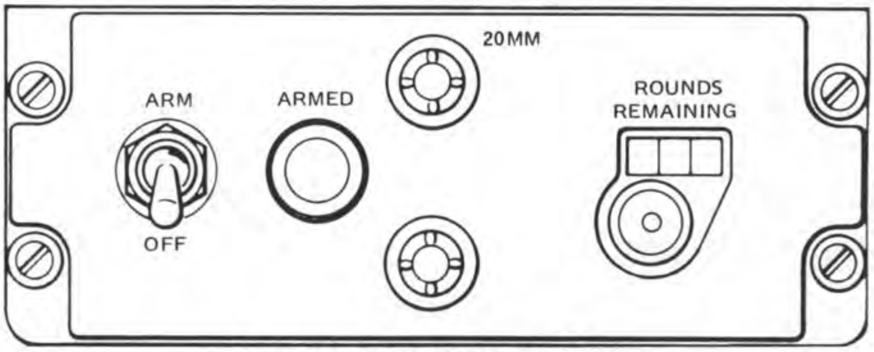
NOTE

Checks herein are only applicable if the armament is installed.

4-5. EXTERIOR CHECK — TURRET — PREFLIGHT.

a. Turret Right Side — Machine Gun.

1. Bullet trap — Installed.
2. Access door — Open/remove.
3. Barrel clamp and retaining bolt — Secure.
4. Gun mounting — Quick-release pins (ring up) installed through gun saddle outboard holes and recoil adapters, recoil adapters secure on gun, gun support extension over saddle azimuth boresight support.
5. Link ejection chute — Check condition and security.
6. Ammunition chute — Check condition and security.
7. Cartridge ejection chute — Check condition and security.
8. Delinking feeder — Check condition and security.



LOCATION: PILOT INSTRUMENT PANEL

ITEM	FUNCTION		
ARM Switch	ARM	—	Activates sight and all weapon control/firing circuits. Charges wing gun pod battery.
	OFF	—	Deactivates sight and weapon control firing circuits.
ARMED Indicator	ARMED	—	Indicates ARM switch in ARM (amber light)
	OFF	—	Indicates ARM switch is off.
ROUNDS REMAINING Indicator			Indicates number of rounds remaining.

209071-407A

Figure 4-12. Pilots M35 armament control panel

9. Gate solenoid — Plunger returns to extended position when pressed, electrical connectors condition and security.

10. Gun drive — Flexible shaft and electrical connectors condition and security.

11. Gun timing pin — Set.

12. Delinking feeder timing — Set.

13. Hydraulic lines — Check condition and security.

14. Access door — Close/replace and secure.

b. Ammunition Bay Right Side — Machine Gun.

1. Bay door — Open.

2. Ammunition drum — Check condition and secure with quick-release pins.

3. Flexible shaft — Check condition and secure to torque limiter.

4. Round counter — Check condition and electrical cable connected.

5. Ammunition chute — Check condition, security, and ammunition present.

6. Turret circuit breakers — In.

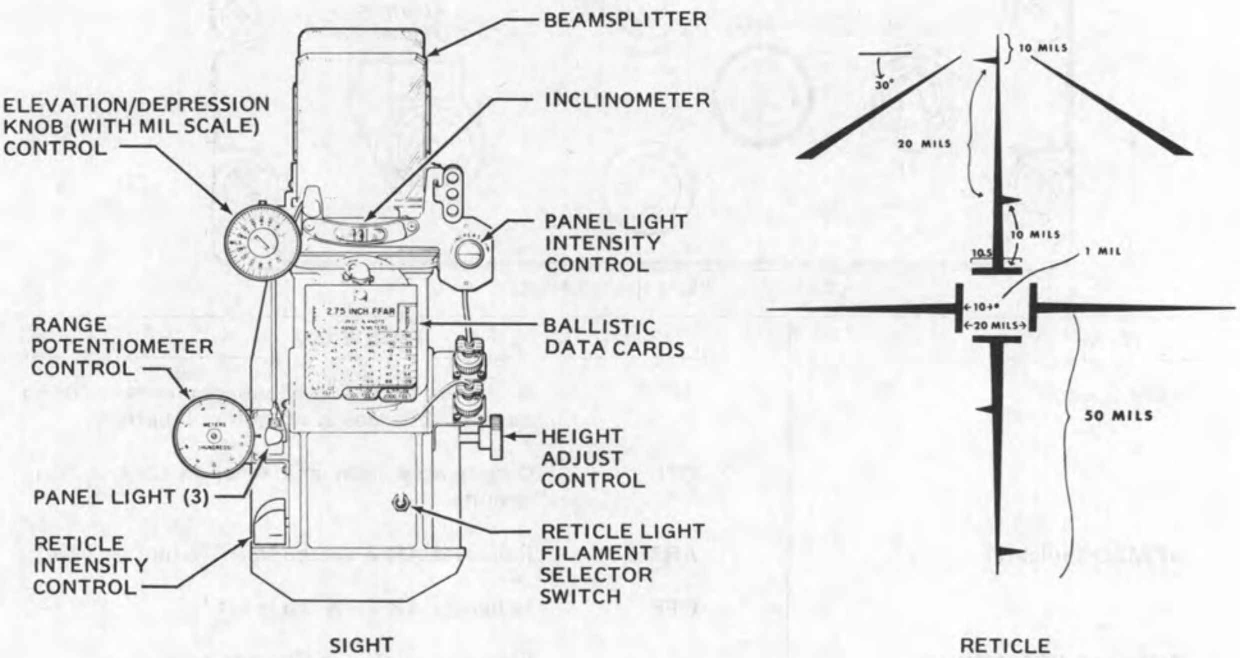
7. Hydraulic/electrical lines — Check condition and security.

8. Bay door — Close and secure.

c. Turret Left Side — Grenade Launcher.

1. Access door — Open/remove.

2. Gun cradle mounting — Quick-release pins (ring up) installed through gun saddle inboard holes and recoil adapters, recoil adapters secure on

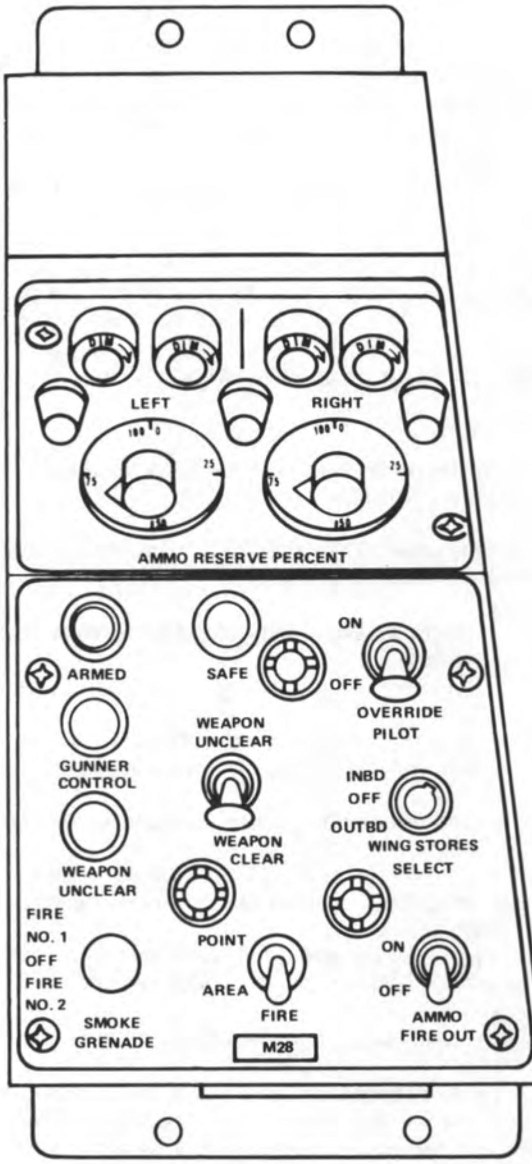


LOCATION: TOP OF PILOT INSTRUMENT PANEL

ITEM		FUNCTION
Elevation/Depression Control	Turn	— Varies angle of beamsplitter to adjust for range and airspeed when firing wing stores per the ballistic data cards.
Range Potentiometer Control	Turn	— Applies correctional elevation signal to turret.
Height Adjust Control	Turn	— Raises upper portion of sight.
Reticle Intensity Control	Turn	— Adjust intensity of reticle lights.
Reticle Light Filament Selector Switch	Down/Up	— Selects one of two filaments of reticle light.
Panel Light Intensity Control	Turn	— Adjust intensity of panel lights.
Inclinometer		— Indicates helicopter yaw attitude.

209071-348

Figure 4-13. Pilot reflect sight



LOCATION: GUNNER RIGHT CONSOLE

209071-408-1A

Figure 4-16. Gunner armament control panel (typical) (Sheet 1 of 2)

ITEM	FUNCTION
OVERRIDE PILOT Switch	ON — Energizes pilot override relay and transfers control of armament subsystems and pods (except smoke) to gunner when MASTER ARM switch is in ARMED position. Illuminates pilot and gunner ARMED idicators.. OFF — Pilot retains control of armament subsystems.
WEAPON CLEAR/ UNCLEAR Switch (M134 only)	Selects mode of firing. WEAPON CLEAR position — At end of firing cycle, gun rotates one full revolution after delinking feeder gate is closed. WEAPON UNCLEAR position —At end of firing cycle, ammunition remains in rotor assembly of gun.
WEAPON UNCLEAR Switch	Delinking feeder remains open during last revolution. Incorporated to save ammunition, should be used during combat only.
WING STORES SELECT Switch	Functions only when OVERRIDE PILOT switch is ON. May be used to select either inboard or outboard wing pods for firing.
AMMO FIREOUT Switch	OFF — Turret automatically stops firing with 200 rounds remaining. ON — Ammunition remaining in chutes may be fired.
POINT/AREA FIRE Switch	AREA — Applies voltage to azimuth servo valve causing weapons to oscillate 60 mils in azimuth about their trained position. POINT — Removes voltage from azimuth servo valve, allows gun to remain stable.
ARMED Indicator	Illuminates (amber) when pilot MASTER ARM switch is in ARMED position or when gunner OVERRIDE PILOT switch is in ON, indicating armament systems energized.
GUNNER CONTROL Indicator	Illuminates (blue) when pilot places GUNNER/PILOT CONTROL switch to GUNNER or when gunner places OVERRIDE PILOT switch to ON.
SAFE Indicator	Illuminates (green) when pilot MASTER ARM switch is in SAFE position.
WEAPON UNCLEAR Indicator (M134 only)	Based on mode of previous firing while WEAPON UNCLEAR/CLEAR switch selects mode of next firing. When last firing was in UNCLEAR mode, WEAPON UNCLEAR indicator will illuminate and remain illuminated until weapon is fired in CLEAR mode.
WEAPON Indicator	When left weapon indicator light illuminates, indicates type of weapon mounted in left side of turret. When right weapon light indicator illuminates indicates type of weapon mounted in right turret.
AMMO RESERVE PERCENT Meters	Indicate percentage of 4000 rounds of ammunition remaining in M134 machinegun ammunition box or magazine or percentage of 270 (plus or minus 5) rounds remaining in M129 grenade launcher magazine.
Panel Edge Lights	Provide panel lighting controlled from gunner miscellaneous panel.
SMOKE GRENADE	Not used.

209071-408-2A

Figure 4-16. Gunner armament control panel (typical) (Sheet 2 of 2) receptacles. Jettison quick disconnect lanyard attached to harness and launcher.

3. Launcher — Check launcher exterior and tube interiors for damage and corrosion.

4. Rocket installation — Check rocket aft end secure in launcher tube aft detent.

5. Igniter arms — Check condition.

4-7. EXTERIOR CHECK — WING GUN POD — PREFLIGHT.

1. Front fairing — Removed.

2. Bullet trap — Installed.

3. Pod mounting — Check pod front and rear lugs secure to helicopter ejector racks. Rack swaybrace bolts firmly against pod but not denting exterior.

4. Electrical connection — Check harness connected to pod and helicopter receptacles. Jettison quick disconnect lanyard attached to harness and pod.

5. Pod — Check pod exterior for condition (includes front fairing).

6. Gun barrel clamp and retaining bolt — Check secure.

7. Gun mounting — Check recoil adapters, quick release pins, and rear mount secure.

8. Gun gate solenoid — Check plunger returns to extended position when pressed, electrical connectors condition and security.

9. Gun exit unit — Check condition and security.

10. Gun feeder wheel — Check condition and security.

11. Gun electrical drive — Check drive and electrical connectors condition and security.

12. Gun safing sector — Secure.

13. ROUNDS IN POD counter — Set.

14. Gun timing pin — Set.

15. Gun feeding timing pin — Set.

16. Gun exit unit timing pin — Set.

17. Rear fairing — Remove.

18. BATTERY HTR switch — AUTO. OFF above 0°C.

19. BATTERY CHGR switch — AUTO.

O 20. RATE firing switch — As desired.

O 21. FLD switch — As desired.

22. Battery — Check for damage, leaking cells, and corrosion.

23. Rear fairing — Replace and secure.

24. Bullet trap — Remove.

25. Front fairing — Replace and secure.

4-8. EXTERIOR CHECK — WING GUN M35 — PREFLIGHT.

WARNING

Do not walk in front of gun. Safety gun before servicing. Observe all standard safety precautions governing handling of weapons and live ammunition.

Do not attempt to perform operational check with ammunition present in the system. If operation of the weapon is in doubt, contact qualified armament personnel for safe clearing procedures.

a. *Safety Checks.*

1. MASTER ARM switch — OFF.

2. Firing lead quick-disconnect — Remove.

3. Shorting plug — Install.

WARNING

To ensure feeder delinker assembly is clear of rounds, the declutching solenoid linkage must be fully pressed to engage feeder delinker when rotating gun to clear rounds.

4. Declutching solenoid linkage — Press.
5. Gun — Rotate.

b. General Checks.

1. Total rounds fired — Check.
2. Loading procedures — Review.
3. Correct number of rounds — Check.

CAUTION

If partial load of ammunition is to be carried, load right ammunition can first.

4. Proper ammunition loaded and correctly linked — Check.

c. Right Ammunition Box Check.

1. Nine round retainer spring doors — Latched.
2. Rounds — Aft of forward-most retainer spring.
3. Aft ammunition box cable — Taut.
4. Booster mounting pins — Installed.
5. Ammunition at booster — Free.
6. Booster motor connector — Secure.
7. Flexible chuting clips — Secure.
8. Right forward fairing and panel latches — Secure.
9. Forward ammunition box cable — Taut.

d. Crossover Gun Feed Chute Check.

1. Right and left chute support pins — Secure.
2. Cross chute fairing door latches — Secure.

e. Left Ammunition Box Check.

1. Flexible chute clips — Secure.
2. Short ammunition loops — Over booster switch.
3. Booster switch connector — Secure.
4. Booster switch — Actuate and release.
5. Nine round retainer spring doors — Secure.
6. Chute shield and bellmouth — Secure.
7. Chute clips — Secure to bellmouth.
8. Ammunition — Free in bellmouth.
9. Left fairing and panel latches — Secure.

f. Weapon Check.

1. Flexible chute "D" rings — Secure.
2. Flexible chute clips — Secure to feeder.
3. Feeder — Timed to gun.
4. Link chute — Secure to feeder.
5. Feeder solenoid and linkage — Free.
6. Feeder connector — Secure.
7. Feeder mounting pins — Secure (lockwired).
8. Gun lubrication — Check.
9. Gun drive motor bolts — Secure.
10. Case chute bolts — Secure.
11. Firing lead connector secure at gun firing contact assembly — Check.

12. Boresight of gun — Check.

13. Gun forward and aft mounts — Secure.

14. Wing mount — Secure.

15. Center barrel clamp — Secure, cotter pin installed.

16. Blast suppressor bolts — Secure.

g. Final Arming Check.

1. ROUNDS REMAINING indicator — Set.

WARNING

Check with pilot and gunner before proceeding.

2. Ammunition belt into feeder and strip one round — Feed.

3. Gun drive brake lever — ON.

4. Shorting plug — Remove and connect firing lead.

WARNING

Weapon is ready to fire when MASTER ARM switch is placed to ARM.

4-9. EXTERIOR CHECK — SMOKE GRENADE DISPENSER — PREFLIGHT.

1. Smoke grenades (desired colors) — Loaded.

2. Smoke grenade safety pins — Removed.

3. Ejector safety pin — Remove (each rack).

4. Electrical connection between helicopter and dispenser — Connected.

5. Quick-disconnect lanyard — Taut.

6. Smoke grenade dispensers — Cocked.

4-10. BEFORE STARTING ENGINE CHECK — PREFLIGHT.

NOTE

Check to be performed after Chapter 8 helicopter and systems check.

1. SMOKE panel — Color indicating dials set to indicate color of grenades installed.

2. AMMO FIRE OUT switch — OFF.

3. AMMO RESERVE PERCENT dials — Set.

4-11. BEFORE TAKEOFF CHECK — ALL ARMAMENT.

NOTE

Check cannot be performed prior to engine start because hydraulic power is required for portions of the check.

(1.) OVERRIDE PILOT switch — OFF.

2. MASTER ARM switch — SAFE.

3. WG ST ARM switch — OFF.

O 4. 20 MM ARM switch — OFF.

O (5.) 20 MM ARM switch — OFF.

6. WG ST JETTISON SELECT switch — As desired.

4-12. INFLIGHT PROCEDURES — ALL ARMAMENT.

The following armament inflight procedures paragraphs are based on only one weapon installed, all armament circuit breakers in, and armament preflight interior check performed.

4-13. TURRET OPERATION — INFLIGHT.

a. Gunner.

1. MASTER ARM switch — ARMED.

(2.) GUNNER/PILOT CONTROL switch — GUNNER.

(3) OVERRIDE PILOT switch — OFF.

4. Emergency procedures — Refer to Chapter 9.

b. *Gunner Firing Procedures.*

NOTE

Armament circuit breakers must be in/on, 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 — As desired.
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 — Press.
9. Sighting station — On target.
10. To fire the machinegun:
    Low rate — Press trigger to first detent.
    High rate — Fully press firing trigger(s).
11. To fire the grenade launcher — Press firing button(s).

c. *Pilot Firing Procedures.*

NOTE

TH-1G only, power to armament circuit is controlled by Instructor Pilot through MASTER ARM switch on IP instrument panel.

1. Armament circuit breakers — In/on.
2. MASTER ARM switch — ARMED.
3. GUNNER/PILOT CONTROL switch — PILOT.
4. POINT/AREA FIRE switch — As desired.
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 the machine gun:
    (a) Weapon select switch — As applicable for desired weapon(s).
    (b) Cyclic trigger switch.
    Low rate — Partially press.
    High rate — Fully press.
10. To fire the grenade launcher:
    (a) Weapon select switch — As applicable for desired weapon(s).
    (b) Cyclic trigger switch — Fully press.

d. *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.

e. *Before Leaving Helicopter.*

1. MASTER ARM switch — OFF.

(2) OVERRIDE PILOT switch — OFF.

3. Armament circuit breakers — Out/off.

4. Emergency procedures — Refer to Chapter 9.

4-14. ROCKET OPERATION — INFLIGHT.

a. *Pilot.*

1. MASTER ARM switch — ARMED.
2. OVERRIDE PILOT switch — OFF.
3. RKT PR SEL switch — As desired.
4. WG ST ARM switch — As required. ARMED indicator illuminates.
5. Elevation depression knob — Position per range card data.
6. Reflex sight — Adjust and align with target.
7. Cyclic WING ARM FIRE switch — Pressed.

b. *Gunner.*

1. OVERRIDE PILOT switch — ON.
2. WING STORES SELECT switch — As required. ARMED indicator illuminates.
3. Cyclic WING ARM FIRE switch — Pressed.

4-15. WING GUN POD OPERATION — INFLIGHT PROCEDURES.

a. *Pilot.*

1. MASTER ARM switch — ARMED.
2. OVERRIDE PILOT switch — OFF.

WARNING

After firing rockets with WG ST ARM switch 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.

3. WG ST ARM switch — INBD. ARMED indicator illuminates.
4. Reflex sight — Adjust and align with target.
5. Cyclic WING ARM FIRE switch — Pressed.

b. *Gunner.*

1. MASTER ARM switch — ARMED.
2. OVERRIDE PILOT switch — ON. ARMED indicator illuminates.
3. WING STORES SELECT switch — INBD.
4. Cyclic WING ARM FIRE switch — Pressed.

4-16. M35 WING GUN OPERATION — INFLIGHT.

a. *Pilot.*

WARNING

After firing rockets with WG ST ARM switch 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 — ARMED.
2. WG ST ARM switch — INBD. ARMED indicator illuminates.
3. 20 MM ARM switch — ARM. ARMED indicator illuminates.
4. Elevation depression knob — As desired.
5. Reflex sight — On target.
6. Pilot cyclic WING ARM FIRE switch — Pressed.

b. Gunner.

1. MASTER ARM switch — ARMED.
2. WG ST ARM switch — INBD. ARMED indicator illuminates.
3. 20 MM ARM switch — ARM. ARMED indicator illuminates.
4. Aim M195 gun by flying helicopter directly at target.
5. Cyclic WING ARM FIRE switch — Pressed.

4-17. SMOKE GRENADE DISPENSER OPERATION — INFLIGHT.

1. MASTER ARM switch — ARMED.
2. LEFT ARM and RIGHT ARM switches — As desired.
3. SMOKE REL button — Press.

4-18. WING STORES JETTISON — INFLIGHT. Refer to Chapter 9, Section I.

4-19. BEFORE LANDING CHECK — ALL ARMAMENT.

(1.) OVERRIDE PILOT switch — OFF.

(2.) WEAPON UNCLEAR/ WEAPON CLEAR switch — WEAPON CLEAR. WEAPON UNCLEAR light should extinguish.

3. MASTER ARM switch — OFF.

4. WG ST ARM switch — OFF.

5. WG ST JETTISON SELECT switch — BOTH.

O 6. 20 MM ARM switch — OFF.

O (7.) 20 MM ARM switch — OFF.

4-20. BEFORE LEAVING HELICOPTER CHECK — ALL ARMAMENT.

1. Wing ejector rack jettison safety pins — Installed.
2. Rocket igniter arms — In contact with rockets. If rockets are installed.

CHAPTER 5

OPERATING LIMITS AND RESTRICTIONS

SECTION I. GENERAL

5-1. General.

a. This chapter includes all important operating limits and restrictions that shall be observed during ground and flight operations.

b. The operating limitations set forth in this chapter are the direct results of design analysis tests and operating experiences. Compliance with these limits will allow the pilot to safely perform the assigned missions and to derive maximum utility from the helicopter. Limits concerning maneuvers, weight and center of gravity limitations are also covered in this chapter.

5-2. Exceeding Operational Limits.

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

5-3. Minimum Crew Requirements.

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.

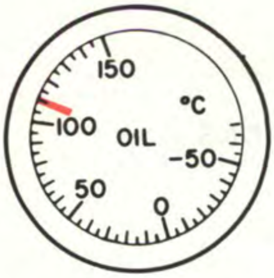
SECTION II. SYSTEM LIMITS

5-4. Instrument Markings.

The operating ranges for both the helicopter and engine are shown on figure 5-1.

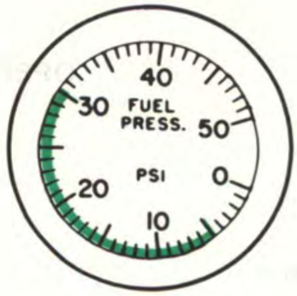
a. Instrument Marking Color Codes. Operating limitations and ranges are illustrated by the colored markings which appear on the dial faces of engine, flight and utility system instruments. Red markings on the dial faces of these instruments indicate the limit above or below which continued operation is likely to cause damage or shorten component life. The green markings on instruments indicate the safe or normal range of operation. The yellow markings on instruments indicate the range when special attention should be given to the operation covered by the instrument. Operation is permissible in the yellow range, but is time-limited.

b. Instrument Glass Alignment Marks. Limitation markings consists of strips of semi-transparent color tape which adheres to the glass outside of an indicator dial. Each tape strip aligns to increment marks on the dial face so cirrect operating limits are protrayed. The pilot should occasionally verify alignment of the glass to the dial face. For this purpose, all engine instruments have short vertical white alignment marks extending from the bottom part of the dial glass on to the fixed base of the indicator. These slippage marks appear as a single vertical line when limitation markings on the glass properly align with reading increments on the dial face. However, the slippage marks appear as separate radial lines when a dial glass has rotated.



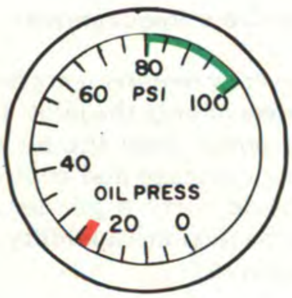
TRANSMISSION OIL TEMPERATURE

110 C Maximum



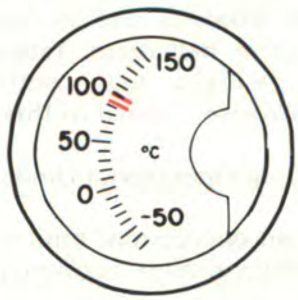
FUEL PRESSURE

5 to 30 PSI Continuous Operation



ENGINE OIL PRESSURE

25 PSI Minimum
80 to 100 PSI Continuous Operation
100 PSI Maximum



ENGINE OIL TEMPERATURE

93°C Maximum

TRANSMISSION OIL PRESSURE

30 PSI Minimum
40 to 60 PSI Continuous Operation
70 PSI Maximum

NOTE

100°C maximum is permissible above 30°C ambient. Time above 93°C shall be logged in DA Form 2408-13.

209078-26-1A

Figure 5-1. Instruments markings (Sheet 1 of 2)

ROTOR TACHOMETER

- 294 to 324 RPM Continuous Operation (green)
- 339 RPM Maximum for Autorotation (red)

ENGINE TACHOMETER

- 6400 to 6600 RPM Continuous Operation (green)
- 6700 RPM Maximum (red)
- 6900 RPM Transient (3 second) Limit (red)

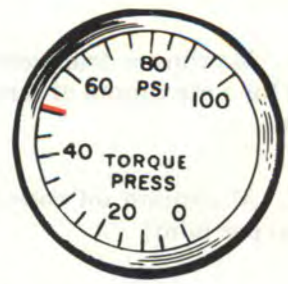
AIRSPEED

- Above 70 Knots — 6400 RPM Minimum (yellow)
- 190 Knots Maximum (red)

See Airspeed Operating Limits Chart for additional data.

GAS PRODUCER TACHOMETER

- 101.5 Percent Maximum (red)



TORQUE PRESSURE

- 50 PSI Maximum Calibrated Torque. Refer to Chapter 7 for maximum indicated torque. (red)

EXHAUST TEMPERATURE

- 400°C to 610°C Continuous (green)
- 610°C to 625°C 30 minutes (yellow)
- 625°C to 675°C 10 seconds (red)
- 675°C to 760°C 5 seconds (red)

209078-26-2A

Figure 5-1. Instruments markings (Sheet 2 of 2)

5-5. Rotor Limitations.

a. Refer to figure 5-1.

b. Wind Limitations. The helicopter shall not be started if wind velocity exceeds 30 knots and/or spread exceeds 15 knots.

NOTE

Gust spreads are not normally reported. To obtain spread, compare minimum and maximum wind velocity.

SECTION III. POWER LIMITS

5-6. Engine Limitations.
Refer to Figure 5-1.

a. Maximum N2 rpm allowable is 6900 at or below 15 PSI torque.

b. Maximum N2 rpm allowable is 6700 above 15 PSI torque.

c. Maximum transient N2 rpm allowable is 6900 for a maximum of three seconds above 15 PSI torque.

d. Maximum oil consumption is 0.3 gal (2.4 pints) per hour.

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

f. Maximum EGT for ECU operation is 610°C.

5-7. Hovering Limitations.

Ten percent of total pedal travel full right to full left is considered adequate for safe control. Operation beyond limits shown in figure 5-2 is hazardous. Yellow indicates conditions where the directional control margin may be less than 10% in zero wind hover. Red indicates airspeed limits.

SECTION IV. LOADING LIMITS

5-8. Center of Gravity Limitations.

The maximum center of gravity limitations are: Station 190.0 to Station 201.0. See Center of Gravity Limitations Chart for additional limitations (figure 6-7).

5-9. Weight Limitations.

Refer to Chapter 6. Maximum gross weight is 9500 pounds.

SECTION V. AIRSPEED LIMITS

5-10. Airspeed Limitations.

a. Forward airspeed limits refer to figure 5-3.

b. Sideward and rearward airspeed limits refer to figure 5-2.

c. Steady state autorotation airspeed is limited to 120 KIAS.

d. Canopy door shall not be opened above 45 knots.

SECTION VI. MANEUVERING LIMITS

5-11. Prohibited Maneuvers.

a. No aerobatic maneuvers permitted.

b. Flight near or below zero "g's" is prohibited.

c. Practice autorotations and/or rapid throttle-setting reduction at airspeeds greater than 150 KIAS are prohibited when indicated engine torque pressure is greater than 35 psi.

SECTION VII. ENVIRONMENTAL RESTRICTIONS

5-12. Environmental Restrictions.

Environmental restrictions refer to Sections IV and V of Chapter 8.

5-13. Flight Under IMC (Instrument Meteorological Conditions).

This helicopter is not qualified for flight under instrument meterological conditions.

SECTION VIII. HEIGHT VELOCITY

5-14. Height Velocity.

Refer to figure 9-2.

DIRECTIONAL CONTROL MARGIN

CONTROL MARGIN
AH-1G
T53-L-13B

EXAMPLE

WANTED

CONDITIONS (AIRSPEED — AZIMUTH) WHERE DIRECTIONAL CONTROL MARGIN MAY BE LESS THAN 10%

KNOWN

PRESSURE ALTITUDE = 5000 FEET
FAT = 0°C
GROSS WEIGHT = 8500 POUNDS

METHOD

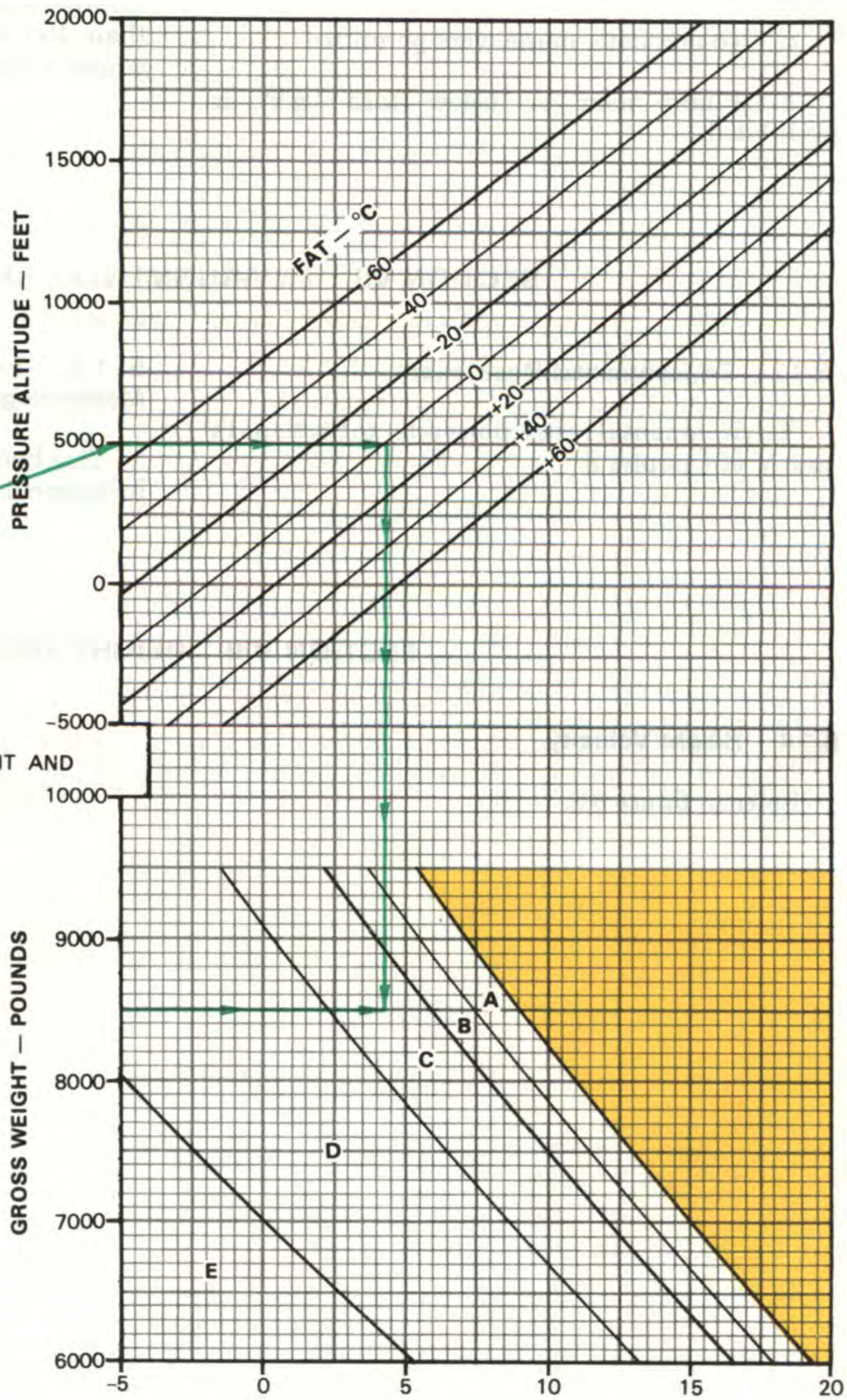
ENTER PRESSURE ALTITUDE HERE

MOVE RIGHT TO FAT

MOVE DOWN TO KNOWN GROSS WEIGHT

DETERMINE INTERSECTION OF GROSS WEIGHT AND DENSITY ALTITUDE LINES IS IN AREA C

REFER TO SHEET 2
DIRECTIONAL CONTROL MARGIN MAY BE LESS THAN 10% FOR THE CONDITIONS (AIRSPEED & AZIMUTH)

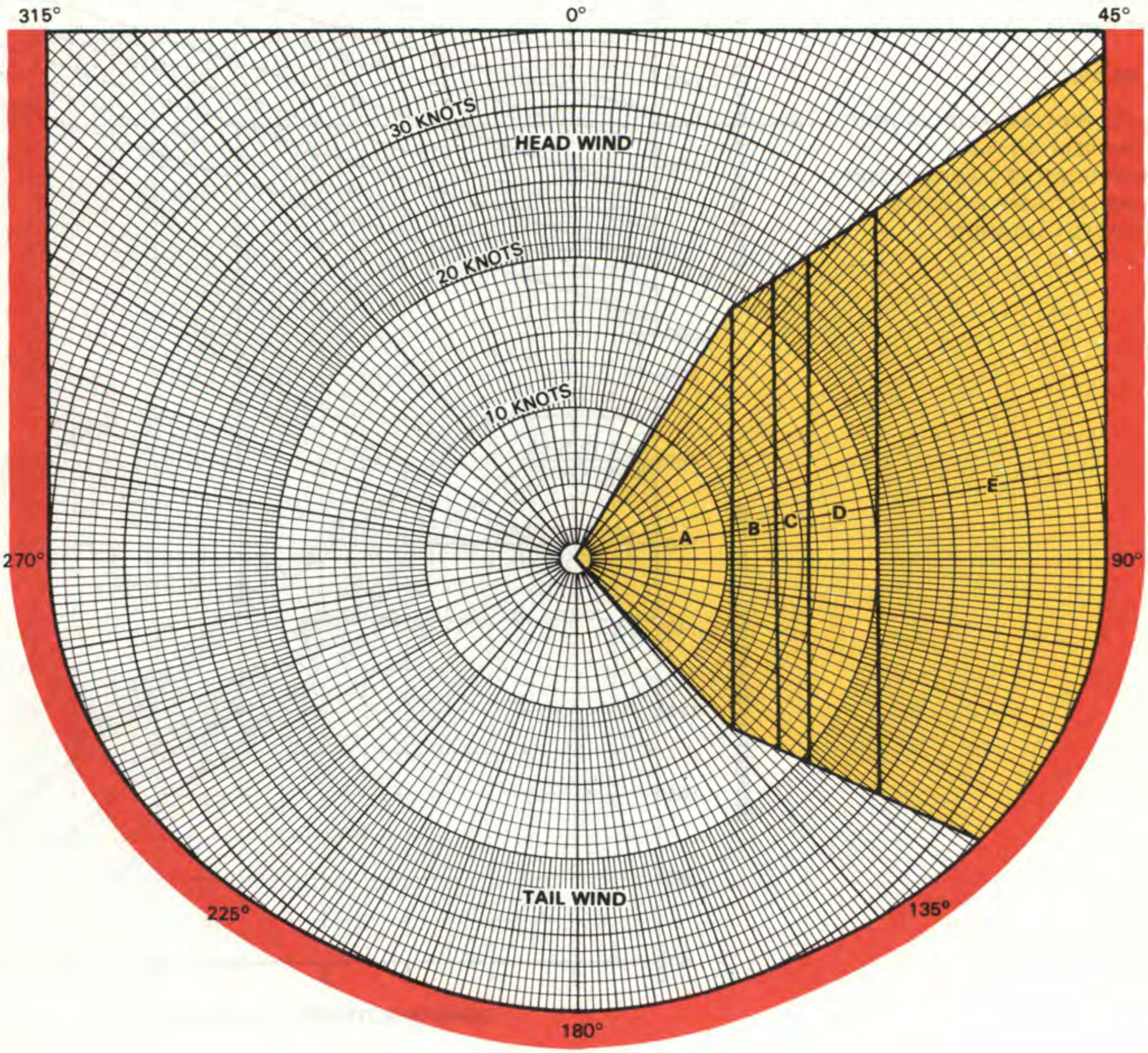


DATA BASIS: DERIVED FROM FLIGHT TEST USA ASTA 68-37, JUNE 1969.

Figure 5-2. Directional control margin chart (Sheet 1 of 2)

DIRECTIONAL CONTROL MARGIN

CONTROL MARGIN
AH-1G
T53-L-13B



DATA BASIS: DERIVED FROM FLIGHT TEST USA ASTA 68-37, JUNE 1969.

Figure 5-2. Directional control margin chart (Sheet 2 of 2)

AIRSPEED OPERATING LIMITS

324 ROTOR/6600 ENGINE RPM

AIRSPEED OPERATING LIMITS AH-1G T53-L-13B

EXAMPLE

WANTED

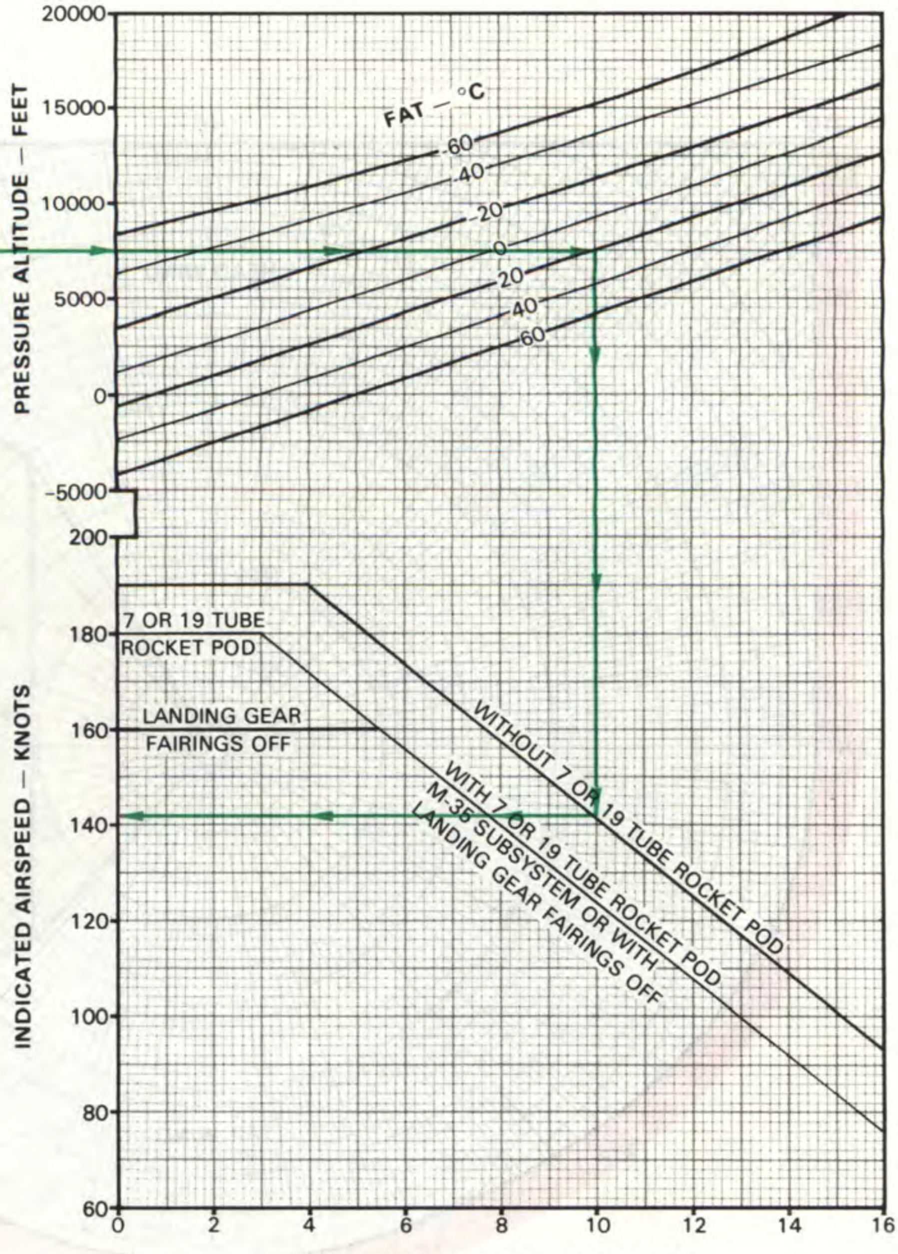
INDICATED AIRSPEED

KNOWN

CONFIGURATION WITHOUT 7 OR 19 TUBE ROCKET POD
PRESSURE ALTITUDE = 7500 FEET
FAT = +20°C

METHOD

ENTER PRESSURE ALTITUDE HERE
MOVE RIGHT TO FAT
MOVE DOWN TO CONFIGURATION
MOVE LEFT, READ INDICATED AIRSPEED = 142 KNOTS



DATA BASIS: DERIVED FROM BELL HELICOPTER TEXTRON FLIGHT TEST

Figure 5-3. Airspeed operating limits chart

CHAPTER 6

WEIGHT/BALANCE AND LOADING

SECTION I. GENERAL

6-1. General.

This chapter contains sufficient instructions and data so that an aviator knowing the basic weight and moment of the helicopter can compute any combination of weight and balance.

6-2. Classification of Helicopter.

For the purpose of clarity, Army AH-1G helicopters are in class IB. Additional directives governing weight and balance of class I helicopter forms and records, are contained in AR95-16, AR750-31, and TM 55-405-9.

6-3. Helicopter Station Diagram.

Figure 6-1 shows the helicopter reference datum lines, fuselage stations, buttlines, and waterlines. The primary purpose of the figure is to aid personnel in the computation of helicopter weight/balance and loading.

6-4. Loading Charts.

a. Information. The loading data contained in this chapter are intended to provide information necessary to work a loading problem for the helicopters to which this manual is applicable.

b. Use. From the figures contained in this chapter, weight and moment are obtained for all variable load items and are added to the current basic weight and moment (DD Form 365C) to obtain the gross weight and moment.

(1) The gross weight and moment are checked on figure 6-8 to determine the approximate center of gravity (cg).

(2) The effect on cg by the expenditures in flight of such items are fuel, ammunition, etc., may be checked by subtracting the weights and moments of such items from the takeoff weight and moment and checking the new weight and moment on the Center of Gravity Limits Chart.

(3) If the weight and moment lines do not intersect, the cg is not within the flight limits.

NOTE

This check shall be made to determine whether or not the cg will remain within limits during the entire flight.

SECTION II. WEIGHT AND BALANCE

6-5. Weight and Balance Records.

Weight and Balance forms are maintained in the helicopter Weight and Balance file. Refer to Section VIII of this chapter for additional information on DA Forms 365A, C, and F.

SECTION III. PERSONNEL

6-6. Personnel Moments.

Refer to figure 6-2 to compute pilot and gunner moments.

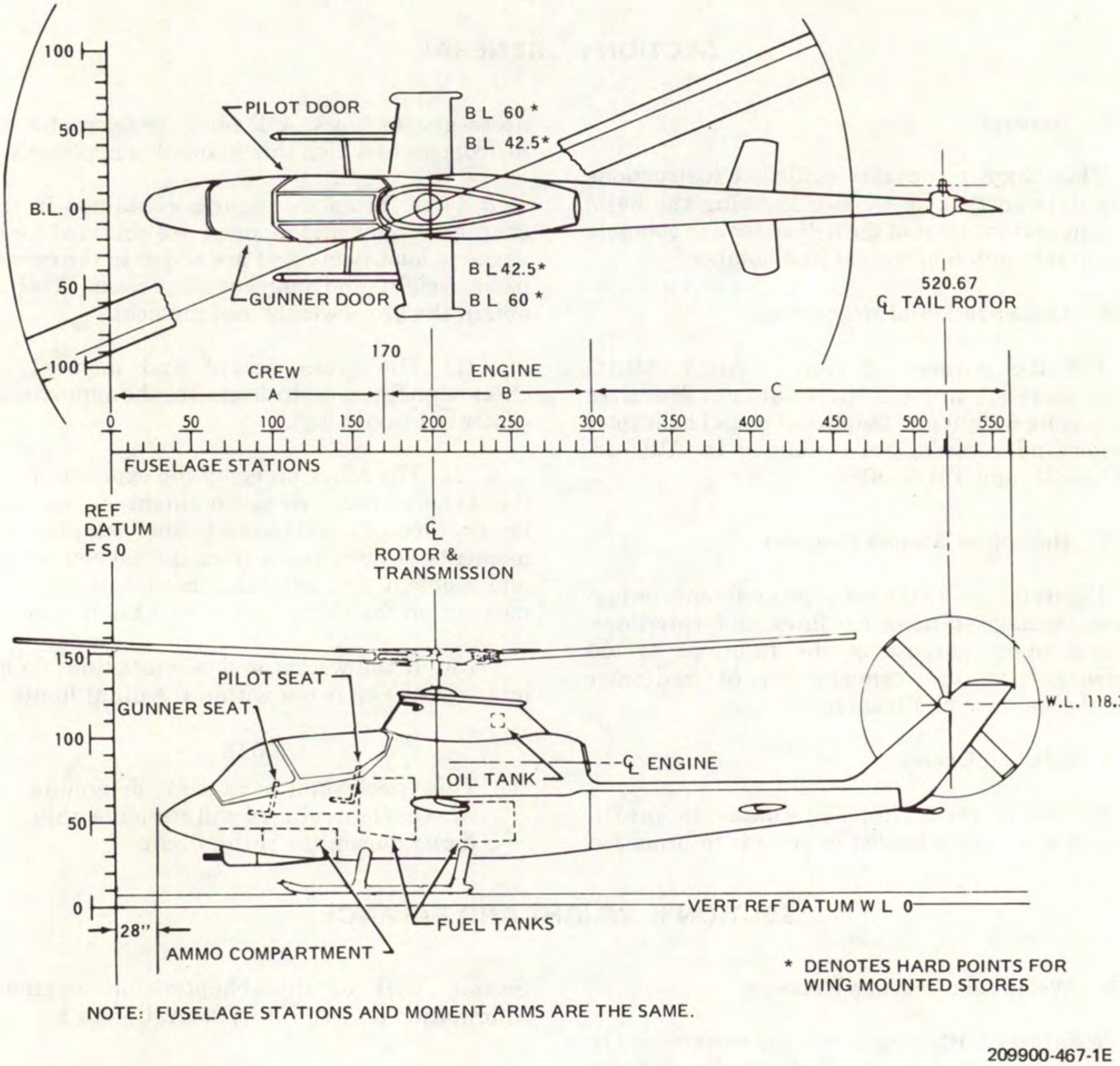


Figure 6-1. Helicopter station diagram

PERSONNEL MOMENT
AH-1G

EXAMPLE

WANTED

PERSONNEL MOMENT

KNOWN

PERSONNEL WEIGHT = 180 POUNDS
SEAT POSITION IS GUNNER (FRONT) SEAT

METHOD

MOVE RIGHT FROM 180 POUNDS TO GUNNER POSITION LINE. PROJECT DOWN TO READ MOMENT/ 100 OF 150 IN-LBS.

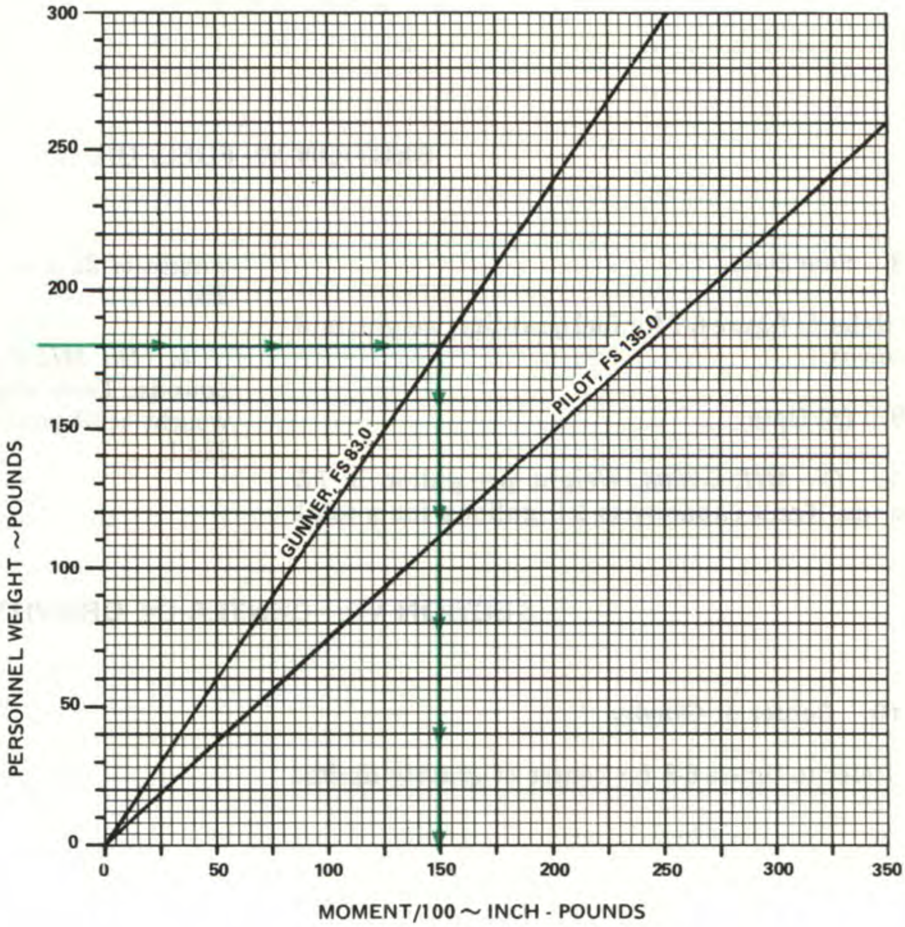


Figure 6-2. Personnel moment chart

Section IV. MISSION EQUIPMENT

6-7. Weight and Balance Loading Data.

