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INSTRUCTIONS FOR CONTINUED AIRWORTHINESS

ICA-E407-789

Honeywell HTS900-2-1D
Engine Installation
Bell 407 Models
SH14-47

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Honeywell HTS900-2-1D Engine Installation Bell 407 Models SH14-47

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Dart Aerospace

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Revision	Date	Description
0	14.08.29	New Issue

BULLETIN RECORD

ALERT SERVICE BULLETINS

ASB NUMBER	SUBJECT	DATE REISSUE

TECHNICAL BULLETINS

TB NUMBER	SUBJECT	DATE REISSUE

LIST OF EFFECTIVE PAGES

CUSTOMER FEEDBACK

Return via email to *maintenance@eaglecopters.com*

Manual Title: ______________________________

Date of latest Revision: ______________________________

Section; Chapter; Paragraph Affected: ______________________________

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LIST OF CHAPTERS/SECTIONS

Chapter 01
GENERAL INFORMATION
(01-00-00)

CHAPTER 01 — GENERAL INFORMATION

Contents

1.1 INTRODUCTION

1.1.1 GENERAL INFORMATION – DESCRIPTION OF THE HELICOPTER

Eagle Copters has developed a Supplemental Type Certificate (STC) for the Bell 407 to remove the Allison Model 250-C47B engine and install a Honeywell HTS900-2-1D engine. The modified helicopter will be referred to as an Eagle 407HP. The purpose of this conversion is to provide better performance at altitude and in hot day conditions without increasing power output to the transmission. This modification only applies to Bell 407 model serial numbers 53000 through 54299, except for the following S/N which are NOT eligible: 53139, 53280, 53471 and 53901 to 53910

The engine replacement and conversion process consists of the following modifications:

- Removal of the Allison Model 250-C47B engine and existing engine mounts.
- Removal of Chandler Evans ECU and associated wiring.
- Installation of Honeywell HTS900-2-1D engine and new engine mounts.
- Replacement of the Torque, MGT, Dual Tach, Ng, Engine Oil Temp/Pressure, Transmission Oil Temp/Pressure, Fuel Pressure/Ammeter and Fuel Quantity Gauges with Diamond J Gauges that are compatible with the ECU for the HTS900-2-1D engine
- Modification of existing forward firewall and transmission area to accommodate the installation of the Honeywell HTS900-2-1D engine.
- Modification of induction and exhaust system to service the HTS900-2-1D engine.
- Modification of engine cowlings, including the modification on routing the fire detect element.
- Installation of engine fire detection system as a requirement of this conversion.
- Modification of the lines to/from existing engine oil cooler to service the HTS900-2-1D engine.
- Removal of throttle power cable and installation of PLA LVDT for power control.
- Modification of electrical wirings, warning/caution/advisory panel annunciators, circuit breaker panel, switch panel and instruments, as required.

The following systems/parts are NOT affected by this conversion:

- Main rotor system
- Tail rotor system
- Transmission and rotor drive system, including main input shaft
- Fuel/hydraulic system
- Tailboom
- Majority of the airframe
- Primary flight controls
- Fuel tank
- Engine oil tank
- Engine /transmission oil cooler

1.1.2 GENERAL INFORMATION – INSTRUCTIONS FOR CONTINUED AIRWORTHINESS (ICA)

This manual provides the requirements set forth in Appendix A of FAR Part 27 for the Instructions for Continued Airworthiness for a Bell Model 407HP helicopter S/N 53000 through 54299 modified per TCCA STC SH14-47 (Ref. FAA STC SRXXXXXNE). In general, this ICA supplements the information found in BHT-407-MM. In some sections of some chapters, the information provided in BHT-407-MM has been reproduced to provide clarity to the user. Where material is reproduced, it has been shaded with an ivory background. Where a chapter of BHT-407-MM still applies in its entirety, the reader must refer to BHT-407-MM as instructed in the applicable chapter cover page. This manual must be used in conjunction with the Bell Helicopter Textron Manual BHT-407-MM and Honeywell Light Maintenance Manual: Gas Turbine Engine HTS900-2-1D.

1.1.2.1 SUPPLEMENTAL DOCUMENTS

Technical Bulletins (TB) and Alert Service Bulletins (ASB) are published when necessary. These documents supplement the Instructions for Continued Airworthiness (ICA) and provide instructions and data to replace or modify components or systems, and perform maintenance practices on the helicopter. When a bulletin affects the way the helicopter is maintained, it is incorporated in the ICA at the next available opportunity. Refer to the bulletin record for the list of bulletins that have been incorporated in the document.

1.1.2.2 DISTRIBUTION

All operators who possess this STC will be provided with any update or revision to this document. Additionally, any changes will be sent to Transport Canada and FAA. All changes will be recorded in the Revision Record at the front of this manual.

As necessary, Technical Bulletins (TB) and Alert Service Bulletins (ASB) will be issued. These documents provide information or data to replace or modify components or systems on the helicopter. Refer to Bulletin Record, in the front of this manual. Additional space is provided for listing TBs and ASBs which are incorporated by the owner/operator.

As a general rule, Airworthiness Directives that apply to the Bell 407 aircraft continue to apply to the Bell 407 with TCCA STC SH14-47 (Ref. FAA STC SRXXXXXXNE) incorporated unless the part or equipment that they reference has been removed as part of the modification. If confusion regarding the applicability exists when new Bell 407 or Honeywell HTS900-2-1D series ADs are issued, the operator/maintainer should contact Eagle Copters for clarification. Owner/operators of aircraft incorporating this STC will be notified of Airworthiness Directives that may apply to their helicopter because of this STC but may not appear on the Transport Canada website because of their airframe applicability

1.1.3 USE OF MANUAL

1.1.3.1 GENERAL

These Instructions for Continued Airworthiness are to be referred to for description and operation, disassembly, inspection, assembly, testing and maintenance when the Eagle Copters E407-789 Modifications are installed on, removed from, or in service on the rotorcraft Eagle 407HP Model.

Generally, maintenance procedures for components or assemblies which have been removed from the helicopter are contained in either BHT-407-CR&O Component Repair & Overhaul Manual.

1.1.3.2 DOCUMENT STRUCTURE

This manual is divided into Chapters listed at the beginning of this document. Refer to the desired Chapter and using the tabbed pages provided which separate each Chapter, refer to the Table of Contents at the beginning of the desired Chapter to locate the specific subject.

1.1.3.3 REVISION STATUS

The revision status of this document is provided at the beginning of the document and on the list of effective pages .The list of effective pages provides the revision status of every page of this document.

1.1.3.4 CONSUMABLE MATERIALS

WARNING

HANDLING AND STORAGE OF CONSUMABLE MATERIALS SHALL BE IN ACCORDANCE WITH MANUFACTURERS INSTRUCTIONS UNLESS OTHERWISE NOTED IN APPLICABLE MAINTENANCE TASKS.

Consumable materials required while performing maintenance are listed in the text by name and an item number such as "solvent (C-304)". The number refers to item 304 in Chapter 13 of BHT-ALL-SPM, Standard Practices Manual. In addition, a list of all consumable materials (by item number and full nomenclature) required for each individual Chapter may be provided following the Table of Contents for that Chapter.

Occasionally, materials used in maintenance change properties, suppliers, or are discontinued. Also, new and more advanced materials become available. In the event of conflict between this manual and the Standard Practices manual, the manual with the latest date of issue list the preferred material. However, either material may be used for the accomplishment of the prescribed task unless specifically stated otherwise.

1.1.3.5 SPECIAL TOOLS

Certain maintenance procedures require the use of special tools. Special tools required are listed at the beginning of the applicable maintenance paragraph

1.1.3.6 TORQUES

Torques are specified as either standard or special within this manual. Standard torque values for various type fasteners will be found in BHT-ALL-SPM. Where applicable, special torques are specified within the text (or on illustrations) within this manual.

1.1.3.7 TERMINOLOGY

Warnings, cautions, and notes are used throughout this manual to emphasize important and critical instructions as follows:

WARNING

AN OPERATING PROCEDURE, PRACTICE, ETC., WHICH, IF NOT CORRECTLY FOLLOWED, COULD RESULT IN PERSONAL INJURY OR LOSS OF LIFE

CAUTION

AN OPERATING PROCEDURE, PRACTICE, ETC., WHICH IF NOT STRICTLY OBSERVED, COULD RESULT IN DAMAGE TO, OR DESTRUCTION OF, EQUIPMENT.

NOTE

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

1.1.3.8 USE OF PROCEDURAL WORDS

The concept of procedural word usage and intended meaning which is used throughout this manual is as follows:

"Shall" is used only when application of a procedure is mandatory.

"Should" is used only when application of a procedure is recommended.

"May" and "need not" is used only when application of a procedure is optional.

"Will" is used only to indicate futurity, never to indicate a mandatory procedure.

1.1.3.9 WEAR LIMITS

CAUTION

METRIC EQUIVALENTS TO U.S. STANDARD WEIGHTS AND MEASURES ARE PROVIDED THROUGHOUT THIS MANUAL. WHILE PERFORMING MEASUREMENTS TO DETERMINE THE SERVICEABILITY OF A COMPONENT OR TO ESTABLISH A SPECIFIED DIMENSION, ONLY THE U.S. STANDARD VALUES SHALL BE USED.

Throughout this manual, wear limits are provided to show the required fit between mating parts. It is not intended that all dimensions be checked as a prescribed maintenance procedure; however, parts that show evidence of wear or physical damage must be checked dimensionally.

Wear limits, fit, and tolerances are integrated into the inspection, repair, and assembly procedures. Unless otherwise specified, dimensions shall carry the following tolerances on decimals.

DECIMAL	TOLERANCE
.XXX	+/- 0.010 inch
.XX	+/- 0.03 inch
.X	+/- 0.1 inch

1.1.3.10 STANDARD PRACTICES

Standard maintenance practices and procedures not specifically described within this manual are contained in BHT-ALL-SPM.

1.1.3.11 REPLACEMENT PARTS AND ASSEMBLIES

Replacement parts and assemblies required for proper maintenance are listed in a companion Illustrated Parts Catalog (IPC-E407-789) and/or the Installation Instructions (IIN-E407-789). The Illustrated Parts Catalog (IPC-E407-789) provides complete nomenclatures, part numbers, and ordering information.

1.1.3.12 ABBREVIATION

°C	Degree Celsius
°F	Degrees Fahrenheit
A/C	Aircraft
A/F	Airframe
AGB	Accessory Gearbox
ALF	Aft Looking Forward
AMP	Ampere
ARINC	Aeronautical Radio, Inc.
ASB	Alert Service Bulletin
AWG	American Wire Gauge
BATT	Battery
BIT	Built-In Test
BRN	Binary
CAN	Controller Area Network
CAUT	Caution
CCDL	Cross-Channel Data Link
CH	Channel
CONT	Control
CP	Collective Pitch
CV	Control Valve
DC	Direct Current
DOD	Depth of Discharge
EC	Exceedance Count
ECM	Engine Control Monitoring
ECU	Electronic Control Unit
ECUIC	Electronic Control Unit Interface Computer
EMER	Emergency
EMF	Electromagnetic Field
EMI	Electromagnetic Interference
ENG	Engine
FAA	Federal Aviation Authority
FADEC	Full-Authority Digital Electronic Control
FFIB	Fuel Filter Impending Bypass
FI	Flight Idle
FMU	Fuel Metering Unit
FOD	Foreign Object Damage
FTI	Flight Test Instrumentation
FWD	Forward
GI	Ground Idle
GP	Gas Producer
GSE	Ground Support Equipment
GSTS	Ground Station Test Set
HMA	Hydromechanical Assembly
HMU	Hydromechanical Unit
HP	High Pressure
HPF	High Pressure Filter
Hz	Hertz
IGN	Ignition
INSTR	Instrument
LBL	Left Butt Line

LBO	Lean Blowout
LCD	Liquid Crystal Display
LED	Light Emitting Diode
LFP	Low Fuel Pressure
LH	Left Hand
LOPC	Loss of Power Control
LP	Low Pressure
LRU	Line Replaceable Unit
LVDT	Linear Variable Differential Transducer
MAINT	Maintenance
MCP	Maximum Continuous Power
MFV	Minflow Valve
MGT	Measured Gas Temperature
NG	Gas Generator Rotor Speed
NP	Power Turbine Speed
NR	Aircraft Rotor Speed
NVM	Non Volatile Memory
N/A	Not Applicable
OE	Operation Exceedance
OEC	Operation Exceedance Count
OPS	Overspeed Protection System
OVSPD	Overspeed
PLA	Power Lever Angle
PMA	Permanent Magnet Alternator
POT	Potentiometer
PRESS	Pressure
PSI	Pounds Per Square Inch
PT	Power Turbine
PWR	Power
P0	Ambient Static Pressure
P3	Compressor Discharge Pressure
QTY	Quantity
RBL	Right Butt Line
RH	Right Hand
RPM	Revolution Per Minute

STA	Station
STC	Supplemental Type Certificate
TB	Technical Bulletin
TC	Transport Canada
TEMP	Temperature
TLD	Time Limited Dispatch
TRQ	Torque
TYP	Typical
T1	Ambient Temperature (inlet)
T/R	Tail Rotor
VDC	Volts, Direct Current
VRLA	Valve Regulated Lead-Acid
Wf	Fuel Flow
WFMV	Fuel Flow Metering Valve
XFR	Transfer
XMSN	Transmission

Chapter 04
AIRWORTHINESS LIMITATIONS
(04-00-00)

CHAPTER 4 — AIRWORTHINESS LIMITATIONS

Contents

The Airworthiness Limitations section is approved by the Minister and specifies maintenance required by any applicable airworthiness or operating rule unless an alternative program has been approved by the Minister.

F. J. B. Wright, Technical Team Lead, Aircraft Certification
Transport Canada Civil Aviation (TCCA) Prairie and Northern Region
Edmonton Operations

The Airworthiness Limitations section is FAA approved and specifies inspections and other maintenance required under sections 43.16 and 91.403 of the Federal Aviation Regulations unless an alternative program has been FAA approved

4.1 AIRWORTHINESS LIMITATIONS SCHEDULE

The airworthiness limitations presented in this manual supplement the airworthiness limitations presented in Chapter 4 of BHT-407-MM

4.2 SCHEDULED INSPECTIONS

DATA REFERENCE	INSPECTION TASK DESCRIPTION
ICA-E407-789 Chapter 5	**150 HR** 1. Verify the engine chip detector function. 2. Replace the engine oil and submit the oil filter for backflush analysis. **2400 HR** 1. Disassemble and conduct a detailed inspection of the engine gearbox including the free-wheel clutch components.

4.3 CONDITIONAL INSPECTIONS

4.3.1 HARD LANDINGS

DATA REFERENCE	INSPECTION TASK DESCRIPTION
ICA-E407-789 Chapter 5	1. After a Hard Landing resulting in structural damage to the fuselage or tailboom or if metal is present on the engine chip detector, disassemble and conduct a detailed inspection of the engine gearbox including the free-wheel clutch components.

4.3.2 SUDDEN STOPPAGE

DATA REFERENCE	INSPECTION TASK DESCRIPTION
ICA-E407-789 Chapter 5	1. Sudden Stoppage of the main or tail rotors resulting in: a) Torsional yielding of the mast requires disassembly and detailed inspection of the engine gearbox and replacement of the free-wheel clutch, inner shaft, coupling shaft and forward and aft couplings b) Engine output shaft coupling damage requires disassembly and detailed inspection of the engine gearbox including the free-wheel clutch components.

4.3.3 OVERSPEED EXCEEDANCE

DATA REFERENCE	INSPECTION TASK DESCRIPTION
ICA-E407-789 Chapter 5	**AFTER MAIN ROTOR OVERSPEED OF 118% AND ABOVE** 1. If the main rotor speed exceeds 118%, resulting in metal present on the engine chip detector, disassemble and conduct a detailed inspection of the engine gearbox including the free-wheel clutch components.

4.3.4 OVERTORQUE

DATA REFERENCE	INSPECTION TASK DESCRIPTION
	NOTE *The torque values given in this section are those displayed by the torque indicator. The FADEC/ECU will record torque values that are different. Refer to Chapter 76 for the relationship between these two values. To determine the engine (FADEC/ECU) torque, use the factor i.e. (Q × .8903) or (Q ÷1.123).*
ICA-E407-789 Chapter 5	**AFTER OVERTORQUE — 110 TO 135%** 1. When an overtorque has occurred, resulting in metal present on the engine chip detector, disassemble and conduct a detailed inspection of the engine gearbox including the freewheel clutch components.
ICA-E407-789 Chapter 5	**AFTER OVERTORQUE — ABOVE 135%** 1. Inspect the output shaft couplings for damage. If distortion is noted, disassemble and conduct a detailed inspection of the engine gearbox including the freewheel clutch components. 2. Inspect engine chip detector. Re-inspect engine chip detector after 25 hours of operation.

4.3.5 ENGINE COMPRESSOR STALL OR SURGE

DATA REFERENCE	INSPECTION TASK DESCRIPTION
ICA-E407-789 Chapter 5	**<u>COMPRESSOR STALL WITH NOTICEABLE YAW</u>** 1. Inspect the engine chip detector. Re-inspect the engine chip detector after 25 hours of operation.

4.3.6 LIGHTNING STRIKE

DATA REFERENCE	INSPECTION TASK DESCRIPTION
ICA-E407-789 Chapter 5	1. If arc burns are present on the gearbox assembly, tail rotor driveshaft, engine mounts, or engine ground straps, disassemble and conduct a detailed inspection of the engine gearbox including the free-wheel clutch components.

Chapter 05
INSPECTIONS AND COMPONENT OVERHAUL SCHEDULES
(05-00-00)

CHAPTER 5 — INSPECTIONS AND COMPONENT OVERHAUL SCHEDULE

Contents

Tables

5.1 INSPECTIONS AND COMPONENT OVERHAUL SCHEDULE

5.1.1 GENERAL

The inspection schedules noted in Chapter 05 of the BHT-407-MM apply to the modified helicopter. In addition, the inspections listed in section 5.2 to 5.4 of this document supplement/modify those of the helicopter manufacturer.

Refer to the Honeywell Light Maintenance Manual HTS900-2-1D for inspection and overhaul items and tolerances of the powerplant.

5.2 SCHEDULED INSPECTIONS

5.2.1 DAILY INSPECTION REQUIREMENT

Perform daily inspection requirement per Honeywell Light Maintenance Manual for HTS900-2-1D Chapter 72-00-00 Table 2.

5.2.2 AIRFRAME INSPECTION PROGRAM

BHT-407-MM provides two airframe inspection programs. They are the Airframe Periodic Inspection and the Airframe Progressive Inspection.

5.2.3 AIRFRAME PROGRESSIVE INSPECTION PROGRAM

Perform Airframe Progressive Inspection program per BHT-407-MM section 5-9 with following amendments adhered to:

- Where engine inspections are required to be performed in accordance with Rolls-Royce Operation and Maintenance Manual, Publication CSP21001, refer to Honeywell Light Maintenance Manual for HTS900-2-1D instead.
- All checks pertaining to Manual Mode of the FADEC system are not applicable.
- All inspections referenced to the applicable chapter of BHT-407-MM, refer to applicable chapter of ICA-E407-789.
- Ground run procedure shall be in accordance with FMS-E407-789-1.
- Perform Progressive Inspection – Event #3, per Table 5-1 of this document.
- Perform Progressive Inspection – Event #5, per Table 5-2 of this document.
- Perform Progressive Inspection – Event #6, per Table 5-3 of this document.

5.2.4 AIRFRAME PERIODIC INSPECTION PROGRAM

Perform Airframe Periodic Inspection program per BHT-407-MM section 5-10 with following amendments adhered to:

- Where engine inspections are required to be performed in accordance with Rolls-Royce Operation and Maintenance Manual, Publication CSP21001, refer to Honeywell Light Maintenance Manual for HTS900-2-1D instead.
- All checks pertaining to Manual Mode of the FADEC system are not applicable.
- All inspections referenced to the applicable chapter of BHT-407-MM, refer to applicable chapter of ICA-E407-789.

- Ground run procedure shall be in accordance with FMS-E407-789-1.

- Perform 600 Hour Inspection – ROTOR BRAKE per Northwest Dynamics Document No. B0223-OM for Caliper Assembly 206-340-301-103 identified in Table 5-2 of BHT-407-MM.

- Perform the 2400 HR inspection per Table 5-4 of this document

5.2.5 SPECIAL INSPECTIONS

Perform Special Inspections per Bell Maintenance Manual BHT-407-MM-1.

Refer to Honeywell Light Maintenance Manual HTS900-2-1D Chapter 72-00-00, Table 25 for Engine Special Inspections Requirements.

Table 5-1: PROGRESSIVE INSPECTION – EVENT #3

DATA REFERENCE	INSPECTION TASK DESCRIPTION	INITIAL MECH	INITIAL OTHER
	DATE: ________________ W.O. ____________________ FACILITY: ____ HELICOPTER S/N: __________________________________ REGISTRY NO.: ____________________________________ TOTAL TIME: _____________________________________ SIGNATURE: ______________________________________		
	ZONE 4 - POWERPLANT		
	PLACARDS AND MARKINGS		
	Per BHT-407-MM		
ICA-E407-789 Chapter 71 ICA-E407-789 Chapter 53	**ENGINE** 1. Examine the engine cowling and the doors for condition and security.		
	2. Examine the engine for condition, leaks, and security. Examine the components as follows:		
	a. Fluid flexible and rigid lines.		
ICA-E407-789 Chapter 96	b. Electrical harness.		
ICA-E407-789 Chapter 71	c. Engine mounts, fittings, and legs.		
	d. Exhaust stack.		
	e. Air Intake duct, bellmouth and FOD screen		
ICA-E407-789 Chapter 53	3. Examine the firewalls for condition and security.		
	4. Examine the drain valves. Make sure that they are not clogged.		
ICA-E407-789 Chapter 96	5. Examine the engine chip detector for metal particles. Examine the electrical circuit of the chip detector for continuity.		
	6. Examine fuel filter bypass indicator for condition and correct operation.		
	7. Examine the anti-ice system for condition, correct operation, and security.		

DATA REFERENCE	INSPECTION TASK DESCRIPTION	INITIAL	
		MECH	OTHER
Honeywell Light Maintenance Manual HTS900-2-1D	8. Do the applicable engine inspection.		
ICA-E407-789 Chapter 79	9. Replace the engine oil and submit the oil filter for backflush analysis.		
	ENGINE TO TRANSMISSION DRIVESHAFT		
	Per BHT-407-MM		
	TAIL ROTOR FORWARD SHORT SHAFT ASSEMBLY		
	Per BHT-407-MM		
	FREEWHEEL ASSEMBLY		
	N/A to this modification		
	ROTOR BRAKE DISC		
	Per BHT-407-MM		
	STARTER GENERATOR		
	Per BHT-407-MM		
	GROUND RUN		
FMS-E407-789-1	1. Complete a ground run to 100% NR to check for leaks and confirm system operation		

Table 5-2: PROGRESSIVE INSPECTION – EVENT #5

DATA REFERENCE	INSPECTION TASK DESCRIPTION	INITIAL	
		MECH	OTHER
	DATE: _________________ W.O. ____________________ FACILITY: _______________________________________ HELICOPTER S/N: __________________________________ REGISTRY NO.: ____________________________________ TOTAL TIME:______________________________________ SIGNATURE:______________________________________		
	ZONE 7 – CABIN INTERIOR (CREW AND PASSENGER COMPARTMENTS)		
	PLACARDS AND MARKINGS		
	Per BHT-407-MM		
	INSTRUMENTS		
FMS-E407-789-1	1. Inspect instruments for operation, condition and security. Inspect for correct markings.		
ICA-E407-789 Chapter 95	2. Examine instrument interface connector for condition and security.		
	EQUIPMENT AND FURNISHINGS		
ICA-E407-789 Chapter 53	1. Examine the cabin floor for condition.		
ICA-E407-789 Chapter 25	2. Examine the seat cushions, seat backs, and interior trim for condition and security.		
	3. Examine the restraints for condition, security, and correct operation.		
ICA-E407-789 Chapter 21	4. Examine the ventilation system for condition and security.		
	5. Make sure the fuel valve switch guard operates correctly.		
	6. Inspect first aid kit contents for condition and for security of installation.		
ICA-E407-789 Chapter 26	7. Examine fire extinguisher and quick-release for condition and security.		
ICA-E407-789 Chapter 96	8. Examine the heating system of the pitot and static ports for correct operation.		

DATA REFERENCE	INSPECTION TASK DESCRIPTION	INITIAL	
		MECH	OTHER
ICA-E407-789 Chapter 76	9. Examine the FADEC interface connector for operation, condition and security. Confirm that ECU is bonded to airframe with a resistance of 2.5 mΩ or less. 10. Examine the engine controls PLA LVDT for condition, correct operation, and security. 11. Examine the engine controls CP potentiometer for condition, correct operation, and security. 12. Confirm voltage regulator puts out 12V ± 1V. **CONTROLS** Per BHT-407-MM **ELECTRICAL** Per BHT-407-MM **ZONE 8 – FORWARD FUSELAGE** **PLACARDS AND MARKINGS** Per BHT-407-MM **FORWARD FUSELAGE** Per BHT-407-MM **GROUND RUN**		
FMS-E407-789-1	1. Perform a ground run to 100% NR to check for leaks and to confirm system operation.		

Table 5-3: PROGRESSIVE INSPECTION – EVENT #6

DATA REFERENCE	INSPECTION TASK DESCRIPTION	INITIAL	
		MECH	OTHER
	DATE: __________________ W.O. _____________________ FACILITY: ____ HELICOPTER S/N: __________________________________ REGISTRY NO.: ____________________________________ TOTAL TIME:_______________________________________ SIGNATURE:_______________________________________		
	ZONE 9 – AFT FUSELAGE		
	PLACARDS AND MARKINGS		
	Per BHT-407-MM		
	AIRFRAME		
	Per BHT-407-MM		
	HYDRAULIC		
	Per BHT-407-MM		
	ZONE 10 – LANDING GEAR		
	PLACARDS AND MARKINGS		
	Per BHT-407-MM		
	LANDING GEAR		
	Per BHT-407-MM		
	LUBRICATION		
	Per BHT-407-MM		
	ENGINE		
ICA-E407-789 Chapter 96	1. Examine the engine chip detector for metal particles. Examine the electrical circuit of the chip detector for continuity.		
ICA-E407-789 Chapter 79	2. Replace the engine oil and submit the oil filter for backflush analysis.		
	CORROSION CONTROL		
	Per BHT-407-MM		

DATA REFERENCE	INSPECTION TASK DESCRIPTION	INITIAL	
		MECH	OTHER
	GROUND RUN		
FMS-E407-789-1	1. Perform a ground run to 100% NR to check for leaks and to confirm system operation.		

Table 5-4: SCHEDULED INSPECTION - 2400 HR

DATA REFERENCE	INSPECTION TASK DESCRIPTION	INITIAL	
		MECH	OTHER
	DATE: ___________________ W.O. ______________________ FACILITY: ____ HELICOPTER S/N: ____________________________________ REGISTRY NO.: ______________________________________ TOTAL TIME:____ SIGNATURE:____		
Honeywell Light Maintenance Manual HTS900-2-1D	<u>**GEARBOX**</u> 1. Disassemble and conduct a detailed inspection of the engine gearbox including the free-wheel clutch components.		

5.3 CONDITIONAL INSPECTIONS

5.3.1 CONDITIONAL INSPECTIONS

Perform the conditional inspections per BHT-407-MM except as noted in Tables 5-5 through 5-10 of this document

Table 5-5: CONDITIONAL INSPECTION - HARD LANDING

DATA REFERENCE	INSPECTION TASK DESCRIPTION	INITIAL MECH	OTHER
	DATE: ________________ W.O. ____________________ FACILITY: ______________________________________ HELICOPTER S/N: _________________________________ REGISTRY NO.: __________________________________ TOTAL TIME:___________________________________ SIGNATURE:____________________________________ A hard landing is any accident or incident in which the impact of the helicopter with the ground causes severe pitching of the main rotor or results in noticeable yielding or cracking of the fuselage pylon structure or the landing gear. After the hard landing: If the cabin fuselage is resting on the ground or shows signs of having touched the ground, think of it as having been exposed to loads in excess of 10 G.		
	If you think that the helicopter has had a hard landing, perform a hard landing inspection per BHT-407-MM, with the following exceptions:		
ICA-E407-789 Chapter 63	1. If the hard landing inspection reveals structural damage to the fuselage or tailboom or if metal is present on the engine chip detector, disassemble and conduct a detailed inspection of the engine gearbox including the free-wheel clutch components.		
Honeywell Light Maintenance Manual for HTS900-2-1D	2. Do engine Excessive G Inspection, Chapter 72-00-00 Table 28.		
Honeywell Light Maintenance Manual for HTS900-2-1D	3. When main and tail rotor blades come in contact with the ground or other obstacles perform Sudden Stoppage Inspection, Chapter 72-00-00 Table 29.		
	4. The freewheel inspections outlined in BHT-407-MM are no longer applicable.		
FMS-E407-789-1	5. Perform the 30 minute ground run per FMS-E407-789-1		

Table 5-6: CONDITIONAL INSPECTION - SUDDEN STOPPAGE

DATA REFERENCE	INSPECTION TASK DESCRIPTION	INITIAL MECH	OTHER
	DATE: __________________ W.O. ______________________ FACILITY: ____ HELICOPTER S/N: ___________________________________ REGISTRY NO.: _____________________________________ TOTAL TIME:_____________________________________ SIGNATURE:_______________________________________ Sudden stoppage is any fast deceleration of the main rotor drive system. This may be caused by the seizure of the transmission or by contact of the main rotor blades with the ground, water, snow, dense vegetation, or other objects of sufficient mass to cause a fast deceleration of the main rotor.		
	If a sudden stoppage has occurred, perform a **SUDDEN STOPPAGE - MAIN ROTOR – POWER- "ON "OR "OFF"** per BHT-407-MM with the following exceptions:		
Honeywell Light Maintenance Manual for HTS900-2-1D	1. Perform engine Sudden Stoppage Inspection per Chapter 72-00-00, Table 29.		
ICA-E407-789 Chapter 63	2. If the sudden stoppage has resulted in torsional yielding of the mast, disassemble and conduct a detailed inspection of the engine gearbox and replace the free-wheel clutch, inner shaft, coupling shaft and forward and aft couplings.		
ICA-E407-789 Chapter 63	3. If the sudden stoppage has resulted in engine output shaft coupling damage, disassemble and conduct a detailed inspection of the engine gearbox including the free-wheel clutch components.		
	4. The Freewheel Inspection outlined in BHT-407-MM is no longer applicable.		
FMS-407-789-1	5. Perform the 30 minute ground run per FMS-E407-789-1		

Table 5-7: CONDITIONAL INSPECTION – OVERSPEED

DATA REFERENCE	INSPECTION TASK DESCRIPTION	INITIAL MECH	INITIAL OTHER
	DATE: ________________ W.O. ____________________ FACILITY: _____________________________________ HELICOPTER S/N: ________________________________ REGISTRY NO.: _________________________________ TOTAL TIME:___________________________________ SIGNATURE:____________________________________		
	MAIN ROTOR RPM **AFTER MAIN ROTOR OVERSPEED OF 118% AND ABOVE** 1. When a main rotor overspeed of 118% and above has occurred, perform the main rotor overspeed inspection per BHT-407-MM with the exception of engine inspections.		
ICA-E407-789 Chapter 63	2. If metal is present on the engine chip detector, disassemble and conduct a detailed inspection of the engine gearbox including free-wheel clutch components.		
	GAS GENERATOR RPM		
Honeywell Light Maintenance Manual for HTS900-2-1D	**AFTER NG OVERSPEED OF 103.6% - 104.4%** 1. Record duration of each occurrence in the Engine Logbook. See Chapter 72-00-00 Table 26, Overspeed inspection for inspection requirement.		
Honeywell Light Maintenance Manual for HTS900-2-1D	**AFTER NG OVERSPEED OF 104.4% AND ABOVE** 1. Record duration and peak of each occurrence in the Engine Log Book. See Chapter 72-00-00 Table 26, Overspeed inspection for inspection requirement.		
	POWER TURBINE RPM		
Honeywell Light Maintenance Manual for HTS900-2-1D	**AFTER NP OVERSPEED OF 105% - 115%** 1. If maximum transient NP does not exceed 115.0%, perform step 3 and 5 of Overspeed Inspection Requirement, Chapter 72-00-00, Table 26.		
Honeywell Light Maintenance Manual for HTS900-2-1D	**AFTER NP OVERSPEED OF 115% AND ABOVE** 1. Record duration and peak of each occurrence in the Engine Log Book. See Chapter 72-00-00 Table 26, Overspeed inspection for inspection requirement.		

Table 5-8: CONDITIONAL INSPECTION - OVERTORQUE

DATA REFERENCE	INSPECTION TASK DESCRIPTION	INITIAL MECH	INITIAL OTHER
	DATE: __________________ W.O. ______________________ FACILITY: ____ HELICOPTER S/N: ___________________________________ REGISTRY NO.: ____________________________________ TOTAL TIME:_______________________________________ SIGNATURE:____ An overtorque is an incident in which torsional loads greater than those permitted are applied to the helicopter dynamic system		
	NOTE *The torque values given in this section are those displayed by the torque indicator. The FADEC/ECU will record torque values that are different. Refer to Chapter 76 for the relationship between these two values. To determine the engine (FADEC/ECU) torque, use the factor i.e. (Q × .8903) or (Q ÷1.123).*		
Honeywell Light Maintenance Manual HTS-900-2-1D	**AFTER OVERTORQUE — 110 TO 120%** **1.** Perform the overtorque inspection per BHT-407-MM with the exception of powerplant inspections, which should be performed per HTS900-2-1D LMM		
Honeywell Light Maintenance Manual for HTS900-2-1D	**AFTER OVERTORQUE — ABOVE 120%** 1. Perform overtorque inspection per BHT-407-MM, with the exception of powerplant and freewheel assembly inspections, which should be performed per HTS900-2-1D LMM. 2. Record duration of each occurrence in the Engine Log Book. When accumulated time reaches 2 hours (7200 seconds), perform Overtorque Inspection, Chapter 72-00-00 Table 27.		
ICA-E407-789 Chapter 63	**AFTER OVERTORQUE — 110 TO 135%** 1. If metal is present on the engine chip detector, disassemble and conduct a detailed inspection of the engine gearbox including free-wheel clutch components.		

DATA REFERENCE	INSPECTION TASK DESCRIPTION	INITIAL MECH	OTHER
ICA-E407-789 Chapter 63	**<u>AFTER OVERTORQUE — ABOVE 135%</u>** 1. Inspect output shaft couplings for damage. If distortion is noted, disassemble and conduct a detailed inspection of the engine gearbox including the freewheel clutch components. 2. Inspect engine chip detector. Re-inspect chip detector after 25 hours of operation.		

Table 5-9: CONDTIONAL INSPECTION - ENGINE COMPRESSOR STALL OR SURGE

DATA REFERENCE	INSPECTION TASK DESCRIPTION	INITIAL MECH	OTHER
	DATE: _________________ W.O. ____________________ FACILITY: ____ HELICOPTER S/N: __________________________________ REGISTRY NO.: ____________________________________ TOTAL TIME:_____________________________________ SIGNATURE:______________________________________ An engine compressor stall or surge can be described as a sharp rumble, a series of loud sharp pops, severe engine vibration, or a rapid rise in Measured Gas Temperature (MGT) depending on the severity of stall or surge. When a stall or surge is suspected, follow steps as dictated by reported conditions. 1. Obtain a pilot's report of the circumstances related to the suspected compressor stall or surge to determine if it corresponds to one of the following conditions: • If the stall or surge occurred on the ground or in flight at any NR speed or torque setting and there was no noticeable yaw of the helicopter, do Part I and Part II of this inspection. • If the stall or surge occurred on the ground or in flight at any NR or torque setting and there was a noticeable yaw of the helicopter, do Part I, Part II, and Part III of this inspection.		
Honeywell Light Maintenance Manual for HTS900-2-1D	**PART I: INVESTIGATE CAUSE OF COMPRESSOR STALL OR SURGE** 1. Do boroscope inspection of the engine compressor per Chapter 72-00-00, Table 30. 2. Perform Engine Troubleshooting (Engine Surges on Acceleration) per Chapter 72-00-00, Table 39. **PART II: INSPECTION FOR COMPRESSOR STALL OR SURGE WITHOUT NOTICEABLE YAW** 1. Perform Inspection for compressor stall or surge without noticeable yaw per BHT-407-MM. **PART III: INSPECTION FOR COMPRESSOR STALL OR SURGE WITH NOTICEABLE YAW** 1. Perform Inspection for compressor stall or surge with noticeable yaw per BHT-407-MM		

DATA REFERENCE	INSPECTION TASK DESCRIPTION	INITIAL MECH	OTHER
	2. Perform the 30 minute ground run per FMS-E407-789-1 3. Inspect engine chip detector. Re-inspect chip detector after 25 hours of operation.		

Table 5-10: CONDITIONAL INSPECTION - LIGHTNING STRIKE

DATA REFERENCE	INSPECTION TASK DESCRIPTION	INITIAL MECH	OTHER
	DATE: __________________ W.O. ______________________ FACILITY: ____ HELICOPTER S/N: ____________________________________ REGISTRY NO.: ______________________________________ TOTAL TIME:____ SIGNATURE:____ Because lightning behavior is difficult to predict, do a full inspection of the helicopter. Lightning damage can show as burn marks, heat discoloration, arc marks, or a small weld marks (where the metal has melted and become solid again). Honeycomb and other composite materials may show signs of delamination.		
	When a lightning strike has occurred, perform the AFTER LIGHTNING STRIKE inspection per BHT-407-MM with the following exceptions:		
Honeywell Light Maintenance Manual for HTS900-2-1D	1. Perform Engine Lightning Strike Inspection per Chapter 72-00-00, Table 31.		
ICA-E407-789 Chapter 63	2. If inspection reveals arc burns on the gearbox assembly, tail rotor driveshaft, engine mounts or engine ground straps, disassemble and conduct a detailed inspection of the engine gearbox including the free-wheel clutch components.		
	3. The Freewheel Inspection outlined in BHT-407-MM is no longer applicable		

5.4 COMPONENT INTERIM INSPECTION SCHEDULE

5.4.1 COMPONENT INTERIM INSPECTION SCHEDULE

The Component Interim Inspection Schedule (Table 5-4) of BHT-407-MM applies to the helicopter components with the exception of freewheel inspection schedule.

The freewheel unit will be inspected per the Honeywell Light Maintenance Manual HTS900-2-1D.

5.4.2 COMPONENT OVERHAUL SCHEDULE

The Component Overhaul Schedule (Table 5-5) of BHT-407-MM applies to the helicopter components with the exception of parts listed on Table 5-11 of this document.

Table 5-11: Component Overhaul Schedule

NOMENCLATURE	PART NUMBER 1	OVERHAUL INTERVAL (HOURS)
DRIVE SYSTEM		
Rotor Brake Disc	E4126-1	3000 hours
POWER PLANT		
Engine	4-007-000-03	Refer to Honeywell Light Maintenance Manual HTS900-2-1D

NOTES:

1 The operating time specified for overhaul of any given part number listed applies to all successive dash numbers for that component, unless otherwise specified.

Chapter 06
DIMENSIONS AND AREAS
(06-00-00)

REFER TO
BHT-407-MM

Chapter 07
LIFTING AND JACKING
(07-00-00)

REFER TO
BHT-407-MM

Chapter 08
WEIGHT AND BALANCE
(08-00-00)

REFER TO
BHT-407-MM

Chapter 09
TOWING
(09-00-00)

REFER TO
BHT-407-MM

Chapter 10
PARKING, MOORING AND STORAGE
(10-00-00)

REFER TO
BHT-407-MM

Chapter 11
Placards and Markings
(11-00-00)

CHAPTER 11 — PLACARDS AND MARKINGS

Contents

11.1 PLACARDS AND MARKINGS

11.1.1 PLACARDS AND MARKINGS

The placards, markings, and stencils applicable to the internal and external surfaces of the Model 407 helicopter are shown in Figure 11-1. Refer to IPC-E407-789 to find the full part numbers and the quantities required.

The procedures given in paragraph 11-2 are for the application of pressure-sensitive (adhesive-backed) decals to internal and external surfaces of the helicopter.

11.1.2 APPLICATION OF DECALS

MATERIALS REQUIRED
Refer to BHT-ALL-SPM for specifications.

NUMBER	NOMENCLATURE
C-210*	Epoxy Coating
C-233**	Polyurethane Enamel
C-245***	Polyurethane Coating
C-305	Aliphatic Naphtha
C-306	Toluene
C-349	Edge Sealer
C-385	Isopropyl Alcohol
C-426	Masking Tape
C-516	Clean Cloth

NOTES:

*Use color code 37925 (white) per FED-STD-595.

**Use color code 11136 (red), 17875 (white), and 37038 (black) per FED-STD-595.

***Use color code 17038 (black) per FED-STD-595.

NOTE
Bonding surfaces must be non-porous.

1. Remove dirt, grease, wax, or other contaminants from the surfaces to be bonded as follows:
   a. For non-metallic and painted surfaces, clean with a clean cloth moistened with aliphatic naphtha (C-305). Dry the surfaces with a clean cloth (C-516) before the aliphatic naphtha (C-305) evaporates.

CAUTION

DO NOT ALLOW TOLUENE (C-306) TO MAKE CONTACT WITH PAINTED OR NON-METALLIC SURFACES OR DAMAGE TO THE SURFACE MAY OCCUR.

   b. For bare metal surfaces, clean with a clean cloth (C-516) moistened with toluene (C-306). Dry the surfaces with a clean cloth (C-516) before the toluene evaporates.

2. Apply the pressure-sensitive (adhesive-backed) decal to the bonding surface as follows:
   a. Apply the decal at temperatures above 60°F (16°C) for best results. Otherwise, first apply solvent (refer to the manufacturer's instructions) or isopropyl alcohol (C-385) to the decal.
   b. Remove the adhesive protection from one edge of the decal with a quick smooth movement.

c. Carefully align the decal in the correct position.

d. Put the peeled edge of the decal on the edge of the bonding surface and apply firm pressure with your finger along the same edge.

NOTE

For application of large decals, use a plastic squeegee with firm pressure.

e. While you continue to remove the adhesive protection, apply finger pressure to the remaining part of the decal until the entire decal is applied. For best results, hold the opposite edge away from the surface until the entire decal is applied.

f. Make sure there are no air bubbles trapped under the decal. Otherwise, make a hole in the bubble with a pin and press with your finger or a squeegee to remove the air.

3. Edge seal or fully coat the decal with the applicable coating as follows:
   a. Apply masking tape (C-426) 1/8 inch (3 mm) away from the edge and all around the decal.

NOTE

A clear polyurethane enamel (C-233) may be used to seal decals applied to all types of exterior finishes.

   b. For the sealing of exterior decals, apply the same material used for the exterior painting. For example, if the exterior paint is polyurethane enamel, then use a clear polyurethane enamel (C-233).

   c. For the sealing of interior decals, apply a clear edge sealer (C-349).

   d. Remove the masking tape (C-426) from around the decal when the coating is dry.

11.1.3 INSTRUMENT PANEL PLACARDS AND MARKINGS

Put the placards and markings on the instrument panel as shown in Figure 11-1 and refer to the Flight Manual Supplement (FMS-E407-789-1) for correct configuration.

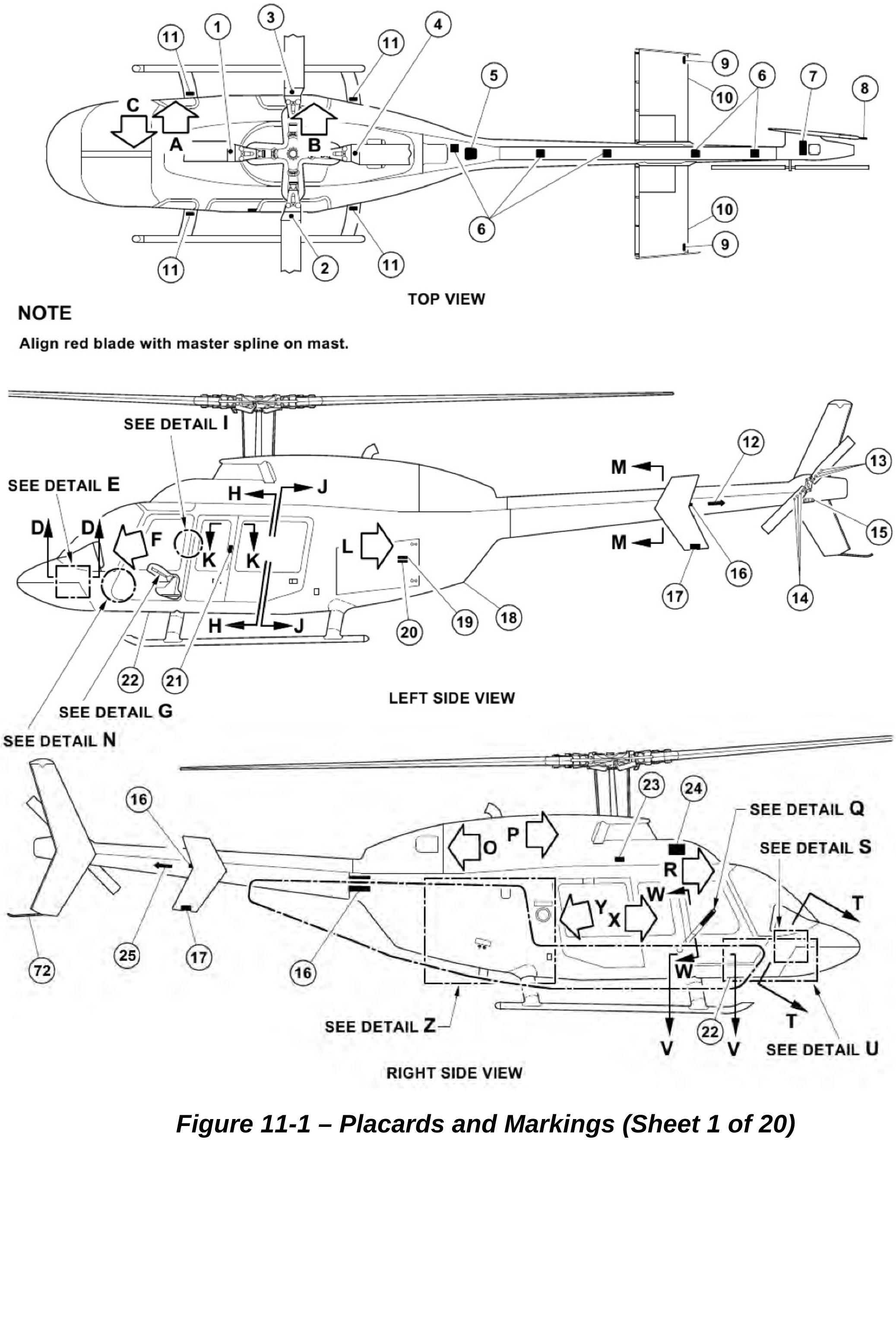


Figure 11-1 – Placards and Markings (Sheet 1 of 20)

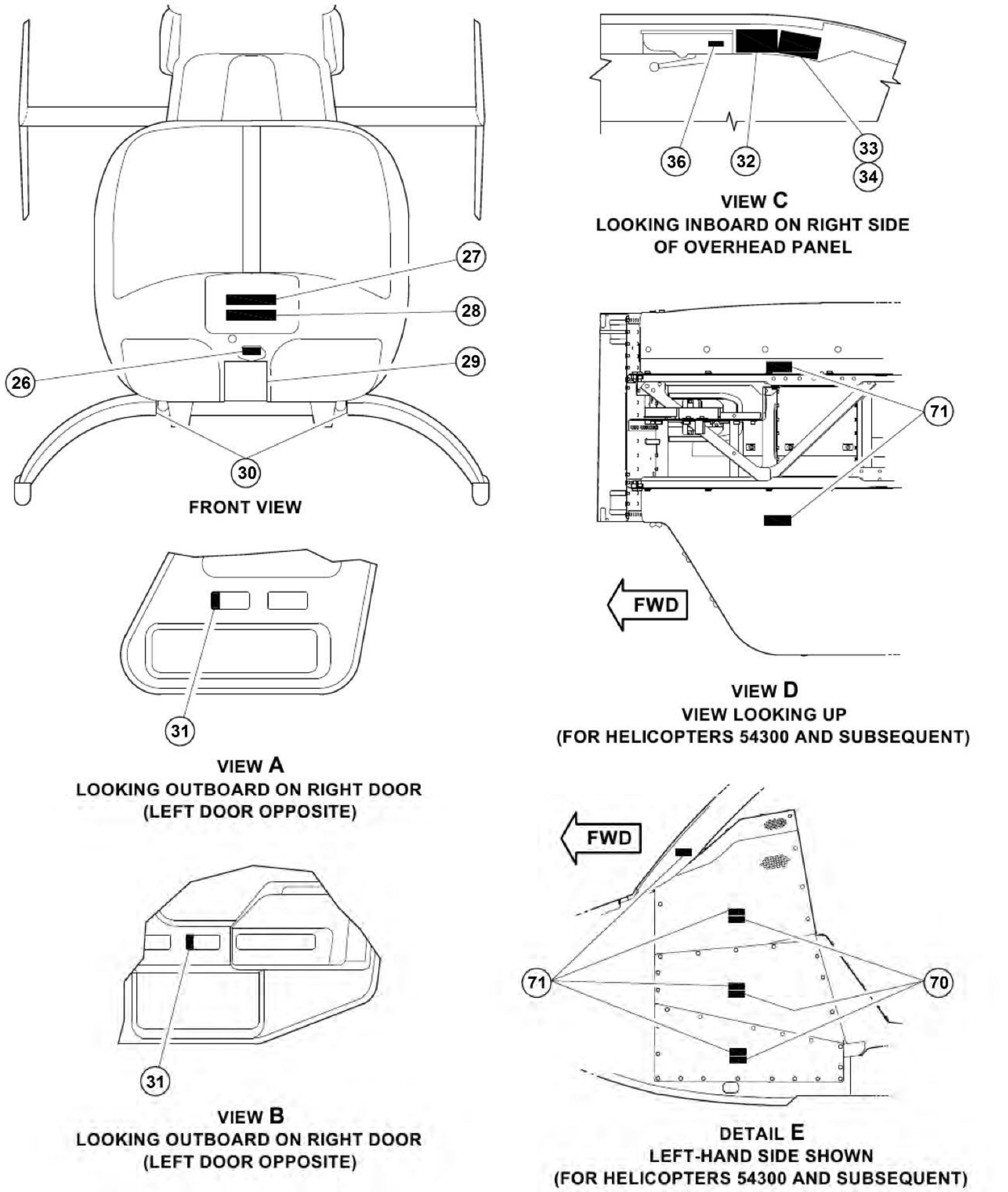
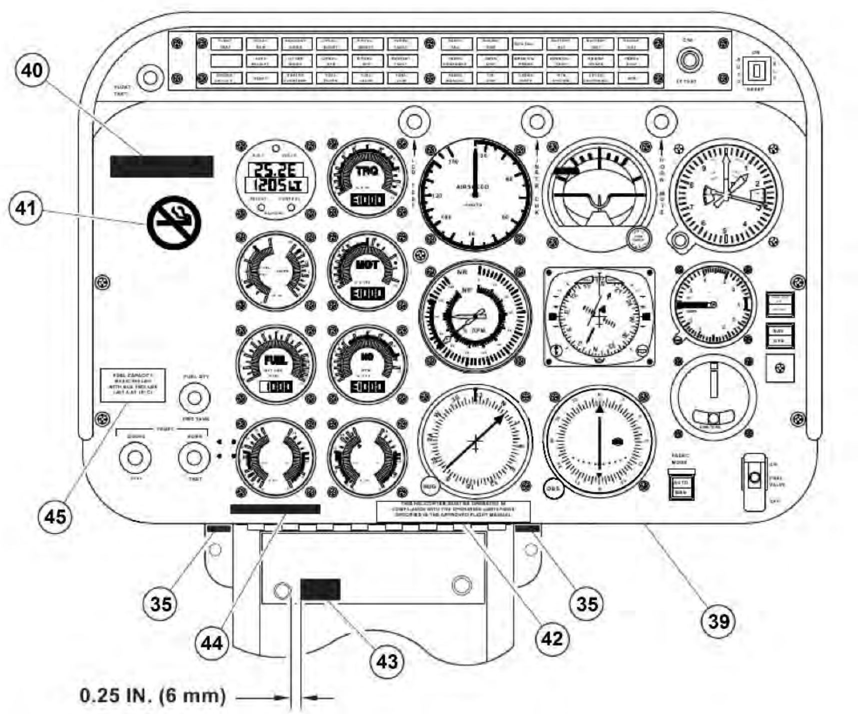


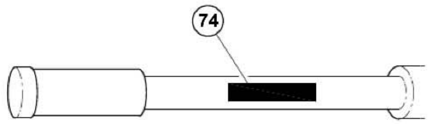
Figure 11-1 – Placards and Markings (Sheet 2 of 20)



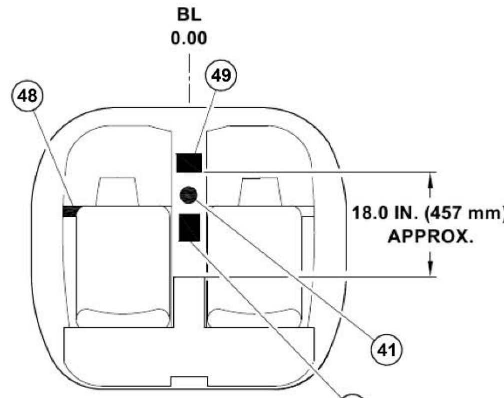
NOTE

Refer to the Flight Manual (BHT-407-FM-1 or BHT-407-FM-2) for correct configuration.

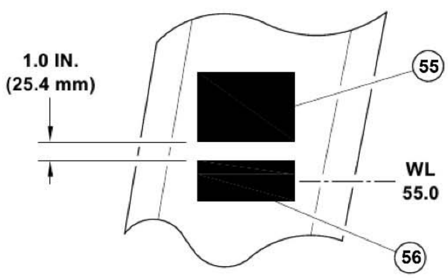
Figure 11-1 – Placards and Markings (Sheet 3 of 20)



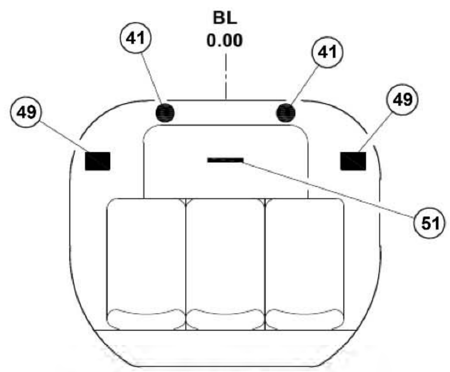
DETAIL G
DUAL CONTROL ONLY



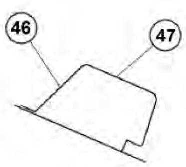
VIEW H
LOOKING FORWARD ON AFT FACING SEATS



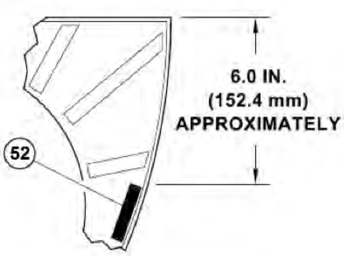
DETAIL I
LOOKING OUTBOARD ON LEFT-HAND SIDE



VIEW J
LOOKING AFT ON AFT ROW SEATS



VIEW K
VIEW THROUGH LITTER DOOR TRIM ON LEFT SIDE
(RIGHT SIDE OPPOSITE EXCEPT THROUGH FIXED TRIM)



VIEW L
LOOKING AFT ON BULKHEAD

Figure 11-1 – Placards and Markings (Sheet 4 of 20)

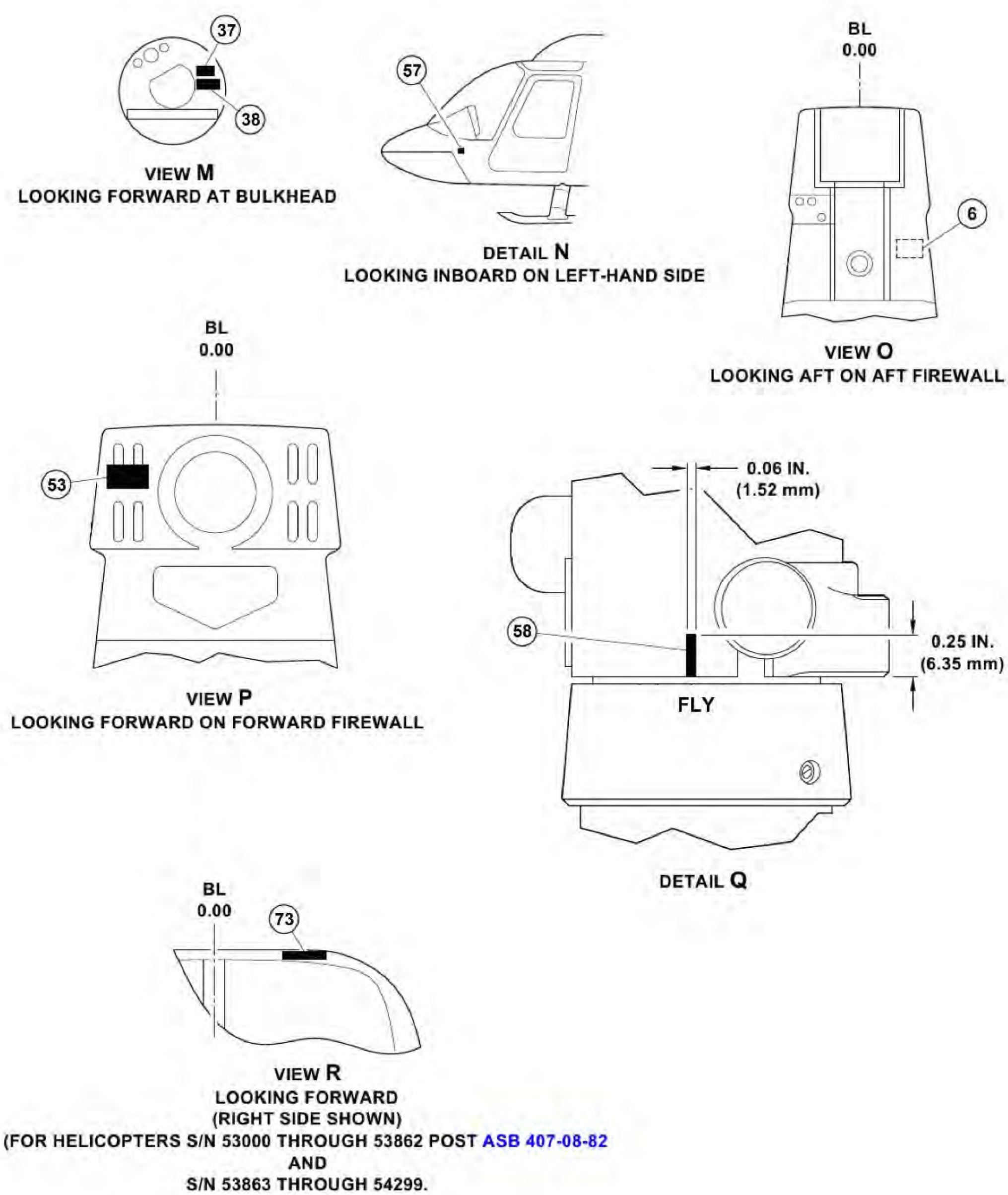


Figure 11-1 – Placards and Markings (Sheet 5 of 20)

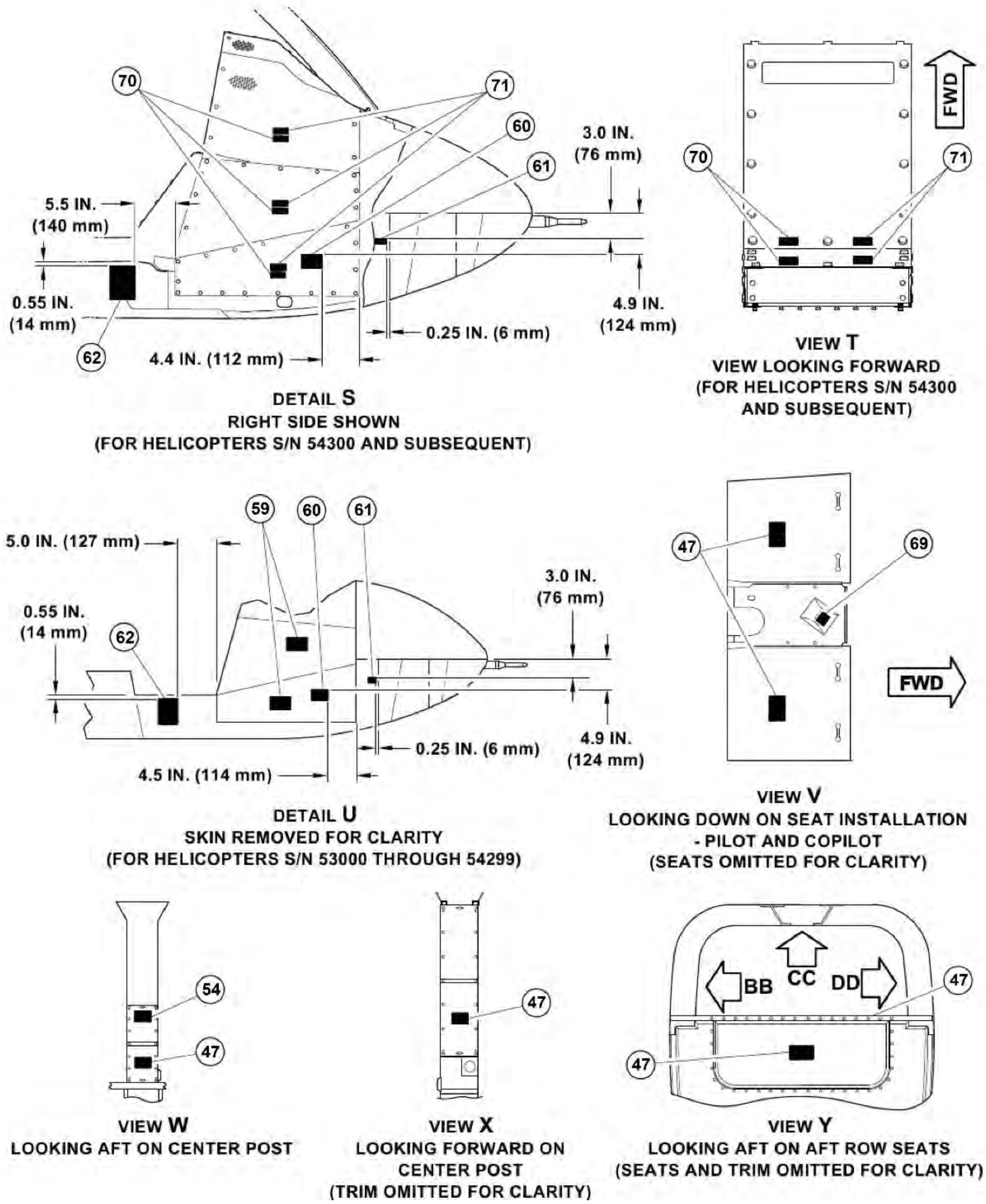


Figure 11-1 – Placards and Markings (Sheet 6 of 20)

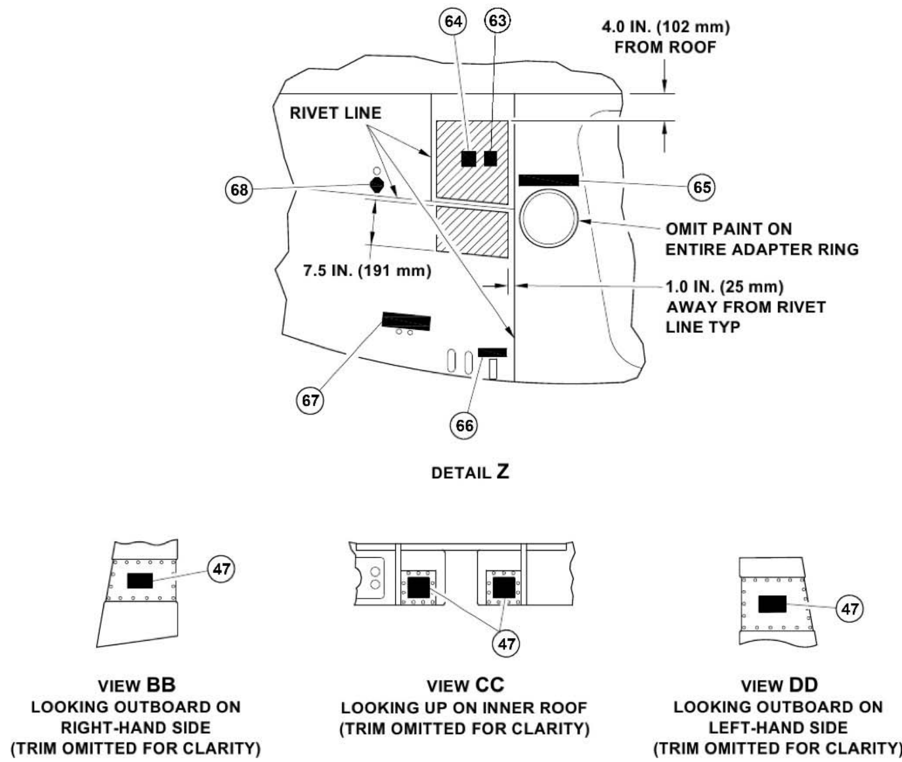
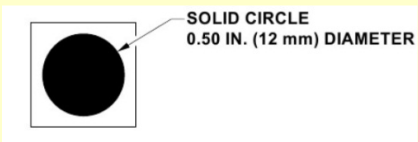
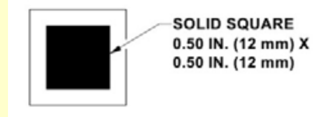


Figure 11-1 – Placards and Markings (Sheet 7 of 20)

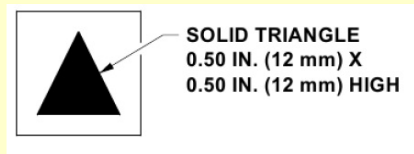
1) 31-018-13 Decal “Blue Diamond”, 7 required. Locate on upper and lower blade surfaces. Upper and lower yoke surfaces. Pitch change adaptor to correspond with pitch link, pitch link to correspond with blade yoke and pitch change adaptor. Upper outer swashplate surface to correspond with pitch link. (Locate in a conspicuous place on each part).



