TM 1-1520-238-T-5

TECHNICAL MANUAL

AVIATION UNIT AND INTERMEDIATE TROUBLESHOOTING MANUAL

FOR

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

CHAPTER 7 HYDRAULIC AND PNEUMATIC SYSTEMS

CHAPTER 8 INSTRUMENTS

SUPERSEDURE NOTICE: **This manual supersedes TM 55-1520-238-T-1, dated 15 DECEMBER 1985, including all changes.**

DISTRIBUTION STATEMENT A: **Approved for public release; distribution is unlimited.**

HEADQUARTERS, DEPARTMENT OF THE ARMY

30 April 1992

CHANGE
NO. 8

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 15 February 2002

TECHNICAL MANUAL
AVIATION UNIT AND INTERMEDIATE
TROUBLESHOOTING MANUAL
FOR
ARMY MODEL AH-64A HELICOPTER
NSN: (1520-01-106-9519) EIC: (RHA)

DISTRIBUTION STATEMENT A: Approved for public release; distribution is unlimited.

OZONE DEPLETING CHEMICAL INFORMATION

This document has been reviewed for the presence of Class I Ozone depleting chemicals. As of Change 6 dated 19 December 1997, all references to Class I Ozone depleting chemicals have been removed from this document by substitution with chemicals that do not cause atmospheric Ozone depletion.

TM 1-1520-238-T-5, 30 April 1992, is changed as follows:

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Remove pages	Insert pages
A and B	A and B
i and ii	i and ii
8-149 and 8-150	8-149 and 8-150

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

By Order of the Secretary of the Army:

ERIC K. SHINSEKI
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Official:

JOEL B. HUDSON
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TECHNICAL MANUAL
AVIATION UNIT AND INTERMEDIATE
TROUBLESHOOTING MANUAL
FOR
ARMY MODEL
AH-64A HELICOPTER
NSN: (1520-01-106-9519) EIC: (RHA)

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Remove pages	Insert pages
———	A and B
7–77 and 7–78	7–77 and 7–78
8–81 through 8–88	8–81 through 8–88
8–101 and 8–102	8–101 and 8–102
8–111 and 8–112	8–111 and 8–112
8–117 through 8–120	8–117 through 8–120

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TECHNICAL MANUAL
AVIATION UNIT AND INTERMEDIATE
TROUBLESHOOTING MANUAL
FOR
ARMY MODEL
AH-64A HELICOPTER
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Remove pages	Insert pages
i through iv	i through iv
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AVIATION UNIT AND INTERMEDIATE
TROUBLESHOOTING MANUAL
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AH–64A HELICOPTER
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Remove pages	Insert pages
7–55 and 7–56	7–55 and 7–56
7–79 and 7–80	7–79 and 7–80
8–45 and 8–46	8–45 and 8–46

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AVIATION UNIT AND INTERMEDIATE
TROUBLESHOOTING MANUAL
FOR
ARMY MODEL
AH–64A HELICOPTER
NSN: (1520–01–106–9519) (EIC: RHA)

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Remove pages	Insert pages
7–7 and 7–8	7–7 and 7–8
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– – – –	7–136.1/(7–136.2 blank)
8–97 and 8–98	8–97 and 8–98
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Aviation Unit and Intermediate
Troubleshooting Manual

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

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Remove pages	Insert pages
iii thru v/(vi blank)	iii thru v/(vi blank)

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CHANGE
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WASHINGTON, D.C., 15 January 1993

Aviation Unit and Intermediate
Troubleshooting Manual

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

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Remove pages	Insert pages
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MILTON H. HAMILTON
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CHANGE
NO. 1

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Aviation Unit and Intermediate
Troubleshooting Manual
for
ARMY MODEL
AH–64A HELICOPTER
NSN: (1520–01–106–9519) EIC: (RHA)

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Remove pages	Insert pages
iii and iv	iii and iv
7–1 through 7–6	7–1 through 7–6
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The WARNINGS on these pages are to notify you of operating or maintenance procedures, practices or conditions, which, if not strictly observed, could result in long term health hazards, injury or death to personnel. If injury occurs, seek medical aid immediately. These WARNINGS must be obeyed by all personnel using this volume.

WARNING

NOISE

Personnel in the area of jet engine operation will wear approved ear protection to protect their hearing.

WARNING

ELECTRICAL POWER

- **Voltages used may cause arcing. Remove rings, watches, and other jewelry which may cause a shock/burn hazard.**
- **Voltages used may cause severe shock or death on contact. Use caution to avoid contact with energized components.**
- **Turn off power before detaching or attaching wires and connectors. Failure to do so could result in death or serious injury.**
- **When opening a circuit breaker during system checks, tag circuit breaker to prevent unforeseen closing, which may cause injury or death to personnel.**
- **For artificial respiration, refer to FM 21-11.**

WARNING

PITOT TUBES

Do not touch Pitot tubes when heating switch is set to on. Heaters in these tubes can cause serious burns. If burns occur, obtain medical help.

WARNING

SOLVENTS AND CHEMICALS (INCLUDING HYDRAULIC FLUID)

Solvents and chemicals, including hydraulic fluid, are flammable and toxic to eyes, skin, and respiratory tract. Skin and eye protection is required. Use solvents and chemicals only with adequate ventilation. If solvents or chemicals touch the eyes or skin, flush with water and seek medical aid immediately.

WARNING

HYDRAULIC PRESSURE

Hydraulic system operates at 3000 psi. Do not perform maintenance on system until hydraulic pressure is removed from helicopter. Be certain that trapped hydraulic pressure is released before loosening any connections. Failure to do so could result in death or serious injury. If injury occurs, get medical aid immediately.

WARNING

PRESSURIZED AIR

Remove pressurized air before removing electrical power to avoid pressurized lines in the nitrogen inerting system. The sudden release of pressurized air can injure personnel. If injury occurs, get medical aid immediately.

WARNING

CONTROL MOVEMENTS

Maintenance personnel must be warned verbally prior to moving the collective or cyclic stick. Any control activated can result in sudden blade movement that can sever or crush fingers or hands.

INSERT LATEST CHANGED PAGES: DESTROY SUPERSEDED PAGES.

LIST OF EFFECTIVE PAGES

NOTE: The portion of the text affected by the changes is indicated by a vertical line in the outer margins of the page. Changes to illustrations are indicated by miniature pointing hands. Changes to wiring diagrams are indicated by shaded areas.

Date of issue for original and change pages are:

Original . . . . . 0 . . . . . 30 April 1992
Change . . . . . 1 . . . . 31 December 1992
Change . . . . . 2 . . . . . 15 January 1993
Change . . . . . 3 . . . . 30 December 1993
Change . . . . . 4 . . . . 28 December 1994
Change . . . . . 5 . . . . . 1 February 1996
Change . . . . . 6 . . . . 19 December 1997
Change . . . . . 7 . . . . . 25 May 2001
Change . . . . . 8 . . . . . 15 February 2002

TOTAL NUMBER OF PAGES IN THIS PUBLICATION IS 355, CONSISTING OF THE FOLLOWING:

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7-80 – 7-87	0
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7-95	0
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7-99	6
7-100 – 7-127	0
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7-139 – 7-144	0
7-145	1
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7-148 Blank	0
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LIST OF EFFECTIVE PAGES

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*Zero in this column indicates an original page.

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DEPARTMENT OF THE ARMY
WASHINGTON, D. C., 30 APRIL 1992

TECHNICAL MANUAL

AVIATION UNIT AND INTERMEDIATE TROUBLESHOOTING MANUAL

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

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistakes, or if you know of a way to improve the procedures, please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2 located in the back of this manual directly to: Commander, U.S. Army Aviation and Missile Command, ATTN: AMSAM-MMC-MA-NP, Redstone Arsenal, AL 35898–5230. A reply will be furnished to you.

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

OZONE DEPLETING CHEMICAL INFORMATION:
This document has been reviewed for the presence of Class I Ozone depleting chemicals. As of Change 6 dated 19 December 1997, all references to Class I Ozone depleting chemicals have been removed from this document by substitution with chemicals that do not cause atmospheric Ozone depletion.

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*** SUPERSEDURE NOTICE: This manual supersedes TM 55-1520-238-T-5, dated 15 DECEMBER 1985, including all changes.**

HOW TO USE THIS VOLUME

OVERVIEW

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

USING AH–64A HELICOPTER EFFECTIVITY CODES

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

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

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

  Example: Narrative text and FIPs (AAA)

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

  Example: Wiring interconnect diagrams 

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

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

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

Effectivity Code	Helicopter Serial No.
AAA	82–23355 thru 82–23365
AAB	82–23355 thru 83–23798
AAC	82–23355 thru 83–23814
AAD	85–25424 and subsequent
AAE	82–23355 thru 84–24231
AAF	84–24216 and subsequent
AAG	82–23355 thru 84–24289
AAH	82–23355 thru 85–25398
AAJ	85–25351 and subsequent
AAK	82–23355 thru 85–25488
AAL	88–0215 and subsequent
AAM	85–25465 and subsequent
AAN	83–23787 thru 85–25415

Effectivity Code	Helicopter Serial No.
AAP	82–23355 thru 88–0214
AAQ	82–23355 thru 84–24311
AAR	82–23355 thru 84–24239
AAS	84–24240 and subsequent
AAT	82–23355 thru 83–23804
AAU	83–23787 and subsequent
AAV	83–23805 and subsequent
AAW	83–23799 and subsequent
AAX	83–23799 thru 84–24245
AAY	83–23799 thru 85–25470 (Before MWO 1–1520–238–50–37)
AAZ	83–23815 and subsequent
ABA	84–24200 and subsequent
ABB	84–24246 and subsequent
ABC	84–24290 and subsequent
ABD	82–23355 thru 85–25415
ABE	82–23355 thru 84–24295
ABF	84–24296 and subsequent
ABG	85–25399 and subsequent
ABH	82–23355 thru 84–24245
ABJ	85–25447 and subsequent
ABK	82–23355 thru 85–24446
ABL	82–23355 thru 89–0215
ABM	84–24290 thru 88–0199
ABN	89–0192 and subsequent
ABP	85–25471 and subsequent
ABQ	86–8940 and subsequent
ABR	82–23355 thru 84–24232
ABS	84–24233 and subsequent
ABT	82–23355 thru 83–23816
ABU	83–23817 thru 85–25415
ABV	84–24246 thru 85–25398
ABW	82–23355 thru 83–23795
ABX	83–23796 and subsequent
ABY	With T700–GE 701 engines

Effectivity Code	Helicopter Serial No.
ABZ	With T700–GE 701C engines
ACA	82–23355 thru 88–0199
ACB	88–0200 and subsequent
ACC	82–23355 thru 83–23834
ACD	85–25416 and subsequent
ACE	82–23355 thru 86–9011
ACF	82–23355 thru 88–0284
ACG	89–0192 and subsequent
ACH	82–23355 thru 85–25423
ACJ	82–23355 thru 90–0290, 90–0292 thru 90–0301 (Before MWO 1–1520–238–50–07)
ACK	82–23355 thru 90–0290, 90–0292 thru 90–0301 (After MWO 1–1520–238–50–07) 90–0291, 90–0302 and subsequent
ACL	82–23355 thru 83–23814
ACM	83–23815 and subsequent
ACN	85–25471 thru 90–0448 (Before MWO 1–1520–238–50–37)
ACP	85–25471 thru 90–0448 (After MWO 1–1520–238–50–37) 90–0449 and subsequent
ACQ	82–23355 thru 90–0448 (Before MWO 1–1520–238–50–36)
ACR	82–23355 thru 90–0448 (After MWO 1–1520–238–50–36) 90–0449 and subsequent
ACS	82–23355 thru 90–0437
ACT	90–0438 and subsequent
ACU	82–23355 thru 90–0436
ACV	89–0192 thru 90–0434 with T700–GE–701C engines (Before MWO 1–1520–238–50–38)
ACW	89–0192 thru 90–0434 with T700–GE–701C engines (After MWO 1–1520–238–50–38) 90–0435 and subsequent with T700–GE–701C engines
ADF	Before MWO 1–1520–238–50–52
ADG	After MWO 1–1520–238–50–52

USING THE ELECTRICAL COMPONENT LOCATION AND CONFIGURATION (ECLC) INDEX

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

EXAMPLE OF ECLC INDEX

FROM COLUMN		TO COLUMN			
Connector Ref Des	**Component/ Harness**	**Connector Ref Des**	**Component/ Harness**	**Grid Area**	**Access**
P1	A76/W605	J1	A402	8B	PLT STATION
P402	W170	J402	W211	13E	R295 DOOR

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

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

For example, to locate connector P1 on the aircraft find connector P1 in the **FROM COLUMN Connector Ref Des** column, then refer to the **FROM COLUMN Component/Harness** column. This column shows that P1 is part of component/harness A76/W605. The **TO COLUMN Connector Ref Des** column shows that P1 connects to J1 on component A402 (**TO COLUMN Component/Harness** column). The **Grid Area** column indicates that P1 is depicted at illustration grid zone 8B, and that **Access** to the connector is obtained through the PLT STATION.

CHAPTER 7
HYDRAULIC AND PNEUMATIC SYSTEMS

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SECTION I. EQUIPMENT DESCRIPTION AND DATA

7–1. EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES 7–1

a. **Characteristics**.

(1) The primary hydraulic system provides hydraulic power for the operation of the main rotor and tail rotor servocylinders.

(2) The utility hydraulic system provides hydraulic power for the operation of the main rotor and tail rotor servocylinders, auxiliary power unit (APU) start motor, rotor brake, hydraulically operated weapon system components and provides a source of stored high pressure fluid for emergency operation of the flight control servocylinders.

(3) The pressurized air system (PAS) cleans, pressurizes, regulates and distributes air to pneumatically operated systems and components.

b. **Capabilities and Features**.

(1) The primary hydraulic system provides 3000 psi hydraulic fluid pressure to hydraulically operated components. Flow rate is 6.0 gallons per minute (gpm) and capacity is three quarts of MIL–H–83282 or MIL–H–5606. The primary hydraulic system is serviced and bled using ground service equipment (GSE) through the GSE panel. External primary pressure is supplied, through the GSE panel, to provide ground hydraulic power operation for flight controls.

(2) The utility hydraulic system provides 3000 psi hydraulic fluid pressure to hydraulically operated components. Flow rate is 6.0 gpm and capacity is 2.6 gallons of MIL–H–83282 or MIL–H–5606. The system is serviced and bled using GSE through a **UTILITY** GSE panel. External primary pressure is supplied, through the GSE panel, to provide ground hydraulic power operation for the utility system.

(3) The PAS system provides 35 psi heated air to pneumatically operated components and has three modes of operation: primary, secondary and external. Engines 1 and 2, or the APU provides primary operation to drive the shaft driven compressor (SDC), secondary operation uses bleed air from engine 1, and external operation uses external air from the aviation ground power unit (AGPU).

7–2. LOCATION AND DESCRIPTION OF MAJOR COMPONENTS 7–2

a. **Primary Hydraulic System.** The primary hydraulic system (fig. 7–1) consists of the primary hydraulic pump, primary hydraulic manifold, primary GSE panel, longitudinal servocylinder, lateral servocylinder, collective servocylinder, and the directional servocylinder.

(1) **Primary Hydraulic Pump.** The primary hydraulic pump, located on the left forward drive pad of the main transmission accessory geartrain housing, pressurizes and transfers fluid for system operation. The primary hydraulic pump is a constant pressure, variable delivery, piston–type pump driven by the main transmission accessory geartrain. The external drive shaft mates with the main transmission accessory geartrain and is designed to shear under excessive loads.

(2) **Primary Hydraulic Manifold.** The primary hydraulic manifold, located on the main transmission deck forward and left of the main transmission, stores, filters and routes hydraulic fluid for system operation.

(3) Deleted.

(4) **Primary GSE Panel**. The primary GSE panel, located on the aft equipment bay deck outboard of the utility manifold, provides connections for external hydraulic application and for servicing the primary and utility reservoirs with fluid. The fluid is filtered by a 45 micron screen filter (ADF) or a 5 micron cartridge filter element (ADG).

(5) **Longitudinal Servocylinder**. The longitudinal servocylinder, located on the left transmission deck in front and to the right of the main transmission, converts mechanical inputs during normal operation, or electrical inputs during digital automatic stabilization equipment backup control system (DASE BUCS) operation, into hydraulic pressure outputs which are sent to the main rotor swashplate.

(6) **Lateral Servocylinder**. The lateral servocylinder, located on the transmission deck in front and to the left of the main transmission, converts mechanical inputs during normal operation, or electrical inputs during DASE BUCS operation, into hydraulic pressure outputs which are sent to the main rotor swashplate.

(7) **Collective Servocylinder**. The collective servocylinder, located on the transmission deck in front of the main transmission, converts mechanical inputs during normal operation, or electrical inputs during DASE BUCS operation, into hydraulic pressure outputs which are sent to the main rotor swashplate.

(8) **Directional Servocylinder**. The directional servocylinder, located on the top of the tail rotor gearbox, converts mechanical inputs during normal operation, or electrical inputs during DASE BUCS operation, into hydraulic pressure outputs which are sent to the tail rotor swashplate.

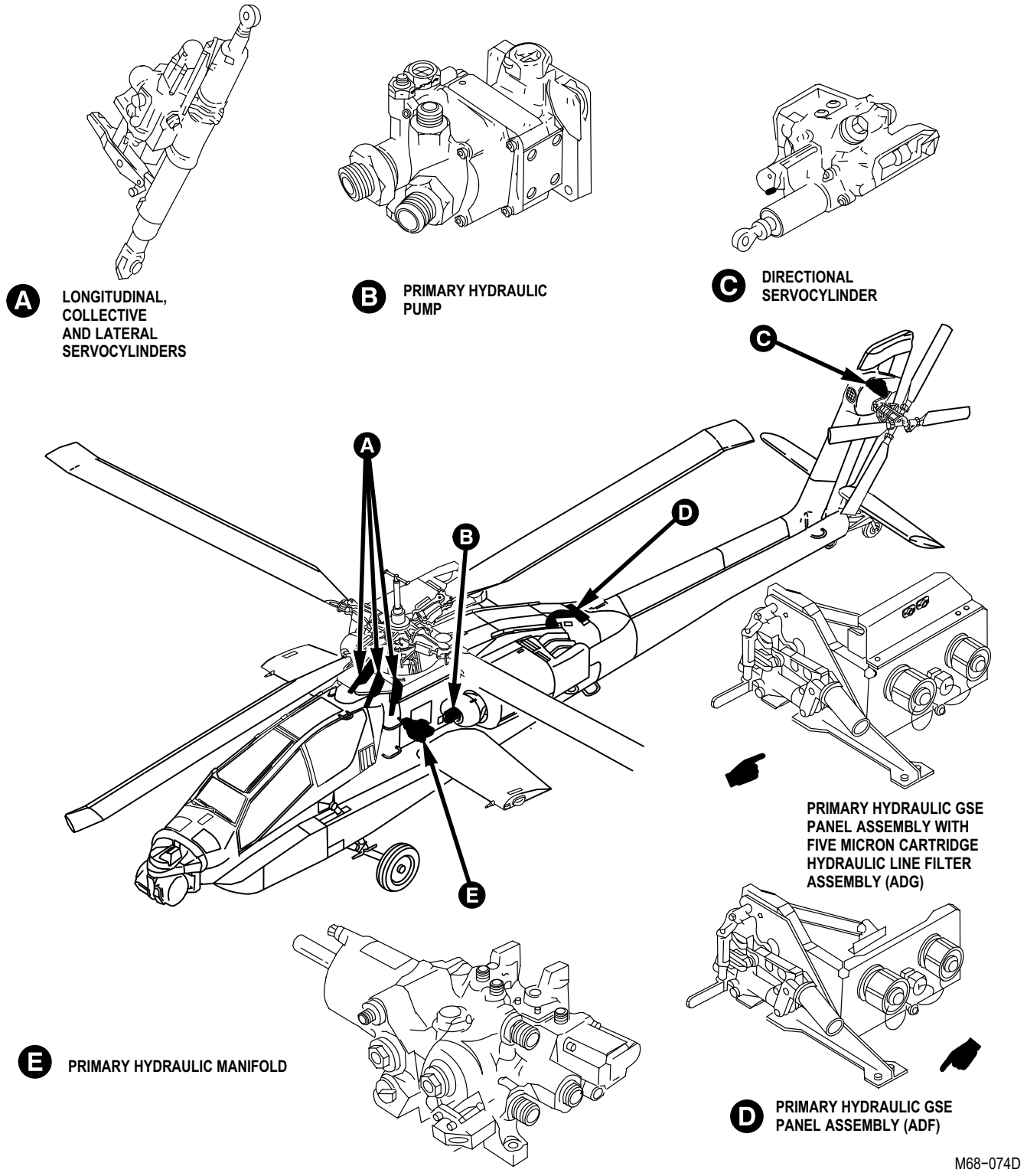


Figure 7–1. Primary Hydraulic System Major Component Location

b. **Utility Hydraulic System.** The utility hydraulic system (fig. 7–2) consists of the utility hydraulic pump, utility hydraulic manifold, utility GSE panel, longitudinal servocylinder, lateral servocylinder, collective servocylinder, and the directional servocylinder, utility hydraulic accumulator assembly, tail wheel lock control valve, low level shutoff valve, and the utility hydraulic return accumulator.

(1) **Utility Hydraulic Pump**. The utility hydraulic pump, located on the right forward drive pad of the main transmission accessory gear train housing, pressurizes and transfers fluid for system operation. The utility hydraulic pump is a constant pressure, variable delivery, piston–type pump driven by the main transmission accessory geartrain. The external drive shaft mates with the transmission accessory geartrain and is designed to shear under excessive loads.

(2) **Utility Hydraulic Manifold**. The utility hydraulic manifold, located on the right–side of the aft equipment bay deck, stores, filters and routes hydraulic fluid for system operation.

(3) Deleted.

(4) **Utility GSE Panel**. The utility GSE panel, located on the aft equipment bay deck outboard of the utility manifold, provides connections for external hydraulic application used for servicing primary and utility reservoirs, and charging/bleeding the gas reservoir and accumulator with nitrogen.

(5) **Longitudinal Servocylinder**. The longitudinal servocylinder, located on the left transmission deck in front and to the right of the main transmission, converts mechanical inputs during normal operation, or electrical inputs during DASE BUCS operation, into hydraulic pressure outputs which are sent to the main rotor swashplate.

(6) **Lateral Servocylinder**. The lateral servocylinder, located on the transmission deck in front and to the left of the main transmission, converts mechanical inputs during normal operation, or electrical inputs during DASE BUCS operation, into hydraulic pressure outputs which are sent to the main rotor swashplate.

(7) **Collective Servocylinder**. The collective servocylinder, located on the transmission deck in front of the main transmission, converts mechanical inputs during normal operation, or electrical inputs during DASE BUCS operation, into hydraulic pressure outputs which are sent to the main rotor swashplate.

(8) **Directional Servocylinder**. The directional servocylinder, located on the top of the tail rotor gearbox, converts mechanical inputs during normal operation, or electrical inputs during DASE BUCS operation, into hydraulic pressure outputs which are sent to the tail rotor swashplate.

(9) **Utility Hydraulic Accumulator Assembly**. The utility hydraulic accumulator assembly, located on the right side of the aft equipment bay underneath the APU, stores and restricts the rate of hydraulic fluid flow under high pressure for APU starting, rotor brake operation and emergency operation of flight control servocylinders.

(10) **Tail Wheel Lock Control Valve**. The tail wheel lock control valve, located at the end of the tail boom slightly forward of the intermediate gearbox, controls hydraulic pressure to the tail wheel lock actuator.

(11) **Low Level Shutoff Valve**. The low level shutoff valve, located in the forward top portion of the tail boom just aft of the GSE panels, shuts off utility hydraulic fluid flow to the directional servocylinder and tail wheel lock control valve.

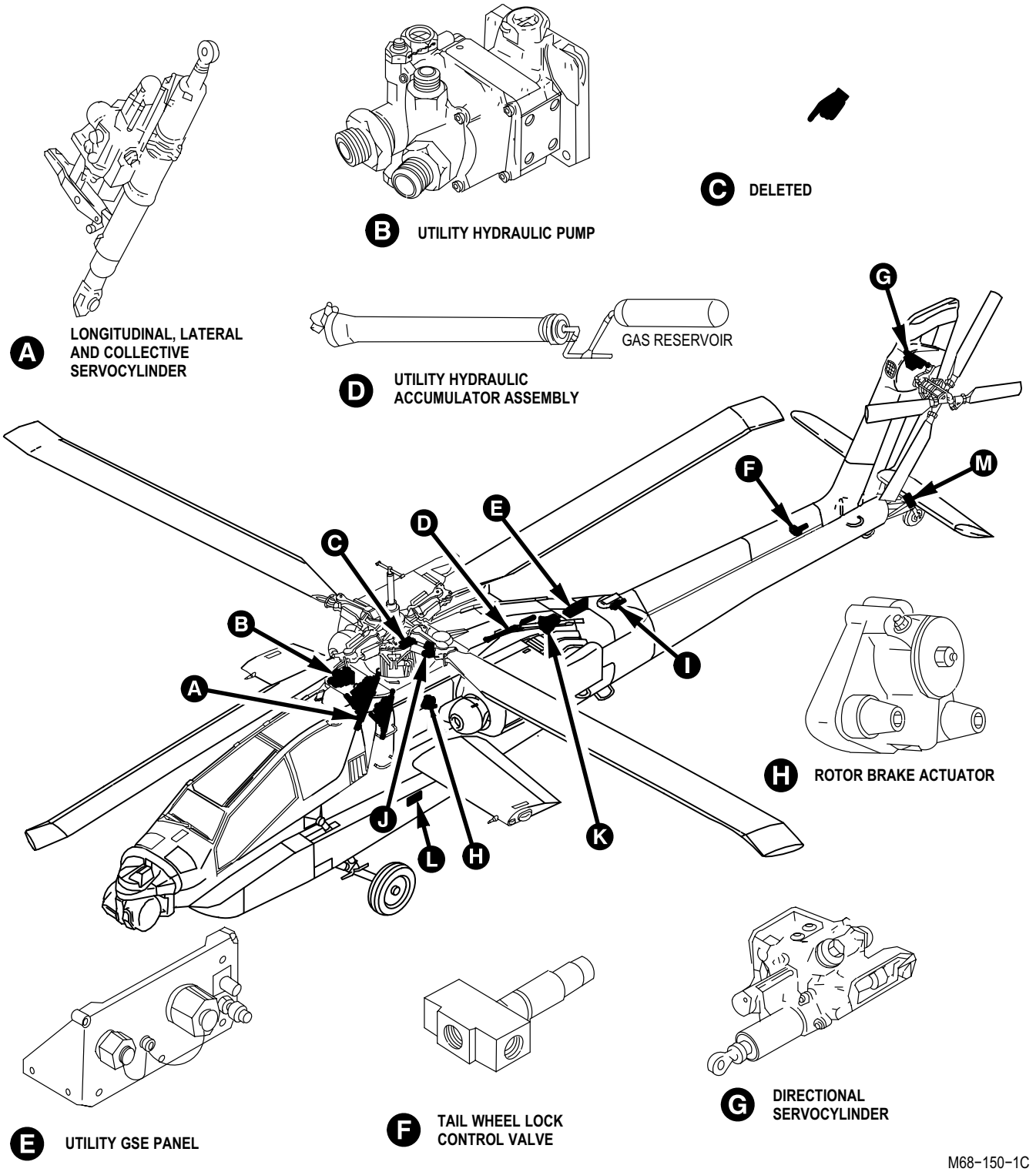


Figure 7–2. Utility Hydraulic System Major Component Location (Sheet 1 of 2)

(12) **Utility Hydraulic Return Accumulator**. The utility hydraulic return accumulator, located in the left forward avionics bay (FAB), dampens pressure spikes in the utility hydraulic system return lines when the area weapon subsystem is operating.

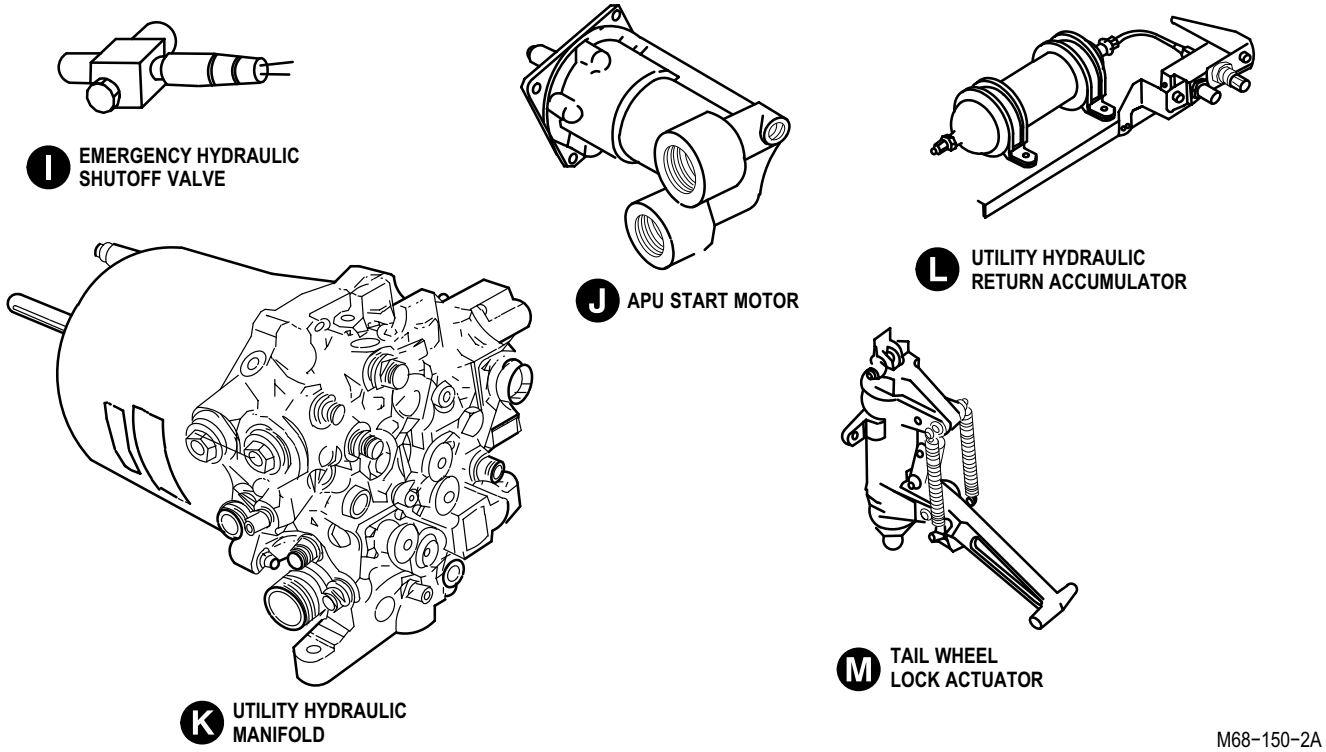


Figure 7–2. Utility Hydraulic System Major Component Location (Sheet 2 of 2)

c. **PAS.** The PAS (fig. 7–3) consists of the air particle separator, inlet throttle valve, SDC, surge valve, temperature sensor, outlet pressure switch, outlet check valve, air pressure manifold, air pressure regulating valve, bleed air shutoff valve, bleed air check valve, external air receptacle, and the utility air receptacle.

(1) **Air Particle Separator**. The air particle separator, located on the upper fuselage fairing frame, removes 85 percent of the particles 20 microns or larger.

(2) **Inlet Throttle Valve**. The inlet throttle valve, located on the upper fuselage fairing frame, reduces APU starting load.

(3) **SDC**. The SDC, located on the rear face of the main transmission accessory section, compresses and heats air to 30 ± 5 psi at approximately 400° F (204° C).

(4) **Surge Valve**. The surge valve, located on the SDC, maintains constant pressure throughout the PAS system.

(5) **Temperature Sensor.** The temperature sensor, located on the SDC, illuminates the **SHAFT DRIVEN COMP** indicator on the pilot caution/warning panel when the temperature of the SDC reaches 340° to 360° F (171° to 182° C). The **SHAFT DRIVEN COMP** indicator extinguishes when the temperature decreases to 315° to 330° F (157° to 166° C).

(6) **Outlet Pressure Switch**. The outlet pressure switch, located on the SDC check valve tube assembly (between the flexible outlet hose and air pressure manifold), monitors SDC output pressure and controls the **SHAFT DRIVEN COMP** indicator on the pilot's caution/warning panel.

(7) **Outlet Check Valve**. The outlet check valve, located on the SDC check valve tube assembly (between the flexible outlet hose and air pressure manifold), prevents loss of air through the SDC when secondary or external air is applied

(8) **Air Pressure Manifold**. The air pressure manifold, located on the aft equipment bay deck, receives air from the SDC and distributes it to pneumatic systems and components.

(9) **Air Pressure Regulating Valve**. The air pressure regulating valve, located in the aft equipment bay, regulates PAS air for the fuel system.

(10) **Bleed Air Shutoff Valve**. The bleed air shutoff valve, mounted between the engine 1 bleed air input and the air pressure manifold, allows flow of bleed air upon SDC failure.

(11) **Bleed Air Check Valve**. The bleed air check valve, mounted in the air pressure manifold, prevents primary or external air from entering the bleed air shutoff valve.

(12) **External Air Receptacle**. The external air receptacle, located on the bottom of the engine 1 nacelle, provides a connection point for external air via the AGPU.

(13) **Utility Air Receptacle**. The utility air receptacle, located in the engine 1 nacelle, provides access for low pressure power tools and test equipment.

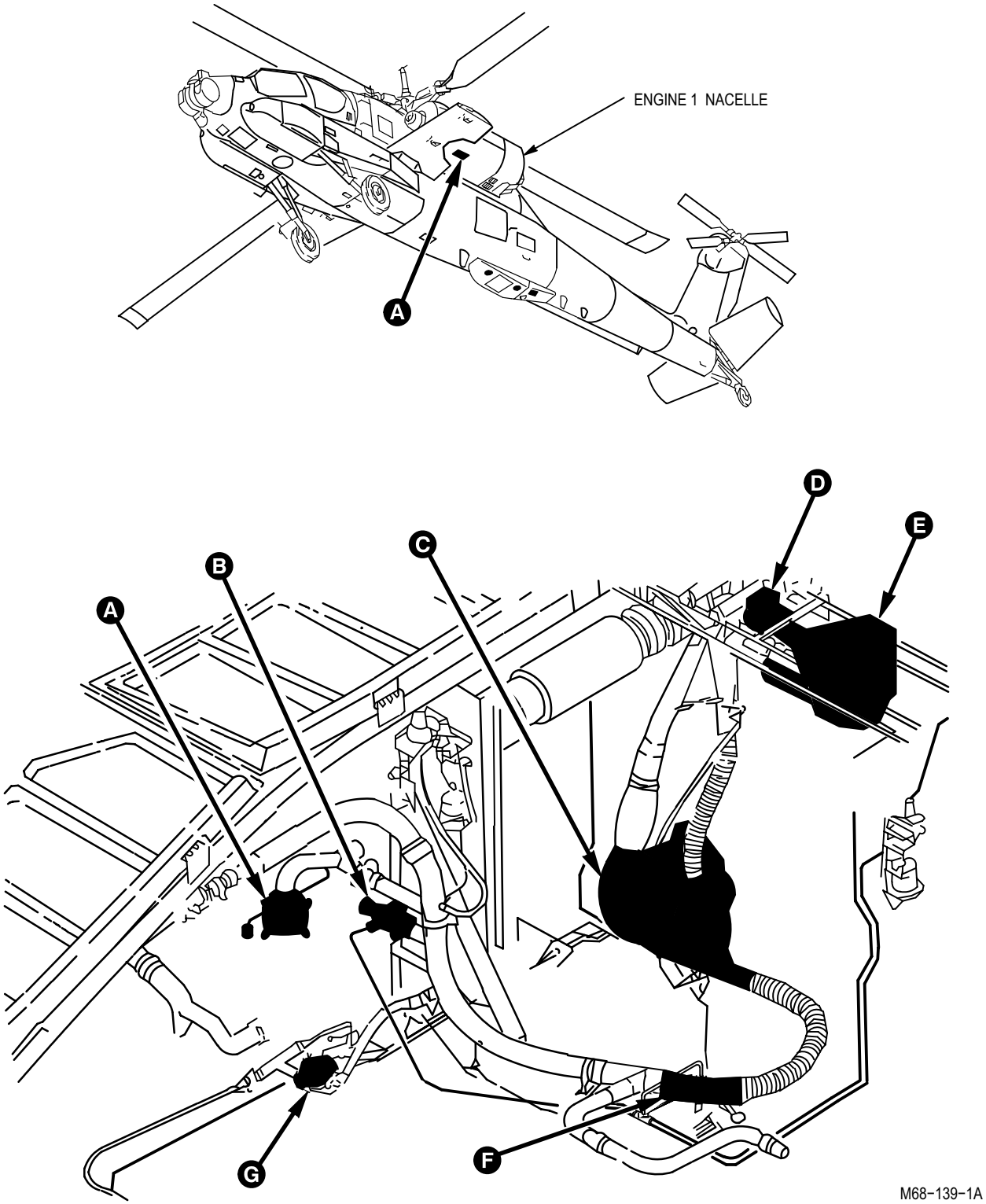


Figure 7–3. PAS Major Component Location (Sheet 1 of 3)

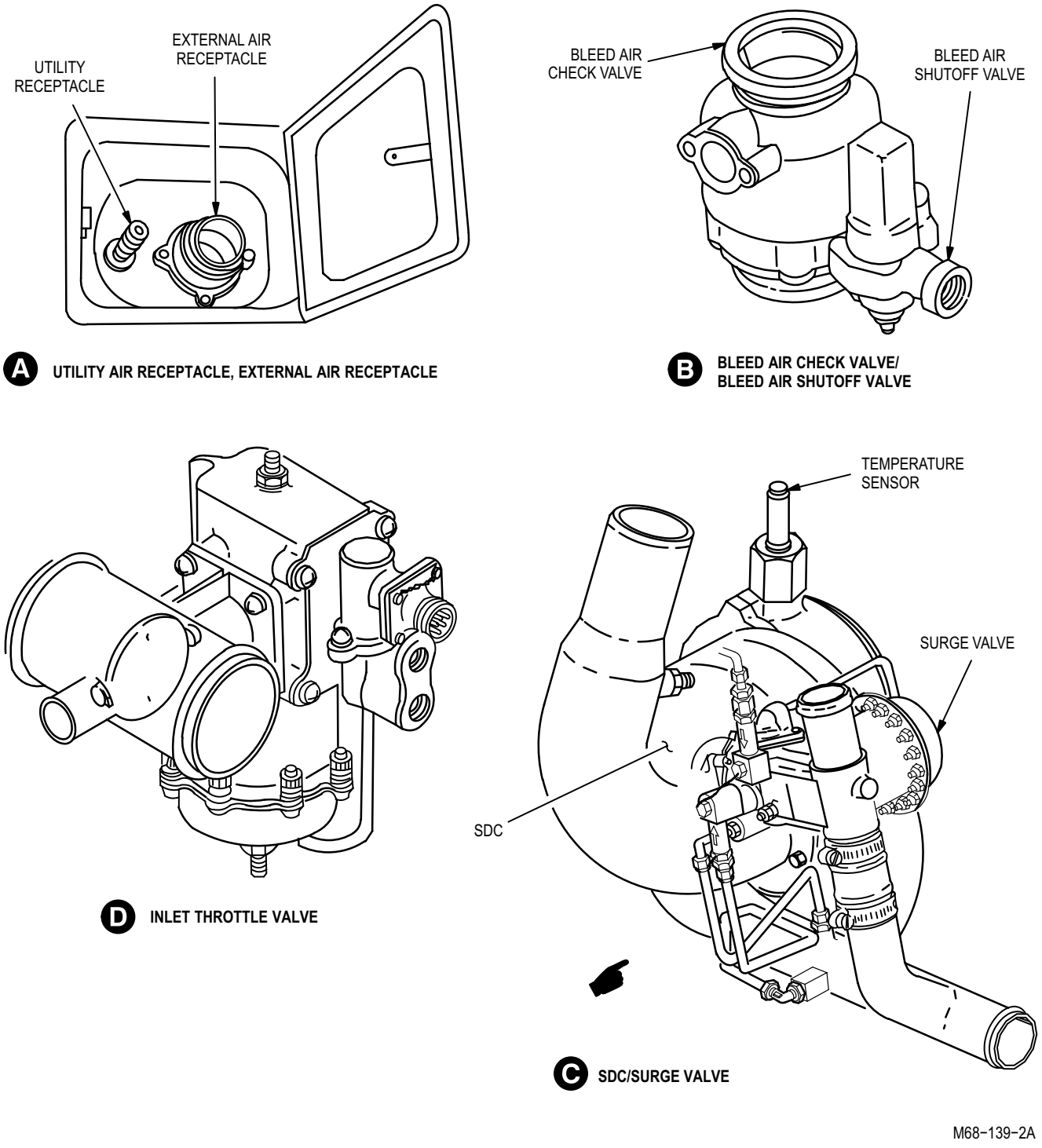


Figure 7–3. PAS Major Component Location (Sheet 2 of 3)

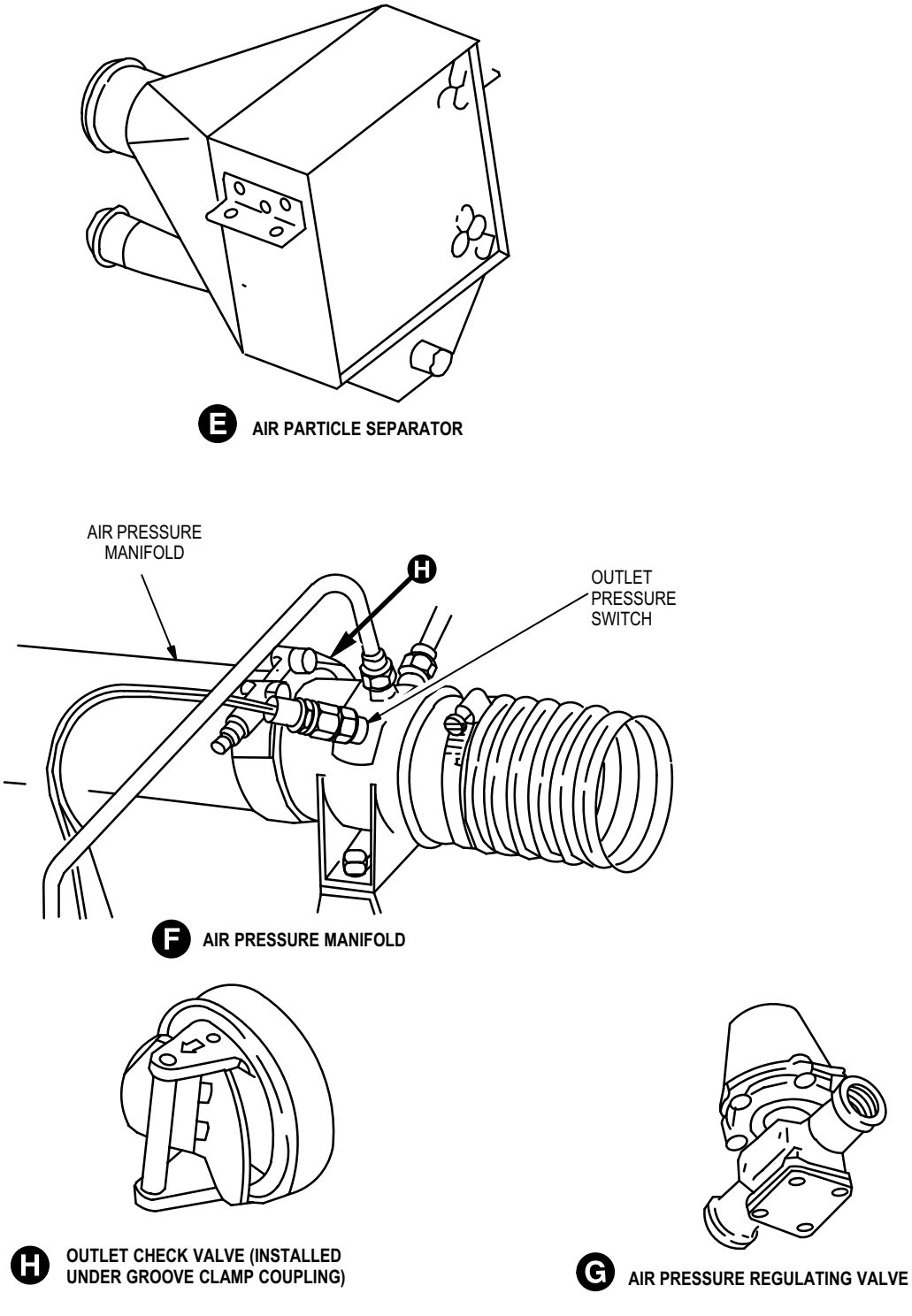


Figure 7–3. PAS Major Component Location (Sheet 3 of 3)

7–3. EQUIPMENT DATA 7–3

Not applicable.

7–4. EQUIPMENT CONFIGURATION 7–4

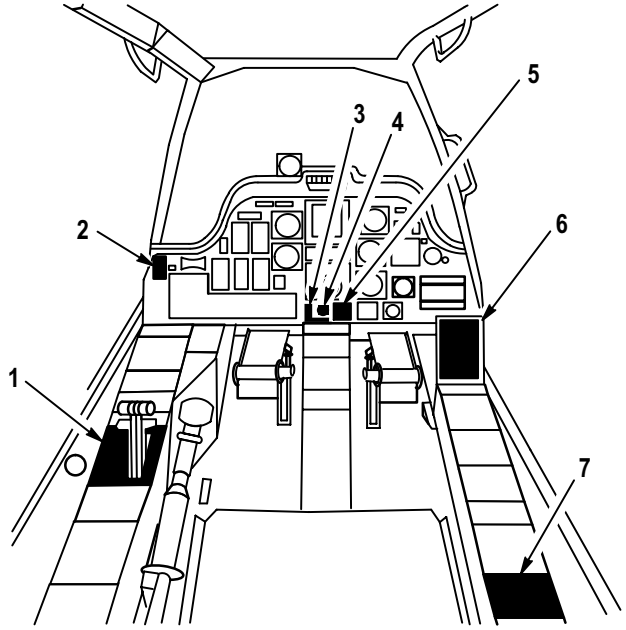
Not applicable.

7–5. SAFETY, CARE AND HANDLING OF EQUIPMENT 7–5

Not applicable.

7–6. CONTROLS AND INDICATORS 7–6

The hydraulic and pneumatic systems receive mode selects and remote switch inputs from various controls located in the pilot station (fig. 7–4) and the CPG station (fig. 7–5). Table 7–1 provides a listing of the controls, switches and associated indicators pertaining to the hydraulic and pneumatic systems along with a description of their function.



1. PILOT POWER QUADRANT
2. PILOT TAIL WHEEL LOCK PANEL
3. PILOT EMERGENCY HYDRAULIC (EMER HYD) CONTROL PANEL
4. PILOT EMERGENCY HYDRAULIC PRESSURE INDICATOR
5. PILOT DUAL HYDRAULIC PRESSURE INDICATOR
6. PILOT CAUTION/WARNING PANEL
7. PILOT APU PANEL

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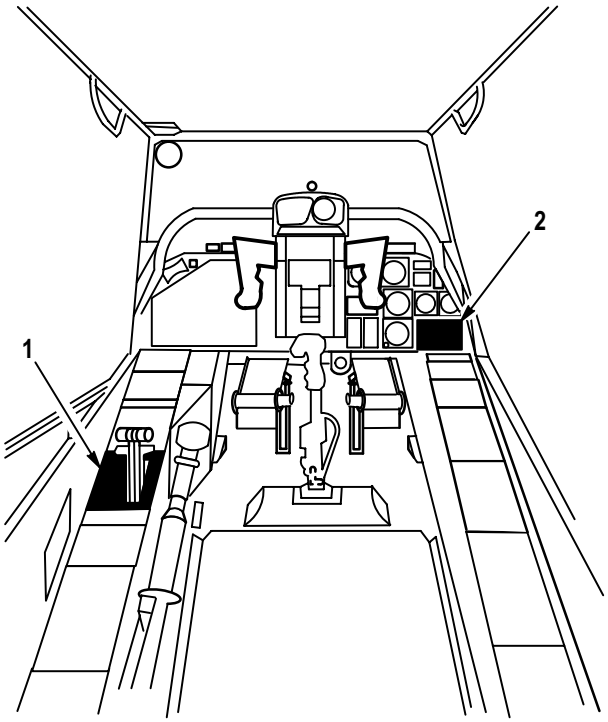
Figure 7–4. Pilot Station



1. CPG POWER QUADRANT
2. CPG CAUTION/WARNING PANEL

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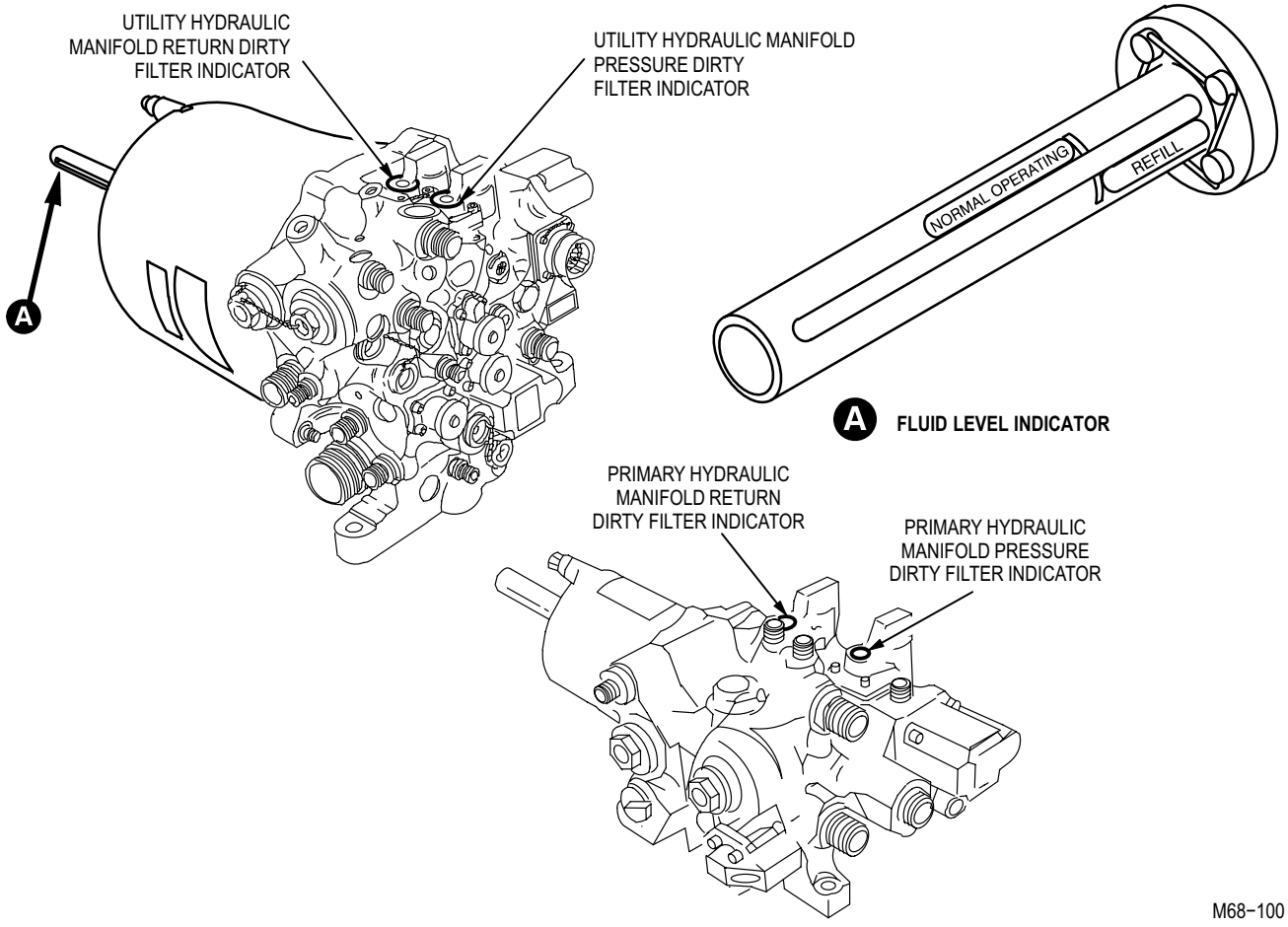
Figure 7–5. CPG Station

Table 7–1. Hydraulic and Pneumatic Systems Controls and Indicators

Primary/Utility Hydraulic Manifolds		
SWITCH/INDICATOR	POSITION	FUNCTION
Pressure dirty filter indicator	Up	Indicates clogged pressure filter.
Return dirty filter indicator	Up	Indicates clogged return filter.
Fluid level indicator	RED	Indicates low fluid level.
	GREEN	Indicates normal operating area.

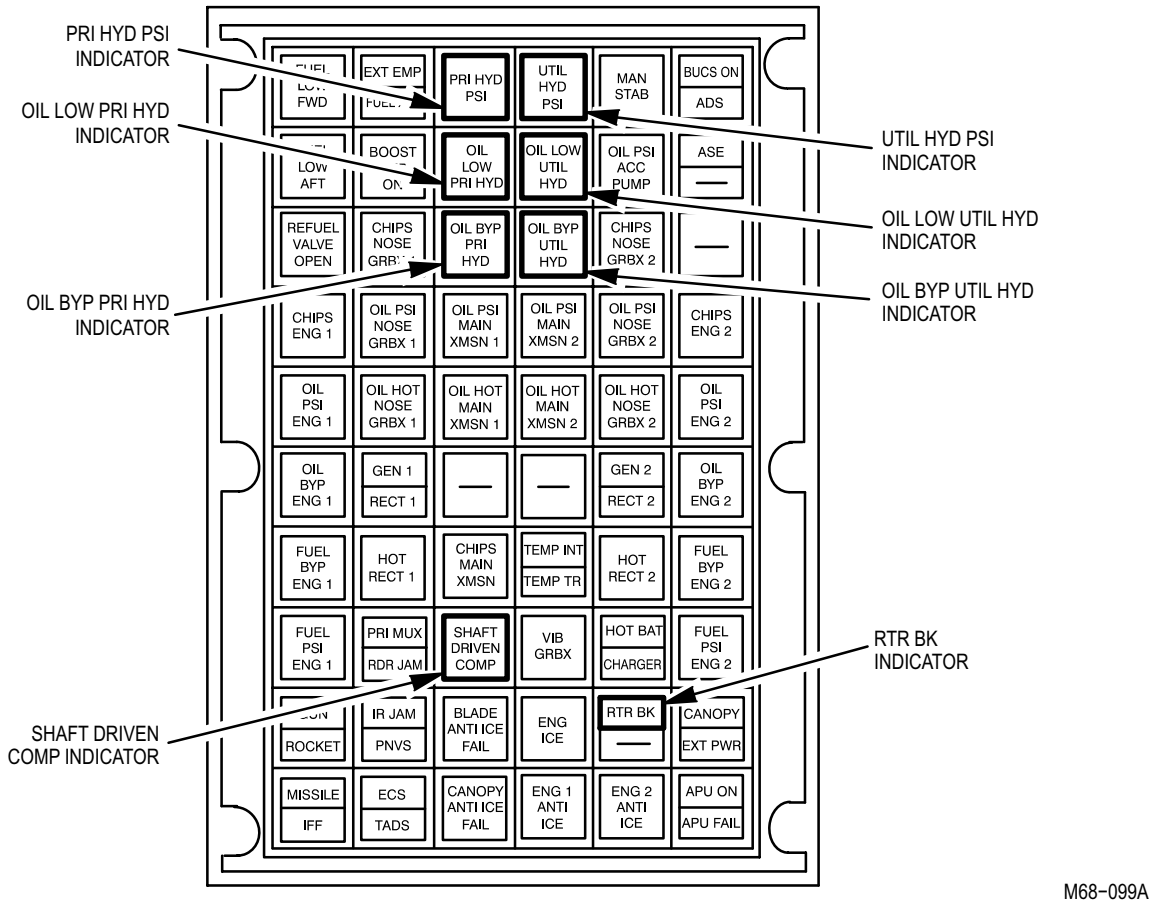


Primary/Utility Hydraulic Manifolds

Table 7–1. Hydraulic and Pneumatic Systems Controls and Indicators (cont)

Pilot Caution/Warning Panel		
SWITCH/INDICATOR	POSITION	FUNCTION
PRI HYD PSI indicator	AMBER	Lights when primary system hydraulic oil pressure is below 1250 psi.
UTIL HYD PSI indicator	AMBER	Lights when utility system hydraulic oil pressure is below 1250 psi.
OIL LOW UTIL HYD indicator	AMBER	Lights when utility system hydraulic fluid is at minimum operating level.
OIL BYP UTIL HYD indicator	AMBER	Lights when oil bypassing utility pressure or return filter.
RTR BK indicator	AMBER	Lights when **RTR BK** switch is in **BRAKE** or **LOCK** position.
SHAFT DRIVEN COMP indicator	AMBER	Lights when SDC oil temperature is above 340° to 360° F (171° to 182° C), or SDC pressurized air output is less than 5 to 9 psi.
OIL LOW PRI HYD indicator	AMBER	Lights when primary system hydraulic fluid is at minimum operating level.
OIL BYP PRI HYD indicator	AMBER	Lights when oil bypassing primary pressure or return filter.

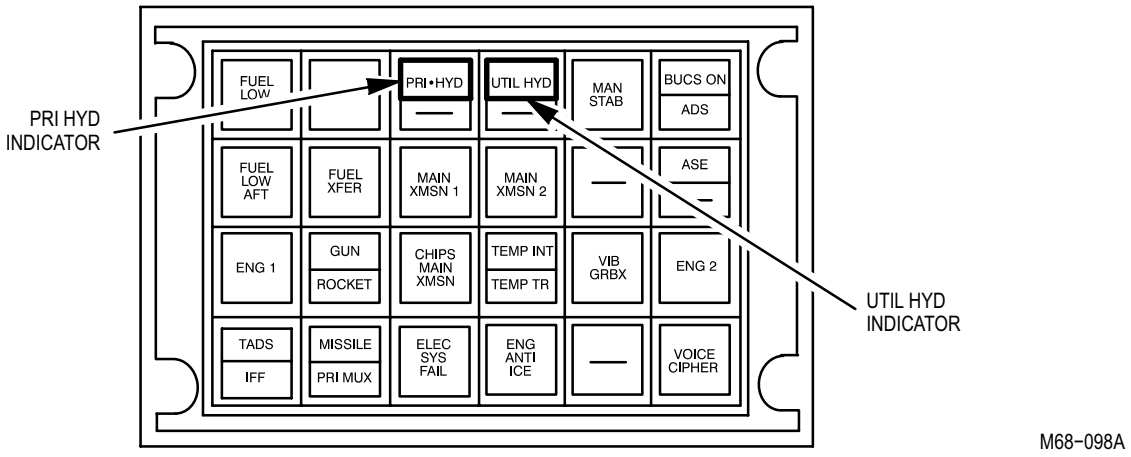
Table 7–1. Hydraulic and Pneumatic Systems Controls and Indicators (cont)



Pilot Caution/Warning Panel

Table 7–1. Hydraulic and Pneumatic Systems Controls and Indicators (cont)

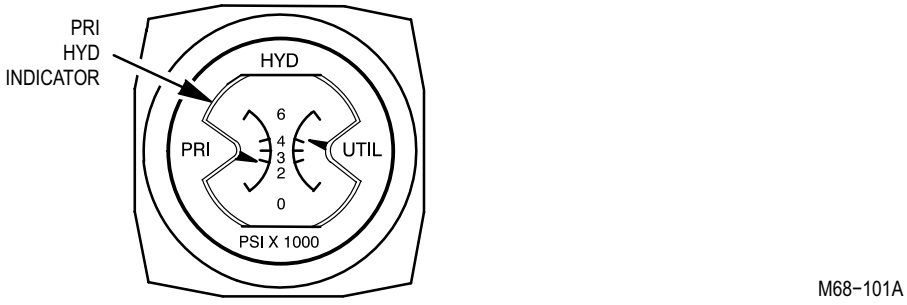
CPG Caution/Warning Panel		
SWITCH/INDICATOR	POSITION	FUNCTION
PRI HYD indicator	AMBER	Lights when primary system hydraulic oil pressure is below 1250 psi.
UTIL HYD indicator	AMBER	Lights when utility system hydraulic oil pressure is below 1250 psi.



CPG Caution/Warning Panel

Table 7–1. Hydraulic and Pneumatic Systems Controls and Indicators (cont)

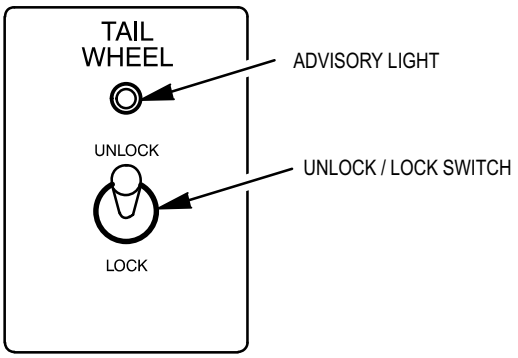
Pilot Dual Hydraulic Pressure Indicator		
SWITCH/INDICATOR	POSITION	FUNCTION
PRI UTIL HYD indicator	**PSI X 1000**	Indicates both primary and utility hydraulic system pressure (0 to 6 psi X 1000).



Pilot Dual Hydraulic Pressure Indicator

Table 7–1. Hydraulic and Pneumatic Systems Controls and Indicators (cont)

Pilot TAIL WHEEL Lock Panel		
SWITCH/INDICATOR	POSITION	FUNCTION
UNLOCK/LOCK switch	**UNLOCK**	Energizes the control valve solenoid to unlock tail wheel.
	LOCK	De–energizes the control valve solenoid to lock tail wheel.
Advisory light	GREEN	Lights when the tail wheel is unlocked.



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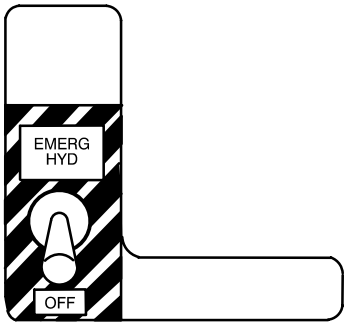
Pilot TAIL WHEEL Lock Panel

Table 7–1. Hydraulic and Pneumatic Systems Controls and Indicators (cont)

Pilot EMERG HYD Switch		
SWITCH/INDICATOR	POSITION	FUNCTION
EMERG HYD switch	**EMERG HYD**	Allows pressurized fluid stored in accumulator to be used for operating flight control servocylinders.
	OFF	De–energizes switch.



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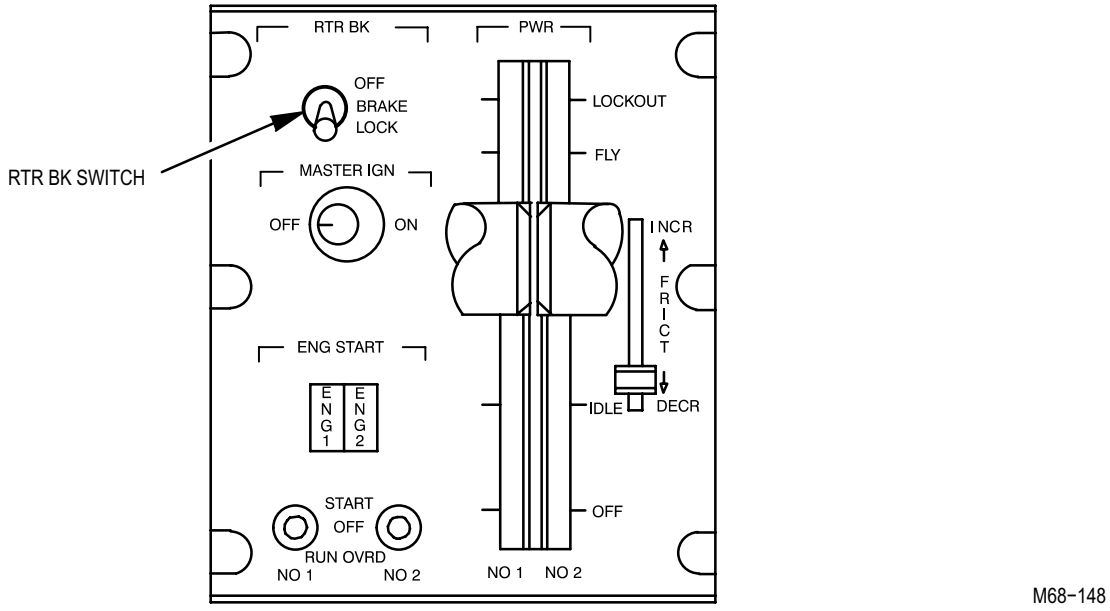
Pilot EMERG HYD Switch

Table 7–1. Hydraulic and Pneumatic Systems Controls and Indicators (cont)

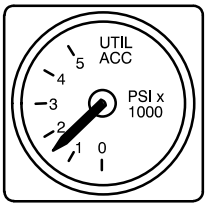
Pilot Power Quadrant		
SWITCH/INDICATOR	POSITION	FUNCTION
RTR BK toggle switch	**OFF**	Releases rotor brake hydraulic pressure.
	BRAKE	Applies utility system pressure regulated to 337 psi to stop rotor brake disc on main transmission.
	LOCK	Locks rotor brake by trapping 3000 psi pressure between manifold and rotor brake actuator.



Pilot Power Quadrant

Table 7–1. Hydraulic and Pneumatic Systems Controls and Indicators (cont)

Pilot Emergency Hydraulic Pressure Indicator		
SWITCH/INDICATOR	POSITION	FUNCTION
UTIL ACC emergency hydraulic pressure indicator	**PSI X 1000**	Indicates emergency hydraulic accumulator pressure (0 to 5 psi X 1000).



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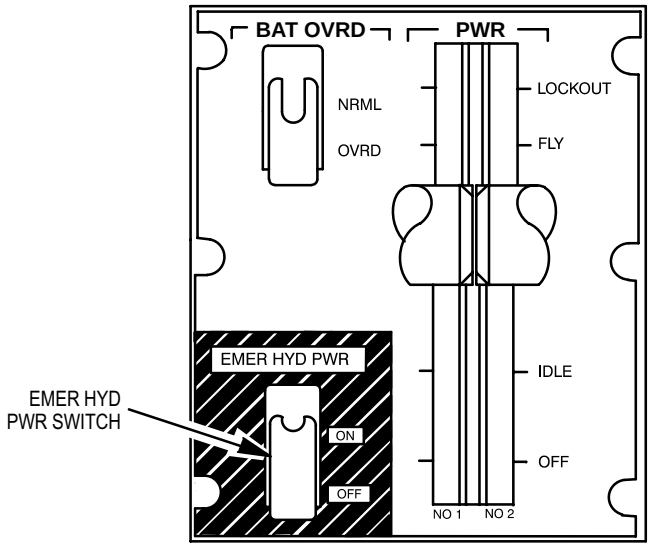
Pilot Emergency Hydraulic Pressure Indicator

Table 7–1. Hydraulic and Pneumatic Systems Controls and Indicators (cont)

CPG Power Quadrant		
SWITCH/INDICATOR	POSITION	FUNCTION
EMER HYD PWR switch	**ON**	Allows pressurized fluid stored in accumulator to be used for operating flight control servocylinders.
	OFF	De–energizes switch.



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CPG Power Quadrant

SECTION II. THEORY OF OPERATION

7–7. SYSTEM DESCRIPTION 7–7

a. **Hydraulic Systems**. The hydraulic systems (fig. 7–6) (primary and utility) are used to store, pressurize, and distribute hydraulic fluid used by hydraulic system components.

(1) The primary hydraulic system provides power assistance to one–half of each flight control servocylinder. The primary hydraulic system provides operational power for use by the stability augmentation system (SAS) and BUCS.

(2) The utility hydraulic system provides power assist to the four pylon actuators, the area weapons azimuth drive motor and elevation drive actuator, ammunition handling system carrier drive motor, APU starter, tail wheel lock actuator, and the rotor brake actuator. The utility hydraulic system also provides power assist to the other half of each flight control servocylinder and emergency pressure use of the flight controls.

(3) Each hydraulic system contains an identical constant displacement, variable delivery hydraulic pump which provides 3000 psi pressure with a 6 gpm flow capability to the hydraulic system components. The hydraulic pumps are driven by the main transmission accessory gear box.

(4) Each hydraulic system contains a hydraulic manifold to store system replenishment fluid. The hydraulic manifolds filters and distributes fluid to using components. The primary hydraulic manifold stores approximately one pint of fluid in its reservoir, while the entire system holds approximately three quarts of hydraulic fluid. The utility hydraulic manifold stores approximately 5 quarts in its reservoir, while the entire system holds approximately 10 quarts of hydraulic fluid.

b. **Primary Hydraulic System**.

(1) **Purpose**. The purpose of the primary hydraulic system is to provide hydraulic pressure for electrical or mechanical directional control of flight control servocylinders. The primary hydraulic system provides visual indication of primary and utility system pressure.

(2) **System Operation** (fig. 7–7).

(a) The primary hydraulic pump draws low pressure fluid from the primary reservoir and provides pressurized hydraulic fluid of 3000 psi to the primary hydraulic manifold. The fluid is then sent past a pressure switch, filters and a pressure transducer before exiting the primary hydraulic manifold. The primary hydraulic manifold provides high pressure hydraulic fluid to the longitudinal, collective, lateral, and directional servocylinders. The fluid from the servocylinders is then returned to the primary hydraulic manifold reservoir. The primary reservoir is serviced and bled through the primary GSE panel and ground power hydraulic unit, or through the use of a hand pump and a container of hydraulic fluid.

(b) The primary hydraulic manifold (fig. 7–8) has two methods of operation, normal and GSE.

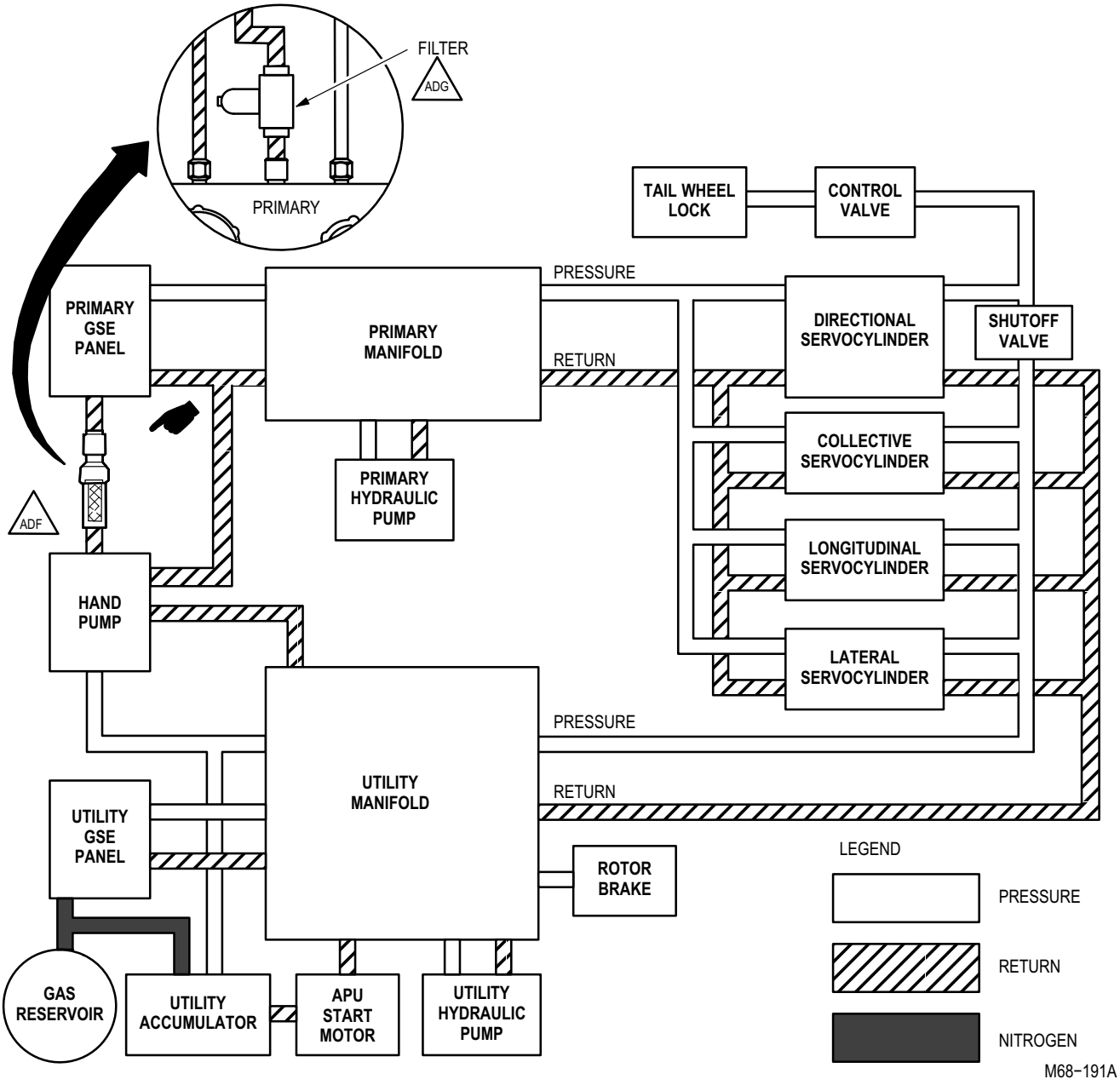


Figure 7–6. Primary and Utility Hydraulic System Block Diagram

7–7. SYSTEM DESCRIPTION (cont) 7–7

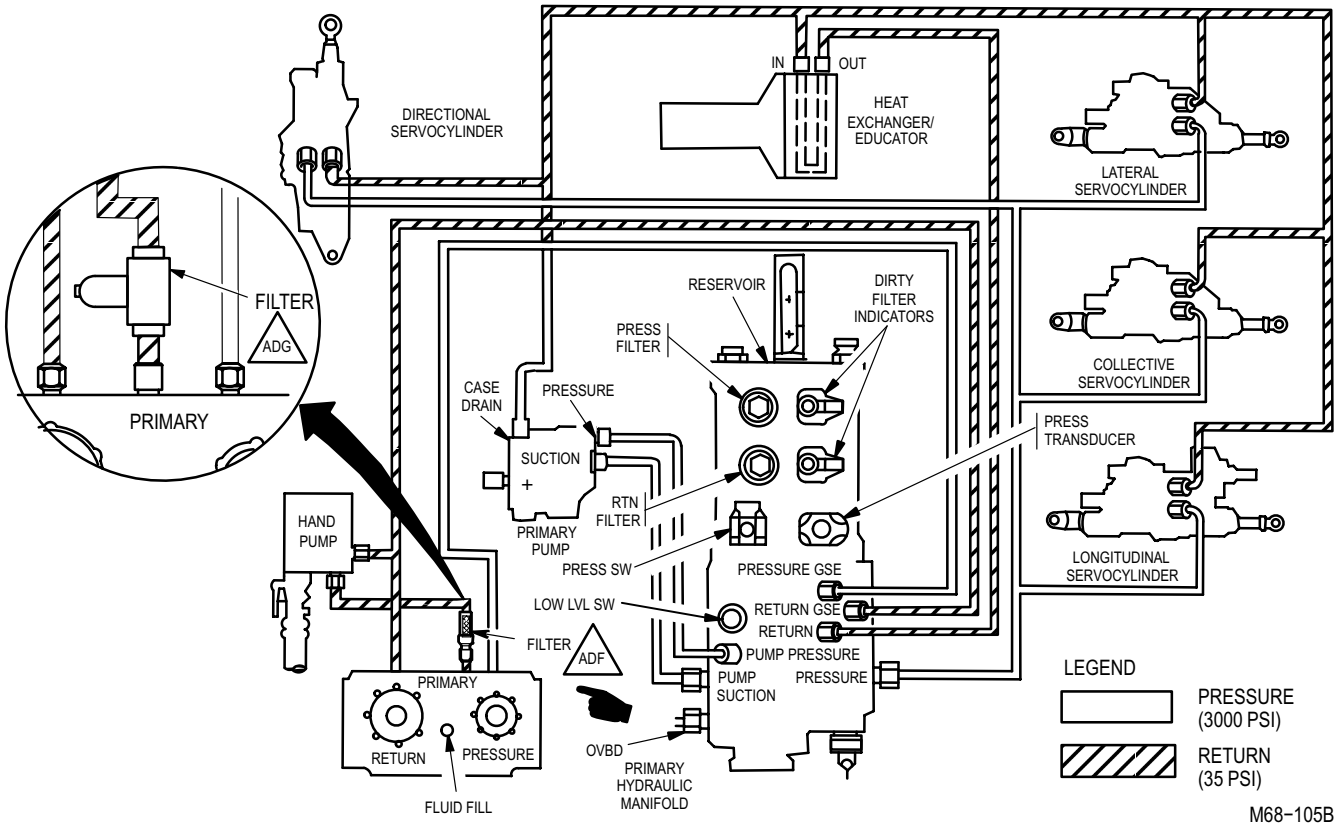


Figure 7–7. Primary Hydraulic System Functional Diagram

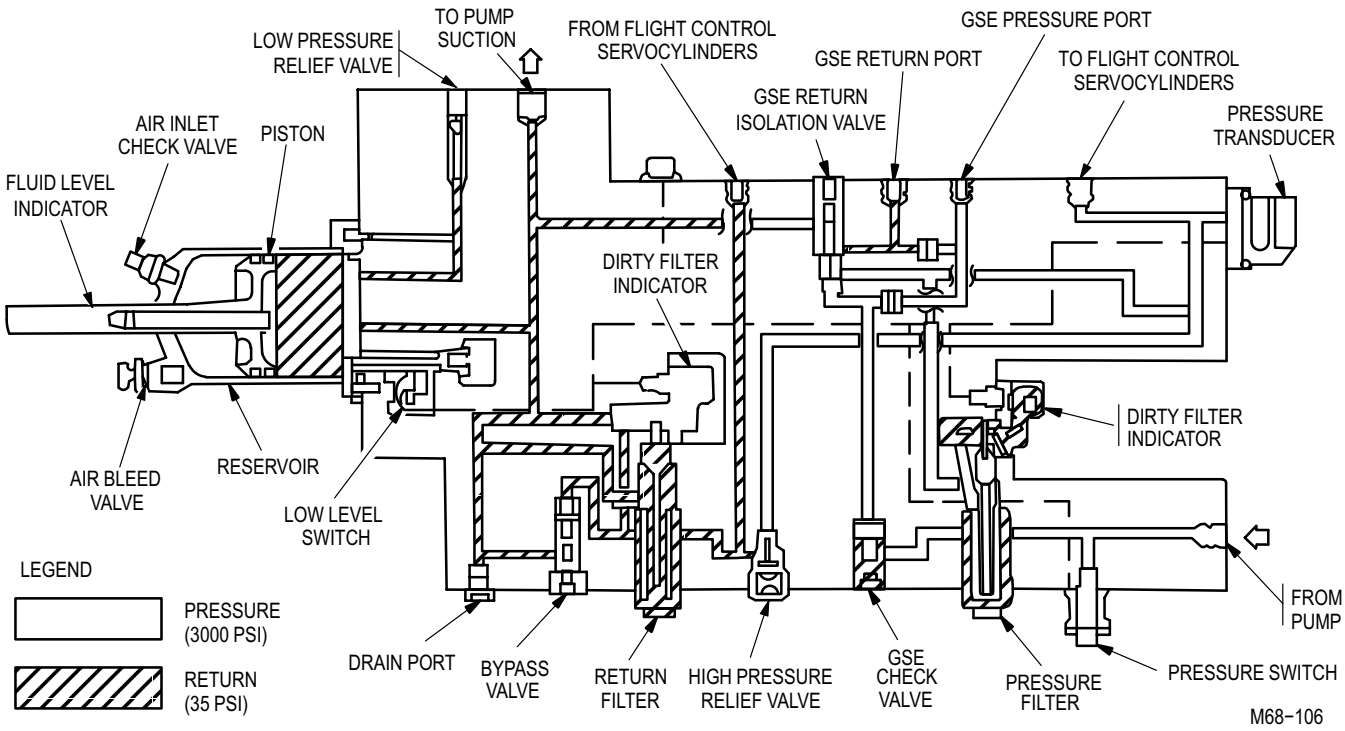


Figure 7–8. Primary Hydraulic Manifold Normal Operation Functional Diagram

(c) During normal operation, pressurized air (30 ± 5 psi) from the PAS manifold enters through the air inlet check valve of the reservoir. The pressurized air acts upon the reservoir piston creating low pressure hydraulic fluid and helps prevent pump cavitation. The low pressure relief valves open at 215 psi, relieving excess trapped fluid and air. When the reservoir reaches the lowest permissible fluid level volume, the low level switch closes and lights the pilot's caution/warning panel **OIL LOW PRI HYD** indicator. The low pressure fluid is drawn by pump suction to the primary hydraulic pump, pressurized to 3000 psi, and returned to the primary hydraulic manifold. High pressure entering the manifold is sensed by the pressure switch. When pressure falls below 1250 psi, the pressure switch closes lighting the pilot's **PRI HYD PSI** indicator and the CPG **PRI HYD** indicator on the respective caution/warning panels. The pressurized fluid is filtered by a five micron filter. If the filter is partially clogged, the differential pressure of 70 ±10 psi is sensed by an electrical switch in the dirty filter indicator. The switch closes, causing the **OIL BYP PRI HYD** indicator on the pilot's caution/warning panel to light and a pop–up visual indicator on the primary hydraulic manifold to extend (the pressure filter has no bypass capabilities). Fluid is isolated from GSE ports during normal operation by the GSE check valve. A high pressure relief valve returns excessive pressure to the return side of the primary hydraulic manifold. Prior to output to the flight control servocylinders, the fluid pressure is monitored by the pressure transducer. The pressure transducer provides signals to the **PRI** side of the pilot dual hydraulic pressure indicator. Fluid returning from the flight control servocylinders is filtered by a five micron filter. If the filter is partially clogged, differential pressure of 70 ±10 psi is sensed by an electrical switch in the dirty filter indicator. The switch closes, causing the **OIL BYP PRI HYD** indicator on the pilot's caution/warning panel to light, and extends a pop–up visual indicator in the primary hydraulic manifold. At a differential pressure of 100 ±15 psi, a bypass valve opens and allows fluid to be routed around the return filter to the primary hydraulic manifold reservoir and the primary hydraulic pump.

(d) During GSE operation, an AGPU sends high pressure fluid to the GSE pressure port. A flow limiting orifice restricts the flow to a maximum flow of eight gpm at 3000 psi. The back pressure from the GSE return isolation valve piston forces the GSE check valve open. The GSE return isolation valve opens the reserve return system to the GSE return port so that hydraulic fluid flows evenly out. A pressure bleed orifice between the GSE pressure and return ports prevents hydraulic lock of the GSE return isolation valve. Hydraulic lock prevents the GSE check valve from reseating. GSE pressure flows through the GSE check valve and through the normal and return primary hydraulic manifold system. Normal operating leakage across the GSE check valve leaks back into the return system through the GSE return isolation valve which prevents pressure build up and actuation of the isolation piston.

7–7. SYSTEM DESCRIPTION (cont) 7–7

(e) The longitudinal, collective, lateral and directional servocylinders (fig. 7–9) are of tandem design which utilize primary and utility hydraulic system pressure. The servocylinder has two modes of operation, normal and BUCS (refer to TM 1-1520-238-T-7 for BUCS mode of operation). During normal (mechanical input) mode of operation, pressurized fluid from the primary hydraulic manifold enters the servocylinder through port P1. Fluid is filtered by a 25 micron filter and routed through a one–way check valve to the stability augmentation actuator. The check valve prevents pressurized fluid from being forced back through the pressure port. The manual servo valve and stability augmentation actuator control both the primary and utility system fluids in the servocylinder. The position of the manual servo valve and stability augmentation actuator determine if fluid pressure is equalized or routed to the power piston and primary barrel. When one side of the piston is pressurized, the other side is routed through return port R1 to the primary hydraulic reservoir.

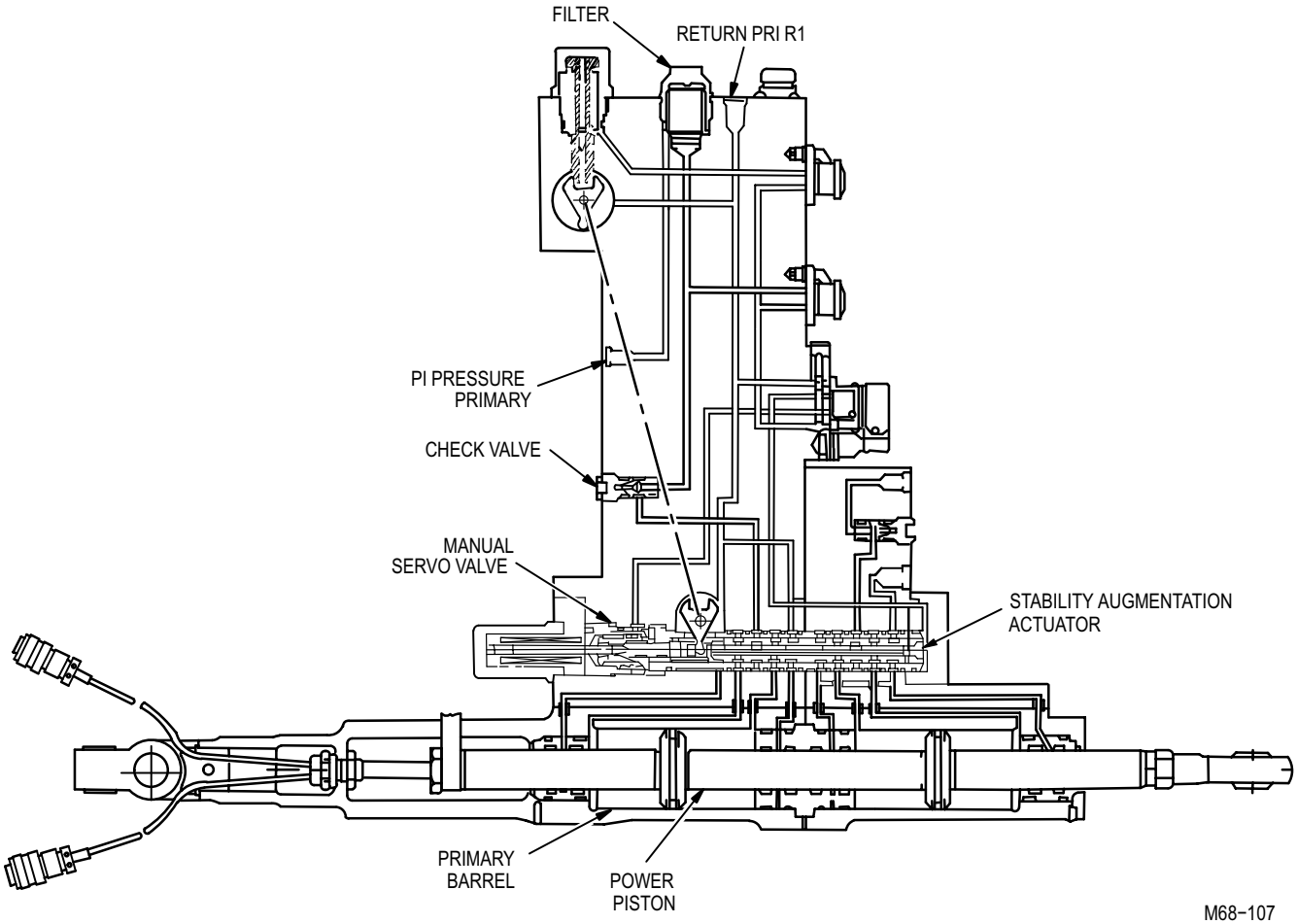


Figure 7–9. Servocylinder Functional Diagram

(f) The primary GSE panel provides a means for servicing and bleeding the primary hydraulic system with the use of ground support equipment. The hand pump (fig. 7–11) services the primary and utility reservoirs from a bulk container of hydraulic fluid and charges the accumulator to 3000 psi. Positioning the selector lever on the manifold inboard (fill primary reservoir) rotates the camshaft causing the M1 check valve to open. The low pressure fluid entering the fill port is filtered by a 45 micron screen filter (ADF) or a 5 micron cartridge filter element (ADG) and enters the hydraulic pump manifold by overriding spring poppet B. The bellcrank handle is then manipulated, forcing fluid through check valve M1 into the primary reservoir. Spring poppet valve A remains closed due to high back pressure (3000 psi) from the accumulator.

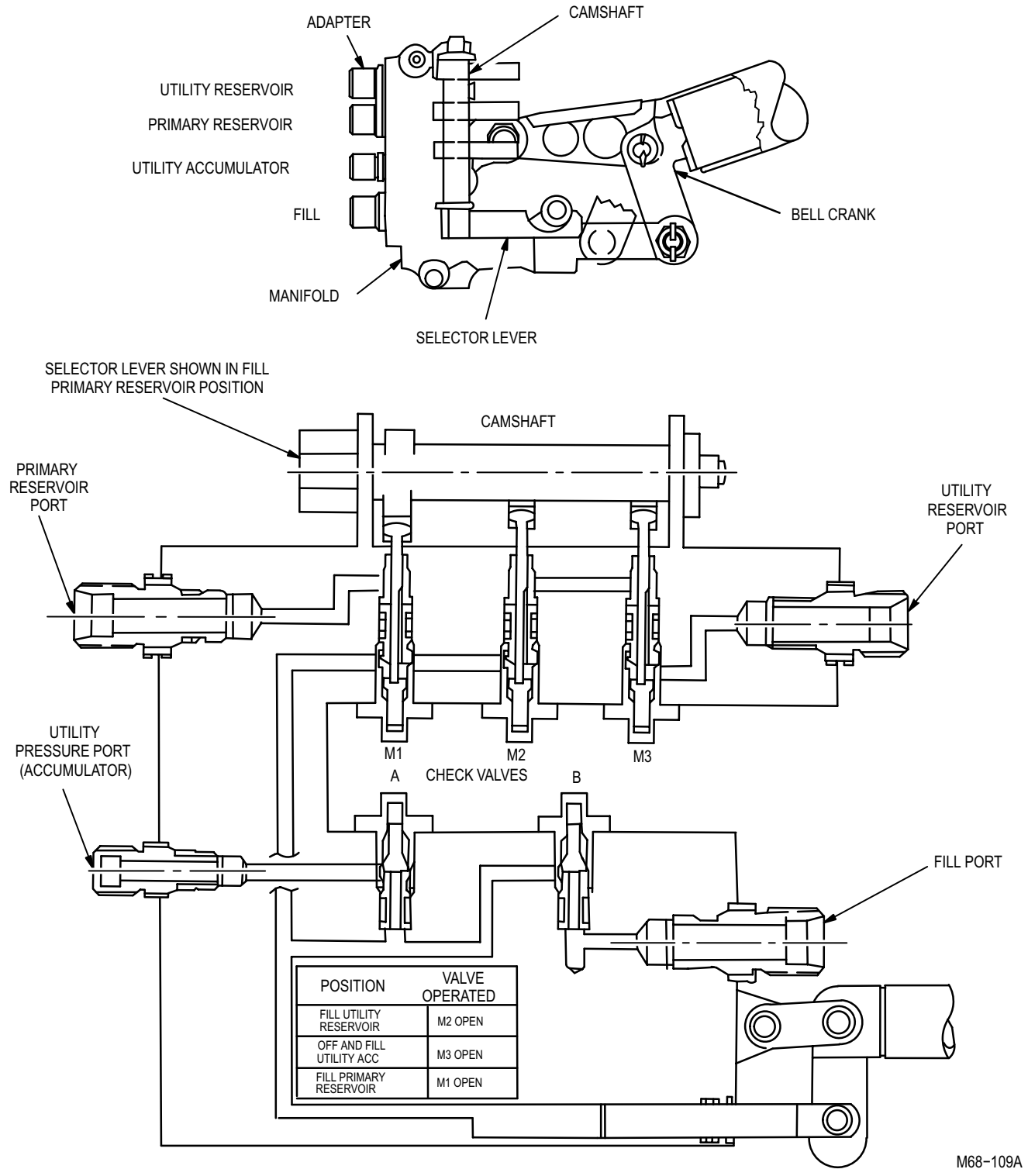


Figure 7–11. Hand Pump Functional Diagram

c. **Utility Hydraulic System.**

(1) **Purpose.** The purpose and use of the utility hydraulic system is to provide hydraulic pressure for electrical or mechanical directional control of flight control servocylinders, APU start motor, rotor brake, tail wheel lock actuator, pylon actuators, and weapon system components. The utility hydraulic system provides high pressure for emergency operation of flight control servocylinders. A return accumulator provides area weapon system (AWS) return pressure dampening. The utility hydraulic system provides visual indications of system status.

(2) **System Operation (**fig. 7–12)**.**

(a) The utility hydraulic pump draws low pressure fluid from the utility hydraulic manifold reservoir to provide pressurized hydraulic fluid of 3000 psi to the utility hydraulic manifold. Fluid is then sent past a pressure switch, filters, and a pressure transducer before exiting the utility hydraulic manifold. Output of the utility manifold provides high pressure hydraulic fluid to the longitudinal, collective, lateral, and directional servocylinders, four external stores controllers, AWS azimuth and elevation motors, and utility accumulator via a restrictor valve. The utility hydraulic manifold supplies hydraulic pressure to the rotor brake using the pilot power quadrant **RTR BK** switch and tail wheel control valve using the pilot **TAIL WHEEL LOCK** switch. During initiation of the APU start sequence, the APU start motor is supplied with hydraulic pressure from the accumulator. Pressurized fluid in the accumulator can also be used as a limited source for flight control servocylinders. An emergency hydraulic shutoff valve shuts off the flow of fluid to the directional servocylinders and tail wheel lock control valve when the fluid level is low. The hydraulic return accumulator dampens hydraulic pressure spikes generated by the AWS. The fluid is then returned to the utility hydraulic manifold reservoir. The utility hydraulic manifold reservoir is serviced and bled through the **UTILITY** GSE panel and the AGPU, or through use of a hand pump and a container of hydraulic fluid. The low pressure fluid is filtered by a 45 micron screen filter (ADF) or a 5 micron cartridge filter element (ADG). Nitrogen servicing of the accumulator is also accomplished at the **UTILITY** GSE panel.

7–7. SYSTEM DESCRIPTION (cont) 7–7

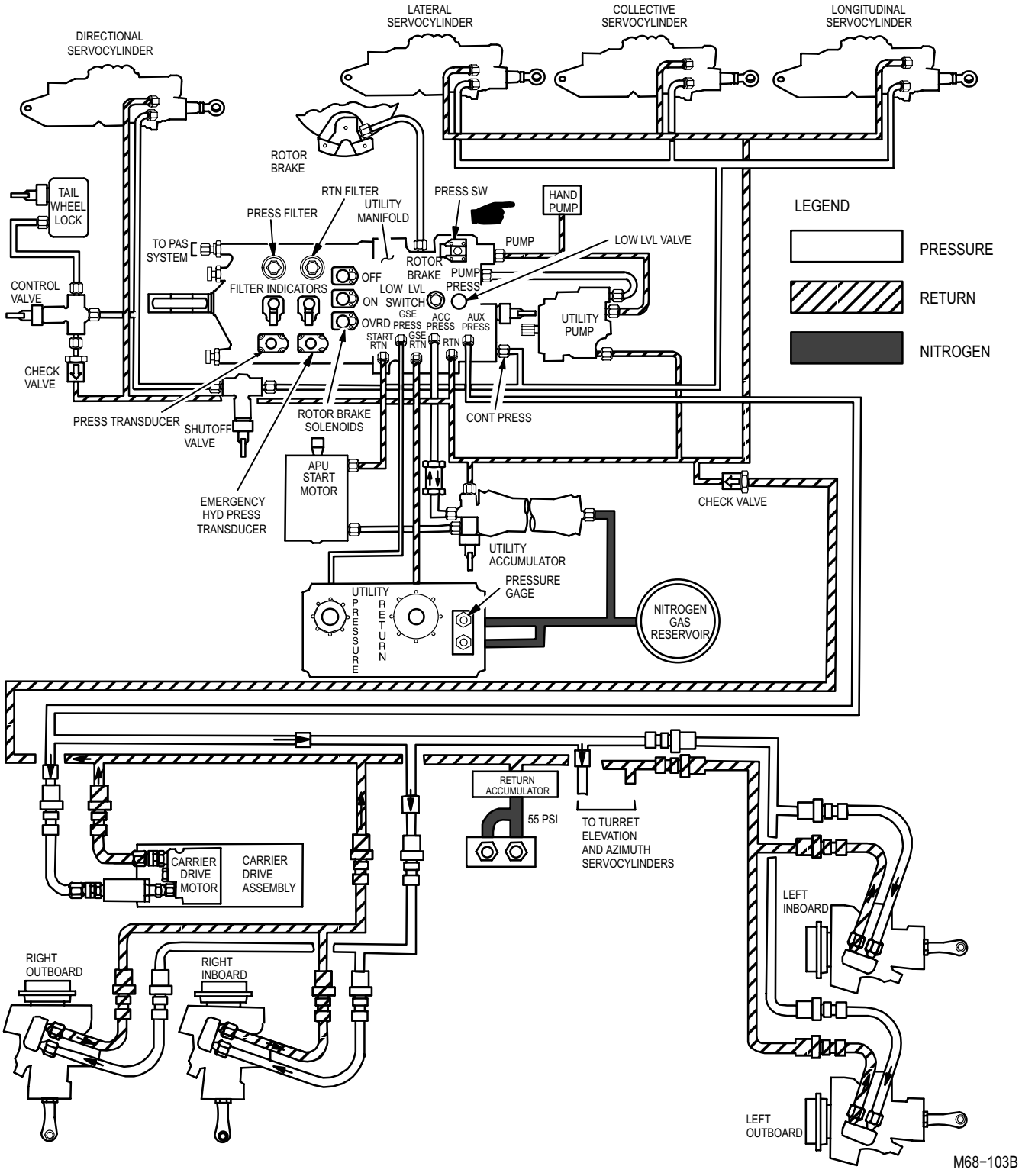


Figure 7–12. Utility Hydraulic System Functional Diagram

(b) The utility hydraulic manifold (fig. 7–13) has two modes of operation, normal and GSE. During normal operation, pressurized air (30 ± 5 psi) from the PAS manifold enters through a one–way air inlet check valve. The pressurized air acts upon the reservoir piston creating a low pressure hydraulic fluid and helps prevent pump cavitation. The air relief valve protects the air pressure side by opening at 105 psi. The low pressure relief valves open at 215 psi, relieving excess trapped fluid and air. A manual air bleed valve is used to relieve reservoir air pressure during maintenance. When the reservoir reaches the lowest permissible fluid level volume, the low level switch closes. A low level valve is actuated causing all auxiliary functions to be turned off hydraulically. The low level switch lights the pilot caution/warning panel **OIL LOW UTIL HYD** indicator and actuates the emergency hydraulic control valve. Low pressure fluid is drawn by pump suction to the utility hydraulic pump, pressurized to 3000 psi, and returned to the utility hydraulic manifold. High pressure entering the utility hydraulic manifold is sensed by the pressure switch. When pressure rises above 2050 psi the pressure switch opens and extinguishes the pilot **PRI UTIL PSI** indicator and the CPG **UTIL HYD** indicator on the respective caution/warning panels. The pressurized fluid is filtered by a five micron filter. If the filter is partially clogged, the differential pressure of 70 ±10 psi is sensed by an electrical switch in the dirty filter indicator. The switch closes, causing the **OIL BYP UTIL HYD** indicator on the pilot caution/warning panel to light and extends a pop–up visual indicator on the utility hydraulic manifold (the pressure filter has no bypass capabilities). Fluid is isolated from the GSE ports during normal operation by the GSE check valve. A high pressure relief valve returns excessive pressure to the return side of the utility hydraulic manifold. The accumulator isolation inlet valve and the accumulator isolation valve isolate accumulator pressure in the accumulator and utility hydraulic manifold. When the helicopter is shutdown, the accumulator isolation valve opens, dumping accumulator pressure when the rotor head is rotated in the normal direction. The hydraulic pump pressurizes fluid to cause the opening of the valve. Fluid going through the accumulator isolation inlet valve is replenished after an APU start and pressurized to 3000 psi. Rotor brake solenoid S1 is energized by the pilot power quadrant **RTR BK** switch when set to **BRAKE** position. Opening of the solenoid permits 3000 psi into the brake circuit. With solenoid S2 closed, the brake metering valve permits 337 ±25 psi pressure to be routed to the rotor brake actuator. A rotor break pressure switch actuates a throttle lock relay and lights the pilot caution/warning panel **RTR BK** indicator. The power lock relay prevents the power levers from being advanced past the **IDLE** position. The override solenoid is opened by the pilot instrument panel **EMER HYD** switch and the CPG power quadrant **EMER HYD PWR** switch. When opened, the solenoid routes accumulator pressure to open the accumulator isolation valve, permitting use of emergency power to the utility side of the servocylinders. The emergency transducer transmits the amount of pressure available to the **UTIL ACC** indicator. The pilot **EMER HYD** and CPG **EMER HYD PWR** switches are also used to deplete accumulator pressure before maintenance on the utility system, except when removing and replacing manifold or servocylinder filters. Prior to output to the flight control servocylinders, fluid pressure is monitored by the pressure transducer. The pressure transducer provides signals to the **UTIL** side of the pilot dual hydraulic pressure indicator. Pressure from the pump to the accumulator isolation valve goes through the auxiliary isolation valve to flight controls. Fluid returning from the flight control servocylinders is filtered by a five micron filter. If the filter is partially clogged, the differential pressure of 70 ±10 psi is sensed by an electrical switch in the dirty filter indicator. The switch closes, causing the **OIL BYP UTIL HYD** indicator on the pilot caution/warning panel to light and extends a pop–up visual indicator in the primary hydraulic manifold. A differential pressure of 100 ±15 psi, a bypass valve opens and allows the unfiltered fluid to be routed around the return filter to the primary hydraulic manifold. After being filtered, the fluid returns to the pump. The APU return port routes fluid from the APU through a system return filter screen into the utility hydraulic reservoir.