Refer to figures 6-3 through 6-6 for the quantity, weight, and moment of each armament item up to maximum load.

SECTION V. CARGO LOADING

Not Applicable

SECTION VI. FUEL/OIL

6-8. Fuel Data.

Refer to figure 6-7 for fuel quantity, weight, and moment.

6-9. Oil Data.

a. Oil MIL-L-7808. Weight per gallon is 7.5 pounds. Tank capacity is 2.9 gallons for a total weight of 22 pounds. Moment/100 is 51 at station 234.1.

b. Oil MIL-L-23699. Weight per gallon is 8.4 pounds. Tank capacity is 2.9 gallons for a total weight of 24 pounds. Moment/100 is 57 at station 234.1

SECTION VII. CENTER OF GRAVITY

6-10. Center of Gravity.

Refer to figure 6-8 for center of gravity limits.

M151/M423 FUSE
(10 POUND WARHEAD WITH POINT DETONATING FUSE)

M159C POD S/N PRIOR TO 004178			
Rockets (Number)	Weight (Pounds) Pod & No. of Rockets Indicated	LOCATION ON WING	
		Inboard Moment/100	Outboard Moment/100
0	152	302	308
1	173	343	349
2	193	383	390
3	214	423	431
4	234	463	472
5	255	503	513
6	275	543	554
7	296	583	595
8	316	623	636
9	337	663	676
10	357	703	717
11	378	744	758
12	398	784	799
13	419	824	840
14	439	864	881
15	460	904	922
16	480	944	963
17	501	984	1004
18	521	1024	1045
19	542	1064	1085
M200A1 POD			
0	139	277	282
1	160	318	323
2	180	358	364
3	201	398	405
4	221	438	447
5	242	478	488
6	262	518	529
7	283	558	570
8	303	598	611
9	324	638	652
10	344	678	694
11	365	719	735
12	385	759	776
13	406	799	817
14	426	839	858
15	447	879	899
16	467	919	941
17	488	959	982
18	508	999	1023
19	529	1039	1064

ROCKETS @ 20.5 LBS. EACH

Figure 6-3. Folding fin aerial rocket (2.75 inch) moment table (Sheet 1 of 19)

M151 WARHEAD/M429 FUSE
(10 POUND WARHEAD WITH PROXIMITY FUSE)

M159C POD S/N PRIOR TO 004178			
Rockets (Number)	Weight (Pounds) Pod & No. of Rockets Indicated	LOCATION ON WING	
		Inboard Moment/100	Outboard Moment/100
0	152	302	308
1	173	343	350
2	194	384	391
3	214	424	433
4	235	465	474
5	256	505	515
6	277	546	557
7	298	587	598
8	318	627	640
9	339	667	681
10	360	708	723
11	381	749	764
12	402	790	805
13	422	830	847
14	443	871	888
15	464	912	930
16	485	952	971
17	506	993	1012
18	526	1033	1054
19	547	1074	1095
M200A1 POD			
0	139	277	282
1	160	318	324
2	181	359	365
3	201	399	407
4	222	440	449
5	243	480	490
6	264	521	532
7	285	562	574
8	305	602	615
9	326	642	657
10	347	683	699
11	368	724	740
12	389	765	782
13	409	805	824
14	430	846	865
15	451	887	907
16	472	927	949
17	493	968	991
18	513	1008	1032
19	534	1049	1074

ROCKETS @ 20.8 LBS. EACH

Figure 6-3. Folding fin aerial rocket (2.75 inch) moment table (Sheet 2 of 19)

XM229 WARHEAD/M423 FUSE
(17 POUND WARHEAD WITH POINT DETONATING FUSE)

M159C POD S/N PRIOR TO 004178			
Rockets (Number)	Weight (Pounds) Pod & No. of Rockets Indicated	LOCATION ON WING	
		Inboard Moment/100	Outboard Moment/100
0	152	302	308
1	180	355	362
2	208	408	416
3	236	461	470
4	264	514	524
5	292	567	578
6	319	620	632
7	347	672	686
8	375	725	740
9	403	778	794
10	431	831	847
11	459	884	901
12	487	937	955
M200A1 POD			
0	139	277	282
1	167	330	336
2	195	383	390
3	223	436	445
4	251	489	499
5	279	542	553
6	306	595	607
7	334	647	662
8	362	700	716
9	390	753	770
10	418	806	825
11	446	859	879
12	474	912	933
13	502	964	
14	530	1017	

ROCKETS @ 27.9 LBS. EACH

*S/N 004041 & SUB

Figure 6-3. Folding fin aerial rocket (2.75 inch) moment table (Sheet 3 of 19)

XM229 WARHEAD/M429 FUSE
(17 POUND WARHEAD WITH PROXIMITY FUSE)

M159C POD S/N PRIOR TO 004178			
Rockets (Number)	Weight (Pounds) Pod & No. of Rockets Indicated	LOCATION ON WING	
		Inboard Moment/100	Outboard Moment/100
0	152	302	308
1	180	356	363
2	208	409	417
3	237	462	472
4	265	516	526
5	293	569	580
6	321	622	635
7	349	676	689
8	378	729	744
9	406	782	798
10	434	835	852
11	462	889	907
12	490	942	961
M200A1 POD			
0	139	277	282
1	167	331	337
2	195	384	391
3	224	437	446
4	252	491	501
5	280	544	556
6	308	597	610
7	336	651	665
8	365	704	720
9	393	757	775
10	421	801	830
11	449	864	884
12	477	917	939
13	506	970	
14	534	1024	

ROCKETS @ 28.2 LBS. EACH

Figure 6-3. Folding fin aerial rocket (2.75 inch) moment table (Sheet 4 of 19)

WDU-4A/A (FLECHETTE) WARHEAD
(9.3 POUND WARHEAD WITH DECELERATION ACTUATED FUSE)

M159C POD S/N PRIOR TO 004178			
Rockets (Number)	Weight (Pounds) Pod & No. of Rockets Indicated	LOCATION ON WING	
		Inboard Moment/100	Outboard Moment/100
0	152	302	308
1	172	342	349
2	192	381	389
3	213	421	429
4	233	460	469
5	253	500	509
6	273	539	550
7	293	578	590
8	314	618	630
9	334	657	670
10	354	697	711
11	374	736	751
12	394	776	791
13	415	815	831
14	435	855	871
15	455	894	912
16	475	933	952
17	495	973	992
18	516	1012	1032
19	536	1052	1073
M200A1 POD			
0	139	277	282
1	159	317	322
2	179	356	363
3	200	395	403
4	220	435	444
5	240	475	484
6	260	515	525
7	280	554	565
8	301	593	606
9	321	633	646
10	341	673	687
11	361	713	727
12	381	752	768
13	402	792	808
14	422	831	849
15	442	871	889
16	462	910	930
17	482	950	970
18	503	990	1011
19	523	1029	1051

ROCKETS @ 20.2 LBS. EACH

Figure 6-3. Folding fin aerial rocket (2.75 inch) moment table (Sheet 5 of 19)

M151 WARHEAD/M423 FUSE
(10 POUND WARHEAD WITH POINT DETONATING FUSE)

Rockets (Number)	Weight (Pounds) Pod & No. of Rockets Indicated	LOCATION ON WING Inboard Momemt/100	Outboard Moment/100
M157A POD			
0	57	113	115
1	78	152	155
2	98	191	195
3	119	230	235
4	139	269	274
5	160	308	314
6	180	347	354
7	201	386	394
M157B POD			
0	67	134	136
1	88	174	177
2	108	214	218
3	129	254	259
4	149	294	300
5	170	334	341
6	190	374	382
7	211	414	423
M158 POD			
0	42	83	85
1	62	122	126
2	83	162	166
3	103	202	206
4	124	241	247
5	144	281	287
6	165	320	327
7	185	360	368
M158A-1 POD			
0	48	95	97
1	69	136	138
2	89	176	179
3	110	216	220
4	130	256	261
5	151	296	302
6	171	336	343
7	192	376	384

ROCKETS @ 20.5 LBS. EACH

Figure 6-3. Folding fin aerial rocket (2.75 inch) moment table (Sheet 6 of 19)

M151 WARHEAD/423 FUSE
(10 POUND WARHEAD WITH POINT DETONATING FUSE)

M159B POD			
Rockets (Number)	Weight (Pounds) Pod & No. of Rockets Indicated	LOCATION ON WING	
		Inboard Moment/100	Outboard Moment/100
0	118	234	238
1	139	273	278
2	159	312	318
3	180	351	358
4	200	390	398
5	221	429	437
6	241	468	477
7	262	507	517
8	282	546	557
9	303	585	597
10	323	624	636
11	344	663	676
12	364	702	716
13	385	741	756
14	405	780	796
15	426	819	836
16	446	858	875
17	467	897	915
18	487	936	955
19	508	975	995
M159C POD S/N PRIOR TO 004040			
0	130	259	264
1	151	299	305
2	171	340	346
3	192	380	387
4	212	420	428
5	233	460	469
6	253	500	510
7	274	540	551
8	294	580	592
9	315	620	632
10	335	660	673
11	356	700	714
12	376	741	755
13	397	781	796
14	417	821	837
15	438	861	878
16	458	901	919
17	479	941	960
18	499	981	1001
19	520	1021	1041

ROCKETS @ 20.5 LBS. EACH

Figure 6-3. Folding fin aerial rocket (2.75 inch) moment table (Sheet 7 fo 19)

M151 WARHEAD/M423 FUSE
(10 POUND WARHEAD WITH POINT DETONATING FUSE)

Rockets (Number)	Weight (Pounds) Pod & No. of Rockets Indicated	LOCATION ON WING	
		Inboard Moment/100	Outboard Moment/100
M157A POD			
0	57	113	115
1	78	152	156
2	99	192	196
3	119	231	236
4	140	271	277
5	161	311	317
6	182	350	358
7	203	390	398
M157B POD			
0	67	134	136
1	88	174	178
2	109	215	219
3	129	255	261
4	150	296	302
5	171	337	343
6	192	377	385
7	213	418	426
M158 POD			
0	42	83	85
1	62	123	126
2	83	163	167
3	104	203	208
4	125	243	249
5	146	283	290
6	166	323	330
7	187	363	371
M158A-1 POD			
0	48	95	97
1	69	136	139
2	90	177	180
3	110	217	222
4	131	258	263
5	152	298	304
6	173	339	346
7	194	380	387

ROCKETS @20.8 LBS. EACH

Figure 6-3. Folding fin aerial rocket (2.75 inch) moment table (Sheet 8 of 19)

M151 WARHEAD/M429 FUSE
(10 POUND WARHEAD WITH PROXIMITY FUSE)

Rockets (Number)	Weight (Pounds) Pod & No. of Rockets Indicated	LOCATION ON WING Inboard Moment/100	LOCATION ON WING Outboard Moment/100
M159B POD			
0	118	234	238
1	139	273	279
2	160	313	319
3	180	352	359
4	201	392	400
5	222	431	440
6	243	471	480
7	264	510	521
8	284	550	561
9	305	589	601
10	326	629	641
11	347	668	682
12	368	708	722
13	388	748	762
14	409	787	803
15	430	827	843
16	451	866	883
17	472	906	924
18	492	945	964
19	513	985	1004
M159C POD PRIOR TO S/N 004040			
0	130	259	264
1	151	300	306
2	172	341	347
3	192	381	389
4	213	422	430
5	234	462	471
6	255	503	513
7	276	544	554
8	296	584	596
9	317	625	637
10	338	665	679
11	359	706	720
12	380	747	761
13	400	787	803
14	421	828	844
15	442	868	886
16	463	909	927
17	484	950	968
18	504	990	1010
19	525	1031	1051

ROCKETS @ 20.8 LBS. EACH

Figure 6-3. Folding fin aerial rocket (2.75 inch) moment table (Sheet 9 of 19)

M229 WARHEAD/M423 FUSE
(17 POUND WARHEAD WITH POINT DETONATING FUSE)

M157B POD			
Rockets (Number)	Weight (Pounds) Pod & No. of Rockets Indicated	LOCATION ON WING	
		Inboard Moment/100	Outboard Moment/100
0	67	134	**136**
1	95	187	**190**
2	123	239	**244**
3	151	292	**298**
4	179	345	**352**
5	207	398	**406**
6	234	451	**460**
7	262	504	**514**
M159C * POD *PRIOR TO S/N 004040			
0	130	259	**264**
1	158	312	**318**
2	186	365	**372**
3	214	418	**426**
4	242	471	**480**
5	270	524	**534**
6	297	576	**588**
7	325	629	**642**
8	353	682	**696**
9	381	735	**750**
10	409	788	**803**
11	437	841	**857**
12	465	893	**911**
13	493	946	
14	521	999	

ROCKETS @ 27.9 LBS. EACH

Figure 6-3. Folding fin aerial rocket (2.75 inch) moment table (Sheet 10 of 19)

XM229 WARHEAD/M429 FUSE
(17 POUND WARHEAD WITH PROXIMITY FUSE)

M157B POD			
Rockets (Number)	Weight (Pounds) Pod & No. of Rockets Indicated	LOCATION ON WING	
		Inboard Moment/100	Outboard Moment/100
0	67	134	136
1	95	187	191
2	123	240	245
3	152	294	299
4	180	347	354
5	208	400	408
6	236	453	463
7	264	507	517
M159C* POD *PRIOR TO S/N 004040			
0	130	259	264
1	158	313	319
2	186	366	373
3	215	419	428
4	243	473	482
5	271	526	536
6	299	579	591
7	327	632	645
8	356	686	700
9	384	739	754
10	412	792	808
11	440	846	863
12	468	899	917
13	497	952	
14	525	1006	

ROCKETS @ 28.2 LBS. EACH

Figure 6-3. Folding fin aerial rocket (2.75 inch) moment table (Sheet 11 of 19)

XM229 WARHEAD/M423 FUSE
(17 POUND WARHEAD WITH POINT DETONATING FUSE)

Rockets (Number)	Weight (Pounds) Pod & No. of Rockets Indicated	LOCATION ON WING	
		Inboard Moment/100	Outboard Moment/100
M158 POD			
0	42	83	85
1	70	135	138
2	97	187	192
3	125	239	245
4	153	291	298
5	181	343	351
6	209	395	404
7	237	447	457
M158A-1 POD			
0	48	95	97
1	76	148	151
2	104	201	205
3	132	254	259
4	160	307	313
5	188	360	367
6	215	413	421
7	243	465	475

ROCKETS @ 27.9 LBS. EACH

XM229 WARHEAD/M429 FUSE
(17 POUND WARHEAD WITH PROXIMITY FUSE)

M158 POD			
0	42	83	85
1	70	135	139
2	98	188	193
3	126	241	246
4	154	293	300
5	183	346	353
6	211	398	407
7	239	451	461
M158A-1 POD			
0	48	95	97
1	76	149	152
2	104	202	206
3	133	255	261
4	161	309	315
5	189	362	369
6	217	415	424
7	245	469	478

ROCKETS @ 28.2 LBS. EACH

Figure 6-3. Folding fin aerial rocket (2.75 inch) moment table (Sheet 12 of 19)

WDU-4A/A (FLECHETTE) WARHEAD
(9.3 POUND WARHEAD WITH A DECELERATION ACTUATED FUSE)

Rockets (Number)	Weight (Pounds) Pod & No. of Rockets Indicated	LOCATION ON WING	
		Inboard Moment/100	Outboard Moment/100
M157A POD			
0	57	113	115
1	77	151	154
2	97	190	194
3	118	228	233
4	138	266	272
5	158	305	311
6	178	343	351
7	198	382	390
M157B POD			
0	67	134	136
1	87	173	176
2	107	213	217
3	128	252	257
4	148	291	297
5	168	331	337
6	188	370	378
7	208	410	418
M158 POD			
0	42	83	85
1	62	122	125
2	82	161	164
3	102	200	204
4	122	238	244
5	143	277	284
6	163	316	323
7	183	355	363
M158A-1 POD			
0	48	95	97
1	68	135	138
2	88	174	178
3	109	214	218
4	129	253	258
5	149	293	298
6	169	332	339
7	189	371	379

ROCKETS @20.2 LBS. EACH

Figure 6-3. Folding fin aerial rocket (2.75 inch) moment table (Sheet 13 of 19)

WDU-4A/A (FLECHETTE) WARHEAD
(9.3 POUND WARHEAD WITH A DECELERATION ACTUATED FUSE)

M159B POD			
Rockets (Number)	Weight (Pounds) Pod & No. of Rockets Indicated	LOCATION ON WING	
		Inboard Moment/100	Outboard Moment/100
0	118	234	238
1	138	272	278
2	158	311	317
3	179	349	356
4	199	387	395
5	219	426	434
6	239	464	473
7	259	502	512
8	280	541	552
9	300	579	591
10	320	618	630
11	340	656	669
12	360	694	708
13	381	733	747
14	401	771	786
15	421	809	826
16	441	848	865
17	461	886	904
18	482	925	943
19	502	963	982
M159C POD PRIOR TO S/N 004040			
0	130	259	264
1	150	299	305
2	170	338	345
3	191	378	385
4	211	417	425
5	231	457	466
6	251	496	506
7	271	535	546
8	292	575	586
9	312	614	626
10	332	654	667
11	352	693	707
12	372	733	747
13	393	772	787
14	413	811	827
15	433	851	868
16	453	890	908
17	473	930	948
18	494	969	988
19	514	1009	1029

ROCKETS @20.2 LBS. EACH

Figure 6-3. Folding fin aerial rocket (2.75 inch) moment table (Sheet 14 of 19)

M151/M423 FUSE
(10 POUND WARHEAD WITH POINT DETONATING FUSE)

XM260 LAUNCHER			
Rockets (Number)	Weight (Pounds) Pod & No. of Rockets Indicated	LOCATION ON WING	
		Inboard Moment/100	Outboard Moment/100
0	35	70	71
1	56	111	113
2	76	151	154
3	97	142	196
4	117	233	237
5	138	274	279
6	158	314	320
7	179	355	362
XM261 LAUNCHER			
0	80	159	162
1	101	200	204
2	121	240	245
3	142	281	287
4	162	322	328
5	183	363	370
6	203	403	411
7	224	444	453
8	244	485	494
9	265	526	536
10	285	566	577
11	306	607	619
12	326	648	660
13	347	689	702
14	367	729	743
15	388	770	785
16	408	811	826
17	429	851	868
18	449	892	909
19	470	933	951

ROCKETS @ 20.5 LBS. EACH

Figure 6-3. Folding fin aerial rocket (2.75 inch) momemt table (Sheet 15 of 19)

M151 WARHEAD/M429 FUSE
(10 POUND WARHEAD WITH PROXIMITY FUSE)

XM260 LAUNCHER			
Rockets (Number)	Weight (Pounds) Pod & No. of Rockets Indicated	LOCATION ON WING	
		Inboard Moment/100	Outboard Moment/100
0	35	70	71
1	56	111	113
2	77	152	155
3	97	194	197
4	118	235	239
5	139	276	281
6	160	317	323
7	181	359	365
XM261 LAUNCHER			
0	80	159	162
1	101	200	204
2	122	241	246
3	142	283	288
4	163	324	330
5	184	365	372
6	205	406	414
7	226	448	456
8	246	489	499
9	267	530	541
10	288	571	583
11	309	613	625
12	333	654	667
13	350	695	709
14	371	736	751
15	392	778	793
16	413	819	835
17	434	860	877
18	454	901	919
19	475	943	961

ROCKETS @ 20.8 LBS. EACH

Figure 6-3. Folding fin aerial rocket (2.75 inch) moment table (Sheet 16 of 19)

M229/WARHEAD/M423 FUSE
(17 POUND WARHEAD WITH POINT DETONATING FUSE)

XM260 LAUNCHER			
Rockets (Number)	Weight (Pounds) Pod & No. of Rockets Indicated	LOCATION ON WING	
		Inboard Moment/100	Outboard Moment/100
0	35	70	71
1	63	124	126
2	91	177	181
3	119	231	235
4	147	285	290
5	175	339	345
6	202	392	400
7	230	446	455
XM261 LAUNCHER			
0	80	159	162
1	108	213	217
2	136	266	272
3	164	320	327
4	192	374	381
5	220	428	436
6	247	481	491
7	275	535	546
8	303	589	601
9	331	642	655
10	359	696	710
11	387	750	765
12	415	803	820
13	443	857	
14	471	911	
15	499	965	
16	526	1018	
17	554	1072	
18	582	1126	
19	610	1179	

ROCKETS @ 27.9 LBS. EACH

Figure 6-3 Folding fin aerial rocket (2.75 inch) moment table (Sheet 17 of 19)

M229/ WARHEAD/M429 FUSE
(17 POUND WARHEAD WITH PROXIMITY FUSE)

XM260 LAUNCHER			
Rockets (Number)	Weight (Pounds) Pod & No. of Rockets Indicated	LOCATION ON WING	
		Inboard Moment/100	Outboard Moment/100
0	35	70	71
1	63	124	126
2	91	178	182
3	120	232	237
4	148	286	292
5	176	341	348
6	204	395	403
7	232	449	458
XM261 LAUNCHER			
	80	159	162
1	108	213	217
2	136	268	273
3	165	322	328
4	193	376	383
5	221	430	438
6	249	484	494
7	277	538	549
8	306	593	604
9	334	647	659
10	362	701	715
11	390	755	770
12	418	809	825
13	447	863	
14	475	918	
15	503	972	
16	531	1026	
17	559	1080	
18	588	1134	
19	616	1188	

ROCKETS @ 28.2 LBS. EACH

Figure 67-3. Folding fin aerial rocket (2.75 inch) moment table (Sheet 18 of 19)

WDU-4A/A (FLECHETTE) WARHEAD
(9.3 WARHEAD WITH DECELERATION ACTUATED FUSE)

	XM260 LAUNCHER		
Rockets (Number)	Weight (Pounds) Pod & No. of Rockets Indicated	LOCATION ON WING	
		Inboard Moment/100	Outboard Moment/100
0	35	70	71
1	55	110	112
2	75	150	153
3	96	190	194
4	116	230	234
5	136	270	275
6	156	310	316
7	176	350	357
XM261 LAUNCHER			
	80	159	162
1	100	199	203
2	120	239	244
3	141	279	285
4	161	319	326
5	181	359	366
6	201	400	407
7	221	440	448
8	242	480	489
9	262	520	530
10	282	560	570
11	302	600	611
12	322	640	652
13	343	680	693
14	363	720	734
15	383	760	775
16	403	800	815
17	423	840	856
18	444	880	897
19	464	920	938

ROCKETS @ 20.2 LBS. EACH

Figure 6-3. Folding fin aerial rocket (2.75 inch) moment table (Sheet 19 of 19)

7.62 MM (LINKED) FOR M134		
Rounds (Number)	Weight (Lbs) For No. of Rounds Indicated	Moment/100
250	16	21
500	33	42
750	49	63
1000	65	83
1250	81	103
1500	98	123
1750	114	142
2000	130	161
2250	146	179
2500	163	197
2750	179	215
3000	195	232
3250	211	250
3500	228	266
3750	244	283
4000	260	299

7.62MM AMMO (LINKED) @ 0.065 LBS. EACH

40MM GRENADES FOR M129		
Rounds (Number)	Weight (Lbs) For No. of Rounds Indicated	Moment/100
25	19	21
50	38	43
75	57	64
100	76	86
125	95	107
150	114	129
175	133	150
200	152	172
225	171	193
250	190	215
265	201	228

GRENADES @ 0.76 LBS. EACH

7.62MM (LINKLESS) FOR M18

Rounds (Number)	Weight (Lbs) Pod & No. of Rounds Indicated	Inboard Wing Position (Only) Moment/100
0	245	481
100	251	492
200	256	503
300	262	514
400	267	526
500	273	537
600	278	548
700	284	559
800	289	570
900	295	581
1000	300	592
1100	306	603
1200	311	615
1300	317	626
1400	322	637
1500	328	648

7.62MM AMMO (LINKLESS) @ 0.055 LBS. EACH

POD WEIGHT WITHOUT GUN AND AMMO IS APPROXIMATELY 187 POUNDS

Figure 6-4. Ammunition moment table

WHITE SMOKE GRENADES IN M118 POD		
Number	Weight (Lbs) Pod & No. of Grenades Indicated	Outboard Location Only Moment/100
0	17	33
1	19	37
2	21	40
3	22	43
4	24	47
5	26	50
6	28	54
7	29	57
8	31	61
9	33	65
10	35	69
11	36	72
12	38	76

WHITE SMOKE GRENADES @ 1.75 LBS. EACH

COLORED SMOKE GRENADES IN M118 POD		
Number	Weight (Lbs) Pod & No. of Grenades Indicated	Outboard Location Only Moment/100
0	17	33
1	18	35
2	19	37
3	20	39
4	21	41
5	22	43
6	23	45
7	24	47
8	25	49
9	26	51
10	27	54
11	28	56
12	29	58

COLORED SMOKE GRENADES @ 1.0 LBS. EACH

Figure 6-5. Smoke grenade moment table

20MM AMMO FOR M35

ROUNDS	WEIGHT (LBS) FOR NO. OF ROUNDS INDICATED	LONGITUDINAL ARM	LONGITUDINAL MOMENT/100
25	17	214.4	36
50	34	210.0	70
75	50	195.0	98
100	67	183.4	123
125	84	183.9	154
150	101	189.3	190
175	117	193.5	227
200	134	195.9	263
225	151	197.2	297
250	168	198.1	332
275	184	198.6	366
300	201	198.6	399
325	218	198.4	432
350	235	198.0	464
375	251	197.3	496
400	268	196.6	527
425	285	195.8	558
450	302	194.9	588
475	318	193.7	616
500	335	192.7	646
525	352	191.6	674
550	369	190.4	702
575	385	189.4	730
600	402	188.6	758
625	419	188.3	789
650	436	187.6	817
675	452	187.4	848
700	469	187.3	878
725	486	187.3	910
750	503	187.5	942
775	519	187.8	975
800	536	188.1	1008
825	553	188.5	1042
850	570	189.0	1076
875	586	189.6	1112
900	603	190.2	1147
925	620	190.9	1183
950	637	191.7	1220

20MM AMMO @ 0.67 LBS. EA.

Figure 6-6. M35 20MM ammunition moment table

FUEL MOMENT

EXAMPLE

WANTED

MOMENT FOR KNOWN FUEL QUANTITY AND AMOUNT OF JP-4 FUEL IN GALLONS

KNOWN

FUEL QUANTITY = 1200 LB OF JP-4

METHOD

ENTER FUEL WEIGHT SCALE HERE
MOVE RIGHT TO INTERSECT JP-4 LINE
INTERPOLATE FOR FUEL QUANTITY IN GALLONS,
READ FUEL = 184.5 LB OF JP-4
MOVE DOWN,
READ MOMENTS = 244,000 IN-LBS

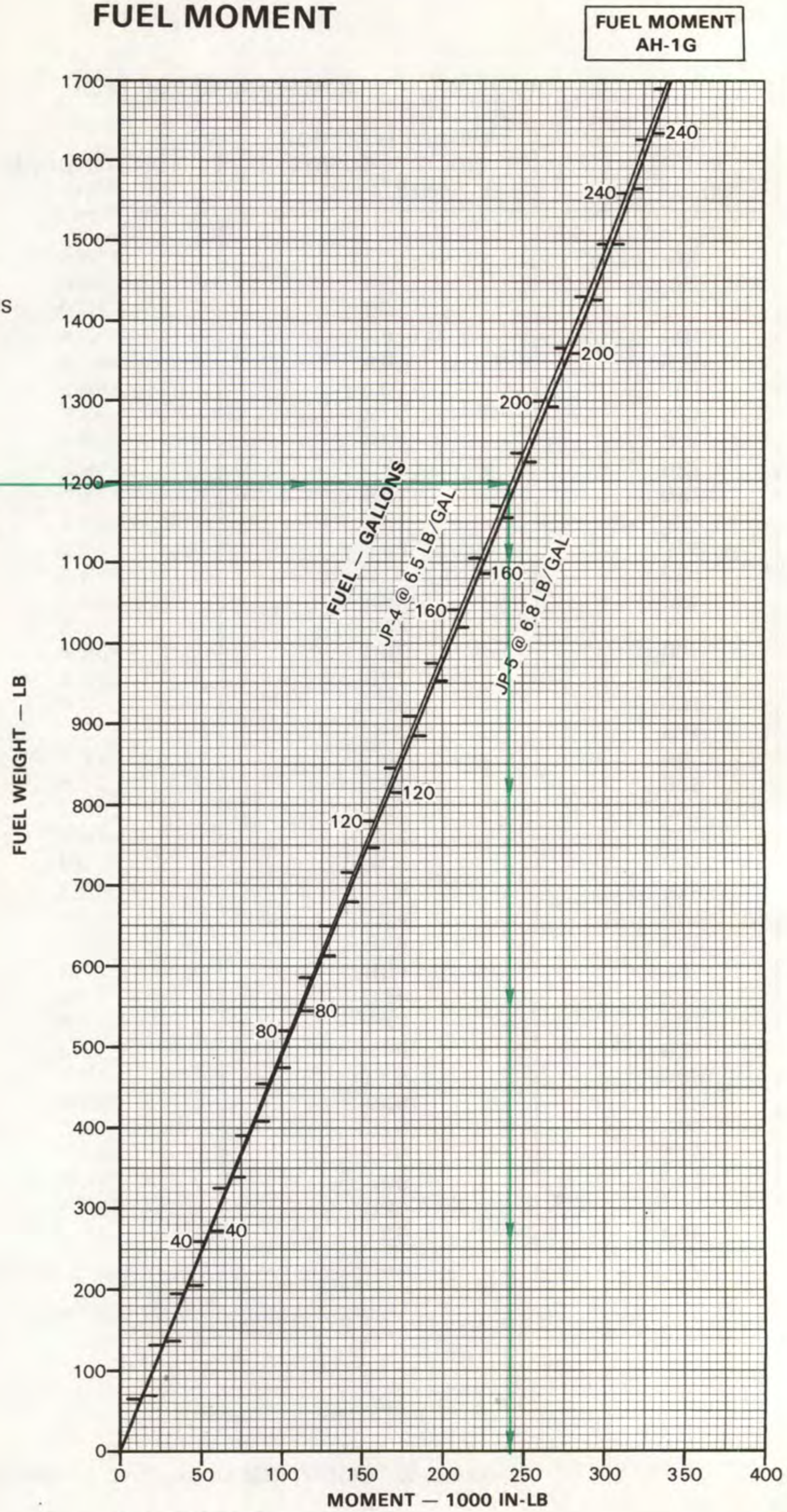


Figure 6-7 Fuel moment chart

LOADING LIMITS

EXAMPLE

WANTED

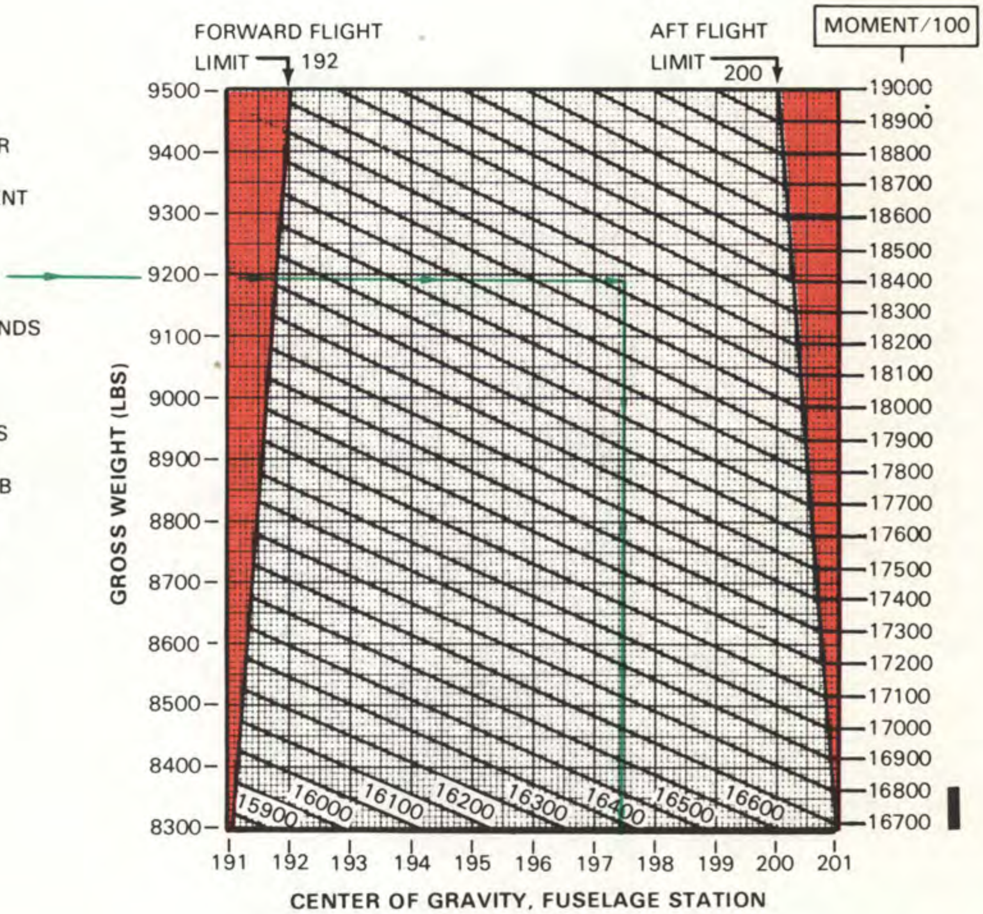
DETERMINE APPROXIMATE CENTER OF GRAVITY FOR KNOWN WEIGHT AND MOMENT

KNOWN

GROSS WEIGHT = 9200 POUNDS
MOMENT/100 = 18150 INCH-POUNDS

METHOD

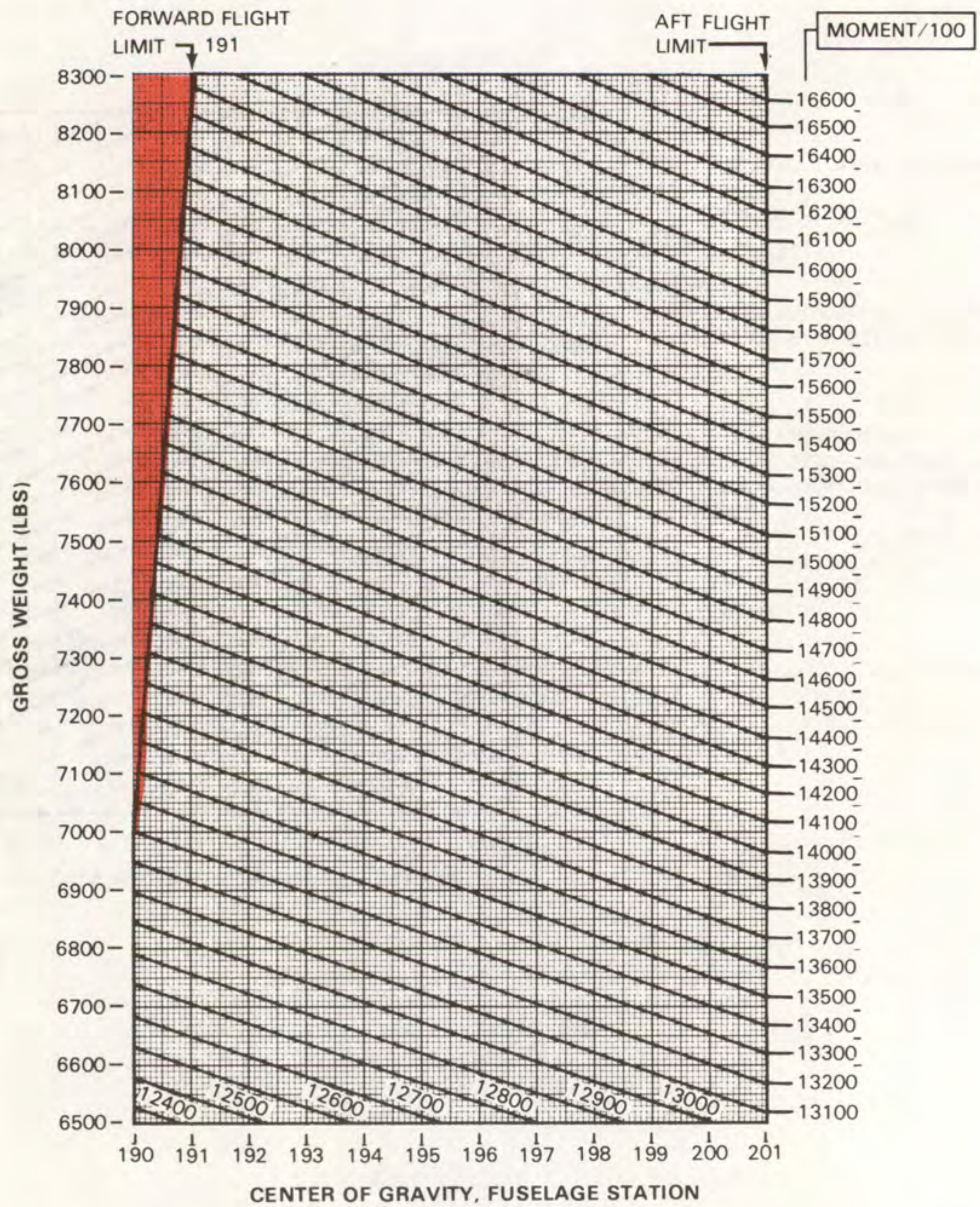
MOVE RIGHT FROM 9200 POUNDS TO APPROXIMATE MIDPOINT BETWEEN 18100 AND 18200 IN-LB DIAGONAL LINES.
FROM THIS POINT MOVE DOWN TO READ 197.4 ON CENTER OF GRAVITY SCALE.



209900-489-1F

Figure 6-8. Center of gravity limit chart (Sheet 1 of 2)

CG LIMITS



209900-489-2E

Figure 6-8. Center of gravity limit chart (Sheet 2 of 2)

SECTION VIII. DD FORM 365

6-11. DD Form 365A — Basic Weight Check List.

The form is initially prepared by the manufacturer before the helicopter is delivered. The form is a tabulation of equipment that is, or may be installed and for which provision for fixed stowage has been made in a definite location. The form gives the weight, arm, and moment/100 of individual items for use in correcting the basic weight and moment on DD Form 365C as changes are made in this equipment. Figure 6-8 lists selected items from the DD Form 365A.

6-12. DD Form 365C — Basic Weight and Balance Record.

The form is initially prepared by the manufacturer at time of delivery of the helicopter. The form is a continuous history of the basic weight and moment resulting from structural and equipment changes. At all times the last entry is considered current weight and balance status of the basic helicopter. Figure 6-10 shows a sample DD Form 365C.

6-13. DD Form 365F — Weight and Balance Clearance Form F.

a. General. The form is a summary of actual disposition of the load in the helicopter. It records the balance status of the helicopter, step-by-step. It serves as a worksheet on which to record weight and balance calculations, and any corrections that must be made to ensure that the helicopter is within weight and cg limits. The form is required only when the loading is such as to seriously effect the flying characteristics and safety of the helicopter and in all cases where alternate loading is employed.

b. Form Preparation. Specific instructions for filling out the form is given in the following paragraphs. Figure 6-11 shows the results of the instructions.

NOTE

Reference 1, 2, etc., are references to item 1, 2, etc., on DD Form 365F.

(1) Inspect the necessary identifying information at the top of the form.

NOTE

Enter moment/100 values from figures within this chapter throughout the form.

(2) Reference 1 — Enter the helicopter basic weight and moment/100. Obtain these figures from the last entry on DD Form 365C — 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 in figure 6-1 (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 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/100 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 weight and moment/100 figures opposite reference 10 on figure 6-11 to ascertain that the cg is within the allowable limits. ENTER CG RESTRICTIONS IN LIMITATIONS TABLE.

(13) Reference 11 — if changes in amount of distribution of load are required, indicate necessary adjustments by proper entries in the "Corrections" table in the 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".

(d) Subtract the smaller from the larger of the totals and enter the difference (with applicable plus or minus 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 figure 6-10 determine the takeoff cg position. Enter this figure in the space provided opposite. "Takeoff CG". ENTER CG RESTRICTIONS IN LIMITATIONS TABLE.

(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/100 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 DD Form 365F.

EXAMPLE	GAL	WEIGHT	MOMENT
Fuel at takeoff	206	1400	2900
Fuel estimated to remain at landing		200	400

EXAMPLE	WEIGHT	MOMENT
Fuel expended (enter in section 14 of Form 365F)	1200	2500

(17) Reference 15 — Enter the difference in weights and moment/100 between reference 12 and the total of reference 14.

(18) Reference 16 — By again referring to figure 6-8, determine the estimated landing cg position. Enter the figure opposite "ESTIMATED LANDING CG".

(19) The necessary signatures shall appear at the bottom of the form.

Armament	Weight	Arm	Moment/100
Turret	130	76	98.4
Electronic Box	13	66	8.4
Pilot Sight	6	110	7.0
Gunner Sight	20	73	14.2
M134			
Gun	58	72	41.8
Dynamic Brake	10	91	9.2
Chute	5	100	4.8
Drum	63	119	75.1
M-129 Grenade Launcher			
Gun	52	74	40.9
Gearbox	9	78	7.1
Dynamic Brake	10	91	8.9
Chute	8	100	7.7
Drum	75	115	86.3
M35 Gun Instl			
Gun Assy	242	197	474.5
Chute — Right	8	157	12.6
Chute — Left	8	157	12.6
Chute — Crossover	17	145	23.9
Chute — Gun Feed	8	210	15.8
Ammo Box — L.H.	47	192	89.3
Ammo Box — R.H.	45	192	85.8
Wing Mount	14	198	27.7
Ejector Rack			
Outboard (Ea.)	13	201	26.1
Inboard (Ea.)	15	193	29.0
Outboard Incl. Instl. (Ea.)	18	198	35.2
Inboard Incl. Instl. (Ea.)	29	194	57.0

Armor Plate	Weight	Arm	Moment/100
Gunner	18	85	14.9
Seat Bottom	18	85	14.9
Lower Left Side	8	86	6.9
Lower Right Side	8	86	7.1
Door	4	87	3.3
Upper Left Side	7	91	6.6
Upper Right Side	12	91	10.6
Seat Back	29	97	28.1
Pilot			
Lower Left Side	6	138	8.8
Loser Right Side	7	138	9.0
Seat	48	145	70.0
Upper Left Side	14	145	20.4
Upper Right Side	14	145	19.6
Engine			
Left Side	20	241	48.2
Right Side	20	241	48.2

Figure 6-9. DD Form 365A selected items

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 & AN 01-1B-40

AIRPLANE MODEL: AH-1G | SERIAL NO.: SAMPLE | PAGE NO.:

DATE	ITEM NO.		DESCRIPTION OF ARTICLE OR MODIFICATION	WEIGHT CHANGE						RUNNING TOTAL BASIC AIRPLANE		
				ADDED (+)			REMOVED (−)					
	IN	OUT		WEIGHT	ARM	MOMENT[1] / 100	WEIGHT	ARM	MOMENT[1] / 100	WEIGHT	MOMENT[1] / 100	~~INDEX[2]~~ CG
4-10-76			BASIC HELICOPTER							6900	13952	202.2
5-25-76		B-1	ECU				26	171	44.2			
	✓		ECU-TEST, HEAVY DUTY	35	173	60.6						
		B-7	PARTICLE SEPARATOR				19	224	42.6			
	C-3		UNIT, TSEC/KY-28	17	310	52.7						
	C-4		TEST SET, TS-1843/APX	3	314	9.4				6910	13988	202.4

SAMPLE 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.

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209900-487C

Figure 6-10. DD Form 365C Sample

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
6-1-76	AH-1G		
MISSION/TR P/FLIGHT/NO.	**SERIAL NO.**	**TO**	**PILOT**
	SAMPLE		

REMARKS

REF	ITEM	WEIGHT	[1] INDEX OR MOM/
1	BASIC AIRPLANE *(From Chart C)*	6067	12309
2	OIL (2.9 *Gal.*)	24	57
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	150

SAMPLE ONLY

COMPUTER PLATE I.O. *(If used)*

Pertinent instructions to the pilot for shifting load and crew during takeoff and landing should be noted above.

REF	ITEM			WEIGHT	[1] INDEX OR MOM/
4	OPERATING WEIGHT			6461	12773
5	AMMUNITION: COMPT.	ROUNDS	CALIBER		
	Ammo	4000	7.62mm	260	299
	Ammo	250	40mm	190	215
6	BOMBS, ROCKETS, ETC.: FORWARD				
	M157B PODS (2)				
	AFT WITH 229/423 (14)			524	1028
	EXTERNAL				
	ROCKETS				
7	FUEL: BUILT IN (206 *Gal.*)			1400	2900
	BOMB BAY (*Gal.*)				
	EXTERNAL (*Gal.*)				
8	WATER INJ. FLUID (*Gal.*)				
9	JATO OR RATO				
10	TAKEOFF CONDITION *(Uncorrected)*			8835	17215
11	CORRECTIONS *(If required)*				
12	TAKEOFF CONDITION *(Corrected)*			8835	17215
13	TAKEOFF C. G. IN % M. A. C. OR IN.			194.9	
14	LESS EXPENDABLES: JATO OR RATO				
	~~BOMBS~~ 40mm			190	215
	AMMUNITION 7.62mm			260	299
	FUEL (200#; 44"#)			1200	2856
15	ESTIMATED LANDING CONDITION			7185	13845
16	ESTIMATED LANDING C. G. IN % M. A. C. OR IN.			192.7	

CORRECTIONS *(Ref. 11)*

COMPT.	ITEM	CHANGES (+ or −) WEIGHT	[1] INDEX OR MOM/
	TOTAL WEIGHT REMOVED	−	−
	TOTAL WEIGHT ADDED	+	+
	NET DIFFERENCE *(Ref. 11)*		

LIMITATIONS

[3] GROSS WT. TAKEOFF *(lb.)*	[3] GROSS WT. LANDING *(lb.)*
9500	9500

	FROM	TO (~~% M.A.C.~~ or IN.)
[3] PERMISSIBLE C. G. TAKEOFF	191.4	200.5
[4] PERMISSIBLE C. G. LANDING	190.2	201.0

COMPUTED BY *(Signature)*

WEIGHT AND BALANCE AUTHORITY *(Signature)*

PILOT *(Signature)*

[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).*

DD FORM 1 SEPT 54 365F

Figure 6-11. Weight and balance clearance form F

CHAPTER 7

PERFORMANCE DATA

SECTION I. INTRODUCTION

7-1. Purpose.

The purpose of this chapter is to provide the best available performance data for the AH-1G helicopter. Regular use of this information will enable you to receive maximum safe utilization from the aircraft. Although maximum performance is not always required, regular use of this chapter is recommended for the following reasons.

a. Knowledge of your performance margin will allow you to make better decisions when unexpected conditions or alternate missions are encountered.

b. Situations requiring maximum performance will be more readily recognized.

c. Familiarity with the data will allow performance to be computed more easily and quickly.

d. Experience will be gained in accurately estimating the effects of variables for which data are not presented.

NOTE

The information provided in this chapter is primarily intended for mission planning and is most useful when planning operations in unfamiliar areas or at extreme conditions. The data may also be used inflight, to establish unit or area standing operating procedures, and to inform ground commanders of performance/risk tradeoffs.

7-2. Chapter 7 Index.

The following index contains a list of the sections and their titles, the figure numbers, subjects and page numbers of each performance data chart contained in this chapter.

INDEX

INDEX (Cont)

7-3. General.

The data presented covers the maximum range of conditions and performance that can reasonably be expected. In each area of performance, the effects of altitude, temperature, gross weight, and other parameters relating to that phase of flight are presented. In addition to the presented data, your judgment and experience will be necessary to accurately obtain performance under a given set of circumstances. The conditions for the data are listed under the title of each chart. The effects of different conditions are discussed in the text accompanying each phase of performance. Where practical, data are presented at conservative conditions. However, NO GENERAL CONSERVATISM HAS BEEN APPLIED. All performance data presented are within the applicable limits of the aircraft.

7-4. Limits.

Applicable limits are shown on the charts as red lines. Performance generally deteriorates rapidly beyond limits. If limits are exceeded, minimize the amount and time. Enter the maximum value and time above limits on DA Form 2408-13 so proper maintenance action can be taken.

7-5. Use of Charts.

a. Chart Explanation. The first page of each section describes the chart(s) and explains its uses.

b. Color Coding. Chart color codes are used as follows.

(1) Green is used for example guidelines.

(2) Red is used for limit lines.

(3) Yellow is used for precautionary or time-limited operation.

c. Reading the Charts. The primary use of each chart is given in an example and a green guideline is provided to help you follow the route through the chart. The use of a straight edge (ruler or page edge) and a hard fine point pencil is recommended to avoid cumulative errors. The majority of the charts provide a standard pattern for use as follows: enter first variable on top left scale, move right to the second variable, reflect down at right angles to the third variable, reflect left at right angles to the fourth variable, reflect down, etc. until the final variable is read out at the final scale. In addition to the primary use, other uses of each chart are explained in the text accompanying each set of performance charts. Colored registration blocks located at the bottom and top of each chart are used to determine if slippage has occurred during printing. If slippage has occurred, refer to chapter 5 for correct operating limits.