2) 31-018-10 Decal Green Circle”, 7 required. Locate on upper and lower blade surfaces. Upper and lower yoke surfaces. Pitch change adaptor to correspond with pitch link. Pitch link to correspond with blade yoke and pitch change adaptor. Upper outer swashplate surface to correspond with pitch link. (Locate in a conspicuous place on each part).



3) 31-018-11 Decal Orange Square”, 7 required. Locate on upper and lower blade surfaces. Upper and lower yoke surfaces. Pitch change adaptor to correspond with pitch link. Pitch link to correspond with blade yoke and pitch change adaptor. Upper outer swashplate surface to correspond with pitch link. (Locate in a conspicuous place on each part).



NOTE: Align red blade with master spline on mast.

4) 31-018-12 Decal “Red Triangle”, 7 required. Locate on upper and lower blade surfaces. Upper and lower yoke surfaces. Pitch change adaptor to correspond with pitch link. Pitch link to correspond with blade yoke and pitch change adaptor. Upper outer swashplate surface to correspond with pitch link. (Locate in a conspicuous place on each part).

Figure 11-1 - Placards and Markings (Sheet 8 of 20)

5) E4696-3. 2 required. Locate on inside of access door and on top of oil tank.

6) 31-116-1 Decal, 6 Required. Locate in close proximity to the hanger bearing supports. (Helicopters S/N 5300 through 53579 post ASB 407-04-63 and S/N 53580 and subsequent.

7) 31-045-22DHP Decal. Locate approximately as shown.

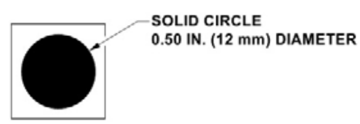
8) 31-053-18CFHP Decal. Locate on top of tail skid

9) 31-053-18CFHP Decal. Locate on near side.

10) 31-053-1DFHP Decal. Locate on far side

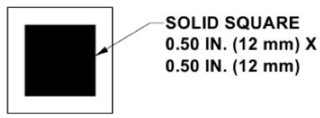
11) 31-053-18CFHP Decal. Locate on crosstube fairings.

12) 31-075-1 Decal. Left-hand side, centerline of tailboom



13) 31-018-10 Decal "Green Circle" 5 required. Locate on blade, pitch link, hub and supports, Chinese counterweight. (Locate in a conspicuous place on each part).

Figure 11-1 – Placards and Markings (Sheet 9 of 20)



14) 31-018-11 Decal "Orange Square" 5 required. Locate on blade, pitch link, hub and supports, Chinese counterweight. (Locate in a conspicuous place on each part).

STRUCTURAL PANEL
REQUIRED GROUND
RUN AND FLIGHT

15) 31-055-1DMHP Decal, 2 required. Locate one on inner side of door or panel and on outside of opening on adjacent structure in a clearly visible location under fairing trim line.

STRUCTURAL PANEL
REQUIRED GROUND
RUN AND FLIGHT

16) 31-055-1DMHP Decal, 6 Required. Locate one on inner side of door or panel and one on inside opening on adjacent structure in a clearly visible location.

NO PUSH

17) 31-053-1DFHP Decal. Locate on lower near side of aux fin.

JACK AND MOORING

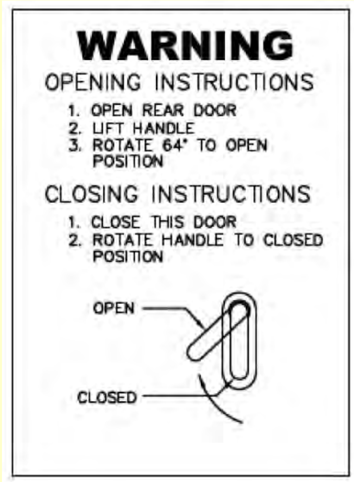
18) 31-053-8DFHP Decal. Locate near aft Jack and mooring point.

MAXIMUM ALLOWABLE WEIGHT 250 LBS.
MAXIMUM ALLOWABLE WEIGHT PER SQ. FT. 86 LBS.

19) 31-043-4CHP Decal. Locate on inside of baggage compartment door.

CARGO MUST BE SECURED
IN ACCORDANCE WITH
FLIGHT MANUAL INSTR

20) 206-070-619-101 Stencil, color black, No. 17038 per FED STD 595. Locate on inside of baggage compartment door. (Helicopters S/N 53000 through 53514). 31-030-170G48 Decal (Helicopters S/N 53515 and subsequent).



21) 206-072-630-103 Decal. Locate above litter door handle

Figure 11-1 – Placards and Markings (Sheet 10 of 20)

22) 31-053-8DFHP Decal. Locate near forward jack and mooring point.

23) 31-045-22DHP Decal. Locate on Transmission in area of filler cap.

24) 31-053-18FHP Decal. Locate on top of FADEC.

25) 31-075-2 Decal, Right-hand side centerline of tailboom.

26) 31-026-2A24 Decal. Locate on Access door.

27) No Longer Applicable

28) No Longer Applicable

29) 31-043-149EHP Decal. Locate in landing light compartment on visible area next to ballast plates.

30) Paint inboard side of navigation light shields Color Black No. 37038 per FED STD 595.

31) 31-062-10DFK Decal, 4 required. Locate approximately as shown.

Figure 11-1 – Placards and Markings (Sheet 11 of 20)

407 (5250LB) AIRSPEED LIMITATIONS-KNOTS-IAS											
OAT	PRESSURE ALTITUDE FT X 1000										
C°	0	2	4	6	8	10	12	14	16	18	20
52	137	-	-	-	-	-	-	-	-	-	-
45	139	132	123	-	-	-	-	-	-	-	-
40	140	133	125	113	-	-	-	-	-	-	-
35	140	135	128	116	104	-	-	-	-	-	-
30	140	137	129	118	106	99	-	-	-	-	-
25	140	138	131	121	109	100	93	86	-	-	-
20	140	140	133	124	112	102	94	87	80	-	-
0	140	140	140	132	123	111	101	94	86	79	-
-25	140	140	140	135	130	125	114	102	95	88	80
-40	137	133	128	123	118	114	110	105	101	93	86
MAXIMUM AUTOROTATION VNE 100 KIAS											

32) 407-070-201-129 Decal. (Helicopters S/N 53000 through 53399 post ASB 407-99-33 and S/N 53400 and subsequent). Locate adjacent to 407-070-201-125 or 407-070-201-127 for helicopters with increased internal gross weight kit only. For helicopters with dual controls kit, locate one additional decal on left side of overhead panel.

33) No Longer Applicable

34) No Longer Applicable

Figure 11-1 – Placards and Markings (Sheet 12 of 20)

VENT

35) 206-070-670-001 Decal. Locate as shown, 2 required.

DO NOT APPLY ROTOR BRAKE
ABOVE 40% RPM

36) 204-076-336-001 Decal. Locate approximately as shown on right-hand side of trim panel. For helicopters with rotor brake only.

MAXIMUM ALLOWABLE
BALLAST MIDBOOM
20 POUNDS

37) 31-044-19EHF Decal. Locate on aft bulkhead.

BALLAST STACK UP
NOT TO EXCEED
.50 INCH

38) 31-044-44EHF Decal. Locate on aft bulkhead.

ADF INDICATION/AUDIO OUTPUT UNRELIABLE
FOR ADF FREQUENCIES BELOW 400 KHZ
WHEN AIR CONDITIONING IS ON

39) 407-075-014-107 Decal Locate as shown. For helicopters with Aircomm air conditioning only.

ELT TO BE USED FOR
AVIATION EMERGENCY ONLY
UNAUTHORIZED
OPERATION PROHIBITED

40) 407-075-014-101 Decal. Locate as shown. For Canadian registered helicopters with ELT only.

Figure 11-1 – Placards and Markings (Sheet 13 of 20)

41) 31-084-1 Decal, 4 required. Locate approximately as shown.

THIS AIRCRAFT IS EQUIPPED WITH A HONEYWELL HTS900-2-1D ENGINE AND IS APPROVED FOR DAY/NIGHT VFR OPERATIONS ONLY. SEE EAGLE COPTERS LTD FLIGHT MANUAL SUPPLEMENT FMS-E407-789-1 FOR MODIFIED OPERATING LIMITATIONS, PROCEDURES AND PERFORMANCE DATA. E4696-5

42) E4696-5 Locate on bottom and center on Panel

RADIO CALL

43) 100-029-1 Plate, radio call. Locate approximately as shown. Adhesive (C-308) or tape (C-148). Engrave with radio call number.

GPS LIMITED TO VFR USE ONLY

44) 407-075-014-103 Decal. Locate as shown. For helicopters with KLN 89B GPS only.

FUEL CAPACITY
BASIC 869 LBS
WITH AUX 1005 LBS
(JET A AT 15°C)

45) 31-045-23RGJ Decal. Locate as shown.

TAKEOFF AND LANDING
HEAD REST MUST BE IN
UP POSITION

46) 31-044-17EJP Decal, 2 required. Locate central on face shown.

STRUCTURAL PANEL
REQUIRED GROUND
RUN AND FLIGHT

47) Decal, 21 required. Locate on exposed side of door or panel and one adjacent structure in clearly visible location.

Figure 11-1 – Placards and Markings (Sheet 14 of 20)

STRUCTURAL SUPPORT MUST BE INSTALLED IN THE UPPER POSITION OR LOWER POSITION FOR FLIGHT

48) 31-054-54DKHF Decal. Locate centrally on support assembly. For helicopters with litter only.

49) 100-149-1 Decal, 3 required. Locate on flat area approximately as shown.

TO MANUALLY ACTIVATE THE ELT SWITCH LOCATED AT THE TOP RIGHT HAND SIDE OF INSTRUMENT PANEL MOVE SWITCH TO THE "ON" POSITION.
ELT IS LOCATED AT THE LEFT HAND FORWARD CREW SECTION.

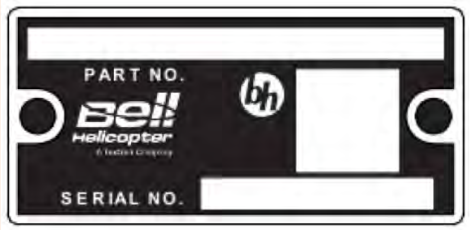
POUR ACTIVER MANUELLEMENT LE "ELT" PLACER L'INTERRUPTEUR LOCALISE DANS LA PARTIE SUPERIEURE DROITE DU TABLEAU DE BORD A LA POSITION "ON".
LE "ELT" EST SITUE DANS LA SECTION GAUCHE AVANT DU POSTE DE PILOTAGE.

50) 407-075-014-105 Decal, locate as shown. For Canadian registered helicopters with ELT only.

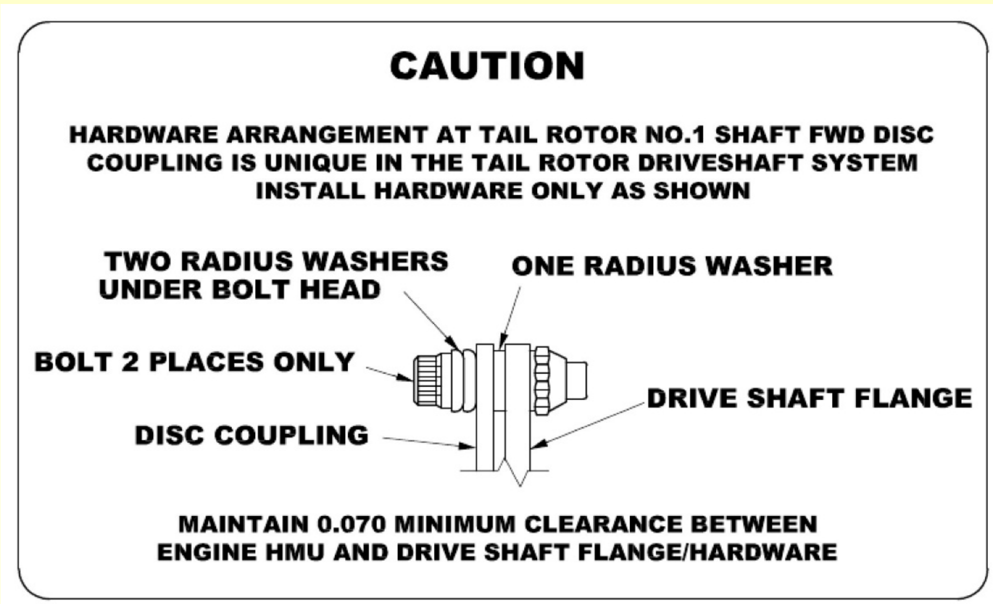
SOFT GOODS ONLY

51) 206-072-626-101 Decal. Locate in center of hat bin.

Figure 11-1 – Placards and Markings (Sheet 15 of 20)

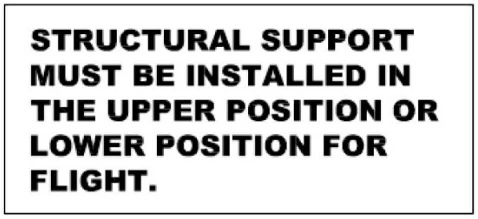


52) Plate, serial number, part number, name. Locate lower edge of plate outboard. This part not procurable and part number is not provided.

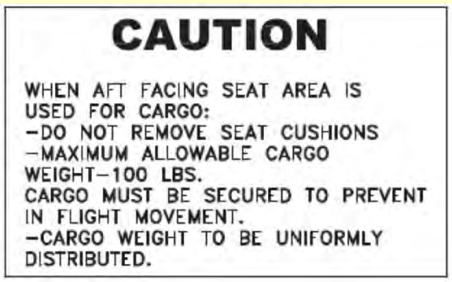


53) 31-095-1 Decal. Locate as shown

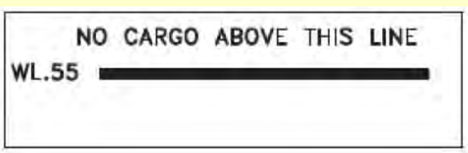
Figure 11-1 – Placards and Markings (Sheet 16 of 20)



54) 31-064-7TKHF Decal. Locate centrally on cover assembly. For helicopters with litter only.



55) 206-072-338-103 Decal, 2 required. Locate as shown. One each side of control tunnel. For helicopters with cargo tiedown only.



56) 206-072-338-101 Decal, 2 required. Locate as shown. One each side of control tunnel. For helicopters with cargo tiedown only.

57) 407-075-014-105 Decal, Install on interior plastic between door post and chin bubble. For Canadian registered helicopters with ELT only.

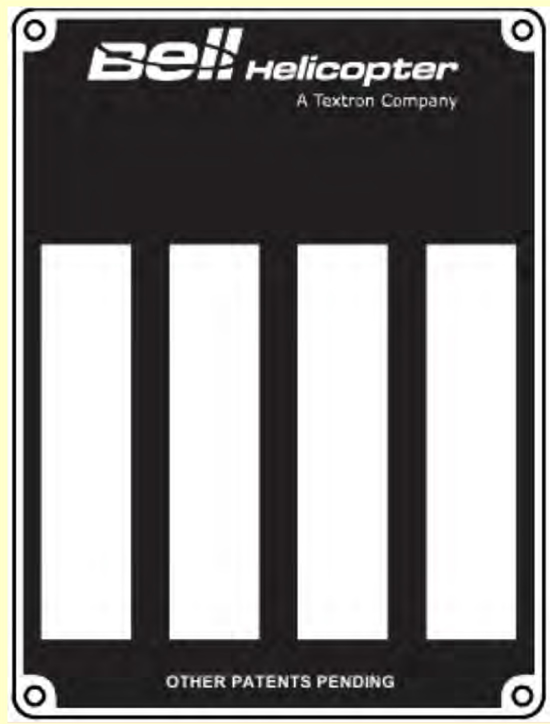
58) Marking, adjust throttle to fly position (refer to Chapter 76 Throttle/Fly Detent Rigging Procedure). Mark 0.06 in (1.5 mm) wide x 0.25 in (6mm) long. Mark to align with fly throttle marking on Ferrule E4514-041. Apply epoxy coating (C-210), Colour White No. 37925 per FED-STD-595.

Figure 11-1 – Placards and Markings (Sheet 17 of 20)

59) 31-055-1DMHP Decal, 8 required. Locate one on exposed side of door panel and one on adjacent structure in a clearly visible location. Left-hand side opposite.

60) Plate, company name. This part not procurable and part number is not provided.

61) Plate, serial number, part number, name. This part is not procurable and part number is not provided.

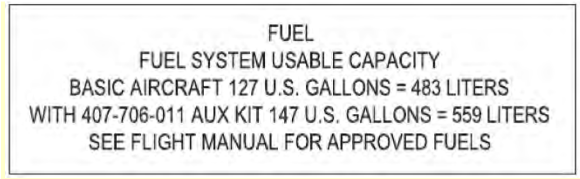


62) Plate, Patent. This part not procurable and part number is not provided.

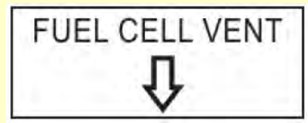
Figure 11-1 – Placards and Markings (Sheet 18 of 20)

63) E4696-1 Mod Plate. Locate in either shaded area shown.

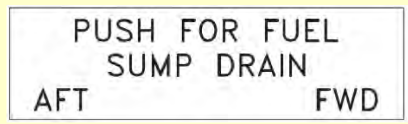
64) Ident plate. Locate in either shaded area shown. This part not procurable and part number is not provided.



65) 31-064-6DFHP Decal. Locate above fuel filler cap.

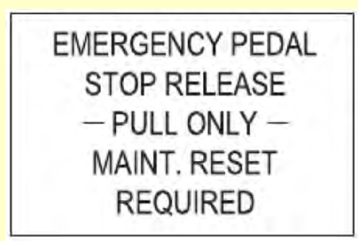


66) 31-123-1CFHP Decal. Centered above vent so that arrow is pointing at fuel cell vent tube.



67) 31-055-11DFHP decal. Centered above switches.

68) 31-087-1 Decal. Centered below ground receptacle.



69) 427-001-296-119 Decal. Between pilot and co-pilot seats.

Figure 11-1 – Placards and Markings (Sheet 19 of 20)

STRUCTURAL PANEL REQUIRED GROUND RUN AND FLIGHT

70) 31-055-1DMHP Decal, 16 Required. Locate one on exposed side of door or panel and one on adjacent structure in clearly visible location.

HIRF / LIGHTNING PROTECTION PART REQUIRED FOR FLIGHT

71) 31-055-18TMHP Decal, 11 required. Locate approximately as shown.

72) Paint stripes.

73) Identification No. Stencil

NO STEP

74) 31-053-18DFHP Decal. Locate as shown. (For helicopters with 407-706-702-103, -105, -107, -109, -113, or -115 dual control kit only.)

Outside Air Temperature, °F (°C)	5 (-15) and above	0 (18)	-4 (-20)	-13 (-25)	-22 (-30)	-31 (-35)	-40 (-40)
Modified Ng Takeoff Limit, Percent of 100% Ng	Observe takeoff and maximum continuous speed limits	103.6	103.1	102.1	101.0	100.0	98.9

75) E4696-7 OAT - Ng LIMITATIONS PLACARD

Paint stripes. 4.0 inches (101mm wide, alternating polyurethane enamel (C-233) color code 11136 (red) and 17875 (white) per FED-STD-595.

Figure 11-1 – Placards and Markings (Sheet 20 of 20)

Chapter 12
SERVICING
(12-00-00)

CHAPTER 12 — SERVICING

Contents

12.1 SERVICING

12.1.1 SERVICING – GENERAL

This chapter contains the data required to service the helicopter.

Table 12-1, Table 12- ***2***, and Table 12- ***3*** contain the list of the recommended servicing intervals for fuel, oil, filter, grease lubrication, and miscellaneous servicing. The intervals given are the maximum permitted intervals under normal operation of the helicopter. Do not exceed these intervals unless stated otherwise. It may be necessary to increase the frequency of these intervals if the helicopter operates in extreme environmental conditions. Refer to the specific instructions and figures in this chapter for servicing and lubrication procedures. For data on the consumable materials, refer to the BHT-ALL-SPM.

For specific information on fuels, oils, and fluids, refer as required to FMS-E407-789-1.

12.1.2 SERVICING TOLERANCE

CAUTION

DO NOT APPLY THESE TOLERANCES IF THE HELICOPTER IS OPERATED IN EXTERME ENVIRONMENTAL CONDITIONS REQUIRING AN INCREASED FREQUENCY OF SERVICING OTHERWISE, DAMAGE TO THE PARTS MAY OCCUR.

The Bell Helicopter Textron approved tolerance for Chapter 12 servicing intervals, unless otherwise stated, is 10% of the specified hourly or calendar time interval, whichever is less. The tolerances are established for maintenance scheduling convenience only.

Servicing intervals required beyond the stated tolerances must be approved by Product Support Engineering.

NOTE

The following is only applicable for those operators whose governing aviation authority requires to specifically approve the servicing tolerance.

If approval of the servicing tolerance is required by the applicable governing aviation authority, this is the responsibility of the owner/operator.

Refer to the Honeywell Light Maintenance Manual for HTS900-2-1D for servicing tolerances.

12.1.3 ACCESS PANELS, DRAINS, AND SIGHT GAUGES

Figure 12-1 and Figure 12-2 show the location of all the access panels, drains, and sight gauges required for servicing the helicopter. For the location of other panels required for maintenance access, refer to Chapter 53

Table 12-1: Fuel and Filters Intervals

INTERVALS (HOURS)	COMPONENT	TYPE OF FUEL	CAPACITY
N/A	Fuel Cells	Turbine Fuel (C-003)	129.7 gallons (492.0 L)
300 Hours	Airframe Fuel Filter	N/A	N/A
Refer to Honeywell Light Maintenance Manual for HTS-900-2-1D	Engine Fuel Filter	N/A	N/A

Table 12- 2: Grease Lubrication Intervals

INTERVALS (HOURS/MONTHS)[1]	COMPONENT	TYPE OF GREASE
25 Hours [4]	406-040-339-ALL Tail Rotor Driveshaft Hanger Bearings	Grease (C-001), Mobil 28 Only [5]
300 Hours [4 8]	407-340-339-107 Tail Rotor Driveshaft and Oil Cooler Blower Hanger Bearings	Grease (C-001), Mobil 28 Only [5]
50 Hours/ 3 Months [2 3 4]	Swashplate Bearings (2 Places)	Grease (C-001)
50 Hours/ 3 Months [2 3 4]	Pitch Change Link Bearing (4 Places)	Grease (C-001)
100 Hours [4 10]	Tail Rotor Driveshaft Splines (2 Places)	Grease (C-525) or grease (C-561)
300 Hours [4]	Hydraulic Pump Drive	Grease (C-525) or grease (C-561)
300 Hours/ 3 Months [4]	Tail Rotor Pitch Change Mechanism (2 Places)	Grease (C-001)
600 Hours/ 12 Months [9]	Expandable Blade Bolts (2 Place)	Grease (C-561)
6 Months [4]	Ground Handling Wheel (2 Places)	Grease (C-001)
25 Hours or as required [4 7 11]	Litter Door Seal	Lubricant (C-018)

Notes:

1. Do the servicing at the interval that comes first
2. If the helicopter is parked outside in a heavy dew environment, purge lubricate all exposed control bearings every 7 days to make sure that are no air pockets that could trap moisture.

3. After each day of operation in rain or snow, or after washing the helicopter, purge to remove any trapped moisture and to make sure lubrication film is applied to any exposed, unprotected surface.

4. Specified interval or whenever a new component is installed

5. WARNING: THIS BEARING HAS A BROWN ELASTOMER SEAL. MIXING GREASE (C-001) MOBIL 28 WITH LUBRICANT (C-026) OR ANY OTHER GREASE, WILL DAMAGE THE BEARING. THE BEARING MUST BE SCRAPPED IF GREASES HAVE BEEN MIXED.

6. WARNING: THIS BEARING HAS AN ORANGE ELASTOMER SEAL. MIXING GREASE (C-001) MOBIL 28 WITH LUBRICANT (C-026) OR ANY OTHER GREASE, WILL DAMAGE THE BEARING. THE BEARING MUST BE SCRAPPED IF GREASES HAVE BEEN MIXED.

7. Applicable to S/N 53000 through 53169 Post TB 407-98-11 and S/N 53170 through 54061. It is recommended that lubricant (C-018) be applied every 25 hours. If required, application of lubrication may be extended to next inspection interval to accommodate maintenance scheduling.

8. As applicable to S/N 53000 through 53518, ASB 407-02-54 “OIL COOLER INLET AIRFLOW – IMPROVEMENTS TO” shall have been accomplished to coincide with 300 hour oil cooler blower hanger bearing lubrication interval. Also applicable to S/N 53519 and subsequent.

9. The lubrication procedure is a part of the 600-hour/12-month inspection (BHT-407-MM-6, Chapter 62)

10. Interval may be extended to 150 hours, provided TB 407-02-35, Part IV-B has been accomplished.

11. Helicopters S/N 53000 through 54061 Post TB 407-11-94 and S/N 54062 and subsequent do not require lubrication and ae therefore not affected by this recurrent lubrication interval.

Table 12- 3: Oil and Lubricants

INTERVALS (HOURS/ MONTHS) [1]	COMPONENT	TYPE OF OIL	CAPACITY
12 Months	Oil/Ground Handling Wheel Hydraulic Cylinder	Hydraulic Fluid (C-002) Red	0.07 Pints (0.033 Liters)
Refer to Honeywell Light Maintenance Manual for HTS900-2-1D	Oil/Engine	Lubricating Oil [2]	7.0 Quarts (6.62 Liters)
300 Hours/12 Months	Oil/Transmission	Lubricating Oil [2]	6.0 Quarts (5.68 Liters)
300 Hours/12 Months	Oil/Tail Rotor Gearbox	Lubricating Oil [2]	0.33 Quart (0.31 Liters)
300 Hours/12 Months [3]	Filter/Hydraulic	N/A	N/A
300 Hours/12 Months [4]	Filter/Transmission	N/A	N/A
300 Hours/12 Months	Oil/Hydraulic	Hydraulic Fluid Red [2]	1.68 Quarts (1.59 Liters)

NOTES:

1. Do the servicing at the interval that comes first.
2. Refer to the Flight Manual (FMS-E407-789-1) for the approved oils.
3. Refer to Chapter 29 for inspection and cleaning procedures.
4. Refer to Chapter 63 for the removal, inspection, and installation procedures.

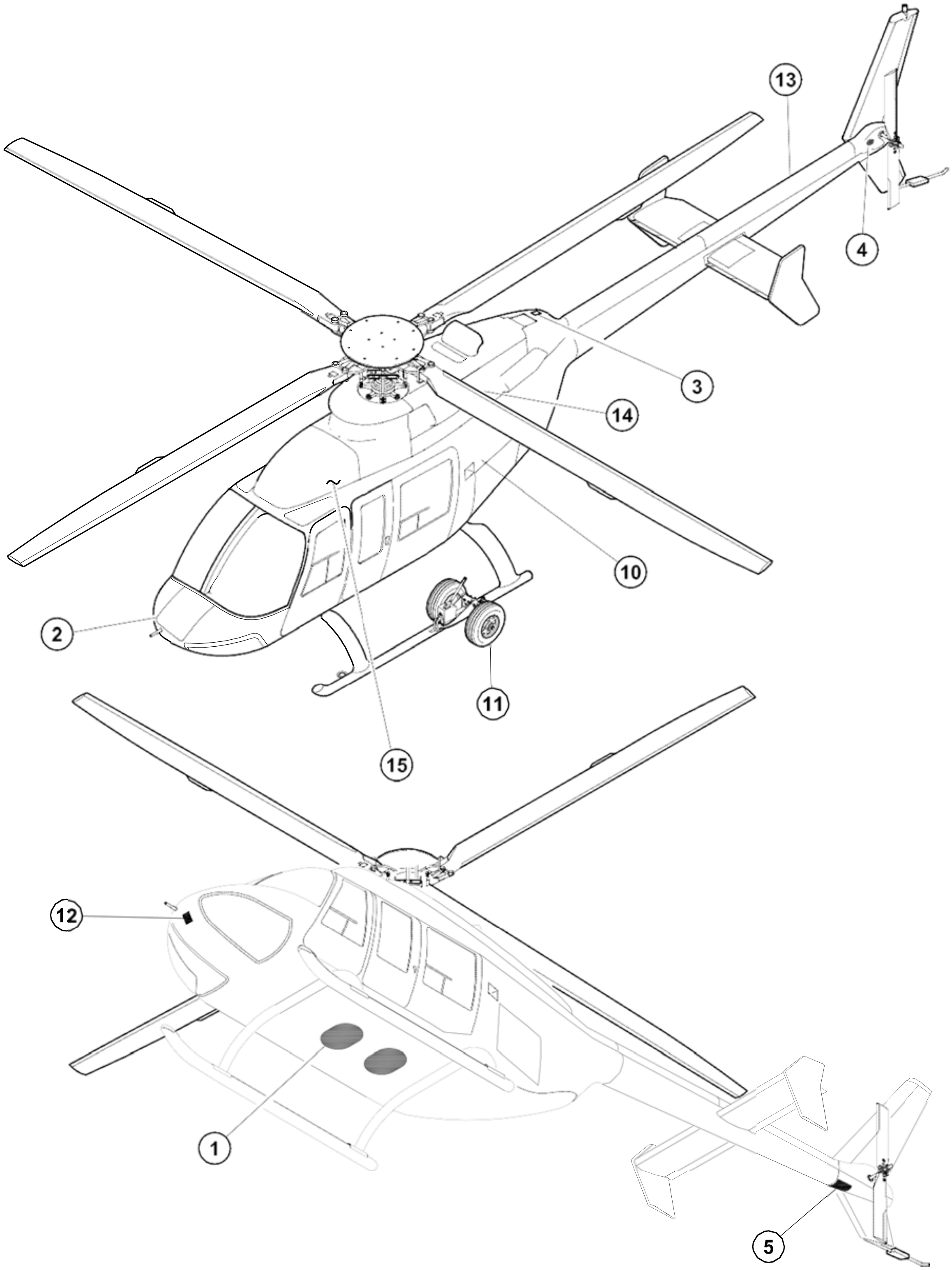
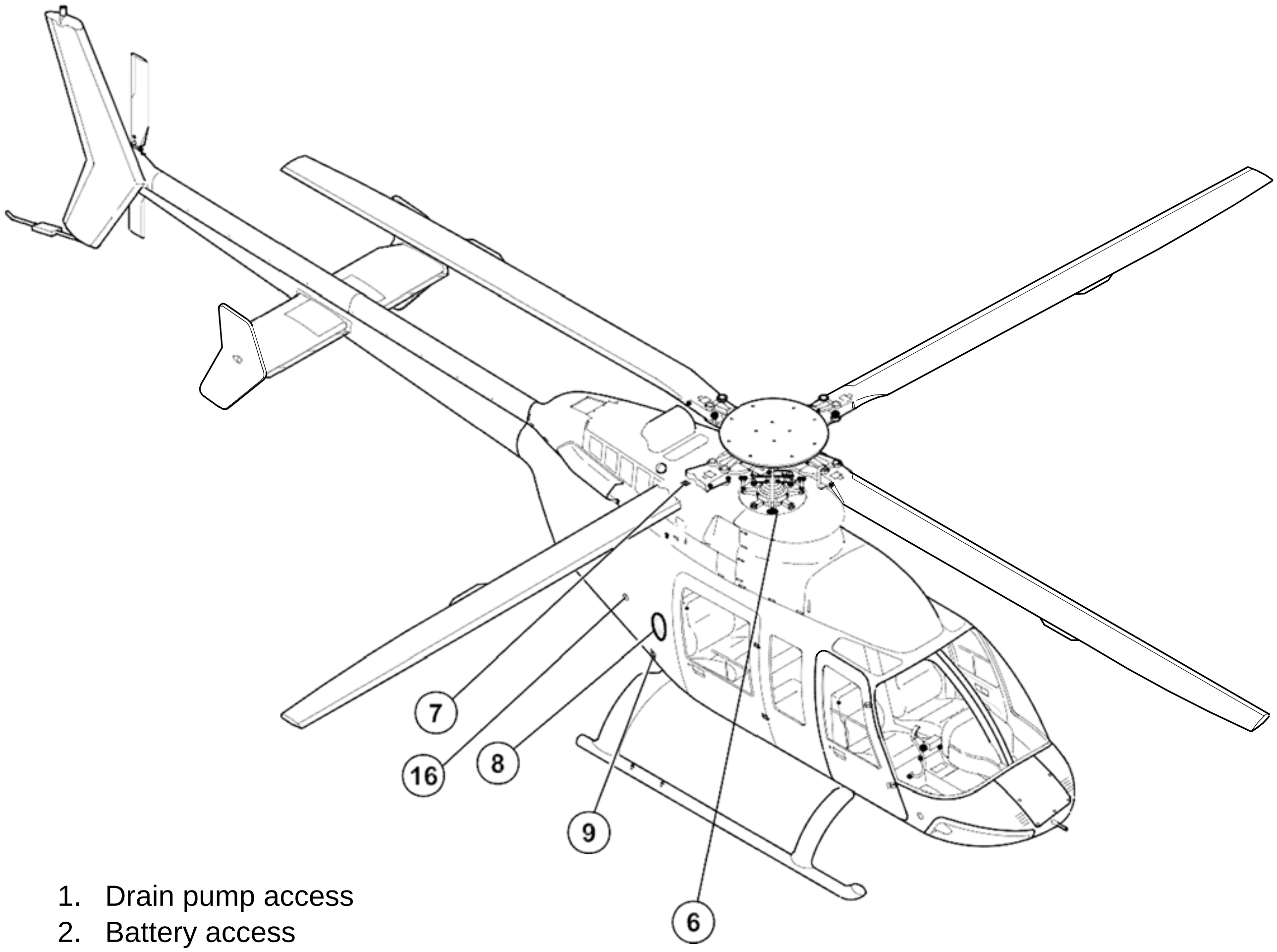


Figure 12-1: Access Panels, Drains, and Sight Gauges



1. Drain pump access
2. Battery access
3. Engine oil access door
4. Tail rotor gearbox oil servicing
5. Tail rotor gearbox oil drain and chip detector
6. Transmission oil filler port and chip detector
7. Airframe fuel filter
8. Refueling port
9. Drain tube, drain switches
10. Manual drain valves (transmission oil cooler)
11. Ground handling wheels
12. External power receptacle
13. Tail rotor drive shaft
14. Freewheel chip detector
15. Hydraulic reservoir
16. Grounding receptacle

Figure 12-2: Access Panels, Drains, and Sight Gauges

12.2 FUEL SYSTEM SERVICING

12.2.1 FUEL SYSTEM – SERVICING

See BHT-407-MM Chapter 12-3.

12.2.2 FUELING/DEFUELING – PREPARATION

12.2.2.1 Fuel System – General Servicing Instructions

See BHT-407-MM Chapter 12-5.

12.2.2.2 Fuel System – Draining

1. Make sure the FUEL BOOST/XFR LEFT and FUEL BOOST/XFR RIGHT circuit breaker switches are off.

2. Set the BATT switch to the ON position.

3. Make sure the EMERGENCY FUEL VALVE switch is OFF.

4. On the right side of the aft fuselage push in the FWD FUEL SUMP and AFT FUEL SUMP drain switches and drain the forward and aft fuel cells into a clean dry container. Inspect for water or other contamination.

12.2.3 FUEL SYSTEM – FUELING

See BHT-407-MM Chapter 12-7.

12.2.4 FUEL SYSTEM – DEFUELING

See BHT-407-MM Chapter 12-8.

12.2.5 FUEL CELL – PURGING

See BHT-407-MM Chapter 12-9.

12.3 OIL SYSTEM SERVICING

12.3.1 OIL LEVEL – CHECK

The sight gauges in the transmission, the engine oil tank, and the tail rotor gearbox permit personnel to make sure the oil level in these components is within the permitted limits. Refer to Figure 12-1 for the location of the sight gauges.

Stained or discolored sight gauges could give a false indication of oil/fluid quantity. Clean or replace stained or discolored sight gauges.

12.3.2 CHANGING OIL BRANDS OR SPECIFICATIONS

CAUTION

DO NOT MIX OILS OF DIFFERENT SPECIFICATIONS. IF OILS BECOME MIXED, SYSTEM SHALL BE DRAINED, FLUSHED AND REFILLED WITH PROPER SPECIFICATION OIL.

Use only the oil brands or specifications approved by the manufacturer of the helicopter or of the engine. Refer to Flight Manual FMS-E407-789-1 or Honeywell LMM for HTS-900-2-1D. Record the specification and brand of oil used in the helicopter logbook. Refer to the logbook to make sure the oil will not be mixed incorrectly.

When adding oil to the engine, main transmission, or tail rotor gearbox, the identical brand and specification of oil already in the engine or each gearbox shall be used. However, in circumstances where emergency top-off or inadvertent mixing may occur, it is acceptable to use oil with a different brand name within the same specification.

If oils of different specifications have been mixed or a different oil specification is being introduced, do the following:

NOTE

Only perform the following steps as they pertain to the specific components affected.

1. Refer to Honeywell LMM for HTS-900-2-1D for specific engine requirements.

   a. Drain the engine oil system, flush the engine oil system and service the engine oil system with clean oil.

2. Drain the transmission oil system, flush the transmission oil lines and hoses, replace the transmission oil filter, and service the transmission oil system with clean oil.

3. Drain the tail rotor gearbox and service the tail rotor gearbox with clean oil.

4. Operate the helicopter for not less than 30 minutes or longer than 5 hours.

5. Drain the engine, transmission, and tail rotor gearbox. Service the engine, transmission and tail rotor gearbox with proper amount of approved oil. Refer to previous step a, step 2 and step 3.

6. During first 100 hours of operation with new oil, check oil sight glasses closely for indications of foggy and hazy appearance. If these indications occur, repeat step 5 until eliminated.

12.3.3 ENGINE OIL SYSTEM

12.3.3.1 Engine Oil System – Servicing

The engine oil system is serviced by removing the oil filter cap installed on the engine oil tank. The oil tank is installed aft of the oil cooler blower and close by the aft fairing. Access to the oil tank is gained through an access door on the top of the aft fairing.

CAUTION

USE ONLY APPROVED OIL PER FMS-E407-789-1 OR HONEYWELL LMM FOR HTS900-2-1D.

NOTE

If the helicopter engine has been shutdown for more than 15 minutes, scavenge oil could have drained into the gearbox. Dry motor the engine for 30 seconds before checking the oil level. If you do not do this, a false high engine oil consumption rate indication or overfilling of the oil tank could result.

Make sure the helicopter is level when servicing. If not level, underfill or overfill of the engine oil system will result.

1. Check the quantity of oil in the engine oil tank within 15 minutes of the engine shutdown.

NOTE

If the oil pressure fluctuates and oil foams, drain the engine oil system and replace the oil with new oil.

If you use oil stored in small containers, shake the container to mix the additives before you pour the oil in the engine oil tank.

If there is mixing of oil between the engine and the transmission, the engine gearbox double lip PTO seals could be leaking. Refer to Chapter 71. If different oil is used in the engine; refer to Honeywell Light Maintenance Manual. If different oil is used in the transmission, refer to BHT-407-MM-2 paragraph 12-11.

2. Open the access door on the aft fairing and remove the oil filler cap from the engine oil tank.

3. Fill the engine oil tank to the correct range on the sight gauge. Use only approved lubricating oil.

4. Install the filler cap on the engine oil tank.

5. Close the access door on the aft fairing.

12.3.3.2 Engine Oil System – Draining

1. Position a container under the helicopter below the drain tubes.

2. Open the access door on the top of the aft fairing and remove the oil filler cap.

3. Open the access door on the left hand side of the aft fairing, open the manual drain valve, and drain the oil from the engine oil tank.

4. Close the manual drain valve and the manual drain valve access door.

5. Install the filler cap on the engine oil tank and close the access door on the aft fairing.

6. Drain the engine gearbox in accordance with Honeywell Light Maintenance Manual for HTS900-2-1D.

12.3.4 TRANSMISSION – OIL SYSTEM

The transmission oil system is serviced through the oil filler cap installed on the transmission.

12.3.4.1 Transmission Oil System – Servicing

The transmission is installed on the roof of the helicopter. The system is serviced by removing the filler cap installed on the forward right side of the transmission.

NOTE

If the oil pressure fluctuates and oil foams, drain the engine oil system and replace the oil with new oil.

If you use oil stored in small containers; shake the container to mix the additives before you pour the oil in the transmission.

If there is mixing of oil between the engine and the transmission, the engine gearbox double lip PTO seals could be leaking. Refer to Chapter 71. If different oil is used in the engine; refer to Honeywell Light Maintenance Manual. If different oil is used in the transmission, refer to BHT-407-MM-2 paragraph 12-11.

1. Remove the transmission cowling (Chapter 53).

2. Make sure the oil cooler and drain lines manual shut-off drain valves (3 and 4, Figure 12-2) located on the baggage compartment wall are closed.

3. Remove the filler cap (2) on the transmission.

4. Fill the transmission with lubricating oil (refer to FMS-E407-789-1)

5. Install the filler cap (2) on the transmission.

6. Install the transmission cowling (Chapter 53).

12.3.4.2 Transmission Oil System – Draining

The transmission oil system can be drained in the three ways that follow:

- With the special drain fitting and hose assembly (only the transmission is drained)

- Without the special drain fitting and hose assembly (only the transmission is drained)

- By draining the residual oil from the oil cooler and the oil lines (only the oil cooler and oil lines are drained)

12.3.4.2.1 Transmission Oil System – Draining (With the Special Drain Fitting and Hose Assembly)

SPECIAL TOOLS REQUIRED

NUMBER	NOMENCLATURE
H4713	Drain Fitting and Hose Assembly

1. Remove the transmission cowling (Chapter 53).
2. Remove the oil filler cap from the transmission (2, Figure 12-2).
3. Remove the drain plug (6).
4. Install the drain fitting (7) in the drain port.
5. Drain the oil from the transmission oil system.
6. Remove the drain fitting (7) from the drain port.
7. Install the drain plug (6).
8. Install the oil filler cap (2) in the transmission.
9. Install the transmission cowling (Chapter 53).
10. Drain the oil cooler and drain lines.

12.3.4.2.2 Transmission Oil System – Draining (Without the Special Drain Fitting and Hose Assembly)

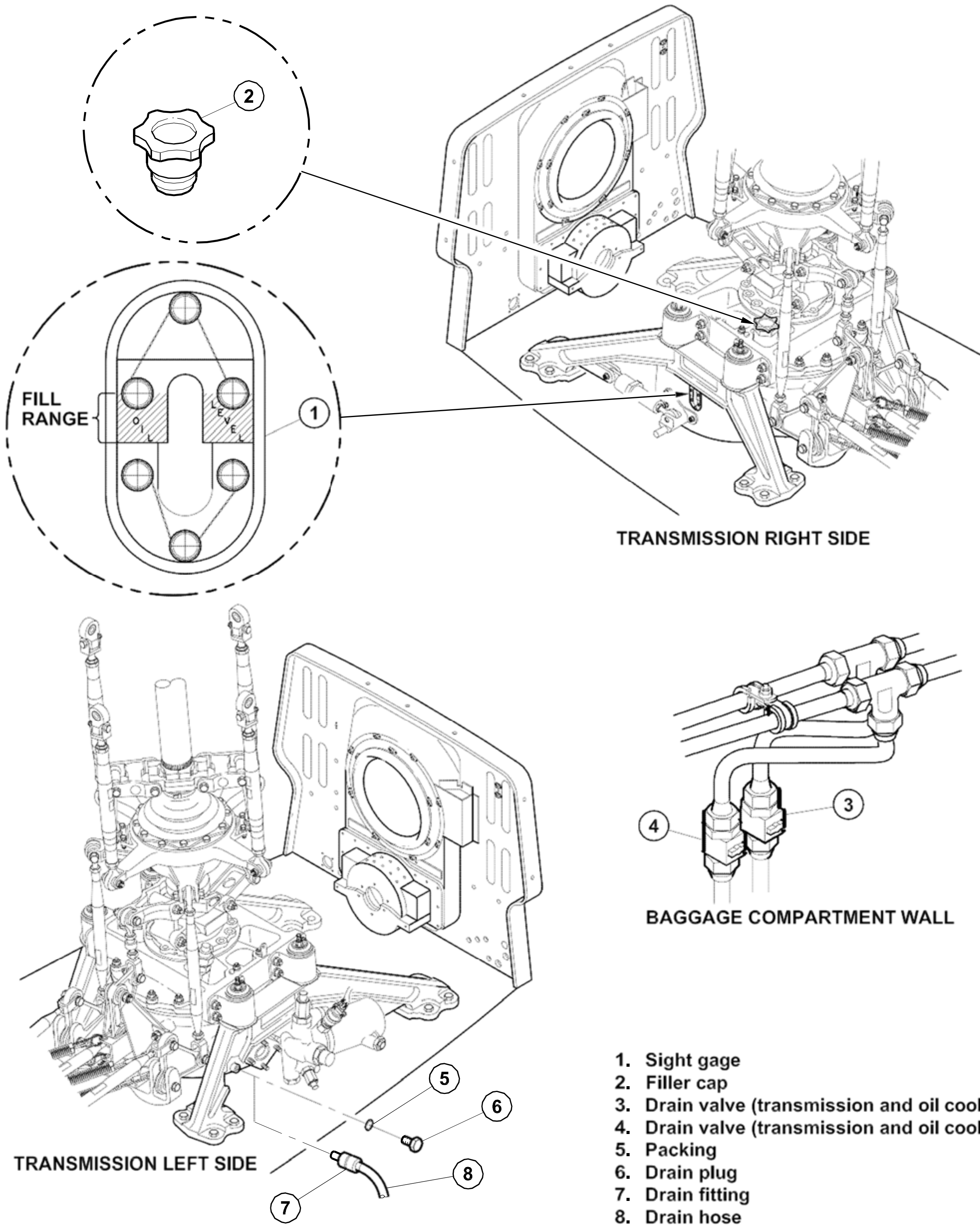
1. Remove the transmission cowling (Chapter 53).
2. Remove the oil filler cap (2, Figure 12-2) from the transmission.
3. Position a container under the helicopter drain.
4. Disconnect the freewheel to transmission return line at the forward firewall.
5. Drain the oil from the transmission oil cooler and the oil lines.
6. Connect the freewheel to transmission return line at the forward firewall.
7. Install the filler cap (2) on the transmission.
8. Install the transmission cowling (Chapter 53).

12.3.4.2.3 Transmission Oil Cooler and Oil Line Draining

1. Position a container under the helicopter drain tubes.
2. Open the two drain valves (3 and 4, figure 12-2) on the baggage compartment wall.
3. Drain the oil from the transmission oil cooler and oil lines.
4. Close the drain valves (3 and 4).

12.3.5 FREEWHEEL OIL SYSTEM

Refer to Honeywell Light Maintenance Manual for HTS900-2-1D for operation and description of freewheel oil system.



1. Sight gage
2. Filler cap
3. Drain valve (transmission and oil cooler)
4. Drain valve (transmission and oil cooler)
5. Packing
6. Drain plug
7. Drain fitting
8. Drain hose

Figure 12-3: Access Panels, Drains, and Sight Gauges

12.3.6 TAIL ROTOR GEARBOX OIL SYSTEM

See BHT-407-MM Chapter 12-27.

12.3.6.1 TAIL ROTOR GEARBOX OIL SYSTEM – SERVICING

See BHT-407-MM Chapter 12-28.

12.3.6.2 TAIL ROTOR GEARBOX OIL SYSTEM – DRAINING

See BHT-407-MM Chapter 12-29.

12.3.6.2.1 Tail Rotor Gearbox Oil System – Draining (With the Special Drain Fitting and Hose Assembly)

See BHT-407-MM Chapter 12-30.

12.3.6.2.2 Tail Rotor Gearbox Oil System – Draining (Without the Special Drain Fitting and Hose Assembly)

See BHT-407-MM Chapter 12-31

12.4 HYDRAULIC SYSTEM SERVICING

12.4.1 HYDRAULIC SYSTEM SERVICING

See BHT-407-MM Chapter 12-32.

12.4.1.1 HYDRAULIC SYSTEM – SERVICING

See BHT-407-MM Chapter 12-33.

12.4.1.2 HYDRAULIC SYSTEM – DRAINING

See BHT-407-MM Chapter 12-34.

12.5 GREASE LUBRICATION

12.5.1 GREASE LUBRICATION – SERVICING

See BHT-407-MM Chapter 12-35.

12.5.2 PITCH CHANGE LINK BEARING – SERVICING

See BHT-407-MM Chapter 12-36.

12.5.2.1 PITCH CHANGE LINK BEARING – GREASE

See BHT-407-MM Chapter 12-37.

12.5.2.2 SWASHPLATE – PURGING

See BHT-407-MM Chapter 12-38.

12.5.2.3 HYDRAULIC PUMP DRIVE SHAFT – GREASE

See BHT-407-MM Chapter 12-39.

12.5.2.4 OIL COOLER BLOWER HANGER BEARINGS – GREASE

See BHT-407-MM Chapter 12-40.

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Chapter 18
ROTOR TRACK AND BALANCE AND VIBRATION MONITORING
(18-00-00)

REFER TO
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Chapter 21
AIR CONDITIONING AND VENTILATION
(21-00-00)

REFER TO
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Chapter 25
EQUIPMENT AND FURNISHINGS
(25-00-00)

REFER TO
BHT-407-MM

Chapter 26
FIRE PROTECTION
(26-00-00)

CHAPTER 26 — FIRE PROTECTION

Contents

26.1 ENGINE FIRE DETECTION

26.1.1 GENERAL

This chapter provides information regarding engine fire detection system installed on Eagle 407HP. Maintenance procedure herewith is in conjunction with BHT-407-II-19, thus to be followed and used for continued airworthiness of Eagle 407HP.

26.1.1.1 Applicability

These maintenance procedures only apply to Engine Fire Detection System kit number 407-706-015-101 for helicopter serial no. 53000 through 53599 and kit number 407-706-025-101 for helicopter serial no. 53600 and subsequent modified or installed per TCCA STC SH14-47 (Ref. FAA STC SRXXXXXNE).

26.1.2 Operation- Fire Detect System

26.1.2.1 Description

Fire detection system installed on 407HP incorporates a fire/overheat detector element installed on the engine upper cowling (refer to Figure 26-3) that senses fire or overheat. When the temperature reaches 338°F (170°C) over its entire length or 842°F (450°C) over a 12 inch section, the contacts inside the overheat detector activate. 28VDC from FIRE DETECT circuit breaker (refer to Figure 26-2) will be provided to the ENGINE FIRE annunciator to illuminate. When the temperature drops, the contacts in the fire overheat detector open and break the circuit.

The system also features a FIRE DETECT TEST switch to enable testing of the sensor and the wiring. The push-type switch is installed on the instrument panel as per Figure 26-1. This provides 28VDC throughout the system and the ENGINE FIRE warning annunciator message comes on. When the switch is released, the circuit is broken and the warning annunciator extinguishes.

Wiring interconnect can be found in Chapter 98.

26.1.2.2 Removal – Fire Detection Element

NOTE

Fire Detector element is very fragile; maintain a 0.5 inch (127 mm) minimum radius on all bends when bending the detector element.

1. Ensure FIRE DETECT (2600CB1) circuit breaker is pulled.

2. In the engine compartment, disconnect connector 2600A1P1 from detector element.

3. Gain access to the upper engine cowl. Remove the hinges that hold the engine upper cowl. Remove cowl.

4. Lay cowl upside down on flat surface.

5. Loosen element clamps starting from the end of the element, keeping grommet on the clamp.

6. Remove screws and washers holding the clamp of the connector end of the detector element.

7. Open the clamp and completely remove the detector element.

26.1.2.3 Installation – Fire Detection Element

NOTE

Fire Detector element is very fragile; maintain a 0.5 inch (127 mm) minimum radius on all bends when bending the detector element.

1. Gain access to the upper engine cowl. Remove the hinges that hold the engine upper cowl. Remove cowl.

2. Install the connector end of the detector element on the mount.

3. Secure connector with two clamps, two screws and two washers.

4. Install detector element in 23 grommets and clamps starting from the connector end.

5. When installing detector element in last clamp, maintain the 1.50 inch (38.10mm) dimension as show on Figure 26-3.

6. Install the upper engine cowl. Secure hinges.

7. Install connector 26001P1 to the element.

8. Perform Functional Test – Fire Detect System per paragraph 26.1.2.4

26.1.2.4 Functional Test – Fire Detect System

TOOLS REQUIRED

Number	Nomenclature
5499-01 Systron-Donner	Portable Heat Test Unit
2742-01 Syston-Dronner	Input Power Cable
3340 Systron-Donner	Heat Test Clamp

WARNING

DO NOT PERFORM REPEATED TESTS ON THE SAME PORTION OF SENSOR TUBE.

1. Ensure connector 26001P1 is connected to the detector unit.

2. Ensure FIRE DETECT (2600CB1) circuit breaker is closed.

3. Connect portable Heat Test Unit to power supply and sensor heat test clamp.

4. Move Heat Test Unit ON/OFF switch to ON position and verify that blue power ON lamp comes on.

5. Press and hold Heat Test Unit LAMP TEST switch. Verify that ALARM, TEST, and INTEGRITY lamps come on. Release LAMP TEST switch.

WARNING

ENSURE THAT THE PORTION OF SENSOR TUBE TO BE TESTED IS CLEAN AND WELL CLEAR OF ANY FLAMMABLE MATERIALS OR ELECTRICAL CONDUCTORS WHICH MAY PROVIDE A SHORT CIRCUIT BETWEEN THE JAWS

6. Attach Sensor Heat Test Clamp Assembly jaws to sensor so that firm electrical contact is achieved. Support Assembly as necessary to prevent stressing sensor tube.

WARNING

DURING TESTING, PORTION OF THE SENSOR TUBE BETWEEN TWO SETS OF JAWS MAY BECOME RED HOT (1500°F OR 65.66°C). KEEP HANDS, CLOTHING, AND FLAMMABLE MATERIALS OR ELECTRICAL CONDUCTORS WHICH MAY PROVIDE A SHORT CIRCUIT BETWEEN THE JAWS, WELL CLEAR TO PREVENT INJURY OR FIRE. WEAR LEATHER WORK GLOVES OR ALLOW ENOUGH TIME FOR SENSOR TUBE TO COOL BEFORE HANDLING.

NOTE

Do not cycle power ON and OFF without pressing STOP/RESET switch.

7. If TEST light comes on when ON/OFF switch is moved to ON, press STOP/RESET switch or move ON/OFF switch to OFF.

8. Set the battery switch to BATT, or connect the external DC power to the helicopter.

9. Position Latch switch to OFF.

10. Press and release START switch. TEST lamp of the tester box will come on immediately. On the instrument panel, verify that ENGINE FIRE caution light comes on within 10 seconds. TEST lamp will go out at the same time.

WARNING

AFTER REPEATED TESTS, JAWS MAY BECOME HOT. WEAR LEATHER WORK GLOVES OR ALLOW ENOUGH TIME TO COOL BEFORE HANDLING.

11. When testing is complete, move ON/OFF switch to OFF and disconnect all test equipment.

Figure 26-1: Fire Detect Test Switch

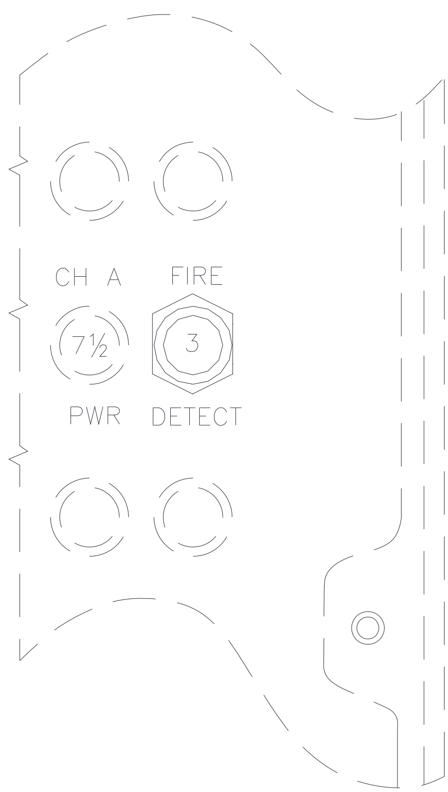
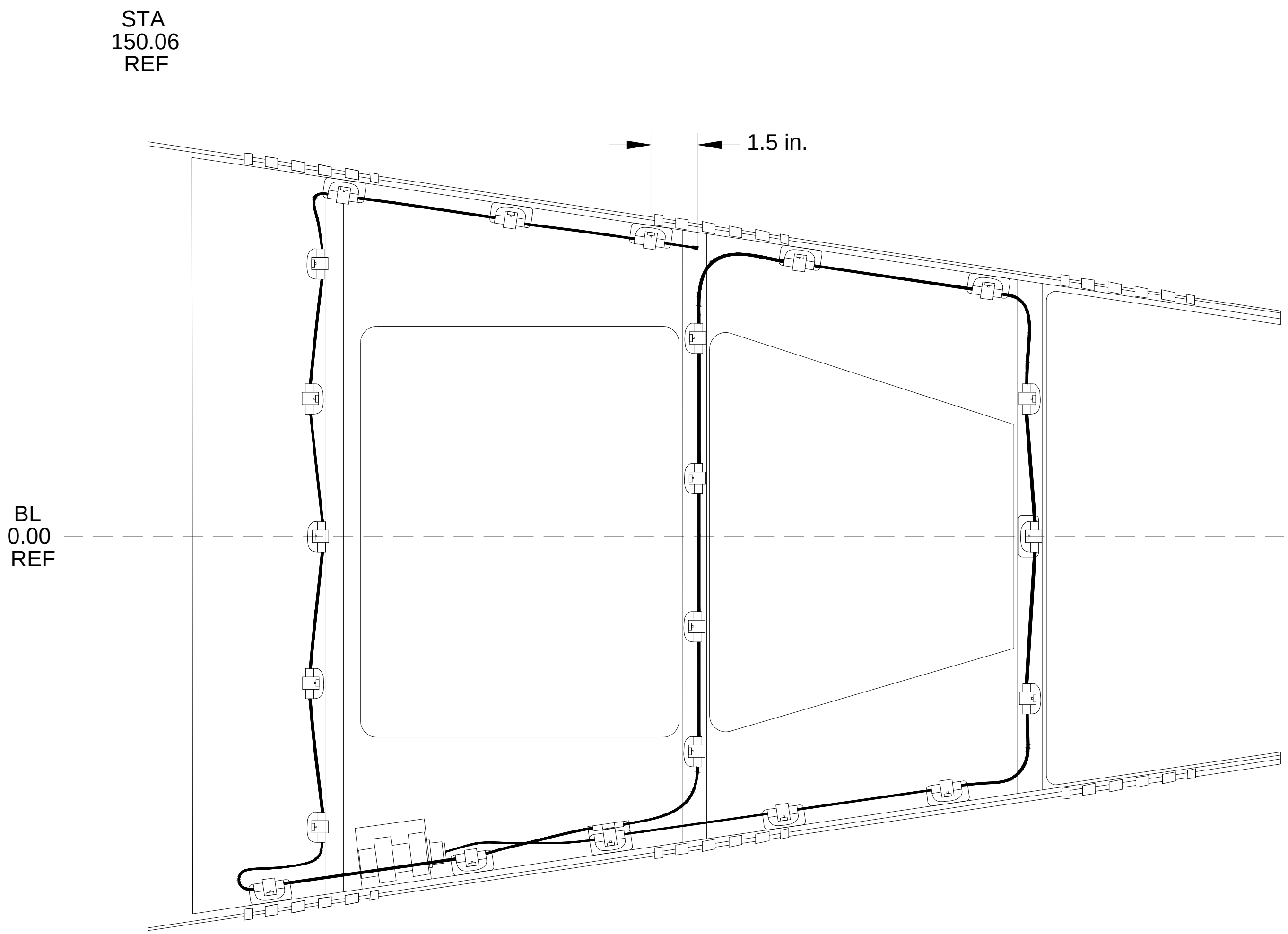


Figure 26-2: Fire Detect Circuit Breaker



VIEW LOOKING UP ON THE ENGINE UPPER COWLING

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Chapter 28
FUEL SYSTEM
(28-00-00)

CHAPTER 28 — FUEL SYSTEM

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28.2.14.1 Fuel Filter Assembly — Removal

MATERIALS REQUIRED

Refer to BHT-ALL-SPM for specifications.

NUMBER	NOMENCLATURE
C-156	Caps and/or Plugs
C-428	Caps and/or Plugs

WARNING

OBEY ALL THE SAFETY PRECAUTIONS WHEN YOU DO MAINTENANCE ON FUEL SYSTEM EQUIPMENT.

NOTE

Remove components only to the extent necessary to perform maintenance.

1. Make sure the helicopter is grounded.
2. Disconnect battery and external DC power from the helicopter (Chapter 96).
3. Open the right lower engine cowl (Chapter 53).
4. Disconnect the electrical connector (5, Figure 28-15) from the receptacle on the fuel filter (6).
5. Put protective caps and/or plugs (C-156) on all the electrical connectors.
6. Turn the handle on the drain valve (13) and drain the fuel filter (6).
7. Remove the drain hose (12) from the manual drain valve (13).
8. Loosen the nut (11), and remove the manual drain valve (13) and the packing (10) from the fuel filter (6). Discard the packing.

CAUTION

DO NOT KINK, BEND, OR TWIST THE FUEL HOSE BEYOND ALLOWABLE LIMITS (INFORMATION LETTER (IL) 407-98-19). IF A FUEL HOSE HAS BEEN KINKED, BENT, OR TWISTED BEYOND LIMITS, OR IS SUSPECTED OF THIS OCCURRENCE, IT SHALL BE REPLACED WITH A SERVICEABLE FUEL HOSE PRIOR TO RETURNING THE HELICOPTER TO SERVICE

9. Remove the fuel inlet hose (9) from the inlet fitting (8).
10. Remove the inlet fitting (8) and the packing (7) from the inlet port of the fuel filter (6). Discard the packing.