7–7. SYSTEM DESCRIPTION (cont) 7–7

(c) During GSE operation, an AGPU sends high pressure fluid to the GSE pressure port. A flow limiting orifice restricts flow to a maximum of eight gallons per minute at 3000 psi. The back pressure from the GSE return isolation valve piston forces the GSE check valve open. The GSE return isolation valve opens the reserve return system to the GSE return port so that fluid flows out evenly. A pressure bleed orifice between the GSE pressure and return ports prevents hydraulic lock on the GSE return isolation valve. Hydraulic lock prevents the GSE check valve from reseating. GSE pressure flows through the GSE check valve and through the normal and return utility hydraulic manifold system. Normal operating leakage across the GSE check valve leaks back into the return system through the GSE return isolation valve, this prevents pressure build up and actuation of the isolation piston. The utility GSE panel assembly provides connections for direct external hydraulic power and nitrogen servicing. A hand pump services the primary and utility reservoirs from a bulk container of hydraulic fluid and charges the accumulator to 3000 psi (accumulator must be properly serviced prior to using the hand pump). The nitrogen is charged by the use of a nitrogen fill–bleed valve. A nitrogen pressure gauge provides an indication of nitrogen pressure.

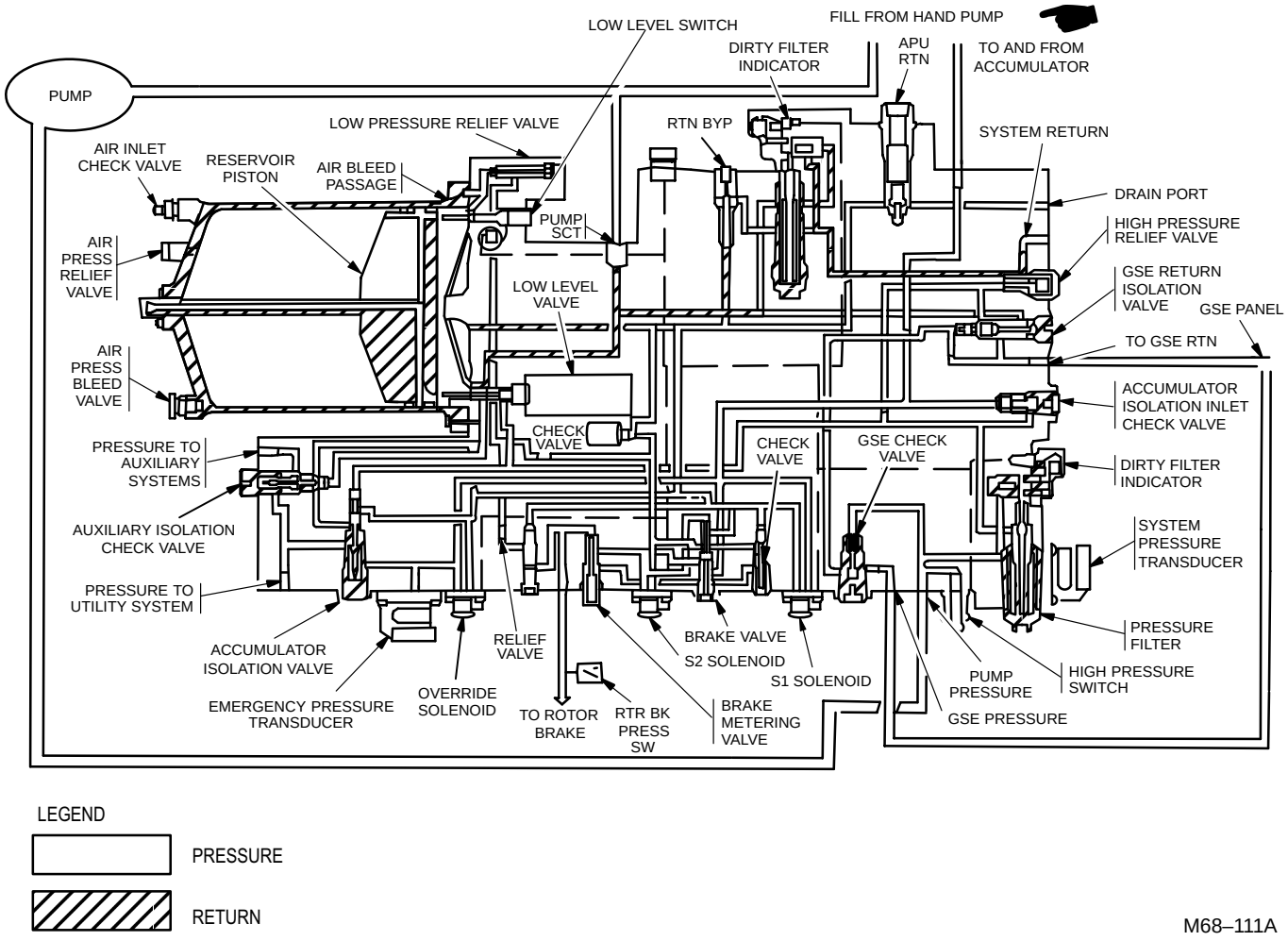


Figure 7–13. Utility Hydraulic Manifold Functional Diagram

7–7. SYSTEM DESCRIPTION (cont) 7–7

(d) The longitudinal, collective, lateral and directional servocylinders (fig. 7–14) are of tandem design and utilize primary and utility hydraulic system pressure. The servocylinder has two modes of operation, normal and BUCS (refer to TM 1-1520-238-T-7 for BUCS operation). During normal (mechanical input) operation, pressurized fluid from the utility hydraulic manifold enters the servocylinder through port P2. Fluid is routed through a one–way check valve to the stability augmentation actuator. The check valve prevents pressurized fluid from being forced back through the pressure port. The manual servo valve and stability augmentation actuator control both the primary and utility system fluids in the servocylinder. The position of the manual servo valve and stability augmentation actuator determines if fluid pressure is equalized or routed to the piston or primary barrel. When one side of the piston is pressurized, the other side is routed through return port R2 to the primary hydraulic reservoir.

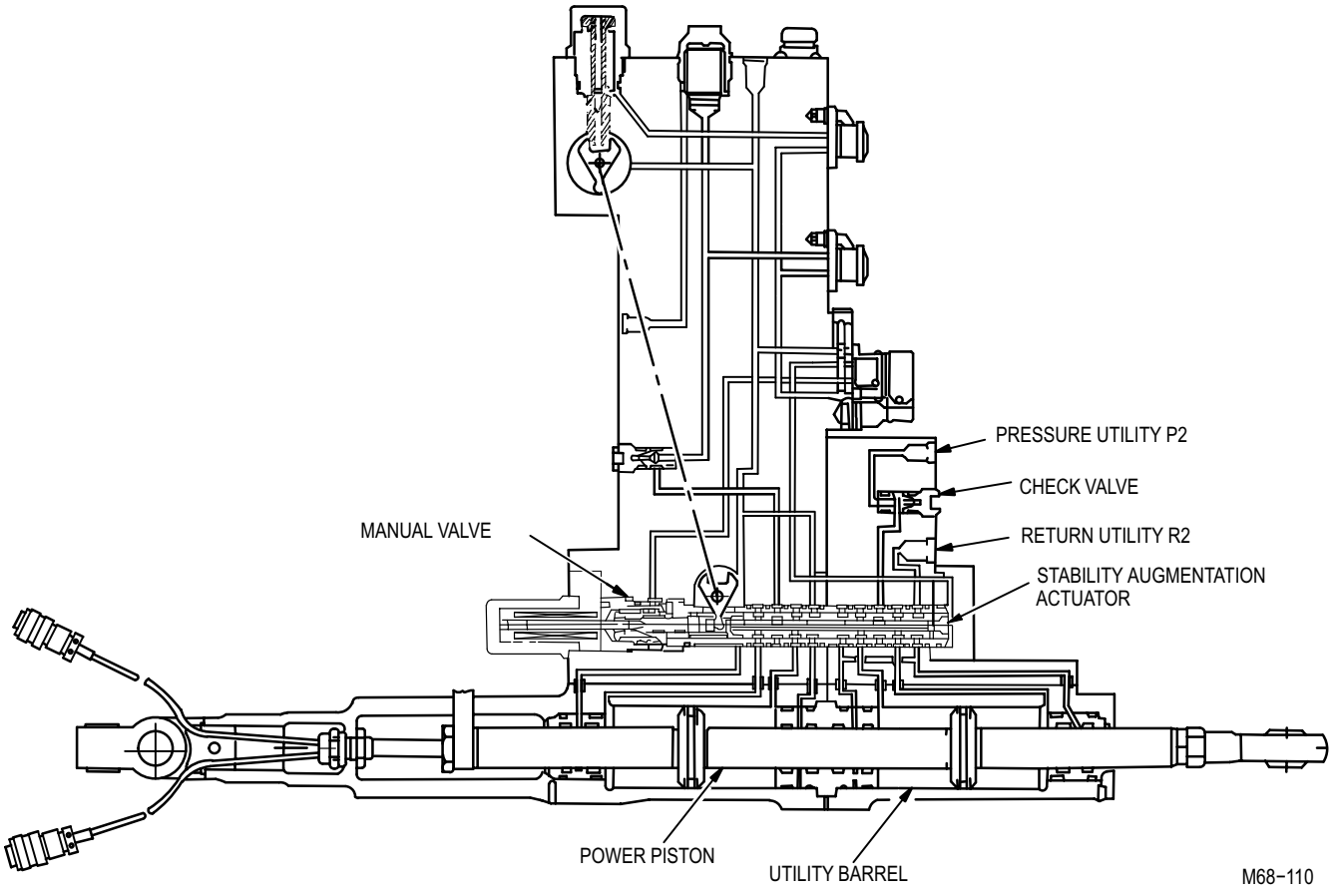


Figure 7–14. Servocylinder Functional Diagram

(e) The tail wheel lock control valve (fig. 7–16) is a two position three–way solenoid operated valve, controlling hydraulic pressure to the tail wheel lock actuator. The **TAIL WHEEL** lock control panel supplies 28 VDC from the **TWHL LK** circuit breaker to the valve. When the tail wheel lock switch is placed in the **LOCK** position, the control valve is de–energized and bypasses hydraulic fluid from the lock actuator to the return line. Spring tension overcomes hydraulic pressure, locking the tail wheel. When the tail wheel lock switch is placed in the **UNLOCK** position, the control valve is energized. This closes the return line and applies hydraulic pressure. Hydraulic pressure overcomes spring tension, unlocking the tail wheel. A proximity switch is activated and lights the **TAIL WHEEL UNLOCK** advisory indicator. The emergency hydraulic shutoff valve shuts off the flow of utility hydraulic pressure to the directional servocylinder and tail wheel lock control valve when the low level switch is activated. During normal operation, the emergency hydraulic shutoff valve is open, allowing pressure to flow from the utility manifold to the directional servocylinder and the tail wheel lock control valve. When the low level switch is actuated, a 28 VDC signal closes the emergency hydraulic shutoff valve. The fluid prevented from flowing is conserved for use by the main rotor flight control servocylinders.

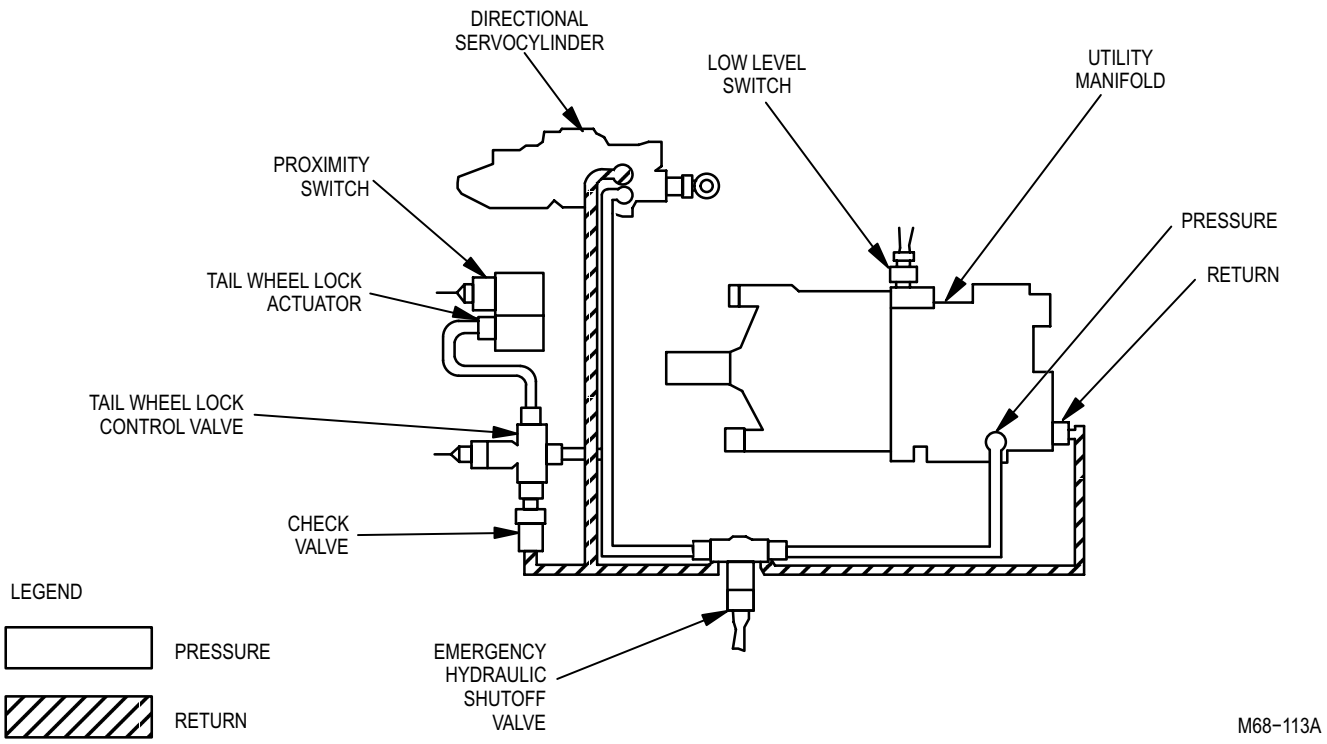


Figure 7–16. Tail Wheel Lock and Emergency Hydraulic Shutoff Valves

d. **PAS**. The PAS system provides air for use by air driven or operated components such as the air turbine starters, environmental control system (ECS), canopy side window defogging, engine cooling louver actuators, hydraulic reservoir pressurization, ice detector sensor, the nitrogen inerting system, and regulated air pressure to the fuel system components.

(1) **Purpose** (fig. 7–17). The PAS cleans, pressurizes, regulates, and distributes air to the following pneumatically operated systems and components: main engine starting, ECS, canopy/windshield defog, louver actuators, ice detector probe, hydraulic system, utility receptacle, nitrogen inerting system, and the air pressure regulating valve (to fuel system).

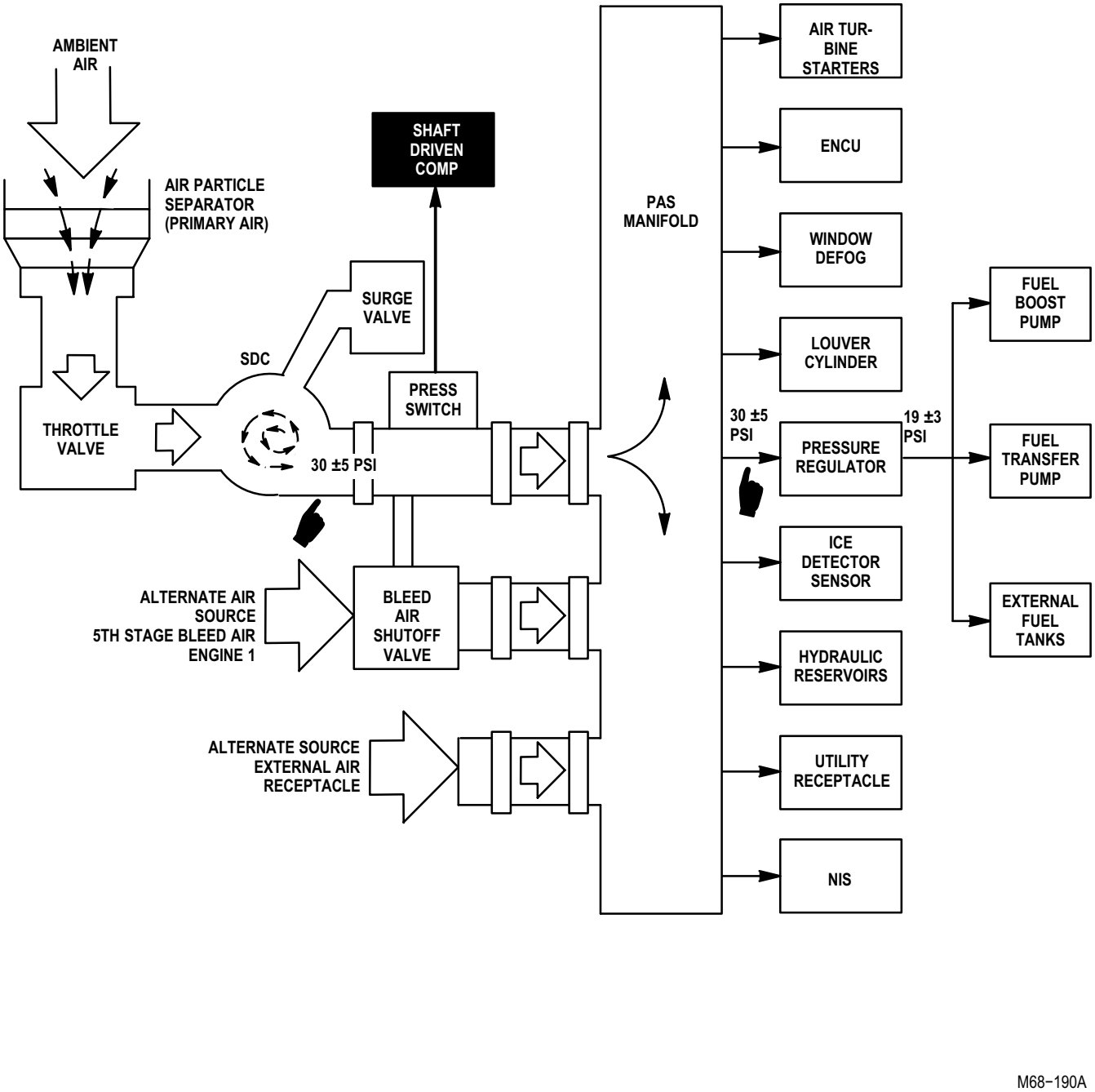


Figure 7–17. PAS Block Diagram

(2) **System Operation.** The PAS system (fig. 7–18) has the following three modes of operation: primary mode (SDC air), secondary mode (bleed air), and external mode (AGPU).

(a) During primary operation, the engines or APU drive the SDC. Air is drawn through a screen into the air particle separator which separates the dirt particles using centrifugal force. PAS air creates a low pressure area and ejects dirt particles through an exhaust tube. Clean air then passes to the SDC throttle inlet valve. The SDC throttle valve reduces the starting load on the APU by decreasing the air available to the SDC by 70%. The SDC throttle inlet valve solenoid is controlled by the pilot **APU** panel **START/RUN** switch through a 60 second time delay. The SDC throttle inlet valve is open except during APU start. Placing the **START/RUN** switch to **RUN** causes the solenoid to de–energize, restricting air from the air particle separator to the SDC for 60 seconds. The SDC compresses air to 30 ± 5 psi and raises the temperature to approximately 400° F (204° C). The surge valve maintains a constant pressure by monitoring supply air pressure, static air pressure and total air. A differential in pressure causes the valve to open or close as necessary, which prevents pressure surges that cause compressor stall. The overboard vent discharges excessive compressor air flow. The SDC outlet pressure switch monitors SDC pressure output. When pressure drops below 14 psi, the switch closes, lighting the **SHAFT DRIVEN COMP** indicator on the pilot's caution/warning panel. The SDC check valve is a one–way valve which routes hot pressurized air to the air pressure manifold and is then distributed to the pneumatic systems. In the secondary and external modes, the SDC check valve prevents manifold air from entering the SDC. The air pressure regulating valve reduces manifold pressure to 19 ±3 psi for fuel system use. The utility air receptacle allows the use of a low–pressure air hose with pressure driven tools and test equipment. The SDC over temperature switch lights the **SHAFT DRIVEN COMP** indicator when the oil temperature is above 340° to 360° F (171° to 182° C).

(b) During secondary operation, when SDC outlet pressure drops below 14 psi, the bleed air shutoff valve opens automatically, allowing 60 psi of fifth stage bleed air from engine 1 to enter the manifold. The bleed air check valve prevents manifold air from entering the bleed air shutoff valve during primary or external modes of operation. Air pressure is distributed in the same manner as the primary mode.

(c) During external operation, high pressure air generated by an AGPU enters the manifold through the external air receptacle. The check valve prevents loss of manifold air during other modes of operation. Air pressure is distributed in the same manner as the primary mode.

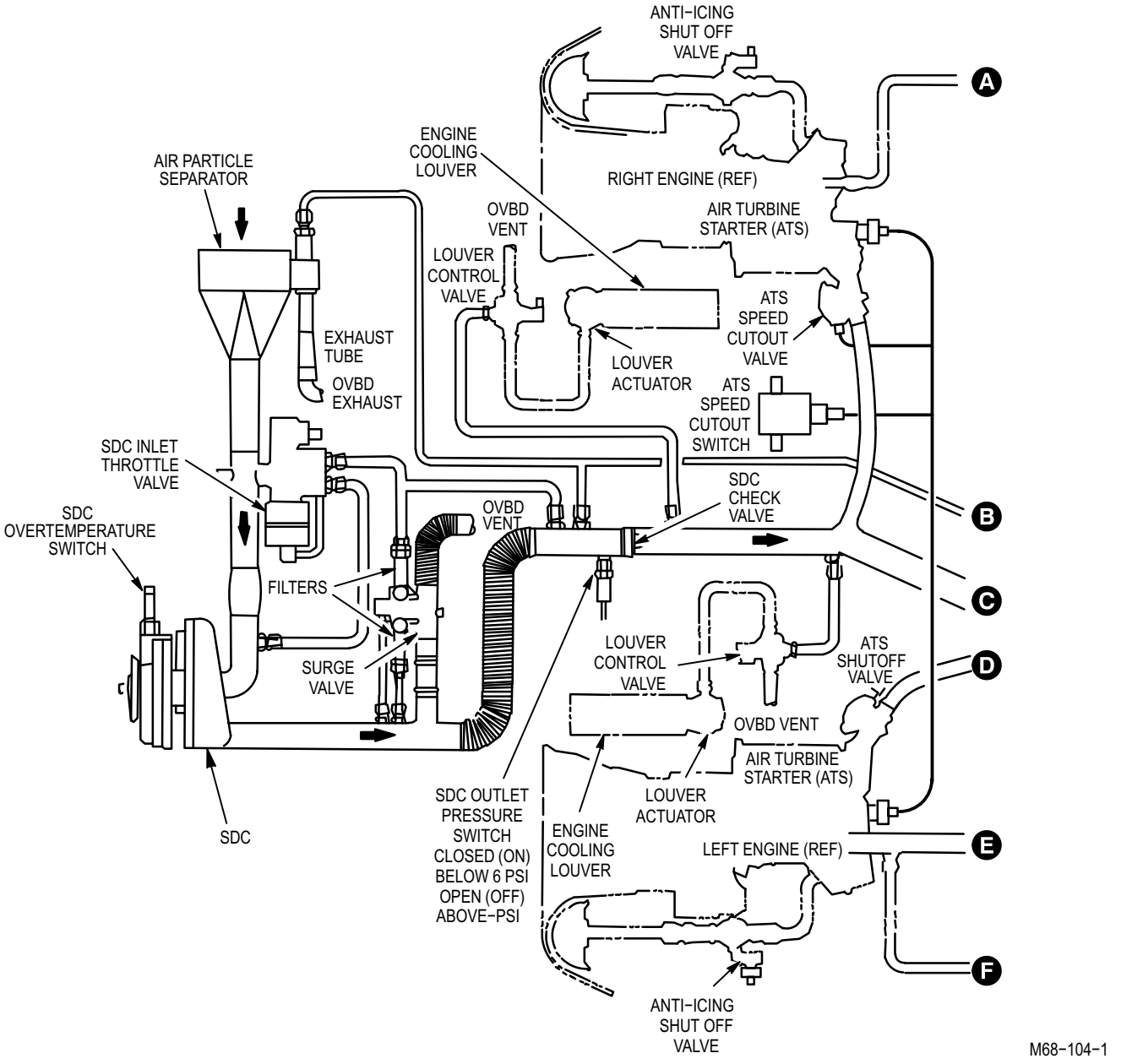


Figure 7–18. PAS Flow Diagram (Sheet 1 of 2)

7–7. SYSTEM DESCRIPTION (cont) 7–7

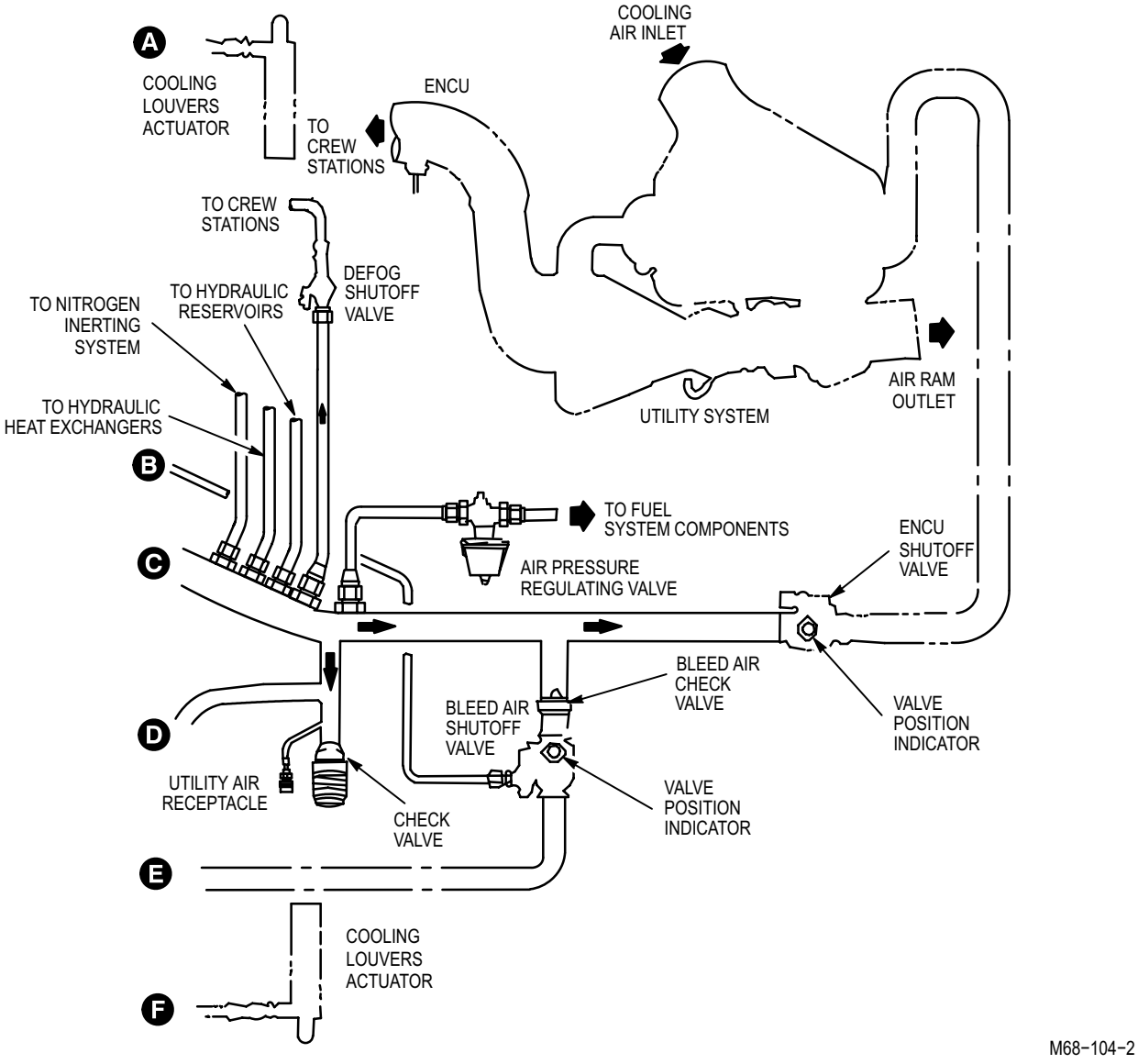


Figure 7–18. PAS Flow Diagram (Sheet 2 of 2)

7–8. MULTIPLEX READ CODES 7–8

Not applicable.

SECTION III. TROUBLESHOOTING PROCEDURES

7–9. ELECTRICAL COMPONENT LOCATION AND CONFIGURATION (ECLC) INDEX 7–9

Use the information in Table 7–2 to locate the electrical components and their connectors to perform the troubleshooting tasks in this chapter. Table 7–2 includes locator illustrations which supplement the ECLC listing. The listing entry in the grid area column tells where to find the component in the illustrations.

Table 7–2. Electrical Component Location and Configuration (ECLC) Index Listing

FROM COLUMN		TO COLUMN			
Connector Ref Des	Component/ Harness	Connector Ref Des	Component/ Harness	Grid Area	Access
P1	W605	JI	A402	32B	PLT STATION
P18	W118	J1	A106	17B	PLT STATION
P19	W118	J1	A157	1B	R40 PANEL
P121	W119	J1	M21	34B	PLT STATION
P123	W119	J1	M21	34A	PLT STATION
P173	W119	J1	A24	22D	PLT STATION
P190	W119	J1	A29	11C	CPG STATION
P217	W102	J1	L13	47E	205 PANEL
P238	W102	J1	HP2	53B	R325 PANEL
P239	W119	J1	HP1	42C	L200 PANEL
P265	W119	J1	M28	39B	PLT STATION
P431	W211	J27	A402	29D	L200 PANEL
P440	W118	J16	A402	29C	R200 PANEL
P441	W119	J24	A402	29D	L200 PANEL
P442	W118	J5	A402	29B	R200 PANEL
P449	W211	J449	W119	42E	T205L FAIRING
P463	W119	J1	A76	28D	PLT STATION
P527	W119	J527	W645	40B	CPG STATION
P746	W118	J1	M29	39A	PLT STATION
P748	W119	J2	A403	6D	L90 PANEL

Table 7–2. Electrical Component Location and Configuration (ECLC) Index Listing (cont)

FROM COLUMN		TO COLUMN			
Connector Ref Des	Component/ Harness	Connector Ref Des	Component/ Harness	Grid Area	Access
P754	W170	J1	HP5	58E	R475 FAIRING
P760	W170	J760	HP4	59A	TAIL STRUT
P914	W118	J914	W119	13C	CPG STATION
P1011	W102	J1	HP6	55A	T355 FARING
P1072	W102	J1	S88	49D	T250L DOOR
P1323	W102	J1	S132	41B	T250L DOOR

Table 7–2. Electrical Component Location and Configuration (ECLC) Index Listing (cont)

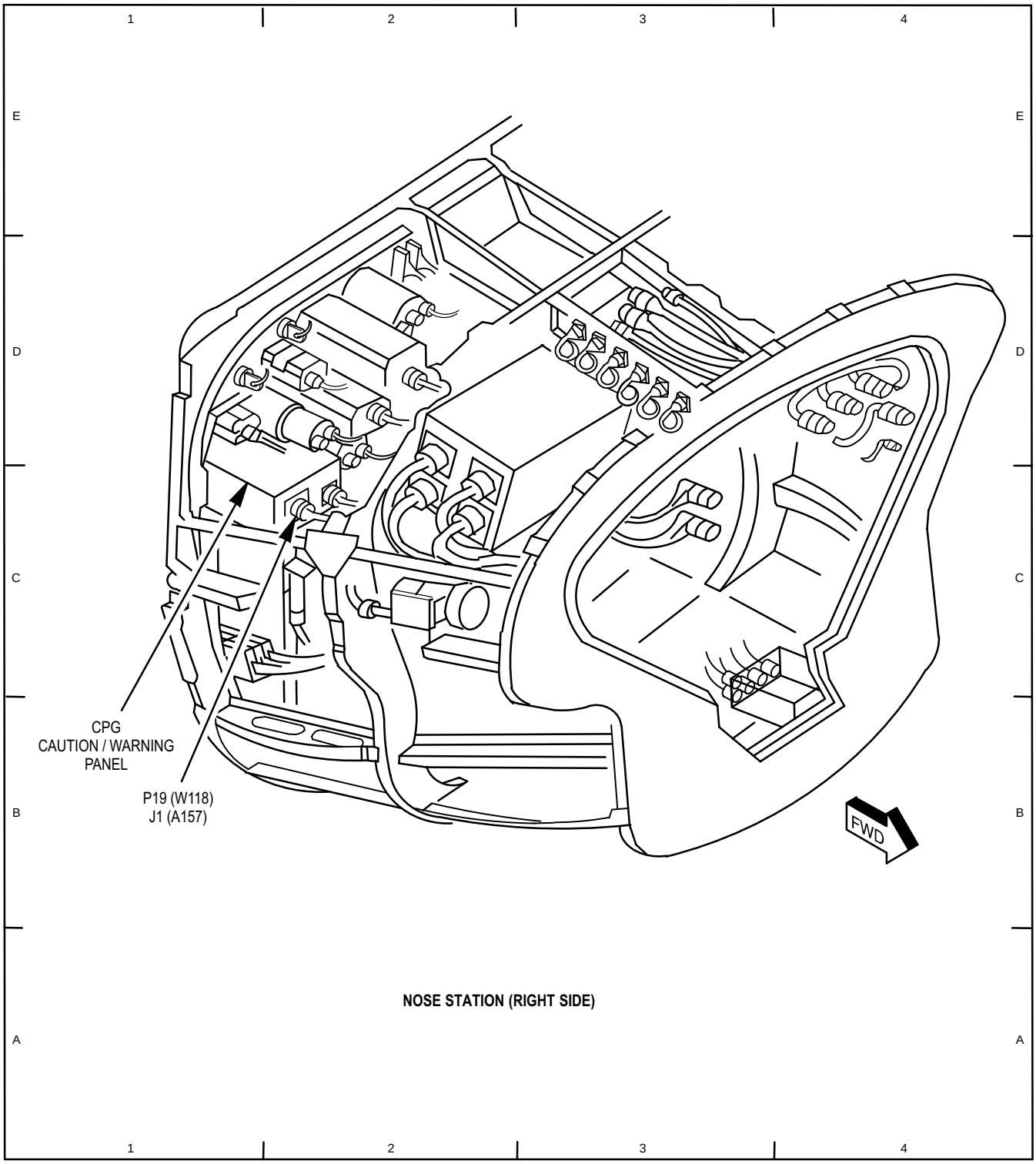
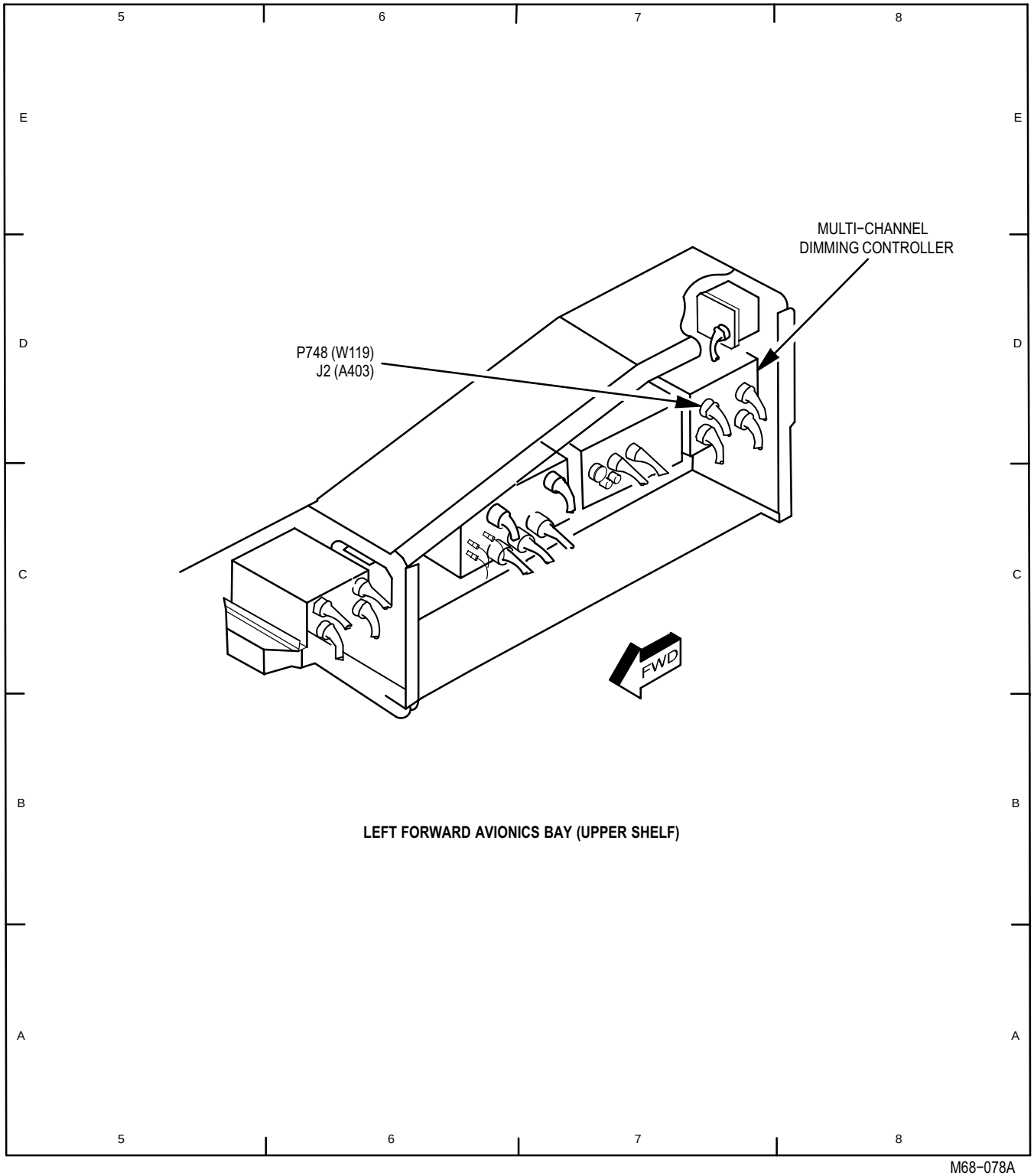


Table 7–2. Electrical Component Location and Configuration (ECLC) Index Listing (cont)



7–9. ELECTRICAL COMPONENT LOCATION AND CONFIGURATION (ECLC) INDEX (cont) 7–9

Table 7–2. Electrical Component Location and Configuration (ECLC) Index Listing (cont)

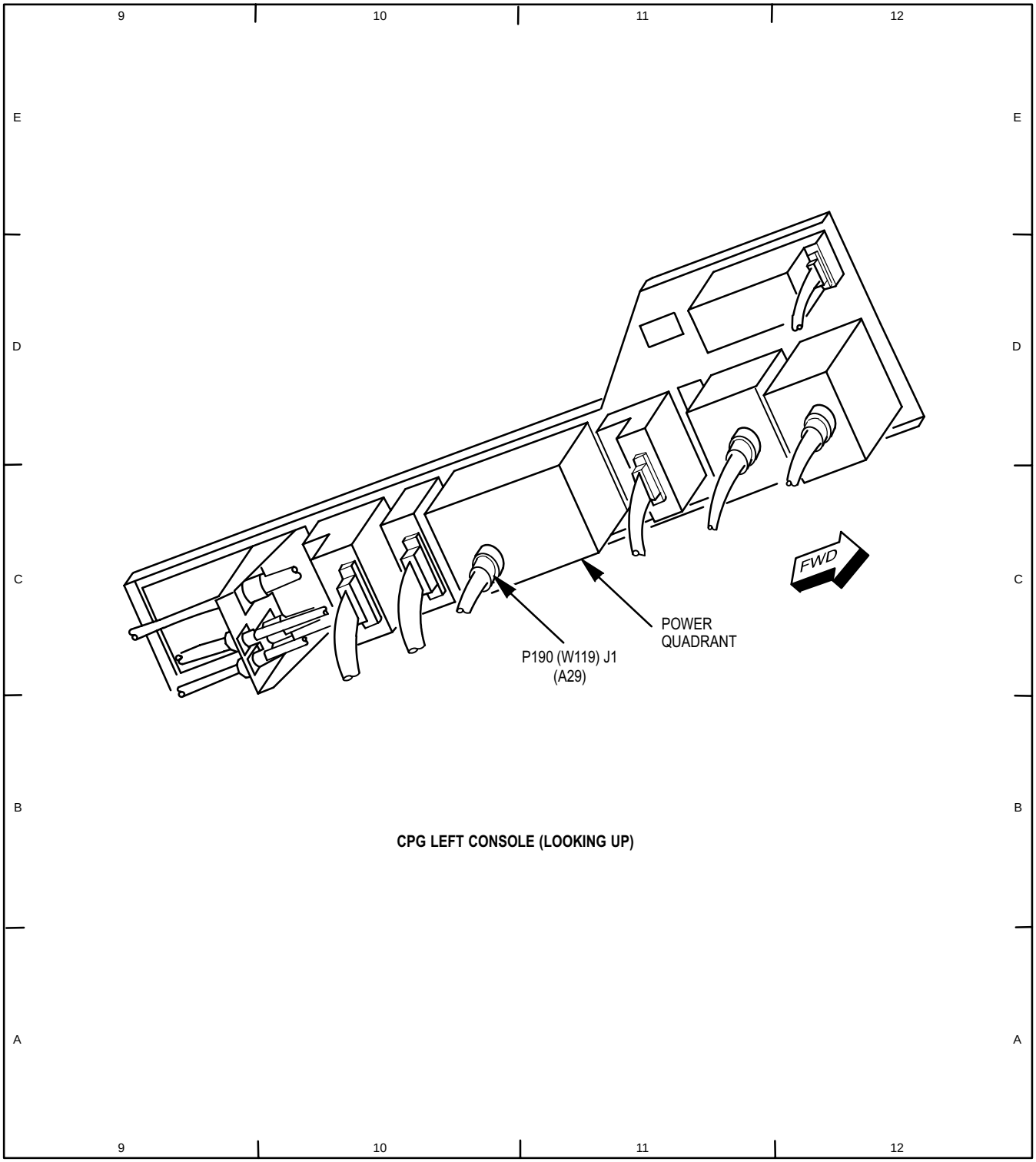
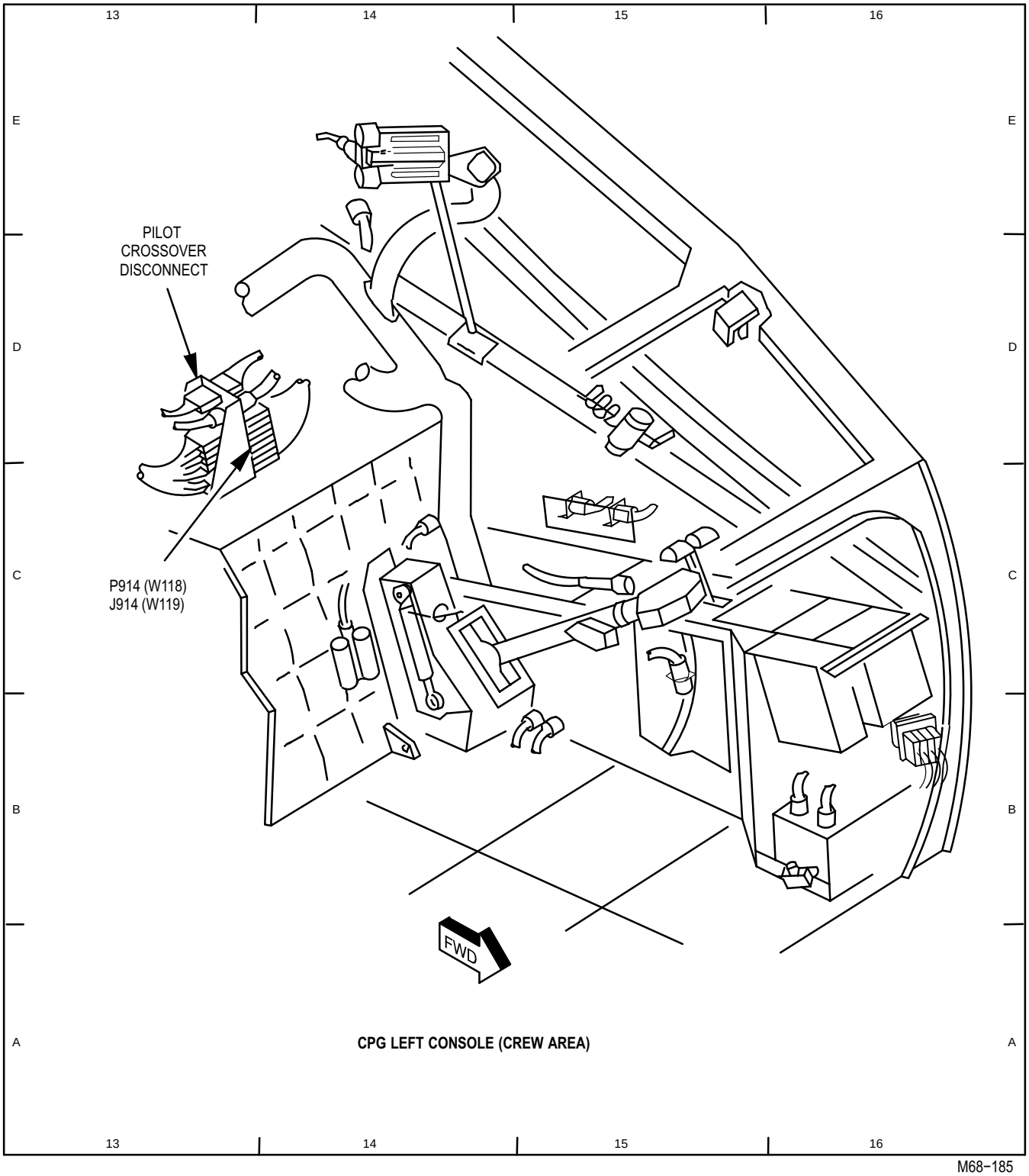


Table 7–2. Electrical Component Location and Configuration (ECLC) Index Listing (cont)



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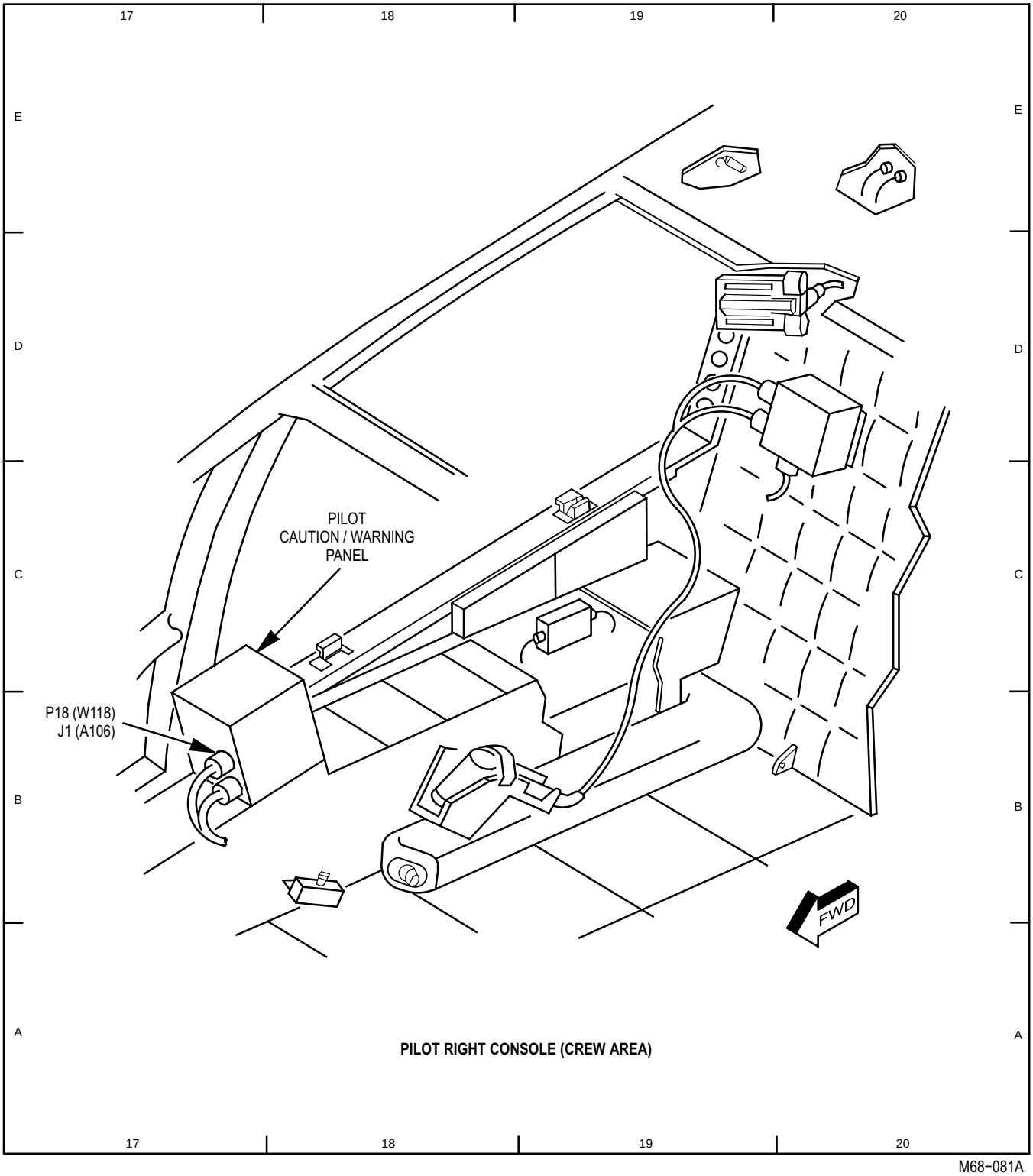

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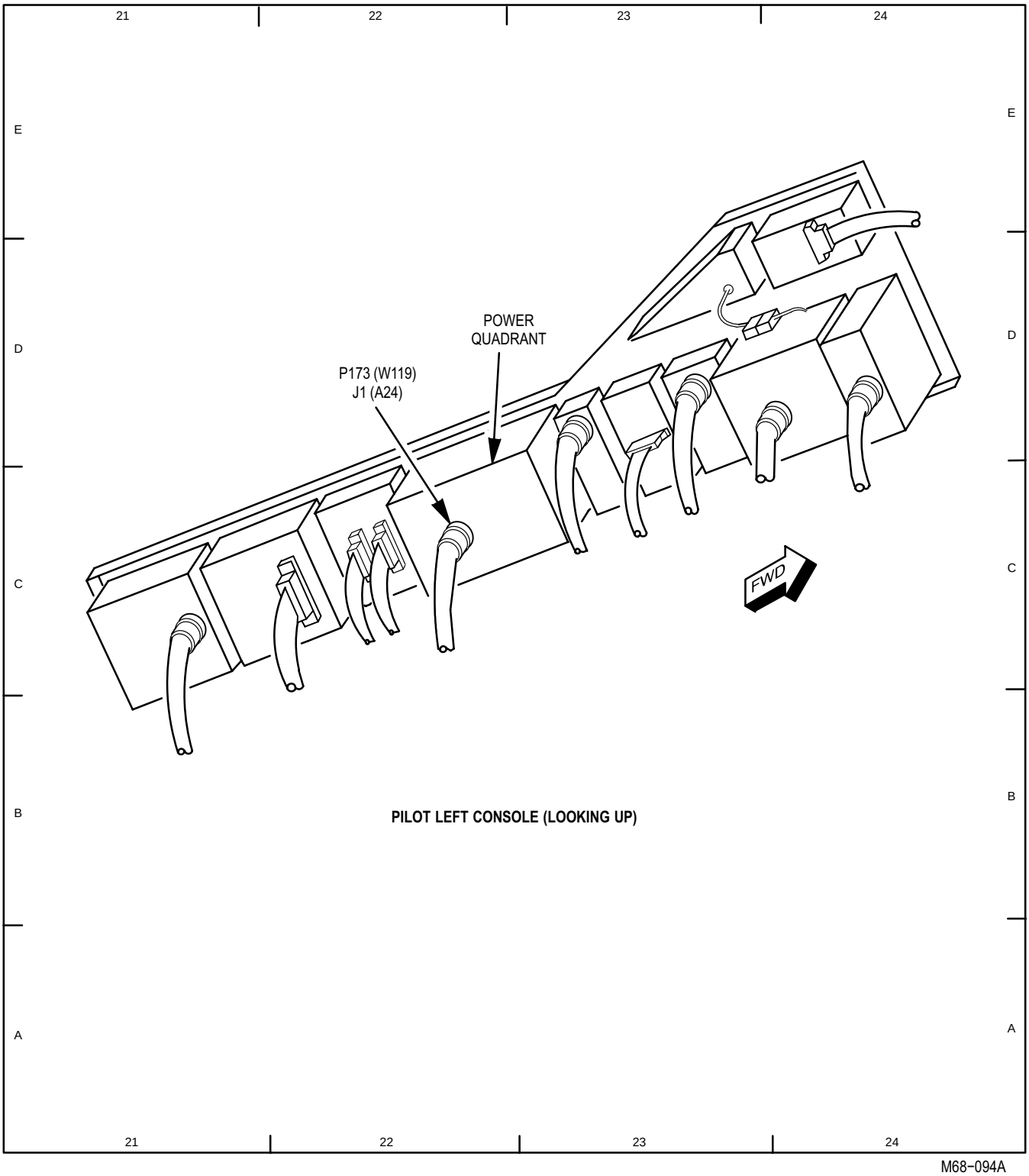

Table 7–2. Electrical Component Location and Configuration (ECLC) Index Listing (cont)

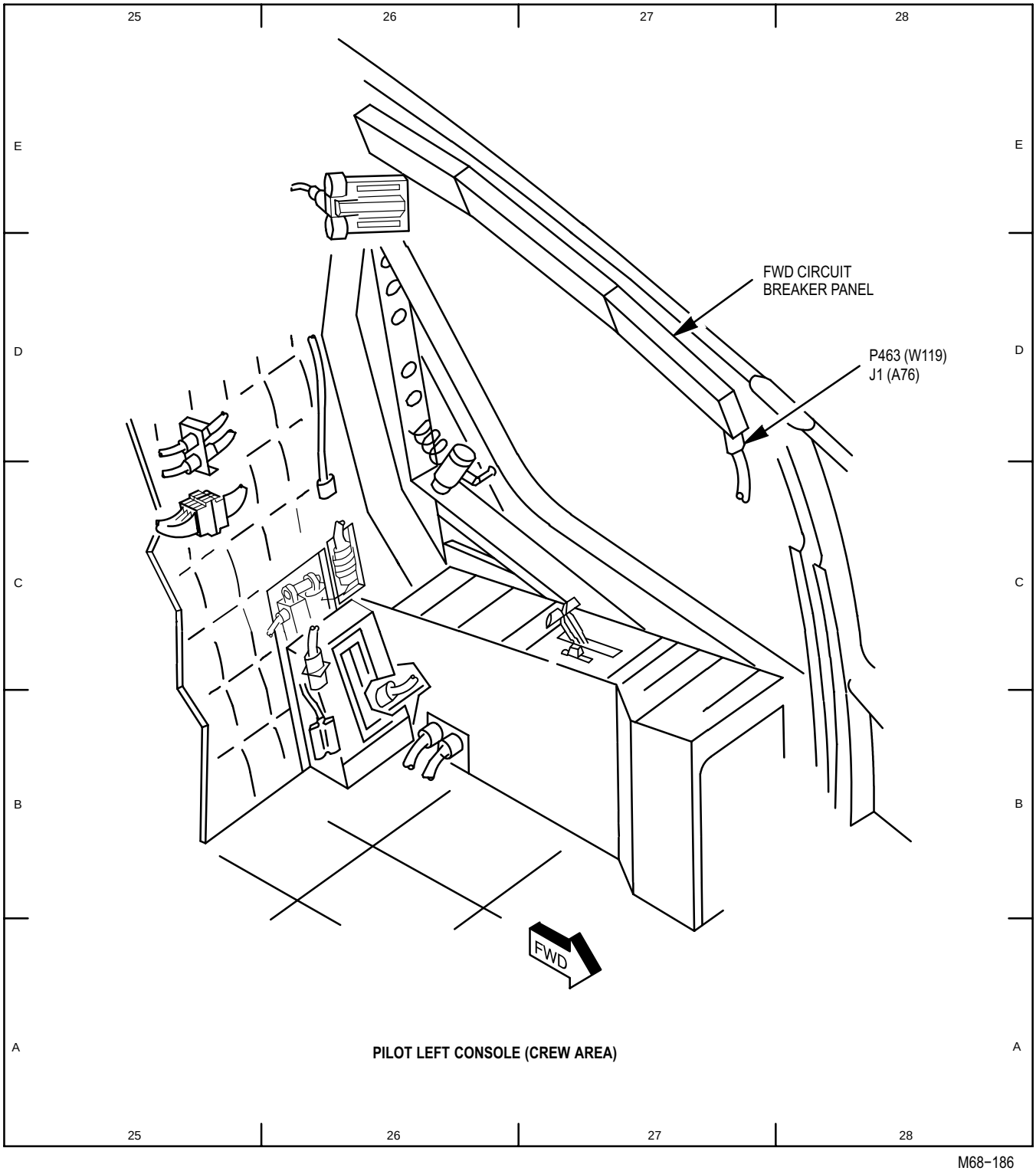

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Table 7–2. Electrical Component Location and Configuration (ECLC) Index Listing (cont)

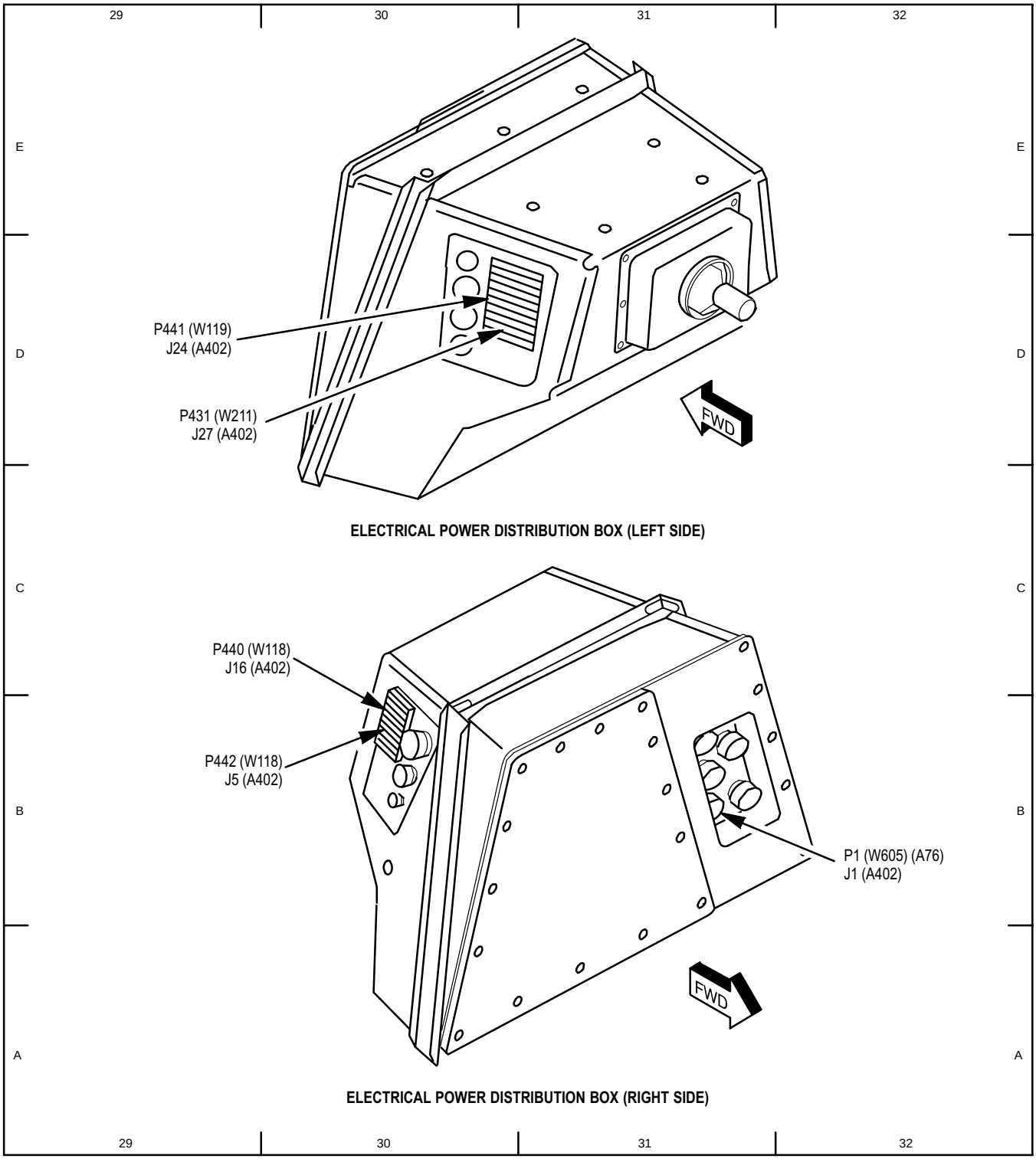

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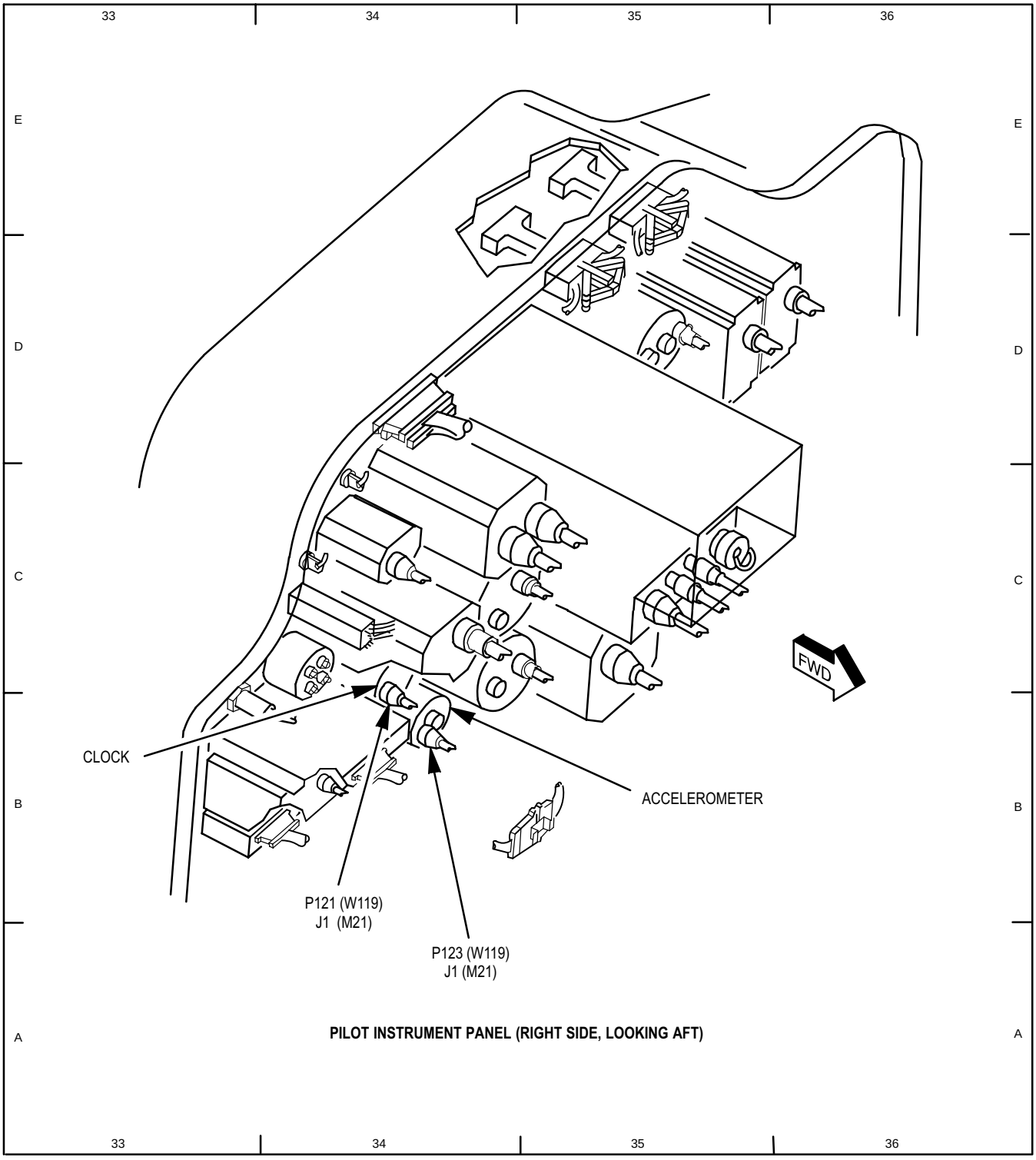
Table 7–2. Electrical Component Location and Configuration (ECLC) Index Listing (cont)



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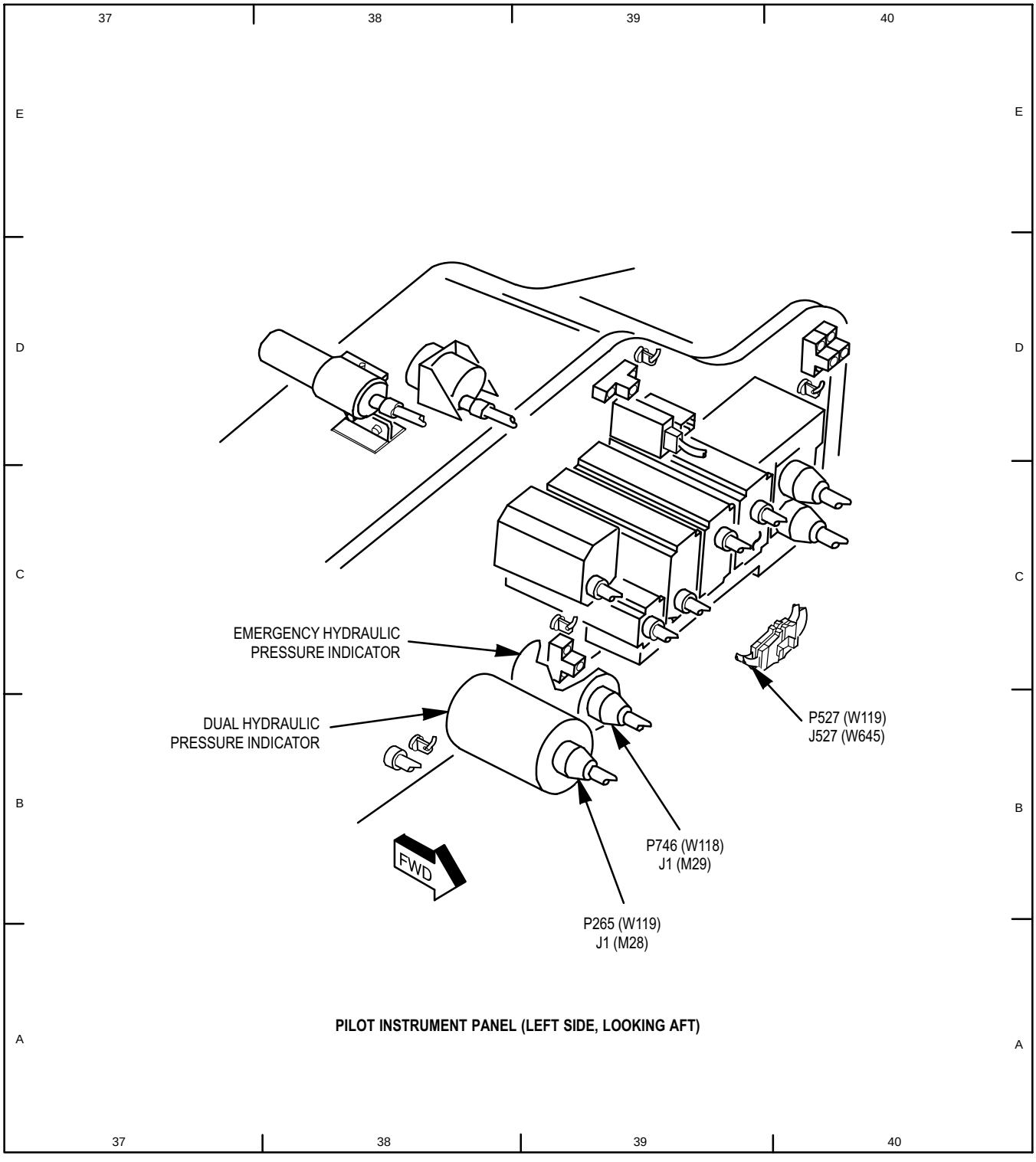

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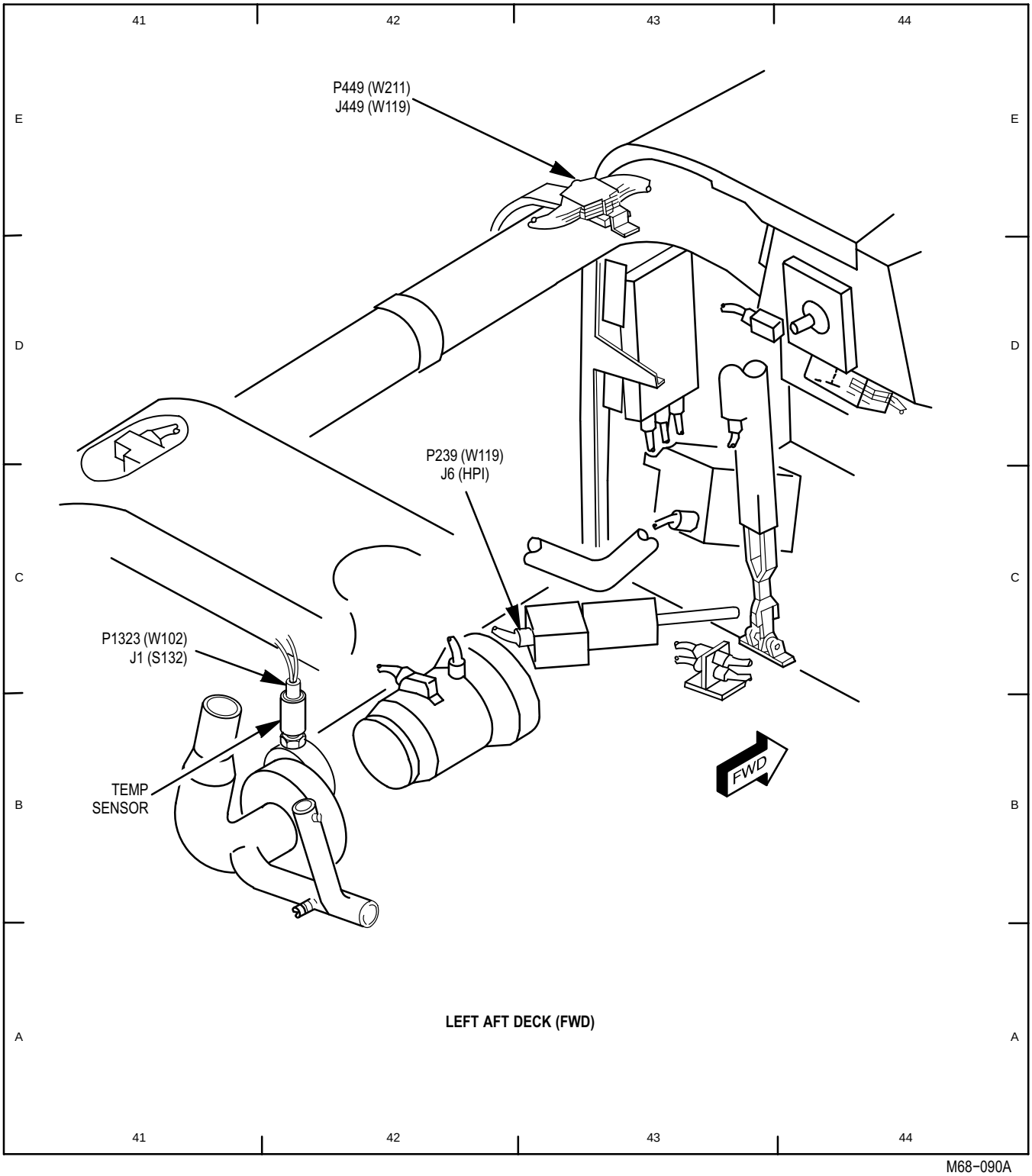
7–9. ELECTRICAL COMPONENT LOCATION AND CONFIGURATION (ECLC) INDEX (cont) 7–9

Table 7–2. Electrical Component Location and Configuration (ECLC) Index Listing (cont)



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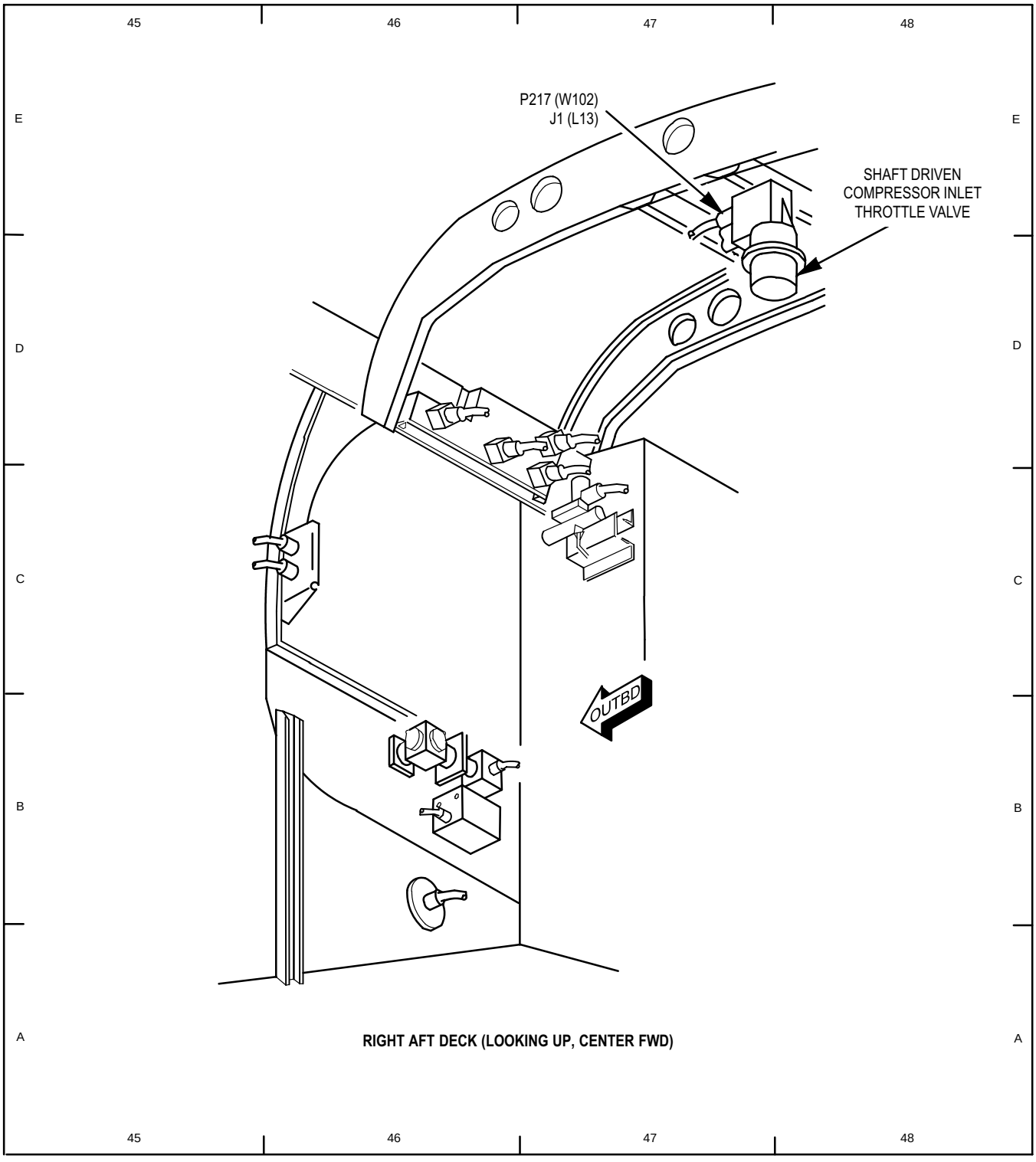

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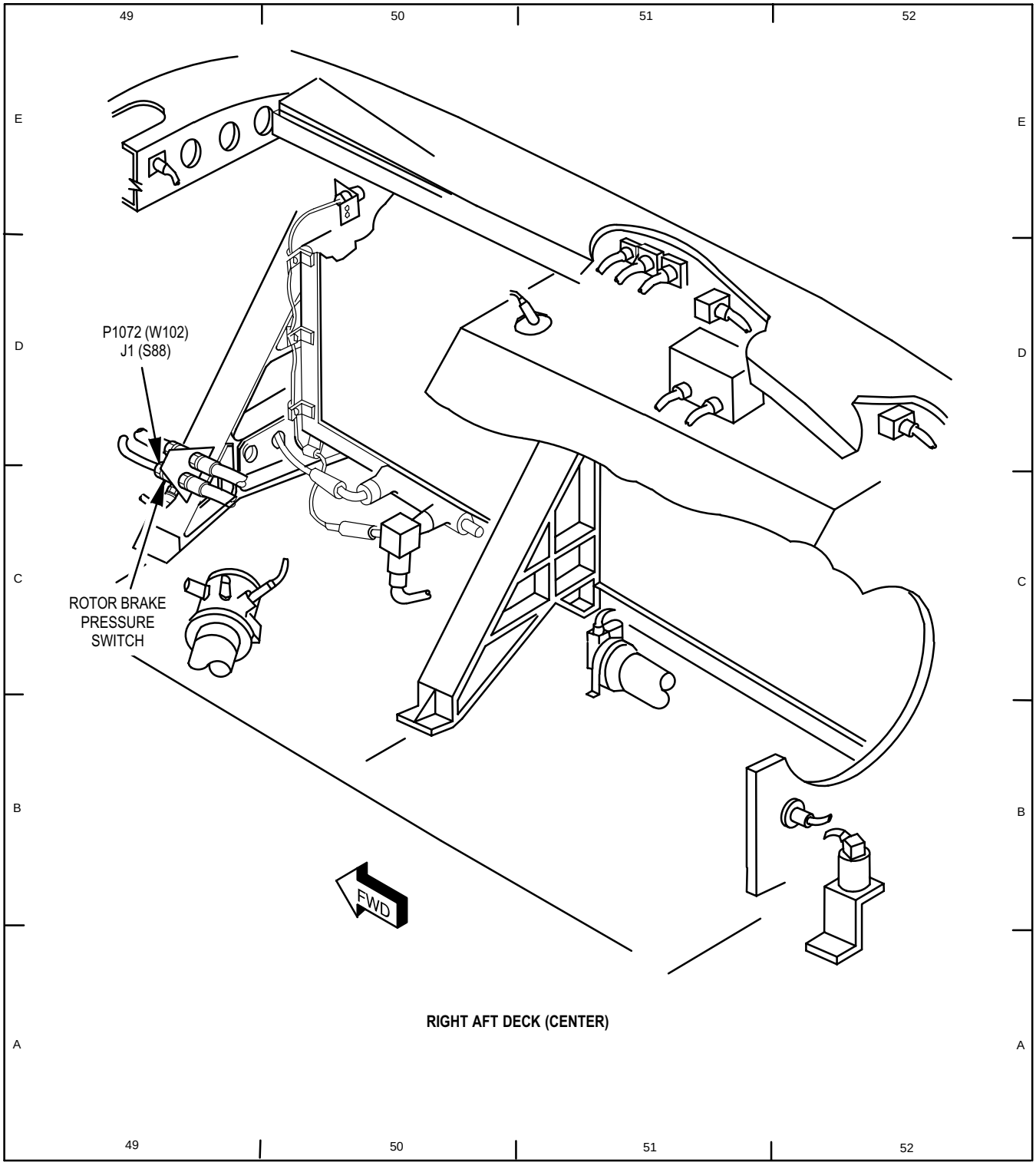

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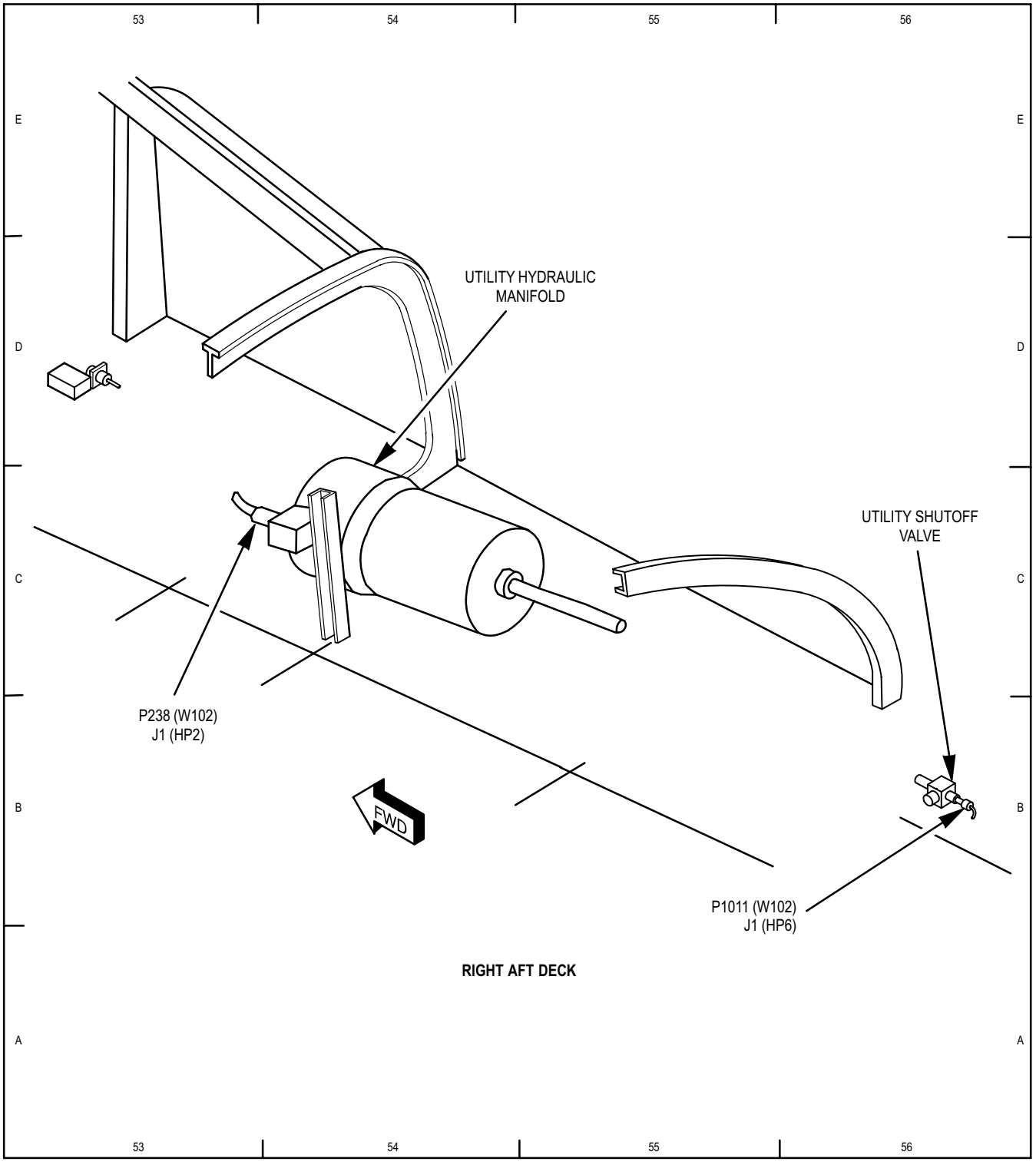
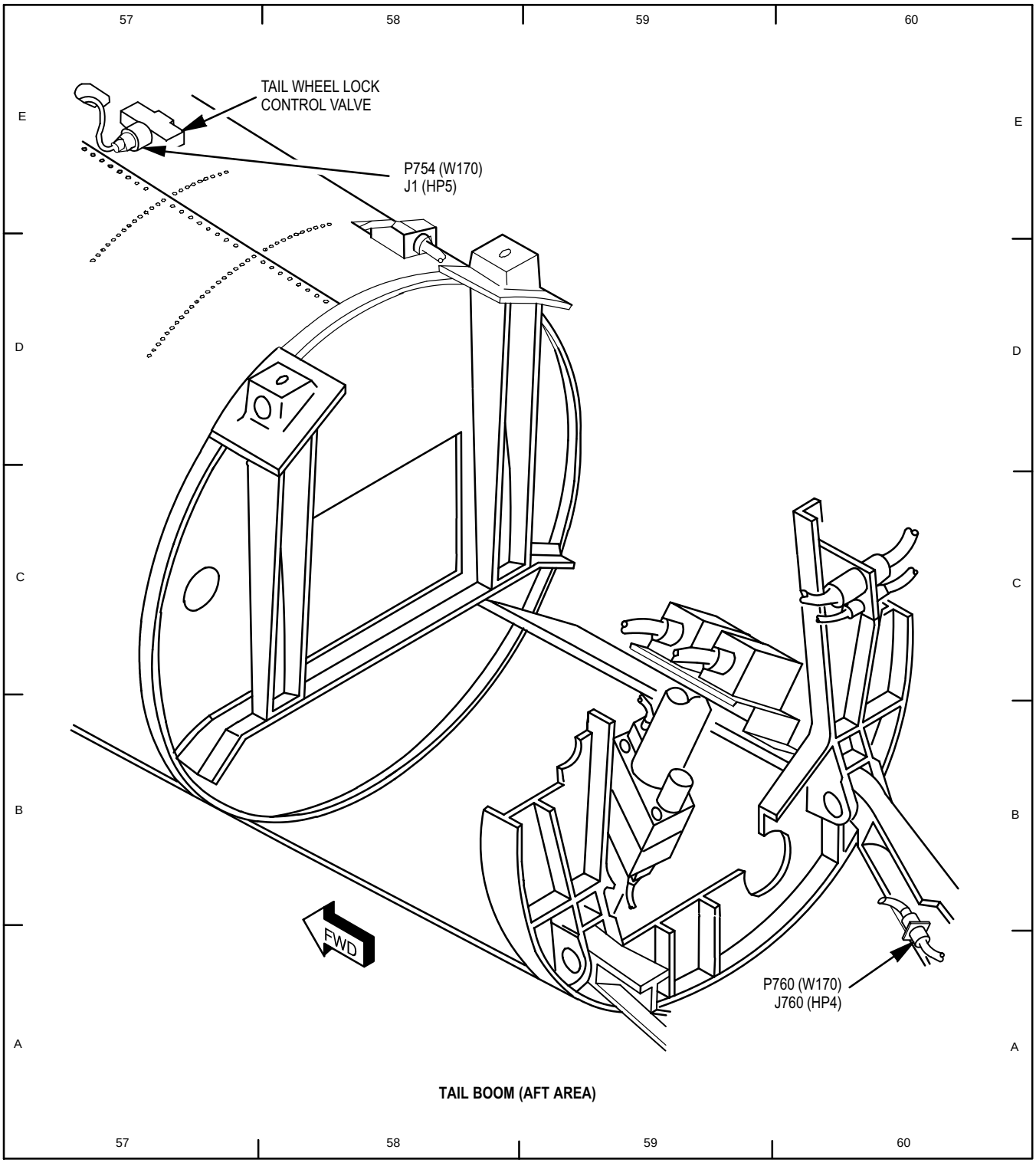


7–9. ELECTRICAL COMPONENT LOCATION AND CONFIGURATION (ECLC) INDEX (cont) 7–9

Table 7–2. Electrical Component Location and Configuration (ECLC) Index Listing (cont)



7–10. PRIMARY HYDRAULIC SYSTEM – MAINTENANCE OPERATIONAL CHECK 7–10

Tools:

Nomenclature	Part Number
Tool Kit, Aircraft Mechanic's	SC518099CLA01
Caliper, Inside	GGG-C-95

Personnel Required:

67R Attack Helicopter Repairer (2)

References:

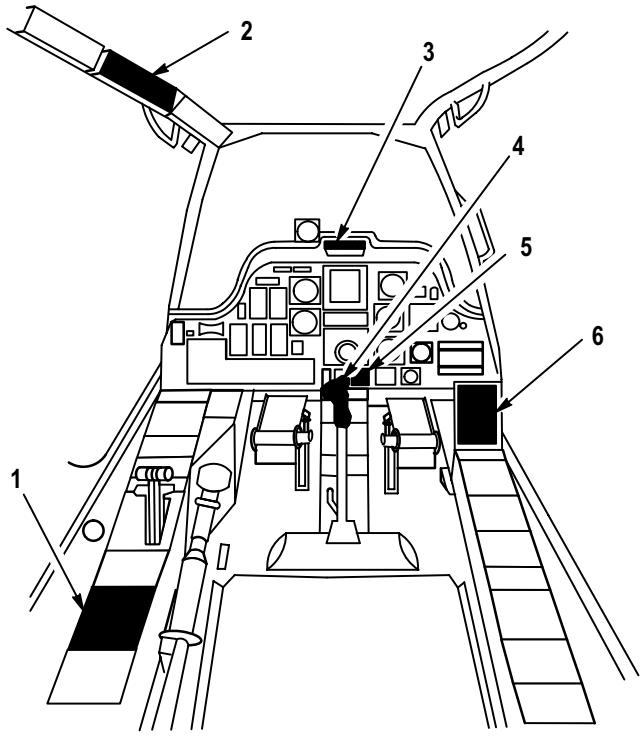
TM 1-1520-238-T-4
TM 1-1520-238-T-6
TM 1-1520-238-T-7
TM 1-1520-238-23
TM 1-1520-238-PMS

Equipment Conditions:

Ref	Condition
TM 1-1520-238-23	Helicopter safed
	External power application
	–
	Electrical
	Hydraulic (primary)
	Pressurized air
TM 1-1520-238-T-4	Maintenance headset connected

NOTE

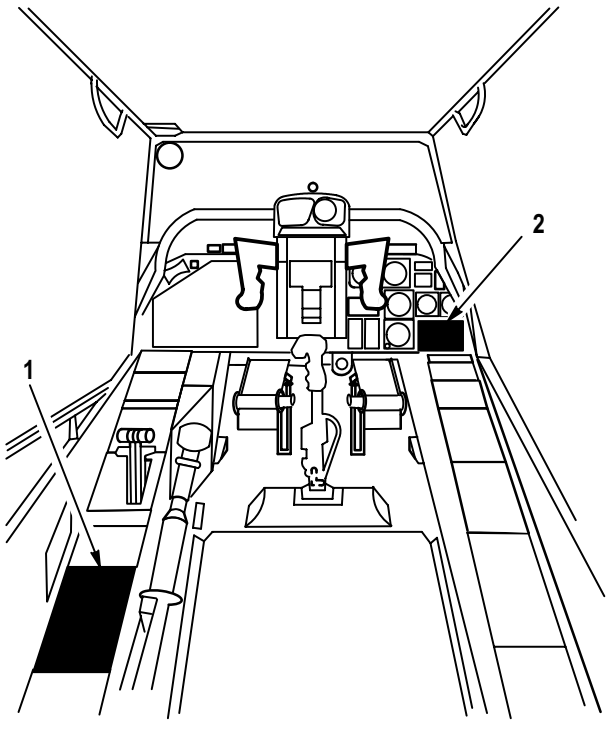
Refer to pilot station (fig. 7–19) and CPG station (fig. 7–20) for configurations and equipment.



1. PILOT EXT LT/INTR LT PANEL
2. PILOT CENTER CIRCUIT BREAKER PANEL
3. PILOT MASTER CAUTION/WARNING PANEL
4. PILOT CYCLIC STICK
5. PILOT DUAL HYDRAULIC PRESSURE INDICATOR
6. PILOT CAUTION/WARNING PANEL

M68–166

Figure 7–19. Pilot Station



1. CPG CIRCUIT BREAKER PANEL 1
2. CPG CAUTION/WARNING PANEL

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Figure 7–20. CPG Station

7–10. PRIMARY HYDRAULIC SYSTEM – MAINTENANCE OPERATIONAL CHECK (cont) 7–10

NOTE

If referenced out of one paragraph or volume into another for additional troubleshooting, upon completion of the task, return to the maintenance operational check for the original paragraph or volume.

1. Perform visual check of primary hydraulic system with AGPU operating (TM 1-1520-238-PMS). Replace any leaking component (TM 1-1520-238-23).
   a. If hydraulic fluid is leaking from drilled passageway/port on inboard side of primary hydraulic manifold about one inch below dirty filter indicators, replace indicator packings (TM 1-1520-238-23).
2. If rotors begin to turn when primary hydraulic external power is applied, replace primary hydraulic pump outlet check valve (TM 1-1520-238-23).
3. Remove external pressurized air and hydraulic (primary) power (TM 1-1520-238-23).
4. Do not close access doors or install access panels until maintenance operational check is completed.

WARNING

The hydraulic system is pressurized to 3000 psi. Be certain that trapped hydraulic pressure is released before loosening any connections. Failure to do so could result in death or serious injury. If injury occurs, get medical aid immediately.

NOTE

Total primary system fluid volume is 0.75 gallons.

5. Drain primary reservoir to **REFILL** level if required (TM 1-1520-238-23).

NOTE

Decal on access door R325 shows proper positioning of selector valve of hydraulic hand pump.

6. Set hydraulic hand pump selector valve (fig. 7–21) to **INBOARD** position**.**

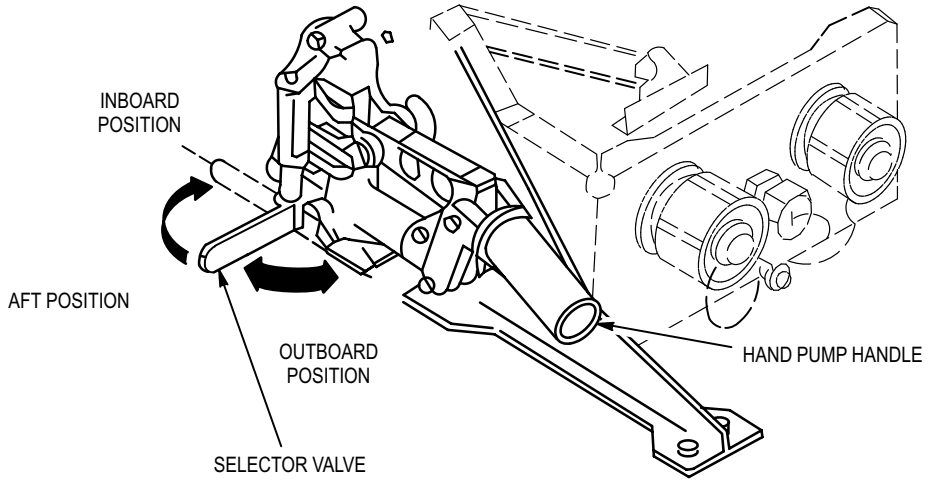


Figure 7–21. Hydraulic Hand Pump Selector Valve

7–10. PRIMARY HYDRAULIC SYSTEM – MAINTENANCE OPERATIONAL CHECK (cont) 7–10

7. On pilot center circuit breaker panel (fig. 7–22), close the **LT CAUT**, **TWHL LOCK**, and **LT PRI** circuit breakers.

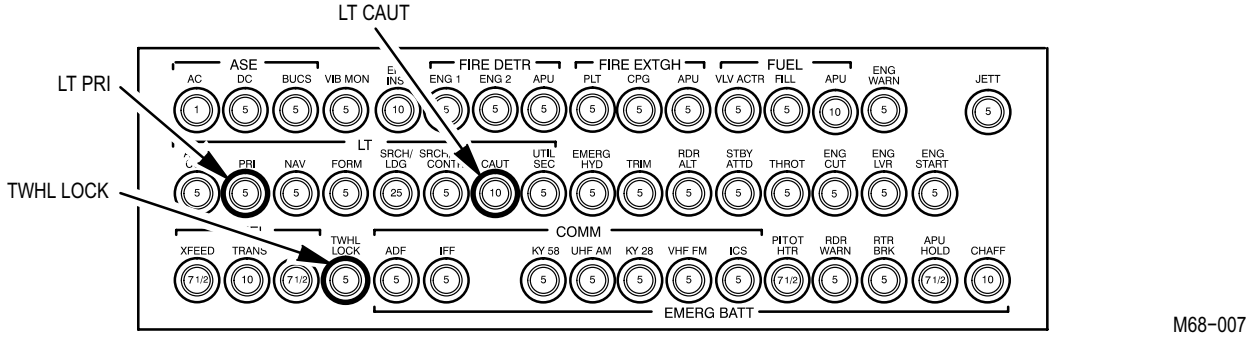


Figure 7–22. Pilot Center Circuit Breaker Panel

8. Complete the maintenance operational check as follows:

NOTE

Removable handle for hydraulic hand pump is stowed in cross beam of access door R325.

Task	Result
a. Using hydraulic hand pump handle, service primary hydraulic manifold reservoir to normal operating level (TM 1-1520-238-23).	If hydraulic hand pump does not service primary hydraulic manifold reservoir, go to paragraph 7–12.
b. Set hydraulic hand pump selector valve (fig. 7–21) to **INBOARD** position**.**	
c. On pilot master caution/warning panel (fig. 7–23), press **PRESS TO TEST** indicator. Check pilot master caution/warning panel and pilot caution/warning panel (fig. 7–24). All caution/warning indicators are lighted.	If any of the caution/warning indicators are not lighted, replace lamps. If lamps still do not light, refer to TM 1-1520-238-T-6 to troubleshoot caution/warning system. If **PRI HYD PSI** indicator is not lighted, replace lamp (TM 1-1520-238-23). If lamp still does not light, go to paragraph 7–13.

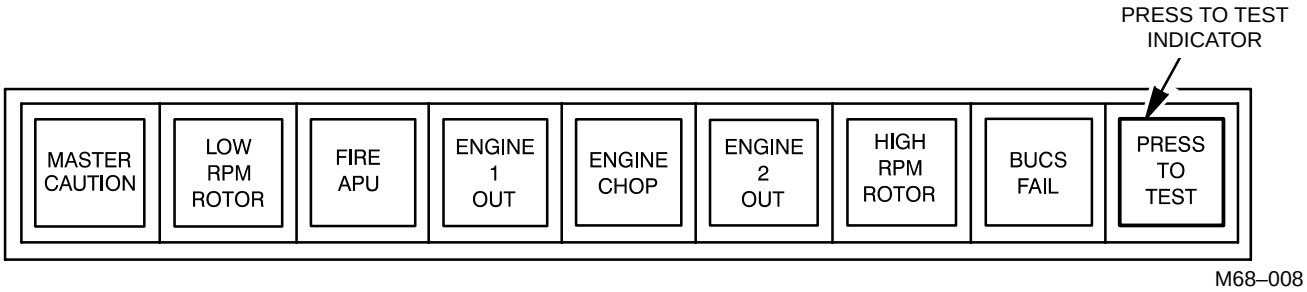


Figure 7–23. Pilot Master Caution/Warning Panel

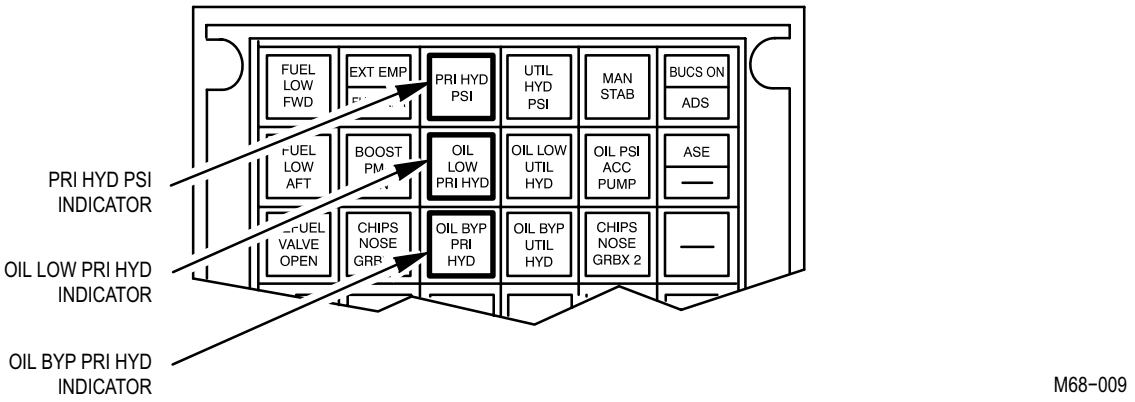


Figure 7–24. Pilot Caution/Warning Panel

Task	Result
d. Release **PRESS TO TEST** indicator.	
e. Perform external power application – hydraulic (primary) (TM 1-1520-238-23).	
f. On pilot instrument panel, check that **PRI HYD** indicator (fig. 7–25) indicates **3000 PSI.**	If **PRI HYD** indicator does not indicate **3000 PSI**, go to paragraph 7–14.

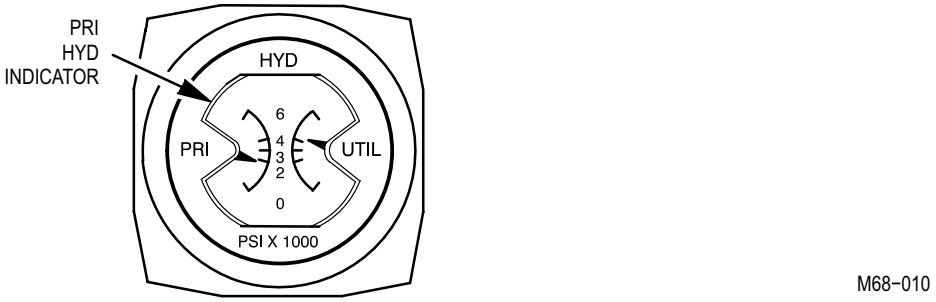


Figure 7–25. Pilot Dual Hydraulic Pressure Indicator

g. On pilot caution/warning panel (fig. 7–24), check that **PRI HYD PSI, OIL LOW PRI HYD, OIL BYP PRI HYD** indicators are not lighted.	If **PRI HYD PSI** indicator is lighted, go to paragraph 7–15. If **OIL LOW PRI HYD** indicator is lighted, go to paragraph 7–16. If **OIL BYP PRI HYD** indicator is lighted, have assistant manually reset primary hydraulic manifold pressure and/or return dirty filter indicator (fig. 7–26). If indicators are retracted, or if either indicator pops up after manual reset, go to paragraph 7–17.