NOTE

An example of an auxiliary use of the charts referenced above is as follows: Although the hover chart is primarily arranged to find torque required to hover, by entering torque available as torque required, maximum skid height for hover can also be found. In general, any single variable can be found if all others are known. Also, the tradeoffs between two variables can be found. For example, at a given pressure altitude, you can find the maximum gross weight capability as free air temperature changes.

7-6. Data Basis.

The type of data used is indicated at the bottom of each performance chart under DATA BASIS. The applicable report and date of the data are also given. The data provided generally is based on one of four categories:

a. Flight Test Data. Data obtained by flight test of the aircraft by experienced flight test personnel at precise conditions using sensitive calibrated instruments.

b. Derived From Flight Test. Flight test data obtained on a similar rather than the same aircraft and series. Generally small corrections will have been made.

c. Calculated Data. Data based on tests, but not on flight test of the complete aircraft.

d. Estimated Data. Data based on estimates having aerodynamic theory or other means but not verified by flight test.

7-7. Specific Conditions.

The data presented are accurate only for specific conditions listed under the title of each chart. Variables for which data are not presented, but which may affect that phase of performance, are discussed in the text. Where data are available or reasonable estimates can be made, the amount that each variable affects performance will be given.

7-8. General Conditions.

In addition to the specific conditions, the following general conditions are applicable to the performance data.

a. Rigging. All airframe and engine control are assumed to be rigged within allowable tolerances.

b. Pilot Technique. Normal pilot technique is assumed. Control movements should be smooth and continuous.

c. Aircraft Variation. Variations in performance between individual aircraft are known to exist; however, they are considered to be small and cannot be individually accounted for.

d. Instrument Variation. The data shown in the performance charts do not account for instrument inaccuracies or malfunctions.

7-9. Performance Discrepancies.

Regular use of this chapter will allow you to monitor instruments and other aircraft systems for malfunction, by comparing actual performance with planned performance. Knowledge will also be gained concerning the effects of variables for which data are not provided, thereby increasing the accuracy of performance predictions.

7-10. Definitions of Abbreviations.

a. Unless otherwise indicated in Appendix B, abbreviations and symbols used in this manual conform to those established in Military Standard MIL-STD-12, which is periodically revised to reflect current changes in abbreviations usage. Accordingly, it may be noted that certain previously established definitions have been replaced by more current abbreviations and symbols.

b. Capitalization and punctuation of abbreviations varies, depending upon the context in which they are used. In general, lower case abbreviations are used in text material, whereas abbreviations used in charts and illustrations appear in full capital letters. Periods do not usually follow abbreviations; however, periods are used with abbreviations that could be mistaken for whole words if the period were omitted.

SECTION II. PERFORMANCE PLANNING

7-11. Purpose.

This section of this manual contains a performance planning card, a temperature conversion chart, and information needed for use of the performance planning card.

7-12. Performance Planning Card.

This card (figure 7-1) is provided to assist you in recording data applicable to the mission and may be reproduced at the local level.

7-13. Performing Planning Sequence.

The following sequence is provided to aid you in preparing the performance planning card.

a. Pressure Altitudes. Obtain departure point pressure altitude by setting 29.92 in. hg at the altimeter barometric pressure scale and reading pressure altitude from outer scale pointers. Record in space provided under departure heading. Estimate pressure altitudes for climb, cruise and arrival by adding the altitude increase above departure elevation; (if destination is below departure elevation, subtract difference in elevation). Record pressure altitudes in space provided under climb, cruise, and arrival headings.

b. Free Air Temperatures. Obtain the local free air temperature and record in space provided under departure heading. Estimate FAT for climb, cruise, and arrival by subtracting 2 degrees C for each 1000 feet altitude increase above departure point; (if destination is below departure elevation, add 2°C for each 1000 feet difference in elevation). Record temperature in space provided under climb, cruise and arrival headings.

NOTE

If required, see figure 7-2 for temperature conversion chart (Fahrenheit to Celsius, or vice versa).

c. Departure.

(1) Calculate and record the departure gross weight. Refer to chapter 6.

(2) Determine and record torque available. See figure 7-3.

(3) Determine and record torque required to hover at desired skid height. See figure 7-5.

(4) Determine if takeoff to hover can be made by comparing torque required for desired skid height with maximum torque available. For takeoff, torque available must be greater than torque required.

(5) Determine and record obstacle height.

(6) Determine and record distance to obstacle.

(7) Select and record the airspeed that will allow the helicopter to safely clear obstacle. See figure 7-6.

d. Climb.

(1) Conservatively, using departure gross weight, determine and record speed for maximum rate of climb, IAS and the torque pressure for cruise at this speed. See figures 7-7 (sheets 1 through 23) using pressure altitude and FAT previously determined.

(2) Record maximum torque pressure available and maximum fuel flow. See figures 7-7 (sheets 1 through 23).

(3) Subtract level flight torque required from maximum torque available to obtain change in excess torque for climb. Record this value.

(4) Determine rate of climb from figure 7-9.

e. Cruise.

(1) Select and record cruise speed (TAS).

(2) Calculate and record gross weight at beginning of cruise segment or average weight during cruise segment.

(3) Using pressure altitude and FAT previously determined, from figures 7-7 (sheets 1 through 23) determine and record the following:

(a) Cruise speed (IAS).

(b) Cruise torque pressure.

(c) Cruise fuel flow.

f. Arrival.

(1) Calculate and record gross weight.

(2) Select and record approach airspeed (IAS).

(3) Using the method described for departure in steps c(2), (3) and (4) above, determine whether a hovering approach to landing can be accomplished. Torque available for landing must exceed torque required. See figures 7-3 and 7-6.

NOTE

Performance information obtained may make it necessary to alter gross weight, airspeed, altitude, or other variables in order to safely operate the aircraft. If any of these variables are changed on one chart, corresponding changes will be necessary on all other charts where that information is used.

PERFORMANCE PLANNING

DEPARTURE

PRESS ALT ______________ FT FAT ________ °C GRWT ____________ LB

MAX TORQUE AVAILABLE ____________ PSI

TORQUE REQUIRED TO HOVER _______ FT AT ______ PSI

TORQUE REQUIRED TO HOVER 5 FT AT ______ PSI

OBSTACLE CLEARANCE

OBSTACLE HEIGHT ________ FT DISTANCE ________ FT

CLIMBOUT IAS ____________ KNOTS

CLIMB

PRESS ALT ______________ FT FAT ________ °C GRWT ____________ LB

MAX R/C IAS ____________ KNOTS MAX TORQUE AVAILABLE _________ PSI

LEVEL FLIGHT TORQUE AT R/C IAS ________ PSI

CHANGE IN TORQUE FOR CLIMB ___ PSI (MAX TORQUE AVAIL — LEVEL FLT TORQUE)

RATE OF CLIMB _________ FT/MIN FUEL FLOW _________ LB/HR

CRUISE

PRESS ALT ______________ FT FAT ________ °C GRWT ____________ LB

CRUISE SPEED, TAS _________ KNOTS CRUISE SPEED, IAS ________ KNOTS

CRUISE TORQUE ____________ PSI CRUISE FUEL FLOW _________ LB/HR

ARRIVAL

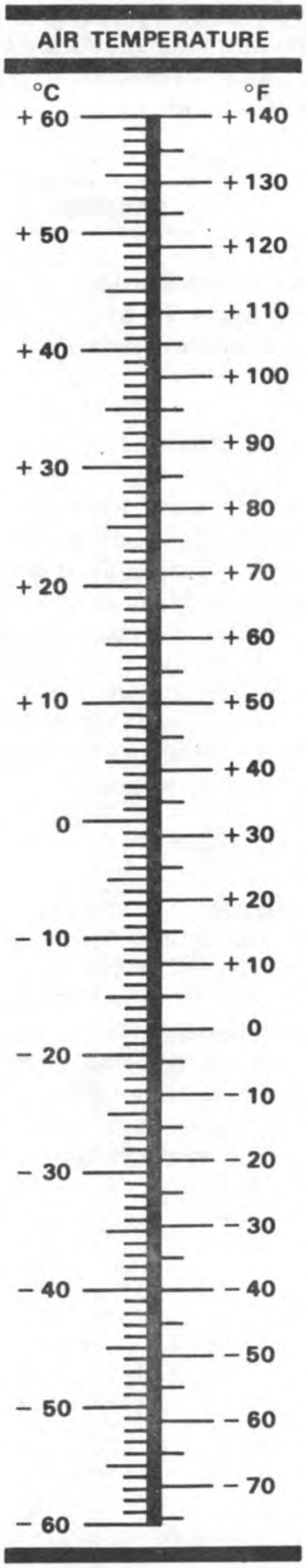
PRESS ALT ______________ FT FAT ________ °C GRWT ____________ LB

MAX TORQUE AVAILABLE ____________ PSI

TORQUE REQUIRED TO HOVER _______ FT AT ______ PSI

Figure 7-1. Performance planning card

TEMPERATURE CONVERSION CHART



CENTIGRADE		FAHRENHEIT
-50C°	....	-58F°
-45C°	....	-49F°
-40C°	....	-40F°
-35C°	....	-31F°
-30C°	....	-22F°
-25C°	....	-13F°
-20C°	....	-4F°
-15C°	....	+5F°
-10C°	....	+14F°
-5C°	....	+23F°
0C°	....	+32F°
+5C°	....	+41F°
+10C°	....	+50F°
+15C°	....	+59F°
+20C°	....	+68F°
+25C°	....	+77F°
+30C°	....	+86F°
+35C°	....	+95F°
+40C°	....	+104F°
+45C°	....	+113F°
+50C°	....	+122F°

Figure 7-2. Temperature conversion chart

SECTION III. TORQUE AVAILABLE

7-14. Description.

The torque available charts show the effects of altitude and temperature on engine torque.

7-15. Chart Differences.

Both pressure altitude and FAT affect engine power production. Figures 7-3 and 7-4 show power available data at 30 minute power and maximum continuous power ratings in terms of the allowable torque as recorded by the torquemeter (PSI).

Note that the power output capability of the T53-L-13B engine can exceed the transmission structural limit (50 PSI) under certain conditions.

CAUTION

The power output capability of the T53-L-13B engine can exceed the transmission structural limit (50 PSI) under certain conditions.

a. Figure 7-3 (sheet 1) is applicable for maximum power, engine air de-ice off and ECU off, 30 minute operation.

b. Figure 7-3 (sheet 2) is applicable for maximum power, engine air de-ice on and ECU off, 30 minute operation.

c. Figure 7-4 (sheet 1) is applicable for maximum continuous power, engine air de-ice off, and ECU off.

d. Figure 7-4 (sheet 2) is applicable for maximum continuous power, engine air de-ice off and ECU on.

e. Figure 7-4 (sheet 3) is applicable for maximum continuous power, engine air de-ice on, and ECU off.

f. Prolonged IGE hover may increase engine inlet temperature as much as 10°C, therefore,a higher FAT must be used to correct for the increase under this condition.

CAUTION

Engine torque available values in figure 7-3 and figure 7-4 are in error. Decrease engine torque available by 2 PSI.

7-16. Use of Charts.

The primary use of the charts is illustrated by the examples. In general, to determine the maximum power available, it is necessary to know the pressure altitude, temperature, and the aircraft calibration factor. By entering the upper left side of the chart at the known pressure altitude, moving right to the known temperature, then straight down to the calibrating factor line, then move left to the indicated torque scale and read an indicated torque available.

7-17. Conditions.

Charts (figure 7-3 and 7-4) are based upon speeds at 324 rotor 6600 engine rpm with grade JP-4 fuel. The use of aviation gasoline will not influence engine power. Fuel grade of JP-5 will yield the same nautical miles per pound of fuel and being 6.8 pounds per gallon will only result in increased fuel weight per gallon. Because JP-4 and JP-5 have the same energy value per pound, then JP-5 fuel will increase range by almost 5 percent . per gallon of fuel.

MAXIMUM TORQUE AVAILABLE (30 MINUTE OPERATION)

MAXIMUM TORQUE AH-1G T53-L-13B

ENGINE AIR DE-ICE — OFF, ECU OFF

324 ROTOR/6600 ENGINE RPM, JP-4 FUEL

EXAMPLE

WANTED

INDICATED TORQUE
CALIBRATED TORQUE

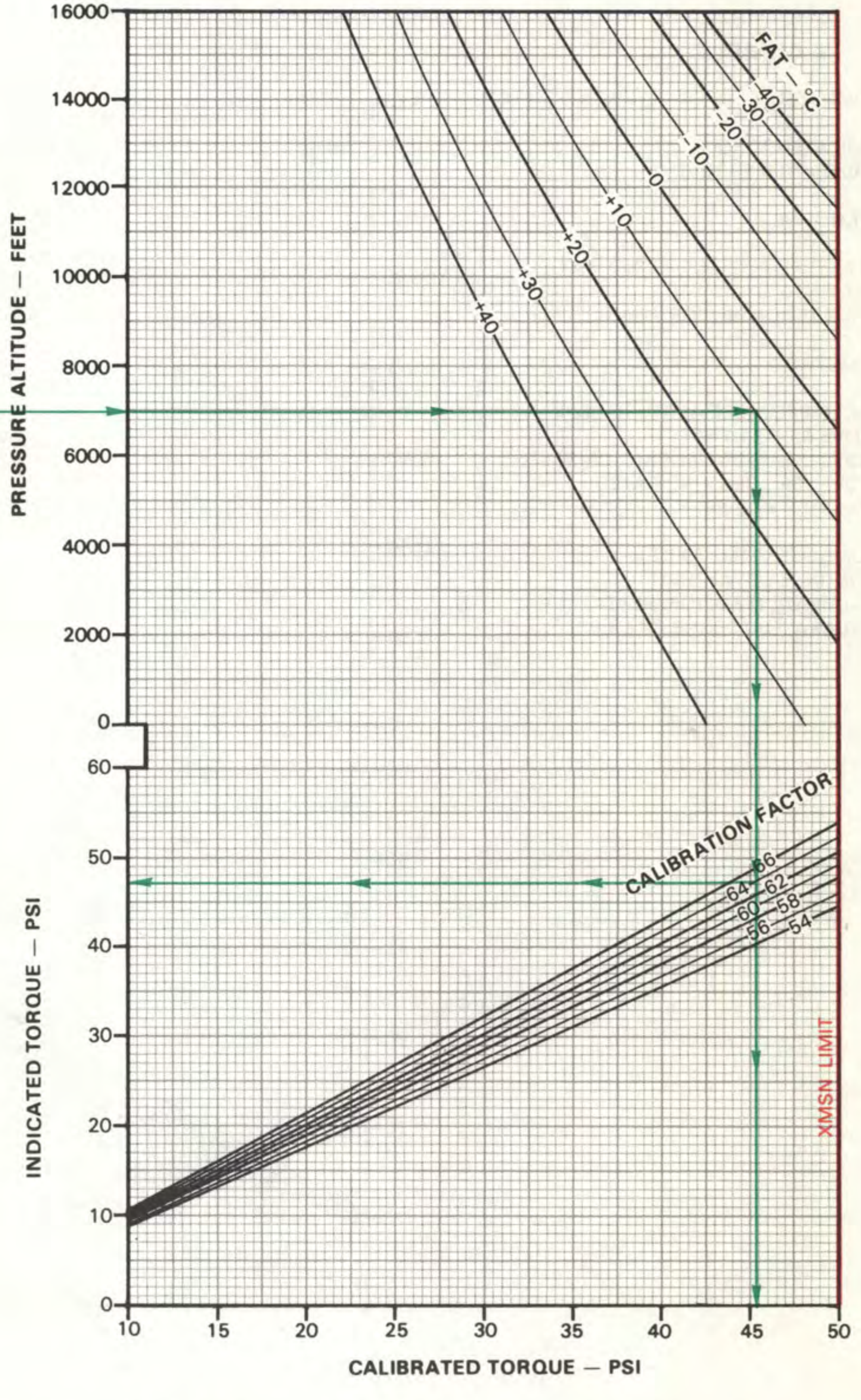
KNOWN

PRESSURE ALTITUDE = 7000 FEET
FAT = + 10°C
CALIBRATION FACTOR = 64

METHOD

ENTER PRESSURE ALTITUDE HERE
MOVE RIGHT TO FAT
MOVE DOWN TO CALIBRATION FACTOR
MOVE LEFT, READ INDICATED TORQUE = 45.2 PSI

FOR CALIBRATED TORQUE CONTINUE DOWN THRU CALIBRATION FACTOR, READ CALIBRATED TORQUE = 47.2 PSI



DATA BASIS: CALCULATED FROM MODEL SPEC 104.33, SEPT 1964, CORRECTED FOR INSTALLATION LOSSES BASED ON FLIGHT TEST, USAASTA 66-06, APRIL 1970

Figure 7-3. Maximum torque available (30 minute operation) chart (Sheet 1 of 2)

MAXIMUM TORQUE AVAILABLE (30 MINUTE OPERATION)

MAXIMUM TORQUE AH-1G T53-L-13B

ENGINE AIR DE-ICE — ON, ECU OFF
324 ROTOR/6600 ENGINE RPM, JP-4 FUEL

EXAMPLE

WANTED

INDICATED TORQUE
CALIBRATED TORQUE

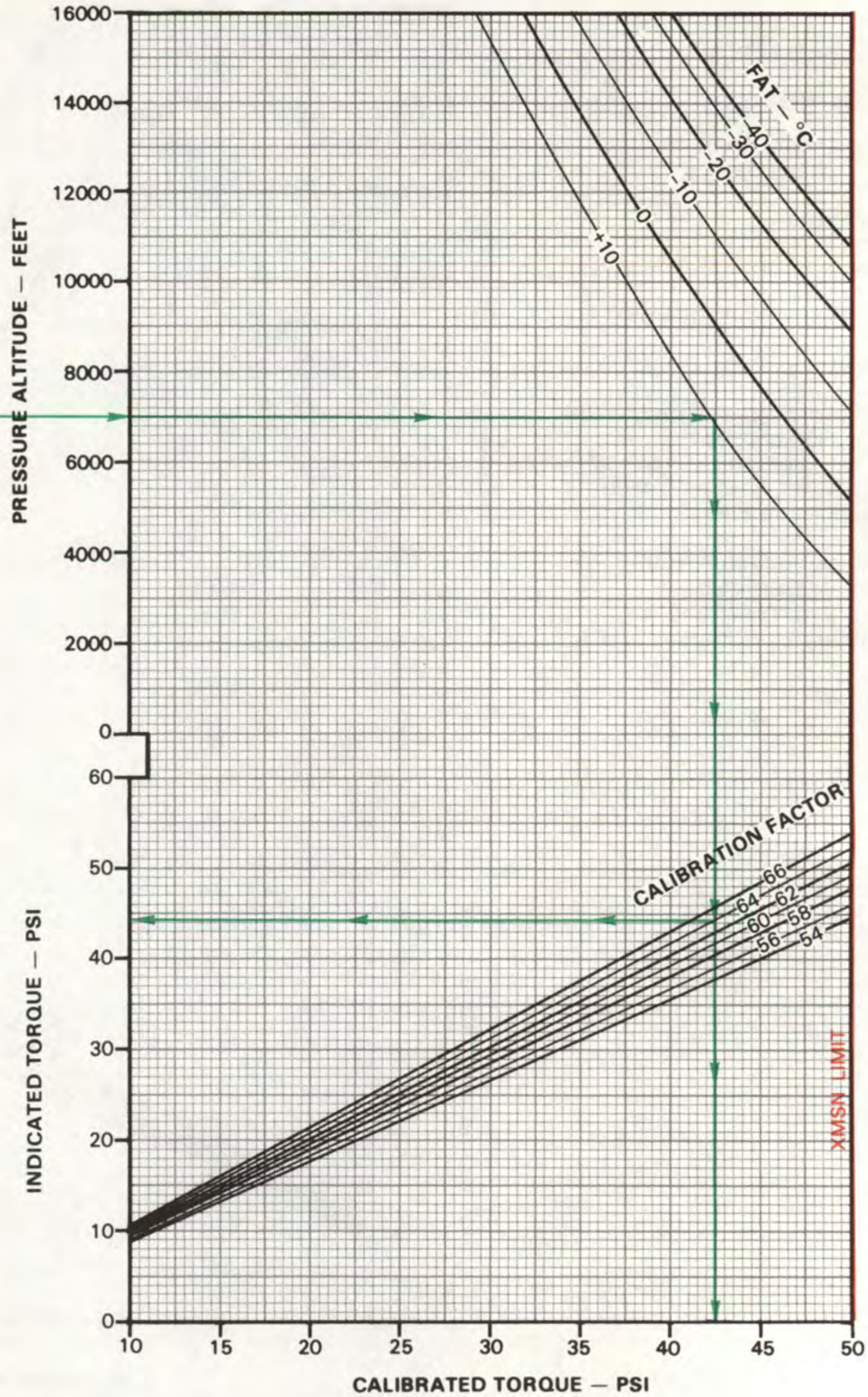
KNOWN

PRESSURE ALTITUDE = 7000 FEET
FAT = + 10°C
CALIBRATION FACTOR = 64

METHOD

ENTER PRESSURE ALTITUDE HERE
MOVE RIGHT TO FAT
MOVE DOWN TO CALIBRATION FACTOR
MOVE LEFT, READ INDICATED TORQUE = 44.2 PSI

FOR CALIBRATED TORQUE CONTINUE DOWN THRU CALIBRATION FACTOR, READ CALIBRATED TORQUE = 42.3 PSI



DATA BASIS: CALCULATED FROM MODEL SPEC 104.33, SEPT 1964, CORRECTED FOR INSTALLATION LOSSES BASED ON FLIGHT TEST, USAASTA 66-06, APRIL 1970

Figure 7-3. Maximum torque available (30 minute operation) chart (Sheet 2 of 2)

TORQUE AVAILABLE (CONTINUOUS OPERATION)

TORQUE AVAILABLE AH-1G T53-L-13B

ENGINE AIR DE-ICE — OFF, ECU OFF
324 ROTOR/6600 ENGINE RPM, JP-4 FUEL

EXAMPLE

WANTED

INDICATED TORQUE
CALIBRATED TORQUE

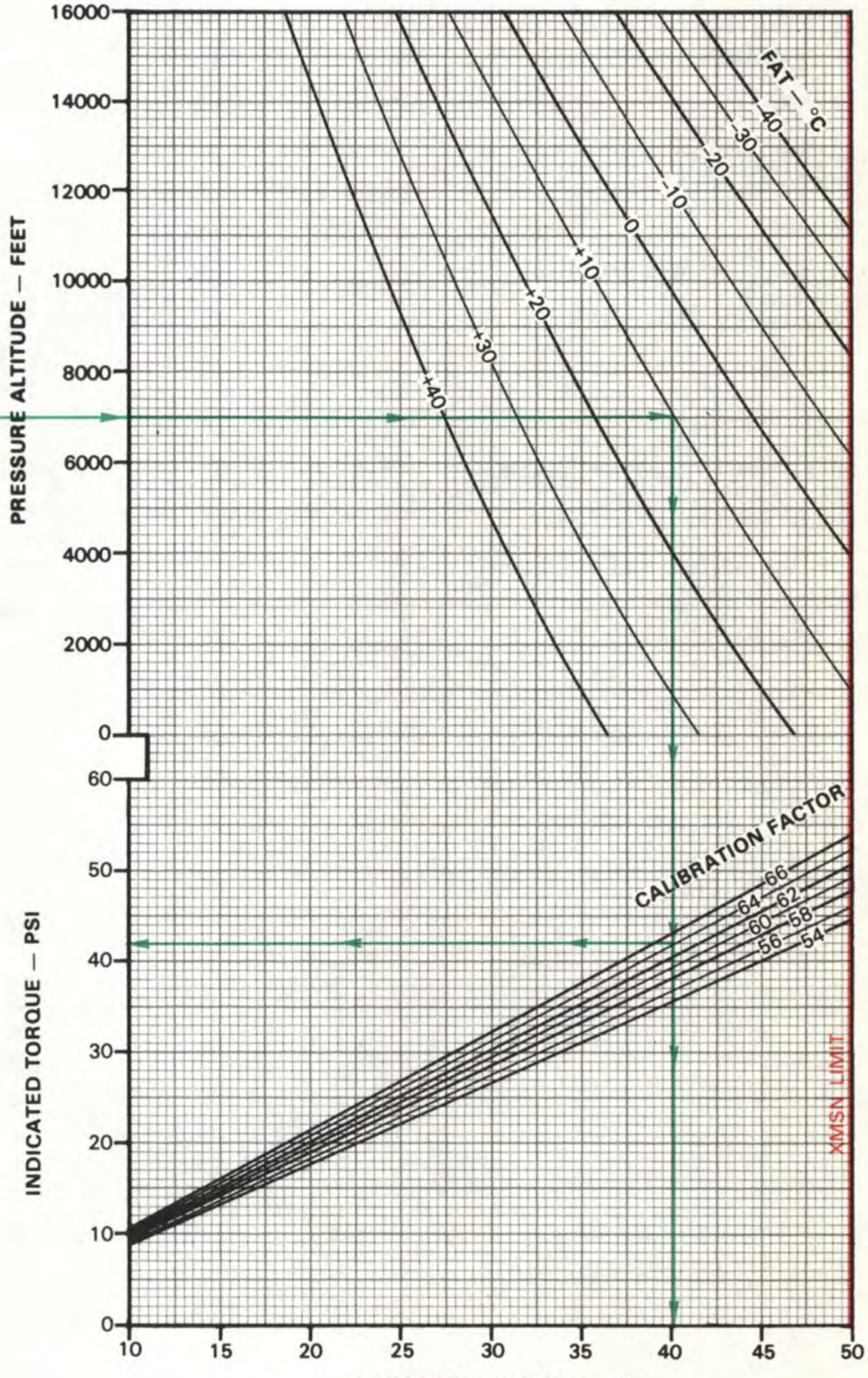
KNOWN

PRESSURE ALTITUDE = 7000 FEET
FAT = + 10°C
CALIBRATION FACTOR = 64

METHOD

ENTER PRESSURE ALTITUDE HERE
MOVE RIGHT TO FAT
MOVE DOWN TO CALIBRATION FACTOR
MOVE LEFT, READ INDICATED TORQUE = 42.0 PSI

FOR CALIBRATED TORQUE CONTINUE DOWN THRU CALIBRATION FACTOR, READ CALIBRATED TORQUE = 40.2 PSI



DATA BASIS: CALCULATED FROM MODEL SPEC 104.33, SEPT 1964, CORRECTED FOR INSTALLATION LOSSES BASED ON FLIGHT TEST, USAASTA 66-06, APRIL 1970

Figure 7-4. Torque available (continuous operation) chart (Sheet 1 of 3)

TORQUE AVAILABLE (CONTINUOUS OPERATION)

ENGINE AIR DE-ICE — OFF, ECU ON
324 ROTOR/6600 ENGINE RPM, JP-4 FUEL

TORQUE AVAILABLE
AH-1G
T53-L-13B

EXAMPLE

WANTED

INDICATED TORQUE
CALIBRATED TORQUE

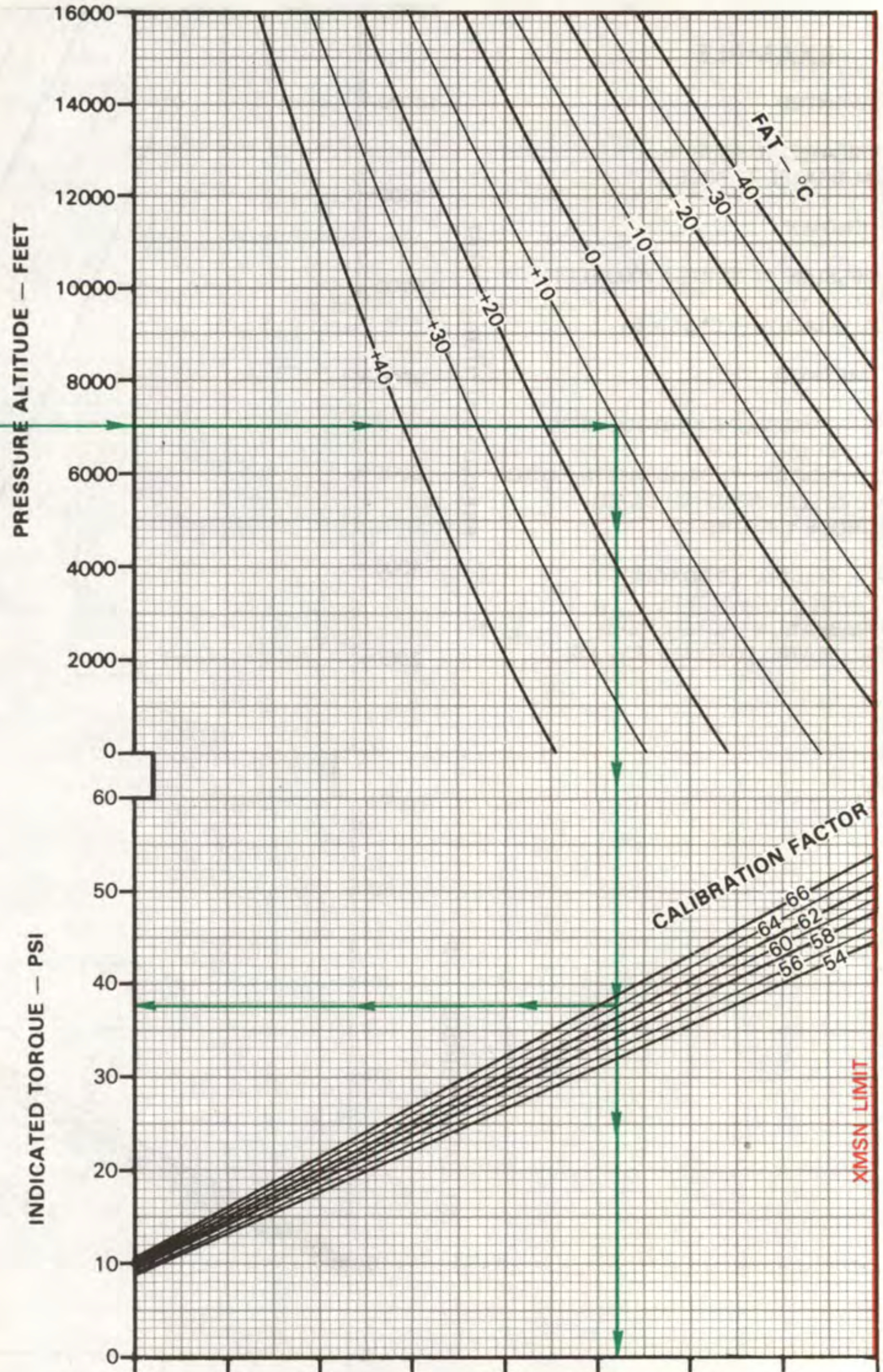
KNOWN

PRESSURE ALTITUDE = 7000 FEET
FAT = + 10°C
CALIBRATION FACTOR = 64

METHOD

ENTER PRESSURE ALTITUDE HERE
MOVE RIGHT TO FAT
MOVE DOWN TO CALIBRATION FACTOR
MOVE LEFT, READ INDICATED
TORQUE = 37.7 PSI

FOR CALIBRATED TORQUE
CONTINUE DOWN THRU
CALIBRATION FACTOR, READ
CALIBRATED TORQUE = 36.2 PSI



DATA BASIS: CALCULATED FROM MODEL SPEC 104.33, SEPT 1964, CORRECTED FOR INSTALLATION LOSSES BASED ON FLIGHT TEST, USAASTA 66-06, APRIL 1970

Figure 7-4. Torque available (continuous operation) chart (Sheet 2 of 3)

TORQUE AVAILABLE (CONTINUOUS OPERATION)

TORQUE AVAILABLE AH-1G T53-L-13B

ENGINE AIR DE-ICE — ON, ECU OFF
324 ROTOR/6600 ENGINE RPM, JP-4 FUEL

EXAMPLE

WANTED

INDICATED TORQUE
CALIBRATED TORQUE

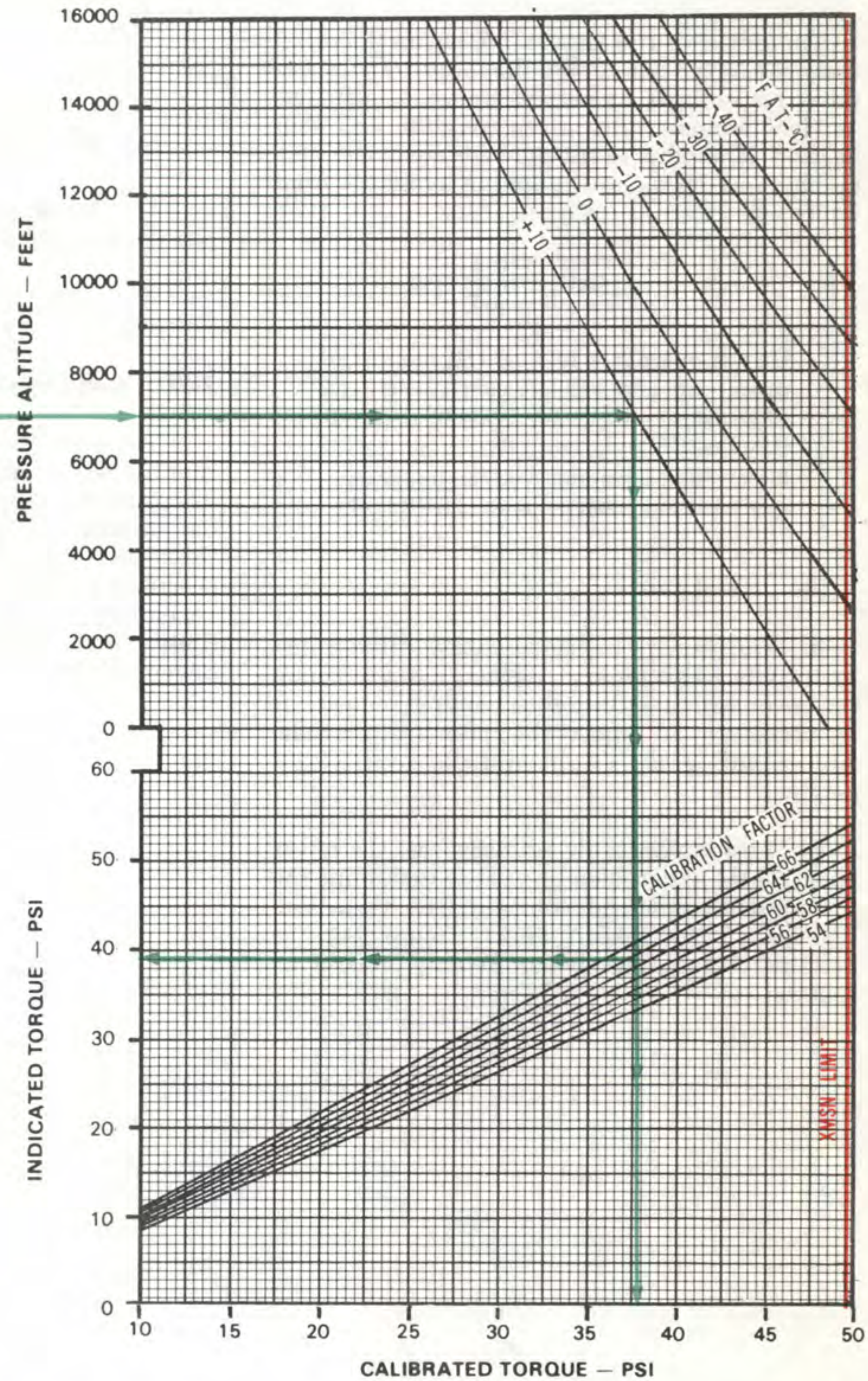
KNOWN

PRESSURE ALTITUDE = 7000 FEET
FAT = + 10°C
CALIBRATION FACTOR = 64

METHOD

ENTER PRESSURE ALTITUDE HERE
MOVE RIGHT TO FAT
MOVE DOWN TO CALIBRATION FACTOR
MOVE LEFT, READ INDICATED TORQUE = 39.3 PSI

FOR CALIBRATED TORQUE CONTINUE DOWN THRU CALIBRATION FACTOR, READ CALIBRATED TORQUE = 37.7 PSI



DATA BASIS: CALCULATED FROM MODEL SPEC 104.33, SEPT 1964, CORRECTED FOR INSTALLATION LOSSES BASED ON FLIGHT TEST, USAASTA 66-06, APRIL 1970

Figure 7-4. Torque available (continuous operation) chart (Sheet 3 of 3)

SECTION IV. HOVER

7-18. Description.

The hover charts (figure 7-5, sheets 1 and 2) show the hover ceiling and the torque required to hover respectively at various pressure altitudes, ambient temperatures, gross weights, and skid heights. Maximum skid height for hover can also be obtained by using the torque available from figure 7-3.

CAUTION

On the average a loss of 150 pounds of lifting capacity will be experienced per 1 PSI loss of torque for both in or OUT-OF-GROUND effect (IGE or OGE) hovering operations. Note engine torque available has been decreased by 2 PSI.

7-19. Use of Chart.

a. The primary use of the charts is illustrated by the charts examples. In general, to determine the hover ceiling or the torque required to hover, it is necessary to know the pressure altitude, temperature, gross weight and the desired skid height.

b. In addition to its primary use, the hover chart (sheet 2) can also be used to determine the predicted maximum hover height, which is needed for use of the takeoff chart (figure 7-6). To determine maximum hover height, proceed as follows:

(1) Enter chart at appropriate pressure altitude.

(2) Move right to FAT.

(3) Move down to gross weight.

(4) Move left to intersection with maximum power available (obtained from figure 7-3).

(5) Read predicted maximum skid height. This height is the maximum hover height.

7-20. Conditions.

The hover charts are based upon calm wind conditions, a level ground surface, and the use of 324 rotor/6600 engine rpm. In ground effect hover data is based upon hovering over a level surface. If the surface over which hovering will be conducted is known to be steep, uneven, covered with high vegetation, or if the type of terrain is unknown, the flight should be planned for out of ground effect hover capability.

HOVER CEILING
MAXIMUM TORQUE AVAILABLE (30 MINUTE OPERATION)
324 ROTOR/6600 ENGINE RPM

HOVER CEILING AH-1G T53-L-13B

EXAMPLE

WANTED

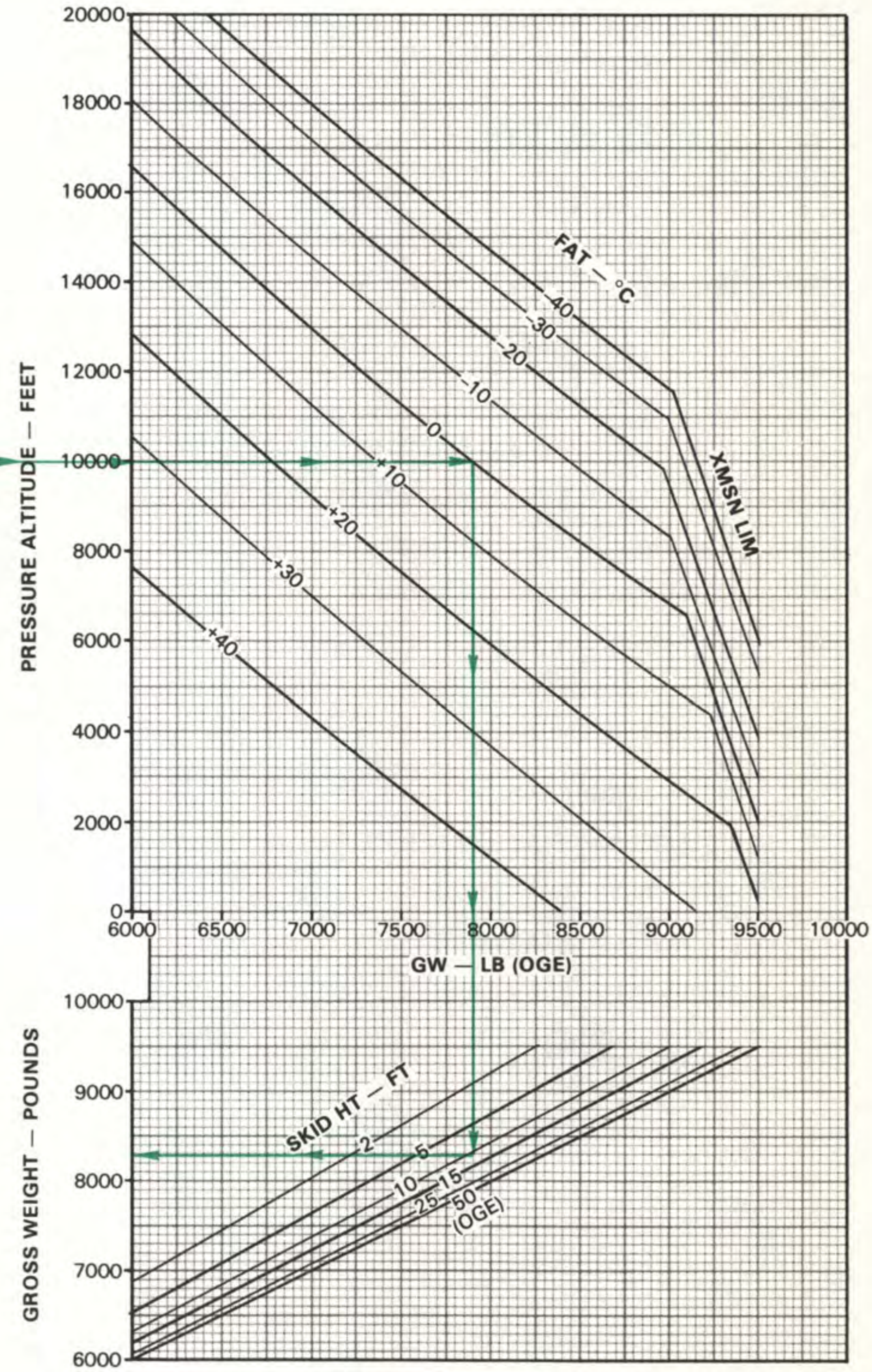
GROSS WEIGHT TO HOVER

KNOWN

PRESSURE ALTITUDE = 10000 FEET
FAT = 0°C
SKID HEIGHT = 10 FEET

METHOD

ENTER PRESSURE ALTITUDE HERE
MOVE RIGHT TO FAT
MOVE DOWN TO SKID HEIGHT
MOVE LEFT, READ GROSS WEIGHT TO HOVER = 8300 POUNDS



DATA BASIS: DERIVED FROM FLIGHT TEST, USAASTA 66-06, APRIL 1970

Figure 7-5. Hover chart (Sheet 1 of 2)

EXAMPLE

WANTED

MAXIMUM GROSS WEIGHT TO HOVER AT OGE

KNOWN (REFERENCE EXAMPLE FOR FIGURE 7-3 SHEET 1)

30 MINUTE TORQUE AVAILABLE = 41.0 PSI

PRESSURE ALTITUDE = 7000 FEET

FAT = +20°C

METHOD

ENTER PRESSURE ALTITUDE HERE → (1)

MOVE RIGHT TO INTERSECT +20°C FAT LINE

MOVE DOWN AND READ DENSITY ALTITUDE = 9200 FEET

ENTER TORQUE HERE → (2)

MOVE UP TO INTERSECT OGE LINE

MOVE RIGHT TO INTERSECT THE VERTICAL

LINE FROM (1) AND READ GROSS WEIGHT TO HOVER = 7700 POUNDS

HOVER

HOVER
AH-1G
T53-L-13B

ALL CONFIGURATIONS 324 ROTOR/6600 ENGINE RPM
LEVEL SURFACE CALM WIND

EXAMPLE

WANTED

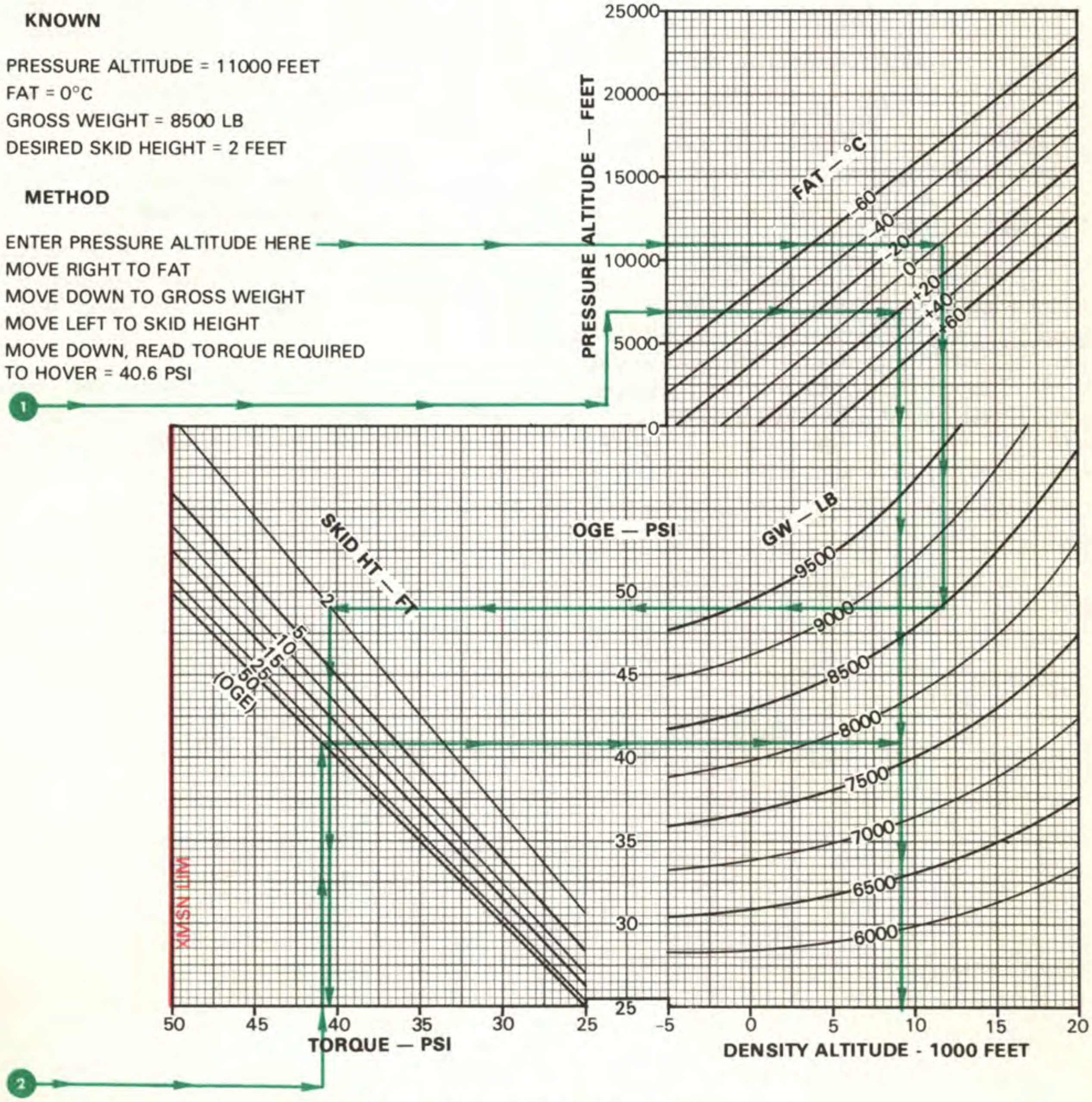
TORQUE REQUIRED TO HOVER

KNOWN

PRESSURE ALTITUDE = 11000 FEET
FAT = 0°C
GROSS WEIGHT = 8500 LB
DESIRED SKID HEIGHT = 2 FEET

METHOD

ENTER PRESSURE ALTITUDE HERE
MOVE RIGHT TO FAT
MOVE DOWN TO GROSS WEIGHT
MOVE LEFT TO SKID HEIGHT
MOVE DOWN, READ TORQUE REQUIRED TO HOVER = 40.6 PSI



DATA BASIS: DERIVED FROM FLIGHT TEST USA ASTA 66-06, APRIL 1970

Figure 7-5. Hover chart (Sheet 2 of 2)

SECTION V. TAKEOFF

7-21. Description.

The takeoff chart (figure 7-6) shows the distances to clear various obstacle heights, based upon several hover height capabilities. The upper chart grid presents data for climbout at a constant 35 knots INDICATED airspeed. The two lower grids present data for climbouts at various TRUE airspeeds.

NOTE

The hover heights shown on the chart are only a measure of the aircraft's climb capability and do not imply that a higher than normal hover height should be used during the actual takeoff.

7-22. Use of Chart.

The primary use of the chart is illustrated by the chart examples. The main consideration for takeoff performance is the hovering skid height capability, which includes the effects of pressure altitude, free air temperature, gross weight, and torque. Hover height capability is determined by use of the hover chart, figure 7-5.

A hover check can be made to verify the hover capability. If winds are present, the hover check may disclose that the helicopter can actually hover at a greater skid height than the calculated value, since the hover chart is based upon calm wind conditions.

7-23. Conditions.

a. Wind. The takeoff chart is based upon calm wind conditions. Since surface wind velocity and direction cannot be accurately predicted, all takeoff planning should be used upon calm wind conditions. Takeoff into any prevailing wind will improve the takeoff performance.

WARNING

A tailwind during takeoff and climbout will increase the obstacle clearance distance and could prevent a successful takeoff.

b. Power Settings. All takeoff performance data are based upon the torque used in determining the hover capabilities in figure 7-5.