CAUTION

DO NOT KINK, BEND, OR TWIST THE FUEL HOSE BEYOND ALLOWABLE LIMITS (INFORMATION LETTER (IL) 407-98-19). IF A FUEL HOSE HAS BEEN KINKED, BENT, OR TWISTED BEYOND LIMITS, OR IS SUSPECTED OF THIS OCCURRENCE, IT SHALL BE REPLACED WITH A SERVICEABLE FUEL HOSE PRIOR TO RETURNING THE HELICOPTER TO SERVICE.

11. Remove the fuel outlet hose (2) from the outlet fitting (3).
12. Remove the outlet fitting (3) and the packing (4) from the outlet port of the fuel filter (6). Discard the packing.
13. Put protective caps and/or plugs (C-428) on all the open lines and ports.
14. Cut and remove the lockwire from the three bolts (17).
15. Remove the three bolts (17) and the washers (16) from the fuel filter (6).
16. Remove the fuel filter assembly (6) and the three washers (15) from the D4429-041 Fuel Filter Bracket (1).
17. Remove the three washers (15) from the fuel filter (6).

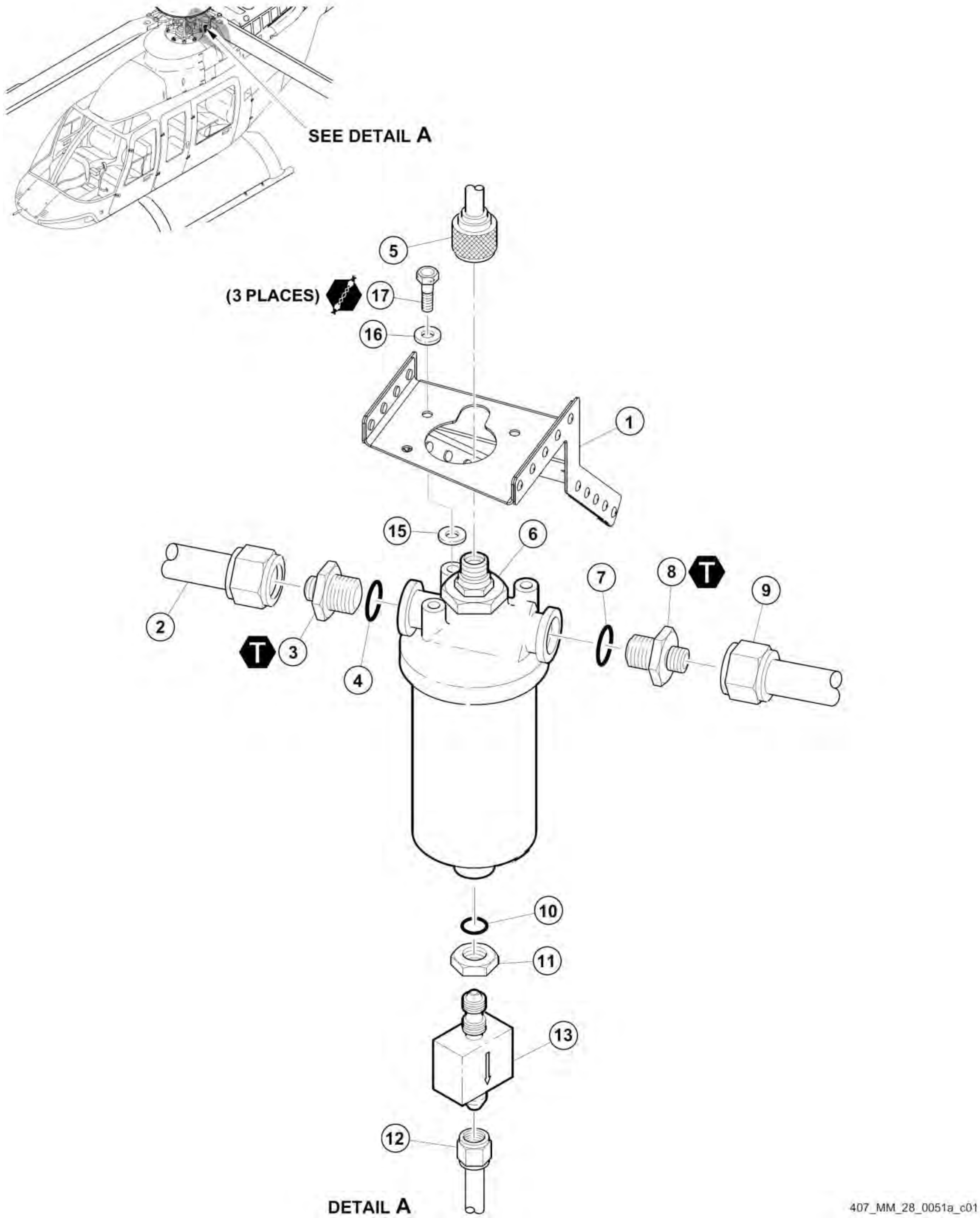

Figure 28-15. Fuel Filter Assembly (Sheet 1 of 2)

1. **E4429-041 Fuel Filter Bracket Assembly**
2. **Packing**
3. **Fitting**
4. **Outlet hose**
5. **Electrical connector**
6. **Fuel filter**
7. **Packing**
8. **Fitting**
9. **Inlet hose**
10. **Packing**
11. **Nut**
12. **Drain hose**
13. **Drain valve**
15. **Washer**
16. **Washer**
17. **Bolt**

235 TO 265 IN-LBS
(27 TO 30 Nm)

LOCKWIRE (C-405)

Figure 28-15. Fuel Filter Assembly (Sheet 2 of 2)

28.2.14.2 Fuel Filter Assembly — Inspection

See BHT-407-MM Chapter 28, Paragraph 28-81

28.2.14.3 Fuel Filter Assembly — Installation

MATERIALS REQUIRED

Refer to BHT-ALL-SPM for specifications

NUMBER	NOMENCLATURE
C-003	Turbine Fuel
C-308	Sealant
C-405	Lockwire

1. Align the fuel filter (6) with the E4429-041 mount bracket (1).
2. Install the three washers (15) between the fuel filter (6) and the E4429-041 mount bracket (1).
3. Safety the fuel filter (6) to the E4429-041 mount bracket (1) with the three washers (16) and the bolts (17). Tighten the bolts.
4. Safety the three bolts (17) with lockwire (C-405).
5. Remove the caps and/or plugs from the lines and the ports of the fuel filter (6).
6. Apply a light layer of turbine fuel (C-003) on the packing (4) and install the packing on the outlet fitting (3).
7. Install the outlet fitting (3) in the outlet port of the fuel filter (6). Torque the outlet fitting Ⓣ.

CAUTION

DO NOT KINK, BEND, OR TWIST THE FUEL HOSE BEYOND ALLOWABLE LIMITS (INFORMATION LETTER (IL) 407-98-19). IF A FUEL HOSE HAS BEEN KINKED, BENT, OR TWISTED BEYOND LIMITS, OR IS SUSPECTED OF THIS OCCURRENCE, IT SHALL BE REPLACED WITH A SERVICEABLE FUEL HOSE PRIOR TO RETURNING THE HELICOPTER TO SERVICE.

8. Install the fuel outlet hose (2) on the outlet fitting (3). Tighten the coupling nut.
9. Apply a light layer of turbine fuel (C-003) on the packing (7) and install the packing on the inlet fitting (8).
10. Install the inlet fitting (8) in the inlet port of the fuel filter (6). Torque the inlet fitting Ⓣ.

CAUTION

DO NOT KINK, BEND, OR TWIST THE FUEL HOSE BEYOND ALLOWABLE LIMITS (INFORMATION LETTER (IL) 407-98-19). IF A FUEL HOSE HAS BEEN KINKED, BENT, OR TWISTED BEYOND LIMITS, OR IS SUSPECTED OF THIS OCCURRENCE, IT SHALL BE REPLACED WITH A SERVICEABLE FUEL HOSE PRIOR TO RETURNING THE HELICOPTER TO SERVICE.

11. Install the fuel inlet hose (9) on the inlet fitting (8). Tighten the coupling nut.
12. Install the nut (11) on the drain valve (13).
13. Apply a light layer of turbine fuel (C-003) on the packing (10) and install the packing on the manual drain valve (13).
14. Install the manual drain valve (13) on the drain port of the fuel filter (6). Tighten the nut (11).
15. Install the drain hose (12) on the manual drain valve (13). Tighten the coupling nut.
16. Remove protective caps and/or plugs from all the electrical connectors.
17. Connect the electrical connector (5) to the receptacle on the fuel filter (6).
18. Connect the battery or the external DC power to the helicopter.
19. On the overhead console, set the LEFT BOOST/ XFER pump and the RIGHT BOOST/XFER pump switches to ON to pressurize the fuel system.
20. Examine the fuel filter assembly for signs of leaks.
21. Set the LEFT BOOST/XFER and the RIGHT BOOST/XFER switch to OFF.
22. Close the right lower engine cowl (Chapter 53).

28.2.15 Fuel Filter Element

See BHT-407-MM Chapter 28, Paragraph 28-83

28.2.15.1 Fuel Filter Element — Replacement

See BHT-407-MM Chapter 28, Paragraph 28-84

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28.3.1.1 Forward Fuel Cell Fuel Quantity Probe — Removal

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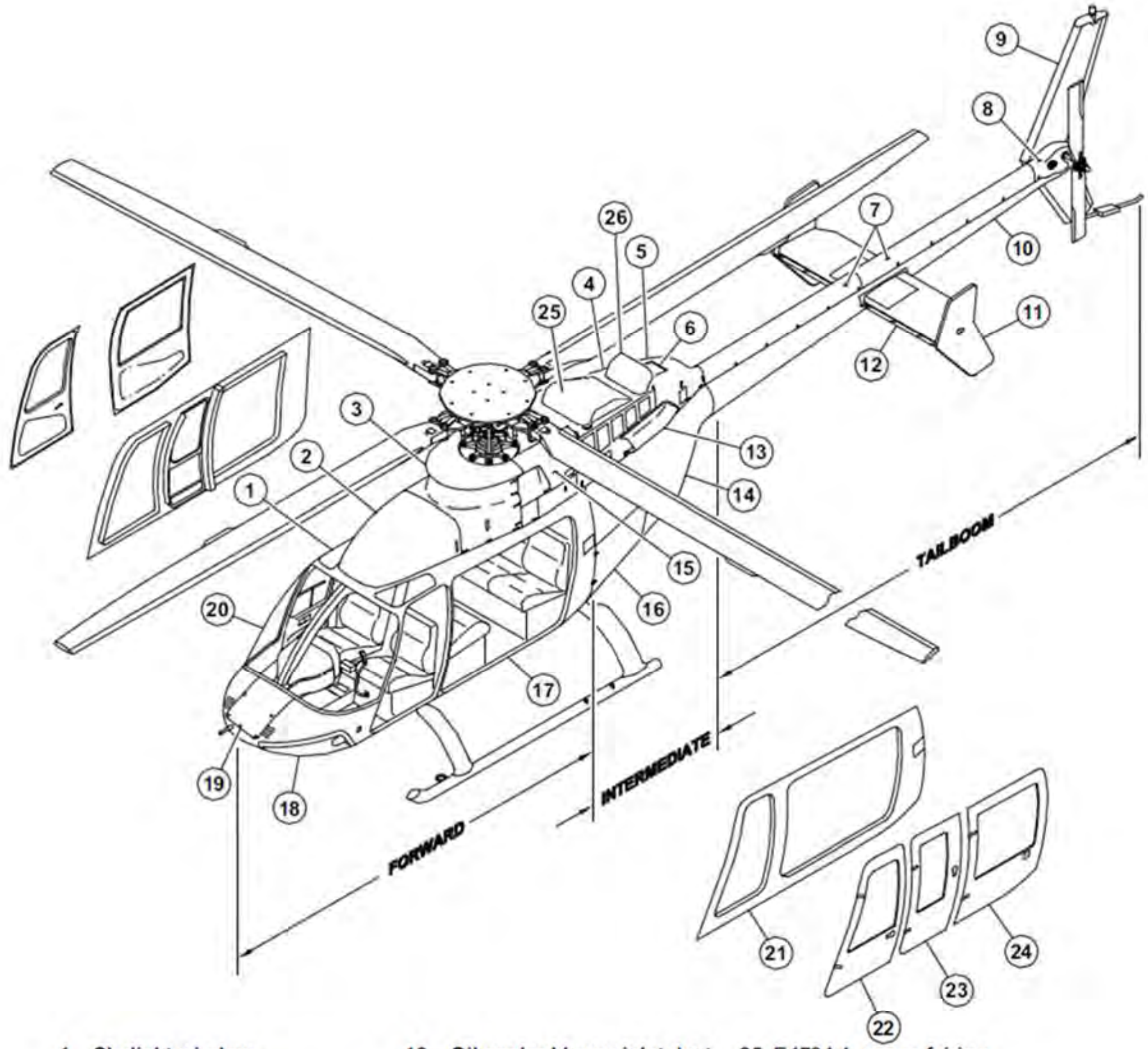

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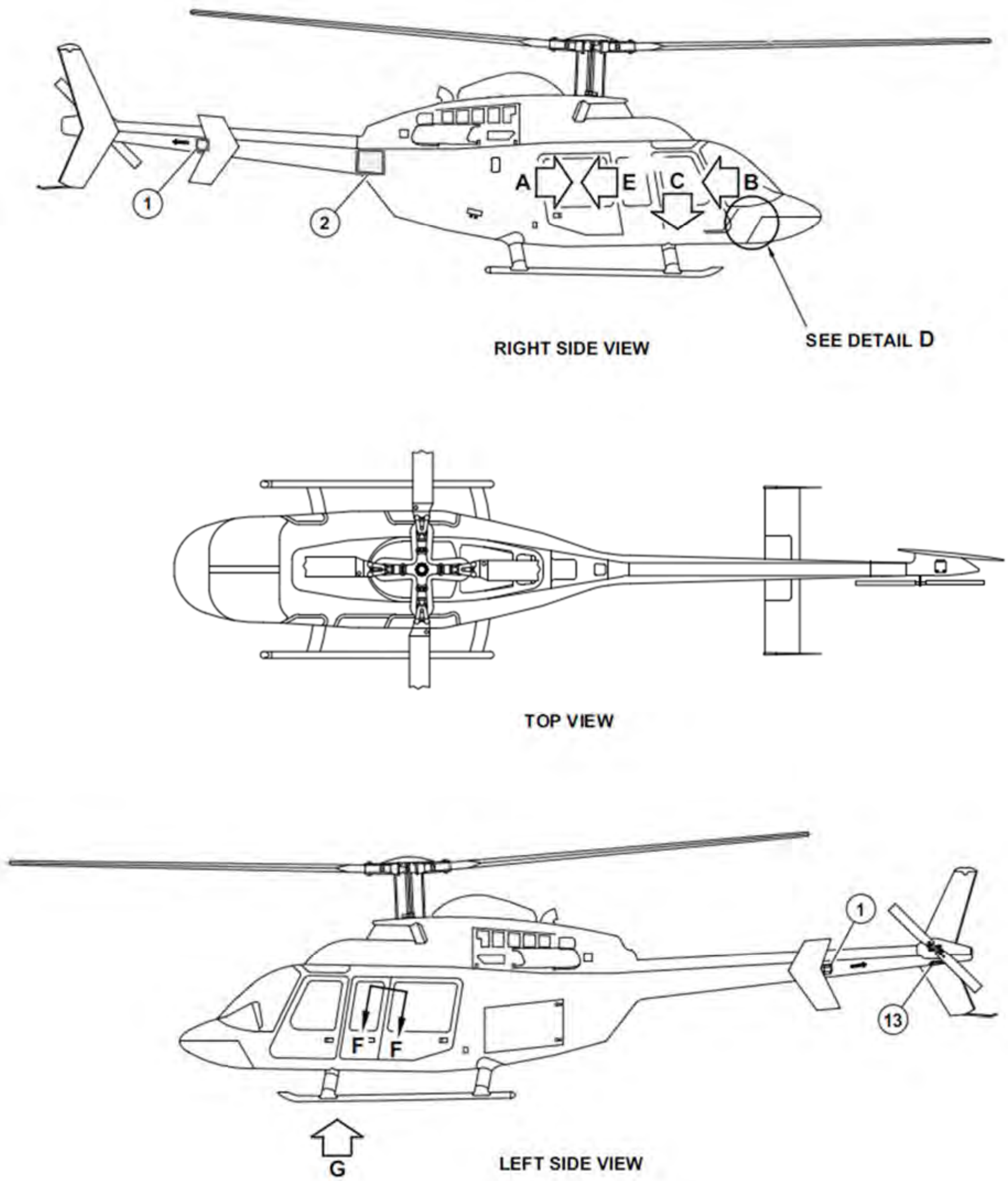

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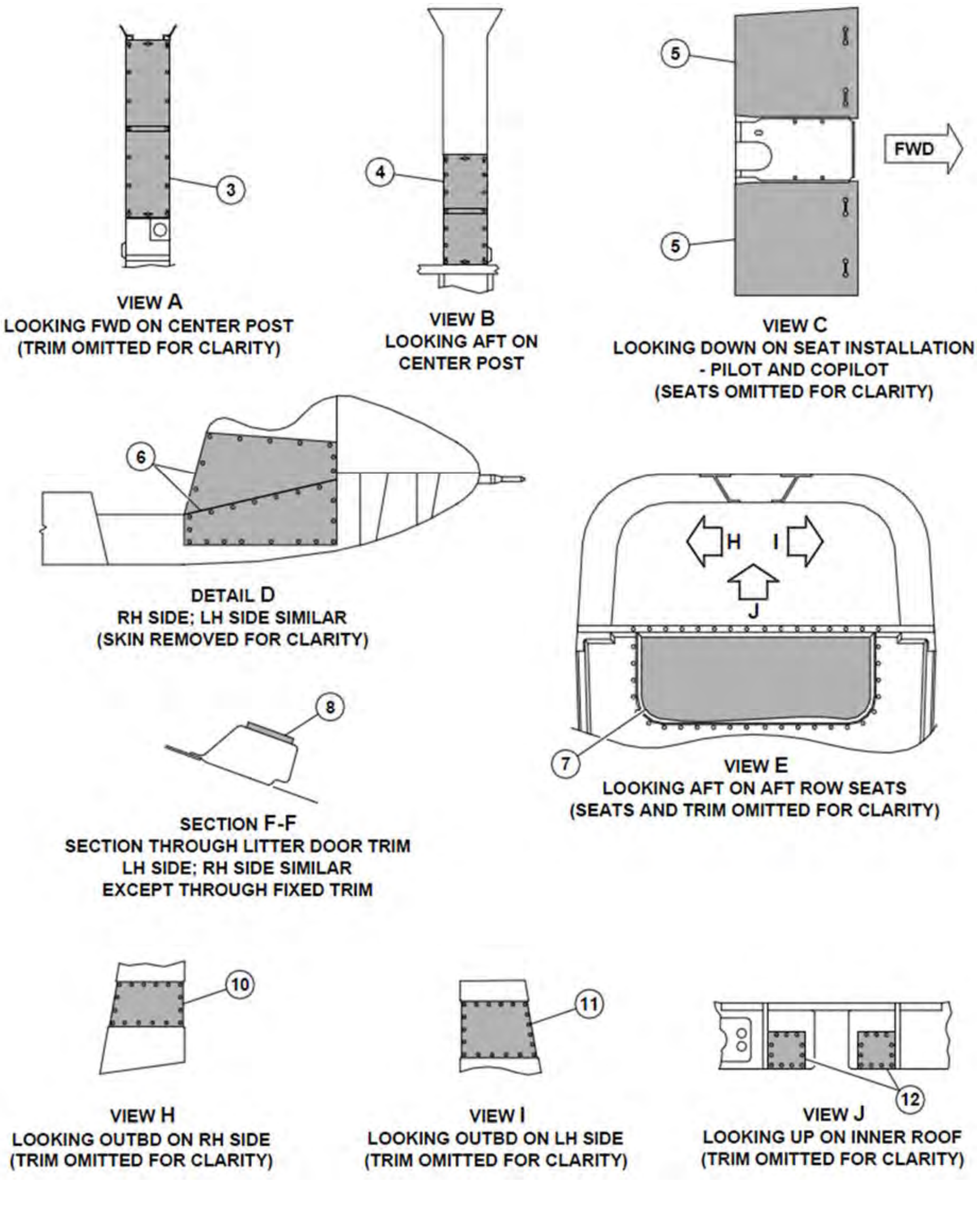

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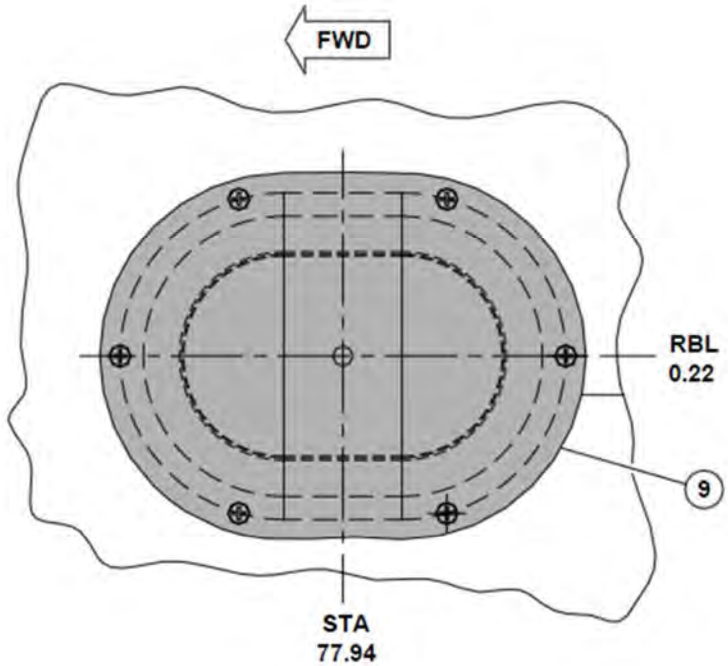

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53.7.3 AIR INLET COWL ASSEMBLY

The air inlet cowl assembly (8 or 37, Figure 53-28) is installed on the cabin roof over the aft half of the main transmission. The air inlet cowl assembly (8) is made of aluminum. The air inlet cowl assembly (37) is made of carbon/fiberglass. There are air inlet ducts on each side of the air inlet cowl assembly that direct the flow of air to the inlet screen (9) and into the engine inlet. There is a hinged access door (25 or 44) on each side of the air inlet cowl assembly to permit inspection procedures to be done without having to remove the air inlet cowl assembly. On the right side there is a hole (7) so you can see the transmission oil level.

53.7.3.1 Air Inlet Cowl Assembly – Removal

MATERIALS REQUIRED

Refer to BHT-ALL-SPM for specifications

NUMBER	NOMENCLATURE
C-156	Caps and/or Plugs
C-428	Caps and/or Plugs

1. Open the forward fairing assembly (1, Figure 53-28) (paragraph 53.7.1.1).

2. Remove the transmission fairing assembly (5) (paragraph 53.1.2.1).

3. Remove the engine cowl assembly (20 and 14) (paragraph 53.7.4.1).

4. For helicopters S/N 53000 through 54133, remove the air inlet cowl assembly (8) as follows:

   a. Remove the screw (27) and the turnlock fastener (26) on each side of the air inlet cowl assembly (8).

   b. Unlock the flush latches and open the access doors (25).

   c. Remove the E4734-1 Upper Fairing.

   d. Remove the E4315-041 Intake Scoop Assembly

   e. Put protective caps and/or plugs (C-156) on all the electrical connectors and caps and/or plugs (C-428) on any open ports.

CAUTION

UPON REMOVAL OF THE AIR INLET COWL ASSEMBLY MAKE SURE TO COVER THE ENGINE INTAKE COMPRESSOR TO PREVENT FOR FOD.

   f. Remove the air inlet cowl assembly (8) from the airframe.

5. For helicopters S/N 54134 and subsequent, remove the air inlet cowl assembly (37) as follows:

   a. Remove the screws (41), washers (42), and the turnlock fastener (43) on each side of the air inlet cowl assembly (37).

   b. Unlock the flush latches and open the access doors (44).

   c. Remove E4734-1 Upper Fairing.

   d. Remove E4315-041 Intake Scoop Assembly.

   e. Put protective caps and/or plugs (C-156) on all the electrical connectors and caps and/or plugs (C-428) on any open ports.

CAUTION

UPON REMOVAL OF THE AIR INLET COWL ASSEMBLY MAKE SURE TO COVER THE ENGINE INTAKE COMPRESSOR TO PREVENT FOR FOD.

   f. Remove the air inlet cowl assembly (37) from the airframe.

53.7.3.2 Air Inlet Cowl Assembly – Cleaning

See BHT-407-MM Chapter 53, Paragraph 53-68

53.7.3.3 Air Inlet Cowl Assembly – Inspection

NOTE

The following inspection criteria are primarily intended when the part or component has been removed from the helicopter. To accommodate all inspection requirements, applicable criteria may also be used when the part or component is installed on the helicopter.

NOTE

Contact Product Support Engineering for information on wear and damage limits applicable to structural parts but not contained in this chapter or in the BHT-ALL-SRM.

1. Examine the air inlet cowl assembly (8, Figure 53-28) for the following:
   - Dents
   - Punctures
   - Corrosion damage
   - Cracks
   - Loose or missing rivets
   - Condition of the nut plates
2. Examine the air inlet cowl assembly (37), E4734-1 Upper Fairing (23) and E4315-041 Intake Scoop Assembly (12) for the following:
   - Cracks, delamination, and damage
   - Condition of the shims
   - Mechanical damage
   - Punctures
   - Loose or missing rivets
   - Condition of the nut plates

Repair or replace the air inlet cowl assembly (8 or 37), E4734-1 Upper Fairing (23), or E4315-041 Intake Scoop Assembly (12) as required.

3. Visually examine the engine intake sight glass (10 or 44) for condition. Replace as required.
4. Make sure that the turnlock fasteners (26 or 43) on the air inlet cowl assembly (8 or 37), as applicable, are serviceable and that they lock correctly.
5. Visually examine all the attaching hardware for wear, mechanical damage, and corrosion damage. Replace as required.

53.7.3.4 Air Inlet Cowl Assembly – Repair

See BHT-407-MM Chapter 53, Paragraph 53-70

53.7.3.5 Air Inlet Cowl Assembly – Installation

1. For helicopters S/N 53000 through 54133, install the air inlet cowl assembly (8, Figure 53-28) as follows:
   a. If installed, remove protective device from the engine compressor intake.
   b. Put the air inlet cowl assembly (8) in position on the airframe.
   c. Install the screw (27) and the turnlock fastener (26) on each side of the air inlet cowl assembly (8). Tighten the screws.
   d. Close the access door (25) and lock the flush latches.
2. For helicopters S/N 54134 and subsequent, install the air inlet cowl assembly (37) as follows:
   a. If installed, remove protective device from the engine compressor intake.
   b. Put the air inlet cowl assembly (37) in position on the airframe.
   c. Install the screw (41), washer (42), and the turnlock fastener (43) on each side of the air inlet cowl assembly (37). Tighten the screws.
   d. Close the access door (44) and lock the flush latches.
3. Install the engine cowl assembly (20 and 14) (paragraph 53.7.4.3).
4. Install the transmission fairing assembly (5) (paragraph 53.7.2.3).
5. Close the forward fairing assembly (2) (paragraph 53.7.1.3).
6. Install the E4315-041 Intake Scoop Assembly
7. Install the E4734-1 Upper Fairing

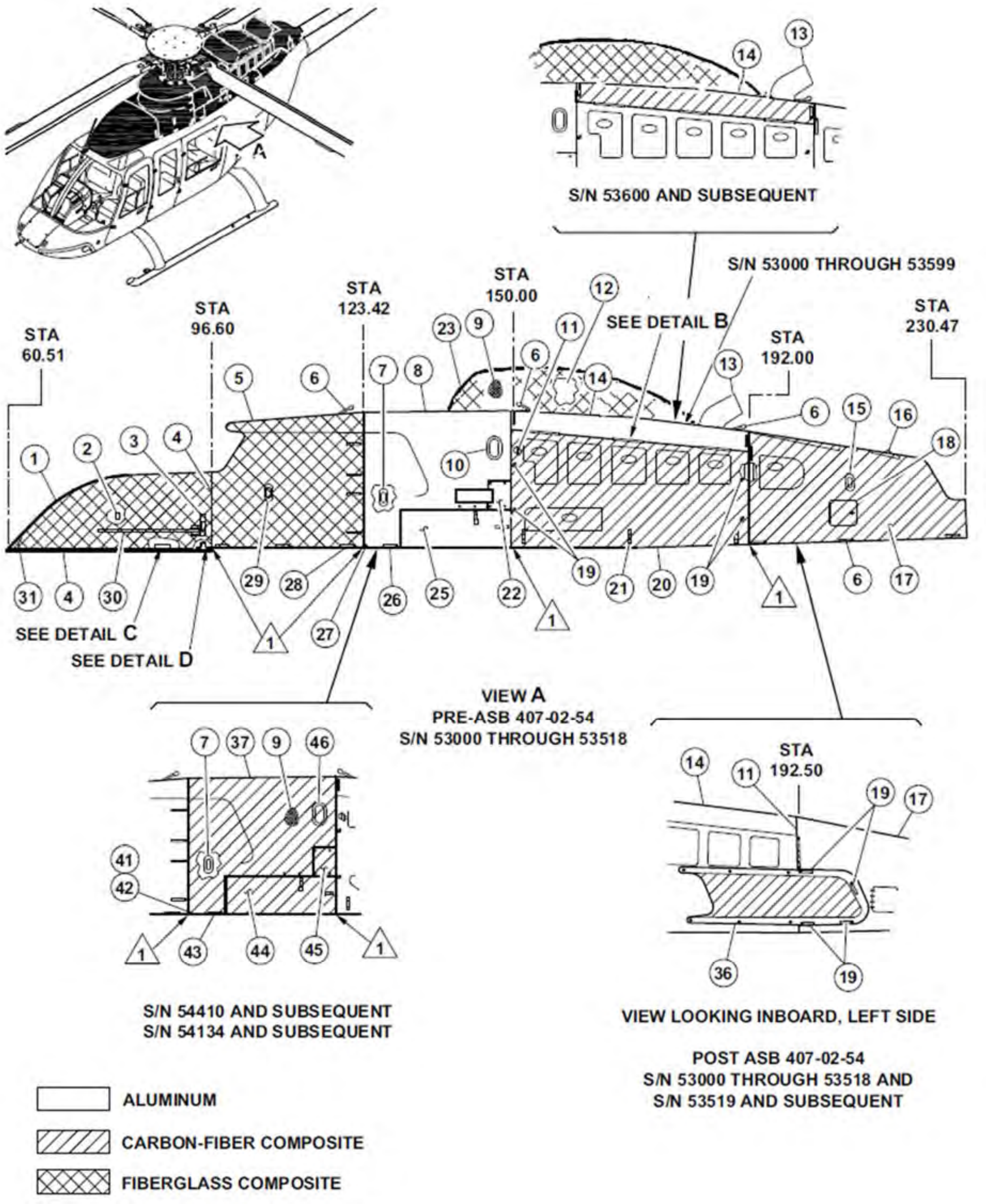

Figure 53-28. Cowls and Fairings (Sheet 1 of 3)

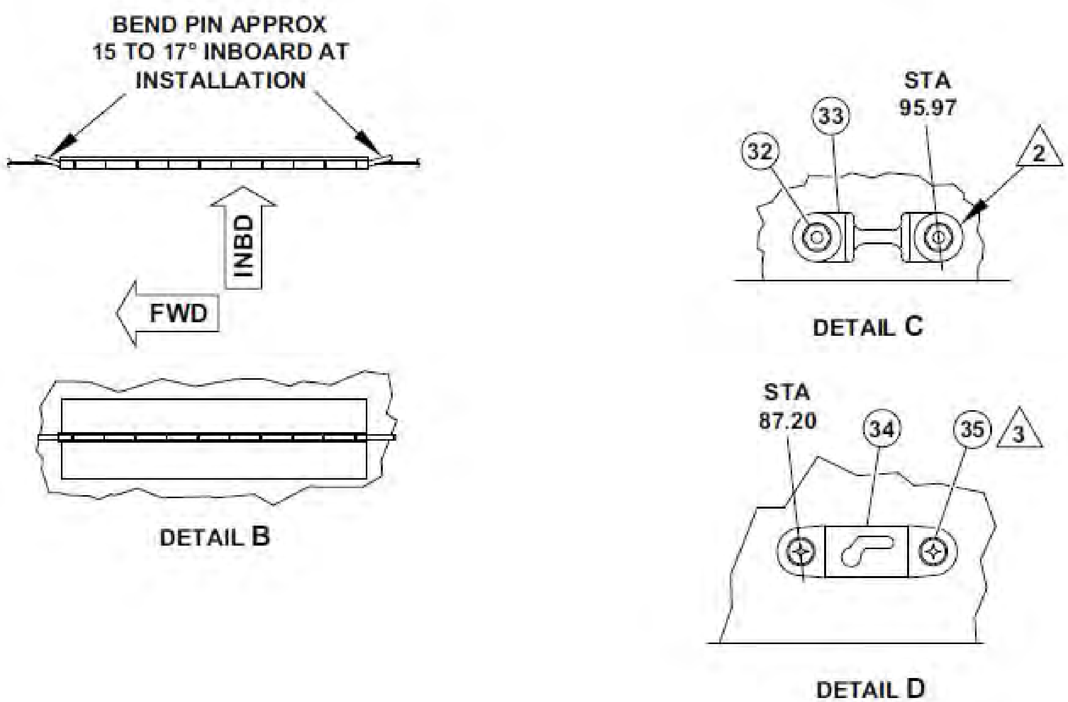

Figure 53-28. Cowls and Fairings (Sheet 2 of 3)

1. Forward fairing assembly
2. Stowage clip
3. Toggle hook latch fitting
4. Seal
5. Transmission fairing assembly
6. Turnlock fastener (slot type)
7. Cut out for transmission sight glass (right side only)
8. Air inlet cowl assembly
9. Screen installation
10. Engine intake sight glass (both sides)
11. Engine cowl door support
12. E4315-041 intake scoop
13. E4313-041 Exhaust stack
14. Upper engine cowl
15. Cut out for oil tank sight glass
16. Oil tank filler cap access
17. Aft oil cooler fairing assembly
18. Oil cooler access door
19. Turnlock fastener, wing type
20. Engine side cowl
21. Flush latch
22. Panel
23. E4734-1 upper fairing
24.
25. Access door
26. Turnlock fastener
27. Screw
28. Turnlock fastener
29. Cut out for hydraulic oil reservoir sight glass
30. Rod
31. Hinge
32. Bolt and washer
33. Toggle latch fitting
34. Fairing hold-open bracket
35. Screw and washer
36. Oil cooler blower inlet ducts
37. Air inlet cowl assembly
38.
39.
40.
41. Screw
42. Washer
43. Turnlock fastener
44. Access door
45. Panel
46. Engine intake sight glass (both sides)

NOTES

△1 0.12 inch (3.05 mm) gap between cowls to be constant. Gap between cowl and airframe structure not to exceed 0.16 inch (4.06 mm).

△2 Wet install fasteners and seal faying surfaces with sealant (C-251). Shim with washers as required to obtain correct fairing gap.

△3 Wet install fasteners with sealant (C-251).

Figure 53-28. Cowls and Fairings (Sheet 3 of 3)

53.7.4 ENGINE COWL ASSEMBLY

See BHT-407-MM Chapter 53, Paragraph 53-72

53.7.4.1 Engine Cowl Assembly – Removal

1. Remove the E4743-1 Upper Faring (23).
2. Remove the E4315-041 Intake Scoop Assembly. (12)
3. Unlock the flush latches (21, Figure 53-28) and the turnlock fasteners (19) (including oil cooler blower duct fasteners, if installed). Open the engine side cowls (20).
4. Unlock the turnlock fasteners (6) that attach the upper engine cowl (14) to the forward and aft firewalls.
5. Disconnect the door supports (11).
6. Remove the engine cowl assembly (20 and 14).

53.7.4.2 Engine Cowl Assembly – Inspection and Repair

See BHT-407-MM Chapter 53, Paragraph 53-74

53.7.4.3 Engine Cowl Assembly – Installation

1. Install the engine cowl assembly (20 and 14, Figure 53-28) on the engine over the exhaust stack (13). Make sure that it is aligned correctly with the forward and the aft firewalls.
2. Attach the upper engine cowl (14) to the forward and the aft firewall with the turnlock fasteners (6).
3. Connect the door supports (11).
4. Close the engine side cowls (20), lock the flush latch assemblies (21), and turnlock fasteners (19), including oil cooler blower duct fasteners.
5. Install the E4315-041 Intake Scoop Assembly.
6. Install the E4734-1 Upper Fairing.

53.7.5 AFT OIL COOLER FAIRING ASSEMBLY

See BHT-407-MM Chapter 53, Paragraph 53-76

53.7.5.1 Aft Oil Cooler Fairing Assembly – Removal

See BHT-407-MM Chapter 53, Paragraph 53-77

53.7.5.2 Aft Oil Cooler Fairing Assembly – Inspection and Repair

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See BHT-407-MM Chapter 53, Paragraph 53-83

53.7.7 TAIL ROTOR GEARBOX FAIRING

See BHT-407-MM Chapter 53, Paragraph 53-84

53.7.7.1 Tail Rotor Gearbox Fairing – Removal

See BHT-407-MM Chapter 53, Paragraph 53-85

53.7.7.2 Tail Rotor Gearbox Fairing – Inspection and Repair

See BHT-407-MM Chapter 53, Paragraph 53-86

53.7.7.3 Tail Rotor Gearbox Fairing – Installation

See BHT-407-MM Chapter 53, Paragraph 53-87

See BHT-407-MM Chapter 53, Figure 53-29

Figure 53-29. Tail Rotor Driveshaft Cover

See BHT-407-MM Chapter 53, Figure 53-30

Figure 53-30. Driveshaft Covers – Negligible Damage and Repair

See BHT-407-MM Chapter 53, Figure 53-31

Figure 53-31. Tail Rotor Gearbox Fairing

See BHT-407-MM Chapter 53, Figure 53-32

Figure 53-32. Gearbox Fairings – Negligible Damage and Repair

53.8 FIREWALLS

See BHT-407-MM Chapter 53, Paragraph 53-88

53.8.1 FORWARD ENGINE FIREWALL

The forward firewall (12, Figure 53-33) isolates the engine and the transmission compartments. The forward firewall includes openings for the following items:

- air inlet ducts
- main driveshaft
- fuel and the oil lines
- engine controls
- engine FADEC system electric harness
- E4442-041 Firewall Pan

The forward firewall gives support for the intake screen. The main driveshaft opening includes a two-piece removable cover assembly that attaches to the forward firewall. The cover assemblies make a fire shield around the main driveshaft. You can remove the two covers to do an inspection of the main driveshaft. Inspection and repair of the forward firewall assembly can be done with the firewall still in position.

53.8.1.1 Forward Engine Firewall – Inspection and Repair

1. Open the forward fairing assembly (1, Figure 53-28) (paragraph 53.7.1.1).
2. Remove the transmission fairing assembly (5, Figure 53-28) (paragraph 53.7.2.1).
3. Remove the air inlet cowl assembly (8, Figure 53-28) (paragraph 53.7.3.1).
4. Remove upper engine cowl and doors (14 and 20, Figure 53-28) (paragraph 53.7.4.1).
5. Inspection and repair of the forward engine firewall assembly can be done with the firewall still in position. Examine the forward firewall assembly (12, Figure 53-33) for deterioration of the seals (1). Bond the new seal (1) to the firewall with adhesive (C-311).
6. Examine the firewall for loose fittings receptacles and nutplates. Examine the nutplates for damage to the threads.
7. Examine the firewall for loose or missing sealer material in the bend radii and the bend ends. Fill all the open spaces to a depth of 0.018 inch (4.57 mm) with sealing compound (C-353).
8. Examine the firewall for nicks, scratches, and dents. Negligible damage includes smooth contour dents, nicks, and scratches that do not go through the firewall materials. You do not have to repair the negligible damage.
9. To repair the damage to the firewall beyond the negligible limit contact Product Support Engineering.
10. Install the air inlet cowl assembly (8, Figure 53-28) (paragraph 53.7.3.5).
11. Install the transmission fairing assembly (5, Figure 53-28) (paragraph 53.7.2.3).
12. Close the forward fairing assembly (1, Figure 53-28) (paragraph 53.7.1.3).
13. Install the upper engine cowl and doors (14 and 20, Figure 53-28) (paragraph 53.7.4.3).

53.8.2 Aft Engine Firewall

See BHT-407-MM Chapter 53, Paragraph 53-95

53.8.2.1 Aft Engine Firewall – Inspection and Repair

See BHT-407-MM Chapter 53, Paragraph 53-97

53.8.3 TAIL ROTOR DRIVESHAFT FIRESEAL COVER

See BHT-407-MM Chapter 53, Paragraph 53-98

53.8.3.1 Tail Rotor Driveshaft Fireseal Cover – Removal

See BHT-407-MM Chapter 53, Paragraph 53-99

53.8.3.2 Tail Rotor Driveshaft Fireseal Cover – Inspection

See BHT-407-MM Chapter 53, Paragraph 53-100

53.8.3.3 Tail Rotor Driveshaft Fireseal Cover – Installation

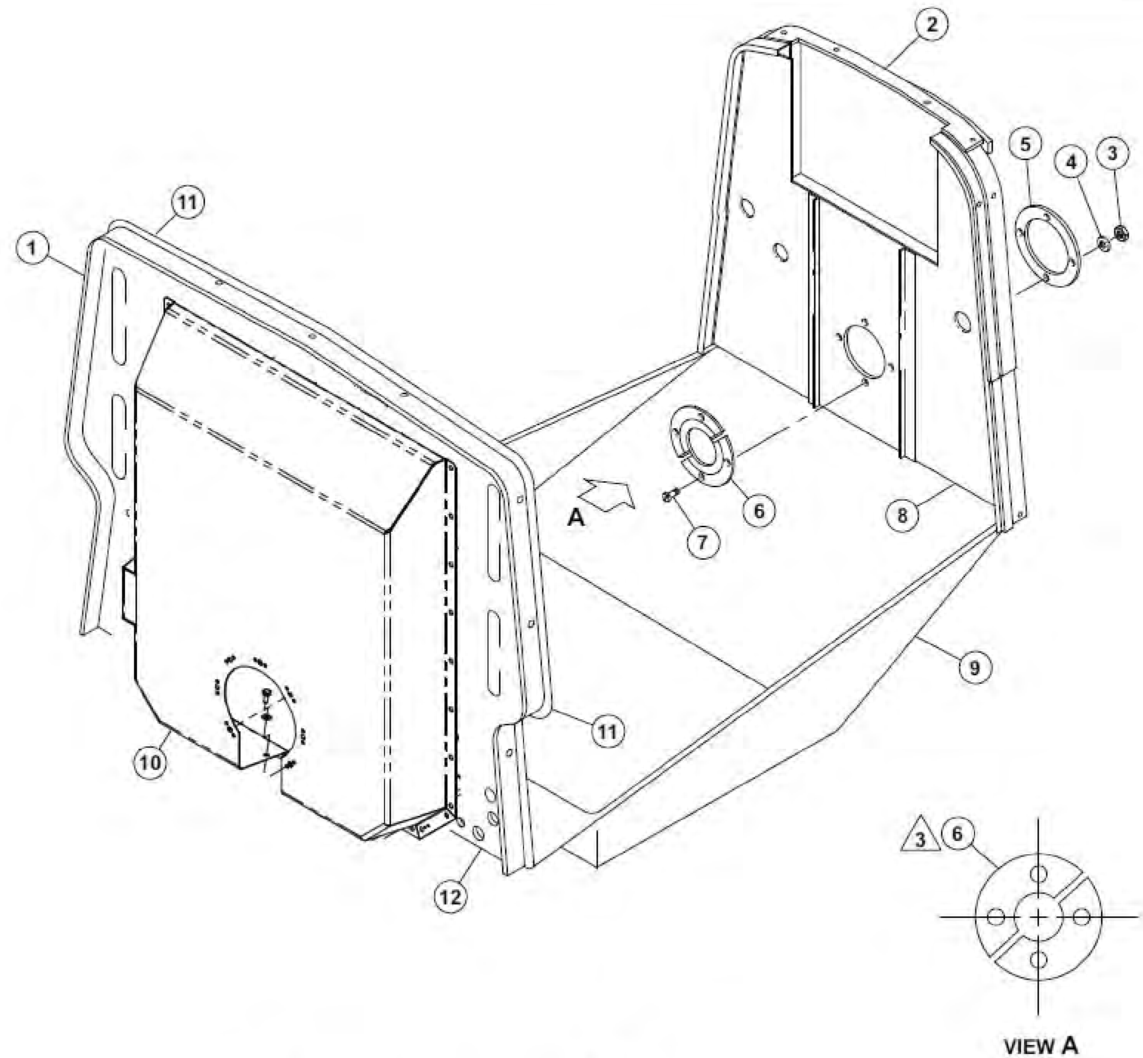
See BHT-407-MM Chapter 53, Paragraph 53-101

53.8.4 ENGINE PAN

See BHT-407-MM Chapter 53, Paragraph 53-102

53.8.4.1 Engine Pan – Inspection and Repair

See BHT-407-MM Chapter 53, Paragraph 53-103



1. Fireproof seal
2. Fireproof seal
3. Nut
4. Washer
5. Doubler
6. Cover
7. Screw
8. Aft firewall
9. Engine pan
10. E4442-041 firewall pan
11. "P" seal
12. Forward firewall

NOTES

1 Clearance between the oil cooler blower shaft and aft firewall covers (6) shall be 0.050 inch minimum to 0.100 inch maximum (1.27 to 2.54 mm)

Figure 53-32. Forward and Aft Firewalls

AFT AVIONICS SHELF

53.9 AFT AVIONICS SHELF (S/N/ 54300 AND SUBSEQUENT)

This modification is not applicable to S/N 54300 and subsequent, so BHT-407-MM Chapter 53, Paragraph 103 is not applicable.

53.9.1 AFT AVIONICS EQUIPMENT SHELF – REMOVAL

This modification is not applicable to S/N 54300 and subsequent, so BHT-407-MM Chapter 53, Paragraph 104 is not applicable.

53.9.2 AFT AVIONICS SHELF – CLEANING

This modification is not applicable to S/N 54300 and subsequent, so BHT-407-MM Chapter 53, Paragraph 105 is not applicable.

53.9.3 AFT AVIONICS SHELF – INSPECTION

This modification is not applicable to S/N 54300 and subsequent, so BHT-407-MM Chapter 53, Paragraph 106 is not applicable.

53.9.4 AFT AVIONICS SHELF – REPAIR

This modification is not applicable to S/N 54300 and subsequent, so BHT-407-MM Chapter 53, Paragraph 107 is not applicable.

53.9.5 AFT AVIONICS SHELF – INSTALLATION

This modification is not applicable to S/N 54300 and subsequent, so BHT-407-MM Chapter 53, Paragraph 108 is not applicable.

This modification is not applicable to S/N 54300 and subsequent

Figure 53-34. Aft Avionics Shelf – Removal and Installation

WIRE STRIKE PROTECTION SYSTEM

53.10 WIRE STRIKE PROTECTION SYSTEM

See BHT-407-MM Chapter 53, Paragraph 53-109

53.10.1 WIRE STRIKE PROTECTION SYSTEM – LOWER GROUND CONTACT INSPECTION

See BHT-407-MM Chapter 53, Paragraph 53-110

53.10.2 WIRE STRIKE PROTECTION SYSTEM – POST WIRE STRIKE INSPECTION

See BHT-407-MM Chapter 53, Paragraph 53-111

53.10.3 WIRE STRIKE PROTECTION SYSTEM – HARD LANDING, ROTOR STRIKE OR LIGHTNING STRIKE PROTECTION

See BHT-407-MM Chapter 53, Paragraph 53-112

53.10.4 UPPER CUTTER ASSEMBLY

See BHT-407-MM Chapter 53, Paragraph 53-113

53.10.4.1 Upper Cutter Assembly – Removal

See BHT-407-MM Chapter 53, Paragraph 53-114

53.10.4.2 Upper Cutter Assembly – Cleaning

See BHT-407-MM Chapter 53, Paragraph 53-115

53.10.4.3 Upper Cutter Assembly Inspection

See BHT-407-MM Chapter 53, Paragraph 53-116

53.10.4.4 Upper Cutter Assembly – Repair

See BHT-407-MM Chapter 53, Paragraph 53-117

53.10.4.5 Upper Cutter Assembly – Installation

See BHT-407-MM Chapter 53, Paragraph 53-118

53.10.5 UPPER STRUT

See BHT-407-MM Chapter 53, Paragraph 53-119

53.10.5.1 Upper Strut – Removal

See BHT-407-MM Chapter 53, Paragraph 53-120

53.10.5.2 Upper Strut – Cleaning

See BHT-407-MM Chapter 53, Paragraph 53-121

53.10.5.3 Upper Strut – Inspection

See BHT-407-MM Chapter 53, Paragraph 53-122

53.10.5.4 Upper Strut – Repair

See BHT-407-MM Chapter 53, Paragraph 53-123

53.10.5.5 Upper Strut – Installation

See BHT-407-MM Chapter 53, Paragraph 53-124

53.10.6 MOUNTING ANGLE

See BHT-407-MM Chapter 53, Paragraph 53-125

53.10.6.1 Mounting Angle – Removal

See BHT-407-MM Chapter 53, Paragraph 53-126

53.10.6.2 Mounting Angle – Cleaning

See BHT-407-MM Chapter 53, Paragraph 53-127

53.10.6.3 Mounting Angle – Inspection

See BHT-407-MM Chapter 53, Paragraph 53-128

53.10.6.4 Mounting Angle – Repair

See BHT-407-MM Chapter 53, Paragraph 53-129

53.10.6.5 Mounting Angle – Installation

See BHT-407-MM Chapter 53, Paragraph 53-130

53.10.7 LOWER CUTTER ASEMBLY

See BHT-407-MM Chapter 53, Paragraph 53-131

53.10.7.1 Lower Cutter Assembly – Removal

See BHT-407-MM Chapter 53, Paragraph 53-132

53.10.7.2 Lower Cutter Assembly – Cleaning

See BHT-407-MM Chapter 53, Paragraph 53-133

53.10.7.3 Lower Cutter Assembly – Inspection

See BHT-407-MM Chapter 53, Paragraph 53-134

53.10.7.4 Lower Cutter Assembly – Repair

See BHT-407-MM Chapter 53, Paragraph 53-135

53.10.7.5 Lower Cutter Assembly – Installation

See BHT-407-MM Chapter 53, Paragraph 53-136

53.10.8 LOWER STRUT

See BHT-407-MM Chapter 53, Paragraph 53-137

53.10.8.1 Lower Strut – Removal

See BHT-407-MM Chapter 53, Paragraph 53-138

53.10.8.2 Lower Strut – Cleaning

See BHT-407-MM Chapter 53, Paragraph 53-139

53.10.8.3 Lower Strut – Inspection

See BHT-407-MM Chapter 53, Paragraph 53-140

53.10.8.4 Lower Strut – Repair

See BHT-407-MM Chapter 53, Paragraph 53-141

53.10.8.5 Lower Strut – Installation

See BHT-407-MM Chapter 53, Paragraph 53-142

53.10.9 MOUNTING TEE

See BHT-407-MM Chapter 53, Paragraph 53-143

53.10.9.1 Mounting Tee – Removal

See BHT-407-MM Chapter 53, Paragraph 53-144

53.10.9.2 Mounting Tee – Cleaning

See BHT-407-MM Chapter 53, Paragraph 53-145

53.10.9.3 Mounting Tee – Inspection

See BHT-407-MM Chapter 53, Paragraph 53-146

53.10.9.4 Mounting Tee – Repair

See BHT-407-MM Chapter 53, Paragraph 53-147

53.10.9.5 Mounting Tee – Installation

See BHT-407-MM Chapter 53, Paragraph 53-148

See BHT-407-MM Chapter 53, Figure 53-35

Figure 53-35. Upper Cutter Assembly – Removal and Installation

See BHT-407-MM Chapter 53, Figure 53-36

Figure 53-36. Upper Strut – Removal and Installation

See BHT-407-MM Chapter 53, Figure 53-37

Figure 53-37. Mounting Angle – Removal and Installation

See BHT-407-MM Chapter 53, Figure 53-38

Figure 53-38. Lower Cutter Assembly – Removal and Installation

See BHT-407-MM Chapter 53, Figure 53-39

Figure 53-39. Lower Strut – Removal and Installation

See BHT-407-MM Chapter 53, Figure 53-40

Figure 53-40. Mounting Tee – Removal and Installation

Chapter 62
MAIN ROTOR
(62-00-00)

REFER TO
BHT-407-MM

Chapter 63
MAIN ROTOR DRIVE
(63-00-00)

Contents

MAIN ROTOR DRIVE SYSTEM

MAST ASSEMBLY

TRANSMISSION ASSEMBLY

PYLON ASSEMBLY

ENGINE TO TRANSMISSION DRIVESHAFT

FREEWHEEL ASSEMBLY

ROTOR BRAKE SYSTEM

TRANSMISSION OIL SYSTEM

TABLE OF FIGURES

MAIN ROTOR DRIVE SYSTEM

63.1 MAIN ROTOR DRIVE SYSTEM

The main rotor drive system (Figure 63-1) transmits power from the engine to the main rotor. The system is made up of the mast assembly, transmission assembly, pylon assembly, engine to transmission driveshaft assembly, rotor brake kit and the transmission oil system. This chapter will describe each of the above systems under its own section.

63.1.1 MAIN ROTOR DRIVE SYSTEM – OPERATIONAL CHECK

See BHT-407-MM Chapter 63, Paragraph 63-2

63.1.2 MAIN ROTOR DRIVE SYSTEM – SCHEDULED INSPECTION

See BHT-407-MM Chapter 63, Paragraph 63-3

63.1.3 MAIN ROTOR DRIVE SYSTEM – CONDITION AND SECURITY INSPECTION

See BHT-407-MM Chapter 63, Paragraph 63-4

63.1.3.1 Transmission Top Case – Torque Check Special Instructions

See BHT-407-MM Chapter 63, Paragraph 63-5

63.1.3.2 Mast – 12 Month Inspection

See BHT-407-MM Chapter 63, Paragraph 63-6

63.1.3.3 Mast – 60 Month Inspection

See BHT-407-MM Chapter 63, Paragraph 63-7

63.1.3.4 Transmission – 60 Month Inspection

See BHT-407-MM Chapter 63, Paragraph 63-8

63.1.4 MAIN ROTOR DRIVE SYSTEM – PERMITTED LEAKAGE RATE

See BHT-407-MM Chapter 63, Paragraph 63-10

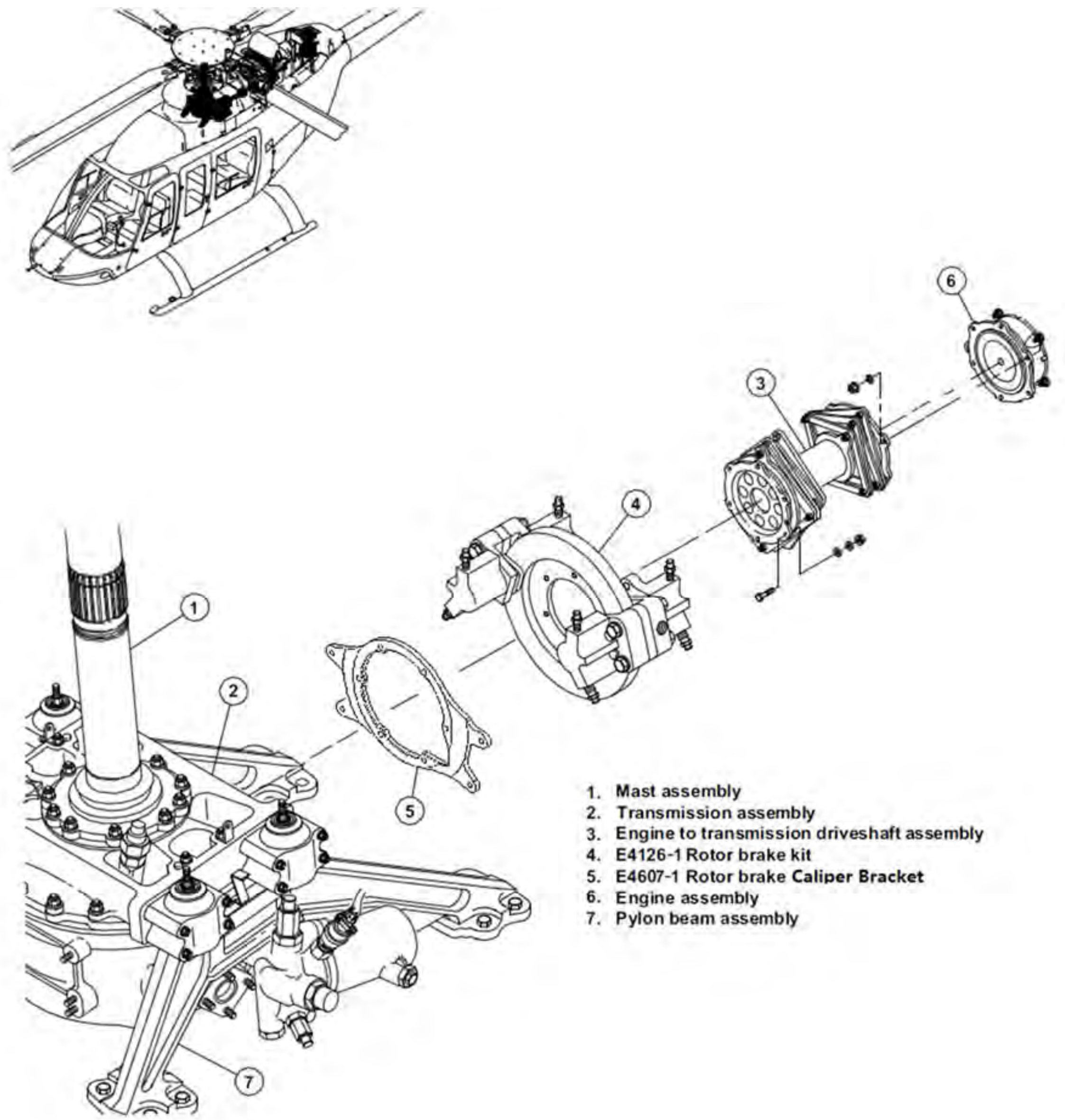


Figure 63-1. Main Rotor Drive System

See BHT-407-MM Chapter 63, Figure 63-2

Figure 63-2. Trouble No. 1 – No Transmission Oil Pressure Indication

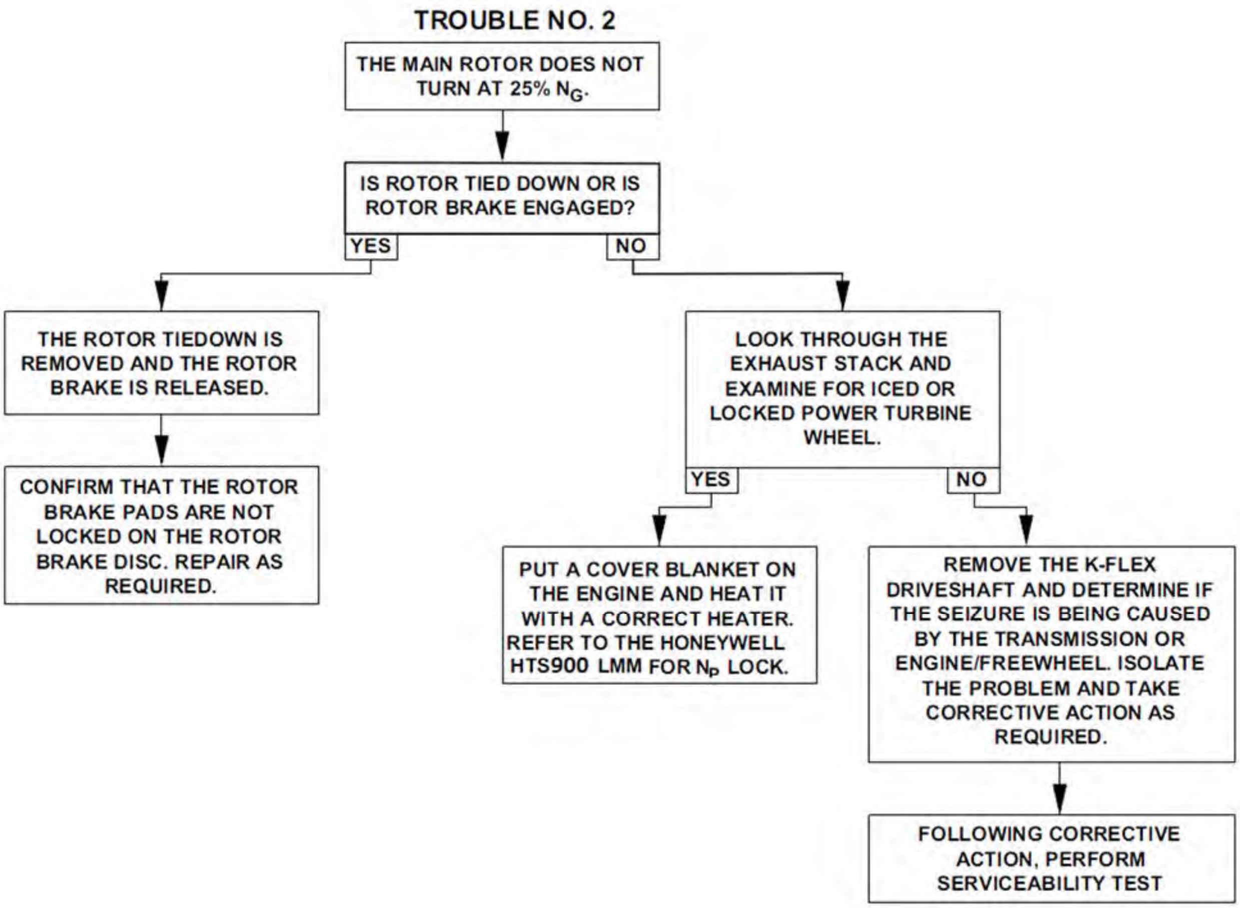


Figure 63-3. Trouble No. 2 – Main Rotor Does Not Rotate by 25% NG

See BHT-407-MM Chapter 63, Paragraph 63-4

Figure 63-4. Trouble No. 3 – Transmission Oil Filter Impending Bypass Indicator Extended