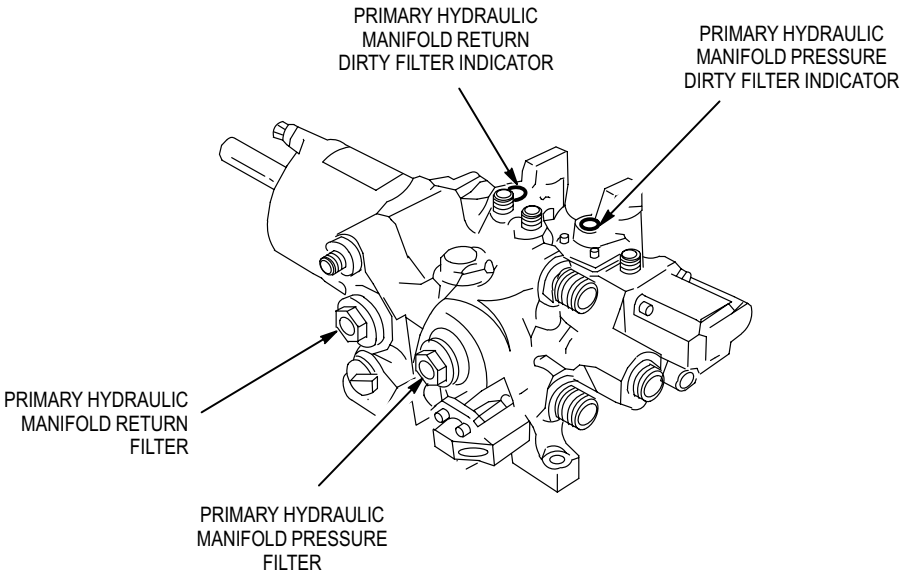


Figure 7–26. Primary Hydraulic Manifold

Task	Result
h. On CPG circuit breaker panel 1 (fig. 7–27), close **EMERG BATT CAUT** circuit breaker.	If circuit breaker does not stay closed, refer to TM 1-1520-238-T-6 to troubleshoot CPG caution/warning system.

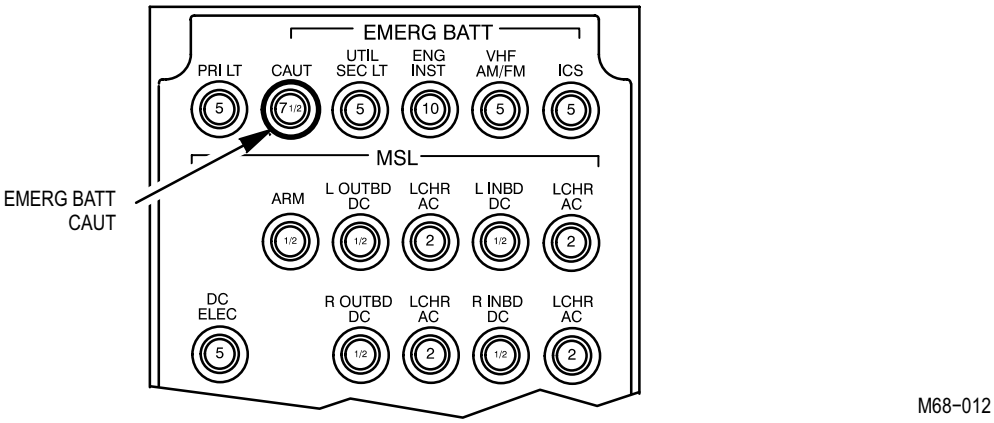


Figure 7–27. CPG Circuit Breaker Panel 1

i. Check that **PRI HYD** indicator located on CPG caution/warning panel (fig. 7–28) is not lighted.	If **PRI HYD** indicator is lighted, go to paragraph 7–18.

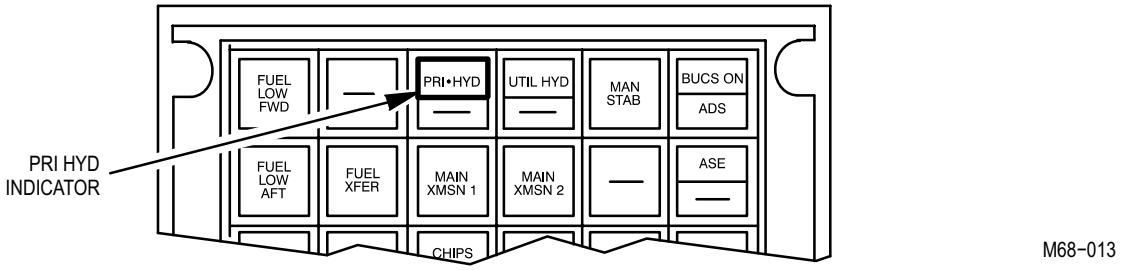


Figure 7–28. CPG Caution/Warning Panel

Task	Result
j. On pilot **EXT LT/INTR LT** panel (fig. 7–29), set **INST** control to **BRT**.	

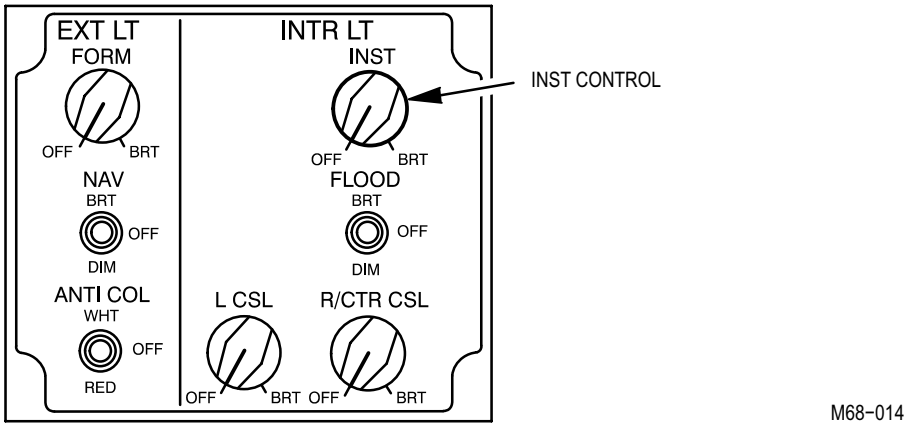


Figure 7–29. Pilot EXT LT/INTR LT Panel

k. On pilot instrument panel, check that dual hydraulic pressure indicator (fig. 7–25) edge–light is lighted.	If dual hydraulic pressure indicator edge–light is not lighted, go to paragraph 7–19.

WARNING

Maintenance personnel must be verbally warned prior to moving the collective or cyclic stick. Any activated control can result in sudden blade movement that can sever or crush fingers or hands. If injury occurs, get immediate medical help.

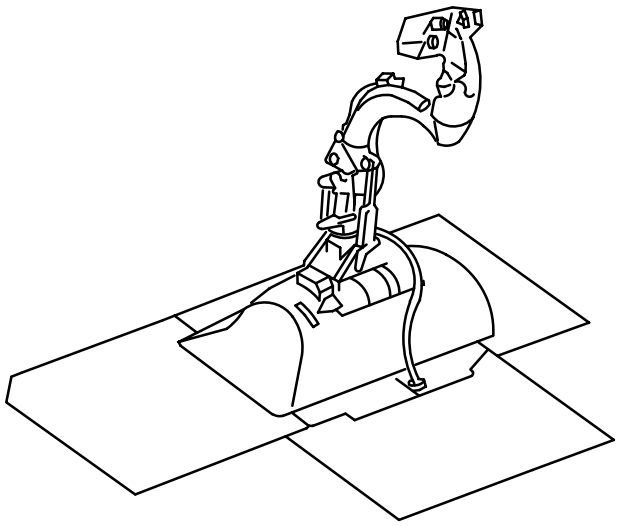
CAUTION

To prevent damage to flight control system components, do not use force if binding or roughness occurs while moving controls with hydraulic power. Prior to continuing the procedure, clear controls of binding. Failure to clear controls of binding may result in sheared pins in the control axis.

NOTE

If suspected fault does not apply to flight control system, go to step am.

Task	Result
l. Slowly push pilot cyclic stick (fig. 7–30), to full forward position to retract longitudinal servocylinder piston.	



M68-015

Figure 7–30. Pilot Cyclic Stick

Task	Result
m. Have assistant measure and record cylinder stroke. Use inside calipers. Measurement A is from bottom of jam nut to top surface of servocylinder housing (cylinder retracted) (fig. 7–31).	

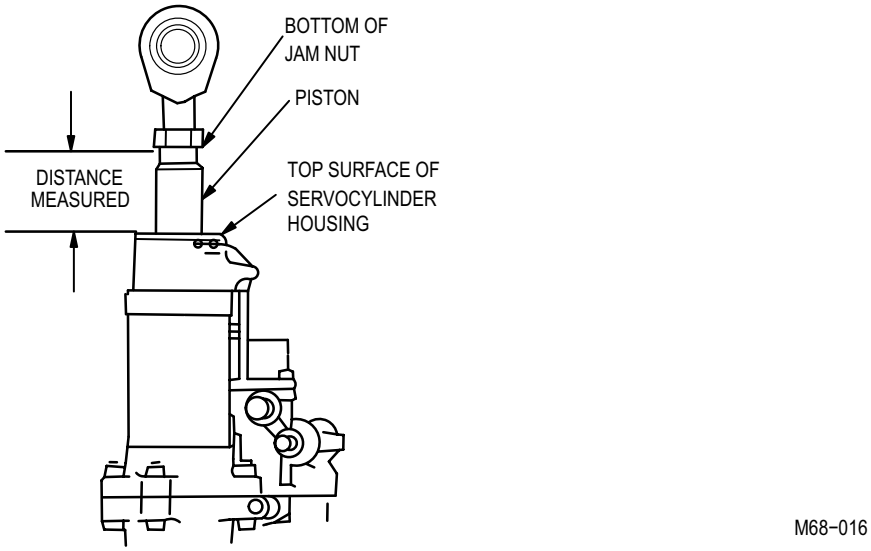


Figure 7–31. Servocylinder (Typical)

n. Slowly pull pilot cyclic stick to full aft position to extend piston.	
o. Have assistant measure and record cylinder stroke. Use inside calipers. Measurement B is from bottom of jam nut to top surface of servocylinder housing (cylinder extended).	
p. Subtract measurement A from B. Cylinder travel is 3.500 to 3.560 inches.	If cylinder does not travel full stroke, go to step af.
q. Slowly pull pilot collective stick to full up position to retract collective servocylinder piston.	
r. Have assistant measure and record cylinder stroke. Use inside calipers. Measurement A is from bottom of jam nut to top surface of servocylinder housing (cylinder retracted).	

7–10. PRIMARY HYDRAULIC SYSTEM – MAINTENANCE OPERATIONAL CHECK (cont) 7–10

Task	Result
s. Slowly push pilot collective stick to full down position to extend piston.	
t. Have assistant measure and record cylinder stroke. Use inside calipers. Measurement B is from bottom of jam nut to top surface of servocylinder housing (cylinder retracted).	
u. Subtract measurement A from B. Cylinder travel is 3.500 to 3.560 inches.	If cylinder does not travel full stroke, go to step af.
v. Slowly push pilot cyclic stick to full left position to retract lateral servocylinder piston.	
w. Have assistant measure and record cylinder stroke. Use inside calipers. Measurement A is from bottom of jam nut to top surface of servocylinder housing (cylinder retracted).	
x. Slowly pull pilot cyclic stick to full right position to extend piston.	
y. Have assistant measure and record cylinder stroke with inside calipers. Measurement B is from bottom of the jam nut to top surface of the servocylinder housing (cylinder extended).	
z. Subtract measurement A from B. Cylinder travel is 3.500 to 3.560 inches.	If cylinder does not travel full stroke, go to step af.
aa. Slowly push pilot right directional pedal to full right position to retract directional servocylinder piston.	
ab. Have assistant measure and record cylinder stroke with inside calipers. Measurement A is from bottom of the jam nut to top surface of the servocylinder housing (cylinder retracted).	
ac. Slowly push pilot left directional pedal to full left position to extend piston.	
ad. Have assistant measure and record cylinder stroke with inside calipers. Measurement B is from bottom of the jam nut to top surface of the servocylinder housing (cylinder extended).	

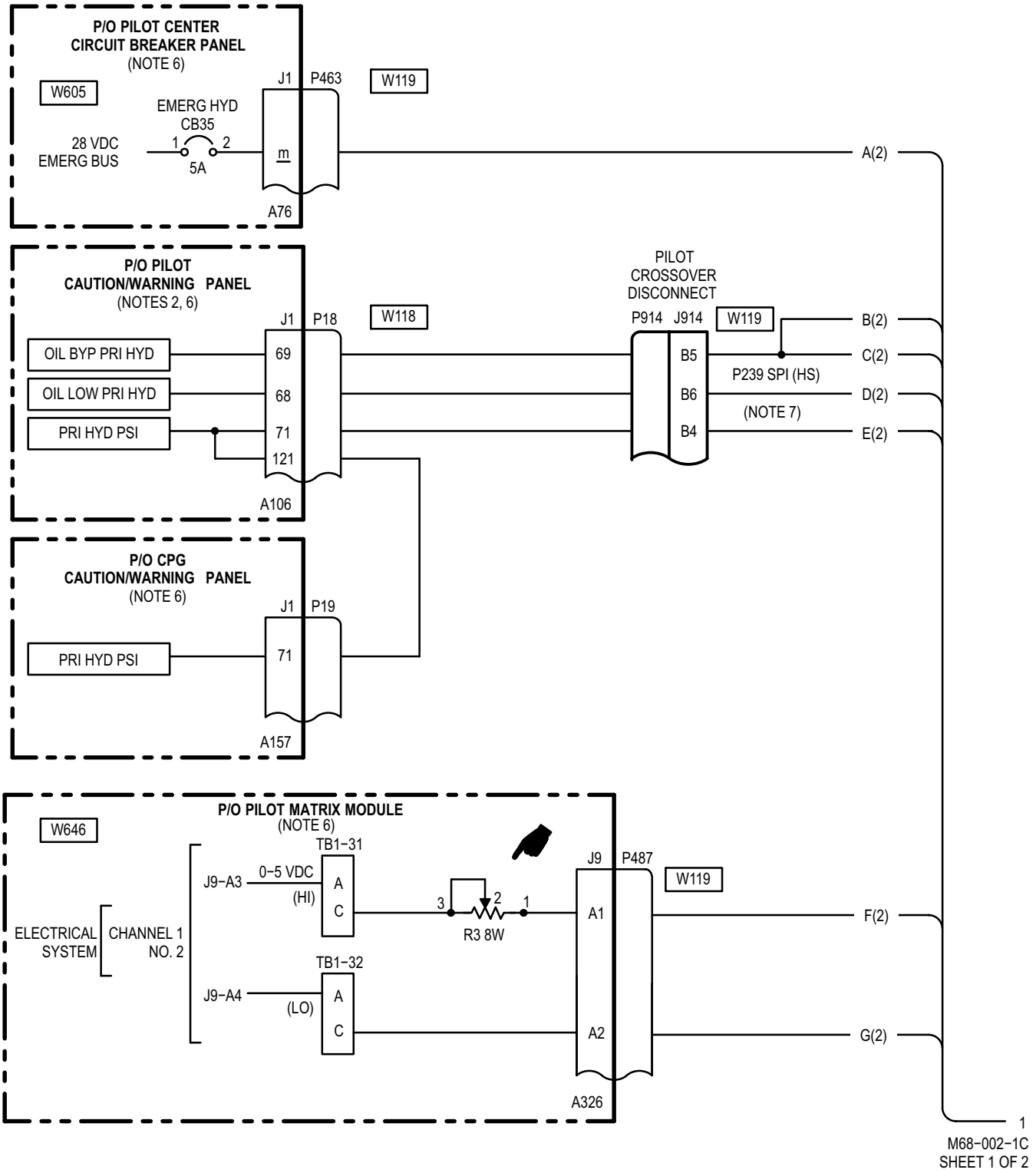
7–10. PRIMARY HYDRAULIC SYSTEM – MAINTENANCE OPERATIONAL CHECK (cont) 7–10

Task	Result
ae. Subtract measurement A from B. Cylinder travel is 1.564 to 1.624 inches.	If cylinder travels full stroke, go to step am.
af. Check servocylinders for fluid leakage (TM 1-1520-238-23).	If leakage is present, replace leaking servocylinder (TM 1-1520-238-23).
ag. Disconnect push–pull rod from servocylinder valve arm (TM 1-1520-238-23).	
ah. Slowly push servocylinder valve arm upward to fully retract piston.	
ai. Have assistant measure and record cylinder stroke with inside calipers. Measurement A is from bottom of jam nut to top surface of servocylinder housing (cylinder retracted).	
aj. Slowly pull servocylinder valve arm downward to fully extend piston.	
ak. Have assistant measure and record cylinder stroke with inside calipers. Measurement B is from bottom of the jam nut to top surface of the servocylinder housing (cylinder extended).	
al. Subtract measurement A from B. Directional travel is 1.564 to 1.624 inches. All other cylinders travel is 3.500 to 3.560 inches.	If cylinder does not travel full stroke, replace servocylinder (TM 1-1520-238-23). If cylinder travels full stroke, perform appropriate flight control system rigging check (TM 1-1520-238-T-7).
am. Disconnect and remove AGPU hydraulic pressure from helicopter (TM 1-1520-238-23).	
an. Start helicopter APU (TM 1-1520-238-23).	
ao. Check that **PRI HYD** indicator (fig. 7–25) indicates **3000 PSI**.	If **3000 PSI** is not indicated, go to paragraph 7–20.
ap. Shutdown APU (TM 1-1520-238-23).	

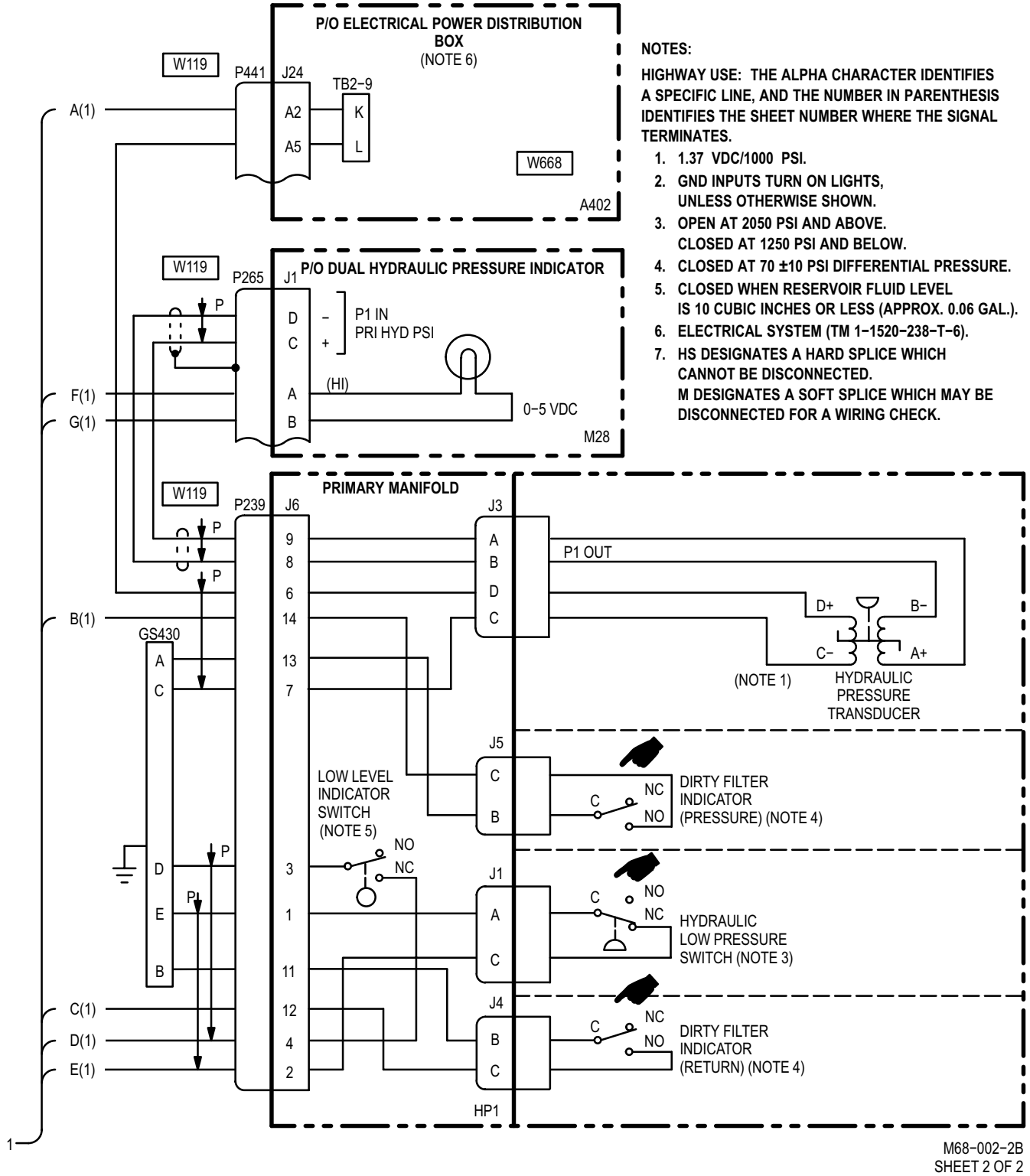
9. Remove external power – electrical (TM 1-1520-238-23).
10. Disconnect maintenance headset (TM 1-1520-238-T-4).
11. Close and secure all access panel and doors opened during this maintenance operational check (TM 1-1520-238-23).

END OF TASK

7–11. PRIMARY HYDRAULIC SYSTEM – WIRING INTERCONNECT DIAGRAM 7–11



7–11. PRIMARY HYDRAULIC SYSTEM – WIRING INTERCONNECT DIAGRAM (cont) 7–11



NOTES:

HIGHWAY USE: THE ALPHA CHARACTER IDENTIFIES A SPECIFIC LINE, AND THE NUMBER IN PARENTHESIS IDENTIFIES THE SHEET NUMBER WHERE THE SIGNAL TERMINATES.

1. **1.37 VDC/1000 PSI.**
2. **GND INPUTS TURN ON LIGHTS, UNLESS OTHERWISE SHOWN.**
3. **OPEN AT 2050 PSI AND ABOVE. CLOSED AT 1250 PSI AND BELOW.**
4. **CLOSED AT 70 ±10 PSI DIFFERENTIAL PRESSURE.**
5. **CLOSED WHEN RESERVOIR FLUID LEVEL IS 10 CUBIC INCHES OR LESS (APPROX. 0.06 GAL.).**
6. **ELECTRICAL SYSTEM (TM 1−1520−238−T−6).**
7. **HS DESIGNATES A HARD SPLICE WHICH CANNOT BE DISCONNECTED. M DESIGNATES A SOFT SPLICE WHICH MAY BE DISCONNECTED FOR A WIRING CHECK.**

7–12. HYDRAULIC HAND PUMP – DOES NOT SERVICE PRIMARY HYDRAULIC MANIFOLD RESERVOIR 7–12

Tools:

Nomenclature	Part Number
Tool Kit, Aircraft Mechanic's	SC518099CLA01
Service Unit, Hydraulic Fluid	E159-1000

Personnel Required:

67R Attack Helicopter Repairer

References:

TM 1-1520-238-23

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. Operate hydraulic hand pump a minimum of ten strokes.
   Does binding or roughness occur?

   YES — Go to step 4.

   NO — Go to step 2.

2. Wrap clean rag around air relief valve on primary hydraulic manifold reservoir push air relief valve.
   Is hydraulic fluid present?

   YES — Replace primary manifold reservoir housing (TM 1-1520-238-23).

   NO — Go to step 3.

3. Using container to catch fluid, detach overboard drain line from primary hydraulic manifold reservoir. Operate hydraulic hand pump.
   Is hydraulic fluid present?

   YES — Replace primary hydraulic manifold (TM 1-1520-238-23).

   NO — Replace hydraulic hand pump (TM 1-1520-238-23).

4. Inspect hydraulic filter.
   Is filter dirty or clogged?

   YES — Replace hydraulic filter element (ADG) or hydraulic filter screen (ADF) (TM 1-1520-238-23).

   NO — Replace hydraulic hand pump (TM 1-1520-238-23).

END OF TASK

7–13. PRI HYD PSI INDICATOR – IS NOT LIGHTED WITH NO PRIMARY HYDRAULIC SYSTEM PRESSURE INDICATED 7–13

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer

References:

TM 1-1520-238-23

Equipment Conditions:

Ref	Condition
TM 1-1520-238-23	Access provisions – L200 panel removed

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. On primary hydraulic manifold, check for open between (HP1):
   J6–1 and J6–2.
   Does open exist?

   YES — Go to step 3.

   NO — Go to step 2.

2. Check for open between:
   P239–1 and GS430–E,
   P239–2 and P18–71.
   Does open exist?

   YES — Repair open wire. Go to paragraph 7–10.

   NO — Replace pilot caution/warning panel (TM 1-1520-238-23).

3. Remove primary hydraulic low pressure switch (TM 1-1520-238-23).
   Check for open wire between (HP1):
   J6–1 and J1–A,
   J6–2 and J1–C.
   Does open exist?

   YES — Replace primary hydraulic manifold (TM 1-1520-238-23).

   NO — Replace primary hydraulic low pressure switch (TM 1-1520-238-23).

END OF TASK

7–14. PRI HYD INDICATOR– DOES NOT INDICATE 3000 PSI (AGPU OPERATING) 7–14

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer (2)

References:

TM 1-1520-238-T-6
TM 1-1520-238-23

Equipment Conditions:

Ref	Condition
TM 1-1520-238-23	Hydraulic system leak check – completed

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. Check **EMERG HYD** circuit breaker.
   Is circuit breaker closed?
   - YES — Go to step 2.
   - NO — Go to paragraph 7–42.
2. Check for 28 VDC at P239–6.
   Is voltage present?
   - YES — Go to step 3.
   - NO — Go to step 4.
3. Check for open between P239–7 and ground.
   Does open exist?
   - YES — Repair open wire between P239–7 and GS430–C. Go to paragraph 7–10.
   - NO — Go to step 5.
4. Check for 28 VDC at (A76)J1–m.
   Is voltage present?
   - YES — Repair open wire between P463–m and P239–6. Go to paragraph 7–10.
   - NO — Refer to TM 1-1520-238-T-6 to troubleshoot circuit protection system (dc emergency bus – pilot station).
5. Verify AGPU pressure for 3000 psi. Check for 4.2 VDC at P265–C and P265–D.
   Is voltage present?
   - YES — Replace dual hydraulic pressure indicator (TM 1-1520-238-23).
   - NO — Go to step 6.
6. Check for open between:
   P265–C and P239–9,
   P265–D and P239–8.
   Does open exist?
   - YES — Repair open wire. Go to paragraph 7–10.
   - NO — Go to step 7.

7–14. PRI HYD INDICATOR– DOES NOT INDICATE 3000 PSI (AGPU OPERATING) (cont) 7–14

7. Remove primary hydraulic pressure transducer (TM 1-1520-238-23).
   Check for open between (HP1):
   J6–9 and J3–A,
   J6–8 and J3–B,
   J6–7 and J3–C,
   J6–6 and J3–D.
   Does open exist?

YES	Replace primary hydraulic manifold (TM 1-1520-238-23).
NO	Replace primary hydraulic pressure transducer (TM 1-1520-238-23).

END OF TASK

7–15. PRI HYD PSI INDICATOR – IS LIGHTED 7–15

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Service Unit, Hydraulic Fluid	E159-1000

Personnel Required:

68X Armament/Electrical Systems Repairer (2)

References:

TM 1-1520-238-23

Equipment Conditions:

Ref	Condition
TM 1-1520-238-23	Hydraulic system leak check – completed

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. Detach P18.
   Is PRI HYD PSI indicator lighted?

   YES — Replace pilot caution/warning panel (TM 1-1520-238-23).

   NO — Go to step 2.

2. Detach P19 and P239. Check for short between:
   P18–71 and ground,
   P18–121 and ground.
   Does short exist?

   YES — Repair shorted wire between:
   P18–121 and P19–71,
   P18–71 and P914–B4,
   J914–B4 and P239–2.
   Go to paragraph 7–10.

   NO — Go to step 3.

3. Remove primary hydraulic manifold low pressure switch (TM 1-1520-238-23). Check for short between (HP1)J6–2 and chassis ground.
   Does short exist?

   YES — Replace primary hydraulic manifold (TM 1-1520-238-23).

   NO — Replace primary hydraulic low pressure switch (TM 1-1520-238-23).

END OF TASK

7–16. OIL LOW PRI HYD INDICATOR – IS LIGHTED 7–16

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Service Unit, Hydraulic Fluid	E159-1000

Personnel Required:

68X Armament/Electrical Systems Repairer (2)

References:

TM 1-1520-238-23

Equipment Conditions:

Ref	Condition
TM 1-1520-238-23	Hydraulic system leak check – completed

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. Detach P18.
   Is OIL LOW PRI HYD indicator lighted?

   YES — Replace pilot caution/warning panel (TM 1-1520-238-23).

   NO — Go to step 2.

2. Detach P239. Check for short between P18–68 and ground.
   Does short exist?

   YES — Repair shorted wire between: P18–68 and P914–B6, P239–4 and J914–B6. Go to paragraph 7–10.

   NO — Replace primary hydraulic manifold (TM 1-1520-238-23).

END OF TASK

7–17. OIL BYP PRI HYD INDICATOR – IS LIGHTED 7–17

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer (2)

References:

TM 1-1520-238-23

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. Check primary hydraulic manifold pressure dirty filter indicator.
   Is indicator retracted?
   - YES — Go to step 2.
   - NO — Replace primary hydraulic manifold pressure strainer (TM 1-1520-238-23).
2. Check primary hydraulic manifold return dirty filter indicator.
   Is indicator retracted?
   - YES — Go to step 3.
   - NO — Replace primary hydraulic manifold return strainer (TM 1-1520-238-23).
3. Check for short between P18–69 and ground.
   Does short exist?
   - YES — Go to step 4.
   - NO — Replace pilot caution/warning panel (TM 1-1520-238-23).
4. Detach P239. Check for short between P18–69 and ground.
   Does short exist?
   - YES — Repair shorted wire between: P18–69 and P914–B5, J914–B5 and P239 SP1, P239 SP1 and P239–12, P239 SP1 and P239–14. Go to paragraph 7–10.
   - NO — Go to step 5.
5. Check for continuity between (HP1): J6–13 and J6–14.
   Does continuity exist?
   - YES — Replace primary hydraulic manifold pressure dirty filter indicator (TM 1-1520-238-23).
   - NO — Go to step 6.
6. Check for continuity between (HP1): J6–11 and J6–12.
   Does continuity exist?
   - YES — Replace primary hydraulic manifold return dirty filter indicator (TM 1-1520-238-23).
   - NO — Go to step 7.
7. Check for short between (HP1)J6–14 and chassis ground.
   Does short exist?
   - YES — Go to step 8.
   - NO — Go to step 9.

8. Remove primary hydraulic manifold pressure dirty filter indicator (TM 1-1520-238-23). Check for short between (HP1)J6–14 and ground.
Does short exist?

   YES — Replace primary hydraulic manifold (TM 1-1520-238-23).

   NO — Replace primary hydraulic manifold pressure dirty filter indicator (TM 1-1520-238-23).

9. Remove primary hydraulic manifold return dirty filter indicator (TM 1-1520-238-23). Check for short between (HP1)J6–12 and ground.
Does short exist?

   YES — Replace primary hydraulic manifold (TM 1-1520-238-23).

   NO — Replace primary hydraulic manifold pressure dirty filter indicator (TM 1-1520-238-23).

END OF TASK

7–18. PRI HYD INDICATOR – IS LIGHTED 7–18

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06

Personnel Required:

68X Armament/Electrical Systems Repairer

References:

TM 1-1520-238-23

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

Detach P19.

Is PRI HYD indicator lighted?

YES	Replace CPG caution/warning panel (TM 1-1520-238-23).
NO	Go to paragraph 7–15.

END OF TASK

7–19. DUAL HYDRAULIC PRESSURE INDICATOR EDGE–LIGHT – IS NOT LIGHTED 7–19

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer

References:

TM 1-1520-238-T-6
TM 1-1520-238-23

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. Check **LT PRI** circuit breaker.
   Does circuit breaker stay closed?
   - YES — Go to step 2.
   - NO — Refer to TM 1-1520-238-T-6 to troubleshoot circuit protection system (ac essential bus – pilot station).
2. Check for 5 VDC between P265–A and P265–B.
   Is voltage present?
   - YES — Replace dual hydraulic pressure indicator (TM 1-1520-238-23).
   - NO — Go to step 3.
3. Check for 5 VDC between (A326): J9–A1 and J9–A2.
   Is voltage present?
   - YES — Repair open wire between: P265–A and P487–A1, P265–B and P487–A2. Go to paragraph 7–10.
   - NO — Go to step 4.
4. Check for 5 VDC between (A326): TB1–31–C and TB1–32–C.
   Is voltage present?
   - YES — Go to step 5.
   - NO — Refer to TM 1-1520-238-T-6 to troubleshoot pilot edge–lights.
5. Check for resistance between (A326): R3–1 and R3–3.
   Is resistance present?
   - YES — Repair open wire between (A326): J9–A1 and R3–1, J9–A2 and TB1–32–C, R3–3 and TB1–31–C. Go to paragraph 7–10.
   - NO — Replace resistor (A326)R3 (TM 1-1520-238-23).

END OF TASK

7–20. PRI HYD INDICATOR – DOES NOT INDICATE 3000 PSI (APU OPERATING) 7–20

Tools:

Nomenclature	Part Number
Tool Kit, Aircraft Mechanic's	SC518099CLA01
Service Unit, Hydraulic Fluid	E159-1000

Personnel Required:

67R Attack Helicopter Repairer

References:

TM 1-1520-238-T-4
TM 1-1520-238-T-8
TM 1-1520-238-23

Equipment Conditions:

Ref	Condition
TM 1-1520-238-23	APU operating

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. Check APU shaft 7.
   Is APU 7 shaft turning?

   YES — Go to step 2.

   NO — Refer to TM 1-1520-238-T-8 to troubleshoot APU system.

2. Shut down APU (TM 1-1520-238-23). Remove primary hydraulic pump.
   Is primary hydraulic pump shaft sheared?

   YES — Replace primary hydraulic pump (TM 1-1520-238-23).

   NO — Refer to TM 1-1520-238-T-4 to troubleshoot drive system.

END OF TASK

7–21. UTILITY HYDRAULIC SYSTEM – MAINTENANCE OPERATIONAL CHECK 7–21

Tools:

Nomenclature	Part Number
Tool Kit, Aircraft Mechanic's	SC518099CLA01
Caliper, Inside	GGG-C-95

Personnel Required:

67R Attack Helicopter Repairer (2)

References:

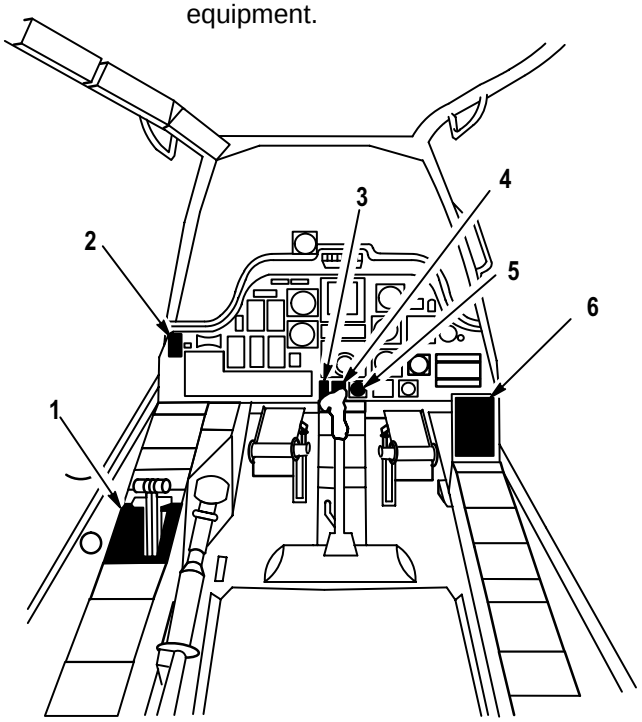
TM 1-1520-238-PMS
TM 1-1520-238-T-4
TM 1-1520-238-T-6
TM 1-1520-238-T-7
TM 1-1520-238-T-8
TM 1-1520-238-23

Equipment Conditions:

Ref	Condition
TM 1-1520-238-23	Helicopter safed
	External power application – Electrical Hydraulic (utility) Pressurized air
TM 1-1520-238-T-4	Maintenance headset connected

NOTE

Refer to pilot station (fig. 7–32) and CPG station (fig. 7–33) for configurations and equipment.



1. PILOT POWER QUADRANT
2. PILOT TAIL WHEEL LOCK PANEL
3. PILOT EMERGENCY HYDRAULIC (EMER HYD) CONTROL PANEL
4. PILOT EMERGENCY HYDRAULIC PRESSURE INDICATOR
5. PILOT DUAL HYDRAULIC PRESSURE INDICATOR
6. PILOT CAUTION / WARNING PANEL

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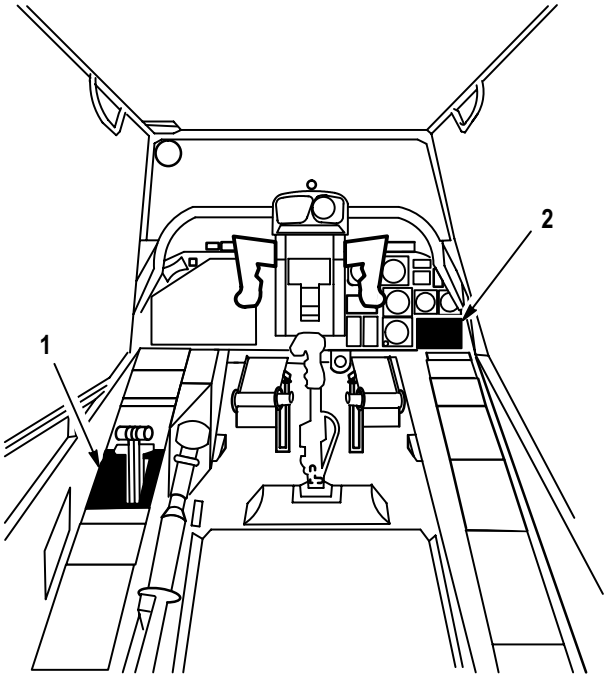
Figure 7–32. Pilot Station



1. CPG POWER QUADRANT
2. CPG CAUTION / WARNING PANEL

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Figure 7–33. CPG Station

NOTE

If referenced out of one paragraph or volume into another for additional troubleshooting, upon completion of the task, return to the maintenance operational check for the original paragraph or volume.

1. Perform visual check of utility hydraulic system with AGPU operating (TM 1-1520-238-PMS). Replace any leaking component (TM 1-1520-238-23).
   (a). If hydraulic fluid is leaking from drilled passageway/port forward of utility hydraulic manifold about one inch below dirty filter indicators, replace indicator packings (TM 1-1520-238-23).
2. If rotors begin to turn when utility hydraulic external power is applied, replace utility hydraulic pump outlet check valve (TM 1-1520-238-23).
3. Do not close access doors or install access panels until maintenance operational check is completed.
4. Remove external pressurized air and utility hydraulic power (TM 1-1520-238-23).

WARNING

The hydraulic system is pressurized to 3000 psi. Be certain that trapped hydraulic pressure is released before loosening any connections. Failure to do so could result in death or serious injury. If injury occurs, get medical aid immediately.

NOTE

Total utility system fluid volume is 2.60 gallons.

5. Drain utility reservoir to refill level, if required (TM 1-1520-238-23).

NOTE

- **Decal on access door R325 shows proper positioning of selector valve of hydraulic hand pump.**
- **Refer to figure 7–34 for location of hydraulic hand pump selector valve.**

6. Set hydraulic hand pump selector valve (fig. 7–34), to **OUTBOARD** position**.**

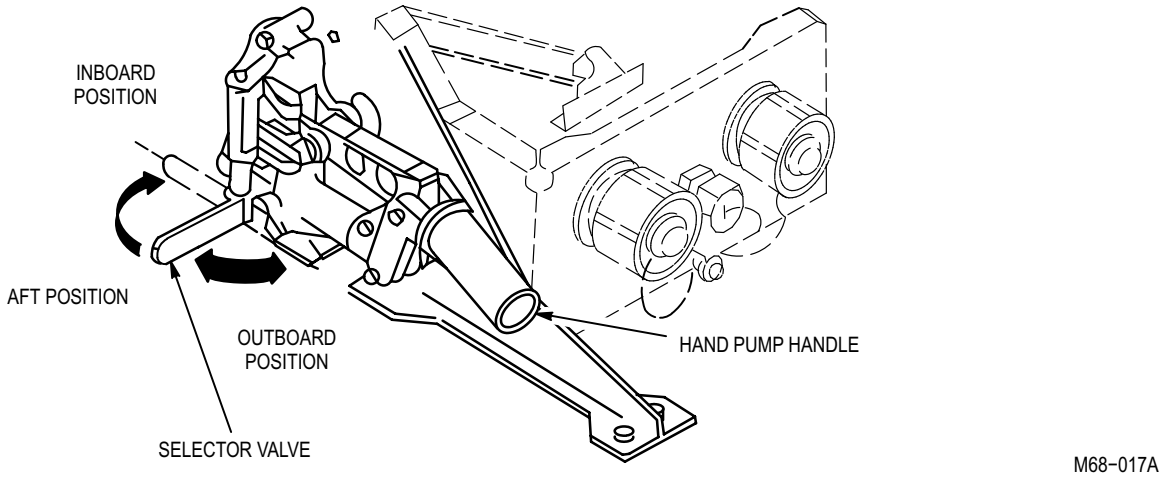


Figure 7–34. Hydraulic Hand Pump Selector Valve

7. On pilot center circuit breaker panel (fig. 7–35), close the **LT CAUT, TWHL LOCK,** and **LT PRI** circuit breakers.

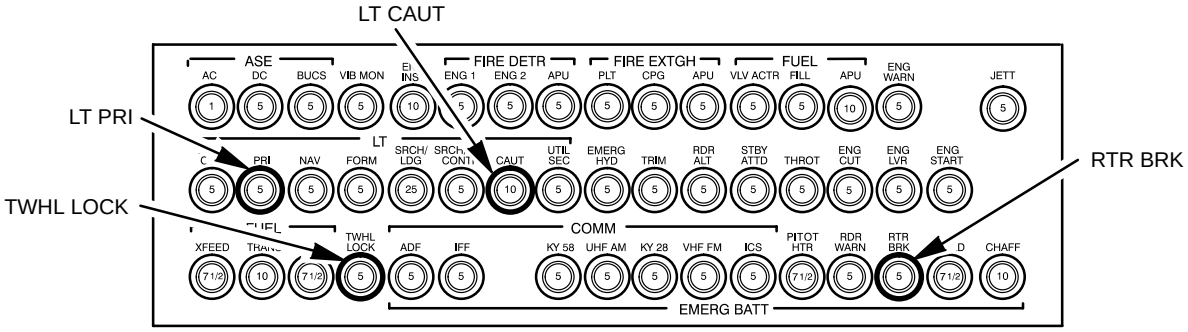


Figure 7–35. Pilot Center Circuit Breaker Panel

8. Complete the maintenance operational check as follows:

Task	Result
a. Using hydraulic hand pump handle, fill utility hydraulic manifold reservoir to normal operating level (TM 1-1520-238-23).	If hydraulic hand pump does not service utility hydraulic manifold reservoir, go to paragraph 7–23.
b. Set hydraulic hand pump selector valve to **AFT** position. On pilot caution/warning panel (fig. 7–36), check **UTIL HYD PSI** indicator.	If **UTIL HYD PSI** indicator is not lighted, replace lamp (TM 1-1520-238-23). If lamp still does not light, go to paragraph 7–24.
c. Perform external power application – hydraulic (utility) (TM 1-1520-238-23).	

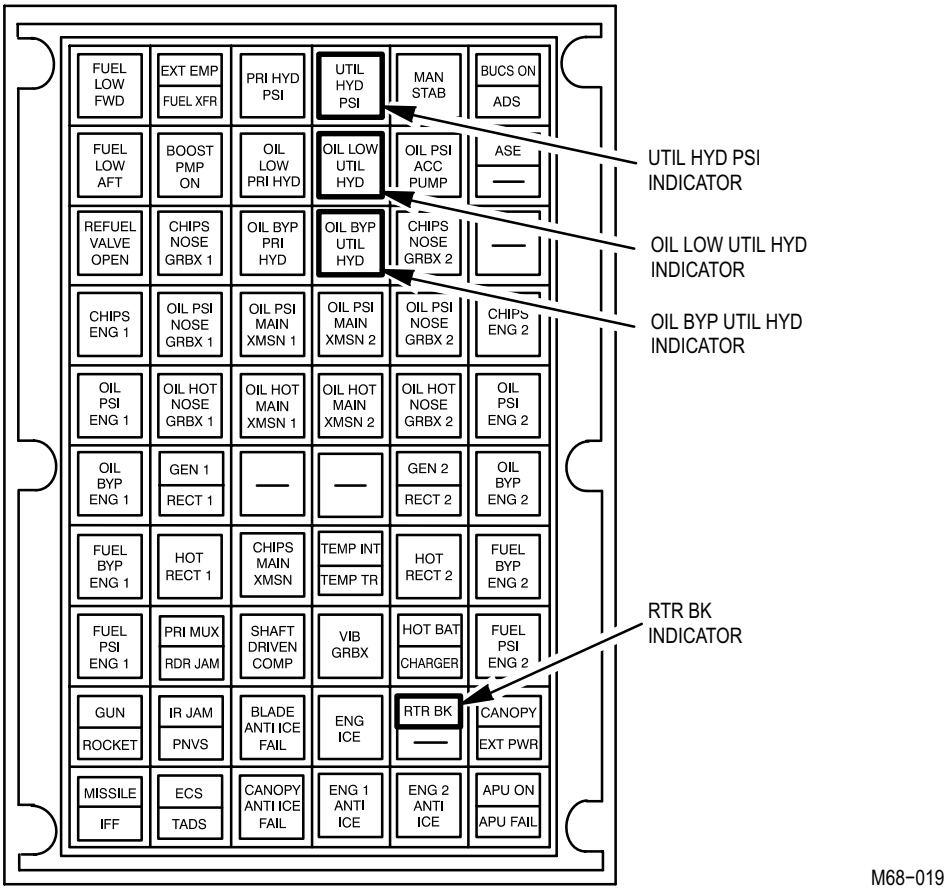


Figure 7–36. Pilot Caution/Warning Panel

Task	Result
d. On pilot master caution/warning panel (fig. 7–37), depress **PRESS TO TEST** switch. Check that all pilot master caution/warning indicators are on, release **PRESS TO TEST.**	If any of the caution/warning display indicators are not on, refer to TM 1-1520-238-T-6 to troubleshoot pilot caution/warning system.

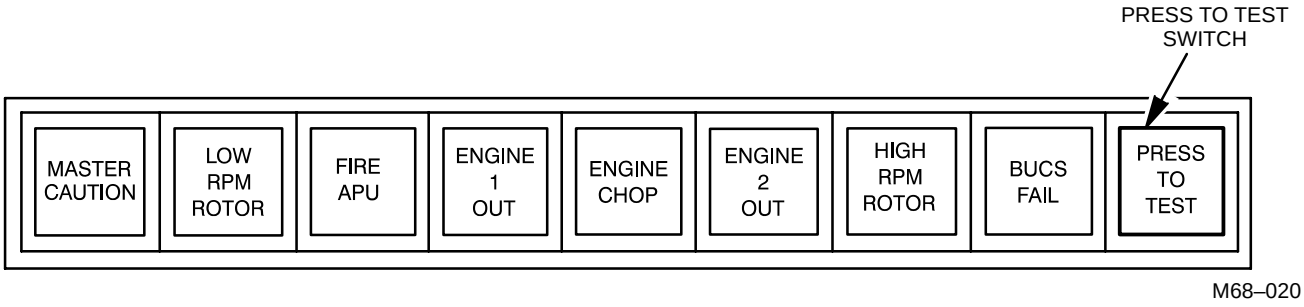


Figure 7–37. Master Caution/Warning Panel

Task	Result
e. On pilot instrument panel, check that **UTIL HYD** indicator (fig. 7–38) indicates **3000 PSI**.	If **UTIL HYD** indicator does not indicate **3000 PSI**, go to paragraph 7–25.

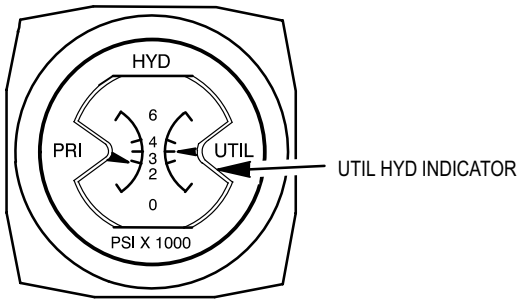


Figure 7–38. Pilot Dual Hydraulic Pressure Indicator

f. On pilot caution/warning panel (fig. 7–36), check that **UTIL HYD PSI, OIL LOW UTIL HYD,** and **OIL BYP UTIL HYD** indicators are not lighted.	If pilot **UTIL HYD PSI** indicator is lighted, go to paragraph 7–26. If **OIL LOW UTIL HYD** indicator is lighted, go to paragraph 7–27. If **OIL BYP UTIL HYD** indicator is lighted, have assistant manually reset utility hydraulic manifold pressure and/or return dirty filter indicator (fig. 7–39). If indicators are retracted, or if indicators pop up after manual reset, go to paragraph 7–28.

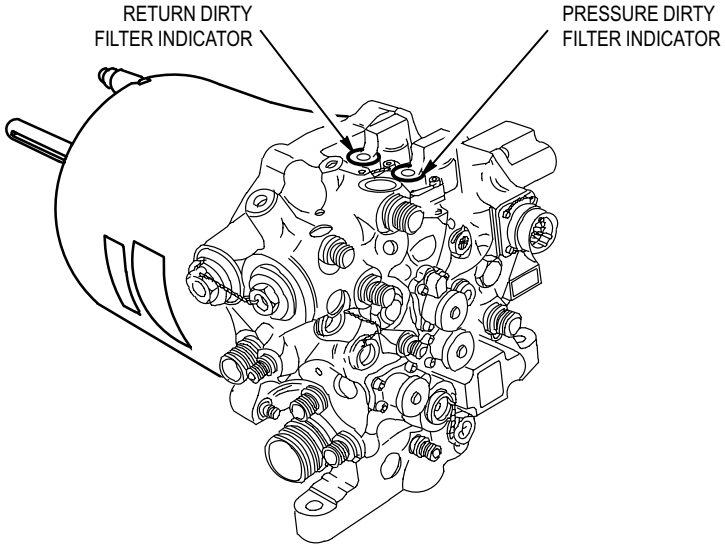


Figure 7–39. Utility Hydraulic Manifold

7–21. UTILITY HYDRAULIC SYSTEM – MAINTENANCE OPERATIONAL CHECK (cont) 7–21

Task	Result
g. On CPG circuit breaker panel 1 (fig. 7–40), close **EMERG BATT CAUT** circuit breaker.	If circuit breaker does not stay closed, refer to TM 1-1520-238-T-6 to troubleshoot circuit protection system (dc emergency bus – CPG station).
h. On CPG caution/warning panel (fig. 7–41), check that **UTIL HYD** indicator is not lighted.	If CPG **UTIL HYD** indicator is lighted, go to paragraph 7–29.
i. On pilot **EXT LT/INTR L**T panel (fig. 7–42), set **INST** control to **BRT**.	

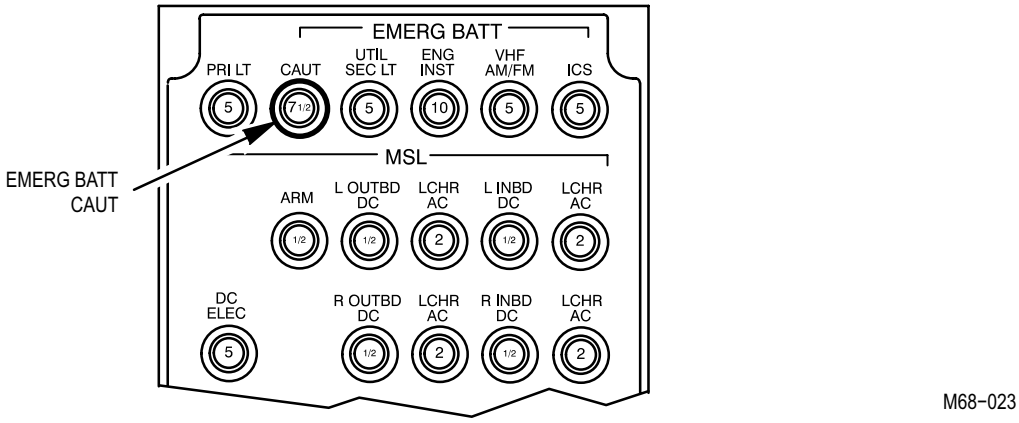


Figure 7–40. CPG Circuit Breaker Panel 1

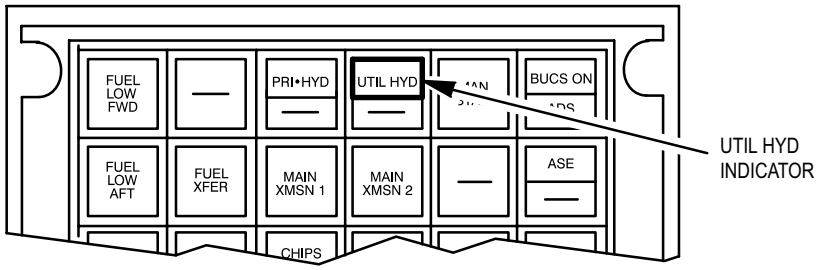


Figure 7–41. CPG Caution/Warning Panel

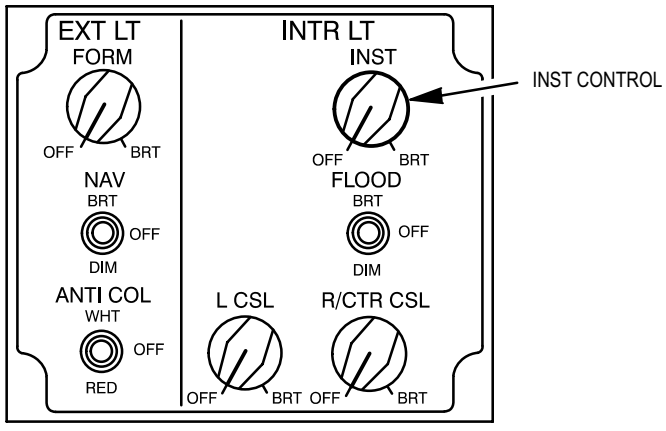
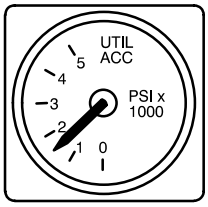


Figure 7–42. Pilot EXT LT/INTR LT Panel

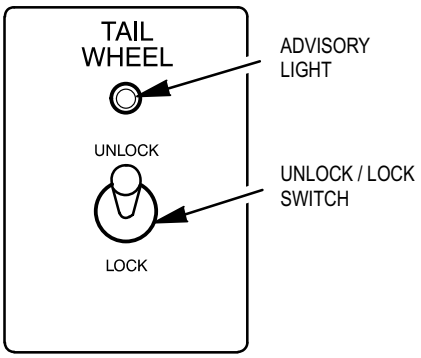
Task	Result
j. On pilot instrument panel, check that dual hydraulic pressure indicator (fig. 7–38) edge–light is lighted.	If edge–light is not lighted, go to paragraph 7–19.
k. On pilot instrument panel, check that emergency hydraulic pressure indicator (fig. 7–43) edge–light is lighted.	If emergency hydraulic pressure indicator edge–light is not lighted, go to paragraph 7–30.



M68-025

Figure 7–43. Pilot Emergency Hydraulic Pressure Indicator

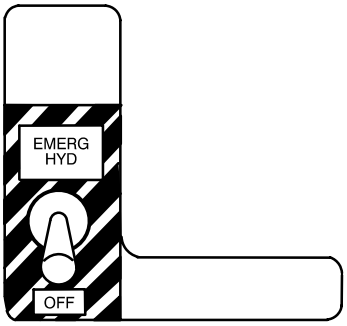
l. On pilot instrument panel, check that **TAIL WHEEL** lock panel (fig. 7–44) edge–light is lighted.	If edge–light is not lighted, go to paragraph 7–31.



M68-026

Figure 7–44. Pilot TAIL WHEEL Lock Panel

m. On pilot instrument panel, check that **EMERG HYD** switch (fig. 7–45), edge–light is lighted.	If edge–light is not lighted, go to paragraph 7–32.



M68-027

Figure 7–45. Pilot Emergency Hydraulic Switch

WARNING

Maintenance personnel must be verbally warned prior to moving the collective or cyclic stick. Any control activated can result in sudden blade movement that can sever or crush fingers or hands. If injury occurs, get immediate medical help.

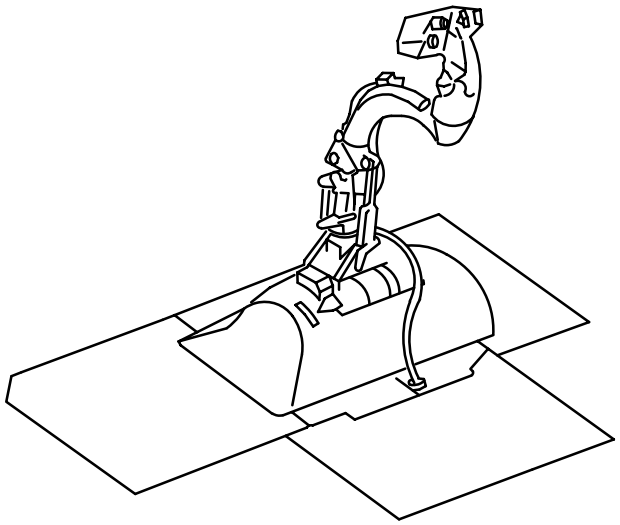
CAUTION

To prevent damage to flight control system components, do not use force if binding or roughness occurs while moving controls with hydraulic power. Prior to continuing the procedure, clear controls of binding. Failure to clear controls of binding many result in sheared pins in the control axis.

NOTE

If suspected fault does not apply to flight control system, go to step ap.

Task	Result
n. Slowly push pilot cyclic stick (fig. 7–46) to full forward position to retract longitudinal servocylinder piston.	



M68-028

Figure 7–46. Pilot Cyclic Stick

Task	Result

NOTE

Refer to figure 7–1. for servocylinder location.

o. Have assistant measure and record cylinder stroke. Use inside calipers. Measurement A is from bottom of jam nut to top surface of servocylinder housing (cylinder retracted) (fig. 7–47).

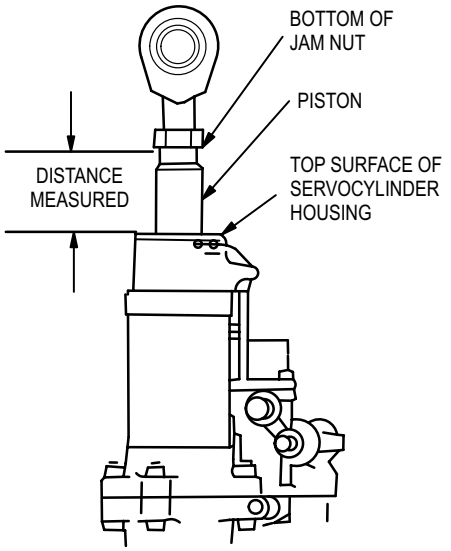


Figure 7–47. Servocylinder (Typical)

p. Slowly pull pilot cyclic stick to full aft position to extend piston.

q. Have assistant measure and record cylinder stroke. Use inside calipers. Measurement B is from bottom of jam nut to top surface of servocylinder housing (cylinder extended).

r. Subtract measurement A from B. Cylinder travel is 3.500 to 3.560 inches.

If cylinder does not travel full stroke, go to step ah.

s. Slowly pull pilot collective stick to full up position to retract collective servocylinder piston.

t. Have assistant measure and record cylinder stroke. Use inside calipers. Measurement A is from bottom of jam nut to top surface of servocylinder housing (cylinder retracted).

7–21. UTILITY HYDRAULIC SYSTEM – MAINTENANCE OPERATIONAL CHECK (cont) 7–21

Task	Result
u. Slowly push pilot collective stick to full down position to extend piston.	
v. Have assistant measure and record cylinder stroke. Use inside calipers. Measurement B is from bottom of jam nut to top surface of servocylinder housing (cylinder extended).	
w. Subtract measurement A from B. Cylinder travel is 3.500 to 3.560 inches.	If cylinder does not travel full stroke, go to step ah.
x. Slowly push pilot cyclic stick to full left position to retract lateral servocylinder piston.	
y. Have assistant measure and record cylinder stroke. Use inside calipers. Measurement A is from bottom of jam nut to top surface of servocylinder housing (cylinder retracted).	
z. Slowly pull pilot cyclic stick to full right position to extend piston.	
aa. Have assistant measure and record cylinder stroke. Use inside calipers. Measurement B is from bottom of jam nut to top surface of servocylinder housing (cylinder extended).	
ab. Subtract measurement A from B. Cylinder travel is 3.500 to 3.560 inches.	If cylinder does not travel full stroke, go to step ah.
ac. Slowly push pilot right directional pedal to full right position to retract directional servocylinder piston.	
ad. Have assistant measure and record cylinder stroke with inside calipers. Measurement A is from bottom of the jam nut to top surface of the servocylinder housing (cylinder retracted).	
ae. Slowly push pilot left directional pedal to full left position to extend piston.	
af. Have assistant measure and record cylinder stroke with inside calipers. Measurement B is from bottom of the jam nut to top surface of the servocylinder housing (cylinder extended).	

Task	Result
ag. Subtract measurement A from B. Cylinder travel is 1.564 to 1.624 inches.	If cylinder travels full stroke, go to step ao.
ah. Check servocylinder for fluid leakage (TM 1-1520-238-23).	If leakage is present, replace leaking servocylinder (TM 1-1520-238-23).

NOTE

If all servocylinders strokes are within specified limits, go to step ap.

ai. Disconnect push–pull rod from servocylinder valve arm (TM 1-1520-238-23).	
aj. Slowly push servocylinder valve arm upward to fully retract piston.	
ak. Have assistant measure and record cylinder stroke with inside calipers. Measurement A is from bottom of the jam nut to top surface of the servocylinder housing (cylinder retracted).	
al. Slowly pull servocylinder valve arm downward to fully extend piston.	
am. Have assistant measure and record cylinder stroke with inside calipers. Measurement B is from bottom of the jam nut to top surface of the servocylinder housing (cylinder extended).	
an. On pilot center circuit breaker panel (fig. 7–35), check that **RTR BRK** circuit breaker is closed.	If **RTR BRK** circuit breaker does not stay closed, go to paragraph 7–33.
ao. Subtract measurement A from B. Directional cylinder travel is 1.564 to 1.624 inches. All other cylinder travel is 3.500 to 3.560 inches.	If cylinder does not travel full stroke, replace servocylinder (TM 1-1520-238-23). If cylinder travels full stroke, perform appropriate flight control system rigging operational check (TM 1-1520-238-T-7).

7–21. UTILITY HYDRAULIC SYSTEM – MAINTENANCE OPERATIONAL CHECK (cont) 7–21

Task	Result
ap. Check that **RTR BK** switch located on pilot power quadrant (fig. 7–48) is **OFF**. Hand rotate main rotor blade assembly.	If main rotor blade assembly does not rotate (rotor brake does not release), go to paragraph 7–34.
aq. On pilot caution/warning panel (fig. 7–36), check **RTR BK** indicator is off.	If **RTR BK** indicator is on, go to paragraph 7–35.

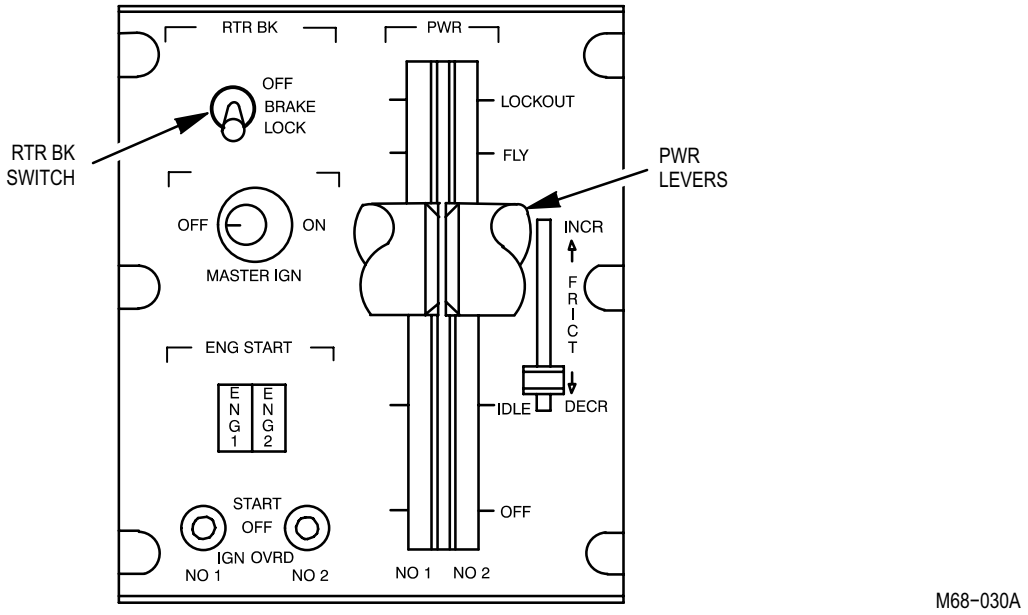


Figure 7–48. Pilot Power Quadrant

ar. To stop blade rotation, set **RTR BK** switch to **BRAKE**.	If rotor brake does not stop rotation of rotor assembly and **RTR BRK** circuit breaker is closed, go to paragraph 7–36. If rotor brake does not stop rotation of rotor assembly and **RTR BRK** circuit breaker is open, go to paragraph 7–33.
as. On pilot caution/warning panel (fig. 7–36), check that **RTR BK** indicator is on.	If **RTR BK** indicator is off, go to paragraph 7–37.
at. Disconnect and remove AGPU hydraulic pressure from helicopter (TM 1-1520-238-23).	
au. Start helicopter APU (TM 1-1520-238-23).	If APU start sequence does not begin, refer to TM 1-1520-238-T-8 to troubleshoot APU.
av. On pilot instrument panel, check that **UTIL HYD** indicator (fig. 7–38) indicates **3000 PSI**.	If **UTIL HYD** indicator does not indicate **3000 PSI**, go to paragraph 7–38.

7–21. UTILITY HYDRAULIC SYSTEM – MAINTENANCE OPERATIONAL CHECK (cont) 7–21

Task	Result
aw. Remove tail wheel safety flag/pin (TM 1-1520-238-23).	
ax. On pilot **TAIL WHEEL** lock panel (fig. 7–44), set **UNLOCK/LOCK** switch to **UNLOCK** position.	
ay. On pilot **TAIL WHEEL** lock panel (fig. 7–44), check that the advisory light is lighted.	If advisory light does not light, go to paragraph 7–39.
az. Check tail wheel lock actuator located above tail wheel. Actuator retracts when tail wheel lock switch is in **UNLOCK** position.	If tail wheel lock actuator does not unlock tail wheel and **TWHL LOCK** circuit breaker is closed, go to paragraph 7–40. If **TWHL LOCK** circuit breaker is open, go to paragraph 7–41.
ba. Insert tail wheel safety flag/pin (TM 1-1520-238-23).	
bb. Shutdown APU (TM 1-1520-238-23).	

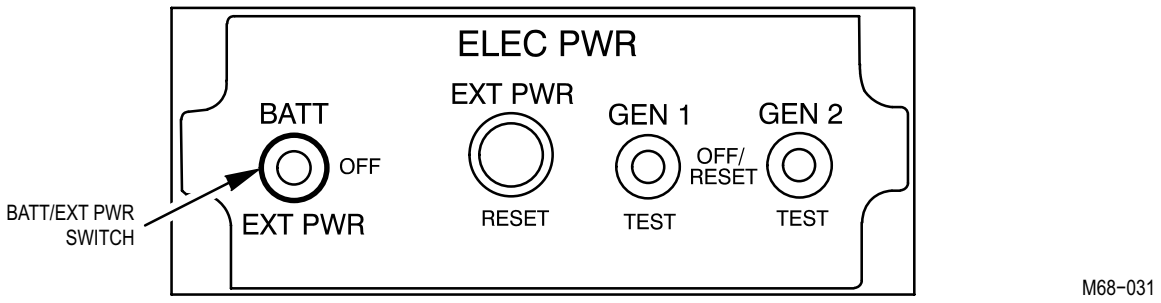


Figure 7–49. Pilot ELEC PWR Panel

bc. On pilot instrument panel, set **EMERG HYD** switch (fig. 7–45) to **EMERG HYD** position. Check pilot emergency hydraulic pressure indicator (fig. 7–43) for **3000 PSI** steady indication.	If pilot emergency hydraulic pressure indicator does not indicate **3000 PSI** and **EMERG HYD** circuit breaker is closed, go to paragraph 7–42. If **EMERG HYD** circuit breaker is open go to paragraph 7–43.

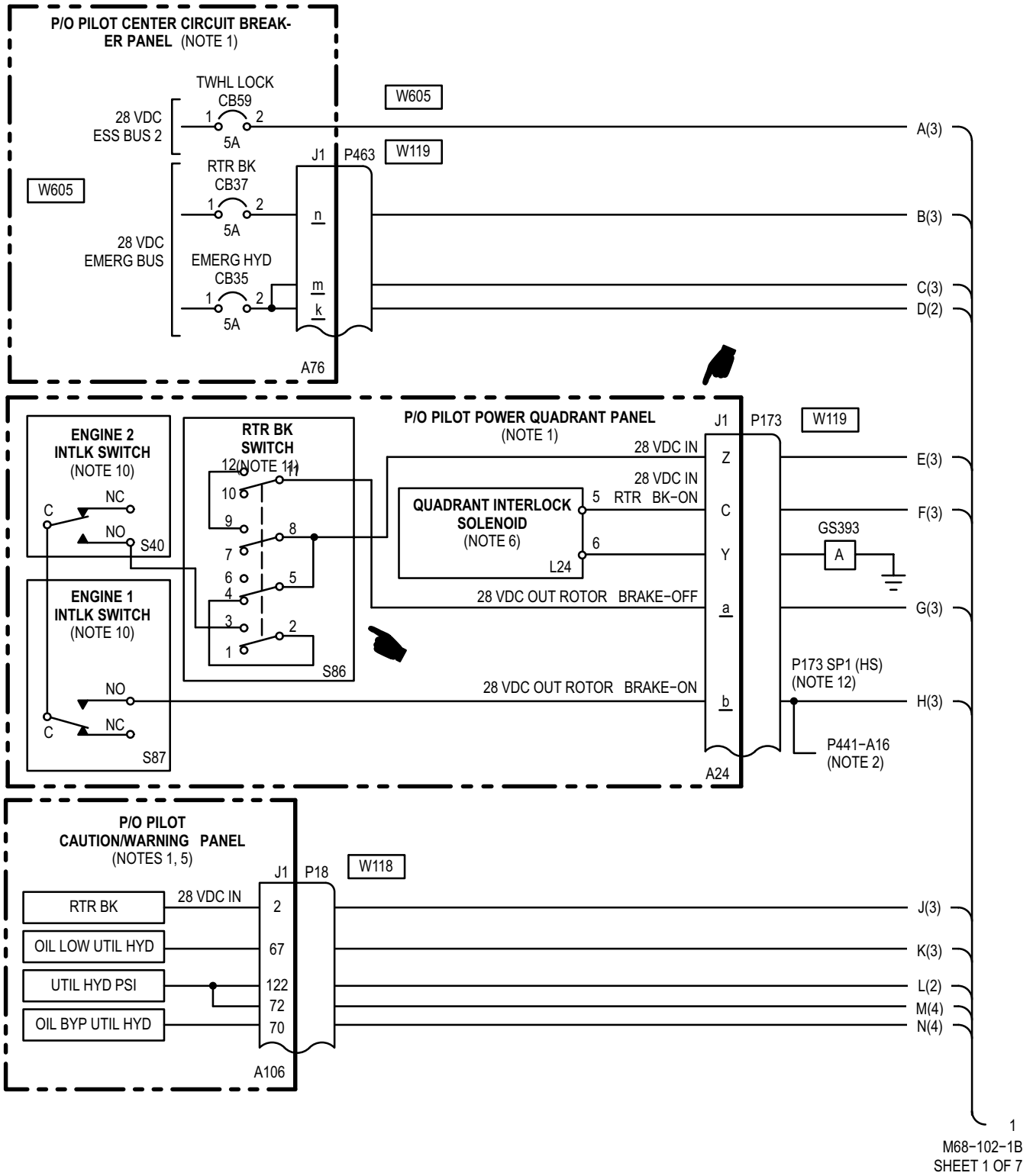
7–21. UTILITY HYDRAULIC SYSTEM – MAINTENANCE OPERATIONAL CHECK (cont) 7–21

Task	Result
bd. Move pilot cyclic stick. Track stick motion with hydraulic servocylinder movements to verify proper emergency hydraulic flight controls operation.	If emergency hydraulic flight controls do not operate properly and **EMERG HYD** circuit breaker is closed, go to paragraph 7–44. If emergency hydraulic flight controls do not operate properly and **EMERG HYD** circuit breaker is open, go to paragraph 7–43.
be. On pilot **ELEC PWR** panel (fig. 7–49), set **BATT/EXT PWR** switch to **BATT**.	
bf. Set **EMERG HYD** switch to **OFF**.	
bg. On pilot power quadrant (fig. 7–48), check that engine **NO 1** and engine **NO 2 PWR** levers are in **OFF** position.	
bh. On pilot **ELEC PWR** panel set **BATT/EXT PWR** switch to **OFF**.	
bi. Service utility hydraulic reservoir, if required (TM 1-1520-238-23).	

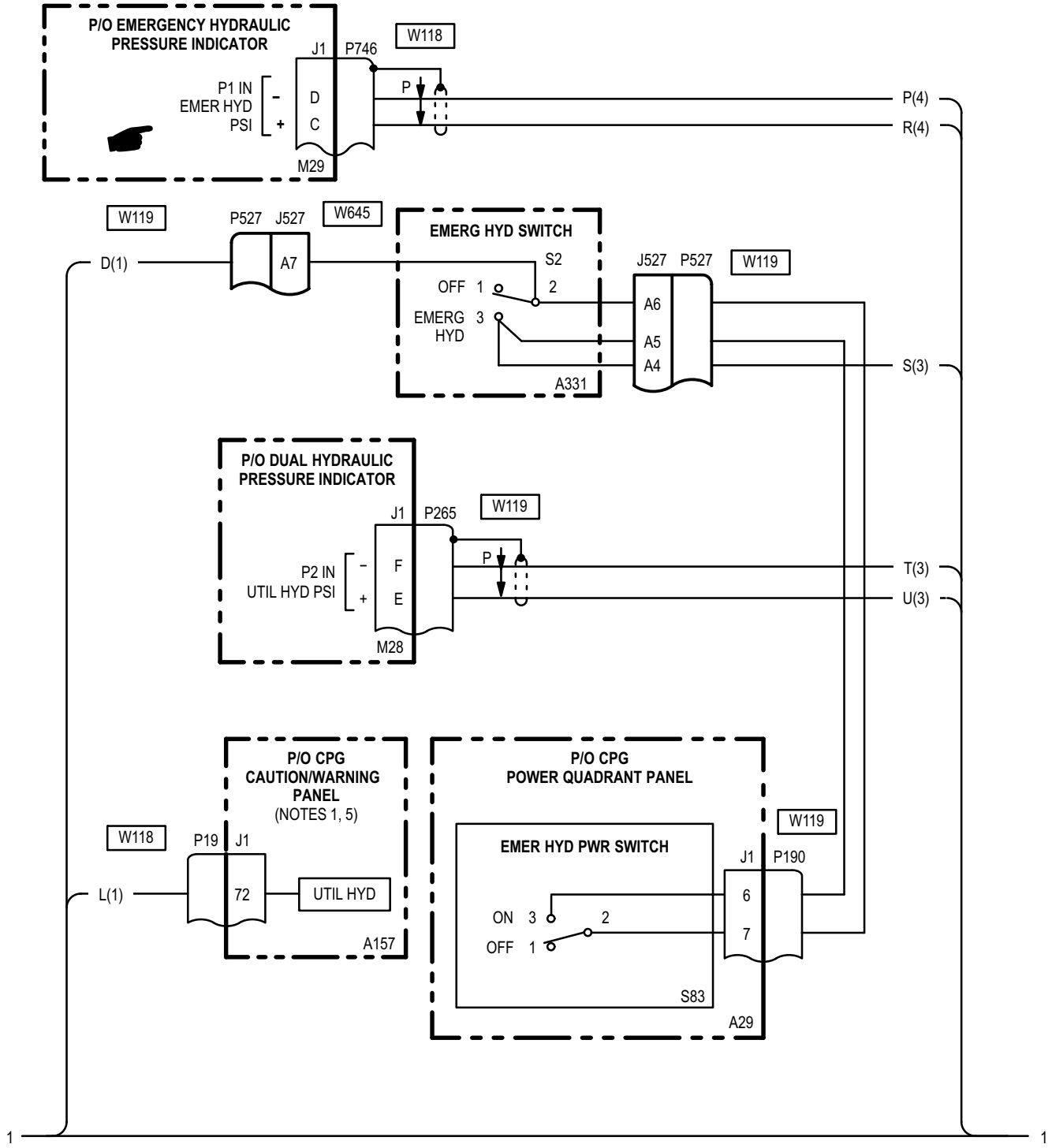
9. Remove external power – electrical (TM 1-1520-238-23).
10. Disconnect maintenance headset (TM 1-1520-238-T-4).
11. Close and secure all access panels and doors opened during this maintenance operational check (TM 1-1520-238-23).

END OF TASK

7–22. UTILITY HYDRAULIC SYSTEM – WIRING INTERCONNECT DIAGRAM 7–22

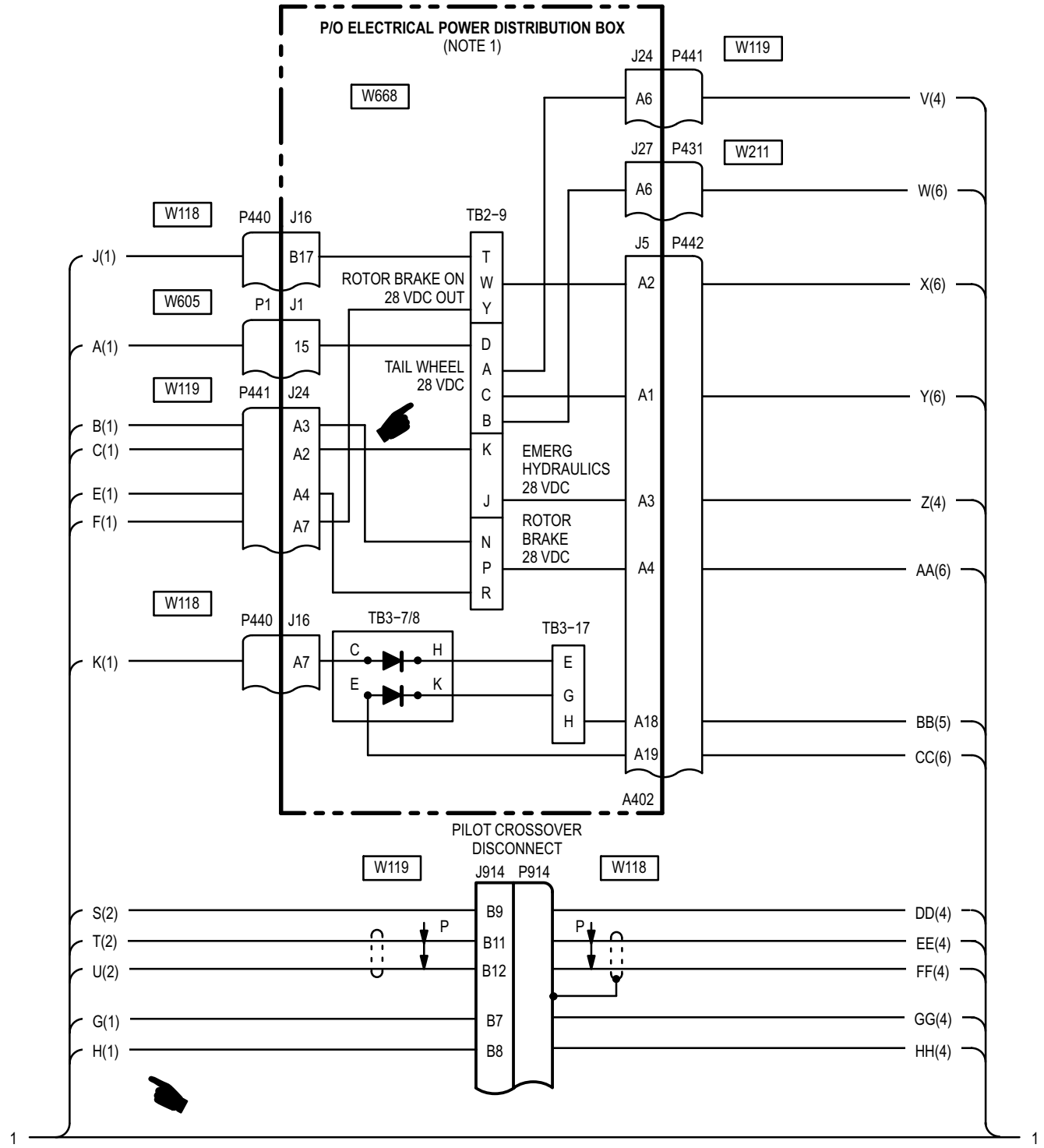


7–22. UTILITY HYDRAULIC SYSTEM – WIRING INTERCONNECT DIAGRAM (cont) 7–22



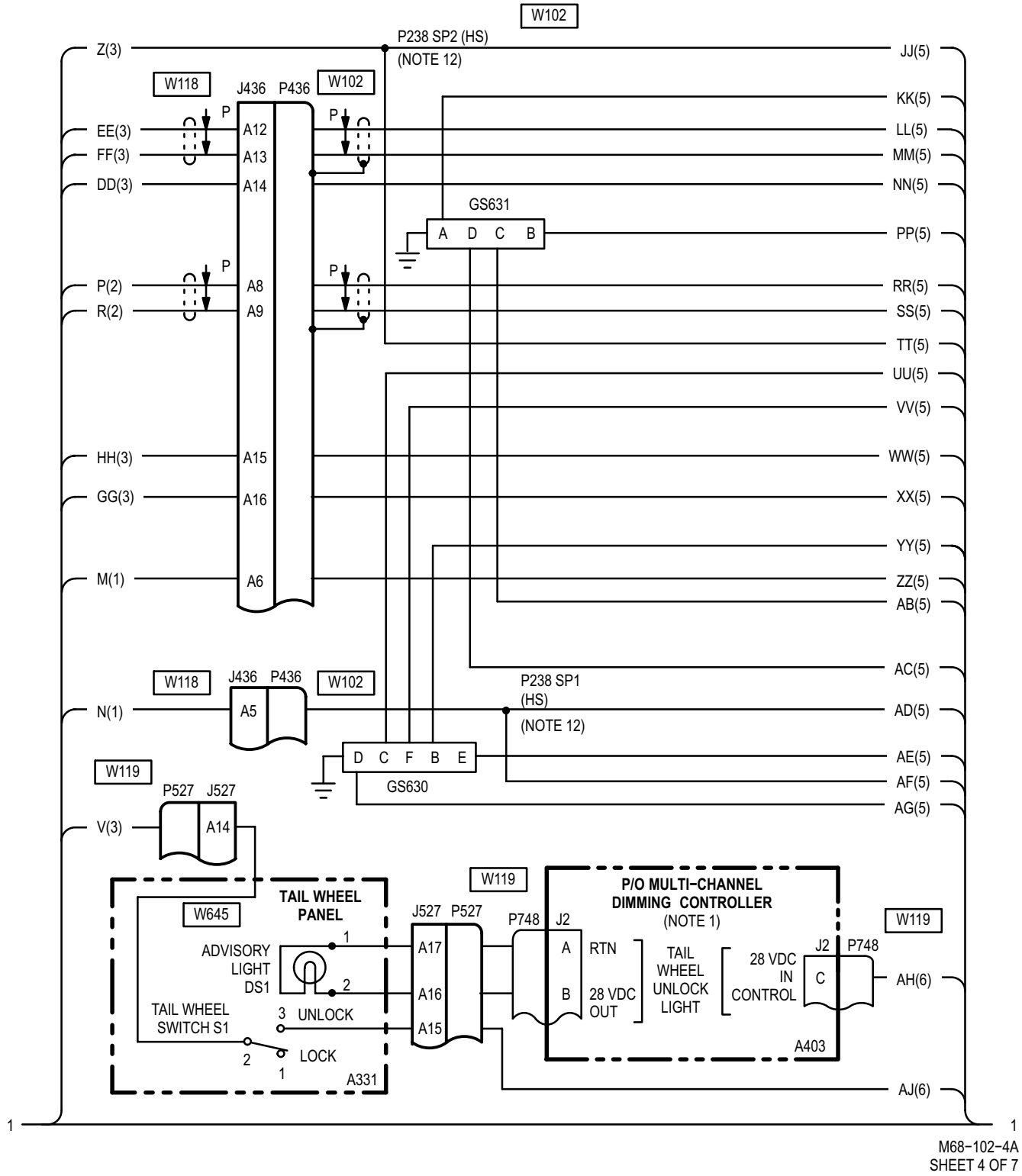
M68−102−2B
SHEET 2 OF 7

7–22. UTILITY HYDRAULIC SYSTEM – WIRING INTERCONNECT DIAGRAM (cont) 7–22

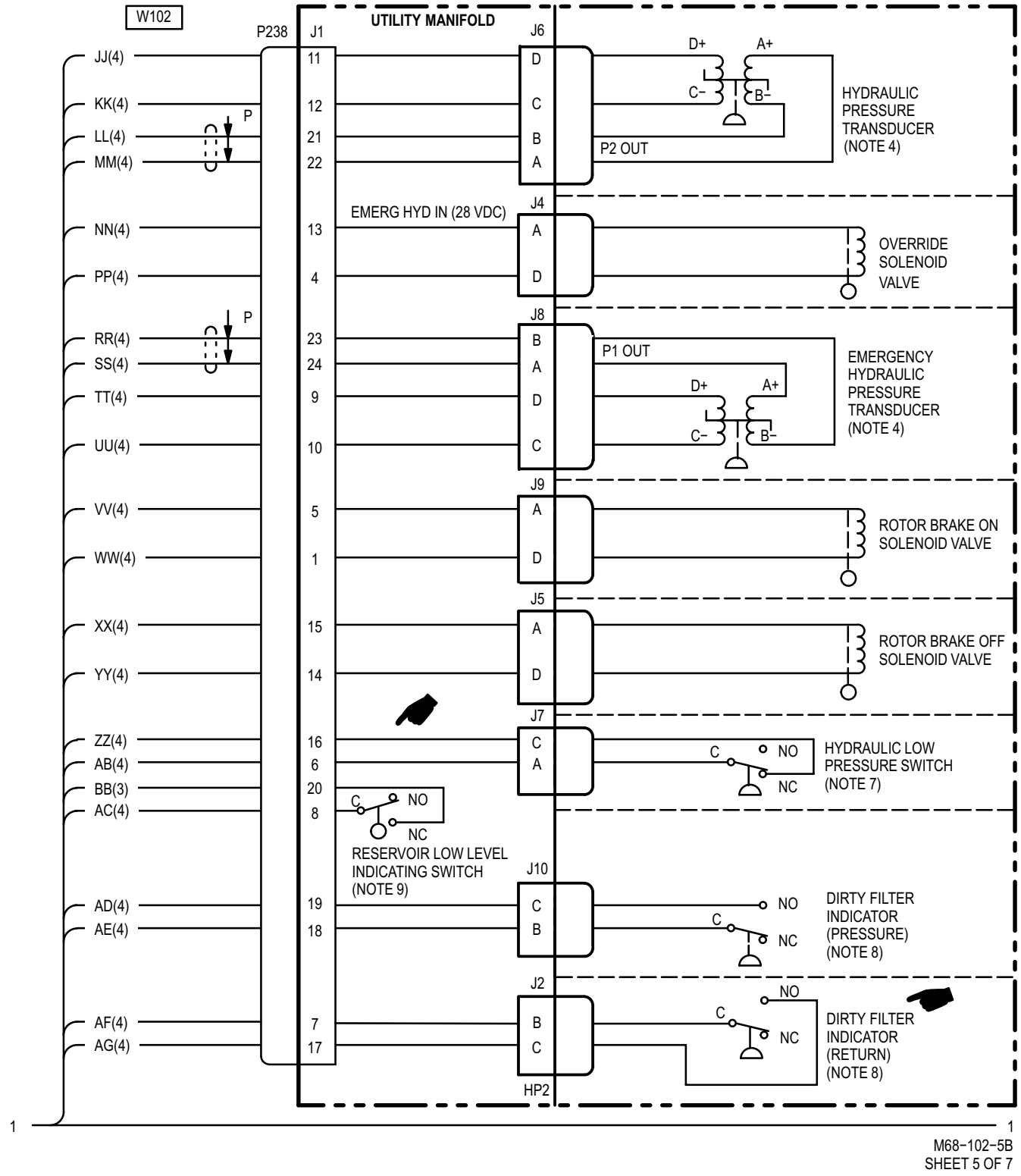


M68−102−3B
SHEET 3 OF 7

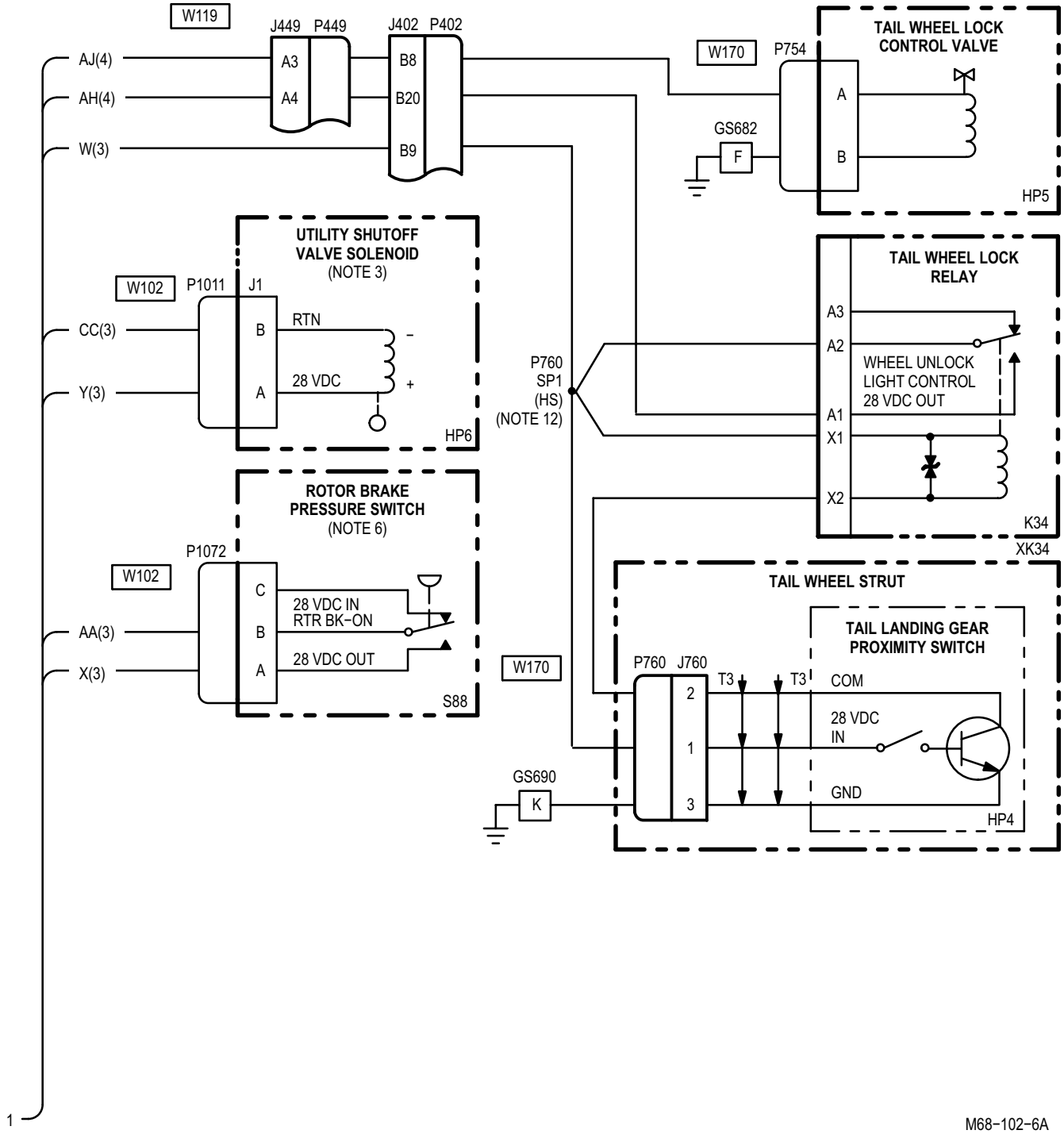
7–22. UTILITY HYDRAULIC SYSTEM – WIRING INTERCONNECT DIAGRAM (cont) 7–22



7–22. UTILITY HYDRAULIC SYSTEM – WIRING INTERCONNECT DIAGRAM (cont) 7–22

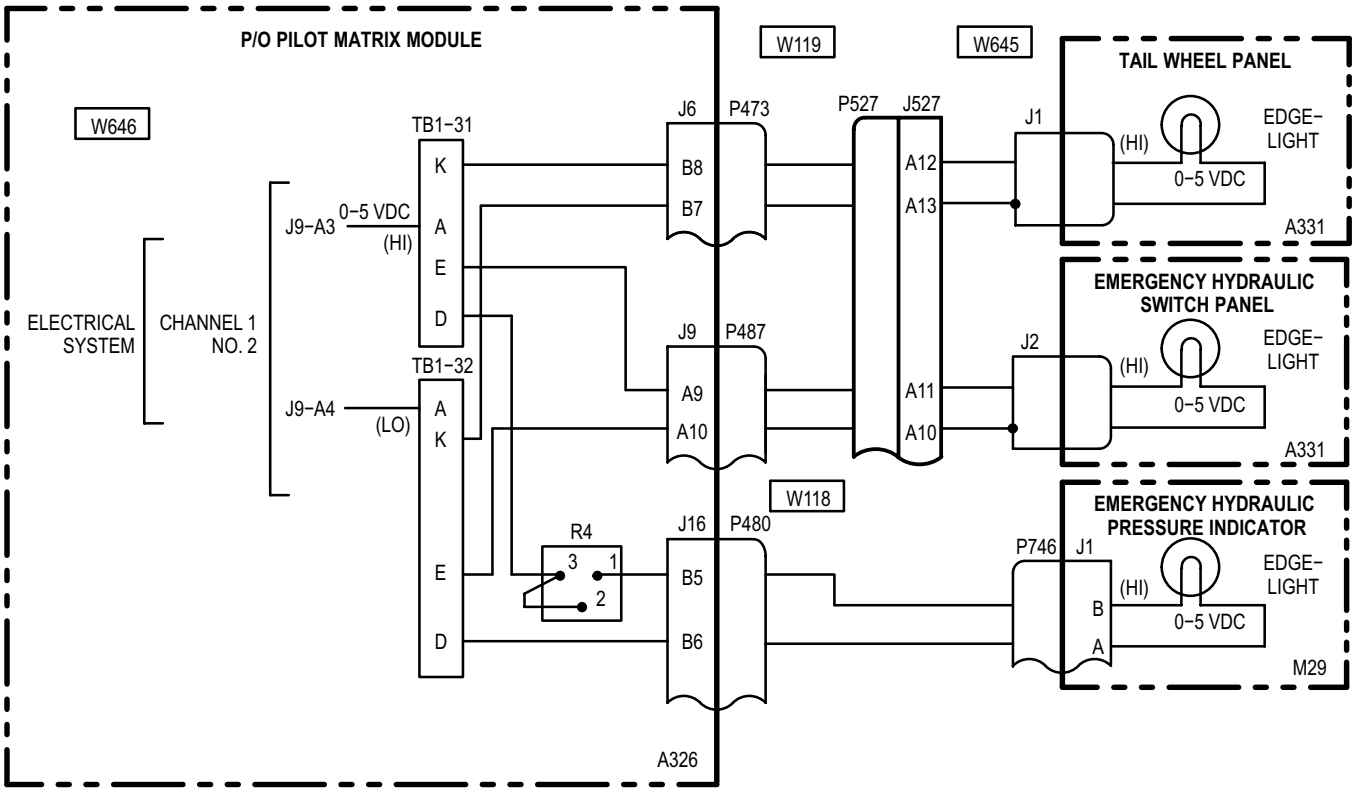


7–22. UTILITY HYDRAULIC SYSTEM – WIRING INTERCONNECT DIAGRAM (cont) 7–22



M68–102–6A
SHEET 6 OF 7

7–22. UTILITY HYDRAULIC SYSTEM – WIRING INTERCONNECT DIAGRAM (cont) 7–22



NOTES:

HIGHWAY USE: THE ALPHA CHARACTER IDENTIFIES A SPECIFIC LINE, AND THE NUMBER IN PARENTHESIS IDENTIFIES THE SHEET NUMBER WHERE THE SIGNAL TERMINATES.

1. **ELECTRICAL SYSTEM (TM 1-1520-238-T-6).**
2. **FLIGHT CONTROL SYSTEM (TM 1-1520-238-T-7).**
3. **CLOSED WHEN ENERGIZED.**
4. **1.37 VDC/1000 PSI.**
5. **GND INPUTS TURN ON LIGHTS, UNLESS OTHERWISE SHOWN.**
6. **ACTIVATED WITH ROTOR BRAKE ON.**
7. **OPEN AT 2050 PSI AND ABOVE. CLOSED AT 1250 PSI AND BELOW.**
8. **CLOSED AT 70 ±10 PSI DIFFERENTIAL PRESSURE.**
9. **CLOSED WHEN RESERVOIR FLUID LEVEL IS 10 CUBIC INCHES OR LESS (APPROX. 0.06 GAL).**
10. **SHOWN WITH THROTTLE IN ADVANCE POSITION.**
11.

CONTACT	RTR BK SW INDICATOR POSITION		
	BRAKE	OFF	LOCK
1-2			X
2-3	X	X	
4-5	X		X
5-6		X	
7-8	X		X
8-9		X	
10-11			X
11-12	X	X	
X-INDICATES CONTACTS CLOSED			

12. **HS DESIGNATES A HARD SPLICE WHICH CANNOT BE DISCONNECTED. M DESIGNATES A SOFT SPLICE WHICH MAY BE DISCONNECTED FOR A WIRING CHECK.**

M68-102-7
SHEET 7 OF 7

7–23. HYDRAULIC HAND PUMP – DOES NOT SERVICE UTILITY HYDRAULIC MANIFOLD RESERVOIR 7–23

Tools:

Nomenclature	Part Number
Tool Kit, Aircraft Mechanic's	SC518099CLA01
Service Unit, Hydraulic Fluid	E159-1000

Personnel Required:

67R Attack Helicopter Repairer

References:

TM 1-1520-238-23

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. Operate hydraulic hand pump a minimum of ten strokes.
   Does binding or roughness occur?
   - YES — Go to step 4.
   - NO — Go to step 2.
2. Wrap clean rag around air relief valve on utility hydraulic manifold reservoir.
   Push air relief valve.
   Is hydraulic fluid present?
   - YES — Replace utility hydraulic manifold reservoir housing (TM 1-1520-238-23).
   - NO — Go to step 3.
3. Using container to catch fluid, disconnect overboard drain line from utility hydraulic manifold reservoir. Operate hydraulic hand pump.
   Is hydraulic fluid present?
   - YES — Replace utility hydraulic manifold (TM 1-1520-238-23).
   - NO — Replace hydraulic hand pump (TM 1-1520-238-23).
4. Inspect hydraulic filter.
   Is filter dirty or clogged?
   - YES — Replace hydraulic filter element (ADG) or hydraulic filter screen (ADF) (TM 1-1520-238-23).
   - NO — Replace hydraulic hand pump (TM 1-1520-238-23).

END OF TASK

7–24. UTIL HYD PSI INDICATOR – IS NOT LIGHTED WITH NO UTILITY HYDRAULIC SYSTEM PRESSURE INDICATED 7–24

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer

References:

TM 1-1520-238-23

Equipment Conditions:

Ref	Condition
TM 1-1520-238-23	Access provisions – L200 panel removed

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. On utility hydraulic manifold, check for open between (HP2):
   J1–6 and J1–16.
   Does open exist?

   YES — Go to step 3.

   NO — Go to step 2.

2. Check for open between:
   P238–6 and GS631–C,
   P238–16 and P18–72.
   Does open exist?

   YES — Repair open wire. Go to paragraph 7–21.

   NO — Replace pilot caution/warning panel (TM 1-1520-238-23).

3. Remove utility manifold low pressure switch (TM 1-1520-238-23). Check for open between (HP2):
   J1–6 and J7–A,
   J1–16 and J7–C.
   Does open exist?

   YES — Replace utility hydraulic manifold (TM 1-1520-238-23).

   NO — Replace utility hydraulic low pressure switch (TM 1-1520-238-23).