TAKEOFF
AH-1G
T53-L-13B

TAKEOFF

LEVEL ACCELERATION TECHNIQUE 3 FT SKID HEIGHT

324 ROTOR/6600 ENGINE RPM MAXIMUM TORQUE AVAILABLE
ALL CONFIGURATIONS CALM WIND

EXAMPLE A

WANTED

DISTANCE TO CLEAR OBSTACLE

KNOWN

MAXIMUM HOVER HEIGHT = 10 FEET
OBSTACLE HEIGHT = 50 FEET

METHOD

ENTER MAX HOVER HEIGHT HERE

MOVE RIGHT TO OBSTACLE HEIGHT

MOVE DOWN, READ DISTANCE
TO CLEAR OBSTACLE = 825 FEET

EXAMPLE B

WANTED

DISTANCE TO CLEAR OBSTACLE

KNOWN

MAX HOVER HEIGHT = 8 FEET

OBSTACLE HEIGHT = 50 FEET

CLIMBOUT AIRSPEED = 40 KNOTS

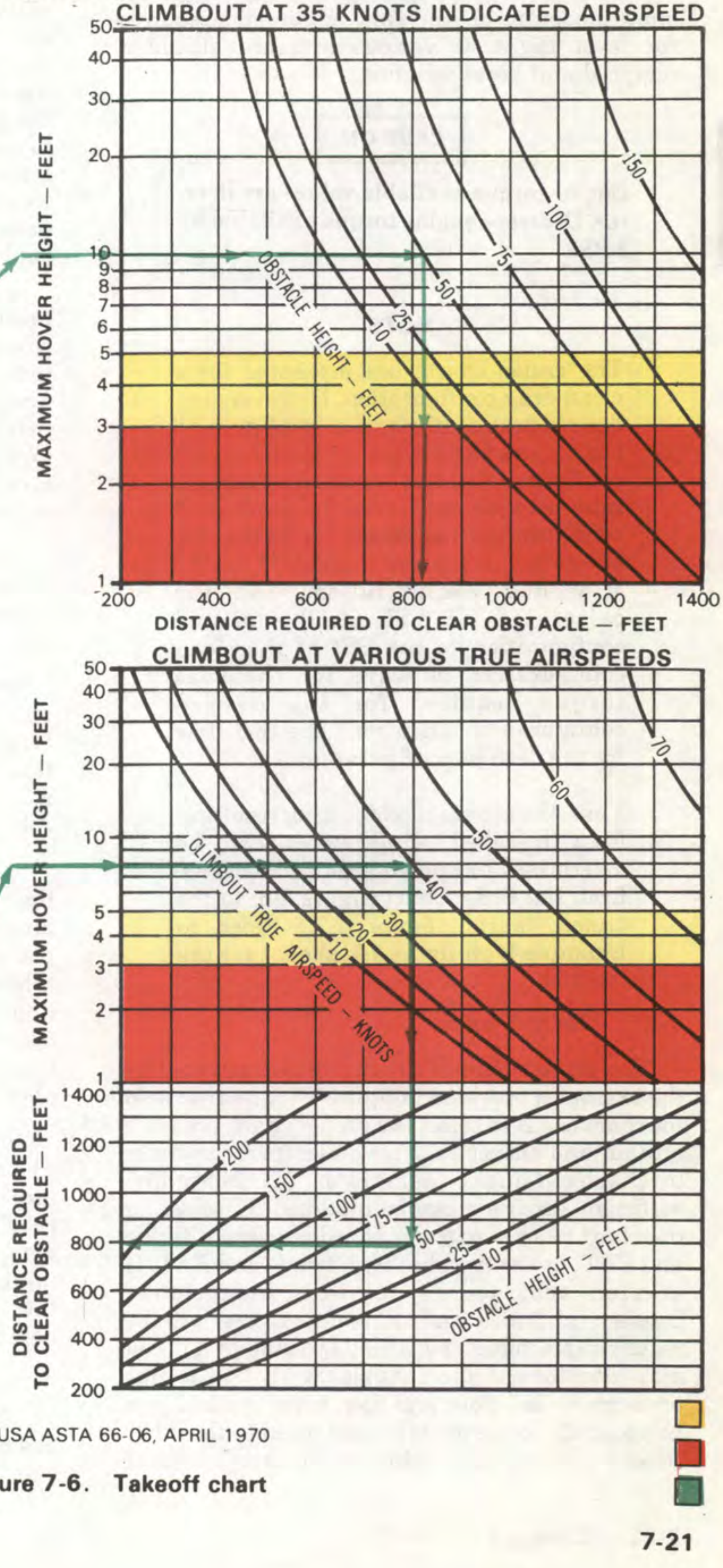
METHOD

ENTER MAX HOVER HEIGHT HERE

MOVE RIGHT TO CLIMBOUT TRUE AIRSPEED

MOVE DOWN TO OBSTACLE HEIGHT

MOVE LEFT READ DISTANCE
TO CLEAR OBSTACLE = 800 FEET



DATA BASIS: DERIVED FROM FLIGHT TEST USA ASTA 66-06, APRIL 1970

Figure 7-6. Takeoff chart

SECTION VI. CRUISE

7-24. Description.

The cruise charts (figure 7-7, sheet 1 through 23) show the torque pressure and engine rpm required for level flight at various pressure altitudes, airspeed and gross weights.

CAUTION

Engine torque available values are in error. Decrease engine torque available by 2 PSI.

NOTE

The cruise charts are presented for a clean drag configuration. However, any desired drag configuration (see figure 7-8 for authorized armament configurations) can be solved by using a ratio between the △ PSI for the desired configuration (as shown in figure 7-7, sheets 1 thru 23) and the △ PSI for the Hvy hog configuration. Add the calculated △ PSI of the desired configuration to the PSI of the clean configuration to solve for the total torque required for the desired configuration. Then read the fuel flow for the desired configuration.

Thus, the effects of added drag resulting from installed wing stores can be determined by applying the △ F - SQ FT from the Drag Chart (figure 7-8) to the cruise charts (figure 7-7). Refer to Example B on figure 7-7, sheet 1 for the method.

7-25. Use of Charts.

The primary use of the charts is illustrated by the examples provided in figure 7-7. The first step for chart use is to select the proper chart, pressure altitude and anticipated free air temperature; refer to chapter 7 index (paragraph 7-2). Normally, sufficient accuracy can be obtained by selecting the chart nearest to the planned cruising altitude and FAT, or the next higher altitude and FAT. If greater accuracy is required, interpolation between altitudes and/or temperatures will be required (see figure 7-7, sheet 1, example A). You may enter the charts on any side: TAS, IAS, torque pressure, or fuel flow, and then move vertically or horizontally to the gross weight, then to the other three parameters. Maximum performance conditions are determined by entering the chart where the maximum range or maximum endurance and rate of climb lines intersect the appropriate gross weight; then read airspeed, fuel flow and torque pressure. For conservatism, use the gross weight at the beginning of cruise flight. For greater accuracy on long flights it is preferable to determine cruise information for several flight segments in order to allow for decreasing fuel weight (reduced gross weight). The following parameters contained in each chart are further explained as follows.

a. Airspeed. True and indicated airspeeds are presented at opposite sides of each chart. On any chart, indicated airspeed can be directly converted to true airspeed (or vice versa) by reading directly across the chart without regard for other chart information. Maximum permissible airspeed (V_{NE}) limits appear as red lines on some charts. If no red line appears, V_{NE} is above the limits of the chart.

b. Torque Pressure (PSI). Since pressure altitude and temperature are fixed for each chart, torque pressure vary according to gross weight and airspeed.

c. Fuel Flow. Fuel flow scales are provided opposite the torque pressure scales. On any chart, torque pressure may be converted directly to fuel flow without regard for other chart information. All fuel flow information is presented ECU off. Add 4% fuel flow for ECU on.

d. Maximum Range. The maximum range lines indicate the combinations of weight and airspeed that will produce the greatest flight range per gallon of fuel under zero wind conditions. When a maximum range condition does not appear on a chart it is because the maximum range speed is beyond the maximum permissible speed (V_{NE}); in such cases, use V_{NE} cruising speed to obtain maximum range.

e. Maximum Endurance and Rate of Climb. The maximum endurance and rate of climb lines indicate the airspeed for minimum torque pressure required to maintain level flight for each gross weight, FAT and pressure altitude. Since minimum torque pressure will provide minimum fuel flow, maximum flight endurance will be obtained at the airspeeds indicated.

7-26. Conditions.

The cruise charts are based upon operation at 324 rotor/6600 engine rpm and ECU off.

CRUISE

PRESSURE ALTITUDE — SEA LEVEL

324 ROTOR/6600 ENGINE RPM, CLEAN CONFIGURATION, JP-4 FUEL

CRUISE
AH-1G
T53-L-13B

FAT = -30°C

EXAMPLE A

WANTED

TORQUE REQUIRED FOR LEVEL FLIGHT, FUEL FLOW, INDICATED AIRSPEED

KNOWN

CLEAN CONFIGURATION, GROSS WEIGHT = 8000 LB, PRESSURE ALTITUDE = 1000 FEET, FAT = -30°C, DESIRED TRUE AIRSPEED = 110 KNOTS.

METHOD (INTERPOLATE)

ENTER TRUE AIRSPEED HERE

READ TORQUE, FUEL FLOW, AND IAS ON EACH ADJACENT ALTITUDE AND/OR FAT, THEN INTERPOLATE BETWEEN ALTITUDE AND FAT

SEE FIGURE 7-7 (SHT 2) 1

ALTITUDE, FEET	SEA LEVEL	2000 FEET	1000 FEET
FAT, °C	-30	-30	-30
TORQUE, PSI	27	26.5	26.8
FUEL FLOW, LB/HR	520	495	508
IAS, KNOTS	122	118	120

EXAMPLE B

WANTED

ADDITIONAL TORQUE REQUIRED AND FUEL FLOW FOR ARMAMENT CONFIGURATION AND CONDITION IN EXAMPLE A

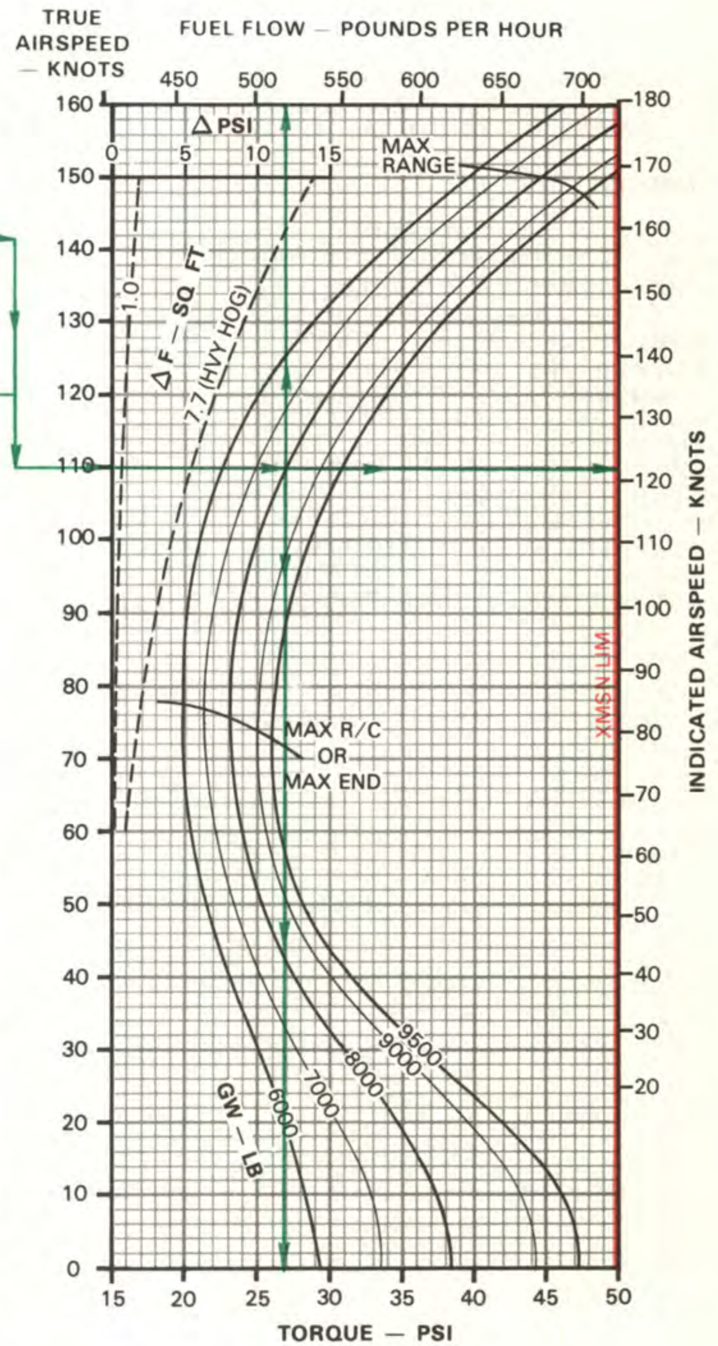
KNOWN

ARMAMENT CONFIGURATION FOR 2 19 TUBE ROCKET LAUNCHERS = 3.1 △F -SQ FT (FROM FIGURE 7-8)

METHOD

ENTER TRUE AIRSPEED AT 110 KNOTS AND MOVE RIGHT TO △F - SQ FT = 3.1 (BETWEEN 1.0 AND 7.7 △F - SQ FT). FROM THAT POINT MOVE UP TO READ 2 PSI TORQUE. ADD 2 PSI TORQUE TO THE TORQUE REQUIRED FOR LEVEL FLIGHT IN THE CLEAN CONFIGURATION AND THE CORRESPONDING INCREASE IN FUEL FLOW (APPROXIMATELY 20 POUNDS PER HOUR) TO THE CLEAN CONFIGURATION FUEL FLOW.

SEA LEVEL
PRESSURE ALTITUDE



DATA BASIS: DERIVED FROM FLIGHT TEST USA ASTA 66-06, APRIL 1970; MODEL SPEC 104 33, SEPT 1964

Figure 7-7. Cruise chart (Sheet 1 of 23)

CRUISE

PRESSURE ALTITUDE — 2000 FEET

324 ROTOR/6600 ENGINE RPM, CLEAN CONFIGURATION, JP-4 FUEL

CRUISE
AH-1G
T53-L-13B

FAT = -30°C

EXAMPLE

WANTED

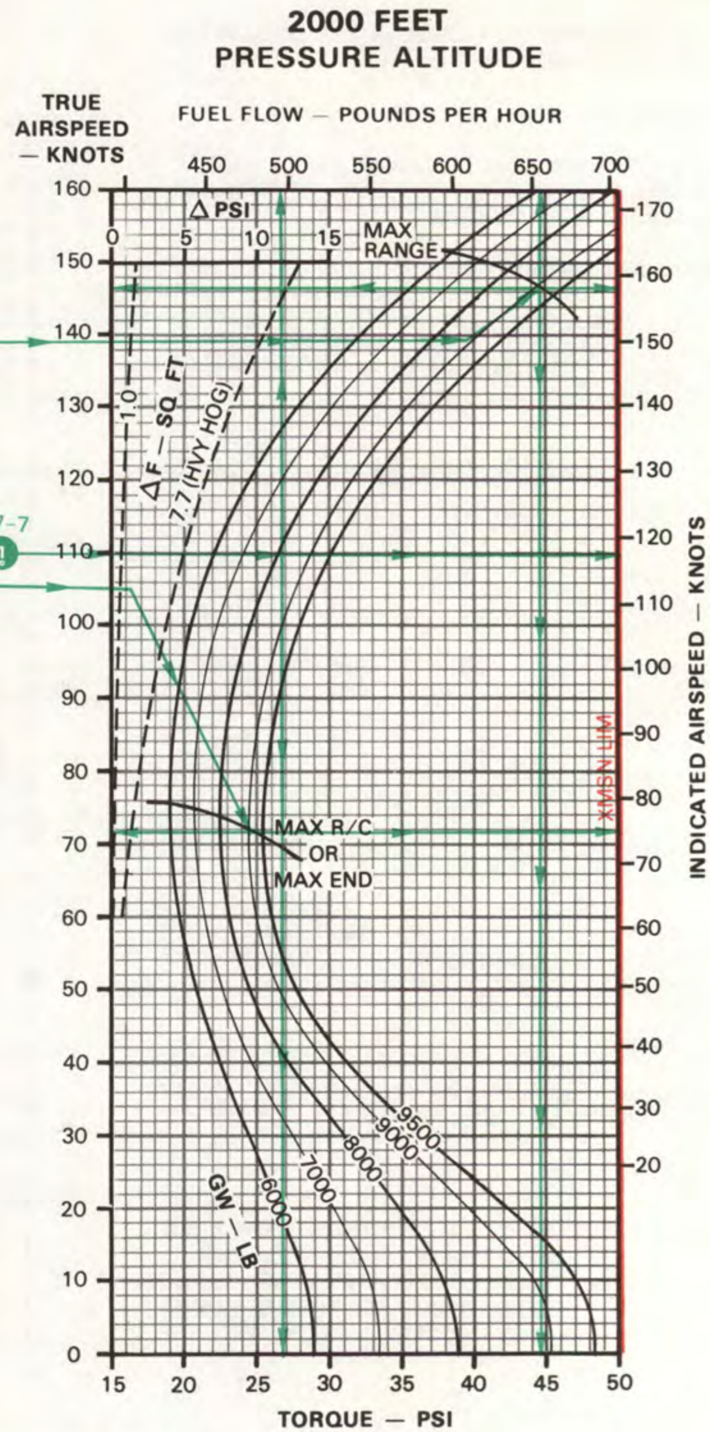
SPEED FOR MAXIMUM RANGE
TORQUE REQUIRED AND FUEL FLOW AT MAXIMUM RANGE SPEED FOR MAXIMUM ENDURANCE

KNOWN

CLEAN CONFIGURATION, FAT = -30°C,
PRESSURE ALTITUDE = 2000 FEET,
AND GROSS WEIGHT = 9000 POUNDS

METHOD

LOCATE (-30°C FAT, 2000 FEET) CHART
FIND INTERSECTION OF 9000 LB GROSS WEIGHT LINE WITH THE MAXIMUM RANGE LINE
TO READ SPEED FOR MAXIMUM RANGE:
MOVE LEFT, READ TAS = 147 KNOTS AND
MOVE RIGHT, READ IAS = 158 KNOTS
TO READ FUEL FLOW REQUIRED:
MOVE UP, READ FUEL FLOW = 655 LB/HR
TO READ TORQUE REQUIRED
MOVE DOWN, READ TORQUE = 44.5 PSI
FIND INTERSECTION OF 9000 LB GROSS WEIGHT LINE WITH THE MAXIMUM ENDURANCE LINE
TO READ SPEED FOR MAXIMUM ENDURANCE:
MOVE LEFT, READ TAS = 72 KNOTS AND
MOVE RIGHT, READ IAS = 75 KNOTS



DATA BASIS: DERIVED FROM FLIGHT TEST USA ASTA 66-06, APRIL 1970; MODEL SPEC 104.33, SEPT 1964

Figure 7-7. Cruise chart (Sheet 2 of 23)

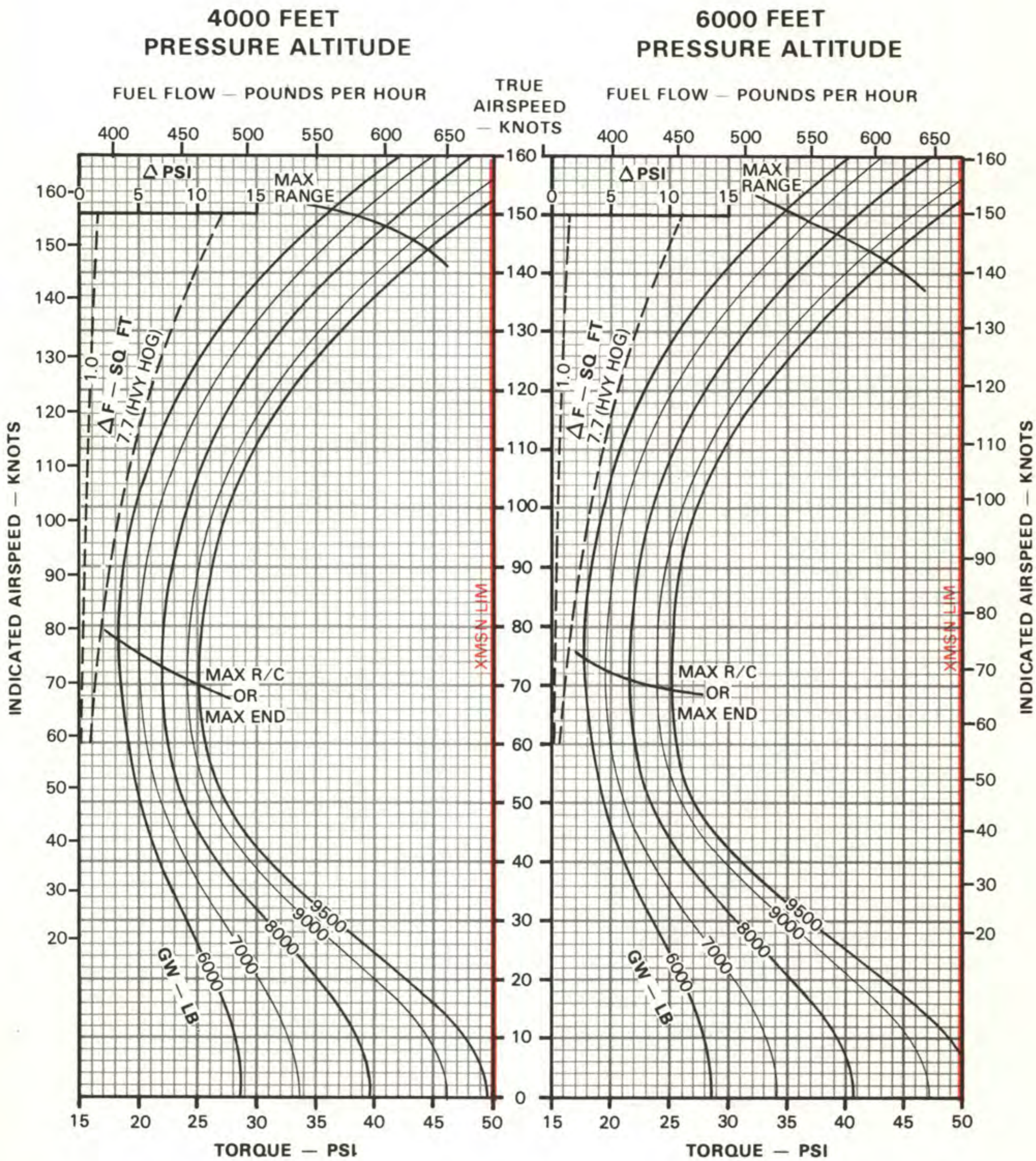
CRUISE

PRESSURE ALTITUDE — 4000 FEET TO 6000 FEET

324 ROTOR/6600 ENGINE RPM, CLEAN CONFIGURATION, JP-4 FUEL

CRUISE
AH-1G
T53-L-13B

FAT = -30°C



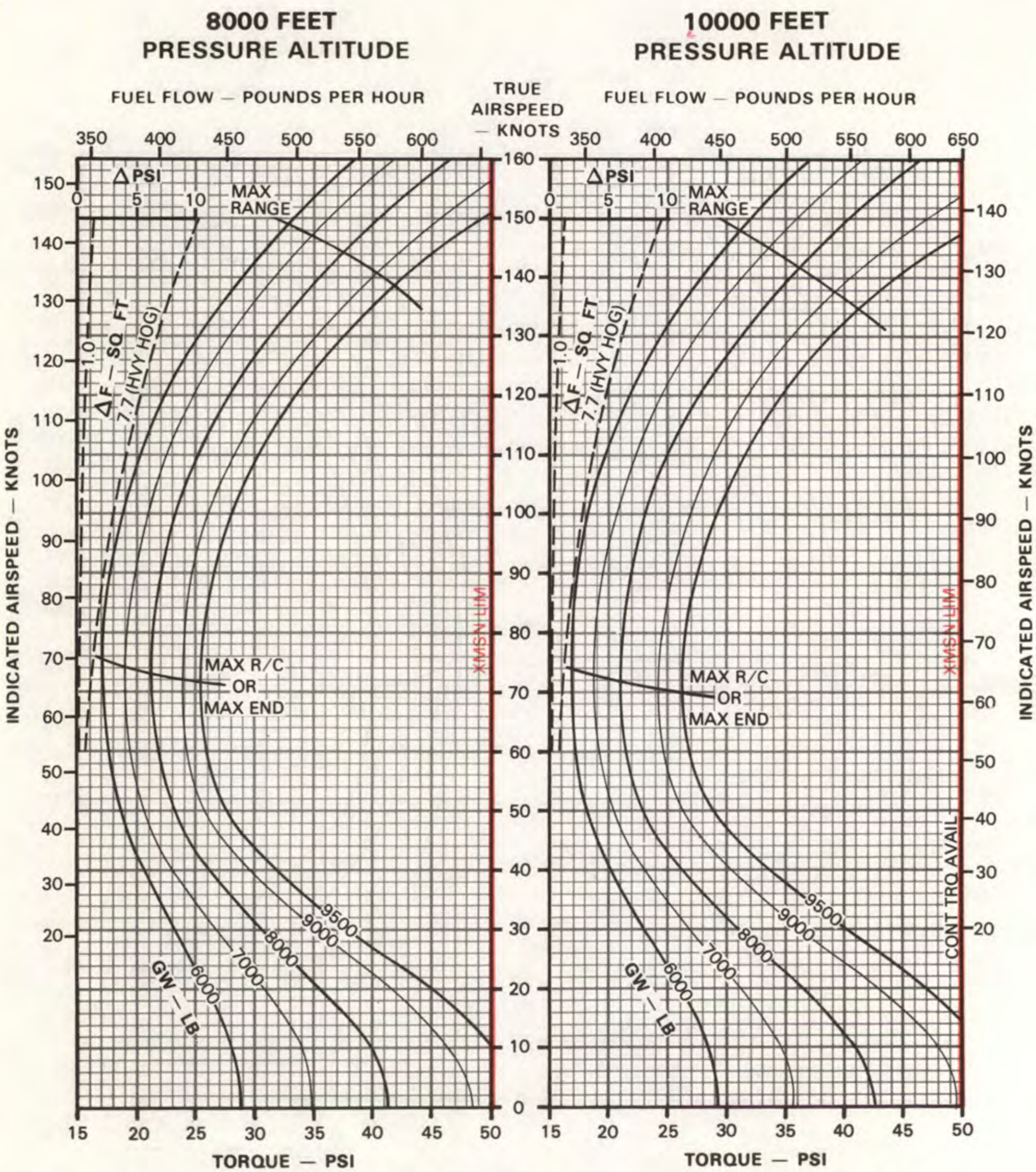
DATA BASIS: DERIVED FROM FLIGHT TEST USA ASTA 66-06, APRIL 1970; MODEL SPEC 104.33, SEPT 1964

Figure 7-7. Cruise chart (Sheet 3 of 23)

CRUISE
PRESSURE ALTITUDE — 8000 FEET TO 10000 FEET
324 ROTOR/6600 ENGINE RPM, CLEAN CONFIGURATION, JP-4 FUEL

CRUISE
AH-1G
T53-L-13B

FAT = -30°C



DATA BASIS: DERIVED FROM FLIGHT TEST USA ASTA 66-06, APRIL 1970; MODEL SPEC 104.33, SEPT 1964

Figure 7-7. Cruise chart (Sheet 4 of 23)

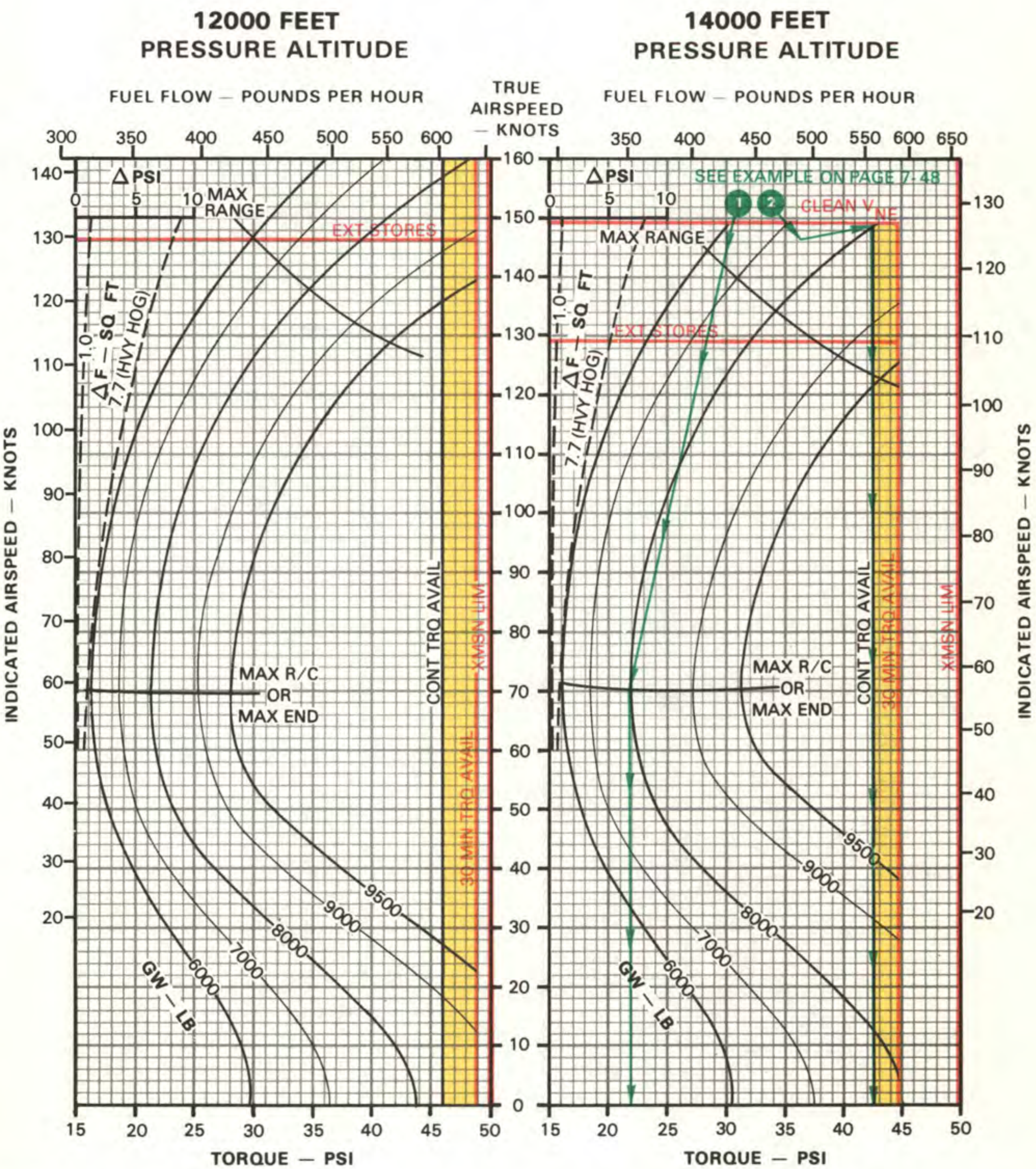
CRUISE

PRESSURE ALTITUDE — 12000 FEET TO 14000 FEET

324 ROTOR/6600 ENGINE RPM, CLEAN CONFIGURATION, JP-4 FUEL

CRUISE
AH-1G
T53-L-13B

FAT = -30°C



DATA BASIS: DERIVED FROM FLIGHT TEST USA ASTA 66-06, APRIL 1970; MODEL SPEC 104.33, SEPT 1964

Figure 7-7. Cruise chart (Sheet 5 of 23)

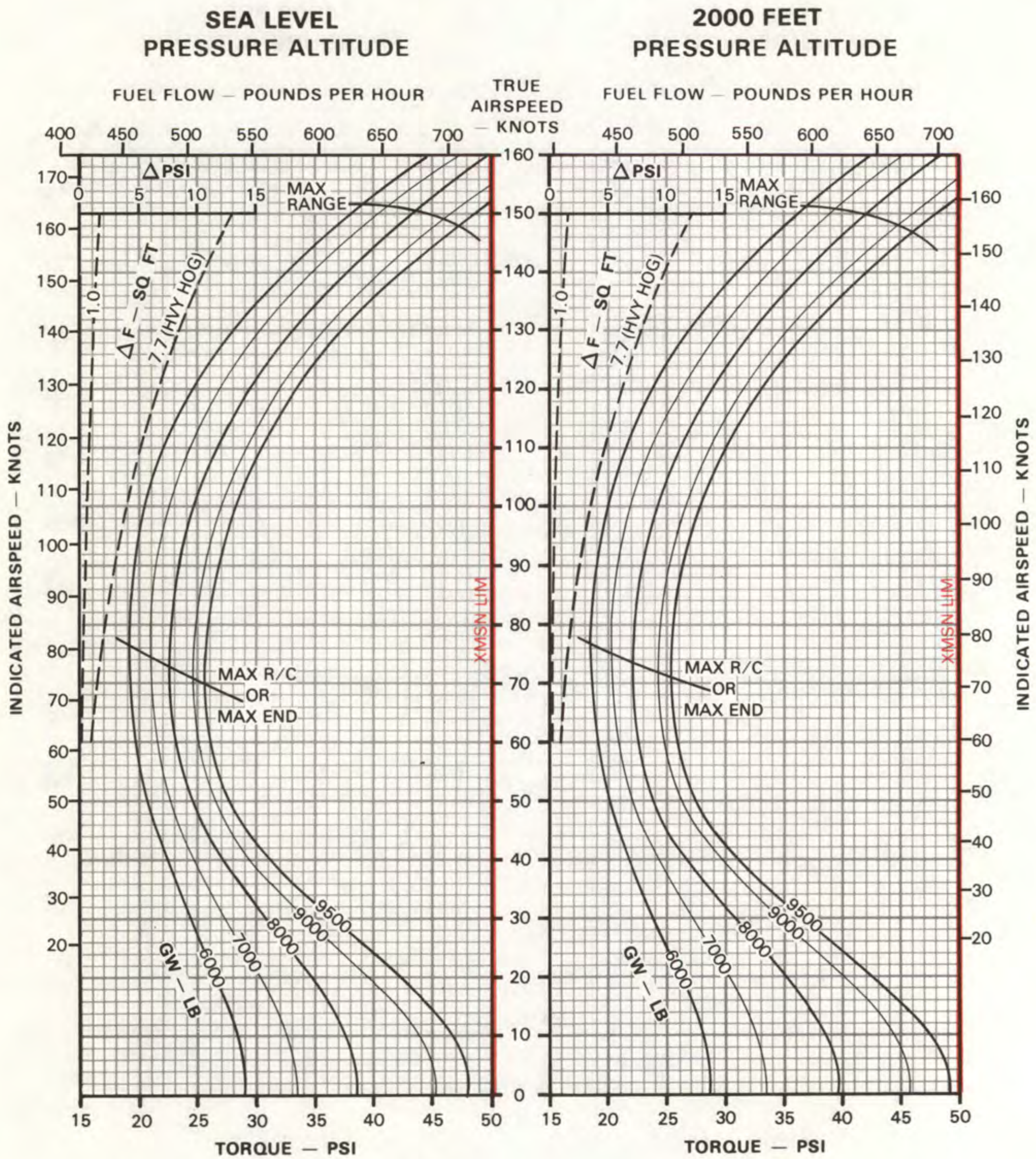
CRUISE

PRESSURE ALTITUDE — SEA LEVEL TO 2000 FEET

324 ROTOR/6600 ENGINE RPM, CLEAN CONFIGURATION, JP-4 FUEL

CRUISE
AH-1G
T53-L-13B

FAT = – 15°C



DATA BASIS: DERIVED FROM FLIGHT TEST USA ASTA 66-06, APRIL 1970; MODEL SPEC 104 33, SEPT 1964

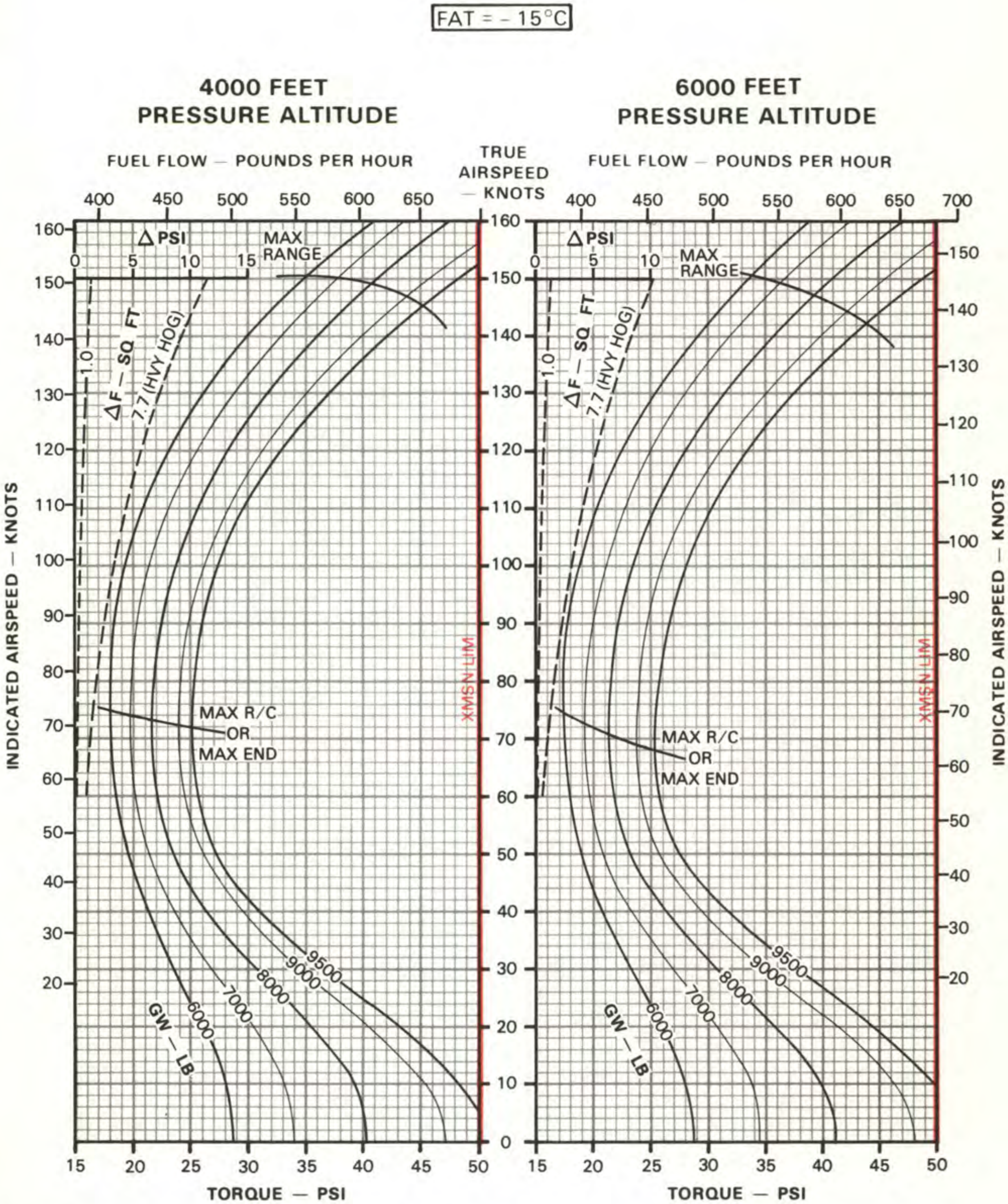
Figure 7-7. Cruise chart (Sheet 6 of 23)

CRUISE

PRESSURE ALTITUDE — 4000 FEET TO 6000 FEET

324 ROTOR/6600 ENGINE RPM, CLEAN CONFIGURATION, JP-4 FUEL

CRUISE
AH-1G
T53-L-13B



DATA BASIS: DERIVED FROM FLIGHT TEST USA ASTA 66-06, APRIL 1970; MODEL SPEC 104.33, SEPT 1964

Figure 7-7. Cruise chart (Sheet 7 of 23)

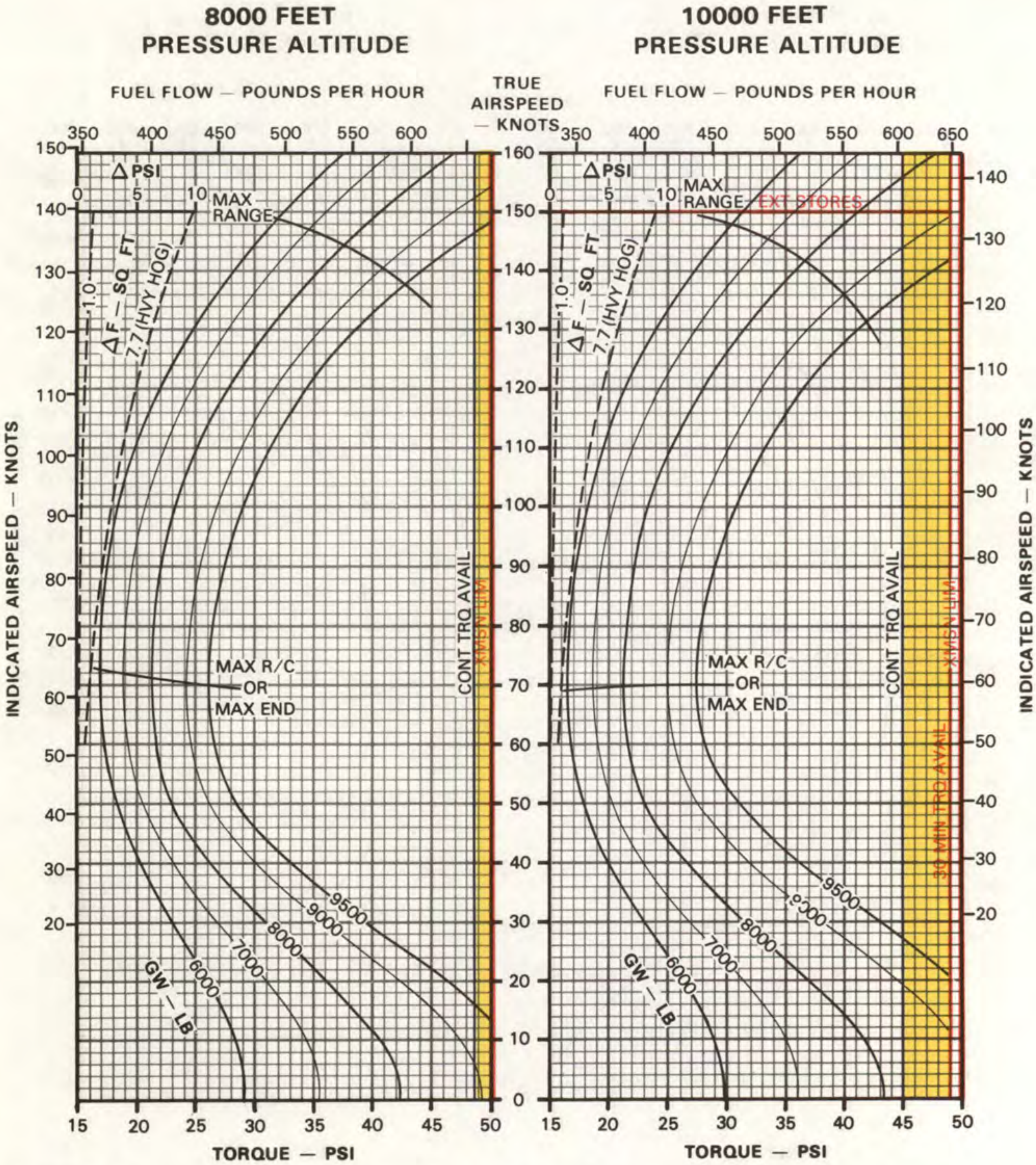
CRUISE

PRESSURE ALTITUDE — 8000 FEET TO 10000 FEET

324 ROTOR/6600 ENGINE RPM, CLEAN CONFIGURATION, JP-4 FUEL

CRUISE
AH-1G
T53-L-13B

FAT = - 15°C



DATA BASIS: DERIVED FROM FLIGHT TEST USA ASTA 66-06, APRIL 1970; MODEL SPEC 104.33, SEPT 1964

Figure 7-7. Cruise chart (Sheet 8 of 23)

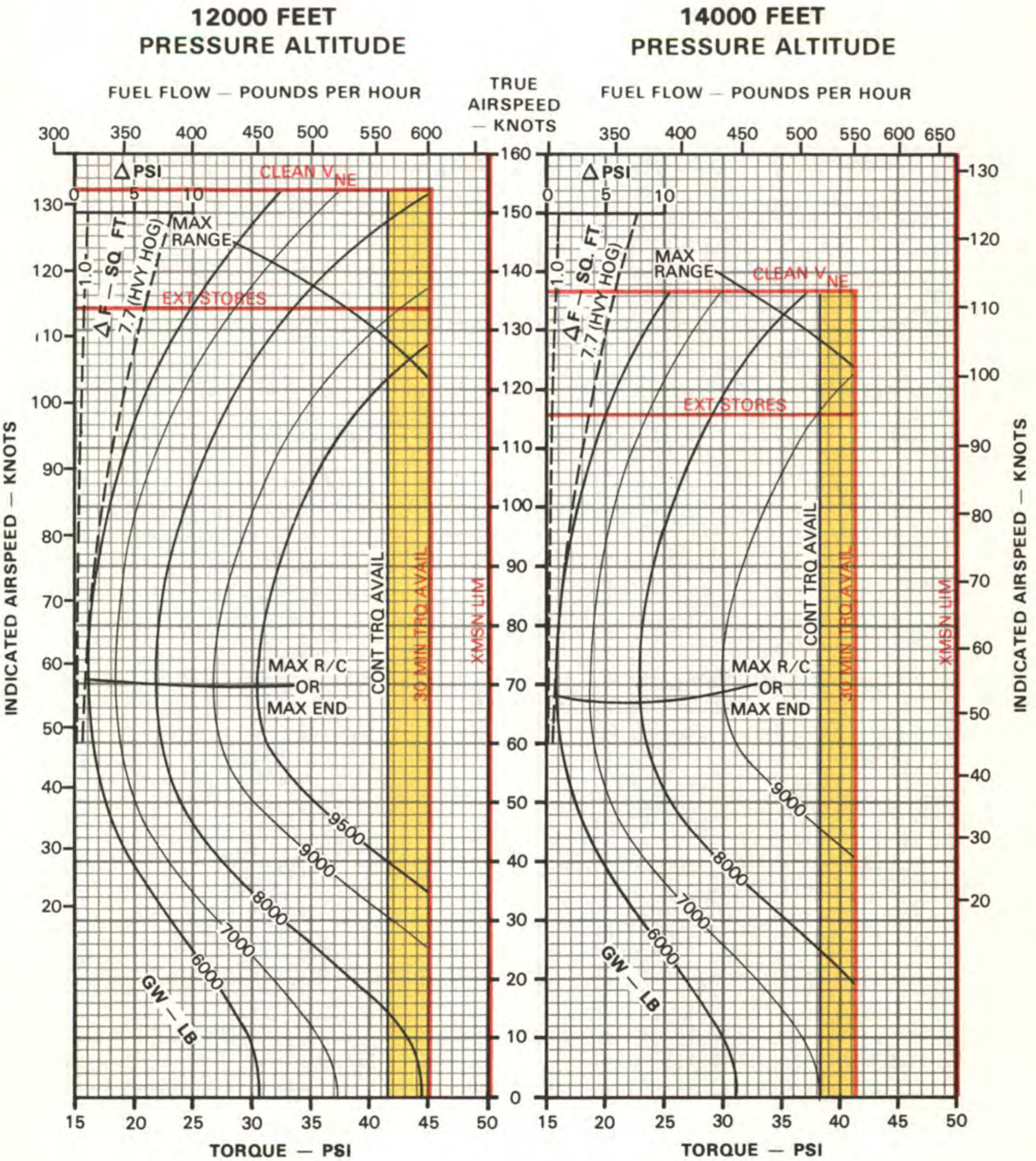
CRUISE

PRESSURE ALTITUDE — 12000 FEET TO 14000 FEET

324 ROTOR/6600 ENGINE RPM, CLEAN CONFIGURATION, JP-4 FUEL

CRUISE
AH-1G
T53-L-13B

FAT = -15°C



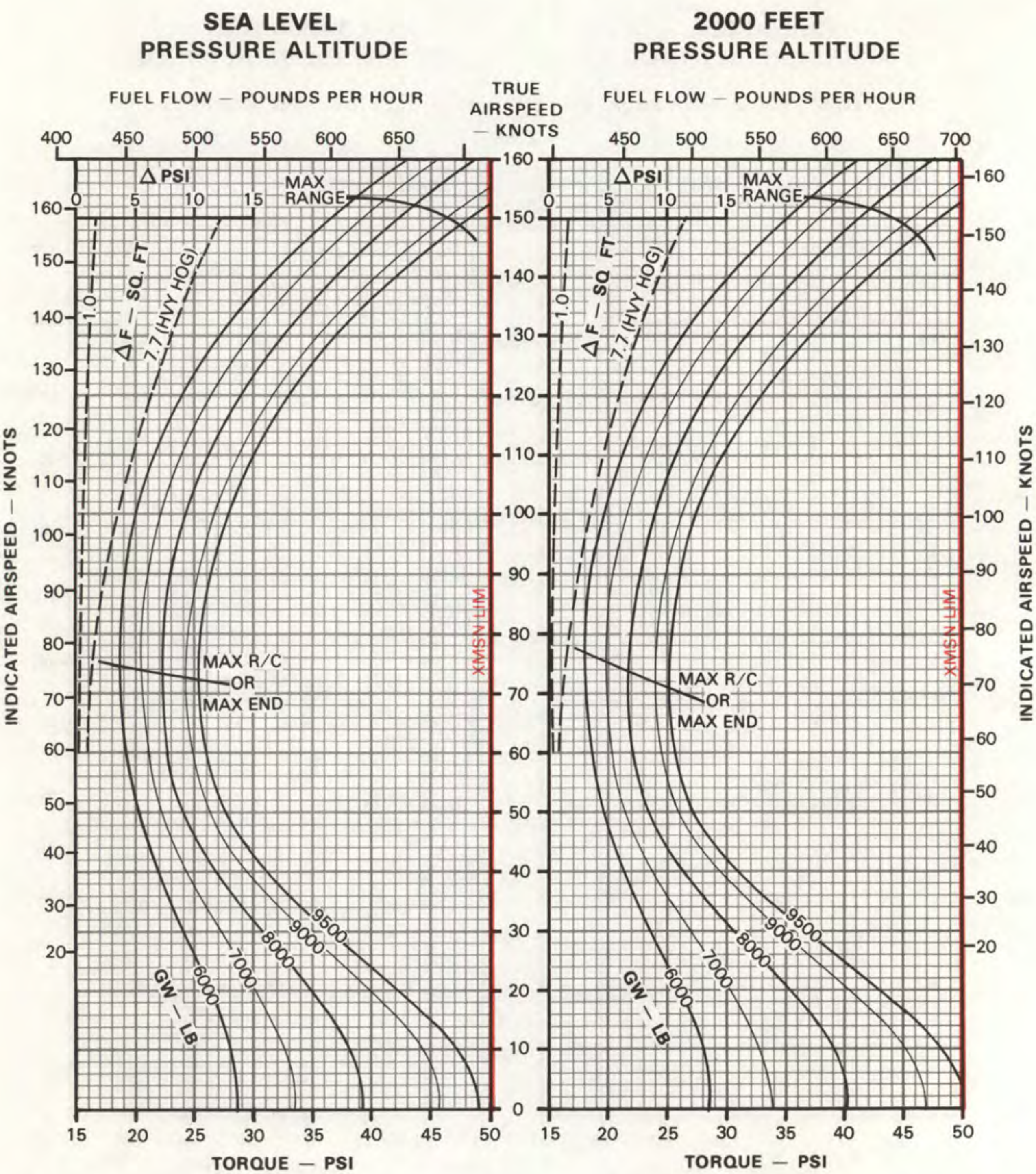
DATA BASIS: DERIVED FROM FLIGHT TEST USA ASTA 66-06, APRIL 1970 MODEL SPEC 104.33, SEPT 1964

