*TM 1-1520-237-23-1

TECHNICAL MANUAL

AVIATION UNIT AND INTERMEDIATE MAINTENANCE MANUAL FOR

HELICOPTERS, UTILITY TACTICAL TRANSPORT
UH-60A NSN 1520-01-035-0266 (EIC: RSA)
UH-60L NSN 1520-01-298-4532 (EIC: RSM)
EH-60A NSN 1520-01-082-0686 (EIC: RSB)
HH-60A NSN 1520-01-459-9468 (EIC: RSN)
HH-60L NSN 1520-01-471-6743 (EIC: RSI)

*This manual supersedes TM 1-1520-237-23-1 dated 17 April 2006 including all changes.

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HEADQUARTERS, DEPARTMENT OF THE ARMY
25 SEPTEMBER 2009

WARNING SUMMARY

INTRODUCTION

This warning summary contains general safety warnings and hazardous materials warnings that must be understood and applied during operation and maintenance of this equipment. Failure to observe these precautions could result in serious injury or death to personnel.

WARNING

Personnel performing operations, procedures, and practices which are included or implied in this technical manual shall observe the following warnings. To disregard these warnings and precautionary information can cause serious injury, death, or an aborted mission.

LOSS OF HEARING

Serious hearing loss and injury can occur during drilling, grinding and riveting operations. Wear ear and eye protection.

FUMES

Volatile and toxic fumes occur when using solvents, causing both a fire and a health hazard. Get fresh air and immediate medical attention. Wash contacted skin with clean water for 15 minutes. If solvent contacts eyes, flush them with clean water (15 minutes) and get immediate medical help. Provide proper ventilation and protective clothing, including eye shield, when using solvents. Avoid breathing vapors and skin contact as much as possible.

HEAVY LIFT

Injury to personnel or damage to equipment will result if FRIES bar is not supported during removal. Use at least two assistants to support FRIES bar during removal/installation.

EXTERNAL CARRY

Personnel carried externally are subject to injury from exposure to wind chilling, dehydration, difficult breathing conditions, and foreign objects.

ROPES

All rope ends must be secured away from rotors during landing. This applies both to ropes hanging from the aircraft and ropes dropped onto the ground in the landing area.

RADAR ALTIMETER

Radar altimeter indications should not be relied upon exclusively during FRIES operations as the altimeter may either measure the distance from the aircraft to the top of trees in heavy foliage or from the aircraft to the ground in lighter foliage.

WARNING SUMMARY – Continued

VISIBILITY

Do not use FRIES under conditions in which the rope end/landing is not visible from the aircraft.

NOTE

FIRST AID

Refer to FM 4-25.11.

CHANGE NO. 1

HEADQUARTERS DEPARTMENT OF THE ARMY WASHINGTON, D.C., 30 JULY 2010

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1. File this sheet in front of the manual for reference.
2. This change is a result of new preventive maintenance checks and services procedures and new expendable/durable supplies and materials.
3. New or updated text is indicated by a vertical bar in the outer margin of the page.
4. Added illustrations are indicated by a vertical bar adjacent to the figure number. Changed illustrations are indicated by a miniature pointing hand adjacent to the updated area and a vertical bar adjacent to the figure number.Remove old pages and insert new pages as indicated below.

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DEPARTMENT OF THE ARMY
Washington, D.C., 25 September 2009

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HOW TO USE THIS MANUAL

INTRODUCTION

NOTE

In case of conflict with other technical documentation, this manual has precedence.

This manual is one of a set of 20 separate chapters that cover maintenance, inspection, and troubleshooting instructions for the models UH-60A, UH-60L, EH-60A, HH-60A, and HH-60L helicopters. The helicopters are manufactured by Sikorsky Aircraft Corporation, 6900 Main Street, Post Office Box 9729, Stratford, Connecticut 06615-9129. The other 4 manuals are:

- Preventive Maintenance Services, Daily Inspection Checklist, TM 1-1520-237-PMD
- Preventive Maintenance Services, 40-Hour Inspection Checklist, TM 1-1520-237-PMS
- Phase Maintenance Services, Periodic Inspection Checklist, TM 1-1520-237-PMI
- Repair Parts and Special Tools List (RPSTL), TM 1-1520-237-23P

The following manuals are managed by CECOM. These manuals contain maintenance inspection and troubleshooting data for Aviation Unit Maintenance (AVUM) and Aviation Intermediate Maintenance (AVIM) support levels. They do not have depot level maintenance instructions.

- UH-60A UH-60L HH-60A HH-60L> Aircraft Avionics Maintenance Procedures, TM 11-1520-237-23
- EH-60A> Aircraft Avionics Maintenance Procedures, TM 11-1520-249-23

TYPES OF MANUALS BY AIRCRAFT

UH-60A> The manuals, TM 1-1520-237-23, TM 1-1520-237-PMD, TM 1-1520-237-PMS, TM 1-1520-237-PMI, and TM 11-1520-237-23 contain references to the model UH-60A. This reference applies to helicopters with the following serial numbers:

- 77-22714 thru 77-22728
- 78-22960 thru 78-23015
- 79-23265 thru 79-23370
- 80-23416 thru 80-23509
- 81-23547 thru 81-23647
- 82-23660 thru 82-23761
- 83-23837 thru 83-23932
- 84-23933 thru 84-24016
- 85-24387 thru 85-24464
- 86-24485 thru 86-24559
- 87-24579 thru 87-24656
- 88-26015 thru 88-26086
- 89-26123 thru 89-26173

HH-60A HH-60> The manuals, TM 1-1520-237-23, TM 1-1520-237-PMD, TM 1-1520-237-PMS, TM 1-1520-237-PMI, and TM 11-1520-237-23 contain references to the model HH-60A and HH-60L. This reference applies to helicopters with the following serial numbers:

- 97-26768 thru 97-26771

EH-60A> The manuals, TM 1-1520-237-23, TM 1-1520-237-PMD, TM 1-1520-237-PMS, TM 1-1520-237-PMI, and TM 11-1520-249-23, contain references to the model EH-60A. This reference applies to helicopters with the following serial numbers:

- 84-24017 through 84-24028
- 85-24465 through 85-24482

HOW TO USE THIS MANUAL – Continued

TYPES OF MANUALS BY AIRCRAFT – CONTINUED

- 86-24561 through 86-24578
- 87-24657 through 87-24674

UH-60L> The manuals, TM 1-1520-237-23, TM 1-1520-237-PMD, TM 1-1520-237-PMS, TM 1-1520-237-PMI, and TM 11-1520-237-23, contains reference to the model UH-60L. This reference applies to helicopters with the following serial numbers:

- 84-23953
- 89-26149
- 89-26154
- 89-26179 and subsequent

TM 1-1520-237-23

This Aviation Unit and Intermediate Maintenance Manual includes the purpose, function, physical characteristics, location, access, and theory of operation, servicing, information for the maintenance specialist to do specific maintenance tasks, and wire data information for all helicopter systems and major components. This manual is arranged in the same general sequence as the Maintenance Allocation Chart. Refer to Army Requlations and Operator's Manual for personnel requirements and procedures for ground run and flight checking the helicopter.

Description of Chapter 1

Chapter 1 contains general information, equipment description and data, and theory of operation related to the system's components. Simplified block diagrams are used in describing some electrical, hydraulic, and fuel systems.

Description of Chapters 2 through 4

Chapters 2 through 4 contains data to troubleshoot the helicopter's mechanical, fuel, pneudraulic, flight instrument, and electrical systems. There are two major breakdowns of these work packages, operational/troubleshooting procedures and fault isolation procedures. Schematic diagrams are included for point-to-point troubleshooting. Location diagram illustrations are also provided. The wiring data is also useful for troubleshooting (WP 1800 00 through WP 2008 00). If a wire number is known and the connectors are not, refer to the WIRE DATA LIST BY WIRE NUMBER sections. If the connector number is known and the wire number is not, refer to WIRE DATA LIST BY REFERENCE DESIGNATOR sections. For further information on proper usage of the wiring data list, refer to the General Information (WP 1800 00).

Operational/troubleshooting procedures contain step-by-step instructions to isolate a reported discrepancy or ensure the system is fully functional. These procedures may be subdivided into smaller procedures which focus on specific functions of the system. Operational checks reduce maintenance time by providing simultaneous troubleshooting, eliminating circuitry which could cause a reported discrepancy. The procedures direct the user to a specific fault isolation procedure or describe corrective action when the discrepancy is confirmed. Fault isolation procedures provide additional troubleshooting which will correct most reported discrepancies. Fault isolation procedures do not stand alone in their troubleshooting approach. The operational/troubleshooting procedures must be performed before using the fault isolation procedures.

Description of Chapters 5 through 19

Chapters 5 through 19 contains on aircraft inspections including detailed inspections as specified by the daily inspection and 40 hour inspection checklist, AVUM maintenance and repair procedures, AVIM maintenance and repair procedures, structural repair information such as paint touch up, metal structure repair limits, water integrity sealing, extrusion charts, and composite structure repair, and wire data lists.

HOW TO USE THIS MANUAL – Continued

TM 1-1520-237-23 **– CONTINUED**

Description of Chapter 20

Chapter 20 contains reference material, Maintenance Allocation Chart (MAC), expendable and durable items list, and locally fabricated tools information.

TM 1-1520-237-PMD**,** TM 1-1520-237-PMS**, AND** TM 1-1520-237-PMI

The Daily Inspection Checklist TM 1-1520-237-PMD, Preventive Maintenance Services (40 Hour) Inspection Checklist TM 1-1520-237-PMS, and Phase Maintenance (360/720 Hour) Periodic Inspection Checklists, TM 1-1520-237-PMI, contain complete inspection requirements for Daily, Preventive Maintenance, and Periodic Phase Inspections. They do not have instructions for repair, adjustment or other means of correcting conditions, nor do they have troubleshooting instructions to find causes for malfunctioning. Refer to TM 1-1520-237-23 or TM 11-1520-249-23 for specific inspection, accept/reject criteria, or operational checks.

TM 11-1520-237-23 **UH-60A UH-60L HH-60A HH-60L>**

The Aircraft Avionics Maintenance Procedures Manual, TM 11-1520-237-23, contains equipment descriptions, theories of operation, operational/troubleshooting procedures, and maintenance tasks for all the UH-60A, UH-60L, HH-60A, and HH-60L helicopter avionics systems. This manual does not contain data regarding EH-60A avionics systems.

TM 11-1520-249-23-1 **AND** TM 11-1520-249-3 **EH-60A>**

The Aircraft Avionics Maintenance Procedures Manuals, TM 11-1520-249-23-1 and TM 11-1520-249-23-3, contain descriptions, theories of operation, and maintenance tasks for the EH-60A helicopter avionics systems.

TM 11-1520-249-2 **EH-60A>**

The Avionics Fault Isolation Procedures Manual, TM 11-1520-249-23-2, has data for troubleshooting the EH-60A helicopter's avionic systems. Operational checkout procedures and logic-type troubleshooting charts give detailed step-by-step instructions to identify malfunctioning components. Component location diagrams and schematics are also included. The Avionics Fault Isolation Procedures Manual covers only EH-60A avionics systems.

USE OF ICONS

Ranges of helicopter effectivities, MWOs, and production line modifications referenced throughout this manual shall be identified by an icon.

Helicopter Serial Numbers and Model Designations

Ranges of helicopter effectivities shall be identified by an icon. **UH-60A-77-22717-SUBQ>** This icon is an example of an effectivity for UH-60A helicopters serial numbers 77-22717 and subsequent.

Electromagnetic Environmental Protection

EMEP> Designates UH-60L, HH-60A or HH-60L serial number 90-26272, serial numbers 90-26293 and subsequent or UH-60A, UH-60L and EH-60A, modified by MWO 1-1520-237-50-59.

W/O EMEP> Designates UH-60L prior to serial number 90-26272 and serial numbers 90-26273 through 90-26292, or UH-60A and EH-60A not modified by MWO 1-1520-237-50-59.

External Stores Support System (ESSS)

ESSS> Designates UH-60A, HH-60A or HH-60L serial numbers 82-23748 and subsequent, EH-60A and UH-60L are provisioned for ESSS.

W/O ESSS> Designates UH-60A prior to serial number 82-23748 are not provisioned for ESSS.

HOW TO USE THIS MANUAL – Continued

USE OF ICONS – CONTINUED

Improved Flight Controls

IMP FLT CONT> Designates UH-60L and HH-60L serial numbers 91-26360 and subsequent, or UH-60L prior to serial number 91-26360 modified by MWO 1-1520-50-71.

W/O IMP FLT CONT> Designates UH-60L prior to serial number 91-26360 not modified by MWO 1-1520-237-50-71.

Heated Center Windshield

HCW> Designates UH-60A, HH-60A, HH-60L or EH-60A serial numbers 85-24441 and subsequent, UH-60L or UH-60A and EH-60A prior to serial number 85-24441 modified by MWO 1-1520-237-50-70.

W/O HCW> designates UH-60A and EH-60A prior to serial number 85-24441 not modified by MWO 1-1520-237-50-70.

Hover Infrared Suppressor System

HIRSS> Designates UH-60A, HH-60A or HH-60L serial numbers 86-24560 and subsequent, UH-60L and EH-60A, or UH-60A, modified by MWO 1-1520-237-50-63.

W/O HIRSS> Designates UH-60A prior to serial number 86-24560 not modified by MWO 1-1520-237-50-63.

Hellfire/Volcano Fixed Provision Connector

HFIRE/VOL> Designates UH-60A, UH-60L, and EH-60A modified by MWO 1-1520-237-50-66.

W/O HFIRE/VOL> Designates UH-60A, UH-60L, and EH-60A not modified by MWO 1-1520-237-50-66.

Roll Vibration Absorber

ROLL> Designates UH-60L, HH-60A or HH-60L serial numbers 90-26278 and subsequent, or modified by MWO 1-1520-237-50-60 and EH-60A serial numers 87-24669 and subsequent.

Modernization Program

MOD> Designates UH-60A and HH-60A modified by MWO 1-1520-237-55-7.

W/O MOD> designates UH-60A not modified by MWO 1-1520-237-55-7.

Improved Airspeed System

IAS> Designates UH-60L, HH-60A or HH-60L serial numbers 82-23747 and subsequent,UH-60L, EH-60A and UH-60A, serial number prior to 82-23748 modified by MWO 55-1520-237-50-22.

W/O IAS> Designates UH-60A helicopters not modified by MWO 55-1520-237-50-22.

Wire Strike Protection System

WSPS> Designates UH-60A, HH-60A or HH-60L serial numbers 86-23416 and subsequent, UH-60L, EH-60A serial numbers 85-24469 and subsequent or UH-60A and EH-60A modified by MWO 55-1520-237-23-47.

W/O WSPS> Designates UH-60A prior to serial number 86-232416 and EH-60A prior to serial number 85-24469 not modified by MWO 55-1520-237-23-47.

Heads Up Display

HUD> Designates helicopters equipped with Heads Up Display.

De-Ice Harness (Installation and Sleeving)

MWO 50-36> Designates UH-60A, UH-60L HH-60A, HH-60L and EH-60A modified by MWO 55-1520-237-50-36.

W/O MWO 50-36> Designates UH-60A, UH-60L and EH-60A not modified by MWO 55-1520-237-50-36.

HOW TO USE THIS MANUAL – Continued

USE OF ICONS – CONTINUED

Engine Quadrant Secondary Stop to No. 1 and No. 2 Engine Power Control Levers

MWO 50-39> Designates UH-60A, HH-60A or HH-60L serial numbers 86-24516 and subsequent, UH-60L and EH-60A serial numbers 85-24469 and subsequent or UH-60A and EH-60A modified by MWO 55-1520-237-50-39.

W/O MWO 50-39> Designates UH-60A prior to serial number 86-24516 and EH-60A prior to serial number 85-24469 not modified by MWO 55-1520-237-50-39.

Modification of Dowel Pin Retention, Main Gear Box

MWO 50-43> Designates UH-60A, HH-60A or HH-60L serial numbers and subsequent, UH-60L and EH-60A serial numbers 87-24663 and subsequent, or UH-60A and EH-60A modified by MWO 55-1520-237-50-43.

W/O MWO 50-43> Designates UH-60A prior to serial number 87-27004 and EH-60A prior to serial number 87-24663 not modified by MWO 55-1520-237-50-43.

Modification of Main Rotor Antiflap Brackets

MWO 50-44> Designates UH-60A, HH-60A or HH-60L serial numbers 86-24537 and subsequent, UH-60L and EH-60A serial numbers 85-24475 and subsequent or UH-60A and EH-60A modified by MWO 55-1520-237-50-44.

W/O MWO 50-44> Designates UH-60A prior to serial number 86-24537 and EH-60A prior to serial number 85-24475 not modified by MWO 55-1520-237-50-44.

Incorporation of Exhaust Extender Doublers

MWO 50-51> Designates UH-60A, HH-60A or HH-60L serial numbers 86-24560 and subsequent, UH-60L and EH-60A or UH-60A modified by MWO 55-1520-237-50-51.

W/O MWO 50-51> Designates UH-60A prior to serial number 86-24560 not modified by MWO 55-1520-237-50-51.

Incorporation of Stabilator Actuator Grounding Strap

MWO 50-54> Designates UH-60A, HH-60A or HH-60L serial numbers 88-26085 and subsequent and UH-60L or UH-60A, and EH-60A modified by MWO 55-1520-237-50-54.

W/O MWO 50-54> Designates UH-60A serial number prior to 88-26085 and EH-60A not modified by MWO 55-1520-237-50-54.

Incorporation of Engine Drive Shaft Balancing Procedure

MWO 50-58> Designates UH-60A, HH-60A, HH-60L or EH-60A modified by MWO 55-1520-237-50-58 and UH-60L.

W/O MWO 50-58> Designates UH-60A and EH-60A not modified by MWO 55-1520-237-50-58.

Improved Eyebolt, 70219-02136-102

MWO 50-61> Designates UH-60L, HH-60A or HH-60L serial numbers 91-26337 and subsequent or UH-60A, UH-60L and EH-60A modified by MWO 55-1520-237-50-61.

W/O MWO 50-61> Designates UH-60L prior to serial number 91-26337, UH-60A and EH-60A not modified by MWO 55-1520-237-50-61.

Modification of Engine Cowling Release Handle

MWO 50-64> Designates UH-60L, HH-60A or HH-60L serial numbers 92-26408 and subsequent or UH-60A, UH-60L and EH-60A modified by MWO 55-1520-237-50-64.

HOW TO USE THIS MANUAL – Continued

USE OF ICONS – CONTINUED

W/O MWO 50-64> Designates UH-60L prior to serial number 92-26408, UH-60A, and EH-60A not modified by MWO 55-1520-237-50-64.

Modification of Engine Trim Balance Hardware

MWO 50-73> Designates UH-60L, HH-60A or HH-60L serial numbers 93-26518 and subsequent or UH-60A, UH-60L, and EH-60A modified by MWO 1-1520-237-50-73.

W/O MWO 50-73> Designates UH-60L prior to serial number 93-26518 not modified by MWO 1-1520-237-50-73.

Incorporation of Improved Chip Detector System For UH-60A Helicopters

MWO 50-26> Designates UH-60A serial numbers 77-22714 through 83-23895 modified by MWO 1-1520-237-50-26.

W/O MWO 50-26> Designates UH-60A serial numbers 77-22714 through 83-23895 not modified by MWO 1-1520-237-50-26.

Modification of ESSS System

MWO 50-78> Designates UH-60A, UH-60L, HH-60A, HH-60L and EH-60A modified by MWO 1-1520-237-50-78.

W/O/ MWO 50-78> Designates UH-60A, UH-60L, and EH-60A not modified by MWO 1-1520-237-50-78.

Improved Fire Extinguisher

FIRE> Designates UH-60L, HH-60A or HH-60L serial numbers 90-26272, 90-26293 and subsequent, UH-60A, UH-60L, and EH-60A modified by MWO 1-1520-237-50-66.

W/O FIRE> Designates UH-60L serial numbers prior to 90-26272, 90-26293 and subsequent, UH-60A, UH-60L, and EH-60A not modified by MWO 1-1520-237-50-66.

Improved Stabilator System

ISS> Designates UH-60A, HH-60A or HH-60L serial numbers 87-26005 and subsequent, UH-60L, and EH-60A modified by MWO 1-1520-237-50-42.

W/O ISS> Designates UH-60A serial numbers prior to 87-26005 and subsequent, UH-60L, and EH-60A not modified by MWO 1-1520-237-50-42.

Winterization Kit

WINTER> Designates a kit installed to assist engine start in winter weather.

W/O WINTER> Designates a kit not installed to assist engine start in winter weather.

Radio Improvement Set

RIS> Designates EH-60A modified by MWO 1-1520-237-50-67.

W/O RIS> Designates EH-60A not modified by MWO 1-1520-237-50-67.

HF Radio (AN/ARC-220(V)1) Set

HF> Designates UH-60A, UH-60L, HH-60A and HH-60L modified by MWO 1-1520-237-50-76.

Ballistic Fuel Line

MWO 50-74> Designates helicopters modified by MWO 1-1520-237-50-74.

W/O MWO 50-74> Designates helicopters not modified by MWO 1-1520-237-50-74.

Bearing Ret Spring Clip

MWO 50-52> Designates helicopters modified by MWO 1-1520-237-50-52.

HOW TO USE THIS MANUAL – Continued

USE OF ICONS – CONTINUED

W/O MWO 50-52> Designates helicopters not modified by MWO 1-1520-237-50-52.

Cockpit Air Bag System (CABS)

MWO 50-82> Designates helicopters modified by MWO 1-1520-237-50-82.

W/O/ MWO 50-82> Designates helicopters not modified by MWO 1-1520-237-50-82.

DEFINITIONS

WARNING

An operating or maintenance procedure, practice, condition, statement, etc., which if not strictly observed, could result in injury to or death of personnel.

CAUTION

An operating or maintenance procedure, practice, condition, statement, etc., which if not strictly observed, could result in damage to, or destruction of, equipment or loss of mission effectiveness or long term health hazards to personnel.

NOTE

An essential operating or maintenance procedure, condition, or statement, which must be highlighted.

CHANGES TO THIS MANUAL

On a changed page, the portion of text affected by the latest change is indicated by a vertical line in the outer margin of the page. Changes to illustrations are indicated by a hand pointing to the changed area on the illustration or a MAJOR CHANGE symbol.

CHAPTER 1

GENERAL INFORMATION,

EQUIPMENT DESCRIPTION AND THEORY OF OPERATION

FOR

ARMY MODEL HELICOPTERS UH-60A, UH-60L, EH-60A, HH-60A, AND HH-60L

AIRFRAME

GENERAL

This WP supersedes WP 0001 00, dated 25 September 2009.

SCOPE

This manual contains complete descriptive information and maintenance procedures for UH-60A, UH-60L, HH-60A , HH-60L, and EH-60A helicopters.

MAINTENANCE FORMS, RECORDS, AND REPORTS

Forms, records, and reports which are to be used by maintenance personnel at all maintenance levels are listed in and prescribed by PAM 738-751.

REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS (EIR)

If your AIRFRAME needs improvement, let us know. Send us an EIR. You, the user, are the only one who can tell us what you don't like about your equipment. Let us know why you don't like the design or performance. Put it on an SF 368 (Product Quality Deficiency Report). Mail it to the address specified in DA PAM 738-750, Functional Users Manual for the Army Maintenance Management System (TAMMS), or as specified by the contracting activity. We will send you a reply.

CORROSION PREVENTION AND CONTROL (CPC)

For additional information on corrosion prevention and control (CPC), refer to TM 55-1500-343-23.

OZONE DEPLETING SUBSTANCES (ODS)

To be provided.

DESTRUCTION OF ARMY MATERIEL TO PREVENT ENEMY USE

See TM 750-244-1-5 for destruction of helicopter.

PREPARATION FOR STORAGE OR SHIPMENT

Refer to WP 1798 00 for instructions on preparation for storage.

LIST OF ABBREVIATIONS/ACRONYMS

Abbreviations are in accordance with ASME Y14.38, except when the abbreviation stands for a marking actually found in the aircraft.

QUALITY ASSURANCE (QA)

The text of each quality assurance procedure or step in the manual is preceded (and highlighted) by the abbreviation **"QA"**.

QUALITY OF MATERIAL

Material used for replacement, repair, or modification must meet the requirements of this TM 1-1520-237-23. If quality of material requirements are not stated in this manual, the material must meet the requirements of the drawings, standards, specifications, or approved engineering change proposals applicable to the subject equipment.

SAFETY, CARE, AND HANDLING

Refer to MIL-STD-1686 and MIL-HDBK-263, which contains ESD control procedures and material necessary to protect ESD sensitive items.

FLIGHT SAFETY CRITICAL AIRCRAFT PARTS (FSCAP)

A CSI is defined as any part, assembly, or installation whose failure, malfunction, or absence could cause loss of aircraft, serious damage to aircraft, death of crewmembers, or serious injury to crewmembers.

A critical characteristic is defined as any feature throughout the life cycle of a CSI, such as dimension, tolerance, finish, material or assembly, manufacturing process, inspection process, operation, missing, or degraded, could cause failure or malfunction of a CSI.

SUPPORTING INFORMATION FOR REPAIR PARTS, SPECIAL TOOLS, TMDE, AND SUPPORT EQUIPMENT

COMMON TOOLS AND EQUIPMENT

For authorized common tools and equipment, refer to the Modified Table of Organization and Equipment (MTOE), CTA 50-970, Expendable/Durable Items (Except: Medical, Class V, Repair Parts, and Heraldic Items), or CTA 8-100, Army Medical Department Expendable/Durable Items, as applicable to your unit.

SPECIAL TOOLS, TMDE, AND SUPPORT EQUIPMENT

Refer to TM 1-1520-237-23P for Repair Parts and Special Tools List (RPSTL). Refer to WP 2010 00 and WP 2011 00 for Maintenance Allocation Chart (MAC). For local made tools, refer to WP 2014 00.

REPAIR PARTS

Repair parts are listed and illustrated in the repair parts and special tools list TM 1-1520-237-23P.

CONNECTION OF ELECTRICAL CONNECTORS

Self-locking threaded connectors, MIL-C-5015 and MIL-C-83723, will not connect with their receptacles unless properly torqued. The coupling rings must be hand-torqued until the tabs on the locking devices align with the center of the groove.

Bayonet coupling connectors, MIL-C-26482 and MIL-C-38999, will not connect with their receptacles unless properly torqued. The coupling rings must be hand-torqued until the bayonet pins can be seen, heard, and felt snapping into the holes of the coupling rings.

Threaded connectors not using a locking mechanism will not connect with their receptacles unless properly torqued. These connectors are identified by a 1/2-inch red dot located on the structure adjacent to the connector receptacles. Connectors of this type must be hand-torqued and safety wired.

ROUTING AND CLAMPING OF WIRE HARNESSES

Upon reinstallation of components such as the left and right relay panels, the No. 3 relay panel, and the No. 1 and No. 2 junction boxes, check for adequate clearance between these components and the wire harnesses routed close to them. All wiring should be checked for proper clamping and for installation of sufficient harness ties to avoid wire chafing.

AIRCRAFT GENERAL

AIRCRAFT DESCRIPTION AND DATA

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

AIRCRAFT DESCRIPTION

Helicopters are twin turboshaft engine aircraft (Figure 1. (Sheet 1 of 2) and Figure 1. (Sheet 2 of 2). Their primary mission is the transportation of troops, litter patients, and equipment. UH-60A EH-60A HH-60A> Helicopters are powered by two T700-GE-700 engines, mounted above the mid-fuselage. < UH-60L HH-60L> Helicopters are powered by two T700-GE-701C or T700-GE-701D/CC engines, mounted above the mid-fuselage. < The main rotor group consists of a four bladed, fully articulated, elastomeric rotor. The tail rotor group consists of a canted crossbeam tail rotor with two continuous composite spars running from blade tip to blade tip, crossing each other at the hub to form the four tail rotor blades. Forward, rear, lateral, and vertical flight is done by the main rotor system, while the tail rotor system counteracts torque from the main rotor and provides directional control. Power to drive the main rotor is supplied from engine torque transmitted by drive shafting to the input module of the main transmission. The tail rotor is driven by drive shafting extending from the main module of the main transmission through the intermediate gear box to the tail gear box. Three separate hydraulic systems are used in the helicopter. The No. 1 and No. 2 hydraulic systems provide power for the main rotor servos and the pilot-assist servos. The No. 3 or backup hydraulic system provides backup power for the No. 1 and No. 2 hydraulic systems and recharges the APU start subsystem. The backup hydraulic system also provides power for ground checks without operation of the main transmission. Basic electrical power is supplied by two ac generators mounted on the accessory module. Ac power is converted to dc power for operation of certain systems.

EH-60A> Helicopter similar to the UH-60A described except its primary mission is electronic surveillance of selected targets using sophisticated intercept and direction-finding (DF) equipment, the AN/ALQ-151(V)2 system (TM 32-5865-012-10). In addition to a pilot and copilot, the crew includes an electronic countermeasures (ECM) equipment operator and a DF equipment operator. The mission equipment, AN/ALQ-151(V)2, and its operators are housed in the aircraft cabin replacing troop seats or other mission flexibility kits. An Environmental Control System (ECS) replaces the standard heater/ventilator system. Aircraft Survivability Equipment (ASE) includes Hover Infrared Suppression System (HIRSS). <

HH-60A HH-60L> Helicopter similar to the UH-60A described except its primary mission is MEDEVAC. Secondary missions include transport of medical teams, deliver medical supplies, and provide support for combat search and rescue missions. Kit installations for helicopter consist of range extension tanks, rescue hoist, medical evacuation, infrared suppression, blade anti-icing, and blackout devices. The medical interior contains space for seating of three medical attendants, two independent medical stations are designed to transport three littered patients or three ambulatory (seated) patients or crew members. Litter platforms can also be moved up, out of way to transport cargo. Restraint of cargo is by tiedown rings installed on floor. A medical cabinet provides storage for carry on equipment. Provisions for securing carry on medical equipment and supporting intravenous fluid bags are mounted through out cabin. <

EMEP> < Electrical wiring and components are hardened for electromagnetic environment protection (EME) for eliminating abnormal responses to external electromagnetic radiation. Electrical wiring for selected systems and components of EME helicopters are equipped with pin filtered adapters, connectors, and receptacles where necessary. Components susceptible to electromagnetic radiation are internally modified with filters and gaskets. The instrument panel and other mounting surfaces for EME components are metal with a chemical conversion coating conforming to MIL-C-5541, Class 3, or use bonding straps to provide low resistance to airframe ground. The following list identifies those components having pin filtered adapters and pin filtered connectors:

1. Blade Deice Test Panel (pin filter adapter).
2. Blade Deice Controller (pin filter adapter).
3. Copilot HSI (pin filter adapter).
4. Pilot HSI (pin filter adapter).
5. SAS/FPS Computer (pin filter adapter).
6. Rate Gyro (pin filter adapter).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

7. No. 1 Generator Control Unit (pin filter adapter).
8. No. 2 Generator Control Unit (pin filter adapter).
9. Copilot VSI (pin filter adapter).
10. Pilot VSI (pin filter adapter).
11. Caution/Advisory Panel (pin filter adapter).
12. APU Generator Control Unit (pin filter adapter).
13. No. 1 Lateral Accelerometer (pin filter adapter).
14. No. 2 Lateral Accelerometer (pin filter adapter).
15. Battery Charger Analyzer (pin filter adapter).
16. Pilot HSI/VSI Mode Select Panel (pin filter adapter).
17. Copilot HSI/VSI Mode Select Panel (pin filter adapter).
18. Yaw Trim Servo (filtered connector).
19. Pilot Master Warning Panel (filtered connector).
20. Copilot Master Warning Panel (filtered connector).
21. Radar Altimeter Receiver (pin filter adapter).
22. Airspeed Transducer (pin filter adapter).
23. No. 1 Signal Data Converter (pin filter adapter).
24. No. 2 Signal Data Converter (pin filter adapter).
25. No. 1 Stabilator Actuator (pin filter adapter).
26. No. 2 Stabilator Actuator (pin filter adapter).
27. Roll Trim Servo (pin filter adapter).
28. No. 1 Stabilator Amplifier (pin filter adapter).
29. No. 2 Stabilator Amplifier (pin filter adapter).
30. VOR/ILS Receiver (pin filter adapter).
31. CIS Processor (pin filter adapter).
32. Air Data Transducer (pin filter adapter).
33. Compass Control Panel (pin filter adapter).
34. Doppler SDC (pin filter adapter).
35. Doppler Computer Display Unit (pin filter adapter).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

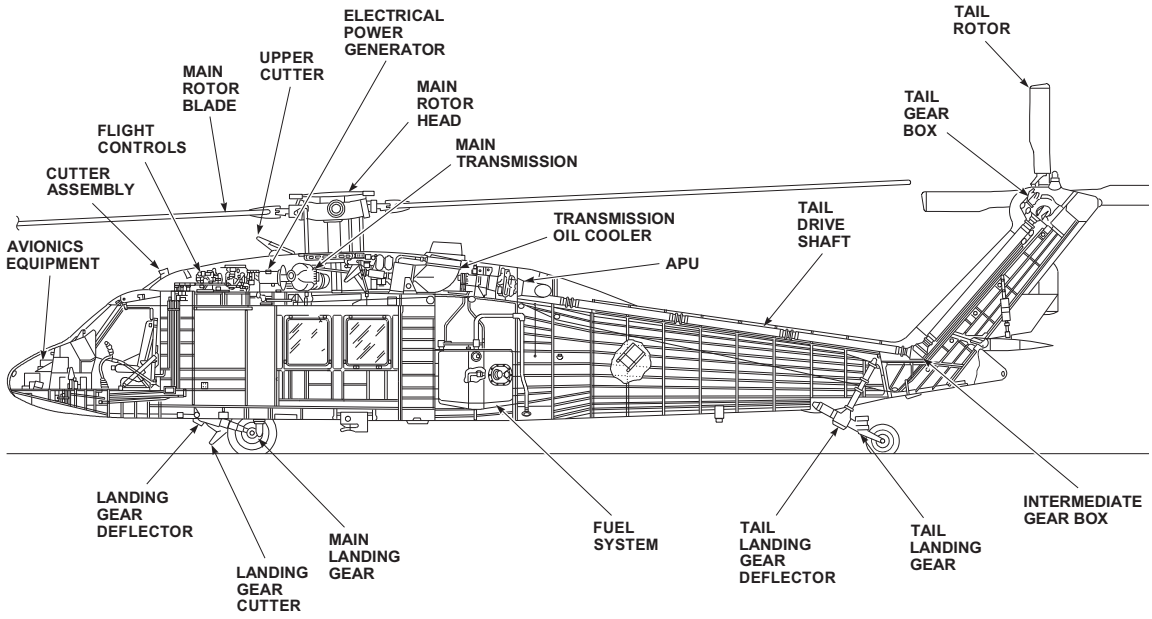


Figure 1. General Arrangement (Sheet 1 of 2).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

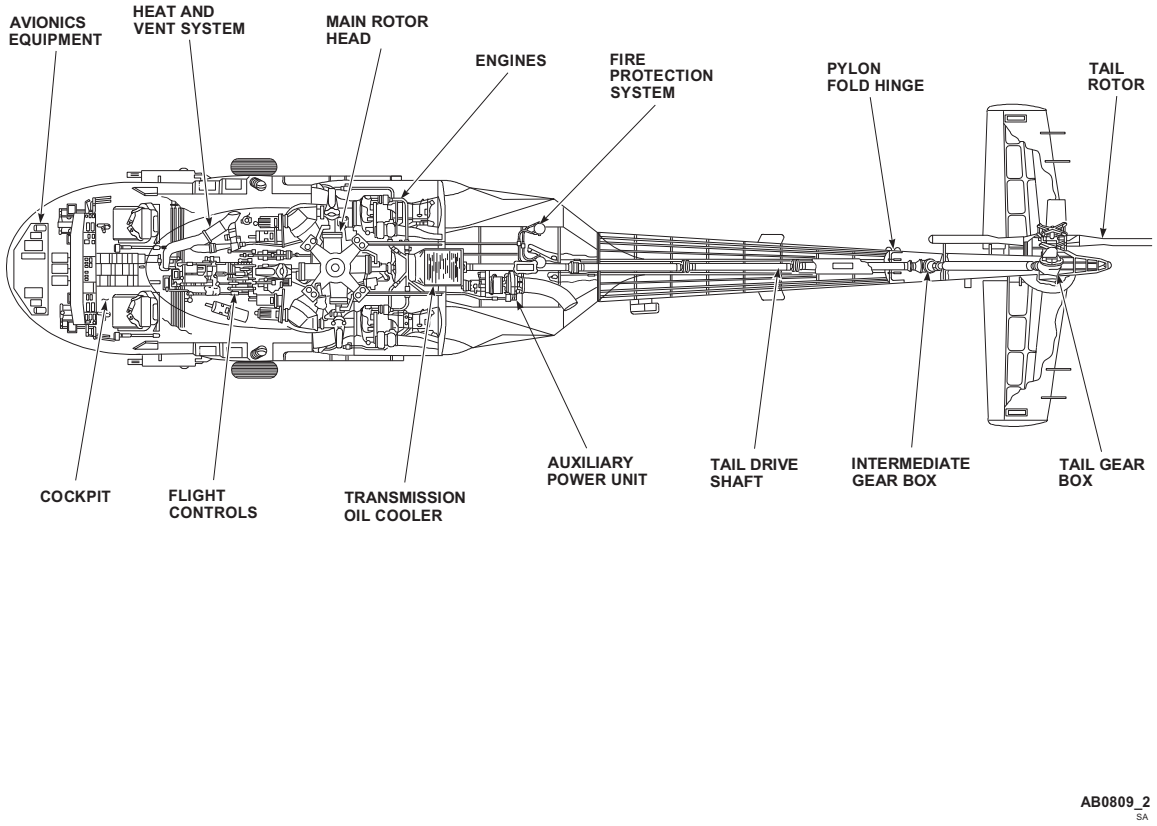


Figure 1. General Arrangement (Sheet 2 of 2).

PRINCIPAL DIMENSIONS

Principal dimensions of the helicopter are shown in Figure 2. (Sheet 1 of 4), Figure 2. (Sheet 2 of 4), Figure 2. (Sheet 3 of 4) and Figure 2. (Sheet 4 of 4).

Stations, waterlines, and buttlines (in inches) are used as an accurate method of locating or installing equipment in the airframe. See Figure 3. (Sheet 1 of 2) and Figure 3. (Sheet 2 of 2) for stations, waterlines, and buttlines for this helicopter

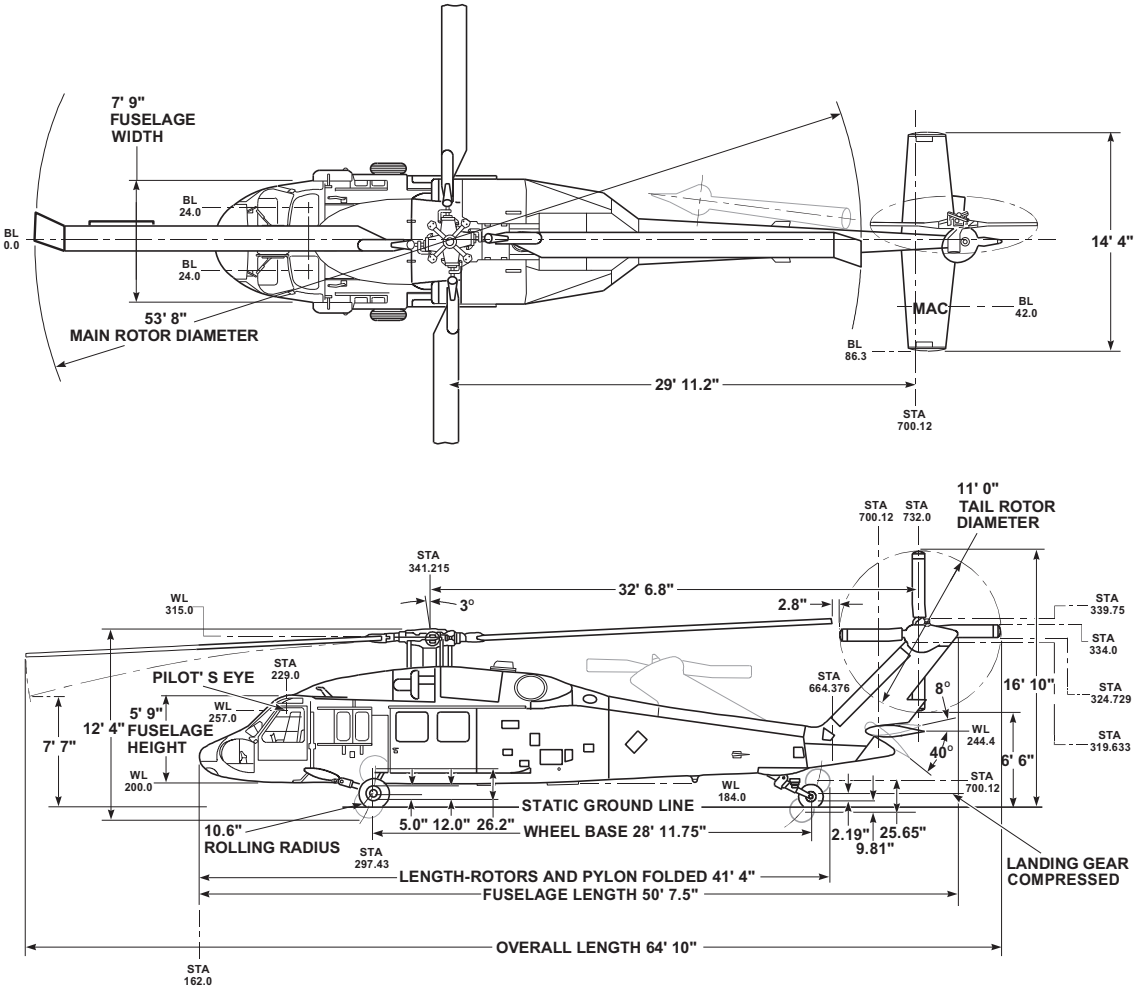
ACCESS AND INSPECTION PROVISIONS

Access and inspection provisions consist of access doors, covers, panels, platforms, screens, and openings used for maintenance, inspection, and servicing of the helicopter and its components. Principal access and inspection openings are shown in Figure 4. (Sheet 1 of 2), Figure 4. (Sheet 2 of 2) and Table 1

STEPS, HANDHOLDS, AND WALKWAYS

Steps, handholds, and walkways aid in inspection and maintenance of the helicopter are shown in Figure 5. (Sheet 1 of 2)and Figure 5. (Sheet 2 of 2). Work areas are shown in Figure 6. (Sheet 1 of 2)and Figure 6. (Sheet 2 of 2).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED



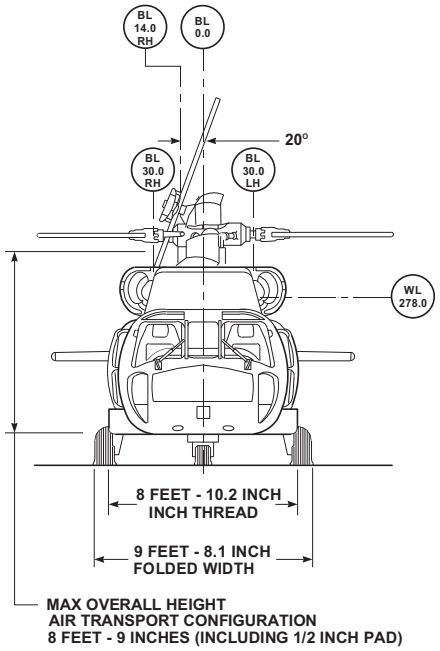
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Figure 2. Principal Dimensions (Sheet 1 of 4).

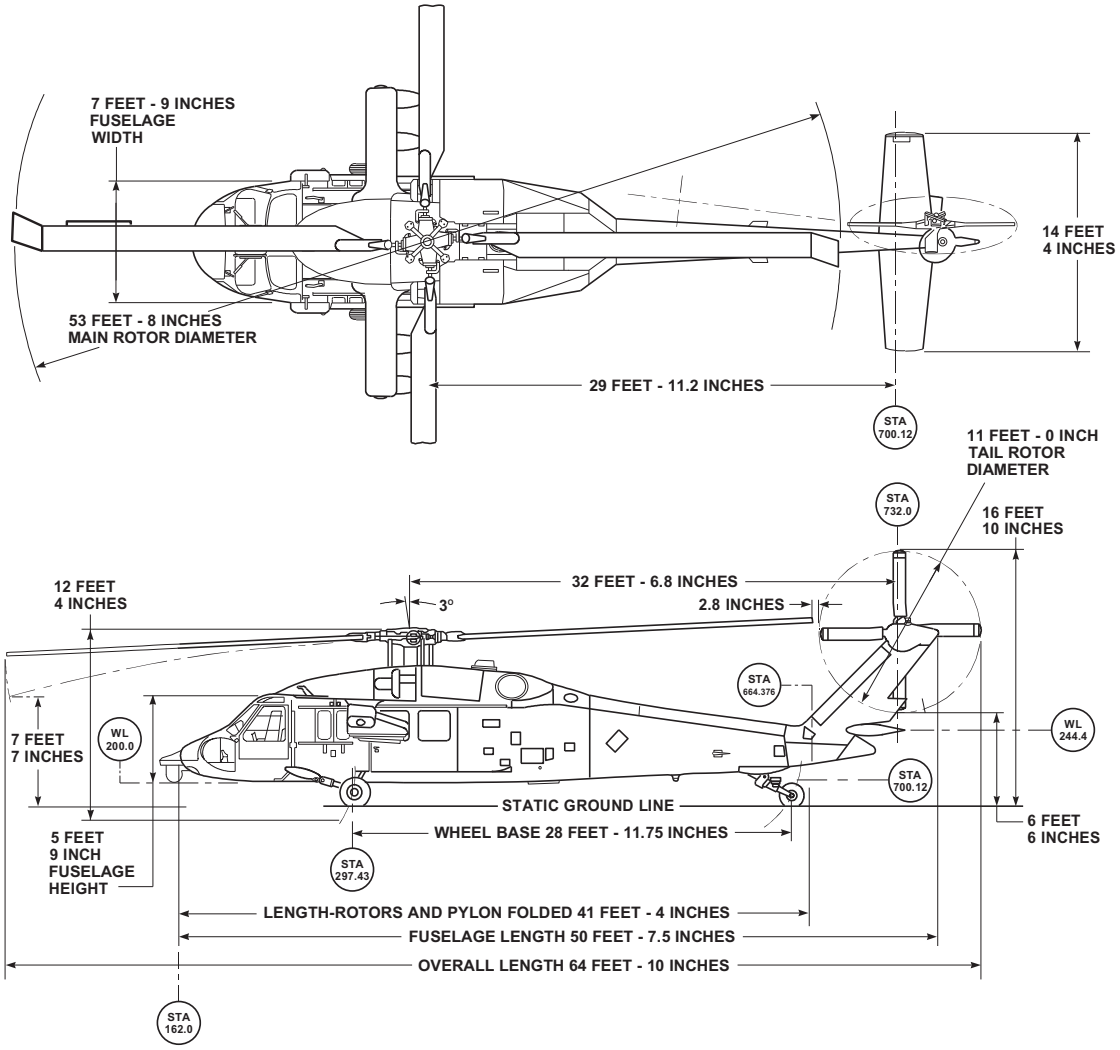
EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED



EFFECTIVITY
W/O ESSS

Figure 2. Principal Dimensions (Sheet 2 of 4).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED



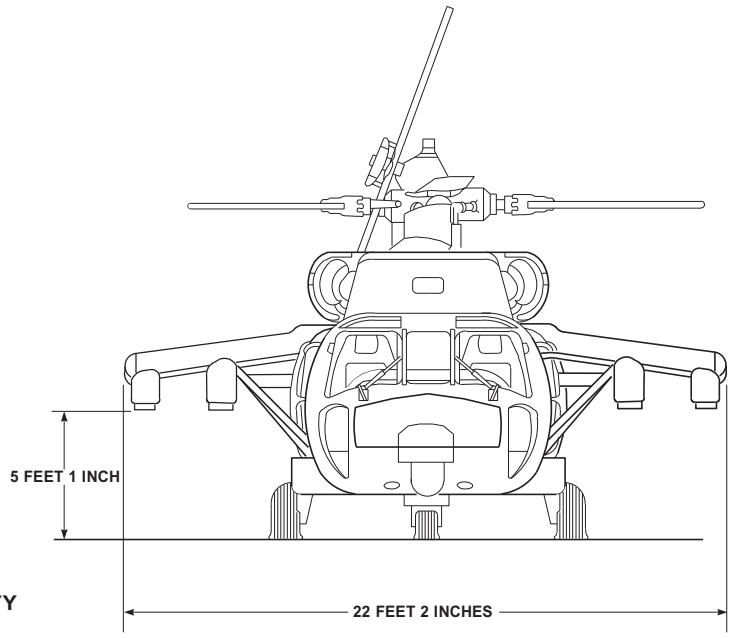
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Figure 2. Principal Dimensions (Sheet 3 of 4).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED



EFFECTIVITY
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Figure 2. Principal Dimensions (Sheet 4 of 4).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

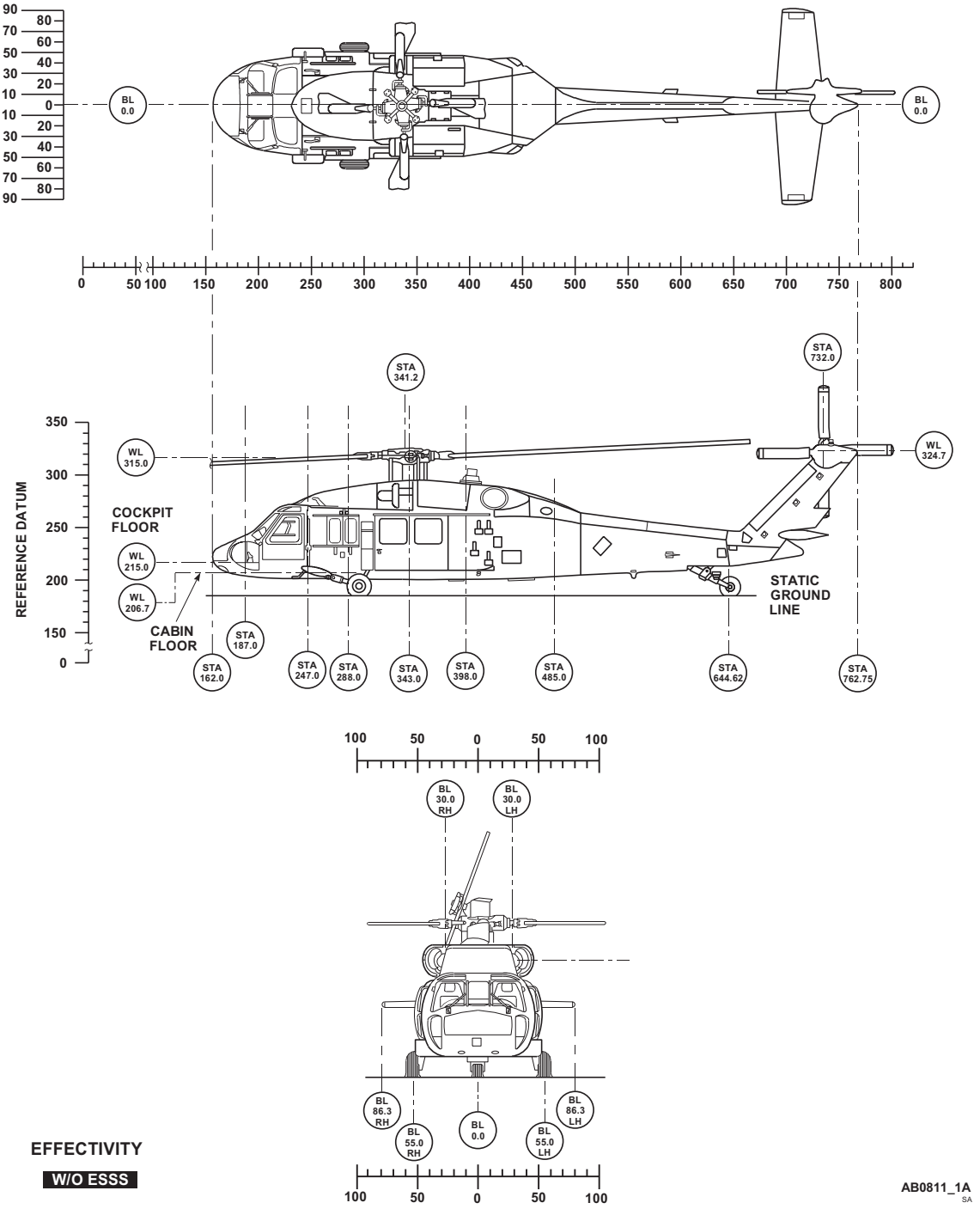


Figure 3. Stations, Waterlines and Buttlines (Sheet 1 of 2).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

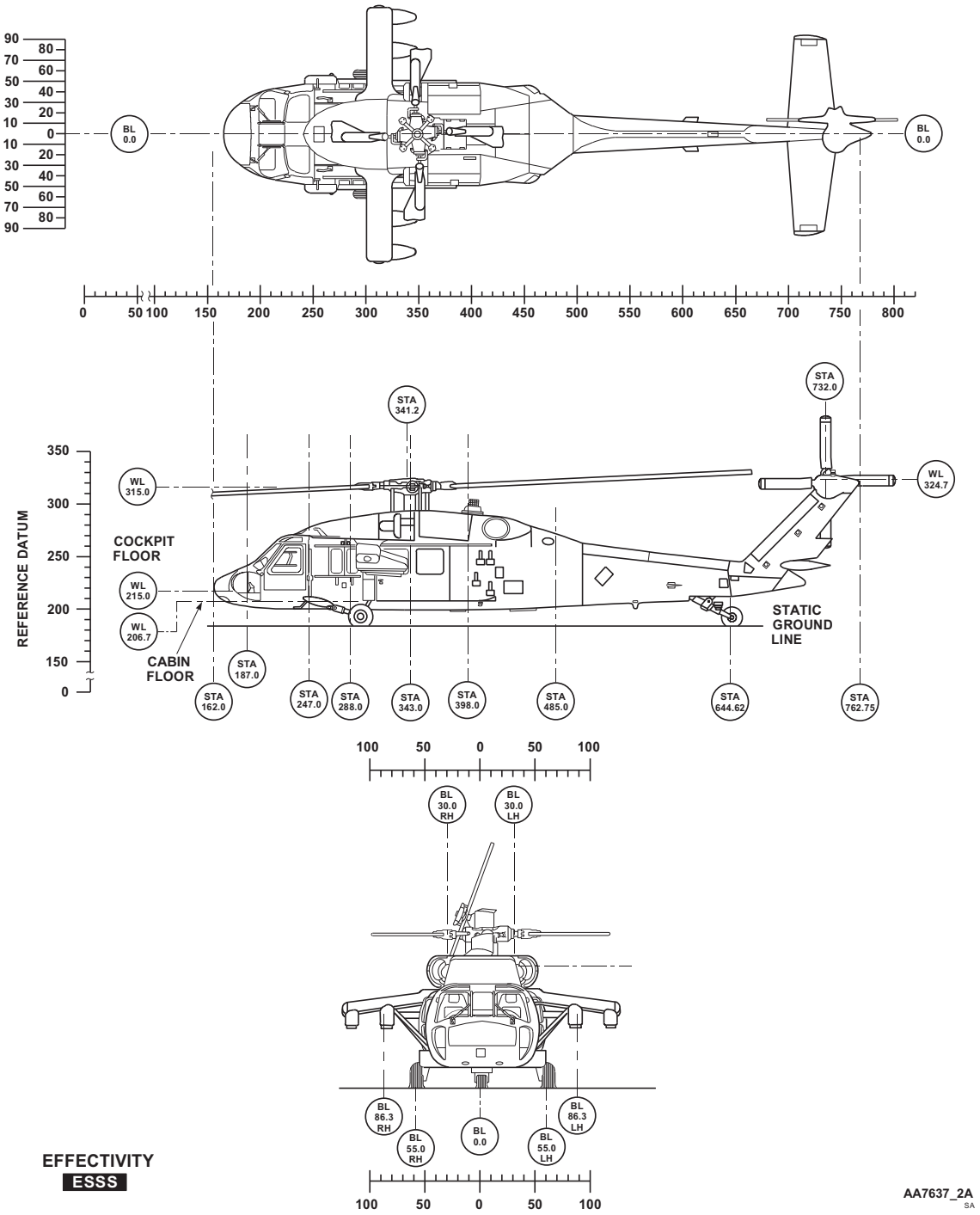


Figure 3. Stations, Waterlines and Buttlines (Sheet 2 of 2).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

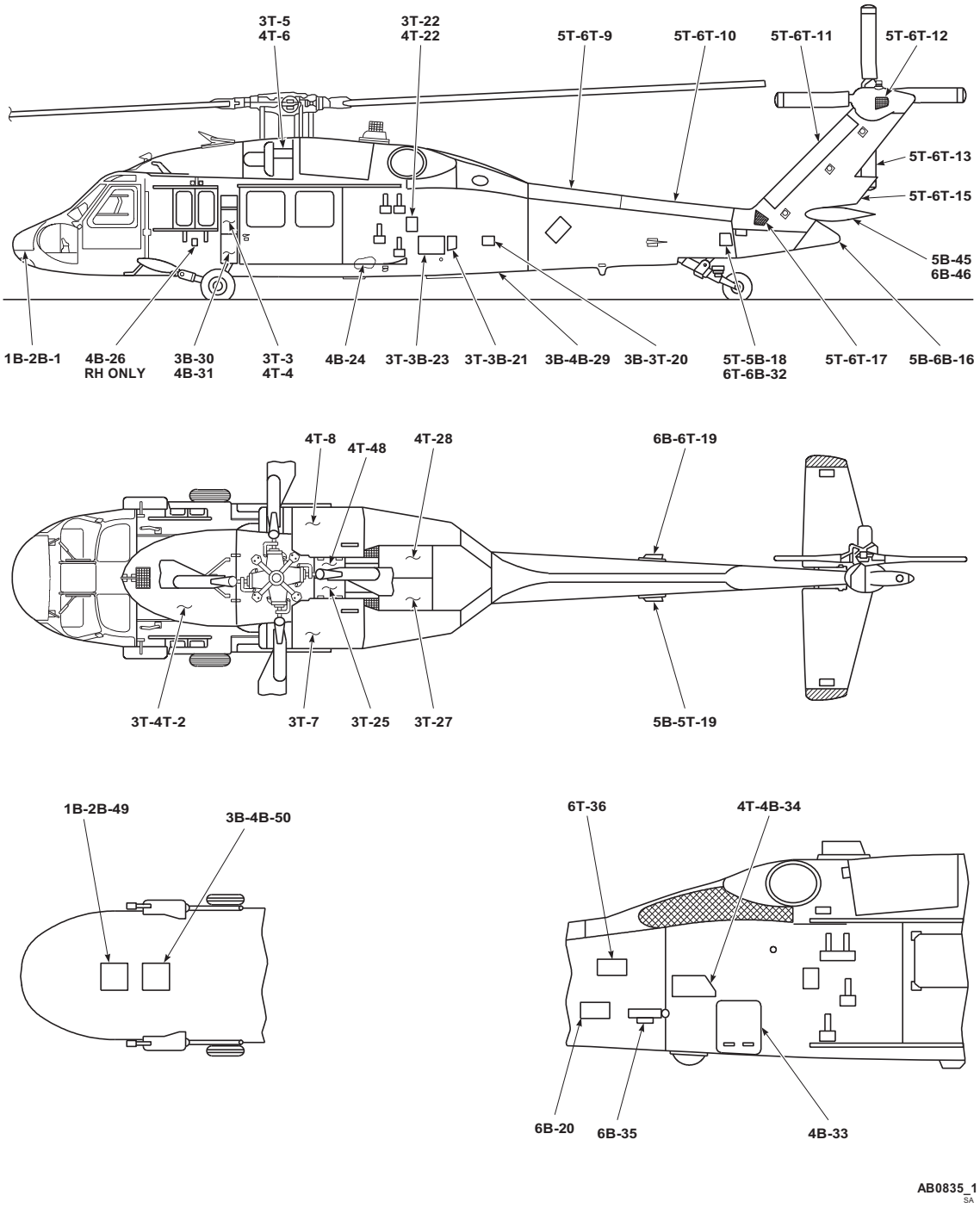


Figure 4. Access and Inspection Provisions (Sheet 1 of 2).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

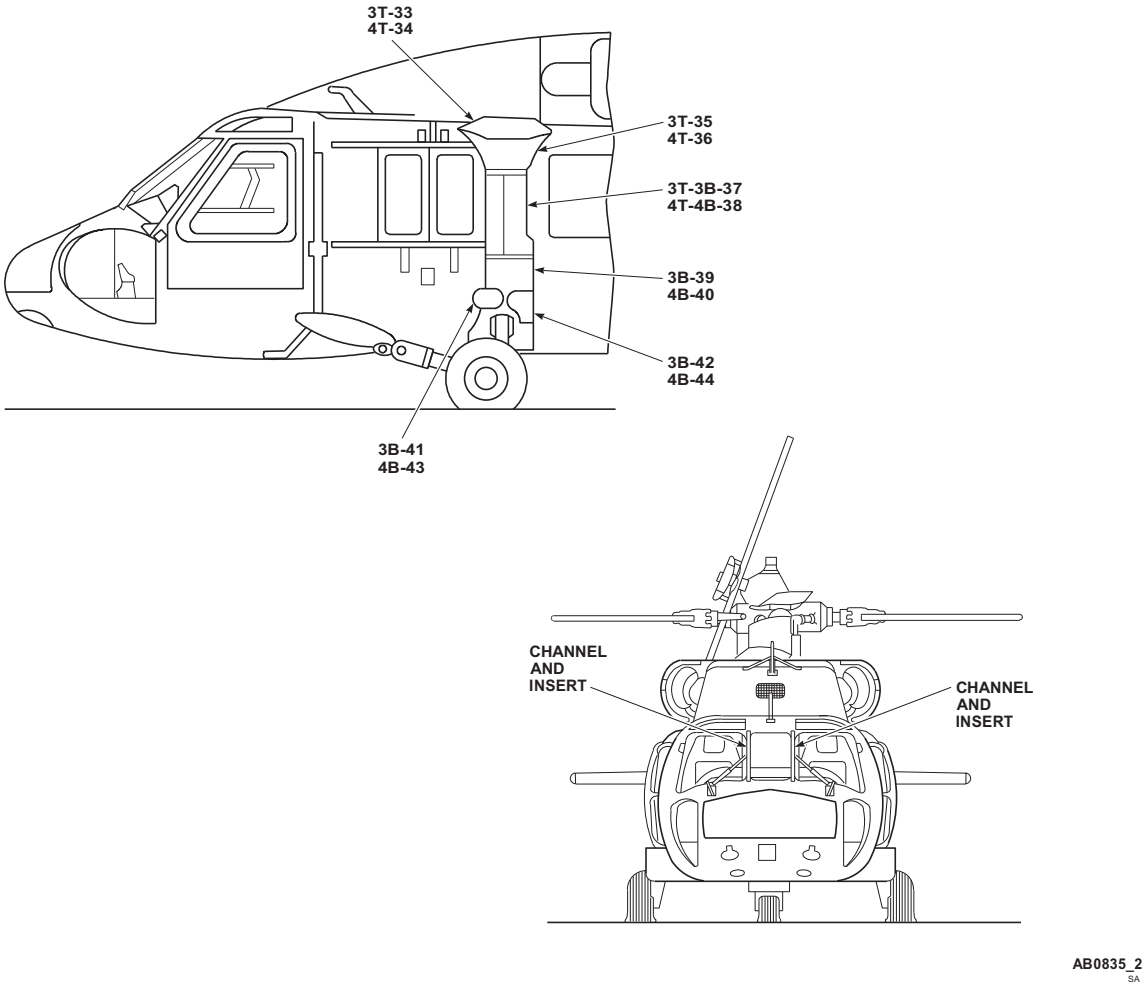


Figure 4. Access and Inspection Provisions (Sheet 2 of 2).

Table 1. Access Panels and Fairing.

PANELNO.	TYPE OF PANEL	SIZE (INCHES)	TYPE OFFASTENERS	ACCESS TO
1B-2B-1	Nose Door (Hinged)	37 1/4 x 70	2 Latches	Electronics
4B-26	Access Panel	6 x 7	1 Latch	External Power
3T-3 4T-4	Access Panel (Hinged) (Note 4)	13 1/2 x 33 1/2	2 Latches 12 Screws	Shock Strut
3B-30 4B-31	Access Panel (2 Parts) (Note 4)	23 x 25	18 Screws	Shock Strut
3T-4T-2	Sliding Cover (On Tracks)	64 x 81	2 Camlocs 12 Dzus	Controls/Acces-sories

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

Table 1. Access Panels and Fairing. – Continued

PANELNO.	TYPE OF PANEL	SIZE (INCHES)	TYPE OFFASTENERS	ACCESS TO
3T-7 4T-8	Engine Cowl (Hinged)	26 x 50	2 Latches	Engine
3T-5 4T-6	Access Panel	6 x 15	4 Screws	Anti-Icing Valve
4B-24	Access Cover			Cargo Hook
3T-25	Access Panel (Hinged)	14 x 22	2 Latches	Oil Cooler
4T-48	Access Panel (Hinged) (Note 3)	14 x 22	2 Latches	Oil Cooler
3T-27	Access Panel (Hinged)	12 x 40	2 Latches	APU
4T-28	Access Panel (Hinged)	12 x 40	2 Latches	Fire-Extinguishers
3T-22 4T-22	Access Panel (Hinged)	8 x 10	1 Latches	Gravity Fuel
3T-3B-23	Access Panel (Hinged)	12 x 16	2 Latches	Pressure Fuel
3T-3B-21	Access Panel (Hinged)	7 x 10	Latch	Pneumatic Ground Start
3B-3T-20	Access Panel (Note 4)	7 x 10	10 Screws	Magnetic Flux Valve
5T-6T-9	Access Panel (Hinged)	9 x 80	4 Dzus	Drive Shaft
5T-6T-10	Access Panel (Hinged)	9 x 79	4 Dzus	Drive Shaft
5T-6T-17	Intermediate Gear Box Cover	19 x 32	12 Screws	Intermediate Gear Box
5T-6T-11	Pylon Drive Shaft Cover/#1 FM Antenna	14 x 79	9 Dzus	Drive Shaft
5T-5B-18 6T-6B-32	Access Panel	14 x 12	12 Screws	Pylon Fold Hinge Bolts
5T-6T-12	Tail Gear Box Cover		1 Flat-Tip Fastener 11 Phillips-Head	Tail Gear Box
5T-6T-15	Fairing	20 x 23	26 Screws	Pylon Trailing Edge
5B-6B-16	Fairing		16 Screws 4 Bolts	Lower Pylon

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

Table 1. Access Panels and Fairing. – Continued

PANELNO.	TYPE OF PANEL	SIZE (INCHES)	TYPE OFFASTENERS	ACCESS TO
5B-45 6B-46	Cover	4 x 7	4 Screws	Stabilator Attach Fittings
5B-5T-19 6B-6T-19	VOR/LOC Antenna		4 Screws	
5T-6T-13	Troop Commander Antenna		31 Screws	
4B-33	Access Panel (Hinged) (Note 2)	20 x 27	2 Latches	Electronics
4T-4B-34	Access Panel (Hinged) (Note 2)	10 x 20	11 Dzus	
6B-35	Access Panel (Hinged) (Note 2)	3 x 10 3/4	3 Dzus	Filter
6T-36	Access Panel, Flux Valve (Note 2)	7 1/2 x 13	10 Screws	Magnetic Flux Valve
6B-20	Access Panel, Flux Valve (Note 3)	7 1/2 x 13	10 Screws	Magnetic Flux Valve
3T-33 4T-34	Fairing & Platform (2-Part Hinged) (Note 1)		6 Camlocs 19 Screws	ESSS Maintenance Crane Attachment
3T-35 4T-36	Cap Fairing (Note 1)		14 Camlocs	ESSS
3T-3B-37 4T-4B-38	Access Panel (Hinged) (Note 1)		3 Camlocs 7 Screws	Step/Shock Strut
3B-39 4B-40	Access Panel (Note 1)		14 Screws	Shock Strut
3B-41	Lower Fairing STA 295.0 (Note 1)		6 Camlocs	ESSS
3B-42	Lower Fairing STA 308.0 (Note 1)		4 Camlocs	ESSS

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

Table 1. Access Panels and Fairing. – Continued

PANELNO.	TYPE OF PANEL	SIZE (INCHES)	TYPE OFFASTENERS	ACCESS TO
4B-43	Lower Fairing STA 295.0 (Note 1)		6 Camlocs	ESSS
4B-44	Lower Fairing STA 308.0 (Note 1)		4 Camlocs	ESSS
1B-2B-49	FLIR CEU Door (Note 3)	14 x 14	Screws	FLIR
3B-4B-50	Battery Door (Note 3)	14 x 14	20 Screws	Battery

NOTES

1. ESSS>
2. EH-60A>
3. HH-60A HH-60L>
4. UH-60A UH-60L EH-60A>
5. Number codes for panels and fairings:

1 - Left side cockpit.

2 - Right side cockpit.

3 - Left side cabin.

4 - Right side cabin.

5 - Left side tailcone and pylon.

6 - Right side tailcone and pylon.

T - Top above WL 232.0.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

Table 1. Access Panels and Fairing. – Continued

PANELNO.	TYPE OF PANEL	SIZE (INCHES)	TYPE OFFASTENERS	ACCESS TO
B - Bottom below WL 232.0.				

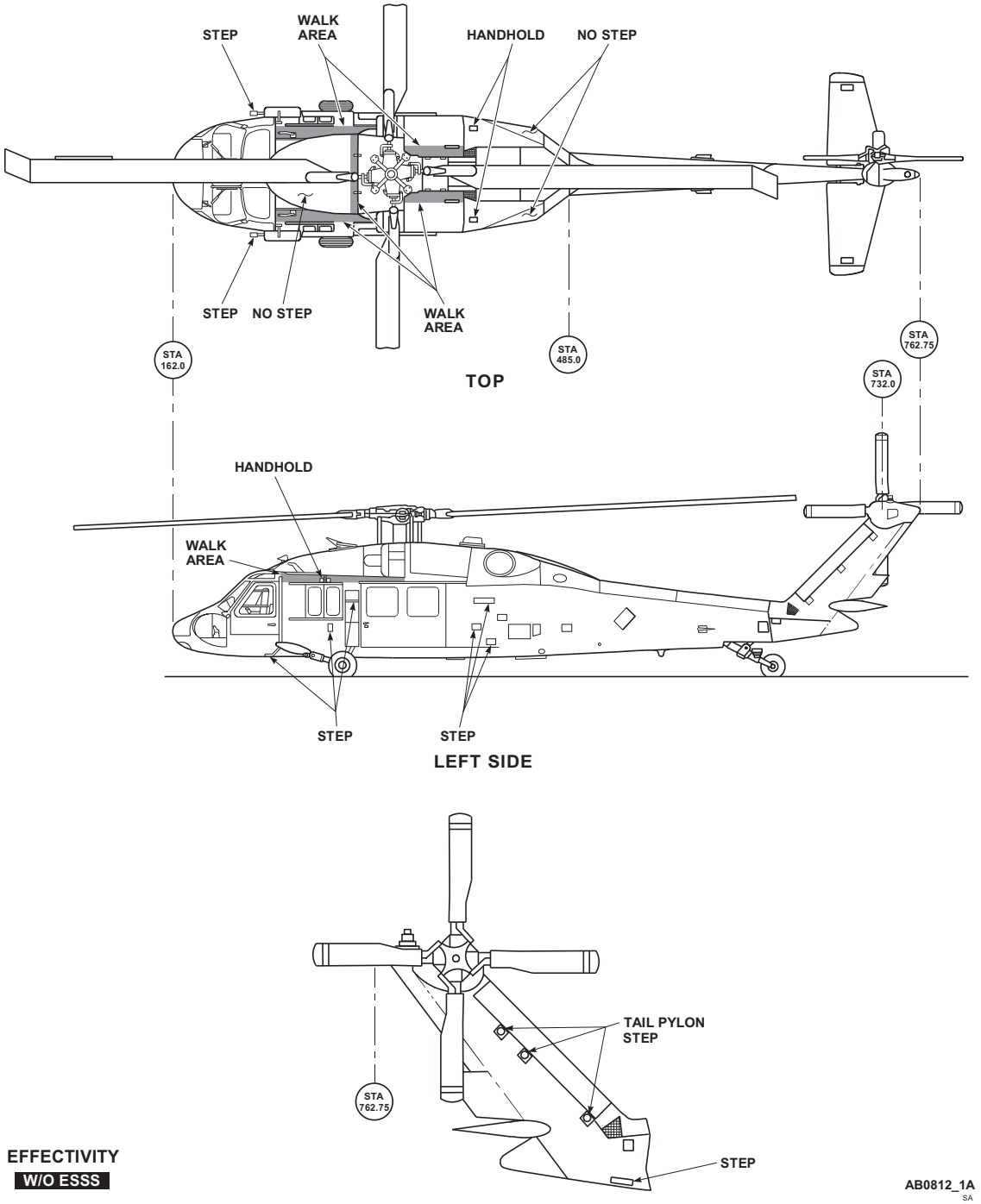


Figure 5. Steps, Handholds and Walkways (Sheet 1 of 2).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

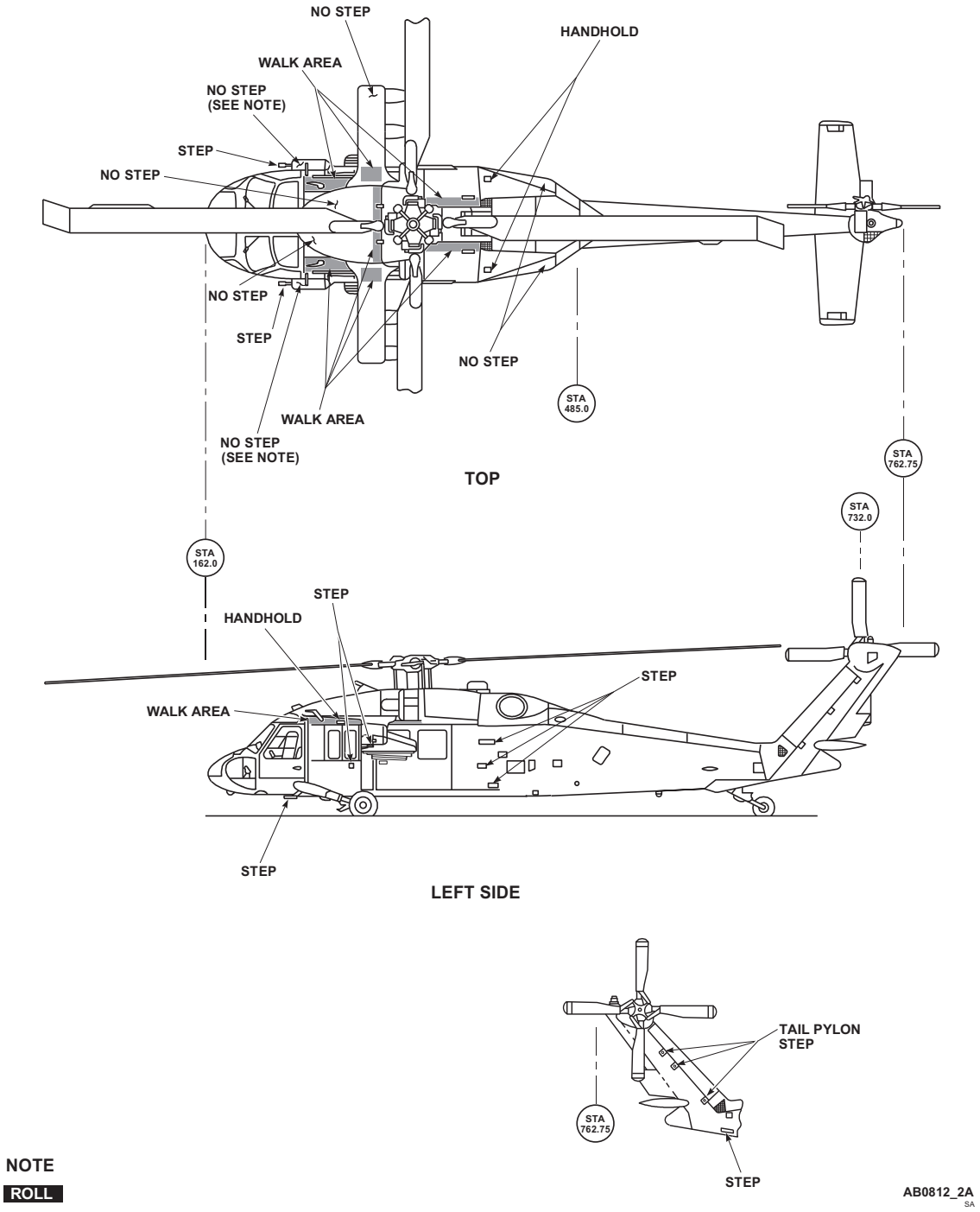
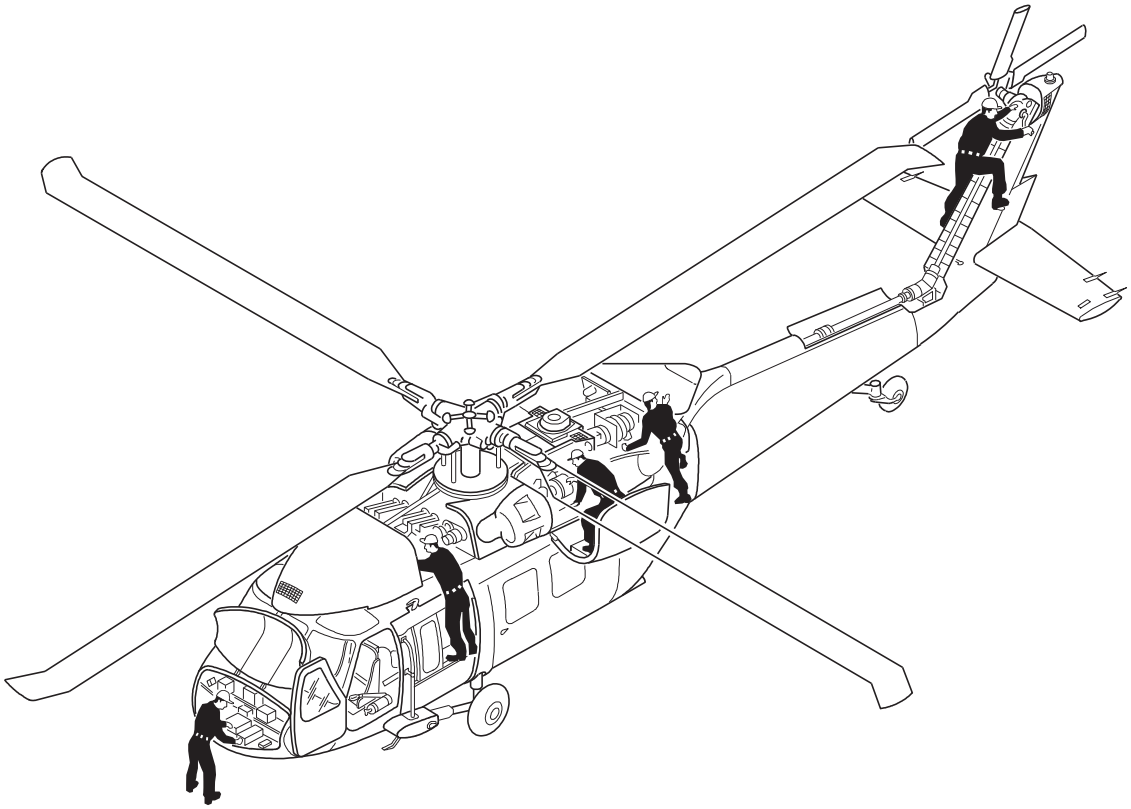


Figure 5. Steps, Handholds and Walkways (Sheet 2 of 2).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED



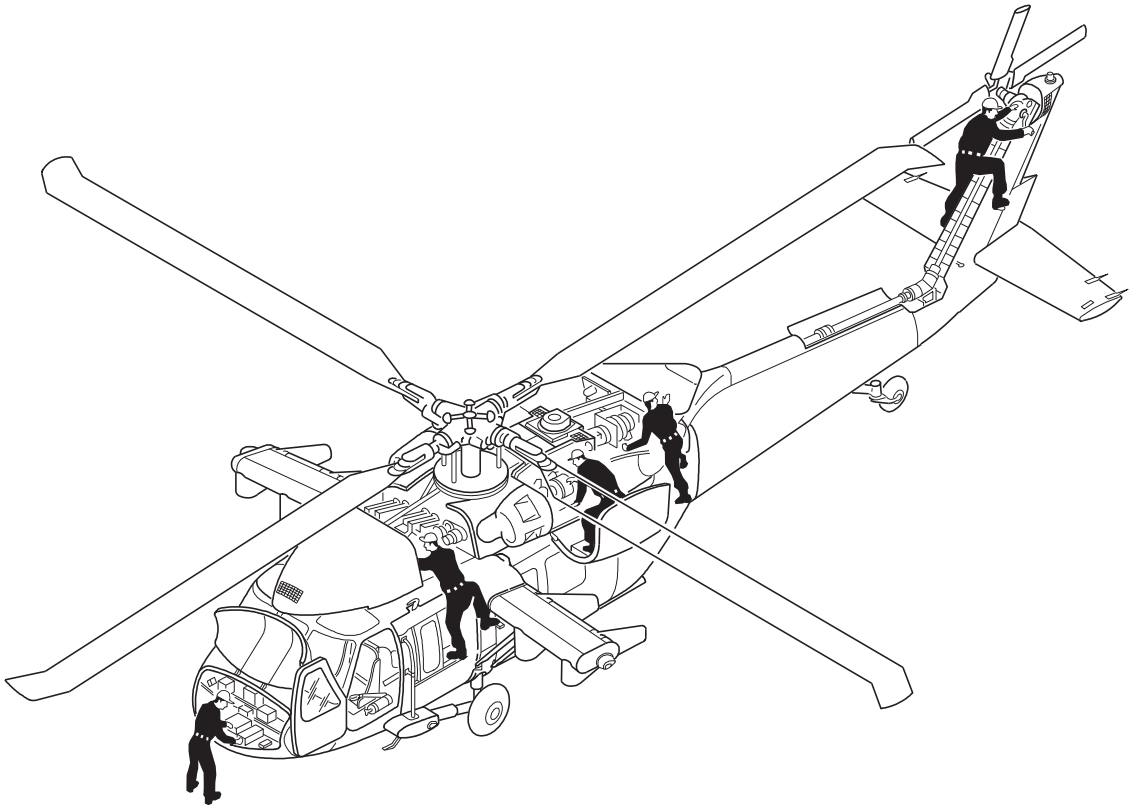
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Figure 6. Work Areas (Sheet 1 of 2).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED



EFFECTIVITY

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Figure 6. Work Areas (Sheet 2 of 2).

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

LOCATION OF MAJOR COMPONENTS

For location of major components, refer to Figure 1. (Sheet 1 of 2), in this work package.

EQUIPMENT DATA

EQUIPMENT DATA

For detailed equipment data, refer to AIRCRAFT DESCRIPTION, in this work package.

AIRFRAME

AIRFRAME DESCRIPTION AND DATA

This WP supersedes WP 0003 00, dated 25 September 2009.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

AIRFRAME OVERVIEW

This section contains descriptions of the airframe and associated equipment. The helicopter airframe is divided into six sections (Figure 1):

1. Cockpit (Nose Section)
2. Cabin
3. Transition Section
4. Tail Cone
5. Tail Rotor Pylon
6. Main Rotor Pylon

The primary structure is aluminum alloy. Some titanium and steel are used for firewalls and various fittings. Non-structural members are primarily made of reinforced plastic. The fuselage is semi-monocoque construction with horizontal anti-plough beams extending through the tub from the cockpit to the transition section. Structural arrangement of each section of the helicopter is shown in Figure 1 through Figure 7

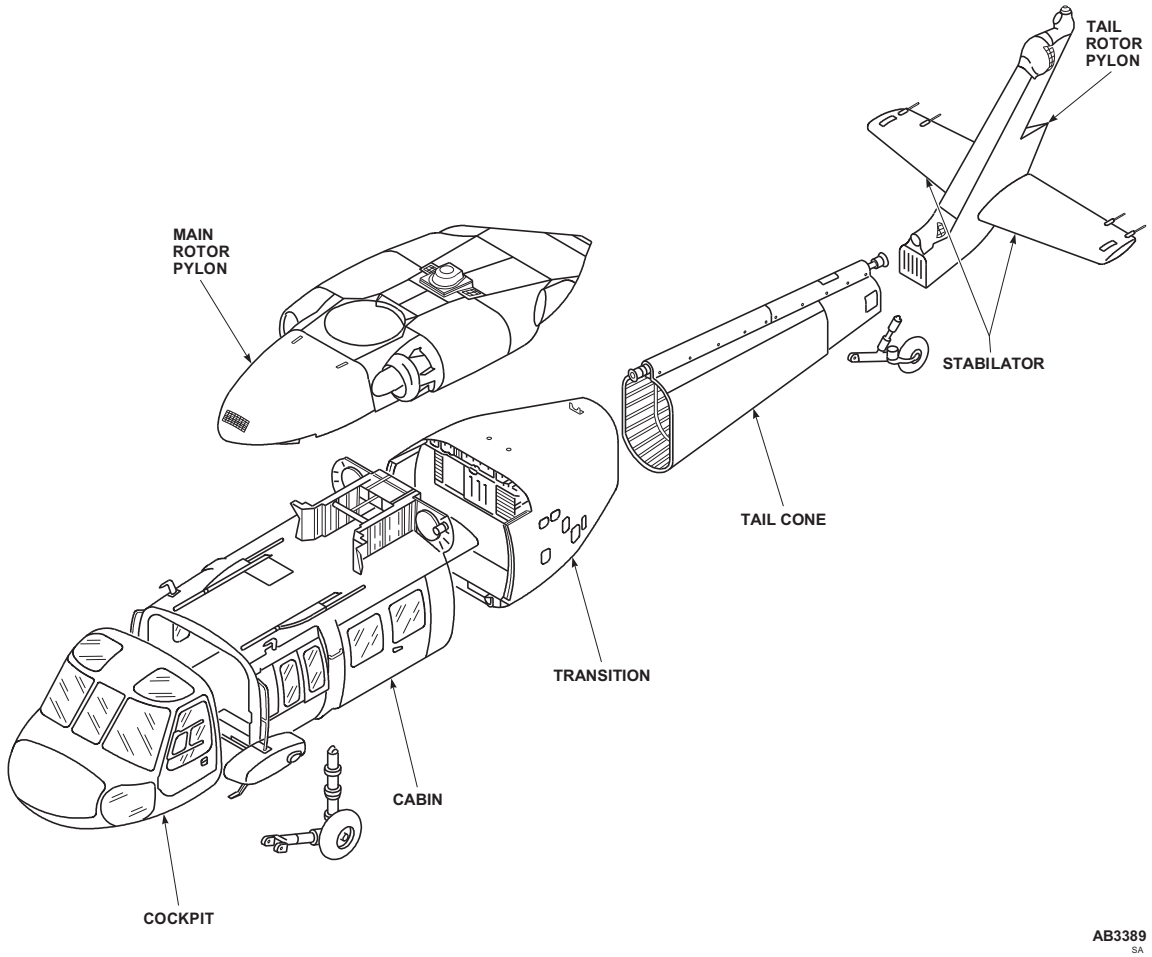


Figure 1. Airframe Sections.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

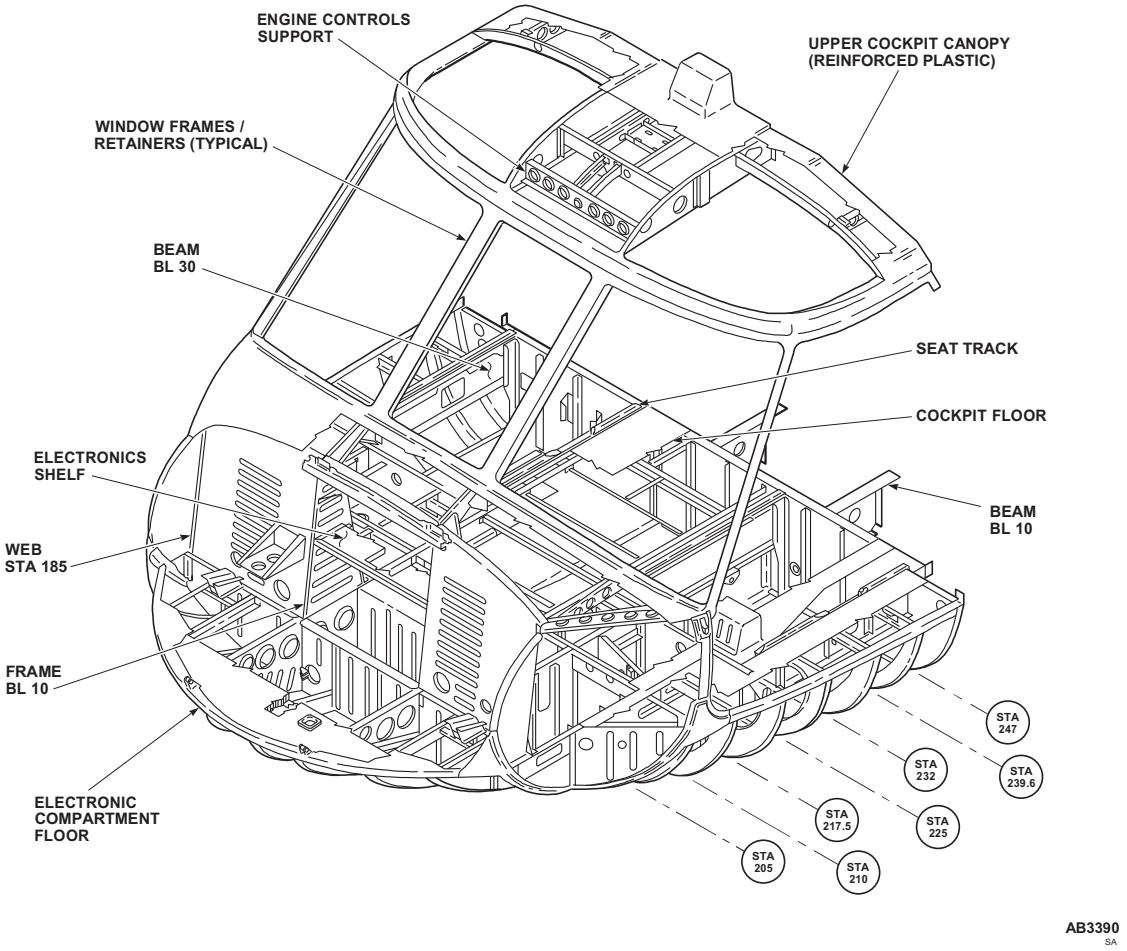


Figure 2. Cockpit Structure.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

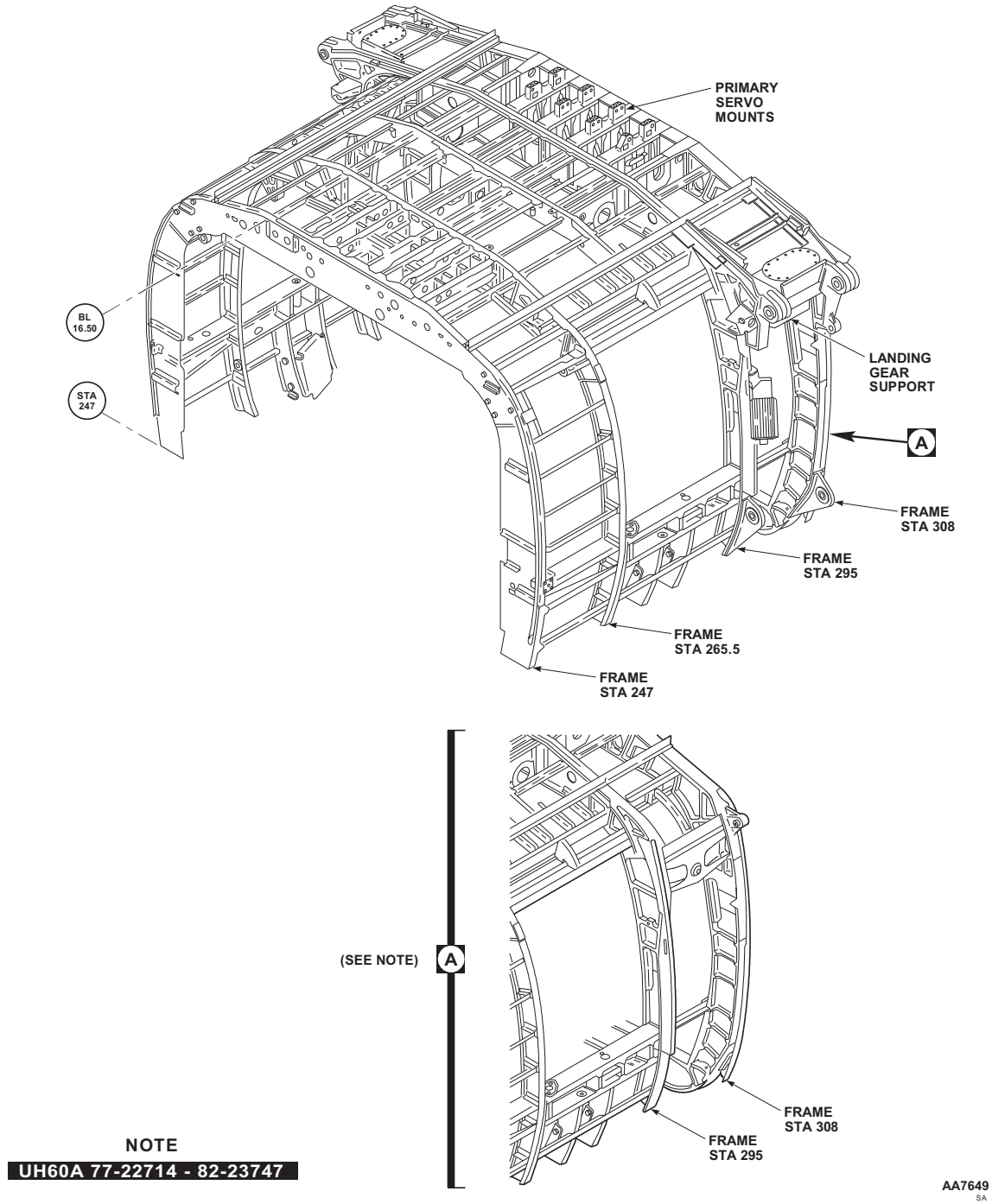


Figure 3. Cabin Structure (Sheet 1 of 2).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

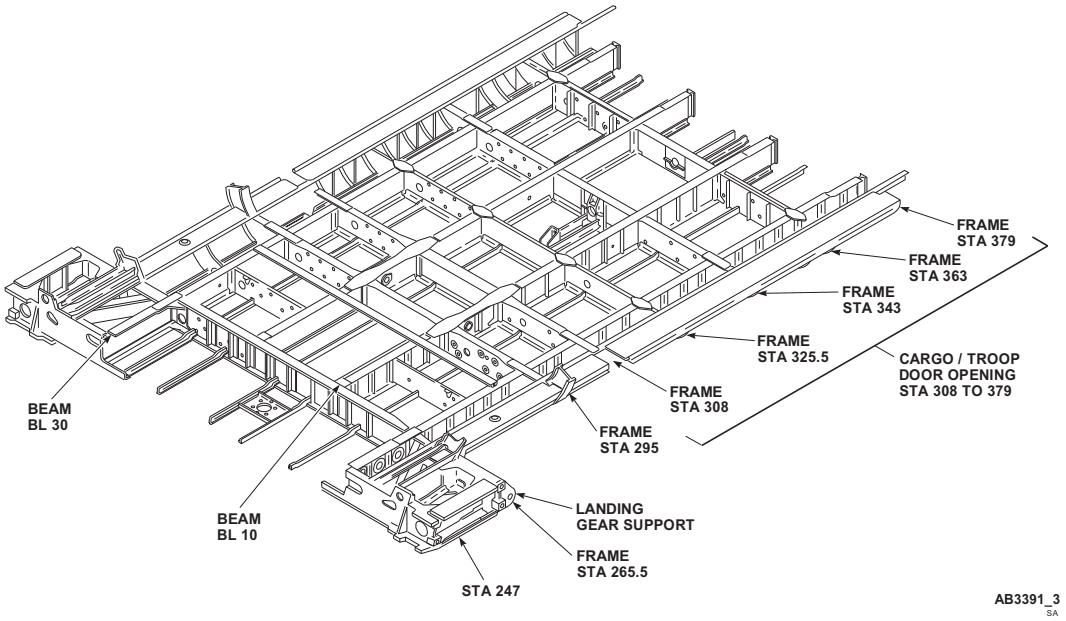


Figure 3. Cabin Structure (Sheet 2 of 2).

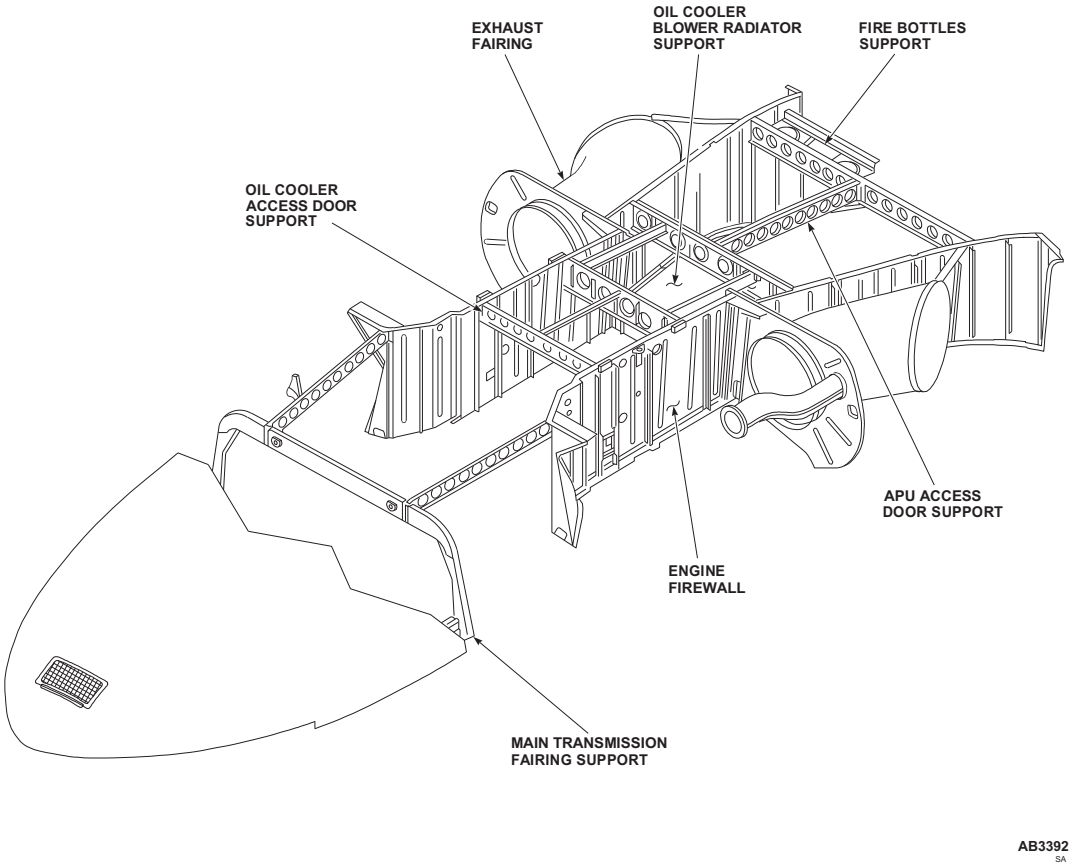


Figure 4. Main Rotor Pylon Structure.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

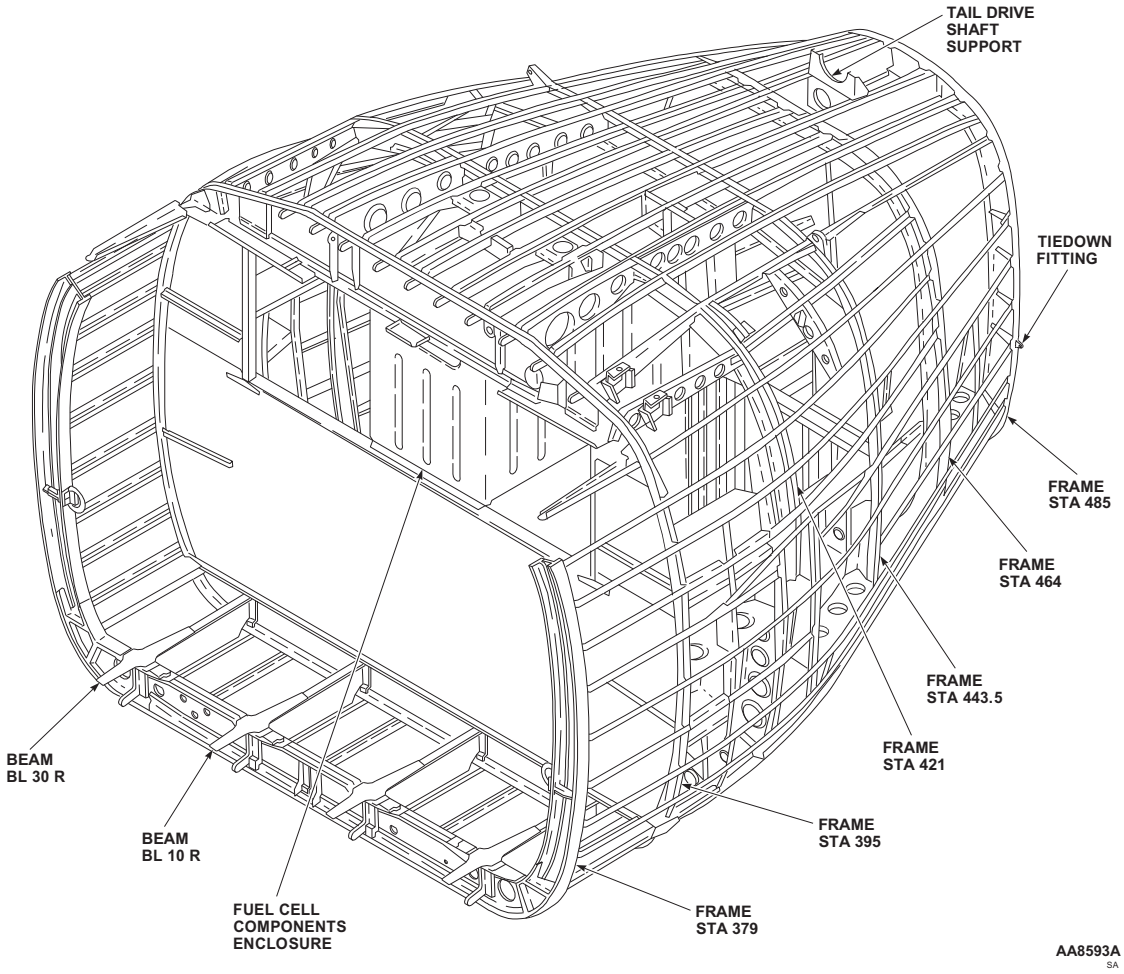


Figure 5. Transition Section Structure.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

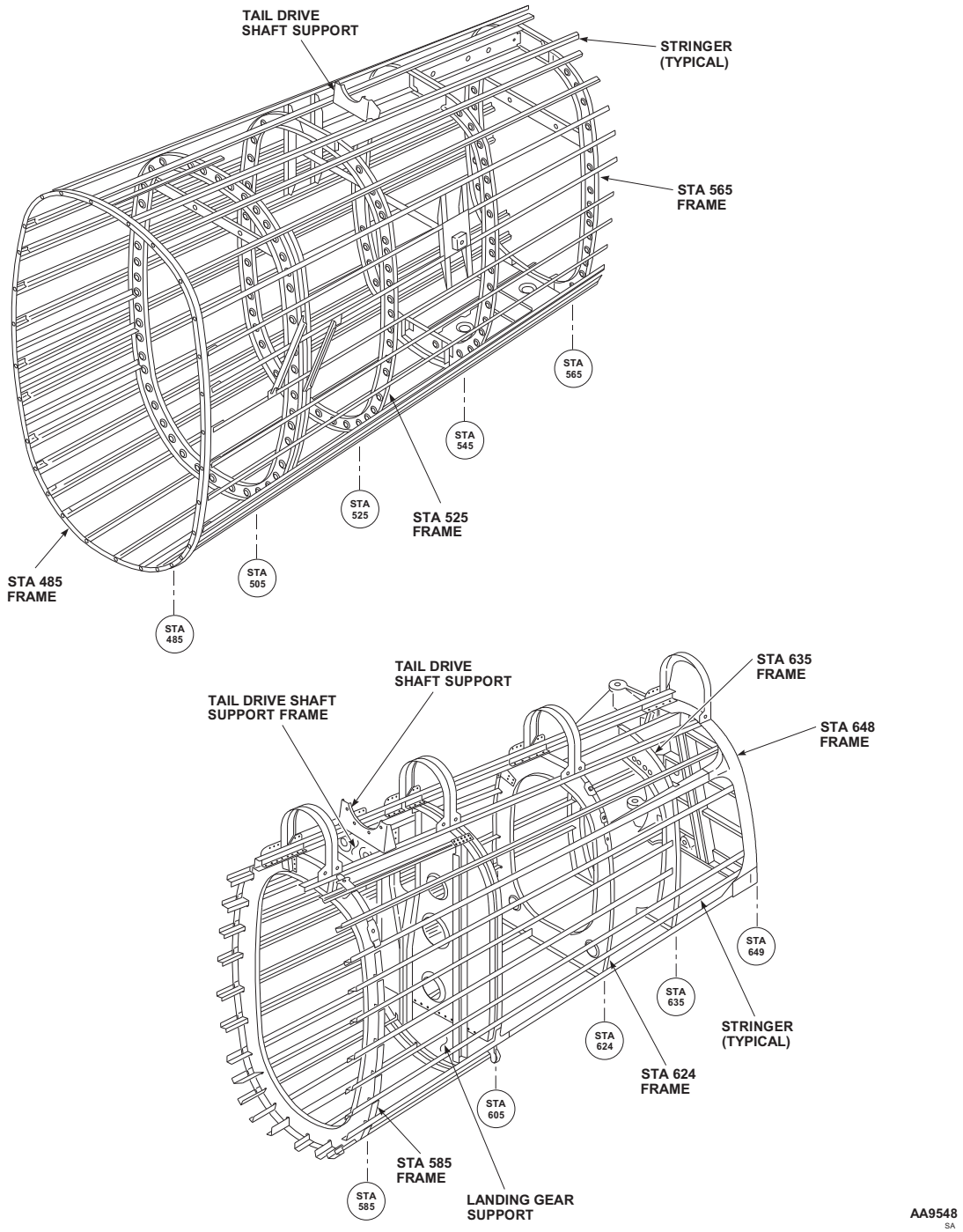


Figure 6. Tail Cone Structure.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

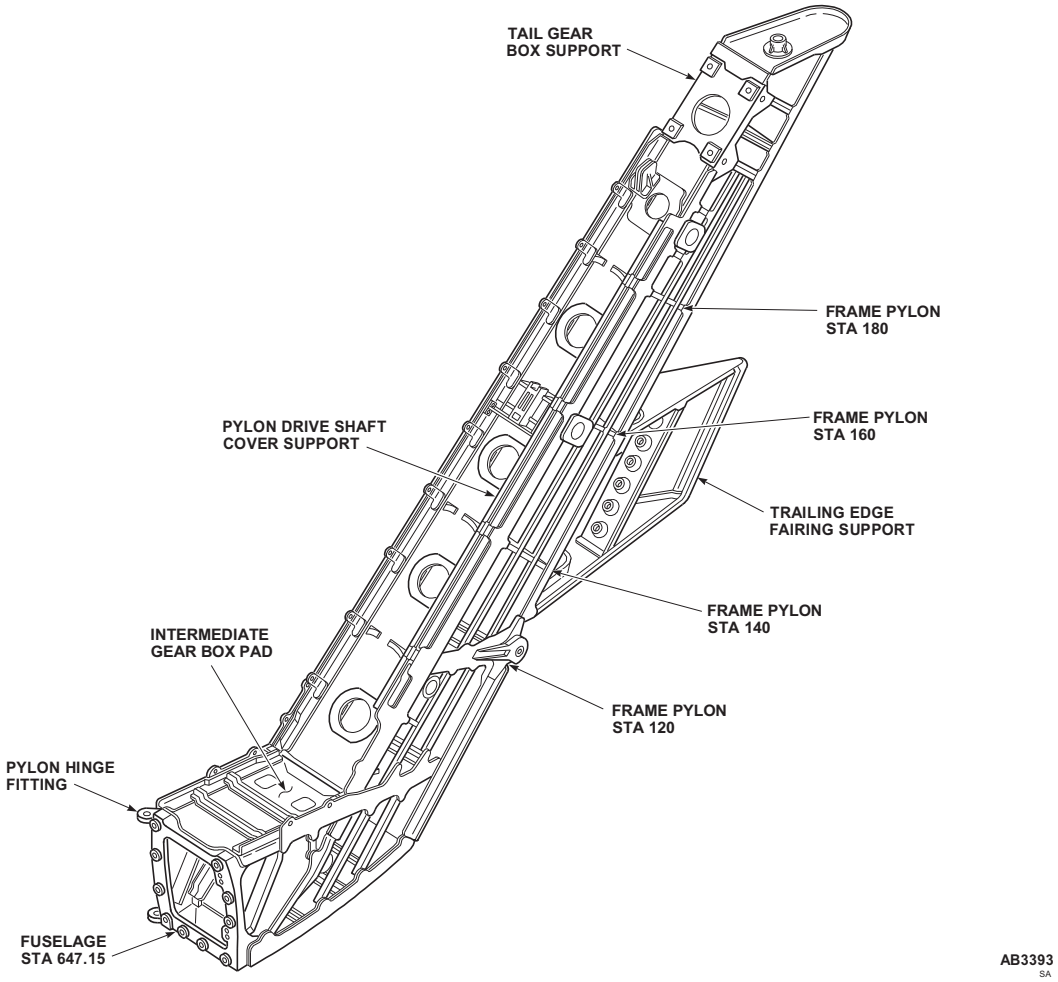


Figure 7. Tail Pylon Structure.

COCKPIT

The cockpit, consisting of an avionics compartment, accommodates the pilot and copilot and associated systems components. The cockpit is entered through hinged jettisonable cockpit doors on each side of the nose canopy. The avionics compartment is entered through a hinged nose door (Figure 1 and Figure 8).

Nose Door

A reinforced plastic avionics compartment nose door, on the nose section, opens to the front nose section interior systems and components (Figure 8). The door, which is hinged at the top, is opened by pulling out the two latches on the bottom, disengaging latch mechanisms from lockpins. The door is held in the open position by a support strut. A watertight seal is installed on the door.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

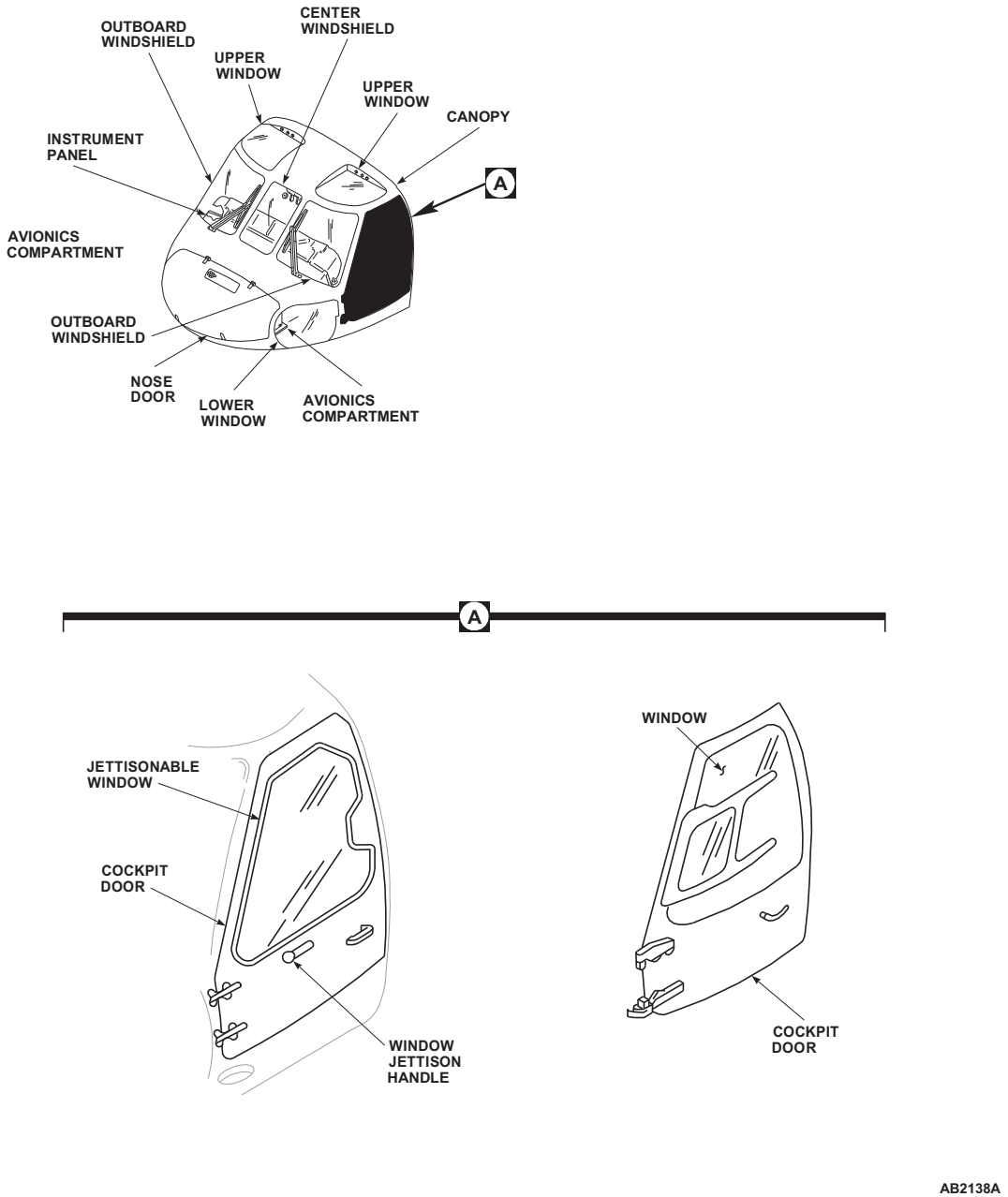


Figure 8. Cockpit (Nose Section). HH-60A HH-60L> .

Windshield and Windows

The cockpit windshield and windows consist of left and right upper windows, left and right lower windows, pilot and copilot outboard windshields, and a center windshield (Figure 8). The pilot and copilot shatter-resistant windshields are made of electropane panels containing braid lead-in and resistance wiring, used for anti-icing

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

purposes. HCW > The center windshield is equipped with anti-ice heater elements. < All other windows and center windshield are made of stretched Plexiglass. Foam seal tape, installed between all mating surfaces, has the addition of sealant for watertightness.

Cockpit Doors

Cockpit doors, on each side of the cockpit for the pilot and copilot, are hinged at the front edge (Figure 8). Each door contains either a fixed, slide-open, or jettisonable window made of stretched Plexiglass. A single-action release mechanism in each door allows the door to be jettisoned in an emergency. A watertight seal is installed on each door.

Pilot's and Copilot's Seats

These seats are in the cockpit and are interchangeable with each other. Individual seats, however, are made by different vendors and differ in construction and operational details (Figure 9 and Figure 10). Each seat has a vertical height adjustment and a horizontal seat adjustment. Two tracks on the cockpit floor allow the seat to slide to front or rear. The seat can be locked into position at 1/2-inch spaces. Pilot or copilot restraint is by a shoulder harness, lap belt, and crotch strap. A shoulder harness inertia reel is on the rear center of each seat. The reel allows about 12 to 18 inches of travel. It automatically locks when subjected to a sudden force. Each seat has a rear tilt feature which allows the seat to be disengaged from its tracks and tilted back into the troop compartment. This is done by pulling the emergency vertical release handle (Figure 9) to the right, or by pushing down on the foot operated vertical release pedal (Figure 10). This will allow the seat to drop to its lowest position. On seat shown in Figure 9, the tilt back release handles must be pushed in toward center. On seat shown in Figure 10, the handles must be pushed outboard. Seats must be in their lowest position prior to tilting. Do not operate emergency vertical release mechanisms unless seat is occupied.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

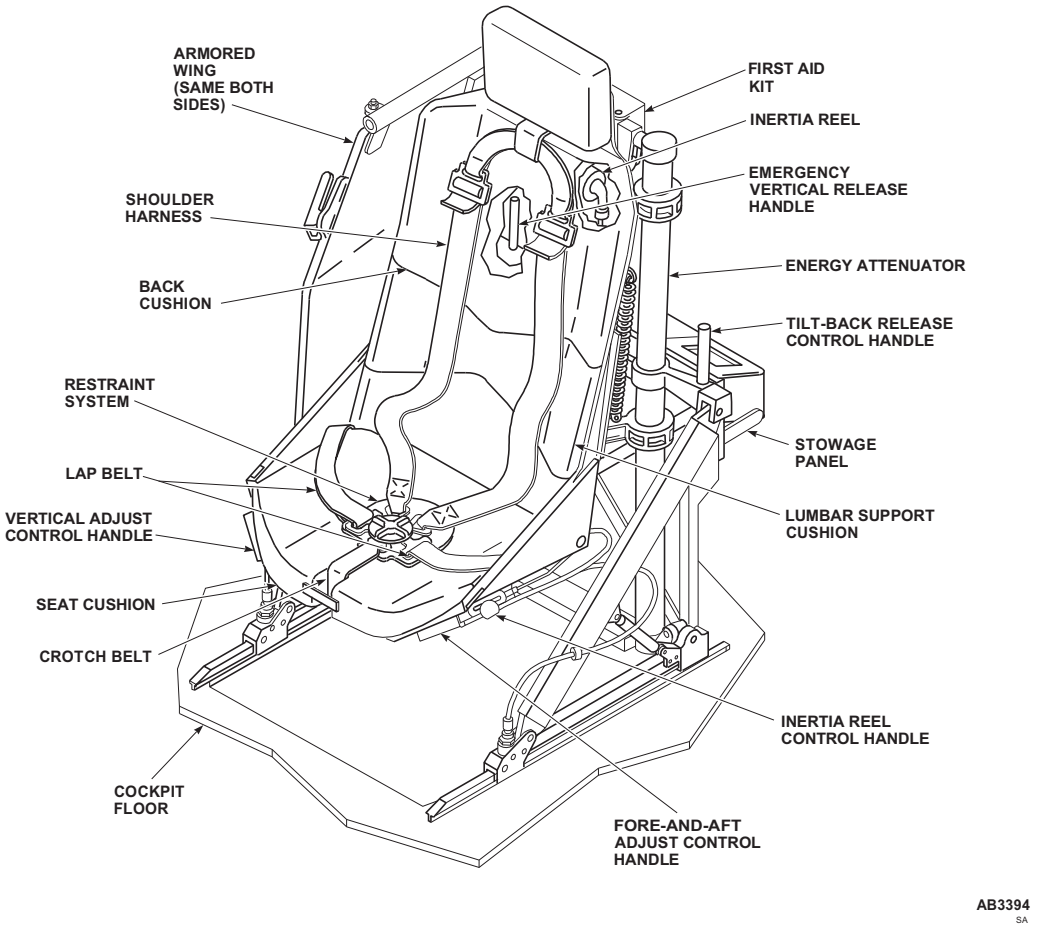


Figure 9. Pilot's/Copilot's Seats, RA-30525.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

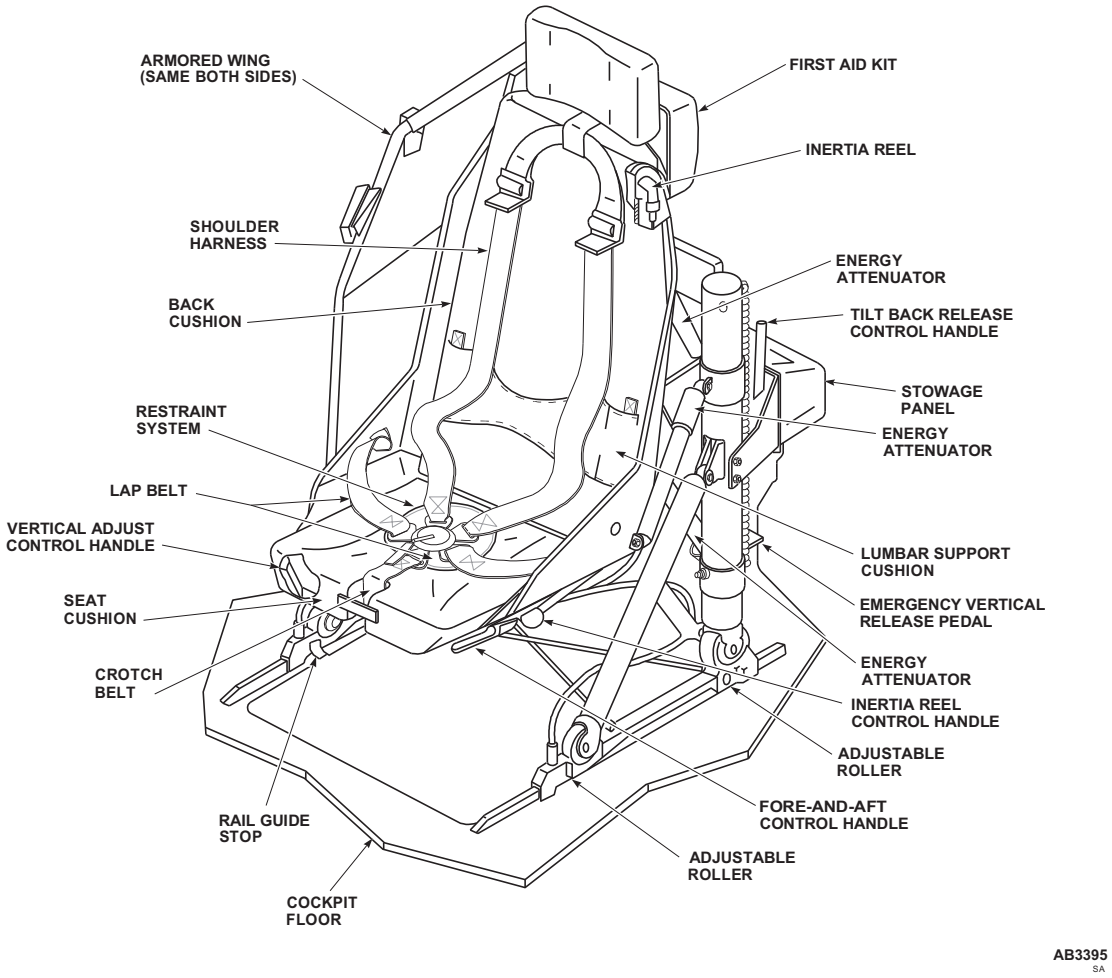
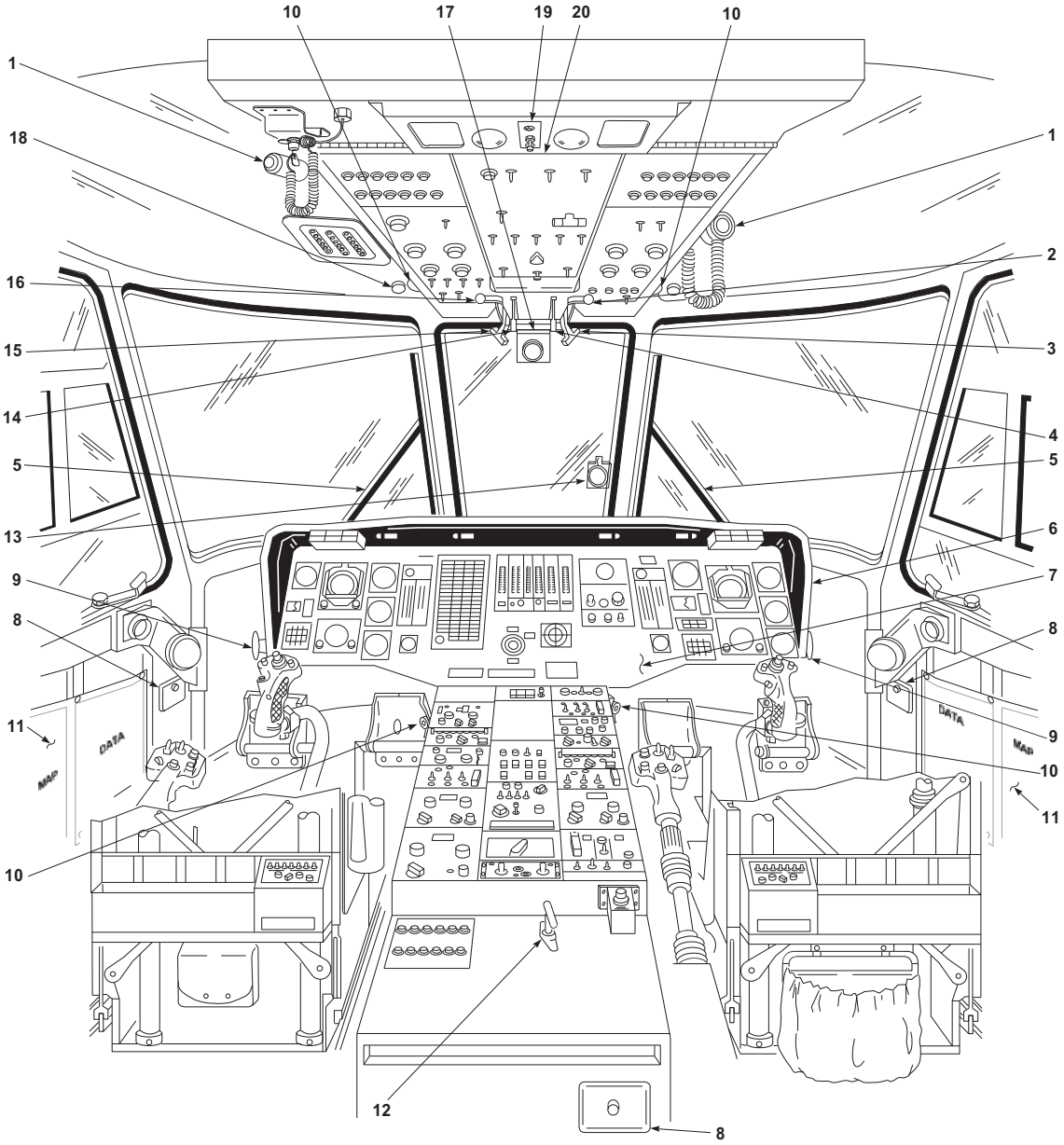


Figure 10. Pilot's/Copilot's Seats, D3801.

Miscellaneous Furnishings

These consist of two portable fire extinguishers, three first aid kits, two ashtrays, and a map data case (Figure 11. (Sheet 1 of 2)and Figure 12. (Sheet 1 of 2)).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED



1. UTILITY LIGHT
2. NO. 2 ENGINE FUEL SELECTOR LEVER
3. NO. 2 ENGINE OFF / FIRE T-HANDLE
4. NO. 2 ENGINE POWER CONTROL LEVER
5. WINDSHIELD WIPER
6. INSTRUMENT PANEL GLARE SHIELD
7. INSTRUMENT PANEL
8. ASHTRAY
9. PEDAL ADJUST LEVER
10. VENT
11. MAP / DATA CASE
12. PARKING BRAKE LEVER
13. STANDBY (MAGNETIC) COMPASS
14. NO. 1 ENGINE POWER CONTROL LEVER
15. NO. 1 ENGINE OFF / FIRE T-HANDLE
16. NO. 1 ENGINE FUEL SELECTOR LEVER
17. FREE-AIR THERMOMETER **W/O HCW**
18. FREE-AIR THERMOMETER **HCW**
19. COCKPIT FLOODLIGHT CONTROL
20. UPPER CONSOLE

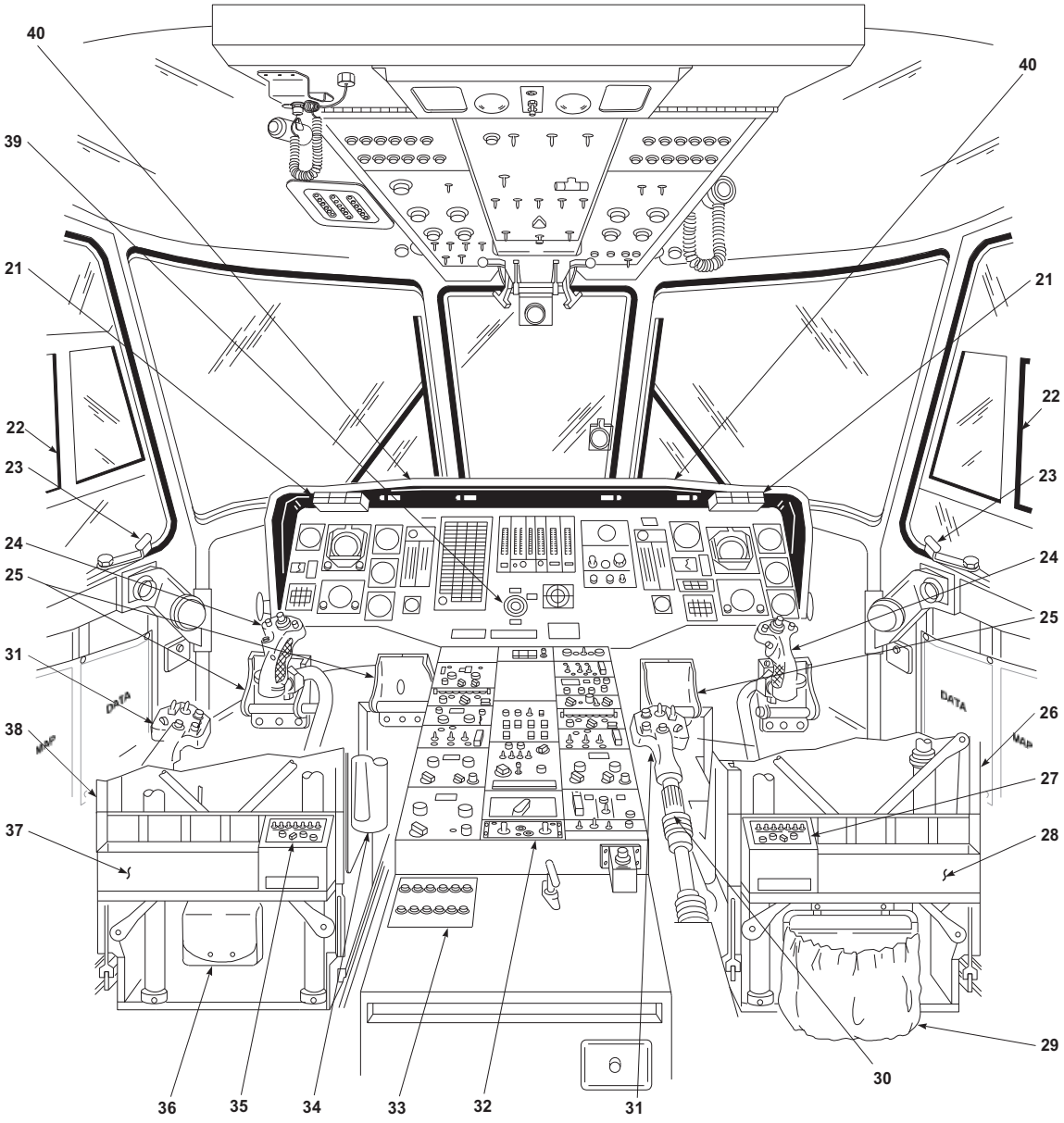
EFFECTIVITY

UH60A **UH60L** **EH60A**

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Figure 11. Miscellaneous Cockpit Furnishings (Sheet 1 of 2).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

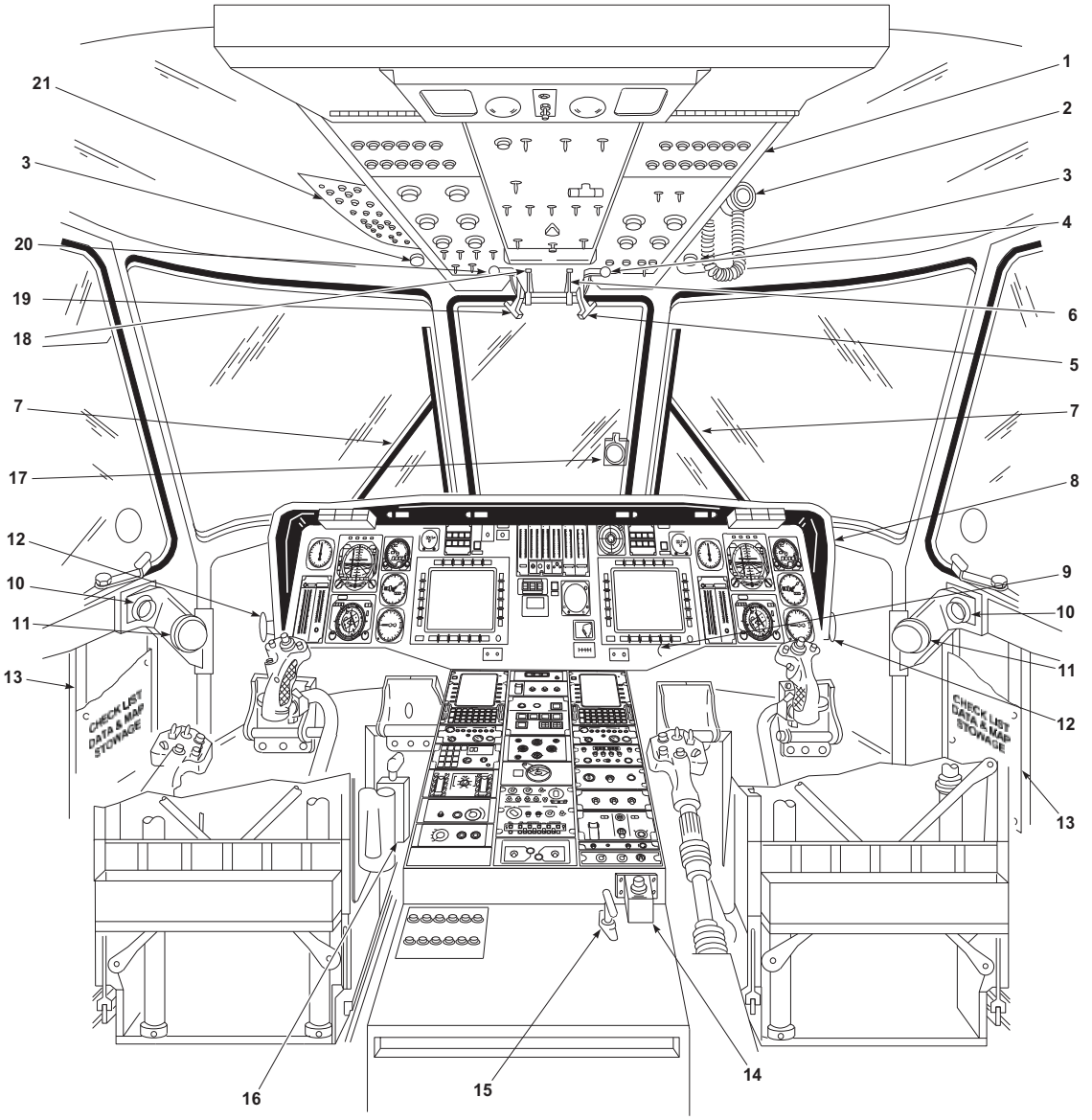


21. MASTER WARNING PANEL
22. SLIDING WINDOW
23. COCKPIT DOOR EMERGENCY RELEASE
24. CYCLIC STICK
25. DIRECTIONAL CONTROL PEDALS
26. PILOT'S SEAT
27. CREW CHIEF / GUNNER ICS CONTROL PANEL
28. CREW CHIEF AMMUNITION / GRENADE STOWAGE COMPARTMENT
29. STOWAGE BAG
30. COLLECTIVE STICK FRICTION CONTROL
31. COLLECTIVE STICK GRIP
32. LOWER CONSOLE
33. BATTERY / BATTERY UTILITY BUS CIRCUIT BREAKER PANEL
34. FIRE EXTINGUISHER
35. GUNNER'S ICS CONTROL PANEL
36. FIRST AID KIT
37. GUNNER'S AMMUNITION / GRENADE STOWAGE COMPARTMENT
38. COPILOT'S SEAT
39. ENGINE IGNITION KEY LOCK
40. COCKPIT AIR BAGS

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Figure 11. Miscellaneous Cockpit Furnishings (Sheet 2 of 2).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

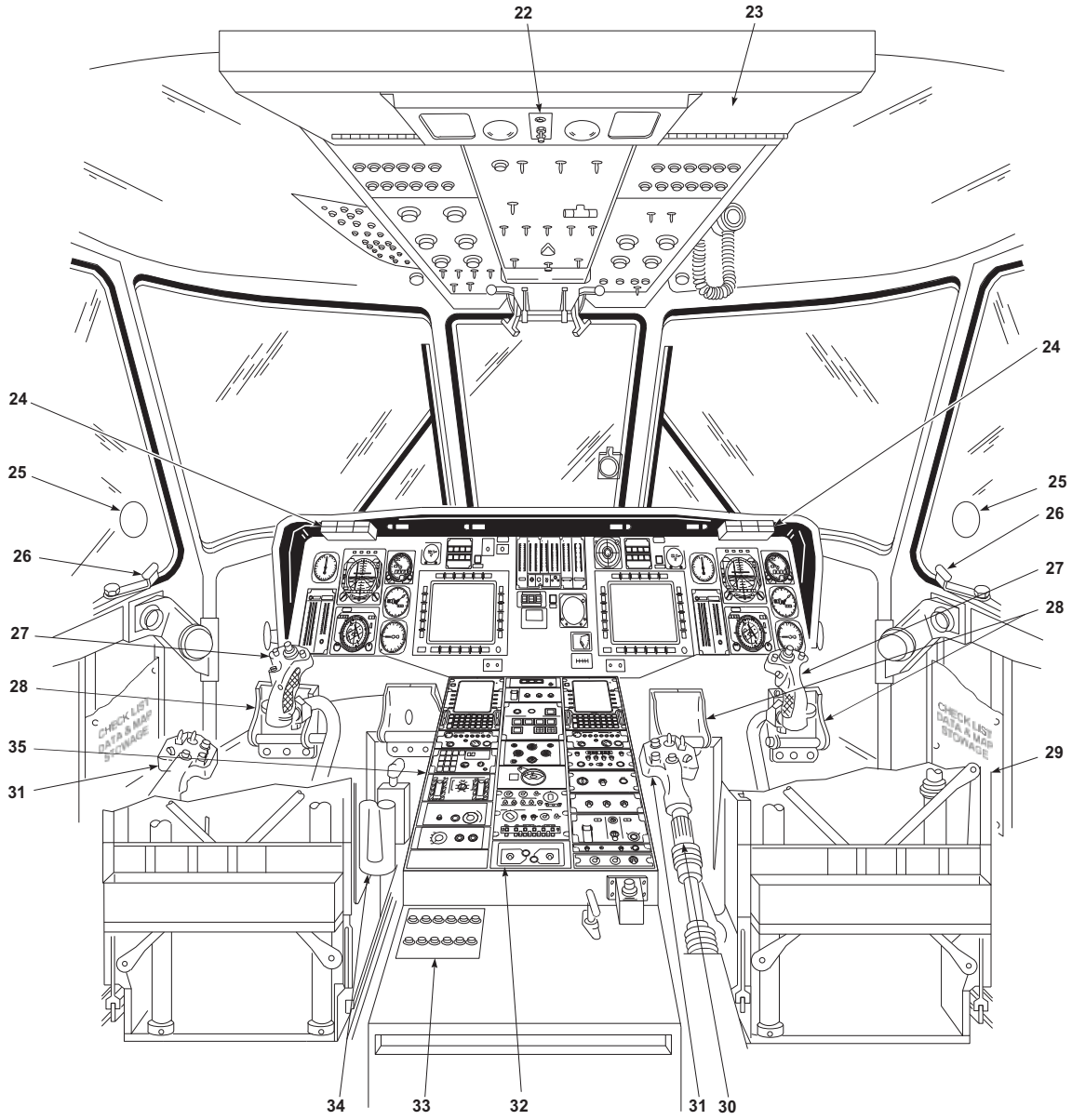


1. UPPER CONSOLE
2. PILOT'S COCKPIT UTILITY LIGHT
3. FREE-AIR TEMPERATURE GAGE
4. NO. 2 ENGINE FUEL SELECTOR LEVER
5. NO. 2 ENGINE OFF / FIRE T-HANDLE
6. NO. 2 ENGINE POWER CONTROL LEVER
7. WINDSHIELD WIPER
8. INSTRUMENT PANEL GLARE SHIELD
9. INSTRUMENT PANEL
10. VENT / DEFOGGER
11. ASHTRAY
12. PEDAL ADJUST LEVER
13. MAP / DATA CASE
14. CHAFF RELEASE SWITCH
15. PARKING BRAKE LEVER
16. COPILOT'S UTILITY LIGHT
17. STANDBY (MAGNETIC COMPASS)
18. NO. 1 ENGINE POWER CONTROL LEVER
19. NO. 1 ENGINE OFF / FIRE T-HANDLE
20. NO. 1 ENGINE FUEL SELECTOR LEVER
21. AUXILIARY CIRCUIT BREAKER PANEL

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Figure 12. Miscellaneous Cockpit Furnishings. **HH-60A HH-60L>** (Sheet 1 of 2).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED



22. COCKPIT FLOODLIGHT CONTROL
23. UPPER CONSOLE
24. MASTER WARNING PANEL
25. WINDOW
26. COCKPIT DOOR EMERGENCY RELEASE
27. CYCLIC STICK
28. DIRECTIONAL CONTROL PEDALS
29. PILOT'S SEAT
30. COLLECTIVE STICK FRICTION CONTROL
31. COLLECTIVE STICK GRIP
32. LOWER CONSOLE
33. BATTERY / BATTERY UTILITY BUS CIRCUIT BREAKER PANEL
34. FIRE EXTINGUISHER
35. ENGINE IGNITION KEYLOCK LOCATED ON SIDE

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Figure 12. Miscellaneous Cockpit Furnishings. **HH-60A HH-60L>** (Sheet 2 of 2).

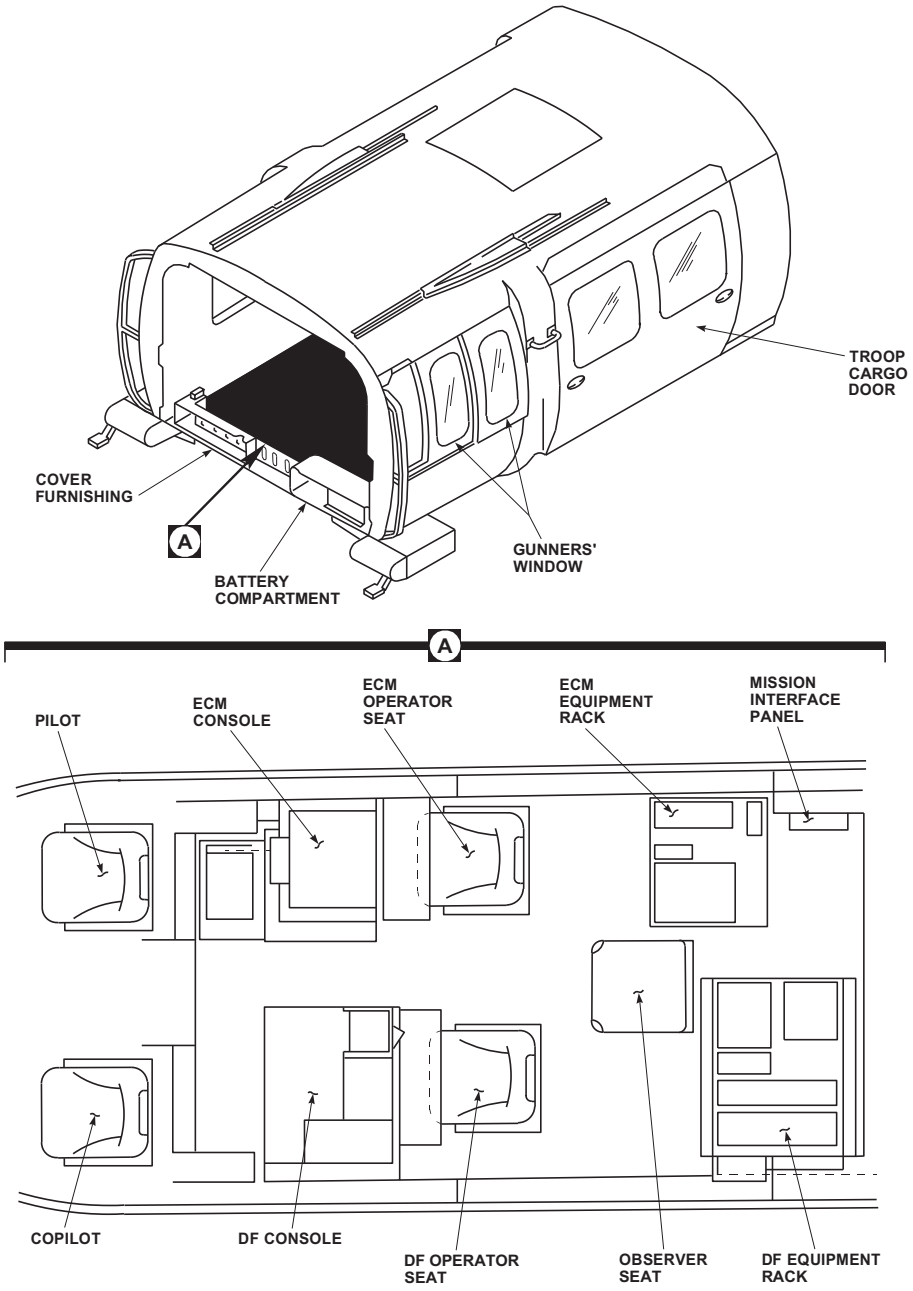
CABIN

UH-60A UH-60L > The cabin, interconnecting the cockpit and transition section, has two crew chief/gunner stations and a troop/cargo compartment. The cabin is entered through aft-sliding troop/cargo doors on each side of the helicopter. The crew chief/gunner stations are rear of the cockpit and to front of the troop cargo/doors, on each side of the helicopter. There are provisions for four litters. **<**

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

EH-60A > The cabin, interconnecting the cockpit and transition section, has two operator stations and one observer's seat. Operator stations are aft of the cockpit and forward of the cabin doors on either side of the helicopter. The observer's seat is located behind the operators' stations and forward of the fuel tank area. Racks for ECM and DF equipment are placed adjacent to the observer's seat. The mission interface panel provides power and signal connections between aircraft systems and mission equipment. The cabin is entered through aft-sliding cabin doors on each side of the helicopter (Figure 13). <

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED



EFFECTIVITY

EH60A

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SA

Figure 13. Cabin (Midsection).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

Troop/Cargo Doors

These rear sliding doors, on each side of the helicopter cabin, open to the troop/cargo compartment (Figure 13). Each door has two Plexiglass windows. A single-action release mechanism incorporated in each door allows both windows to be jettisoned in an emergency.

Cabin Floors

There are three removal panels in the midsection of the floor (Figure 14). They are made of fiberglass bottom skin, honeycomb core, and a reinforced plastic (fiberglass) top skin covering. It also has 27 multipurpose fittings for cargo tiedown, troop/litter installations. The cargo hook is reached through the cargo hook access panel in the floor. Floor panel installation is not required for towing, jacking, tiedown, or mooring. In flight or transport, the floor panels are not required provided that no unrestrained equipment is stored in the cabin area which would normally be secured to the floor. Sidewall interior panels that secure to the floor will require another method of retention or removal during flight or transport operations. Flight or transport of the helicopter is not allowed with personnel or equipment in the cabin without the floor panels installed.

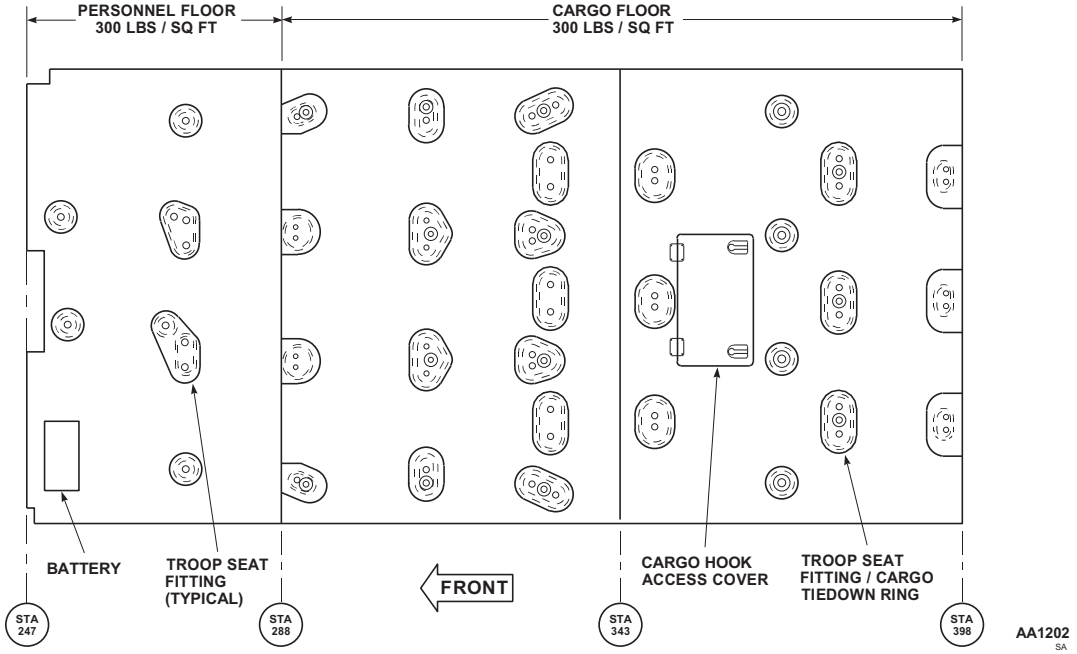


Figure 14. Cabin Floors.

Gunner's Sliding Windows

Two front sliding Plexiglass windows on each side of the helicopter, rear of the cockpit and front of the troop/cargo doors, provide a split hatch covering over each gunner station opening. When opened fully, the windows allow the crew chief to operate armament (Figure 13). Each window has a seal bonded to the front and rear edge of the frame which interlocks when both windows are closed. A locking mechanism on the rear window is used to secure/unlock both sliding windows.

Battery Compartment

UH-60A UH-60L EH-60A > The battery compartment houses a 28 vdc, 5.5 ampere-hour, 20-cell battery. It is located behind the copilot's seat in the forward left corner on the cabin floor. **< HH-60A HH-60L >** The 24 vdc, 9.5 ampere-hour, twelve-cell sealed lead acid battery is mounted to the inside of the battery acccess door located at STA 247, BL 0, on the belly of the helicopter. **<**

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

Troop Seats UH-60A & UH-60L >

Twelve troop seats are installed in the helicopter midsection (Figure 15). One seat is in each crew chief/gunner station, four seats are against the midsection rear fuselage, and two rows of three seats each are back-to-back in the cabin center. Each seat consists of a tubular frame and nylon cloth and has a seat belt and shoulder harness.

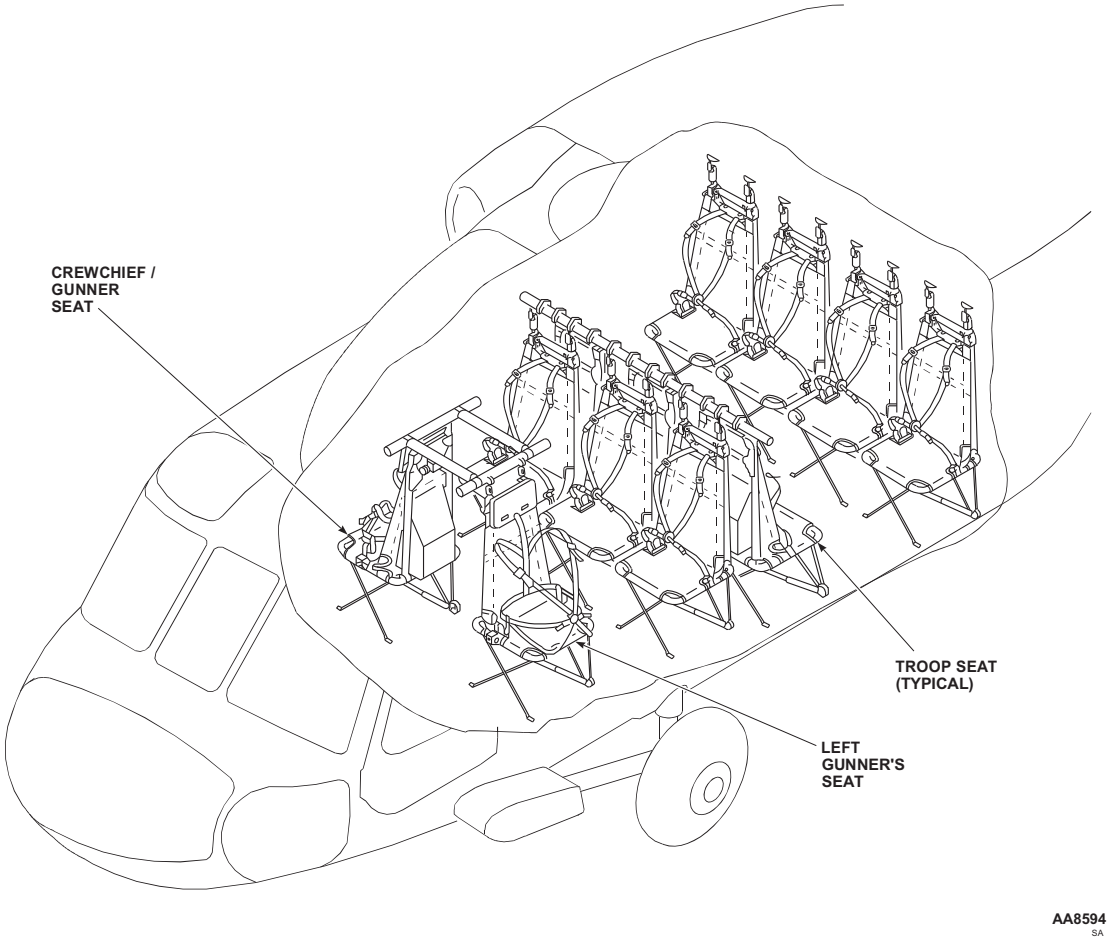


Figure 15. Troop Seat Arrangement.

Mission Operator's Seats EH-60A >

These seats are in the cabin and are similar to the alternate configuration of the pilot/copilot seat. They do not have the armored wings installed. Track/frame assemblies mounted to the cabin floor allow the seat to slide forward or aft (Figure 13).

Observer Seat EH-60A >

An observer's seat is located in the rear of the cabin (Figure 13). The seat is a standard troop seat with tubular frame-nylon cloth construction and a seat belt-shoulder harness restraint system.

Soundproofing

Soundproofing panels, made of an acoustical insulation-type material to lessen noise, are attached to the fuselage structure throughout the helicopter cabin.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

TRANSITION SECTION

The transition section, interconnecting the helicopter cabin and tail cone, holds the fuel tanks and equipment stowage compartments. The transition section is reached from the inside of the troop/cargo compartment (Figure 16).

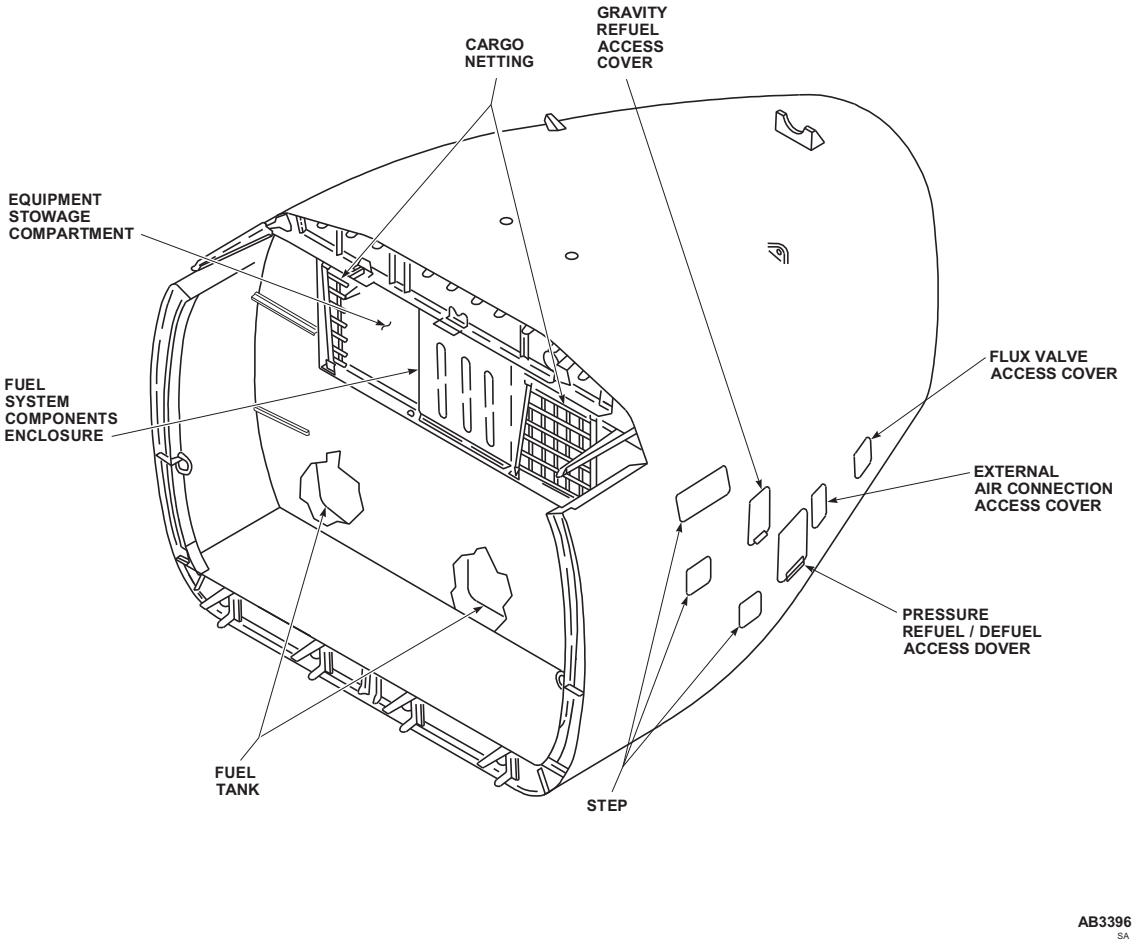


Figure 16. Transition Section.

Aft Transition Avionics Compartment Access Door HH-60L >

A fiberglass and Kevlar aft transition avionics compartment access door, on the right side of the aft transition section, opens to the aft transition avionics systems and components (Figure 17). The door is hinged at the top, and opened by pulling out the two latches on the bottom, disengaging latch mechanisms from lock pins. The door is held in the open position by a support strut. A watertight seal is installed on the door and jamb.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

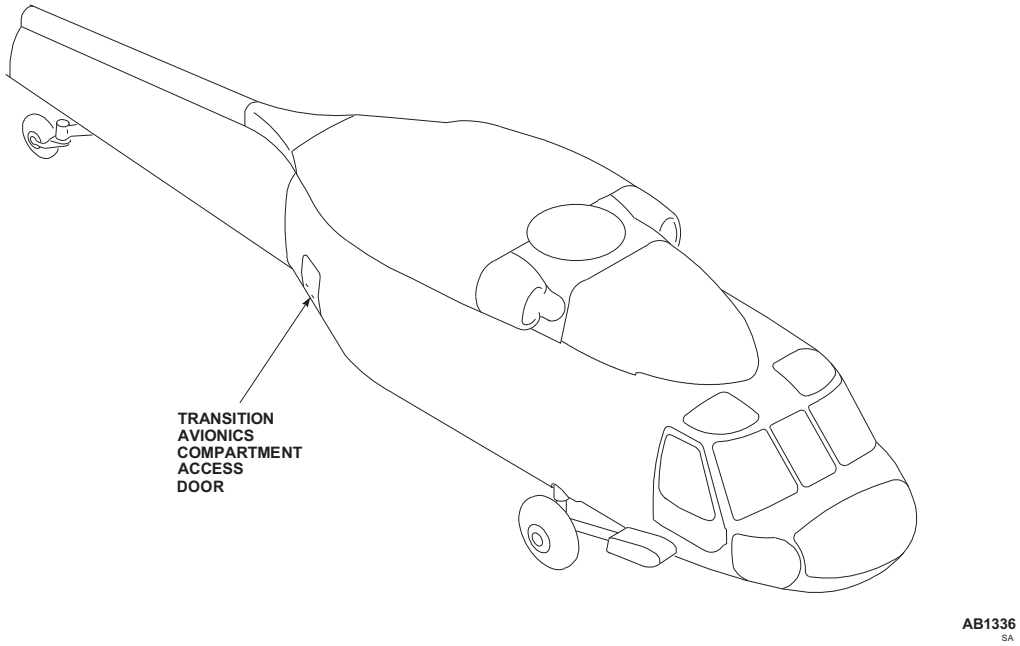


Figure 17. AFT Transition Avionics Compartment Access Door EH-60A HH-60A HH-60L> .

Fuel Cell Compartment

Two fuel cell compartments are on each side of the transition section. Each compartment, consisting of foam liner panels and an aluminum skinned honeycomb cover panel, houses a fuel cell and fuel system components. Fuel cell compartments are reached from inside the troop/cargo compartment (Figure 16).

Equipment Stowage Compartment

These compartments are on each side of the transition section over the fuel cell compartments. The equipment compartment, reached from inside the troop/cargo compartment, has folded troop seats. Removable panels in the compartment open to the tail cone. A restraint system in the front end of the compartment prevents stowed equipment from shifting (Figure 16).

TAIL CONE

The tail cone, interconnecting the transition section and tail rotor pylon, supports the tail rotor drive shaft and tail pylon. The tail cone also encloses the tail rotor flight controls and tail landing gear. It is reached from inside the rear troop/cargo compartment. An access cover on each rear end side opens to the tail pylon attachment bolts, flight controls, and tail landing gear (Figure 18).

The tail cone has two covers on the top exterior. They are made of Kevlar and can be opened to reach the tail drive shafts. Each cover is piano hinged at the right edge. Five quick-release fasteners on the left edge secure the cover closed (Figure 18).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

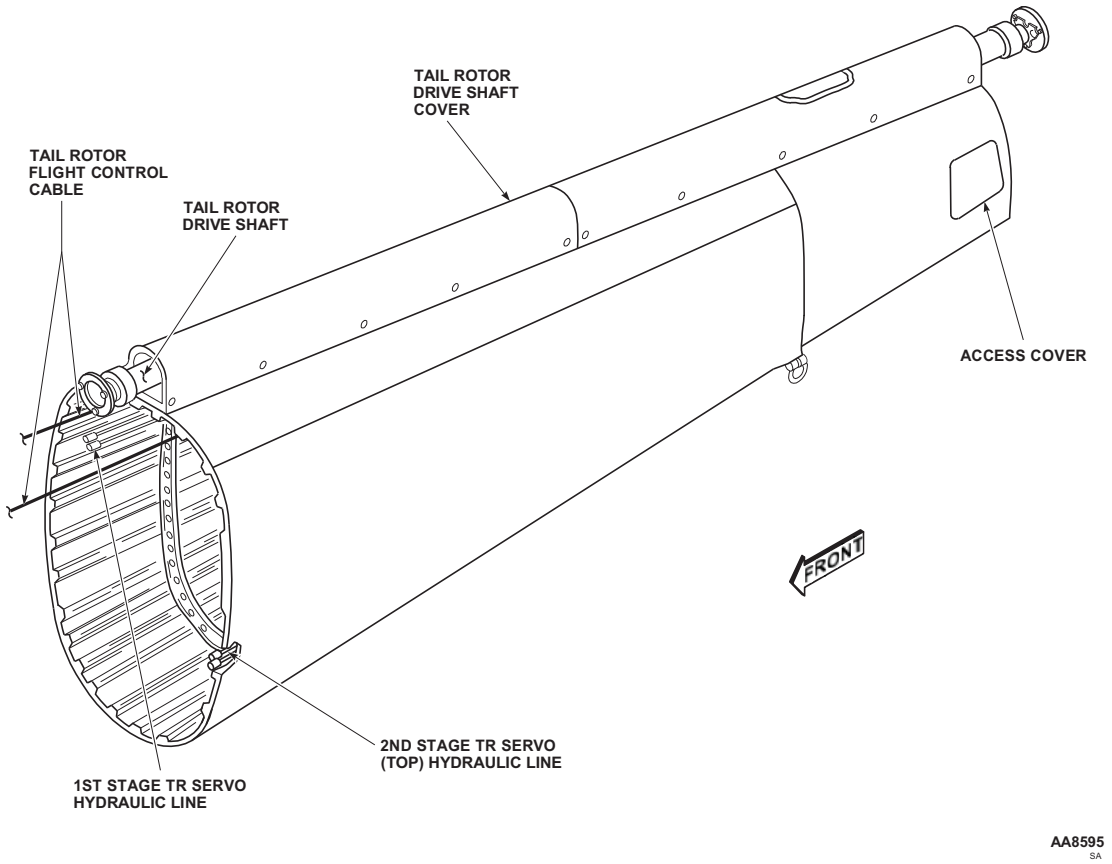


Figure 18. Tail Cone.

TAIL ROTOR PYLON

The tail pylon is a foldable section at the rear end of the helicopter. The tail pylon is supported by and hinged to the tail cone section. The pylon supports the stabilizers, the intermediate and tail gear boxes and connecting drive shaft, the tail rotor assembly, and part of the flight controls. When the stabilator is removed, the tail pylon can be folded along the right side of the tail cone. Removable fairings on the pylon open to the intermediate and tail gear boxes, tail drive shafts, and tail rotor flight controls (Figure 19).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

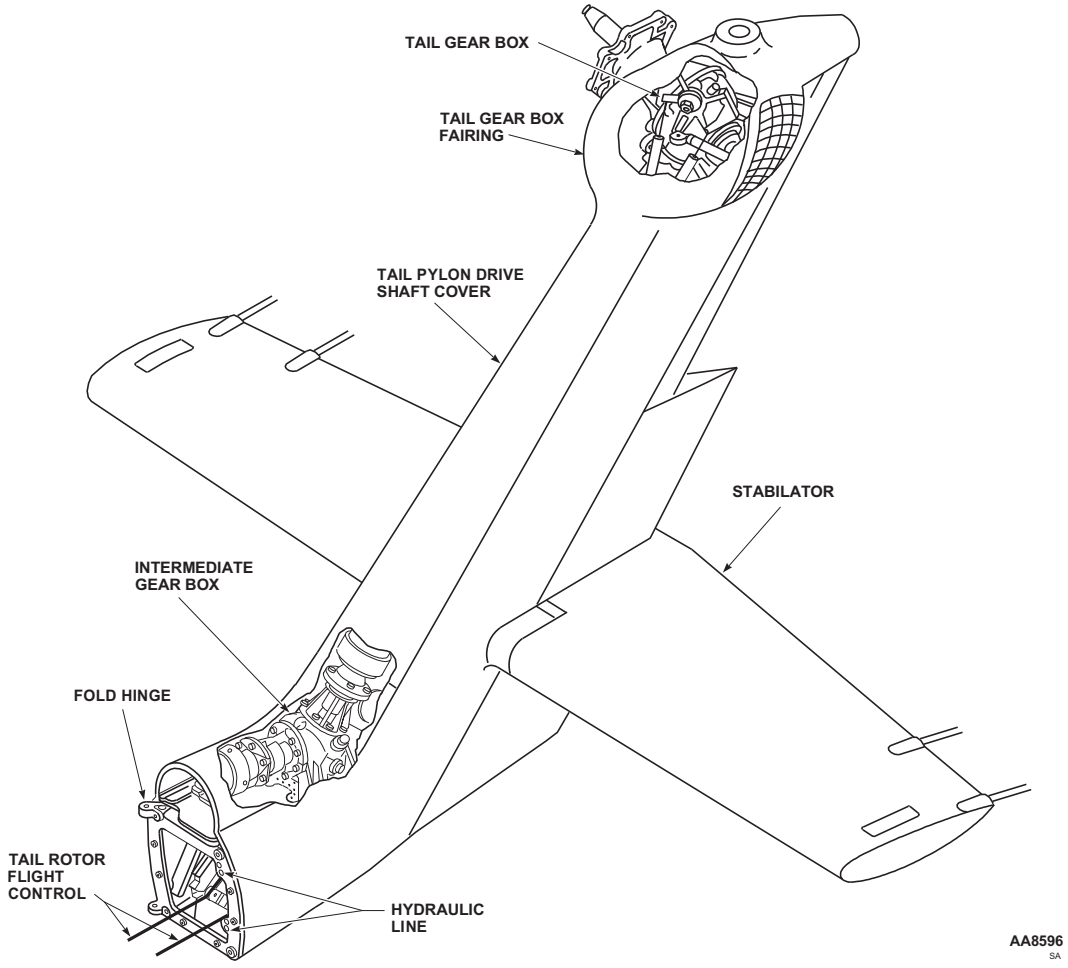


Figure 19. Tail Pylon.

Tail Pylon Drive Shaft Cover

This cover, on the pylon leading edge, opens to the tail drive shafts. The cover consists of nonmetallic honeycomb core sandwiched between reinforced plastic skins, four hinges, and nine quick-release fasteners. The cover is removed from the pylon by separating the hinge-halves (Figure 19). The drive shaft cover also serves as a VHF/FM antenna.

Stabilator

A controllable stabilator is on the tail pylon (Figure 19). The stabilator provides longitudinal stability in forward flight. During hover and low speed forward flight, the stabilator swings down to eliminate nose up attitudes caused by tail rotor down wash hitting the flat stabilator surface. For a complete description of the stabilator control system, refer to TM 11-1520-237-23.

Position Transmitter/Limit Switch Assembly

The position transmitter/limit switch assembly provides a signal to the stabilator indicators that visually indicates the stabilator position relative to the centerline of the helicopter. The switch assembly also limits stabilator TM 11-1520-237-23 movement to 8° up and 40°down. The position transmitter, which provides the signal to the stabilator indicators, requires 26 vac excitation. Four limit switches, two up-limit and two down-limit, limit stabilator movement. The limit switches require 28 vdc operating power (Figure 20).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

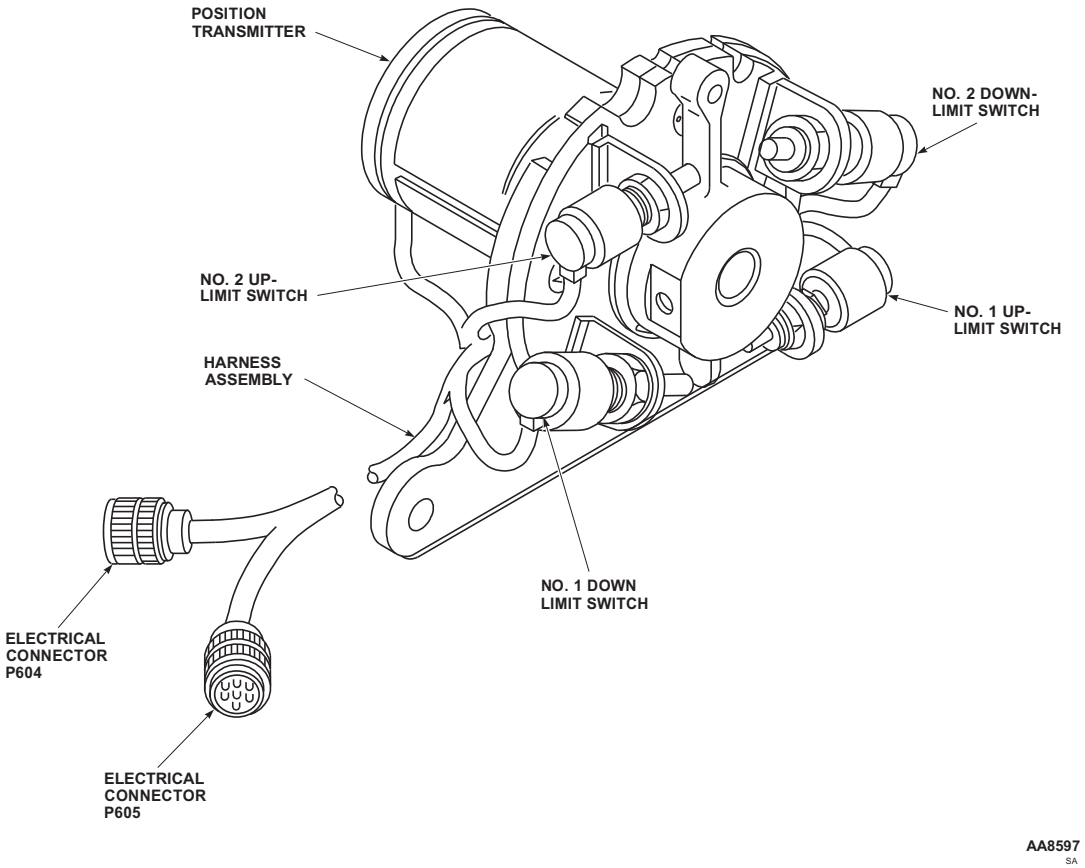


Figure 20. Position Transmitter/Limit Switch Assembly Parts Location.

MAIN ROTOR PYLON

The main rotor pylon attached to the upper cabin and rear fuselage is a protective aerodynamic covering that also gives smooth airflow induction for cooling aircraft major subsystem components. Hinged fiber glass/honeycomb-sandwiched panels and covers open to the internal pylon areas and helicopter component subsystems (Figure 21).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

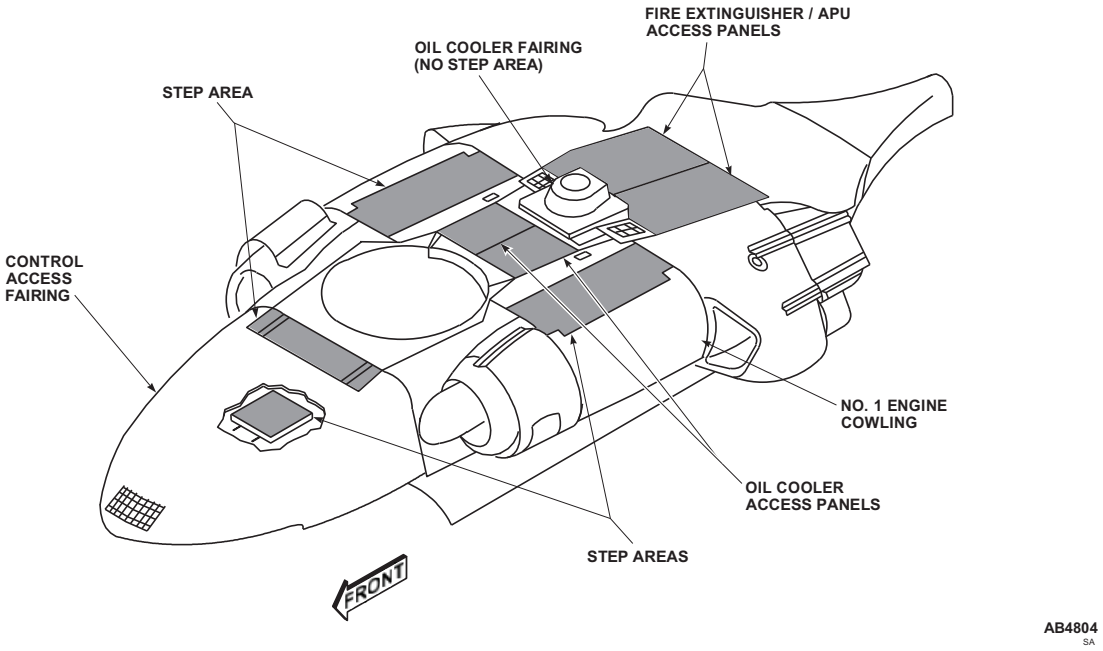


Figure 21. Main Rotor Pylon.

Engine Cowling and Work Platform

This is on each side of the main rotor pylon. When opened, each platform has a flat surface for maintenance use and inspection (Figure 22). Each platform is capable of supporting a static weight of 400 pounds. When closed in the flight position, the platform confines and directs cooling air into the engine area. The platforms are made of honeycomb aluminum, steel channels, and titanium sheet.

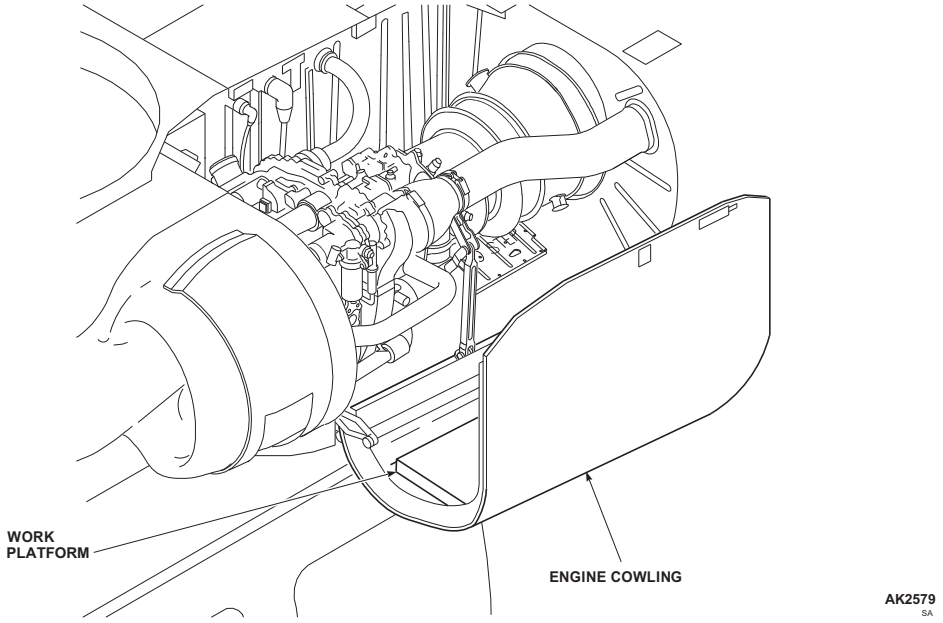


Figure 22. Engine Cowling and Work Platform.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

Sliding Access Cover

The cover is on the front section of the main rotor pylon. Moving the sliding cover to front on the tracks exposes the helicopter's flight control, hydraulic and heating systems. The cover consists of a honeycomb aluminum, fiberglass structure, latch assemblies, rollers, and tracks (Figure 23).

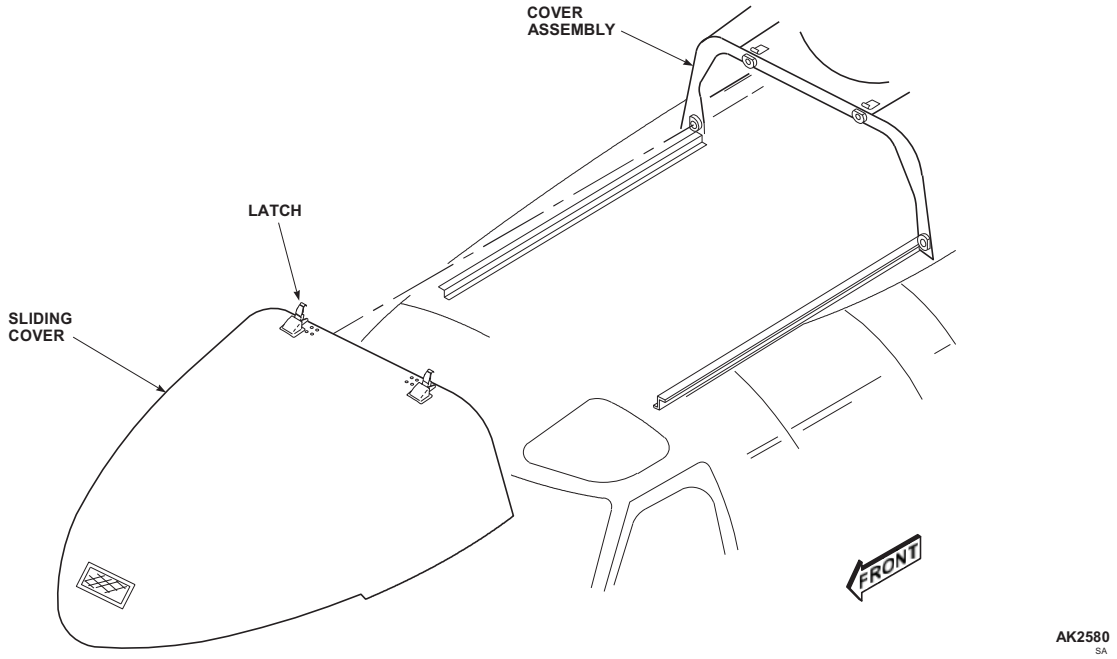


Figure 23. Sliding Access Cover.

ARMOR PLATING

Armor plating is provided for the pilot and copilot (Figure 24). Protection for No. 1 and No. 2 fuel tank sumps consists of a self sealing rubber compound.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

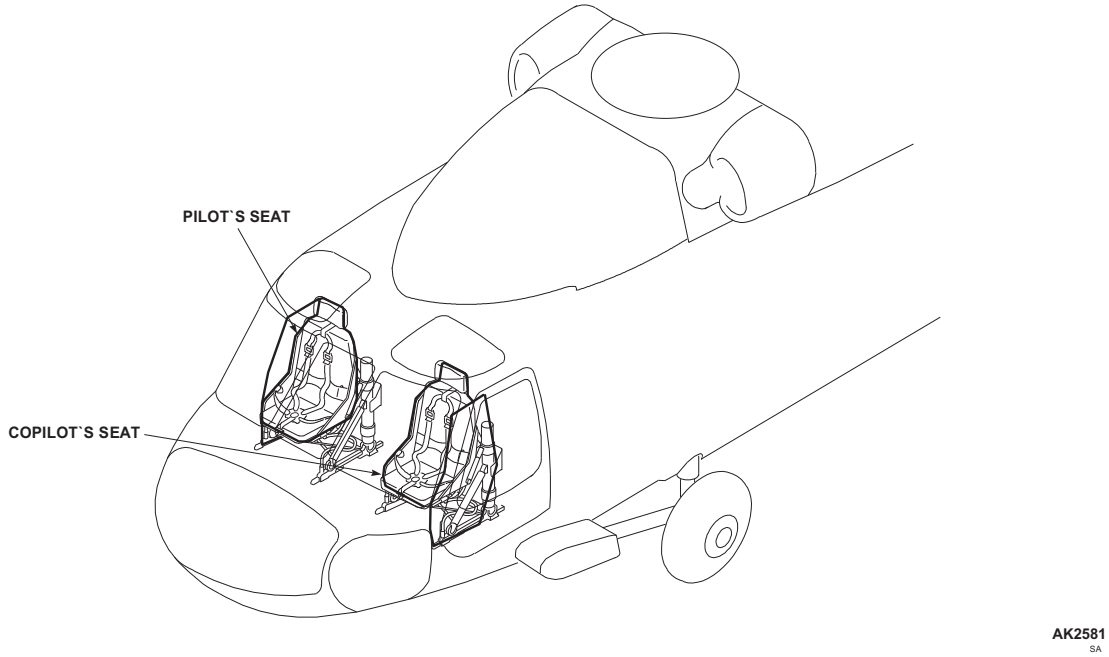


Figure 24. Armor Plating.

WIRE STRIKE PROTECTION SYSTEM WSPS >

The wire strike protection system is a simple, lightweight system that will cut, break, or deflect wires that may strike the helicopter. The system consists of cutters and deflectors located on the fuselage and landing gear. They include the upper cutter on the rear of the sliding fairing, the pitot cutter/deflector on the front of the sliding fairing, windshield post and wiper deflectors, door hinge deflector, step extension and step deflector, landing gear joint deflector, main landing gear cutter/deflector, and tail landing gear deflector. The cutters are clamped to landing gear drag beams, and bolted to the airframe and main rotor sliding pylon cover.

VIBRATION ABSORBERS

Three vibration absorbers are installed: one in the nose section, one in the cabin overhead just in front of the main transmission and one on the tail pylon (Figure 25. (Sheet 1 of 2)). ROLL > A roll vibration absorber is installed under each drag beam support fairing. < Also, a bifilar is installed on top of the main rotor head to dampen rotor vibrations. For a description of the bifilar, refer to WP 0012 00.

Nose Vibration Absorber

The nose vibration absorber is behind the glide slope antenna, underneath the avionics compartment lower shelf (Figure 25. (Sheet 1 of 2), Detail A). The absorber is tuned to reduce cockpit centerline vertical 4/rev vibrations. The vibration absorber consists of a body (mass), springs bolted to the body, weights (tuning plates), and support fittings. The absorber weighs about 70 pounds.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

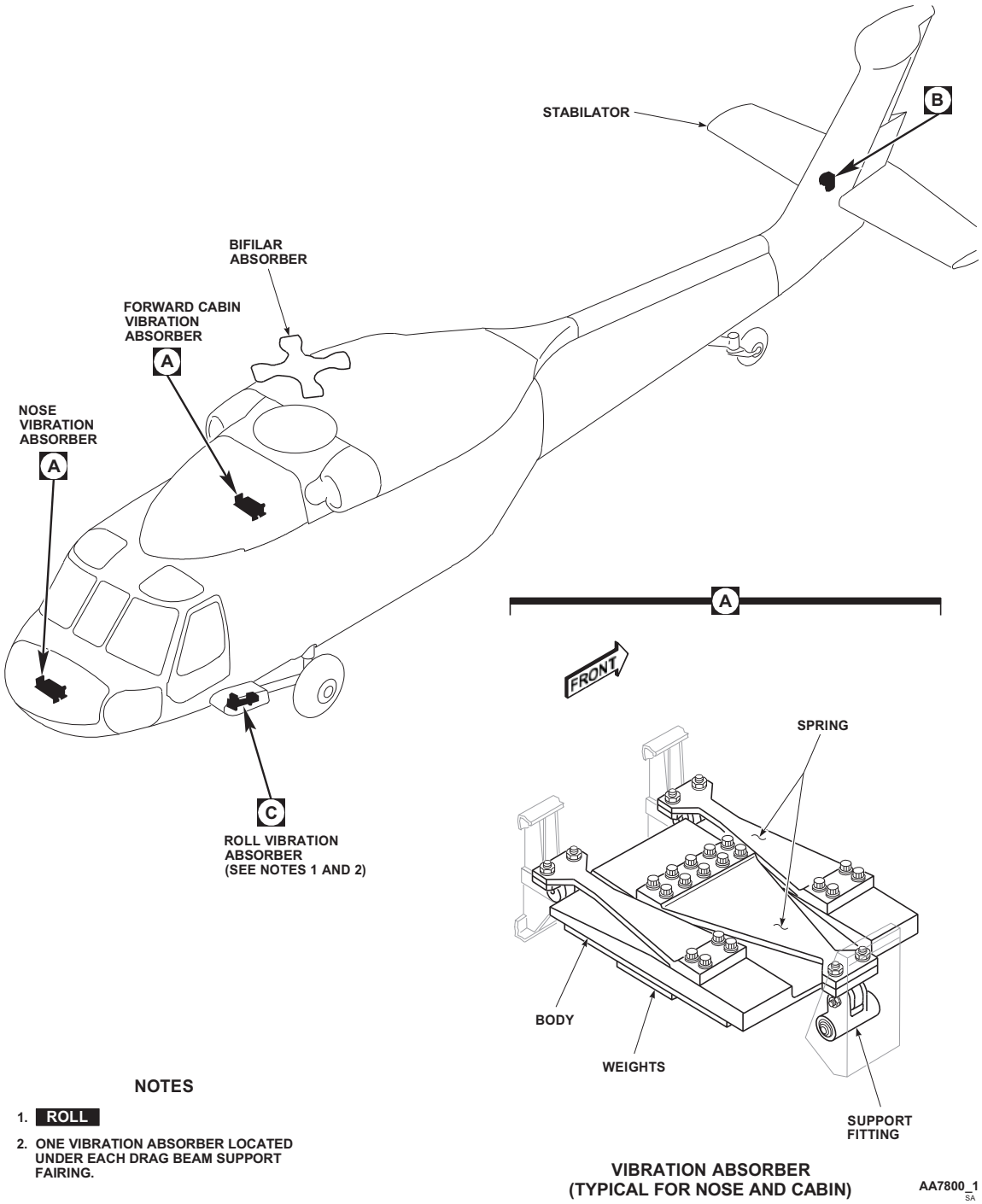


Figure 25. Vibration Absorber (Sheet 1 of 2).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

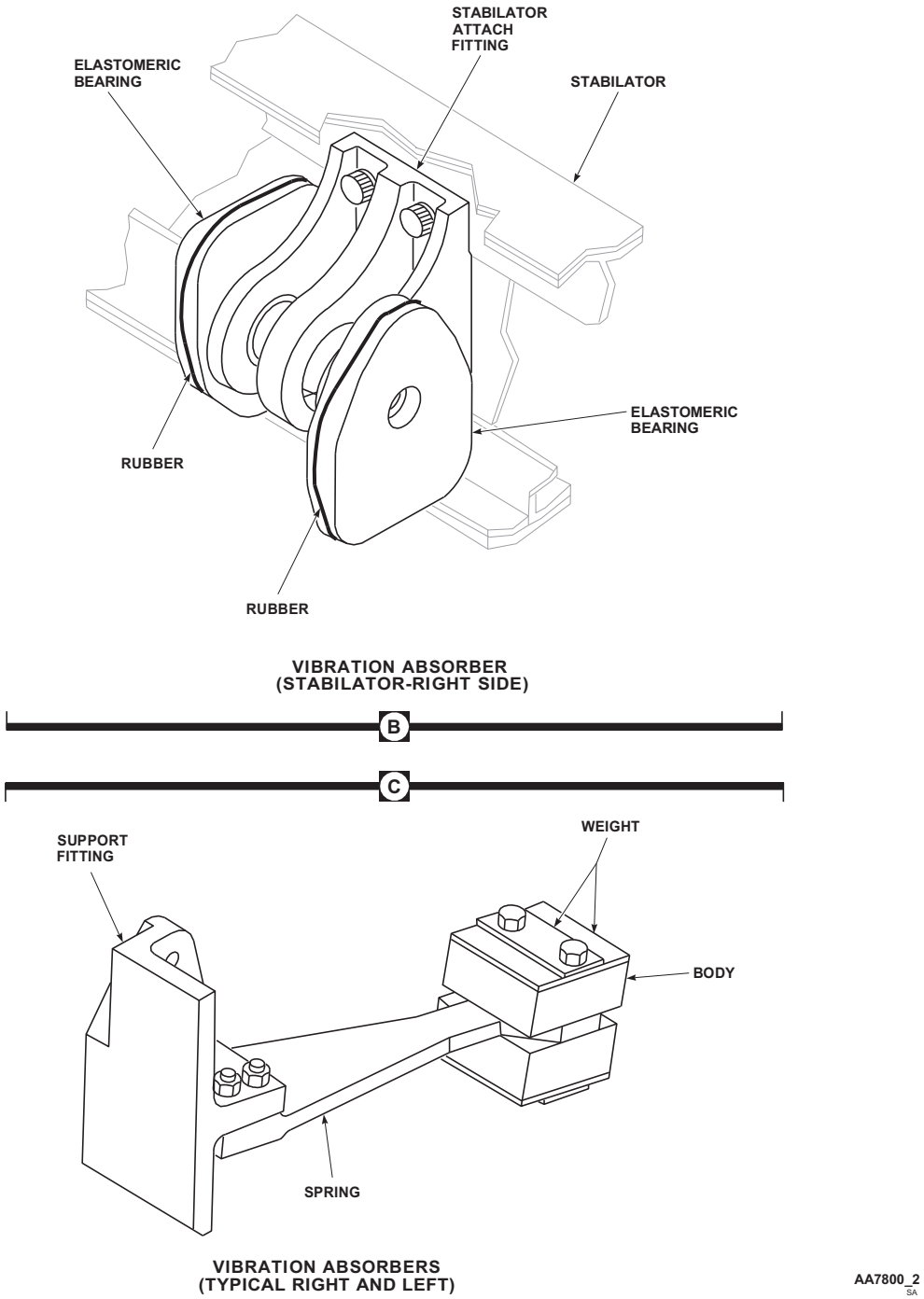


Figure 25. Vibration Absorber (Sheet 2 of 2).