END OF TASK

7–25. UTIL HYD INDICATOR – DOES NOT INDICATE 3000 PSI (AGPU OPERATING) 7–25

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer (2)

References:

TM 1-1520-238-T-6
TM 1-1520-238-23

Equipment Conditions:

Ref	Condition
TM 1-1520-238-23	Hydraulic system leak check – completed

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. Check **EMERG HYD** circuit breaker.
   Is circuit breaker closed?
   - YES — Go to step 2.
   - NO — Go to paragraph 7–43.
2. Check for 28 VDC at P238–11.
   Is voltage present?
   - YES — Go to step 4.
   - NO — Go to step 3.
3. Check for 28 VDC at (A76)J1–m.
   Is voltage present?
   - YES — Repair open wire between P463–m and P238–11. Go to paragraph 7–21.
   - NO — Refer to TM 1-1520-238-T-6 to troubleshoot circuit protection system (dc emergency bus – pilot station)
4. Check for open between P238–12 and ground.
   Does open exist?
   - YES — Repair open wire between P238–12 and GS631–A. Go to paragraph 7–21.
   - NO — Go to step 5.
5. Verify AGPU pressure for 3000 psi. Check for 4.2 VDC between P265–E and P265–F.
   Is voltage present?
   - YES — Replace dual hydraulic pressure indicator (TM 1-1520-238-23).
   - NO — Go to step 6.
6. Check for open between:
   P265–E and P238–22,
   P265–F and P238–21.
   Does open exist?
   - YES — Repair open wire. Go to paragraph 7–21.
   - NO — Go to step 7.

7. Remove utility hydraulic pressure transducer (TM 1-1520-238-23). Check for open between (HP2):
   J1–22 and J6–A,
   J1–21 and J6–B,
   J1–12 and J6–C,
   J1–11 and J6–D.
   Does open exist?

YES	Replace utility hydraulic manifold (TM 1-1520-238-23).
NO	Replace utility hydraulic pressure transducer (TM 1-1520-238-23).

END OF TASK

7–26. PILOT UTIL HYD PSI INDICATOR – IS LIGHTED 7–26

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer (2)

References:

TM 1-1520-238-23

Equipment Conditions:

Ref	Condition
TM 1-1520-238-23	Hydraulic system leak check – completed

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. Detach P18.
   Is UTIL HYD PSI indicator lighted?

   YES — Replace pilot caution/warning panel (TM 1-1520-238-23).

   NO — Go to step 2.

2. Detach P19 and P238. Check for short between:
   P18–72 and ground,
   P18–122 and ground.
   Does short exist?

   YES — Repair shorted wire between:
   P18–122 and P19–72,
   P18–72 and J436–A6,
   P436–A6 and P238–16.
   Go to paragraph 7–21.

   NO — Go to step 3.

3. Remove utility hydraulic manifold low pressure switch (TM 1-1520-238-23). Check for short between (HP2)J1–16 and ground.
   Does short exist?

   YES — Replace utility hydraulic manifold (TM 1-1520-238-23).

   NO — Replace utility hydraulic manifold low pressure switch (TM 1-1520-238-23).

END OF TASK

7–27. OIL LOW UTIL HYD INDICATOR – IS LIGHTED 7–27

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer (2)

References:

TM 1-1520-238-23

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. Detach P18.
   Is OIL LOW UTIL HYD indicator lighted?

   YES — Replace pilot caution/warning panel (TM 1-1520-238-23).

   NO — Go to step 2.

2. Check for short between:
   P18–67 and ground,
   P440–A7 and ground,
   P442–A18 and ground,
   P238–20 and ground.
   (A402):
   J16–A7 and ground,
   TB3–7/8–C and ground,
   TB3–7/8–H and ground,
   TB3–17–E and ground,
   TB3–17–H and ground,
   J5–A18 and ground,
   TB3–17–G and ground,
   TB3–7/8–K and ground.
   Does short exist?

   YES — Repair shorted wire. Go to paragraph 7–21.

   NO — Go to step 3.

3. Check for short between (A402)TB3–7/8 and ground.
   Does short exist?

   YES — Replace (A402)TB3–7/8 (TM 1-1520-238-23).

   NO — Replace utility hydraulic manifold (TM 1-1520-238-23).

END OF TASK

7–28. OIL BYP UTIL HYD INDICATOR – IS LIGHTED 7–28

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer

References:

TM 1-1520-238-23

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. Check utility hydraulic manifold pressure dirty filter indicator.
   Is indicator retracted?
   - YES — Go to step 2.
   - NO — Replace utility hydraulic manifold pressure strainer (TM 1-1520-238-23).
2. Check utility hydraulic manifold return dirty filter indicator.
   Is indicator retracted?
   - YES — Go to step 3.
   - NO — Replace utility hydraulic manifold return strainer (TM 1-1520-238-23).
3. Check for short between P18–70 and ground.
   Does short exist?
   - YES — Go to step 4.
   - NO — Replace pilot caution/warning panel (TM 1-1520-238-23).
4. Detach P238, check for short between P18–70 and ground.
   Does short exist?
   - YES — Repair shorted wire between: P18–70 and J436–A5, P436–A5 and P238 SP1, P238 SP1 and P238–7, P238 SP1 and P238–19. Go to paragraph 7–21.
   - NO — Go to step 5.
5. Check for continuity between (HP2): J1–18 and J1–19.
   Does continuity exist?
   - YES — Replace utility hydraulic manifold pressure dirty filter indicator (TM 1-1520-238-23).
   - NO — Go to step 6.
6. Check for continuity between (HP2): J1–7 and J1–17.
   Does continuity exist?
   - YES — Replace utility hydraulic manifold return dirty filter indicator (TM 1-1520-238-23).
   - NO — Go to step 7.
7. Check for short between (HP2)J1–19 and chassis ground.
   Does short exist?
   - YES — Go to step 8.
   - NO — Go to step 9.

8. Remove utility hydraulic manifold pressure dirty filter indicator (TM 1-1520-238-23). Check for short between (HP2)J1–19 and chassis ground. **Does short exist?**

   YES — Replace utility hydraulic manifold (TM 1-1520-238-23).

   NO — Replace utility hydraulic manifold pressure dirty filter indicator (TM 1-1520-238-23).

9. Remove utility hydraulic manifold return dirty filter indicator (TM 1-1520-238-23). Check for short between (HP2)J1–7 and chassis ground. **Does short exist?**

   YES — Replace utility hydraulic manifold (TM 1-1520-238-23).

   NO — Replace utility hydraulic manifold pressure dirty filter indicator (TM 1-1520-238-23).

END OF TASK

7–29. CPG UTIL HYD INDICATOR – IS LIGHTED 7–29

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer

References:

TM 1-1520-238-23

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

Detach P19.

Is UTIL HYD indicator lighted?

YES	Replace CPG caution/warning panel (TM 1-1520-238-23).
NO	Go to paragraph 7–26.

END OF TASK

7–30. EMERGENCY HYDRAULIC PRESSURE INDICATOR EDGE–LIGHT – IS NOT LIGHTED 7–30

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer (2)

References:

TM 1-1520-238-T-6
TM 1-1520-238-23

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. Check **LT PRI** circuit breaker.
   Does circuit breaker stay closed ?

   YES — Go to step 2.

   NO — Refer to TM 1-1520-238-T-6 to troubleshoot pilot edge–lights.

2. Check for 5 VDC between P746–A and P746–B.
   Is voltage present?

   YES — Replace emergency hydraulic pressure indicator (TM 1-1520-238-23).

   NO — Go to step 3.

3. Check for 5 VDC between (A326): J16–B5 and J16–B6.
   Is voltage present?

   YES — Repair open wire between: P746–B and P480–B5, P746–A and P480–B6. Go to paragraph 7–21.

   NO — Go to step 4.

4. Check for 5 VDC between (A326): TB1–31–D and TB1–32–D.
   Is voltage present?

   YES — Go to step 5.

   NO — Refer to TM 1-1520-238-T-6 to troubleshoot pilot edge–lights.

5. Check for resistance between (A326): R4–1 and R4–3.
   Is resistance present?

   YES — Repair open wire between (A326): J16–B5 and R4–1, J16–B6 and TB1–32–D, R4–3 and TB1–31–D. Go to paragraph 7–21.

   NO — Replace resistor (A326)R4 (TM 1-1520-238-23).

END OF TASK

7–31. TAIL WHEEL LOCK PANEL EDGE–LIGHT – IS NOT LIGHTED 7–31

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer (2)

References:

TM 1-1520-238-T-6
TM 1-1520-238-23

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. Check **LT PRI** circuit breaker.
   Does circuit breaker stay closed?

   YES — Go to step 2.

   NO — Refer to TM 1-1520-238-T-6 to troubleshoot pilot edge–lights.

2. On pilot **INTR LT** panel, turn **INST** control knob to full **BRT**. Check for 5 VDC between (A331)J1POS and case.
   Is voltage present?

   YES — Replace pilot **TAIL WHEEL** lock panel (TM 1-1520-238-23).

   NO — Go to step 3.

3. Check for 5 VDC between (A326): J6–B8 and J6–B7.
   Is voltage present?

   YES — Repair open wire between: (A331)J1POS and J527–A12, (A331)J1CASE and J527–A13, P527–A12 and P473–B8, P527–A13 and P473–B7. Go to paragraph 7–21.

   NO — Go to step 4.

4. Check for 5 VDC at (A326): TB1–31–K and TB1–32–K.
   Is voltage present?

   YES — Repair open wire between (A326): TB1–31–K and J6–B8, TB1–32–K and J6–B7. Go to paragraph 7–21.

   NO — Refer to TM 1-1520-238-T-6 to troubleshoot pilot edge–lights.

END OF TASK

7–32. EMERGENCY HYDRAULIC SWITCH EDGE–LIGHT – IS NOT LIGHTED 7–32

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer (2)

References:

TM 1-1520-238-T-6
TM 1-1520-238-23

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. Check **PRI** circuit breaker.
   Is circuit breaker closed?

   YES — Go to step 2.

   NO — Refer to TM 1-1520-238-T-6 to troubleshoot circuit protection system (dc emergency bus – pilot station).

2. On pilot **EXT LT/INTR LT** panel, turn **INST** control knob to full **BRT**. Check for 5 VDC between (A331)J2POS and case.
   Is voltage present?

   YES — Replace **EMERG HYD** switch panel (TM 1-1520-238-23).

   NO — Go to step 3.

3. Check for 5 VDC between J9–A9 and J–A10.
   Is voltage present?

   YES — Repair open wire between:
   (A331)J2POS and J527–A11,
   (A331)J2CASE and J527–A10,
   P527–A11 and P487–A9,
   P527–A10 and A487–A10.
   Go to paragraph 7–21.

   NO — Go to step 4.

4. Check for 5 VDC between (A326):
   TB1–31–E and TB1–32–E.
   Is voltage present?

   YES — Repair open wire between (A326):
   TB1–31E and J9–A9,
   TB1–32E and J9–A10.
   Go to paragraph 7–21.

   NO — Refer to TM 1-1520-238-T-6 to troubleshoot circuit protection system (dc emergency bus – pilot station).

END OF TASK

7–33. RTR BRK CIRCUIT BREAKER – DOES NOT STAY CLOSED 7–33

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer

References:

TM 1-1520-238-T-6
TM 1-1520-238-23

Equipment Conditions:

Ref	Condition
TM 1-1520-238-23	Access provisions – L200 panel removed

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. Open **RTR BRK** circuit breaker. Check for short between P441–A3 and ground.
   Does short exist?

   YES — Go to step 2.

   NO — Go to step 3.

2. Detach P463. Check for short between (A76)J1–n and ground.
   Does short exist?

   YES — Refer to TM 1-1520-238-T-6 to troubleshoot circuit protection system (dc emergency bus – pilot station).

   NO — Repair shorted wire between P463–n and P441–A3.

3. Detach P441. Check for short between (A402)J5–A4 and ground.
   Does short exist?

   YES — Repair shorted wire between (A402):
   J5A–A4 and TB2–9–P,
   J24–A3 and TB2–9–N,
   J24–A4 and TB2–9–R.
   Go to paragraph 7–21.

   NO — Go to step 4.

4. Detach P440. Check for short between (A402)J5–A2 and ground.
   Does short exist?

   YES — Repair shorted wire between (A402):
   J5–A2 and TB2–9–W,
   J16–B17 and TB2–9–T,
   J24–A7 and TB2–9–Y.
   Go to paragraph 7–21.

   NO — Go to step 5.

5. Check for short between:
   P442–A2 and ground,
   P442–A4 and ground.
   Does short exist?

   YES — Go to step 8.

   NO — Go to step 6.

6. Check for short between P440–B17 and ground.
   Does short exist?

   YES — Go to step 7.

   NO — Go to step 8.

7. Detach P18. Check for short between P440–B17 and ground.
   Does short exist?

   YES — Repair shorted wire between P440–B–17 and P18–2.
   Go to paragraph 7–21.

   NO — Replace pilot caution/warning panel (TM 1-1520-238-23).

7–33. RTR BRK CIRCUIT BREAKER – DOES NOT STAY CLOSED (cont) 7–33

8. Detach P173 and P914. Check for short between:
   P173–Z and ground,
   P173–C and ground,
   P173–a and ground,
   P173–b and ground.
   Does short exist?

   YES — Repair shorted wire between:
   P173–Z and P441–A4,
   P173–C and P441–A7,
   P173–a and J914–B7,
   P173–b and J914–B8.
   Go to paragraph 7–21.

   NO — Go to step 10.

9. Detach P1072. Check for short between:
   P442–A2 and ground,
   P442–A4 and ground.
   Does short exist?

   YES — Repair shorted wire between:
   P442–A2 and P1072–A,
   P442–A4 and P1072–B.
   Go to paragraph 7–21.

   NO — Replace rotor brake pressure switch (TM 1-1520-238-23).

10. Attach P173. Set meter to low scale (R x 10). Check for short between P441–A7 and ground.
    Does short exist?

    YES — Replace pilot power quadrant panel (TM 1-1520-238-23).

    NO — Go to step 11.

11. Check for short between P441–A4 and ground while setting pilot power quadrant **RTR BK** switch to **OFF** and **BRAKE**.
    Does short exist?

    YES — Go to step 13.

    NO — Go to step 12.

12. Detach P238. Check for short between:
    P914–B7 and ground,
    P914–B8 and ground.
    Does short exist?

    YES — Repair shorted wire between:
    P914–B7 and J436–A16,
    P436–A16 and P238–15,
    P914–B8 and J436–A15,
    P436–A15 and P238–1.
    Go to paragraph 7–21.

    NO — Replace utility manifold (TM 1-1520-238-23).

13. Remove pilot power quadrant panel (TM 1-1520-238-23). On pilot power quadrant **RTR BK** switch (A24)S86, tag and remove terminal lugs from S86–3, S86–5, S86–11. Check for short between (A24):
    S86–3 and ground,
    S86–5 and ground,
    S86–11 and ground.
    Does short exist?

    YES — Repair shorted wire between (A24):
    J1–Z and S86–5,
    J1–a and S86–11.
    Go to paragraph 7–21.

    NO — Go to step 14.

14. Check for short between (A24)S86–3 and ground.
    Does short exist?

    YES — Go to step 15.

    NO — Replace pilot power quadrant **RTR BK** switch (A24)S86 (TM 1-1520-238-23).

15. On pilot power quadrant set engine **NO 1 PWR** lever to **FLY**. Check for short between (A24)S86–3 and ground.
Does short exist?

YES	Replace pilot power quadrant engine 2 interlock switch S40 (TM 1-1520-238-23).
NO	Replace pilot power quadrant engine 1 interlock switch S87 (TM 1-1520-238-23).

END OF TASK

7–34. ROTOR BRAKE – DOES NOT RELEASE 7–34

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer (2)

References:

TM 1-1520-238-23

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. With **RTR BK** switch set to **OFF**, check **RTR BRK** circuit breaker.
   Is circuit breaker open?
   - YES — Go to paragraph 7–33.
   - NO — Go to step 2.
2. Check for 28 VDC at P238–15.
   Is voltage present?
   - YES — Go to step 5.
   - NO — Go to step 3.
3. Check for 28 VDC at P173–Z.
   Is voltage present?
   - YES — Go to step 4.
   - NO — Repair open wire between P173–Z and (A402)TB2–9–R. Go to paragraph 7–21.
4. Check for open between P173–a and P238–15.
   Does open exist?
   - YES — Repair open wire. Go to paragraph 7–21.
   - NO — Replace pilot power quadrant. (TM 1-1520-238-23).
5. Check for open between P238–14 and GS630–B.
   Does open exist?
   - YES — Repair open wire. Go to paragraph 7–21.
   - NO — Go to step 6.
6. Remove rotor brake off solenoid (TM 55–1520–238–23). Check for open between (HP2):
   J1–15 and J5–A,
   J1–14 and J5–D.
   Does open exist?
   - YES — Replace utility hydraulic manifold (TM 1-1520-238-23).
   - NO — Replace rotor brake off solenoid (TM 1-1520-238-23).

END OF TASK

7–35. RTR BK INDICATOR – REMAINS LIGHTED WITH ROTOR BRAKE RELEASED 7–35

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer (2)

References:

TM 1-1520-238-T-6
TM 1-1520-238-23

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. Check for 28 VDC at P18–2.
   Is voltage present?

YES	Go to step 2.
NO	Refer to TM 1-1520-238-T-6 to troubleshoot pilot caution/warning system.

2. Check for open between S88–A and S88–B.
   Does open exist?

YES	Replace shorted connector P1072 (TM 1-1520-238-23).
NO	Replace rotor brake pressure switch (TM 1-1520-238-23).

END OF TASK

7–36. ROTOR BRAKE – DOES NOT STOP ROTOR ROTATION 7–36

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer (2)

References:

TM 1-1520-238-T-6
TM 1-1520-238-23

Equipment Conditions:

Ref	Condition
TM 1-1520-238-23	Access provisions – 250R, 250L, 290R, 290L and L325 doors open

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. On pilot power quadrant, set **RTR BK** switch to **BRAKE** and **PWR** levers to **OFF**. Check for 28 VDC at P238–1.
   Is voltage present?
   - YES — Go to step 2.
   - NO — Go to step 3.
2. Check for 90 ±9 ohms resistance between (HP2):
   J1–5 and J1–1.
   Is resistance present?
   - YES — Repair open wire between P238–5 and GS630–F. Go to paragraph 7–21.
   - NO — Go to step 6.
3. Check for 28 VDC at P173–Z.
   Is voltage present?
   - YES — Go to step 5.
   - NO — Go to step 4.
4. Check for 28 VDC at (A76)J1–n.
   Is voltage present?
   - YES — Repair open wire between: (A402)TB2–9–N and P463–n, (A402)TB2–9–R and P173–Z, or replace (A402)TB2–9. Go to paragraph 7–21.
   - NO — Refer to TM 1-1520-238-T-6 to troubleshoot circuit protection system (dc emergency bus – pilot station).
5. Set **RTR BK** switch to **BRAKE** and **PWR** levers to **OFF**. Check for open between (A24): J1–Z and J1–b.
   Does open exist?
   - YES — Replace pilot power quadrant (TM 1-1520-238-23).
   - NO — Repair open wire between 173–b and P238–1. Go to paragraph 7–21.
6. Remove utility manifold rotor brake **ON** solenoid (TM 1-1520-238-23). Check for open between (HP2):
   J1–1 and J9–D,
   J1–5 and J9–A.
   Does open exist?
   - YES — Replace utility hydraulic manifold (TM 1-1520-238-23).
   - NO — Replace utility manifold rotor brake **ON** solenoid (TM 1-1520-238-23).

END OF TASK

7–37. RTR BK INDICATOR – IS NOT LIGHTED 7–37

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer (2)

References:

TM 1-1520-238-T-6
TM 1-1520-238-23

Equipment Conditions:

Ref	Condition
Paragraph 7–21	Rotor brake engaged

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. Check for 28 VDC at P1072–B.
   Is voltage present?
   - YES — Go to step 3.
   - NO — Go to step 2.
2. Check for 28 VDC at (A76)J1–n.
   Is voltage present?
   - YES — Repair open wire between: P463–n and P441–A3, P442–A4 and P1072–B, (A402): J5–A4 and TB2–9–P, J24–A3 and TB2–9–N, or replace TB2–9. Go to paragraph 7–21.
   - NO — Refer to TM 1-1520-238-T-6 to troubleshoot circuit protection system (dc emergency bus – pilot station).
3. Check for open between S88–A and S88–B.
   Does open exist?
   - YES — Replace rotor brake pressure switch (S88) (TM 1-1520-238-23).
   - NO — Go to step 4.
4. Check for 28 VDC at (A402)J16–B17.
   Is voltage present?
   - YES — Go to step 5.
   - NO — Repair open wire between: P442–A2 and P1072–A, (A402): J16–B17 and TB2–9–T, J5–A2 and TB2–9–W, or replace TB2–9. Go to paragraph 7–21.
5. Check for open between P18–2 and P440–B17.
   Does open exist?
   - YES — Repair open wire. Go to paragraph 7–21.
   - NO — Refer to TM 1-1520-238-T-6 to troubleshoot pilot and CPG caution/warning system.

END OF TASK

7–38. UTIL HYD INDICATOR – DOES NOT INDICATE 3000 PSI (APU OPERATING) 7–38

Tools:

Nomenclature	Part Number
Tool Kit, Aircraft Mechanic's	SC518099CLA01

Personnel Required:

67R Attack Helicopter Repairer (2)

References:

TM 1-1520-238-T-4
TM 1-1520-238-T-8
TM 1-1520-238-23

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. Start APU (TM 1-1520-238-23).
   Is APU shaft 7 turning?

   YES — Go to step 2.

   NO — Refer to TM 1-1520-238-T-8 to troubleshoot APU system.

2. Shutdown APU (TM 1-1520-238-23). Remove utility hydraulic pump (TM 1-1520-238-23).
   Is utility hydraulic pump shaft sheared?

   YES — Replace utility hydraulic pump (TM 1-1520-238-23).

   NO — Refer to TM 1-1520-238-T-4 to troubleshoot drive system.

END OF TASK

7–39. TAIL WHEEL ADVISORY LIGHT – IS NOT LIGHTED 7–39

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer (2)

References:

TM 1-1520-238-T-6
TM 1-1520-238-23

Equipment Conditions:

Ref	Condition
TM 1-1520-238-23	Tail landing gear lock actuator target adjustment – completed Access provisions – L90 door open

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. Check for 28 VDC at P748–C.
   Is voltage present?
   - YES — Go to step 2.
   - NO — Go to step 3.

2. Check for open between P748–A and P748–B.
   Does open exist?
   - YES — Repair open wire. Go to paragraph 7–21.
   - NO — Replace multi–channel dimming controller (TM 1-1520-238-23).

3. Check for 28 VDC at P754–A.
   Is voltage present?
   - YES — Go to step 6.
   - NO — Go to step 4.

4. Check for 28 VDC at P1–15.
   Is voltage present?
   - YES — Go to step 5.
   - NO — Refer to TM 1-1520-238-T-6 to troubleshoot circuit protection system (dc emergency bus – pilot station).

5. With **TAIL WHEEL** switch set to **UNLOCK**, check for open between (A331): S1–2 and S1–3.
   Does open exist?
   - YES — Replace **TAIL WHEEL** switch (TM 1-1520-238-23).
   - NO — Repair open wire between: P754–A and (A331)S1–3, (A402)TB2–9–A and (A331)S1–2, (A402)TB2–9–D and (A402)J1–15. Go to paragraph 7–21.

6. Check for open between P754–B and ground.
   Does open exist?
   - YES — Repair open wire between P754–B and GS682–F. Go to paragraph 7–21.
   - NO — Go to step 7.

7. Check for open between HP5–A and HP5–B.
Does open exist?

YES	Replace tail wheel lock control valve (TM 1-1520-238-23).
NO	Go to step 8.

8. Check for open between P760–3 and ground.
Does open exist?

YES	Repair open wire between: P760–3 and GS690–K. Go to paragraph 7–21.
NO	Go to step 9.

9. Check for 28 VDC at P760–1.
Is voltage present?

YES	Go to step 10.
NO	Repair open wire between P760–1 and (A402)TB2–9–B. Go to paragraph 7–21.

10. Detach wire at XK34–A1.
Check for 28 VDC at XK34–A1.
Is voltage present?

YES	Repair open wire between: XK34–A1 and P748–C. Go to paragraph 7–21.
NO	Go to step 11.

11. Check for 300 to 340 ohms resistance between: K34–X1 and K34–X2.
Is resistance present?

YES	Go to step 12.
NO	Replace relay K34. (TM 1-1520-238-23).

12. Check for open between:
XK34–A2 and P760–1,
XK34–X1 and P760–1,
XK34–X2 and P760–2.
Does open exist?

YES	Repair open wire. Go to paragraph 7–21.
NO	Replace tail wheel lock proximity switch. (TM 1-1520-238-23).

END OF TASK

7–40. TAIL WHEEL LOCK ACTUATOR – DOES NOT UNLOCK TAIL WHEEL 7–40

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer (2)

References:

TM 1-1520-238-23

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. On pilot center circuit breaker panel, check **TWHL LOCK** circuit breaker.
   Does circuit breaker stay closed?
   - YES — Go to step 2.
   - NO — Go to paragraph 7–41.
2. With **TAIL WHEEL** switch in **UNLOCK** position, check for 28 VDC at P754–A.
   Is voltage present?
   - YES — Go to step 3.
   - NO — Go to step 6.
3. Check for open between P754–B and GS682–F.
   Does open exist?
   - YES — Repair open wire between P754–B and GS682–F. Go to paragraph 7–21.
   - NO — Go to step 4.
4. On pilot caution/warning panel, check **OIL LOW UTIL HYD** indicator.
   Is OIL LOW UTIL HYD indicator illuminated?
   - YES — Go to step 5.
   - NO — Replace tail wheel lock control valve (TM 1-1520-238-23).
5. Shut down AGPU (TM 1-1520-238-23). Check utility hydraulic system for leaks.
   Do leaks exists?
   - YES — Repair leaking components (TM 1-1520-238-23).
   - NO — Service utility manifold reservoir (TM 1-1520-238-23). Go to paragraph 7–21.
6. Check for open between J527–A14 and J527–A15.
   Does open exist?
   - YES — Replace **TAIL WHEEL** switch (TM 1-1520-238-23).
   - NO — Go to step 7.
7. Check for 28 VDC at P527–A14.
   Is voltage present?
   - YES — Repair open wire between P527–A15 and P754–A. Go to paragraph 7–21.
   - NO — Repair open wire between P527–A14 and CB59–2. Go to paragraph 7–21.

END OF TASK

7–41. TWHL LOCK CIRCUIT BREAKER (CB59) – DOES NOT STAY CLOSED 7–41

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45
Extractor, Relay	CTJ-RO6

Personnel Required:

68X Armament/Electrical Systems Repairer

References:

TM 1-1520-238-T-6
TM 1-1520-238-23

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. Open **TWHL LOCK** circuit breaker. Check for short between P1–15 and ground.
   Does short exist?

   YES — Repair shorted wire between (A76)P1–15 and CB59. Go to paragraph 7–21.

   NO — Go to step 2.

2. Identify and detach wires from (A402): TB2–9–A, TB2–9–B, TB2–9–C, and TB2–9–D. Check for short between (A402):
   J1–15 and ground,
   J24–A6 and ground,
   J27–A6 and ground,
   J5–A1 and ground.
   Does short exist?

   YES — Repair shorted wire between (A402):
   J1–15 and TB2–9–D,
   J27–A6 and TB2–9–B,
   J5–A1 and TB2–9–C.
   Go to paragraph 7–21.

   NO — Go to step 3.

3. Check for short between P441–A6 and ground.
   Does short exist?

   YES — Go to step 4.

   NO — Go to step 7.

4. Check for short between P527–A15 and ground.
   Does short exist?

   YES — Go to step 5.

   NO — Go to step 6.

5. Detach P754. Check for short between P527–A15 and ground.
   Does short exist?

   YES — Repair shorted wire between P527–A15 and P754–A. Go to paragraph 7–21.

   NO — Replace tail wheel lock control valve (TM 1-1520-238-23).

7–41. TWHL LOCK CIRCUIT BREAKER (CB59) – DOES NOT STAY CLOSED (cont) 7–41

6. Identify and detach wires from (A331): S1–2 and S1–3. Check for short between: J527–A14 and ground, J527–A15 and ground, P527–A14 and ground.
   Does short exist?

   YES — Repair shorted wire between: J527–A14 and (A331)S1–2, J527–A15 and (A331)S1–3, P527–A14 and P441–A6. Go to paragraph 7–21.

   NO — Replace **TAIL WHEEL** switch (TM 1-1520-238-23).

7. Check for short between P442–A1 and ground.
   Does short exist?

   YES — Go to step 8.

   NO — Go to step 9.

8. Detach P1011. Check for short between P442–A1 and ground.
   Does short exist?

   YES — Repair shorted wire between P442–A1 and P1011–A. Go to paragraph 7–21.

   NO — Replace utility shutoff valve solenoid (TM 1-1520-238-23).

9. Check for short between P402–B9 and ground.
   Does short exist?

   YES — Go to step 10.

   NO — Repair shorted wire between P431–A6 and J402–B9. Go to paragraph 7–21.

10. Detach P760. Check for short between P402–B9 and ground.
    Does short exist?

    YES — Go to step 11.

    NO — Replace tail landing gear proximity switch (TM 1-1520-238-23).

11. Remove tail wheel lock relay. Check for short between P402–B9 and ground.
    Does short exist?

    YES — Repair shorted wire between: P402–B9 and XK34–A2, P402–B9 and XK34–X1, P402–B9 and P760–1. Go to paragraph 7–21.

    NO — Replace relay K34 (TM 1-1520-238-23).

END OF TASK

7–42. EMERGENCY HYDRAULIC PRESSURE INDICATOR – DOES NOT INDICATE 3000 PSI 7–42

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer (2)

References:

TM 1-1520-238-23

Equipment Conditions:

Ref	Condition
TM 1-1520-238-23	Hydraulic system leak check – completed

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. Check for 28 VDC at P238–9.
   Is voltage present?

   YES — Go to step 2.

   NO — Repair open wire between (A402)TB2–9–J and P238–9, or replace (A402)TB2–9. Go to paragraph 7–21.

2. Check for open between P238–10 and ground.
   Does open exist?

   YES — Repair open wire between P238–10 and GS630–C. Go to paragraph 7–21.

   NO — Go to step 3.

3. Verify AGPU pressure for 3000 psi (TM 1-1520-238-23). Check for 4.2 VDC at P746–C and P746–D.
   Is voltage present?

   YES — Replace emergency hydraulic pressure indicator (TM 1-1520-238-23).

   NO — Go to step 4.

4. Check for open between:
   P746–C and P238–24,
   P746–D and P238–23.
   Does open exist?

   YES — Repair open wire. Go to paragraph 7–21.

   NO — Go to step 5.

5. Remove emergency hydraulic pressure transducer (TM 1-1520-238-23). Check for open between (HP2):
   J1–9 and J8–D,
   J1–10 and J8–C,
   J1–23 and J8–B,
   J1–24 and J8–A.
   Does open exist?

   YES — Replace utility hydraulic manifold (TM 1-1520-238-23).

   NO — Replace emergency hydraulic pressure transducer (TM 1-1520-238-23).

END OF TASK

7–43. EMERG HYD CIRCUIT BREAKER – DOES NOT STAY CLOSED 7–43

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer

References:

TM 1-1520-238-T-6
TM 1-1520-238-23

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. Open **EMERG HYD** circuit breaker. Check for short between (A76):
   J1–k and ground,
   J1–m and ground.
   Does short exist?

   YES — Refer to TM 1-1520-238-T-6 to troubleshoot circuit protection system (dc emergency bus – pilot station).

   NO — Go to step 2.

2. On CPG power quadrant panel, set **EMERG HYD PWR** switch to **OFF**. On pilot instrument panel, set **EMERG HYD** pressure switch to **OFF**. Check for short between P463–k and ground.
   Does short exist?

   YES — Go to step 6.

   NO — Go to step 3.

3. Detach P238 and P239. Check for short between P463–m and ground.
   Does short exist?

   YES — Go to step 11.

   NO — Go to step 4.

4. Check for short between (HP1)J6–6 and chassis ground.
   Does short exist?

   YES — Go to step 5.

   NO — Go to step 9.

5. Remove primary hydraulic pressure transducer (TM 1-1520-238-23). Check for short between (HP1)J6–6 and ground.
   Does short exist?

   YES — Replace primary hydraulic manifold (TM 1-1520-238-23).

   NO — Replace primary hydraulic pressure transducer.

6. Detach P190. Check for short between P463–k and ground.
   Does short exist?

   YES — Go to step 7.

   NO — Replace CPG power quadrant panel (TM 1-1520-238-23).

7. Detach wires at (A331)S2–2. Check for short between P463–k and ground.
   Does short exist?

   YES — Repair shorted wire between:
   P463–k and P527–A7
   J527–A7 and (A331)S2–2.
   Go to paragraph 7–21.

   NO — Go to step 8.

8. Check for short between (A331)S2–2 wire ends and ground.
Does short exist?

   YES — Repair shorted wire between: P190–7 and P527–A6, J527–A6 and (A331)S2–2. Go to paragraph 7–21.

   NO — Replace pilot **EMERG HYD** pressure switch (TM 1-1520-238-23).

9. Check for short between (HP2)J1–11 and chassis ground.
Does short exist?

   YES — Go to step 10.

   NO — Go to step 12.

10. Remove utility hydraulic pressure transducer (TM 55–1520–238–23). Check for short between (HP2)J1–11 and chassis ground.
Does short exist?

   YES — Replace utility hydraulic manifold (TM 1-1520-238-23).

   NO — Replace utility hydraulic pressure transducer (TM 1-1520-238-23).

11. Detach wire at (A402)TB2–9–J. Check for short between P463–m and ground.
Does short exist?

   YES — Repair shorted wire between: P463–m and P441–A2, P441–A5 and P239–6. (A402): J24–A2 and TB2–9–K, TB2–9–L and J24–A5. Go to paragraph 7–21.

   NO — Repair shorted wire between: P442–A3 and P238–11, P238 SP2 and P238–9. (A402): TB2–9–J and J5–A3. Go to paragraph 7–21.

12. Remove emergency hydraulic pressure transducer (TM 1-1520-238-23). Check for short between (HP2)J1–9 and chassis ground.
Does short exist?

   YES — Replace utility hydraulic manifold (TM 1-1520-238-23).

   NO — Replace emergency hydraulic pressure transducer (TM 1-1520-238-23).

END OF TASK

7–44. EMERGENCY HYDRAULIC FLIGHT CONTROLS – DO NOT FUNCTION PROPERLY 7–44

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer (2)

References:

TM 1-1520-238-T-6
TM 1-1520-238-23

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. Check **EMERG HYD** circuit breaker.
   Is circuit breaker closed?
   - YES — Go to step 2.
   - NO — Go to paragraph 7–43.
2. Set **EMERG HYD** switch to **EMERG HYD**. Check for 28 VDC at P238–13.
   Is voltage present?
   - YES — Go to step 3.
   - NO — Go to step 5.
3. Check for open between P238–4 and GS631–B.
   Does open exist?
   - YES — Repair open wire. Go to paragraph 7–21.
   - NO — Go to step 4.
4. Remove utility hydraulic manifold override solenoid (TM 1-1520-238-23). Check for open between (HP2):
   J1–13 and J4–A,
   J1–4 and J4–D.
   Does open exist?
   - YES — Replace utility hydraulic manifold (TM 1-1520-238-23).
   - NO — Replace utility hydraulic manifold override solenoid (TM 1-1520-238-23).
5. Check for 28 VDC at P527–A7.
   Is voltage present?
   - YES — Go to step 6.
   - NO — Go to step 7.
6. Check for open between J527–A7 and P238–13.
   Does open exist?
   - YES — Repair open wire. Go to paragraph 7–21.
   - NO — Replace pilot **EMERG HYD** switch S2. Go to paragraph 7–21.
7. Check for 28 VDC at (A76)J1–K.
   Is voltage present?
   - YES — Repair open wire between P463–K and P527–A7.
   - NO — Refer to TM 1-1520-238-T-6 to troubleshoot circuit protection system (dc emergency bus – pilot station).

END OF TASK

7–45. PRESSURIZED AIR SYSTEM – MAINTENANCE OPERATIONAL CHECK 7–45

Tools:

Nomenclature	Part Number
Tool Kit, Aircraft Mechanic's	SC518099CLA01

Personnel Required:

67R Attack Helicopter Repairer
152FG Maintenance Test Pilot

References:

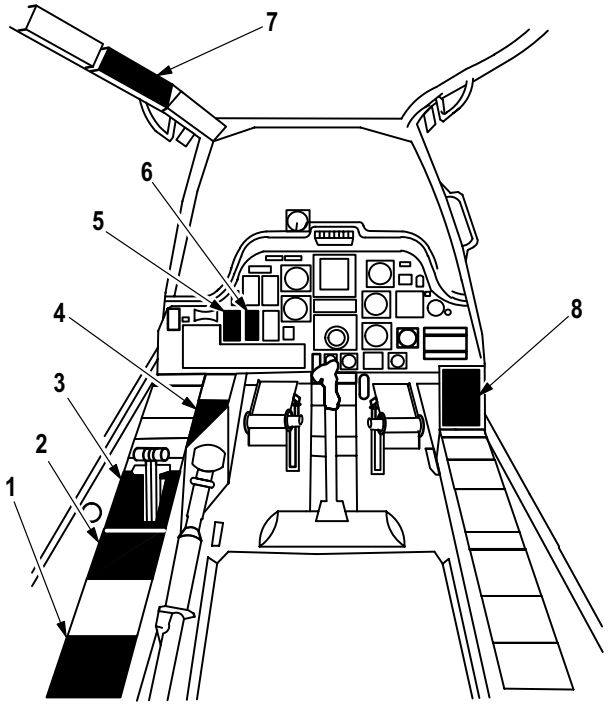
TM 1-1520-238-T-4
TM 1-1520-238-T-7
TM 1-1520-238-T-8
TM 1-1520-238-23
TM 1-1520-238-CL

Equipment Conditions:

Ref	Condition
TM 1-1520-238-23	Helicopter safed Access provisions – L325, T250L, T250R, T290L, and T290R doors opened External power application – Electrical Pressurized air
TM 1-1520-238-T-4	Maintenance headset connected

NOTE

Refer to pilot station (fig. 7–50) for cockpit configuration and equipment.



1. PILOT ANTI ICE PANEL
2. PILOT FUEL PANEL
3. PILOT POWER QUADRANT
4. PILOT ECS PANEL
5. PILOT FUEL QUANTITY INDICATOR
6. PILOT N_G RPM% INDICATOR
7. PILOT CENTER CIRCUIT BREAKER PANEL
8. PILOT CAUTION/WARNING PANEL

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Figure 7–50. Pilot Station

NOTE

If referenced out of one paragraph or volume into another for additional troubleshooting, upon completion of the task, return to the maintenance operational check for the original paragraph or volume.

WARNING

Make sure all helicopter safing procedures are accomplished. Observe all safety precautions during troubleshooting and maintenance operations. Failure to do so could result in death or serious injury. If injury occurs, get medical aid immediately.

1. Check to ensure that bleed air shutoff valve indicator is in the **CLOSED** position. If valve indicator is in **OPEN** position (fig. 7–51), replace bleed air shutoff valve (TM 1-1520-238-23).

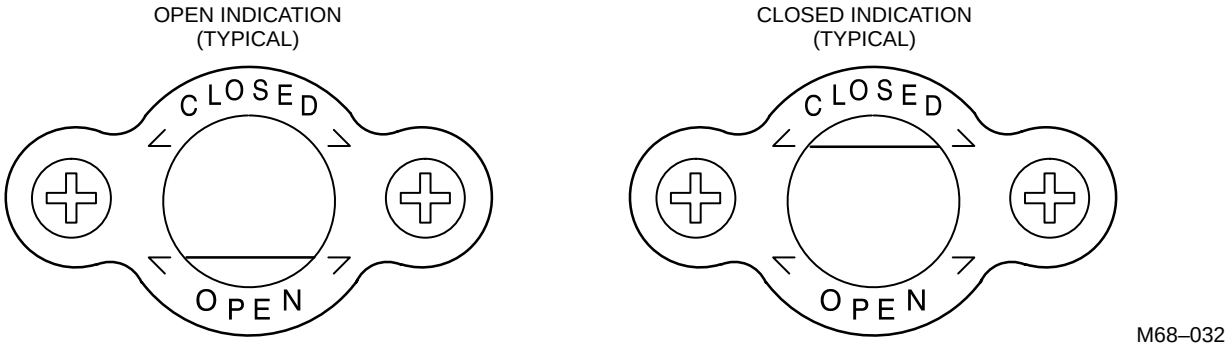


Figure 7–51. Bleed Air Shutoff Valve Indicator

2. Deleted.

3. Perform visual check of pressurized air system, main transmission, and APU. If any damage or leakage is found, repair leaking/damaged component. If air flow is present at SDC overboard exhaust, replace SDC check valve (TM 1-1520-238-23).

4. Remove external power application – pressurized air (TM 1-1520-238-23).

5. Check to ensure that bleed air shutoff valve indicator is in the **CLOSED** position. If valve indicator is in **OPEN** position, replace bleed air shutoff valve (TM 1-1520-238-23).

WARNING

PAS components get hot during operation. To prevent possible burns, avoid touching hot surfaces. If injury occurs seek medical aid immediately.

6. Complete the maintenance operational check as follows:

Task	Result
a. With **ENCU** switch on pilot **ECS** panel (fig. 7–52) set to **ON**, start/operate APU (TM 1-1520-238-CL). On pilot center circuit breaker panel (fig.7–53), check **FUEL BST** circuit breaker stays closed. On pilot caution/warning panel (fig.7–54), check that **SHAFT DRIVEN COMP** indicator remains lighted approximately 60 seconds after APU start.	If **FUEL BST** circuit breaker does not stay closed, go to paragraph 7–47. If **SHAFT DRIVEN COMP** indicator is not lighted for approximately 60 seconds after APU start, go to paragraph 7–48. If **SHAFT DRIVEN COMP** indicator remains lighted longer than approximately 60 seconds after APU start, go to paragraph 7–49. If APU fails to start, refer to TM 1-1520-238-T-8 to troubleshoot APU.

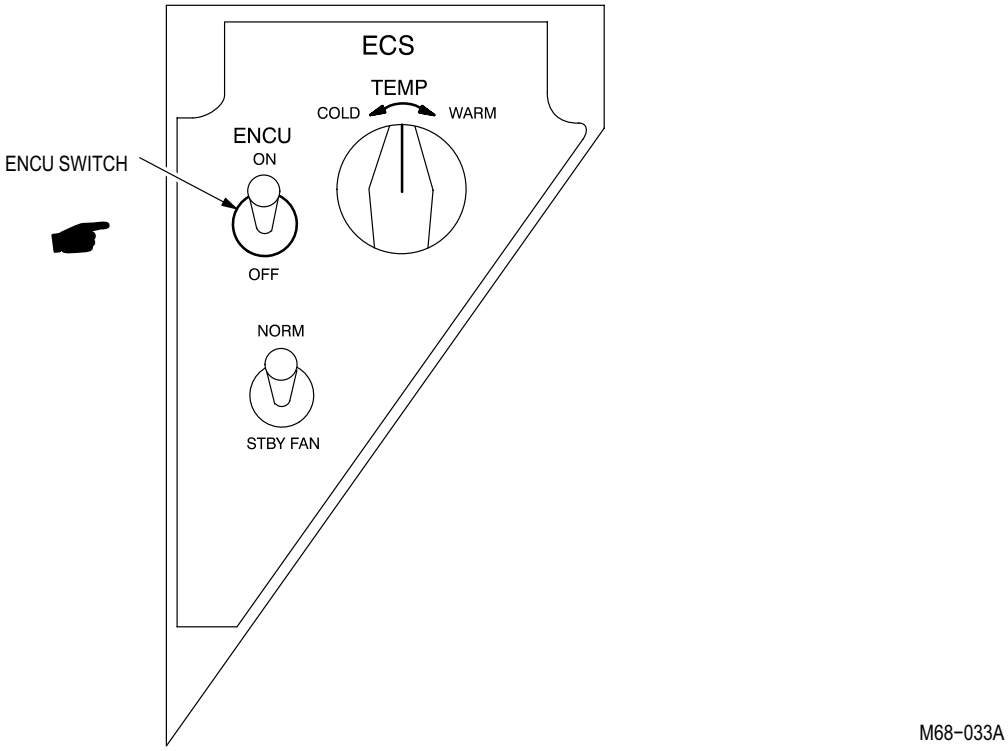


Figure 7–52. Pilot ECS Panel

7–45. PRESSURIZED AIR SYSTEM – MAINTENANCE OPERATIONAL CHECK (cont) 7–45

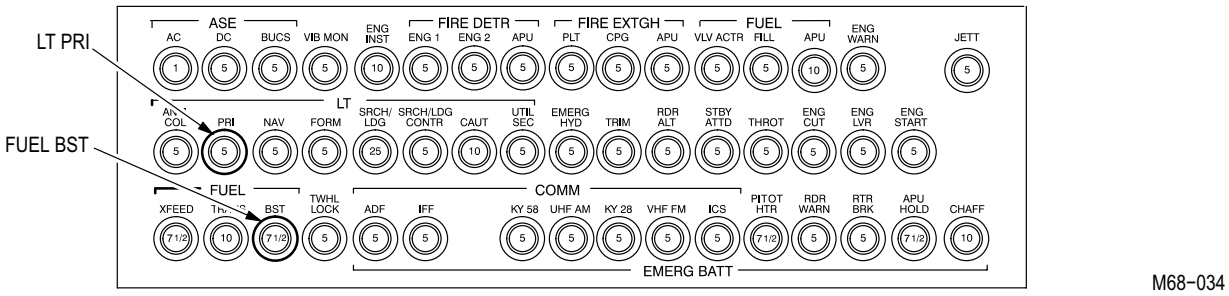


Figure 7–53. Pilot Center Circuit Breaker Panel

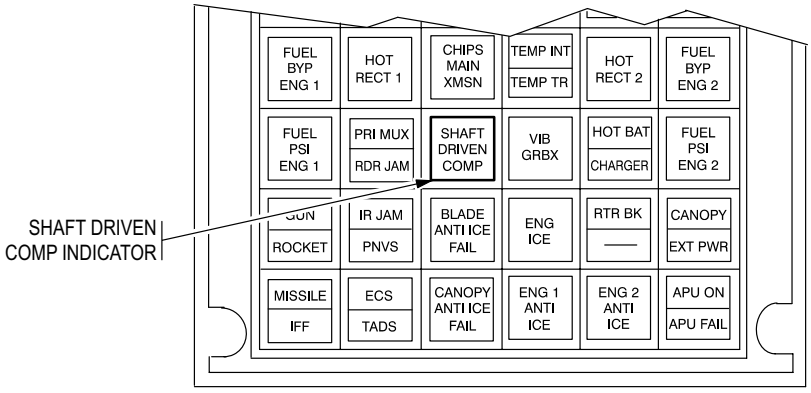


Figure 7–54. Pilot Caution/Warning Panel

WARNING

APU is operating. To prevent injury to personnel, avoid contact with rotating components and high pressure air discharge. Secure any loose clothing and personal articles. Failure to do so could result in death or serious injury. If injury occurs, get medical aid immediately.

Task	Result
b. Set **ENCU** temperature switch (fig. 7–52) to full **WARM**. On aft deck, check for pulsing air discharge from PAS overboard vent (fig. 7–55).	If a pulsing air discharge is present or a loud banging sound (surge) is heard, immediately shut down APU (TM 1-1520-238-CL) and replace SDC (TM 1-1520-238-23).
c. Check that air flows from ECS vents.	If air does not flow from ECS vents, have assistant check ENCU shutoff valve indicator on aft deck (fig. 7–51). If valve indicates **OPEN**, replace SDC (TM 1-1520-238-23). If valve indicates **CLOSED,** refer to TM 1-1520-238-T-8 to troubleshoot ECS.

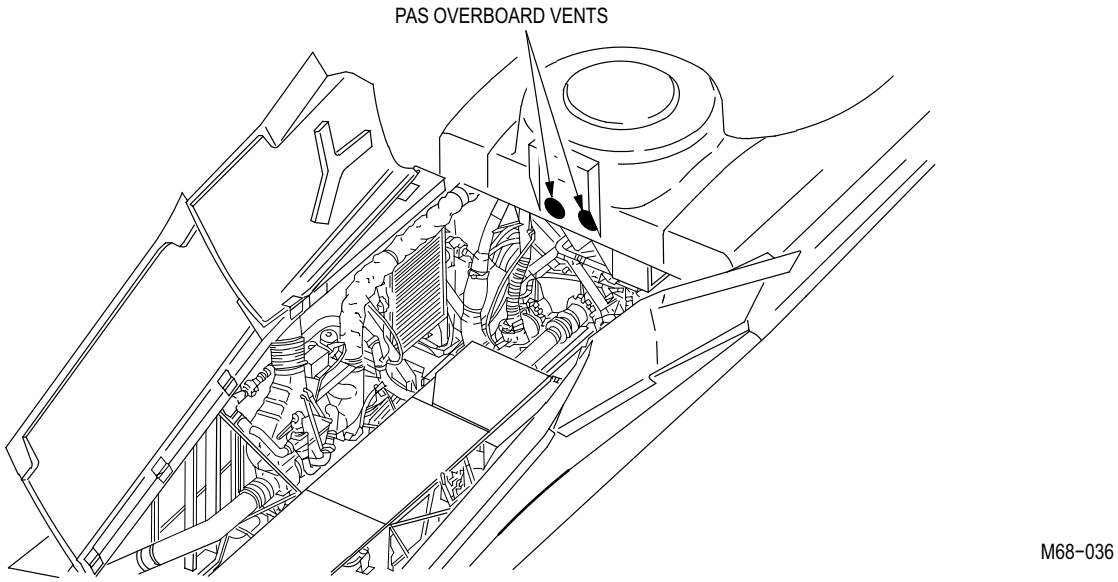


Figure 7–55. PAS Overboard Vents

Task	Result
d. On pilot **ECS** panel (fig. 7–52), set **ENCU** switch to **OFF**. Check that air flow from the ECS vents stops. After check is made, on pilot **ECS** panel (fig. 7–52), set **ENCU** switch to **ON**.	If air flow continues from vents, have assistant check ENCU shutoff valve indicator position (fig. 7–51) on aft deck. If valve position indicates **OPEN**, refer to TM 1-1520-238-T-8 to troubleshoot ECS system.
e. On pilot **ANTI ICE** panel (fig. 7–56), set **CANOPY DEFOG** switch to **ON**. Check that air flows from defog air mixers (fig. 7–57).	If air does not flow from defog air mixers, refer to TM 1-1520-238-T-8 to troubleshoot anti–ice system.

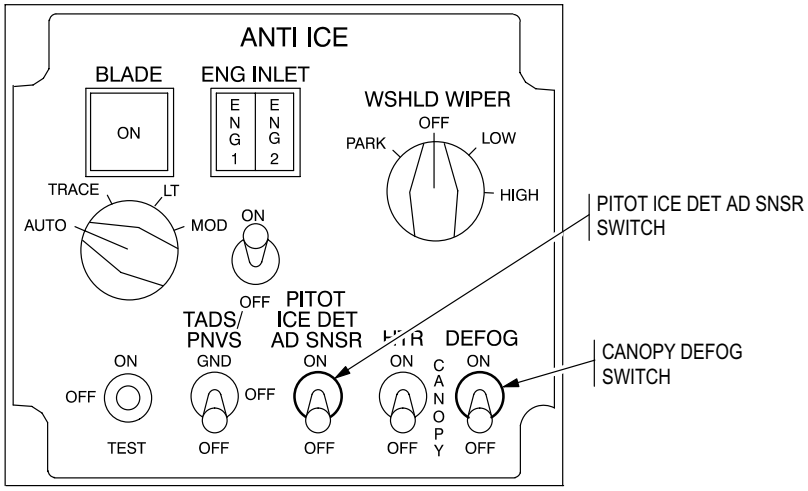


Figure 7–56. Pilot ANTI ICE Panel

f. On pilot **ANTI ICE** panel, (fig. 7–56), set **CANOPY DEFOG** switch to **OFF**. Check that air stops flowing from defog air mixers (fig. 7–57).

If air does not stop flowing from defog air mixers, refer to TM 1-1520-238-T-8 to troubleshoot pitot anti–ice system.

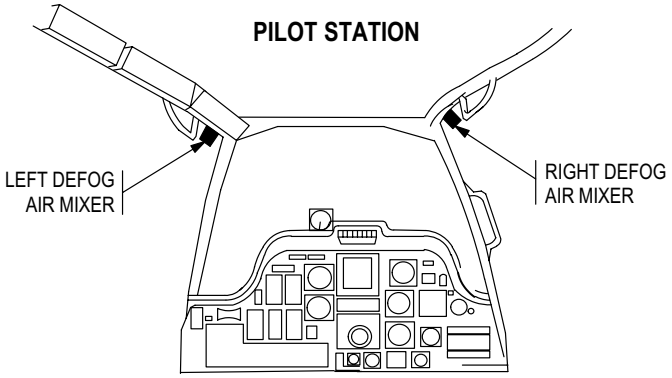


Figure 7–57. Defog Air Mixers

Task	Result
g. On pilot **ANTI ICE** panel (fig. 7–56), set **PITOT ICE DET AD SNSR** switch to **ON**. Check that air flows from rear of ice detector sensor (fig. 7–58).	If air does not flow from ice detector sensor refer to TM 1-1520-238-T-8 to troubleshoot anti–ice system.

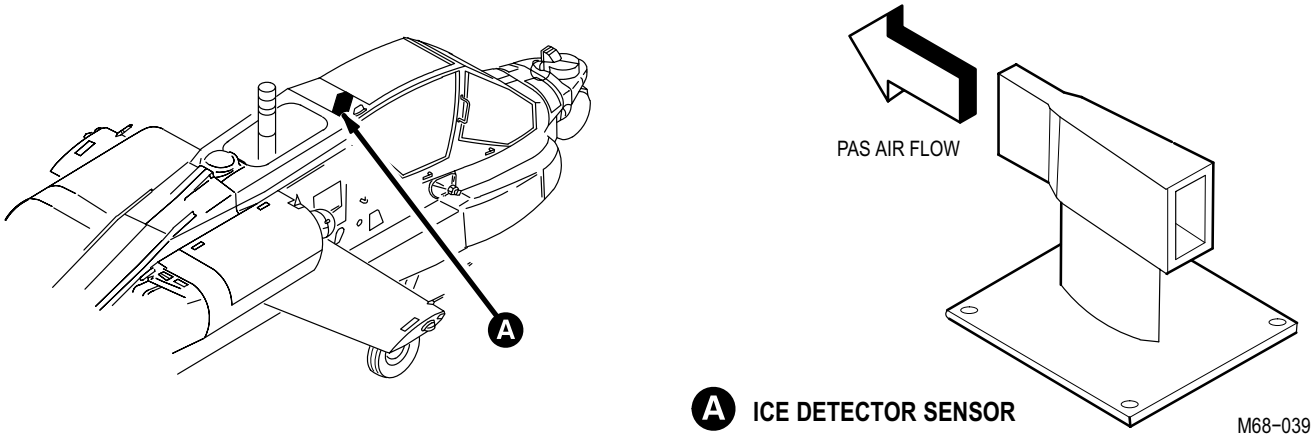


Figure 7–58. Ice Detector Sensor

h. On pilot **ANTI ICE** panel (fig. 7–56), set **PITOT ICE DET AD SNSR** switch to **OFF**. Air flow from ice detector sensor (fig. 7–58) stops.

If air flow from ice detector sensor does not stop, refer to TM 1-1520-238-T-8 to troubleshoot anti–ice system.

i. On pilot instrument panel, check **FUEL** quantity indicator (fig. 7–59). Note which tank has the greater amount of fuel.

If **FUEL** quantity indicator shows both tanks full, go to step l below.

j. On pilot **FUEL** panel (fig. 7–60), position **TRANS** switch as required to transfer fuel from the tank with the greater amount of fuel noted in step i above. **FUEL** quantity indicator shows fuel transfer.

If **FUEL** quantity indicator does not show fuel transfer, have assistant check for airflow at cockpit ECS vents. If airflow is present, go to TM 1-1520-238-T-7 to troubleshoot the fuel quantity indication/transfer system. If airflow is not present, locate and repair broken PAS manifold, or replace air pressure regulating valve TM 1-1520-238-23).

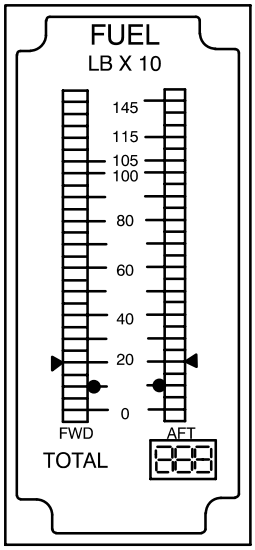


Figure 7–59. Pilot FUEL Quantity Indicator

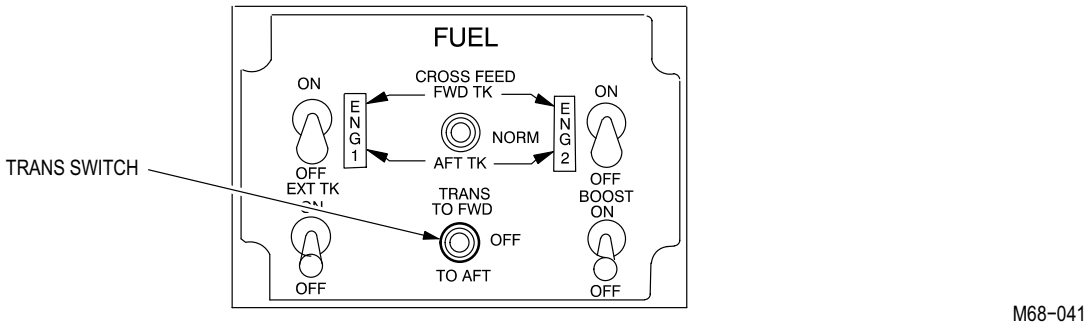
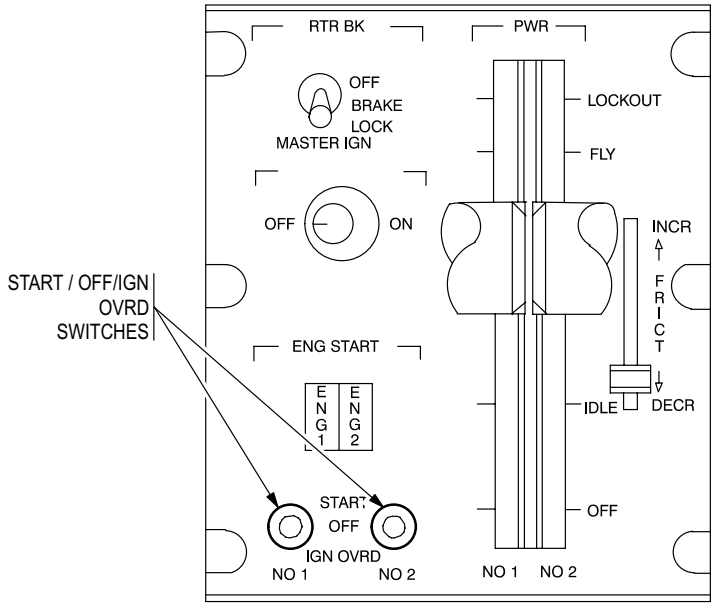


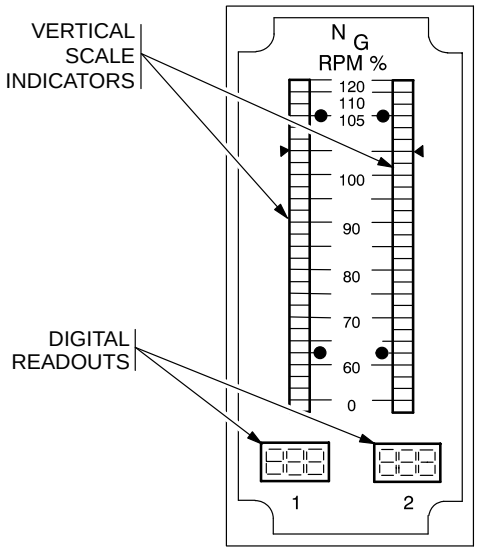
Figure 7–60. Pilot FUEL Panel

Task	Result
k. On pilot **FUEL** panel (fig. 7–60), set **TRANS** switch to **OFF**.	
l. Secure access doors L325, T250L, T250R, T290L and T290R (TM 1-1520-238-23).	
m. On pilot power quadrant (fig. 7–61), set **NO 1 START/OFF/IGN OVRD** switch to **IGN OVRD**.	
n. On pilot instrument panel, check that **N_G RPM%** indicator digital readout **1** (fig. 7–62) stabilizes at 22% minimum.	If **N_G RPM%** indicator digital readout **1** does not stabilize at 22% minimum, go to paragraph 7–52.
o. Repeat steps m and n for engine 2.	If **N_G RPM%** indicator digital readout **2** does not stabilize at 22% minimum, go to paragraph 7–53.



M68-042A

Figure 7–61. Pilot Power Quadrant



M68–043

Figure 7–62. Pilot N_G RPM% Indicator

Task	Result
p. Start/operate engine 1 (TM 1-1520-238-CL).	If loud banging sound is heard, refer to TM 1-1520-238-T-4 to troubleshoot ECS time delay relay. If engine 1 does not start refer to TM 1-1520-238-T-4 to troubleshoot engine 1.

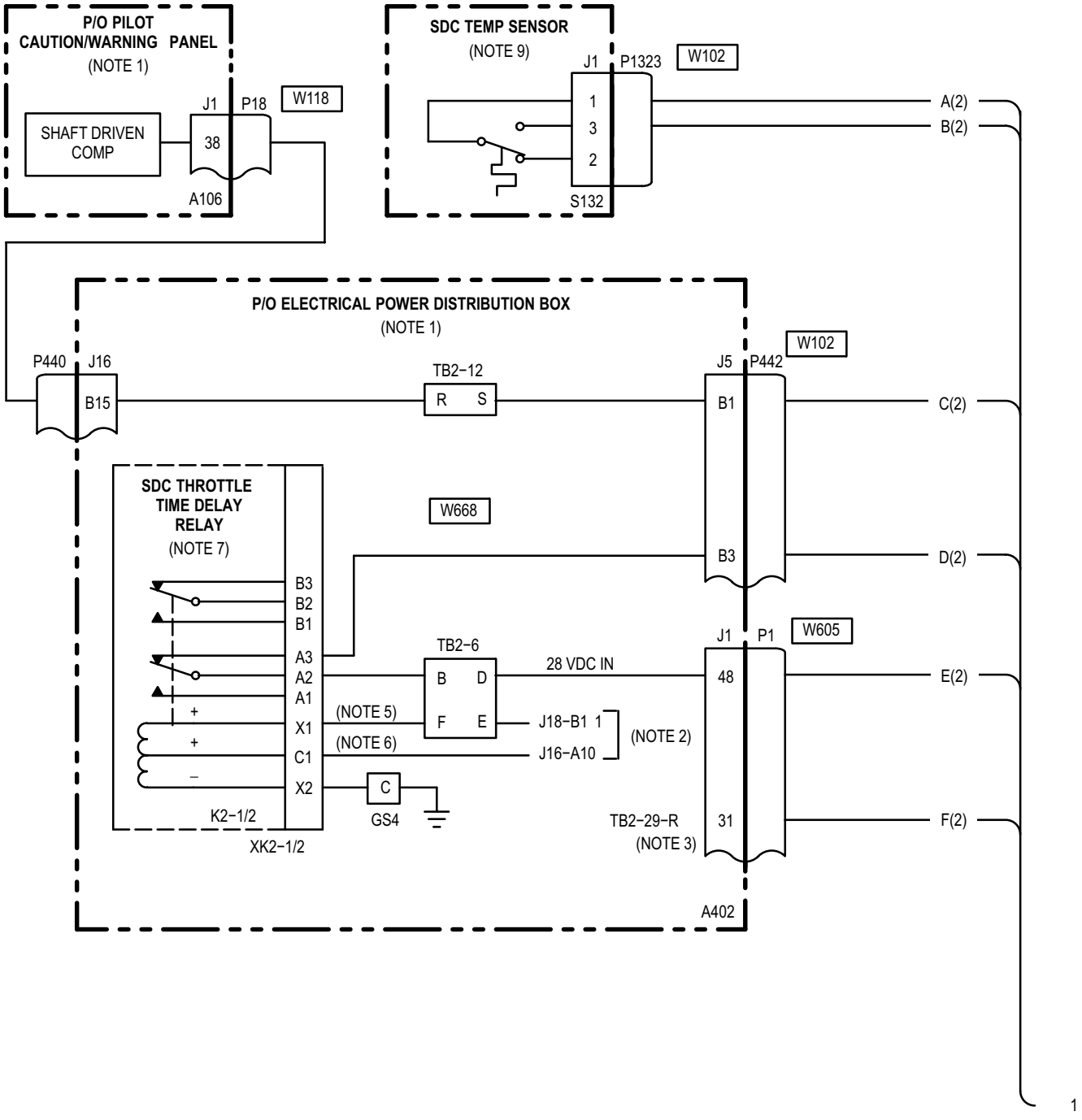
7–45. PRESSURIZED AIR SYSTEM – MAINTENANCE OPERATIONAL CHECK (cont) 7–45

q. With engine 1 operating, open **FUEL BST** circuit breaker on pilot center circuit breaker panel (fig. 7–53). Check for noticeable reduction of ECS airflow.	If ECS airflow is not reduced, go to paragraph 7–50. If PAS manifold loses pressure, replace bleed air shutoff valve (TM 1-1520-238-23).
r. With **FUEL BST** circuit breaker open and engine 1 supplying bleed air for PAS, transfer fuel back to original levels as in step h above. Check that **FUEL** quantity indicator shows transfer.	If **FUEL** quantity indicator does not show transfer, go to paragraph 7–51.
s. On pilot center circuit breaker panel, close **FUEL BST** circuit breaker. On pilot caution/warning panel, check that **SHAFT DRIVEN COMP** indicator is not lighted.	If **SHAFT DRIVEN COMP** indicator is lighted, go to paragraph 7–49.
t. Shut down engine 1 (TM 1-1520-238-CL).	
u. Open access doors L325, R200, T250L, T290L, and T290R (TM 1-1520-238-23).	
v. On aft deck, perform visual inspection of PAS components (TM 1-1520-238-23).	If PAS components are leaking, or appear damaged, replace (TM 1-1520-238-23).

7. Shut down APU TM 1-1520-238-CL).
8. Secure access doors L325, R200, T250L, T290L, and T290R (TM 1-1520-238-23).
9. Disconnect maintenance headset (TM 1-1520-238-T-4).

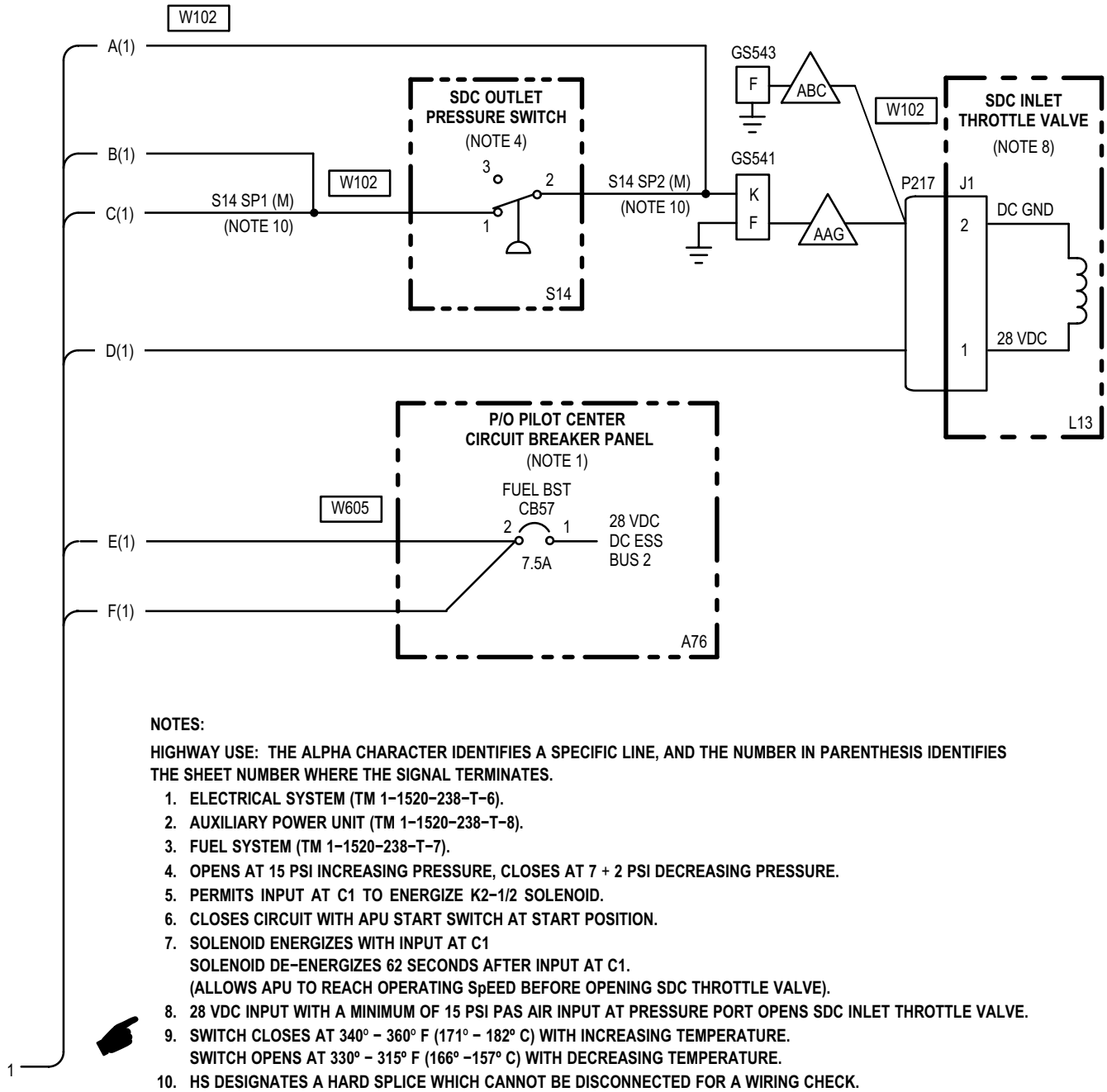
END OF TASK

7–46. PRESSURIZED AIR SYSTEM – WIRING INTERCONNECT DIAGRAM 7–46



M68−003−1A
SHEET 1 0F 2

7–46. PRESSURIZED AIR SYSTEM – WIRING INTERCONNECT DIAGRAM (cont) 7–46



NOTES:

HIGHWAY USE: THE ALPHA CHARACTER IDENTIFIES A SPECIFIC LINE, AND THE NUMBER IN PARENTHESIS IDENTIFIES THE SHEET NUMBER WHERE THE SIGNAL TERMINATES.

1. **ELECTRICAL SYSTEM (TM 1−1520−238−T−6).**
2. **AUXILIARY POWER UNIT (TM 1−1520−238−T−8).**
3. **FUEL SYSTEM (TM 1−1520−238−T−7).**
4. **OPENS AT 15 PSI INCREASING PRESSURE, CLOSES AT 7 + 2 PSI DECREASING PRESSURE.**
5. **PERMITS INPUT AT C1 TO ENERGIZE K2−1/2 SOLENOID.**
6. **CLOSES CIRCUIT WITH APU START SWITCH AT START POSITION.**
7. **SOLENOID ENERGIZES WITH INPUT AT C1**
   SOLENOID DE−ENERGIZES 62 SECONDS AFTER INPUT AT C1.
   (ALLOWS APU TO REACH OPERATING SpEED BEFORE OPENING SDC THROTTLE VALVE).
8. **28 VDC INPUT WITH A MINIMUM OF 15 PSI PAS AIR INPUT AT PRESSURE PORT OPENS SDC INLET THROTTLE VALVE.**
9. **SWITCH CLOSES AT 340° − 360° F (171° − 182° C) WITH INCREASING TEMPERATURE.**
   SWITCH OPENS AT 330° − 315° F (166° −157° C) WITH DECREASING TEMPERATURE.
10. **HS DESIGNATES A HARD SPLICE WHICH CANNOT BE DISCONNECTED FOR A WIRING CHECK.**
    M DESIGNATES SOFT SPLICE WHICH MAY BE DISCONNECTED FOR A WIRING CHECK.

M68−003−2B
SHEET 2 0F 2

7–47. FUEL BST CIRCUIT BREAKER – DOES NOT STAY CLOSED 7–47

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45
Extractor, Relay	CTJ-RO6

Personnel Required:

68X Armament/Electrical Systems Repairer

References:

TM 1-1520-238-T-6
TM 1-1520-238-T-7
TM 1-1520-238-T-8
TM 1-1520-238-23

Equipment Conditions:

Ref	Condition
TM 1-1520-238-23	Access provisions – R200 panel removed

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. Open **FUEL BST** circuit breaker. Check for short between P1–48 and ground.
   Does short exist?

   YES — Refer to TM 1-1520-238-T-6 to troubleshoot circuit protection system (dc emergency bus – pilot station).

   NO — Go to step 2.

2. Check for short between (A402)J1–48 and ground.
   Does short exist?

   YES — Go to step 3.

   NO — Refer to TM 1-1520-238-T-7 to troubleshoot fuel crossfeed/boost system.

3. Detach wire end from (A402)TB2–6–E. Check for short between (A402)J1–48 and ground.
   Does short exist?

   YES — Go to step 4.

   NO — Refer to TM 1-1520-238-T-8 to troubleshoot APU fire detection system.

4. Detach P217. Check for short between P217–1 and ground.
   Does short exist?

   YES — Go to step 5.

   NO — Replace SDC inlet throttle valve (TM 1-1520-238-23).

5. Check for short between (A402)XK2–1/2–A3 and ground.
   Does short exist?

   YES — Repair shorted wire between:
   P217–1 and P442–B3.
   (A402):
   XK2–1/2–A3 and J5–B3.
   Go to paragraph 7–45.

   NO — Go to step 6.

6. Detach wire end at (A402):
   XK2–1/2–X1 and XK2–1/2–A2. Check for short between (A402):
   TB2–6–B and ground,
   TB2–6–D and ground,
   TB2–6–F and ground.
   Does short exist?

YES	Repair shorted wire between (A402): XK2–1/2–X1 and TB2–6–F, XK2–1/2–A2 and TB2–6–B, TB2–6–D and J1–48. Go to paragraph 7–45.
NO	Replace relay (A402)K2–1/2 (TM 1-1520-238-23).

END OF TASK

7–48. SHAFT DRIVEN COMP INDICATOR – IS NOT LIGHTED DURING APU START CYCLE 7–48

Tools:

Nomenclature	Part Number
Tool Kit, Aircraft Mechanic's	SC518099CLA01
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45
Extractor, Relay	CTJ-RO6

Personnel Required:

67R Attack Helicopter Repairer
68X Armament/Electrical Systems Repairer

References:

TM 1-1520-238-T-7
TM 1-1520-238-T-8
TM 1-1520-238-23

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. Check **FUEL BST** circuit breaker.
   Does circuit breaker stay closed?

   YES — Go to step 2.

   NO — Refer to TM 1-1520-238-T-7 to troubleshoot fuel crossfeed/boost system.

2. Detach P1323. Check for open between P442–B1 and wire end at GS541–K.
   Does open exist?

   YES — Replace SDC outlet pressure switch (S14) (TM 1-1520-238-23).

   NO — Go to step 3.

3. Check for open between P18–38 and S14–SP1.
   Does open exist?

   YES — Repair open wire between:
   P18–38 and P440–B15,
   S14–SP1 and P442–B1.
   (A402):
   J16–B15 and TB2–12–R,
   J5–B1 and TB2–12–S.
   Go to paragraph 7–45.

   NO — Go to step 4.

4. During APU start, check SDC throttle inlet valve indicator position.
   Is indicator at open position?

   YES — Go to step 5.

   NO — Refer to TM 1-1520-238-T-8 to troubleshoot ECS.

5. During APU start sequence check for 28 VDC between P217–1 and P217–2.
   Is voltage present?

   YES — Go to step 6.

   NO — Replace SDC inlet throttle valve (TM 1-1520-238-23).

6. Remove SDC time delay relay. Check for open between (A402):
   XK2–1/2–X1 and TB2–6–F,
   XK2–1/2–X2 and GS4–C.
   Does open exist?

   YES — Repair open wire. Go to paragraph 7–45.

   NO — Go to step 7.

7. Refer to TM 1-1520-238-T-8 to locate and detach P51 and P941. Set and hold **APU START/RUN** switch to **START**. Check for 28 VDC at (A402)XK2–1/2–C1.
   Is voltage present?

   YES — Replace relay (A402)K2–1/2 (TM 1-1520-238-23).

   NO — Refer to TM 1-1520-238-T-8 to troubleshoot APU.

END OF TASK

7–49. SHAFT DRIVEN COMP INDICATOR – REMAINS LIGHTED AFTER APU START CYCLE 7–49

Tools:

Nomenclature	Part Number
Tool Kit, Aircraft Mechanic's	SC518099CLA01
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45
Thermometer, Digital Degrees Celsius	MIC-11CF
Extractor, Relay	CTJ-RO6

Personnel Required:

67R Attack Helicopter Repairer
68X Armament/Electrical Systems Repairer

References:

TM 1-1520-238-T-6
TM 1-1520-238-23

Equipment Conditions:

Ref	Condition
TM 1-1520-238-23	Access provisions – R200 panel removed

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. Check for open between (S132): J1–1 and J1–3.
   Does open exist?

   YES Go to step 2.

   NO Go to step 5.

2. Detach P217. Start and operate APU (TM 1-1520-238-23). After 60 seconds of APU operation, check for 28 VDC between P217–1 and P217–2.
   Is voltage present?

   YES Go to step 3.

   NO Go to step 8.

3. On pilot **ELEC PWR** panel, set **GEN 1** and **GEN 2** switches to **OFF/RESET.** Attach P217. Set **GEN 1** switch to **GEN 1** and **GEN 2** switch to **GEN 2**. On pilot **ECS** panel, set **ENCU** switch to **ON**. Check for strong, steady air flow from ECS vents.
   Is airflow from ECS vents strong and steady?

   YES Go to step 11.

   NO Go to step 4.

4. Check air particle separator for obstructions.
   Is air particle separator obstructed?

   YES Clear obstructions from air particle separator. (TM 1-1520-238-23). Go to paragraph 7–45.

   NO Go to step 6.

5. Remove SDC oil temperature sensor (TM 1-1520-238-23). Check for SDC oil temperature above 340° F (171° C).
   Is SDC oil temperature above 340° F (171° C)?

   YES Replace SDC (TM 1-1520-238-23).

   NO Replace SDC oil temperature sensor (TM 1-1520-238-23).

6. Check SDC pressure interconnect hose and surge valve pressure hose for cuts, tears, leaks or obstructions.
   Are hoses cut, torn, leaking or obstructed?

   YES Replace SDC pressure interconnect hose and/or surge valve pressure hose (TM 1-1520-238-23).

   NO Go to step 7.

7. Check SDC overboard vent for very strong, steady air discharge.
   Is very strong, steady air discharge present?

   YES — Replace SDC total pressure sense line filter and surge valve pressure filter (TM 1-1520-238-23). If filters have been replaced once, replace SDC assembly (TM 1-1520-238-23).

   NO — Replace SDC inlet throttle valve (TM 1-1520-238-23).

8. Shutdown APU (TM 1-1520-238-23).
   (AAG) Check for open between P217–2 and GS541–F.
   (ABC) Check for open between P217–2 and GS543–F.
   Does open exist?

   YES — Repair open wire. Go to paragraph 7–45.

   NO — Go to step 9.

9. Check for open between (A402)J1–48 and P217–1.
   Does open exist?

   YES — Go to step 10.

   NO — Refer to TM 1-1520-238-T-6 to troubleshoot circuit protection system (dc emergency bus – pilot station).

10. Check for open between (A402):
    K2–1/2–A3 and K2–1/2–A2.
    Does open exist?

    YES — Replace relay (A402)K2–1/2. (TM 1-1520-238-23).

    NO — Repair open wire between:
    P442–B3 and P217–1.
    (A402):
    J1–48 and TB2–6–D,
    XK2–1/2–A3 and J5–B3,
    TB2–6–B and XK2–1/2–A2.
    Go to paragraph 7–45.

11. With APU running and air flowing from ECS vents, detach wire from GS541–K.
    Is SHAFT DRIVEN COMP indicator on?

    YES — Go to step 12.

    NO — Replace SDC outlet pressure switch (TM 1-1520-238-23).

12. Check for short to ground between:
    P440–B15 and P18–38,
    P442–B1 and P1323–3.
    (A402):
    J5–B1 and TB2–12–S,
    TB2–12–R and J16–B15.
    Does short exist?

    YES — Repair shorted wire. Go to paragraph 7–45.

    NO — Replace pilot caution/warning panel (TM 1-1520-238-23).

END OF TASK

7–50. ECS AIRFLOW – DOES NOT DECREASE WITH FUEL BST CIRCUIT BREAKER OPEN AND ENGINE 1 OPERATING 7–50

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer (2)

References:

TM 1-1520-238-T-6
TM 1-1520-238-23

Equipment Conditions:

Ref	Condition
TM 1-1520-238-23	Access provisions – R200 panel removed

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

Open **FUEL BST** circuit breaker. Check for 28 VDC at P217–1.
Is voltage present?

YES	Refer to TM 1-1520-238-T-6 to troubleshoot circuit protection (dc essential bus – pilot station).
NO	Replace SDC inlet throttle valve (TM 1-1520-238-23).

END OF TASK

7–51. FUEL DOES NOT TRANSFER – WITH ENGINE 1 BLEED AIR SUPPLYING PAS MANIFOLD 7–51

Tools:

Nomenclature	Part Number
Tool Kit, Aircraft Mechanic's	SC518099CLA01

Personnel Required:

67R Attack Helicopter Repairer
152FG Maintenance Test Pilot

References:

TM 1-1520-238-T-7
TM 1-1520-238-CL
TM 1-1520-238-23

Equipment Conditions:

Ref	Condition
TM 1-1520-238-CL	Engine 1 operating
TM 1-1520-238-23	Access provisions – L325 door opened

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. Check for airflow at ECS vents.
   Is airflow present?

   YES — Go to step 2.

   NO — Go to step 3.

2. Check pas manifold for air leaks.
   Are air leaks present?

   YES — Replace leaking component (TM 1-1520-238-23).

   NO — Replace pressure regulator valve (TM 1-1520-238-23). If trouble persists refer to TM 1-1520-238-T-7 to troubleshoot fuel quantity indication/transfer system.

3. Have assisitant check for high volume airflow at air particle separator overboard exhaust.
   Is airflow present?

   YES — Replace SDC check valve (TM 1-1520-238-23).

   NO — Replace engine bleed air shutoff valve (TM 1-1520-238-23).

END OF TASK

7–52. ONE ENGINE – WILL NOT MOTOR TO 22% N_G 7–52

Tools:

Nomenclature	Part Number
Tool Kit, Aircraft Mechanic's	SC518099CLA01
Gage Pressure, Dial Indicating (0-200 PSI)	GGG76
Coupling Half	AN-6027

Personnel Required:

67R Attack Helicopter Repairer
152FG Maintenance Test Pilot

References:

TM 1-1520-238-T-4
TM 1-1520-238-23
TM 1-1520-238-CL

Equipment Conditions:

Ref	Condition
TM 1-1520-238-23	PAS inspection – completed
TM 1-1520-238-23	Access provisions – LN5 door opened

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

NOTE

Pressure reading on gage may fluctuate slightly. Use average reading.

1. Install dial pressure gage in utility air receptacle. On pilot **ECS** panel, set **ECS** switch to **ON** and **TEMP** switch to **COLD**. On pilot **ANTI ICE** panel, set **DEFOG** switch to **OFF**. Start and operate APU (TM 1-1520-238-23). On pilot power lever quadrant, set the faulty engine **START/OFF/IGN OVRD** switch to **IGN OVRD**. Check for 20 psi or greater on dial pressure gage.
   Is pressure 20 psi or greater?

   YES — Refer to TM 1-1520-238-T-4 to troubleshoot power plants.

   NO — Go to step 2.

2. Set **START/OFF/IGN OVRD** switch to **IGN OVRD**, check for ECS airflow from cockpit ECS air ducts.
   Is ECS airflow present?

   YES — Refer to TM 1-1520-238-T-4 to troubleshoot power plants.

   NO — Go to paragraph 7–49.

END OF TASK

7–53. BOTH ENGINES – WILL NOT MOTOR TO 22% N_G 7–53

Tools:

Nomenclature	Part Number
Tool Kit, Aircraft Mechanic's	SC518099CLA01
Gage Pressure, Dial Indicating (0-200 PSI)	GGG76
Coupling Half	AN-6027

Personnel Required:

67R Attack Helicopter Repairer

References:

TM 1-1520-238-T-4
TM 1-1520-238-T-8
TM 1-1520-238-23

Equipment Conditions:

Ref	Condition
TM 1-1520-238-23	PAS inspection – completed Access provisions – L325 door opened

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

NOTE

Pressure reading on gage may fluctuate slightly. Use average reading.

1. Check air particle separator for obstructions.
   Is air particle separator obstructed?

   YES — Clear obstructions from air particle separator (TM 1-1520-238-23).

   NO — Go to paragraph 7–45.

2. Install dial pressure gage in utility air receptacle (TM 1-1520-238-23). On **ECS** panel, set **ECS** switch to **ON** and **TEMP** switch to **COLD**. On pilot **ANTI ICE** panel, set **DEFOG** switch to **OFF**. Start and operate APU (TM 1-1520-238-23). Check for 25 psi or greater on dial pressure gage.
   Is pressure 25 psi or greater?

   YES — Refer to TM 1-1520-238-T-4 to troubleshoot power plants.

   NO — Go to step 3.

3. Check dial pressure gage for pressure greater than 0 psi.
   Is pressure greater than 0 psi?

   YES — Go to step 4.

   NO — Replace SDC (TM 1-1520-238-23).

4. Check cockpit defog air mixers for airflow.
   Is airflow present at cockpit air mixers?

   YES — Refer to TM 1-1520-238-T-8 to troubleshoot Pitot anti–ice system.

   NO — Go to paragraph 7–49.

END OF TASK

CHAPTER 8
INSTRUMENTS

CHAPTER INDEX

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SECTION I. EQUIPMENT DESCRIPTION AND DATA

8–1. EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES 8–1

a. **Characteristics.**

(1) Engine instruments measure and display engine and rotor performance.

(2) Flight instruments measure and display helicopter flight performance.

(3) Miscellaneous instruments display hydraulic pressure, fuel quantity, outside temperature and time.

b. **Capabilities and Features.**

(1) Engine instruments provide the means to monitor power turbine (N_P) speed, rotor rpm (N_R), gas generator turbine ($N_{G)}$ speed, turbine gas temperature (TGT), engine oil pressure (ENG OIL), engine torque (TORQUE), and fuel quantity. Engine instruments are self contained rectangular units with fixed numbered scales and colored columns of lamp segments that illuminate when a corresponding numeric value is reached. The lamp segments are divided into colored zones. The colors are red (danger zone), amber (caution zone), and green (normal operating zone). The bottom lamp segment of each scale is a blue segment that lights to indicate electrical power is applied to the instrument. Some instruments have three–digit readouts that display values in numbers that are more accurate and easier to read than vertical scales. Engine instruments operate in three modes: normal, digital blanking, and test. In normal mode, digital readouts change numbers as performance changes. In digital blanking mode, the digital readout blanks, but the vertical displays read normally. In test mode, vertical scales display full columns of lights and digital readouts display three eights (**888**).

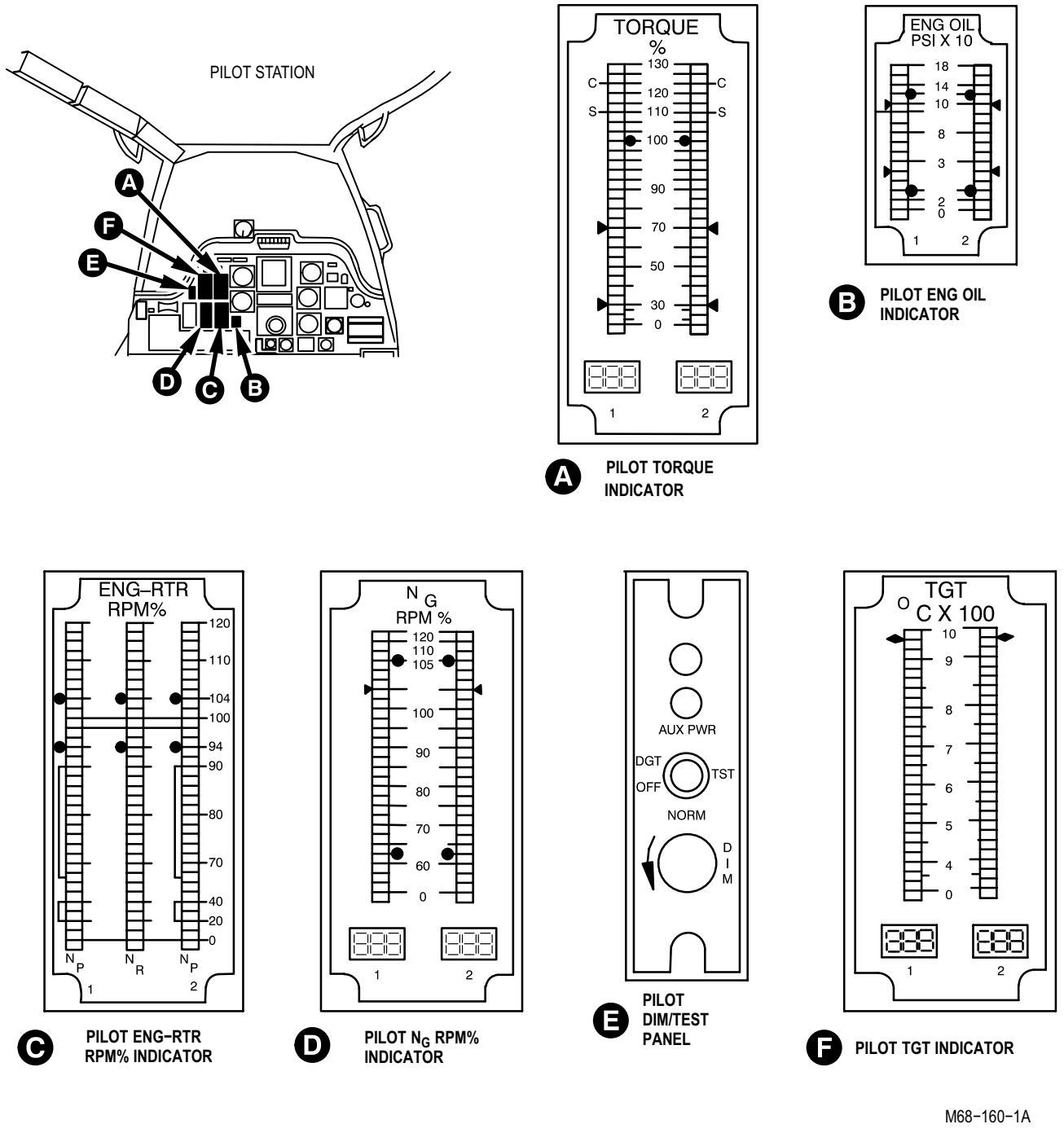
(2) Flight instruments provide the means to monitor airspeed (forward, up, and down), altitude and gravity (g) forces, magnetic heading to provide visual displays of helicopter attitude and flight conditions. Flight instruments operate from direct impact air forces and static outside air pressure. Air is supplied through air inlets and tubing. The air inlets are two Pitot tubes and two static ports. The airtight tubing has drains to let any moisture escape. Heating elements in the Pitot tubes prevent ice buildup from blocking the air flow. Flight reference instruments operate from power and flight data inputs. All flight instruments are edge–lighted.

(3) Miscellaneous instruments provide the means to monitor primary, secondary, and emergency hydraulics, forward and aft fuel cell quantities, refuel indications, hours, minutes, seconds, elapsed–time, and outside air temperature. Miscellaneous instruments receive inputs from hydraulic pressure sensors, a fuel signal conditioner (FSC) and fuel quantity sensors, outside air sensors, and 28 VDC from the signal data converter (SDC).

8–2. LOCATION AND DESCRIPTION OF MAJOR COMPONENTS 8–2

a. **Engine Instruments.** Engine instruments (fig. 8–1) consist of the pilot **TGT** indicator, pilot **TORQUE** indicator, pilot **ENG OIL** indicator, pilot **ENG–RTR RPM**% indicator, pilot **N_G RPM%** indicator, CPG selectable digital display (SDD) panel, dim/test panel, and the SDC.

(1) **Pilot TGT Indicator.** The pilot **TGT** indicator, located in the pilot instrument panel, has a vertical scale display mounted above each digital readout. The left side displays turbine engine 1 values and the right side displays turbine engine 2 values.



A PILOT TORQUE INDICATOR

B PILOT ENG OIL INDICATOR

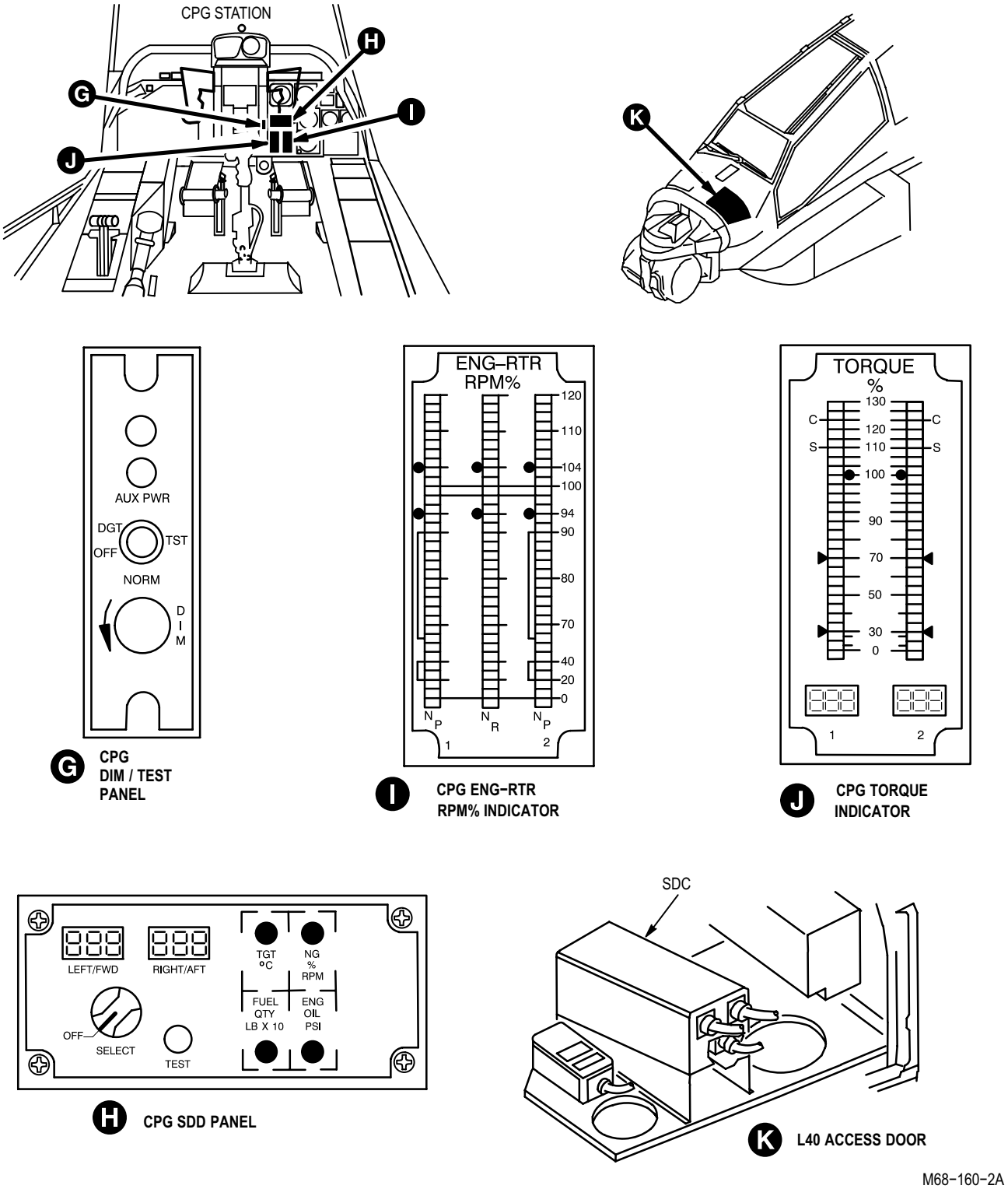
C PILOT ENG–RTR RPM% INDICATOR

D PILOT N_G RPM% INDICATOR

E PILOT DIM/TEST PANEL

F PILOT TGT INDICATOR

Figure 8–1. Engine Instrument Major Component Location (Sheet 1 of 2)



G CPG DIM / TEST PANEL

I CPG ENG–RTR RPM% INDICATOR

J CPG TORQUE INDICATOR

H CPG SDD PANEL

K L40 ACCESS DOOR

Figure 8–1. Engine Instruments Major Component Location (Sheet 2 of 2)

(2) **TORQUE Indicators**. The **TORQUE** indicators, located in the pilot and CPG instrument panels, have a vertical scale above each digital readout. The left scale displays engine 1 torque values and the right scale displays engine 2 torque values.

(3) **Pilot ENG OIL Indicator.** The pilot **ENG OIL** indicator, located in the pilot instrument panel, has a vertical scale above each digital readout. The left scale displays engine 1 oil pressure values and the right scale displays engine 2 oil pressure values.

(4) **ENG–RTR RPM% Indicator.** The **ENG–RTR RPM**% indicators, located in the pilot and CPG instrument panels, have three vertical scales. The left scale displays engine 1 rpm (N_p 1), the middle scale displays main rotor rpm (N_R), and the right scale displays engine 2 rpm (N_p 2).

(5) **Pilot N_G RPM% Indicator.** The **N_G RPM**% indicator, located in the pilot instrument panel, has a vertical scale display mounted above each digital readout. The vertical scales display 0 to 120% N_G. The left scale displays gas generator rpm% for engine 1 and the right scale displays gas generator rpm% for engine 2.

(6) **CPG SDD Panel.** The CPG SDD panel, located in the CPG instrument panel, provides digital readout of selected pilot instrument data. The CPG SDD **TEST** function tests the SDD and CPG engine torque instrument displays and readouts.

(7) **Dim/Test Panels**. The dim/test panels, located in the pilot and CPG instrument panels, enable setting or changing of instrument display brightness, testing instrument displays, and blanking out of digital readouts on pilot and CPG instruments.

(8) **SDC**. The SDC, located in the nose of the helicopter at access station L40, converts 28 VDC into signal processing voltages and provides power to the fuel signal conditioner and engine torque indicators.

b. **Flight Instruments. F**light instruments (fig. 8–2) consist of the Pitot tubes, static ports, airspeed indicators, vertical speed indicators (VSI), pilot accelerometer indicator, barometric altimeters, pilot standby attitude indicator (SAI), CPG remote attitude indicator (RAI), and the pilot magnetic compass.

(1) **Pitot Tubes**. The Pitot tubes, located on the leading edge of each wing, supply impact air for flight instruments.

(2) **Static Ports**. The static ports, located on each side of the helicopter, supply static air pressure for flight instruments.

(3) **Airspeed Indicators**. The airspeed indicators, located in the pilot and CPG instrument panels, show helicopter airspeed in knots. The calibrated airspeed dial reads from 20 to 250 knots.

(4) **VSIs.** The VSIs, located in the pilot and CPG instrument panels, display vertical speed **(UP** or **DOWN)**. Vertical speeds can be measured to a maximum rate of 6000 feet per minute.

(5) **Pilot Accelerometer Indicator**. The pilot accelerometer indicator, located in the pilot instrument panel, shows positive and negative changes in gravity. Positive gravity forces can be measured up to +4g. Negative gravity forces can be measured down to –2g.

(6) **Barometric Altimeters**. The barometric altimeters, located in the pilot and CPG instrument panels, display aircraft altitude from –1,000 to 50,000 feet.

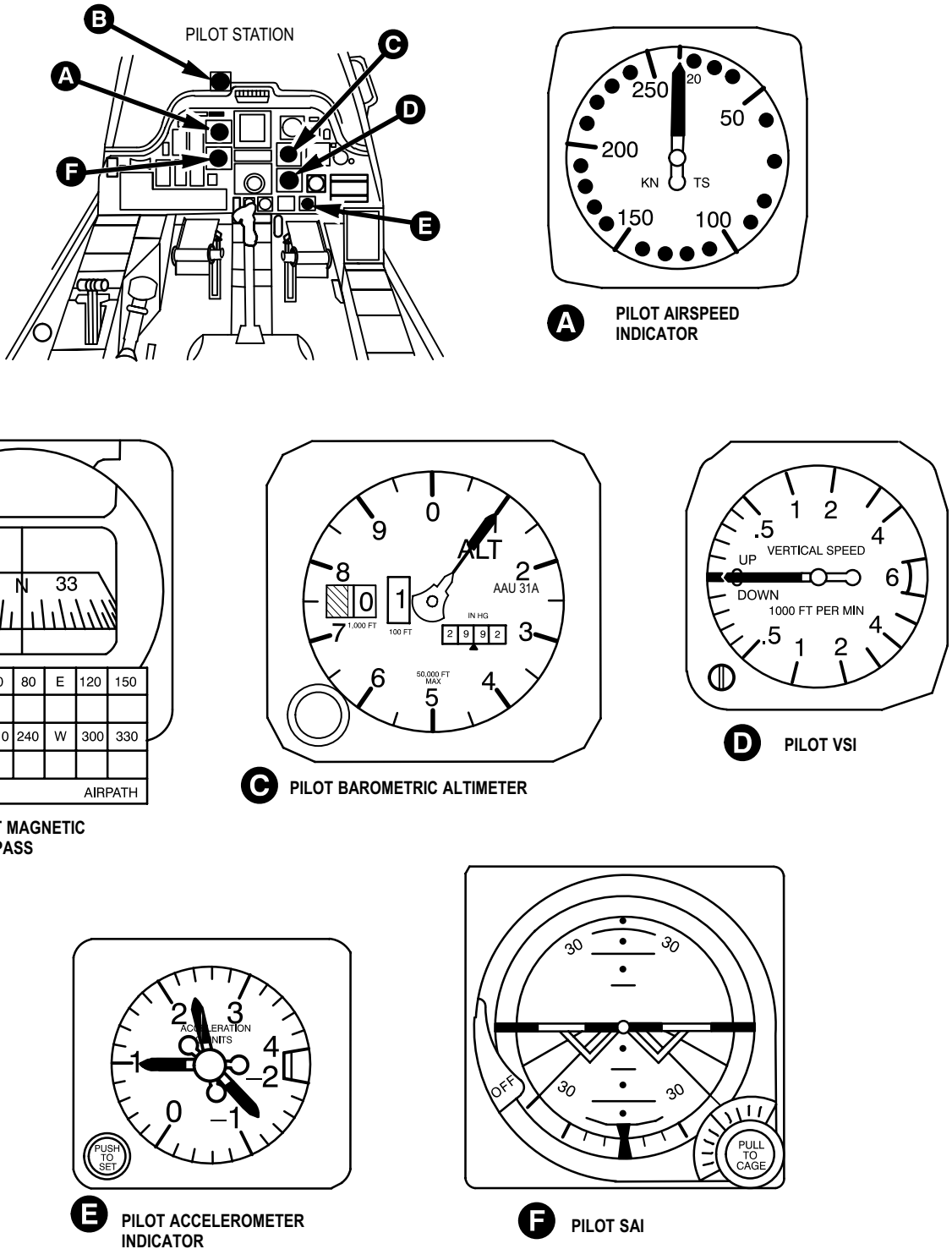
8–2. LOCATION AND DESCRIPTION OF MAJOR COMPONENTS (cont) 8–2

(7) **Pilot SAI**. The pilot SAI, located in the pilot instrument panel, provides the pilot with an independent, continuous backup display of helicopter attitude. The SAI displays 360° horizontal roll, 85° climb pitch, or 85° dive pitch. The two–color gyrosphere is divided into halves by a white horizon line. The upper (climb) half is gray, the lower (dive) half is black. Degree of pitch is scaled and numbered on both halves. Degree of roll is marked by white lines on the bottom half of the casing. White markers indicate 0°, 10°, 20°, 30°, 60°, and 90° positions. Helicopter attitude is read by comparing the fixed helicopter symbol with the gyrosphere degree marking.