Figure 7-7. Cruise chart (Sheet 9 of 23)

CRUISE
PRESSURE ALTITUDE — SEA LEVEL TO 2000 FEET
324 ROTOR/6600 ENGINE RPM, CLEAN CONFIGURATION, JP-4 FUEL

CRUISE
AH-1G
T53-L-13B

FAT = 0°C



DATA BASIS: DERIVED FROM FLIGHT TEST USA ASTA 66-06, APRIL 1970; MODEL SPEC 104. 33, SEPT 1964

Figure 7-7. Cruise chart (Sheet 10 of 23)

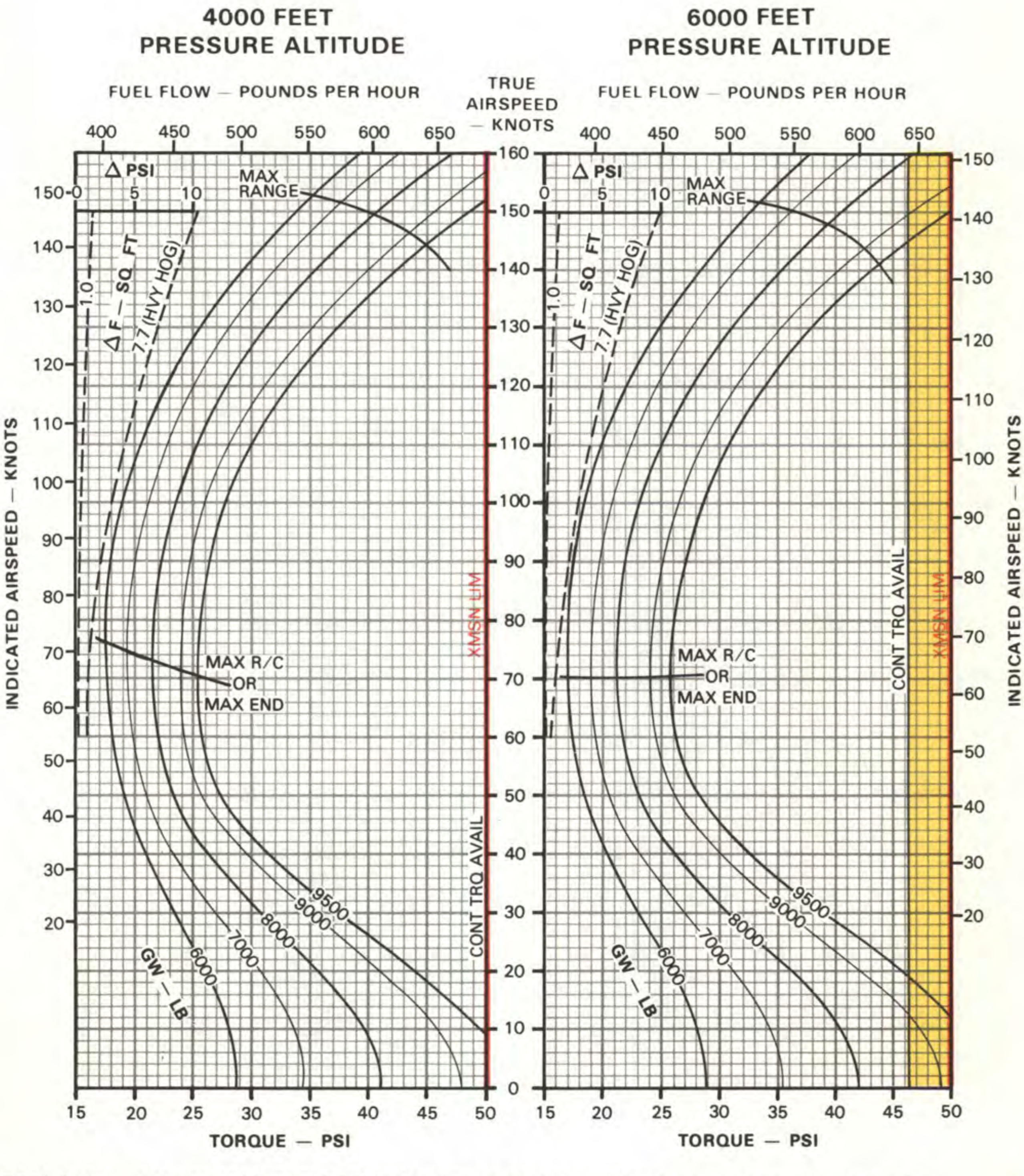
CRUISE

PRESSURE ALTITUDE — 4000 FEET TO 6000 FEET

324 ROTOR/6600 ENGINE RPM, CLEAN CONFIGURATION, JP-4 FUEL

CRUISE
AH-1G
T53-L-13B

FAT = 0°C



DATA BASIS: DERIVED FROM FLIGHT TEST USA ASTA 66-06, APRIL 1970; MODEL SPEC 104.33, SEPT 1964

Figure 7-7. Cruise chart (Sheet 11 of 23)

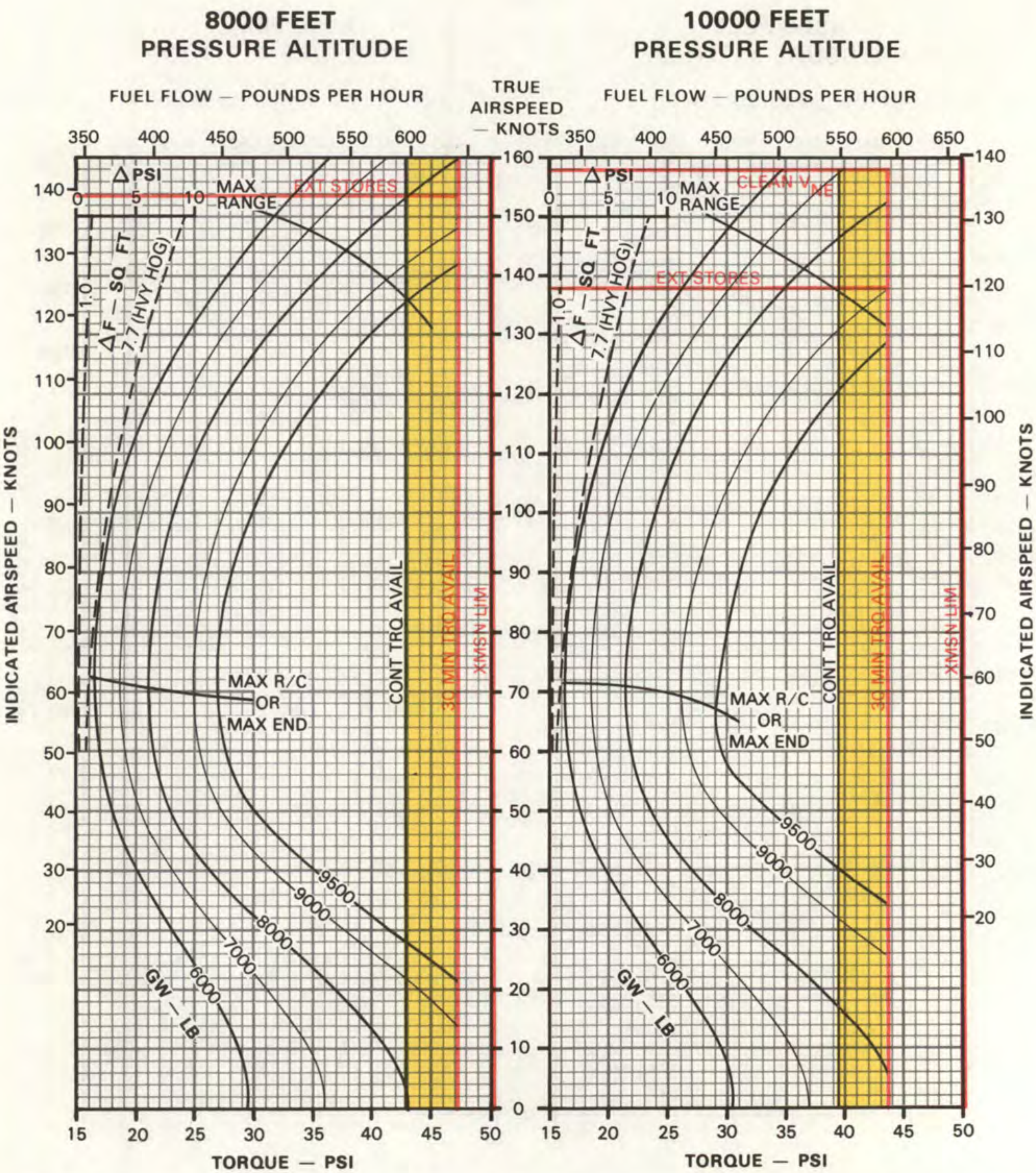
CRUISE

PRESSURE ALTITUDE — 8000 FEET TO 10000 FEET

324 ROTOR/6600 ENGINE RPM, CLEAN CONFIGURATION, JP-4 FUEL

CRUISE
AH-1G
T53-L-13B

FAT = 0°C



DATA BASIS: DERIVED FROM FLIGHT TEST USA ASTA 66-06, APRIL 1970; MODEL SPEC 104 33, SEPT 1964

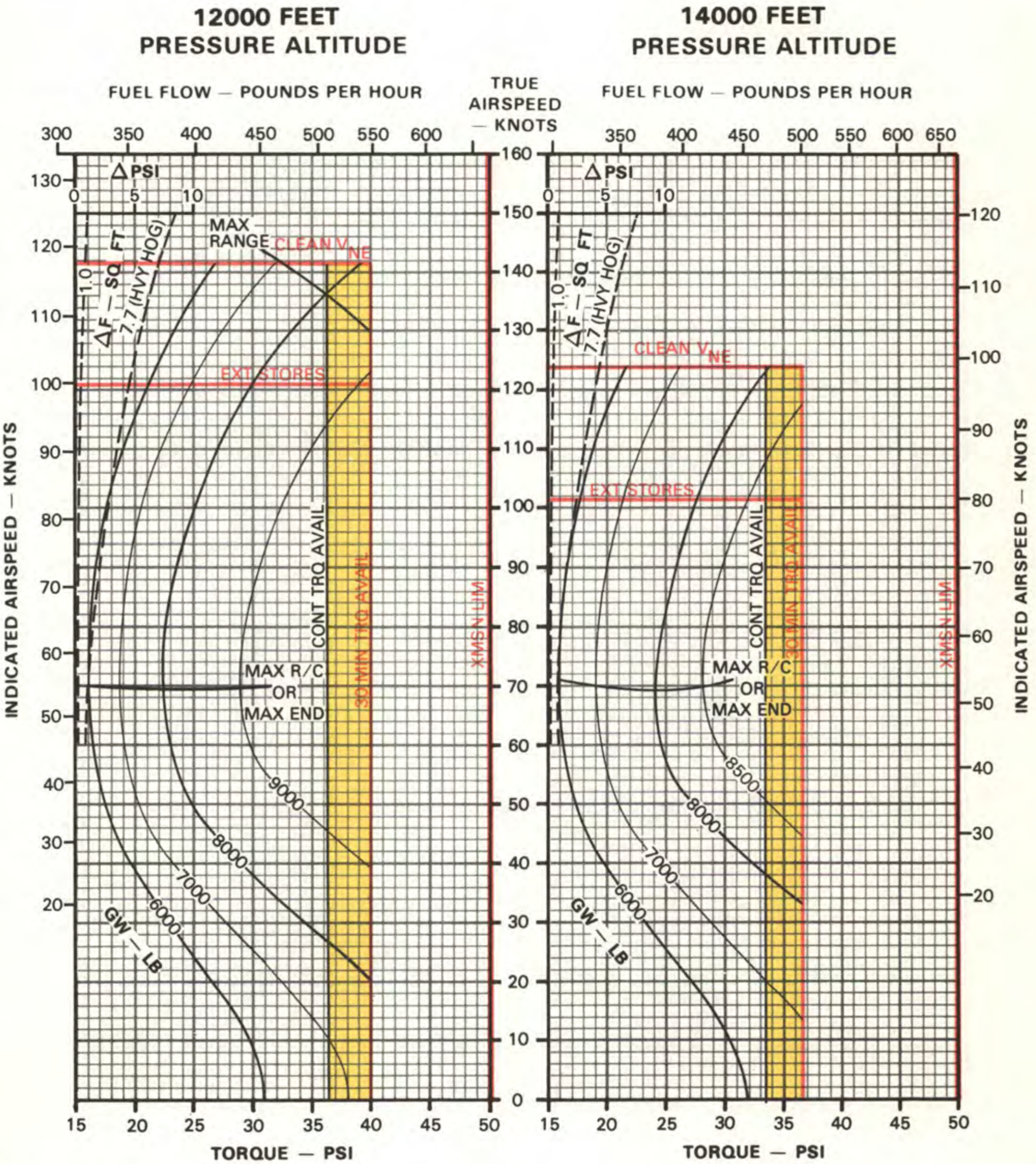
Figure 7-7. Cruise chart (Sheet 12 of 23)

CRUISE

PRESSURE ALTITUDE — 12000 FEET TO 14000 FEET

324 ROTOR/6600 ENGINE RPM, CLEAN CONFIGURATION, JP-4 FUEL

FAT = 0°C



DATA BASIS: DERIVED FROM FLIGHT TEST USA ASTA 66-06, APRIL 1970; MODEL SPEC 104.33, SEPT 1964

Figure 7-7. Cruise chart (Sheet 13 of 23)

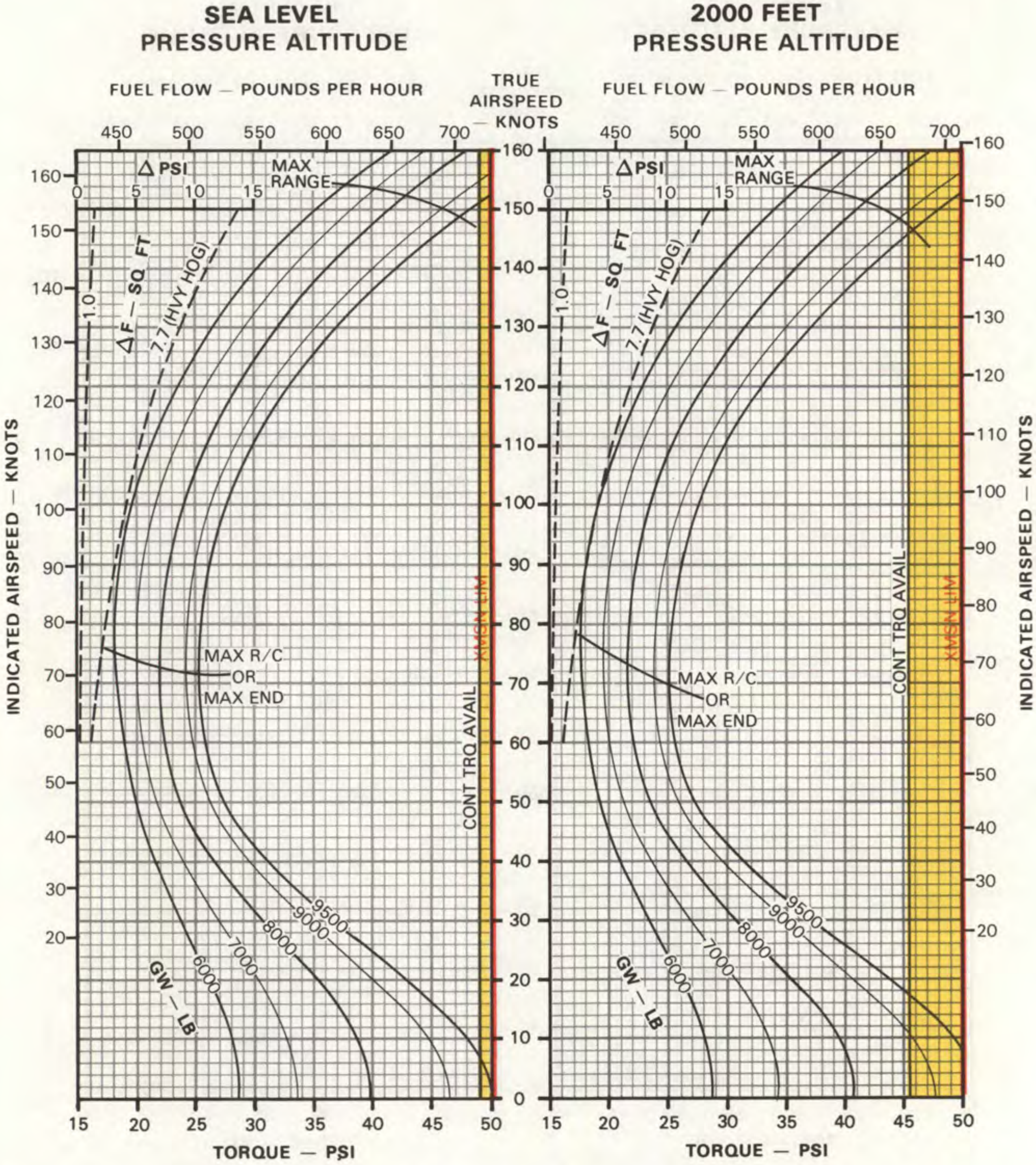
CRUISE

PRESSURE ALTITUDE — SEA LEVEL TO 2000 FEET

324 ROTOR/6600 ENGINE RPM, CLEAN CONFIGURATION, JP-4 FUEL

CRUISE
AH-1G
T53-L-13B

FAT = +15°C



DATA BASIS: DERIVED FROM FLIGHT TEST USA ASTA 66-06, APRIL 1970; MODEL SPEC 104.33, SEPT 1964

Figure 7-7. Cruise chart (Sheet 14 of 23)

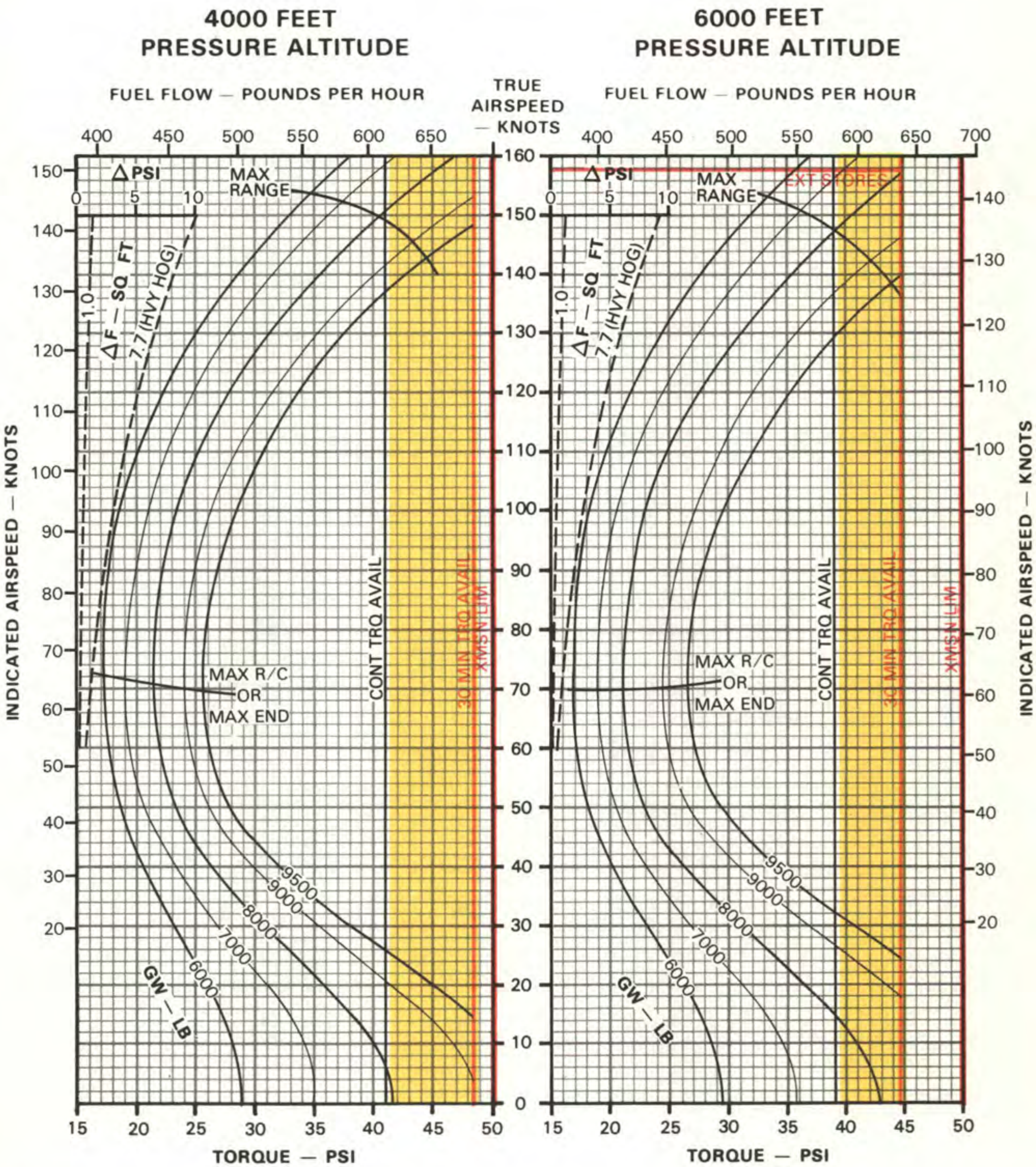
CRUISE

PRESSURE ALTITUDE — 4000 FEET TO 6000 FEET

324 ROTOR/6600 ENGINE RPM, CLEAN CONFIGURATION, JP-4 FUEL

CRUISE
AH-1G
T53-L-13B

FAT = +15°C



DATA BASIS: DERIVED FROM FLIGHT TEST USA ASTA 66-06, APRIL 1970; MODEL SPEC 104.33, SEPT 1964

Figure 7-7. Cruise chart (Sheet 15 of 23)

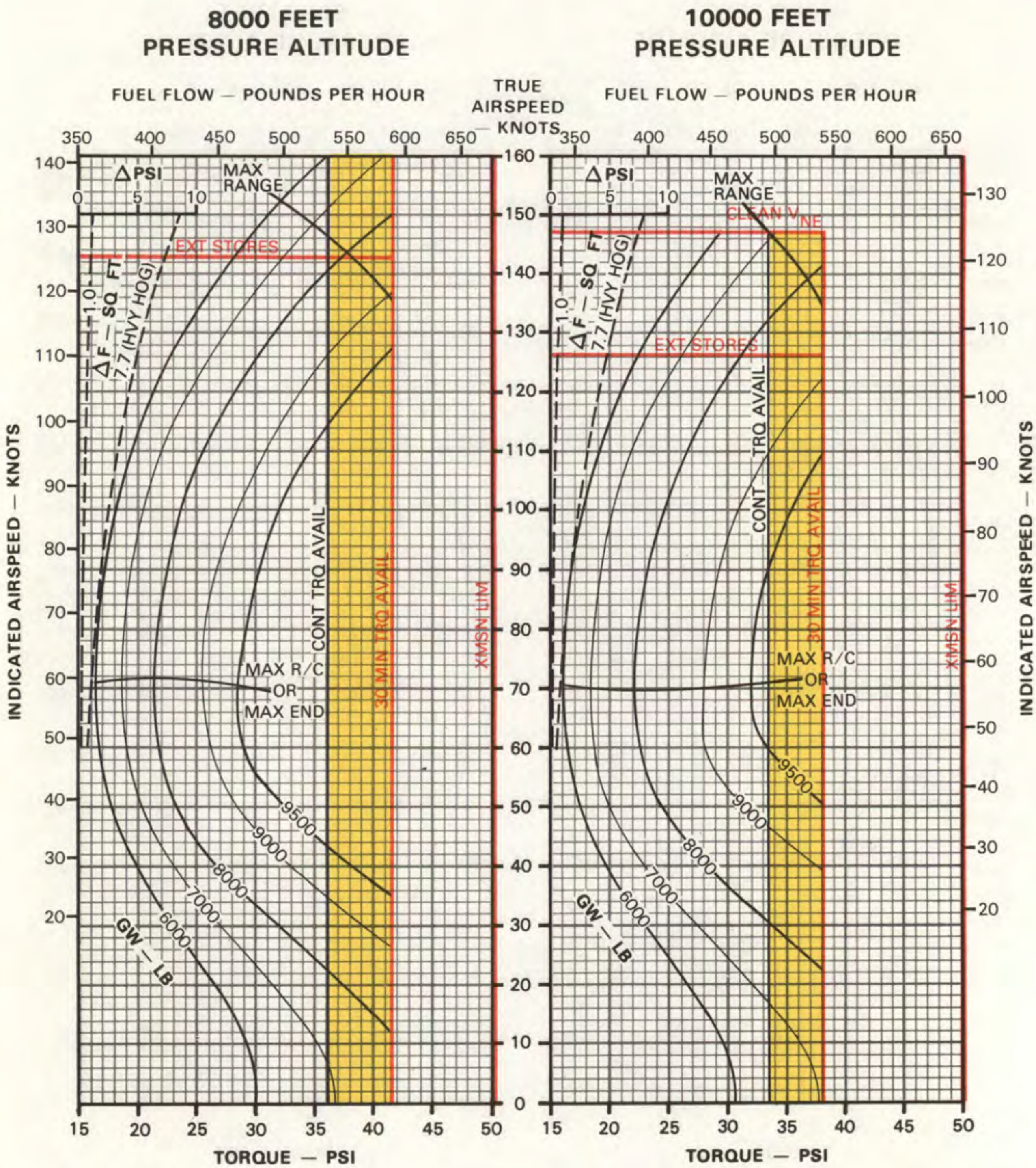
CRUISE

PRESSURE ALTITUDE — 8000 FEET TO 10000 FEET

324 ROTOR/6600 ENGINE RPM, CLEAN CONFIGURATION, JP-4 FUEL

CRUISE
AH-1G
T53-L-13B

FAT = +15°C



DATA BASIS: DERIVED FROM FLIGHT TEST USA ASTA 66-06, APRIL 1970 MODEL SPEC 104.33, SEPT 1964

Figure 7-7. Cruise chart (Sheet 16 of 23)

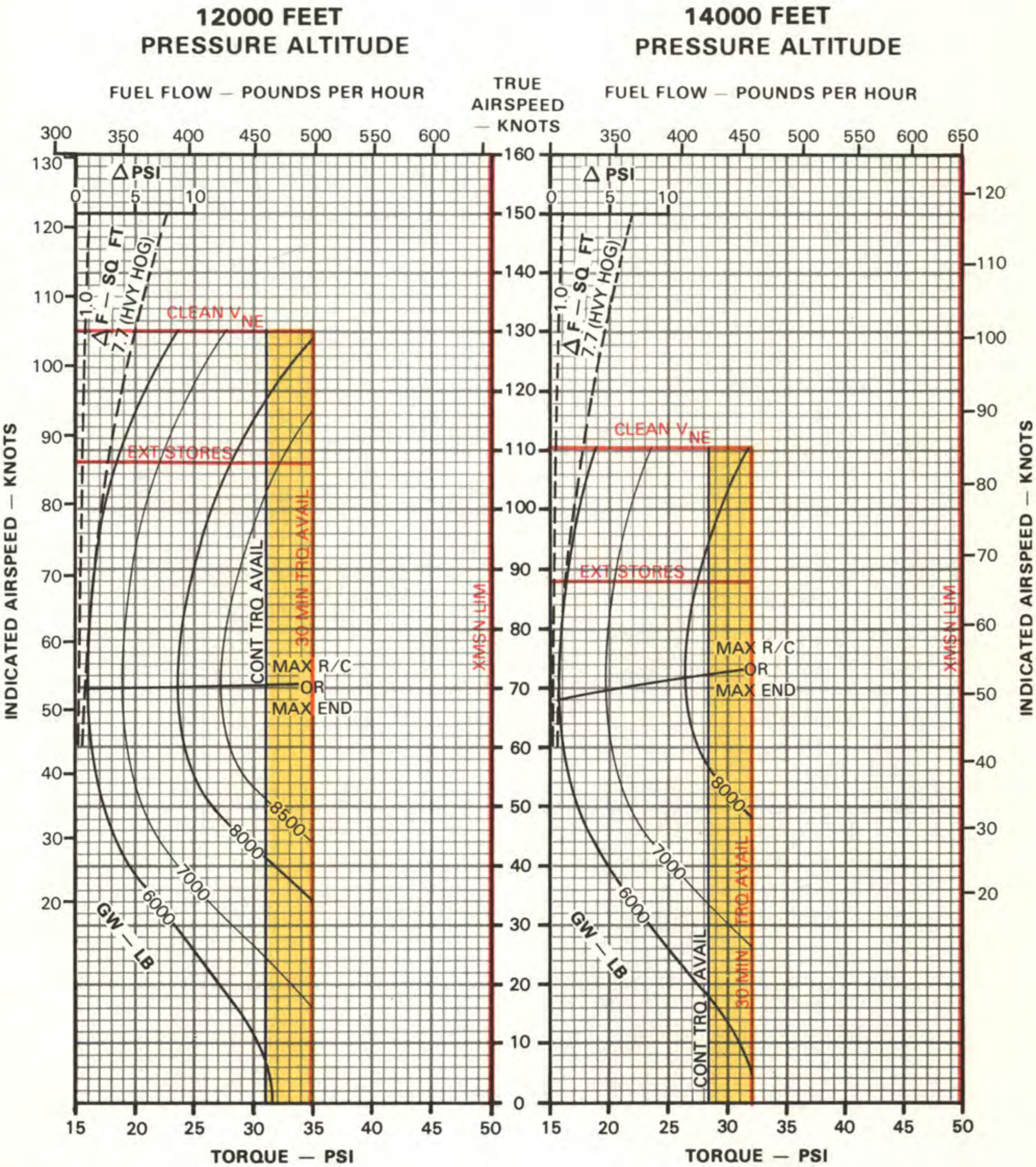
CRUISE

PRESSURE ALTITUDE — 12000 FEET TO 14000 FEET

324 ROTOR/6600 ENGINE RPM, CLEAN CONFIGURATION, JP-4 FUEL

CRUISE
AH-1G
T53-L-13B

FAT = + 15°C



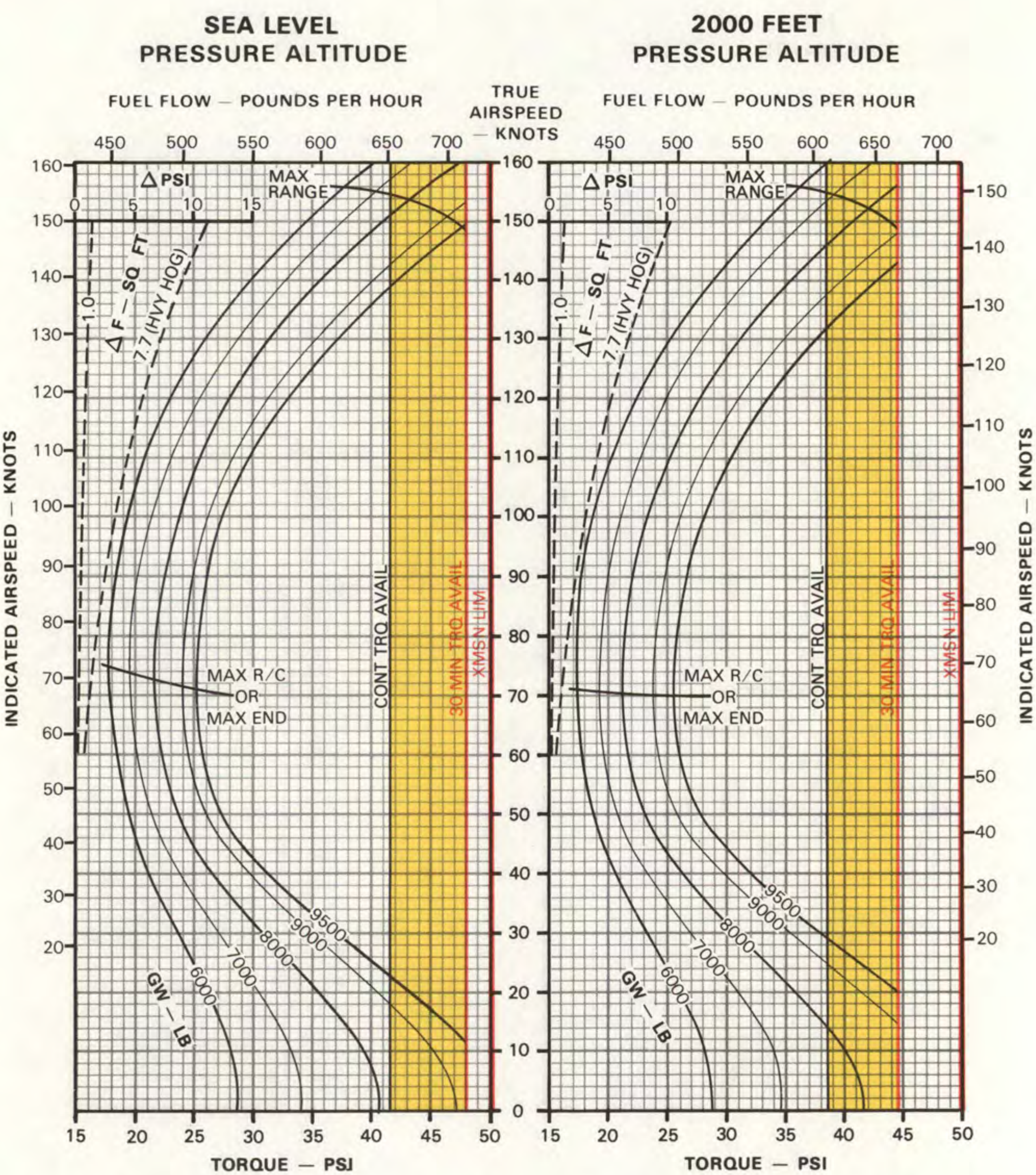
DATA BASIS: DERIVED FROM FLIGHT TEST USA ASTA 66-06, APRIL 1970; MODEL SPEC 104 33, SEPT 1964

Figure 7-7. Cruise chart (Sheet 17 of 23)

CRUISE
PRESSURE ALTITUDE — SEA LEVEL TO 2000 FEET
324 ROTOR/6600 ENGINE RPM, CLEAN CONFIGURATION, JP-4 FUEL

CRUISE
AH-1G
T53-L-13B

FAT = +30°C



DATA BASIS: DERIVED FROM FLIGHT TEST USA ASTA 66-06, APRIL 1970; MODEL SPEC 104 33, SEPT 1964

Figure 7-7. Cruise chart (Sheet 18 of 23)

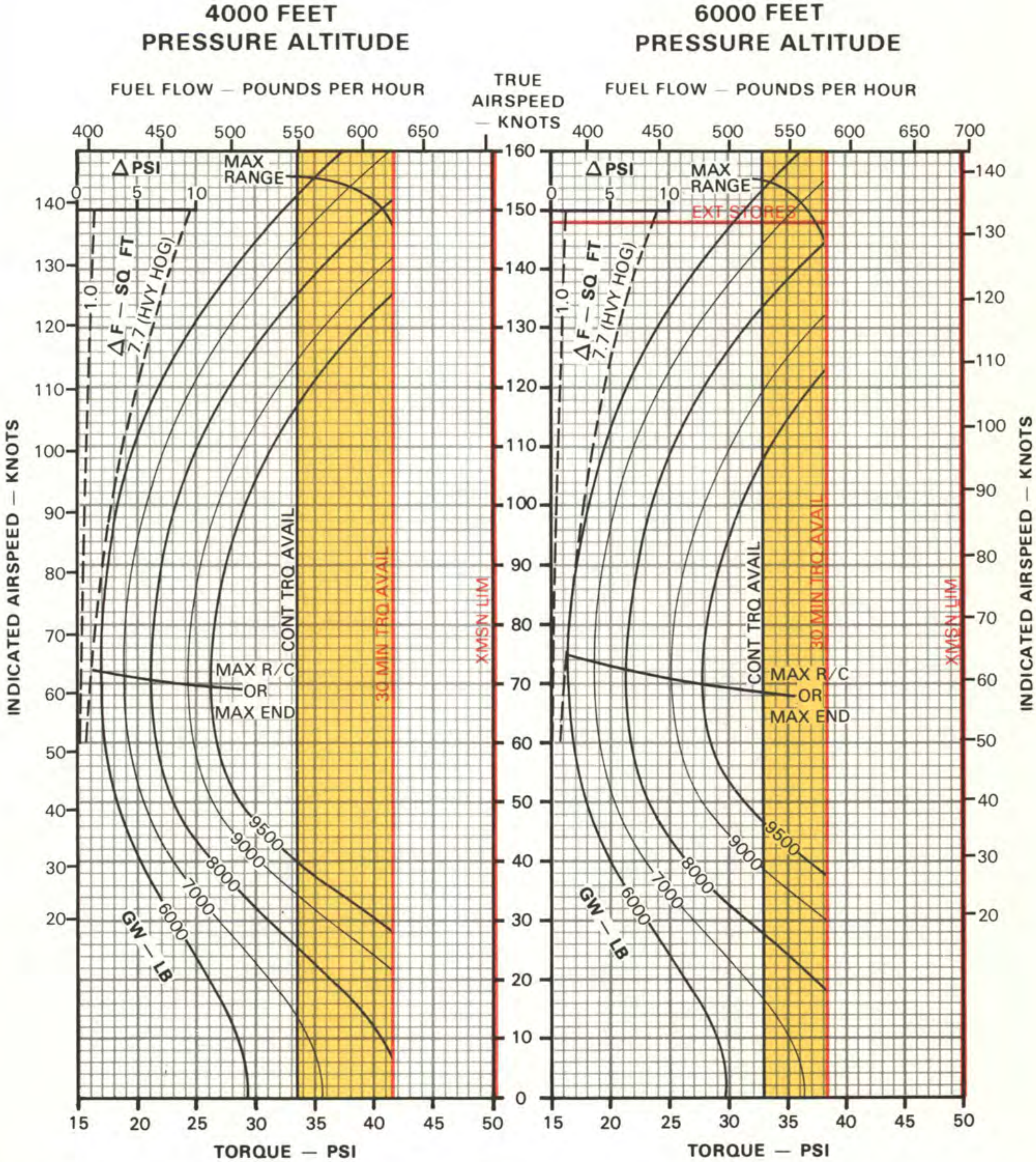
CRUISE

PRESSURE ALTITUDE — 4000 FEET TO 6000 FEET

324 ROTOR/6600 ENGINE RPM, CLEAN CONFIGURATION, JP-4 FUEL

CRUISE
AH-1G
T53-L-13B

FAT = +30°C



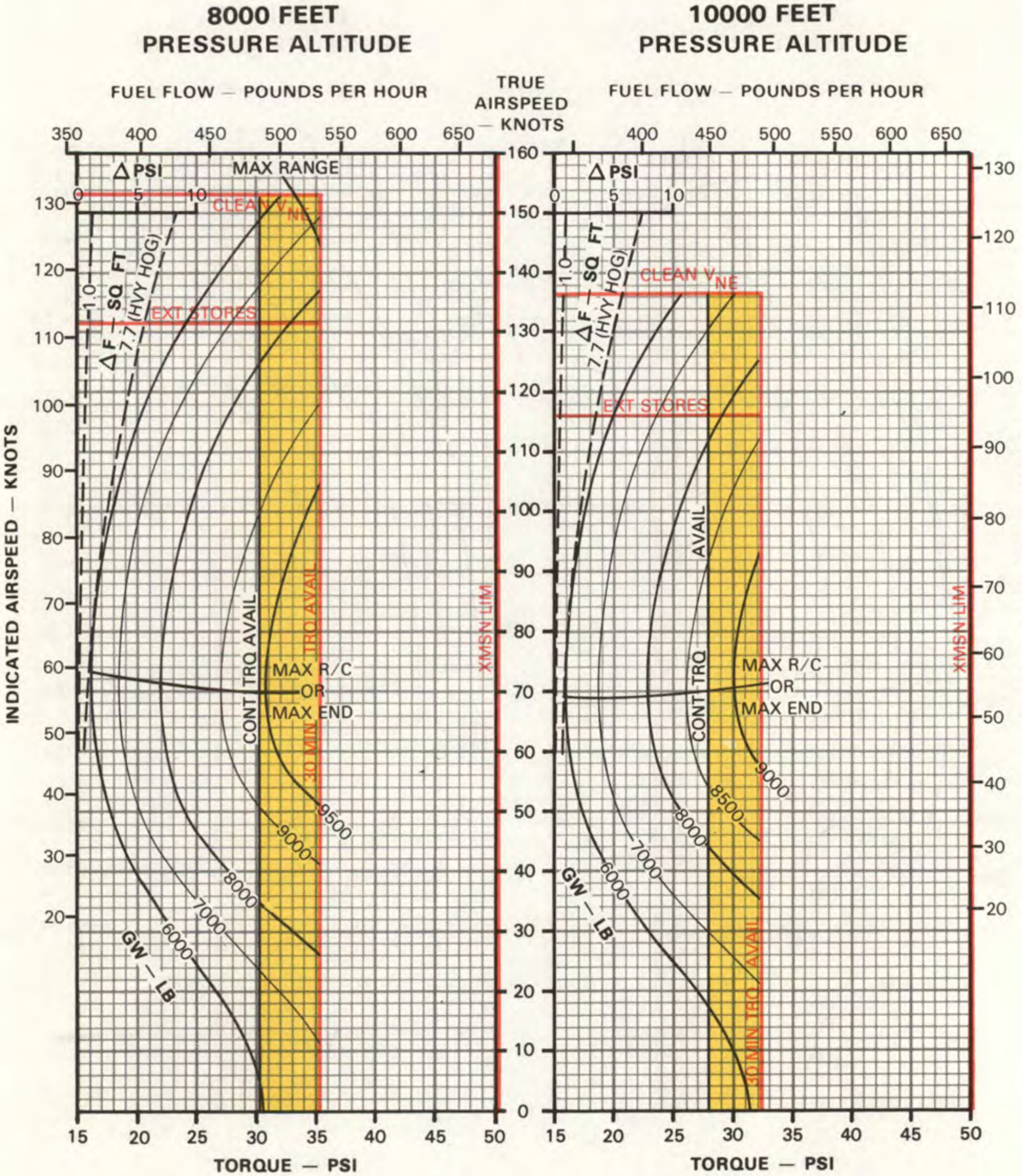
DATA BASIS: DERIVED FROM FLIGHT TEST USA ASTA 66-06, APRIL 1970; MODEL SPEC 104 33, SEPT 1964

Figure 7-7. Cruise chart (Sheet 19 of 23)

CRUISE
PRESSURE ALTITUDE — 8000 FEET TO 10000 FEET
324 ROTOR/6600 ENGINE RPM, CLEAN CONFIGURATION, JP-4 FUEL

CRUISE
AH-1G
T53-L-13B

FAT = +30°C



DATA BASIS: DERIVED FROM FLIGHT TEST USA ASTA 66-06, APRIL 1970; MODEL SPEC 104 33, SEPT 1964

Figure 7-7. Cruise chart (Sheet 20 of 23)

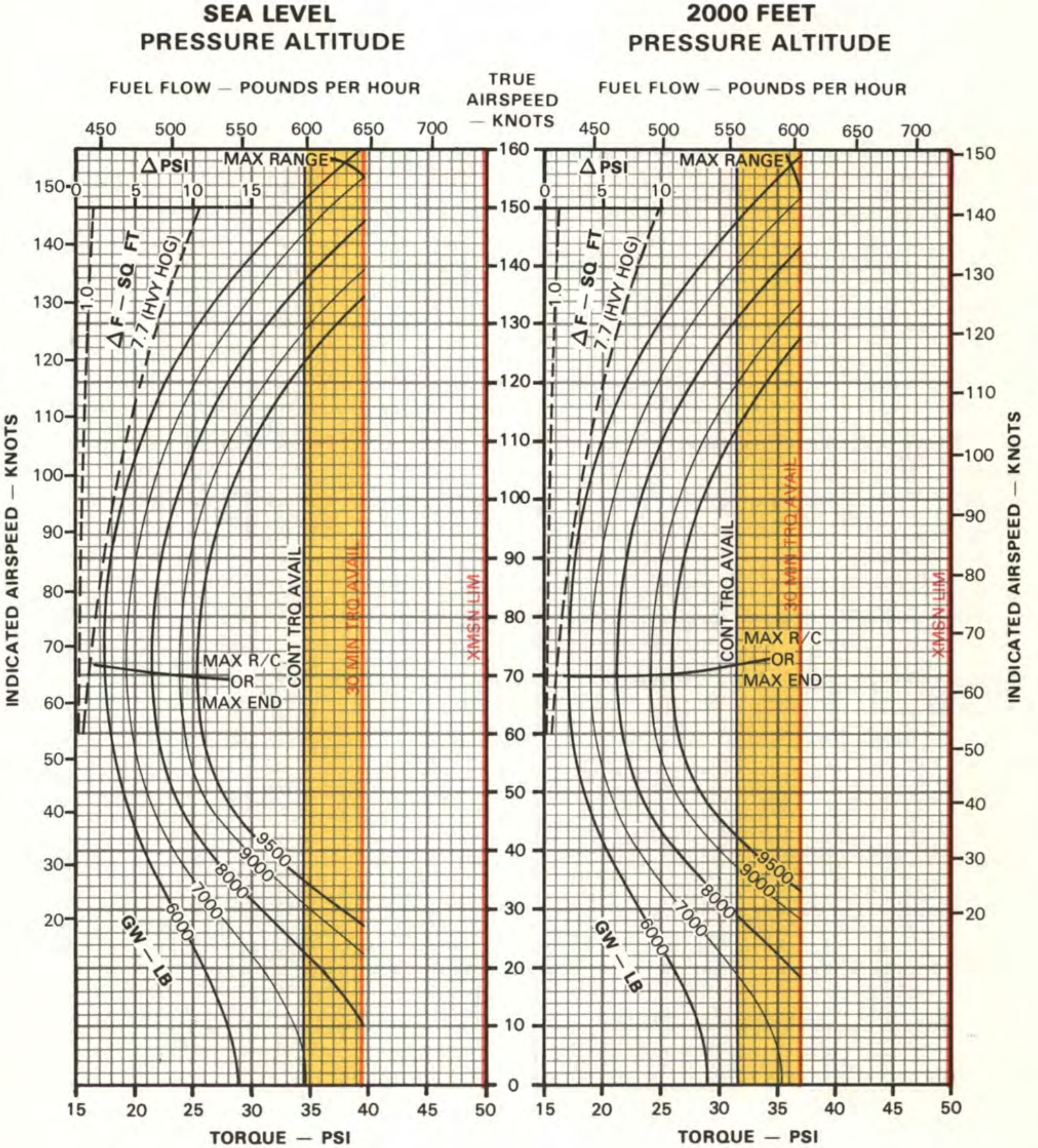
CRUISE

PRESSURE ALTITUDE — SEA LEVEL TO 2000 FEET

324 ROTOR/6600 ENGINE RPM, CLEAN CONFIGURATION, JP-4 FUEL

CRUISE
AH-1G
T53-L-13B

FAT = +45°C



DATA BASIS: DERIVED FROM FLIGHT TEST USA ASTA 66-06, APRIL 1970; MODEL SPEC 104.33, SEPT 1964

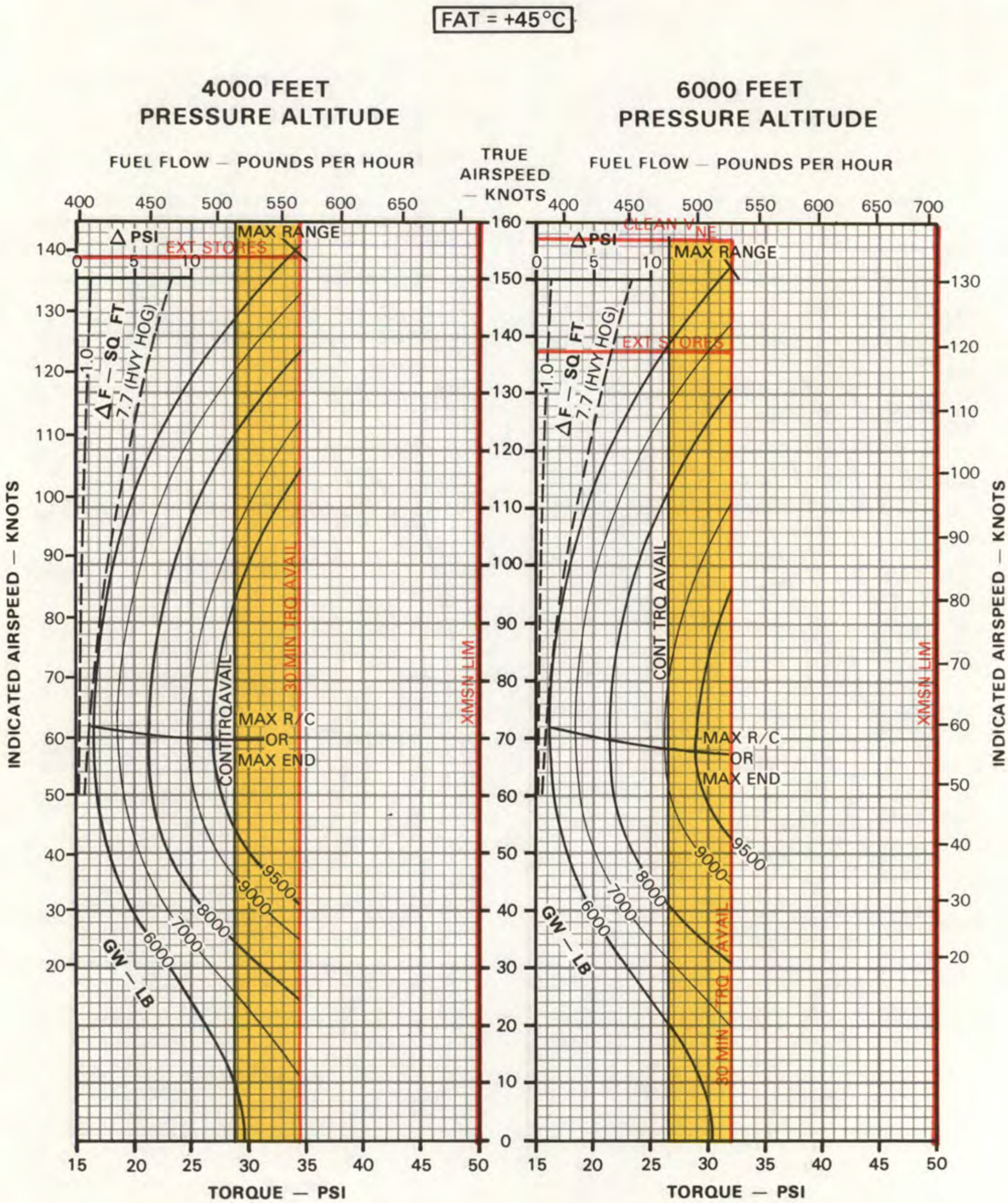
Figure 7-7. Cruise chart (Sheet 21 of 23)

CRUISE

PRESSURE ALTITUDE — 4000 FEET TO 6000 FEET

324 ROTOR/6600 ENGINE RPM, CLEAN CONFIGURATION, JP-4 FUEL

CRUISE
AH-1G
T53-L-13B



DATA BASIS: DERIVED FROM FLIGHT TEST USA ASTA 66-06, APRIL 1970; MODEL SPEC 104.33, SEPT 1964

Figure 7-7. Cruise chart (Sheet 22 of 23)

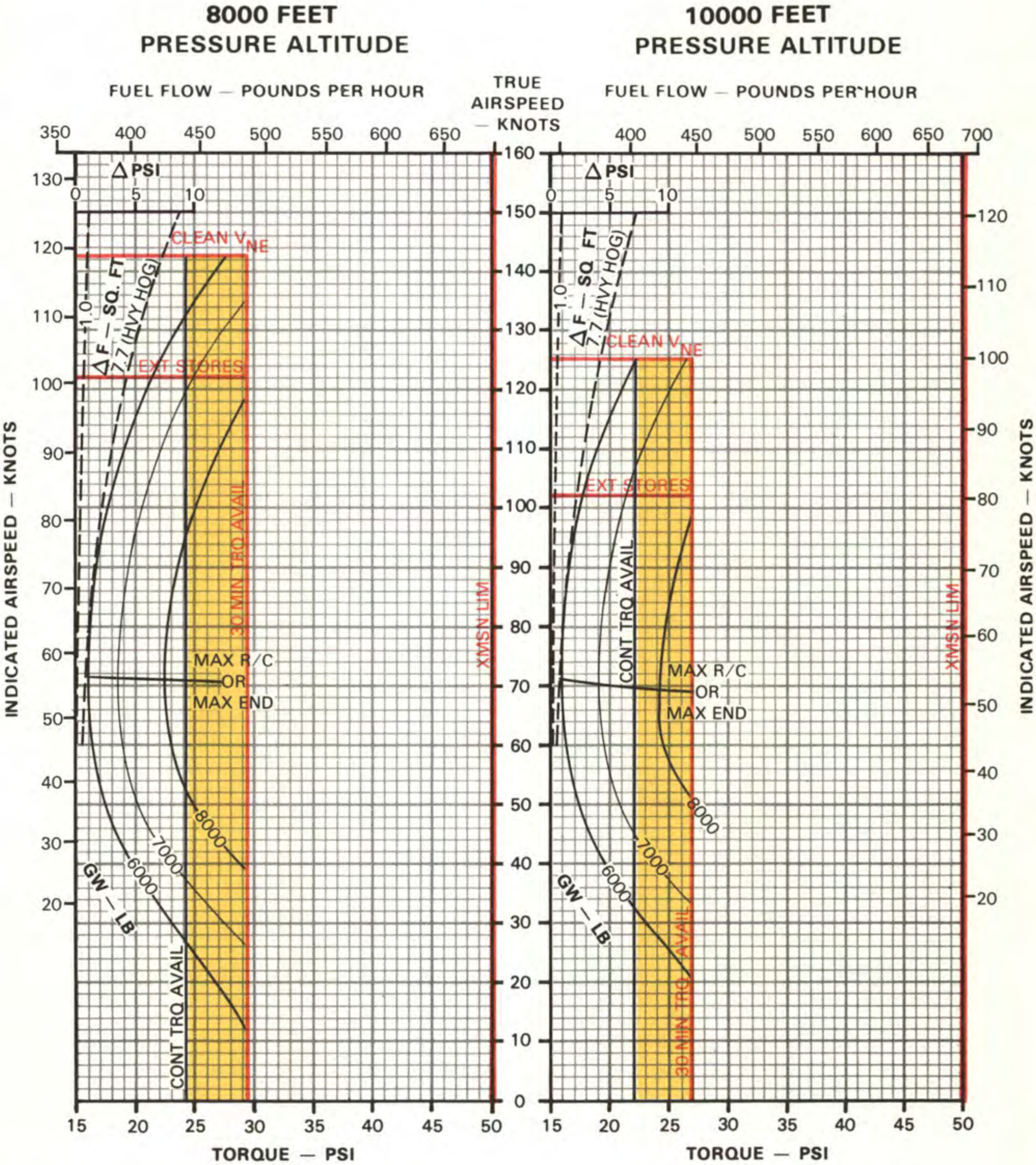
CRUISE

PRESSURE ALTITUDE — 8000 FEET TO 10000 FEET

324 ROTOR/6600 ENGINE RPM, CLEAN CONFIGURATION, JP-4 FUEL

CRUISE
AH-1G
T53-L-13B

FAT = +45°C



DATA BASIS: DERIVED FROM FLIGHT TEST USA ASTA 66-06, APRIL 1970; MODEL SPEC 104.33, SEPT 1964

Figure 7-7. Cruise chart (Sheet 23 of 23)

SECTION VII. DRAG

7-27. Description.

