TM 1-1520-238-T-7

TECHNICAL MANUAL

Aviation Unit and Intermediate Troubleshooting Manual

FOR

ARMY Model AH-64A HELICOPTER (NSN 1520-01-106-9519) (EIC: RHA)

CHAPTER 10 FUEL SYSTEM

CHAPTER 11 FLIGHT CONTROL SYSTEM

SUPERSEDURE NOTICE: This manual supersedes TM 55-1520-238-T-3, dated 15 DECEMBER 1985, including all changes.

HEADQUARTERS, DEPARTMENT OF THE ARMY
30 APRIL 1992

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D. C., 30 April 1992

TECHNICAL MANUAL

AVIATION UNIT AND INTERMEDIATE TROUBLESHOOTING MANUAL

FOR

ARMY MODEL
AH-64A HELICOPTER
(NSN 1520-01-106-9519) (EIC: RHA)

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistakes, 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 directly to: Commander, U.S. Army Aviation and Missile Command, ATTN: AMSAM-MMC-MA-NP, Redstone Arsenal, AL 35898–5230. A reply will be furnished to you.

You may also send in your comments electronically to our e–mail address: 2028@redstone.army.mil or by fax 205–842–6546/DSN 788–6546. Instructions for sending an electronic 2028 may be found at the end of this manual immediately preceding the hard copy 2028.

OZONE DEPLETING CHEMICAL INFORMATION:
This document has been reviewed for the presence of Class I Ozone depleting chemicals. As of Change 7 dated 19 December 1997, all references to Class I Ozone depleting chemicals have been removed from this document by substitution with chemicals that do not cause atmospheric Ozone depletion.

TABLE OF CONTENTS

*** SUPERSEDURE NOTICE: This manual supersedes TM 55-1520-238-T-7, dated 15 DECEMBER 1985, including all changes.**

HOW TO USE THIS VOLUME

OVERVIEW

If you can't find information, you can't do the job. Learn how to use the Integrated Troubleshooting Manual System and this volume. Refer to TM 1-1520-238-T-2 for instructions on how to use the troubleshooting manual system and TM 1-1520-238-T-4 for instructions on how to use this volume.

USING AH-64A HELICOPTER EFFECTIVITY CODES

Helicopter effectivity codes designate differences between helicopters by helicopter serial numbers. These codes consist of three letters representing various helicopter serial number blocks. They are used throughout this volume as necessary to aid the helicopter troubleshooting effort.

The codes are used to designate serial number block differences as follows:

- When used within narrative text and fault isolation procedures (FIPs), effectivity codes appear within parentheses.

  For Example: Narrative text and FIPs (AAA)

- When used inside wiring interconnect diagrams, effectivity codes appear within triangular borders and are placed on the line which represents that particular helicopter's configuration.

  For Example: Wiring interconnect diagram 

This volume uses these effectivity codes and corresponding helicopter serial numbers for reference.

To use the helicopter effectivity codes, note the helicopter serial number on the left side of the fuselage directly below the CPG window. Use this serial number to determine which procedure or path in a wiring interconnect diagram or FIP to use.

The effectivity codes and helicopter serial number blocks applicable to this volume are as follows:

Effectivity Code	Helicopter Serial No.
AAA	82-23355 thru 82-23365
AAB	82-23355 thru 83-23798
AAC	82-23355 thru 83-23814
AAD	85-25424 and subsequent
AAE	82-23355 thru 84-24231
AAF	84-24216 and subsequent
AAG	82-23355 thru 84-24289
AAH	82-23355 thru 85-25398
AAJ	85-25351 and subsequent
AAK	82-23355 thru 85-25488
AAL	88-0215 and subsequent

HOW TO USE THIS VOLUME (cont)