See BHT-407-MM Chapter 63, Figure 63-5

Figure 63-5. TroubleNo.4 – Low Transmission Oil Temperature Indication

See BHT-407-MM Chapter 63, Figure 63-6

Figure 63-6. Trouble No. 5 – High Transmission Oil Temperature

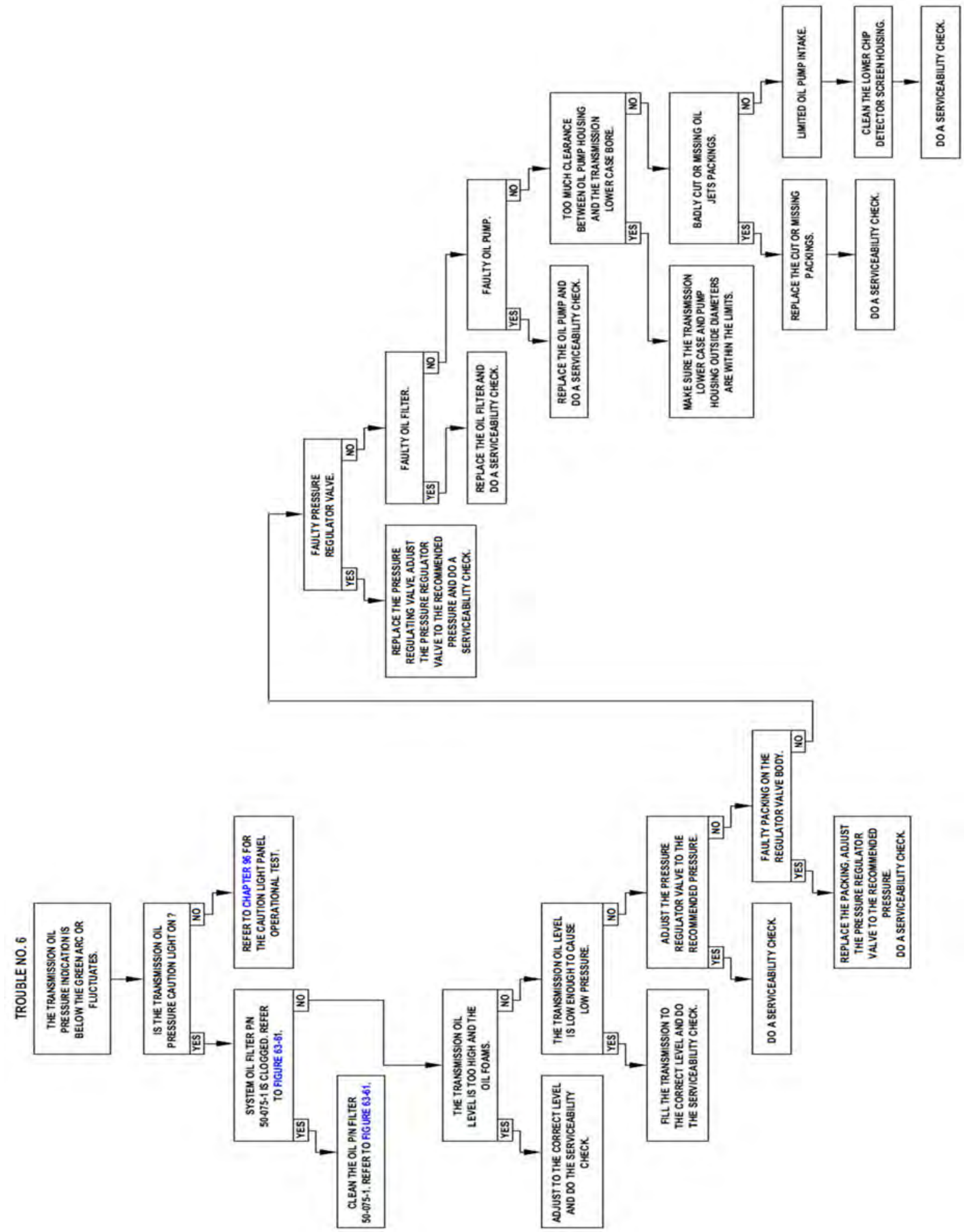


Figure 63-7. Trouble No. 6 – Low Transmission Oil Pressure Indication

See BHT-407-MM Chapter 63, Figure 63-8

Figure 63-8. Trouble No. 7 – High Transmission Oil Pressure Indication

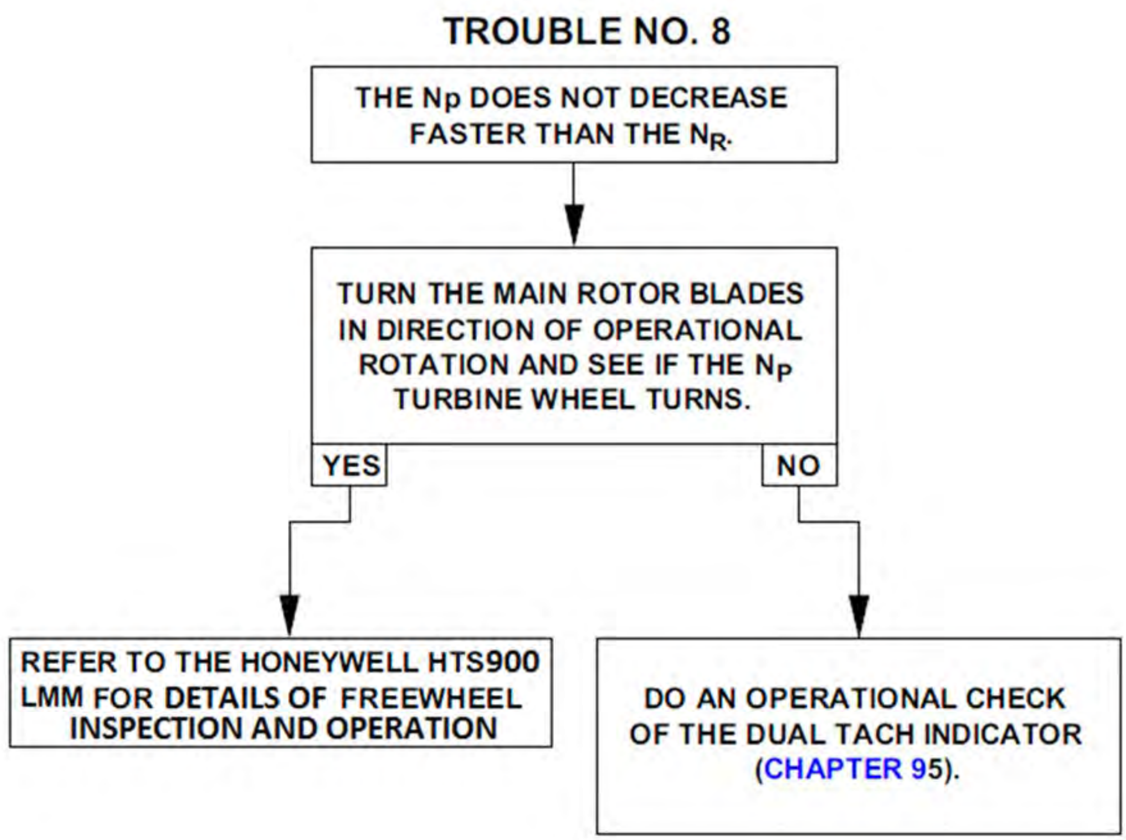


Figure 63-9. Trouble No. 8 – No N_P Decrease

See BHT-407-MM Chapter 63, Figure 63-10

Figure 63-10. Trouble No. 9 – Transmission Oil Leak

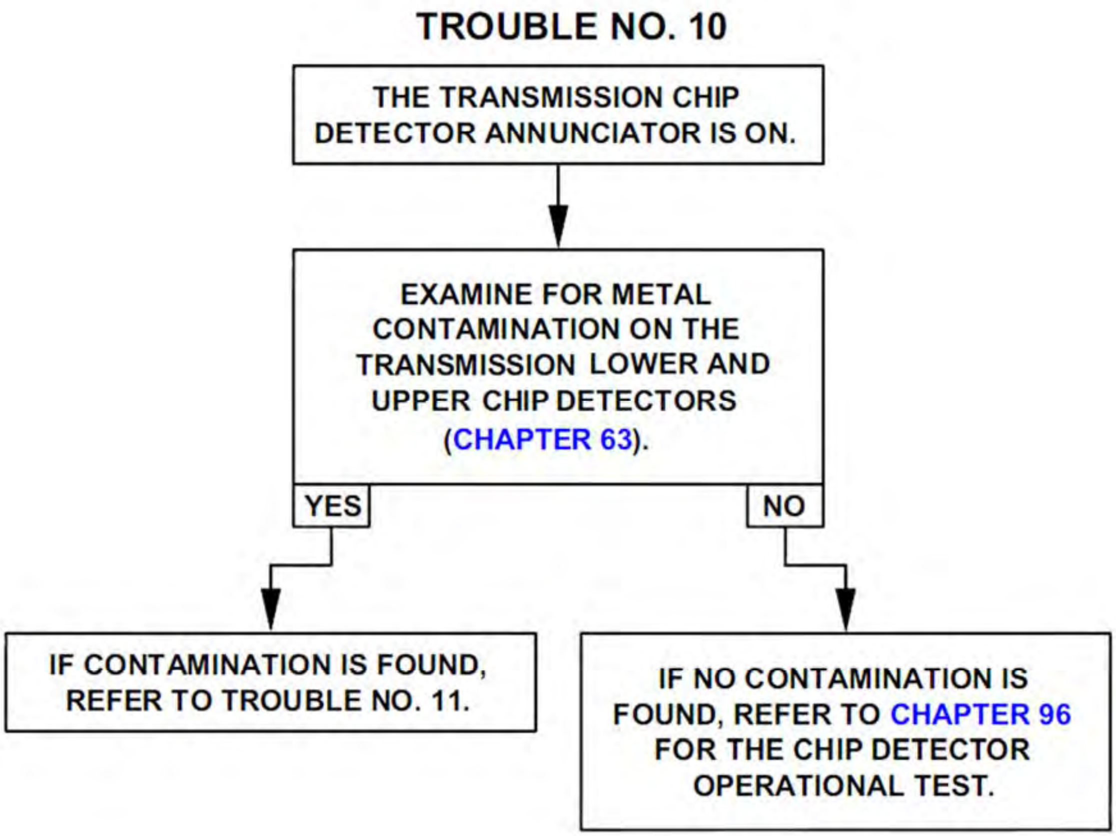


Figure 63-11. Trouble No. 10 – Transmission Chip Indication

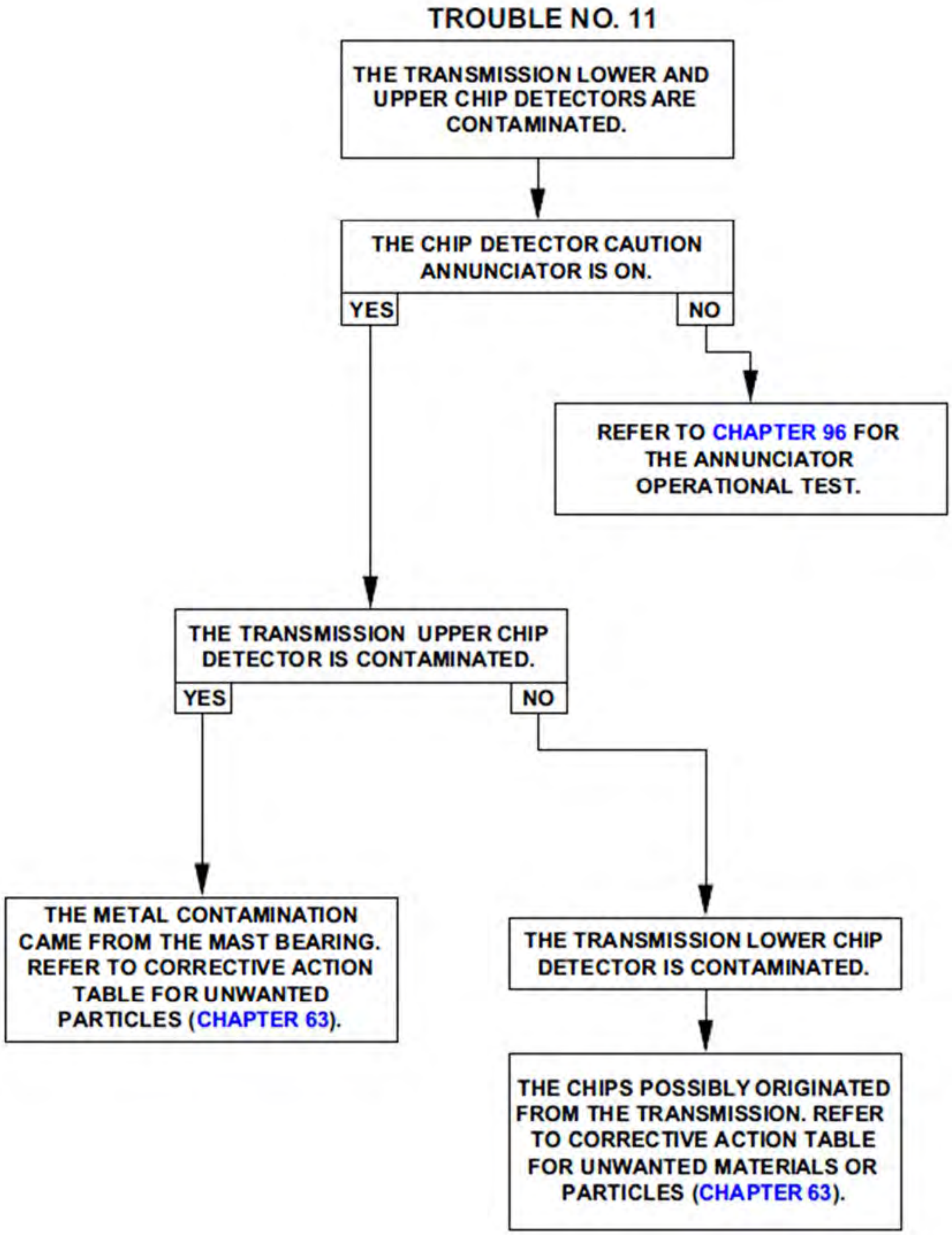


Figure 63-12. Trouble No. 11 – Transmission Chip Indication

63.2 SERVICEABILITY CHECK

63.2.1 TRANSMISSION ASSEMBLY– SERVICEABILITY CHECK

1. Drain the transmission oil system (Chapter 12) through a paper filter and save the paper filter for the inspection. Flush the transmission with clean oil.
2. Examine the electrical magnetic element of the transmission top chip detector for unwanted particles.
3. Examine the electrical magnetic element of the transmission lower chip detector and the screen of the chip detector housing for unwanted particles.
4. Collect and identify the unwanted particles (paragraph 63.3).
5. Install the transmission top chip detector.
6. Install the transmission lower chip detector.
7. Remove the filter element. Cut open the filter element and examine for unwanted particles.
8. Replace the filter element with a serviceable filter element.
9. If the indicating bypass valve assembly is pushed out, do the steps that follow:
   - **a.** Remove the oil cooler and replace it with a serviceable unit (Chapter 79).
   - **b.** Fully flush all the oil system lines.
   - **c.** Connect the hose assemblies.
   - **d.** Remove the jet assemblies No. 1, No. 2, No. 3 and No. 4.
   - **e.** Clean and examine the jet assemblies No. 1, No. 2, No. 3 and No. 4.
   - **f.** Install the jet assemblies No. 1, No. 2, No. 3 and No. 4.
   - **g.** Disconnect the hose from the union filter.
   - **h.** Remove the union filter.
   - **i.** Clean and examine the union filter.
   - **j.** Install the union filter.
   - **k.** Connect the hose to the union filter.
10. Fill the transmission oil system (Chapter 12).
11. Do an operational check (paragraph 63.1.1).
12. Remove and examine the transmission top chip detector for unwanted particles.
13. Remove and examine the transmission lower chip detector for unwanted particles.
14. Drain the transmission oil system (Chapter 12) through a clean paper filter. Compare the filter with the previous results.

NOTE

If you do the serviceability check because of metal particle contamination and the number of particles has increased or the particles are large enough to be identified as chips from the gear or bearing, replace the effected component. If the number of particles has decreased and you find only minute particles, the transmission assembly are serviceable.

15. Install the transmission top chip detector.
16. Install the transmission lower chip detector.
17. Fill the transmission oil system (Chapter 12).

63.3 UNWANTED PARTICLES

63.3.1 UNWANTED PARTICLES – VISUAL IDENTIFICATION

See BHT-407-MM Chapter 63, Paragraph 63-14

63.3.2 UNWANTED PARTICLES – CHEMICAL IDENTIFICATION

See BHT-407-MM Chapter 63, Paragraph 63-15

Table 63-2. Identification of Unwanted Materials

See BHT-407-MM Chapter 63, Table 63-2

See BHT-407-MM Chapter 63, Figure 63-13

Figure 63-13. Unwanted Material on the Transmission Chip Detectors

MAST ASSEMBLY

63.4 MAST ASSEMBLY

See BHT-407-MM Chapter 63, Paragraph 63-16

63.4.1 MAST ASSEMBLY – REMOVAL

See BHT-407-MM Chapter 63, Paragraph 63-17

63.4.2 MAST ASSEMBLY – CLEANING

See BHT-407-MM Chapter 63, Paragraph 63-18

63.4.3 MAST ASSEMBLY – INSPECTION AND REPAIR

See BHT-407-MM Chapter 63, Paragraph 63-19

63.4.4 MAST ASSEMBLY – INSTALLATION

See BHT-407-MM Chapter 63, Paragraph 63-20

See BHT-407-MM Chapter 63, Figure 63-14

Figure 63-14. Mast Assembly – Removal/Installation

63.5 TRANSMISSION ASSEMBLY

See BHT-407-MM Chapter 63, Paragraph 63-21

63.5.1 TRANSMISSION – REMOVAL

SPECIAL TOOLS REQUIRED

NUMBER	NOMENCLATURE
T102102	Dehydrator
T102137-107	Lifting Tool
T103314-101	Cover and Lift Plate

MATERIALS REQUIRED

Refer to BHT-ALL-SPM for all specifications

NUMBER	NOMENCLATURE
C428	Caps and/or Plugs

1. Remove the external power from the helicopter. Disconnect the battery power (Chapter 96).

2. Remove the forward fairing assembly, transmission cowling assembly, and engine air inlet cowling (Chapter 53) to get access to the transmission assembly (2, Figure 63-15).

3. Drain the transmission oil system (Chapter 12).

4. Drain the hydraulic fluid (Chapter 12).

5. Disconnect the pitch links from the main rotor hub (Chapter 67).

6. Remove the Frahm damper from the main rotor hub (Chapter 62).

7. Remove the main rotor hub and blade assembly (Chapter 62).

8. Disconnect the cyclic control tubes and the collective control link from the swashplate assembly and the bellcranks on the transmission control support assembly (Chapter 67).

9. Disconnect the collective and cyclic control tubes from the servo actuators and the bellcranks on the transmission control support assembly (Chapter 67).

10. Remove the transmission control support assembly with the bellcranks (Chapter 67).

NOTE

You can remove the transmission assembly with the mast, swashplate, and pylon assembly installed. Install the mast nut and lifting tool (T102137-107) on the mast pole, disconnect the pylon beams from the deck and remove the stop deck fitting on the right-hand side. Hoist the transmission with the mast, swashplate, and pylon assembly off the helicopter and put on to a clean work stand.

11. Remove the swashplate and support assembly (Chapter 67).

CAUTION

TO PREVENT CORROSION, DO NOT HANDLE THE MAST ASSEMBLY BELOW THE BEARING LINER WITH BARE HANDS. WEAR CLEAN WHITE GLOVES.

12. Remove clamps and attaching hardware as required (Figure 63-15, Sheet 1).

13. Remove the mast assembly (paragraph 63.4.1).

CAUTION

THE COVER AND LIFT PLATE (T103314-101) MUST BE INSTALLED ON THE TRANSMISSION AT ALL TIMES WHEN THE MAST IS REMOVED.

NOTE

The cover and lift plate (T103314-101) prevents foreign object and water ingress in the transmission and holds the transmission gearing in place during transportation.

14. Install the cover and lift plate (T103314-101) (3) on the transmission top case studs and attach with nuts (4).

15. Remove the engine-to-transmission driveshaft assembly (paragraph 63.7.1).

16. Remove the clamps that attach the wire harness to the aft and left-hand side of the transmission.

17. Disconnect the connector from the transmission lower chip detector (Chapter 96).

18. Disconnect the connector from the transmission oil temperature bulb (Chapter 95).

19. Disconnect the connector from the transmission oil temperature switch (Chapter 96).

20. Disconnect the connector from the transmission top chip detector (Chapter 96).

21. Disconnect the connector from the monopole sensor (Chapter 95).

22. Disconnect the connector from the vibration sensor (Chapter 18).

NOTE

Do not remove the bonded shim below the pylon stop deck fitting.

23. Remove the pylon stop deck fitting (paragraph 63.6.3.1).

24. Disconnect all the hoses from the hydraulic pump (Chapter 29).

25. Close the hoses, elbow fittings, and unions on the hydraulic pump with caps and/or plugs (C-428).

26. Disconnect the oil filter outlet line from the oil filter manifold fitting. Install the protective cover on the oil filter manifold fitting (paragraph 63.12.19.1).

27. Disconnect the oil filter inlet line from the oil filter manifold fitting. Install the protective cover on the oil filter manifold fitting (paragraph 63.12.19.1).

28. Remove the bolts (6) and washers (7) that attach the left-hand and right-hand pylon beams (8 and 9) to the forward top deck.

29. Make sure that you disconnect all attachments between the transmission assembly (2) and the helicopter.

CAUTION

REMOVE ALL SLACK FROM THE HOIST, THIS PREVENTS ACCIDENTAL MOVEMENT OF THE TRANSMISSION. IF YOU PERMIT THE TRANSMISSION TO MOVE, IT CAN CAUSE DAMAGE TO THE COMPONENTS THAT ARE INSTALLED ON THE CABIN ROOF.

30. Connect the hoist cable (1) to the lifting tool (T102137-107) or the cover and lift plate (T103314-101) (3).

CAUTION

THE COVER AND LIFT PLATE (T103314-101) MUST BE INSTALLED ON THE TRANSMISSION AT ALL TIMES WHEN THE MAST IS REMOVED.

NOTE

The cover and lift plate (T103314-101) prevents foreign object and water ingress in the transmission and holds the transmission gearing in place during transportation.

NOTE

The pylon beam shims are bonded to the forward top deck. Be careful not to move or damage the shims during the removal of the pylon beams and transmission assembly.

31. Carefully hoist the transmission assembly (2) with the left-hand and right-hand pylon beams (8 and 9) from the helicopter and put on an appropriate work surface.

32. Install the bolts (6) and washers (7) in the shims (5) on the forward top deck to avoid damage to the shims. If the shims require replacement or reinstallation, perform the instructions contained in paragraph 63-24.

33. Remove the spring assemblies (paragraph 63.6.1.1).

34. Remove the pylon beams and corner mounts as an assembly from the transmission top case (paragraph 63.6.1.1).

35. Remove the hydraulic pump (Chapter 29).

36. Remove the oil filler cap assembly (paragraph 63.12.3.1).

37. Install a dehydrator (T102102) in the filler cap opening while the transmission assembly (2) is removed.

38. If you do not install the transmission assembly (2) for a long period of time, preserve it in agreement with BHT-ALL-SPM.

63.5.2 TRANSMISSION ASSEMBLY – CLEANING

See BHT-407-MM Chapter 63, Paragraph 63-23

63.5.3 TRANSMISSION ASSEMBLY – INSPECTION AND REPAIR

See BHT-407-MM Chapter 63, Paragraph 63-24

63.5.4 TRANSMISSION ASSEMBLY – INSTALLATION

SPECIAL TOOLS REQUIRED

NUMBER	NOMENCLATURE
T102102	Dehydrator
T102137-107	Lifting Tool
T103314-101	Cover and Lift Plate

MATERIALS REQUIRED

Refer to BHT-ALL-SPM for specifications

NUMBER	NOMENCLATURE
T102102	Dehydrator
T102137-107	Lifting Tool
T103314-101	Cover and Lift Plate

1. Remove the dehydrator (T102102) from the oil filler cap opening. Install the filler cap assembly (paragraph 63-138).

2. If you preserved the transmission assembly (2, Figure 63-15), refer to the BHT-ALL-SPM for the depreservation or return to service procedures.

3. Install the hydraulic pump (Chapter 29).

4. Install the pylon beams and corner mounts to the transmission top case (paragraph 63-41).

5. Install the bellcrank support and the bellcranks (Chapter 67).

6. Remove the transmission cover and lift plate T103314-101 (3), if installed.

7. Install the mast assembly (paragraph 63-20).

8. Install the swashplate and support assembly (Chapter 67).

9. Install new washers and new nuts on each stud of the transmission top case (Chapter 67).

10. Temporarily install the mast nut on the mast assembly.

11. Install the lifting tool T102137-107 on the mast nut.

12. Remove the bolts (6) and washers (7) from the shims (5) on the forward top deck.

13. Attach the hoist cable (1) to the mast lifting tool T102137-107 and carefully lift the transmission assembly (2) into position, for installation on the helicopter. Lower the transmission assembly (2) until the pylon beams (8 and 9) rest on the forward top deck.

14. Install the bolts (6) and washers (7) that attach the pylon beams (8 and 9) to the forward top deck.

15. Tighten bolts (6) Apply a bead of sealant (C-308) around the base of each pylon beam. Apply a layer of corrosion preventive compound (C-101) Grade 1 to the bolt (6, Figure 63-15) heads and exposed portion of the washers (7).

16. Install the pylon stop deck fitting (paragraph 63-53).

17. Install and adjust restraint spring assembly (paragraph 63-61).

18. Remove the lifting tool T102137-107.

NOTE

Remove all protective covers, plugs and barrier material before you connect the lines.

19. Connect the oil filter outlet line to the fitting on the oil filter manifold (paragraph 63-205).

20. Connect the oil filter inlet line to the fitting on the oil filter manifold (paragraph 63-205).

21. Connect all the hoses to the hydraulic pump (Chapter 29).

22. Connect the cyclic control tubes and collective control link from the swashplate to the bellcranks on the transmission support assembly (Chapter 67).

23. Connect the cyclic and collective control tubes from the servo actuators to the bellcranks on the transmission support assembly (Chapter 67).

24. Connect the connector to the transmission lower chip detector (Chapter 96).

25. Connect the connector to the transmission top chip detector (Chapter 96).

26. Connect the connector to the transmission oil temperature switch (Chapter 96).

27. Connect the connector to the transmission oil temperature bulb (Chapter 95).

28. Connect the connector to the monopole sensor (Chapter 95).

29. Connect the connector to the vibration sensor (Chapter 18).

30. Connect cable connectors (Chapter 96), and install clamps with attaching hardware.

31. Install clamps and attaching hardware as required (Figure 63-15, sheet 1).

32. Install the engine to transmission driveshaft (paragraph 63-67).

33. Install the main rotor hub and blades (Chapter 62).

34. If applicable, install the Frahm damper on the main rotor hub (Chapter 62).

35. Connect the pitch links to the main rotor hub (Chapter 67).

36. Do the rigging for the collective and cyclic controls (Chapter 67).

37. Fill the transmission oil system (Chapter 12).

38. Fill the hydraulic reservoir (Chapter 12).

39. Install the forward fairing assembly, transmission cowling assembly and the engine air inlet cowling (Chapter 53).

40. Do an operational check (paragraph 63-2).

See BHT-407-MM Chapter 63, Figure 63-15

Figure 63-15. Transmission Assembly – Removal/Installation

See BHT-407-MM Chapter 63, Figure 63-16

Figure 63-16. Pylon Beam Shim Bonding Workaid

63.5.5 TRANSMISSION – INPUT SEAL

See BHT-407-MM Chapter 63, Paragraph 63-26

63.5.5.1 Transmission Input Magnetic Carbon Seal – Removal

See BHT-407-MM Chapter 63, Paragraph 63-27

63.5.5.2 Transmission Input Magnetic Carbon Seal – Cleaning

See BHT-407-MM Chapter 63, Paragraph 63-28

63.5.5.3 Transmission Input Magnetic Carbon Seal – Inspection and Repair

See BHT-407-MM Chapter 63, Paragraph 63-29

63.5.5.4 Transmission Input Magnetic Carbon Seal – Installation

See BHT-407-MM Chapter 63, Paragraph 63-30

63.5.5.5 Transmission Input Lip Seal – Removal

See BHT-407-MM Chapter 63, Paragraph 63-31

63.5.5.6 Transmission Input Lip Seal – Cleaning

See BHT-407-MM Chapter 63, Paragraph 63-32

63.5.5.7 Transmission Input Lip Seal – Inspection

See BHT-407-MM Chapter 63, Paragraph 63-33

63.5.5.8 Transmission Input Lip Seal – Installation

See BHT-407-MM Chapter 63, Paragraph 63-34

See BHT-407-MM Chapter 63, Figure 63-17

Figure 63-17. Transmission Input Magnetic Carbon Seal

See BHT-407-MM Chapter 63, Figure 63-18

Figure 63-18. Magnetic Seal Inspection Limits

See BHT-407-MM Chapter 63, Figure 63-19

Figure 63-19. Input Housing Shim Adjustment

See BHT-407-MM Chapter 63, Figure 63-20

Figure 63-20. Transmission Input Housing Assembly and Lip Seal – Removal/Installation

See BHT-407-MM Chapter 63, Figure 63-21

Figure 63-21. Lip Seal and Wear Sleeve - Workaids

See BHT-407-MM Chapter 63, Figure 63-22

Figure 63-22. Transmission Input Lip Seal - Installation

See BHT-407-MM Chapter 63, Figure 63-23

Figure 63-23. Input Adapter Wear Sleeve – Removal/Installation

See BHT-407-MM Chapter 63, Figure 63-24

Figure 63-24. Input Adapter – Wear, Damage and Repair Limits

See BHT-407-MM Chapter 63, Figure 63-25

Figure 63-25. Wear Sleeve – Wear, Damage and Repair Limits

PYLON ASSEMBLY

63.6 PYLON ASSEMBLY

See BHT-407-MM Chapter 63, Paragraph 63-35

63.6.1 PYLON BEAM ASSEMBLY

See BHT-407-MM Chapter 63, Paragraph 63-36

63.6.1.1 Pylon Beam Assembly – Removal

See BHT-407-MM Chapter 63, Paragraph 63-37

63.6.1.2 Pylon Beam Assembly – Cleaning

See BHT-407-MM Chapter 63, Paragraph 63-38

63.6.1.3 Pylon Beam Assembly – Inspection

See BHT-407-MM Chapter 63, Paragraph 63-39

63.6.1.4 Pylon Beam Assembly – Repair

See BHT-407-MM Chapter 63, Paragraph 63-40

63.6.1.5 Pylon Beam Assembly – Installation

See BHT-407-MM Chapter 63, Paragraph 63-41

63.6.2 PYLON STOP TRANSMISSION FITTING

See BHT-407-MM Chapter 63, Paragraph 63-42

63.6.2.1 Pylon Stop Transmission Fitting – Removal

See BHT-407-MM Chapter 63, Paragraph 63-43

63.6.2.2 Pylon Stop Transmission Fitting – Cleaning

See BHT-407-MM Chapter 63, Paragraph 63-44

63.6.2.3 Pylon Stop Transmission Fitting – Stripping

See BHT-407-MM Chapter 63, Paragraph 63-45

63.6.2.4 Pylon Stop Transmission Fitting – Inspection

See BHT-407-MM Chapter 63, Paragraph 63-46

63.6.2.5 Pylon Stop Transmission Fitting – Painting

See BHT-407-MM Chapter 63, Paragraph 63-47

63.6.2.6 Pylon Stop Transmission Fitting – Installation

See BHT-407-MM Chapter 63, Paragraph 63-48

See BHT-407-MM Chapter 63, Figure 63-26

Figure 63-26. Pylon Beam Assembly – Removal and Installation

See BHT-407-MM Chapter 63, Figure 63-27

Figure 63-27. Corner Mount – Wear, Damage and Repair Limits

See BHT-407-MM Chapter 63, Figure 63-28

Figure 63-28. Up Stop Assembly – Wear, Damage and Repair Limits

See BHT-407-MM Chapter 63, Figure 63-29

Figure 63-29. Down Stop Assembly – Wear, Damage and Repair Limits

See BHT-407-MM Chapter 63, Figure 63-30

Figure 63-30. Bushing – Wear, Damage and Repair Limits

See BHT-407-MM Chapter 63, Figure 63-31

Figure 63-31. Bolt – Wear, Damage and Repair Limits

See BHT-407-MM Chapter 63, Figure 63-32

Figure 63-32. Beam Assembly – Wear, Damage and Repair Limits

See BHT-407-MM Chapter 63, Figure 63-33

Figure 63-33. Corner Mount Installation

See BHT-407-MM Chapter 63, Figure 63-34

Figure 63-34. Corner Mount Alignment

See BHT-407-MM Chapter 63, Figure 63-35

Figure 63-35. Pylon Stop Transmission Fitting – Wear, Damage and Repair Limits

63.6.3 PYLON STOP DECK FITTING

See BHT-407-MM Chapter 63, Paragraph 63-49

63.6.3.1 Pylon Stop Deck Fitting – Removal

See BHT-407-MM Chapter 63, Paragraph 63-50

63.6.3.2 Pylon Stop Deck Fitting – Cleaning

See BHT-407-MM Chapter 63, Paragraph 63-51

63.6.3.3 Pylon Stop Deck Fitting – Inspection

See BHT-407-MM Chapter 63, Paragraph 63-52

63.6.3.4 Pylon Stop Deck Fitting – Installation

See BHT-407-MM Chapter 63, Paragraph 63-53

63.6.4 RESTRAINT SPRING ASSEMBLY

See BHT-407-MM Chapter 63, Paragraph 63-54

63.6.4.1 Restraint Spring Assembly – Removal

See BHT-407-MM Chapter 63, Paragraph 63-55

63.6.4.2 Restraint Spring Assembly – Disassembly

See BHT-407-MM Chapter 63, Paragraph 63-56

63.6.4.3 Restraint Spring Assembly – Cleaning

See BHT-407-MM Chapter 63, Paragraph 63-57

63.6.4.4 Restraint Spring Assembly – Inspection

See BHT-407-MM Chapter 63, Paragraph 63-58

63.6.4.5 Restraint Spring Assembly – Repair

See BHT-407-MM Chapter 63, Paragraph 63-59

63.6.4.6 Restraint Spring Assembly – Assembly

See BHT-407-MM Chapter 63, Paragraph 63-60

63.6.4.7 Restraint Spring Assembly – Installation

See BHT-407-MM Chapter 63, Paragraph 63-61

See BHT-407-MM Chapter 63, Figure 63-36

Figure 63-36. Pylon Stop Deck Fitting – Wear, Damage and Repair Limits

See BHT-407-MM Chapter 63, Figure 63-37

Figure 63-37. Fitting Dimension and Clearance

See BHT-407-MM Chapter 63, Figure 63-38

Figure 63-38. Restraint Spring Assembly

See BHT-407-MM Chapter 63, Figure 63-39

Figure 63-39. Restrain Spring Assembly – Wear, Damage and Repair Limits

See BHT-407-MM Chapter 63, Figure 63-40

Figure 63-40. Anvil Staking Tool – Workaid

See BHT-407-MM Chapter 63, Figure 63-41

Figure 63-41. Bullet - Workaid

ENGINE TO TRANSMISSION DRIVESHAFT

63.7 ENGINE TO TRANSMISSION DRIVESHAFT

The engine to transmission driveshaft (K-FLEX) is made up of four flex frames that are attached with bolts to each other and to each end of the shaft. The two flange adapters are attached to the flex frame with bolts. One flange adapter is attached to the transmission input adapter and rotor disc. The other flange adapter is attached to the engine.

The engine to transmission driveshaft turns at 6317 RPM and transmits the power from the engine to the transmission. The engine to transmission driveshaft is designed to flex and permit a certain misalignment between the engine and the transmission that is caused by the movement of the transmission.

63.7.1 ENGINE TO TRANSMISSION DRIVESHAFT – REMOVAL

SPECIAL TOOLS REQUIRED

NUMBER	NOMENCLATURE
SKSP1425-101	Driveshaft Tool Set

1. Remove the transmission cowling and the engine air inlet cowling (Chapter 53) to get access to the engine to transmission driveshaft (6, Figure 63-42).

2. Remove the left-hand and right-hand brake calipers (19) (paragraph 63-105).

3. Remove the nuts (15), washers (14) and bolts (13) that attach the aft adapter flange of the engine to transmission driveshaft (6) to the rotor brake disc (12).

NOTE

The transmission input seal housing has a notch that you can use to remove the bolts that attach the driveshaft forward adapter flange to the transmission input quill adapter.

4. Remove the nuts (4), washers (3) and bolts (1) that attach the drive shaft end fitting (5) of the engine to transmission driveshaft (6) to the adapter (2).

NOTE

As you evenly tighten the compressing tools on both sides of the engine to transmission driveshaft, it is possible that the drive shaft assemblies do not detach at both ends. If this occurs, decrease the tension on the compressing tool and permit the driveshaft to return to its installed position. Two bolts must be installed in diametrically opposed locations through both end adapters of the driveshaft and the adapters of the transmission input quill and the engine. Install four nuts on the four bolts, finger tight only. The limited free play in these temporary bolts will force the detachment of the driveshaft from the adapters on both ends, as you apply pressure with the compressing tool.

NOTE

Refer to Special Tools Required for applicable driveshaft tool set.

CAUTION

THE ENGINE TO TRANSMISSION DRIVESHAFT MUST BE COMPRESSED ONLY ENOUGH TO PERMIT REMOVAL OF THE DRIVESHAFT. TIGHTEN EACH TURNBUCKLE TO EVENLY COMPRESS BOTH SIDES.

CAUTION

EXERCISE CARE NOT TO DAMAGE THE DRIVESHAFT DURING REMOVAL.

5. Using the SKSP1425-101 tool set (Figure 63-45), install SKSP1425-103 compression tool onto the transmission end of the driveshaft and install SKSP1425-105 compression tool onto the engine end of the driveshaft.

CAUTION

EXERCISE CARE NOT TO DAMAGE THE DRIVESHAFT DURING REMOVAL.

6. Compress both flex frame assemblies until the shaft lightly contacts the adapters by evenly tightening the two nuts on the transmission and engine compression tools until the nuts bottom out. Do not exceed 50 inch-pounds (5.65 Nm) of torque on the nuts. Remove the driveshaft.

7. Remove the tool set.

63.7.2 ENGINE TO TRANSMISSION DRIVESHAFT – CLEANING

See BHT-407-MM Chapter 63, Paragraph 63-64

63.7.3 ENGINE TO TRANSMISSION DRIVESHAFT – INSPECTION

See BHT-407-MM Chapter 63, Paragraph 63-65

63.7.4 ENGINE TO TRANSMISSION DRIVESHAFT – REPAIR

See BHT-407-MM Chapter 63, Paragraph 63-66

63.7.5 ENGINE TO TRANSMISSION DRIVESHAFT – INSTALLATION

SPECIAL TOOLS REQUIRED

NUMBER	NOMENCLATURE
SKSP1425-101	Driveshaft Toolset

NOTE

Minimize the removal of the protective coat during the repair.

CAUTION

COMPRESS THE ENGINE TO TRANSMISSION DRIVESHAFT ONLY TO THE LENGTH NECESSARY TO PERMIT THE INSTALLATION.

CAUTION

EXERCISE CARE NOT TO DAMAGE THE DRIVESHAFT DURING INSTALLATION.

NOTE

To aid in bolt hole alignment, you can install a bolt through the driveshaft fittings and the adapter and the freewheel adapter before you remove the tool set.

NOTE

Compression tools SKSP1425-103 and SKSP1425-105 are part of the Installation/ Removal Tool Set SKSP1425-101

1. Install compression tools SKSP1425-103 (transmission end) and SKSP1425-105 (engine end) on the driveshaft (Figure 63-45).

NOTE

The end of the 407-340-310-101 driveshaft that is larger in diameter attaches to the transmission input adapter (2, Figure 63-42).

2. Evenly compress both driveshaft end flex frame assemblies until the shaft lightly contacts the end fittings. This is to be accomplished by evenly tightening the two nuts on the transmission and engine compression tools until they bottom out. Do not exceed 50 inch-pounds (5.65 Nm) of torque on the nuts.

CAUTION

EXERCISE CARE NOT TO DAMAGE THE DRIVESHAFT DURING INSTALLATION.

3. Place rotor brake disc (12) adjacent to and lower than the transmission input adapter (2).

4. Tilt the top of rotor brake disc (12) forward to facilitate engagement with the forward driveshaft end fitting (5).

5. Engage the forward end of the driveshaft end fitting (5) into the rotor brake disc (12).

6. Lift the rotor brake disc (12) and aft driveshaft fitting (5) together, so that they are correctly oriented to the transmission input adapter (2) and lower the aft end of the driveshaft so that it is correctly oriented with the engine output adapter (18).

7. Evenly loosen the nuts on the compression tools and remove tool SKSP1425-103 from the transmission end of the engine to transmission driveshaft (6) and tool SKSP1425-105 from the engine end of the engine to transmission driveshaft (6).

NOTE

The transmission input seal housing has a notch in the lower side that you can use to install the bolts that attach the driveshaft forward flange adapter to the transmission input quill flange adapter (2).

NOTE

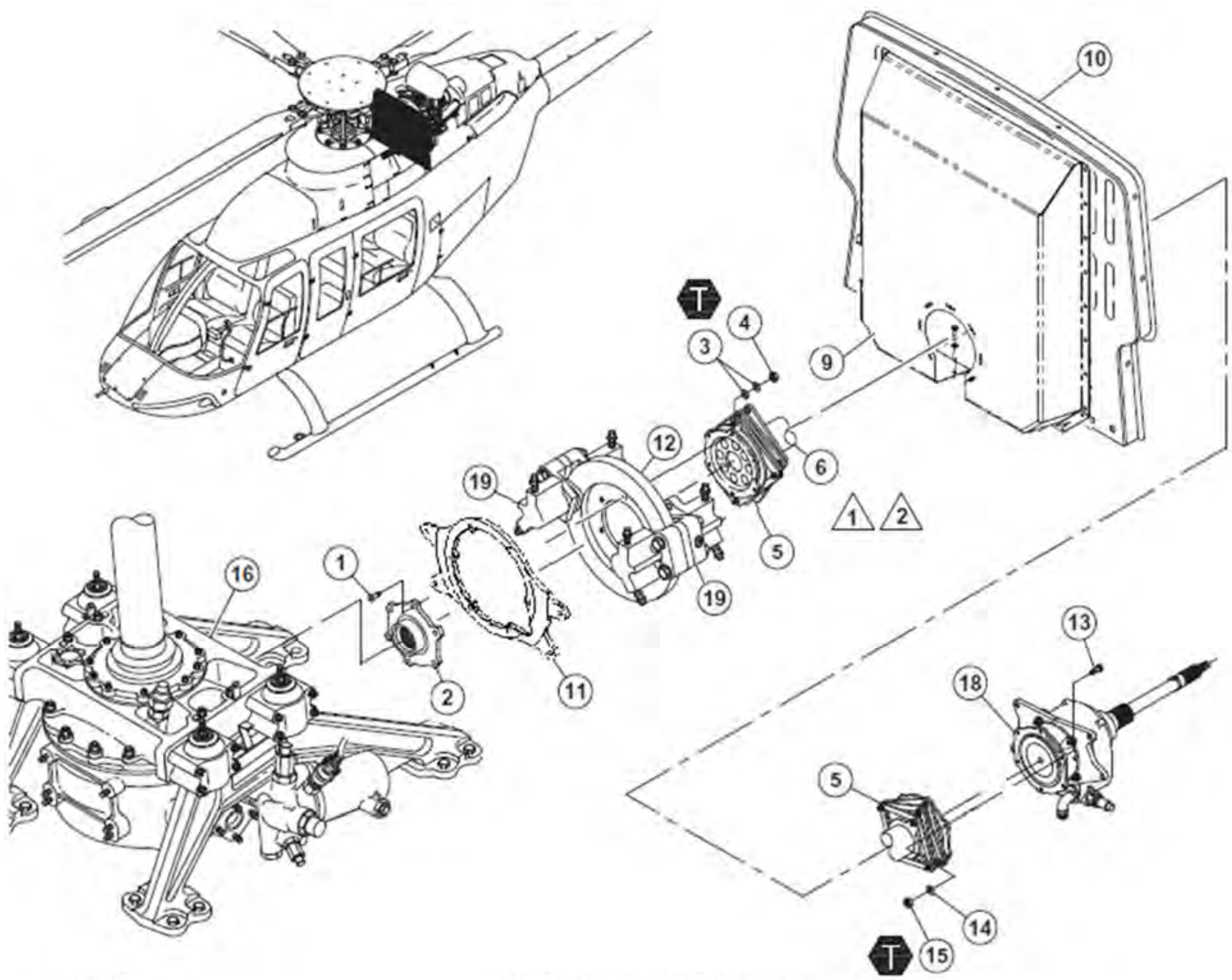
Two washers (3) are installed adjacent to each nut (4) at the driveshaft to transmission adapter (2) location.

8. Install the bolts (1, Figure 63-42), washers (3) and nuts (4) that attach the forward fitting (5) of the engine to transmission driveshaft (6) to adapter (2) of transmission assembly (16).

9. Install the bolts (13), washer (14) and nuts (15) that attach the aft fitting of the engine to transmission driveshaft (6) to the rotor brake disc (12) to the enginel output adapter (18).

10. Install the rotor brake calipers (paragraph 63-108).

11. Install the transmission cowling and the engine air inlet cowling (Chapter 53).



1. Bolt
2. Adapter
3. Washer
4. Nut
5. Driveshaft end fitting
6. Engine to transmission driveshaft
7.
8.
9. E4442-041 firewall pan
10. Forward firewall
11. E4607-1 Rotor brake Caliper Bracket
12. E4126-1 Rotor brake disc
13. Bolt
14. Washer
15. Nut
16. Transmission assembly
17.
18. Engine output adapter
19. Rotor brake caliper

T 50 TO 70 IN-LBS (5.65 TO 7.91 Nm)

Figure 63-42. Engine to Transmission Driveshaft – Removal/Installation

See BHT-407-MM Chapter 63, Figure 63-43

Figure 63-43. KAFLEX Driveshaft Tool Set – Removal/Installation

See BHT-407-MM Chapter 63, Figure 63-44

Figure 63-44. KAFLEX Driveshaft Tool Set – Modification

See BHT-407-MM Chapter 63, Figure 63-45

Figure 63-45. KAFLEX Driveshaft (SKSP1425-101) Tool Set

See BHT-407-MM Chapter 63, Figure 63-46

Figure 63-46. Engine to Transmission Driveshaft – Wear, Damage and Repair Limits

FREEWHEEL ASSEMBLY

63.8 FREEWHEEL ASSEMBLY

The freewheel assembly on the 407HP is integral to the Honeywell HTS900 Turboshaft Engine. For all maintenance activity, refer to Honeywell HTS900 Light Maintenance Manual (LMM) 72-09-46.

ROTOR BRAKE SYSTEM

63.9 ROTOR BRAKE SYSTEM

The rotor brake is a single disc, two-caliper hydraulic brake attached to the main rotor drive adapter on the aft side of the main rotor transmission. A flexible hose and hydraulic lines connect the rotor brake to the master cylinder and reservoir assembly. The master cylinder is installed overhead between the crew seats (Figure 63-56).

To apply the rotor brake, manually operate the handle on the rotor brake master cylinder after the engine is shut down and the main rotor has slowed to 40% NR or below. The hydraulic pressure from the master cylinder moves the pistons in the two cylinders of the rotor brake caliper assemblies. The movement of the pistons forces the friction linings against both sides of the metal disc attached to the engine to transmission driveshaft.

Internal relief provisions in the master cylinder limit the pressure in the system. When the handle is returned to the released position, hydraulic pressure is fully released and the springs in the rotor brake caliper assembly move the friction linings out of contact with the disc.

63.9.1 ROTOR BRAKE SYSTEM – TROUBLESHOOTING

See BHT-407-MM Chapter 63, Paragraph 63-97

63.9.2 ROTOR BRAKE SYSTEM – INSPECTION

1. Remove the necessary transmission cowlings, forward cowl, and covers to gain access to the rotor brake system components (Chapter 53).

NOTE

Refer to Northwest Dynamics, Inc., document no. B0223-OM, B0233-OM4, or B0244-OM Maintenance and Overhaul Manual. Refer to Table 63-3 to identify the component versus inspection document.

1. Examine the caliper assembly for condition, security, and leaks.

a. Check caliper friction linings for condition and wear.

NOTE

Refer to Northwest Dynamics, Inc., document no. B0223-OM, B0223-OM4, or B0244-OM Maintenance and Overhaul Manual. Refer to Table 63-3 to identify the component versus inspection document.

2. Check rotor brake disc for cracks, distortion, wear, and corrosion.

3. Examine master cylinder, reservoir, and hydraulic lines for condition, security, and leaks.

4. Verify that rotor brake handle operates smoothly without binding and latches into stowed or parked position.

Table 63-3. Rotor Brake Component Versus Northwest Dynamics Document

ITEM NAME/PART NUMBER ⚠1	RELATED KIT 407-II-8	EFFECTIVITY	NORTHWEST DYNAMICS DOCUMENT
CALIPER ASSEMBLY			
206-340-301-103	206-706-502-103	S/N 53000 – 53442 Pre 407-II-30	B0223-OM
407-340-302-101	206-706-502-105 206-706-502-107	S/N 53443 – 53631 Pre TB 407-05-67	B0223-OM
407-340-302-101FM	Kit not applicable Field Mod per 407-II-30 (upgrade of 206-340-301-103)	S/N 53000 – 53442 Post 407-II-30/Pre TB 407-05-67	B0223-OM
407-340-302-103	206-706-502-109	S/N 53632 – 54140 and 54300 – 54380	B0223-OM4
407-540-304-101FM	Kit not applicable Field Mod per TB 407-05-67 (upgrade of 407-340-302-101 and -101FM)	S/N 53000 – 53631 Post TB 407-05-63 and TB 407-05-67	B0223-OM4
427-340-352-113	206-706-502-115	S/N 54141 – 54299 and 54381 and subsequent	B0244-OM
DISC			
E4126-1	NA	ALL	B0223-OM4 or B0244-OM

NOTE:

⚠1 Refer to BHT-407-CR&O-V manual or contact Northwest Dynamics for latest version of document.
Northwest Dynamics, Inc.
6709 NE 131 Avenue
Vancouver, WA 98682
U.S.A.
Phone: 360-253-3656
Fax: 360-253-3657

Table 63-4. Rotor Brake System Troubleshooting

See BHT-407-MM Chapter 63, Table 63-4

63.10 ROTOR BRAKE SYSTEM – ROTOR BRAKE SYSTEM FITTINGS, HOSE AND TUBE ASSEMBLIES

63.10.1 ROTOR BRAKE SYSTEM FITTINGS, HOSE AND TUBE ASSEMBLIES – REMOVAL

MATERIALS REQUIRED

Refer to BHT-ALL-SPM for specifications.

NUMBER	NOMENCLATURE
C-428	Caps and/or Plugs

1. Drain the hydraulic fluid (Chapter 12).
2. Remove the forward fairing assembly, transmission cowling assembly, and the engine cowling (Chapter 53).
3. Remove the air intake fairing (Chapter 53).
4. Disconnect hose assembly (6, Figure 63-56) and tube assemblies (5, 14 and 18) from elbows (7 and 26) and the tee (3).
5. Remove clamps that attach hose assembly (6) or tube assemblies (5, 14, and 18) to the structure.
6. Remove the elbows (7 and 26), tee (3), retainers (1, 9, and 15) and preformed packings (4, 10, and 16). Discard the preformed packings (4, 10, and 16).
7. Install protective caps and/or plugs (C-428) to prevent system contamination.

63.10.2 ROTOR BRAKE SYSTEM FITTINGS, HOSE AND TUBE ASSEMBLIES – CLEANING

MATERIALS REQUIRED

Refer to BHT-ALL-SPM for specifications.

NUMBER	NOMENCLATURE
C-304	Drycleaning Solvent

CAUTION

DO NOT USE ISOPROPYL ALCOHOL. IT CAN CAUSE DAMAGE TO ROTOR BRAKE COMPONENTS.

1. Clean the elbows (7 and 26, Figure 63-56), tee (3), hose assembly (6), and tube assemblies (5, 14, and 18) with drycleaning solvent (C-304). Dry with dry compressed filtered air.

63.10.3 ROTOR BRAKE SYSTEM FITTINGS, HOSE AND TUBE ASSEMBLIES – INSPECTION

1. Examine the hose assembly (6, Figure 63-56) and tube assemblies (5, 14, and 18) for rubbing, wear, crimping, twisting, cracks, damaged threads, and obstruction.
2. Examine the elbows (7 and 26), tee (3), and ports for damaged threads and obstruction.

63.10.4 ROTOR BRAKE SYSTEM FITTINGS, HOSE AND TUBE ASSEMBLIES – INSTALLATION

MATERIALS REQUIRED

Refer to BHT-ALL-SPM for specifications.

NUMBER	NOMENCLATURE
C-002	Hydraulic Fluid

1. Remove the protective caps and/or plugs from the hose assembly (6, Figure 63-56), tube assemblies (5, 14, and 18), elbows (7 and 26), tee (3), and components.

2. Install retainers (1, 9, and 15) on elbows (7 and 26) and tee (3).

3. Lubricate the preformed packings (4, 10, and 16) with hydraulic fluid (C-002) and install on the elbows (7 and 26) and tee (3).

4. Install elbows (7 and 26), tee (3), and components.

5. Connect hose assembly (6) and tube assemblies (5, 14, and 18).

6. Install clamps that attach hose (6) and tube assemblies (5, 14, and 18) to the structure.

7. Add hydraulic fluid and bleed system (paragraph 6311.8).

8. Install the air intake fairing (Chapter 53).

9. Install forward fairing assembly, transmission cowling assembly, and engine cowling (Chapter 53).

63.10.5 ROTOR BRAKE SYSTEM – CALIPER ASSEMBLY

The rotor brake caliper assembly has two opposite hydraulically operated pistons that force the friction linings against the brake disc. The valves on top of the rotor brake caliper assemblies allow air to be bled from the system.

63.10.5.1 Caliper Assembly – Removal

1. Remove forward fairing assembly, transmission cowling assembly, and engine cowling (Chapter 53).

2. Remove the air intake fairing (Chapter 53).

3. Drain hydraulic fluid (Chapter 12).

NOTE

Make sure rotor brake handle assembly is in stowed (OFF) position. The removal procedure is similar for the left and right caliper assembly.

4. Disconnect hose or tube assemblies from fittings (paragraph 63.11.1).

5. Remove bolts (24), washers (25, and 33), and nuts (32).

6. Remove bolts (22) and washers (23, and 12), and nuts (11). Remove the caliper assembly (19).

7. If required, remove fitting from caliper assembly (19) (paragraph 63.11.1).

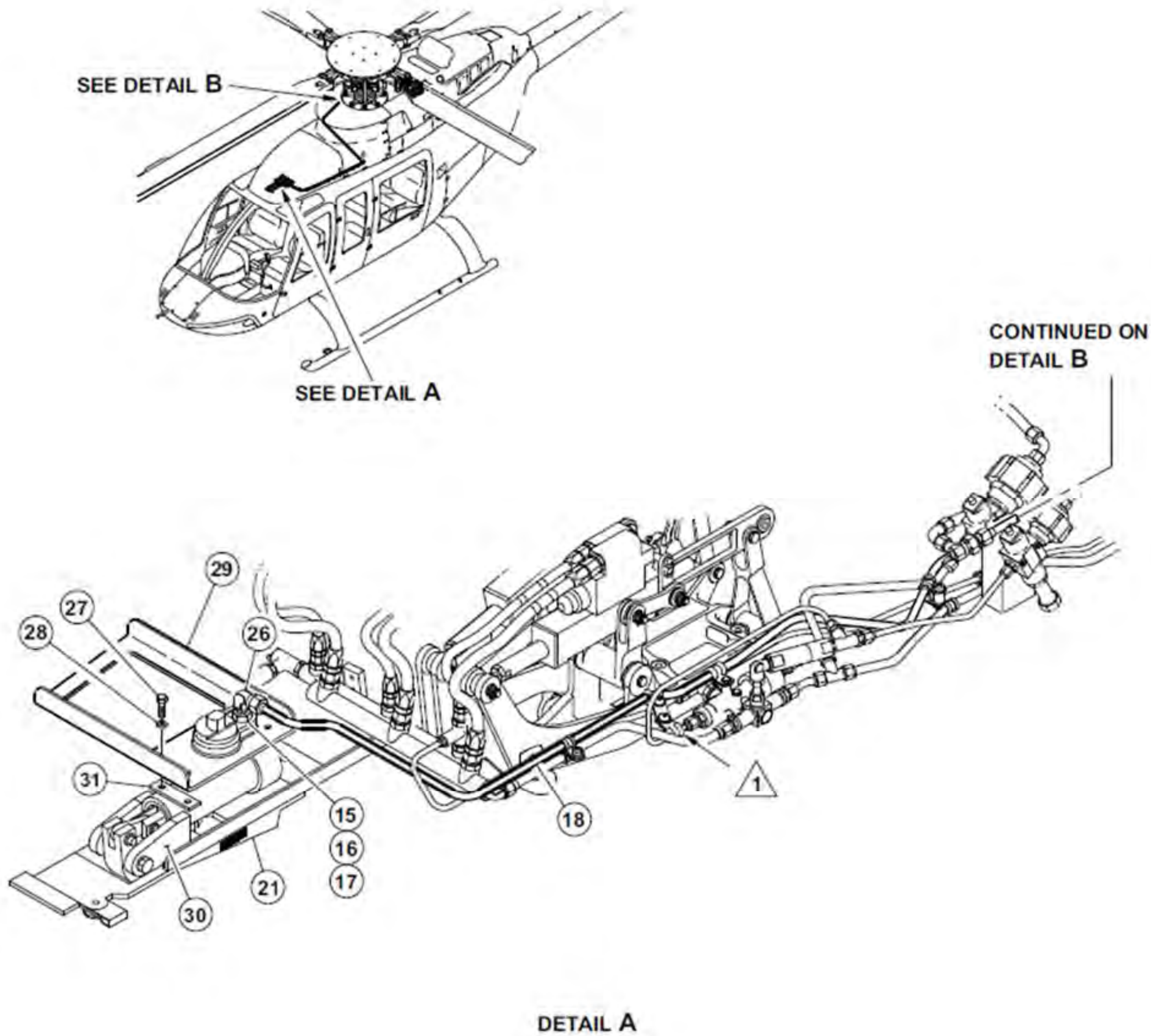


Figure 63-56. Rotor Brake System – Removal/Installation (Sheet 1 of 4)

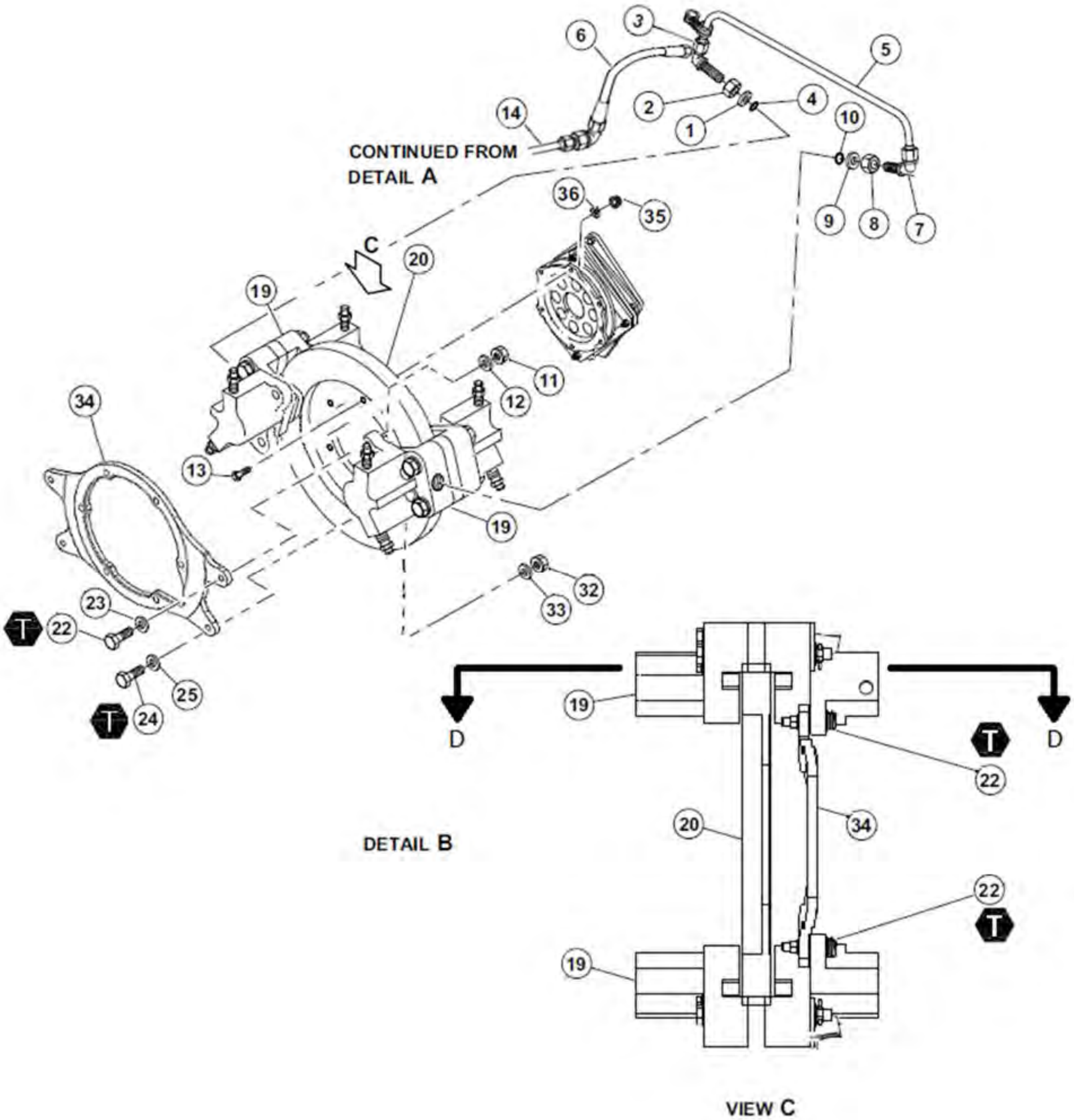
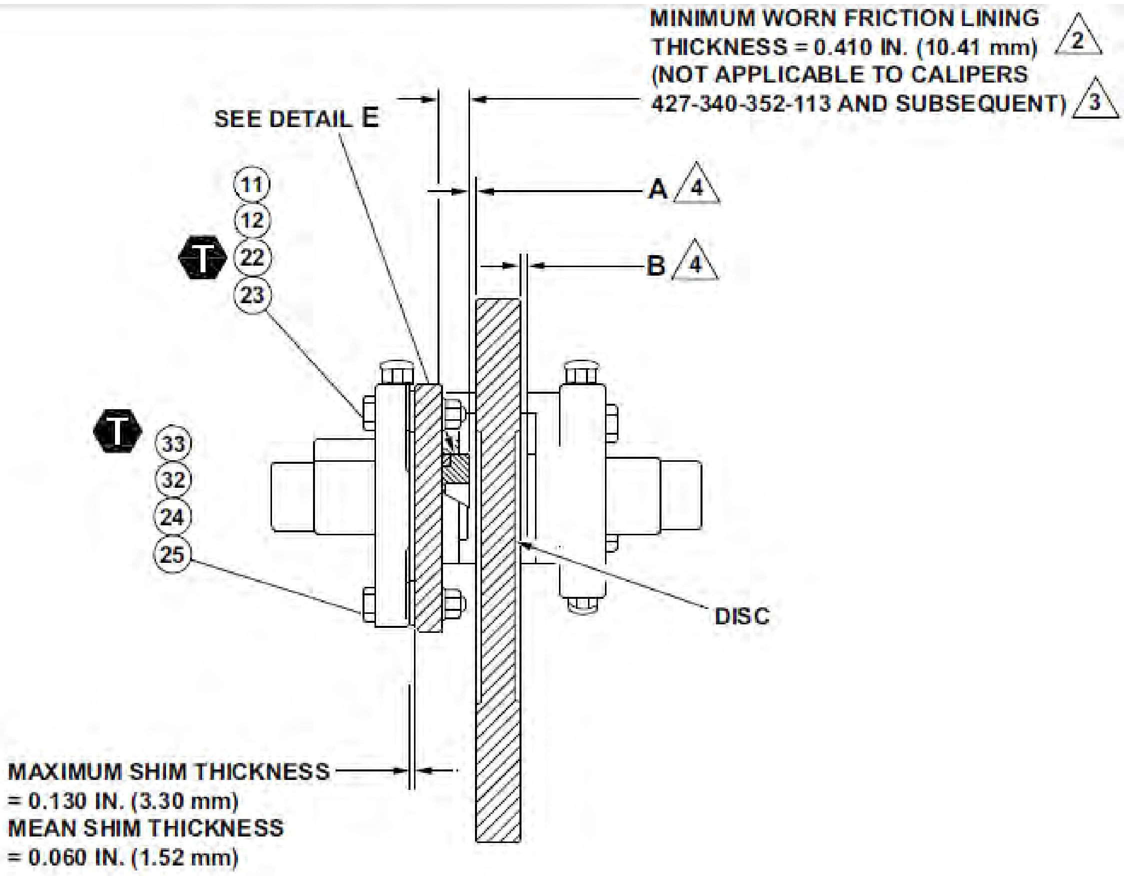
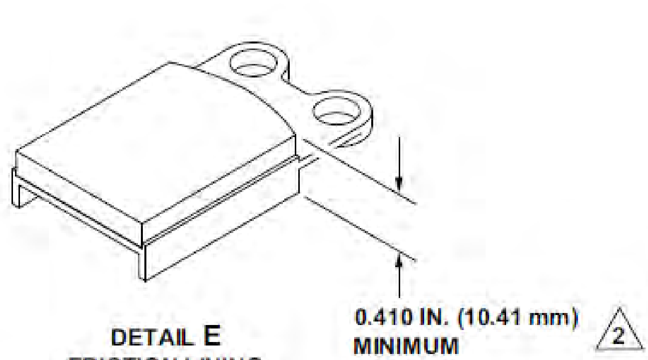


Figure 63-56. Rotor Brake System – Removal/Installation (Sheet 2 of 4)



SECTION D-D



DETAIL E
FRICTION LINING
AND BACKING PLATE
(NOT APPLICABLE TO CALIPERS 427-340-352-113 AND SUBSEQUENT) 3

Figure 63-56. Rotor Brake System – Removal/Installation (Sheet 3 of 4)

1. Retainer
2. Nut
3. Tee
4. Preformed packing
5. E4627-067 Tube assembly
6. E4619-015 Hose assembly
7. Elbow
8. Nut
9. Retainer
10. Preformed packing
11. Nut
12. Washer
13. Bolt
14. E4627-065 Tube assembly
15. Retainer
16. Preformed packing
17. Nut
18. Tube assembly
19. Caliper assembly
20. E4126-1 Disc
21. Rotor brake cover
22. Bolt
23. Washer
24. Bolt
25. Washer
26. Elbow
27. Bolt
28. Washer
29. Support
30. Master cylinder assembly
31. Plate assembly
32. Nut
33. Washer
34. E4607-1 Rotor brake Caliper Bracket
35. Nut
36. Washer

LOCKWIRE (C-405)

T 50 TO 70 IN-LBS
(5.65 TO 7.91 Nm)

NOTES

1. The clamping arrangement is only installed when the helicopter is equipped with the Autopilot Kit (BHT-407-II-42).

2. The combined thickness of friction lining plus backing plate shall be 0.410 inch (10.41 mm) minimum. Refer to Northwest Dynamics Maintenance and Overhaul manual. See Note 7.