Nose Box Frame Vibration Absorber **UH-60L 95-26610, 95-26621 - SUBQ >**

The nose box frame vibration absorber is behind the glide slope antenna, underneath the avionics compartment lower shelf (Figure 26, Detail A). The absorber is tuned to reduce cockpit centerline vertical 4/rev vibrations. The vibration absorber consists of an upper and lower housing, containing a mass trapped between, two sets of springs. The springs are always in compression, even at the limits of the mass travel. The absorber is attached to airframe fittings by four tension bolts and barrel-nuts. The absorber weighs approximately 50 pounds.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

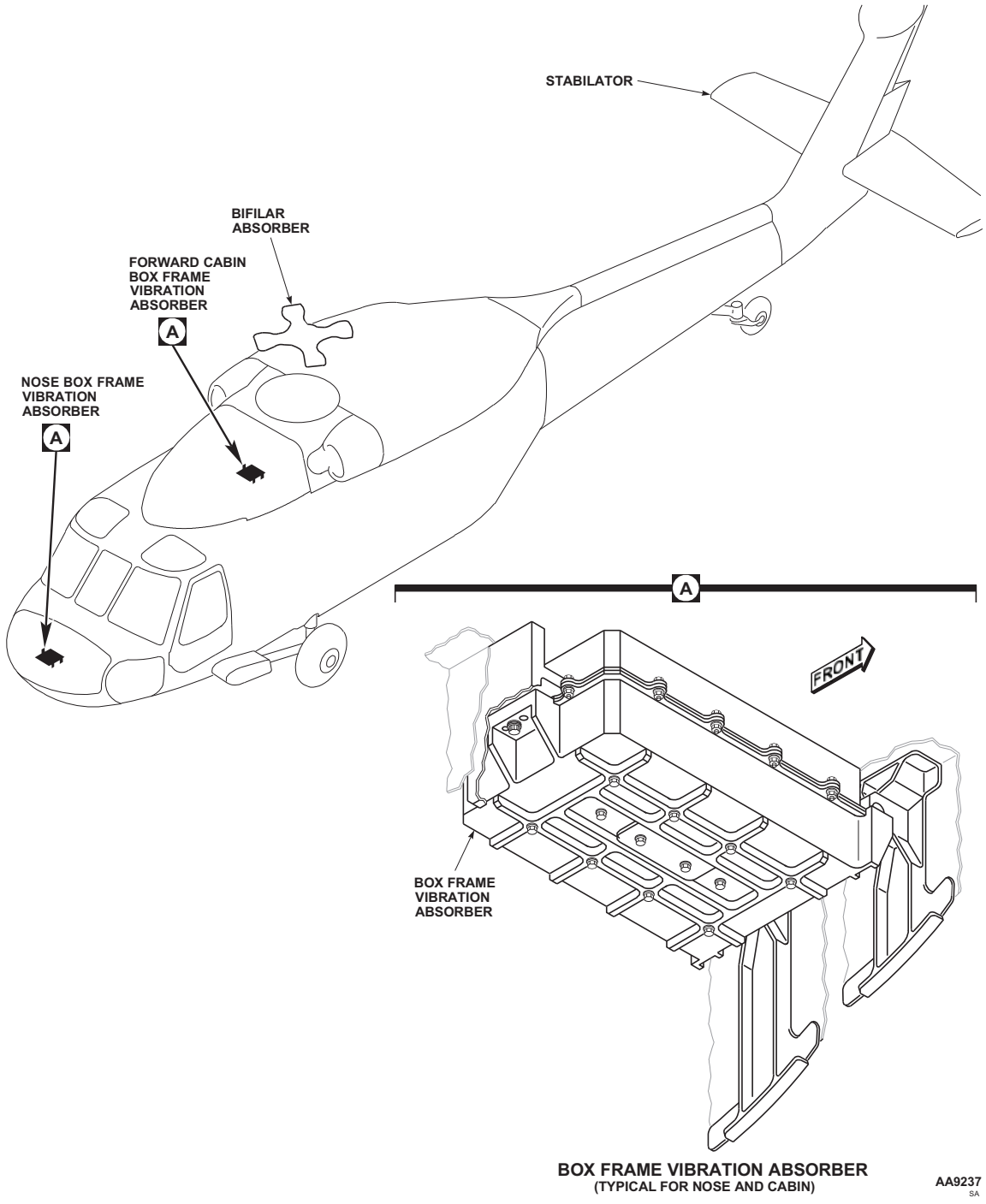


Figure 26. Box Frame Vibration Absorber **UH-60L 95-26610, 95-26621 - SUBQ >** .

Cabin Vibration Absorber

The cabin vibration absorber is under the soundproofing just in front of the main transmission at about station 308 (Figure 25. (Sheet 1 of 2), Detail A). The vibration absorber is tuned to reduce cabin overhead vertical 4/rev vibrations. The vibration absorber consists of a body (mass), springs bolted to the body, weights (tuning plates), and support fittings. The absorber weighs about 75 pounds.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

Cabin Box Frame Vibration Absorber UH-60L 95-26610, 95-26621 - SUBQ >

The cabin box frame vibration absorber is under the soundproofing just in front of the main transmission at about station 308 (Figure 26). The vibration absorber is tuned to reduce cabin overhead vertical 4/rev vibrations. The vibration absorber consists of an upper and lower housing, containing a mass trapped between, two sets of springs. The springs are always in compression, even at the limits of the mass travel. The absorber is attached to airframe fittings by four tension bolts and barrel-nuts. The absorber weighs approximately 94 pounds.

Stabilator Vibration Absorber

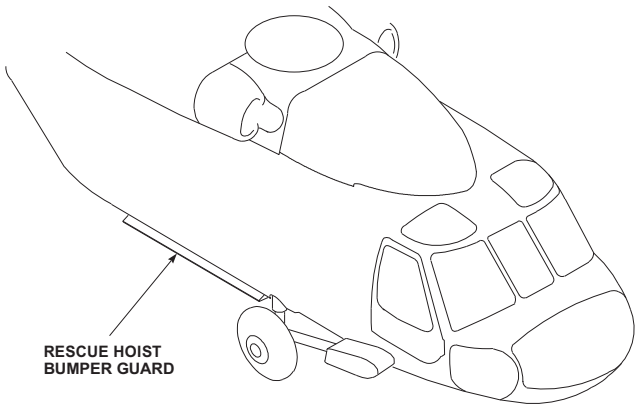
The stabilator vibration absorber is on the tail pylon (Figure 25. (Sheet 2 of 2), Detail B). The vibration absorber dampens stabilator vibrations induced by main rotor blade downwash. The absorber consists of an elastomeric bearing attached to the right stabilator attach fitting.

Roll Vibration Absorber ROLL >

A roll vibration absorber is installed under both left and right drag beam support fairings (Figure 25. (Sheet 2 of 2), Detail C). The absorbers are tuned to reduce roll vibrations. The vibration absorbers consist of a spring, body (mass) bolted to the spring, weights (tuning plates), and support fitting. Each absorber weighs about 21 pounds.

RESCUE HOIST BUMPER GUARD HH-60L >

The rescue hoist bumper guard (bumper guard) is a metal strip installed on the bottom of the cabin airframe (right side). During the rescue hoist operation, the bumper guard prevents the rescue hoist cable from chafing against the helicopter's airframe. The bumper guard also prevents the rescue hoist hook from fastening to the helicopter's airframe (Figure 27).



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Figure 27. Rescue Hoist Bumper Guard HH-60L > .

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

For location and description of major components, refer to the data in this work package.

EQUIPMENT DATA

If applicable, refer to this work package for equipment data information.

LANDING GEAR

LANDING GEAR DESCRIPTION AND DATA

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

LANDING GEAR SYSTEM

The landing gear system consists of two fixed main landing gears, one mounted on each side of the helicopter fuselage midsection, a tail landing gear mounted on lower rear section of tail cone, a wheel and self adjusting brake assembly on each main landing gear, and the landing gear brake system. The landing gear system enables the helicopter to maneuver during ground operations, absorbs landing loads, and insulates the airframe and occupants from shock (Figure 1. (Sheet 1 of 2), Detail A).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

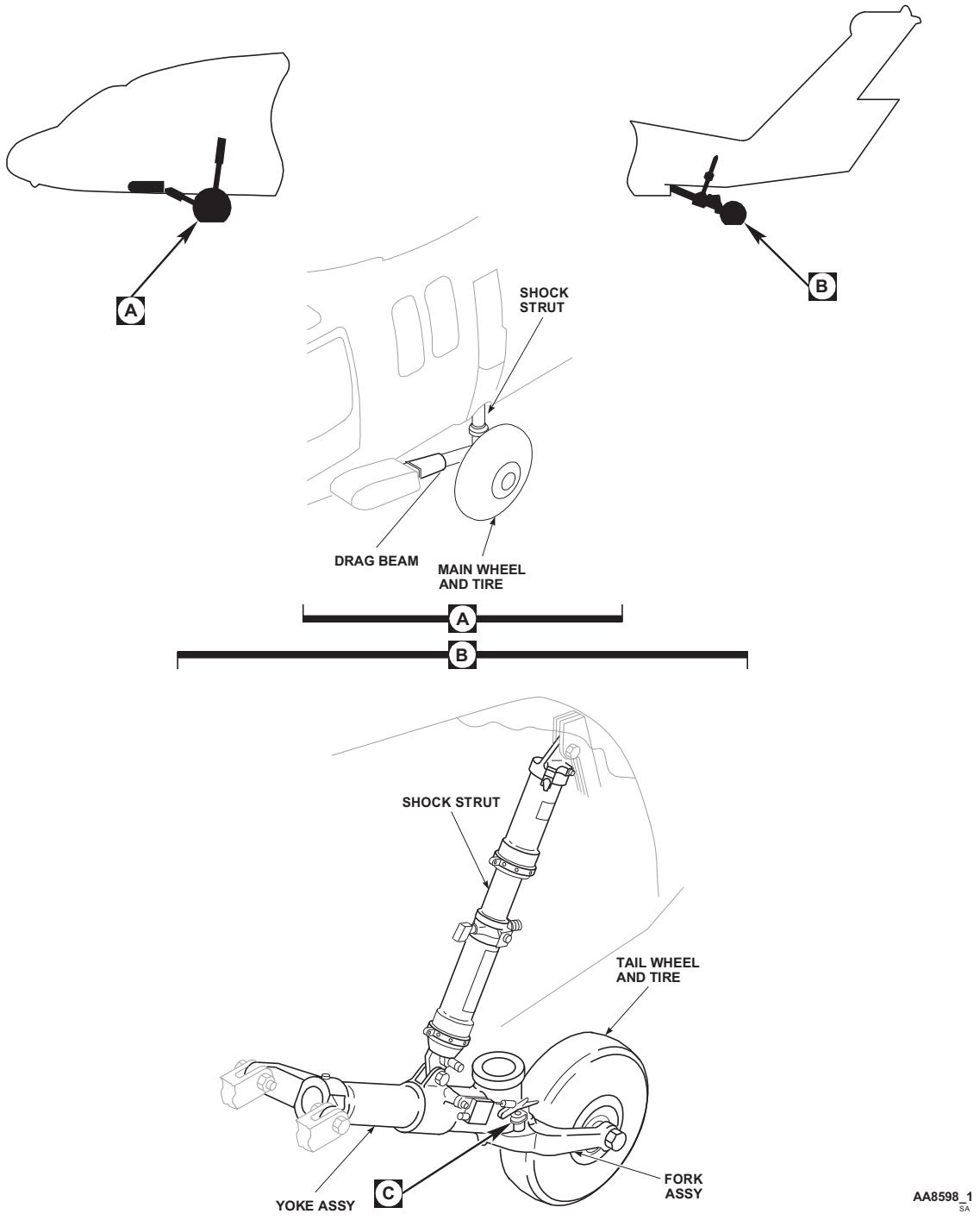


Figure 1. Landing Gear (Sheet 1 of 2).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

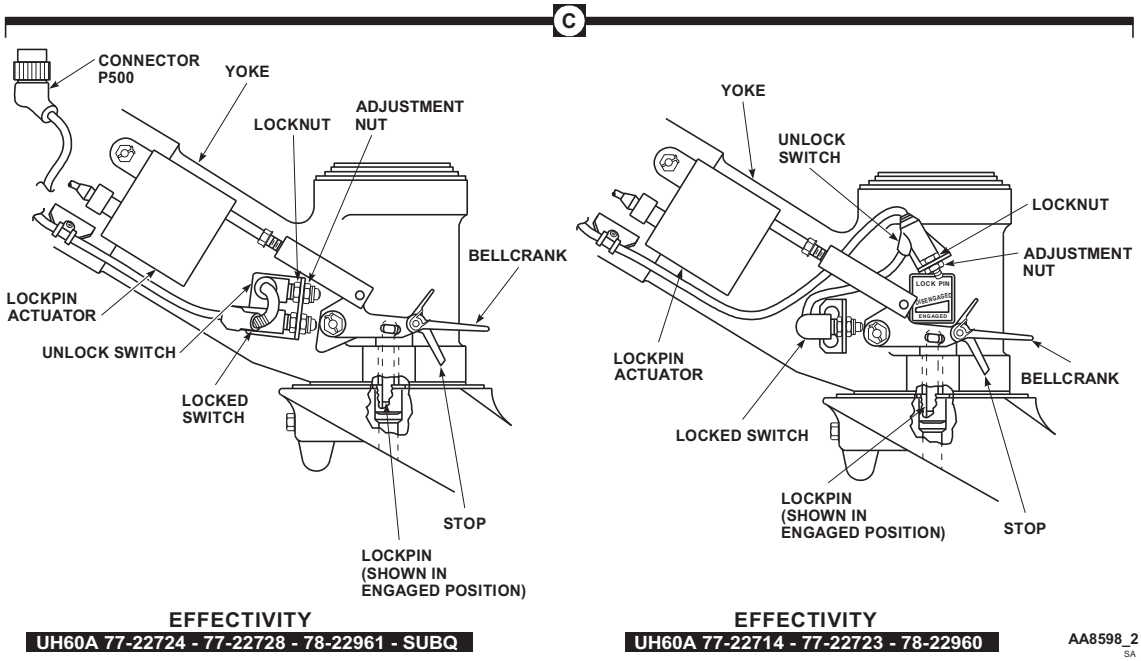


Figure 1. Landing Gear (Sheet 2 of 2).

MAIN LANDING GEAR

A fixed main landing gear, mounted rear of the crew chief/gunner's window on each side of the helicopter fuselage midsection, supports the helicopter while it is on the ground (Figure 1. (Sheet 1 of 2), Detail A). Each main landing gear consists of a shock strut assembly, drag beam and axle assembly, wheel and tire, and hydraulic brake. The shock strut supports the helicopter during ground operations and absorbs impact loads when landing. It consists of two floating pistons, one in the upper cylinder and one in the lower cylinder, which separate nitrogen from hydraulic fluid, and a servicing valve for each floating piston cylinder. The lower cylinder absorbs the normal landing loads. During a hard landing (rate of descent above 600 feet per minute), the upper and lower cylinders work together to absorb the shock, preventing damage to the helicopter. The drag beam and axle is a cylinder attached to the airframe at one end and to the shock strut at the other, which transmits landing loads to the airframe and shock strut, and to which the wheel is attached. Each wheel consists of a 26 x 10.0-11 tubeless tire, a two section wheel rim, bearings, and self-adjusting disc-type brake assembly.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

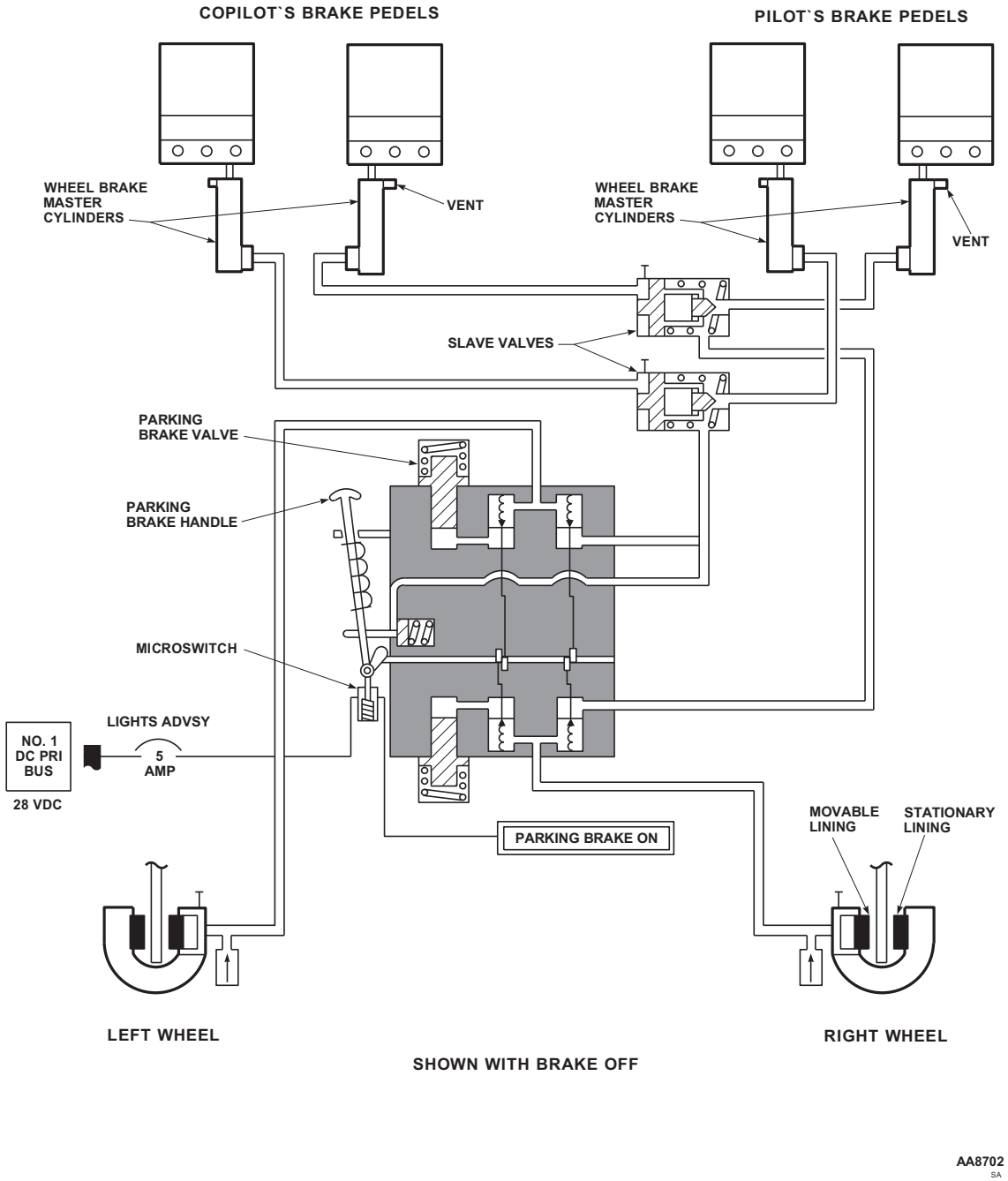


Figure 2. Main Landing Gear Brake System Block Diagram.

BRAKE SYSTEM

This system consists of two brake controls on each pilot's and copilot's directional control pedals, four master cylinders, two slave mixer valves, a parking brake handle, and two wheel brakes (Figure 2). When the pilot's or copilot's brake pedals are pressed, hydraulic pressure builds up in the master cylinder attached to the pedal. The pressurized hydraulic fluid flows from the master cylinder through the slave mixer valves and the parking brake valve below the cockpit floor, to each brake at each main landing gear wheel.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

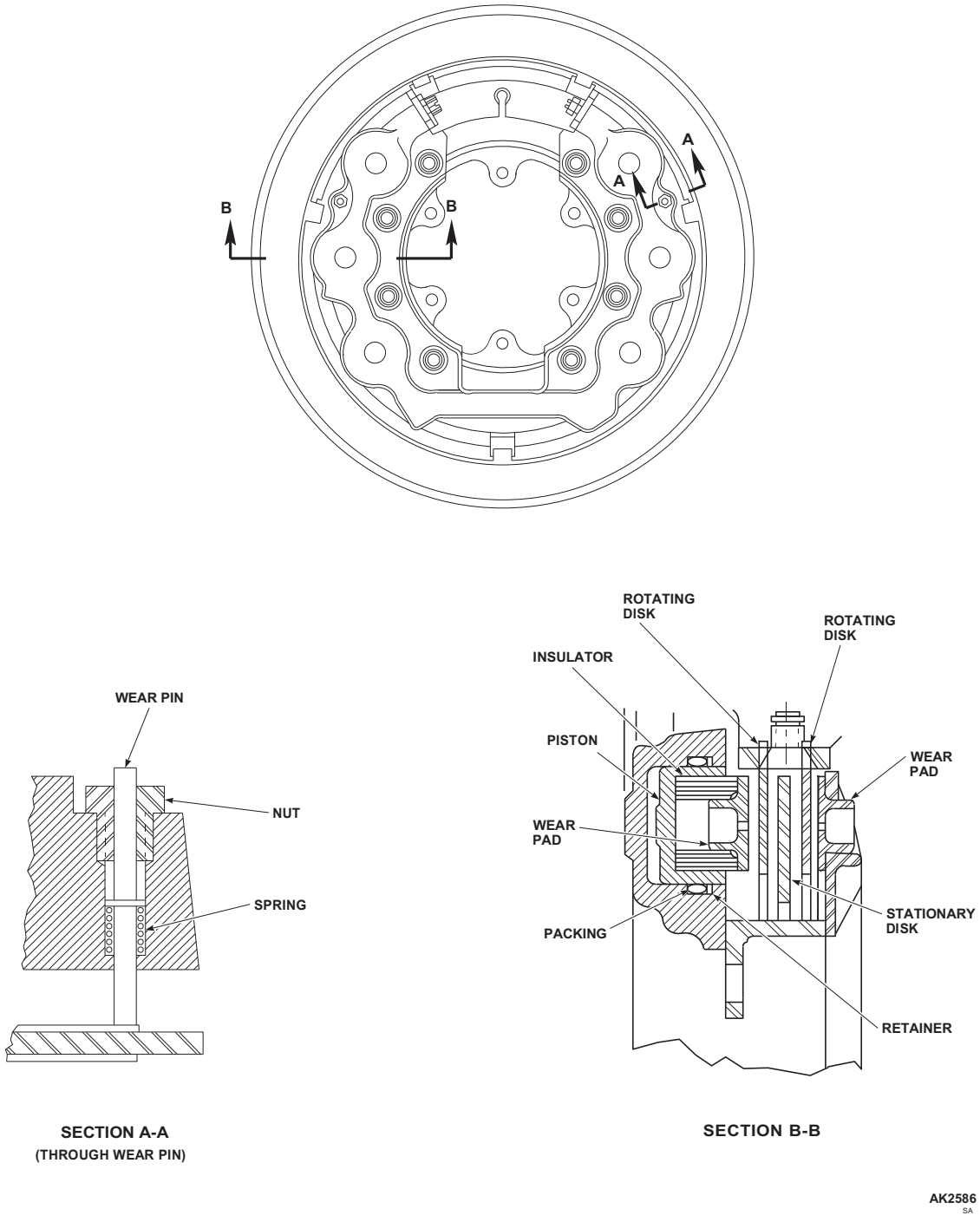


Figure 3. Wheel Brakes - Cutaway.

Parking Brake Valve

The parking brake valve is actuated by a parking brake tee handle on the pilot's side of center console. The valve then traps fluid pressure to the brakes and closes a microswitch, lighting the PARKING BRAKE ON advisory light on the caution/advisory panel. Pressing the brake pedals produces pressure in the master cylinder to actuate the

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

parking brake valve release mechanism and release the parking brake. Thermal compensation is provided in the parking brake valve when the brakes are at PARK, and in the master cylinders when the brakes are OFF.

Wheel Brakes

Both main wheels have a self-adjusting, double disc, three-cavity brake assembly, which includes a visual brake lining wear indicator (Figure 3). The brake consists of two steel rotating discs, brake linings, and a housing that contains the pistons. The discs are key-slotted to engage the drive keys of the main wheel. The disc turns through the throat between the brake housing. Brake linings are fitted into recesses in the housing and pistons. The pistons produce braking action by clamping the discs between the brake linings.

Slave Mixer Valve

The slave mixer valve isolates the pilot and copilot brake line circuits from each other. The valve contains a piston and spring-loaded pin. A bleed plug on the valve allows air to be bled from the brake lines.

Master Brake Cylinder

There are four identical master brake cylinders. Each consists of a cylinder containing a large capacity reservoir. There are also two pistons operating manually in series and in two separate stages. Reservoir and pistons function from the same fluid connection in either flow direction. The first stage operating pressure is 75 psi. The second stage operating pressure is 800 psi. Maximum operating pressure is 1020 psi.

TAIL LANDING GEAR

A fixed tail landing gear, secured to structural attachment fittings in the rear tail cone structure, provides rear support of the helicopter (Figure 1. (Sheet 1 of 2), Detail B). The tail landing gear consists of shock strut, fork assembly, tailwheel lock and actuator, yoke assembly, and wheel and tire. The shock strut supports the helicopter rear structure during ground operations and cushions impact loads when landing. The shock strut is a two-stage air-oil type with two floating pistons separating air from hydraulic fluid, with a servicing valve for each stage. The fork assembly, secured to the yoke assembly, is the attachment point for the tailwheel and allows the wheel to swivel through 360° for ground control. The wheel lock and electrically operated actuator, secured to the yoke assembly, secures the tailwheel in the trailing position when the helicopter is parked or in flight. Two tailwheel lock switches are installed near the tailwheel lockpin. When the pin is locked or unlocked, one of the switches is actuated, giving a cockpit indication as to position of pin. The unlock switch is relocated above the lock switch. The yoke assembly, attached to the tail cone structure and the shock strut, transmits landing loads to the helicopter airframe and shock strut. The wheel, installed in the fork assembly, consists of a 15 x 6.00-6 tube type tire, a 600-6 tube, and a two piece wheel rim and bearings.

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

For location and description of major components, refer to the data in this work package.

EQUIPMENT DATA

If applicable, refer to WP 1646 00, WP 1647 00, WP 1648 00, WP 1649 00, WP 1691 00, and WP 1717 00, for equipment data information.

ENGINE SYSTEM

POWERPLANT DESCRIPTION AND DATA

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

POWERPLANT SYSTEM

The powerplant system consists of two demountable power packages containing the engines, the engine control system, engine starting system, engine anti-ice system, engine overspeed protection system, engine speed trim system, and indicating systems.

DEMOUNTABLE POWER PACKAGE

Two demountable power packages are installed, one on each side of the main transmission. Each power package consists of an engine, a pneumatic (air) starter, drive shaft assembly, fuel and lubrication lines, and a wiring harness. A drive shaft assembly and forward support tube connect the engine to the input gear box module of the main transmission. A power turbine shaft extending through the engine drives the input gear box module. Each power package allows a quick change of engines with all components installed, for ease of maintenance and handling. The demountable power packages, less starters, may be ordered already built up as quick engine change kits, or assembled and disassembled on a buildup stand. The demountable power packages are then installed or removed as complete units (Figure 1).

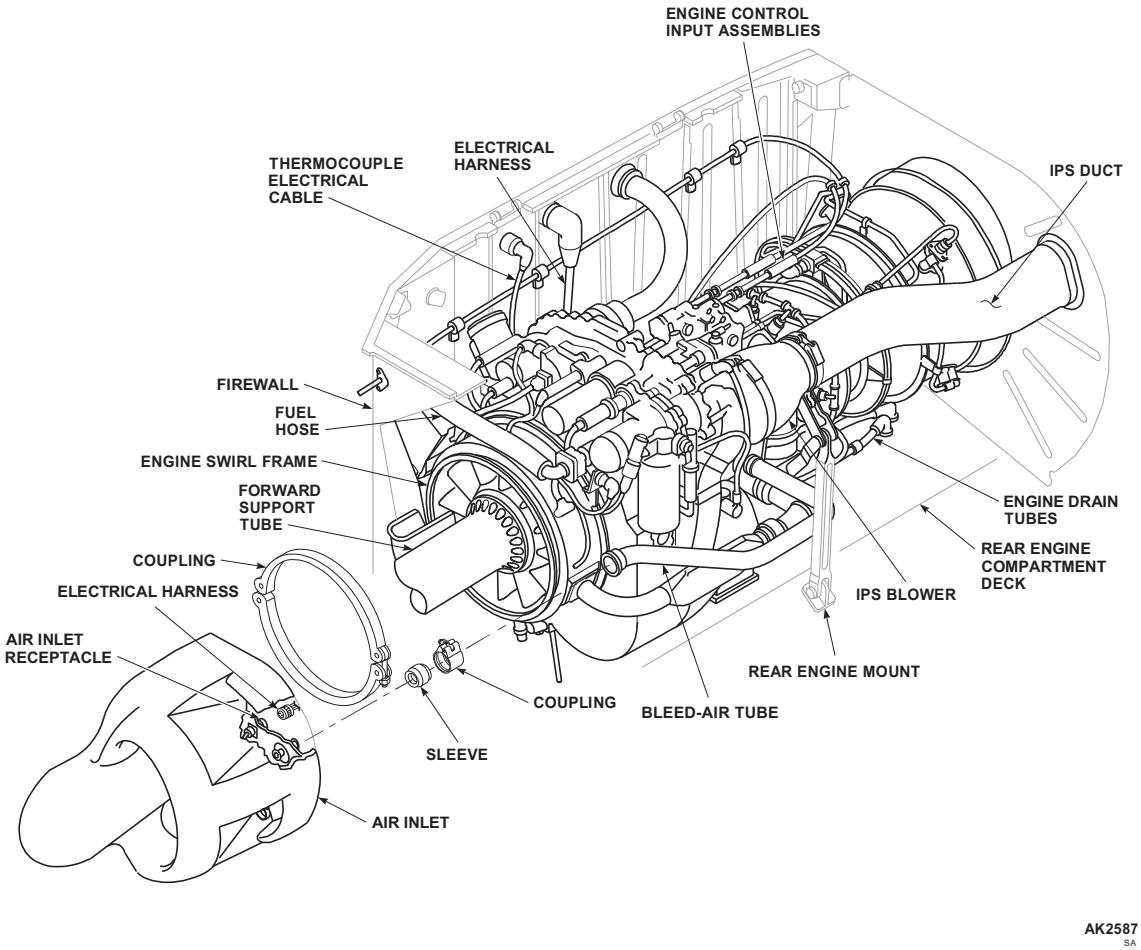


Figure 1. Demountable Power Package.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

ENGINE

UH-60A 70AD ENG MOD AR/TDI> Two General Electric T700-GE-701C turboshaft engines with front drive are used as the primary powerplant (Figure 2. (Sheet 1 of 2) and Figure 3). Refer to Table 1 for basic engine data. Each engine has four modules: cold section, hot section, power turbine section, and accessory section. The engine, with bleed-air capability at the compressor, provides heated air for engine inlet anti-icing and cockpit/cabin heating, and crossbleed engine starting. For a more detailed description of the engine, refer to Engine Maintenance Manual, TM1-2840-248-23&P. <

UH60L HH-60L> <Two General Electric T700-GE-701C turboshaft engines with front drive are used as the primary powerplant (Figure 2. (Sheet 1 of 2) and Figure 3). Refer to Table 2 for basic engine data. Each engine has four modules: cold section, hot section, power turbine section, and accessory section. The engine, with bleed-air capability at the compressor, provides heated air for engine inlet anti-icing and cockpit/cabin heating, and crossbleed engine starting. For a more detailed description of the engine, refer to Engine Maintenance Manual, TM1-2840-248-23&P

UH-60A EH-60A HH-60A > Two General Electric T700-GE-700 turboshaft engines with front drive are used as the primary powerplants (Figure 2. (Sheet 1 of 2)). Refer to Table 3 for basic engine data. Each engine has four modules: cold section, hot section, power turbine section, and accessory section. The engine, with bleed-air capability at the compressor, provides heated air for engine inlet anti-icing and cockpit/cabin heating, and crossbleed engine starting. For a more detailed description of the engine, refer to Engine Maintenance Manual, TM1-2840-248-23&P. <

Table 1. Basic Engine Data, T700-GE-701C UH-60L UH-60A 701D ENG MOD AR/TDI> .

Model	T700-GE-701D
Type of Engine	Turboshaft
Output Power (Intermediate)	1800 SHP at sea level, standard day conditions at 20900 RPM
Type of Compressor	Combined axial/centrifugal
Number of Compressor Stages	6 stages: 5 axial and 1 centrifugal
Variable Geometry	Inlet guide vanes, and stage 1 and 2 stator vanes
Type of Combustion Chamber	Single annular chamber with axial flow
Gas Generator Turbine Stages	2 cooled
Power Turbine Stages	2 uncooled
Direction of Engine Rotation (from rear looking to front)	Clockwise
Engine Weight (Dry)	456 lb max.
Max. Engine Length	47 in.
Max. Engine Diameter	25 in.
Fuel	MIL-T-5624 Grade JP-4, JP-5, or MIL-T-83133 Grade JP-8
Lubricating Oil	MIL-L-23699 or MIL-L-7808
HELICOPTER POWER REQUIREMENTS:	

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

Table 1. Basic Engine Data, T700-GE-701C UH-60L UH-60A 701D ENG MOD AR/TDI> . – Continued

History Counter, and Np overspeed protection	40w, 115 vac, 400 Hz
Anti-icing valve, fuel filter bypass indication, oil filter bypass indication, and magnetic chip detector	1 amp, 28 vdc each

Table 2. Basic Engine Data, T700-GE-701C UH 60-L HH-60L> .

Model	T700-GE-700C
Type of Engine	Turboshaft
Output Power (Intermediate)	1800 SHP at sea level, standard day conditions at 20900 RPM
Type of Compressor	Combined axial/centrifugal
Number of Compressor Stages	6 stages: 5 axial and 1 centrifugal
Variable Geometry	Inlet guide vanes, and stage 1 and 2 stator vanes
Type of Combustion Chamber	Single annular chamber with axial flow
Gas Generator Turbine Stages	2 cooled
Power Turbine Stages	2 uncooled
Direction of Engine Rotation (from rear looking to front)	Clockwise
Engine Weight (Dry)	456 lb max.
Max. Engine Length	47 in.
Max. Engine Diameter	25 in.
Fuel	MIL-T-5624 Grade JP-4, JP-5, or MIL-T-83133 Grade JP-8
Lubricating Oil	MIL-L-23699 or MIL-L-7808
HELICOPTER POWER REQUIREMENTS:	
History Counter, and Np overspeed protection	40w, 115 vac, 400 Hz
Anti-icing valve, fuel filter bypass indication, oil filter bypass indication, and magnetic chip detector	1 amp, 28 vdc each

Table 3. Basic Engine Data, T700-GE-700 UH-60A EH-60A HH-60A> .

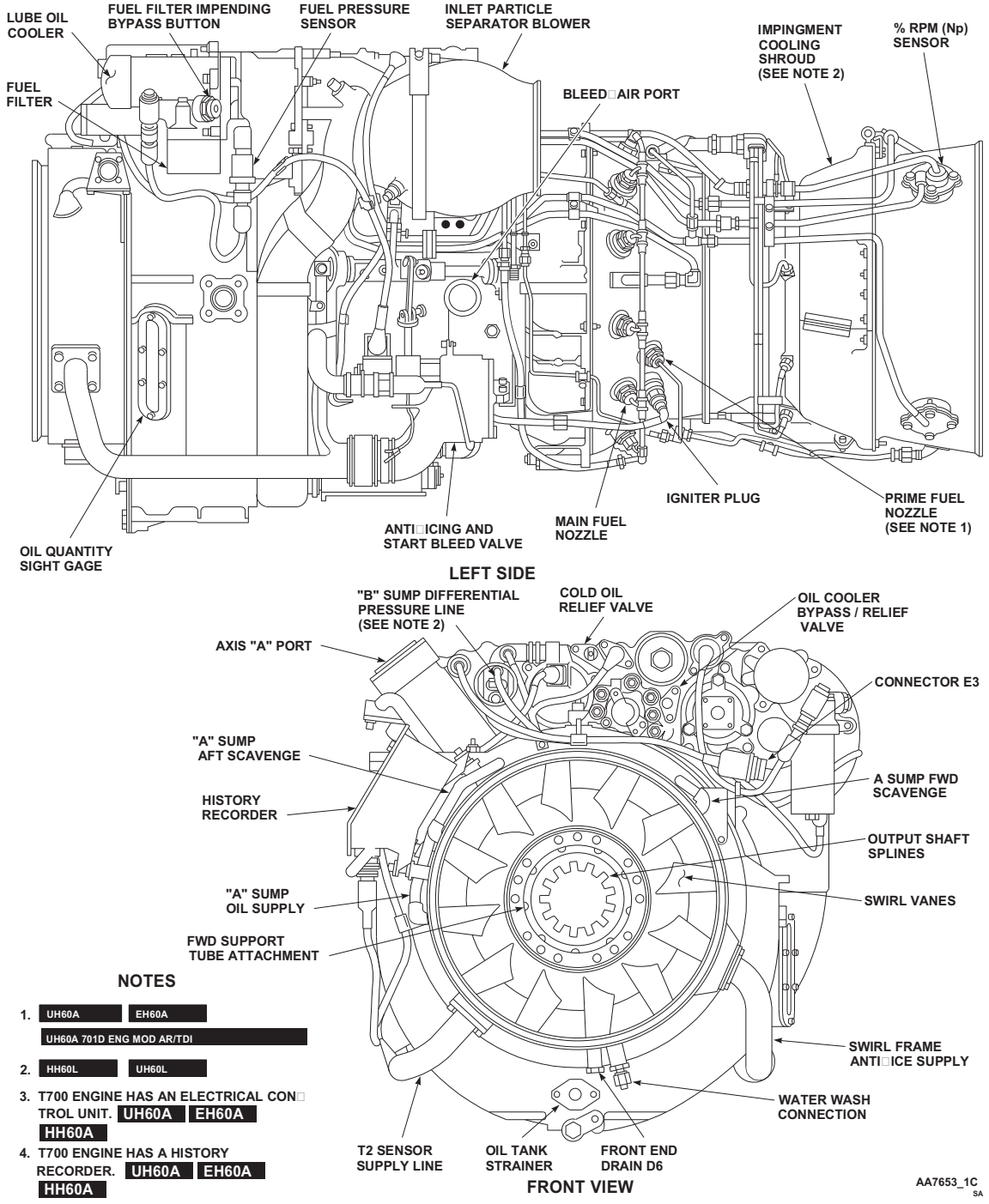
Model	T700-GE-700
Type of Engine	Turboshaft

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

Table 3. Basic Engine Data, T700-GE-700 UH-60A EH-60A HH-60A> . – Continued

Output Power (Intermediate)	1622 SHP at sea level, standard day conditions at 20900 RPM
Type of Compressor	Combined axial/centrifugal
Number of Compressor Stages	6 stages: 5 axial and 1 centrifugal
Variable Geometry	Inlet guide vanes, and stage 1 and 2 stator vanes
Type of Combustion Chamber	Single annular chamber with axial flow
Gas Generator Turbine Stages	2 cooled
Power Turbine Stages	2 uncooled
Direction of Engine Rotation (from rear looking to front)	Clockwise
Engine Weight (Dry)	437 lb max.
Max. Engine Length	47 in.
Max. Engine Diameter	25 in.
Fuel	MIL-T-5624 Grade JP-4, JP-5, or MIL-T-83133 Grade JP-8
Lubricating Oil	MIL-L-23699 or MIL-L-7808
HELICOPTER POWER REQUIREMENTS:	
History Counter, and Np overspeed protection	40w, 115 vac, 400 Hz
Anti-icing valve, fuel filter bypass indication, oil filter bypass indication, and magnetic chip detector	1 amp, 28 vdc each

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED



NOTES

1. UH60A EH60A
   UH60A 701D ENG MOD AR/TDI
2. HH60L UH60L
3. T700 ENGINE HAS AN ELECTRICAL CON TROL UNIT. UH60A EH60A HH60A
4. T700 ENGINE HAS A HISTORY RECORDER. UH60A EH60A HH60A

Figure 2. Engine (Sheet 1 of 2).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

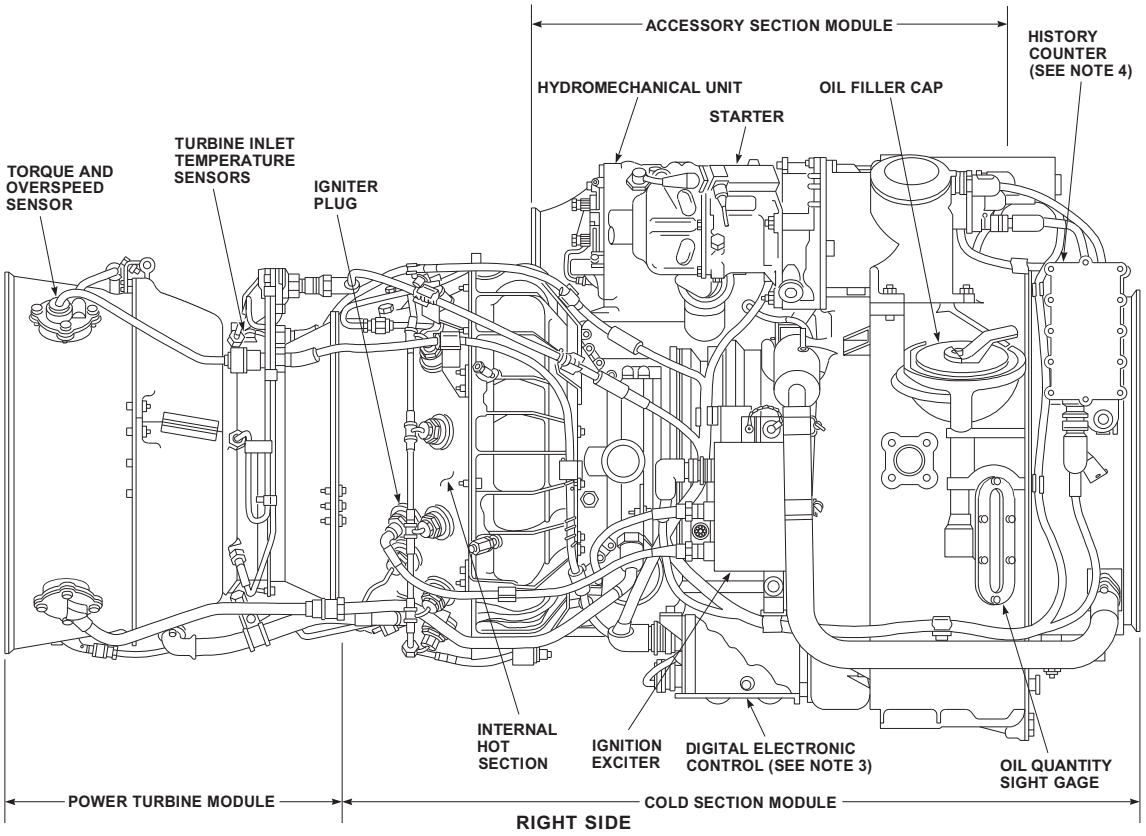


Figure 2. Engine (Sheet 2 of 2).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

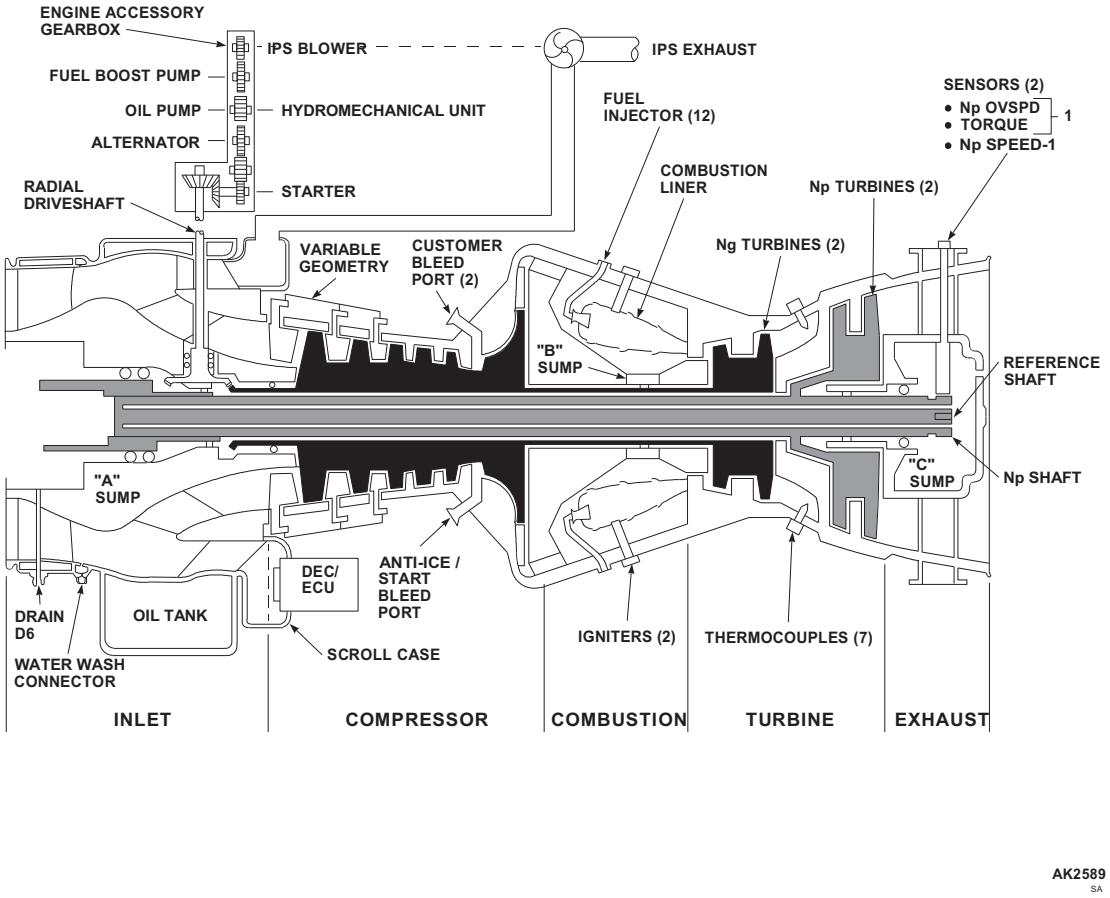


Figure 3. Engine Operation Schematic.

Engine Mounts

Each engine is held in place by front and rear engine mounts. The mounts, parts of the demountable power package, hold the demountable power package to the airframe. Vibrations transmitted from the engine to the fuselage are reduced by the shock-absorbing mounts. The forward mount is bolted to the swirlframe on the engine and the input module of the main transmission. The rear mounts are bolted to the combustion chamber midframe and to the airframe (Figure 4).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

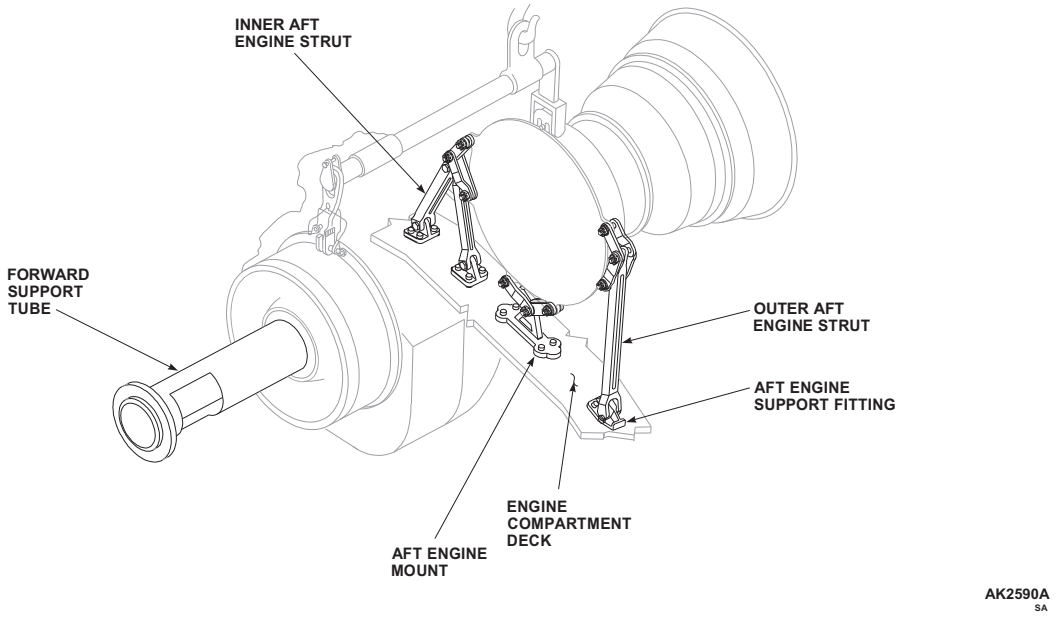


Figure 4. Engine Mounts.

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

For location and description of major components, refer to the data in this work package.

EQUIPMENT DATA

If applicable, refer to WP 1650 00, WP 1651 00, WP 1685 00, WP 1707 00, WP 1740 00, WP 1760 00, WP 1766 00, WP 1770 00, WP 1773 00, andWP 1774 00, for equipment data information.

ENGINE SYSTEM

ENGINE CONTROL SYSTEM DESCRIPTION AND DATA

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

LOAD-DEMAND SYSTEM

The load-demand system supplies a collective pitch signal to the load-demand spindle on the engine hydromechanical fuel control through a push-pull control. The load-demand spindle automatically adjusts the engine gas generator (Ng) speed to a level about equal to the rotor load, thereby reducing transient droop (Figure 1).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

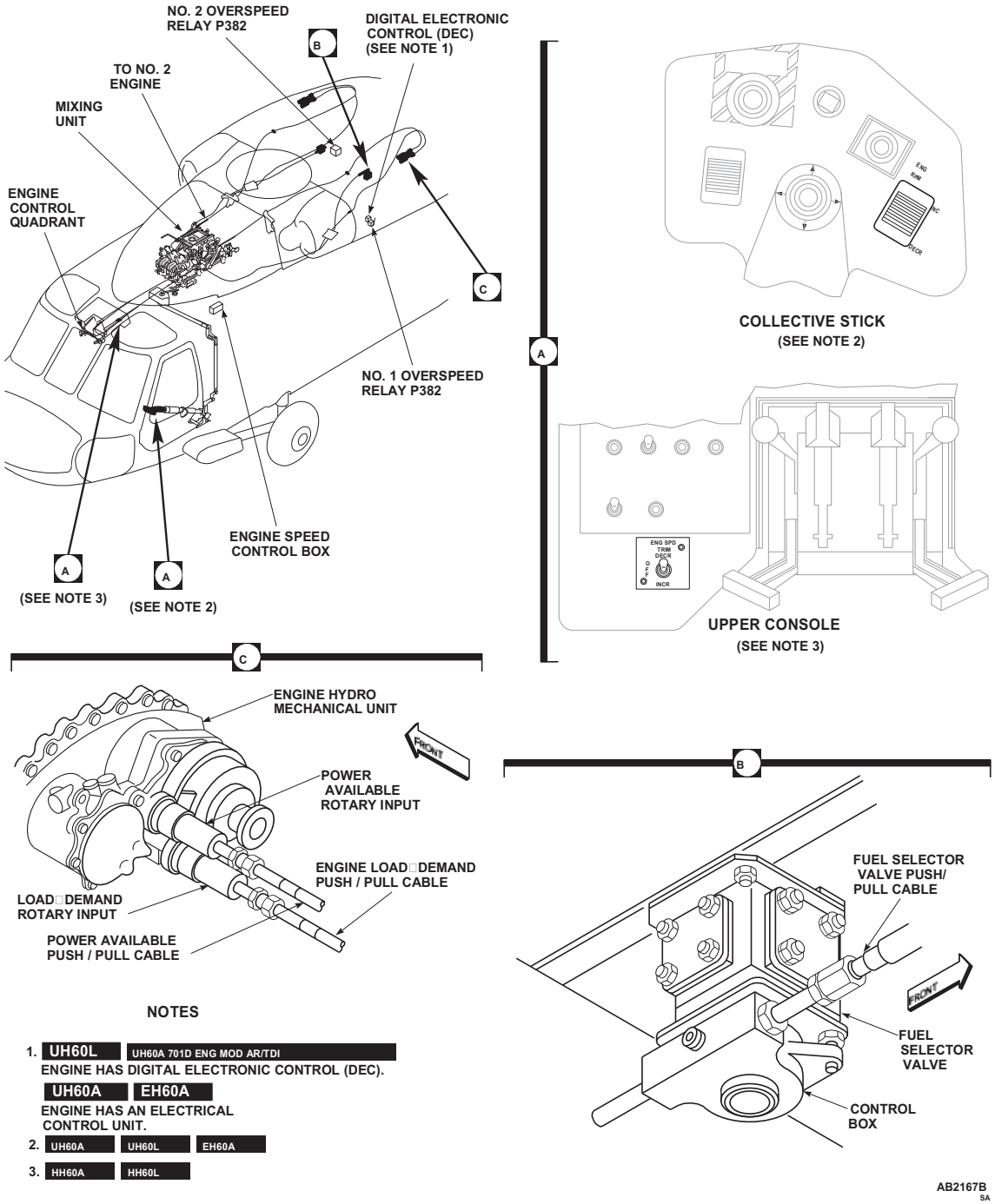


Figure 1. Engine Control System.

UH-60L HH-60L UH-60A 701D ENG MOD AR/TDI > The T700-GE-701C and T700-GE-701D/CC engine provides additional transient droop improvement within the digital electronic control (DEC). A load demand signal from a potentiometer in the collective mixer and rotor speed signal from a magnetic pickup in the input module are both fed to the engine DEC where they are processed to provide better anticipation of load demand, thereby reducing transient rotor droop. **<**

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

POWER CONTROL SYSTEM

The power control system for each engine operates through a engine power control levers on the control quadrant. These levers permit starting and start-aborting. Each lever has four positions OFF, IDLE, FLY and LOCKOUT. The power control lever is connected through a push-pull control to the power-available spindle on the engine fuel control. The spindle can either mechanically stopcock fuel or set permissible gas generator (Ng) speeds for operating between IDLE and FLY. Movement of the power control lever to LOCKOUT mechanically locks out the electrical control unit (ECU) or DEC input into the hydromechanical unit and gives manual control over gas generator (Ng) speed, using the power control lever as a throttle.

SPEED CONTROL SYSTEM

The engine speed control system operates through a motor-driven potentiometer system and the ECU or DEC. When the ENG RPM switch on **EH-60A UH-60A UH-60L >** the collective stick **<** or **HH-60A HH-60L >** upper console **<** is moved to INC or DECR, an electrical signal goes through a potentiometer to the ECU or DEC on the engine. This signal, in turn, electrically adjusts the HMU on each engine increasing or decreasing engine power turbine speed Np (% RPM 1 or 2) and thereby increasing main rotor speed Nr (% RPM RTR) to between 96% and 100%.

UH-60L HH-60L UH-60A 701D ENG MOD AR/TDI > A Nr sensor is added to the left accessory module. The Nr sensor senses main rotor RPM. This signal is sent to both engine's DECs, for engine speed control, and to both SDCs, for instrument displays. **<**

ENGINE CONTROLS QUADRANT

The controls quadrant, centered on the upper console, permits either the pilot or copilot to select engine speed, stopcock fuel, start engine, abort start, and control engine fire extinguisher. Four normally open switches mounted in the quadrant actuate as levers are moved or the start button is pressed. Two lamps are in each fire extinguishing T-handle. The ENG POWER CONT lever positions are marked NUMBER 1 ENGINE and NUMBER 2 ENGINE, and identify the OFF, IDLE, FLY and LOCKOUT positions. They are connected mechanically to each engine's HMU and are used to govern engine speeds. The HMU starts to open whenever the power control level is advanced more than 2° from OFF and increases proportionately with engine speed to FLY. The engine start switch button is in the power control lever handle. The starter and starter override switches are actuated when the start button is pressed. The abort switch, mounted on the power control lever, is opened when the lever is pulled straight down. Each power control lever also includes a secondary stop, which prevents the inadvertent stop-cock of the engine when retarding the levers. The fire extinguishing arming switch is actuated when the fire extinguishing T-handle is pulled to the armed position. Lamps in the fire extinguishing T-handle go on when a fire is detected in the No. 1 or No. 2 engines. The fuel selector levers marked NO 1 ENG FUEL SYS and NO 2 ENG FUEL SYS allow pilot or copilot to select OFF, DIR (direct), or XFD (crossfeed) position for engine fuel supply. T-handles on the outboard side of either fuel selector lever are used to direct the flow of the fire extinguishing agent to either engine compartment. Ball and push-pull cables connect both the power control levers and the fuel selector levers to their components (Figure 2).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

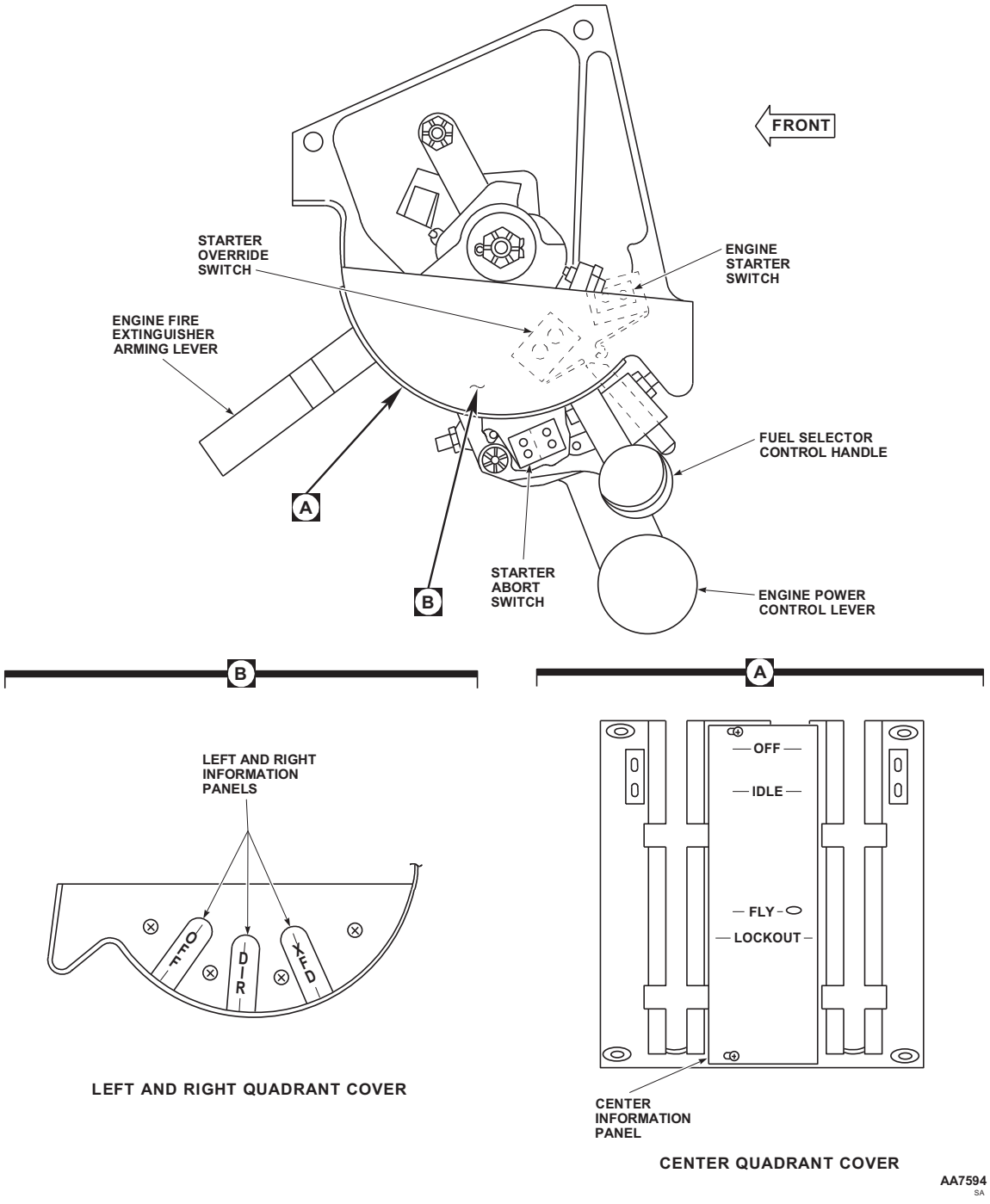


Figure 2. Engine Control Quadrant.

The left, right, and center information panels on the quadrant are illuminated by 400 Hz power from the CONSOLE LT UPPER control on the upper console. For a further description of lighting, refer to console lighting (WP 0035 00).

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

For location and description of major components, refer to the data in this work package.

EQUIPMENT DATA

For equipment data information, refer to this work package.

ENGINE SYSTEM

ENGINE START AND IGNITION SYSTEM DESCRIPTION AND DATA

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

ENGINE START AND IGNITION SYSTEM

The engine start and ignition system contains an electrically controlled pneumatic start system and an electrical capacitive-discharge ignition system. The pneumatics uses compressed air ducted to air turbine starters for engine starting. Compressed air is obtained either from: (1) the APU, (2) engine crossbleed, or (3) an external air supply. The APU has a check valve to control APU bleed-air flow to the starter of either engine. The engine crossbleed has a bleed-air manifold and a combination crossbleed shutoff and check valve for each engine to permit starting the opposite engine. The external air source supplies air through a combination external connector and check valve to either engine. Electrical power for the No. 1 engine start system is obtained from the dc essential bus circuit breaker panel. Electrical power for the No. 2 engine start system is obtained from the No. 2 dc primary bus through the No. 2 ENG START CONTR circuit breaker on the pilot's circuit breaker panel. An ENGINE IGNITION switch, marked ON and OFF, is at the center of the main instrument panel. When it is ON, and when an engine start button is pressed, the capacitor discharge engine ignition system operates. The ignition system is a noncontinuous ac powered, low-voltage system. Ignition is automatically shut off when Ng reaches 52% to 65%. The system consists of an ignition exciter, two igniter plugs, ignition leads, switches, and relays. Electrical power for the ignition system is obtained from the engine-mounted alternator.

ENGINE STARTING

There are three ways to start the engine:

APU. The APU is started, and the AIR SOURCE HEAT/START switch on the upper console is placed to APU. When the starter switch is pressed, the start control valve is opened and its relay is energized. Activation of the start control valve relay also opens the engine prime shutoff valve, closes the APU start bypass valve, and lights the ENGINE STARTER capsule. Opening the start control valve releases compressed air from the APU to the engine start motor. The engine fuel system is primed when the prime shutoff valve is opened. As engine speed increases, the speed sensor pickup produces a signal that activates the starter speed switch, holding the engine start relay in the energized position. When the engine reaches 52% to 65% Ng, the starter speed switch deactivates, closing the engine start control valve, which then closes the prime shutoff valve and turns off the ENGINE STARTER LIGHT capsule.

ENGINE CROSSBLEED. (ONE ENGINE OPERATING). When the AIR SOURCE HEAT/START switch on upper console is placed to ENG, the engine crossbleed valve of the engine operating opens. The crossbleed valve of the engine not operating stays closed to prevent bleed-air from entering and turning the engine compressor in the opposite direction of start. With the ENG POWER CONT lever of the stopped engine at OFF, and the start button on that engine pressed, the start control valve of the engine being started opens. This releases between 27 and 31 psig bleed-air to the engine starter of the stopped engine. Activation of the start control valve opens the engine prime shutoff valve, priming the engine. The ENGINE STARTER capsule on the caution/advisory panel also goes on. As the engine accelerates to between 52% and 65% Ng, the start control valve closes, cutting off bleed-air to the starter. At this point ignition stops, the bleed-air shutoff valve opens, and the ENGINE STARTER capsule goes off. When the start control valve closes, the prime boost pump motor is turned off, the PRIME BOOST PUMP ON light on the caution/advisory panel goes off, and the engine prime shutoff valve closes. Placing the AIR SOURCE HEAT/START switch OFF closes both bleed-air shutoff valves.

EXTERNAL AIR SUPPLY. With the AIR SOURCE HEAT/START switch on the upper console OFF, and an external air supply connected to the helicopter, the engine start and ignition system operates the same as when starting using the APU.

Pressing the starter switch will also automatically turn on the prime boost pump motor, light the PRIME BOOST PUMP ON capsule on the caution/advisory panel, and open the prime shutoff valve on that engine. When the engine starter speed switch stops the ignition sequence, it also closes the prime shutoff valve, turns off the prime boost pump motor, and the PRIME BOOST PUMP ON capsule. Automatic fuel prime to engine will happen no matter what position APU BOOST/FUEL PRIME switch is in.

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

For location and description of major components, refer to the data in this work package.

EQUIPMENT DATA

If applicable, refer to WP 1651 00 for equipment data information.

ENGINE SYSTEM

ENGINE SPEED GOVERNING SYSTEMS DESCRIPTION AND DATA

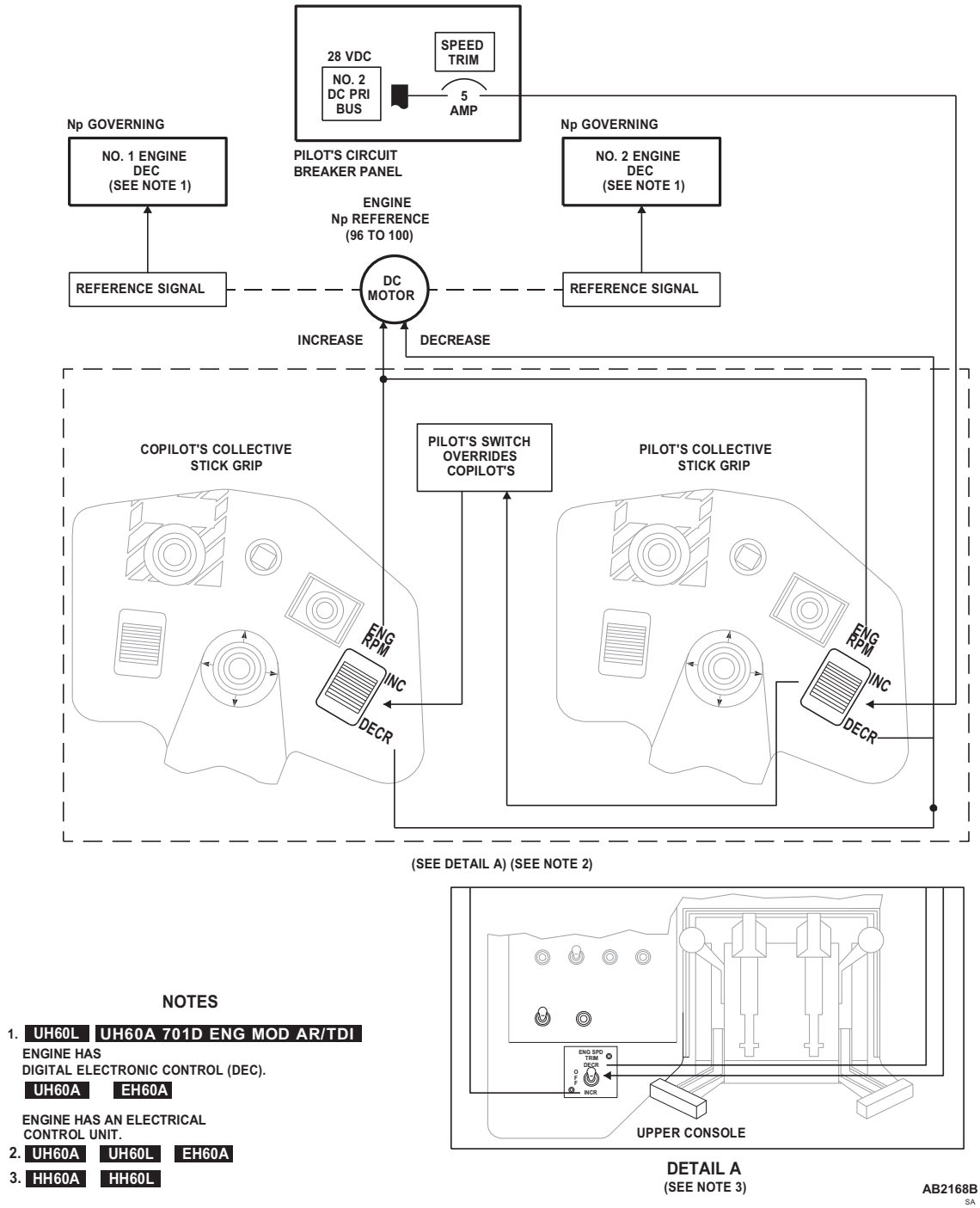
This WP supersedes WP 0008 00, dated 25 September 2009.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

ENGINE SPEED TRIM SYSTEM

EH-60A UH-60A UH-60L > The engine speed trim system consists of two speed trim switches, a pair of potentiometers, and a dc electric motor. The engine speed trim switches on each collective stick grip are used to increase or decrease engine power turbine speed Np (% RPM 1 and 2), thereby increasing main rotor speed Nr (%RPM RTR) to between 96% and 100%. The switches are spring loaded to the center position and marked ENG RPM, with positions INC and DECR. Electrical power for the system is obtained for the No. 2 dc primary bus through the SPEED TRIM circuit breaker on the pilot's circuit breaker panel. The speed trim switches supply power to the dc motor through a gear to two potentiometers (one for each engine). These transmit a signal to each engine's electrical control unit (ECU) or digital electronic control (DEC) that automatically increases or decreases each engine's Np equally and simultaneously. The pilot can override copilot authority any time (Figure 1). **< HH-60A HH-60L >** The engine speed trim system consists of one speed trim switch, a pair of potentiometers, and a dc electric motor. The engine speed trim switch, on the upper console, is used to increase or decrease engine power turbine speed Np (% RPM 1 and 2), thereby increasing main rotor speed Nr (% RPM RTR) to between 96% and 100%. The switch is marked ENG RPM, with positions INC and DECR. Electrical power for the system is obtained for the No. 2 dc primary bus through the SPEED TRIM circuit breaker on the pilot's circuit breaker panel. The speed trim switch supplies power to the dc motor through a gear to two potentiometers (one for each engine). These transmit a signal to each engine's ECU or DEC that automatically increases or decreases each engine's Np equally and simultaneously (Figure 1). **<**

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED



NOTES

1. UH60L UH60A 701D ENG MOD AR/TDI
   ENGINE HAS
   DIGITAL ELECTRONIC CONTROL (DEC).
   UH60A EH60A
   ENGINE HAS AN ELECTRICAL
   CONTROL UNIT.
2. UH60A UH60L EH60A
3. HH60A HH60L

Figure 1. Engine Speed Trim System Block Diagram.

ENGINE OVERSPEED PROTECTION SYSTEM

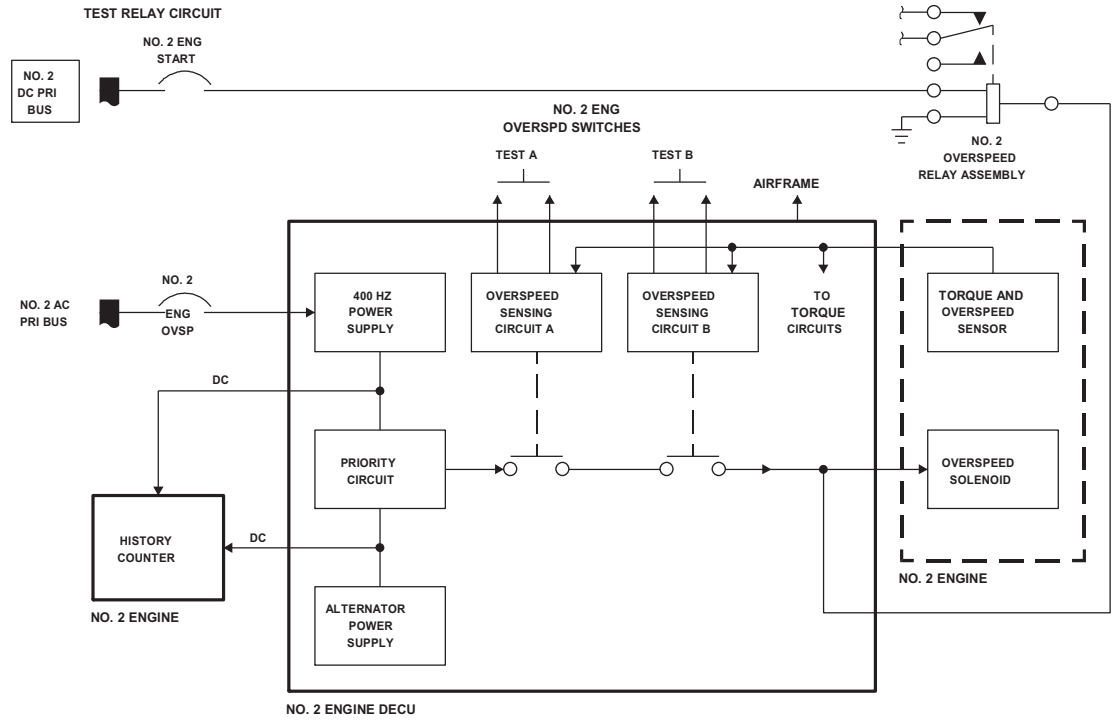
The engine overspeed protection system prevents destructive overspeed of the power turbine. The system is controlled by the engine-mounted ECU or DEC. Two identical electrical pickups mounted on the turbine section of

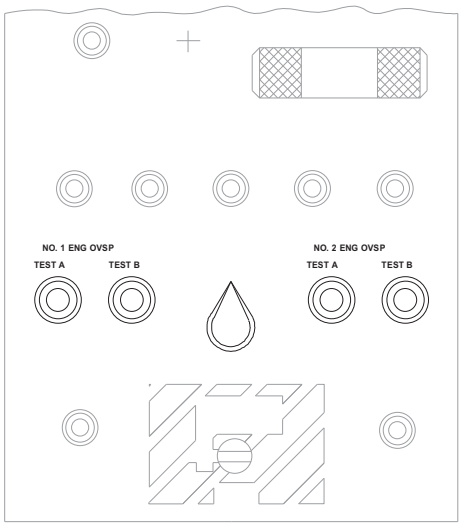
EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

the engine sense power turbine speed and torque. One pickup senses basic power turbine speed control and cockpit speed indication. The other pickup senses power turbine torque and provides a speed signal to the Np overspeed limiter in the ECU or DEC. When the Np overspeed limiter senses an overspeed signal, the fuel flow is either cut back by the POU (T700), or shutoff by the ODV (T701, T701C, T701D). **UH-60L HH-60L >** The system is set to operate at 120% Np (% RPM 1 or 2) and result in a fuel flow shutoff, by the overspeed protection relay, causing engine flameout. When % RPM is reduced, fuel flow is returned to the engine and engine ignition will remain on for an additional 5 seconds to allow for engine restart. The overspeed protection system is also used as a hot start prevention system. The DEC senses the hot start condition and sends a signal to the engine overspeed protection relay setting that system in operation. **< UH-60A EH-60A HH-60A >** The system is set to operate at 106% Np (% RPM 1 or 2) and will result in an initial reduction and eventual cycling of both Ng and Np until the cause of the overspeed is removed. Since the engine has been set at 100% Np, the result is an overspeed signal to the pressurizing and overspeed unit. **<**

The engine overspeed test buttons on the upper console marked TEST A and TEST B, under the headings NO. 1 ENG OVSP and NO. 2 ENG OVSP, permit checkout of overspeed circuits to verify correct operation. The overspeed checkout system permits circuits A and B to be checked, thereby avoiding in-flight overspeed signals. **UH-60L HH-60L >** The overspeed test buttons, when pressed individually, also suppress/redisplay DEC diagnostic codes on the PDU, and override the automatic hot start prevention system. **<**

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED





UPPER CONSOLE PANEL

EFFECTIVITY

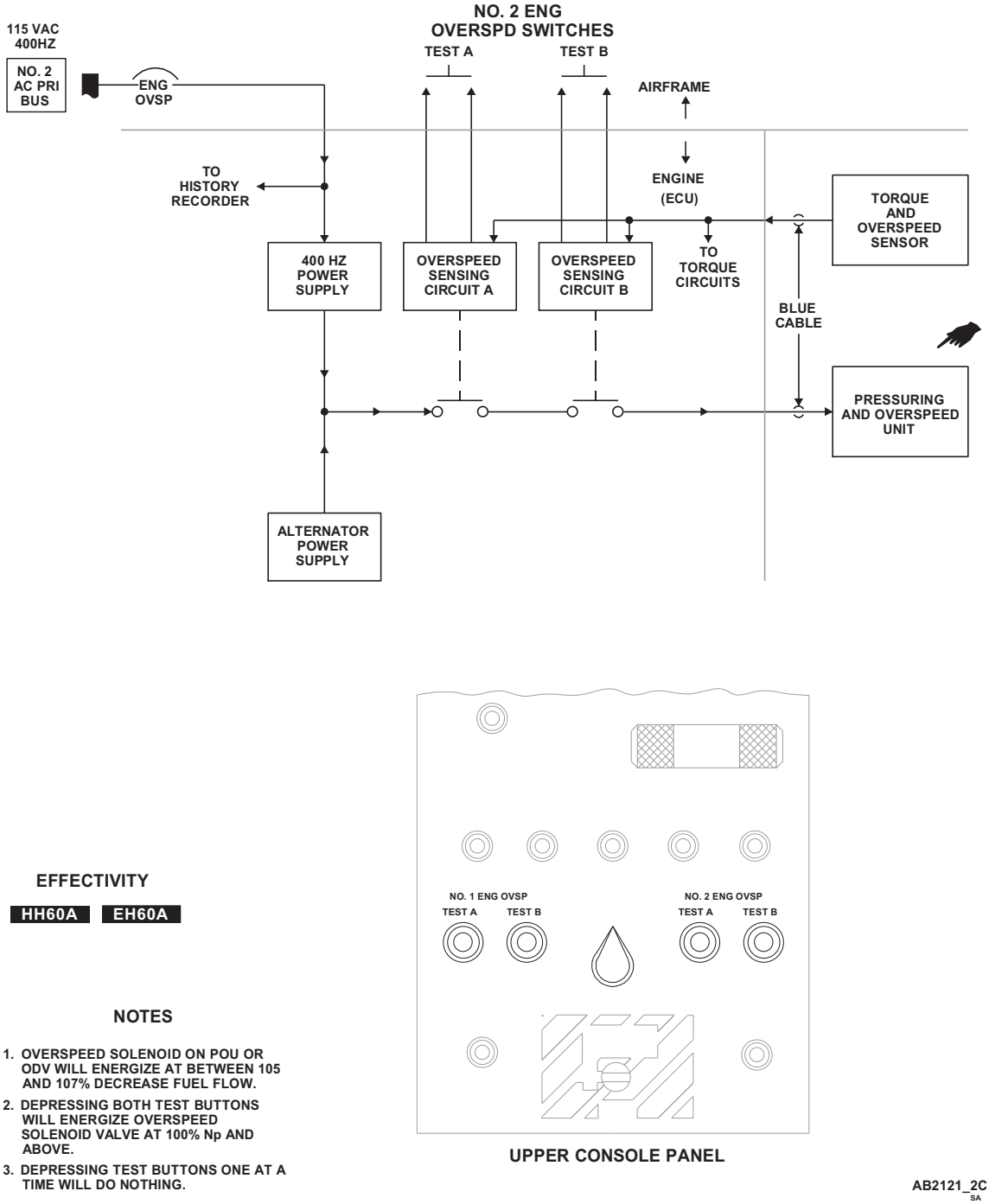
UH60A 701D ENG MOD AR/TDI

HH60L UH60L

AB2121_1A_SA

Figure 2. Engine Overspeed System. (Sheet 1 of 2).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED



EFFECTIVITY

HH60A **EH60A**

NOTES

1. OVERSPEED SOLENOID ON POU OR ODV WILL ENERGIZE AT BETWEEN 105 AND 107% DECREASE FUEL FLOW.
2. DEPRESSING BOTH TEST BUTTONS WILL ENERGIZE OVERSPEED SOLENOID VALVE AT 100% Np AND ABOVE.
3. DEPRESSING TEST BUTTONS ONE AT A TIME WILL DO NOTHING.

Figure 2. Engine Overspeed System. (Sheet 2 of 2).

The engines are at 100% Np. When test switch B is actuated, and if test circuit A is working correctly, no change in either Np or Ng will result. Similarly with test circuit B. **UH-60L HH-60L >** When both switches A and B are closed simultaneously, an overspeed condition is sensed by the DEC and a signal is sent to the engine overspeed relays causing a shutoff of fuel flow to the engine. When the switches are released, the engine will restart and climb back to 100% Np (Figure 2. (Sheet 1 of 2)). **< UH-60A EH-60A HH-60A >** When both switches A and B are closed si-

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

multaneously, the overspeed reference signal is reduced from the normal 106% Np to 100%Np. Since the engine has been set at 100% Np, the result is an overspeed signal to the pressurizing and overspeed unit. The engine will then experience Np and Ng cycling with 2% Np and 1% Ng variations. Power for the engine overspeed protection system is normally supplied by the engine alternator. Redundant power for the No. 1 engine overspeed protection system is supplied by the No. 1 primary ac bus through the NO. 1 ENG OVSP circuit breaker on the copilot's circuit breaker panel. Redundant power for No. 2 engine overspeed protection system is supplied by the No. 2 primary ac bus through the NO. 2 ENG OVSP circuit breaker on the pilot's circuit breaker panel (Figure 2. (Sheet 2 of 2)). <

UH-60L HH-60L > A collective stick position sensor is added, located on the mixer assembly. The collective stick sensor converts collective stick position to a corresponding electrical signal, which is sent to the engine's DEC for engine speed trim adjustments (positive droop control). <

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

For location and description of major components, refer to the data in this work package.

EQUIPMENT DATA

For equipment data information, refer to this work package.

ENGINE SYSTEM

ENGINE INDICATING SYSTEMS DESCRIPTION AND DATA

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

ENGINE INDICATING SYSTEMS

The engine indicating systems consist of the power turbine gas temperature (TGT), oil temperature, oil pressure, engine torque, power turbine/rotor speed, and gas generator (Ng) speed indicating systems (Figure 1. (Sheet 1 of 2)). Power for the No. 1 engine indicating systems is supplied by the No. 1 DC PRI BUS and No. 1 AC PRI BUS through the No. 1 DC INSTR and No. 1 AC INSTR circuit breakers. Power for the No. 2 engine indicating systems is supplied by the No. 2 DC PRI BUS and No. 2 AC PRI BUS through the No. 2 DC INSTR and No. 2 AC INSTR circuit breakers. All engine instruments are part of the instrument display system. For a complete description of this system, refer to WP 0022 00.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

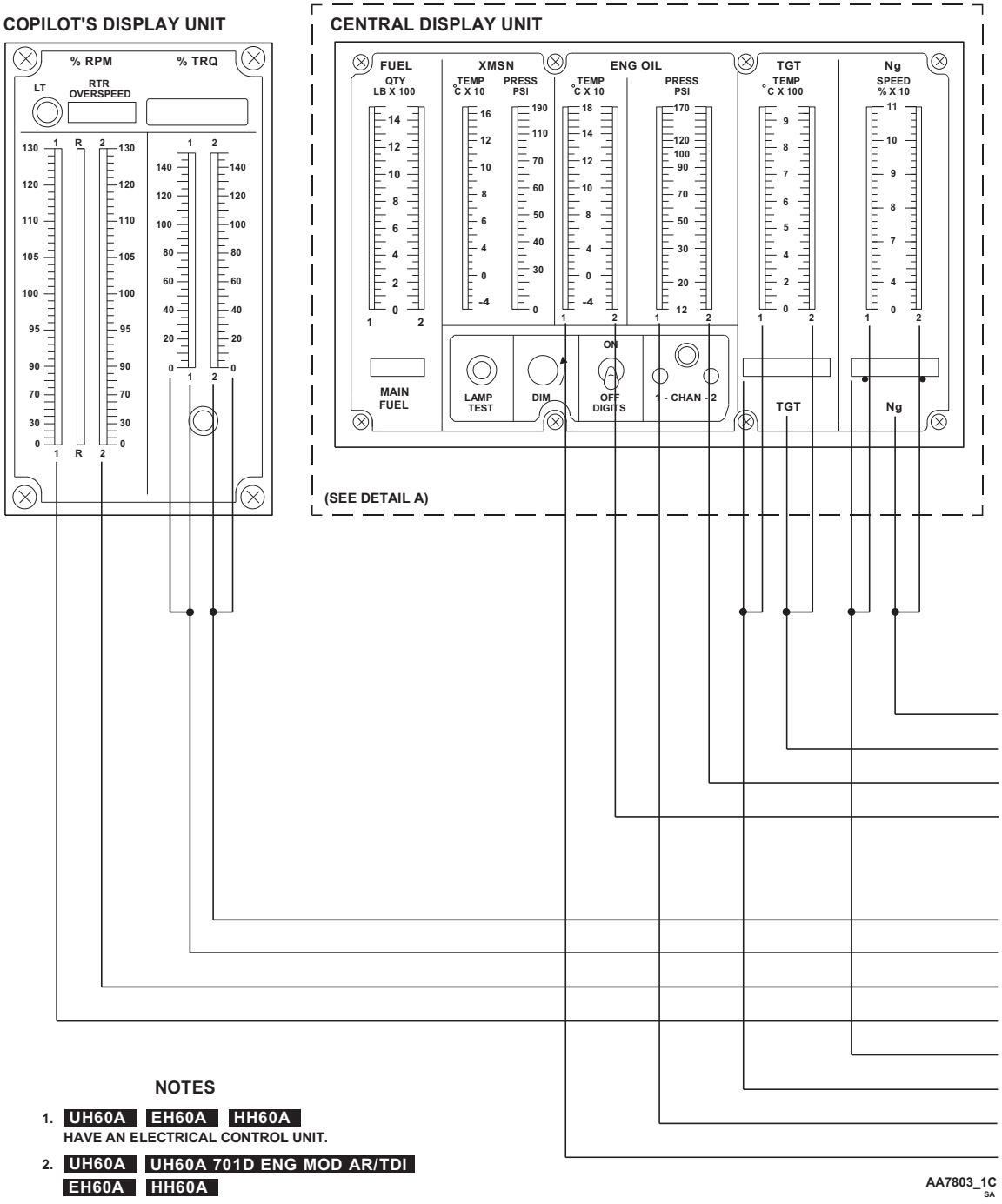


Figure 1. Engine Indicating Systems Block Diagram (Sheet 1 of 2).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

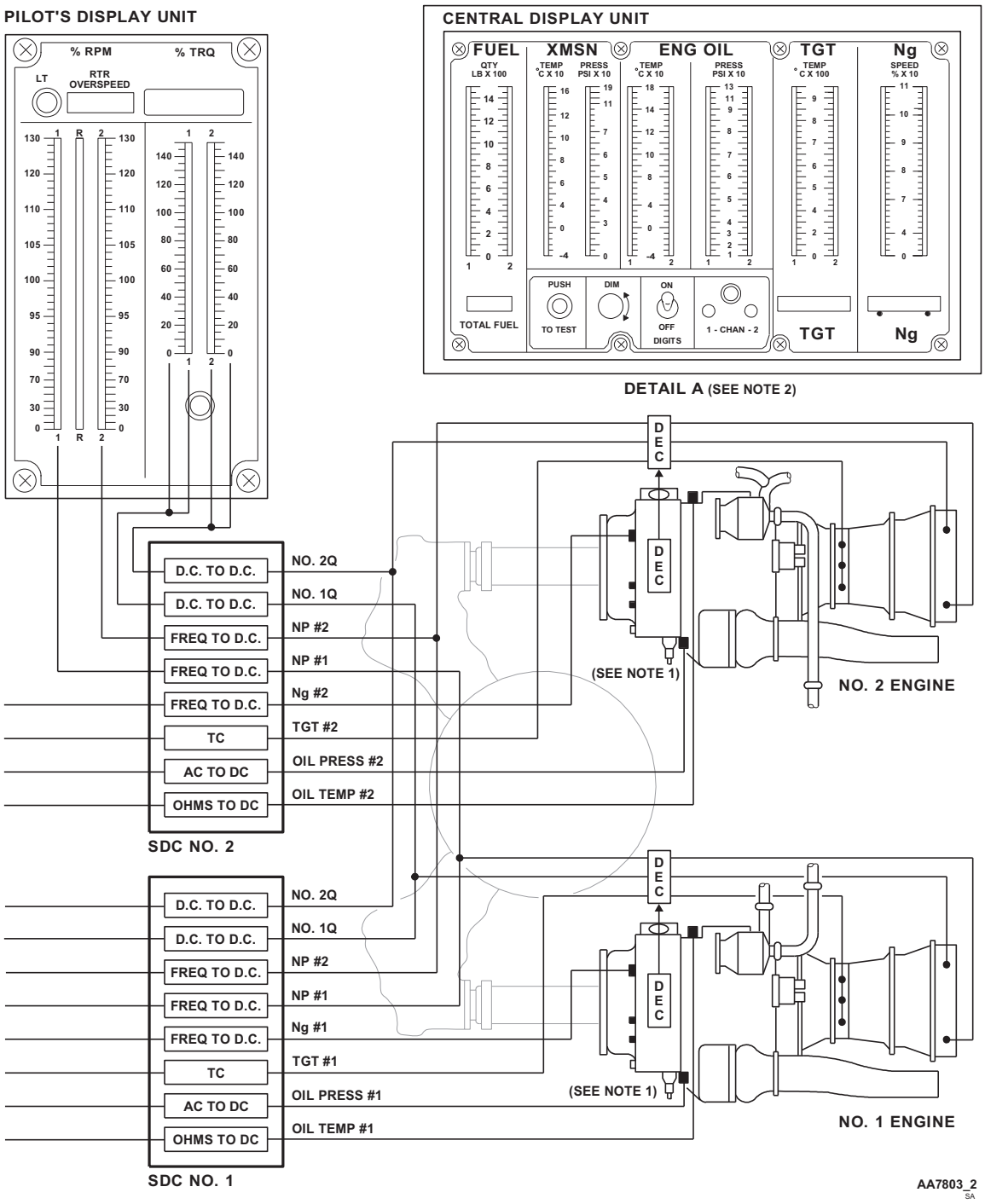


Figure 1. Engine Indicating Systems Block Diagram (Sheet 2 of 2).

POWER TURBINE GAS TEMPERATURE INDICATING SYSTEM

The power turbine gas temperature (TGT) indicating system consists of a vertical scale indicator, seven thermocouples, and a harness. The harness is mounted on the power turbine module. The thermocouples are connected in parallel to provide an electrical output of the temperature sensed by the individual thermocouples. One vertical scale indicator and one digital indicator for each engine is on the instrument panel central display unit

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

under the heading marked TGT TEMP. The scale has a range of 0°C to 950°C. UH-60L HH-60L > The normal range is 0°C to 810°C. UH60A UH60L EH60A HH60A HH60L 701D ENG MOD AR/TDI> The normal range is 0°C to 775°C. <

OIL TEMPERATURE INDICATING SYSTEM

The engine oil temperature indicating system consists of a temperature bulb in each engine and vertical scale indicators on the instrument panel. The ENG OIL TEMP indicators, one for each engine, are on the instrument panel central display unit and have a range of -50°C to 180°C. Highest normal oil temperature operating limit is 135°C.

OIL PRESSURE INDICATING SYSTEM

The engine oil pressure indicating system consists of a pressure switch in each engine and vertical scale indicators on the instrument panel central display unit, one for each engine, under the marked heading ENG OIL PRESS. UH-60L HH-60L > The scale has a range of 12 - 170 psi. The normal range is 26 - 100 psi. UH-60A EH-60A HH-60A > The scale has a range of 10 - 130 psi. UH60A 701D ENG MOD AR/TDI> The normal range is 40 - 100 psi. <

ENGINE TORQUE INDICATING SYSTEM

The engine torque indicating system consists of vertical scale indicators on the pilot's and copilot's display units and a torque sensor on each power turbine drive shaft. The torque indicating system shows the amount of power the engine is supplying to the main transmission by measuring the twist of the shaft. Each indicator is marked: %TRQ. The scale has a range of 0% to 150% torque. Normal range is 0% to 100%.

POWER TURBINE/ROTOR SPEED INDICATING SYSTEM

Power turbine and rotor speed are indicated for each engine on a single, vertical scale instrument with two scales. This is mounted on the pilot's and copilot's central display unit. Power turbine speed is indicated in percentage Np, and rotor speed in percent Nr. Power turbine speed system consists of electrical sensors on each engine drive shaft, and vertical scale indicators marked % RPM 1 and 2. The power turbine speed indicator scale is 0 to 130% RPM. Normal range is 96% to 101%. The rotor speed indicating system consists of a speed sense pickup on the rear of the right accessory input module, and a vertical scale indicator marked R. The rotor speed indicator scale is 0%- 130% RPM. Normal range is 96% - 101%.

GAS GENERATOR SPEED INDICATING SYSTEM

The gas generator speed indicating system consists of an electrical signal from the alternator on the engine gear box and a vertical scale indicator marked Ng SPEED on the central display unit. The scale has a range of 0% - 110%. Normal range is 0% - 102%.

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

For location and description of major components, refer to the data in this work package.

EQUIPMENT DATA

For equipment data information, refer to this work package.

ENGINE SYSTEM

ENGINE WARNING SYSTEMS DESCRIPTION AND DATA

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

GAS GENERATOR SPEED INDICATING SYSTEM

The gas generator speed indicating system consists of an electrical signal from the alternator on the engine gear box and a vertical scale indicator marked Ng SPEED on the central display unit. The scale has a range of 0% - 110%. Normal range is 0% - 102%.

ENGINE WARNING SYSTEMS

The engine warning systems consist of the fuel pressure, fuel filter bypass, oil pressure, oil temperature, oil filter bypass, chip detection, and starter warning system (Figure 1. (Sheet 1 of 2)).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

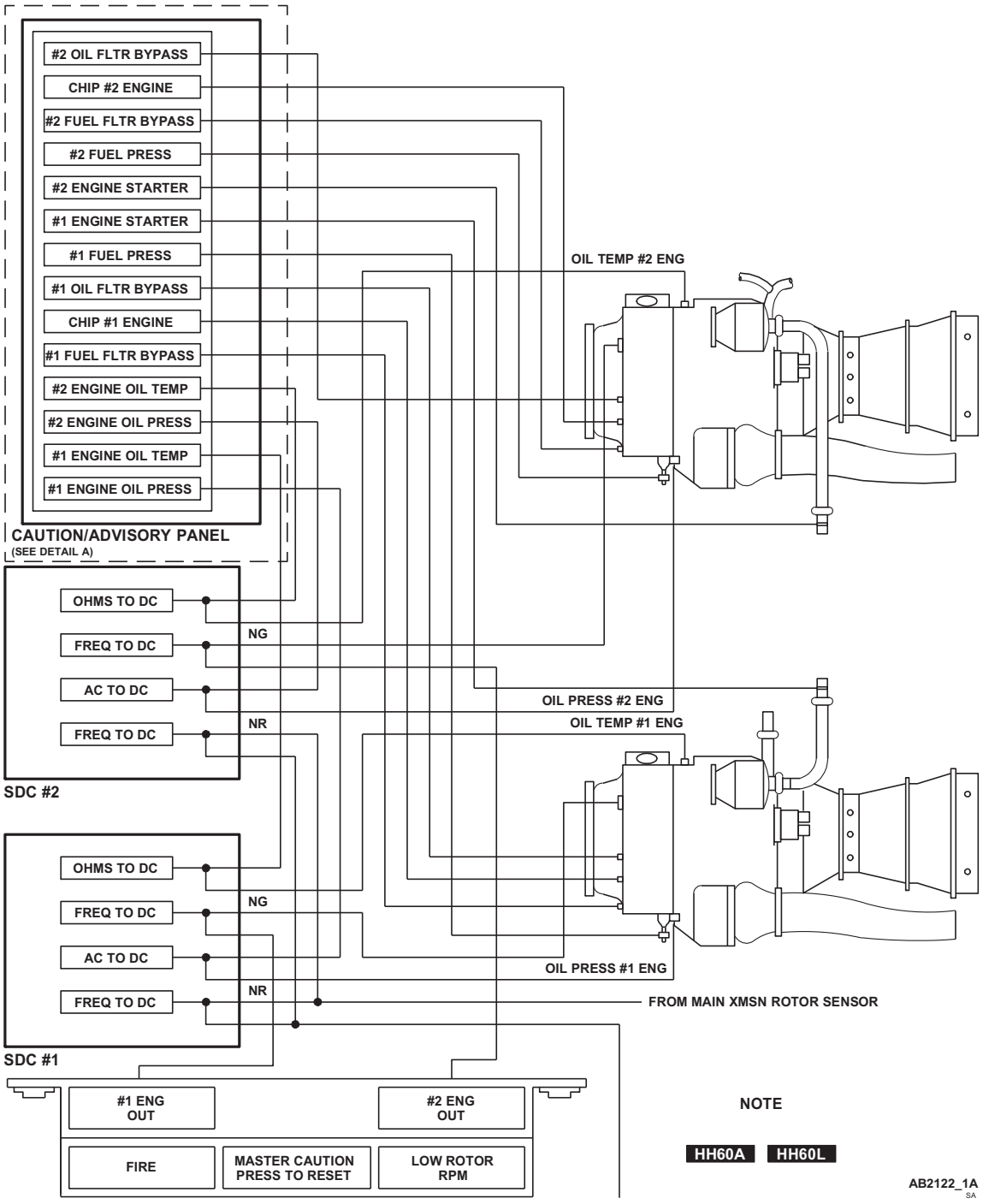


Figure 1. Engine Warning Systems Block Diagram (Sheet 1 of 2).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

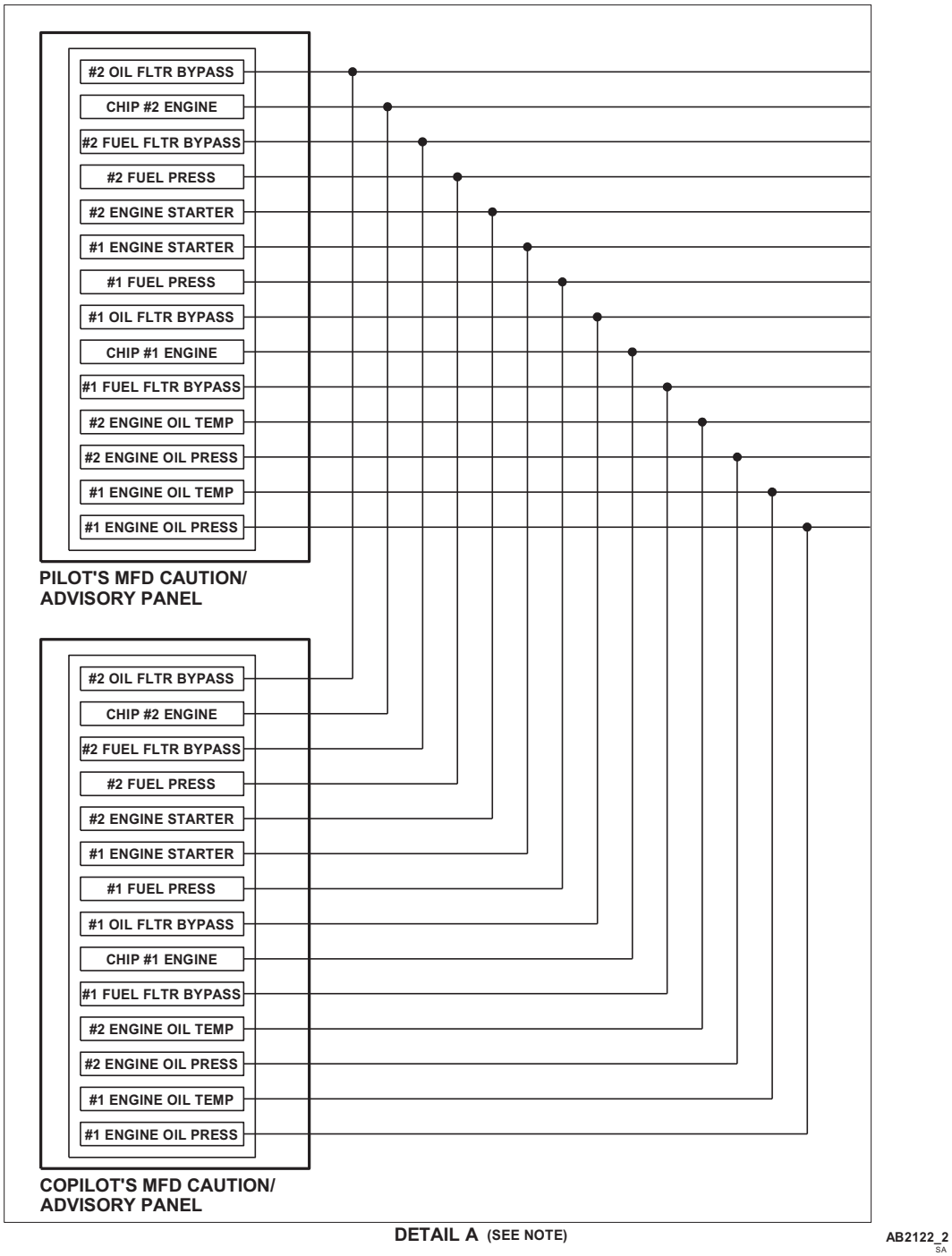


Figure 1. Engine Warning Systems Block Diagram (Sheet 2 of 2).

Fuel Pressure Warning System

The engine fuel pressure warning system for each engine consists of a pressure switch that turns on the caution lights at a decreasing pressure of between 8 and 9 psi. The pressure switch is connected to the fuel line between the engine-driven fuel boost pump and the hydromechanical unit (HMU) high-pressure pump. This visually indicates a possible malfunction in the engine-driven fuel boost pump or an air leak in the fuel system. Nor-

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

mal discharge pressure of fuel boost pump is not less than 30 psi at full power. The No. 1 and No. 2 engine fuel pressure caution capsules, marked #1 FUEL PRESS and #2 FUEL PRESS, on the instrument panel caution/advisory panel, HH-60L HH-60A > pilot's and copilot's multifunction display panels, < light when fuel pressure drops below 8 to 9 psi. Power for the No. 1 engine fuel pressure warning system is supplied by the No. 1 primary dc bus through the NO. 1 ENG WARN LTS circuit breaker on the copilot's circuit breaker panel. Power for the No. 2 engine fuel pressure warning system is supplied by the No. 2 primary dc bus through the NO. 2 ENG WARN LTS circuit breaker on pilot's circuit breaker panel.

Fuel Filter Bypass Warning System

The engine fuel filter bypass warning system for each engine consists of an electrical switch, impending bypass popout button, and caution lights. The button is mounted on the fuel filter assembly at the front left side of the engine accessory gear box. It is displayed when fuel pressure at the filter reaches 8 - 10 psi. The electrical switch, an integral part of the fuel filter assembly, visually indicates in the cockpit that fuel is bypassing the fuel filter. The caution capsules, marked #1 FUEL FLTR BYPASS and #2 FUEL FLTR BYPASS on the instrument panel caution/advisory panel, HH-60L HH-60A > pilot's and copilot's multifunction display panels, < go on when the fuel filter bypass valve opens at not less than 8 psi. Power for the No. 1 engine fuel filter bypass warning system is supplied by the No. 1 primary dc bus through the NO. 1 ENG WARN LTS circuit breaker on copilot's circuit breaker panel. Power for the No. 2 engine fuel filter bypass warning system is supplied by the No. 2 primary dc bus through the NO. 2 ENG WARN LTS circuit breaker on the pilot's circuit breaker panel.

Oil Pressure Warning System

The engine oil pressure warning system for each engine consists of a pressure switch and caution lights. The switch, connected to the engine main frame, lets you know when oil pressure is low. The caution capsules, marked #1 ENGINE OIL PRESS AND #2 ENGINE OIL PRESS on the caution/advisory panel, HH-60L HH-60A > pilot's and copilot's multifunction display panels, < light when oil pressure is below 25 psi. Power for the No. 1 engine oil pressure warning system is supplied by the No. 1 primary dc bus through the NO. 1 DC INST circuit breaker on copilot's circuit breaker panel. Power for the No. 2 engine oil pressure warning system is supplied by the No. 2 primary dc bus through the NO. 2 DC INST circuit breaker on the pilot's circuit breaker panel.

Oil Temperature Warning System

The engine oil temperature warning system for each engine consists of a temperature sensing bulb and caution lights. The bulb connected to the engine main frame, tells you when oil temperature is high. The caution capsules, marked #1 ENGINE OIL TEMP and #2 ENGINE OIL TEMP on the instrument panel caution/advisory panel, HH-60L HH-60A > pilot's and copilot's multifunction display panels, < light when engine oil temperature goes over 150°C. Power for the No. 1 engine oil temperature warning system is supplied by the No. 1 primary dc bus through the NO. 1 DC INST circuit breaker on the copilot's circuit breaker panel. Power for the No. 2 engine oil temperature warning system is supplied by the No. 2 primary dc bus through the NO. 2 DC INST circuit breaker on the pilot's circuit breaker panel.

Oil Filter Bypass Warning System

The engine oil filter bypass warning system for each engine consists of an electrical switch, impending bypass popout button, and caution lights. The bypass button, on the oil filter assembly, is displayed when oil pressure buildup at the filter is between 44 to 60 psid. The oil filter is mounted on the top front center of engine accessory gearbox. The electrical switch, mounted on the engine accessory gear box, turns on the caution capsules, marked #1 OIL FLTR BYPASS and #2 OIL FLTR BYPASS on the instrument panel caution/advisory panel, HH-60L HH-60A > pilot's and copilot's multifunction display panels, < when oil pressure at the filter builds up to 60 or 80 psi. This indicates that oil will soon bypass the filter. Power for the No. 1 engine oil filter bypass warning is supplied by the No. 1 primary dc bus through the NO. 1 ENG WARN LTS circuit breaker on the copilot's circuit breaker panel. Power for the No. 2 engine oil filter bypass warning is supplied by the No. 2 primary dc bus through the NO. 2 ENG WARN LTS circuit breaker on the pilot's circuit breaker panel.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

Chip Detector Warning System

The engine chip detector warning system consists of a magnetic chip detector and caution capsules. The chip detector, mounted on the engine accessory gear box, tells when there are metal chips in the engine oil system. The caution capsules, marked CHIP #1 ENGINE and CHIP #2 ENGINE on the instrument panel caution/advisory panel, HH-60L HH-60A > pilot's and copilot's multifunction display panels, < light when metal chips collect on the chip detector. Power for the No. 1 engine chip detector warning system is supplied by the No. 1 primary dc bus through the NO. 1 ENG WARN LTS circuit breaker on the copilot's circuit breaker panel. Power for the No. 2 engine chip detector warning system is supplied by the No. 2 primary dc bus through the NO. 2 ENG WARN LTS circuit breaker on pilot's circuit breaker panel.

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

For location and description of major components, refer to the data in this work package.

EQUIPMENT DATA

For equipment data information, refer to this work package.

ENGINE SYSTEM

HOVER INFRARED SUPPRESSION SYSTEM (HIRSS) DESCRIPTION AND DATA

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

HOVER INFRARED SUPPRESSION SYSTEM (HIRSS)

The hover infrared suppressor system (HIRSS) provides improved helicopter survivability from heat seeking missiles during hover and cruise flight. The HIRSS kit contains a three-stage core and inner baffle which reduces exhaust gas radiation and prevent line-of-sight viewing of hot engine surfaces. The HIRSS channels hot exhaust gasses through its three-stage core and inner baffle by inducing the flow of cooling air from the engine bay and inlet scoop. The three-stage core and inner baffle cold surfaces are coated with low-reflectance material. Additional cooling is provided by ducting hot exhaust gasses outboard and then forcing the exhaust gasses downward with downwash from the main rotor. An exhaust extender is attached to the HIRSS module to reduce fuselage surface temperature in the transition section and to allow operation of the aircraft with cargo doors open. Installation of each HIRSS module requires removal of standard engine exhaust modules and cargo door track fairings. HIRSS modules are installed on the basic airframe, with two additional mounts, and one angle. The rear fairings are installed using existing mounting points and hardware. While operating in a nonhostile environment, the inner baffle can be removed to enhance engine performance.

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

For location and description of major components, refer to the data in this work package.

EQUIPMENT DATA

For equipment data information, refer to this work package.

ROTOR SYSTEM

MAIN ROTOR SYSTEM DESCRIPTION AND DATA

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

MAIN ROTOR BLADE

Four main rotor blades are installed on the main rotor head (Figure 1). The main rotor blade has a pressurized titanium spar, Nomex honeycomb core, fiberglass skin, nickel and titanium abrasion strips, a removable swept-back tip fairing, and a resistive heating mat used when the blade deice system is activated. A wire mesh is bonded to the surface of the blade, to protect the blade from lightning. The spar of the main rotor blade is pressurized with nitrogen through a servicing valve at the inboard end of the blade. A BIM® (Blade Indication Method) pressure indicator visually indicates that the spar pressure has not dropped below minimum. The nickel and titanium abrasion strips, bonded to the leading edge of the blade, prevent damage that could occur from erosion. Each blade is statically and dynamically balanced to permit replacement of individual blades. Balance strips painted around the blade locate the hoisting point. A titanium cuff and expandable pins attach the blade to the rotor head (Figure 2). With the use of a blade fold set, each blade can be folded manually.

Blade Indication Method (BIM®) Pressure Indicator

The BIM® indicator is installed in the back wall of the spar at the root of the blade (Figure 1, Detail A). A color indicates if the blade becomes unserviceable. The indicator compares a reference pressure built into the indicator with the pressure in the blade spar. When the pressure in the blade spar is within the required service limits, indicating the blade is serviceable, three yellow stripes show. If the pressure in the blade spar drops below the minimum permissible service pressure, the indicator will show three red stripes (Figure 1, Detail B).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

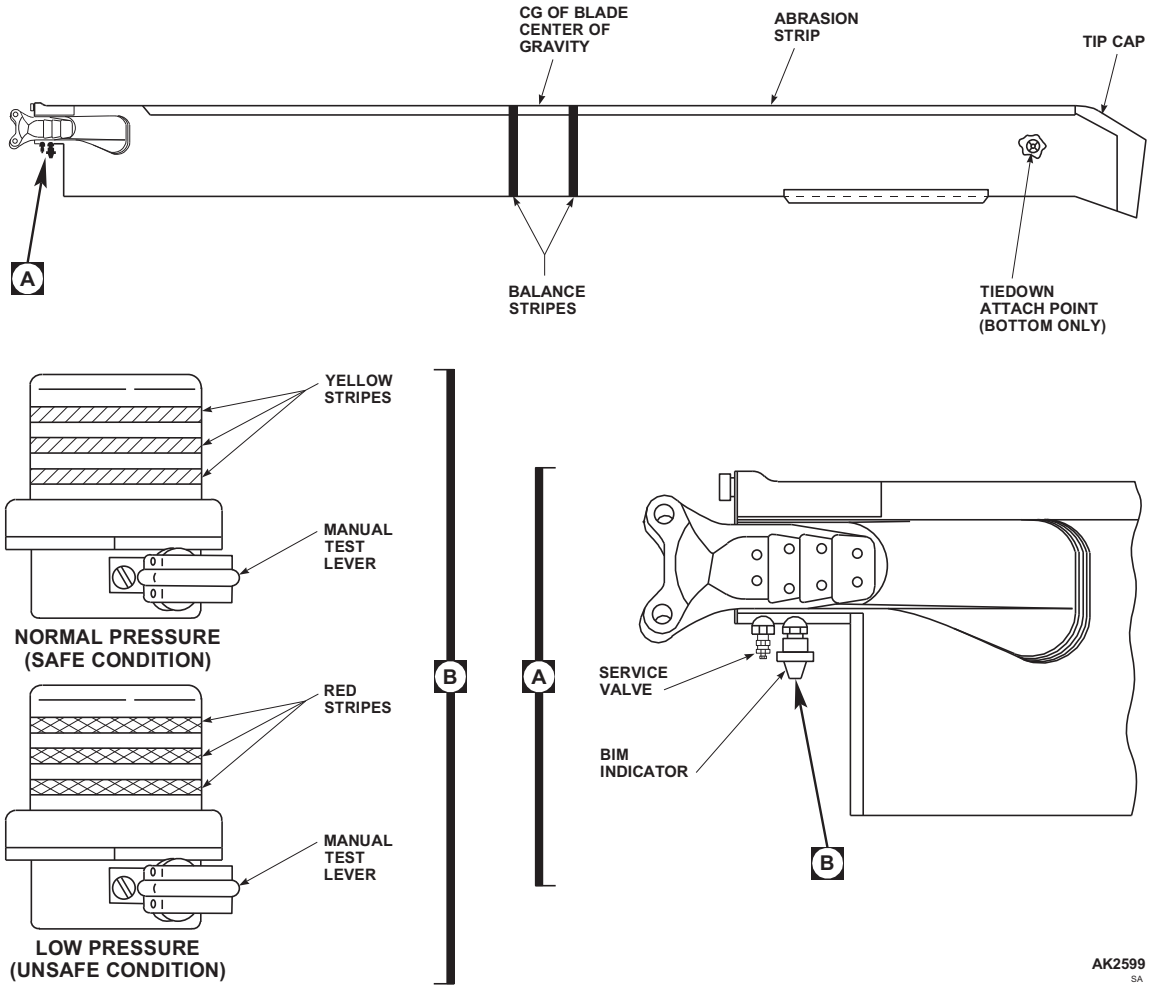
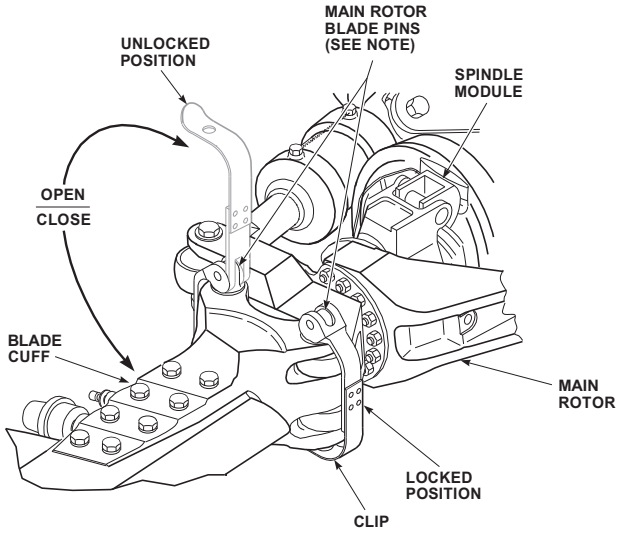
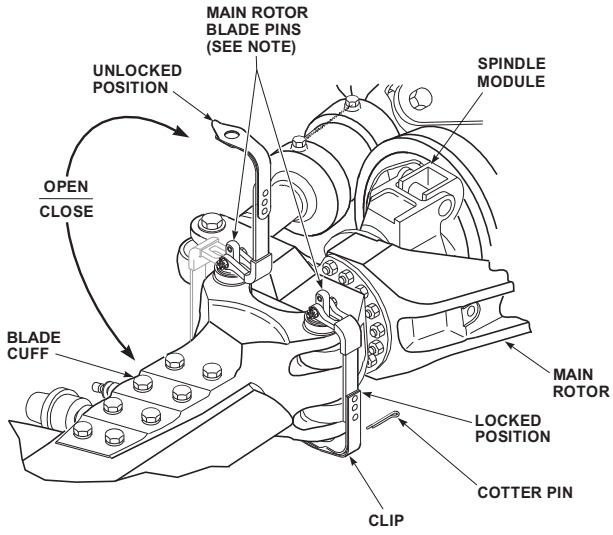


Figure 1. Main Rotor Blade and Pressure Indicator.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED



EFFECTIVITY
HELICOPTERS WITH 70103-08107-102
MAIN ROTOR BLADE EXPANDABLE PINS.



EFFECTIVITY
HELICOPTERS WITH 70103-08108-041
MAIN ROTOR BLADE SOLID PINS.

AA0482
SA

Figure 2. Main Rotor Blade Expandable Pins.

MAIN ROTOR HEAD

The main rotor head transmits the movements of the flight controls to the four main rotor blades (Figure 3 and Figure 4). The main rotor head turns in a counterclockwise direction. The head is supported by the main rotor shaft extension. The shaft extension is splined to the main transmission main shaft, which drives the head. The

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

lower pressure plate and cones, in conjunction with the main shaft nut, secure the shaft extension to the main shaft. The lower pressure plate also provides attachment for the rotating scissors. The principal components of the main rotor head are the main rotor hub (including the spindle modules), the droop stops, the bifilar vibration absorber, pitch control rods, dampers, antiflap assemblies and swashplate.

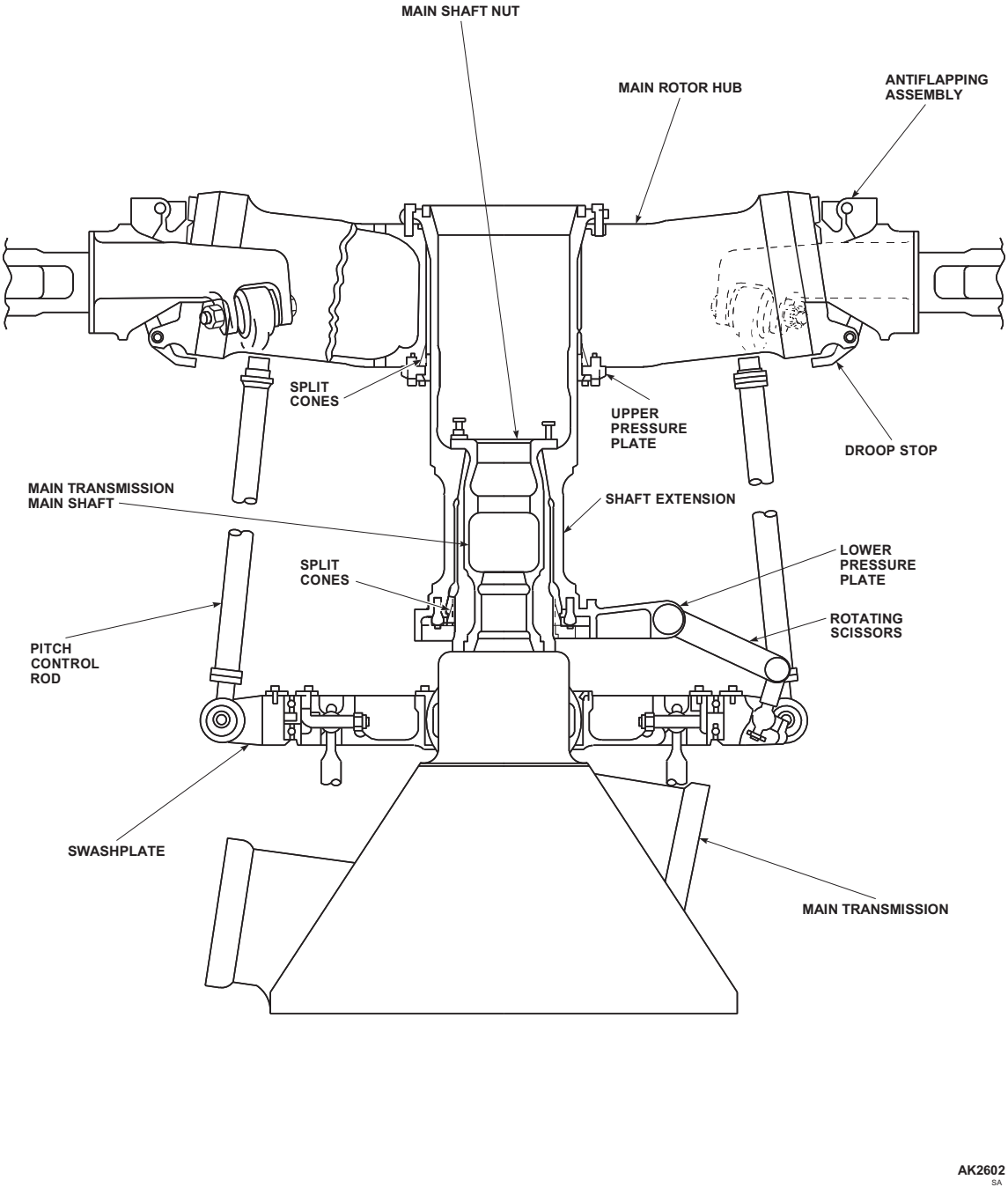


Figure 3. Main Rotor Head And Main Transmission.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

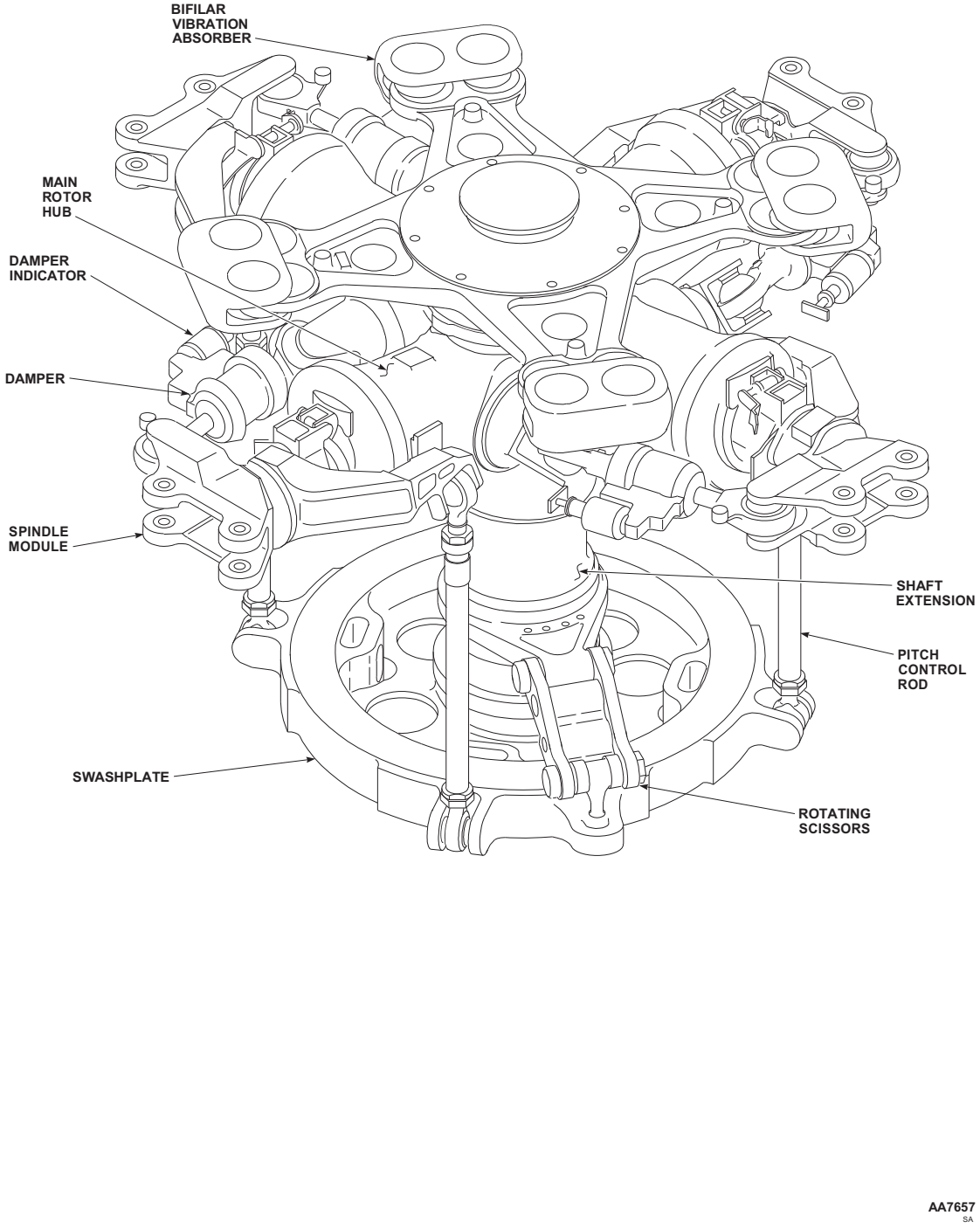


Figure 4. Main Rotor Head.

Main Rotor Hub

The hub consists of titanium spindle modules, hydraulic dampers, pitch control rods, antiflapping assemblies, and a titanium housing (Figure 5). Each blade is hinged through elastomeric bearings (rubber and steel laminates) in the spindle modules. The elastomeric bearings allow the blades to flap, lead, and lag. The bearing also permits

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

the blade to move about its axis for pitch changes. The spindle module titanium endplate contains the lugs for blade attachment.

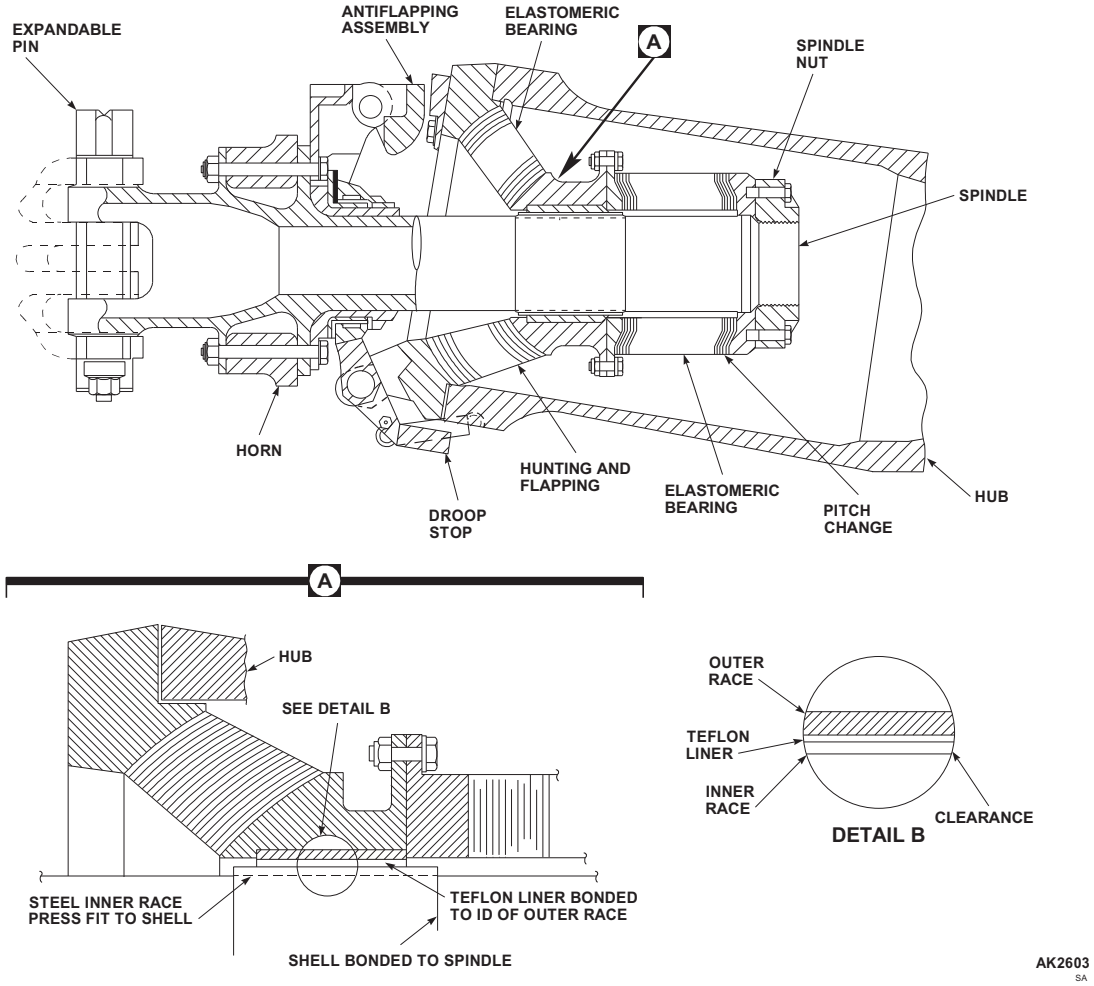


Figure 5. Main Rotor Head Spindle Module - Cutaway.

Antiflapping Assemblies

An antiflapping assembly is installed on each of the four main rotor spindle modules, next to the hub (Figure 3 and Figure 5). These are spring loaded locks that prevent the main rotor blades from flapping when the main rotor head is slowing down or stopped. When the main rotor is rotating at above 35%, centrifugal force pulls the anti-flapping assemblies outward and holds them in their locked positions to permit flapping and coning of the blades.

Droop Stops

The droop stops, on the spindle module next to the hub, limit droop of the blades when the main rotor head is slowing down or stopped (Figure 3). When the main rotor head is rotating between 70% to 75% Nr, centrifugal force throws the droop stops out and permits increased vertical movement of the blade.

Pitch Control Rods

Four pitch control rods extend from the rotating swashplate to the blade pitch horn on the spindle (Figure 4). The pitch control rods transmit all movement of the flight controls from the swashplate to the main rotor blades. Each rod is adjustable. Rotation of the rod changes main rotor blade angle 2 minutes per notch. This allows for tracking adjustment.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

Dampers

Dampers are installed between each of the main rotor hub and spindle modules to restrain hunting (lead and lag motions) of the blades during rotation and to absorb rotor head engagement loads (Figure 4). Each damper is filled with hydraulic fluid. An indicator mounted on the side of the damper monitors hydraulic fluid quantity. When the damper is fully serviced the indicator will show full gold.

Bifilar

The bifilar vibration absorber, absorbs vibrations and stresses. It not only contributes to longer life of all components but to a smoother ride for the crew and passengers (Figure 4). The bifilar vibration support is a cross-shaped aluminum forging. A tungsten weight pivots on two points at the end of each arm. The bifilar is bolted to the main rotor hub.

Swashplate

The swashplate has stationary and rotating discs joined by a bearing (Figure 4). It transmits flight control movement to the main rotor head through the four pitch control rods. The swashplate is permitted to slide on the main rotor shaft and tilt in any direction following the motion of the flight controls.

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

For location and description of major components, refer to the data in this work package.

EQUIPMENT DATA

If applicable, refer to WP 1660 00, WP 1677 00, WP 1688 00, WP 1695 00, WP 1743 00, and WP 1780 00 for equipment data information.

ROTOR SYSTEM

TAIL ROTOR SYSTEM DESCRIPTION AND DATA

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

TAIL ROTOR

The canted tail rotor head is driven by the tail gear box (Figure 1). A pitch change beam on the pitch control shaft changes the angle of the tail rotor blades through pitch change links. Because of it's canted design, the tail rotor provides about 400 pounds of lift and more clearance for ground personnel.

Pitch Beam

A four-armed pitch beam is bolted to the end of the pitch change shaft. The pitch beam increases or decreases the pitch of all blades simultaneously through pitch links connected to the blades.

Pitch Control Links

Four pitch control links are installed on the tail rotor head assembly. Each link connects an arm of the pitch beam to a pitch control horn on the blade. The links transmit movement necessary for blade pitch changes from the pitch beam. Each link consists of two rod ends with boots, locking devices, and a link. The rod end that is connected to the pitch beam is marked for proper installation.

TAIL ROTOR BLADES

The tail rotor blades are built around two graphite composite spars running from tip-to-tip and crossing each other at the center to form the four blades (Figure 2). The two spars are interchangeable and may be replaced individually. The blade spars are covered with crossply fiber glass to form the airfoil shape. Polyurethane and nickel abrasion strips are bonded to the leading edge of the blades. Blade pitch changes are made by twisting the spar.

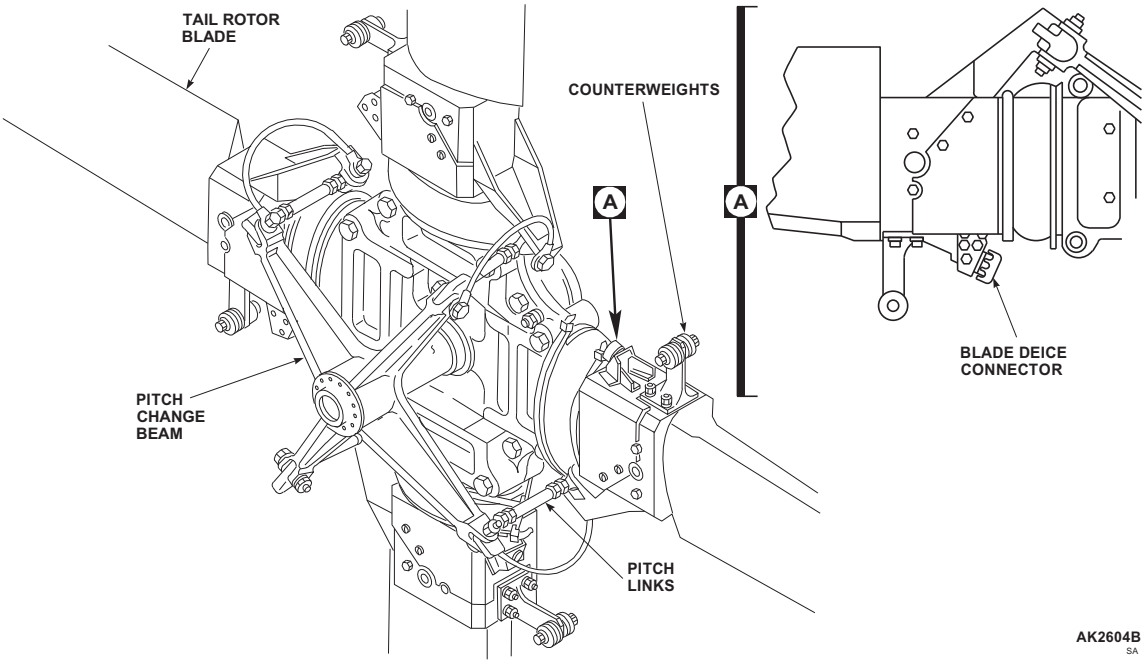


Figure 1. Tail Rotor System.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

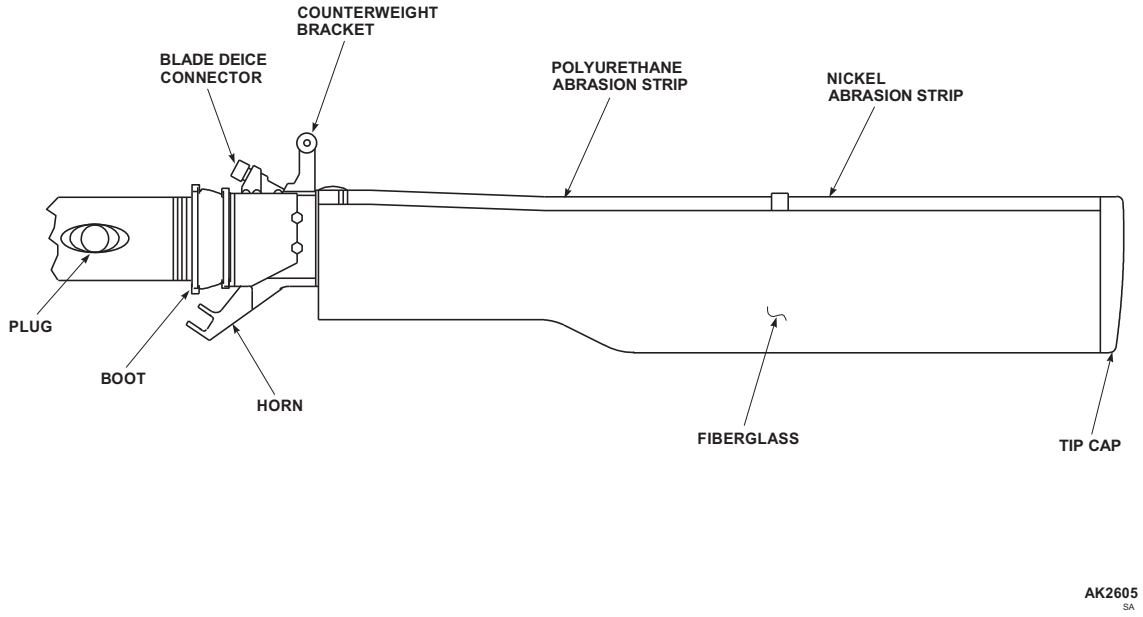


Figure 2. Tail Rotor Blade.

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

For location and description of major components, refer to the data in this work package.

EQUIPMENT DATA

If applicable, refer to WP 1686 00, WP 1696 00, WP 1732 00, WP 1747 00, and WP 1787 00, for equipment data information.

DRIVE SYSTEM

TRANSMISSION SYSTEM DESCRIPTION AND DATA

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

TRANSMISSION SYSTEMS

The transmission system carries engine torque to the main rotor and tail rotor (Figure 1). It consists of a main transmission with oil cooler, intermediate gear box, tail gear box, and drive shafts. The transmission system has oil pressure and oil temperature indicating systems, hot oil and low oil pressure warning systems, and a chip detector system. The main transmission drives the main rotor, tail rotor, main transmission oil cooler fan, No. 1 and No. 2 hydraulic pump modules, and No. 1 and No. 2 generators.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

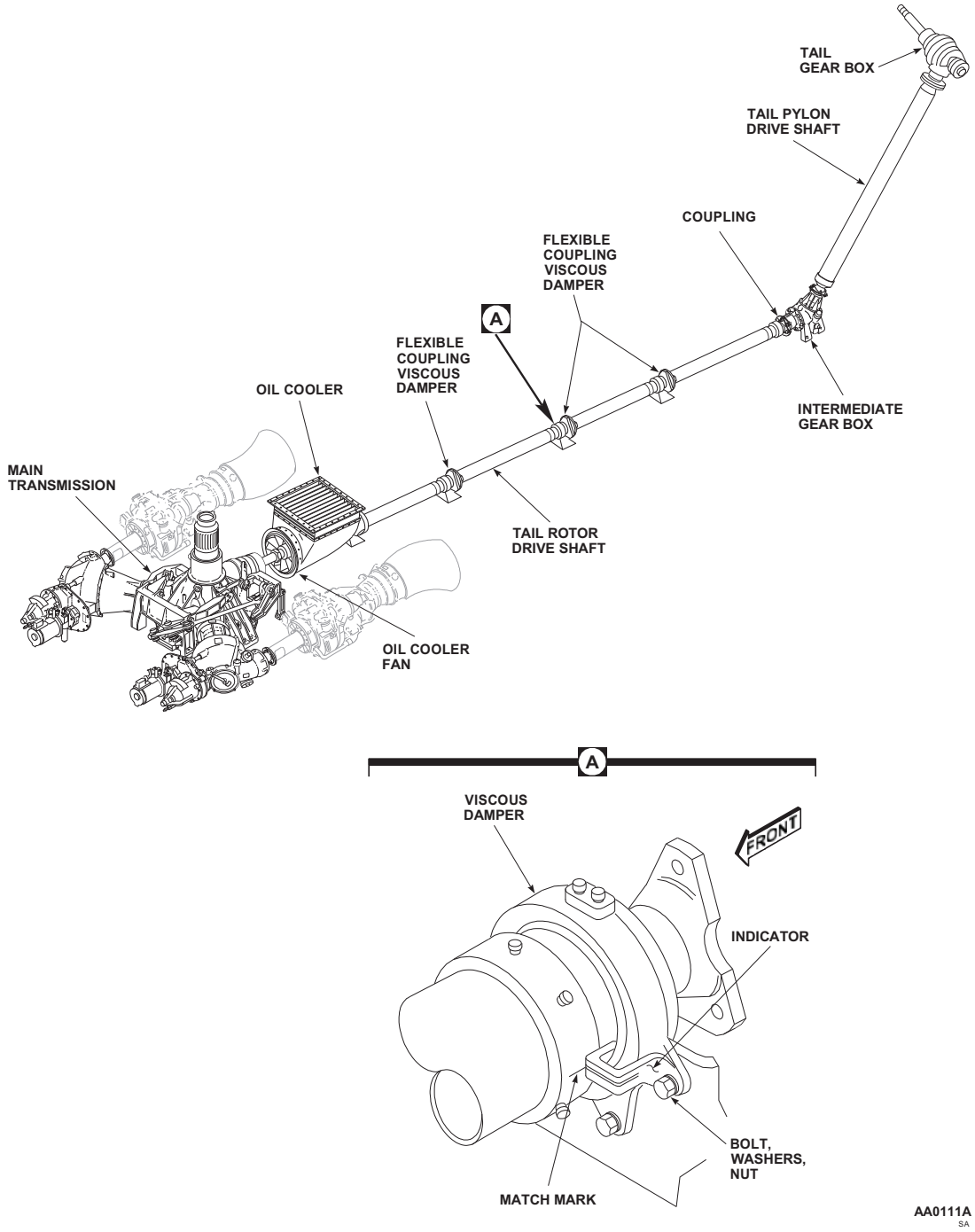


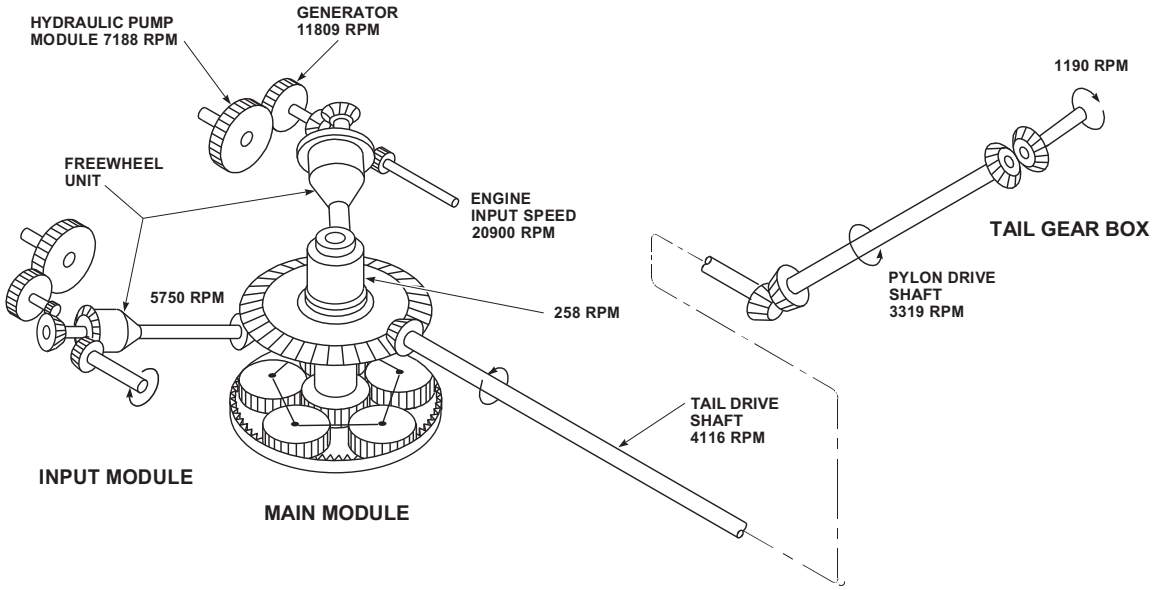
Figure 1. Transmission System Powertrain.

TRANSMISSION SYSTEM OPERATION

The helicopter's power to the transmission begins at the front end of the engines. The engine input drive shaft, turning at 20,900 RPM (100% Nr) provides the power to the input module, which then drives the main module and accessory modules (Figure 2). The input module reduces engine input RPM to 5750 RPM and also allows the drive angle to be changed from the engine to the main module. The main module then provides reduction

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

for the main rotor head down to 258 RPM and a reduction for the tail drive and oil cooler to 4110 RPM. The intermediate gear box receiving the tail drive shaft RPM then provides a reduction to 3319 RPM plus changes the angle of drive about 58°. The tail gear box provides the remaining gear reduction for the tail rotor to 1190 RPM and a 105° change in drive direction. During operation of the main transmission, the hydraulic pump modules are driven at 7188 RPM and the generators at 11,809 RPM.



	RPM'S		
	IN	OUT	REDUCTION
MAIN GEAR BOX INPUT MODULE	20900	5750	3.63:1
MAIN GEAR BOX MAIN MODULE	5750	258	22.89:1
INTERMEDIATE GEAR BOX	4116	3319	1.24
TAIL GEAR BOX	3319	1190	2.79

NOTE: ALL RPM'S AT 100%.

AA7628_1
SA

Figure 2. Transmission Gear Ratios.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

MAIN TRANSMISSION

The main transmission is mounted on the main fuselage with a built in 3° forward tilt. It consists of five modules: a main module, two input modules, and two accessory modules (Figure 3). It mounts and drives the main rotor head, changes the angle of drive from the engines, reduces engine RPM, and drives the tail rotor drive shaft along with the accessory modules. Both input modules and both accessory modules are interchangeable with one another and are replaceable without removing any other major components.

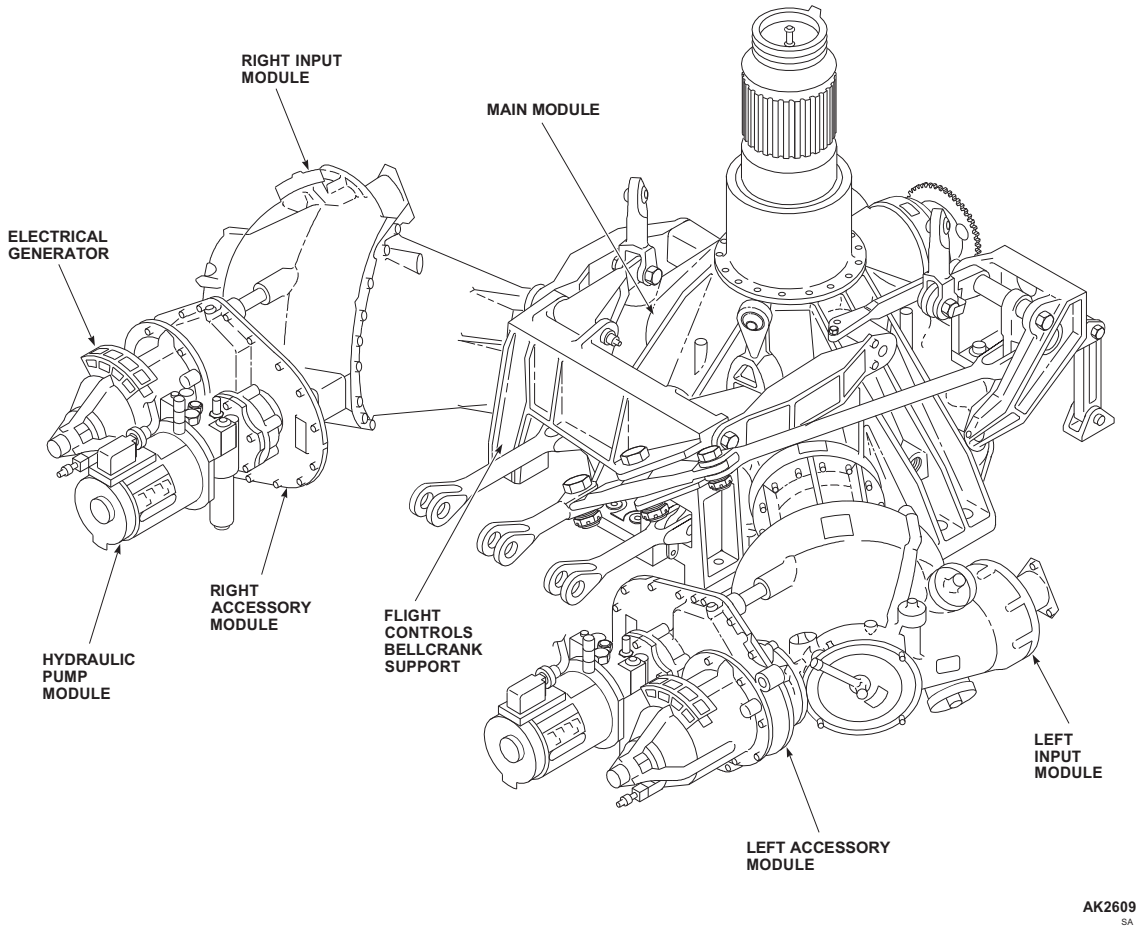


Figure 3. Main Transmission.

Main Module

The main module is mounted on top to the cabin fuselage. The main module supports and drives the main rotor head. It also drives the tail rotor system.

Input Module

The two input modules are mounted on the left and right front side of the main module (Figure 3). They connect the main module to the engines by shafting and gears. Each input module is identical and directly interchangeable. Over running clutches (free-wheeling units) disengage a nonoperating engine from the transmission, but not the accessory module.

Accessory Module

An accessory module is mounted on the front of each input module (Figure 3). The accessory module drives the electrical generators and hydraulic pump modules. A rotor speed sensor is mounted on the right accessory mod-

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

ule and an oil pressure switch is mounted in the left accessory module. UH-60L HH-60L > An additional rotor speed sensor is mounted on the left accessory module. < Each basic module is identical and directly interchangeable.

INTERMEDIATE GEAR BOX

The intermediate gear box is mounted at the base of the pylon (Figure 4 and Figure 5). The intermediate gear box carries main transmission torque to the tail gear box and changes the angles of the drive about 58°. The intermediate gear box also reduces tail drive shaft input speed of 4110 RPM to 3319 RPM pylon shaft output speed. The gear box is divided into three sections, the input housing and gear, the center housing, and the output housing and gear.

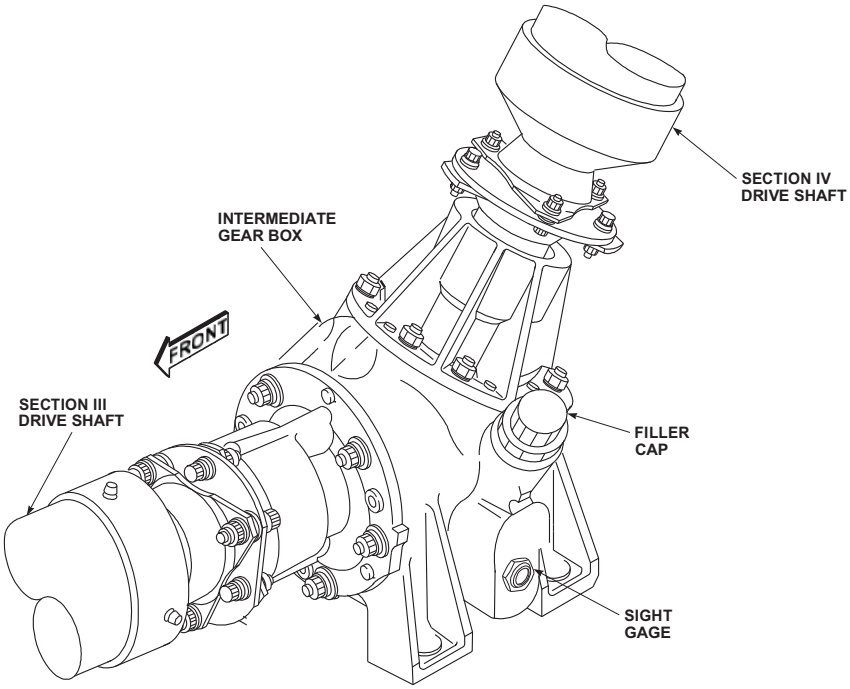


Figure 4. Intermediate Gear Box Installed.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

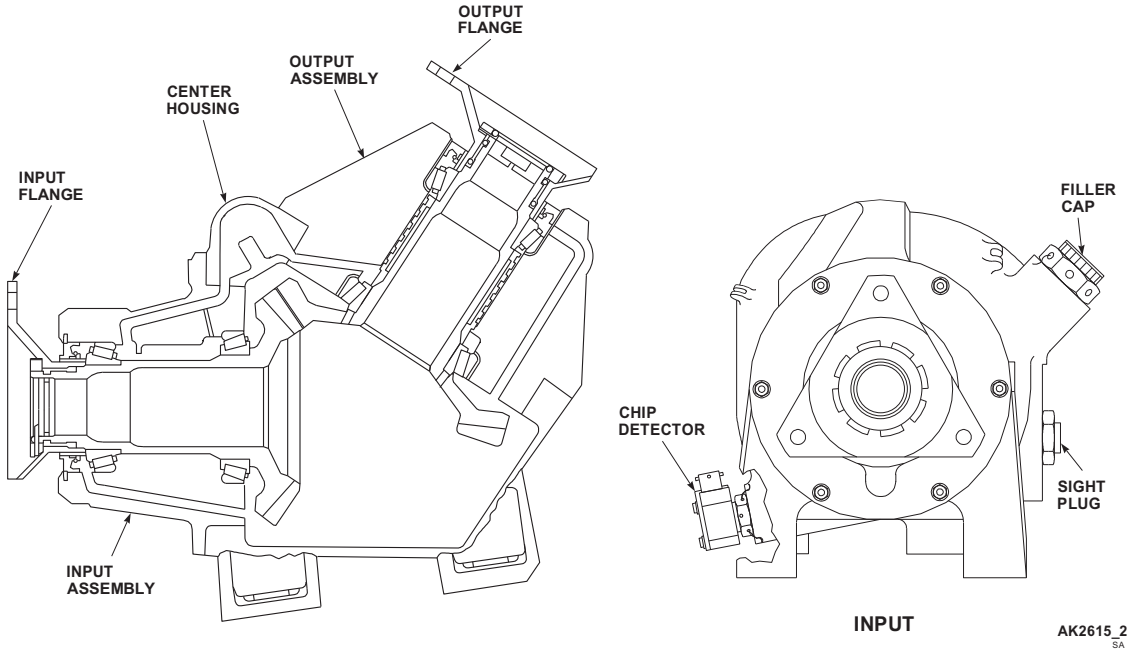


Figure 5. Intermediate Gear Box Cutaway.

TAIL GEAR BOX

The tail gear box, mounted at the top of the pylon, holds the tail rotor head and changes the direction of drive 105° (Figure 6). The tail gear box is divided into three sections: input housing and gear, center housing, and output housing and gear. The tail gear box includes an input linkage, bearing, and pitch control shaft, for tail rotor pitch controls. The tail rotor servo mounts on and in the tail gear box. The tail rotor blade deice slip ring can be installed on the tail gear box assembly.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

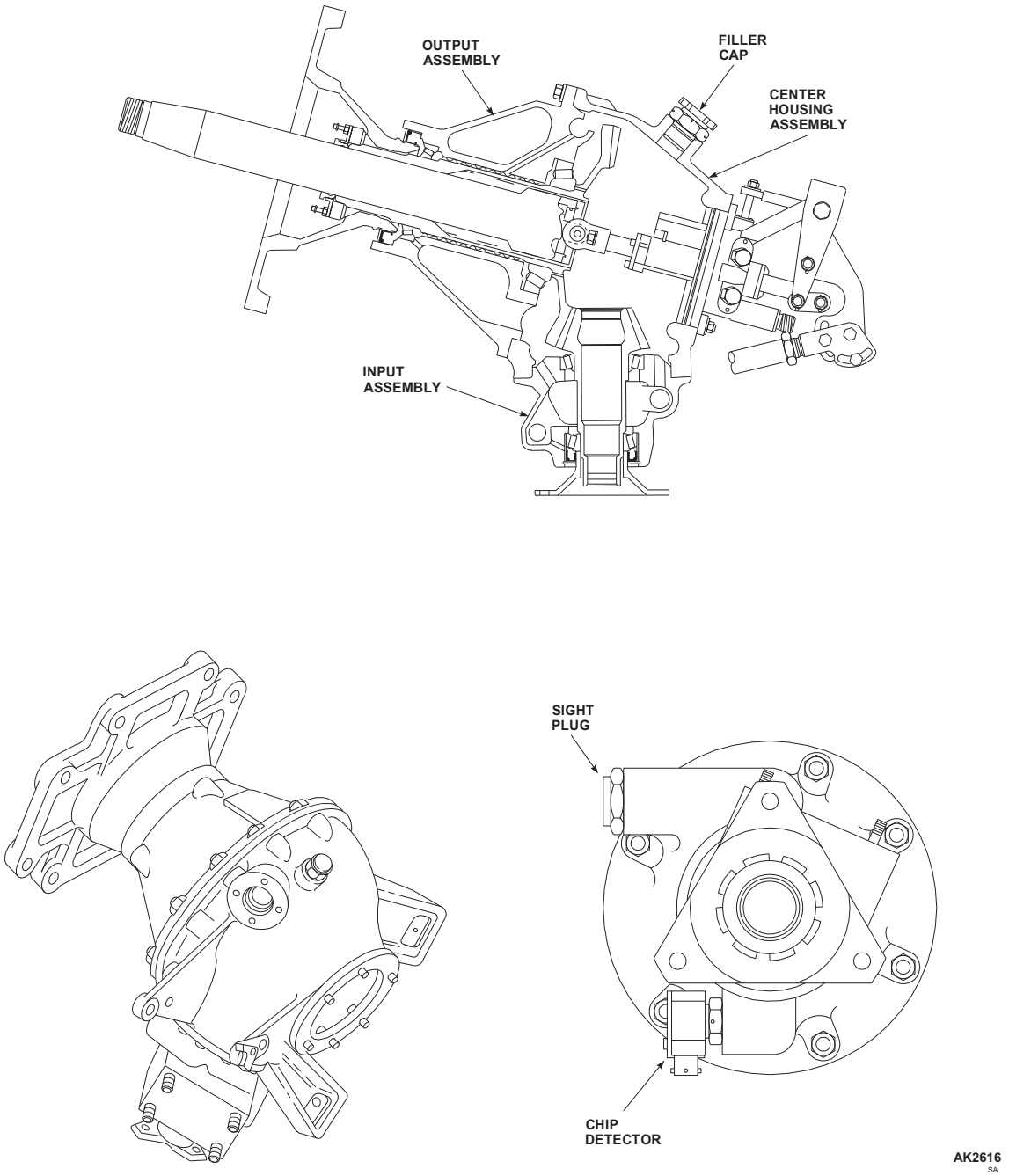


Figure 6. Tail Gear Box.

GUST LOCK

A manually operated gust lock, at the tail takeoff flange, permits the main rotor and tail rotor to be locked when the helicopter is parked or stored. The gust lock is operated by pressing the handle release button, in the cabin, and moving the handle in or out. The gust lock lever meshes with teeth on the tail takeoff flange. A switch in the rod assembly, between the handle and lock lever, turns the GUST LOCK light on. The light is on the caution/advisory panel (Figure 7).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

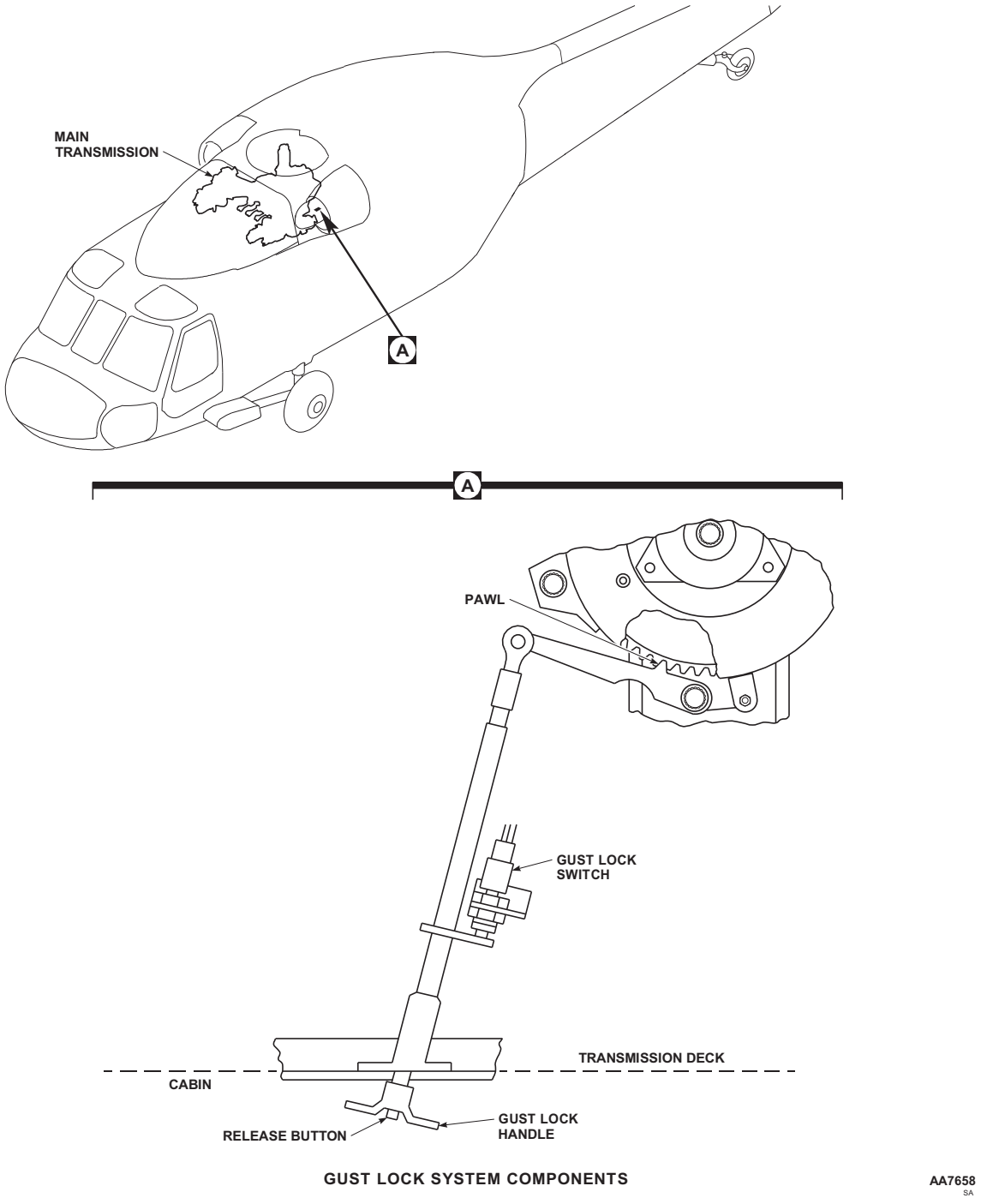


Figure 7. Gust Lock.

TAIL ROTOR DRIVE SHAFT

The tail rotor drive shaft runs from the tail takeoff flange on the rear of the main transmission, to the intermediate gear box. It then runs up from the intermediate gear box to the tail gear box (Figure 8). The drive shaft carries engine torque to the tail rotor and drives the oil cooler blower. The aluminum tail drive shaft is made up of four sections containing seven shafts. Each shaft is dynamically balanced. The sections are joined together by flexi-

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

ble couplings. The first three sections of shafting, from the rear of the oil cooler, are directly interchangeable. The rear end of these three shafts are held by special shock absorbing bearings. After replacement of any or all sections of drive shaft, alignment is not necessary.

Multiple disc flexible couplings are used to carry torque and allow for minor misalignment of tail drive shaft components. Along with the special shock absorbing bearings, the couplings also allow the drive shaft to remain in alignment as the airframe flexes in flight.

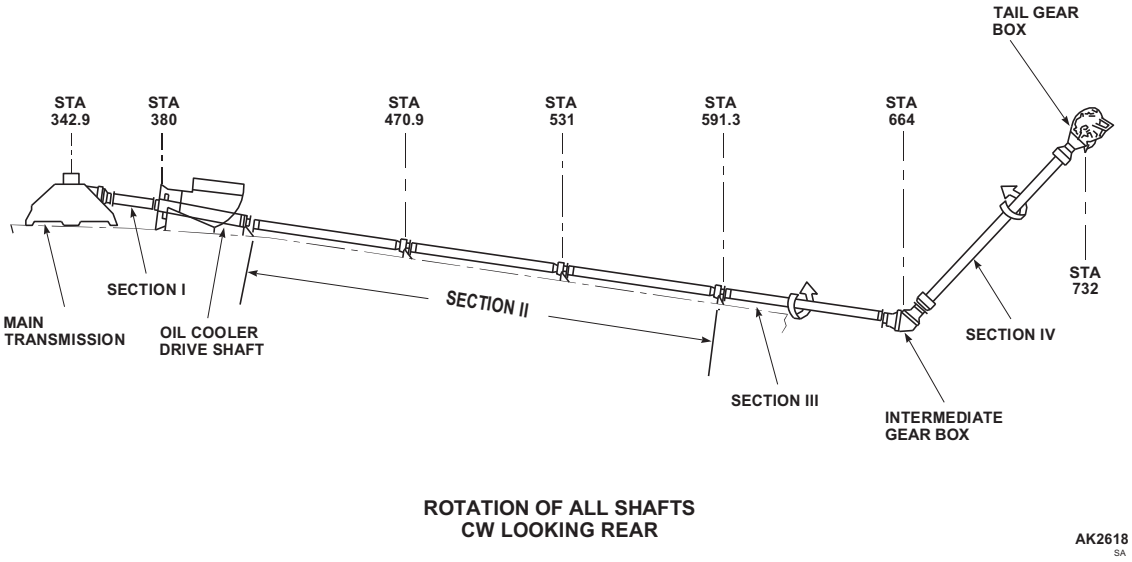


Figure 8. Tail Rotor Drive Shaft.

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

For location and description of major components, refer to the data in this work package.

EQUIPMENT DATA

If applicable, refer to WP 1657 00,WP 1658 00, WP 1659 00, WP 1661 00, WP 1741 00, WP 1745 00, WP 1746 00, WP 1760 00, WP 1769 00, WP 1770 00, WP 1771 00, WP 1788 00, WP 1789 00, WP 1790 00, WP 1791 00, WP 1792 00, for equipment data information.

DRIVE SYSTEM

MAIN TRANSMISSION LUBRICATION SYSTEM DESCRIPTION AND DATA

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

MAIN TRANSMISSION LUBRICATION SYSTEM

The main transmission is a wet sump lubrication system that cools and filters the oil to all the gears and bearings (Figure 1. (Sheet 1 of 2)). The No. 1 and No. 2 generators also receive oil for cooling by way of internal lubrication lines. The oil is pumped through internally cored oil lines, except for the oil cooler inlet and outlet lines. The main transmission has an oil capacity of about 7 gallons. A dipstick is used for checking oil quantity. When the oil level reaches the ADD mark the system is 2 quarts low. The system includes two pressure and scavenge, vane-type lubricating pumps that have pressure regulating and bypass valves, a two-stage oil filter, an oil cooler and blower, and warning and indicating systems.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

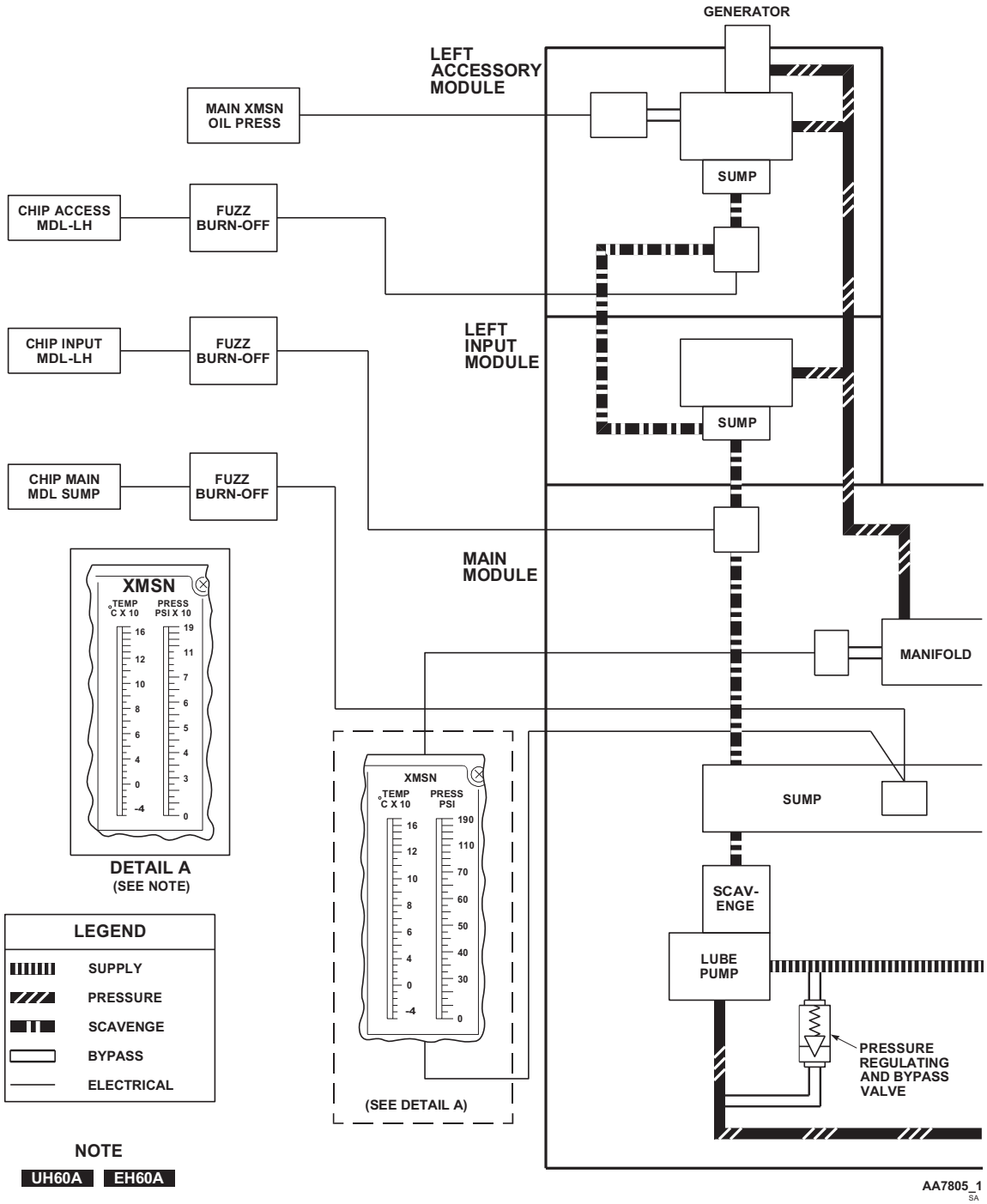


Figure 1. Main Transmission Lubrication System Block Diagram (Sheet 1 of 2).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

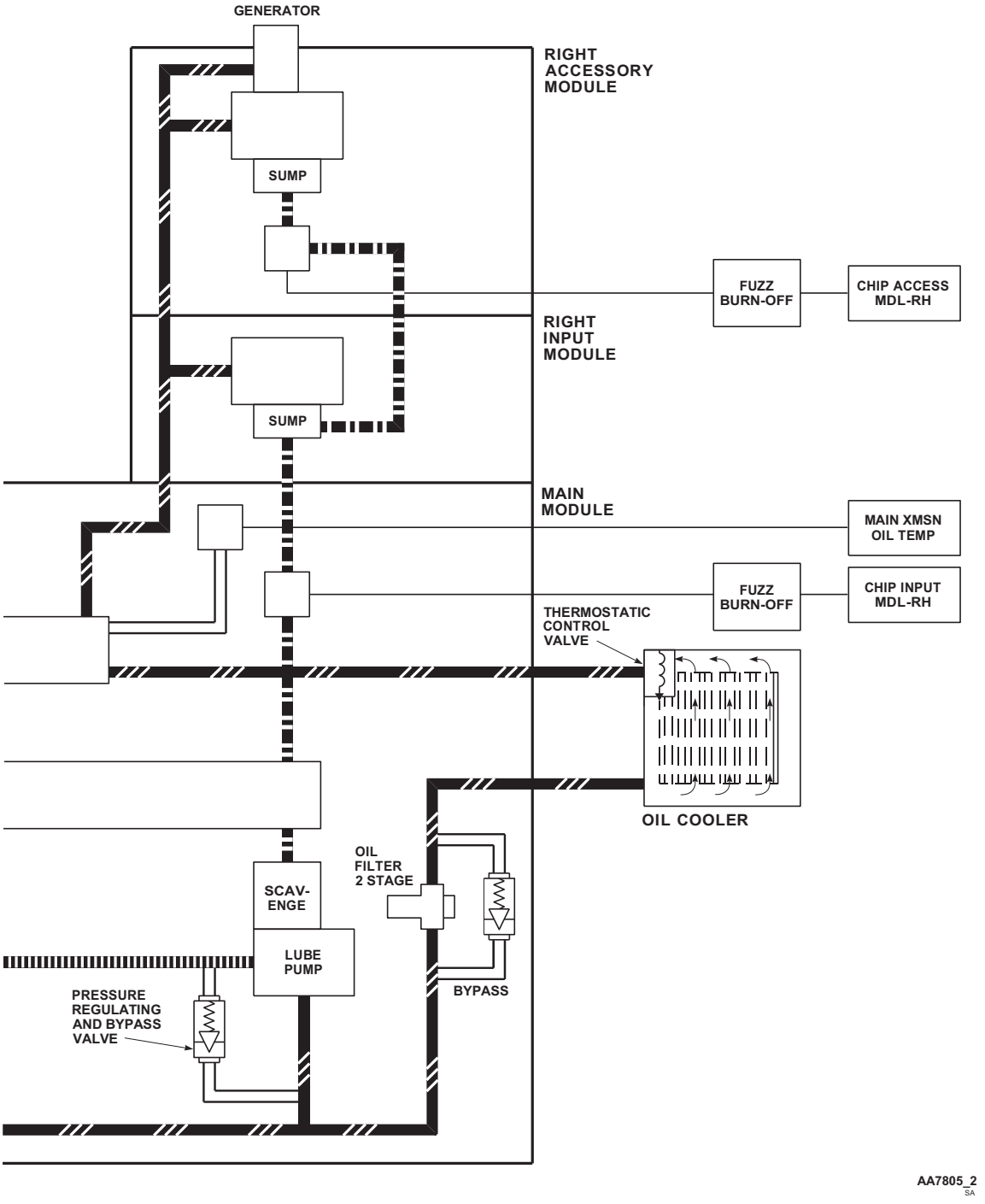


Figure 1. Main Transmission Lubrication System Block Diagram (Sheet 2 of 2).

Lubrication Pumps

The main transmission lubrication pumps are combination pressure and scavenge vane-type operating in parallel. The pressure side of the pumps supplies oil at 15 gpm at a pressure between 50-55 psi. **UH-60L >** The scavenge side returns oil at a rate of 14 gpm at a pressure between 50-55 psi to the sump. **<UH-60A EH-60A >** The scavenge side returns oil at a rate of 7 gpm at a pressure between 50-55 psi to the sump. The pressure side is regulated by

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

an adjustable pressure regulating valve. As pressure exceeds 55 psi, the bypass valve starts to open and extra oil is bypassed back to the inlet side of the pump. <

Two-Stage Oil Filter

The two-stage oil filter , at the right rear section of the sump, protects the lubrication system by removing lubricant contaminants. Filter elements are paper, throw-away types. Three-micron filter elements are not interchangeable between the UH-60A EH-60A UH-60L> . Also, neither UH-60A EH-60A UH-60L> three-micron filter can be installed in place of the UH-60A EH-60A> 46-micron filter in the field.UH-60L > Filter, 70351-38801-101, has two separate elements, a 3-micron first stage filter element and a 75-micron second stage filter element. When primary filter begins to clog and pressure drops between 9 and 15 psi, a red button extends 3/16 inch from bottom of filter bowl. It cannot be reset unless filter elements are replaced. A thermal lockout prevents the indicator from extending when the temperature goes below 125°F to 155°F. The first stage filter will protect the system up to a differential pressure of 16 to 24 psi. At this point the flow is bypassed to the second stage filter element, which will protect the system up to 30 to 40 psi differential pressure. <

UH-60A EH-60A > Filter, 70351-08143-101 , has two separate elements, a 46-micron first stage filter element and a 75-micron second stage filter element. When primary filter begins to clog and pressure drops between 9 and 15 psi, a red button extends 3/16 inch from bottom of filter bowl. It cannot be reset unless filter elements are replaced. A thermal lockout prevents the indicator from extending when the temperature goes below 60°F to 100°F. The first stage filter will protect the system up to a differential pressure of 16 to 24 psi. At this point the flow is bypassed to the second stage filter element, which will protect the system up to 30 to 40 psi differential pressure. <

UH-60A EH-60A > Main Module (70351-08100-073/074 and 076 Filter, 70351-08143-104, has two separate elements, a 3-micron first stage filter element and a 75-micron second stage filter element. When primary filter begins to clog and pressure drops between 11 and 15 psi, a red button extends 3/16 inch from bottom of filter bowl. It cannot be reset unless filter elements are replaced. A thermal lockout prevents the indicator from extending when the temperature goes below 125°F to 155°F. The first stage filter will protect the system up to a differential pressure of 16 to 24 psi. At this point the flow is bypassed to the second stage filter element, which will protect the system up to 30 to 40 psi differential pressure. <

Oil Cooler and Fan

The oil cooler and fan, in the rear of the main rotor pylon, consists of a radiator, duct, fan and shafting. The fan, driven by the tail rotor drive shaft, forces air through the radiator. Hot oil from the main module sump is pumped into the radiator. A thermostatic control valve within the radiator allows cold oil (less than 70°C) to bypass the radiator. Also, if the radiator becomes clogged, the oil will bypass. Oil is routed from the oil cooler to the main module manifold to be divided between the lubrication jets in the main module and the oil passages to the input modules, accessory modules, and generators.

Spline Wear Indicators

Spline wear indicators are installed on the viscous damper at station 531. The viscous damper has a scribed line on the tail rotor drive shaft which is lined up with an indicator mounted on the viscous damper. On helicopters with oil cooler fan, 70361-03005-103 through 70361-03005-106, installed, the oil cooler fan has a scribed mark on the fan blade which is compared to a wear indicator on fan housing. On helicopters with oil cooler fan, 70361-03005-107, installed, spline wear inspection is not required.

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

For location and description of major components, refer to the data in this work package.

EQUIPMENT DATA

For equipment data information, refer to this work package.

DRIVE SYSTEM

MAIN TRANSMISSION WARNING AND INDICATING SYSTEM DESCRIPTION AND DATA

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

MAIN TRANSMISSION WARNING AND INDICATING SYSTEM

The warning and indicating systems indicate possible troubles in the transmission system. They cover oil pressure and oil temperature indications, and chip detectors throughout the main transmission.

MAIN TRANSMISSION OIL TEMPERATURE AND PRESSURE WARNING INDICATING SYSTEM

When the temperature of the oil entering the manifold is over 112° to 121°C the sensor lights the MAIN XMSN OIL TEMP light in the caution/advisory panel HH-60A HH-60L > MFD/caution/advisory panel < (Figure 1. (Sheet 1 of 3)). The oil pressure warning system has an oil pressure switch in the left accessory module connected to the MAIN XMSN OIL PRESS light in the caution/advisory panel HH-60A HH-60L > MFD/caution/advisory panel <. When the oil pressure in the left accessory module falls below 14 psi, the switch turns on the MAIN XMSN OIL PRESS light.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

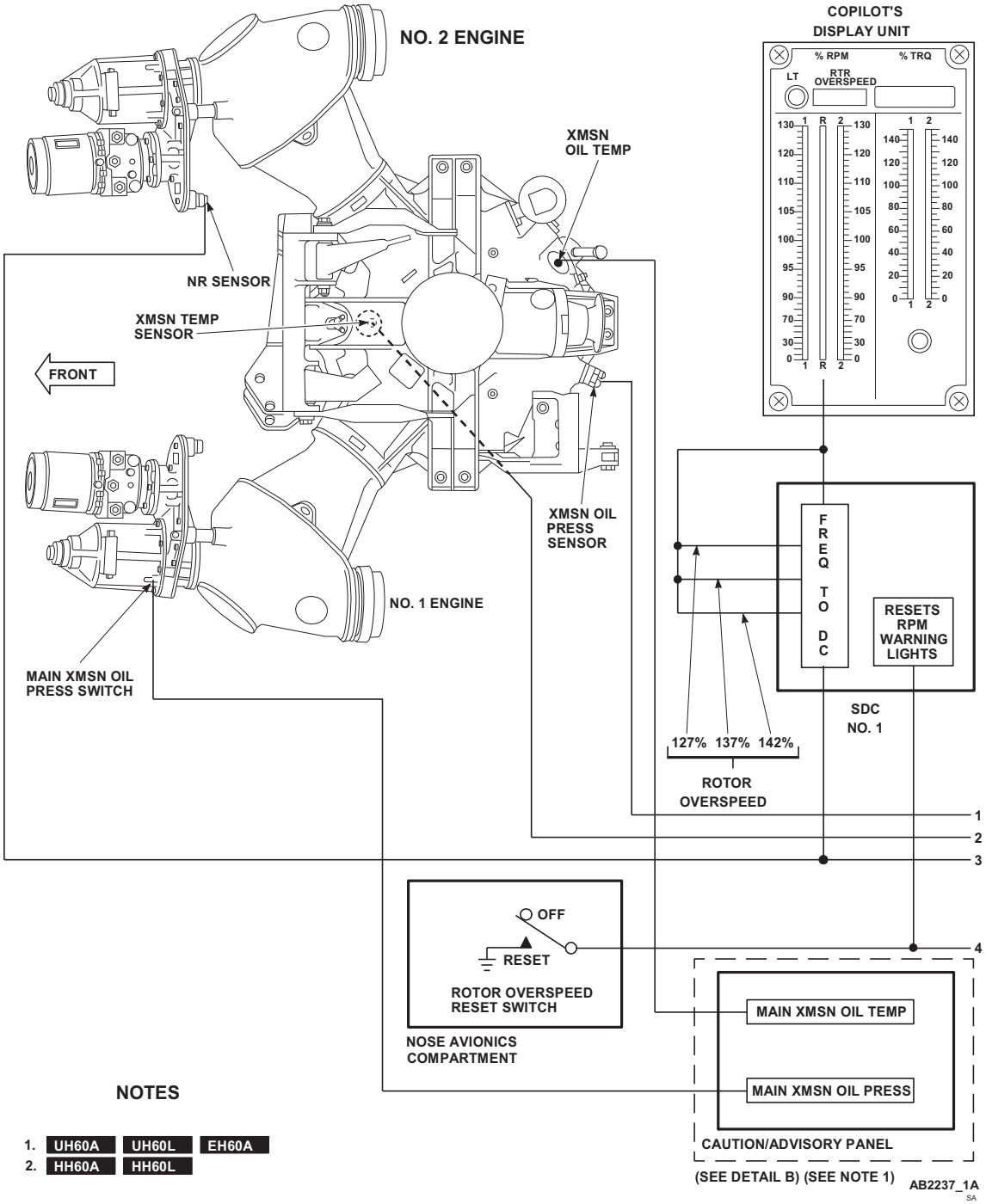


Figure 1. Main Transmission Oil and Pressure Warning and Indicating Systems Block Diagram (Sheet 1 of 3).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

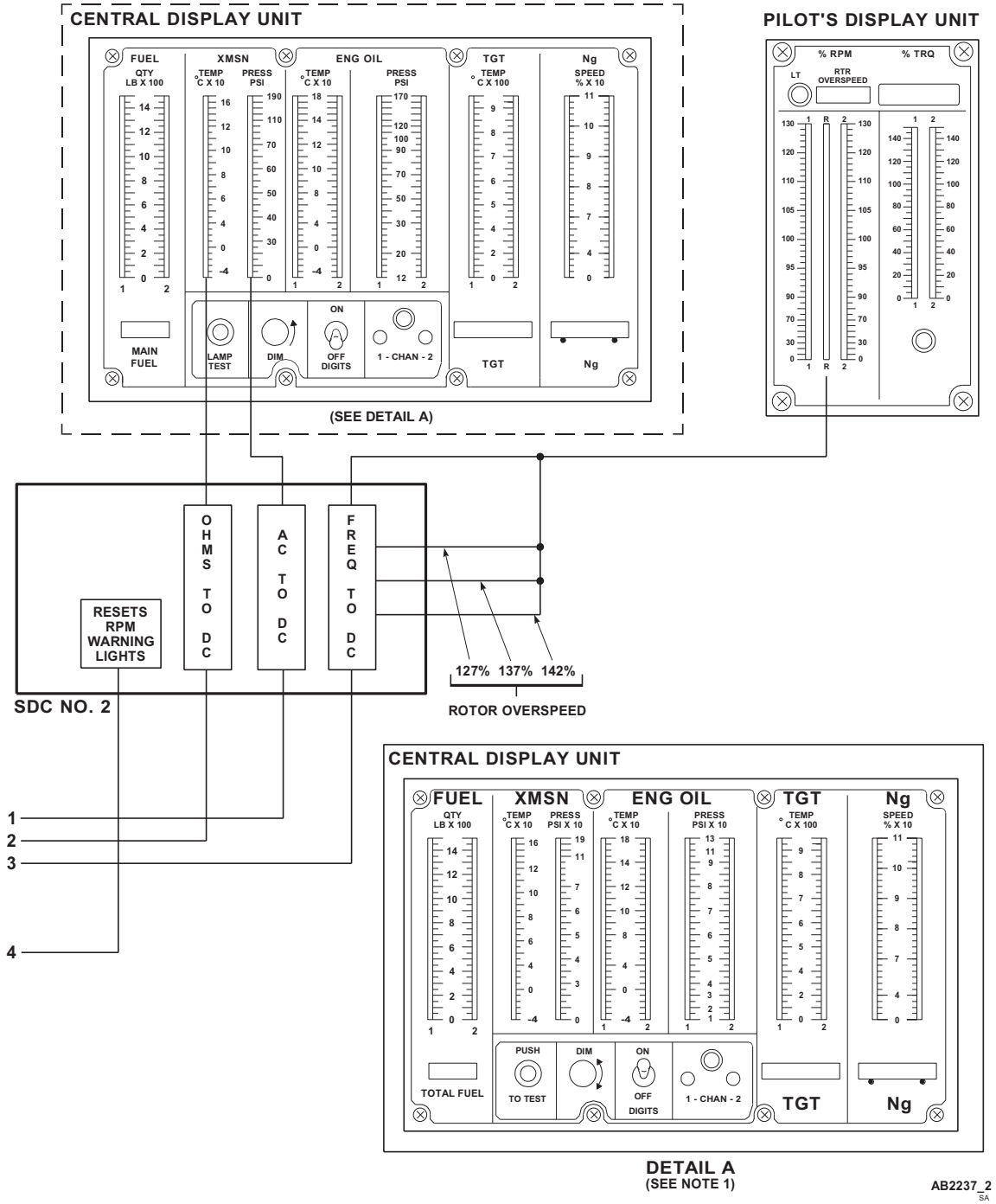


Figure 1. Main Transmission Oil and Pressure Warning and Indicating Systems Block Diagram (Sheet 2 of 3).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

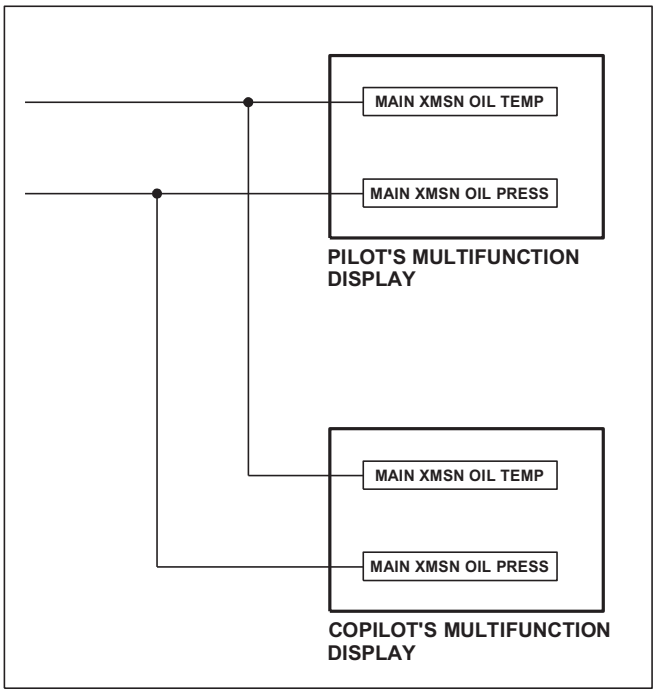


Figure 1. Main Transmission Oil and Pressure Warning and Indicating Systems Block Diagram (Sheet 3 of 3).

MAIN TRANSMISSION OIL TEMPERATURE AND PRESSURE INDICATING SYSTEMS

The oil temperature indicating system has an oil temperature sensor and MAIN XMSN OIL TEMP indicator in the central display unit (Figure 1. (Sheet 1 of 3)). The MAIN XMSN OIL TEMP indicator gives a main transmission temperature in degrees Celsius. Indicator ranges are shown in Table 1.

Table 1. XMSN TEMP Ranges.

GREEN	50° to 120°C
AMBER	120° to 140°C
RED	140° to 170°C

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

The oil pressure indicating system has an oil pressure sensor and MAIN XMSN OIL PRESS indicator in the central display unit. The MAIN XMSN OIL PRESS indicator gives main transmission oil pressure in psi. Indicator ranges are shown in Table 2.

Table 2. XMSN PRESS Ranges.

GREEN	30 to 65 psi
AMBER	20 to 30 psi
AMBER	65 to 130 psi
RED	130 to 190 psi

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

For location and description of major components, refer to the data in this work package.

EQUIPMENT DATA

If applicable, refer to WP 1769 00 and WP 1789 00 for equipment data information.

DRIVE SYSTEM

MAIN TRANSMISSION AND GEAR BOX CHIP DETECTOR SYSTEM DESCRIPTION AND DATA

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

MAIN GEAR BOX CHIP DETECTOR

One chip detector, mounted on the sump assembly, constantly monitors lubricating oil for possible metal contamination (Figure 1. (Sheet 1 of 4)). Any metal chips that accumulate within the chip detector gaps close an electrical circuit that lights the CHIP MAIN MDL SUMP capsule on the caution/advisory panel **HH-60A HH-60L >** MFD/caution/advisory panel **<**. The chip detector has a fuzz suppressing feature that prevents minute metal particles (fuzz) from activating the chip capsule by burning them off. Refer to WP 0026 00 for information on latching and time-delay circuits.

Accessory Modules Chip Detectors

Two chip detectors, one mounted on each accessory module, constantly monitor lubricating oil for possible metal contamination (Figure 1. (Sheet 1 of 4)). Any metal chips that accumulate within chip detector gaps close an electrical circuit that lights either CHIP ACCESS MDL - LH or CHIP ACCESS MDL - RH capsule on the caution/advisory panel **HH-60A HH-60L >** MFD/caution/advisory panel **<**. Each chip detector has a fuzz suppressing feature that prevents minute metal particles (fuzz) from activating the chip capsule by burning them off. For information on latching circuits, refer to, WP 0026 00..

Input Modules Chip Detectors

Two chip detectors, on the sump assembly, constantly monitor lubricating oil for possible metal contamination (Figure 1. (Sheet 1 of 4)). Any metal chips that accumulate within chip detector gaps close an electrical circuit that lights either CHIP INPUT MDL - LH or CHIP INPUT MDL - RH capsule on the caution/advisory panel **HH-60A HH-60L >** MFD/caution/advisory panel **<**. Each chip detector has a fuzz suppressing feature that prevents minute metal particles (fuzz) from activating the chip capsule by burning them off. For information on latching circuits, refer to, WP 0026 00..

INTERMEDIATE GEAR BOX CHIP DETECTOR

One chip detector in the gear box monitors possible metal contamination. Any metal chips that accumulate on the chip detector plug close an electrical circuit and light the CHIP INT XMSN light. The chip detector has a burn-off circuit that burns off minute metal particles (fuzz) to prevent unnecessary lighting of the caution light. The chip detector also contains a normally open bimetal temperature switch. When gear box oil temperature reaches 140°C (284°F), the switch closes and causes the fuzz burn capacitor to discharge. This prevents arcing within the gear box when gear box oil is hot. When the temperature switch closes, the INT XMSN OIL TEMP light on the caution advisory panel **HH-60A HH-60L >** MFD/caution/advisory panel **<** goes on. The magnetic capability of the chip detector is retained. The chip detector is self-sealing to permit removal for inspection without loss of oil.

TAIL GEAR BOX CHIP DETECTOR

One chip detector in the gear box monitors possible metal contamination. Any metal chips that accumulate on the chip detector plug close an electrical circuit and light the CHIP TAIL XMSN light. The chip detector has a burn-off circuit that burns off minute metal particles (fuzz) to prevent unnecessary lighting of the caution light. The chip detector also contains a normally open bimetal temperature switch. When gear box oil temperature reaches 140°C (284°F), the switch closes and causes the fuzz burn capacitor to discharge. This prevents arcing within the gear box when gear box oil is hot. When the temperature switch closes, the TAIL XMSN OIL TEMP light on the caution advisory panel **HH-60A HH-60L >** MFD/caution/advisory panel **<** goes on. The magnetic capability of the chip detector is retained. The chip detector is self-sealing to permit removal for inspection without loss of oil.

CHIP DETECTOR RESISTOR UNIT

W/O MWO 50-26 MWO 50-26> **UH-60A 77-22714 - 83-23895 >** A chip detector resistor unit is installed. **<** The resistor unit, along with the caution/advisory system **HH-60A HH-60L >** MFD/caution/advisory warning system **<** ensures proper operation of the master caution reset circuit and the chip detector fuzz-burn circuits for the MAIN GEAR

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

BOX, RH ACCESS MODULE, LH ACCESS MODULE, RH INPUT MODULE, and LH INPUT MODULE chip detectors. UH-60A 83-23896 - SUBQ EH-60A > The chip detector resistor unit has been deleted and internal modifications to the caution/advisory panel HH-60A HH-60L > MFD/caution/advisory panel < increase the efficiency of the chip detector fuzz-burn circuits and master caution reset circuits. <

CHIP DETECTOR WITH BUILT-IN-TEST (BIT) CIRCUITRY

The chip detector with built-in-test (BIT) circuitry is a self-test used to check each chip detector and its wiring. The BIT feature operates upon the power up of aircraft. The BIT circuitry, inside the pod of each chip detector, simulates fine metal particles, chips, and fuzz, which turns on the appropriate warning capsule on the caution/advisory panel. The appropriate warning capsule on the caution/advisory panel remains illuminated for approximately 45 to 75 seconds except for the main module sump warning capsule. The CHIP MAIN MDL SUMP capsule shall go on after a 30-second time delay and remain on for an additional 30 seconds.