The drag chart (figure 7-8, sheets 1 and 2) shows the equivalent flat plate drag area (△F) increment of all approved configurations.

7-28. Use of Chart.

This chart is used to adjust the cruise charts (figure 7-7) for the appropriate torque and fuel flow due to the equivalent flat plate drag area change (△F).

7-29. Conditions.

The drag chart is based on 324 rotor/6600 engine rpm.

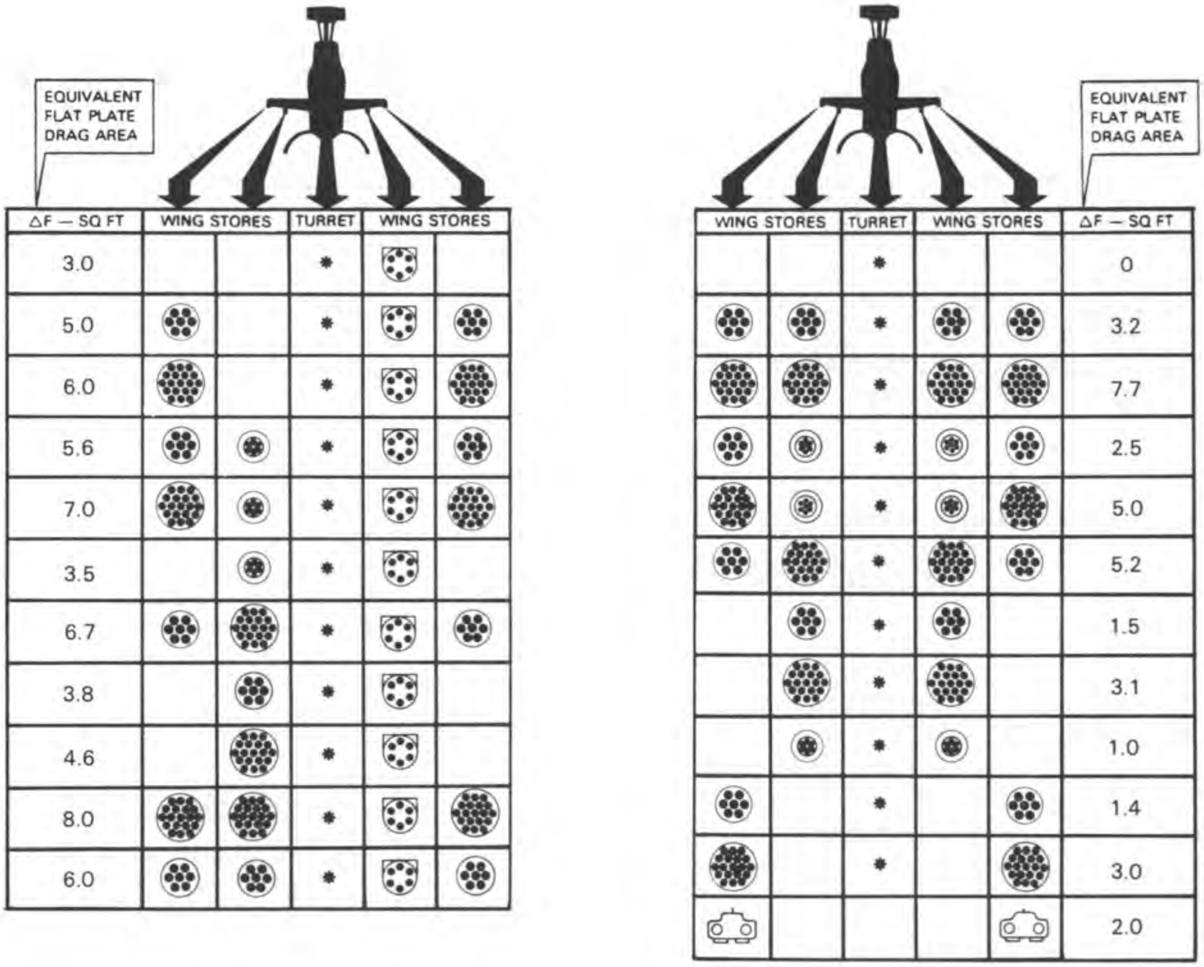


Figure 7-8. Drag chart

SECTION VIII. CLIMB — DESCENT

7-30. Description — Climb-Descent Chart.

The upper grid of the climb descent chart (figure 7-9) shows the change in torque (above or below torque required for level flight under the same gross weight and atmospheric conditions) to obtain a given rate of climb or descent. The lower grid of the chart shows the relationships between descent-climb angles, airspeeds, and rates of descent or climb.

7-31. Use of Climb-Descent Chart.

The primary uses of the chart are illustrated by the chart examples.

a. The torque change obtained from the upper grid scale must be added to the torque required for level flight (for climb) - or subtracted from the torque required for level flight (for descent) - obtained from the appropriate cruise chart in order to obtain a total climb or descent torque.

b. By entering the bottom of the upper grid with a known torque change, moving upward to the gross weight, and left to the corresponding rate of climb or descent may also be obtained.

c. By entering the lower grid chart with any two of the three parameters (rate of climb/descent, descent/climb angle, or airspeed) the third parameter can be read directly from the chart. For example, by entering the chart with a known TAS of 65 knots, moving upward to a known climb angle of nine degrees, and then moving left, the corresponding rate of climb (1025 feet per minute) is obtained.

7-32. Conditions.

The climb-descent chart is based on the use of 324 rotor/6600 engine rpm.

EXAMPLE

WANTED

EXCESS TORQUE AVAILABLE FOR CLIMB AT MAXIMUM CONTINUOUS POWER

KNOWN

CLEAN CONFIGURATION

GROSS WEIGHT = 8000 LB

FAT = -30°C

PRESSURE ALTITUDE = 14000 FEET

METHOD

LOCATE CHART (FIGURE 7-7, PAGE 7-27)

FIND INTERSECTION OF 8000 LB GROSS WEIGHT

LINE WITH THE MAXIMUM RATE OF CLIMB LINE → 1

MOVE DOWN, READ TORQUE REQUIRED = 22 PSI

FIND INTERSECTION OF 8000 LB GROSS WEIGHT

LINE WITH THE CONTINUOUS TORQUE AVAILABLE LINE → 2

MOVE DOWN, READ TORQUE AVAILABLE = 42.5 PSI

EXCESS TORQUE AVAILABLE =(42.5 -22) = 20.5

WANTED

RATE OF CLIMB AT 60 KIAS

MAXIMUM CONTINUOUS POWER

KNOWN

EXCESS TORQUE AVAILABLE (FROM EXAMPLE ON FIGURE 7-7, PAGE 7-27) = 20.5 PSI

GROSS WEIGHT = 8000 LB

METHOD

ENTER CALIBRATED TORQUE SCALE HERE → 3

MOVE UP TO GROSS WEIGHT LINE

MOVE LEFT TO RATE OF CLIMB OR DESCENT SCALE, READ RATE OF CLIMB = 1520 FT/MIN

CLIMB — DESCENT

324 ROTOR/6600 ENGINE RPM

CLIMB — DESCENT
AH-1G
T53-L-13B

EXAMPLE A

WANTED

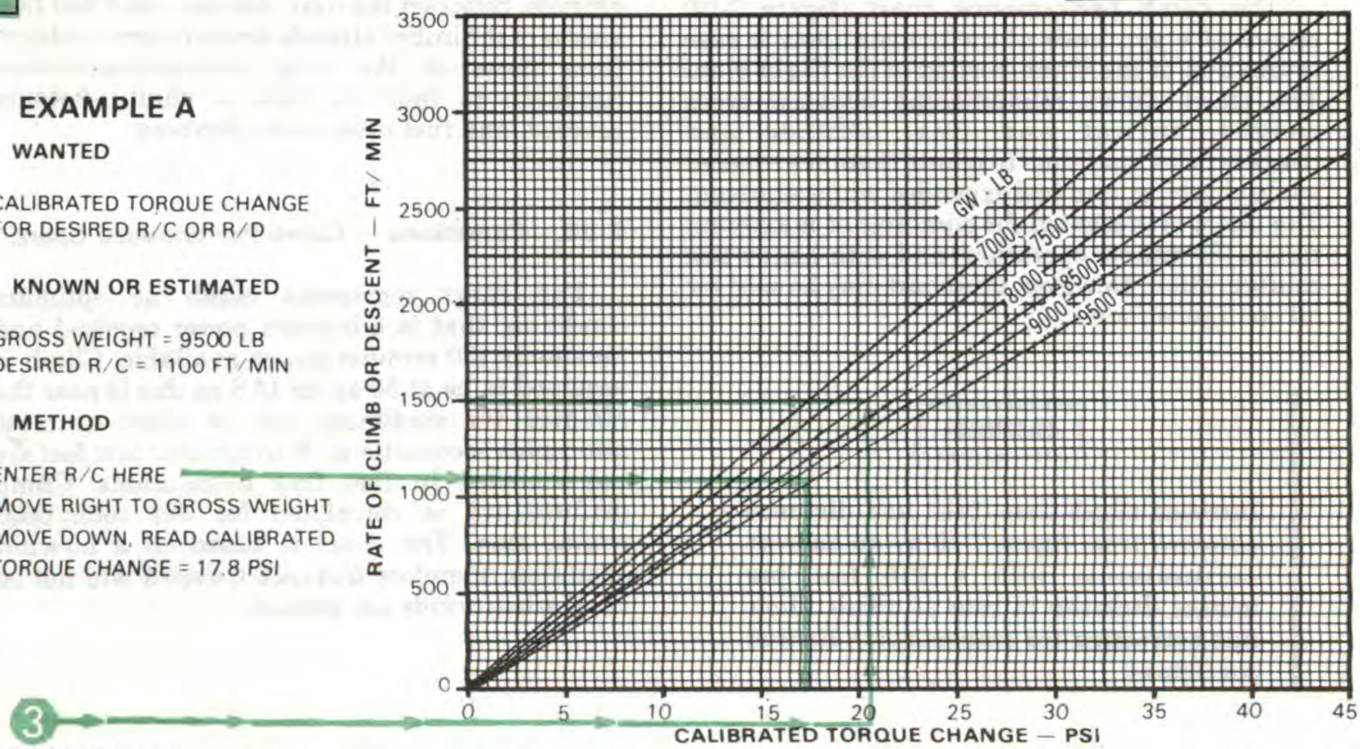
CALIBRATED TORQUE CHANGE FOR DESIRED R/C OR R/D

KNOWN OR ESTIMATED

GROSS WEIGHT = 9500 LB
DESIRED R/C = 1100 FT/MIN

METHOD

ENTER R/C HERE
MOVE RIGHT TO GROSS WEIGHT
MOVE DOWN, READ CALIBRATED TORQUE CHANGE = 17.8 PSI



REMARK: TORQUE CHANGE IS THE DIFFERENCE BETWEEN THE TORQUE USED DURING THE CLIMB OR DESCENT AND THE TORQUE REQUIRED FOR LEVEL FLIGHT AT THE SAME CONDITIONS (ALTITUDE, GROSS WEIGHT, AIRSPEED, CONFIGURATION, ETC)

APPROACH (CLIMB) ANGLE

EXAMPLE B

WANTED

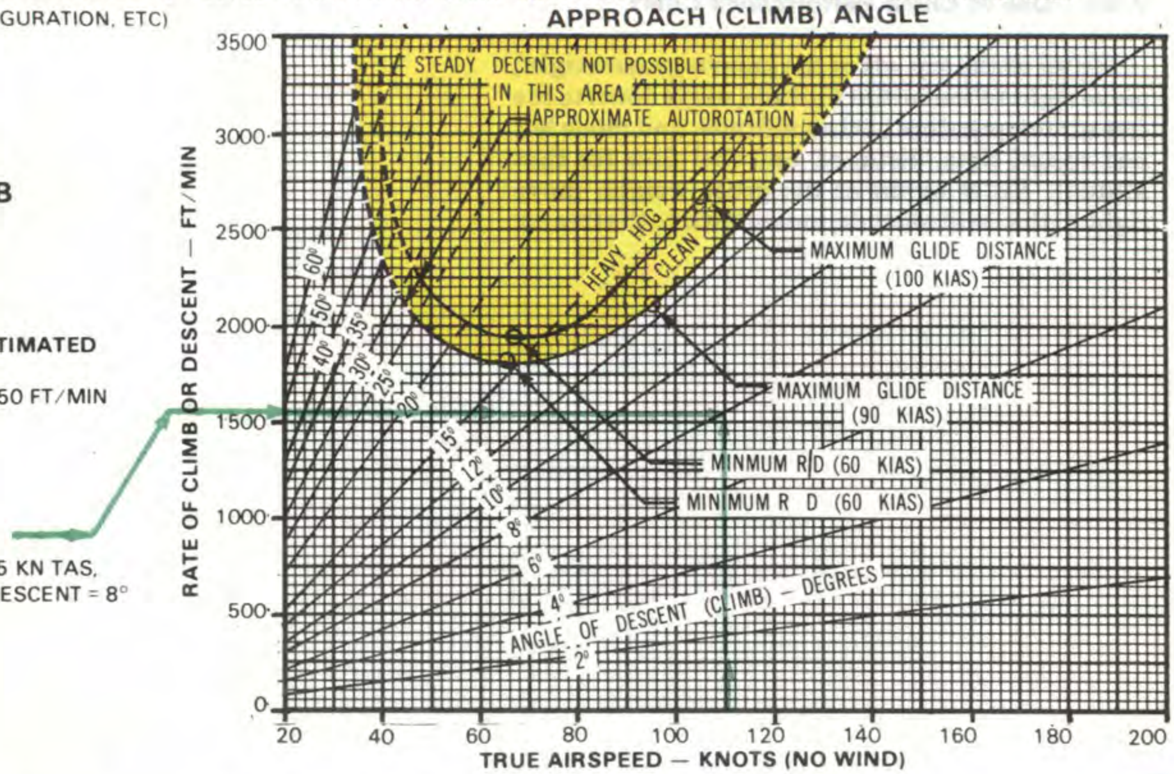
DESCENT ANGLE

KNOWN OR ESTIMATED

DESIRED R/D = 1550 FT/MIN
TAS = 110 KNOTS

METHOD

ENTER R/D HERE-
MOVE RIGHT TO 85 KN TAS,
READ ANGLE OF DESCENT = 8°



DATA BASIS: DERIVED FROM FLIGHT TEST USA ASTA 72-43, JULY 1973 AND CALCULATED DATA

Figure 7-9 . Climb — descent chart

7-33. Description — Climb Performance Chart.

The climb performance chart (figure 7-10) represent a synthesis of the cruise charts to ease estimation of the climb portion of the flight plan. The chart shows relationships between gross weight, initial and final altitude and temperatures, and time to climb, distance covered while climbing, and fuel expended while climbing. The chart is presented for climbing at maximum torque (30-minute operation) and with heavy hog configuration. However, this chart may be used for all configurations.

CAUTION

Increase climb time, fuel, and distance obtained from figure 7-10 by an amount commensurate with a 150 feet per minute decrease in rate of climb. Omit this correction for transmission limited conditions.

7-34. Use of Climb Performance Chart.

Enter at the top left at the known gross weight, move right to the initial altitude, move down to the free air temperature at that altitude, and move left and record time, distance, and fuel flow for that altitude. Enter again at the gross weight, move right to the final altitude, move down to the free air temperature at that altitude, and move right and record the time, distance, and fuel flow for that altitude. Subtract the time, distance, and fuel flow values of the initial altitude-temperature condition from those of the final altitude-temperature condition to find the time to climb, distance covered, and fuel used while climbing.

7-35. Conditions — Climb Performance Chart.

The chart represents climb at optimum condition, that is minimum power required and maximum (30 minute) power available. Climb is assumed to be at 50 knots IAS as this is near the airspeed for maximum rate of climb at most atmospheric conditions. Warmup and taxi fuel are not included in fuel flow calculations. Climb performance is calculated for 324 rotor/6600 engine rpm. The chart is based on a no-wind condition, therefore distance traveled will not be valid when winds are present.

CLIMB PERFORMANCE
(MAXIMUM TORQUE — 30 MINUTE OPERATION)
324 ROTOR/6600 ENGINE RPM CLIMB AT 60 KIAS

CLIMB
AH-1G
T53-L-13B

EXAMPLE

WANTED

MAXIMUM TORQUE
TIME TO CLIMB
DISTANCE TRAVELED
FUEL USED

KNOWN

GROSS WEIGHT = 9000 LBS
INITIAL PRESSURE ALTITUDE = 2000 FT
FINAL PRESSURE ALTITUDE = 12000 FT
INITIAL FAT = 40°C
FINAL FAT ESTIMATED AT 0°C

METHOD

ENTER GROSS WEIGHT HERE
MOVE RIGHT TO INITIAL PRESSURE ALTITUDE
MOVE DOWN TO INITIAL FAT ON
TIME, DISTANCE, AND FUEL CHARTS
MOVE LEFT, READ:

TIME = 1.8 MIN

DISTANCE = 2 NM

FUEL = 19.6 LB

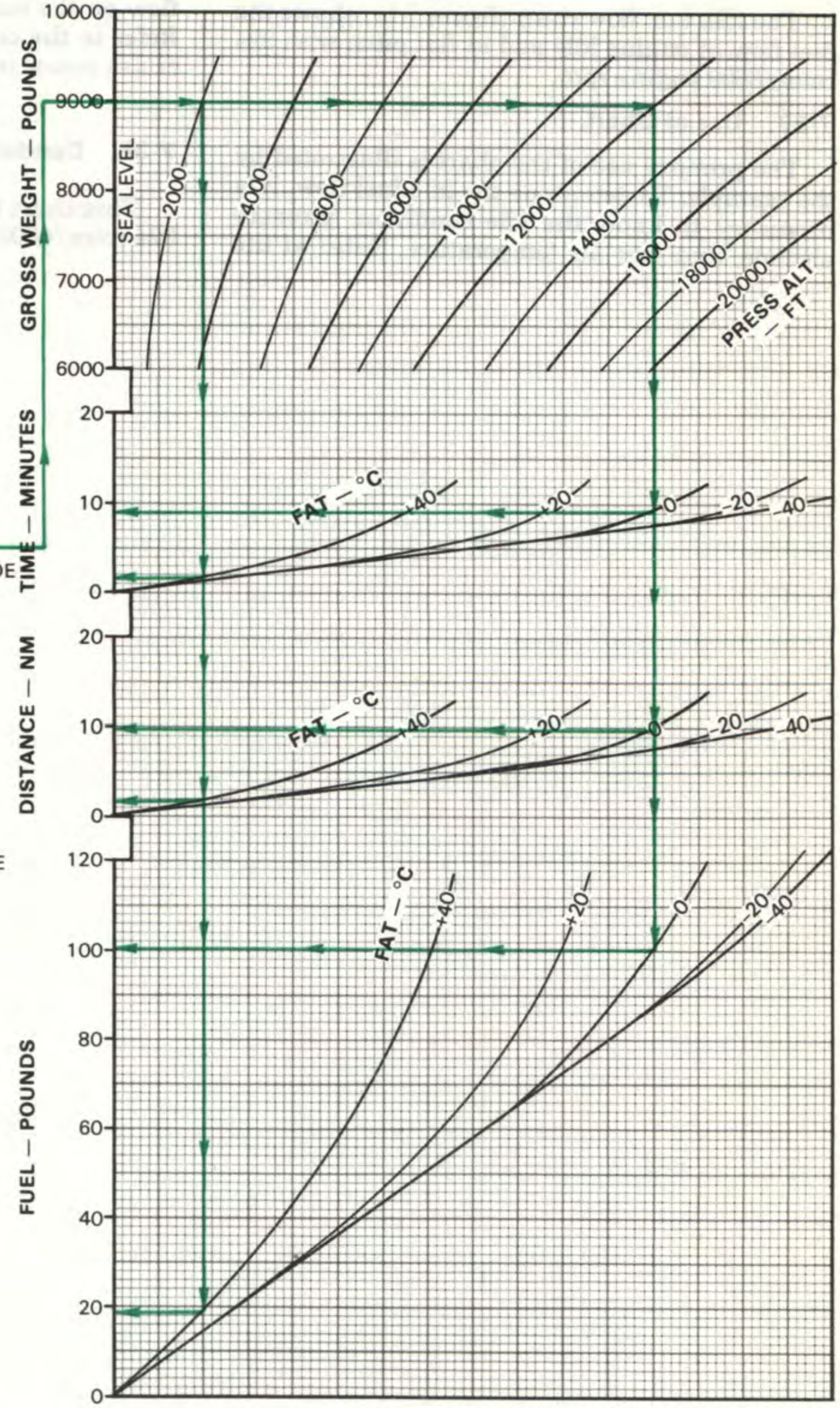
REENTER AT SAME GROSS WEIGHT
MOVE RIGHT TO FINAL PRESSURE ALTITUDE
MOVE DOWN TO FINAL FAT, ON TIME,
DISTANCE, AND FUEL CHARTS
MOVE LEFT, READ:

TIME = 9.2 MIN

DISTANCE = 10 NM

FUEL = 101 LB

TIME TO CLIMB = (9.2 - 1.8) = 7.4 MIN
DISTANCE COVERED = (10 - 2) = 8 NM
FUEL USED = (101 - 19.6) = 81.4 LB



DATA BASIS: DERIVED FROM FLIGHT TEST, USAASTA 66-06, APRIL 1970

Figure 7-10. Climb performance chart

SECTION IX. IDLE FUEL FLOW

7-36. Description.

The idle fuel flow chart (figure 7-11) shows the fuel flow at engine idle and at flat pitch with 324 rotor/6600 engine rpm.

7-37. Use of Chart.

The primary use of the chart is illustrated by the example. To determine the idle fuel flow, it is necessary to know the idle condition, pressure altitude, and free air temperature. Enter at the pressure altitude, move right to FAT in appropriate grid, then move down and read fuel flow on the scale corresponding to the condition. Refer to the cruise charts to obtain fuel flow for cruise power conditions.

7-38. Conditions.

This chart is based on the use of JP-4 fuel and 324 rotor/6600 engine rpm.

IDLE FUEL FLOW

JP-4 FUEL

IDLE FUEL FLOW
AH-1G
T53-L-13B

EXAMPLE

WANTED

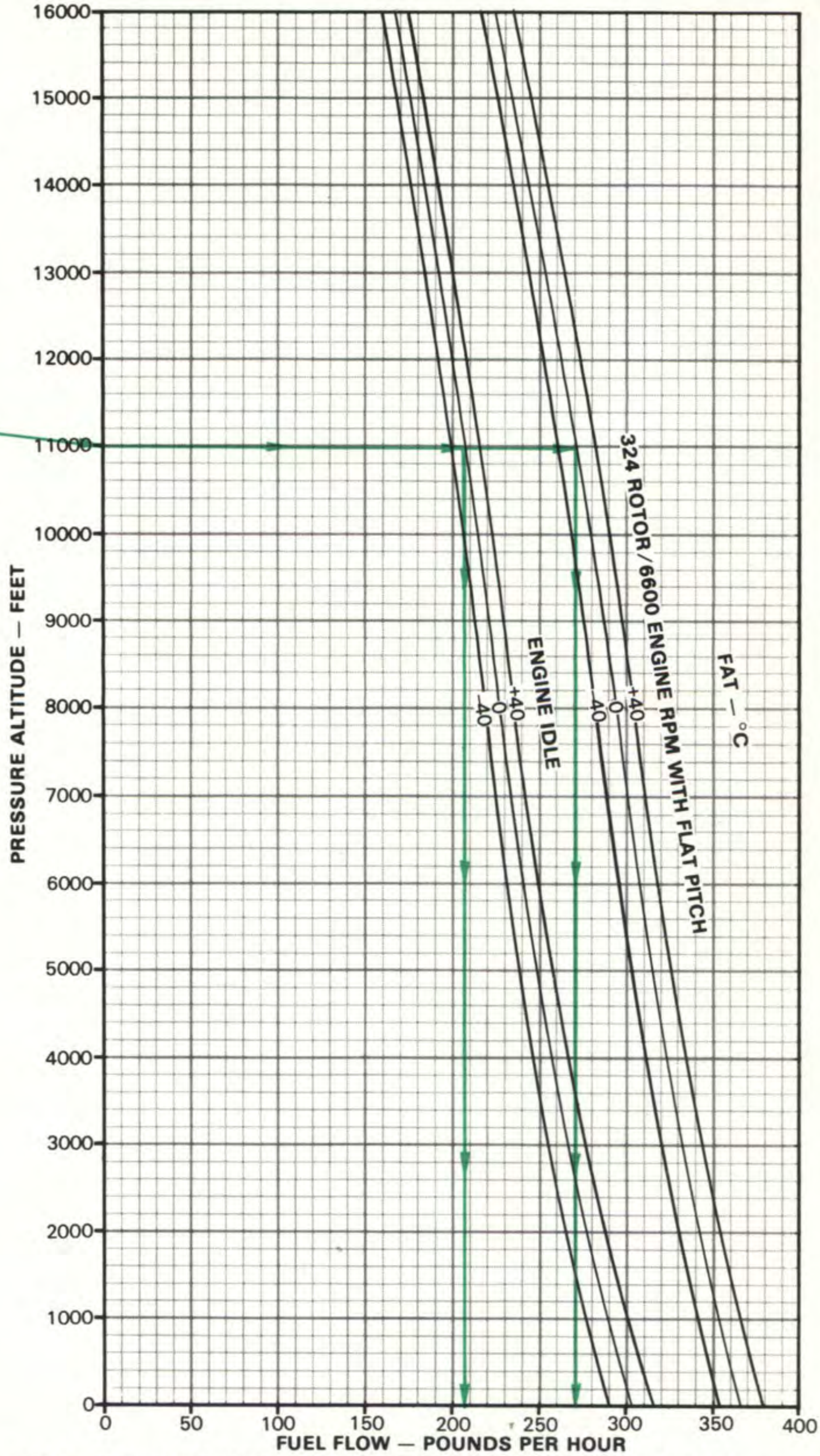
FUEL FLOW AT ENGINE IDLE AND AT 324 ROTOR/6600 ENGINE RPM WITH FLAT PITCH

KNOWN

PRESSURE ALTITUDE = 11000 FEET
FAT = 0°C

METHOD

ENTER PRESSURE ALTITUDE HERE
MOVE RIGHT TO (ENGINE IDLE)
FAT = 0°C
MOVE DOWN, READ GROUND IDLE
FUEL FLOW = 207 LB/HR
REENTER PRESSURE ALTITUDE HERE
MOVE RIGHT TO (FLAT PITCH)
FAT = 0°C
MOVE DOWN, READ FLAT PITCH
FUEL FLOW = 272 LB/HR



DATA BASIS: CALCULATED FROM MODEL SPEC 104.33, SEPT 1964, CORRECTED FOR INSTALLATION LOSSES BASED ON FLIGHT TEST, USAASTA 66-06, APRIL 1970

Figure 7-11. Idle fuel flow chart

CHAPTER 8

NORMAL PROCEDURES

SECTION I. MISSION PLANNING

8-1. Mission Planning.

Mission planning begins when the mission is assigned and extends to the preflight check of the helicopter. It includes, but is not limited to check of operating limits and restrictions; weight and balance loading; performance; publications; flight plan and crew briefings. The pilot in command shall ensure compliance with the contents of this manual that are applicable to the mission.

8-2. Operating Limits and Restrictions.

The minimum, maximum, normal and cautionary operational ranges represent careful aerodynamic and structural calculations, substantiated by flight test data. These limitations shall be adhered to during all phases of the mission. Refer to chapter 5, OPERATING LIMITS AND RESTRICTIONS, for detailed information.

8-3. Weight Balance and Loading.

The helicopter shall be loaded, armament secured, and weight and balance verified in accordance with chapter 6, WEIGHT, BALANCE, AND LOADING. This helicopter is in weight and balance class 1B and requires a weight and balance clearance in accordance with AR 95-16. The aircraft weight and center-of-gravity conditions shall be within the limits prescribed in Center-of-Gravity Limits chart in Chapter 6.

8-4. Performance.

Refer to Chapter 7, PERFORMANCE DATA, to determine the capability of the helicopter for the entire mission. Consideration shall be given to changes in performance resulting from variations in loads, temperatures, and pressure altitudes. Record the data on the Performance Planning Card for use in completing the flight plan and for reference throughout the mission.

8-5. Flight Plan.

A flight plan shall be completed and filed in accordance with AR 95-1, DOD FLIP, and local regulations.

8-6. Crew Briefing.

A crew briefing shall be conducted to ensure a thorough understanding of individual and team responsibilities. The briefing shall include, but not be limited to, copilot/gunner and ground crew responsibilities and the coordination necessary to complete the mission in the most efficient manner. A review of visual signals is desirable when ground guides do not have a direct voice communications link with the crew.

8-7. Danger Area.

Refer to figure 8-1.

SECTION II. OPERATING PROCEDURES AND MANEUVERS

8-8. Operating Procedures and Maneuvers.

This section deals with normal procedures, and includes all steps necessary to ensure safe and efficient operation of the helicopter from the time a preflight begins until the flight is completed and the helicopter is parked and secured. Unique feel, characteristics and reaction of the helicopter during various phases of operation and the techniques and procedures used for hovering, takeoff, climb, etc., are described, including precautions to be observed. Your flying experience

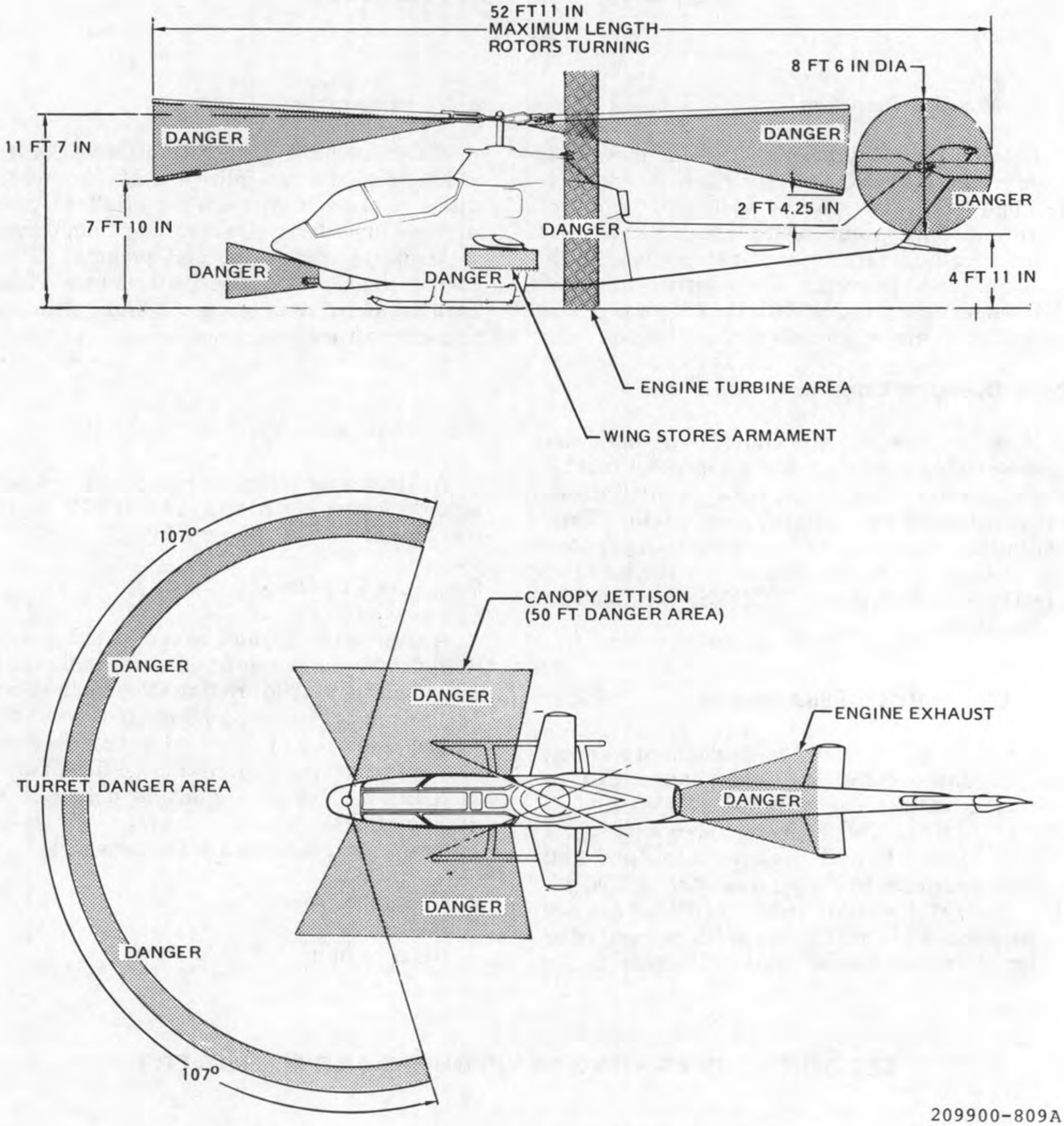


Figure 8-1. Danger areas

is recognized; therefore, basic flight principles are avoided. Only the duties of the minimum crew necessary for the actual operation of the helicopter are included.

8-9. Mission Equipment.

Mission equipment checks are contained in Chapter 4, MISSION EQUIPMENT. Procedures specifically related to instrument flight that are different from normal procedures are covered in section III. Descriptions of functions, operations, and effects of controls are covered in Section IV, FLIGHT CHARACTERISTICS, and are repeated in this section only when required for emphasis. Checks that shall be performed under adverse environmental conditions, such as desert and cold weather operations, supplement normal procedures checks in this section and are covered in Section V, ADVERSE ENVIRONMENTAL CONDITIONS.

8-10. Checklist.

Normal procedures are given primarily in checklist form, and amplified as necessary to accompanying paragraph form when a detailed description of a procedure or maneuver is required. A condensed version of the amplified checklist, omitting all explanatory text, is contained in the Operators and Crewmembers Checklist, TM 55-1520-221-CL. To provide for easier cross-referencing, the procedural steps in TM 55-1520-221-CL are numbered to coincide with the corresponding numbered steps in TM 55-1520-221-10.

8-11. Checks.

The checklist inculdes items for day, night, and instrument flights with annotative indicators immediately preceding the check to which they are pertinent; N for night operations only; I for instrument operations only; and O to indicate a requirement if the equipment is installed. The symbol ★ preceding steps of the checklist indicates that detailed procedures for those checks are included in the performance checks section located at the back of the condensed checklist (TM 55-1520-221-CL). Those duties which are the responsibility of the gunner are indicated by a circle around the step number, e.g., (4)

8-12. Thru-Flight Check.

When an aircraft is flown by the same flight crew on a mission requiring intermediate stops it is not necessary to perform all of the normal checks. The steps that are essential for safe aircraft operation on intermediate stops are designated as "thru-flight" checks. An asterisk * indicates that performance of steps is mandatory for all thru-flights. When there has been no change in crew, the asterisk applies only to checks performed prior to takeoff.

8-13. Checklist Callout.

Pilot and gunner shall not rely on memory for accomplishment of prescribed operational checks except for those immediate action emergency procedures that must be memorized for safe aircraft emergency operation. Checklist items are called out orally and are verified by pilot and gunner.

8-14. BEFORE EXTERIOR CHECK.

WARNING

Do not preflight until armament systems are safe. Refer to chapter 4, section II for safety and preflight procedures.

*1. Armament systems — Safe as follows:

a. Wing ejector racks — Jettison safety pins installed.

b. Rocket launcher — Igniter arms in contact with rockets.

*2. MASTER ARM switch — OFF.

O *3. 20MM ARM switches — OFF.

*4. WG ST ARM switch — OFF.

*5. OVERRIDE PILOT switch — OFF.

T *6. IP MASTER ARM switch — OFF.

*7. Publications — Check DA Forms 2408-12, -13, -14, and -18; DD Form 1896; DD Form 365F; locally required forms and publications; and availability of operators manual (-10) and checklist (-CL).

*8. IGNITION switch — ON.

9. BAT switch — BAT. Check voltmeter indication.

10. NON-ESS BUS switch — MANUAL.

11. Lights — On; check search, anticollision, position, and interior lights for condition and operation as required; then OFF.

12. BAT switch — OFF.

13. FM homing and ADF antennas — Check condition and security.

14. Area behind pilot seat — Check condition and security of first aid kit, sensor amplifier unit, and pylon compensator unit.

15. Canopy — Check condition and security.

O 16. Pilot and gunner canopy removal arming/firing mechanism safety pin — In.

O 17. Breakout knife — Check secure.

8-15. EXTERIOR CHECKS. (Figure 8-2.)

8-16. AREA 1 — FUSELAGE AND MAIN ROTOR.

*1. Forward main rotor blade — Tiedown removed, check condition.

2. Fuselage — Check condition as other items are checked.

3. Static port — Check unobstructed.

*4. Ammunition bay — Check condition and security of right door; loading security, electrical connection, and internal hydraulic lines. Secure door.

*5. Hydraulic compartment — Check condition and security of utility hydraulic connections, lines, reservoirs, caps and ECU. Check module filter buttons in.

*6. Fuel — Check quantity for first flight of the day and when refueled. Secure cap.

7. Landing gear — Check condition and security of fairings, cross tubes, skid shoe and handling wheels removed.

*8. Fuel sample — Check for contamination for first flight of the day and when refueled. If the fuel sump pumps and filter have not been drained by maintenance personnel, drain and check as follows:

a. Sumps — Drain and secure doors.

b. BAT switch — BAT.

c. FUEL switch — FUEL.

d. Drain fuel filter — Check fuel lines for leaks.

e. FUEL switch — OFF.

f. BAT switch — OFF.

9. Area beneath transmission — Check condition and security of hydraulic, oil, and fuel lines; controls, and accumulator for proper charge.

10. Wing — Check condition and security of retention bolts, wing stores, and position light.

11. Engine and transmission cowling — Open.

12. Engine air intake — Shield removed; check condition.

13. Transmission area — Check condition and security of hydraulic pumps and lines, servo, and transmission.

14. Transmission oil level — Check.

15. Pylon access — Check condition and security of FM antenna and engine oil reservoir.

*16. Engine oil level — Check by removing cap; then secure cap.

17. Swashplate and support — Check condition and security of collective lever, antidrive link, swashplate drive link, scissors levers and friction collet.

18. Main rotor system — Check condition and security of control tubes — pitch change tubes, mast, split cones, rotor retaining nut, blade grip, and sand and

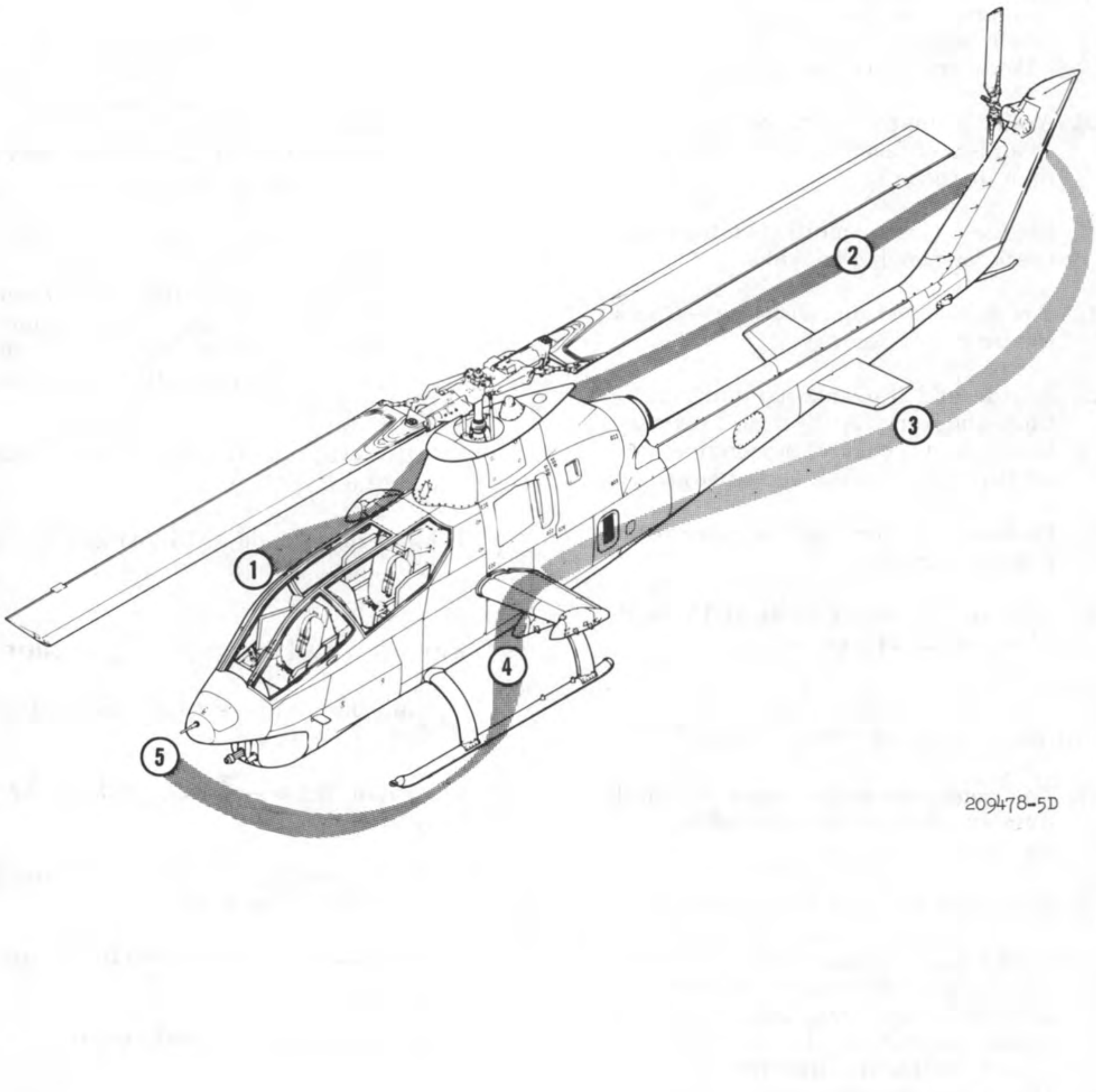


Figure 8-2. Exterior check diagram

dust deflectors, flapping bearings, feathering bearings, drag braces, top of rotor blades and flapping bearing bolts. Safety bar properly secured to elastomeric trunnion bearings, if so equipped.

19. Plenum — Check condition and security of components, lines, particle separator, mesh screen around FOD screen, latches, and area beneath the separator.

20. Area beneath plenum — Check condition of fuel and oil lines and tail rotor driveshaft.

21. Engine — Check condition and security; check for fuel and oil leaks.

O 22. Fire detector sensing elements — Check condition and security.

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

24. Fuselage — Check condition as other items are checked.

25. Tailpipe — Cover removed and stowed. Check condition and security.

8-17. AREA 2 — TAIL SECTION — RIGHT SIDE.

1. Tail rotor driveshaft access — Check number 1 hanger bearing condition and security.

2. Air ejector area — Check condition.

3. Electrical compartment — Check condition and security of electrical equipment and lines, tail rotor servo, battery and vent, rivets, and rivet plates; tailboom attaching bolts for slippage marks, and circuit breakers in.

4. Tailboom — Check condition as other items are checked.

5. Synchronized elevator — Check condition and security.

6. Position light — Check condition and security.

*7. Tail rotor gearboxes (42° and 90°) — Check condition, oil levels, filler caps secure.

*8. Tail rotor — Check condition and security as follows:

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

b. Tail rotor assembly with blade chord of 11.5 inches: trunnion retaining nut, shield, cross head, counterweights, pitch change links, retainer assembly, split cones, safeties, cotter pins, hub, and blades.

9. Tail skid — Check security and condition.

*10. Main rotor blade — Untied and check condition.