3. To obtain friction and wear limits for calipers 427-340-352-113 and subsequent, refer to Northwest Dynamics Maintenance and Overhaul Manual B0244-OM (BHT-407-CR&O-V, Chapter 63).

4. Adjust shim washer(s) as required to make gaps A and B equal within 0.020 inch (0.508 mm). Total shim thickness on the two mounting bolts must be equal within 0.004 inch (0.101 mm). Refer to Northwest Dynamics, Inc., document no. B0223-OM Maintenance and Overhaul Manual (TB 407-02-36 and TB 407-05-63), to document no. B0223-OM4 Maintenance and Overhaul Manual (TB 407-05-67), or B0244-OM Maintenance and Overhaul Manual. Refer to table 63-3 to identify applicable document.

Figure 63-56. Rotor Brake System – Removal/Installation (Sheet 4 of 4)

63.10.5.2 Caliper Assembly – Disassembly/Assembly

See BHT-407-MM Chapter 63, Paragraph 63-106

63.10.5.3 Caliper Assembly – Inspection

See BHT-407-MM Chapter 63, Paragraph 63-107

63.10.5.4 Caliper Assembly – Installation

MATERIALS REQUIRED

Refer to BHT-ALL-SPM for specifications.

NUMBER	NOMENCLATURE
C-405	Lockwire
C-508	Lockwire

NOTE

Left rotor brake caliper assembly requires installation of elbow and the right caliper assembly requires installation of tee in the following steps. If fittings are already installed on calipers, proceed to step 3.

NOTE

Position elbow to be pointing up when brake assembly is installed.

1. Install elbow (7, Figure 63-56), preformed packing (10), retainer (9), and nut (8) on one rotor brake assembly.

NOTE

Position short leg of tee to be pointing up when brake assembly is installed.

2. Install tee (3), preformed packing (4), retainer (1), and nut (2) on other rotor brake assembly.

NOTE

On left side caliper, bleed valves must be changed from bottom of caliper to top of caliper.

3. Install both rotor brake calipers (19) on E4607-1 Rotor Brake Caliper Bracket (34) as follows:

   a. Install bolt (22) through washer (23), rotor brake caliper (19), Rotor Brake Caliper Bracket (34), Washer (12) and Nut (11).

   b. Install bolt (24) through washer (25), rotor brake caliper (19), Rotor Brake Caliper Bracket (34), Washer (33) and Nut (34).

   c. Tighten bolts (22) and nuts (11) until just snug.

   d. Measure gap between brake linings and disc on both sides of disc.

   e. Add shim washers, as required to make gaps -A- and -B- equal within 0.020 inch (0.508 mm).

   f. Verify total thickness of shim washers on each bolt is equal within 0.004 inch (0.101 mm).

4. Torque bolts (22) and nuts (11) 50 to 70 inch-pounds (5.65 to 7.91 Nm).
5. Install lockwire (C-405) on mounting bolts (22)
6. Torque nuts (35) securing adapter, disc, and driveshaft 50 to 70 inch-pounds (5.65 to 7.91 Nm) (6 places).
7. Connect the tube assembly (5) between the elbow (7) and the tee (3).
8. Connect the hose assembly (6) to the remaining fitting on the tee (3).
9. Tighten all the rotor brake hydraulic line fittings.

10. Fill and bleed the rotor brake system (paragraph 63.11.8).

11. Complete a functional test in accordance with Northwest Dynamics Maintenance and Overhaul Manual B0223-OM, B0223-OM4, or B0244-OM. Refer to Table 63-3 to identify the appropriate Northwest Dynamics manual.

12. Install the air intake fairing (Chapter 53).

CAUTION

IF THE AIRFRAME FUEL FILTER WAS REMOVED TO IMPROVE ACCESS, AND THE FUEL LINES WERE KINKED, BENT, OR TWISTED BEYOND ALLOWABLE LIMITS (INFORMATION LETTER (IL) 407-98-19), OR ARE SUSPECTED OF THIS OCCURRENCE, THE AFFECTED FUEL LINE SHALL BE REPLACED WITH A SERVICEABLE PART PRIOR TO RETURNING THE HELICOPTER TO SERVICE.

13. If the airframe fuel filter assembly was removed for access to the rotor brake, reinstall (Chapter 28).

14. Install the forward fairing assembly, transmission cowling, and engine cowling (Chapter 53).

63.10.6 ROTOR BRAKE SYSTEM – DISC

63.10.6.1 Disc – Removal

1. Remove the forward fairing assembly, transmission cowling assembly, and engine cowling (Chapter 53).

2. Remove the air intake fairing

3. Drain the hydraulic fluid (Chapter 12).

4. Disconnect the hose or the tube assemblies from the fittings (paragraph 63.11.1).

5. Remove the caliper assemblies (19, Figure 63-56) (paragraph 63.11.5.1).

6. Remove the engine to transmission driveshaft (paragraph 63.7.1).

7. Remove the bolts (13), washers (14), and nuts (21).

8. Remove the disc (20) from the helicopter.

63.10.6.2 Disc – Cleaning

See BHT-407-MM Chapter 63, Paragraph 63-111

63.10.6.3 Disc – Inspection

See BHT-407-MM Chapter 63, Paragraph 63-112

See BHT-407-MM Chapter 63, Figure 63-57

Figure 63-57. Caliper Assembly

63.10.6.4 Disc – Installation

1. Insert the disc (20, Figure 63-56) from the right side of the helicopter onto the Main Rotor Transmission adapter.
2. Align the bolt holes in the disc (20) and the Main Rotor Transmission adapter.
3. Install the engine to transmission driveshaft (paragraph 63.7.5).
4. Install the first bolt (13) through the Main Rotor Transmission adapter, Main Rotor Drive Shaft, and the disc (20) at the 12 o'clock position.
5. Tighten the bolt (13) slowly until the disc (20) is perpendicular to the drive shaft centerline.
6. Rotate the disc (20), Main Rotor Transmission adapter and the Main Rotor Drive Shaft 120° and install the second bolt (13).
7. Tighten the bolt (13) slowly until snug.
8. Rotate the disc (20) Main Rotor Transmission adapter and the Main Rotor Drive Shaft 120° and install the third bolt (13).
9. Tighten the bolt (13) slowly until snug.
10. Tighten each bolt (13) in order of installation, one turn until the disc (20) is firmly seated on the Main Rotor Transmission adapter.

NOTE

Final torquing of the nuts (35) will be accomplished during caliper installation (paragraph 63.11.5.4).

11. Tighten the nuts (35) finger tight.
12. Install the caliper assemblies (paragraph 63.11.5.4).

63.10.7 ROTOR BRAKE SYSTEM – MASTER CYLINDER ASSEMBLY

63.10.7.1 Master Cylinder Assembly – Removal

See BHT-407-MM Chapter 63, Paragraph 63-115

63.10.7.2 Master Cylinder Assembly – Disassembly

See BHT-407-MM Chapter 63, Paragraph 63-116

63.10.7.3 Master Cylinder Assembly – Cleaning

See BHT-407-MM Chapter 63, Paragraph 63-117

63.10.7.4 Master Cylinder Assembly – Inspection

See BHT-407-MM Chapter 63, Paragraph 63-118

63.10.7.5 Master Cylinder Assembly – Assembly

See BHT-407-MM Chapter 63, Paragraph 63-119

63.10.7.6 Master Cylinder Assembly – Installation

See BHT-407-MM Chapter 63, Paragraph 63-120

See BHT-407-MM Chapter 63, Figure 63-58

Figure 63-58. Master Cylinder Assembly

See BHT-407-MM Chapter 63, Figure 63-59

Figure 63-59. Master Cylinder Assembly Wear Limits

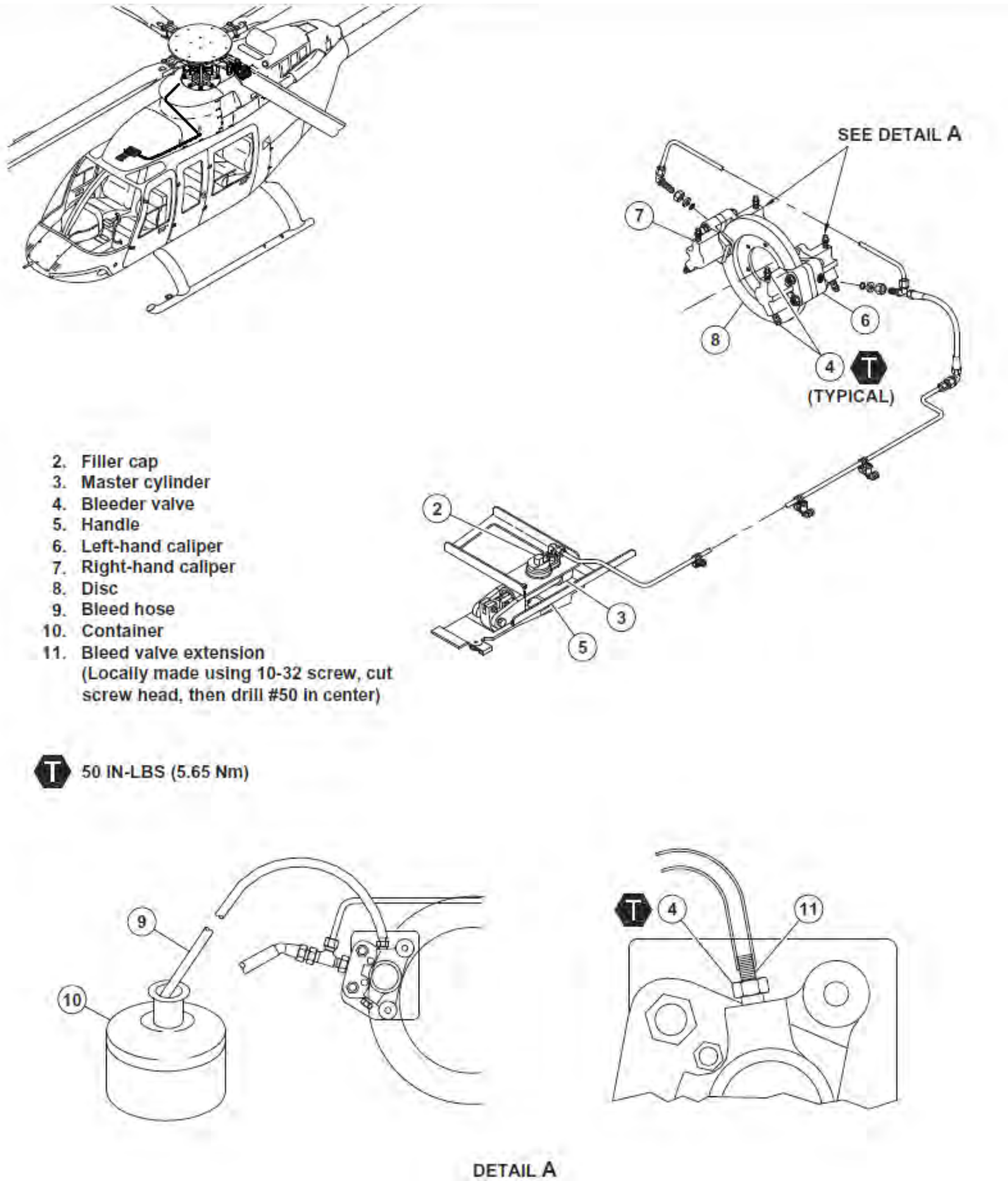


Figure 63-60. Caliper Assembly - Bleeding

63.10.8 ROTOR BRAKE SYSTEM – CALIPER ASSEMBLY BLEEDING

MATERIALS REQUIRED

Refer to BHT-ALL-SPM for specifications.

NUMBER	NOMENCLATURE
C-002	Hydraulic Fluid

1. Use the following procedure to bleed air, as necessary, from the rotor brake system:

a. Open forward fairing (Chapter 53).

b. Remove inlet cowl (Chapter 53).

c. Remove filler cap (2) from master cylinder assembly (3).

d. Make sure handle assembly (5) on master cylinder assembly (3) is in stowed position.

NOTE

The forward and aft sections of each caliper assembly require bleeding. The correct fluid level for the master cylinder assembly is when the fluid is level with the bottom of the filler neck.

e. Fill master cylinder assembly (3) with correct level of hydraulic fluid (C-002). Fill as necessary during the bleeding process to keep the correct fluid level. If the fluid level drops below the minimum, air can get into the system.

f. Screw the bleeder valve extension (11) into the upper bleeder valve (4) on the left-hand caliper assembly (6).

g. Attach a clean bleed hose (9) on bleeder valve extension (11).

h. Put other end of rubber hose (9) in container (10). Container (10) will receive discharged fluid.

i. Slowly pull handle assembly (5) down and hold it in position. Make sure handle assembly (5) does not move back into stowed position.

j. Slowly open bleeder valve (4) to release fluid under pressure. Bleed until the discharged fluid runs clear without bubbles.

k. Close bleeder valve (4) and return handle assembly (5) to the stowed position.

l. Remove bleed hose (9) and bleeder valve extension (11).

m. Tighten bleeder valves (4) on left-hand caliper (6).

n. Repeat step e through step m for right-hand caliper (7).

o. Tighten bleeder valves (4) on right-hand caliper (7).

p. Install master cylinder assembly filler cap (2).

q. Clean all fluid residues from work area.

Warning

A QUALIFIED PERSON MUST BE AT THE CONTROLS TO CONDUCT THE GROUND RUN (FMS-E407-789-1).

2. Conduct a ground run and confirm appropriate rotor brake operation.

TRANSMISSION OIL SYSTEM

63.11 TRANSMISSION OIL SYSTEM

The transmission oil system is made up of the following:

- oil pump
- pressure regulator valve
- drain valve
- oil cooler
- breather
- oil filter manifold
- oil filter housing
- filter element
- bypass valve and indicator
- four oil jets
- two external oil systems
- system oil manifold
- top chip detector
- lower chip detector
- high pressure relief valve
- pressure transducer
- thermostatic bypass valve
- temperature bulb
- temperature switch
- bypass valve
- sight glass

The transmission oil system consists of a wet sump main transmission. The transmission accessory drive gear drives the oil pump. The oil is suction lifted from the sump through an oil inlet screen and across an electrical debris detector. The transmission oil system also contains an oil level sight gauge, a non-vented oil filler cap, and a breather assembly. Refer to Figure 63-61.

Oil from the pump is directed to the oil filter manifold. The oil filter manifold contains a temperature switch, temperature bulb, high pressure relief valve, and a thermostatic bypass valve to route the oil to the oil cooler core and oil filter assembly. Oil from the oil manifold is routed to an adjustable pressure regulating valve, where proper pressure is established and excess oil is sent back to the sump. Regulated oil enters internal passages in the main transmission and is directed to four removable oil jets and a series of case jets. At the same time, the oil flows through a filter fitting to an airframe mounted manifold. This manifold contains an oil pressure switch, oil pressure transmitter, and pressure test port.

The **OIL PUMP INLET SCREEN AND CHIP DETECTOR ASSEMBLY** is flange-mounted to the lower, forward, left side of the main transmission case assembly. Packings inboard of the 16 mesh oil pump inlet screen ensure all oil entering the pump passes through the mesh screen and electrical chip detector. The outboard packing prevents external oil leaks.

The **OIL PUMP ASSEMBLY** acts as a constant displacement gerotor assembly driven by an accessory drive gear. The pump is rated at 6.0 to 6.7 gallons per minute (3.79 LPM) at 80 PSI (551.58 kPa). Higher pressures may be obtained at lower flow rates. The pump drive shaft extends through the pump assembly to provide an external drive to the hydraulic pump.

The **OIL FILTER MANIFOLD ASSEMBLY** contains the filter element, housing, oil differential bypass valve and impending bypass button indicator, temperature switch, and temperature bulb. In the oil filter manifold, the oil is routed through the passages to the oil filter element. When the oil passes across the filter element, the oil pressure drops. Pressure drop depends on the condition of the filter element, oil temperature, and the type of oil used.

The **TEMPERATURE SWITCH** is an on/off switch that activates at 230°F (110°C). It provides a high temperature warning signal to the XMSN OIL TEMP annunciator on the caution/warning and advisory panel.

The **TEMPERATURE BULB** sends a signal to the instrument panel gauge. It provides a measured indication of oil pump discharge temperature.

The **HIGH PRESSURE RELIEF VALVE** is designed to crack (or open) at a differential pressure of 29.6 to 38.6 PSI (204.08 to 266.14 kPa). It provides protection to the cored passages of the main transmission when the oil system cannot supply sufficient oil flow because of contamination, collapse, excessive viscosity, or blockage.

The **THERMOSTATIC BYPASS VALVE** regulates oil flow to the oil cooler and protects against oil starvation if the oil cooler becomes clogged. The valve is normally open, allowing oil to bypass the oil cooler, until the pump discharge temperature reaches 150°F (66°C). The valve then begins to close and direct some of the oil to the oil cooler. The valve fully closes at a temperature of 178 ±2°F (81 ±1°C) and directs all oil flow through the oil cooler. If a high differential pressure exists across the oil cooler core, the valve will open at a minimum of 40 PSI (differential) (275.79 ⊗kPa) and 190°F (88°C).

The **OIL FILTER DIFFERENTIAL BYPASS VALVE AND IMPENDING BYPASS INDICATOR** has two functions. First, it gives an impending bypass indication at a differential pressure of 14 ±2 PSI (96.53 ±13.79 kPa). This is indicated by the extension of a red impending bypass button. Second, the bypass valve will begin to crack open when the differential pressure reaches a minimum of 17 PSI (117.21 kPa). It reaches a full flow bypass when the differential pressure reaches 27 PSI (186.16 kPa). A thermal lockout is included in the system to prevent actuation of the indicator button until the oil temperature has reached 120°F (49°C).

The **PRESSURE REGULATOR VALVE** is made up of a body, piston, spring, adjustable screw, and lock nut. When the adjustable screw is turned clockwise, it increases the spring pressure on the piston. The piston will then block the passage that permits the oil back into the main transmission lower case sump. The pressure regulator valve keeps the oil pressure at the normal operational range and compensates for pressure drops. The pressure regulator valve is adjusted to 52 PSI (358.53 kPa) and must hold the pressure between 50 and 55 PSI (344.74 and 379.21 kPa).

The **TOP CASE OIL EXTERNAL OIL TRANSFER TUBE** is located on the aft left-hand corner of the lower and top main transmission case. It directs the oil to the No. 2 oil jet.

The **LOWER CASE AND SUPPORT CASE INTERNAL PASSAGES** are connected to the main transmission lower case internal cored passages. They guide the oil flow to the No. 1 oil jet, the input pinion triplex bearings, and the circular groove that lubricates the sun gear and gear shaft.

The **TRANSMISSION OIL JETS** ensure lubrication of transmission gears and bearings.

No. 1 OIL JET is located on the left-hand side of the main transmission lower case, behind the oil filter bowl. It sprays oil onto the alignment roller bearing of the input pinion. It guides parts of the oil flow to the circular groove that lubricates the gear shaft duplex bearing. The No. 1 oil jet also gives oil to the No. 3 and No. 4 oil jets.

No. 2 OIL JET is located aft of the main transmission top case. It sprays oil onto the planetary pinion roller bearings. It guides the oil flow to the circular groove in the mast bearing. The oil is then collected in the top case pan where the electric chip detector monitors the condition of the mast bearing. The oil then flows back into the lower case sump, lubricating the main transmission internal components on the way down.

No. 3 OIL JET is located in the main transmission lower case on the left-hand side of the input pinion. It sprays oil in the mesh of the spiral bevel gear and input pinion gear teeth. It also sprays oil in the mesh of the sun gear and planetary gear teeth.

No. 4 OIL JET is located in the main transmission lower case on the right-hand side of the input pinion. It sprays oil out of the mesh of the spiral bevel gear and input pinion gear teeth.

The **AIRFRAME MOUNTED MANIFOLD** consists of an oil pressure transducer, oil pressure switch, and test port.

The **OIL PRESSURE SWITCH** is located on the airframe mounted manifold. It senses pressure from the pressure regulator oil discharge. The switch is normally closed. The oil pressure switch opens at 38 PSI (262 kPa) with increasing pressure. The switch closes at 30 ±2 PSI (206.84 ±13.78 kPa) with decreasing pressure. The oil pressure switch allows current flow and illuminates the XMSN OIL PRESSURE annunciator on the caution/warning/ advisory panel.

The **OIL PRESSURE TRANSDUCER** is located on the airframe mounted manifold. It gives the indication to the oil pressure gauge.

The **TEST PORT** is located on the airframe mounted manifold. It is used to install a direct read gauge to monitor the system oil pressure.

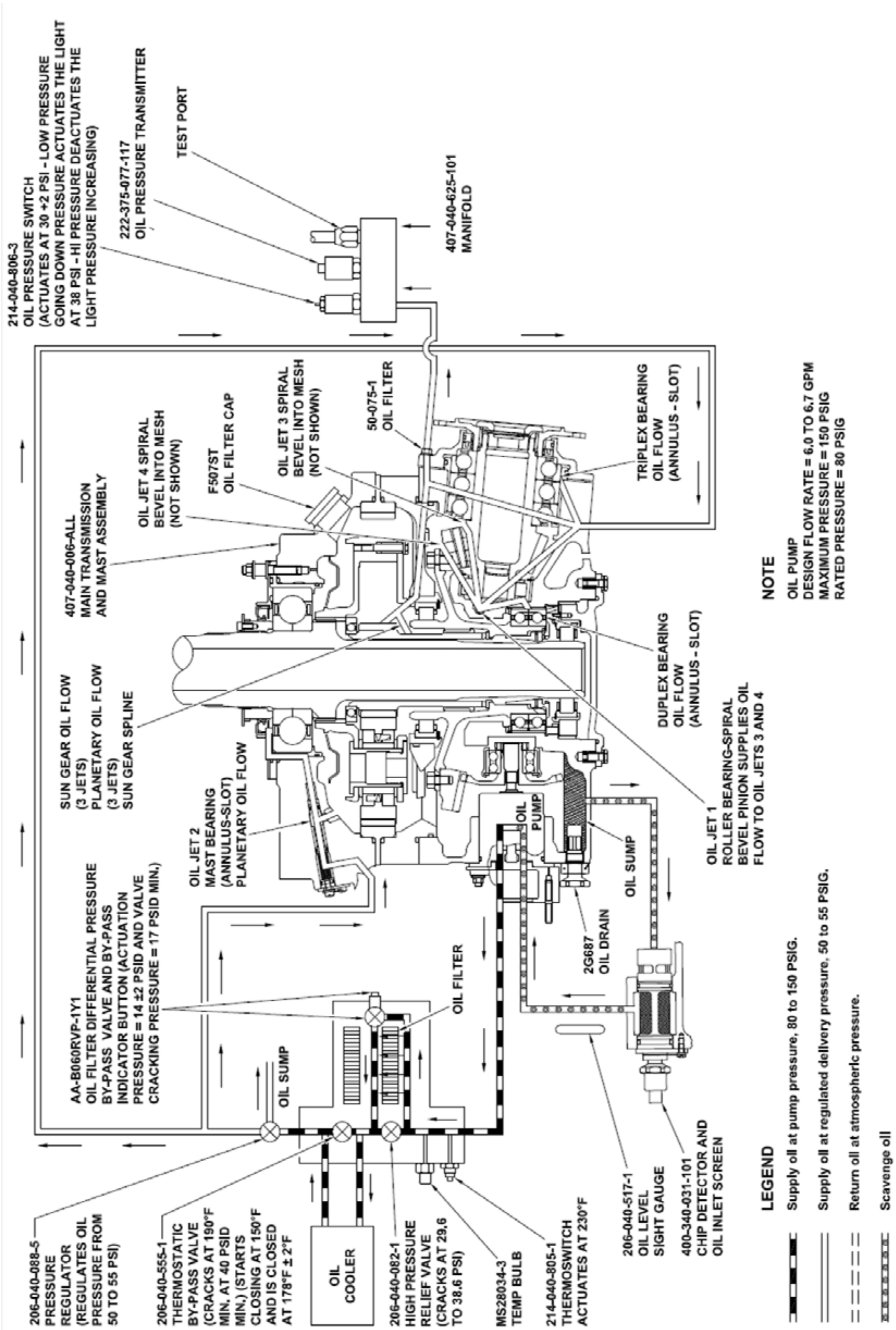


Figure 63-61. Transmission Oil System Schematic

See BHT-407-MM Chapter 63, Figure 63-62

Figure 63-62. Transmission Oil Pump and Housing Assembly

See BHT-407-MM Chapter 63, Figure 63-63

Figure 63-63. Oil Pump Removal

63.11.1 MAIN TRANSMISSION OIL PUMP

See BHT-407-MM Chapter 63, Paragraph 63-123

63.11.1.1 Main Transmission Oil Pump – removal

See BHT-407-MM Chapter 63, Paragraph 63-124

63.11.1.2 Main Transmission Oil Pump – Cleaning

See BHT-407-MM Chapter 63, Paragraph 63-125

63.11.1.3 Main Transmission Oil Pump – Inspection and Repair

See BHT-407-MM Chapter 63, Paragraph 63-126

63.11.1.4 Main Transmission Oil Pump – Disassembly

See BHT-407-MM Chapter 63, Paragraph 63-127

63.11.1.5 Main Transmission Oil Pump – Assembly

See BHT-407-MM Chapter 63, Paragraph 63-128

63.11.1.6 Main Transmission Oil Pump – Installation

See BHT-407-MM Chapter 63, Paragraph 63-129

63.11.2 TRANSMISSION – BREATHER AND TUBE

See BHT-407-MM Chapter 63, Paragraph 63-130

63.11.2.1 Breather and Tube – Removal

See BHT-407-MM Chapter 63, Paragraph 63-131

63.11.2.2 Breather and Tube – Cleaning

See BHT-407-MM Chapter 63, Paragraph 63-132

63.11.2.3 Breather and Tube Inspection

See BHT-407-MM Chapter 63, Paragraph 63-133

63.11.2.4 Breather and Tube – Installation

See BHT-407-MM Chapter 63, Paragraph 63-134

See BHT-407-MM Chapter 63, Figure 63-64

Figure 63-64. Oil Pump Seal Removal

See BHT-407-MM Chapter 63, Figure 63-65

Figure 63-65. Transmission Components

63.11.3 TRANSMISSION – FILLER CAP

63.11.3.1 Filler Cap – Removal

See BHT-407-MM Chapter 63, Paragraph 63-136

63.11.3.2 Filler Cap – Inspection

See BHT-407-MM Chapter 63, Paragraph 63-137

63.11.3.3 Filler Cap – Installation

See BHT-407-MM Chapter 63, Paragraph 63-138

63.11.4 TRANSMISSION – OIL DRAIN PLUG

See BHT-407-MM Chapter 63, Paragraph 63-139

63.11.4.1 Drain Fitting – Removal

See BHT-407-MM Chapter 63, Paragraph 63-140

63.11.4.2 Drain Fitting – Inspection

See BHT-407-MM Chapter 63, Paragraph 63-141

63.11.4.3 Drain Fitting – Installation

See BHT-407-MM Chapter 63, Paragraph 63-142

63.11.5 TRANSMISSION – FILTER AND UNION

See BHT-407-MM Chapter 63, Paragraph 63-143

63.11.5.1 Filter and Union – Removal

See BHT-407-MM Chapter 63, Paragraph 63-144

63.11.5.2 Filter and Union – Inspection

See BHT-407-MM Chapter 63, Paragraph 63-145

63.11.5.3 Filter and Union – Installation

See BHT-407-MM Chapter 63, Paragraph 63-146

63.11.6 OIL AND FILTER MANIFOLD – OIL FITTINGS

63.11.6.1 Oil Fittings – Removal

See BHT-407-MM Chapter 63, Paragraph 63-148

63.11.6.2 Oil Fittings Inspection – Inspection

See BHT-407-MM Chapter 63, Paragraph 63-149

63.11.6.3 Oil Fittings – Installation

See BHT-407-MM Chapter 63, Paragraph 63-150

See BHT-407-MM Chapter 63, Figure 63-66

Figure 63-66. Transmission Oil Level Sight Gauge

63.11.7 TRANSMISSION – OIL LEVEL SIGHT GAUGE

See BHT-407-MM Chapter 63, Paragraph 63-151

63.11.7.1 Oil Level Sight Gauge – Removal

See BHT-407-MM Chapter 63, Paragraph 63-152

63.11.7.2 Oil level Sight Gauge – Cleaning

See BHT-407-MM Chapter 63, Paragraph 63-153

63.11.7.3 Oil Level Sight Gauge – Inspection and Repair

See BHT-407-MM Chapter 63, Paragraph 63-154

63.11.7.4 Oil Level Sight Gauge – Installation

See BHT-407-MM Chapter 63, Paragraph 63-155

63.11.8 TRANSMISSION – JET ASSEMBLIES (NO. 1, NO. 2, NO. 3 AND NO. 4)

See BHT-407-MM Chapter 63, Paragraph 63-156

63.11.8.1 Jet Assembly – Removal

See BHT-407-MM Chapter 63, Paragraph 63-157

63.11.8.2 Jet Assembly – Cleaning

See BHT-407-MM Chapter 63, Paragraph 63-158

63.11.8.3 Jet Assembly – Inspection and Repair

See BHT-407-MM Chapter 63, Paragraph 63-159

63.11.8.4 Jet Assembly – Installation

See BHT-407-MM Chapter 63, Paragraph 63-160

63.11.9 TRANSMISSION – OIL FILTER MANIFOLD ASSEMBLY

See BHT-407-MM Chapter 63, Paragraph 63-161

63.11.9.1 Oil Filter Manifold Assembly – Removal

See BHT-407-MM Chapter 63, Paragraph 63-162

63.11.9.2 Oil Filter Manifold Assembly – Cleaning

See BHT-407-MM Chapter 63, Paragraph 63-163

63.11.9.3 Oil Filter and Manifold Assembly – Inspection

See BHT-407-MM Chapter 63, Paragraph 63-164

63.11.9.4 Oil Filter and Manifold Assembly – Installation

See BHT-407-MM Chapter 63, Paragraph 63-165

See BHT-407-MM Chapter 63, Figure 63-67

Figure 63-67. Transmission Oil Jet – Removal/Installation

See BHT-407-MM Chapter 63, Figure 63-68

Figure 63-68. Manifold Assembly and Housing

See BHT-407-MM Chapter 63, Figure 63-69

Figure 63-69. Transmission Oil Pressure Regulator Valve

See BHT-407-MM Chapter 63, Figure 63-70

Figure 63-70. Transmission Bypass Valve and Indicator

See BHT-407-MM Chapter 63, Figure 63-71

Figure 63-71. Transmission High Pressure Oil Filter Bypass Valve

63.11.10 TRANSMISSION – FILTER ELEMENT AND HOUSING

See BHT-407-MM Chapter 63, Paragraph 63-166

63.11.10.1 Filter Element and Housing – Removal

See BHT-407-MM Chapter 63, Paragraph 63-167

63.11.10.2 Filter Element and Housing – Cleaning and Inspection

See BHT-407-MM Chapter 63, Paragraph 63-168

63.11.10.3 Filter Element and Housing – Installation

See BHT-407-MM Chapter 63, Paragraph 63-169

63.11.11 TRANSMISSION – OIL PRESSURE REGULATOR VALVE ASSEMBLY

See BHT-407-MM Chapter 63, Paragraph 63-170

63.11.11.1 Oil Pressure Regulator Valve Assembly – Removal

See BHT-407-MM Chapter 63, Paragraph 63-171

63.11.11.2 Oil Pressure Regulator Valve Assembly – Inspection

See BHT-407-MM Chapter 63, Paragraph 63-172

63.11.11.3 Oil Pressure Regulator Valve Assembly – Installation

See BHT-407-MM Chapter 63, Paragraph 63-173

63.11.11.4 Oil Pressure Regulator Valve Assembly – Adjustment

See BHT-407-MM Chapter 63, Paragraph 63-174

63.11.12 OIL FILTER – INDICATING BYPASS VALVE ASSEMBLY

See BHT-407-MM Chapter 63, Paragraph 63-175

63.11.12.1 Indicating Bypass valve Assembly – Reset

See BHT-407-MM Chapter 63, Paragraph 63-176

63.11.12.2 Indicating Bypass Valve Assembly – Removal

See BHT-407-MM Chapter 63, Paragraph 63-177

63.12.12.3 Indicating Bypass Valve Assembly – Cleaning and Inspection

See BHT-407-MM Chapter 63, Paragraph 63-178

63.12.12.4 Indicating Bypass Valve Assembly - Installation

See BHT-407-MM Chapter 63, Paragraph 63-179

63.11.13 TRANSMISSION – HIGH PRESSURE OIL FILTER BYPASS VALVE

See BHT-407-MM Chapter 63, Paragraph 63-180

63.11.13.1 High Pressure Oil Filter Bypass Valve - Removal

See BHT-407-MM Chapter 63, Paragraph 63-181

63.11.13.2 High Pressure Oil Filter Bypass Valve – Inspection

See BHT-407-MM Chapter 63, Paragraph 63-182

63.11.13.3 High Pressure Oil Filter Bypass Valve – Installation

See BHT-407-MM Chapter 63, Paragraph 63-183

63.11.14 TRANSMISSION – THERMOSTAT

See BHT-407-MM Chapter 63, Paragraph 63-184

63.11.14.1 Thermostat – Removal

See BHT-407-MM Chapter 63, Paragraph 63-185

63.11.14.2 Thermostat – Testing

See BHT-407-MM Chapter 63, Paragraph 63-186

63.11.14.3 Thermostat – Installation

See BHT-407-MM Chapter 63, Paragraph 63-187

63.11.15 TRANSMISSION – NR MONOPOLE SENSOR

See BHT-407-MM Chapter 63, Paragraph 63-188

63.11.16 TRANSMISSION – OIL TEMPERATURE TRANSMITTER BULB

See BHT-407-MM Chapter 63, Paragraph 63-189

63.11.17 OIL TEMPERATURE THERMOSWITCH

See BHT-407-MM Chapter 63, Paragraph 63-190

63.11.18 TRANSMISSION CHIP DETECTOR

See BHT-407-MM Chapter 63, Paragraph 63-191

63.11.18.1 Transmission Top Chip Detector – Removal

See BHT-407-MM Chapter 63, Paragraph 63-192

63.11.18.2 Transmission Top Chip Detector – Inspection

See BHT-407-MM Chapter 63, Paragraph 63-193

63.11.18.3 Transmission Top Chip Detector – Installation

See BHT-407-MM Chapter 63, Paragraph 63-194

63.11.18.4 Transmission Lower Chip Detector – Removal

See BHT-407-MM Chapter 63, Paragraph 63-195

63.11.18.5 Transmission Lower Chip Detector – Inspection

See BHT-407-MM Chapter 63, Paragraph 63-196

63.11.18.6 Transmission Lower Chip Detector – Installation

See BHT-407-MM Chapter 63, Paragraph 63-197

63.11.19 TRANMISSION – OIL SYSTEM FITTINGS, HOSES AND TUBE ASSEMBLIES

The Oil Cooler System is shown in Figure 63-75. From the transmission oil filter manifold, the oil is bypassed through the tubes and hoses to the oil cooler and returned to the oil filter manifold. The two drains are located in the baggage compartment to drain the oil lines and the oil cooler.

The oil system uses flared fittings, tubes, lines and packings to make sure the system is free of leaks.

63.11.19.1 Oil System Fittings, Hoses, and Tube Assemblies – Removal

See BHT-407-MM Chapter 63, Paragraph 63-202

63.11.19.2 Oil System Fittings, Hoses, and Tube Assemblies – Cleaning and Flushing

See BHT-407-MM Chapter 63, Paragraph 63-203

63.11.19.3 Oil System Fittings, Hoses, and Tube Assemblies – Inspection

See BHT-407-MM Chapter 63, Paragraph 63-204

63.11.19.4 Oil System Fittings, Hoses, and Tube Assemblies – Installation

See BHT-407-MM Chapter 63, Paragraph 63-205

63.11.20 TRANSMISSION & ENGINE – OIL COOLER

See BHT-407-MM Chapter 63, Paragraph 63-206

63.11.21 OIL COOLER – DUCT

See BHT-407-MM Chapter 63, Paragraph 63-207

63.11.22 TRANSMISSION – OIL MANIFOLD

See BHT-407-MM Chapter 63, Paragraph 63-208

63.11.22.1 Oil Manifold – Inspection

See BHT-407-MM Chapter 63, Paragraph 63-209

63.11.23 TRANSMISSION – OIL PRESSURE TRANSDUCER

See BHT-407-MM Chapter 63, Paragraph 63-210

63.11.24 TRANSMISSION – OIL PRESSURE SWITCH

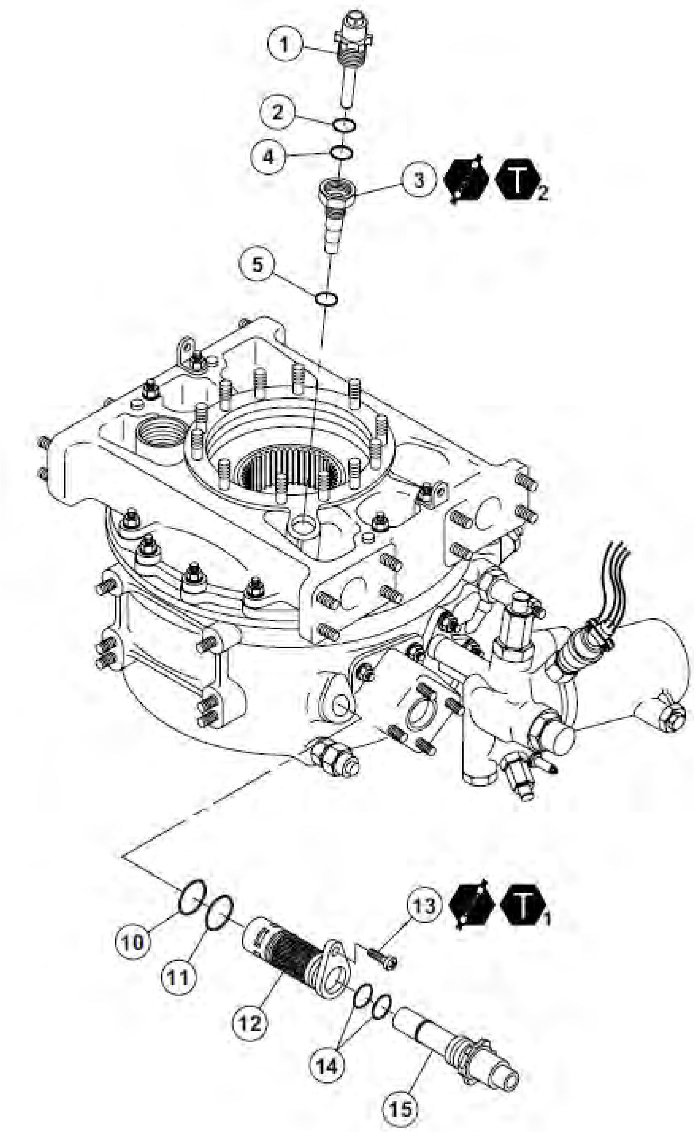
See BHT-407-MM Chapter 63, Paragraph 63-211

See BHT-407-MM Chapter 63, Figure 63-72

Figure 63-72. Transmission Thermostat

See BHT-407-MM Chapter 63, Figure 63-73

Figure 63-73. Transmission NR Monopole Sensor, Temperature Transmitter Bulb, and Temperature Thermoswitch - Location



1. Chip detector
2. Preformed packing
3. Chip detector housing
4. Preformed packing
5. Preformed packing

7. Chip detector housing

10. Preformed packing
11. Preformed packing
12. Chip detector housing and screen
13. Screw
14. Preformed packing
15. Chip detector assembly

LOCKWIRE (C-405)

T1 12 TO 15 IN-LBS (1.36 TO 1.70 Nm)

T2 40 TO 60 IN-LBS (4.52 TO 6.77 Nm)

Figure 63-74. Transmission Chip Detector

See BHT-407-MM Chapter 63, Figure 63-75

Figure 63-75. Transmission Oil Cooler System

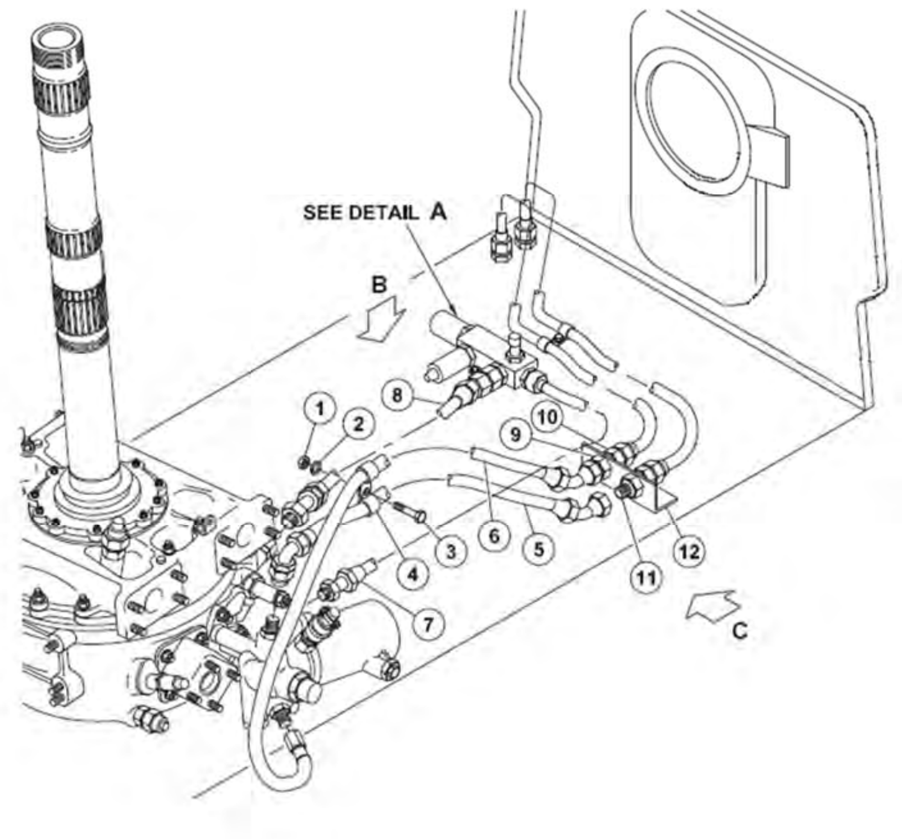
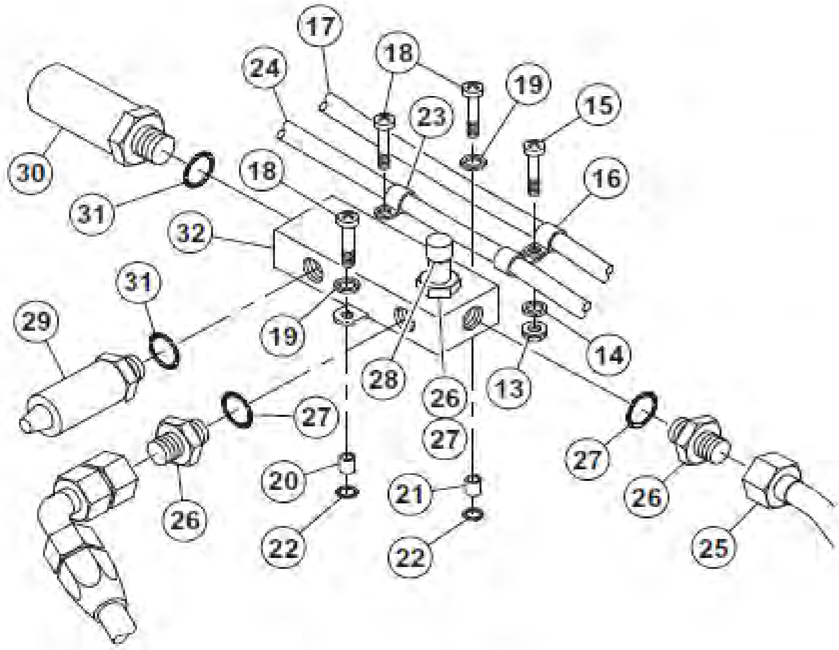
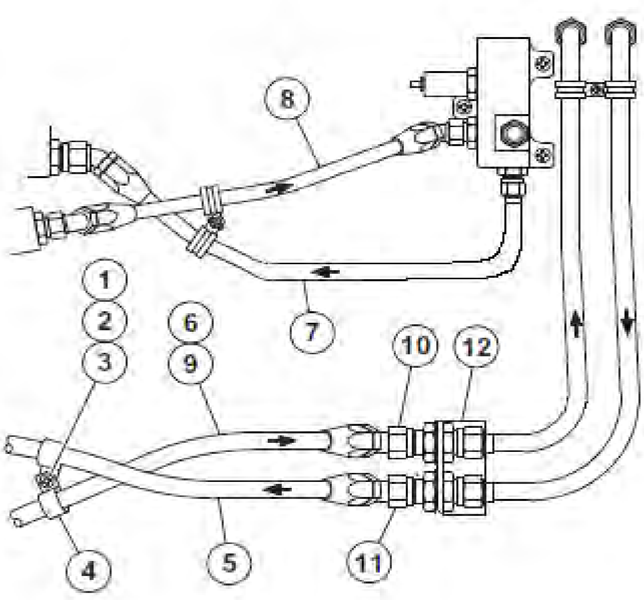


Figure 63-76. Transmission Lubrication System (Sheet 1 of 4)

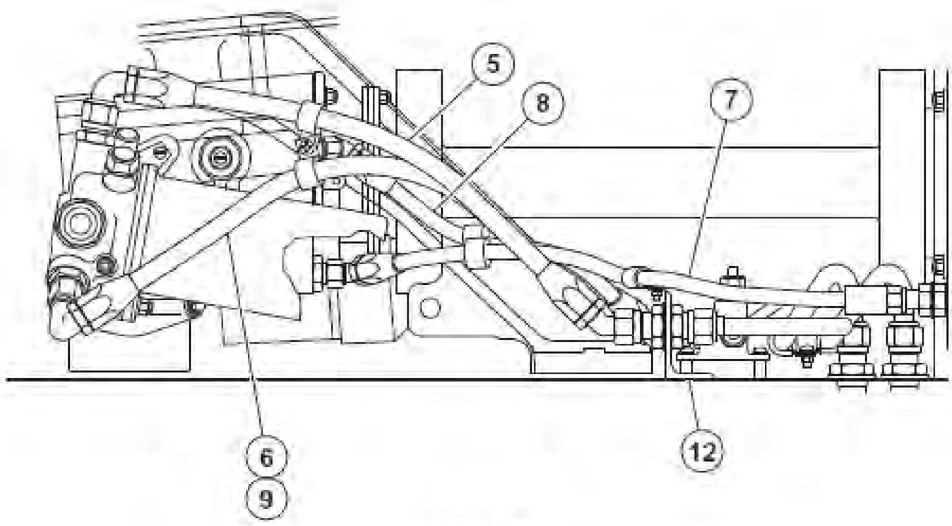


DETAIL A



VIEW B

Figure 63-76. Transmission Lubrication System (Sheet 2 of 4)



VIEW C

Figure 63-76. Transmission Lubrication System (Sheet 3 of 4)

1. Nut
2. Washer
3. Screw
4. Clamp
5. Hose assembly
6. Hose assembly
7. Hose assembly
8. Hose assembly
9. Nut
10. Washer
11. Union
12. Bracket
13. Nut
14. Washer
15. Screw
16. Clamp
17. Tube assembly
18. Screw
19. Washer
20. Spacer
21. Spacer
22. Washer
23. Clamp
24. Tube assembly
25. Tube assembly
26. Union
27. Preformed packing
28. Cap
29. Transmission oil pressure switch
30. Transmission oil pressure transmitter
31. Preformed packing
32. Manifold

Figure 63-76. Transmission Lubrication System (Sheet 4 of 4)

Chapter 64
TAIL ROTOR
(64-00-00)

REFER TO
BHT-407-MM

Chapter 65
TAIL ROTOR DRIVE SYSTEM
(65-00-00)

CHAPTER 65 — TAIL ROTOR DRIVE SYSTEM

Contents

List of Figures

65.1 Tail Rotor Drive

Power to operate the tail rotor comes through the tail rotor drive system, from the engine freewheel unit.

The engine freewheel unit turns the forward short shaft (1, Figure 65-1) and supplies power to the oil cooler blower assembly (2). The power then goes through the aft short shaft (3) and the four tail rotor driveshaft segment assemblies (4) to the tail rotor gearbox (5). The tail rotor gearbox changes the direction of the power 90° and reduces the speed by a ratio of 2.53 to 1. The tail rotor drive system turns at 6317 RPM and the tail rotor gearbox output shaft turns at 2500 RPM.

Major components of the tail rotor drive system are:

- forward short shaft assembly
- D4145-1 Spacers
- oil cooler blower assembly
- aft short shaft assembly
- tail rotor driveshaft segment assemblies
- the tail rotor gearbox assembly

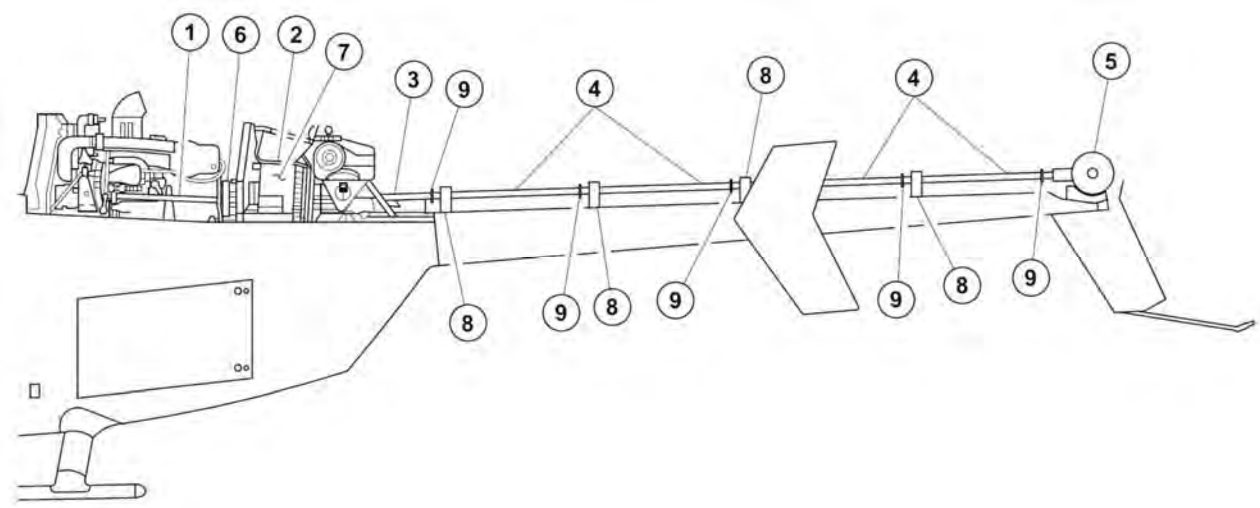
The forward short shaft assembly (1) is a steel shaft. The forward end is fixed. It is connected to a coupling disc pack on the engine output adapter. The aft end is connected to the oil cooler blower assembly (2) by a coupling disc pack and a sliding splined adapter.

The oil cooler blower assembly (2) is part of the tail rotor drive system. The impeller is attached to the shaft. For S/N 53443 and subsequent or S/N 53000 through 53442 Post BHT-407-II-30 two weights (7) are attached, along with the impeller, to the shaft. The weights (7) are positioned aft of the impeller. The shaft is steel and drives the aft short shaft. The oil cooler blower shaft is splined at both ends. The oil cooler blower assembly (2) is installed aft of the aft firewall. It holds the engine and transmission oil coolers. The oil cooler blower shaft is held by two bearing hangers (8), one on the forward end and one on the aft end. These are bolted to the helicopter structure. The oil cooler blower shaft is connected to the forward short shaft (1) with a splined adapter, and to the aft short shaft (3) with a splined adapter. The splined adapters can slide fore and aft on the oil cooler blower shaft splines. Balance plates may also be installed on each end of the oil cooler blower shaft to allow for dynamic balancing. The balance plates are only used with the splined adapter configuration. The impeller is covered by a housing that is attached to the helicopter structure.

Helicopters that have an environmental control system use the oil cooler blower shaft to operate the air conditioner compressor. One of the weights (7) is removed when the tail rotor drive is equipped with a compressor.

The aft short shaft assembly (3) is an aluminum shaft. The forward end is connected to the oil cooler blower by a coupling disc pack and a sliding splined adapter. The aft end is fixed. It is connected to a coupling disc pack (9) on the first tail rotor driveshaft segment assembly (4).
The four tail rotor driveshaft segment assemblies (4) are installed along the top of the tailboom. The tail rotor driveshaft segment assemblies are accessed through the removal of two tailboom fairings. The four tail rotor driveshaft segment assemblies are connected by coupling disc packs (9) that make allowance for tailboom

movement. Each of the four tail rotor driveshaft segment assemblies are the same and are interchangeable. Each tail rotor driveshaft segment assembly is aluminum, and has an aluminum adapter flange. The bearing hangers (8) hold the tail rotor driveshaft segment assemblies aligned. The most aft tail rotor driveshaft segment assembly is attached to the tail rotor gearbox input adapter through a coupling disc pack (9). The tail rotor gearbox input adapter is part of the tail rotor gearbox (5). Allowance for tail rotor gearbox movement is through the coupling disc pack.



1. **Forward short shaft**
2. **Oil cooler blower assembly**
3. **Aft short shaft**
4. **Tail rotor driveshaft segment assembly**
5. **Tail rotor gearbox**
6. **Splined adapter**
7. **Weights (quantity 2) (S/N 53443 and subsequent or S/N 53000 through 53442 Post BHT-407-II-30)**
8. **Bearing hanger**
9. **Coupling disc pack**

All bearing hangers (8) can be lubricated through a grease fitting. They can be shimmed to align the tail rotor driveshaft.

The coupling disc packs (9) join the different components of the tail rotor driveshaft to each other. The coupling disc packs (9) are made of 9 to 12 separate steel discs. The disc circumference has two index flats, parallel to the grain of the steel. These index flats are an aid to ensure that the grain of the steel is alternated with each disc (each disc is turned 90° from the previous disc).

The tail rotor gearbox (5) contains an input pinion and a spiral bevel gear set that changes the direction of the drive 90°. The speed is reduced by a ratio of 2.53 to 1 at these gears. The tail rotor gearbox housing is made of magnesium and is attached to the tailboom. The tail rotor gearbox assembly includes a filler cap, oil sight glass, a breather and rigid line, and a combination electrical chip detector/self-closing valve. The tail rotor gearbox (5) also gives the support for the tail rotor pitch change control system (Chapter 67).

The tail rotor chip detector/self-closing valve and oil sight glass help during maintenance. The self closing valve makes it possible to examine the electric chip detector for metal particles without draining the oil. The self-closing valve also serves as a drain plug for the tail rotor gearbox (5). The oil sight glass makes it possible to visually examine the quantity of oil in the tail rotor gearbox (5). The breather assembly permits the lubricating oil and the air in the tail rotor gearbox (5) to expand and contract due to changes in temperature and altitude. The tail rotor gearbox (5) will not pressurize because the breather assembly vents to the atmosphere.

65.1.1 Tail Rotor Drive System — Operational Check

See BHT-407-MM Chapter 65, Paragraph 65-2

65.1.1.1 Tail Rotor Drive System — Operational Check — Procedures

See BHT-407-MM Chapter 65, Paragraph 65-3

65.1.2 Tail Rotor Drive System — Inspection for Condition and Security

See BHT-407-MM Chapter 65, Paragraph 65-4

65.1.2.1 Tail Rotor Drive System — Inspection

See BHT-407-MM Chapter 65, Paragraph 65-5

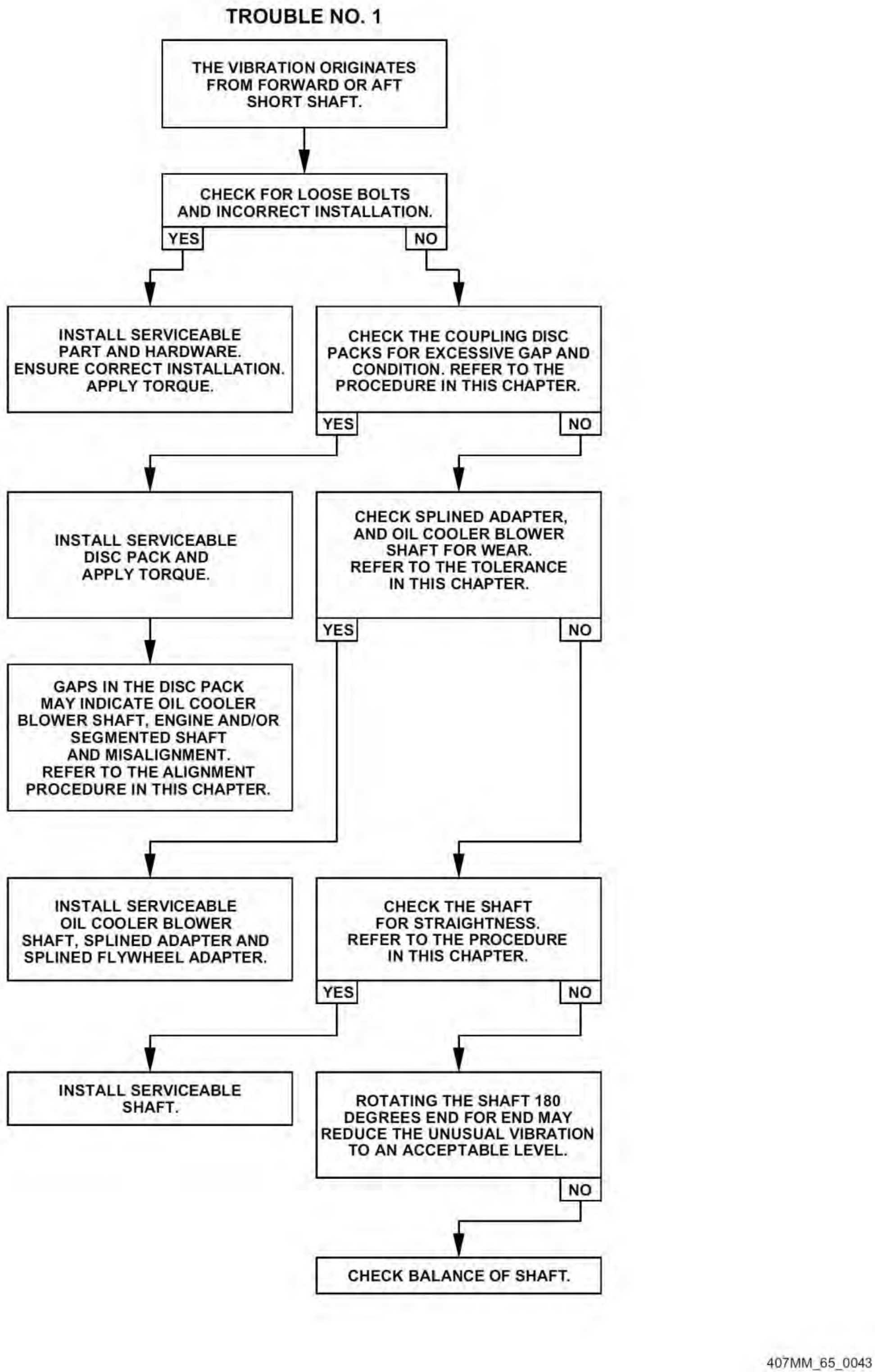


Figure 65-2. Tail Rotor Drive System – Trouble No. 1

65.1.2.2 Tail Rotor Drive System — Scheduled Condition and Security Inspection

1. Examine the forward and the aft short shafts as follows:

a. Examine the shafts for corrosion and mechanical damage.

b. Examine the shafts for loose hardware.

c. Make sure that the number, location, and direction of the coupling washers (2, 8, 13, and 18, Figure 65-11) and (3, 5, 10, 15, and 20, Figure 65-28) are correct. Make sure the number of coupling washers installed 180° opposite of each other are the same.

d. Examine the coupling disc packs for condition, security, and gaps between the discs (paragraph 65-59).

e. Examine the rivets that hold the shaft adapters to the shaft for looseness.

f. Examine the splines of the splined adapter (5, Figure 65-11), and the splined adapter (17, Figure 65-28) for condition.

2. Examine the oil cooler blower assembly as follows:

a. Examine the oil cooler blower shaft for corrosion and mechanical damage.

b. Make sure the impeller is clean (Chapter 12) and examine for corrosion, mechanical damage, and cracks.

c. Examine the housing and covers for corrosion, cracks, and mechanical damage.

d. Examine the impeller, housing, and bearing hangers for loose hardware.

e. Examine the bearing hangers for cracks, corrosion, and mechanical damage.

f. Examine the bearings for black colored grease around the seal. Refer to paragraph 65-22 for bearing serviceability check.

g. Examine the bearing hanger retaining ring for security.

3. Examine the four tail rotor driveshaft segment assemblies as follows:

a. Examine the shaft for corrosion and mechanical damage.

b. Examine the bearing hanger for loose hardware.

c. Examine the bearing hanger for cracks, corrosion, and mechanical damage.

d. Examine the bearing hanger retaining ring for security.

e. Examine the bearing for black colored grease around the seal. Refer to paragraph 65-22 for bearing serviceability check.

f. Ensure that the number, location, and direction of the coupling washers is correct. Make sure the number of coupling washers that are installed 180° opposite of each other are the same.

g. Examine the coupling disc packs for condition, security, and gaps between the discs (paragraph 65-59).

h. Examine the rivets that hold the shaft adapters to the shaft for looseness.

4. Examine the tail rotor gearbox as follows:

a. Examine the tail rotor gearbox for corrosion, mechanical damage, and cracks.

b. Examine the tail rotor gearbox for leaks (Table 65-3).

c. Examine the tail rotor gearbox for looseness at the attachment points.

d. Examine the tail rotor gearbox for the correct oil level.

e. Make sure the filler cap and the chip detector are correctly installed.