PN 8933639-03 / PN HH-60-00001A-01 > When the first MFD is switched ON, (the MFDs source power to the chip detectors), the CHIP INPUT MDL-LH, CHIP ACCESS MDL-LH, CHIP INT XMSN, CHIP TAIL XMSN, CHIP INPUT MDL-RH, CHIP ACCESS MDL-RH, and CHIP MAIN MDL SUMP chip detectors start a BIT check that runs for approximately 45 - 70 seconds, all seven legends are displayed after the MFD start sequence of approximately 23-seconds and then disappear upon completion of BIT. A caution legend that does not appear indicates a failed test on its chip detector circuit. The main transmission chip detector has a 30-second software controlled time delay to allow small chips and fuzz to burn off and/or wash away. The main transmission 30-second delay is software controlled and not active during the MFD start up sequence. <

PN 8933639-03 / PN HH-60-00001A-01 > The MFD sources power to the transmission chip detectors system, the first MFD turned on will start the transmission chip detector BIT sequence/check. If power is removed from the chip detectors by turning both MFDs off for >5 seconds the CHIP INT XMSN and/or CHIP TAIL XMSN may initiate the BIT sequence and activate the legends, additionally the CHIP INPUT MDL-LH, CHIP ACCESS MDL-LH, CHIP INPUT MDL-RH, CHIP ACCESS MDL-RH, and CHIP MAIN MDL SUMP may initiate BIT if power is removed from both MFDs for >15 seconds and activate the legends. The BIT sequence runs for approximately 45 - 70 seconds. <

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

For location and description of major components, refer to the data in this work package.

EQUIPMENT DATA

If applicable, refer to WP 1658 00, WP 1659 00, WP 1750 00, WP 1789 00, and WP 1790 00 for equipment data information.

EQUIPMENT DATA – CONTINUED

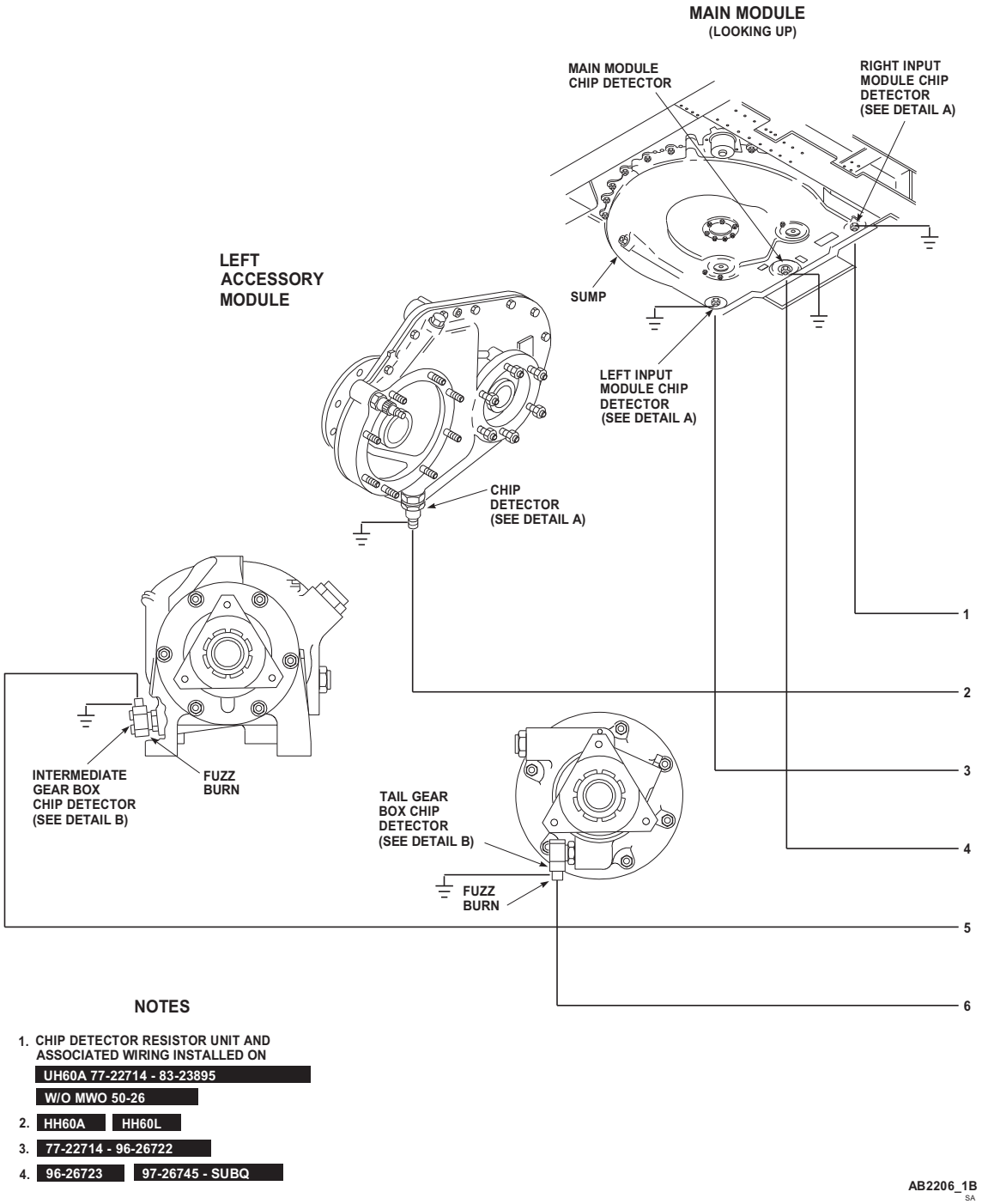


Figure 1. Main Transmission Chip Detector System Block Diagram (Sheet 1 of 4).

EQUIPMENT DATA – CONTINUED

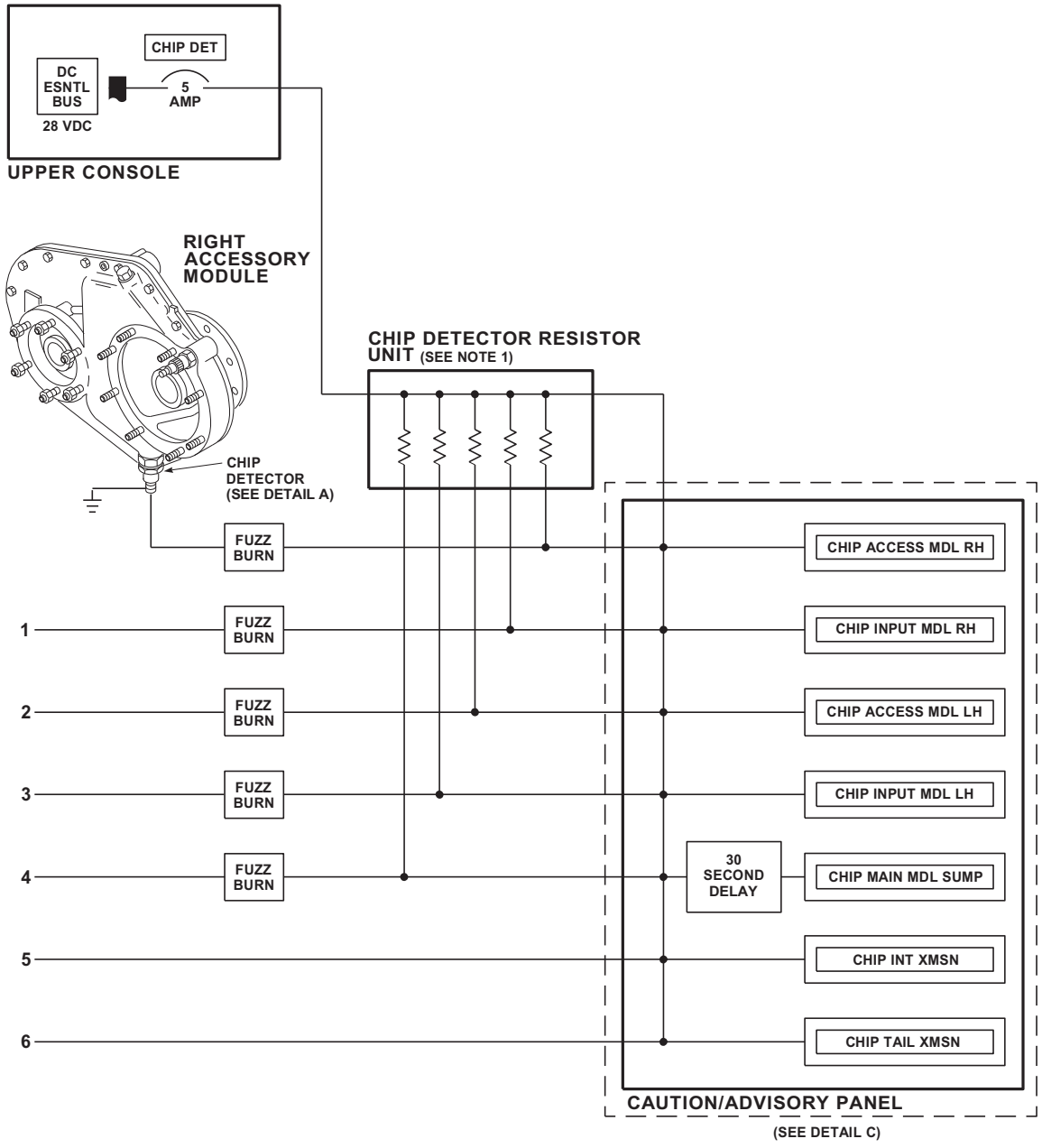
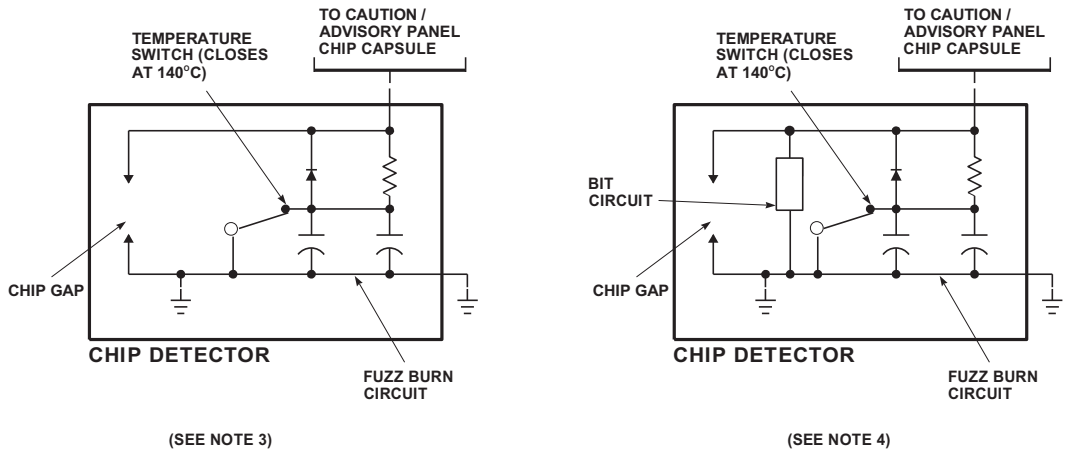


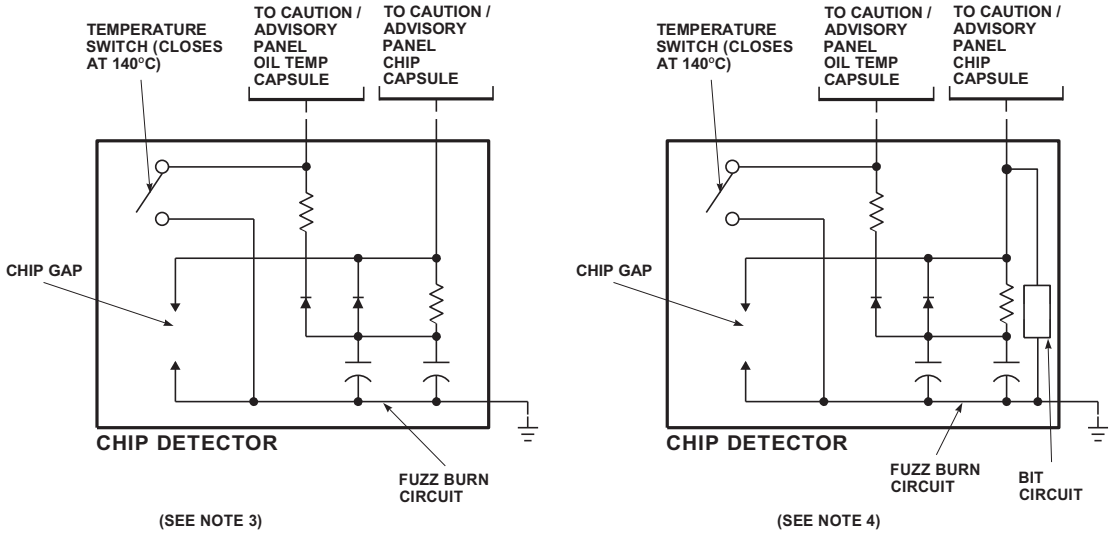
Figure 1. Main Transmission Chip Detector System Block Diagram (Sheet 2 of 4).

EQUIPMENT DATA – CONTINUED



DETAIL A

CHIP DETECTOR SCHEMATIC-TYPICAL FOR ACCESSORY AND INPUT MODULES



DETAIL B

CHIP DETECTOR SCHEMATIC-TYPICAL FOR INTERMEDIATE AND TAIL GEAR BOXES

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Figure 1. Main Transmission Chip Detector System Block Diagram (Sheet 3 of 4).

EQUIPMENT DATA – CONTINUED

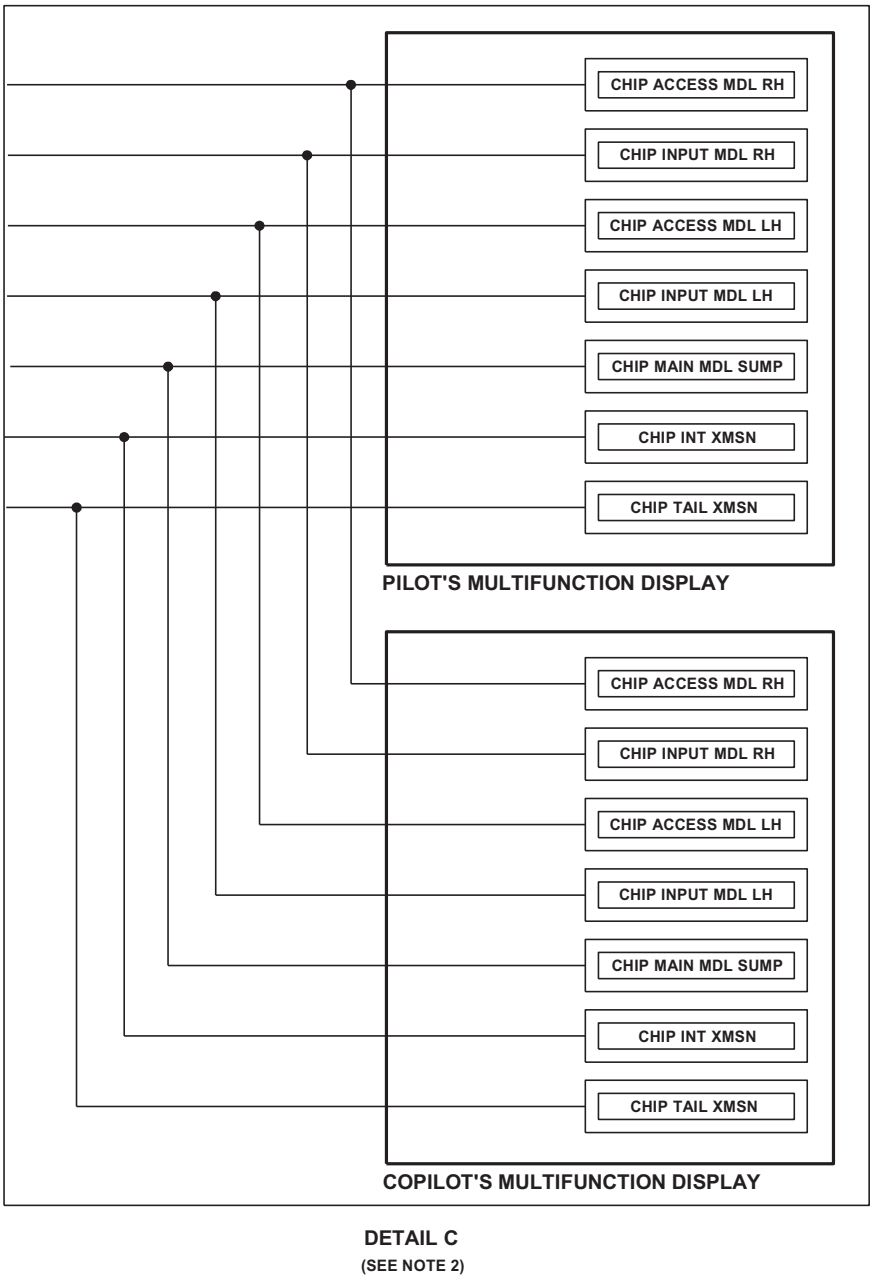


Figure 1. Main Transmission Chip Detector System Block Diagram (Sheet 4 of 4).

PNEUDRAULIC SYSTEM

HYDRAULIC SYSTEMS DESCRIPTION AND DATA

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

HYDRAULIC SYSTEM DESCRIPTION

The hydraulic systems provide between 3000 to 3100 ± 50 psi of hydraulic pressure to operate the primary servos, tail rotor servos, pilot assist servos, and APU start motor. There are three hydraulic systems:

1. No. 1 or first stage hydraulic system.
2. No. 2 or second stage hydraulic system.
3. Backup hydraulic system.

The major components of these systems are three hydraulic pump modules, two transfer modules, a utility module, a pilot-assist module, three primary servos, a tail rotor servo, four pilot-assist servos, an APU accumulator, an APU handpump, and a refill handpump. Most of these components are grouped together on the upperdeck in front of the main transmission. These servos are connected to the hydraulic modules through manifolds and self-sealing couplings.

The three hydraulic systems have pressure switches which illuminate appropriate capsules on the caution/advisory panel **HH-60A HH-60L >** MFD/caution/advisory panel **<** when pressure loss is detected (Figure 1). A leak detection/isolation feature is built into the hydraulic system using pressure switches on the pump modules, check valves and shutoff valves in the transfer modules, and electronic logic modules. When a pressure switch senses a pressure loss in a system, the logic module will shut off the required valve or valves to isolate the leak and turn on the backup pump.

No. 1 Hydraulic System

The No. 1 hydraulic system supplies hydraulic pressure from the No. 1 pump module to the No. 1 transfer module. From the transfer module, pressure is supplied to the first stage of the primary servos (lateral, forward and aft), and the first stage of the tail rotor servo.

No. 2 Hydraulic System

The No. 2 system supplies pressure from the No. 2 pump module to the No. 2 transfer module. From the transfer module, pressure is supplied to the second stage of the primary servos (lateral, forward, and aft) and the pilot-assist module. From the pilot-assist module, pressure is supplied to the pilot-assist servos (collective boost, yaw boost, yaw SAS actuator, roll SAS actuator, pitch SAS actuator, pitch/trim). The pitch/trim servo is supplied pressure at a reduced rate of 1000 psi by means of a pressure regulating valve.

Backup Hydraulic System

The backup hydraulic system supplies hydraulic pressure for ground checks, acts as a backup for first and second stage hydraulic pressure, supplies pressure to the second stage of the tail rotor servo if first stage pressure is lost, and recharges the APU accumulator. The BACK-UP HYD PUMP switch on the upper console is marked OFF, ON, and AUTO. During ground checks (APU running) the switch is at AUTO. If the APU is running and hydraulic pressure is not needed, the switch is placed OFF. For flight, the switch should be at AUTO. If hydraulic pressure drops below 2000 psi in the first and/or second stage system, the backup system automatically picks up the load regardless of switch position during flight or on the ground. After the APU has started, the backup pump recharges the APU accumulator regardless of switch position. The BACK-UP PUMP ON capsule on caution/advisory panel **HH-60A HH-60L >** MFD/caution/advisory panel **<** goes on any time the pump is running.

HYDRAULIC PUMP MODULES

The hydraulic pump modules are combination hydraulic pumps and reservoirs (Figure 2). The No. 1, No. 2, and backup pump modules are identical and interchangeable with each other. The No. 1 pump module is mounted on and driven by the left accessory transmission module. The No. 2 pump module is mounted on and driven by the right accessory transmission module. The backup pump module is mounted on and driven by an ac electric motor.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

The reservoir part of each pump module has a fluid level indicator window marked EMPTY, REFILL, and FULL. The position of the piston indicator stripe viewed through the sight glass of the pump module compared to the fluid ident and level indicator plate indicates amount of hydraulic fluid in the pumps reservoir. The pressure relief valve and bleed valve protect the pump from high pressure in the return system.

The pump has two valves: a high pressure relief valve and a bleed relief valve; two filters: a pressure filter and return filter. A red indicator button on each filter housing will pop out when differential pressure across the filter reaches 60 to 80 psid. The indicator button can only be reset from inside the filter housing when filter element is replaced. The return filter has a bypass valve that opens when return pressure reaches between 90 and 110 psid. The pressure filter has no bypass.

Each pump has three check valves: one at the external ground coupling, one at the pressure side, and one at the return side.

A low level switch, mounted on top of each pump module, senses reservoir fluid quantity for that system. When the piston in the pump module reaches the REFILL mark, the piston closes the low level switch which lights the #1, #2, or BACKUP RSVR LOW caution capsule in the caution/advisory panel **HH-60A HH-60L >** MFD/caution/advisory panel **<**. In the 1st and 2nd stage systems activation of the low level switch will also signal the leak detection isolation system of a leak.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

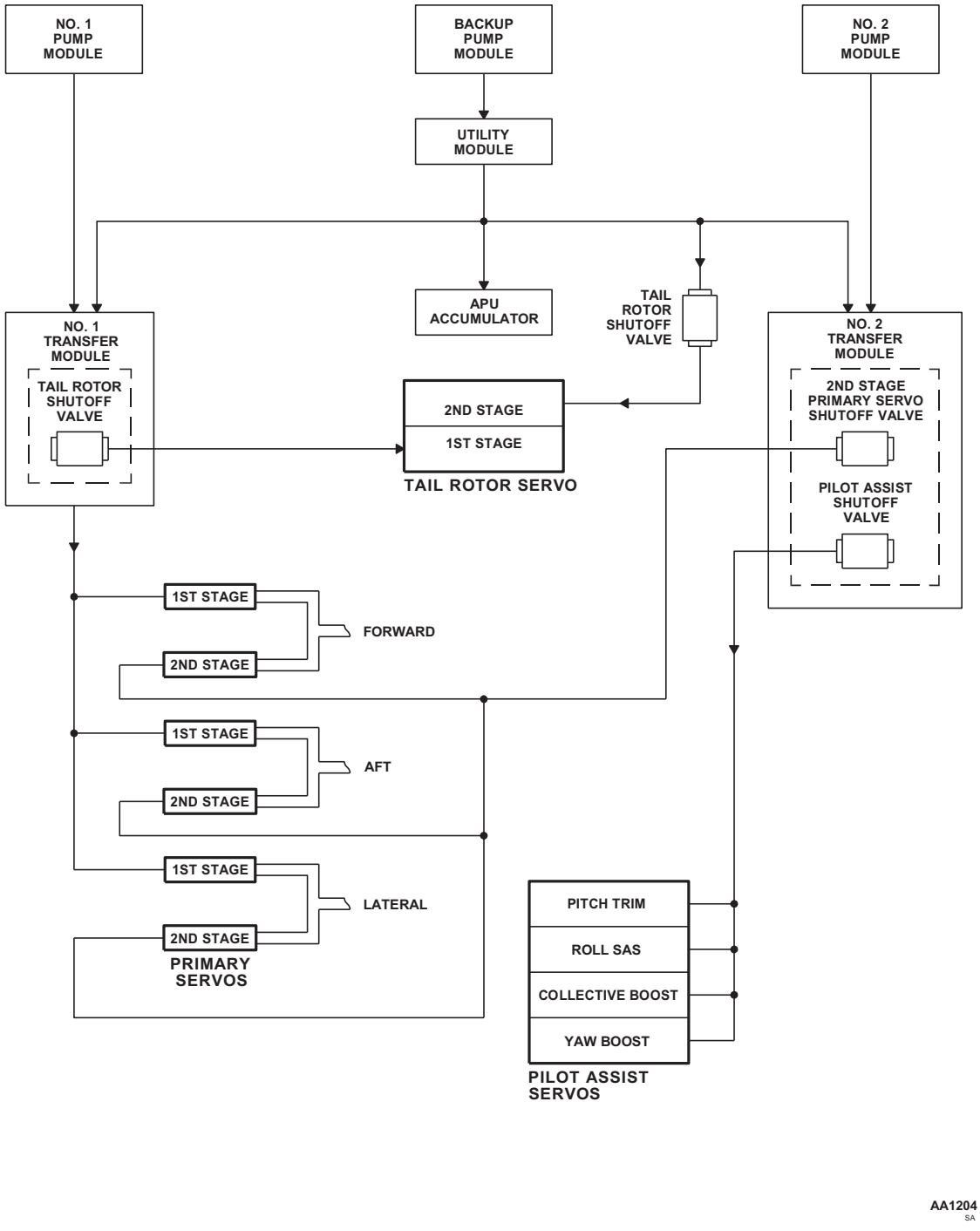


Figure 1. Hydraulic System Simplified Block Diagram.

A depressurization valve in the backup pump module allows the motor to get up to rated speed before a load is applied. When the backup pump motor is turned on, the depressurization valve in the backup pump module destrokes the output pressure of the pump to 700 psi. This valve is held open by the logic module in the right relay panel for 4 seconds when either the APU generator or external power is supplying power, or for 1/2 second

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

when the helicopter generators are supplying power. After the pump motor is started, the valve closes, allowing the pump to develop between 3000 and 3100 psi output pressure.

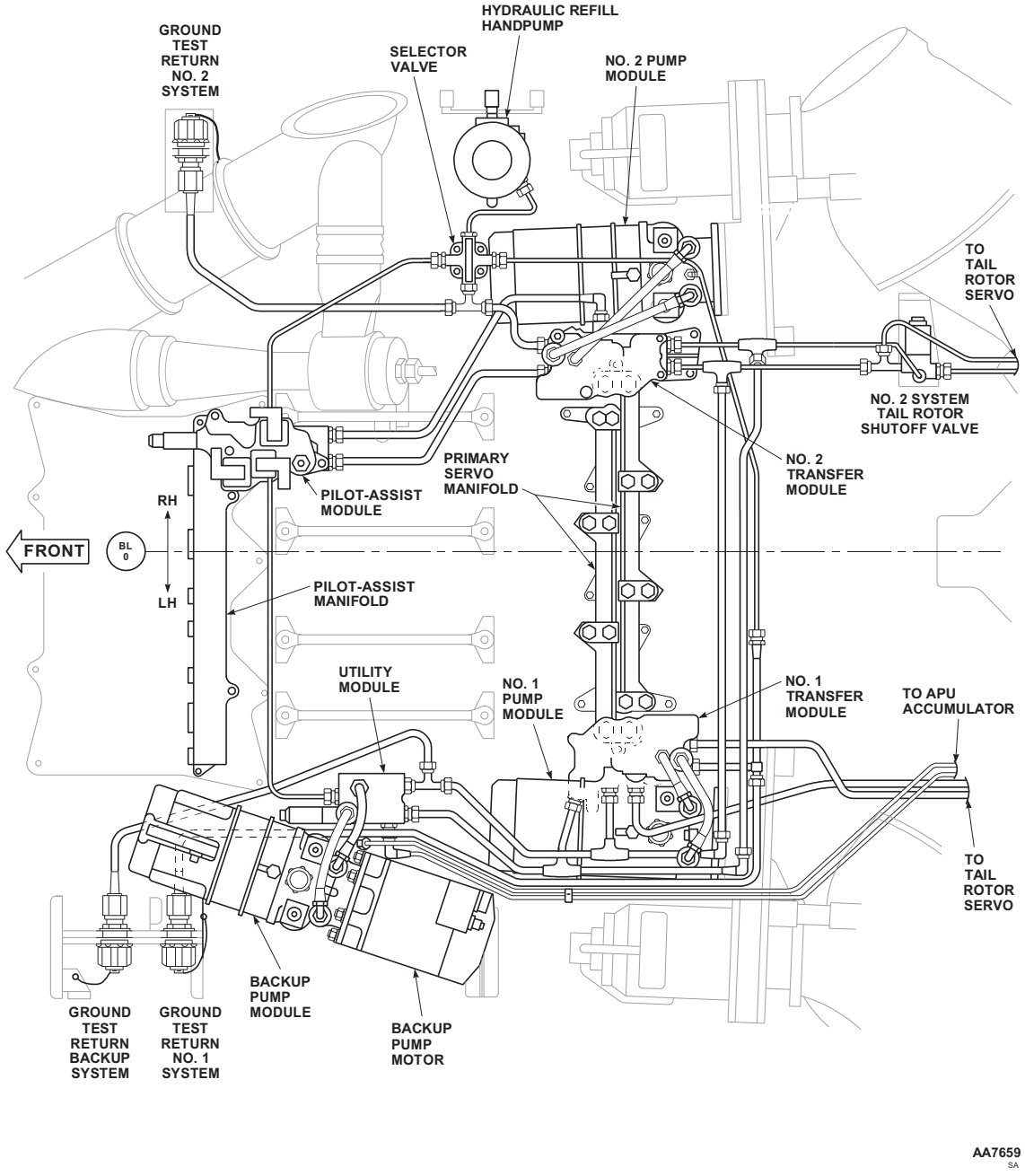


Figure 2. Main Rotor Pylon Hydraulic Component Location.

PRIMARY SERVO SHUTOFF SWITCH

These switches, on the pilot's and copilot's collective stick grips, are marked SVO OFF - 1ST STG and 2ND STG. If either stage of any primary servo jams or if pressure is lost, that stage may be shut off. The #1 and #2 PRI SERVO PRESS capsules on the caution/advisory panel **HH-60A HH-60L >** MFD/caution/advisory panel **<** show which stage has jammed or lost pressure. The systems are electrically interlocked through the opposite

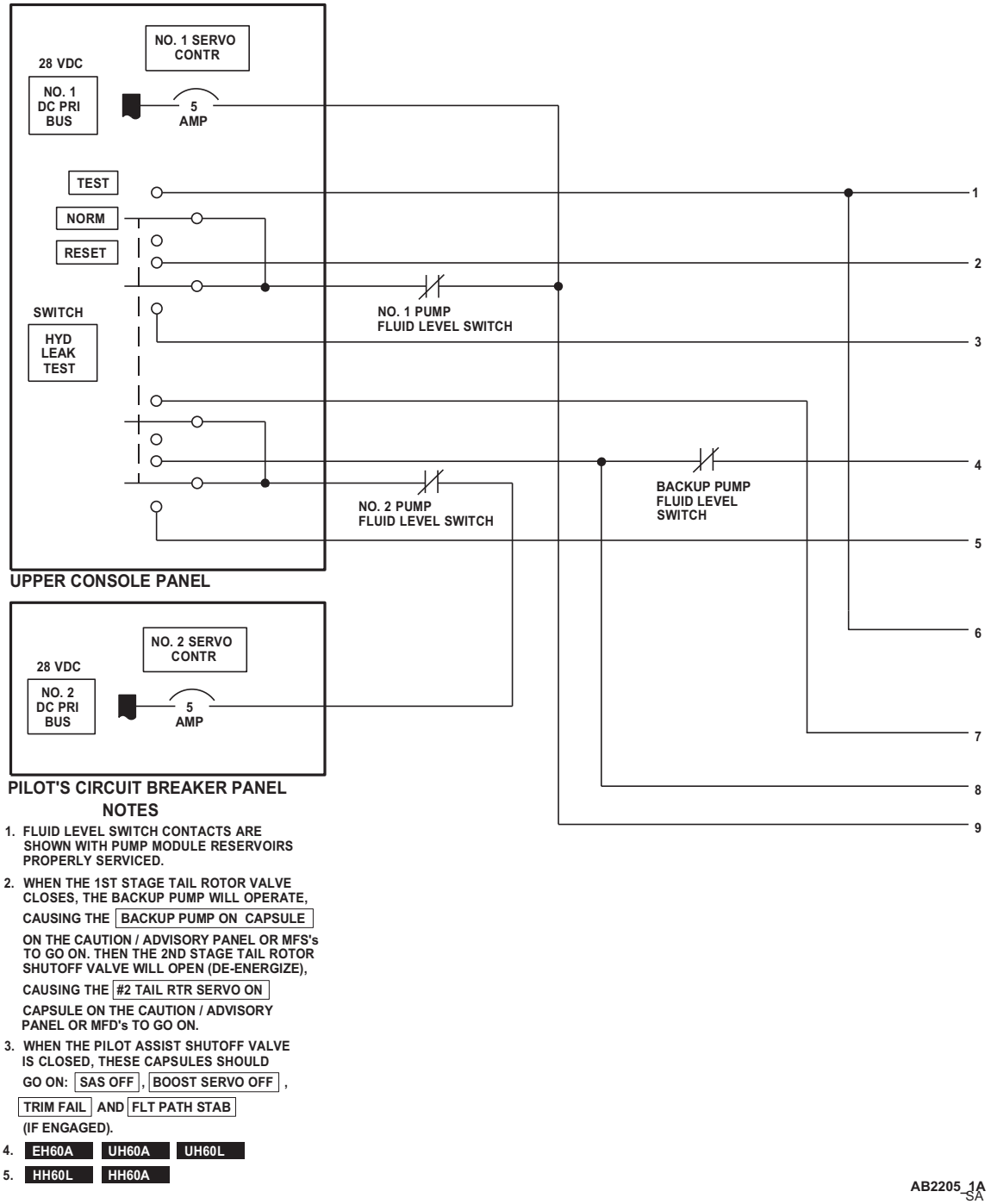
EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

system's servo pressure switch to prevent both systems from being shut off at the same time. As an example, when the SERVO switch is placed to 1ST STG, second stage pressure must be above 2350 psig before the first stage shutoff valve closes, and the #1 PRI SERVO PRESS capsule goes on. The tail rotor servo is not affected. With the switch in 2ND STG off, only the #2 PRI SERVO PRESS capsule goes on. The pilot-assist servos are not affected.

HYDRAULIC LEAK TEST SWITCH

The HYD LEAK TEST switch, on the upper console panel, checks out the leak detection isolation feature of the hydraulic systems (Figure 3. (Sheet 1 of 3) and Figure 3. (Sheet 2 of 3)). Electrical power for the switch comes from the No. 2 SERVO CONTR and No. 1 SERVO CONTR circuit breakers. When the switch is placed to TEST (with at least one engine operating at IDLE speed) the first stage tail rotor shutoff valve and the pilot-assist shutoff valves are closed. When the first stage tail rotor servo shutoff valve closes, the #1 TAIL RTR SERVO caution capsule goes on, causing the backup pump to operate. Then the second stage tail rotor shutoff valve opens, causing the #2 TAIL RTR SERVO ON advisory capsule to go on. After the test, the switch is placed to RESET, to set the hydraulic system back to its normal state.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED



NOTES

1. FLUID LEVEL SWITCH CONTACTS ARE SHOWN WITH PUMP MODULE RESERVOIRS PROPERLY SERVICED.
2. WHEN THE 1ST STAGE TAIL ROTOR VALVE CLOSES, THE BACKUP PUMP WILL OPERATE, CAUSING THE BACKUP PUMP ON CAPSULE ON THE CAUTION / ADVISORY PANEL OR MFS's TO GO ON. THEN THE 2ND STAGE TAIL ROTOR SHUTOFF VALVE WILL OPEN (DE-ENERGIZE), CAUSING THE #2 TAIL RTR SERVO ON CAPSULE ON THE CAUTION / ADVISORY PANEL OR MFD's TO GO ON.
3. WHEN THE PILOT ASSIST SHUTOFF VALVE IS CLOSED, THESE CAPSULES SHOULD GO ON: SAS OFF, BOOST SERVO OFF, TRIM FAIL AND FLT PATH STAB (IF ENGAGED).
4. EH60A UH60A UH60L
5. HH60L HH60A

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SA

Figure 3. Hydraulic Isolation Block Diagram (Sheet 1 of 3).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

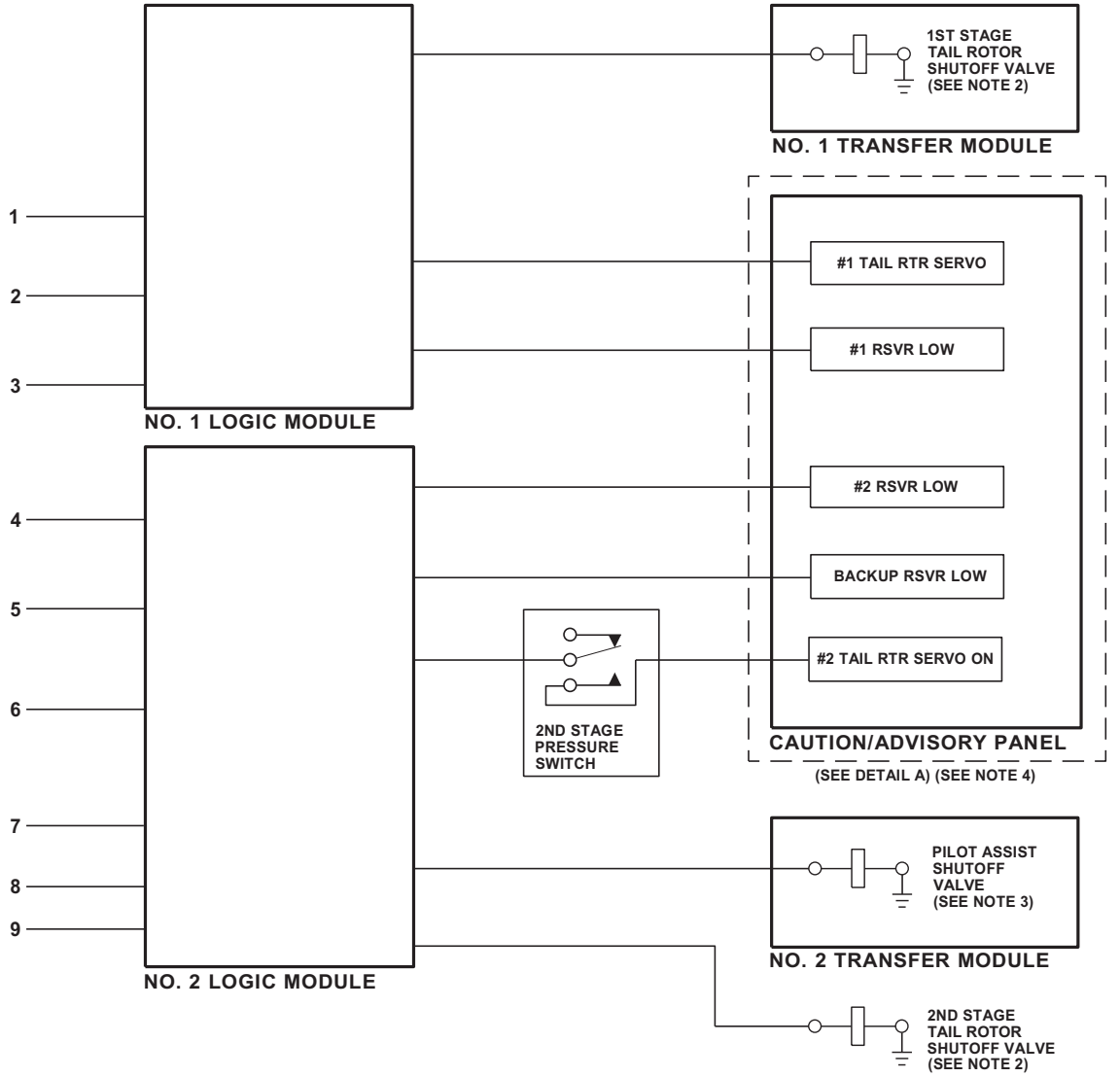


Figure 3. Hydraulic Isolation Block Diagram (Sheet 2 of 3).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

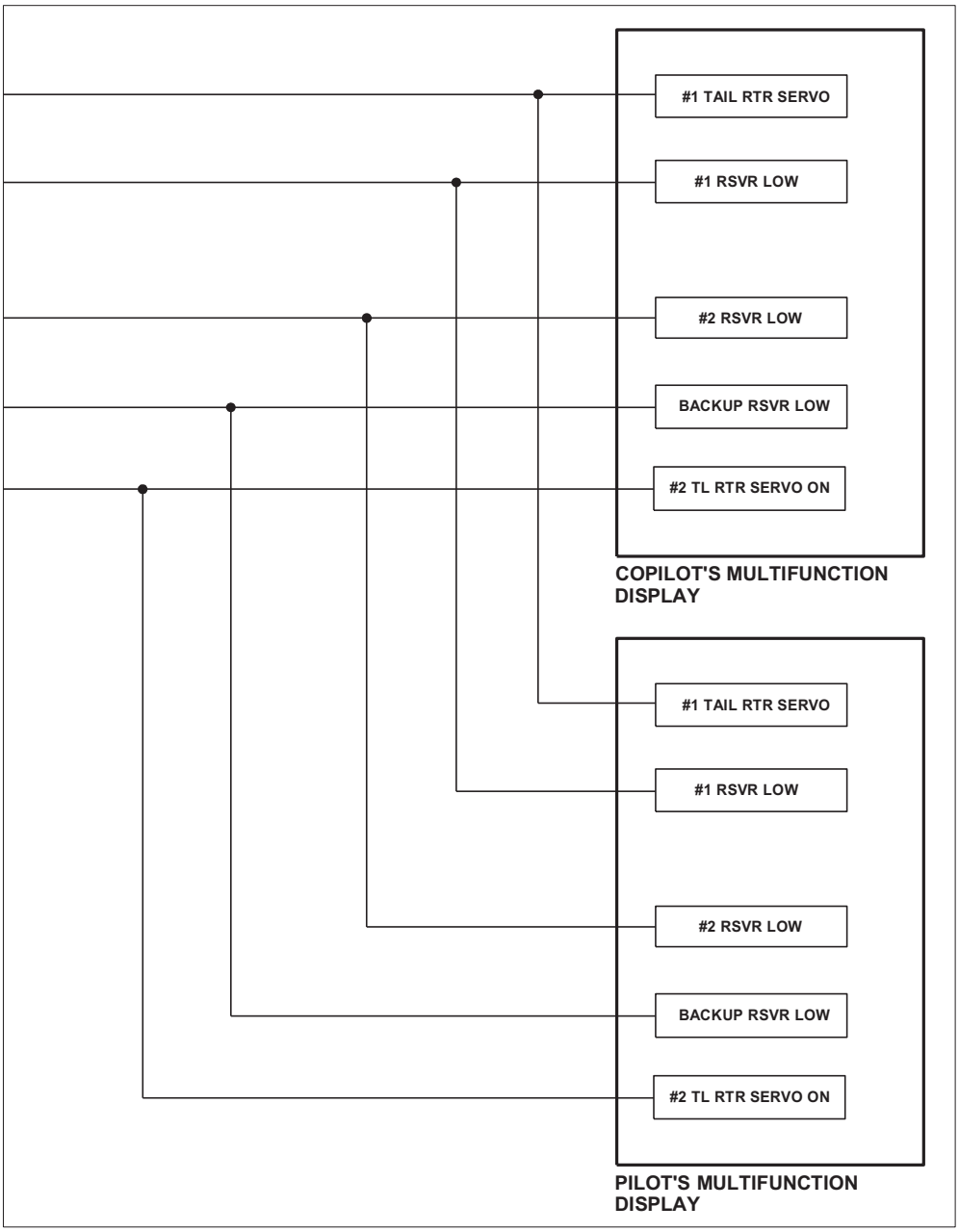


Figure 3. Hydraulic Isolation Block Diagram (Sheet 3 of 3).

APU ACCUMULATOR

The accumulator supplies between 3000 to 3100 ± 50 psig hydraulic charge to the APU start motor (Figure 4and Figure 5). Hydraulic fluid in the accumulator compresses a charge of nitrogen. If the back-up pump fails to recharge the accumulator, it may be manually charged pumping the APU handpump. The handpump is on the rear cabin ceiling. A tape indicator assembly on the accumulator shows the percent of the pressure charge in the accumulator. A pressure gage shows the pressure of the nitrogen precharge. The tape will indicate zero (0)

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

when the hydraulic charge has been released. However, the pressure gage will indicate the nitrogen precharge pressure which at 70°F shall be 1450 psig.

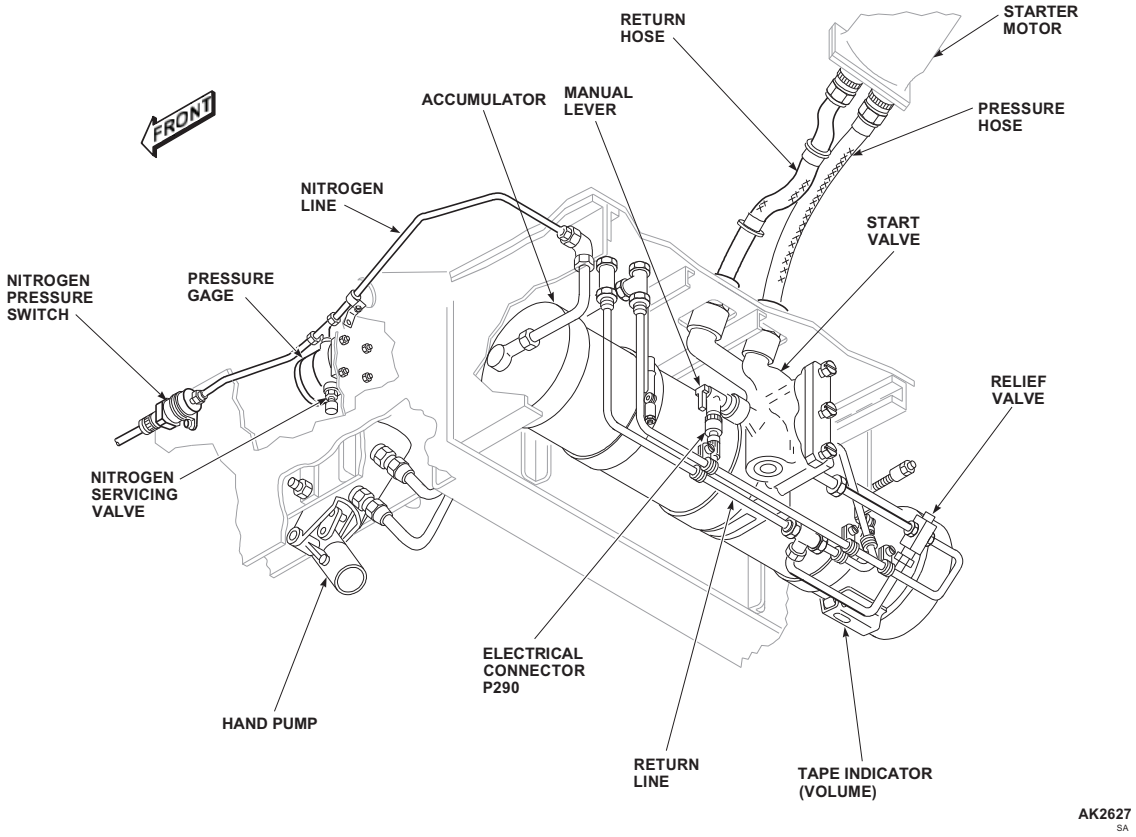


Figure 4. APU Accumulator.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

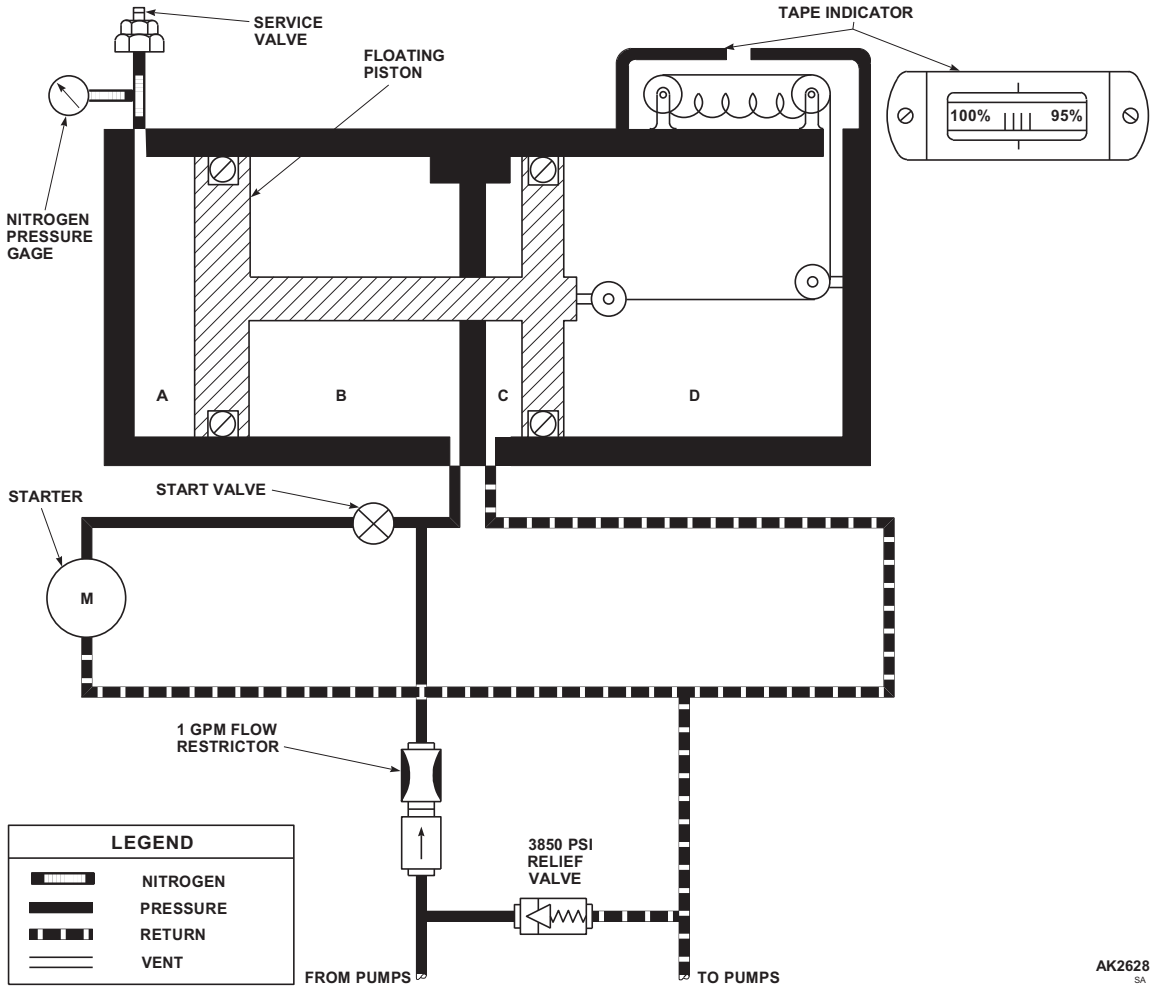


Figure 5. APU Accumulator Block Diagram.

HYDRAULIC REFILL HANDPUMP AND SELECTOR VALVE

The hydraulic refill handpump on the upper deck, in front of the No. 2 ac generator, is used to refill the pump module reservoirs (Figure 2). The refill pump has a total capacity of 1.3 quarts of hydraulic fluid, a replaceable 15-micron filter, and a selector valve. A bull's-eye window on the side of the pump shows fluid level. When the fluid level is even with the line through the window, a 1-quart can of fluid can be added to the pump. The selector valve has four numbered positions. Port 1 for the No. 1 pump reservoir. Port 2 for the No. 2 pump reservoir. Port 3 for the backup pump reservoir. Port 4 is plugged and used for the stowed position when not in use. To refill, open can of fluid, using can opener on lid of pump; pour fluid into reservoir; turn selector valve handle to desired port; hold handle down and crank pump handle. Continue to crank pump until indicator on reservoir indicates FULL.

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

For location and description of major components, refer to the data in this work package.

EQUIPMENT DATA

If applicable, refer to WP 1653 00, WP 1654 00, WP 1655 00, WP 1656 00, WP 1707 00, WP 1683 00, and WP 1736 00, for equipment data information.

PNEUDRAULIC SYSTEM

HYDRAULIC SERVOS, ACTUATORS, AND MODULES DESCRIPTION AND DATA

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

TRANSFER MODULES

The No. 1 and No. 2 transfer modules connect hydraulic pressure from the pump modules to the flight control servos. Each module is an integrated assembly of shutoff valves, pressure switches, check valves, shuttle valves, and restrictor.

No. 1 Transfer Module

This module has a transfer valve, a pressure switch, a first stage primary shutoff valve, a first stage tail rotor shutoff valve, a restrictor, and check valves. The transfer valve is spring loaded to the open or normal position. If first stage hydraulic pressure is lost, the valve automatically transfers backup pump pressure to the first stage system. The first stage primary shutoff valve lets the pilot or copilot, by use of the SERVO switch on the collective sticks, shut off first stage pressure to the primary servos. The pressure switch lights the #1 HYD PUMP light on the caution/advisory panel **HH-60A HH-60L >** MFD/caution/advisory panel **<** when pressure drops to 2000 psi and also sends a signal to a logic module that pressure is lost in the first stage hydraulic system. The restrictor allows fluid to circulate for cooling under no-flow conditions. If a fluid leak develops past the transfer module, the check valves prevent fluid loss on the return side of the transfer module.

No. 2 Transfer Module

The No. 2 transfer module is like the No. 1 module except that it supplies second stage pressure. The pilot assist shutoff valve turns off pressure to the pilot assist module. The second stage primary servo shutoff valve, controlled by the SERVO switch on the collective sticks, turns off pressure to the second stage of the primary servos. The pressure switch turns on the #2 HYD PUMP caution light on the caution/advisory panel **HH-60A HH-60L >** MFD/caution/advisory panel **<** when second stage system pressure is below 2000 psi, and also sends a signal to a logic module that pressure is lost in the second stage system.

UTILITY MODULE

The utility module connects hydraulic pressure from the backup pump to the No. 1 and No. 2 transfer modules, the second stage of the tail rotor servo, and the APU accumulator. A pressure switch on the module senses the backup pump operating and turns on the BACK-UP PUMP ON advisory light on the caution/advisory panel **HH-60A HH-60L >** MFD/caution/advisory panel **<**. If the flow rate through the module to the APU accumulator goes over 1-1/2 gpm, a velocity fuse shuts off flow.

PRIMARY SERVOS

There are three interchangeable primary servos: the forward servo, aft servo, and lateral servo (Figure 1). The servos provide a power boost to the main rotor flight controls. They also reduce feedback forces from the main rotor head. Each servo has two independent stages (first stage and second stage). Each stage has an independent piston, valve housing, and hydraulic supply. The input linkage is common. The servos are interchangeable. The primary servo manifold connects the servos to the No. 1 and No. 2 transfer modules. Each stage of the servo has a jam simulation button. When pressed, the jam simulation button displaces the spool valve sleeve, causing the # 1 or # 2 PRI SERVO PRESS caution light on the caution/advisory panel **HH-60A HH-60L >** MFD/caution/advisory panel **<** to go on. Each stage of a primary servo has a ballistic tolerant feature built in so that if a projectile should damage one stage, that stage will be inoperative, but will not stop the other stage from operating properly.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

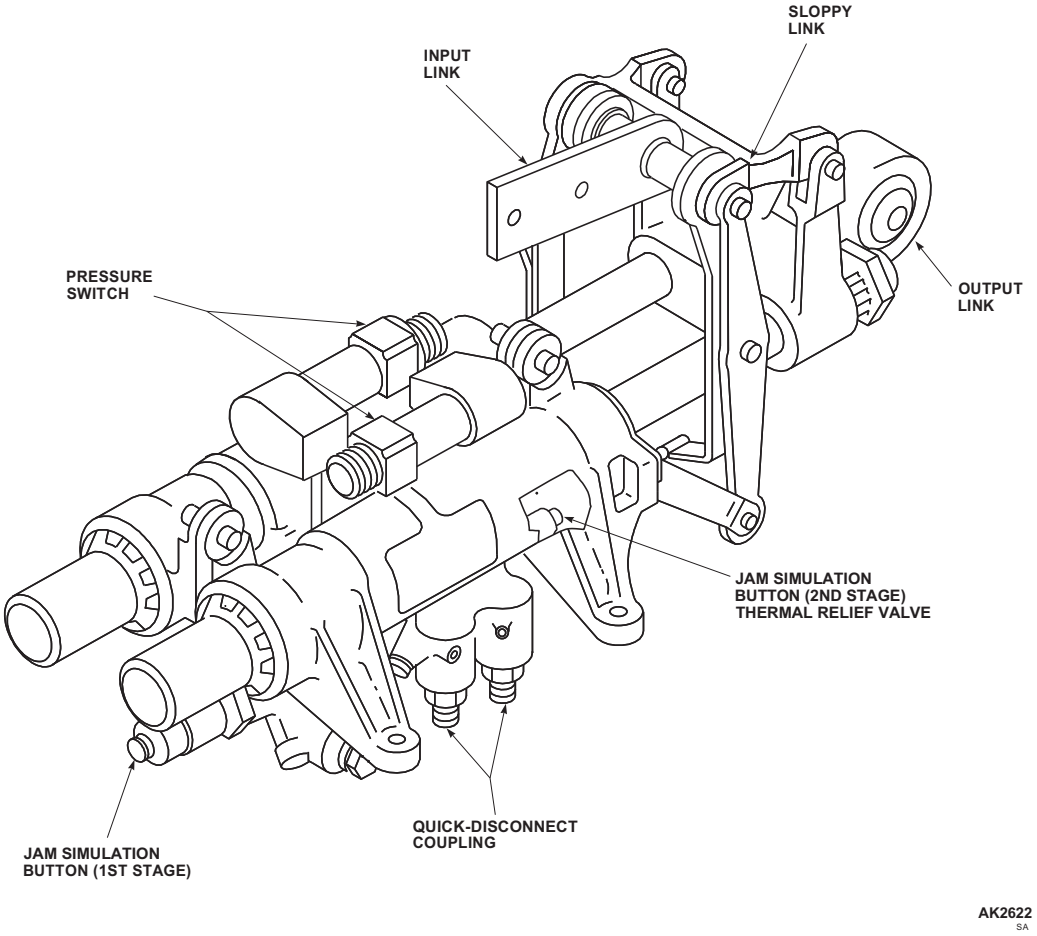


Figure 1. Primary Servo.

PILOT ASSIST SERVOS AND MODULE

The pilot assist servo assemblies reduce pilot work load by providing control boost, stick trimming, stability augmentation, and control inputs from the AFCS.

COLLECTIVE BOOST SERVO

The collective boost servo reduces stick and flight control friction (Figure 2). The servo is controlled by a button marked BOOST on the STABILATOR CONTROLS/AUTO FLIGHT CONTROL panel.

The collective boost servo has a jam simulation button. When pressed, the button displaces the spool valve sleeve and causes the BOOST SERVO OFF capsule or legend on the caution/advisory panel **HH-60A HH-60L** > MFD/caution/advisory panel < to go on.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

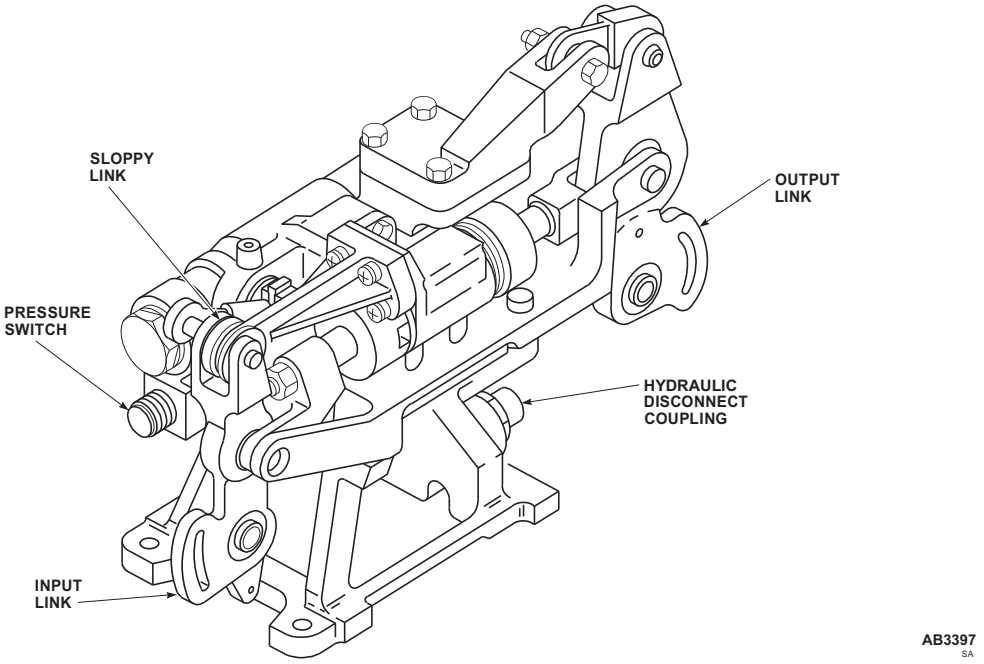


Figure 2. Collective Boost Servo.

YAW BOOST SERVO

The yaw boost servo reduces stick and flight control friction (Figure 3). The yaw boost servo is the same as the collective boost except for the addition of a SAS actuator, which provides rate damping. The servo is controlled by a button marked BOOST, on the STABILATOR CONTROLS/AUTO FLIGHT CONTROL panel.

The yaw boost servo has a jam simulation button. When pressed, the button displays the spool valve sleeve and causes the BOOST SERVO OFF capsule or legend on the caution/advisory panel **HH-60A HH-60L >** MFD/caution/advisory panel **<** to go on.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

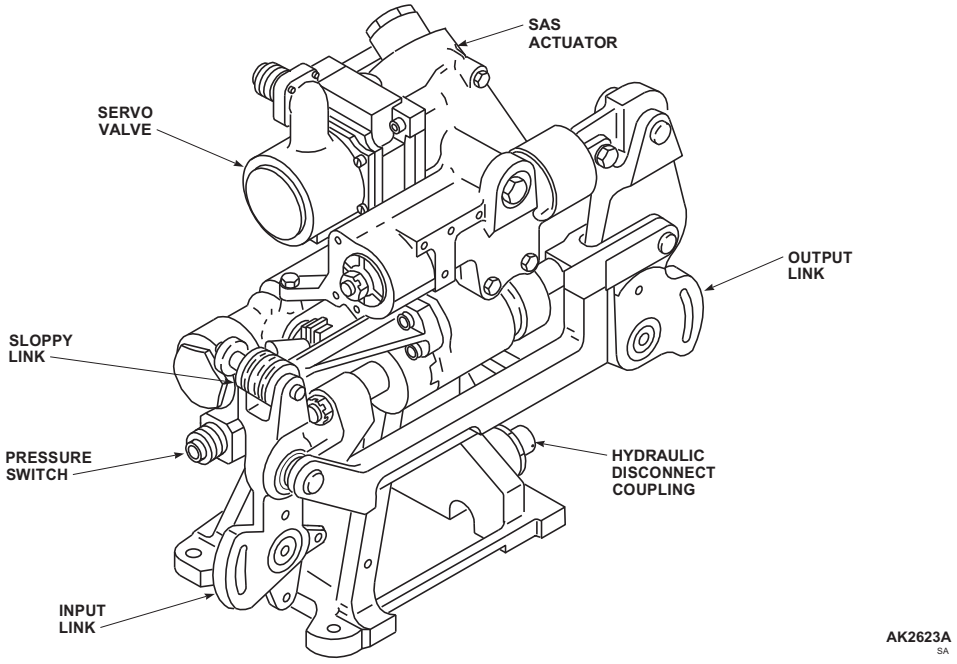


Figure 3. Yaw Boost Servo.

ROLL SAS ACTUATOR

The roll SAS actuator is a dynamic rate stabilization system that gives rate dampening for the helicopter in the roll axis (Figure 4). When engaged, the helicopter cockpit controls do not move. The actuator is controlled by SAS 1 and 2 buttons on the STABILATOR CONTROLS/AUTO FLIGHT CONTROL panel.

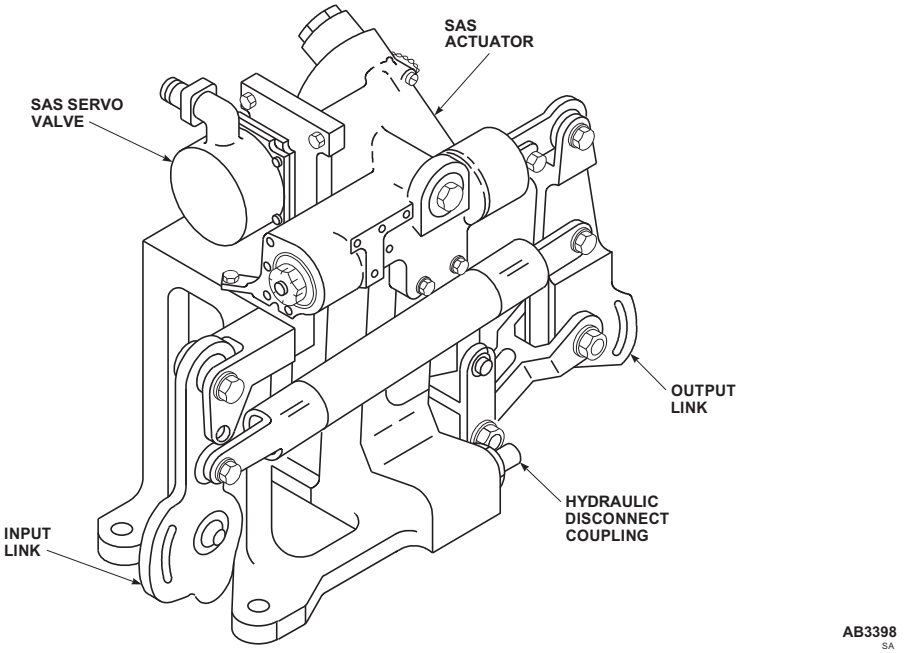


Figure 4. Roll SAS Actuator.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

PITCH/TRIM ACTUATOR ASSEMBLY

The pitch/trim actuator assembly controls the longitudinal axis and the attitude of the helicopter (Figure 5). The actuator is controlled by the SAS1, SAS2, TRIM and FPS buttons on the STABILATOR CONTROLS/AUTO FLIGHT CONTROL panel. Trim maintains a position of the cyclic stick in the longitudinal axis.

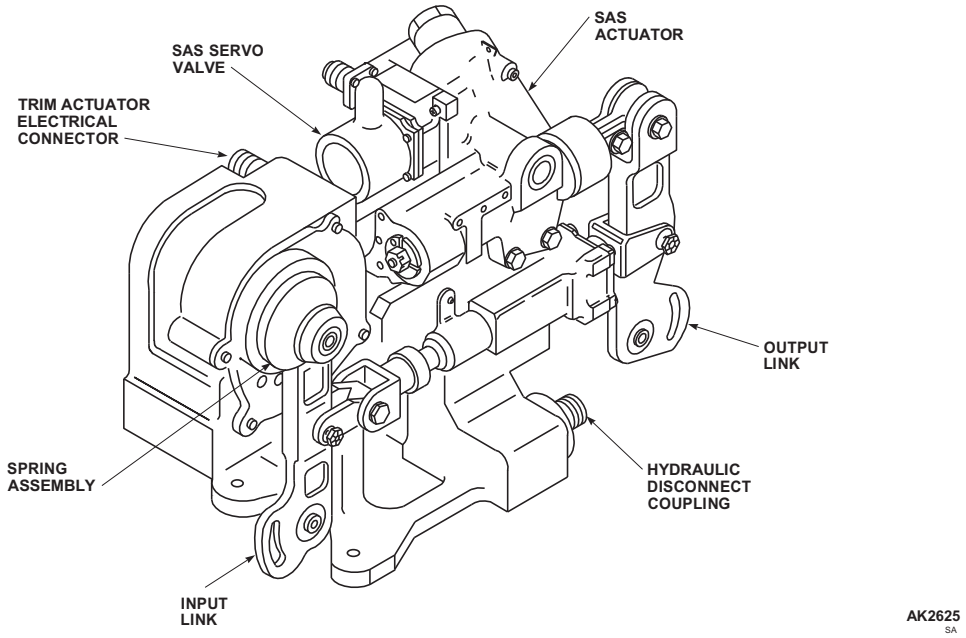


Figure 5. Pitch/Trim Actuator Assembly.

PILOT-ASSIST MODULE

The pilot-assist module consists of a thermal relief valve, a pressure reducer, a SAS shutoff valve, a boost shutoff valve, a pitch/trim turn-on valve, a pressure switch, and self-sealing quick-disconnect couplings. The thermal relief valve protects the module from damage due to thermal expansion of hydraulic fluid kept in the module during storage. The thermal relief valve has no function when the module is installed on the helicopter. The pressure reducer reduces system hydraulic pressure from 3000 to 1000 psi for pitch/trim servo operation. It has a relief valve built into it to protect the pitch/trim servo from adverse system pressure. If the pressure reducer fails, the relief valve goes into bypass, and a visual indicator, on the pressure reducer, pops. The indicator will remain visible until manually reset. The SAS shutoff valve turns off system pressure to the SAS actuators. The boost shutoff valve turns off system pressure to the collective and yaw boost servos. The pitch/trim turn-on valve turns on system pressure to the pitch/trim servo. The pressure switch on the module turns on the SAS OFF light on the caution/advisory panel **HH-60A HH-60L >** MFD/caution/advisory panel **<** when pressure drops below limits. The module also has self-sealing, quick-disconnect couplings on all input and output ports, for ease of maintenance.

TAIL ROTOR SERVO

The tail rotor servo is located on the tail gear box. It furnishes a power boost to the tail rotor flight controls (Figure 6). The servo has two independent stages, first and second. The stages of the servo are controlled by the TAIL SERVO switch located on the miscellaneous switch panel on the lower console. A cooling restrictor is installed for the No. 1 pump module. Normally only the first stage of the servo is pressurized.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

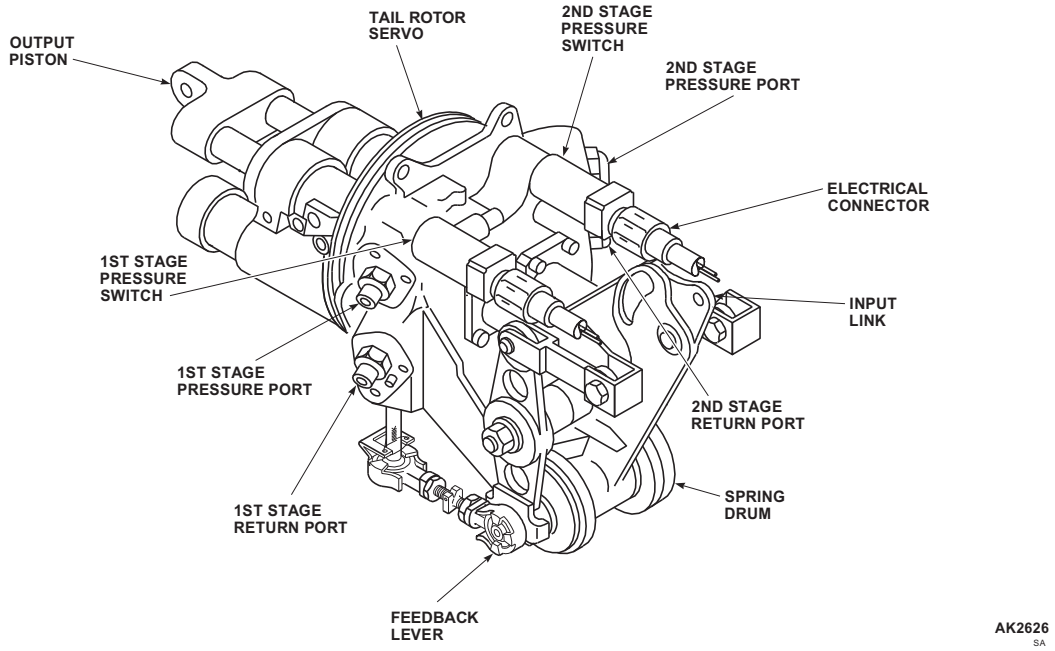


Figure 6. Tail Rotor Actuator Assembly.

LOGIC MODULES

Two logic modules, one in the left relay panel and the other in the right relay panel, are used to control the operation of the hydraulic systems. The logic modules continually monitor the operation of the hydraulic systems by inputs received from pressure switches, fluid level switches on the pump modules, and inputs received from control switches in the hydraulic system. The outputs of the logic modules will turn on capsules or legends on the caution/advisory panel **HH-60A HH-60L >** MFD/caution/advisory panel **<** notifying the pilot of a failure, turn off a valve due to a system malfunction, or command the backup pump to operate.

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

For location and description of major components, refer to the data in this work package.

EQUIPMENT DATA

For equipment data information, refer to this work package.

INSTRUMENT SYSTEMS

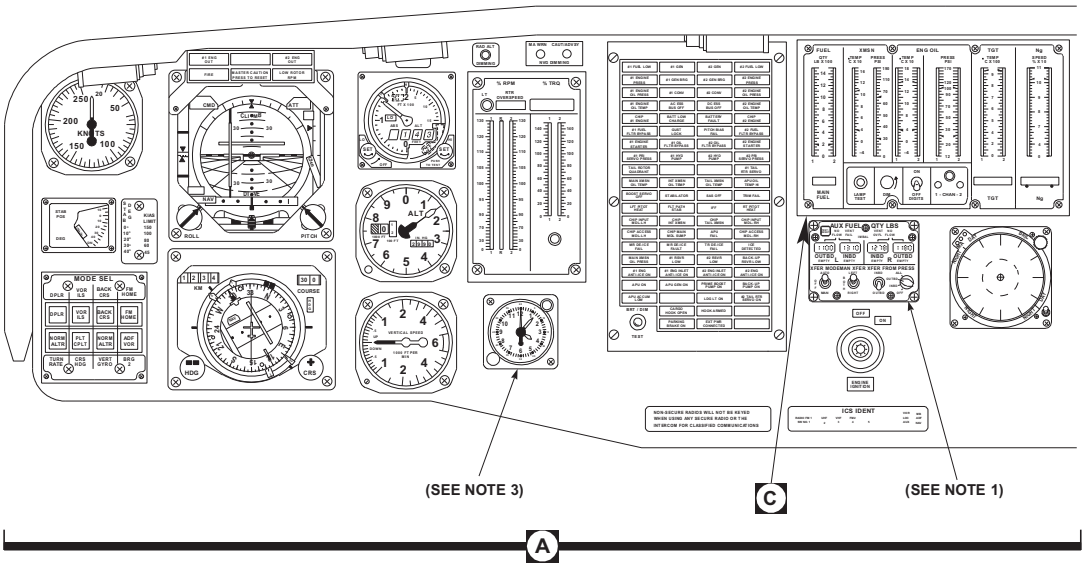
FLIGHT INSTRUMENTS DESCRIPTION AND DATA

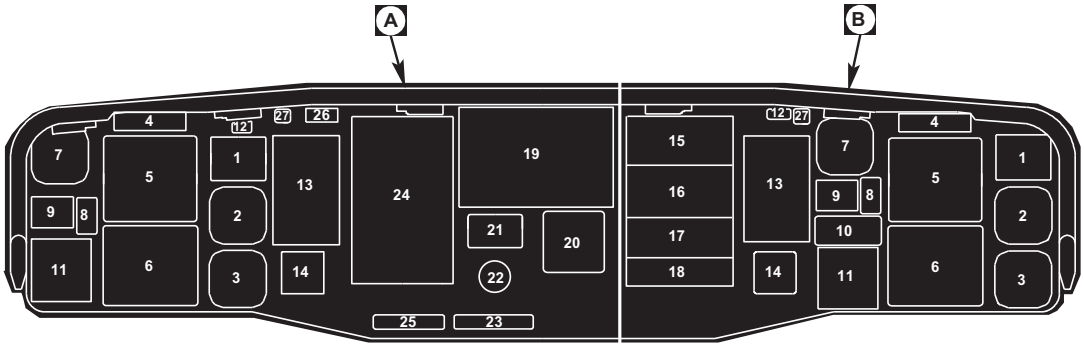
EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

FLIGHT INSTRUMENTS DESCRIPTION

The flight instruments provide the pilot with information necessary for correct flight (Figure 1). The flight instruments include the barometric altimeters, airspeed indicators, vertical speed indicators, associated Pitot-Static system, radar altimeters, horizontal situation indicators (HSI), vertical situation indicators (VSI), stabilator position indicator, and standby compass.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED





NOTES

1. ON HELICOPTERS WITH **MWO 50-78**
2. **86-24491 - SUBQ**
   THE COMPONENTS ARE INSTALLED AS FOLLOWS:
   BLADE DE-ICE CONTROL PANEL (TOP)
   BLADE DE-ICE TEST PANEL (CENTER)
   ICING RATE METER (BOTTOM)
3. ABU-11/A (ANALOG), PD89MME-637-3 (DIGITAL), OR LC-6 (DIGITAL) CLOCK MAY BE INSTALLED.
4. LC-6 (DIGITAL) CLOCK MAY BE INSTALLED.

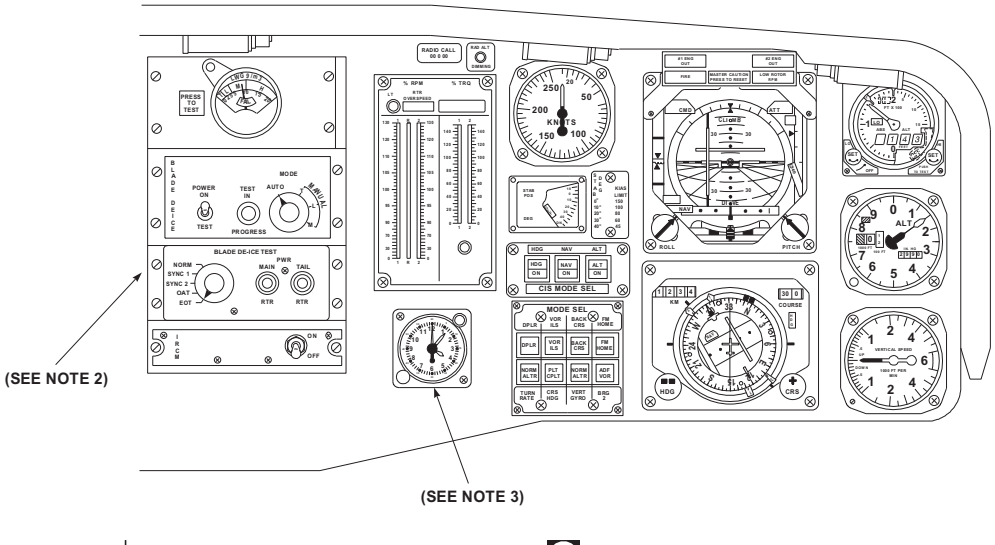
EFFECTIVITY

UH60A **UH60L**

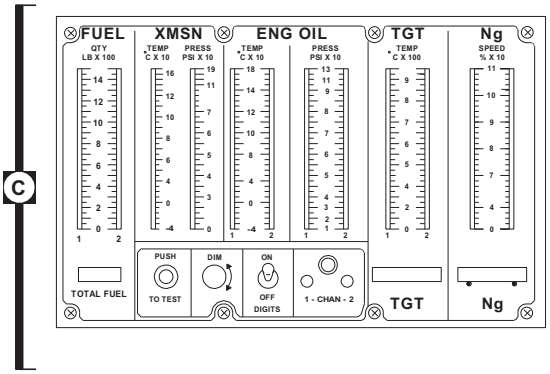
AB2162_1B
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Figure 1. Instrument Panel Front View (Sheet 1 of 6).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED



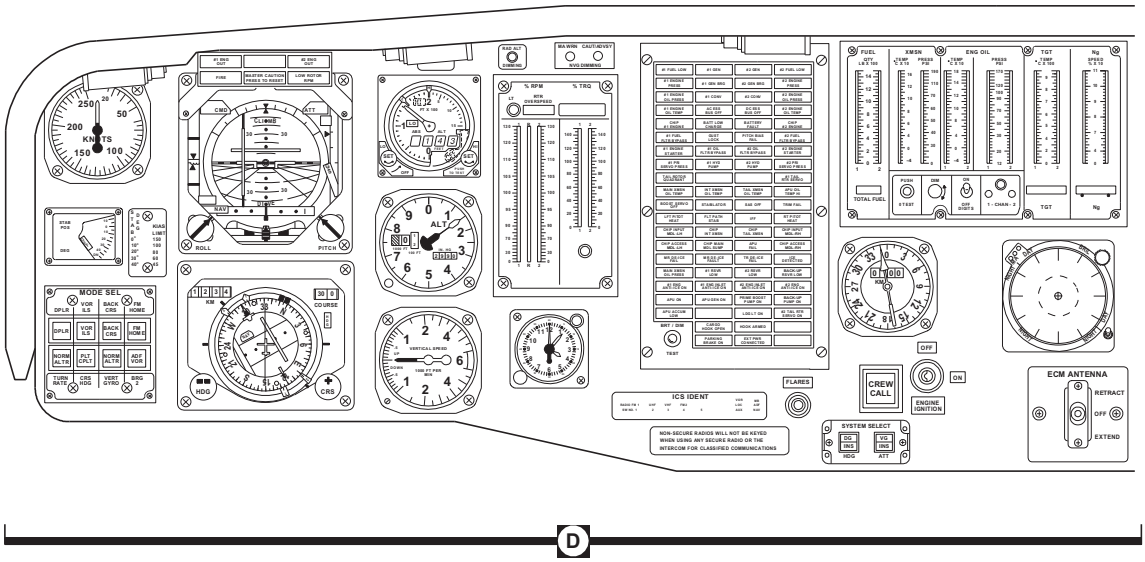
1. RADAR ALTIMETER
2. BAROMETRIC ALTIMETER
3. VERTICAL SPEED INDICATOR
4. MASTER WARNING PANEL
5. VERTICAL SITUATION INDICATOR
6. HORIZONTAL SITUATION INDICATOR
7. AIRSPEED INDICATOR
8. STABILATOR POSITION PLACARD
9. STABILATOR POSITION INDICATOR
10. CIS MODE SELECTOR
11. VSI / HSI MODE SELECTOR
12. RADIO CALL PLACARD
13. PILOT'S AND COPILOT'S DISPLAY UNIT
14. CLOCK
15. ICING RATE METER (SEE NOTE 2)
16. BLADE DE-ICE CONTROL PANEL (SEE NOTE 2)
17. BLADE DE-ICE TEST PANEL (SEE NOTE 2)
18. INFRARED COUNTERMEASURE CONTROL PANEL
19. CENTRAL DISPLAY UNIT
20. RADAR WARNING INDICATOR
21. AUXILIARY FUEL PANEL
22. ENGINE IGNITION SWITCH
23. RADIO SELECT PLACARD
24. CAUTION / ADVISORY PANEL
25. SECURE RADIO WARNING PLACARD
26. NVG DIMMING CONTROL PANEL
27. RADAR ALTIMETER DIMMING CONTROL
28. UH-60L DUAL ENGINE TORQUE LIMITS

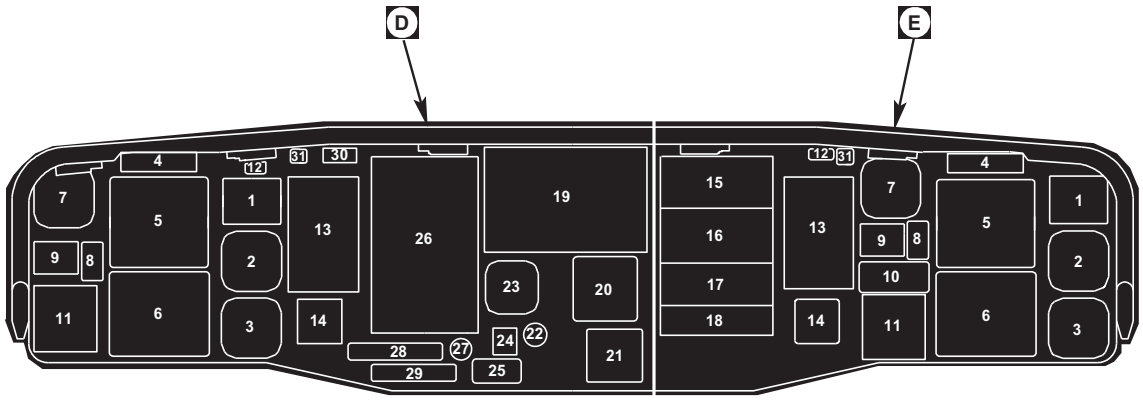


AB2162_2B
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Figure 1. Instrument Panel Front View (Sheet 2 of 6).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED



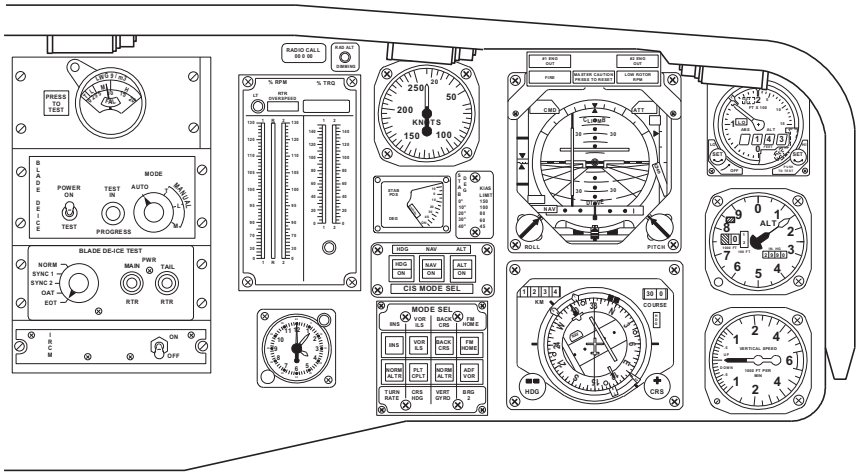


EFFECTIVITY
EH60A

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Figure 1. Instrument Panel Front View (Sheet 3 of 6).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED



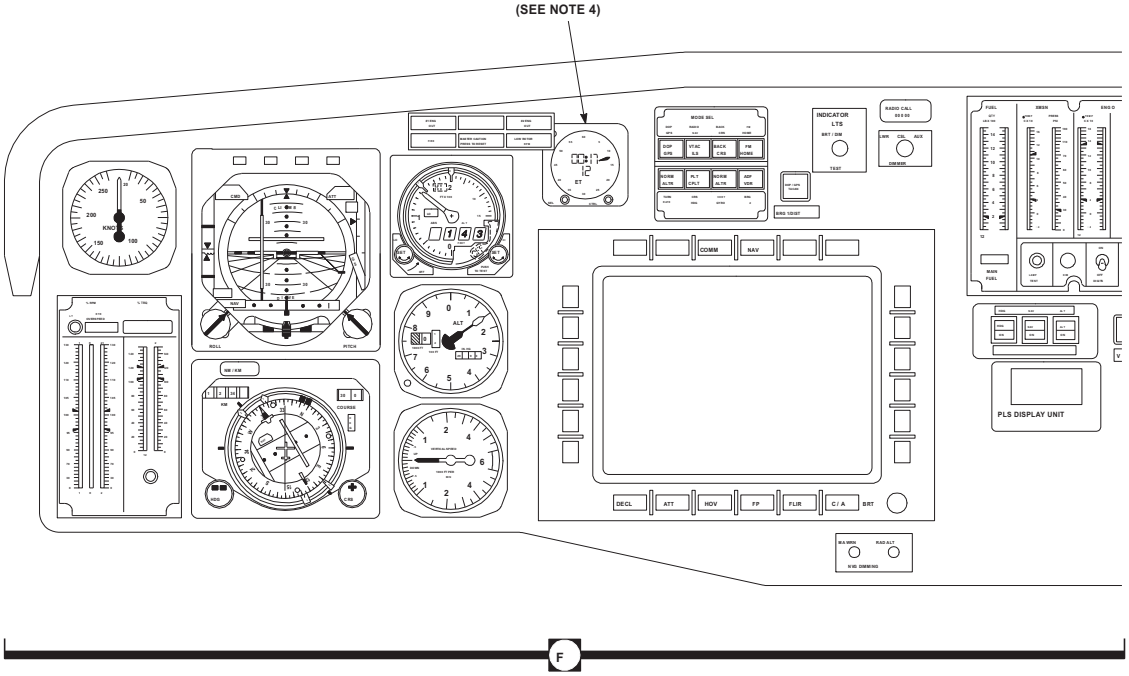
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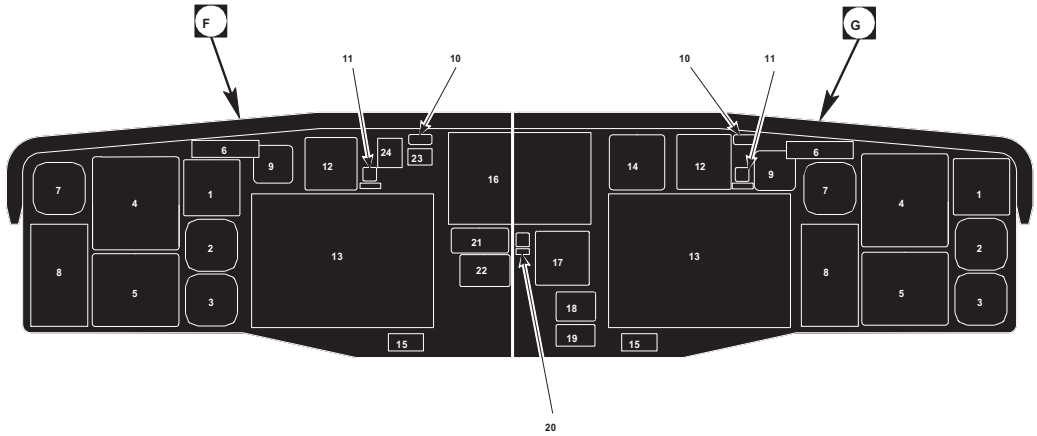
1. RADAR ALTIMETER
2. BAROMETRIC ALTIMETER
3. VERTICAL SPEED INDICATOR
4. MASTER WARNING PANEL
5. VERTICAL SITUATION INDICATOR
6. HORIZONTAL SITUATION INDICATOR
7. AIRSPEED INDICATOR
8. STABILATOR POSITION PLACARD
9. STABILATOR POSITION INDICATOR
10. CIS MODE SELECTOR
11. VSI / HSI MODE SELECTOR
12. RADIO CALL PLACARD
13. PILOT'S AND COPILOT'S DISPLAY UNIT
14. CLOCK
15. ICING RATE INDICATOR PANEL
16. BLADE DE-ICE CONTROL PANEL
17. BLADE DE-ICE TEST PANEL
18. INFRARED COUNTERMEASURE CONTROL PANEL
19. CENTRAL DISPLAY UNIT
20. RADAR WARNING INDICATOR
21. ECM ANTENNA SWITCH
22. ENGINE IGNITION SWITCH
23. BEARING DISTANCE HEADING INDICATOR
24. CREW CALL SELECT PANEL
25. SYSTEM SELECT PANEL
26. CAUTION / ADVISORY PANEL
27. FLARE DISPENSE SWITCH
28. RADIO SELECT PLACARD
29. SECURE RADIO WARNING PLACARD
30. NVG DIMMING CONTROL PANEL
31. RADAR ALTIMETER DIMMING CONTROL

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Figure 1. Instrument Panel Front View (Sheet 4 of 6).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED





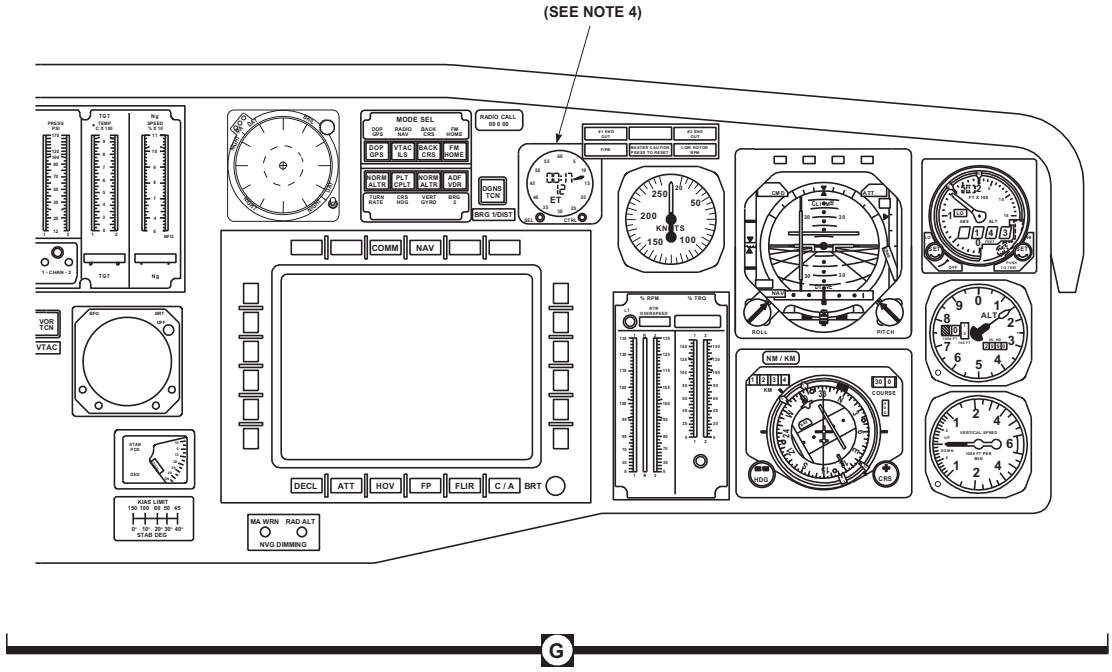
EFFECTIVITY

HH□60A HH□60L

AB2162_5C
SA

Figure 1. Instrument Panel Front View (Sheet 5 of 6).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED



1. RADAR ALTIMETER
2. BAROMETRIC ALTIMETER
3. VERTICAL SPEED INDICATOR
4. VERTICAL SITUATION INDICATOR
5. HORIZONTAL SITUATION INDICATOR
6. MASTER WARNING PANEL
7. AIRSPEED INDICATOR
8. PILOT'S DISPLAY UNIT
9. CLOCK
10. RADIO CALL PLACARD
11. GPS / TACAN SELECT BUTTON
12. VSI / HSI MODE SELECTOR
13. MULTIFUNCTION DISPLAY
14. RADAR WARNING INDICATOR
15. NVG DIMMING CONTROL PANEL
16. CENTRAL DISPLAY UNIT
17. STORMSCOPE INDICATOR
18. STABILATOR INDICATOR
19. STABILATOR POSITION PLACARD
20. VOR / TACAN SELECT BUTTON
21. CIS MODE SELECTOR
22. PERSONNEL LOCATOR DISPLAY
23. LOWER CONSOLE DIMMING CONTROL PANEL
24. INDICATOR LIGHTS CONTROL / TEST PANEL

AB2162_6B
SA

Figure 1. Instrument Panel Front View (Sheet 6 of 6).

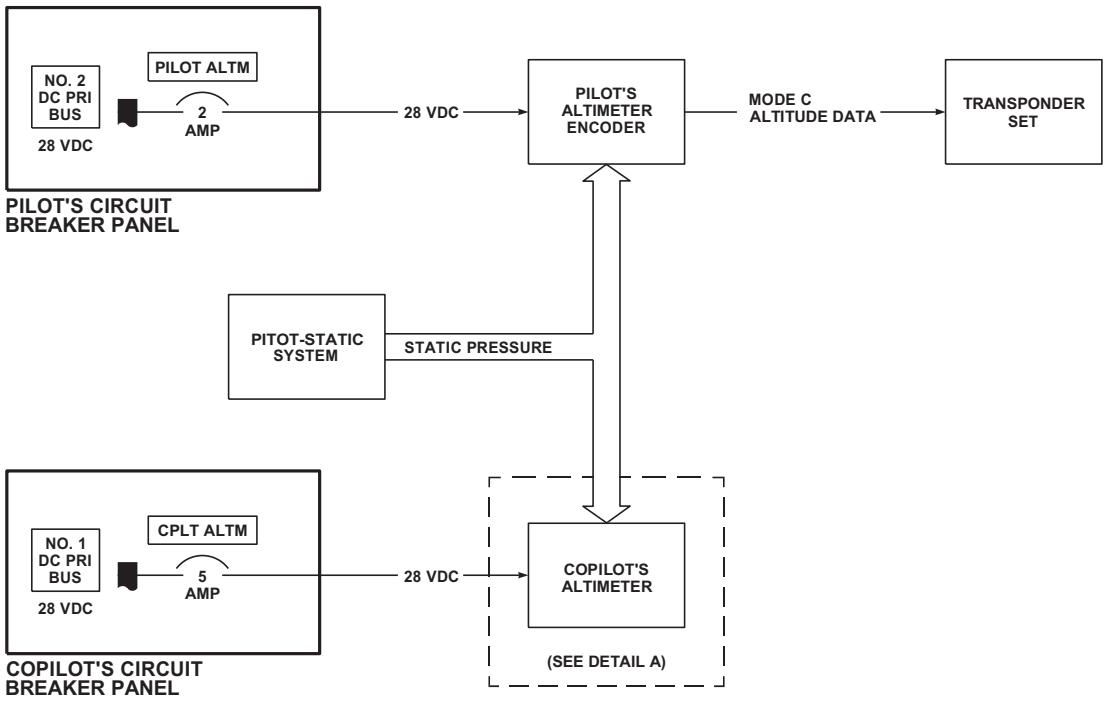
BAROMETRIC ALTIMETERS

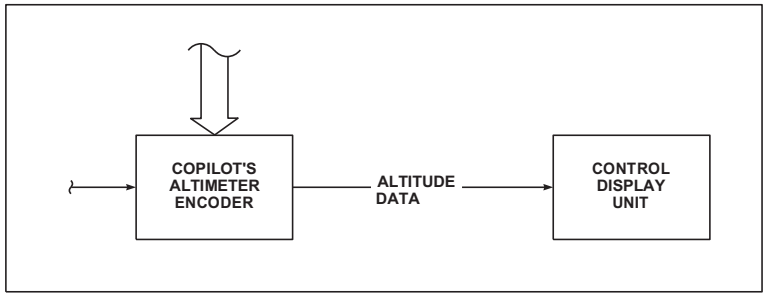
Two indicators, one on each side of the instrument panel, indicate altitude above or below sea level under standard conditions of temperature and atmospheric pressure (Figure 1). The range of the altimeter is between -1000 to 50,000 feet as indicated by three drum indicators and a pointer. The numeral on the 100-foot drum represents hundreds of feet. The pointer is a vernier indication of the hundreds drum as well as being an indication of trend information. Each digit on the 1,000-foot drum represents 1,000-foot intervals while each digit of the 10,000-foot drum represents 10,000-foot levels. In the space corresponding to zero, the 10,000-foot drum has striped lines. The combined readings of the three drums indicate the altitude of the helicopter. The barometric pressure zero

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

set knob in the lower left corner is adjusted to compensate for varying barometric pressures. A small barometric scale, showing through a cutout in the dial between 3 and 4 markings, indicates the adjusted barometric pressure setting. The range of this scale is 28.1 to 31.0 inches of mercury. Each altimeter has two connectors on the back side, one static and one electrical. The electrical connector provides a 28 vdc input to an internal vibrator that decreases the friction in the mechanism. Lighting for both the pilot's and copilot's barometric altimeter is provided by a lighted bezel. The pilot's altimeter integral lighting is controlled by the INSTR LT PILOT FLT control, on the upper console. The copilot's altimeter integral lighting is controlled by the CPLT FLT INST LTS control, on the upper console. The pilot's altimeter encoder provides a digital output of pressure altitude to the transponder set (AN/APX-100). **EH-60A >** The copilot's altimeter encoder provides a digital output of pressure altitude to the control display unit. The copilot's altimeter receives 28 vdc from the No. 1 dc primary bus through the CPLT ALTM circuit breaker on the copilot's circuit breaker panel. The pilot's altimeter encoder receives 28 vdc from the No. 2 dc primary bus, through the PILOT ALTM circuit breaker on the pilot's circuit breaker panel. In the event of power failure, a CODE OFF warning flag will appear from a recess behind the dial. **<**

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED





DETAIL A
(SEE NOTE)

NOTE

EH60A

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Figure 2. Barometric Altimeter Block Diagram.

AIRSPEED INDICATORS

Two airspeed indicators, one on each side of the instrument panel, indicate helicopter speed in knots (Figure 1). The range is between 0 to 250 knots, marked in 5 knot units. The indicators are differential pressure instruments, measuring the difference between impact pressure and static pressure. The two pressures are equal when the helicopter is stationary. As ram air pressure in the Pitot tube becomes greater than pressure in the static line, the

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

diaphragm connected to the pressure line will expand, moving the airspeed needle upscale and indicating airspeed in knots. System installation error is noted on two placards (one each for the pilot and copilot) located on the sides of the lower console.

VERTICAL SPEED INDICATORS

Two vertical speed indicators, one on each side of the instrument panel, indicate helicopter rate of ascent or descent in feet per minute (Figure 1). Range markings begin at level flight and are in units of 100 fpm up to 1000 fpm. From 1000 fpm units are in 500 fpm. Maximum indicated vertical speed is 6000 fpm. Indicator operation is controlled by pressure differential between two chambers. **UH-60A 77-22714 - 82-23747 >** A diaphragm-type chamber is connected to the static line. **< UH-60A 82-23748 - SUBQ UH-60L EH-60A MWO 50-42 HH-60A HH-60L >** The vertical speed indicator is vented to cockpit atmosphere. The other chamber is the instrument case itself, connected by an air-restricting tube to the internal connection of the diaphragm supply line. The pointer may be zeroed externally by the adjusting screw in the lower left corner of the indicator. **<**

PITOT-STATIC PRESSURE SYSTEM

The Pitot-Static system provides pressure for operation of the differential pressure instruments, which are the altimeters, airspeed and vertical speed indicators Figure 3. (Sheet 1 of 2) and Figure 3. (Sheet 2 of 2)). Differential pressure used to actuate these instruments is created either by impact (Pitot) and static, or by static and trapped air pressures. The Pitot-Static system supplies both Pitot and static pressures to the instruments.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

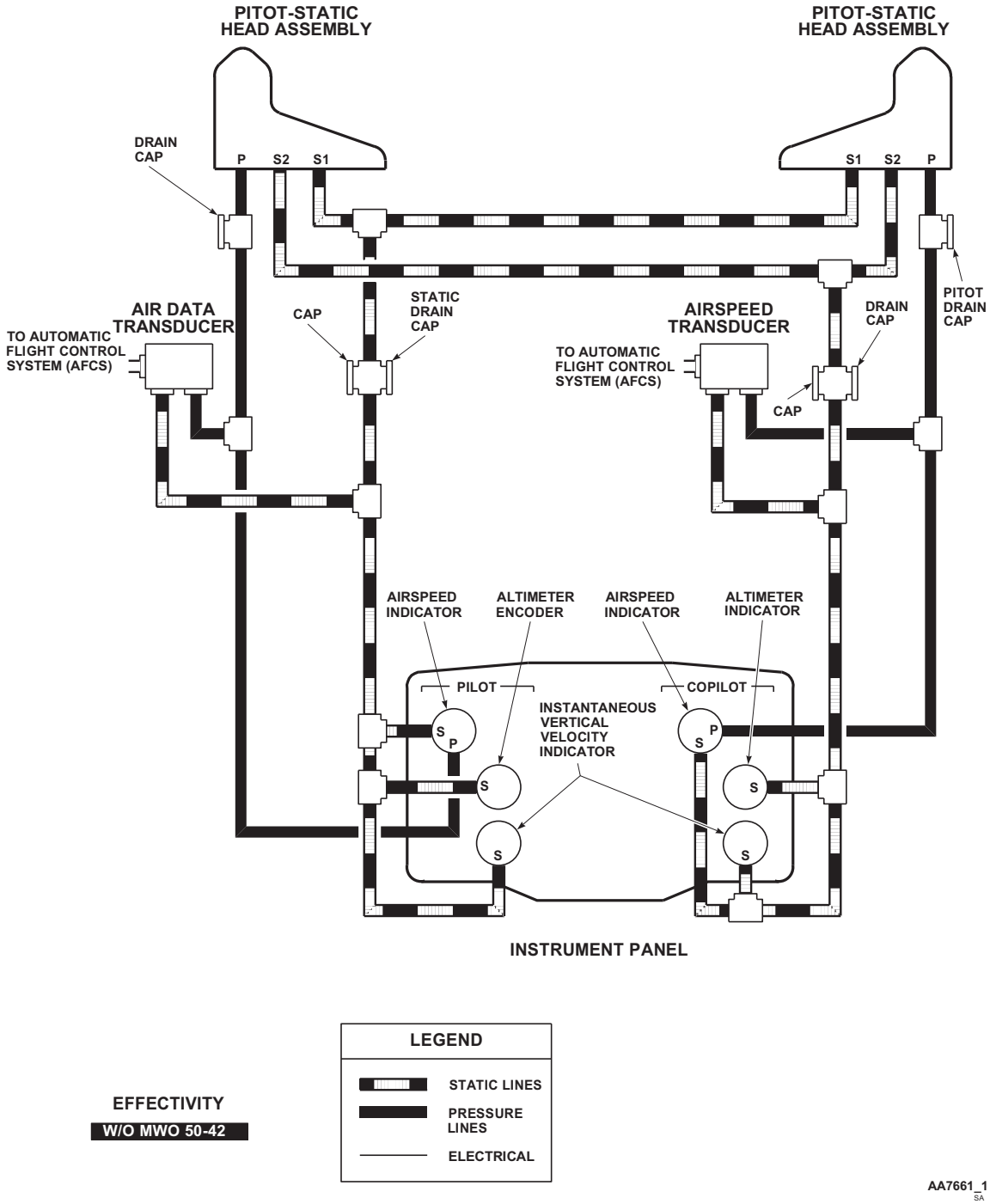


Figure 3. Pitot-Static Preasure System Block Diagram (Sheet 1 of 2).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

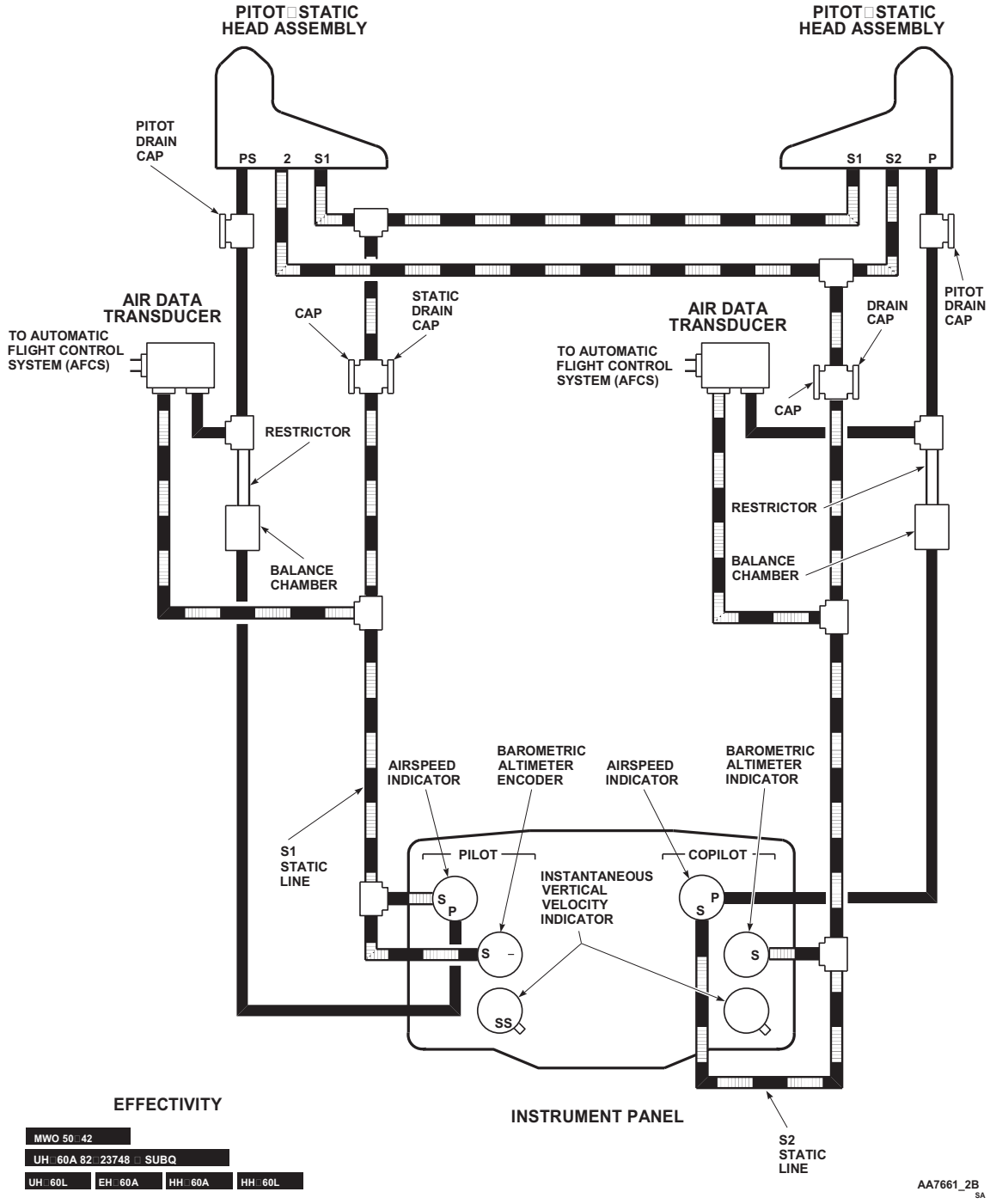


Figure 3. Pitot-Static Preasure System Block Diagram (Sheet 2 of 2).

Pitot pressure is supplied through Pitot lines from two Pitot-Static tubes to the airspeed indicators, airspeed and air data transducers, and to Pitot drain caps Figure 3. (Sheet 1 of 2) and Figure 3. (Sheet 2 of 2)). Static air pressure from the atmosphere is supplied through static lines from the Pitot-Static tube to the altimeters, airspeed indicators, and static drain caps. The Pitot-Static tubes are mounted on top of each side of the cockpit and provide Pitot and/or static pressure to instrument lines. The lines from the Pitot-Static tubes are routed down the sides of the cockpit and are connected to the applicable instruments mounted on the instrument panel. **UH-60A 82-23748**

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

- SUBQ UH-60L EH-60A MWO 50-42 HH-60A HH-60L > A filtered restrictor assembly and balance chamber installed in each Pitot line provide improved airspeed indicator damping. The restrictor filters (screens) provide protection from possible restrictor blockage caused by contaminants and airborne particles. < The Pitot-Static system has screw-capped drain ports, PITOT DRAIN and STATIC DRAIN, to release water vapor that has condensed to the lines. Two PITOT and two STATIC DRAIN ports are on the bottom of the helicopter under the front cabin.

PITOT-STATIC HEAD ASSEMBLY

The Pitot-Static head assembly consists of a baseplate with a strut and probe tube. The base plate contains the Pitot tube fitting, two static tube fittings (S1 and S2) and an electrical connector wired to two deicing heaters in the tube. The probe tube contains these pressure sensing ports; Pitot, static 1, and static 2. Pitot pressure is sensed at the opening of the front end of the tube. Static 1 and static 2 pressure is sensed at the contoured midsection of the tube. UH-60A 82-23748 - SUBQ UH-60L EH-60A MWO 50-42 HH-60A HH-60L > The Pitot-Static head assembly is attached to a tapered mounting block assembly surrounded by an aerodynamic fairing that alleviates potential ice buildup at the head assembly/airframe interface. <

PITOT-STATIC HEATER SYSTEM

Pitot heaters, in the Pitot-Static tubes, keep ice from forming on the tubes that restricts air flow (Figure 4). Electrical power of 115 vac for the Pitot heaters is supplied by the No. 1 ac primary bus through the LEFT PITOT HEAT circuit breaker on the copilot's circuit breaker panel. UH-60A UH-60L HH-60A HH-60L > Electrical power of 115 vac is supplied by the No. 2 ac primary bus through the RT PITOT HEAT circuit breaker on the pilot's circuit breaker panel. <Electrical power of 115 vac is supplied by the No. 2 ac primary bus through the RT PITOT HEAT circuit breaker on the pilot's circuit breaker panel.EH-60A > Electrical power of 115 vac is supplied by the No. 2 ac primary bus through the RIGHT PITOT HEAT circuit breaker on the pilot's circuit breaker panel. < DC power is supplied by the No. 1 dc primary bus through the NO 1 ENG ANTI ICE circuit breaker on the copilot's circuit breaker panel. When the PITOT HEAT switch is ON, power of 115 vac is fed through current sensors in the right and left hand relay panels to the right and left Pitot tube heaters, causing the de-icing heaters to go on. Also, 28 vdc is fed to a normally open electronic switch within the current sensors. When a low heat or no heat condition is sensed by the current sensors, 28 vdc is then fed through the electronic switch to the caution/advisory panel or HH-60A HH-60L > MFD/caution/advisory panel <, lighting the RT or LFT PITOT HEAT caution capsules.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

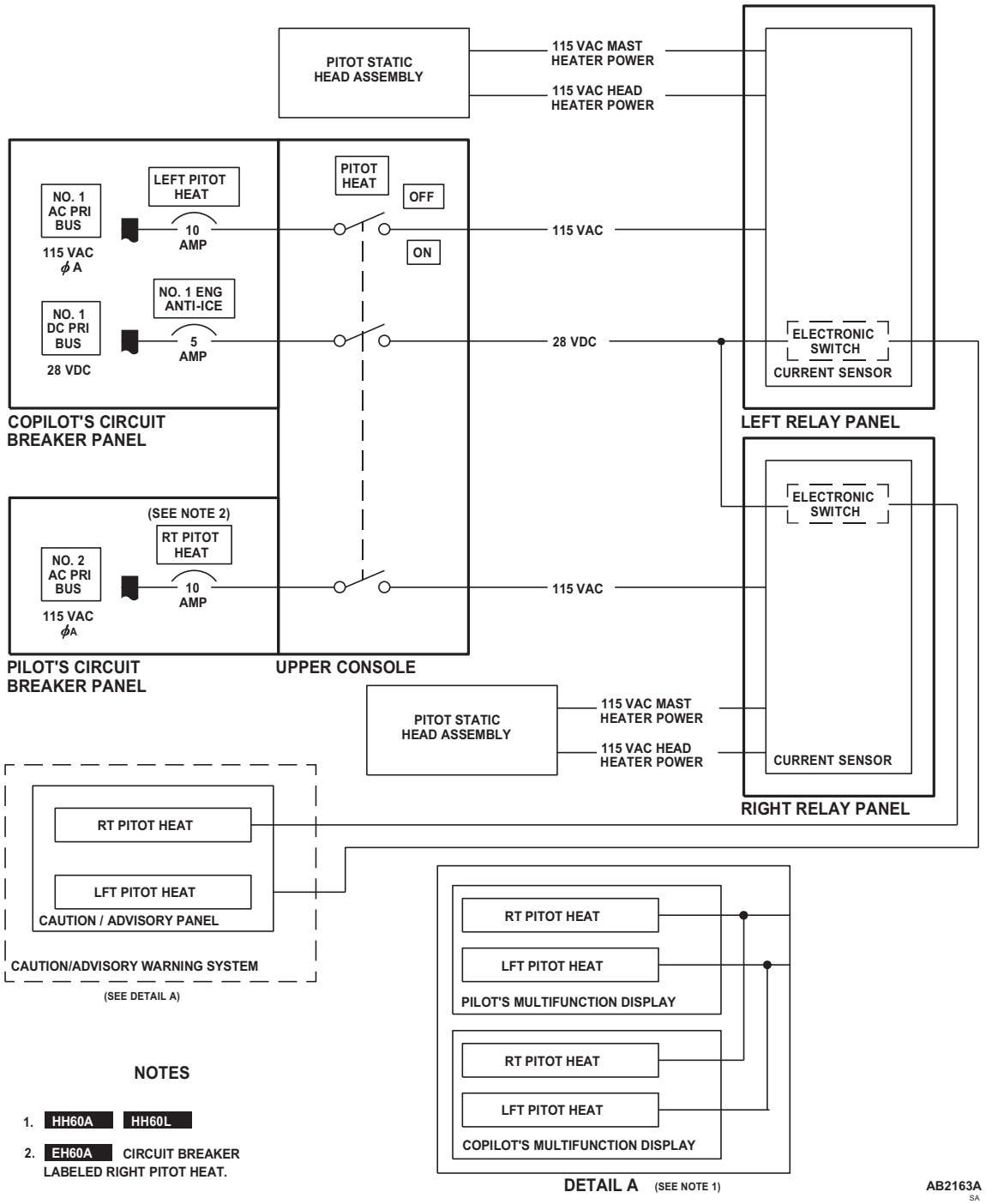


Figure 4. Pitot-Static Heater Block Diagram.

HORIZONTAL SITUATION INDICATORS

Two horizontal situation indicators (HSI), one on each side of the instrument panel, display heading, bearing, and course deviation information (Figure 1). This information is provided by a compass card, two bearing-to-station pointers with back course markers, a course deviation bar, a doppler range window marked KM, a heading set

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

knob and marker, a course set knob, a course set counter readout, a to-from indicator, a navigation flag (NAV) and a heading warning flag (HDG). The compass card is 360°rotating scale that displays heading data obtained from the compass control, and is read at the upper lubber line. Bearing pointer No. 1 is read against the compass card and displays relative bearing to a target selected on the doppler computer display. Bearing pointer No. 2 is read against the compass card and displays the relative heading to the selected VOR or ADF station. The course deviation bar indicates lateral deviation from a selected VOR/LOC or doppler course. Deviation from the selected course is measured by the position of the bar with respect to the fixed aircraft symbol. When the helicopter is on the selected course, the course bar will be lined up with a course pointer and will be centered on a fixed aircraft symbol. The doppler range readout (KM) displays distance to a selected target. A shutter covers the display when doppler is not used. The heading knob turns the heading marker to the magnetic heading desired. The heading marker rides with the azimuth ring as the helicopter heading changes. Heading error is indicated by the displacement of the heading marker with respect to the lubber line. The course set (CRS) knob that drives the course counter and course pointer allows the pilots to select any of 360 courses. Once set, the course pointer will turn the compass card and will be centered on the upper lubber line when flying the selected course. A reciprocal course pointer is used to read the back course. The course set counter, that displays numbers 000 through 359, is a digital readout of the course selected by the CRS knob. Heading and course data outputs are supplied for use in the CIS and the civil navigation system.

A to-from pointer indicates that the helicopter is flying toward or away from the selected VOR or ILS station only if the heading is the same as that selected. When the helicopter is in the cone of silence (above the selected station), the pointers will be removed from view. A navigation warning flag (NAV) indicates the reliability of navigational signals. When a reliable navigation signal is applied to the HSI, the NAV flag will retract from view. A heading warning flag (HDG) is visible when the HSI magnetic compass circuits are not operating properly. For a complete description of HSI mode selection and display functions, refer to VSI/HSI mode select system in TM 11-1520-237-23.

VERTICAL SITUATION INDICATORS

Two vertical situation indicators (VSI), one on each side of the instrument, display the helicopter's pitch and roll attitude, a turn rate, slip and skid, and CIS steering commands Figure 1. (Sheet 1 of 6), Figure 1. (Sheet 2 of 6), Figure 1. (Sheet 3 of 6), Figure 1. (Sheet 4 of 6), Figure 1. (Sheet 5 of 6) and Figure 1. (Sheet 6 of 6), Detail A). The VSI consists of a fixed horizon bar, four warning indicator flags, two trim knobs, a bank angle scale, and a bank angle index, a rate turn indicator, cyclic (pitch and roll) and collective command bars and pointer, a course deviation pointer, glide slope pointer, localizer pointer and three advisory lamps. The steering command bars and pointer consist of the vertical (roll) and horizontal (pitch) command bars and the collective command pointer. The steering command bars and pointer operate in conjunction with the CIS.

The roll bar is displayed during CIS HDG (heading) and NAV (navigation) modes to indicate steering information to a desired VOR/ILS radial, a selected course, or a VHF/FM station. The pitch bar is displayed during the CIS NAV mode to indicate airspeed hold and deceleration information. When a command bar or pointer is not used in a particular CIS function, it is biased out of view by the CIS processor. Should a malfunction occur in the processor or input sensor, the CMD (command) flag is displayed and the respective bar or pointer is biased out of view.

A glide slope warning flag is on the right face of the indicator. The flag marked GS will be out of view when the receiver is operating and reliable signals are received. A navigation flag, marked NAV is on the lower left side of the indicator. The flag will be out of view when the navigation receiver is operating and reliable signals are received. The course deviation pointer indicates to the pilot the helicopter's position with respect to the course selected on the horizontal situation indicator. The course deviation scale represents right or left off-course position measured in dots from center (on course). Each dot from center indicates a course deviation of 1.25°for ILS, 5° VOR and FM. The glide slope deviation pointer, on the right side of the indicator, represents the helicopter's position with respect to the glide slope. Each dot from the center glide slope line indicates a deviation of 0.25° above or below glide slope. The fixed horizon bar provides a reference to artificial horizon. Bank angle scale, with markings at right and left at 0°, 10°, 20°, 30°, 60° and 90°, provides bank angle indications. The rate of turn indicator is read against a fixed scale which gives rate gyro information. The artificial horizon gives a reference of the helicopter's attitude with reference to the horizon. The PITCH trim knob adjusts the artificial horizon line up or down. The ROLL trim

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

knob adjusts the artificial horizon right or left. Three advisory lamps and one spare are mounted on removable panels across the upper face of the indicator. The GA lamp indicates when the CIS Go-Around function has been selected. The DH lamp indicates when the decision height (minimum radar altitude) has been reached during CIS altitude operation. The MB lamp indicates when an outer, middle, or airways marker beacon signal is received by the civil navigation system. The lamps may be checked by setting the caution/advisory panel BRT/DIM-TEST switch to TEST. For a complete description of VSI mode selection and display functions, refer to VSI/HSI mode select system in TM 11-1520-237-23.

BEARING-DISTANCE-HEADING INDICATOR EH-60A> <

The bearing-distance-heading indicator (BDHI) is on the center section of the instrument panel (Figure 1). The BDHI provides the following flight information: the compass rose displays the helicopter heading relative to magnetic north; a bearing pointer displays the bearing to an emitter selected by the mission equipment direction finder (DF) operator; and a distance readout displays the distance, in kilometers, to the emitter selected by the mission equipment DF operator.

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

For location and description of major components, refer to the data in this work package.

EQUIPMENT DATA

If applicable, refer to WP 1677 00 and WP 1758 00 for equipment data information.

INSTRUMENT SYSTEMS

MISCELLANEOUS INSTRUMENTS DESCRIPTION AND DATA

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

STABILATOR POSITION INDICATOR

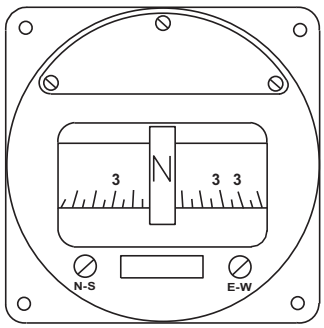
Two stabilator position indicators, one on each side of the instrument panel provide the pilot and copilot with an indication of stabilator position (Refer to WP 0020 00). The indicator range is marked from 45° DN to 10° UP. When power is lost or removed the OFF flag will come into view and the pointer will disappear behind the mask.

STABILATOR POSITION PLACARD

Two stabilator position placards, one on each side of the instrument panel next to the stabilator position indicators (Refer to WP 0020 00) indicate the maximum allowable indicated airspeed in knots for a given stabilator position. This permits the pilot to keep forward airspeed within safe limits when flying in the manual mode, or when the stabilator malfunctions and locks up in a position other than 0°.

STANDBY COMPASS

The standby compass on the top of the instrument panel, housed in a filled sealed case, indicates heading relative to the magnetic north pole (Figure 1). It has a lubber line, a compass card, and a permanent magnet compensating system. The lubber line is constructed so the parallax will be reduced to a minimum when reading the compass card. The compass card is nonmagnetic and is marked in 5° units. Cardinal headings are shown in enlarged letters: N for north at zero degrees, E for east at 90°, S for south at 180°, and W for west at 270°. The enlarged numerals 3, 6, 12, 15, 21, 30, and 33 on the compass card indicate 30° units. The compensating system consists of permanent bar magnets that can be manually adjusted for removing compass deviations. The compensator screws are on the front, behind a cover plate below the compass card and are marked N-S and E-W. The standby compass lighting receives power from the dc essential bus through LIGHTS SEC PNL circuit breaker, on the upper console.



SHOWN WITH COVER PLATE REMOVED

AK2632
SA

Figure 1. Standby Compass.

8-DAY CLOCK

An 8-day, 24-hour clock is installed on each side of the instrument panel (Refer to WP 0020 00). The elapsed time knob is on the upper right corner of the clock. The clock is wound and set with a knob on the lower left corner.

DIGITAL CLOCK

Digital clocks are installed on each side of the instrument panel (Refer toWP 0020 00). The digital clock has six-digit liquid crystal display, twenty-four hour numerals and sweep second indicator. Sweep second indicator op-

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

erates in clock or elapsed mode. Clock contains a replaceable battery that allows continuous timekeeping with helicopter power turned off.

LC-6 DIGITAL CLOCK GFI> <

Digital clocks are installed on each side of the instrument panel (Refer toWP 0020 00). The digital clock has six-digit liquid crystal display, 12 hour numerals and three-button operation. Clock contains a replaceable battery that allows continuous timekeeping with helicopter power turned off. The clock has five modes of operation, as listed below. Power to operate the clock is provided by the No. 1 dc and No. 2 dc primary buses through circuit breakers marked CPLT ALTM and PILOT ALTM respectively. Digital clock modes are:

- LT - Local Time
- UTC - Universal Coordinated Time
- Flight - Trip or Flight Timer (Not Functional)
- SW - Stop Watch
- DC - Down Counter

MISCELLANEOUS SWITCH PANEL

The miscellaneous switch panel consists of three push-button switches marked FUEL IND TEST, TAIL WHEEL, and GYRO ERECT, one toggle switch marked TAIL SERVO/NORMAL/BACKUP, a lighted information panel and, on the rear of the panel, two electrical connectors (Figure 2). The switches control several helicopter systems. The FUEL IND TEST momentary switch, when pressed in and held, tests the fuel quantity indicating system. The TAIL WHEEL switch locks and unlocks the tailwheel. The GYRO ERECT momentary switch initiates a "fast erect" voltage to the attitude indicating system's vertical gyros. The TAIL SERVO switch controls which hydraulic system supplies pressure to the tail rotor servo.

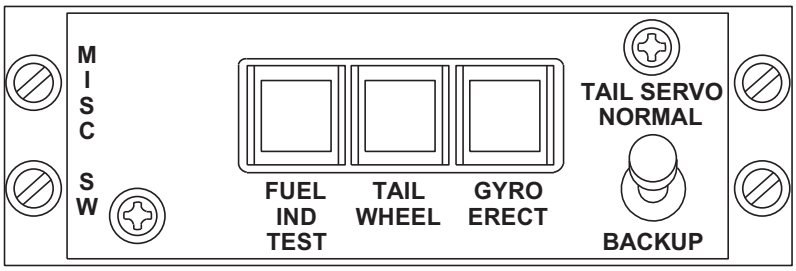


Figure 2. Miscellaneous Switch Panel.

CHIP DETECTOR RESISTOR UNIT W/O MWO 50-26> <

The chip detector resistor unit consists of five resistors and one diode (Figure 3, Detail A). These components are mounted on the bottom of the cover assembly of the enclosure. The resistors are used with the chip detector system to insure proper operation of burn-off circuits. The diode, when installed, is used with the caution/advisory system to insure proper operation of the master caution reset circuit.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

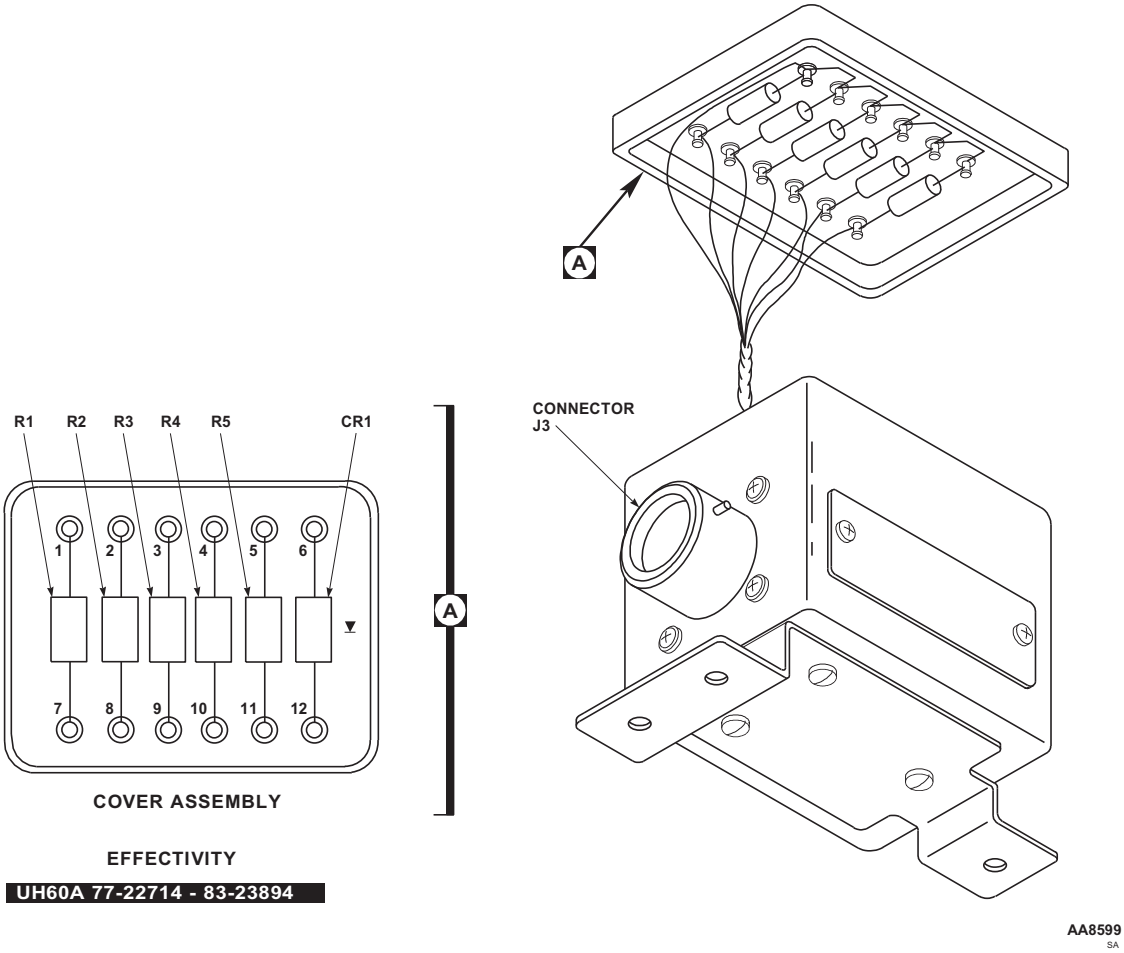


Figure 3. Chip Detector Resistor Unit W/O MWO 50-26> .

FREE-AIR THERMOMETER

W/O HCW > The free-air thermometer is located in the center windshield of the cockpit (Figure 4). < HCW > Two free-air thermometers are installed, one in the left upper window and one in the right upper window of the cockpit (Figure 4). The thermometer is a self-indicating bimetallic instrument that displays the free-air temperature. The thermometer dial is marked from -70°to 40°C in 2° units. The 10° markings are indicated numerals. To avoid parallax, the pointer is mounted close to the dial. <

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

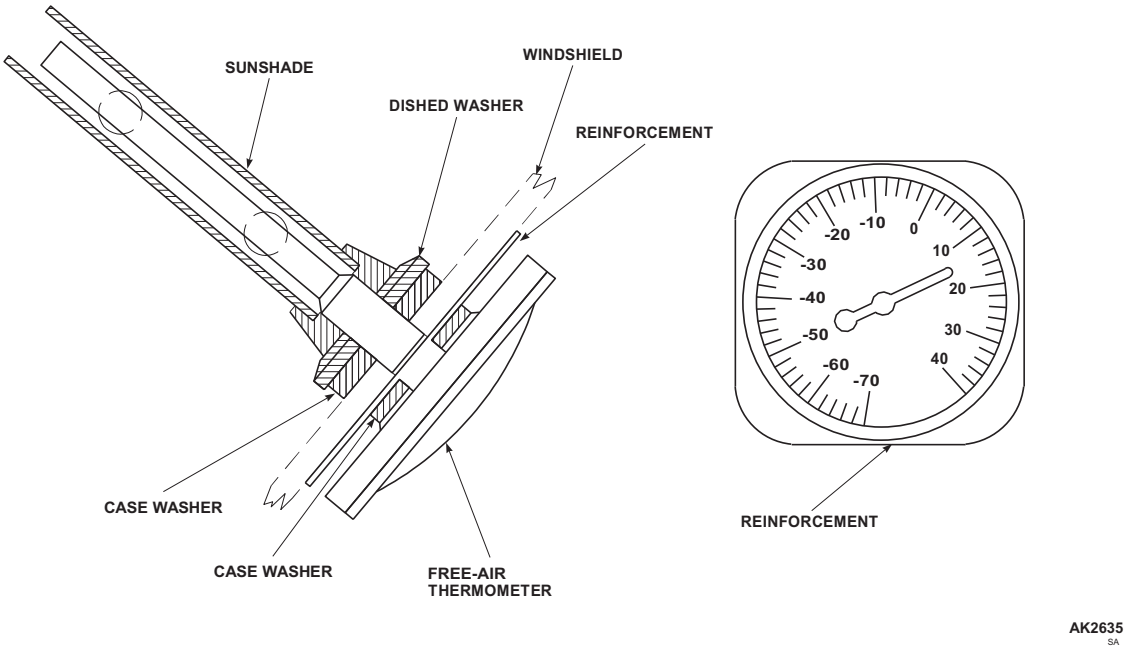


Figure 4. Free-Air Thermometer.

CREW CALL SWITCH/INDICATOR EH60A>

The CREW CALL switch/indicator is on the center section of the instrument panel (Refer to WP 0020 00. The switch functionally interfaces with the mission equipment operators station(s) and the mission interface panel. The switch is used to provide signals between crew members to indicate communication is desired, and to establish ICS circuits between the cockpit and cabin. When the CREW CALL switch is pressed in, it lights steady. This allows only one-way communication, from pilot/copilot to mission equipment operator(s). The pilot's ICS audio overrides all other mission equipment operator's audio. For further description of the CREW CALL switch/indicator refer to TM 11-1520-249-23.

ENGINE INSTRUMENTS

The engine instruments give the pilot and copilot indications of engine operating conditions (Refer to WP 0020 00). The engine instruments consist of a central display unit, pilot's display unit, and copilot's display unit. The three units are components of the instrument display system (IDS).

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

For location and description of major components, refer to the data in this work package.

EQUIPMENT DATA

If applicable, refer to WP 1758 00 for equipment data information.

INSTRUMENT SYSTEMS

INSTRUMENT DISPLAY SYSTEM DESCRIPTION AND DATA

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

INSTRUMENT DISPLAY SYSTEM

The instrument display system (IDS), used in conjunction with engine and subsystem sensors (temperature, pressure, torque, fuel and RPM), provides the pilots with engine and subsystem monitoring. The IDS gives continuous indications of the parameters on vertical scales, digital readouts, and status lights. The IDS consists of a pilot's display unit (PDU), copilot's display unit (CPDU), and central display unit (CDU), on the instrument panel, No. 1 signal data converter (No. 1 SDC) and No. 2 signal data converter (No. 2 SDC), on the shelf front of the instrument panel, and a rotor overspeed reset switch, in the avionics compartment. Since the PDU and CPDU are identical and the No. 1 and No. 2 SDCs are identical, the IDS consists of three basic units: PDUs, SDCs, and the CDU.

POWER DISTRIBUTION

System electrical power of 28 vdc is supplied by the No. 1 dc primary bus through the NO. 1 DC INST circuit breaker, and by the No. 2 dc primary bus through the NO. 2 DC INST circuit breaker Figure 1. (Sheet 1 of 3), Figure 1. (Sheet 2 of 3), and Figure 1. (Sheet 3 of 3)). System electrical power of 115 vac is supplied by the No. 1 ac primary bus through the NO. 1 AC INST circuit breaker and by the No. 2 ac primary bus through the NO. 2 AC INST circuit breaker. The NO. 1 DC INST and NO. 1 AC INST circuit breakers, on the copilot's circuit breaker panel, provide power to the No. 1 SDC. The NO. 2 DC INST and NO. 2 AC INST circuit breakers, on the pilot's circuit breaker panel, provide power to the No. 2 SDC. Each SDC contains a logic power supply, that feeds IDS digital and analog processing circuitry. Each SDC also contains a lamp supply that feeds IDS lamp display circuitry.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

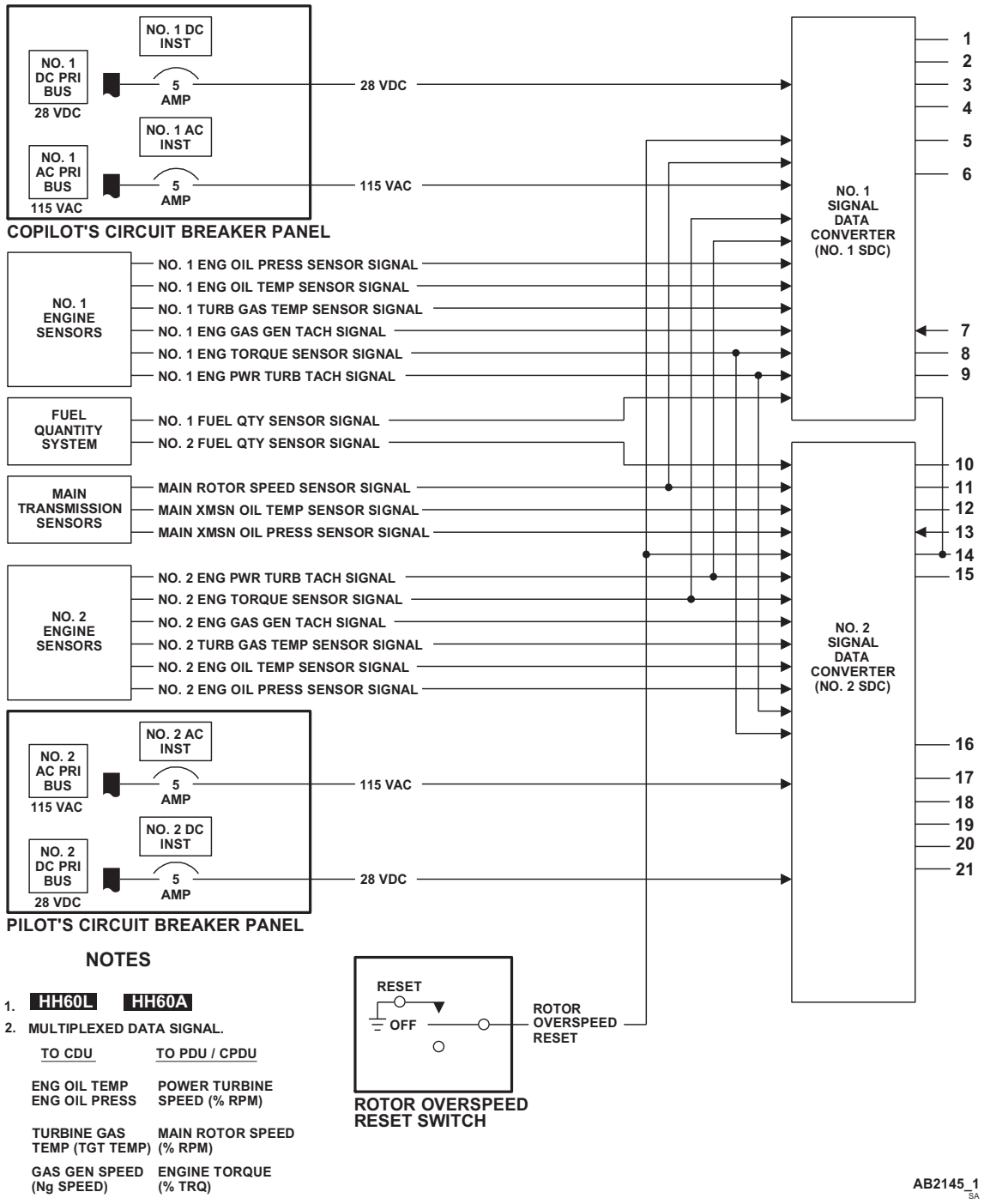


Figure 1. Instrument Display System Block Diagram (Sheet 1 of 3).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

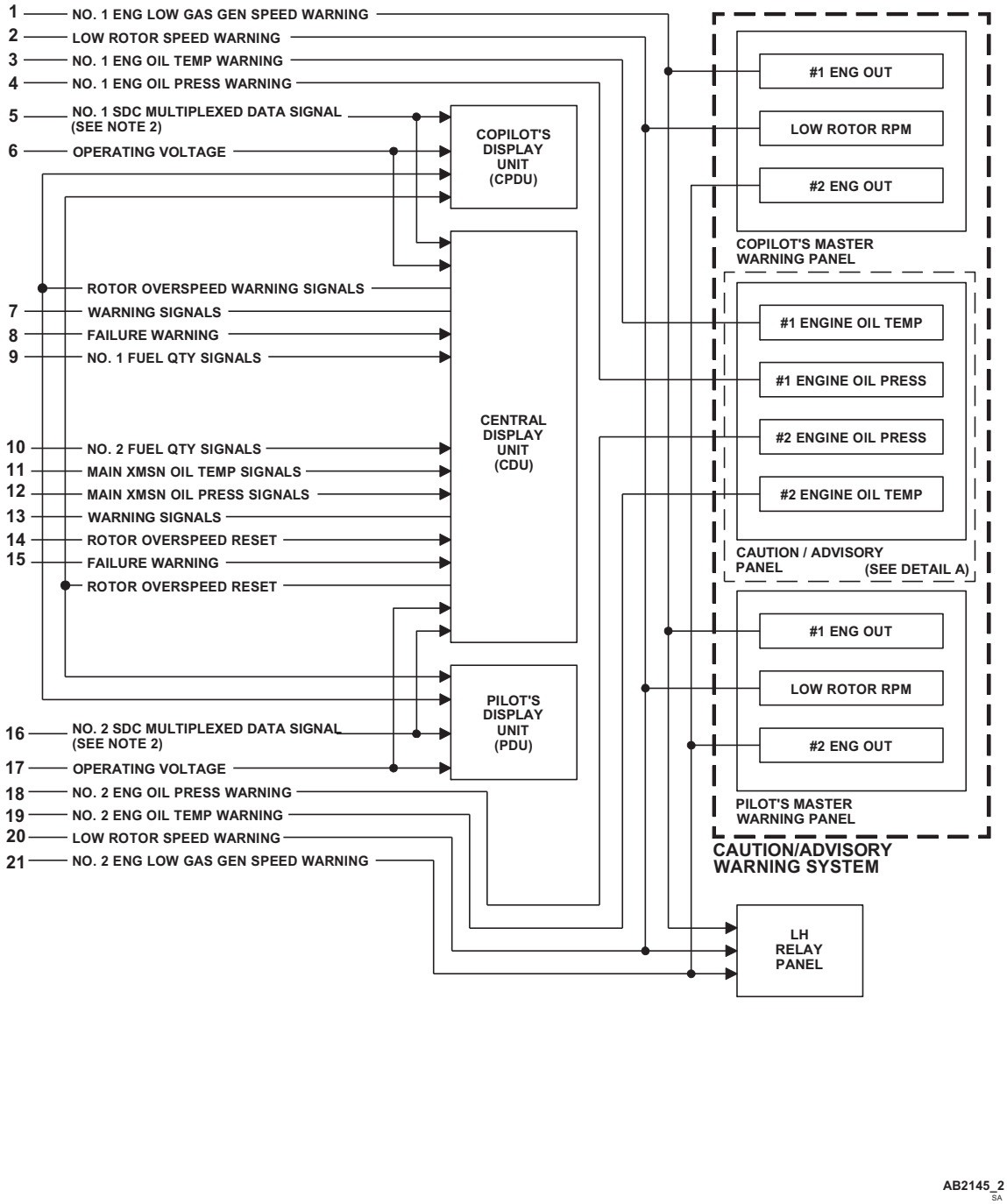


Figure 1. Instrument Display System Block Diagram (Sheet 2 of 3).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

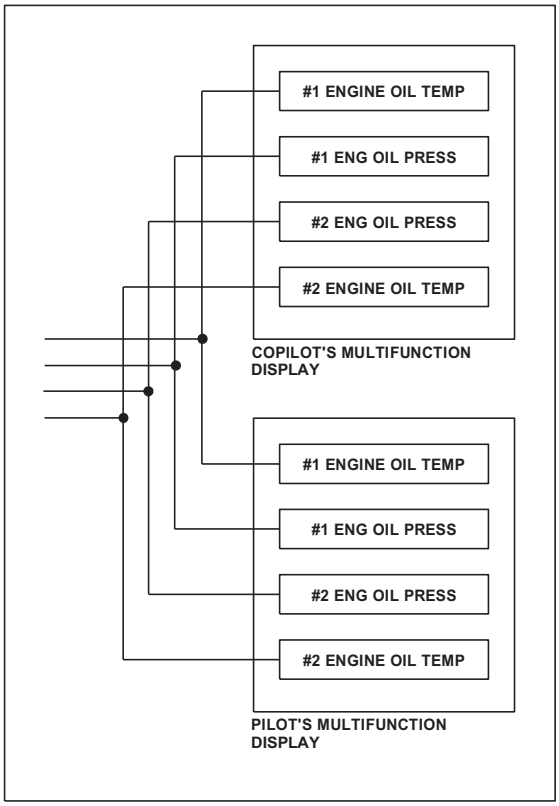


Figure 1. Instrument Display System Block Diagram (Sheet 3 of 3).

FACEPLATE LIGHTING

Faceplate lighting for the CDU and PDU is controlled by the INSTR LT NON FLT, INSTR LT PILOT FLT, and CPLT FLT INST LTS controls on the upper console. CDU faceplate lighting voltage, between 0 to 5 vac, is applied from the INSTR LT NON FLT control through the No. 1 SDC, to the CDU. Copilot's PDU faceplate lighting voltage is applied from the CPLT FLT INST LTS control to the copilot's flight instrument lights 5V/115V transformer. The output voltage from the transformer is routed through the No. 1 SDC to the copilot's PDU. PDU faceplate lighting voltage is applied from the INSTR LT PILOT FLT control to the pilot's flight instrument lights 5V/115V transformer. The output voltage from the transformer is routed through the No. 2 SDC to the pilot's PDU.

SENSOR SIGNAL PROCESSING

All engine and subsystem sensor signals monitored by the IDS are applied to the No. 1 or No. 2 SDC. The No. 1 SDC receives all No. 1 engine sensor signals (oil pressure, oil temperature, turbine gas temperature, gas generator tachometer, torque, power turbine tachometer), No. 1 fuel quantity sensor signal, main rotor speed sensor signal, No. 2 engine power turbine tachometer signal, and No. 2 engine torque sensor signal. The No. 2 SDC

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

receives all No. 2 engine sensor signals (oil pressure, oil temperature, turbine gas temperature, gas generator tachometer, torque, power turbine tachometer), No. 2 fuel quantity sensor signal, main rotor speed sensor signal, No. 1 engine power turbine tachometer signal, No. 1 engine torque sensor signal, main transmission oil temperature sensor signal, and main transmission oil pressure sensor signal.

Within each SDC the associated sensor signals, except for No. 1 and No. 2 fuel quantity, main transmission oil temperature, and main transmission oil pressure are conditioned to a common digital format for multiplexing. The fuel quantity and main transmission sensor signals are conditioned and multiplexed within the CDU. After the sensor signals have been conditioned and multiplexed, the sensor data is routed to latching circuits in the CDU, pilot's PDU and copilot's PDU. The latching circuits retain the last signal data until it is time to update. During update (twice per second), the latches activate lamp drivers that energize miniature lamps on the edge of the display modules. Light from the lamps is carried to the display panel face by fiber optic strips, giving visual analog and digital displays corresponding to the level of the sensed parameter.

DISPLAY LIGHTING CONTROL

Each SDC contains a lamp power supply that limits the light intensity of the IDS displays. The No. 1 SDC lamp power supply provides voltage to all copilot's PDU displays, alternate lamps on the CDU analog displays, and No. 1 engine and total fuel CDU digital displays. The No. 2 SDC lamp power supply provides voltage to all PDU displays and alternate lamps on the CDU analog display; and No. 2 engine CDU digital displays. The output voltages of the lamp power supplies are determined by three photocell outputs and the DIM control. The three photocells, one on each display unit, sense the surrounding light level. The photocell sensing the highest level of light controls the input to the lamp power supply. The DIM control, on the CDU, is a gain adjustment for the lamp power supply and sets the display lighting contrast level to be maintained by the photocells. Turning the DIM control clockwise, past the detent, sets the display lighting to a fixed preset level and disables the three photocells. The control loops of both lamp power supplies are tied together so both lamp supplies provide the same output voltage.

Main transmission oil pressure, No. 1 engine oil pressure, No. 2 engine oil pressure, No. 1 fuel quantity, No. 2 fuel quantity, and engine and rotor speed analog displays have low scale segments colored red and/or amber to indicate undesirable operating ranges. When the scale reading is above this low range, the IDS automatic bottom segment turn-off circuitry causes the bottom segment lamps to go off. If the display reading drops back into the undesirable operating range, the bottom segment lamps go on again.

SYSTEM INTERFACE

The IDS provides control voltages for these helicopter status capsules:

1. #1 ENG OUT
2. #2 ENG OUT
3. LOW ROTOR RPM
4. #1 ENGINE OIL PRESS
5. #1 ENGINE OIL TEMP
6. #2 ENGINE OIL PRESS
7. #2 ENGINE OIL TEMP

The #1 ENG OUT, #2 ENG OUT, and LOW ROTOR RPM capsules are on the pilot's and copilots master warning panels, on the instrument panel. The remaining capsules are on the caution/advisory panel **HH-60A HH-60L >** or MFD/caution/advisory panel, **<** also on the instrument panel. The #1 ENG OUT capsules will be on whenever the No. 1 engine gas generator tachometer (No. 1 Ng SPEED) is less than 55%. The #2 ENG OUT capsules will be on whenever the No. 2 engine gas generator tachometer (No. 2 Ng SPEED) is less than 55%. The LOW ROTOR RPM capsule will be on whenever the main rotor speed (RTR) is less than 96%. The #1 ENGINE OIL PRESS capsule will be on whenever the No. 1 engine oil pressure (1 ENG OIL PRESS) is less than 25 psi. The #1 ENGINE OIL TEMP capsule will be on whenever the No. 1 engine oil temperature (1 ENG OIL TEMP) is more than 150°C. The #2 ENGINE OIL PRESS capsule will be on whenever the No. 2 engine oil pressure (2 ENG OIL PRESS) is less than 25 psi. The #2 ENGINE OIL TEMP capsule will be on whenever the No. 2 engine oil temperature (2 ENG OIL TEMP) is more than 150°C.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

The control voltages provided by the IDS to the LOW ROTOR RPM and #1 and #2 ENG OUT capsules also control low rotor RPM and engine-out audible warning signals. The IDS signals energize a relay in the left relay panel that controls an audible warning circuit. For a further description of the audible warning circuit, refer to caution/advisory warning system (WP 0026 00) **HH-60A HH-60L >** or multifunction display/caution/advisory warning system (WP 0027 00) **<**.

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

For location and description of major components, refer to the data in this work package.

EQUIPMENT DATA

If applicable, refer to WP 1800 00 for equipment data information.

INSTRUMENT SYSTEMS

SIGNAL DATA CONVERTER DESCRIPTION AND DATA

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

SIGNAL DATA CONVERTER DESCRIPTION

The signal data converter (SDC) processes a variety of helicopter sensor signals and provides proportional digital signals in a multiplexed format to the central display unit (CDU) and the pilot's display unit (PDU) (Figure 1). The CDU and PDU provide visual indications of the processed sensor signals. The SDC operates on helicopter 115 vac, 400 Hz and 28 vdc power. The SDC contains the circuitry to process the following helicopter sensor signals: engine oil pressure, engine oil temperature, No. 1 and No. 2 engine torque, engine turbine gas temperature (TGT), No. 1 and No. 2 engine power turbine tachometer (% RPM), engine gas generator tachometer (Ng), and rotor RPM. The SDC updates this data twice per second. The fuel quantity, main transmission oil temperature and main transmission oil pressure signals are routed through the SDC and processed in the CDU. The more important signals are processed through redundant circuits for reliability. Monitoring circuits are used to ensure the validity of the displayed data. The SDC also provides output voltages to the helicopter caution/advisory warning system when any of the following conditions exists: low engine oil pressure, high engine oil temperature, low engine gas generator tachometer (Ng), and low rotor speed. There are three external electrical connectors on the SDC: J1 which provides input/output interface with helicopter power and sensors, J2 which provides signal and power input/output interface with the PDU, and J3 which provides signal and power input/output interface with CDU. The SDC contains the following modules:

1. Lamp power supply (A2)
2. Logic power supply (A3)
3. Interface No. 4 module (A4)
4. Interface No. 3 module (A5)
5. Interface No. 2 module (A6)
6. Interface No. 1 module (A7)
7. Analog processor No. 2 module (A8)
8. Analog processor No. 1 module (A9)
9. Digital processor module (A10)
10. Voltage regulator module (A11)

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

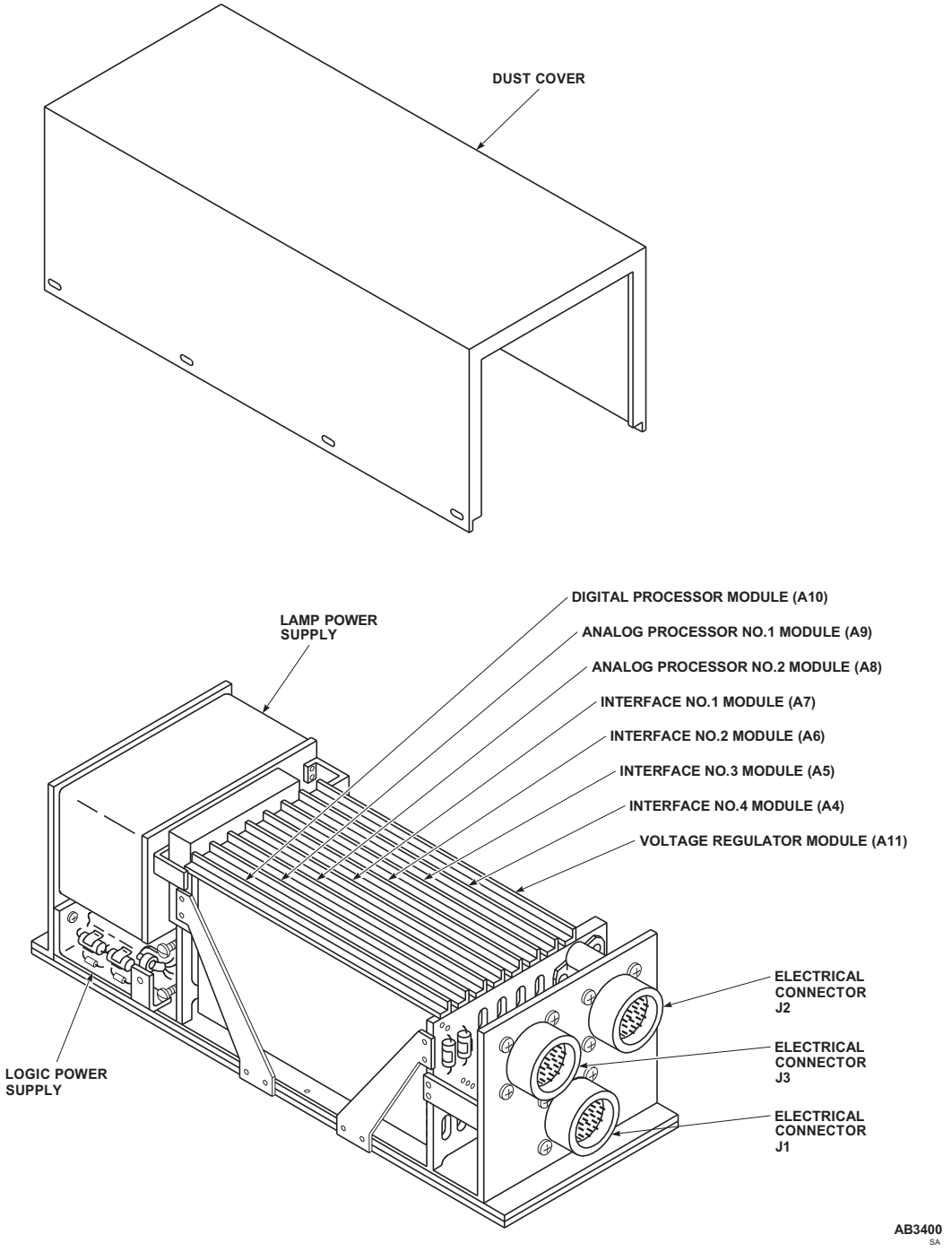


Figure 1. Signal Data Converter Parts Location.

LAMP POWER SUPPLY (A2)

The lamp power supply A2 is a high current low voltage unit (Figure 1). External power of 28 vdc and unregulated 15.5 vdc and -15.5 vdc are provided to the lamp power supply. The lamp supply control voltage is provided from the voltage regulator module. The output of the lamp power supply can be varied between 200 millivolts and 6 vdc determined by the control voltage input.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

LOGIC POWER SUPPLY (A3)

The logic power supply receives 115 vac, 400 Hz power from the helicopter power system (Figure 1). The power supply uses a step-down multi-secondary winding transformer and conventional diode rectifiers to generate various dc voltages and ac excitation for the engine and main transmission oil pressure sensors.

INTERFACE NO. 4 MODULE (A4)

The interface No. 4 module A4 contains engine oil pressure interface circuitry with its -5 vdc reference voltage regulator, a floating 5 vdc regulator for the temperature compensating unit, and turbine gas temperature interface circuitry. A 10 vac, 400 Hz reference voltage from the logic power supply is used with the engine oil pressure sensor signal (400 Hz) to generate a dc analog signal proportional to the pressure. The dc analog voltage is applied to the A/T converter which produces the engine oil pressure update signal when enabled by the multiplexer signal from the analog processor. The analog reset signal generated by the analog processor resets the A/T converter. The update signal is applied to the engine oil pressure lamp driver module in the CDU. A floating 8 vdc is supplied to the interface No. 4 module from the logic power supply. This input is applied to a voltage regulator that generates 5 vdc output to the temperature compensating unit. The output of the thermocouple probes which sense the turbine gas temperature (TGT) is applied to the interface circuitry through a temperature compensating unit. A 5 vdc regulator supplies a floating output to the temperature compensating unit which compensates for ambient temperature changes. The conditioned thermocouple signal is applied to the analog and digital A/T converters which supply TGT analog and digital update signals to the CDU. The TGT circuitry also receives analog reset and multiplex signals generated by the analog processor and digital reset and multiplex signals generated by the digital processor. The interface No. 4 module receives -10 vdc, 10 vdc, and 5 vdc operating voltage from the voltage regulator module.

INTERFACE NO. 3 MODULE (A5)

The interface No. 3 module A5 contains voltage regulators that provide 11 vdc, -11 vdc, and -5 vdc, and interface circuitry for No. 1 and No. 2 engine torque signals. The 11 vdc and -11 vdc regulators operate from the 14.5 vdc and -14.5 vdc floating input, from the logic power supply. The ground isolated -5 vdc regulator operates from the -11 vdc regulator. The -5 vdc is used as a reference voltage for the A/T converters. Since the engine control unit (ECU) is floating, all reference voltages must also be isolated. The torque sensor signals are conditioned by the ECU, and applied to buffer amplifiers. The outputs of the buffers are applied to differential amplifiers. The differential amplifiers provide signals to the A/T analog and digital converters which produce analog and digital update No. 1 and No. 2 engine torque signals to both PDUs. The No. 1 and No. 2 engine torque circuits receive reset and multiplex signals generated by the analog and digital processors. The interface No. 3 module receives -10 vdc, 10 vdc, and 5 vdc from the voltage regulator module.

INTERFACE NO. 2 MODULE (A6)

Interface No. 2 module contains interface circuitry for the engine oil temperature, No. 1 engine power turbine tachometer signal (% RPM 1) and No. 2 engine power turbine tachometer signal (% RPM 2). The oil temperature sensor provides a variable resistance input. This resistance forms part of the feedback loop of an operational amplifier. The dc voltage output is proportional to the oil temperature and is applied to the A/T converter which produces an update engine oil temperature signal for the CDU. The engine oil temperature circuits receive analog reset and multiplex signals generated by the analog processor. The 1.28 MHz reference frequency is used to convert both No. 1 and No. 2 power turbine tachometer signals to a dc analog voltage proportional to the sensor input frequency. There are identical circuits for the engine No. 1 and engine No. 2 sensors. The dc analog signals are fed to the A/T converters which produce update % RPM 1 and % RPM 2 signals to the PDU. The engine No. 1 and No. 2 circuits receive reset and multiplex signals generated by the analog processor. The interface No. 2 module receives -10 vdc, and 10 vdc, and 5 vdc operating power from the voltage regulator module.

INTERFACE NO. 1 MODULE (A7)

The interface No. 1 module A7 contains interface circuitry for the main rotor speed and gas generator tachometer (Ng) signal inputs. The 1.28 MHz reference voltage from the digital processor module is used with the main rotor speed signal to generate a dc analog signal proportional to the input frequency. The dc analog signal is fed to the A/T converter which produces an update rotor speed signal to both the PDU. The rotor speed circuits receive

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

an analog reset pulse and rotor speed multiplex signal generated by the analog processor. The 1.28 MHz reference frequency is also used to convert the gas generator tachometer signal (Ng SPEED) to a dc analog voltage proportional to the sensor input frequency. The dc analog signal is fed to the A/T analog converter and the A/T digital converter. The A/T analog converter receives an analog reset signal and Ng SPEED analog multiplex signal generated by the analog processor and sends an Ng SPEED analog update signal to the CDU for the analog display. The A/T digital converter receives a digital reset signal and Ng SPEED multiplex signal generated by the digital processor and sends an Ng SPEED digital update signal to the CDU for the digital display. The interface No. 1 module receives -10 vdc, 10 vdc, and 5 vdc operating power from the voltage regulator module.

ANALOG PROCESSOR NO. 2 MODULE (A8)

The analog processor No. 2 module A8 contains the last stages of the A and B shift registers, overflow counters, circuitry to generate reset pulses, decoding circuitry to generate multiplex frame pulses, and failure warning detectors. The No. 2 module receives the 12.8 kHz clock signal and the output of the last stage of the A and B registers from the analog processor No. 1 module. The A and B monitor signals from the analog processor No. 1 module are combined with the monitor signals in the analog processor No. 2 module to generate the analog A or analog B select signal. The select gates are inhibited when a failure warning signal is received from the digital processor. Shift register reset pulses are produced and sent to the No. 1 analog processor. In addition, the analog reset pulse is produced which resets the A/T converters after amplification by the voltage regulator. Decoding circuits decode the output of a counter to produce the analog multiplex signal that controls the sequence in which the various analog signals are enabled for updating in the interface circuitry.

ANALOG PROCESSOR NO. 1 MODULE (A9)

The analog processor No. 1 module A9 contains two shift registers, an A register and a B register. It also contains the AND/OR select gates which connect either the A or the B register to the output for the analog data word to the PDU and the CDU. The output of the last stage of the shift registers is connected to the No. 2 analog processor module. The shift registers are clocked by a 128 KHz signal from the digital processor. The output of the last stage is also fed to a monitor circuit for each register. The output of the monitors is fed to the analog processor No. 2 module. The A or B shift register select signal is received from the analog processor No. 2 module. The analog processor No. 1 module receives 5 vdc operating power from the voltage regulator module.

DIGITAL PROCESSOR MODULE (A10)

The digital processor module A10 generates clock signals for both digital and analog processors and digital multiplexing signals. In addition, it provides binary coded decimal (BCD) information for use on the digital displays in the CDU and PDU. Two crystal controlled oscillators generate 1.28 MHz frequencies in a redundant configuration. The 1.28 MHz is used in the No. 1 and No. 2 interface modules. The 1.28 MHz signal is divided down to provide the analog and digital clock signals. Redundant decade counters A and B produce BCD data from the 128 kHz clock signal. The last stages of the counter are used to generate a reset pulse, multiplex sequencing pulses, digital test frequency, and a monitor input signal. The output of the monitor provides the digital select A or digital select B signal. The digital reset pulse is fed to the voltage regulator for amplification. Analog clock inhibit signals are received from the PDU are connected through circuitry to the No. 1 analog processor. Digital clock inhibit signals are received from the CDU and PDU for use in the digital processor. These signals stop the clock pulses during update. This prevents any clock inputs to either the analog or digital processors from being processed during transfer of data into the displays.

VOLTAGE REGULATOR MODULE (A11)

The voltage regulator module contains three regulators. These are -10 volt, 10 volt, and 5 volt. In addition there are buffer amplifiers for the analog and digital reset signals and the error amplifier of the lamp power supply control. The 10 vdc regulator operates on 15.5 vdc input power. The 15.5 vdc is also fed out to the lamp power supply. The -10 vdc regulator operates on -15.5 vdc input power. The -15.5 vdc is also fed out to the lamp power supply. The 5 vdc regulator operates on 8 vdc power. The 8 vdc is also sent to the PDU. The analog reset is a narrow positive pulse generated on the analog processor No. 2 module. This pulse is used to reset all the A/T converters synchronously with the resetting of the analog processor. The voltage regulator module amplifies this pulse for use in the SDC and the CDU. A similar circuit does the same for the digital reset signal from the digital processor.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

The lamp power supply error amplifier receives a control signal from the auto dim circuit in the CDU and the lamp power supply output. Operational amplifiers compare the two signals and produce a lamp supply control signal for the lamp power supply.

LAMP DRIVER MODULES

All the lamp driver modules operate in basically the same way. The only difference is some modules (No. 1 and No. 2 fuel quantity, No. 1 and No. 2 engine oil pressure and main transmission oil pressure modules) have automatic bottom segment turnoff. This feature automatically turns off the low scale red and/or amber segments when the scale reading reaches the green segment. The low scale segments are automatically turned on when the scale reading drops below the green segment. Analog data is fed to the lamp drivers from the analog processor shift registers in the SDCs. The analog processors also supply the update pulses and test frequency. The analog update initiates the transfer of the data into the parallel-in/parallel-out shift registers. The output of the registers is applied to transistor lamp drivers to light the appropriate lamps. Light from the lamps is carried to the display panel faceplate by fiber optic strips, giving visual displays corresponding to the level of the sensed parameter. Power for the lamps is supplied by lamp supply voltages from SDC No. 1 and SDC No. 2. The No. 1 SDC supplies lamp voltage to all even numbered lamps while the No. 2 SDC supplies lamp voltage to all the odd numbered lamps on the vertical scale. A fault detection circuit monitors the test frequency and update pulse. In the absence of the test frequency or an update pulse, the fault detection circuit produces a failure warning signal and a reset pulse which resets the shift register, turning off all module display lamps on that module. When the CDU PUSH TO TEST switch is pressed, a lamp test voltage is applied to the driver module causing all its lamps to go on.

VOLTAGE REGULATOR (A17)

The voltage regulator receives both power and selective multiplexed analog data/update pulses from both the No. 1 and No. 2 SDCs. The voltage regulator provides over current protection (in conjunction with Q1) and regulated -10 vdc, 10 vdc, and 5 vdc operating voltages for the CDU. In addition, the voltage regulator provides output signals when any specific helicopter parameter high/low warning condition is detected. The regulator provides three rotor overspeed warning voltages to both pilot's display units (PDU) and also provides output voltages through the appropriate CDU fuse and the SDCs to the helicopter caution/advisory warning system when any of the following conditions exists: No. 1 or No. 2 low engine oil pressure, No. 1 or No. 2 high engine oil temperature, No. 1 or No. 2 low engine gas generator tachometer (Ng), or low rotor speed. When any of the rotor overspeed conditions (127%, 137%, or 142%) are detected, a relay on the voltage regulator is energized (latched) and connects the lamp power supply voltage to the respective overspeed lamps on both PDUs, causing the lamps to go on. The PDU lamps will now remain on and the regulator relay will remain latched even when the overspeed condition no longer exists (safe RPM). An external reset signal from the helicopter system to the voltage regulator module is required to reset the latching relay and cause the PDU overspeed lamps to go off. The remaining warning detection circuits on the voltage regulator will reset whenever the warning (unsafe) condition no longer exists.

INTERFACE NO. 1 MODULE (A15)

The interface No. 1 module contains the signal conditioning circuitry for transmission oil pressure signal and the auto dim control circuitry for the CDU, pilot's PDU and copilot's PDU. A 10 vac, 400 Hz reference voltage from the SDC logic power supply is used with the transmission oil pressure sensor signal (400 Hz) to generate a dc analog signal proportional to the pressure. The dc analog is applied to the A/T converter which produces the transmission oil pressure update signal when enabled by the multiplexer signal from the SDC analog processor. The analog reset signal from the SDC resets the A/T converter. The update signal is applied to the transmission oil pressure lamp driver module. The auto dim circuitry provides a reference voltage for the SDC lamp supply that is proportional to the ambient light level. The three photocells, one on the CDU, and one on both PDU's, sense the surrounding light level. The photocell sensing the highest level of light will provide the controlling input to the interface No. 1 module. The DIM control, on the CDU, is a gain adjustment which sets the display light level output. Turning the DIM control clockwise, past the detent, sets the display lighting to a fixed preset level and disables the three photocells.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

INTERFACE NO. 2 MODULE (A16)

The interface No. 2 module contains the signal conditioning circuitry for transmission oil temperature and the No. 1 and No. 2 fuel quantity signals. It also contains the transmission oil temperature A/T converter for the analog scale, the No. 1 and No. 2 A/T converters for the fuel quantity analog scales and the digital A/T converter for total fuel. The output from the No. 1 and No. 2 fuel quantity sensors are fed to a fuel quantity conditioning circuit where they are converted to a dc voltage. The outputs are applied to the No. 1 and No. 2 fuel quantity A/T converters. They are summed by the A/T converter for the digital display for total fuel. The interface No. 2 module also receives analog reset and multiplex signals from the analog processor in the SDC and generates the fuel 1 and fuel 2 update signals to the respective lamp driver modules. The digital reset and total fuel multiplex signal are provided by the digital processor in the SDC and the total fuel update signal is applied to the digital readout module. The transmission oil temperature sensor, a variable resistance, is fed to a conditioning circuit where it is converted to a dc voltage proportional to the oil temperature. The proportional dc voltage is then applied to the transmission oil temperature A/T converter. The analog reset signal and the transmission oil temperature multiplex signal from the SDC are used by the A/T converter to generate the transmission oil temperature update signal which is applied to the transmission oil temperature lamp driver module.

DIGITAL READOUT MODULE (A18)

The digital readout module provides digital readouts for total fuel, No. 1 and No. 2 engine gas generator tachometer (Ng SPEED 1 and 2) and No. 1 and No. 2 engine turbine gas temperature sensor signals (TGT TEMP 1 and 2). The digital readout module receives digital data from both SDCs. The digital data is fed to latching circuits on the digital module. When a parameter update signal is received, the incoming digital data is coupled through the latching circuitry to the seven-segment decoder drivers which light the appropriate lamps. Digital data as well as the appropriate update, multiplexing, test frequency, and lamp power supply voltages for total fuel, No. 1 engine gas generator tachometer (Ng 1) and No. 1 engine turbine gas temperature (TGT TEMP 1) are provided by the No. 1 SDC. The equivalent voltages for No. 2 engine gas generator tachometer (Ng 2) and No. 2 engine turbine gas temperature (TGT TEMP 2) display are provided by the No. 2 SDC. Each update pulse and the test frequency are applied to a monitor circuit on the digital readout module. In the absence of an update pulse or test frequency pulse, the monitor circuit produces a failure warning signal which lights the appropriate CHAN 1 or CHAN 2 warning light. In addition, the warning signal turns off the fault detected digital readout. All digital readouts can be blanked by placing the DIGITS switch to OFF. When the CDU PUSH TO TEST switch is engaged, all digital segments will light and be displayed in the digital readout.

LAMP DRIVER MODULES

All the lamp driver modules operate in basically the same way. The only difference is that some modules (No. 1 and No. 2 engine RPM and rotor RPM modules) have automatic bottom segment turnoff. This feature automatically turns off the low scale red and/or amber segments when the scale reading reaches the green segment. The low scale segments are automatically turned on when the scale reading drops below the green segment. Analog data is fed to the lamp drivers from the analog processor shift registers in the SDCs. The analog processors also supply the update pulses and test frequency. The analog update initiates the transfer of the data into the parallel-in/parallel-out shift registers. The output of the registers is applied to transistor lamp drivers to light the appropriate lamps. Light from the lamps is carried to the display panel faceplate by fiber optic strips, giving visual displays corresponding to the level of the sensed parameter. Power for the lamps is supplied by lamp supply voltages from the SDC. A monitor circuit checks for the presence of update pulses and a test frequency. Should either signal fail, the monitor circuit turns off the display of that module and applies a failure warning signal to the CDU.

TORQUE DIGITAL READOUT MODULE (A8)

The torque digital readout module provides digital readouts for percentage of No. 1 and No. 2 engine torque. The module receives digital data from the SDC and stores the data in a latching circuit when an update pulse is present. The data is fed to two decoder drivers which light the seven-segment units and tens displays, and to two transistors that drive separate lamps for the "hundreds" display (numeral 1 only). Each update pulse and a test frequency

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

are applied to a monitor circuit that checks for the presence of update pulses. If the update pulses fail to correspond with the test frequency, the monitor circuit turns off the digital readout and applies a failure warning signal to the CDU. When the TEST switch is pressed, all digital segments will go on.

AUTODIM MODULE (A9)

The autodim module produces a dc lamp supply voltage which is proportional to ambient light detected by the photocell on the front panel. The lamps supply voltage is routed out to the CDU as a reference for the CDU dimming control circuit. The autodim module contains a lamp test supply circuit for testing all analog and digital displays. When the TEST switch is pressed, the circuit provides five separate lamp test voltages for the analog displays and a logic signal for the digital displays. The module also contains clock inhibit drivers, which provide the combined analog and digital update pulses to the analog and digital clock inhibit circuits.

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

For location and description of major components, refer to the data in this work package.

EQUIPMENT DATA

If applicable, refer to WP 0002 00 for equipment data information.

INSTRUMENT SYSTEMS

CENTRAL DISPLAY UNIT DESCRIPTION AND DATA

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

CENTRAL DISPLAY UNIT

The central display unit (CDU), in the center of the instrument panel, receives signal and power inputs from both the No. 1 and No. 2 signal data converters (SDC) (Figure 1, Detail A).The CDU contains twelve analog displays, five digital displays, and two failure lights. The CDU receives the following multiplexed data signals from the SDCs. No. 1 and No. 2 engine oil temperature, No. 1 and No. 2 engine oil pressure, No. 1 and No. 2 engine turbine gas temperature (TGT), and No. 1 and No. 2 engine gas generator tachometer (Ng). These parameters are displayed on the CDU analog scales. The No. 1 and No. 2 engine turbine gas temperature and No. 1 and No. 2 engine gas generator tachometer information are also displayed on CDU digital readouts. The No. 1 and No. 2 fuel quantity signals from the No. 1 SDC and No. 2 SDC, respectively, and main transmission oil temperature and pressure signals from the No. 2 SDC are conditioned and multiplexed by the CDU for analog display. Total fuel quantity is displayed on a digital readout. Additional information on CDU analog displays is given in the following tabular data. The CDU failure lights, CHAN 1 and CHAN 2, are part of the IDS fault detection circuit. A failure of any SDC or CDU processing circuit, CDU or PDU display driver module, or SDC logic power supply will cause the associated display channel to turn off or switch to backup processor, and will light the associated CHAN failure light. Failure of lamp power supply within an SDC will cause every second display light on the CDU to go off. The CDU also contains: a PUSH TO TEST switch that, when pressed, causes all CDU vertical scale lamps, digital readouts, and CHAN 1 and CHAN 2 failure lights and the PDU and CPDU RTR OVERSPEED lights to go on; a DIGITS switch that gives ON-OFF control for all digital displays; a photocell to sense ambient light for automatic level adjustment and a DIM control that sets the level of display lighting to be determined by the photocells.

The CDU also contains: a PUSH TO TEST switch which, when pressed, lights all the CDU lamps; a DIGITS switch that gives ON-OFF control for all digital displays; a photocell to sense ambient light for automatic level adjustment; and a DIM control that sets the level of display lighting to be maintained by the photocells. On the back panel of the CDU there are four electrical connectors (J1, J2, J3, and J4), and eight fuses (seven used, one spare). The CDU contains the following modules:

1. No. 1 fuel quantity lamp driver module (A3)
2. No. 2 fuel quantity lamp driver module (A4)
3. Transmission oil temperature lamp driver module (A5)
4. Transmission oil pressure lamp driver module (A6)
5. No. 1 engine oil temperature lamp driver module (A7)
6. No. 2 engine oil temperature lamp driver module (A8)
7. No. 1 engine oil pressure lamp driver module (A9)
8. No. 2 engine oil pressure lamp driver module (A10)
9. No. 1 TGT lamp driver module (A11)
10. No. 2 TGT lamp driver module (A12)
11. No. 1 Ng speed lamp driver module (A13)
12. No. 2 Ng speed lamp driver module (A14)
13. Interface No. 1 module (A15)
14. Interface No. 2 module (A16)
15. Voltage regulator (A17)
16. Digital readout module (A18)

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

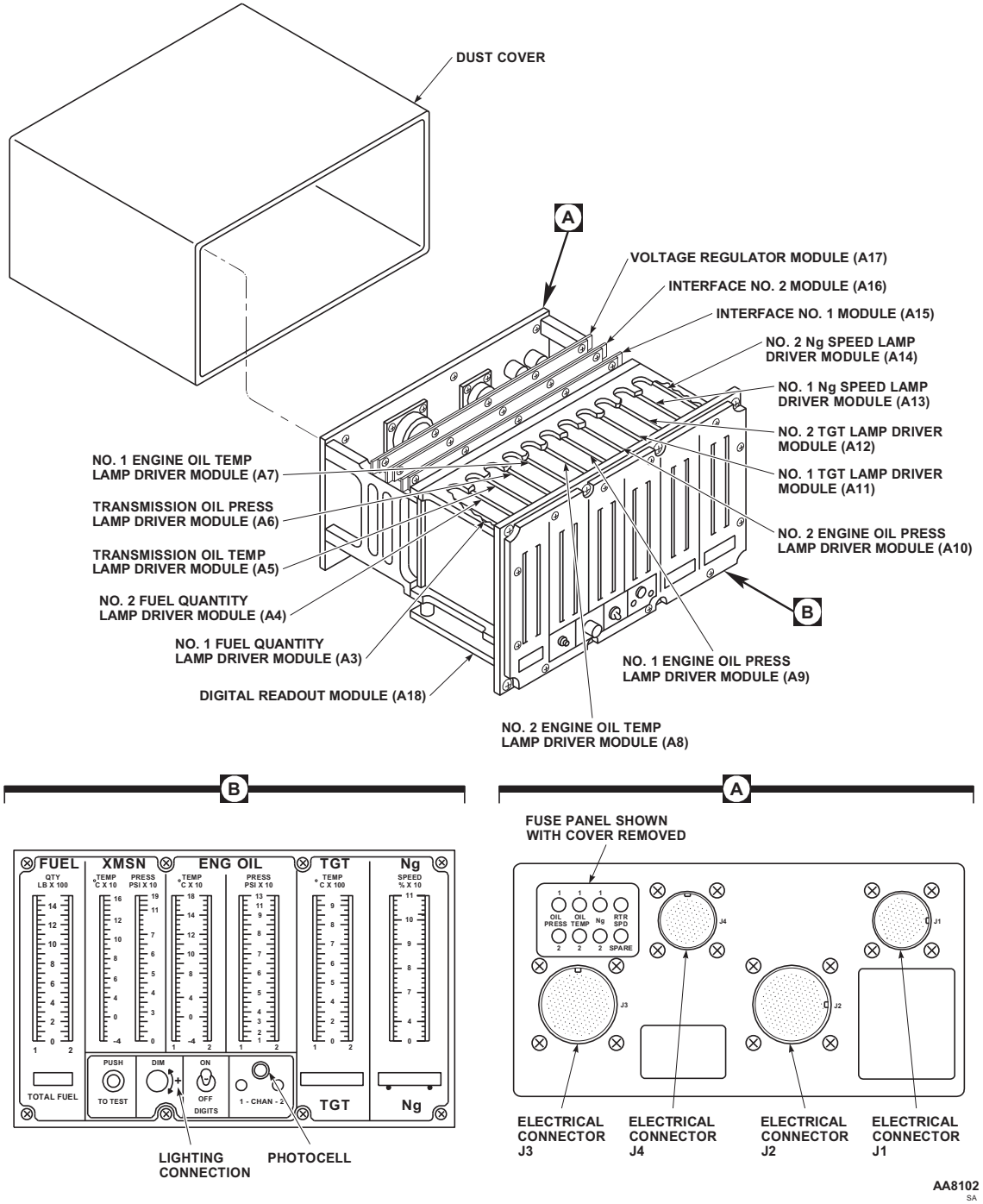


Figure 1. Central Display Unit Parts Location Diagram.

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

For location and description of major components, refer to the data in this work package.

EQUIPMENT DATA

If applicable, refer to WP 1445 00 for equipment data information.

INSTRUMENT SYSTEMS

PILOT'S DISPLAY UNIT DESCRIPTION AND DATA

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

PILOT'S DISPLAY UNIT

The pilot's display unit (PDU) receives signal and power inputs from an associated signal data converter (SDC) and central display unit (CDU) (Figure 1). The PDU contains five analog vertical scale displays, two digital displays, three indicator lights and a photocell. The PDU receives the following multiplexed data signals from the SDC: percentage of RPM speed for No. 1 and No. 2 engines and main rotor, and percentage of torque for the No. 1 and No. 2 engines. These parameters are displayed on the PDU analog scales. The percentage of torque for the No. 1 and No. 2 engines are also displayed on the digital readouts.

The PDU also contains a LT switch which, when pressed, lights the vertical displays and digital readouts. The RTR OVERSPEED lights go on individually to indicate overspeeds of 127%, 137% and 142%. The CDU provides power to each of the lights. On the back panel of the PDU are two electrical connectors (J1 and J2). The PDU contains the following modules: No. 1 engine RPM lamp driver module (A3), Rotor RPM lamp driver module (A4), No. 2 engine RPM lamp driver module (A5), No. 1 engine torque (analog) lamp driver module (A6), No. 2 engine torque (analog) lamp driver module (A7), torque digital readout module (A8), and autodim module (A9).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

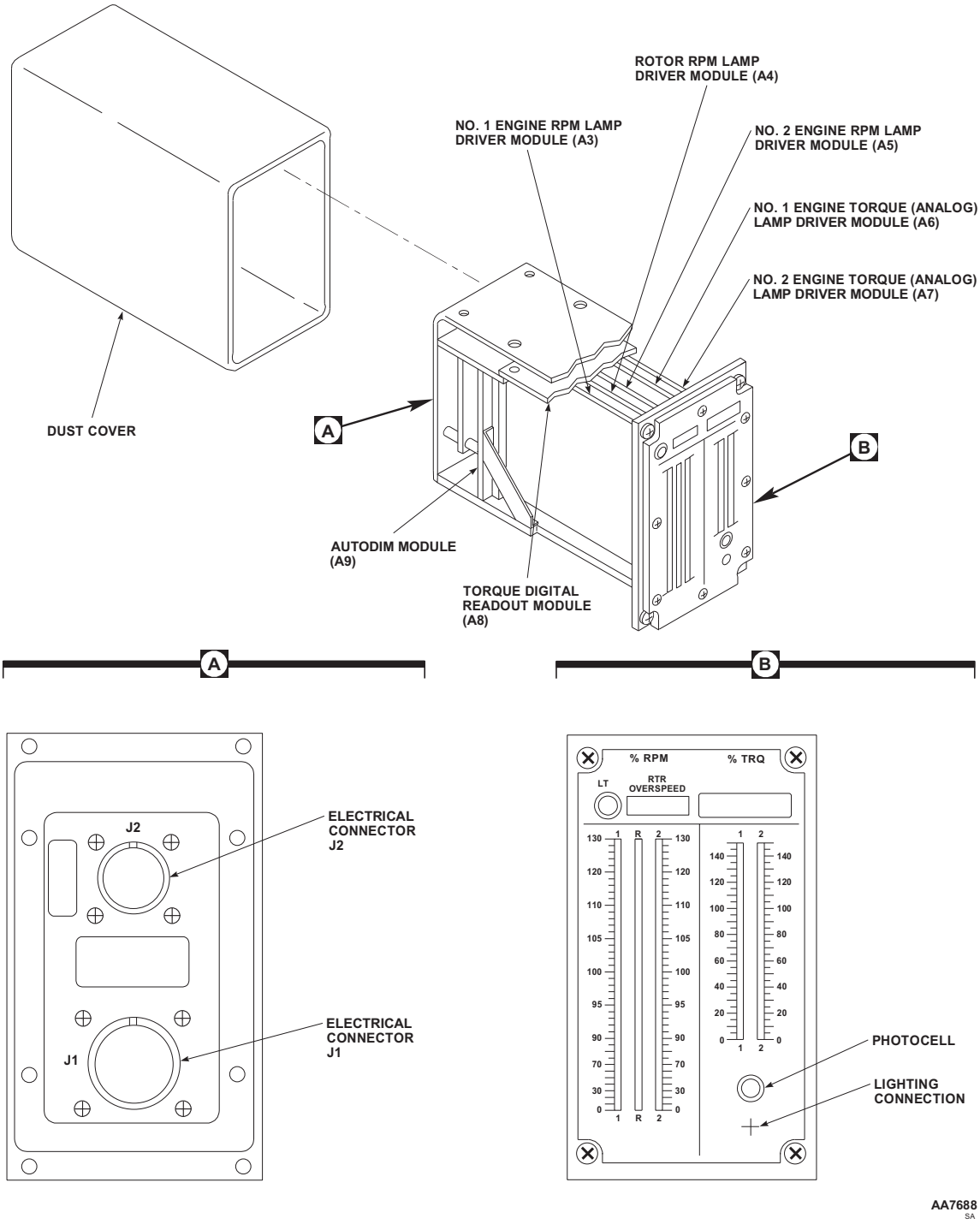


Figure 1. Pilots Display Unit Parts Location Diagram.

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

For location and description of major components, refer to the data in this work package.

EQUIPMENT DATA

If applicable, refer to WP 1704 00 for equipment data information.

INSTRUMENT SYSTEMS

CAUTION/ADVISORY WARNING SYSTEM DESCRIPTION AND DATA

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

CAUTION/ADVISORY WARNING SYSTEM

The caution/advisory warning system gives visual capsule indications for up to 82 helicopter subsystem conditions, and aural indications for three of these conditions (Figure 1, Detail A). Each indicator capsule has a colored legend that is visible when the capsule lights, to indicate the condition monitored. Green advisory capsules indicate actuation and normal operation of helicopter equipment. Yellow caution capsules indicate unsafe flight conditions and system failures. Red warning capsules indicate unsafe flight conditions requiring immediate action. When an advisory, caution, or warning condition exists, the related capsule goes on and remains on until the condition is removed or the trouble is corrected. On helicopters equipped with caution/advisory panel, 70550-01107-102, there are seven latching caution capsules that remain on, once turned on, and do not go off until reset. On helicopters with caution/advisory panel, 70550-01107-103, these capsules do not latch. When a caution capsule goes on, two MASTER CAUTION PRESS TO RESET capsules also go on to attract the attention of the pilot and copilot to the caution condition. The MASTER CAUTION PRESS TO RESET capsules will remain on until the trouble is corrected or until either capsule is pressed to reset both capsules for another caution condition. The system provides aural warnings to the pilot's and copilot's ICS stations in addition to the visual warnings for low rotor RPM, engine out, and stabilator shutdown conditions. A steady tone is provided for either low rotor RPM or engine out conditions, and a beeping tone is provided for stabilator shutdown. The system also gives indicator light test and dimming control signals to other helicopter systems. The caution/advisory warning system consists of a caution/advisory panel on the center of the instrument panel, two master warning panels; one on each side of the instrument panel glare shield, an audible warning unit on the canted bulkhead on the left side of the avionics compartment, and two dimming controls on the left side of the instrument panel.

NOTE

Two variations of the caution/advisory panel exist. While the system operations are identical, the internal operations are different. The internal operation differences are due to the insertion of light emitting diodes to illuminate the caution/advisory panel (LED) panel's light capsules where the legacy caution/advisory panels use incandescence lights.

The caution/advisory panel gives visual indications, on aviation yellow or green color-coded capsules, that show the status of as many as 82 helicopter subsystem conditions (Figure 1). Each capsule has a legend that becomes visible when a capsule lights. Sixty four capsules are yellow, while eighteen are green. The 64 yellow capsules are caution capsules that indicate unsafe flight condition system failures. The 18 green capsules are advisory capsules that indicate actuation or normal operation of various helicopter subsystems. With the exception of two caution capsules, 1 and 62, all of the caution and advisory capsules light steady. Capsules 1 and 62 flash when activated. Whenever a fault signal is applied to one of the 64 caution capsules, a 28 vdc output from the caution/advisory panel is also produced. In the helicopter installation, this output is used to power external lights on two master warning panels. The external master caution signal may be reset by unlatching a circuit in the caution/advisory panel with an external reset command voltage. The capsules are arranged on the front of the caution/advisory panel in 4 horizontal rows, with 19 capsules in the extreme left vertical row and 21 capsules in each of the remaining 3 rows. The upper portion displays 64 caution indications. The lower portion displays 18 advisory indications. On panel, 70550-01107-102, there are seven latching capsules (13, 14, 21, 33, 42, 74, and 75). Once they are turned on, they remain on until a reset is applied. All the latching capsules are identical in operation except 33, which has a 30-second time delay before turn-on. The caution/advisory panel also consists of a three position momentary-type contact toggle switch, with panel markings of BRT/DIM and TEST; a frame assembly; two side covers; four circuit channel cards and one control card, which plug into mating connectors within the frame; two input/output signal and power connectors and chassis mounted electronic components. Refer to Table 1 The caution/advisory panel (LED) Figure 2, consists of a three position momentary-type contact toggle switch, with

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

markings of BRT/DIM and TEST; a chassis assembly containing an input circuit card assembly; a lightbox assembly containing a lightbox circuit card assembly; and a circuit card interconnect wire harness. Refer to Table 1 for caution/advisory legend light capsules/LED indicators.