Effectivity Code	Helicopter Serial No.
AAM	85-25465 and subsequent
AAN	83-23787 thru 85-25415
AAP	82-23355 thru 88-0214
AAQ	82-23355 thru 84-24311
AAR	82-23355 thru 84-24239
AAS	84-24240 and subsequent
AAT	82-23355 thru 83-23804
AAU	83-23787 and subsequent
AAV	83-23805 and subsequent
AAW	83-23799 and subsequent
AAX	83-23799 thru 84-24245
AAY	83-23799 thru 85-25470 (Before MWO 1-1520-238-50-37)
AAZ	83-23815 and subsequent
ABA	84-24200 and subsequent
ABB	84-24246 and subsequent
ABC	84-24290 and subsequent
ABD	82-23355 thru 85-25415
ABE	82-23355 thru 84-24295
ABF	84-24296 and subsequent
ABG	85-25399 and subsequent
ABH	82-23355 thru 84-24245
ABJ	85-25447 and subsequent
ABK	82-23355 thru 85-24446
ABL	82-23355 thru 89-0215
ABM	84-24290 thru 88-0199
ABN	89-0192 and subsequent
ABP	85-25471 and subsequent
ABQ	86-8940 and subsequent
ABR	82-2355 thru 84-24232
ABS	84-24233 and subsequent
ABT	82-23355 thru 83-23816
ABU	83-23817 thru 85-25415
ABV	84-24246 thru 85-25398

HOW TO USE THIS VOLUME (cont)

Effectivity Code	Helicopter Serial No.
ABW	82-23355 thru 83-23795
ABX	83-23796 and subsequent
ABY	With T700-GE 701 engines
ABZ	With T700-GE 701C engines
ACA	82-23355 thru 88-0199
ACB	88-0200 and subsequent
ACC	82-23355 thru 83-23834
ACD	85-25416 and subsequent
ACE	82-23355 thru 86-9011
ACF	82-23355 thru 88-0284
ACG	89-0192 and subsequent
ACH	82-23355 thru 85-25423
ACJ	82-23355 thru 90-0290, and 90-0292 thru 90-0301 (Before MWO 1-1520-238-50-07)
ACK	82-23355 thru 90-0290, 90-0292 thru 90-0301 (After MWO 1-1520-238-50-07) 90-0291, 90-0302 and subsequent
ACL	82-23355 thru 83-23814
ACM	83-23815 and subsequent
ACN	85-25471 thru 90-0448 (Before MWO 1-1520-238-50-37)
ACP	85-25471 thru 90-0448 (After MWO 1-1520-238-50-37) 90-0449 and subsequent
ACQ	82-23355 thru 90-0448 (Before MWO 1-1520-238-50-36)
ACR	82-23355 thru 90-0448 (After MWO 1-1520-238-50-36) 90-0449 and subsequent
ACS	82-23355 thru 90-0437
ACT	90-0438 and subsequent
ACU	82-23355 thru 90-0436
ACV	89-0192 thru 90-0434 with T700-GE-701C engines (Before MWO 1-1520-238-50-38)
ACW	89-0192 thru 90-0434 with T700-GE-701C engines (After MWO 1-1520-238-50-38) 90-0435 and subsequent with T700-GE-701C engines

ADA	Before MWO 1–1520–238–50–40
ADB	After MWO 1–1520–238–50–40
ADC	Before MWO 1–1520–238–50–49
ADD	After MWO 1–1520–238–50–49

USING THE ELECTRICAL COMPONENT LOCATION AND CONFIGURATION (ECLC) INDEX

The ECLC index will help you find electrical components and their connectors on the helicopter during troubleshooting. The ECLC is located at the beginning of the troubleshooting procedures of each chapter (when applicable). This index is a list of connectors and applicable wiring harnesses which are illustrated by component location. Component locations are shown from the helicopter's forward sections to its aft sections by horizontal and vertical grid numbers. Connectors are listed numerically in the **FROM COLUMN Connector Ref Des** column of the index. Every connector is referenced to a grid area within the illustrations.