(8) **CPG RAI.** The CPG RAI, located in the CPG instrument panel, displays 360° horizontal roll, 90° climb pitch, or 90° dive pitch. The two–color gyrosphere is divided into halves by a white horizon line. The upper (climb) half is gray, the lower (dive) half is black. Degree of pitch is scaled and numbered on both halves. Degree of roll is marked by white lines on the bottom half of the casing. The white markers indicate 0°, 10°, 20°, 30°, 60°, and 90° positions. Helicopter attitude is read by comparing the fixed helicopter symbol with the gyrosphere degree marking.

(9) **Pilot Magnetic Compass**. The pilot magnetic compass, located on top of the pilot instrument panel, displays magnetic heading in relationship to the magnetic North pole. The magnetic compass displays headings from 0° to 360°.

8–2. LOCATION AND DESCRIPTION OF MAJOR COMPONENTS (cont) 8–2



A PILOT AIRSPEED INDICATOR

B PILOT MAGNETIC COMPASS

C PILOT BAROMETRIC ALTIMETER

D PILOT VSI

E PILOT ACCELEROMETER INDICATOR

F PILOT SAI

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Figure 8–2. Flight Instruments Major Component Location (Sheet 1 of 2)

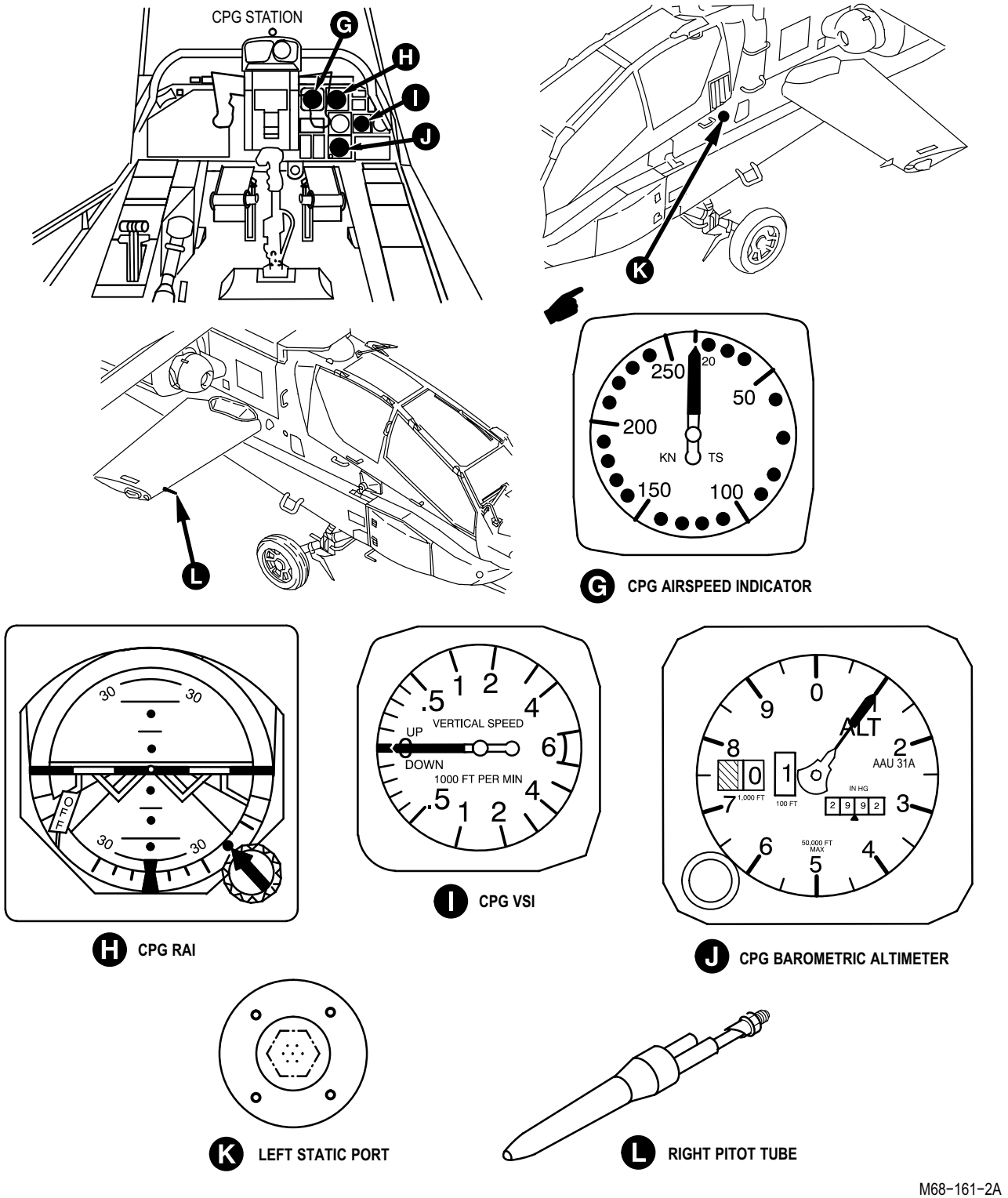


Figure 8–2. Flight Instruments Major Component Location (Sheet 2 of 2)

c. **Miscellaneous Instruments**. Miscellaneous instruments (fig. 8–3) consist of the pilot fuel quantity indicator, refuel panel **FUEL QTY** indicator, FSC, pilot emergency hydraulic pressure indicator, pilot dual hydraulic pressure indicator, clock, and the pilot outside air temperature (OAT) indicator.

(1) **Pilot FUEL Quantity Indicator**. The pilot **FUEL** quantity indicator, located in the pilot instrument panel, has two vertical scale displays that are positioned side–by–side. A **TOTAL** digital readout is mounted below the vertical scale displays. Forward fuel cell fuel quantity is displayed on the left scale and the aft fuel cell fuel quantity is displayed on the right scale. Total available fuel is displayed on the **TOTAL** digital readout.

(2) **Refuel Panel FUEL QTY Indicator**. The **FUEL QTY** indicator, located on the refuel panel on the forward right side of the fuselage (access door R160), has two scales and two movable pointers. The right **FUEL QTY** scale measures fuel level in the **FWD** fuel cell. The left **FUEL QTY** scale measures fuel level in the **AFT** fuel cell. The pointers move between empty (**E**) and full (**F**) markers as fuel levels change.

(3) **FSC**. The FSC, located on the left side of the helicopter nose (access door L40), converts forward and aft fuel cell sensor inputs into 0 to 5 VDC outputs for the **FUEL** quantity indicator and the refuel panel **FUEL QTY** indicator.

(4) **Pilot Emergency Hydraulic Pressure Indicator**. The pilot emergency hydraulic pressure indicator, located in the pilot instrument panel, displays emergency hydraulic pressure from 0 to 5000 psi.

(5) **Pilot Dual Hydraulic Pressure Indicator**. The pilot dual hydraulic pressure indicator, located in the pilot instrument panel, displays primary and utility pressure from 0 to 6000 psi.

(6) **Clocks**. The clocks, located in the pilot and CPG instrument panels, display time of day in hours, minutes, and seconds. The clocks also show elapsed time in minutes.

(7) **Pilot OAT Indicator**. The pilot OAT indicator, located in the left side of the pilot station fuselage, has a shielded sensing element which extends through the fuselage to the outside air. The luminous dial shows temperature from –70° C to 50° C.

8–2. LOCATION AND DESCRIPTION OF MAJOR COMPONENTS (cont) 8–2

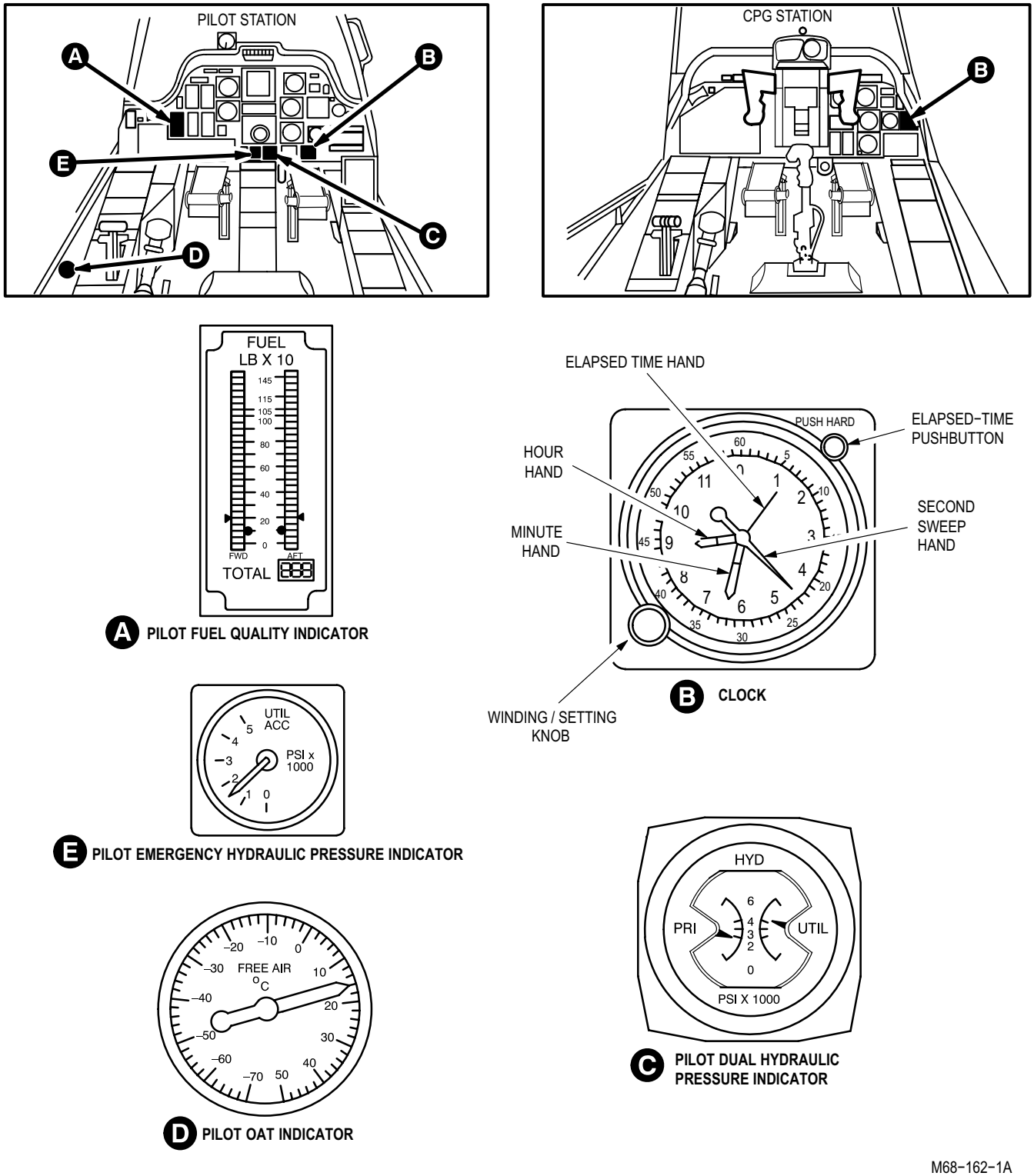


Figure 8–3. Miscellaneous Instrument Major Component Location (Sheet 1 of 2)

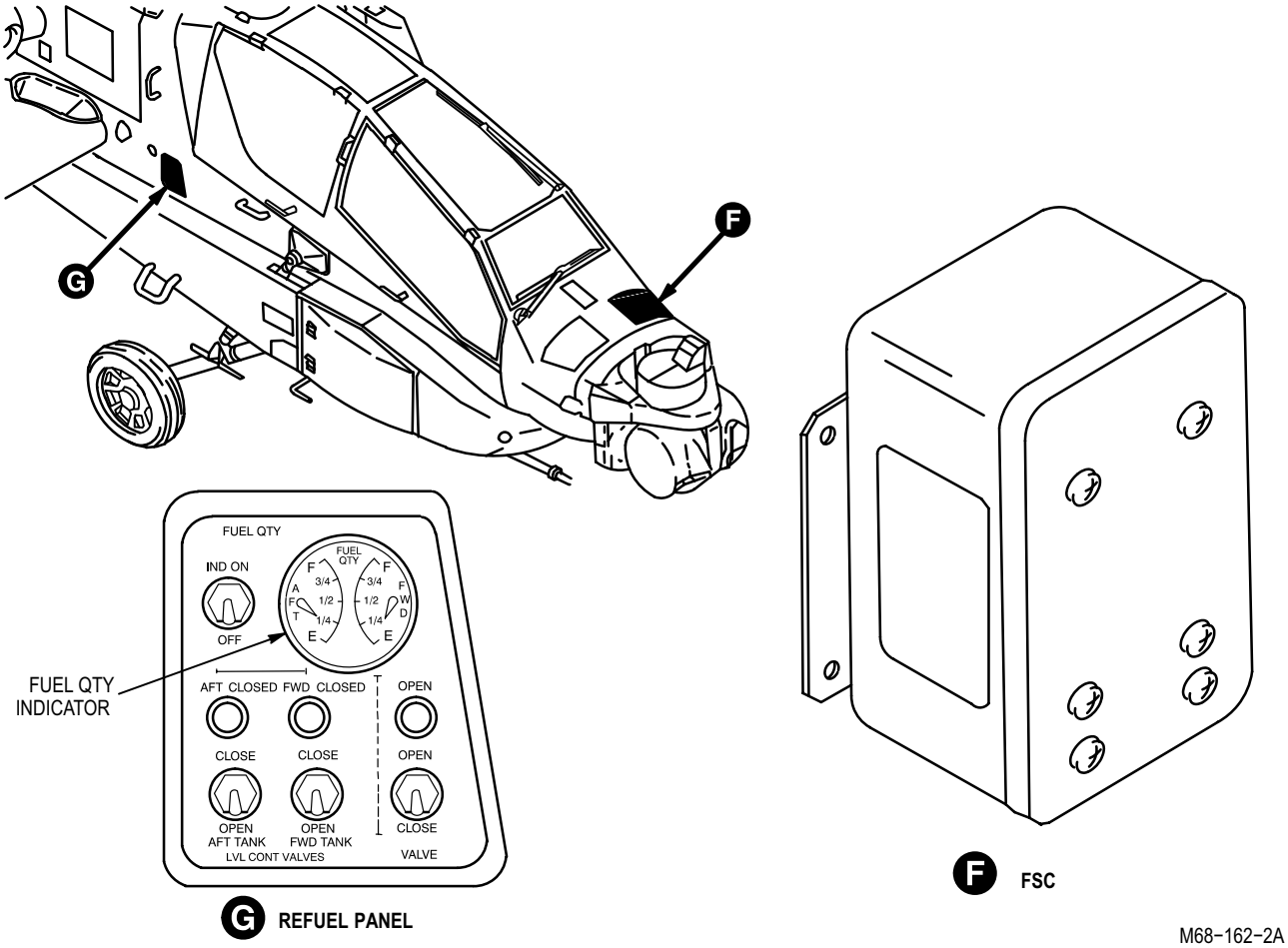


Figure 8–3. Miscellaneous Instruments Major Component Location (Sheet 2 of 2)

8–3. EQUIPMENT DATA 8–3

Not applicable.

8–4. EQUIPMENT CONFIGURATION 8–4

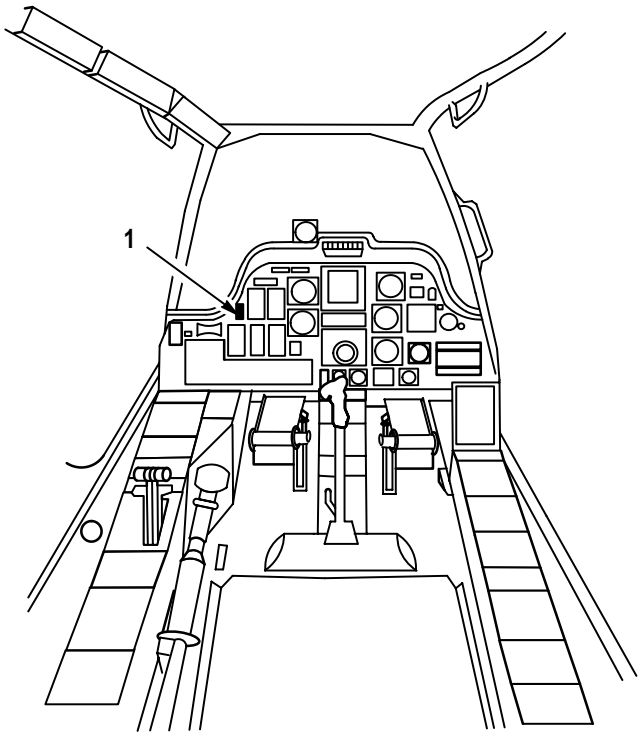
Not applicable.

8–5. SAFETY, CARE AND HANDLING OF EQUIPMENT 8–5

Not applicable.

8–6. CONTROLS AND INDICATORS 8–6

The instruments receive mode selects and remote switch inputs from various controls located in the pilot station (fig. 8–4) and the CPG station (fig. 8–5). Table 8–1 provides a listing of the controls, switches and associated indicators pertaining to the instruments along with a description of their function.



1. PILOT DIM / TEST PANEL

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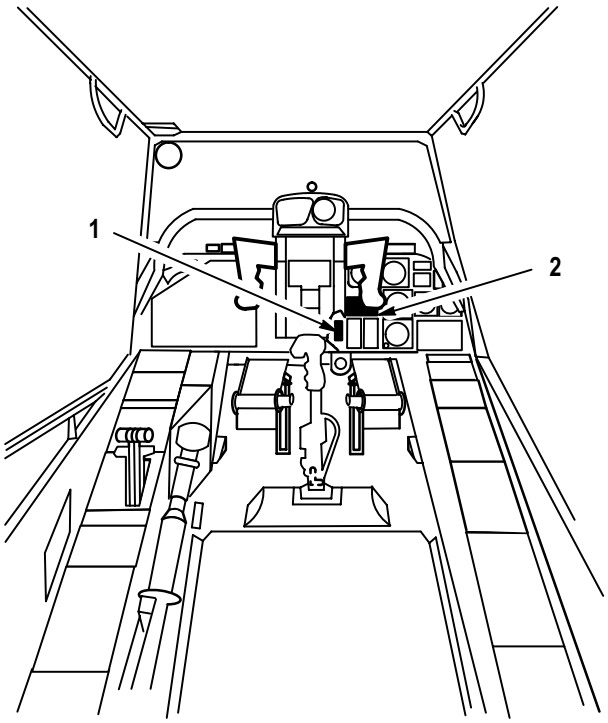
Figure 8–4. Pilot Station



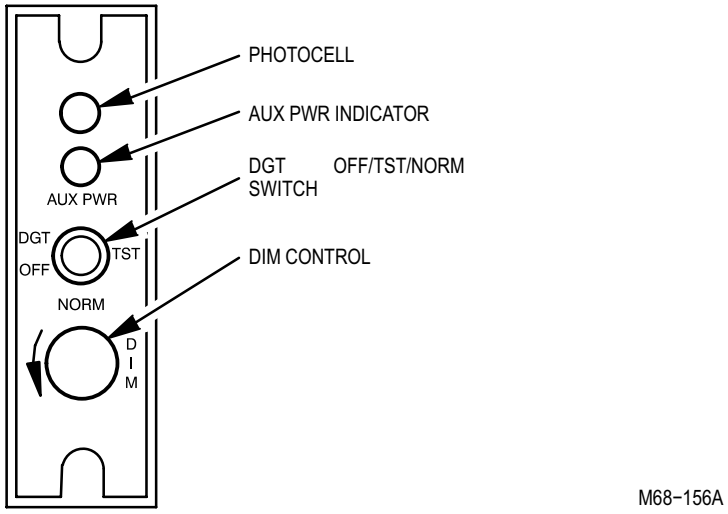
1. CPG DIM/TEST PANEL
2. CPG SDD PANEL

M68−159

Figure 8–5. CPG Station

Table 8–1. Instrument Controls and Indicators

Dim/Test Panel		
SWITCH/INDICATOR	POSITION	FUNCTION
Photocell		Adjusts instrument display brightness in relationship to crew station lighting.
AUX PWR indicator	AMBER	Indicates SDC power or lamp supply fail, or the **DGT/TST/OFF** switch is set to **TST** position.
DGT OFF/TST/NORM three–position spring loaded switch	**DGT OFF**	Disables digital displays, allows vertical scales to operate normally.
	TST	Initiates testing of all vertical scales, illuminates from bottom to full scale for three seconds. All digital readouts display in eights (**888**).
	NORM	Indicates normal operation of both vertical scales and digital readouts.
DIM variable control		Allows instrument brightness to be adjusted.

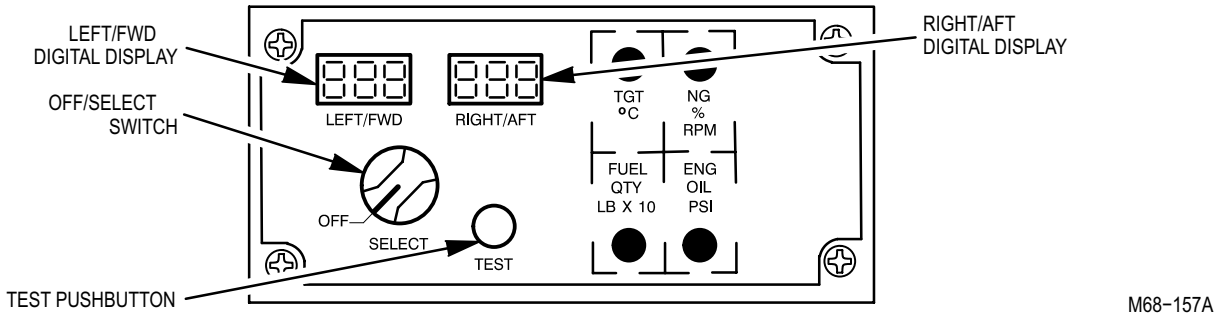


Dim/Test Panel

8–6. CONTROLS AND INDICATORS (cont) 8–6

Table 8–1. Instruments Controls and Indicators (cont)

CPG SDD Panel		
SWITCH/INDICATOR	POSITION	FUNCTION
LEFT/FWD digital display		Indicates pounds of fuel remaining in forward fuel cell.
RIGHT/AFT digital display		Indicates pounds of fuel remaining in aft fuel cell.
TEST pushbutton		Press to test the SDD indicators.
OFF/SELECT two–position switch	**OFF**	De–energizes SDD panel.
	SELECT	Energizes SDD panel. Enables CPG to monitor, via digital displays, the engine function indicator selected (pilot **TGT °C** indicator, pilot **N_G% RPM** indicator, pilot **FUEL QTY LB X 10** indicator, and pilot **ENG OIL PSI** indicator).



CPG SDD Panel

SECTION II. THEORY OF OPERATION

8–7. SYSTEM DESCRIPTION 8–7

a. **Instruments.**

(1) Engine instruments provide the crew with the means to monitor power turbine (N_p) speed, gas producer turbine (N_G) speed, oil pressure, TGT, and torque of each engine plus fuel quantity and the main rotor rpm. Each instrument operates independently with some readings being duplicated when identical instruments are located in both crew stations.

(2) The flight instruments measure and display helicopter performance (forward, up, and down), altitude, and g forces. Not all flight instruments are common to both crew stations. Each instrument operates independently with some readings being duplicated when identical instruments are located in both crew stations.

(3) Miscellaneous instruments display hydraulic pressure, fuel quantity, outside temperature, and time. Each instrument operates independently with some readings being duplicated when identical instruments are located in both crew stations.

b. **Engine Instruments.**

(1) **Purpose.** Engine instruments measure and display helicopter engine and rotor performance. Pilot's indicator edge–lighting is controlled by the pilot **EXT LT/INTR LT** panel. CPG's indicator edge–lighting is controlled by CPG **INTR LT** panel. The pilot dim/test panel provides display lamp test, display lamp dim automatic control, and digital blanking. The CPG SDD provides the display lamp test for the CPG's indicator.

(2) **System of Operation.**

(a) The pilot **TGT** indicator (fig. 8–6) receives operating and lamp supply voltages from the SDC. Engine turbine 1 and 2 temperature sensors supply temperature data to the indicators.

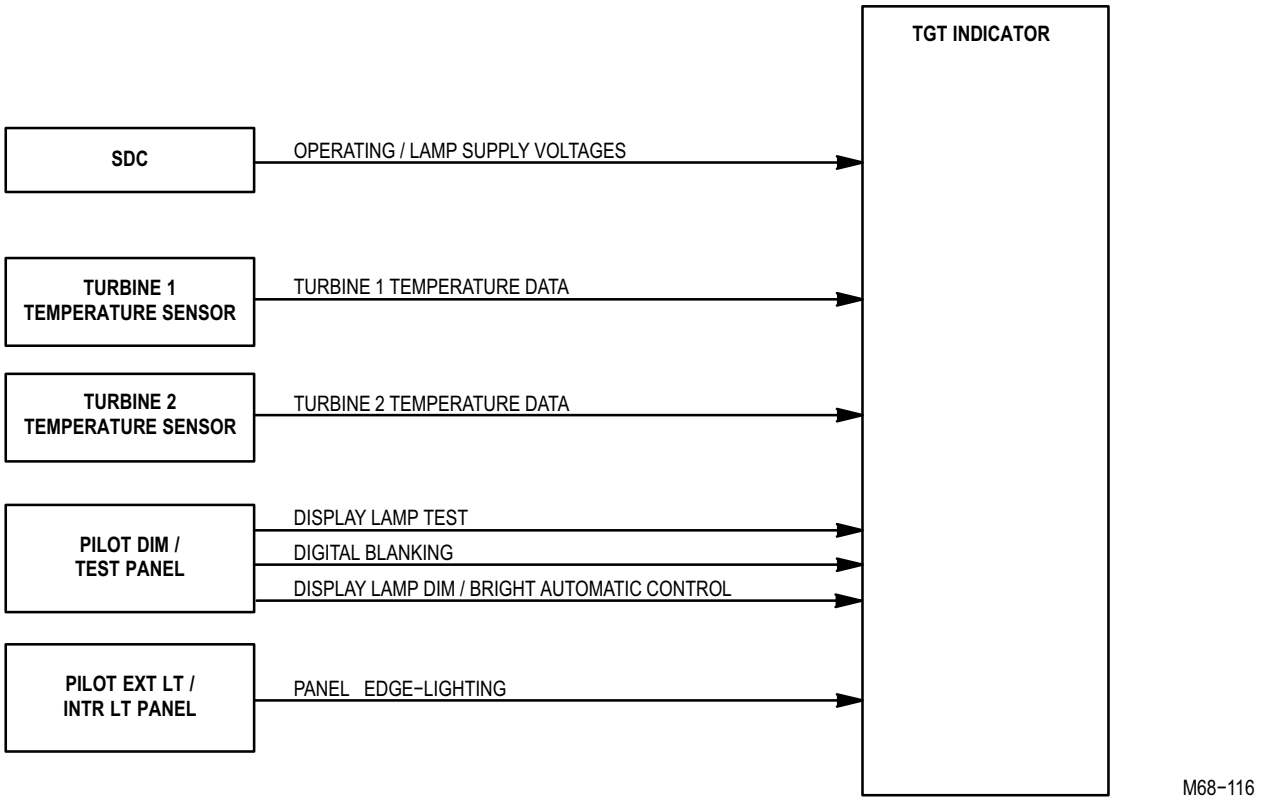


Figure 8–6. Pilot TGT Indicator Functional Block Diagram

(b) The engine **TORQUE** indicators (fig. 8–7) receive operating and lamp supply voltages from the SDC. Engine 1 and 2 torque sensors supply torque data to the indicators.

(c) The pilot **ENG–OIL** indicator (fig. 8–8) receives operating and lamp supply voltages from the SDC. Engine 1 and 2 oil pressure sensors supply oil pressure data.

(d) The **ENG–RTR RPM**% indicators (fig. 8–9) receive operating and lamp supply voltages from the SDC. Engine 1 and 2 rpm sensors supply engine rpm (N_P) data. The main rotor rpm sensor supplies rotor rpm (N_R) data.

(e) The pilot **N_G RPM**% indicator (fig. 8–10) receives operating and lamp supply voltages from the SDC. Engine 1 and 2 gas generator rpm sensors supply required data.

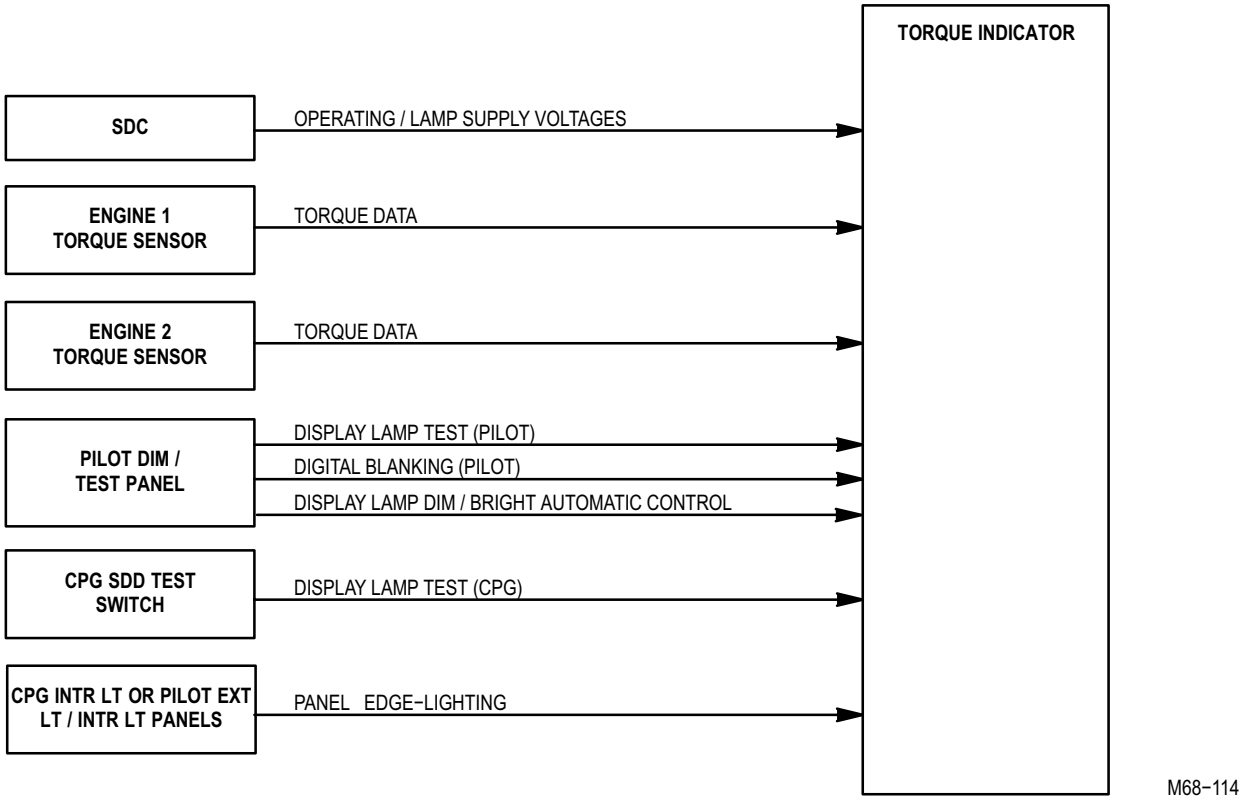


Figure 8–7. TORQUE Indicator Functional Block Diagram

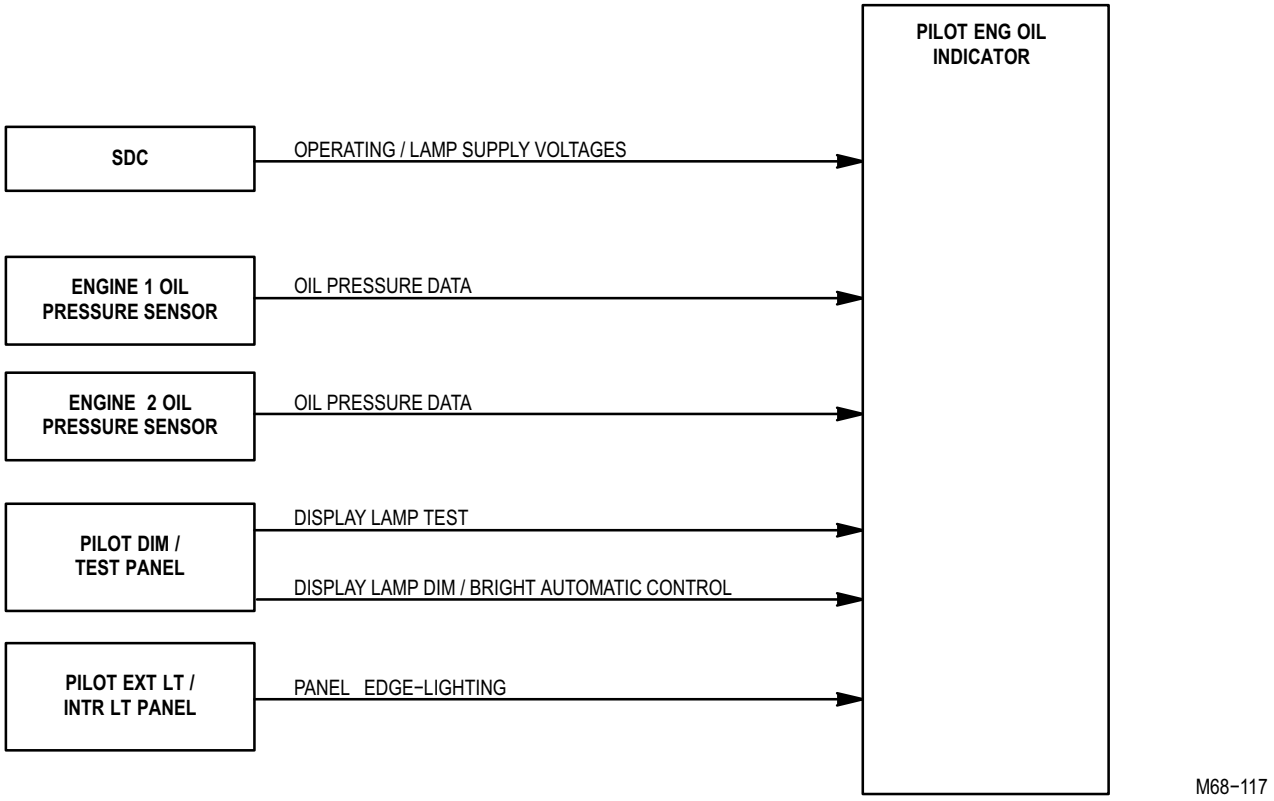


Figure 8–8. Pilot ENG OIL Indicator Functional Block Diagram

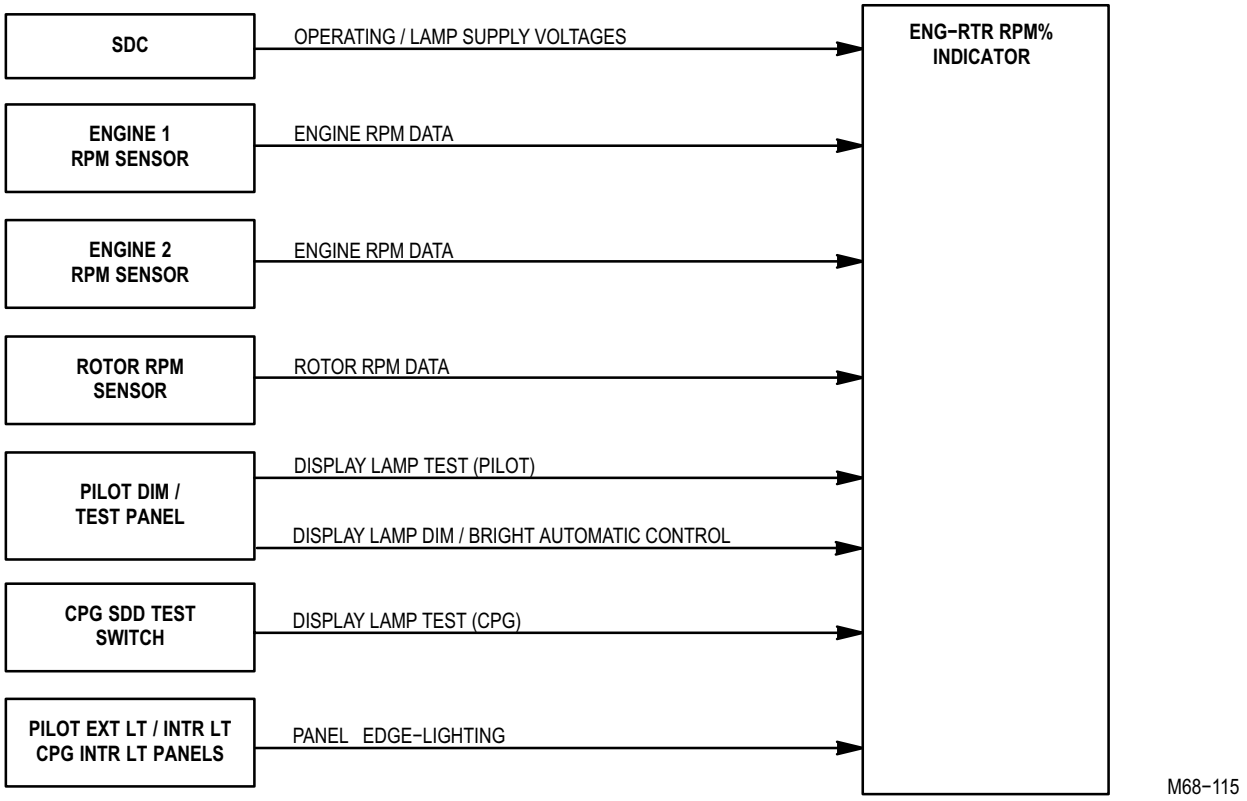


Figure 8–9. ENG–RTR RPM% Indicator Functional Block Diagram

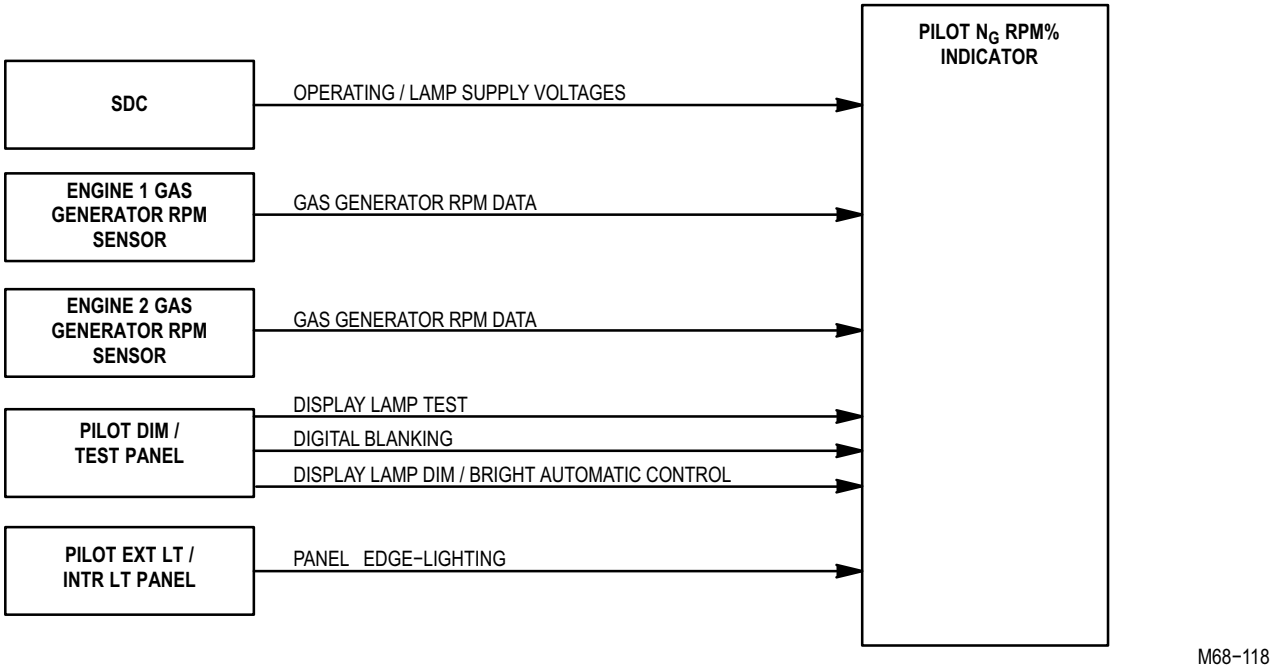


Figure 8–10. Pilot N_G RPM% Indicator Functional Block Diagram

(f) The CPG SDD panel (fig. 8–11) selects pilot instrument data for display on the CPG SDD readouts. The **OFF/SELECT** switch selects the indicator data to be displayed and lights the selected indicator. The **TEST** pushbutton tests the CPG SDD and CPG engine torque instrument displays and readouts. The CPG SDD panel receives operating and lamp supply voltages from the SDC. The **ENG–OIL** indicator supplies oil pressure data. The **TGT** indicator supplies **TGT °C** data. The **N_G RPM%** indicator supplies gas generator rpm data. The **FUEL** quantity indicator supplies **FUEL QTY** data.

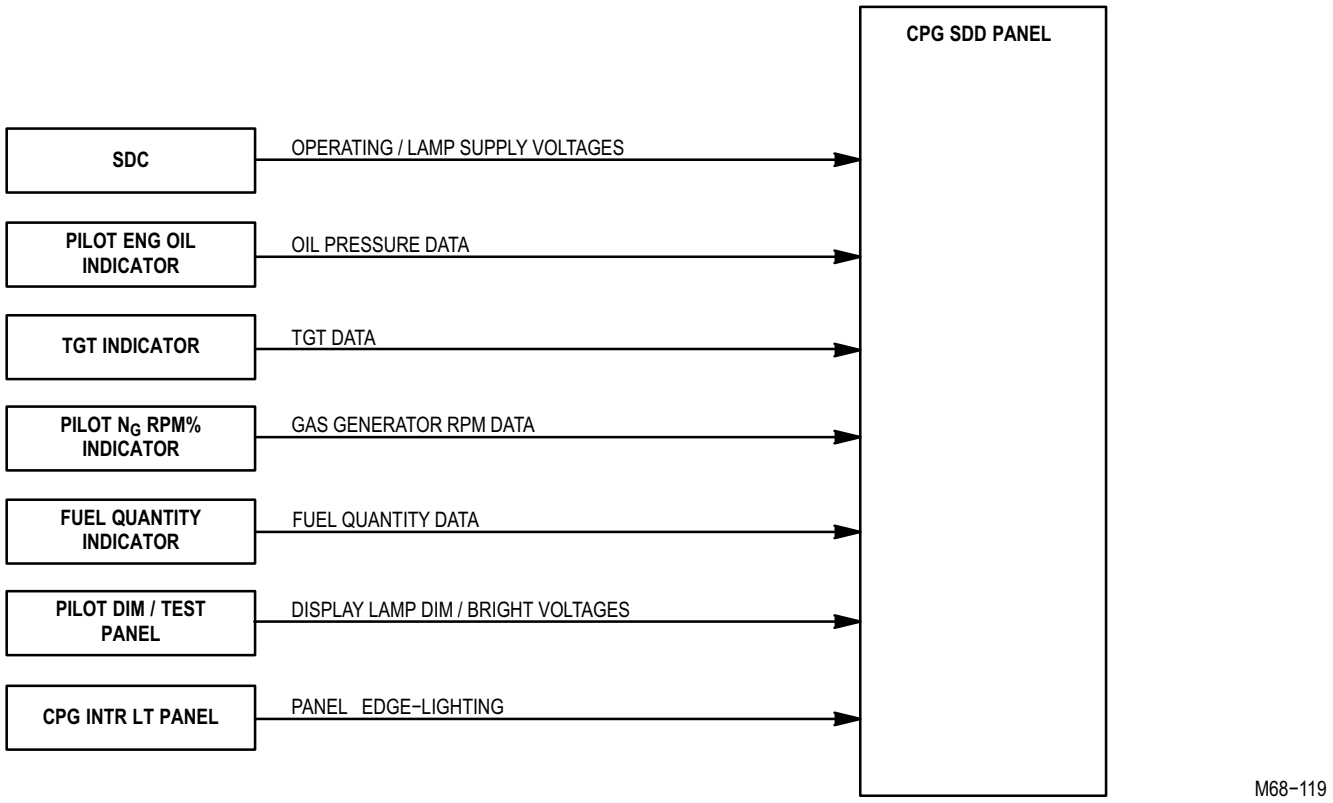


Figure 8–11. CPG SDD Panel Functional Block Diagram

(g) The dim/test panels (fig. 8–12) automatically cause brightness of the indicators to change. A photocell varies the brightness in accordance with the variance of ambient light in the pilot and CPG compartments. The pilot dim/test panel routes signals to the indicators. The CPG dim/test panel routes signals through the CPG dimmer power supply to the indicators. The SDC outputs a failure voltage upon SDC power supply failure or lamp supply fails. The failure signal lights the **AUX PWR** indicator.

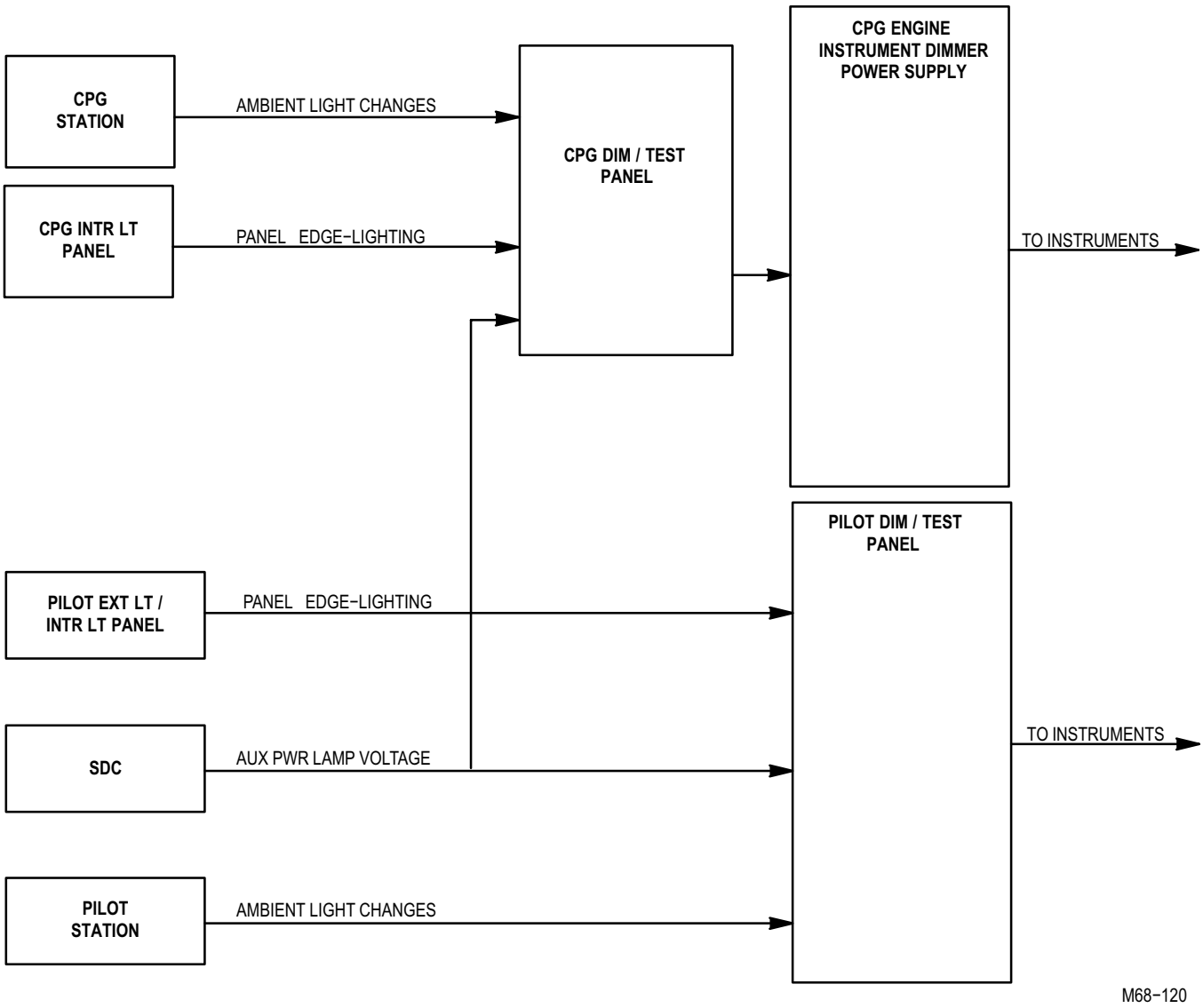


Figure 8–12. Dim/Test Panel Functional Block Diagram

8–7. SYSTEM DESCRIPTION (cont) 8–7

(h) The SDC (fig. 8–13) receives 28 VDC during normal operation and 24 VDC during refueling. The input voltage is reduced for operation of the instrument system. Power is routed through an internal fuse panel to two power supplies. The power supplies lower the 28 VDC to signal processing voltages. Operating power is also routed to the FSC and engine torque sensors. The fuse panel protects all instruments from overload. Forward and aft fuel cells send low fuel warning signals. The SDC outputs the signals to light the pilot and CPG caution/warning panel **FUEL LOW FWD** and **FUEL LOW AFT** indicators. Engine temperature inputs are converted by the SDC and sent to the pilot and CPG indicators.

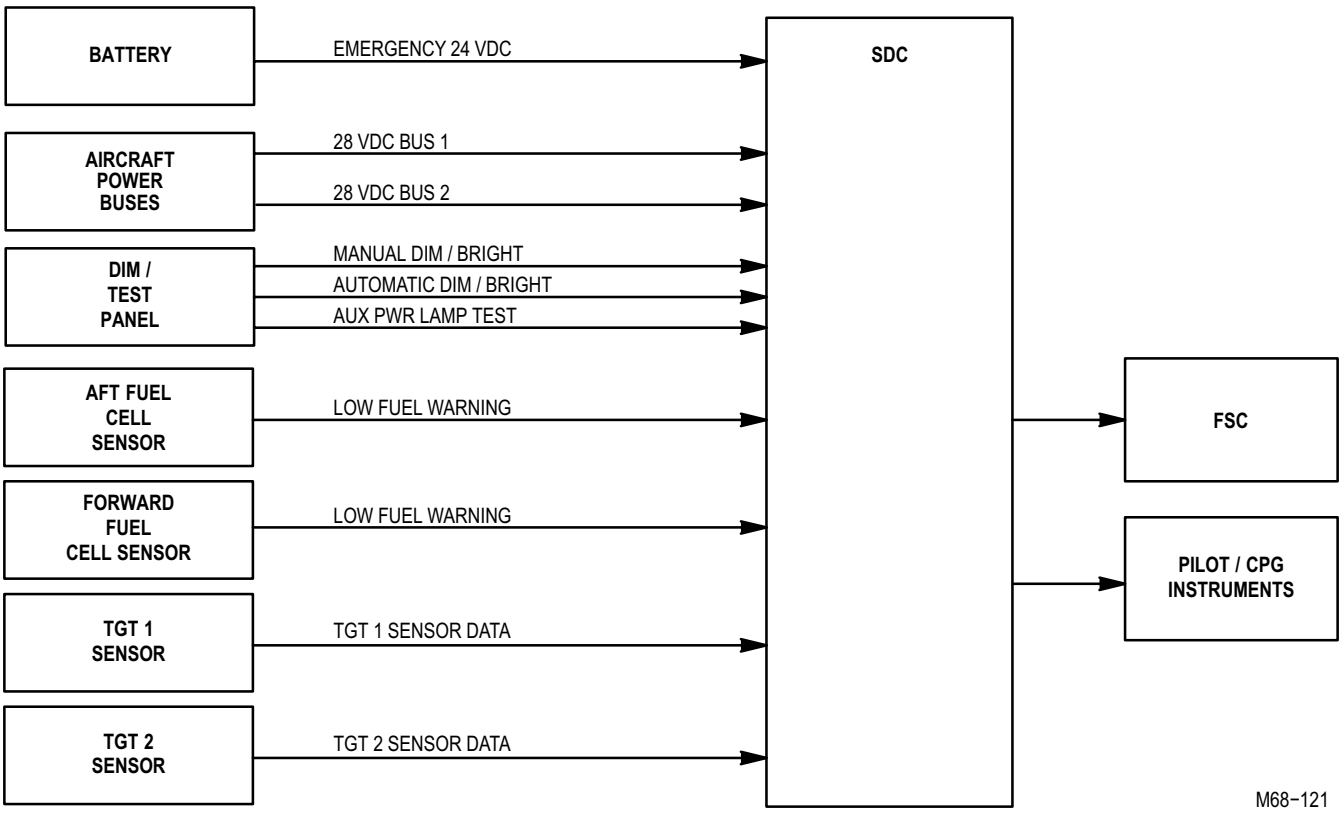


Figure 8–13. SDC Functional Block Diagram

c. **Flight Instruments.**

(1) **Purpose**. Flight instruments measure and display helicopter performance and provide visual displays of attitude and flight conditions. Pilot's indicator edge–lighting is controlled by the pilot **EXT LT/INTR LT** panel. CPG's indicator edge–lighting is controlled by CPG **INTR LT** panel.

(2) **System of Operation**.

(a) The airspeed indicator (fig. 8–14) is connected to the static port for air pressure reference. As the helicopter moves forward, the Pitot tube provides ram air into an airtight diaphragm. The expanding diaphragm triggers the mechanical multiplier. The mechanical multiplier drives the instrument pointer to display airspeed on the calibrated indicator dial.

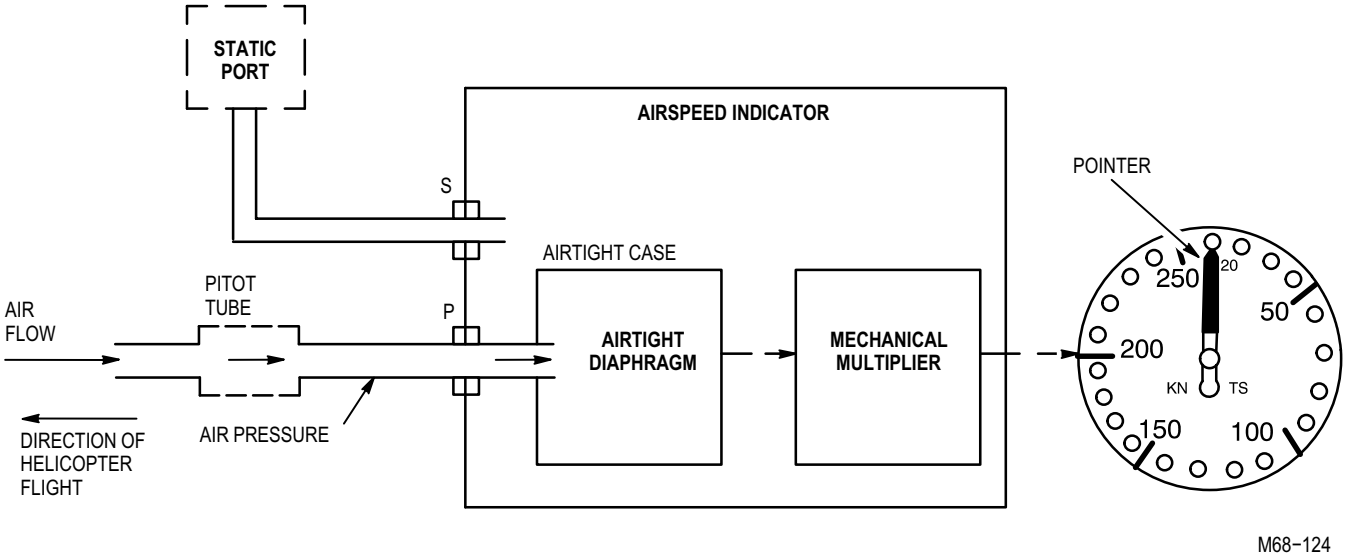


Figure 8–14. Airspeed Indicator Functional Block Diagram

(b) The VSI (fig. 8–15) is connected to the static port for air pressure reference. The VSI has a capillary tube for air pressure. Air pressure inside and outside is equal when the helicopter remains at the same altitude. Pressure changes are sensed by the airtight diaphragm when the helicopter moves up or down. The airtight diaphragm moves the mechanical multiplier. The mechanical multiplier proportionally moves the indicator dial clockwise for upward movement and counter–clockwise for downward movement.

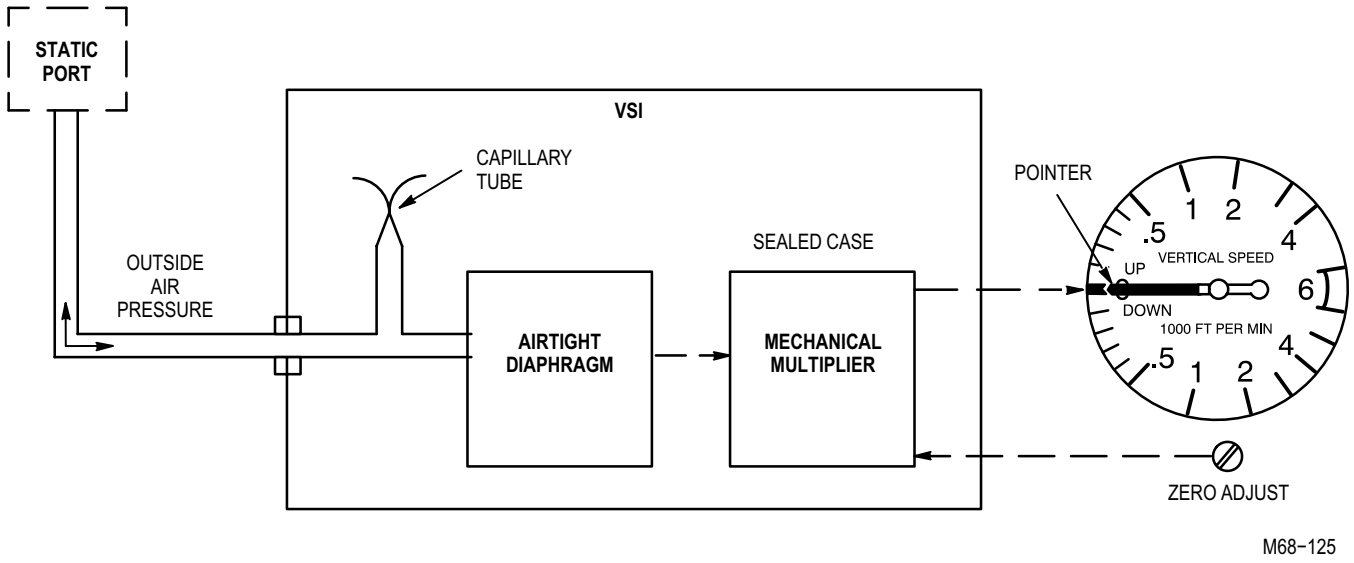


Figure 8–15. VSI Functional Block Diagram

(c) The pilot accelerometer (fig. 8–16) indicates positive and negative changes in gravity. The accelerometer has a weight attached internally to a spring for +1g reference. When the helicopter is moving up, force is applied to the weight and moves it down the shaft. The mechanical linkage moves the continuous pointer and maximum pointer in a clockwise direction. When the helicopter is moving down, force is applied to the weight and moves it up the shaft. The mechanical linkage moves the continuous pointer and maximum pointer in a counter–clockwise direction. The maximum and minimum pointers are connected to ratchets. These pointers follow the continuous pointer, but stop and remain at the highest reading reached until reset to +1g by the **PUSH TO SET** control.

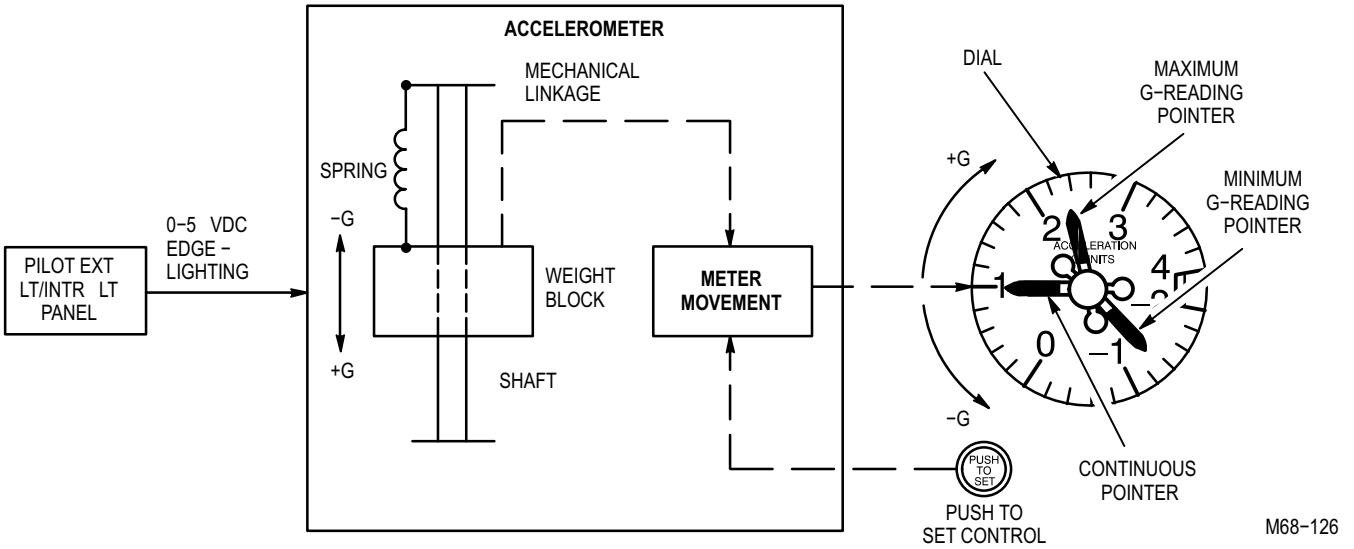


Figure 8–16. Pilot Accelerometer Functional Block Diagram

8–7. SYSTEM DESCRIPTION (cont) 8–7

(d) The barometric altimeter (fig. 8–17) is connected to the static port. Sea level barometric pressure is set using the zero–set locking screw. The zero set knob is then used to set the altitude pointer to zero. A change in outside air pressure acts instantly on the two opposed aneroids (elastic metal disks). The aneroids (elastic metal disks) expand or contract as air pressure changes, which causes the rocking shaft to rotate. This rotation is multiplied by the gear train, which moves the altitude pointer and counters.

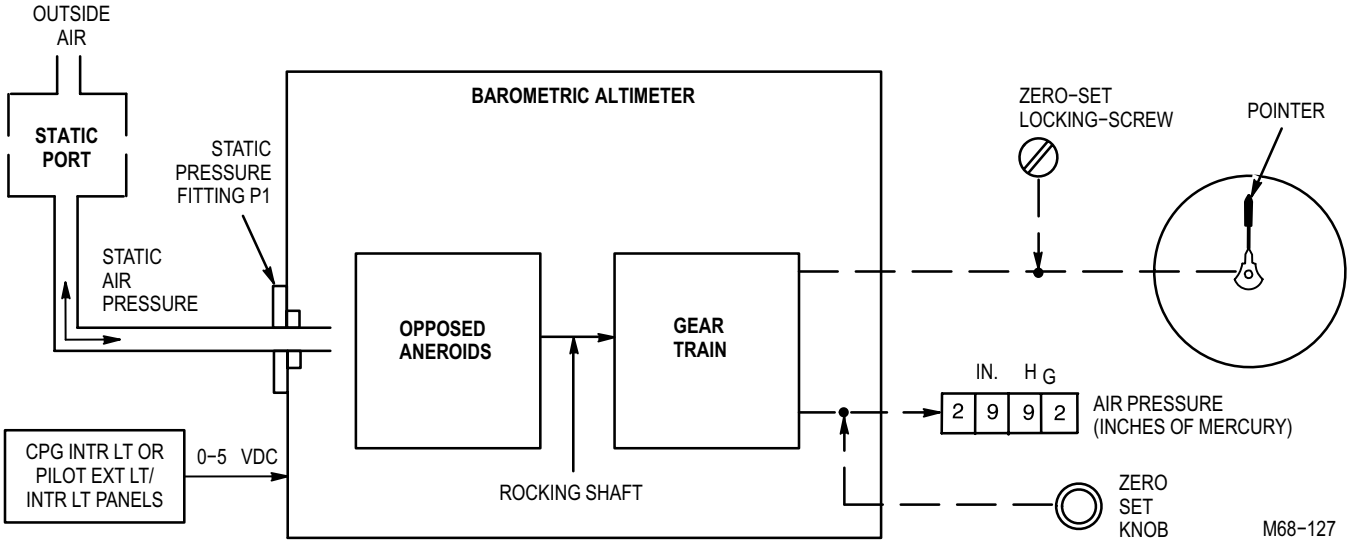


Figure 8–17. Barometric Altimeter Functional Block Diagram

8–7. SYSTEM DESCRIPTION (cont) 8–7

(e) The pilot SAI (fig. 8–18) is a self contained gyroscope (gyro) which indicates pitch and roll motion of the helicopter. The pilot SAI operates on 28 VDC input or 24 VDC emergency power. An internal static converter converts VDC input to 26 VAC, 400 Hz. The 26 VAC runs the motor which spins the gyro. The spinning gyro provides visual roll and pitch information. The word **CLIMB** appears on the gyrosphere when the helicopter upward pitch reaches 35°. The word **DIVE** appears on the gyrosphere when the helicopter downward pitch reaches –35°. The pitch trim control knob adjusts the pitch of the gyrosphere horizon to the fixed aircraft symbol. An **OFF** flag is displayed if the gyro is caged or power is lost.

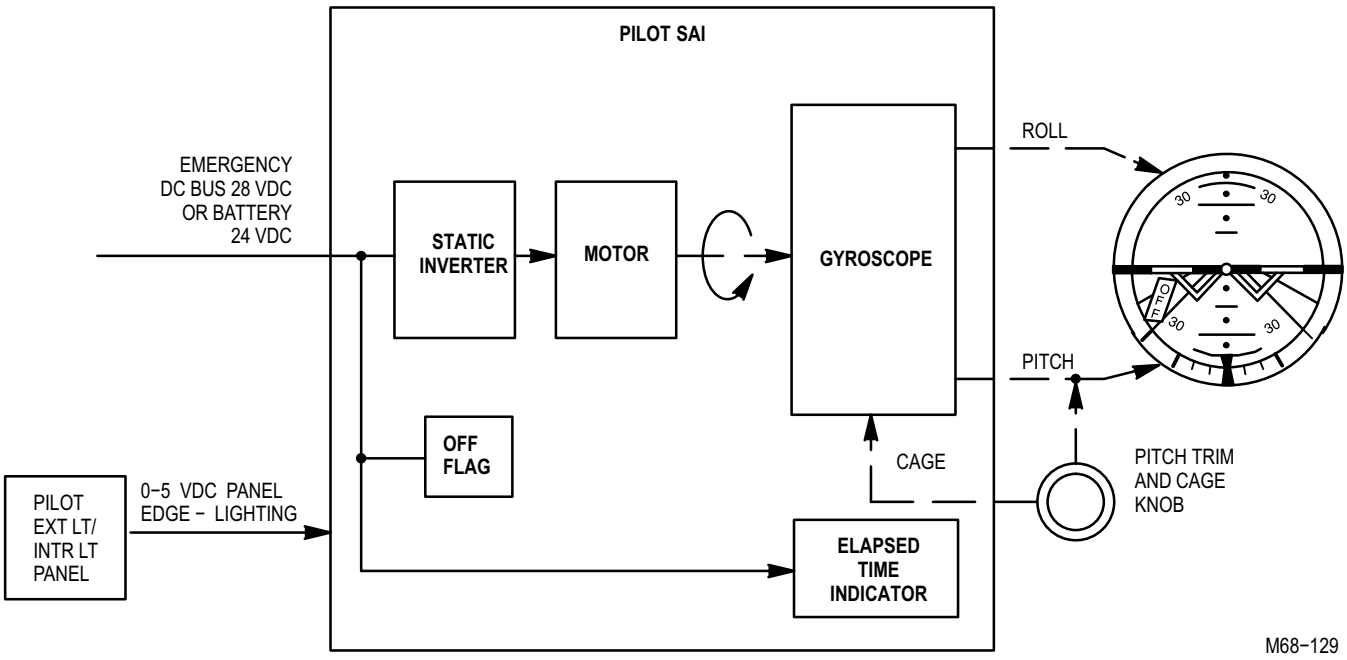


Figure 8–18. Pilot SAI Functional Block Diagram

8–7. SYSTEM DESCRIPTION (cont) 8–7

(f) The CPG RAI (fig. 8–19) receives pitch and roll synchro inputs from heading attitude reference system (HARS). The CPG RAI operates on 115 VAC, single phase 400 Hz. The input is applied to the RAI pitch trim knob and an internal stepdown transformer. The internal stepdown transformer converts VAC to excitation voltages for pitch and roll servos. The pitch trim control knob adjusts the pitch of the gyrosphere horizon to the fixed aircraft symbol. HARS pitch data is applied as pitch synchro signals are sent to the RAI pitch servo stator. The pitch servo rotates the gyrosphere to a new up or down position. HARS roll data is applied as roll synchro signals are sent to the RAI roll servo stator. The roll servo rotates the gyrosphere to a new degree–of–roll position. The word **CLIMB** appears on the gyrosphere when the helicopter upward pitch reaches 35°. The word **DIVE** appears on the gyrosphere when the helicopter downward pitch reaches –35°. An **OFF** flag is displayed if the HARS fails.

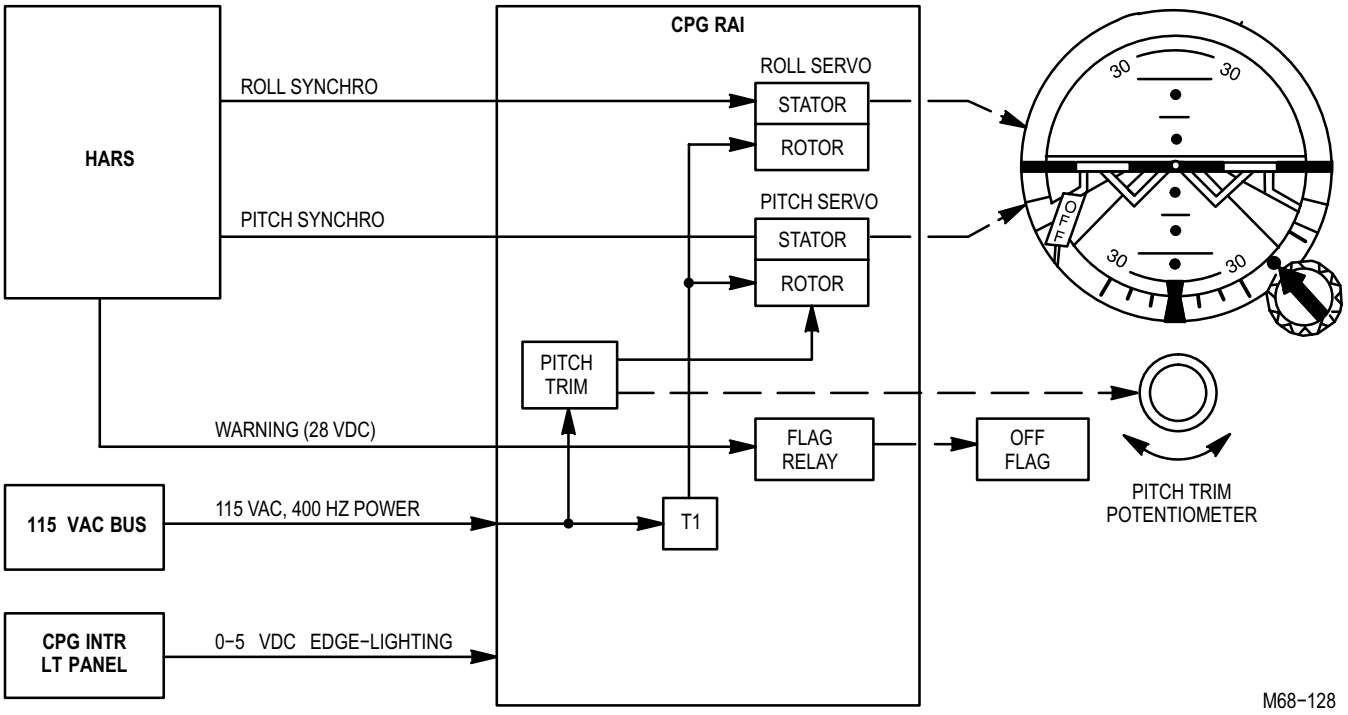


Figure 8–19. CPG RAI Functional Block Diagram

(g) The pilot magnetic compass (fig. 8–20) is liquid filled to keep vibrations from affecting operation. The offsetting magnets adjust the compass pointer to true magnetic North. Magnets correct compass errors caused by magnetic forces of the helicopter structure (deviation). A compass correction card is provided to note errors that remain after magnetic correction. The compass card rotates on the pivot point inside the sealed liquid–filled bowl. The compass card lines up with the earth's magnetic field.

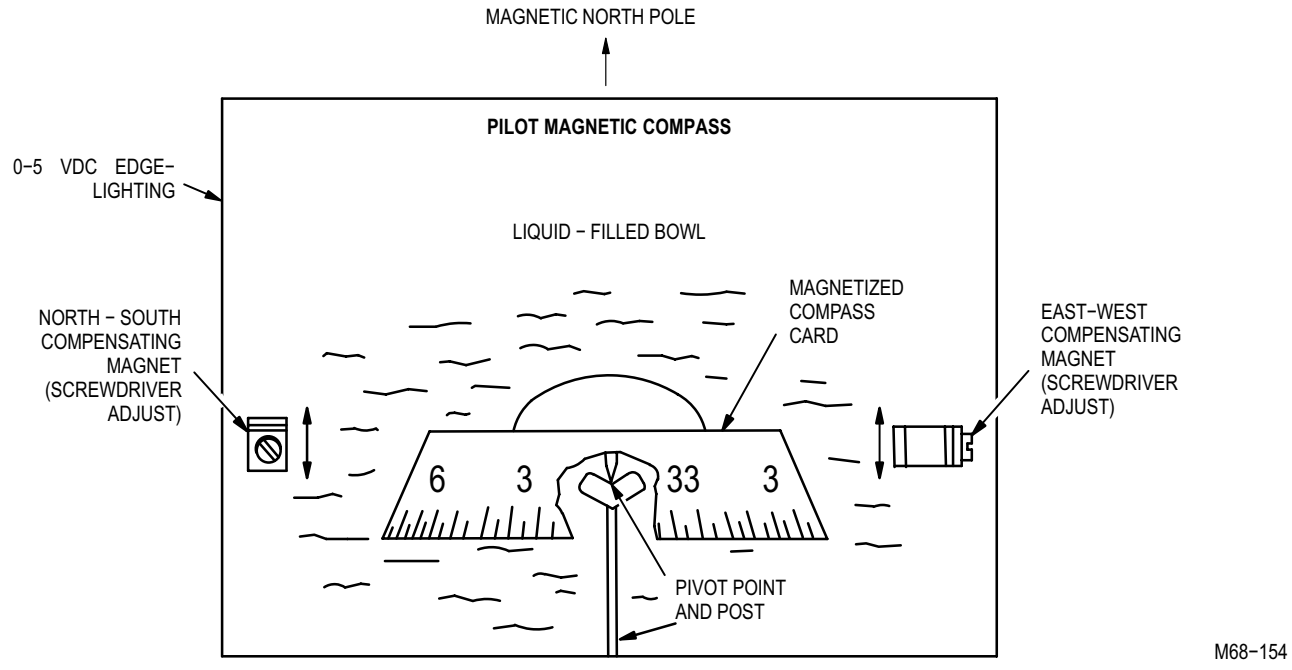


Figure 8–20. Pilot Magnetic Compass

d. **Miscellaneous Instruments.**

(1) **Purpose**. Miscellaneous instruments display hydraulic pressure, **FUEL** quantity, outside temperature, and time. The pilot indicator edge–lighting is controlled by the pilot **EXT LT/INTR LT** panel. The CPG edge–lighting is controlled by CPG **INTR LT** panel.

(2) **System of Operation.**

(a) The pilot dual hydraulic pressure indicator (fig. 8–21) receives inputs from the primary and utility hydraulic pressure transducers. The hydraulic pressure transducers convert hydraulic pressure into 0 to 5 VDC signals. VDC power moves the pointers across the dial. The pointer moves with changes in pressure.

(b) The pilot emergency hydraulic pressure indicator (fig. 8–22) receives inputs from the utility hydraulic system emergency pressure transducer. The emergency pressure transducer converts hydraulic pressure into 0 to 5 VDC signals. VDC power moves the pointer across the dial. The pointer moves with changes in pressure.

(c) The **FUEL** quantity indicator (fig. 8–23) receives operating and lamp supply voltages from the SDC. Aft and forward fuel cell sensors supply fuel cell data to the fuel quantity indicator. The dim/test panel provides display lamp test, digital blanking, and display lamp dim/bright automatic control.

8–7. SYSTEM DESCRIPTION (cont) 8–7

(d) The refuel **FUEL QTY** indicator (fig. 8–24) receives 24 VDC battery power through the **IND ON/OFF** switch via the FSC. The FSC converts forward and aft fuel cell sensor data to linear 0 to 5 VDC. The refuel indicator changes electrical inputs into mechanical outputs. The mechanical outputs move the pointers along the scale.

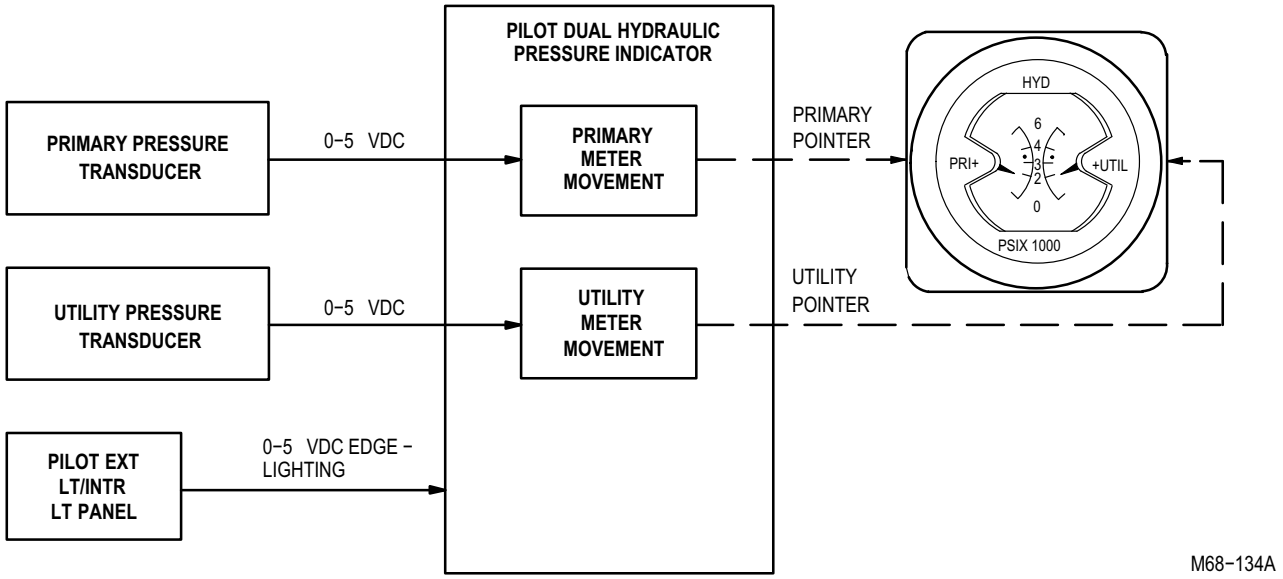


Figure 8–21. Pilot Dual Hydraulic Pressure Indicator Functional Block Diagram

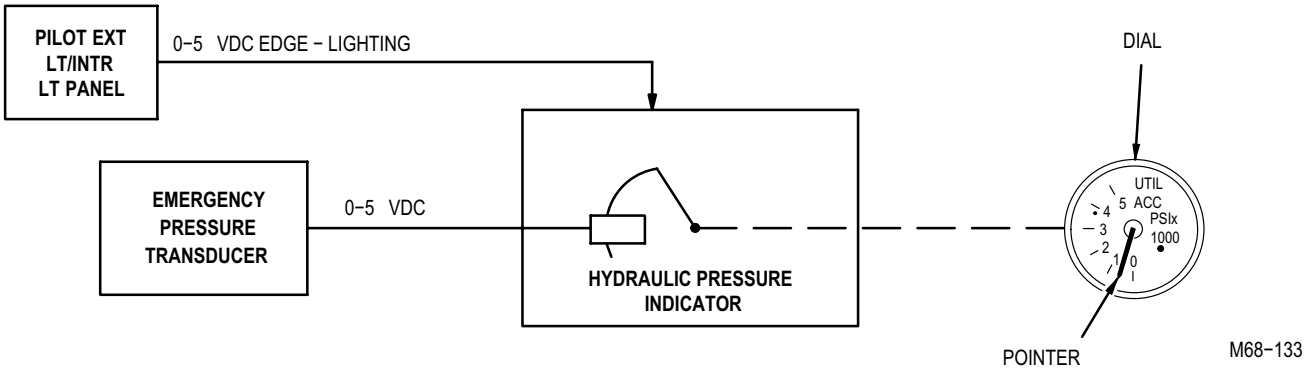


Figure 8–22. Pilot Emergency Hydraulic Pressure Indicator Functional Block Diagram

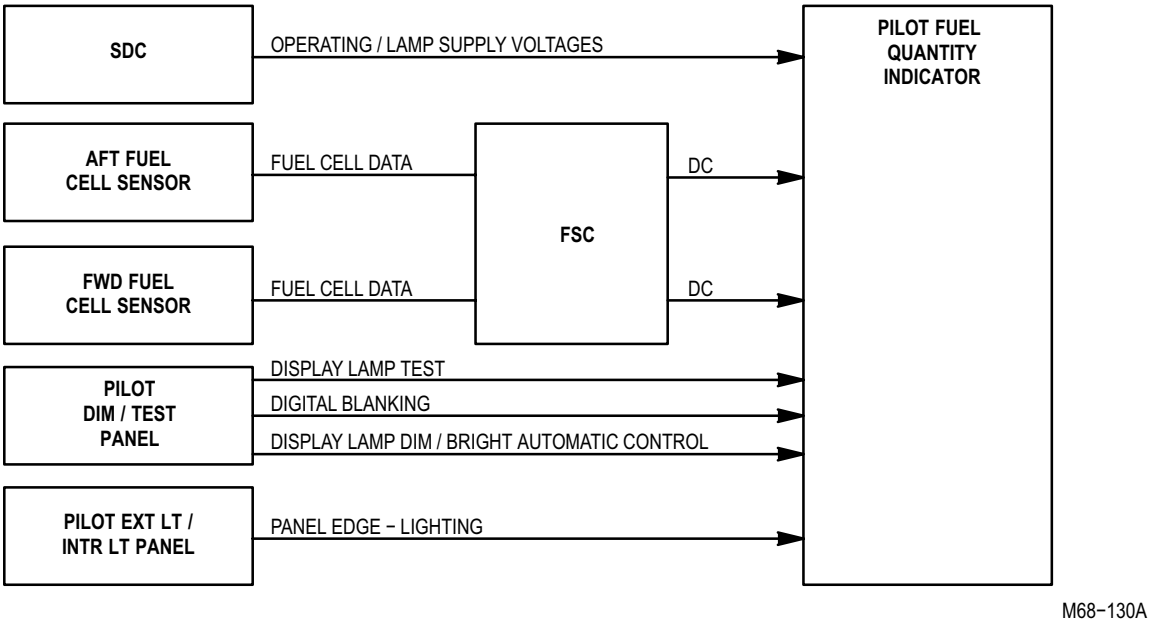


Figure 8–23. Pilot FUEL Quantity Indicator Functional Block Diagram

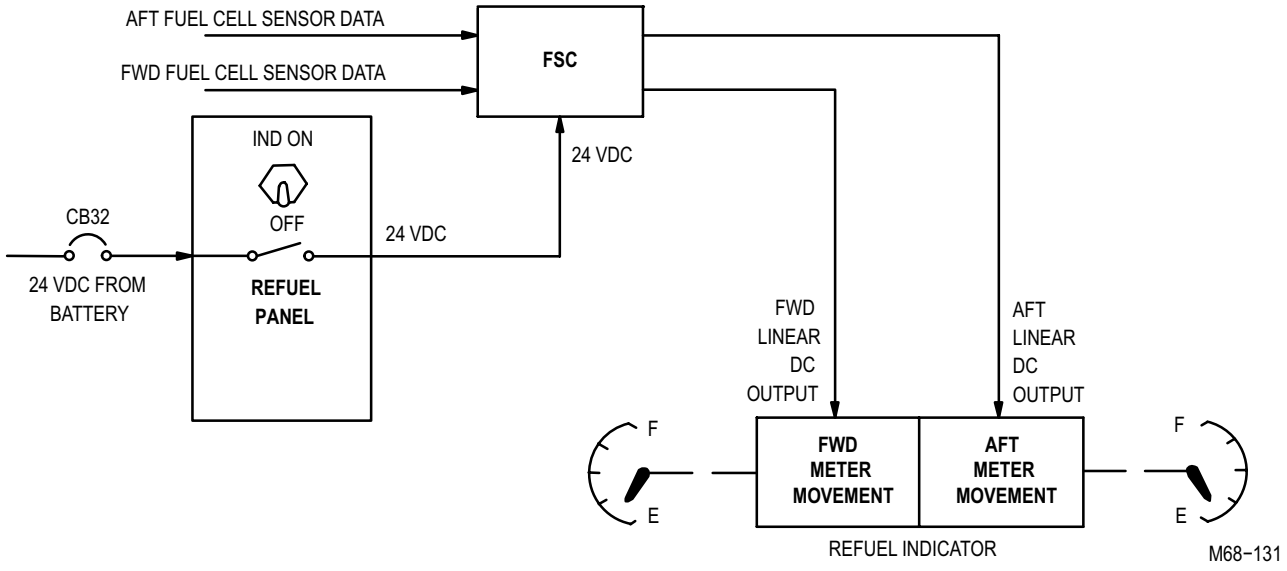


Figure 8–24. Refuel FUEL QTY Indicator Functional Block Diagram

8–7. SYSTEM DESCRIPTION (cont) 8–7

(e) The FSC (fig. 8–25) operates on 28 VDC from the SDC except during refueling. During refueling the FSC operates on 24 VDC from the battery. The fuel cells act as the sensing capacitor for the system. The capacitive value is determined by the level of fuel between the inner and outer tubes of the sensor, density of fuel, and the shape of the inner tube. The FSC derives the operating voltages from an internal power supply. A 6 KHz oscillator provides a LO–Z voltage across the fuel tanks. The amount of current the cell passes from the LO–Z unshielded line to the HI–Z shielded line is directly proportional to the mass of fuel in the tank. The forward and aft FSCs amplify and rectify the HI–Z signals, producing 0 to 5 VDC to the fuel indicators. Internal empty adjustment is made at the transformer centertaps at the oscillator. Internal full adjustment is made in the dc amplifier. The FSC contains built–in–test (BIT) circuitry. BIT provides a known signal to functionally check the FSC by full cell simulation. BIT is activated by an external switch on the FSC.

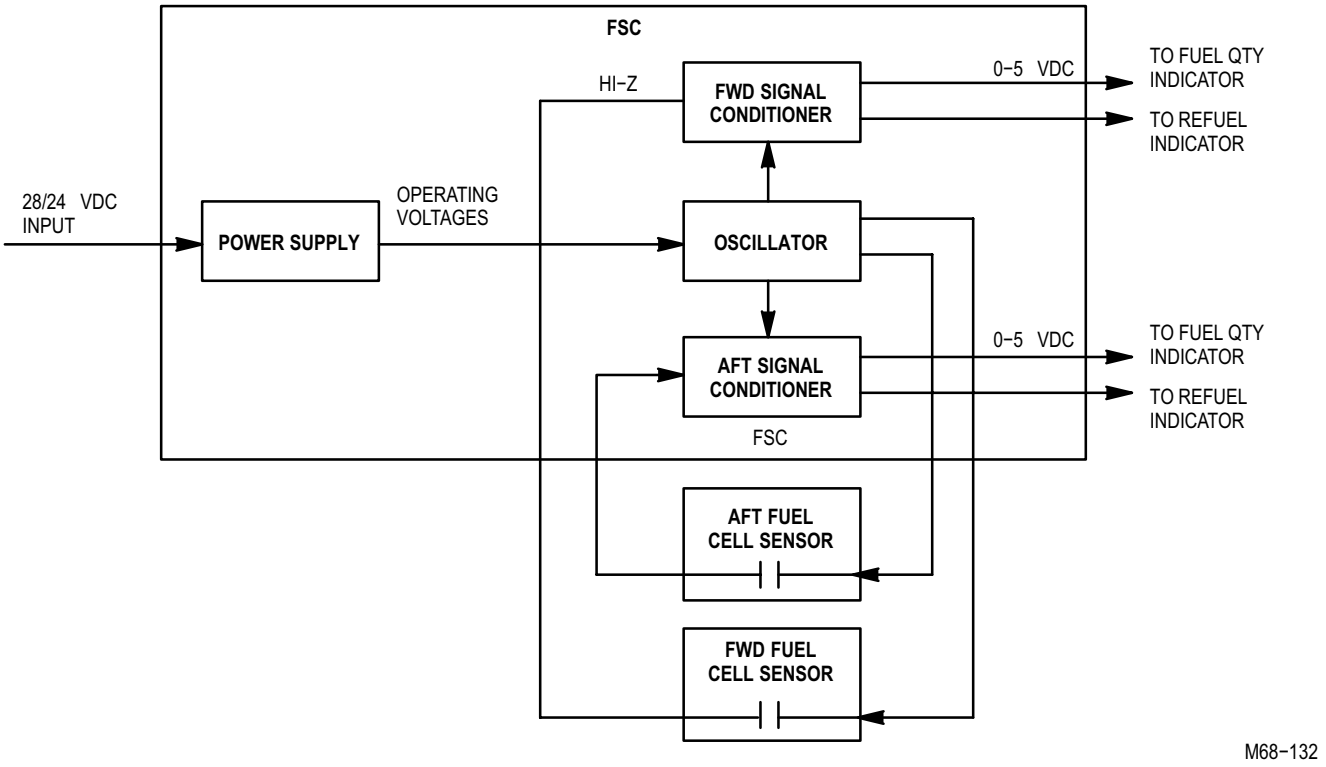


Figure 8–25. FSC Functional Block Diagram

(3) The pilot OAT indicator (fig. 8–26) contains a sensing element which contracts or expands as temperature changes. This movement is mechanically coupled to the pointer, which moves to indicate current outside air temperature.

8–7. SYSTEM DESCRIPTION (cont) 8–7

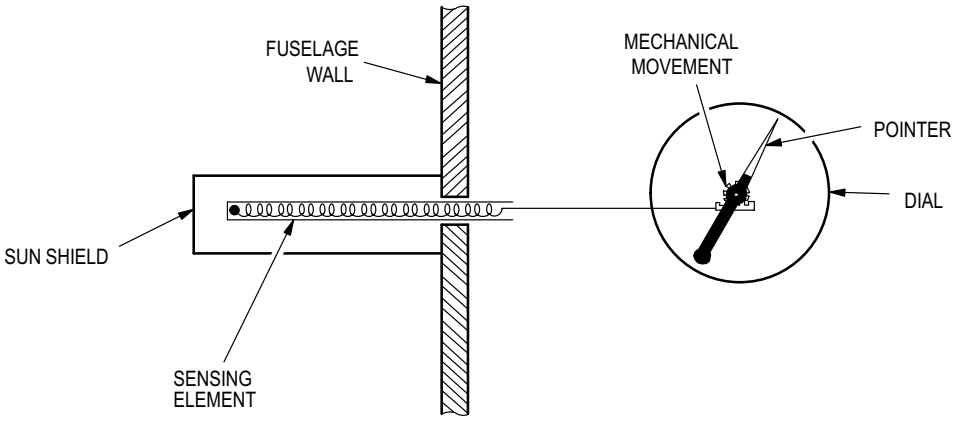


Figure 8–26. Pilot OAT Indicator Functional Block Diagram

(4) The clock (fig. 8–27) mainspring drives the clock mechanism which in turn drives the clock hands and the elapsed time hand. To wind the main spring, the winding set knob is pushed in and turned. When winding, the set knob is pulled out to set the hour and minute hands. The elapsed–time pushbutton control has three stages of action. The first push resets the elapsed–time and second sweep hand to zero. The second push starts the elapsed–time and second sweep hand to keep time. The third push stops the elapsed–time and second sweep hand to keep time. The third push stops the elapsed–time and second sweep hand.

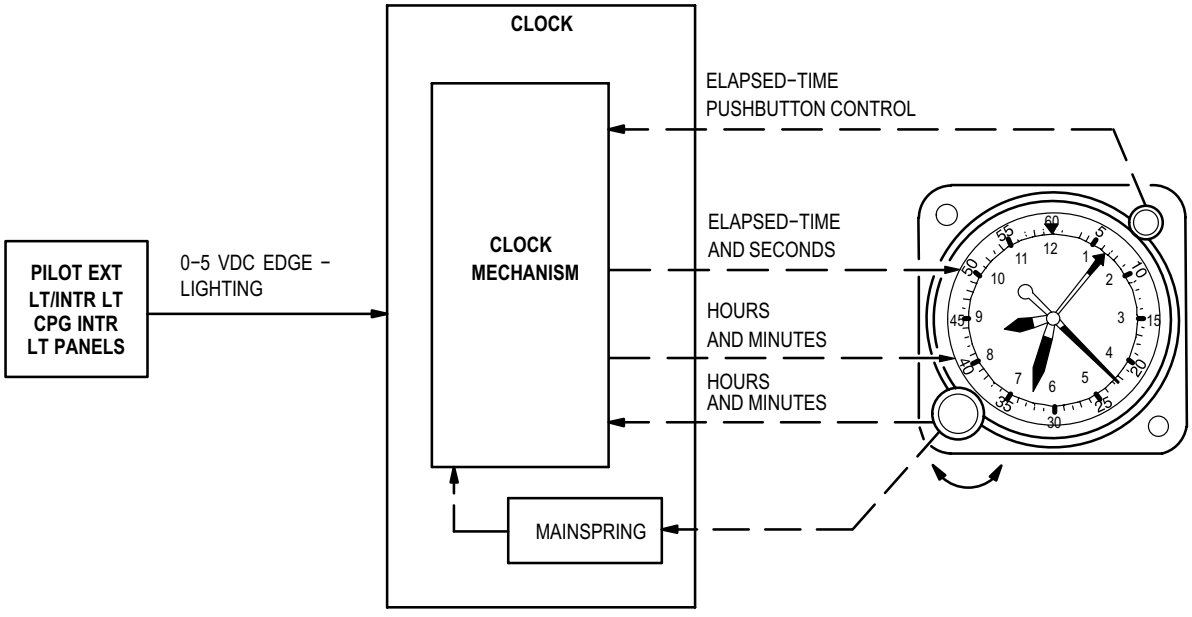


Figure 8–27. Clock Functional Block Diagram

8–8. MULTIPLEX READ CODES 8–8

Multiplex read codes are not applicable to instruments, but are applicable to HARS signal outputs which are sent to the flight instruments.

SECTION III. TROUBLESHOOTING PROCEDURES

8–9. ELECTRICAL COMPONENT LOCATION AND CONFIGURATION (ECLC) INDEX 8–9

Use the information in Table 8–2 to locate the electrical components and their connectors to perform the troubleshooting tasks in this chapter. Table 8–2 includes locator illustrations which supplement the ECLC listing. The listing entry in the grid area column tells where to find the component in the illustrations.