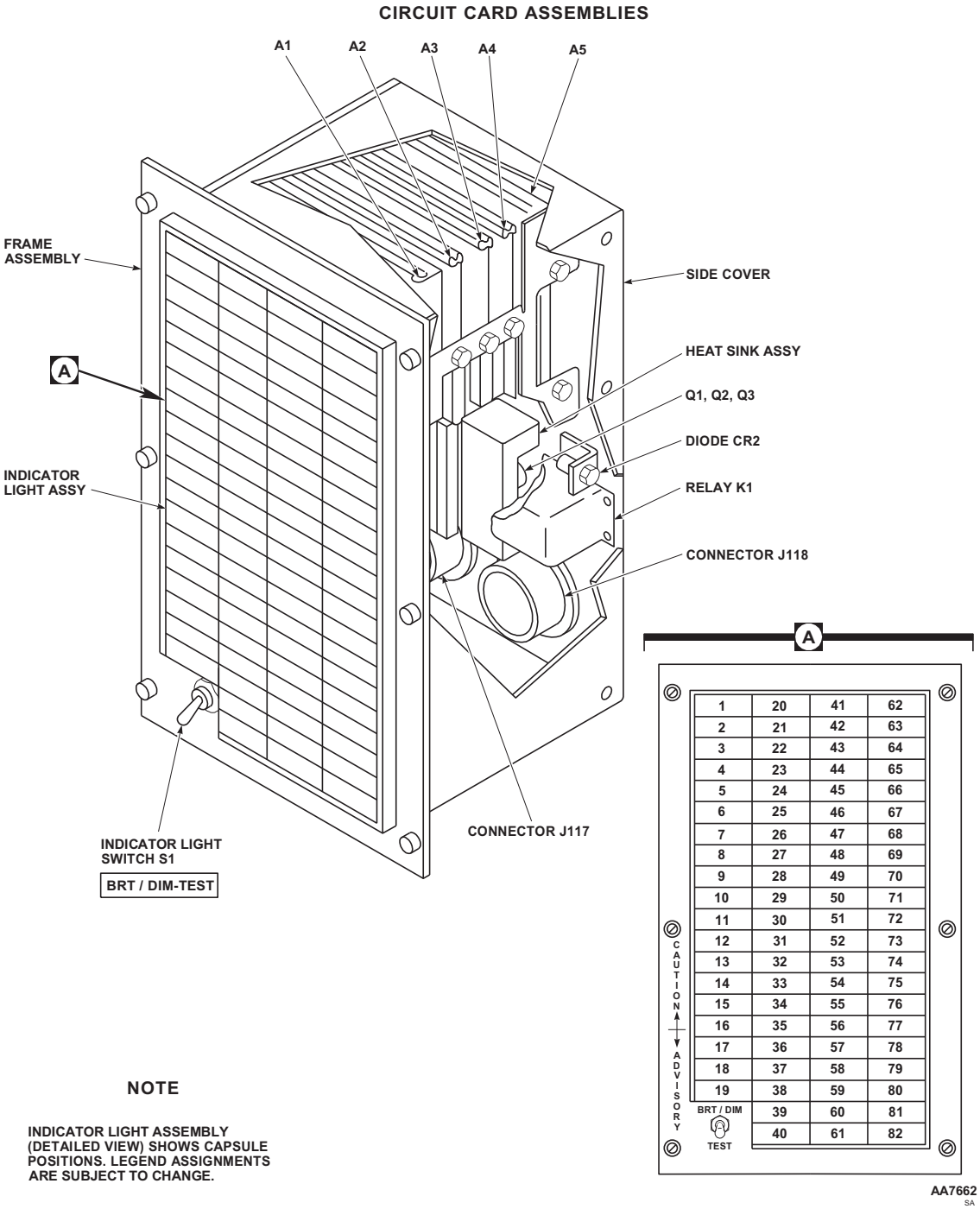


Figure 1. Caution/Advisory Panel Parts Location Diagram.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

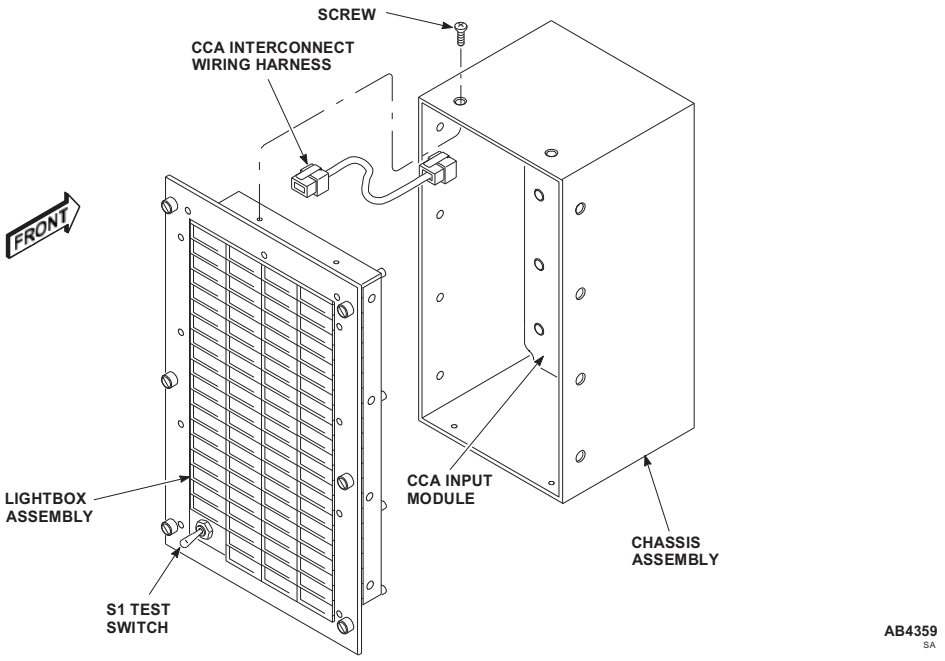


Figure 2. Caution/Advisory Panel (LED) Parts Location Diagram.

Table 1. Caution/Advisory Panel Caution Capsules.

LEGEND	FAULT
#1 FUEL LOW	Flashes at between 3 to 5 flashes per second when left fuel tank level is about 172 pounds (20 minutes) remaining at normal cruise flight.
#1 FUEL PRESS	Left engine fuel pressure is below 8.0 to 9.0 psi between engine-driven low pressure fuel pump and high pressure vane fuel pump.
#1 ENGINE OIL PRESS	Left engine oil pressure is below 25 psi on helicopters without modified faceplate, or below 20 psi on helicopters with modified faceplate.
#1 ENGINE OIL TEMP	Left engine oil temperature is above 150°C.
CHIP #1 ENGINE	Left engine chip detector in scavenge oil system has metal chip or particles buildup.
#1 FUEL FLTR BYPASS	Left engine fuel filter has 7.5 psid across filter.
#1 ENGINE STARTER	Left engine start valve is open.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

Table 1. Caution/Advisory Panel Caution Capsules. – Continued

LEGEND	FAULT
#1 PRI SERVO PRESS	First stage pressure is shut off, or has dropped to 2000 ± 50 psi, or servo pilot valve is jammed.
TAIL ROTOR QUADRANT	Goes on when a tail rotor cable is broken or disconnected.
MAIN XMSN OIL TEMP	Main transmission oil temperature is above 120°C.
BOOST SERVO OFF	Indicates loss of 2nd stage hydraulic pressure to the boost servo, or a boost servo jam.
LFT PITOT HEAT	Indicates left pitot heater element is not receiving power with PITOT HEAT switch in ON position.
CHIP INPUT MDL - LH	Indicates a metal particle has been detected by the chip detector.
CHIP ACCESS MDL - LH	Indicates a metal particle has been detected by the chip detector.
MR DE-ICE FAIL	Indicates a short or open in the main rotor de-ice system, which will disable the system.
MAIN XMSN OIL PRESS	Main transmission oil pressure is below 14 psi.
#1 GEN	Left generator is not supplying power to the buses.
#1 GEN BRG	Generator main bearing has failed.
#1 CONV	Left converter (ac to dc current) has no output.
AC ESS BUS OFF	Indicates that no power (115 vac phase B) is being supplied to the ac essential bus.
BATT LOW CHARGE	Indicates that the battery charge state is at or below 40% of full charge state.
GUST LOCK	Indicates the gust lock is not fully disengaged.
#1 OIL FLTR BYPASS	Left engine oil filter pressure differential is between 60 - 80 psi.
#1 HYD PUMP	Left hydraulic pump output pressure to 2000± 50 psi.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

Table 1. Caution/Advisory Panel Caution Capsules. – Continued

LEGEND	FAULT
IRCM INOP (NOTE 1)	Indicates a countermeasure system malfunction has been detected or countermeasures system is in cool down period.
INT XMSN OIL TEMP	Intermediate gear box oil temperature is above 140°C.
STABILATOR	Stabilator system is turned on but is in the manual mode.
FLT PATH STAB	Indicates that FPS is inoperative.
CHIP INT XMSN	Indicates a metal particle has been detected by the chip detector.
CHIP MAIN MDL SUMP	Indicates a metal particle has been detected by the chip detector.
MR DE-ICE FAULT	Indicates partial failure of the blade de-ice system. Uneven shedding of ice can be expected.
#1 RSVR LOW	Hydraulic fluid level has dropped below 60%of full capacity.
#2 GEN	Right generator is not supplying power to the buses.
#2 GEN BRG	Generator main bearing has failed.
#2 CONV	Right converter (ac to dc current) has no output.
DC ESS BUS OFF	Indicates that no power (28 vdc) is being supplied to the dc essential bus.
BATTERY FAULT	Indicates that the battery has exceeded safe operating temperature (over temperature) or a battery cell dissimilarity exists.
ANTENNA EXTENDED (NOTE 4)	Indicates ECM antenna switch is set to EXTEND.
#2 OIL FLTR BYPASS	Right engine oil filter pressure differential is between 60 - 80 psi.
#2 HYD PUMP	Right hydraulic pump output pressure to 2000± 50 psi.
AUX FUEL (NOTE 2)	Indicates one or more auxiliary fuel tanks are empty, fuel flow is desired but not present, or the system is operating in a degraded mode.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

Table 1. Caution/Advisory Panel Caution Capsules. – Continued

LEGEND	FAULT
TAIL XMSN OIL TEMP	Tail gear box oil temperature is above 140°C.
SAS OFF	Hydraulic pressure supplied to the SAS actuator is 2000 ± 50 psi.
IFF	Mode 4 is not capable of responding to interrogation.
CHIP TAIL XMSN	Indicates a metal particle has been detected by the chip detector.
APU FAIL	APU was automatically shut down by the electrical sequence unit.
TR DE-ICE FAIL	Indicates a short or open in a tail rotor blade de-ice element.
#2 RSVR LOW	Hydraulic fluid level has dropped below 60% of full capacity.
#2 FUEL LOW	Flashes at 3 to 5 flashes per second when right fuel level is about 172 pounds (20 minutes) remaining at normal cruise flight.
#2 FUEL PRESS	Right engine fuel pressure is below 8.0 to 9.0 psi between engine-driven low pressure fuel pump and high pressure fuel pumps.
#2 ENGINE OIL PRESS	Right engine oil pressure is below 25 psi on helicopters without modified faceplate, or below 20 psi on helicopters with modified faceplate.
#2 ENGINE OIL TEMP	Right engine oil temperature is above 150°C.
CHIP #2 ENGINE	Right engine chip detector in scavenge oil system has metal chips or particles buildup.
#2 FUEL FLTR BYPASS	Right fuel filter has 7.5 psid across filter.
#2 ENGINE STARTER	Right engine start valve is open.
#2 PRI SERVO PRESS	Second stage pressure is shut off, or has dropped to 2000 ± 50 psi, or servo pilot valve is jammed.
#1 TAIL RTR SERVO	Hydraulic pressure to the first stage tail rotor servo is 2000 ± 50 psi.
APU OIL TEMP HI	APU oil temperature is above about 149°C.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

Table 1. Caution/Advisory Panel Caution Capsules. – Continued

LEGEND	FAULT
TRIM FAIL	Indicates that yaw, roll or pitch trim actuators are not responding accurately to computer signals.
RT PITOT HEAT	Indicates right pitot heat element is not receiving power.
CHIP INPUT MDL - RH	Indicates a metal particle has been detected by the chip detector.
CHIP ACCESS MDL - RH	Indicates a metal particle has been detected by the chip detector.
ICE DETECTED	Indicates that ice is detected on the rotor blade ice detector sensor.
BACK-UP RSVR LOW	Hydraulic fluid level has dropped below 60% of full capacity.
#1 ENG ANTI-ICE ON	Indicates that No. 1 engine anti-ice/start bleed valve is open.
APU ON	APU speed is above 90% for 1.5 seconds.
APU ACCUM LOW	APU accumulator pressure is below 2600 psi.
#1 ENG INLET ANTI-ICE ON	Indicates the No. 1 engine inlet temperature is 93°C or above.
APU GEN ON	APU generator output is accepted and being supplied to the helicopter.
SEARCH LT ON	Either pilot or copilot has selected SEARCH LT ON.
CARGO HOOK OPEN (NOTE 3)	Indicates that cargo hook load beam is not latched.
AIR COND ON (NOTE 4)	Indicates AIR COND switch has been set to COOL and 15 seconds has elapsed.
PARKING BRAKE ON	Indicates that PARKING BRAKE handle is pulled.
#2 ENG INLET ANTI-ICE ON	Indicates that No. 2 engine inlet temperature is 93°C or above.
PRIME BOOST PUMP ON	Prime boost pump switch is at PRIME or BOOST.
LDG LT ON	Either pilot or copilot has selected LDG LT ON.
HOOK ARMED (NOTE 3)	The cargo hook release system is armed.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

Table 1. Caution/Advisory Panel Caution Capsules. – Continued

LEGEND	FAULT
CABIN HEAT ON (NOTE 4)	Indicates AIR COND switch is in FAN position and HTR switch is set to ON.
EXT PWR CONNECTED	Indicates that external power plug is connected to helicopter's EXT POWER connector and BATT switch is ON, if EXT PWR switch is OFF.
#2 ENG ANTI-ICE ON	Indicates that No. 2 engine inlet anti-ice/start bleed valve is open.
BACKUP PUMP ON	Backup pump pressure is being supplied at a pressure above 2350 psi.
#2 TAIL RTR SERVO ON	Pressure to second stage tail rotor servo is above 2350 psi.
ANTENNA RETRACTED (NOTE 4)	Indicates ECM antenna switch is set to RETRACT and antenna is in its fully retracted position.
GPS POS ALERT	Indicates that GPS signals are not reliable.
NOTES	
1. **ESSS>** IRCM INOP capsule is installed.	
2. **W/O ESSS>** AUX FUEL capsule is not functional.	
3. **UH-60A UH-60L>**	
4. **EH-60A>**	

CAUTION/ADVISORY WARNING SYSTEM OPERATION

The caution/advisory warning system gets dc electrical power from the upper console circuit breaker panel and from the copilot's circuit breaker panel (Figure 3. (Sheet 1 of 7), Figure 3. (Sheet 2 of 7), Figure 3. (Sheet 3 of 7), Figure 3. (Sheet 4 of 7), Figure 3. (Sheet 5 of 7), Figure 3. (Sheet 6 of 7), and Figure 3. (Sheet 7 of 7)). Electrical power of 28 vdc is supplied by the dc essential bus and routed through the CAUT/ADVSY PNL circuit breaker to the caution/advisory panel, the master warning panels, and the left relay panel. The 28 vdc is also applied to the INSTR LT PILOT FLT control. When the control is turned from OFF, 28 vdc is applied to the caution/advisory panel for lamp dimming control. Electrical power of 28 vdc is supplied by the No. 1 dc primary bus and routed through the LIGHTS CAUT ADVSY circuit breaker for lamp test power. (The caution/advisory panel (LED) does not use any power from the DC Primary Bus) . Electrical power of 28 vdc is applied to the PNL LTS switches on the pilot's and copilot's cyclic stick grips from the LIGHTS ADVSY circuit breaker. **UH-60A 79-23302 - SUBQ UH-60L EH-60A >** When the switches are pressed to turn off panel lights, the 28 vdc is applied to the caution/advisory panel for night vision goggle dimming control. **<**

The caution/advisory panel receives 28 vdc and ground signals from helicopter systems to light the caution and advisory capsules listed in Table 2 For most of the caution capsules and all of the advisory capsules, a 28 vdc signal from the monitored system is applied directly to the capsule circuit to light the capsule. These capsules will remain on until the input signal is removed. For chip detection and generator bearing failure monitoring, 28 vdc caution capsule power is applied to ground sensing circuits in the caution/advisory panel. When a chip is de-

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

tected or a generator bearing fails, a ground is applied to the ground sensing circuit. (The caution/advisory panel (LED) does not use any power from the DC Primary Bus). The sensing circuit then applies the 28 vdc power to the caution capsule circuit to light the capsule. (In the caution/advisory panel (LED), the sensing circuit activates the caution capsule logic circuit to light the light emiting diodes). UH-60A 77-22714 - 78-22986 > Five transmission chip and two generator bearing failure capsules latch when turned on and remain latched until reset. When the fault is removed, a latched capsule can be turned off by applying either a master or special reset signal. A master reset occurs when power is removed from the caution/advisory warning system for longer than 200 msec. When a master reset is applied, all latched capsules reset so that when power is reapplied, all capsules will be off. A special reset signal is generated when power is removed from the particular system being monitored. With a special reset applied only the associated capsule resets. When power is removed from the chip detector system, a special reset is generated and these capsules reset, if latched: CHIP INPUT MDL-LH, CHIP ACCESS MDL-LH, CHIP MAIN MDL-SUMP, CHIP INPUT MDL-RH and CHIP ACCESS MDL-RH. When ac electrical system No. 1 generator warning power is removed, a special reset pulse will reset the #1 GEN BRG capsule, if latched. When ac electrical system No. 2 generator warning power is removed, a special reset pulse will reset the #2 GEN BRG capsule. < With the exception of the #1 and #2 FUEL LOW capsules, all caution and advisory capsules light steady. The #1 and #2 FUEL LOW capsules flash at a rate of about four flashes per second when activated by a low fuel caution input.

Table 2. Master Warning Panel Capsules.

LEGEND	FAULT
#1 ENG OUT	No. 1 engine gas turbine speed (Ng) is below 55%.
FIRE	Indicates a fire detector has actuated a fire warning circuit.
MASTER CAUTION PRESS TO RESET	Indicates a caution light on the caution panel has been actuated by failed system.
#2 ENG OUT	No. 2 engine gas turbine speed (Ng) is below 55%.
LOW ROTOR RPM	Rotor speed is below about 95% RPM R.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

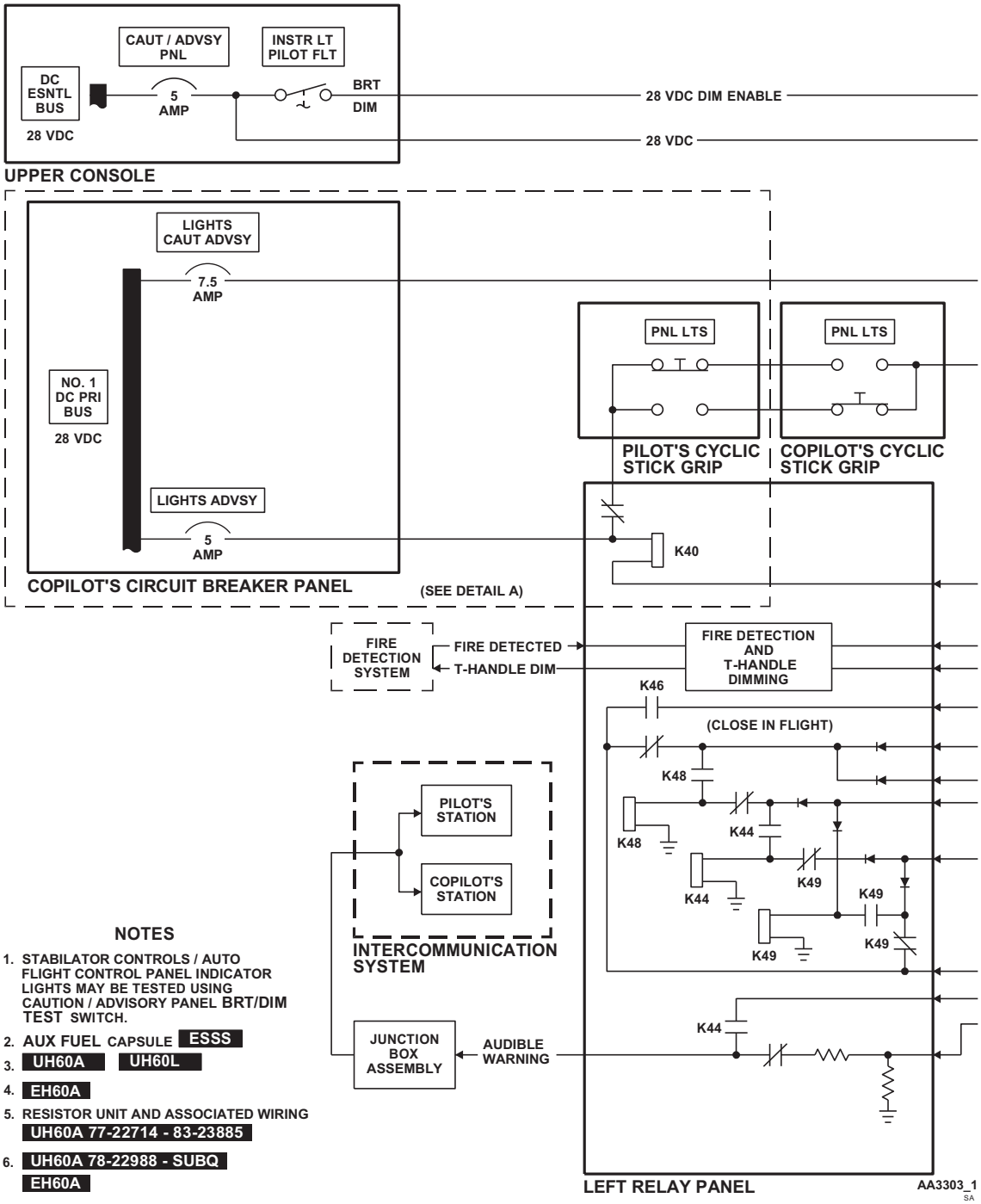


Figure 3. Caution/Advisory System Block Diagram (Sheet 1 of 7).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

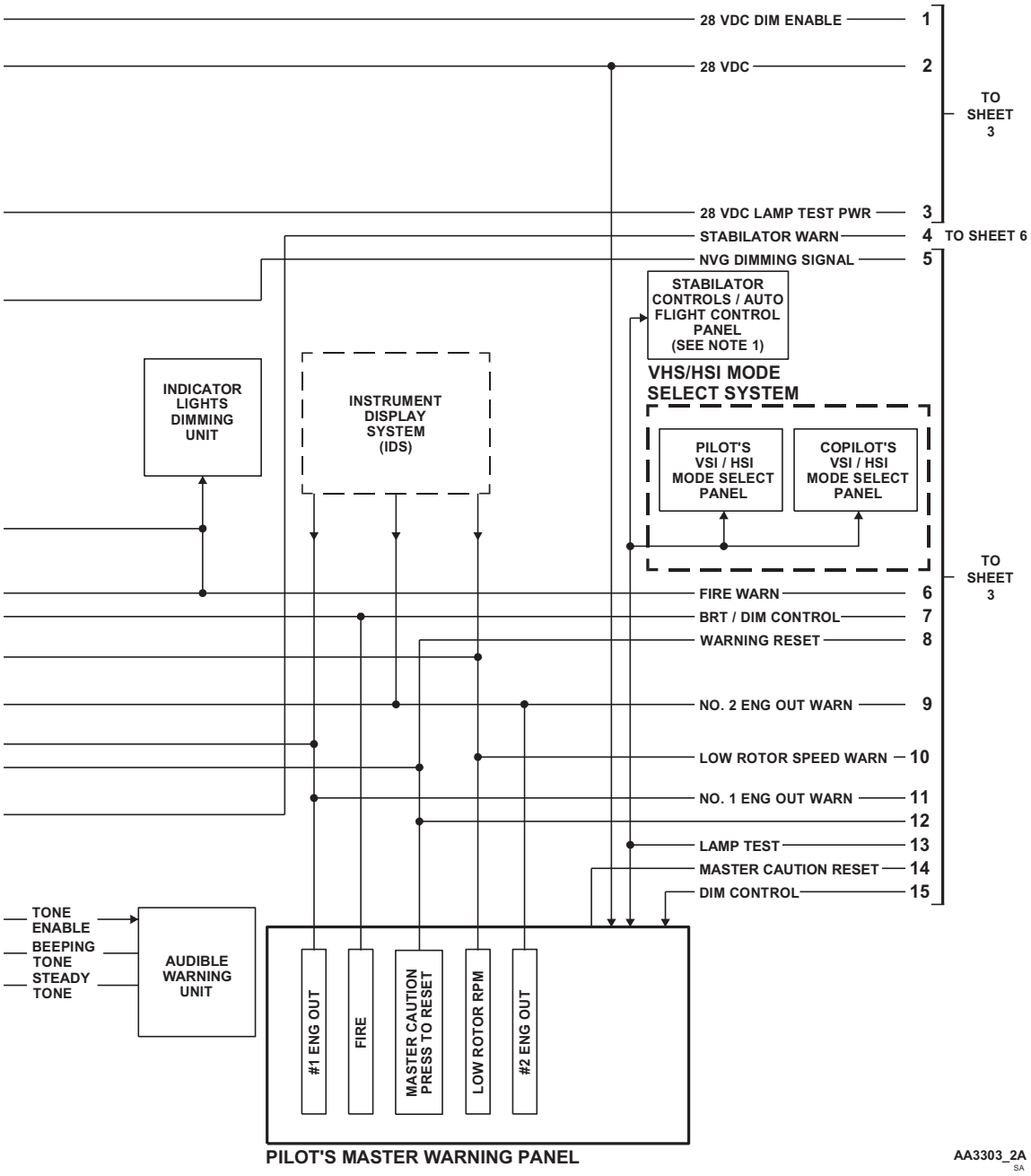


Figure 3. Caution/Advisory System Block Diagram (Sheet 2 of 7).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

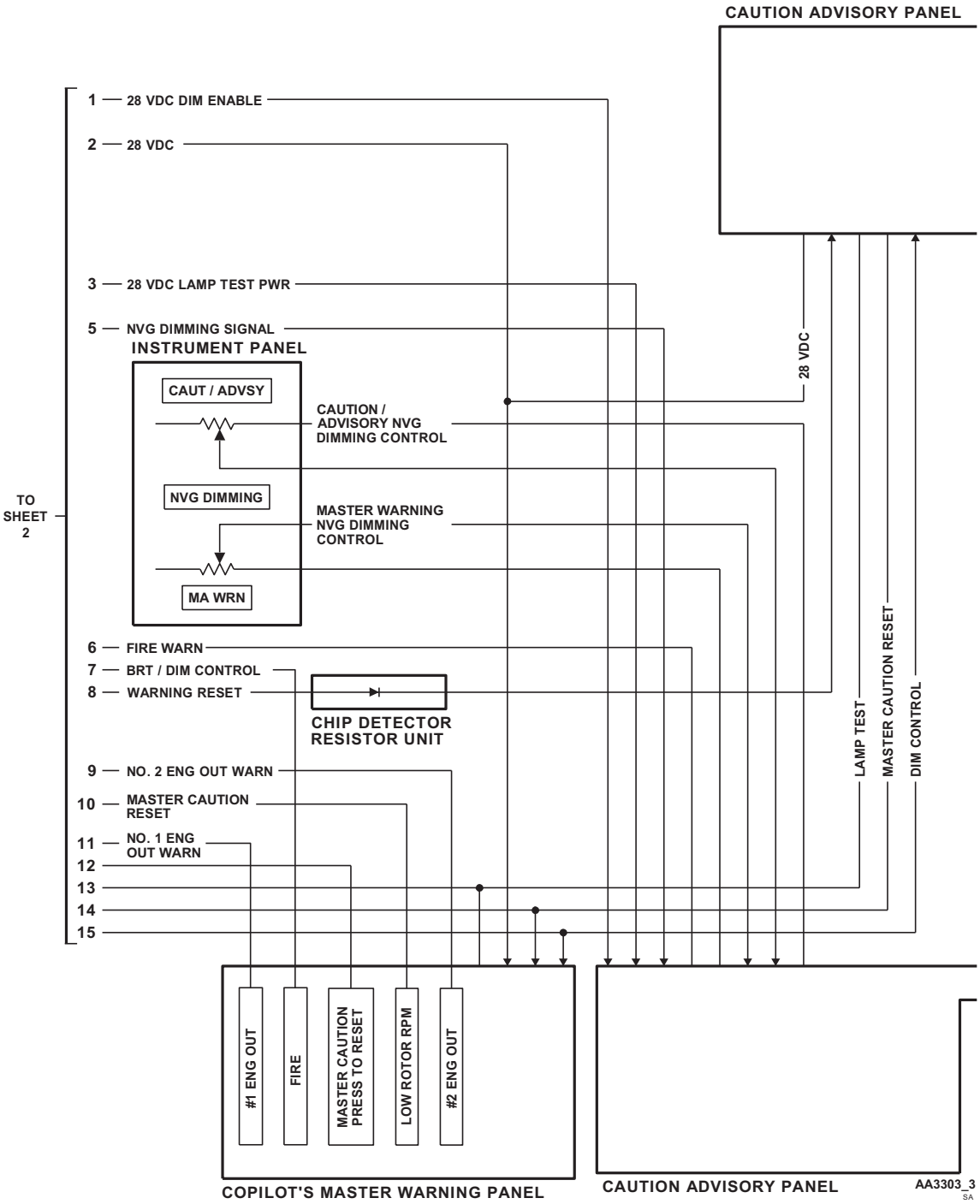


Figure 3. Caution/Advisory System Block Diagram (Sheet 3 of 7).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

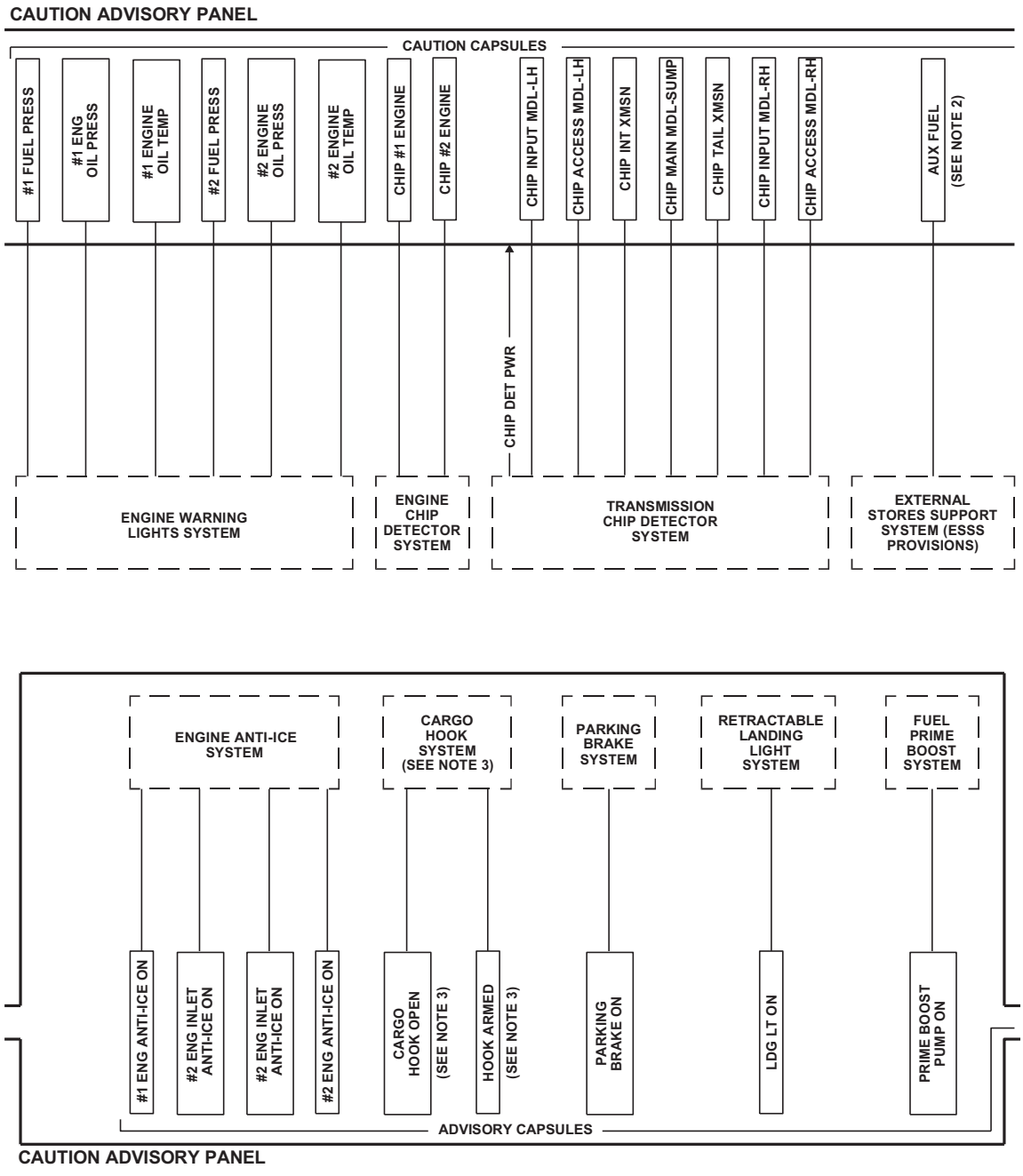


Figure 3. Caution/Advisory System Block Diagram (Sheet 4 of 7).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

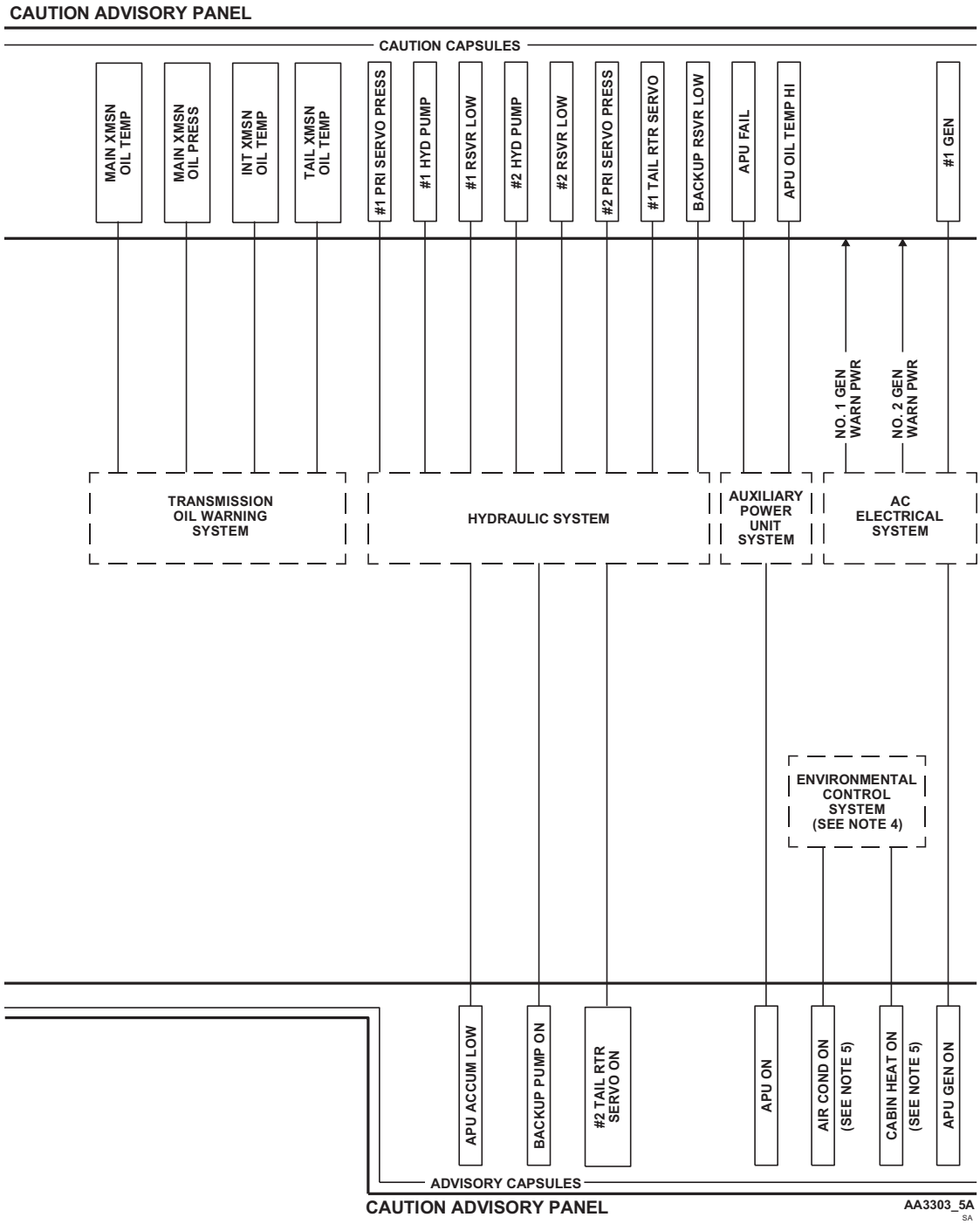


Figure 3. Caution/Advisory System Block Diagram (Sheet 5 of 7).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

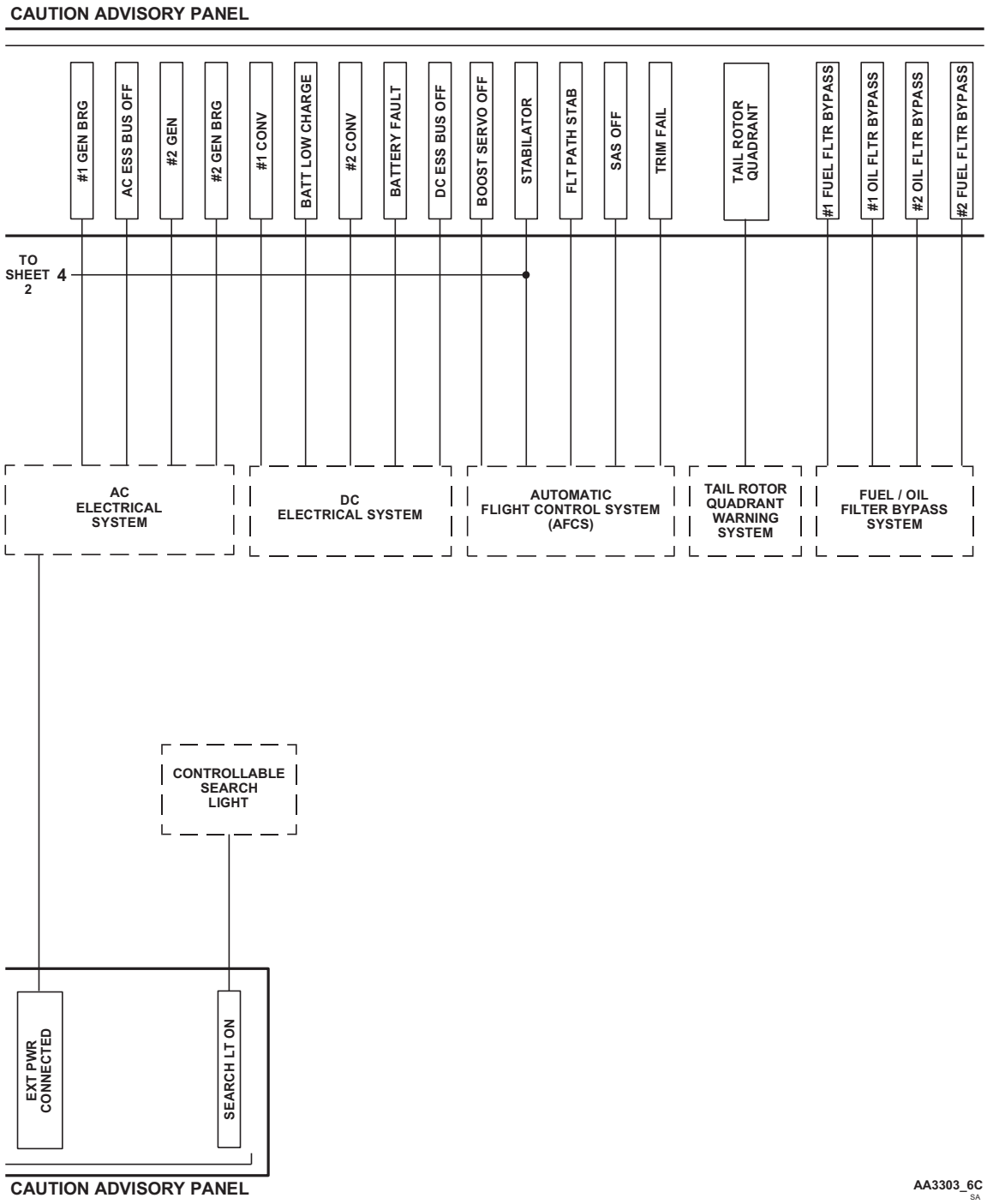


Figure 3. Caution/Advisory System Block Diagram (Sheet 6 of 7).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

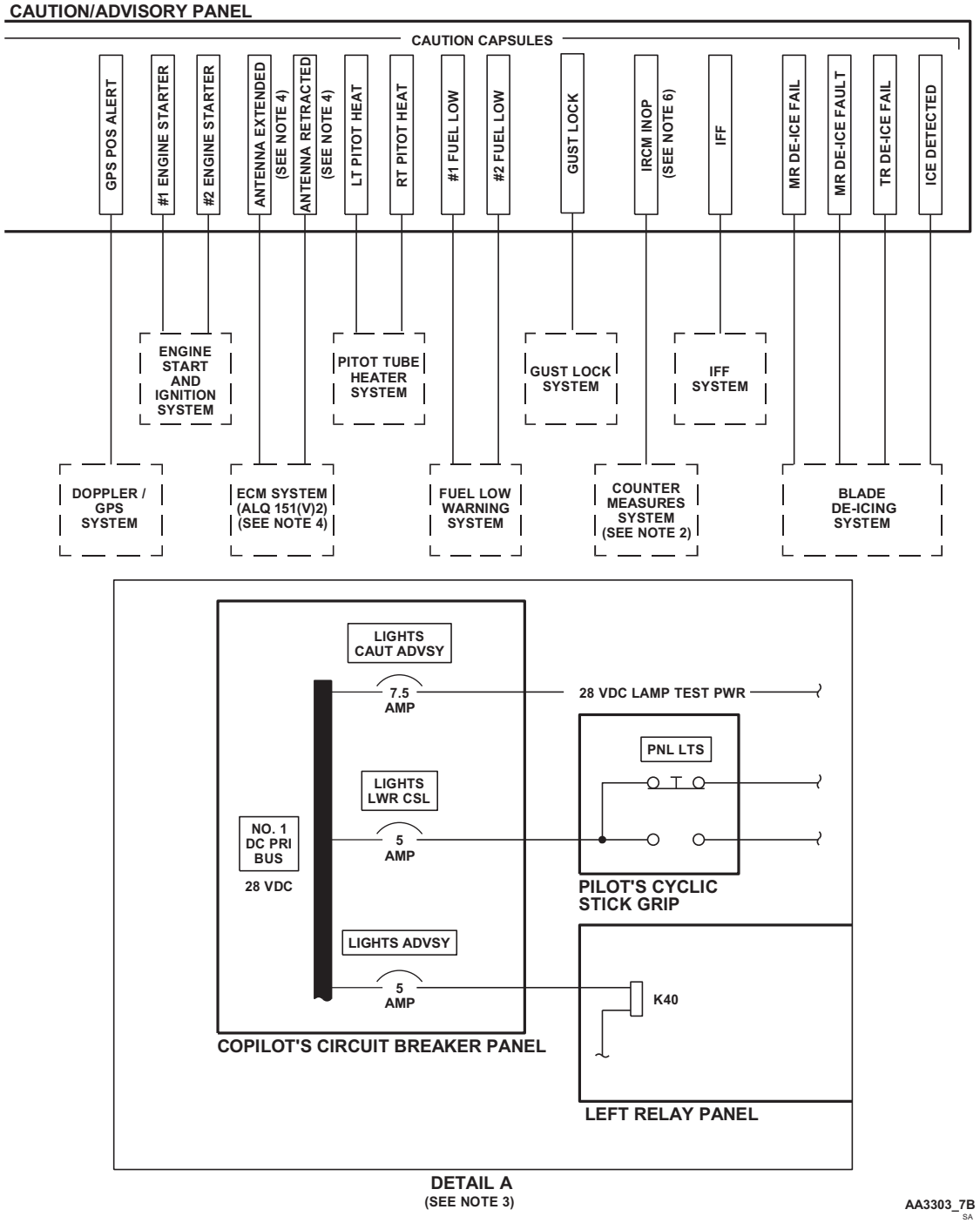


Figure 3. Caution/Advisory System Block Diagram (Sheet 7 of 7).

When any caution capsule lights, a signal is applied to a master caution light circuit in the caution/advisory panel. This circuit applies a 28 vdc signal to the pilot's and copilot's master warning panels to light the MASTER CAUTION PRESS TO RESET capsules. These capsules remain on until the caution condition is removed or until manually reset by pressing either capsule. This applies a 28 vdc reset signal to the master caution light circuit to reset it for another caution input. When the MASTER CAUTION PRESS TO RESET capsules are activated by

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

a low fuel caution, they flash as do the #1 and #2 FUEL LOW caution capsules. **UH-60A 77-22714 - 83-23896 >** A diode in the chip detector resistor unit is installed in the warning reset line to the caution/advisory panel. This eliminates audible warning reset relay transients from preventing reset of the master warning caution circuits when the MASTER CAUTION PRESS TO RESET is pressed and released. **<UH-60A 83-23895 - SUBQ UH-60L EH-60A >** The chip detector resistor unit has been removed. A diode has been installed in the caution/advisory panel to achieve the same function. **<**

The pilot's and copilot's master warning panels receive 28 vdc signals from the instrument display system (IDS) and the fire detection system to light the warning capsules listed in Table 2. The IDS provides warning signals for low engine gas turbine speed (engine-out) and low rotor RPM. The #1 and #2 ENG OUT capsules light steady when activated. The LOW ROTOR RPM capsules flash at 3 to 5 flashes per second when activated. The fire detection system generates a fire warning signal when a fire is detected in the No. 1 engine, No. 2 engine, or APU area. The 28 vdc warning signal is routed through a fire detection circuit in the left relay panel to the pilot's and copilot's master warning panels to light the FIRE capsules.

The audible warning function is controlled by the left relay panel. Warning signals from the IDS (low rotor RPM and No. 1 or No. 2 engine out) and the stabilator system are routed through the left relay panel to activate the audible warning unit, which generates both beeping and steady warning tones. The warning tones are applied to the left relay panel which selects either one for application to the intercommunication system. The stabilator system warning signal is given priority over both IDS warning signals. With a stabilator warning condition present, the 28 vdc stabilator warning signal is applied through the normally closed contacts of relay K49 to the audible warning unit and to the solenoid of relay K44. Relay K44 energizes, selecting the beeping warning tone output from the audible warning unit. The warning tone is fed from the left relay panel through the junction box assembly to the pilot's and copilot's intercommunication system stations. With a No. 1 or No. 2 engine-out warning condition present, the 28 vdc signals are applied through the normally closed contacts of relay K48 to the audible warning unit. The steady warning tone is selected by the deenergized contacts of relay K44 and routed to the pilot's and copilot's stations. With a low rotor RPM warning condition present during flight, the 28 vdc signal is applied through energized contacts of relay K46 to the audible warning unit. The steady warning signal is applied to the pilot's and copilot's stations as described for engine-out warning condition. The low rotor RPM warning is disabled with weight on wheels. The audible warnings for stabilator shutdown and engine-out conditions may be cleared by pressing one of the MASTER CAUTION PRESS TO RESET capsules. Pressing a capsule applies 28 vdc to the left relay panel audio reset circuit consisting of relays K48 and K49. Relay K48 energizes to disable an engine-out warning and relay K49 energizes to disable a stabilator shutdown warning.

The caution/advisory panel contains a BRT/DIM TEST switch that enables testing and changing the light intensity of all caution, advisory, and warning capsules. The switch is momentary in both the BRT/DIM and TEST positions. Placing the switch to TEST applies 28 vdc to all caution and advisory capsule circuits to light all capsules. (In the caution/advisory panel (LED), the sensing circuit activates the caution capsule logic circuit to light the light emitting diodes.) A 28 vdc test signal is also applied to the master warning panels to light all warning capsules. As in normal operation, the #1 and #2 FUEL LOW caution capsules and the LOW ROTOR RPM warning capsules flash when activated by the test signal. With the switch placed to TEST, a 28 vdc test signal is also applied to the pilot's and copilot's VSI/HSI mode select panels. The panels provide ground signals to light the mode select switch lights, the VSI advisory lights and the CIS mode select panel switch light. The BRT/DIM position of the caution/advisory panel BRT/DIM-TEST switch permits changing the light intensities of all caution, advisory, and warning capsules. When the INSTR LT PILOT FLT control is turned from OFF, 28 vdc is applied to the caution/advisory panel to enable the light dimming circuit. When the BRT/DIM-TEST switch is placed to BRT/ DIM, 28 vdc is applied to a dimming logic circuit. The dimming logic circuit applies a ground to the caution and advisory light dimming circuits to dim all caution/advisory panel capsules. A ground is also applied to the master caution and master warning light dimming circuits in the caution/advisory panel. These circuits apply ground outputs to the master warning panel capsules to dim them. A dim control ground is also applied from the caution/advisory panel to the indicator light dimming and the T-handle light dimming circuits in the LH relay panel and to the flight control panel and the range extension kit to enable dimming of other helicopter lights. When the BRT/DIM-TEST switch is placed to BRT/DIM again, or if the 28 vdc input to the switch is removed, the ground output from the dimming logic circuit is removed, and all caution/advisory panel, master warning panel, and all other helicopter lights that were dimmed

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

now go on bright. Further dimming of the caution/advisory and master warning panel capsules is provided when night vision goggles (NVG) are used. When the pilot's or copilot's PNL LTS switch is pressed, the following panel indicating lights are disabled: UH-60A UH-60L > CARGO HOOK EMERG REL, <EH-60A > chaff dispenser control panel ARM light <, UH-60A UH-60L > rescue hoist control panel when installed, <SQUIB IND light, IRCM control panel ON and INOP lights, miscellaneous switch panel TAIL WHEEL LOCK and UNLOCK lights, pilot's and copilot's radar altimeter indicator LOW warning lights and ALT FEET digital readouts, blade de-ice test panel MAIN RTR and TAIL RTR PWR lights, blade de-ice control panel TEST IN PROGRESS light, all failure and advisory lights on the auto flight control panel, UH-60A UH-60L > the keyboard and digital readout lights on the Doppler control panel, < push-button switch lights on the CIS mode select panel, lighted push-button switches on the pilot's and copilot's VSI/HSI mode select panels, and the DH, GA, and MB pilot's and copilot's VSI/HSI MODE SELECT panels, and the DH, GA, and MG lights on the pilot's and copilot's VSIs. The No. 1 engine, No. 2 engine, and APU fire control T-handles may also go to the dim operating mode, depending on the lighting loads selected when the PNL LTS switch was pressed. Also, when the pilot's or copilot's PNL LTS switch is pressed, a 28 vdc signal is applied to the caution/advisory panel dimming logic circuit to enable the caution/advisory and master warning dimming circuits. The CAUT/ADVSY NVG use. The MA WRN NVG DIMMING control, on the instrument panel, can be used to dim the master warning capsules to night vision goggle intensity.

The panel light dimming system will enter an out of synchronization condition if the PNL LTS switch was pressed to establish NVG conditions and left in that position when the helicopter is shut down. When electrical power is restored to the helicopter, the caution/advisory panel lights will be bright, while the lower console warning lights will be off. To restore synchronization, the PNL LTS switch must be pressed and released, followed by removing and then restoring helicopter electrical power.

CAUTION/ADVISORY WARNING PANEL

The control circuits for distributing input and output signals within the caution/advisory panel are on four channel cards and one control card. These are designated cards A1 through A5. (In the caution/advisory panel (LED), placing the switch to TEST activates all caution/advisory capsule logic circuits to light all light emitting diodes.)

Channel Card A1

Channel card A1 contains positive input seeking circuitry that control 27 caution capsules. When a fault is detected by any of those associated helicopter systems, 28 vdc input is applied to channel card A1. Channel card A1 then supplies a voltage to the corresponding capsule, causing the capsule lamps to go on. Whenever a caution capsule goes on, an output from the channel card is also applied (through channel card A4) to light external master caution lights. Master caution lights remain on until either master caution capsule is reset (pressed) or until the fault that caused the capsule to light is no longer present. Pressing either master caution capsule provides a reset signal to channel card A4, turning off the master caution capsules while the caution capsule on the caution/advisory panel will remain on until the fault that caused the capsule to light is no longer present.

Channel Card A2

Channel card A2 contains positive input seeking circuitry that controls 22 caution capsules and 3 advisory capsule. The operation of the caution capsule circuitry is identical to channel card A1 caution capsule circuitry. Refer to, Channel Card A1, in this work package. The operation of all the advisory capsules (whether controlled by channel cards A2, A3, or A4) is the same. The advisory capsule will be on whenever the corresponding positive input is present and will automatically go/be off when the positive input is removed/not present.

Channel Card A3

Channel card A3 contains seven negative (50 ohms or less) input seeking circuits that control seven caution capsules and 13 positive input seeking circuits that control 13 advisory capsules. The operation of caution capsules (5 and 66) is identical to channel card A1 caution circuitry except that these capsules require a negative (50 ohms or less) input. The operation of the five remaining caution capsules (21, 33, 42, 74, and 75) is identical to channel card A1 caution circuitry except that these capsules require a negative (50 ohms or less) input. When the fault is removed, a latched capsule can be turned off by applying either a master or special reset signal. A master reset occurs when operational power is removed from the caution/advisory panel for longer than 200 msec. When a master reset is applied, all latched capsules will be off. A special reset signal is generated when power is removed

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

from the particular system being monitored. With a special reset applied only the associated capsule resets. One special reset input, resets capsules 33, 74, and 75, from channel card A3, and capsules 13 and 14, from channel card A4. A second special reset signal only resets capsule 21, while another special reset signal only resets capsule 42. Caution capsule 33 control circuitry also requires that the negative input be present for at least 30 seconds before capsule 33 is turned on. The operation of the 13 advisory capsules is identical to channel card A2 advisory capsule circuitry. Refer to, Channel Card A2, in this work package.

Channel Card A4

Channel card A4 contains, the four negative input seeking circuits that control four caution capsules (29, 32, 50 and 53), two negative input seeking circuits (latching type) that control two caution capsules (13 and 14) a flasher circuit and two positive input seeking circuits that control two caution capsules (1 and 62), and two positive input seeking circuits that control two advisory capsules (81 and 82) except that these capsules require a negative (50 ohms or less) input. The operation of caution capsules (13 and 14) is identical to channel card A1 caution circuitry except that these capsules require a negative (50 ohms or less) input. On panel, 70550-01107-102, caution capsules 13 and 14 also have latching circuits that remain on, once turned on, and do not go off until reset. Refer to, Channel Card A1, in this work package. The operation of caution capsules (1 and 62) is identical to channel A1 caution circuitry except that these capsules are driven by a flashing circuit, causing the capsules and master warning capsules to flash. The advisory capsules (81 and 82) will be on whenever the corresponding positive input is present and will automatically go/be off when the positive input is removed/not present.

Bright/Dim/NVG Control Card A5

Card A5 contains the circuits which permit changing the intensity of the capsules on the caution/advisory panel (and on the external master warning panels) from bright to dim. Two levels of dim intensity are provided. Card A5 contains three voltage regulators, with a Darlington-pair transistor circuit at the output of each regulator. One half of each Darlington circuit is on card A5; the other half is chassis mounted. Chassis mounted Q1 is in the return to ground path of the lighting circuit for all capsules in the external master warning panel; Q2 is in the return path for all 18 advisory capsules on the caution/advisory panel; Q3 is in the return path for all 64 caution capsules. In the absence of a dimming enable signal, each of the three Darlington-pairs conduct full on and provide a low impedance return path to ground for all lamps in all panels. Therefore, all lamps light at full brightness. When a dimming enable signal is externally applied and the BRT/DIM - TEST switch S1 is placed to BRT/ DIM, circuit conditions change. Switch S1 applies the enabling signal to channel card A4 to energize a logic circuit. A ground is then applied to the three voltage regulators on card A5. The output of the regulations biases the Darlington-pair transistors so that current flow is reduced. With increased resistance in the lamp return circuits, all capsules light at reduced intensity. To restore their intensity to full brightness, press and release the BRT/DIM switch. This deenergizes the logic circuit on card A4, removing the ground input signal to the three voltage regulators. Pressing the BRT/DIM switch energizes the relays, reapplies the ground to the voltage regulations which control current flow in the Darlington-pair transistors; causing all lights to dim. Card A5 also contains two additional voltage regulators and three relays for night vision goggle (NVG) lighting. The NVG circuit logic will activate NVG if a 28 vdc enable is present upon initial power application and is removed. The NVG circuit logic will activate NVG if a 0 vdc enable is present upon initial power application, and 28 vdc is applied. One voltage regulator controls current flow in Darlington-pair Q1, which is in the ground return lighting circuit for all capsules in the external master warning panels. Current flow in Q1 is held to a low level; therefore, lamps on this external panel have a high impedance in their return path and light at lowest intensity. Variation of the input voltage to the lamps is provided by an external control. The second voltage regulator on card A5 is used to control current flow in Darlington-pairs Q2 and Q3. With this circuit arrangement, the lamps in both the advisory and caution capsules of the caution/advisory panel operate at the identical low intensity. A separate external control is provided to vary the intensity of all 82 lamps on this panel and are discussed in the paragraphs describing circuit cards A1 through A5. All input and output signals in the caution/advisory panel (LED) are processed by the input circuit card assembly (CCA). Capsule illumination logic, drivers, and light emitting diodes are all contained within the lightbox CCA. The two CCAs are connected via the CCA interconnect wire harness and are discussed in paragraphs titled input CCA and lightbox CCA.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

Input CCA

The input CCA, contained within the input module assembly, includes printed circuit board mounted circular military connectors for connection to all input and output signals. All input and output signals are filtered for EMI, ESD, and over voltage conditions. 28 vdc input power is routed through an EMI filter module to the primary dc to dc converter to provide power to all caution/advisory circuits. All 28 vdc input activation signals are connected to opt isolators to isolate the signals from processing logic. All impedance and ground sense inputs are voltage comparator circuits that output logic signal. All logic signals are connected to a single programmable logic device that handles all caution/advisory panel input/output signals. The input signals are converted to a serial logic stream that is sent to the lightbox CCA via the CCA interconnect harness. Output signal status is also received from the lightbox CCA via the serial interconnect. 28 vdc output signals are switched from optically-isolated transistors driven by logic signals from the programmable logic device. The dimming potentiometers are used in a timming circuit to create a pulse sequence corresponding to the dim pot position. The pulses are optoisolated and counted by logic within the programmable device. The digitized dimming signal is transmitted to the lightbox CCA via the interconnect harness. Caution/advisory panel output dimming is controlled by a pulse width modulation logic signal generated by the programmable logic device. The pulse dimming signals drive optically-isolated transistors for dimming external indicators.

Lightbox CCA

The Lightbox CCA, contained within the lightbox assembly, includes all light emitting diodes (LEDs) for illumination of all capsules. The Lightbox CCA receives regulated dc power and serial data from the Input CCA. The Lightbox CCA transmits caution/advisory panel output signal status data to the Input CCA. A small dc to dc converter integrated onto the Lightbox CCA provides LED power for the capsules. A single field programmable gate array (FPGA) on the Lightbox CCA contains all of the core logic of the caution/advisory panel. The FPGA controls all capsule illumination, dimming, output signal control, and timing. The FPGA generates serial data signals to control the individual LED driver integrated circuits (ICs). Each LED driver IC controls 8 capsules. The FPGA also generates a pulse width modulated dimming signal to control dimming of the LED driver ICs. Caution/advisory panel input signal status is received from the Input CCA as a serial data stream. The FPGA decodes the serial stream, applies any necessary processing logic, and generates a capsule illumination status code for each driver IC. The capsule illumination codes are serially transmitted to all LED drivers. The LED drivers decode the serial status data and apply the dimming level specified by the pulse dimming signal to each capsule. Each capsule contains three LEDs in a constant current scheme. If any one of the LEDs fails, the other two increase output to keep a constant light output. The FPGA logic determines the status of the caution/advisory panel output signals and translates pot dimming position to output dimming level. This status data and digitized output dimming level is coded and serially transmitted to the input CCA.

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

For location and description of major components, refer to the data in this work package.

EQUIPMENT DATA

For equipment data information, refer to this work package.

INSTRUMENT SYSTEMS

MULTIFUNCTION DISPLAY/CAUTION ADVISORY WARNING SYSTEM DESCRIPTION AND DATA HH-60A HH-60L>

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

FUNCTIONAL OVERVIEW

The multifunction display (MFD) displays flight data, caution and advisory notices, and provides displays for initiated built-in tests (IBIT). Displays include flight data, flight plan, attitude, hover, communication, navigation, and forward-looking infrared (FLIR) displays. Figure 1shows the controls and screen areas of the MFD. The controls are used to turn the MFD on and off, select displays, and adjust the brightness and night or day presentation of displays.

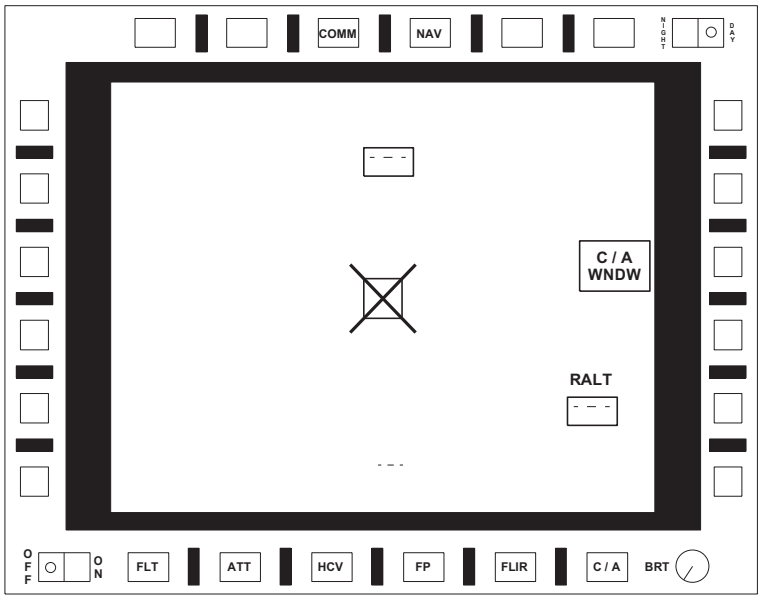


Figure 1. Hover Display, Invalid Data.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

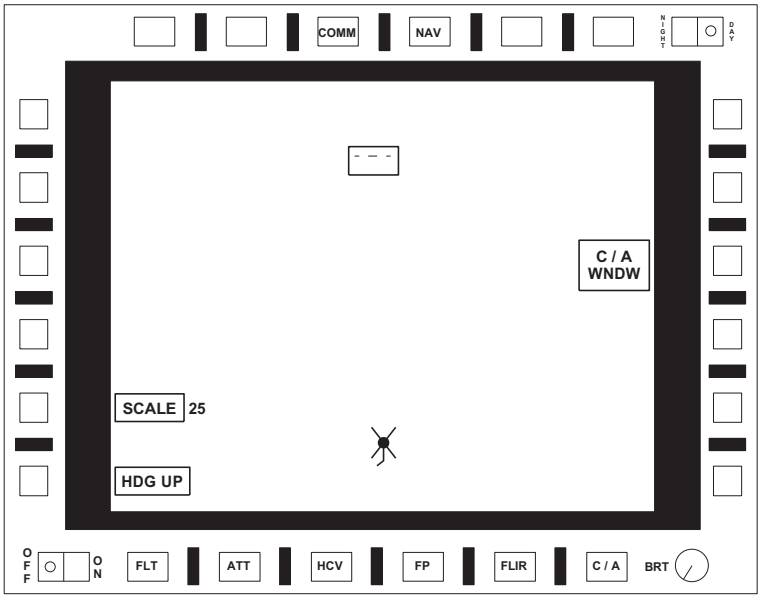


Figure 2. Flight Plan Display, Invalid Data.

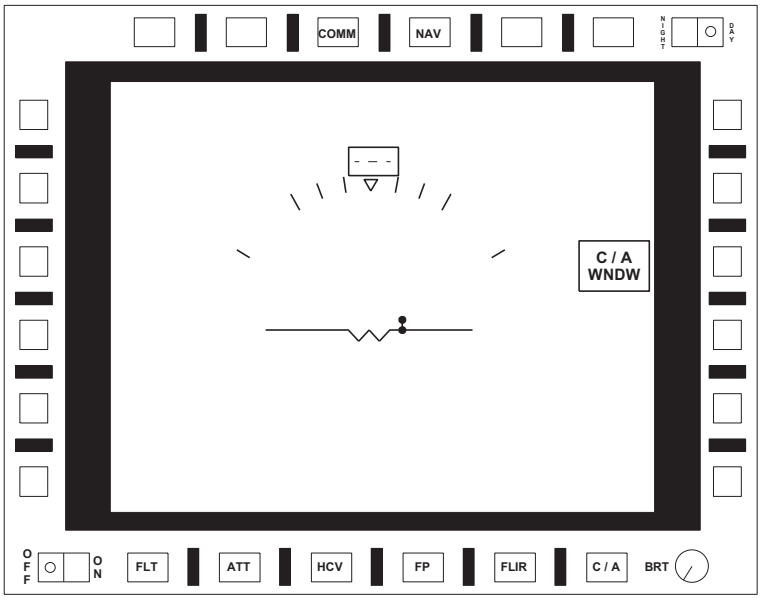
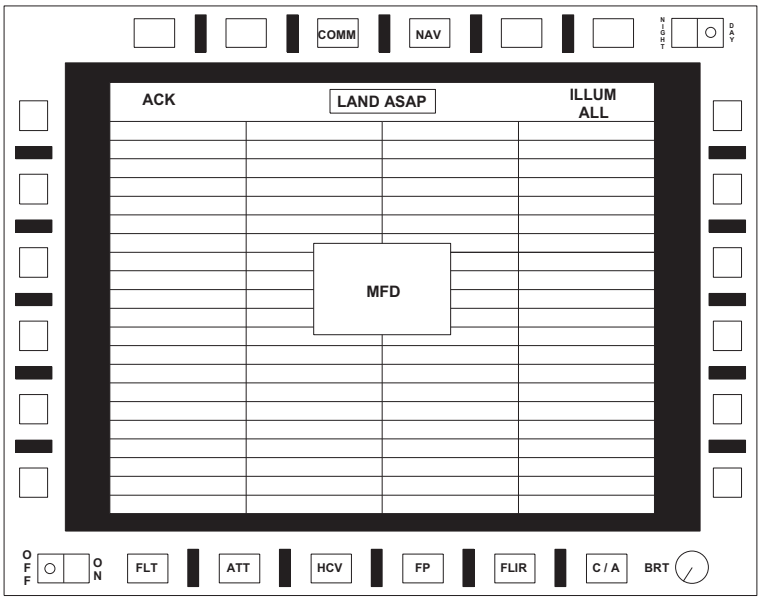


Figure 3. Attitude Display, Invalid Data.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED



FUNCTION:	PROVIDES INITIAL DISPLAY TO INDICATE POWER ON.
ACTIVATION:	BY SETTING ON-OFF SWITCH TO ON. SWITCH T2 CONTROLS DISPLAY (ON OR OFF) OF PART NUMBER.

DISPLAY CUE	FUNCTION
ACK LABEL FOR SWITCH T1	USED WHEN CAUTION NOTICES ARE DISPLAYED. INDICATES T1 (ACK) SWITCH IS ENABLED TO ACKNOWLEDGE CAUTION NOTICES. CAUTION NOTICES ARE DISPLAYED AS INVERSE TEXT UNTIL ACKNOWLEDGED BY PRESSING T1 (ACK) SWITCH. WHEN ACKNOWLEDGED, CAUTION NOTICES ARE DISPLAYED IN YELLOW. ACKNOWLEDGEMENT IS NOT REQUIRED FOR ADVISORY NOTICES, WHICH ARE DISPLAYED IN GREEN.
ILLUM ALL LABEL FOR SWITCH T6	INDICATES T6 (ILLUM ALL) SWITCH IS ENABLED TO TEST-VIEW CAUTION AND ADVISORY NOTICES. WHEN T6 (ILLUM ALL) SWITCH IS PRESSED, ALL CAUTION AND ADVISORY NOTICES ARE DISPLAYED FOR 10 SECONDS. AFTER 10 SECONDS, ONLY ACTIVE CAUTION AND ADVISORY NOTICES ARE DISPLAYED.

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Figure 4. Caution/Advisory Grid Display.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED



MULTIFUNCTION DISPLAY'S CAUTION/ADVISORY GRID

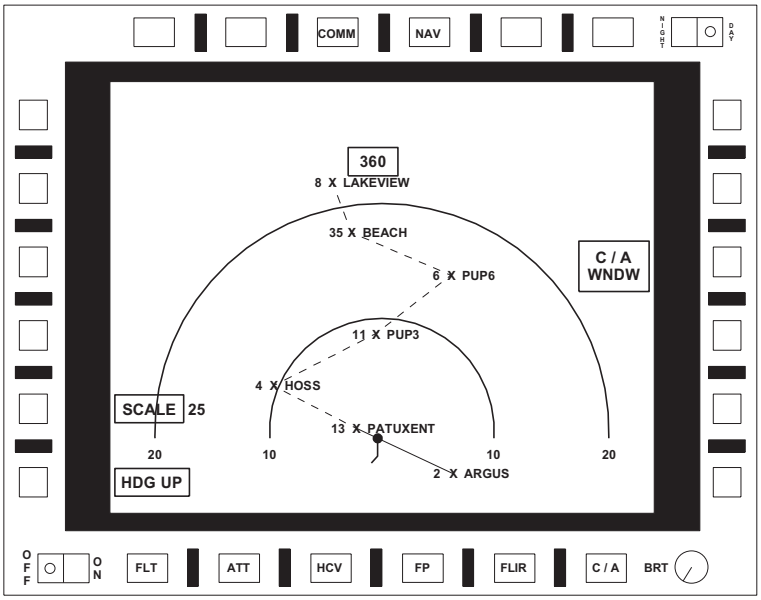
FUNCTION:	DISPLAYS CAUTION AND ADVISORY NOTICES.
ACTIVATION:	BY PRESSING B6 (C / A) SWITCH. PRESSING C / A SWITCH AGAIN ACTIVATES PREVIOUS DISPLAY.

DISPLAY CUE	FUNCTION
ACK LABEL FOR SWITCH T1	INDICATES T1 (ACK) SWITCH IS ENABLED TO ACKNOWLEDGE CAUTION NOTICES. CAUTION NOTICES ARE DISPLAYED AS INVERSE TEXT UNTIL ACKNOWLEDGED BY PRESSING T1 (ACK) SWITCH. WHEN ACKNOWLEDGED, CAUTION NOTICES ARE DISPLAYED IN YELLOW. ACKNOWLEDGEMENT IS NOT REQUIRED FOR ADVISORY NOTICES, WHICH ARE DISPLAYED IN GREEN.
ILLUM ALL LABEL FOR SWITCH T6	INDICATES T6 (ILLUM ALL) SWITCH IS ENABLED TO TEST-VIEW CAUTION AND ADVISORY NOTICES. WHEN T6 (ILLUM ALL) SWITCH IS PRESSED, ALL CAUTION AND ADVISORY NOTICES ARE DISPLAYED FOR 10 SECONDS. AFTER 10 SECONDS, ONLY ACTIVE CAUTION AND ADVISORY NOTICES ARE DISPLAYED.
LAND ASAP	NOTICE TO LAND AS SOON AS POSSIBLE - PRESENTED WITH SPECIFIC CAUTIONS.

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Figure 5. Caution/Advisory Grid Display with Caution and Advisory Indications.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED



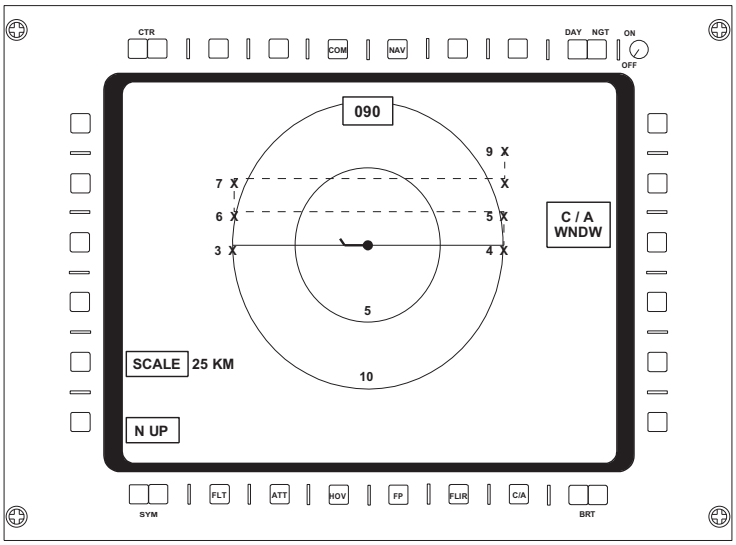
FUNCTION:	DISPLAYS FLIGHT PLAN WITH HEADING UP.
ACTIVATION:	BY PRESSING B4 (FP) SWITCH.

DISPLAY CUE	FUNCTION
SCALE 25 LABEL FOR SWITCH L5	INDICATES SCALE OF DISPLAY IN 25 NAUTICAL MILES. ALSO INDICATES L5 (SCALE) SWITCH IS ENABLED TO CHANGE SCALE OF DISPLAY. SCALE IS EITHER KILOMETERS (LABELED KM) OR NAUTICAL MILES (NOT LABELED) - SELECTED EXTERNAL TO MFD. WHEN L5 (SCALE) SWITCH IS PRESSED, SCALE CHANGES. SCALES AVAILABLE ARE 3, 25, AND 200 IN NAUTICAL MILES AND 5, 40, AND 300 IN KILOMETERS.
HDG UP LABEL FOR SWITCH L6	INDICATES ORIENTATION (HEADING UP) OF DISPLAY. ALSO INDICATES L6 (HDG UP) SWITCH IS ENABLED TO CHANGE DISPLAY. WHEN SWITCH L6 (HDG UP) SWITCH IS PRESSED, DISPLAY CHANGES TO NORTH UP FLIGHT PLAN - PRESSED AGAIN, DISPLAY RETURNS TO HEADING UP.
360	INDICATES HEADING (360 DEGREES) OF AIRCRAFT.
WAYPOINTS AND FLIGHT PATH	WAYPOINT NUMBER AND NAME ARE DISPLAYED RESPECTIVELY TO LEFT AND RIGHT OF WAYPOINT. CURRENT FLIGHT PATH IS DISPLAYED BY SOLID LINE. OTHER FLIGHT PATHS ARE DISPLAYED BY DOTTED LINES.
C / A WNDW OR NEW ADV LABEL FOR SWITCH R3	FOR ACTIVE ADVISORY, LABEL IS NEW ADV. INDICATES R3 (C / A WNDW OR NEW ADV) SWITCH IS ENABLED TO ACTIVATE DISPLAY OF CAUTION ADVISORY POPUP WINDOW. WHEN R3 (C / A WNDW OR NEW ADV) SWITCH IS PRESSED, CAUTION ADVISORY POPUP WINDOW IS DISPLAYED AS OVERLAY. ALSO, CAUTION ADVISORY POPUP WINDOW IS DISPLAYED IF CAUTION BECOMES ACTIVE.

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Figure 6. Heading Up Flight Plan Display.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED



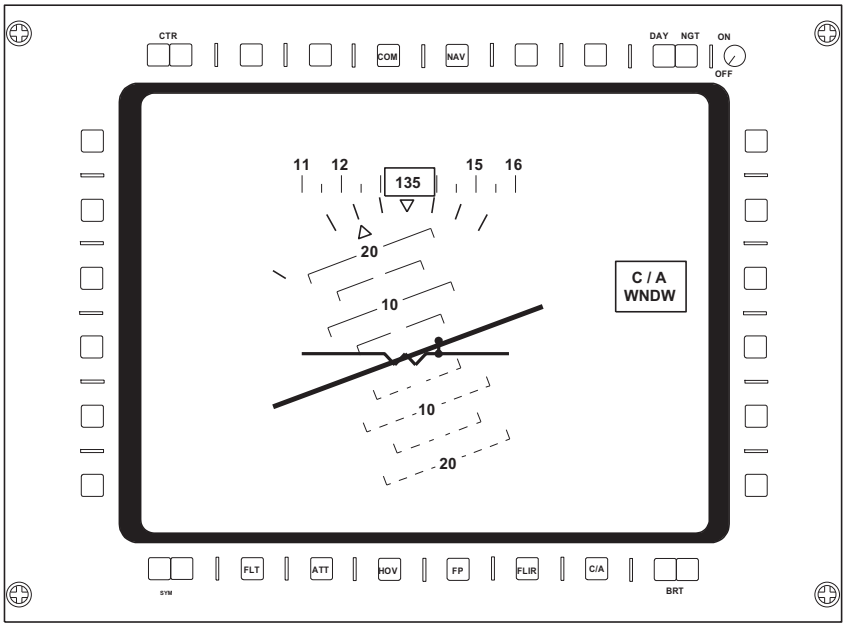
FUNCTION:	DISPLAYS FLIGHT PLAN WITH NORTH UP. AIRCRAFT SYMBOL IS DISPLAYED IN DIRECTION OF HEADING.
ACTIVATION:	BY PRESSING L6 (HDG UP) SWITCH WHEN HEADING UP FLIGHT PLAN IS DISPLAYED. PRESSING L6 ALTERNATES DISPLAY, HEADING UP TO NORTH UP OR NORTH UP TO HEADING UP.

DISPLAY CUE	FUNCTION
SCALE 25 LABEL FOR SWITCH L5	INDICATES SCALE OF DISPLAY IN 25 NAUTICAL MILES. ALSO INDICATES L5 (SCALE) SWITCH IS ENABLED TO CHANGE SCALE OF DISPLAY. SCALE IS EITHER KILOMETERS (LABELED KM) OR NAUTICAL MILES (NOT LABELED) - SELECTED EXTERNAL TO MFD. WHEN L5 (SCALE) SWITCH IS PRESSED, SCALE CHANGES. SCALES AVAILABLE ARE 3, 25, AND 200 IN NAUTICAL MILES AND 5, 40, AND 300 IN KILOMETERS.
N UP LABEL FOR SWITCH L6	INDICATES ORIENTATION (NORTH UP) OF DISPLAY. ALSO INDICATES L6 (N UP) SWITCH IS ENABLED TO CHANGE DISPLAY. WHEN SWITCH L6 (N UP) SWITCH IS PRESSED, DISPLAY CHANGES TO HEADING UP FLIGHT PLAN - PRESSED AGAIN, DISPLAY RETURNS TO NORTH UP.
090	INDICATES HEADING (90 DEGREES) OF AIRCRAFT.
WAYPOINTS AND FLIGHT PATH	WAYPOINT NUMBER AND NAME ARE DISPLAYED RESPECTIVELY TO LEFT AND RIGHT OF WAYPOINT. CURRENT FLIGHT PATH IS DISPLAYED BY SOLID LINE. OTHER FLIGHT PATHS ARE DISPLAYED BY DOTTED LINES.
C / A WNDW OR NEW ADV LABEL FOR SWITCH R3	FOR ACTIVE ADVISORY, LABEL IS NEW ADV. INDICATES R3 (C / A WNDW OR NEW ADV) SWITCH IS ENABLED TO ACTIVATE DISPLAY OF CAUTION ADVISORY POPUP WINDOW. WHEN R3 (C / A WNDW OR NEW ADV) SWITCH IS PRESSED, CAUTION ADVISORY POPUP WINDOW IS DISPLAYED AS OVERLAY. ALSO, CAUTION ADVISORY POPUP WINDOW IS DISPLAYED IF CAUTION BECOMES ACTIVE.

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Figure 7. North Up Flight Plan Display.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

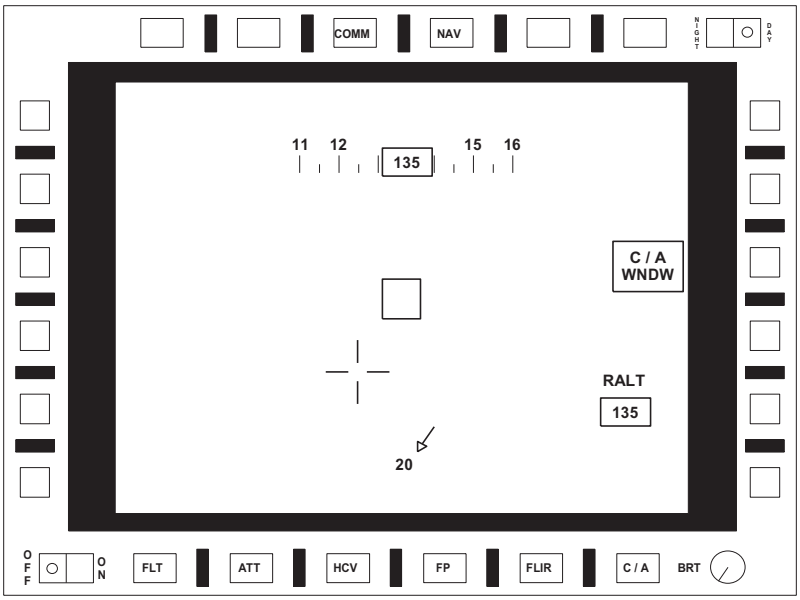


FUNCTION:	DISPLAYS ATTITUDE DATA: HEADING, HEADING TAPE, PITCH, ROLL, AND COURSE DEVIATION. BANK ANGLE INDICATORS DISAPPEAR FOR ANGLES GREATER THAN 60 DEGREES.
ACTIVATION:	BY PRESSING B2 (ATT) SWITCH.
DISPLAY CUE	**FUNCTION**
135	INDICATES HEADING (135 DEGREES) OF AIRCRAFT.
C / A WNDW OR NEW ADV LABEL FOR SWITCH R3.	FOR ACTIVE ADVISORY, LABEL IS NEW ADV. INDICATES R3 (C / A WNDW OR NEW ADV) SWITCH IS ENABLED TO ACTIVATE DISPLAY OF CAUTION ADVISORY POPUP WINDOW. WHEN R3 (C / A WNDW OR NEW ADV) SWITCH IS PRESSED, CAUTION ADVISORY POPUP WINDOW IS DISPLAYED AS OVERLAY. ALSO, CAUTION ADVISORY POPUP WINDOW IS DISPLAYED IF CAUTION BECOMES ACTIVE.

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Figure 8. Attitude Display.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED



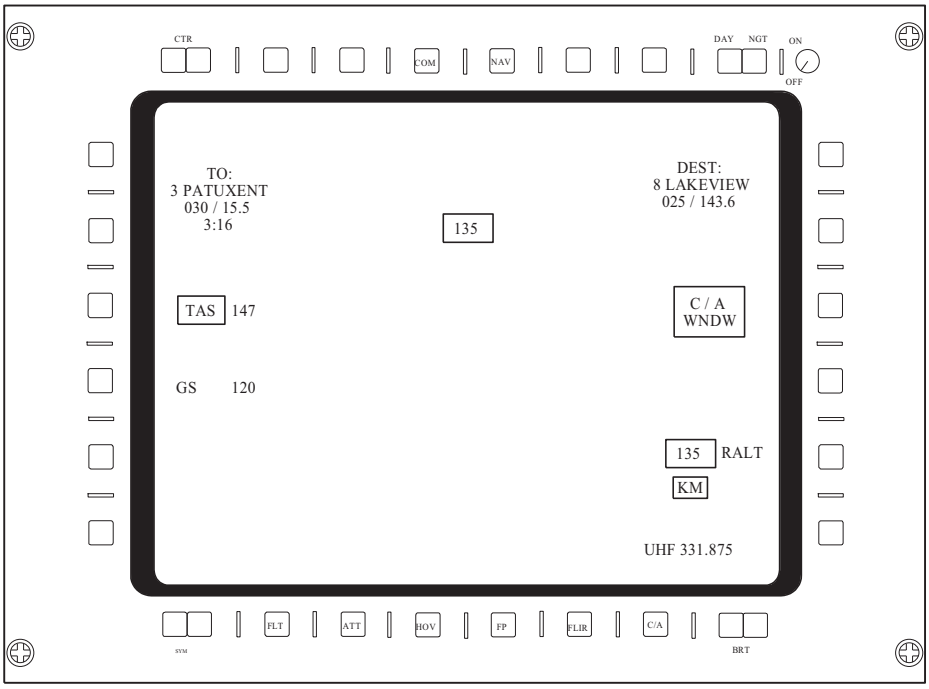
FUNCTION:	DISPLAYS HOVER DATA: HEADING, HEADING TAPE, DEVIATION, ALTITUDE, WIND DIRECTION AND SPEED.
ACTIVATION:	BY PRESSING B3 (HOV) SWITCH.

DISPLAY CUE	FUNCTION
135 (AT TOP)	INDICATES HEADING (135 DEGREES) OF AIRCRAFT.
RALT 135	INDICATES ALTITUDE (135 FEET) OF AIRCRAFT.
ARROW 20 AT BOTTOM OF DISPLAY	INDICATES DIRECTION (FROM 45 DEGREES) AND SPEED (20 KNOTS) OF WIND. ARROW ROTATES ABOUT WIND SPEED READOUT TO INDICATE DIRECTION.
C / A WNDW OR NEW ADV LABEL FOR SWITCH R3.	FOR ACTIVE ADVISORY, LABEL IS NEW ADV. INDICATES R3 (C / A WNDW OR NEW ADV) SWITCH IS ENABLED TO ACTIVATE DISPLAY OF CAUTION ADVISORY POPUP WINDOW. WHEN R3 (C / A WNDW OR NEW ADV) SWITCH IS PRESSED, CAUTION ADVISORY POPUP WINDOW IS DISPLAYED AS OVERLAY. ALSO, CAUTION ADVISORY POPUP WINDOW IS DISPLAYED IF CAUTION BECOMES ACTIVE.

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Figure 9. Hover Display.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED



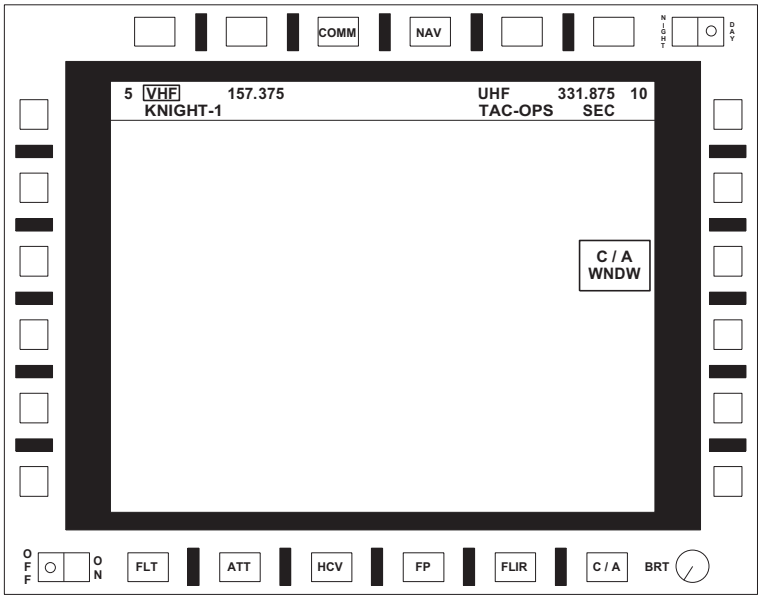
FUNCTION:	DISPLAYS FLIGHT DATA: HEADING, AIRSPEED, GROUND SPEED, ALTITUDE, RADIO BAND, RADIO FREQUENCY, AND DATA (RANGE, BEARING, TIME TO GO) FOR CURRENT AND DESTINATION WAYPOINTS.
ACTIVATION:	BY PRESSING B1 (FLT) SWITCH.

DISPLAY CUE	FUNCTION
TO: 3 PATUXENT 030 / 15.5 3:16	IDENTIFIES CURRENT WAYPOINT NUMBER (3) AND NAME (PATUXENT); INDICATES BEARING (030 DEGREES), RANGE (15.5 NAUTICAL MILES), AND TIME TO GO (3 HOURS, 16 MINUTES). RANGE IS EITHER KILOMETERS (LABELED KM) OR NAUTICAL MILES (NOT LABELED) SELECTED EXTERNAL TO MFD.
DEST: 8 LAKEVIEW 025 / 143.6	IDENTIFIES DESTINATION WAYPOINT NUMBER (8) AND NAME (LAKEVIEW); INDICATES BEARING (025 DEGREES) AND RANGE (143.6 NAUTICAL MILES). TIME TO GO IS NOT DISPLAYED. RANGE IS EITHER KILOMETERS (LABELED KM) OR NAUTICAL MILES (NOT LABELED) SELECTED EXTERNAL TO MFD.
135 (AT TOP)	INDICATES HEADING (135 DEGREES) OF AIRCRAFT.
TAS 147 IAS LABEL FOR SWITCH L3	CURRENTLY SELECTED AIRSPEED IS BOXED. INDICATES TRUE AIRSPEED IS 147 KNOTS. ALSO INDICATES L3 (TAS IAS) SWITCH IS ENABLED TO CHANGE DISPLAY. PRESSING L3 (TAS IAS) SWITCH CHANGES DISPLAY FROM TRUE AIRSPEED TO INDICATED AIRSPEED. PRESSING L3 (TAS IAS) AGAIN, RETURNS DISPLAY TO TRUE AIRSPEED.
GS 120	INDICATES GROUND SPEED (120 KNOTS) OF AIRCRAFT.
C / A WNDW OR NEW ADV LABEL FOR SWITCH R3.	FOR ACTIVE ADVISORY, LABEL IS NEW ADV. INDICATES R3 (C / A WNDW OR NEW ADV) SWITCH IS ENABLED TO ACTIVATE DISPLAY OF CAUTION ADVISORY POPUP WINDOW. WHEN R3 (C / A WNDW OR NEW ADV) SWITCH IS PRESSED. CAUTION ADVISORY POPUP WINDOW IS DISPLAYED AS OVERLAY. ALSO, CAUTION ADVISORY POPUP WINDOW IS DISPLAYED IF CAUTION BECOMES ACTIVE.
RALT 135	INDICATES ALTITUDE (135 FEET) OF AIRCRAFT.
UHF 331.875	NOT DISPLAYED IF COMM HEADER IS DISPLAYED. INDICATES BAND (UHF) AND FREQUENCY (331.875) OF RADIO SELECTED FOR MFD STATION SELECTION EXTERNAL TO MFD. RADIO 1 IS SELECTED FOR COPILOT MFD. RADIO 2 IS SELECTED FOR PILOT MFD.

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Figure 10. Flight Data Display with True Airspeed Indicated.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED



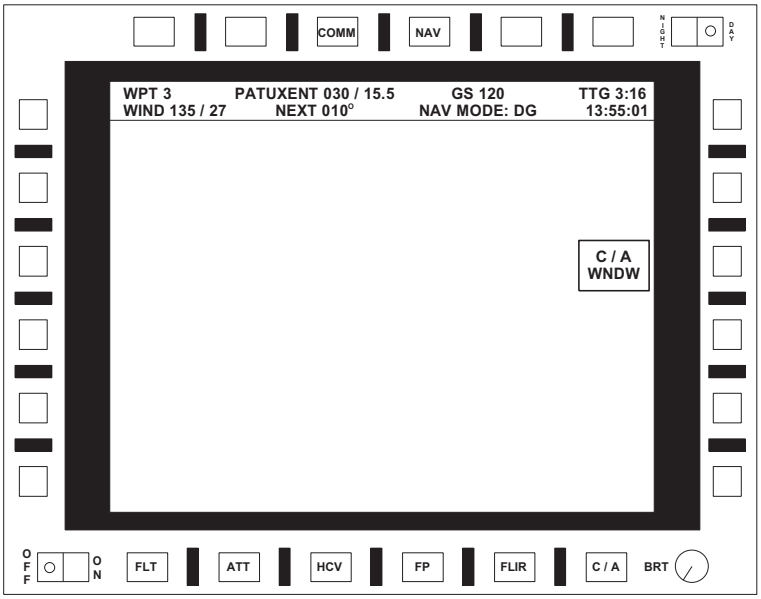
FUNCTION:	DISPLAYS COMMUNICATION DATA FOR TWO RADIOS: CHANNEL, BAND, FREQUENCY, CALL SIGN, AND CRYPTO MODE.
ACTIVATION:	BY PRESSING T3 (COMM) SWITCH.

DISPLAY CUE	FUNCTION
5 VHF 157.375 KNIGHT-1	PROVIDES DATA FOR THE COPILOT'S SELECTED RADIO: INDICATES CHANNEL (5), BAND (VHF), FREQUENCY (157.375), CALL SIGN (KNIGHT-1), AND CRYPTO MODE (NOT DISPLAYED INDICATES NOT ENCRYPTED). WHEN RADIO IS KEYED, BAND IS DISPLAYED IN INVERSE TEXT.
UHF 331.875 10 TAC-OPS SEC	PROVIDES DATA FOR THE PILOT'S SELECTED RADIO: INDICATES CHANNEL (NOT DISPLAYED INDICATES NO PRESET CHANNEL), BAND (UHF), FREQUENCY (331.875), CALL SIGN (TAC-OPS), AND CRYPTO MODE (SEC). WHEN RADIO IS KEYED, BAND IS DISPLAYED IN INVERSE TEXT.
C / A WNDW OR NEW ADV LABEL FOR SWITCH R3.	FOR ACTIVE ADVISORY, LABEL IS NEW ADV. INDICATES R3 (C / A WNDW OR NEW ADV) SWITCH IS ENABLED TO ACTIVATE DISPLAY OF CAUTION ADVISORY POPUP WINDOW. WHEN R3 (C / A WNDW OR NEW ADV) SWITCH IS PRESSED, CAUTION ADVISORY POPUP WINDOW IS DISPLAYED AS OVERLAY. ALSO, CAUTION ADVISORY POPUP WINDOW IS DISPLAYED IF CAUTION BECOMES ACTIVE.

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Figure 11. Communications Header Display.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED



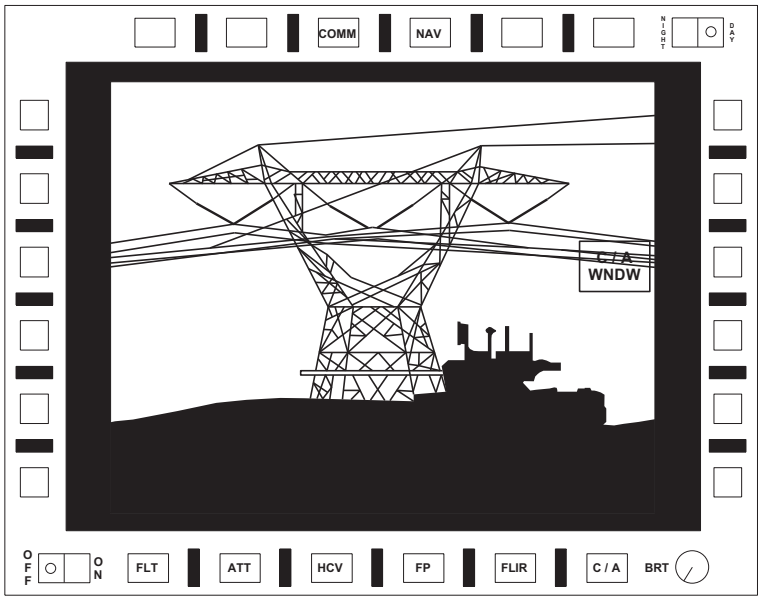
FUNCTION:	DISPLAYS NAVIGATION DATA: RANGE, BEARING, AND TIME-TO-GO FOR CURRENT WAYPOINT, COURSE FOR NEXT LEG, WIND DIRECTION AND SPEED, NAVIGATION MODE, AND SYSTEM TIME.
ACTIVATION:	BY PRESSING T4 (NAV) SWITCH.

DISPLAY CUE	FUNCTION
WPT 3 PATUXENT 030 / 15.5 TTG 3:16	IDENTIFIES CURRENT WAYPOINT NUMBER (3) AND NAME (PATUXENT); INDICATES BEARING (030 DEGREES), RANGE (15.5 NAUTICAL MILES), AND TIME-TO-GO (3 HOURS, 16 MINUTES). RANGE IS EITHER KILOMETERS (LABELED KM) OR NAUTICAL MILES (NOT LABELED) - SELECTED EXTERNAL TO MFD.
GS 120	INDICATES GROUND SPEED (102 KNOTS) OF AIRCRAFT.
WIND 137 / 27	INDICATES WIND DIRECTION (137 DEGREES) AND SPEED (27 KNOTS).
NEXT 010°	INDICATES COURSE (10 DEGREES) FOR NEXT LEG.
NAV MODE: DG	INDICATES NAVIGATION MODE (DG) IS DOPPLER GPS. NAVIGATION MODES ARE TWO LETTERS: DG = DOPPLER GPS; DO = DOPPLER; GP = GPS; IN = INS; IG = INS GPS.
13:55:01	INDICATES SYSTEM TIME IS 13 HOURS, 55 MINUTES, 1 SECOND.
C / A WNDW OR NEW ADV LABEL FOR SWITCH R3.	FOR ACTIVE ADVISORY, LABEL IS NEW ADV. INDICATES R3 (C / A WNDW OR NEW ADV) SWITCH IS ENABLED TO ACTIVATE DISPLAY OF CAUTION ADVISORY POPUP WINDOW. WHEN R3 (C / A WNDW OR NEW ADV) SWITCH IS PRESSED, CAUTION ADVISORY POPUP WINDOW IS DISPLAYED AS OVERLAY. ALSO, CAUTION ADVISORY POPUP WINDOW IS DISPLAYED IF CAUTION BECOMES ACTIVE.

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Figure 12. Navigation Header Display.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED



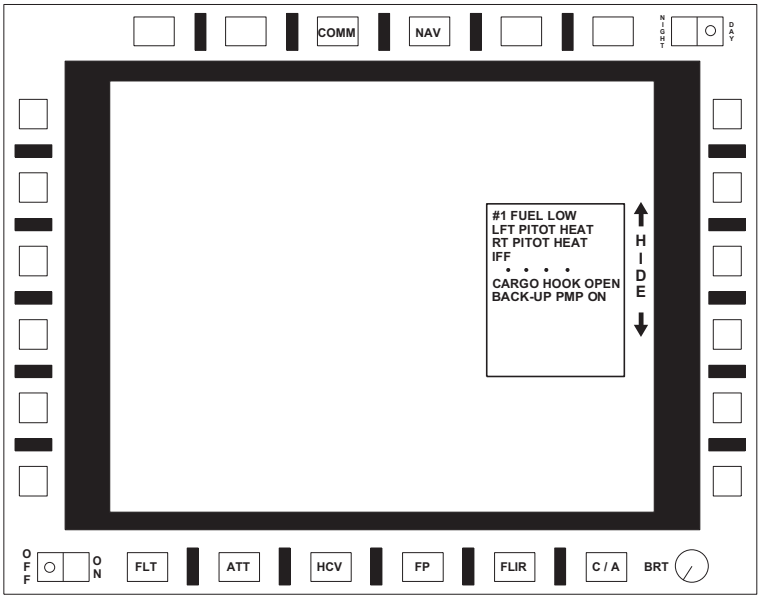
FUNCTION:	DISPLAYS FORWARD-LOOKING INFRARED (FLIR).
ACTIVATION:	BY PRESSING B5 (FLIR) SWITCH.

DISPLAY CUE	FUNCTION
ALL LABELED SWITCHES EXCEPT SWITCH B6 (C / A)	SWITCHES ARE ENABLED TO ACTIVATE DISPLAYS AS OVERLAYS TO FLIR.

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Figure 13. FLIR Video Display.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED



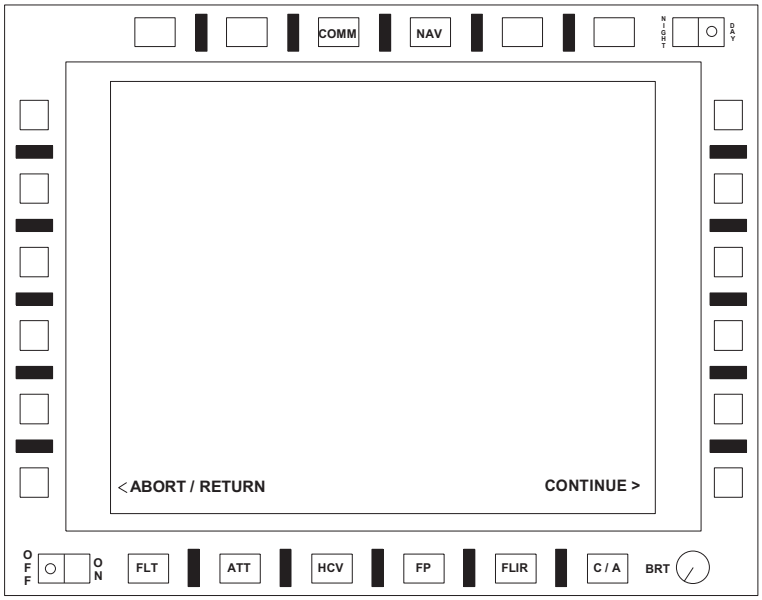
FUNCTION:	DISPLAYS LIST OF ACTIVE CAUTION AND ADVISORY NOTICES. CAUTIONS ARE SEPARATED FROM ADVISORIES BY ROW OF WHITE ASTERISKS. NOTICE TO LAND AS SOON AS POSSIBLE (LAND ASAP) IS PRESENTED WITH SPECIFIC CAUTIONS.
ACTIVATION:	BY PRESSING R3 (C / A WNDW OR NEW ADV) SWITCH. ALSO, ACTIVATED WHEN CAUTION BECOMES ACTIVE. ACTIVE CAUTION IS DISPLAYED (FIRST ON LIST) IN INVERSE TEXT.

DISPLAY CUE	FUNCTION
UP ARROW LABEL FOR SWITCH R2	INDICATES R2 (UP ARROW) SWITCH IS ENABLED TO SCROLL LIST OF CAUTION AND ADVISORY NOTICES. TEN CAUTION / ADVISORIES ARE VISIBLE WITHOUT HAVING TO SCROLL.
HIDE LABEL FOR SWITCH R3	INDICATES R3 (HIDE) SWITCH IS ENABLED TO REQUEST ACKNOWLEDGEMENT OR REMOVE LIST OF CAUTION AND ADVISORY NOTICES FROM DISPLAY. IF ACTIVE CAUTION IS DISPLAYED, PRESSING R3 (HIDE) SWITCH REQUESTS ACKNOWLEDGEMENT FROM EXTERNAL SOURCE. WHEN ACKNOWLEDGED, CAUTION CHANGES FROM INVERSE TO NORMAL TEXT. IF CAUTIONS ARE ACKNOWLEDGED, PRESSING R3 (HIDE) SWITCH REMOVES WINDOW AND DISPLAYS C / A WNDW LABEL FOR SWITCH R3.
DOWN ARROW LABEL FOR SWITCH R4	INDICATES R4 (DOWN ARROW) SWITCH IS ENABLED TO SCROLL LIST OF CAUTION AND ADVISORY NOTICES. TEN CAUTION / ADVISORIES ARE VISIBLE WITHOUT HAVING TO SCROLL.

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Figure 14. Caution Advisory Popup List Display.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED



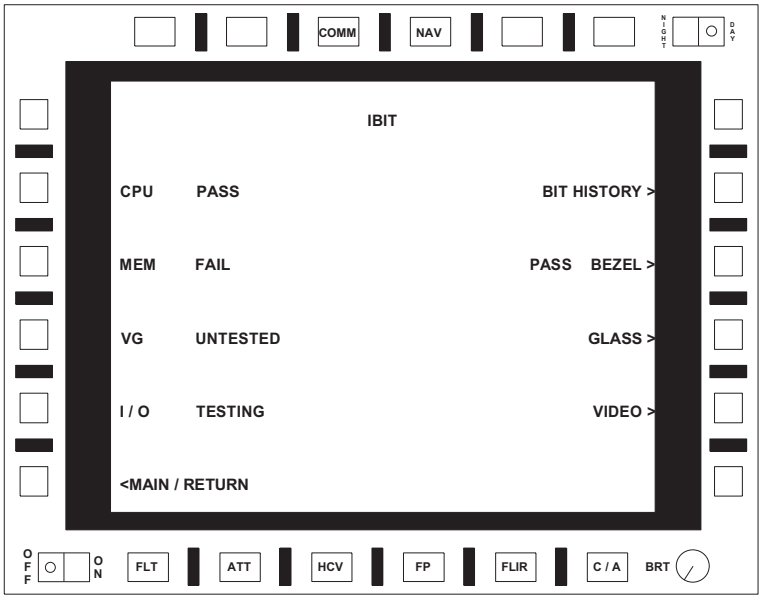
FUNCTION:	PROVIDES INITIAL DISPLAY TO INDICATE SELECTION OF INITIATE BIT (IBIT). ONLY DISPLAY-LABELED (SOFT SWITCHES) ARE ENABLED.
ACTIVATION:	ACTIVATION IS EXTERNAL TO MFD.

DISPLAY CUE	FUNCTION
ABORT / RETURN LABEL FOR SWITCH L6	INDICATES L6 (ABORT / RETURN) SWITCH IS ENABLED TO ABORT IBIT AND RETURN TO PREVIOUS DISPLAY. PRESSING L6 (ABORT / RETURN) SWITCH RETURNS TO PREVIOUS DISPLAY.
CONTINUE LABEL FOR SWITCH R6	INDICATES R6 (CONTINUE) SWITCH IS ENABLED TO CONTINUE WITH IBIT. PRESSING R6 (CONTINUE) SWITCH DISPLAYS IBIT STATUS MENU.

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Figure 15. Initiated Bit (IBIT) Main Page.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED



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Figure 16. IBIT Status Menu (Sheet 1 of 2).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

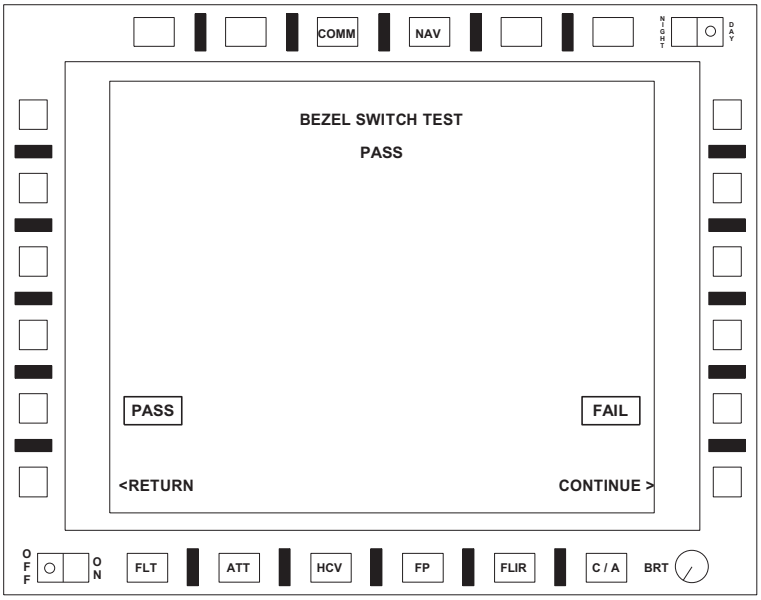
FUNCTION:	DISPLAYS STATUS AND ENABLES INITIATION OF TESTS. ONLY DISPLAY-LABELED (SOFT SWITCHES) ARE ENABLED.
ACTIVATION:	BY PRESSING R6 (CONTINUE) SWITCH WHEN IBIT MAIN PAGE IS DISPLAYED. ALSO, PRESSING R6 (CONTINUE) INITIATES CPU, MEM, VG, I / O TESTS. OTHER TESTS ARE PERFORMED MANUALLY.

DISPLAY CUE	FUNCTION
CPU PASS LABEL FOR SWITCH L2	INDICATES PASS STATUS FOR CPU TEST. ALSO INDICATES L2 (CPU) SWITCH IS ENABLED TO RERUN CPU TEST. IF SWITCH IS LABELED TESTING, TEST IS RUNNING AND SWITCH IS INHIBITED. PRESSING L2 (CPU) SWITCH RERUNS CPU TEST.
MEM FAIL LABEL FOR SWITCH L3	INDICATES FAIL STATUS FOR MEM TEST. ALSO INDICATES L3 (MEM) SWITCH IS ENABLED TO RERUN MEM TEST. IF SWITCH IS LABELED TESTING, TEST IS RUNNING AND SWITCH IS INHIBITED. PRESSING L3 (MEM) SWITCH RERUNS MEM TEST.
VG UNTESTED FOR SWITCH L4	INDICATES UNTESTED STATUS FOR VG TEST. ALSO INDICATES L4 (VG) SWITCH IS ENABLED TO RERUN VG TEST. IF SWITCH IS LABELED TESTING, TEST IS RUNNING AND SWITCH IS INHIBITED. PRESSING L4 (VG) SWITCH RERUNS VG TEST.
I / O TESTING FOR SWITCH L5	INDICATES TESTING STATUS FOR I / O TEST. IF SWITCH IS LABELED TESTING, TEST IS RUNNING AND SWITCH IS INHIBITED. WHEN TESTING IS COMPLETED (NOT LABELED TESTING), PRESSING L5 (I / O) SWITCH RERUNS I / O TEST.
BEZEL PASS FOR SWITCH R3	INDICATES PASS STATUS FOR BEZEL SWITCHES. TEST IS PERFORMED MANUALLY. PRESSING R3 (BEZEL) SWITCH DISPLAYS BEZEL SWITCH TEST MENU TO BEGIN MANUAL TESTING.
GLASS FOR SWITCH R4	INDICATES R4 (GLASS) SWITCH IS ENABLED TO BEGIN GLASS SURFACE TEST. TEST IS PERFORMED MANUALLY. PRESSING R4 (GLASS) SWITCH DISPLAYS GLASS SURFACE TEST MENU TO BEGIN MANUAL TESTING.
VIDEO PASS FOR SWITCH R5	INDICATES PASS STATUS FOR VIDEO TEST. TEST IS PERFORMED MANUALLY. PRESSING R5 (VIDEO) SWITCH DISPLAYS VIDEO TEST MENU TO BEGIN MANUAL TESTING.
BIT HISTORY FOR SWITCH R2	INDICATES R2 (BIT HISTORY) SWITCH IS ENABLED TO DISPLAY HISTORY OF BIT. PRESSING R2 (BIT HISTORY) SWITCH DISPLAYS BIT HISTORY PAGE.
MAIN / RETURN FOR SWITCH L6	INDICATES L6 (MAIN / RETURN) SWITCH IS ENABLED TO RETURN TO IBIT MAIN PAGE.

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Figure 16. IBIT Status Menu (Sheet 2 of 2).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

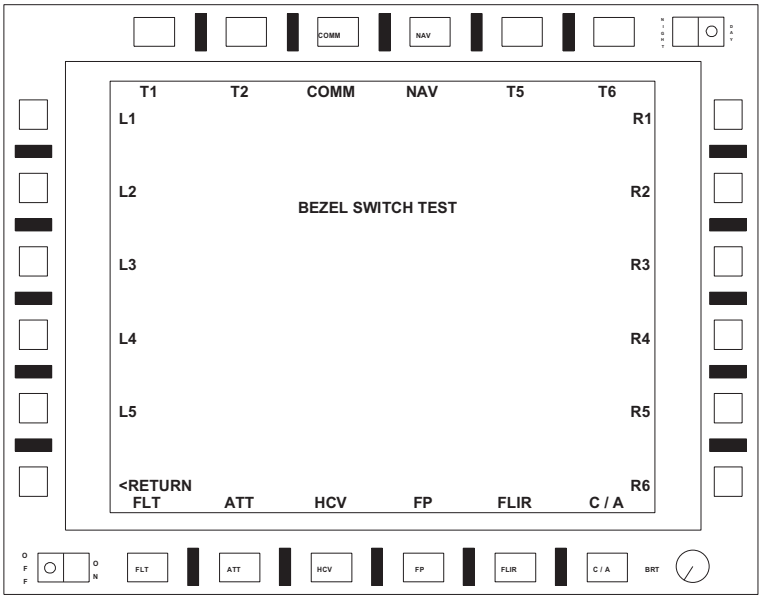


FUNCTION:	ENABLE SELECTION OF PASS OR FAIL FOR BEZEL SWITCH TEST.
ACTIVATION:	BY PRESSING R3 (BEZEL) SWITCH WHEN IBIT STATUS MENU IS DISPLAYED.
DISPLAY CUE	**FUNCTION**
PASS LABEL FOR SWITCH L5	INDICATES L5 (PASS) SWITCH IS ENABLED TO SELECT PASS STATUS FOR BEZEL SWITCH TEST. PRESSING L5 (PASS) SWITCH DISPLAYS PASS AT TOP OF DISPLAY.
FAIL LABEL FOR SWITCH R5	INDICATES R5 (FAIL) SWITCH IS ENABLED TO SELECT FAIL STATUS FOR BEZEL SWITCH TEST. PRESSING R5 (FAIL) SWITCH DISPLAYS FAIL AT TOP OF DISPLAY.
PASS AT TOP OF DISPLAY	INDICATES TEST WAS RUN AND OPERATOR SELECTED PASS STATUS FOR BEZEL SWITCH TEST.
RETURN FOR SWITCH L6	INDICATES L6 (RETURN) SWITCH IS ENABLED TO RETURN TO IBIT STATUS MENU.
CONTINUE LABEL FOR SWITCH R6	INDICATES R6 (CONTINUE) SWITCH IS ENABLED TO CONTINUE WITH IBIT. PRESSING R6 (CONTINUE) SWITCH DISPLAYS BEZEL SWITCH TEST PAGE.

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Figure 17. Bezel Switch Test Menu.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED



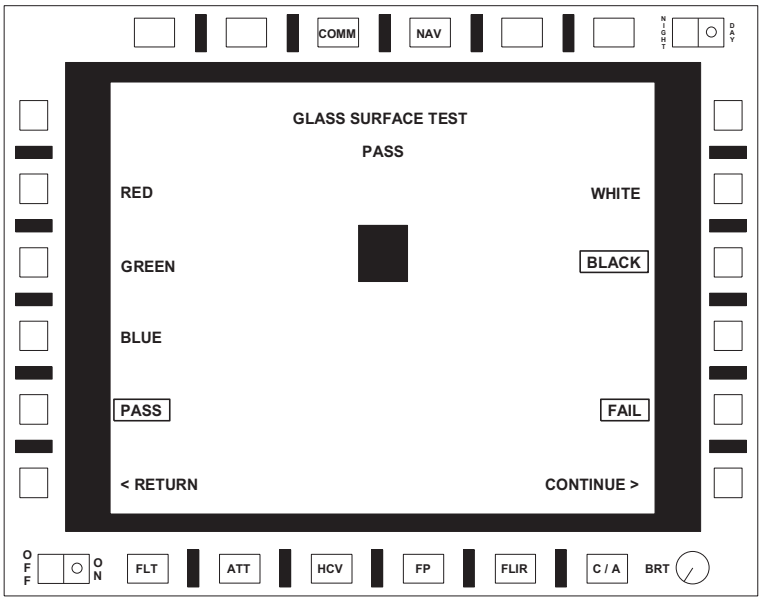
FUNCTION:	ENABLE TESTING OF BEZEL SWITCHES.
ACTIVATION:	BY PRESSING R6 (CONTINUE) SWITCH WHEN BEZEL SWITCH TEST MENU IS DISPLAYED.

DISPLAY CUE	FUNCTION
EACH BEZEL SWITCH (EXCEPT L6) IS SELF□IDEN□TIFIED.	INDICATES EACH SWITCH (EXCEPT L6) IS ENABLED FOR SELF TEST. TO PASS TEST, SWITCH LABEL MUST CHANGE (FROM SHADED TO UNSHADED OR FROM UNSHADED TO SHADED) EACH TIME SWITCH IS PRESSED.
RETURN FOR SWITCH L6	INDICATES L6 (RETURN) SWITCH IS ENABLED TO RETURN TO BEZEL SWITCH TEST MENU.

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Figure 18. Bezel Switch Test Page.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED



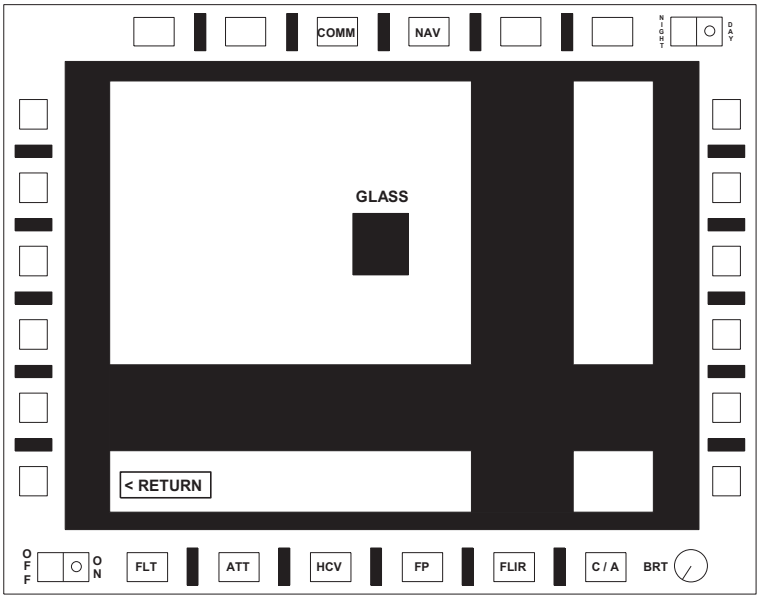
FUNCTION:	ENABLE SELECTION OF TEST COLOR AND PASS OR FAIL FOR GLASS SURFACE TEST.
ACTIVATION:	BY PRESSING R4 (GLASS) SWITCH WHEN IBIT STATUS MENU IS DISPLAYED.

DISPLAY CUE	FUNCTION
PASS LABEL FOR SWITCH L5	INDICATES L5 (PASS) SWITCH IS ENABLED TO SELECT PASS STATUS FOR GLASS SURFACE TEST. PRESSING L5 (PASS) SWITCH DISPLAYS PASS AT TOP OF DISPLAY.
FAIL LABEL FOR SWITCH R5	INDICATES R5 (FAIL) SWITCH IS ENABLED TO SELECT FAIL STATUS FOR GLASS SURFACE TEST. PRESSING R5 (FAIL) SWITCH DISPLAYS FAIL AT TOP OF DISPLAY.
PASS AT TOP OF DISPLAY	INDICATES TEST WAS RUN AND OPERATOR SELECTED PASS STATUS FOR GLASS SURFACE TEST.
RETURN FOR SWITCH L6	INDICATES L6 (RETURN) SWITCH IS ENABLED TO RETURN TO IBIT STATUS MENU.
CONTINUE LABEL FOR SWITCH R6	INDICATES R6 (CONTINUE) SWITCH IS ENABLED TO CONTINUE WITH IBIT. PRESSING R6 (CONTINUE) SWITCH DISPLAYS GLASS SURFACE TEST PAGE.
COLOR LABEL FOR SWITCHES L2-L4, R2, AND R3	INDICATES EACH SWITCH (L2-L4, R2 AND R3) IS ENABLED TO SELECT A COLOR TEST.

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Figure 19. Glass Surface Test Menu.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED



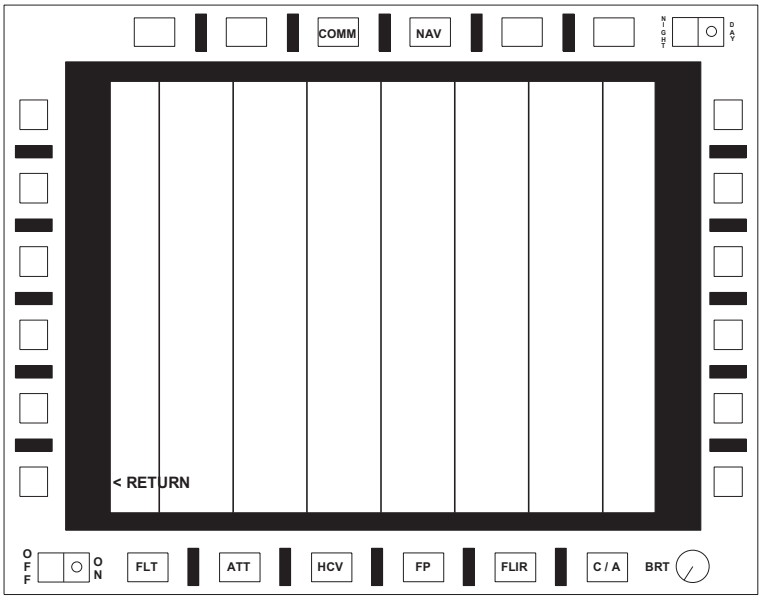
FUNCTION:	ENABLE TESTING OF GLASS SURFACE.
ACTIVATION:	BY PRESSING R6 (CONTINUE) SWITCH WHEN GLASS SURFACE TEST MENU IS DISPLAYED.

DISPLAY CUE	FUNCTION
SWITCHES L1 THRU L5 AND R1 THRU R6	PRESSING SWITCH DISPLAYS HORIZONTAL LINE IN COLOR SELECTED FROM GLASS SURFACE TEST MENU.
SWITCHES T1 THRU T5 AND B1 THRU B6	PRESSING SWITCH DISPLAYS VERTICAL LINE IN COLOR SELECTED FROM GLASS SURFACE TEST MENU.
RETURN FOR SWITCH L6	INDICATES L6 (RETURN) SWITCH IS ENABLED TO RETURN TO GLASS SURFACE TEST MENU.

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Figure 20. Glass Surface Test Page.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

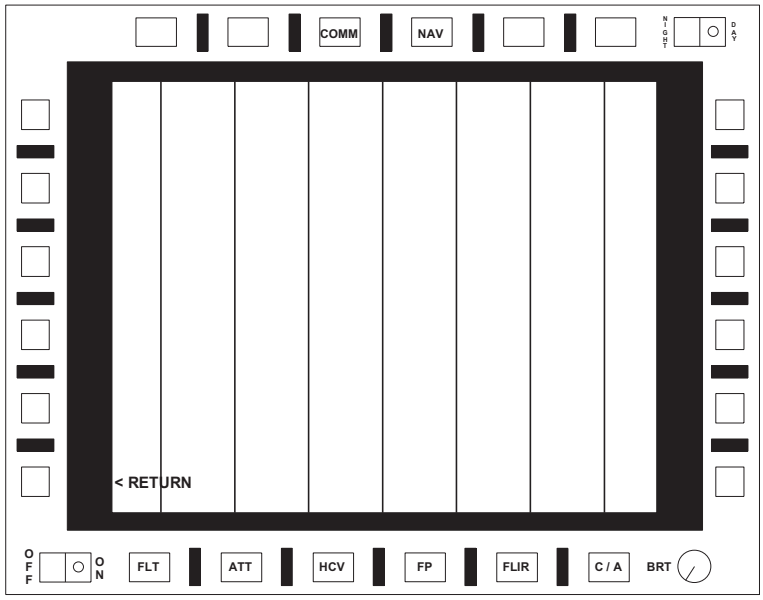


FUNCTION:	DISPLAY RESULTS OF VIDEO TEST. TO PASS TEST, DISPLAY IS GREEN GRADIENT (DARK TO LIGHT FROM LEFT TO RIGHT).
ACTIVATION:	BY PRESSING R6 (CONTINUE) SWITCH WHEN VIDEO TEST MENU IS DISPLAYED.
DISPLAY CUE	**FUNCTION**
RETURN FOR SWITCH L6	INDICATES L6 (RETURN) SWITCH IS ENABLED TO RETURN TO VIDEO TEST MENU.

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Figure 21. Video Test Menu.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED



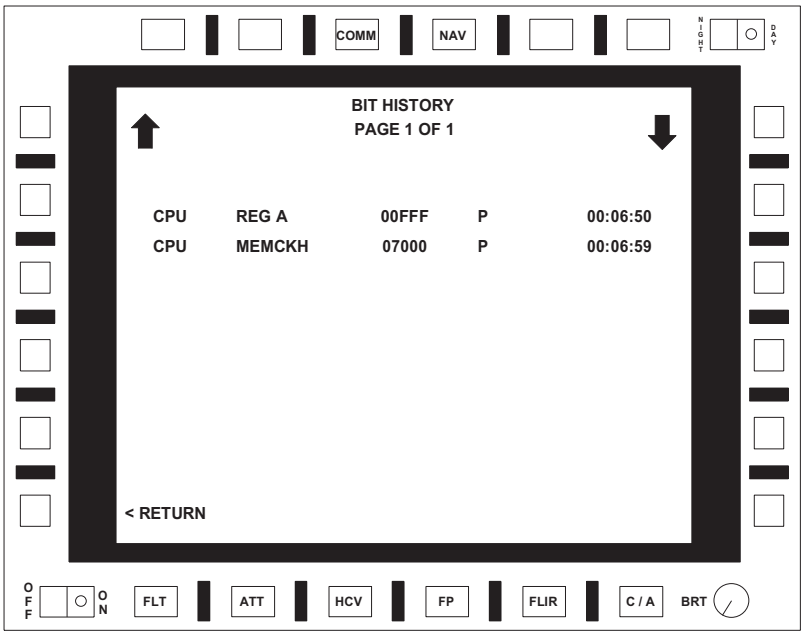
FUNCTION:	DISPLAY RESULTS OF VIDEO TEST. TO PASS TEST, DISPLAY IS GREEN GRADIENT (DARK TO LIGHT FROM LEFT TO RIGHT).
ACTIVATION:	BY PRESSING R6 (CONTINUE) SWITCH WHEN VIDEO TEST MENU IS DISPLAYED.

DISPLAY CUE	FUNCTION
RETURN FOR SWITCH L6	INDICATES L6 (RETURN) SWITCH IS ENABLED TO RETURN TO VIDEO TEST MENU.

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Figure 22. Video Test Page.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED



FUNCTION:	DISPLAY HISTORY OF BIT. BIT HISTORY CAN DISPLAY 100 ERRORS (TEN ERRORS PER PAGE). IF BIT ERRORS EXCEED 100, OLD ERRORS ARE OVERWRITTEN.
ACTIVATION:	BY PRESSING R2 (BIT HISTORY) SWITCH WHEN IBIT STATUS MENU IS DISPLAYED. BIT HISTORY IS CLEARED EXTERNAL TO MFD.

DISPLAY CUE	FUNCTION
	FIRST COLUMN DISPLAYS ITEM TESTED. LAST COLUMN DISPLAYS SYSTEM TIME WHEN ERROR OCCURRED. NEXT TO LAST COLUMN DISPLAYS ERROR TYPE: P FOR PBIT ERROR, I FOR IBIT ERROR, OR S FOR SBIT ERROR.
UP ARROW LABEL FOR SWITCH L1	INDICATES L1 (UP ARROW) SWITCH IS ENABLED TO SCROLL BIT LIST.
DOWN ARROW LABEL FOR SWITCH R1	INDICATES R1 (DOWN ARROW) SWITCH IS ENABLED TO SCROLL BIT LIST.
RETURN FOR SWITCH L6	INDICATES L6 (RETURN) SWITCH IS ENABLED TO RETURN TO IBIT STATUS MENU.

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Figure 23. Bit History Page.

CONTROLS

Controls surround the screen of the MFD. Table 1 lists these controls and explains their function.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

Table 1. Controls.

CONTROL	FUNCTION
T1,T2,T5,T6, L1 thru L6, and R1 thru R6 switches	Function of switch is determined by display mode. Display labels switch to identify function that is activated by pressing switch.
HH-60A > **NIGHT-DAY** < HH-60L > **OFF-NIGHT-DAY** < switch	Activates night or day lighting for display. HH-60L > Turns MFD on or off. <
HH-60A > **OFF-ON** switch <	Turns MFD on or off.
OFF-ONswitch	Turns MFD on or off.
BRT control	Enables adjustment of brightness for display.
T3 (**COMM**) switch	Enables display of communication header. Switch acts to toggle header on and off. Switch is not active during IBIT and C/A displays.
T4 (**NAV**) switch	Enables display of navigation header. Switch acts to toggle header on and off. Switch is not active during IBIT and C/A displays.
B1 (**FLT**) switch	Enables display of flight data. Switch toggles flight data on and off. Switch is not active during IBIT and C/A displays.
B2 (**ATT**) switch	Enables display of attitude data. Switch toggles attitude data on and off. Switch is not active during IBIT displays.
B3 (**HOV**) switch	Enables display of hover data. Switch toggles hover data on and off. Switch is not active during IBIT displays.
B4 (**FP**) switch	Enables display of flight plan data Switch toggles flight plan data on and off. Switch is not active during IBIT displays.
B5 (**FLIR**) switch	Enables display of forward looking infrared data. Switch toggles forward looking infrared data on and off. Switch is not active during IBIT display.
B6 (**C/A**) switch	Enables display of caution and advisory notices. Switch toggles grid on and off.

DATA ENTRY

The data for displays are generated external to the MFD. Refer to external sources of display for information on data entry.

DATA DISPLAY

There are three types of screen displays: IBIT, C/A grid, and main screen. A pulsing asterisk appears in the lower left corner of all screen displays, to indicate the MFD is operating.

The IBIT screen presents various Initiated Built-in Test (IBIT) displays to test operation of the MFD. The C/A grid screen presents caution and/or advisory (C/A) notices and a LAND ASAP alert. Table 2 lists the caution and advisory notices. Also, Table 2 indicates the caution requirements for the LAND ASAP abort. The main screen presents data to operate the aircraft. These data are flight plan and flight data, attitude, hover, communication, navigation, and forward-looking infrared (FLIR) displays. The main screen (Figure 1) is divided into header, flight, central, and popup areas.

The header area is used to display communication and navigation data, selected respectively by the COMM and NAV switches. The flight area is used to display flight data, selected by the FLT switch. The central area is used to display attitude, hover, flight plan, and forward-looking infrared data, selected respectively by the ATT, HOV, FP, and FLIR switches. The Slipup area provides a quick-alert area for display of caution and advisory notices.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

Table 2. Caution and Advisory Notices.

NOTICE	TYPE
CHIP INPUT MDL-LH	Caution
CHIP ACCESS MDL-LH	Caution (LAND ASAP)
CHIP TAIL XMSN	Caution (LAND ASAP)
CHIP INPUT MDL-RH	Caution
CHIP ACCESS MDL-RH	Caution (LAND ASAP)
CHIP #1 ENGINE	Caution
CHIP #2 ENGINE	Caution
#2 GEN BRG	Caution
#1 GEN BRG	Caution
CHIP INT XMSN	Caution (LAND ASAP)
CHIP MAIN MDL SUMP (delayed 30 seconds position on popup is don't care)	Caution (LAND ASAP)
APU ACCUM LOW	Advisory
#1 GEN	Caution
#1 CONV	Caution
AC ESS BUS OFF	Caution
BATT LOW CHARGE	Caution
GUST LOCK	Caution
#1 OIL FLTR BYPASS	Caution
#1 HYD PUMP	Caution (SEE NOTE 2)
IRCM INOP	Caution
STABILATOR	Caution
FLT PATH STAB	Caution
MR DE-ICE FAULT	Caution
#2 FUEL FLTR BYPAS	Caution (SEE NOTE 1)
#2 ENGINE STARTER	Caution
#2 PRI SERVO PRESS	Caution
#2 GEN	Caution
#2 CONV	Caution
#2 ENG ANTI-ICE ON	Advisory
#2 RSVR LOW	Caution
#2 INL ANTI-ICE ON	Advisory
#1 TAIL RTR SERVO	Caution

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

Table 2. Caution and Advisory Notices. – Continued

NOTICE	TYPE
#2 TL RTR SERVO ON	Advisory
INT XMSN OIL TEMP	Caution (LAND ASAP)
TAIL XMSN OIL TEMP	Caution (LAND ASAP)
#1 FUEL LOW	Caution
#1 FUEL PRESS	Caution
#1 RSVR LOW	Caution
#1 INL ANTI-ICE ON	Advisory
APU GEN ON	Advisory
SEARCH LT ON	Advisory
CARGO HOOK OPEN	Advisory
PARKING BRAKE ON	Advisory
DC ESS BUS OFF	Caution
BATTERY FAULT	Caution (SEE NOTE 4)
PITCH BIAS FAIL	Caution (SEE NOTE 3)
AUX FUEL	Caution
SAS OFF	Caution
IFF	Caution
APU FAIL	Caution
TR DE-ICE FAIL	Caution
PRIME BOOST PMP ON	Advisory
LDG LT ON	Advisory
HOOK ARMED	Advisory
EXT PWR CONNECTED	Advisory
APU OIL TEMP HI	Caution
TRIM FAIL	Caution
RT PITOT HEAT	Caution
ICE DETECTED	Caution
BACK-UP RSVR LOW	Caution
BACK-UP PUMP ON	Advisory
#2 OIL FLTR BYPASS	Caution
#2 HYD PUMP	Caution (SEE NOTE 2)
#2 FUEL LOW	Caution
#2 FUEL PRESS	Caution

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

Table 2. Caution and Advisory Notices. – Continued

NOTICE	TYPE
#2 ENG OIL PRESS	Caution
#2 ENGINE OIL TEMP	Caution
#1 ENGINE OIL TEMP	Caution
#1 FUEL FLTR BYPAS	Caution (SEE NOTE 1)
#1 ENGINE STARTER	Caution
#1 PRI SERVO PRESS	Caution
TAIL RTR QUADRANT	Caution
MAIN XMSN OIL PRESS	Caution (LAND ASAP)
MAIN XMSN OIL TEMP	Caution (LAND ASAP)
BOOST SERVO OFF	Caution
LET PITOT HEAT	Caution
MR DE-ICE FAIL	Caution
#1 ENG ANTI-ICE ON	Advisory
APU ON	Advisory
NOTES	
1. #1 FUEL FLTR BYPAS and #2 FUEL FLTR BYPAS are required for LAND ASAP alert.	
2. #1 HYD PUMP and #2 HYD PUMP are required for LAND ASAP alert.	
3. Not used.	
4. **HH-60A>**	

DISPLAY ORGANIZATION

The displays are organized for switch selection at the MFD and response to external signals. Table 3 indicates the relationships of switches to displays. For example in Table 3, when the ON-OFF switch is first set to ON, the C/A Grid (Figure 4) is displayed without part number. Then, if switch T2 is pressed, the part number is displayed. When the C/A switch is pressed, the C/A Grid is displayed with caution and advisory indications (Figure 4).

Table 3. Display Organization.

SWITCH	DISPLAY	FIGURE
Only switches used to select displays are listed in Table 3. For switches used within displays - such as ACK and IULUM ALL (C/A Grid Display), SCALE (Flight Plan Display) TAS and IAS (Flight Data Display) - refer to appropriate figure listed in Table 1.		
ON-OFFswitch, when first set ON	C/A Grid without part number	
T2 switch	C/A Grid with part number	4

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

Table 3. Display Organization. – Continued

SWITCH	DISPLAY	FIGURE
C/A switch	C/A Grid with C/A Indications	5
FP switch	Heading Up Flight Plan	6
L6 (**HOG UP**) switch	North Up Flight Plan	7
L6 (**N UP**) switch	Returns to Heading Up Flight Plan	
ATT switch	Attitude	8
HOV switch	Hover	9
FLT switch	Flight Data	10
COMM switch	Communications Header	11
NAV switch	Navigation Header	12
FLIRswitch	FLIR Video	13
R3 (**C/A WNDW**) switch (on all displays except C/A and IBIT)	Caution Advisory Popup List	14
(Activation is external to MFD)	Initiated Bit (IBIT) Main Page	15
R6 (**CONTINUE**) switch	IBIT Status Menu	16
R3 (**BEZEL**) switch	Bezel Switch Test Menu	17
R6 (**CONTINUE**) switch	Bezel Switch Test Page	18
R4 (**GLASS**) switch	Glass Surface Test Menu	19
R6 (**CONTINUE**) switch	Glass Surface Test Page	20
R5 (**VIDEO**) switch	Video Test Menu	21
R6 (**CONTINUE**) switch	Video Test Page	22
R2 (**BIT HISTORY**) switch	BIT History Page	23

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

For location and description of major components, refer to the data in this work package.

EQUIPMENT DATA

For equipment data information, refer to this work package.

ELECTRICAL SYSTEMS

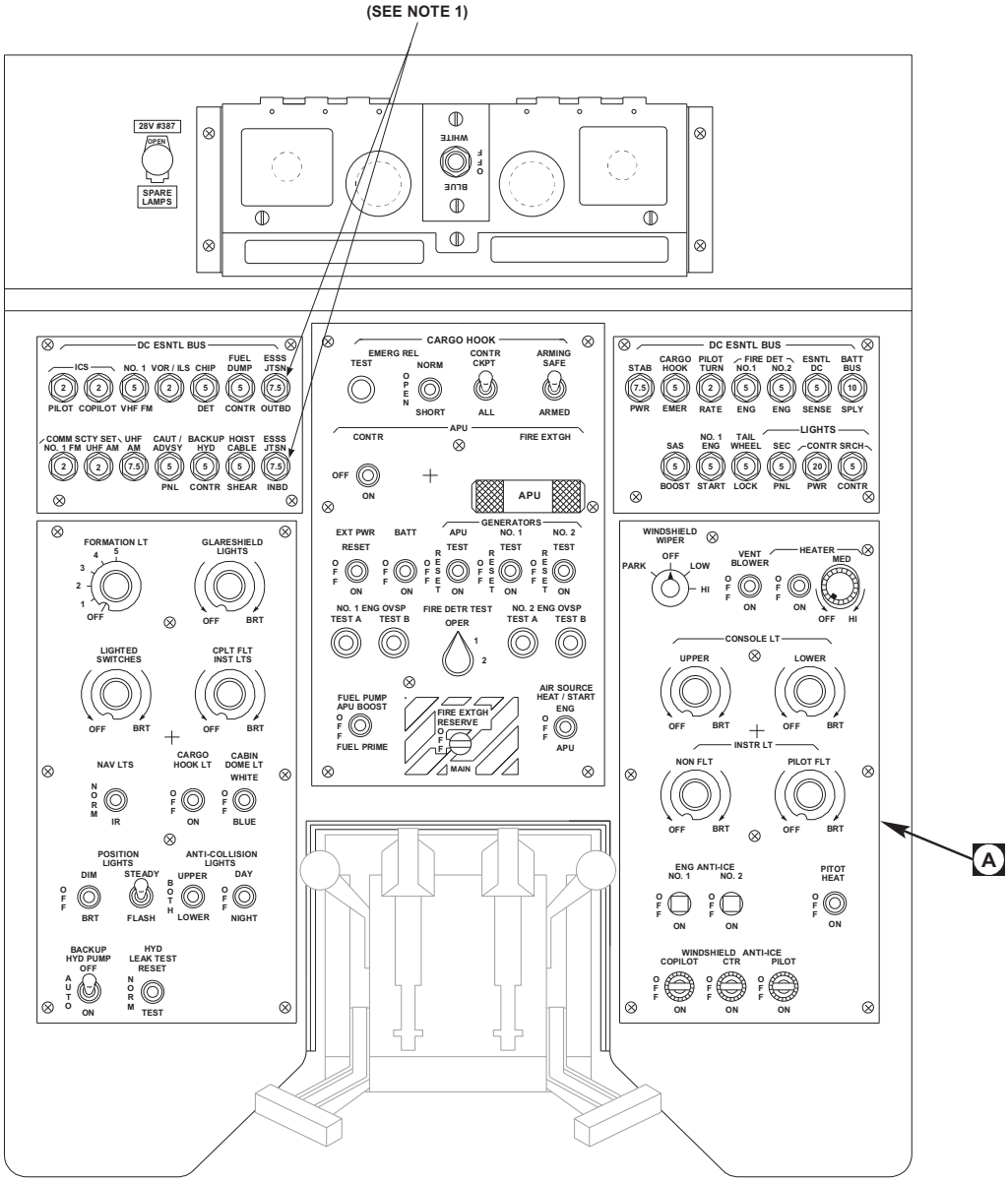
AC ELECTRICAL SYSTEM DESCRIPTION AND DATA

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

AC ELECTRICAL SYSTEM DESCRIPTION

This section contains general information for the ac electrical systems, interior and exterior lighting systems, windshield anti-ice system, fire detection system, flight instruments, engine instruments, miscellaneous instruments and EH-60A > mission electrical interface. < Each description contains the function of the system and system theory of operation. Operating controls for the systems described are on the upper console (Figure 1. (Sheet 1 of 4), Figure 1. (Sheet 1 of 4), Figure 1. (Sheet 2 of 4), and Figure 1. (Sheet 3 of 4)). Circuit breakers for these systems are located on the various circuit breakers panels.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED



NOTES

1. **ESSS**
2. **W/O HCW**

EFFECTIVITY

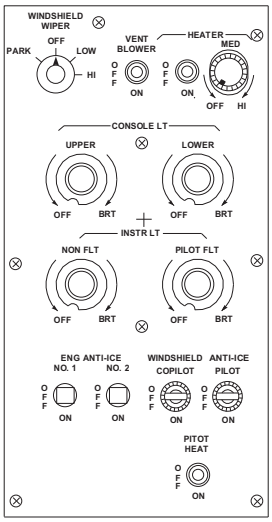
UH60A **UH60L**

AA8600_1A
SA

Figure 1. Upper Console (Sheet 1 of 4).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

A



(SEE NOTE 2)

AA8600_2A
SA

Figure 1. Upper Console (Sheet 2 of 4).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

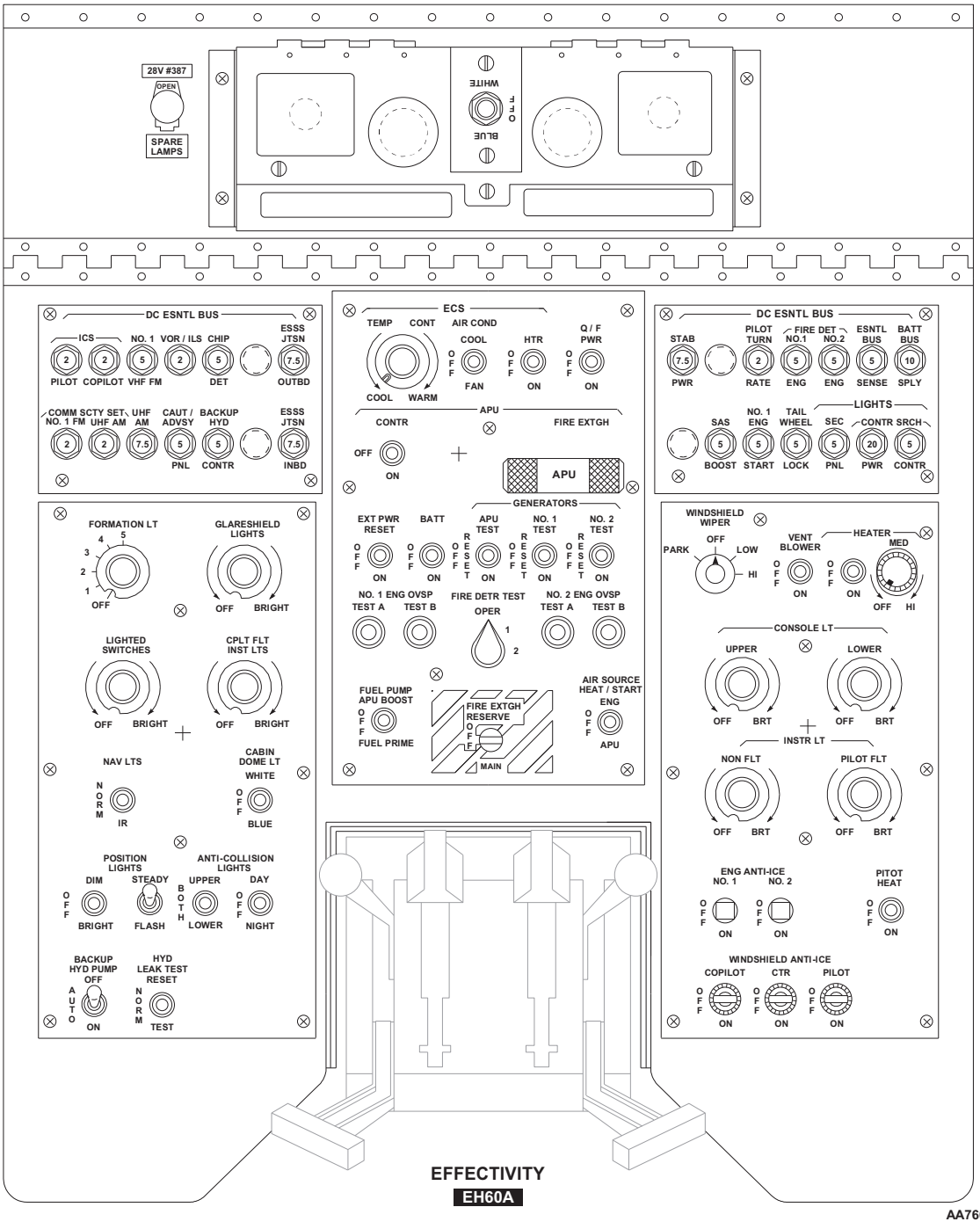
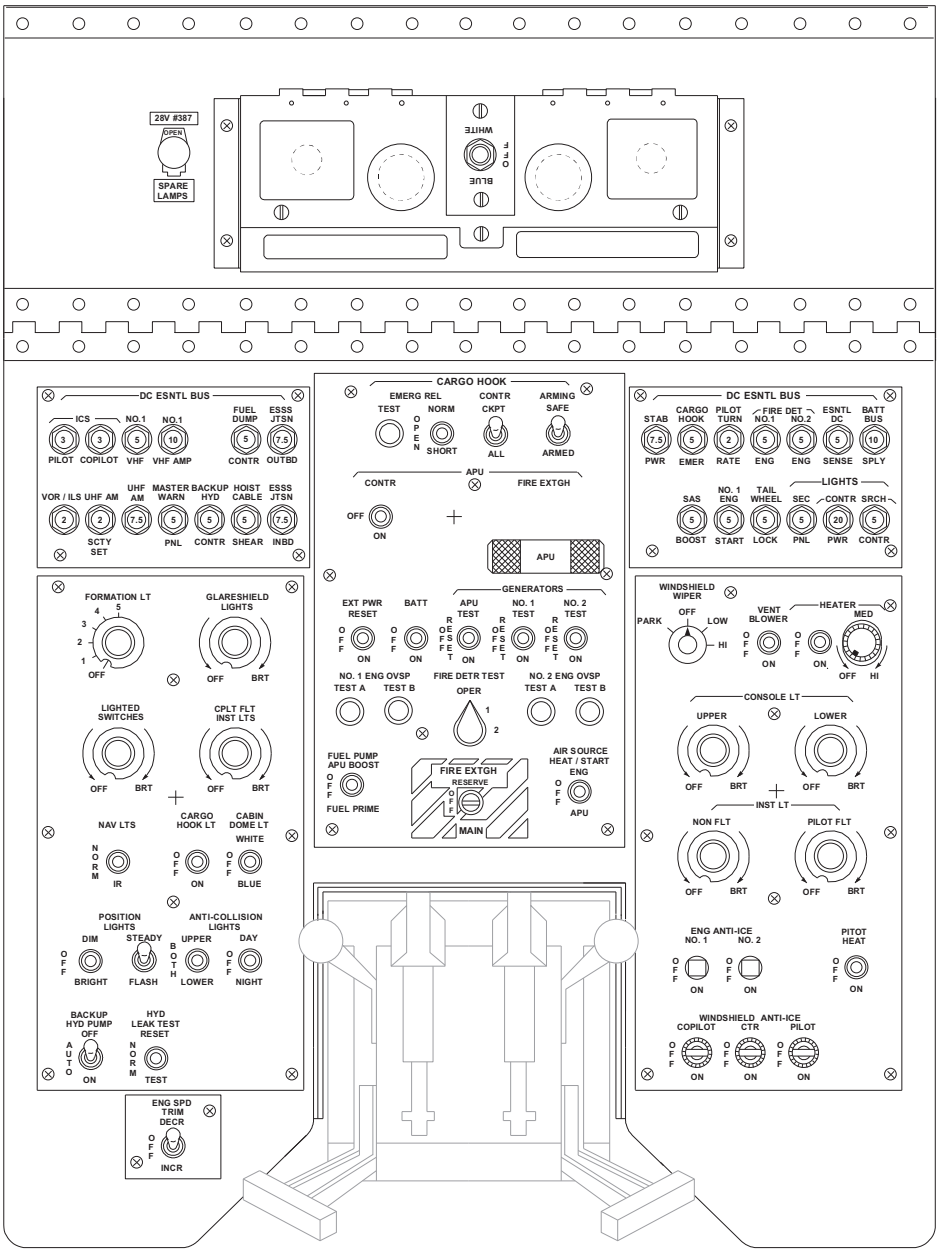


Figure 1. Upper Console (Sheet 3 of 4).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED



UPPER CONSOLE

EFFECTIVITY

HH-60A **HH-60L**

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SA

Figure 1. Upper Console (Sheet 4 of 4).

The ac electrical system consists of primary ac power, auxiliary ac power, and external ac power (Figure 2). Primary ac power is provided by two independent generating systems, each consisting of a brushless generator, generator control unit, current transformer, and generator control switch. Auxiliary ac power is provided by a single generating system consisting of a brushless generator, generator control unit, current transformer, and generator control switch. External ac power is supplied to the helicopter through an external power receptacle. It is con-

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

trolled by an external power monitor panel, and external power switch. AC power is distributed to the helicopter buses from the generating systems and external ac source through a series of contactors and relays. The system interfaces with the caution/advisory warning system where caution and advisory capsules monitor the electrical systems operation and status.

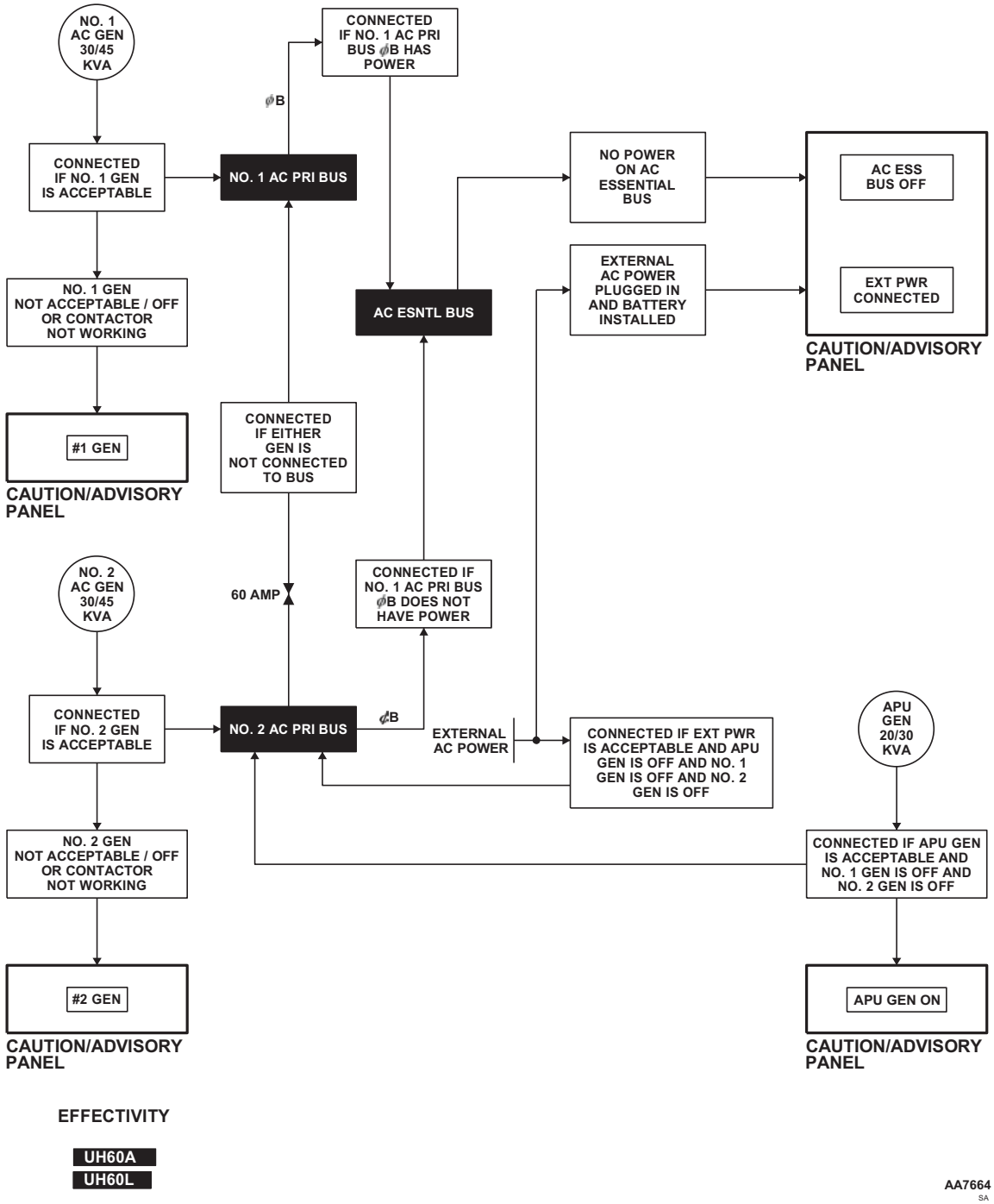


Figure 2. AC Electrical System General Block Diagram.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

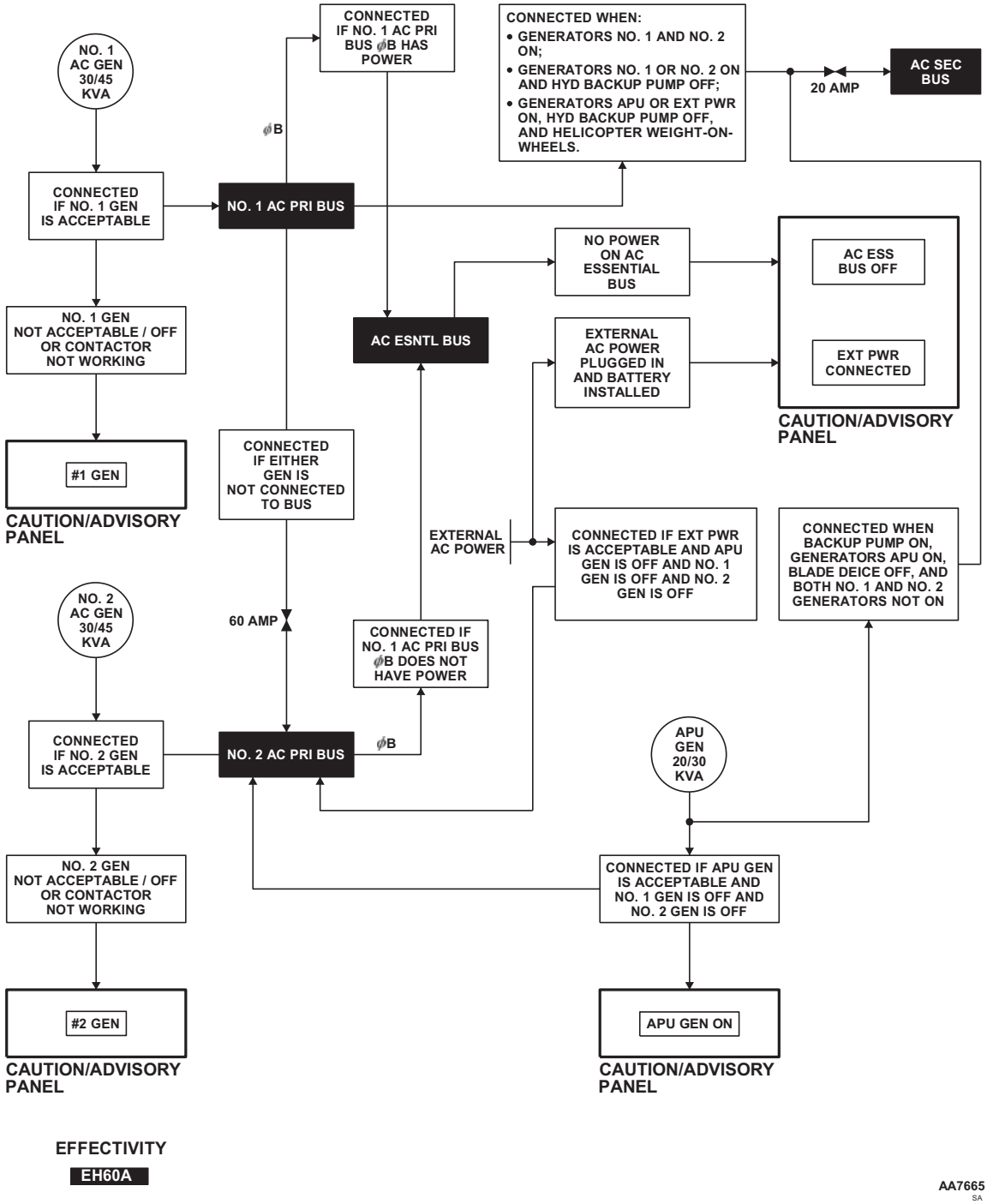


Figure 3. AC Electrical System General Block Diagram.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

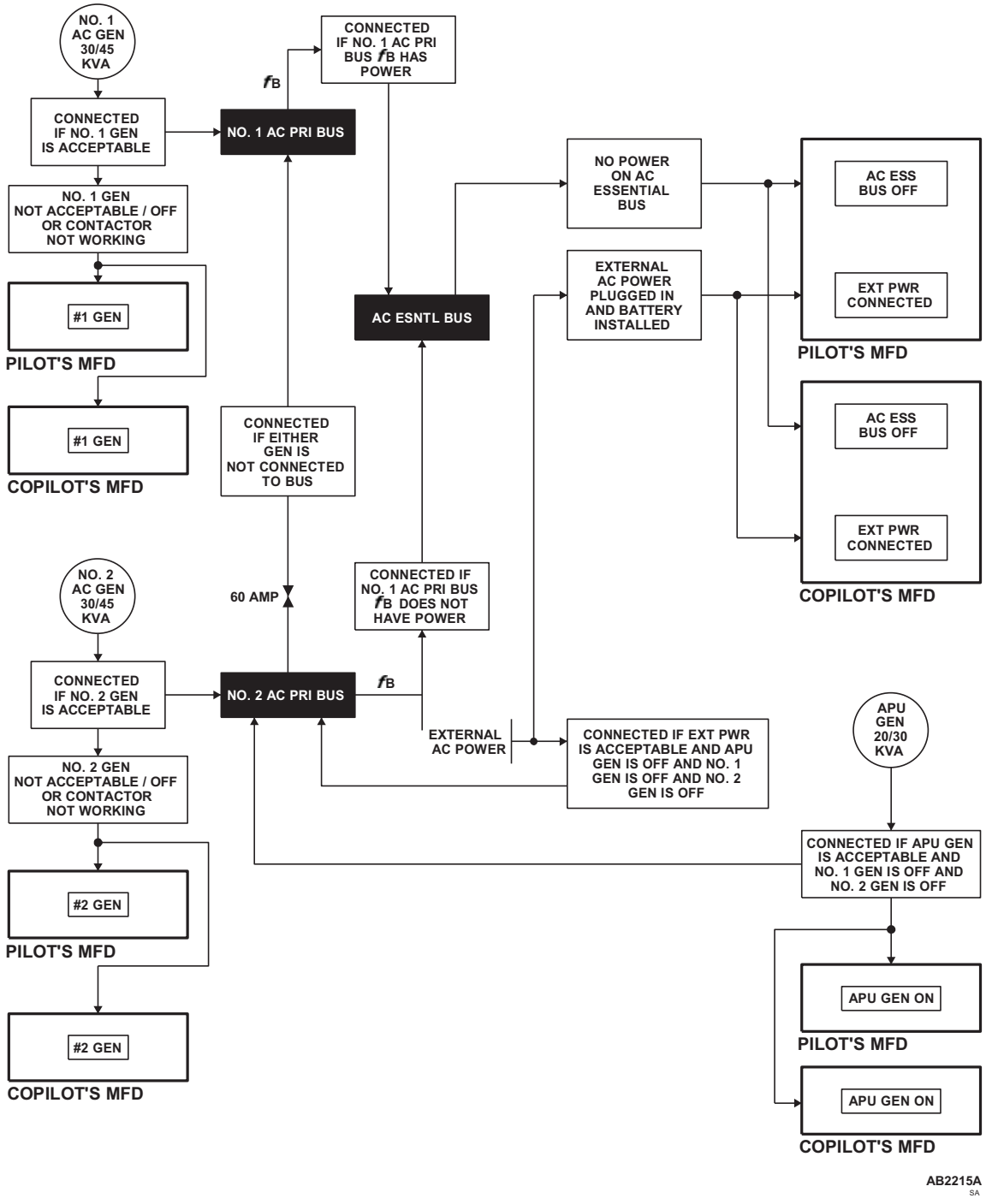


Figure 4. AC Electrical System General Block Diagram. **HH-60A HH-60L>** .

GENERATOR CONTROL UNITS

The No. 1 and APU generator control units, on the upper left cabin, and the No. 2 generator control unit, on the upper right cabin, continuously monitor and regulate generator ac output to provide voltage regulation, current regulation, over voltage protection, under-voltage protection, feeder fault protection, and under-frequency pro-

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

tection. Voltage and current regulation, over voltage, under-voltage, and feeder fault protection are provided during all flight and ground operations. Under-frequency protection by the No. 1 and No. 2 generator control units is provided only during ground operation.

Power for the generator control unit and for generator field excitation is provided by the permanent magnet generator portion of the generator whenever the generator is turning. By controlling generator excitation, the voltage regulator maintains a preset voltage and current level of generator ac output under varying load conditions. The regulator senses the generator variations, amplifies the changes, and then varies the average current flow to the exciter control field. If the generator output level is above the preset level, a decreased current flow is applied to the exciter control field. If the generator output is below the preset level, an increased current flow is applied to the exciter control field.

When the generator three-phase output rises above 124 to 126 vac, the over voltage protection circuit senses this and, after a marginal time delay period to prevent nuisance trips, disables and disconnects the generator from ac loads. The length of time the over voltage condition is permitted to exist is inversely proportional to the magnitude of the over voltage condition.

When any single-phase voltage drops below 95 to 105 vac, the under-voltage protection circuit senses this and initially provides a marginal time delay period to prevent nuisance trips. If the voltage remains low for 5 to 7 seconds, the protection circuit disables and disconnects the generator from the ac loads.

If the amount of current flow in the generator feeder lines differs from that in the generator main windings as monitored by two sets of current transformers, the difference probably results from a leakage path to ground. The feeder fault protection circuit senses this differential current and immediately disables and disconnects the affected generator from the ac loads.

During ground operations, if the frequency of phase C of the permanent magnet generator drops below 1110 to 1130 Hz (equivalent to 370 to 380 Hz from main generator), the under-frequency protection circuit senses this and initially provides a marginal time delay to prevent nuisance trips. If the under-frequency condition is sustained for a period of 1 to 3 seconds, the protection circuit disables and disconnects the generator from the ac loads. Should the frequency rise to the acceptable level and 12 Hz (4 Hz from main generator) above the dropout frequency, the generator is automatically reenergized and reconnected to the ac loads. During flight operations, the under-frequency protection circuits in the No. 1 and No. 2 generator control units are intentionally disabled through action of the landing gear drag beam switch. **W/O ESSS >** The left drag beam switch provides under-frequency disable signal. **<ESSS >** The right drag beam switch provides the under-frequency disable signal. **<**

Generator Control Switches

Generator outputs are connected to their associated generator control units and the ac primary bus contactors by the three-position control switches on the upper console (GENERATORS No. 1, No. 2, and APU). The ON position energizes the associated GCU relay circuitry and the associated ac contactor to connect the generator main output to the primary buses. The TEST position disconnects the main output from the buses, but allows the GCU to control the generator output so that output can be monitored at the test connector. OFF/RESET either deenergizes the generator or permits generator recycling if the generator is disabled and disconnected from its loads. The control switch is manually positioned to RESET and then back to ON.

JUNCTION BOXES UH-60A UH-60L HH-60A HH-60L> <

The No. 1 junction box, on the upper left cabin, and the No. 2 junction box, on the upper right cabin, provide mounting space for ac power system components. The No. 1 junction box contains the No. 1 generator contactor, current transformer, current limiters, and a test receptacle. The No. 2 junction box contains the No. 2 generator contactor, APU/external power contactor, ac bus tie contactor, current transformers, current limiters, and test receptacles.

JUNCTION BOXES EH-60A> <

The No. 1 junction box, on the upper left cabin, and the No. 2 junction box, on the upper right cabin, provide mounting space for ac system components. The No. 1 junction box contains the No. 1 generator contactor, current transformer T13, ac current limiters CL4, CL5, and CL6, a test receptacle, ac secondary bus contactor

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

K11, ac secondary bus current limiters CL16, CL17, and CL18, backup pump interlock relay K80, generators on relay K81, secondary buss ground power control relay K82, and diodes CR17, CR18, CR19, and CR20. The No. 2 junction box contains the No. 2 generator contactor, APU/external power contactor, current transformer, test receptacle, ac current limiters CL1, CL2, and CL3, K12 blade deice on relay, and diodes CR22 and CR23.

Generator Contactors

The No. 1 and No. 2 generator contactors, on the No. 1 and No. 2 junction boxes, respectively, provide connections from the No. 1 and No. 2 generator three-phase feeder lines to the No. 1 and No. 2 ac primary buses for distribution of ac power. With the generator control switches placed ON, dc voltage from the generator control units is applied through the control switches to energize the generator contactor solenoids. Energized auxiliary contacts of No. 1 or No. 2 generator contactors complete the voltage path to the No. 2 hydraulic logic module when backup pump operation is required. Two sets of normally open contacts provide dual generators on voltages to the blade deicing system. EH-60A > Dual generators on voltage is also applied to the environmental control system and to the ac secondary bus contactor. <

When de-energized, auxiliary contacts of the contactors complete the dc voltage path to energize the ac bus tie contactor. This applies APU generator ac power or external ac power, through the de-energized main contacts of the generator contactors to the ac primary buses. The de-energized main contacts also provide a path to transfer power from a working generator to the ac primary bus of a failed generator. Deenergized power, through the de-energized main contacts of the generator contactors to the ac primary buses. The de-energized main contacts also provide a path to transfer power from a working generator to the ac primary bus of a failed generator. UH-60A EH-60A UH-60L > De-energized auxiliary contacts complete the dc voltage paths to the caution/advisory #1 GEN and #2 GEN capsules <. HH-60A HH-60L > De-energized auxiliary contacts complete the dc voltage paths to the pilot's and copilot's MFDs #1 GEN and #2 GEN legends. <Another set of normally closed contacts provide a dual generators off voltage to the blade de-icing system. EH-60A > Normally closed contacts provide a path to energize the ac secondary bus during ground operations. <

APU/External Power Contactors

The APU/external power contactor, on the No. 2 junction box, provides connection from the APU generator three-phase feeder lines or the ac external power receptacle to the ac primary buses for distribution. With the APU generator control switch placed ON, dc voltage from the APU generator control unit is applied through the control switch to energize the APU/external power contactor solenoid. UH-60A EH-60A UH-60L > The energized auxiliary contacts of the contactor are used to complete the dc voltage path from the generator control unit through the ac bus tie contactor to the caution/advisory panel APU GEN ON capsule. < HH-60A HH-60L > The energized auxiliary contacts of the contactor are used to complete the dc voltage path from the generator control unit through the ac bus tie contactor to the pilot's and copilot's MFDs APU GEN ON legend. < EH-60A > Voltage is also supplied to the environmental control system to energize the APU on relay K95. Additional auxiliary energized contacts of the APU/external power contactor provide paths which, through other contacts, supply voltage to the blade deice system. This voltage is also supplied to the secondary bus contactor when auxiliary power is required. <

With external ac power connected to the helicopter, de-energized main contacts of the APU/external power contactor apply the external ac power to the energized main contacts of the ac bus tie contactor for distribution to the ac primary buses. EH-60A > Another set of normally closed contacts, when de-energized, provide a path to energize the ac secondary bus contactor during single main generator operation. <

AC Bus Tie Contactors

The ac bus tie contactor, on the No. 2 junction box, provides three-phase ac power from the APU generator or external ac power receptacle to the ac primary buses. With the APU generator control switch placed ON, the ac bus tie contactor solenoid is energized by dc voltage from the APU generator control unit. This is accomplished through the de-energized auxiliary contacts of the No. 1 and No. 2 generator contactors. The energized main contacts of the ac bus tie contactor provide a connection from the APU/external power contactor to the ac primary buses. UH-60A EH-60A UH-60L > The energized auxiliary contacts of the ac bus tie contactor complete the dc voltage path to the caution/advisory panel APU GEN ON capsule. < HH-60A HH-60L > The energized auxiliary

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

contacts of the ac bus tie contactor complete the dc voltage path to the pilot's and copilot's MFDs APU GEN ON legends. <

With external ac power connected to the helicopter and the EXT PWR switch placed ON, the ac bus tie contactor solenoid is energized. If receives dc voltage from the external power monitor panel through the deenergized auxiliary contacts of the No. 1 and No. 2 generator contactors. The energized main contacts of the ac bus tie contactor provide a connection from the external ac power receptacle to the ac primary buses.

Auxiliary energized contacts of the ac bus tie contactor complete the voltage path to the No. 2 hydraulic logic module when backup pump operation is required. Additional sets of normally open and normally closed contacts provide additional logic to the hydraulic system and the blade deicing system. EH-60A > Another set of energized auxiliary contacts provides a path to energize the secondary bus contactor when auxiliary power is required. <

Back-up Pump Interlock Relay, K80 EH-60A>

The back-up pump interlock relay, K80, on the No. 1 junction box, provides logic switching for the ac secondary bus contactor. Relay K80 is energized whenever the helicopter weight is on wheels and the backup pump is operating, or the helicopter is airborne and hydraulic pressure is less than 2000 psi. Power is routed from BACKUP HYD CONTR circuit breaker, on the dc essential bus, through energized contacts of relay K32, on the right relay panel, to energize K80. Contacts of the energized back-up pump interlock relay provide a path to energize the ac secondary bus contactor when auxiliary power is required. Voltage that energizes relay K80 is also routed to the environment control system to energize relay K80A during backup pump operation.

In normal system operation the backup pump is off and the back-up pump interlock relay K80 is deenergized. Normally closed contacts provide a path to energize the ac secondary bus contactor during ground operation or with the APU off.

Generators On Relay, K81 EH-60A>

The generators on relay, K81, on the No. 1 junction box, provides logic switching for the ac secondary bus contactor. Relay K81 is energized whenever both No. 1 and No. 2 generators are on and their outputs are acceptable. From SEC MON BUS CONTR circuit breaker, power is routed through diode CR5 on the right relay panel, through energized contacts of No. 1 and No. 2 generator contactors, to energize the generators on relay.

When deenergized, normally closed contacts of the generators on relay provide a path to energize the ac secondary bus contactor when auxiliary power is required.

Secondary Bus Ground Power Control Relay, K82 EH-60A>

The secondary bus ground power control relay, K82, on the No. 1 junction box, provides logic switching for the ac secondary bus contactor. Relay K82 is energized whenever the helicopter weight is off the wheels as sensed by the left drag beam switch. 28 vdc is applied to relay K82 from the SEC MON BUS CONTR circuit breaker. The left drag beam switch completes the path to ground during flight to energize K82 and disable secondary bus ground power.

When the helicopter weight is on wheels and the secondary bus ground power control relay is deenergized, normally closed contacts provide a path to energize the ac secondary bus contactor for ground testing and troubleshooting. Another set of normally closed contacts provide logic for the environmental control system.

Blade Deice On Relay, K12 EH-60A>

Relay, K12, on the No. 2 junction box, provides logic switching for the ac secondary bus contactor. Relay K12 is energized whenever blade deice control panel POWER switch is placed to ON or TEST. Power to energize relay K12 is supplied by DE-ICE CONT RLP circuit breaker, on the No. 1 dc primary bus. If the blade deice system is being tested, power is routed through the deice control panel POWER-TEST switch, through diode CR23 on the No. 2 junction box, to energize relay K12. If the blade deice system is being operated, power is routed through the deice control panel POWER-ON switch, through diode CR22 on the No. 2 junction box, to energize relay K12.

Relay K12 is deenergized with the deice control panel POWER switch placed OFF. Normally closed contacts of deenergized relay K12 provide a path to energize the ac secondary bus contactor when auxiliary power is required.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

AC Secondary Bus Contactor, K11 EH-60A>

The ac secondary bus contactor, on the No. 1 junction box, supplies three phase ac primary, external, or auxiliary electrical power to the ac secondary bus. The ac secondary bus contactor contains two normally open sets of contacts, each energized separately. Solenoid X1, through its associated contactors, provides a connection between the No. 1 primary bus and the ac secondary bus. Solenoid Y1, through its associated contactors, provides a connection between the APU generator and the ac secondary bus.

AC secondary bus contactor solenoid X1 is energized with both No. 1 and No. 2 generators on. Twenty-eight vdc from the SEC MON BUS CONTR circuit breaker, on the No. 2 dc primary bus, is applied through energized contacts of No. 1 and No. 2 generator contactors and blocking diode CR17 to energize solenoid X1. If one generator is turned off, solenoid X1 is energized if the backup pump is off. Twenty-eight vdc from the SEC MON BUS CONTR circuit breaker is applied through blocking diode CR18 and normally closed contacts of deenergized backup pump interlock relay to energize solenoid X1.

With both No. 1 and No. 2 generators off and the helicopter weight-on-wheels switch engaged, ac secondary bus contactor solenoid X1 is energized with external power applied or with the APU on, if the backup pump is off. With external power applied, dc voltage to energize solenoid X1 is supplied by the external power monitor panel, through the upper console EXT PWR switch, and a blocking diode in the right relay panel. With the APU generator operating, dc voltage to energize solenoid X1 is supplied by the APU generator control unit, through the upper console GENERATOR APU switch, and a blocking diode in the right relay panel. From the right relay panel, voltage to energize solenoid X1 follows a common path for ground operation. From the right relay panel, voltage is routed through normally closed contacts of deenergized No. 1 and No. 2 generator contactors, secondary bus ground power control relay, and backup pump interlock relay, to energize solenoid X1.

AC secondary bus contactor solenoid Y1 is energized with either, but not both, No. 1 and No. 2 generators on, the APU generator on, the hydraulic backup pump on, and blade deice off. From the SEC MON BUS CONTR circuit breaker, dc voltage is routed through contacts of deenergized ac bus tie contactor, contacts of energized APU/external power contactor, contacts of deenergized generators on relay, contacts of energized backup pump interlock relay, and contacts of deenergized blade deice on relay, to energize solenoid Y1 and provide auxiliary power to the ac secondary bus.

Current Transformers

Three current transformers, one on the No. 1 junction box and two on the No. 2 junction box, are installed in the output legs of each generator to monitor generator output current and to detect feeder faults. Each current transformer consists of three individual windings, one winding on each of the generator feeder lines. The current transformers are connected in series with current limit sense circuits within each generator. As the output current of the generator increases during transient load conditions, the increased current through the transformer is sensed by the generator control unit. This decreases the generator exciter control field and the generator output current. When a feeder fault (short circuit to ground) occurs between the generator and the generator contactor, a differential current develops between the current transformer windings and the current limit sense circuit in the generator. This current difference is sensed by the generator control unit and disables and disconnects the generator from its loads.

Current Limiters

Current limiters CL1 through CL3, on the No. 2 junction box, and CL4 through CL6, on the No. 1 junction box, are 60 ampere fuses protecting the operating generator from excessive overloading during transfer operations. The current limiters are affected when one generator is used to carry both ac primary buses, permitting the loss of one or more phases of ac while the remaining phase or phases remain on-line. Current limiters CL1 through CL3 carry three-phase ac power from the No. 2 generator to the No. 1 ac primary bus in case of a No. 1 generator failure. Current limiters CL4 through CL6 carry three-phase ac power from the No. 1 generator to the No. 2 ac primary bus in case of a No. 2 generator failure.

EH-60A > Three 20-ampere secondary bus current limiters, CL16, CL17, and CL18, carry 115 vac power to the interface panel from the ac secondary bus contactor. Secondary bus current limiters CL16 through CL18 are in the No. 1 junction box. <

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

Test Receptacles

The No. 1 generator test receptacle, on the No. 1 junction box, and the No. 2 and APU generator test receptacles, on the No. 2 junction box, are provided for monitoring generator three-phase ac output. The generator three-phase ac output is applied to the test receptacle when the generator control switch is placed to ON or TEST.

AC ESSENTIAL BUS XFR RELAY

UH-60A UH-60L HH-60A HH-60L > The AC essential bus XFR relay, on the pilot's circuit breaker panel provides connection of 115 vac, B phase power to the ac essential bus. < EH-60A > The ac essential bus circuit breaker panel provides connection of 115 vac, B phase power to the ac essential bus. < The relay solenoid is energized by 115 vac, B phase power from No. 1 ac primary bus. When energized, the relay applies 115 vac, B phase power from the No. 1 ac primary bus to the ac essential bus. If there is a loss of B phase power on the No. 1 ac primary bus, the ac essential bus relay is deenergized, and 115 vac, B phase power from the No. 2 ac primary bus is applied through the deenergized contacts to the ac essential bus.

AC ESSENTIAL BUS FAIL RELAY

UH-60A UH-60L HH-60A HH-60L > The ac essential bus fail relay, on the pilot's circuit breaker panel is energized whenever there is power on the ac essential bus. < EH-60A > The ac essential bus circuit breaker panel is energized whenever there is power on the ac essential bus. < If this power is lost, the relay is deenergized and its deenergized contacts complete the dc voltage path from the battery bus to light the caution/advisory panel AC ESS BUS OFF capsule.

EXTERNAL POWER RECEPTACLE

The external power receptacle, on the front right-hand cabin, permits three-phase ac power from an external power cart to be applied to the helicopter electrical system during ground operations. The receptacle contains four pins for the application of power and two additional pins which are jumpered in the external power cart plug, forming an interlock when the external power cart is connected. The jumpered pins complete the path for applying battery bus voltage to light the EH-60A UH-60A UH-60L > caution/advisory panel EXT PWR CONNECTED capsule < HH-60A HH-60L > pilot's and copilot's MFDs EXT PWR CONNECTED legend. <

EXTERNAL POWER MONITOR PANEL

The external power monitor panel, on the upper right-hand cabin, monitors the external ac input for under-voltage, over voltage, under-frequency, over frequency, and correct phase rotation conditions. During external power application, if the monitor panel requirements are not met, external power is disconnected from the helicopter distribution system. It remains disconnected until the EXT PWR switch is positioned to RESET.

When external power drops below 100 to 105 vac, the power monitor panel under-voltage protection circuit senses this and initially provides a marginal time delay to prevent nuisance trips. If the voltage remains low for 0.85 to 2.55 seconds, the protection circuit opens the monitor panel output circuit. With the output circuit open, dc voltage to the ac bus tie contactor is removed and external power cannot be used.

When external power rises above 125 to 130 vac, the over voltage protection circuit senses this. After a marginal time delay of 0.75 and 1.25 seconds, to prevent nuisance trips, it disconnects external power as in the under-voltage condition. The length of time the over voltage condition is permitted to exist is inversely proportional to the magnitude of the over voltage condition.

When external power frequency drops below 370 to 375 Hz, the under-frequency protection circuit senses this and provides a time delay to prevent nuisance trips. If the frequency remains low for 0.75 to 1.25 seconds, the protection circuit disconnects external power as in the under-voltage condition.

When external power frequency rises above 425 to 430 Hz, the over frequency sensing circuit senses this and provides a time delay to prevent nuisance trips. If the frequency remains high for 0.75 to 1.25 seconds, the protection circuit disconnects external power as in the under-voltage condition.

When external power phase rotation (normal A-B-C) is incorrect, the phase rotation sensing circuit senses this and does not close the monitor panel output circuit. With the output circuit open, dc voltage is not applied to the ac bus tie contactor, and external power usage is not possible.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

EXTERNAL POWER CONTROL SWITCH

The external power control switch, on the upper console, is a three-position switch used to apply external power to the helicopter ac buses. The ON position completes the dc voltage path to energize the ac bus tie contactor to apply ac external power to the ac buses. The RESET position closes the external power monitor panel output circuit to reconnect external power to the ac buses if it had been disconnected as a result of an under-voltage, over voltage, under-frequency, or over frequency condition. The OFF position opens the dc voltage path to deenergize the ac bus tie contactor and remove external power from the ac buses.

INTERFACE PANEL EH-60A>

The interface panel contains a three-phase ac power jack marked J511 AC PWR which supplies 115 vac. Another power jack, marked J958R ASN132, supplies single-phase, 26 vac power.

ECM ANTENNA SYSTEM INTERFACE EH-60A>

The ECM antenna system is composed of both aircraft and mission equipment. Power to operate the system is provided from the No. 1 DC PRI BUS through the Q/F EQUIP PWR circuit breaker to connector J510 on the mission interface panel. Operator control of the system is provided by the ECM ANTENNA switch located on the center section of the instrument panel. It is a three-position, spring-loaded to OFF, toggle switch. The switch is momentarily placed in the RETRACT or EXTEND position to either fully retract or fully extend the ECM antenna. The retract or extend signal (ground) routes through mission interface connector J970R to the mission equipment relay assembly. Relay contacts in the mission relay assembly and limit switch contacts in the aircraft ECM antenna actuator assembly control mechanical movement of the antenna and provide system status signals.

The linear actuator assembly, a component of the ECM antenna actuator assembly, converts electrical energy to mechanical motion. It operates a clevis pivot in the ECM antenna actuator assembly to position the ECM antenna in the retracted or extended position.

The instrument panel caution/advisory panel ANTENNA RETRACTED capsule is turned on when the ECM antenna is in the fully retracted position. The ANTENNA EXTENDED capsule is controlled by relay and switch contacts that monitor inputs from the copilot's radar altimeter. The capsule is turned on if the ECM antenna is not fully retracted and the altimeter is not installed, has lost power, or is not turned on. It also lights if the antenna is not fully retracted and the helicopter descends below the altimeter's LO bug setting. It does not light during normal operation. An ANTENNA EXTENDED lamp on the mission operators ECM indicator panel does light when the antenna is fully extended during normal operations. The mission equipment relay assembly and ECM antenna actuator assembly limit switches also provide an enable signal to the turnable coupler when the ECM antenna is fully extended.

The lower IFF antenna (avionics equipment) is installed on the bottom of the ECM antenna actuator assembly. Its cable is routed through the ECM antenna actuator assembly to an interface connector at the top of the assembly. The IFF antenna is functionally unrelated to the ECM antenna system.

AC ELECTRICAL POWER INTERFACE

Mission equipment three-phase, 115 vac power is supplied to mission interface panel connector J511 and 26 vac power is supplied to the mission interface panel connector J958R from either the No. 1 generator, No. 2 generator, APU generator, or from an external source. Circuits within the helicopter ac system connect the 115 and 26 vac power source to the mission interface panel according to a predetermined priority. EH-60A > Refer to the ac electrical system description paragraph 1.10. for a description of power source priority. < In addition to power source priority, loads on the ac electrical system determine the conditions under which ac power is applied to the mission interface panel. Power is applied under these conditions:

- No. 1 and No. 2 generators on.
- No. 1 or No. 2 generators on and hydraulic backup pump off.
- APU on, hydraulic backup pump off, and weight-on-wheels.
- No. 1 or No. 2 generator on, APU on, and blade deice off.
- External power on, hydraulic backup pump off, and weight-on-wheels.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

Power is removed from the mission interface panel when the blade deicing system and hydraulic backup pump are on and both No. 1 and No. 2 generators are not on.

MISSION INTERFACE PANEL EH-60A> <

The ac secondary bus (Mission Interface Panel) receives primary, auxiliary, or external electrical power. With both generators operating and their outputs acceptable, the ac secondary bus is powered by the No. 1 ac primary bus. If either the No. 1 or No. 2 generator is off, its output is not acceptable, or if its associated contactor is not working, the ac secondary bus receives primary ac power if the hydraulic backup pump is not on. If either the No. 1 or No. 2 generator is off and the hydraulic backup pump is on, the ac secondary bus receives auxiliary ac power if the APU generator is on. Under these conditions, secondary bus auxiliary power will be disabled if the blade deice system is operated. With the helicopter on the ground, the ac secondary bus receives ac electrical power from the APU generator if operating, or an external power source if the APU is not operating. Secondary bus ground power will be disabled if the backup pump is operating.

MISSION ELECTRICAL INTERFACE EH-60A> <

Refer to WP 0032 00.

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

For location and description of major components, refer to the data in this work package.

EQUIPMENT DATA

For equipment data information, refer to this work package.

ELECTRICAL SYSTEMS

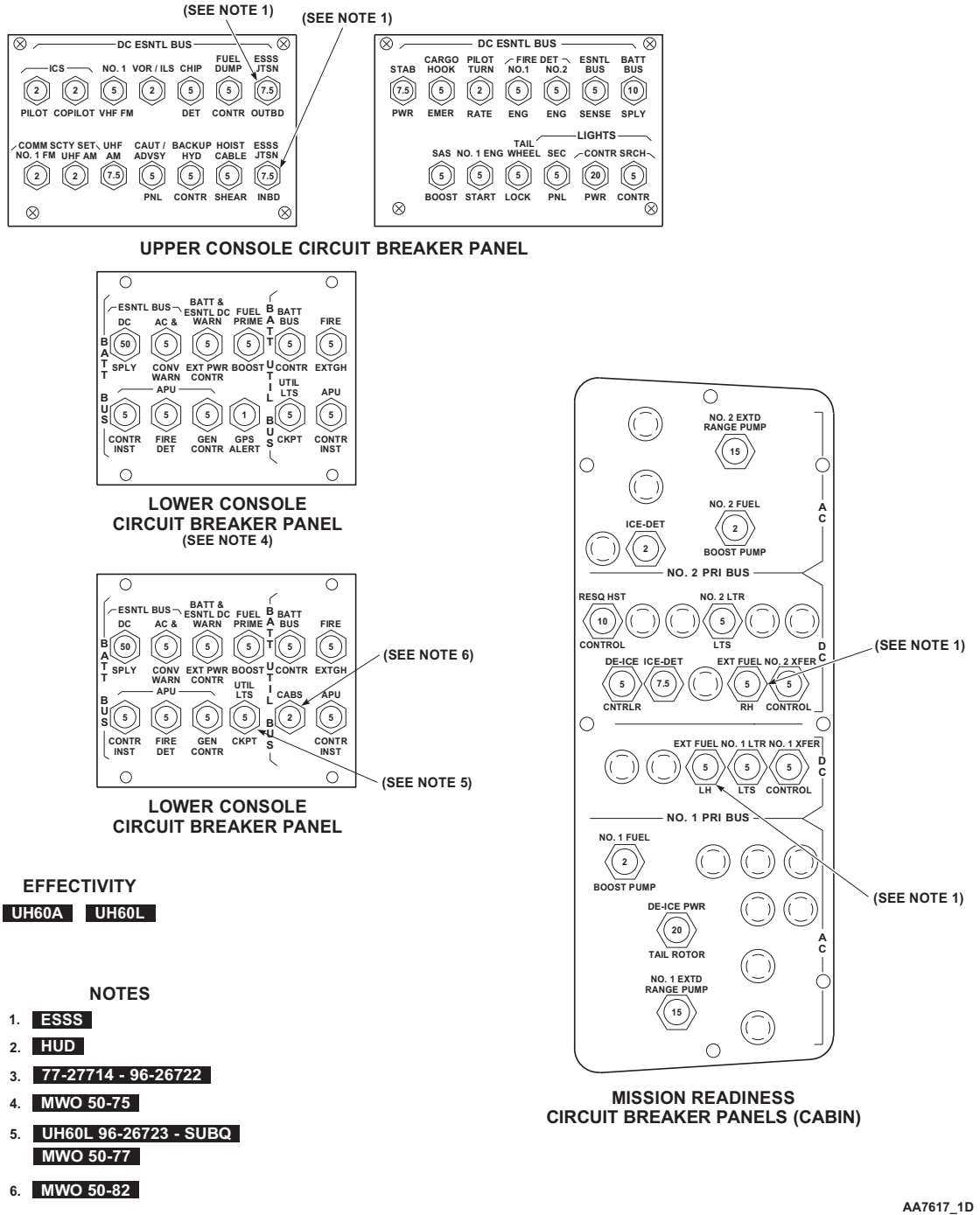
AC ELECTRICAL PRIMARY SYSTEM DESCRIPTION AND DATA

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

PRIMARY AC POWER SYSTEM

Primary ac power is supplied by the No. 1 and No. 2 ac generators (Figures Figure 1. (Sheet 1 of 2), Figure 2. (Sheet 1 of 2), and Figure 3. (Sheet 1 of 2)). Under normal operating conditions, with both generators operating and their outputs acceptable, the No. 1 generator supplies the No. 1 ac primary bus and the No. 2 generator supplies the No. 2 ac primary bus. Both generators are protected from overload by 60 amp current limiters. **EH-60A UH-60A UH-60L >** If the No. 2 generator output is not acceptable, or if the generator is off, or if the associated contactor is not working, the #2 GEN capsule on the caution/advisory panel will light and both ac primary buses (No. 1 and No. 2) will be supplied from the No. 1 generator. Similarly, if the No. 1 generator output is not acceptable, or if the associated contactor is not working, generator is off, or if the associated contactor is not working, the #1 GEN capsule on the caution/advisory panel will light and both ac primary buses (No. 1 and No. 2) will be supplied from the No. 2 generator. **< HH-60A HH-60L >** If the No. 2 generator output is not acceptable, or if the generator is off, or if the associated contactor is not working, the #2 GEN legend on the pilot's and copilot's MFDs legend will light and both ac primary buses (No. 1 and No. 2) will be supplied from the No. 1 generator. Similarly, if the No. 1 generator output is not acceptable, or if the generator is off, or if the associated contactor is not working, the #1 GEN legend on the pilot and copilot MFDs will light and both ac primary buses (No. 1 and No. 2) will be supplied from the No. 2 generator. **<** The ac essential bus is normally supplied with B phase power from the No. 1 ac primary bus. If No. 1 ac primary bus B phase power is not available, the ac essential bus is supplied from B phase of the No. 2 ac primary bus. **HH-60A UH-60A UH-60L >** If no power is present on the ac essential bus, the AC ESS BUS OFF capsule on the caution/advisory panel will light. **<** **HH-60A HH-60L >** If no power is present on the ac essential bus, the AC ESS BUS OFF legend on the pilot and copilot MFDs will light. **<** **UH-60A UH-60L >** The No. 1 ac primary bus also supplies power to a 60 Hz converter (provisional) for two power receptacles. **<HH-60A HH-60L >** The No. 1 ac primary bus also supplies power to a 60 Hz converter for one power receptacle. **<**

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED



EFFECTIVITY

UH60A **UH60L**

NOTES

1. **ESSS**
2. **HUD**
3. **77-27714 - 96-26722**
4. **MWO 50-75**
5. **UH60L 96-26723 - SUBQ**
   MWO 50-77
6. **MWO 50-82**

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Figure 1. Circuit Breaker Panels (Sheet 1 of 2).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

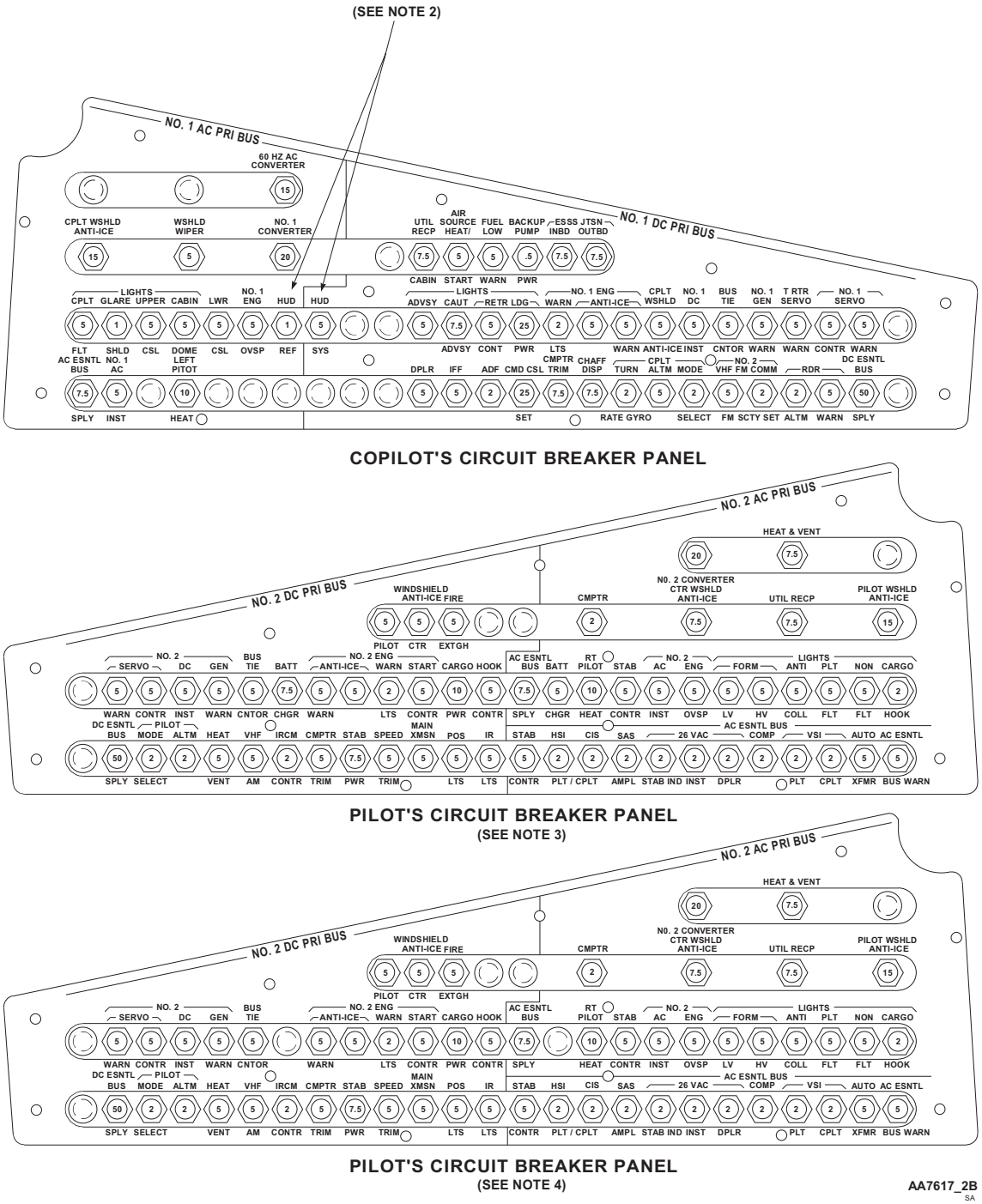
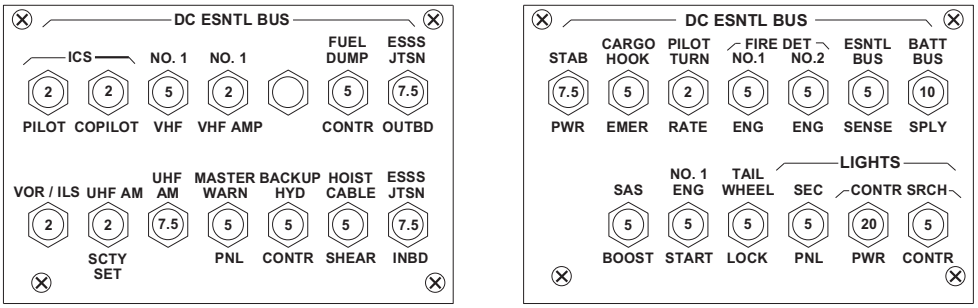
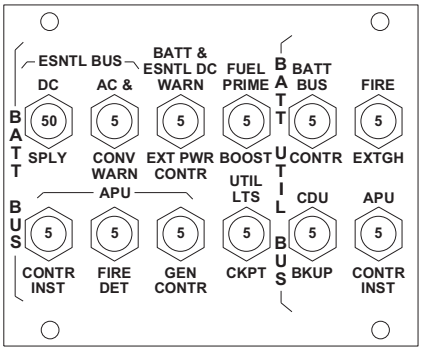


Figure 1. Circuit Breaker Panels (Sheet 2 of 2).