EXAMPLE OF ECLC INDEX

FROM COLUMN		TO COLUMN			
Connector Ref Des	**Component/ Harness**	**Connector Ref Des**	**Component/ Harness**	**Grid Area**	**Access**
P1	A322	J1039	W119	7A	CPG STATION
P141	W157	J1	L5	78E	LW9
P142	W158	J1	L4	78C	RW9

Use the index to find connectors on the aircraft by first locating the connector reference designator number in the **FROM COLUMN Connector Ref Des** column of the index. Then, cross-reference the **FROM COLUMN Connector Ref Des** column with the following:

- **FROM COLUMN Component/Harness** column to locate the component or wire harness number.
- **TO COLUMN Connector Ref Des** column to locate the mating connector number.
- **TO COLUMN Component/Harness** column to locate the mating component or wire harness number.
- **Grid Area** column to find the grid zone (within the illustration) depicting the location of the connector on the aircraft.
- **Access** column to find where access can be obtained (TM 1-1520-238-23).

For example, to locate connector P1 on the aircraft find connector P1 in the **FROM COLUMN Connector Ref Des** column, then refer to the **FROM COLUMN Component/Harness** column. This column shows that P1 is part of component A322. The **TO COLUMN Connector/Ref Des** column shows that P1 connects to J1039 on wire harness W119 (**TO COLUMN Component/Harness**). The **Grid Area** column indicates that P1 is depicted at illustration grid zone 7A, and that **Access** to the connector is obtained through the CPG STATION.

CHAPTER 10
FUEL SYSTEM

CHAPTER INDEX

SECTION I. EQUIPMENT DESCRIPTION AND DATA

10–1. EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES 10–1

a. **Characteristics.**

(1) **Fuel Storage System.** The purpose of the fuel storage system is to store fuel for distribution to the engines and the auxiliary power unit (APU).

(2) **Fuel Crossfeed/Boost System.** The fuel crossfeed/boost system provides fuel to the forward and aft fuel cells for starting and normal helicopter operation.

(3) **Fuel Quantity Indication/Transfer System.** The fuel quantity indication/transfer system allows crew members to monitor fuel quantity and to transfer fuel from cell to cell to maintain helicopter center of gravity, or to transfer fuel from a damaged cell.

(4) **Nitrogen Inerting System.** The nitrogen inerting system reduces fire hazards associated with fuel cell air space by filling air space with oxygen-depleted air to a level that does not support combustion.

(5) **Gravity Refueling/Defueling.** Gravity refueling/defueling provides a means for refueling or defueling the forward and aft fuel cells.

(6) **Pressure Refueling/Defueling.** The pressure refueling/defueling system allows pressure refueling or suction defueling of the forward and aft fuel cells.

(7) **Auxiliary Fuel System.** The auxiliary fuel system transfers fuel from the auxiliary fuel tanks to the internal fuel cells. Auxiliary fuel tanks store and supply fuel for ferry operations.

b. **Capabilities and Features**.

(1) **Fuel Storage System.** The fuel storage system provides fuel and fuel management provisions to operate both engines and the APU. Fuel is stored in two crash-resistant, self-sealing fuel cells, one forward and one aft. Fuel may be transferred from one fuel cell to another. The fuel system also enables either crewmember to select fuel supply to engines.

(2) **Fuel Crossfeed/Boost System.** The fuel crossfeed/boost system provides fuel pressure to the engine-driven fuel pumps during engine start-up. Positive fuel pressure is provided at altitudes over 10,000 feet. A crossfeed/shutoff valve allows or disables either cell to supply or shutoff fuel to both engines.

(3) **Fuel Quantity Indication/Transfer System.** The fuel quantity indication/transfer system uses the pressurized air system (PAS) to direct air for fuel transfer. **FUEL** panels provide crew members quick access for fuel management. Fuel quantity is continuously monitored and various panels indicate fuel level.

(4) **Nitrogen Inerting System.** The nitrogen inerting system provides a continuous oxygen-depleted airflow to both fuel cells, approximately 94% nitrogen. It is self-contained and automatically operates whenever pressurized air and 115 VAC power is available.

(5) **Gravity Refueling/Defueling.** The gravity refueling/defueling system fuels the forward, and aft fuel cells, and the auxiliary tanks separately. Refueling time required for gravity refueling is dependent upon the flow-rate capability of the servicing equipment.