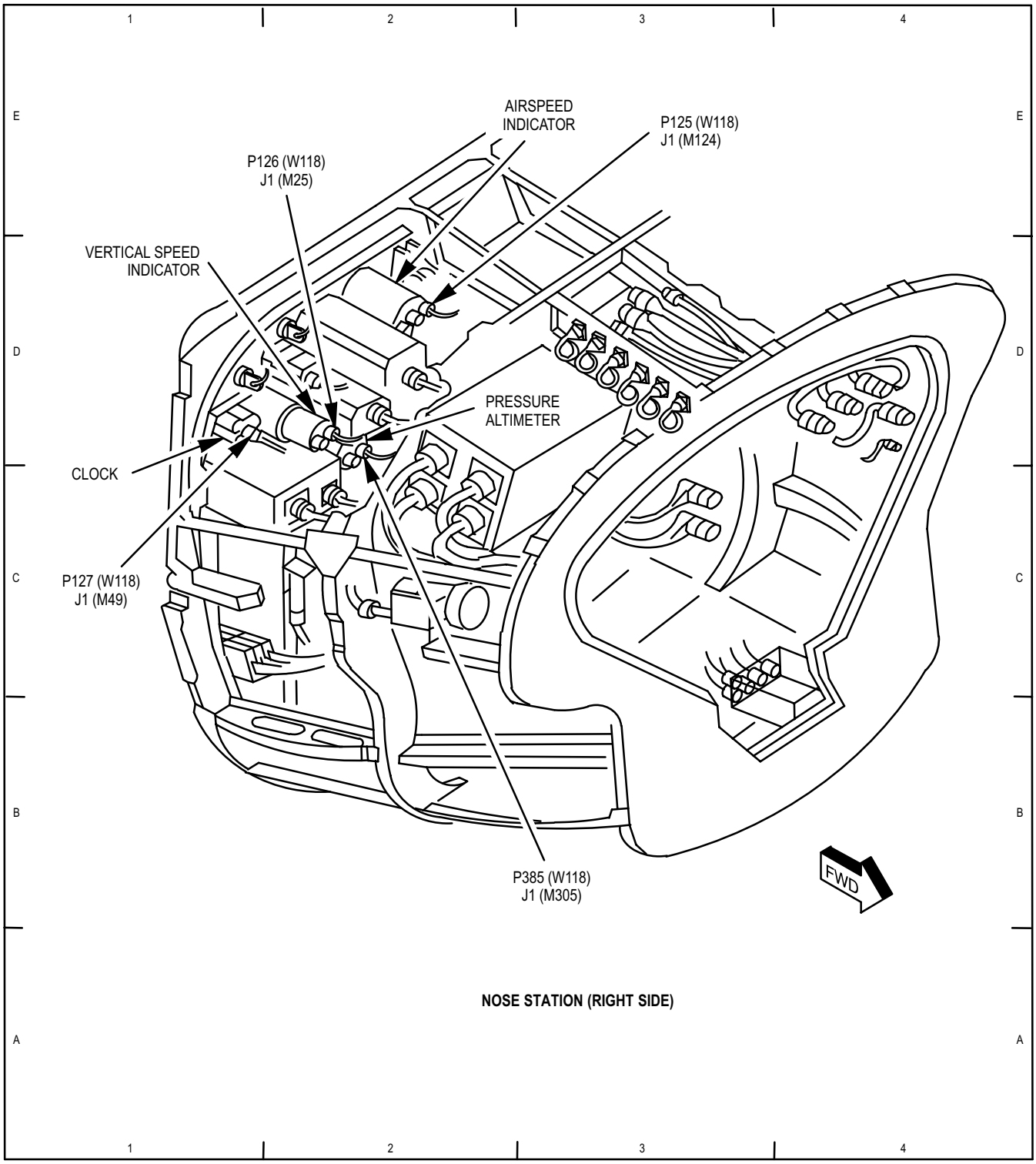
Table 8–2. Electrical Component Location and Configuration (ECLC) Index Listing

FROM COLUMN		TO COLUMN			
Connector Ref Des	Component/ Harness	Connector Ref Des	Component/ Harness	Grid Area	Access
P1	W605/A76	J1	A402	32B	PILOT STATION
P21	W165	J21	W119	35E	LN1 DOOR
P22	W166	J22	W118	38E	RN1 DOOR
P23	W165	J23	W261	35E	LN1 DOOR
P24	W166	J24	W118	38E	RN1 DOOR
P41	W165	J1	E1	35D	LN1 DOOR
P42	W166	J1	E1	39C	RN1 DOOR
P45	W165	J1	E3	33E	LN1 DOOR
P46	W166	J1	E3	37C	RN1 DOOR
P74	W261	J1	A69	5D	L40 COVER
P75	W261	J1	A518	5E	L40 COVER
P119	W119	J1	M19	23D	CPG STATION
P120	W118	J1	M20	23B	CPG STATION
P121	W119	J1	M22	22B	CPG STATION
P122	W119	J1	M23	26D	CPG STATION
P123	W119	J1	M22	22A	CPG STATION
P125	W118	J1	M124	3E	R40 COVER
P126	W118	J1	M25	2E	R40 COVER
P127	W118	J1	M49	1C	R40 COVER
P382	W118	J1	M301	23C	CPG STATION
P383	W119	J1	M302	26C	CPG STATION

Table 8–2. Electrical Component Location and Configuration (ECLC) Index Listing(cont)

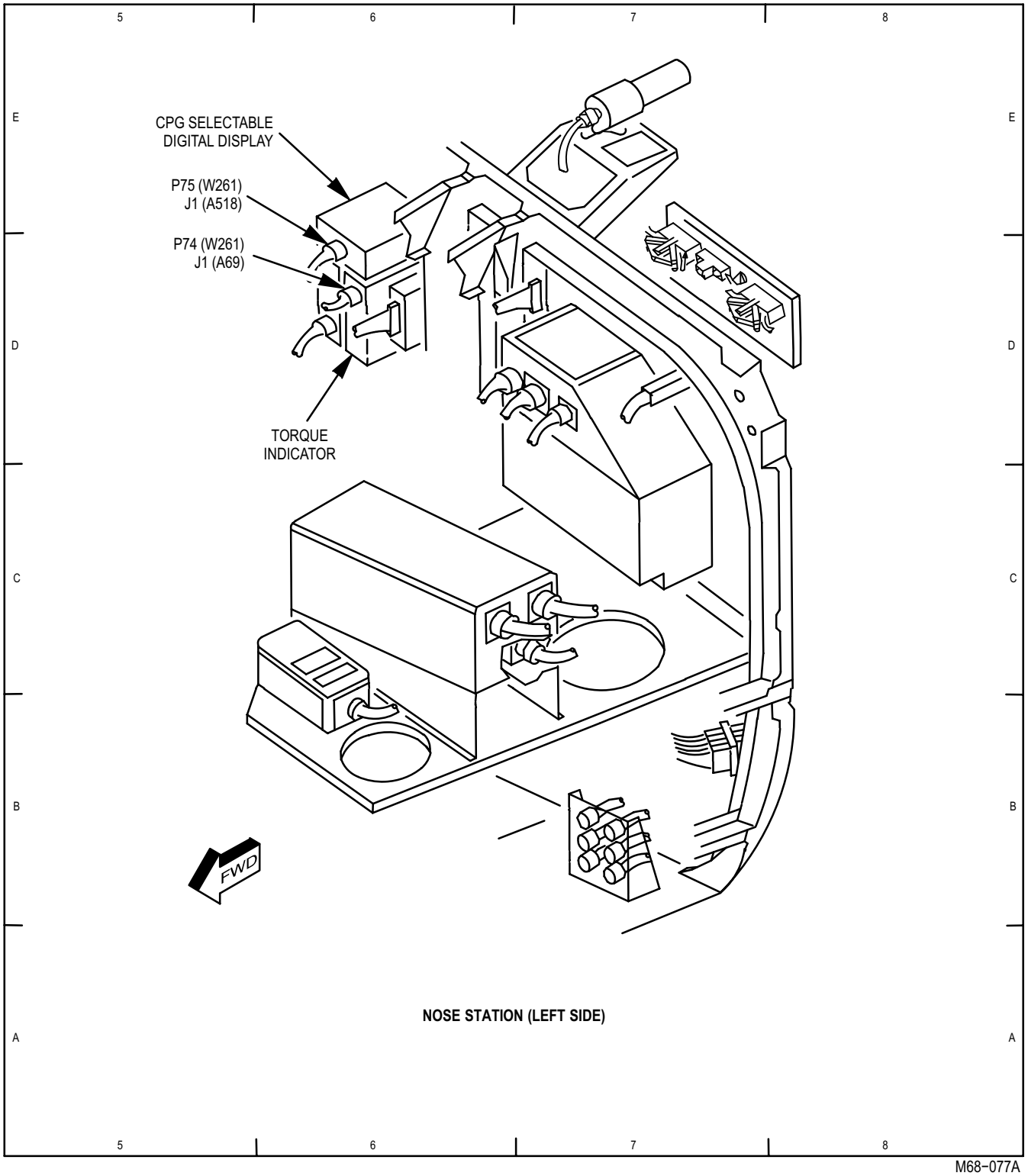
FROM COLUMN		TO COLUMN			
Connector Ref Des	Component/ Harness	Connector Ref Des	Component/ Harness	Grid Area	Access
P385	W118	J1	M305	3B	R40 COVER
P429	W119	J1	A402	29D	L200 PANEL
P449	W211	J449	W119	67D	T205 FAIRING
P452	W261	J452	W261	13C	PILOT STATION
P463	W119	J1	A76	16D	PLT STATION
P466	W118	J14	A326	17C	CPG STATION
P473	W119	J6	A326	19C	CPG STATION
P480	W118	J16	A326	17C	CPG STATION
P487	W119	J9	A326	23C	CPG STATION
P488	W266	J17	A326	17C	CPG STATION
P750	W118	J1	A320	23C	CPG STATION
P908	W118	J908	W119	10E	CPG STATION

8–9. ELECTRICAL COMPONENT LOCATION AND CONFIGURATION (ECLC) INDEX (cont) 8–9



NOSE STATION (RIGHT SIDE)

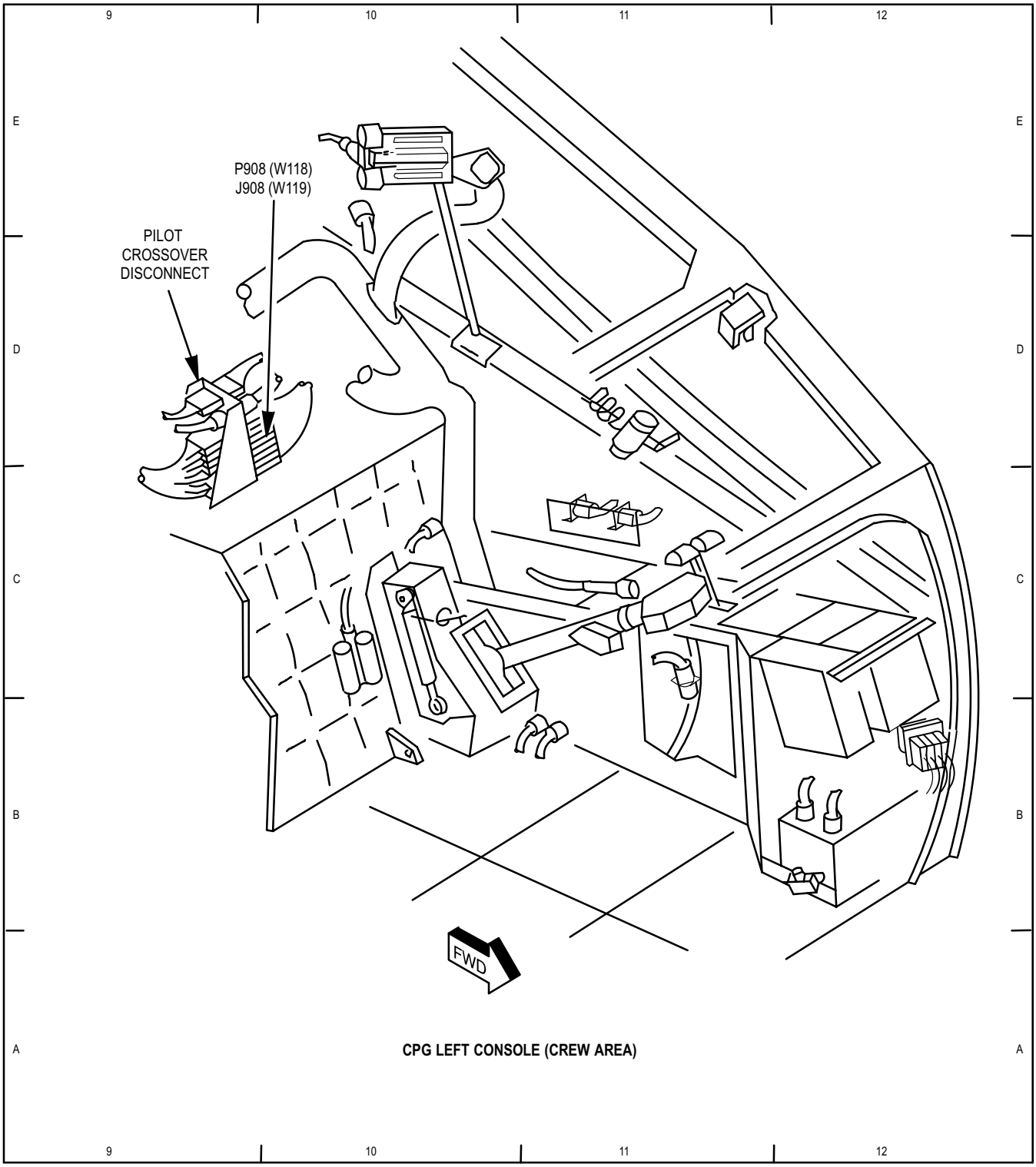
M68-075A



NOSE STATION (LEFT SIDE)

M68−077A

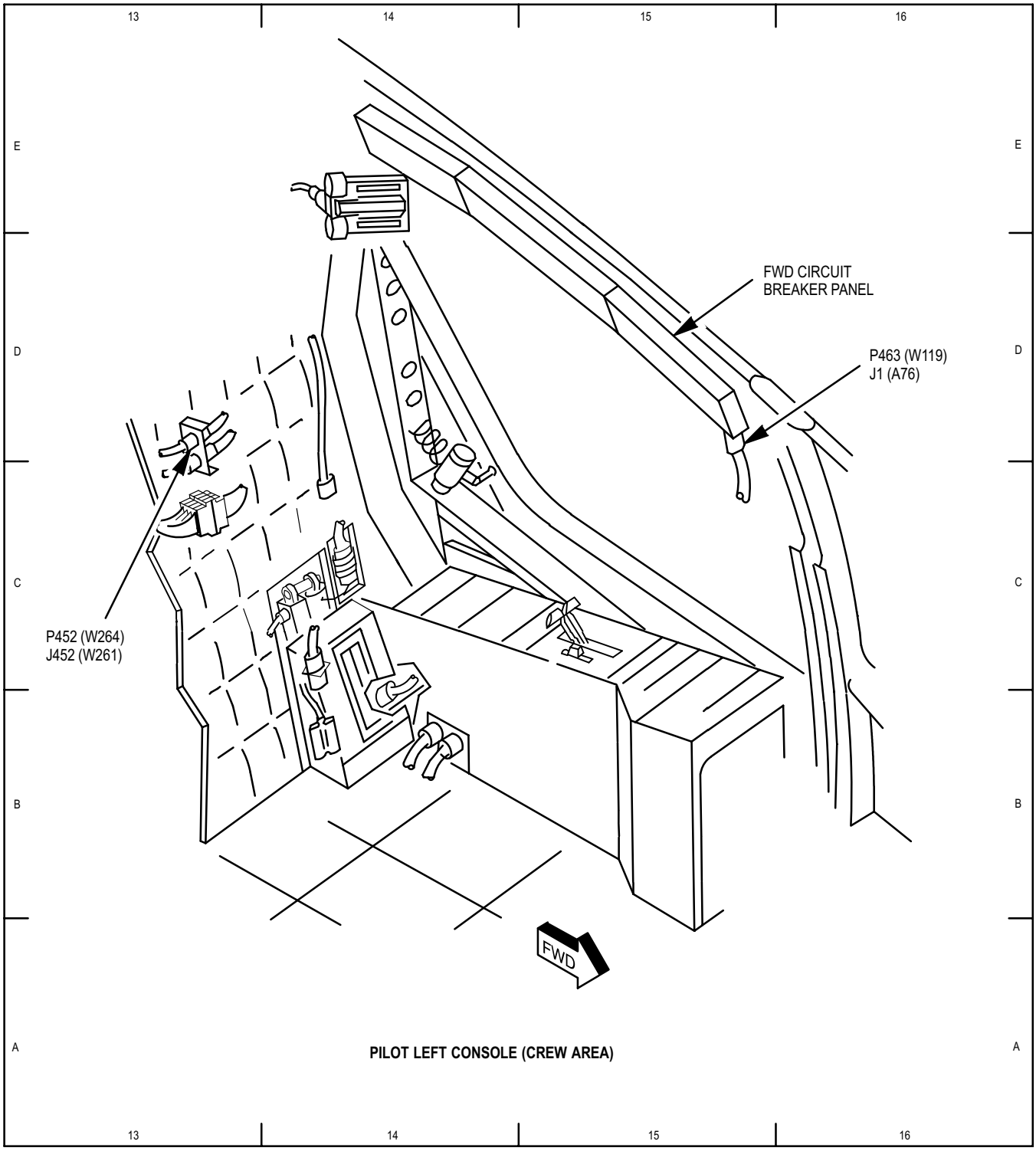
8–9. ELECTRICAL COMPONENT LOCATION AND CONFIGURATION (ECLC) INDEX (cont) 8–9



CPG LEFT CONSOLE (CREW AREA)

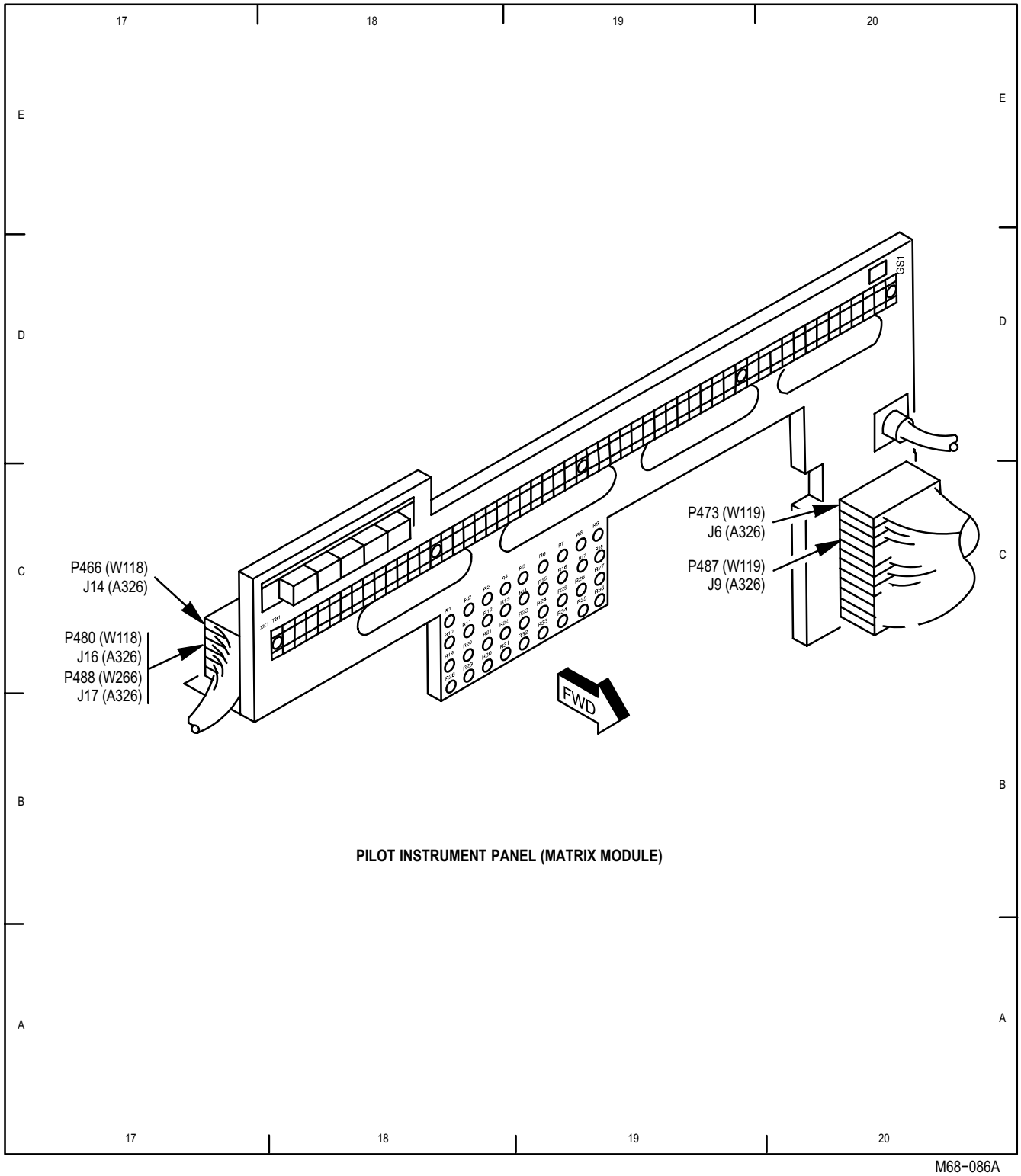
M68−080A

8–9. ELECTRICAL COMPONENT LOCATION AND CONFIGURATION (ECLC) INDEX (cont) 8–9



M68−082A

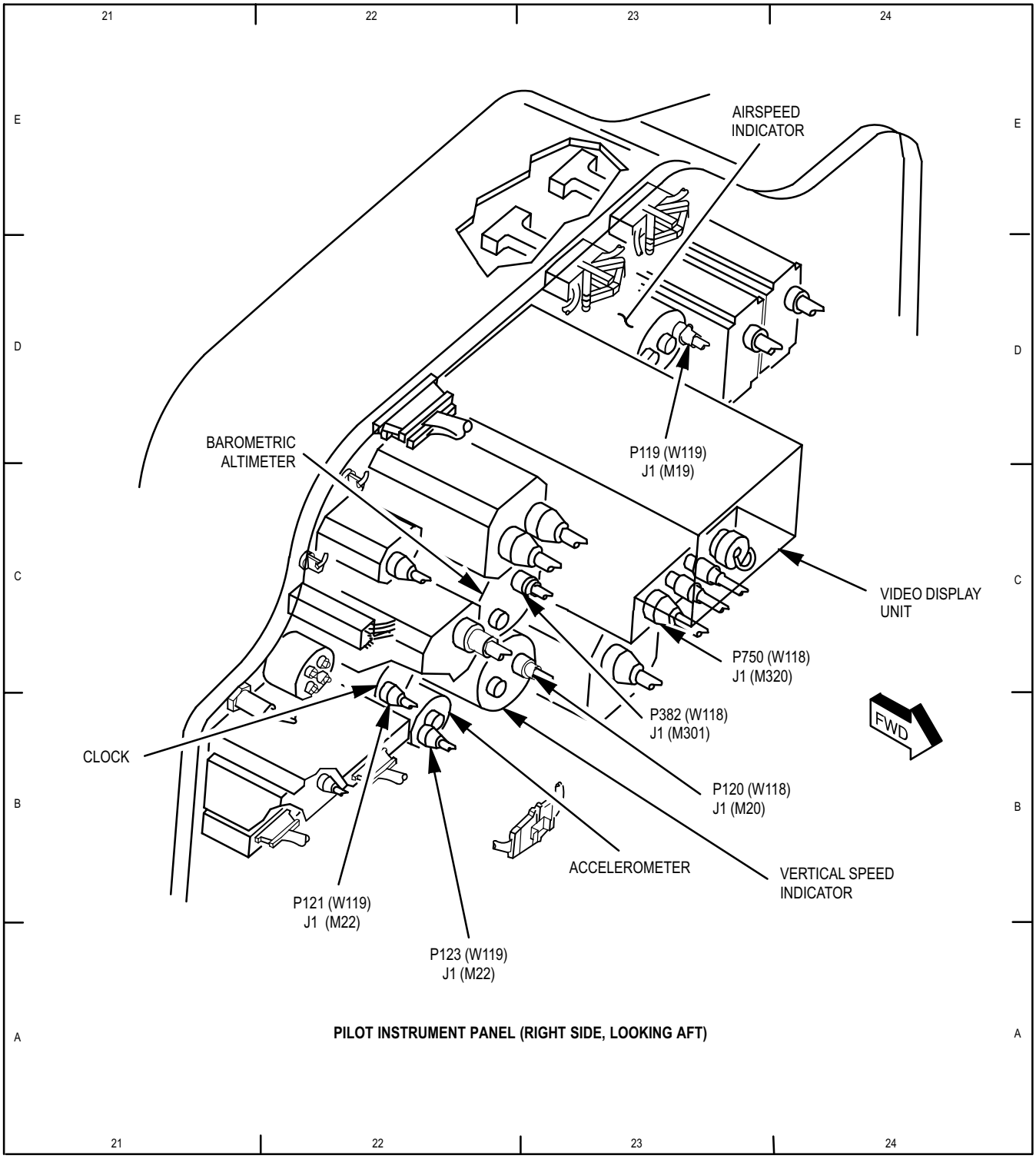
8–9. ELECTRICAL COMPONENT LOCATION AND CONFIGURATION (ECLC) INDEX (cont) 8–9



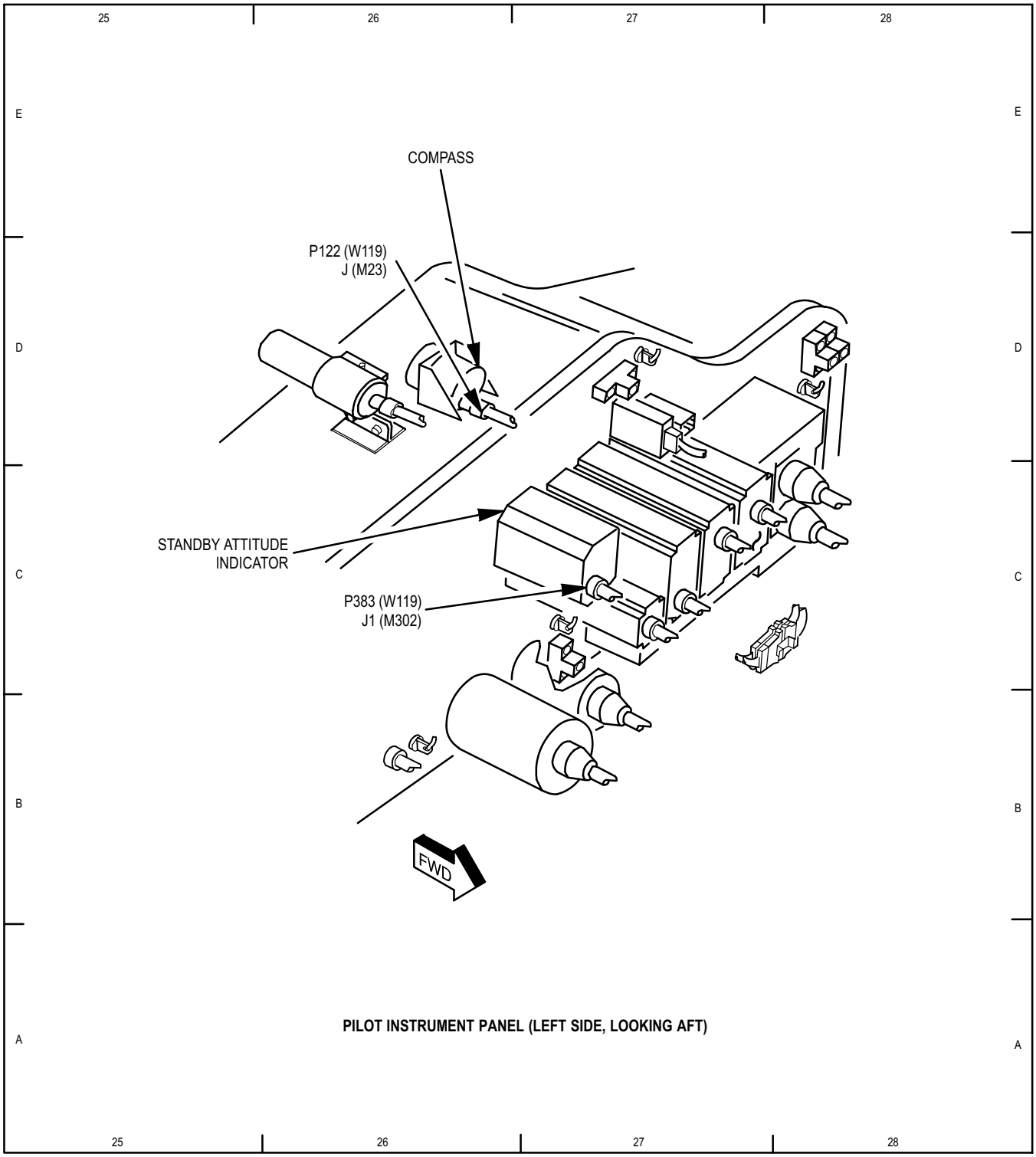
PILOT INSTRUMENT PANEL (MATRIX MODULE)

M68−086A

8–9. ELECTRICAL COMPONENT LOCATION AND CONFIGURATION (ECLC) INDEX (cont) 8–9



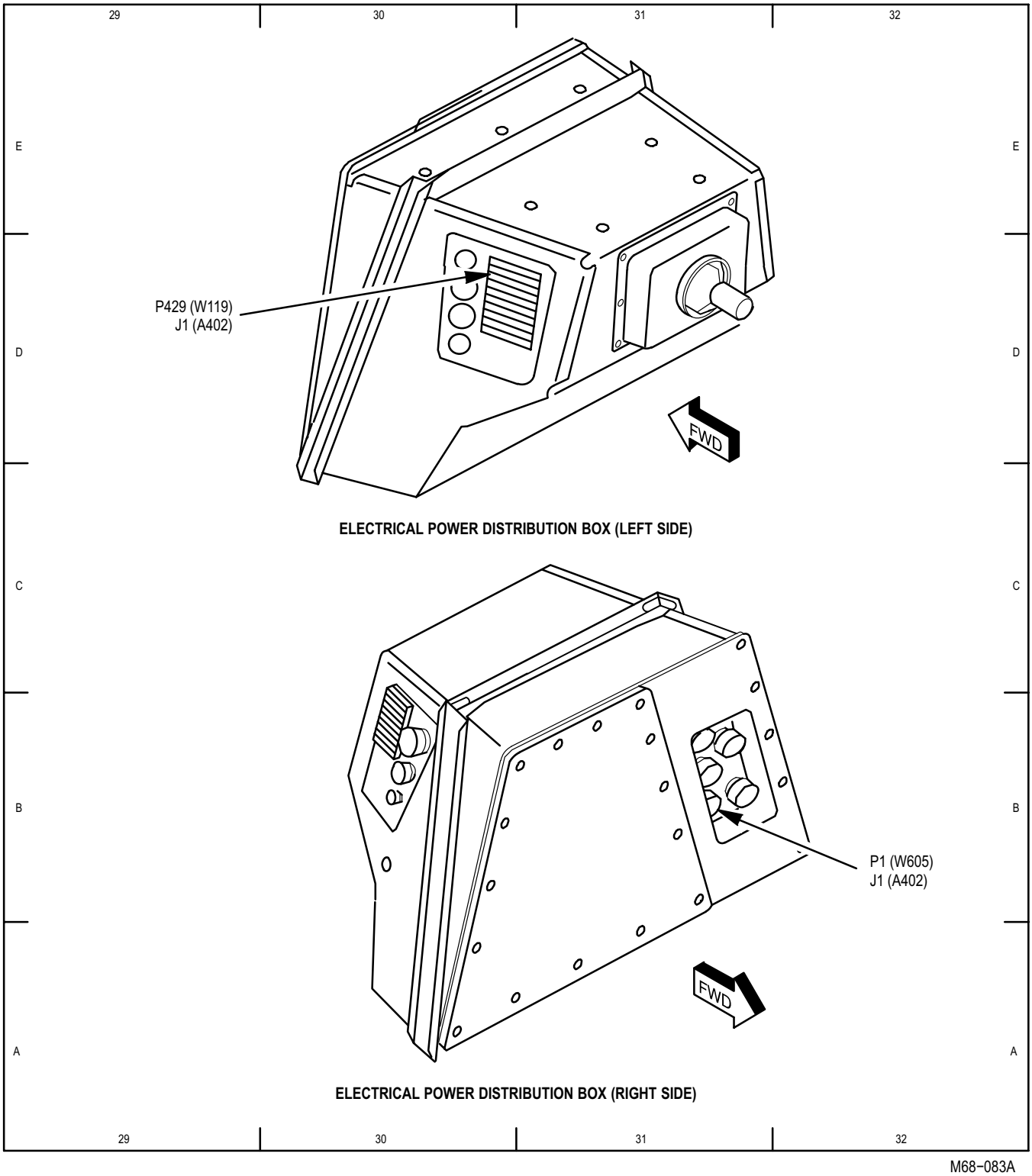
M68−084A



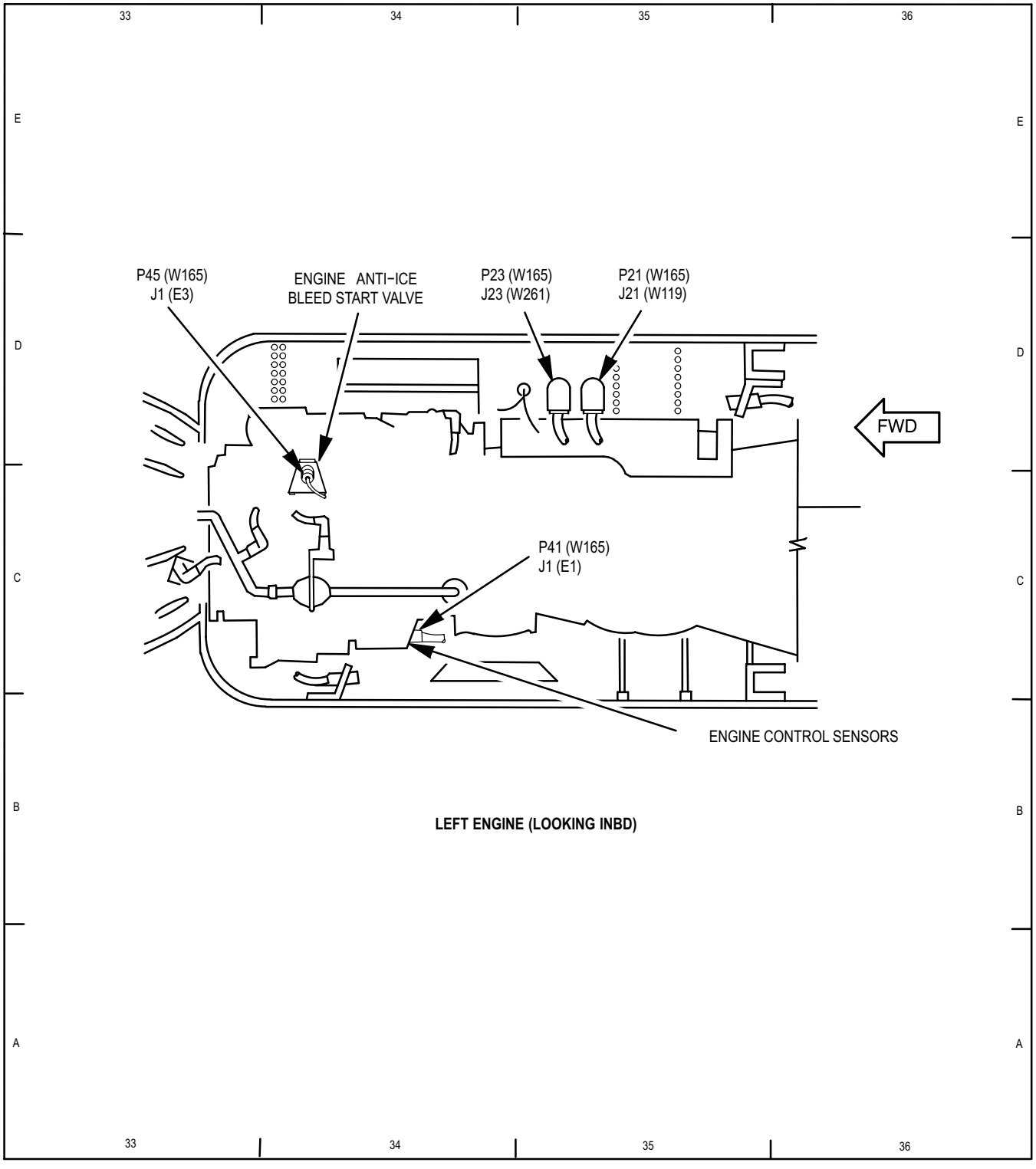
PILOT INSTRUMENT PANEL (LEFT SIDE, LOOKING AFT)

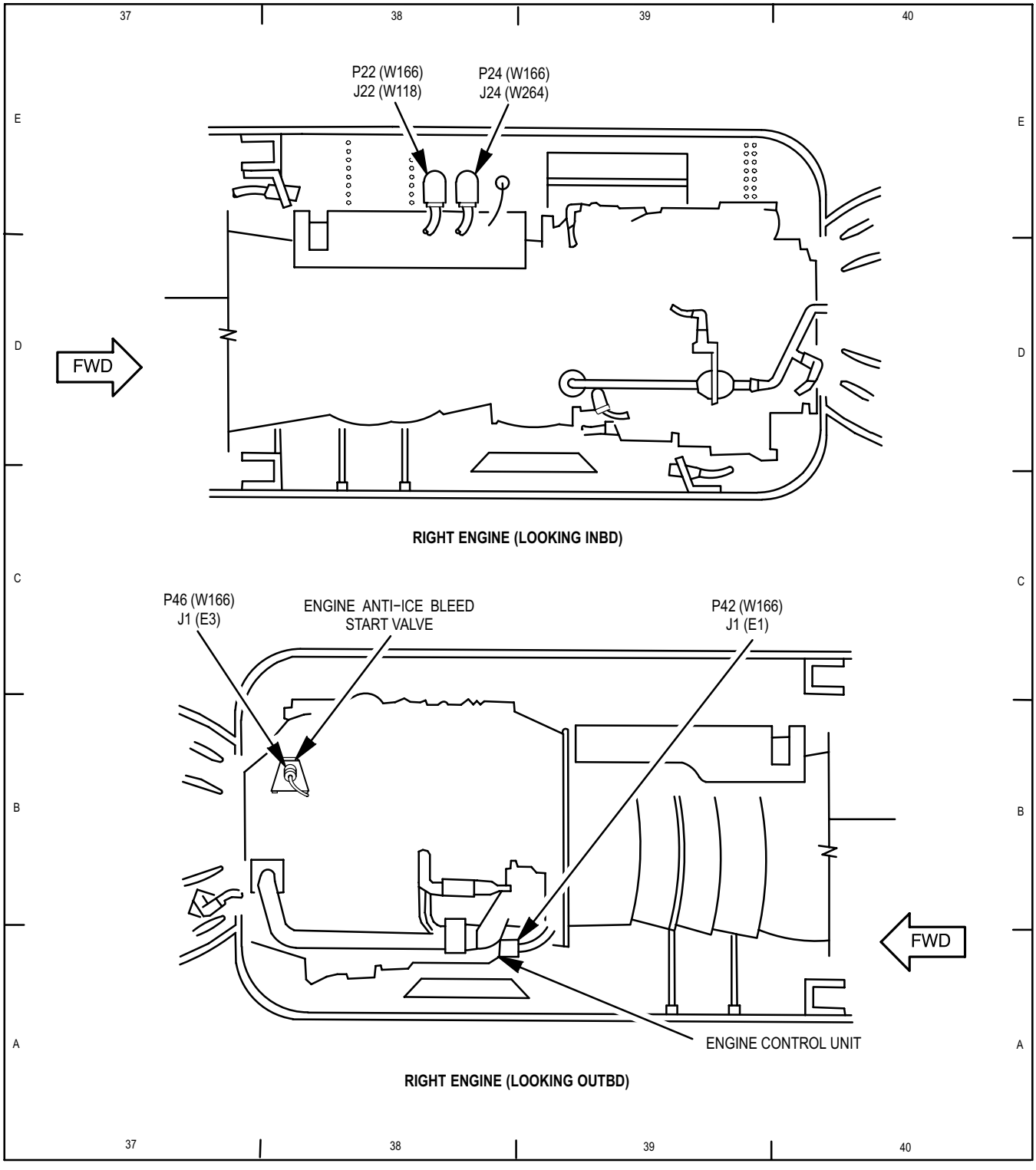
M68-085A

8–9. ELECTRICAL COMPONENT LOCATION AND CONFIGURATION (ECLC) INDEX (cont) 8–9



M68-083A


33
34
35
36
E
D
C
B
A
P45 (W165)
J1 (E3)
ENGINE ANTI−ICE
BLEED START VALVE
P23 (W165)
J23 (W261)
P21 (W165)
J21 (W119)
FWD
P41 (W165)
J1 (E1)
ENGINE CONTROL SENSORS
LEFT ENGINE (LOOKING INBD)
M68−096A


37
38
39
40
E
D
C
B
A
P22 (W166)
J22 (W118)
P24 (W166)
J24 (W264)
FWD
RIGHT ENGINE (LOOKING INBD)
P46 (W166)
J1 (E3)
ENGINE ANTI−ICE BLEED
START VALVE
P42 (W166)
J1 (E1)
FWD
ENGINE CONTROL UNIT
RIGHT ENGINE (LOOKING OUTBD)
M68−097A

8–10. ENGINE INSTRUMENTS – MAINTENANCE OPERATIONAL CHECK 8–10

Tools:

Nomenclature	Part Number
Tool Kit, Aircraft Mechanic's	SC518099CLA01

Personnel Required:

67R Attack Helicopter Repairer (2)
152FG Maintenance Test Pilot

References:

TM 1-1520-238-T-4
TM 1-1520-238-T-6
TM 11-1520-238-23-2
TM 1-1520-238-23
TM 1-1520-238-CL
TM 1-1520-238-PMS

Equipment Conditions:

Ref	Condition
TM 1-1520-238-23	Helicopter safed
	External power application – Electrical
TM 1-1520-238-T-4	Maintenance headset connected

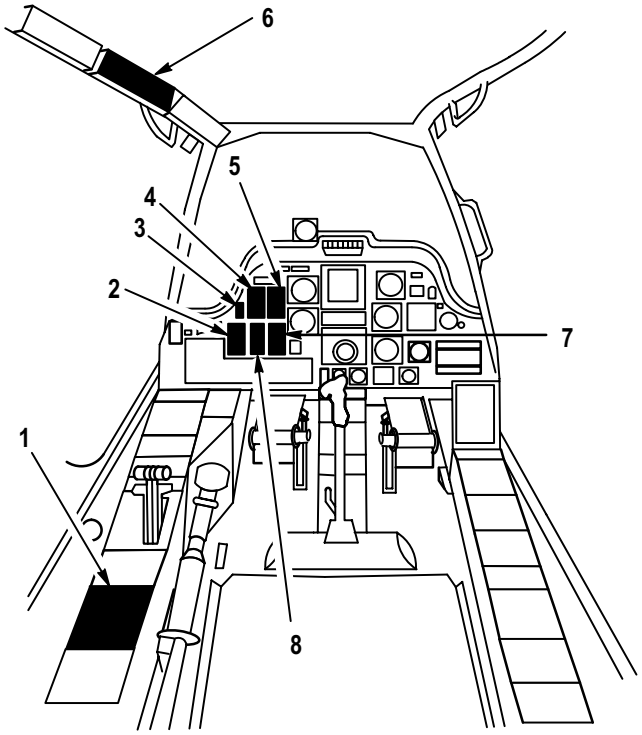
NOTE

- **Refer to pilot station (fig. 8–28) and CPG station (fig. 8–29) for configurations and equipment.**
- **If referenced out of one paragraph or volume into another for additional troubleshooting, upon completion of the task, return to the maintenance operational check for the original paragraph or volume.**

1. Perform visual inspection of power plants and engine instruments (TM 1-1520-238-PMS).
2. Complete the maintenance operational check as follows:

Task	Result
a. Check the **ENG INST** circuit breaker on pilot center circuit breaker panel (fig. 8–30) is closed.	If pilot **ENG INST** circuit breaker does not stay closed, go to paragraph 8–12.
b. Check that **EMERG BATT ENG INST** circuit breaker on CPG circuit breaker panel 1 (fig. 8–31) is closed.	If CPG **EMERG BATT ENG INST** circuit breaker does not stay closed (helicopters without CPG dim/test panel installed), go to paragraph 8–13. (Helicopters with CPG dim/test panel installed), go to paragraph 8–14.

8–10. ENGINE INSTRUMENTS – MAINTENANCE OPERATIONAL CHECK (cont) 8–10



1. PILOT EXT LT/INTR LT PANEL
2. PILOT FUEL QUANTITY INDICATOR
3. PILOT DIM/TEST PANEL
4. PILOT TGT INDICATOR
5. PILOT TORQUE INDICATOR
6. PILOT CENTER CIRCUIT BREAKER PANEL
7. PILOT ENG − RTR RPM% INDICATOR
8. PILOT N_G RPM% INDICATOR

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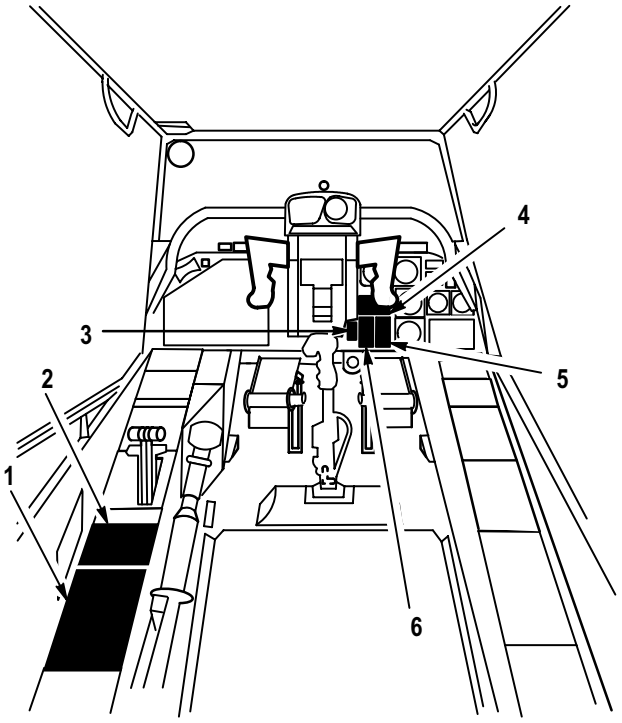
Figure 8–28. Pilot Station



1. CPG CIRCUIT BREAKER PANEL 1
2. CPG INTR LT PANEL
3. CPG DIM/TEST PANEL
4. CPG SDD PANEL
5. CPG ENG − RTR RPM% INDICATOR
6. CPG TORQUE INDICATOR

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Figure 8–29. CPG Station

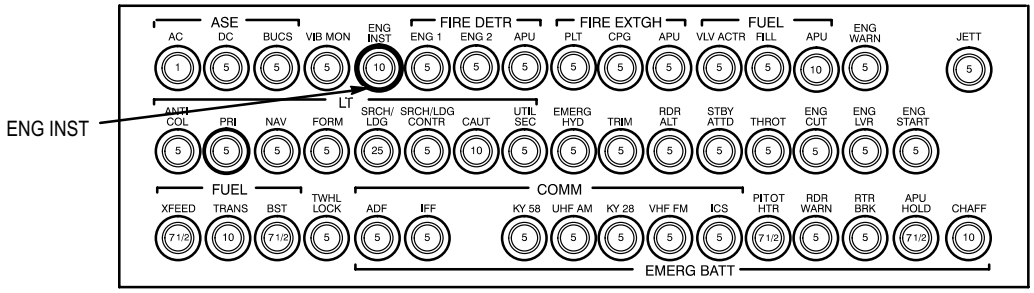

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Figure 8–30. Pilot Center Circuit Breaker Panel

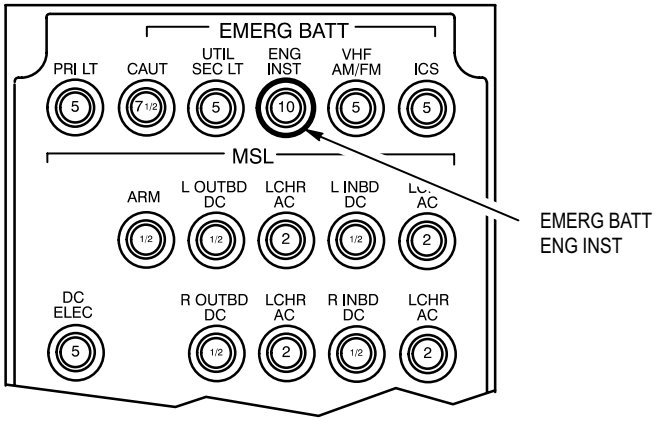


Figure 8–31. CPG Circuit Breaker Panel 1

NOTE

- **Troubleshooting procedures isolating the vertical scale and digital readout of engine 1 or 2 are the same. Follow instructions pertaining only to applicable display of engines 1 or 2, where indicated.**
- **DGT OFF/NORM/TST switch located on the dim/test panel (fig. 8–32), is a momentary switch. When DGT OFF/NORM/TST switch is placed in TST position, all engine instruments vertical scale indicators light for three seconds and all the digital readouts remain lighted as long as the switch is held in TST position.**

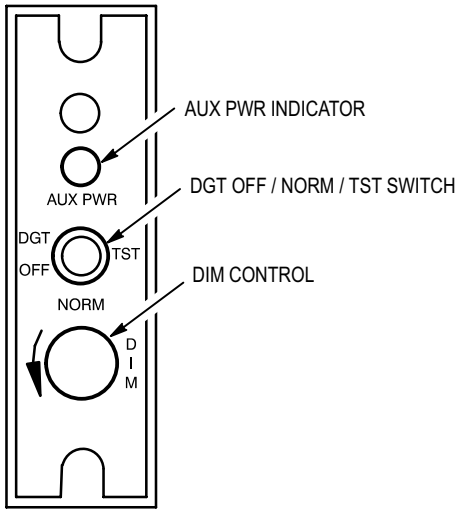


Figure 8–32. Dim /Test Panel

Task	Result
c. On pilot dim/test panel (fig. 8–32), set **DGT OFF/NORM/TST** switch to **NORM** and manual **DIM** control to midposition. Check **AUX PWR** indicator on dim/test panel.	If **AUX PWR** indicator lights, go to paragraph 8–15.

8–10. ENGINE INSTRUMENTS – MAINTENANCE OPERATIONAL CHECK (cont) 8–10

Task	Result
d. On pilot dim/test panel (fig. 8–32), set and hold **DGT OFF/NORM/TST** switch to **TST**. Check all pilot engine instrument digital readouts and vertical scale indicators.	If any single pilot engine instrument vertical display lamp does not light for three seconds, replace the applicable indicator (TM 1-1520-238-23). If all pilot engine instruments do not indicate full scale or digital **888**, go to paragraph 8–17. If all pilot engine instruments have every other vertical display lamp not lighted, go to paragraph 8–17.
e. Hold **DGT OFF/NORM/TST** switch to **TST**. Check **AUX PWR** indicator.	If **AUX PWR** indicator does not light, replace lamp (TM 1-1520-238-23). If lamp still does not light, go to paragraph 8–16.
f. Hold **DGT OFF/NORM/TST** switch at **TST**. Check all pilot engine instruments.	If pilot **TGT** indicator (fig. 8–33) does not indicate full scale or show digital **888**, go to paragraph 8–18. If pilot **TGT** indicator does not show digital readouts, go to paragraph 8–18. If pilot **TGT** indicator vertical scale indicators have every other lamp not lighted, go to paragraph 8–18. If pilot **TORQUE** indicator (fig. 8–33) does not indicate full scale or show digital **888,** go to paragraph 8–19. If pilot **TORQUE** indicator does not show digital readouts, go to paragraph 8–19. If pilot **TORQUE** indicator vertical scale indicators have every other lamp not lighted, go to paragraph 8–19. If pilot **FUEL** quantity indicator (fig. 8–33) does not indicate full scale or show digital **888**, go to paragraph 8–20. If pilot **FUEL** quantity indicator does not show digital readouts, go to paragraph 8–20.

8–10. ENGINE INSTRUMENTS – MAINTENANCE OPERATIONAL CHECK (cont) 8–10

Task	Result
(Step f. cont)	If pilot **FUEL** quantity indicator vertical scale indicators have every other lamp not lighted, go to paragraph 8–20. If pilot **N_G RPM%** indicator (fig. 8–33) does not show digital readouts, go to paragraph 8–21. If pilot **N_G RPM%** indicator vertical scale indicators have every other lamp not lighted, go to paragraph 8–21. If pilot **N_G RPM%** indicator does not indicate full scale or show digital **888**, go to paragraph 8–21. If pilot **ENG–RTR RPM%** indicator (fig. 8–33) vertical scale indicators have every other lamp not lighted, go to paragraph 8–22. If pilot **ENG–RTR RPM%** indicator does not indicate full scale, go to paragraph 8–22. If pilot **ENG OIL** indicator (fig. 8–34) vertical scale indicators have every other lamp not lighted, go to paragraph 8–23. If pilot **ENG OIL** indicator does not indicate full scale, go to paragraph 8–23.
g. On pilot dim/test panel (fig. 8–32), set **DGT OFF/NORM/TST** switch to **DGT OFF**. Check **TGT, TORQUE, FUEL** quantity, and **N_G RPM%** indicator (fig. 8–33) digital readouts.	If pilot **TGT, TORQUE, FUEL** quantity, and **N_G RPM%** indicator digital readouts are not blanked out, go to paragraph 8–24. If pilot **TGT** indicator digital readouts are not blanked out, go to paragraph 8–25. If pilot **TORQUE** indicator digital readouts are not blanked out, go to paragraph 8–26. If pilot **FUEL** quantity indicator digital readouts are not blanked out, go to paragraph 8–27. If pilot **N_G RPM%** indicator digital readouts are not blanked out, go to paragraph 8–28.

8–10. ENGINE INSTRUMENTS – MAINTENANCE OPERATIONAL CHECK (cont) 8–10

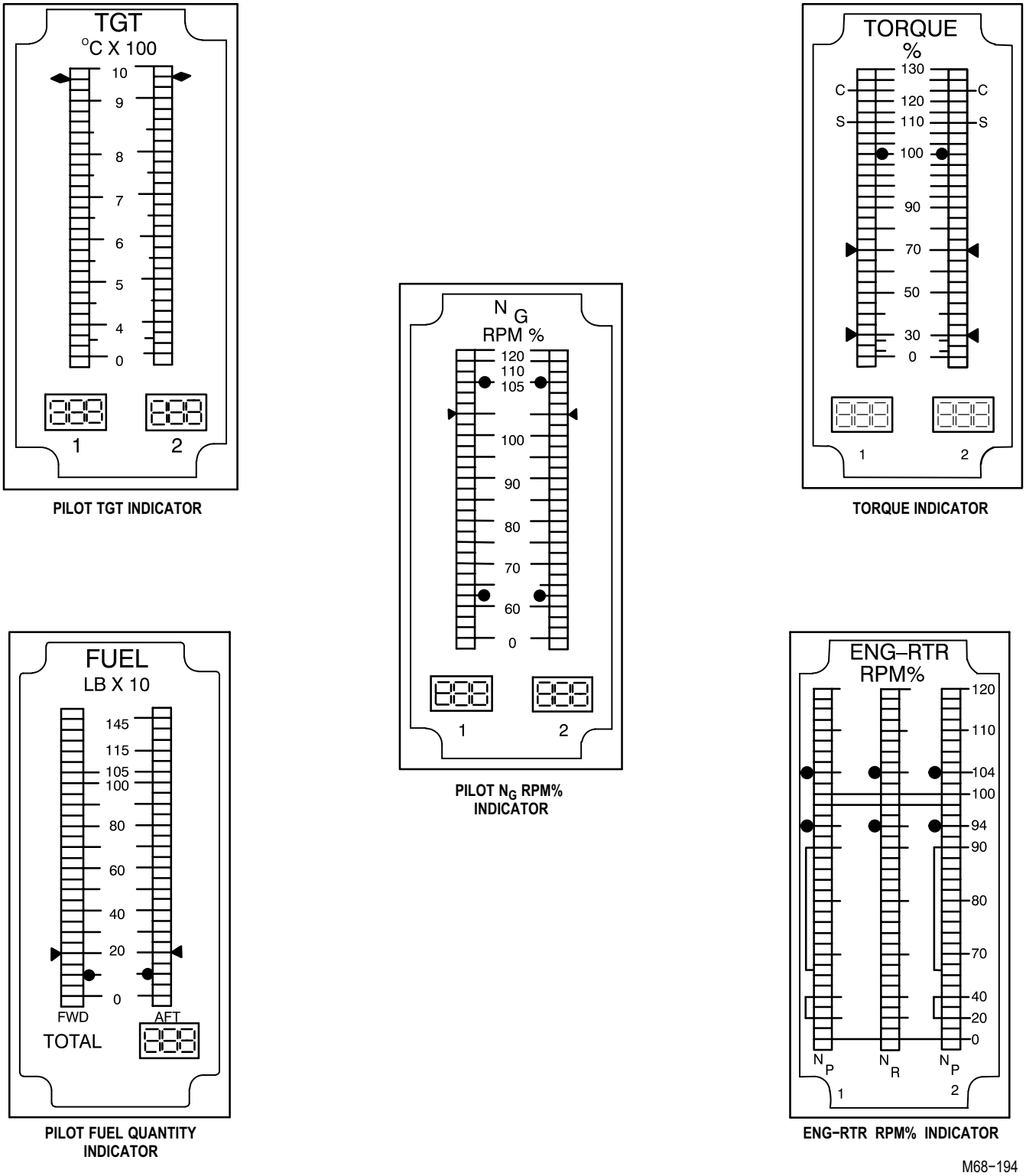


Figure 8–33. Engine Instrument Indicators

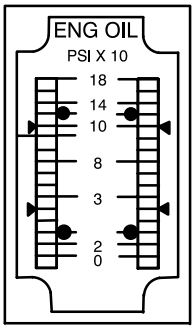


Figure 8–34. Pilot ENG OIL Indicator

Task	Result
h. On pilot dim/test panel (fig. 8–32), set **DGT OFF/NORM/TST** switch to **NORM** and rotate **DIM** control to midposition.	If pilot **TGT, TORQUE, FUEL** quantity , and **N_G RPM%** indicator digital readouts are blanked out, go to paragraph 8–29.
i. Cover photocell on dim/test panel.	If pilot **ENG OIL, TGT, TORQUE, FUEL** quantity, **ENG–RTR RPM%**, and **N_G RPM%** indicator vertical scale indicators do not dim, go to paragraph 8–30.
j. Shine light directly into photocell located on dim/test panel.	If pilot **ENG OIL, TGT, TORQUE, FUEL** quantity, **ENG–RTR RPM%**, and **N_G RPM%** indicator vertical scale indicators do not brighten, replace dim/test panel (TM 1-1520-238-23).
k. Rotate the manual **DIM** control fully counter–clockwise.	If pilot **ENG OIL, TGT, TORQUE, FUEL** quantity, **ENG–RTR RPM%**, and **N_G RPM%** indicator vertical scale indicators do not dim, go to paragraph 8–31.
l. On the dim/test panel, (fig. 8–32) rotate the manual **DIM** control fully clockwise.	If pilot **ENG OIL, TGT, TORQUE, FUEL** quantity, **ENG–RTR RPM%**, and **N_G RPM%** indicator vertical scale indicators do not brighten, replace dim/test panel (TM 1-1520-238-23).
m. Rotate **DIM** control to midposition. Check all pilot engine instruments.	If pilot **TGT** indicator vertical display scale or digital readouts do not indicate ambient temperature (±5°), go to paragraph 8–32. If pilot **TORQUE** indicator vertical scale indicators or digital readouts do not indicate between **0** and **2%**, go to paragraph 8–33.

8–10. ENGINE INSTRUMENTS – MAINTENANCE OPERATIONAL CHECK (cont) 8–10

Task	Result
(Step m. cont)	If pilot **N_G RPM%** indicator vertical scale indicators or digital readouts do not indicate between **0** and **5%**, go to paragraph 8–34. If pilot **FUEL** quantity indicator vertical scale indicators or digital readout do not indicate existing fuel (±20 pounds), go to paragraph 8–35. If pilot **ENG OIL** indicator vertical scale indicators do not indicate **0** pressure, go to paragraph 8–36. If pilot **ENG–RTR RPM%** indicator vertical scale indicators do not indicate **0%**, go to paragraph 8–37.

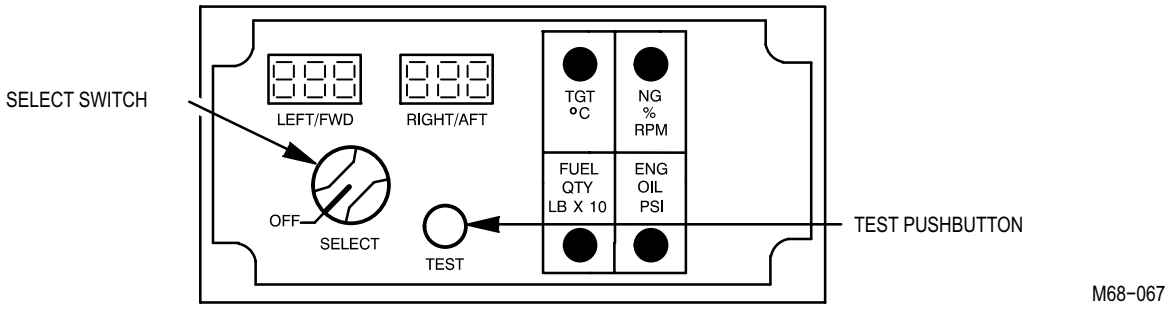


Figure 8–35. CPG SDD

Task	Result
n. On the CPG SDD panel (fig. 8–35), rotate selector switch to **SELECT**. Press the **TEST** switch and check all CPG engine instruments.	If all CPG engine instruments have every other vertical scale indicators not lighted, replace SDC (TM 1-1520-238-23). If any single CPG engine instrument vertical scale indicator does not light for 3 seconds, replace applicable indicator (TM 1-1520-238-23).
o. On the CPG dim/test panel (fig. 8–32), set the **DGT OFF/NORM/TST** switch to **DGT OFF**. Check CPG SDD and **TORQUE** indicator digital readouts are blank.	If all digital readouts remain lighted, go to paragraph 8–38. If CPG **TORQUE** indicator digital readouts do not blank, go to paragraph 8–39. If CPG SDD panel digital readouts do not blank, go to paragraph 8–40.

8–10. ENGINE INSTRUMENTS – MAINTENANCE OPERATIONAL CHECK (cont) 8–10

Task	Result
p. On CPG dim/test panel (fig. 8–32), set **DGT OFF/NORM/TST** switch to **NORM**, rotate the manual **DIM** control fully counterclockwise and then fully clockwise.	If the brightness of the CPG instrument vertical scale indicators and digital readouts do not change, go to paragraph 8–41.
q. On CPG dim/test panel, set **DGT OFF/NORM/TST** switch to **TST**. Check all CPG engine instruments digital readouts and vertical scale indicators.	If all CPG engine instruments do not indicate full scale or show digital **888**, go to paragraph 8–42. If CPG **TORQUE** indicator does not indicate full scale, or show digital **888**, or vertical scale indicators have every other lamp not lighted, go to paragraph 8–43. If CPG **ENG–RTR RPM%** indicator does not indicate full scale or vertical have every other lamp not lighted, go to paragraph 8–44. If CPG SDD panel **LEFT/FWD** or **RIGHT/AFT** digital readouts do not show digital **888**, go to paragraph 8–45.
r. On CPG dim/test panel, set **DGT OFF/NORM/TST** switch to **NORM**.	If all CPG engine instruments digital readouts are blanked, go to paragraph 8–46.
s. On CPG SDD panel (fig. 8–35), rotate **SELECT** switch to **OFF**.	If CPG SDD panel digital readouts are not blanked out, replace the SDD panel (TM 1-1520-238-23). If CPG engine instrument indicators are not blanked out, go to paragraph 8–47. If CPG **TORQUE** indicator digital readouts are not blanked out, go to paragraph 8–48.
t. Rotate **SELECT** switch to each of the discrete clockwise positions and check the respective **LEFT/FWD** and **RIGHT/AFT** digital readouts. SDD indicators will light as **SELECT** switch is rotated.	If any indicators do not light when selected, replace the SDD panel (TM 1-1520-238-23). If CPG SDD panel **TGT** digital readouts do not indicate ambient temperature ±5° when **TGT** indicator lights, go to paragraph 8–49.

Task	Result
(Step t. cont)	If CPG SDD panel **N_G% RPM** digital readouts do not indicate within .5% when **N_G RPM%** indicator lights, go to paragraph 8–50. If CPG SDD panel **FUEL QTY LBX10** digital readouts do not indicate existing fuel ±20 pounds when **FUEL** quantity indicator lights, go to paragraph 8–51. If CPG SDD panel **ENG OIL** digital readouts do not indicate 0 to 5 pounds pressure when **ENG OIL** indicator lights, go to paragraph 8–52. If CPG **TORQUE** indicator vertical scale indicators and digital readouts do not indicate 0 to 2%, go to paragraph 8–53. If CPG **ENG–RTR RPM%** indicator vertical scale indicators do not indicate 0%, go to paragraph 8–54.
u. On CPG SDD panel (fig. 8–35), rotate **SELECT** switch to **OFF**.	

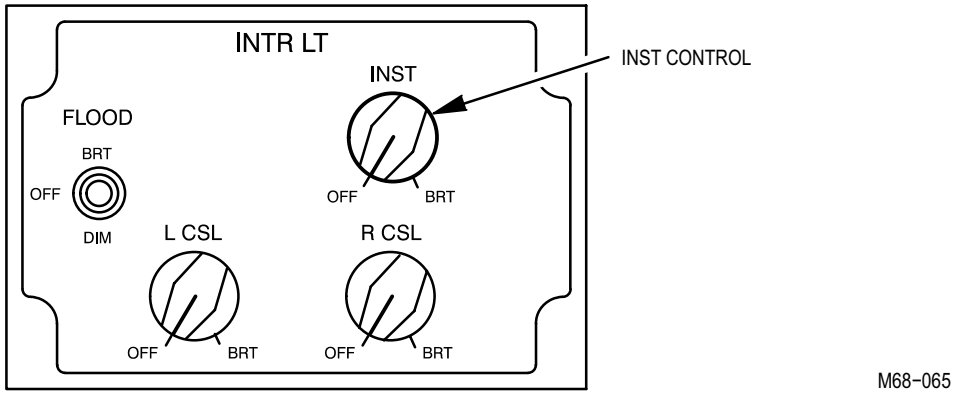


Figure 8–36. CPG INTR LT Panel

Task	Result
v. On CPG **INTR LT** panel (fig. 8–36), rotate the **INST** control to **BRT**. Check all CPG engine instruments.	If CPG SDD, dim/test panel, CPG **TORQUE** and CPG **ENG–RTR RPM%** indicators edge–lighting does not light, replace lamp (TM 1-1520-238-23). If lamp still does not light, refer to TM 1-1520-238-T-6 to troubleshoot CPG edge–lights.

8–10. ENGINE INSTRUMENTS – MAINTENANCE OPERATIONAL CHECK (cont) 8–10

Task	Result
(Step v. cont)	If CPG SDD panel edge–lighting does not light, replace lamp (TM 1-1520-238-23). If lamp still does not light, go to paragraph 8–55. If CPG **TORQUE** indicator edge–lighting does not light, replace lamp (TM 1-1520-238-23). If lamp still does not light, go to paragraph 8–56. If CPG **ENG–RTR RPM%** indicator edge–lighting does not light, replace lamp (TM 1-1520-238-23). If lamp still does not light, go to paragraph 8–57. If CPG dim/test panel edge–lighting does not light, replace lamp (TM 1-1520-238-23). If lamp still does not light, go to paragraph 8–58. (Helicopters with dim/test panel installed).
w. On CPG **INTR LT** panel (fig. 8–36), rotate the **INST** control switch to **OFF**.	
x. On pilot **EXT LT/INTR LT** panel (fig. 8–37), rotate **INST** control switch to **BRT**. Check all pilot engine instruments.	If dim/test panel, **FUEL** quantity and **ENG OIL** indicators do not light, replace lamp (TM 1-1520-238-23). If lamp still does not light, refer to TM 1-1520-238-T-6 to troubleshoot pilot edge–lights. If **TORQUE, TGT, N_G RPM%** and **ENG–RTR RPM%** indicators do not light, replace lamp (TM 1-1520-238-23). If lamp still does not light, refer to TM 1-1520-238-T-6 to troubleshoot pilot edge–lights. If pilot dim/test panel edge–lighting does not light, replace lamp (TM 1-1520-238-23). If lamp still does not light, go to paragraph 8–59. If pilot **TGT** indicator edge–lighting does not light, replace lamp (TM 1-1520-238-23). If lamp still does not light, go to paragraph 8–60.

8–10. ENGINE INSTRUMENTS – MAINTENANCE OPERATIONAL CHECK (cont) 8–10

Task	Result
(Step x. cont)	If pilot **TORQUE** indicator edge–lighting does not light, replace lamp (TM 1-1520-238-23). If lamp still does not light, go to paragraph 8–61. If pilot **FUEL** quantity indicator edge–lighting does not light, replace lamp (TM 1-1520-238-23). If lamp still does not light, go to paragraph 8–62. If pilot **N_G RPM%** indicator edge–lighting does not light, replace lamp (TM 1-1520-238-23). If lamp still does not light, go to paragraph 8–63. If pilot **ENG–RTR RPM%** indicator edge–lighting does not light, replace lamp (TM 1-1520-238-23). If lamp still does not light, go to paragraph 8–64. If pilot **ENG OIL** indicator edge–lighting does not light, replace lamp (TM 1-1520-238-23). If lamp still does not light, go to paragraph 8–64.

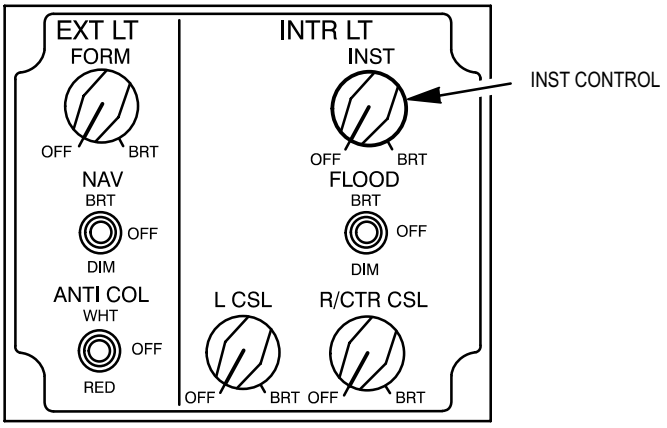


Figure 8–37. Pilot EXT LT/INTR LT Panel

y. On pilot **EXT LT/INTR LT** panel (fig. 8–37), rotate **INST** control switch to **OFF**.

Task	Result
z. On pilot VDU (fig. 8–38), set **OFF/TEST/PLT/CPG** switch to **PLT**.	If symbology does not appear on pilot VDU, refer to TM 11-1520-238-23-2.

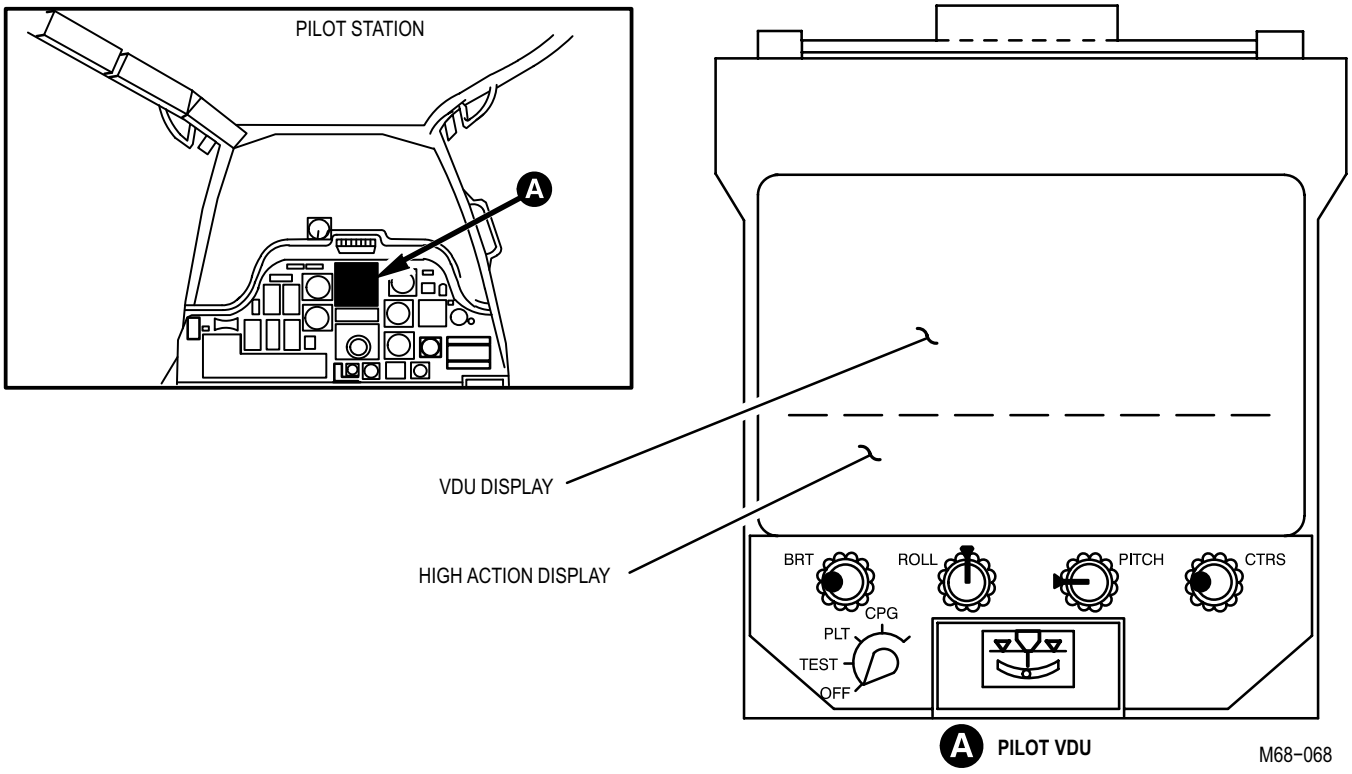


Figure 8–38. Pilot VDU

aa. Start engines 1 and 2 (TM 1-1520-238-CL). Check that engine instrument indications are visible on pilot and CPG **N_G RPM%, TGT, ENG–RTR RPM%, TORQUE** (fig. 8–33), **ENG OIL** indicator (fig. 8–34), and CPG SDD panel (fig. 8–35).	If pilot and CPG **ENG OIL** indicator does not indicate engine 1 oil pressure, go to paragraph 8–66. If pilot and CPG **ENG OIL** indicator does not indicate engine 2 oil pressure, go to paragraph 8–67. If CPG SDD panel does not indicate engine 1 or engine 2 oil pressure, go to paragraph 8–69. If pilot and CPG **TORQUE** indicators do not indicate engine 1 torque, go to paragraph 8–68. If pilot **TORQUE** indicator does not indicate engine 1 torque, go to paragraph 8–70.

8–10. ENGINE INSTRUMENTS – MAINTENANCE OPERATIONAL CHECK (cont) 8–10

Task	Result
(Step aa. cont)	If CPG **TORQUE** indicator does not indicate engine 1 torque, go to paragraph 8–71. If pilot and CPG **TORQUE** indicators do not indicate engine 2 torque, go to paragraph 8–72. If pilot **TORQUE** indicator does not indicate engine 2 torque, go to paragraph 8–73. If CPG **TORQUE** indicator does not indicate engine 2 torque, go to paragraph 8–74. If engine torque display on pilot VDU flashes, or is not present, go to paragraph 8–75. If pilot and CPG **ENG–RTR RPM%** indicators do not indicate engine **1 N_P**, go to paragraph 8–76. If pilot and CPG **ENG–RTR RPM%** indicators do not indicate engine **2 N_P**, gp to paragraph 8–77. If pilot **ENG–RTR RPM%** indicator does not indicate engine **1 N_P**, go to paragraph 8–78. If CPG **ENG–RTR RPM%** indicator does not indicate engine **1 N_P**, go to paragraph 8–79. If pilot **ENG–RTR RPM%** indicator does not indicate engine **2 N_P**, go to paragraph 8–80. If CPG **ENG–RTR RPM%** indicator does not indicate engine **2 N_P**, go to paragraph 8–81. If pilot and CPG **ENG–RTR RPM%** indicators do not indicate **N_R**, go to paragraph 8–82. If pilot **ENG–RTR RPM%** indicator does not indicate **N_R**, go to paragraph 8–83. If CPG **ENG–RTR RPM%** indicator does not indicate **N_R**, go to paragraph 8–84. If pilot **N_G RPM%** indicator does not indicate engine **1 N_G**, go to paragraph 8–85.

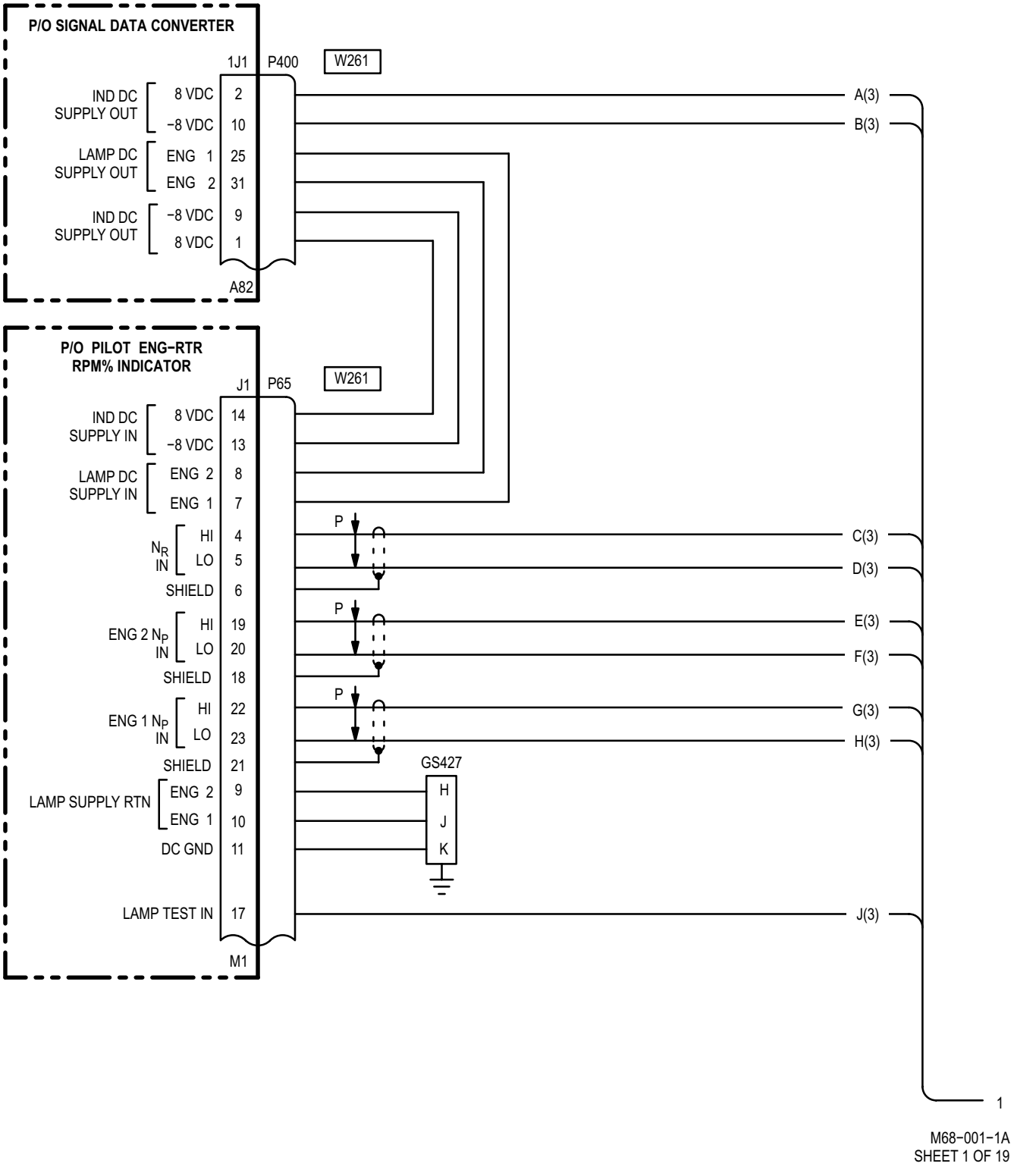
8–10. ENGINE INSTRUMENTS – MAINTENANCE OPERATIONAL CHECK (cont) 8–10

Task	Result
(Step aa. cont)	If pilot **N_G RPM%** indicator does not indicate engine **2 N_G**, go to paragraph 8–86. If CPG SDD panel does not indicate engine **1** and/or engine **2 N_G% RPM**, go to paragraph 8–87. If pilot **TGT** indicator does not indicate engine **1 TGT**, go to paragraph 8–88. If pilot **TGT** indicator does not indicate engine **2 TGT**, go to paragraph 8–89. If CPG SDD panel does not indicate engine **1** and/or engine **2 TGT**, go to paragraph 8–90.
ab. On pilot VDU (fig. 8–38), set **OFF/TEST/PLT/CPG** switch to **OFF**.	
ac. Shut down engines 1 and 2 (TM 1-1520-238-CL).	

3. Remove external power – electrical (TM 1-1520-238-23).
4. Disconnect maintenance headset (TM 1-1520-238-T-4).

END OF TASK

8–11. ENGINE INSTRUMENTS – WIRING INTERCONNECT DIAGRAM 8–11



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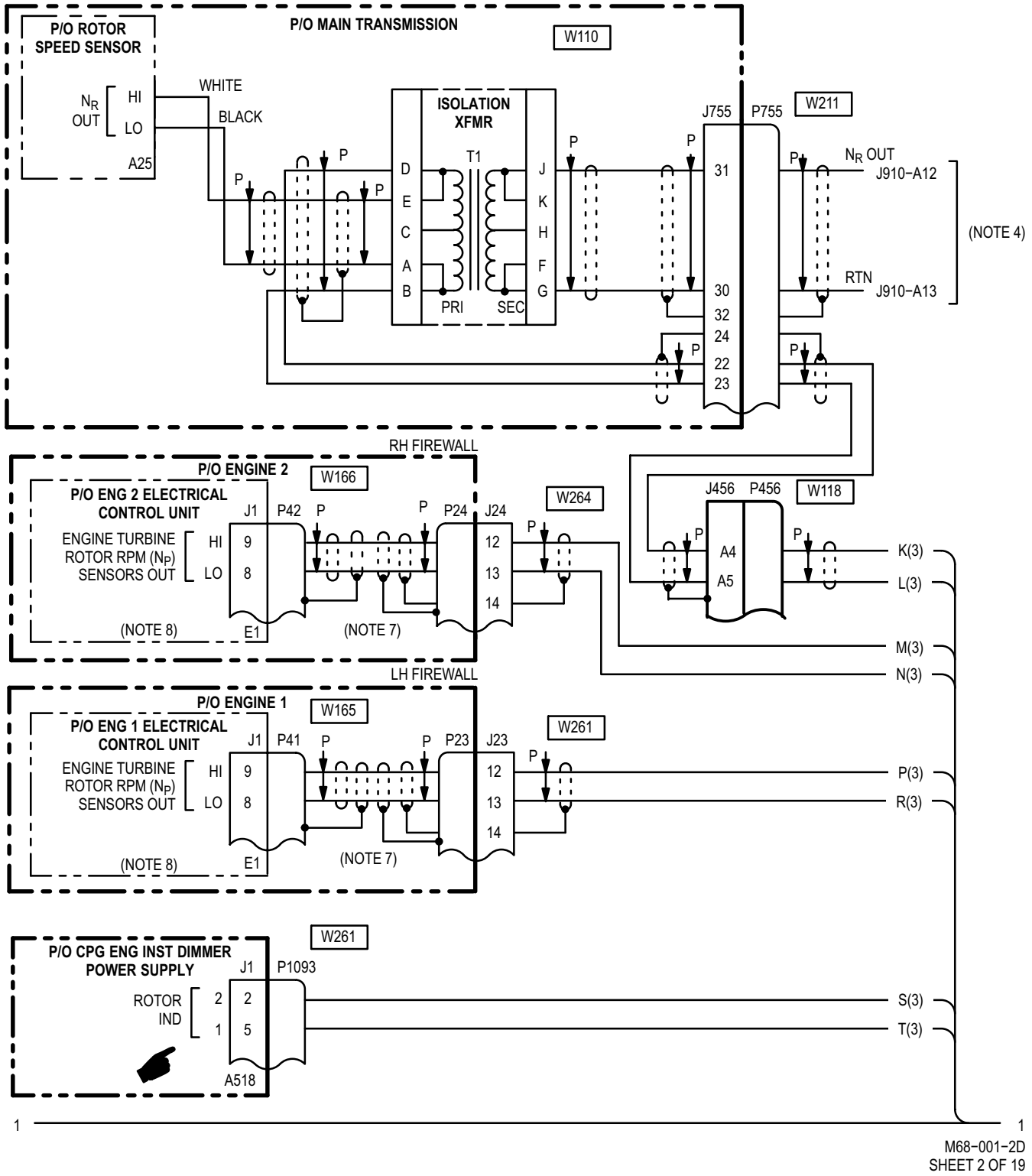
SHEET 1 OF 19

8–11. ENGINE INSTRUMENTS – WIRING INTERCONNECT DIAGRAM (CONT) 8–11



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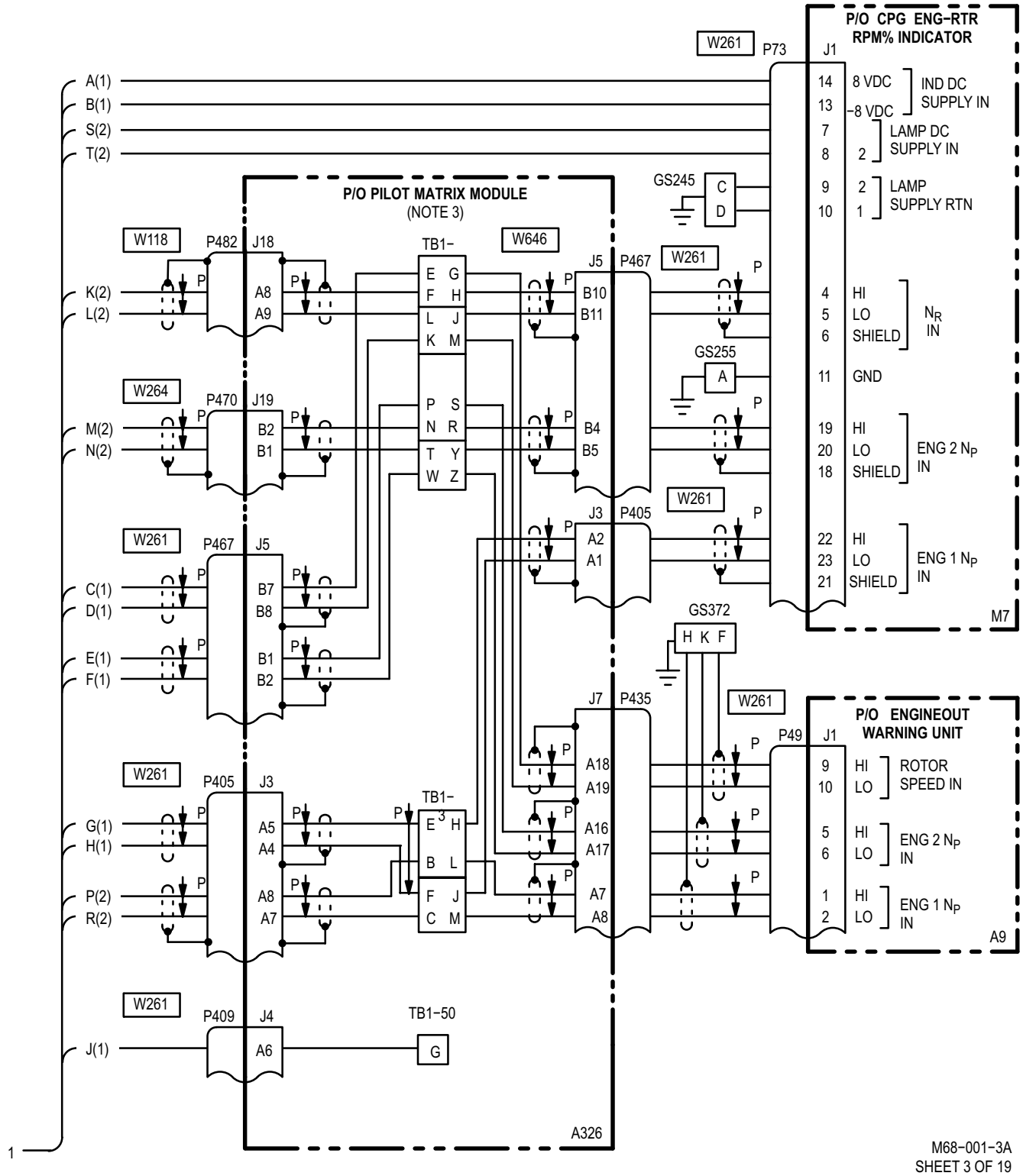
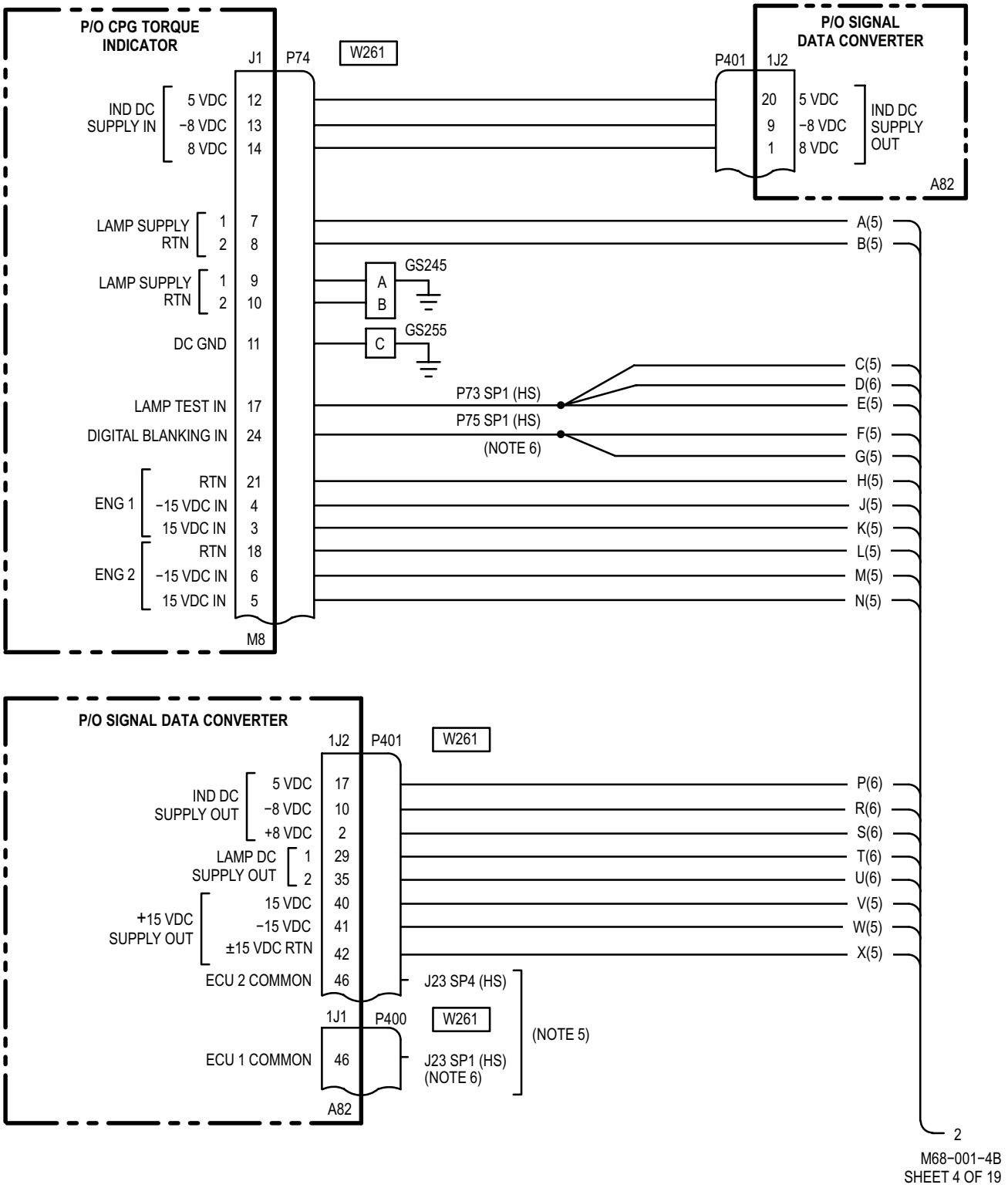
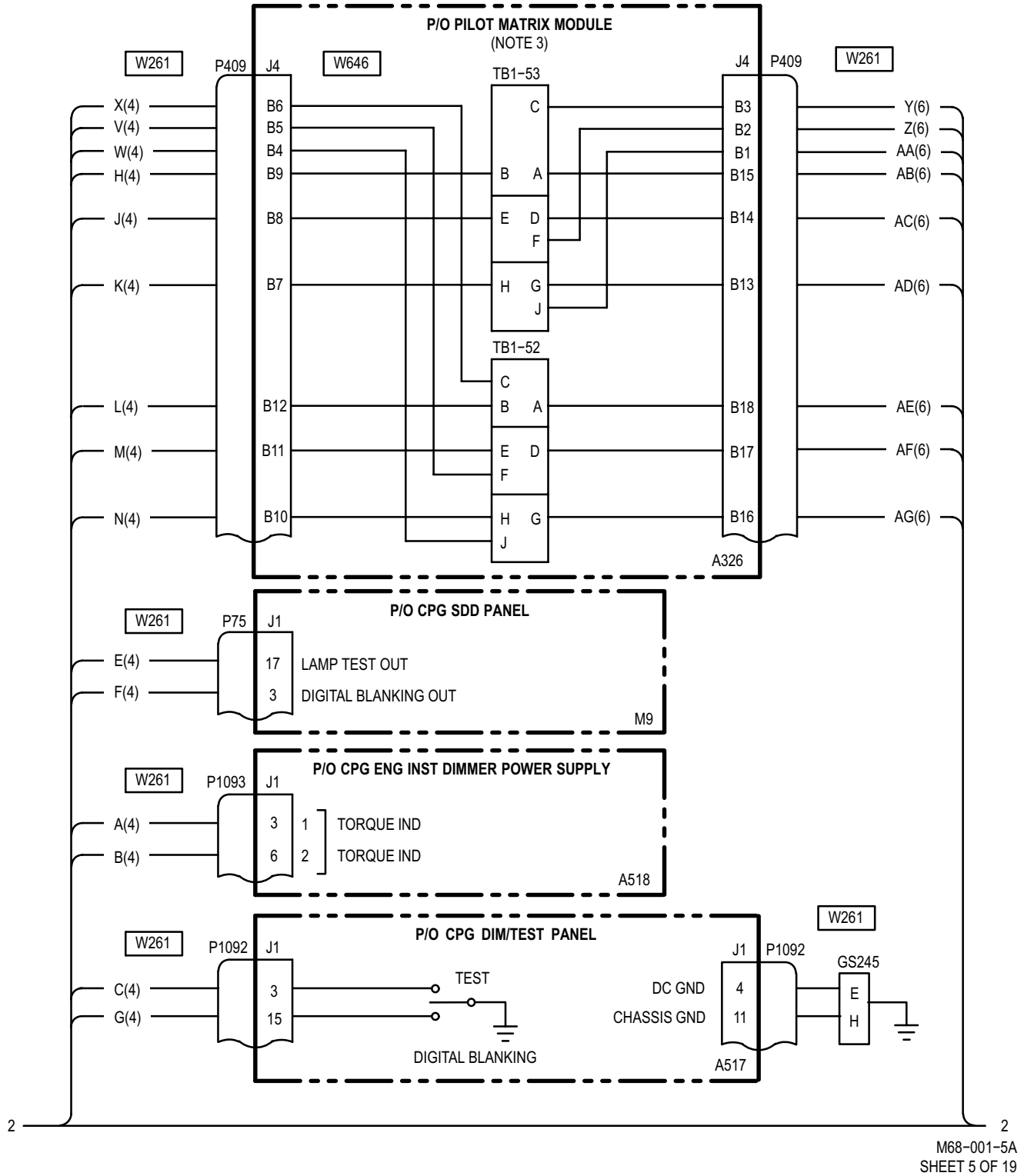
8–11. ENGINE INSTRUMENTS – WIRING INTERCONNECT DIAGRAM (CONT) 8–11



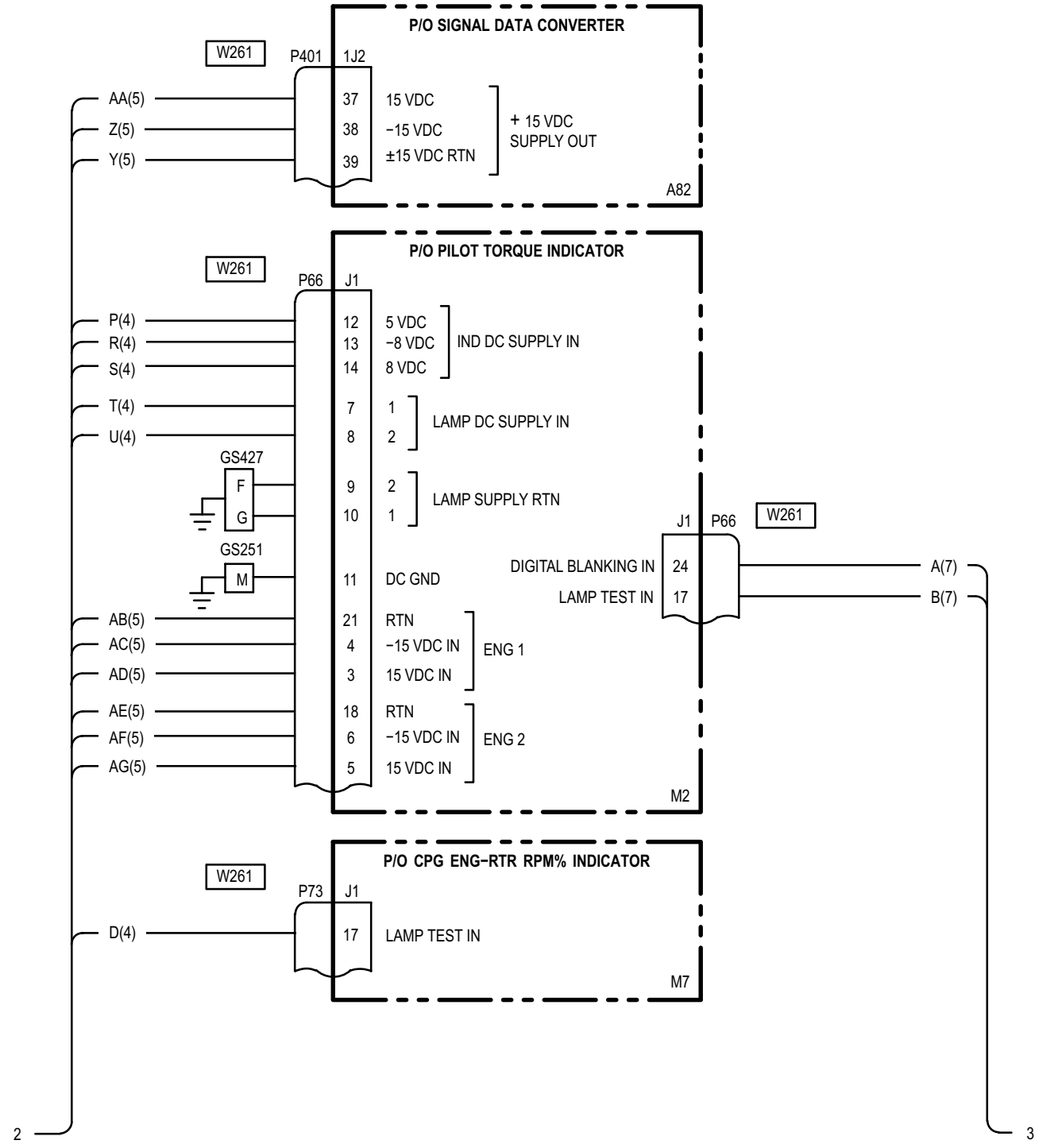
8–11. ENGINE INSTRUMENTS – WIRING INTERCONNECT DIAGRAM (CONT) 8–11



8–11. ENGINE INSTRUMENTS – WIRING INTERCONNECT DIAGRAM (CONT) 8–11



8–11. ENGINE INSTRUMENTS – WIRING INTERCONNECT DIAGRAM (CONT) 8–11



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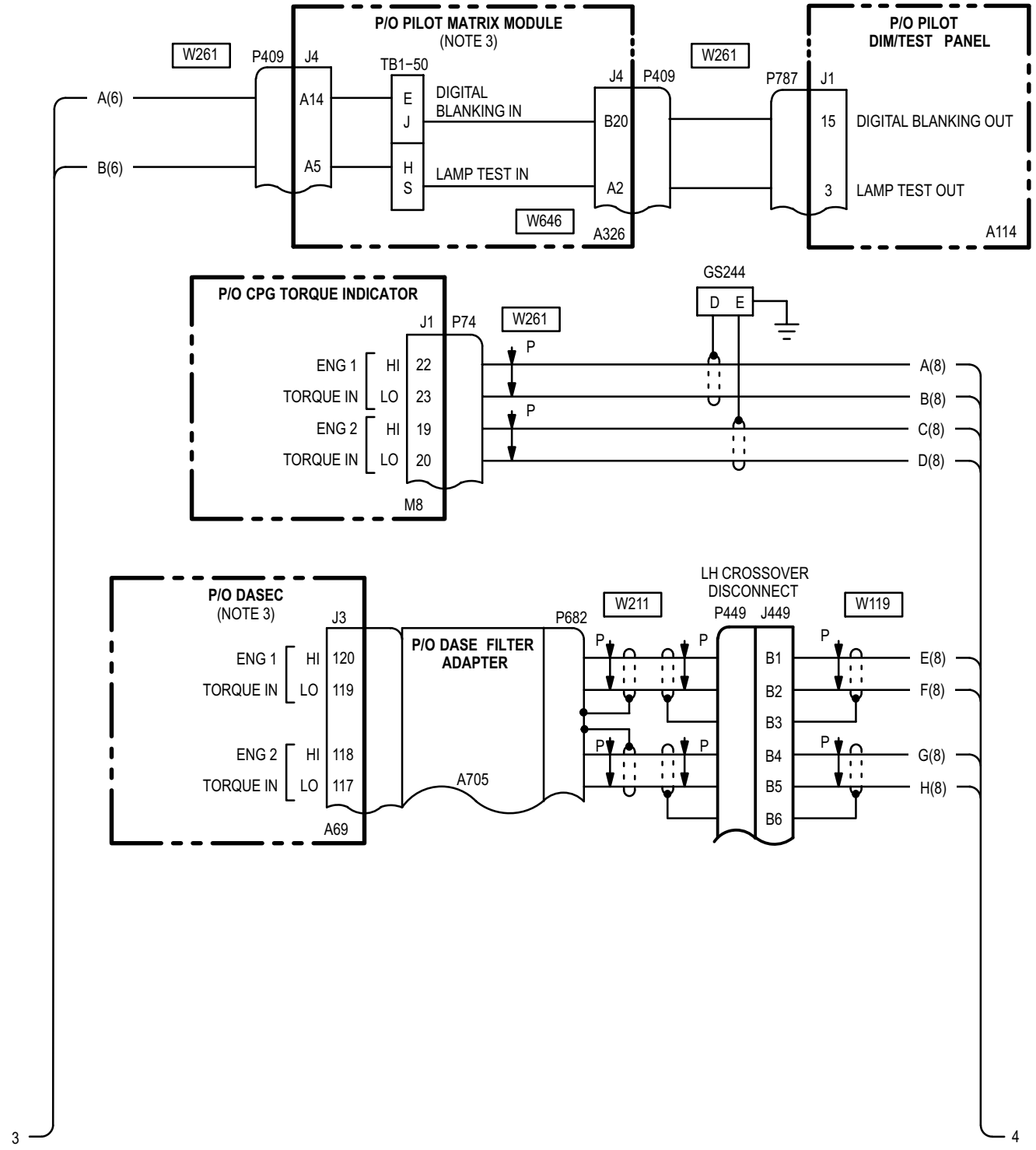
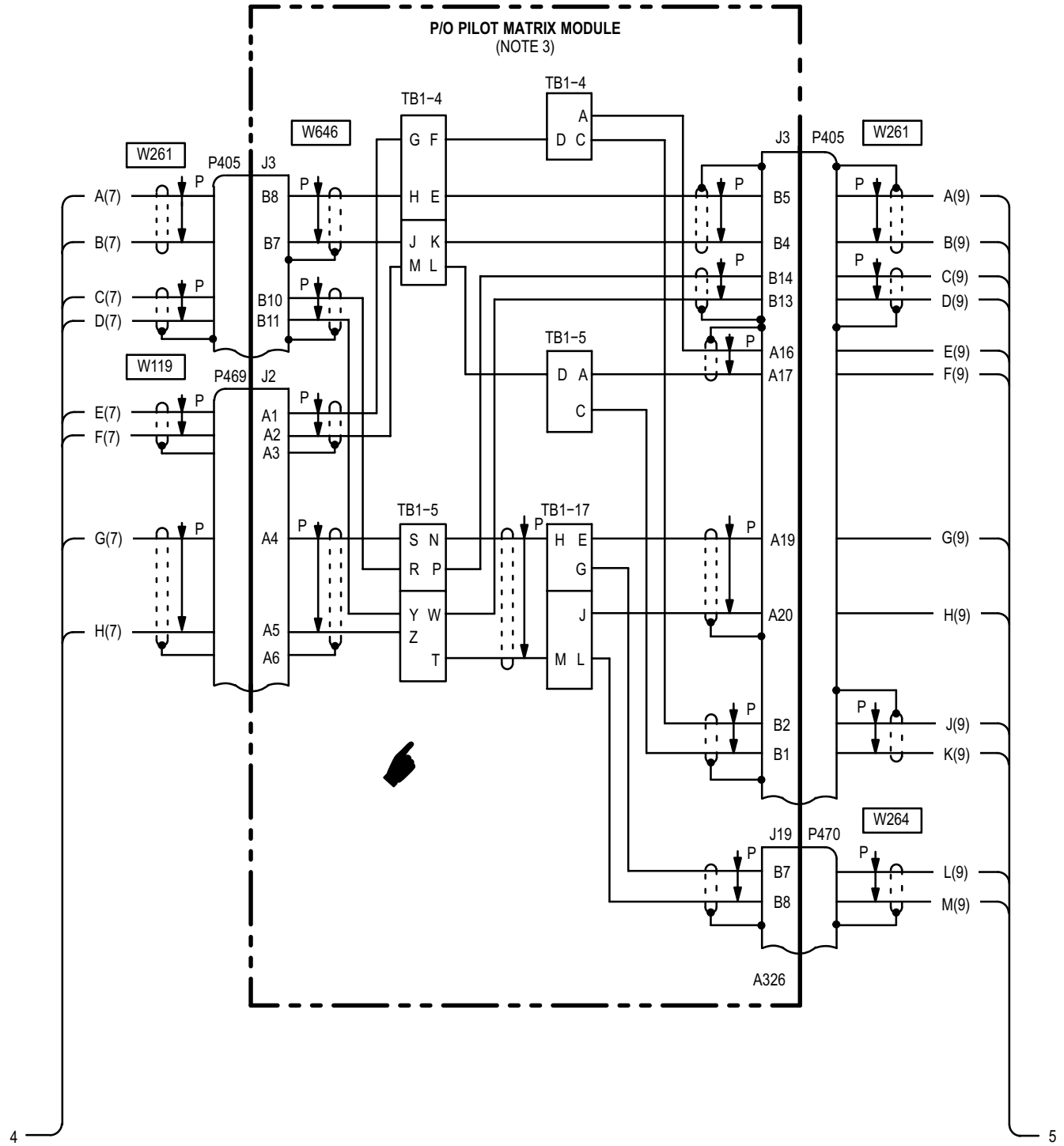
SHEET 6 OF 19