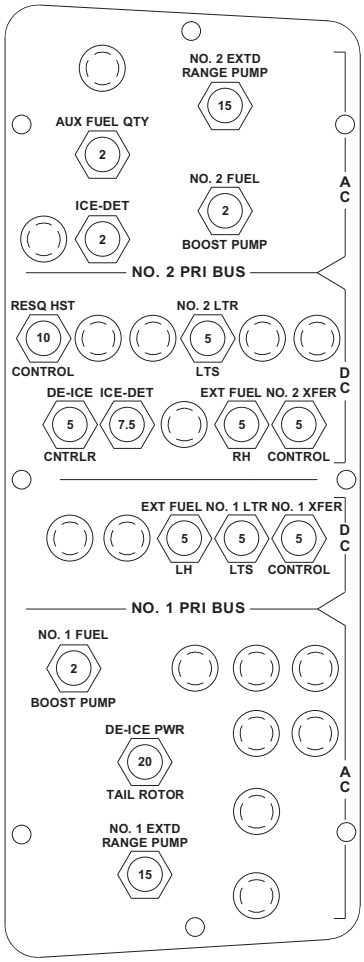
EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED



UPPER CONSOLE CIRCUIT BREAKER PANEL



LOWER CONSOLE
CIRCUIT BREAKER PANEL



MISSION READINESS
CIRCUIT BREAKER PANEL
(CABIN)

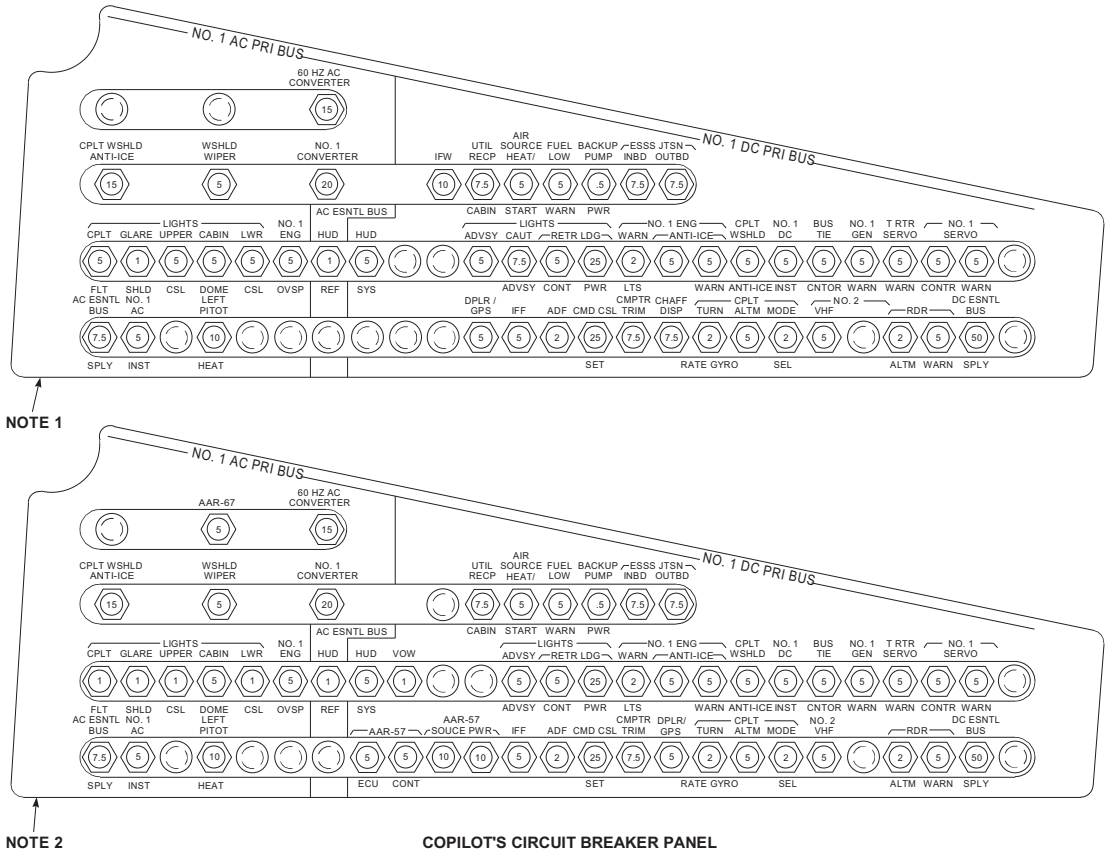
AB2332_1A
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NOTES

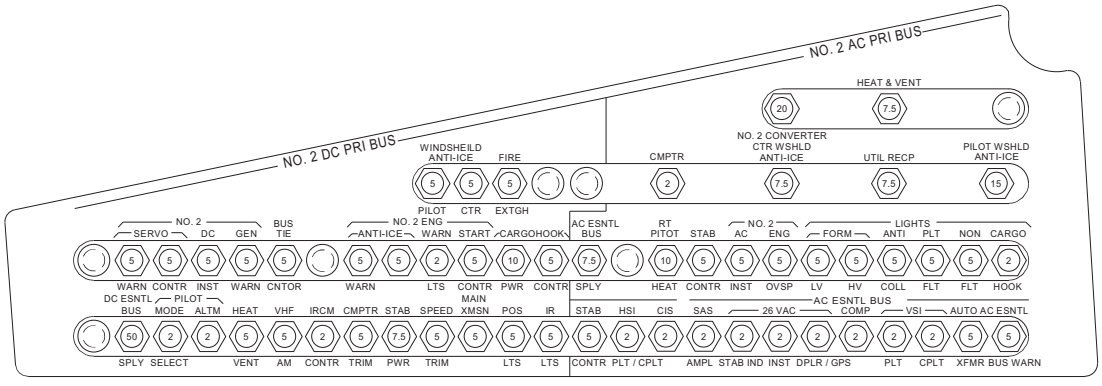
1. WITHOUT CMWS
2. WITH CMWS

Figure 2. Circuit Breaker Panels. **HH-60A HH-60L>** (Sheet 1 of 2).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED



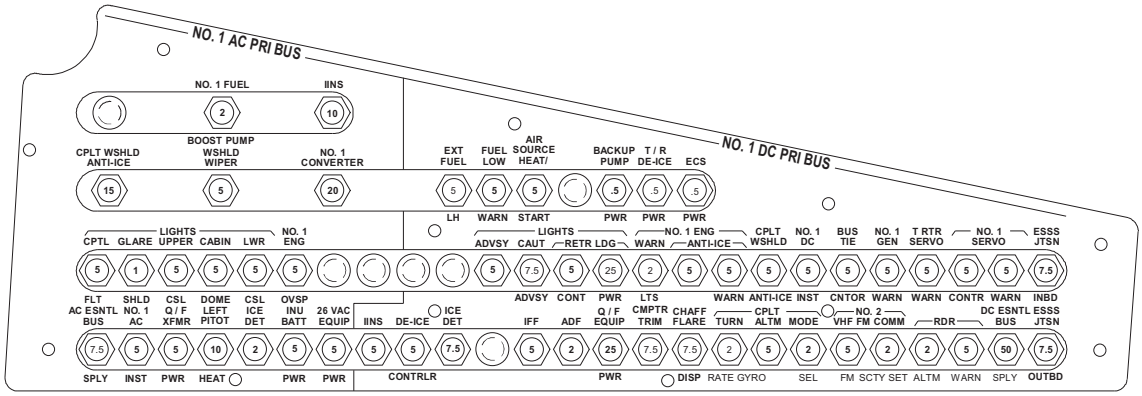
COPILOT'S CIRCUIT BREAKER PANEL



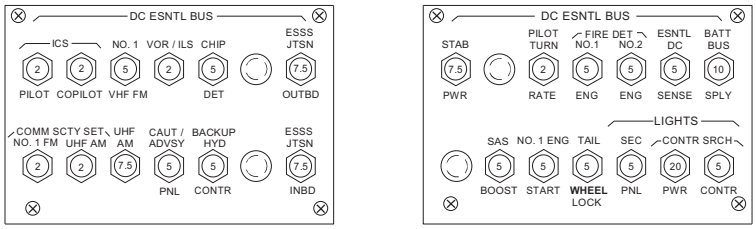
PILOT'S CIRCUIT BREAKER PANEL

Figure 2. Circuit Breaker Panels. **HH-60A HH-60L>** (Sheet 2 of 2).

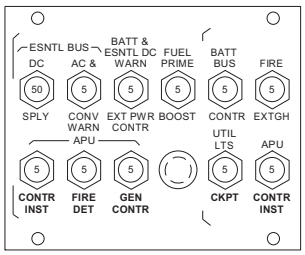
EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED



COPILOT'S CIRCUIT BREAKER PANEL



UPPER CONSOLE CIRCUIT BREAKER PANEL



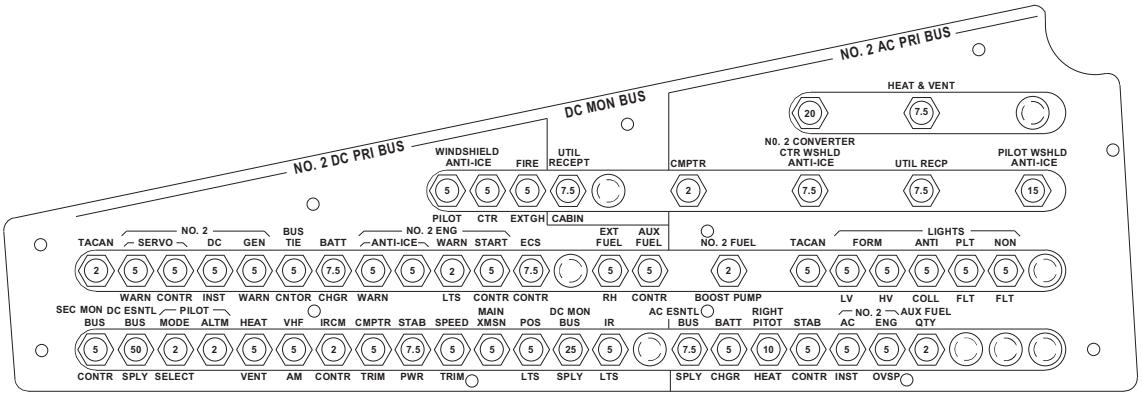
LOWER CONSOLE CIRCUIT BREAKER PANEL

EFFECTIVITY
EH60A

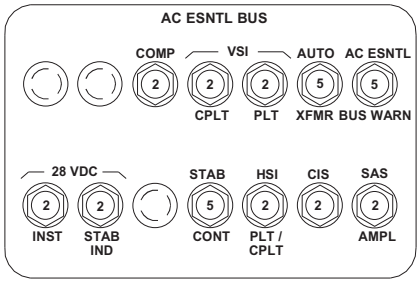
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Figure 3. Circuit Breaker Panels (Sheet 1 of 2).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED



PILOT'S CIRCUIT BREAKER PANEL



AC ESSENTIAL BUS CIRCUIT BREAKER PANEL

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SA

Figure 3. Circuit Breaker Panels (Sheet 2 of 2).

PRIMARY AC POWER DISTRIBUTION

With the No. 1 and No. 2 generators operating and their outputs at rated value, the No. 1 and No. 2 generator contactors K1 and K2 are energized. The No. 1 and No. 2 generator outputs are applied through the main contacts of K1 and K2 to supply the No. 1 and No. 2 ac primary buses, respectively. The No. 1 ac primary bus supplies 115 vac, B phase power through the AC ESNTL BUS SPLY circuit breaker to energize K8 AC ESNTL BUS XFR relay K8. With K8 energized, 115 vac, B phase power from the No. 1 ac primary bus is applied through the energized contacts of K8 to supply the ac essential bus.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

If one generator fails due to overvoltage, undervoltage, or feeder fault, the generator is disabled and the associated ac generator contactor deenergizes to disconnect the generator from its loads. When this occurs, the operating generator will supply both ac primary buses. If the No. 1 generator fails, the No. 2 generator supplies the No. 1 ac primary bus through current limiters and the normally closed main contacts of No. 1 generator contactor K1. If the No. 2 generator fails, the No. 1 generator supplies the No. 2 ac primary bus through current limiters and the normally closed main contacts of ac bus tie contactor K4 and No. 2 generator contactor K2. The 60 amp current limiters protect the operating generator from too much overloading as a result of a feeder fault that may have disabled the failed generator. If there is a loss of B phase power on the No. 1 ac primary bus, K8 AC ESNTL BUS XFR relay K8 will deenergize. When this occurs, 115 vac, B phase power from the No. 2 ac primary bus will be applied through the AC ESNTL BUS SPLY circuit breaker and the normally closed contacts of relay K8, to supply the ac essential bus. If no power is available on the ac essential bus, K13 AC ESNTL BUS FAIL relay K13 will deenergize. This closes the path between the battery bus and the caution/advisory panel AC ESS BUS OFF capsule, and the capsule will go on.

EH-60A > With No. 1 and No. 2 generators operating and their outputs at rated value, three-phase ac primary power is applied to the interface panel ac secondary bus (J511 ac power connector) from the No. 1 ac primary bus. Power is supplied to the ac secondary bus through contacts of energized No. 1 generator contactor, contacts of energized ac secondary bus contactor K11, and secondary bus current limiters. If either generator fails, the operating generator supplies three-phase primary power to the ac secondary bus if emergency hydraulic backup pump operation is not selected. Power is applied through contacts of the energized operating generator contactor, contacts of the deenergized failed generator contactor, contacts of energized ac secondary bus contactor K11, and secondary bus current limiters, to the interface panel. **<**

POWER GENERATION

Operation of the No. 1, No. 2, and APU generating systems is identical. With the generators driven at rated speed, the permanent magnet generator (PMG) section of each generator supplies ac voltage to the PMG rectifier of the associated generator control unit (GCU). The ac voltage is rectified and used as supply voltage for the GCU circuitry. When the No. 1, No. 2, or APU GENERATORS switch is placed ON, the voltage regulator section of the GCU controls the current flow to the exciter field of the generator, and the generator main output builds up. This output is monitored by the GCU and when it reaches at least 95 vac at a frequency of between 370 and 380 Hz, power-ready sensing circuitry connects it to its loads. For each generator system, the main AC output and the primary DC bus output can be monitored at a test connector located on the associated junction box. With the generator switch at TEST, the generator main output is disconnected from the ac primary bus. **EH-60A UH-60A UH-60L >** With all generators running, the #1 and #2 GEN capsules go off, and the APU GEN ON capsule goes on **<**. **HH-60A HH-60L >** With all generators running, the #1 and #2 GEN legends go off, and the APU GEN ON legend goes on. **<**

No. 1 and No. 2 Generator Description

The No. 1 and No. 2 oil-cooled, brushless generators, mounted on the left and right accessory modules of the main gear box, are driven whenever the main rotor head is turning. Each generator, rated at 30/45 KVA at 115/200 volts, is connected for a 4-wire output, with grounded neutral, furnishing three-phase alternating current. The generator drive shaft is normally driven at about 12,000 RPM to maintain an output frequency of 400 Hz. The generator output voltage is regulated by a voltage regulator within the generator control unit, which varies the exciter control field.

The No. 1 and No. 2 generators, driven by the left and right accessory gear box modules, respectively, are oil-spray cooled brushless generators rated at 30/45 KVA at 115/200 vac, three-phase. The APU generator, driven by the APU turbine engine, is an air-cooled brushless generator rated at 20/30 KVA at 115/200 vac, three-phase. Each generator output is controlled by its generator control unit (GCU). The GCU contains sensing circuits to disconnect the generator from its respective loads when an overvoltage, undervoltage, underfrequency, or feeder-fault condition occurs.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

No. 1 and No. 2 Generator Operation

With the left and right accessory gear box modules driving the generators at rated speed, each generator's 12-pole permanent magnet generator (PMG) applies three-phase ac voltage to the PMG rectifier in the generator control unit (GCU). The PMG rectifier rectifies and filters the ac voltage and applies a dc voltage to the No. 1 and No. 2 GENERATORS switches and to a regulated dc power supply that supplies the GCU sensing circuits. When the generator control switch is placed ON, the dc voltage from the PMG rectifier is routed through AND gates 13 and 3. With no inhibit signal from OR gate 1, gate 3 is enabled, energizing generator control relay (GCR) K1. Energizing the GCR routes PMG power from the PMG rectifier to the voltage regulator, and also energizes the generator exciter control field. The exciter is rotated in the magnetic field produced by the exciter control field, thereby producing three-phase ac voltages that are applied to diode rectifiers. A flywheel diode across the exciter control field input in the GCU allows the field to collapse rapidly, increasing response from the voltage regulator. The positive half cycle of each phase of the exciter voltage activates one of the diodes and causes a continuous flow of current in the rotating field. This moving field causes a voltage to be induced in the main generator winding, which supplies a three-phase ac output voltage.

The same dc voltage that is applied to GCU AND gates 13 and 3 through the ON position of the generator control switch is also applied to AND gates 7 and 8. AND gate 7 receives a second inhibiting input from OR gate 6, which senses an underfrequency or overvoltage condition from the respective sensing circuits. The voltage sensing circuit monitors the main generator's three-phase output for deviations in voltage from specified limits. The frequency sensing circuit monitors one of the three PMG voltages for frequency deviations. With no underfrequency, undervoltage, or overvoltage condition present, no inhibit signal is passed through OR gate 6. As a result, gate 7 is enabled and senses a power ready condition. With gate 7 satisfied, a signal through OR gate 9 satisfies one half of AND gate 11. With no signal from OR gate 2 or TD3 through OR gate 12, gate 11 is satisfied and the contactor control relay (CCR) K2 energizes. With the CCR energized, the logic 0 is removed from AND gates 8 and 4 and dc voltage from the PMG rectifier is applied through the contacts of No. 2 and No. 1 GENERATORS switches to energize No. 2 and No. 1 generator contactors K2 and K1, respectively. **EH-60A UH-60A UH-60L >** Energizing the CCR also opens the path between the No. 2 dc primary bus and the caution/advisory panel #2 GEN capsule, and between the No. 1 dc primary bus and the caution/advisory panel #1 GEN capsule. The capsules then go off. **< HH-60A HH-60L >** Energizing the CCR also opens the path between the No. 2 dc primary bus and the pilot's and copilot's MFDs #2 GEN legends, and between the No. 1 dc primary bus and the MFD #1 GEN legend. The legends then go off. **<**

Dual Generator Operation

The main generator is protected from transient current overloads and feeder faults. The current monitoring circuit consists of a current transformer, on the generator's feeder lines to the generator contactor, and an internal generator current limiter circuit. Current limiting is performed by the current transformer, connected in series with the current limit circuit within the generator, to regulate the output voltage. As the load causes the current from the main generator to increase, the induced voltage in the current transformer windings increases proportionately to the load current. The GCU monitors this induced voltage and regulates the field current of the main generator. When the current from the current transformer winding is at the preset value, the GCU reduces the current in the exciter control field, thereby causing less voltage to be generated by the exciter. This action reduces the dc current through the rotating field, thereby lowering the induced voltage in the main generator. Less output results in a reduction of current in the field of the main generator, thereby returning the output current to the preset value. Under normal operation, the current flowing through the two current transformer windings around the main generator output are equal and out-of-phase, resulting in zero differential current. If a feeder fault (short circuit to ground) should occur, an unbalance condition is developed, producing a differential current in the current transformer loop. This differential current is sensed by the GCU feeder fault sensing circuit, which applies a signal directly to OR gate 2. The signal is routed through OR gate 2, through OR gate 1, to AND gate 3, inhibiting AND gate 3. With AND gate 3 inhibited, CGR relay K1 trips, and the generator is deenergized. The same signal from OR gate 2 inhibits gate 11 through gate 12, to immediately open CCR relay K2. **EH-60A UH-60A UH-60L >** The generator's load is disconnected and the caution/advisory panel #1 GEN or #2 GEN capsule goes on. </applic> **HH-60A HH-60L >** The generator's load is disconnected and the pilot's and copilot's MFDs #1 GEN or #2 GEN leg-

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

end goes on. <The output of OR gate 2 is also applied to AND gate 13, through TD5, back into OR gate 2, causing OR gate 2 output to be continuous. The GCR and CCR relays cannot release until the signal to AND gate 13 is removed by placing the generator control switch to OFF/RESET. <

If an overvoltage condition is sensed, a trip signal is developed through inverse time delay TD1; the greater the overvoltage, the shorter the time delay. This trip signal is applied to OR gate 2 and the GCR and CCR relays open as described above.

If an undervoltage condition is sensed, a GCR trip signal is developed through fixed time delay TD2 to OR gate 2, causing the GCR and CCR relays to open. At the same time an undervoltage is sensed, gate 7 is inhibited through gate 6. Thus, if you cycle the generator control switch from OFF/RESET to ON, the generator is energized, but the CCR relay is not allowed to close and apply the underfrequency, undervoltage or overvoltage condition onto the load bus. The CCR relay closes only when the frequency and voltage become acceptable again.

If an underfrequency condition is sensed (during ground operation), it produces a trip signal through fixed time delay TD3 to OR gate 1. The signal from OR gate 1 inhibits gate 3, opening the GCR relay, thereby deenergizing the generator. The signal from TD3 also causes the CCR relay to open by inhibiting AND gate 11 via OR gate 12. When the CCR relay opens, a logic 0 inhibit signal is applied to AND gate 4. When the frequency is again within limits, the inhibit at gate 3 is removed and the GCR relay closes again. The input to AND gate 11 is not satisfied until the underfrequency inhibit signal at gate 7 through gate 6 disappears. This occurs when the power ready signal has been restored. When the frequency is within limits, the CCR relay again closes, energizing the bus load. During flight, with the helicopter's weight-off-wheels, the landing gear drag beam switch is closed. This applies a ground to the underfrequency sensing circuit, disabling it. **W/O ESSS >** The left drag beam switch provides the underfrequency disable signal. **<ESSS >** The right drag beam switch provides the underfrequency disable signal. Thus, the generator will not be deenergized and disconnected from its load during an autorotative flare, when generator frequency decreases. <

EH-60A UH-60A UH-60L > Too much wear of the generator main bearing is detected during generator operation and a caution/advisory panel indication is given. < **HH-60A HH-60L >** Too much wear of the generator main bearing is detected during generator operation and a pilot's and copilot's MFDs indication is given. < When the main bearing is worn a predetermined amount, a detector ring with a sensing lead contacts the outer race of the generator auxiliary bearing, grounding the sensing lead. **EH-60A UH-60A UH-60L >** The ground is applied from the generator to the caution/advisory panel, and the #1 GEN BRG or #2 GEN BRG capsule goes on. < **HH-60A HH-60L >** The ground is applied from the generator to the pilot's and copilot's MFDs #1 GEN BRG or #2 GEN BRG legend goes on. <

With the No. 1 and No. 2 generators operating at rated value, the three-phase ac output of the No. 2 generator is applied to the No. 2 test receptacle for monitoring, and through the energized main contacts of No. 2 generator contactor K2 to supply the No. 2 ac primary bus. Similarly, the three-phase ac output of the No. 1 generator is applied to the No. 1 test receptacle and through the energized main contacts of No. 1 generator contactor K1 to supply the No. 1 ac primary bus. The No. 1 ac primary bus supplies 115 vac. B phase power, through the AC ESNTL BUS SPLY circuit breaker, to the coil and contacts of ac essential bus XFR relay K8. With relay K8 energized, the 115 vac, B phase power is supplied to the ac essential bus. The ac essential bus applies 115 vac, B phase power to an autotransformer that supplies 26 vac to navigation instrument loads. When the generator control switch is placed to TEST, system operation is the same as for the ON position, except that generator contactors K1 and K2 remain de-energized and GCU test relay K3 is energized. With K3 energized, its contacts open and the caution/advisory panel GEN capsules go off. The generator outputs are not applied to the ac buses but are applied to the test receptacles for monitoring.

EH-60A > With the No. 1 and No. 2 generators operating at rated value, three-phase ac electrical power from the No. 1 ac primary bus is applied to the ac secondary bus. Power is supplied through contacts of energized K1 No. 1 generator contactor, contacts of energized ac secondary bus contactor, and secondary bus current limiters to the interface panel. <

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

Single No. 1 Generator Operation

With only the No. 1 GENERATOR switch ON, the No. 1 generator output builds up and is controlled by the No. 1 GCU. When the No. 1 generator output reaches rated value, No. 1 generator contactor K1 is energized and the three-phase ac generator output is applied through the energized main contacts of K1 to supply the No. 1 ac primary bus. **EH-60A UH-60A UH-60L >** The path between the No. 1 dc primary bus and the caution/advisory panel#1 GEN capsule is open through open auxiliary contacts of K1 and the capsule is off. **< HH-60A HH-60L >** The path between the No. 1 dc primary bus and the pilot's and copilot's MFDs#1 GEN legends is open through open auxiliary contacts of K1 and the capsule is off. **<** The No. 1 ac primary bus supplies 115 vac, B phase power, through the AC ESNTL BUS SPLY circuit breaker, to the coil and contacts of K8 AC ESNTL BUS XFER relay K8. With relay K8 energized, 115 vac, B phase power is supplied to the ac essential bus. The ac essential bus applies 115 vac, B phase power to an autotransformer, which supplies 26 vac to navigation instrument loads.

With No. 2 GENERATORS switch OFF, the No. 2 generator output does not build up. **EH-60A UH-60A UH-60L >** No. 2 generator contactor K2 is deenergized, the path between the No. 2 dc primary bus and the caution/advisory panel #2 GEN capsule is closed through normally closed auxiliary contacts of K2, and the capsule is on. **< HH-60A HH-60L >** No. 2 generator contactor K2 is deenergized, the path between the No. 2 dc primary bus and the pilot's and copilot's MFDs #2 GEN legends is closed through normally closed auxiliary contacts of K2, and the capsule is on. **<** The three-phase output of the No. 1 generator is applied from the No. 1 ac primary bus, through current limiters CL4, 5, and 6, and through the normally closed main contacts of ac bus tie contactor K4 and No. 2 generator contactor K2, to supply the No. 2 ac primary bus.

EH-60A > With only the No. 1 GENERATOR switch ON, the ac secondary bus is supplied by the No. 1 ac primary bus if the hydraulic backup pump is off. Power is applied through contacts of energized No. 1 generator contactor, contacts of energized ac secondary bus contactor, and secondary bus current limiters to the interface panel. If backup pump operation is required, the ac secondary bus instead receives auxiliary power from the APU generator, if on. This protects the No. 1 generator from excessive current damage. **<**

Single No. 2 Generator Operation

With only the No. 2 GENERATOR switch ON, the No. 2 generator output builds up and is controlled by the No. 2 GCU. When the No. 2 generator output reaches rated value, No. 2 generator contactor K2 is energized and the three-phase ac generator output is applied through the energized main contacts of K2 to supply the No. 2 ac primary bus. **EH-60A UH-60A UH-60L >** The path between the No. 2 dc primary bus and the caution/advisory panel#2 GEN capsule is open through the open auxiliary contacts of K2 and the capsule is off. **< HH-60A HH-60L >** The path between the No. 2 dc primary bus and the pilot's and copilot's MFDs#2 GEN legends is open through the open auxiliary contacts of K2 and the capsule is off. **<**

With No. 1 GENERATOR switch OFF, the No. 1 generator output does not build up. **EH-60A UH-60A UH-60L >** No. 1 generator contactor K1 is deenergized, the path between the No. 1 dc primary bus and the caution/advisory panel #1 GEN capsule is closed through normally closed auxiliary contacts of K1, and the capsule is on. **< HH-60A HH-60L >** No. 1 generator contactor K1 is deenergized, the path between the No. 1 dc primary bus and the pilot's and copilot's MFDs #1 GEN legends is closed through normally closed auxiliary contacts of K1, and the capsule is on. **<** The three-phase output of the No. 2 generator is applied from the No. 2 ac primary bus, through current limiters CL1, CL2, and CL3, and the normally closed contacts of No. 1 generator contactor K1 to supply the No. 1 ac primary bus. The No. 1 ac primary bus supplies 115 vac, B phase power, through the AC ESNTL BUS SPLY circuit breaker, to the coil and contacts of AC ESNTL BUS XFER relay K8. With relay K8 energized, the 115 vac, B phase power is supplied to the ac essential bus. The ac essential bus applies 115 vac, B phase power to an autotransformer that supplies 26 vac to navigation instrument loads.

EH-60A > With only the No. 2 GENERATOR switch ON, the ac secondary bus is connected to the No. 2 ac primary bus if the hydraulic backup pump is off. Power is applied through contacts of energized No. 2 generator contactor, current limiters CL1, CL2, and CL3, contacts of deenergized No. 1 generator contactor, contacts of energized ac secondary bus contactor, and secondary bus current limiters, to the interface panel. If backup pump operation is required, the ac secondary bus instead receives auxiliary power from the APU generator, if on. This protects the No. 2 generator from excessive current damage. **<**

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

For location and description of major components, refer to the data in this work package.

EQUIPMENT DATA

For equipment data information, refer to this work package.

ELECTRICAL SYSTEMS

AC ELECTRICAL AUXILIARY POWER SYSTEM DESCRIPTION AND DATA

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

APU GENERATOR DESCRIPTION

The APU air-cooled, brushless generator, mounted on the APU, is driven whenever the APU is operating. The generator, rated at 20/30 KVA at 115/200 volts, is connected for a 4-wire Wye output, with grounded neutral, furnishing three-phase alternating current. The generator drive shaft is normally driven at about 12,000 RPM to maintain an output frequency of 400 Hz. The generator output voltage is regulated by a voltage regulator within the generator control unit which varies the exciter control field. The generator is cooled by drawing air in at the front end and exhausting it at the drive end.

The No. 1 and No. 2 generators, driven by the left and right accessory gear box modules, respectively, are oil-spray cooled brushless generators rated at 30/45 KVA at 115/200 vac, three-phase. The APU generator, driven by the APU turbine engine, is an air-cooled brushless generator rated at 20/30 KVA at 115/200 vac, three-phase. Each generator output is controlled by its generator control unit (GCU). The GCU contains sensing circuits to disconnect the generator from its respective loads when an overvoltage, undervoltage, underfrequency, or feeder-fault condition occurs.

AUXILIARY AC POWER SYSTEM

Auxiliary ac power is supplied by the APU generator. When the No. 1 and No. 2 ac generators are off and the APU generator output is acceptable, the APU generator supplies the No. 1 and No. 2 ac primary buses. EH-60A UH-60A UH-60L > The APU GEN ON capsule on the caution/advisory panel will then light. < HH-60A HH-60L > The APU GEN ON legends on pilot's and copilot's MFDs will then light. < When the No. 1, No. 2 and APU generators are off, external ac power can supply the No. 1 and No. 2 ac primary buses. EH-60A UH-60A UH-60L > With external ac power connected and the helicopter battery installed, the EXT PWR CONNECTED capsule on the caution/advisory panel will light. < HH-60A HH-60L > With external ac power connected and the helicopter battery installed, the EXT PWR CONNECTED legends on pilot's and copilot's MFDs will light. < When the external ac power is acceptable, it will supply the No. 1 and No. 2 ac primary buses.

AUXILIARY POWER DISTRIBUTION

With the No. 1 and No. 2 generators OFF and the APU generator operating at its rated value, APU/external power contactor K3 is energized. DC voltage is applied through a blocking diode and the normally closed auxiliary contacts of No. 2 and No. 1 generator contactors K2 and K1, to energize ac bus tie contactor K4. The three-phase ac output of the APU generator is applied through the energized main contacts of contactors K3 and K4 and the normally closed main contacts of contactor K2 to supply the No. 2 ac primary bus. The No. 1 ac primary bus is supplied through current limiters and the normally closed main contacts of contactor K1.

EH-60A > With both No. 1 and No. 2 generators off and the APU generator on, the ac secondary bus receives auxiliary power with weight-on-wheels and the backup pump off. Under these conditions, ac electrical power is supplied from the APU generator, through contacts of energized APU/external power contactor, contacts of energized ac bus tie contactor, contacts of deenergized No. 2 generator contactor, current limiters CL1, CL2, and CL3, contacts of deenergized No. 1 generator contactor, contacts of energized ac secondary bus contactor, and secondary bus current limiters, to the mission interface panel. <

With either No. 1 or No. 2 generators on, the APU generator on, and the backup pump on, the ac secondary bus receives auxiliary power if the blade deice system is off. Under these conditions, ac electrical power is supplied from the APU, through energized ac secondary bus contactor and secondary bus current limiters, to the interface panel.

EXTERNAL POWER DISTRIBUTION

With the No. 1, No. 2, and APU generators off, a source of external ac power can be connected to supply the helicopter buses. When a source of 115 vac, three-phase power is connected to the ac external power receptacle

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

and the battery is installed in the helicopter, dc voltage from the battery bus is applied through the power receptacle and jumpered pins in the external power cart plug. **EH-60A UH-60A UH-60L >** This lights the caution/advisory panel EXT PWR CONNECTED capsule. < **HH-60A HH-60L >** This lights the pilot's and copilot's MFDs EXT PWR CONNECTED legends. < The external power is monitored for proper phase rotation, voltage, and frequency by the external power monitor panel. When external power is acceptable, the monitor panel provides a dc output voltage. When you place the EXT PWR switch ON, the monitor panel dc voltage is applied through the switch. It goes through a blocking diode and the normally closed auxiliary contacts of No. 2 and No. 1 generator contactors K2 and K1 to energize ac bus tie contactor K4. The three-phase external ac power is applied through the normally closed main contacts of contactor K3, the energized main contacts of contactor K4 and the normally closed main contacts of contactor K2 to supply the No. 2 ac primary bus. The No. 1 ac primary bus is supplied through current limiters and the normally closed main contacts of contactor K1. If an overvoltage, undervoltage, overfrequency, or underfrequency fault occurs, the external power monitor panel dc output circuit opens; the ac bus tie contactor K4 will be deenergized; and the external ac power will be disconnected from the helicopter buses. When the fault is corrected, external power can be reconnected to the buses if you place the EXT PWR switch to RESET and then back ON.

The three-phase ac output of the APU generator is applied through the energized main contacts of contactors K3 and K4 and the normally closed main contacts of contactor K2 to supply the No. 2 ac primary bus. The No. 1 ac primary bus is supplied through current limiters. CL1, CL2, and CL3 and the normally closed main contacts of contactor K1. The No. 1 ac primary bus supplies 115 vac, B phase power, through the AC ESNTL BUS SPLY circuit breaker, to the coil and contacts of ac essential bus XFR relay K8. With relay K8 energized, the 115 vac, B phase power is supplied to the ac essential bus. The ac essential bus applies 115 vac, B phase power to an autotransformer, which supplies 26 vac to navigation instrument loads. With the APU GENERATOR switch to TEST, APU/external power contactor K3 remains deenergized and the APU generator output is applied only to the test receptacle. The dc voltage from the GCU PMG rectifier is applied through the TEST position of the switch to light the caution/advisory panel APU GEN ON capsule.

EH-60A > With both the No. 1 and No. 2 generators off and the APU generator on, the APU generator supplies auxiliary power to the ac secondary bus during weight-on-wheels and if the hydraulic backup pump is off. Under these conditions, ac electrical power is supplied from the APU generator, through contacts of energized APU/external power contactor, contacts of energized ac bus tie contactor, contacts of deenergized No. 2 generator contactor, contacts of energized ac secondary bus contactor, and ac secondary bus current limiters, to the interface panel. To avoid overloading the APU generator under these conditions, auxiliary power to the ac secondary bus is disabled if the backup pump is turned on. <

EH-60A > With either the No. 1 or No. 2 generators on, the APU generators on, and the backup pump on, the APU supplies auxiliary power to the ac secondary bus if blade deice is not on. Under these conditions, ac electrical power is supplied from the APU generator, through contacts of energized ac secondary bus contactor and ac secondary bus current limiters, to the interface panel. To avoid overloading the APU generator under these conditions, auxiliary power to the ac secondary bus is disabled if blade deice operation is selected. <

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

For location and description of major components, refer to the data in this work package.

EQUIPMENT DATA

If applicable, refer to WP 1654 00, WP 1655 00, WP 1656 00 and WP 1707 00 for equipment data information.

ELECTRICAL SYSTEMS

AC ELECTRICAL EXTERNAL POWER SYSTEM DESCRIPTION AND DATA

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

EXTERNAL POWER DISTRIBUTION

With the No. 1, No. 2, and APU generators off, a source of external ac power can be connected to supply the helicopter buses. When a source of 115 vac, three-phase power is connected to the ac external power receptacle and the battery is installed in the helicopter, dc voltage from the battery bus is applied through the power receptacle and jumpered pins in the external power cart plug. **EH-60A UH-60A UH-60L >** This lights the caution/advisory panel EXT PWR CONNECTED capsule. **< HH-60A HH-60L >** This lights the pilot's and copilot's MFDs EXT PWR CONNECTED legends. **<** The external power is monitored for proper phase rotation, voltage, and frequency by the external power monitor panel. When external power is acceptable, the monitor panel provides a dc output voltage. When you place the EXT PWR switch ON, the monitor panel dc voltage is applied through the switch. It goes through a blocking diode and the normally closed auxiliary contacts of No. 2 and No. 1 generator contactors K2 and K1 to energize ac bus tie contactor K4. The three-phase external ac power is applied through the normally closed main contacts of contactor K3, the energized main contacts of contactor K4 and the normally closed main contacts of contactor K2 to supply the No. 2 ac primary bus. The No. 1 ac primary bus is supplied through current limiters and the normally closed main contacts of contactor K1. If an overvoltage, undervoltage, overfrequency, or underfrequency fault occurs, the external power monitor panel dc output circuit opens; the ac bus tie contactor K4 will be deenergized; and the external ac power will be disconnected from the helicopter buses. When the fault is corrected, external power can be reconnected to the buses if you place the EXT PWR switch to RESET and then back ON.

EH-60A > With the No. 1, No. 2, and APU generators OFF, the helicopter weight-on-wheels, the hydraulic backup pump off, and an external source connected, the external source supplies ac electrical power to the ac secondary bus. Under these conditions, power is routed through the contacts of deenergized APU/EXT power contactor, contacts of energized ac bus tie contactor, contacts of deenergized No. 2 generator contactor, current limiters CL1, CL2, and CL3, contacts of deenergized No. 1 generator contactor, contacts of energized ac secondary bus contactor, and secondary bus current limiters to the interface panel. **<**

EXTERNAL POWER OPERATION

With the No. 1, No. 2, and APU generators OFF, an external power source can be connected to supply all ac buses. A source of 115 vac, three-phase power is connected to the external power receptacle. With a battery installed in the helicopter and the BATT switch ON, the battery supplies power to the battery bus. **EH-60A UH-60A UH-60L >** DC voltage from the battery bus is applied through the power receptacle and jumpered pins in the external power cart plug to light the caution/advisory panel EXT PWR CONNECTED capsule. **< HH-60A HH-60L >** DC voltage from the battery bus is applied through the power receptacle and jumpered pins in the external power cart plug to light the pilot's and copilot's MFDs EXT PWR CONNECTED legends. **<** The external power monitor panel monitors the external power for proper phase rotation, voltage, and frequency. One phase of external power is also supplied to a power supply in the monitor panel that provides dc voltage to the sensing circuits and to an output circuit. When the external power is acceptable, the monitor panel output circuit closes and applies dc voltage to the EXT PWR switch. With the No. 1, No. 2, and APU generators off, No. 1 and No. 2 generator contactors K1 and K2 and APU/external power contactor K3 are deenergized. When you place the EXT PWR switch ON, the dc voltage is applied through a blocking diode and the normally closed auxiliary contacts of contactors K2 and K1 to energize ac bus tie contactor K4. The blocking diode prevents 28 vdc from being applied to the EXT PWR switch when the APU generator is on.

The three-phase ac power is applied from the external power receptacle through the normally closed main contacts of contactor K3, the energized main contacts of contactor K4, and the normally closed main contacts of contactor K2 to supply the No. 2 ac primary bus. The No. 1 ac primary bus is supplied through current limiters CL1, CL2, and CL3 and the normally closed main contacts of contactor K1. The No. 1 ac primary bus supplies 115 vac, B phase power, through the AC ESNTL BUS SPLY circuit breaker, to the coil and contacts of ac essential bus XFR relay K8. With relay K8 energized, and 115 vac, B phase power is supplied to the ac essential bus. The

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

ac essential bus applies 115 vac, B phase power to an autotransformer that supplies 26 vac to navigation instrument loads.

An overvoltage, undervoltage, overfrequency, or underfrequency fault in the external power is sensed by the external power monitor panel. When this occurs, the monitor panel output circuit opens, deenergizing ac bus tie contactor K4 and removing the external power from the ac buses. When the fault is corrected, you can reenergize contactor K4 and reconnect external power to the buses by setting the EXT PWR switch to RESET and then back to ON.

EH-60A > With the No. 1, No. 2, and APU generators OFF, the helicopter weight-on-wheels, an external power source connected, and the EXT PWR switch ON, external power is applied to the ac secondary bus if the hydraulic backup pump is off. External power is supplied from the external power receptacle, through contacts of deenergized APU/EXT power contactor, contacts of energized ac bus tie contactor, contacts of deenergized No. 2 generator contactor, current limiters CL1, CL2, and CL3, contacts of deenergized No. 1 generator contactor, contacts of energized secondary bus contactor, and secondary bus current limiters, to the interface panel. To avoid overloading the external power source, external power to the ac secondary bus is disabled if the backup pump is turned on. **<**

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

For location and description of major components, refer to the data in this work package.

EQUIPMENT DATA

For equipment data information, refer to this work package.

ELECTRICAL SYSTEMS

DC ELECTRICAL SYSTEM DESCRIPTION AND DATA

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

DC ELECTRICAL SYSTEM DESCRIPTION

Helicopter dc electrical power is provided by a primary dc system (Figure 1Figure 2Figure 3 or Figure 4). **EH-60A UH-60A UH-60L >** The primary dc system consists of two converters, supplied from the ac power system, and associated caution/advisory capsules. **< HH-60A HH-60L >** The primary dc system consists of two converters, supplied from the ac power system, and associated MFD/caution/advisory legends. **< 77-27714-96-26722 EH-60A >** The battery system consists of a NiCad battery with a battery analyzer/conditioner, battery relay, battery switch, and its associated caution/advisory capsules. **< UH-60L 96-26723-SUBQ MWO 50-77 >** The battery system consists of a lead acid battery, battery relay, battery switch, and its associated caution/advisory capsules. **< HH-60A HH-60L >** The battery system consists of a lead acid battery, battery relay, battery switch, and its associated MFD/caution/advisory legends. **<** DC power is distributed to the helicopter buses through a series of contactors and relays. The primary dc system supplies electrical power to the No. 1 and No. 2 dc primary buses, the dc essential bus, and the battery bus. **EH-60A >** Primary dc electrical power is also supplied to the dc monitor bus and the mission interface panel. **<**The battery always supplies the battery utility bus. The battery also supplies power to the battery bus when no ac electrical power is supplied to the helicopter buses. The battery bus controls APU starting on the ground, or in the air if both ac generators fail.

The No. 1 and No. 2 converters receive three-phase ac power from the No. 1 and No. 2 ac primary buses. With both converters operating normally, the No. 1 converter supplies the No. 1 dc primary bus and the No. 2 converter supplies the No. 2 dc primary bus. **EH-60A UH-60A UH-60L >** If the No. 2 (or No. 1, as applicable) converter has no output or if the associated contactor is not working, the #2 (or #1) CONV capsule on the caution/advisory panel will light and the No. 2 (or No. 1) dc primary bus will be supplied from the No. 1 (or No. 2) dc primary bus through a 100-amp current limiter. **< HH-60A HH-60L >** If the No. 2 (or No. 1, as applicable) converter has no output or if the associated contactor is not working, the #2 (or #1) CONV legend on pilot's and copilot's MFDs will light and the No. 2 (or No. 1) dc primary bus will be supplied from the No. 1 (or No. 2) dc primary bus through a 100-amp current limiter. **<** The dc essential bus is normally supplied by the No. 1 dc primary bus. If there is no power on the No. 1 dc primary bus, the dc essential bus is supplied by the No. 2 dc primary bus. With the dc essential bus supplied from either the No. 1 or No. 2 dc primary bus, the battery bus is supplied from the dc essential bus. **UH-60A UH-60L >** The No. 1 and No. 2 primary bus also supplies power to a cabin utility receptacle and a command console power receptacle. **<**

EH-60A > Provide additional dc outputs to power associated quick fix equipment. **<** Power for the dc monitor bus is supplied by the No. 2 dc primary bus. The dc monitor bus supplies power to a cabin utility receptacle. The mission interface panel has two dc power output jacks. J510 receives dc power from the No. 1 dc primary bus. J512 receives dc power from the No. 2 dc primary bus through current limiter CL10. Contactors associated with the dc monitor bus and connector J512 remove power if a converter fails.

77-27714-96-26722> The battery is connected directly to and always supplies the battery utility bus. When both converters are off and the battery switch is ON, the battery also supplies the battery bus and the battery bus supplies the dc essential bus. Battery temperature and percent of charge are continuously monitored by the battery analyzer/conditioner. If a battery over temperature or overcharge condition occurs, the BATTERY FAULT capsule on the caution/advisory panel will light. If the battery is less than 40% charged, the BATT LOW CHARGE capsule will light. If the battery charge drops below 35%, the dc essential bus will be dropped and the DC ESS BUS OFF capsule will light.

UH-60L 96-26723-SUBQ MWO 50-77> The battery is connected to and supplies the battery bus when both converters are off and the battery switch is ON. If battery voltage drops to less than 23 vdc, the BATT LOW CHARGE capsule will light.

HH-60A HH-60L > The battery is connected directly to and always supplies the battery utility bus. When both converters are off and the battery switch is ON, the battery also supplies the battery bus and the battery bus supplies the dc essential bus. If battery voltage drops to less than 23 vdc, relay K201 de-energizes, and the BATT LOW

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

CHARGE legend will light. The battery charging is done via relay K200 when either converter is on line and the battery switch is on. <

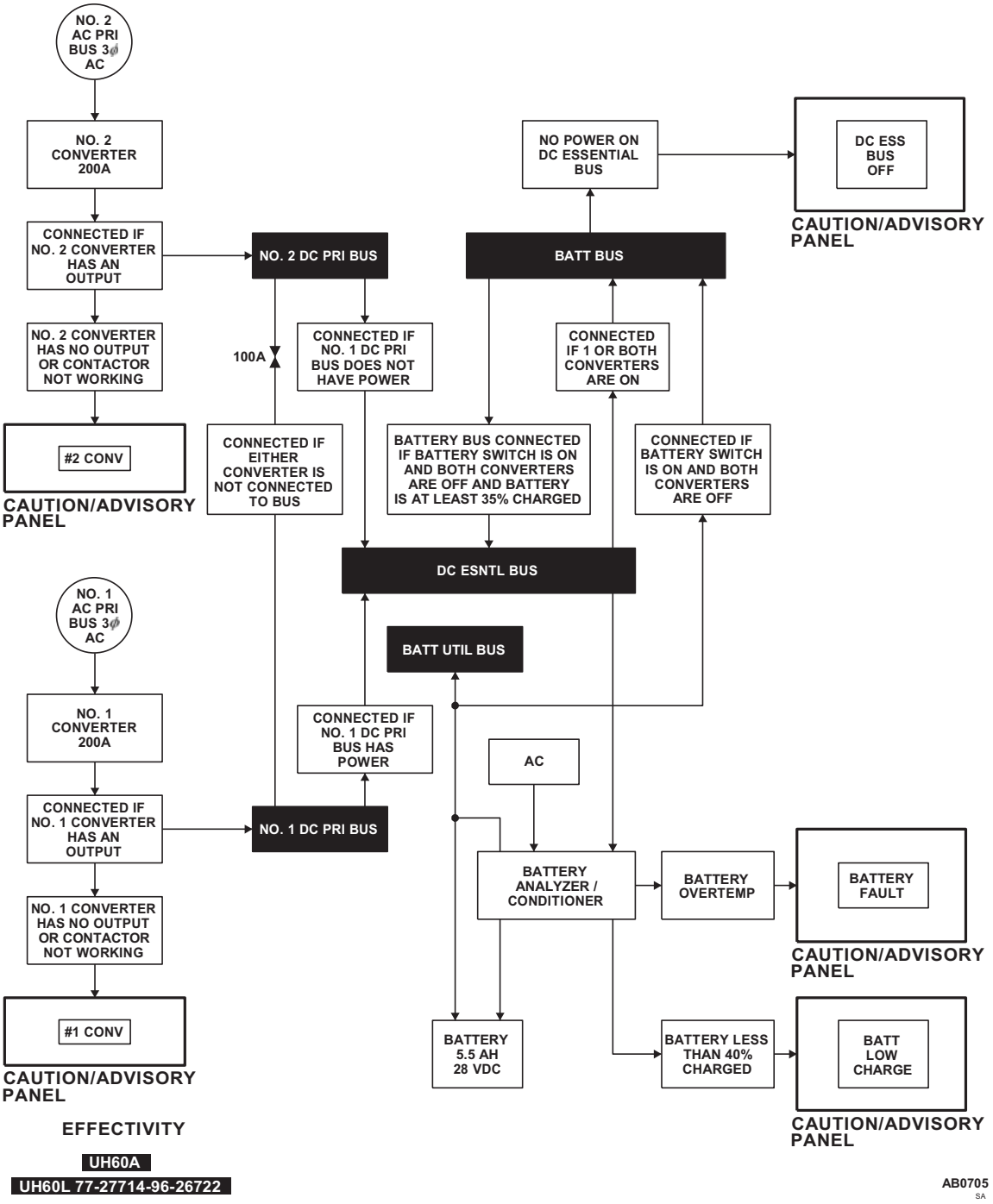


Figure 1. DC Electrical System General Block Diagram.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

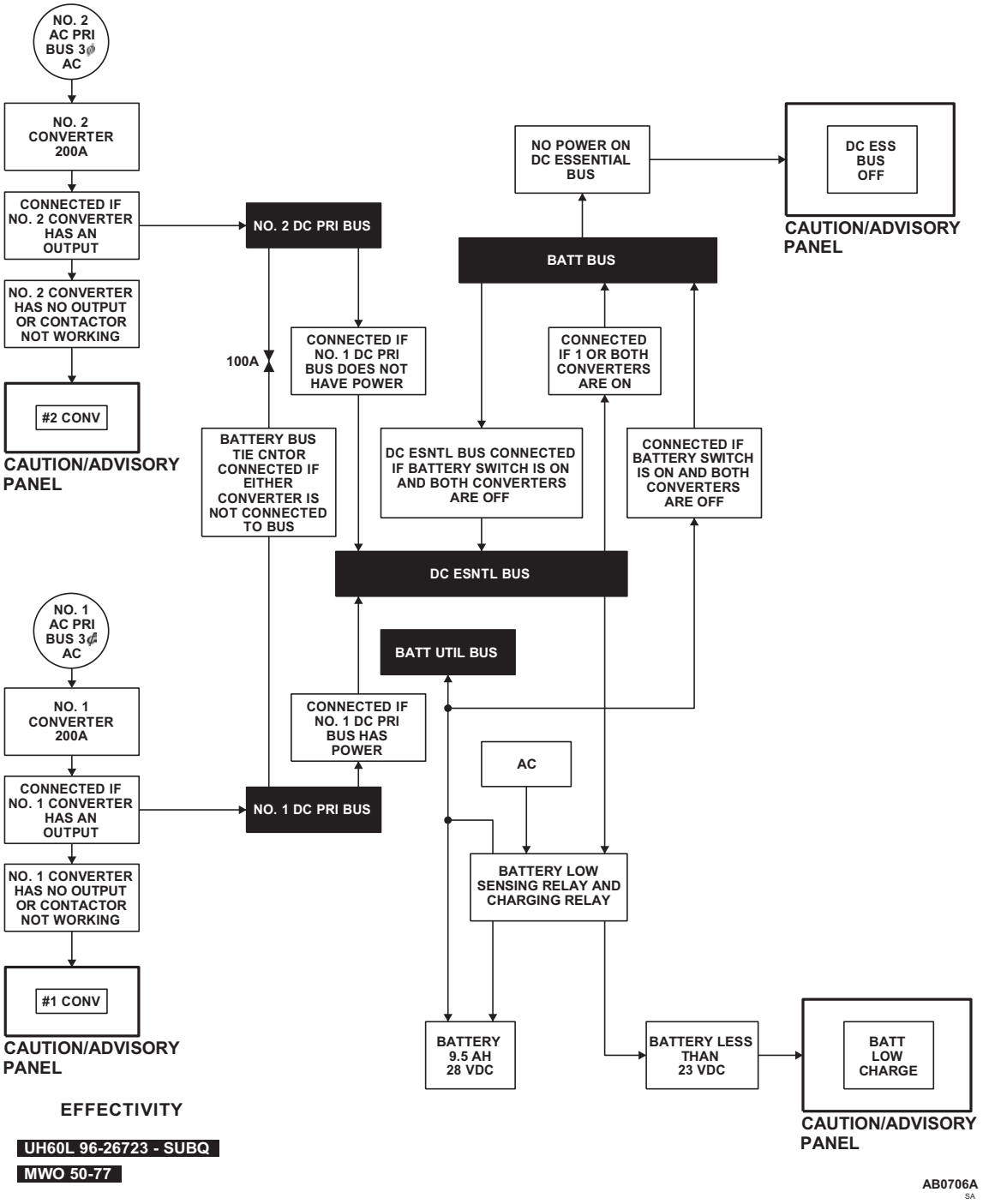


Figure 2. DC Electrical System General Block Diagram.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

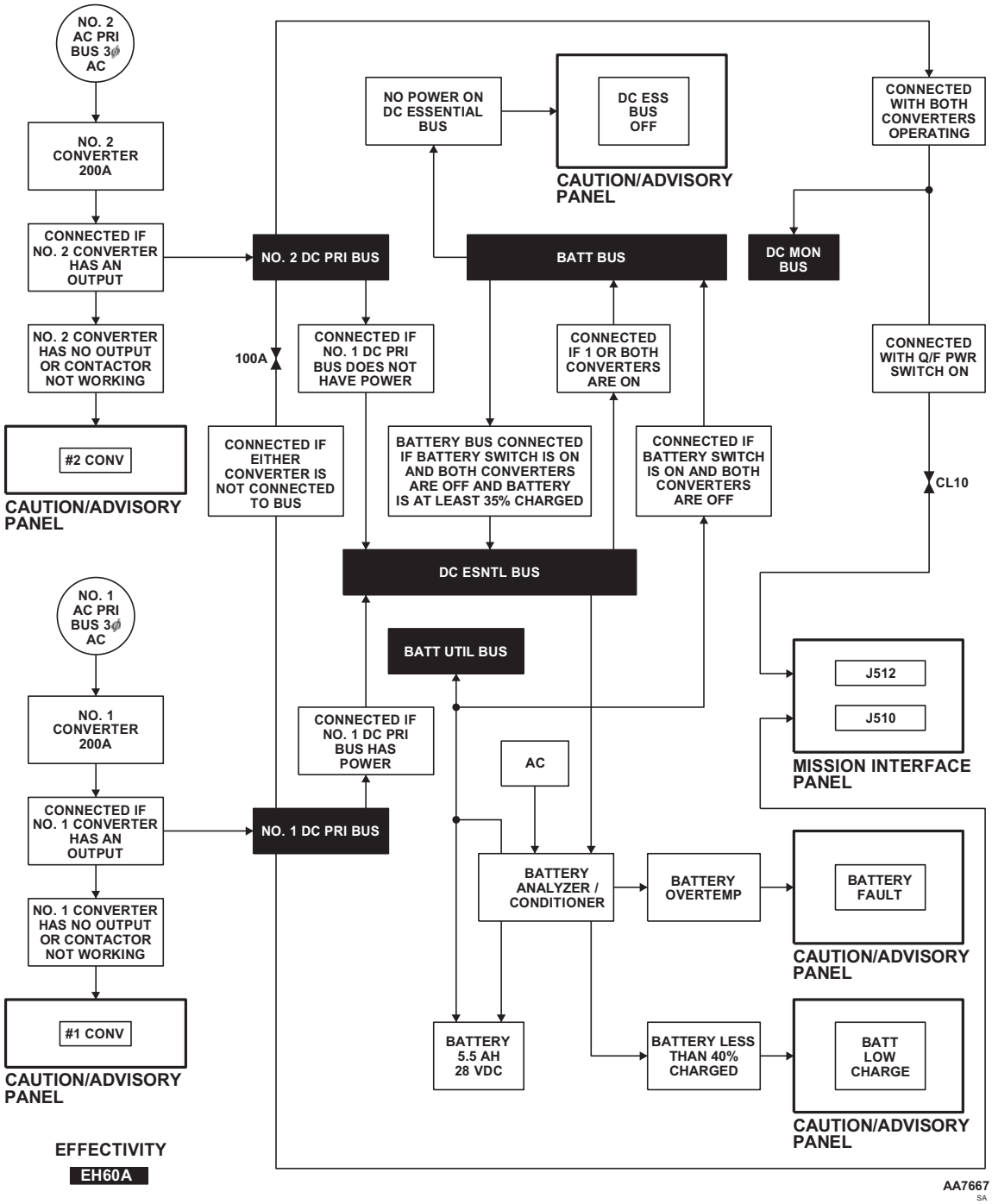


Figure 3. DC Electrical System General Block Diagram.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

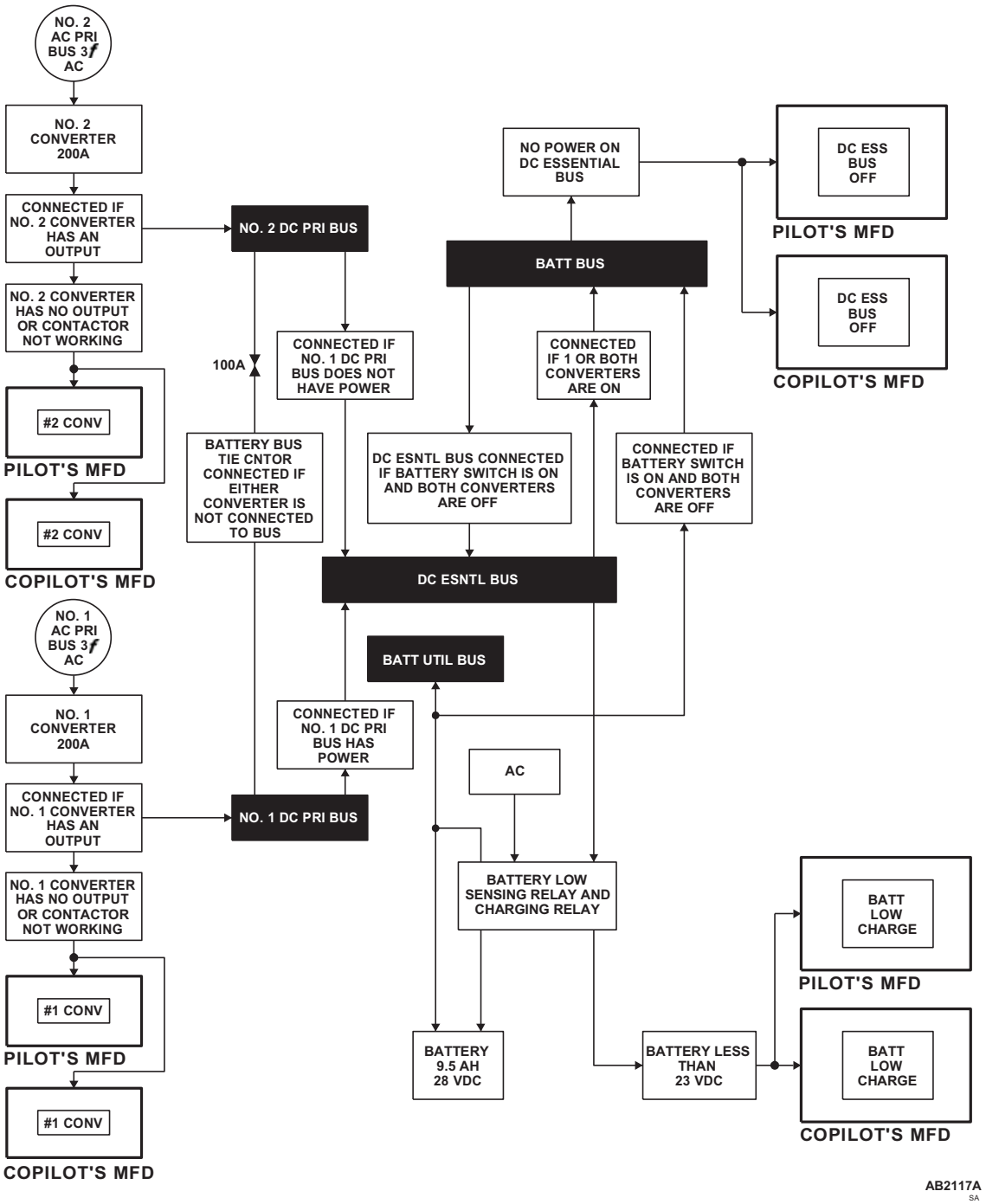


Figure 4. DC Electrical System General Block Diagram. **HH-60A HH-60L>** .

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

CONVERTERS

The No. 1 converter, on the upper left-hand cabin, and the No. 2 converter, on the upper right-hand cabin, provide dc power for helicopter equipment. The converters operate from 115/200 vac, three-phase, 400 Hz power and provide outputs of 31 vdc at no load to 25 vdc at 200 amperes. The converters are cooled by internal fans.

JUNCTION BOXES

The No. 1 junction box, on the upper left-hand cabin, and the No. 2 junction box, on the upper right-hand cabin, provide mounting space for dc power system components. The No. 1 junction box contains the No. 1 dc primary bus contactor, the dc bus tie contactor, and a current limiter. The No. 2 junction box contains the No. 2 dc primary bus contactor. EH-60A > The No. 2 junction box also contains the dc monitor bus contactor, the quick fix power contactor, and a current limiter CL10 < (Figure 1Figure 2Figure 3 or Figure 4).

DC Primary Bus Contactors

The No. 1 and No. 2 dc primary bus contactors, on the No. 1 and No. 2 junction boxes, respectively, provide connections from the No. 1 and No. 2 converters to the No. 1 and No. 2 dc primary buses. With the converters operating, their dc outputs energize the contactor solenoids and supply the dc primary buses. When energized, one set of contactor auxiliary contacts open the path to the battery relay to prevent the battery from supplying power to the dc buses. EH-60A UH-60A UH-60L > If either converter fails, deenergizing its primary bus contactor, a set of auxiliary contacts closes, energizing the dc bus tie contactor, and another set of contacts closes, lighting the caution/advisory panel #1 or #2 CONV capsule. < HH-60A HH-60L > If either converter fails, deenergizing its primary bus contactor, a set of auxiliary contacts closes, energizing the dc bus tie contactor, and another set of contacts closes, lighting the pilot's and copilot's MFDs #1 or #2 CONV legend. < When both converters are off, normally closed contacts of both contactors provide paths for energizing the battery relay and the No. 2 dc essential bus supply relay to allow the battery to supply dc buses.

DC Bus Tie Contactor

The dc bus tie contactor, on the No. 1 junction box, provides a connection between the No. 1 and No. 2 dc primary buses. If one converter fails, the path is closed from the primary bus of the operating converter to energize the solenoid of the dc bus tie contactor. The energized contactor connects the primary bus of the operating converter to the primary bus of the failed converter. EH-60A > The dc bus tie contactor also provides a path to energize the dc monitor bus supply contactor and quick fix power contactor through an auxiliary set of normally closed contacts. <

DC Monitor Bus Supply Relay EH-60A>

The dc monitor bus supply relay, on the No. 2 junction box, provides a connection from the No. 2 dc primary bus to the dc monitor bus. With both No. 1 and No. 2 converters operating, power to energize the dc monitor bus supply relay solenoid is routed from the No. 2 dc primary bus BUS TIE CNTOR circuit breaker through the normally closed contacts of the dc bus tie contactor. If a converter failure occurs that energizes the dc bus tie contactor, power to energize the dc monitor bus supply contactor is removed, thus disabling the dc monitor bus.

Quick Fix Power Contactor EH-60A>

The quick fix power contactor, on the No. 2 junction box, provides a connection from the No. 2 dc primary bus to the mission interface panel. With both No. 1 and No. 2 converters operating and the quick fix power switch on, power to energize the quick fix power contactor solenoid is routed from the No. 2 dc primary bus BUS TIE CNTOR circuit breaker through the switch and the normally closed contacts of the dc bus tie contactor. If a converter failure occurs that energizes the dc bus tie contactor, power to energize the quick fix power contactor is removed, disabling quick fix power to J512.

DC Bus Tie Current Limiter

A current limiter on the No. 1 junction box is a 100-ampere fuse protecting the operation. This current limiter operates when one dc primary bus is supplying the other dc primary bus as a result of a converter failure caused by a load short-circuit.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

Quick Fix Power Current Limiter CL10 EH-60A>

A current limiter on the No. 2 junction box is a 100-ampere fuse protecting the No. 2 dc primary bus from overload because of a fault in the quick fix system. CL10 operates whenever quick fix equipment operation is selected by the upper console Q/F PWR switch and both converters are operating.

No. 1 DC Essential Bus Supply Relay

The No. 1 dc essential bus supply relay, behind the pilot's circuit breaker panel, connects the dc essential bus to the No. 1 dc primary bus when energized, or the dc essential bus to the No. 2 dc primary bus or the battery bus when deenergized. When the converters are operating, power from the No. 1 dc primary bus energizes the solenoid of the No. 1 dc essential bus supply relay. This power is applied through the energized relay contacts to supply the dc essential bus. If power is lost on the No. 1 dc primary bus, the relay is deenergized and power from the No. 2 dc primary bus is applied through the normally closed relay contacts to supply the dc essential bus. When the converters are off and the BATT switch is ON, power from the battery bus is applied through the normally closed contacts of the No. 1 dc essential bus supply relay to supply the dc essential bus.

No. 2 DC Essential Bus Supply Relay

The No. 2 dc essential bus supply relay, behind the pilot's circuit breaker panel, connects the dc essential bus to the battery bus when energized, or the dc essential bus to the No. 2 dc primary bus when de-energized. 77-27714-96-26722 > When the converters are off, the BATT switch is ON, and the battery is more than 35% charged, the path is closed from the battery utility bus, through the battery analyzer/conditioner, to energize the solenoid of the No. 2 essential bus supply relay. Power from the battery bus is applied through the energized relay contacts to supply the dc essential bus. If the battery charge falls to 35%, the path through the analyzer/conditioner to the relay solenoid is opened and the relay de-energizes. The path from the battery bus to the dc essential bus is opened and the dc essential bus is dropped. If only the No. 2 converter is operating and there is no power on the No. 1 dc primary bus, power from the No. 2 dc primary bus is applied through the normally closed contacts of the No. 2 dc essential bus supply relay and the No. 1 dc essential bus supply relay to supply the dc essential bus. <

DC Essential Bus Fail Relay

EH-60A UH-60A UH-60L > The dc essential bus fail relay, on the right relay panel in the upper cabin, provides a path to light the caution/advisory panel DC ESS BUS OFF capsule. Power from the dc essential bus energizes the relay solenoid and the path is opened between the battery bus and the caution/advisory panel capsule. When the charge of the battery supplying the dc essential bus falls to 35%, the bus is dropped. The relay is now de-energized and the normally closed relay contacts close the path from the battery bus to light the DC ESS BUS OFF capsule. < HH-60A HH-60L > The dc essential bus fail relay, on the right relay panel in the upper cabin, provides a path to light the pilot's and copilot's MFDs DC ESS BUS OFF legends. Power from the dc essential bus energizes the relay solenoid and the path is opened between the battery bus and the pilot's and copilot's MFD legends. When the charge of the battery supplying the dc essential bus falls to 35%, the bus is dropped. The relay is now de-energized and the normally closed relay contacts close the path from the battery bus to light the DC ESS BUS OFF legend. <

DC ELECTRICAL POWER INTERFACE EH-60A> <

Mission equipment dc power is supplied to mission interface panel connector J512 from the No. 2 DC PRI BUS through a 100-amp fuse and power contactor K83 (Figure 5). When dc power is available at both the No. 1 and No. 2 DC PRI BUS, 28 vdc is applied to the upper console Q/F PWR switch. A failure of either bus will remove the 28 vdc input to the Q/F PWR switch. Placing the Q/F PWR switch ON, when power is available at both dc primary buses, energizes power contactor K83. The contacts of K83 route 28 vdc to the mission equipment through connector J512.

MISSION ELECTRICAL INTERFACE EH-60A> <

The mission electrical interface provides ac and dc power connections between helicopter systems and mission equipment. AC power is provided through the No. 1 junction box to the mission interface panel. DC power is provided through the No. 2 junction box to the mission interface panel.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

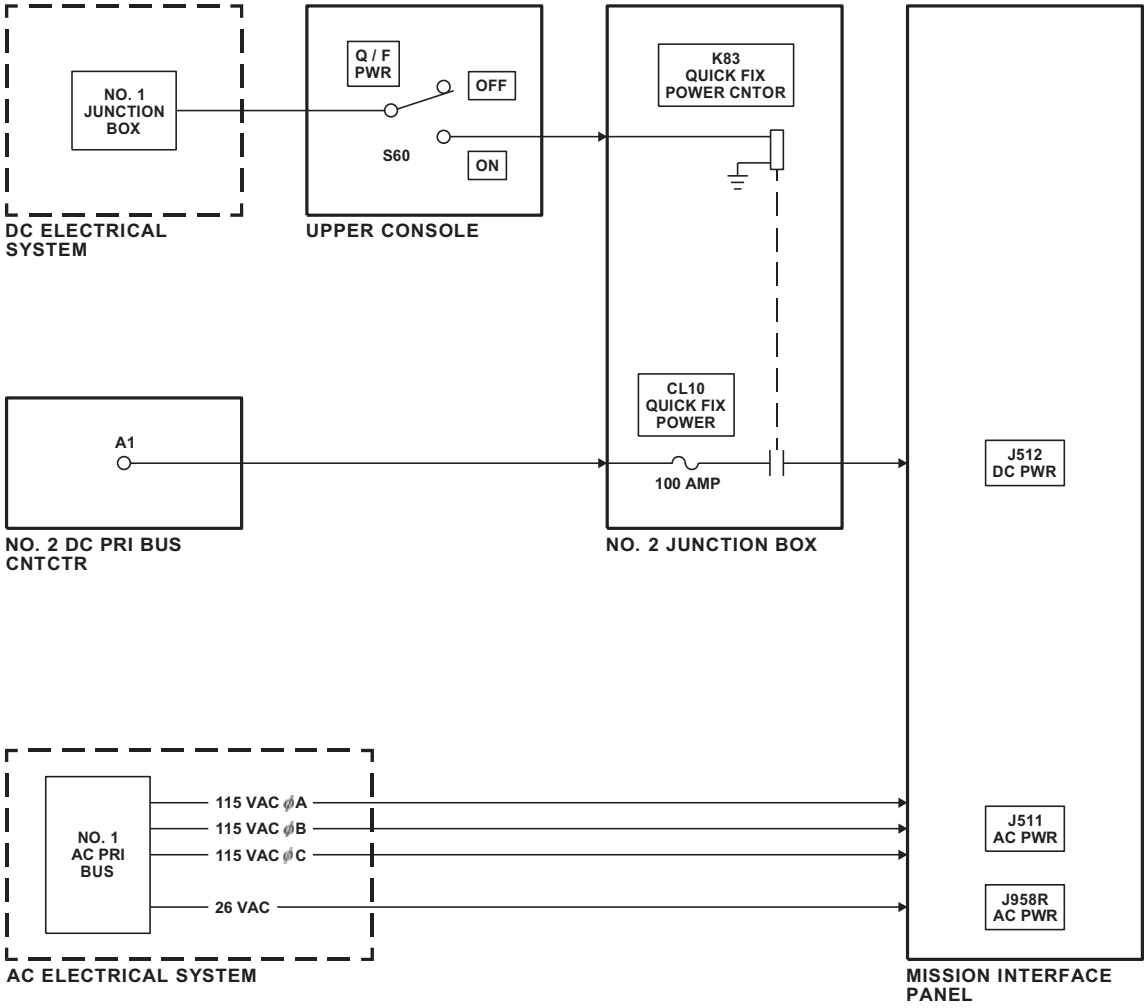


Figure 5. Mission Electrical Interface Block Diagram.

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

For location and description of major components, refer to the data in this work package.

EQUIPMENT DATA

For equipment data information, refer to this work package.

ELECTRICAL SYSTEMS

DC ELECTRICAL PRIMARY SYSTEM DESCRIPTION AND DATA

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

DC PRIMARY POWER SYSTEM

Primary dc power is developed by the No. 1 and No. 2 converters using three-phase ac inputs from the No. 1 and No. 2 ac primary buses, respectively. The dc outputs of the converters are applied through the energized contacts of No. 1 and No. 2 dc primary bus contactors K16 and K6 to supply the No. 1 and No. 2 primary buses, respectively. If one converter fails, dc bus tie contactor K15 is energized and dc power from the primary bus of the operating converter is applied, through a current limiter, to the primary bus of the failed converter. The current limiter protects the operating converter from an excessive overload that may have disabled the failed converter.

EH-60A > Electrical dc power from the No. 2 dc primary bus is applied through contacts of dc monitor bus relay K5, when energized, to power the dc monitor bus. The No. 2 dc primary bus also provides power through current limiter CL10 and contacts of quick fix power contactor K83, when energized, to power J512 on the mission interface panel. Primary power to energize dc monitor bus contactor K5 and quick fix power contactor K83 is applied through normally closed contacts of dc bus tie contactor K15. If one converter fails, dc bus tie contactor K15 is energized, deenergizing K5 and K83 and removing power from the dc monitor bus and interface panel J512. Power to energize quick fix power contactor K83 is also routed through the upper console Q/F PWR switch. This switch must be ON to energize K83 and power up connector J512. **<**

DC power from the No. 1 dc primary bus is applied through the energized contacts of the No. 1 dc essential bus supply relay K10 to supply the dc essential bus. If there is no power on the No. 1 dc primary bus, power from the No. 2 dc primary bus is applied through the normally closed contacts of the No. 2 essential bus supply relay K9 and the No. 1 dc essential bus supply relay K10, to supply the dc essential bus. The battery bus is supplied by the dc essential bus through the normally closed contacts of battery relay K7.

UH-60A EH-60A UH-60L 89-26149 - 96-26722 > When the converters are on and the battery switch is ON, the battery is charged by the battery analyzer/conditioner. The analyzer/conditioner is supplied with 115 vac, B phase power from the No. 2 ac primary bus and with dc power from the No. 2 dc primary bus. The analyzer/conditioner output is applied through the normally closed contacts of battery relay K7 to charge the battery. If excessive battery temperature or an overcharge condition is sensed by the analyzer/conditioner, battery charging is discontinued and the caution/advisory panel BATTERY FAULT capsule goes on. **<**

CONVERTER OPERATION

The No. 1 converter is supplied with 115 vac, three-phase power from the No. 1 ac primary bus, through the No. 1 CONVERTER circuit breaker. The No. 2 converter is supplied with 115 vac, three-phase power from the No. 2 ac primary bus, through the No. 2 CONVERTER circuit breaker. The ac input is rectified and filtered by each converter to produce a dc output. The dc output of the No. 1 (or No. 2, as applicable) converter energizes No. 1 (or No. 2) dc primary bus contactor K16 (or K6) and is applied through the energized main contacts of contactor K16 (or K6) to supply the No. 1 (or No. 2) dc primary bus.

DC power from the No. 1 dc primary bus, through the DC ESNTL BUS SPLY circuit breaker, energizes No. 1 dc essential bus supply relay K10 and is applied through the energized contacts of relay K10 to supply the dc essential bus. The dc essential bus supplies dc power, through the BATT BUS SPLY circuit breaker and the normally closed contacts of battery relay K7, to the battery bus. **EH-60A UH-60A UH-60L >** The dc essential bus also supplies dc power through the ESNTL DC SENSE circuit breaker to energize dc essential bus fail relay K20. With relay K20 energized, the path between the battery bus and the caution/advisory panel DC ESS BUS OFF capsule is open and the capsule is off. **< HH-60A HH-60L >** The dc essential bus also supplies dc power through the ESNTL DC SENSE circuit breaker to energize dc essential bus fail relay K20. With relay K20 energized, the path between the battery bus and the pilot's and copilot's MFDs DC ESS BUS OFF legends are open and the legends are off. **<**

EH-60A UH-60A UH-60L > If the No. 2 converter fails and its output drops to zero, No. 2 dc primary bus contactor K6 deenergizes. DC power from the battery bus is applied through the ESNTL BUS AC & CONV WARN circuit

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

breaker and normally closed auxiliary contacts of contactor K6 to light the caution/advisory panel #2 CONV capsule. < HH-60A HH-60L > If the No. 2 converter fails and its output drops to zero, No. 2 dc primary bus contactor K6 deenergizes. DC power from the battery bus is applied through the ESNTL BUS AC & CONV WARN circuit breaker and normally closed auxiliary contacts of contactor K6 to light the pilot's and copilot's MFDs #2 CONV legends. < DC power from the No. 1 dc primary bus is applied through the BUS TIE CNTOR circuit breaker and normally closed auxiliary contacts of contactor K6 to energize dc bus tie contactor K15. With contactor K15 energized, dc power from the No. 1 dc primary bus is applied through the 100 amp current limiter to supply the No. 2 dc primary bus. If the No. 1 converter fails and its output drops to zero, No. 1 dc primary bus contactor K16 deenergizes. EH-60A UH-60A UH-60L > DC power from the battery bus is applied through the ESNTL BUS AC & CONV WARN circuit breaker and normally closed auxiliary contacts of contactor K16 to light the caution/advisory panel #1 CONV capsule. < HH-60A HH-60L > DC power from the battery bus is applied through the ESNTL BUS AC & CONV WARN circuit breaker and normally closed auxiliary contacts of contactor K16 to light the pilot's and copilot's MFDs #1 CONV legends. < DC power from the No. 2 dc primary bus is applied through the BUS TIE CNTOR circuit breaker and normally closed auxiliary contacts of contactor K16 to energize dc bus tie contactor K15. With contactor K15 energized, dc power from the No. 2 dc primary bus is applied through the 100 amp current limiter to supply the No. 1 dc primary bus.

If a short circuit causes the No. 1 converter to be disabled and the 100 amp current limiter to open, all power is lost on the No. 1 dc primary bus. If this occurs, No. 1 dc essential bus supply relay K10 deenergizes. DC power from the No. 2 dc primary bus is applied through the DC ESNTL BUS SPLY circuit breaker and normally closed contacts of relay K10 to supply the dc essential bus.

UH-60A EH-60A UH-60L 89-26149 - 96-26722 > With the converters operating and the BATT switch ON, power is provided from the battery analyzer/conditioner to charge the battery. DC power from the battery utility bus is applied through the BATT switch to energize relay K2 in the analyzer/conditioner. Relays K2 and K3 provide the paths for connecting the charger/analyzer circuit operating power and charging power from the No. 2 ac and dc primary buses. DC power from the No. 2 dc primary bus, through the BATT CHGR circuit breaker, is used for most of the required charging power. AC power from the No. 2 ac primary bus, through the BATT CHGR circuit breaker, is converted to dc power to provide a voltage boost to allow a timed overcharge to be applied to the battery. The timed overcharge is applied only when the battery has been discharged below a certain level during the previous discharge cycle. A current control circuit controls the charging current, applied from the analyzer/conditioner through the normally closed contacts of battery relay K7, to charge the battery. When the battery voltage reaches a reference level, a voltage control circuit automatically stops battery charging. A temperature-compensation sensor in the battery feeds temperature information to the voltage control circuit to modify the voltage reference level and accommodate charging over a wide temperature range. <

UH-60A EH-60A UH-60L 89-26149 - 96-26722 > The analyzer/conditioner monitors the battery for overtemperature or overcharge conditions occurring during charging. If the battery temperature increases to 160°F, the battery overtemperature switch opens. This is sensed by the analyzer battery fault indicator and an input is applied to the voltage control circuit that discontinues battery charging. The fault indicator also applies voltage to light the caution/advisory panel BATTERY FAULT capsule. When the battery temperature decreases to a safe level, the battery overtemperature switch closes, battery charging is continued, and the BATTERY FAULT capsule goes off. A battery or analyzer/conditioner malfunction may cause a battery overcharge condition. An overcharge condition is indicated by an unbalance in cell voltages. The analyzer detects a voltage difference between battery cells. The fault indicator then stops battery charging and lights the BATTERY FAULT capsule. <

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

For location and description of major components, refer to the data in this work package.

EQUIPMENT DATA

For equipment data information, refer to this work package.

ELECTRICAL SYSTEMS

DC ELECTRICAL BATTERY SYSTEM DESCRIPTION AND DATA

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

BATTERY

The battery is on the front cabin floor behind the copilot HH-60A HH-60L > in access area on underside of the cockpit <. It provides power for the dc essential bus on the ground when neither the engines nor the APU are operating. It also provides power for controlling APU starting on the ground, or in the air if both ac generators fail. 77-27714-96-26722 > The NiCad battery has a capacity of 5.5 ampere-hours, based on a 2-hour discharge rate at 25°C. The battery has a total of 20 cells: 19 interchangeable cells and one low-capacity sense cell. <UH-60L 96-26723-SUBQ MWO 50-77 HH-60A HH-60L > The sealed lead acid battery has a capacity of 9.5 ampere-hours, based on a 1-hour discharge rate at 24°C ambient temperature to a cutoff voltage of 18 volts. <

UH-60L 89-26149 - 96-26722 UH-60A EH-60A > The battery low-capacity sense cell provides information to the battery analyzer/conditioner as to the percent of charge of the battery. Two temperature sensors in the battery provide continuous signals to the analyzer/conditioner to compensate for voltage changes occurring as a result of battery temperature variations during charging and discharging. An over-temperature switch in the battery opens when the battery temperature increases to 160°F during charging, disabling the analyzer/conditioner charging circuit to prevent thermal runaway. <

BATTERY ANALYZER/CONDITIONER UH-60L 89-26149 96-26722 UH-60A EH-60A> <

The battery analyzer/conditioner, on the rear cockpit floor inside the lower console, continuously monitors battery voltage and temperature condition and contains a charging circuit for battery charging. When the battery is supplying the helicopter dc buses, the analyzer/conditioner monitors the battery low capacity cell to sense battery capacity. When the battery capacity falls to 40%, a low cell voltage detector in the analyzer lights the caution/advisory panel BATT LOW CHARGE capsule. When capacity falls to 35%, a battery low disconnect circuit disconnects the dc essential bus loads to make sure that enough charge remains on the battery for APU starting. The analyzer voltage detector circuit also receives temperature information from the battery to compensate for voltage changes as battery temperature varies.

When the helicopter converters are operating and the battery switch is ON, the charging circuit of the analyzer/conditioner receives ac and dc power to charge the battery. Battery output voltage and temperature are monitored by the charging circuit to regulate the charging current applied to the battery. The charging circuit is automatically disabled when a battery over temperature or overcharge condition is sensed by the analyzer/conditioner fault indication circuit. The fault indication circuit also lights the caution/advisory panel BATTERY FAULT capsule to indicate the fault condition.

BATTERY SWITCH

77-27714-96-26722 > The two-position BATT switch, on the upper console, controls battery system operation. ON permits the battery to supply the battery and dc essential buses when the converters are off, or the battery to be charged by the analyzer/conditioner when the converters are on. < UH-60L 96-26723-SUBQ MWO 50-77 HH-60A HH-60L > The two-position BATT switch, on the upper console, controls battery system operation. ON permits the battery to supply the battery and dc essential buses when the converters are off, or the battery to be charged by the battery relay when the converters are on. < OFF disables all battery system operation 77-27714-96-26722 > except supply of the battery utility bus. <

BATTERY RELAY

The battery relay, on the lower front cabin bulkhead left-hand side, connects the battery to the battery bus when energized or the dc essential bus to the battery bus when deenergized. When the converters are off and the BATT switch is ON, the path is closed and the battery utility bus energizes the solenoid of the battery relay. The energized contacts of the battery relay apply power from the battery to the battery bus. When the converters are operating, the normally closed contacts of the battery relay apply power from the dc essential bus to the battery bus. When the converters are operating and the BATT switch is ON, the battery relay is de-energized. 77-27714-

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

96-26722 > Normally closed relay contacts connect the battery to the analyzer/conditioner to allow the battery to be charged. <

BATTERY POWER SYSTEM

The battery system provides dc power to the battery bus and dc essential bus when the battery switch is ON and the converters are off. The battery is connected directly to the battery utility bus. With the battery switch ON and both converters off, battery relay K7 is energized and the battery supplies the battery bus through the energized contacts of relay K7. With the battery sufficiently charged, the No. 2 dc essential bus supply relay K9 is energized and the battery bus supplies the dc essential bus through the energized contacts of relay K9 and the normally closed contacts of the No. 1 dc essential bus supply relay K10. The No. 1 and No. 2 dc primary buses are not supplied by the battery.

77-27714-96-26722 > The condition of the battery is continuously monitored by the battery analyzer/conditioner. The analyzer/conditioner lights the caution/advisory panel BATT LOW CHARGE capsule to indicate a low battery charge. When the battery charge falls below the low charge level, the analyzer/conditioner reserves the remaining charge for control of APU starting by dropping the dc essential bus load. <

BATTERY SYSTEM OPERATION

The helicopter battery is connected either directly to and is always supplying the battery utility bus. With both helicopter converters off and the BATT switch placed to ON, dc power from the battery utility bus is applied through the BATT BUS CONTR circuit breaker, the normally closed auxiliary contacts of No. 1 and No. 2 dc primary bus contactors K16 and K6, and the BATT switch, to energize battery relay K7. DC power from the battery is applied through the energized contacts of relay K7 to supply the battery bus.

77-27714-96-26722 > The battery condition is continuously monitored by the battery analyzer/conditioner. The analyzer section of the analyzer/conditioner senses battery voltage, low cell voltage, and battery temperature. One of the 20 battery cells is used as a sense cell to indicate the battery state of charge. A temperature sensing compensation circuit in the battery compensates for the effect of cell voltage variations with temperature. With a battery charge of at least 35%, as indicated by the battery sense cell, analyzer/conditioner relay K1 is energized. DC power from the battery utility bus is applied through the BATT BUS CONTR circuit breaker, normally closed auxiliary contacts of No. 1 and No. 2 dc primary bus contactors K16 and K6, and the energized contacts of relay K1 to energize No. 2 dc essential bus supply relay K9. DC power from the battery bus is applied through the ESNTL DC SPLY circuit breaker, the energized contacts of relay K9, and the normally closed contacts of No. 1 dc essential bus supply relay K10, to supply the dc essential bus. The dc essential bus applies power through the ESNTL DC SENSE circuit breaker to energize dc essential bus fail relay K20 to keep the caution/advisory panel DC ESS BUS OFF capsule off. <

77-27714-96-26722 > If the voltage in the battery sense cell falls to a level indicating a battery charge of less than 40%, this is sensed by the analyzer low cell voltage detector circuit. It applies a voltage to light the caution/advisory panel BATT LOW CHARGE capsule. To reserve enough battery capacity for controlling APU starting, the dc essential bus is dropped if battery charge falls below 35%. When the sense cell indicates a battery charge of less than 35%, the analyzer low disconnect circuit deenergizes analyzer relay K1, thus deenergizing No. 2 dc essential bus supply relay K9. With relay K9 deenergized, the path between the battery bus and the dc essential bus is open and the dc essential bus is dropped. The removal of power from the dc essential bus deenergizes dc essential bus fail relay K20. This closes the path from the battery bus through the BATT & ESNTL DC WARN EXT PWR CONTR circuit breaker to light the caution/advisory panel DC ESS BUS OFF capsule. <

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

For location and description of major components, refer to the data in this work package.

EQUIPMENT DATA

For equipment data information, refer to this work package.

ELECTRICAL SYSTEMS

INTERIOR LIGHTING DESCRIPTION AND DATA

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

INTERIOR LIGHTING

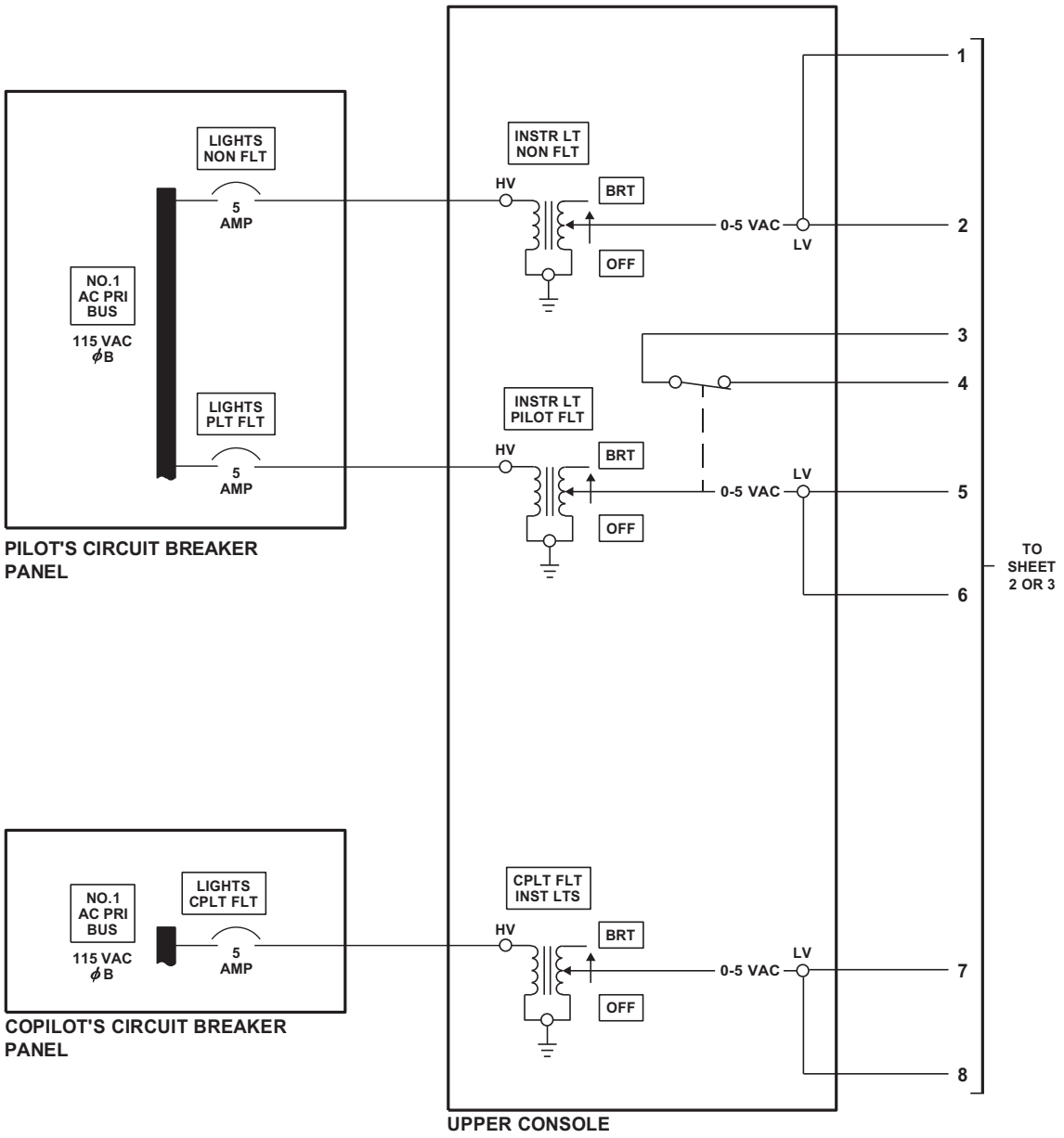
The interior lighting systems are used for general interior illumination in the cockpit and/or in the cabin area. The interior lighting systems consists of instrument panel lights, console lights, instrument panel and console lights dimming circuit, cabin dome lights, cockpit flood and secondary lights, and utility and maintenance lights.

INSTRUMENT PANEL LIGHTS

The instrument panel lights consist of the pilot's flight instrument lights, the copilot's flight instrument lights, and the nonflight lights (Figure 1. (Sheet 1 of 3)). The lights are used to light instrument panel instruments and controls. Electrical power for the pilot's flight instruments is routed from the No. 1 ac primary bus through the LIGHTS PLT FLT circuit breaker to the INSTR LT PILOT FLT control on the upper console. Electrical power for the copilot's flight instruments is routed from the No. 1 ac primary bus through the LIGHTS CPLT FLT circuit breaker to the CPLT FLT INST LT control on the upper console. Electrical power for the nonflight instruments is routed from the No. 1 ac primary bus through the LIGHTS NON FLT circuit breaker to the INSTR LT NON FLT control, also on the upper console. Turning the dimming controls from OFF to BRT allows the pilot or copilot to vary the intensity of the flight and nonflight instrument lights. **UH-60L UH-60A >** Lighted bezel assemblies provide lighting for the airspeed indicators (pilot's and copilot's), clocks, barometric altimeters, vertical situation indicators, horizontal situation indicators, vertical speed indicators, radar altimeters, and stabilator position indicators. A bracket-mounted post light assembly provides lighting for the icing rate meter. **< HH-60A HH-60L >** Lighted bezel assemblies provide lighting for the digital clocks, airspeed indicator, vertical situation indicator, horizontal situation indicator, vertical velocity indicator (VVI), barometric altimeter indicator (copilot's) altimeter/encoder (pilot's), radar altimeter, and stabilator position indicators. **<EH-60A >** Lighted bezel assemblies provide lighting for the digital clocks, airspeed indicator, vertical situation indicator, horizontal situation indicator, vertical velocity indicator (VVI), barometric altimeter indicator (copilot's) altimeter/encoder (pilot's), radar altimeter, bearing distance heading indicator, and stabilator position indicators. A bracket-mounted post light assembly provides lighting for the icing rate meter. **< MWO 50-78 >** A bracket-mounted post light assembly provides lighting for the icing rate meter and an integrally illuminated panel provides lighting for the auxiliary fuel management panel. **<EH-60A >** Electrical power (0 to 5 vac) from the INSTR LT NON FLT dimming control is routed to the nonflight instrument lights 5V/115V transformer and to the system select panel, ECM antenna placard, blade deice test panel, and blade deice control panel. The output of the transformer (0 to 115 vac) is routed to the icing rate meter light. **<MWO 50-78 >** Electrical power (0 to 5 vac) from the INSTR LT NON FLT dimming control is routed to the non-flight instrument lights 5V/115V transformer and to the blade deice test panel, and blade deice control panel. The output of the transformer (0 to 115 vac) is routed to the icing rate meter light and to the auxiliary fuel management panel. **<UH-60L UH-60A EH-60A >** Electrical power (0 to 5 vac) from the INSTR LT PILOT FLT dimming control is routed to the pilot's flight instrument lights 5V/115V transformer. The output of the transformer (0 to 115 vac) is routed to the pilot's VSI/HSI mode select panel, pilot's stabilator position placard, and the No. 2 signal data converter. The No. 2 signal data converter routes 0 to 115 vac power to the pilot's display unit. Electrical power (0 to 5 vac) from the CPLT FLT INST LTS dimming control is routed to the copilot's flight instrument lights 5V/115V transformer. The output of the transformer (0 to 115 vac) is routed to the copilot's VSI/HSI mode select panel, copilot's stabilator position placard, and the No. 1 signal data converter. The No. 1 signal data converter routes 0 to 115 vac power to the central display unit. **< HH-60A HH-60L >** Electrical power (0 to 5 vac) from the INSTR LT PILOT FLT dimming control is routed to the pilot's flight instrument lights 5V/115V transformer. The transformer's output (0 to 115 vac) is routed to the pilot's HSI/VSI mode select panel and No. 2 signal data converter. The No. 2 signal data converter then routes power to the pilot's display unit on the instrument panel. The MFD/ Caution/Advisory Warning system receives its dimming ability from the INSTR LT PILOT FLT dimming control. The INSTR LT NON FLT dimming control supplies electrical power (0 to 5 vac) to the non-flight instrument lights 5V/115V transformer and to the pilot's and copilot's collective stick grips. The non-flight instrument lights 5V/115V transformer then routes power (0 to 115 vac) to the stabilator indicator lighted bezel assembly while the stabilator indicator placard directly receives its 0 to 5 vac from the INSTR LT NON FLT dimming control. The INSTR LT NON FLT dimming control also supplies 0 to 5 vac to the

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

No. 1 signal data converter. The No. 1 signal data converter then routes 0 to 115 vac to the central display unit and to the copilot's display unit on the instrument panel. The CPLT FLT INST LTS dimming control supplies 0 to 5 vac to the copilot's flight instrument lights 5V /115V transformer which routes power to the No. 1 signal data converter and 0 to 115 vac to the copilot's HSI/VSI mode select panel on the instrument panel. ◄



NOTES

1. EH60A
2. ESSS

AA2235_1B SA

Figure 1. Instrument Panel Lights Block Diagram (Sheet 1 of 3).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

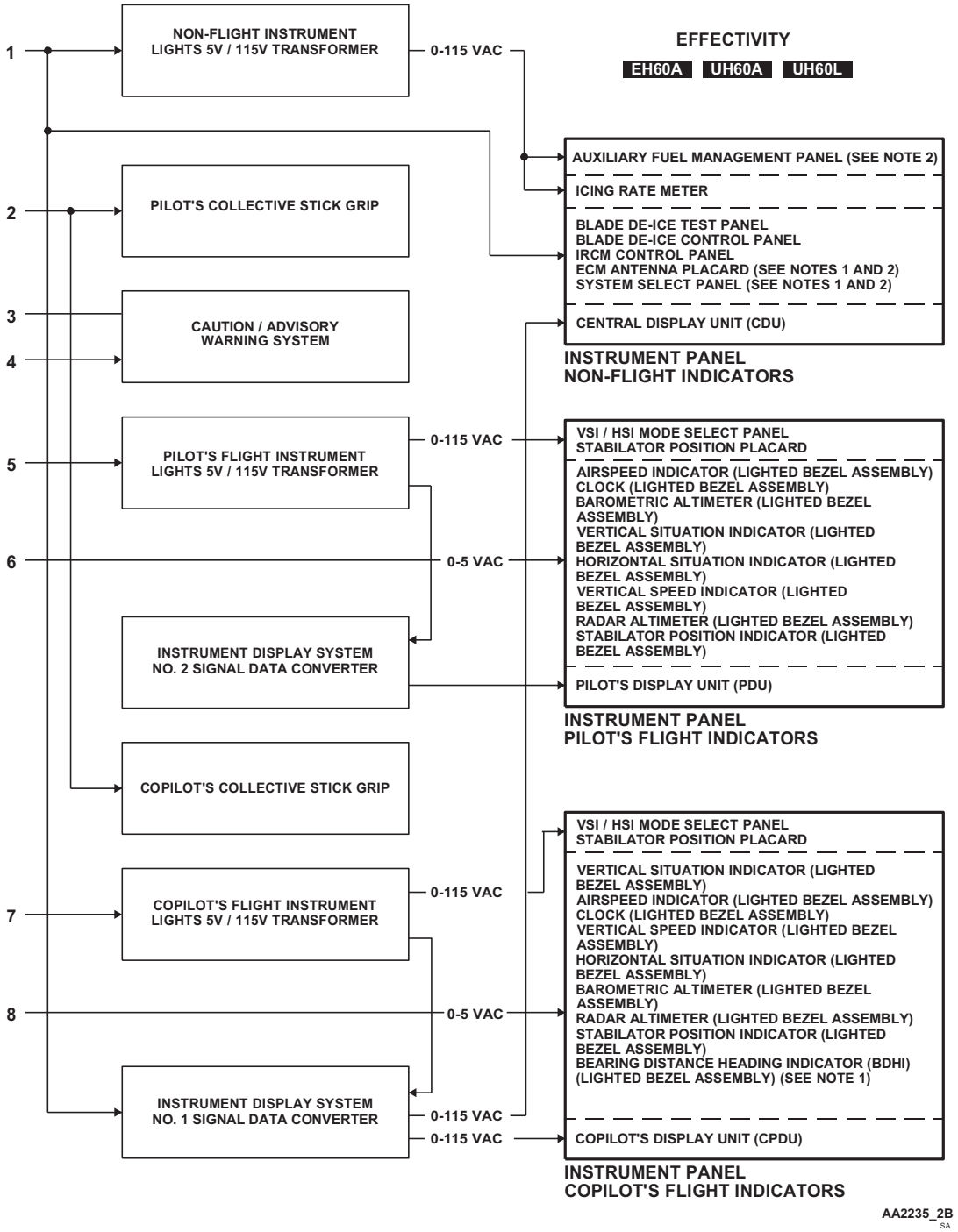


Figure 1. Instrument Panel Lights Block Diagram (Sheet 2 of 3).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

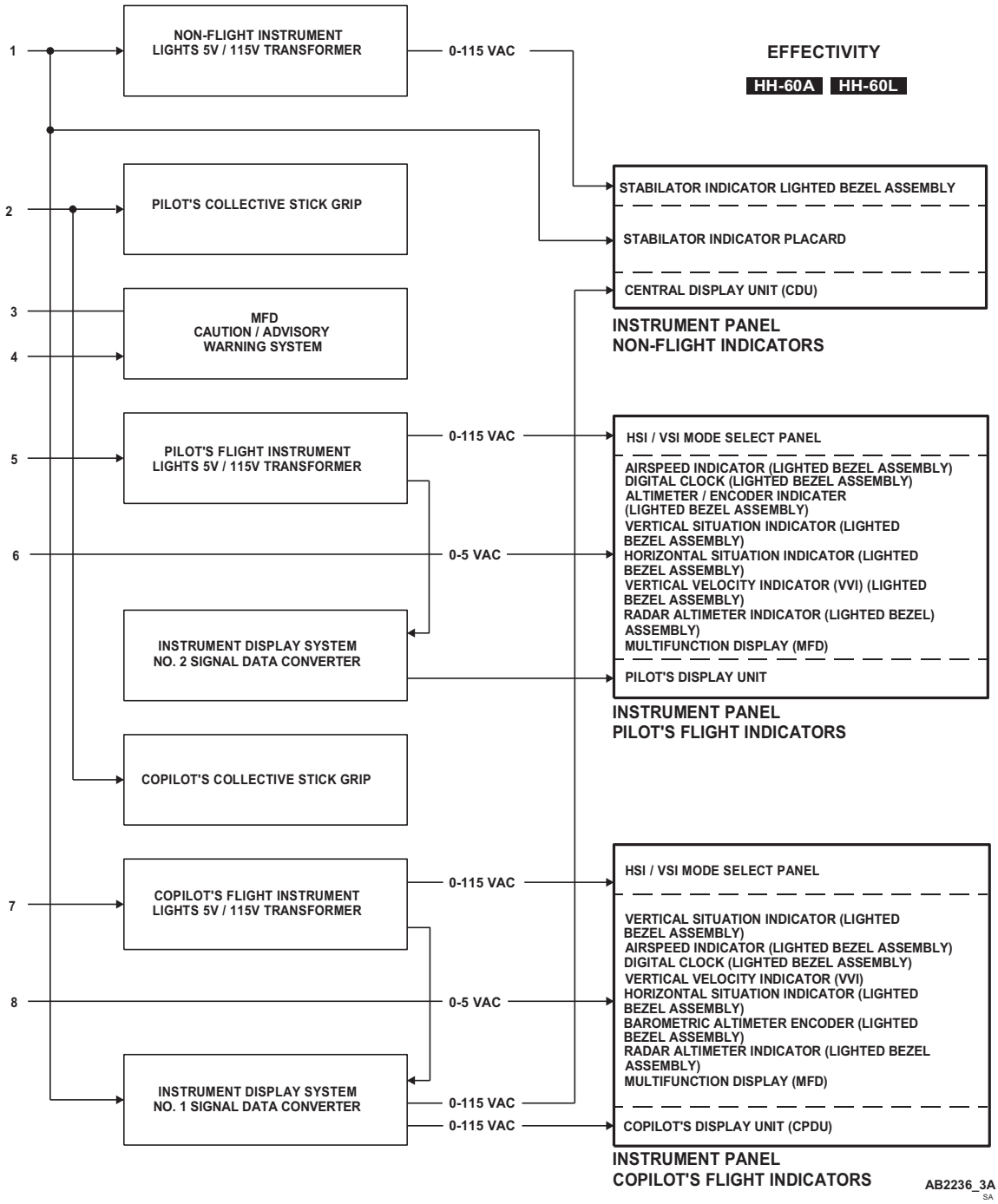


Figure 1. Instrument Panel Lights Block Diagram (Sheet 3 of 3).

CONSOLE LIGHTING

The console lighting consists of the upper and lower console lights. Upper console lighting provides control for panel lighting of all control panels on the upper console and engine controls quadrant. **UH-60L UH-60A EH-60A** > Lower console lighting provides control for panel lighting of limited control panels on the lower console, left and right gunners' ICS control panel floodlights, and troop commander's ICS control panel floodlight. < **HH-60A**

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

HH-60L > Lower console lighting provides control for panel lighting of limited control panels on the lower console, MED 2 ICS control panel, MED 1 ICS control panel, and crew chief's ICS control panel. < Console lighting uses separate circuits for the upper and lower consoles (Figure 2. (Sheet 1 of 3)). The upper console lighting circuit is powered from the No. 1 ac primary bus through the LIGHTS UPPER CSL circuit breaker on the copilot's circuit breaker panel. The lower console lighting circuit is powered from the No. 1 ac primary bus through the LIGHTS LWR CSL circuit breaker on the copilot's circuit breaker panel. The upper console light intensity is controlled by the CONSOLE LT UPPER control, on the upper console. Turning the control from OFF to BRT provides a variable voltage (0 to 115 vac) to the upper console panels, cockpit flood and secondary lights panel, and engine controls quadrant panels. The lower console light intensity is controlled by the CONSOLE LT LOWER control, also on the upper console. Turning the control from OFF to BRT provides a variable voltage (0 to 115 vac) directly to the ESSS > ESSS range extension system connector, <fuel boost pump control panel, the rescue hoist kit control panel when installed, and the stabilator controls/auto flight control panel. UH-60L UH-60A EH-60A > The variable 115 vac is also fed through the junction box assembly to the following lower console panels: miscellaneous switch panel, retransmit switch panel, compass system control panel, cabin dome light dimmer panel, and ESSS stores jettison control panel connector; also the left and right gunners' ICS control panel floodlights and the troop commander's ICS control panel floodlight. < HH-60A HH-60L > The variable 115 vac is also fed to the following lower console panels: miscellaneous switch panel, compass system control panel, ESSS stores jettison control panel, personnel locator system (PLS) control panel, blade de-ice control panel, blade de-ice test panel, pilot's ICS control panel, copilot's ICS control panel, MED2 ICS control panel, MED1 ICS control panel, and crew chief's ICS control panel. The auxiliary lighting circuit is powered from the No.1 ac primary bus through the LIGHTS LWR CSL 5V circuit breaker on the auxiliary circuit breaker panel. The auxiliary light intensity is controlled by the LWR CSL AUX DIMMER on the instrument panel. Turning the control clockwise provides a variable voltage 0 to 5 vac to the following lower console panels: ice rate meter, the pilot's and copilot's CDUs, emergency control panel, pilot's rescue hoist control panel, onboard oxygen generating system (OBOGS) status panel, auxiliary switch panel, VHF AM/FM radio, environmental control unit (ECU) control panel, forward looking infrared (FLIR) control panel, auxiliary fuel management control panel, and crew's rescue hoist control panel. <

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

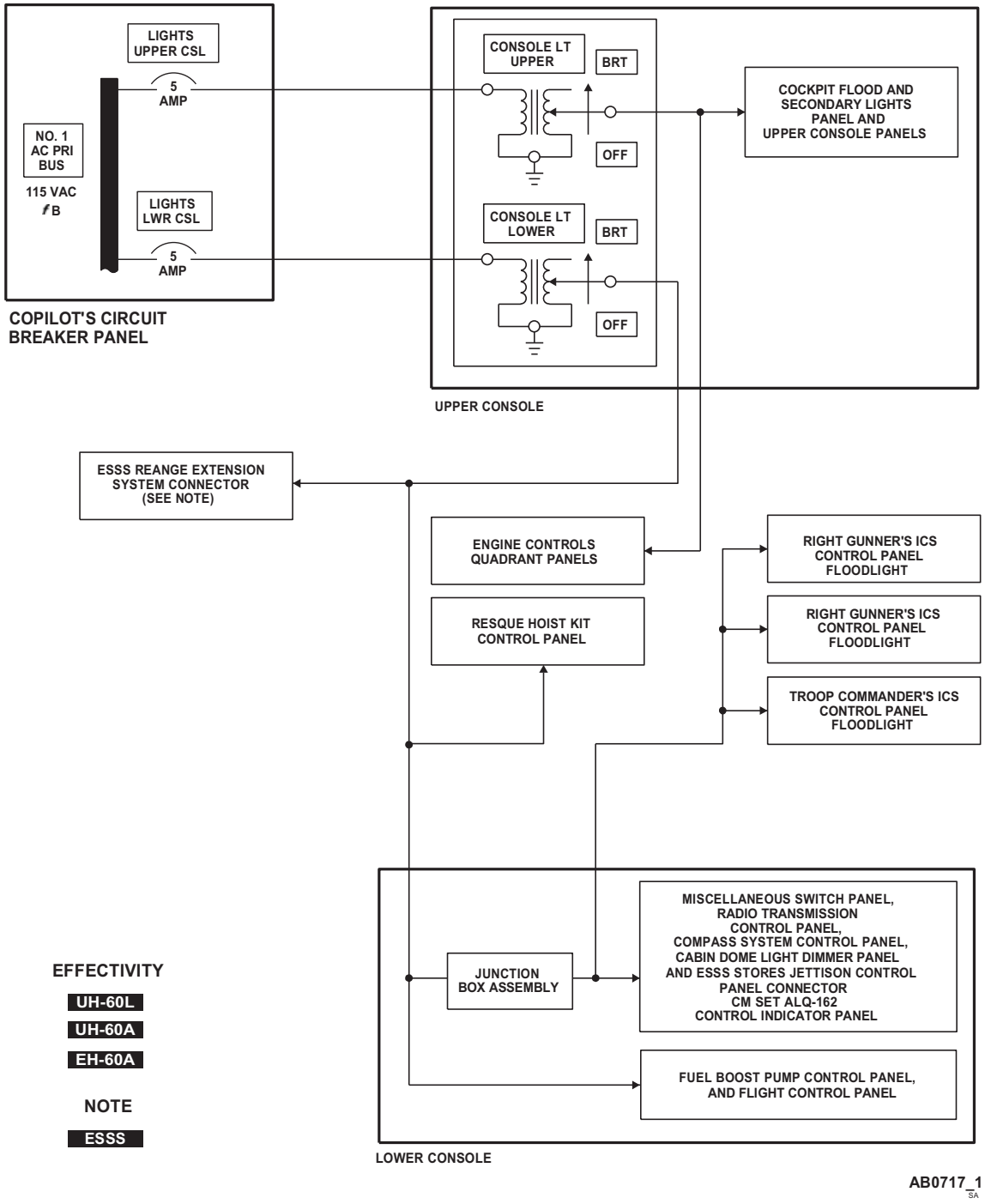


Figure 2. Console Lighting Block Diagram (Sheet 1 of 3).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

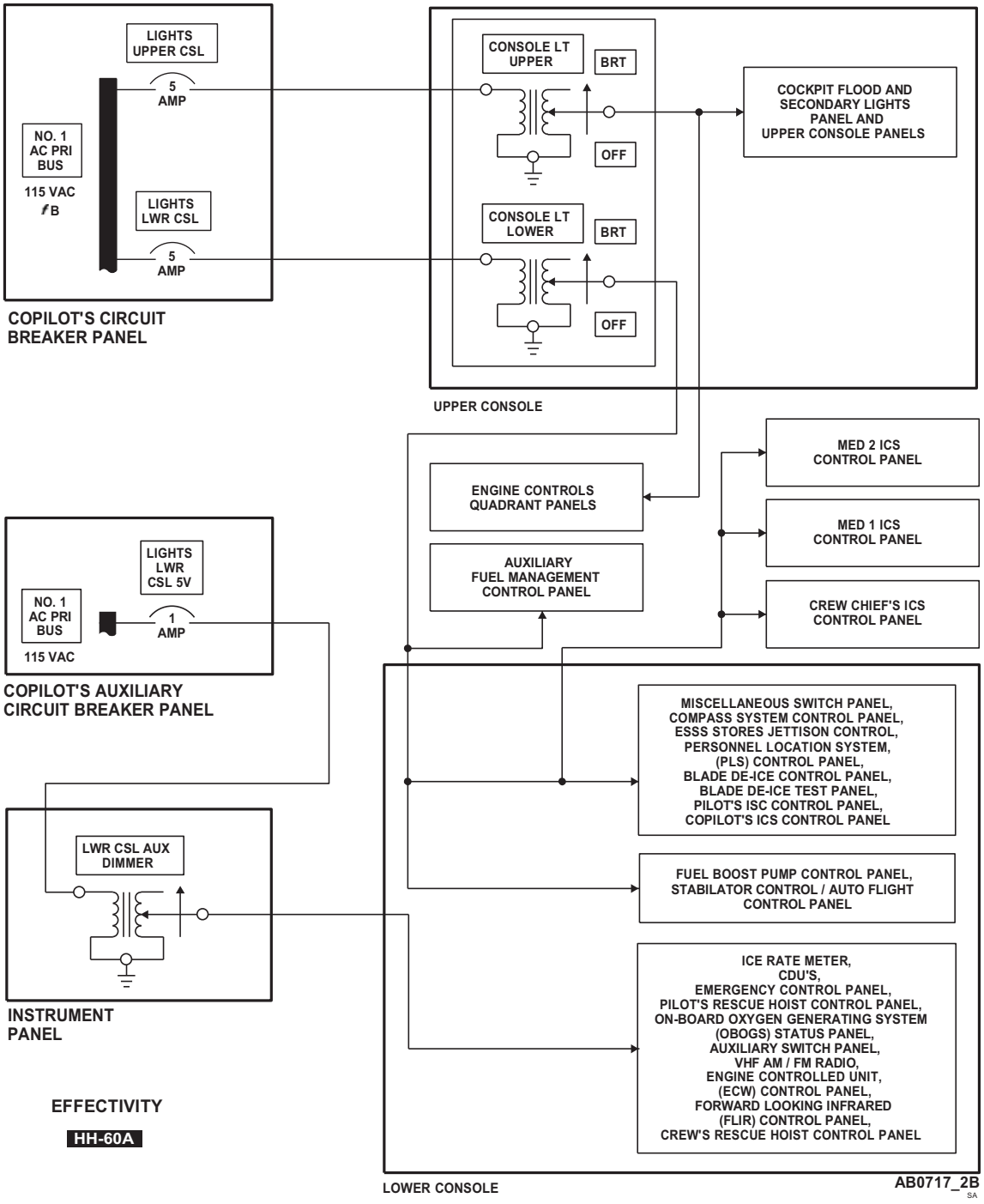


Figure 2. Console Lighting Block Diagram (Sheet 2 of 3).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

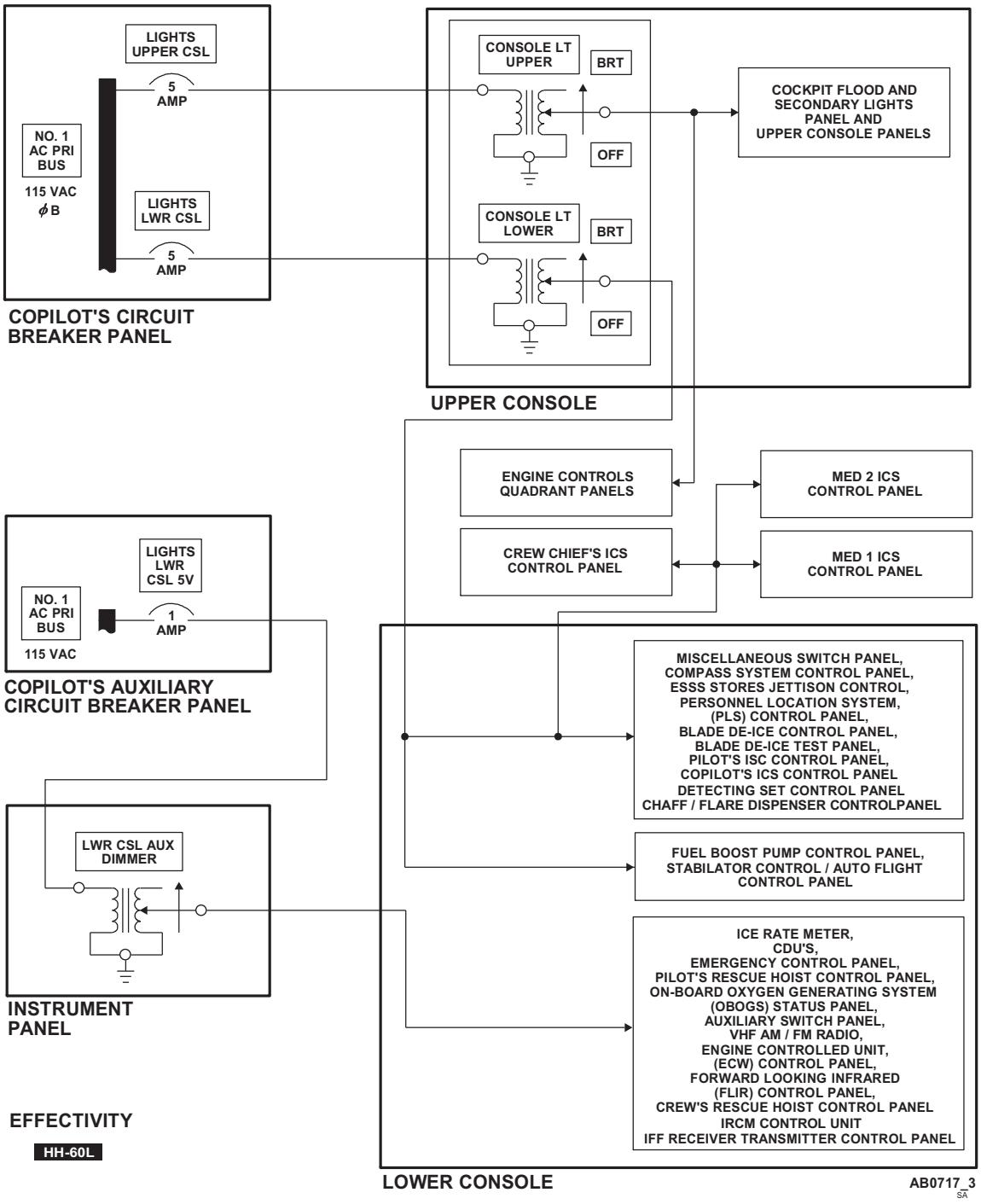


Figure 2. Console Lighting Block Diagram (Sheet 3 of 3).

INSTRUMENT PANEL AND CONSOLE INDICATOR LIGHTS DIMMING

The instrument panel and consoles indicator lights dimming system (Figure 3. (Sheet 1 of 4)) provides control for decreasing the intensity of or turning off indicator lights on the instrument panel, upper and lower consoles, and engine and APU fire T-handles. The dimming system consists of relays K40 and K43 as well as dimming resistors R8, R9, and R10 in the left relay panel, a LIGHTED SWITCHES dimmer control on the upper console, indicator

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

lights dimmer forward of the lower console, pilot's and copilot's RAD ALT DIMMING controls on the instrument panel, and the BRT/DIM-TEST switch on the caution/advisory panel **UH-60L UH-60A EH-60A >** BRT/DIM-TEST switch on the caution/advisory panel **< HH-60A HH-60L >** indicator LTS BRT/DIM-TEST switch on the instrument panel **<** .

The system is electrically powered by 28 vdc in three different places. The major part of the system is powered from the No. 1 dc primary bus through the LIGHTS ADVSY circuit breaker on the copilot's circuit breaker panel. **UH-60L UH-60A EH-60A >** A second part of the system, relay K43, receives its power from the dc essential bus through the FIRE DET No. 1 ENG circuit breaker in the upper console. A third part of the system, the T-handles for the #1 Engine, #2 Engine, and APU are powered by their respective fire detector control amplifiers located in the cabin overhead. **< HH-60A HH-60L >** A fourth part of the system, relay K303, receives its power from the No. 1 dc primary bus through the HOIST CONTR circuit breaker panel, on the copilot's auxiliary circuit breaker panel. **<**

MWO 50-78 > The LIGHTED SWITCHES dimmer control provides 0 to 26 vdc to the auxiliary fuel management panel annunciators and displays. **<** In the bright mode of operation, relay K40 is de-energized and full voltage is applied through normally closed contacts of K40 to brighten legend lights on the pilot's and copilot's HSI/VSI mode select panels, CIS mode select panel, advisory light on the pilot's and copilot's vertical situation indicators (VSIs), doppler computer display, blade de-ice test and control panels, fuel boost pump control panel, rescue hoist control panel when installed, the CARGO HOOK EMERG REL TEST light, and the tail wheel lock indicating system. The dimming system also applies the 28 vdc to warning and display lights on the pilot's and copilot's radar altimeters. The LIGHTED SWITCHES dimmer control provides 0 to 26 vdc to the auxiliary fuel management panel annunciators and displays. **UH-60L UH-60A >** In the bright mode of operation, relay K40 and K43 are de-energized and full voltage is applied through normally closed contacts of K40 to brighten legend lights on the pilot's and copilot's HSI/VSI mode select panels, CIS mode select panel, advisory light on the pilot's and copilot's vertical situation indicators (VSIs), stabilator controls/auto flight control panel, doppler computer display, blade de-ice test and control panels, fuel boost pump control panel, rescue hoist control panel when installed, the CARGO HOOK EMERG REL TEST light, and the tail wheel lock indicating system. The dimming system also applies the 28 vdc to warning and display lights on the pilot's and copilot's radar altimeters. Normally closed contacts of relay K43 apply full output voltage of the No. 1 engine, No. 2 engine, and APU fire detector control amplifiers directly to the respective fire warning T-handles. **< EH-60A >** In the bright mode of operation, relay K40 and K43 are de-energized and full voltage is applied through normally closed contacts of K40 to brighten legend lights on the pilot's and copilot's HSI/VSI mode select panels, CIS mode select panel, advisory light on the pilot's and copilot's vertical situation indicators (VSIs), stabilator controls/auto flight control panel, doppler computer display, blade de-ice test and control panels, fuel boost pump control panel, rescue hoist control panel when installed, the CARGO HOOK EMERG REL TEST light, ECS control panel, system select panel, crew call switch, and the tail wheel lock indicating system. The dimming system also applies the 28 vdc to warning and display lights on the pilot's and copilot's radar altimeters. Normally closed contacts of relay K43 apply full output voltage of the No. 1 engine, No. 2 engine, and APU fire detector control amplifiers directly to the respective fire warning T-handles. **< HH-60A HH-60L >** In the bright mode of operation, relays K40 and K303 are de-energized and full voltage is applied through normally closed contacts of K40 to brighten legend lights on the pilot's and copilot's HSI/VSI mode select panels, CIS mode select panel, advisory light on the pilot's and copilot's vertical situation indicators (VSIs), stabilator controls/auto flight control panel, blade de-ice test and control panels, fuel boost pump control panel, rescue hoist control panel when installed, the CARGO HOOK EMERG REL TEST light, OBOGS status panel, and the tail wheel lock indicating system. The dimming system also applies the 28 vdc to warning and display lights on the pilot's and copilot's radar altimeters. **<**

UH-60L UH-60A > When the BRT/DIM-TEST switch is actuated to dim mode, a ground is applied to the left relay panel to energize relays K40 and K43. Then, dimming voltages are routed through energized contacts of relay K40 in the following way: from the indicator lights dimmer, 9 vdc is applied to the blade deice control and test panels, pilot's and copilot's VSI's, rescue hoist control panel when installed, doppler computer display, and the CARGO HOOK EMERG REL TEST light. Through the LIGHTED SWITCHES dimmer control, 26 vdc variable voltage is routed to the pilot's and copilot's HSI/VSI mode select panel, CIS mode select panel, flight control panel, tail wheel lock system, and fuel boost pump control panel. Also, through two RAD ALT DIMMING controls, 28 vdc variable voltage is directed to the pilot's and copilot's radar altimeters. While dimming is occurring through relay

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

K40, a 28 vdc output of each of the fire detector control amplifiers is applied through the energized contacts of relay K43 via the dimming resistors R8, R9, and R10 to dim the T-handles should a fire warning occur. **< EH-60A >** When the BRT/DIM-TEST switch is actuated to dim mode, a ground is applied to the left relay panel to energize relay K40. Then, dimming voltages are routed through energized contacts of relay K40 in the following way: from the indicator lights dimmer, 9 vdc is applied to the blade deice control and test panels, pilot's and copilot's VSI's, rescue hoist control panel when installed, system select panel, crew call switch, doppler computer display, and the CARGO HOOK EMERG REL TEST light. Through the LIGHTED SWITCHES dimmer control, 26 vdc variable voltage is routed to the pilot's and copilot's HSI/VSI mode select panel, CIS mode select panel, flight control panel, tail wheel lock system, and fuel boost pump control panel. Also, through two RAD ALT DIMMING controls, 28 vdc variable voltage is directed to the pilot's and copilot's radar altimeters. While dimming is occurring through relay K40, a 28 vdc output of each of the fire detector control amplifiers is applied through the energized contacts of relay K43 via the dimming resistors R8, R9, and R10 to dim the T-handles should a fire warning occur. **< HH-60A HH-60L >** When the BRT/DIM-TEST switch is actuated to dim mode, a ground is applied to the left relay panel to energize relays K40 and K303. Then, dimming voltages are routed through energized contacts of relay K40 in the following way: from the indicator lights dimmer, 9 vdc is applied to the blade deice control and test panels, pilot's and copilot's VSI's, rescue hoist control panel when installed, OBOGS status panel, system select panel, crew call switch, and the CARGO HOOK EMERG REL TEST light. Through the LIGHTED SWITCHES dimmer control, 26 vdc variable voltage is routed to the pilot's and copilot's HSI/VSI mode select panel, CIS mode select panel, flight control panel, tail wheel lock system, and fuel boost pump control panel. Also, through two RAD ALT DIMMING controls, 28 vdc variable voltage is directed to the pilot's and copilot's radar altimeters. While dimming is occurring through relay K40, a 28 vdc output of each of the fire detector control amplifiers is applied through the energized contacts of relay K303 via the dimming resistors R8, R9, and R10 to dim the T-handles should a fire warning occur. **<**

UH-60L UH-60A EH-60A > When the BRT/DIM-TEST switch is actuated again to select the bright mode, the ground is removed from the left relay panel. The loss of the ground de-energizes relays K40, K43, and and all panel indicator lights mentioned above will brighten again. **< HH-60A HH-60L >** When the INDICATOR LTS BRT/DIM TEST switch is actuated again to select the bright mode, the ground is removed from the left relay panel. The loss of the ground de-energizes relays K40, K303, and all panel indicator lights mentioned above will brighten again. **<**

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

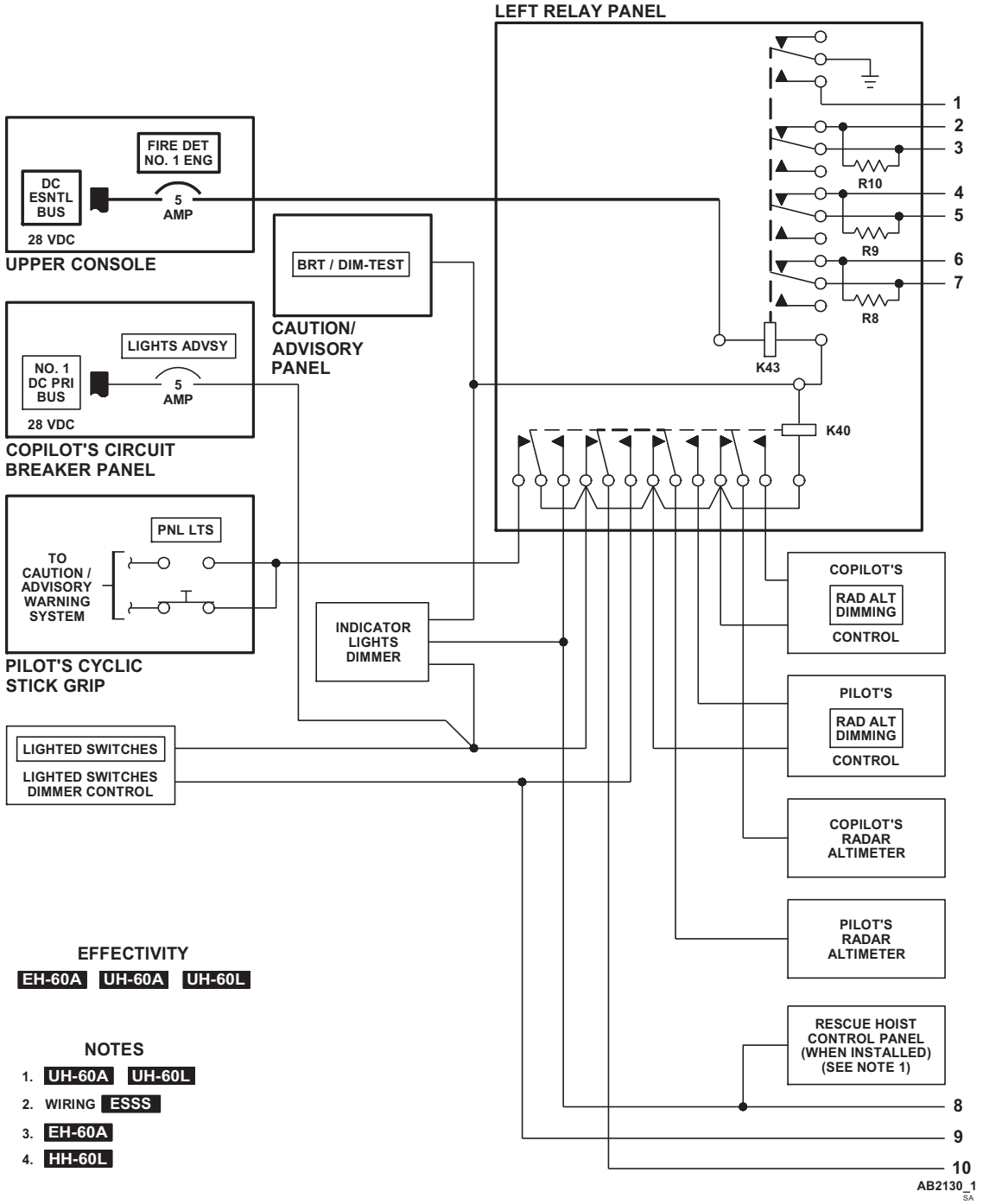


Figure 3. Instrument Panel and Consoles Indicator Lights Dimming Block Diagram (Sheet 1 of 4).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

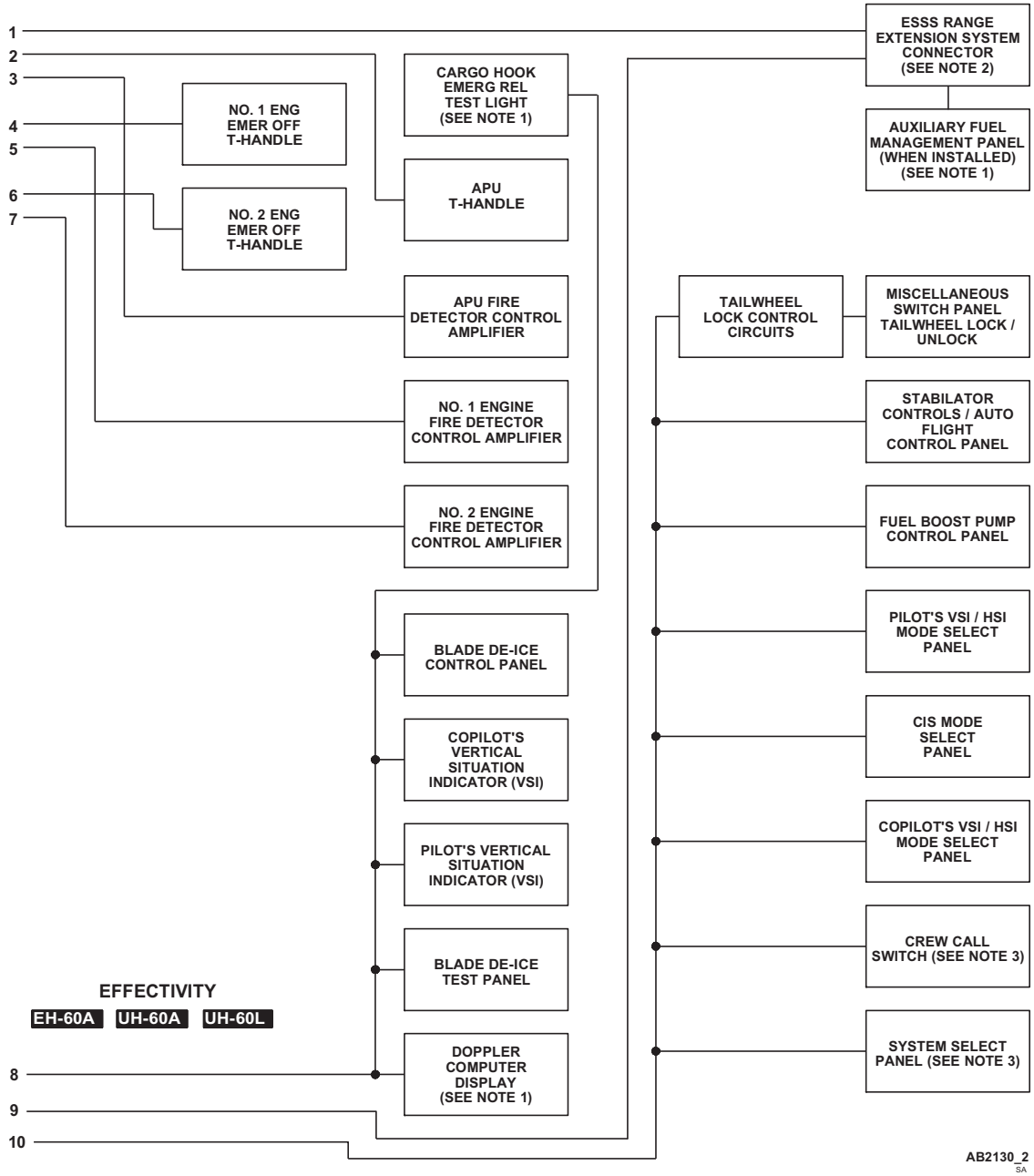


Figure 3. Instrument Panel and Consoles Indicator Lights Dimming Block Diagram (Sheet 2 of 4).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

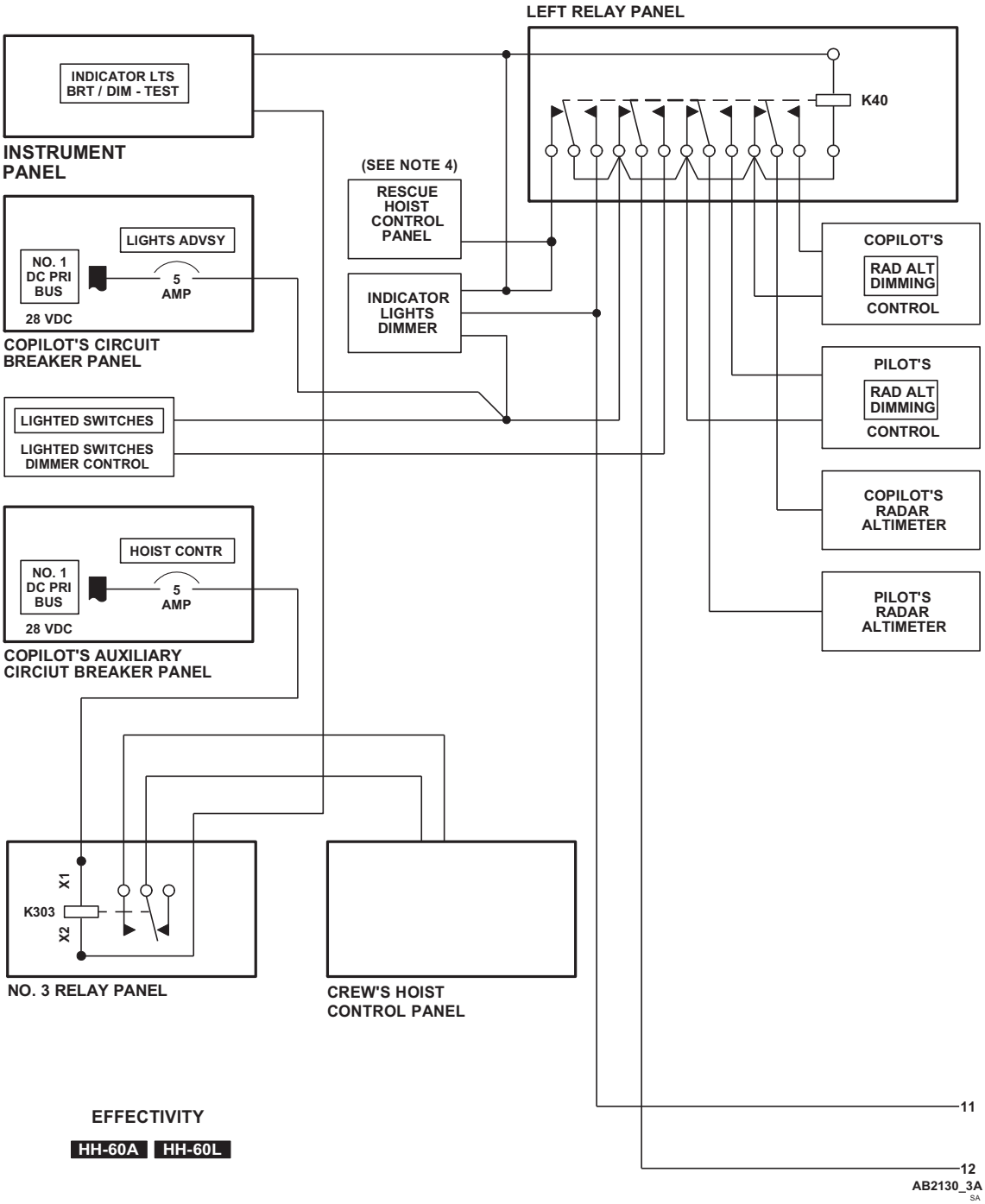


Figure 3. Instrument Panel and Consoles Indicator Lights Dimming Block Diagram (Sheet 3 of 4).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

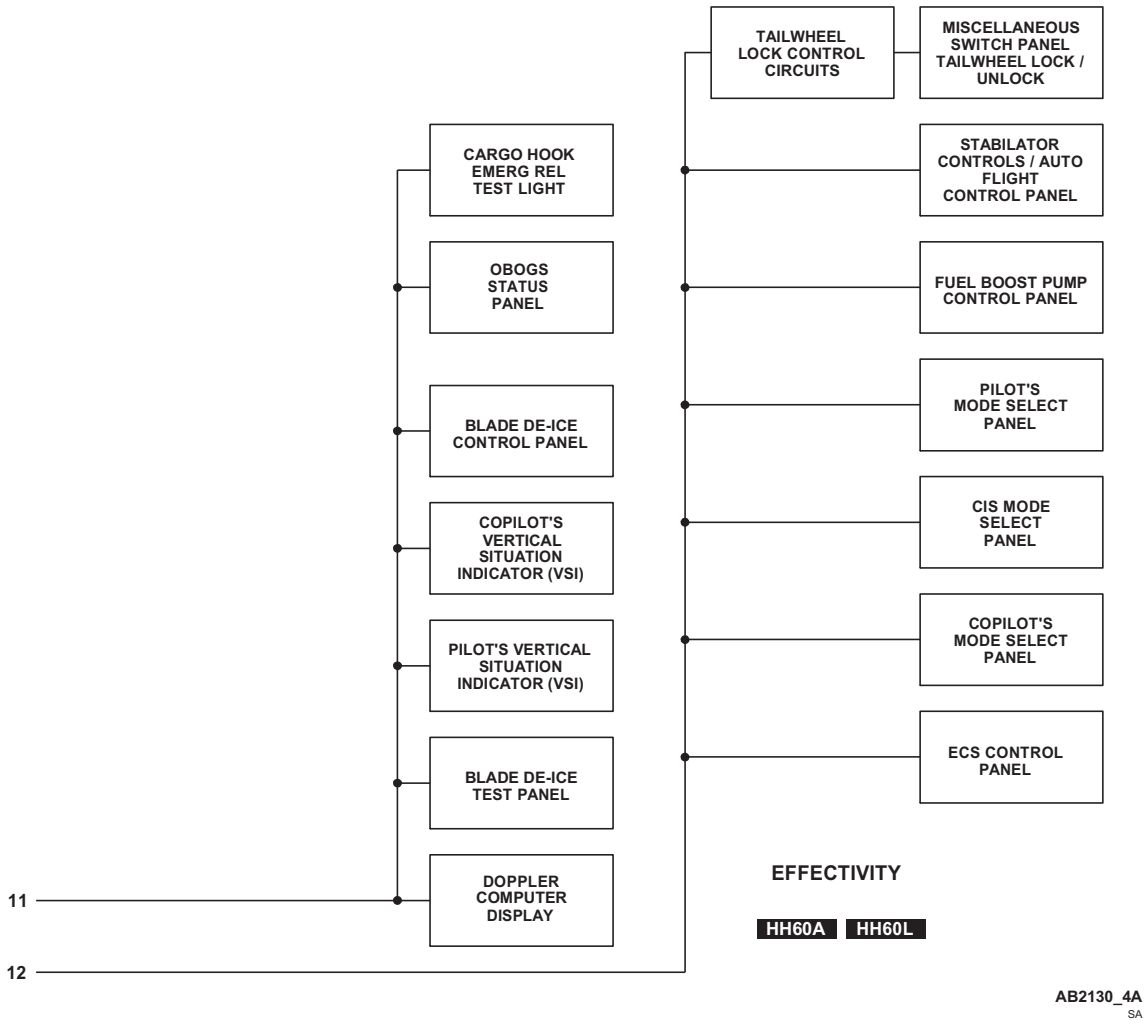


Figure 3. Instrument Panel and Consoles Indicator Lights Dimming Block Diagram (Sheet 4 of 4).

CABIN DOME LIGHTS

Three dome light assemblies are installed in the cabin area to provide blue or white lighting (Figure 4). Each dome light assembly contains a blue light and a white light. System electrical power is supplied by the No. 1 ac primary

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

bus through the LIGHTS CABIN DOME circuit breaker on the copilot's circuit breaker panel. The lights are controlled by the CABIN DOME LT, OFF-BRT dimmer unit behind the pilot's seat and the CABIN DOME LT WHITE-OFF-BLUE switch on the upper console. The three-position switch, WHITE-OFF-BLUE, has on-off control and permits selection of color.

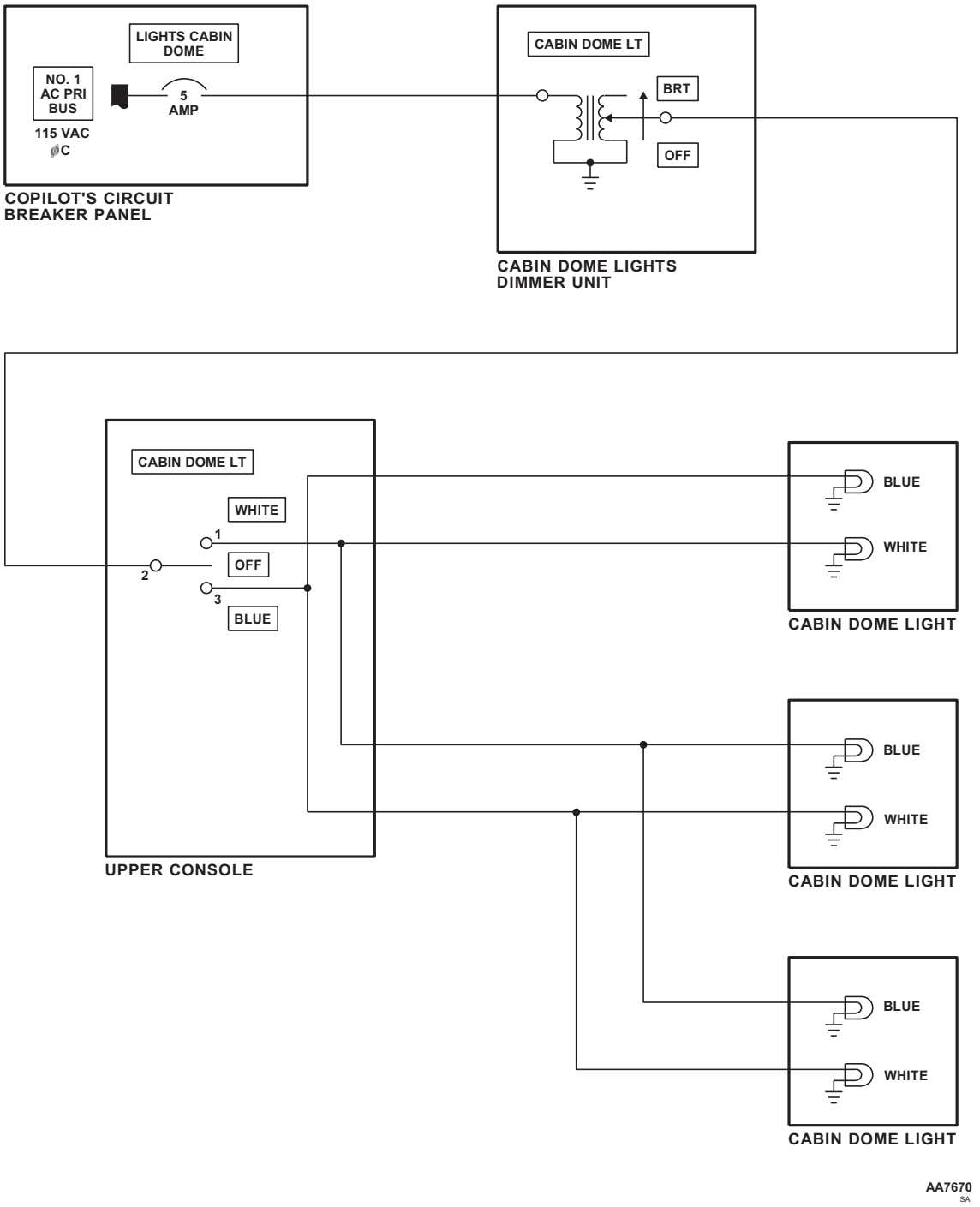


Figure 4. Cabin Dome Lights Block Diagram.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

COCKPIT FLOOD AND SECONDARY LIGHTS

The cockpit flood and secondary lights consist of two white flood lights and two blue secondary lights on the cockpit overhead, six blue glareshield lights on the instrument panel, and standby compass light. The lighting is controlled by the BLUE/OFF/WHITE switch on the cockpit flood and secondary lights panel, and by the GLARESHIELD LIGHTS control on the upper console. Electrical power of 28 vdc is supplied to the BLUE/OFF/WHITE switch and to standby compass switch by the dc essential bus through the LIGHTS SEC PNL circuit breaker on the upper console (Figure 5). Electrical power of 115 vac is supplied to the GLARESHIELD LIGHTS control by the No. 1 ac primary bus through the GLARESHLD circuit breaker on the copilot's circuit breaker panel. Both blue and white secondary overhead lights are controlled by the BLUE/OFF/WHITE switch located on the secondary light panel. The six glareshield lights are controlled by the GLARESHIELD LIGHTS control.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

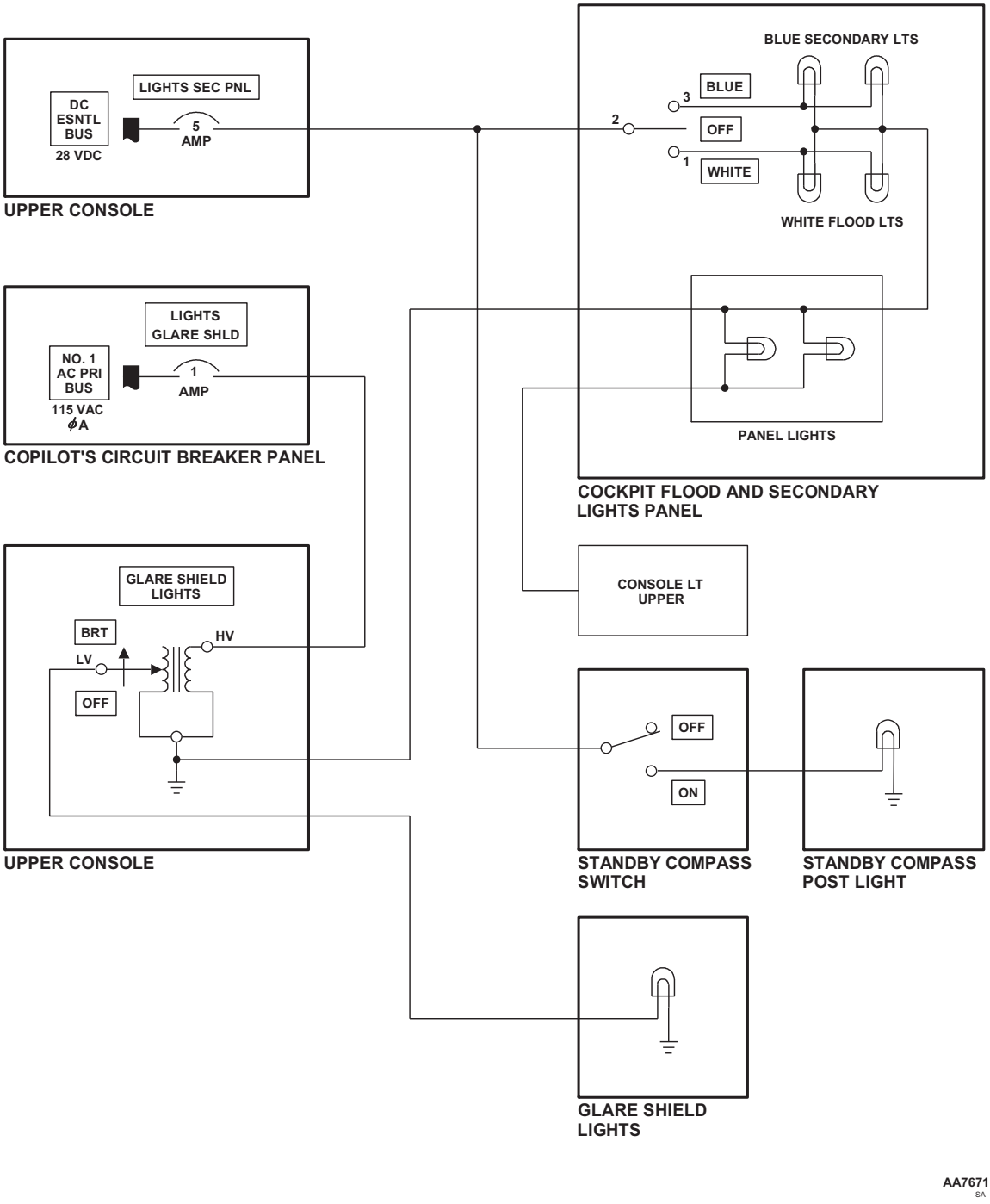


Figure 5. Cockpit Flood and Secondary Lights Block Diagram.

UTILITY AND MAINTENANCE LIGHTS

Three portable, hand-held utility lights with coil cords are installed. Two lights are installed on the upper console; one each for the pilot and copilot. The third light is installed on the right side of the copilot's seat. All three utility lights provide blue or white lighting (Figure 6). **77-27714-96-26722 >** System electrical power is supplied by the battery utility bus through the UTIL LTS CKPT circuit breaker on the lower console. **<UH-60L 96-26723-SUBQ MWO**

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

50-77 > System electrical power is supplied by the battery bus through the UTIL LTS CKPT circuit breaker on the lower console. < The utility lights are attached to swivel-type detachable mountings and may be held to provide blue or white flood or spotlighting. Depressing the lock button on the casing assembly and simultaneously turning the lens casing selects a light filter for blue or white lighting.

The maintenance light, stored in a stowage bag behind the pilot's seat, is a portable floodlight on a 20-foot cord. A DIM, OFF, and BRIGHT switch controls the brightness of the light. UH-60A UH-60L > The cord of the light assembly can be connected to either of two maintenance light receptacles. One maintenance light receptacle is on the right side overhead in the forward cabin, while the other receptacle is on the bottom, outside of the tail cone aft of the tail wheel strut. <EH-60A > The cord of the light assembly can be connected to either of the two receptacles previously mentioned, or, to a third receptacle located in the transition section. Power to operate the maintenance light is provided from the battery utility bus through the UTIL LTS CKPT circuit breaker on the lower console circuit breaker panel. <

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

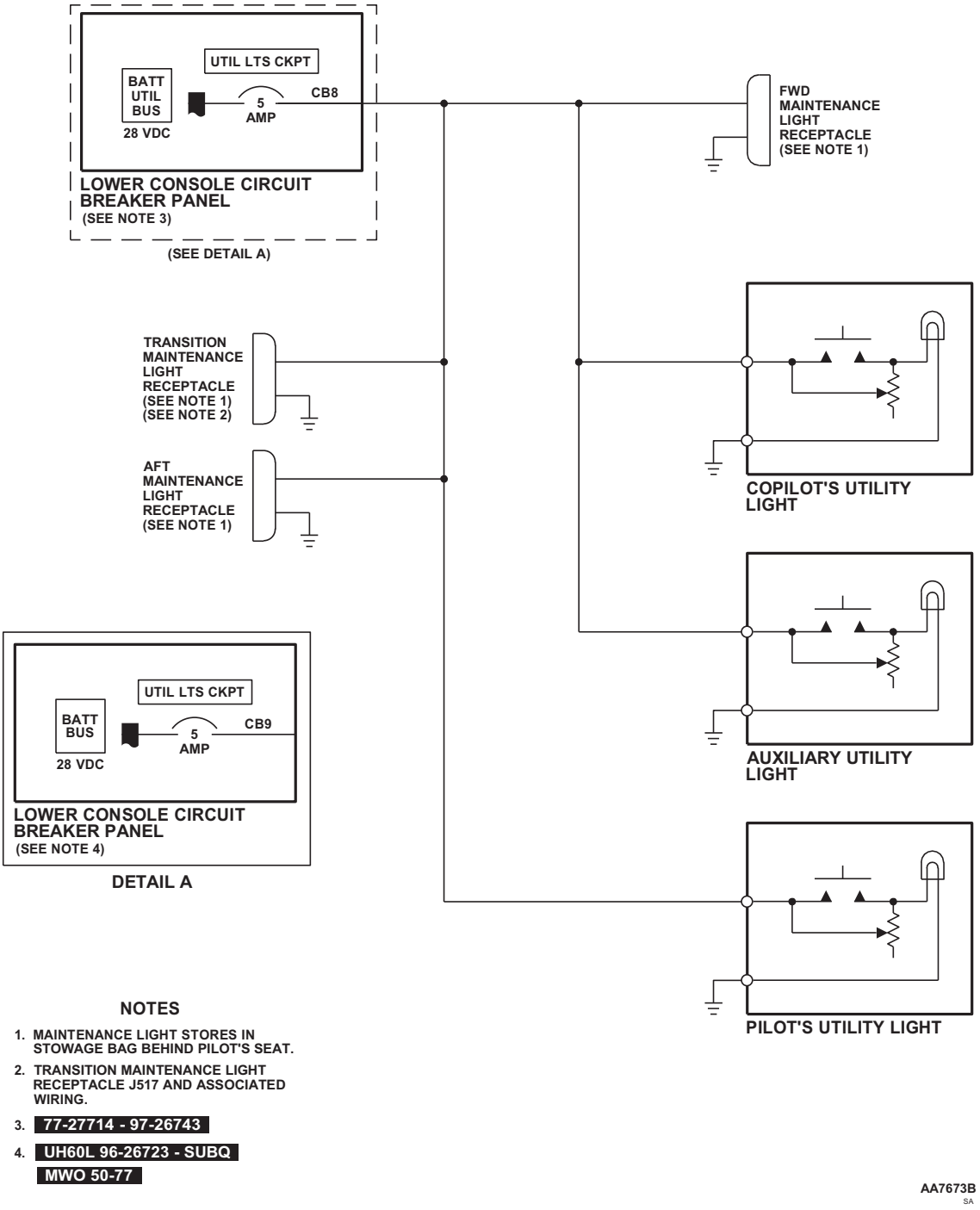


Figure 6. Utility and Maintenance Lights Block Diagram.

CM SET LIGHTS EH-60A> <

The control indicator unit of the AN/ALQ-156 CM set is mounted on the instrument panel and receives bezel assembly lighting power from the upper console. Control indicator status lamp lighting is also controlled at the upper console.

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

For location and description of major components, refer to the data in this work package.

EQUIPMENT DATA

For equipment data information, refer to this work package.

ELECTRICAL SYSTEMS

EXTERIOR LIGHTING DESCRIPTION AND DATA

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

EXTERIOR LIGHTING

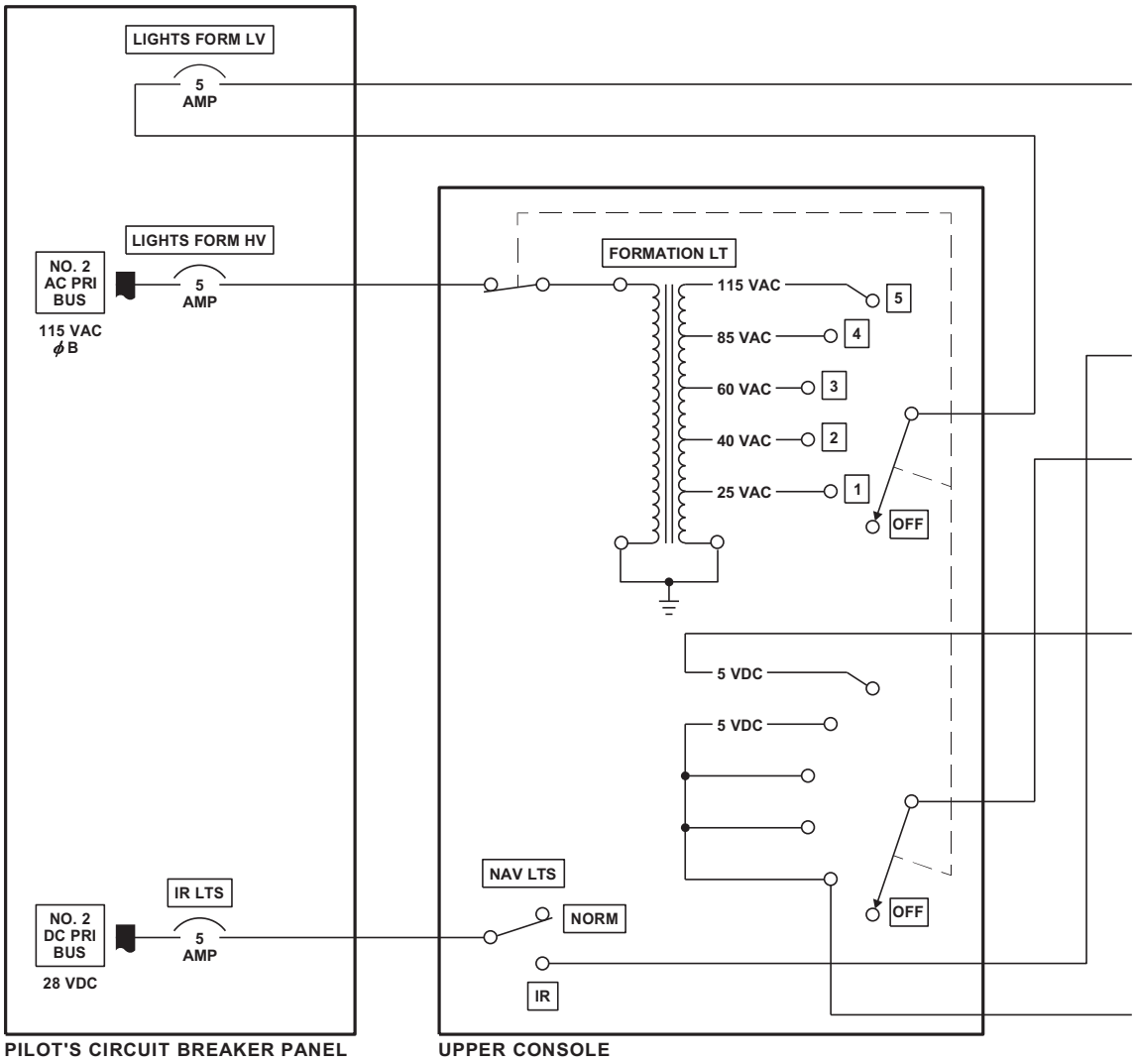
The exterior lighting systems are used either as navigational aids or for lighting an area outside of the helicopter for search or landing operations. The exterior lighting systems consist of formation lights, anti-collision lights, position lights, a retractable landing light, controllable searchlight, and cargo hook lights.

FORMATION LIGHTS

There are two sets of formation lights. Each set consists of two lights on the right and left horizontal stabilator, one on the rear of the main rotor pylon, and one on the tail cone (Figure 1. (Sheet 1 of 2)). One set of the formation lights, one at each position, are electro-luminescent light assemblies that emit green light when an alternating electrical field is applied to the phosphorescent plate (NORM). The other set of formation lights, one at each position, are infrared (IR) light emitting diode assemblies. With the NAV LTS switch at NORM, 115 vac is routed from the No. 2 ac primary bus through LIGHTS FORM HV circuit breaker, FORMATION LT control, LIGHTS FORM LV circuit breaker, and normally-closed contacts of relay K53 to the formation lights.

With the NAV LTS switch at IR, 28 vdc is routed from the No. 2 dc primary bus through the IR LTS circuit breaker and NAV LTS switch to energize relay K53 in the left relay panel. Also, 28 vdc is routed to circuitry in the left relay panel, producing a 5 vdc output. This voltage is routed through the FORMATION LT control to the IR formation lights. The FORMATION LT control, on the upper console, has an OFF position, and positions marked 1 through 5. With the NAV LTS switch positioned at NORM, the intensity of the electro-luminescent formation lights is controlled by rotating the FORMATION LT control clockwise from 1 to 5. Position 1 is dim and position 5 is bright. With the NAV LTS switch at IR, the electro-luminescent formation lights are disabled by energizing relay K53 in the left relay panel. With the FORMATION LT control at 5, 5 vdc is applied to the clear (bright) side of the IR assemblies. At positions 1 through 4, 5 vdc is applied to the filtered (dim) side of the IR assemblies.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED



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Figure 1. Formation Lights Block Diagram (Sheet 1 of 2).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

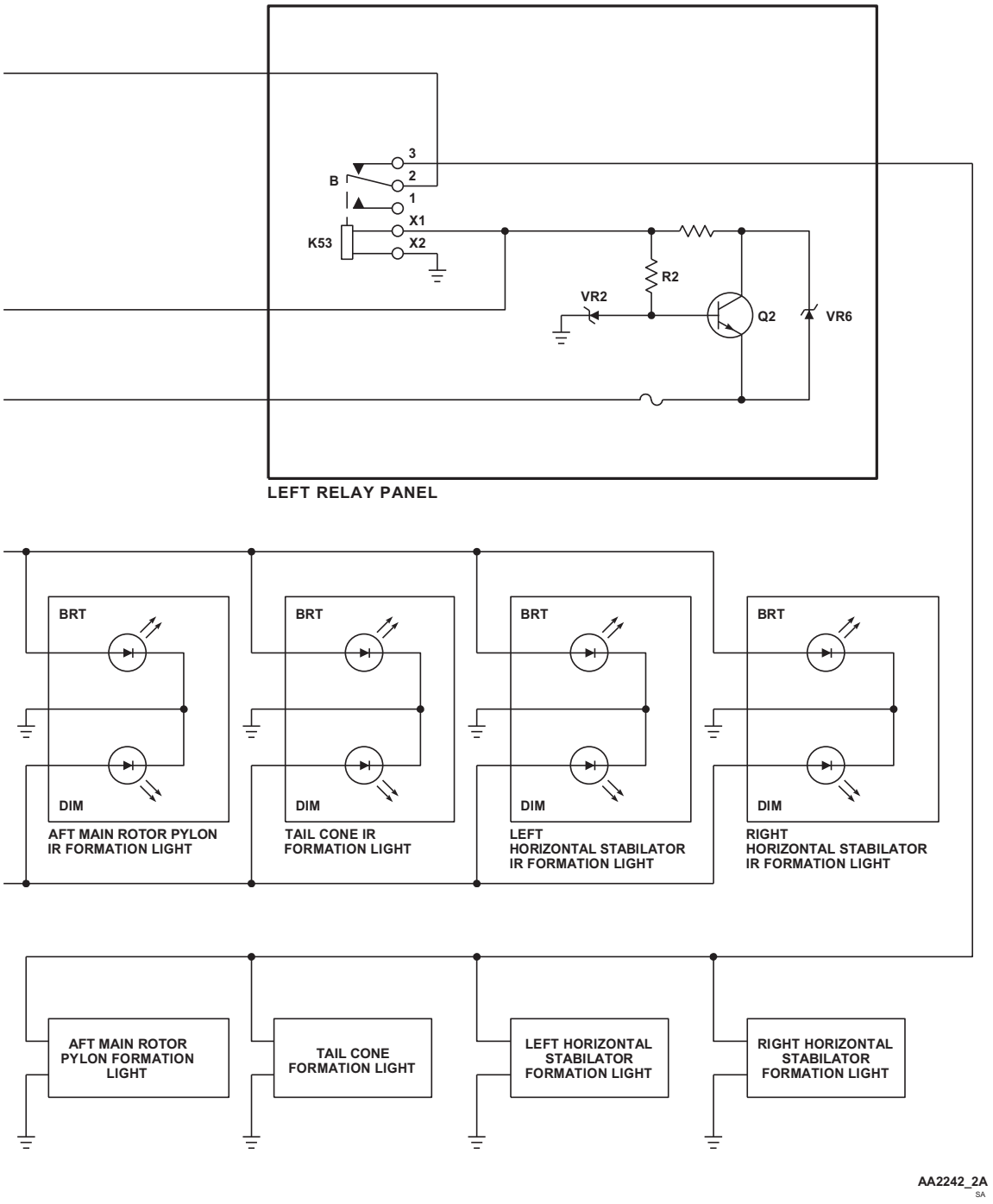


Figure 1. Formation Lights Block Diagram (Sheet 2 of 2).

ANTI-COLLISION LIGHTS

The helicopter has two anti-collision light assemblies; one on the underside of the tail cone, and the other on the top of the tail rotor pylon (Figure 2). Each anti-collision light assembly contains two strobe lamps. One lamp is enclosed in a white lens and provides light for daylight operation. The second lamp is enclosed in a red lens and provides light for night operation. The mode of operation is controlled by the ANTI-COLLISION LIGHTS

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

UPPER/BOTH/LOWER and DAY/OFF/NIGHT switches on the upper console. System electrical power is provided by the No. 2 ac primary bus and routed through the LIGHTS ANTI COLL circuit breaker, on the pilot's circuit breaker panel, to the power supply. The power supply, located in the tail cone section, can power either one or both light assemblies in either the red or white mode, as selected by the ANTI-COLLISION LIGHTS switches. With the DAY/OFF/NIGHT switch placed to NIGHT, and with UPPER/BOTH/LOWER switch placed to BOTH, the power supply alternately provides trigger voltages to the red lamps in both the upper and lower anti-collision light assemblies. With the DAY/OFF/NIGHT switch placed to DAY, the power supply alternately provides trigger voltages to the white lamp in both the upper and lower anti-collision light assemblies. With the UPPER/BOTH/LOWER switch placed to either UPPER or LOWER, the opposite light is disabled; the frequency of the trigger voltage to the selected lamps are 30 - 40 flashes per minute.

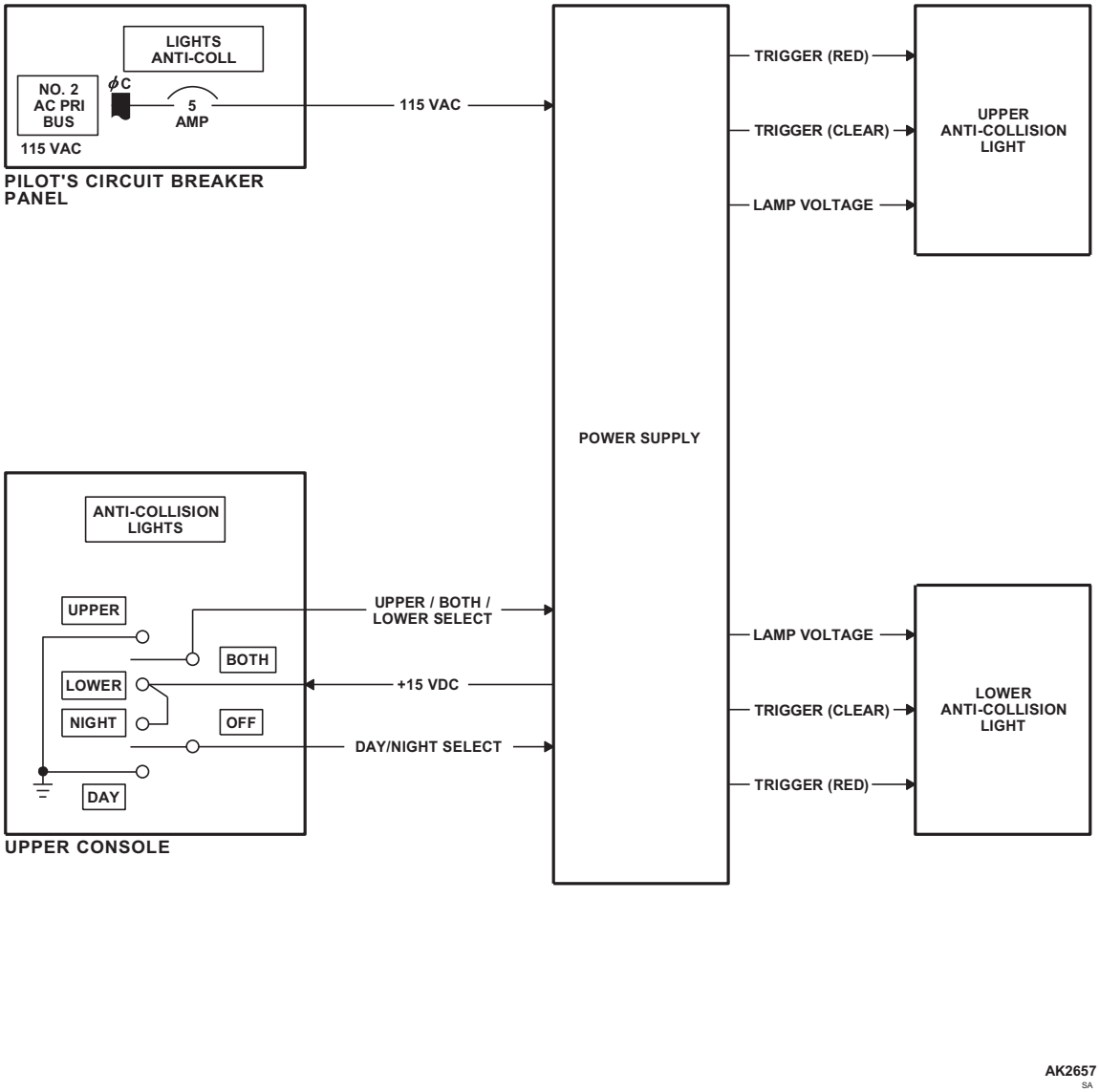


Figure 2. Anti-Collision Lights Block Diagram.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

POSITION LIGHTS

The helicopter has two sets of either three or five position lights (Figure 3. (Sheet 1 of 2)). One set is infrared and one is incandescent. On helicopters without horizontal stores support (HSS) installed, the helicopter has three position lights: a white light on the rear of the tail rotor pylon, a red light on the left landing gear support fairing, and a green light on the right landing gear support fairing. On helicopters with HSS installed, the helicopter has two additional position lights: a red light on the left horizontal stores support and a green light on the right horizontal stores support. On helicopters without HSS installed, the HSS disconnects are jumpered so the existing three lights are operational. On helicopters with HSS installed, the position lights on the landing gear support fairings are disabled and the position lights on the horizontal stores supports are operational. Therefore, three position lights are operational in either helicopter configuration. Power for the incandescent set of position lights is applied to the lights from the No. 2 dc primary bus through the POS LTS circuit breaker, on the pilot's circuit breaker panel, and the POSITION LIGHTS switches on the upper console. With the POSITION LIGHTS STEADY/FLASH switch placed to STEADY and DIM/OFF/BRT switch placed to either DIM or BRT, all three position lights illuminate accordingly. With the POSITION LIGHTS DIM/OFF/BRT switch placed to either DIM or BRT and STEADY/FLASH switch placed to FLASH, 28 vdc is applied to the flasher. Pulsing power is then routed from the flasher through the DIM/OFF/BRT switch to the lights, causing the three position lights to flash between 70 and 90 times per minute.

Power for the IR position lights is applied when the NAV LTS switch is placed to the IR position. Power of 28 vdc is applied to the left relay panel from the No. 2 dc primary bus through the POS LTS circuit breaker and the POSITION LIGHTS switch on the upper console. When the NAV LTS switch is placed to IR, the 28 vdc from the POSITION LIGHTS STEADY/FLASH switch is reduced to 5 vdc and applied through the POSITION LIGHTS DIM/OFF/BRT switch to the IR position lights. With the POSITION LIGHTS STEADY/FLASH switch placed to FLASH, 28 vdc is applied to the flasher. This circuit is protected by a fuse mounted on the left relay panel.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

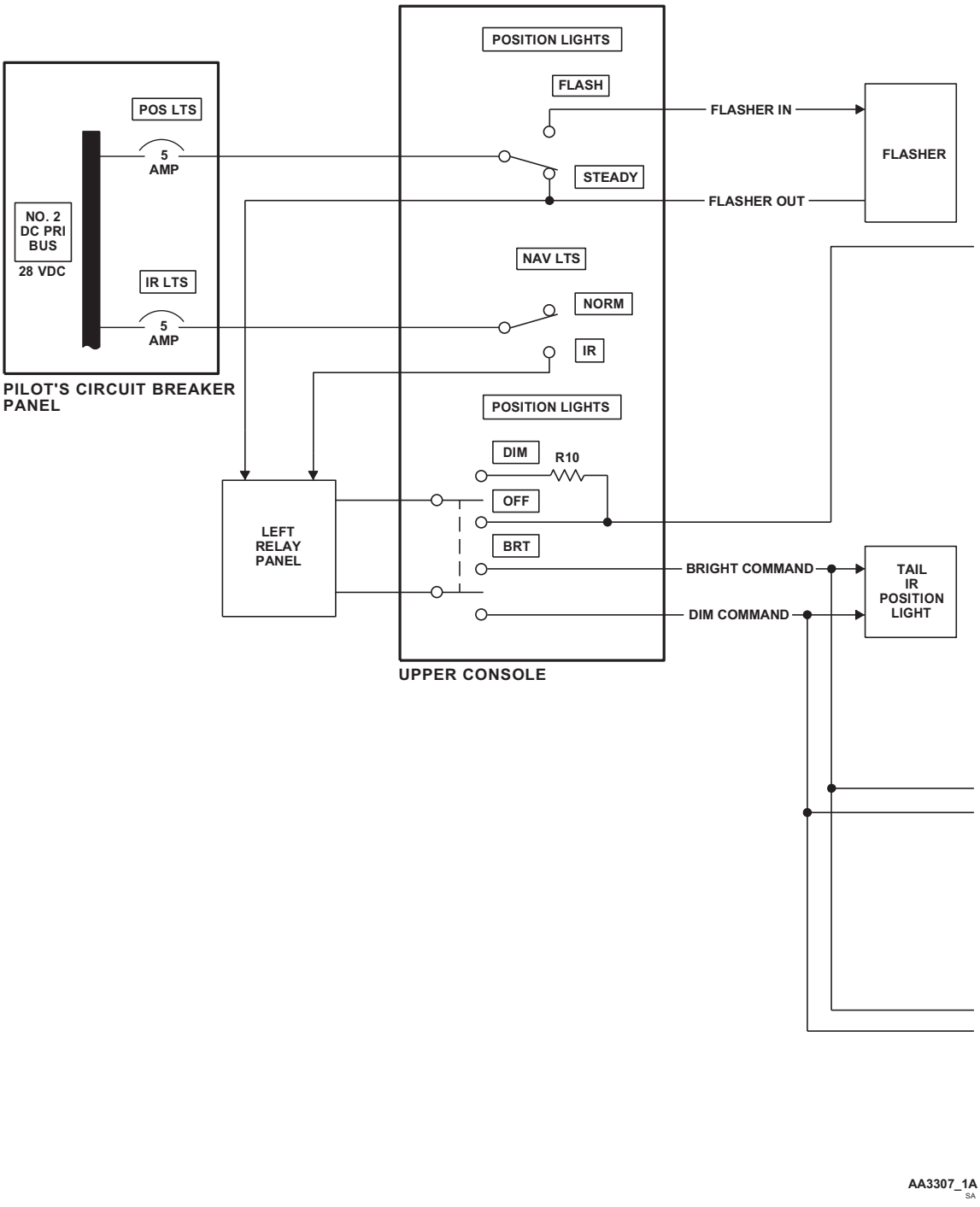


Figure 3. Position Lights Block Diagram (Sheet 1 of 2).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

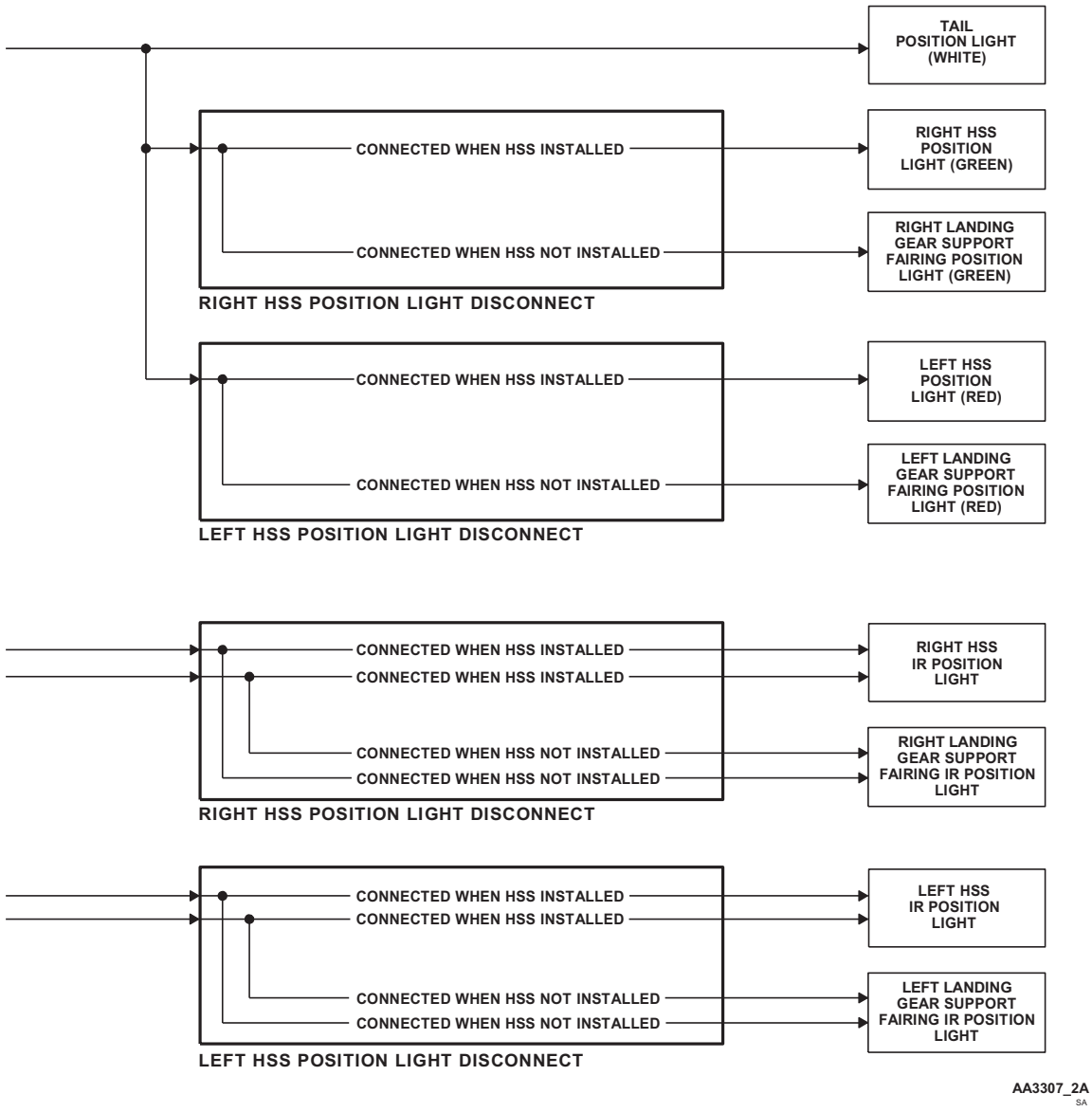


Figure 3. Position Lights Block Diagram (Sheet 2 of 2).

RETRACTABLE LANDING LIGHT

The retractable landing light assembly is on the left-forward lower nose area of the helicopter (Figure 4. (Sheet 1 of 2)). Power of 28 vdc for the 600-watt quartz lamp is supplied by the No. 1 dc primary bus through the LIGHTS RETR LDG PWR circuit breaker on the copilot's circuit breaker panel. The light assembly is controlled by a LDG LT combination push-button/toggle switch on both the pilot's and copilot's collective stick grips. Both LDG LT switches receive operating power from the No. 1 dc primary bus through the LIGHTS RETR LDG CONT circuit breaker on the copilot's circuit breaker panel. **UH-60L UH-60A EH-60A >** When either LDG LT ON/OFF switch is pushed and released, 28 vdc control voltage is applied through relay latching circuitry in the right relay panel to the retractable landing light assembly, causing the lamp to light, and to the caution/advisory panel, causing the LDG LT ON caution capsule to light. Pressing the LDG LT ON/OFF switch again and releasing it causes the lamp and the LDG LT ON capsule to go out. **< HH-60A HH-60L >** When either LDG LT ON/OFF switch is pushed and released, 28 vdc control voltage is applied through relay latching circuitry in the right relay panel to the retractable landing light assembly, causing the lamp to light, and to the pilot's and copilot's multifunction displays, causing the

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

LDG LT ON legends to appear. Pressing the LDG LT ON/OFF switch again and releasing it causes the lamp and the LDG LT ON legends to go out. ◁ When either LDG LT EXT/RET switch is moved to EXT, and held, 28 vdc power is applied to the retractable landing light assembly to extend the light. When either LDG LT EXT/RET switch is moved to RET, 28 vdc power is applied to the retractable landing light assembly to retract the light. The beam angle of the landing light can be controlled from straight down to straight ahead.

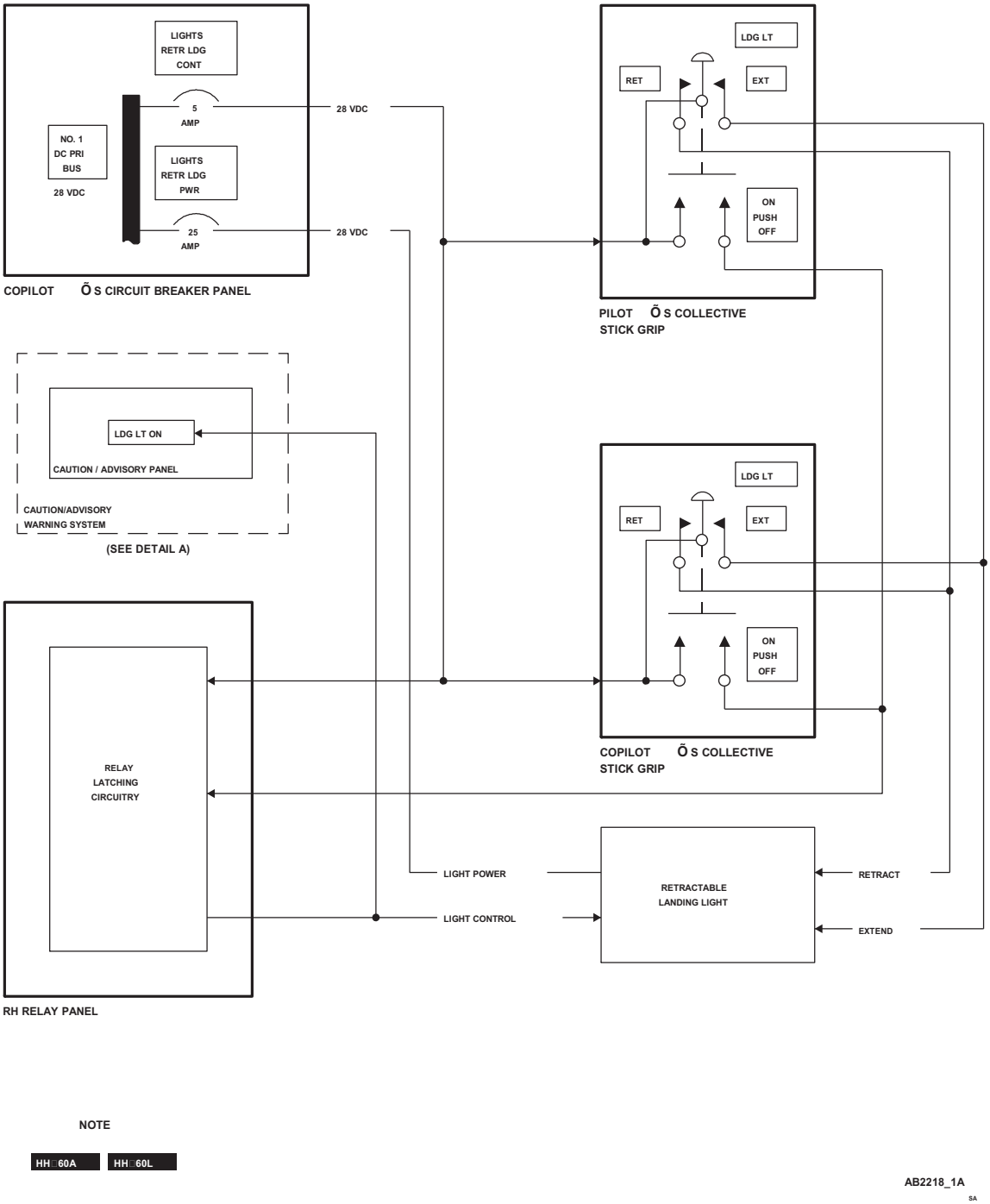
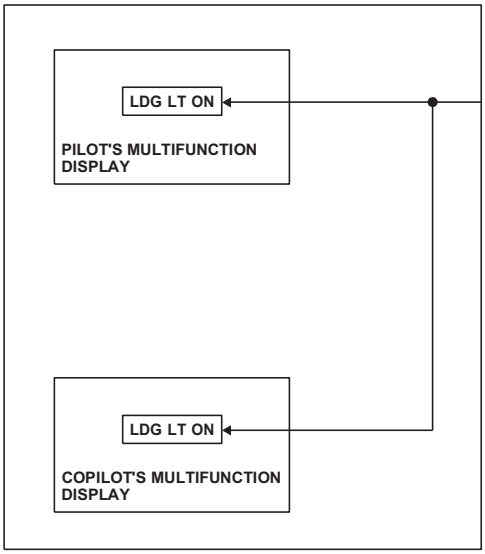


Figure 4. Retractable Landing Light Block Diagram (Sheet 1 of 2).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED



DETAIL A
(SEE NOTE)

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Figure 4. Retractable Landing Light Block Diagram (Sheet 2 of 2).

CONTROLLABLE SEARCHLIGHT

The controllable searchlight assembly provides a directional beam of light which is manually controlled by switches on the pilot's or copilot's collective stick grips (Figure 5. (Sheet 1 of 2)). The searchlight can be extended about 120° from fully retract position and can be rotated either left or right a full 360° when in any extended position. Power of 28 vdc for the 150-watt lamp is supplied by the dc essential bus through the LIGHTS CONTR PWR circuit breaker on the upper console, to the dimming control and to the searchlight. Power of 28 vdc to control the searchlight is supplied by the essential bus through the LIGHTS CONTR SRCH CONTR circuit breaker on upper console to the left relay panel, to the SRCH LT PUSH ON-OFF/BRT-DIM switch and a four-way thumb switch on the pilot's and copilot's collective stick grips. **UH-60L UH-60A EH-60A >** Pressing and releasing the SRCH LT PUSH ON-OFF/BRT-DIM switch causes the searchlight lamp to light and the SEARCH LT ON capsule on the caution advisory panel to go on. **< HH-60A HH-60L >** Pressing and releasing the SRCH LT PUSH ON-OFF/BRT-DIM switch causes the searchlight lamp to light and the SEARCH LT ON legends on the pilot's and copilot's MFDs to go on. **<** If the controllable searchlight dimming unit, on the glareshield, OUTPUT NORM/BYPASS switch is in NORM position, the lamp intensity is that of when it was last turned on and controllable by the SRCH LT PUSH ON-OFF/BRT-DIM switch BRT/DIM positions. If the controllable searchlight dimming unit OUTPUT NORM/BYPASS switch is in BYPASS position, the lamp intensity is full bright and is not

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

dimmable. Pressing and releasing the SRCH LT ON-OFF/BRT-DIM switch again turns the searchlight lamp off. The searchlight lamp has a removable infrared filter for NVG operations or incandescent lamp operation. Placing the four-way thumb switch to EXT causes the searchlight to extend. Placing the four-way thumb switch to R or L causes the searchlight to turn right or left. Placing the four-way thumb switch to RET causes the searchlight to retract and also to stow if held at RET.