65.1.3 Tail Rotor Gearbox — Torque Check

See BHT-407-MM Chapter 65, Paragraph 65-7

65.1.3.1 Tail Rotor Gearbox — 10 to 25 Hours After Installation Torque Check

See BHT-407-MM Chapter 65, Paragraph 65-8

65.1.3.2 Tail Rotor Gearbox — 300 Hour Torque Check

See BHT-407-MM Chapter 65, Paragraph 65-9

65.1.3.3 Coupling Disc Pack — Torque Check

See BHT-407-MM Chapter 65, Paragraph 65-10

65.1.4 Tail Rotor Drive System — Conditional Inspection

See BHT-407-MM Chapter 65, Paragraph 65-11

65.1.4.1 Conditional Inspection — Hard Landing

See BHT-407-MM Chapter 65, Paragraph 65-12

65.1.4.2 Conditional Inspection — Sudden Stoppage

See BHT-407-MM Chapter 65, Paragraph 65-13

65.1.4.3 Conditional Inspection — Overspeed

See BHT-407-MM Chapter 65, Paragraph 65-14

65.1.4.4 Conditional Inspection — Overtorque

See BHT-407-MM Chapter 65, Paragraph 65-15

65.1.4.5 Conditional Inspection — Lightning Strike

See BHT-407-MM Chapter 65, Paragraph 65-16

65.1.4.6 Tail Rotor Gearbox — 60 Month Interim Scheduled Inspection

See BHT-407-MM Chapter 65, Paragraph 65-17

65.1.5 Tail Rotor Drive System — Leakage Limits

See BHT-407-MM Chapter 65, Paragraph 65-18

65.1.6 Tail Rotor Drive System — Serviceability Check

See BHT-407-MM Chapter 65, Paragraph 65-19

65.1.7 Unwanted Particles — Visual Identification

See BHT-407-MM Chapter 65, Paragraph 65-20

65.1.8 Unwanted Particles — Chemical Identification

See BHT-407-MM Chapter 65, Paragraph 65-21

65.1.9 Tail Rotor Driveshaft Bearings — Serviceability Check

See BHT-407-MM Chapter 65, Paragraph 65-22

65.2 Tail Rotor Drive System Components

The tail rotor drive system includes the components that follow:

- forward short shaft assembly
- oil cooler blower assembly
- aft short shaft assembly
- tail rotor driveshaft segment assemblies
- coupling disc packs
- tail rotor gearbox
- D4145-1 Spacers

65.2.1 Forward Short Shaft Assembly

The forward short shaft assembly (11, Figure 65-11) is a steel shaft. The forward end is fixed. It is connected to a coupling disc pack (19) on the engine output adapter (16) using the D4145-1 Spacer (35). The aft end of the forward shaft assembly is connected to the oil cooler blower by a coupling disc pack (22), adapter (5) and a D4145-1 Spacer (35).

65.2.1.1 Forward Short Shaft Assembly — Removal

MATERIALS REQUIRED

Refer to BHT-ALL-SPM for specifications

NUMBER	NOMENCLATURE
C-405	Lockwire

NOTE

To help minimize rebalance procedures following reinstallation, note installed position of all items prior to removal.

1. Gain access to the forward short shaft assembly (Chapter 53).

CAUTION

SUPPORT THE FORWARD SHORT SHAFT TO PREVENT DAMAGE TO THE COUPLING DISC PACKS.

THE SURFACE CONDITION OF THE FORWARD SHORT SHAFT ASSEMBLY IS VERY IMPORTANT TO FLIGHT SAFETY. THE SURFACE OF THE SHAFT MUST BE SMOOTH AND UNMARRED. THE SURFACE MUST NOT BE DAMAGED DURING REMOVAL OR HANDLING. BE VERY CAREFUL DURING REMOVAL AND WHEN YOU HOLD THE FORWARD SHORT SHAFT ASSEMBLY.

2. Loosen the nuts (21, Figure 65-11) that attach the coupling disc pack (19) and D4145-1 Spacer (7) to the forward short shaft (11) until they are finger tight.

NOTE
Complete step 3, step 4, or step 5 as it applies to the helicopters configuration.

3. For helicopters without a balance plate (24) installed, remove the nuts (10), the flat washers (9), the coupling washers (8) and the bolts (6) that attach the coupling disc pack (22) and the D4145-1 Spacer (7) to the forward short shaft assembly (11).

4. For helicopters without air conditioning and with a balance plate (24) installed, remove the nuts (10), the flat washers (9), the coupling washers (8), and the bolts (6).

5. For helicopters with air conditioning and with a balance plate (24) installed, remove nuts (32, Figure 65-11, Sheet 4), washers (31), bevel washers (30), bevel washers (29), and bolts (28).

6. Remove the nuts (21, Figure 65-11), the flat washers (20), the coupling washers (18) and the bolts (17) that attach the coupling disc pack (19) to the forward short shaft assembly (11).

7. Push the splined adapter (5) aft and remove the forward short shaft assembly (11). If applicable, also remove the balance plate (24).

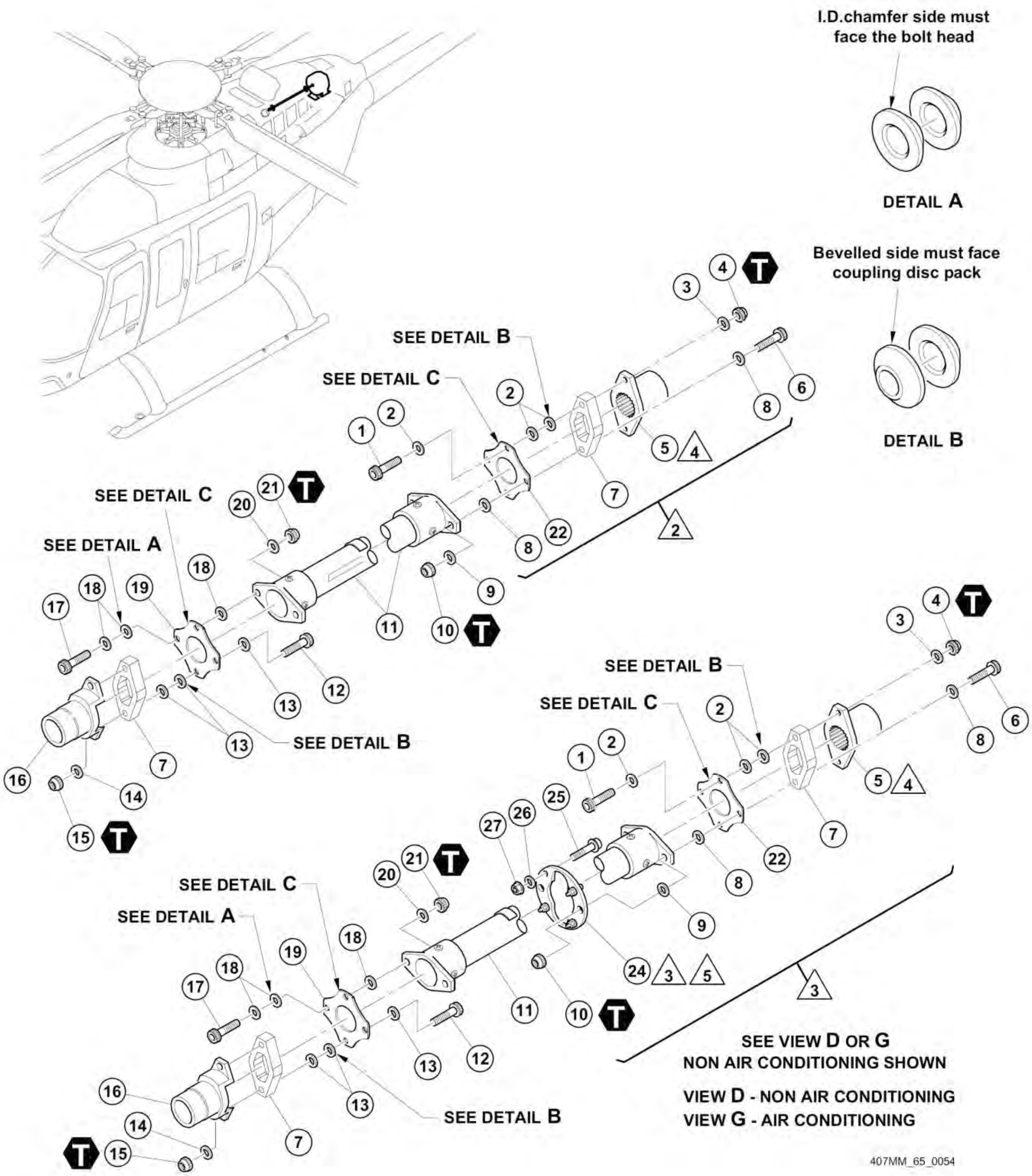
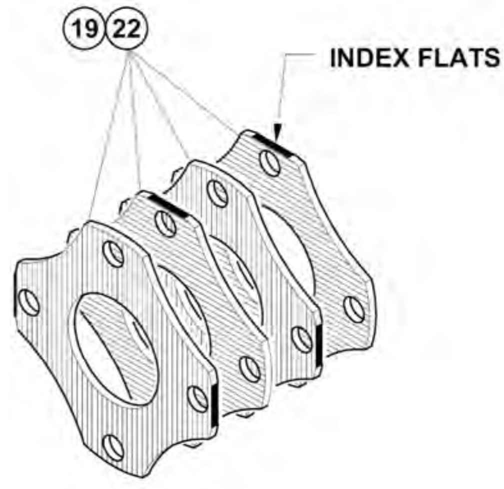
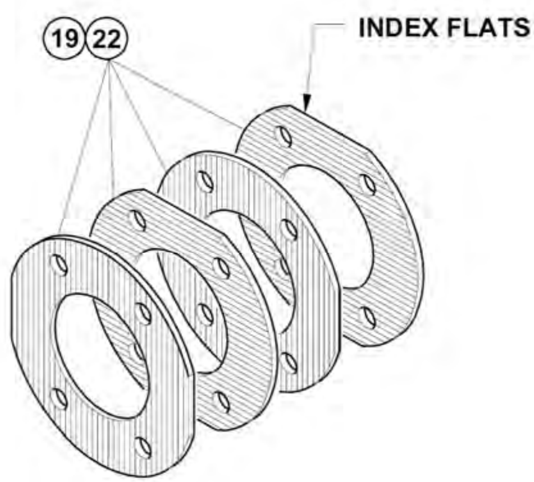


Figure 65-11. Forward Short Shaft Assembly – Removal/Installation (Sheet 1 of 5)



DETAIL C

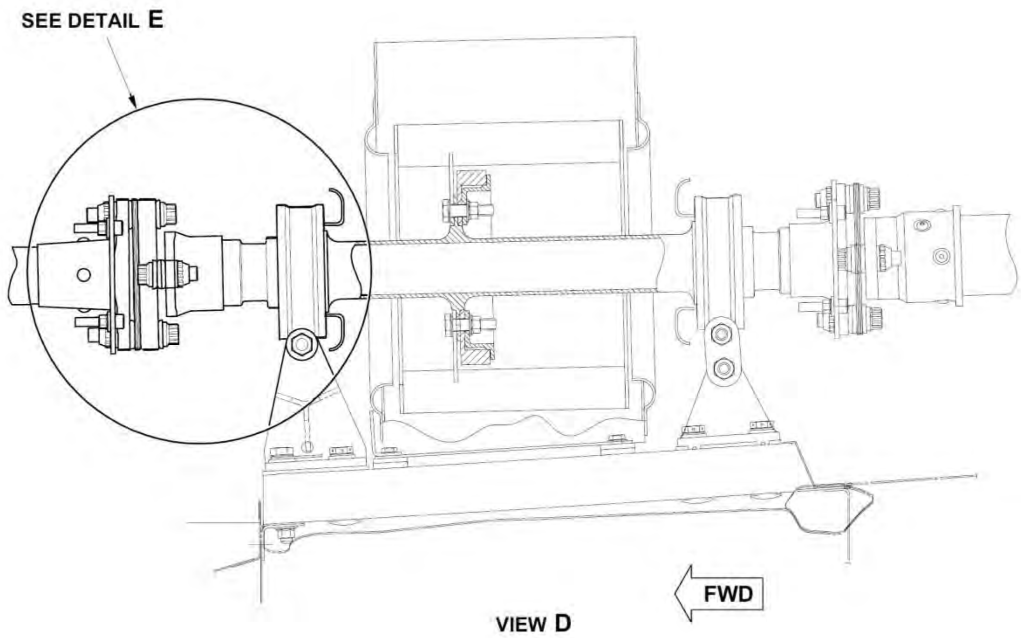
S/N 53292 AND SUBSEQUENT OR POST TB 407-99-18/POST TB 407-02-35



DETAIL C

S/N 53000 THROUGH 53291 OR PRE TB 407-99-18/PRE TB 407-02-35

Figure 65-11. Forward Short Shaft Assembly – Removal/Installation (Sheet 2 of 5)



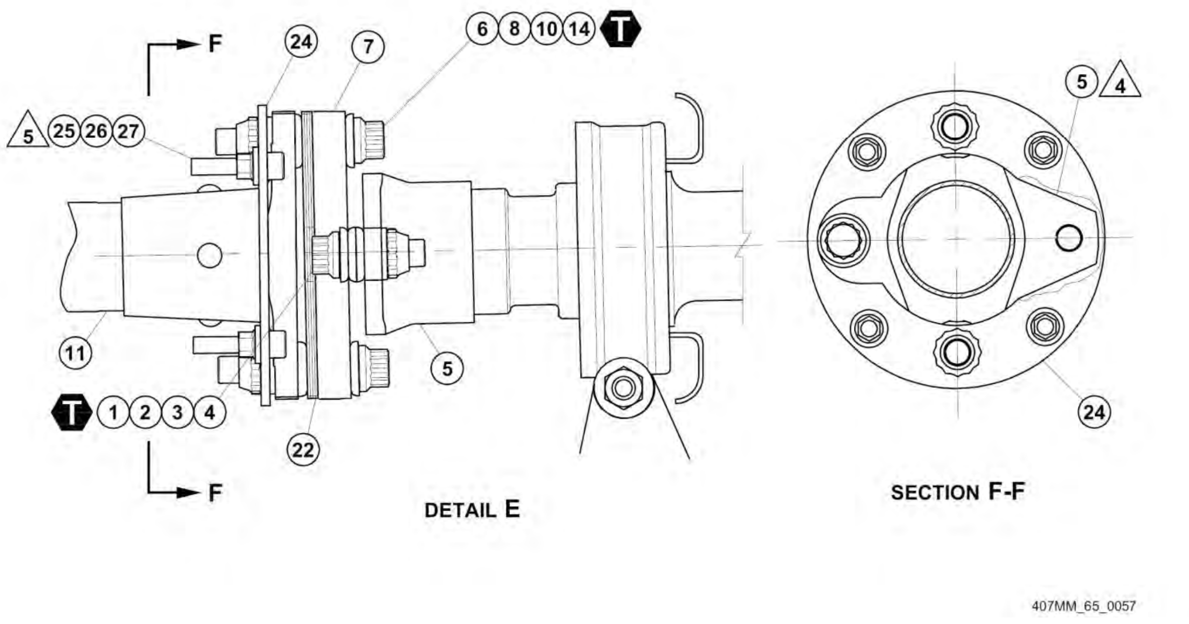


Figure 65-11. Forward Short Shaft Assembly – Removal/Installation (Sheet 3 of 5)

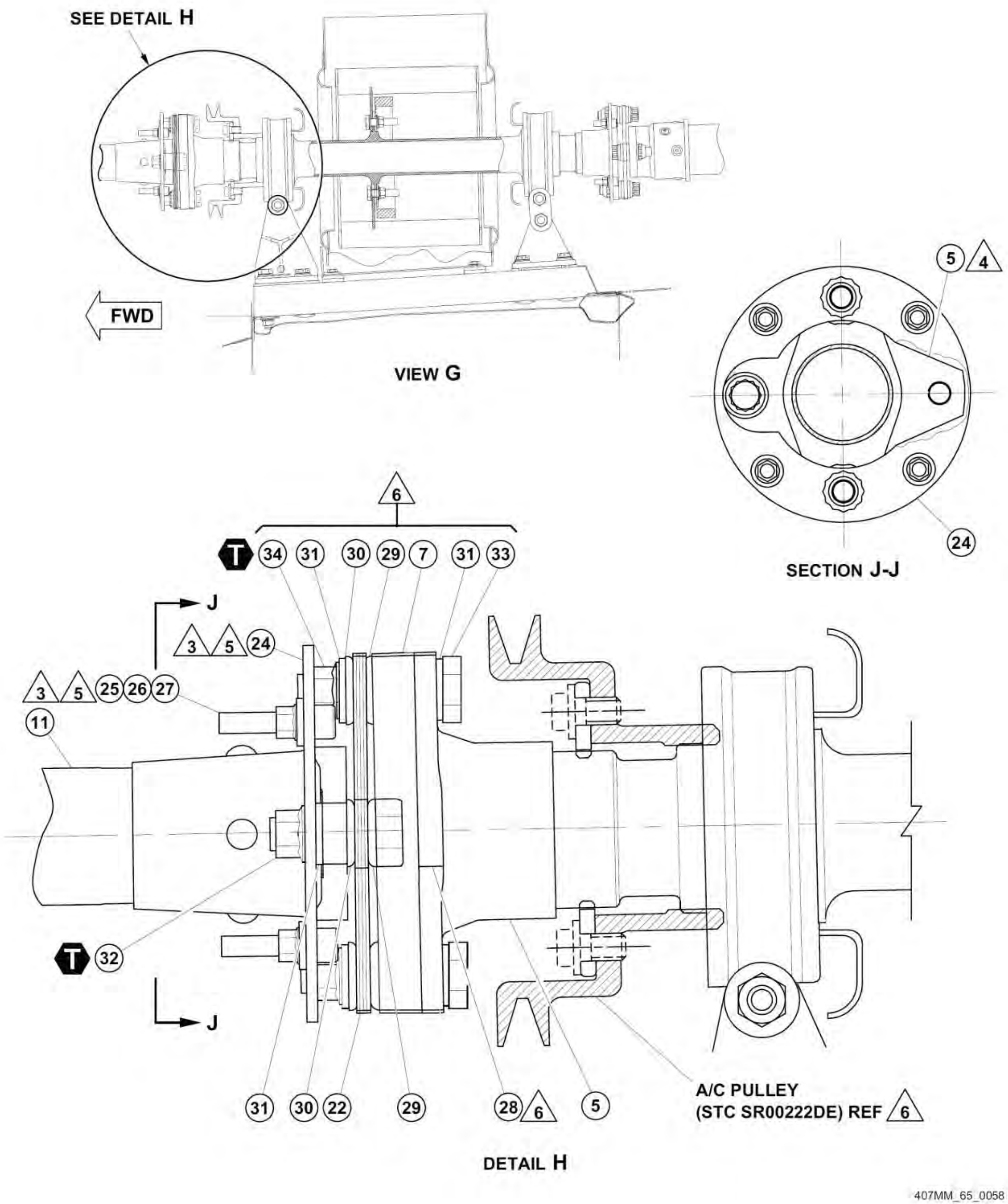


Figure 65-11. Forward Short Shaft Assembly – Removal/Installation (Sheet 4 of 5)

1. Bolt
2. Coupling washer
3. Flat washer
4. Nut
5. Splined adapter
6. Bolt
7. D4145-1 Spacer
8. Coupling washer
9. Flat washer
10. Nut
11. Forward short shaft assembly
12. Bolt
13. Coupling washer
14. Flat washer
15. Nut
16. Freewheel output adapter
17. Bolt
18. Coupling washer
19. Coupling disc pack
20. Flat washer
21. Nut
22. Coupling disc pack
23.
24. Balance plate
25. Screw
26. Washer
27. Nut
28. Bolt
29. Bevel washer (S-3526EC-7) is 0.035 inch (0.89 mm) thick.
30. Bevel washer (S-3526EC-5) is 0.077 inch (1.95 mm) thick.
31. Flat washer
32. Nut
33. Bolt
34. Nut

T 150 TO 180 IN-LBS (16.9 TO 20.3 Nm)

NOTES

1 Helicopters S/N 53000 through 53442 Pre BHT-407-II-30.

2 Helicopters S/N 53443 through 53497 Pre TB 407-02-35.

3 Helicopters S/N 53000 through 53442 Post BHT-407-II-30, S/N 53443 through 53497 Post TB 407-02-35 and S/N 53498 through subsequent. Refer to view D for non-air conditioning and view G for air conditioning.

4 Flanges of forward splined adapter (5, Figure 65-11) and aft splined adapter (17, Figure 65-28) must be positioned 90° to each other within spline tolerances. Ensure that each adapter slides freely on blower shaft splines prior to installation. To facilitate sliding, remove dry lubricant coating from top of shaft splines.

5 Initial hardware setup on all four balance screw locations, is one NAS1351-3-14 screw, one NAS1149F0363P washer and one MS21042L3 nut. For balancing, use a maximum of seven (7) washers (NAS1149F0363P) or any combination of varying thickness washers (NAS1149F03( )( )P) provided that a minimum of two threads extend past the nut. It is permissible to remove one or more screws (NAS1351-3-14) to obtain proper balance. If screw is installed, one washer (NAS1149F0363P) and one nut (MS21042L3) must be installed. Until such time that chapter 18 is updated, refer to BHT-407-II-30 part VII for balancing procedures.

6 Configuration shown in detail H applies to helicopters equipped with Air Comm air conditioner kit. Refer to AIRCOMM STC SR00222DE, drawing 407EC-300 and AIRCOMM Service Bulletin SB 407-3526 Rev A for information on air conditioning installation and maintenance.

Figure 65-11. Forward Short Shaft Assembly – Removal/Installation (Sheet 5 of 5)

8. Slide the splined adapter (5) off the oil cooler blower shaft.

CAUTION

MAKE SURE THAT THE ORDER IN WHICH THE DISC SEGMENTS ARE STACKED DOES NOT CHANGE AFTER THE COUPLING DISC PACK HAS OPERATED. FIGURE 65-12 CONTAINS INSTRUCTIONS FOR MAINTENANCE AND REPAIR.

9. Put lockwire (C-405) through an empty bolt hole in the coupling disc pack (22) to make sure that the order of the discs are not changed.

NOTE
Complete step 10 or step 11 as it applies to the helicopters configuration.

10. For helicopters without air conditioning, remove the nuts (4), the flat washers (3), the coupling washers (2), and the bolts (1) that attach the coupling disc pack (22) to the splined adapter (5).

11. For helicopters with air conditioning and with a balance plate (24), remove the nuts (34, Figure 65-11, sheet 4), the flat washers (31), the bevel washers (30 and 29), the flat washers (31) and the bolts (33).

12. Put lockwire (C-405) through an empty bolt hole in the coupling disc pack (19, Figure 65-11) to make sure the order of the discs are not changed.

13. Remove the nuts (15), the flat washers (14), the coupling washers (13), and the bolts (12) that attach the coupling disc pack (19) to the engine output adapter (16).

65.2.1.2 Forward Short Shaft Assembly — Cleaning

See BHT-407-MM Chapter 65, Paragraph 65-26

65.2.1.3 Forward Short Shaft Assembly — Paint Removal and Application

See BHT-407-MM Chapter 65, Paragraph 65-27

65.2.1.4 Forward Short Shaft Assembly — Inspection and Repair

See BHT-407-MM Chapter 65, Paragraph 65-28

65.2.1.5 Forward Short Shaft Assembly — Installation

MATERIALS REQUIRED

Refer to BHT-ALL-SPM for specifications

NUMBER	NOMENCLATURE
C-405	Lockwire
C-525	Grease
C-561	Grease

CAUTION

THE SURFACE CONDITION OF THE FORWARD SHORT SHAFT ASSEMBLY IS VERY IMPORTANT TO FLIGHT SAFETY. THE SURFACE OF THE SHAFT MUST BE SMOOTH AND UNMARRED. THE SURFACE MUST NOT BE DAMAGED DURING INSTALLATION OR HANDLING. BE VERY CAREFUL DURING THE INSTALLATION OF THE FORWARD SHORT SHAFT ASSEMBLY.
MAKE SURE THAT THE ORDER IN WHICH THE DISC SEGMENTS ARE STACKED DOES NOT CHANGE

AFTER THE COUPLING DISC PACK HAS OPERATED. FIGURE 65-12 CONTAINS INSTRUCTIONS FOR MAINTENANCE AND REPAIR.

INDIVIDUAL COUPLING WASHERS ARE TO BE INSTALLED WITH THE BEVELED EDGE AGAINST THE COUPLING DISK PACK AND THE FLAT SIDE AGAINST THE ADAPTER FLANGE. IF TWO COUPLING WASHERS ARE INSTALLED TOGETHER, REFER FIGURE 65-11, DETAIL A AND DETAIL B FOR THE CORRECT INSTALLATION OF THE COUPLING WASHERS.

NOTE

Hold the bolt stationary and turn the nut only. If you turn the bolt, gaps in the coupling disc pack may occur.

Make sure bolt lengths are equal. Ensure that only the grip portion (unthreaded portion) of the bolt is in contact with the coupling disc pack.

To maintain balance, reinstall items in same position as noted prior to disassembly.

1. For helicopters without air conditioning, install the coupling disc pack (22, Figure 65-11) on the splined adapter (5) with the bolts (1), coupling washers (2, Figure 65-11, Detail B), flat washers (3), and nuts (4). Tighten the nuts until they lightly contact. The bolts must remain loose enough so that they can be turned by hand.

2. For helicopters with air conditioning, install the coupling disk pack (22) on the splined adapter (5) with the bolts (33, Figure 65-11), flat washers (31), bevel washers (29 and 30), flat washer (31), and nuts (34). Tighten the nuts until they lightly contact. The bolts must remain loose enough so that they can be turned by hand.

3. Remove the lockwire (C-405) from the coupling disc pack (22)

CAUTION

FORWARD AND AFT OIL COOLER BLOWER SHAFT SLIDING SPLINED ADAPTERS MUST SLIDE FREELY ON ENDS OF BLOWER SHAFT. IF REQUIRED TO ATTAIN THIS RESULT, IT MAY BE NECESSARY TO REMOVE THE DRY LUBRICANT FROM TOP OF SHAFT SPLINES. IF ADAPTERS DO NOT SLIDE FREELY, DAMAGE TO BEARINGS MAY OCCUR DUE TO PRELOADING.

NOTE

Flanges of forward splined adapter (5, Figure 65-11) and aft splined adapter (17, Figure 65-28) must be positioned 90° to each other within spline tolerance.

4. Apply grease (C-525) or grease (C-561) to the splines of the adapter (5). Slide the splined adapter onto the oil cooler blower shaft.

5. Install the coupling disc pack (19) and the D4145-1 Spacer (7) on the engine output adapter (16) with the bolts (12), coupling washers (13, Figure 65-11, Detail B), flat washers (14), and nuts (15). Tighten the nuts until they lightly contact. The bolts must remain loose enough so that they can be turned by hand.

6. Remove the lockwire from the coupling disc pack (19).

CAUTION

DURING INSTALLATION, SUPPORT THE FORWARD SHORT SHAFT TO PREVENT DAMAGE TO THE COUPLING DISC PACKS.

7. Put the forward short shaft assembly (11) in position on the helicopter. If applicable, position the balance plate (24) over the aft end of the short shaft, prior to putting it in position.

8. Install the bolts (17), coupling washers (18) (Figure 65-11, Detail A), flat washers (20), and nuts (21) that attach the coupling disc pack (19) to the forward end of the forward short shaft. Tighten the nuts until they lightly contact. The bolts must remain loose enough so that they can be turned by hand.

NOTE

Depending on helicopter configuration, perform step 9 or step 10.

9. For helicopters with a splined adapter (5), with or without a balance plate (24) and without air conditioning, install the bolts (6), coupling washers (8), flat washers (9), and nuts (10) that attach the coupling disc pack (22) and the D4145-1 Spacer (7) to the forward short shaft (11). Tighten the nuts until they lightly contact. The bolts must remain loose enough so that they can be turned by hand.

10. For helicopters with a splined adapter (5), with a balance plate (24) and with air conditioning, install the bolts (28, Figure 65-11), bevel washers (29 and 30), flat washers (31), and nuts (32). Tighten the nuts until they lightly contact. The bolts must remain loose enough so that they can be turned by hand.

11. Apply torque Ⓣ to all the nuts (Figure 65-11) on the coupling disc packs. Make sure that you follow the torque sequence (paragraph 65-60).

12. Perform an operational check (paragraph 65-3). Refer to BHT-II-30, part VII for balancing procedures.

65.2.2 Oil Cooler Blower

See BHT-407-MM Chapter 65, Paragraph 65-30

65.2.2.1 Oil Cooler Blower — Removal

See BHT-407-MM Chapter 65, Paragraph 65-31

65.2.2.2 Oil Cooler Blower — Disassembly

See BHT-407-MM Chapter 65, Paragraph 65-32

65.2.2.3 Oil Cooler Blower — Cleaning

See BHT-407-MM Chapter 65, Paragraph 65-33

65.2.2.4 Oil Cooler Blower — Inspection and Repair

See BHT-407-MM Chapter 65, Paragraph 65-34

65.2.2.5 Oil Cooler Blower Shaft — Stripping and Painting

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Chapter 67
FLIGHT CONTROLS
(67-00-00)

REFER TO
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Chapter 71
POWERPLANT
(71-00-00)

CHAPTER 71 — POWERPLANT

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71.1 POWER PLANT

71.1.1 POWER PLANT

The Bell 407 helicopter is supplied with power by a Honeywell HTS900-2-1D turboshaft engine. The engine has three modules; the accessory/reduction gearbox, the gas producer, and the combustor/power turbine assembly consisting of a two-stage centrifugal compressor, a single combustion chamber, a single gas producer turbine, and a single stage free power turbine.

The engine, and all the related pipes, hoses, and components, is called the power plant. The power plant is horizontally installed aft of the transmission, in the engine pan above the fuselage. The power plant is held in place by four engine mounts, two bipods and two monopods (Figure 71-1), which are all attached to the service deck. The engine output power is transmitted to a front-mounted reduction gear box via the power turbine shaft concentrically mounted within the gas producer rotor shaft, through the freewheel unit inside the engine and then to the rotor drive system (Chapter 65).

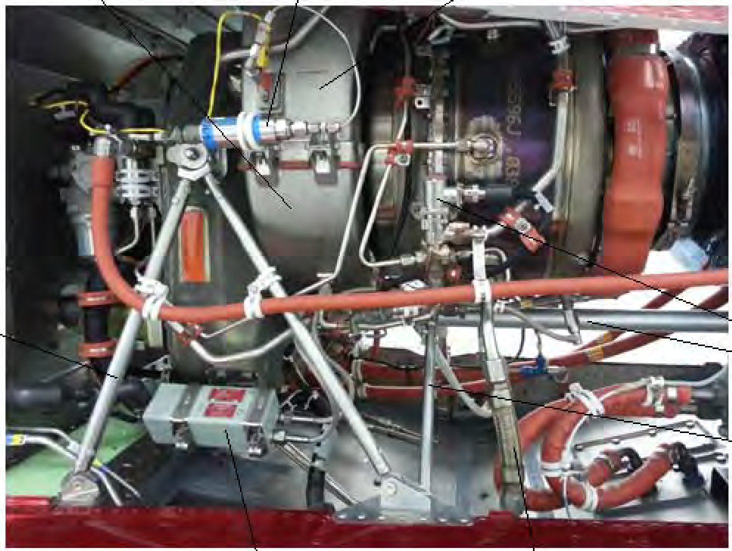
71.1.1.1 POWER PLANT — OPERATIONAL TEST

The Ground Operation Check procedures are a useful method to find if the power plant system operates correctly. The troubleshooting information is contained in Engine Troubleshooting, Table 39, (Honeywell Light Maintenance Manual: Gas Turbine Engine HTS900-2-1D). Use this information to find and correct the majority of the faults that can occur in the engine.

When you do the troubleshooting on an unserviceable system, do an operational check first. The results will show if the system operation is satisfactory. The defects or failures within a system are identified by the corrective action sections of the operational check. The corrective action statement recommends a repair procedure or refers to a troubleshooting chart that deals with a specific defect of the system. After you repair the defect, continue the operational check or the functional test at the point where you found the initial defect. Make sure the operation of the complete system is satisfactory.

71.1.1.1.1. Power Plant Operational Test — Procedures

Do an operational test of the power plant when you have removed or replaced a component of the engine (HMU, fuel nozzle, or thermocouple). Operate the engine in accordance with 71-00-00, Paragraph 12, Engine Operation and Limits (Honeywell Light Maintenance Manual: Gas Turbine Engine HTS900-2-1D) and FMS-E407-789-1. Honeywell recommends start temperatures below 850ºC. Make a note of all incidents of the operational test, such as leaks, unusual vibration or noise, and/or irregular operation of the power plant equipment. Also monitor to see that the items that follow are in the limits:



RH Side

LH Side

Figure 71-1. Powerplant General Assembly

CAUTION

ONLY AN APPROVED PERSON MUST BE AT THE HELICOPTER CONTROLS DURING THIS PROCEDURE.

CAUTION

AFTER YOU CHANGE A POWER PLANT OR AFTER YOU DISCONNECT THE ENGINE OIL INLET HOSE, YOU MUST PRIME THE OIL PUMP BEFORE YOU START THE ENGINE. (SECTION 79.1.1.4)

NOTE

For all operations, follow the instructions in the Flight Manual (FMS-E407-789-1).

1. Prepare the helicopter for the ground run. Do a preflight check.

2. Before you do the initial engine start, do a dry motor run of the engine until you see an indication of oil pressure. Do not go over the starter limits. If you do not see an indication of oil pressure in 30 seconds, stop and find the cause. The dry motor run also removes any caught internal fuel or fuel vapors.

CAUTION

HAVE AN OBSERVER LOOK AT THE HELICOPTER. MAKE SURE THAT THE PILOT IS ALWAYS READY TO STOP THE ENGINE IF AN UNUSUAL INCIDENT IS SEEN TO HAPPEN. KEEP CLEAR OF THE COMPONENTS OF THE HELICOPTER THAT TURN.

3. Do an engine start, a systems check and an engine run-up. Make sure that the results that follow occur:

RESULT:
- no leaks;
- no unusual vibration;
- no unusual noise;
- the measured gas temperature (MGT) is in the limits;
- the torque is in the limits;
- the oil pressure and temperature and consumption are in the limits;
- the gas producer speed is in the limits
- the output shaft speed is in the limits.

CORRECTIVE ACTION:
Refer to Table 25: Special Inspections and Table 39: Engine Troubleshooting of 71-00-00 (Honeywell Light Maintenance Manual: Gas Turbine Engine HTS900-2-1D) for corrective actions.

71.1.1.2 POWERPLANT — STANDARD PRACTICES

When you remove, disassemble, assemble, and install the powerplant, obey all of the standard procedures that follow:

1. Unless a procedure gives you other instructions, lubricate all of the seals and the gaskets with the system fluid in which they operate.

2. Make sure that you follow the correct maintenance procedures for:
   - the bend radii and the length of the hoses that are not held in position,
   - the correct type of clamps and clamp location,

- the clearance between the adjacent hoses,
- the clearance between the hoses and structural parts.

3. Install new packing when you assemble or install hose or tube assemblies.

4. Remove and install the clamps that hold the tubes, the hoses, and the harness assemblies. This helps you to remove and install the components.

5. Use caps to seal all of the orifices and the ends of the tubes and hoses. This keeps all contamination out.

6. Tag the tubes, the hoses, and the harness assemblies as you remove them.

7. Make sure that the accessories turn freely before you install them.

8. Make sure that there are no nicks, burrs, or bends on the mating faces of the accessories and on the engine pads before you install them.

9. Make sure that you remove all of the adhesive tape, corrosion preventive compound, and unwanted materials from the engine before you assemble them to it.

71.1.1.3 POWERPLANT — INSPECTIONS

There are two types of inspections. They are scheduled inspections and special inspections. The scheduled inspections follow prescribed intervals.

NOTE

Refer to 72-00-00, Paragraphs 9 (Honeywell Light Maintenance Manual: Gas Turbine Engine HTS900-2-1D) for other events than those listed below that make a non-scheduled inspection necessary.

The incidents that follow make a non-scheduled inspection necessary, but there are other incidents not included that also make such an inspection necessary:

- Hard landing
- Sudden stoppage, main or tail rotor - power ON or OFF
- Overspeed
- Overtorque
- Lightning strike
- Compressor surge
- Foreign Object Damage (FOD)

71.1.1.4 POWERPLANT — SCHEDULED INSPECTIONS

71.1.1.4.1. Power Plant — Inspection for Condition and Security

Do an inspection of the power plant installation for condition and security as part of a scheduled inspection or unscheduled inspection (Chapter 5), after the engine or an engine component is changed. See also Engine Servicing/Consumable Materials; Chapter 72-00-00, Tables 1, 2 and 3; (Honeywell Light Maintenance Manual: Gas Turbine Engine HTS900-2-1D)

1. Examine the engine fairings and firewalls for condition and security (Chapter 53). Make sure that there are no loose fasteners or other objects that can break loose and get into the engine inlet.

2. Examine the general condition of the engine. Examine all areas that you can get access to for loose bolts, broken or loose connections, broken or missing safeties, and signs of fuel or oil leaks. Examine all areas to make sure that all accessories are attached correctly. Examine the slippage marks on all fuel, oil, and air tube B-nuts to make sure that the nuts have not become loose.

NOTE

On helicopters that have particle separators, examine the particle separator for missing elements. If elements are missing, examine engine compressor inlet for evidence of Foreign Object Damage (FOD).

3. Examine the compressor inlet and impeller for FOD and for dirt that has collected. Examine the engine bellmouth assembly (paragraph 71.2.1.2).

NOTE

Check the quantity of oil in the engine oil tank within 15 minutes of engine shutdown. If the engine has been shut down for more than 15 minutes, scavenge oil could have drained into the gearbox. Do a dry motor run of the engine for 30 seconds before you check the oil level (FMS-E407-789-1). If you do not do this, a false high engine oil consumption rate indication or an overfilling of the oil tank could result.

NOTE

It is usual for engines to consume a small quantity of oil; however, a sudden increase in oil consumption shows that there are oil system problems that you must correct.

4. Do an oil level check for the quantity of oil in the engine oil tank (Chapter 12).

5. Examine the engine outer combustion case (sheet metal and weld seams) for cracks. No cracks are permitted. Make sure to carefully examine for cracks in the weld seams in the areas that follow, and adjacent areas:
   - Igniter plugs
   - Drain valves
   - Fuel nozzle bosses

6. Examine the fuel filter and oil filter impending bypass indicator to make sure that it is not extended.

7. Without disassembly, examine the turbine, the exhaust collector supports, and the air tubes for cracks, buckling, and general condition.

8. Examine the electrical harness for loose, worn, frayed, or broken wires and loose connectors.

9. Examine the compressor scroll for cracks. Make sure to carefully examine the welded areas.

10. Examine the anti-icing and bleed-air valves for:
    - Loose, worn, frayed, or broken wires
    - Loose connections
    - Security of attachment

11. Examine the horizontal and vertical firewall shields for cracks.

12. Examine all linkages for condition and security.

13. Remove the engine oil scavenge magnetic drain chip. Clean it; then do an operational test of the engine magnetic chip plugs.

14. Examine the ignition lead for sign of burn marks, wear marks, or cracks in the conduit. Also, examine for loose connectors and/or broken lockwire. Do an operational test of the igniters.

15. Examine the engine mount monopods for condition and security of the bearings. Examine the bearings for wear.

16. Examine the exhaust duct for cracks, buckling, and general condition (paragraph 71.6.1.1.3).

17. Do the servicing to the engine (Chapter 12).

71.1.1.4.2. Power Plant — Torque Check

1. Apply the minimum torque necessary for the fastener. If the fastener does not move, the test is complete (Figure 71-4 and 71-5).

2. If the fastener moves, do the instructions that follow:

   a. Examine the engine mount bolts, the washers, the bipod mount legs, the monopod mount legs, the bipod and monopod assemblies, the engine mount fittings and clevis and the structure for condition.

   b. Examine the trunnion mounts and the stud on the trunnion mounts, the washers and the nuts for condition.

   c. If you find damage, repair the damage to the part or replace the part. Apply the correct torque to the fasteners (Figure 71-4 and 71-5).

   d. If you do not find damage, install the parts that were removed. Then apply torque to the fasteners (Figure 71-4 and 71-5)

3. Do the engine mount torque check (paragraph 71.1.1.4.2) again at the same scheduled interval (Chapter 5).

71.1.1.4.3. Power Plant — Power Assurance Check

Do a power assurance check, also known as a power check, to monitor the condition of the power plant. A power check, done at regular intervals, will give you the information necessary to make a decision to adjust the schedule of preventive maintenance, compressor wash/rinse, fuel-nozzle inspection, etc.

Power Assurance Checks should be performed in accordance with the information in FMS-E407-789-1.

71.1.1.5 POWERPLANT — NON-SCHEDULED INSPECTIONS

NOTE

Refer to 72-00-00, (Honeywell Light Maintenance Manual: Gas Turbine Engine HTS900-2-1D) for information for other inspection specifications that are not shown here.
Always refer to the Honeywell Light Maintenance Manual: Gas Turbine Engine HTS900-2-1D

Do a non-scheduled inspection when you know or think that a malfunction, defect, or incident has occurred to the helicopter airframe, engine or dynamic components. During the inspection, all components must be examined as a related group. Put a tag on the removed part(s) that you send for more inspection or repair that says: "This [name of part] was removed from the helicopter because of a [reason for removal]."

71.1.1.5.1. Powerplant — Hard landing

CAUTION

AFTER A HARD LANDING, IF THE CABIN FUSELAGE IS ON THE GROUND OR IF IT SHOWS SIGNS THAT IT TOUCHED THE GROUND, THINK THAT THE ENGINE WAS EXPOSED TO LOADS OF MORE THAN 10G.

1. Examine the powerplant installation for condition and security (Paragraph 71.1.1.4.1).

2. Examine the engine mounts to make sure that they are straight. If you find that the engine mount(s) are not straight, replace the engine mount(s).

3. Examine for condition the points on the fuselage where the engine mounts attach. If you find that the fuselage is not straight, then the fuselage must be put in a fuselage fixture to make sure that the alignment is correct.

4. If you must make sure that the fuselage alignment is correct with a fuselage fixture (step 3 above), remove the components that follow. Put a tag on the components. Then write "THIS COMPONENT WAS REMOVED FROM THE HELICOPTER BECAUSE OF A HARD LANDING." Do a hard landing inspection for that component:
   - the transmission assembly (Chapter 63);
   - the mast assembly (Chapter 63);
   - the engine to transmission driveshaft (Chapter 63); and
   - the complete tail rotor driveshaft (Chapter 65).

5. Do a torque check of the powerplant installation (Paragraph 71.1.1.4.2).

6. Do a Hard landing inspection for the engine (refer to 72-00-00, Table 25: Special Inspections, Honeywell Light Maintenance Manual: Gas Turbine Engine HTS900-2-1D).

71.1.1.5.2. Powerplant — Sudden stoppage

1. Examine the powerplant installation for condition and security (Paragraph 71.1.1.4.1).

2. Examine the engine mounts to make sure that they are straight. If you find that the engine mount(s) are not straight, replace the engine mount(s).

3. Examine for condition the points on the fuselage where the engine mounts attach. If you find that the fuselage is not straight, you must put the fuselage in a fuselage fixture to make sure that the alignment is correct.

4. Do a torque check of the powerplant installation (Paragraph 71.1.1.4.2).

5. Do a Sudden stoppage of the rotor inspection for the engine (refer to 72-00-00, Table 25 Special Instructions, Honeywell Light Maintenance Manual: Gas Turbine Engine HTS900-2-1D).

71.1.1.5.3. Powerplant — Overspeed

1. Refer to 71-00-00, Paragraph 12, Rotational Speed Limits, Honeywell Light Maintenance Manual: Gas Turbine Engine HTS900-2-1D to find if the engine has also had an overspeed. If the engine has had an overspeed, do the procedures that are recommended by the engine manufacturer.

2. Examine the powerplant installation for condition and security (Paragraph 71.1.1.4.1).

3. Do a torque check of the powerplant installation (Paragraph 71.1.1.4.2).

71.1.1.5.4. Powerplant — Overtorque

NOTE

The torque values that are used in this manual are those that are shown on the helicopter torque indicator.

1. Refer to 71-00-00, Paragraph 12, Torque Limits, Honeywell Light Maintenance Manual: Gas Turbine Engine HTS900-2-1D to find if the engine has also had an overtorque. If the engine has had an overtorque, do the procedures that are recommended by the engine manufacturer.

2. Examine the powerplant installation for condition and security (Paragraph 71.1.1.4.1).

3. Do a torque check of the powerplant installation (Paragraph 71.1.1.4.2).

71.1.1.5.5. Powerplant — Lightning Strike

1. Examine the powerplant installation for condition and security (Paragraph 71.1.1.4.1).

2. Do a torque check of the powerplant installation (Paragraph 71.1.1.4.2).

3. Do a Lightning Strike inspection for the engine (refer to 72-00-00, Table 25: Special Instructions, Honeywell Light Maintenance Manual: Gas Turbine Engine HTS900-2-1D).

71.1.1.5.6. Powerplant — Compressor Surge

1. Examine the powerplant installation for condition and security (Paragraph 71.1.1.4.1).

2. Do a torque check of the powerplant installation (Paragraph 71.1.1.4.2).

3. Do the Compressor Surge inspection for the engine (refer to 72-00-00, Table 25: Special Instructions, Honeywell Light Maintenance Manual: Gas Turbine Engine HTS900-2-1D)

71.1.1.5.7. Powerplant — Leakage Limits

NOTE
Engines use a small amount of oil. However, a sudden increase in oil consumption shows that there are oil system problems that you must correct.

Oil leaks will cause oil to collect in the engine pan area; if the leak is very bad, oil can show up on the fuselage of the helicopter. Oil leaks are also a possible sign that you have filled the oil system more than the necessary level. Make sure that you do the correct servicing of the engine (Chapter 12). Oil leaks in the engine are not permitted. You must repair all leaks.

NOTE
If oil comes out of the diffuser vent orifice, the vent orifice is not the correct size. Adjust the size of the orifice.

1. Examine the engine to find the source of the oil leak. If the leak is from a seal, replace the seal (refer to Chapter 72-00-00 Table 39: Engine Troubleshooting, Honeywell Light Maintenance Manual: Gas Turbine Engine HTS900-2-1D).

71.1.1.5.8. Powerplant — Serviceability check

Do this test when the ENG CHIP annunciator comes on, or when required by this manual.

Refer to Power and accessory gearbox Maintenance practices, 72-60-00, Paragraph 3, Honeywell Light Maintenance Manual: Gas Turbine Engine HTS900-2-1D for the maintenance action that is necessary when you find an engine chip.

71.1.1.5.9. Powerplant — Unwanted Particles

NOTE
When you find metal particles, or if you are not sure of the serviceability of the engine, do a serviceability check (Paragraph 71.1.1.5.8).

The engine has a chip detector installed in the lubrication system. The chip detectors will give a visual alarm on the caution/warning and advisory panel (ENG CHIP light) when some ferrous particles are caught in it. Figure 71-2 shows the location of the engine chip detector.

If you find paste or a small quantity of metal particles in the engine gearbox, this can be from usual wear. When the particles are large enough to be identified as part of a component, replace the engine. Refer to Accessory/ Reduction Gearbox Section, 72-60-00, Paragraph 3, Honeywell Light Maintenance Manual: Gas Turbine Engine HTS900-2-1D for the identification of unwanted particles and for the procedure recommended by the engine manufacturer.

71.1.2 POWERPLANT ENGINE

71.1.2.1 POWERPLANT — ENGINE REMOVAL

The procedures that follow are for the general maintenance of the powerplant and the related systems. For the detailed maintenance instructions, refer to the Honeywell Light Maintenance Manual: Gas Turbine Engine HTS900-2-1D

TOOLS REQUIRED

NUMBER	NOMENCLATURE
3700611-1	Engine Sling (Honeywell)
3700659-1	Engine Maintenance Stand (Honeywell)

NOTE

Disconnect and remove the powerplant from the airframe as a quick change assembly. Do the general procedures that follow.

NOTE

Disconnect all of the fittings, the unions, the reducers, the restrictors, and the related attaching hardware from the powerplant that is removed and make a note of where they are from. If you install a new engine, connect these components immediately to the new engine. This will speed up the engine change and prevent the mix-up of parts. If the new engine is not available, identify all the parts to help in the assembly of the new engine.

NOTE

Seal all of the openings and the ports on the removed engine with a cap, a plug or a cover to prevent contamination. Refer to the Honeywell Light Maintenance Manual: Gas Turbine Engine HTS900-2-1D for preservation and engine storage data.

1. Disconnect the battery. Remove any external electric power (Chapter 96).
2. Remove the upper cowling of the powerplant (E4734-1) (Chapter 53).
3. Drain the engine oil (Chapter 12).
4. Disconnect the electrical connectors as follows:
   a. Disconnect the engine bay connector (4962-P7, 4962-P8 and 4962-P9).
   b. Disconnect the starter-generator connector (2P1 and 1P1).
   c. Disconnect the starter-generator ground wire (K5A2N).
   d. Disconnect the engine jumper wire (4962-J1).

NOTE

Put a tag on all the tubes and the hoses before you disconnect them. This will help when you install them.

5. Disconnect and remove the lines, tubes and hoses that follow:
   - the combustion chamber drain lines,
   - the fuel pump seal drain tube assembly,
   - the starter-generator pad drain tube assembly,
   - the fire shield drain tube assembly,
   - the exhaust collector lines,
   - the engine oil pressure lines,
   - the engine torque pressure hose assembly
   - the fuel line from the airframe filter to the engine
   - the oil vent hose assembly,
   - the engine oil outlet hose assembly, and
   - the engine oil inlet hose assembly.

6. Remove airframe fuel filter and fuel filter bracket from engine

7. Remove three FADEC canon plugs

8. Remove the engine intake duct and engine inlet screen per paragraph 71.5.1.1.1.

9. Remove bell mouth assembly per paragraph 71.2.1.1

10. Disconnect engine exhaust assembly

11. Disconnect the starter-generator canon plug and starter-generator ground line.

12. Disconnect customer bleed air line from customer bleed air port.

13. If the rotor brake is installed, disconnect it (Chapter 63).

14. Disconnect the tail rotor driveshaft (Chapter 65).

15. Remove the engine-to-transmission driveshaft (Chapter 63).

16. Disconnect the engine gearbox vent line.

17. Install the Engine Sling 3700611-1 on the forward and aft lifting points (Figure 71-2).

18. Attach a hoist to the Engine Sling. Lift the engine as necessary to remove the tension on the four mounts.

19. Remove the engine mounts (Paragraph 71.3.1).

20. Make sure that all of the engine-to-airframe connections and attachments are disconnected.

21. Carefully lift the powerplant from the airframe. Remove the two trunnion mounts (Figure 71-4).

22. Install the powerplant on the Engine Maintenance Stand 3700659-1.

23. When you disassemble or assemble the engine, refer to 72-10-00, Paragraph 1 and 3; Honeywell Light Maintenance Manual: Gas Turbine Engine HTS900-2-1D and BHT-407-CR&O.

71.1.2.2 POWERPLANT — ENGINE DISASSEMBLY

1. Remove the starter-generator (Paragraph 71.4.1.1).

2. Remove the engine bleed air discharge tube.

3. Remove the exhaust duct assembly (Paragraph 71.6.1.1.1).

4. Cut the lockwire. Remove the bolts, the washers, and the trunnion mounts.

NOTE

Put a tag on all the tubes and the hoses before you disconnect them. This will help you to connect them.

5. Disconnect and remove the tubes and the hoses that follow:
   - engine oil inlet tube assembly (Figure 71-2)
   - combustion chamber drain lines

71.1.2.3 POWERPLANT — ENGINE INSPECTION AND REPAIR

1. For the detailed engine inspection procedures, refer to the Honeywell Light Maintenance Manual: Gas Turbine Engine HTS900-2-1D

71.1.2.4 POWERPLANT — ENGINE ASSEMBLY

NOTE

When you assemble the power plant, make sure that you install only serviceable parts and attaching hardware. Remove any caps, plugs, or covers as you install the components.

1. Install the starter generator duct (18) (paragraph 71.4.1.3).
2. Install the exhaust duct assembly (17) (paragraph 71.6.1.1.3).
3. Install the engine bleed air discharge tube.
4. Install the tubes and the hoses that follow:
   - engine oil inlet tube assembly (2)
   - combustion chamber drain line

71.1.2.5 POWERPLANT — ENGINE INSTALLATION

SPECIAL TOOLS REQUIRED

NUMBER	NOMENCLATURE
3700611-1	Engine Sling (Honeywell)

MATERIALS REQUIRED

Refer to BHT-ALL-SPM for specifications.

NUMBER	NOMENCLATURE
C-405	Lockwire

1. Make sure that the engine deck is clean. Make sure that all the cables, hoses, and lines are clear of the installation area. This gives sufficient clearance.
2. Install the lift assembly (6889888) on the forward and aft lifting points (Figure 71-2).
3. Use a hoist that has the capacity to lift the engine assembly and attach it to the lift tool. Remove the engine from the turnover stand or from the engine stand.
4. Use the bolts and the washers and install the trunnion mounts. Tighten the bolts. Use lockwire (C-405) and safety the bolts.
5. Lift the engine over the engine deck.
6. Lower the engine sufficiently and install it on the engine mounts (paragraph 71.3.1.3).
7. Install the engine-to-transmission driveshaft (Chapter 63).
8. Install the tail rotor driveshaft connection (Chapter 65).
9. Connect the starter-generator cannon plug and starter-generator ground line.
10. Connect customer bleed air line from customer bleed air port.

11. If the rotor brake was removed, connect it. (Chapter 63).

12. Connect engine exhaust assembly

13. Install bellmouth assembly per paragraph 71.2.1.3.

14. Install the engine intake duct and engine inlet screen per paragraph 71.5.1.1.3.

15. Install three FADEC canon plugs.

16. Install airframe fuel filter in engine.

17. Install the tubes and the hoses that follow:
    - the combustion chamber drain lines,
    - Fuel pump seal drain tube assembly
    - Starter generator pad drain tube assembly
    - Fire shield drain tube assembly
    - Exhaust collector hose assembly
    - the exhaust collector lines,
    - the engine oil pressure lines,
    - Engine torque pressure hose assembly
    - the fuel line from the airframe filter to the engine
    - Oil vent hose assembly
    - Engine oil outlet hose assembly
    - Engine oil inlet hose assembly

18. Connect the electrical connectors as follows:
    a. Connect the engine bay connector (4962-P7, 4962-P8 and 4962-P9)).
    b. Connect the starter generator connector (2P1 and 1P1).
    c. Connect the starter generator ground wire (K5A2N).
    d. Connect the engine jumper wire (4962-J1).

19. Use the correct oil and fill the engine oil system to the correct level (Chapter 12).

20. Install the transmission, the aft fairings, and the upper, inlet, and lower cowlings of the power plant (Chapter 53).

21. Connect the battery (Chapter 12).

22. Do the power plant operational test (paragraph 71.1.1.1).

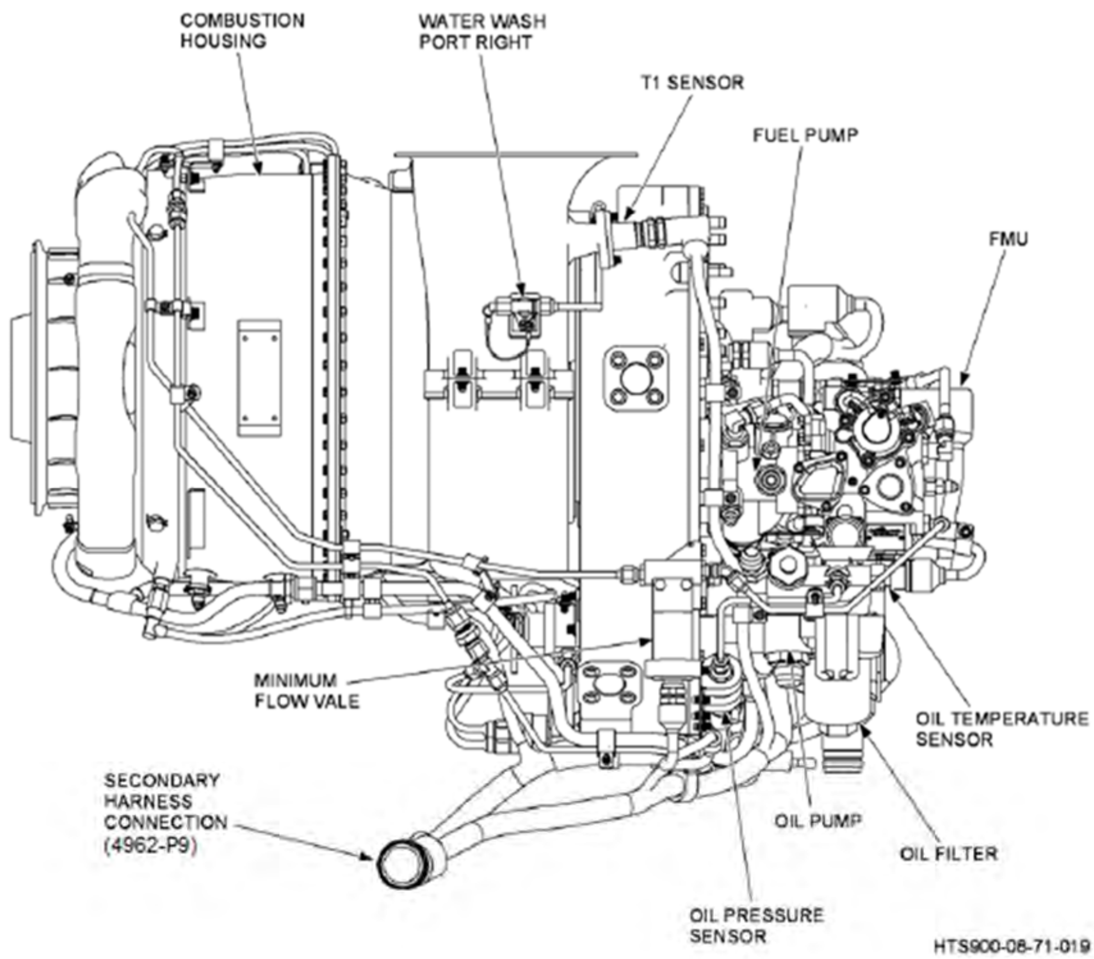


Figure 71-2. Engine View (Sheet 1 of 5)

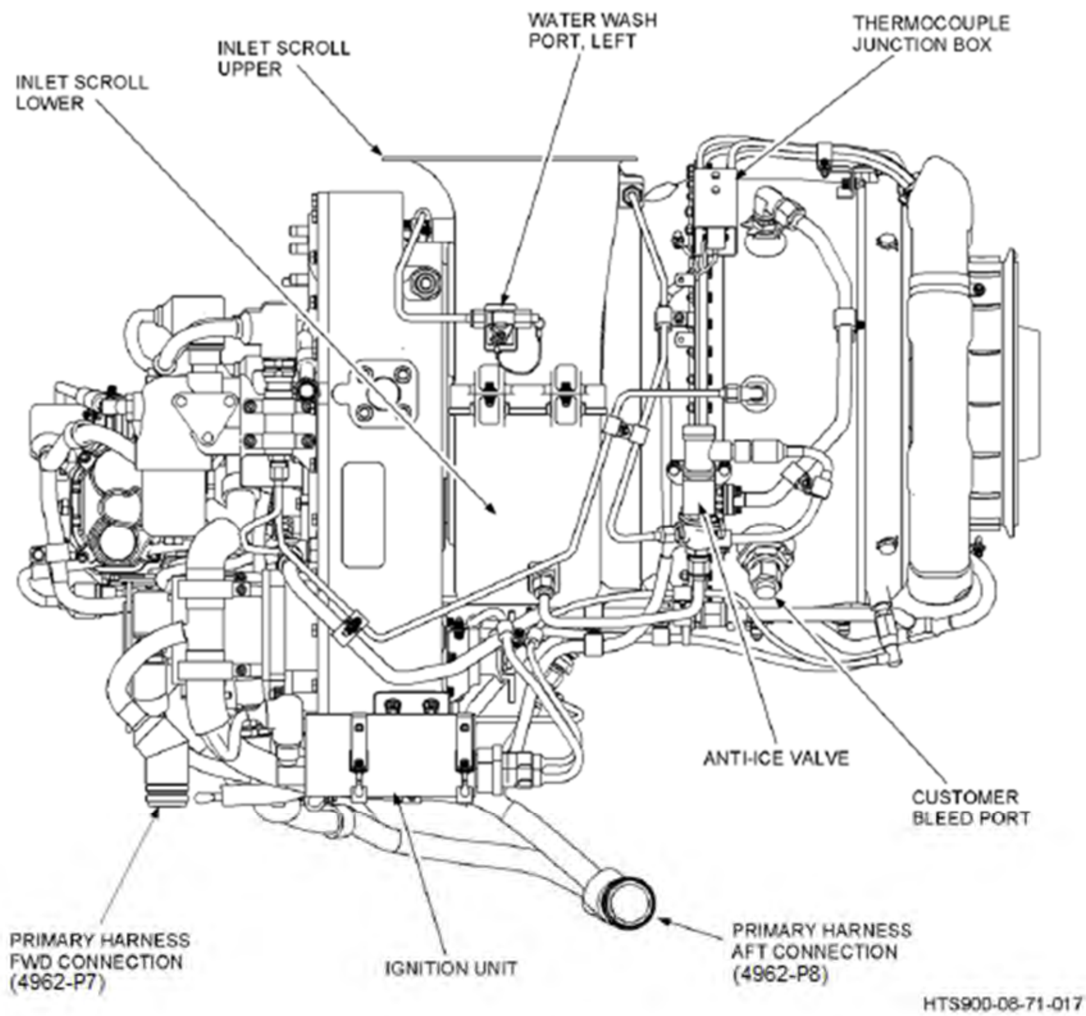


Figure 71-2. Engine View (Sheet 2 of 5)

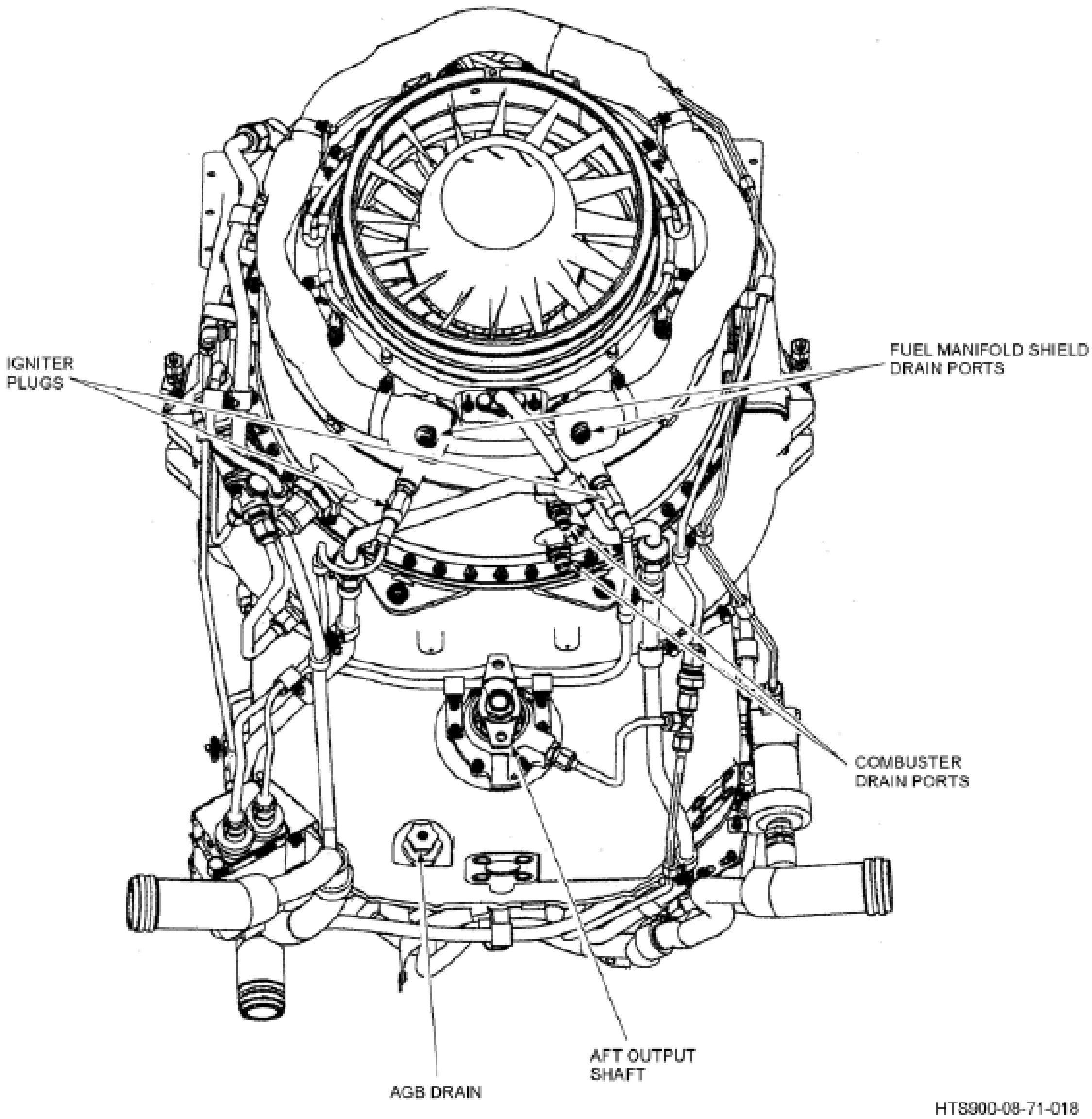


Figure 71-2. Engine View (Sheet 3 of 5)

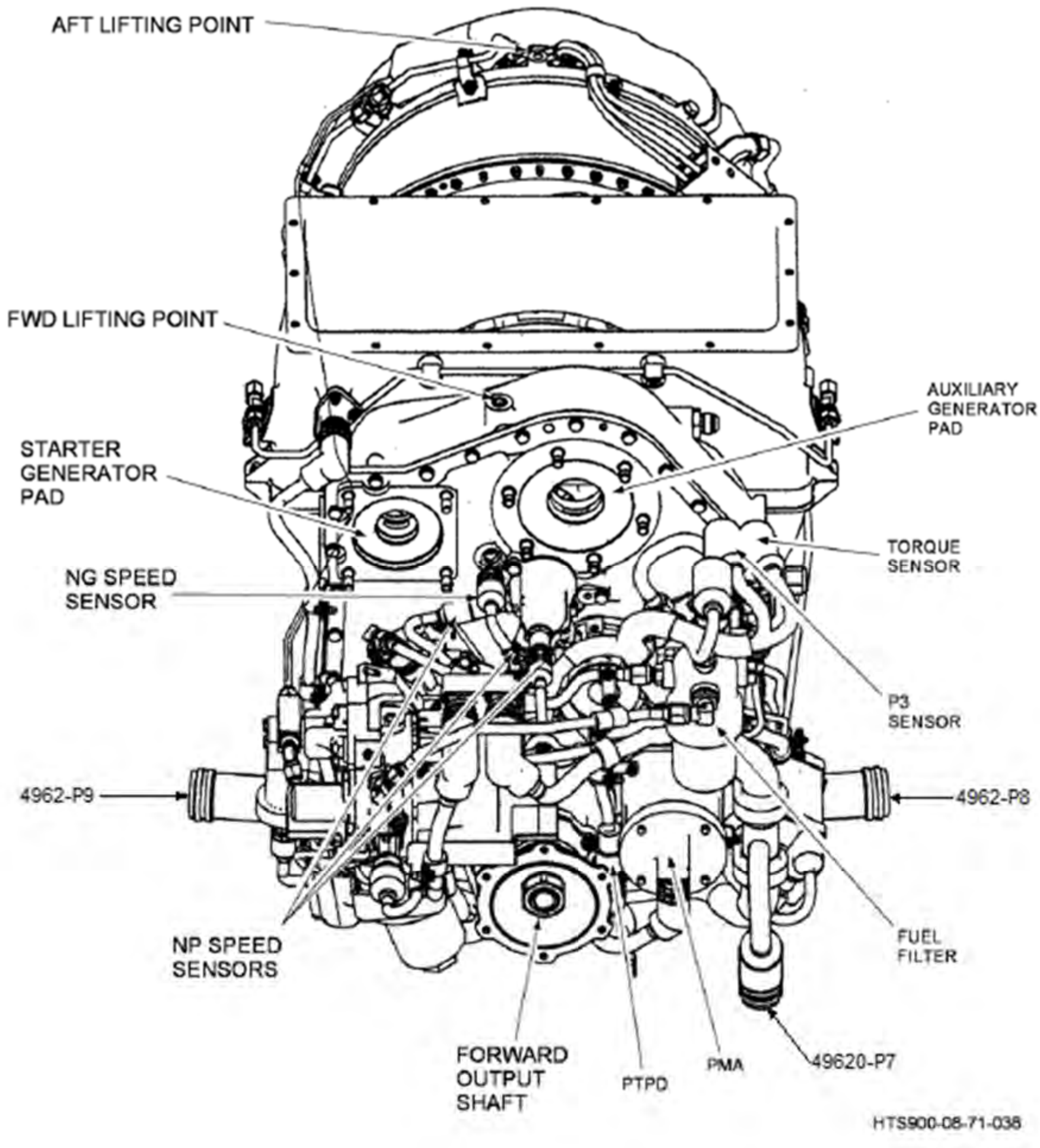


Figure 71-2. Engine View (Sheet 4 of 5)

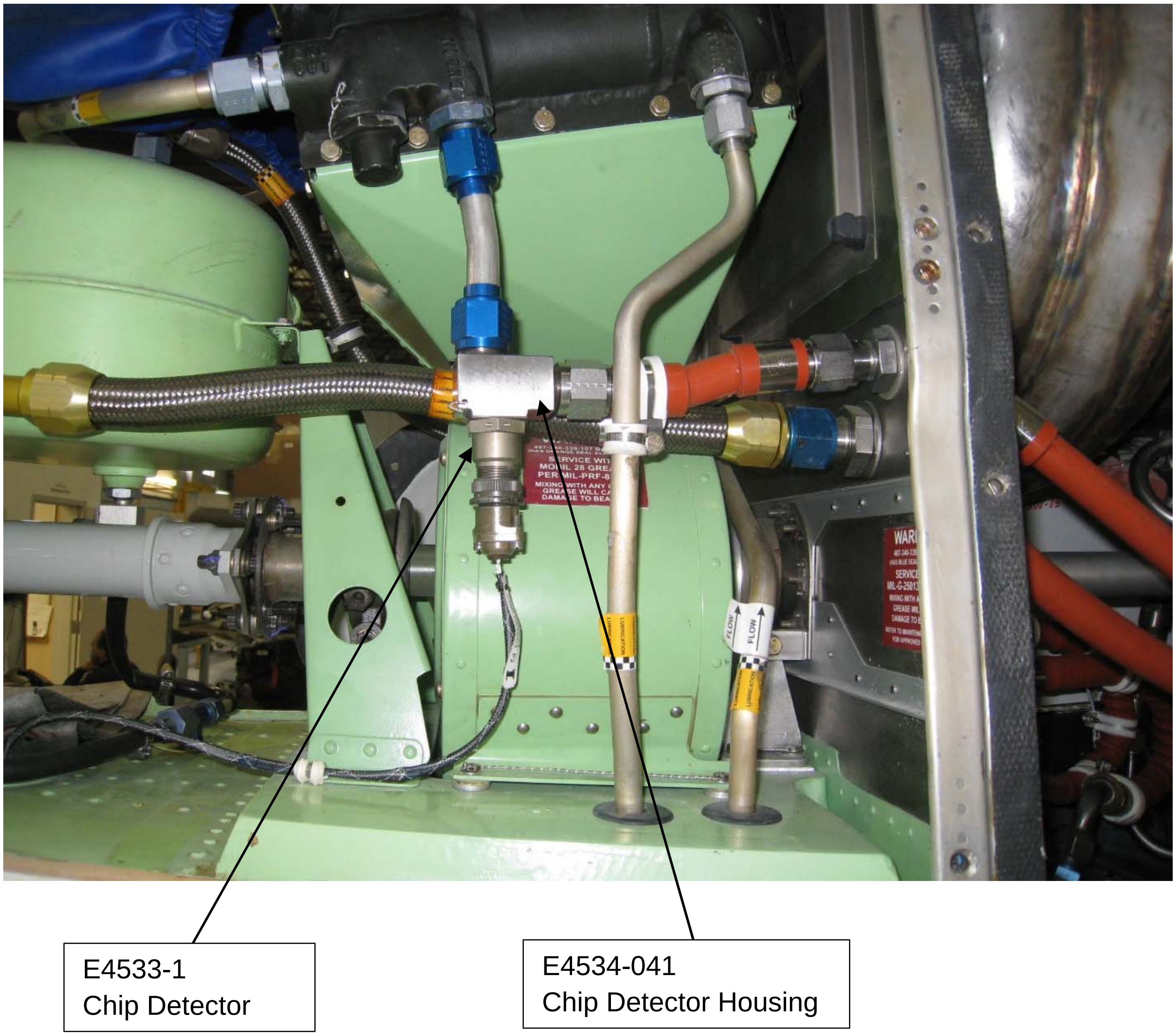


Figure 71-2. Engine View (Sheet 5 of 5)

71.2 ENGINE BELLMOUTH ASSEMBLY

71.2.1 ENGINE BELLMOUTH ASSEMBLY

The engine bellmouth assembly (Figure 71-3) sends inlet air to the engine. It is made of aluminum alloy. The engine bellmouth assembly is attached to the underside of the 206-064-819-161 intake cowl.