(6) **Pressure Refueling/Defueling**. The pressure refueling/defueling system provides two adapters for alternative fuel nozzles. Forward and aft fuel cells may be filled separately or simultaneously dependent upon refueling panel switch settings. Fuel quantity is continuously monitored and fuel flow is automatically stopped by fuel cell sensors.

10–1. EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES (cont) 10–1

(7) **Auxiliary Fuel System.** The auxiliary fuel system provides fuel and air lines which are installed in each wing. Auxiliary fuel tanks can be jettisoned. Disconnect couplings are breakaway and self-sealing.

10–2. LOCATION AND DESCRIPTION OF MAJOR COMPONENTS 10–2

a. **Fuel Storage System.** The fuel storage system (fig. 10–1) consists of the forward and aft fuel cells, breakaway valves, a baffle/check valve, and the fuel sump drain assembly. Various fuel subsystems control fuel flow operation which are described in detail in the following paragraphs.

(1) **Forward Fuel Cell.** The forward fuel cell is located under the pilot's station and supplies fuel to engine 1 (left). The outer and inner layers are made of several layers of rubber-impregnated nylon. The intermediate layer consists of uncured rubber which forms a sealant material. The uncured rubber reacts to fuel whenever the fuel cell is punctured. This reaction causes the uncured rubber to swell and seal the hole. It is surrounded on the bottom and sides by the helicopter skin, rigid foam, Kevlar liner, and backing boards. The rigid foam is used to fill the voids between the bulkheads. The Kevlar liner is between the rigid foam and the backing boards and gives the fuel cell additional ballistic protection. The backing boards, made of fiberglass, reduce the possibility of fuel cell chafing. The forward fuel cell is secured in the helicopter fuselage by seven mounting pads which are molded to the fuel cell. The mounting pads consist of the forward fuel cell access panel pad, gravity filler port mount pad, pressure fuel inlet mount pad, fuel outlet mount pad, sump plate/drain valve mount pad, air vent/pressure relief valve mounting pad, and the pilot valve mounting pad.

(2) **Aft Fuel Cell.** The aft fuel cell, located aft of the ammunition bay, normally supplies fuel to engine 2 (right), the APU, and both engines during startup. If desired, either cell can supply both engines. The aft fuel cell is secured in the helicopter fuselage by six mounting pads which are molded to the fuel cell. The mounting pads consist of the boost pump mount pad, the air vent/pressure relief valve mount pad, the gravity filler port mount pad, the pilot valve mount pad, the pressure fuel inlet mount pad, and the sump plate/drain valve mount pad.

(3) **Breakaway Valves**. The breakaway valves, located in the upper left and right corners of the fuel cells, reduce fire hazards by sealing the fuel cells and lines in the event of a high impact landing. They are dual flapper-type breakaway valves that are normally open to permit fuel flow. In the event of valve displacement, the valve separates allowing spring tension to force the piston out which allows the flapper to seal the valve. If this happens, a yellow caution band becomes visible between the flange section and the connection assembly. If the caution band is visible, the valve is no longer serviceable and must be replaced.

(4) **Baffle/Check Valve**. The baffle/check valve, located inside the forward fuel cell, ensures that an uninterrupted supply of fuel is supplied to the engines. During level or nose-up attitude, the double-flapper check valve opens allowing fuel to flow between the forward and aft section of the forward fuel cell. When the fuel level is below the baffle and the helicopter is in a nose low attitude, the check valve closes and traps fuel.

(5) **Fuel Sump Drain Assembly**. The fuel sump drain assembly, located at the bottom of each fuel cell, permits fuel sampling checks for contamination, water content and draining of the fuel cells. The fuel sump drain assembly consists of a spring-loaded closed sump drain valve, a sump drain plunger, which when pushed, opens the sump drain valve allowing fuel to drain. Releasing the pushbutton on the sump drain plunger allows the spring-loaded drain valve to close, stopping fuel flow.