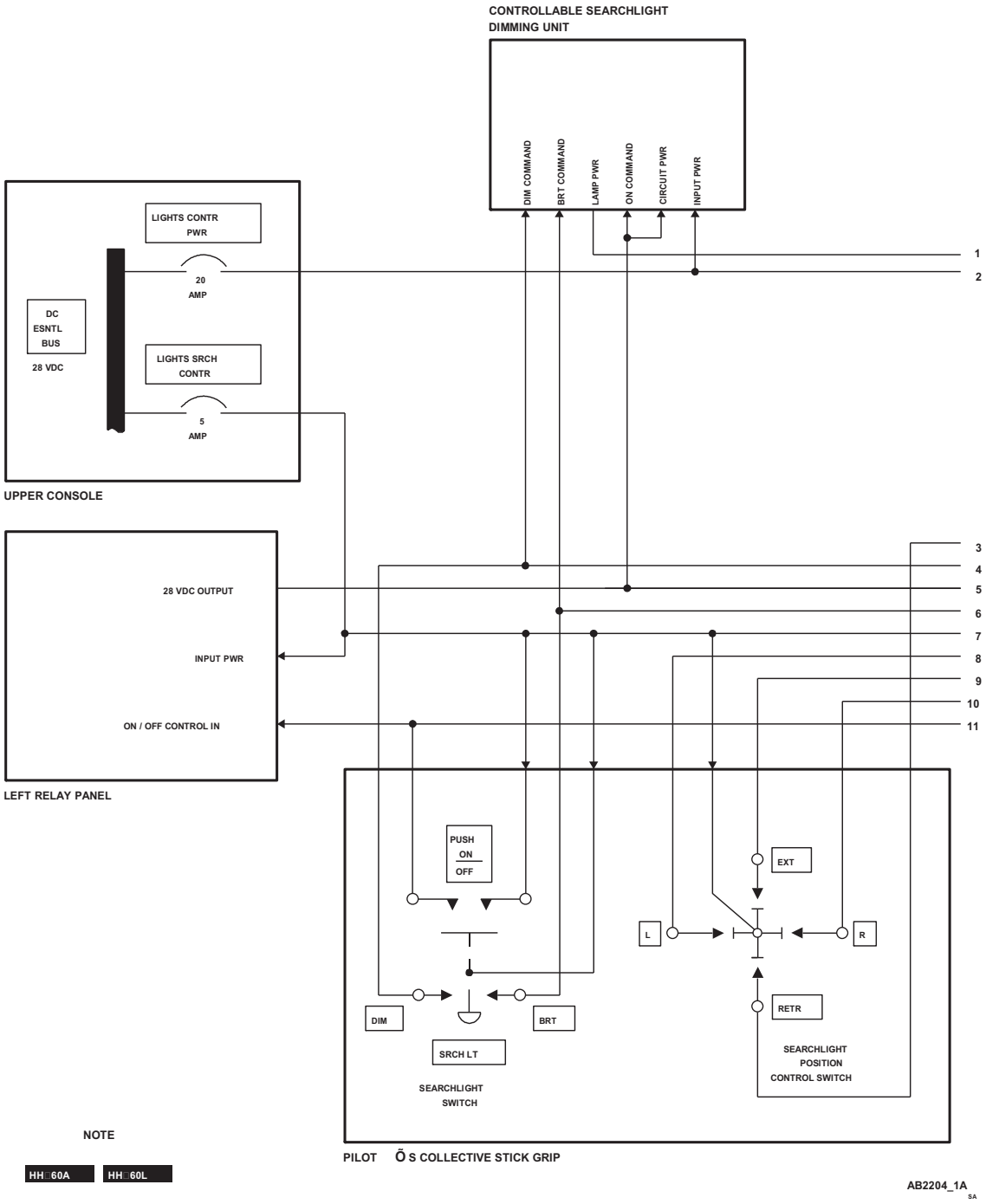


Figure 5. Controllable Searchlight Block Diagram (Sheet 1 of 2).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

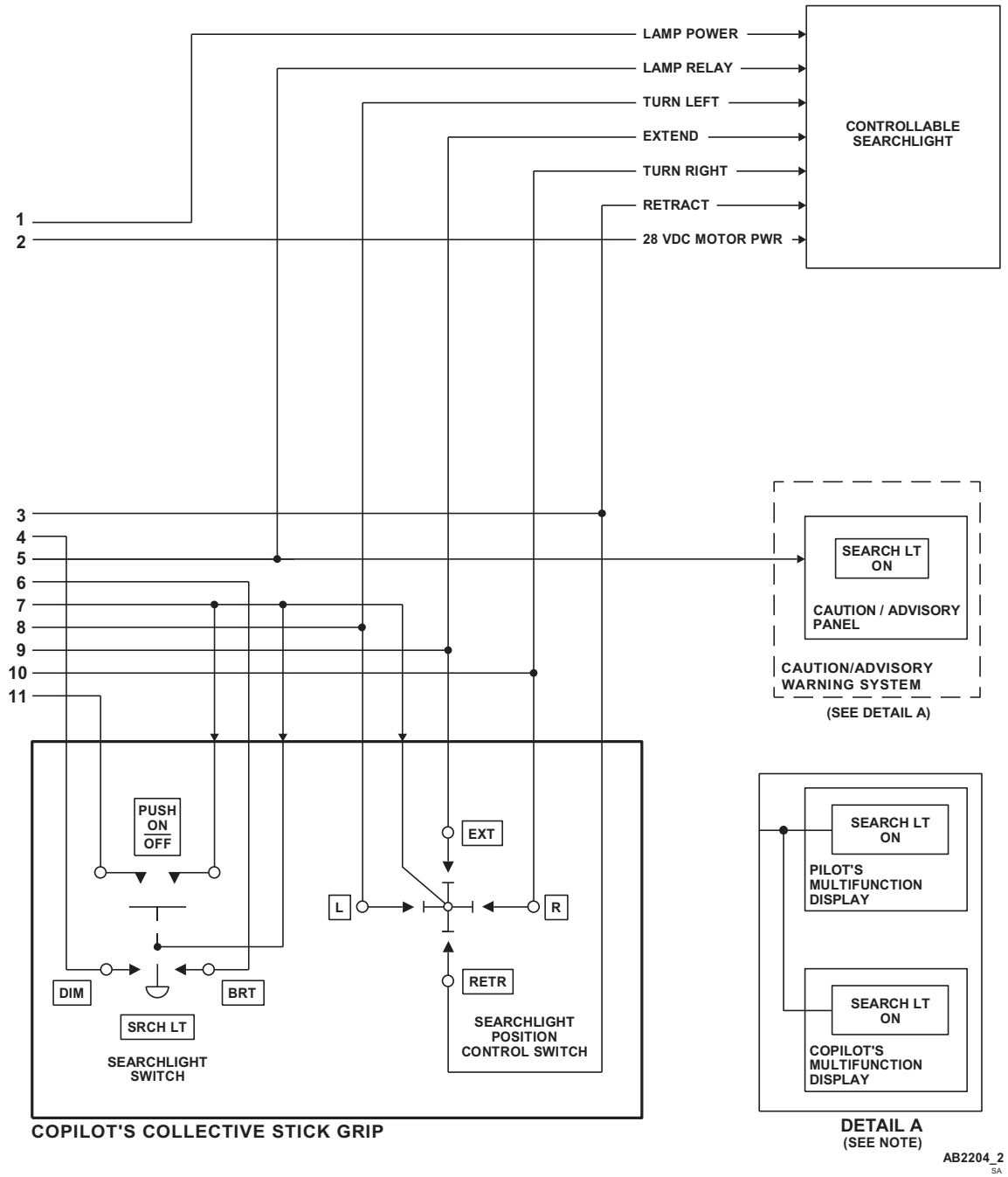


Figure 5. Controllable Searchlight Block Diagram (Sheet 2 of 2).

CARGO HOOK LIGHTS

Three lights are mounted in the cargo hook well area. Power for these lights is provided by the No. 2 ac primary bus through the LIGHTS CARGO HOOK circuit breaker on the pilot's circuit breaker panel (Figure 6). From the circuit breaker, power is routed to the CARGO HOOK LT switch on the upper console. From there, power is routed to the three cargo hook lights. The CARGO HOOK LT switch is a two-position toggle switch that provides on-off control of cargo hook lighting.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

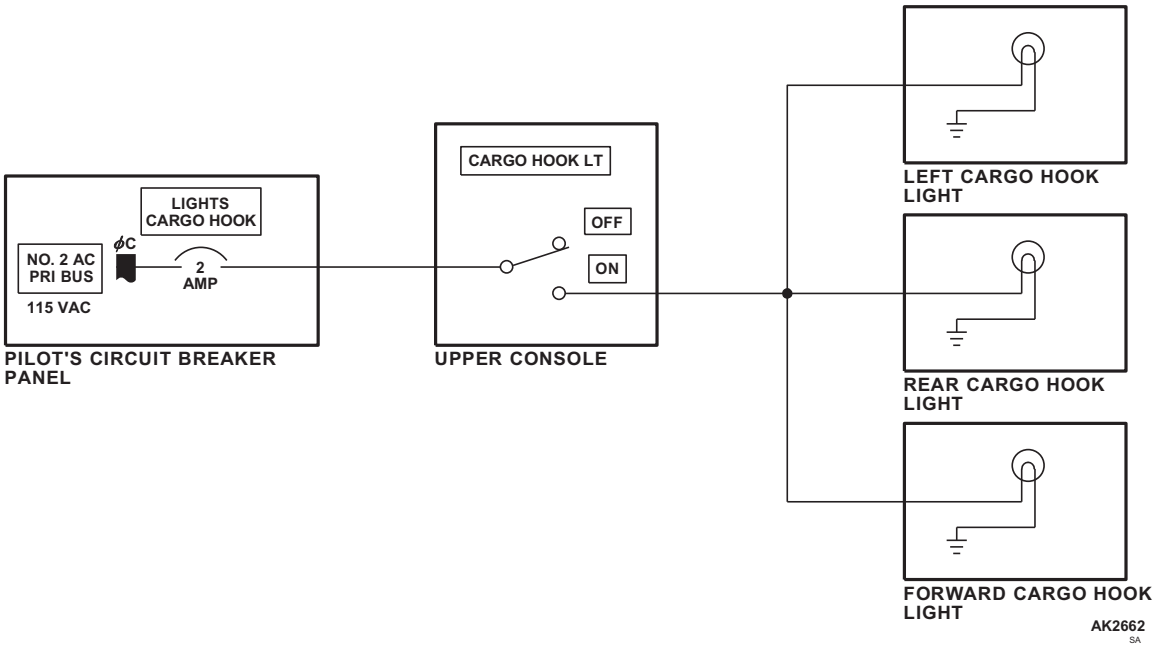


Figure 6. Cargo Hook Lights Block Diagram.

DUAL-MODE CONTROLLABLE SEARCHLIGHT

The dual-mode controllable searchlight assembly (Figure 7) provides a directional beam of light which is manually controlled by a switch on the rescue hoist pendant. The searchlight can be extended about 120° from the fully retracted position and can be rotated either left or right a full 360° when in any extended position. The searchlight assembly has three lamps, all three lamps are identical. Two lamps are wired in parallel, and are installed under a clear lens, these lamps are called normal lamps and are used for normal white light operation. The third lamp is located under an infrared (IR) lens and is called the IR lamp and is used for night vision goggle (NVG) operations. The searchlight lamps are controlled by a three position toggle switch SEARCHLIGHT ON/NORMAL OFF ON/NVG switch on the crew's hoist control panel. When the switch is placed to ON/NORMAL 28 vdc is applied to the two normal lamps. When the switch is placed to ON/NVG 28 vdc is applied to the IR lamp. Placing the four-way thumb switch on the rescue hoist pendant to FWD causes the searchlight to extend. Placing the four-way thumb switch to LEFT or RIGHT causes the searchlight to turn left or right. Placing the four-way thumb switch to AFT causes the searchlight to retract and also stow if held at AFT.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

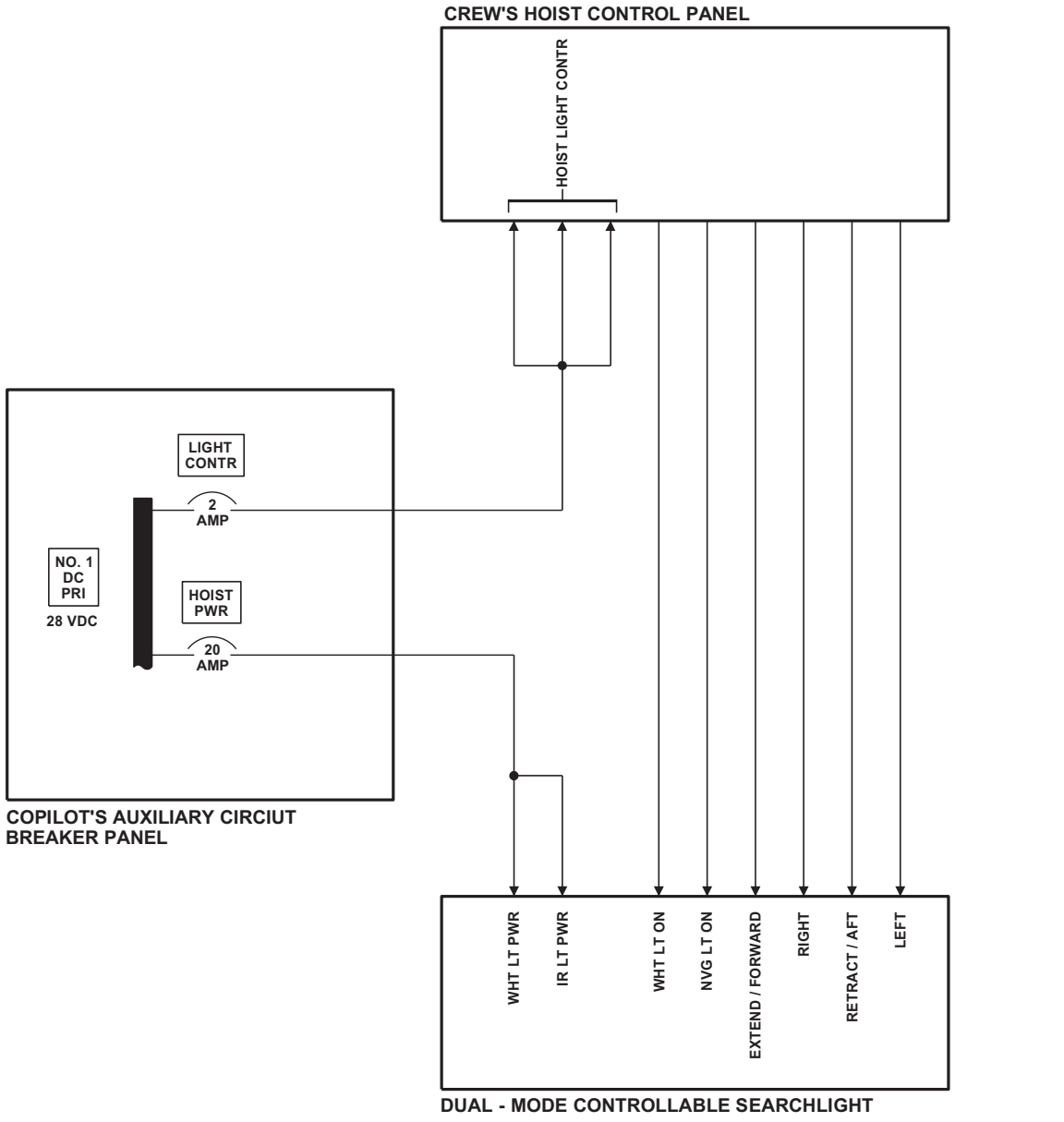


Figure 7. Dual-Mode Controllable Searchlight Block Diagram.

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

For location and description of major components, refer to the data in this work package.

EQUIPMENT DATA

For equipment data information, refer to this work package.

FUEL SYSTEM

FUEL SYSTEM DESCRIPTION AND DATA

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

FUEL SYSTEM GENERAL

The fuel system supplies fuel to both engines and to the APU. The system consists of a main fuel system, a fuel quantity system, and a fuel low-level warning system. Fuel from both main fuel tanks is drawn by suction to the hydromechanical unit (HMU) and the engine-driven pumps. Fuel from the No. 1 fuel tank is drawn by suction to the APU fuel control.

MAIN FUEL SYSTEM

Fuel from both main fuel tanks is drawn by suction to the HMU and the engine-driven pumps. Fuel from the No. 1 fuel tank is drawn by suction to the APU fuel control.

Main Fuel Tanks

Two interchangeable fuel tanks are in the transition section. The tanks are crashworthy and self-sealing. Tank material is a rubber compound with a nylon filament added for strength and an outer coat of Vithane added for scuff resistance. Each tank's usable capacity varies with the method of fueling as follows:

Single-point pressure fueling - 180.5 gallons
Closed circuit fueling - 179 gallons
Gravity fueling - 181 gallons

Sump drains are in the bottom of each tank. Vent lines from each tank, in addition to venting, prevent over pressurization during refueling if the high-level shutoff valves malfunction. Location of components in each fuel tank are shown in Figure 1 and Figure 2

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

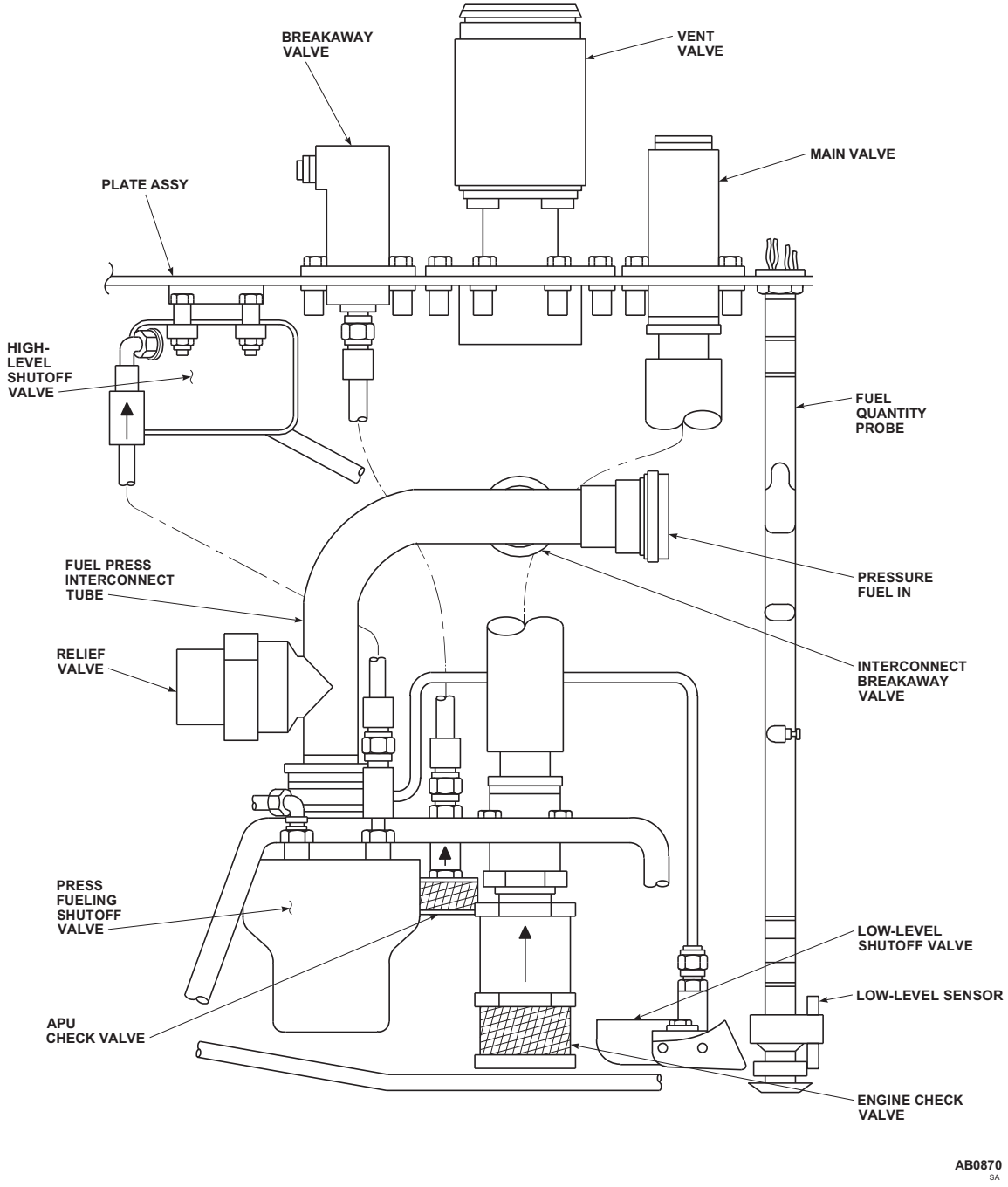


Figure 1. Fuel Tank Components.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

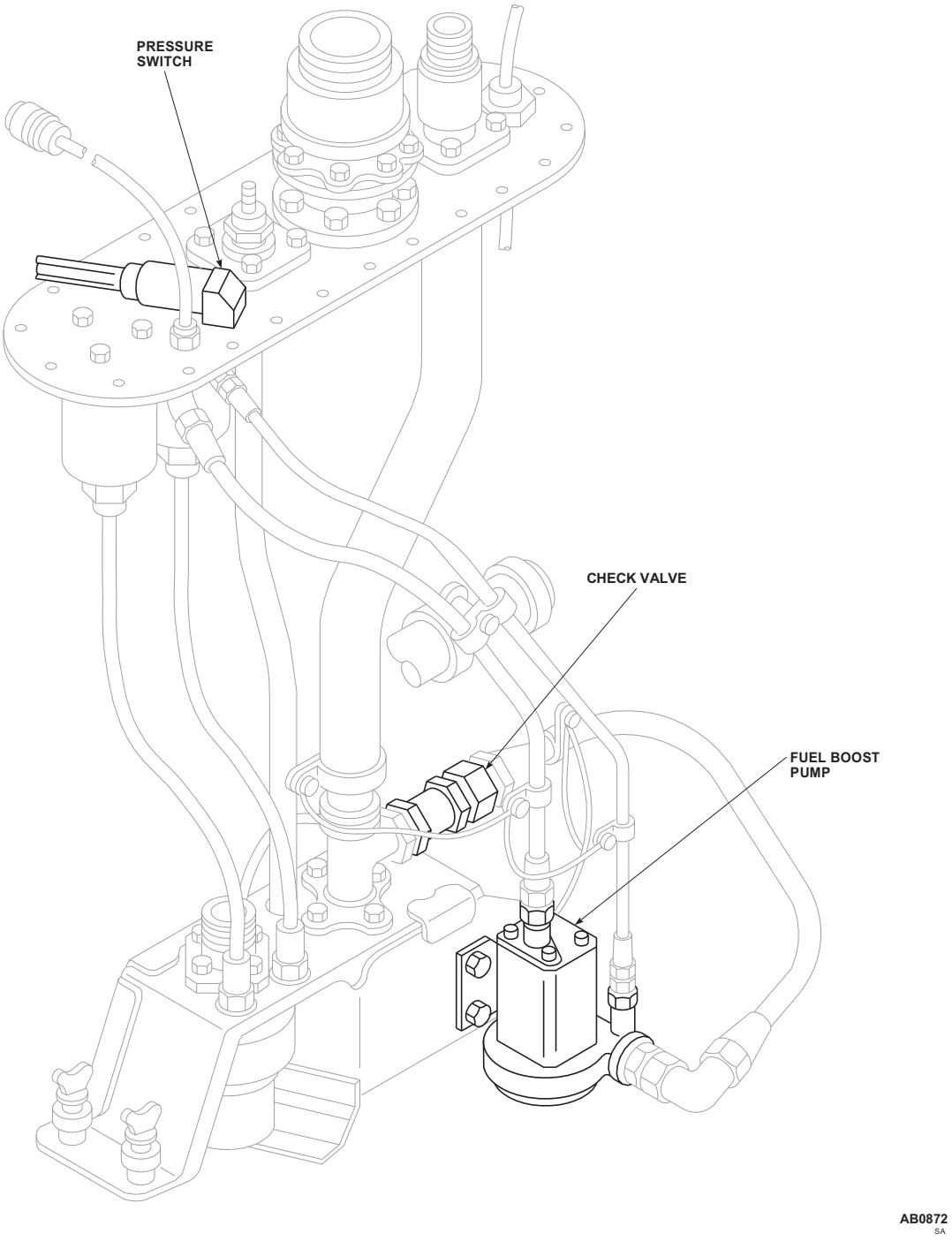


Figure 2. Fuel Tank Pressure Switch, Check Valve and Fuel Boost Pump.

Fuel Lines

The fuel lines are self-sealing, and have self-sealing, breakaway type valves. These valves and lines prevent loss of fuel if the valves break away from the fuel lines or a line is severed.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

REFUEL/DEFUEL SYSTEM

Both the pressure refueling and closed circuit refueling adapters are in one refueling receptacle on the left side of the helicopter. Gravity refueling is done through separate filler ports on each side of the helicopter. No electrical power is needed for refueling. A high-level shutoff valve in each tank closes the pressure refueling valve in the tank when the tank is full. During pressure defueling a low-level shutoff valve closes the pressure refueling valve when the tank is empty (Figure 1). Fueling of the fuel tanks can be done by:

Single-point pressure refueling.
Closed circuit refueling.
Gravity refueling.

VENT SYSTEM

The vent system allows air to enter or exit the main fuel tanks. It also prevents fuel spillage from the main tanks if the helicopter banks and/or rolls excessively. Vent valves are attached to breakaway valves on each main tank panel assembly. A single Y shaped vent tube connects each vent valve to a common line extending to the rear and down, exiting at the bottom of the fuselage. The vent valves have double-acting check valves which open due to a pressure differential between the tank and atmosphere. This allows air to exit or enter the tanks. If the helicopter banks or rolls excessively these valves will remain closed preventing fuel loss. Main tank fuel overflow is detected by an overflow sensor in the vent line. **ESSS >** The signal output will turn on the OVERFLOW indicator on the fuel management panel. **<**

SUPPLY SYSTEM

The fuel supply system consists of a low pressure engine boost pump, fuel filter, fuel selector valve, HMU, and a main tank check valve. Fuel is drawn to each engine HMU by suction created by the engine boost pump. Under particular situations a tank's fuel boost pump can be utilized to pressurize fuel to the HMU. A prime/boost system will automatically pressurize (prime) the fuel supply upon engine start. The fuel filter for each engine has a bypass valve to assure continuous fuel flow when the filter becomes blocked. A bypass warning device in the form of a popout button will indicate the bypass condition. The main tank check valve prevents loss of fuel prime when the engines are shut down. Fuel selector valves control the source of fuel for each engine.

PRIME BOOST SYSTEM

A prime/boost pump is installed in front of the No. 1 fuel component plate assembly in the fuel tank compartment. If the main fuel lines lose their prime, the electrically operated pump will prime them. The pump is controlled by the FUEL PUMP switch on the upper console. Electrical power is supplied from the battery bus through the FUEL PRIME BOOST circuit breaker. While the pump is running, the PRIME BOOST PUMP ON capsule on the caution/advisory panel will be on. The prime/boost system is activated by the engine start system, automatically priming each engine fuel line while the engine is being started.

FUEL BOOST PUMP SYSTEM

The fuel boost pump system consists of a submerged centrifugal pump in the bottom of each fuel tank, two pressure switches, two pump lights, two check valves, and two control switches. The pump and control switches are mounted on the fuel boost pump control panel on the lower console (Figure 3). When either the NO. 1 PUMP or NO. 2 PUMP switch is placed ON, the respective boost pump will go on and a pump light will go on. The check valve (one at each pump outlet) prevents loss of engine fuel line prime. Power for the No. 1 boost pump is supplied by the No. 1 primary ac bus through the NO. 1 FUEL BOOST PUMP circuit breaker mounted on the mission readiness panel. Power for the No. 2 boost pump is supplied by the No. 2 primary ac bus through the NO. 2 FUEL BOOST PUMP circuit breaker mounted on the mission readiness panel. **EH-60A >** Power for the No. 1 boost pump is supplied by the No. 1 ac primary bus through the NO. 1 FUEL BOOST PUMP circuit breaker mounted on the copilot's circuit breaker panel. Power for the No. 2 boost pump is supplied by the No. 2 ac primary bus through the NO. 2 FUEL BOOST circuit breaker mounted on the pilot's circuit breaker panel. Power to the No. 1 and No. 2 pump lights on the fuel boost pump control panel is routed through one set of contracts of relay K40 in the left relay panel. **<**

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

Fuel Boost Pump Control Panel

The fuel boost pump control panel consists of two toggle switches, two press-to-test light indicators, a lighted information plate and, on the back of the control panel, an electrical connector (Figure 3). The NO. 1 PUMP and NO. 2 PUMP toggle switches control the operating voltage to the respective fuel boost pump. The NO. 1 PUMP and NO. 2 PUMP indicators go on to indicate adequate pressure at the respective boost pump output.

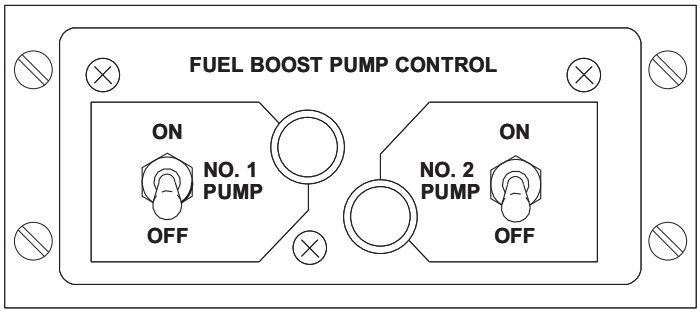


Figure 3. Fuel Boost Pump Control Panel.

ENGINE FUEL SELECTOR CONTROL

There are two fuel selector levers, one for each engine, in the engine control quadrant. The levers are connected by push-pull cables to fuel selector valves. Each lever has three positions, OFF, DIR (direct), and XFD (crossfeed). With the levers at OFF, the fuel selector valves are closed. When you push the levers forward to DIR the selector valves open, allowing fuel flow for each engine from its fuel tank. Pushing the lever further forward to XFD connects the crossfeed position of the selector valves. The fuel crossfeed system allows:

Fuel from No. 1 tank to supply No. 1 engine.
Fuel from No. 2 tank to supply No. 2 engine.
Fuel from either tank to supply both engines.
Fuel from either tank to supply the opposite engine.

FUEL QUANTITY INDICATING SYSTEM

The fuel quantity system visually indicates the amount of fuel, in pounds, in each tank and also the amount of total fuel remaining in both tanks. The fuel quantity system consists of one fuel quantity probe in each fuel tank, a fuel quantity signal conditioner, and a fuel indicator test circuit. See Figure 4. (Sheet 1 of 2) for system block diagram. The fuel quantity system information is displayed on the instrument display system FUEL QTY indicators. The quantity of fuel in each fuel tank is sensed by the fuel quantity probe. The FUEL QTY vertical indicators display fuel quantity in LBS X 100 for both the No. 1 and No. 2 fuel tanks. The FUEL QTY indicator scales are amber for 0 to 200 pounds of fuel, and green for 200 to 1500 pounds of fuel. A digital readout of total fuel in both tanks is shown at the bottom of the vertical indicators. The system may be checked out by pressing the FUEL IND TEST push-button on the miscellaneous switch panel, causing both vertical scales of the FUEL QTY indicator and the digital readout to change, and the #1 and #2 FUEL LOW caution lights on the caution/advisory panel **HH-60L HH-60A >** pilot's or copilot's multifunction display **<** to flash. When the button is released, the scale returns to the original readings. The signal conditioner has external empty and full adjustments for each fuel tank.

FUEL LOW LEVEL WARNING SYSTEM

The fuel low level warning system consists of one low-level sensor on each fuel quantity probe, a low level warning conditioner, #1 FUEL LOW and #2 FUEL LOW caution lights on the caution/advisory panel, **HH-60L HH-60A >**

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

pilot's or copilot's multifunction display, < and a fuel low indicator test circuit. See Figure 5. (Sheet 1 of 2) for system block diagram. Power for the system is supplied by the No. 1 dc primary bus through the FUEL LOW WARN circuit breaker. The low-level warning conditioner supplies dc current to the fuel low level sensor circuitry. The sensor, at the lower portion of the fuel quantity probe, contains a thermistor which senses the presence or absence of fuel. When the thermistor beads are wet, the sensor signal voltage supplied to the low level warning conditioner is high. A high sensor signal causes the conditioner to open the supply voltage path to the #1 FUEL LOW and #2 FUEL LOW caution lights. When the thermistor beads are dry, the sensor signal voltage supplied to the low level warning conditioner is low. A low sensor signal causes the conditioner to close the supply voltage path. The 28 vdc from the FUEL LOW WARN circuit breaker is then supplied through the low-level warning conditioner to the caution/advisory panel **HH-60L HH-60A >** pilot's or copilot's multifunction display < , causing the #1 FUEL LOW or #2 FUEL LOW caution light to flash. Each light flashes when about a 20-minute fuel supply (172 pounds of fuel) remains in its tank. Both lights also flash when the FUEL IND TEST push-button on the miscellaneous switch panel is pressed.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

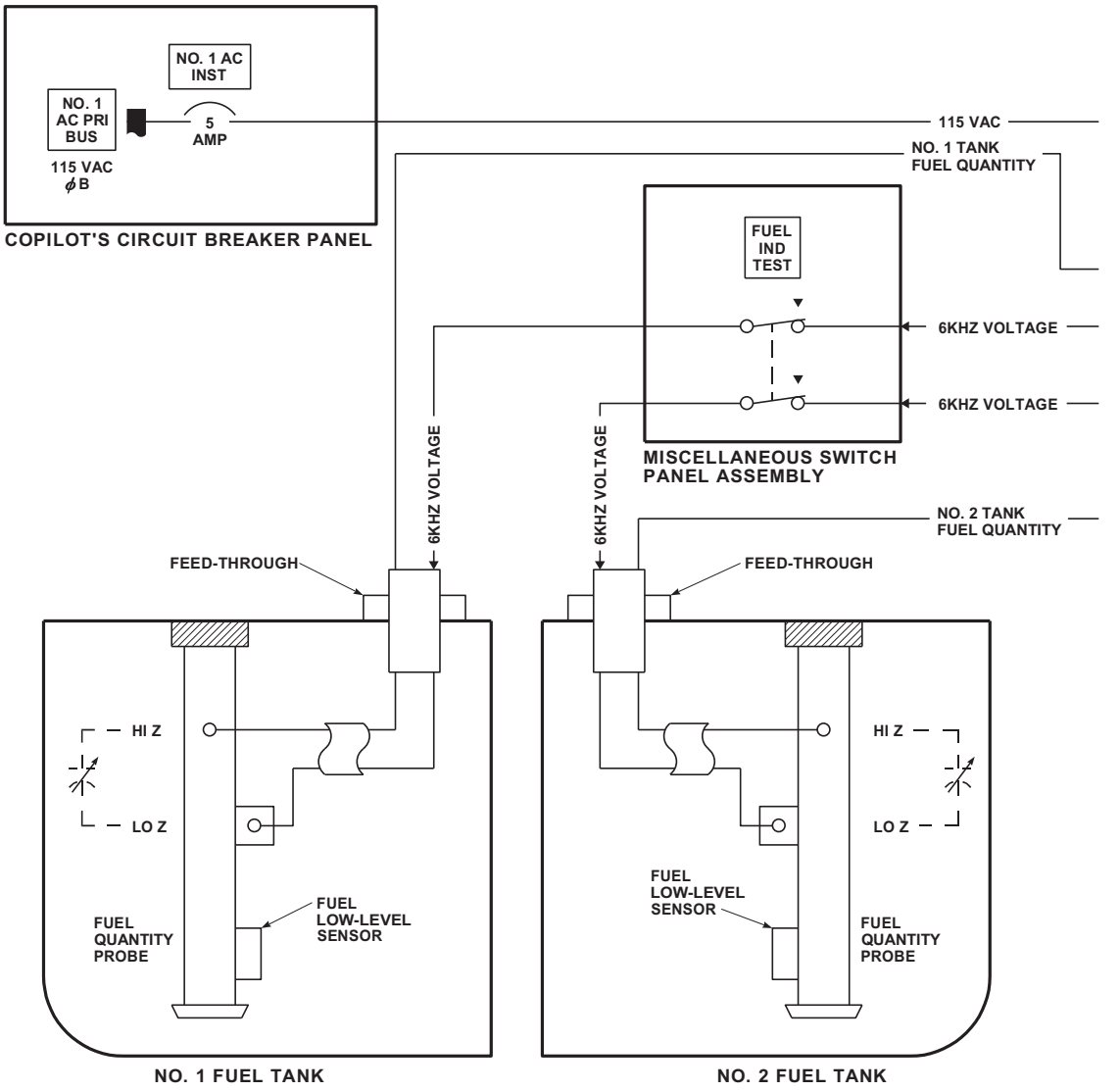


Figure 4. Fuel Quantity System Block Diagram (Sheet 1 of 2).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

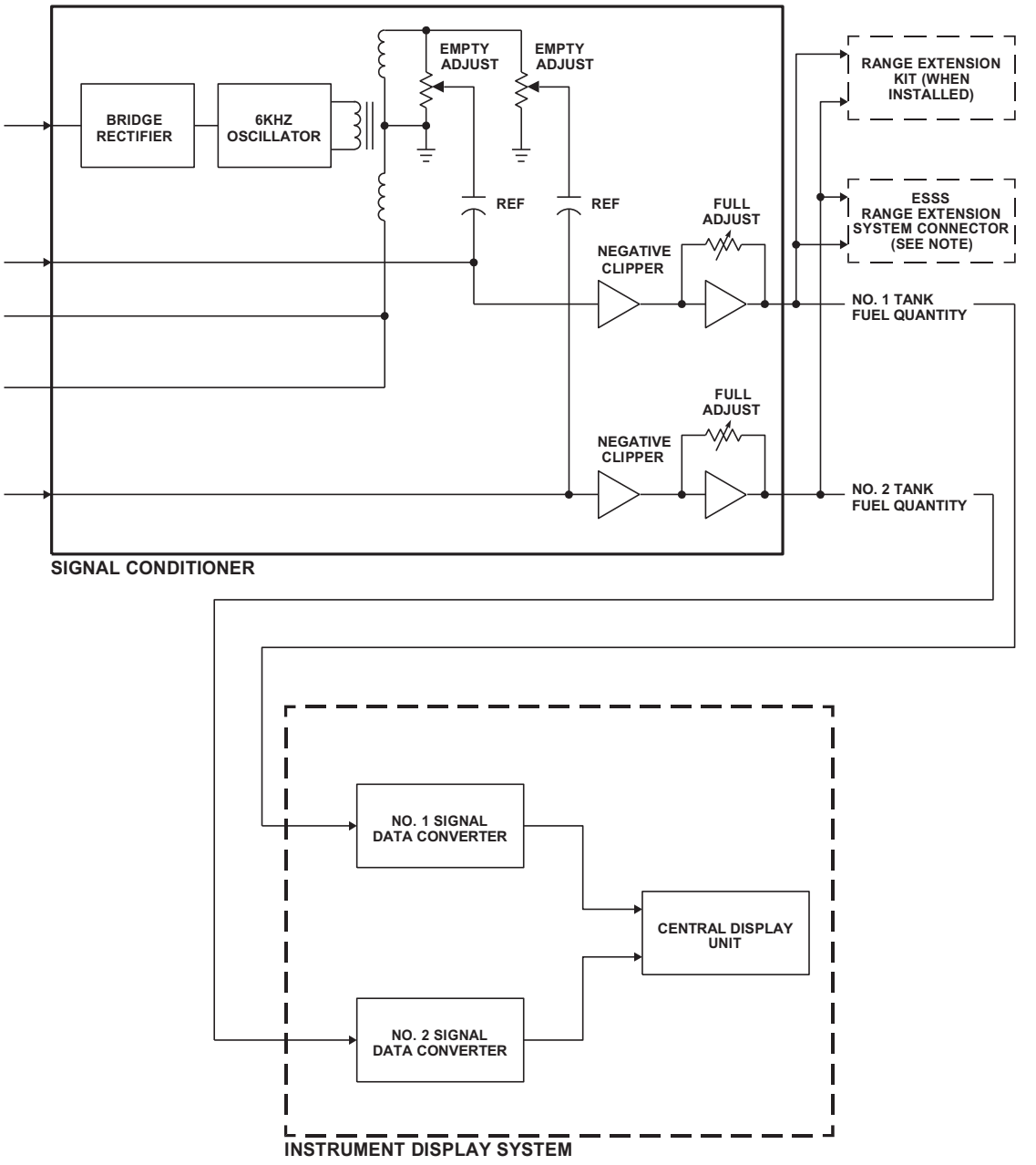
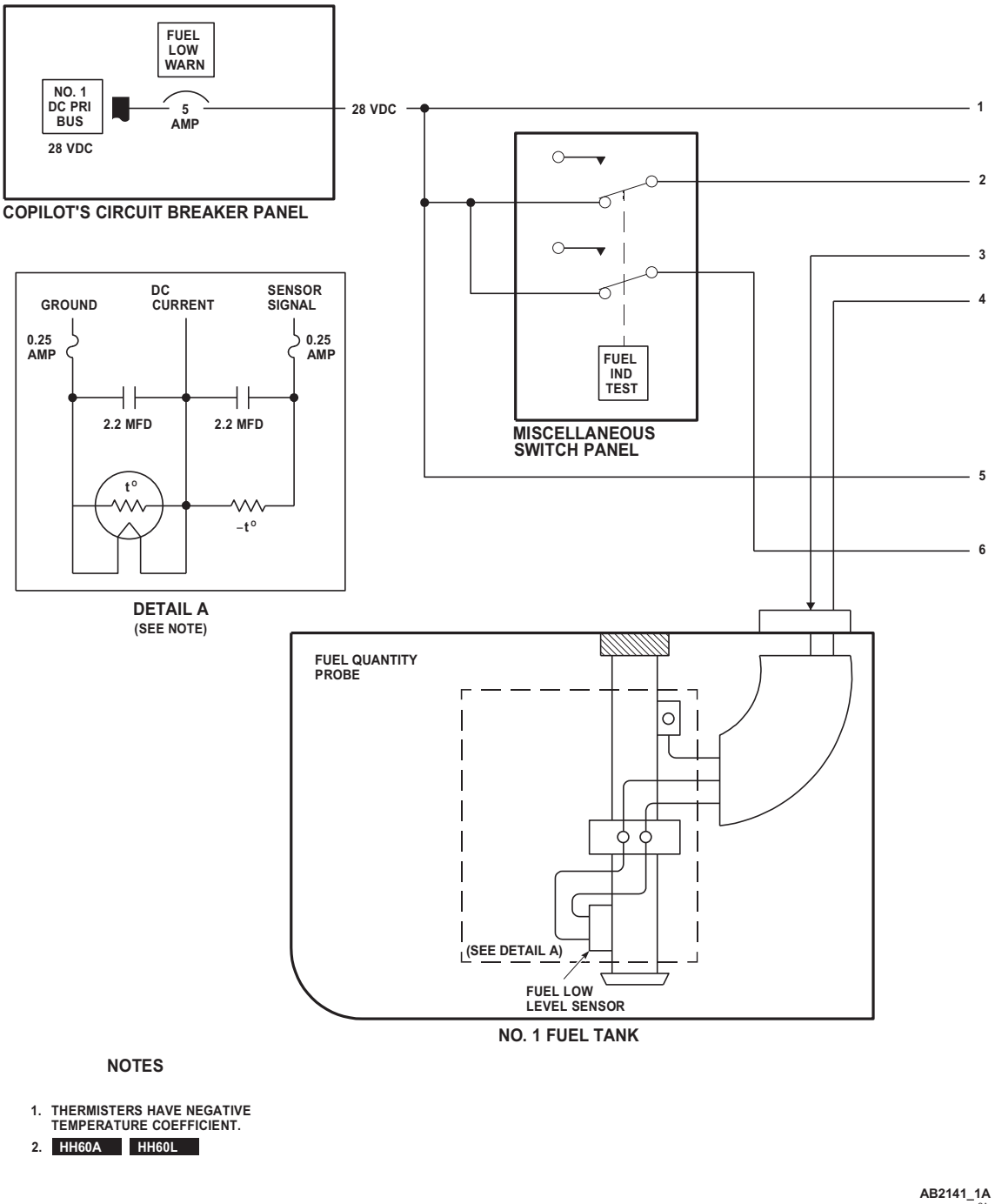


Figure 4. Fuel Quantity System Block Diagram (Sheet 2 of 2).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED



NOTES

1. THERMISTERS HAVE NEGATIVE TEMPERATURE COEFFICIENT.
2. HH60A HH60L

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Figure 5. Fuel Low Level Warning System Block Diagram (Sheet 1 of 2).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

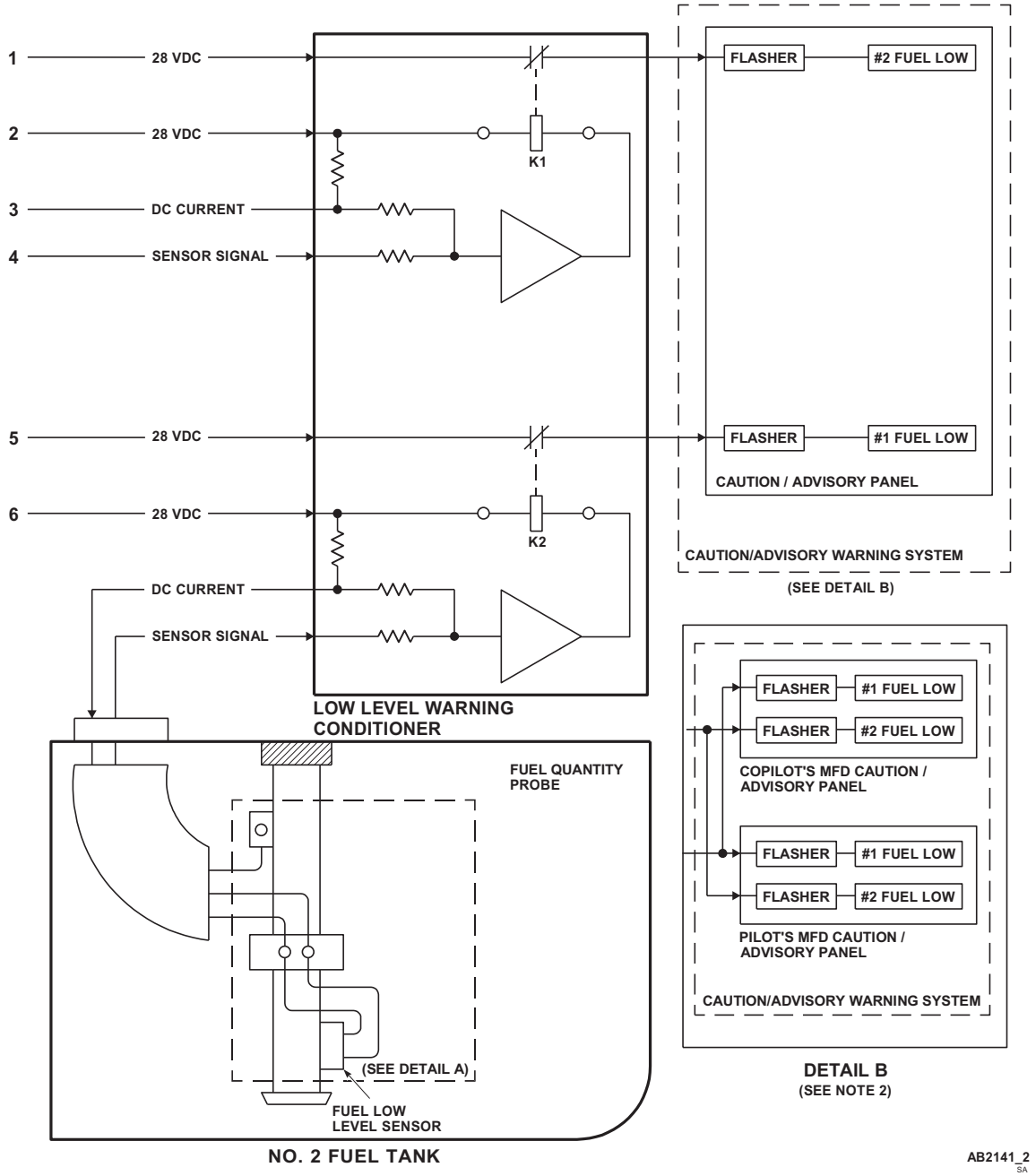


Figure 5. Fuel Low Level Warning System Block Diagram (Sheet 2 of 2).

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

For location and description of major components, refer to the data in this work package.

EQUIPMENT DATA

If applicable, refer to WP 1785 00 for equipment data information.

FLIGHT CONTROLS

FLIGHT CONTROL SYSTEM DESCRIPTION AND DATA

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

DESCRIPTION

The flight controls consist of the collective, cyclic, and tail rotor (directional) control systems. These systems use a series of push-pull rods, bellcranks, cables, pulleys, and servos that transmit control movements from cockpit to the main and tail rotors (Figure 1. (Sheet 1 of 2)). The pilot and copilot have dual controls. Cyclic control sticks control forward, rearward, and lateral helicopter movements; collective control sticks control vertical helicopter movements; and tail rotor control pedals control helicopter headings. Hydraulic power is supplied by the first stage, second stage, and backup hydraulic systems. Electrical power is supplied by the ac and dc electrical system. Assistance for the pilot or copilot in pitch, roll, and yaw control is provided by the stability augmentation system (SAS), flight path stabilization (FPS), and electromechanical trim. For a complete description of these systems, refer to TM 11-1520-237-23.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

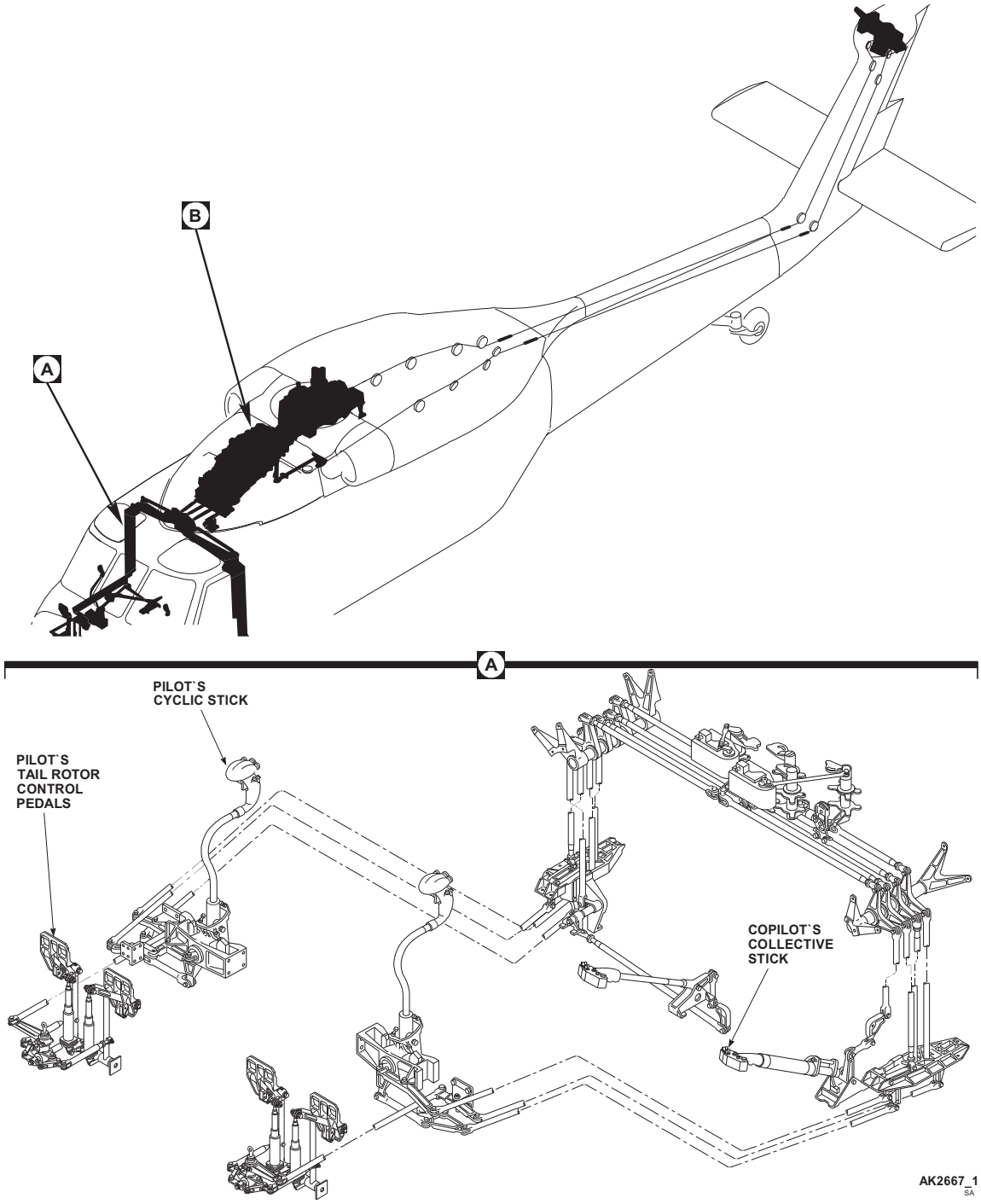


Figure 1. Flight Control System (Sheet 1 of 2).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

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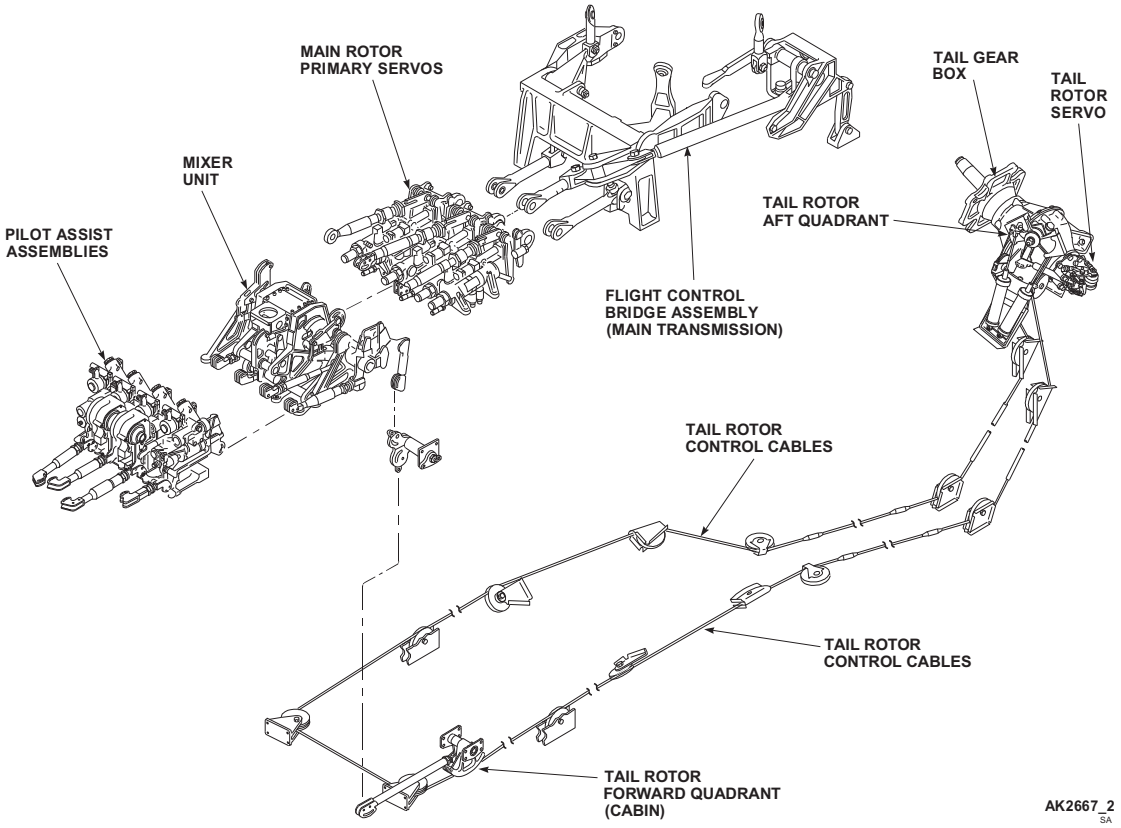


Figure 1. Flight Control System (Sheet 2 of 2).

OPERATION

The flight controls are either manually operated, by the pilot or copilot moving the cyclic control stick, collective control stick, and tail rotor control pedals, or automatically by the SAS. Movement of the cyclic or collective control stick is transmitted by mechanical linkage to hydraulic servos for power assist, and then to the mixing unit. The mixing unit mechanically combines inputs to the main rotor and provides proportional control movements to the tail rotor. This takes place through the collective to yaw coupling and through the hydraulic primary servos. The primary servos move the main rotor swashplate, which changes blade pitch. The tail rotor pedals are connected by bellcranks, idlers, and control rods to the hydraulic yaw boost servo for power assist, and then through the mixing unit. Control cables transmit this movement to the rear control quadrant, then to a control rod to the hydraulic tail rotor servo. This moves the pitch change beam, which changes the tail rotor blade angles (Figure 2).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

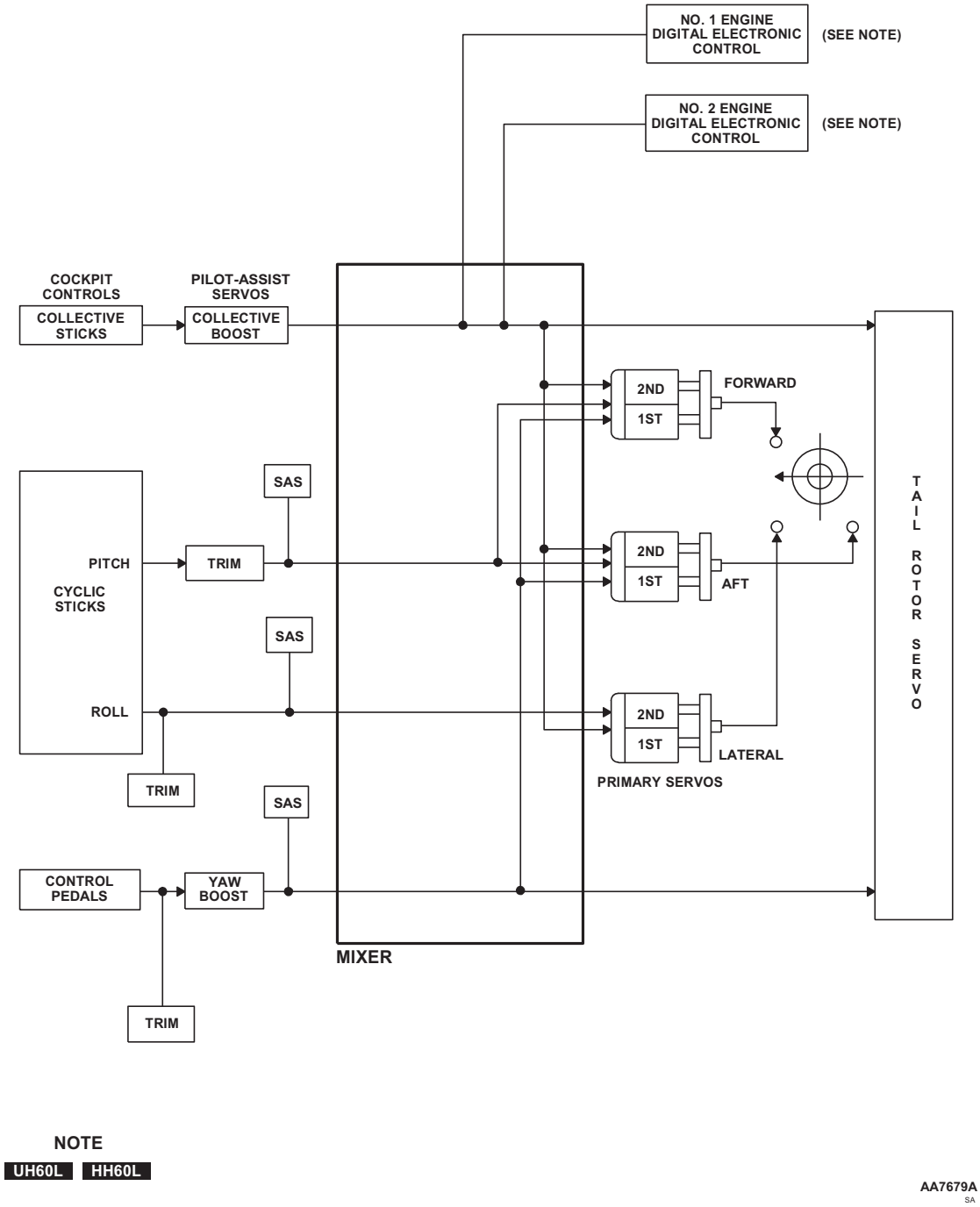


Figure 2. Flight Controls - Simplified Diagram.

FLIGHT CONTROL SELF-RETAINING BOLTS

Self-retaining (impedance) bolts are used as the primary connections in the flight controls system to prevent components from disconnecting accidently. These bolts are identified by a split collar on the bolt shank at the threaded end. The collar provides the self-retaining feature of the bolt. The split collar is compressed into a groove during installation and expands on the outside of the hole when the bolt is completely installed.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

COLLECTIVE CONTROL SYSTEM

This system gives vertical helicopter control. The collective sticks are connected through a series of control rods, bellcranks, the collective boost servo and the mixing unit to the primary servos. These all raise or lower the main rotor swashplate, independent of the cyclic position of the swashplate. This causes the pitch angle of all blades to change equally. The collective boost servo is powered by the second stage hydraulic system.

Collective Stick Assembly

The pilot's collective stick assembly consists of a grip assembly, friction lock boot assembly, tube assembly, socket assembly, drag strut assembly, and associated wiring (Figure 3. (Sheet 1 of 2)and Figure 3. (Sheet 2 of 2)). The copilot's collective stick assembly consists of a grip assembly, telescoping tube assembly, socket assembly, and associated wiring. Both stick assemblies use the same grip assembly. The grip assembly has a LDG LT (landing light control) push-button/toggle switch, SVO OFF (servo shutoff) toggle switch, searchlight control thumb switch, SRCH LT (search light) toggle switch, **EH-60A UH-60A UH-60L >** ENG RPM (engine speed trim) switch, **< HH-60A HH-60L >** RAD SEL (radio select) switch, **<** EMERG HOOK REL push button, and HUD control switch, marked BRT, DIM, MODE, DCLT.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

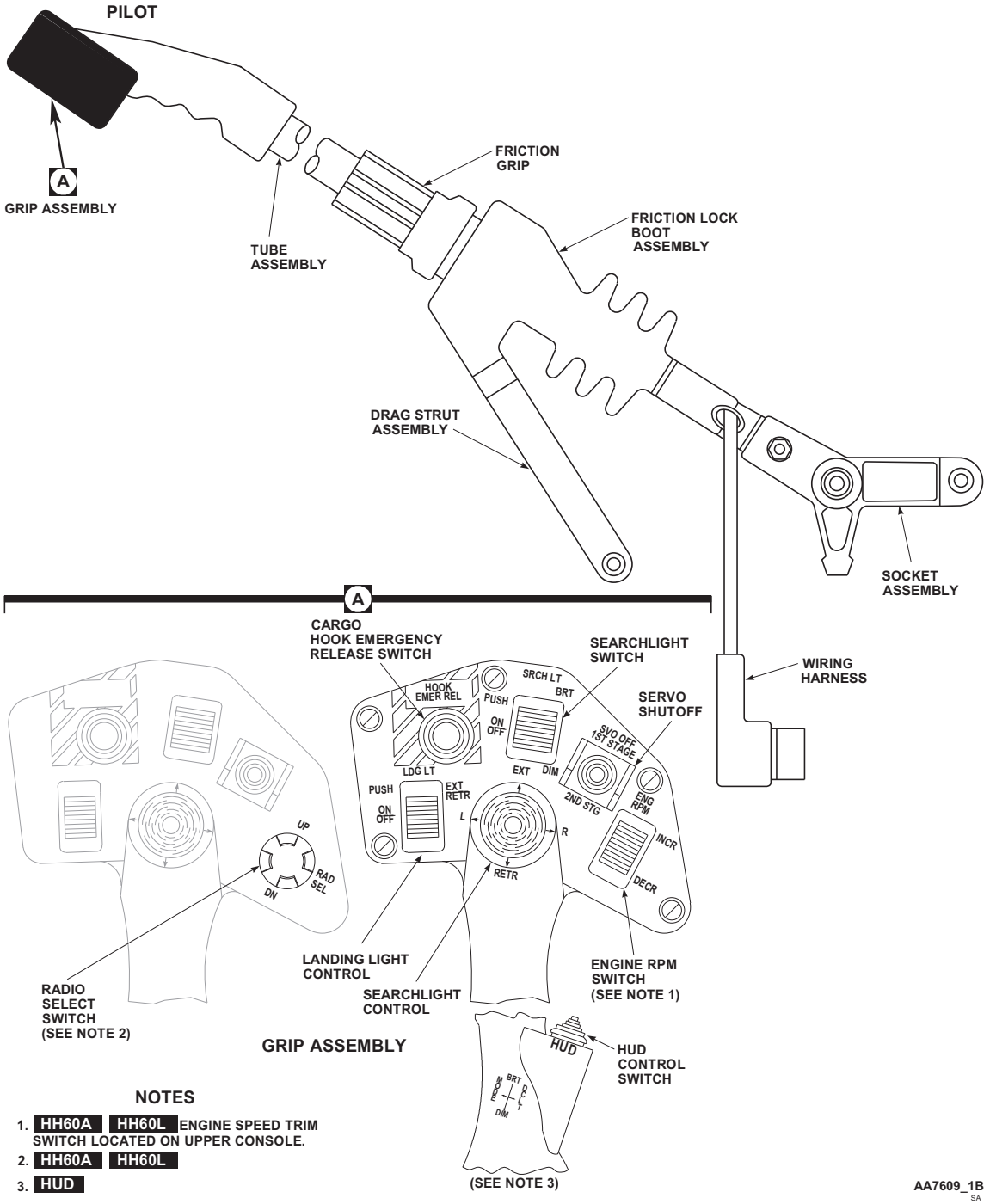


Figure 3. Collective Stick Assembly (Sheet 1 of 2).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

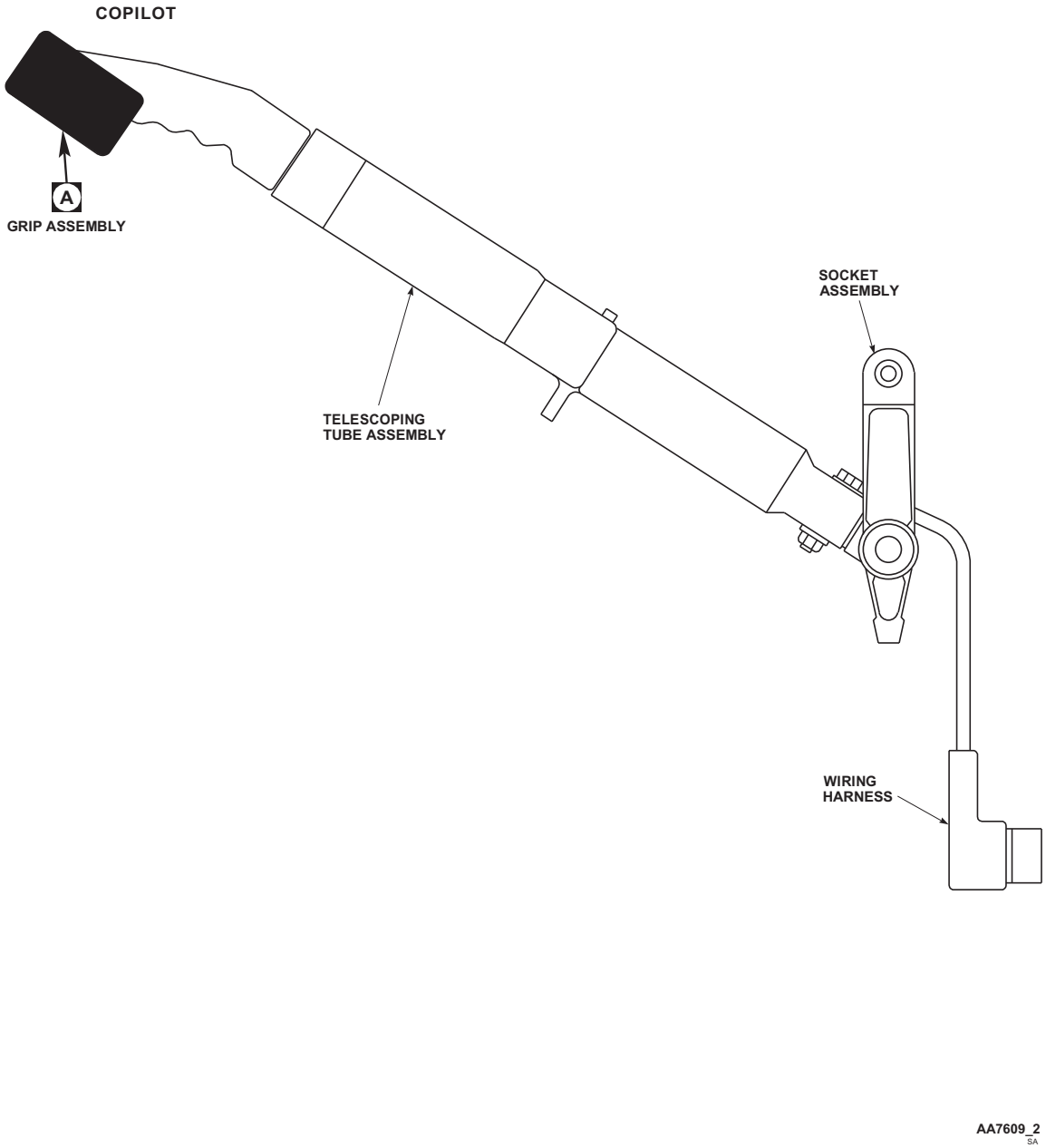


Figure 3. Collective Stick Assembly (Sheet 2 of 2).

CYCLIC CONTROL SYSTEM

This system provides forward, rearward, and lateral control of the helicopter. The cyclic sticks are mechanically-coupled, lever-type controls for both pilot and copilot. The cyclic sticks are connected through a torque shaft, a series of control rods, bellcranks, pitch trim assembly, roll assembly SAS actuator and a mixing unit, to the primary servos. These control movement of the main rotor blades. The servos are powered by the first stage and second stage hydraulic systems.

Cyclic Stick Assembly

The cyclic stick assembly consists of a grip assembly, tube assembly, socket assembly, and associated wiring (Figure 4). The grip assembly has a STICK TRIM thumb switch, ICS - RADIO rocker switch, and push button

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

switches marked TRIM REL (trim release), PNL LTS (panel lights kill switch), GA (go around enable), and CARGO REL (cargo hook release). The cyclic stick also houses a manual slew-up switch (Figure 5). **HFIRE/VOL >** Have provisions on the pilot's and copilot's sticks to disable the GA (go around enable) function. **<**

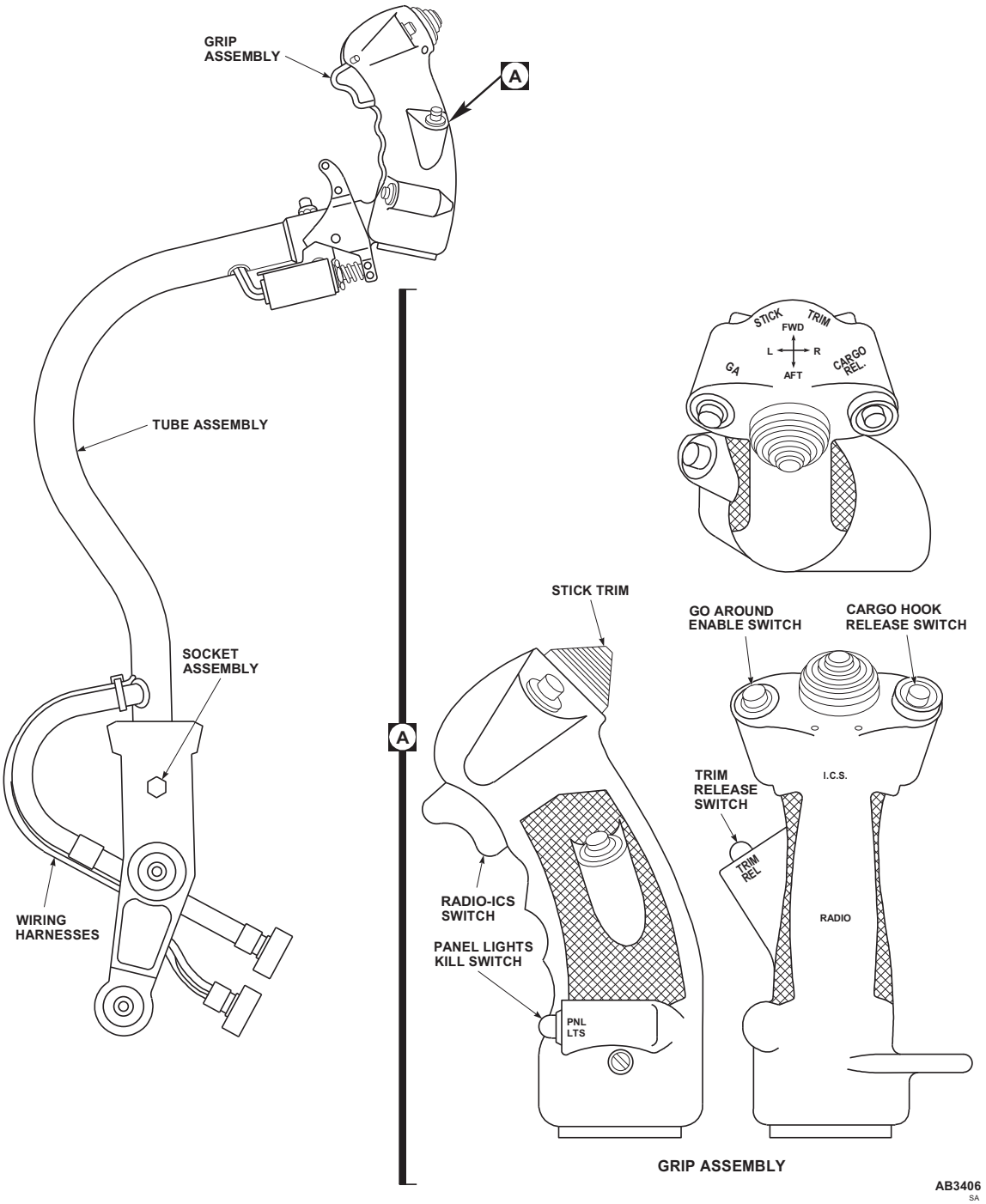


Figure 4. Cyclic Stick, Typical.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

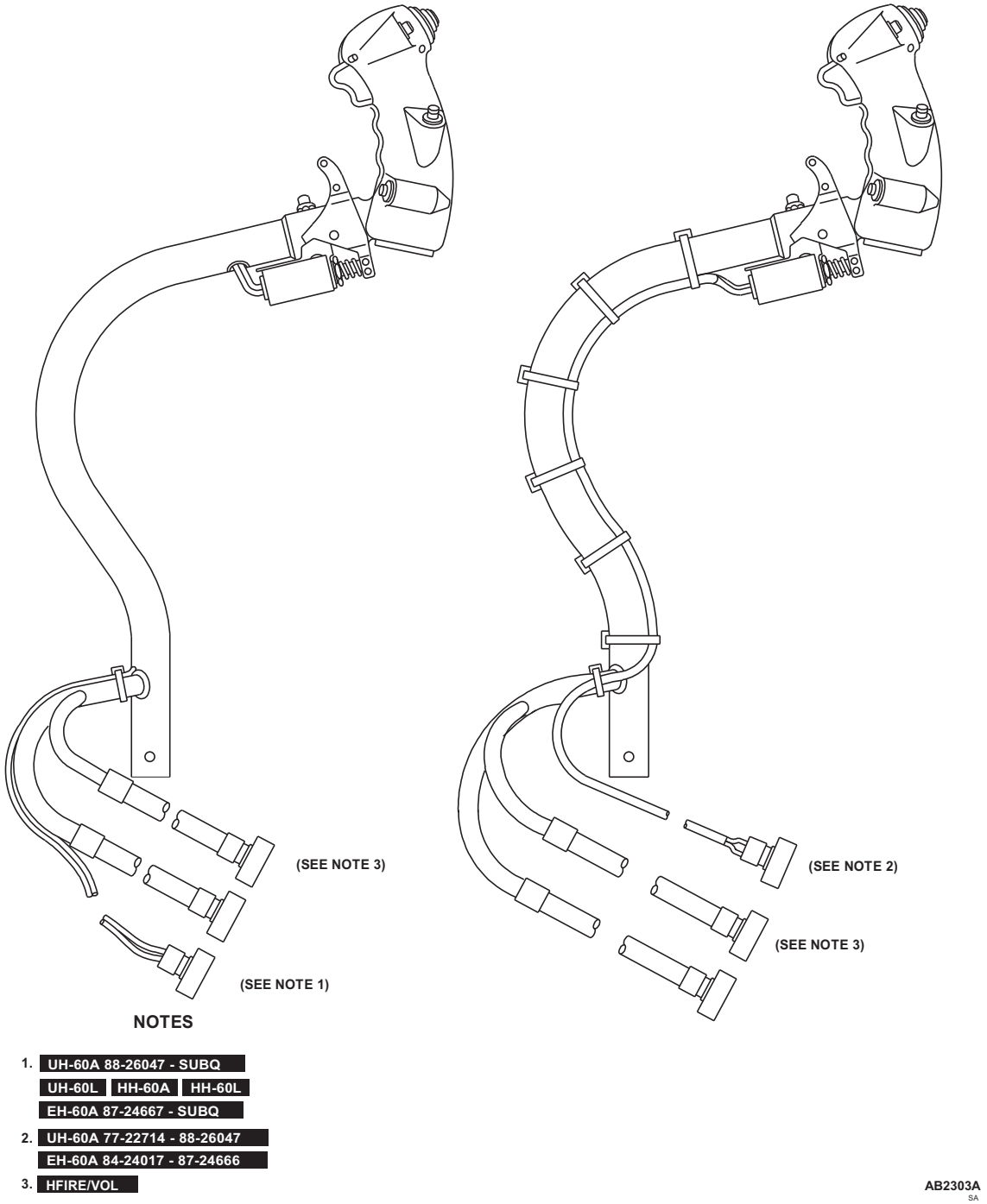


Figure 5. Cyclic Stick Slew Switch Configurations.

TAIL ROTOR CONTROL ASSEMBLY

The tail rotor (directional) control system determines helicopter heading, or yaw, by controlling pitch of the tail rotor blades. The control pedals are connected through a series of control rods, bellcranks, yaw boost servo, the

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

mixing unit, cables, and quadrants to the tail rotor servo. This moves the pitch change beam to change tail rotor blade angles. The tail rotor controls are powered by the first stage or backup hydraulic systems.

DIRECTIONAL CONTROL PEDALS

The pedals are mechanically coupled and permit the pilot and copilot to control helicopter headings. The pedals contain independent toe-operated wheel brake controls. Each set of pedals can be adjusted to the pilot's leg length.

TAIL ROTOR QUADRANT

A tail rotor quadrant, mounted on the tail gear box, transmits tail rotor cable movements into the tail rotor servo (Figure 6). Two spring cylinders are connected to the quadrant. If one cable is broken, the spring cylinders allow the quadrant to operate normally. The TAIL ROTOR QUADRANT caution capsule on the caution/advisory panel will go on if a cable breaks. The remaining cable will unlatch when the helicopter is shut down.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

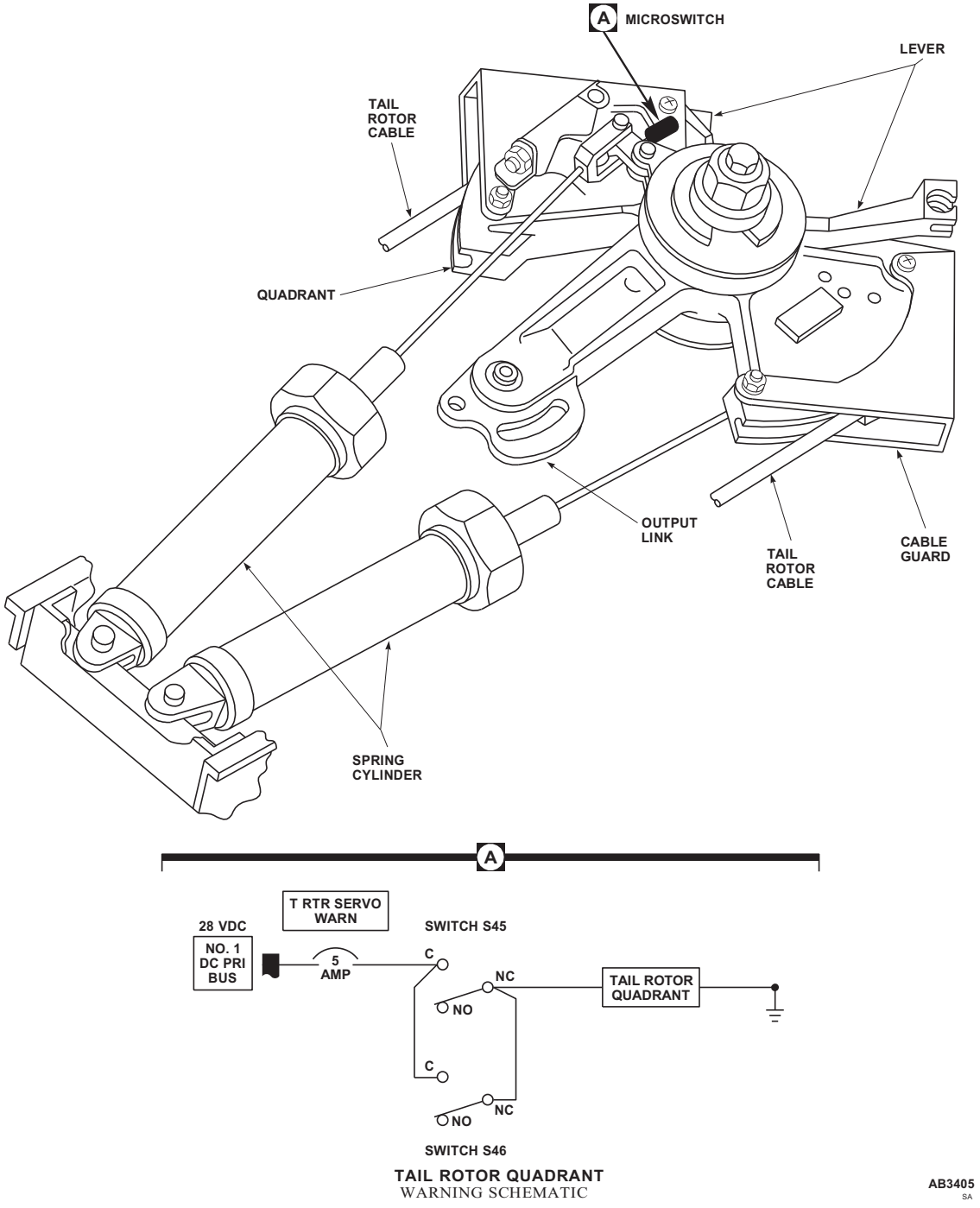


Figure 6. Tail Rotor Quadrant.

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

For location and description of major components, refer to the data in this work package.

EQUIPMENT DATA

For equipment data information, refer to this work package.

UTILITY SYSTEM

WINDSHIELD ANTI-ICE SYSTEM DESCRIPTION AND DATA

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

WINDSHIELD ANTI-ICE SYSTEM

The windshield anti-ice system prevents ice from forming on the pilot's and copilot's windshields. HCW> The center windshield is also equipped with the anti-ice system. < The anti-ice system applies three-phase, 115 vac power to heater elements within the windshield to keep a temperature of 70° to 115°F on the windshield surface. The ac power is supplied to the windshield heater elements by anti-ice controllers that are activated by two temperature sensors within each windshield. The system consists of heater elements and temperature sensors in the pilot's and copilot's windshields, pilot's and copilot's anti-ice controllers on the right and left sides of the cabin overhead, and control switches on the upper console. HCW> The system also consists of heater elements and temperature sensors in the center windshield and center anti-ice controller on the left side of the cabin overhead, and control switch on the upper console. <

POWER DISTRIBUTION

The windshield anti-ice system gets ac and dc electrical power from the pilot's and copilots circuit breaker panels (Figure 1. (Sheet 1 of 4), Figure 1. (Sheet 2 of 4), Figure 1. (Sheet 3 of 4), and Figure 1. (Sheet 4 of 4)). Electrical power of 28 vdc is supplied by the No. 1 and No. 2 dc primary buses and routed through the CPLT WSHLD ANTI-ICE, PILOT WSHLD ANTI-ICE, and HCW> CTR WSHLD ANTI-ICE < circuit breakers, respectively, to the WINDSHIELD ANTI-ICE COPILOT, PILOT, and HCW> CTR switches. <Electrical power of 115 vac is supplied by the No. 1 and No. 2 ac primary buses and routed through the respective anti-ice circuit breakers to the copilot's, pilot's, and center anti-ice controllers.

NORMAL OPERATION

Anti-ice operation for the pilot's, copilot's, and HCW> center windshields < is the same. Copilot's anti-ice operation is described. When the WINDSHIELD ANTI-ICE COPILOT switch is placed ON, 28 vdc control voltage is applied through the switch and normally closed contacts of automatic cutout relay K21 in the right relay panel, to the copilot's anti-ice controller. Windshield heater element power of 115 vac is also applied to the controller. The temperature of the copilot's windshield is monitored by two parallel connected temperature sensors within the windshield. The sensors form one leg of a resistance bridge circuit in the anti-ice controller. Changes in windshield temperature cause corresponding changes in sensor resistance, resulting in a bridge unbalance. The bridge unbalance produces a signal of specific phase that corresponds to a sensor resistance above or below the bridge balance point. This signal is phase-detected and compared with a 400 Hz reference signal within the controller. When windshield temperature decreases to a value giving a sensor resistance of between 167 to 169 ohms, an in-phase bridge unbalance signal is produced. This signal turns on the controller that applies 115 vac power to the windshield heater elements to heat the windshield. When the temperature of the windshield increases to a value giving a sensor resistance of between 4 to 5 ohms above the turn-on resistance value, the unbalanced bridge circuit produces an out-of-phase signal that turns off the controller.

The windshield anti-ice system contains protection circuitry to prevent damage to the windshield in case of a fault. If a windshield temperature sensor opens or shorts, or if there is a loss of ac or dc power, the anti-ice controller removes power from the windshield heater elements. The system is also automatically shut off if the auxiliary power unit (APU) generator is the only source of electrical power and the backup hydraulic pump is on. Under these conditions, 28 vdc from the APU is applied through the normally closed contacts of No. 2 and No. 1 ac generator contactors K2 and K1, through the energized contacts of APU/external power contactor K3, and the energized contacts of hydraulic emergency relay K19 to energize automatic cutout relay K21. With K21 energized, the 28 vdc is removed from the anti-ice controller and the system shuts off.

EH-60A> When any of the WINDSHIELD ANTI-ICE switches are set to ON, relay K96 disables operation of the environmental control system. <

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

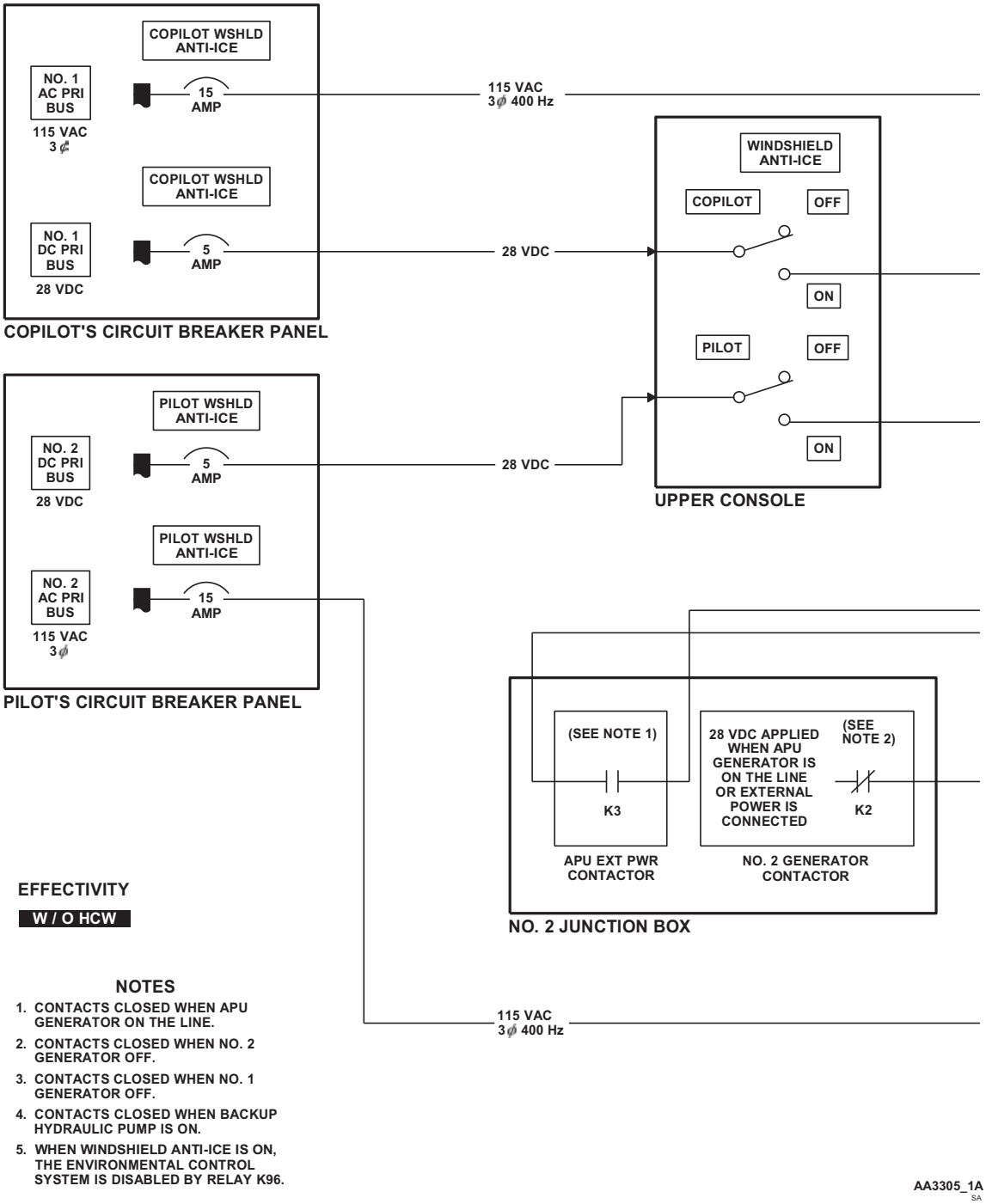


Figure 1. Windshield Anti-Ice System Block Diagram (Sheet 1 of 4).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

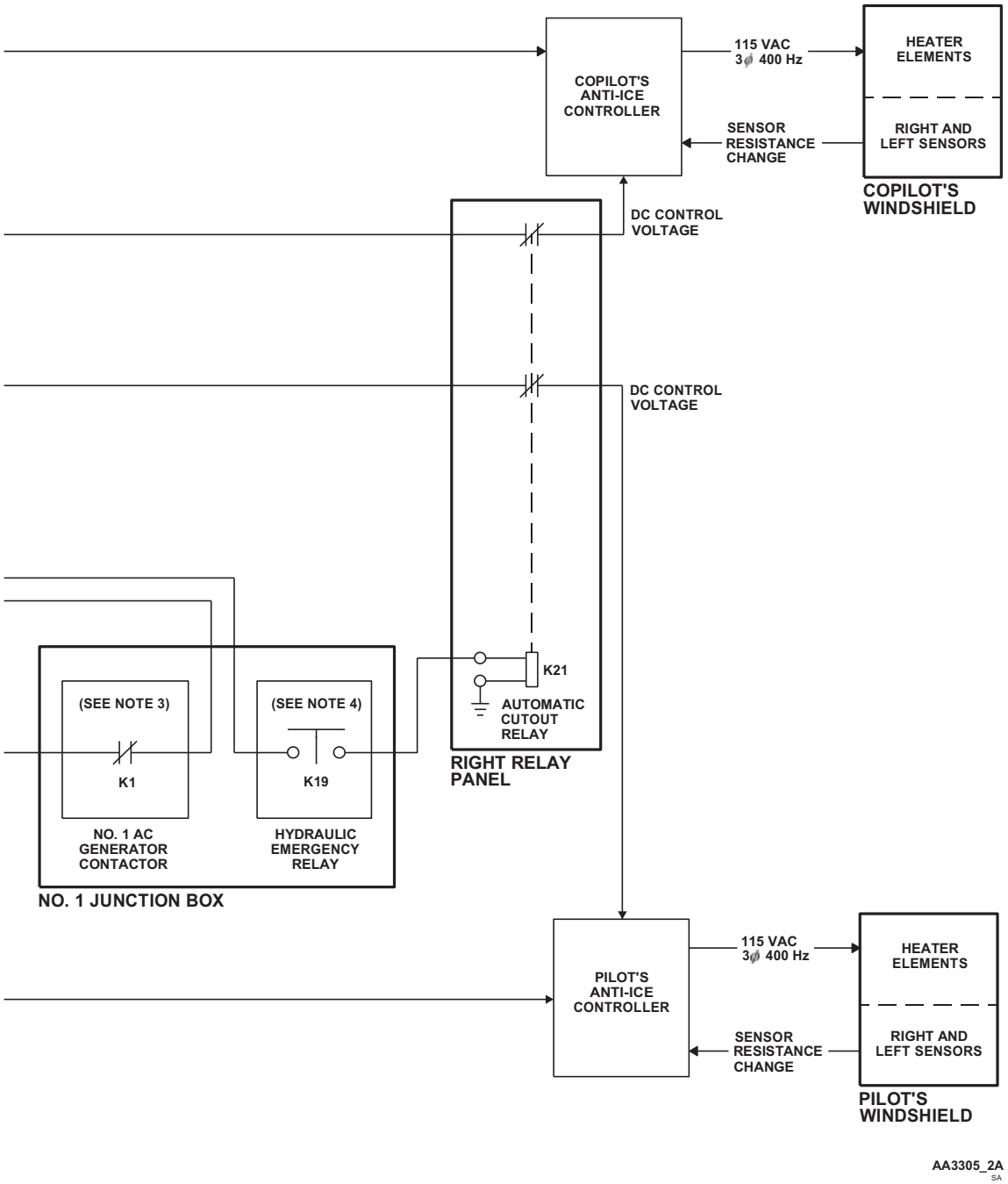


Figure 1. Windshield Anti-Ice System Block Diagram (Sheet 2 of 4).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

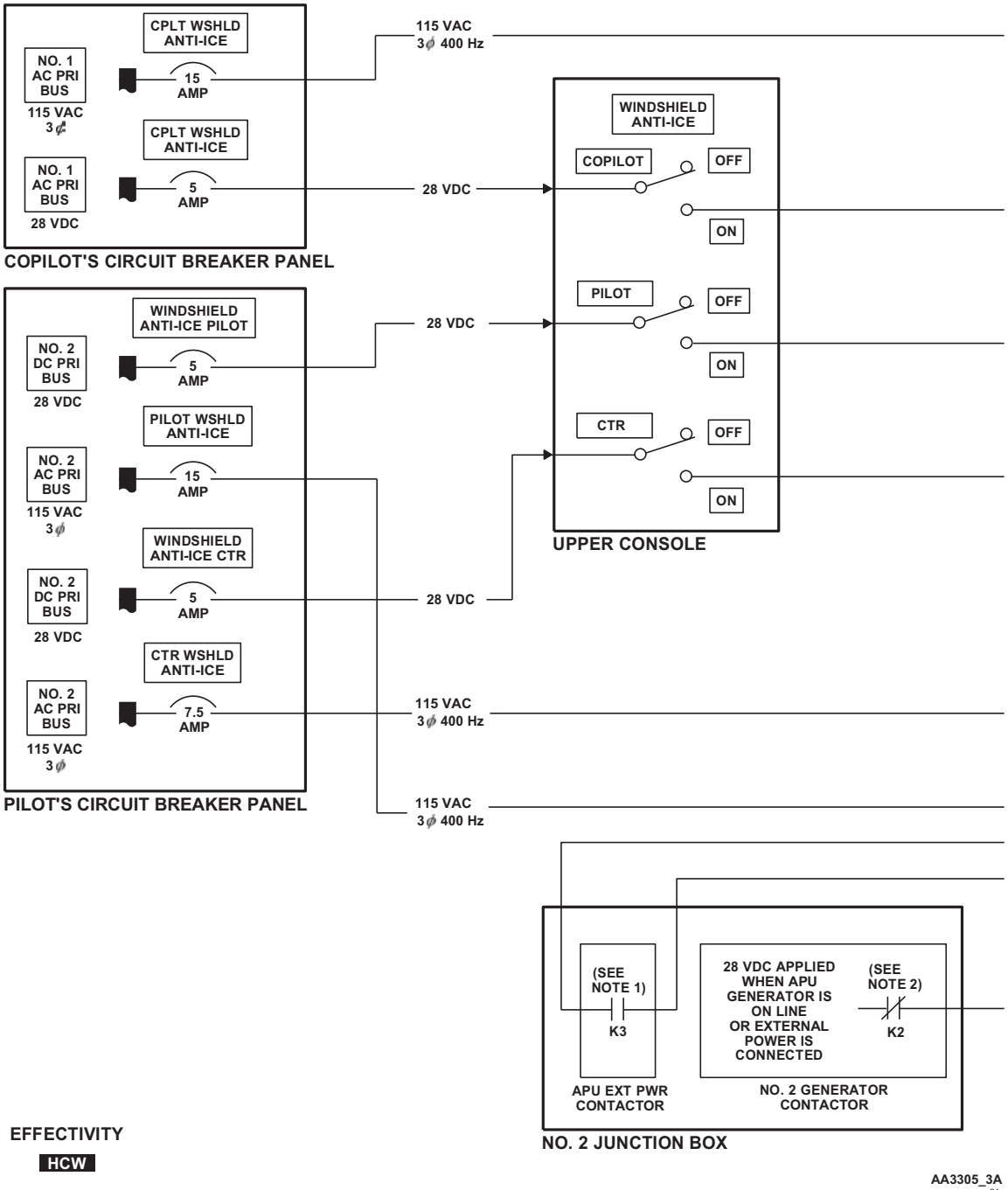


Figure 1. Windshield Anti-Ice System Block Diagram (Sheet 3 of 4).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

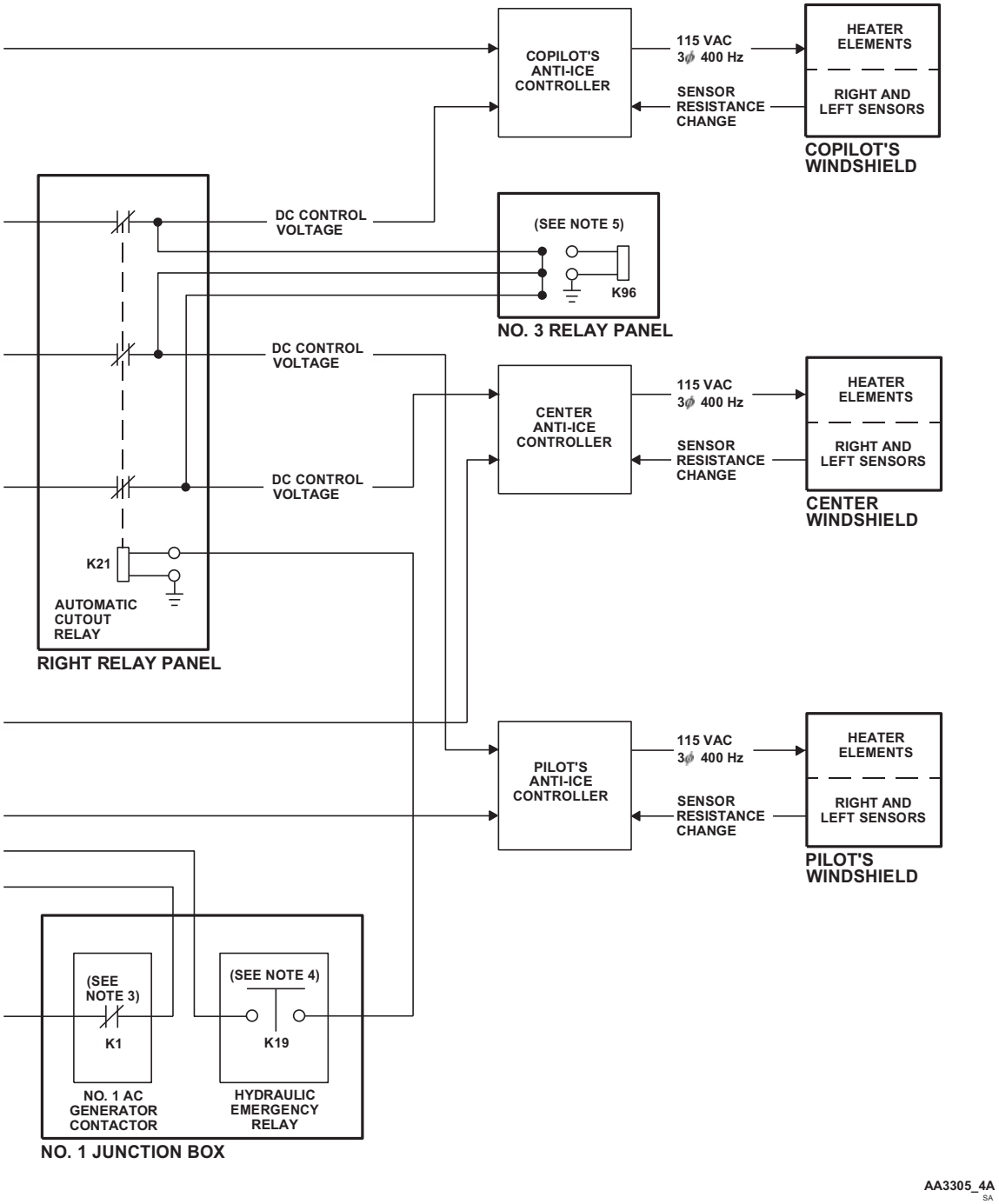


Figure 1. Windshield Anti-Ice System Block Diagram (Sheet 4 of 4).

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

For location and description of major components, refer to the data in this work package.

EQUIPMENT DATA

For equipment data information, refer to this work package.

UTILITY SYSTEM

WINDSHIELD WIPER SYSTEM DESCRIPTION AND DATA

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

WINDSHIELD WIPER SYSTEM DESCRIPTION

The electrically-operated windshield wiper system consists of a two-speed ac motor, two converters, two wipers, and a control switch (Figure 1). The HI and LOW positions of the WINDSHIELD WIPER control switch, on the upper console, control the wiper blade speed. The PARK position is used to return the wiper blade to the inboard edge of the windshields. Power for the wiper system is supplied by the No. 1 primary ac bus through the WSHLD WIPER circuit breaker on the copilot's circuit breaker panel.

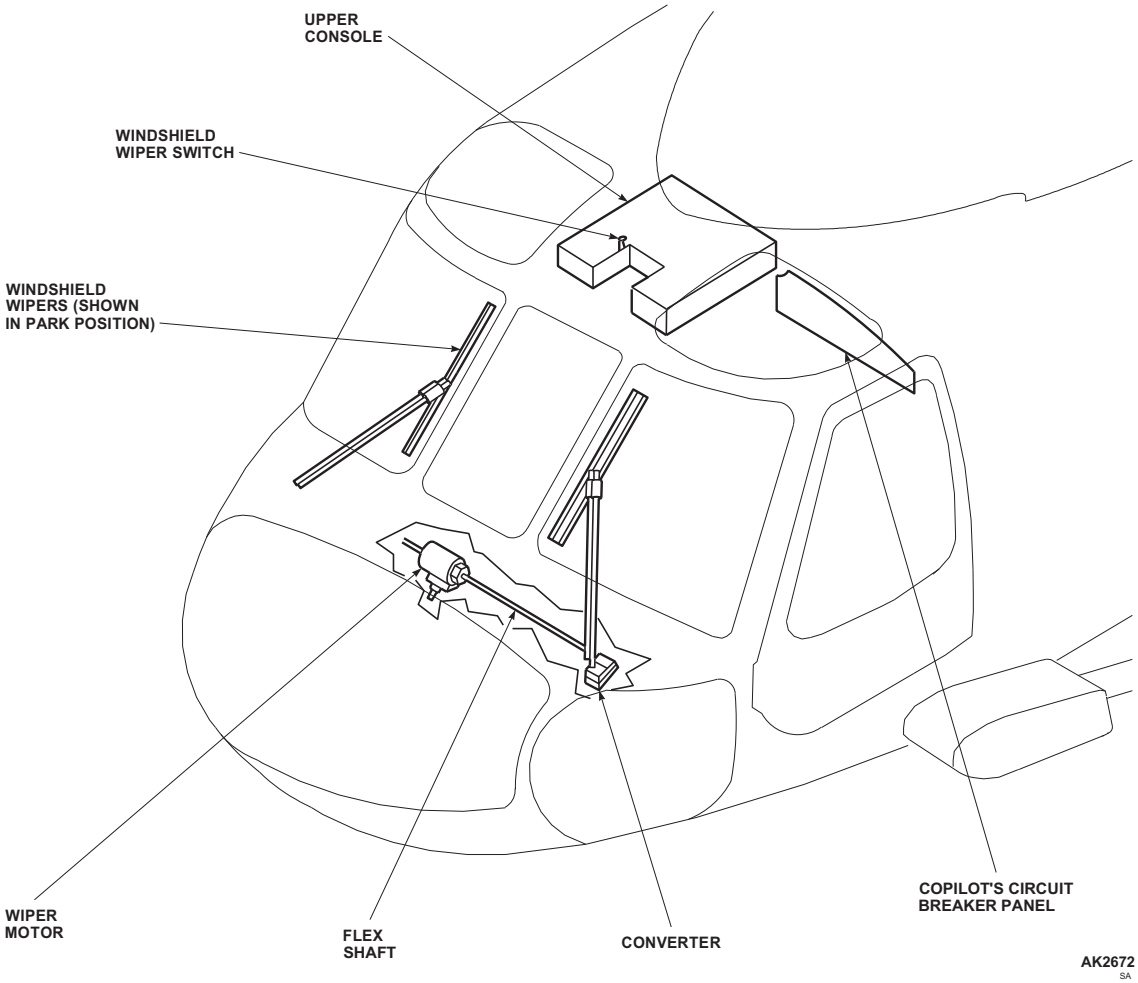


Figure 1. Windshield Wiper System.

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

For location and description of major components, refer to the data in this work package.

EQUIPMENT DATA

If applicable, refer to WP 1699 00 and WP 1719 00 for equipment data information.

UTILITY SYSTEM

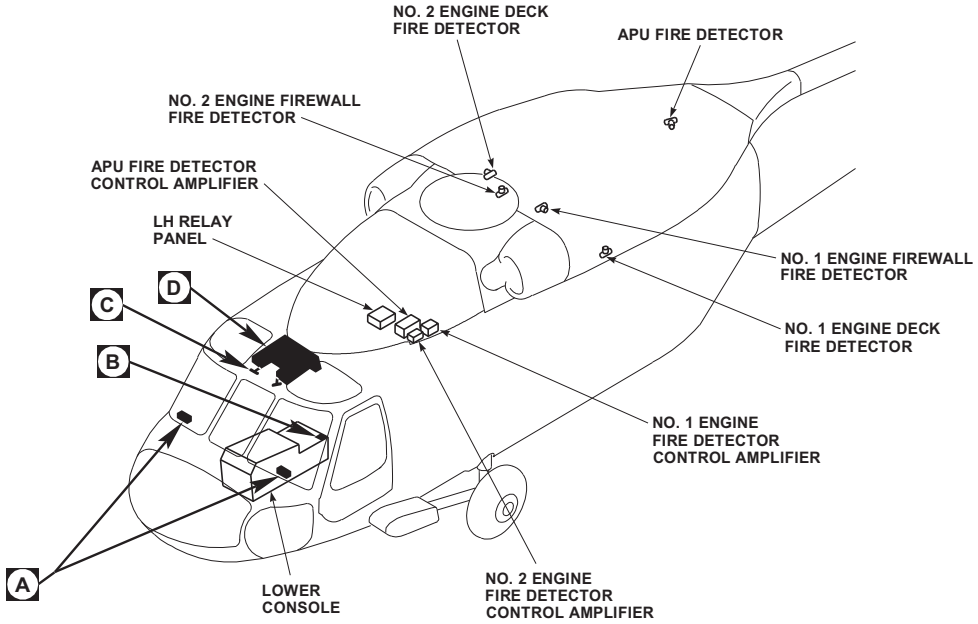
FIRE DETECTION SYSTEM DESCRIPTION AND DATA

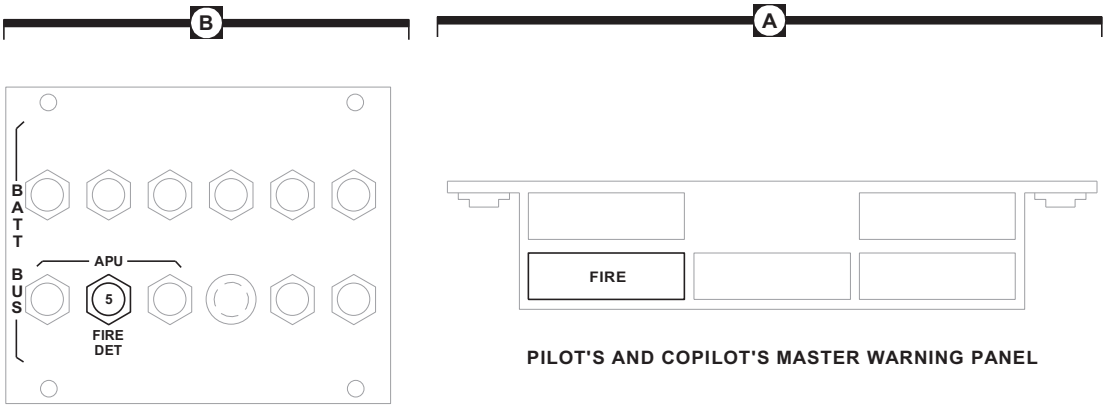
EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

FIRE DETECTION SYSTEM DESCRIPTION

The fire detection system provides fire warning in the cockpit if there is a fire in either the main engine compartment or the APU compartment. For a complete description, refer to POWER DISTRIBUTION, NORMAL OPERATION and TEST OPERATION in this work package. The fire detection system warns the pilot and copilot, when infrared radiation, caused by a fire or extreme overheating, is detected in either engine compartment or APU compartment. The system consists of three control amplifiers, one for each engine and one for the APU, in the forward cabin ceiling; five sensors, two in each engine compartment, one on the firewall and the other on the engine deck, and one in the APU compartment; No. 1 and No. 2 engine T-handle fire warning lights in the engine controls quadrant; and an APU T-handle fire warning light and a FIRE DET TEST/OPER switch on the upper console. The fire detection system functionally interfaces with the caution/advisory warning system, or the HH-60A> HH-60L > MFD/caution/advisory warning system, < through the left relay panel. The caution/advisory warning system, or HH-60L > MFD/caution/advisory warning system, < provides FIRE capsules, one each on the pilot's and copilot's master warning panel. It also provides T-handle light dimming control. The fire detection system is associated with the discharge-type fire extinguishing system described in WP 0042 00.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED





CIRCUIT BREAKER PANEL

PILOT'S AND COPILOT'S MASTER WARNING PANEL

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Figure 1. Fire Detection System Location Diagram (Sheet 1 of 2).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

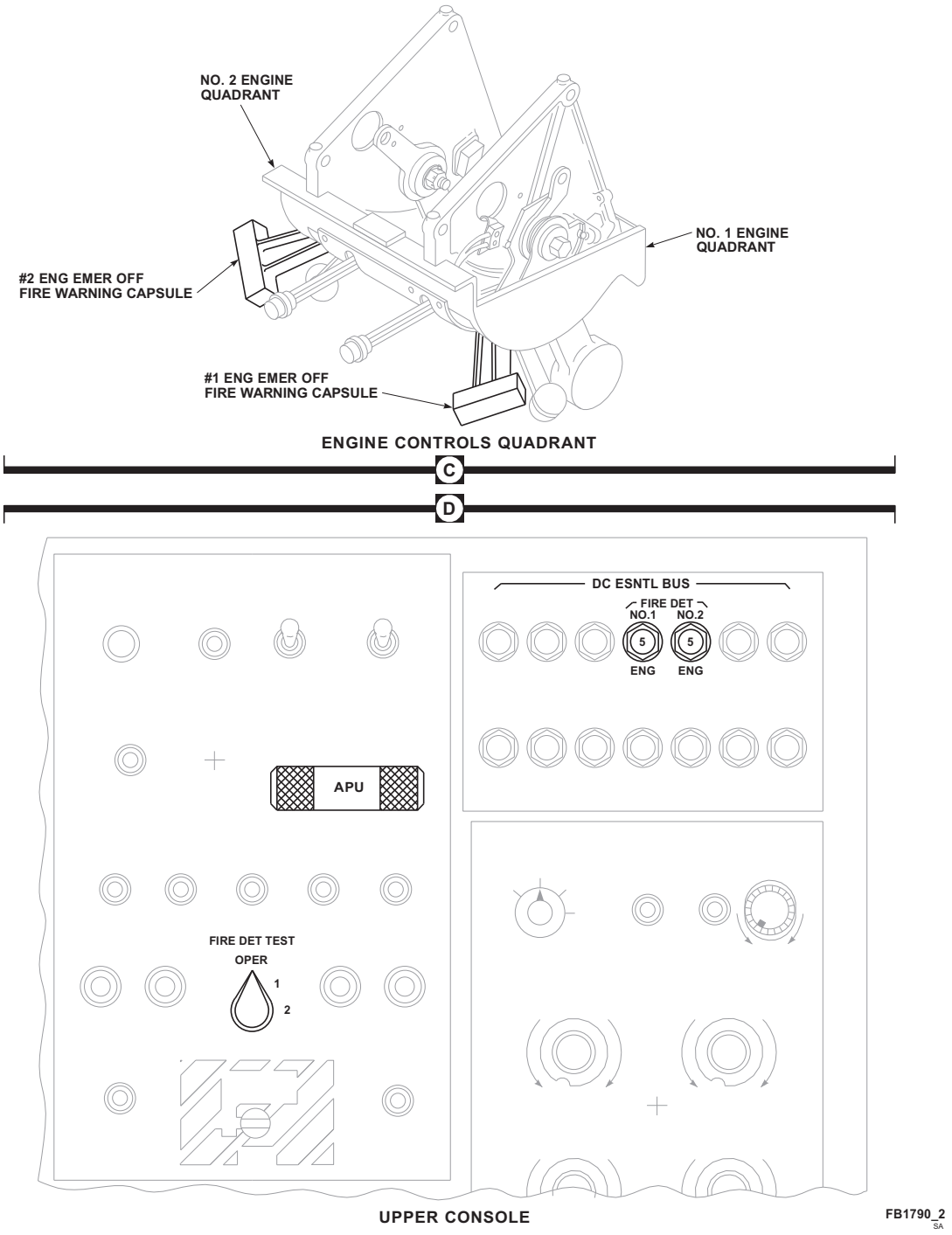


Figure 1. Fire Detection System Location Diagram (Sheet 2 of 2).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

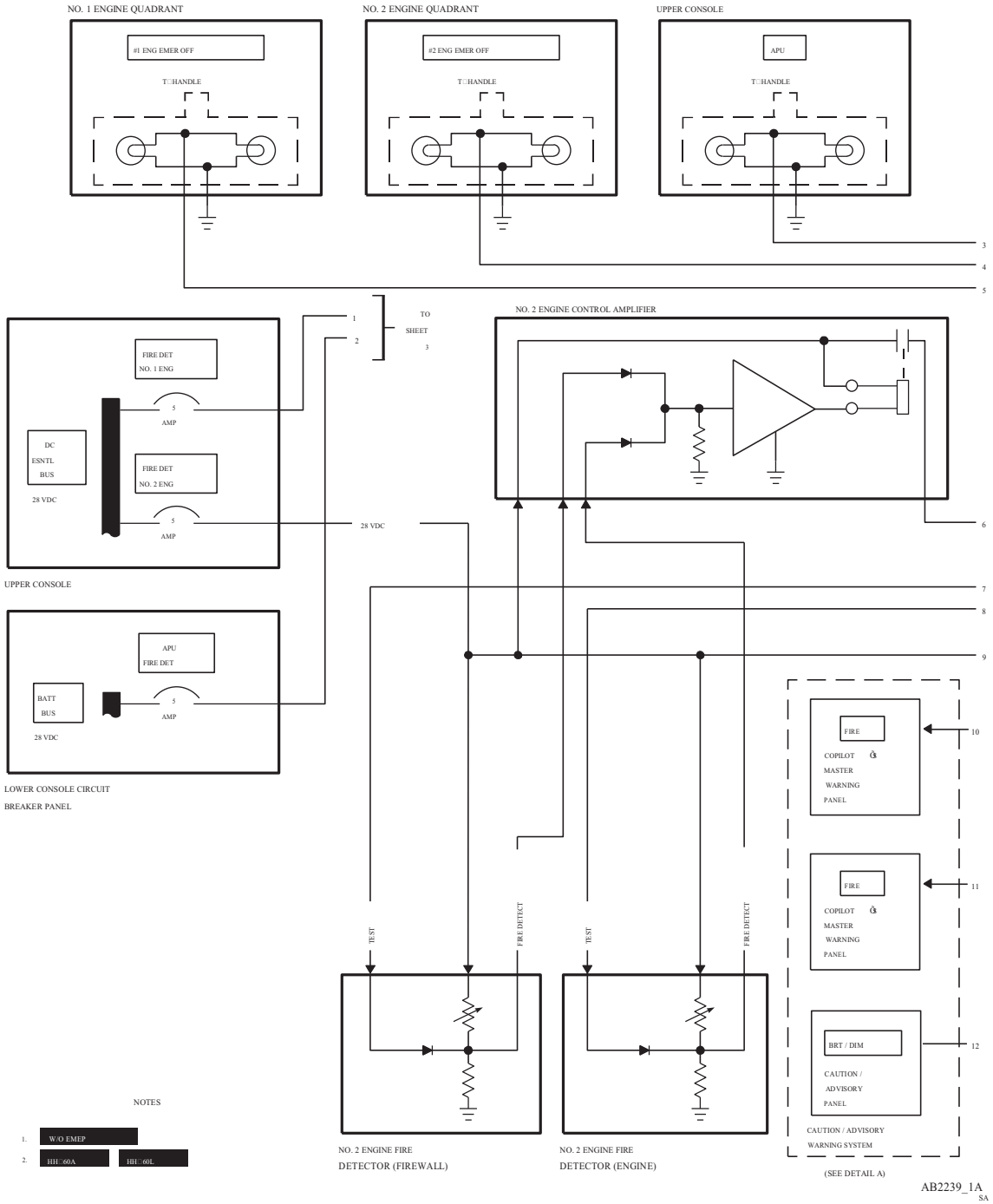


Figure 2. Fire Detection System Block Diagram (Sheet 1 of 4).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

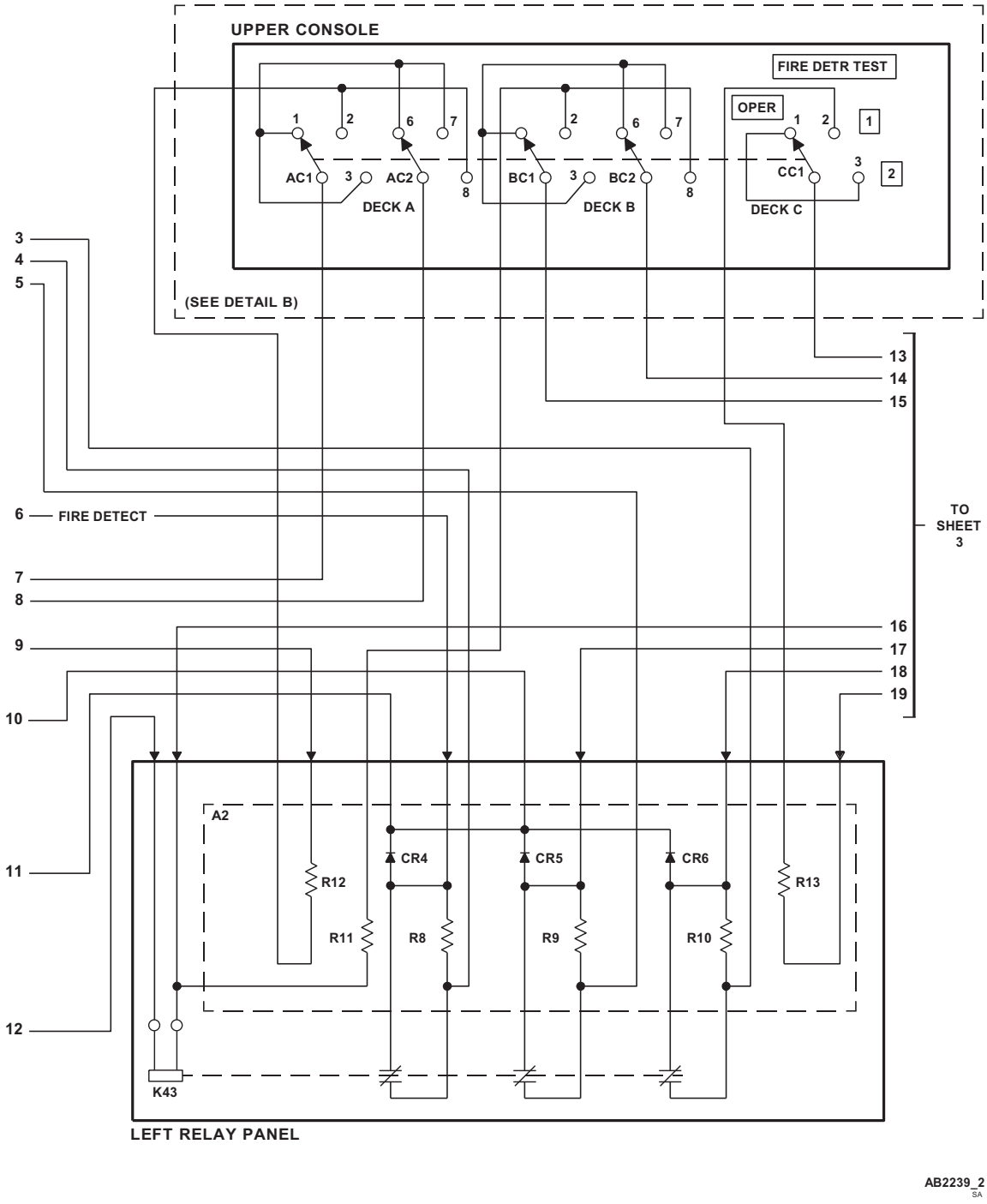


Figure 2. Fire Detection System Block Diagram (Sheet 2 of 4).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

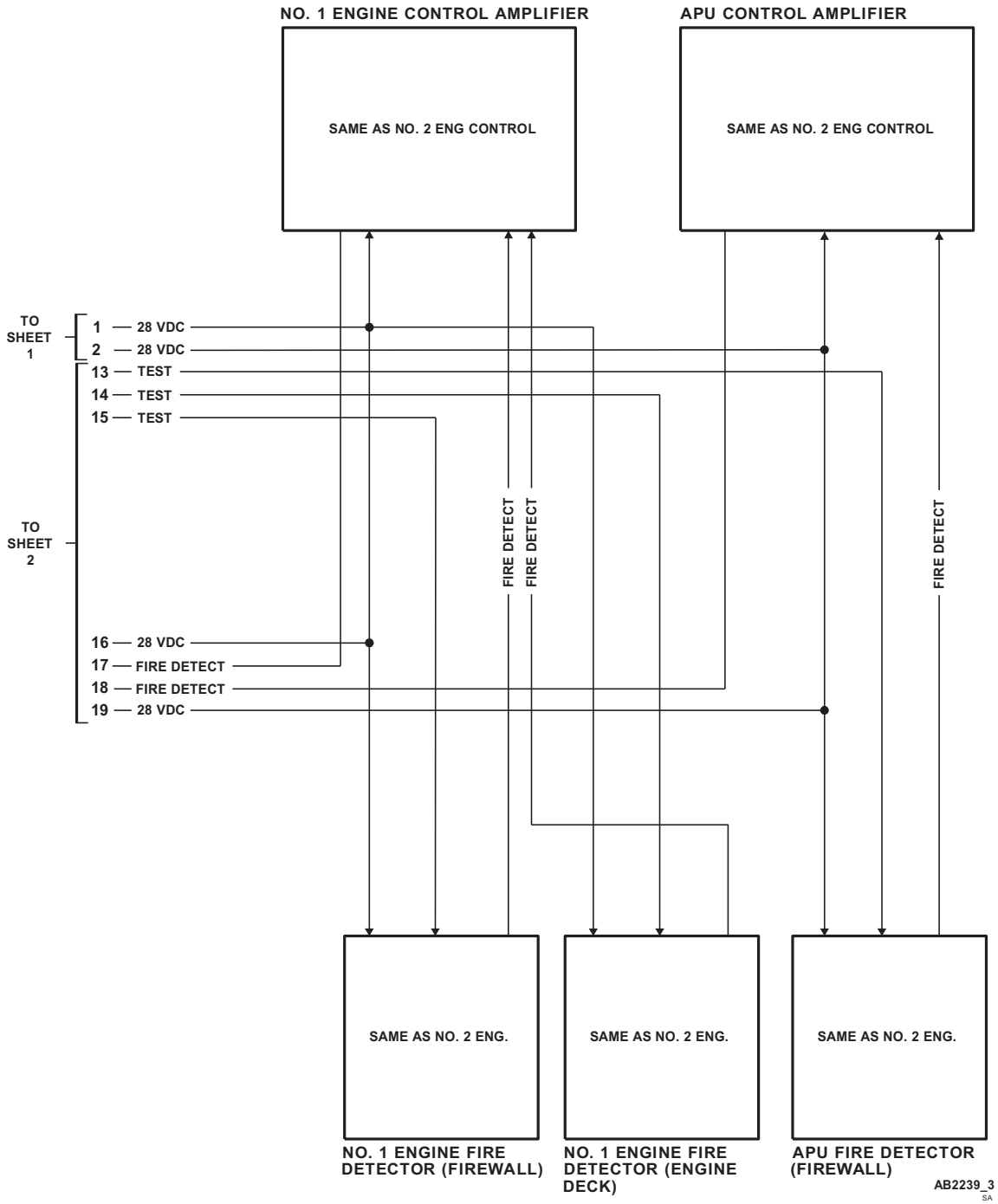
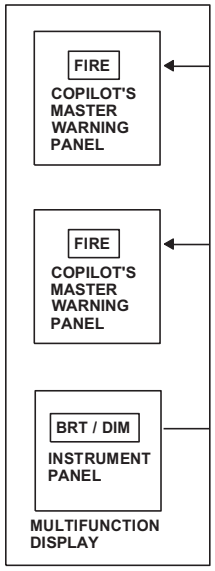
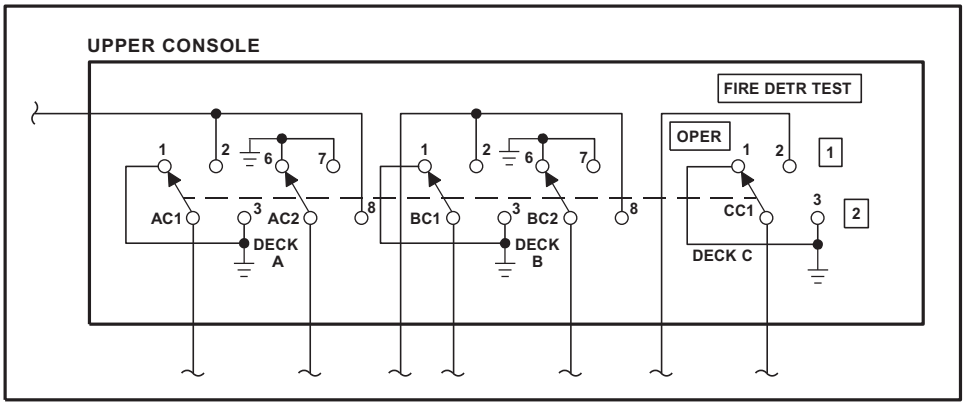


Figure 2. Fire Detection System Block Diagram (Sheet 3 of 4).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED



DETAIL A
(SEE NOTE 2)



DETAIL B
(SEE NOTE 1)

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Figure 2. Fire Detection System Block Diagram (Sheet 4 of 4).

POWER DISTRIBUTION

Electrical power for the fire detection system is supplied by the dc essential bus and the battery bus. The 28 vdc from the dc essential bus is routed through the FIRE DET NO. 1 ENG and the FIRE DET NO. 2 ENG circuit breakers on the upper console. The FIRE DET NO. 1 ENG circuit breaker supplies 28 vdc to both No. 1 engine fire detectors, the No. 1 engine fire detector amplifier and the left relay panel. The FIRE DET NO. 2 ENG circuit breaker supplies 28 vdc to both NO. 2 engine fire detectors, the No. 2 engine fire detector amplifier and the left relay panel. The 28 vdc from the BATT BUS is routed through the APU FIRE DET circuit breaker on the lower console. The APU FIRE DET circuit breaker supplies 28 vdc to the APU fire detector, APU fire detector amplifier and the left

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

relay panel. Lighting intensity of the three T-handle warning capsules and two FIRE capsules on the pilot's and copilot's master warning panels are controlled by the BRT/DIM-TEST switch on the caution/advisory panel, or **HH-60A>** **HH-60L >** MFD on the instrument panel. **<** The BRT/DIM-TEST switch controls dim circuits in the left relay panel.

NORMAL OPERATION

The system consists of five identical fire detector sensors. Each sensor is a dual-element photoresistive light sensor, whose electrical resistance decreases with the intensity and color of the light energy reaching the detector elements. One element is sensitive to red light, the other is sensitive to blue. In normal operation (selected by the OPER position of the FIRE DET TEST/OPER switch), the detector circuit configuration produces an output of from 9 to 11 vdc when the blue component of ambient light reaches the detector and an output of from 13 to 15 vdc when the red component of fire's flame reaches the detector. The fire detector amplifiers control switching of 28 vdc to the capsule described in FIRE DETECTION SYSTEM DESCRIPTION, through a relay in the amplifiers. When detector output/amplifier input is from 9 to 11 vdc, amplifier output is 0 vdc; when detector output/amplifier input is from 13 to 15 vdc, amplifier output is 28 vdc.

TEST OPERATION

The FIRE DET TEST switch is used to simulate a fire condition. When the FIRE DET TEST switch is placed to 1, a simulated fire detected signal is applied to the APU fire detector, No. 1 engine firewall-mounted detector and No. 2 engine firewall-mounted detector. This causes the two FIRE warning capsules on the master warning panels, #1 and #2 ENG EMER OFF and APU T-handle capsules to go on. When the FIRE DET TEST switch is placed to 2, a simulated fire detected signal is applied to the No. 1 and No. 2 engine deck-mounted detectors. This causes the two FIRE warning capsules on the master warning panels as well as the #1 and #2 ENG EMER OFF T-handle capsules to go on. When the FIRE DET TEST switch is placed to OPER, all simulated fire detected signals are removed and the system operates in the normal mode.

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

For location and description of major components, refer to the data in this work package.

EQUIPMENT DATA

For equipment data information, refer to this work package.

UTILITY SYSTEM

FIRE EXTINGUISHING SYSTEM DESCRIPTION AND DATA

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

FIRE EXTINGUISHING SYSTEM DESCRIPTION

The fire extinguishing system puts out fire in the APU or in either of the main engine compartments (Figure 1). The system consists of two pressurized containers, an overboard discharge line, a discharge indicator on the right side of the helicopter, and electrical switches and wiring. Each pressurized container is charged with 2.5 pounds of monobromotrifluoromethane and has a pressure gage. Each container serves as a backup for the other, there by providing a two shot capability to extinguish fires in either main engine compartment. The APU compartment is only extinguished by one container. A single, overboard discharge line is connected to both pressurized containers. A red indicator disc is at the end of the line on the right side of the helicopter at station 464. A broken-out red disc shows you that a container relief valve has discharged and a container must be replaced. Upon impact of a crash of 10 Gs or more, an inertia switch automatically fires both containers into both main engine compartments.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

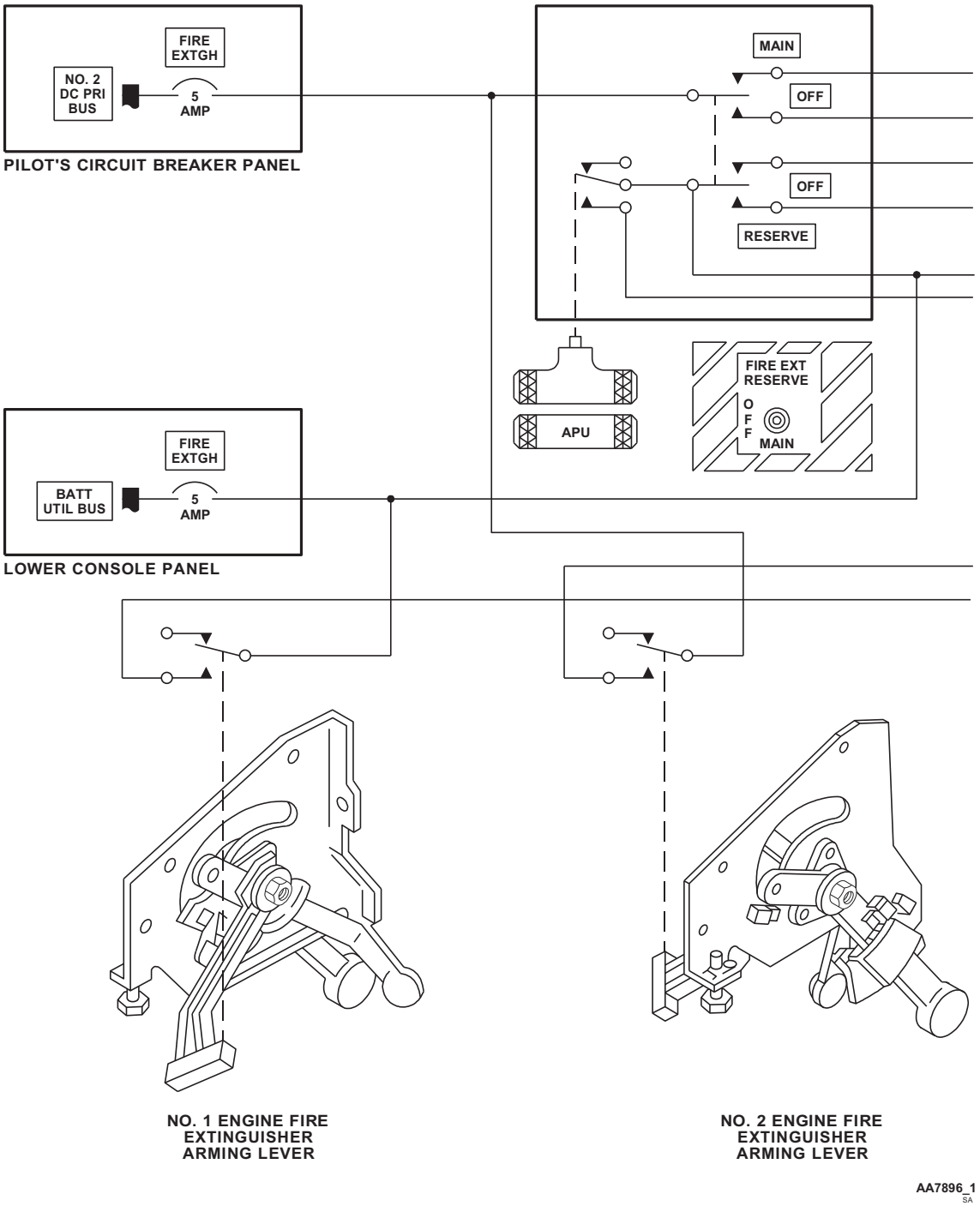


Figure 1. Fire Extinguishing System Block Diagram (Sheet 1 of 2).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

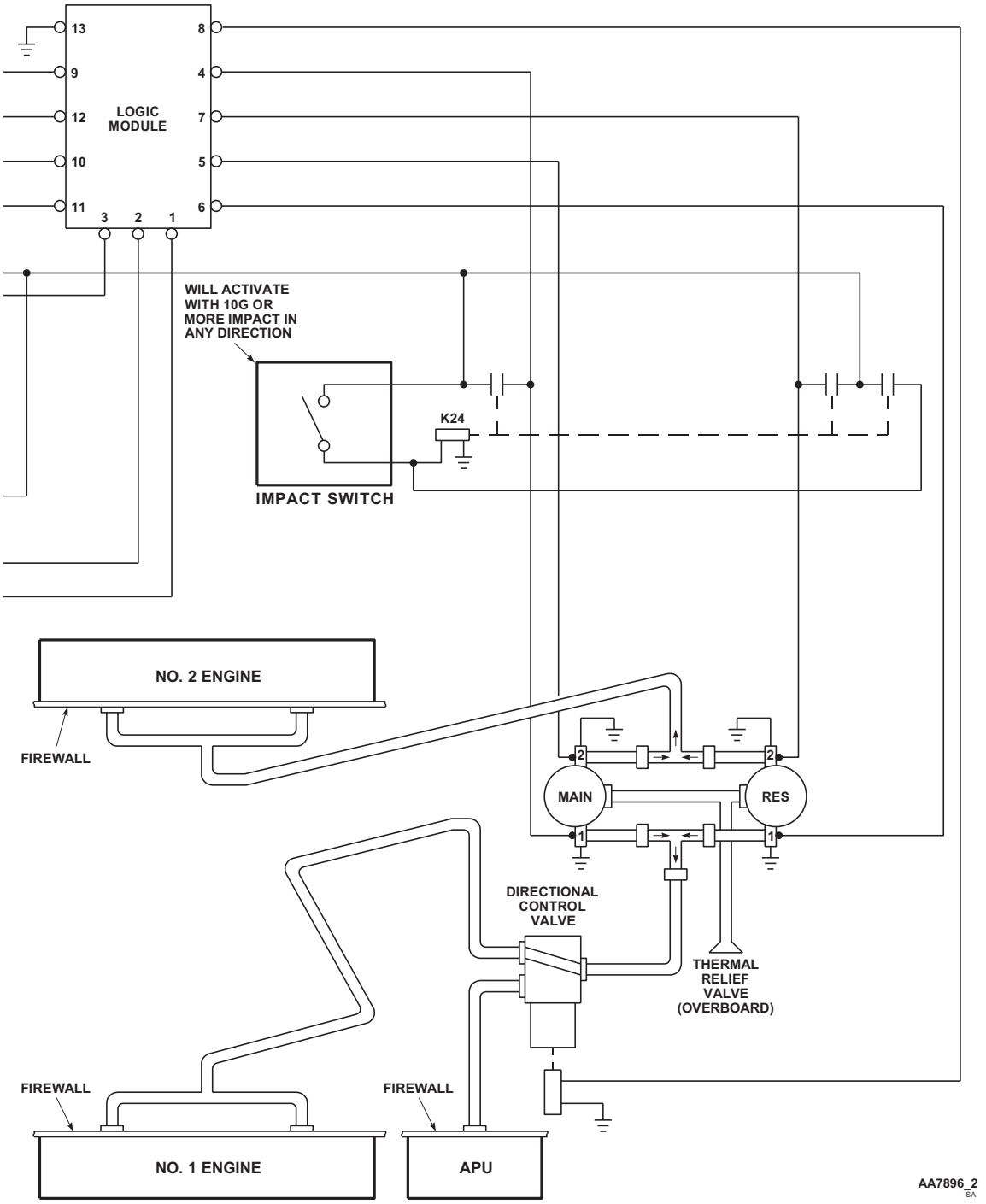


Figure 1. Fire Extinguishing System Block Diagram (Sheet 2 of 2).

FIRE EXTINGUISHING SYSTEM OPERATION

If a fire is detected in the No. 1 engine, No. 2 engine, or APU compartment, a light in the extinguishing agent T-handle on the upper console will go on. Pulling out on the lighted T-handle selects the compartment to which the extinguishing agent will be discharged (Figure 1). The FIRE EXTGH switch on the upper console is spring-loaded OFF, and controls the release of the extinguishing agent. Moving the switch to either MAIN or RESERVE selects the container from which the extinguishing agent will be discharged.

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

For location and description of major components, refer to the data in this work package.

EQUIPMENT DATA

If applicable, refer to, WP 1762 00 for equipment data information.

UTILITY SYSTEM

ENGINE ANTI-ICE SYSTEMS DESCRIPTION AND DATA

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

ENGINE ANTI-ICE SYSTEMS DESCRIPTION

The engine anti-ice systems consist of an inlet anti-ice valve and temperature sensing switch, and an engine-mounted anti-ice valve with a position switch. When the ENG ANTI-ICE No. 1 or No. 2 switch is placed ON, the engine mounted anti-ice valve opens, causing a position switch to close. Then, the #1 or #2 ENG ANTI-ICE ON advisory light goes on. After the inlet valve has opened and the engine inlet temperature reaches 200°F the #1 or #2 ENG INLET ANTI-ICE ON advisory light will go on (Figure 1. (Sheet 1 of 3), Figure 1. (Sheet 1 of 3) and Figure 1. (Sheet 2 of 3)).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

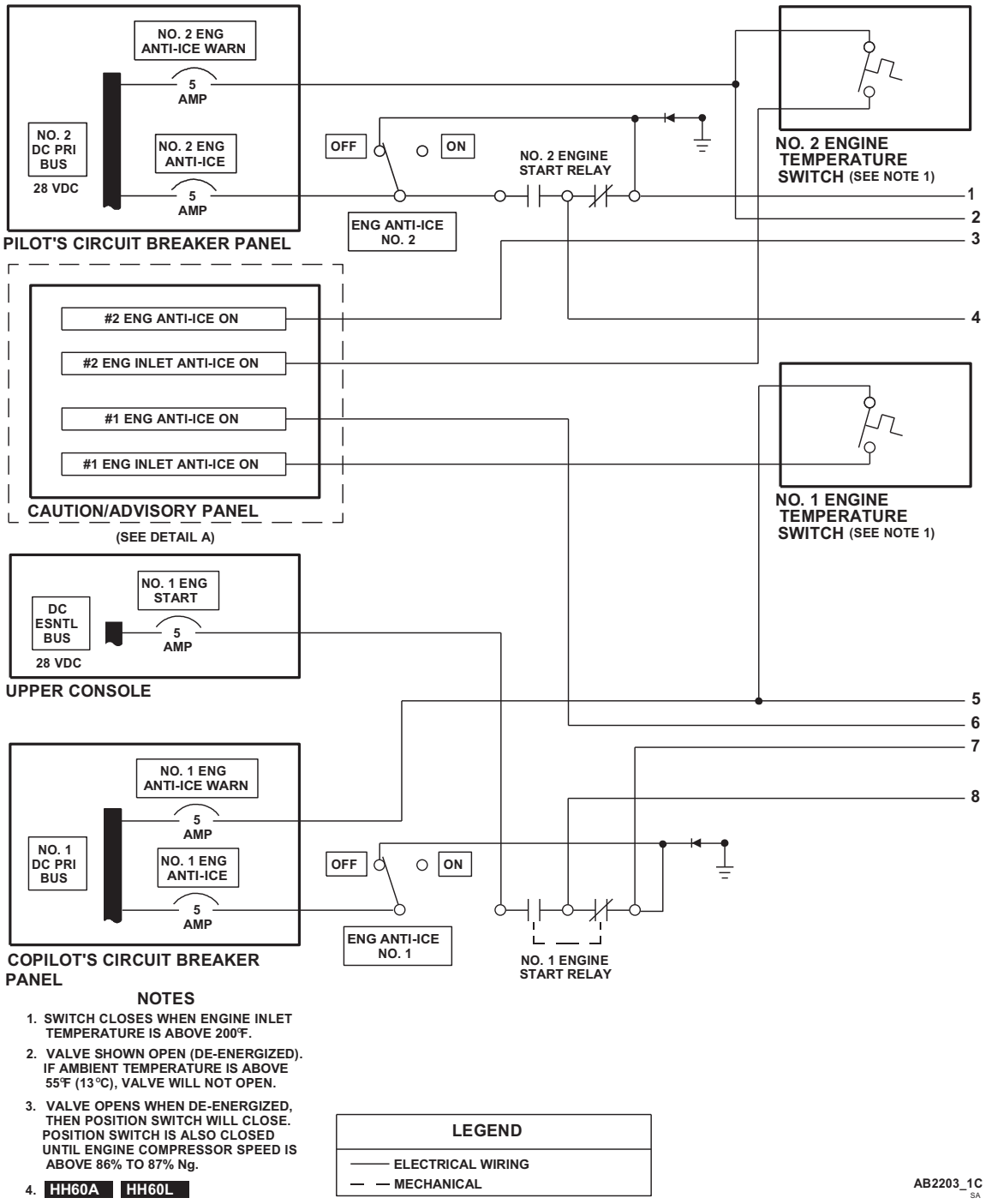


Figure 1. Engine Anti-Ice System Block Diagram (Sheet 1 of 3).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

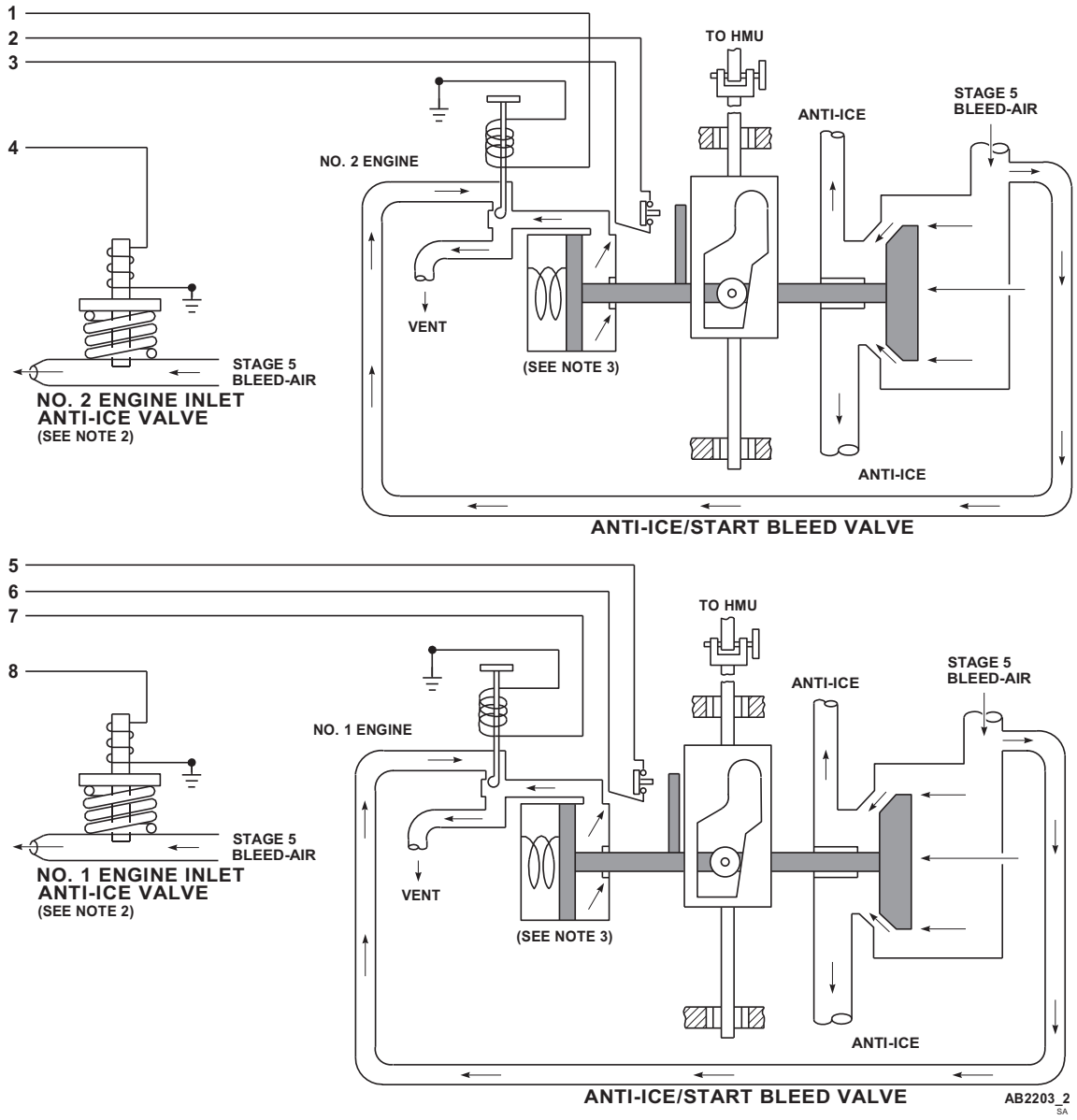


Figure 1. Engine Anti-Ice System Block Diagram (Sheet 2 of 3).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

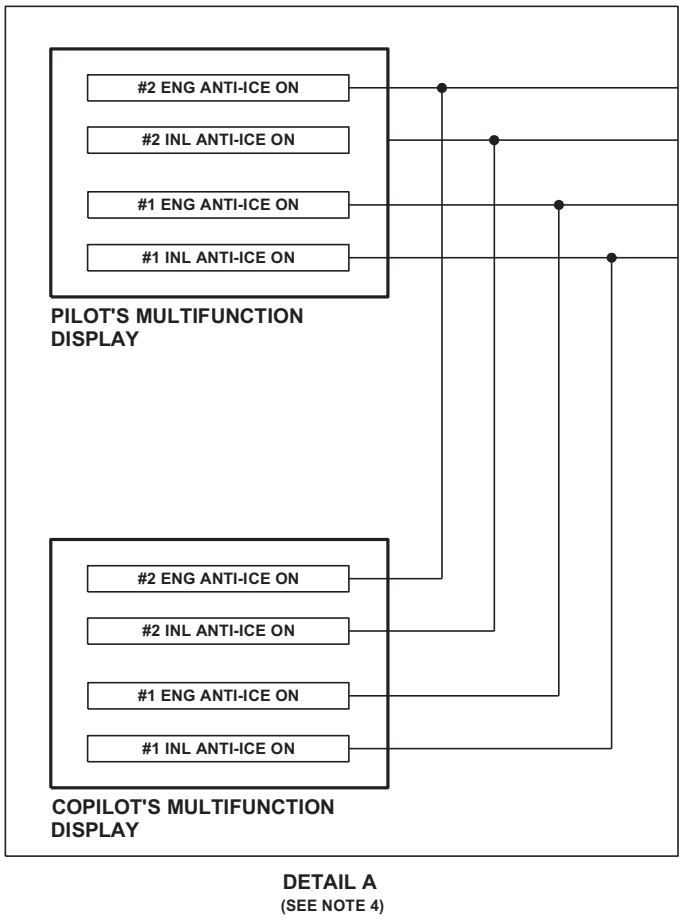


Figure 1. Engine Anti-Ice System Block Diagram (Sheet 3 of 3).

ENGINE INLET ANTI-ICING

The engine air inlets are anti-iced by bleed-air from the engines. Four advisories, #1 ENG ANTI-ICE ON, #2 ENG ANTI-ICE ON, #1 ENG INLET ANTI-ICE ON, and #2 ENG INLET ANTI-ICE ON, are provided for the engines. The #1 and #2 ENG ANTI-ICE ON advisories will appear when the ENG ANTI-ICE NO. 1 and ENG ANTI-ICE NO. 2 switches are placed ON. When the anti-ice system is operating and an engine is started, the inlet anti-ice valve for that engine will close. The #1 and #2 ENG INLET ANTI-ICE ON advisories operate from temperature sensed at the engine inlet fairing. When the temperature reaches about 93°C (199°F), the temperature switch will activate the appropriate ENG INLET ANTI-ICE ON advisory. If this advisory appears with the switches at ENG ANTI-ICE NO. 1 and NO. 2 OFF, it indicates that heat is being applied to that engine inlet and a malfunction exists. Inlet anti-icing will turn on if dc primary power failure occurs; dc electrical power is applied to keep the valve closed. Functioning of ENG INLET ANTI-ICE is controlled as follows:

- Above 13°C (55°F) - Appearance of the ENG INLET ANTI-ICE ON advisory indicates a system malfunction.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

- Above 4°C (39°F) to 13°C (55°F) - The ENG INLET ANTI-ICE ON advisory may appear or may not appear.
- At 4°C (39°F) and below - Failure of ENG INLET ANTI-ICE ON advisory to appear indicates a system malfunction. Do not fly the aircraft in known icing conditions.

At engine power levels of 10% TRQ per engine and below, full inlet anti-ice capability cannot be provided due to engine bleed limitations. Power to operate the valves is normally provided from the No. 1 and No. 2 dc primary buses, respectively, through circuit breakers marked NO. 1 and NO. 2 ENG ANTI-ICE, respectively. During engine start, power to operate the No. 1 engine inlet anti-ice valve is provided from the dc essential bus through a circuit breaker marked NO. 1 ENG START. The #1 and #2 ENG INLET ANTI-ICE ON advisories receive power from No. 1 and No. 2 dc primary buses, through circuit breakers marked NO. 1 and NO. 2 ENG ANTI-ICE WARN, respectively.

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

For location and description of major components, refer to the data in this work package.

EQUIPMENT DATA

If applicable, refer to WP 1452 00 for equipment data information.

UTILITY SYSTEM

BLADE DEICING SYSTEM DESCRIPTION AND DATA

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

BLADE DEICING SYSTEM

The blade deicing system provides for deicing the main and tail rotor blades and droop stops. The deicing system may be operated in either of two selectable modes, manual or automatic. The automatic mode uses a signal from the outside air temperature sensor to determine the amount of time the heating current is applied to the main and tail rotor blades. The manual mode provides selection of three predetermined deicing conditions: trace, light, and moderate. The main and tail rotor channels of the deice system electrically heat mats bonded into the leading edges of each blade. Each main rotor blade contains four separate heating zones. Deicing current is sequentially supplied to identical zones of opposite blades to assure symmetrical ice shedding. The amount of time heating current is applied to each blade zone is determined by the outside air temperature (OAT). This is sensed by an outside OAT sensor. The time between heating cycles is determined by an ice detector probe. The signals from both the OAT sensor and the ice detector probe are applied to the main and tail rotor channels in the deice controller. Each tail rotor blade contains only one heating zone, and all tail rotor blades are simultaneously pulsed by deicing current. The amount of time heating current is supplied to the blades in the automatic mode is greater as the outside air temperature decreases. In the manual mode, the time between heating cycles is determined by the mode selector switch setting. A blade deice test panel permits testing of the internal fail detection circuits in the deice controller. At NORM, the test panel permits normal system operation. At SYNC 1 and SYNC 2, the main rotor synchronization fail detection circuits are tested. At OAT, a short-circuited OAT sensor is simulated, and fail detection circuits in main and tail rotor channels are tested. At EOT, faulty element-on-timers are simulated in the main and tail channels and their associated failure detection circuits are tested. The PWR MAIN RTR and PWR TAIL RTR lamps monitor power application to the main and tail rotor blades. The lamps will go on during system test, any time power remains applied to the blades with the MR DEICE FAIL or TR DEICE FAIL caution capsule is on and the system POWER switch is ON, or any time power remains applied to the blades with the system POWER switch OFF. The droop stops are continuously heated as long as the BLADE DEICE control panel POWER switch is in the TEST or ON mode. The blade deicing system is made up of an outside air temperature sensor mounted on the fuselage forward of the pilot's window; an ice detector mounted on the right engine air inlet duct, with a sensing probe exposed to outside air; an icing rate meter, BLADE DEICE control panel, and BLADE DEICE TEST panel, all of which are mounted on the instrument panel. The blade deicing system also includes a slipring mounted on the main and tail gear boxes, auxiliary ac, and main rotor blade deice junction boxes, a blade deice controller mounted in the cabin containing separate main and tail rotor channels, and droop stop heaters built into the rotor head droop stops. The main and tail rotor blades are not part of the system. All blades contain resistive heating mats built into the blade during its construction.

Panel lighting of the icing rate meter panel is controlled by the INSTR LT NON FLT control on the upper console. For a further description of panel lighting, refer to INSTRUMENT PANEL LIGHTING in WP 0035 00. The left relay panel connects the TEST IN PROGRESS lamp on the BLADE DEICE control panel, and the PWR MAIN RTR and PWR TAIL RTR lamps on the BLADE DE-ICE TEST panel, to dimming voltage and permits indicator lamp dimming and disabling functions. For a further description of indicator lighting, refer to INSTRUMENT PANEL AND CONSOLES INDICATOR LIGHTS DIMMING in WP 0035 00.

POWER DISTRIBUTION UH-60A UH-60L HH-60A HH-60L> <

28 vdc from the No. 2 dc primary bus is applied through the DE-ICE CNTRLR circuit breaker, on the mission readiness circuit breaker panel, as follows: to the blade deice controller, as power supply voltage; through deenergized contacts of ac bus tie contactor and energized contacts of APU/external power contactor, or through diode CR5, energized No. 1 and No. 2 generator contactors, and diode CR11, to the blade deice controller power monitor circuits; to the BLADE DE-ICE TEST panel as press-to-test lamp voltage; and to the BLADE DE-ICE control panel POWER switch. If this switch is placed ON, 28 vdc will energize the icing rate meter, the blade deice controller, and relay K64 via diode CR16. If the POWER switch is placed to TEST, 28 vdc will energize relay K64 through diode CR15 and contacts of relay K65, if the backup pump is not operating. This test voltage is also applied to

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

the blade deice controller. No. 1 dc primary voltage is applied through the ICE DET circuit breaker, on the copilots circuit breaker panel, to the icing rate meter. 28 vdc from the battery bus is applied through the APU GEN CONTR circuit breaker, through normally open or normally closed contacts of No. 1 and No. 2 generator contactors, and energized contacts of relay K64, to energize contactors K62 and K63.

Three-phase 115 vac tail rotor heater power may come from one of two sources: from the No. 1 ac primary bus through the DE-ICE PWR TAIL ROTOR circuit breaker and normally open contacts of contactor K63, or from the APU generator through normally closed contacts of contactor K63. From contactor K63, power is routed through current limiters CL13, CL14, and CL15, contacts of contactor K61, and fault detection circuitry within the blade deice controller, to the tail rotor sliprings. Three-phase 115 vac main rotor heater power may come from one of two sources: from the No. 2 ac primary bus through current limiters CL7, CL8, and CL9, and normally open contacts of contactor K62, or from the APU generator through normally closed contacts of contactor K62. From contactor K62, power is routed through current limiters CL10, CL11, and CL12, contacts of contactor K60, and MN RTR BLADE DE-ICE CT transformers T14 and T14A, to the main rotor sliprings. Single-phase 115 vac for the BLADE DE-ICE TEST panel and the icing rate meter is supplied by the No. 2 ac primary bus via the ICE DET circuit breaker.

POWER DISTRIBUTION UH-60A> <

28 vdc from the No. 1 dc primary bus is applied through the DE-ICE CONTRLR circuit breaker, on the copilot's circuit breaker panel, as follows: to the blade deice controller, as power supply voltage; to the BLADE DE-ICE TEST panel as press-to-test lamp voltage; and to the BLADE DE-ICE control panel POWER switch. If this switch is placed ON, 28 vdc will energize the icing rate meter, the blade deice controller, relay K64 via diode CR16, and relay K12 via diode CR22. If the POWER switch is placed to TEST, 28 vdc will energize relay K12 through diode CR23, and relay K64 through diode CR15 and contacts of relay K65, if the backup pump is not operating. This test voltage is also applied to the blade deice controller. No. 1 dc primary voltage is applied through the ICE DET circuit breaker, on the copilot's circuit breaker panel, to the icing rate meter. 28 vdc from the battery bus is applied through the APU GEN CONTR circuit breaker, normally open or normally closed contacts of the No. 1 and No. 2 generator contactors, and energized contacts of relay K64, to energize contactors K62 and K63. No. 2 dc primary voltage, from the SEC MON BUS CONTR circuit breaker on the pilot's circuit breaker panel, is applied to blade deice controller power monitor circuits by one of two paths: through deenergized contacts of ac bus tie contactor, energized contacts of APU/external power contactor, and diode CR20; or through diode CR5, energized contacts of No. 1 and No. 2 generator contactors, and diode CR11.

Three-phase 115 vac tail rotor heater power may come from one of two sources: from the No. 2 ac primary bus through current limiters CL1, CL2, and CL3, the DE-ICE PWR TAIL ROTOR circuit breaker, and normally open contacts of contactor K63; or from the APU generator through normally closed contacts of contactor K63. From contactor K63, power is routed through current limiters CL13, CL14, and CL15, contacts of contactor K61, and fault detection circuitry within the blade deice controller, to the tail rotor sliprings. Three-phase 115 vac main rotor heater power may come from one of two sources: from the No. 2 ac primary bus through current limiters CL7, CL8, and CL9, and normally open contacts of contactor K62; or from the APU generator through normally closed contacts of contactor K62. From contactor K62, power is routed through current limiters CL10, CL11, and CL12, contacts of contactor K60, and MN RTR BLADE DE-ICE CT transformers T14 and T14A, to the main rotor sliprings. Single-phase 115 vac for the BLADE DE-ICE TEST panel and the icing rate meter is supplied by the No. 1 ac primary bus via the ICE DET circuit breaker.

ICE DETECTOR OPERATION

The ice detector senses ice accumulation on a vibrating probe by a change in probe frequency. The probe excitation frequency is supplied by the icing rate meter (nulling voltage from icing rate meter). A sensing coil returns the probe's oscillation frequency to the icing rate meter (icing output to icing rate meter drive coil). The icing rate meter processes the signal from the ice detector and visually displays icing intensity. Also, the icing rate meter sends an ice detected 28 vdc signal to the ICE DETECTED caution capsule when the BLADE DE-ICE control panel POWER switch is OFF or at TEST. When the POWER switch is placed ON, the ice detector aspirator heater is turned on and the ICE DETECTED caution capsule is turned off. If the BLADE DE-ICE control panel MODE switch is at AUTO, the icing rate meter sends an ice rate signal through the switch to the deice controller. After

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

the probe has generated a signal proportional to the rate of icing, 28 vdc from the icing rate meter is applied to the probe strut heater. This melts the ice accumulated on the probe. The probe heater operates for about 5 to 7 seconds, and then cools down to allow another icing rate sensing cycle. The icing rate signal is held by circuitry within the icing rate meter panel. The hold circuits prevent the controller from receiving a false no-ice signal. An aspirator built into the detector uses engine bleed-air to create a vacuum near the probe sensing area. This draws air over the sensing probe when the helicopter is in a hover, and there is no ram air flowing over the probe.

MAIN ROTOR BLADE SYSTEM AUTOMATIC MODE OPERATION

If the main rotor distributor is not in its proper reference position, 28 vdc power is applied to the deice controller from the ON position of the BLADE DE-ICE control panel POWER switch, and the main rotor channel automatically enters the fast synchronization mode. During this time the distributor driver delivers a series of short pulses (375 milliseconds) to step the distributor to a reference position. During synchronization, the controller monitors the sync pulse input signal from the distributor, to check for synchronization and proper sequencing. The distributor will provide a -3 to -7 volt reference signal to the controller when the stepping relay is in position for deicing to start. If the reference signal is not present, the controller continues to generate pulses (to a maximum of eight) to advance a stepping relay in the distributor. If the -3 to -7 volt sync signal is not received within the first eight-pulse cycle, the controller generates a main blade deice fail signal, which turns on the MR DE-ICE FAIL capsule. If the reference signal is present, the output from the element-on-time (EOT) pulse counter and sync control circuit is a synchronizer functional signal to the main blade fail/fault detect circuits. A no-fail signal from the main blade fail/fault detect circuit is applied to the main rotor power monitor. The power monitor is enabled when the POWER switch on the BLADE DE-ICE control panel is ON or at TEST, and the synchronizer is functional.

The output of the main rotor power monitor enables the main rotor contactor driver, which energizes the main rotor blade deice contactor K60 through the contacts of relay K64. Contactor K60 supplies 115 vac, three-phase power to the distributor through current transformers T14 and T14A, and the main rotor sliprings. The controller now begins a normal main rotor cycle. The eight element-on-time heating control pulses used to step the stepping relay in the distributor are generated by the main blade element-on-timer of the blade deice controller. The EOT distributor drive pulses are applied to the input control logic circuit in the distributor. The 28 vdc EOT signal simultaneously energizes stepping relay K2 and contactors K1 and K3. The gate circuits are also enabled. Stepping relay K2 cocks a ratchet mechanism to advance the rotary distributor. The gate circuits control the SCRs, which provide arc suppression for contactors K1 and K3. When the EOT signal goes low, contactor K1 and K3 open. The input control logic circuit and gate circuits keep the SCRs conducting until after the contacts of K1 and K3 have opened. Finally, the stepping relay solenoid is deenergized, allowing its contacts to advance. Sync information is derived from stepping relay K2 and a sync forming circuit. This provides a negative output pulse of 5 volts for position 1, and 30 volts for positions 3, 5, and 7. Positions 2, 4, 6, and 8 are sensed by zero volts on the sync pulse input line.

TAIL ROTOR BLADE SYSTEM AUTOMATIC MODE OPERATION

The icing rate signal is also applied to the tail deice integrator circuit through the normally closed contacts of a test relay. The output of the integrator is used to determine the off-time (OT) of the tail blade heating elements. With the POWER switch ON, 28 vdc energizes relay K64 through diode CR16. The 28 vdc is also supplied to the ON command input of the blade deice controller's tail rotor power monitor circuit.

The tail rotor power monitor is enabled because the ON input is present, and a no-fail signal from the fail detect circuit enables the power monitor. The output of the tail rotor contactor driver energizes the TL RTR DE-ICE CONTOR K61 through the contacts of relay K64 when both inputs to the tail rotor contactor driver are present. The ON signal to OR-gate U6 provides one input to AND gate U5. Then, a no-fail signal enables U5. The output of U5 enables the contactor driver and supplies one input to AND gate U4. The other input to U4 is the tail rotor element on-timer signal. The pulse width of the timer signal is a function of the outside air temperature (OAT). The lower the temperature, the greater the pulse width. The timer output pulse (EOT) enables AND gate U4, which energizes the heat control contactor in the controller. Heating power is connected through the tail rotor sliprings to the tail rotor blade heating elements. The time between EOT cycles is determined by the icing rate signal as sensed by the ice detector. The icing rate signal is applied to the tail deice integrator. The output of the integrator controls the operation of the tail rotor element-on-timer.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

MAIN AND TAIL BLADE DEICE SYSTEM TEST MODE

Placing the BLADE DE-ICE control panel POWER switch to TEST applies 28 vdc to the test control circuits in the controller, which energizes the test relay and applies a command to all test circuits in the blade deice controller. The controller also feeds back 28 vdc to turn on the TEST IN PROGRESS lamp in the BLADE DE-ICE control panel for 105 to 135 seconds. During the test mode, the controller overrides existing element-on-time (EOT), element-off-time (OT), and any MANUAL or AUTO commands, to execute a preset test program. Test relay contacts remove the icing rate signal supplied by the AUTO or MANUAL position of the MODE switch on the BLADE DE-ICE control panel to the main and tail blade integrators in the controller. A fixed resistor is substituted, which provides a nominal off-time to 100 seconds for the main rotor channel, and 100 seconds for the tail rotor channel. Another set of test relay contacts removes the outside air temperature (OAT) signal to the main and tail blade element-on-time (EOT) circuits, and substitutes a fixed resistor, which provides for eight 375 millisecond main blade element-on-time pulses and a single tail blade EOT pulse of 1 second. A test command input to the EOT pulse counter and sync check circuit causes the main rotor channel to enter the fast cycle mode. During this mode, the main blade element-on-timer generates eight EOT pulses. The EOT test program is generated by the same timing circuits that generate EOT and OT during normal operation. The main and tail blade systems fault detection circuits signal the existence of any malfunction in the same way as in normal operation. During the test cycle, the OT timers are checked for proper operation. If the tail OT is less than 90 seconds or more than 110 seconds, a failure indication will be generated. If the main blade OT is less than 90 seconds or more than 110 seconds, a failure indication will be generated. If the BLADE DE-ICE control panel POWER switch is placed OFF before the test cycle is complete, the controller terminates the test sequence and resets any existing warning outputs. When the test is allowed to terminate, all warning outputs are reset, so that if the POWER switch is placed OFF and then ON, no warning capsules will be on. The BLADE DE-ICE TEST panel provides a check of blade deice system for failures that are not detected during the normal TEST mode. The panel does this by inserting specific failure signals into the system, which should be detected by the built-in-test circuits, in the controller. When the BLADE DE-ICE TEST panel switch is at SYNC or SYNC 2, the test panel interrupts the distributor sync line and injects a false sync signal to the controller. The test panel provides the controller with a -30 vdc pulse when the mode switch is at SYNC, and presents an open circuit with switch at SYNC 2. This causes the MR DE-ICE FAIL capsule to go on. When the BLADE DE-ICE TEST panel switch is placed to OAT, the switch short circuits the OAT sensor input to the controller. The main blade and tail blade fail detect circuits sense the simulated failure and cause the MR DE-ICE FAIL and TR DE-ICE FAIL caution capsules to go on.

When the BLADE DE-ICE TEST panel switch is placed to EOT, the switch connects grounds from relay K3 to the main blade and tail blade fault detect circuits in the controller to simulate malfunctioning EOT timing circuits. Thus the MR DE-ICE FAIL and TR DE-ICE FAIL caution capsules are turned on. When the test function switch on the BLADE DE-ICE TEST panel is at NORM, the test panel does not inject failure signals into the system, and allows normal system operation. The BLADE DE-ICE TEST panel also functions to sense faults in the deice power circuits. If electrical power remains applied to either the main or tail rotor heating elements after a fail condition, or when blade deice power is switched off, the BLADE DE-ICE TEST panel causes the corresponding PWR monitor indicator to go on. The tail rotor power monitor circuit monitors the three-phase ac voltage to the tail rotor heating elements. If voltage is present on at least two phases, a ground return is provided for fault detector relay K2. When the POWER switch on the BLADE DE-ICE control panel is OFF, or the controller generates a tail rotor deice fail signal, relay K2 is energized. The PWR TAIL RTR lamp is turned on through the contacts of K2, warning that the tail rotor blade heater power has not been turned off as required. The main rotor power monitor circuit monitors the voltage from three main rotor blade current transformers. If power is being applied to any rotor blade heating element, the main rotor power monitor circuit provides a ground return for fault detector relay K1. If the POWER switch on the BLADE DE-ICE control panel is OFF, or a main blade deice fail signal is generated by the controller, relay K1 is energized. The PWR MAIN RTR lamp on the BLADE DE-ICE TEST panel is turned on, warning that the main rotor blade heater power has not been turned off as required.

ICING RATE METER TEST

If there is no ice on the ice detector probe, pressing and releasing the PRESS TO TEST push button on the icing rate meter will cause the meter's needle to move to center scale (1.0) and then to drop to zero or below. The ICE

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

DETECTED caution capsule goes on. The probe heater and aspirator heater turn on at the same time. When the indicator needle goes below zero, the ICE DETECTED capsule, probe heater, and aspirator heater turn off.

MAIN AND TAIL BLADE MANUAL MODE OPERATION

The MANUAL mode of system operation provides the ability to maintain blade deice operation should either the ice detector or icing rate meter fail, **UH-60A UH-60L HH-60A HH-60L>** 28 vdc from the No. 2 dc primary bus DE-ICE CONTRLR circuit breaker, **<** or **UH-60A>** 28 vdc from the No. 1 dc primary bus DE-ICE CONTRLR circuit breaker, **<** supplies the blade deice controller power supply. The blade deice power supply powers the manual mode power supply, which produces three dc voltages for the three icing rate signals: T (trace) 2.0 vdc, L (light) 3.5 vdc, and M (moderate) 5.0 vdc. The dc voltages are supplied from the blade deice controller to the BLADE DE-ICE control panel. By turning the MODE select switch out of AUTO and to MANUAL, one of three discrete levels of off-time, T, L, or M, may be selected. The selected voltage is routed from the BLADE DE-ICE control panel to the main and tail deice integrators in the blade deice controller. In the MANUAL mode, the off-time (OT) is constant for any selected position and no updating occurs as in AUTO mode.

MAIN BLADE FAIL/FAULT DETECTION

During element-on-time periods (EOT), three-phase pulsed current is supplied to the main blade heating elements through the current transformers of T14/T14A. Each of the current transformer outputs are applied to the blade deice controller's current sensing circuits in the main blade fail/fault circuits. The three-phase voltages are also supplied to the controller which makes proportional adjustments to counteract the effect of power line voltage fluctuations. An increase of any single blade line current to between 58 and 64 amperes, a decrease to between 22 and 26 amperes, or a ground current of between 1 to 10 amperes, will cause the current sensing circuits in the controller to produce a fail signal, which causes the MR DE-ICE FAIL capsule on the caution panel to go on. The same fail signal is applied to the main blade power monitor, which removes 28 vdc from the main blade contactor driver, deenergizing MN RTR BLADE DE-ICE CNTOR K60, which removes 115 vac, three-phase power from the distributor. The fail signal applied to the main blade power monitor is also applied to the main blade control circuits to inhibit the element-on-timer. These malfunctions will cause an identical shutdown of the main blade deicing system: element-on-time failure, outside air temperature sensor failed open or shorted, synchronization pulse failure, or distributor advance failure. When a failure is detected, the controller's main blade deice channel is latched off by the action of the main rotor power monitor circuit. To attempt to restore system operation, the POWER switch on the BLADE DE-ICE control panel must be cycled to OFF and returned to ON. If the problem was transient, the system will return to operation. If the problem remains, the system will again be returned to the failed condition. If a single blade line is sensed to decrease to between.39 and.43 amperes, the blade deice controller fail/fault circuit produces a fault output, causing the MR DE-ICE FAULT capsule to go on. However, the blade deice system, though degraded, will continue to operate.

TAIL BLADE FAIL DETECTION

During element-on-time periods (EOT) three-phase pulsed current is supplied to the tail rotor blades through three current transformers in the blade deice controller. Each of the three current transformer outputs is applied to the blade deice controllers current sensing circuit in the tail blade fail detect circuits. The three-phase voltages are also supplied to the controller, which makes proportional adjustments to counteract the effect of power line voltage fluctuations. An increase of any single blade line current to between 15 and 18 amperes, a decrease of between 5 and 7 amperes, or a ground current between 1 and 10 amperes, will cause the current sensing circuit to the controller to produce a fail signal, which causes the TL DE-ICE FAIL capsule, on the caution panel, to go on. The same signal is applied to the tail rotor power monitor, which removes 28 vdc from the tail rotor contactor driver. This removes one enabling input from AND gate U4, thereby deenergizing the tail rotor contactor, which removes 115 vac, three-phase power from the tail rotor heating elements. The tail rotor power monitor disabling signal from the tail blade fail circuitry also inhibits the element-on-time timer in the tail blade deice control circuits. These malfunctions will cause an identical shutdown of the tail deicing system: element-on-time failure or outside air temperature sensor failure if a heating element is open or shorted. When a failure is detected, the controller's tail blade deice channel is latched off by the action of the tail rotor power monitor circuit. To attempt to restore system operation, the POWER switch on the BLADE DE-ICE control panel must be cycled to OFF and returned to ON. If the problem remains, the system will again be returned to the failed condition.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

BLADE DE-ICE TEST PANEL

The blade de-ice test panel applies simulated malfunctions to the blade deice system and produces failure indications if system shutdown occurs The test panel contains a lighted information plate, a five-position rotary switch, and two push-button indicator lamps. The blade de-ice test panel also consists of a printed wiring board, a circuit board, and electrical connectors P2/J2, which electrically interfaces the rotary switch and the indicator lamps with the printed wiring board. Electrical interface with the helicopter is accomplished through electrical connector J1.

BLADE DEICE TEST PANEL OPERATION

Internal circuits within the test panel are controlled by selecting specific modes on the five-position rotary switch. The five rotary switch positions are NORM-SYNC 1-SYNC 2-OAT-EOT. When the switch is at SYNC 1 or SYNC 2, the test panel interrupts the distributor sync pulse line and injects a false sync signal to the controller. The test panel sync circuitry provides the controller with a -30 vdc pulse when the switch is at SYNC 1, and provides an open circuit with the switch at SYNC 2. When at OAT, the switch short circuits the OAT sensor input to the controller. When the switch is placed to EOT, the EOT test circuit grounds relay K3, which electrically grounds the circuit to the controller. When at NORM, the test panel does not inject failure signals into the system (outputs), and allows normal operation.

BLADE DEICE TEST PANEL FAULT DETECTION

The main rotor power monitor circuit monitors the voltage from three main rotor blade current transformers. If a main rotor fault is detected and power remains applied to the main rotor circuitry, relay K1 is energized and the MAIN ROTOR POWER indicator lamp is turned on. The energized relay K1 also supplies 28 vdc output to the main rotor fail light system indicator. The tail rotor power monitor circuit monitors the three-phase ac voltage to the tail rotor heating elements. If a tail rotor fault is detected, and power remains applied to the tail rotor circuitry, a ground return is provided for relay K2 and the TAIL RTR PWR indicator lamp is turned on. The energized relay K2 also supplies 28 vdc output to the tail rotor light system indicator.

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

For location and description of major components, refer to the data in this work package.

EQUIPMENT DATA

If applicable, refer to WP 1695 00 and WP 1696 00 for equipment data information.

UTILITY SYSTEM

CARGO HOOK SYSTEM DESCRIPTION AND DATA

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

CARGO HOOK SYSTEM

NOTE

The external load limit of the airframe (UH-60A, 8000-pound-capacity or UH-60L, 9000-pound-capacity) will not be exceeded when using either cargo hook. UH60L 89-26179-92-26420 > helicopters may carry up to 9000 pounds only when cargo hook, P/N 70800-02503-113, 9000-pound-capacity, is installed, but will require a 100-hour inspection (WP 1750 00) after first use and every 100 hours thereafter. <

The cargo hook system consists of a P/N 70800-02503-111, 8000-pound-capacity or P/N 70800-02503-113, 9000-pound-capacity cargo hook and electrical circuits which control it. The hook is in the cargo hook well underneath the cabin floor. The electrical controls of the cargo hook system consist of the following: a CARGO HOOK ARMING switch labeled SAFE and ARMED; a CARGO HOOK CONTR switch labeled CKPT and ALL; CARGO HOOK EMERG REL. switch labeled NORM, OPEN and SHORT; a TEST light; CARGO REL. switches on the pilot's and copilot's cyclic stick; a switch labeled NORMAL RLSE on the crewman's pendant; an emergency hook release button on the pilot's and copilot's collective sticks; and an EMER RLSE button on the crewman's pendant.

The system incorporates three modes of load release:

A normal release powered from the No. 2 dc primary bus through the CARGO HOOK CONTR and PWR circuit breakers.

A manual release worked by the crewmember through a covered hatch in the cabin floor or by personnel on the ground.

An emergency release system (cockpit or cabin controlled) using an electrically activated explosive charge. When 28 vdc is supplied to the cartridge it explodes, driving a piston inside the hook into the load arm lock. The load beam will not support a load, and the CARGO HOOK OPEN light will stay on until the old explosive charge has been replaced. Power to operate the emergency release system is by the dc essential bus through the CARGO HOOK EMER circuit breaker.

The cargo hook can be placed in a stowed position by opening the cargo hook access cover in the cabin floor, and pulling the hook to the right and up. The cargo hook shall be maintained in the stow position while not in use. When the hook is in the stowed position, the load beam rests on a spring-loaded latch assembly and is prevented from vibrating by a Teflon bumper applying downward pressure on the load beam. To release the hook from its stowed position, downward pressure is placed on the latch assembly lever, retracting the latch from beneath the load beam, allowing the cargo hook to swing into the operating position.

CREWMAN'S PENDANT CONTROL

The crewman's cargo hook pendant consists of two normally open push-button switches marked NORMAL RLSE and EMER RLSE (Figure 1). The switches control the release of the cargo hook under normal and emergency conditions. Guards are mounted over each switch to prevent accidental cargo release. The pendant electrically interfaces with the helicopter system through a six-foot cable assembly. The pendant can be attached to the crewman by way of a strap assembly.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

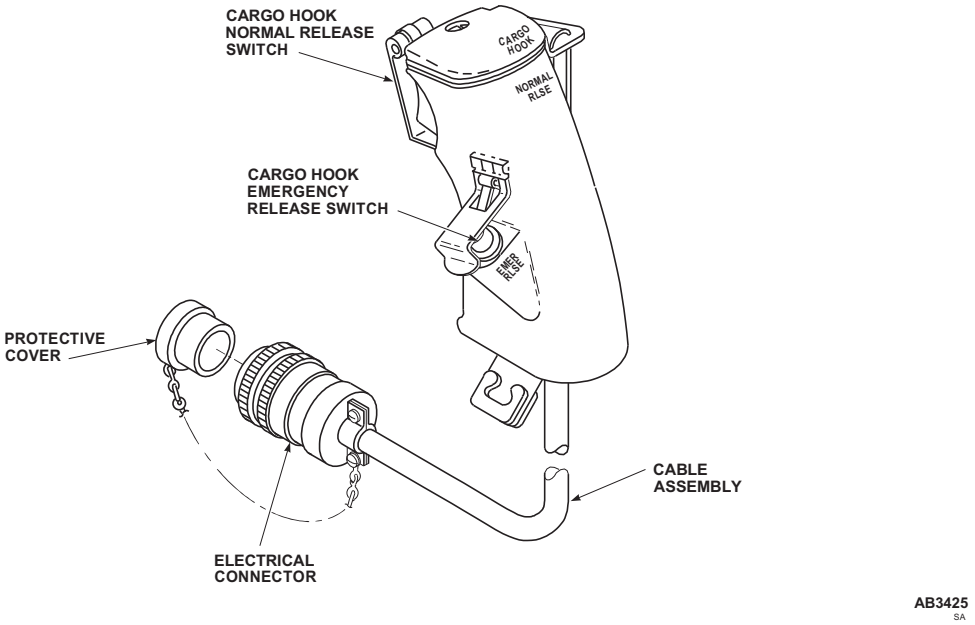


Figure 1. Crewman's Cargo Hook Pendant.

POWER DISTRIBUTION

The cargo hook system gets dc electrical power from the cabin overhead circuit breaker panel. Electrical power of 28 vdc is supplied by the No. 2 dc primary bus through the CARGO HOOK PWR circuit breaker to the cargo hook relay and through the CARGO HOOK CONTR circuit breaker to the CARGO HOOK CONTROL switch, CARGO HOOK ARMING switch, pilot's and copilot's CARGO REL. switches and to the LOAD BEAM OPEN switch.

NORMAL RELEASE

Placing the CARGO HOOK ARMING switch on the upper console to ARMED completes the circuit from the CARGO REL. switches on the pilot's and copilot's cyclic sticks to the hook. At the same time, the HOOK ARMED advisory light on the caution/advisory panel goes on. Pressing either CARGO REL. switch opens the cargo hook load arm and releases the load. At the same time the load arm starts to open, the CARGO HOOK OPEN advisory light goes on. When the load is released, the load arm will swing up and latch, and the CARGO HOOK OPEN advisory light will go off. If the CARGO HOOK CONTR switch is placed to ALL, the crewman's pendant can be used to release the load by pressing the NORMAL RLSE button.

MANUAL RELEASE

The cargo hook can be opened manually either through the cargo hook access panel in the cabin floor or from outside the helicopter. Pushing the manual release lever down, on the right side of the hook, opens the cargo hook and releases the load. If electrical power is on and the CARGO HOOK ARMING switch is at ARMED, the CARGO HOOK OPEN advisory light will go on and then off as the hook opens and closes.

EMERGENCY RELEASE

Cargo hook emergency release power is provided by the dc essential bus through the CARGO HOOK EMER circuit breaker. When the crewman's cargo hook pendant EMER RLSE button, or the pilot's or copilot's collective stick emergency hook release switch is pressed, dc power is supplied through R4 to the EMERG REL switch on the upper console. With the EMERG REL switch placed to NORM, dc power is routed to the pressure cartridge (squib). The cartridge explodes and the pressure from the explosion drives a piston into the lock, releasing the load arm.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

TEST FUNCTION

The testing function of the cargo hook emergency release system checks the associated circuitry for open and short conditions. When the EMERG REL switch, on the upper console, is placed to OPEN or SHORT, the EMERG REL TEST light goes on if there are no open or short circuits in the emergency release circuitry. Power is routed from the left relay panel to one side of the EMERG REL TEST light. The press-to-test light circuit is completed to ground when the EMERG REL TEST light is pressed. Placing the EMERG REL switch to OPEN, and pressing the emergency hook release switch on the pilot's or copilot's collective stick, or the EMER RLSE button on the crewman's cargo hook pendant, causes the EMERG REL TEST light to go on if no open conditions exist in the emergency release circuitry. Placing the EMERG REL switch to SHORT and pressing the pilot's, copilot's, or crewman's emergency release button, causes the EMERG REL TEST light to go on if there are no short circuits in the emergency release test circuitry. The weight of the load causes the hook to open, and the CARGO HOOK OPEN advisory light to go on. The CARGO HOOK OPEN light will remain on until the explosive charge has been replaced.

CARGO HOOK LIGHTS

Lighting of the cargo hook well area is provided by three lights. For a description of the cargo hook lights refer to WP 0036 00.

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

For location and description of major components, refer to the data in this work package.

EQUIPMENT DATA

If applicable, refer to WP 1690 00 for equipment data information.

ENVIRONMENTAL CONTROL SYSTEMS

HEATING AND VENTILATION SYSTEM DESCRIPTION AND DATA

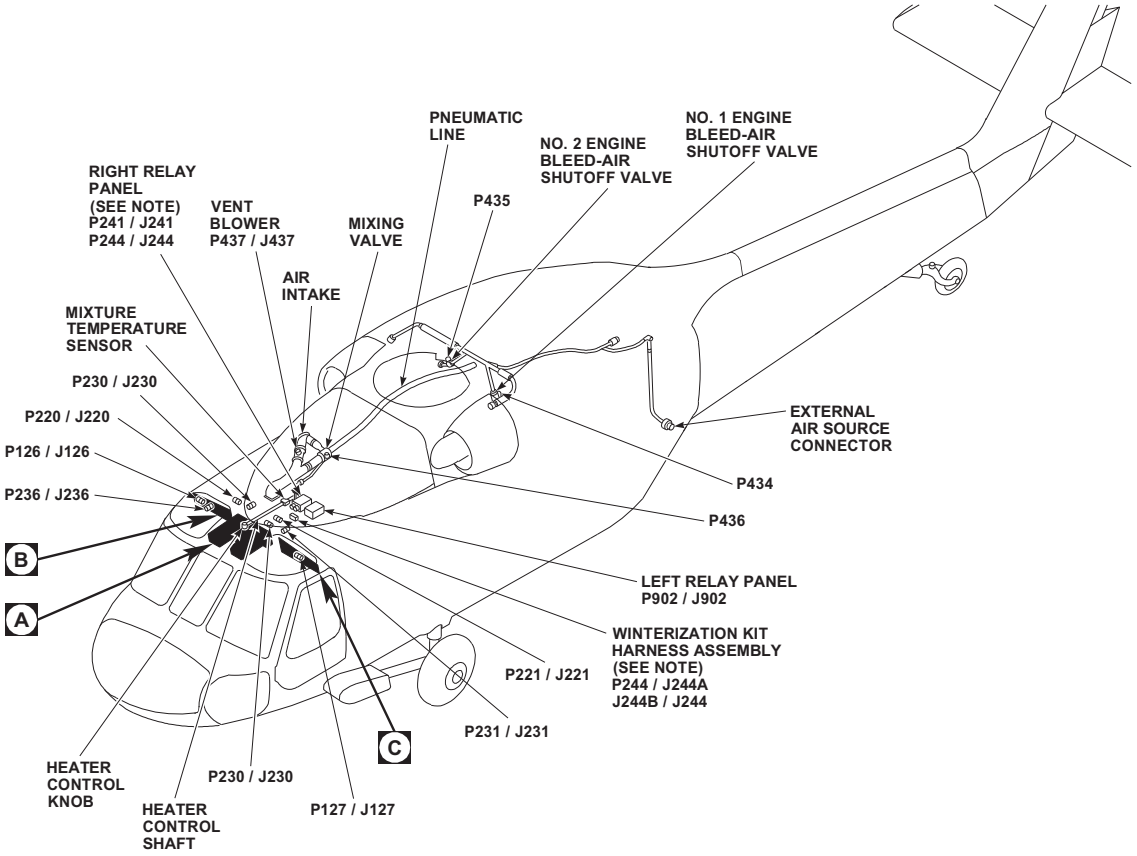
EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

DESCRIPTION

The heating and ventilation system consists of heating system with a winterized subsystem, a ventilation system, heat and ventilation control. See Figure 1. (Sheet 1 of 3) and Figure 1. (Sheet 2 of 3). and Figure 2. (Sheet 1 of 4) through Figure 2. (Sheet 4 of 4). for system component location and block diagrams.

The heating system is a bleed-air system with bleed-air supplied by the main engines under flight conditions or the APU during ground operations. The heater system uses a bleed-air mixing valve to mix engine or APU bleed-air and ambient air at a cockpit selected mixture temperature. Heated air is distributed to the cockpit and cabin through a system of ducts. A mixture temperature sensor works along with the bleed-air mixture valve, regulating the bleed-air flow to match the mixture temperature selected at the cockpit heating control. On helicopters with mixing valve, 70309-02101-103, the heating system gives a temperature of 40°F when the outside ambient temperature is -25°F. On helicopters with mixing valve, 70309-02113-101, the heating system gives a temperature of 40°F when the outside ambient temperature is -65°F. The ventilation system provides ventilated air to the cockpit and cabin. Air obtained from outside the helicopter by an air intake duct is then distributed by the blower unit through the heating system ducts.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED



TERMINAL BOARD / DISCONNECT PLUG / RECEPTACLE	LOCATION / CONNECTION POINT
J437	VENTILATION BLOWER VALVE
P126 / J126	COCKPIT CEILING, BL 28 RH, STA 243
P127 / J127	COCKPIT CEILING, BL 28 LH, STA 243
P220 / J220	JUNCTION BOX, MAIN ROTOR PYLON DECK
P221 / J221	JUNCTION BOX, MAIN ROTOR PYLON DECK
P222 / J222	JUNCTION BOX, MAIN ROTOR PYLON DECK
P230 / J230	CABIN CEILING, BL 4 RH, STA 247
P231 / J231	CABIN CEILING, BL 9 LH, STA 247
P236 / J236	BEHIND PILOT'S CIRCUIT BREAKER PANEL, BL 23 RH

NOTE

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Figure 1. Heating and Ventilation System Location Diagram (Sheet 1 of 3).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

TERMINAL BOARD/ DISCONNECT PLUG/ RECEPTACLE	LOCATION/ CONNECTION POINT
P241 / J241	RIGHT RELAY PANEL ASSEMBLY
P244 / J244	RIGHT RELAY PANEL ASSEMBLY (SEE NOTE)
P244 / J244A J244B / J244	WINTERIZATION KIT HARNESS ASSEMBLY (SEE NOTE)
P434	NO. 1 ENGINE BLEED-AIR SHUTOFF VALVE
P435	NO. 2 ENGINE BLEED-AIR SHUTOFF VALVE
P436	MIXING VALVE
P437 / J437	VENTILATION BLOWER
P902 / J902	LEFT RELAY PANEL ASSEMBLY

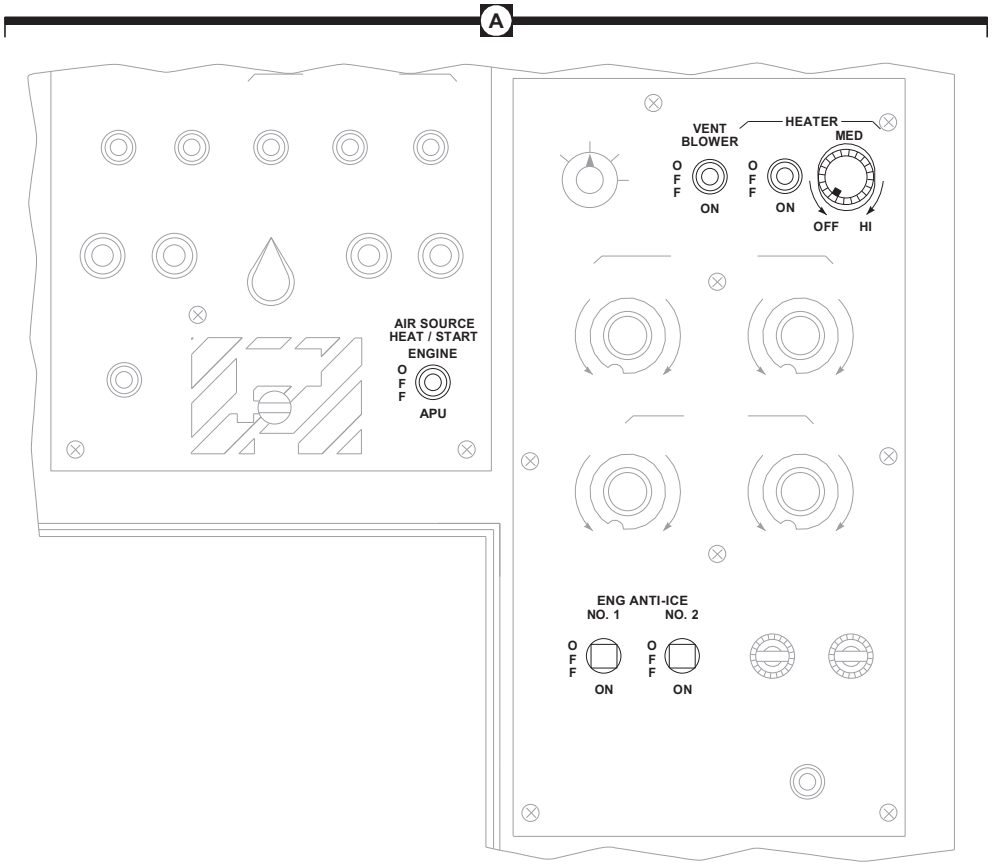
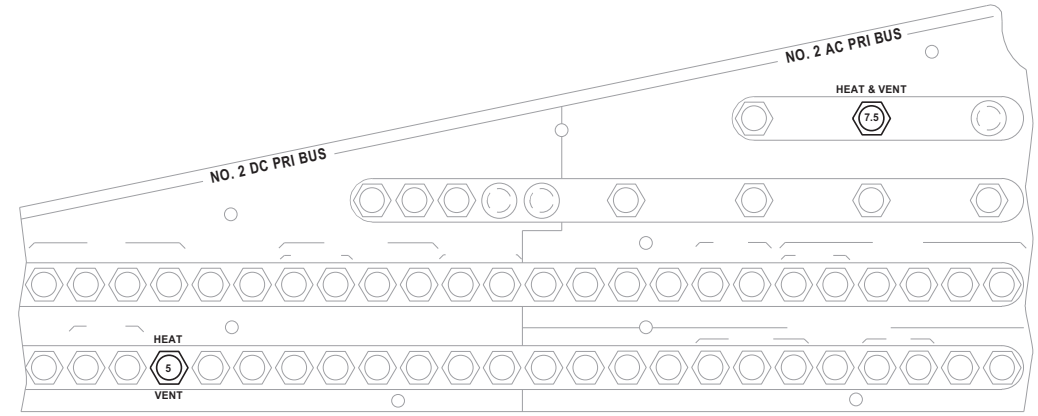


Figure 1. Heating and Ventilation System Location Diagram (Sheet 2 of 3).