71.2.1.1 ENGINE BELLMOUTH ASSEMBLY — REMOVAL

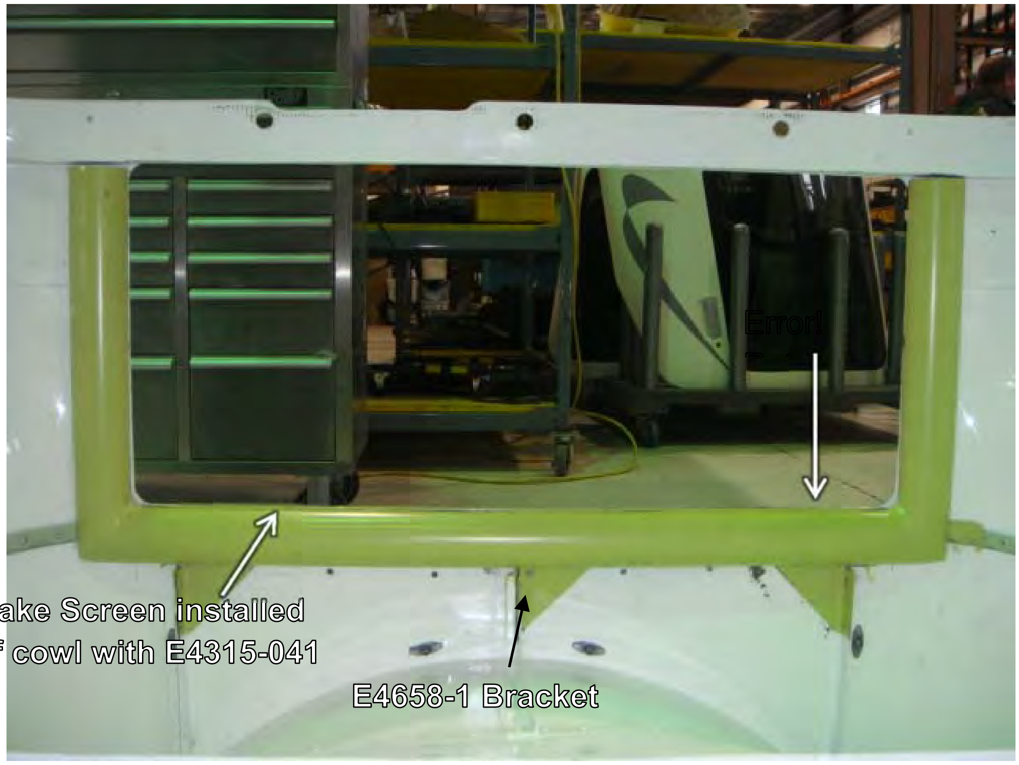
1. Remove the upper engine cowling (E4734-1) (Chapter 53).
2. Remove Intake duct (E4315-041) and Inlet screen (E4528-041), Bellmouth assembly (E4590-041) and Shim (E4658-3)
3. Remove the engine inlet cowling (Chapter 53).

71.2.1.2 ENGINE BELLMOUTH ASSEMBLY — INSPECTION AND REPAIR

1. Examine the engine bellmouth assembly for cracks or dents.
2. Examine the nutplates for damage. Make sure that the nutplates are installed correctly.

71.2.1.3 ENGINE BELLMOUTH ASSEMBLY — INSTALLATION

1. Use the screws and the washers to attach the engine inlet flange to the engine bellmouth assembly.
2. Install the engine inlet cowling (Chapter 53).
3. Connect the Engine Intake Duct (E4315-041), Inlet screen (E4528-041), Bellmouth assembly (E4590-041) and Shim (E4658-3) onto the Intake cowl.
4. Install the upper engine cowling (E4734-1) (Chapter 53).



VIEW LOOKING UP ON INLET COWL

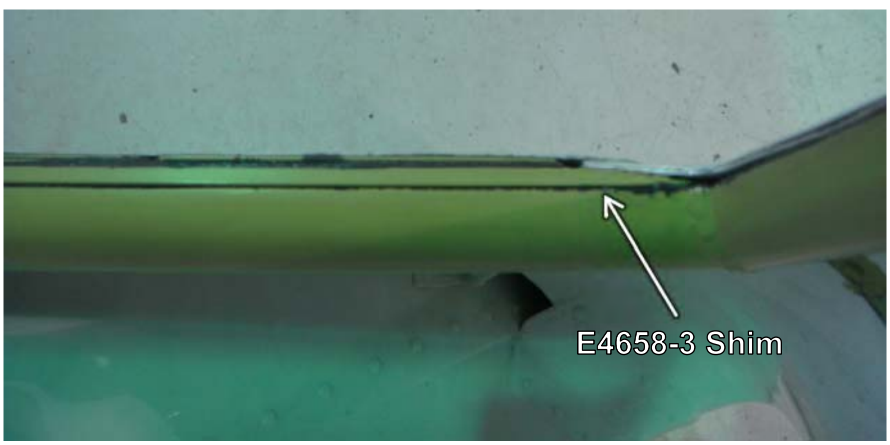


Figure 71-3. Bell mouth Installation

71.3 ENGINE MOUNTS

71.3.1 ENGINE MOUNTS

The engine is installed in the engine pan with two bipod type mounts and two monopod type mounts (Figure 71-4). The mounts are found on the left, right and aft side of the engine. The engine mount legs are made of steel tubes and riveted to clevises and fittings. Shims between the fittings and airframe are installed at the factory. The shims make sure that the engine is aligned when you install it.

71.3.1.1 ENGINE MOUNTS — REMOVAL

TOOLS REQUIRED

NUMBER	NOMENCLATURE
3700611-1	Engine Sling (Honeywell)

MATERIALS REQUIRED
Refer to BHT-ALL-SPM for specifications.

NUMBER	NOMENCLATURE
C-317	Adhesive

1. Install the Engine Sling 3700611-1 on the pad for the engine lifting tool (Figure 71-2).

2. Attach a hoist to the lift assembly. Lift the engine as necessary to remove the tension on the four mounts.

3. Remove all of the clamps that attach the electrical cables, the tubes, and the hoses to the engine mount legs.

NOTE
The removal procedure is the same for the left and the right engine mounts.

4. Remove the left and the right engine mounts as follows:
   a. Remove the bolts, washer and nuts from the aft fittings and remove the monopods and bipods. Adjust the hoist as necessary to remove any tension on the mount legs.

CAUTION
IF ANY SHIMS MUST BE REMOVED, MAKE A MARK OF THEIR POSITION. THIS WILL HELP YOU ALIGN THE ENGINE PROPERLY WHEN YOU INSTALL IT.

NOTE
Do not remove shims that are bonded in place.

   b. Remove the bolts, washers and nuts from the forward fittings and clevises and remove the bipods.
   c. Bond loose shims in place with adhesive (C-317, BHT-ALL-SPM).

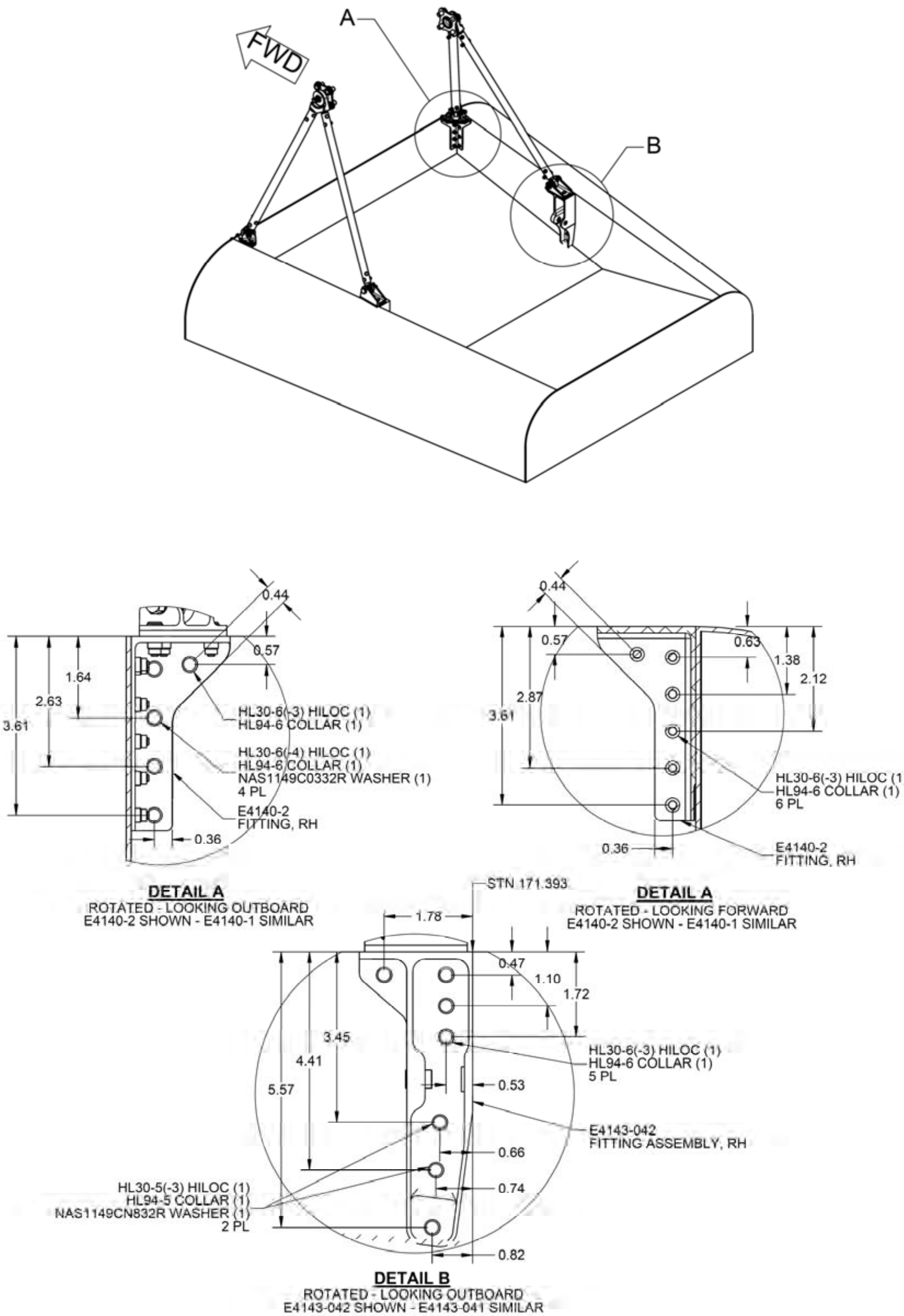


Figure 71-4. Bipod mounts (Sheet 1 of 3)

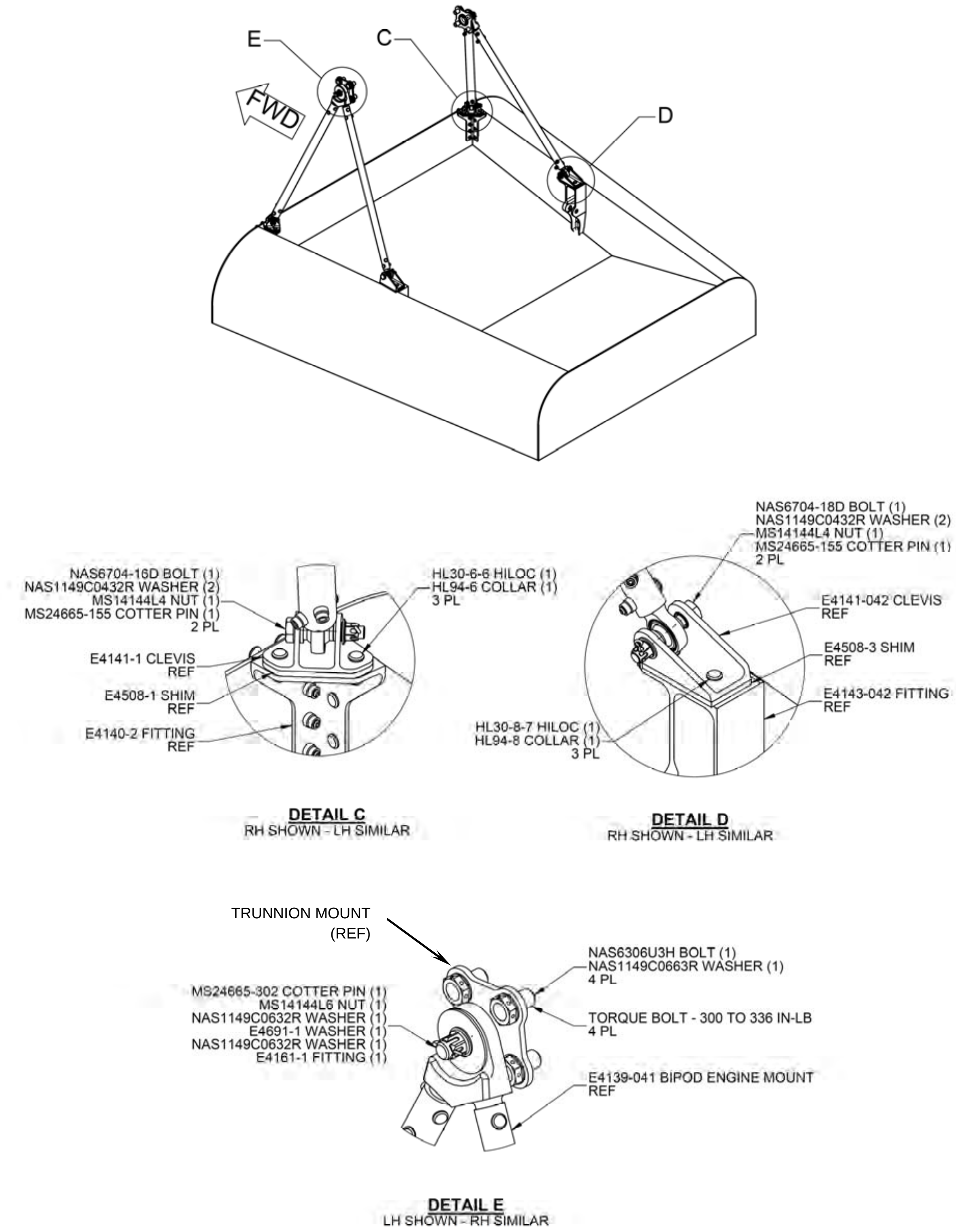


Figure 71-4. Bipod mounts (Sheet 2 of 3)

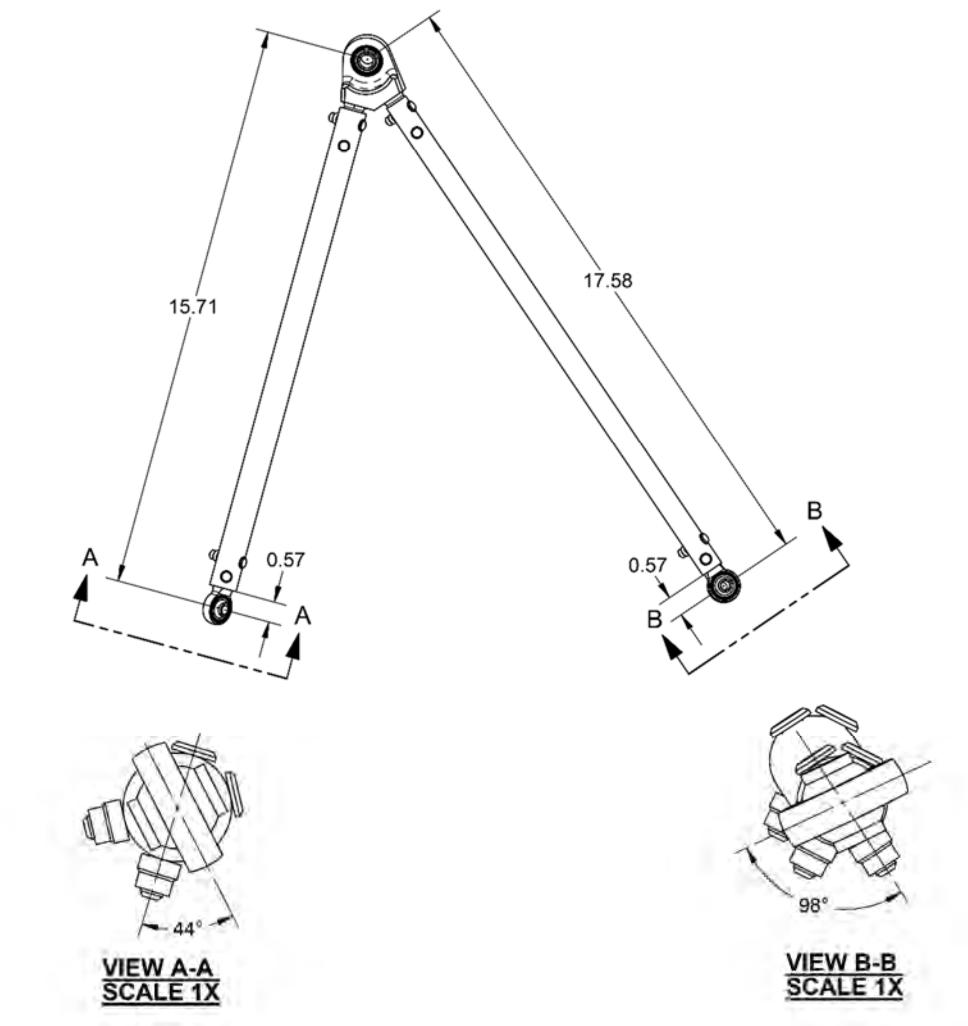
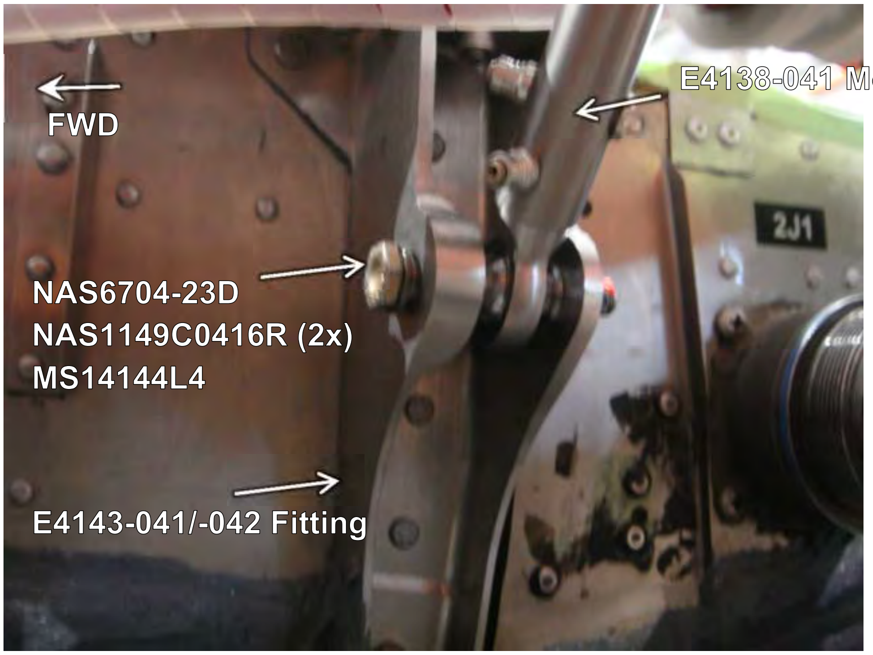
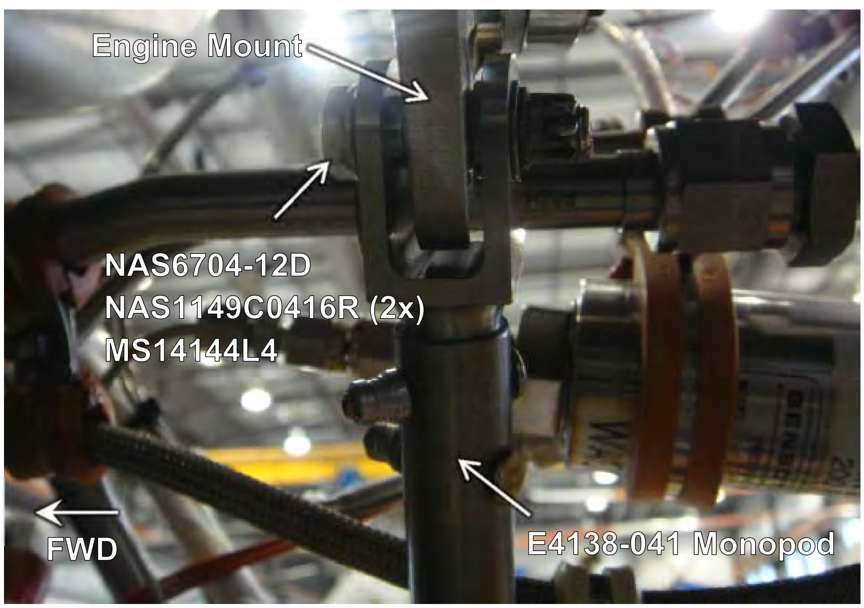


Figure 71-4. Bipod mounts (Sheet 3 of 3)
(LH shown, RH similar)



RH Shown – LH Similar



RH shown – LH Similar

Figure 71-5. Monopod Installation (Sheet 1 of 2)

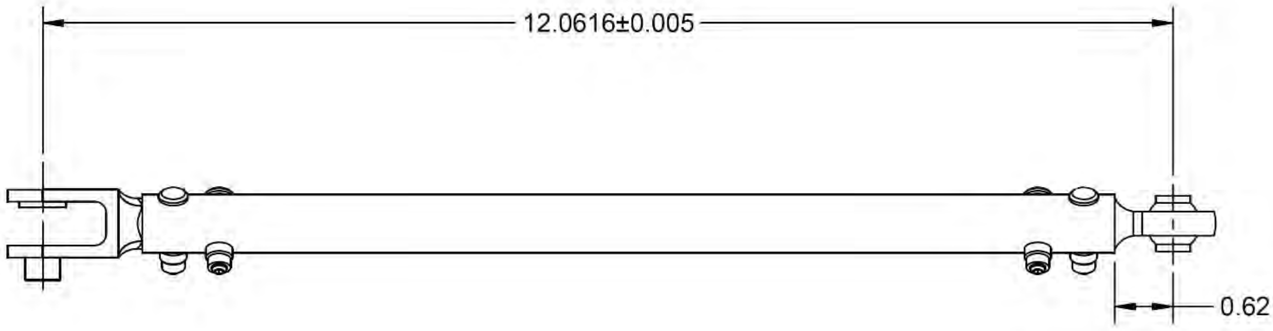


Figure 71-5. Monopod Installation (Sheet 2 of 2)

71.3.1.2 ENGINE MOUNTS — INSPECTION AND REPAIR

MATERIALS REQUIRED
Refer to BHT-ALL-SPM for specifications

NUMBER	NOMENCLATURE
C-309	MEK
C-317	Adhesive
C-339	Alcohol
C-423	Abrasive Cloth or Paper

NOTE

Examine the support fittings for scratches, dents, and corrosion. Polish out damages on each side of the flange to a maximum depth of 0.005 inch (0.127 mm) and to a maximum area that is less than 20% of the flange area.

1. Examine the leg supports as follows:
   a. If you find any sharp or smooth dents more than 0.006 inch (0.152 mm) in depth, replace the leg support.
   b. Examine the leg support for scratches and corrosion. Polish out the damages to a maximum depth of 0.003 inch (0.076 mm) and to a maximum area that is less than 10% of the leg support.
   c. Examine the fittings for scratches, dents, and corrosion. Polish out the damage to a maximum depth of 0.002 inch (0.051 mm) and to a maximum area that is less than 25% of the area.
   d. Examine the mount bolts and the nuts for thread damage.

2. Examine the rod end bearings of the legs (Figure 71-4). If the axial play is greater than 0.005 inch (0.127 mm) or if the radial play is greater than 0.0005 inch (0.0127 mm), replace the rod end bearings as follows (Figure 71-4):
   a. Remove the pins and collars.
   b. Lightly tap the rod end bearing and twist it out.
   c. Clean the area inside the end of the support leg of the aft bipod assembly (15).
   d. Put the new rod end bearing into the support leg. Drill the holes to match. For the correct dimensions, refer to Figure 71-4 and Figure 71-5.
   e. After the holes are drilled, remove the rod end bearing from the support leg of the bipod assembly (15). Deburr the holes.
   f. Use abrasive cloth or paper (C-423, BHT-ALLSPM) and make the rod end and the inside of the support leg rough. Use MEK (C-309, BHT-ALL-SPM) and clean the areas.

CAUTION

DO NOT LET THE ADHESIVE ENTER THE ROD END BEARING. IF ADHESIVE ENTERS THE ROD END BEARING, IT WILL DECREASE THE OPERATION OF THE BEARING.

   g. Apply adhesive (C-317, BHT-ALL-SPM) to the surface of the rod end and to the inside of the support leg.
   h. While the adhesive is still wet, use the pins and the collars and attach the rod end bearing to the support leg of the engine mount assemblies.

71.3.1.3 ENGINE MOUNTS — INSTALLATION

SPECIAL TOOLS REQUIRED

NUMBER	NOMENCLATURE
3700611-1	Engine Sling (Honeywell)

MATERIALS REQUIRED
Refer to BHT-ALL-SPM for specifications.

NUMBER	NOMENCLATURE
C-308	Sealant
C-317	Adhesive
C-405	Lockwire
C-447	Lockwire

NOTE

The installation procedure is the same for the left and the right engine mounts.

1. Install the left and the right engine mounts as follows:
   a. Install the bipods with the bolts, washer and nuts to the fittings and clevises.

CAUTION

IF THE FITTINGS AND CLEVISES OF THE MOUNT LEGS WERE REMOVED, MAKE SURE THE CORRECT SHIMS ARE INSTALLED UNDER THEM.

   b. Install the monopods with the bolts, washer and nuts to the aft fittings.
   c. Install engine onto bipod and monopod mounts and perform engine shimming

2. Disconnect the hoist. Remove the Engine Sling 3700611-1.

71.4 STARTER-GENERATOR

71.4.1 STARTER-GENERATOR

The starter-generator (Figure 71-6) is installed on the top of the powerplant gearbox and to the right of the helicopter centerline. The starter-generator supplies DC power and the start functions for the engine. Refer to Chapter 96 for the power distribution of the starter-generator.

71.4.1.1 STARTER-GENERATOR — REMOVAL

1. Remove the starter-generator duct as follows:
   a. Remove upper cowl (Chapter 53).
   b. Remove the two screws and the washers. Disconnect the duct assembly from the support assembly.
   c. Loosen the band clamp. Remove the duct assembly and the spacer along with the clamp from the starter-generator.
2. Remove the starter-generator as follows:
   a. Disconnect the electrical wires. Protect the ends of the wires with electrical tape.

CAUTION

DO NOT LET THE DRIVE SPLINE OF THE STARTER-GENERATOR SUPPORT THE WEIGHT OF THE UNIT. SUPPORT THE STARTER-GENERATOR WHENEVER THE CLAMP IS LOOSENED OR UNTIL THE CLAMP IS INSTALLED CORRECTLY AND TORQUED. IF YOU DO NOT SUPPORT THE STARTER-GENERATOR CORRECTLY, YOU CAN CAUSE DAMAGE TO THE SHEAR SECTION OF THE DRIVE SPLINE.

   b. Remove 206-062-200-113 starter-generator.
   c. Remove the band clamp on the adapter.
   d. Remove the washers and the nuts in the studs.
   e. Remove the 206-062-200-115 adapter on the accessory mounting pad lining up to the four install studs.

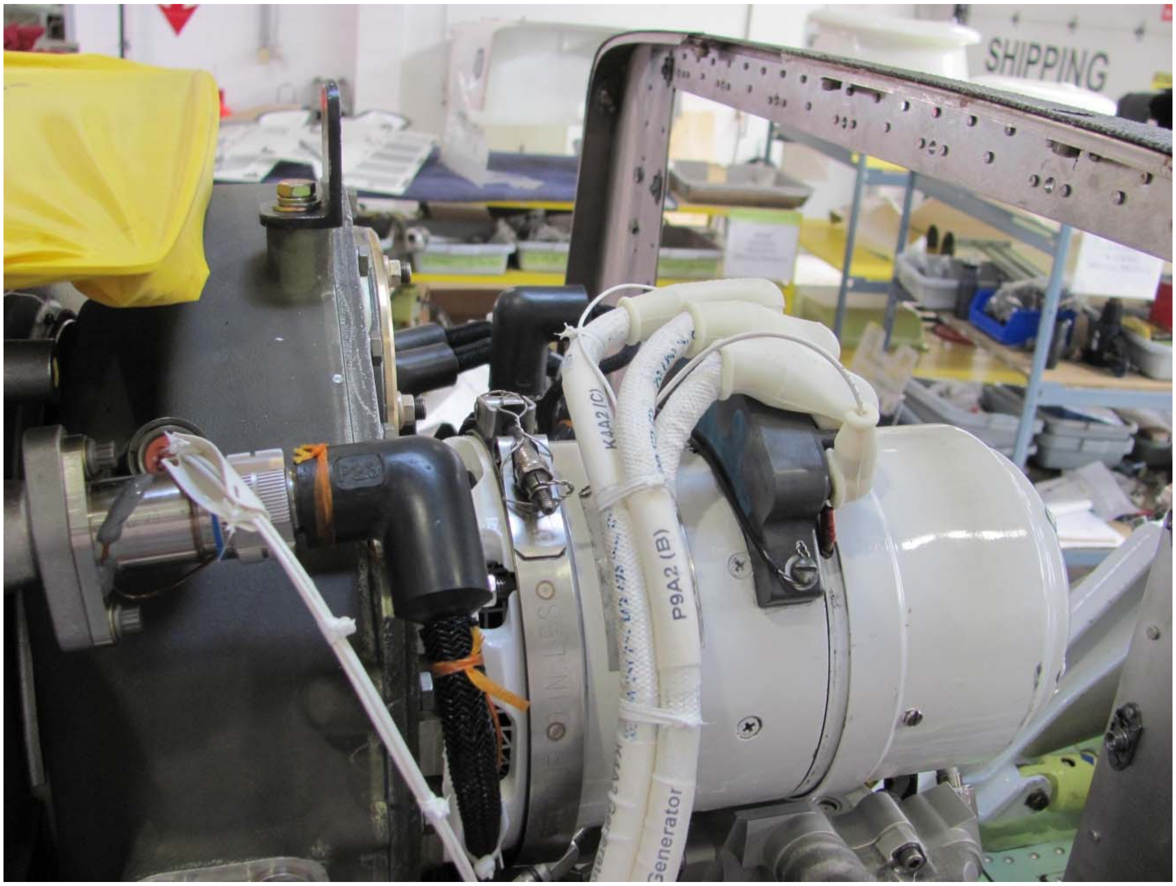


Figure 71-6. Starter-generator Installation

71.4.1.2 STARTER-GENERATOR — INSPECTION

1. Examine the duct assembly for cracks and too much wear.

2. Examine the spacer for deterioration of the rubber.

3. Inspect the accessory mounting pad for any visible cracks and damage.

4. Inspect the packing for deterioration and wear.

CAUTION

AS YOU LOOK AT THE STARTER-GENERATOR FROM THE SHAFT END, TURN THE SHAFT ONLY COUNTERCLOCKWISE.

5. Make sure that the starter-generator turns freely.

6. Examine the shaft spline for too much wear.

7. Do an electrical inspection of the starter-generator (Chapter 96).

71.4.1.3 STARTER GENERATOR — INSTALLATION

1. Install the accessory mounting pad with the washers and the nuts. Tighten the nuts.

CAUTION

DO NOT LET THE DRIVE SPLINE OF THE STARTER GENERATOR SUPPORT THE WEIGHT OF THE UNIT. SUPPORT THE STARTER GENERATOR WHENEVER THE CLAMP IS LOOSENED OR UNTIL THE CLAMP IS INSTALLED CORRECTLY AND TORQUED. IF YOU DO NOT SUPPORT THE STARTER GENERATOR CORRECTLY, YOU CAN CAUSE DAMAGE TO THE SHEAR SECTION OF THE DRIVE SPLINE.

2. Apply a film of lubricating oil (C-011) to the splines on the shaft and packing. Install the 206-062-200-115 adapter onto the accessory mounting pad lining up to the four install studs.

3. Install four washers and nuts to the studs.

4. Install the band clamp on the adapter.

5. Install 206-062-200-113 starter generator. Electrical terminals should be facing upward.

NOTE

Starter Generator 206-062-200-123 or 206-062-200-141 and adapter 206-062-200-121 as a unit are alternates for starter generator 206-062-200-113 and adapter 206-200-115 as a unit.

6. Install electrical connections.

7. Do an operational test of the starter generator (Chapter 96).

71.5 AIR INTAKES

71.5.1 AIR INTAKES

The air intakes include the engine air inlet cowling (Chapter 53) and the engine inlet screen assembly.

Install the engine inlet screen before you start the engine. This will prevent possible engine damage from any unwanted material that is sucked in when the engine is in operation.

71.5.1.1 ENGINE INLET SCREEN ASSEMBLY

The engine inlet screen assembly (Figure 71-3) is installed between the engine inlet duct assembly and the engine intake. The engine inlet screen assembly lets air go through, but it stops unwanted objects that could get into the engine.

The engine compressor can be washed or rinsed through a compressor wash provision installed on the engine assembly (refer to Figure 71-2).

71.5.1.1.1. Engine inlet screen assembly — Removal

1. Remove the upper engine cowling (Chapter 53).
2. Remove nine bolts and the washers. Disconnect the Air Inlet Duct and Screen from the Intake cowl.

71.5.1.1.2. Engine inlet screen assembly — Inspection and repair

1. Examine the engine inlet screens for broken wires or corrosion.
2. Examine the engine inlet screen assembly for any loose, corroded, or lost rivets.
3. Examine all the seals for deterioration or damage.

71.5.1.1.3. Engine inlet screen assembly —Installation

1. Put the engine inlet screen assembly in position on the inlet cowl.
2. Use the bolts and the washers. Install the engine inlet screen assembly on the engine inlet cowl.
3. Install the air inlet cowling.
4. Install the upper engine cowling (Chapter 53).

71.5.1.2 SNOW DEFLECTORS

The snow deflectors (3 and 4, Figure 71-7) are part of the snow deflector kit. The snow deflector kit has two deflectors that are installed to the engine air inlet cowl assemblies, just forward of the engine air inlets. The deflectors are attached with screws (1 and 7) into the dome-type nutplates that are part of the cowling (6).

71.5.1.2.1. Snow deflectors — Removal

MATERIALS REQUIRED
Refer to BHT-ALL-SPM for specifications.

NUMBER	NOMENCLATURE
C-405	Lockwire

NOTE

The following procedure is for the deflector assembly on the left side. The procedure is the same for the deflector assembly on the right side.

1. Cut and remove the lockwire from the screws (7, Figure 71-7) on the lower tab of the deflector assembly (3).

2. Remove the screws (7) and the washers (2) from the lower tab of the deflector assembly (3).

3. Remove the screws (11) and the washers (2) from the upper tab of the deflector assembly (3).

4. Remove the screws (1), washers deflector assembly (3) from the air assembly (6), (2), and inlet cowl

5. Put the screws and the washers removed in step 2 and step 4 in a bag and attach the bag to the deflector assembly (3 or 4) for future installation.

6. If the deflector assemblies (3 and 4) are to remain removed, do as follows:
   a. Install the screws (7) and the washers (13) on the air inlet cowl assembly (6) as shown in View D. Safety the screws (7) with lockwire (C-405).
   b. Install the screws (12) on the top of the air inlet cowl assembly (6). Tighten the screws.

71.5.1.2.2. Snow deflectors — Inspection and repair

CAUTION

INSTALL ENGINE INLET COVER (CHAPTER 10) IN DEFLECTORS WHEN YOU PARK OR MOOR THE HELICOPTER.

1. Examine the right-hand and left-hand deflectors for condition and security as follows:
   a. Make sure that the screws (1 and 7) are tight and the screws (7) are safetied.
   b. Examine the seals (9 and 10) for general condition. Make sure that the seals are installed correctly and are not broken.
   c. Examine the deflector for general condition:
      - the paint is in good condition;
      - the fiberglass is not chipped; and
      - there are no blisters or missing parts in the fiberglass.
   d. Examine the mounting flanges for condition and security:

- the material is not cracked and not blistered; and
- no part of the flange is missing.

2. Examine carefully to make sure that there are no objects that can cause FOD.

71.5.1.2.3. Snow deflectors — Installation

MATERIALS REQUIRED
Refer to BHT-ALL-SPM for specifications.

NUMBER	NOMENCLATURE
C-405	Lockwire

NOTE

The following installation procedures apply only to helicopters equipped with the optional Snow Deflector Kit (BHT-407-II-4). If the optional snow deflector kit is being installed for the first time, this must be done in accordance with the instructions provided in the BHT-407-II-4. Any subsequent installation may use the following procedure.

NOTE

The following procedure is for the deflector assembly on the left side. The procedure is the same for the deflector assembly on the right side.

1. If the screws (7 and 12, Figure 71-7) are installed, do as follows:
   a. Cut and remove the lockwire from the screws (7).
   b. Remove the screws (7 and 12) from the air inlet cowl assembly (6).

2. Put the defector assembly (3 or 4) in position on the air inlet cowl assembly (6) and align the holes in the deflector assembly with the holes on the air inlet cowl assembly.

3. Install the screws (11) and the washers (2) to attach the upper tab of the deflector assembly (3) on the air inlet cowl assembly (6).

4. Install the screws (1) and the washers (2) to attach the forward tab of the deflector assembly (3) on the air inlet cowl assembly (6).

NOTE

Make sure that the lower edge of the deflector is clear of the access door. If the access door is blocked by the lower edge of the deflector, make a mark on the lower edge of the deflector to show where the access door catches the deflector. Remove the deflector. Cut the deflector as necessary so that it is clear of the access door.

5. Install the screws (7) and the washers (2) to attach the lower tab of the deflector assembly (3) on the air inlet cowl assembly (6).

6. Tighten the screws (1, 7, and 11).

7. Safety the screws (7) with lockwire (C-405).

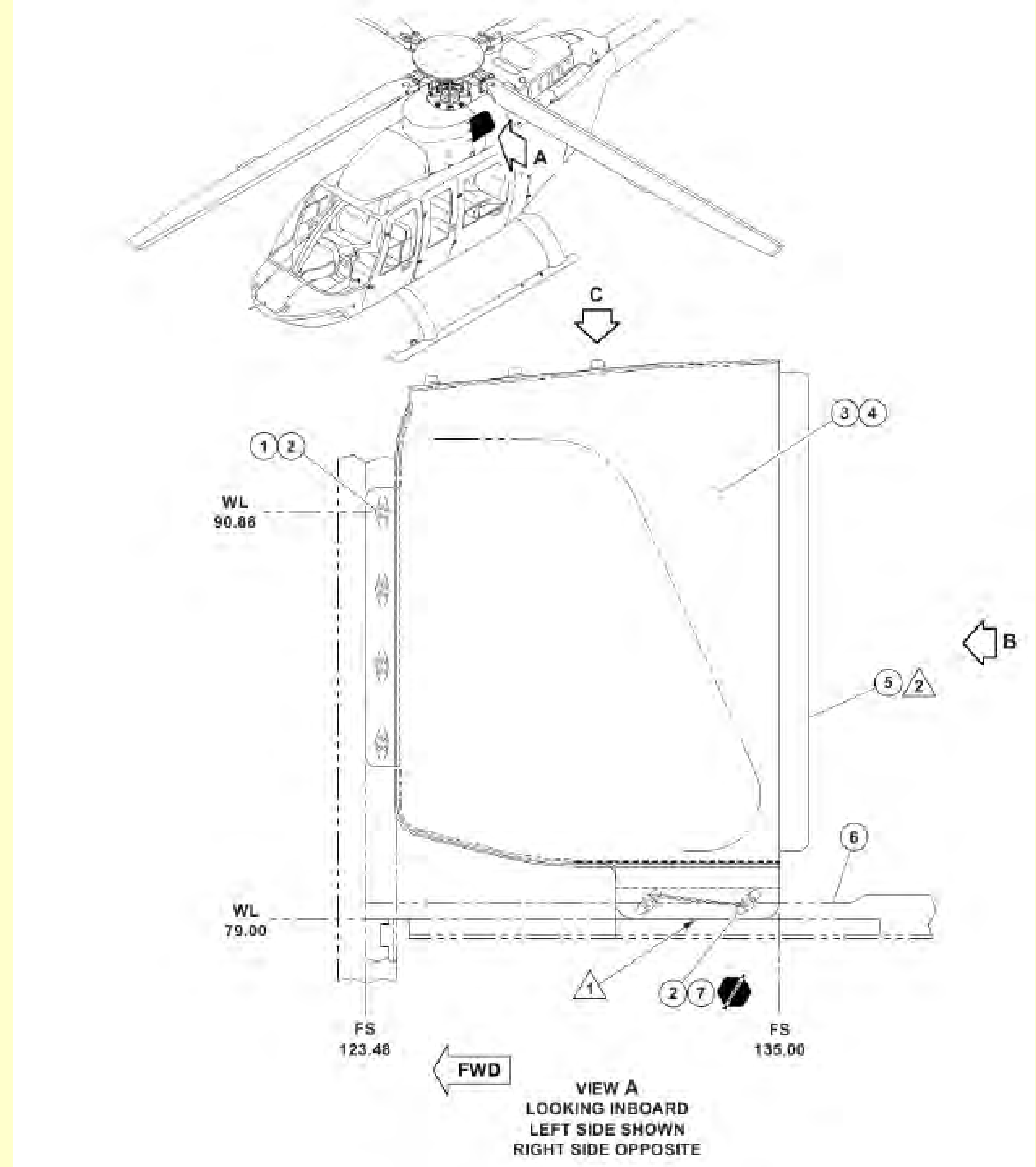


Figure 71-7. Snow deflector kit installation (Sheet 1 of 3)

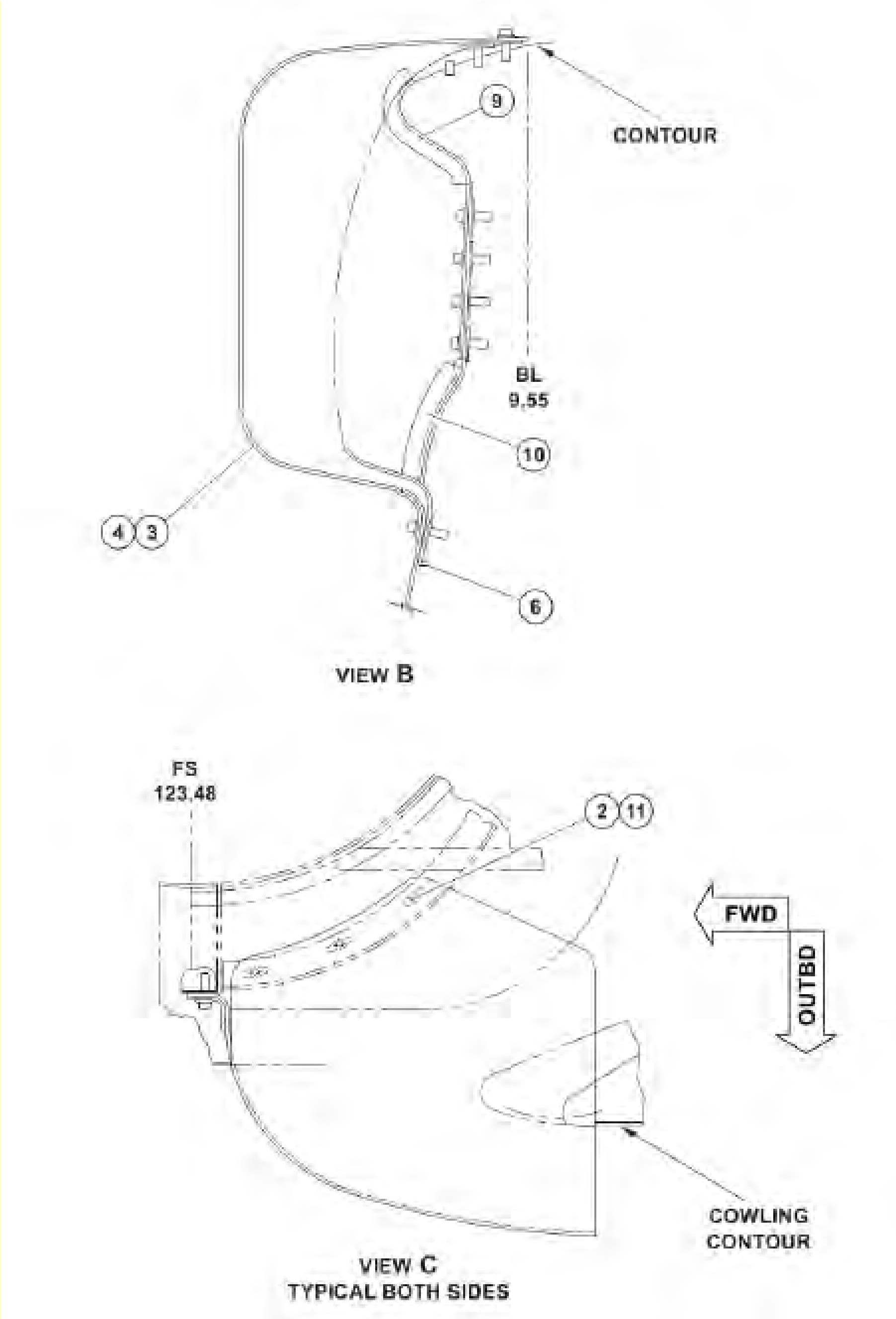
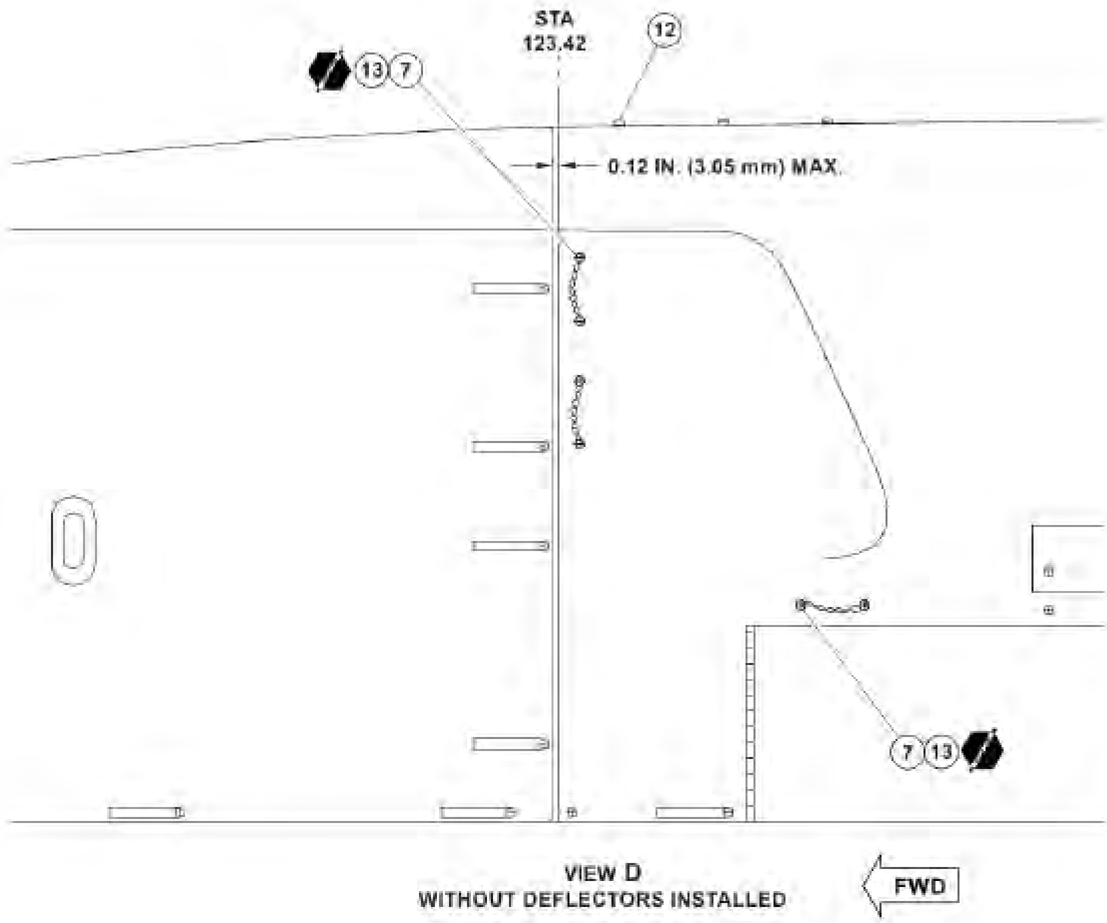


Figure 71-7. Snow deflector kit installation (Sheet 2 of 3)



1. Screw (AN525-10R10)
2. Washer (NAS1149DO363J)
3. Deflector assembly (206-064-226-101) shown
4. Deflector assembly (206-064-226-103) opposite
5. Cover assembly (206-072-402-101)
6. Air inlet cowl assembly
7. Screw (NAS1801-3D10)
8. Deleted
9. Seal
10. Seal
11. Screw (AN525-10R9)
12. Screw (MS27039-1-06)
13. Washer (NAS1149D00332J)

LOCKWIRE (C-405)

NOTES

1. If necessary, cut the lower edge of the deflector so that it is clear of the access door.
2. Remove inlet cover assembly (5) before flight (Chapter 10).

Figure 71-7. Snow deflector kit installation (Sheet 3 of 3)

71.6 EXHAUST SYSTEM

71.6.1 EXHAUST SYSTEM

The exhaust system includes the exhaust duct assembly. This assembly is attached to the engine exhaust flange.

71.6.1.1 EXHAUST DUCT ASSEMBLY

The exhaust duct assembly (Figure 71-8) lets out the exhaust gases. The exhaust duct assembly is made of corrosion resistant steel.

71.6.1.1.1. Exhaust duct assembly — Removal

1. Remove the upper engine cowling assembly (Chapter 53) to get access to the exhaust duct.
2. Remove the band clamp that secures the exhaust duct to the engine exhaust flange.
3. Remove the exhaust duct assembly.

71.6.1.1.2. Exhaust duct assembly — Inspection and repair

1. Examine the exhaust duct assembly for cracks, dents, and general condition.

71.6.1.1.3. Exhaust duct assembly — Installation

1. Install the exhaust duct assembly on the engine exhaust flange.
2. Install the band clamp on the exhaust flange and engine exhaust flange. Torque to 70-100 in-lbs. Lock wire per BHT-ALL-SPM.
3. Install the upper engine cowling assembly (Chapter 53).

VIEW LOOKING INBOARD LH SIDE

Figure 71-8. Exhaust Duct Installation

Chapter 75
ENGINE AIR
(75-00-00)

CHAPTER 75 — ENGINE AIR

Contents

75.1 ENGINE AIR

75.1.1 ANTI-ICING AIR SYSTEM

This chapter provides information regarding the engine installed anti-ice system.

The engine supplies bleed air to an engine inlet anti-ice system to prevent the formation of ice on engine inlet surfaces during icing condition.

The anti-ice system incorporates a solenoid-actuated valve to deliver compressor bleed air to the associated anti-ice air tubes and internal passages within the engine inlet; the air then discharges into the engine compartment. The anti-ice bleed valve assembly is located on the left hand side of the engine (see Figure 75-1). The anti-ice system is a pilot-selected ON/OFF system that features a pressure port that provides cockpit indication of system operation.

The anti-icing solenoid valve receives 28VDC from the aircraft bus through the ENGINE CONTROLS ANTI-ICE circuit breaker, found on the overhead circuit breaker panel.

When the electrical power is removed from the anti-icing solenoid valve, the valve opens and lets engine bleed air from the engine compressor diffuser go through the anti-icing solenoid valve to the engine inlet housing.

NOTE

Maintenance procedures for the engine anti-icing switch and annunciator circuit are in Chapter 96.

75.1.2 ANTI-ICING SOLENOID VALVE

For the anti-icing solenoid valve maintenance procedures, refer to the Honeywell Light Maintenance Manual for HTS900-2-1D.

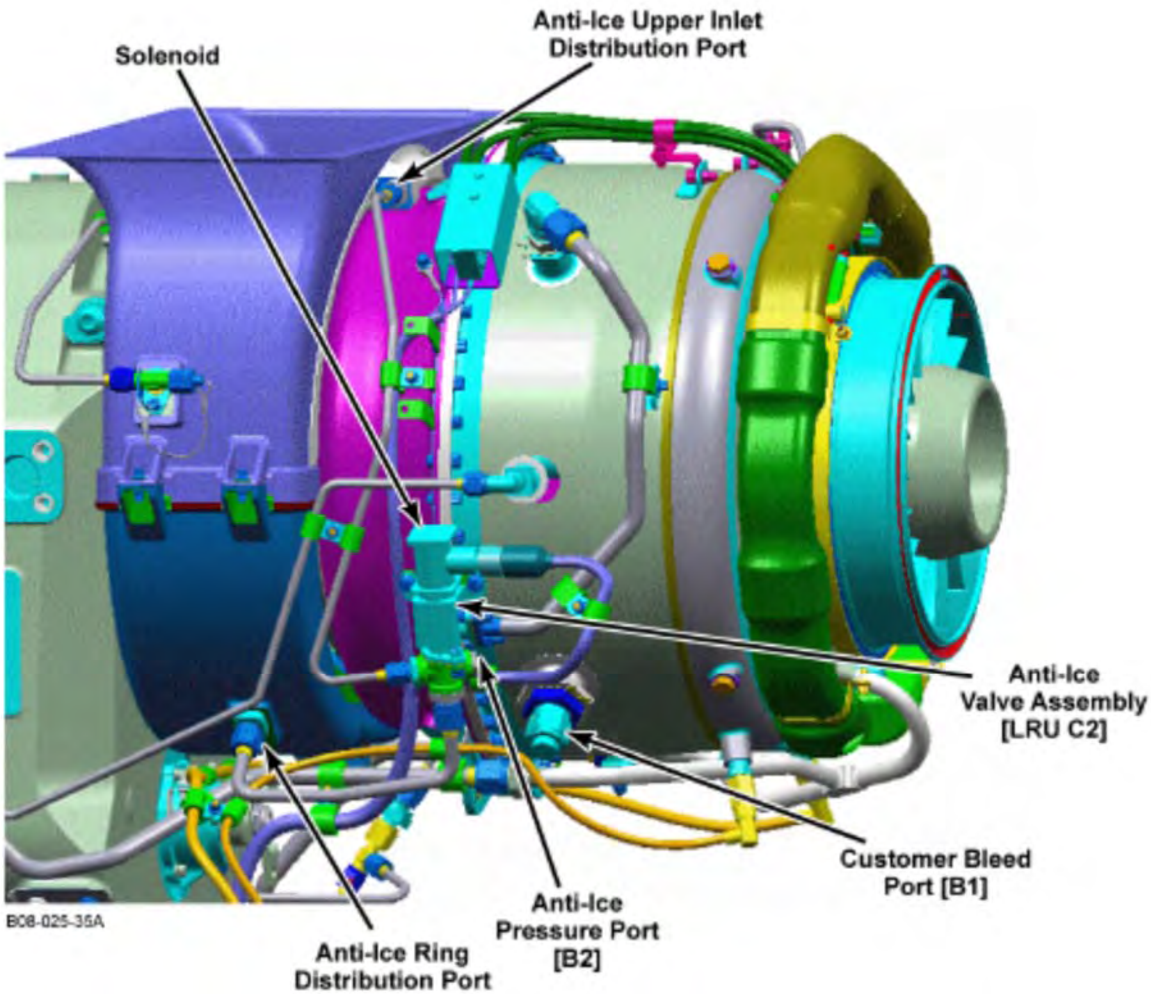


Figure 75-1: HTS900-2-1D Bleed Air Anti-Ice System

Chapter 76
ENGINE CONTROLS
(76-00-00)

CHAPTER 76 – ENGINE CONTROLS

Contents

76.1 FULL AUTHORITY DIGITAL ELECTRONIC CONTROL (FADEC)

This chapter contains information pertaining to the FADEC engine control system and its associated airframe inputs.