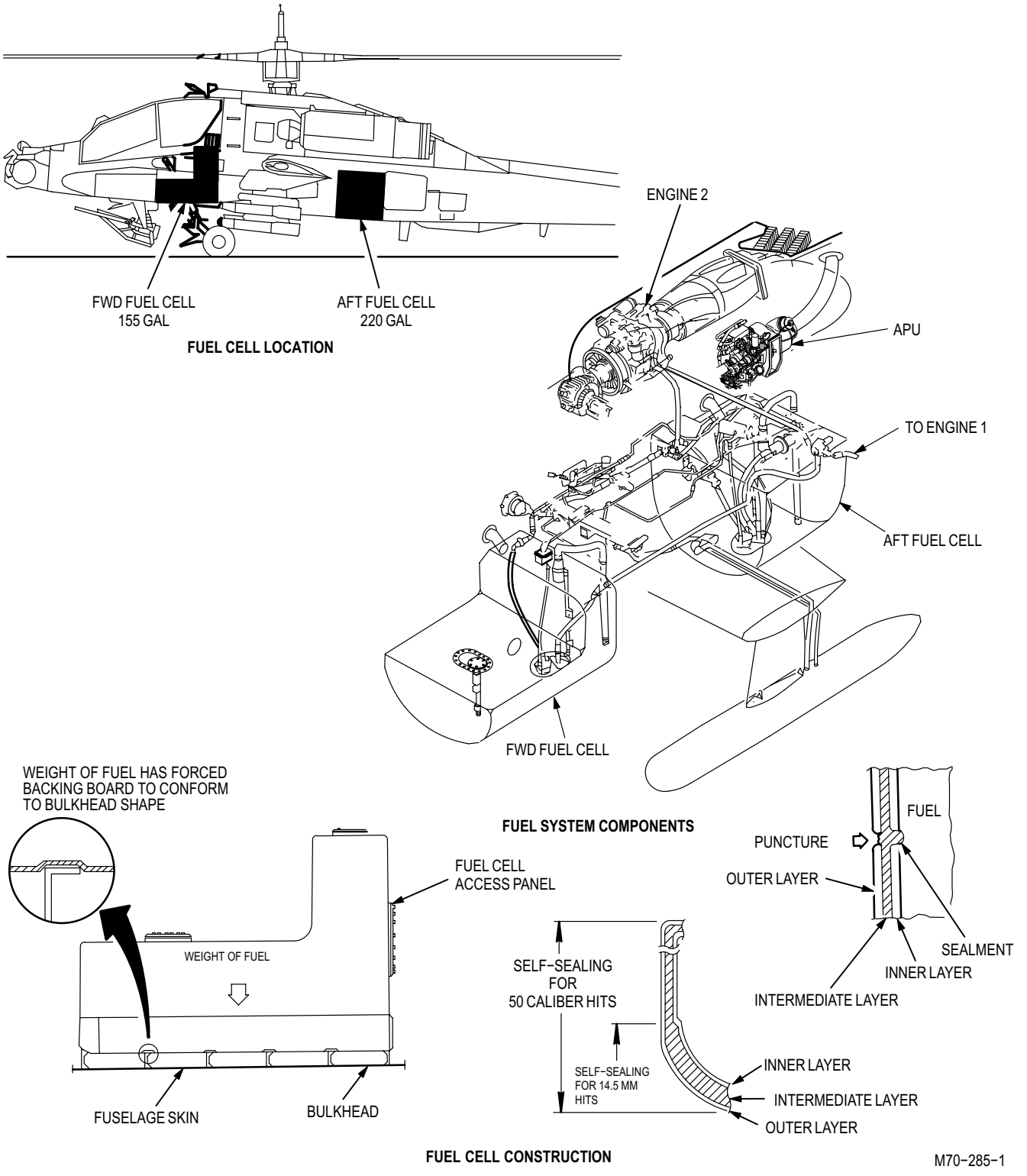

Figure 10–1. Fuel Storage System Major Component Location (Sheet 1 of 3)