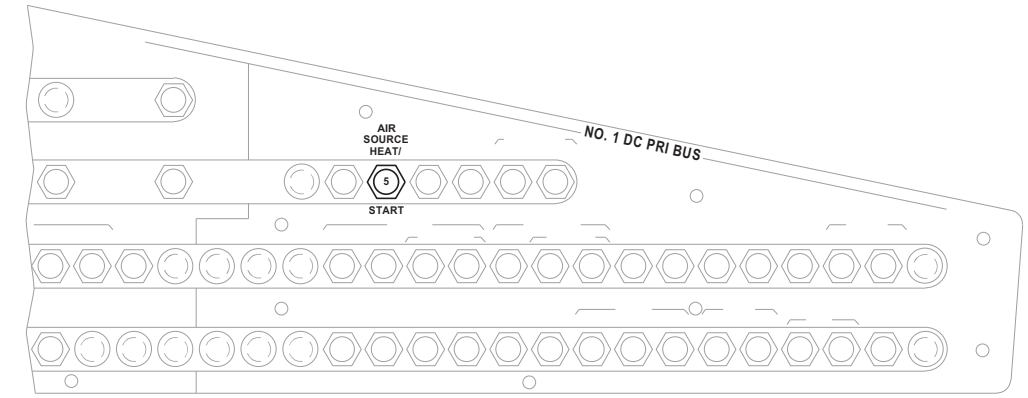
EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED



PILOT'S CIRCUIT BREAKER PANEL

B

C



COPILOT'S CIRCUIT BREAKER PANEL

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Figure 1. Heating and Ventilation System Location Diagram (Sheet 3 of 3).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

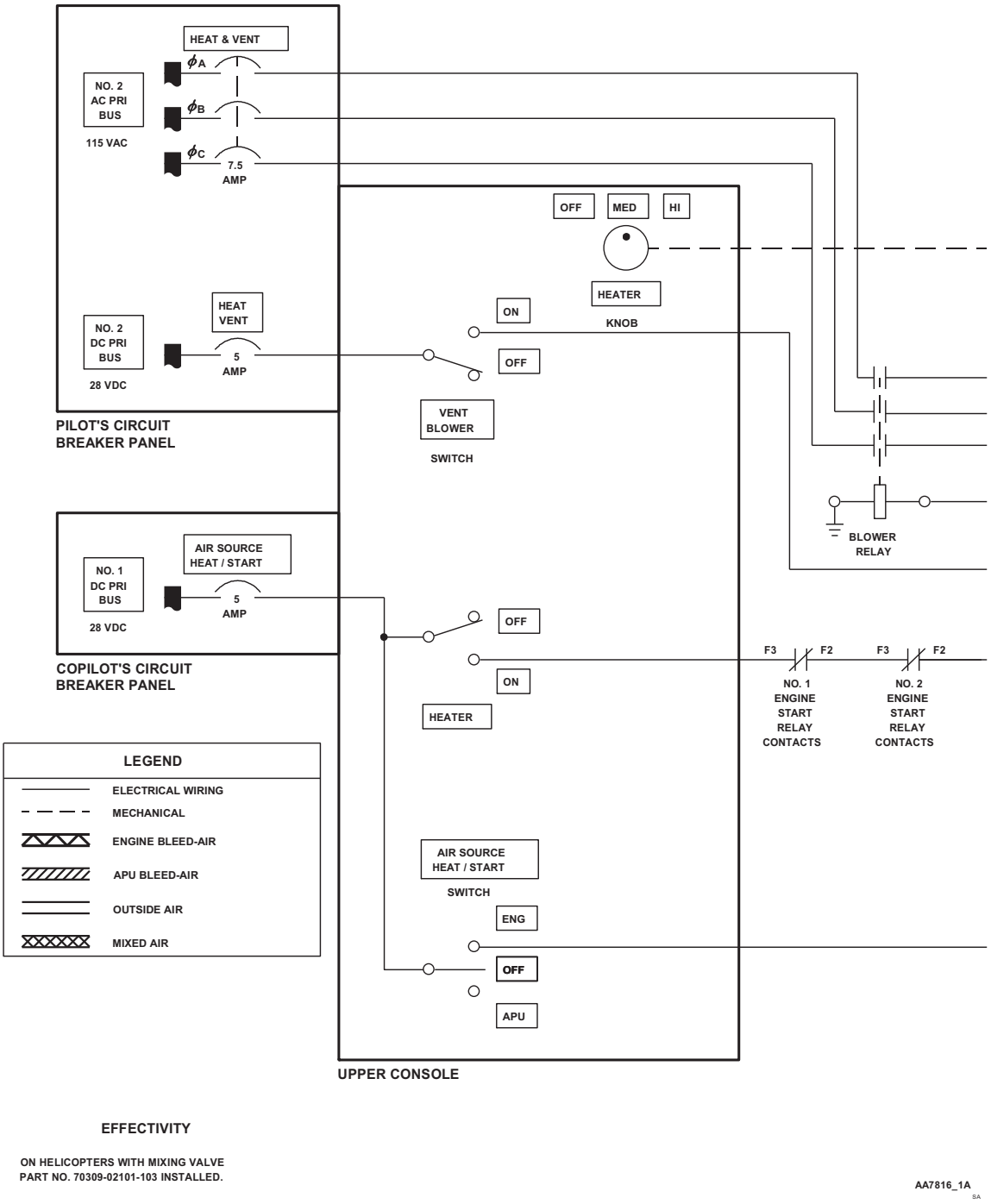


Figure 2. Heating and Ventilation System Block Diagram (Sheet 1 of 4).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

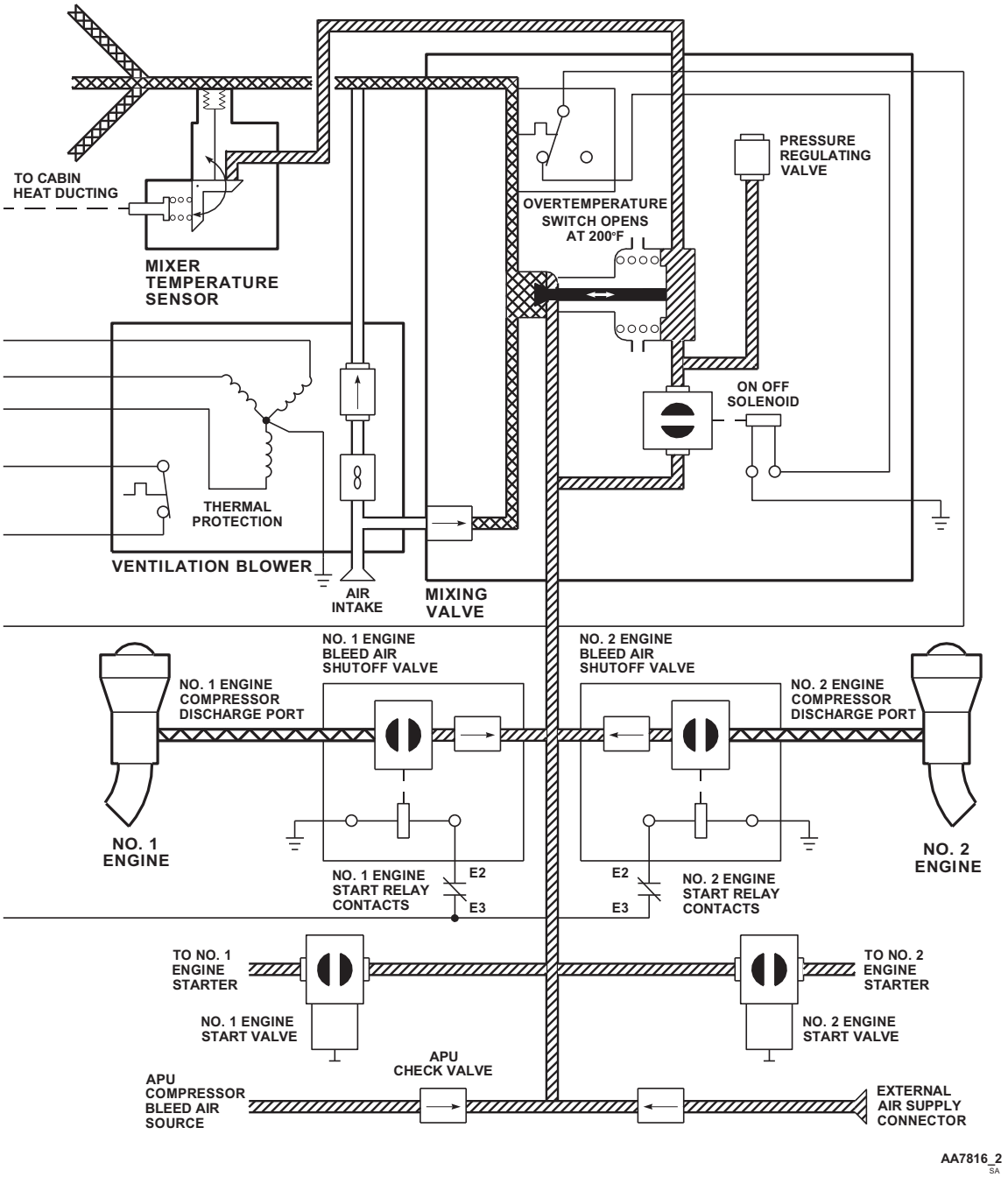
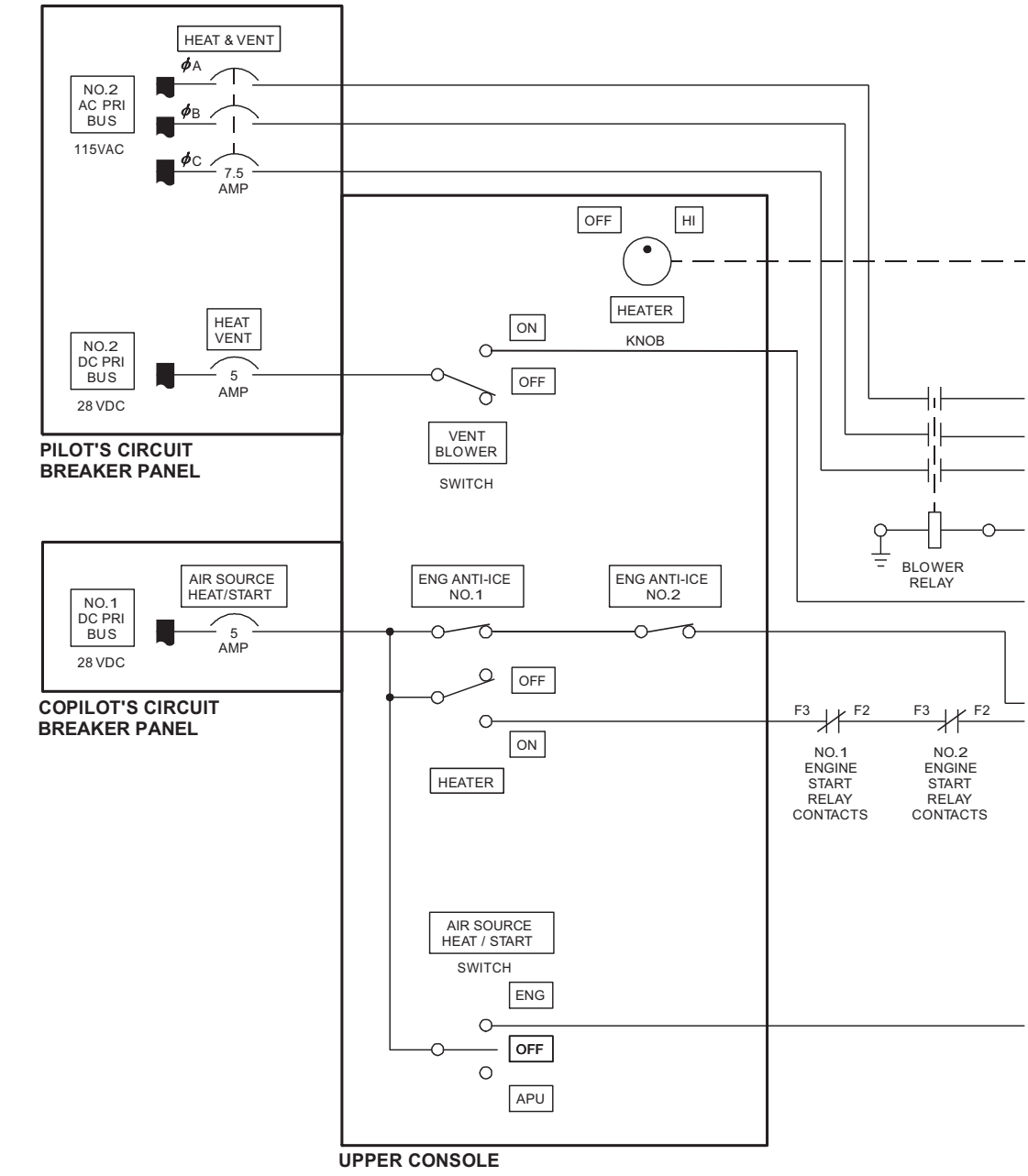


Figure 2. Heating and Ventilation System Block Diagram (Sheet 2 of 4).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED



EFFECTIVITY

ON HELICOPTERS WITH MIXING VALVE PART NO. 70309-02113-101 INSTALLED.

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Figure 2. Heating and Ventilation System Block Diagram (Sheet 3 of 4).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

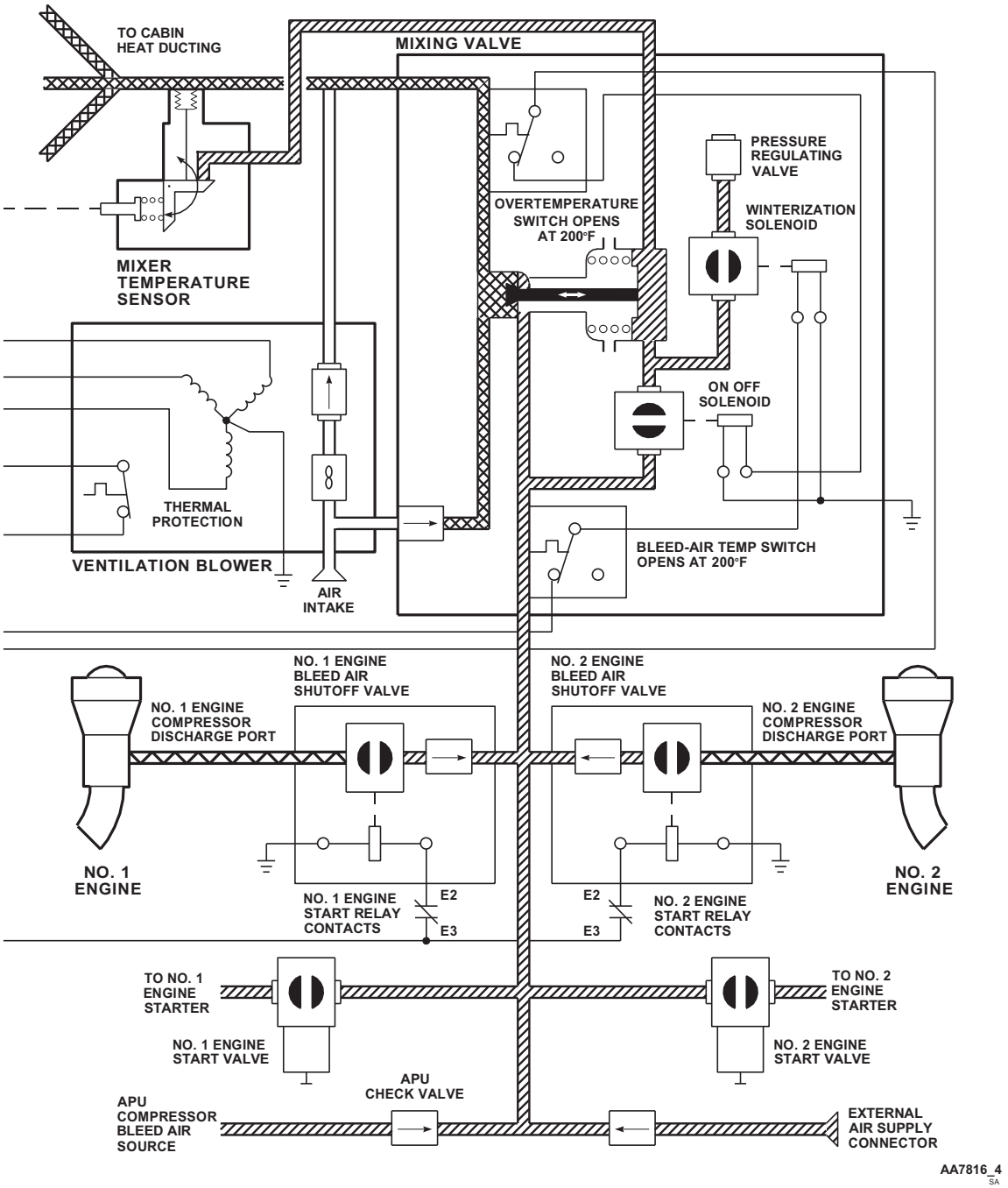


Figure 2. Heating and Ventilation System Block Diagram (Sheet 4 of 4).

POWER DISTRIBUTION

The ventilation system gets ac and dc electrical power from the pilot's circuit breaker panel. Electrical power of 28 vdc is supplied by the No. 2 dc primary bus and routed through the HEAT VENT circuit breakers, to the VENT BLOWER switch. Electrical power of 115 vac is supplied by the No. 2 ac primary bus and routed through the HEAT & VENT circuit breaker to open contacts of the BLOWER relay (K-25). The heating system gets dc electrical power from the copilot's circuit breaker panel. Electrical power of 28 vdc is supplied by the No. 1 dc pri-

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

mary bus and routed through the AIR SOURCE HEAT START circuit breaker to the AIR SOURCE HEAT/START switch, HEATER switch and to the winterization solenoid.

VENTILATION SYSTEM

Placing the VENT BLOWER switch on the upper console ON completes the electrical circuit to the blower and motor. The blower pulls in outside air through the external air intake and circulates it through the cabin heat ducting.

HEATING SYSTEM (APU OPERATION)

Placing the HEATER switch ON opens the mixing valve, and bleed-air circulates through the cabin heat ducting. The HEATER knob on the upper console controls the temperature of the heated bleed-air entering the cabin. Turning the knob from OFF to MED or HI regulates the temperature of the air entering the cabin by allowing more bleed-air to pass through the mixing valve into the cabin heat ducting.

HEATING SYSTEM (ENGINES OPERATING)

Placing the AIR SOURCE HEAT/START switch on the upper console to ENG opens the No. 1 and No. 2 engine bleed-air shutoff valves, and engine bleed-air goes to the mixing valve. Placing the HEAT switch ON opens the mixing valve, and bleed-air circulates through the cabin heat ducting. The HEATER knob on the upper console controls the temperature of the heated air entering the cabin. Turning the knob from OFF to MED or HI regulates the temperature of heated air entering the cabin by allowing more bleed-air to pass through the mixing valve into the cabin heat ducting.

WINTERIZATION MODE

Mixing valve, 70309-02113-101, has a mode that gives additional bleed-air for maximum heating capacity. When the ENG ANTI-ICE No. 1 or No. 2 switch is ON or the bleed-air temperature entering the mixing valve is above 200°F, the winterization mode of the valve is shut off, and the valve operates in the normal mode.

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

For location and description of major components, refer to the data in this work package.

EQUIPMENT DATA

For equipment data information, refer to this work package.

ELECTRICAL SYSTEMS

ENVIRONMENTAL CONTROL SYSTEM (ECS) DESCRIPTION AND DATA EH60A>

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

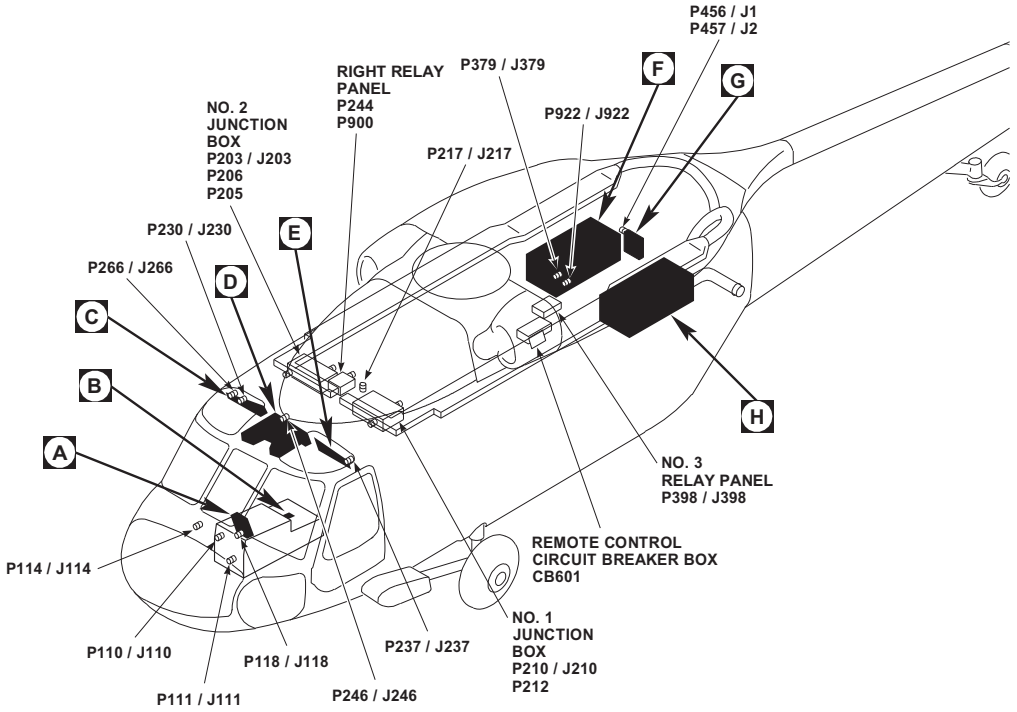
DESCRIPTION

The environmental control system (ECS) consists of a heater/demister and a vapor cycle air conditioner that provides heating, cooling, ambient air circulation, and humidity control in the helicopter's cockpit and cabin in addition to the standard heating/ventilating system. Table 1 lists the ECS components and their locations. The system is controlled from the ECS control panel on the upper console. The ECS functionally interfaces with the caution/advisory warning system and the ac electrical system through the electrical control unit (ECU). Panel lighting for the air conditioning controls is provided by the upper console lights. See Figure 1. (Sheet 1 of 6) through Figure 1. (Sheet 6 of 6), and Figure 2

Table 1. Environmental Control System Component Locations.

COMPONENT	LOCATION
Compressor/Motor	Evaporator Pallet
Condenser	Condenser Pallet
Condenser Fan	Condenser Pallet
Filter/Drier	Evaporator Pallet
Expansion Valve	Evaporator Pallet
Evaporator	Evaporator Pallet
Evaporator Fan	Evaporator Pallet
High Temperature Switch	Heater/Demister
Low Temperature Switch	Heater/Demister
Air Conditioning Ducts	Overhead On Left And Right Sides Of Cabin
Hot Gas Bypass Valve	Evaporator Pallet
Heater/Demister	Evaporator Pallet
Return Air Temperature Sensor	Return Air Plenum
ECU (Electrical Control Unit)	Electrical Pallet
Air Conditioning Control Panel	Upper Console
Sight Glass	Electrical Pallet
Service Valves	Electrical Pallet
High Pressure Switch	Electrical Pallet
Low Pressure Switch	Electrical Pallet
Ambient Air Valve	Evaporator Pallet
Thermistor Sensor	Evaporator Low Pressure Line

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED



TERMINAL BOARD/ DISCONNECT PLUG/ RECEPTACLE	LOCATION/ CONNECTION POINT
P3 / J3	ELECTRICAL CONTROL UNIT
P4 / J4	ELECTRICAL CONTROL UNIT
P5 / J5	ELECTRICAL CONTROL UNIT
P6 / J6	ELECTRICAL CONTROL UNIT
P7 / J7	ELECTRICAL CONTROL UNIT
P8 / J8	COMPRESSOR / MOTOR
P9 / J9	EVAPORATOR FAN
P10 / J10	CONDENSER FAN
P11 / J11	HIGH PRESSURE SWITCH
P12 / J12	LOW PRESSURE SWITCH
P110 / J110	COCKPIT, BL 7.5 RH, STA 197
P111 / J111	COCKPIT, LB 7.5 LH, STA 197
P114 / J114	COCKPIT, BL 8, STA 200
P118 / J118	CAUTION / ADVISORY PANEL
P203 / J203	NO. 2 MAIN ELECTRICAL JUNCTION BOX
P205	NO. 2 JUNCTION BOX

TERMINAL BOARD/ DISCONNECT PLUG/ RECEPTACLE	LOCATION/ CONNECTION POINT
P206	NO. 2 JUNCTION BOX
P210 / J210	NO. 1 JUNCTION BOX
P212	NO. 1 JUNCTION BOX
P217 / J217	CABIN CEILING, BL 0, STA 284
P230 / J230	MAIN ROTOR PYLON DECK, BL 8 RH, STA 247
P237 / J237	COPILOT'S CIRCUIT BREAKER PANEL
P244	RIGHT RELAY PANEL
P246 / J246	CABIN CEILING, BL 5 RH, STA 247
P266 / J266	BEHIND PILOT'S CIRCUIT BREAKER PANEL, BL 25 RH
P379 / J379	CABIN CEILING, STA 379, WL 269, BL 5
P398 / J398	NO. 3 RELAY PANEL
P456 / J1	ELECTRICAL CONTROL UNIT
P457 / J2	ELECTRICAL CONTROL UNIT
P900	RIGHT RELAY PANEL
P922 / J922	CABIN CEILING, BL 10.7 LH, STA 380

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Figure 1. Environmental Control System Location Diagram (Sheet 1 of 6).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

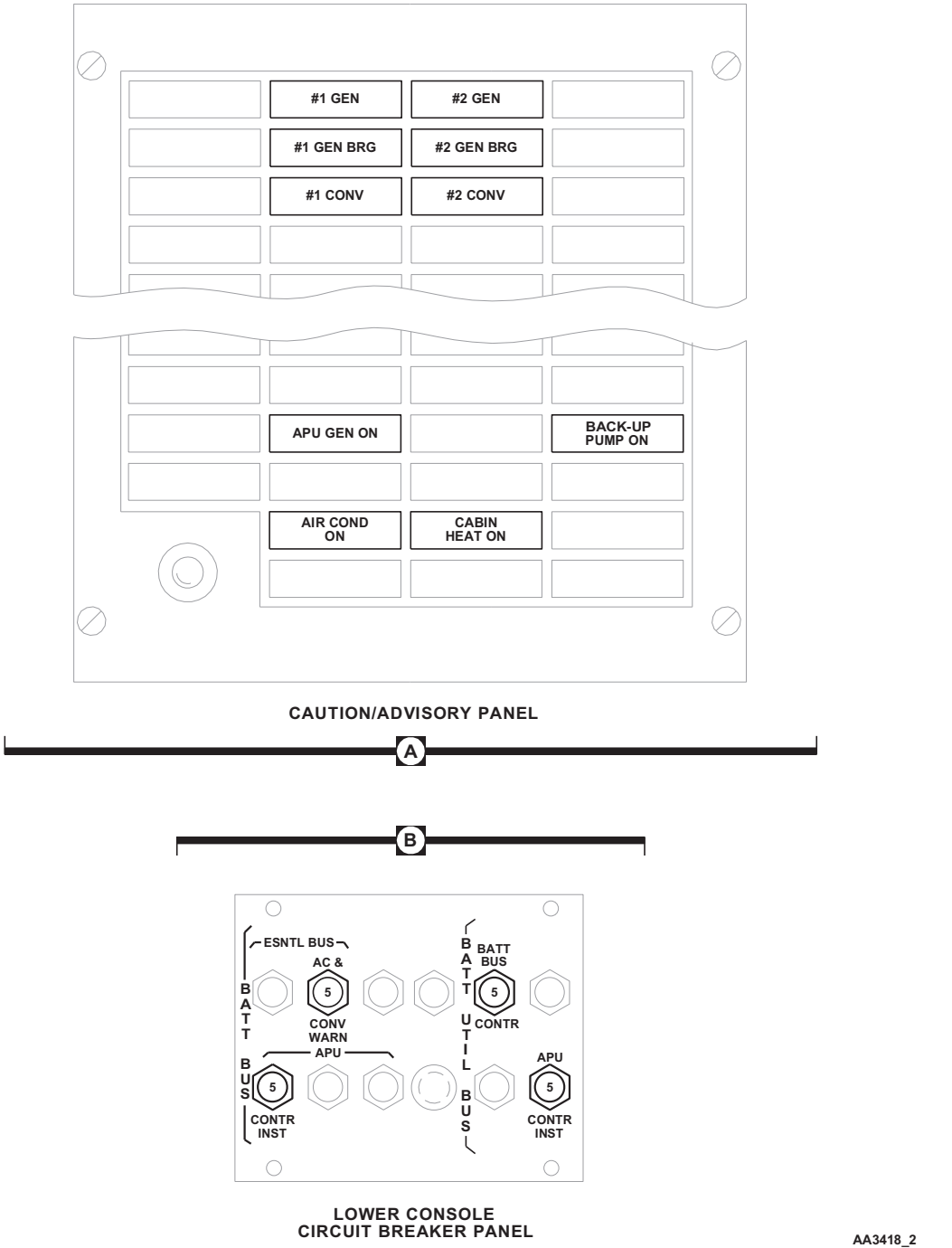


Figure 1. Environmental Control System Location Diagram (Sheet 2 of 6).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

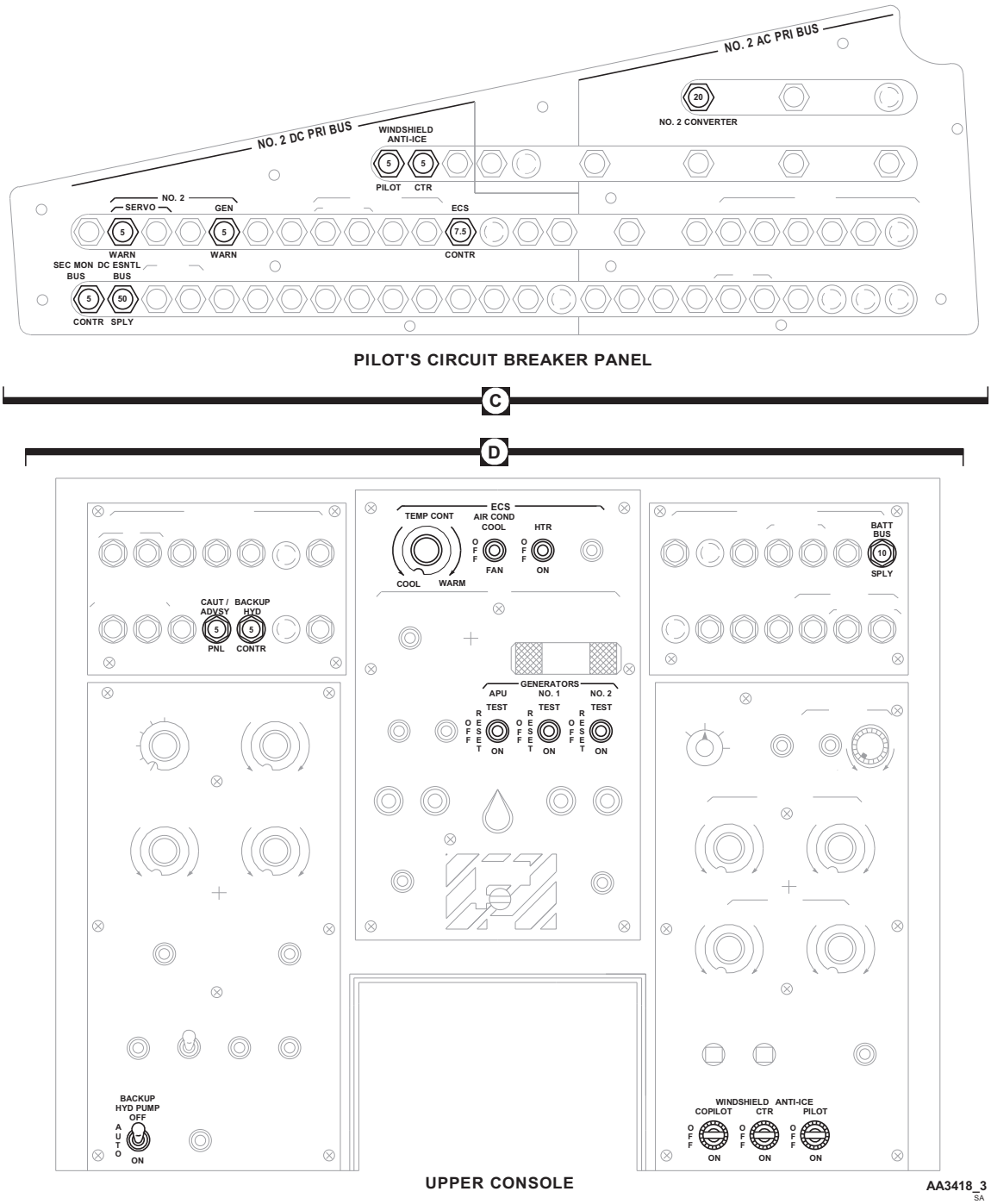


Figure 1. Environmental Control System Location Diagram (Sheet 3 of 6).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

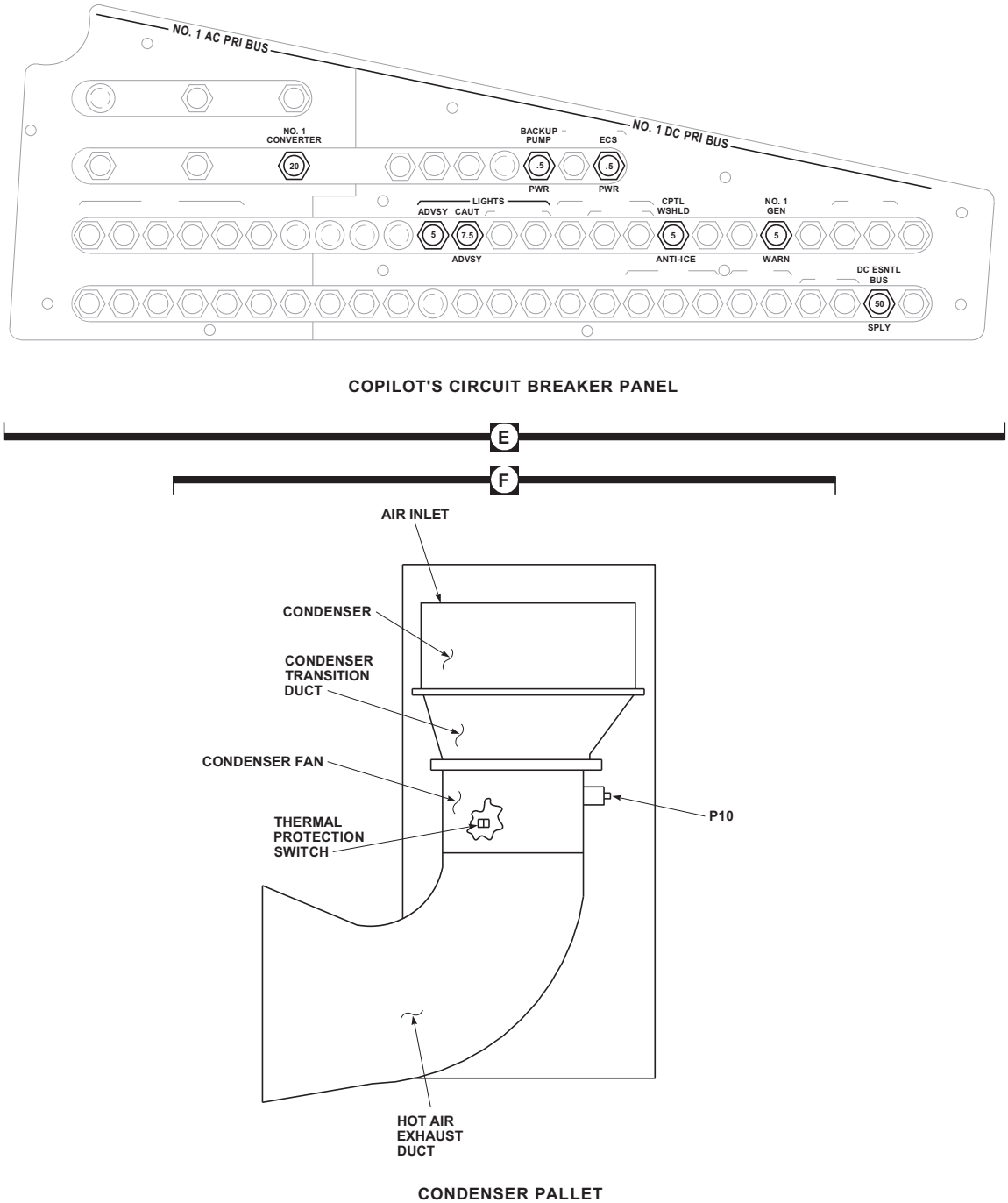
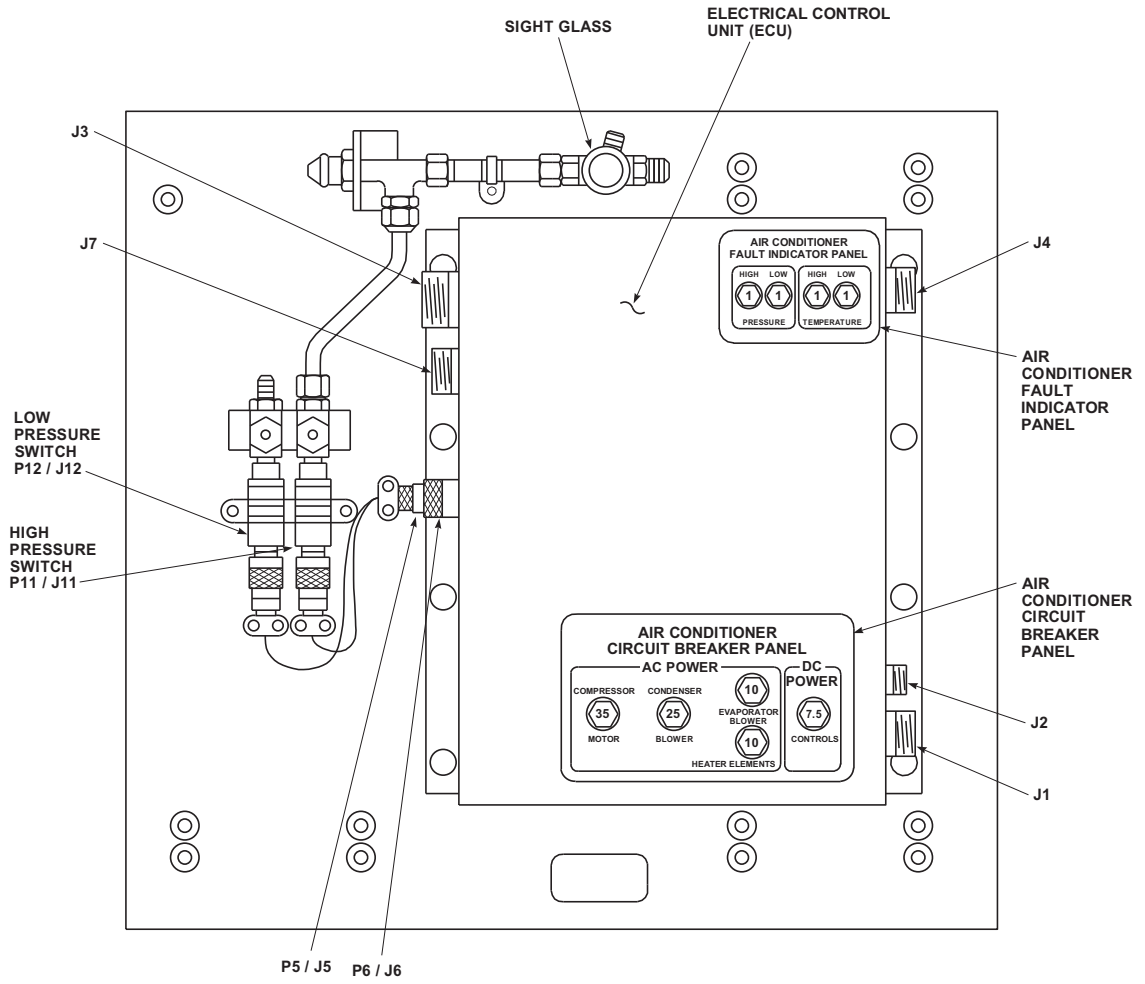


Figure 1. Environmental Control System Location Diagram (Sheet 4 of 6).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

G



ELECTRICAL PALLET

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Figure 1. Environmental Control System Location Diagram (Sheet 5 of 6).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

H

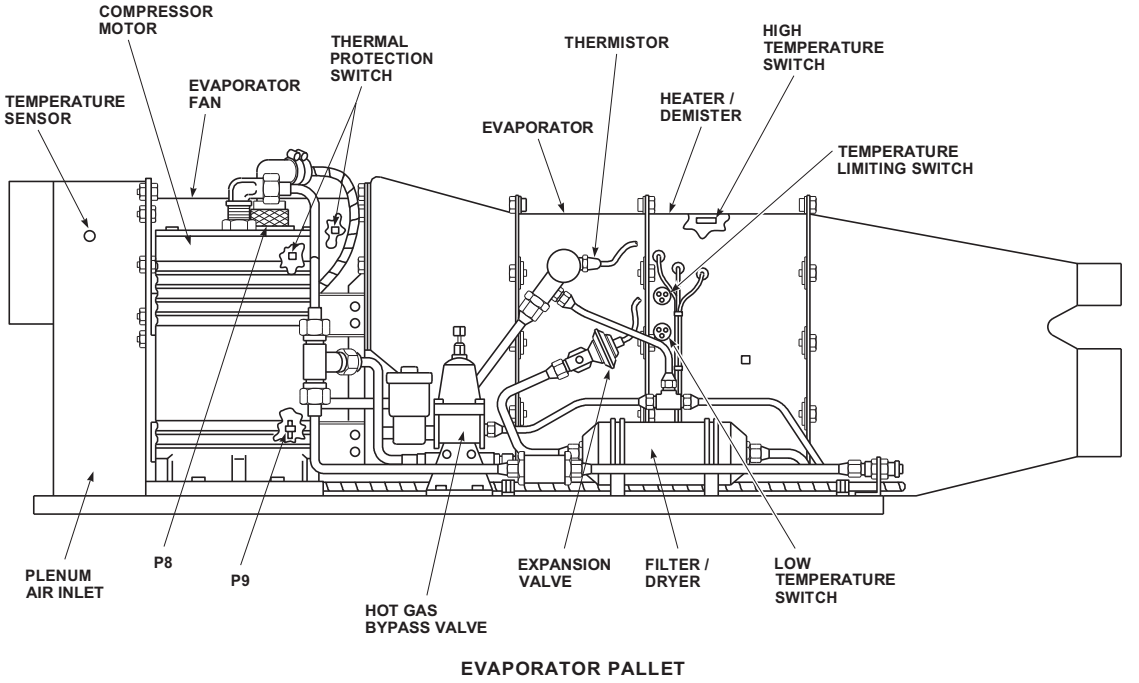


Figure 1. Environmental Control System Location Diagram (Sheet 6 of 6).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

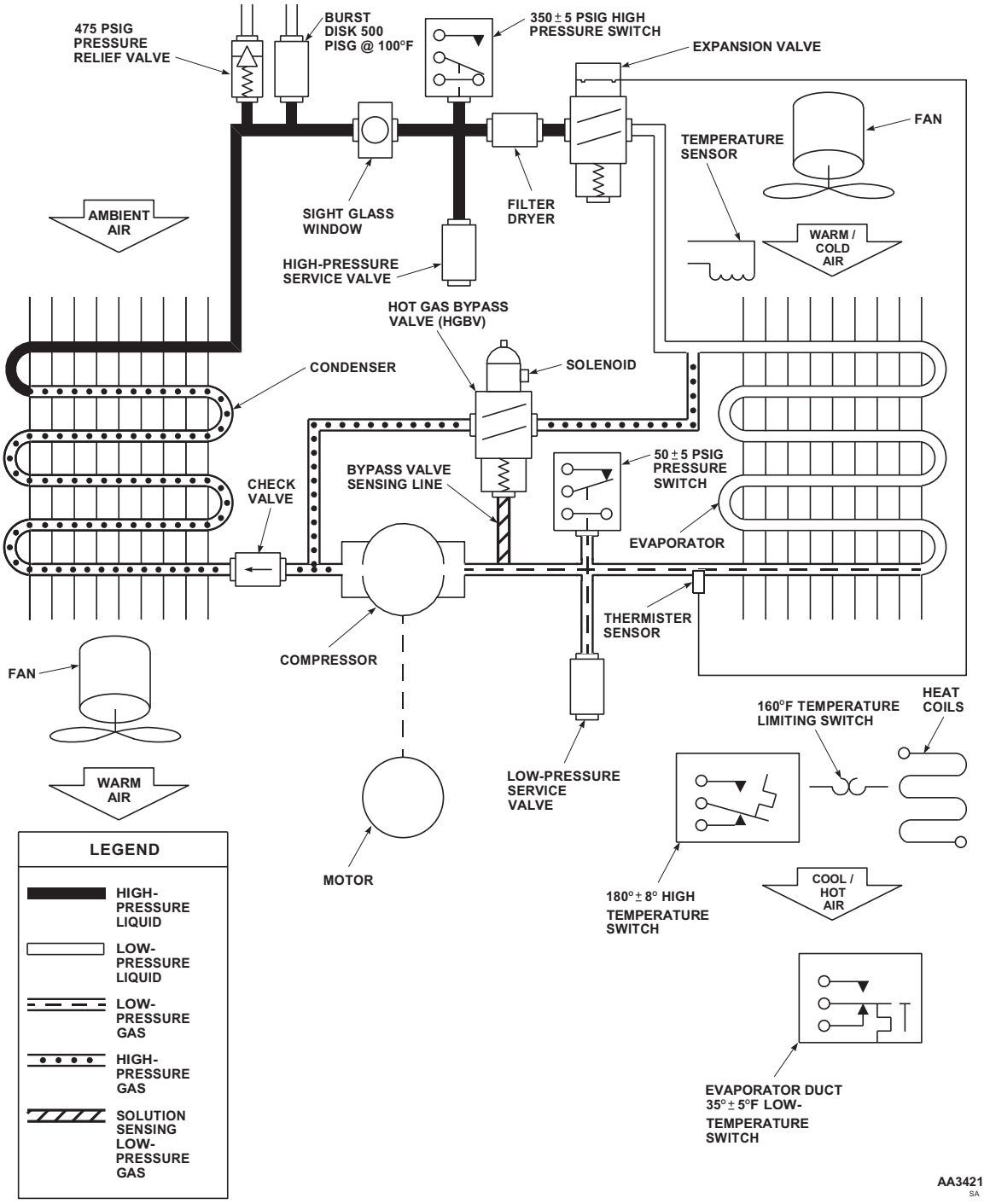


Figure 2. Environmental Control System Refrigerant Flow Diagram.

Evaporator Pallet

The evaporator pallet is horizontally-mounted on the left side of the helicopter, rear of the cabin bulkhead. Its major components are the compressor/motor, evaporator, inlet transition duct, evaporator blower, heater/demister

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

housing, discharge transition duct, expansion valve, filter/dryer, and hot gas bypass valve. The evaporator and heater/demister housing are insulated with neoprene foam insulation.

The expansion valve controls the rate of refrigerant evaporation; it allows only enough refrigerant to flow into the evaporator to keep the evaporator operating efficiently, depending on its heat load. Refrigerant enters the expansion valve in a liquid state and passes through a small orifice. It emerges as a vapor at a lower pressure. As a vapor and under low pressure, the refrigerant then enters the evaporator and begins to evaporate. The evaporator is a crossflow plate-fin type aluminum heat exchanger that absorbs heat by boiling off liquid refrigerant flowing through it. The blower draws hot cabin air through the evaporator. The heat in this air is absorbed by the evaporating refrigerant. The resultant cool air is then recirculated through the aircraft air distribution system back into the cabin. At this point, the refrigerant is a low pressure gas and is drawn back to the compressor through the suction line.

Compressor/Motor

The compressor/motor is a single, hermetically sealed unit. An eight horsepower motor is mounted vertically over a rotary pump to compress and circulate the R-500 refrigerant throughout the system. The compressor's function is to draw the low pressure refrigerant gas (suction) from the evaporator and compress it to a high pressure gas for routing to the condenser (discharge). An electrical connector for the electrical power supply, discharge port, suction port, and oil level sight glass are mounted in the compressor/motor housing.

Inlet Transition Duct

The fiberglass evaporator inlet transition duct connects the evaporator with the evaporator blower. The duct includes guide vanes to ensure an even air flow through the evaporator.

Evaporator Fan

The evaporator fan is a six-inch vane, axial-type fan that draws return air from the cabin interior and circulates it through the evaporator.

Heater/Demister Housing

The heater/demister housing is mounted between the evaporator and the evaporator outlet transition duct. It is a steel housing insulated with neoprene foam. It contains three heating elements, a heater high temperature switch, an air conditioner low temperature switch, a heater temperature limiting switch, and an aluminum mesh demister pad for water elimination.

Outlet Transition Duct

Conditioned air is ducted to the aircraft air distribution system through the evaporator outlet transition duct. This duct is constructed of fiberglass and insulated with neoprene foam.

Filter/Dryer

The filter/dryer is mounted in the high pressure (liquid) refrigerant line just before the expansion valve on the evaporator pallet. Through its molded porous core, both contaminants and moisture are filtered from the refrigerant. Moisture in the air conditioning system interferes with the proper operation of the expansion valve and reacts with the refrigerant to form corrosive hydro-fluoric acid.

Hot Gas Bypass Valve

The hot gas bypass valve regulates the evaporator pressure, hence temperature, to provide evaporator outlet air temperature adjustment. The cooling system is designed to produce not lower than 42°F conditioned air. The valve will discharge hot refrigerant gas directly into the evaporator to increase its pressure and, therefore, temperature. The valve receives refrigerant from the compressor discharge line to discharge it directly into the evaporator. The valve receives sensing input from a duct temperature sensor mounted in the helicopter return air plenum, and control voltage from the TEMP CONT rheostat through the temperature controller in the ECU.

Condenser Pallet

The condenser pallet is horizontally-mounted on the right side of the helicopter aft of the cabin bulkhead. Its major components are the heat exchanger, condenser fan, transition duct, pressure relief valve, thermal protection

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

switch, and burst disc. The condenser unit extracts the heat absorbed by the refrigerant in the evaporator, exhausts it overboard, and changes the refrigerant to a liquid state for routing back to the expansion valve. The refrigerant enters the condenser from the compressor as a compressed gas under high pressure. Ambient air is blown over the condenser by the fan. Because the refrigerant is at a higher temperature than the ambient air, the heat is transferred from the refrigerant to the air. The condenser is constructed similarly to the evaporator. The condenser is a crossflow, plate-fin type heat exchanger that uses air from the fan to extract heat from the refrigerant gas, allowing it to condense into a manifold that connects to a sub-cooler, across the condenser lower face, then out the discharge port.

Condenser Transition Duct

A fiberglass transition duct separates the condenser and blower. It is bolted to flanges on both components and supported by aluminum brackets.

Pressure Relief Valve

A pressure relief valve protects the air conditioning system from over pressure. If system pressure reaches 475 psig, the relief valve will open, discharge refrigerant directly into the condenser transition duct and exhausting it overboard. As pressure decreases below 475 psig, the pressure relief valve will automatically reseal and air conditioner operation will resume. The valve is mounted to the high pressure (liquid) discharge refrigerant line.

Burst Disc

A burst disc is included in the system to provide redundancy in high pressure protection. Mounted "in-line" with the pressure relief valve, the disc will burst at 500 psig. This would occur under a high pressure condition when both the high pressure switch and pressure relief valve failed. The burst disc must be replaced after rupture before resuming air conditioner operation.

Electrical Pallet

The electrical pallet is vertically mounted aft of the condenser and evaporator pallet assemblies in the helicopter aft transition avionics compartment. The major components are: ECU, air conditioner circuit breaker panel, air conditioner fault indicator panel, high pressure switch, low pressure switch, refrigerant liquid indicator (sight glass), and high/low pressure service valves.

Electrical Control Unit (ECU)

The ECU is a sealed unit containing practically all of the electrical components necessary for operation. Contents include the temperature controller, relays, circuit breakers, and compressor/motor capacitor.

Circuit Breaker Panel

The circuit breaker panel is mounted on the ECU cover. The panel includes four ac circuit breakers and one dc circuit breaker. A description is as follows:

- COMPRESSOR MOTOR, 35 amps ac.
- CONDENSER BLOWER, 25 amps ac.
- EVAPORATOR BLOWER, 10 amps ac.
- HEATER ELEMENTS, 10 amps ac.
- DC POWER CONTROLS, 7.5 amps dc.

Fault Indicator Panel

A fault indicator panel, containing four one-amp circuit breakers, is mounted on the ECU cover to indicate extremes in either pressure or temperature during ECS operation. The circuit breakers are labeled HIGH PRESSURE, LOW PRESSURE, HIGH TEMPERATURE, and LOW TEMPERATURE. High pressure, low pressure, high temperature, or low temperature conditions will cause the affected circuit breaker to pop. The affected breaker should be reset before flight.

Service Valves

The air conditioner contains two service ports for system maintenance; one in the high pressure line and one in the low pressure line. The service valve in the high pressure line (from compressor to condenser) allows access

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

to the high pressure side of the system for attaching a service hose and pressure gauge. The service valve in the low pressure line (from evaporator to compressor) allows access to the low pressure side of the system. Access to both pressure lines is required for monitoring the system during maintenance operations and for servicing the system.

High And Low Pressure Switches

The high and low pressure switches protect the air conditioning system from abnormally high and low pressures. Both switches are located in the servicing manifold and exposed to either the high or low side pressures. The high pressure switch will disengage the compressor/motor if system high side pressure reaches between 345 to 355 psi. The compressor/motor will reengage as pressure decreases to between 270 to 280 psi. The low pressure switch will disengage the compressor/motor at between 7 to 53 psi. At between 17 to 23 psi, the compressor/motor will reengage.

POWER DISTRIBUTION

Ac power is supplied by the No. 1 generator contactor K1 in the No. 1 junction box and routed through the No. 2 junction box to the ECU PWR circuit breaker in the remote control circuit breaker box. The ECU PWR circuit breaker is controlled remotely by the ECS PWR circuit breaker on the copilot's circuit breaker panel. From the ECU PWR circuit breaker, ac power is routed to connector J1 on the ECS electrical control unit. In the ECU, the 115 vac three-phase power arms the normally-open contacts of four relays (K1, K2, K3, and K4), each protected by its own circuit breakers for ac operation of the ECS compressor, condenser, evaporator, and heater/demister. These circuit breakers are identified on the ECU AIR CONDITIONER CIRCUIT BREAKER PANEL as COMPRESSOR MOTOR, CONDENSER BLOWER, EVAPORATOR BLOWER, and HEATER ELEMENTS.

Dc power controls the operation of the 115 vac components through dc interlock circuitry. The 28 vdc is supplied by the No. 2 primary bus and routed through the ECS CONTR circuit breaker on the pilot's circuit breaker panel to the ECU on the electrical pallet and to the ECS AIR COND COOL-OFF-FAN switch on the upper console. Air conditioning power source priorities, listed in Table 2 are established by circuitry in the ac electrical system and the No. 3 relay panel.

Table 2. Air Conditioning System Power Source Priority.

POWER SOURCE	AIR CONDITIONING SYSTEM OPERATION
APU Generator (Helicopter on Ground)	Air conditioning interrupted if: (1) backup pump is on. or (2) windshield anti-ice is on. Windshield anti-ice interrupted when backup pump is on.
APU Generator (Helicopter in Air)	Air conditioning interrupted while helicopter in air. Windshield anti-ice interrupted when backup pump is on.
Dual Main Generator (No. 1 and No. 2)	Air conditioning, backup pump, and windshield anti-ice can operate simultaneously.
Single Generator (Helicopter in Air or on Ground) or External ac Power (Weight on or Off Wheels)	Air conditioning interrupted when weight off wheels.

SYSTEM OPERATION

Control of the air conditioning system is accomplished by the ECS TEMP CONT, AIR COND, and HTR controls on the upper console. The temperature rheostat (TEMP CONT COOL-WARM) has two arrows. One arrow indicates an increase to COOL (counterclockwise), the other an increase to WARM (clockwise). The AIR COND switch is marked FAN-OFF-COOL. The TEMP CONT rheostat R5 is used with the AIR COND switch to set the desired cabin temperature.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

When the switch is placed to either COOL or FAN, the evaporator immediately starts, providing air flow to the cockpit and cabin. When the manually-operated ambient air valve is open, fresh air is drawn from outside the helicopter into the plenum chamber, mixed with inside cool or vent air, and circulated through the helicopter. With the ambient air valve closed, inside air will be recirculated through the helicopter by the evaporator fan. When air conditioning is desired, the switch is placed to COOL, starting a sequence of events leading to full air conditioning operation. Major electrical components are started at spaced intervals to prevent surges in 115 vac electrical power. The evaporator fan operates first, followed by the condenser fan, after a five-second delay. Finally, after an additional ten-second delay, the compressor motor operates. Temperature control is accomplished by mixing the cool refrigerant in the evaporator with warm refrigerant in the compressor. This is in response to a signal from the temperature sensor in the return air rear plenum. This signal is processed by the temperature controller and is adjusted by the TEMP CONT rheostat R5 to open the hot gas bypass valve solenoid when the desired cabin and cockpit comfort level is reached. Safety of the air conditioning system is maintained by high and low pressure and temperature switches, and by a pressure relief valve and a burst disk. The switches also latch individual fault indicators (CB6 through CB9) on the ECU (identified as AIR CONDITIONER FAULT INDICATOR PANEL) to provide visual indication of an air conditioning system malfunction.

When the helicopter is on the ground, the 28 vdc interlock circuitry is as follows: The AIR COND control is armed with 28 vdc through contacts of relay K82 in the No. 1 junction box. The ECS can then be used either with or without the APU running (through relay K95). **EH60A 86-24561 - SUBQ >** The APU must be running or external power applied (contacts B1 and B2 of relay K95 must be closed). **<** Placing the AIR COND switch to COOL energizes evaporator fan relay K3 to switch on ac power to the evaporator fan. When the hydraulic backup pump and windshield anti-ice are off, placing the AIR COND switch to COOL also energizes the expansion valve and thermistor through relays K96 and K80A. After a five-second delay, this energizes relay K5 to in turn energize condenser fan relay K2, which connects 115 vac to start the condenser fan. After an additional ten-second delay, relay K6 energizes. Compressor motor relay K4 then energizes through the high and low pressure switches, the low temperature switch, and contacts of relay K6. Relay K4 connects ac power to start the compressor, and dc power to light the AIR COND ON capsule on the caution/advisory panel.

The high and low pressure switches and the low temperature switch are connected in series between 28 vdc from DC POWER circuit breaker on the ECU and contacts B1-B2 of relay K6. This causes the compressor motor to stop running when the pressure in the high pressure line exceeds 300 psig, the pressure in the low pressure line drops below 50 psig, or the temperature in the evaporator duct drops below 35°F. Either of these conditions can be monitored on the AIR CONDITIONER FAULT INDICATOR PANEL on the ECU. The circuit breakers are marked: HIGH PRESSURE, LOW PRESSURE, and LOW TEMPERATURE. When one of the switches is activated, 28 vdc is shorted to ground through the corresponding circuit breaker, which pops the breaker.

Placing the AIR COND switch to FAN arms the HTR switch on the ECS control panel when either the backup pump or windshield anti-ice is off, or when No. 1 and No. 2 generators are on. Placing the HTR switch to ON energizes relay K7 which provides a ground to energize relay K1 through contacts of relay K3 and the NC contacts of the high temperature switch in the evaporator duct. When duct temperature exceeds 180°F, the high temperature switch activates to short out and pop the HIGH TEMPERATURE circuit breaker on the fault isolator panel. Relay K1 switches ac power to energize the heater/demister coils and relay K7 switches dc power to light the CABIN HEAT ON capsule on the caution/advisory panel. The heater/demister is also protected by a temperature limiting switch between the high temperature switch and relay K1, which is set to disconnect power to the heater coils when evaporator duct temperature exceeds 160°F.

When the helicopter is airborne, the AIR COND switch can be armed only when the APU is off (through relay K95). Operation of the ECS is the same with the helicopter airborne as it is with the helicopter on the ground except that the backup pump or the windshield anti-ice will not interrupt air conditioning or heater operation because No. 1 and No. 2 generator relay K81A connects the AIR COND and HTR switches to the system components. **EH60A 86-24561 - SUBQ >** When the helicopter is airborne (weight-off-wheels), the air conditioning will operate only when aircraft power is supplied by both No. 1 and No. 2 generators. **<**

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

For location and description of major components, refer to the data in this work package.

EQUIPMENT DATA

If applicable, refer to WP 1675 00, WP 1676 00, WP 1679 00 and WP 1680 00 for equipment data information.

ELECTRICAL SYSTEMS

ENVIRONMENTAL CONTROL SYSTEM (ECS) DESCRIPTION AND DATA HH-60A HH-60L>

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

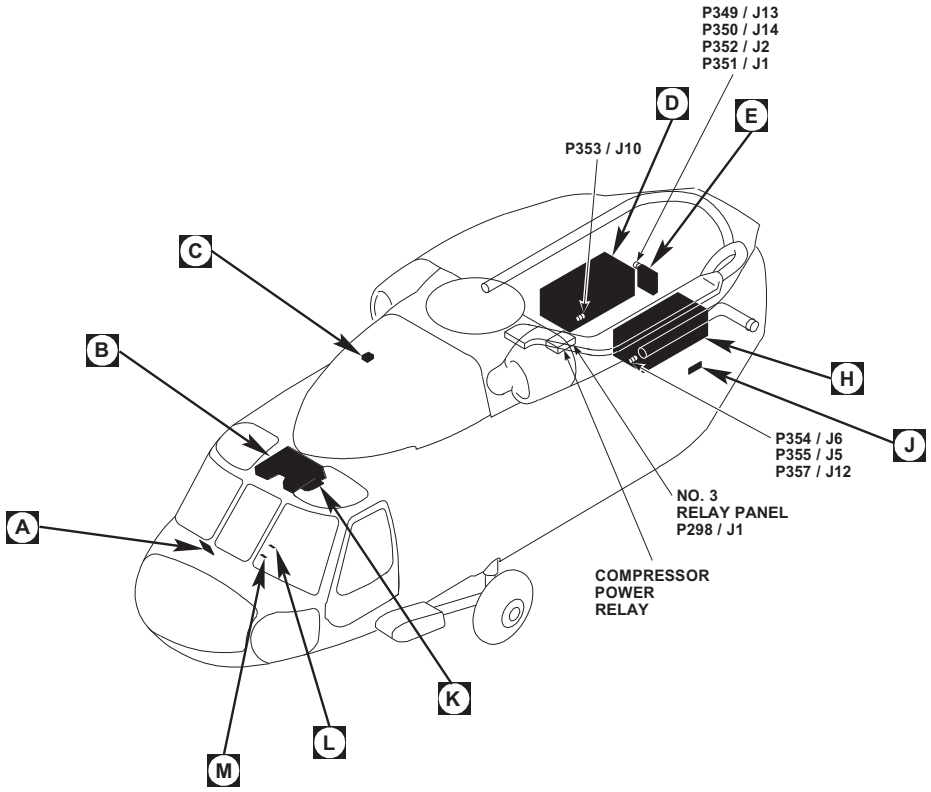
DESCRIPTION

The environmental control system (ECS) consists of a heater/demister and a vapor cycle air conditioner that provide heating, cooling, ambient air circulation, and humidity control in the helicopter's cockpit and cabin. Table 1 lists the ECS components and their locations. The system is controlled from the ECS control panel on the left side of the helicopter, rear cabin. When the AC/OFF/VENT/HEAT switch is in the VENT position, heated air is circulated through the helicopter. The ECS functionally interfaces with the MFD/caution/advisory warning system and the ac electrical system through the electrical control unit (ECU). Panel lighting for the ECS control panel is provided by the lower console lights/indicator lights dimming. See Figure 1. (Sheet 1 of 7) through Figure 1. (Sheet 3 of 7), and Figure 2

Table 1. Environmental Control System Component Locations.

COMPONENT	LOCATION
Compressor/Motor	Evaporator Pallet
Condenser	Condenser Pallet
Condenser Fan	Condenser Pallet
Filter/Drier	Electrical Pallet
Expansion Valve	Evaporator Pallet
Evaporator	Evaporator Pallet
Evaporator Fan	Evaporator Pallet
High Temperature Switch	Heater/Demister
Low Temperature Switch	Heater/Demister
Hot Gas Bypass Valve	Evaporator Pallet
Heater/Demister	Evaporator Pallet
ECU (Electrical Control Unit)	Electrical Pallet
ECS Control Panel	Rear Cabin
Sight Glass	Electrical Pallet
Service Valves	Electrical Pallet
High Pressure Switch	Electrical Pallet
Low Pressure Switch	Electrical Pallet
Thermistor Sensor	Evaporator Low Pressure Line

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED



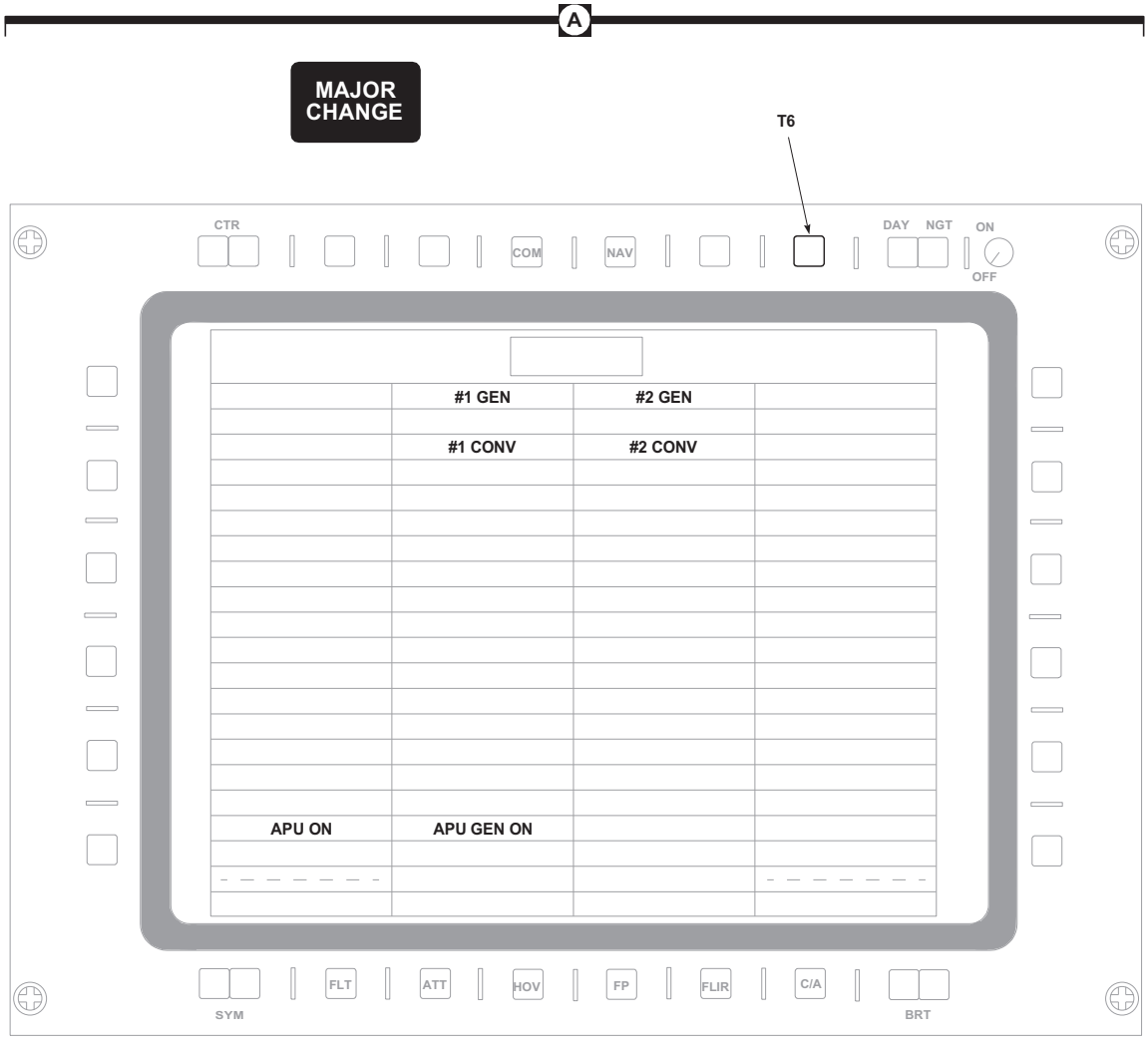
TERMINAL BOARD / DISCONNECT PLUG / RECEPTACLE	LOCATION / CONNECTION POINT
J198	INDICATOR LIGHTS DIMMER
J906	NO. 1 JUNCTION BOX
P3 / J3	ELECTRICAL CONTROL UNIT
P9 / J9	COMPRESSOR / MOTOR
P11 / J11	EVAPORATOR BLOWER
P129 / J129	COPILOT'S AUXILIARY CIRCUIT BREAKER PANEL
P210 / J210	NO. 1 JUNCTION BOX
P212	LOW TEMPERATURE SWITCH SW3
P244 / J244	NO. 1 JUNCTION BOX
P266 / J266	BEHIND PILOT'S CIRCUIT BREAKER PANEL BL 25 RH

TERMINAL BOARD / DISCONNECT PLUG / RECEPTACLE	LOCATION / CONNECTION POINT
P298 / J1	NO. 3 RELAY PANEL
P329 / J329	MAIN ROTOR DE-ICE JUNCTION BOX
P349 / J13	ELECTRICAL CONTROL UNIT DISTRIBUTION BOX
P350 / J14	ELECTRICAL CONTROL UNIT DISTRIBUTION BOX
P351 / J1	ELECTRICAL CONTROL UNIT DISTRIBUTION BOX
P352 / J2	ELECTRICAL CONTROL UNIT DISTRIBUTION BOX
P353 / J10	CONDENSER BLOWER
P354 / J6	EVAPORATOR PALLET
P355 / J5	EVAPORATOR PALLET
P356 / J1	ECS CONTROL PANEL
P357 / J12	EVAPORATOR PALLET

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Figure 1. Environmental Control System Location Diagram (Sheet 1 of 7).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED



MULTIFUNCTION DISPLAY'S
CAUTION/ADVISORY GRID

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Figure 1. Environmental Control System Location Diagram (Sheet 2 of 7).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

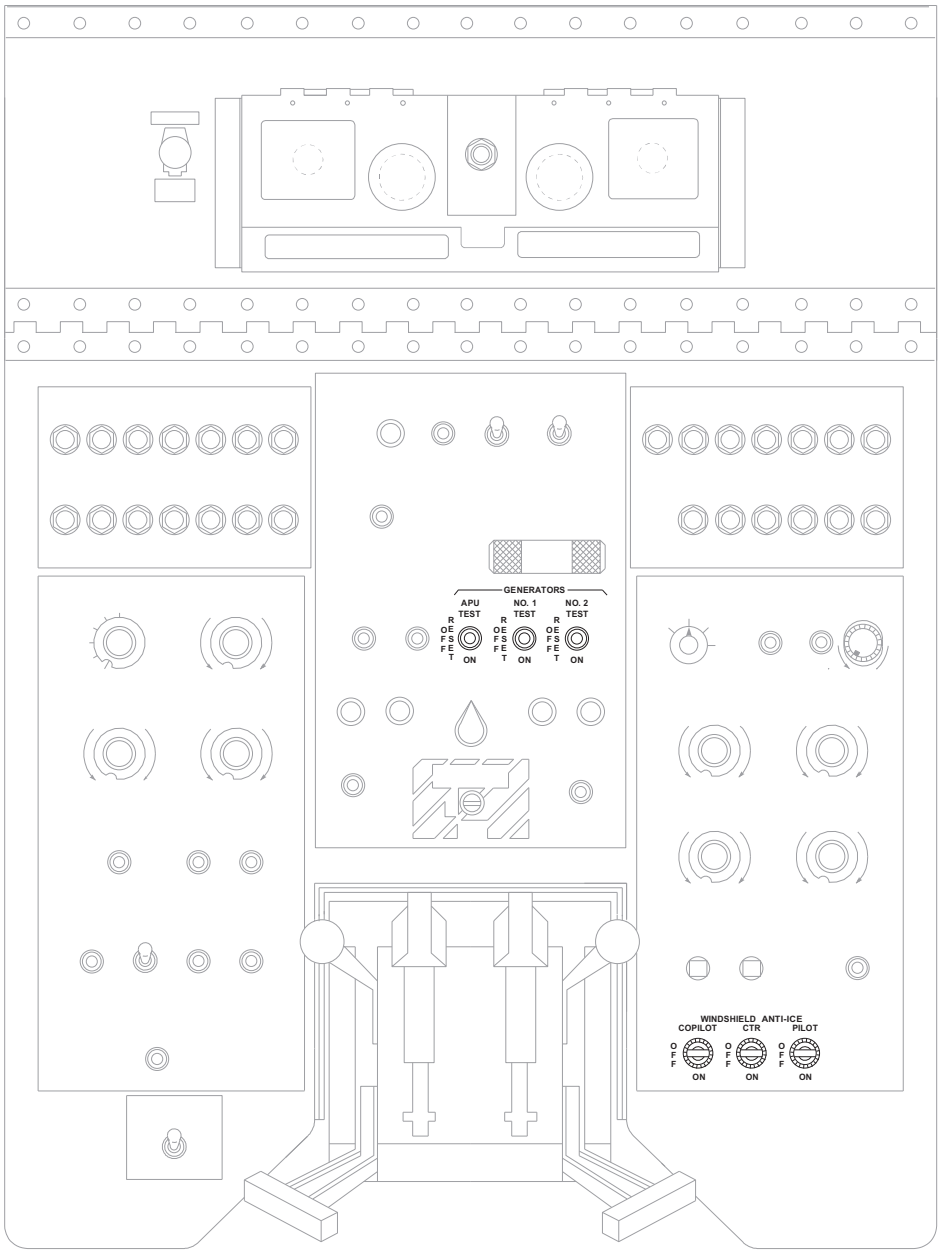
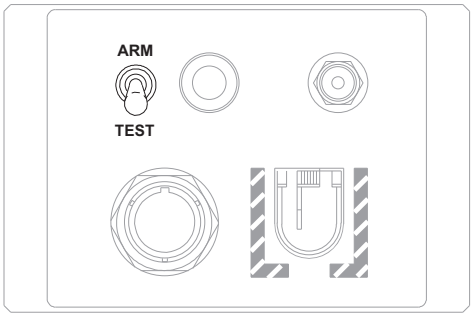


Figure 1. Environmental Control System Location Diagram (Sheet 3 of 7).

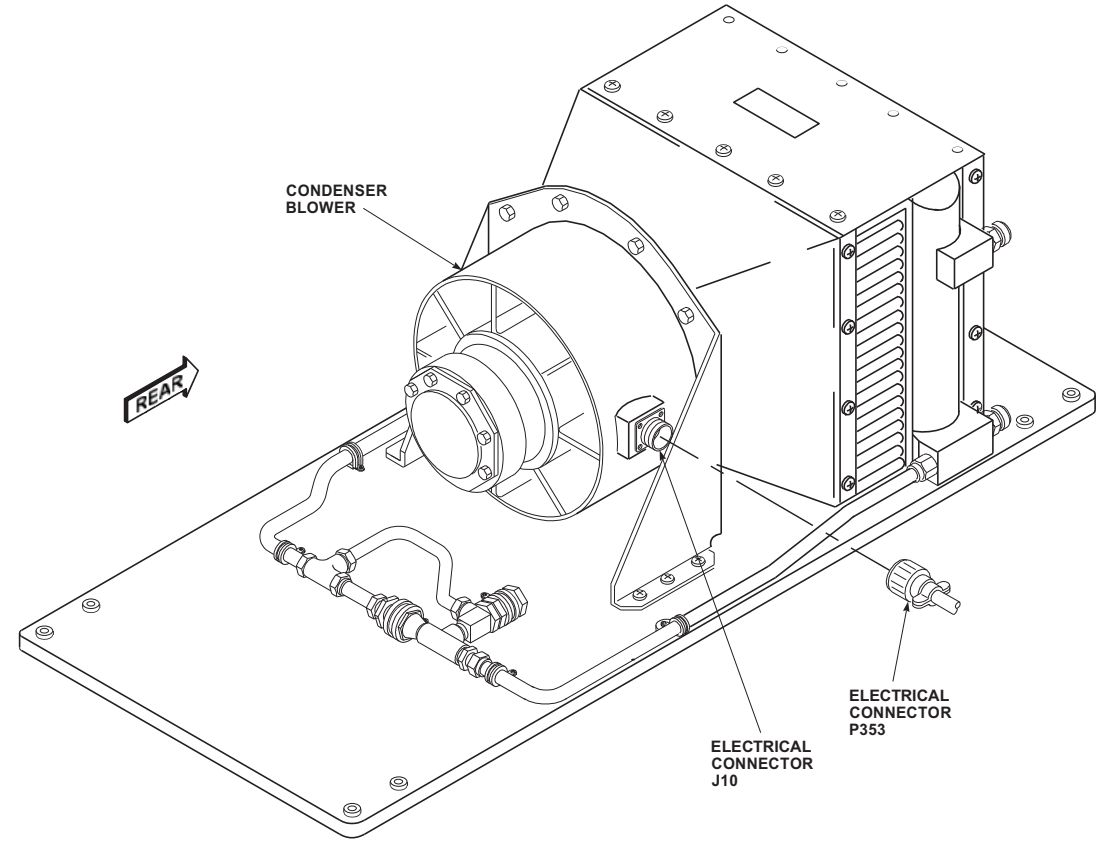
EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED



CREW'S HOIST CONTROL PANEL

C

D



CONDENSER PALLET

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Figure 1. Environmental Control System Location Diagram (Sheet 4 of 7).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

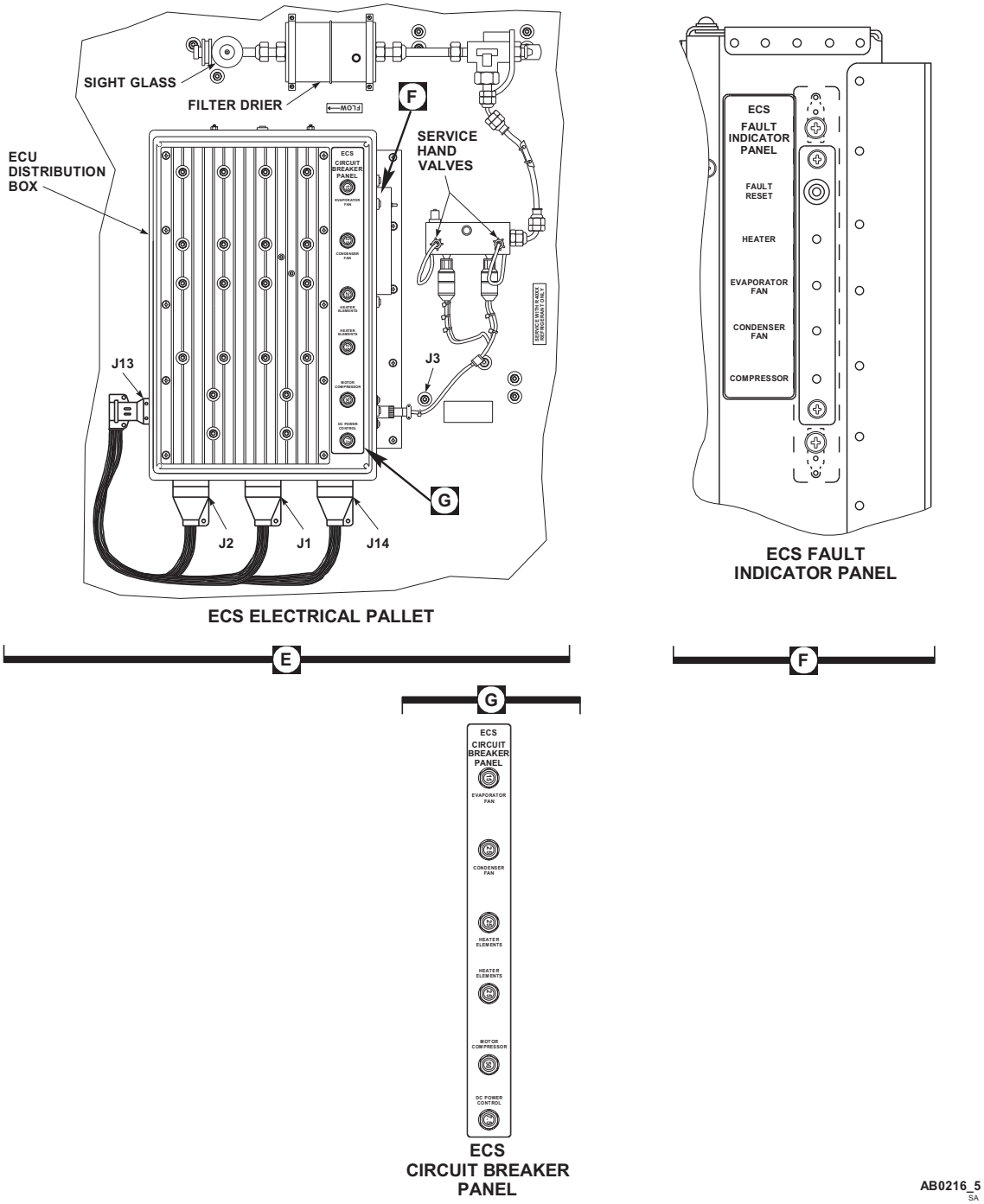


Figure 1. Environmental Control System Location Diagram (Sheet 5 of 7).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

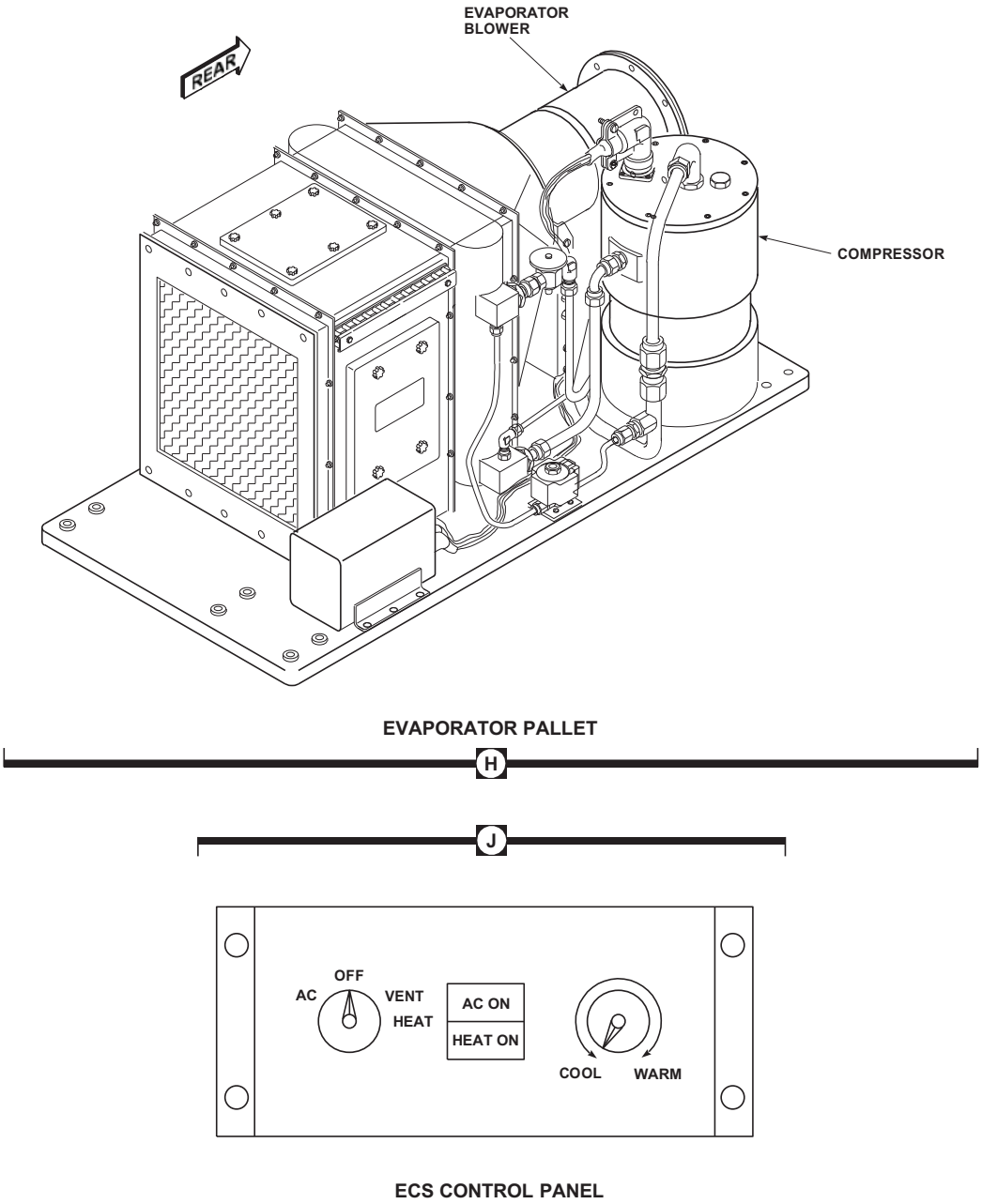


Figure 1. Environmental Control System Location Diagram (Sheet 6 of 7).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

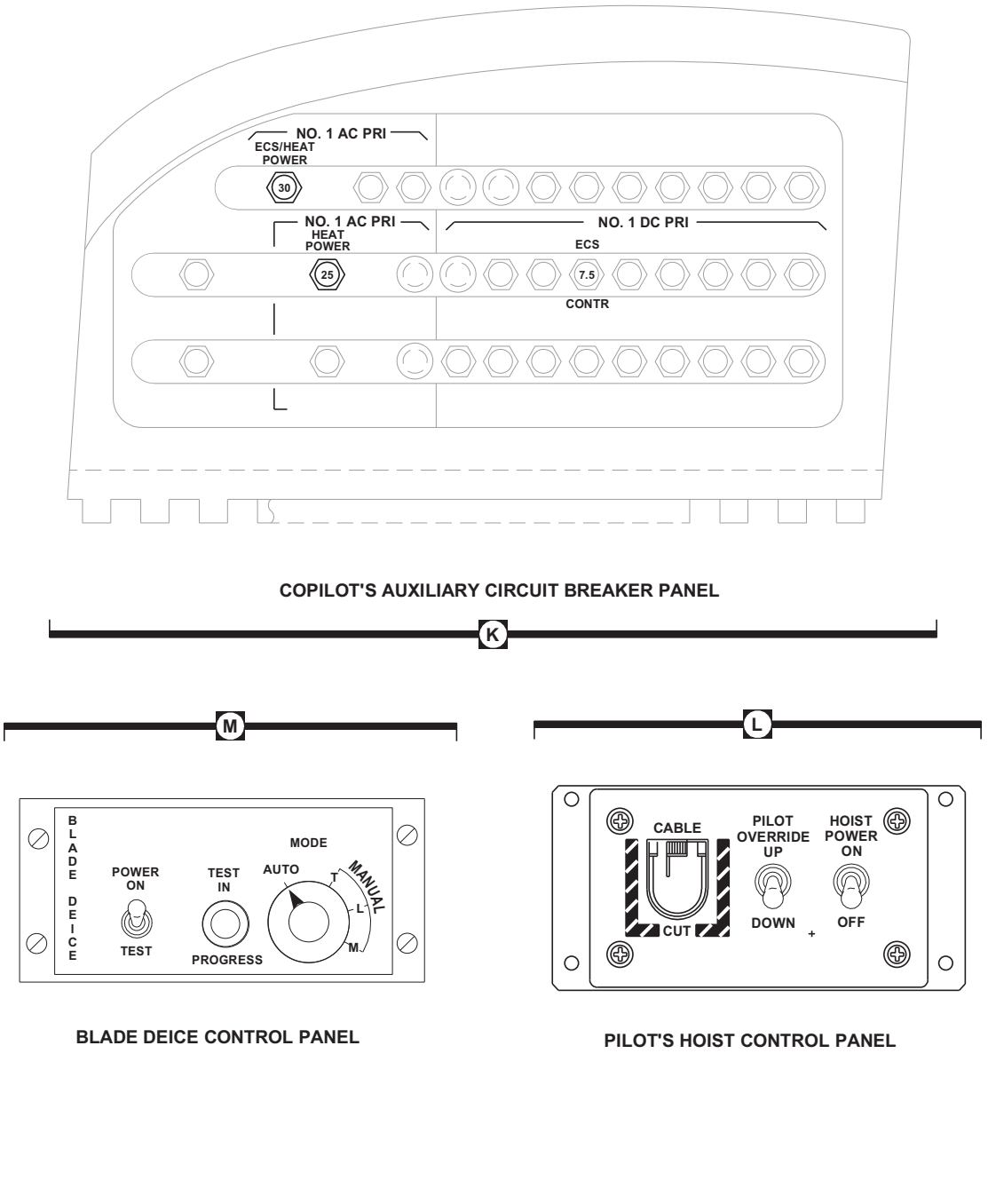


Figure 1. Environmental Control System Location Diagram (Sheet 7 of 7).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

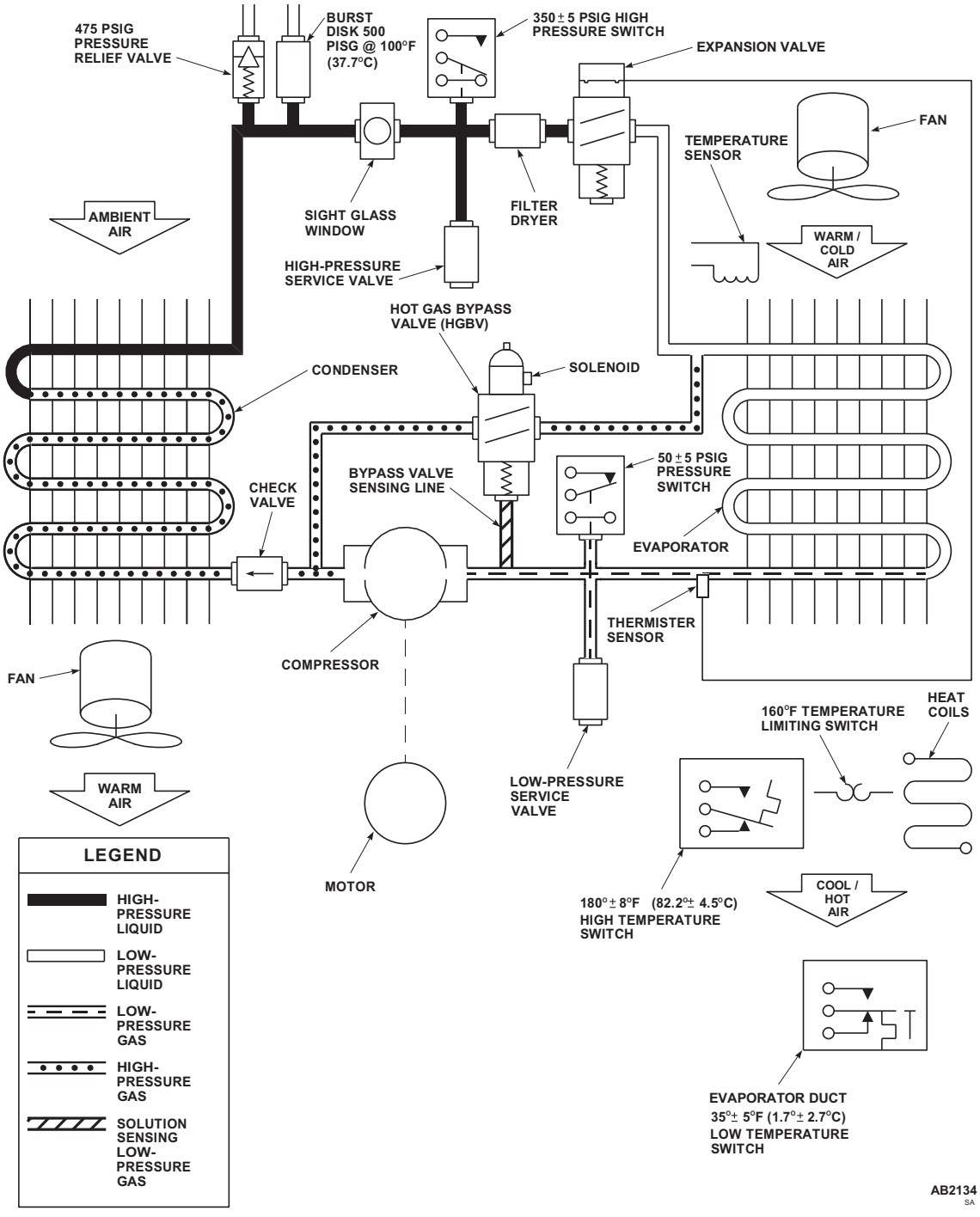


Figure 2. Environmental Control System Refrigerant Flow Diagram.

Evaporator Pallet

The evaporator pallet is horizontally-mounted on the left side of the helicopter, rear of the cabin bulkhead. Its major components are the compressor/motor, evaporator, inlet transition duct, evaporator blower, heater/demis-

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

ter housing, discharge transition duct, expansion valve, and hot gas bypass valve. The evaporator and heater/demister housing are insulated with neoprene foam insulation.

The expansion valve controls the rate of refrigerant evaporation; it allows only enough refrigerant to flow into the evaporator to keep the evaporator operating efficiently, depending on its heat load. Refrigerant enters the expansion valve in a liquid state and passes through a small orifice. It emerges as a vapor at a lower pressure. As a vapor and under low pressure, the refrigerant then enters the evaporator and begins to evaporate. The evaporator is a crossflow plate-fin type aluminum heat exchanger that absorbs heat by boiling off liquid refrigerant flowing through it. The blower draws hot cabin air through the evaporator. The heat in this air is absorbed by the evaporating refrigerant. The resultant cool air is then recirculated through the aircraft air distribution system back into the cabin. At this point, the refrigerant is a low pressure gas and is drawn back to the compressor through the suction line.

Compressor/Motor

The compressor/motor is a single, hermetically sealed unit. A ten horsepower motor is mounted vertically over a scroll compressor to compress and circulate the R407C/SUVA 9000 refrigerant throughout the system. The compressor's function is to draw the low pressure refrigerant gas (suction) from the evaporator and compress it to a high pressure gas for routing to the condenser (discharge). An electrical connector for the electrical power supply, discharge port, suction port, and oil level sight glass are mounted in the compressor/motor housing.

Inlet Transition Duct

The fiberglass evaporator inlet transition duct connects the evaporator with the evaporator blower. The duct includes guide vanes to insure an even air flow through the evaporator.

Evaporator Blower

The evaporator blower is a six-inch vane, axial-type fan that draws return air from the cabin interior and circulates it through the evaporator.

Heater/Demister Housing

The heater/demister housing is mounted between the evaporator and the evaporator outlet transition duct. It is a steel housing insulated with neoprene foam. It contains three heating elements, a heater high temperature switch, an air conditioner low temperature switch, a heater temperature limiting switch, and an aluminum mesh demister pad for water elimination.

Outlet Transition Duct

Conditioned air is ducted to the aircraft air distribution system through the evaporator outlet transition duct. This duct is constructed of fiberglass and insulated with neoprene foam.

Filter/Dryer

The filter/dryer is mounted in the high pressure (liquid) refrigerant line just before the expansion valve on the electrical pallet. Through its molded porous core, both contaminants and moisture are filtered from the refrigerant. Moisture in the air conditioning system interferes with the proper operation of the expansion valve and reacts with the refrigerant to form corrosive hydro-fluoric acid.

Hot Gas Bypass Valve

The hot gas bypass valve regulates the evaporator pressure, hence temperature, to provide evaporator outlet air temperature adjustment. The cooling system is designed to produce not lower than 42°F (5.6°C) conditioned air. The valve will discharge hot refrigerant gas directly into the evaporator to increase its pressure and, therefore, temperature. The valve receives refrigerant from the compressor discharge line to discharge it directly into the evaporator.

Condenser Pallet

The condenser pallet is horizontally-mounted on the right side of the helicopter aft of the cabin bulkhead. Its major components are the heat exchanger, condenser fan, transition duct, pressure relief valve, thermal protection

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

switch, and burst disc. The condenser unit extracts the heat absorbed by the refrigerant in the evaporator, exhausts it overboard, and changes the refrigerant to a liquid state for routing back to the expansion valve. The refrigerant enters the condenser from the compressor as a compressed gas under high pressure. Ambient air is blown over the condenser by the fan. Because the refrigerant is at a higher temperature than the ambient air, the heat is transferred from the refrigerant to the air. The condenser is constructed similarly to the evaporator. The condenser is a crossflow, plate-fin type heat exchanger that uses air from the fan to extract heat from the refrigerant gas, allowing it to condense into a manifold that connects to a sub-cooler, across the condenser lower face, then out the discharge port.

Condenser Transition Duct

A fiberglass transition duct separates the condenser and blower. It is bolted to flanges on both components and supported by aluminum brackets.

Pressure Relief Valve

A pressure relief valve protects the air conditioning system from over pressure. If system pressure reaches 475 psig, the relief valve will open, discharge refrigerant directly into the condenser transition duct and exhaust it overboard. As pressure decreases below 475 psig, the pressure relief valve will automatically reseal and air conditioner operation will resume. The valve is mounted to the high pressure (liquid) discharge refrigerant line.

Burst Disc

A burst disc is included in the system to provide redundancy in high pressure protection. Mounted "in-line" with the pressure relief valve, the disc will burst at 500 psig. This would occur under a high pressure condition when both the high pressure switch and pressure relief valve failed. The burst disc must be replaced after rupture before resuming air conditioner operation.

Electrical Pallet

The electrical pallet is vertically mounted aft of the condenser and evaporator pallet assemblies in the helicopter aft transition avionics compartment. The major components are: ECU, ECS circuit breaker panel, ECS fault indicator panel, high pressure switch, low pressure switch, filter/dryer, refrigerant liquid indicator (sight glass), and high/low pressure service valves.

Electrical Control Unit (ECU)

The ECU is a sealed unit containing practically all of the electrical components necessary for operation. Contents include the temperature controller, relays, circuit breakers, and compressor/motor capacitor.

Ecs Circuit Breaker Panel

The ECS circuit breaker panel is mounted on the ECU cover. The panel includes five ac circuit breakers and one dc circuit breaker. A description is as follows:

- EVAPORATOR FAN, 15 amps ac.
- CONDENSER FAN, 25 amps ac.
- HEATER ELEMENTS, 25 amps ac.
- HEATER ELEMENTS, 25 amps ac.
- MOTOR COMPRESSOR, 50 amps ac.
- DC POWER CONTROL, 7.5 amps dc.

Ecs Fault Indicator Panel

An ECS fault indicator panel, containing four indicator lights, is mounted on the side of the ECU. The lights are labeled HEATER, EVAPORATOR FAN, CONDENSER FAN, and COMPRESSOR. A light on indicates an open circuit for that component from a faulty component or wiring or a loose connection. After investigating for problems, the fault reset button clears the panel lights.

Service Valves

The air conditioner contains two service ports for system maintenance; one in the high pressure line and one in the low pressure line. The service valve in the high pressure line (from compressor to condenser) allows access

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

to the high pressure side of the system for attaching a service hose and pressure gauge. The service valve in the low pressure line (from evaporator to compressor) allows access to the low pressure side of the system. Access to both pressure lines is required for monitoring the system during maintenance operations and for servicing the system.

High And Low Pressure Switches

The high and low pressure switches protect the air conditioning system from abnormally high and low pressures. Both switches are located in the servicing manifold and exposed to either the high or low side pressures. The high pressure switch will disengage the compressor/motor if system high side pressure reaches between 345 to 355 psi. The compressor/motor will reengage as pressure decreases to between 270 to 280 psi. The low pressure switch will disengage the compressor/motor at between 47 to 53 psi. At between 17 to 23 psi, the compressor/motor will reengage.

POWER DISTRIBUTION

Ac power is supplied by the No. 1 generator contactor K1 in the No. 1 junction box and goes through the contacts of the compressor power relay K310. From K310, power is routed to connector J14 on the ECU. Ac power is also supplied by the No. 1 ac primary bus through the ECS/HEAT POWER and HEAT POWER circuit breakers on the copilot's auxiliary circuit breaker panel and routed to connector J13 on the ECU. Inside the ECU, the 115 vac three-phase power from the circuit breakers and the relay arm the normally-open contacts of five relays (SSR1, SSR2, SSR3, SSR4, and SSR5), each protected by its own circuit breakers for ac operation of the compressor, condenser, evaporator, and heater/demister. These circuit breakers are identified on the ECU circuit breaker panel as MOTOR COMPRESSOR, CONDENSER FAN, EVAPORATOR FAN, and HEATER ELEMENTS.

Dc power controls the operation of the 115 vac components through dc interlock circuitry. The 28 vdc is supplied by the No. 1 dc primary bus and routed through the ECS CONTR circuit breaker on the copilot's auxiliary circuit breaker panel to the ECU on the electrical pallet and to the No. 3 relay panel. From the No. 3 relay panel, the 28 vdc continues on to the AC/OFF/VENT/HEAT switch on the ECS control panel. Air conditioning power source priorities, listed in Table 2 are established by circuitry in the ac electrical system and the No. 3 relay panel.

Table 2. Air Conditioning System Power Source Priority.

POWER SOURCE	AIR CONDITIONING SYSTEM OPERATION
APU Generator	Air conditioning interrupted if APU is on.
Generators (No. 1 And No. 2)	Air conditioning can only operate if both are on.
External ac Power	Air conditioning interrupted if external power not on. Air conditioning also interrupted if blade de-ice system or rescue hoist system is operating.

SYSTEM OPERATION

Control of the ECS system is accomplished by the ECS control panel at the rear left side of the aircraft cabin. The temperature rheostat (COOL-WARM) has two arrows. One arrow indicates an increase to COOL (counterclockwise), the other an increase to WARM (clockwise). The ECS mode select switch is marked AC/OFF/VENT/HEAT. The rheostat R1 is used with the mode select switch to set the desired cabin temperature.

When the switch is placed to either AC or VENT, the evaporator immediately starts, providing air flow to the cockpit and cabin. When air conditioning is desired, the switch is placed to AC, starting a sequence of events leading to full air conditioning operation. Major electrical components are started at spaced intervals to prevent surges

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

in 115 vac electrical power. The evaporator fan operates first, followed by the condenser fan, after a five-second delay. Finally, after an additional ten-second delay, the compressor motor operates. Temperature control is accomplished by mixing the cool refrigerant in the evaporator with warm refrigerant in the compressor. Temperature is adjusted by the temperature rheostat R1 which opens the hot gas bypass valve solenoid when the desired cabin and cockpit comfort level is reached. Safety of the air conditioning system is maintained by high and low pressure and temperature switches, and by a pressure relief valve and a burst disk. The switches also latch individual fault indicators on the ECU (identified as the ECS FAULT INDICATOR PANEL) to provide visual indication of an ECS system malfunction.

The 28 vdc interlock circuitry is described as follows. The ECS control mode select switch is armed with 28 vdc through contacts of relay K301 in the No. 3 relay panel. Placing the switch to AC energizes condenser fan relay SSR2 to switch on ac power to the condenser fan and also energizes the expansion valve and thermistor. Motor compressor relay SSR1 then energizes as a result of compressor power relay K310 energizing and sending ac power from the No. 1 junction box through its contacts. Dc power to light the AC ON capsule on the ECS control panel is received from relay K1.

Placing the ECS control mode select switch to VENT energizes evaporator fan relay SSR3 to switch on ac power to the evaporator fan. Placing the ECS control mode select switch to HEAT energizes heater elements relays SSR4 and SSR5 which, in turn, provide power to the contacts of heater overtemperature switches in the evaporator duct. When duct temperature goes too high, the high temperature switch activates to short out and pop the HEATER circuit breaker on the fault indicator panel. Relay SSR1 switches ac power to energize the heater/demister coils and relay K2 switches dc power to light the HEAT ON capsule on the ECS control panel. The heater/demister is also protected by these heater overtemperature switches which are set to disconnect power to the heater coils when evaporator duct temperature goes too high.

The ECS control mode select switch can be armed only when the APU is off (through relay K302), when the external power is on (through relay K312), and when BOTH the No. 1 and No. 2 generators are on (through relays K304 and K305). Operation of the ECS will be interrupted if the rescue hoist or blade de-ice systems are used.

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

For location and description of major components, refer to the data in this work package.

EQUIPMENT DATA

If applicable, refer to WP 1675 00, WP 1676 00, WP 1679 00 and WP 1680 00 for equipment data information.

HOISTS AND WINCHES

RESCUE HOIST DESCRIPTION AND DATA

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

RESCUE HOIST DESCRIPTION HOIST 42305R1> <

The rescue hoist is post-mounted in the cabin on the right side of the helicopter when installed. The hoist system consists of modular components, electrically driven and electronically controlled, to provide maximum lift capacities of 300 pounds at 0 to 250 feet-per-minute and 600 pounds at 0 to 125 feet-per-minute. The hoist motor, mounted at the top of the pole, provides reel-in and reel-out drive of a 250-foot hoist cable. A fail-safe mechanism at all times limits the induced loading to the hoist to 1200 pounds. A continuously running circulating fan cools the hoist motor. The hoist is controlled through a lower console mounted RESCUE HOIST CONTROL panel and/or crewman's control pendant grip in the cabin. A hoist cable shear system is used to cut the hoist cable in case of emergency, by exploding a squib-actuated cable-cutter. The cut cable then drops free of the hoist boom. Power to operate the rescue hoist system is from the No. 2 primary dc bus through a circuit breaker on the mission readiness circuit breaker panel, marked RESQ HST CONTROL. Power for the cable cutter system is from the dc essential bus through a circuit breaker, marked HOIST CABLE SHEAR. Operation of the rescue hoist is disabled if the helicopter's No. 1 or No. 2 converter fails.

Power for the squib test light is controlled by the caution/advisory panel BRT/DIM-TEST switch. When this switch is in the center (normal) position, 28 vdc is applied to the squib test light circuit. Placing the BRT/DIM-TEST switch to BRT/DIM applies a dimming signal to the squib test light circuit from the indicator light dimmer. For a further description of squib test light power, refer to instrument panel and consoles indicator light dimming, WP 0035 00.

The boom assembly module consists of the boom head, up-limit switch, cable-cut device, and a cable guide, all installed in the boom. The boom head is allowed to swivel from side-to-side and guide the cable to wrap or unwrap from a 30° cone angle. The upper limits of cable control includes an automatic means for decelerating the cable to 67 feet-per-minute cable speed. At 10 feet below the boom head, a caution light on the crewman's pendant marked CAUTION will go on. The cable will again decrease speed to 20 feet-per-minute at 8 to 12 inches below the boom head.

Four limit switches are tripped by actuation assembly cams. They are: a down all stop, that actuates when 250 feet of cable is reeled out; a down-limit switch, that actuates at 247 feet, to provide deceleration; a 10-foot caution switch that actuates when the hook is within 8 to 10 feet of the boom head or within 10 feet of the down limit (240 feet); and an up deceleration switch, that actuates when the cable hook is within 12 to 18 inches of the boom head.

The crewman's control pendant grip is a hand held control in the cabin. The pendant grip is connected to the control box by a cable connector. The control pendant contains three switches: HOIST cable control, BOOM positioning, and ICS. The HOIST control is a directional and variable speed, spring-loaded to center switch with positions of OFF, UP, and DOWN. As the switch is moved further away from OFF, the hoist speed increases in the marked direction. When the switch is released the hoist will stop. The BOOM position switch, with marked positions of OUT and IN, operates in the same manner as the HOIST switch, except the boom moves in or out at a single speed. The ICS control switch, on the front of the pendant, provides the operator with intra-helicopter communication.

A cable shear feature releases a rescue hoist load in case of an emergency. The system consists of a dual squib-actuated cable cutter, a CABLE SHEAR switch and a SQUIB test circuit. The cutter may be fired by the pilot or the copilot from the SHEAR switch on the control panel, or by the hoist operator using the CABLE-CUT switch on top of the control box. The SQUIB test circuit consists of a TEST-NORM switch and a test good IND light. When the SQUIB switch is at NORM and the SHEAR switch is placed to FIRE, electrical power is sent to the dual squib for firing. The exploding cartridge then drives a cutter into the hoist cable and shears it. Once fired, the dual squib must be replaced.

RESCUE HOIST CONTROL PANEL DESCRIPTION HOIST 42305R1> <

The rescue hoist control panel provides the controls to position the boom, raise and lower the cable, and to test or fire the cable cutting squib for the rescue hoist. It also provides enabling function for the MASTER toggle switch,

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

BOOM and CABLE control toggle switches, a CABLE SHEAR momentary toggle switch with a switch guard, a SQUIB TEST momentary toggle switch and a press-to-test SQUIB indicator lamp. The squib test circuit consists of a relay, switch, resistor and diode. The squib test circuit components are mounted on the inside of the rear removable panel. The switches and indicator lamp are mounted to the front of the panel under the lighted information plate. The control panel electrical interfaces with the helicopter system through an electrical connector on the side of the control panel.

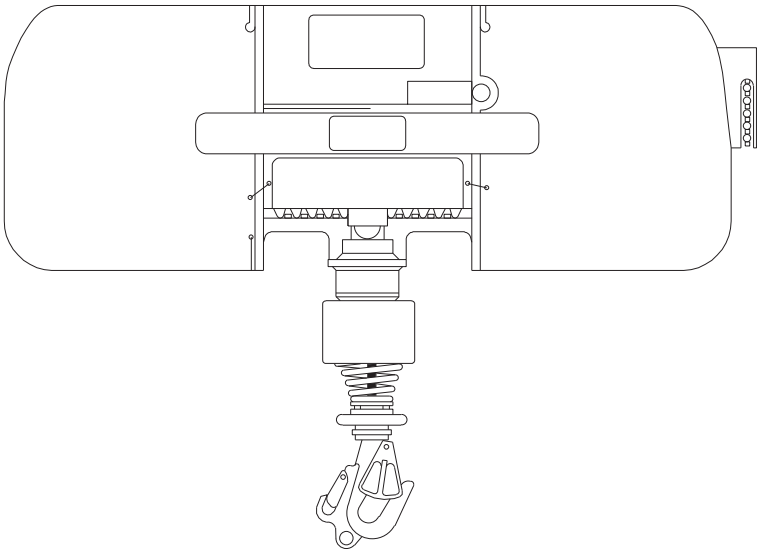
GENERAL HH-60A HH-60L HOIST BL-29900-30> <

The rescue hoist system is comprised of a rescue hoist unit, a movable control handle, a control pendant cable assembly, a pilot control panel, and a crew control panel. These components are considered Line Replaceable Units (LRU) and they are shown in Figure 1, Figure 2, Figure 3, and Figure 4 The hoist system requires 200 V, 3 phase 400 Hz, 24 amp main power; 28 vdc 5 amp control power and a separate 28 vdc 5 amp input for cable cutter power.

RESCUE HOIST UNIT DESCRIPTION HH-60A HH-60L HOIST BL-29900-30> <

The rescue hoist unit operates with the pilot control panel or the control handle (pendant) in this order of precedence.

The unit includes an electric motor, a hoist assembly, a controller section, and aerodynamic fairings. The hoist assembly contains a rotating drum, which is driven by the electric motor through a gear train and a clutch assembly to raise and lower a 290 foot cable terminated in a swivel hook. A brake assembly inside the drum locks the drum when input power is cut off or the load tries to overhaul the motor, and the clutch assembly allows slippage if the load on the hook exceeds 1800 pounds. A levelwind mechanism on the hoist assembly ensures even winding of the cable on the drum. Limit switches sense when the cable approaches the full-in or full-out position, and when the cable reaches these positions. A potentiometer coupled to the drum continuously senses cable position for cable pay out indication.



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Figure 1. Rescue Hoist Unit HH-60A HH-60L HOIST BL-29900-30> .

The hoist utilizes a tension roller located between the cable guide and the drum. The tension roller is gear driven by the drum through an over-running clutch such that when reeling out, the tension roller is rotating faster than the tangential speed of the drum, thereby maintaining a "pull" on the cable at no load. In like manner, the tension roller rotates slower that the tangential speed of the drum when reeling in, thus providing drag on the cable which ensures tight cable storage on the drum under all conditions.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

The cable assembly for this hoist system consists of a wire rope with a swagged stainless steel ball/shank fitting. The wire rope is 3/16 inch diameter, corrosion resistant, performed spin resistant type. The drum end of the cable assembly is cut off by an inert gas shielded electric arc process such that the cable end is sealed and made suitable for attachment at the drum anchor point. The swivel hook assembly prevents inadvertent load release and is operable with one hand.

The swivel hook assembly incorporates a lightweight high strength honeycomb aluminum crushable bumper assembly. During normal hoist operations after the slow in limit switch has actuated, the crushable bumper triggers the "full in" limit switch plunger to stop the hoist. In the event of a failure of the slow in limit signal, the crushable bumper will "absorb" all the rotational energy to safely stop the hoist at the "full in" position. The rotational energy at full speed is capable of producing loads in excess of the rating of the cable. This provides a last line safety device to minimize to the greatest extent possible a hoist cable breakage due to a single point failure. A crushed bumper also provides the operator a visual indication that a failure has occurred.

The cable cutter assembly consists of a pressure cartridge, guillotine and anvil, all of which are contained in the cable guide housing. The cable cutter has a 10 year life. The specific minimum "all fire" current of the pressure cartridge is 5 amps per bridge. This cartridge has the highest EMI rejection with a guaranteed "no fire" rating of 1 watt.

The speed of the hoist is continuously variable from zero to a full speed of 350 feet per minute. It incorporates four guide rollers to guide the cable into the hoist at large fleet angles due to either high winds (30 m/s) or aircraft movement. The bell mouth swivels to follow the angle of the cable at that condition. See below for leading particulars of the High Speed Rescue Hoist System. Figure 5 shows the High Speed Rescue Hoist System Installation drawings.

Rescue Hoist, Functional Characteristics

- Min. 350 fpm cable speed with 600 lb load (average)
- Max. Operating Load 600 lb
- Design Limit Load 1800 lb
- Structural Ultimate Load 2700 lb
- 28 vdc, 5 amp power for cable cutter (momentary)
- 200 V, 3 phase, 400 Hz, 24 amp ac input power
- 28 vdc, 5 amp control power
- Cable angle capability of 30° from the vertical
- Electro-ballistic cable cutter

Rescue Hoist, Physical Characteristics

- Brushless dc motor with integral Power Electronics
- Built in heat sink fins on cable drum
- Optimized fail-safe Weston type brake
- Dual levelwind shaft system
- Optimized cable tensioning system
- Integrated hoist control unit
- Safety overload clutch - slip between 1200 lb and 1850 lb.
- Redundant limit switches
  - Slow down lowering
  - Slow down hoisting
  - Full in
  - Full out
  - Emergency full out
  - Full out and emergency full out override (for cable installation and removal only)

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

Pendant Control Handle HH-60A HH-60L HOIST BL-29900-30>

The movable pendant control handle allows crew selection of the direction and speed of hoist cable travel via thumbwheel activation (Figure 2). Cable speed is directly proportional to thumbwheel deflection. The pendant control handle also provides a Night Vision Goggle (NVG) compatible/ sunlight readable cable pay out display. The display will dim with a 28 vdc signal to the controller. The pendant control handle provides the hoist operator with three NVG indicators, for one second following application of 28 vdc power all indicators are illuminated as a test feature. The indicators provide the operator with cable "Full In", "Full Out" and "Motor Hot" information. A four-way switch is provided for search light control.

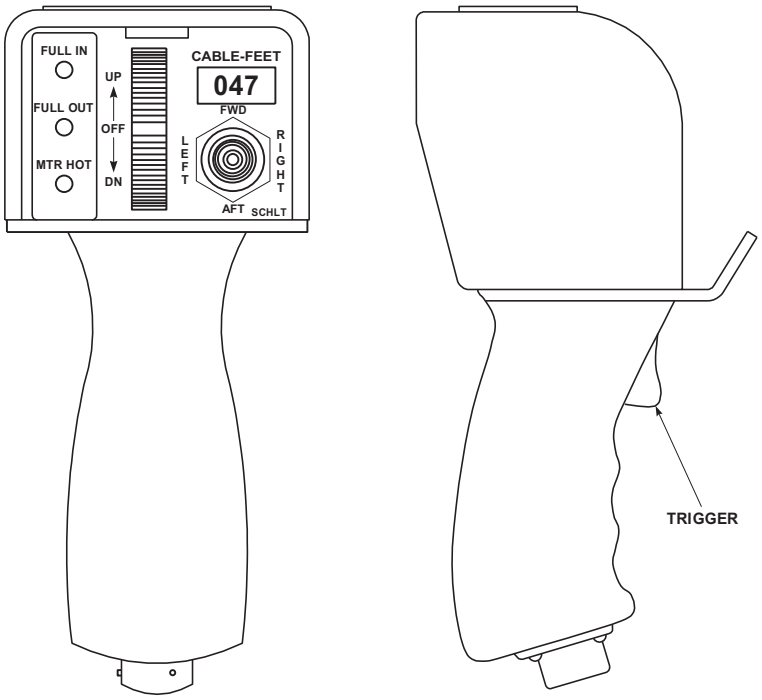
Control Pendant, Functional Characteristics

- Input power - 28 VDC supplied by EC-23000 Rescue Hoist Electronic Controller
- Output:
  - Signal of variable voltage for speed control
  - Up and down directional signals
  - NVG compatible/sunlight readable, digital cable pay out display
  - Motor thermal overheat signa
  - Full in limit switch, full out limit switch and search light control

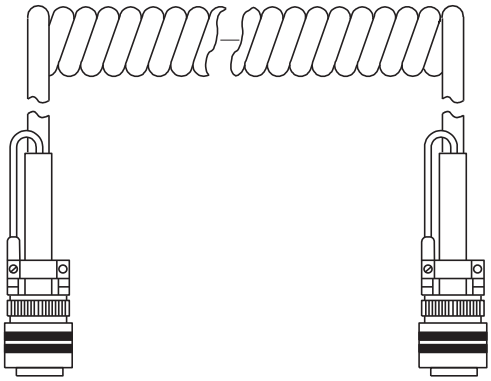
Control Pendant, Physical Characteristics

- Three NVG indicators
- Variable speed thumbwheel
- Ten-foot retractable cord

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED



PENDANT CONTROL



CONTROL CABLE

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Figure 2. Pendant Control Handle and Control Pendant Cable Assembly **HH-60A HH-60L HOIST BL-29900-30>** .

See above for leading particulars of the control pendant.

EC-14170-2 Control Pendant Cable Assembly

The control pendant cable assembly interconnects the control pendant and controller.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

Pilot Control Panel

The hoist system includes a pilot control panel. This will allow the pilot to completely override any hoist command and operate the hoist at a fixed speed. Provisions for cutting the hoist cable are provided with a guarded switch to avoid accidental firing of the cable cutter. All indicators are NVG compatible for one second following application of 28 vdc power. All indicators are illuminated as a test feature.

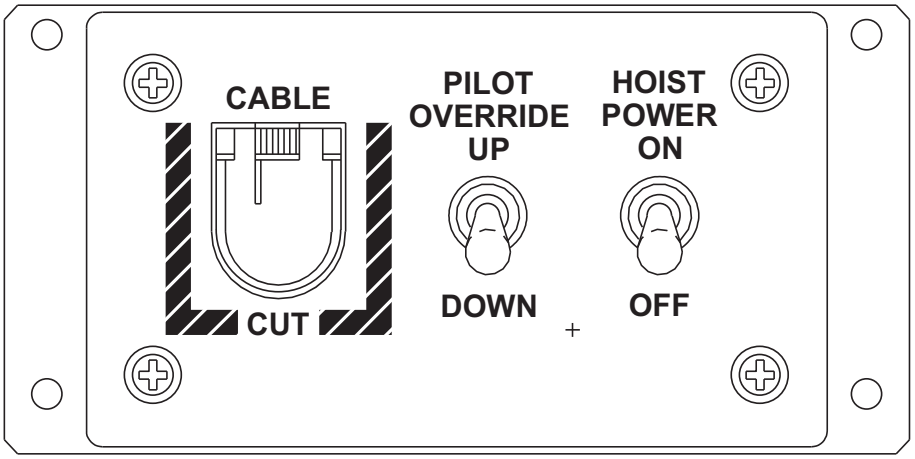


Figure 3. Pilot Control Panel **HH-60A HH-60L HOIST BL-29900-30>** .

Crew Control Panel

The hoist system includes a crew control panel. The crew control panel has a switch for the SEARCH LIGHT, a SQUIB TEST switch, and an ARM TEST switch. Provisions for cutting the hoist cable are provided with a guarded switch to avoid accidental firing of the cable cutter. Also, the crew control panel can be used to activate the NVG lighting by placing the SEARCH LIGHT switch to the lower position.

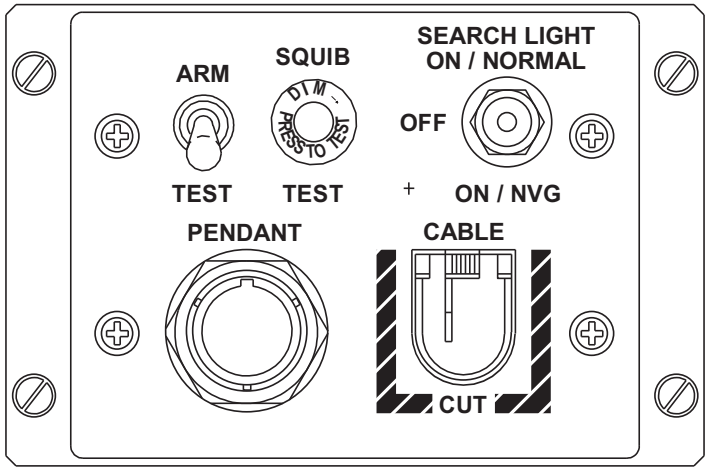


Figure 4. Crew Control Panel **HH-60A HH-60L HOIST BL-29900-30>** .

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

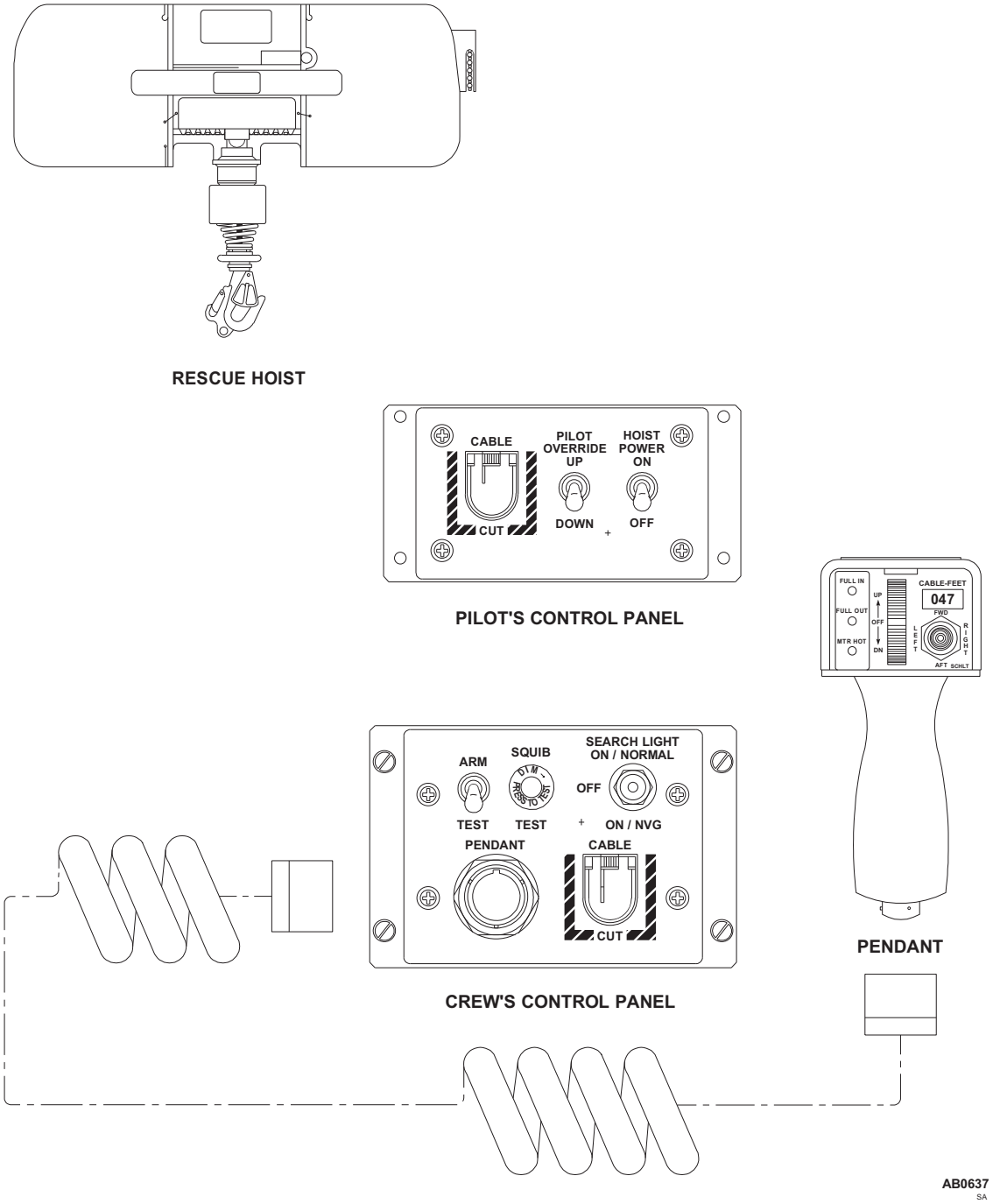


Figure 5. Rescue Hoist System **HH-60A HH-60L HOIST BL-29900-30>** .

The control system allows for two modes of control with the pilot having the highest priority and the movable control handle having the lowest priority. All controls provide indications of overheating, cable extremes and cable length and allow control of the hoist operation. The speed command from the pilot control panel is fixed while variable speed is provided at the crew control panel and pendant control. The pendant control handle controls hoist speed via the deflection of the thumbwheel which is continuously variable and spring loaded to the off position. All controls have automatic slow speed prior to the automatic stop at the cable extremes.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

The pilot and the crew controls have a guarded switch for activation of the cable cutter electro-ballistic device. Searchlight/hover trim capability is provided in the pendant control handle.

Operating Limit Switches

The hoist is equipped with the limit switches that are designed to slow down the hoist as it approaches each cable extreme and to stop the hoist at each cable extreme. The actuation of the "full-in" or "full-out" limit switches also illuminate a NVG compatible indicator on each of the control panels and the movable control handle indicating the hoist has reached the end positions. Each limit switch consists of two switches wired redundantly so that the failure of either switch will not inhibit limit switch operation.

The electronic controller contains internal circuitry that monitors the status of the "up slow" limit switches. The "up slow" limit switch when actuated slows the retracting cable speed to 50 ± 20% fpm fixed. This limit switch is actuated when the retracting cable is 10 ± 2 ft from the fully reeled in position. If the electronic controller detects a "full-in" switch actuation with no "up slow" actuation, the electronic controller inhibits hoist operation. This feature is needed because of the high speed capabilities of the hoist and will prevent the possibility of breaking the cable. It is important that ground testing of the full-in limit switch be done after the "up slow" switch is actuated. When the cable is reeled out, at 10 ±2 ft from the full-out position, the intermediate down switch actuates resulting in a speed deceleration to 50 ± 20% fpm in the down direction. These are built-in safety features of the hoist to avoid reaching cable extremities at full speed. The hoist controller limits the acceleration and deceleration to 1 second from 0 to full speed and from full speed to zero speed. The full-out limit switches stop the hoist with 3.5 to 4.5 dead cable turns on the hoist drum. The full-in limits switches actuate when the cable is at full-in with the conical spring hook assembly installed.

As an added safety feature, the rescue hoist system incorporates an emergency full-out switch. The switch will actuate if the full-out switch signal path fails to stop the hoist. Further operation of the hoist system is inhibited and can only be bypassed by actuating the emergency bypass switch located at front of the hoist.

System Protection

The hoist motor has an internal thermal switch that senses the motor temperature under overheating conditions. The actuation of the thermal switch illuminates an indicator on all control panels. A thermal switch activation will not stop hoist operations. The hoist system will operate at a reduced rate to permit cool down. When ready, it resets automatically.

The controller baseplate also has a thermal switch, which when hot also illuminates the MOTOR HOT indicator on the control panel. Controller baseplate overheat operation is the same as motor overheat operation - hoist function continues at reduced speed. When ready, the controller baseplate thermal switch resets automatically. Reduced loads are recommended when the MOTOR HOT indicator is illuminated.

The power drive bias voltages and the power drive temperature are also monitored. In the event of power drive bias voltage failure or power drive temperature overheat all displays on the pendant are illuminated and hoist operation is stopped. When the conditions are cleared, the displays return to normal and hoist operation may continue.

The hoist system contains an input voltage monitor. If an undervoltage condition is present, all displays on the pendant are illuminated. To clear an undervoltage condition, cycling of the power on switch is required.

The hoist structure can withstand a static load of 2250 lbs. The hoist has an overload safety clutch that will allow the cable drum to rotate under high loads. The slip clutch prevents cable failure or shock loading of the aircraft structure in the event of a cable snag. The clutch slips between 1200 and 1800 lbs.

The hoist is also equipped with a "fail safe" load lowering brake that prevents hoist loads from overhauling the motor. A "fail safe" solenoid brake is also included in the motor. This brake prevents unwinding of the cable while the hoist is at rest.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

Cable Payout Indication

NOTE

The cable payout reading is for reference only since the cable stretch varies with the load and also varies with the amount of cable paid out.

Cable length indicators are provided in the pilot control panel, crew control panel and the movable control handle. The readouts are in feet, NVG compatible and sunlight readable. The readout intensity is dimmed via a 28 vdc input.

Cycle Counting

The hoist has a cycle counter that records the number of drum revolutions. By dividing the cycle counter number by the number of turns of the drum per a complete hoist cycle, the equivalent number of hoist cycles can be accurately obtained (356 counts per cycle).

Emergency Input

Emergency mode can be initiated by shorting the emergency input to the 28 RTN signal. Hoist operation will then proceed at a reduced speed.

This input allows airframe detected faults to be used to reduce hoist speed.

General Rescue Hoist Cable Handling

Rescue hoist cables are subjected to severe operating conditions. Properly applied operating techniques and inspection and maintenance procedures can extend cable life considerably and eliminate causes of fouling failures resulting in a greater degree of safety during hoisting operations.

Rescue hoist cables are made of strands of stainless steel. Nineteen strands consisting of seven individual wires each are used to achieve a flexible, spin resistant cable.

Cable strength is in the order of four times working load, therefore, cable breakage failures will not occur unless the cable is damaged.

Proper hoist function depends on the wrap of the cable on the drum and the cable load created by the tension roller system. If the wrapped cable loses tension, fouling will occur.

Flight Line Cable Handling Techniques

Breeze-Eastern has found the following ground procedures to be vital in achieving reliable rescue hoist operation:

CAUTION

Damage to load cable will occur if load cable is wound from hoist drum onto a take-up reel. This can induce twist into the load cable and cause miswrapping when winding back onto the drum.

Reeling in:

It is important that cable is reeled in under a reasonably heavy, even pull so that it does not wrap loosely on the drum. A drag load must be applied using a gloved hand or clean heavy cloth on the cable to achieve tight, even layers on the drum.

Reeling in should be accomplished at a slow speed so that when loops form they can be straightened out and not form kinks. A kink in the cable is caused by a loop in the cable being pulled up tight, resulting in a sharp, permanent bend in the cable. Kinks can lead to fouling failures as they cause a retarding force on the cable when the kink gets hung up going through the cable guide, especially when reeling out with no load.

If it is required to reel in the cable at full speed for acceptance test purposes, we suggest the cable be reeled out in a straight line for its full length so that no kinks and attendant permanent cable damage occur reeling in. If the purpose of the test is to measure hoist speed, Breeze-Eastern suggests a better way to accomplish this would be to time a specified shorter length.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

CAUTION

Damage to cable will occur if the action of the tension roller is retarded, causing the cable to immediately loosen on the drum and foul. It is important that there is no retarding load on the cable while reeling out.

Reeling out:

The rescue hoist unit incorporates a tension roller system, the purpose of which is to ensure that there is always tension on the cable. During reeling out, the peripheral speed of the tension roller is slightly higher than that of the drum so the cable is always under tension between the roller and the drum. The load is in the order of seventeen pounds.

When reeling out, the cable may be allowed to coil on the ground. It may also be coiled in a drum, however, caution must be exercised while reeling in to avoid kinks.

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

For location and description of major components, refer to the data in this work package.

EQUIPMENT DATA

If applicable, refer to WP 1678 00 and WP 1708 00 for equipment data information.

AUXILIARY POWER PLANT SYSTEM

AUXILIARY POWER SYSTEM DESCRIPTION AND DATA

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

AUXILIARY POWER SYSTEM DESCRIPTION

The auxiliary power unit system consists of an auxiliary power unit (APU), accessories, controls, a monitoring system, and a starting system (Figure 1 and Figure 2). The system provides pneumatic power for main engine starting and cabin heating, electrical and hydraulic power for ground operations, and in-flight emergency electrical power. APU system accessories include a prime/boost pump, hydraulic accumulator, hydraulic handpump, hydraulic utility module, hydraulic backup pump, ac generator, and hydraulic start motor. The prime/boost pump, above the No. 1 fuel cell, is used to prime engine and APU fuel lines, and provide fuel under boost pressure, for APU operation at high altitudes. The hydraulic accumulator, in the aft midsection cabin ceiling, provides the hydraulic pressure used to drive the APU starter. The APU starter is a hydraulic start motor mounted on the APU. If the APU fails during light-off, the hydraulic accumulator is recharged manually by pumping the hydraulic handpump. Once the APU is operating, the ac generator, mounted on the APU, provides electrical power to the helicopter systems. The hydraulic utility module and backup pump, on the left forward deck within the main rotor pylon, automatically recharges the depleted hydraulic accumulator for the next APU start. The APU controls are in the cockpit on the upper console. The control consists of an APU CONTR switch and an APU fire detector/fuel shut-off selector T-handle. Indicator lights on the caution/advisory panel permit cockpit monitoring of the APU system. Monitored conditions include: APU ON, APU FAIL, APU OIL TEMP HI, APU ACCUM LOW, and PRIME BOOST PUMP ON.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

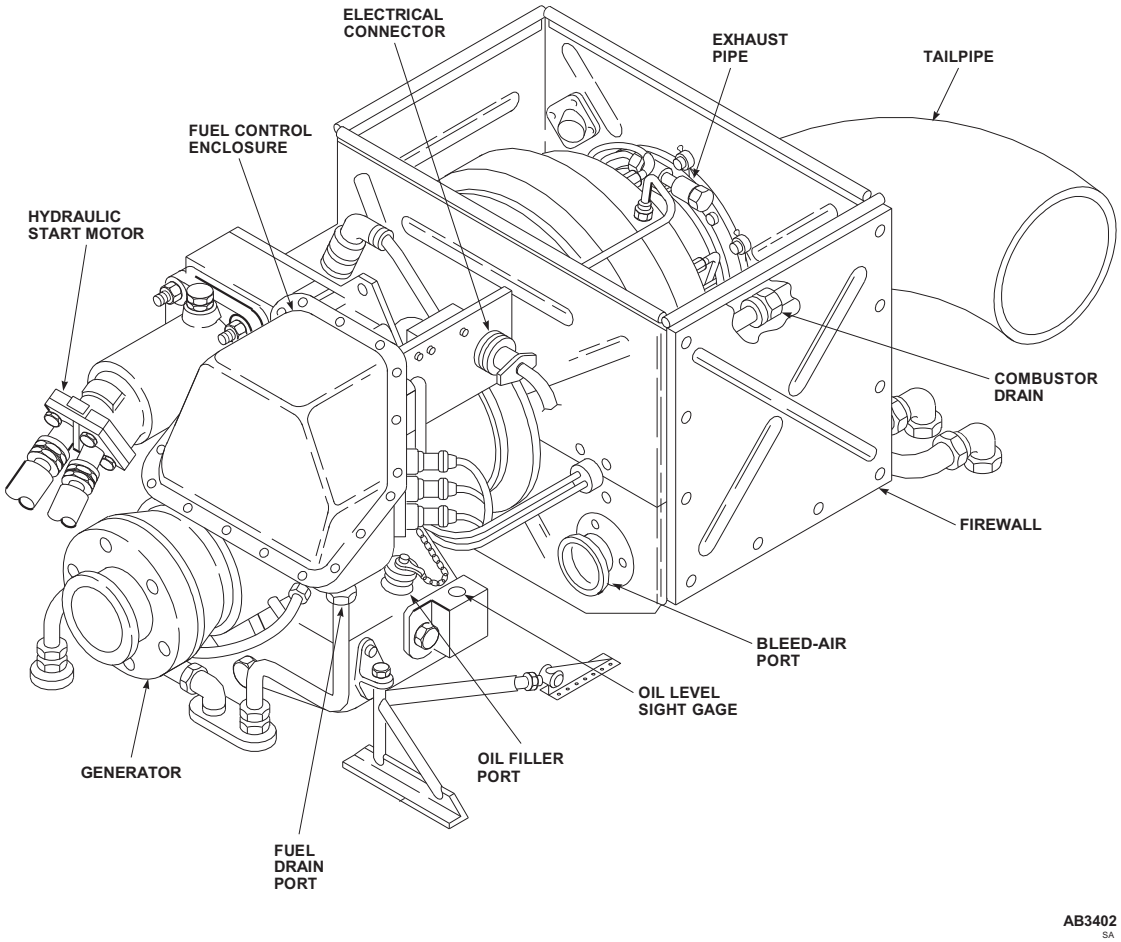


Figure 1. APU Installed.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

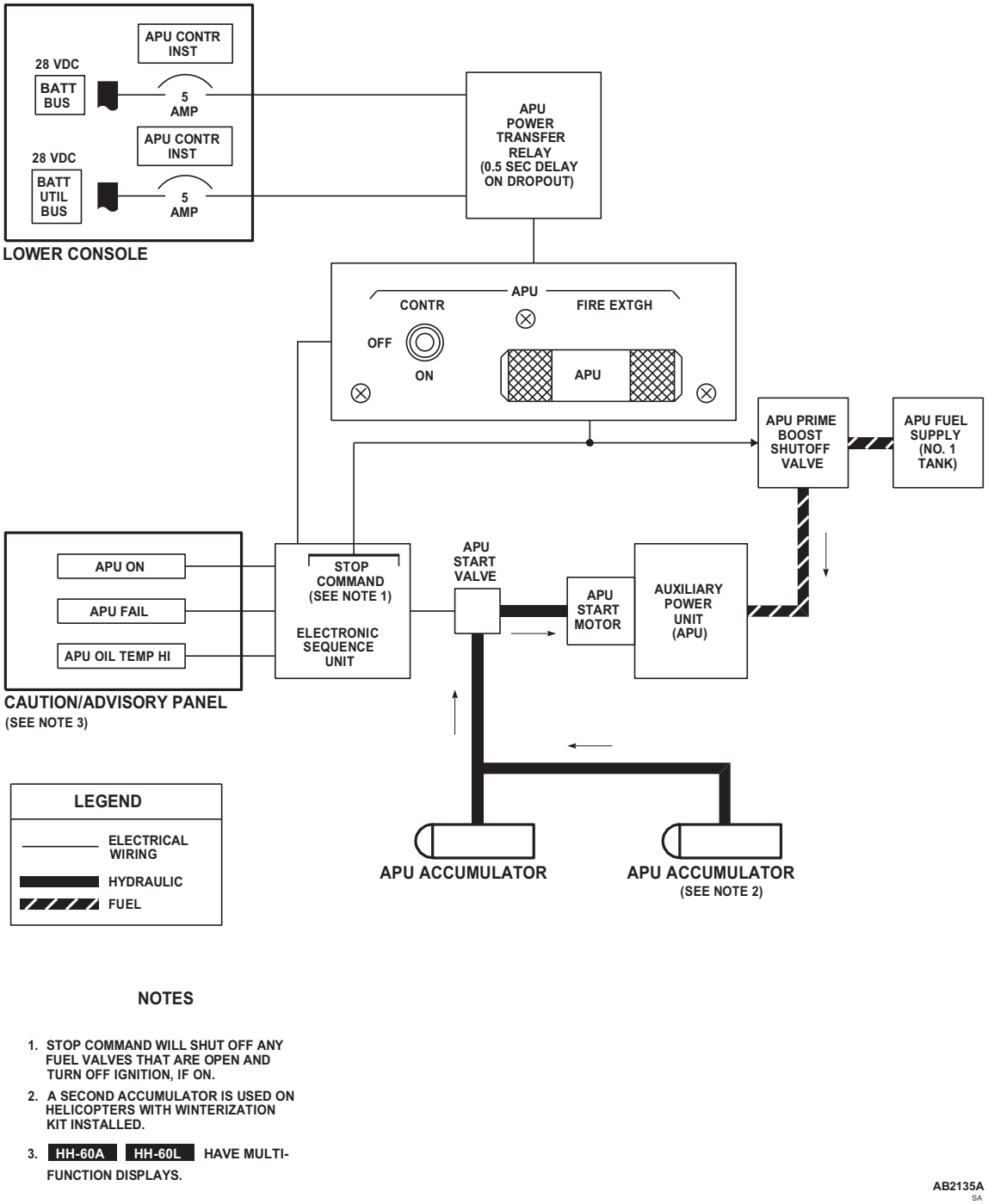


Figure 2. APU Simplified Block Diagram.

AUXILARY POWER SYSTEM OPERATION

Power of 28 vdc for the APU system is supplied by both the battery bus and the battery utility bus through circuit breakers both identified as APU CONTR INST on the lower console. The APU is started with the APU CONTR ON/OFF switch on the upper console. Placing the switch ON sends a 28 vdc start signal, through the APU T-han-

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

dle switch, to the Electronic Sequence Unit (ESU). Initially, this signal comes from the battery bus through one of the circuit breakers and in the left relay panel through diode CR1 to the APU CONTR switch. However, during switch over from battery power to either external power or the helicopter's main engine generators or APU generator, the battery bus is momentarily de-energized. This condition would cause the APU to shut down because of loss of the start signal. To prevent inadvertent drop out of the APU, relay K47, in the left relay panel, has a 0.5 second time delay at dropout. Contacts A1 and A2, previously closed, will remain closed during the bus switch over, allowing 28 vdc from the battery utility bus to be applied through diode CR2 to the APU CONTR switch through the other circuit breaker to maintain the start signal connection.

If, on helicopters with APU ESU 160200-201, APU failure is caused by a momentary power interruption, restoration of power before the APU coasts down to a full stop causes the ESU to reset and the APU fuel valves to recycle according to the APU speed existing when power is restored. Excessive fuel can thus flow, causing a hazardous condition in the APU compartment. On helicopters with APU ESU, 160200-600, restoration of power after a momentary interruption will cause the ESU to prevent an APU restart, allowing it to coast down to a full stop. The ESU cannot initiate a restart until the APU CONTR switch is first placed OFF and then ON.

When the start signal is applied to the ESU, the ESU in turn sends a signal that opens the APU hydraulic start valve, releasing the hydraulic accumulator charge. This charge turns the APU hydraulic start motor and starts the APU compressor and fuel pump rotating. When the APU reaches 90% speed plus 1.5 seconds, the maximum fuel solenoid valve opens, allowing the fuel control governor to control fuel flow. As the unloaded APU continues to accelerate to 103% speed, the APU ACCUM LOW capsule on the caution/advisory panel or legend on multifunction display will go on. During the start and operation, the start bypass valve allows some APU bleed-air to escape, to prevent a possible compressor stall. The start bypass valve is closed (not allowing any bleed-air to escape) whenever either engine is started by placing the AIR SOURCE HEAT/START switch to APU. If the APU fails, it will shut down automatically and the reason for shutdown will show on APU ESU BITE indicators. If the APU fire detector/fuel shutoff selector T-handle is pulled, the APU prime/boost shutoff valve will close; a stop command signal is sent to the ESU, shutting off any fuel valves and ignition; and then the APU will shut down (Figure 3. (Sheet 1 of 2) and Figure 4. (Sheet 1 of 2)).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

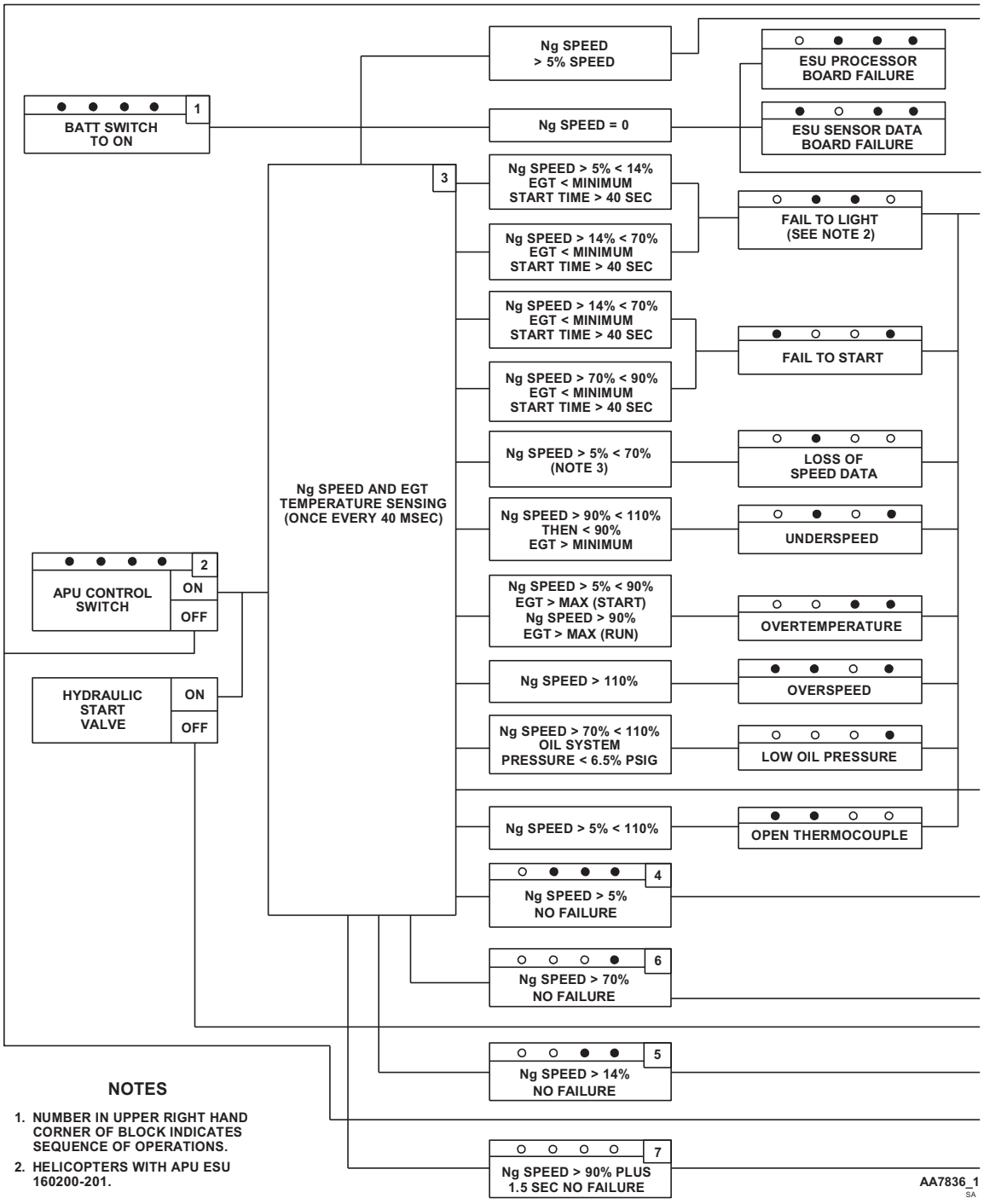


Figure 3. APU System Sequence Chart (Sheet 1 of 2).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

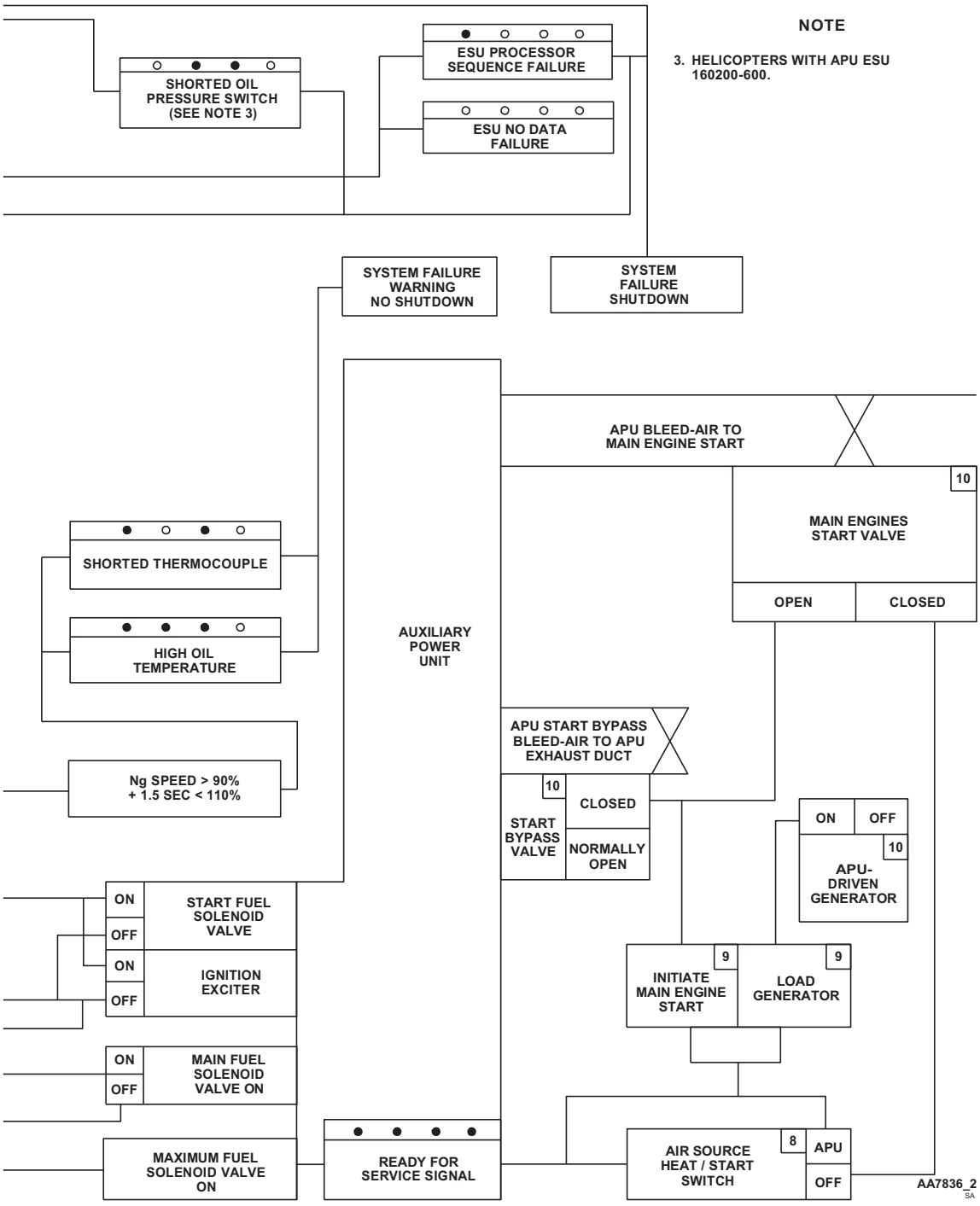


Figure 3. APU System Sequence Chart (Sheet 2 of 2).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

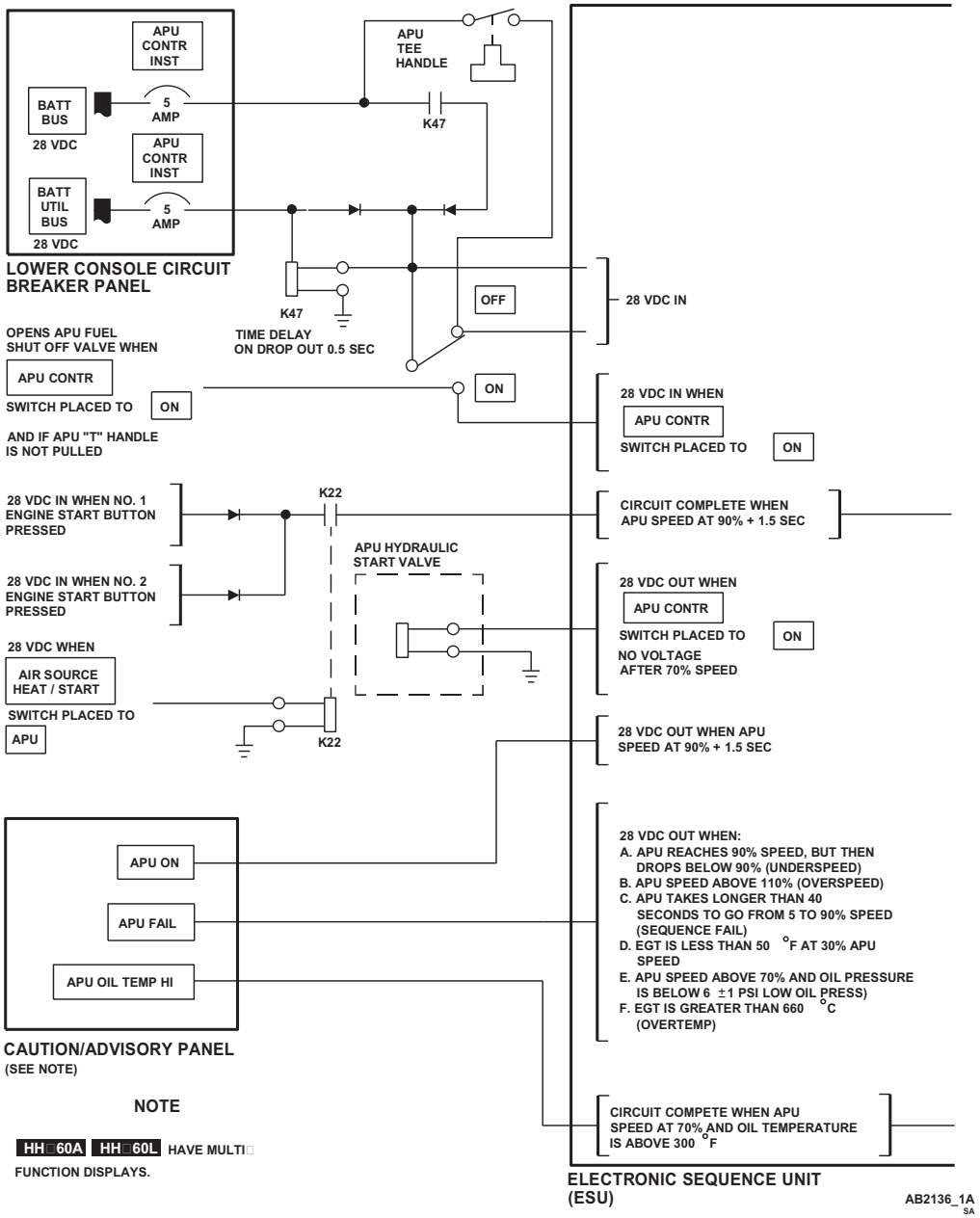


Figure 4. APU System Block Diagram (Sheet 1 of 2).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

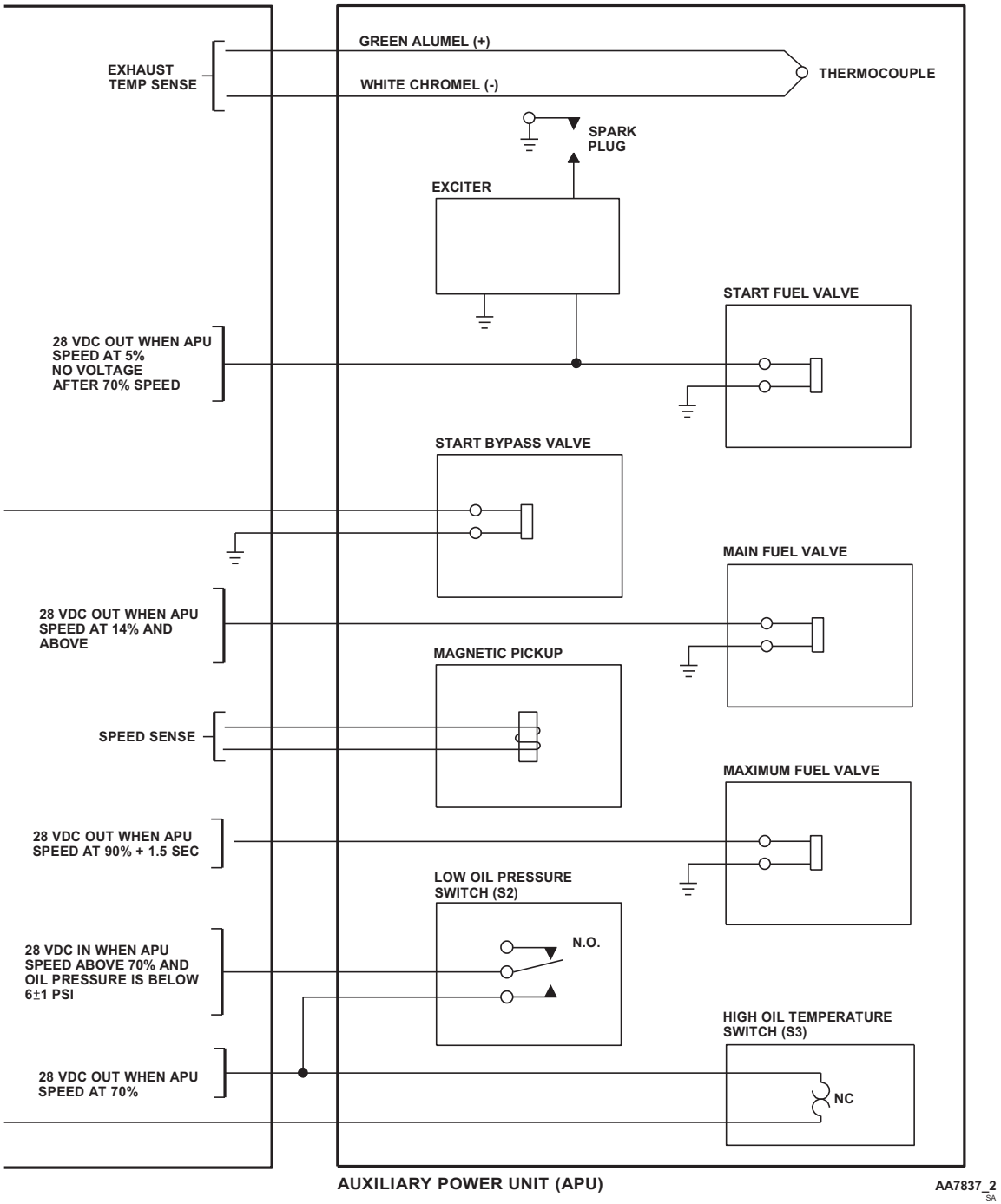


Figure 4. APU System Block Diagram (Sheet 2 of 2).

Placing the GENERATORS APU switch ON will supply electrical power to the helicopter systems, and the APU GEN ON capsule or legend will be on. With electrical power being supplied by the APU generator, the hydraulic backup pump will automatically recharge the APU accumulator. When the APU accumulator is fully recharged, the backup pump will shut off automatically and the APU ACCUM LOW capsule or legend will go off.

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

For location and description of major components, refer to the data in this work package.

EQUIPMENT DATA

If applicable, refer to WP 1654 00, WP 1655 00, WP 1656 00, and WP 1707 00 for equipment data information.

ELECTRICAL SYSTEMS

AUXILIARY POWER UNIT DESCRIPTION AND DATA

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

AUXILIARY POWER UNIT, MODEL 116305-100 THROUGH 116305-300 SERIES

The auxiliary power unit (APU), model 116305-100 through 116305-300 series, consists of a gas turbine power section, a reduction gear drive, and appropriate controls and accessories.

The gas turbine power section uses a single centrifugal compressor and a single-stage radial inflow turbine mounted back-to-back on the end of the high speed shaft. The shaft is supported on two bearings mounted in the air inlet housing. Air flowing through the inlet screen over the bearings to the compressor promotes long bearing and bearing lubricant life. Power extracted from the turbine drives the compressor and high speed output shaft. The combustor is an annular type with six air-atomizing fuel injection points. Ignition is done with a separate pressure atomizing fuel nozzle and a spark plug. Once ignition and combustion is completed, a purge valve on top of the compressor allows compressor discharge pressure (Pcd) to bleed through the fuel nozzle, to continuously keep it clean for the next start.

A high speed pinion gear and shaft connected to the main rotor shaft provides the input to the reduction gear drive. The pinion is supported by the three planetary gears. An internal ring gear which fits over the three planetary gears reduces turbine shaft speed of 61,565 RPM to an output speed to the axial pad of 12,000 RPM. A set of gears extending from the output shaft are used to drive the accessory pads on the gear box upper section at 4235 and 8229 RPM. The lubrication pump, built into the gear box, is also driven by this accessory gear system. The accessory gear box provides pads for an ac generator, start motor, and a fuel control assembly. A magnetic pickup on the accessory gear box senses speed by measuring speed of the fuel control gear teeth.

The fuel system consists of a fuel pump and a control assembly (Figure 3). The fuel pump is protected by a 10-micron inlet filter. The control assembly is protected by a 25-micron filter. A hydromechanical governor and metering valve control fuel flow to the engine during ignition, and once it has accelerated to operating speed. An electronic sequence unit (ESU) provides for APU shutdown after turbine overspeed, under-speed, high exhaust temperature, low oil pressure, loss of electrical power, or sequence failure.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

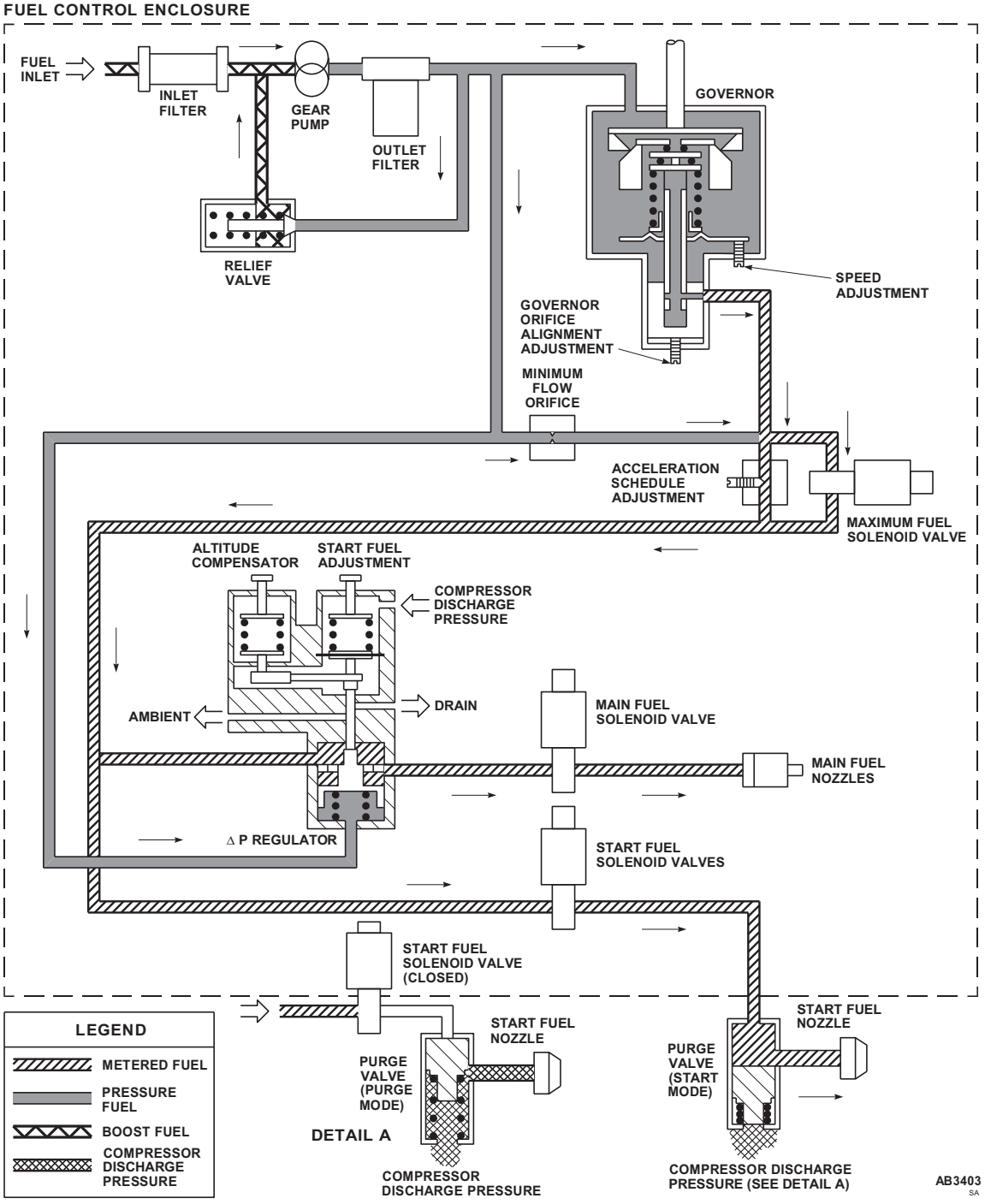


Figure 1. APU Fuel Control Schematic Diagram.

AUXILIARY POWER UNIT, 3800480-1 AND 3800480-2

The 3800480-1 and 3800480-2 (BH) auxiliary power unit (APU) is designed to provide pneumatic and shaft power. Pneumatic power is for main engine start (MES) and environmental control systems (ECS) operations. Shaft power drives an electrical generator mounted on the gearbox assembly of the APU.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

The APU consists of three major sections; the power section assembly, gearbox assembly and the controls and accessories (Figure 2. (Sheet 1 of 2)).

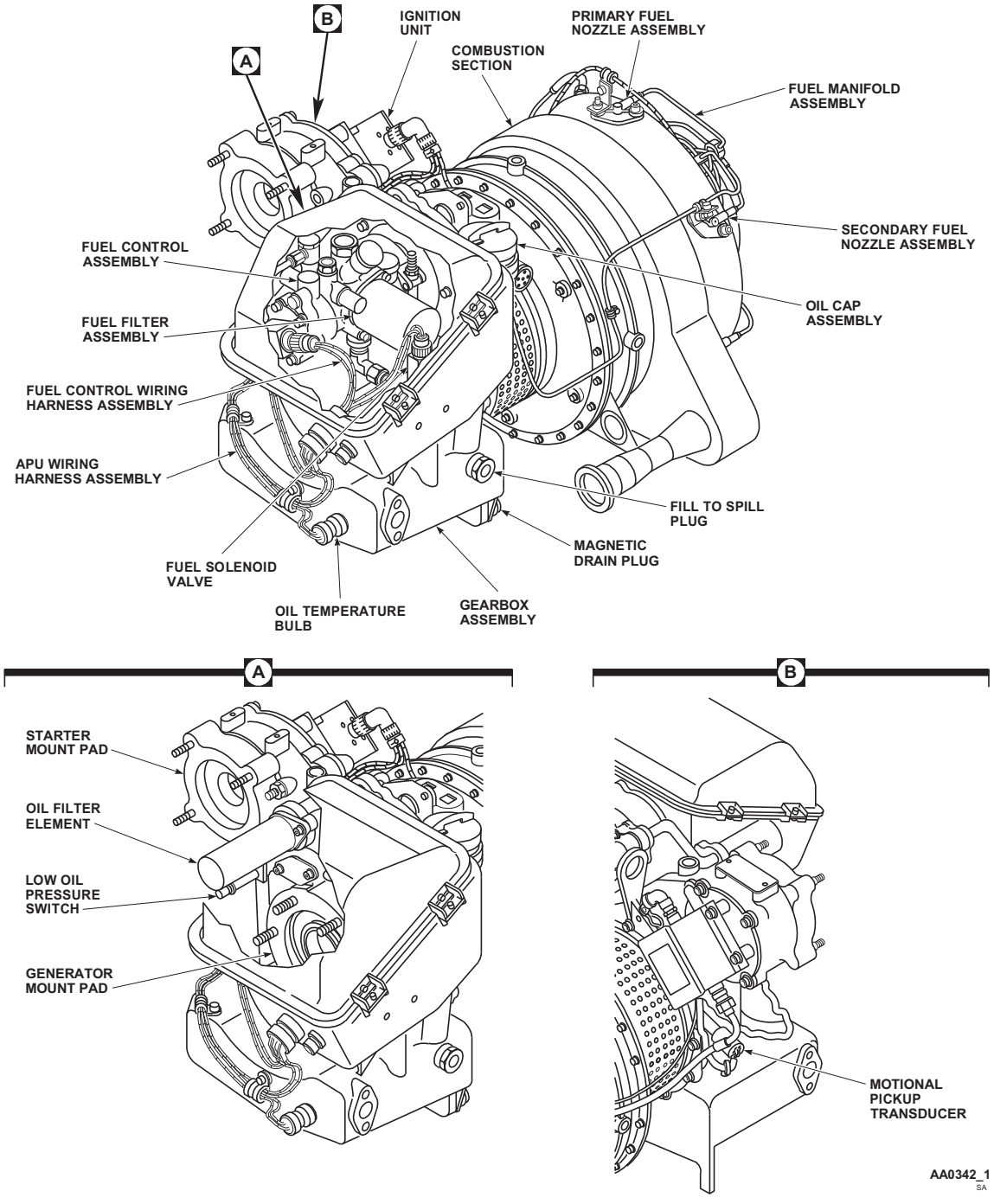


Figure 2. APU, 3800480-1 and 3800480-2 (Sheet 1 of 2).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

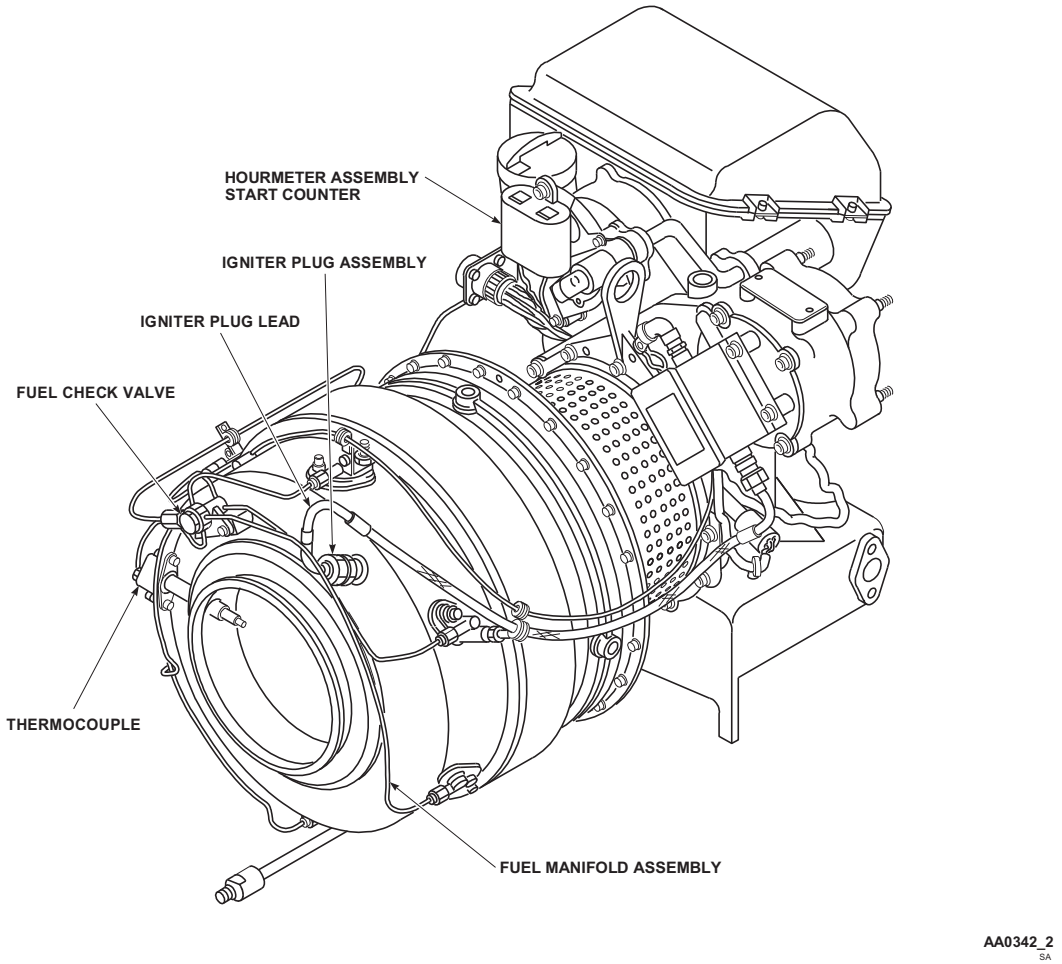


Figure 2. APU, 3800480-1 and 3800480-2 (Sheet 2 of 2).

The power section assembly is comprised of integrated compressor, combustion, and turbine sections. The integrated compressor utilizes a centrifugal impeller and diffuser to provide the compressed air for combustion and bleed air purposes. Compressed air is contained by the compressor assembly housing and is directed into the annular combustion chamber and to the bleed air outlet port when bleed air flow is utilized. Fuel is introduced into the combustion chamber and combined with compressed air then ignited, which creates the hot gas flow that drives the turbine. The turbine section utilizes a turbine nozzle to increase the hot gas flow velocity and direct it against the blades of a turbine wheel. The hot gasses transmit energy into the turbine wheel and are discharged after passing through the turbine wheel.

The gearbox assembly houses the reduction geartrain that reduces the output rotational speed of the power section assembly to the speeds necessary for operation of accessories and customer furnished equipment. Output pads are provided for mounting a generator and starter. The shaft speeds are 12,000 RPM for the generator and 8190 RPM for the starter at 100 percent APU operation speed.

The controls and accessories section includes those elements required for proper APU operation: electronic sequencing unit (ESU), fuel system, lubrication system and ignition system. The APU is equipped with a fully-automatic control system that properly sequences control of fuel and ignition during starting and operation. All APU speed control, switching and protection functions are done through the ESU which is mounted separately from the APU. APU speed is regulated by an ESU signal to the fuel control torque motor assembly that provides delivery of the correct amount of fuel regardless of ambient conditions and load requirements. Overspeed protection is provided by an electronic overspeed switch that is automatically actuated, if required.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

The fuel system contains components (Figure 3) which function automatically to provide proper starting and acceleration and to maintain constant APU speed under all operating conditions. Components of the fuel system are: fuel filter assembly, fuel control assembly, fuel solenoid valve, fuel manifold assembly, fuel check valve and three primary/three secondary fuel nozzle assemblies.

The lubrication system provides lubrication for all gears, shafts and bearings within the APU. The system oil pump maintains operating oil pressure. The lubrication system consists of an oil pump, oil filter element, low oil pressure switch, oil temperature bulb, magnetic drain plug, fill to spill plug and oil fill cap with dip stick.

The electrical system provides automatic actuation in proper sequence of the circuits which control APU starting, ignition, acceleration, fuel flow and monitoring. Components of the electrical system includes the ignition unit, igniter plug lead, igniter plug assembly, motional pickup transducer, hourmeter assembly, thermocouple, APU wiring harness assembly and fuel control wiring harness assembly.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

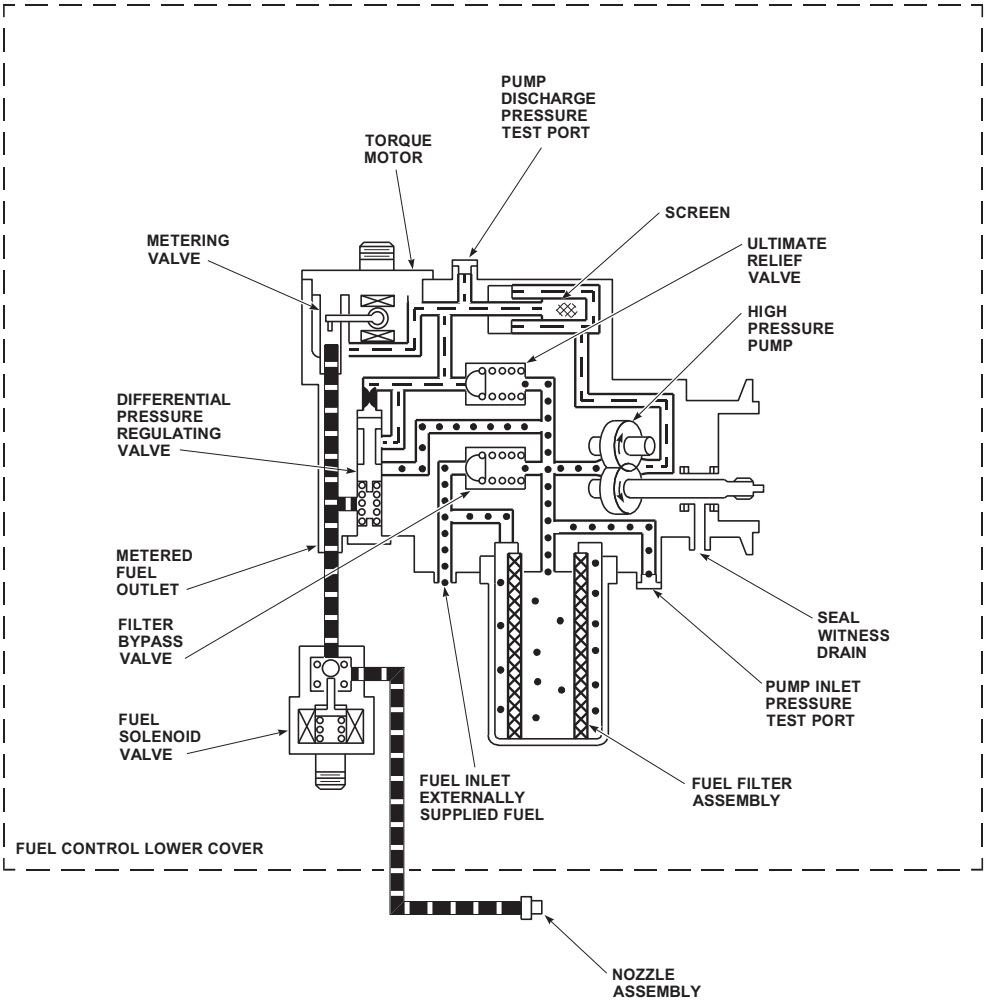


Figure 3. APU, 3800480-1 and 3800480-2, Fuel Control Assembly Schematic Diagram.

AUXILIARY POWER UNIT CONTROLS

The APU controls, on the upper console, consist of a control switch and a fire detector/fuel shutoff selector T-handle. The APU CONTR switch, with marked positions OFF and ON, controls the operation of the APU. Placing the switch to ON energizes the APU hydraulic start valve, setting it in the open position to release the APU accumulator hydraulic charge to the hydraulic start motor. The control switch receives electrical power from the battery bus

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

through the circuit breaker marked APU CONTR INST on the lower console. The fire detector/fuel shutoff selector T-handle, marked APU, warns the pilot/copilot of a fire in the APU compartment, and arms the extinguishing system. When pulled, the T-handle de-energizes the prime/boost pump and APU prime/boost shutoff valve and energizes the control valve and arming system in the fire extinguishing module. The T-handle microswitch receives electrical power from the battery utility bus through the circuit breaker marked FIRE EXTGH on the lower console.

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

For location and description of major components, refer to the data in this work package.

EQUIPMENT DATA

If applicable, refer to WP 1654 00, WP 1655 00, WP 1656 00, and WP 1707 00 for equipment data information.

MISSION EQUIPMENT

ARMAMENT DESCRIPTION AND DATA

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

M-60D MACHINE GUN WITH MOUNT, AND M4 RIFLE WITH MOUNT DESCRIPTION

The armament consists of an M-60D, 7.62 millimeter machine gun installed at each gunner's window (Figure 1. (Sheet 1 of 2)). The machine gun is pintle-mounted and held in place by a quick-release pin for easy removal and use on the ground. The machine gun can also be stored in the helicopter. An ammunition can is on the left side and an ejector control bag for spent cartridges is on the right side of the installed gun. Complete instructions for the gunner are in the operator's manual TM 1-1520-237-10.

Two M4, 5.56 millimeter rifles are stored aft of the center console. The rifles are clamp mounted for easy release and use on the ground. Complete instructions for the aircrew's use of the M4 rifle are in the operators's manual TM 9-1500-319-10. The M4 Mount Assembly consists of two brackets positioned horizontally in the aircraft, held together by an I-Beam. Each M4 Bracket holds one M4 Rifle. A flash suppressor restraint is mounted at the AFT end of the assembly for each rifle and the safety of the aircraft occupants.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

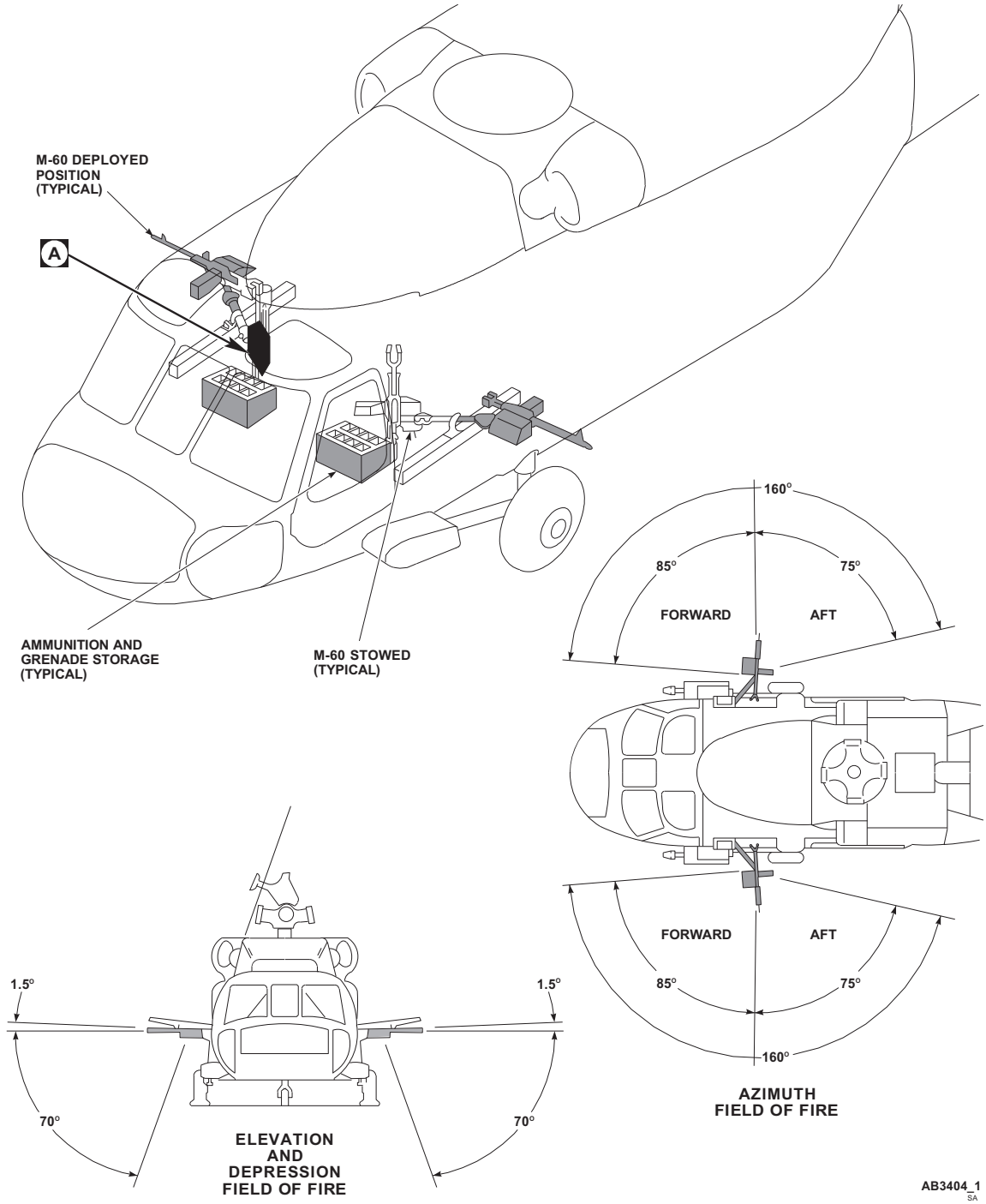


Figure 1. Armament (Sheet 1 of 2).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

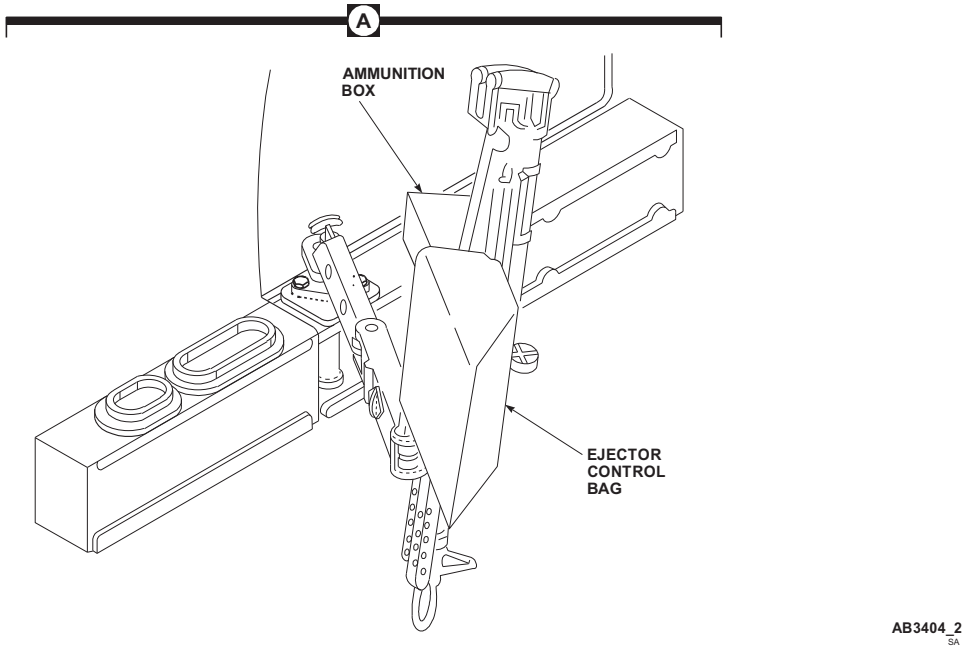


Figure 1. Armament (Sheet 2 of 2).

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

For location and description of major components, refer to the data in this work package.

EQUIPMENT DATA

Not applicable.

ELECTRICAL SYSTEMS

AEROMEDICAL EVACUATION KIT DESCRIPTION AND DATA

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

MEDEVAC KIT DESCRIPTION

A medevac kit consisting of a litter support assembly and provisions for three rear-facing troop seats may be installed in the cabin after removing the existing troop seats. The medevac litter support assembly, when installed, is directly below the main transmission. The support consists of a central pedestal which can be turned about a vertical axis. Four litter supports are cantilevered from the pedestal. There are three possible configurations with variations within each. These are the FOUR-MAN LITTER, the six-man AMBULATORY, and the SIX-MAN LITTER. In the Four-Man Litter configuration, rotation of the central pedestal permits four litter patients to be loaded from either side of the helicopter. For the Six-Man AMBULATORY, the upper litter support is lowered (from the FOUR-MAN LITTER position) to accommodate three patients seated side by side on each side of the pedestal. With the SIX-MAN LITTER arrangement, both litter supports are moved upward to provide clearance for two litters to be placed on the floor, one on each side of the pedestal, beneath the litter supports. These floor litters are held in place by restraints and tiedowns. The pedestal cannot be rotated unless litters are removed, and restraint tubes are rotated out of the way. Upper litter supports are capable of being tilted for loading or unloading litter patients. The medevac kit is positioned along the longitudinal axis of the helicopter for flight, to allow full attention of the patients by the medic. The central pedestal also contains belts for each litter support, belt provisions for ambulatory patients, provisions for eight 1000 ml. intravenous fluid bags, and provisions for two oxygen bottles.

LITTER LIGHTING

Two litter lights are installed in the pedestal at each litter. Each light contains a PUSH-ON, PUSH-OFF switch. The positioning of those lights is adjustable. Power to operate the litter lights is from the No. 1 and No. 2 dc primary buses through circuit breakers on the mission readiness circuit breaker panel, marked No. 1 LTR LTS and No. 2 LTR LTS. The lights are operated from a split bus to provide one light at each litter in case of a single dc primary bus failure. The three-main rear-facing seat provisions are in the forward portion of the cabin, and accommodate standard troop seats.

ELECTRICAL POWER

There is also a 115 vac, 60 Hz frequency converter to provide electrical power for use of standard hospital equipment. On missions not requiring electrical power, the power pack may be left out.

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

For location and description of major components, refer to the data in this work package.

EQUIPMENT DATA

Not applicable.

ELECTRICAL SYSTEMS

BLACKOUT DEVICES KIT DESCRIPTION AND DATA

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

BLACKOUT DEVICES KIT DESCRIPTION

Curtains are provided to cover the cabin windows and the opening between the pilot's compartment and the cabin. Velcro tape is bonded to the cabin structure and the curtains with an adhesive. Loops are attached to the curtains to make removal easy.

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

For location and description of major components, refer to the data in this work package.

EQUIPMENT DATA

If applicable, refer to WP 1424 00, WP 1425 00, WP 1426 00, WP 1427 00, WP 1428 00, for equipment data information.

ELECTRICAL SYSTEMS

WINTERIZATION KIT DESCRIPTION AND DATA

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

WINTERIZATION KIT DESCRIPTION

The winterization kit consists of an extra accumulator and time-delay relay for the APU start system. The kit is installed for easier cold weather starting between -25° and -65°F. The existing accumulator is not removed when the winterization kit accumulator is installed. The extra time-delay relay allows the backup hydraulic pump to charge the accumulators for an additional 90 seconds, making the total run-time of 180 seconds when the kit is installed. The winterization kit accumulator supplies extra hydraulic charge to the APU start motor during cold weather operation. The winterization kit accumulator is identical to the accumulator already installed. Both accumulators are mounted on the APU start valve (Figure 1). Both accumulators are serviced with nitrogen at a common servicing point. In case of either accumulator malfunctioning, the other accumulator will continue to operate normally. The winterization kit accumulator is precharged with nitrogen to 1450 psig at 70°F and then pressurized hydraulically to 2700 to 3100 psig. When starting the APU, both accumulators are discharged at the same time. A winterization kit time-delay relay is wired in series with the APU accumulator time-delay relay in the right relay panel. This ensures that the backup pump will run long enough for both accumulators to be recharged hydraulically.

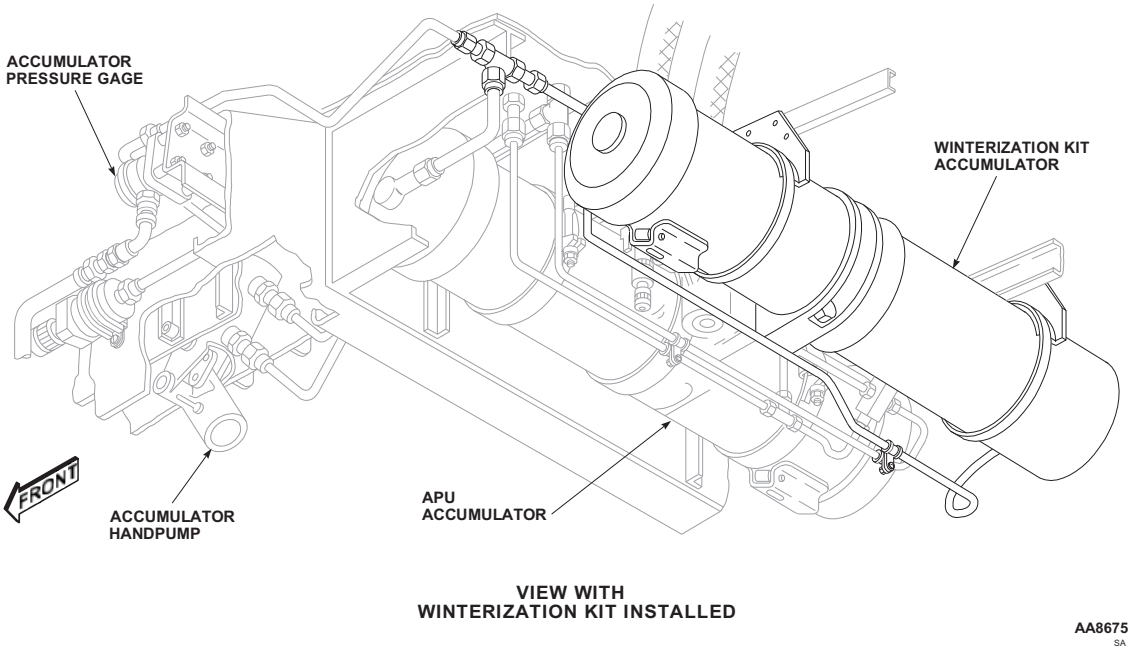


Figure 1. Winterization Kit Accumulator.

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

For location and description of major components, refer to the data in this work package.

EQUIPMENT DATA

If applicable, refer to WP 1656 00 for equipment data information.