8-18. AREA 3 — TAIL SECTION — LEFT SIDE.

1. Tailboom — Check condition as other items are checked.

2. Position light — Check condition and security.

3. Synchronized elevator — Check condition and security.

4. Antennas — Check condition and security.

5. Air ejector area — Check condition.

8-19. AREA 4 — FUSELAGE — LEFT SIDE.

1. Oil cooler — Check condition.

2. Fuselage — Check condition as other items are checked.

*3. Engine and transmission cowling — Open.

4. Engine air intake — Shield removed; check condition.

*5. Engine — Check condition and security; check for fuel and oil leaks.

O 6. Fire detector sensing elements — Check condition and security.

*7. Plenum — Check condition and security of components, lines, particle separator, mesh screen around FOD screen, latches and area beneath the separator.

8. Area beneath plenum — Check condition and security of fuel lines, fuel manifold, and tail rotor driveshaft.

9. Main rotor head and control tubes — Check condition, security movement, safeties, and retention of elastomeric trunnion bearings.

10. Top of pylon — Check condition and security; anti-collision light.

11. Pylon access — Check oil reservoir condition.

*12. Swashplate and support — Check condition and security of collective levers, anti-drive link, swashplate drive links, scissors levers, and friction collet.

*13. Main driveshaft — Check condition and security. (Rotate counterclockwise.)

*14. Transmission area — Check condition and security of lines, servo and transmission.

15. Lift link — Check condition and security.

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

17. Wing — Check condition and security of retention bolts, wing stores and position light.

18. Landing gear — Check condition and security of fairings, cross tubes, skid shoes, and handling wheels removed.

*19. Hydraulic compartment — Check condition and security of lines, reservoir caps and ECU. Check hydraulic fluid levels and module filter indicator buttons in.

20. Canopy — Check condition and security.

21. Fire extinguisher — Check seal not broken and security.

22. Static port — Check unobstructed.

*23. Ammunition bay — Check condition and security of left door, electrical connection, and internal hydraulic lines. Secure door.

8-20. AREA 5 — NOSE SECTION.

1. Turret — Check condition and security of weapons and turret access doors and secure; turret weights security if installed.

2. Fuselage — Check condition of nose and bottom.

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

4. Battery compartment — Check condition and security of components, circuit breaker — In and secure door.

5. Windshield — Check condition; rain removal nozzle unobstructed.

*6. Main rotor — Rotate 90°, remove tiedown.

*7. Helicopter covers, tiedowns, and grounding cables — Removed and secured.

*8. Cowling, compartment doors, and panels — Secure.

8-21. INTERIOR CHECKS.

8-22. BEFORE STARTING ENGINE — GUNNER (GUNNER STATION NOT OCCUPIED).

When single pilot operation is to be conducted, the following items must be checked in the gunner cockpit.

1. Seat belts and shoulder harness — Secure.
2. Loose equipment — Secure.
3. ELEC PWR switch — ELEC PWR.
4. DE-ICE switch — OFF.
5. FORCE TRIM switch — FORCE TRIM.
6. INST LTS switch — As desired.
7. GOV switch — AUTO.
8. IDLE STOP RELEASE switch — OFF.

O 9. Miscellaneous control panel cover — As desired.

10. Standby compass — Check condition, deviation card current.
11. EMER COLL HYD switch — OFF.
12. WING STORES JETTISON switch — Cover down and safetied.

O 13. VHF radio — On; set to desired frequency.

14. Sight — Stowed, gimbal locks secure.
15. Cockpit light — OFF.
16. Canopy door — Secure.

8-23. BEFORE STARTING ENGINE — GUNNER (GUNNER STATION OCCUPIED).

* (1.) Loose equipment — Stowed and secured.

(2.) Pedals — Adjust.

* (3.) Seat belt and shoulder harness — Fasten and tighten.

(4.) Shoulder harness lock — Check operation and leave unlocked.

O (5.) Door jettison handle — Secure and safetied.

(6.) ELEC PWR switch — ELEC PWR.

(7.) DE-ICE switch — OFF.

(8.) FORCE TRIM switch — FORCE TRIM.

(9.) INST LTS — As desired.

(10.) GOV switch — AUTO.

(11.) IDLE STOP RELEASE switch — OFF.

O (12.) Miscellaneous control panel cover — As desired.

(13.) Vents — As desired.

(14.) Standby compass — Check condition, fluid, and deviation card.

(15.) EMER COLL HYD switch — OFF.

(16.) WING STORES JETTISON switch — Cover closed and safetied.

(17.) Avionics — OFF and set to desired frequency.

(18.) Systems Instruments — Check static indications, condition, and markings.

(19.) Flight instruments — Check as follows:

a. Airspeed indicator — Check indication.

b. Altimeter — Set to field elevation.

T c. VSI — Check indication.

(20.) Mirror — Check condition and adjust.

* (21.) Sight — Stowed, gimbal locks secured. Check as follows:

a. Ground safety lever — Horizontal.

b. Glare shield — Check condition and security.

c. WEAPON SELECT switch — As desired.

d. RANGE control knob — Adjust.

e. FIL SEL switch — As desired.

f. Reticle intensity control — As desired.

g. COMP switch — As desired.

* (22.) Armament switches — Set as follows:

a. AMMO RESERVE PERCENT — Set.

b. OVERRIDE PILOT switch — OFF.

c. WEAPON CLEAR/WEAPON UNCLEAR switch — WEAPON CLEAR.

d. WING STORES SELECT switch — OFF.

e. POINT/AREA FIRE switch — As desired.

f. AMMO FIRE OUT switch — As desired.

(23.) Cyclic trigger guard — Down.

O (24.) Breakout knife — Check secured.

O * (25.) Arm/fire mechanism safety pin — Remove and stow.

(26.) Cockpit light — Check condition, set as desired.

8-24. BEFORE STARTING ENGINE — PILOT.

O 1. Breakout knife — Check.

*2. Loose equipment — Secure.

3. Seat and pedals — Adjust.

*4. Seat belt and shoulder harness — Fasten and tighten.

5. Shoulder harness lock — Check operation and leave unlocked.

O 6. Door jettison handle — Secure and safetied.

7. Flight controls — Check position; friction and lock off. The collective may be in a position other than full down. Cyclic trigger guard — Down.

8. AC circuit breakers — In/on.

9. GEN switch — OFF.

10. INVTR switch — OFF.

11. DE-ICE switch — OFF.

12. FORCE TRIM switch — FORCE TRIM.

13. FUEL switch — OFF.

14. ENG OIL BYP switch — As desired.

15. GOV switch — AUTO.

16. FAT indicator — Check FAT and condition.

17. SAS POWER switch — OFF.

18. WG ST JETTISON SELECT switch — As desired.

19. Systems instruments — Check engine, transmission and electrical systems for static indications, slippage marks and operating limits markings.

*20. Flight instruments — Check indication and set as follows:

a. Altimeter — Set to field elevation.

b. Airspeed indicator — Check indication.

c. Vertical speed indicator — Check indication.

d. RMI — Check and set as required. Deviation card current.

* 21. EMER COLL HYD switch — OFF.

22. WING STORES JETTISON switch — Cover down and safetied.

23. Compass slaving switch — As desired.

24. Clock — Wound, running, and set.

★ 25. Armament switches — Set as follows:

a. Weapons select switch — As desired.

b. MASTER ARM switch — OFF.

c. GUNNER/PILOT CONTROL switch — As desired.

d. POINT/AREA FIRE switch — As desired.

e. WG ST JETTISON SELECT — BOTH.

f. RKT PR SEL — Set to 1.

g. WG ST ARM switch — OFF.

O h. SMOKE grenade switches — OFF.

26. PITOT HEAT switch — OFF.

27. RAIN REMOVAL/ENVR CONT switch — OFF.

28. HEAT OR VENT control — PULL. Set heat vent control prior to flight as operation in flight is often impossible.

29. Vents — As desired.

30. Avionics — OFF, set on desired frequencies.

31. INSTR LTS and CONSOLE LTS switch — As desired.

*32. ANTI-COLL LT switch — ON.

*33. POSITION LTS switch — As required.

34. DC circuit breakers — In/on.

35. Cockpit lights — Check condition and security. Set as required.

O *36. Arm/fire mechanism safety pin — Remove and stow.

8-25. STARTING ENGINE.

*1. BAT switch — As required; BAT for battery start, OFF for Ground Power Unit (GPU) start.

WARNING

Accidental firing of rockets may occur if external power is used to start helicopter.

*2. Ground power unit — Connect for GPU start. EXTERNAL POWER caution light illuminates.

3. GOV RPM switch — DECR 10 seconds.

*4. Throttle — Check full travel and operation of idle release switch. Set for start by positioning the throttle as near as possible on the decrease side of the idle stop. Slight twist grip friction may be required to assure that 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.

*5. FUEL switch — FUEL. FUEL BOOST caution lights should be out.

*6. CHIP DET — Test.

*7. MASTER CAUTION and RPM LIMIT warning lights — Check illuminated.

*8. CAUTION panel lights — TEST and RESET MASTER CAUTION light.

*9. FIRE DETECTOR TEST switch — TEST FIRE light should illuminate.

*10. Voltmeter — Check for minimum 22V, maximum 30V.

*11. Fireguard — Posted.

*12. Rotor blades — Check clear and untied.

★ *13. Engine — Start as follows:

EMERGENCY PROCEDURES — Paragraphs 9-16, 9-17, 9-18, 9-47, 9-48.

a. Starter switch — Press and hold — start timing.

b. Collective — Down.

c. Cyclic — Centered.

d. EGT and (N1) — Monitor.

e. Starter switch — Release at 40% gas producer (N1) or after 40 seconds, whichever occurs first. Refer to chapter 5 for starter limits.

*14. GEN switch — GEN. The DC GENERATOR caution light should be out during battery start, ON for GPU start.

*15. INVTR switch — As required; STBY for first flight of the day; MAIN for thru flight.

*16. Engine and transmission oil pressure — Check.

17. INVTR switch — OFF. The INST inverter caution light should be on; then MAIN. The INST INVERTER caution light should be off.

CAUTION

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

*18. Throttle — Slowly advance past the engine idle stop to engine idle position. Manually check stop by attempting to roll throttle off.

*19. Gas Producer (N1) — 68% to 72%. Hold a slight pressure against the idle stop during this check.

*20. GPU — Disconnect after GPU start. The DC GENERATOR caution light should be out.

*21. BAT switch — BAT.

*22. Wing stores ground safety pins — Removed.

8-26. ENGINE RUNUP.

CAUTION

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

*1. Caution lights — Check. All lights should be off.

*2. SAS POWER switch — POWER (check NO-GO lights illuminated). Light should be out in a maximum of 50 seconds.

★ 3. Force trim system — Check as follows:

a. Check force gradients operational.

b. Press cyclic momentary interrupt switch (pilot then gunner) ensuring magnetic brakes release.

c. FORCE TRIM switch — OFF; check pedals and cyclic for freedom of movement and tip-path plane correlation.

★ 4. Hydraulic system — Check as follows:

EMERGENCY PROCEDURES — Paragraphs 9-63, 9-64, 9-65.

a. HYD TEST switch — SYS 1 (system 2 out). HYD PRESS #2 caution light should illuminate; all controls should be free.

NOTE

The cyclic will be stiff on all TH-1G and any AH-1G with MWO 55-1520-221-30/7 incorporated.

b. HYD TEST switch — SYS 2 (system 1 out). HYD PRESS #1 caution light should illuminate; pedals should be stiff; collective and cyclic free.

c. HYD TEST switch — Center position. HYD PRESS #1 and #2 caution lights should be out.

5. FORCE TRIM switch — FORCE TRIM.

*6. Engine and transmission instruments — Check.

*7. Throttle — Slowly increase to full open. Engine rpm (N2) should stabilize at 6000 ± 50 rpm (6600 rpm for thru-flight). Throttle friction as desired.

*8. RPM WARNING switch — WARNING.

9. GOV RPM INCR-DECR switch — Full increase; engine rpm (N2) to 6700 ± 50 rpm. Set rpm at 6600. During GOV check, the low rpm audio and warning light should be off at 6200 ± 100 engine rpm and 305 ± 5 rotor rpm.

*10. Engine and transmission instruments. — Check.

EMERGENCY PROCEDURES — Paragraphs 9-26, 9-27, 9-28, 9-29, 9-30, 9-34, 9-35, 9-36, 9-37, 9-39.

WARNING

If FUEL QUANTITY gage does not coincide with the visual inspection of fuel quantity, do not fly the helicopter.

11. Fuel quantity — Check by pressing the FUEL GAUGE TEST SWITCH until FUEL QUANTITY drops approximately 200 pounds, then release and check that gage returns to original indication.

*12. Avionics — On as desired.

13. DC voltmeter — Check.

NOTE

Generator voltage will be dependent upon the average ambient temperatures:

27.0 Volts 80°F (26°C) and above
28.0 Volts 32°F to 80°F (0°C to 26°C)
28.5 Volts 32°F (0°C) and below

14. PITOT HEAT switch — HEAT; check for increase in ammeter indication; then OFF.

15. DE-ICE switch — DE-ICE; check for rise in EGT; then move to OFF; check for decrease in EGT.

*16. SAS NO-GO lights — Check out.

*17. Engage PITCH, ROLL and YAW channels one at a time. As each channel is engaged, visually check around the helicopter, have hand on the cyclic stick, and be prepared to immediately press the SAS REL switch if any abnormal tip path or control fluctuations are noted.

★ 18. SCAS — Check as follows:

a. Gunner press the SAS REL switch on cyclic. Pilot check channels are OFF.

b. Pilot re-engage PITCH, ROLL, and YAW channels then press the SAS REL switch on his cyclic. Check channels are OFF.

c. Pilot check NO-GO lights are out and re-engage PITCH, ROLL, and YAW channels.

*19. Canopy hatches — Secure.

20. Avionics — Perform operational check as necessary and set as desired.

21. Clock — Set.

*22. Altimeters — Set the current barometric pressure in inches of Mercury (In Hg) and compare with barometric pressure previously set.

23. RMI — Check heading corresponds with standby compass. Set as required.

*24. FORCE TRIM switch — As desired.

25. Health Indicator Test (HIT) check — Perform on first flight of the day.

The HIT provides the pilot with a go-no-go check for engine conditions prior to takeoff. Logging EGT deviations from the HIT EGT baselines provides the maintenance officer with information to monitor EGT trends. This can aid in optimizing the maintenance effect and ensure that the engine receives attention as soon as performance degradation is noted. Refer to HIT EGT Log in aircraft log book.

8-27. Takeoff To Hover.

With cyclic in neutral position, increase collective with a smooth, positive pressure until the desired hovering altitude is reached. Apply pedal pressures to maintain heading as collective is increased. As the helicopter leaves the ground, make minor corrections with cyclic to ensure a vertical ascent, apply pedal pressures as necessary to maintain directional control. As the desired hover height is reached, adjust flight controls as necessary to stabilize the helicopter at that height.

8-28. Hovering Turns.

Apply pressure on the desired pedal to begin the turn, using pressure and counterpressure on pedals as necessary to maintain constant rate of turn. Coordinate cyclic to maintain position over pivot point while maintaining altitude with collective.

8-29. Sideward and Rearward Hovering Flight.

From a stabilized hover, apply cyclic control pressure in direction of flight to begin sideward or rearward movement. Maintain heading with pedals and altitude with collective. Rate of speed should not exceed that of a brisk walk. Return to a stationary hover by applying cyclic pressure opposite the direction of movement while coordinating collective and pedals to maintain altitude and heading. Minimize time spent in rearward and downwind hovering flight.

8-30. Hover/Taxi.

From a stabilized hover, apply forward cyclic to begin forward movement. Maintain heading with pedals and altitude with collective. Rate of speed should not exceed that of a brisk walk. Changes in direction should be made primarily with pedal control to avoid excessive bank angles. To stop the forward movement, apply aft cyclic while coordinating collective and pedals to maintain altitude and heading.

8-31. HOVER CHECK.

Perform the following checks at a hover.

*1. Flight controls — Check flight controls for correct responses.

*2. Engine and transmission instruments — Check.

*3. Flight instruments — Check as required.

a. Airspeed indicator — Check airspeed.

b. Attitude indicator — Indicates nose high and low and banks left and right.

c. VSI and altimeter — Indicates climb and descent.

d. Turn and Slip indicator — Ball free in race.

e. Turn needle, RMI and magnetic compass indicate turns left and right.

4. Power-check. The power check will determine if sufficient power is available for the mission and is performed by comparing the highest

indicated torque required to hover at five feet (during a 360° left turn) with the predicted values from performance charts in Chapter 7. If the indicated torque at a five-foot hover exceeds the predicted torque for the mission, takeoff should not be attempted.

8-32. Landing From A Hover.

EMERGENCY PROCEDURE — Paragraph 9-10, 9-11, 9-13, 9-33.

From a stabilized hover, decrease collective to begin a gradual descent to touchdown, making necessary corrections with pedals and cyclic to prevent movement over the ground. Upon contact with the ground, continue to decrease collective smoothly and steadily until the entire weight of the helicopter is on the ground. Apply cyclic to level rotor system.

8-33. BEFORE TAKEOFF.

*1. RPM — 6600.

*2. Systems — Check engine, transmission, electrical, and fuel systems indications.

*3. Armament systems — As required (refer to Chapter 4).

*4. Transponder — As required.

8-34. Takeoff.

EMERGENCY PROCEDURES — Paragraphs 9-10, 9-15, 9-20, 9-22, 9-24, 9-25.

8-35. Normal.

a. Align the helicopter with takeoff course at a stabilized hover of approximately 3 feet (skid height), or an altitude permitting safe obstacle and terrain clearance. Smoothly apply forward cyclic pressure to begin acceleration into effective translational lift. As the helicopter begins its forward movement, additional collective will be required to maintain altitude. Simultaneously adjust pedal pressure to maintain the desired heading. Control rate of acceleration and direction of flight with cyclic and altitude with collective. Continue to accelerate at the required altitude until effective translational lift has been attained, then begin a climb. Establish climb at the desired rate and airspeed. Continuous coordinated application of control pressures is necessary to maintain trim, heading, flight path, airspeed, rate of climb.

b. Refer to Chapter 9, Height Velocity, for avoid areas. The section assumes the availability of a suitable landing area in the event of engine failure. Since suitable landing areas are often times not available, operating outside the avoid areas during takeoff and climb will provide the highest margin of safety. Additionally, autorotational landings can be made at minimum sink rate and low or zero forward speed, thereby minimizing damage and injuries, regardless of terrain.

c. A normal takeoff may be made from the ground by aligning the helicopter with takeoff course on the ground and positioning cyclic slightly forward of neutral. Smoothly increase collective to begin a climb to an altitude of approximately three feet, (or an altitude permitting safe obstacle and terrain clearance) while simultaneously accelerating the helicopter. Continue takeoff as above.

8-36. Maximum Performance.

EMERGENCY PROCEDURES — Paragraph 9-13, 9-14.

A takeoff that demands maximum performance from the helicopter is necessary because of various combinations of heavy helicopter loads, limited power and restricted performance due to high density altitudes, barriers that must be cleared and other terrain features. The decision to use either of the following takeoff techniques must be based on an evaluation of the conditions and helicopter performance.

a. Coordinated Climb. Align the helicopter with the desired takeoff course at a stabilized hover of approximately three feet (skid height). Apply forward cyclic pressure smoothly and gradually while simultaneously increasing collective to begin a corrdinated acceleration and climb. Adjust pedal pressure as necessary to maintain the desired heading. Maximum torque available should be applied (without exceeding helicopter limits) as the helicopter attitude is established that will permit safe obstacle clearance. The climbout is continued at that attitude and power setting until the obstacle is cleared. After the obstacle is cleared, adjust helicopter attitude and collective as required to establish a climb at the desired rate and airspeed. Continuous coordinated application of control pressure is necessary to maintain trim heading, flight path, airspeed, and rate of climb. Takeoff may be made from the ground by positioning the cyclic slightly forward of neutral prior to increasing collective.

b. Level — Acceleration. Align the helicopter with takeoff course at a stabilized hover of approximately three feet (skid height). Apply forward cyclic pressure smoothly and gradually while simultaneously increasing collective to begin an acceleration at approximately 3 feet skid height. Adjust pedal pressure to maintain heading. Maximum torque available should be applied (without exceeding helicopter limits) prior to accelerating through effective translational lift. Additional forward cyclic pressure will be necessary to allow for level acceleration to the desired climb airspeed. Approximately 5 knots prior to reaching the desired climb airspeed, gradually release forward cyclic pressure and allow the helicopter to begin a constant airspeed climb to clear the obstacle. Care must be taken not to decrease airspeed during the climbout since this may result in the helicopter descending (falling through). After the obstacle is cleared adjust helicopter attitude and collective as required to establish a climb at the desired rate and airspeed. Continuous coordinated application of control pressures is necessary to maintain trim, heading, flight path, airspeed, and rate of climb. Takeoff may be made from the ground by positioning cyclic slightly forward of neutral prior to increasing collective.

c. Comparison of Techniques. The two techniques give approximately the same distance over a fifty foot obstacle when the helicopter can just hover OGE. As hover capability is decreased, the level acceleration techniques gives increasingly shorter distances than the coordinated climb technique. Where the two techniques yield the same distance over a fifty-foot obstacle, the coordinated climb technique will give a shorter distance over obstacles higher than fifty feet. In addition to the distance comparison, the main advantages of the level acceleration technique are: (1) It requires less or not time in the avoid area of the height velocity diagram; (2) performance is more repeatable since reference to attitudes which change with loading and airspeed is not required; (3) at the higher climbout airspeeds (30 knots or more), reliable indicated airspeeds are available for accurate airspeed reference from the beginning of the climbout, therefore minimizing the possibility of fall through. The main advantage of the coordinated climb technique is that the climb angle is established early in the takeoff and more distance and time are available to abort the takeoff if the obstacle cannot be cleared.

8-37. Crosswind Takeoff.

A crosswind takeoff does not require a significantly different technique than a takeoff into the wind. The primary difference is the requirement to hold cyclic into the wind to prevent drift. For right crosswinds, additional power is required because of more left pedal being applied to maintain the desired heading.

8-38. Climb.

After takeoff, select the airspeed necessary to clear obstacles. When obstacles are cleared, adjust the airspeed as desired at or above the maximum rate-of-climb airspeed. Refer to Chapter 7 for recommended airspeeds.

8-39. Cruise.

When the desired cruise altitude is reached, adjust power to maintain the required airspeed. Refer to Chapter 7 for recommended airspeeds, power settings, and fuel flow.

8-40. Descent.

EMERGENCY PROCEDURE — Paragraph 9-66.

Adjust power and attitude to attain and maintain the desired airspeed and rate of descent. Refer to Chapter 7 for power requirements at selected airspeeds and rates of descent. All checks of mission equipment that must be made in preparation for landing should be accomplished during descent.

8-41. BEFORE LANDING.

1. RPM — 6600.
2. Systems — Check engine, transmission, electrical, and fuel system indications.

3. Armament system — Safe (refer to paragraph 8-4).

4. Searchlight — As required.

8-42. Landing.

EMERGENCY PROCEDURES — Paragraphs 9-11, 9-66.

8-43. Normal Approach.

The approch begins by adjusting power and attitude as required to establish an approch angle of approximately 8 to 10 degrees at an airspeed specified in Chapter 7. Maintain the entry airspeed until the apparent ground speed and rate of closure appear to increase. From this point, progressively decrease rate of descent and forward speed to stop all forward movement at an approximate 3-foot hover (or continue to the ground). As forward speed decreases below effective translational lift it will be necessary to gradually and smoothly increase collective to terminate the approach. Refer to chapter 7 for airspeeds, rates of descent and power requirements. Refer to chapter 9, Height Velocity, for areas to avoid during the approach.

8-44. Steep Approach.

A steep approch is used as necessary to clear obstacles in the approach path. It is executed in the same manner as the normal approach except for the slower airspeeds that must be maintained throughout the approach. Approach angles may vary from that of a normal approach to a vertical descent. Because of the increased power requirements during termination, smooth and gradual collective movements are very important.

8-45. Shallow Approach.

A shallow approach is used as necessary when instrument, tactical, or emergency requirements make it necessary to execute an approach at an angle less than that of a normal approach. It is executed in the same manner as a normal approach except that deceleration may be more rapid. Approach angles may vary from that of a normal approach to approximately zero.

8-46. Running Landing.

EMERGENCY PROCEDURES — Paragraph 9-62.

A running landing is used during emergency conditions of hydraulic power failure and some flight control malfunctions. The approach is shallow and flown at an airspeed that provides safe helicopter control. After ground contact is made, slowly decrease collective to minimize forward speed. If braking action is necessary, the collective may be lowered as required for quicker stopping.

8-47. AFTER LANDING.

1. Searchlight — As required.

2. Transponder — As required.

8-48. ENGINE SHUTDOWN.

EMERGENCY PROCEDURE — Paragraph 9-43, 9-48.

1. Collective — Down.

2. Cyclic — Centered.

3. FORCE TRIM switch — TRIM.

4. DE-ICE switch — OFF.

5. SAS POWER switch — OFF.

6. ENVR CONT switch — OFF.

7. Throttle — Reduce to engine idle. Allow EGT to stabilize for two minutes. Check N1 speed 68% to 72%.

8. Systems — Check engine, transmission, and electrical systems indications.

9. Throttle — Off.

10. FUEL switch — OFF.

11. INVTR switch — OFF.

12. GEN switch — OFF.

13. Avionics — OFF.

CAUTION

If a rapid rise in EGT is noted, press the starter switch to motor the engine (throttle closed) stabilizing temperature within limits.

★ 14. Collective accumulator — Check as follows:

a. With the EMER COLL HYD switch OFF, attempt to raise the collective. If the collective cannot be raised, the accumulator switch is functioning properly.

b. EMER COLL HYD switch — ON. Move the collective up one full stroke and down one full stroke.

c. EMER COLL HYD switch — OFF.

d. BAT switch — OFF.

(e.) Gunner EMER COLL HYD switch — ON. Move the collective up one full stroke and down one full stroke. This indicates that the gunners EMER COLL HYD switch is functioning properly. Continue to bleed the accumulator with short strokes from the down position to prevent the collective from stopping in the up position. In the event the collective stops in the up position, rotate the main rotor in the normal direction of rotation, simultaneously moving the collective to the down position.

(f.) Gunner EMER COLL HYD switch — OFF. During single pilot operations all collective accumulator checks are performed from the aft seat.

15. Light switches — OFF.

16. IGNITION switch — OFF. Remove key as required.

O 17. Arming/firing mechanism safety pins — In.

18. Main rotor blades — Tie down.

8-49. BEFORE LEAVING HELICOPTER.

1. Conduct a thorough walk-around inspection of the helicopter checking for damage, fluid leaks and levels.
2. Armament systems — Safe.
3. Complete DA Forms 2408-12 and -13.
4. Secure helicopter.

SECTION III. INSTRUMENT FLIGHT

8-50. Instrument Flight Procedures.

a. This helicopter is not qualified for operation under instrument meterological conditions. Refer to FM 1-5, FM 1-30, AR 95-1, FAR Part 91, and procedures described in this manual.

b. Flight characteristics and range are the same during instrument flight conditions as operations in visual flight conditions. Adequate navigation and communications are installed for instrument flight. Refer to chapter 3, Avionics, for description and operation of avionics equipment.

c. Preflight checks and procedures are the same as for visual flight except where prefaces with (I). To be certain of proper instrument operation, allow approximately 2 minutes for warmup prior to takeoff.

8-51. Instrument Takeoff.

a. Complete the procedural steps prescribed in normal procedures checklist and align the helicopter on the takeoff heading. Set the cursor on the pilot RMI over the takeoff heading and adjust the horizon bar of the attitude indicator so that the miniature aircraft will appear one bar width above the horizon bar (figure 8-3, step 1).

b. To begin the takeoff, increase collective pitch with a smooth and steady movement until a minimum of 5 PSI torque above hover power is attained. As the helicopter leaves the ground

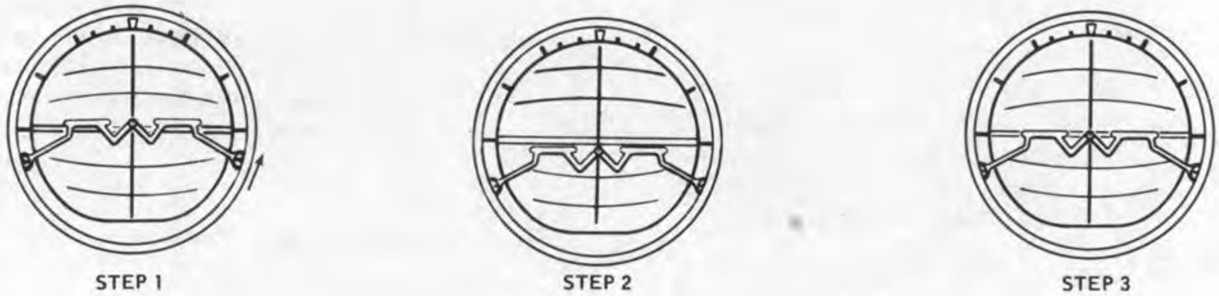


Figure 8-3. Instrument takeoff

(figure 8-3, Step 2) position the miniature aircraft on the attitude indicator one bar width below the horizon bar in a wing level attitude and continue to increase collective pitch smoothly until takeoff power is attained. Takeoff attitude should be maintained until the airspeed approaches that desired for the climb. The attitude is then adjusted, placing the miniature aircraft on the horizon bar (figure 8-3, Step 3), and establishing the desired climb airspeed. Refer to Chapter 7 to determine if adequate power is available for the takeoff.

8-52. Instrument Climb.

Climb in instrument conditions is performed the same as visual conditions. Changes in pitch attitude should not exceed an indication of one bar width above or below the horizon. The angle of bank during a climb should not exceed 15 degrees.

8-53. Instrument Cruise.

Cruise in instrument conditions is performed the same as in visual conditions. After cruise speed has been established and power adjusted to maintain that speed, the attitude indicator is adjusted as necessary to provide the desired indication of the cruise condition. Changes in pitch attitude should not exceed one bar width above or below the horizon. The angle of bank should not exceed 15 degrees. Refer to Chapter 7 for information regarding recommended speeds, power settings, and fuel consumption.

8-54. Instrument Descent.

Descent in instrument conditions is performed the same as in visual conditions. The descent is initiated by decreasing collective pitch and maintaining the miniature aircraft on the horizon. Minor adjustments in the pitch attitude may be necessary to maintain the desired airspeed. Changes in pitch attitude should not exceed one bar width above or below the horizon. The angle of bank should not exceed 15 degrees. Refer to Chapter 7 for information regarding recommended speeds, power settings, and fuel consumption.

8-55. Instrument Autorotation.

Because of the high rate of descent, autorotation is recommended for emergency descent only. Autorotation in instrument conditions is performed the same as for visual conditions. To attain the minimum rate of descent shown in Chapter 5 position the miniature aircraft approximately one bar width above the horizon initially and adjust pitch attitude as necessary to maintain the desired airspeed.

8-56. Holding.

100 KIAS is recommended for holding. Maximum endurance of 55 to 65 KIAS to achieve minimum fuel flow are not recommended due to the poor instrument handling qualities at these airspeeds.

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 change unless the airspeed varies more than ± 10 KIAS.

8-57. Instrument Approaches.

a. Before commencing the approach have the attitude indicator properly set with the miniature aircraft on horizon bar at a straight and level cruise speed. Recommended approach speed is 100 KIAS.

b. 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°.

c. During the descent phase of an approach, make rate of descent corrections with the cyclic by reference to the altitude indicator. Allow the airspeed to vary ± 10 KIAS during these corrections before making a collective adjustment.

8-58. Night Flying.

Generally, interior lighting should be kept to the minimum amount which will still allow complete visibility of all instruments and gages. Excessive cockpit lighting decreases outside visibility. Avoid using searchlight when in thick haze, smoke, or fog, as reflected light will reduce visibility and may affect depth perception. During ground operations, the helicopter should be hovered/taxied slowly, because it is difficult to judge actual ground speed and excessive speeds may be developed without realizing it.

SECTION IV. FLIGHT CHARACTERISTICS

8-59. Operating Characteristics.

The flight characteristics of this helicopter in general are similar to other single rotor helicopters.

8-60. 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.

a. 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 (figure 8-4).

b. Beyond this critical angles, 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.

c. When performing maneuvers with one skid on the ground, care must be taken to keep the helicopter trimmed, especially laterally. For example, if a slope takeoff is attempted and the tail rotor thrust contribution to rolling moment is not 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.

d. 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.

e. 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.

f. 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 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 suddenly to get airborne as a large and abrupt rolling moment in the opposite direction will result. This moment may be uncontrollable.

8-61. Rotor Blade Stall.

a. 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 depend on the size of the stalled area and the type of rotor system. The size of the stalled area increases with increase in gross weight, airspeed, density altitude, "g" loading, or with a decrease in rpm.

b. 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.

8-62. 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 of rotor stall and no meaningful "stall limit" exists.

8-63. 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.
2. Applying forward cyclic or by reducing the severity of the rotor operating state by:
   a. Reducing airspeed
   b. Increasing operating rpm
   c. Reducing altitude.

Altitude may be gained or lost, depending on the flight condition and technique chosen.

8-64. Control Feedback.

a. 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.

b. The gunner 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 control, severe maneuvers should be avoided while flying from the gunners station.

8-65. Diving Flight.

Diving flight presents no particular problems in the helicopter; 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. 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 the condition. Figure 8-5 depicts the altitude lost during a pullout versus rate of descent for various "g" loadings.

8-66. 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.

8-67. Pitch — Cone Coupling.

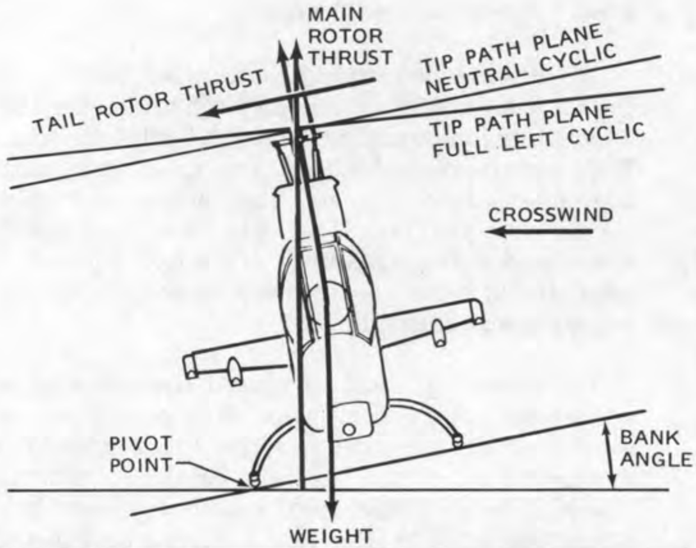
a. Pitch-cone coupling is the characteristic of the rotor to inherently reduce pitch under loading which aids to maintain rpm and retard blade stall. With severe rotor loading, the rotor rpm may overspeed above the red line unless the pilot increases collective. With the increased speed range and maneuverability of the helicopter, the pilot should have an increased awareness of this aerodynamic characteristic.

b. 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 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.

8-68. Transient Torque.

a. Transient torque, although evident in all semi-rigid 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.

b. 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 blade's resistance to the airflow. Increasing and decreasing rotor system drag will produce corresponding torque changes due to the fact that

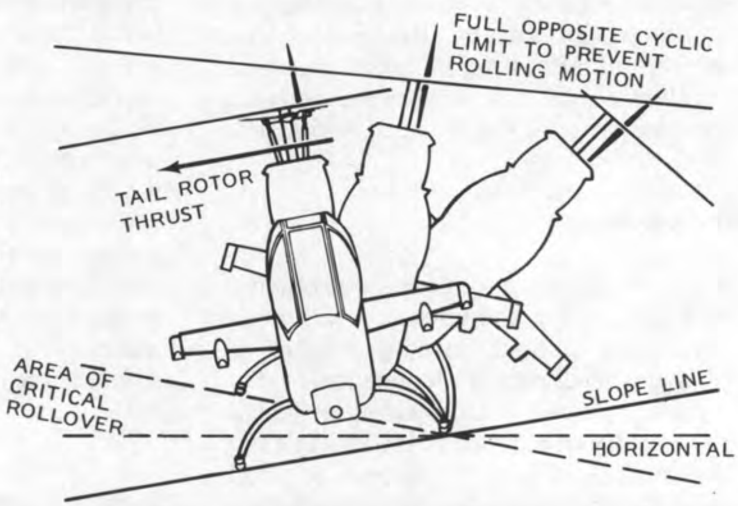


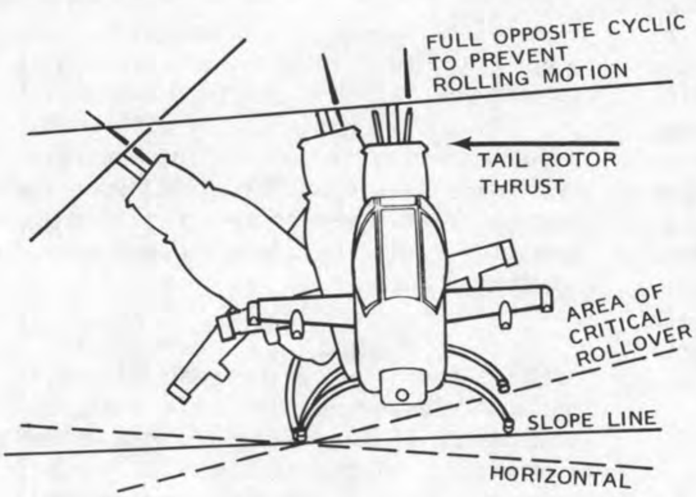
EXAMPLE OF FORCES ACTING ON A HELICOPTER WITH RIGHT SKID ON THE GROUND

During normal takeoffs to a hover and landings from a hover, cross slope takeoffs and landings, and takeoffs from the ground with bank angle or side drift, a situation can exist where the helicopter will pivot about the skid/wheel which remains on the ground and enter a rolling motion that cannot be corrected with full lateral cyclic input.

UPSLOPE ROLLING MOTION

Excessive application of cyclic into the slope, in coordination with collective pitch application. During landings or takeoffs, this condition results in the downslope skid rising sufficiently to exceed lateral cyclic control limits and an upslope rolling motion occurs.





DOWNSLOPE ROLLING MOTION

Excessive application of collective pitch in coordination with cyclic application into the slope. When the downslope skid is on the slope, excessive application of collective may result in the upslope skid rising sufficiently to exceed lateral cyclic limits and induce a downslope rolling motion.

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Figure 8-4. Forces acting on the helicopter

DIVE RECOVERY DISTANCE

EXAMPLE

WANTED

ALTITUDE LOST

KNOWN

RATE OF DESCENT 2000 FEET PER MINUTE
"G" LOAD OF 1.2

METHOD

MOVE RIGHT FROM 2000 FEET AND INTERSECT 1.2 "G" LINE. MOVE DOWN TO READ 125 FEET

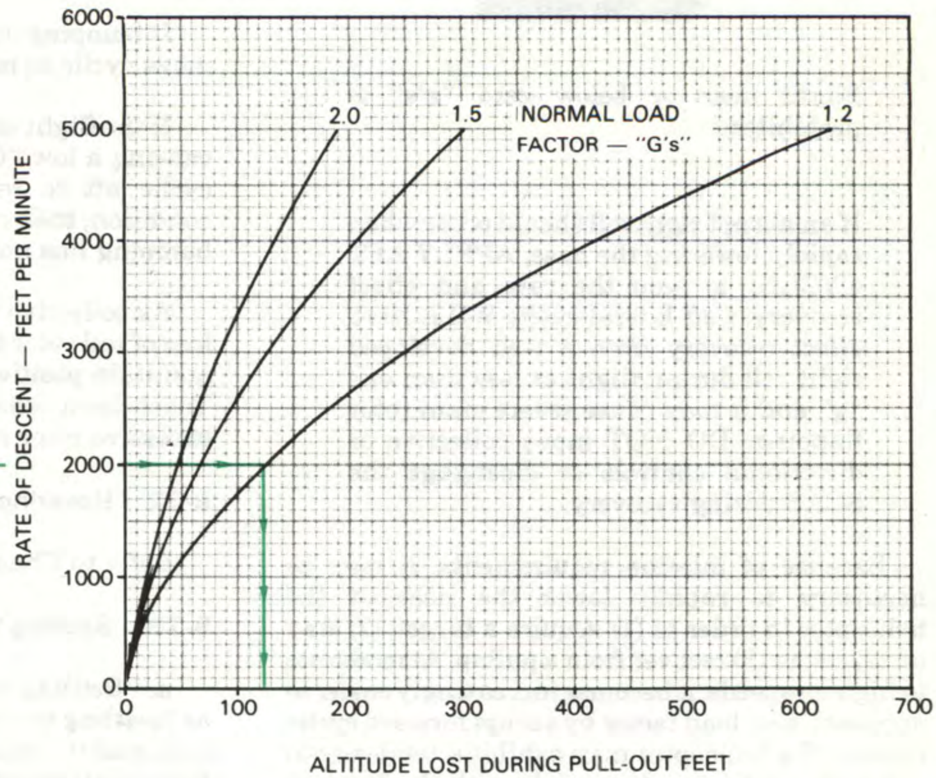

Figure 8-5. Dive recovery distances

the rotor system's 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.

8-69. Maneuvering Flight.

During left rolling maneuvers or high power dives torque increases occur. To prevent main transmission overtorque, care must be exercised in monitoring torque pressure to enable the pilot to reduce power as required to prevent overtorque conditions.

8-70. Low "G" Maneuvers.

WARNING

Flight near or below zero "g's" is prohibited.

If an abrupt right roll should occur when rapidly lowering the nose, APPLY 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.

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 target; or (3) recover from a pullup. At moderate to high airspeeds, it becomes increasingly easier to approach zero load factor by abrupt forward cyclic inputs. The helicopter may exhibit a tendency to roll to the right simultaneously with the forward cyclic input; this characteristic being most pronounced when roll SCAS is disengaged.

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 move 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.

8-71. Mast Bumping.

Mast bumping (flapping-stop contact) is the yoke contacting the mast. It may occur during slope landings, rotor startup/coastdown, or when the flight envelope is exceeded. If mast bumping is encountered in flight, land as soon as possible.

If bumping occurs during a slope landing, reposition the cyclic to stop the bumping and reestablish a hover.

If bumping occurs during startup or shutdown, move cyclic to minimize or eliminate bumping.

If the flight envelope is inadvertently exceeded, causing a low "G" condition and right roll, move cyclic aft to return rotor to a positive thrust condition, then roll level, continuing flight if mast bumping has not occurred.

As collective is reduced after engine failure or loss of tail rotor thrust, cyclic must be positioned to maintain positive "G" forces during autorotation. Touchdown should be accomplished prior to excessive rotor rpm decay.

8-72. Hovering Capability.

Refer to Chapter 7.

8-73. Settling With Power.

a. Settling with power is sometimes described as "settling in your own downwash". This phrase is in reality, quite descriptive since the helicopter finds itself entering air which has just previously been accelerated downward by the rotor. Settling with power is a transient condition of downward flight during which an appreciable portion of the main rotor system is being forced to operate at angles of attack above maximum. Tuft studies show that blade stall starts in near the hub and progresses outward along the blade as the rate of descent increases. The application of collective and power results only in stalling more of the blade area and producing an even more rapid descent rate. It follows that since inboard portions of the blades are stalled, cyclic control response will be reduced accordingly.

b. "Settling" can be quite hazardous if inadvertently entered near the ground. Rates of descent exceeding 2200 feet per minute have been recorded during this state of flight. The characteristics of settling are very similar to the "feel" of stall in a conventional aircarft (Roughness in the airframe and controls and some loss of control effectiveness). The recovery procedure is also approximately the same, i.e., drop the nose and accelerate into forward flight. Recovery can also be made by reducing collective to the minimum which will almost immediately result in vertical autorotation. This procedure, however, results in considerable altitude loss.

8-74. Rotor RPM — Power Off.

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 knots (figure 8-6). Rotor rpm decreases at stabilized airspeeds above or below 60 to 80 knot 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 knot 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.

b. Gross Weight. The power-off rotor rpm varies significantly with gross weight. A low gross weight will produce a low rotor rpm. A high gross weight will produce a high rotor rpm. With the

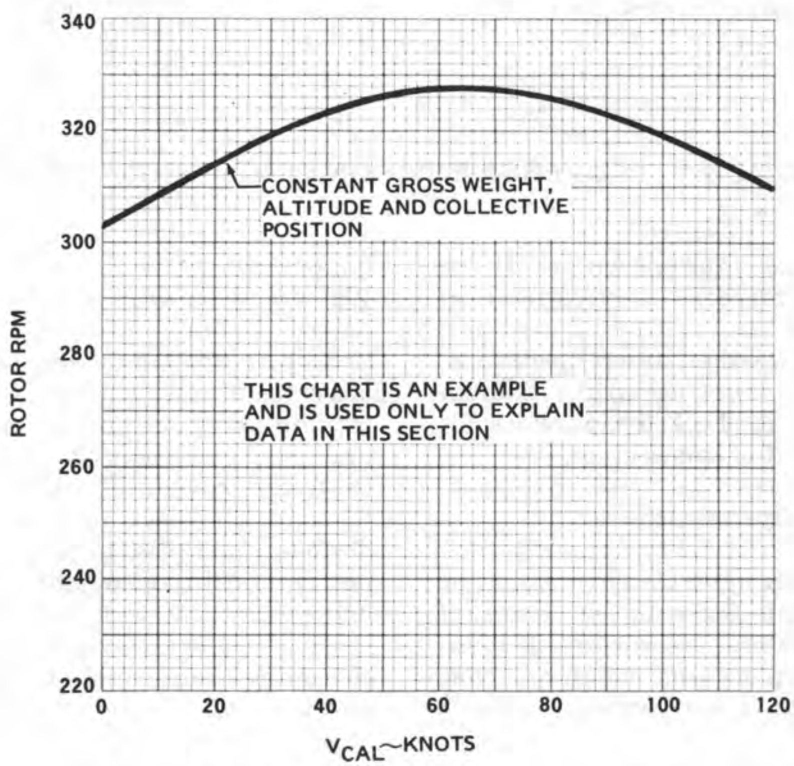

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Figure 8-6. Main rotor RPM versus airspeed

collective system correctly rigged the pilot must manually control rpm with collective in order to prevent overspeed of the rotor when at high gross weight.

8-75. 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.

8-76. Autorotation Characteristics.

The following steps explain the necessity of maintaining the rotor rpm in its normal range.

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 with rpm. Normal rotor rpm assures the pilot that he will have normal inertia and normal collective response with which to arrest the sink rate in the autorotation landing.

d. Density Altitude. The power off rotor rpm varies with altitude; low altitude — low rpm; high altitude — high rpm. For the same flight conditions as in step a., the pilot will find that the higher the altitude — the higher the collective stick position required to prevent overspeed of the rotor.

e. Cyclic Flare. Aft cyclic (nose up pitching) produces an increase in rotor rpm proportional to the flare and entry speed. The higher the speed — the greater the flare effectiveness. From a high speed entry condition, a steep flare can produce an overspeed unless limited by collective.

8-77. Pilot Technique.

It can be readily seen from the foregoing information, that the pilot technique must vary in accordance with the actual conditions of airspeed, altitude, and gross weight at the time of engine failure.

SECTION V. ADVERSE ENVIRONMENTAL CONDTIONS

This section provides information relative to operation under adverse environmental conditions (snow, ice and rain, turbulent air, extreme cold and hot weather, desert operations, mountainous and altitude operation) at maximum gross weight. Section II check list provides for operational requirement of this section.

8-78. Cold Weather Operations.

Operation of the helicopter in cold weather or an arctic environment presents no unusual problems if the operators are aware of those changes that do take place and conditions that may exist because of the lower temperatures and freezing moisture.

a. Inspection. The pilot must be more thorough in the walk-around inspection when temperatures have been at or below 0°C (32°F). Water and snow may have entered many parts during operations or in periods when the helicopter was parked unsheltered. This moisture often remains to form ice which will immobilize moving parts or damage structure by expansion and will occasionally foul electric circuitry. Protective covers afford protection against rain, freezing rain, sleet, and snow when installed on a dry helicopter prior to the precipitation. Since it is not practical 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 remove ice and snow can result in hazardous flight due to aerodynamic and center of gravity disturbances as well as the introduction of snow, water, and ice into internal moving parts and electrical systems. The pilot should be particularly attentive to the main and tail rotor systems and their exposed control linkages.

CAUTION

At temperatures of -35°C (-31°F) and lower, the grease in the spherical couplings of the main transmission driveshaft may congeal to a point that the couplings cannot operate properly. 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.

CAUTION

If temperature is -44°C (-47°F) or below the pilot must be particularly careful to monitor engine and transmission instruments for high oil pressure.

b. Checks.

(1) Before exterior check — 0°C (32°F) and lower. Perform check as specified in Section II.

(2) Exterior check — 0°C (32°F) to -54°C (-65°F). Perform exterior check as outlined in Section II, 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 system 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 free of ice, frost. and snow.

(b) Engine Air Inlet — Remove all loose snow that could be pulled into and block the engine intake during starting.

(3) Interior Check — All flights 0°C (32°F) to -54°C (-65°F). Perform check as specified in Section II.

(4) Interior Check — Night flights 0°C (32°F) to -54°C (-65°F). External Power connected, Perform check as specified in Section II.

(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 inlet housing will free a frozen rotor. Perform check as outlined in Section II.

NOTE

During cold weather starting the engine oil pressure gage will indicate maximum (100 psi). The engine should be warmed up at engine idle until the engine oil pressure indication is below 100 psi. The time required for warmup is entirely dependent on the starting temperature of the engine and lubrication system.

(6) Hydraulic Filter Indicators — Reset if popped out.

(7) Engine Runup Check. Perform the check as outlined in Section II.

WARNING

Control system checks should be performed with extreme caution when helicopter is parked on snow and ice. There is reduction in ground friction holding the helicopter stationary, controls are sensitive and response is immediate.

c. Engine Starting Without External Power Supply. If a battery start must be attempted when the helicopter and battery have 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 to reach a self-sustaining speed (40% N1) in the least possible time.

8-79. Snow.

a. Takeoff. Snow takeoff may be considered normal except for the following precautions that should be observed.