8–11. ENGINE INSTRUMENTS – WIRING INTERCONNECT DIAGRAM (CONT) 8–11



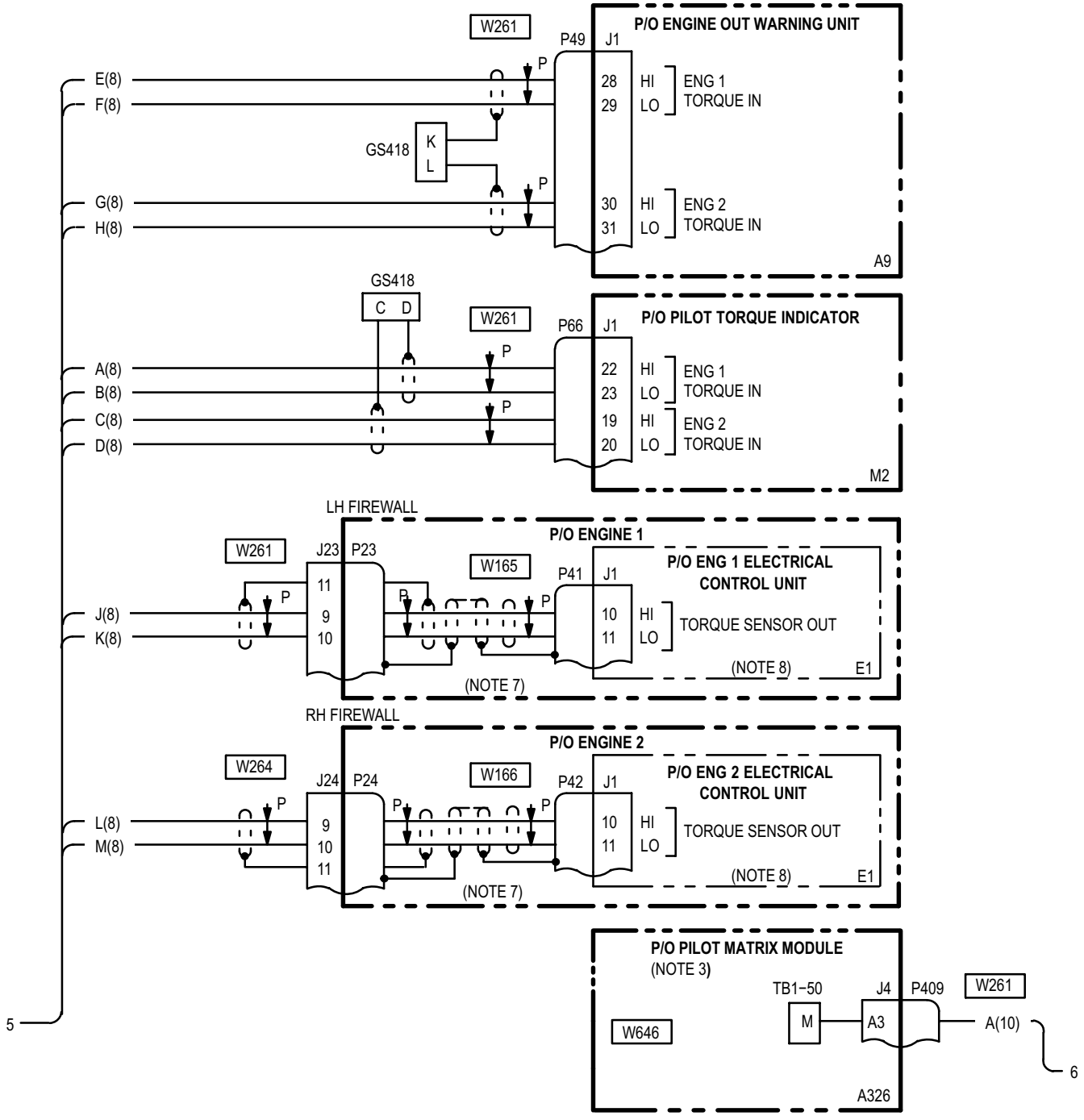
M68−001−7A
SHEET 7 OF 19

8–11. ENGINE INSTRUMENTS – WIRING INTERCONNECT DIAGRAM (CONT) 8–11



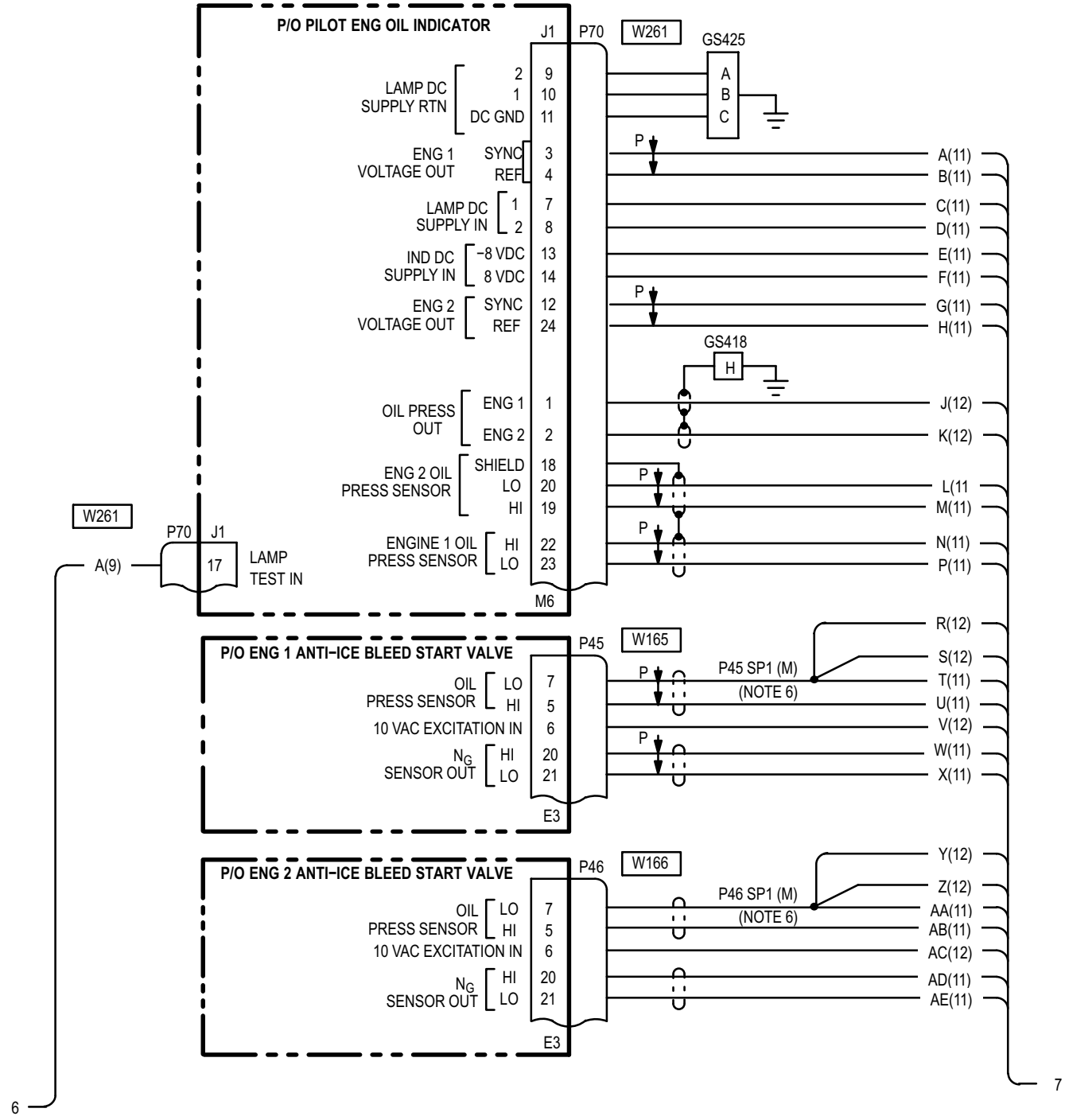
M68−001−8B
SHEET 8 OF 19

8–11. ENGINE INSTRUMENTS – WIRING INTERCONNECT DIAGRAM (CONT) 8–11



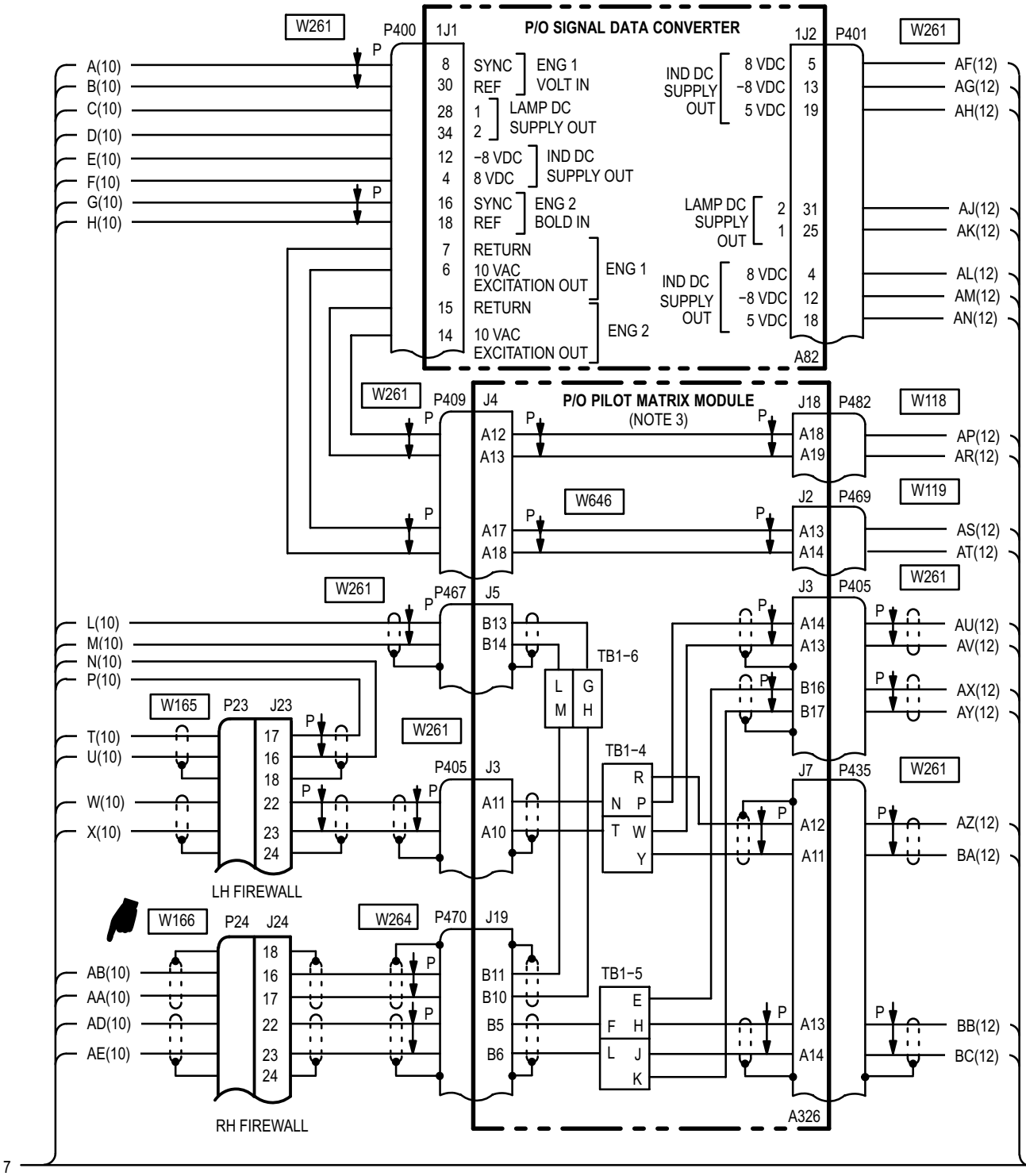
M68-001-9A
SHEET 9 OF 19

8–11. ENGINE INSTRUMENTS – WIRING INTERCONNECT DIAGRAM (CONT) 8–11



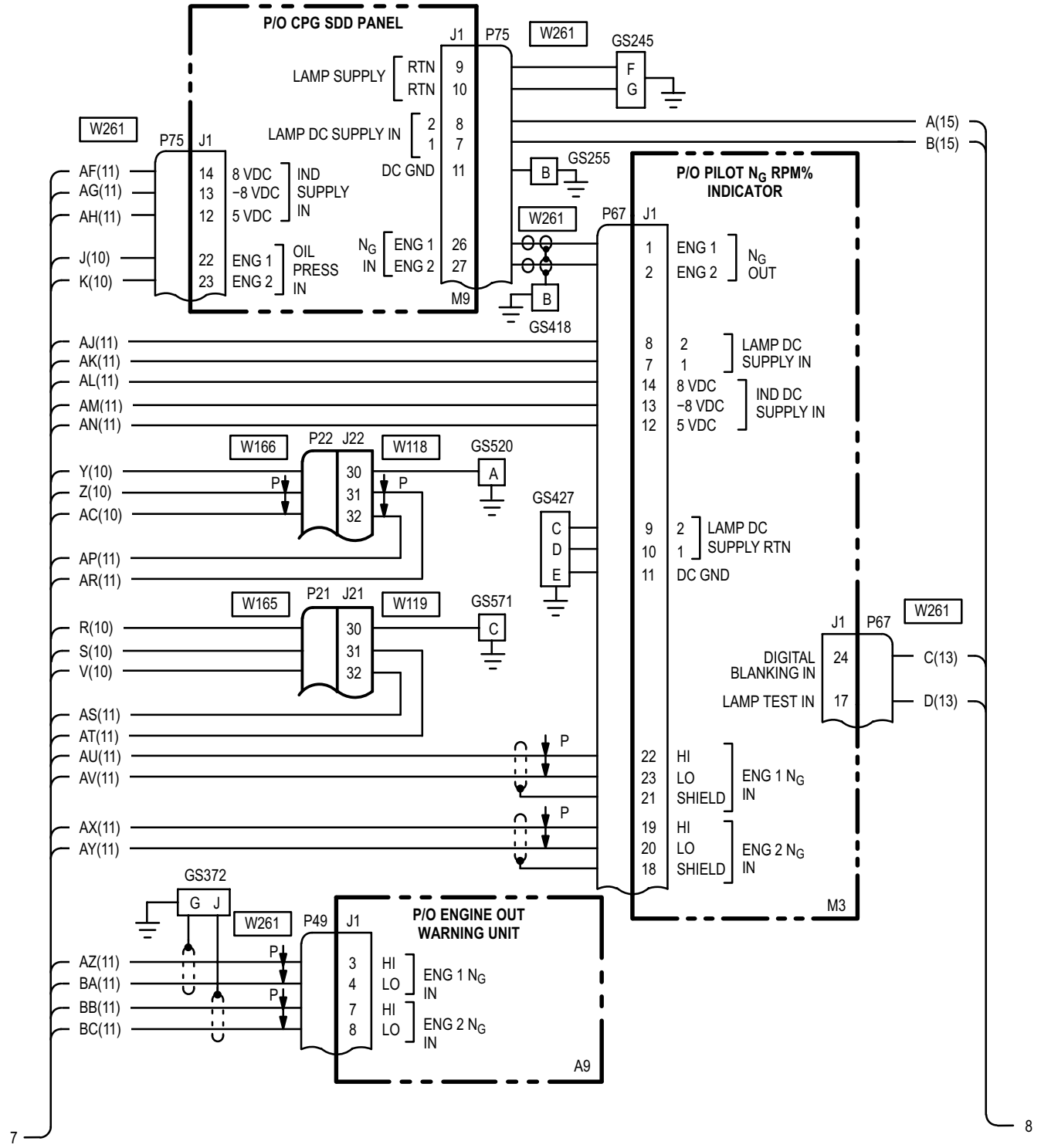
M68−001−10A
SHEET 10 OF 19

8–11. ENGINE INSTRUMENTS – WIRING INTERCONNECT DIAGRAM (CONT) 8–11



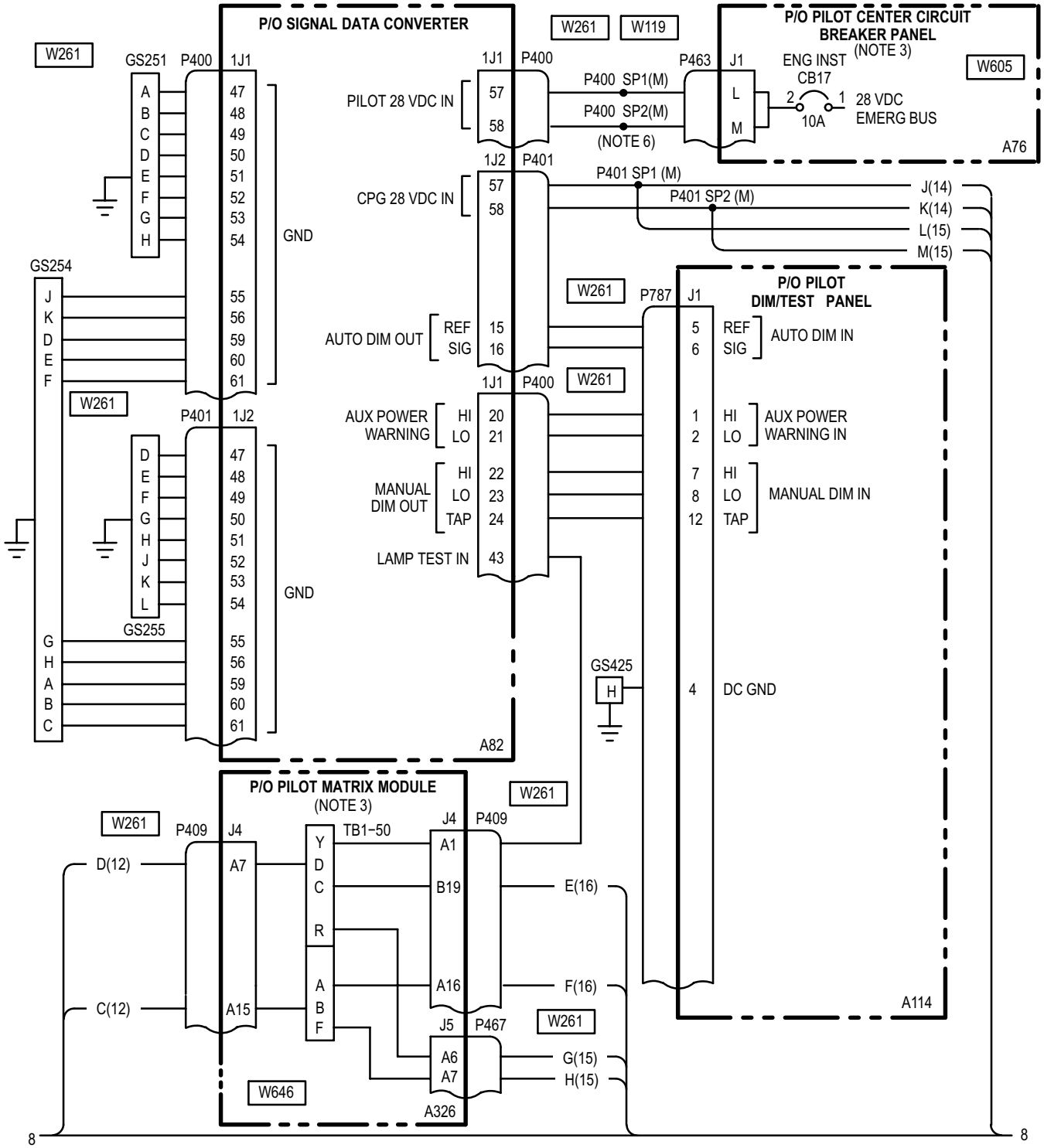
M68−001−11B
SHEET 11 OF 18

8–11. ENGINE INSTRUMENTS – WIRING INTERCONNECT DIAGRAM (CONT) 8–11



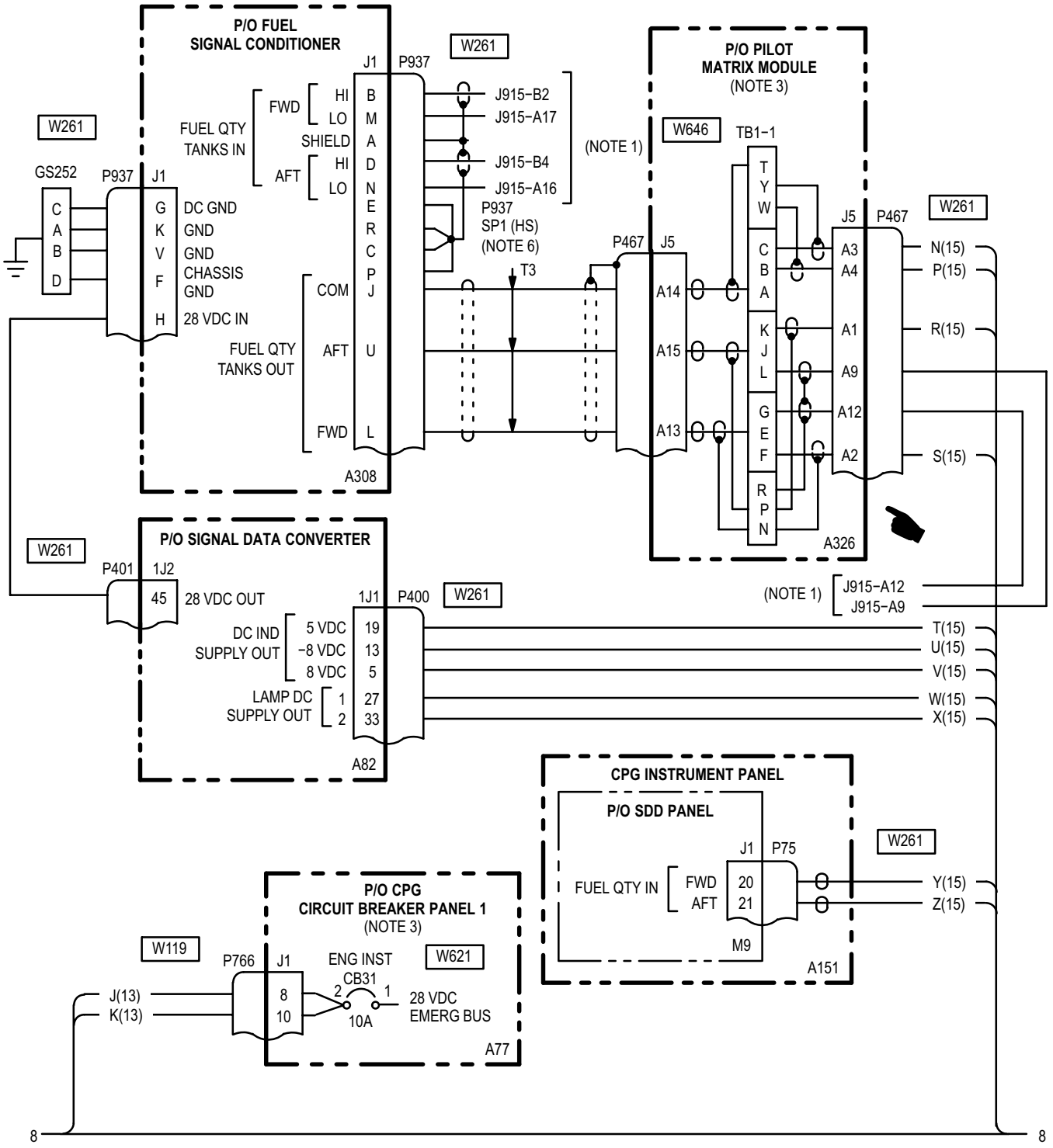
M68−001−12A
SHEET 12 OF 19

8–11. ENGINE INSTRUMENTS – WIRING INTERCONNECT DIAGRAM (CONT) 8–11



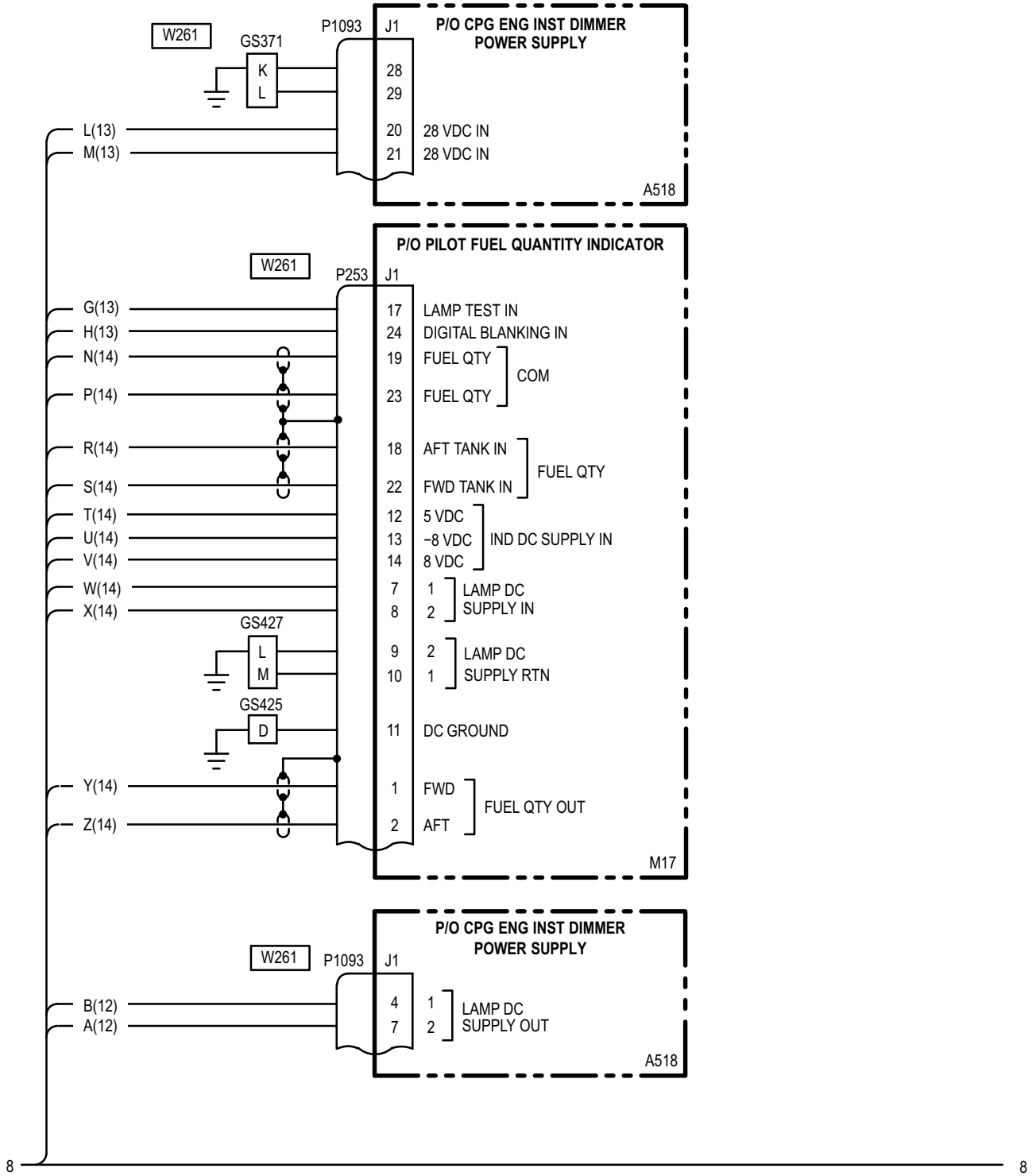
M68–001–13A
SHEET 13 OF 19

8–11. ENGINE INSTRUMENTS – WIRING INTERCONNECT DIAGRAM (CONT) 8–11



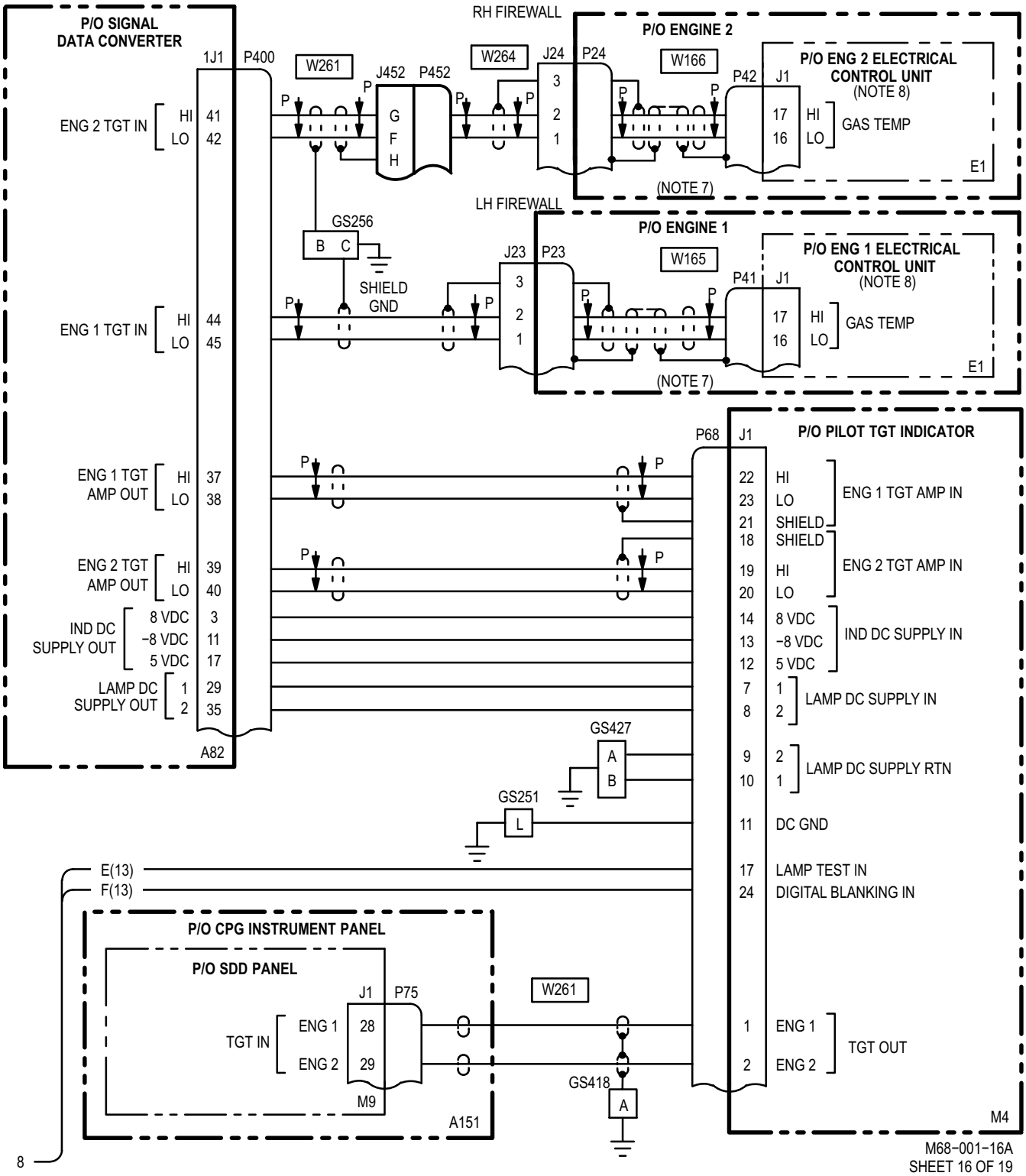
M68−001−14B
SHEET 14 OF 19

8–11. ENGINE INSTRUMENTS – WIRING INTERCONNECT DIAGRAM (CONT) 8–11

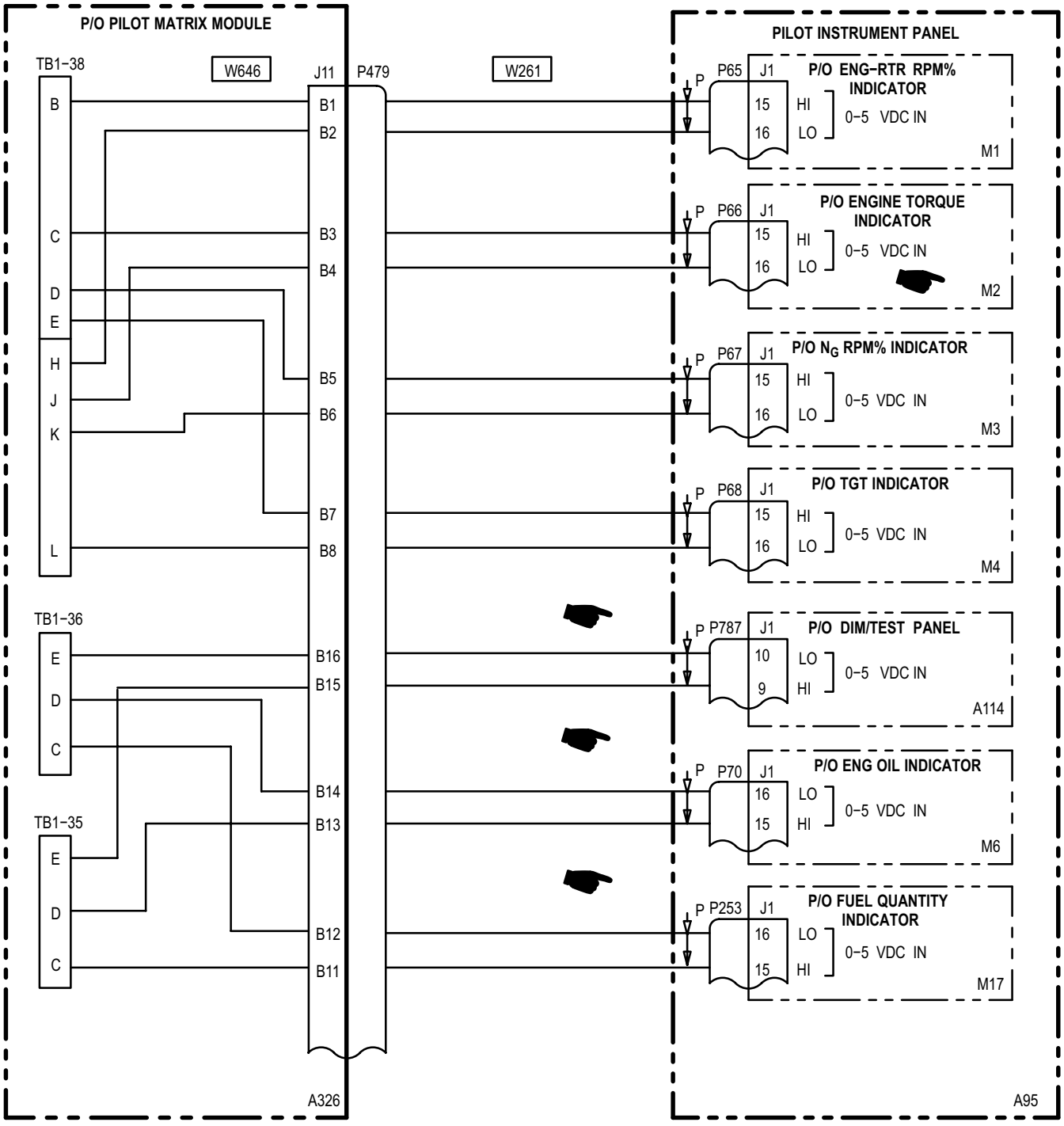


M68−001−15A
SHEET 15 OF 19

8–11. ENGINE INSTRUMENTS – WIRING INTERCONNECT DIAGRAM (CONT) 8–11

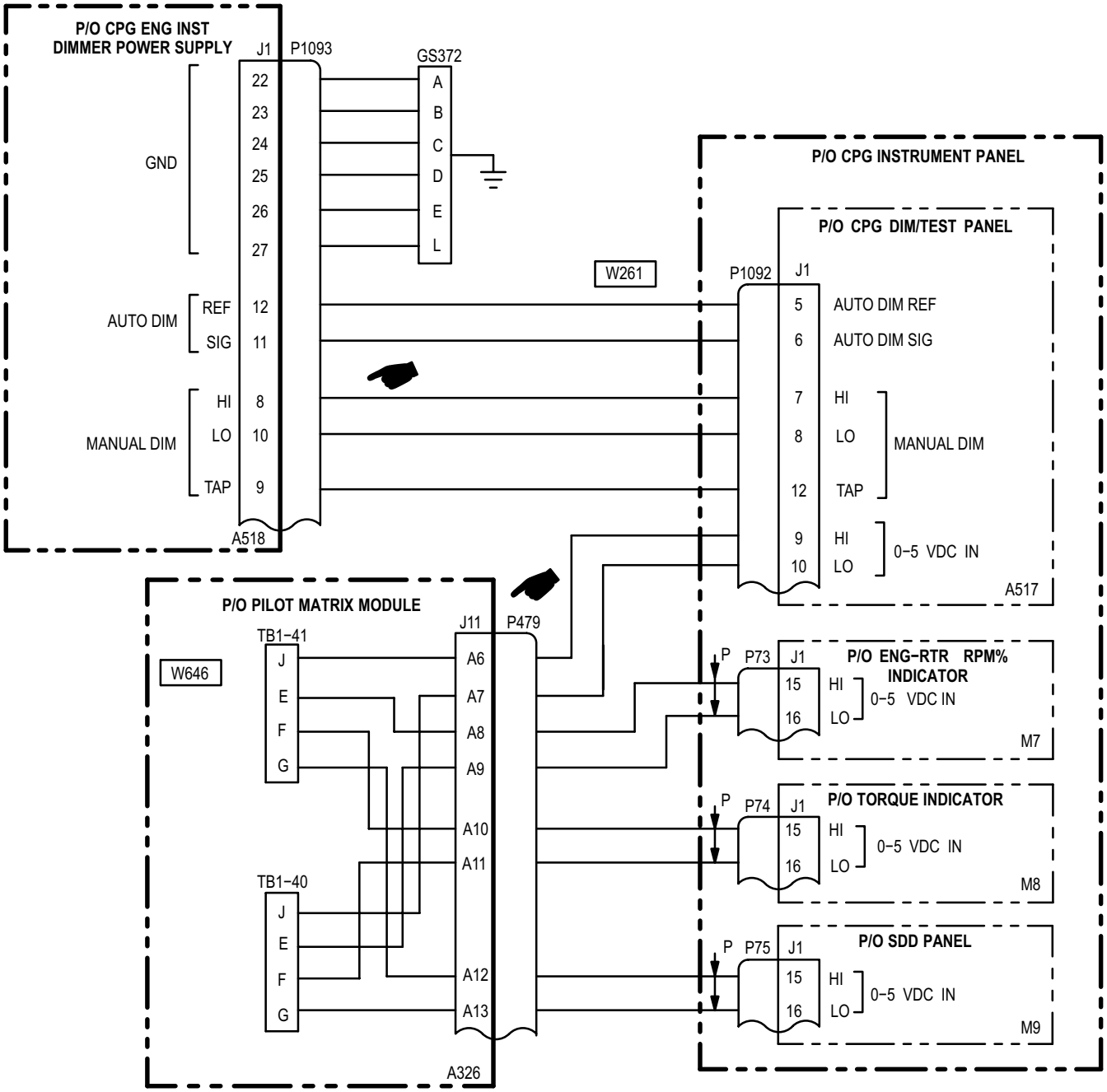


8–11. ENGINE INSTRUMENTS – WIRING INTERCONNECT DIAGRAM (CONT) 8–11



M68–001–17B
SHEET 17 OF 19

8–11. ENGINE INSTRUMENTS – WIRING INTERCONNECT DIAGRAM (CONT) 8–11



M68–001–18A
SHEET 18 OF 19

8–11. ENGINE INSTRUMENTS – WIRING INTERCONNECT DIAGRAM (CONT) 8–11

NOTES:

HIGHWAY USE: THE ALPHA CHARACTER IDENTIFIES A SPECIFIC LINE, AND THE NUMBER IN PARENTHESIS IDENTIFIES THE SHEET NUMBER WHERE THE SIGNAL TERMINATES.

1. **FUEL SYSTEM (TM 1−1520−238−T−7).**
2. **FLIGHT CONTROL SYSTEM (TM 1−1520−238−T−7).**
3. **ELECTRICAL SYSTEM (TM 1−1520−238−T−6).**
4. **AUXILIARY POWER UNIT (TM 1−1520−238−T−8).**
5. **TORQUE SHARING SYSTEM (TM 1−1520−238−T−4).**
6. **HS DESIGNATES A HARD SPLICE WHICH CANNOT BE DISCONNECTED.**
   M DESIGNATES A SOFT SPLICE WHICH MAY BE DISCONNECTED FOR A WIRING CHECK.
7. **HELICOPTERS WITH T700−GE−701C ENGINES INSTALLED ARE EQUIPPED WITH EMI SHIELDING.**
8. **HELICOPTERS WITH T700−GE−701C ENGINES INSTALLED ARE EQUIPPED WITH DIGITAL ELECTRONIC CONTROL (DECU).**

M68−001−19
SHEET 19 OF 19

8–12. PILOT ENG INST CIRCUIT BREAKER – DOES NOT STAY CLOSED 8–12

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer

References:

TM 1-1520-238-T-6
TM 1-1520-238-23

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. Open **ENG INST** circuit breaker (CB17). Check for short between (A76):
   J1–L and ground,
   J1–M and ground.
   Does short exist?

   YES — Refer to TM 1-1520-238-T-6 to troubleshoot circuit protection system (dc emergency bus – pilot station)

   NO — Go to step 2.

2. With CB17 open, check for short between:
   P400–57 and ground,
   P400–58 and ground.
   Does short exist?

   YES — Repair shorted wire between:
   P400–57 and P463–L,
   P400–58 and P463–M.
   Go to paragraph 8–10.

   NO — Replace SDC
   (TM 1-1520-238-23).

END OF TASK

8–13. CPG EMERG BATT ENG INST CIRCUIT BREAKER – DOES NOT STAY CLOSED (HELICOPTERS WITHOUT CPG DIM/TEST PANEL INSTALLED) 8–13

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer

References:

TM 1-1520-238-T-6
TM 1-1520-238-23

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. Open CPG **EMERG BATT ENG INST** circuit breaker (CB31). Check for short between (A77):
   J1–8 and ground,
   J1–10 and ground.
   Does short exist?

   YES — Refer to TM 1-1520-238-T-6 to troubleshoot circuit protection system (dc emergency bus – pilot station)

   NO — Go to step 2.

2. With CB31 open, detach P401. Check for short between:
   P766–8 and ground,
   P766–10 and ground.
   Does short exist?

   YES — Repair shorted wire between:
   P766–8 and P401–57,
   P766–10 and P401–58.
   Go to paragraph 8–10.

   NO — Replace SDC (TM 1-1520-238-23).

END OF TASK

8–14. CPG EMERG BATT ENG INST CIRCUIT BREAKER – DOES NOT STAY CLOSED (HELICOPTERS WITH CPG DIM/TEST PANEL INSTALLED) 8–14

Tools:

Nomenclature	Part Number
Tool Kit, Aircraft Mechanic's	SC518099CLA01
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

67R Attack Helicopter Repairer
68X Armament/Electrical Systems Repairer

References:

TM 1-1520-238-T-6
TM 1-1520-238-23

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. Open CPG **EMERG BATT ENG INST** circuit breaker. Check for short between (A77):
   J1–8 and ground,
   J1–10 and ground.
   Does short exist?

   YES — Refer to TM 1-1520-238-T-6 to troubleshoot circuit protection system (dc emergency bus – pilot station)

   NO — Go to step 2.

2. Detach P401. Check for short between:
   P766–8 and ground,
   P766–10 and ground.
   Does short exist?

   YES — Go to step 3.

   NO — Replace SDC (TM 1-1520-238-23).

3. Detach P1093. Check for short between:
   P766–8 and ground,
   P766–10 and ground.
   Does short exist?

   YES — Repair shorted wire between:
   P766–8 and P401 SP1,
   P766–10 and P401 SP2,
   P401–57 and P401 SP1,
   P401–58 and P401 SP2,
   P1093–20 and P401 SP1,
   P1093–21 and P401 SP2.
   Go to paragraph 8–10.

   NO — Replace CPG **ENG INST** dimmer power supply (TM 1-1520-238-23).

END OF TASK

8–15. AUX POWER INDICATOR ON DIM/TEST PANEL – LIGHTS 8–15

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer

References:

TM 1-1520-238-23

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. Check for open between P787–4 and ground.
   Does short exist?

   YES — Repair open between P787–4 and GS425–H. Go to paragraph 8–10.

   NO — Go to step 2.

2. On pilot dim/test panel, set and hold **DGT OFF/NORM/TST** to **TST.** Check for open between (A114):
   J1–3 and J1–4.
   Does short exist?

   YES — Replace pilot dim/test panel. (TM 1-1520-238-23).

   NO — Go to step 3.

3. On pilot dim/test panel, hold **DGT OFF/NORM/TST** switch to **TST**. Check for open between P400–43 and ground.
   Does short exist?

   YES — Repair open wire between: P787–3 and (A326)TB1–50–S, P400–43 and (A326)TB1–50–Y. Go to paragraph 8–10.

   NO — Replace SDC (TM 1-1520-238-23).

END OF TASK

8–16. PILOT AUX POWER INDICATOR ON DIM/TEST PANEL– DOES NOT LIGHT 8–16

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer (2)

References:

TM 1-1520-238-T-6
TM 1-1520-238-23

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. Check digital readouts of pilot engine instruments.
   Are any digital readouts lighted?
   - YES — Go to step 4.
   - NO — Go to step 2.
2. Check for 28 VDC at:
   P400–57 and P400–58,
   P401–57 and P401–58.
   Is voltage present?
   - YES — Go to step 6.
   - NO — Go to step 3.
3. Check for open between:
   P463–L and P400–57,
   P463–M and P400–58,
   P766–8 and P401–57,
   P766–10 and P401–58.
   Does open exist?
   - YES — Repair open wire. Go to paragraph 8–10.
   - NO — Refer to TM 1-1520-238-T-6 to troubleshoot circuit protection system (dc emergency bus – pilot station).
4. Check pilot dim/test panel for open between (A114):
   J1–1 and J1–2.
   Does open exist?
   - YES — Replace pilot dim/test panel (TM 1-1520-238-23).
   - NO — Go to step 5.
5. Check for open between:
   P787–1 and P400–20,
   P787–2 and P400–21.
   Does open exist?
   - YES — Repair open wire. Go to paragraph 8–10.
   - NO — Replace SDC (TM 1-1520-238-23).
6. Check for open between:
   P400–55 and ground,
   P400–56 and ground.
   Does open exist?
   - YES — Repair open wire between: P400–55 and GS254–J, P400–56 and GS254–K. Go to paragraph 8–10.
   - NO — Replace SDC (TM 1-1520-238-23).

END OF TASK

8–17. ALL PILOT ENGINE INSTRUMENTS – DO NOT INDICATE FULL SCALE OR SHOW DIGITAL 888 OR VERTICAL SCALE INDICATORS HAVE EVERY OTHER LAMP NOT LIGHTED 8–17

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer (2)

References:

TM 1-1520-238-T-6
TM 1-1520-238-23

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. Check for 28 VDC at:
   P400–57 and P400–58,
   P401–57 and P401–58.
   Is voltage present?

   YES — Go to step 2.

   NO — Go to step 3.

2. On pilot dim/test panel, set and hold **DGT OFF/NORM/TST** switch to **TST**. Check for short between wire end of (A326)TB1–50–S and ground.
   Does short exist?

   YES — Replace SDC (TM 1-1520-238-23).

   NO — Go to step 4.

3. Check for 28 VDC at:
   (A76):
   J1–L and J1–M.
   (A77):
   J1–8 and J1–10.
   Is voltage present?

   YES — Repair open wire between:
   P463–L and P400–57,
   P463–M and P400–58,
   P766–8 and P401–57,
   P766–10 and P401–58.
   Go to paragraph 8–10.

   NO — Refer to TM 1-1520-238-T-6 to troubleshoot circuit protection system (dc emergency bus – pilot station).

4. Check for open between:
   P787–4 and GS425–H,
   P787–3 and P409–A2.
   (A326):
   J4–A2 and TB1–50–S.
   Does open exist?

   YES — Repair open wire.
   Go to paragraph 8–10.

   NO — Replace pilot dim/test panel (TM 1-1520-238-23).

END OF TASK

8–18. PILOT TGT INDICATOR – DOES NOT INDICATE FULL SCALE OR SHOW DIGITAL 888 OR VERTICAL SCALE INDICATORS HAVE EVERY OTHER LAMP NOT LIGHTED 8–18

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer (2)

References:

TM 1-1520-238-23

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. On pilot dim/test panel, set and hold **DGT OFF/NORM/TST** switch to **TST**. Check for short between P68–17 and ground.
   Does short exist?

   YES — Go to step 2.

   NO — Repair open wire between P68–17 and (A326)TB1–50–C. Go to paragraph 8–10.

2. Check for 2 to 5 VDC at P68–7 and P68–8.
   Is voltage present?

   YES — Go to step 3.

   NO — Go to step 6.

3. Check for:
   5 VDC at P68–12,
   –8 VDC at P68–13,
   8 VDC at P68–14.
   Are voltages present?

   YES — Go to step 4.

   NO — Go to step 5.

4. Check for open between:
   P68–9 and GS427–A,
   P68–10 and GS427–B,
   P68–11 and GS251–L.
   Does open exist?

   YES — Repair open wire. Go to paragraph 8–10.

   NO — Replace pilot **TGT** indicator (TM 1-1520-238-23).

5. Check for open between:
   P68–12 and P400–17,
   P68–13 and P400–11,
   P68–14 and P400–3.
   Does open exist?

   YES — Repair open wire. Go to paragraph 8–10.

   NO — Replace SDC (TM 1-1520-238-23).

6. Check for open between:
   P68–7 and P400–29,
   P68–8 and P400–35.
   Does open exist?

   YES — Repair open wire. Go to paragraph 8–10.

   NO — Replace SDC (TM 1-1520-238-23).

END OF TASK

8–19. PILOT TORQUE INDICATOR – DOES NOT INDICATE FULL SCALE OR SHOW DIGITAL 888 OR VERTICAL SCALE INDICATORS HAVE EVERY OTHER LAMP NOT LIGHTED 8–19

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer (2)

References:

TM 1-1520-238-23

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. On pilot dim/test panel, set and hold **DGT OFF/NORM/TST** switch to **TST**. Check for short between P66–17 and ground.
   Does short exist?

   YES — Go to step 2.

   NO — Repair open wire between: P66–17 and (A326)TB1–50–H. Go to paragraph 8–10.

2. Check for 2 to 5 VDC at P66–7 and P66–8.
   Is voltage present?

   YES — Go to step 3.

   NO — Go to step 6.

3. Check for:
   5 VDC at P66–12,
   –8 VDC at P66–13,
   8 VDC at P66–14.
   Are voltages present?

   YES — Go to step 4.

   NO — Go to step 5.

4. Check for open between:
   P66–9 and GS427–F,
   P66–10 and GS427–G,
   P66–11 and GS251–M.
   Does open exist?

   YES — Repair open wire. Go to paragraph 8–10.

   NO — Replace pilot **TORQUE** indicator (TM 1-1520-238-23).

5. Check for open between:
   P66–12 and P401–17,
   P66–13 and P401–10,
   P66–14 and P401–2.
   Does open exist?

   YES — Repair open wire. Go to paragraph 8–10.

   NO — Replace SDC (TM 1-1520-238-23).

6. Check for open between:
   P66–7 and P401–29,
   P66–8 and P401–35.
   Does open exist?

   YES — Repair open wire. Go to paragraph 8–10.

   NO — Replace SDC (TM 1-1520-238-23).

END OF TASK

8–20. PILOT FUEL QUANTITY INDICATOR – DOES NOT INDICATE FULL SCALE OR SHOW DIGITAL 888 OR VERTICAL SCALE INDICATORS HAVE EVERY OTHER LAMP NOT LIGHTED 8–20

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer (2)

References:

TM 1-1520-238-23

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. On pilot dim/test panel, set and hold **DGT OFF/NORM/TST** switch to **TST**.
   Check for short between P253–17 and ground.
   Does short exist?

   YES — Go to step 2.

   NO — Repair open wire between P253–17 and (A326)TB1–50–R. Go to paragraph 8–10.

2. Check for 2 to 5 VDC at P253–7 and P253–8.
   Is voltage present?

   YES — Go to step 3.

   NO — Go to step 6.

3. Check for
   5 VDC at P253–12,
   –8 VDC at P253–13,
   8 VDC at P253–14.
   Are voltages present?

   YES — Go to step 4.

   NO — Go to step 5.

4. Check for open between:
   P253–9 and GS427–L,
   P253–10 and GS427–M,
   P253–11 and GS425–D.
   Does open exist?

   YES — Repair open wire. Go to paragraph 8–10.

   NO — Replace pilot **FUEL** quantity indicator (TM 1-1520-238-23).

5. Check for open between:
   P253–12 and P400–19,
   P253–13 and P400–13,
   P253–14 and P400–5.
   Does open exist?

   YES — Repair open wire. Go to paragraph 8–10.

   NO — Replace SDC (TM 1-1520-238-23).

6. Check for open between:
   P253–7 and P400–27,
   P253–8 and P400–33.
   Does open exist?

   YES — Repair open wire. Go to paragraph 8–10.

   NO — Replace SDC (TM 1-1520-238-23).

END OF TASK

8–21. PILOT N_G RPM% INDICATOR – DOES NOT INDICATE FULL SCALE OR SHOW DIGITAL 888 OR VERTICAL SCALE INDICATORS HAVE EVERY OTHER LAMP NOT LIGHTED 8–21

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer (2)

References:

TM 1-1520-238-23

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. On pilot dim/test panel, hold **DGT OFF/NORM/TST** switch to **TST**. Check for short between P67–17 and ground.
   Does short exist?

   YES — Go to step 2.

   NO — Repair open wire between: P67–17 and (A326)TB1–50–D.

2. Check for 2 to 5 VDC at P67–7 and P67–8.
   Is voltage present?

   YES — Go to step 3.

   NO — Go to step 6.

3. Check for:
   5 VDC at P67–12,
   –8 VDC at P67–13,
   8 VDC at P67–14.
   Are voltages present?

   YES — Go to step 4.

   NO — Go to step 5.

4. Check for open between:
   P67–9 and GS427–C,
   P67–10 and GS427–D,
   P67–11 and GS427–E.
   Does open exist?

   YES — Repair open wire. Go to paragraph 8–10.

   NO — Replace pilot **N_G RPM%** indicator (TM 1-1520-238-23).

5. Check for open between:
   P67–12 and P401–18,
   P67–13 and P401–12,
   P67–14 and P401–4.
   Does open exist?

   YES — Repair open wire. Go to paragraph 8–10.

   NO — Replace SDC (TM 1-1520-238-23).

6. Check for open between:
   P67–7 and P401–25,
   P67–8 and P401–31.
   Does open exist?

   YES — Repair open wire. Go to paragraph 8–10.

   NO — Replace SDC (TM 1-1520-238-23).

END OF TASK

8–22. PILOT ENG–RTR RPM% INDICATOR – DOES NOT INDICATE FULL SCALE OR VERTICAL SCALE INDICATORS HAVE EVERY OTHER LAMP NOT LIGHTED 8–22

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer (2)

References:

TM 1-1520-238-23

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. On pilot dim/test panel, hold **DGT OFF/NORM/TST** switch to **TST**. Check for short between P65–17 and ground.
   Does short exist?

   YES — Go to step 2.

   NO — Repair open wire between: P65–17 and (A326)TB1–50–G. Go to paragraph 8–10.

2. Check for 2 to 5 VDC at P65–7 and P65–8.
   Is voltage present?

   YES — Go to step 3.

   NO — Go to step 6.

3. Check for:
   –8 VDC at P65–13,
   8 VDC at P65–14.
   Does open exist?

   YES — Go to step 4.

   NO — Go to step 5.

4. Check for open between:
   P65–9 and GS427–H,
   P65–10 and GS427–J,
   P65–11 and GS427–K.
   Does open exist?

   YES — Repair open wire. Go to paragraph 8–10.

   NO — Replace pilot **ENG–RTR RPM%** indicator (TM 1-1520-238-23).

5. Check for open between:
   P65–13 and P400–9,
   P65–14 and P400–1.
   Does open exist?

   YES — Repair open wire. Go to paragraph 8–10.

   NO — Replace SDC (TM 1-1520-238-23).

6. Check for open between:
   P65–7 and P400–25,
   P65–8 and P400–31.
   Does open exist?

   YES — Repair open wire. Go to paragraph 8–10.

   NO — Replace SDC (TM 1-1520-238-23).

END OF TASK

8–23. PILOT ENG OIL PRESSURE INDICATOR – DOES NOT INDICATE FULL SCALE OR SHOW DIGITAL 888 OR VERTICAL SCALE INDICATORS HAVE EVERY OTHER LAMP NOT LIGHTED 8–23

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer (2)

References:

TM 1-1520-238-23

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. On pilot dim/test panel, hold **DGT OFF/NORM/TST** switch to **TST**. Check for short between P70–17 and ground.
   Does short exist?

   YES — Go to step 2.

   NO — Repair open wire between: P70–17 and (A326)TB1–50–M. Go to paragraph 8–10.

2. Check for 2 to 5 VDC at P70–7 and P70–8.
   Is voltage present?

   YES — Go to step 3.

   NO — Go to step 6.

3. Check for:
   –8 VDC at P70–13,
   8 VDC at P70–14.
   Are voltages present?

   YES — Go to step 4.

   NO — Go to step 5.

4. Check for open between:
   P70–9 and GS425–A,
   P70–10 and GS425–B,
   P70–11 and GS425–C.
   Does open exist?

   YES — Repair open wire. Go to paragraph 8–10.

   NO — Replace pilot **ENG OIL** indicator (TM 1-1520-238-23).

5. Check for open between:
   P70–13 and P400–12,
   P70–14 and P400–4.
   Does open exist?

   YES — Repair open wire. Go to paragraph 8–10.

   NO — Replace SDC (TM 1-1520-238-23).

6. Check for open between:
   P70–7 and P400–28,
   P70–8 and P400–34.
   Does open exist?

   YES — Repair open wire. Go to paragraph 8–10.

   NO — Replace SDC (TM 1-1520-238-23).

END OF TASK

8–24. PILOT TGT, TORQUE, FUEL QUANTITY, AND N_G RPM% INDICATOR DIGITAL READOUTS – ARE NOT BLANKED OUT 8–24

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer

References:

TM 1-1520-238-23

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. Check for open between P787–4 and ground.
   Does open exist?

   YES — Repair open wire between P787–4 and GS425–H. Go to paragraph 8–10.

   NO — Go to step 2.

2. Check for open between (A326)TB1–50–J and P787–15.
   Does open exist?

   YES — Repair open wire between P787–15 and (A326)TB1–50–J. Go to paragraph 8–10.

   NO — Replace pilot dim/test panel (TM 1-1520-238-23).

END OF TASK

8–25. PILOT TGT INDICATOR DIGITAL READOUTS – ARE NOT BLANKED OUT 8–25

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer

References:

TM 1-1520-238-23

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. On pilot dim/test panel, set **DGT OFF/NORM/TST** switch to **DGT OFF**. Check for open between P68–24 and ground. **Does open exist?**

   YES — Repair open wire between P68–24 and (A326)TB1–50–A. Go to paragraph 8–10.

   NO — Replace pilot **TGT** indicator (TM 1-1520-238-23).

END OF TASK

8–26. PILOT TORQUE INDICATOR DIGITAL READOUTS – ARE NOT BLANKED OUT 8–26

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer

References:

TM 1-1520-238-23

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

On pilot dim/test panel, set **DGT OFF/NORM/TST** switch to **DGT OFF**.
Check for open between P66–24 and ground.
Does open exist?

YES	Repair open wire between P66–24 and (A326)TB1–50–E. Go to paragraph 8–10.
NO	Replace pilot **TORQUE** indicator (TM 1-1520-238-23).

END OF TASK

8–27. PILOT FUEL QUANTITY INDICATOR DIGITAL READOUTS – ARE NOT BLANKED OUT 8–27

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer

References:

TM 1-1520-238-23

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

On pilot dim/test panel, set **DGT OFF/NORM/TST** switch to **DGT OFF**.
Check for open between P253–24 and ground.
Does open exist?

YES	Repair open wire between P253–24 and (A326)TB1–50–F. Go to paragraph 8–10.
NO	Replace pilot **FUEL** quantity indicator (TM 1-1520-238-23).

END OF TASK

8–28. PILOT N_G RPM% INDICATOR DIGITAL READOUTS – ARE NOT BLANKED OUT 8–28

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer

References:

TM 1-1520-238-23

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

On pilot dim/test panel, set **DGT OFF/NORM/TST** switch to **DGT OFF**.
Check for open between P67–24 and ground.
Does open exist?

YES	Repair open wire between P67–24 and (A326)TB1–50–B. Go to paragraph 8–10.
NO	Replace pilot **N_G RPM%** indicator (TM 1-1520-238-23).

END OF TASK

8–29. PILOT TGT, TORQUE, FUEL QUANTITY, AND N_G RPM% INDICATOR DIGITAL READOUTS – ARE BLANKED OUT 8–29

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer

References:

TM 1-1520-238-23

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

Detach P787. Check for short between (A114)J1–15 and chassis ground on pilot dim/test panel.
Does open exist?

YES — Replace pilot dim/test panel (TM 1-1520-238-23).

NO — Repair shorted wire between:
(A326)TB1–50–A and P68–24,
(A326)TB1–50–B and P67–24,
(A326)TB1–50–E and P66–24,
(A326)TB1–50–F and P253–24,
(A326)TB1–50–J and P787–15.
Go to paragraph 8–10.

END OF TASK

8–30. PILOT ENG OIL, TGT, TORQUE, FUEL QUANTITY, ENG–RTR RPM%, AND N_G RPM% VERTICAL SCALE INDICATORS – DO NOT DIM (AUTO DIM) 8–30

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer (2)

References:

TM 1-1520-238-23

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. Detach P787. Cover photocell on pilot **DIM/TEST** panel to stop light penetration. Check resistance between (A114): J1–5 and J1–6.
   Is resistance more than 50K ohms?

   YES — Go to step 2.

   NO — Replace pilot dim/test panel (TM 1-1520-238-23).

2. With pilot **ENG INST** circuit breaker closed, check for 6 VDC at P787–5.
   Is voltage present?

   YES — Go to step 5.

   NO — Go to step 3.

3. With pilot **ENG INST** circuit breaker closed, check for 6 VDC at (A82)1J2–15 on SDC.
   Is voltage present?

   YES — Repair open wire between P401–15 and P787– 5. Go to paragraph 8–10.

   NO — Go to step 4.

4. Check for short between P401–15 and ground.
   Does short exist?

   YES — Repair shorted wire. Go to paragraph 8–10.

   NO — Replace SDC (TM 1-1520-238-23).

5. Check for open between P401–16 and P787–6.
   Does open exist?

   YES — Repair open wire. Go to paragraph 8–10.

   NO — Replace SDC (TM 1-1520-238-23).

END OF TASK

8–31. PILOT ENG OIL, TGT, TORQUE, FUEL QUANTITY, ENG–RTR RPM%, AND N_G RPM% VERTICAL SCALE INDICATORS – DO NOT DIM (MANUAL DIM) 8–31

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer (2)

References:

TM 1-1520-238-23

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. Detach P787. Check pilot dim/test panel for resistance between (A114)J1–7 and (A114)J1–8.
   Is resistance between 9,500 and 10,500 ohms?

   YES — Go to step 2.

   NO — Replace pilot dim/test panel (TM 1-1520-238-23).

2. Check manual **DIM** control potentiometer on pilot dim/test panel for resistance between (A114)J1–12 and (A114)J1–8.
   Does reading increase from between 0 and 500 ohms to between 9,500 and 10,500 ohms when control knob is rotated clockwise?

   YES — Go to step 3.

   NO — Replace pilot dim/test panel (TM 1-1520-238-23).

3. Check for 6.2 VDC to –6.2 VDC between:
   P787–7 and ground,
   P787–8 and ground.
   Is voltage present?

   YES — Go to step 6.

   NO — Go to step 4.

4. Check for open between:
   P787–12 and P400–24,
   P787–7 and P400–22,
   P787–8 and P400–23.
   Does open exist?

   YES — Repair open wire. Go to paragraph 8–10.

   NO — Go to step 5.

5. Check for short between:
   P787–12 and ground,
   P787–7 and ground,
   P787–8 and ground.
   Does short exist?

   YES — Repair shorted wire. Go to paragraph 8–10.

   NO — Replace SDC (TM 1-1520-238-23).

6. Check for open between P787–12 and P400–24.
   Does open exist?

   YES — Repair open wire. Go to paragraph 8–10.

   NO — Go to step 7.

7. Check for short between P787–12 and P400–24.
   Does short exist?

   YES — Repair shorted wire, Go to paragraph 8–10.

   NO — Replace SDC. (TM 1-1520-238-23)

END OF TASK

8–32. PILOT TGT INDICATOR VERTICAL SCALE INDICATORS OR DIGITAL READOUTS – DO NOT INDICATE AMBIENT TEMPERATURE ±5° OIL PRESSURE 8–32

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer (2)

References:

TM 1-1520-238-23
TM 55–2840–248–23

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. Check for 0 to 5 VDC at:
   P68–19 and P68–20,
   P68–22 and P68–23.
   Is voltage present?

   YES — Replace pilot **TGT** indicator (TM 1-1520-238-23).

   NO — Go to step 2.

2. Check for 0 to 5 VDC at:
   P400–37 and P400–38,
   P400–39 and P400–40.
   Is voltage present?

   YES — Repair open wire between:
   P400–37 and P68–22,
   P400–38 and P68–23,
   P400–39 and P68–19,
   P400–40 and P68–20.

   NO — Go to step 3.

3. Check for 0 to 5 VDC at:
   P400–41 and P400–42,
   P400–44 and P400–45.
   Is voltage present?

   YES — Replace SDC (TM 1-1520-238-23).

   NO — Go to step 4.

4. Check for open between:
   J24–2 and P400–41,
   J24–1 and P400–42,
   J23–2 and P400–44,
   J23–1 and P400–45.
   Does open exist?

   YES — Repair open wire.
   Go to paragraph 8–10.

   NO — Go to step 5.

5. Check for short between:
   J24–1 and ground,
   J24–2 and ground,
   J23–1 and ground,
   J23–2 and ground.
   Does short exist?

   YES — Repair shorted wire between:
   J24–2 and P452–G,
   J452–G and P400–41,
   J24–1 and P452–G,
   J452–G and P400–42,
   J23–2 and P400–44,
   J23–1 and P400–45.
   Go to paragraph 8–10.

   NO — Go to step 6.

8–32. PILOT TGT INDICATOR VERTICAL SCALE INDICATORS OR DIGITAL READOUTS – DO NOT INDICATE AMBIENT TEMPERATURE ±5° OIL PRESSURE (cont) **8–32**

6. Check for open between:
   engine 1 (E1)J1–17 and P24–2,
   engine 1 (E1)J1–16 and P24–1,
   engine 2 (E1)J1–17 and P23–2,
   engine 2 (E1)J1–16 and P23–1.
   Does open exist?

   YES — **(ABY)** Repair open wire.
   Go to paragraph 8–10.
   (ABZ) Replace wire harness
   (TM 1-1520-238-23).

   NO — Go to step 7.

7. Check for short between:
   engine 1 (E1)J1–17 and ground,
   engine 1 (E1)J1–16 and ground,
   engine 2 (E1)J1–17 and ground,
   engine 2 (E1)J1–16 and ground.
   Does short exist?

   YES — **(ABY)** Repair shorted wire.
   Go to paragraph 8–10.
   (ABZ) Replace wire harness
   (TM 1-1520-238-23).

   NO — Refer to TM 55-2840-248-23 to troubleshoot
   (**ABY**) ECU.
   (**ABZ**) DECU.

END OF TASK

8–33. PILOT TORQUE INDICATOR VERTICAL SCALE INDICATORS OR DIGITAL READOUTS – DO NOT INDICATE BETWEEN 0% AND 2% 8–33

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer (2)

References:

TM 1-1520-238-23
TM 55-2840-248-23

Equipment Conditions:

Ref	Condition
TM 1-1520-238-23	Access provisions – LN4 and RN4 doors opened

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

Detach P41 from engine 1 and P42 from engine 2
(ABY) ECU.
(ABZ) DECU.
Is torque indication 0?

YES	Refer to TM 55-2840-248-23to troubleshoot **(ABY)** ECU. **(ABZ)** DECU.
NO	Replace pilot **TORQUE** indicator (TM 1-1520-238-23).

END OF TASK

8–34. PILOT N_G RPM% INDICATOR VERTICAL SCALE INDICATORS OR DIGITAL READOUTS – DO NOT INDICATE BETWEEN 0% AND 5% 8–34

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer (2)

References:

TM 1-1520-238-23
TM 55-2840-248-23

Equipment Conditions:

Ref	Condition
TM 1-1520-238-23	Access provisions – LN4 and RN4 doors opened

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. Detach P45 from engine 1 and P46 from engine 2.

Is RPM indication 0?

YES	Refer to TM 55-2840-248-23 to troubleshoot engine.
NO	Replace pilot **N_G RPM%** indicator (TM 1-1520-238-23).

END OF TASK

8–35. PILOT FUEL QUANTITY INDICATOR VERTICAL SCALE INDICATORS OR DIGITAL READOUTS – DO NOT INDICATE EXISTING FUEL ±20 POUNDS 8–35

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer (2)

References:

TM 1-1520-238-T-7
TM 1-1520-238-23

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. On pilot instrument panel check **FUEL** quantity indicator for fuel indications.
   Does either vertical scale indicator or digital readouts indicate existing fuel ±20 pounds?
   - YES — Replace pilot **FUEL** quantity indicator. (TM 1-1520-238-23).
   - NO — Go to step 2.
2. Check for 0 to 5 VDC at:
   P253–18 and P253–19,
   P253–22 and P253–23.
   Is voltage present?
   - YES — Replace pilot **FUEL** quantity indicator (TM 1-1520-238-23).
   - NO — Go to step 3.
3. Check for open between P937–G and ground.
   Does open exist?
   - YES — Repair open wire between GS252–C and P937–G. Go to paragraph 8–10.
   - NO — Go to step 4.
4. Check for 28 VDC at P937–H.
   Is voltage present?
   - YES — Go to step 5.
   - NO — Go to step 7.
5. Check for 0 to 5 VDC at:
   P467–A13 and P467–A14,
   P467–A15 and P467–A14.
   Is voltage present?
   - YES — Repair open wire between:
     (A326)TB1–1–B and P253–23,
     (A326)TB1–1–C and P253–19,
     (A326)TB1–1–F and P253–22,
     (A326)TB1–1–K and P253–18.
     (A326):
     J5–A13 and TB1–1–E,
     J5–A14 and TB1–1–A,
     J5–A15 and TB1–1–J.
     Go to paragraph 8–10.
   - NO — Go to step 6.
6. Check for open between:
   P467–A13 and P937–L,
   P467–A14 and P937–J,
   P467–A15 and P937–U.
   Does open exist?
   - YES — Repair open wire. Go to paragraph 8–10.
   - NO — Refer to TM 1-1520-238-T-7 to troubleshoot fuel quantity indication/transfer system.

8–35. PILOT FUEL QUANTITY INDICATOR VERTICAL SCALE INDICATORS OR DIGITAL READOUTS – DO NOT INDICATE EXISTING FUEL ±20 POUNDS (cont) **8–35**

7. Check for open wire between:
   P401–45 and P937–H.
   Does open exist?

   YES — Repair open wire.
   Go to paragraph 8–10.

   NO — Replace SDC
   (TM 1-1520-238-23).

END OF TASK

8–36. PILOT ENG OIL INDICATOR VERTICAL SCALE INDICATORS – DO NOT INDICATE ZERO PRESSURE 8–36

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer (2)

References:

TM 1-1520-238-23

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

Check for 0 to 10 VAC between:
P70–19 and P70–20,
P70–22 and P70–23.
Is voltage present?

YES	Replace engine 1 or engine 2 oil pressure transmitters (TM 1-1520-238-23).
NO	Replace pilot **ENG OIL** indicator (TM 1-1520-238-23).

END OF TASK

8–37. PILOT ENG–RTR RPM% INDICATOR VERTICAL SCALE INDICATORS – DO NOT INDICATE 0% 8–37

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer (2)

References:

TM 1-1520-238-23
TM 55-2840-248-23

Equipment Conditions:

Ref	Condition
TM 1-1520-238-23	Access provisions – LN1, RN1, 250L, 250R, 290R doors opened

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. Check pilot **ENG–RTR RPM%** indicator vertical display scales.
   Does N_P1 indicate 0%?
   - YES — Go to step 2.
   - NO — Go to step 3.

2. Check pilot **ENG–RTR RPM%** indicator vertical display scales.
   Does N_P2 indicate 0%?
   - YES — Replace rotor speed sensor (TM 1-1520-238-23).
   - NO — Go to step 3.

3. Detach P41.
   Does N_P1 indicate 0%?
   - YES — Refer to TM 55-2840-248-23 troubleshoot engine.
   - NO — Replace **ENG–RTR RPM%** indicator (TM 1-1520-238-23).

4. Detach P42.
   Does N_P2 indicate 0%?
   - YES — Refer to TM 55-2840-248-23 to troubleshoot engine.
   - NO — Replace **ENG–RTR RPM%** indicator (TM 1-1520-238-23).

END OF TASK

8–38. ALL CPG DIGITAL READOUTS – REMAIN LIGHTED (CPG DGT OFF/NORM/TST SWITCH SET TO DGT OFF) 8–38

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer

References:

TM 1-1520-238-23

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. Check for open between:
   P1092–15 and P75–3,
   P1092–15 and P74–24.
   Does open exist?

   YES — Repair open wire between:
   P1092–15 and P75 SP1,
   P75–3 and P75 SP1,
   P74–24 and P75 SP1.
   Go to paragraph 8–10.

   NO — Go to step 2.

2. Check for open between:
   P1092–4 and GS245–E.
   Does open exist?

   YES — Repair open wire.
   Go to paragraph 8–10.

   NO — Replace CPG dim/test panel (TM 1-1520-238-23).

END OF TASK

8–39. CPG TORQUE INDICATOR DIGITAL READOUTS – DO NOT BLANK 8–39

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer

References:

TM 1-1520-238-23

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

Check for open between P74–24 and P1092–15.
Does open exist?

YES	Repair open wire between P74–24 and P75 SP1. Go to paragraph 8–10.
NO	Replace CPG **TORQUE** indicator (TM 1-1520-238-23).

END OF TASK

8–40. CPG SDD DIGITAL READOUTS – DO NOT BLANK (CPG DIM/TEST PANEL INSTALLED) 8–40

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer

References:

TM 1-1520-238-23

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

Check for open between P75–3 and P1092–15.
Does open exist?

YES	Repair open wire between P75–3 and P75 SP1. Go to paragraph 8–10.
NO	Replace CPG SDD indicator (TM 1-1520-238-23).

END OF TASK

8–41. CPG ENGINE INSTRUMENT VERTICAL DISPLAYS AND DIGITAL READOUTS BRIGHTNESS – DOES NOT CHANGE WHEN MANUAL DIM CONTROL IS ROTATED (WITH CPG DIM/TEST PANEL INSTALLED) 8–41

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer (2)

References:

TM 1-1520-238-23

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. Check CPG dim/test panel for resistance between (A517)J1–7 and (A517)J1–8.
   Is resistance between 2250 and 2750 ohms?

   YES — Go to step 2.

   NO — Replace CPG dim/test panel (TM 1-1520-238-23).

2. Check manual **DIM** control potentiometer on CPG dim/test panel for resistance between (A517)J1–12 and (A517)J1–8.
   Does reading increase from between 0 and 250 ohms to between 2250 and 2750 ohms when control knob is rotated clockwise?

   YES — Go to step 3.

   NO — Replace CPG dim/test panel (TM 1-1520-238-23).

3. Check for open between:
   P1092–7 and P1093–8,
   P1092–12 and P1093–9,
   P1092–8 and P1093–10.
   Does open exist?

   YES — Repair open wire. Go to paragraph 8–10.

   NO — Go to step 4.

4. Check for short between:
   P1092–7 and ground,
   P1092–8 and ground,
   P1092–12 and ground.
   Does short exist?

   YES — Repair shorted wire. Go to paragraph 8–10.

   NO — Replace CPG ENG INST dimmer power supply (TM 1-1520-238-23).

END OF TASK

8–42. ALL CPG ENGINE INSTRUMENT VERTICAL SCALE INDICATORS AND DIGITAL READOUTS – ARE BLANK (WITH CPG DIM/TEST PANEL INSTALLED) 8–42

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer (2)

References:

TM 1-1520-238-23

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. Check for 28 VDC between:
   P1093–20 and P1093–28,
   P1093–21 and P1093–29.
   Is voltage present?

   YES — Replace CPG ENG INST dimmer power supply (TM 1-1520-238-23).

   NO — Repair open wire between:
   P1093–20 and P401 SP1,
   P1093–21 and P401 SP2,
   P1093–28 and GS371–K,
   P1093–29 and GS371–L.
   Go to paragraph 8–10.

END OF TASK

8–43. CPG TORQUE INDICATOR – DOES NOT INDICATE FULL SCALE OR SHOW DIGITAL 888 OR VERTICAL SCALE INDICATORS HAVE EVERY OTHER LAMP NOT LIGHTED (HELICOPTERS WITHOUT CPG DIM/TEST PANEL INSTALLED) 8–43

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer (2)

References:

TM 1-1520-238-23

Equipment Conditions:

Ref	Condition
TM 1-1520-238-23	Access provisions – L40 cover removed

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. Check CPG **TORQUE** indicator.
   Are both vertical displays and digital readouts blanked out?

   YES — Go to step 3.

   NO — Go to step 2.

2. With test switch on CPG SDD panel depressed, check for open between P74–17 and ground.
   Does open exist?

   YES — Repair open wire between:
   P74–17 and P73 SP1.
   Go to paragraph 8–10.

   NO — Go to step 3.

3. Check for open between:
   P74–9 and ground,
   P74–10 and ground,
   P74–11 and ground.
   Does open exist?

   YES — Repair open wire between:
   GS245–A and P74–9,
   GS245–B and P74–10,
   GS255–C and P74–11,
   Go to paragraph 8–10.

   NO — Go to step 4.

4. Check CPG **TORQUE** indicator for voltages as follows:
   P74–7 for 2 to 5 VDC,
   P74–8 for 2 to 5 VDC,
   P74–12 for 5 VDC,
   P74–13 for –8 VDC,
   P74–14 for 8 VDC.
   Are voltages present?

   YES — Replace CPG **TORQUE** indicator (TM 1-1520-238-23).

   NO — Go to step 5.

5. Check for open between:
   P74–7 and P401–26,
   P74–8 and P401–32,
   P74–12 and P401–20,
   P74–13 and P401–9,
   P74–14 and P401–1.
   Does open exist?

   YES — Repair open wire.
   Go to paragraph 8–10.

   NO — Replace SDC (TM 1-1520-238-23).

END OF TASK

8–44. CPG ENG–RTR RPM% – DOES NOT INDICATE FULL SCALE OR VERTICAL SCALE INDICATORS HAVE EVERY OTHER LAMP NOT LIGHTED (HELICOPTERS WITH CPG DIM/TEST PANEL INSTALLED) 8–44

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer (2)

References:

TM 1-1520-238-23

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. On CPG dim/test panel, hold **DGT OFF/NORM/TST** switch to **TST**. Check for short between P73–17 and ground.
   Does short exist?
   - YES — Go to step 2.
   - NO — Repair open wire between P73–17 and P73–SP1. Go to paragraph 8–10.
2. Check for 2 to 5 VDC at P73–7 and P73–8.
   Is voltage present?
   - YES — Go to step 3.
   - NO — Go to step 6.
3. Check for:
   –8 VDC at P73–13,
   8 VDC at P73–14.
   Are voltages present?
   - YES — Go to step 4.
   - NO — Go to step 5.
4. Check for open between:
   P73–9 and GS245–C,
   P73–10 and GS245–D,
   P73–11 and GS255–A.
   Does open exist?
   - YES — Repair open wire. Go to paragraph 8–10.
   - NO — Replace CPG **ENG–RTR RPM%** indicator (TM 1-1520-238-23).
5. Check for open between:
   P73–13 and P400–10,
   P73–14 and P400–2.
   Does open exist?
   - YES — Repair open wire. Go to paragraph 8–10.
   - NO — Replace SDC (TM 1-1520-238-23).
6. Check for open between:
   P73–7 and P1093–2,
   P73–8 and P1093–5.
   Does open exist?
   - YES — Repair open wire. Go to paragraph 8–10.
   - NO — Replace CPG ENG INST dimmer power supply. (TM 1-1520-238-23).

END OF TASK

8–45. CPG SDD PANEL – DOES NOT INDICATE FULL SCALE OR SHOW DIGITAL 888 (HELICOPTERS WITH CPG DIM/TEST PANEL INSTALLED) 8–45

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer (2)

References:

TM 1-1520-238-23

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. On CPG dim/test panel, hold **DGT OFF/NORM/TST** switch to **TST**. Check for short between P75–17 and ground.
   Does short exist?

   YES — Go to step 2.

   NO — Repair open wire between P75–17 and P73 SP1. Go to paragraph 8–10.

2. Check for 2 to 5 VDC at P75–7 and P75–8.
   Is voltage present?

   YES — Go to step 3.

   NO — Go to step 6.

3. Check for:
   5 VDC at P75–12,
   –8 VDC at P75–13,
   8 VDC at P75–14.
   Is voltage present?

   YES — Go to step 4.

   NO — Go to step 5.

4. Check for open between:
   P75–9 and GS245–F,
   P75–10 and GS245–G,
   P75–11 and GS255–B.
   Does open exist?

   YES — Repair open wire. Go to paragraph 8–10.

   NO — Replace CPG SDD panel (TM 1-1520-238-23).

5. Check for open between:
   P75–12 and P401–19,
   P75–13 and P401–13,
   P75–14 and P401–5.
   Does open exist?

   YES — Repair open wire. Go to paragraph 8–10.

   NO — Replace SDC (TM 1-1520-238-23).

6. Check for open between:
   P75–7 and P1093–4,
   P75–8 and P1093–7.
   Does open exist?

   YES — Repair open wire. Go to paragraph 8–10.

   NO — Replace CPG ENG INST dimmer power supply (TM 1-1520-238-23).

END OF TASK

8–46. ALL CPG ENGINE INSTRUMENTS – BLANK WITH DGT OFF/NORM/TST SWITCH AT NORM (HELICOPTERS WITH CPG DIM/TEST PANEL INSTALLED) 8–46

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer

References:

TM 1-1520-238-23

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

Detach P1092. Check for open between (A517): J1–15 and J1–4.
Does open exist?

YES — Repair shorted wire between:
P1092–15 and P75–3,
P1092–15 and P74–24.
Go to paragraph 8–10.

NO — Replace CPG dim/test panel (TM 1-1520-238-23).

END OF TASK

8–47. CPG SDD PANEL ENGINE INSTRUMENT INDICATORS – ARE NOT BLANKED OUT 8–47

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer

References:

TM 1-1520-238-23

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

Check CPG **TORQUE** and **ENG–RTR RPM%** indicator vertical scales.
Do scales show full display?

YES	Repair shorted wire between: P75–17 and ground, P74 –17 and ground, P73–17 and ground, P73 SP1 and ground. Go to paragraph 8–10.
NO	Replace CPG SDD panel (TM 1-1520-238-23).

END OF TASK

8–48. CPG TORQUE INDICATOR DIGITAL READOUTS – ARE NOT BLANKED OUT 8–48

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer

References:

TM 1-1520-238-23

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. Check for open between (M9):
   J1–9 and J1–3.
   Does open exist?

   YES — Go to step 2.

   NO — Replace CPG SDD panel (TM 1-1520-238-23).

2. Check for open between P75–3 and P74–24.
   Does open exist?

   YES — Repair open wire.
   Go to paragraph 8–10.

   NO — Replace CPG **TORQUE** indicator (TM 1-1520-238-23).

END OF TASK

8–49. CPG SDD PANEL TGT DIGITAL READOUT – DOES NOT INDICATE AMBIENT TEMPERATURE ±5° 8–49

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer (2)

References:

TM 1-1520-238-23

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. Check pilot **TGT** indicator.
   Are digital readouts within ±5° temperature?

   YES — Go to step 2.

   NO — Go to paragraph 8–32 to troubleshoot pilot **TGT** indicator.

2. With pilot and CPG **ENG INST** circuit breakers (CB 17 and CB 31) closed and ambient temperature greater than 0° C, check for 0 to 5 VDC at:
   P75–28 and P75–29.
   Is voltage present?

   YES — Replace CPG SDD panel (TM 1-1520-238-23).

   NO — Go to step 3.

3. Check for open between:
   P75–28 and P68–1,
   P75–29 and P68–2.
   Does open exist?

   YES — Repair open wire. Go to paragraph 8–10.

   NO — Replace pilot **TGT** indicator (TM 1-1520-238-23).

END OF TASK

8–50. CPG SDD PANEL N_G% RPM DIGITAL READOUT – DOES NOT INDICATE 0% TO .5% 8–50

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer (2)

References:

TM 1-1520-238-23

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. Check pilot **N_G RPM%** indicator.
   Are digital readouts within .5%?

   YES Go to step 2.

   NO Go to paragraph 8–34.

2. With pilot and CPG **ENG INST** circuit breakers closed check CPG SDD panel for 0 to 5 VDC at P75–26 and P75–27.
   Is voltage present?

   YES Replace SDD panel (TM 1-1520-238-23).

   NO Replace pilot **N_G RPM%** indicator (TM 1-1520-238-23).

END OF TASK

8–51. CPG SDD PANEL FUEL QTY LBX10 DIGITAL READOUT – DOES NOT INDICATE EXISTING FUEL ±20 POUNDS 8–51

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer (2)

References:

TM 1-1520-238-23

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. Check pilot fuel quantity indicator digital readouts.
   Is correct existing fuel (± 20 pounds) indicated?
   - YES — Go to step 2.
   - NO — Go to paragraph 8–35.
2. With pilot and CPG **ENG INST** circuit breakers closed. Check between P75–20 and ground for 1 VDC for each 280 pounds of fuel in forward tank.
   Is voltage present?
   - YES — Go to step 3.
   - NO — Go to step 4.
3. Check between P75–21 and ground for 1 VDC for each 280 pounds of fuel in aft tank.
   Is voltage present?
   - YES — Replace CPG SDD panel (TM 1-1520-238-23).
   - NO — Go to step 4.
4. Check for open between:
   P75–20 and P253–1,
   P75–21 and P253–2.
   Does open exist?
   - YES — Repair open wire. Go to paragraph 8–10.
   - NO — Replace pilot fuel indicator (TM 1-1520-238-23).

END OF TASK

8–52. CPG SDD PANEL ENG OIL DIGITAL READOUT – DOES NOT INDICATE 0 TO 5 POUNDS PRESSURE 8–52

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer (2)

References:

TM 1-1520-238-23

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. Check for pilot **ENG OIL** indicator.
   Does vertical display indicate 0 to 5 psi?

   YES Go to step 2.

   NO Go to paragraph 8–36.

2. With pilot and CPG **ENG INST** circuit breakers closed, check for 0 to 10 VAC between:
   P75–22 and ground,
   P75–23 and ground.
   Is voltage present?

   YES Replace CPG SDD panel (TM 1-1520-238-23).

   NO Replace pilot **ENG OIL** indicator (TM 1-1520-238-23).

END OF TASK

8–53. CPG TORQUE INDICATOR VERTICAL SCALE INDICATORS AND DIGITAL READOUTS – DO NOT INDICATE 0% TO 2% 8–53

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer

References:

TM 1-1520-238-23

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

Check pilot **TORQUE** indicator.
Is indication 0 to 2%?

YES	Replace CPG **TORQUE** indicator (TM 1-1520-238-23).
NO	Go to paragraph 8–33.

END OF TASK

8–54. CPG ENG–RTR RPM% INDICATOR VERTICAL SCALE INDICATORS – DO NOT INDICATE 0% 8–54

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer

References:

TM 1-1520-238-23

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

Check pilot **ENG–RTR RPM%** indicator.
Is indication 0%?

YES	Replace CPG **ENG–RTR RPM%** indicator (TM 1-1520-238-23).
NO	Go to paragraph 8–37.

END OF TASK

8–55. CPG SDD PANEL EDGE–LIGHTING – DOES NOT LIGHT 8–55

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer (2)

References:

TM 1-1520-238-23

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

Check for 0 to 5 VDC at P75–16 and P75–15.
Is voltage present?

YES	Replace CPG SDD panel (TM 1-1520-238-23).
NO	Repair open wire between: P75–15 and (A326)TB1–41–G, P75–16 and (A326)TB1–40–G. Go to paragraph 8–10.

END OF TASK

8–56. CPG TORQUE INDICATOR EDGE–LIGHTING – DOES NOT LIGHT 8–56

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer (2)

References:

TM 1-1520-238-23

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

Check for 0 to 5 VDC at P74–16 and P74–15.
Is voltage present?

YES — Replace **TORQUE** indicator (TM 1-1520-238-23).

NO — Repair open wire between: P74–15 and (A326)TB1–41–F, P74–16 and (A326)TB1–40–F. Go to paragraph 8–10.

END OF TASK

8–57. CPG ENG–RTR RPM% INDICATOR EDGE–LIGHTING – DOES NOT LIGHT 8–57

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer (2)

References:

TM 1-1520-238-23

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

Check for 0 to 5 VDC at P73–16 and P73–15.
Is voltage present?

YES	Replace CPG **ENG–RTR RPM%** indicator (TM 1-1520-238-23).
NO	Repair open wire between: P73–15 and (A326)TB1–41–E, P73–16 and (A326)TB1–40–E. Go to paragraph 8–10.

END OF TASK

8–58. CPG DIM/TEST PANEL EDGE–LIGHTING – DOES NOT LIGHT 8–58

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer (2)

References:

TM 1-1520-238-23

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

On CPG **INTR LT** panel, set **INST** control to **BRT**. Check for 5 VDC at P1092–9 and P1092–10.

Is voltage present?

YES	Replace dim/test panel edge–light panel (TM 1-1520-238-23).
NO	Repair open wire between: P1092–9 and P479–A6, P1092–10 and P479–A7. (A326): J11–A6 and TB1–41–J, J11–A7 and TB1–40–J. Go to paragraph 8–10.

END OF TASK

8–59. PILOT DIM/TEST PANEL EDGE–LIGHTING – DOES NOT LIGHT 8–59

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer (2)

References:

TM 1-1520-238-23

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

Check for 0 to 5 VDC at P787–10 and P787–9.
Is voltage present?

YES	Replace pilot dim/test panel (TM 1-1520-238-23).
NO	Repair open wire between: P787–10 and (A326)TB1–36–E, P787–9 and (A326)TB1–35–E. Go to paragraph 8–10.

END OF TASK

8–60. PILOT TGT INDICATOR EDGE–LIGHTING – DOES NOT LIGHT 8–60

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer (2)

References:

TM 1-1520-238-23

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

Check for 0 to 5 VDC at P68–16 and P68–15.
Is voltage present?

YES — Replace pilot **TGT** indicator (TM 1-1520-238-23).

NO — Repair open wire between: P68–15 and (A326)TB1–38–E, P68–16 and (A326)TB1–38–L. Go to paragraph 8–10.

END OF TASK

8–61. PILOT TORQUE INDICATOR EDGE–LIGHTING – DOES NOT LIGHT 8–61

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer (2)

References:

TM 1-1520-238-23

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

Check for 0 to 5 VDC at P66–16 and P66–15.
Is voltage present?

YES — Replace pilot **TORQUE** indicator (TM 1-1520-238-23).

NO — Repair open wire between:
P66–15 and (A326)TB1–38–C,
P66–16 and (A326)TB1–38–J.
Go to paragraph 8–10.

END OF TASK

8–62. PILOT FUEL QUANTITY INDICATOR EDGE–LIGHTING – DOES NOT LIGHT 8–62

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer (2)

References:

TM 1-1520-238-23

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

Check for 0 to 5 VDC at P253–16 and P253–15.
Is voltage present?

YES	Replace pilot **FUEL** quantity indicator (TM 1-1520-238-23).
NO	Repair open wire between: P253–15 and (A326)TB1–35–C, P253–16 and (A326)TB1–36–C. Go to paragraph 8–10.

END OF TASK

8–63. PILOT N_G RPM% INDICATOR EDGE–LIGHTING – DOES NOT LIGHT 8–63

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer (2)

References:

TM 1-1520-238-23

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

Check for 0 to 5 VDC at P67–16 and P67–15.
Is voltage present?

YES	Replace **N_G RPM%** indicator (TM 1-1520-238-23).
NO	Repair open wire between: P67–15 and (A326)TB1–38–D, P67–16 and (A326)TB1–38–K. Go to paragraph 8–10.

END OF TASK

8–64. PILOT ENG–RTR RPM% INDICATOR EDGE–LIGHTING – DOES NOT LIGHT 8–64

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer (2)

References:

TM 1-1520-238-23

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

Check for 0 to 5 VDC at P65–16 and P65–15.
Is voltage present?

YES — Replace pilot **ENG–RTR RPM%** indicator (TM 1-1520-238-23).

NO — Repair open wire between:
P65–15 and (A326)TB1–38–B,
P65–16 and (A326)TB1–38–H.
Go to paragraph 8–10.

END OF TASK

8–65. PILOT ENG OIL INDICATOR EDGE–LIGHTING – DOES NOT LIGHT 8–65

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer (2)

References:

TM 1-1520-238-23

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

Check for 0 to 5 VDC at P70–16 and P70–15.
Is voltage present?

YES	Replace pilot **ENG OIL** indicator (TM 1-1520-238-23).
NO	Repair open wire between: P70–15 and (A326)TB1–35–D, P70–16 and (A326)TB1–36–D. Go to paragraph 8–10.

END OF TASK

8–66. PILOT AND CPG ENG OIL INDICATORS – DO NOT INDICATE ENGINE 1 OIL PRESSURE 8–66

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer (2)

References:

TM 1-1520-238-23
TM 55-2840-248-23

Equipment Conditions:

Ref	Condition
TM 1-1520-238-23	Access provisions – LN1 door opened

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. Check for 10 VAC between P45–6 and P45–7.
   Is voltage present?
   - YES — Go to step 2.
   - NO — Go to step 5.
2. Check for open between:
   J23–16 and P70–22,
   J23–17 and P70–23.
   Does open exist?
   - YES — Repair open wire. Go to paragraph 8–10.
   - NO — Go to step 3.
3. Check for open between:
   P45–5 and P23–16,
   P45–7 and P23–17.
   Does open exist?
   - YES — **(ABY)** Repair open wire. Go to paragraph 8–10. **(ABZ)** Replace wire harness (TM 1-1520-238-23).
   - NO — Go to step 4.
4. Check for open between (M6):
   J1–22 and J1–1.
   Does open exist?
   - YES — Replace pilot **ENG OIL** indicator (TM 1-1520-238-23).
   - NO — Refer to TM 55-2840-248-23 to troubleshoot engine 1.
5. Check for 10 VAC between P45–6 and ground.
   Is voltage present?
   - YES — Go to step 8.
   - NO — Go to step 6.
6. Check for open between J21–32 and P400–6.
   Does open exist?
   - YES — Repair open wire. Go to paragraph 8–10.
   - NO — Go to step 7.

8–66. PILOT AND CPG ENG OIL INDICATORS – DO NOT INDICATE ENGINE 1 OIL PRESSURE (cont) **8–66**

7. Check for open between P21–32 and P45–6.
   Does open exist?

   YES — **(ABY)** Repair open wire.
   Go to paragraph 8–10.
   (ABZ) Replace wire harness
   (TM 1-1520-238-23).

   NO — Replace SDC
   (TM 1-1520-238-23).

8. Check for open between:
   J21–30 and GS571–C,
   J21–31 and P400–7,
   J23–17 and P70–23.
   Does open exist?

   YES — Repair open wire.
   Go to paragraph 8–10.

   NO — **(ABY)** Repair open wire between:
   P45–7 and P21–30,
   P45–7 and P21–31,
   P45–7 and P23–17.
   (ABZ) Replace wire harness
   (TM 1-1520-238-23).

END OF TASK

8–67. PILOT AND CPG ENG OIL INDICATORS – DO NOT INDICATE ENGINE 2 OIL PRESSURE 8–67

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer (2)

References:

TM 1-1520-238-23
TM 55-2840-248-23

Equipment Conditions:

Ref	Condition
TM 1-1520-238-23	Access provisions – RN1 door opened

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. Check for 10 VAC between P46–6 and P46–7.
   Is voltage present?
   - YES — Go to step 2.
   - NO — Go to step 5.
2. Check for open between J24–16 and P70–19.
   Does open exist?
   - YES — Repair open wire. Go to paragraph 8–10.
   - NO — Go to step 3.
3. Check for open between:
   P46–5 and P24–16,
   P46–7 and P24–17.
   Does open exist?
   - YES — **(ABY)** Repair open wire. Go to paragraph 8–10. **(ABZ)** Replace wire harness (TM 1-1520-238-23).
   - NO — Go to step 4.
4. Check for open between (M6):
   J1–22 and J1–1.
   Does open exist?
   - YES — Replace pilot **ENG OIL** indicator (TM 1-1520-238-23).
   - NO — Refer to TM 55-2840-248-23 to troubleshoot engine 1.
5. Check for 10 VAC between P46–6 and ground.
   Is voltage present?
   - YES — Go to step 8.
   - NO — Go to step 6.
6. Check for open between J22–32 and P400–14.
   Does open exist?
   - YES — Repair open wire. Go to paragraph 8–10.
   - NO — Go to step 7.
7. Check for open between P22–32 and P46–6.
   Does open exist?
   - YES — **(ABY)** Repair open wire. Go to paragraph 8–10. **(ABZ)** Replace wire harness (TM 1-1520-238-23).
   - NO — Replace SDC (TM 1-1520-238-23).

8–67. PILOT AND CPG ENG OIL INDICATORS – DO NOT INDICATE ENGINE 2 OIL PRESSURE (cont) **8–67**

8. Check for open between:
   J22–30 and GS520–A,
   J22–31 and P400–15,
   J24–17 and P70–20.
   Does open exist?

   YES — Repair open wire.
   Go to paragraph 8–10.

   NO — **(ABY)** Repair open wire between:
   P46–7 and P22–30,
   P46–7 and P22–31,
   P46–7 and P24–17.
   Go to paragraph 8–10.
   (**ABZ**) Replace wire harness (TM 1-1520-238-23).

END OF TASK

8–68. PILOT AND CPG TORQUE INDICATORS – DO NOT INDICATE ENGINE 1 TORQUE 8–68

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer

References:

TM 1-1520-238-23

Equipment Conditions:

Ref	Condition
TM 1-1520-238-23	Access provisions – LN1 door opened

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. Check for open between:
   P41–10 and P66–22,
   P41–11 and P66–23.
   Does short exist?

   YES Go to step 8.

   NO Go to step 2.

2. Detach P682, P74, P66, and P49. Check for short between:
   P41–10 and ground,
   P41–11 and ground.
   Does short exist?

   YES Go to step 3.

   NO Replace engine 1 torque sensor (TM 1-1520-238-23).

3. Detach P405. Check for short between:
   P41–10 and ground,
   P41–11 and ground.
   Does short exist?

   YES Go to step 7.

   NO Go to step 4.

4. Detach P469. Check for short between (A326):
   J3–B1 and ground,
   J3–B2 and ground.
   Does short exist?

   YES Go to step 6.

   NO Go to step 5.

5. Check for short between:
   P405–B4 and ground,
   P405–B5 and ground,
   P405–B7 and ground,
   P405–B8 and ground.
   Does short exist?

   YES Repair shorted wire between:
   P405–B4 and P66–23,
   P405–B5 and P66–22,
   P405–B7 and P74–23,
   P405–B8 and P74–22,
   P449–B1 and P682–120,
   P449–B2 and P682–119,
   P449–B1 and P469–A1,
   P449–B2 and P469–A2.
   Go to paragraph 8–10.

   NO Repair shorted wire between:
   P405–A16 and P49–28,
   P405–A17 and P49–29.
   Go to paragraph 8–10.

6. Check for short between (A326)J3–B1 and ground.
Does short exist?

   YES — Repair shorted wire between (A326):
   TB1–4–C and J3–B2,
   TB1–4–A and J3–A16,
   TB1–4–F and TB1–4–D,
   TB1–4–E and J3–B5,
   TB1–4–G and J3–A3,
   TB1–4–H and J3–B8.
   Go to paragraph 8–10.

   NO — Repair shorted wire between (A326):
   TB1–5–C and J3–B1,
   TB1–5–A and J3–A17,
   TB1–5–D and TB1–4–L,
   TB1–4–J and J3–B7,
   TB1–4–K and J3–B4,
   TB1–4–M and J2–A2.
   Go to paragraph 8–10.

7. Check for short between:
P41–10 and P23–9,
P41–11 and P23–10.
Does short exist?

   YES — **(ABY)** Repair shorted wire.
   Go to paragraph 8–10.
   (ABZ) Replace wire harness.
   (TM 1-1520-238-23).