ELECTRICAL SYSTEMS

ESSS EXTERNAL STORES SUPPORT SYSTEM DESCRIPTION AND DATA

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

ESSS EXTERNAL STORES SUPPORT SYSTEM DESCRIPTION ESSS>

The external stores support system (ESSS) consists of fixed provisions attachment fittings on bulkheads at stations 295.0 and 304.0, and removable provision horizontal stores supports (HSS) which hold the vertical stores pylons (VSP) at buttlines 80.0 and 112.0. The HSS is held in position by two supports. The HSS, support struts, and ejector rack adapters on the VSP are secured with quick-release expandable bolts.

The HSS consists of a graphite epoxy box beam to which attachment fittings are bolted and bonded. Its fairings are made of aluminum. Fuel and pneumatic hoses and components are clamped to the rear side of the HSS, while electrical harnesses are routed on the front side. Each HSS has its own position light mounted on the tip cap.

The horizontal stores support struts are graphite epoxy with aluminum fairings, and have a clevis at the lower end. The forward clevis is adjustable.

Vertical stores pylons consist of ejector rack adapters, ejector racks, and aluminum fairings. MAU-40/A ejector racks are mounted on the inboard (buttline 80) VSP, while BRU-22A/A ejector racks are mounted on the outboard (buttline 112) VSP.

Fixed provisions are made on the helicopter for fuel transfer hoses for external range extension tanks, and jettison system.

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

For location and description of major components, refer to the data in this work package.

EQUIPMENT DATA

Not applicable.

ELECTRICAL SYSTEMS

ESSS RANGE EXTENSION SYSTEM DESCRIPTION AND DATA

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

ESSS RANGE EXTENSION SYSTEM DESCRIPTION ESSS> <

The ESSS range extension system provides additional fuel from external fuel tanks to extend the range of the helicopter's mission (Figure 1. (Sheet 1 of 2) and Figure 1. (Sheet 2 of 2)). The external range extension system fuel tanks are supported by the two vertical support pylons (VSP) on each horizontal stores support (HSS). A jettisonable 450-gallon tank is installed on each inboard VSP, while a jettisonable 230-gallon tank is installed on each outboard VSP. For a description of the ESSS jettison system operation, refer to WP 0058 00. With the use of engine bleed-air, the ullage space in the external tanks can be pressurized. This will allow fuel transfer from the external tanks to the main fuel tanks. Fuel lines carrying fuel to the main fuel tanks contain check valves to prevent back flow. Bleed air lines incorporate check valves which eliminate the backflow of the fuel vapor into the pneumatic/bleed air system. The range extension system does not supply fuel directly to the engines, but does replenish the fuel in the main tanks through the right main tank. The external tanks can only be gravity refueled. Defueling the tanks can be done by either the gravity method through the sump drain valve; or the suction method, by inserting a hose into the refuel port.

The external range extension fuel transfer and quantity systems consist of the fuel management control panel on the aft portion of the lower console, a fuel low-level sensor in each external fuel tank, a fuel temperature transducer, a fuel flow transmitter (analog signal), a right external tank fuel flow sensor (discrete signal), and a left external tank fuel flow sensor (discrete signal), all on the fuel flow sensor panel above the main fuel tanks; a fuel overflow sensor (discrete signal); a right inboard bleed-air regulator valve, right outboard bleed-air regulator valve, right inboard shutoff gate valve, and a right outboard shutoff gate valve on the right HSS; and a left inboard bleed-air regulator valve, left outboard bleed-air regulator valve, left inboard shutoff gate valve, and a left outboard shutoff gate valve on the left HSS. The external range extension fuel transfer and quantity systems functionally interface with the main tank fuel quantity system, the caution/advisory warning system, left drag beam switch through the ground sense relay in the left relay panel, and console and indicator lighting systems.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

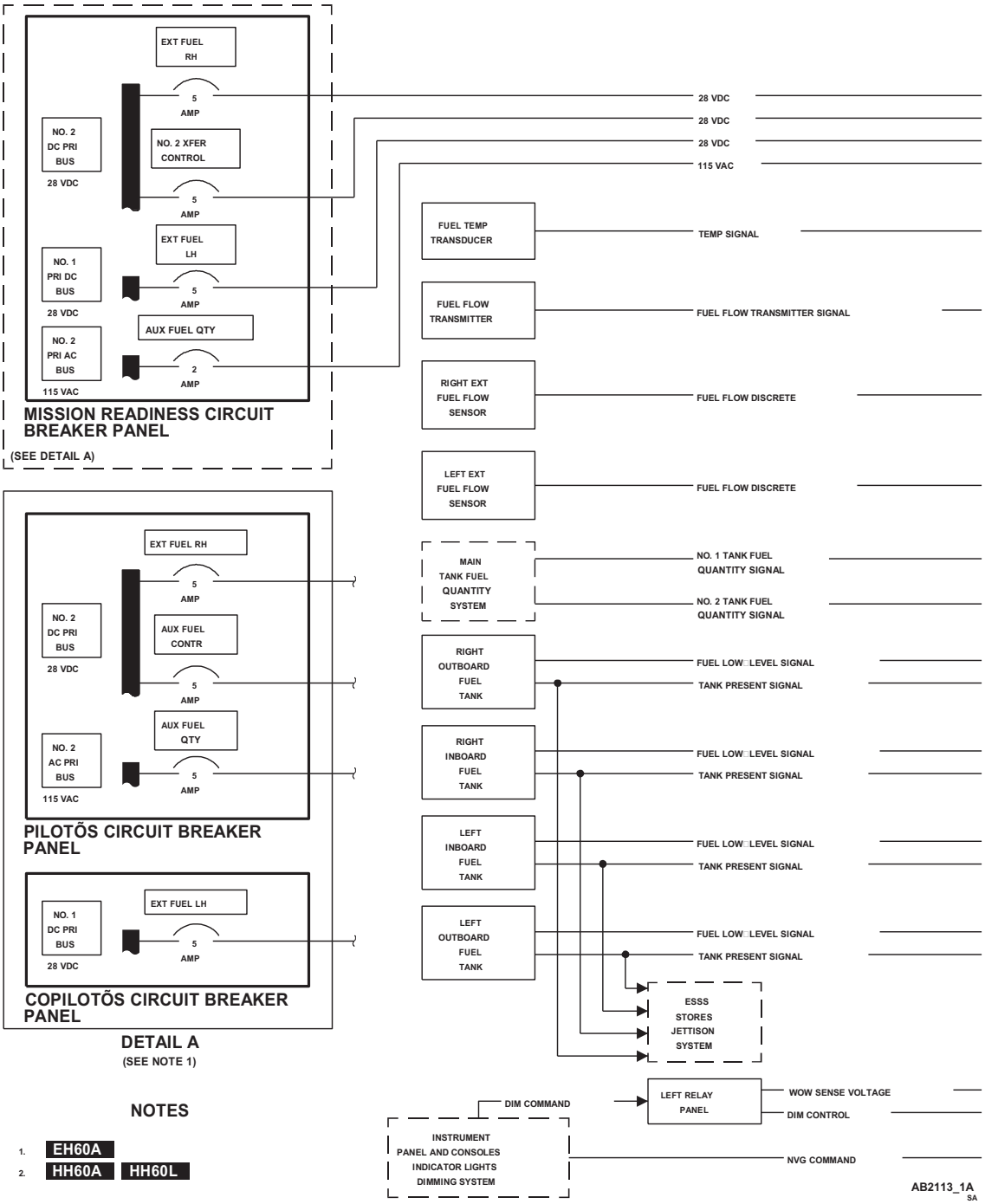


Figure 1. External Stores Support System Range Extension System Block Diagram (Sheet 1 of 2).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

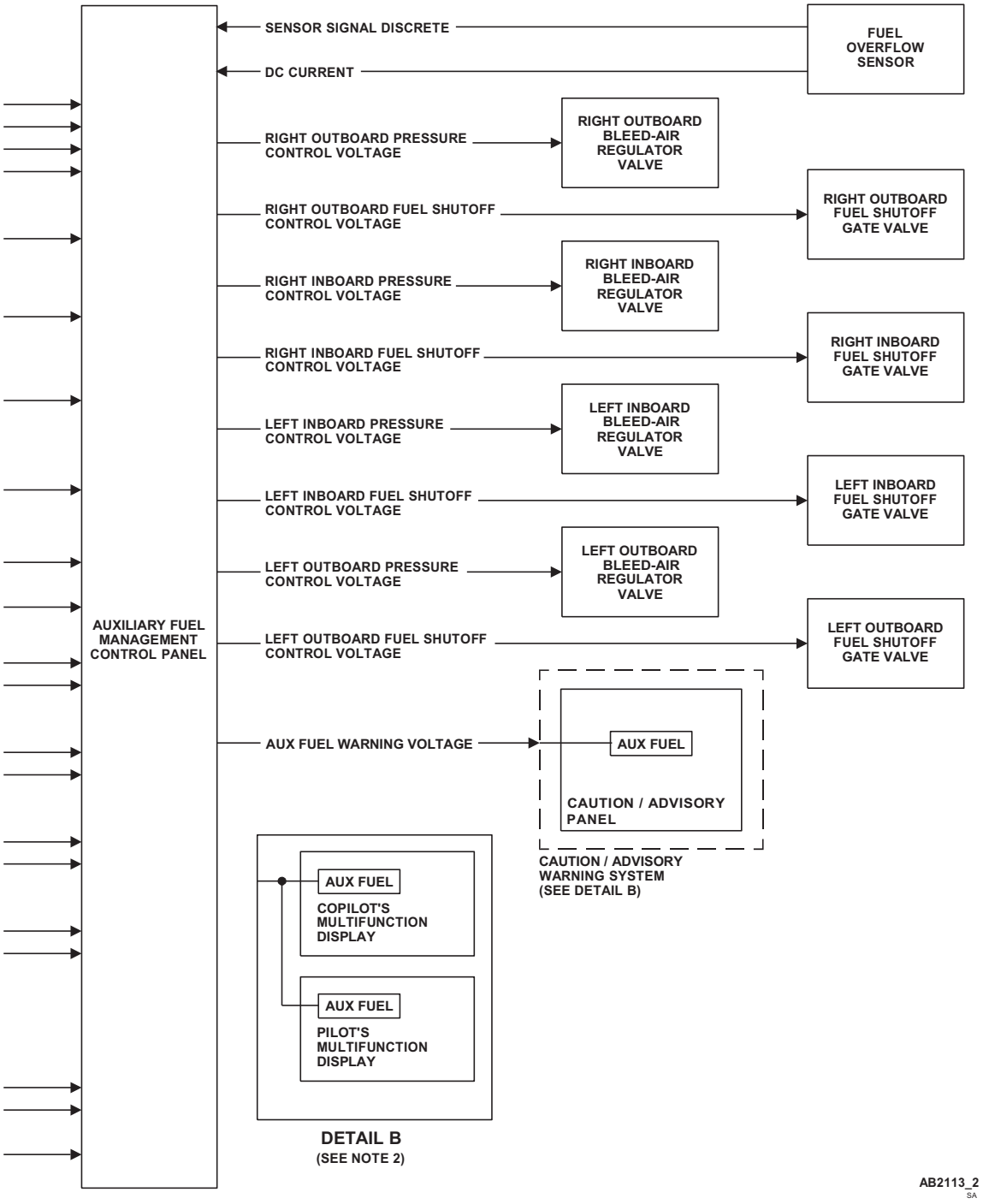


Figure 1. External Stores Support System Range Extension System Block Diagram (Sheet 2 of 2).

RANGE EXTENSION SYSTEM POWER DISTRIBUTION

UH-60A UH-60L HH-60A HH-60L > The ESSS range extension system receives ac and dc electrical power from the mission readiness circuit breaker panel. The 115 vac electrical power is supplied by the No. 2 ac primary bus through the AUX FUEL QTY circuit breaker. The 28 vdc electrical power is supplied by the No. 1 dc primary bus

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

through the EXT FUEL LH circuit breaker, and by the No. 2 dc primary bus through the EXT FUEL RH and No. 2 XFER CONTROL < EH-60A > or AUX FUEL CONTR < circuit breakers.

AUXILIARY FUEL MANAGEMENT CONTROL PANEL DESCRIPTION ESSS W/O MWO 50-78> <

The AUXILIARY FUEL MANAGEMENT control panel contains all controls for operating the internal (provisional) and external range extension fuel transfer and quantity indicating systems. Only the description of the controls for external range extension functions are listed in Table 1

AUXILIARY FUEL MANAGEMENT CONTROL PANEL OPERATION

Refer to Table 1 for panel operation.

Table 1. Auxiliary Fuel Management Control Panel Functions.

CONTROL/INDICATOR	FUNCTION
FUEL XFR	Controls for fuel management of external range extension systems.
PRESS OUTBD switch	
ON	Opens bleed-air regulator valves to outboard tanks for pressurization.
OFF	Closes bleed-air regulator valves to outboard tanks, allowing fuel tanks to automatically pressurize.
PRESS INBD switch	
ON	Opens bleed-air regulator valves to inboard tanks for pressurization.
OFF	Closes bleed-air regulator valves to inboard tanks, allowing fuel tanks to automatically pressurize.
TANKS switch	
INBD	Enables shutoff gate valves from inboard tanks to open when selected for fuel transfer to main tanks; closes outboard shutoff gate valves.
OUTBD	Enables shutoff gate valves from outboard tanks to open when selected for fuel transfer to main tanks; closes inboard shutoff gate valves.
MODE switch	Selects mode of fuel transfer from external tanks.
AUTO	Enables automatic fuel transfer to the main tanks from the selected pair of external tanks, until the empty sensor in each external tank interrupts transfer, or until both main tanks contain about 1000 pounds of fuel.
OFF	Disables automatic and manual fuel transfer.
MANUAL	Enables manual fuel transfer to the main tank from the selected external tank/tanks until main tank fuel high level shutoff valve closes (1150 pounds), manual transfer tank select switches are turned OFF, or MODE switch is placed to AUTO or OFF.
MANUAL XFR RIGHT switch	

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

Table 1. Auxiliary Fuel Management Control Panel Functions. – Continued

CONTROL/INDICATOR	FUNCTION
ON	Select manual fuel transfer from right selected tank.
OFF	Interrupts manual fuel transfer from right selected tank.
MANUAL XFR LEFT switch	
ON	Selects manual fuel transfer from left selected tank.
OFF	Interrupts manual fuel transfer from left selected tank.
AUX FUEL QTY POUNDS Digital Display	Indicates, in POUNDS, the amount of auxiliary fuel remaining in symmetrical pairs of tanks, or total auxiliary fuel remaining, as selected by AUX FUEL QTY switch. With AUX FUEL QTY switch placed to CAL, display indicates information needed by maintenance personnel to preset K FACTOR value shown on fuel flow transmitter identification plate into control panel.
AUX FUEL QTY switch	
OUTBD	Selects display of total fuel remaining in outboard pair of tanks.
INBD	Selects display of total fuel remaining in inboard pair of tanks.
TOTAL	Selects display of total fuel remaining in all external tanks.
CAL	Used by maintenance personnel when presetting K FACTOR value, shown on the fuel flow transmitter identification plate, into the control panel.
INCR-DECR switch	Increases/decreases digital display for setting auxiliary fuel remaining and K FACTOR of fuel flow transmitter. Switch function is disabled in flight.
STATUS switch	Resets AUX FUEL caution capsule. Also resets and stores condition of NO FLOW and EMPTY indicators.
TEST switch	Initiates self-test routine. During the test routine the digital display will indicate a good or an error code.
DEGRADED Indicator	Indicates malfunction in a critical function has occurred.
EXTERNAL Indicators	
RIGHT NO FLOW	Indicates no fuel flow from selected right tank.
RIGHT INBD EMPTY	Indicates right inboard tank fuel is exhausted.
RIGHT OUTBD EMPTY	Indicates right outboard tank fuel is exhausted.
LEFT NO FLOW	Indicates no fuel flow from selected left tank.
LEFT INBD EMPTY	Indicates left inboard tank fuel is exhausted.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

Table 1. Auxiliary Fuel Management Control Panel Functions. – Continued

CONTROL/INDICATOR	FUNCTION
LEFT OUTBD EMPTY	Indicates left outboard tank fuel is exhausted.
VENT SENSOR Indicators	
FAIL	Indicates an open fuel overflow sensor circuit.
OVFL	Indicates the presence of fuel in the overflow vent tube.

SELF-TEST

Pressing the TEST button on the auxiliary fuel management control panel initiates a system self-test routine. The self-test routine basically performs memory checksum; displays 8 sequentially in each digital display; verifies the temperature sensor is connected by checking for a temperature signal equivalent to -60° to 65°C; verifies fuel flow transmitter is connected by checking for an electrical ground or pulses from the meter; does a trial calculation based on a known temperature and flow transmitter input and compares this with a known good value; and checks the digital display and indicator lights. When the TEST button is pressed, the following occurs:

- With the TEST button is pressed, all control panel indicators go on and the digital display indicates 8888.
- When the TEST button is released, the digital display indicates the digit 8 in sequence from left to right three times.
- Then, the digital display indicates Good for about 5 seconds.
- The digital display indicates either 4, 5, or 8 (preset fuel type) in the left-most bit for about 3 seconds.
- The digital display indicates a value of auxiliary fuel remaining as selected by the AUX FUEL QTY selector switch.

If the test is successful, Good is displayed. If the test fails, one of the following codes is displayed:

- E01 Error with microprocessor.
- E02 Temperature sensor output out of range.
- E03 Flow transmitter not connected.
- E04 Error with fuel flow circuitry.
- E05 Error with fuel flow computation.
- E06 Error with memory.

When a test fails, the microprocessor is disabled from doing any further computation. If the test fails due to a malfunctioning temperature sensor input, the microprocessor can be placed in a degraded mode by doing two self-tests. In the degraded mode, a preselected value of temperature is used as a constant in all calculations. If the test fails because of a problem, and then the problem is corrected, doing a self-test will clear that error code. The fuel management control panel continuously does a memory checksum and verifies that the temperature sensor is connected by checking for temperature of -60° to 65° C. It also verifies that the fuel flow transmitter is connected by checking for an electrical ground or pulses from the transmitter.

AUTO TRANSFER

When the MODE switch is placed to AUTO, the system automatically transfers fuel to the main tanks from the selected pair of external tanks. Fuel transfer continues until the fuel level sensors in the auxiliary tanks detect low fuel level or the main fuel quantity system detects about 1000 pounds of fuel in both main tanks. When a fuel level sensor in the selected tank detects low fuel level and the transfer ceases, the corresponding NO FLOW and EMPTY legends go on along with the AUX FUEL capsule on the caution/advisory panel. Pressing the STATUS button resets the AUX FUEL indication and resets and stores the NO FLOW and EMPTY indications.

MANUAL TRANSFER

When the MODE switch is placed to MANUAL, fuel transfer begins immediately from the selected tanks. Manual transfer continues until the MANUAL XFR switches are placed OFF, the main tank high-level shutoff valve closes

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

(at approximately 1000 pounds), or the MODE switch is placed to AUTO or OFF. The NO FLOW, EMPTY, and caution/advisory AUX FUEL capsule operate and are reset as described in the auto transfer operation.

FUEL OVERFLOW SENSOR

The fuel overflow sensor is used to detect the presence of fuel in the vent tube. If fuel is detected, the sensor provides a signal to the auxiliary fuel management control panel to turn on the overflow (OVFL) indicator. This alerts the pilot that fuel is being dumped overboard.

The fuel sensor FAIL indicator is located above the OVFL indicator. This indicator will light when an open in the sensor dc current line is detected by the control panel. Neither of the above indicators are affected by the STATUS function of the control panel.

AUXILIARY FUEL MANAGEMENT PANEL (AFMP) **ESSS MWO 50-78>** **<**

The AFMP contains the electronic circuits, controls, annunciators, and displays for the following:

- Operation of the extended range fuel system (ERFS) in the automatic or manual transfer of fuel from external stores support system (ESSS) auxiliary fuel tanks to the main tanks.
- Display of fuel quantity in pounds to the nearest 10 pounds for each auxiliary fuel tank.
- Annunciation of the following conditions:
  - tank empty
  - no fuel flow
  - vent fail
  - vent overflow
  - imbalanced external stores
- Self-Test.

SELF-TEST

The following self-test functions of the ERFS are performed by built in test (BIT) circuits within the AFMP depending on operational conditions:

- Power up BIT (P-BIT) WOW only.
- Initiated BIT (I-BIT) WOW only.
- Continuous BIT (C-BIT) All operations following P-BIT or I-BIT.

P-BIT performs intrusive testing of operational circuits; thus P-BIT is performed only in non flight conditions with weight on wheels (WOW) enabled. The error codes are described as follows:

- E01 AFMP microprocessor fail.
- E02 AFMP memory fail.
- E03 AFMP display fail.
- E04 AFMP tank gauging electronics fail.
- E05 Auxiliary tank probe (open).
- E06 Auxiliary tank probe (short).
- E07 Attitude sensor input fail.

Error codes E01, E02, and E03 are displayed continuously if activated (no fuel quantities are displayed and no auto transfer). A single error code is displayed in the left-most display. Multiple errors are presented in displays from left to right. Error codes E04, E05, E06, and E07 are displayed momentarily; then for E04 the affected tank circuit display is dashed, for E05 and E06 the affected tank circuit display indicates "FP", and for E07 the display is a conservative quantity from calculations based on a level aircraft.

I-BIT is activated by pressing the TEST/RESET button on the AFMP with WOW enabled. I-BIT begins by simultaneously lighting all 35 cells of each of the four 5 x 7 digital displays, and sequentially lighting the annunciators fails to light. Subsequently all the test run during P-BIT are run during the remainder of I-BIT and the error codes are the same as for P-BIT as indicated above. If WOW is not enabled (inflight condition) pressing the TEST/RESET button resets the AUX FUEL caution light on the caution/advisory panel.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

C-BIT is non-intrusive self testing during all operations subsequent to P-BIT or I-BIT. Error code E01, E02, or E03 is displayed continuously after activation; no fuel quantity is displayed and auto transfer is inoperable. Error codes E04, E05, and E07 are displayed momentarily, auto transfer is inhibited, and annunciators and manual transfer are operable. C-BIT continuous displays are as follows:

- E01 AFMP microprocessor fail (no auto transfer mode).
- E02 AFMP memory fail (no auto transfer mode).
- E03 AFMP display fail (no auto transfer mode).
- "Dashed" AFMP tank gauging electronics failure for affected tank circuit.
- "FP" Auxiliary tank probe fault (open or short) for affected tank circuit.
- Following E07, the display is a conservative quantity from calculations based on a level aircraft.

No-tank advisories are provided by the applicable AFMP display as follows:

- "NT" If XFER MODE is set to AUTO or MAN and no tank is on the pylon indicated by the XFER FROM switch.
- "blank display" If XFER MODE is set to AUTO or MAN and no tank is on the pylon indicated by the XFER FROM switch.

AUTO TRANSFER

When the XFER MODE switch is placed to AUTO, if there are no error codes and the tanks are not empty, the system automatically pressurizes the applicable tanks regardless of the PRESS switch setting and opens the applicable valves to transfer fuel to the main tanks from the selected pair of external tanks. The tanks remain pressurized while in auto mode and not empty. Transfer of fuel from the auxiliary tanks to the main tanks begins when the AFMP detects the fuel quantity in either main tank has fallen below 1100 pounds. Auto transfer of fuel will continue until the sum of the fuel quantities in main tanks 1 and 2 equal 2300 pounds or overflow occurs. When the AFMP detects a tank empty sensor and stops transfer of fuel, the corresponding NO FLOW and EMPTY annunciators on the AFMP will light. The AFMP also provides a signal to light the AUX FUEL capsule on the caution/advisory panel. Pressing the TEST/RESET button without WOW (as in flight) reset the AUX FUEL indication and stores the state of all annunciators in nonvolatile memory (NVM).

MANUAL TRANSFER

For manual transfer to function, the PRESS switch on the AFMP must be either INBD, OUTBD, or ALL; it cannot be in the OFF position. The selection for the XFER FROM switch must be consistent with the PRESS switch selection. The MAN XFER switch can be either LEFT, RIGHT, or BOTH. After the tanks have become pressurized, when the XFER MODE is switched from OFF to MAN, fuel transfer begins immediately from the selected tanks. Manual transfer continues as selected until the XFER MODE switch is placed to OFF.

FUEL OVERFLOW SENSOR, AFMP ANNUNCIATORS, AND RESET

The fuel overflow sensor is used to detect the presence of fuel in the vent tube. If fuel is detected, the sensor provides a signal to the AFMP which lights the overflow (VENT OVFL) annunciator while fuel is being sensed and provides a signal to the AUX FUEL capsule. This alerts the pilot that fuel is being dumped overboard.

The fuel sensor fail (VENT FAIL) annunciator, located to the left of the VENT OVFL annunciator, will light when an open in the fuel overflow sensor dc current line is detected by the AFMP. The VENT FAIL annunciator is not affected by the AFMP TEST/RESET button.

The imbalance (IMBAL) annunciator, located above a line in the center of the AFMP, will light when the AFMP detects that the absolute value of the auxiliary fuel weight (left minus right) varies from the nominal by +/-2%and error codes E01 through E06 are not set.

The two no flow (NO FLOW) annunciators, located above the respective fuel quantity indicators on the AFMP, will light when the AFMP detects that no fuel is flowing in the respective fuel line, AUTO or MAN mode is selected, and the respective fuel shutoff valve is open.

The two auxiliary tank empty (EMPTY) annunciators, located below the respective fuel quantity indicators on the AFMP, will light when the AFMP detects the low fuel in the respective tank.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

The TEST/RESET button on the AFMP that is used to initiate I-BIT on the ground is used to reset the AUX FUEL capsule inflight. The AUX FUEL capsule (if not already on) will be set on if a condition occurs that would set on any one of the annunciators, except the VENT FAIL annunciator which is excluded from the other AFMP annunciators. Pressing the TEST/RESET button on the AFMP under inflight conditions will reset the AUX FUEL capsule to off, if all conditions for setting annunciators on have been removed. The current state of all of the annunciators except AFMP OVFL is saved to the NVM when the AFMP TEST/RESET button is pressed under inflight conditions.

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

For location and description of major components, refer to the data in this work package.

EQUIPMENT DATA

For equipment data information, refer to this work package.

ELECTRICAL SYSTEMS

ESSS JETTISON SYSTEM DESCRIPTION AND DATA

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

JETTISON SYSTEM DESCRIPTION ESSS>

The stores jettison system provides two methods of jettisoning external stores; a primary jettison subsystem and an emergency jettison subsystem. The primary jettison subsystem provides selection of jettisoning individual external stores, a symmetrical pair of stores, or all external stores. An interlock circuit prevents individual stores jettison when external fuel tanks are installed. The emergency jettison subsystem provides release of all external stores. The system consists of a jettison control panel, on the lower console, and ejector racks attached to the two vertical stores pylons (VSP) on each horizontal stores support (HSS). The racks are used to attach fuel tanks or other external stores dispensers. The jettison system functionally interfaces with the ESSS fuel system. It also functionally interfaces with the caution/advisory warning system and drag beam switch through the left relay panel and No. 2 junction box.

JETTISON SYSTEM POWER DISTRIBUTION ESSS>

Electrical power for the stores jettison system is supplied by the dc essential bus and the No. 1 dc primary bus (Figure 1. (Sheet 1 of 2) and Figure 1. (Sheet 2 of 2)). The 28 vdc from the dc essential bus is routed through the ESSS JTSN INBD and ESSS JTSN OUTBD circuit breakers on the upper console. Both the ESSS JTSN INBD and ESSS JTSN OUTBD circuit breakers supply 28 vdc to the jettison control panel and the left relay panel. The 28 vdc from the No. 1 dc primary bus is routed through the ESSS JTSN INBD and ESSS JTSN OUTBD circuit breakers on the copilot's circuit breaker panel. Both circuit breakers supply 28 vdc to the jettison control panel.

STORES JETTISON CONTROL PANEL ESSS>

The control panel provides two methods of jettisoning external stores, a primary jettison subsystem and an emergency jettison subsystem. The primary jettison subsystem provides selection of jettisoning individual external stores, a symmetrical pair of stores, or all external stores. An interlock circuit prevents jettisoning of fuel tanks other than in pairs. The emergency jettison subsystem provides immediate release of all external stores. Emergency jettison operation is completely independent of the primary jettison operation. The control panel consists of two toggle switches having switch guards, a rotary switch, and a lighted information plate on the front of the panel. Two electrical connectors are on the rear of the panel. A relay bracket assembly, installed within the panel, provides mounting for seven relays and eight diodes.

PRIMARY JETTISON SYSTEM

Power to operate the primary jettison system is supplied from the No. 1 dc primary bus through the ESSS JTSN INBD and ESSS JTSN OUTBD circuit breakers on the copilot's circuit breaker panel. A rotary switch, on the jettison control panel, allows selection of jettisoning individual external stores, a symmetrical pair of stores, or all external stores. With the rotary switch at ALL, the inboard stores will jettison 1 second after the outboard stores. When the fuel tanks are installed, tank present signals are supplied to the control panel. These signals prevent individual stores jettison even if the rotary switch is at L or R.

EMERGENCY JETTISON SYSTEM

The emergency jettison system is electrically independent of the primary jettison system. Power to operate the emergency jettison system is supplied from the dc essential bus through the ESSS JTSN INBD and ESSS JTSN OUTBD circuit breakers on the upper console. When the EMER JETT ALL switch is actuated, all external stores are jettisoned, regardless of the rotary switch position. As with the primary jettison system, the inboard stores will jettison 1 second after the outboard stores.

DRAG BEAM INTERLOCKS

When the helicopter is on the ground, the left drag beam switch removes the electrical ground from relay K4 in the jettison control panel. This disables the emergency jettison system. When the helicopter is on the ground,

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

the right drag beam switch removes the electrical ground from the relay K1 in the jettison control panel. This disables the primary jettison system while on the ground. When the helicopter is airborne, both drag beam switches provide grounds to the jettison control panel relays K1 and K4 to enable jettison operation.

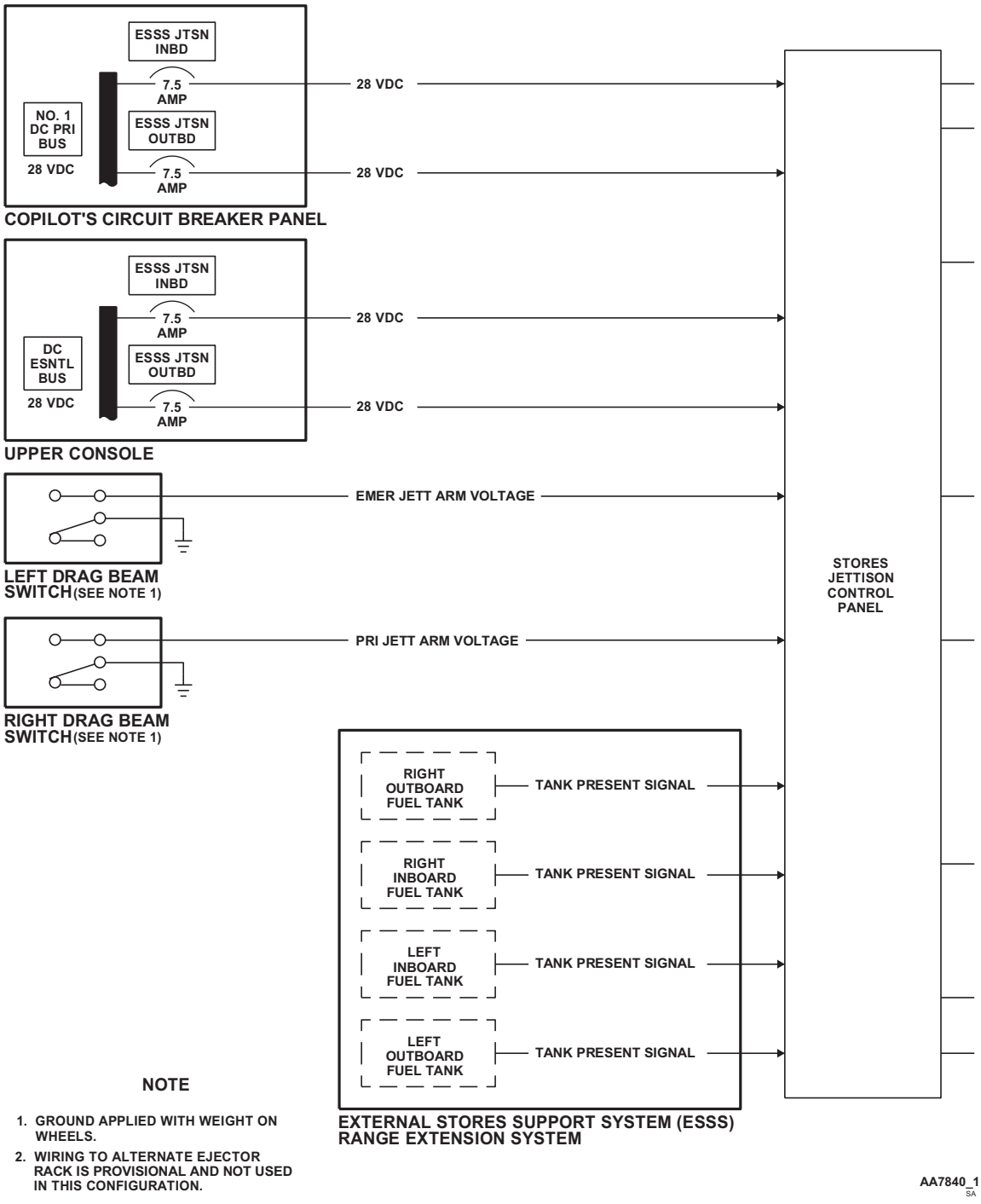


Figure 1. Jettison System Block Diagram ESSS> (Sheet 1 of 2).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

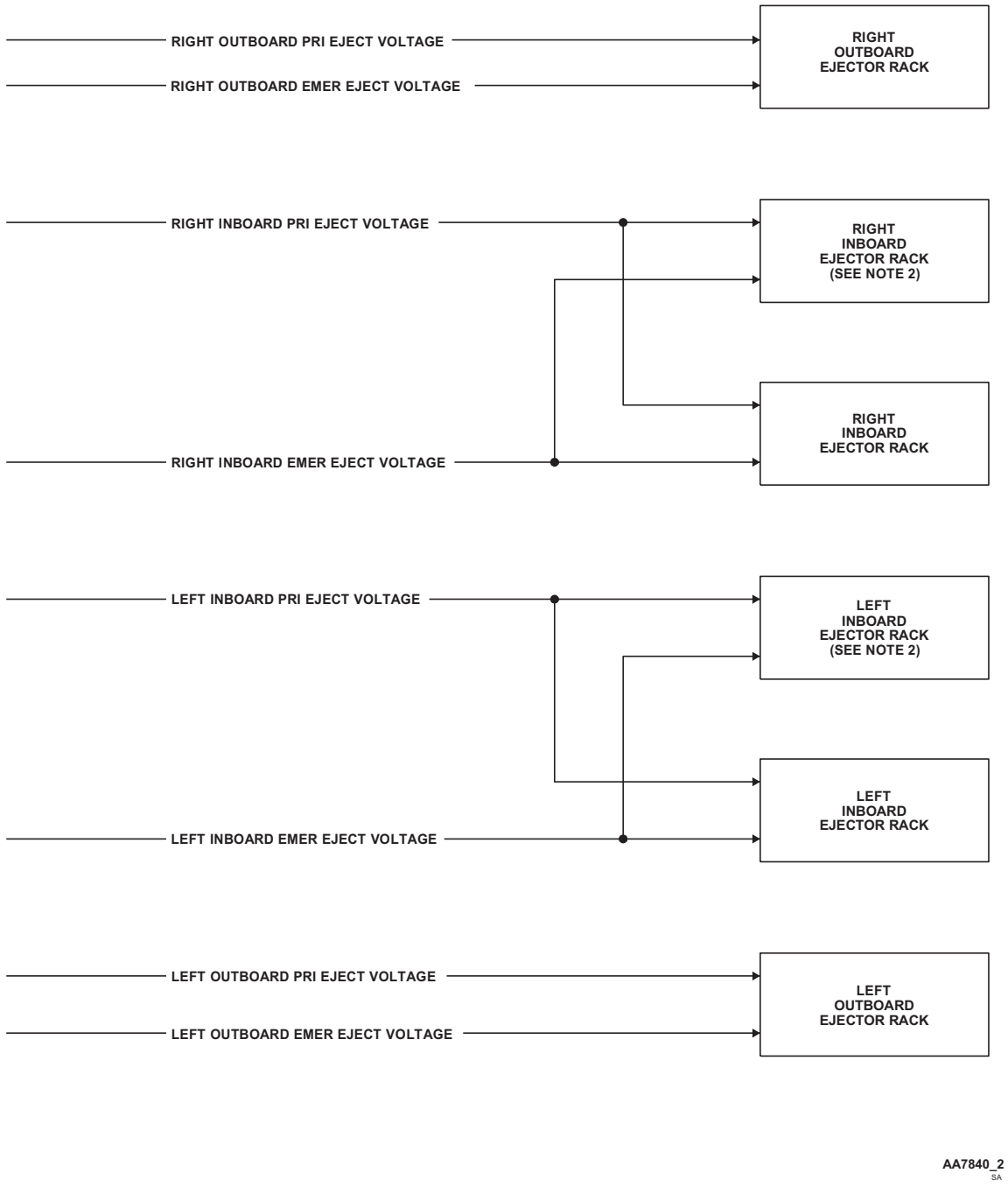


Figure 1. Jettison System Block Diagram ESSS> (Sheet 2 of 2).

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

For location and description of major components, refer to the data in this work package.

EQUIPMENT DATA

For equipment data information, refer to this work package.

ELECTRICAL SYSTEMS

CRASHWORTHY EXTERNAL FUEL SYSTEM DESCRIPTION AND DATA

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

The Crashworthy External Fuel Systems (CEFS) is a crashworthy, ballistically self-sealing external fuel system designed to provide a safe and convenient means of increasing the range and endurance of the UH-60A/L helicopter. The system features up to four jettisonable 200-gallon external auxiliary fuel tanks installed on either the left and right inboard or left and right outboard Horizontal Stores Support (HSS) pylons. Fuel hoses, connecting hardware, and interface controls are also part of the CEFS.

The CEFS consists of four major functional components. They are: 200-gallon CEFS tanks; aircraft and HSS wing interconnect hoses; pump package; and CEFS modified auxiliary fuel management control panel (AFMP).

200-GALLON CEFS TANKS

The 200-gallon CEFS tanks consist of an outer fiberglass container, an internal crashworthy, ballistically self-sealing bladder, and internal fuel lines and shutoff valves. The bladder contains baffles to reduce fuel sloshing. The CEFS tanks are installed in pairs on the inboard or outboard HSS pylons equipped with BRU-22A launcher racks.

AIRCRAFT AND HSS WING INTERCONNECT HOSES

Steel braided hoses are used to connect the CEFS tanks to the pump package, in turn, to the No. 2 main fuel tank. The hoses are equipped with self-sealing quick-disconnect breakaway couplings.

PUMP PACKAGE

The pump package is mounted at STA 443, BL 0 above the No. 1 and No. 2 main fuel cells. It contains a suction pump, refuel valve, and fuel manifold. The suction pump transfers fuel from the CEFS tanks to the main fuel system through the number two fuel cell. The refuel valve works in conjunction with the inboard and outboard wing gate shutoff valves to pressure refuel or defuel the CEFS tanks. Power for the CEFS pump package is provided from the NO. 1 PRI BUS (AC) through circuit breaker marked CEFS PUMP on the mission readiness circuit breaker panel.

AUXILIARY FUEL MANAGEMENT PANEL (AFMP)

The AFMP contains all controls for operating the CEFS. Dimming control for the AFMP lighting is provided by the cockpit INST LT NON FLT rheostat on the upper console. Dimming control for all fuel quantity displays and annunciators on the AFMP is provided by the LIGHTED SWITCHES rheostat on the upper console only when the caution/advisory panel is in the DIM mode. Power for the auxiliary fuel management system is provided from the NO. 2 PRI BUS (DC) through circuit breakers marked EXT FUEL RH and NO. 2 XFER CONTROL on the mission readiness circuit breaker panel.

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

For location and description of major components, refer to the data in this work package.

EQUIPMENT DATA

For equipment data information, refer to this work package.

ELECTRICAL SYSTEMS

AUXILIARY CABIN HEATER SYSTEM DESCRIPTION AND DATA

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

AUXILIARY CABIN HEATER SYSTEM DESCRIPTION

The auxiliary cabin heater is an electrically operated heating system consisting of a heater, blower, control panel and adjustable air temperature switch. The heater and blower are installed in the ceiling of the helicopter's transition section above the main fuel tanks, the blower on the right and the heater on the left. The blower draws air from the cabin and forces it through a distribution elbow and duct, through a transition duct, and back into the cabin through an array of cabin ducts. The heater, located between the distribution duct and transition duct, heats the air flowing out of and into the cabin. The adjustable air temperature switch, located at the bottom of the left gunner's window, has a setting for preselecting cabin air temperature through a range of 50°F to 85°F. The control panel, AUX CABIN HEATER, contains a heater control switch marked OFF-ON-RESET and two indicator lights one marked HTR ON and the other marked HTR INOP. The OFF-ON-RESET switch controls heater and blower operation through relay circuitry in the system's No. 3 Relay Panel. The HTR ON light indicates when the heater system is functioning properly; the HTR INOP light indicates system malfunction. The auxiliary cabin heater interfaces with the helicopter's hydraulics system and the No. 1 and No. 2 main generators. The heater system is disabled when the hydraulics system backup pump is running or when either main generator malfunctions (Figure 1. (Sheet 1 of 2)).

AUXILIARY CABIN HEATER CONTROL PANEL DESCRIPTION

The AUX CABIN HEATER control panel is located on the lower console. It contains the OFF-ON-RESET switch for controlling the auxiliary cabin heater operation, the HTR ON indicator light for indicating normal heater system operation, and the HTR INOP indicator light for indicating heater system malfunction. Both lights are ANVIS yellow and are the press-to-test type. Pressing the lights connects 28 VDC from the helicopter's instrument panel and consoles light dimming system to energize the lamps in the light units.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

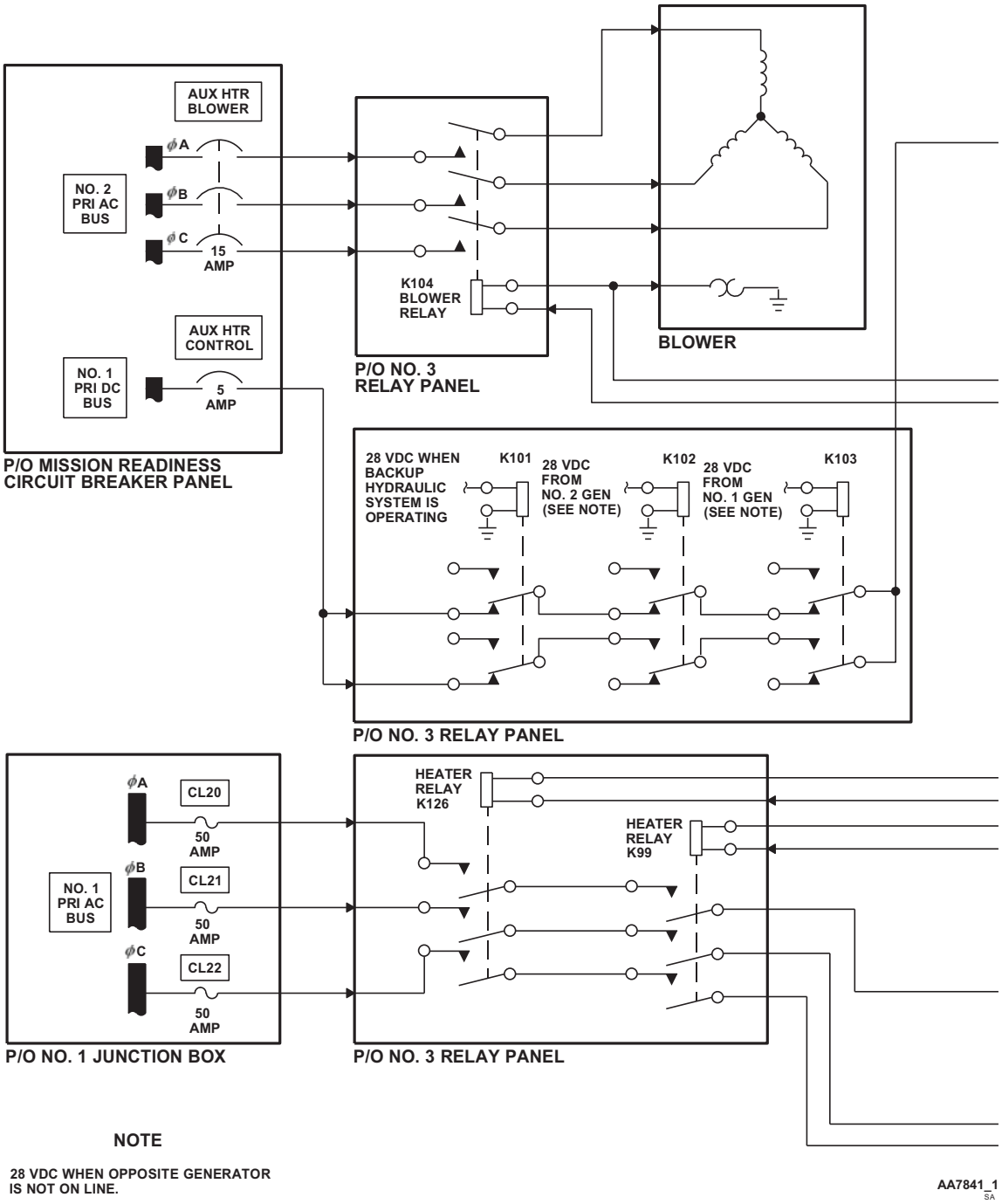


Figure 1. Auxiliary Cabin Heater Block Diagram (Sheet 1 of 2).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

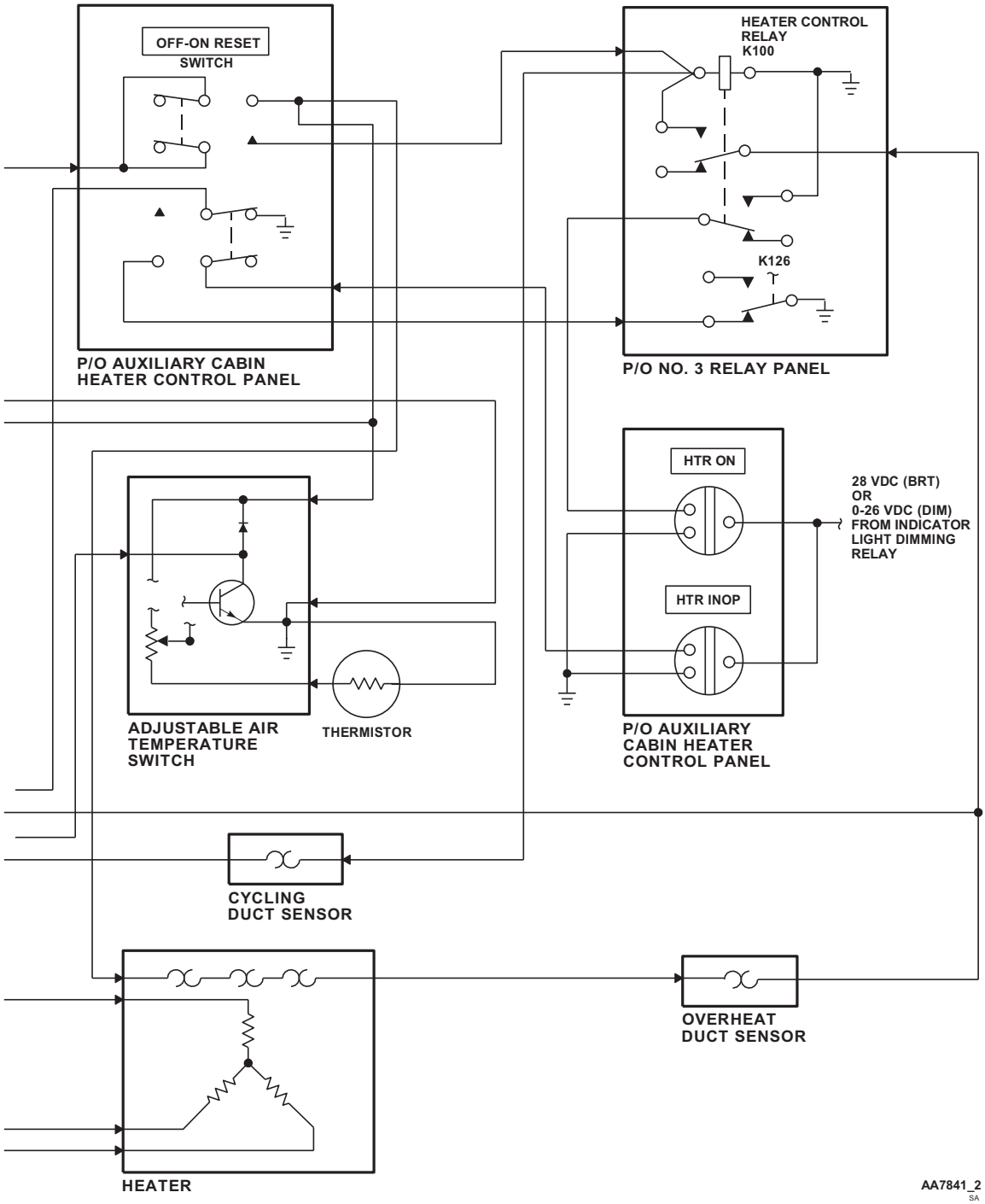


Figure 1. Auxiliary Cabin Heater Block Diagram (Sheet 2 of 2).

NO. 3 RELAY PANEL UH60A UH60L> <

The No. 3 relay panel contains the relays sequenced by the control panel OFF-ON-RESET switch to connect AC operating power to the heater and blower.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

AUXILIARY HEATER SYSTEM OPERATION

Operation of the auxiliary cabin heater is controlled by the adjustable air temperature and the OFF-ON-RESET switches. Placing the adjustable air temperature switch to a temperature greater than cabin ambient temperature provides a path for heater relay, K99. The range of the air temperature switch is 50°F to 85°F. The OFF-ON-RESET switch is a three position switch which has the RESET position spring loaded to return to the ON position when released. Placing the OFF-ON-RESET switch to the ON position provides an electrical path from the AUX HTR CONTROL circuit breaker, through the de-energized contacts of relays, K101, K102, and K103, through the OFF-ON-RESET switch which energizes the blower relay, K104. Relay, K104 provides a path for the 115 vac power from the AUX HTR BLOWER circuit breaker to the blower. An internal thermal switch in the blower will remove the ground for relay, K104, turning off the blower, if the blower becomes overheated. Placing the OFF-ON-RESET switch momentarily to the RESET position, energizes heater control relay, K100, and heater relay, K126. When OFF-ON-RESET switch returns to the ON position, 115 vac is provided through the now energized contacts of relays, K99 and K126 to the heater. There are two thermal switches in the ducts to remove the 28 vdc from relays K99 and K126 if the ducts overheat. An internal thermocouple in the heater when the heater overheats, removes the 28 vdc from relay K126 turning the heater off. When the cabin temperature reaches the temperature set by the air temperature switch a Q circuit removes the ground leg from relays K99 and K104 turning the heater and blower off. The system will not operate unless both No. 1 and No. 2 generators are on the line and the back up hydraulic system is not in operation.

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

For location and description of major components, refer to the data in this work package.

EQUIPMENT DATA

For equipment data information, refer to this work package.

ELECTRICAL SYSTEMS

MAIN AND TAIL ROTOR BLADE EROSION PROTECTION KIT DESCRIPTION AND DATA

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

MAIN AND TAIL ROTOR BLADE EROSION PROTECTION KIT DESCRIPTION

Rotor blade erosion protection kits are applied to the main and tail rotor blades when the helicopter is operating in desert environments. The main and tail rotor blades can be protected by the application of polyurethane tape being applied to the leading edge. The main rotor blade tip caps can be protected by the application of either a polyurethane coating or polyurethane boots. The tail rotor blade tip caps can be protected by the application of a polyurethane coating. The erosion protection kits provide a sacrificial surface that can be repaired or replaced. The blade deice system must not be used when erosion protection kits are installed.

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

For location and description of major components, refer to the data in this work package.

EQUIPMENT DATA

For equipment data information, refer to this work package.

ELECTRICAL SYSTEMS

CHAFF DISPENSER SYSTEM AND M130 CHAFF/FLARE DISPENSER SYSTEM DESCRIPTION AND DATA

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

CHAFF DISPENSER SYSTEM DESCRIPTION UH-60A UH-60L HH-60A HH-60L> <

The chaff dispenser system is used to create navigation and communication interference during survival countermeasure tactics. The system dispenses only chaff in this installation (Figure 1. (Sheet 1 of 4)). The system consists of a chaff dispenser assembly which is made up of an electronics module, dispenser assembly, and payload module assembly mounted on the left forward portion of the tail cone, and a dispenser control panel and chaff dispense switch on the lower console. Panel lighting power for the dispenser control panel is disabled at the control panel.

CHAFF DISPENSER SYSTEM POWER DISTRIBUTION UH-60A UH-60L HH-60A HH-60L> <

The chaff dispenser system gets dc electrical power from the copilot's circuit breaker panel UH-60A 77-22714 - 78-22986 > The 28 vdc is supplied by the NO. 1 DC PRI BUS and routed through the CHAFF DISP circuit breaker through the audio junction box assembly to the dispenser control panel (Figure 4). <UH-60A 78-22987 - SUBQ UH-60L HH-60A HH-60L > The 28 vdc is supplied by the NO. 1 DC PRI BUS and routed through the CHAFF DISP circuit breaker directly to the dispenser control panel (Figure 3). < Panel lighting for the dispenser control panel is controlled by the CONSOLE LT LOWER control on the upper console. From the CONTROL LT LOWER control, power is applied through the junction box assembly to the control panel.

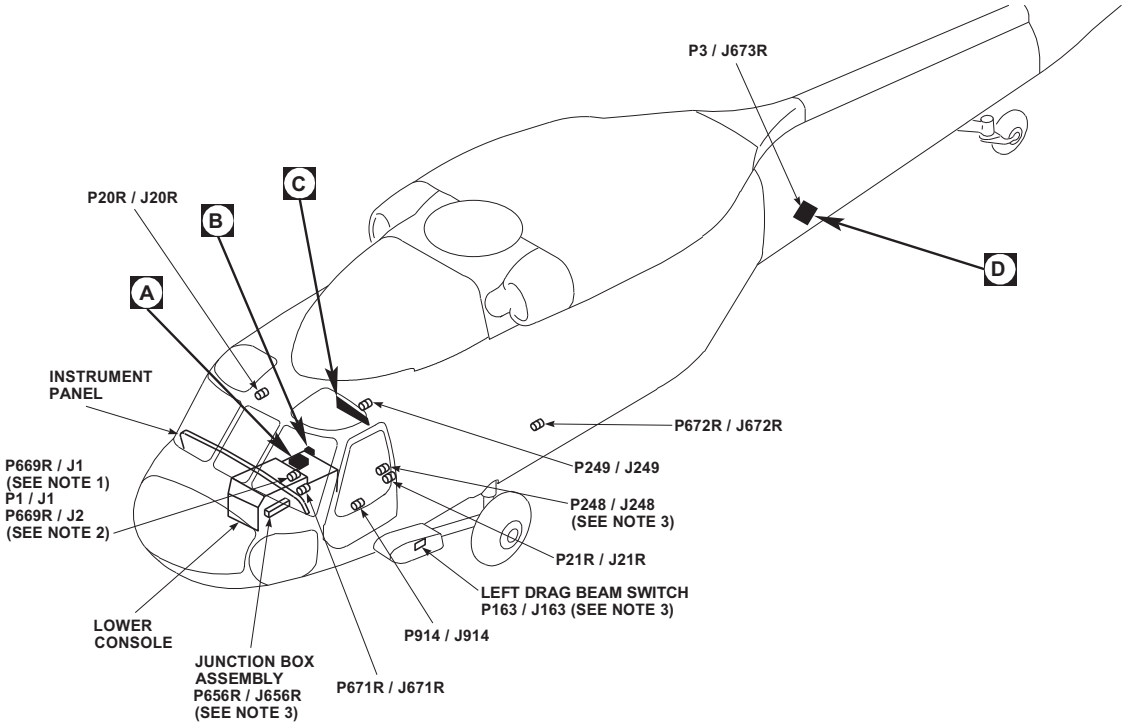
M130 CHAFF/FLARE DISPENSER SYSTEM DESCRIPTION EH-60A> <

The chaff/flare dispenser system provides survival countermeasures against radar-guided weapons and infrared-seeking missiles. Dispensed chaff saturates the helicopter operating area with radar returns, disguising the true location of the helicopter (Figure 2. (Sheet 1 of 4)). Chaff is dispensed by the pilot or copilot when the helicopter radar warning system detects radar signals. Flares are dispensed by the pilot or copilot when a missile launching is observed. Flares serve as decoys, diverting infrared-seeking missiles away from the helicopter. The system consists of a chaff dispenser assembly, a flare dispenser assembly, an electronics module, a dispenser control panel, a flares dispenser push-button, and a chaff dispense push-button. Both dispenser assemblies and the electronics module are on the left side of the tail cone. The chaff dispenser assembly is mounted forward of the flare dispenser assembly. The dispenser control panel and chaff dispense push-button are on the lower console. The flares dispense push-button is on the center section of the instrument panel. The switch is used in conjunction with the lower console chaff/flares dispenser control panel to fire flares. A payload module that holds either 30 packets of chaff or 30 flares is loaded into the chaff assembly and flare dispenser assembly, respectively.

M130 CHAFF/FLARE DISPENSER SYSTEM POWER DISTRIBUTION EH-60A> <

The chaff/flare dispenser system receives 28 vdc from the copilot's circuit breaker panel. (Figure 5. (Sheet 1 of 2)).The 28 vdc is supplied by the No. 1 dc primary bus and routed to the dispenser control panel through the CHAFF/FLARE DISP circuit breaker and the junction box assembly. The circuit breaker output is also routed to the electronics module.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED



TERMINAL BOARD / DISCONNECT PLUG / RECEPTACLE	LOCATION / CONNECTION POINT
P1 / J1	DISPENSER CONTROL PANEL (SEE NOTE 2)
P3 / J673R	ELECTRONIC MODULE
P20R / J20R	CABIN, BL 40 RH, STA 248 (SEE NOTE 4)
P21R / J21R	CABIN, BL 40 LH, STA 248
P163 / J163	LEFT DRAG BEAM SWITCH (SEE NOTE 3)
P248 / J248	CABIN, BL 40 LH, STA 248 (SEE NOTE 3)
P249 / J249	BEHIND COPILOT'S CIRCUIT BREAKER PANEL, BL 23 LH
P656R / J656R	JUNCTION BOX ASSEMBLY
P669R / J1	DISPENSER CONTROL PANEL (SEE NOTE 1)
P669R / J2	COCKPIT, BL 4 LH, STA 245 (SEE NOTE 2)
P671R / J671R	COCKPIT, BL 0, STA 235
P672R / J672R	CABIN, BL 37 LH, STA 389
P914 / J914	COCKPIT, BL 24 LH, STA 247

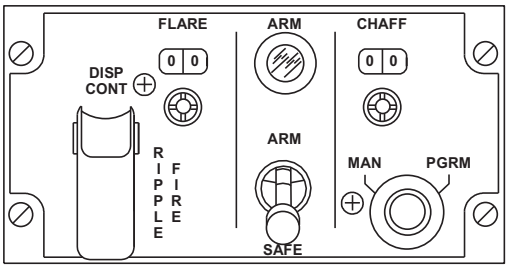
NOTES

1. UH60L 92-26408 - SUBQ MOD HH60A HH60L
2. UH60L 89-26149 89-26154 AND 89-26179 - 92-26407 W/O MOD
3. W/O MOD
4. UH60A UH60L PRIOR TO 92-26408 .

AA2619_1B SA

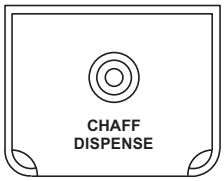
Figure 1. Chaff Dispenser System Location Diagram (Sheet 1 of 4).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED



DISPENSER CONTROL PANEL

A

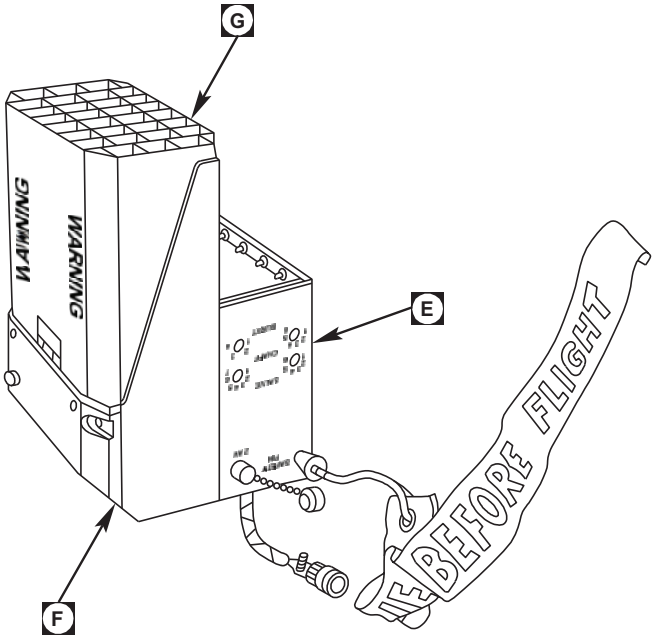


CHAFF DISPENSE SWITCH

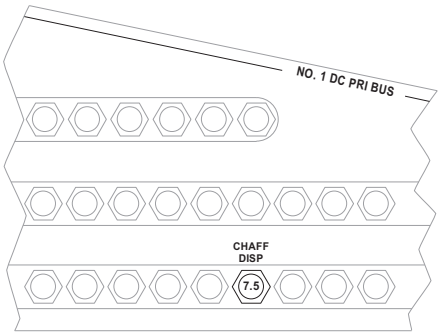
B

D

C



CHAFF DISPENSER ASSEMBLY



COPILOT'S CIRCUIT BREAKER PANEL

AA2619_2A SA

Figure 1. Chaff Dispenser System Location Diagram (Sheet 2 of 4).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

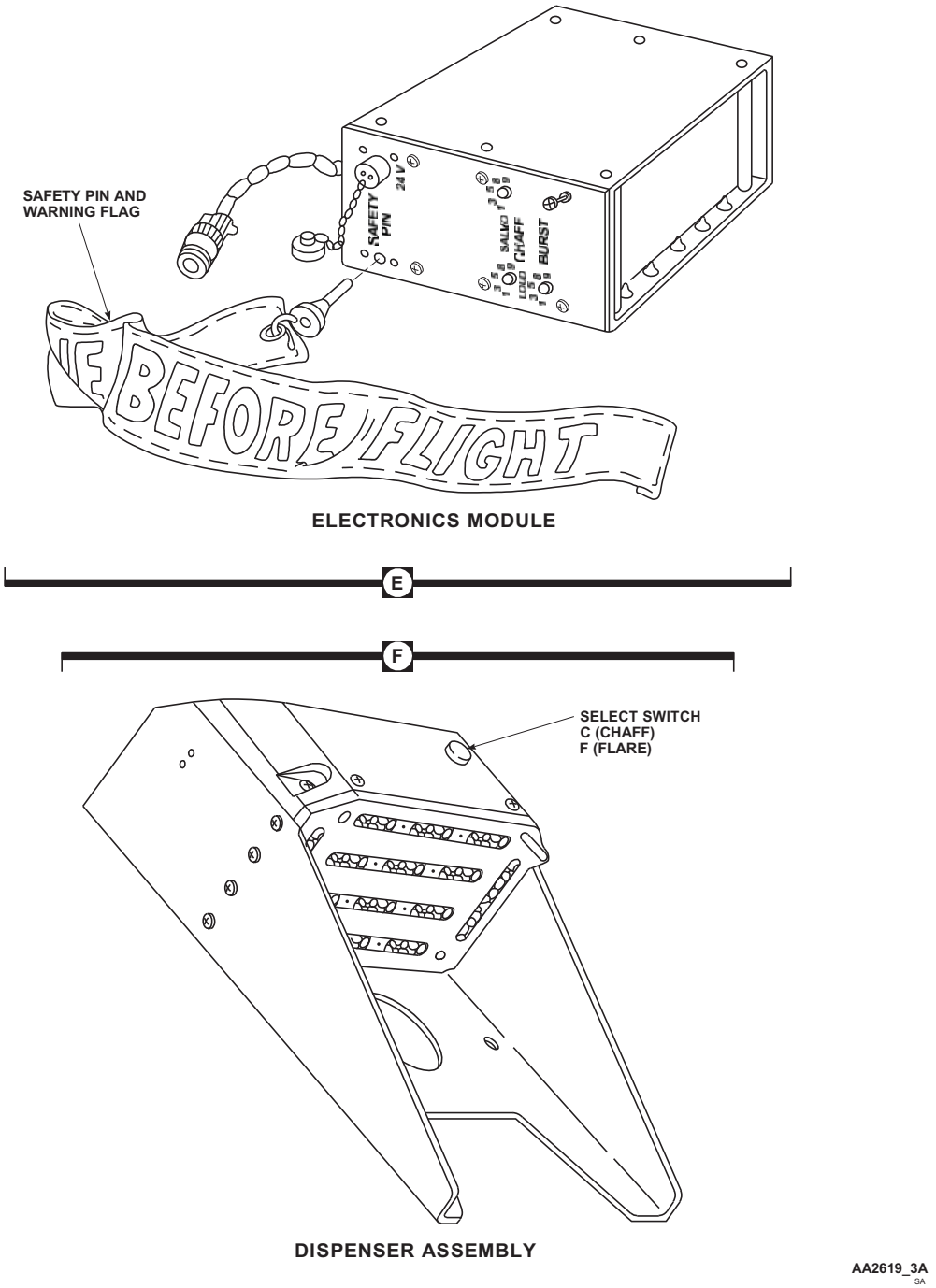
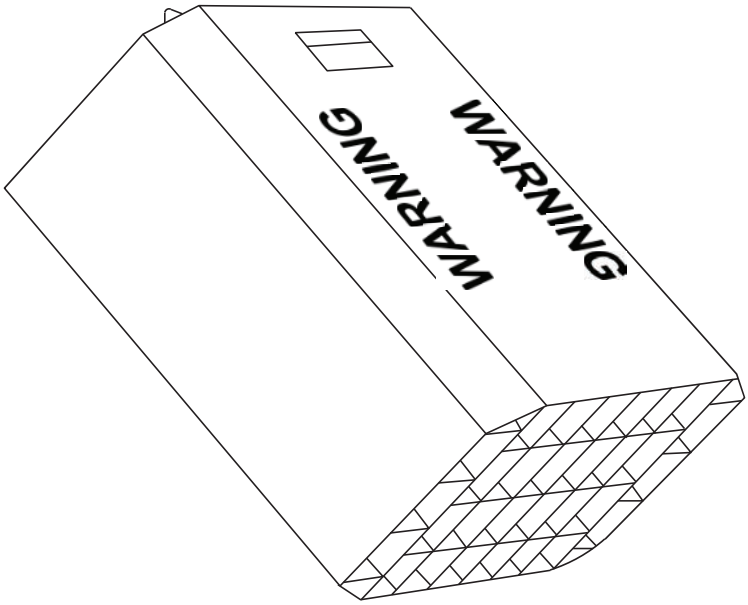


Figure 1. Chaff Dispenser System Location Diagram (Sheet 3 of 4).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

G

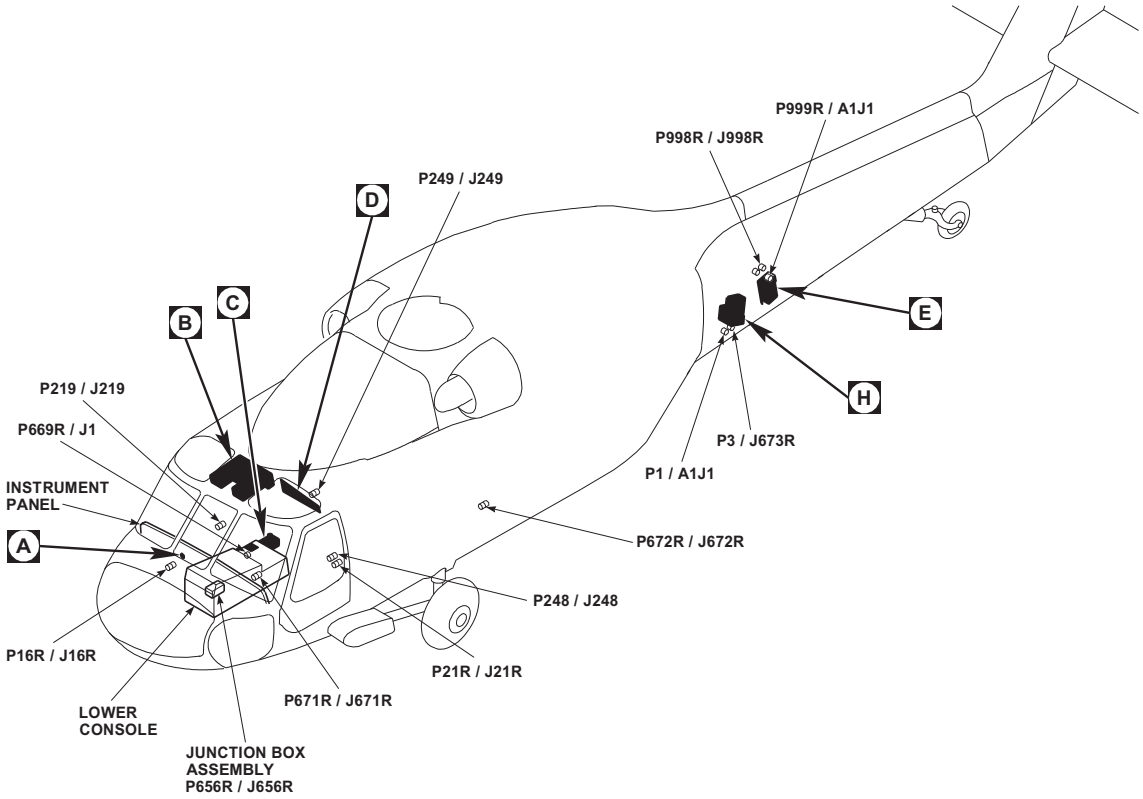


PAYLOAD MODULE

AA2619_4A
SA

Figure 1. Chaff Dispenser System Location Diagram (Sheet 4 of 4).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED



TERMINAL BOARD / DISCONNECT PLUG / RECEPTACLE	LOCATION / CONNECTION POINT
P1 / A1J1	DISPENSER ASSEMBLY
P2 / A2J2	ALQ-156 CONTROL INDICATOR
P3 / J673R	ELECTRONICS MODULE
P16R / J16R	COCKPIT, BL 7.5 RH, STA 197
P21R / J21R	CABIN, BL 40 RH, STA 248

TERMINAL BOARD / DISCONNECT PLUG / RECEPTACLE	LOCATION / CONNECTION POINT
P219 / J219	CABIN FLOOR, BL 25 RH, STA 247
P246 / J246 (SEE NOTE)	UPPER CONSOLE
P248 / J248	CABIN, BL 40 LH, STA 248
P249 / J249	CABIN CEILING, BL 23 LH, STA 247
P656R / J656R	AUDIO JUNCTION BOX ASSEMBLY
P669R / J1	DISPENSER CONTROL PANEL
P671R / J671R	COCKPIT, BL 0, STA 235
P672R / J672R	CABIN, BL 37 LH, STA 389
P998R / J998R	LEFT TAIL CONE, STA 525
P999R / A1J1	FLARE DISPENSER

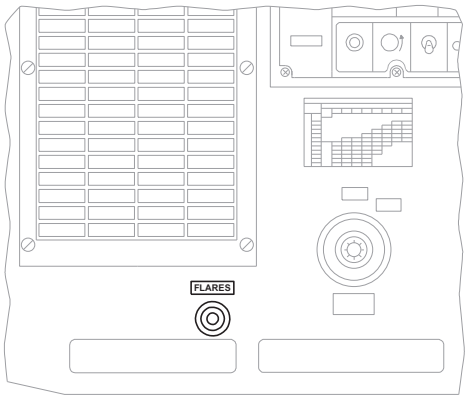
NOTE

EH60A 84-24017 - 84-24020

AA3422_1
SA

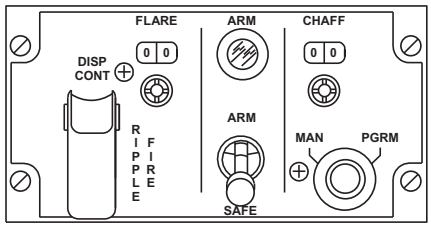
Figure 2. Chaff/Flare Dispenser System Location Diagram (Sheet 1 of 4).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED



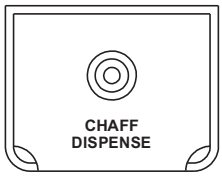
INSTRUMENT PANEL FLARE SWITCH

A



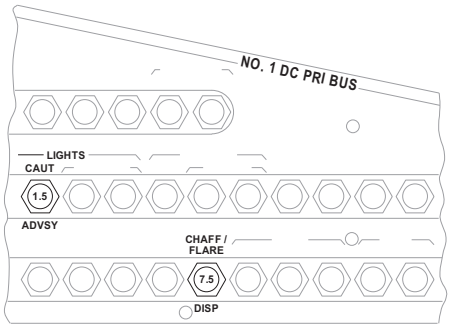
DISPENSER CONTROL PANEL

B



CHAFF DISPENSE SWITCH

C



COPILOT'S CIRCUIT BREAKER PANEL

D

AA3422_2
SA

Figure 2. Chaff/Flare Dispenser System Location Diagram (Sheet 2 of 4).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

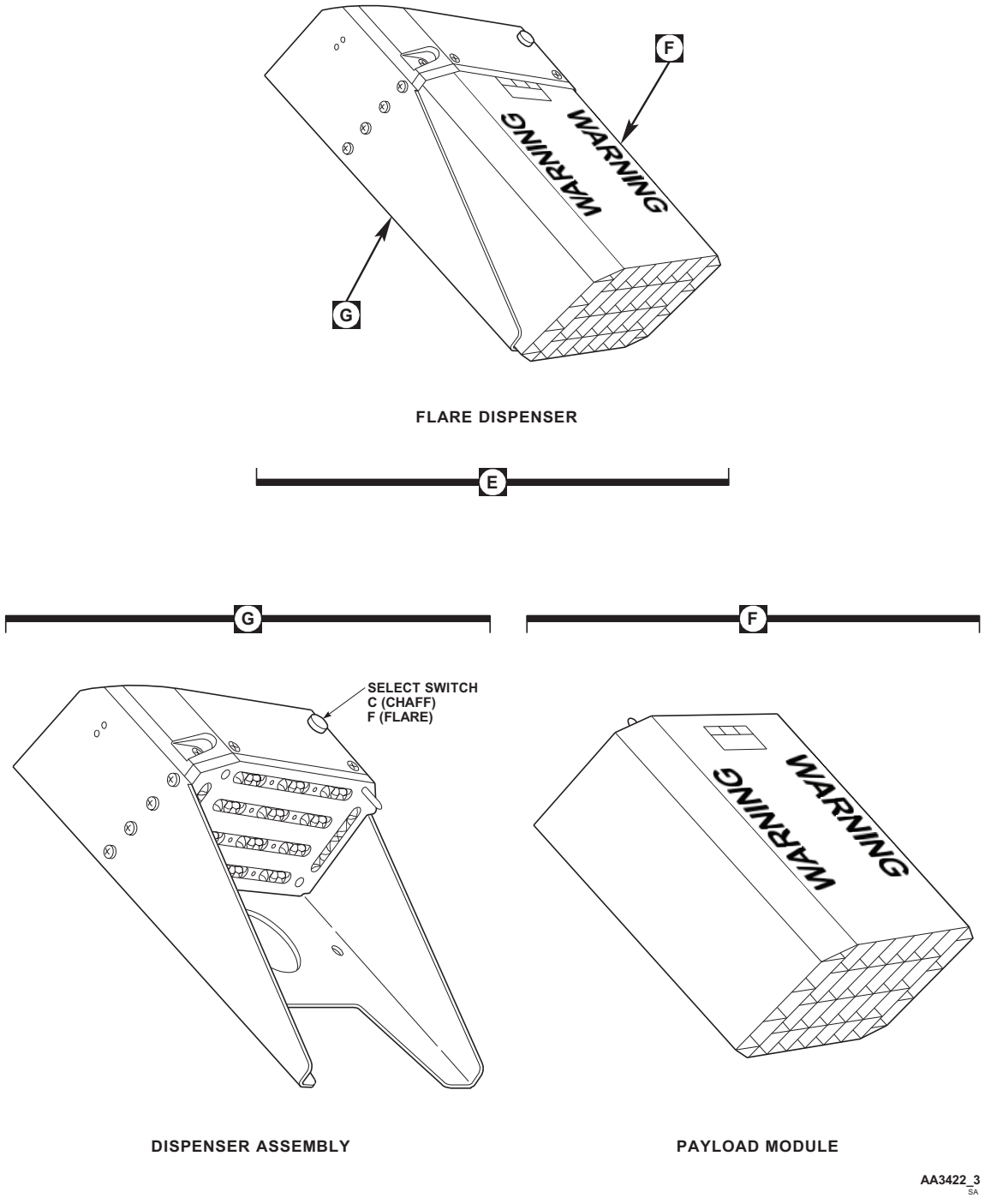


Figure 2. Chaff/Flare Dispenser System Location Diagram (Sheet 3 of 4).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

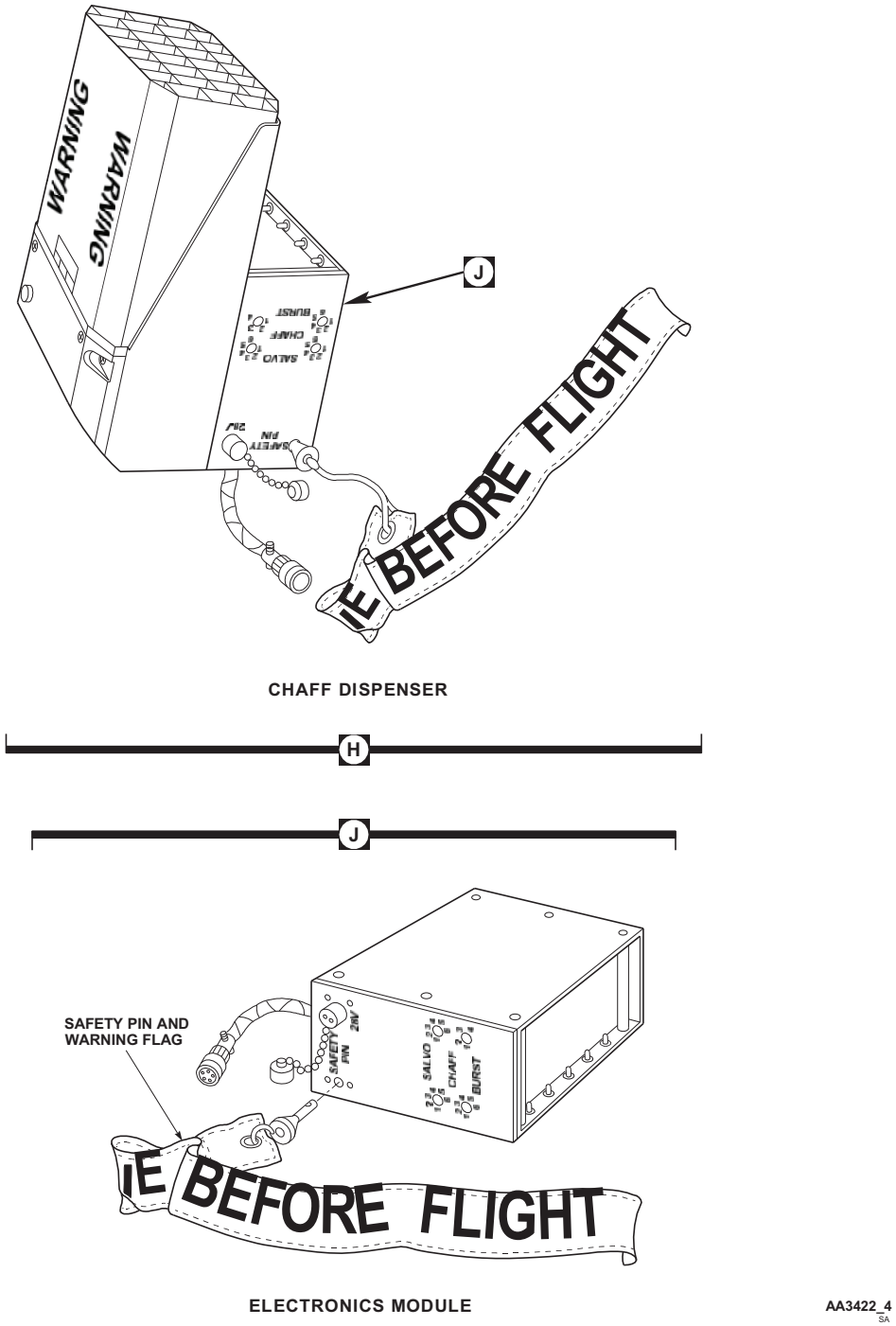


Figure 2. Chaff/Flare Dispenser System Location Diagram (Sheet 4 of 4).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

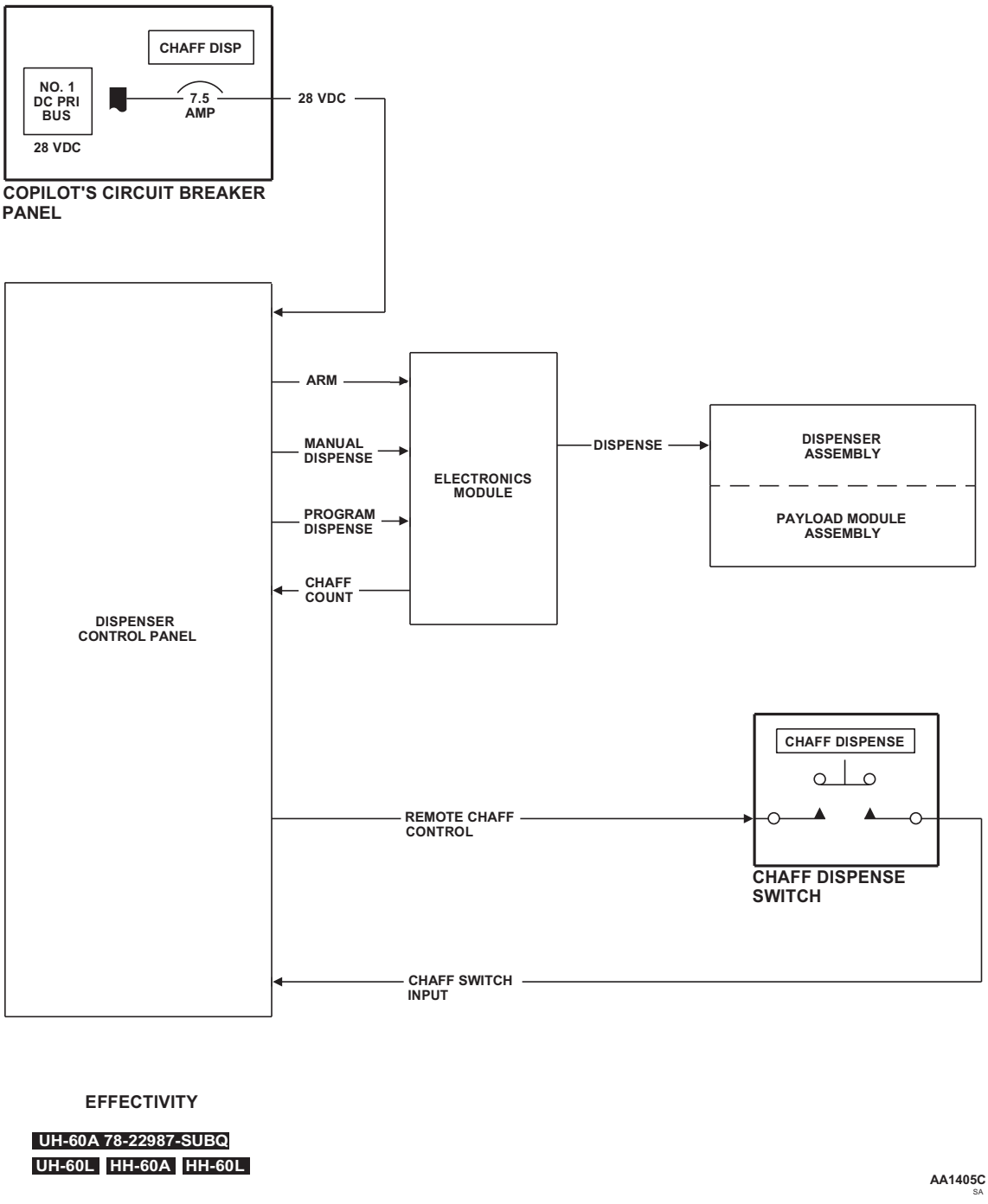


Figure 3. Chaff Dispenser (M130) System Block Diagram.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

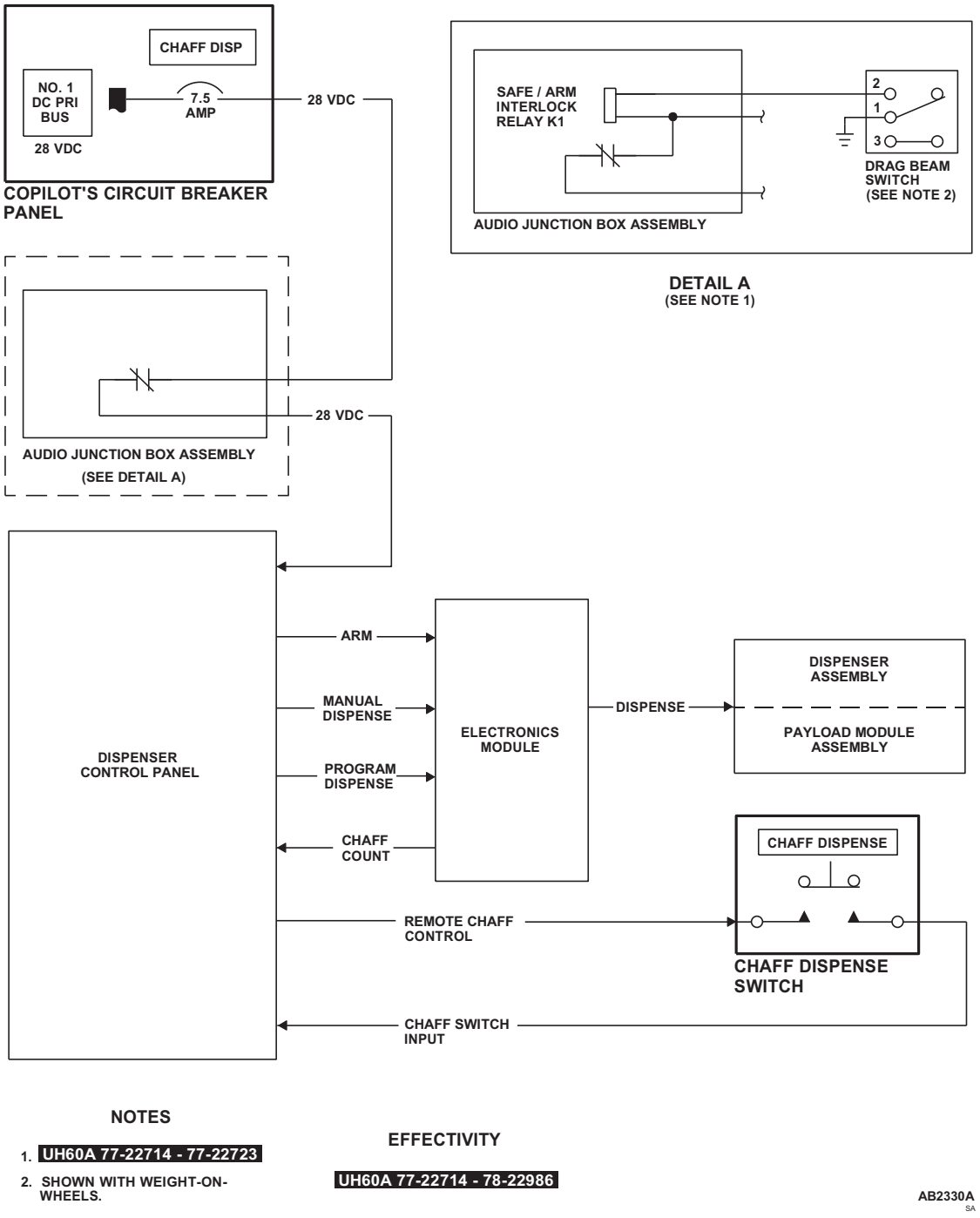


Figure 4. Chaff Dispenser (M130) System Block Diagram.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

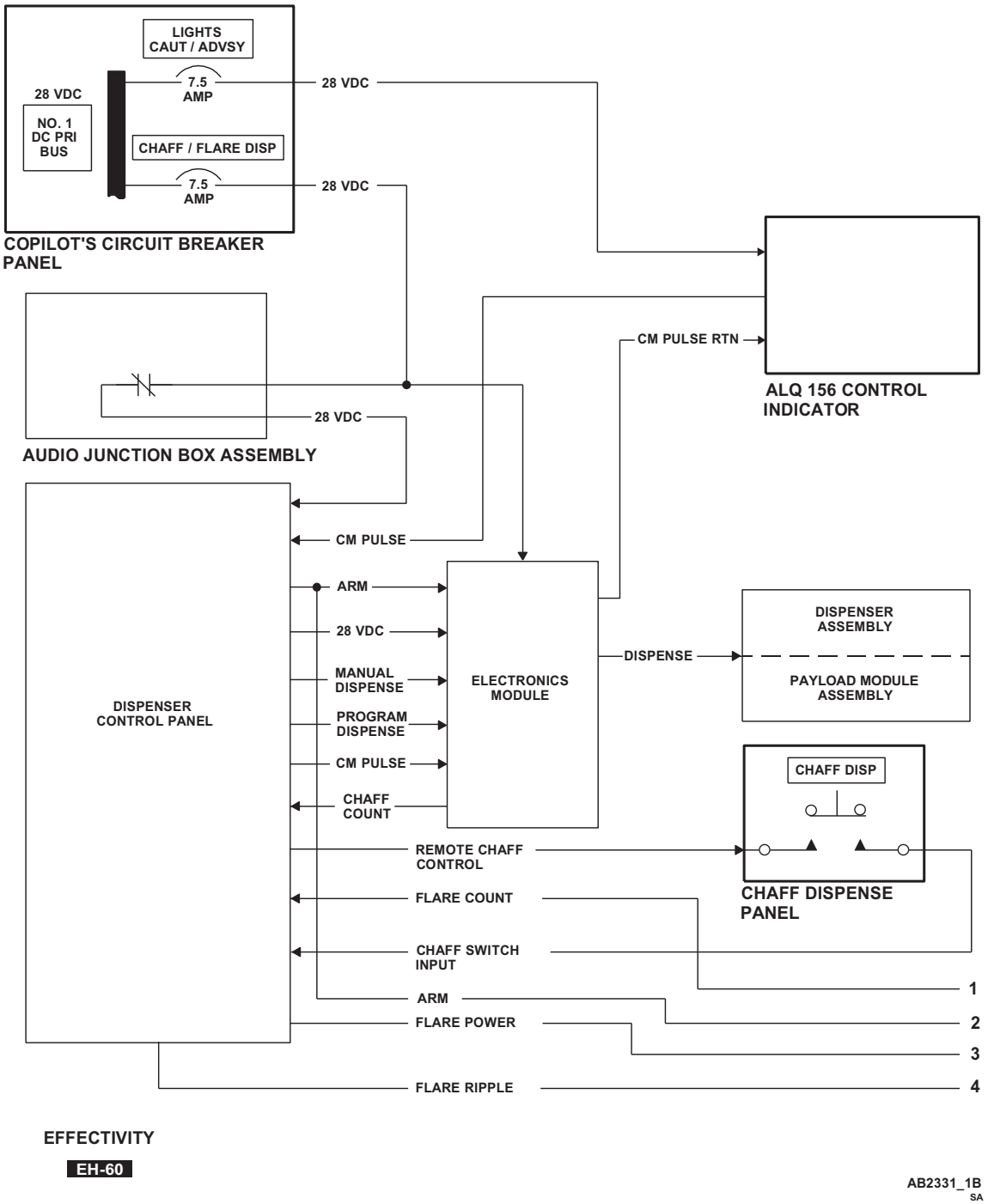


Figure 5. Chaff Dispenser (M130) System Block Diagram (Sheet 1 of 2).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

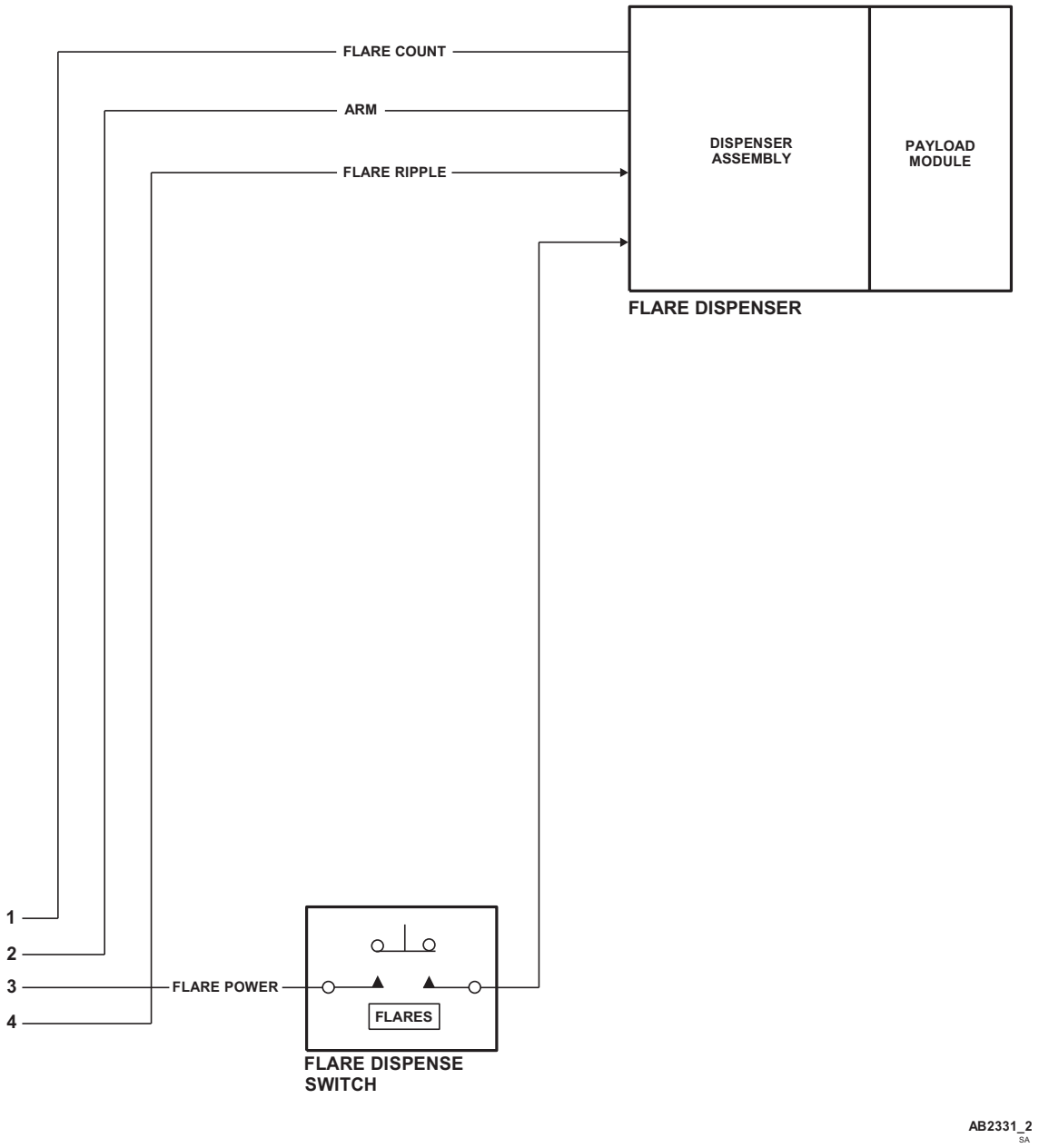


Figure 5. Chaff Dispenser (M130) System Block Diagram (Sheet 2 of 2).

CHAFF DISPENSER PROGRAMMED MODE OPERATION

The programmed mode is selected by placing the ARM-SAFE switch to ARM, removing the flag pin from the electronics module (ARM lamp goes on), setting the CHAFF counter to the number of chaff loaded, and placing the OFF-MAN-PRGM switch to PRGM. Pressing the CHAFF DISPENSE switch applies a dispense command to the dispenser control panel . The control panel then provides a dc signal to the electronics module programmer section. The programmer (preprogrammed) picks the burst interval, salvo number, and salvo interval of chaff to be dispensed. A signal is then fed to the dispenser assembly, activating the sequencer and completing the circuit to the breech plate. This signal is then fed to the impulse cartridge, forcing the chaff out of the payload module.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

CHAFF DISPENSER MANUAL MODE

The manual mode is selected with the system set up as in WP 0057 00, except the OFF-MAN-PRGM switch is placed to MAN. The programmer section of the electronics module is bypassed and only one chaff cartridge is fired each time the CHAFF DISPENSE switch is pressed.

CHAFF DISPENSER FUNCTION

To dispense chaff packets one at a time, the dispenser control panel MAN-PGRM switch is placed to MAN. Pressing the CHAFF DISP push-button causes a manual chaff dispense signal to be applied to the electronics module. The module generates a chaff dispense signal which is applied to the chaff dispenser assembly, causing a single chaff packet to be dispensed. Then, a chaff count signal is routed through the electronics module to the dispenser control panel CHAFF counter. The counter counts down by one, indicating the total number of chaff packets left in the payload module.

To dispense chaff packets in preprogrammed groups, the dispenser control panel MAN-PGRM switch is placed to PGRM. Pressing the CHAFF DISP push-button generates a programmed chaff dispense signal which is applied to the electronics module. Before flying the mission, a program for chaff dispensing is loaded into the electronics module. The program includes salvo count (number of salvos), interval (time between salvos), bursts per salvo (number of packets), and interval between bursts. The programmed chaff dispense signal activates the electronics module program. The electronics module cycles through the program once, applying timed chaff dispense signals to the chaff dispenser assembly. Chaff packets are dispensed, totaling the number set by the program. Each dispensed chaff packet returns a chaff count signal through the electronics module to the dispenser control panel CHAFF counter. The CHAFF counter counts down by one for each chaff packet dispensed. The displayed count is the total chaff packets remaining in the chaff payload module.

MANUAL FLARE DISPENSER SYSTEM FUNCTION EH-60A> <

To dispense flares one at a time, the FLARES push-button is pressed once for each flare to be dispensed. Each time the FLARES push-button is pressed, a flare dispense signal is applied to the electronics module. The electronics module transfers the flare dispense signal to the flare dispenser assembly, causing one flare to be dispensed. Light-sensitive electronics in the flare dispenser look for a flare burst. If one is not detected, a dud signal is sent to the electronics module. The dud signal causes the electronic module to generate a flare dispense signal, causing a second flare to be dispensed. If a flare burst is still not detected, a third flare is dispensed. A third dud will not cause a fourth flare to be dispensed. The electronics module will shut down until the FLARES push-button is pressed again. For each flare dispensed, including duds, a flare count signal is sent to the electronics module and the dispenser control panel FLARE counter. The electronics module uses the count signal to count duds fired. The FLARE counter counts down by one for each flare dispensed. The count remaining on the FLARE counter is the total flares remaining in the payload module.

To dispense flares in short ripple bursts, or to dispense all flares in an emergency, the FLARE RIPPLE FIRE switch is placed to its up position. This action generates the arm and flare ripple fire signals. Operating the FLARE RIPPLE FIRE switch in quick-on-off movements causes flares to be dispensed in short bursts. Holding the switch in the up position causes all flares to be dispensed one after the other. In either case, a flare count signal is applied to the dispenser control panel FLARE counter. The counter counts down by one for each flare dispensed. In the ripple fire mode, the flare count signal is not used by the electronics module.

AUTOMATIC FLARE DISPENSER SYSTEM FUNCTION EH-60A> <

Flares are dispensed, as described previously for FLARE push-button, when a signal is received from the AN/ALQ-156(V)2 countermeasures (CM) set. The CM set detects and evaluates threats from approaching missiles and generates a flare dispense signal to counter the threat. The CM PULSE from the countermeasures set is routed through the dispenser control panel to the electronics module. Within the electronics module, it is processed the same as a signal from the FLARE push-button and is applied to the same output line, FLARE DISPENSER. The control unit for the CM set is mounted on the instrument panel. AC and DC power are provided by the No. 1 (copilot's) circuit breaker panel.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

SAFE/ARM FUNCTION

UH-60A 77-22714 - 77-22723 > With the helicopter on the ground (weight-on-wheels), the drag beam switch completes a circuit to energize relay K1 in the audio junction box assembly. With K1 energized, power is removed from the dispenser control panel. When the helicopter is airborne (weight-off-wheels), K1 de-energizes routing power to the dispenser control panel. This function automatically inhibits system operation (safe condition) while the helicopter is on the ground. < UH-60A 77-22724-78-22986 > K1 relay in the audio junction box assembly is disconnected from the drag beam switch. With K1 relay permanently de-energized, power is routed through the audio junction box assembly to the dispenser control panel. < UH-60A 78-22987-SUBQ UH-60L HH-60A HH-60L EH-60A > The audio junction box assembly is removed from the circuit. Power is routed directly from the circuit breaker to the dispenser control panel. <

UH-60A UH-60L HH-60A HH-60L > While on the ground and parked, a safety pin and red flag assembly (marked REMOVE BEFORE FLIGHT) is inserted at the electronics module. This removes power from the electronics module circuits and prevents accidental dispensing of chaff or flares. The dispenser control panel SAFE-ARM switch is used to set the operating mode while the helicopter is airborne. In the SAFE position, the flare and chaff dispense pushbutton are disabled. To arm the system, the SAFE-ARM switch is placed to ARM. An arm signal is sent to the electronics module arm circuit to activate the chaff dispenser. While armed, an arm indicator signal is applied, through the left relay panel, to the dispenser control panel ARM indicator. The ARM indicator is dimmed at the dispenser control panel by turning the ARM indicator housing. < EH-60A > While on the ground and parked, a safety pin and red flag assembly (marked REMOVE BEFORE FLIGHT) is inserted at the electronics module. This removes power from the electronics module circuits and prevents accidental dispensing of chaff or flares. The dispenser control panel SAFE-ARM switch is used to set the operating mode while the helicopter is airborne. In the SAFE position, the flare and chaff dispense push-button are disabled. To arm the system, the SAFE-ARM switch is placed to ARM. An arm signal is sent to the electronics module arm circuit to activate the chaff dispenser. While armed, an arm indicator signal is applied, through the left relay panel, to the dispenser control panel ARM indicator. The arm indicator signal is also applied to the flare dispenser, arming the dispenser. The ARM indicator is dimmed at the dispenser control panel by turning the ARM indicator housing. With the dispenser control panel FLARE RIPPLE FIRE switch placed to its up position, the arm signal is generated, the ARM indicator lights, and flares are dispensed in rapid succession. <

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

For location and description of major components, refer to the data in this work package.

EQUIPMENT DATA

If applicable, refer to WP 1763 00 for equipment data information.

ELECTRICAL SYSTEMS

MAIN/TAIL LANDING GEAR SKIS DESCRIPTION AND DATA

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

MAIN/TAIL LANDING GEAR SKIS

Main landing gear skis, consist of two main skis installed on main landing gear, using axle adapters on skis and adapter kit mounted on main landing gear axles. Tail landing gear ski consists of one ski mounted on the tail landing gear wheel using axle adapters. When skis are removed, the adapter kit may remain installed, allowing for ease in reinstallation of skis. Safety cables and spring cylinders are mounted on all skis to maintain flight attitude and prevent skis from being damaged in flight. Ski construction consists of fiberglass reinforced main body, top coated with a red isophthalic polyester finish and bottom coated with a furane epoxy resin coating (4B2), finished with a Teflon urethane coating. Skis allow support of 22,000 pounds gross weight at approximately 2.53 pounds per square inch in snow, with main wheels protruding six inches below ski level into snow. Wheels protrude 3 inches under skis on hard surfaces.

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

For location and description of major components, refer to the data in this work package.

EQUIPMENT DATA

If applicable, refer to WP 1752 00 for equipment data information.

ELECTRICAL SYSTEMS

FLIR SYSTEM DESCRIPTION AND DATA HH-60A>

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

EQUIPMENT DESCRIPTION AND DATA

The forward looking infrared set (FLIR) is designed to manually scan, locate, and display images in the IR and visual spectrum. The FLIR set consists of: the turret, mounted on the nose; the FLIR imaging unit located within the turret; the central electronics unit (CEU), in the antenna well; the pilot's and copilot's multifunction display unit (MFD), on the instrument panel; and the FLIR control panel (FCP), in the lower console (Figure 1. (Sheet 1 of 4)). The turret provides three-axis movement of the FLIR line-of-sight (LOS), corresponding to the center of the imaged scene, to any position within the field-of-regard (FOR). The FLIR imager collects and converts IR and visual images into electrical signals for CEU processing. The CEU inputs data from the FLIR and outputs the signal for display on the MFDs. The MFDs provide the processed thermal (IR) imaging in addition to FLIR set information including status bar, grayscale, reticles, graticules, and on-line menus. The FCP provides system control of the following: turret line-of-sight, changing field of view, freezing video images, and adjusting gain, level, and focus controls.

POWER DISTRIBUTION

Electrical power of 28 vdc is supplied by the No. 2 dc primary bus and routed through the FLIR circuit breaker on the copilot's auxiliary circuit breaker panel to the CEU (Figure 2). The CEU provides 13.8 vdc and 28 vdc to the FCP, and 13.8 vdc and 28 vdc to the turret.

TURRET OPERATION

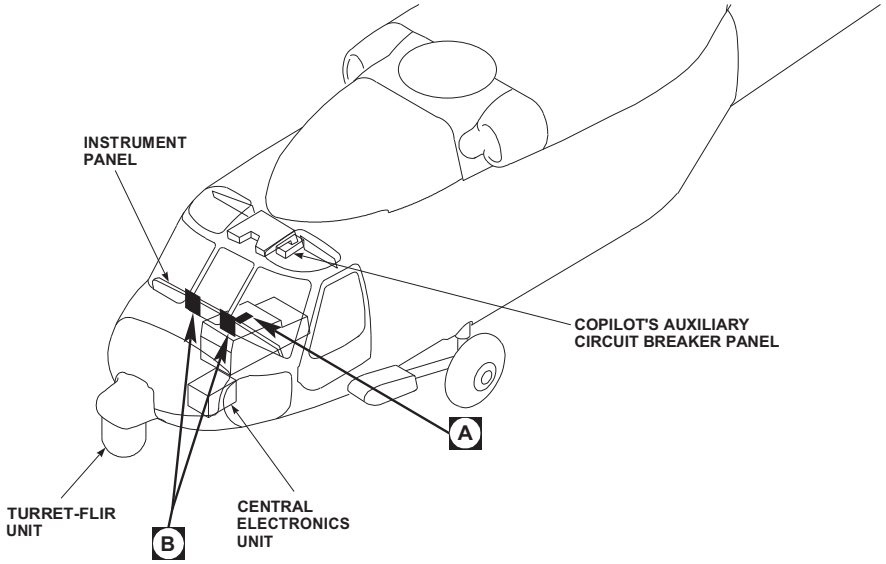
The turret-FLIR unit (TFU) can operate in the following modes. In inertial pointing mode the TFU line-of-sight is controlled manually by commands generated from the FCP joystick. If no commands are generated from the joystick, the TFU gyros direct the TFU to maintain its inertial bearing and elevation, thus compensating for platform vibration and aircraft direction changes.

Heading hold mode consists of two phases. In the first phase the TFU is controlled by the FCP joystick outputs. The first phase is identical to the inertial pointing mode. The second phase commences whenever the FCP joystick outputs return to zero. In this phase the TFU is caged to the last commanded position. It remains caged to this position until a new joystick command is received or a different mode is selected that changes the line of sight.

In CAGE mode the TFU is commanded to a particular pointing angle with respect to the airframe centerline. The default cage position is 0°Az, 0°El, and is automatically configured upon initial power on. The default cage position and one other position can be reprogrammed in the configuration menu.

Stow mode is used for positioning the TFU prior to power off. In stow mode the TFU is rotated to 180° azimuth, +130° elevation to protect the windows. The elevation rotation is automatically locked by magnetic detents. The stow mode is activated by the operator as part of the power off sequence.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED



TERMINAL BOARD/ DISCONNECT PLUG/ RECEPTACLE	LOCATION/ CONNECTION POINT
P129 / J129	COPILOT'S AUXILIARY CIRCUIT BREAKER PANEL
P210 / 1J1	ANTENNA WELL / CEU
P212R / 1J8	ANTENNA WELL / CEU
P213R / 1J7	ANTENNA WELL / CEU
P214R / 3J1	LOWER CONSOLE / FLIR CONTROL PANEL
P215R / 1J3	ANTENNA WELL / CEU
P216R / 1J6	ANTENNA WELL / CEU
P217R / 2J1	TURRET / TURRET-FLIR UNIT
P1015R	COPILOT'S MFD, INSTRUMENT PANEL
P1016R	PILOT'S MFD, INSTRUMENT PANEL
TJ5VB	TERMINAL BOARD, LOWER CONSOLE

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Figure 1. FLIR Set Location Diagram (Sheet 1 of 4).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

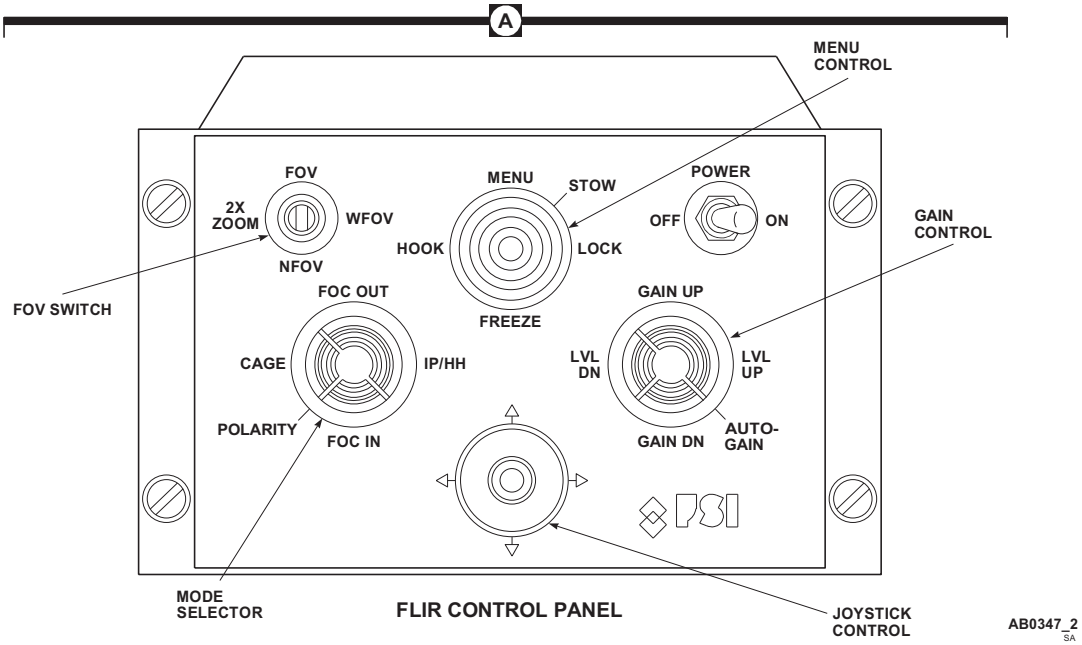


Figure 1. FLIR Set Location Diagram (Sheet 2 of 4).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

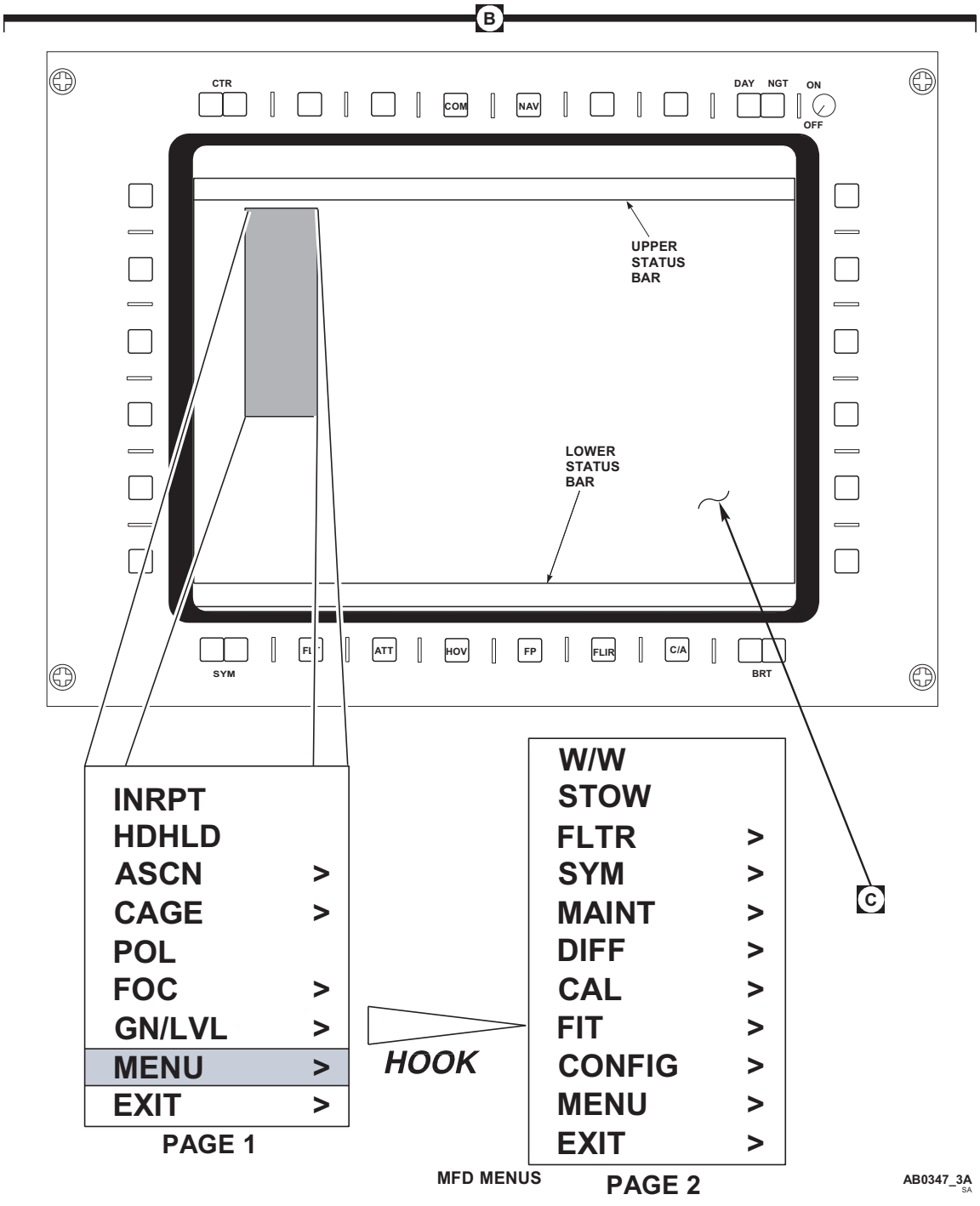


Figure 1. FLIR Set Location Diagram (Sheet 3 of 4).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

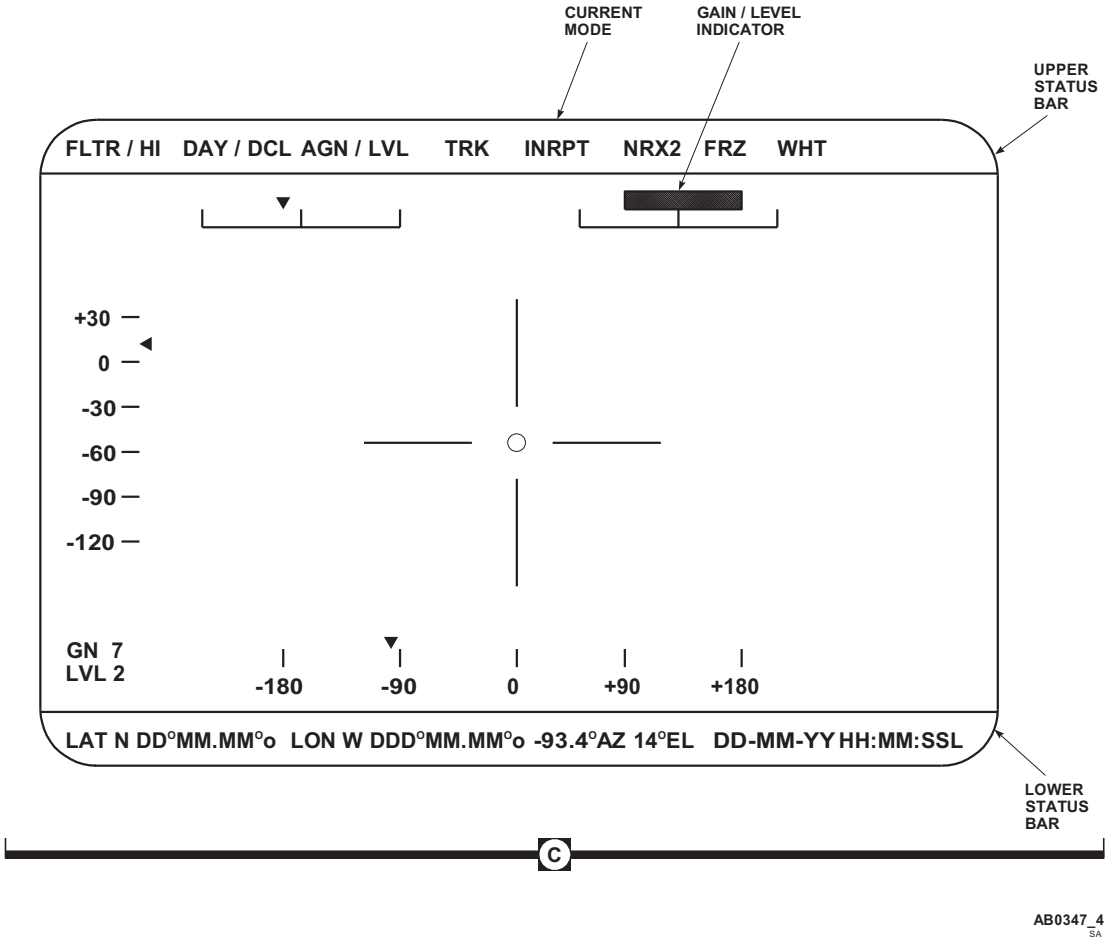


Figure 1. FLIR Set Location Diagram (Sheet 4 of 4).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

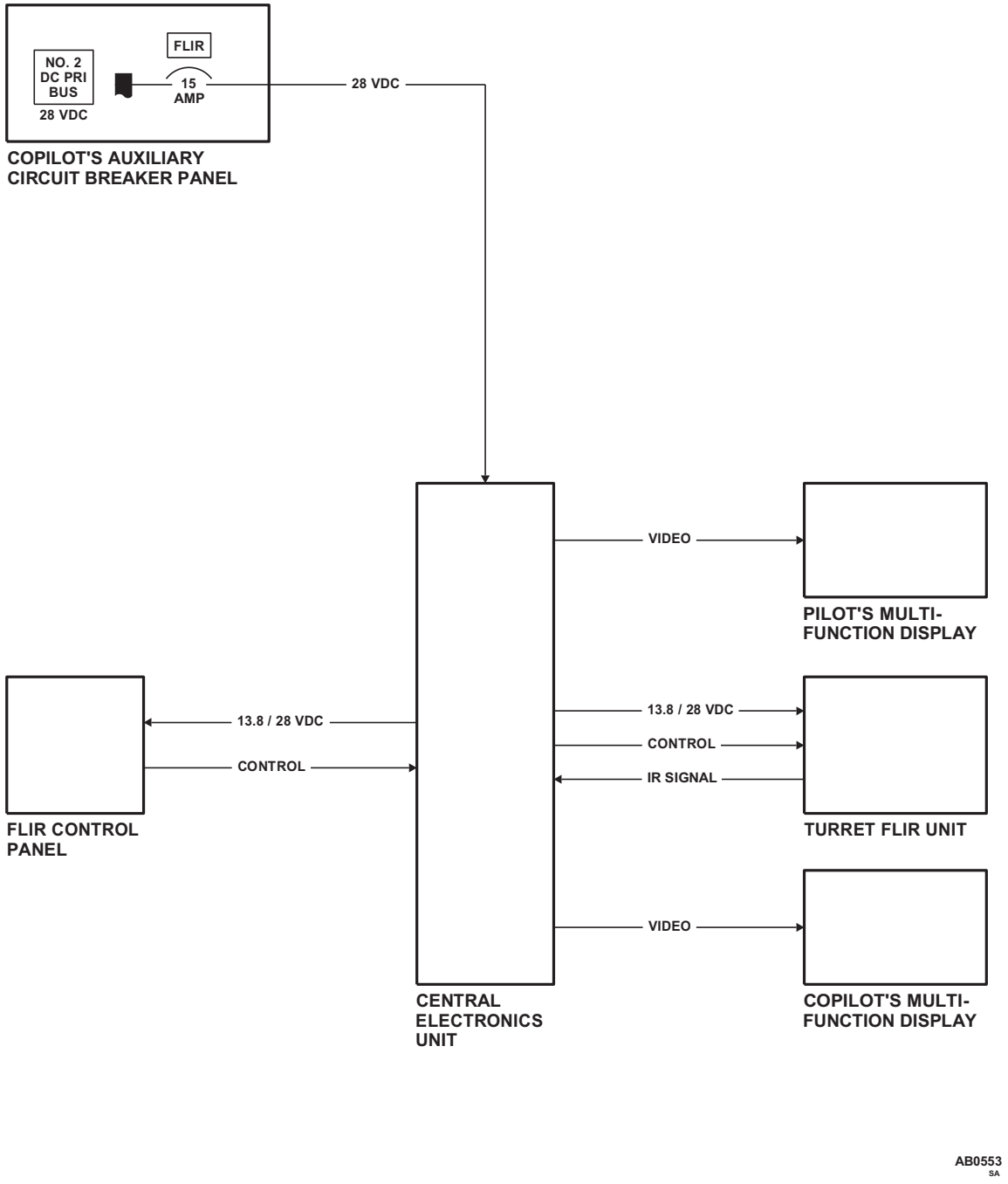


Figure 2. FLIR Set Block Diagram.

IMAGING

The FLIR Imager incorporates scanning optics, infrared detectors, a detector cooler, video preamplifiers, scanner electronics, and a microcontroller necessary to collect and convert infrared radiation to electronic signals for processing by the CEU. The FLIR Imager contains two sets of optics providing both high and low magnification. At low magnification, the wide field-of-view (WFOV) of 28.0 degrees horizontal by 16.8 degrees vertical is displayed on the display monitor. At high magnification, the narrow field-of-view (NFOV) of 5.0 degrees horizontal

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

by 3.0 degrees vertical is displayed. The FLIR imager unit also contains a high resolution TV sensor that provides the visible light image. The TV sensor incorporates a charge-coupled device (CCD) array, camera electronics, and zoom lens necessary to convert visible light to electronic signals for processing. The camera lens is an automatic iris zoom lens.

CENTRAL ELECTRONICS UNIT

The CEU processes and transfers all system signals, commands, and data I/O. It interfaces between the TFU, the MFDs, and the FCP. Communication between the system components is accomplished via a serial data bus. The CEU performs such tasks as auto-infinity focus, automatic level and gain, generation of all overlay symbology, as well as controlling the menu-driven system functions.

FLIR CONTROL PANEL

The FCP provides set interface between the operator and the FLIR set. The set controls are partitioned between the joystick and switches on the FCP, and the menu overlays on the MFDs. The following functions are accomplished via the FCP: menu and command selection, TFU modes and tracking, field of view changes, freezing video, and adjusting camera gain, level, and focus.

MULTIFUNCTION DISPLAY UNIT

The MFDs are the visual interface between the operator and the set. They provide the operator with the thermal and/or visible light imaging display. Serial data containing image information is transmitted to the MFDs via the CEU. The MFDs display command and status information, menus and submenus, and tracking data.

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

For location and description of major components, refer to the data in this work package.

EQUIPMENT DATA

For equipment data information, refer to this work package.

ELECTRICAL SYSTEMS

FLIR SYSTEM DESCRIPTION AND DATA HH-60L>

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

EQUIPMENT DESCRIPTION AND DATA

The forward looking infrared set (FLIR) is designed to manually scan, locate, and display images in the IR and visual spectrum. The FLIR set consists of: the turret, mounted on the nose; the FLIR imaging unit located within the turret; the central electronics unit (CEU), in the antenna well; the pilot's and copilot's multifunction display unit (MFD), on the instrument panel; and the FLIR hand control unit (HCU). The turret is a three axis design, gyro-stabilized in outer azimuth, inner azimuth, and elevation. The turret provides the remote movement of the FLIR line-of-sight (LOS), corresponding to the center of the imaged scene, to any position within the field-of-regard (FOR).The CEU inputs data from the FLIR and outputs the signal for display on the MFDs. The MFDs provide the processed thermal (IR) imaging in addition to FLIR set information including status bar, grayscale, reticles, graticules, and on-line menus. The HCU provides system control of the following: TFU LOS, changing field of view (FOV), freezing video images, and adjusting gain, level, and focus controls. (See Figure 1)

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

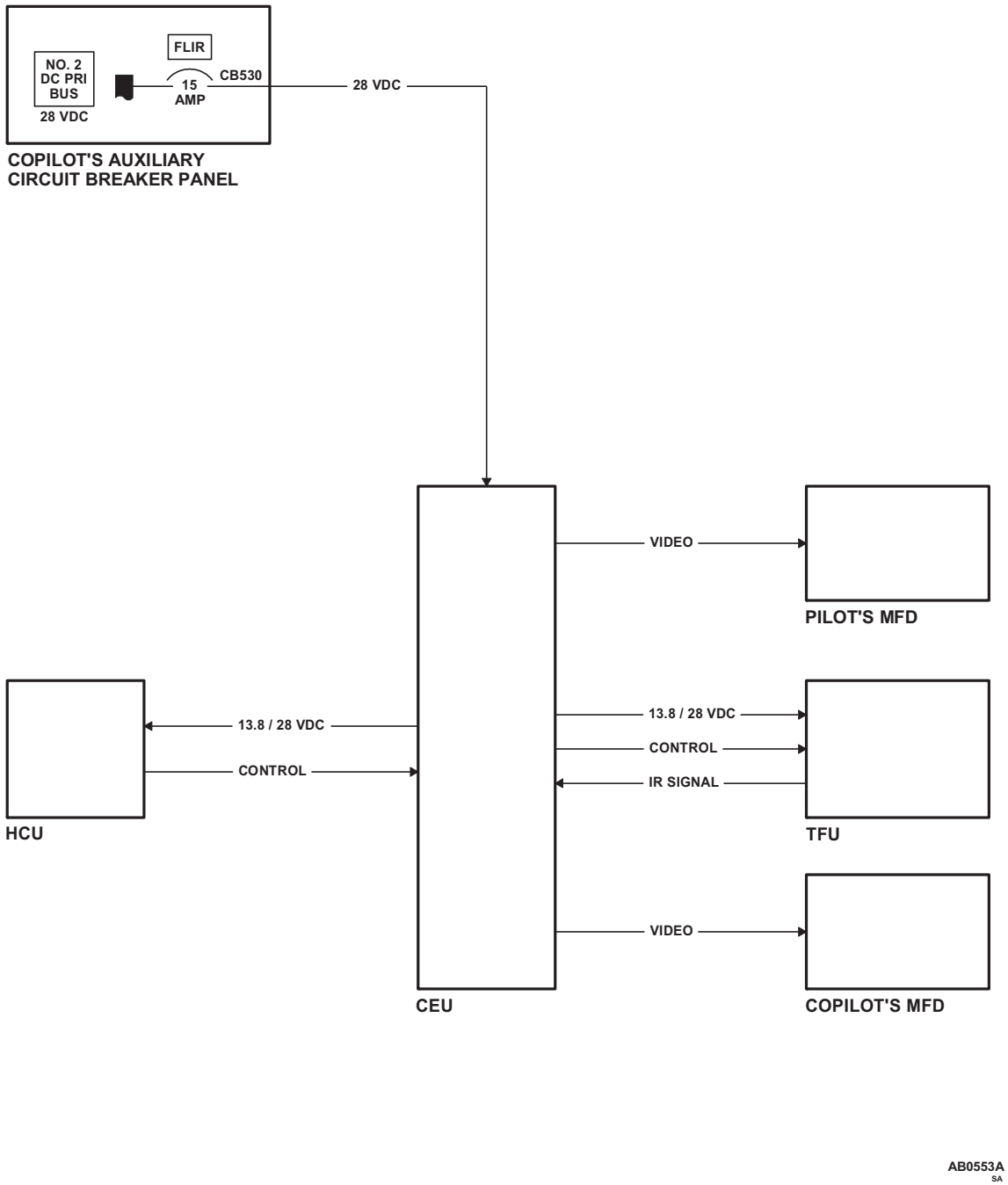


Figure 1. FLIR Set Block Diagram.

TURRET OPERATION

The TFU (Figure 2. (Sheet 1 of 4)) can operate in the following modes. In inertial pointing mode the TFU LOS is controlled manually by commands generated from the HCU force transducer. If no commands are generated

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

from the force transducer, the TFU gyros direct the TFU to maintain its inertial bearing and elevation, thus compensating for platform vibration and aircraft direction changes.

Heading hold mode consists of two phases. In the first phase the TFU is controlled by the HCU force transducer outputs. The first phase is identical to the inertial pointing mode. The second phase commences whenever the HCU force transducer outputs return to zero. In this phase the TFU is Caged to the last commanded position. The TFU remains Caged to this position until a new force transducer command is received or a different mode is selected that changes the LOS.

In Cage mode the TFU is commanded to a particular pointing angle with respect to the airframe centerline. The default Cage position is 0°Az, 0°El, and is automatically configured upon initial power on. The default Cage position and one other position can be reprogrammed in the configuration menu.

Stow mode is used to store the TFU prior to power off. In stow mode the TFU is rotated to 180° azimuth, -270° elevation to protect the windows. The elevation rotation is automatically locked by magnetic detents. The stow mode is activated by the operator as part of the power off sequence.

POWER DISTRIBUTION

Electrical power of 28 vdc is supplied by the No. 2 dc primary bus and routed through the FLIR circuit breaker CB530 on the copilot's auxiliary circuit breaker panel to the CEU. The CEU provides 13.8 vdc and 28 vdc to the HCU, and 13.8 vdc and 28 vdc to the TFU. (See Figure 2. (Sheet 1 of 4), Detail B.)

IMAGING

The FLIR Imager incorporates all imaging optics, infrared detectors, a detector cooler, detector interface, and digitalized electronics. These components collect, process, enhance, and convert infrared radiation into standard video signal suitable for processing by the CEU. The FLIR Imager contains three sets of optics with electronic zoom providing narrow, medium, and wide FOV. The FOV status item indicates the current FOV selection. Wide is displayed when the system is in wide FOV. MED is displayed when the system is in medium FOV. NRW is displayed when in narrow FOV. "2X" is displayed when Electronic Zoom is on. TV will be displayed in the CCD mode.

CENTRAL ELECTRONICS UNIT

The CEU (Figure 2. (Sheet 2 of 4), Detail D) processes and transfers all system signals, commands, and data I/O. It interfaces between the TFU, the MFDs, and the HCU. Communication between the system components is accomplished via a serial data bus. The CEU implements software algorithms to perform such tasks as auto-infinity focus, automatic level and gain, generation of all overlay symbology, as well as controlling the menu-driven system functions.

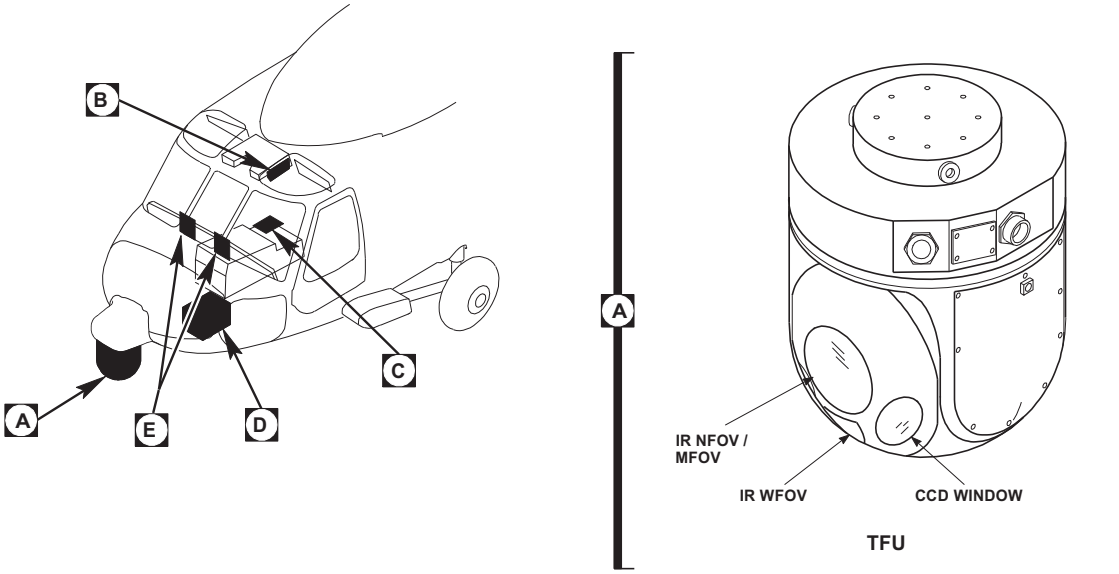
FLIR HAND CONTROL UNIT

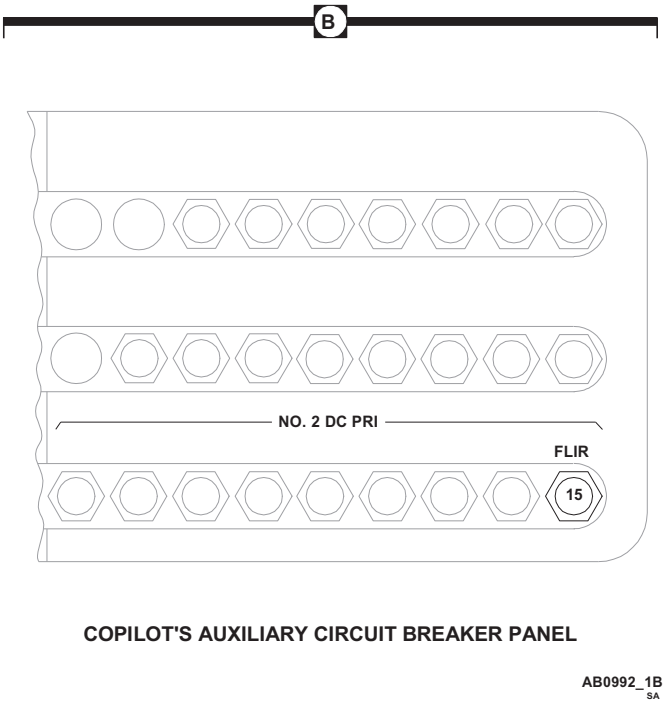
The HCU (Figure 2. (Sheet 2 of 4), Detail C) provides set interface between the operator and the FLIR set. The set controls are partitioned between the pressure transducer and switches on the HCU, and the menu overlays on the MFDs. The following functions are accomplished via the HCU: menu and command selection, TFU modes and tracking, FOV changes, freezing video, and adjusting camera gain, level, and focus.

MULTIFUNCTION DISPLAY UNIT

The MFDs are the visual interface between the operator and the set. They provide the operator with the thermal and/or visible light imaging display. Serial data containing image information is transmitted to the MFDs via the CEU (Figure 2. (Sheet 4 of 4), Detail F). The MFDs display command and status information, menus and submenus, and tracking data (Figure 2. (Sheet 3 of 4), Detail E).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED





TERMINAL BOARD/ DISCONNECT PLUG/ RECEPTACLE	LOCATION/ CONNECTION POINT
J9001	AFT FIXTURE DISCONNECT PANEL
P129 / J129	COPILOT'S AUXILIARY CIRCUIT BREAKER PANEL
P210R / J1	ANTENNA WELL / CEU
P212R / J8	ANTENNA WELL / CEU
P213R / J7	ANTENNA WELL / CEU
P214R / J1	HAND CONTROL UNIT
P215R / J3	ANTENNA WELL / CEU
P216R / J6	ANTENNA WELL / CEU
P217R / J1	TTFU
P219R / 1J10	ANTENNA WELL / CEU
P1015R / J1	COPILOT'S MFD, INSTRUMENT PANEL
P1016R / J1	PILOT'S MFD, INSTRUMENT PANEL
TJ5VB	TERMINAL BOARD, LOWER CONSOLE

Figure 2. FLIR Set Location Diagram (Sheet 1 of 4).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

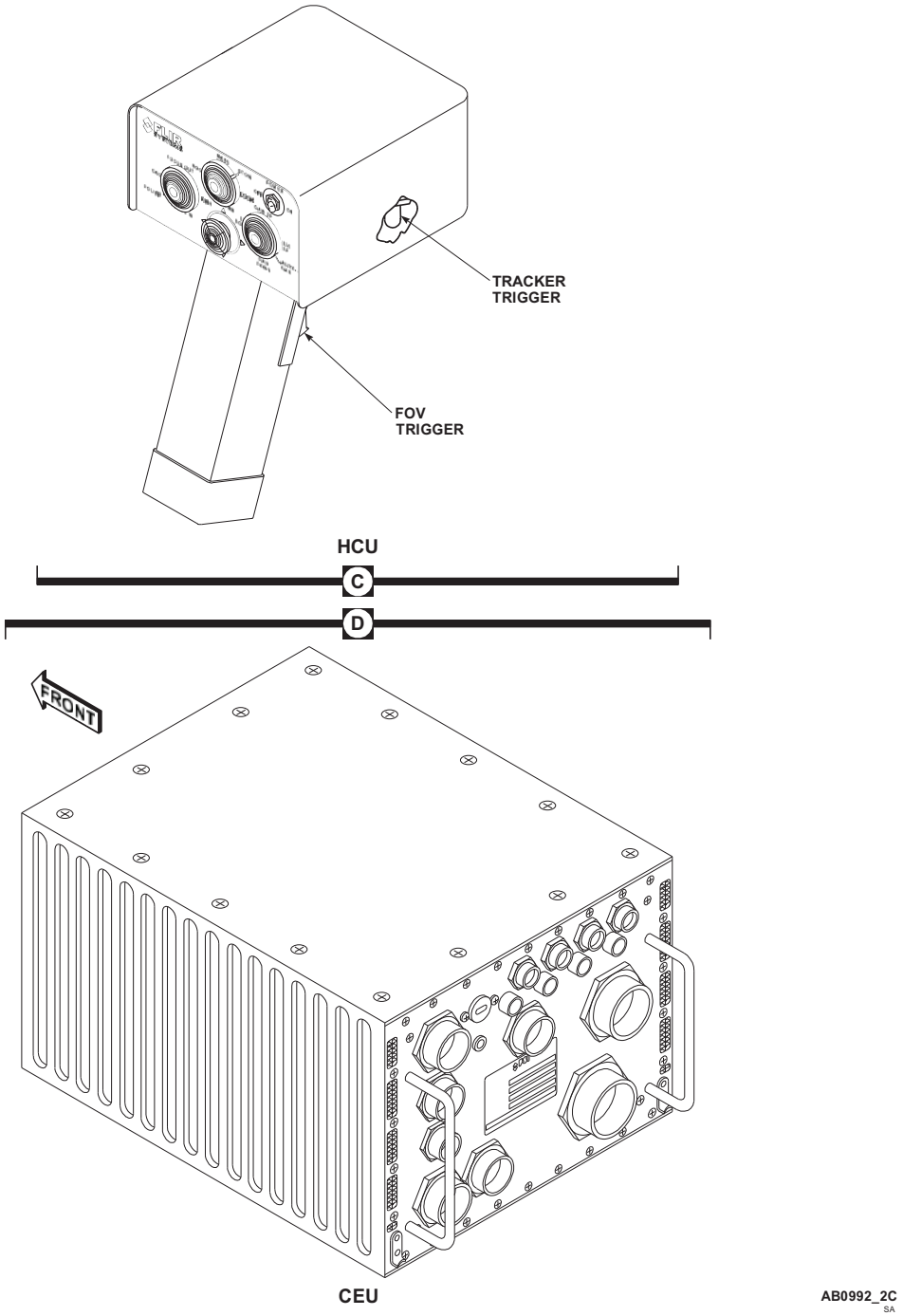


Figure 2. FLIR Set Location Diagram (Sheet 2 of 4).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

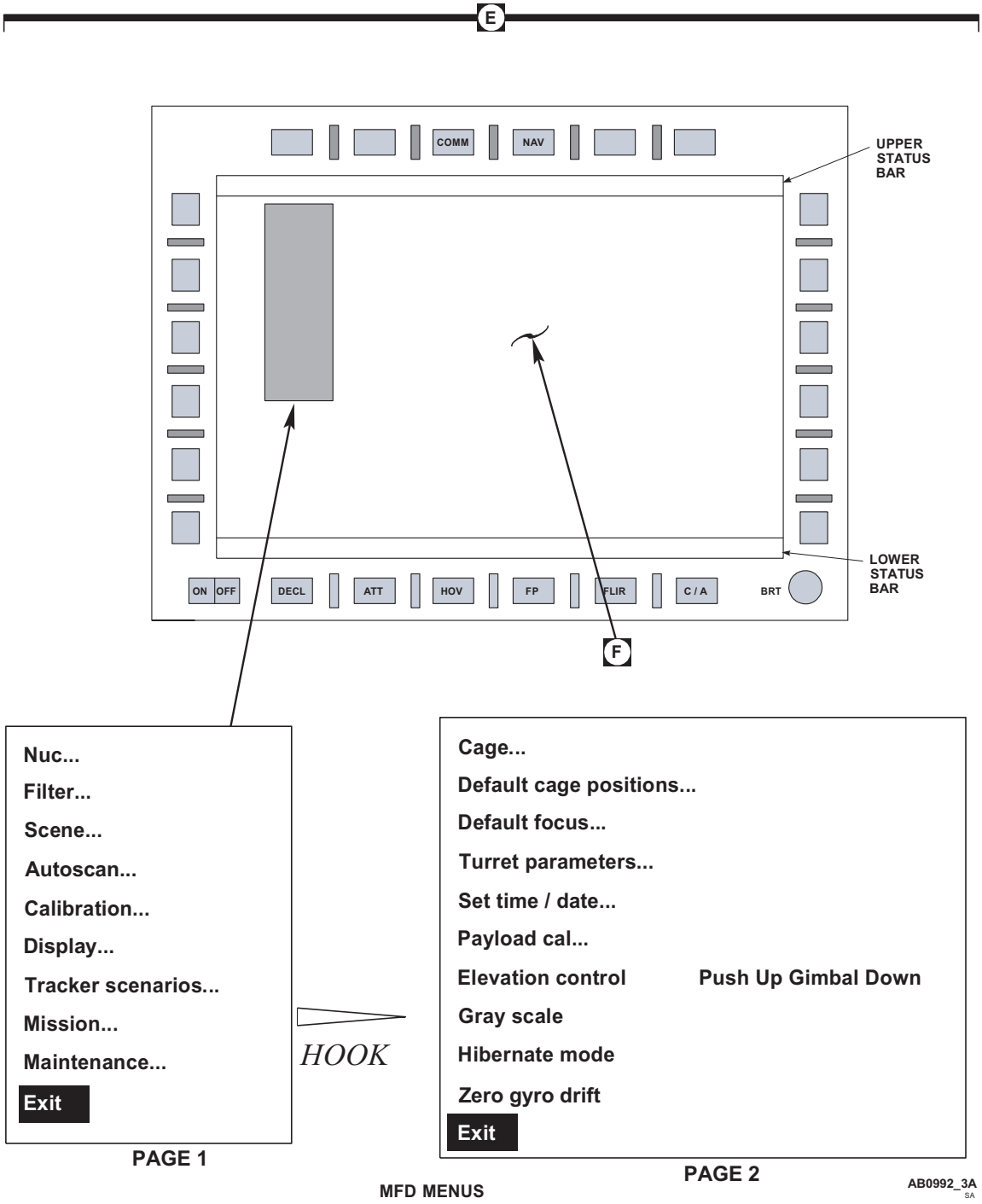
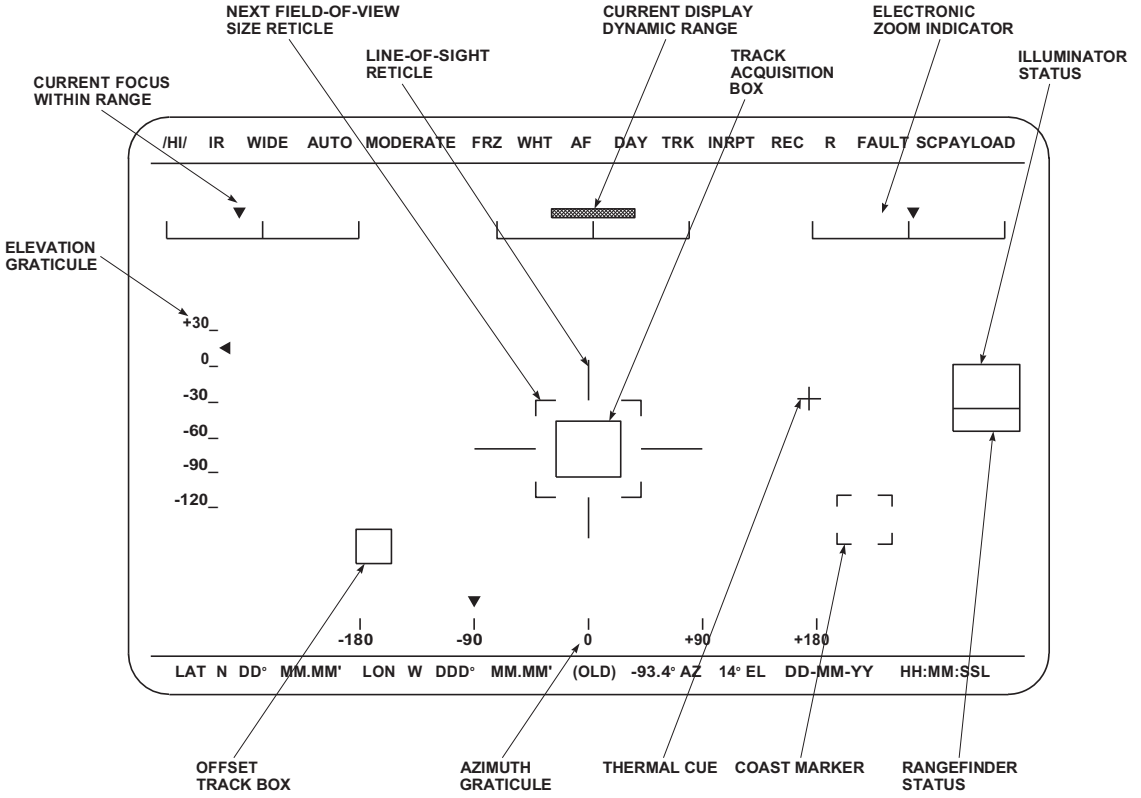


Figure 2. FLIR Set Location Diagram (Sheet 3 of 4).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

F



TYPICAL FLIR DISPLAY

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Figure 2. FLIR Set Location Diagram (Sheet 4 of 4).

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

For location and description of major components, refer to the data in this work package.

EQUIPMENT DATA

For equipment data information, refer to this work package.

MISSION SYSTEMS

BALLISTIC ARMOR PROTECTION (BAPS) SYSTEM DESCRIPTION AND DATA

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

EQUIPMENT DESCRIPTION AND DATA

The Ballistic Armor Protection System (BAPS) is composed of a series of armored panels that cover the inside of the cockpit, cabin floor and lower walls of UH-60 helicopters. BAPS is designed to protect crew and passengers from small and medium arms fire.

When installed, BAPS panels overlay the existing aircraft interior. BAPS armor employs a steel plate with laminated composite that covers the back of each panel and a border, approximately two inches, along the edge of each panel. All BAPS configurations are common for the cockpit and forward crew area. Installation in the rear crew area (aft of STA 319) is specific for the UH-60A/L and each UH-60 Medevac configuration. Both Medevac configurations support installation of the internal hoist. The three BAPS configurations are as follows:

- Configuration R1 shows the UH-60A/L configuration with cargo hook accessible (Figure 1).
- Configuration R3 shows UH-60 Medevac with pedestal configuration. Cargo hook not accessible (Figure 2).
- Configuration R4 shows UH-60 Medevac with pedestal configuration. Cargo hook accessible (Figure 3).

Ballistic protection is compromised if the steel or composite is damaged prior to ballistic impact. Repair of damaged is limited to the outer paint and spall cover. Damage to steel or composite is not field repairable. Cautionary procedures for limiting such damage are described below. It is essential that the paint and spall cover be protected as much as possible during normal use.

CAUTION

- Ensure aircraft floor under panels is clean and completely free of FOD or any other debris prior to placing panels.
- Avoid dropping panels or equipment and tools on panels. The panels have protection against edge drops, but there may be some reduction in ballistic protection.
- Avoid dragging equipment over panels. Damaged paint implies the possibility of damaged spall cover. Damaged spall cover implies possibility of damaged steel or composite.
- Do not use pry bars or other metallic tools while installing, removing or handling the panels.
- Avoid standing water or other corrosive agents. The epoxy paint provides protection from these agents, but an unseen break in the paint and spall cover could lead to reduction of ballistic protection.
- Avoid placing or storing panels in a manner that causes them to bend.

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

For location and description of major components, refer to the data in this work package.

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS – CONTINUED

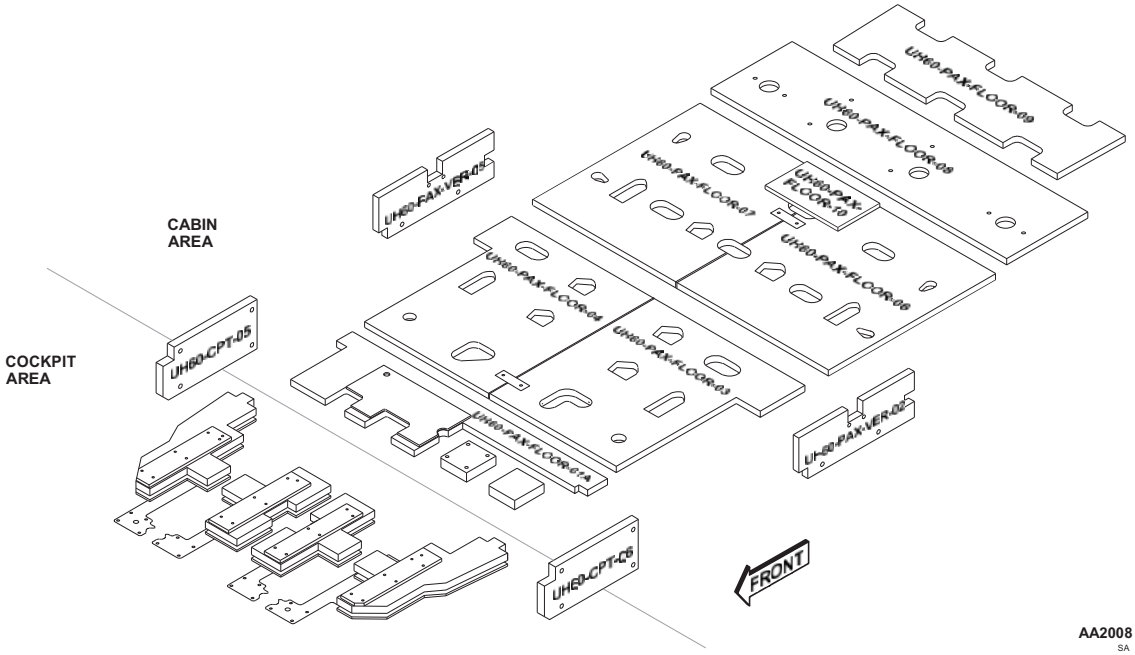


Figure 1. UH-60A/L R1 BAPS Layout Configuration, Cargo Hook Accessible..

EQUIPMENT DATA

For equipment data information, refer to this work package.

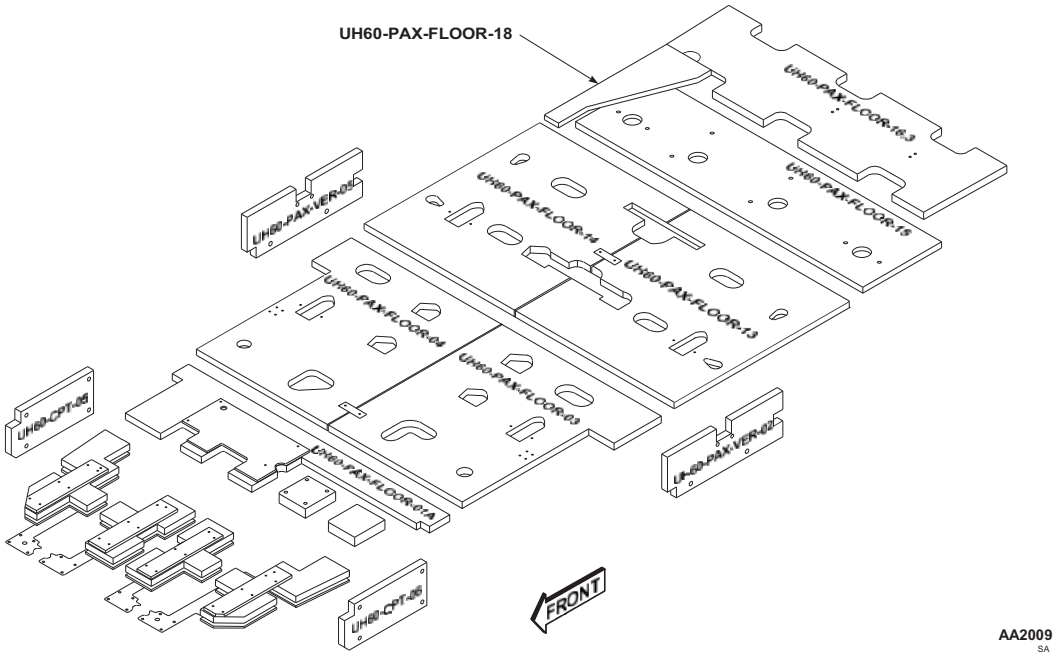


Figure 2. UH-60 Medevac R3 BAPS Layout W/Pedestal Configuration, Cargo Hook Not Accessible..

EQUIPMENT DATA – CONTINUED

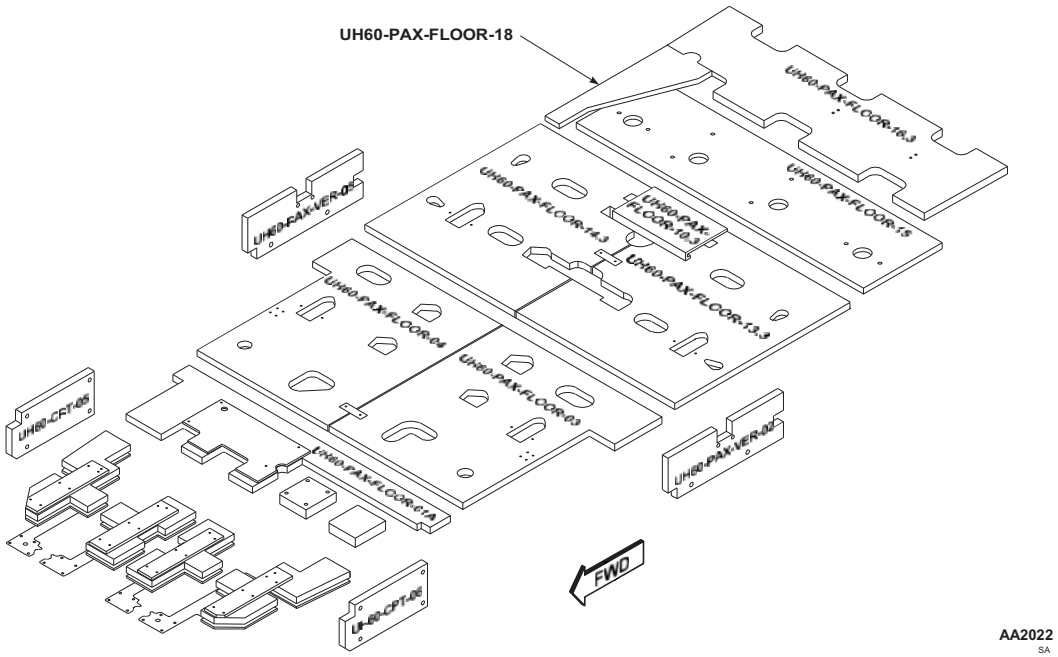


Figure 3. UH-60 Medevac R4 BAPS Layout W/Pedestal Configuration, Cargo Hook Accessible..

EMERGENCY EQUIPMENT

COCKPIT EMERGENCY EQUIPMENT DESCRIPTION AND DATA

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

COCKPIT EMERGENCY EQUIPMENT

The cockpit emergency equipment consists of a fire extinguisher, two first aid kits and an emergency locator transmitter used when emergency conditions exist. A first aid kit is located on the back of each pilot and copilot seat. The fire extinguisher is mounted on the side of the copilot seat. The emergency locator transmitter is located to the right of the pilot seat.

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

For location and description of major components, refer to the data in this work package.

EQUIPMENT DATA

Not applicable.

ELECTRICAL SYSTEMS

CABIN EMERGENCY EQUIPMENT DESCRIPTION AND DATA

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

CABIN EMERGENCY EQUIPMENT

The cabin emergency equipment consists of a fire extinguisher, first aid kit and a crash ax used when emergency conditions exist. A first aid kit is located on the back of the copilot seat. The fire extinguisher is mounted on the side of the pilot seat. The crash ax is mounted behind the lower console.

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

For location and description of major components, refer to the data in this work package.

EQUIPMENT DATA

Not applicable.

ELECTRICAL SYSTEMS

COCKPIT AIR BAG SYSTEM DESCRIPTION AND DATA

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

COCKPIT AIR BAG SYSTEM DESCRIPTION

The cockpit air bag system (CABS) provides supplemental restraint protection for the pilot and copilot during a survivable aircraft crash by minimizing the crewmembers' motion and by providing forward and lateral protection from occupant strike hazards. The CABS consists of pilot's and copilot's forward and lateral air bag modules, gas generators, and the electronic crash sensor unit (ECSU). The pilot's and copilot's forward air bag modules, which contain the gas generators, are mounted on the glareshield. The lateral air bag modules, also containing gas generators, are mounted on the left and right hand stationary wing panels on the outboard bulkhead. The ECSU attaches to the mounting tray located in the copilot's seatwell. During normal flight, the ECSU monitors overall CABS status and readiness. Separate pilot and copilot cable assemblies connect the forward and lateral air bag modules to the ECSU.

COCKPIT AIR BAG SYSTEM OPERATION

The ECSU detects a crash and initiates deployment of the CABS air bags. During a crash, the ECSU identifies the sudden change of velocity and performs a time-integration calculation of the deceleration time-history. If both the measured deceleration and the calculated velocity change occur concurrently and exceed predetermined crash pulse levels, the firing capacitors discharge and a firing signal is sent to the gas generator propellant. The propellant burns very rapidly and produces a large volume high-temperature gas. The high-temperature gas flows from the gas generator combustion chambers, through a series of screens and exhaust ports in the gas generator, into the forward and lateral air bag modules. The propellant gases pressurize and deploy the air bags. The air bags inflate in three seconds and deflate in three to five seconds.

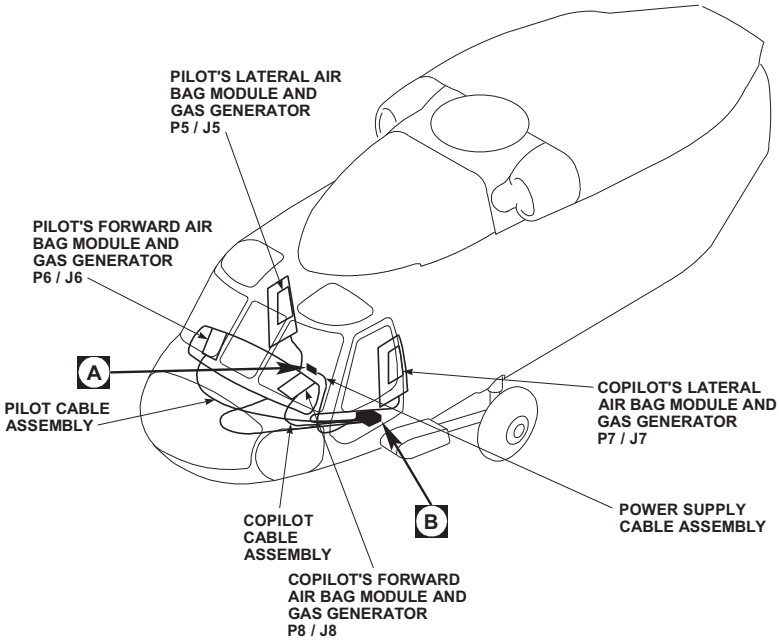
The ECSU incorporates built-in-test (BIT) circuitry to monitor CABS status and readiness. A system fault (SYS FAULT) indicator, located on the ECSU, is a latching indicator that provides rapid identification of the CABS status. When the BIT determines the CABS is operating properly, the twin cylinders on the SYS FAULT indicator remain black. If the BIT identifies a CABS fault, the SYS FAULT indicator will display a fault indication by the BIT software within the ECSU. The twin cylinders on the SYS FAULT indicator rotate to display two white square indicators. When the fault indication is noted, the fault location can be determine by pressing the push-to-display (PTD) button on the ECSU.

When the PTD button is pressed and released, light-emitting diodes (LEDs) mounted on the face of the ECSU will indicate which CABS components are faulty. Eight LEDs are located on the ECSU that indicate fault detection within the CABS. Since four gas generators are installed, two on the pilot's side and two on the copilot's side, only the top four (1 and 2) LEDs are used for fault isolation. If the ECSU LED illuminates after the PTD button is pressed and released, the ECSU is faulty. If the aircraft identification (A/C ID) LED illuminates after the PTD is pressed, it indicates that either ECSU or the aircraft identification resistors, within the ECSU power cable, are defective. To determine which of the air bag modules or electrical interfaces is faulty, the pilot or copilot LEDs will illuminate after the PTD button is pressed.

SYSTEM ELECTRICAL POWER

Electrical power is supplied by the battery bus through the CABS circuit breaker on the lower console circuit breaker panel. The 28 vdc supplied from the CABS circuit breaker is routed to power the ECSU. The ECSU then sends the 28 vdc to the gas generators in the two forward and two lateral modules.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

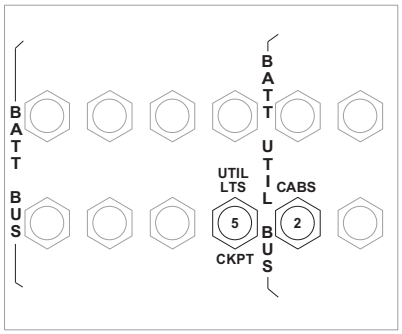


TERMINAL BOARD / DISCONNECT PLUG / RECEPTACLE	LOCATION / CONNECTION POINT
P2 / J2 P3 / J3 P4 / J4	ELECTRONIC CRASH SENSOR UNIT
P5 / J5	PILOT'S LATERAL AIR BAG MODULE AND GAS GENERATOR
P6 / J6	PILOT'S FORWARD AIR BAG MODULE AND GAS GENERATOR
P7 / J7	COPILOT'S LATERAL AIR BAG MODULE AND GAS GENERATOR
P8 / J8	COPILOT'S FORWARD AIR BAG MODULE AND GAS GENERATOR
P107 / J107	LOWER CONSOLE CIRCUIT BREAKER PANEL DISCONNECT

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Figure 1. Cockpit Air Bag System Location Diagram (Sheet 1 of 2).

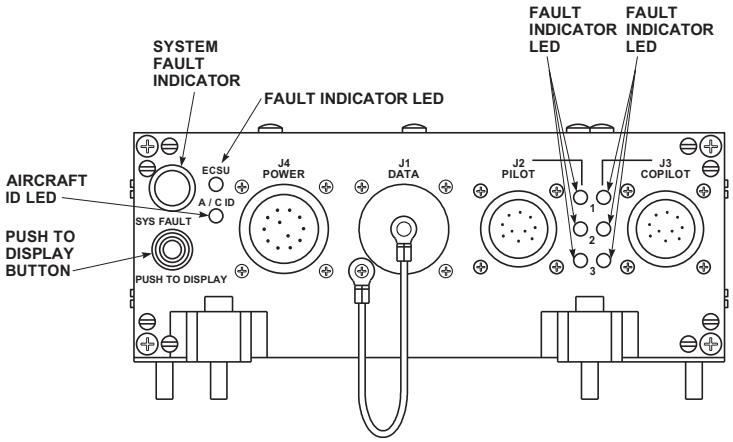
EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED



LOWER CONSOLE CIRCUIT BREAKER PANEL

A

B



ELECTRONIC CRASH SENSOR UNIT (ECSU)

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Figure 1. Cockpit Air Bag System Location Diagram (Sheet 2 of 2).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

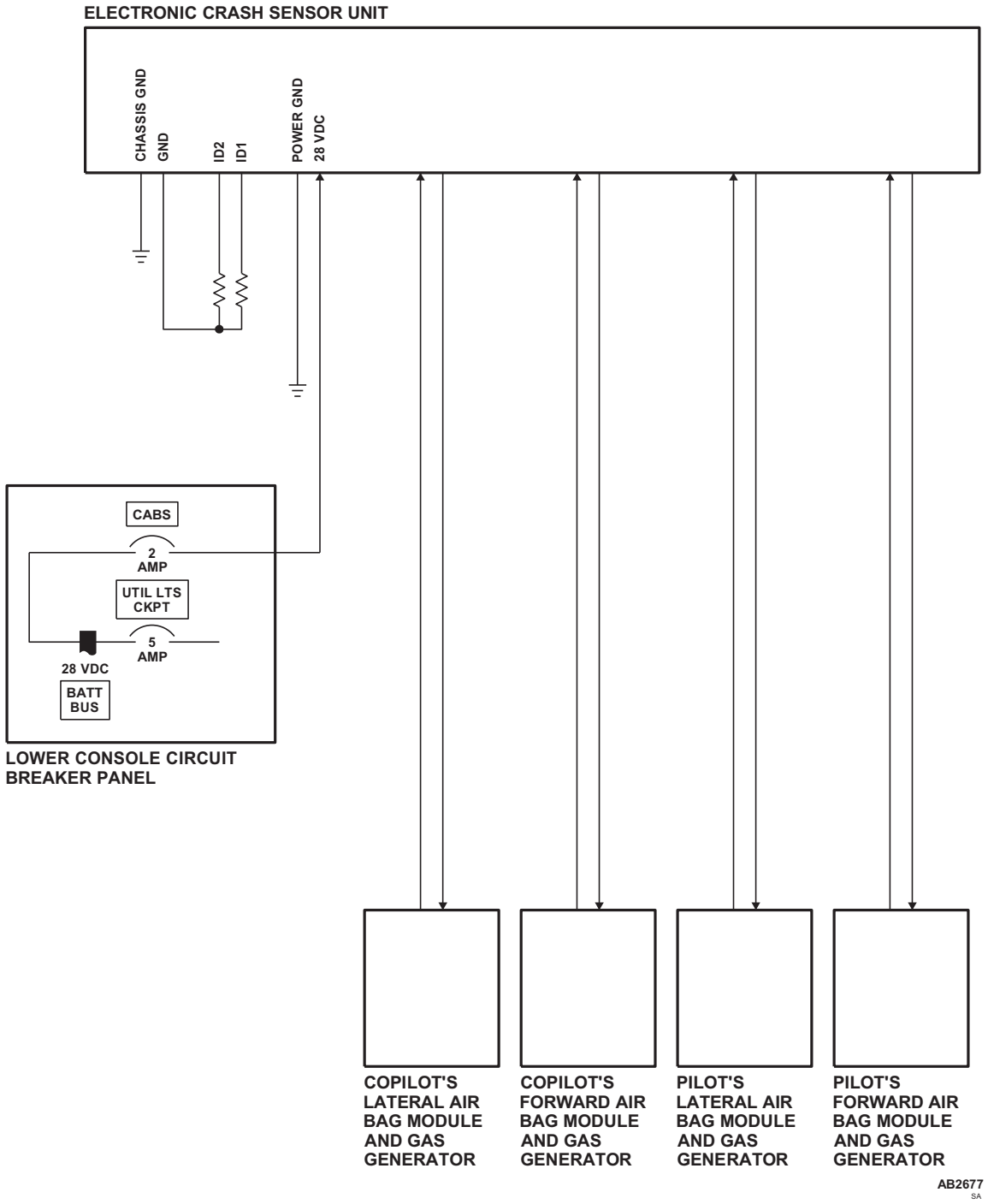


Figure 2. Cockpit Air Bag System Block Diagram.

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

For location and description of major components, refer to the data in this work package.

EQUIPMENT DATA

If applicable, refer to WP 1752 00 for equipment data information.

ELECTRICAL SYSTEMS

MICROCLIMATE COOLING SYSTEM AND MASK BLOWER WIRING ASSEMBLY DESCRIPTION AND DATA

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

MICROCLIMATE COOLING SYSTEM

The Microclimate Cooling System (MCS) provides aircrew members a means to help maintain a lower body temperature while conducting missions in MOPP IV or hot weather environments. The MCS, when installed, consists of four each of the following components: (Figure 1) microclimate cooling unit (MCU), cooling hose assembly, bypass control assembly, and liquid quick disconnect (L-QDC). These components connect together to provide a complete system that circulates cooled liquids through each individual crewmember's microclimate cooling garment (MCG) when attached to the MCS.

MICROCLIMATE COOLING UNIT

The MCU (Figure 1) provides chilled liquid which is pumped through hose assemblies to the aircrew member's MCG where metabolic heat is transferred from the aircrew member's body to the circulating liquid. The warmed liquid is then pumped back to the MCU where heat is rejected to the ambient environment. The MCU provides 320 to 330 watts of cooling for each aircrew member. The MCU delivers cooled liquid approximately 60°F to 72°F depending on the temperature of the external environment. The MCU is approximately 7 inches wide X 11 inches long X 6 inches high and weighs approximately 13 pounds. The MCU is powered from +28VDC source and requires approximately 6-10 amps continuous and 12 amps peak.

COOLING HOSE ASSEMBLY

The cooling hose assembly (Figure 1) consists of two 7/16 inch polybutyl vinyl hoses laid side by side with MCU control wire (electrical) running between the hoses and encased in an insulated jacket.

The hose assembly has attached at one end a bypass control assembly (BCA) with a L-QDC (see description below). On the other end of the hose assembly, are fittings for connection to the MCU. The hose assembly with insulation is approximately two inches in diameter and weighs approximately 0.3 pound per foot (excluding liquid).

BYPASS CONTROL ASSEMBLY

The MCS BCA (Figure 1) utilizes an automatic bypass to allow liquid to be circulated and cooled prior to connection to the MCG. The bypass control assembly is approximately 2 inches wide X 3 inches long X 1 inch high and weighs approximately 0.25 pound. A rotary knob is mounted on the bypass control assembly to allow aircrew members to adjust the temperature of the liquid from the MCU.

LIQUID-QUICK DISCONNECT

The L-QDC (Figure 1) serves as an interface between the hose assembly from the BCA to the MCG. The L-QDC is comprised of two segments: aircraft-retained and aviator-retained. The aviator-retained portion of the L-QDC is connected to the aviator's MCG. The aircraft retained portion of the L-QDC is attached, via the hose assembly, to the manual BCA. The connection of the L-QDC halves allow cooling liquid to flow between the MCU and the MCG. The L-QDC serves as a disconnect point for normal egress and hands-free breakaway for emergency egress. The force required for emergency egress is not more than 25 pounds. The L-QDC is approximately 3 inches long X 2 inches wide X 0.75 inch high and weighs 0.25 pound.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

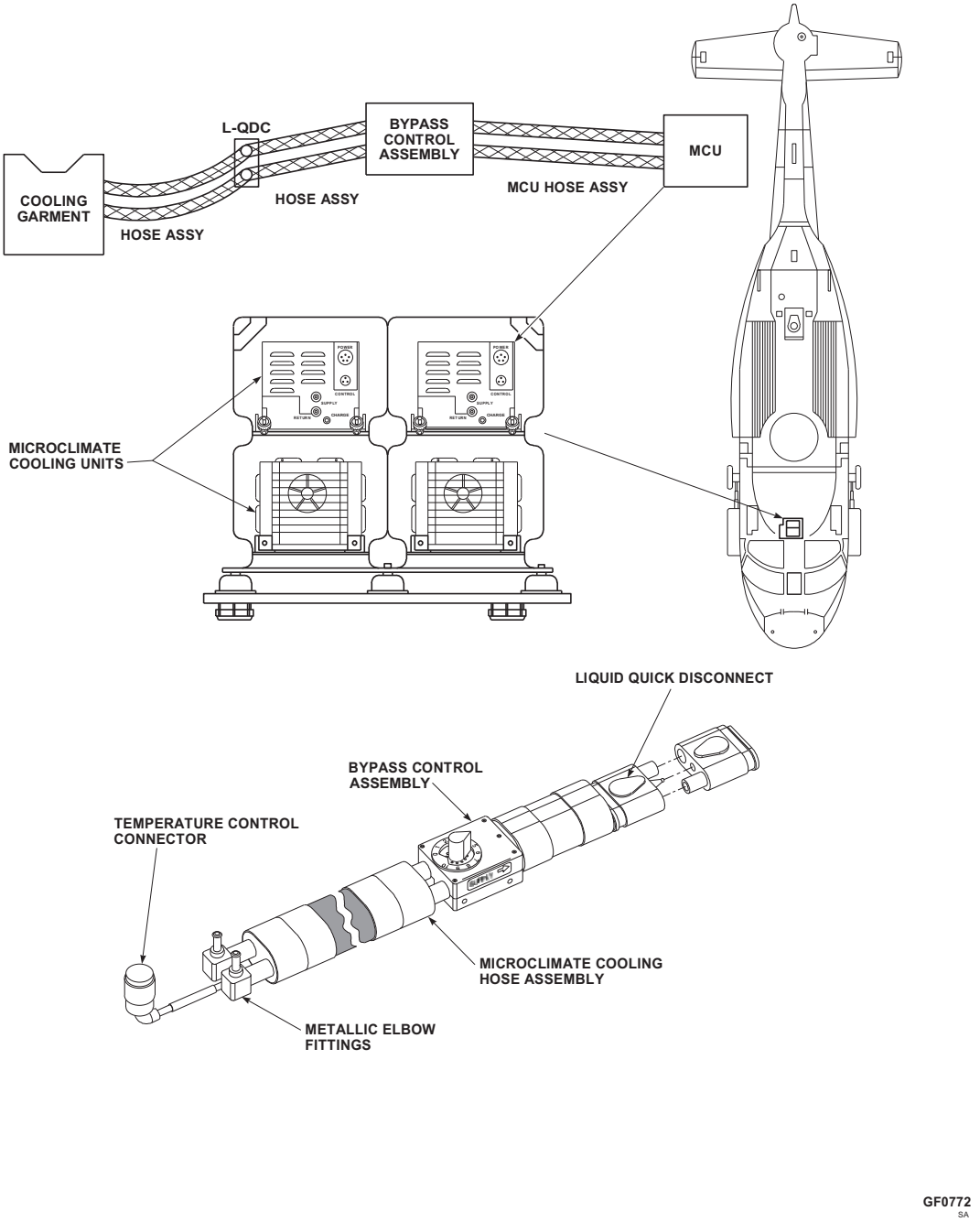
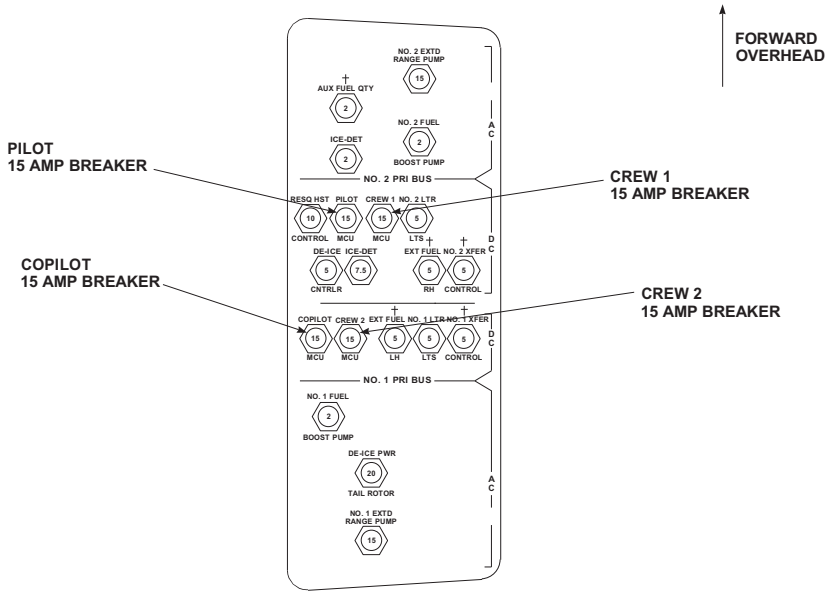


Figure 1. Microclimate Components.

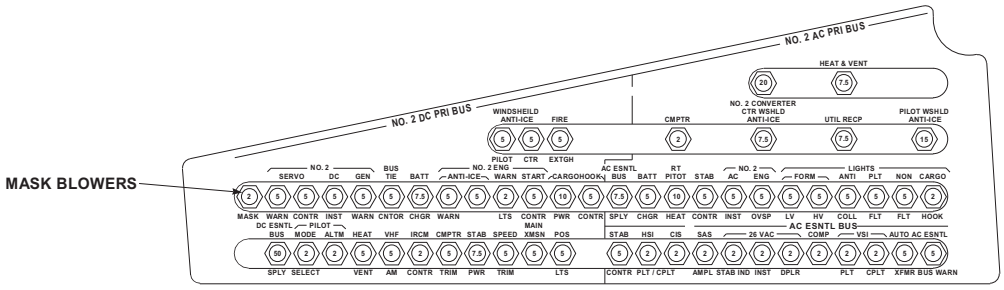
CIRCUIT BREAKERS

Four 15 amp circuit breakers are installed in the aircraft mission readiness circuit breaker panel for the MCUs and one 2 amp circuit breaker installed in the aircraft No. 2 circuit breaker panel for the power distribution box (PDB) (Figure 2).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED



MISSION EQUIPMENT PANEL



PILOT'S CIRCUIT BREAKER PANEL

GF0773
SA

Figure 2. Microclimate Circuit Breaker.

POWER DISTRIBUTION BOX

A PDB (Figure 3) is installed on the bottom of the copilot's stowage grenade box assembly behind the copilot's seat of the aircraft. The PDB has an input of +28 VDC and an output of +3.8 VDC. The PDB powers four mask blowers and requires approximately 1 amp. The PDB is a standard aircraft power converter box.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

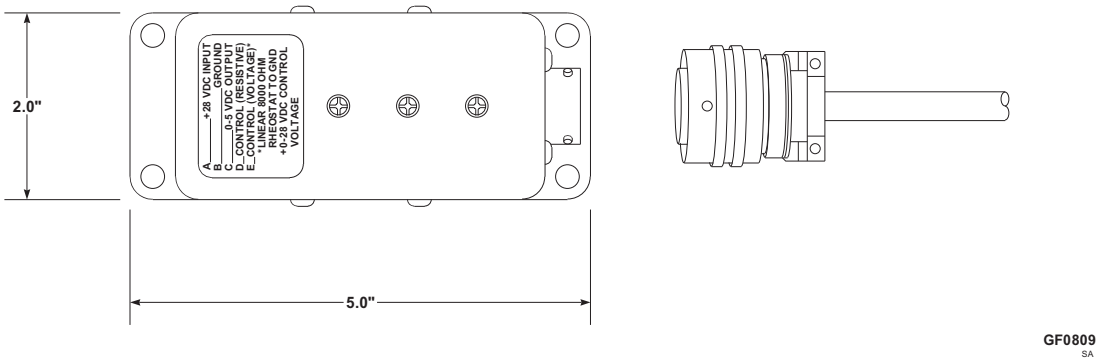


Figure 3. Power Distribution Box.

MASK BLOWER

Mate the blower connector to the blower power wire connector. There is not an on/off switch on the blower, so if aircraft power is active, the blower will operate normally. The blower power wire is normally run concurrent with the ICS cord using plastic wire ties every 8 to 12 inches. If the blower or its power source fails, the mask still provides protection.

NOTE

Failure of mask blower is not criteria for mission abort.

The blower provides two primary functions to the user, one being to relieve the psychological isolation effects of MOPP IV chemical-biological protective gear, the other to defog the mask under certain atmospheric conditions, usually common to lower temperatures. Operation and maintenance of the M45 Mask, Chemical and Biological can be found in TM 3-4240-341-10 and TM 3-4240-341-20&P. Use of the M45 mask blower with the M45 mask can be found in Air Warrior TM 1-1680-377-13&P (see Figure 4).

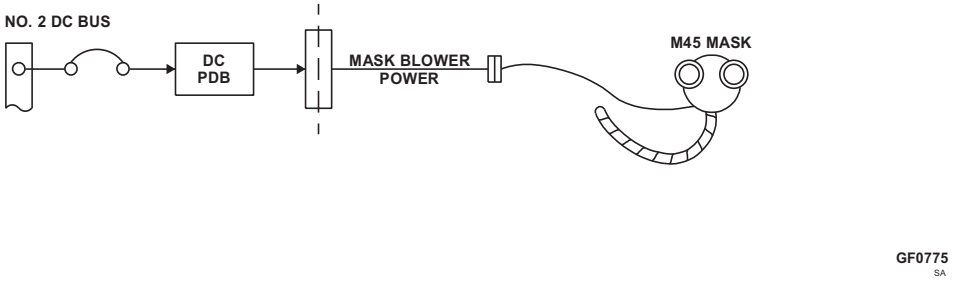


Figure 4. Mask Blower System.

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

For location and description of major components, refer to the data in this work package.

EQUIPMENT DATA

Not applicable.

GROUND SUPPORT EQUIPMENT

GROUND SUPPORT EQUIPMENT DESCRIPTION AND DATA

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

COMPONENT HANDLING ADAPTER KIT

The component handling adapter kit consists of six maintenance stand adapters for major components. The major components for these adapters are: main rotor head, main gear box, APU, oil cooler blower, and main and tail rotor blades. Each adapter is easily attached to a standard maintenance trailer by four vise-like latches.

FUEL QUANTITY SYSTEM HARNESS ADAPTER

The fuel quantity system harness adapter (Figure 1) is used in conjunction with fuel quantity test set to adjust and fault isolate fuel quantity system. The harness adapter contains a function tank select switch to enable fuel quantity test set to read tank unit capacitance or simulate tank unit capacitance for fuel quantity system adjustment. Two test jacks provide a means for measuring dc voltage output of signal conditioner.

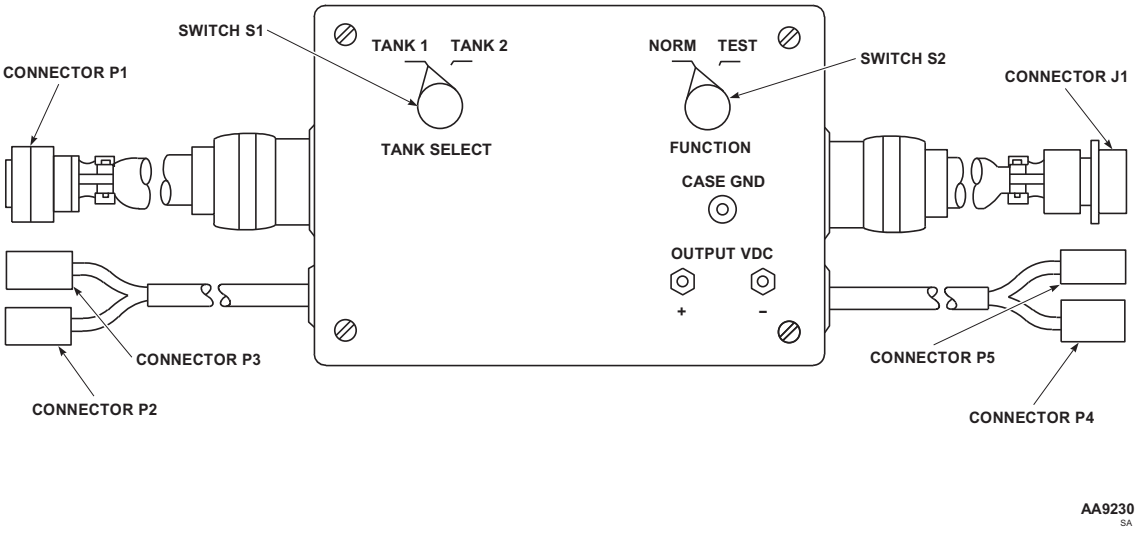


Figure 1. Fuel Quantity System Harness Adapter.

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

For location and description of major components, refer to the data in this work package.

EQUIPMENT DATA

For equipment data information, refer to WP 1785 00 and this work package.

By Order of the Secretary of the Army:

GEORGE W. CASEY, JR.
General, United States Army
Chief of Staff

Official:



JOYCE E. MORROW
Administrative Assistant to the
Secretary of the Army
0925109

Distribution:
To be distributed in accordance with the initial distribution number (IDN) 311284, requirements for TM 1-1520-237-23-1.

These are the instructions for sending an electronic 2028

The following format must be used if submitting an electronic 2028. The subject line must be exactly the same and all fields must be included; however only the following fields are mandatory: 1, 3, 4, 5, 6, 7, 8, 9, 10, 13, 15, 16, 17, and 27.

From: "Whomever" <whomever@wherever.army.mil>
To: 2028@redstone.army.mil

Subject: DA Form 2028

1. From: Joe Smith
2. Unit: home
3. Address: 4300 Park
4. City: Hometown
5. St: MO
6. Zip: 77777
7. Date Sent: 19--OCT--93
8. Pub no: 55--2840--229--23
9. Pub Title: TM
10. Publication Date: 04--JUL--85
11. Change Number: 7
12. Submitter Rank: MSG
13. Submitter FName: Joe
14. Submitter MName: T
15. Submitter LName: Smith
16. Submitter Phone: 123--123--1234
17. Problem: 1
18. Page: 2
19. Paragraph: 3
20. Line: 4
21. NSN: 5
22. Reference: 6
23. Figure: 7
24. Table: 8
25. Item: 9
26. Total: 123
27. Text:

This is the text for the problem below line 27.

RECOMMENDED CHANGES TO PUBLICATIONS AND BLANK FORMS For use of this form, see AR 25-30; the proponent agency is ODISC4.	Use Par reverse) for Repair Parts and Special Tool Lists (RPSTL) and Supply Catalogs/ Supply Manuals (SC/SM)	DATE 8/30/02
TO: (Forward to proponent of publication or form)(Include ZIP Code) Commander, U.S. Army Aviation and Missile Command ATTN: AMSAM-MMC-MA-NP Redstone Arsenal, 35898	FROM: (Activity and location)(Include ZIP Code) MSG, Jane Q. Doe 1234 Any Street Nowhere Town, AL 34565	

PART 1 – ALL PUBLICATIONS (EXCEPT RPSTL AND SC/SM) AND BLANK FORMS

PUBLICATION/FORM NUMBER	DATE	TITLE
TM 9-1005-433-24	16 Sep 2002	Organizational, Direct Support, And General Support Maintenance Manual for Machine Gun, .50 Caliber M3P and M3P Machine Gun Electrical Test Set Used On Avenger Air Defense Weapon System

ITEM NO.	PAGE NO.	PARA-GRAPH	LINE NO. *	FIGURE NO.	TABLE NO.	RECOMMENDED CHANGES AND REASON
1	W PG 3		2			Test or Corrective Action column should identify a different WP number.

EXAMPLE

* Reference to line numbers within the paragraph or subparagraph.

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/ AUTOVON, PLUS EXTENSION	SIGNATURE
MSG, Jane Q. Doe, SFC	788--1234	

TO: (Forward direct to addressee listed in publication)	FROM: (Activity and location) (Include ZIP Code)	DATE
Commander, U.S. Army Aviation and Missile Command ATTN: AMSAM–MMC–MA–NP Redstone Arsenal, 35898	MSG, Jane Q. Doe 1234 Any Street Nowhere Town, AL 34565	8/30/02

PART II – REPAIR PARTS AND SPECIAL TOOL LISTS AND SUPPLY CATALOGS/SUPPLY MANUALS

PUBLICATION NUMBER	DATE	TITLE

PAGE NO.	COLM NO.	LINE NO.	NATIONAL STOCK NUMBER	REFERENCE NO.	FIGURE NO.	ITEM NO.	TOTAL NO. OF MAJOR ITEMS SUPPORTED	RECOMMENDED ACTION

PART III – REMARKS (Any general remarks or recommendations, or suggestions for improvement of publications and blank forms. Additional blank sheets may be used if more space is needed.)

EXAMPLE

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE
MSG, Jane Q. Doe, SFC	788–1234	

RECOMMENDED CHANGES TO PUBLICATIONS AND BLANK FORMS For use of this form, see AR 25-30; the proponent agency is ODISC4.	Use Par reverse) for Repair Parts and Special Tool Lists (RPSTL) and Supply Catalogs/ Supply Manuals (SC/SM)	DATE
TO: (Forward to proponent of publication or form)(Include ZIP Code) Commander, U.S. Army Aviation and Missile Command ATTN: AMSAM-MMC-MA-NP Redstone Arsenal, AL 35898 - 5000	FROM: (Activity and location)(Include ZIP Code)	

PART 1 – ALL PUBLICATIONS (EXCEPT RPSTL AND SC/SM) AND BLANK FORMS

PUBLICATION/FORM NUMBER	DATE	TITLE

ITEM NO.	PAGE NO.	PARA-GRAPH	LINE NO. *	FIGURE NO.	TABLE NO.	RECOMMENDED CHANGES AND REASON

* Reference to line numbers within the paragraph or subparagraph.

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/ AUTOVON, PLUS EXTENSION	SIGNATURE

TO: (Forward direct to addressee listed in publication) Commander, U.S. Army Aviation and Missile Command ATTN: AMSAM-MMC-MA-NP Redstone Arsenal, AL 35898	FROM: (Activity and location) (Include ZIP Code)	DATE

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PART III – REMARKS (Any general remarks or recommendations, or suggestions for improvement of publications and blank forms. Additional blank sheets may be used if more space is needed.)

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE

The Metric System and Equivalents

Linear Measure

1 centimeter = 10 millimeters = .39 inch
1 decimeter = 10 centimeters = 3.94 inches
1 meter = 10 decimeters = 39.37 inches
1 dekameter = 10 meters = 32.8 feet
1 hectometer = 10 dekameters = 328.08 feet
1 kilometer = 10 hectometers = 3,280.8 feet

Weights

1 centigram = 10 milligrams = .15 grain
1 decigram = 10 centigrams = 1.54 grains
1 gram = 10 decigram = .035 ounce
1 decagram = 10 grams = .35 ounce
1 hectogram = 10 decagrams = 3.52 ounces
1 kilogram = 10 hectograms = 2.2 pounds
1 quintal = 100 kilograms = 220.46 pounds
1 metric ton = 10 quintals = 1.1 short tons

Liquid Measure

1 centiliter = 10 milliters = .34 fl. ounce
1 deciliter = 10 centiliters = 3.38 fl. ounces
1 liter = 10 deciliters = 33.81 fl. ounces
1 dekaliter = 10 liters = 2.64 gallons
1 hectoliter = 10 dekaliters = 26.42 gallons
1 kiloliter = 10 hectoliters = 264.18 gallons

Square Measure

1 sq. centimeter = 100 sq. millimeters = .155 sq. inch
1 sq. decimeter = 100 sq. centimeters = 15.5 sq. inches
1 sq. meter (centare) = 100 sq. decimeters = 10.76 sq. feet
1 sq. dekameter (are) = 100 sq. meters = 1,076.4 sq. feet
1 sq. hectometer (hectare) = 100 sq. dekameters = 2.47 acres
1 sq. kilometer = 100 sq. hectometers = .386 sq. mile

Cubic Measure

1 cu. centimeter = 1000 cu. millimeters = .06 cu. inch
1 cu. decimeter = 1000 cu. centimeters = 61.02 cu. inches
1 cu. meter = 1000 cu. decimeters = 35.31 cu. feet

Approximate Conversion Factors

To change	*To*	*Multiply by*	*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	1.356	metric tons	short tons	1.102
pound-inches	Newton-meters	.11296			

Temperature (Exact)

°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

PIN: 073171-000