(1) Select an area that is free of loose or powdery snow to minimize the restriction to visibility from blowing snow.

WARNING

Snow and ice accumulation during ground operation may be detrimental to the engine due to air starvation, and hazardous to the helicopter and crew. Ground operation time should be minimized and FOD screen and particle separator shall 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, abort the mission.

b. Landing — Snow. Snow landing 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 to the ground. Limited visibility will result from swirling snow, when hovering is attempted before making a touchdown.

(3) Anticipate loose powdery snow and crusts on all landings on snow.

(4) 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.

8-80. Desert and Hot Weather Operation.

Problems encountered in desert operation are blowing dust/sand and high ambient temperature.

a. Blowing dust and sand obscure vision. All takeoffs and landings should be made from or to the ground.

b. High ambient temperature affect helicopters performance. Refer to Chapter 7.

8-81. 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.

NOTE

The turbulence penetration speed is 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.

f. Maintain a level attitude and constant power setting. Airspeed fluctuations should be expected and disregarded.

g. Maintain the original heading, turning only when necessary.

h. The altimeter is unreliable due to differential barometric pressures within the storm. An indicated gain or loss of several hundred feet is not uncommon and should be allowed for in determining minimum safe altitude.

8-82. Icing Conditions.

WARNING

Firing of aircraft weapons in icing conditions is prohibited.

A very serious safety hazard exists if the aircraft weapons are fired in icing weather conditions. Gun barrels and breeches can rupture if the gun muzzles are clogged with ice. Rockets are held captive in the launcher tubes by the frozen ice.

CAUTION

To preclude the possibility of icing, it is recommended that the engine particle separator be removed when it is anticipated that the helicopter will be flown under atmospheric conditions conducive to icing.

a. Intentional flight in known icing conditions is prohibited. If icing conditions are encountered during flight every effort should be made to vacate the icing environment. Continuous flight in light icing conditions is not recommended because the ice shedding induces rotor blade vibrations, adding greatly to the pilot work load.

b. If icing conditions become unavoidable, the pilot should actuate the pitot heat and windshield defroster.

c. Flight tests in closely controlled icing conditions have indicated that the pilot can expect one or all of the following to occur.

(1) Obscured forward field of view due to ice accumulation on the windscreens. If the defrosters fail to keep the windshield clear of ice, the side windows may be used for visual reference during landing.

(2) One-per-rotor-revolution vibrations ranging from mild to severe caused by asymmeterical ice shedding from the main rotor system. The severity of the vibration will depend upon the temperatures and the amount of ice accumulation on the blades when the ice shed occurs. Flight test experience has shown that the possibility of an asymmetric ice shed occurring increases as the outside air temperature decreases.

(3) An increase in torque required to maintain a constant airspeed and altitude due to ice accumulation on the rotor system.

(4) Possible degradation of the ability to maintain autorotational rotor speed within operating limits.

d. Severe vibrations may occur as a result of main rotor asymmetrical ice shedding. If icing conditions are encountered while in flight, land as soon as practical. All ice should be removed from the rotor system before attempting further flight.

e. Control activity cannot be depended upon to remove ice from the main rotor system. Vigorous control movements should not be made in an attempt to reduce low-frequency vibrations caused by asymmetrical shedding of ice from the main rotor blades. These movements may induce a more asymmetrical shedding of ice, further aggravating helicopter vibration levels.

f. If a 5 psi (or greater) torque pressure increase is required above the cruise torque setting used prior to entering icing conditions, it may not be possible to maintain autorotational rotor speed within operational limits, should an engine failure occur.

g. Ice shed from the rotor blades and/or other rotating components presents a hazard to personnel during landing and shutdown. Ground personnel should remain well clear of the helicopter during landing and shutdown, and passengers and crewmembers should not exit the helicopter until the rotor has stopped turning.

8-83. Rain.

Maintenance personnel are required to perform special inspections of the tail rotor and particle 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.

SECTION VI. CREW DUTIES

★8-84. Passenger Briefing.

The following is a guide that should be used in accomplishing required passenger briefings, when a unit passenger briefing is not available. Items that do not pertain to specific mission may be omitted.

a. Crew Introduction.

b. Equipment.

(1) Personal to include ID tags.

(2) Professional.

(3) Survival.

c. Flight Data.

(1) Route.

(2) Altitude.

(3) Time en route.

(4) Weather.

d. Normal Procedures.

(1) Entry and exit of aircraft.

(2) Seating.

(3) Seat belts.

(4) Movement in aircraft.

(5) Internal communications.

(6) Security of equipment.

(7) Smoking.

(8) Oxygen.

(9) Refueling.

(10) Weapons.

(11) Protective masks.

(12) Parachutes.

e. Emergency Procedures.

(1) Emergency exits.

(2) Emergency equipment.

(3) Emergency landing/ditching procedures.

(4) Bail out.

CHAPTER 9

EMERGENCY PROCEDURES

SECTION I. HELICOPTER SYSTEMS

9-1. Helicopter Systems.

This section describes the helicopter systems emergencies that may reasonably be expected to occur and presents the procedures to be followed. Emergency procedures are given in checklist form when applicable. A condensed version of these procedures is contained in the Operators and Crewmembers Checklist, TM 55-1520-221-CL. Emergency procedures involving mission equipment are covered in Section II, Mission Equipment, and are repeated in this section only insofar as they affect safety of flight. Emergency operations of avionics equipment are covered when appropriate in Chapter 3, Avionics.

9-2. Immediate Action Emergency Checks.

These checks that must be performed immediately in an emergency procedure are underlined. These immediate action emergency checks must be committed to memory.

WARNING

When anticipating an emergency landing or ditching, each crewman should place his shoulders against the seat back, manually lock the shoulder harness, and keep back straight, to obtain maximum protection from the restraint system.

NOTE

The urgency of certain emergencies requires immediate and instinctive action by the pilot. All procedures are subordinate to this requirement. Reset MASTER CAUTION after each malfunction to prepare the systems to subsequent malfunctions. If time permits during the emergency, make a "MAYDAY" transmission.

9-3. Definition of Landing Terms.

For the purpose of standardization, the following definitions shall apply:

The term *LAND IMMEDIATELY* is defined as executing a landing without delay. The primary consideration is to assure the survival of occupants.

The term *LAND AS SOON AS POSSIBLE* is defined as executing a landing to the nearest suitable landing area (e.g., open field) without delay.

The term *LAND AS SOON AS PRACTICABLE* is defined as executing a landing to the nearest suitable airfield/airport.

9-4. After Emergency Action.

After a malfunction of equipment has occurred, appropriate emergency actions have been taken and the helicopter is on the ground, an entry must be made in the Remarks Section of DA Form 2408-13 describing the malfunction. The helicopter shall not be flown until corrective action has been taken.

9-5. EMERGENCY EXITS.

Emergency exits are shown in figure 9-1. Primary exits are through the crew doors. A linear explosive canopy removal system is incorporated to remove plexiglass from doors and windows.

The pilot will coordinate with the gunner before system firing.

1. Arm/Fire mechanism — Turn 90°.
2. Arm/Fire mechanism — Pull.

9-6. EMERGENCY EQUIPMENT.

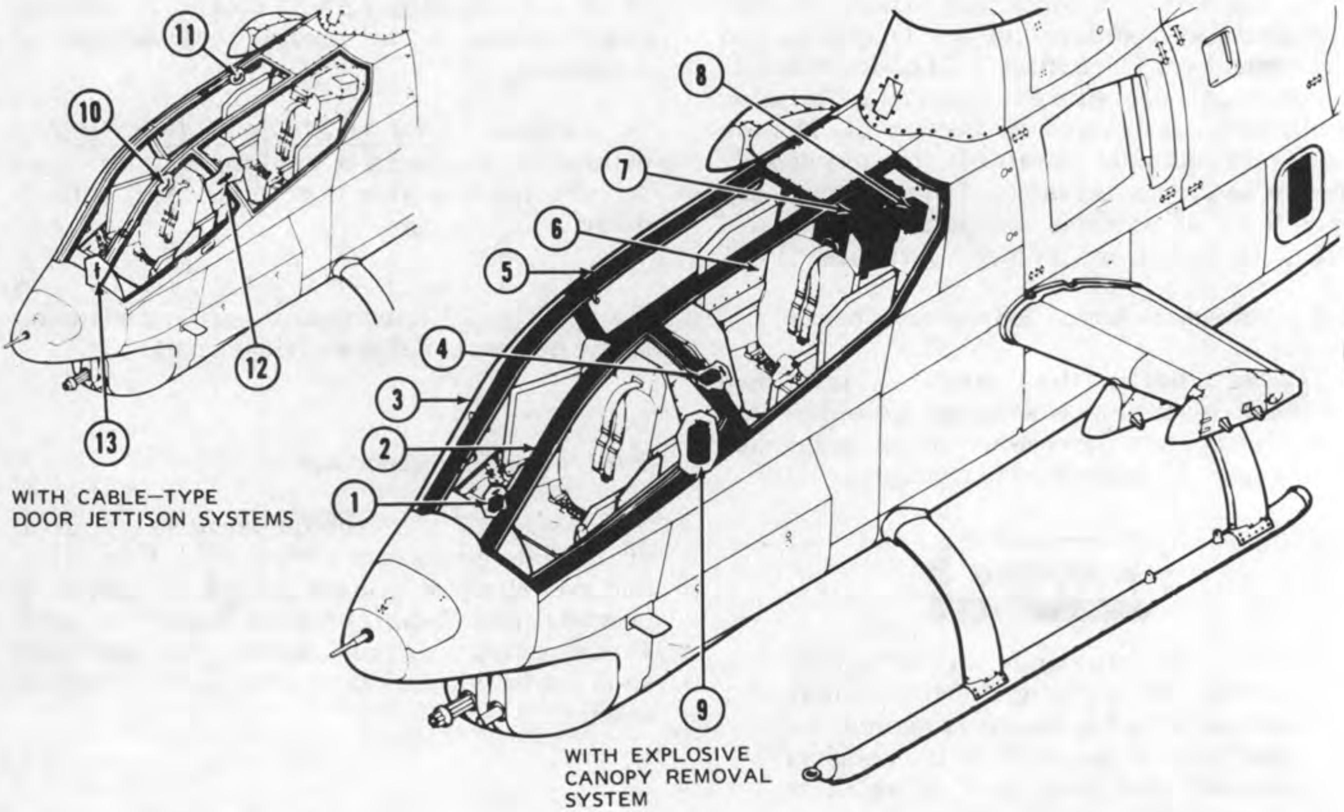
A fire extinguisher (figure 9-1) is mounted aft of the gunner left arm rest.

1. Extinguisher — Remove from bracket.
2. Safety pin and, or plug — Pull.
3. Nozzle — Aim at base of fire.
4. Handle — Press.

9-7. Engine.

9-8. Flight Characteristics.

The characteristics and reaction in this helicopter without power are similar to those of a normal power descent. Full control can be maintained with the helicopter in autorotational descent.



1. Gunner arming/firing mechanism
2. Gunner door
3. Gunner window
4. Pilot arming/firing mechanism
5. Pilot door
6. Pilot window
7. Survival kits stowage
8. First aid kit
9. Fire extinguisher
10. Gunner door jettison handle
11. Pilot door jettison handle
12. Pilot breakout knife
13. Gunner breakout knife

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Figure 9-1. Emergency exits and equipment (typical)

9-9. Height Velocity Diagram.

The height velocity diagram (figure 9-2) 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.

9-10. Engine Failure and Autorotation.

The indications of an engine failure, either a partial power loss or a complete power loss are:

a. Left Yaw. This is caused by the drop in torque applied to the main rotor.

b. Decrease in Engine RPM.

c. Decrease in Rotor RPM.

d. Low RPM Audio Alarm.

e. Illumination of the Low RPM Light.

f. Change in Engine Noise.

The two conditions most likely to affect successful autorotational landings are the altitude and airspeed at which the helicopter is operating at the time of an engine failure. When a loss of engine power is detected, it is necessary to decrease the collective 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 more 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 completely and accomplish an autorotational landing.

9-11. Minimum Rate of Descent — Power Off.

a. Autorotational descent performance is a function of airspeed and is essentially unaffected by density altitude and gross weight.

b. The speed for minimum rate of descent is 60 KIAS. (Refer to figure 9-3.)

9-12. Maximum Glide.

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

a. 90 KIAS at 324 rotor rpm — Clean configuration.

b. 100 KIAS at 324 rotor rpm — Heavy hog configuration.

9-13. ENGINE FAILURE — LOW ALTITUDE/ LOW AIRSPEED.

The height-velocity diagram depicts combinations of airspeed and height above the gound where a successful straight-in autorotation 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 be followed to achieve the capability shown by the height-velocity diagram. 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 diagram exposes the helicopter 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 9-2.

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 as required in chapter 7.

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 as required in Chapter 7.

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

HEIGHT VELOCITY DIAGRAM
324 ROTOR RPM

HEIGHT VELOCITY
AH-1G
T53-L-13B

NOTE:

SEE OPERATING LIMITATIONS

EXAMPLE A

WANTED

INDICATED AIRSPEED

KNOWN

DENSITY ALTITUDE = SEA LEVEL
SKID HEIGHT ABOVE GROUND = 410 FEET

METHOD

ENTER SKID HEIGHT HERE
MOVE RIGHT TO DENSITY ALTITUDE
MOVE DOWN, READ INDICATED
AIRSPEED = 40 KNOTS

EXAMPLE B

WANTED

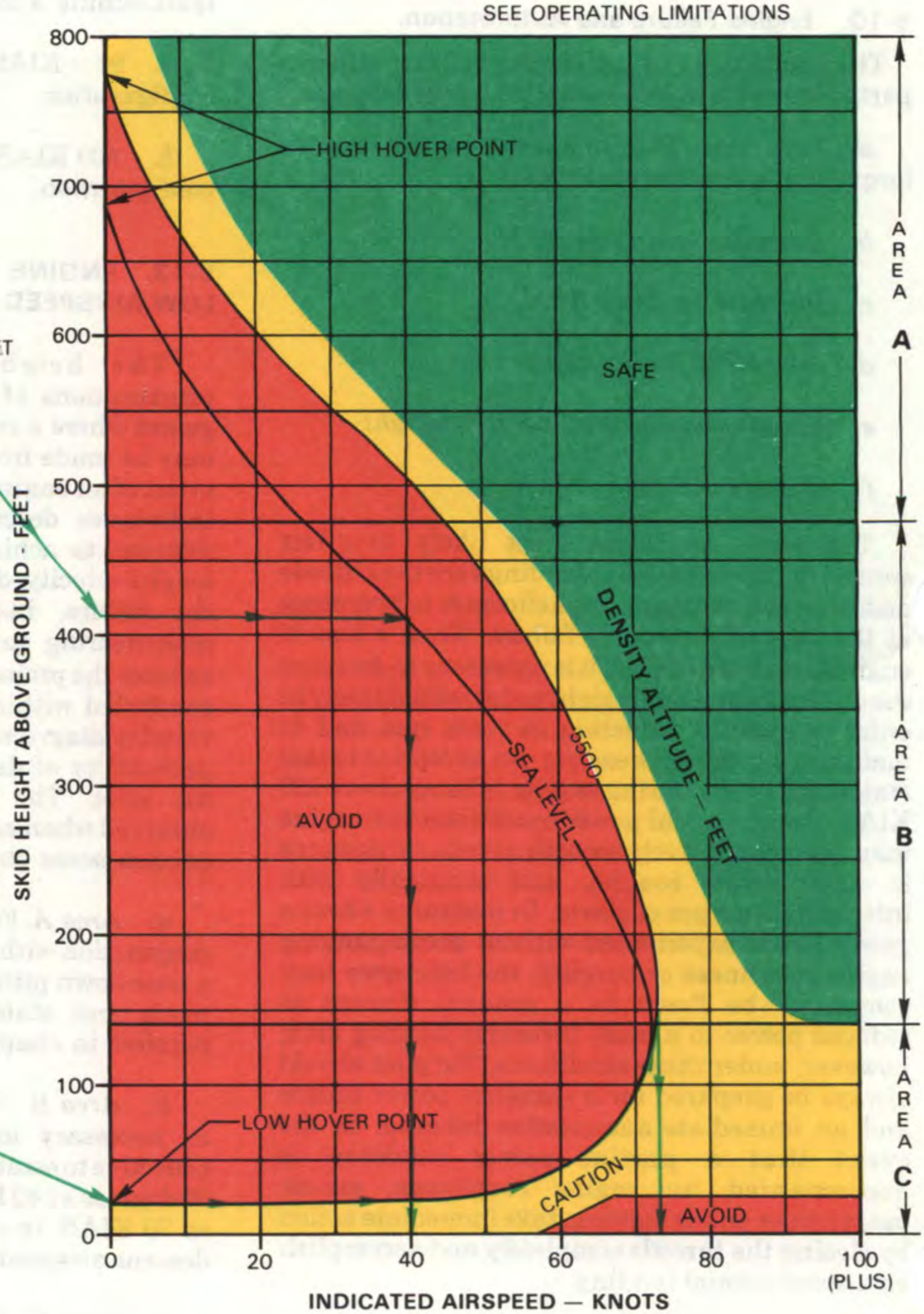
MINIMUM INDICATED AIRSPEED
FOR CLIMBOUT TO AVOID
HEIGHT VELICITY RESTRICTIONS

KNOWN

DENSITY ALTITUDE = 5500 FEET
LOW HOVER POINT = 20 FEET
SKID HEIGHT ABOVE GROUND

METHOD

ENTER DENSITY ALTITUDE HERE
(AT LOW HOVER POINT)
MOVE RIGHT ALONG THE
DENSITY ALTITUDE LINE
TO THE FASTEST AIRSPEED
MOVE DOWN, READ INDICATED
AIRSPEED = 73 KNOTS



DATA BASIS: DERIVED FROM FLIGHT TEST USA ASTA 69-13. FEBRUARY 1971

Figure 9-2. Height velocity diagram

GLIDE DISTANCE
POWER OFF
324 ROTOR RPM

GLIDE DISTANCE
AH-1G
T53-L-13B

EXAMPLE

WANTED

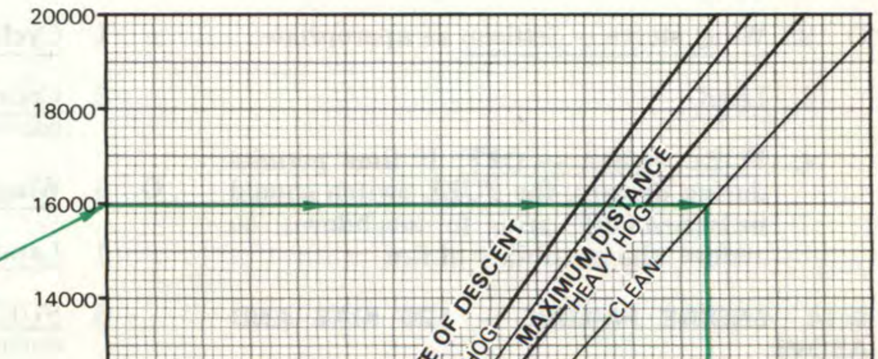
MAXIMUM GLIDE DISTANCE
DURING AUTOROTATION DESCENT
FROM 16000 FT TO 11000 FT
PRESSURE ALTITUDE

KNOWN

CLEAN CONFIGURATION

METHOD

ENTER PRESSURE ALTITUDE HERE
MOVE RIGHT TO MAX DISTANCE LINE
MOVE DOWN, READ
DISTANCE = 12.6 NM
ENTER PRESSURE ALTITUDE HERE
MOVE RIGHT TO MAX DISTANCE LINE
MOVE DOWN, READ
DISTANCE = 8.3 NM
MAX GLIDE DISTANCE = (12.6 - 8.3) = 4.3 NM



DATA BASIS: DERIVED FROM FLIGHT TEST

Figure 9-3. Glide distance chart

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.

d. When engine failure occurs, proceed as follows:

1. Collective — Adjust as necessary; establish autorotational glide.

O 2. Wing stores — Jettison as appropriate.

3. Land.

4. FUEL switch — OFF. If time permits during descent, the FUEL switch should be turned OFF prior to touchdown to reduce the possibility of fire.

9-14. ENGINE FAILURE — 120 KIAS AND ABOVE.

CAUTION

Engine failure at 150 KIAS and greater with indicated engine torque pressure greater than 35 PSI require a pilot recognition and reaction time of less than one second to preclude unacceptable 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 possible mast bumping. To prevent SCAS from making this correction, there must be pilot input. In a nose low altitude 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. After entering autorotation, follow standard autorotation procedures. 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 at slight climb to attain sufficient altitude to execute a full deceleration termination.

1. Cyclic — Adjust as required.

2. Collective — Adjust as necessary to establish autorotational glide.

O 3. Wing stores — Jettison as appropriate.

4. Land.

5. FUEL switch — OFF. If time permits during descent, the FUEL switch should be turned OFF prior to touchdown to reduce the possibility of fire.

6. BAT switch — OFF.

9-15. MAIN DRIVESHAFT/CLUTCH FAILURE.

A failure of the main driveshaft/clutch will result in complete loss of power to the rotor and a possible engine overspeed. If failure occurs, proceed as follows:

1. Cyclic — Adjust as required.

2. Collective — Adjust as necessary; establish autorotational glide.

3. Throttle — Off.

O 4. Wing stores — Jettison as appropriate.

5. Land.

6. FUEL switch — OFF. If time permits during descent, the FUEL switch should be turned OFF prior to touchdown to reduce the possibility of fire.

7. BAT switch — OFF.

9-16. ENGINE GROUND OPERATIONS.

9-17. FLOODED ENGINE.

In the event the engine has been motored with the throttle open and the IGNITION switch OFF or there is any reason to suspect the engine may be flooded with fuel, do the following:

1. IGNITION switch — OFF.
2. FUEL switch — OFF.
3. Throttle — Full off.
4. Start switch — Press and hold for approximately 30 seconds to clear fuel from the engine. Then allow engine to coast to a full stop. Failure to clear fuel from the engine may result in engine damage.

Prior to attempting another start, wait 3 minutes for starter cooling, then do the following:

1. IGNITION switch — ON.
2. FUEL switch — ON.
3. Throttle — Set for start.

9-18. EMERGENCY START.

An emergency start may be attempted if the engine fails to start normally and starting the engine is necessary because of an emergency situation. Normal before-starting checks must be completed prior to beginning the following procedure.

1. Throttle — Off.
2. GOV switch — EMER.
3. Start switch — Press..

CAUTION

Advance and reduce throttle slowly and monitor EGT closely when the GOV switch is in the EMER position in order to avoid exceeding EGT limits or flameout.

4. Throttle — Open slowly to the engine idle position as N1 passes through 8 percent.
5. Start switch — Release at 40 percent N1.
6. Throttle — Open slowly to 80 percent N1, then decrease slowly to engine idle.
7. GOV switch — Move to AUTO as N1 decreases from 80 percent to engine idle. Engine rpm may surge as the GOV switch is placed in the AUTO position; however, this is normal.

9-19. ENGINE RESTART — DURING FLIGHT.

After an engine failure in flight, resulting from a malfunction of the fuel control unit, an engine start may be attempted. Because the exact cause of engine failure cannot be determined in flight, the decision to attempt the start will depend on the altitude and time available, rate of descent, potential landing areas, and crew assistance available. Under ideal conditions, approximately one minute is required to regain powered flight from time the attempted start is begun. If the decision is made to attempt an in-flight start, proceed as follows:

1. GOV switch — EMER.
2. Throttle — Off.
3. Attempt start.
   a. Starter switch — Press.
   b. Throttle — Open slowly to 6400 to 6600 rpm as N1 passes through 8 percent. Control rate of throttle application as necessary to prevent exceeding EGT limits.
   c. Starter switch — Release as N1 passes through 40 percent. After the engine is started and powered flight is re-established, continue with manual throttle control.
4. Land as soon as possible.

9-20. 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. Maneuvers requiring rapid or maximum power applications should be avoided. Should stall occur, the following steps should be accomplished:

1. Reduce collective.

2. RAIN REMOVAL/ENVR CONT switch — OFF.

3. DE-ICE switch — OFF.

4. Land as soon as possible.

5. After landing, accomplish a normal shutdown.

9-21. INLET GUIDE VANE ACTUATOR FAILURE.

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 GOV switch in the EMER position will not provide any increased power capability and increases the possibility of an N1 overspeed and an engine over-temperature. Should a failure occur, proceed as follows:

1. Collective — Adjust as required to maintain rpm.

O 2. Wing stores — Jettison as appropriate.

3. Land as soon as practicable (a running landing is recommended).

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 is applied from increasingly lower N1 speed, acceleration time will correspondingly increase.

9-22. DROOP COMPENSATOR FAILURE.

Droop compensator failure will be indicated when engine rpm is no longer controlled by application of collective. The engine will tend to overspeed as collective is decreased and will underspeed as collective is increased. In the event of failure of the droop compensator, proceed as follows:

1. Collective — Down; establish autorotational glide.

2. Throttle — Engine idle.

3. GOV switch — EMER.

4. Throttle — Open slowly to normal operating rpm and continue flight with manual throttle control.

5. Land as soon as practicable.

9-23. GOVERNOR CONTROL FAILURE.

Failure of the GOV RPM switch or linear actuator results in the inability to control N2 rpm. Failure at normal operating rpm does not require action by the pilot. Should the failure occur below normal operating rpm and due to an emergency situation, a takeoff must be made. Proceed as follows:

1. Throttle — Engine idle.

2. GOV switch — EMER.

3. Throttle — Open slowly to normal operating rpm and continue with manual throttle control.

9-24. ENGINE OVERSPEED.

An engine overspeed is caused by a malfunctioning N2 governor. If an overspeed is experienced, proceed as follows:

1. Collective — Increase to load the rotor and sustain engine rpm below the maximum operating limit.

2. Throttle — Reduce until normal operating rpm is attained.

If normal rpm cannot be maintained, continue as follows:

3. Collective — Down; simultaneously reducing throttle to prevent overspeed, establish autorotational glide.

4. Throttle — Engine idle.

5. GOV switch — EMER.

6. Throttle — Open slowly to normal operating rpm and continue with manual throttle control.

7. Land as soon as practicable.

9-25. ENGINE UNDERSPEED.

An engine underspeed is caused by a malfunctioning N2 governor. At low altitude/low airspeed, the malfunction must be treated as an engine failure because of insufficient time and altitude to regain normal engine rpm with Emergency Governor control. If an underspeed is experienced and altitude permits, proceed as follows:

1. Collective — Down; establish autorotational glide.

2. Throttle — Engine idle.

3. GOV switch — EMER.

4. Throttle — Open slowly to normal operating rpm and continue with manual throttle control.

5. Land as soon as practicable.

Because automatic acceleration, deceleration and overspeed controls are not provided with the GOV switch in the EMER position, control movements must be smooth to prevent compressor stall, overspeed, overtemperature or engine failure.

9-26. CHIP DETECTOR CAUTION LIGHT ILLUMINATION.

If the ENG chip detector caution light illuminates: Land as soon as possible.

9-27. ENGINE OIL BYPASS CAUTION LIGHT ILLUMINATION.

If the ENG OIL BYPASS caution light illuminates:

1. ENG OIL BYP switch — As required.

2. Land as soon as possible.

9-28. LOW ENGINE OIL PRESSURE.

If the ENG OIL PRESSURE caution light illuminates and/or the ENG OIL PRESSURE is below the minimum operating limit: Land as soon as possible.

9-29. HIGH ENGINE OIL TEMPERATURE.

If the ENG OIL temperature exceeds operating limits: Land as soon as possible.

9-30. ENGINE DRIVEN FUEL PUMP FAILURE.

If the ENG FUEL PUMP caution light illuminates: Land as soon as possible.

9-31. Rotor, Transmission, and Drive System.

9-32. Tail Rotor Failure — In Flight.

The key to successfully handling a tail rotor emergency lies in his ability of quickly recognizing 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.

a. Complete Loss of Thrust.

(1) 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 same 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.

(2) Loss of tail rotor components. Except for a greater forward cg shift, this situation would be similar to a complete loss of thrust as discussed above. When a loss of components is suspected, enter autorotation immediately.

b. Fixed Pitch Failure.

(1) Failures of this type (wedged control, 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 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 will be used to land the helicopter. Disengage SAS yaw channel in order to prevent adverse inputs.

(2) 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.

(a) 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.

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

(3) 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.

(4) 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.

c. Loss of Control. If control of tail rotor is lost because of a break in the controls, the pitch setting of the tail rotor may not remain constant. The pilot must be alert for changes in control response.

9-33. Emergency Procedures — Hover.

a. If the tail rotor pitch is fixed in a left-pedal applied position, gradually reduce the throttle and increase collective to stop the turn and allow the helicopter to settle to the ground.

b. If total loss of tail rotor thrust is experienced, close the throttle immediately and accomplish an autorotational landing.

9-34. XMSN, 90°, OR 42° CHIP DETECTOR LIGHT ILLUMINATION.

If either XMSN, 90°, or 42° chip detector caution lights illuminate: Land as soon as possible.

9-35. XMSN OIL BYPASS.

If the XMSN OIL BYPASS caution light illuminates: Land with power immediately.

9-36. LOW XMSN OIL PRESSURE.

If the XMSN OIL PRESS caution light illuminates and/or the XMSN oil pressure is below the minimum operating limit: Land with power immediately.

9-37. HIGH XMSN OIL TEMPERATURE.

WARNING

XMSN OIL HOT caution light and temperature gage depend on oil in the system for operation. Do not depend on a valid indication if total oil supply is lost.

If the XMSN OIL HOT caution light illuminates and/or the XMSN oil temperature exceeds operating limits: Land with power immediately.

9-38. Fuel System.

9-39. FUEL BOOST FAILURE.

a. One Boost Pump. If the fuel pressure gage indicates a drop in pressure and/or one FUEL BOOST caution light illuminates, flight may be continued to a facility where the malfunction can be corrected. With a forward fuel boost failure, nose down attitudes greater than 15° should be avoided to prevent engine failure.

b. Two Boost Pumps. If the fuel pressure gage indicates zero pressure and/or both FUEL BOOST caution lights illuminate, proceed as follows:

1. FUEL switch — FUEL.
2. Descend to a pressure altitude of 4600 feet or less if possible.
3. Land as soon as practicable.

9-40. FUEL FILTER CONTAMINATION.

If the FUEL FILTER caution light illuminates: Land as soon as possible.

9-41. THROTTLE FAILURE — EMERGENCY SHUTDOWN.

If the throttle cannot be closed, engine shutdown can be accomplished by placing the FUEL switch to the OFF position. The engine may continue to run for 1-1/2 to 2 minutes after the switch is off.

9-42. Electrical System.

9-43. ENGINE SHUTDOWN ELECTRICAL FAILURE.

Normal engine shutdown cannot be accomplished after complete electrical failure. Therefore, one of the following methods may be used:

1. Connect another source of power (GPU or battery) if available.
2. Obtain assistance from maintenance personnel.

9-44. OVERHEATED BATTERY.

WARNING

Do not open battery compartment and attempt to disconnect or remove overheated battery. Battery fluid will cause burns and overheated battery will cause thermal burns and may explode.

If an overheated battery is suspected or detected, proceed as follows:

1. BAT switch — OFF.
2. Land as soon as possible. If condition is corrected, flight may be resumed with battery switch OFF.
3. Shutdown engine. Complete normal engine shutdown.
4. Clear the helicopter.

9-45. SPARE CAUTION LIGHT ILLUMINATION.

If a SPARE caution light illuminates: Land as soon as possible.

9-46. DC GENERATOR FAILURE.

A malfunction of the generator will be indicated 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 LIMIT warning light and rpm audio systems.

1. GEN BUS RESET circuit breaker — In.

2. GEN FIELD circuit breaker — In.

3. GEN switch — Move to RESET then to GEN position.
   If the generator is not regained:

4. GEN switch — OFF.

5. GEN FIELD circuit breaker — Out.

6. Turn off switches and/or pull circuit breakers to unnecessary equipment as desired.

7. INVTR switch — STANDBY.

8. SAS switches — As desired.

9-47. AC INVERTER FAILURE.

A malfunction of the main inverter will be indicated by illumination of the INST INVTR caution light. In the event of inverter malfunction, proceed as follows:

1. INV MAIN circuit breaker — In.

2. INV STBY circuit breaker — In.

3. INVTR switch — STBY.

4. SCAS — Re-engage.

5. INV MAIN circuit breaker —Out.

9-48. Fire.

WARNING

Use fire extinguishers only in well ventilated areas because the toxic fumes of the extinguishing agent may cause injury.

The safety of helicopter occupants is the primary consideration when a fire occurs; therefore, it is imperative that every effort be made by the flight crew to put the fire out. On the ground, it is essential that the engine be shut down, crew and passengers evacuated and fire fighting begun immediately. If time permits a "MAYDAY" radio call should be made before the electrical power is OFF to expedite assistance from airfield fire fighting equipment and personnel. If the helicopter is airborne when a fire occurs, the most important single action that can be taken by the pilot is to land the helicopter immediately.

9-49. ENGINE FIRE.

9-50. HOT START — EMERGENCY SHUTDOWN.

The following procedure is applicable during engine starting if flames are emitted from the tail pipe, EGT limits listed in Chapter 5 are exceeded, or it becomes apparent that it will be exceeded.

1. Throttle — Off. The throttle must be closed immediately.

2. Starter switch — Press. The starter switch must be held until EGT is in the normal operating range.

3. FUEL switch — OFF.

4. Complete normal shutdown.

9-51. ENGINE FIRE — FLIGHT.

9-52. LOW ALTITUDE.

If the fire is observed in or around the engine compartment and/or Firelight illuminates during flight at low altitude, proceed as follows:

1. Land immediately — Perform a power-on approach and landing without delay. If conditions permit.

2. Throttle — Off as soon as the helicopter is on the ground.

3. FUEL switch — OFF.

4. BAT switch — OFF.

5. Clear the helicopter.

9-53. CRUISE ALTITUDE.

Prevailing circumstances, such as altitude and landing areas available, must be considered by the pilot in order to determine whether to execute a powered approach or a power-off autorotational descent to the ground. If fire is observed in or around the engine compartment and/or the FIRE light illuminates during flight and the pilot decides to execute a power-off descent, proceed as follows:

1. Collective — Down; autorotate.

O 2. Wing stores — Jettison as appropriate.

3. Throttle — Off.

4. FUEL switch — OFF.

5. Land.

6. BAT switch — OFF.

7. Clear the helicopter.

9-54. FUSELAGE FIRE — GROUND.

If fire is observed in any part of the helicopter during ground operations, proceed as follows:

1. Throttle — Off.

2. FUEL switch — OFF.

3. BAT switch — OFF.

4. Clear the helicopter.

9-55. FUSELAGE FIRE — FLIGHT.

If fire is observed in any part of the helicopter during flight, proceed as follows:

1. Perform an approach and landing with power immediately.

2. Throttle — Off as soon as the helicopter is on the ground.

3. FUEL switch — OFF.

4. BAT switch — OFF.

5. Clear the helicopter.

9-56. ELECTRICAL FIRE.

9-57. ELECTRICAL FIRE — FLIGHT.

In the event of electrical fire, or suspected electrical fire in flight, proceed as follows:

1. Engine and transmission instruments — Check indications.

2. BAT and GEN switches — OFF.

3. Land immediately.

4. Clear the helicopter.

9-58. ELECTRICAL FIRE — FLIGHT CONTINUED.

1. Complete steps 1. and 2. above.

2. Circuit breakers— Out/off except GEN FIELD.

3. GEN switch — GEN. If the GEN FIELD circuit breaker "pops" out, move the GEN switch OFF, and BAT switch to BAT.

4. GEN BUS RESET circuit breaker —In, if the generator remains on line.

5. Circuit breakers — In one at a time. As each circuit is pushed in, check for source of fire.

9-59. ELECTRICAL FIRE — GROUND.

In the event of electrical fire, or suspected electrical fire during ground operations, proceed as follows:

1. Throttle — Off.

2. FUEL switch — OFF.

3. GEN switch — OFF.

4. BAT switch — OFF.

5. Clear the helicopter.

9-60. SMOKE AND FUME ELIMINATION.

1. Airspeed — 40 KIAS or below.
2. Canopy doors — Intermediate position.

9-61. Hydraulic System.

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

WARNING

During a single system failure, do not move HYD TEST switch to the failed system position. Hydraulic pressure to the operative system will be interrupted.

9-62. SYSTEM NO. 1 FAILURE

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

1. EMER COLL HYD switches — OFF, (pilot and gunner) to prevent depletion of the accumulator.
2. HYD CONT circuit breaker — In.
3. SAS — Disengage YAW channel.
4. MASTER ARM switch — OFF.
5. Land as soon as practicable. A running landing is recommended with a touchdown speed of 50 KIAS, terrain permitting.
6. EMER COLL HYD switch — ON (final approach).

9-63. SYSTEM NO. 2 FAILURE.

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

1. EMER COLL HYD switches — OFF (pilot and gunner) to prevent depletion of the accumulator.
2. HYD CONT circuit breaker — In.
3. SAS — Disengage PITCH and ROLL channels.
4. MASTER ARM switch — OFF.
5. Land as soon as practicable. A running landing is recommended with a touchdown speed of 50 KIAS, terrain permitting.
6. EMER COLL HYD switch — ON (final approach).

9-64. SYSTEM NO. 1 AND NO. 2 FAILURE.

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

1. EMER COLL HYD switches — OFF (pilot and gunner) to prevent depletion of the accumulator.
2. HYD CONT circuit breaker — In.
3. SCAS — Disengage all channels.
4. MASTER ARM switch — OFF.

WARNING

Below 20 KIAS cyclic feedback forces becomes uncontrollable.

5. Airspeed — Adjust to 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.

6. Land as soon as practicable. A running landing is recommended with a touchdown speed of 50 KIAS, terrain permitting.

7. EMER COLL HYD switch — ON (final approach).

9-65. Landing and Ditching.

9-66. Landing in Trees.

A landing in trees should be made only after an engine failure when no other landing area is available. In addition to accomplishing engine failure emergency procedures, select a landing area containing the least number of trees of minimum height. Decelerate to a zero ground speed at tree-top level and descend into the trees vertically applying collective as necessary for minimum rate of descent. Prior to the main rotor blades entering the trees, apply all of the remaining collective.

9-67. DITCHING — POWER ON.

If it becomes necessary to ditch the helicopter, accomplish an approach to an approximate 3-foot hover above the water and proceed as follows:

1. Wing stores — Jettison.

2. MASTER ARM switch — OFF.

3. Canopy — Jettison.

4. Gunner — Exit.

5. Hover a safe distance away from the gunner.

6. Throttle — Close and execute an autorotation into the water. Apply full collective prior to the main rotor blades entering the water. Maintain a level attitude as the helicopter sinks and begins to roll, then apply cyclic in direction of the roll.

7. Pilot — Exit when the main rotor is stopped.

9-68. DITCHING — POWER OFF.

If an engine failure occurs over water and ditching is imminent, accomplish engine failure emergency procedures and proceed as follows:

1. Wing stores — Jettison.

2. MASTER ARM switch — OFF.

3. Canopy — Jettison.

4. Land. Accomplish autorotational descent, decelerating to zero forward speed as the helicopter nears the water. Apply all of the collective as the helicopter enters the water. Maintain a level attitude as the helicopter sinks and begins to roll, then apply cyclic in the direction of the roll.

5. Crew — Exit when the main rotor is stopped.

9-69. MAST BUMPING.

If mast bumping occurs, accomplish an approach and land immediately.

9-70. STABILITY AND CONTROL AUGMENTATION SYSTEM (SCAS) FAILURE.

A hardover failure of a SCAS actuator will be evident in an abrupt change in pitch, roll, or yaw attitude which, when corrected by the pilot will result in an abnormal cyclic or pedal position. Mast bumping may occur. SCAS OFF flight should be limited to 100 KIAS. Additionally, high power settings should be avoided when operating at airspeeds between 60 and 100 KIAS with inoperative roll or yaw SCAS channel because of instability. If a hardover failure occurs, proceed as follows:

1. SAS REL button — Press.

2. If condition persists, SAS POWER switch — OFF.

3. After attitude and airspeed control has been re-established, the pilot may re-engage the unaffected SCAS channels.

9-71. FLIGHT CONTROL MALFUNCTIONS.

Failure of components within the flight control system may be indicated through varying degrees of feedback, binding, resistance, vibrations, or sloppiness. These conditions should not be mistaken for hydraulic power failure. In the event of a flight control malfunction, proceed as follows:

1. Land immediately.

2. Complete an engine shutdown immediately.

9-72. Bail Out.

If a decision is made to bail out, proceed as follows:

1. Canopy — Jettison.

2. Trim helicopter and set force trim for a level attitude.

3. Bail out.

9-73. WING STORES EMERGENCY JETTISON.

a. Pilot wing stores jettison procedures.

1. WG ST JETTISON SELECT switch — As required.

2. WING STORES JETTISON switch — Up.

3. WING STORES JETTISON switch — Down.

b. Gunner wing stores jettison procedures.

(1.) WING STORES JETTISON switch — UP.

SECTION II. MISSION EQUIPMENT

9-74. WING STORES HANG FIRE/MISFIRE.

1. Pedals — Maintain trim. Do not overcontrol.

2. Keep weapon pointed toward safe area.

3. Armament switches — OFF.

4. ROCKETS circuit breaker — Out/Off.

5. Land as soon as possible. Keep weapon pointed toward safe area.

6. Complete engine shutdown.

7. Clear helicopter. Exit 90° from line of fire.

9-75. RUNAWAY GUN.

1. Keep weapon oriented downrange or pointed toward safe area until rounds are expended.

2. MASTER ARM switch — OFF.

(3.) OVERRIDE PILOT switch — OFF.

4. WG ST ARM switch — OFF.

O 5. 20MM ARM OFF switches — OFF.

6. DC circuit breaker — Out/Off, affected gun.

APPENDIX A

REFERENCES

AR 70-50	Designating and Naming Military Aircraft, Rockets, and Guided Missiles
AR 95-1	Army Aviation — General Provisions and Flight Regulations
AR 95-5	Aircraft Accident Prevention, Investigation, and Reporting
AR 95-13	Safety Procedures for Operations and Movement of Army Aircraft on the Ground
AR 95-16	Weight and Balance Army Aircraft
AR 385-40	Accident Reporting and Records
AR 385-63	Regulations for Firing Ammunition
AR 750-31	Technical Publication Maintenance Supplies and Equipment
FM 10-68	Aircraft Refueling
FM 10-69	Petroleum Handling Equipment and Operation
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
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 (1005-832-7198)
TM 9-1005-299-12	Operator and Organizational Maintenance Manual: Armament Subsystem. Helicopter, 20 Millimeter 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
TM 750-244-1-5	Procedures for the Destruction of Aircraft and Associated Equipment to Prevent Enemy Use
TM MED 251	Noise and Conservation of Hearing

APPENDIX B

ABBREVIATIONS AND TERMS

ADF	Automatic Direction Finder
AGL	Above Ground Level
ALT	Altitude
ANT	Antenna
AVAIL	Available
BAT	Battery
BFO	Beat Frequency Oscillator
C	Celsius
CAS	Calibrated Airspeed
CARR	Carrier
CCW	Counter Clockwise
CG	Center of Gravity
CHAN	Channel
CL	Centerline
CONFIG	Configuration
CONT	Continuous
CW	Clockwise
DG	Directional Gyro
°	Degree
ECU	Environmental Control Unit
EGT	Exhaust Gas Temperature
EMER	Emergency
END	Endurance
F	Fahrenheit
FAT	Free Air Temperature
FFAR	Folding Fin Aerial Rocket
FLT	Flight
FM	Frequency Modulation
FOD	Foreign Object Damage
FPS	Feet Per Second
FT	Foot
FT/MIN	Feet Per Minute
FWD	Forward
Δ F	Increment of Equivalent Flat Plate Drag Area
GAL	Gallon
GAL/HR	gallon Per Hour
GD	Guard
GND	Ground
GW	Gross WEight
GYRO	Gyroscope
HDG	Heading
HP	Horsepower
HR	Hour
HVY HOG	Heavy Hog
HYDR	Hydraulic
Hz	Hertz
IAS	Indicated Airspeed
ICS	Interphone Control Station
IFF	Identification Friend or Foe

IGE	In Ground Effect
IN	Inch
IND	Indication
IN HG	Inches of Mercury
INV	Inverter
IR	Infrared
KCAS	Knots Calibrated Airspeed
KIAS	Knots Indicated Airspeed
KTAS	Knots True Airspeed
KN	Knots
LB	Pounds
LB/HR	Pounds Per Hour
LIM	Limit
MAG	Magnetic
MAN	Manual
MAX	Maximum
MHF	Medium — High Frequency
MHz	Megahertz
MIC	Microphone
MIN	Minimum
MIN	Minute
MM	Millimeter
MOD	Modified
NAV	Navigation
NO	Number
NM	Nautical Mile
NORM	Normal
N1	Gas Turbine Speed
N2	Power Turbine Speed
OGE	Out of Ground Effect
PRESS	Pressure
PSI	Pounds Per Square Inch
PVT	Private
PWR	Power
R/C	Rate of Climb
RCVR	Receiver
R/D	Rate of Descent
RPM	Revolutions Per Minute
SAS	Stability Augmentation System
SCAS	Stability and Control Augmentation System
SIF	Selected Identification Features
SPEC	Specification
SQ	Squelch
STA	Station
STBY	Standby
SQ FT	Square Feet
TAS	True Airspeed
TOT	Turbine Outlet Temperature
T/R	Transmit-Receive
TRQ	Torque
UHF	Ultra-High Frequency
USAASTA	United States Army Aviation Systems Test Activity
VDC	Volts, Direct Current

VHF	Very HIgh Frequency
VIGV	Variable Inlet Guide Vane
VOL	Volume
V_{NE}	Velocity, Never Exceed (Airspeed Limitation)
XMIT	Transmitter
XMSN	Transmission
XPDR	Transponder

ALPHABETICAL INDEX

Subject	*Paragraph, Figure, Table, Number*

A

Subject	*Paragraph, Figure, Table, Number*

Subject	*Paragraph, Figure, Table, Number*

D

Subject	*Paragraph, Figure, Table, Number*

E

Subject	*Paragraph, Figure, Table, Number*

F

J

K

L

P

Q

R

Subject	*Paragraph, Figure, Table, Number*

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CO A, 3d ENGINEER BN
FT. LEONARD WOOD MO 63108

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PAGE NO.	PARA-GRAPH	FIGURE NO.	TABLE NO.	IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:
6	2-1 a			In line 6 of paragraph 2-1a the manual states the engine has 6 cylinders. The engine on my set only has 4 cylinders. Change the manual to show 4 cylinders.
81		4-3		Callout 16 on figure 4-3 is pointing at a bolt. In the key to fig. 4-3, item 16 is called a shim. Please correct one or the other.
125	line 20			I ordered a gasket, item 19 on figure B-16 by NSN 2910-00-762-3001. I got a gasket but it doesn't fit. Supply says I got what I ordered so the NSN is wrong. Please give me a good NSN.

SAMPLE

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CUT ALONG DOTTED LINE

The Metric System and Equivalents

Linear Measure

1 centimeter = 10 millimeters = . 39 inch
1 decimenter = 10 centimeters = 3.94 inches
1 meter = 10 decimeters = 39.37 inches
1 dekameter = 10 meters = 32.8 feet
1 hectometer = 10 dekameters = 328.08 feet
1 kilometer = 10 hectometers = 3,280.8 feet

Weights

1 centigram = 10 milligrams = . 15 grain
1 decigram = 10 centigrams = 1.54 grains
1 gram = 10 decigrams = . 035 ounce
1 dekagram = 10 grams = . 35 ounce
1 hectogram = 10 dekagrams = 3.52 ounces
1 kilogram = 10 hectograms = 2.2 pounds
1 quintal = 100 kilograms = 220.46 pounds
1 metric ton = 10 quintals = 1.1 short tons

Liquid Measure

1 centiliter = 10 milliters = . 34 fl. ounce
1 deciliter = 10 centiliters = 3.38 fl. ounces
1 liter = 10 deciliters = 38.82 fl. ounces
1 dekaliter = 10 liters = 2.64 gallons
1 hectoliter = 10 dekaliters = 26.42 gallons
1 kiloliter = 10 hectoliters = 264.18 gallons

Square Measure

1 sq. centimeter = 100 sq. millimeters = . 155 sq. inch
1 sq. decimenter = 100 sq. centimeters = 15.5 sq. inches
1 sq. meter (centare) = 100 sq. decimeters = 10.76 sq. feet
1 sq. dekameter (are) = 100 sq. meters = 1,076.4 sq. feet
1 sq. hectometer (hectare) = 100 sq. dekameters = 2.47 acres
1 sq. kilometer = 100 sq. hectometers = . 386 sq. mile

Cubic Measure

1 cu. centimeter = 1000 cu. millimeters = . 06 cu. inch
1 cu. decimeter = 1000 cu. centimeters = 61.02 cu. inches
1 cu meter = 1000 cu. decimeters = 35.31 cu. feet

Approximate Conversion Factors

To change	*To*	*Multiply by*	*To change*	*To*	*Multiply by*
inches	centimeters	2.540	ounce-inches	newton-meters	.007062
feet	meters	.305	centimeters	inches	.394
yards	meters	.914	meters	feet	3.280
miles	kilometers	1.609	meters	yards	1.094
square inches	square centimeters	6.451	kilometers	miles	.621
square feet	square meters	.093	square centimeters	square inches	.155
square yards	square meters	.836	square meters	square feet	10.764
square miles	square kilometers	2.590	square meters	square yards	1.196
acres	square hectometers	.405	square kilometers	square miles	.386
cubic feet	cubic meters	.028	square hectometers	acres	2.471
cubic yards	cubic meters	.765	cubic meters	cubic feet	35.315
fluid ounces	milliliters	29,573	cubic meters	cubic yards	1.308
pints	liters	.473	milliliters	fluid ounces	.034
quarts	liters	.946	liters	pints	2.113
gallons	liters	3.785	liters	quarts	1.057
ounces	grams	28.349	liters	gallons	.264
pounds	kilograms	.454	grams	ounces	.035
short tons	metric tons	.907	kilograms	pounds	2.205
pound-feet	newton-meters	1.365	metric tons	short tons	1.102
pound-inches	newton-meters	.11375			

Temperature (Exact)

°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C