   NO — Repair shorted wire between:
   J23–9 and P405–B2,
   J23–10 and P405–B1.
   Go to paragraph 8–10.

8. Check for open between:
J23–9 and P405–B2,
J23–10 and P405–B1.
Does open exist?

   YES — Repair open wire.
   Go to paragraph 8–10.

   NO — Go to step 9.

9. Check for open between:
P41–10 and P23–9,
P41–11 and P23–10.
Does open exist?

   YES — **(ABY)** Repair open wire.
   Go to paragraph 8–10.
   (ABZ) Replace wire harness.
   (TM 1-1520-238-23).

   NO — Go to step 10.

10. Check for open between (A326):
J3–B1 and TB1–4–L.
Does open exist?

   YES — Repair open wire.
   Go to paragraph 8–10.

   NO — Repair open wire between (A326):
   TB1–4–C and J3–B2,
   TB1–4–D and TB1–4–F.
   Go to paragraph 8–10.

END OF TASK

8–69. CPG SDD – DOES NOT INDICATE ENGINE 1 AND/OR ENGINE 2 OIL PRESSURE 8–69

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer (2)

References:

TM 1-1520-238-23

Equipment Conditions:

Ref	Condition
TM 1-1520-238-23	Access provisions – LN1 door opened

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. Check for 0.1 to 1 VDC at P75–22 and P75–23.
   Is voltage present?

   YES — Replace CPG SDD panel (TM 1-1520-238-23).

   NO — Go to step 2.

2. Check for open between:
   P70–1 and P75–22,
   P70–2 and P75–23.
   Does open exist?

   YES — Repair open wire.
   Go to paragraph 8–10.

   NO — Replace pilot **ENG OIL** indicator (TM 1-1520-238-23).

END OF TASK

8–70. PILOT TORQUE INDICATOR – DOES NOT INDICATE ENGINE 1 TORQUE 8–70

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer

References:

TM 1-1520-238-23

Equipment Conditions:

Ref	Condition
TM 1-1520-238-23	Access provisions – LN1 door opened

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. Check for open between:
   P41–10 and P66–22,
   P41–11 and P66–23.
   Does open exist?

   YES — Go to step 2.

   NO — Replace pilot **TORQUE** indicator (TM 1-1520-238-23).

2. Check for open between:
   P405–B4 and P66–23,
   P405–B5 and P66–22.
   Does open exist?

   YES — Repair open wire.
   Go to paragraph 8–10.

   NO — Repair open wire between (A326):
   J3–B4 and TB1–4–K,
   J3–B5 and TB1–4–E.
   Go to paragraph 8–10.

END OF TASK

8–71. CPG TORQUE INDICATOR – DOES NOT INDICATE ENGINE 1 TORQUE 8–71

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer

References:

TM 1-1520-238-23

Equipment Conditions:

Ref	Condition
TM 1-1520-238-23	Access provisions – LN1 door opened

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. Check for open between:
   P41–10 and P74–22,
   P41–11 and P74–23.
   Does open exist?

   YES — Go to step 2.

   NO — Replace pilot **TORQUE** indicator (TM 1-1520-238-23).

2. Check for open between:
   P405–B7 and P74–23,
   P405–B8 and P74–22.
   Does open exist?

   YES — Repair open wire.
   Go to paragraph 8–10.

   NO — Repair open wire between (A326):
   J3–B7 and TB1–4–J,
   J3–B8 and TB1–4–H.
   Go to paragraph 8–10.

END OF TASK

8–72. PILOT AND CPG TORQUE INDICATORS – DO NOT INDICATE ENGINE 2 TORQUE 8–72

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer

References:

TM 1-1520-238-23

Equipment Conditions:

Ref	Condition
TM 1-1520-238-23	Access provisions – RN1 door opened

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. Check for open between:
   P42–10 and P66–19,
   P42–11 and P66–20.
   Does open exist?

   YES — Go to step 8.

   NO — Go to step 2.

2. Detach P682, P74, P66, and P49.
   Check for short between:
   P42–10 and ground,
   P42–11 and ground.
   Does short exist?

   YES — Go to step 3.

   NO — Replace engine 2 torque sensor (TM 1-1520-238-23).

3. Detach P405 and P469.
   Check for short between:
   P42–10 and ground,
   P42–11 and ground.
   Does short exist?

   YES — Go to step 7.

   NO — Go to step 4.

4. Detach P405 and P469.
   Check for short between (A326):
   J19–B7 and ground,
   J19–B8 and ground.
   Does short exist?

   YES — Go to step 6.

   NO — Go to step 5.

5. Check for short between:
   P405–B10 and ground,
   P405–B11 and ground,
   P405–B13 and ground,
   P405–B14 and ground.
   Does short exist?

   YES — Repair shorted wire between:
   P405–B10 and P74–19,
   P405–B11 and P74–20,
   P405–B13 and P66–20,
   P405–B4 and P66–19,
   P449–B4 and P682–118,
   P449–B5 and P682–117,
   P449–B4 and P469–A4,
   P449–B5 and P469–A5.
   Go to paragraph 8–10.

   NO — Repair shorted wire between:
   P405–A19 and P49–30,
   P405–A20 and P49–31.
   Go to paragraph 8–10.

8–72. PILOT AND CPG TORQUE INDICATORS – DO NOT INDICATE ENGINE 2 TORQUE (cont) 8–72

6. Check for short between:
(A326)J19–B7 and ground.
Does short exist?

YES — Repair shorted wire between (A326):
TB1–17–G and J19–B7,
TB1–17–E and J3–A19,
TB1–17–H and TB1–5–N,
TB1–5–P and J3–B14,
TB1–5–R and J3–B10,
TB1–5–S and J2–A4.
Go to step 8–10.

NO — Repair shorted wire between (A326):
TB1–17–L and J19–B8,
TB1–17–J and J3–A20,
TB1–17–M and TB1–5–T,
TB1–5–W and J3–B13,
TB1–5–Y and J3–B11,
TB1–5–Z and J2–A5.
Go to paragraph 8–10.

7. Check for short between:
P42–10 and P24–9,
P42–11 and P24–10.
Does short exist?

YES — **(ABY)** Go to paragraph 8–10.
(ABZ) Replace wire harness (TM 1-1520-238-23).

NO — Repair shorted wire between:
J24–9 and P470–B7,
J24–10 and P470–B8.
Go to paragraph 8–10.

8. Check for open between:
J24–9 and P470–B7,
J24–10 and P470–B8.
Does open exist?

YES — Repair open wire.
Go to paragraph 8–10.

NO — Go to step 9.

9. Check for open between:
P42–10 and P24–9,
P42–11 and P24–10.
Does open exist?

YES — **(ABY)** Repair open wire.
Go to paragraph 8–10.
(ABZ) Replace wire harness (TM 1-1520-238-23).

NO — Go to step 10.

10. Check for open between (A326):
J19–B7 and TB1–5–N.
Does open exist?

YES — Repair open wire between (A326):
TB1–17–G and J19–B7,
TB1–17–H and TB1–5–N.
Go to paragraph 8–10.

NO — Repair open wire between (A326):
TB1–17–L and J19–B8,
TB1–17–M and TB1–5–T.
Go to paragraph 8–10.

END OF TASK

8–73. PILOT TORQUE INDICATOR – DOES NOT INDICATE ENGINE 2 TORQUE 8–73

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer

References:

TM 1-1520-238-23

Equipment Conditions:

Ref	Condition
TM 1-1520-238-23	Access provisions – RN1 door open

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. Check for open between:
   P42–10 and P66–19,
   P42–11 and P66–20.
   Does open exist?

   YES — Go to step 2.

   NO — Replace pilot **TORQUE** indicator (TM 1-1520-238-23).

2. Check for open between:
   P405–B13 and P66–20,
   P405–B14 and P66–19.
   Does open exist?

   YES — Repair open wire.
   Go to paragraph 8–10.

   NO — Repair open wire between (A326):
   J3–B13 and TB1–5–W,
   J3–B14 and TB1–5–P.
   Go to paragraph 8–10.

END OF TASK

8–74. CPG TORQUE INDICATOR – DOES NOT INDICATE ENGINE 2 TORQUE 8–74

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer

References:

TM 1-1520-238-23

Equipment Conditions:

Ref	Condition
TM 1-1520-238-23	Access provisions – RN1 door open

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. Check for open between:
   P42–10 and P74–19,
   P42–11 and P74–20.
   Does open exist?

   YES — Go to step 2.

   NO — Replace CPG **TORQUE indicator** (TM 1-1520-238-23).

2. Check for open between:
   P405–B10 and P74–19,
   P405–B11 and P74–20.
   Does open exist?

   YES — Repair open wire.
   Go to paragraph 8–10.

   NO — Repair open wire between (A326):
   J3–B10 and TB1–5–R,
   J3–B11 and TB1–5–Y.
   Go to paragraph 8–10.

END OF TASK

8–75. ENGINE TORQUE DISPLAY ON PILOT VDU – FLASHES OR IS NOT PRESENT 8–75

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer

References:

TM 1-1520-238-23

Equipment Conditions:

Ref	Condition
TM 1-1520-238-23	Access provisions – LN1 and R95 doors opened

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. Check for open between:
   P41–10 and P682–120,
   P41–11 and P682–119.
   Does open exist?

   YES — Go to step 4.

   NO — Go to step 2.

2. Check for open between:
   P42–10 and P682–118,
   P42–11 and P682–117.
   Does open exist?

   YES — Go to step 3.

   NO — Replace digital automatic stabilization equipment computer (DASEC) (TM 1-1520-238-23).

3. Check for open between:
   P469–A4 and P682–118,
   P469–A5 and P682–117.
   Does open exist?

   YES — Repair open wire. Go to paragraph 8–10.

   NO — Repair open wire between (A326):
   J2–A4 and TB1–5–S,
   J2–A5 and TB1–5–Z.
   Go to paragraph 8–10.

4. Check for open between:
   P469–A1 and P682–120,
   P469–A2 and P682–119.
   Does open exist?

   YES — Repair open wire. Go to paragraph 8–10.

   NO — Repair open wire between (A326):
   J2–A1 and TB1–4–G,
   J2–A2 and TB1–4–M.
   Go to paragraph 8–10.

END OF TASK

8–76. PILOT AND CPG ENG–RTR RPM% INDICATORS – DO NOT INDICATE ENGINE 1 N_P 8–76

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer

References:

TM 1-1520-238-23
TM 55-2840-248-23

Equipment Conditions:

Ref	Condition
TM 1-1520-238-23	Access provisions – LN1 door opened

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. Check for 490 to 510 ohms resistance between P23–12 and P23–13.
   Is resistance present?

   YES — Go to step 2.

   NO — Go to step 3.

2. Detach wire ends at (A326):
   TB1–3–B and TB1–3–C.
   Check for short between:
   J23–12 and J23–13,
   J23–14 and J23–12,
   J23–14 and J23–13.
   Does short exist?

   YES — Repair shorted wire between:
   J23–12 and P405–A8,
   J23–13 and P405–A7.
   (A326):
   J3–A8 and TB1–3–B,
   J3–A7 and TB1–3–C.
   Go to paragraph 8–10.

   NO — Repair open wire between;
   J23–12 and (A326)TB1–3–B,
   J23–13 and (A326)TB1–3–C.
   Go to paragraph 8–10.

3. Check for open between:
   P23–12 and P41–9,
   P23–13 and P41 –8.
   Does open exist?

   YES — **(ABY)** Repair open wire.
   Go to paragraph 8–10.
   (ABZ) Replace wire harness (TM 1-1520-238-23).

   NO — Go to step 4.

4. Detach P41. Check for short between:
   P23–14 and P23–12,
   P23–14 and P23–13,
   P23–12 and P23–13.
   Does short exist?

   YES — **(ABY)** Repair shorted wire.
   Go to paragraph 8–10.
   (ABZ) Replace wire harness (TM 1-1520-238-23).

   NO — Refer to TM 55-2840-248-23 to troubleshoot engine 1.

END OF TASK

8–77. PILOT AND CPG ENG–RTR RPM% INDICATORS – DO NOT INDICATE ENGINE 2 N_P 8–77

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer

References:

TM 1-1520-238-23
TM 55-2840-248-23

Equipment Conditions:

Ref	Condition
TM 1-1520-238-23	Access provisions–RN1 door opened

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. Check for 490 to 510 ohms resistance between P24–12 and P24–13.
   Is resistance present?
   - YES — Go to step 2.
   - NO — Go to step 3.

2. Detach wire ends at (A326): TB1–9–N and TB1–9–T.
   Check for short between: J24–12 and J24–13, J24–14 and J24–12, J24–14 and J24–13.
   Does short exist?
   - YES — Repair shorted wire between: J24–13 and P470–B1. (A326): J19–B1 and TB1–9–T, J19–B2 and TB1–9–N. Go to paragraph 8–10.
   - NO — Repair open wire between: J24–13 and (A326)TB1–9–T, J24–12 and (A326)TB1–9–N. Go to paragraph 8–10.

3. Check for open between: P24–12 and P42–9, P24–13 and P42–8.
   Does open exist?
   - YES — **(ABY)** Repair open wire. Go to paragraph 8–10. **(ABZ)** Replace wire harness (TM 1-1520-238-23).
   - NO — Go to step 4.

4. Detach P42. Check for short between: P24–14 and P24–12, P24–14 and P24–13, P24–12 and P24–13.
   Does short exist?
   - YES — **(ABY)** Repair shorted wire. Go to paragraph 8–10. **(ABZ)** Replace wire harness (TM 1-1520-238-23).
   - NO — Refer to TM 55-2840-248-23 to troubleshoot engine 2.

END OF TASK

8–78. PILOT ENG–RTR RPM% INDICATOR – DOES NOT INDICATE ENGINE 1 N_P 8–78

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer

References:

TM 1-1520-238-23

Equipment Conditions:

Ref	Condition
TM 1-1520-238-23	Nontransparent barrier removed

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. Detach wire ends at (A326):
   TB1–3–E and TB1–3–F.
   Check for short between:
   P65–22 and P65–23,
   P65–21 and P65–22,
   P65–21 and P65–23.
   Does short exist?

   YES — Repair shorted wire between:
   P65–22 and P405–A5,
   P65–23 and P405–A4,
   (A326):
   J3–A5 and TB1–3–E,
   J3–A4 and TB1–3–F.
   Go to paragraph 8–10.

   NO — Go to step 2.

2. Check for open between:
   P65–22 and (A326)TB1–3–E,
   P65–23 and (A326)TB1–3–F.
   Does open exist?

   YES — Repair open wire.
   Go to paragraph 8–10.

   NO — Replace pilot **ENG–RTR RPM%** indicator (TM 1-1520-238-23).

END OF TASK

8–79. CPG ENG–RTR RPM% INDICATOR – DOES NOT INDICATE ENGINE 1 N_P 8–79

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer

References:

TM 1-1520-238-23

Equipment Conditions:

Ref	Condition
TM 1-1520-238-23	Non–transparent barrier removed

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. Detach wire ends at (A326):
   TB1–3–H and TB1–3–J.
   Check for short between:
   P73–22 and P73–23,
   P73–21 and P73–22,
   P73–21 and P73–23.
   Does short exist?

   YES — Repair shorted wire between:
   P73–22 and P405–A2,
   P73–23 and P405–A1,
   (A326):
   J3–A2 and TB1–3–H,
   J3–A1 and TB1–3–J.
   Go to paragraph 8–10.

   NO — Go to step 2.

2. Check for open between:
   P73–22 and (A326)TB1–3–H,
   P73–23 and (A326)TB1–3–J.
   Does open exist?

   YES — Repair open wire.
   Go to paragraph 8–10.

   NO — Replace CPG **ENG–RTR RPM%** indicator (TM 1-1520-238-23).

END OF TASK

8–80. PILOT ENG–RTR RPM% INDICATOR – DOES NOT INDICATE ENGINE 2 N_P 8–80

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer

References:

TM 1-1520-238-23

Equipment Conditions:

Ref	Condition
TM 1-1520-238-23	Non–transparent barrier removed

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. Detach wire ends at (A326):
   TB1–9–P and TB1–9–W.
   Check for short between:
   P65–19 and P65–20,
   P65–18 and P65–19,
   P65–18 and P65–20.
   Does short exist?

   YES — Repair shorted wire between:
   P65–19 and P467–B1,
   P65–20 and P467–B2.
   (A326):
   J5–B1 and TB1–9–P,
   J5–B2 and TB1–9–W.
   Go to paragraph 8–10.

   NO — Go to step 2.

2. Check for open between:
   P65–19 and (A326)TB1–9–P,
   P65–20 and A326)TB1–9–W.
   Does open exist?

   YES — Repair open wire.
   Go to paragraph 8–10.

   NO — Replace pilot **ENG–RTR RPM%** indicator (TM 1-1520-238-23).

END OF TASK

8–81. CPG ENG–RTR RPM% INDICATOR – DOES NOT INDICATE ENGINE 2 N_P 8–81

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer

References:

TM 1-1520-238-23

Equipment Conditions:

Ref	Condition
TM 1-1520-238-23	Non–transparent barrier removed

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. Detach wire ends at (A326):
   TB1–9–R and TB1–9–Y.
   Check for short between:
   P73–19 and P73–20,
   P73–18 and P73–19,
   P73–18 and P73–20.
   Does short exist?

   YES — Repair shorted wire between:
   P73–19 and P467–B4,
   P73–20 and P467–B5.
   (A326):
   J5–B4 and TB1–9–R,
   J5–B5 and TB1–9–Y.
   Go to paragraph 8–10.

   NO — Go to step 2.

2. Check for open between:
   P73–19 and (A326)TB1–9–R,
   P73–20 and (A326)TB1–9–Y.
   Does open exist?

   YES — Repair open wire.
   Go to paragraph 8–10.

   NO — Replace CPG **ENG–RTR RPM%** indicator (TM 1-1520-238-23).

END OF TASK

8–82. PILOT AND CPG ENG–RTR RPM% INDICATORS – DO NOT INDICATE N_R 8–82

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer

References:

TM 1-1520-238-23

Equipment Conditions:

Ref	Condition
TM 1-1520-238-23	Non–transparent barrier removed Access provisions – L200 panel removed

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. Detach wire ends at XT1–B and XT1–D, (A326)TB1–9–F and (A326) TB1–9–L. Check for open between (wire ends): TB1–9–L and XT1–B, TB1–9–F and XT1–D.
   Does open exist?

   YES — Repair open wire. Go to paragraph 8–10.

   NO — Go to step 2.

2. Detach wire ends at XT1–A and XT1–E. Check for 230 ±5 ohms resistance between (wire ends): XT1–A and XT1–E.
   Is resistance present?

   YES — Go to step 3.

   NO — Replace main transmission magnetic pick–up (rotor speed sensor) (TM 1-1520-238-23).

3. Check for short between (A326): TB1–9–F and TB1–9–L, TB1–9–F and ground.
   Does short exist?

   YES — Repair shorted wire between: XT1–D and J755–22, P755–22 and J456–A4, P456–A4 and P482–A8, XT1–B and J755–23, P755–23 and J456–A5, P456–A5 and P482–A–9. (A326): J18–A8 and TB1–9–F, J18–A9 and TB1–9–L. Go to paragraph 8–10.

   NO — Replace isolation transformer module 1 (TM 1-1520-238-23).

END OF TASK

8–83. PILOT ENG–RTR RPM% INDICATOR – DOES NOT INDICATE N_R 8–83

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer

References:

TM 1-1520-238-23

Equipment Conditions:

Ref	Condition
TM 1-1520-238-23	Non–transparent barrier removed

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. Detach wire ends at (A326):
   TB1–9–E and TB1–9–K.
   Check for short between:
   P65–4 and P65–5,
   P65–6 and P65–4,
   P65–6 and P65–5.
   Does short exist?

   YES — Repair shorted wire between:
   P65–4 and P467–B7,
   P65–5 and P467–B8.
   (A326):
   J5–B7 and TB1–9–E,
   J5–B8 and TB1–9–K.
   Go to paragraph 8–10.

   NO — Go to step 2.

2. Check for open between:
   P65–4 and (A326)TB1–9–E,
   P65–5 and (A326)TB1–9–K.
   Does open exist?

   YES — Repair open wire.
   Go to paragraph 8–10.

   NO — Replace pilot **ENG–RTR RPM%** indicator (TM 1-1520-238-23).

END OF TASK

8–84. CPG ENG–RTR RPM% INDICATOR – DOES NOT INDICATE N_R 8–84

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer

References:

TM 1-1520-238-23

Equipment Conditions:

Ref	Condition
TM 1-1520-238-23	Non–transparent barrier removed

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. Detach wire ends at (A326):
   TB1–9–H and TB1–9–J.
   Check for short between:
   P73–4 and P73–5,
   P73–6 and P73–4,
   P73–6 and P73–5.
   Does short exist?

   YES — Repair shorted wire between:
   P73–4 and P467–B10,
   P73–5 and P467–B11.
   (A326):
   J5–B10 and TB1–9–H,
   J5–B11 and TB1–9–J.
   Go to paragraph 8–10.

   NO — Go to step 2.

2. Check for open between:
   P73–4 and (A326)TB1–9–H,
   P73–5 and (A326)TB1–9–J.
   Does open exist?

   YES — Repair open wire.
   Go to paragraph 8–10.

   NO — Replace CPG **ENG–RTR RPM%** indicator (TM 1-1520-238-23).

END OF TASK

8–85. PILOT N_G RPM% INDICATOR – DOES NOT INDICATE ENGINE 1 N_G 8–85

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM–45

Personnel Required:

68X Armament/Electrical Systems Repairer

References:

TM 1-1520-238-23
TM 55-2840-248-23

Equipment Conditions:

Ref	Condition
TM 1-1520-238-23	Access provisions – LN1 door opened

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. Check for 3 ±0.5 ohms resistance between P23–22 and P23–23.
   Is resistance present?
   - YES — Go to step 2.
   - NO — Go to step 4.
2. Check for open between:
   J23–22 and P67–22,
   J23–23 and P67–23.
   Does open exist?
   - YES — Repair open wire. Go to paragraph 8–10.
   - NO — Go to step 3.
3. Detach P49 and P67. Check for short between:
   J23–22 and J23–23,
   J23–24 and J23–22,
   J23–24 and J23–23.
   Does short exist?
   - YES — Repair shorted wire between:
     J23–22 and P405–A11,
     P67–22 and P405–A14,
     P49–3 and P435–A12,
     J23–23 and P405–A10,
     P67–23 and P405–A13,
     P49–4 and P435–A11.
     (A326):
     J3–A11 and TB1–4–N,
     J3–A13 and TB1–4–W,
     J3–A14 and TB1–4–P,
     J7–A11 and TB1–4–Y.
     J7–A12 and TB1–4–R.
     Go to paragraph 8–10.
   - NO — Replace pilot **N_G RPM%** indicator (TM 1-1520-238-23).
4. Check for open between:
   P23–22 and P45–20,
   P23–23 and P45–21.
   Does open exist?
   - YES — **(ABY)** Repair open wire. Go to paragraph 8–10. **(ABZ)** Replace wire harness (TM 1-1520-238-23).
   - NO — Go to step 5.
5. Detach P45. Check for short between:
   P23–22 and P23–23,
   P23–24 and P23–22,
   P23–24 and P23–23.
   Does short exist?
   - YES — **(ABY)** Repair shorted wire. Go to paragraph 8–10. **(ABZ)** Replace wire harness (TM 1-1520-238-23).
   - NO — Refer to TM 55-2840-248-23 to troubleshoot engine 1.

END OF TASK

8–86. PILOT N_G RPM% INDICATOR – DOES NOT INDICATE ENGINE 2 N_G 8–86

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer

References:

TM 1-1520-238-23
TM 55-2840-248-23

Equipment Conditions:

Ref	Condition
TM 1-1520-238-23	Access provisions – RN1 door opened

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. Check for 3 ±0.5 ohms resistance between P24–22 and P24–23.
   Is resistance present?

   YES — Go to step 2.

   NO — Go to step 4.

2. Check for open between:
   J24–22 and P67–19,
   J24–23 and P67–20.
   Does open exist?

   YES — Repair open wire.
   Go to paragraph 8–10.

   NO — Go to step 3.

3. Detach P49 and P67. Check for short between:
   J24–22 and J24–23,
   J24–24 and J24–22,
   J24–24 and J24–23.
   Does short exist?

   YES — Repair shorted wire between:
   J24–22 and P470–B5,
   P49–8 and P435–A14,
   P67–19 and P405–B16,
   P49–7 and P435–A13,
   P67–20 and P405–B17,
   J24–23 and P470–B6.
   (A326):
   J3–B16 and TB1–5–E,
   J3–B17 and TB1–5–K,
   J7–A13 and TB1–5–H,
   J7–A14 and TB1–5–J,
   J19–B5 and TB1–5–F,
   J19–B6 and TB1–5–L.
   Go to paragraph 8–10.

   NO — Replace pilot **N_G RPM%** indicator. (TM 1-1520-238-23).

4. Check for open between:
   P24–22 and P46–20,
   P24–23 and P46–21.
   Does open exist?

   YES — **(ABY)** Repair open wire.
   Go to paragraph 8–10.
   (ABZ) Replace wire harness (TM 1-1520-238-23).

   NO — Go to step 5.

5. Detach P46. Check for short between:
   P24–22 and P24–23,
   P24–24 and P24–22,
   P24–24 and P24–23.
   Does short exist?

   YES — **(ABY)** Repair open wire.
   Go to paragraph 8–10.
   (ABZ) Replace wire harness (TM 1-1520-238-23).

   NO — Refer to TM 55-2840-248-23 to troubleshoot engine 2.

END OF TASK

8–87. CPG SDD PANEL – DOES NOT INDICATE ENGINE 1 AND/OR ENGINE 2 N_G % RPM 8–87

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer

References:

TM 1-1520-238-23

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. Detach P75. Check for short between:
   P67–1 and P67–2,
   P67–1 and ground,
   P67–2 and ground.
   Does open exist?

   YES — Repair shorted wire between:
   P75–26 and P67–1,
   P75–27 and P67–2.
   Go to paragraph 8–10.

   NO — Go to step 2.

2. Check for open between:
   P75–26 and P67–1,
   P75–27 and P67–2.
   Does open exist?

   YES — Repair open wire.
   Go to paragraph 8–10.

   NO — Replace CPG SDD panel.
   (TM 1-1520-238-23).

END OF TASK

8–88. PILOT TGT INDICATOR – DOES NOT INDICATE ENGINE 1 TGT 8–88

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer

References:

TM 1-1520-238-23
TM 55-2840-248-23

Equipment Conditions:

Ref	Condition
TM 1-1520-238-23	Access provisions – LN1 door opened

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. Check for 590 to 720 ohms resistance between P23–1 and P23–2.
   Is resistance present?

   YES — Go to step 2.

   NO — Go to step 4.

2. Check for open between:
   J23–2 and P400–44,
   J23–1 and P400–45,
   P68–22 and P400–37,
   P68–23 and P400–38.
   Does open exist?

   YES — Repair open wire.
   Go to paragraph 8–10.

   NO — Go to step 3.

3. Detach P68 and P400. Check for short between:
   J23–1 and J23–2,
   J23–3 and J23–1,
   J23–3 and J23–2,
   P68–22 and P68–23,
   P68–21 and P68–22,
   P68–21 and P68–23.
   Does short exist?

   YES — Repair shorted wire between:
   J23–2 and P400–44,
   J23–1 and P400–45,
   P68–22 and P400–37,
   P68–23 and P400–38.
   Go to paragraph 8–10.

   NO — Replace pilot **TGT** indicator (TM 1-1520-238-23).

4. Check for open between:
   P23–1 and P41–16,
   P23–2 and P41–17.
   Does open exist?

   YES — **(ABY)** Repair open wire.
   Go to paragraph 8–10.
   (**ABZ**) Replace wire harness (TM 1-1520-238-23).

   NO — Go to step 5.

5. Detach P41. Check for short between:
   P23–1 and P23–2,
   P23–3 and P23–1,
   P23–3 and P23–2.
   Does short exist?

   YES — **(ABY)** Repair shorted wire.
   Go to paragraph 8–10.
   (ABZ) Replace wire harness (TM 1-1520-238-23).

   NO — Refer to TM 55-2840-248-23 to troubleshoot engine 1.

END OF TASK

8–89. PILOT TGT INDICATOR – DOES NOT INDICATE ENGINE 2 TGT 8–89

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer

References:

TM 1-1520-238-23
TM 55-2840-248-23

Equipment Conditions:

Ref	Condition
TM 1-1520-238-23	Access provisions – LN1 door opened

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. Check for 590 to 720 ohms resistance between P24–1 and P24–2.
   Is resistance present?

   YES — Go to step 2.

   NO — Go to step 4.

2. Check for open between:
   J24–1 and P400–42,
   J24–2 and P400–41,
   P68–19 and P400–39,
   P68–20 and P400–40.
   Does open exist?

   YES — Repair open wire.
   Go to paragraph 8–10.

   NO — Go to step 3.

3. Detach P68 and P400. Check for short between:
   J24–1 and J24–2,
   J24–1 and J24–3,
   J24–2 and J24–3,
   P68–19 and P68–20,
   P68–18 and P68–19,
   P68–18 and P68–20.
   Does short exist?

   YES — Repair shorted wire between:
   J24–2 and P452–G,
   J452–G and P400–41,
   J24–1 and P452–F,
   J452–F and P400–39,
   P68–20 and P400–40.
   Go to paragraph 8–10.

   NO — Replace pilot **TGT** indicator (TM 1-1520-238-23).

4. Check for open between:
   P24–1 and P42–16,
   P24–2 and P42–17.
   Does open exist?

   YES — **(ABY)** Repair open wire.
   Go to paragraph 8–10.
   (ABZ) Replace wire harness (TM 1-1520-238-23).

   NO — Go to step 5.

5. Detach P42. Check for short between:
   P42–1 and P24–2,
   P24–3 and P24–1,
   P24–3 and P24–2.
   Does short exist?

   YES — **(ABY)** Repair shorted wire.
   Go to paragraph 8–10.
   (ABZ) Replace wire harness (TM 1-1520-238-23).

   NO — Refer to TM 55-2840-248-23 to troubleshoot engine 2.

END OF TASK

8–90. CPG SDD PANEL – DOES NOT INDICATE ENGINE 1 AND/OR ENGINE 2 TGT 8–90

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer

References:

TM 1-1520-238-23

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. Detach P75. Check for short between:
   P68–1 and P68–2,
   P68–1 and ground,
   P68–2 and ground.
   Does short exist?

   YES — Repair shorted wire between:
   P68–1 and P75–28,
   P68–2 and P75–29.
   Go to paragraph 8–10.

   NO — Go to step 2.

2. Check for open between:
   P68–1 and P75–28,
   P68–2 and P75–29.
   Does open exist?

   YES — Repair open wire.
   Go to paragraph 8–10.

   NO — Replace CPG SDD panel
   (TM 1-1520-238-23).

END OF TASK

8–91. FLIGHT INSTRUMENTS – MAINTENANCE OPERATIONAL CHECK 8–91

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Tester, Pitot and Static System	S6-21312

Personnel Required:

68X Armament/Electrical Systems Repairer (2)

References:

TM 1-1520-238-T-4
TM 1-1520-238-T-6
TM 11-1520-238-23-2
TM 1-1520-238-23
TM 1-1500-204-23

Equipment Conditions:

Ref	Condition
TM 1-1520-238-23	Helicopter safed
	External power application – Electrical
	Pitot and static system tester connected
TM 1-1520-238-T-4	Maintenance headset connected

NOTE

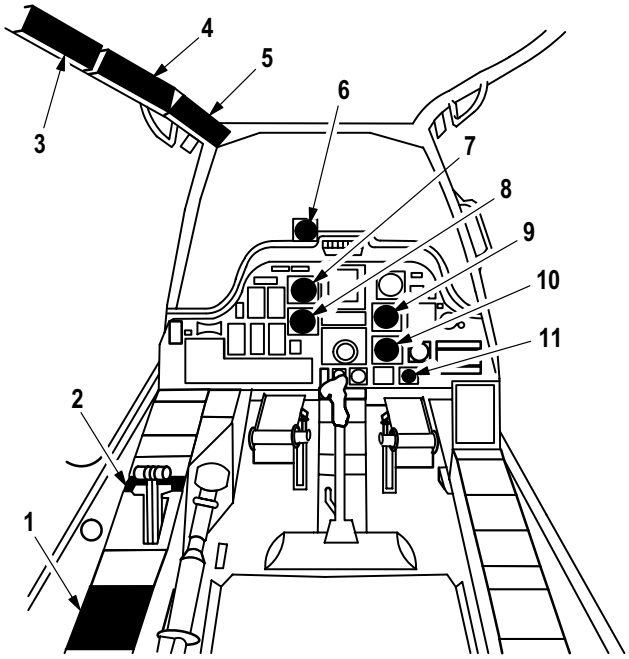
- **Refer to pilot station (fig. 8–39) and CPG station (fig. 8–40) for configuration and equipment.**
- **If referenced out of one paragraph or volume into another for additional troubleshooting, upon completion of the task, return to the maintenance operational check for the original paragraph or volume.**
- **When operating the helicopter in high humidity, rapid change of temperature or at any time that line blockage is suspected, purge Pitot and static system (TM 1-1500-204-23).**

WARNING

Do not apply Pitot heat during this operation. To do so could result in severe burns to anyone touching the Pitot tubes.

1. Perform visual check of pilot and CPG flight instruments (TM 1-1520-238-23).
2. Complete the maintenance operational check as follows:

Task	Result
a. Check left and right static ports (fig. 8–41) for dirt or obstruction.	If static port(s) are obstructed or dirty, clean static port(s) (TM 1-1500-204-23).
b. Remove covers from Pitot tubes (fig. 8–41) and check tubes for dirt or obstruction.	If Pitot tubes are obstructed or dirty clean tubes (TM 1-1500-204-23).
c. Drain Pitot static system (TM 1-1520-238-23).	If excessive water is found at drain cock, purge system (TM 1-1500-204-23).



1. PILOT EXT LT / INTR LT PANEL
2. PILOT ELEC PWR PANEL
3. PILOT AFT CIRCUIT BREAKER PANEL
4. PILOT CENTER CIRCUIT BREAKER PANEL
5. PILOT FORWARD CIRCUIT BREAKER PANEL
6. PILOT MAGNETIC COMPASS
7. PILOT AIRSPEED INDICATOR
8. PILOT SAI
9. PILOT BAROMETRIC ALTIMETER
10. PILOT VSI
11. PILOT ACCELEROMETER INDICATOR

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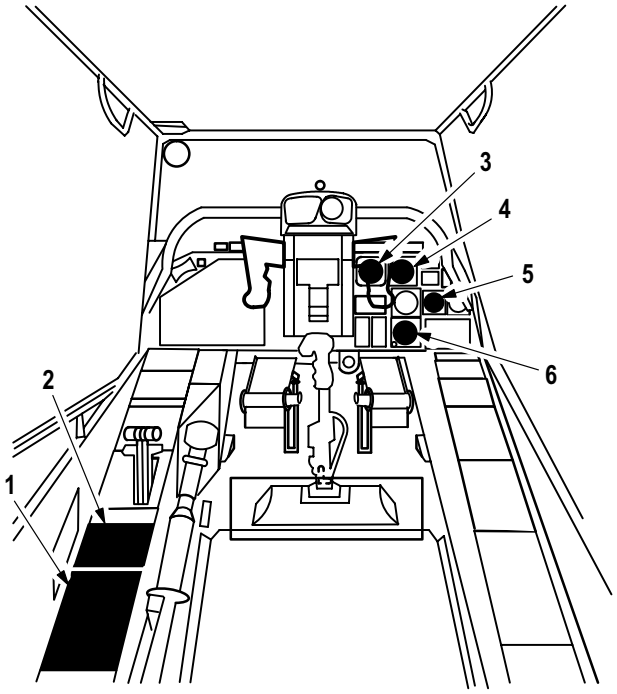
Figure 8–39. Pilot Station



1. CPG CIRCUIT BREAKER PANEL 1
2. CPG INTR LT PANEL
3. CPG AIRSPEED INDICATOR
4. CPG RAI
5. CPG VSI
6. CPG BAROMETRIC ALTIMETER

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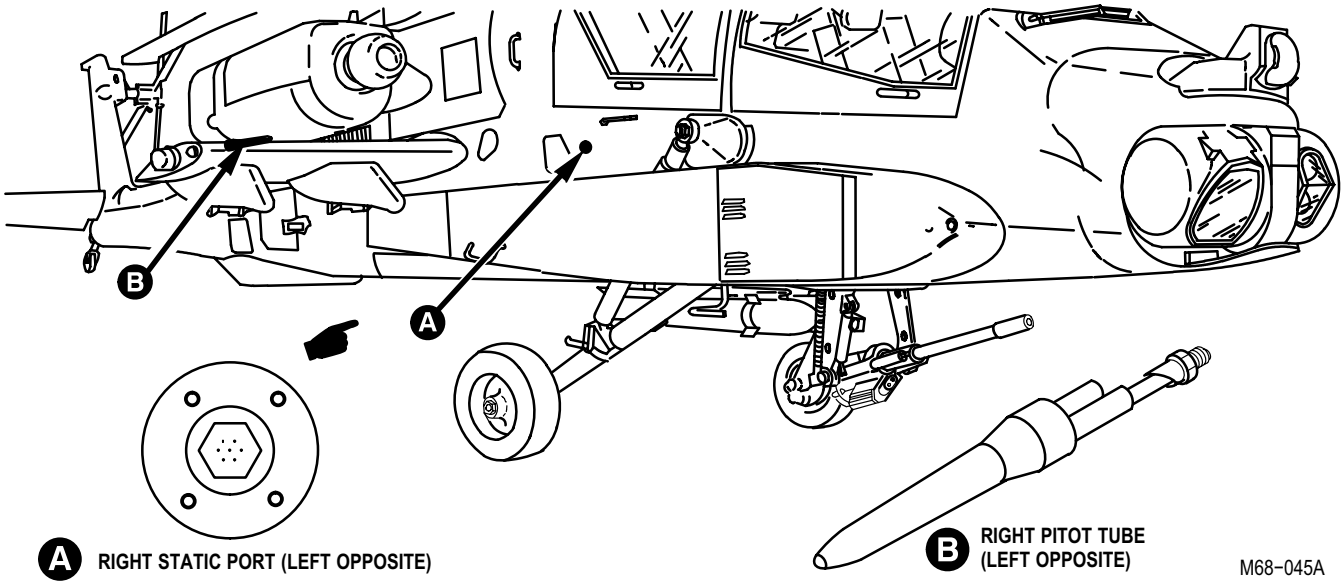
Figure 8–40. CPG Station



M68−045A

Figure 8–41. Static Ports and Pitot Tubes

Task	Result

d. On pilot **ELEC PWR** panel (fig. 8–42), set **BATT/EXT PWR** switch to **EXT PWR**.

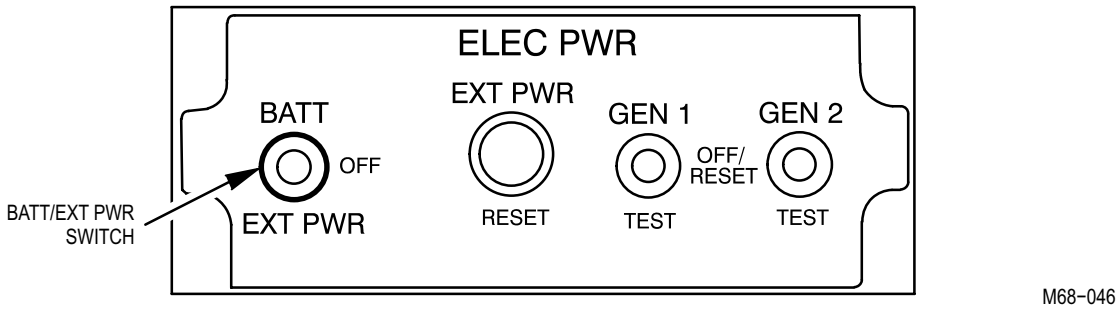


Figure 8–42. Pilot ELEC PWR Panel

e. On CPG circuit breaker panel 1 (fig. 8–43), check that **PRI LT** circuit breaker located is closed.

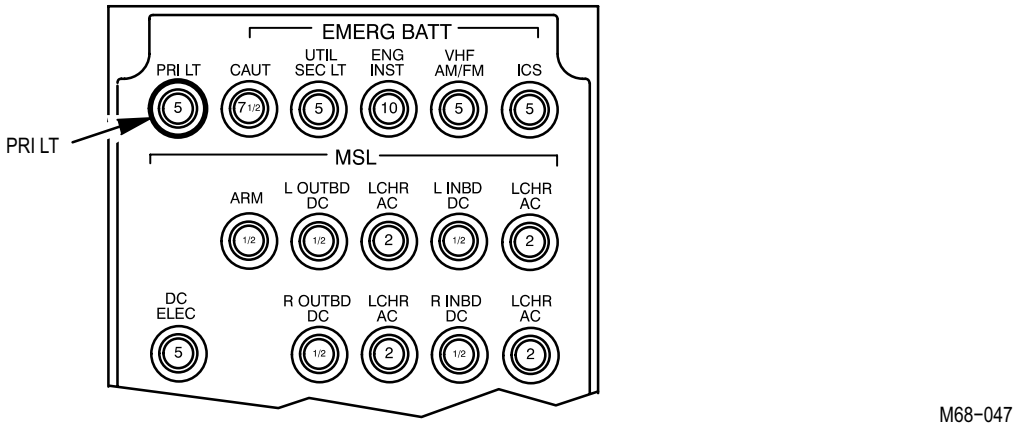


Figure 8–43. CPG Circuit Breaker Panel 1

f. On CPG **INTR LT** panel (fig. 8–44), turn **INST** control to **BRT**.

If CPG airspeed indicator, VSI, and barometric altimeter (fig. 8–45) edge–lights do not light, refer to TM 1-1520-238-T-6 to troubleshoot CPG edge–lights.

If CPG airspeed indicator edge–lighting does not light, go to paragraph 8–93.

If CPG VSI edge–lighting does not light, go to paragraph 8–94.

If CPG barometric altimeter edge–lighting does not light, go to paragraph 8–95.

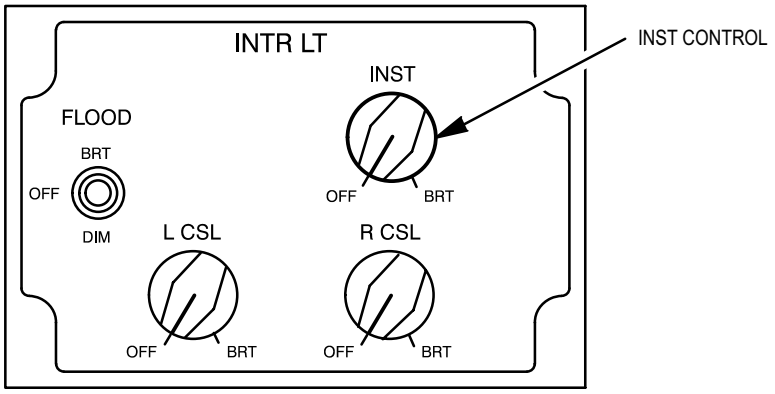
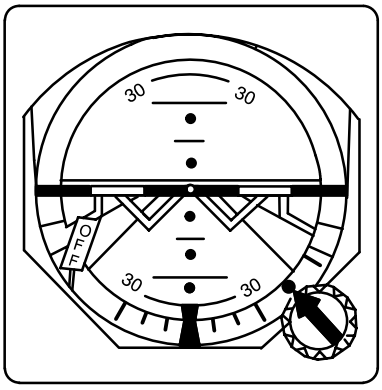
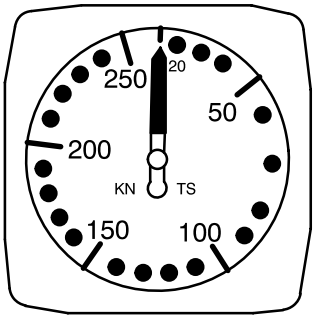


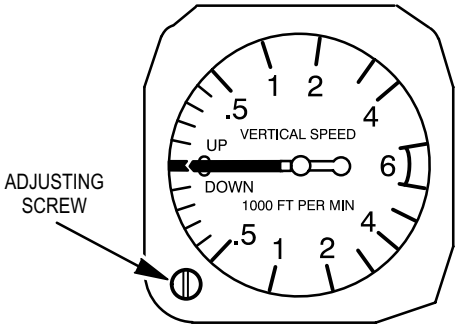
Figure 8–44. CPG INTR LT Panel



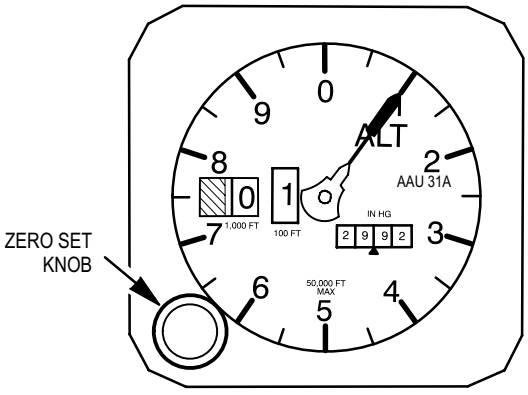
CPG RAI



AIRSPEED INDICATOR



VSI



BAROMETRIC ALTIMETER

M68-195

Figure 8–45. CPG Flight Instrument Indicators

Task	Result
g. Open **NAV AIR DATA DC, NAV AIR DATA AC,** and **STAB AUTO DC** circuit breakers on pilot forward and aft circuit breaker panels (fig 8–46). Check that **LT PRI** circuit breaker on pilot center circuit breaker panel is closed.	

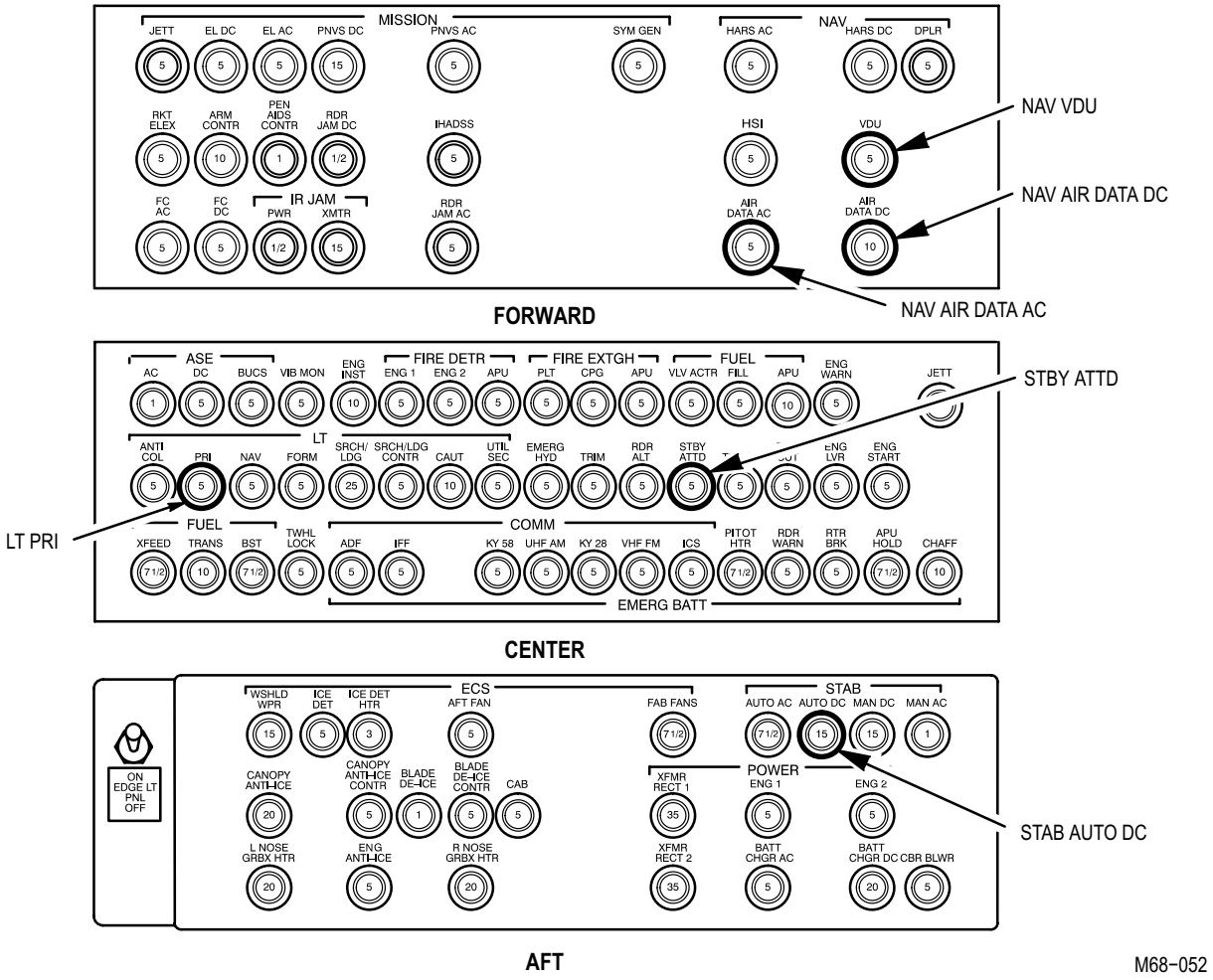


Figure 8–46. Pilot Circuit Breaker Panels

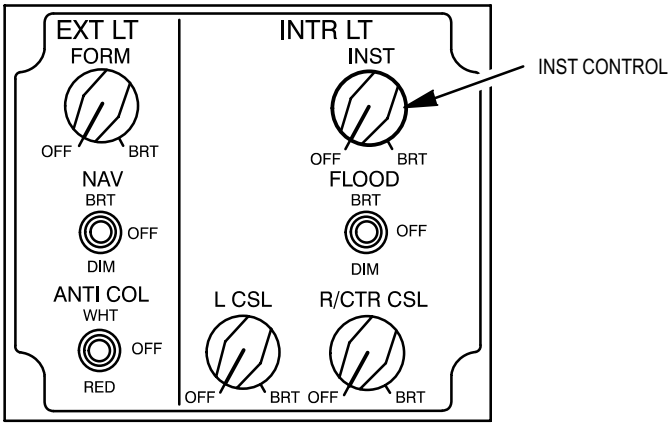
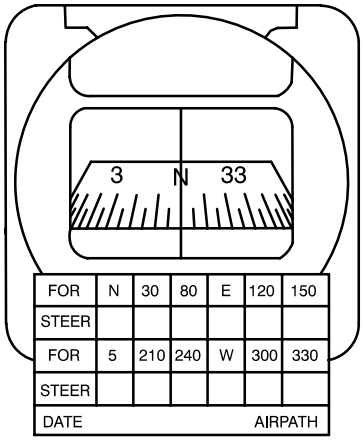


Figure 8–47. Pilot EXT LT/INTR LT Panel

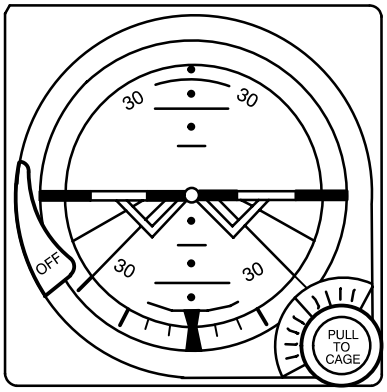
8–91. FLIGHT INSTRUMENTS – MAINTENANCE OPERATIONAL CHECK (cont) 8–91

Task	Result
h. On pilot **EXT LT/INTR LT** panel (fig. 8–47), turn **INST** control to **BRT**.	If accelerometer indicator, VSI, barometric altimeter, magnetic compass, airspeed indicator and SAI (fig. 8–48) edge–lights do not light, refer to TM 1-1520-238-T-6 to troubleshoot pilot edge–lights. If pilot airspeed indicator edge–lighting does not light, go to paragraph 8–96. If pilot accelerometer indicator edge–lighting does not light, go to paragraph 8–97. If pilot barometric altimeter edge–lighting does not light, go to paragraph 8–98. If pilot VSI edge–lighting does not light, go to paragraph 8–99. If pilot SAI edge–lighting does not light, go to paragraph 8–100. If pilot magnetic compass lamp does not light, replace lamp (TM 1-1520-238-23). If lamp still does not light, go to paragraph 8–101.
i. Turn and release **PULL TO CAGE** knob to pilot SAI (fig. 8–48) then turn knob clockwise and counterclockwise.	If fixed aircraft symbol does not move up and down on face of gyrosphere, replace SAI (TM 1-1520-238-23).
j. Check **STBY ATTD** circuit breaker on pilot center circuit breaker panel (fig. 8–46) is closed.	
k. Check **OFF** flag on SAI (fig. 8–48).	If **OFF** flag is visible, go to paragraph 8–102.
l. Pull and turn **PULL TO CAGE** knob on pilot SAI. Check **OFF** flag on SAI.	If **OFF** flag is not visible, replace pilot SAI (TM 1-1520-238-23).
m. On pilot VSI (fig. 8–48), set indicator to **0 FPM** using adjust screw on face of indicator.	If VSI does not adjust **0 FPM**, replace pilot VSI (TM 1-1520-238-23).
n. On CPG VSI (fig. 8–45), set indicator to **0 FPM** using adjust screw on face of indicator.	If VSI does not adjust to **0 FPM**, replace CPG VSI (TM 1-1520-238-23).

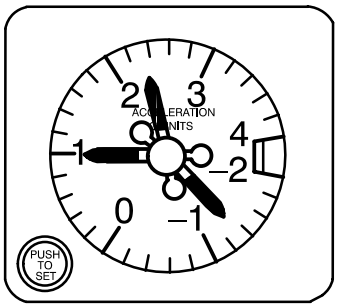
8–91. FLIGHT INSTRUMENTS – MAINTENANCE OPERATIONAL CHECK (cont) 8–91



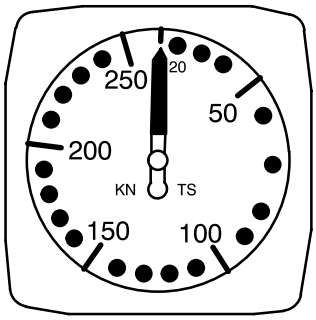
MAGNETIC COMPASS



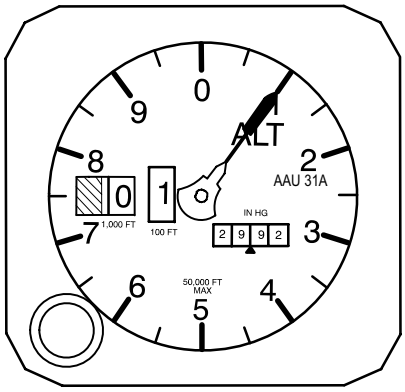
SAI



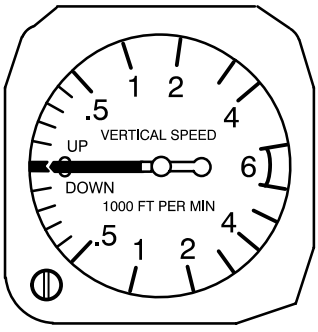
ACCELEROMETER INDICATOR



AIRSPEED INDICATOR



BAROMETRIC ALTIMETER



VSI

M68-196

Figure 8–48. Pilot Flight Instrument Indicators

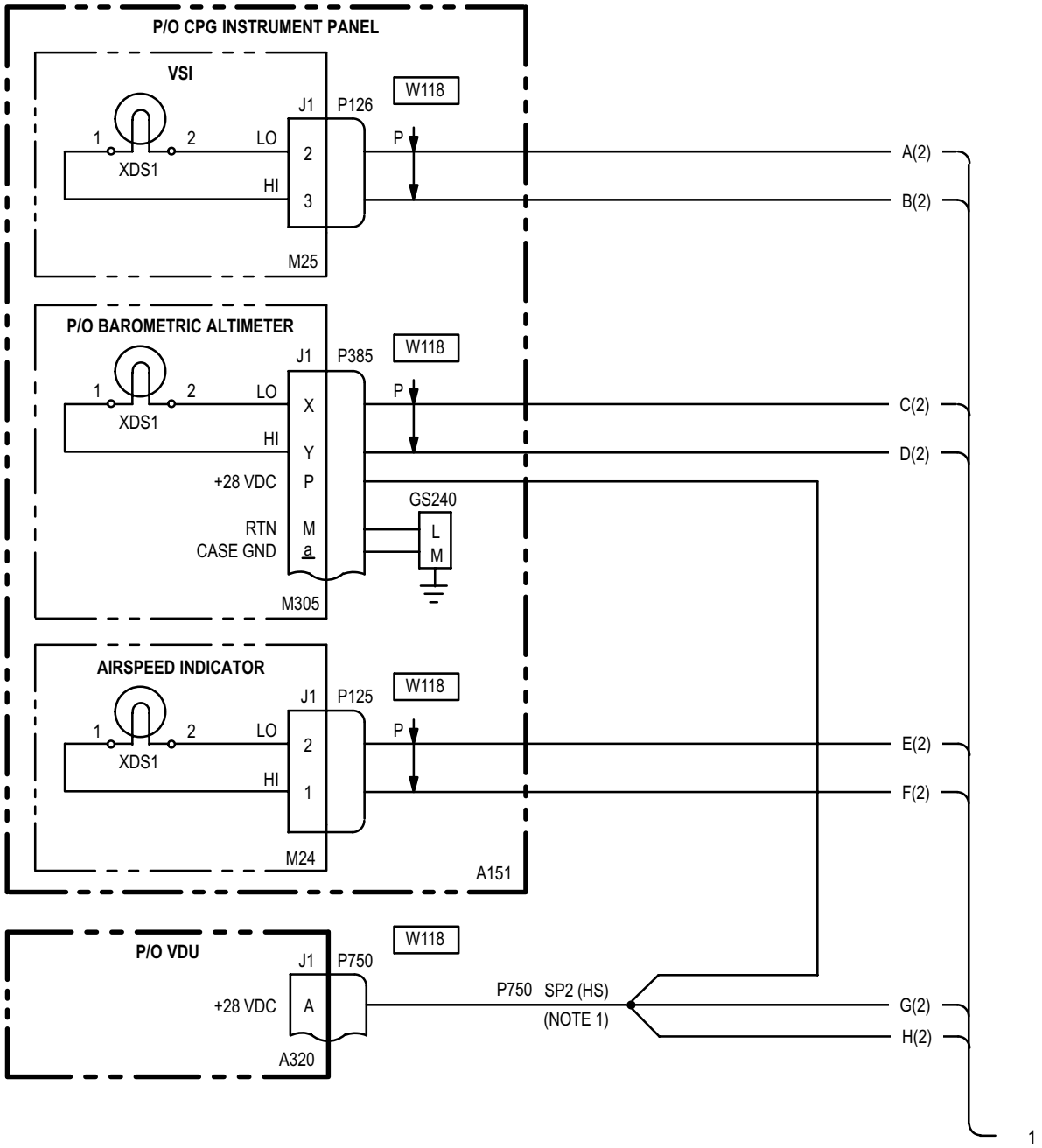
8–91. FLIGHT INSTRUMENTS – MAINTENANCE OPERATIONAL CHECK (cont) 8–91

Task	Result
o. On pilot forward circuit breaker panel (fig. 8–46), check that **VDU** circuit breaker is closed.	If circuit breaker does not stay closed, troubleshoot VDU electrical system (TM 11-1520-238-23-2). If the internal vibrator in the pilot barometric altimeter is not heard, go to paragraph 8–103. If the internal vibrator in the CPG barometric altimeter is not heard, go to paragraph 8–104.
p. Compare pilot barometric altimeter (fig. 8–48) reading to test site ambient barometric pressure (reading obtained from control tower).	If barometric altimeter pressure reading is not within ±70 feet of ambient pressure, check the barometric altimeter (TM 1-1500-204-23) and replace pilot barometric altimeter (TM 1-1520-238-23) if tolerances are exceeded.
q. Compare CPG barometric altimeter (fig. 8–45) reading to test site ambient barometric pressure reading.	If barometric altimeter pressure reading is not within ±70 feet of ambient pressure, check the barometric altimeter (TM 1-1500-204-23) and replace CPG barometric altimeter (TM 1-1520-238-23) if tolerances are exceeded.
r. Perform Pitot and static port system, line, leak check (TM 1-1500-204-23).	Replace any component(s) that failed leak check (TM 1-1520-238-23).

3. Turn **INST** control on CPG **INTR LT** panel (fig. 8–44) to **OFF**.
4. Turn **INST** control on pilot **EXT LT/INTR LT** panel (fig. 8–47) to **OFF**.
5. On pilot **ELEC PWR** panel (fig. 8–42), set **BATT/EXT PWR** switch to **OFF**.
6. Remove external power – electrical (TM 1-1520-238-23).
7. Remove Pitot and static system tester (TM 1-1520-238-23).
8. Disconnect maintenance headset (TM 1-1520-238-T-4).

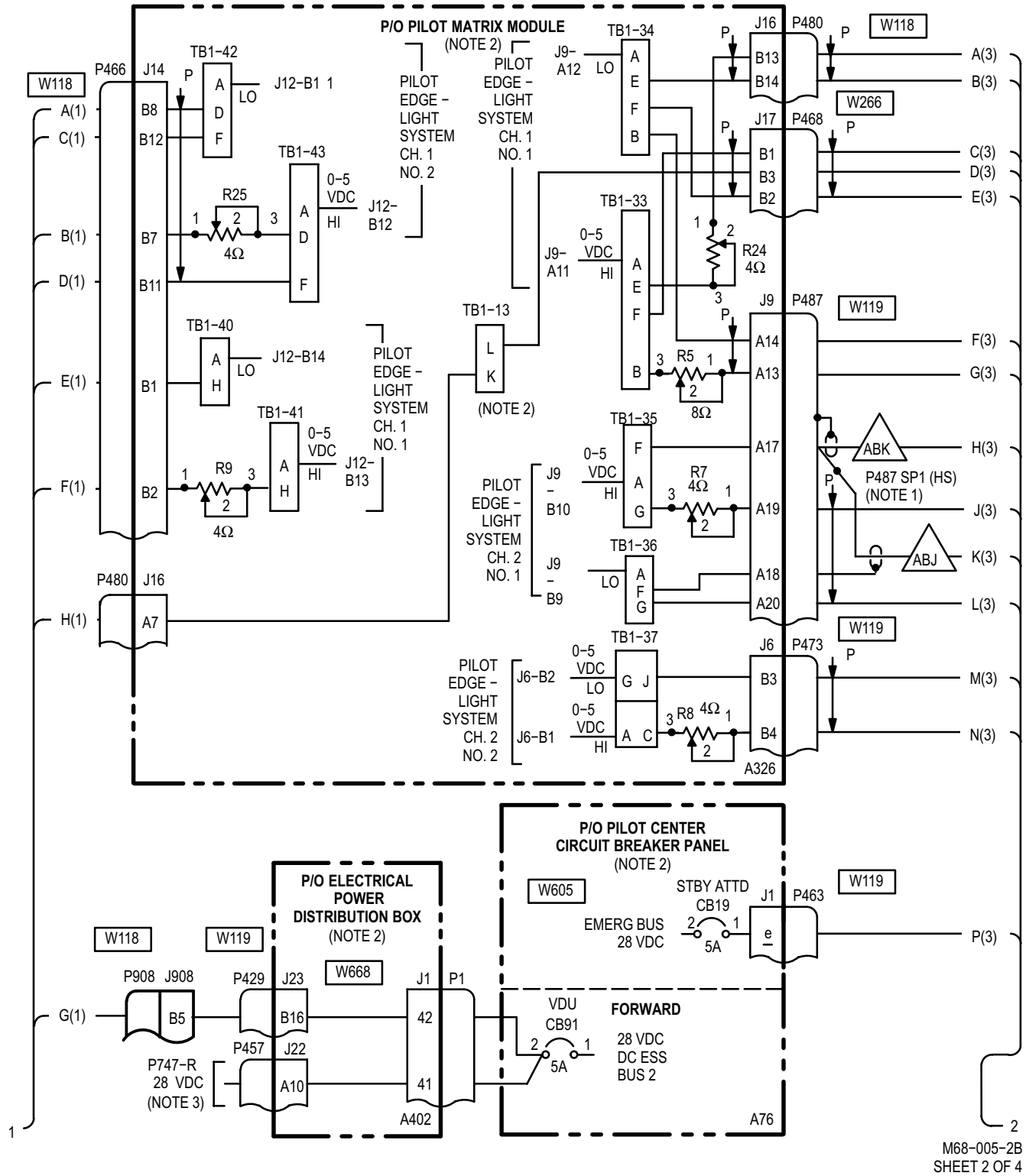
END OF TASK

8–92. FLIGHT INSTRUMENTS – WIRING INTERCONNECT DIAGRAM 8–92

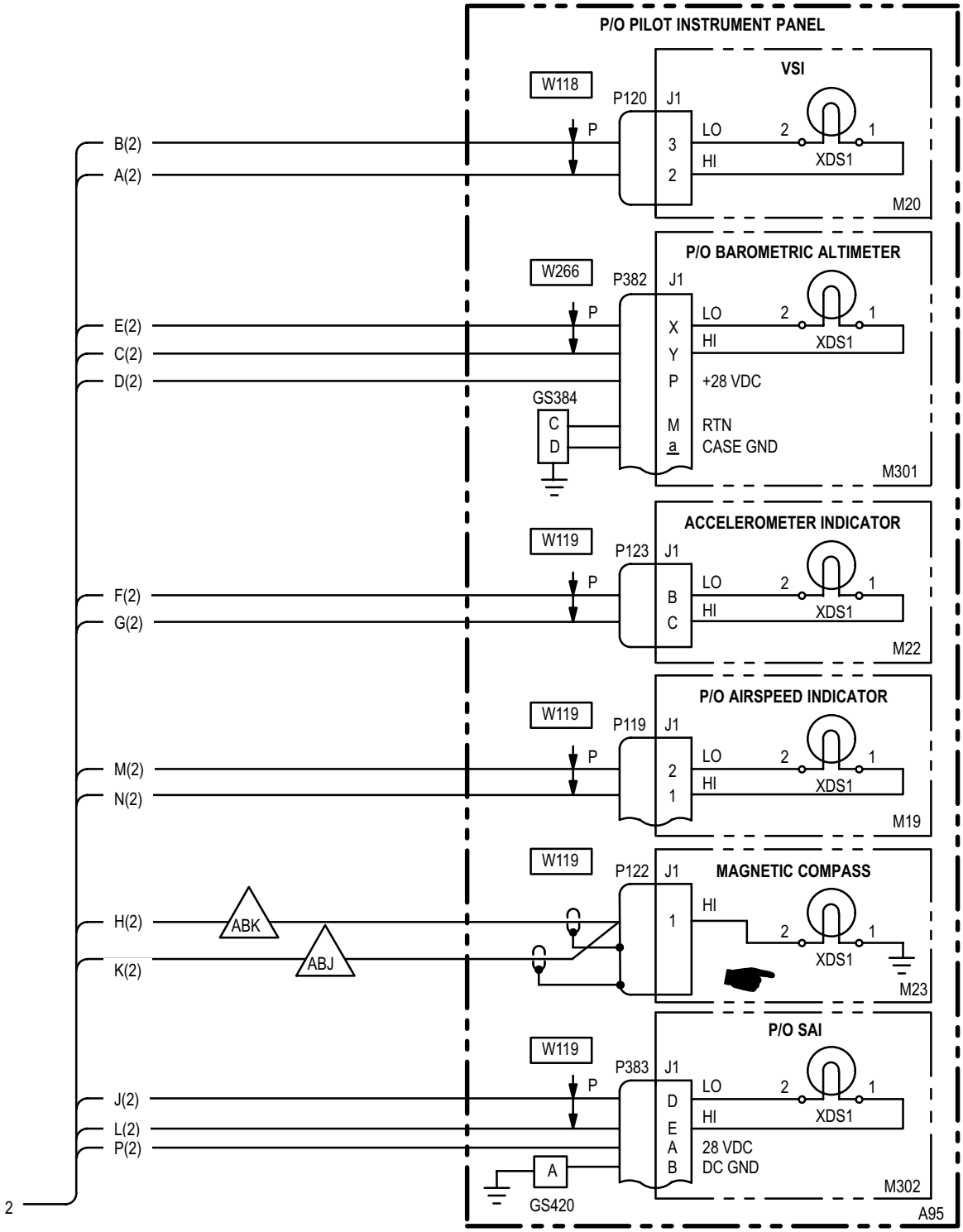


M68−005−1A
SHEET 1 OF 4

8–92. FLIGHT INSTRUMENTS – WIRING INTERCONNECT DIAGRAM (cont) 8–92



8–92. FLIGHT INSTRUMENTS – WIRING INTERCONNECT DIAGRAM (cont) 8–92



M68−005−3B
SHEET 3 OF 4

8–92. FLIGHT INSTRUMENTS – WIRING INTERCONNECT DIAGRAM (cont) 8–92

NOTES:

HIGHWAY USE: THE ALPHA CHARACTER IDENTIFIES A SPECIFIC LINE, AND THE NUMBER IN PARENTHESIS IDENTIFIES THE SHEET NUMBER WHERE THE SIGNAL TERMINATES.

1. **HS DESIGNATES A HARD SPLICE WHICH CANNOT BE DISCONNECTED. M DESIGNATES A SOFT SPLICE WHICH CAN BE DISCONNECTED FOR A WIRING CHECK.**
2. **ELECTRICAL SYSTEM (TM 1−1520−238−T−6).**
3. **VDU − AVIONICS CONFIGURATION (TM 11−1520−238−23−2).**

M68−005−4
SHEET 4 OF 4

8–93. CPG AIRSPEED INDICATOR EDGE–LIGHTING – DOES NOT COME ON 8–93

s
Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer (2)

References:

TM 1-1520-238-T-6
TM 1-1520-238-23

Equipment Conditions:

Ref	Condition
TM 1-1520-238-23	Non–transparent barrier removed

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. Check for 0 to 5 VDC at (A326): TB1–41–H and TB1–40–H.
   Is voltage present?

   YES — Go to step 2.

   NO — Refer to TM 1-1520-238-T-6 to troubleshoot CPG edge–lights.

2. Check for open between: (A326)TB1–41–H and P125–1, (A326)TB1–40–H and P125–2.
   Does open exist?

   YES — Repair open wire. Go to paragraph 8–91.

   NO — Replace CPG airspeed indicator (TM 1-1520-238-23).

END OF TASK

8–94. CPG VSI EDGE–LIGHTING – DOES NOT LIGHT 8–94

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer (2)

References:

TM 1-1520-238-T-6
TM 1-1520-238-23

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. Close CPG **PRI LT** circuit breaker.
   Check for 5 VDC between (A326):
   J14–B7 and J14–B8.
   Is voltage present?

   YES — Go to step 3.

   NO — Go to step 2.

2. Check for 5 VDC at (A326)TB1–43–D.
   Is voltage present?

   YES — Repair open wire between (A326):
   J14–B8 and TB1–42–D,
   J14–B7 and TB1–43–D.
   Go to paragraph 8–91,
   or
   replace resistor (A326)R25 (TM 1-1520-238-23).

   NO — Refer to TM 1-1520-238-T-6 to troubleshoot CPG edge–lights.

3. Check for 5 VDC between P126–3 and P126–2.
   Is voltage present?

   YES — Replace VSI (TM 1-1520-238-23).

   NO — Repair open wire between:
   P466–B8 and P126–2,
   P466–B7 and P126–3.
   Go to paragraph 8–91.

END OF TASK

8–95. CPG BAROMETRIC ALTIMETER EDGE–LIGHTING – DOES NOT LIGHT 8–95

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer (2)

References:

TM 1-1520-238-T-6
TM 1-1520-238-23

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. Close CPG **PRI LT** circuit breaker.
   Check for 5 VDC between (A326):
   J14–B11 and J14–B12.
   Is voltage present?

   YES — Go to step 3.

   NO — Go to step 2.

2. Check for 5 VDC at
   (A326)TB1–43–F.
   Is voltage present?

   YES — Repair open wire between (A326):
   J14–B12 and TB1–42–F,
   J14–B11 and TB1–43–F.
   Go to paragraph 8–91.

   NO — Refer to TM 1-1520-238-T-6 to troubleshoot pilot edge–lights.

3. Check for 5 VDC between
   P119–1 and P119–2.
   Is voltage present?

   YES — Replace CPG barometric altimeter (TM 1-1520-238-23).

   NO — Repair open wire between:
   P473–B4 and P119–1,
   P473–B3 and P119–2.
   Go to paragraph 8–91.

END OF TASK

8–96. PILOT AIRSPEED INDICATOR EDGE–LIGHTING – DOES NOT LIGHT 8–96

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer (2)

References:

TM 1-1520-238-T-6
TM 1-1520-238-23

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. Close CPG **PRI LT** circuit breaker.
   Check for 5 VDC between (A326):
   J14–B11 and J14–B12.
   Is voltage present?

   YES — Go to step 3.

   NO — Go to step 2.

2. Check for 5 VDC at
   (A326)TB1–43–F.
   Is voltage present?

   YES — Check for open between (A326):
   J14–B12 and TB1–42–F,
   J14–B11 and TB1–43–F.
   Repair open wire.
   Go to paragraph 8–91.

   NO — Refer to TM 1-1520-238-T-6 to troubleshoot CPG edge–lights.

3. Check for 5 VDC between
   P385–Y and P385–X.
   Is voltage present?

   YES — Replace pilot air speed indicator (TM 1-1520-238-23).

   NO — Repair open wire between:
   P466–B12 and P385–X,
   P466–B11 and P385–Y.
   Go to paragraph 8–91.

END OF TASK

8–97. PILOT ACCELEROMETER INDICATOR EDGE–LIGHTING – DOES NOT LIGHT 8–97

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer (2)

References:

TM 1-1520-238-23
TM 1-1520-238-T-6

Equipment Conditions:

Ref	Condition
TM 1-1520-238-23	Non–transparent barrier removed

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. Check for 5 VDC between (A326): TB1–33–B and TB1–34–B.
   Is voltage present?

   YES — Go to step 2.

   NO — Refer to TM 1-1520-238-T-6 to troubleshoot pilot edge–lights.

2. Check for open between: (A326)TB1–34–B and P123–B, (A326)TB1–33–B and (A326)R5–3.
   Does open exist?

   YES — Repair open wire. Go to paragraph 8–91.

   NO — Go to step 3.

3. Check for 8 ohms between (A326): R5–3 and R5–1.
   Is resistance present?

   YES — Replace pilot accelerometer indicator (TM 1-1520-238-23).

   NO — Replace resistor (A326)R5 (TM 1-1520-238-23).

END OF TASK

8–98. PILOT BAROMETRIC ALTIMETER EDGE–LIGHTING – DOES NOT LIGHT 8–98

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer (2)

References:

TM 1-1520-238-T-6
TM 1-1520-238-23

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. Close pilot **LT PRI** circuit breaker. Check for 5 VDC between (A326): J17–B1 and J17–B2.
   Is voltage present?
   - YES — Go to step 3.
   - NO — Go to step 2.
2. Check for 5 VDC at (A326)TB1–33–F.
   Is voltage present?
   - YES — Repair open wire between (A326): J17–B1 and TB1–33–F, J17–B2 and TB1–34–F. Go to paragraph 8–91.
   - NO — Refer to TM 1-1520-238-T-6 to troubleshoot pilot edge–lights.
3. Check for 5 VDC between P382–X and P382–Y.
   Is voltage present?
   - YES — Replace pilot barometric altimeter (TM 1-1520-238-23).
   - NO — Repair open wire between: P468–B1 and P382–Y, P468–B2 and P382–X. Go to paragraph 8–91.

END OF TASK

8–99. PILOT VSI EDGE–LIGHTING – DOES NOT LIGHT 8–99

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer (2)

References:

TM 1-1520-238-T-6
TM 1-1520-238-23

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. Close pilot **LT PRI** circuit breaker.
   Check for 5 VDC between (A326):
   J16–B13 and J16–B14.
   Is voltage present?

   YES — Go to step 3.

   NO — Go to step 2.

2. Check for 5 VDC at
   (A326)TB1–33–E.
   Is voltage present?

   YES — Repair open wire between (A326):
   J16–B13 and TB1–33–E,
   J16–B14 and TB1–34–E.
   Go to paragraph 8–91,
   or
   replace resistor (A326)R24 (TM 1-1520-238-23).

   NO — Refer to TM 1-1520-238-T-6 to troubleshoot pilot edge–lights.

3. Check for 5 VDC between
   P120–2 and P120–3.
   Is voltage present?

   YES — Replace pilot vertical speed indicator. (TM 1-1520-238-23).

   NO — Repair open wire between (A326):
   P480–B14 and P120–3,
   P480–B13 and P120–2.
   Go to paragraph 8–91.

END OF TASK

8–100. PILOT SAI EDGE–LIGHTING – DOES NOT LIGHT 8–100

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer (2)

References:

TM 1-1520-238-T-6
TM 1-1520-238-23

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. On pilot center circuit breaker panel, close **LT PRI** circuit breaker. Check for 5 VDC between (A326): J9–A19 and J9–A20.
   Is voltage present?

   YES — Go to step 3.

   NO — Go to step 2.

2. Check for 5 VDC at (A326)TB1–35–G.
   Is voltage present?

   YES — Repair open wire between (A326):
   J9–A20 and TB1–36–G,
   J9–A19 and TB1–35–G.
   Go to paragraph 8–91,
   or
   replace resistor (A326)R7 (TM 1-1520-238-23).

   NO — Refer to TM 1-1520-238-T-6 to troubleshoot pilot edge–lights.

3. Check for 5 VDC between P383–D and P383–E.
   Is voltage present?

   YES — Replace SAI (TM 1-1520-238-23).

   NO — Repair open wire between:
   P487–A19 and P383–D,
   P487–A20 and P383–E.
   Go to paragraph 8–91.

END OF TASK

8–101. PILOT MAGNETIC COMPASS LAMP – DOES NOT LIGHT 8–101

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer (2)

References:

TM 1-1520-238-23

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

Check for 0 to 5 VDC at P122–1.
Is voltage present?

YES	Replace magnetic compass lamp (TM 1-1520-238-23).
NO	Repair open between: P122–1 and P487–A17. (A326): J9–A17 and TB1–35–F. Go to paragraph 8–91.

END OF TASK

8–102. PILOT SAI OFF FLAG – IS VISIBLE WITH ELECTRICAL POWER ON AND INDICATOR UNCAGED 8–102

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer (2)

References:

TM 1-1520-238-T-6
TM 1-1520-238-23

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. On pilot center circuit breaker panel, close **STBY ATTD** circuit breaker.
   Check for 28 VDC at P383–A.
   Is voltage present?

   YES — Go to step 3.

   NO — Go to step 2.

2. Check for 28 VDC at (A76)J1–e.
   Is voltage present?

   YES — Repair open wire between: P463–e and P383–A. Go to paragraph 8–91.

   NO — Refer to TM 1-1520-238-T-6 to troubleshoot circuit protection system (dc emergency bus – pilot station).

3. Check for continuity between P383–B and ground.
   Does continuity exist?

   YES — Replace SAI (TM 1-1520-238-23).

   NO — Repair open wire between P383–B and GS407–B. Go to paragraph 8–91.

END OF TASK

8–103. PILOT BAROMETRIC ALTIMETER INTERNAL VIBRATOR – IS NOT HEARD 8–103

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer (2)

References:

TM 1-1520-238-23

Equipment Conditions:

Ref	Condition
TM 1-1520-238-23	Nontransparent barrier removed

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. Check for 28 VDC at P382–P.
   Is voltage present?

   YES — Go to step 4.

   NO — Go to step 2.

2. Check for open between P382–P and P468–B3.
   Does open exist?

   YES — Repair open wire. Go to paragraph 8–91.

   NO — Go to step 3.

3. Check for open between (A326): J17–B3 and J16–A7.
   Does open exist?

   YES — Repair open wire between (A326): J17–B3 and TB1–13–K, TB1–13–L and J16–A7. Go to paragraph 8–91.

   NO — Repair open wire between P480–A7 and P750 SP2. Go to paragraph 8–91.

4. Check for open between P382–M and ground.
   Does open exist?

   YES — Repair open wire. Go to paragraph 8–91.

   NO — Replace pilot barometer altimeter (TM 1-1520-238-23).

END OF TASK

8–104. CPG BAROMETRIC ALTIMETER INTERNAL VIBRATOR – IS NOT HEARD 8–104

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer (2)

References:

TM 1-1520-238-23

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

Check for open between:
P385–P and P382–P,
P385–M and GS240–L,
P385–a and GS240–M.
Does open exist?

YES	Repair open wire. Go to paragraph 8–91.
NO	Replace CPG barometric altimeter (TM 1-1520-238-23).

END OF TASK

8–105. MISCELLANEOUS INSTRUMENTS – MAINTENANCE OPERATIONAL CHECK 8–105

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06

Personnel Required:

68F Aircraft Electrician

References:

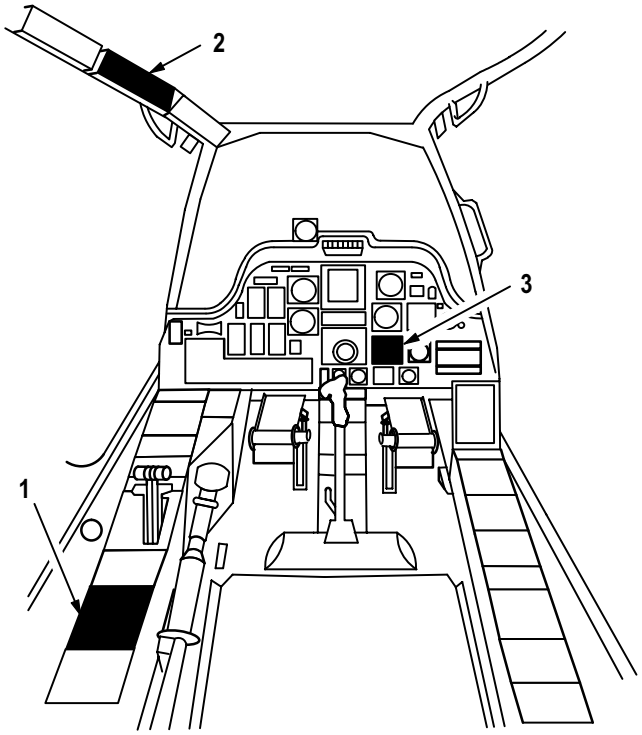
TM 1-1520-238-T-7
TM 1-1520-238-23

Equipment Conditions:

Ref	Condition
TM 1-1520-238-23	Helicopter safed
	External power application – Electrical

NOTE

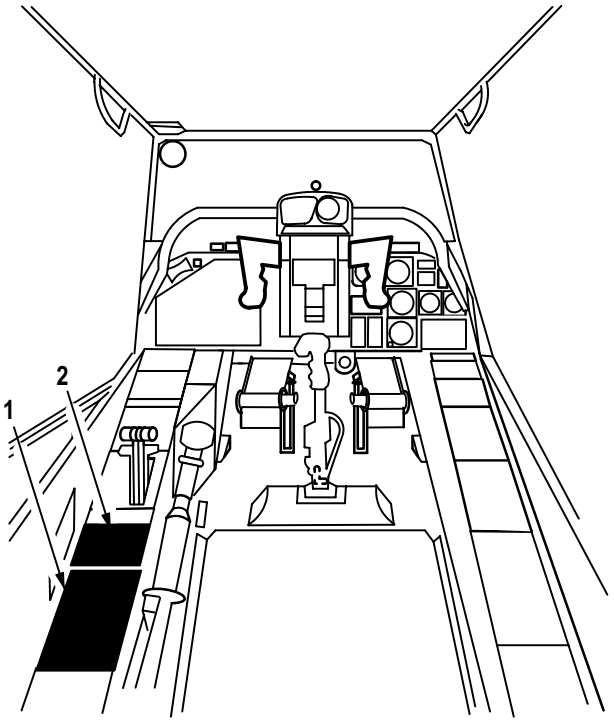
Refer to pilot station (fig. 8–49) and CPG station (fig. 8–50) for configurations and equipment.



1. PILOT EXT LT/INTR LT PANEL
2. PILOT CENTER CIRCUIT BREAKER PANEL
3. PILOT CLOCK

M68−206

Figure 8–49. Pilot Station



1. CPG CIRCUIT BREAKER PANEL 1
2. CPG INTR LT PANEL

M68−207

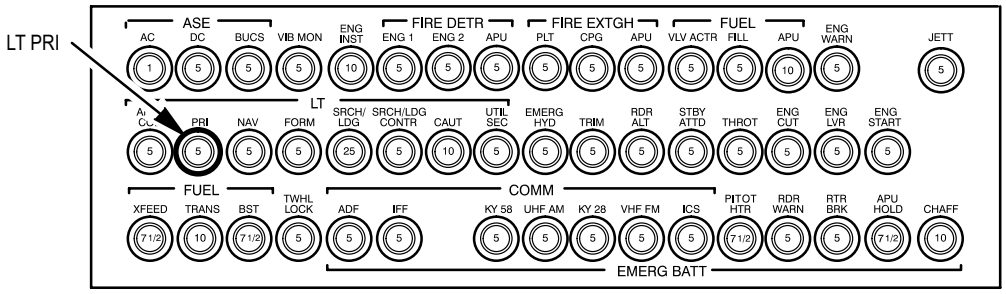
Figure 8–50. CPG Station

NOTE

- **To troubleshoot fuel system refer to TM 1-1520-238-T-7.**
- **To troubleshoot hydraulic system refer to chapter 7.**
- **If referenced out of one paragraph or volume into another for additional troubleshooting, upon completion of the task, return to the maintenance operational check for the original paragraph or volume.**

1. Perform visual check of pilot and CPG miscellaneous instruments (TM 1-1520-238-23).
2. Complete the maintenance operational check as follows:

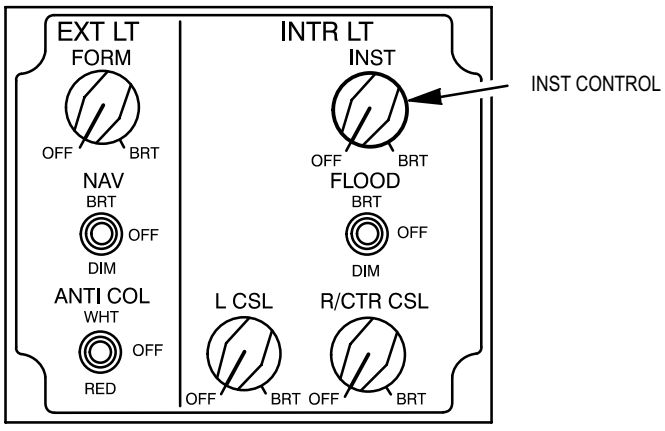
Task	Result
a. On pilot center circuit breaker panel (fig. 8–51), check that **LT PRI** circuit breaker is closed.	



M68-069

Figure 8–51. Pilot Center Circuit Breaker Panel

b. On pilot **EXT LT/INTR LT** panel (fig. 8–52), turn **INST** control to **BRT**.	If pilot clock (fig. 8–54) edge–lighting does not light, go to paragraph 8–107.



M68-071

Figure 8–52. Pilot EXT LT/INTR LT Panel

8–105. MISCELLANEOUS INSTRUMENTS – MAINTENANCE OPERATIONAL CHECK (cont) 8–105

Task	Result
c. If pilot clock (fig. 8–54) is not running, wind clock by turning knob on face of clock.	If pilot clock does not run after winding, replace clock (TM 1-1520-238-23).
d. Set pilot clock time by pulling and turning knob.	If pilot clock hour and minute hands will not move, replace clock (TM 1-1520-238-23).
e. Push knob three times.	If pushing knob first time on pilot clock does not reset sweep hand and elapsed time hand (to top of clock face), replace pilot clock (TM 1-1520-238-23). If pushing knob second time on pilot clock does not start hands moving replace pilot clock (TM 1-1520-238-23). If pushing knob third time on pilot clock does not stop hands from moving, replace pilot clock (TM 1-1520-238-23).

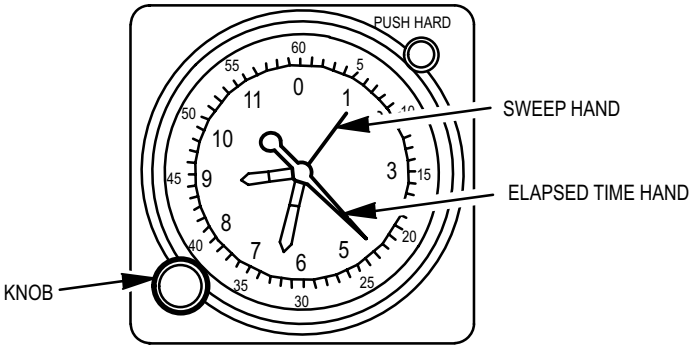


Figure 8–54. Clock

f. On pilot **EXT LT/INTR LT** panel (fig. 8–52), turn **INST** control to **OFF**.

g. On CPG circuit breaker panel 1 (fig. 8–55), close **PRI LT** circuit breaker.

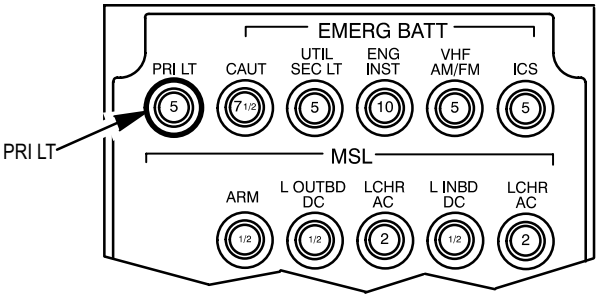


Figure 8–55. CPG Circuit Breaker Panel 1

Task	Result
h. On CPG **INTR LT** panel (fig. 8–56), turn **INST** control to **BRT**.	If CPG clock edge–lighting does not light, go to paragraph 8–108.

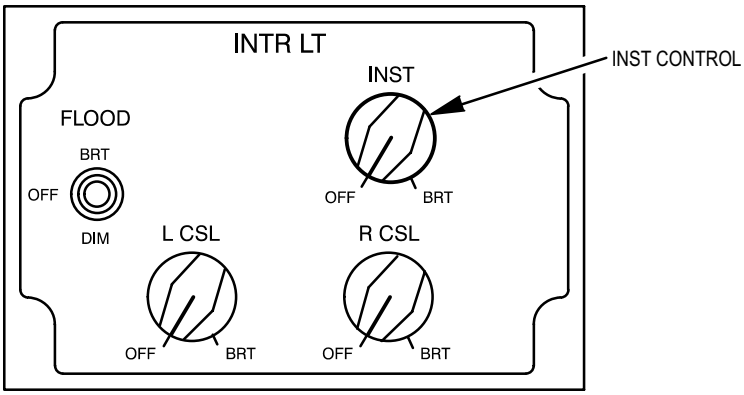


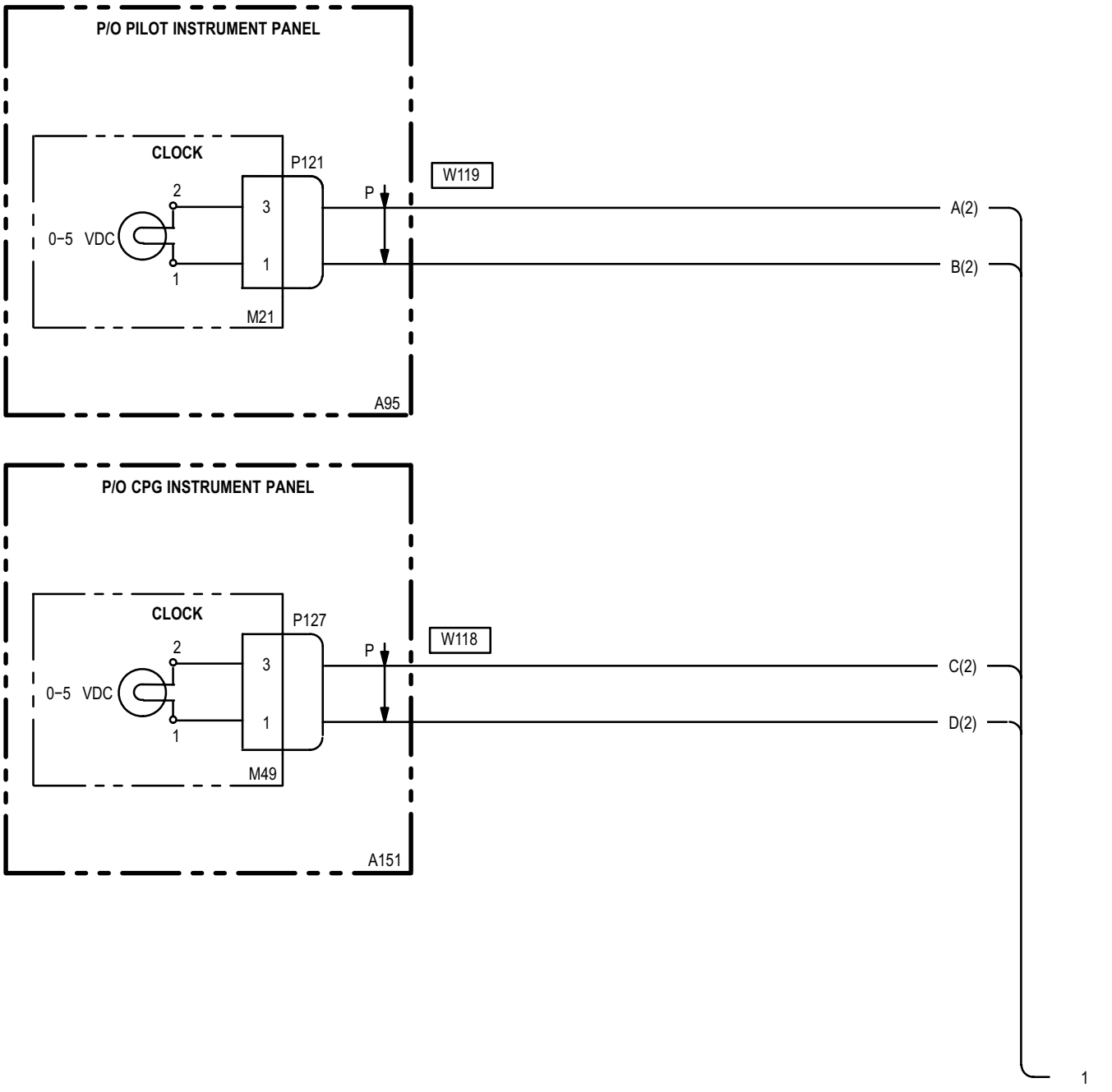
Figure 8–56. CPG INTR LT Panel

i. If CPG clock (fig. 8–54) is not running, wind clock by turning knob on face of clock.	If CPG clock does not run after winding, replace clock (TM 1-1520-238-23).
j. Set CPG clock time by pulling and turning knob.	If CPG clock hour and minute hand will not move, replace clock (TM 1-1520-238-23).
k. Push CPG clock knob three times.	If pushing knob first time on CPG clock does not reset sweep hand and elapsed time hand (to top of clock face), replace CPG clock (TM 1-1520-238-23). If pushing knob second time on CPG clock does not start hands moving, replace CPG clock (TM 1-1520-238-23). If pushing knob third time on CPG clock does not stop hands from moving, replace CPG clock (TM 1-1520-238-23).
l. On CPG **INTR LT** panel turn **INST** control to **OFF**.	

3. Remove external power – electrical (TM 1-1520-238-23).

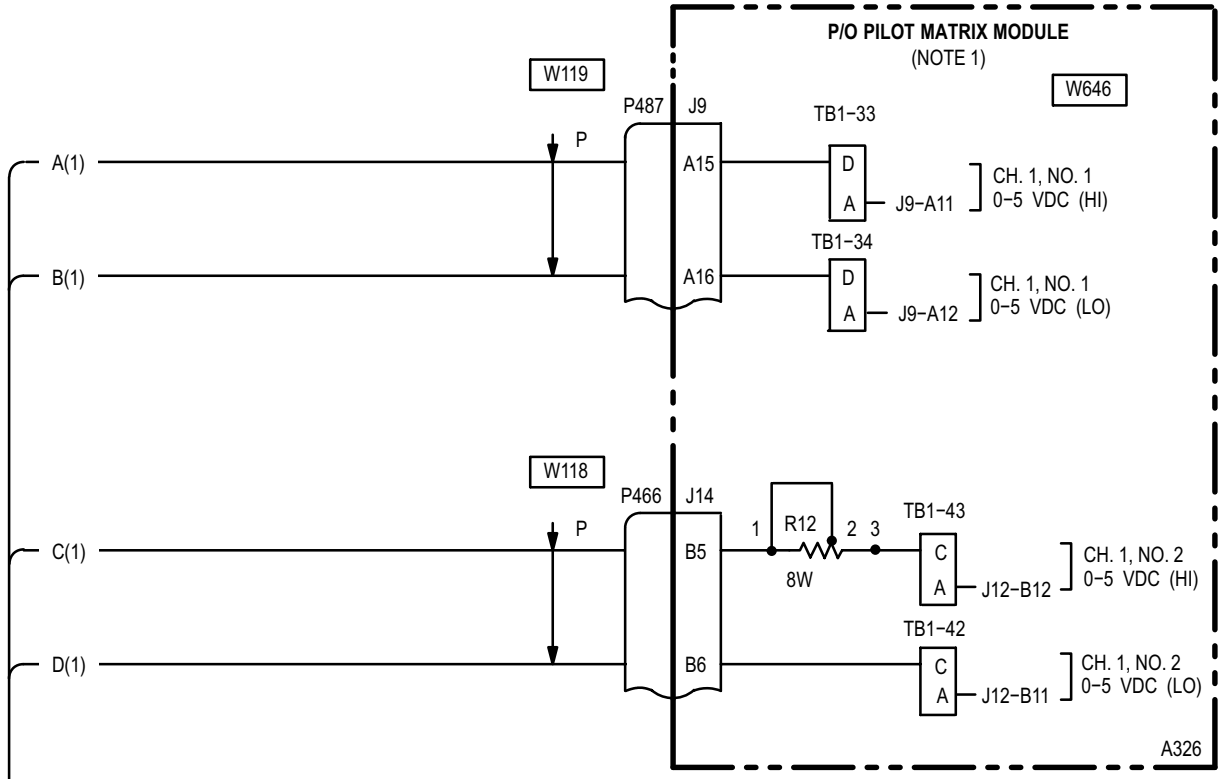
END OF TASK

8–106. MISCELLANEOUS INSTRUMENTS – WIRING INTERCONNECT DIAGRAM 8–106



M68–004–1A
SHEET 1 OF 2

8–106. MISCELLANEOUS INSTRUMENTS – WIRING INTERCONNECT DIAGRAM (cont) 8–106



NOTES:

HIGHWAY USE: THE ALPHA CHARACTER IDENTIFIES A SPECIFIC LINE, AND THE NUMBER IN PARENTHESIS IDENTIFIES THE SHEET NUMBER WHERE THE SIGNAL TERMINATES.

1. **ELECTRICAL SYSTEM (TM 1−1520−238−T−6).**

M68−004−2A
SHEET 2 OF 2

8–107. PILOT CLOCK EDGE–LIGHTING – DOES NOT LIGHT 8–107

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer (2)

References:

TM 1-1520-238-T-6
TM 1-1520-238-23

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. On pilot center circuit breaker panel, close **LT PRI** circuit breaker. Check for 5 VDC between (A326):
   J9–A15 and J9–A16.
   Is voltage present?
   - YES — Go to step 3.
   - NO — Go to step 2.
2. Check for 5 VDC at (A326)TB1–33–D.
   Is voltage present?
   - YES — Repair open wire between (A326):
     J9–A15 and TB1–33–D,
     J9–A16 and TB1–34–D.
     Go to paragraph 8–105.
   - NO — Refer to TM 1-1520-238-T-6 to troubleshoot pilot edge–lights.
3. Check for 5 VDC between P121–1 and P121–3.
   Is voltage present?
   - YES — Replace pilot clock (TM 1-1520-238-23).
   - NO — Repair open wire between:
     P487–A15 and P121–3,
     P487–A16 and P121–1.
     Go to paragraph 8–105.

END OF TASK

8–108. CPG CLOCK EDGE–LIGHTING – DOES NOT LIGHT 8–108

Tools:

Nomenclature	Part Number
Tool Kit, Electrical Repairer's	SC518099CLA06
Multimeter, Digital	AN/PSM-45

Personnel Required:

68X Armament/Electrical Systems Repairer

References:

TM 1-1520-238-T-6
TM 1-1520-238-23

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28 VDC or 115 VAC is present. Failure to do so could result in death or serious injury.

1. On CPG circuit breaker panel 1, close **PRI LT** circuit breaker. Check for 5 VDC between (A326):
   J14–B5 and J14–B6.
   Is voltage present?

   YES Go to step 3.

   NO Go to step 2.

2. Check for 5 VDC at (A326)TB1–43–C.
   Is voltage present?

   YES Go to step 4.

   NO Refer to TM 1-1520-238-T-6 to troubleshoot pilot edge–lights.

3. Check for 5 VDC between P127–3 and P127–1.
   Is voltage present?

   YES Replace CPG clock (TM 1-1520-238-23).

   NO Repair open wire between:
   P466–B5 and P127–3,
   P466–B6 and P127–1.
   Go to paragraph 8–105.

4. Check for open between (A326):
   J14–B5 and R12–1,
   R12–3 and TB1–43–C.
   Does open exist?

   YES Repair open wire.
   Go to paragraph 8–105.

   NO Replace resistor (A326)R12 (TM 1-1520-238-23).

END OF TASK

By Order of the Secretary of the Army:

GORDON R. SULLIVAN
General, United States Army
Chief of Staff

Official:

MILTON H. HAMILTON
Administrative Assistant to the
Secretary of the Army
01691

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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:***

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PFC John DOE
CO A 3rd Engineer Bn
Ft. Leonardwood, MO 63108

DATE SENT
10 January 1999

PUBLICATION NUMBER	PUBLICATION DATE	PUBLICATION TITLE
TM 1–1520–238-T-4	30 December 1998	Troubleshooting Manual for AH-64

BE EXACT PIN–POINT WHERE IT IS

PAGE NO	PARA-GRAPH	FIGURE NO	TABLE NO
6	2-1 a		
B1		4-3	

IN THIS SPACE, TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:

In line 6 of paragraph 2–1a the manual states the engine has 6 cylinders. The engine on my set only has 4 cylinders. Change the manual to show 4 cylinders.

Callout 16 on figure 4–3 is pointed at a bolt. In key to figure 4–3, item 16 is calle a shim. Please correct one or the other

EXAMPLE

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JOHN DOE John Doe

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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: 069966-008