For additional information on the FADEC system, refer to the Honeywell Light Maintenance Manual: Gas Turbine Engine HTS900-2-1D

76.1.1 FADEC SYSTEM ACRONYMS

- Ambient Pressure Sensor (P0)
- Collective Pitch (CP)
- Compressor Discharge Pressure Sensor (P3)
- Compressor Inlet Temperature Sensor (T1)
- Electronic Control Unit (ECU)
- Engine Condition Monitoring (ECM)
- Fuel Flow (Wf)
- Fuel Metering Unit (FMU)
- Fuel Pump (FP)
- Full Authority Digital Electronic Control (FADEC)
- Gas Producer Speed (N_G)
- Gas Producer Speed corrected for inlet temperature (N_{GC})
- Hydromechanical Assembly (HMA)
- High-Pressure Fuel Filter (HPFF)
- Inlet Temperature (T1)
- Line Replaceable Unit (LRU)
- Linear Voltage Differential Transformer (LVDT)
- Nonvolatile Memory – Data Not Lost When Power is Removed (NVM)
- Measured Gas Temperature (MGT)
- Minimum Flow Valve (MFV)
- Main Rotor Speed (N_R)
- Overspeed Protection System (OPS)
- Power Lever Angle (PLA)
- Power Turbine Speed (N_P)
- Rate of Change of N_G Speed (NDOT)
- Resistive Temperature Device (RTD)
- Throttle Position
- Torque (Q)
- Permanent Magnet Alternator (PMA)
- Power Turbine Position Detector (PTPD)

76.1.2 FADEC CONTROL SYSTEM CONCEPT

The Model 407HP power plant is made up of a Honeywell HTS900-2-1D engine with an electronic control system. The control system is based upon a dual channel Full Authority Digital Electronic Control (FADEC) that controls, monitors, and limits engine power while maintaining helicopter rotor speed in primary mode. The system also features a fail fixed mode when the FADEC system encounters dual-channel hard fault.

The dual channel Electronic Control Unit (ECU) monitors numerous internal and external inputs to and from the engine sensors and accessories as shown in Figure 76-1. It also provides command to the engine mounted hydromechanical assembly (HMA) which consists of a fuel pump and an Fuel Metering Unit (FMU) which provides fuel to the engine. Based on engine and cockpit signals, the ECU provides an electrical command to the dual stepper motor unit that sets the correct amount of fuel going to the fuel nozzle, providing complete and automatic control of the engine during starting, steady-state, and transient operation throughout the engine operating envelope.

76.1.2.1 Primary Mode

When operating in primary mode, the control system digitally executes all engine control functions in response to airframe inputs and engine feedback signals. Engine fuel flow scheduling is full controlled by the ECU during the primary mode. Its functions are as follows:

1. Engine Operating Limits – The control system in primary mode limits the following engine operating parameters within the agreed limits: (1) Physical and corrected N_G (2) Gas producer acceleration (3) N_P (4) MGT and (5) Output Shaft Torque.

2. Engine Start Function – The control system provides automatic start scheduling, limited-authority engine gas temperature limiting during starts and automatic start abort capability.

3. Idle Governing Functions – N_G governing is provided when the operating mode is selected to idle.

4. Fly Governing – The control system provides automatic rotor run-up from idle, N_P governing, power turbine overspeed limiting, gas producer overspeed limiting, overtemperature limiting, engine overtorque limiting, Ng transient control and Wf/P3 minimum and maximum limiting.

5. Cockpit Annunciation – The control system provides output drivers for cockpit indications. All annunciations are performed via ARINC 429 data bus and lamp drivers for ECU hard fault.

6. Maintenance – Maintenance required indications are provided through the degrade mode output driver when the engine is commanded to normal shutdown.

7. Engine History Data Recording – Independent of the control system mode, both ECU channels will monitor and record engine history in a non-volatile memory.

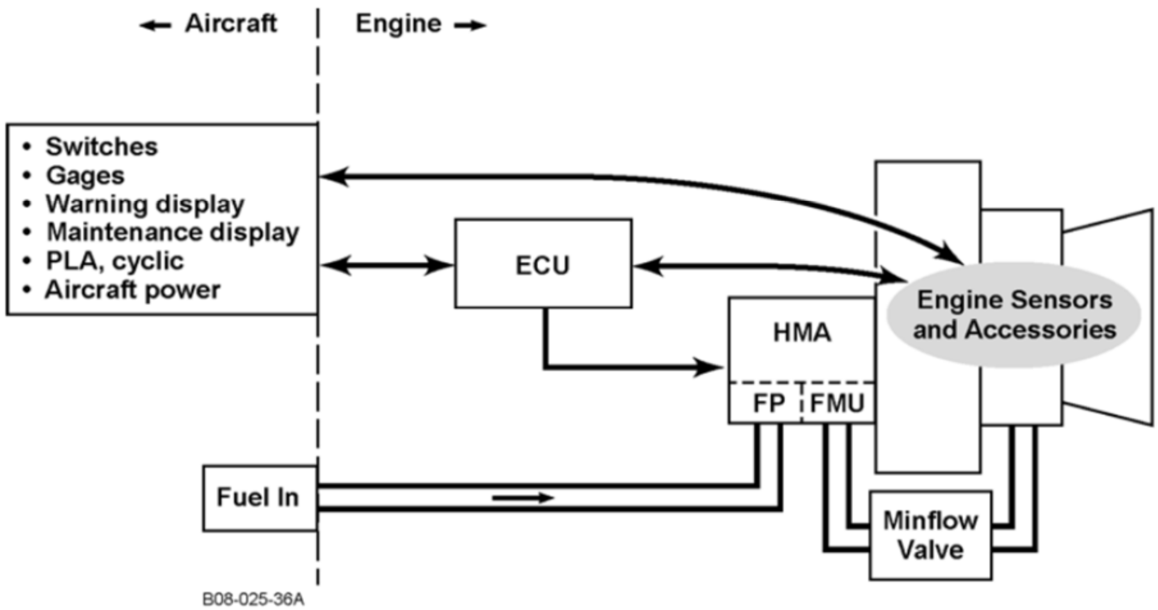


Figure 76-1: FADEC System Schematic

8. Surge Detection and Recovery – The control system has no active surge detection and recovery system, but does provide some level of surge recovery through fuel flow limit schedules based on the compressor discharge air pressure (P3). The P3 drop associated with an engine surge reduces fuel flow, thereby allowing the surge to clear.

9. Fault Accommodation – The primary mode contains fault detection and accommodation strategies to enhance system safety and reliability. It accommodates failure with no performance degradation by automatic switchover to the remote ECU channel or by using the signal from the remote ECU channel. It also accommodates failure by disabling a noncritical control function resulting in an acceptable level of performance degradation. During critical failure that render its capability of controlling the engine, referred to as ECU channel "hard fault", it automatically transfers control to the other channel or, if both channels are hard faulted, it disables the primary mode control and automatically reverts to the fail-fixed mode.

76.1.2.2 Fail Fixed Mode

In the event of dual channel fail, the FMU stepper motor will be failed fixed at its last position, resulting in a fail-fixed engine fuel flow. Engine start and ignition system are inhibited on the fail-fixed mode. Engine shutdown can only be accomplished using the emergency fuel valve switch. In the fail fixed mode, N_P overspeed protection is still provided if there is power to at least one of the two ECU channels, the overspeed protection system (OPS) is not degraded, and the primary N_P sensor is not failed.

76.1.3 CONTROL SYSTEM COMPONENT

The control system components are identified in Figure 76-2. Dual –wound and redundant components are shown as being separately connected to both ECU channel.

76.1.3.1 ECU

The dual channel ECU is mounted on the cabin roof forward of the transmission assembly. Refer to Figure 76-3. The face opposite to the electrical connectors has two ports that are used by the internally mounted pressure transducers to sense P0. These ports do not require electrical connection but requires no obstruction for accurate measure of P0.

The FADEC control system incorporates a two channel ECU that interfaces with all engine and airframe signals to provide control to the engine by regulating the FMU which controls the amount of fuel required under all operating conditions. Both ECU channels are capable of controlling the engine, but only one ECU channel is in control at any given time. The ECU channel not in control serves as a backup to the ECU channel in control. Each channel continuously monitors all inputs and executes the logic required to maintain control but only the outputs of the channel in control are enabled. The output of the other channel (not in control) is ready to automatically assume control should the controlling channel become incapable of controlling the engine. The one exception to this rule is: the output drivers of the channel not in control, for fuel flow reduction only, are always enabled for overspeed backup protection.

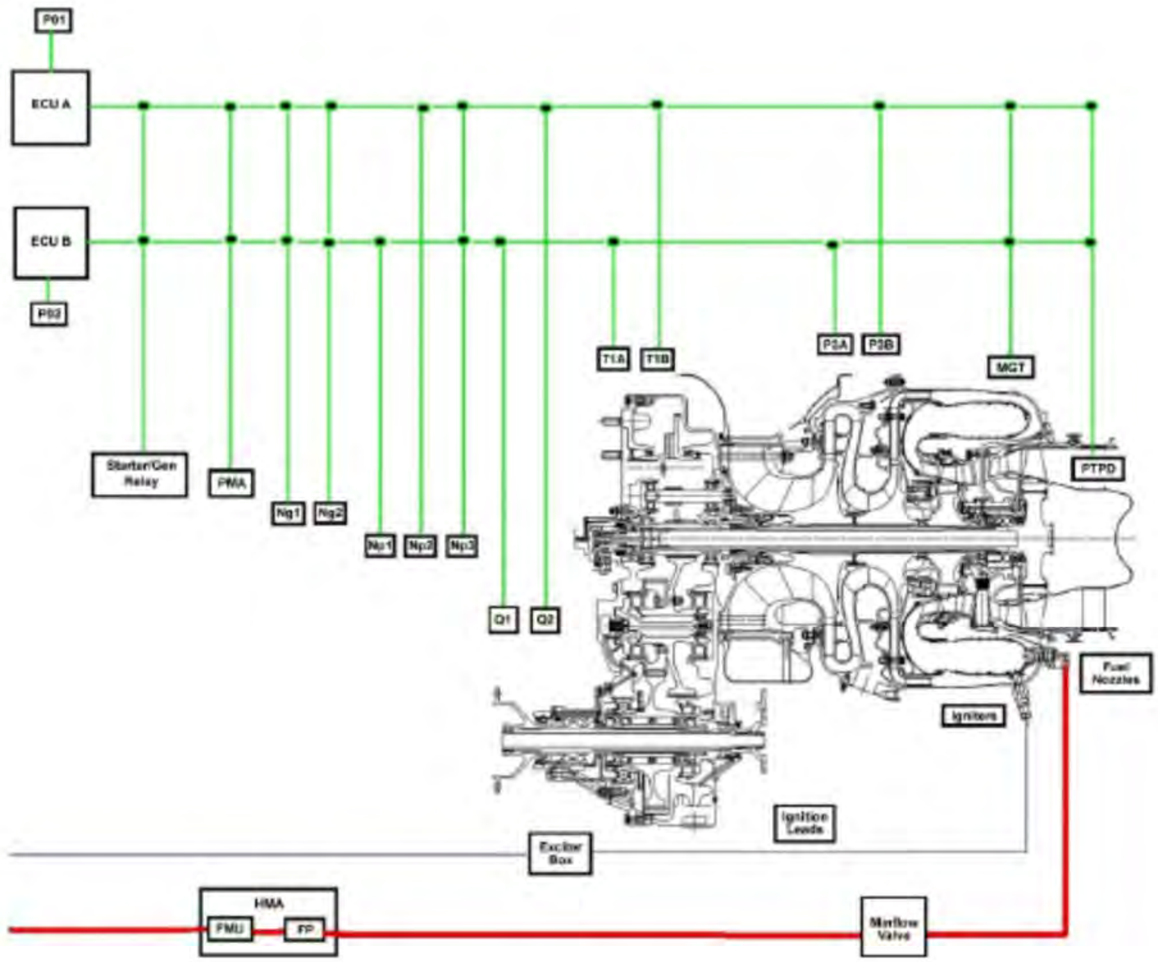
ECU channels share information via a cross-channel data link, with the intent of providing no degradation of function for any single fault of redundant element. The two channels are identical and are mechanically isolated and environmentally sealed from each other.

Fault detection and accommodation routines resident in the control system software that always check system health, and will disable the automatic system, switch from active to inactive channel if failures would result an unsafe operating condition.

76.1.3.2 Fuel System

The fuel system includes the fuel pump, the high fuel filter (HPFF), the FMU, the Minimum Flow Valve (MFV), and the flow divider valve. The pump and the FMU collectively referred to as the HMA provides the required amount of fuel to the engine in the primary mode throughout the starting and operating envelope based on the power demand.

Fuel travels from the fuel pump, through the high-pressure fuel filter, to the FMU, then to the MFV. A single line connects the MFV with the fuel manifold that feeds eight piloted air-blast fuel nozzles. The fuel nozzles provide atomized fuel to ensure proper combustion



Dual-Channel Electronic Control	ECU	Power Turbine Speed Sensors	Np
Hydromechanical Assembly	HMA	Gas Producer Speed Sensor	Ng
Fuel Metering Unit	FMU	Compressor Discharge Pressure Sensor	P3
Fuel Pump	FP	Output Shaft Torque Pressure Sensor	Q
Minimum Flow Valve	MFV	Measured Gas Temperature Thermocouples	MGT
Fuel Manifold Assembly		Power Turbine Position Detector	PTPD
Permanent Magnet Alternator	PMA	Ignition Exciter, Leads, Igniters	
Compressor Inlet Temperature Sensor	T1	Anti-Ice Valve	
Ambient Pressure Sensor	P0	Electrical Wiring Harnesses	

Figure 76-2: Control System Components

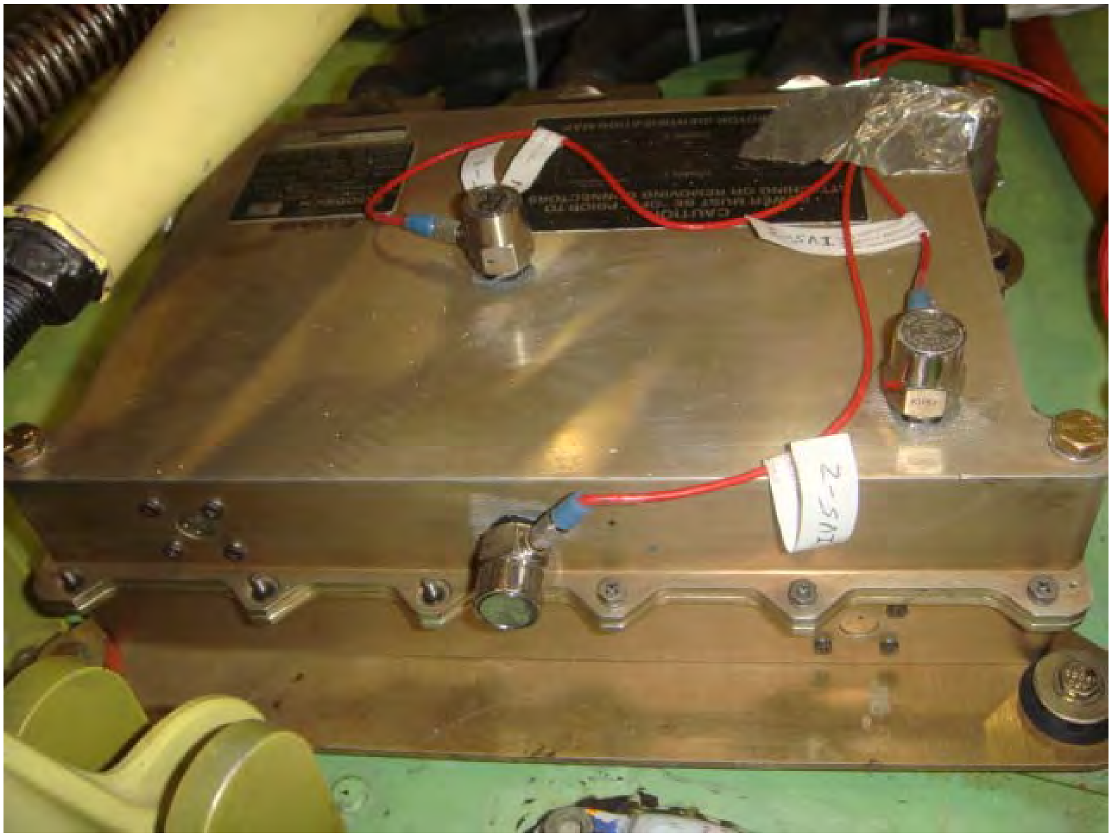


Figure 76-3: ECU

76.1.3.3 Ignition System

The ignition system consists of a dual-channel, medium tension exciter, two output leads and two igniter plugs. Both ignition channels are powered by 28 VDC when the starter is energized.

76.1.4 ROTORCRAFT INPUTS

76.1.4.1 Anti-Ice Switch

An anti-ice switch is available for pilot to activate the anti-ice valve and supply hot compressor discharge air to the inlet duct. This is a direct airframe switch to the valve and no switching logic is included on the ECU. Anti-ice annunciator system is further discussed on Chapter 96- Electrical.

76.1.4.2 Starter Switch

The pilot-activated switch sends a signal to the ECU that initiates the start sequence and provides automatic start scheduling, limited-authority MGT limiting during start, and automatic start abort capability. Start and Ignition system operation is further discussed on Chapter 96 – Electrical.

76.1.4.3 FADEC Reset Switch

The FADEC reset switch is installed on the instrument panel and available for pilot to reset FADEC. When cycled, it clears all the faults that are capable of being reset while the power is turned on.

76.1.4.4 Emergency Fuel Valve Switch

A pilot-activated emergency shutdown switch provides 12VDC power directly to the fuel shutoff solenoid in the engine mounted FMU. Activation of this solenoid shuts off fuel to the engine as well as the airframe fuel solenoid.

76.1.4.5 Power Lever Angle (PLA)

The cockpit PLA consists of a dual-channel linear variable differential transformer (LVDT) that provides power lever position to each ECU channel as indicated in Figure 76-4. PLA LVDT provides power requirement to the ECU depending on the PLA position. Engine is commanded OFF when PLA is less than 15 degrees. When transitioning from OFF to IDLE detent, the ECU recognizes IDLE position to initiate engine start (fuel enabling). After reaching the IDLE position, the control system maintains N_G idle limit. Between 85 and 113 degrees, LVDT provides N_G maximum linear modulation. It also maintains N_P governing (while maintaining maximum N_G limit) for PLA >113 degrees. When transitioning from IDLE to OFF position, the PLA provides shutdown functions when PLA is less than 5 degrees and initiates engine shutdown (fuel disabling).

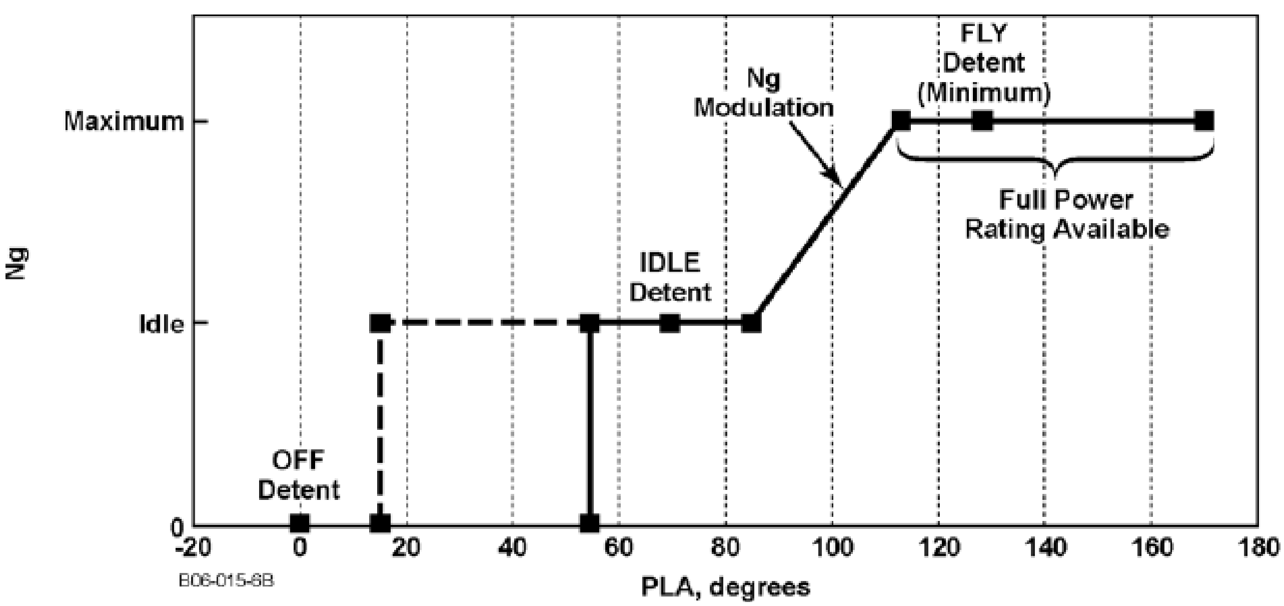


Figure 76-4: Throttle (PLA) Functionality

76.1.4.6 Collective Pitch (CP) Position

The CP input is from two independent potentiometers that sense the collective position installed on the collective jackshaft. The signal is used in anticipation logic that minimizes the speed variation caused by the load changes. The potentiometers are 5 KΩ variable resistors that anticipate 0Ω as full down position (min load) and 5 KΩ as full up position (max load). The CP position and Ngc relationship are shown in Figure 76-5.

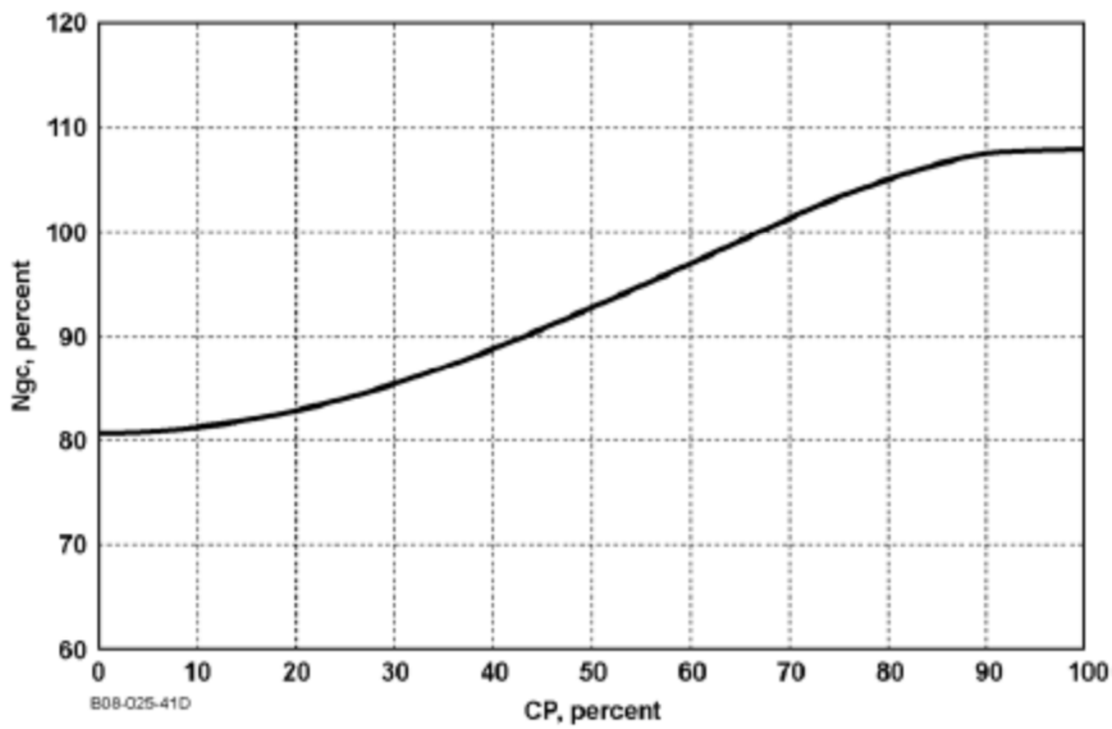


Figure 76-5: Collective Position versus Gas Producer Speed

76.1.4.7 Main Rotor Speed (N_R) Sensor

The N_R speed pick-up is a magnetic sensor mounted on the transmission lower case. The sensor has triple coils that all output the same signal. Two of the pick-up coils are dedicated to the ECU, one to channel A and another to channel B. The third coil provides a signal for the Low RPM horn and light. The N_R signal is used in logic for output shaft failure detection and auto-rotation recovery. The ECU defines 100% N_R =413rpm=2,000.38 Hz.

76.1.5 ENGINE INPUTS

76.1.5.1 Fuel Flow

Fuel flow is calculated from metering valve position as measured by an RVDT within the HMU. The fuel flow from this calculation is used as a position feedback by the ECU and is provided via ARINC 429.

76.1.5.2 Power Turbine Speed (N_P) Sensors

There are three gear-box mounted N_P sensors used to measure the rotational speed of the power turbine spool. The N_P outputs are used for N_P governing and overspeed limiting. Each ECU channel has a dedicated coil for the N_P signal, and one shared between channels via cross-channel link, thus each ECU channel has access to all three N_P signals. The N_P output is provided to the cockpit via ARINC 429. The N_P sensors are hermetically sealed LRUs that require no external calibration or adjustment. The ECU defines 100 % N_P=38,198 rpm.

76.1.5.3 Gas Producer Turbine Speed (N_G) Sensors

There are two independent N_G sensors that are both dual-coil sensors that measure the rotational speed of the gas producer shaft. Each coil on N_G sensor is dedicated for each channel. The ECu defines 100% N_G = 47,870 rpm. The primary N_G signals for each ECU channel are obtained from the pick-up sensor located on the front of the engine gearbox. Redundant speed signals are obtained from the second monopole sensor mounted on the FMU. With data sharing via the cross-data link, each ECU channel has access to both N_G signals.

Each ECU channel determines N_G from one of the two N_G sensor coils by counting the signal pulses resulting from the passage of teeth over a gear revolution. The dual redundant N_G sensor are hermetically sealed LRUs that require no external calibration or adjustment. The N_G output is provided to the cockpit via ARIC 429.

76.1.5.4 Inlet Temperature Sensor

The Inlet Temperature Sensor provides compressor inlet temperature (T1) to ECU. The sensors are dual-element, platinum resistive temperature device (RTD) mounted on the front face of the engine intake. Each ECU channel monitors one RTD element. The elements are housed in a common, hermetically sealed probe body, and generate a resistance proportional to temperature. The air temperature range expected during the operation is -65°F (-54°C) to +150 °F (+65°C).

76.1.5.5 MGT Thermocouples

Twelve MGT thermocouples, each configured as a closed-bead, Type-K probe, are located between the gas producer turbine and the power turbine, providing a signal that is wire-spliced for use by each ECU channel. If either of the Type-K inputs is severed to an ECU channel, the MGT value can be shared between the two channels via the cross-channel data link.

The temperature measuring system consists of four three-probe Chromel-Alumel thermocouple assemblies and an averaging junction box. Closed and ungrounded sheathed thermocouples are used in the gas flow path. A transition is then made to the high-temperature flexible lead, which extends forward on the engine to the junction box. The indicated gas temperature includes an empirically derived bias to account for differences between the thermocouple measurement and thermodynamic gas producer turbine temperature.

The MGT is transmitted via ARINC 429 from ECU to the instrument system.

76.1.5.6 ECU P0 Sensor

P0 sensors are located on the ECU, each for channel. The ECU is mounted in an area such that the perceived P0 will be a static pressure.

76.1.5.7 Compress Discharge Air Pressure Sensors

The compressor discharge air pressure (P3) sensor is an absolute pressure transducer that is composed of two electrically isolated bridges (one output per channel). The sensor is mounted on the front face of the gearbox and requires no external calibration or adjustment. The P3 sensor is connected to the pressure medium via a separate, rigid pressure line.

76.1.5.8 Torque Sensor

The torque sensor is mounted on the front of the gearbox and has redundant strain gages (one output per ECU channel) that measure oil pressure proportional to engine torque.

76.1.5.9 Power Turbine Position Detector (PTPD)

The PTPD consists of a single frangible fuse connected electrically via four wires to each ECU channel. If, due to a thrust bearing failure, the power turbine shaft is displaced and cuts the frangible fuse, the electrical circuit opens, which causes the ECU to enable the overspeed system and command fuel to be shut off.

The wiring for each ECU channel consists of one wire connected to separate connection points at each end of the frangible fuse at the detector end, with each of these leads connected to separate ECU channel connector pins. The PTPD is to provide an open circuit with shaft movement resulting from shaft or bearing failure conditions.

76.1.5.10 Fuel Metering Valve

A dual-element RVDT is connected to the metering valve gear train and provides the metering valve position to the ECU- one element for each ECU channel. The valve position is used in the inner loop of the valve’s position command.

76.2 FADEC CONTROL OPERATION

76.2.1 POWER SUPPLY

During start, the power for ECU, start and ignition system is provided by the airframe system. With engine running and N_G more than 45%, engine control system power is provided by the PMA.

The PMA is dedicated to the engine control system. It is mounted on the gearbox and is connected to the power turbine drive train. It comprises a wound stator and a permanent magnet rotor that provides three-phase power to each ECU channel when the engine is running. It is designed to provide electric power required by the control system and engine at or above 45% N_G.

The airframe 28VDC bus and the engine PMA are supplied in parallel through an isolation diode circuit in the ECU. This feature ensures that the higher of the two sources is always used; while maintaining separation and redundancy of the two sources should one source fails.

76.2.2 START AND IGNITION SYSTEM

For ground starting, the automatic start sequence is enabled by rolling the throttle PLA equal to or above the IDLE position and within 60 seconds, holding the momentary start switch for more than 0.5 second. These two actions in the noted sequence allow the ECU to discriminate start or crank commands, and prevent inadvertent starts when the PLA has been left in a run position.

76.2.2.1 FADEC Start Relays

FADEC start relays (4962-K1 and 4962-K2) are devices used to engage the start contactor as well as to provide 28VDC power to the ignition exciter box. The relay of the active ECU channel is enabled when the pilot closes the momentary start switch within 60 seconds of when PLA transitions from off to greater than or equal to the IDLE detent position.

NOTE

Refer to ICA-E407-789 Chapter 96 for Start and Ignition System maintenance.

76.2.2.2 Starter

The engine is started and motored with a starter/generator (2MG1). The output shaft of the starter features a shear section to protect the engine for overtorque condition. The starter is controlled by the relay/contactor that is energized for starting when commanded by the ECU. Ignition is energized in parallel with the starter during starting.

NOTE

Refer to ICA-E407-789 Chapter 96 for Start and Ignition System maintenance

76.2.2.3 Start and Ignition System Operation

The operation of the start and ignition system is described below. The descriptions are written with the 28 VDC bus powered and all of the applicable circuit breakers closed.

CAUTION

THIS PROCEDURE IS WRITTEN TO GIVE A DESCRIPTION OF THE OPERATION OF THE START AND IGNITION SYSTEM. REFER TO THE FMS-E407-789-1 FOR THE SPECIFIC START PROCEDURES.

1. Set the throttle to the idle position.

NOTE

After the throttle is set to the idle position, the start switch (4962-S6) must be momentarily positioned to START within 60 seconds or the start sequence will be disabled by the FADEC/ECU (4962-A). To reset the system, the throttle must be repositioned to CUT-OFF and back to IDLE.

2. Momentarily set the start switch (4962-S6) to START.

When the start switch (4962-S6) is momentarily set to START, the FADEC/ECU (4962-A) senses start signal through pin 12, 2 and 28 of 4962-P1 (Channel A) and 4962-P4 (Channel B), causing it to energize the FADEC/START relay (4962-K1 and/or 4962-K2) of the channel in control.

FADEC/ECU relay (4962-K1 and/or 4962-K2) is then latched for the entire start sequence. The conditions that follow occur in the system.

1. Power is supplied from the engine controls start circuit breaker (1CB1) through the closed contacts A2 to A1 of either FADEC/START relay 4962-K1 or 4962-K2 to terminal X1 of the starter relay (1K1) and terminal C (START) of the voltage regulator (2VR1).

2. The application of 28 VDC bus power to terminal C of the voltage regulator (2VR1) inhibits the generator output during the start sequence. Approximately 1 VDC is also supplied from terminal M of the voltage regulator (2VR1) to terminal A of the starter generator (2MG1) to flash the shunt field.

3. This supplies the ground to terminal X2 of the FADEC/START relay (4962-K1 and/or 4962-K2). This causes the FADEC/ START relay (4962-K1 and/or 4962-K2) to latch for the start sequence.

4. FADEC/ECU provides cockpit display through ARINC 429 data bus transmitted to the Dual Tachometer Indicator (1M6) to trigger advisory "START" on the Caution/Warning Advisory Panel (4DS1).

With 28 VDC bus power supplied to terminal X1 of the starter relay (1K1), the starter relay (1K1) is energized. With the starter relay (1K1) energized, the conditions that follow occur in the system:

1. The closed main contacts, A2 to A1, of the starter relay (1K1) provide 28 VDC bus power to terminal C of the starter generator (2MG1). This causes the starter to operate.

2. A ground path is also completed through the closed contacts 11 to 12 of the starter relay (1K1) to terminal X2 of the ignitor relay (2K4).

With a ground at terminal X2 of the ignitor relay (2K4) and 28 VDC power applied to terminal X1 of the ignitor relay (2K4) from the engine controls ignitor circuit breaker (1CB2), the relay energizes. With the ignitor relay energized, power is supplied from the 28 VDC bus through the engine controls ignitor circuit breaker (1CB2) through the closed contacts B1 to B2 of the ignitor relay (2K4) to the engine exciter box. This causes the engine exciter box to come on and activate the engine spark ignitor.

The starter will stay engaged until the gas producer speed (N_G) is at 50%. When the FADEC/ECU (4962-A) senses the (N_G) is at 50%, a temporarily open ground circuit is provided from the START terminal of the FADEC/ECU (4962-A). This temporarily open ground circuit unlatches the FADEC/START relay (4962-K1 and/or 4962-K2) and stops the operation of the start system.

During the activation of the start and ignition system, the FADEC/ECU (4962-A) monitors the engine parameters and controls the fuel scheduling to make sure of an efficient start. Upon reaching an engine gas producer speed (N_G) of 50% RPM, the FADEC/ECU (4962-A) unlatches the FADEC/START relay (4962-K1 and/or 4962-K2) to stop the entire start sequence. The engine continues to accelerate until reaching a stabilized idle of 63 ±1% N_G.

76.2.3 ENGINE LIMITING AND PROTECTION FEATURES

76.2.3.1 Torque Limiting

The torque limiter protects the engine from excessive engine torque during transient or failure conditions by reducing fuel flow. The torque limit is set at the maximum permissible torque.

76.2.3.2 Temperature Limiting

An engine overtemperature protection feature is provided to reduce engine fuel flow to shutoff as the gas temperature approaches and exceeds the starting gas temperature limit during starts. The ECU limits gas temperature during the run condition by reducing acceleration or steady-state fuel flow to prevent exceeding 1,847ºF (1,008ºC) MGT. The engine transient temperature limit is 1,790ºF (977ºC). Thus, the control system limit is set above the maximum permissible temperature.

Exceedance of the MGT limit is detected and recorded in NVM by the ECU. See FMS-E407-789-1 for crew actions to be executed in the event of MGT limit exceedance.

76.2.3.3 N_G Limiting

An N_G maximum limit is effectively implemented as part of the N_G governor. The N_G limits set to the lower of these two values: 104.4 percent maximum permissible N_G (mechanical speed) or less than 110.0 percent N_{GC}.

76.2.4 GOVERNING LOGIC

76.2.4.1 Transient and Steady-State

When the power lever is advanced from IDLE to FLY, the engine control system reverts to several control logic features to ensure engine stability during acceleration, medium to high power operation, and deceleration. During acceleration, the control system prevents the engine from encountering compressor surge, and during deceleration, the control system prevents the engine from encountering a lean blowout (LBO) condition.

76.2.4.2 Power Turbine Governor

The power turbine governor is designed to maintain N_P to the aircraft-selected N_P reference during steady-state and transient aircraft maneuvers. This governor is normally active when PLA is in the IDLE position. When the PLA is in the IDLE position the engine normally drops down onto the N_G governor. The relationship between the N_P and N_G governors is a lowest-wins relationship. The power turbine governor uses both proportional and derivative control loops to calculate speed errors. The control logic mathematically integrates these speed errors for isochronous speed governing of the power turbine.

76.2.4.3 Gas Producer Governor

The gas producer governor is intended to set the N_G for idling operation (PLA at IDLE). When PLA is in the FLY position, the N_G governor set point is set arbitrarily high so it will have no effect (N_G governor or other limiter would take control). There is PLA modulation between IDLE and FLY such that the N_G governor can control N_G anywhere between GI and the maximum speed permitted. The set-point logic has a maximum allowable value of 104.4 percent N_G.

76.2.4.4 Ndot Acceleration

The purpose of the acceleration schedule is to provide closed-loop engine rate of acceleration (Ndot) control to limit engine acceleration and minimize the risk of surge. The control system computes an acceleration schedule demand from inputs of T1, P0, N_{GC}, and CP rate of change. The control system monitors both MGT and torque, compares them to limits, and reduces the Ndot schedule as required to preclude overshoots of those limits.

76.2.4.5 Ndot Deceleration

The purpose of the control system engine deceleration schedule is to provide closed-loop control over the maximum allowable deceleration rate of Ng. The deceleration schedule is designed to prevent an engine flameout during commanded engine decelerations. The control system computes deceleration schedule demand for the engine using Ngc, P0, and T1.

76.2.4.6 Gas Producer Underspeed Governor

The purpose of the control system underspeed governor is to prevent an unrecoverable low N_G condition during steady-state and transient operation. The underspeed governor effectively maintains the engine above GI. The control logic prohibits N_G from passing below GI, but in the event of a flameout, deceleration below the minimum gas producer underspeed reference point of GI minus 3 percent results in a shutdown.

76.2.5 OVERSPEED PROTECTION

Overspeed limiting is provided by reducing or shutting off fuel flow to the engine. The ECU contains logic to reduce engine fuel flow if N_G or N_P exceeds the limit settings. The primary overspeed control reduces fuel flow in the event of an overspeed until the speed has been reduced below a prescribed value.

The NP OPS in each ECU channel uses two independent lanes, both of which must sense overspeed before fuel flow can be reduced or completely shut off. Either channel can energize either valve if both lanes in that channel agree. Because of the dual-lane architecture, no single electrical fault can cause either an OPS failure or an inadvertent shutdown.

Following are the levels of overspeed protection provided for the HTS900-2-1D:

a) **Gas Producer Turbine Overspeed Protection** – Each ECU channel contains gas producer turbine overspeed software logic to reduce engine fuel flow to 48±4 lb/hr if the speed exceeds 110.4 % rpm.

b) **Power Turbine Overspeed Protection** – Each ECU channel contains power turbine overspeed software logic to reduce engine fuel flow to 48±4 lb/hr if logic declares an overspeed in two lanes :
   - The first lane is a magnitude lane that is enable if NP exceeds 105.4% rpm.
   - The second lane is a derivative lane that is enabled if NP exceeds a power turbine trip speed set by the rate of change of NP. This is defined by a linear relationship between the NP speed and the rate of change; where the NP speed is 116.8% - rate of change is zero and when the NP speed is 105.4% - rate of change is 142.5 % per second. See Figure 76-6.

In both level, once the overspeed event is no longer present, fuel flow is restored to the commanded position.

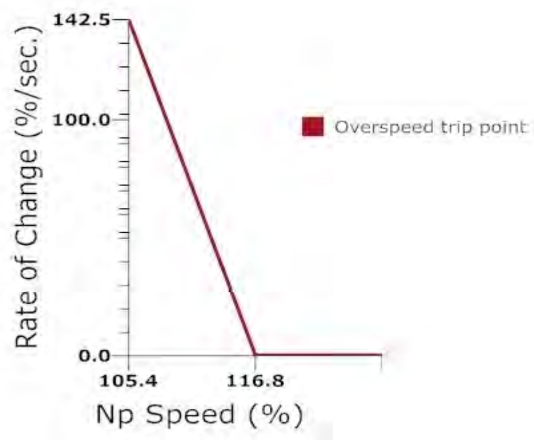


Figure 76-6: NP Overspeed Trip Point

During every ECU power-up sequence, all the OPS electrical circuitry, including the MFV and shutoff solenoid, is tested. Besides the power-up tests, the entire overspeed function, including the hydromechanical and electromechanical parts in the FMU and the electrical parts in the ECU, is checked at every normal shutdown. When the throttle (PLA) is changed from IDLE to OFF, the ECU activates, in order, the MFV, the fuel shutoff solenoid, and then the stepper motor, to zero flow. The electrical and electronic circuits used to detect failure of the power turbine rotor thrust bearing are also checked continuously. Note that in order for the shutoff solenoid to be closed, detection by the hardware overspeed circuitry, as well as software permissive, must be triggered. This logic eliminates the possibility of inadvertent shutdown caused by a single failure.

In addition, the ECU will command fuel cutoff in the loss-of-load event or NP being greater than NR. Specifically if NP is 2% greater than NR and the NP rate of change is more than 50% per second. The fuel flow will remain latched off until NG is less than 10% and the fuel metering valve is in the shutoff position, or when the ECU is depowered.

NOTE

Refer to ICA-E407-789 Chapter 96 for Overspeed Annunciator System Maintenance.

76.2.6 SHUTDOWN

The control system allows the engine to be shut down manually by either PLA command or by using the emergency fuel valve switch. The control system also has the ability to automatically shut down the engine as a result of a start-abort condition. The engine incorporates two ways to shut off fuel completely to the engine combustion system: the FMU shutoff solenoid and the FMU metering valve.

Normal shutdown is initiated from the cockpit by selection of PLA to the OFF position. Following stable engine operation for more than 3 seconds at GI, a shutdown test is performed whereby the MFV and fuel shutoff solenoid in the FMU are enabled and functionally monitored, followed by the metering valve being commanded to 0 lb/hr.

Motoring after shutdown is required to reduce turbine sump temperature. Failure to motor the engine after shutdown may require additional maintenance action. Refer to Honeywell LMM for HTS900-2-1D.

76.2.6.1 Emergency Shutdown System

The control system features a pilot-activated emergency fuel valve switch (4962-S9) that is directly connected to the FMU fuel shutoff solenoid and to the ECU (for feedback confirmation of a pilot-commanded emergency shutdown and for fault detection of the emergency fuel valve switch). No engine starts can be initiated by the control system while the emergency fuel valve switch is activated.

During normal engine shutdown, the FADEC/ECU (4961-A) provides power to the fuel shutoff solenoid in the engine mounted Fuel Metering Unit (4962-A17) when PLA rolled to OFF position. With emergency fuel valve switch (4962-S9) on the ON position, power from ECU channel B is provided through the emergency fuel valve switch.

When the emergency fuel valve switch (4962-S9) is set from ON to OFF, the 12VDC from voltage regulator (4962-VR1) is provided to the fuel solenoid in the engine mounted Fuel Metering Unit (4962-A17). Ground from WTD250 is also provided to the FMU (4962-A17). During this time FADEC/ECU (4962-A) channel A receives feedback confirmation of a pilot-commanded emergency shutdown.

Voltage regulator (4962-VR1) is provided to have the aircraft supply of 28VDC stepped down to 12 VDC required by the solenoid installed on the FMU.

NOTE

Refer to ICA-E407-789 Chapter 96 for Emergency Fuel Valve System Maintenance.

76.2.7 CHECK RUN PROCEDURE

Following completion of any FADEC system maintenance, a successful check run procedure is to be carried out prior to flight. Do the procedures from the FMS-E407-789-1 that follow:

NOTE

Following Maintenance actions and prior to performing check run procedure, ensure no "current" faults exist.

1. Apply electrical power to the helicopter. Wait for completion of FADEC system self-test. If no FADEC related

annunciators are illuminated, no "current" faults exist. If a fault is displayed, refer to paragraph 76.4.3.3 Fault Isolation.

2. Do the PREFLIGHT and PRESTART CHECK procedure.

3. Do the ENGINE START.

4. Do the ENGINE RUN-UP procedure.

5. Do the ENGINE SHUTDOWN procedure.

6. Ensure no FADEC related annunciator illuminates. If a fault is displayed, refer to paragraph 76.4.3.3 for a determination of faults/exceedances and required troubleshooting steps.

76.3 FADEC SYSTEM DISPLAYS

76.3.1 COCKPIT INDICATIONS

ECU software also features engine condition monitoring (ECM) and cockpit annunciations and warnings.

Engine parameters are provided by each ECU channel to the cockpit via ARINC 429 data bus system. ECU faults and status words are also transmitted via ARINC 429 for maintenance purposes. Indicators are designed to decode ARINC 429 data and activate the associated caution and warning lights to indicate faults and status of the engine control system.

Table 76-1 summarizes the ARINC 429 data transmitted by the ECU for engine monitoring, warning and maintenance. Both ECU channels are transmitting data simultaneously and the indicators determine the channel in control via bit 23 and 24 of ARINC data word label 270.

NOTE

Refer to ICA-E407-789 Chapter 95 for Engine Instruments System Maintenance.

76.3.1.1 FADEC System and Engine Warning Signals

Another function of the control system is to perform fault detection and accommodate operation during failures and providing maintenance data for ground crews. This extended operation can range from a loss of a single redundant sensor with no performance degradation, to multiple failures that still allow full-authority safe operation but with degraded performance, or to a complete loss of automatic control resulting in a safe failed-fixed condition. Control system fault accommodation is summarized as follows:

- Select validated signals for engine control purposes.
- Reconfigure the system in the event of a non-critical fault.
- Disable automatic control in the event of hard fault.
- Isolate failures.
- Annunciate failures.

Table 76-2 identifies the caution, warning and advisory lights used to indicate the engine and control system status.

NOTE

Refer to ICA-E407-789 Chapter 96 for Annunciator System Maintenance.

The control system does not provide the capability for time-limited dispatch (TLD), thus the engine is not certified to dispatch with faults present.

Table 76-1: ARINC 429 Data Bus Engine Parameters

Parameter	ARINC Label	Upadate Rate, msec.
Wfmv	244	1000
Power Turbine Speed	346	40
Gas Generator Speed	344	40
Engine Torque	336	40
Measured Gas Temperature	345	40
Compressor Discharge Pressure	264	40
Rotor Speed	40	40
Collective Pitch Position	324	40
PLA	134	1000
FADEC Fault Word No.1	350	40
FADEC Fault Word No. 2	351	40
FADEC Fault Word No.3	352	40
FADEC Fault Word No.4	353	40
FADEC Fault Word No.5	354	40
Loop	7	40
Discrete Word No.1	270	40
Discrete Word No.2	271	40
Cumulative number of starts	155	1000
Total engine hours	156	1000
FADEC total gas producer cycles	157	1000
FADEC total power turbine cycles	160	1000
Last flight NG cycles	161	1000
Last flight NP cycles	162	1000

FUEL FLOW:	Engine fuel flow computed by the FADEC using metering valve position measurement.					
FADEC NAME [1]	LABEL (octal)	UNITS	Min. Value [2] (Ref. Only)	Max Value [3][4] (Ref. Only)	RESOLUTION (Ref. Only)	TRANSMIT RATE (milliseconds)
Wfmv	244	pph	-2048	2048	0.0625	1000

BIT	DEFINITION	VALUE		
1	Label (MSB)	10		
2	Label	10		
3	Label	01		
4	Label	00		
5	Label			
6	Label			
7	Label			
8	Label (LSB)			
		Channel A	Channel B	
9	SDI	0	1	
10	SDI	1	0	
11	Data Word (LSB)	Pad (0)		
12	Data Word	Pad (0)		
13	Data Word	Pad (0)		
14	Data Word	0.0625		
15	Data Word	0.125		
16	Data Word	0.25		
17	Data Word	0.5		
18	Data Word	1		
19	Data Word	2		
20	Data Word	4		
21	Data Word	8		
22	Data Word	16		
23	Data Word	32		
24	Data Word	64		
25	Data Word	128		
26	Data Word	256		
27	Data Word	512		
28	Data Word	1024		
29	Data Word (MSB or sign bit)	0 = positive ; 1 = negative		
		Bit 31	Bit 30	
		0	0	Failure Warning
		0	1	No Computed Data
30	SSM	1	0	Functional Test
31	SSM	1	1	Verified Data/Normal Operation
32	Parity	ODD parity bit computed by the hardware		

Notes:
1. Software variables and constants are shown in italics.
2. Negative values are encoded as the two's complements of positive values with the negative sign bit annunciated in bit 29.
3. Actual maximum value is one least significant bit less than the maximum value shown.
4. ARINC 429 DITS Mark 33 Specifies Max Value of 8129. A max value of 2048 is enough to cover the requirements of this program.

POWER TURBINE SPEED:	Engine power turbine speed measured by the FADEC					
FADEC NAME [1]	LABEL (octal)	UNITS	Min. Value [2] (Ref. Only)	Max Value [3] (Ref. Only)	RESOLUTION (Ref. Only)	TRANSMIT RATE (milliseconds)
Np	346	%	-256	256	0.0078125	40

BIT	DEFINITION	VALUE		
1	Label (MSB)	11		
2	Label	10		
3	Label	01		
4	Label	10		
5	Label			
6	Label			
7	Label			
8	Label (LSB)			
		Channel A	Channel B	
9	SDI	0	1	
10	SDI	1	0	
11	Data Word (LSB)	Pad (0)		
12	Data Word	Pad (0)		
13	Data Word	Pad (0)		
14	Data Word	0.0078125		
15	Data Word	0.015625		
16	Data Word	0.03125		
17	Data Word	0.0625		
18	Data Word	0.125		
19	Data Word	0.25		
20	Data Word	0.5		
21	Data Word	1		
22	Data Word	2		
23	Data Word	4		
24	Data Word	8		
25	Data Word	16		
26	Data Word	32		
27	Data Word	64		
28	Data Word	128		
29	Data Word (MSB or sign bit)	0 = positive ; 1 = negative		
		Bit 31	Bit 30	
		0	0	Failure Warning
		0	1	No Computed Data
30	SSM	1	0	Functional Test
31	SSM	1	1	Verified Data/Normal Operation
32	Parity	ODD parity bit computed by the hardware		

Notes: 1. Software variables and constants are shown in italics.
2. Negative values are encoded as the two's complements of positve values with the negative sign bit annunciated in bit 29.
3. Actual maximum value is one least significant bit less than the max

GAS GENERATOR SPEED:	Engine gas generator speed measured by the FADEC					
FADEC NAME [1]	LABEL (octal)	UNITS	Min. Value [2] (Ref. Only)	Max Value [3] (Ref. Only)	RESOLUTION (Ref. Only)	TRANSMIT RATE (milliseconds)
Ng	344	%	-256	256	0.0078125	40

BIT	DEFINITION	VALUE		
1	Label (MSB)	11		
2	Label	10		
3	Label	01		
4	Label	00		
5	Label			
6	Label			
7	Label			
8	Label (LSB)			
		Channel A	Channel B	
9	SDI	0	1	
10	SDI	1	0	
11	Data Word (LSB)	Pad (0)		
12	Data Word	Pad (0)		
13	Data Word	Pad (0)		
14	Data Word	0.0078125		
15	Data Word	0.015625		
16	Data Word	0.03125		
17	Data Word	0.0625		
18	Data Word	0.125		
19	Data Word	0.25		
20	Data Word	0.5		
21	Data Word	1		
22	Data Word	2		
23	Data Word	4		
24	Data Word	8		
25	Data Word	16		
26	Data Word	32		
27	Data Word	64		
28	Data Word	128		
29	Data Word (MSB or sign bit)	0 = positive ; 1 = negative		
		Bit 31	Bit 30	
		0	0	Failure Warning
		0	1	No Computed Data
30	SSM	1	0	Functional Test
31	SSM	1	1	Verified Data/Normal Operation
32	Parity	ODD parity bit computed by the hardware		

Notes: 1. Software variables and constants are shown in italics.
2. Negative values are encoded as the two's complements of positve values with the negative sign bit annunciated in bit 29.
3. Actual maximum value is one least significant bit less than the max

ENGINE TORQUE:	Engine torque measured by the FADEC					
FADEC NAME [1]	LABEL (octal)	UNITS	Min. Value [2] (Ref. Only)	Max Value [3] (Ref. Only)	RESOLUTION (Ref. Only)	TRANSMIT RATE (milliseconds)
Q	336	%	-256	256	0.0078125	40

BIT	DEFINITION	VALUE		
1	Label (MSB)	1		
2	Label	1		
3	Label	0		
4	Label	1		
5	Label	1		
6	Label	1		
7	Label	1		
8	Label (LSB)	0		
		Channel A	Channel B	
9	SDI	0	1	
10	SDI	1	0	
11	Data Word (LSB)	Pad (0)		
12	Data Word	Pad (0)		
13	Data Word	Pad (0)		
14	Data Word	0.0078125		
15	Data Word	0.015625		
16	Data Word	0.03125		
17	Data Word	0.0625		
18	Data Word	0.125		
19	Data Word	0.25		
20	Data Word	0.5		
21	Data Word	1		
22	Data Word	2		
23	Data Word	4		
24	Data Word	8		
25	Data Word	16		
26	Data Word	32		
27	Data Word	64		
28	Data Word	128		
29	Data Word (MSB or sign bit)	0 = positive ; 1 = negative		
		Bit 31	Bit 30	
		0	0	Failure Warning
		0	1	No Computed Data
30	SSM	1	0	Functional Test
31	SSM	1	1	Verified Data/Normal Operation
32	Parity	ODD parity bit computed by the hardware		

Notes: 1. Software variables and constants are shown in italics.
2. Negative values are encoded as the two's complements of positve values with the negative sign bit annunciated in bit 29.
3. Actual maximum value is one least significant bit less than the max

MEASURED GAS TEMPERATURE:	Engine gas temperature measured by the FADEC					
FADEC NAME [1]	LABEL (octal)	UNITS	Min. Value [2] (Ref. Only)	Max Value [3] (Ref. Only)	RESOLUTION (Ref. Only)	TRANSMIT RATE (milliseconds)
MGTdegC	345	°C	-2048	2048	0.0625	40

BIT	DEFINITION	VALUE		
1	Label (MSB)	11		
2	Label	10		
3	Label	01		
4	Label	01		
5	Label			
6	Label			
7	Label			
8	Label (LSB)			
		Channel A	Channel B	
9	SDI	0	1	
10	SDI	1	0	
11	Data Word (LSB)	Pad (0)		
12	Data Word	Pad (0)		
13	Data Word	Pad (0)		
14	Data Word	0.0625		
15	Data Word	0.125		
16	Data Word	0.25		
17	Data Word	0.5		
18	Data Word	1		
19	Data Word	2		
20	Data Word	4		
21	Data Word	8		
22	Data Word	16		
23	Data Word	32		
24	Data Word	64		
25	Data Word	128		
26	Data Word	256		
27	Data Word	512		
28	Data Word	1024		
29	Data Word (MSB or sign bit)	0 = positive ; 1 = negative		
		Bit 31	Bit 30	
		0	0	Failure Warning
		0	1	No Computed Data
30	SSM	1	0	Functional Test
31	SSM	1	1	Verified Data/Normal Operation
32	Parity	ODD parity bit computed by the hardware		

Notes: 1. Software variables and constants are shown in italics.
2. Negative values are encoded as the two's complements of positive values with the negative sign bit annunciated in bit 29.
3. Actual maximum value is one least significant bit less than the max

COMPRESSOR DISCHARGE PRESSURE Compressor discharge pressure measured by the FADEC

FADEC NAME [1]	LABEL (octal)	UNITS	Min. Value [2] (Ref. Only)	Max Value [3][4] (Ref. Only)	RESOLUTION (Ref. Only)	TRANSMIT RATE (milliseconds)
P3	264	psia	-1024	1024	0.03125	40

BIT	DEFINITION	VALUE		
1	Label (MSB)	10		
2	Label	11		
3	Label	01		
4	Label	00		
5	Label			
6	Label			
7	Label			
8	Label (LSB)			
		Channel A	Channel B	
9	SDI	0	1	
10	SDI	1	0	
11	Data Word (LSB)	Pad (0)		
12	Data Word	Pad (0)		
13	Data Word	Pad (0)		
14	Data Word	0.03125		
15	Data Word	0.0625		
16	Data Word	0.125		
17	Data Word	0.25		
18	Data Word	0.5		
19	Data Word	1		
20	Data Word	2		
21	Data Word	4		
22	Data Word	8		
23	Data Word	16		
24	Data Word	32		
25	Data Word	64		
26	Data Word	128		
27	Data Word	256		
28	Data Word	512		
29	Data Word (MSB or sign bit)	0 = positive ; 1 = negative		
		Bit 31	Bit 30	
		0	0	Failure Warning
		0	1	No Computed Data
30	SSM	1	0	Functional Test
31	SSM	1	1	Verified Data/Normal Operation
32	Parity	ODD parity bit computed by the hardware		

Notes: 1. Software variables and constants are shown in italics.
2. Negative values are encoded as the two's complements of positve values with the negative sign bit ennunciated in bit 29.
3. Actual maximum value is one least significant bit less than the max
4. ARINC 429 DITS Mark 33 Specifies Max Value of 512. A max value of 1024 is necessary to cover the requirements of this program.

ROTOR SPEED		Rotor speed measured by the FADEC					
FADEC NAME [1]		LABEL (octal)	UNITS	Min. Value [2] (Ref. Only)	Max Value [3] (Ref. Only)	RESOLUTION (Ref. Only)	TRANSMIT RATE (milliseconds)
Nr		40	%	-256	256	0.0078125	40

BIT	DEFINITION	VALUE		
1	Label (MSB)	00		
2	Label	10		
3	Label	00		
4	Label	00		
5	Label			
6	Label			
7	Label			
8	Label (LSB)			
		Channel A	Channel B	
9	SDI	0	1	
10	SDI	1	0	
11	Data Word (LSB)	Pad (0)		
12	Data Word	Pad (0)		
13	Data Word	Pad (0)		
14	Data Word	0.0078125		
15	Data Word	0.015625		
16	Data Word	0.03125		
17	Data Word	0.0625		
18	Data Word	0.125		
19	Data Word	0.25		
20	Data Word	0.5		
21	Data Word	1		
22	Data Word	2		
23	Data Word	4		
24	Data Word	8		
25	Data Word	16		
26	Data Word	32		
27	Data Word	64		
28	Data Word	128		
29	Data Word (MSB or sign bit)	0 = positive ; 1 = negative		
		Bit 31	Bit 30	
		0	0	Failure Warning
		0	1	No Computed Data
30	SSM	1	0	Functional Test
31	SSM	1	1	Verified Data/Normal Operation
32	Parity	ODD parity bit computed by the hardware		

Notes: 1. Software variables and constants are shown in italics.
2. Negative values are encoded as the two's complements of positve values with the negative sign bit annunciated in bit 29.
3. Actual maximum value is one least significant bit less than the max

COLLECTIVE PITCH POSITION	Collective pitch position measured by the FADEC					
FADEC NAME [1]	LABEL (octal)	UNITS	Min. Value [2] (Ref. Only)	Max Value [3] (Ref. Only)	RESOLUTION (Ref. Only)	TRANSMIT RATE (milliseconds)
CP	324	%	-256	256	0.0078125	40

BIT	DEFINITION	VALUE		
1	Label (MSB)	11		
2	Label	01		
3	Label	01		
4	Label	00		
5	Label			
6	Label			
7	Label			
8	Label (LSB)			
		Channel A	Channel B	
9	SDI	0	1	
10	SDI	1	0	
11	Data Word (LSB)	Pad (0)		
12	Data Word	Pad (0)		
13	Data Word	Pad (0)		
14	Data Word	0.0078125		
15	Data Word	0.015625		
16	Data Word	0.03125		
17	Data Word	0.0625		
18	Data Word	0.125		
19	Data Word	0.25		
20	Data Word	0.5		
21	Data Word	1		
22	Data Word	2		
23	Data Word	4		
24	Data Word	8		
25	Data Word	16		
26	Data Word	32		
27	Data Word	64		
28	Data Word	128		
29	Data Word (MSB or sign bit)	0 = positive ; 1 = negative		
		Bit 31	Bit 30	
		0	0	Failure Warning
		0	1	No Computed Data
30	SSM	1	0	Functional Test
31	SSM	1	1	Verified Data/Normal Operation
32	Parity	ODD parity bit computed by the hardware		

Notes: 1. Software variables and constants are shown in italics.
2. Negative values are encoded as the two's complements of positve values with the negative sign bit annunciated in bit 29.
3. Actual maximum value is one least significant bit less than the max

POWER LEVER ANGLE	Power lever angle position (in inches) measured by the FADEC					
FADEC NAME [1]	LABEL (octal)	UNITS	Min. Value [2] (Ref. Only)	Max Value [3] (Ref. Only)	RESOLUTION (Ref. Only)	TRANSMIT RATE (milliseconds)
PLATrvl	134	Inches	-4	4	0.00012207	1000

BIT	DEFINITION	VALUE		
1	Label (MSB)	01		
2	Label	01		
3	Label	11		
4	Label	00		
5	Label			
6	Label			
7	Label			
8	Label (LSB)			
		Channel A	Channel B	
9	SDI	0	1	
10	SDI	1	0	
11	Data Word (LSB)	Pad (0)		
12	Data Word	Pad (0)		
13	Data Word	Pad (0)		
14	Data Word	0.00012207		
15	Data Word	0.000244141		
16	Data Word	0.000488281		
17	Data Word	0.000976563		
18	Data Word	0.001953125		
19	Data Word	0.00390625		
20	Data Word	0.0078125		
21	Data Word	0.015625		
22	Data Word	0.03125		
23	Data Word	0.0625		
24	Data Word	0.125		
25	Data Word	0.25		
26	Data Word	0.5		
27	Data Word	1		
28	Data Word	2		
29	Data Word (MSB or sign bit)	0 = positive ; 1 = negative		
		Bit 31	Bit 30	
		0	0	Failure Warning
		0	1	No Computed Data
30	SSM	1	0	Functional Test
31	SSM	1	1	Verified Data/Normal Operation
32	Parity	ODD parity bit computed by the hardware		

Notes: 1. Software variables and constants are shown in italics.
2. Negative values are encoded as the two's complements of positve values with the negative sign bit annunciated in bit 29.
3. Actual maximum value is one least significant bit less than the max

FADEC FAULT WORD #1 FADEC confirmed fault word #1

FADEC NAME [1]	LABEL (octal)	UNITS	Min. Value [2] (Ref. Only)	Max Value [3] (Ref. Only)	RESOLUTION (Ref. Only)	TRANSMIT RATE (milliseconds)
CFltFlgWrd1	350	n/a	n/a	n/a	n/a	40

BIT	DEFINITION	VALUE		
1	Label (MSB)	11		
2	Label	10		
3	Label	10		
4	Label	00		
5	Label			
6	Label			
7	Label			
8	Label (LSB)			
		Channel A	Channel B	
9	SDI	0	1	
10	SDI	1	0	
11	Data Word (LSB)	Pad (0)		
12	Data Word	Pad (0)		
13	Data Word	Pad (0)		
14	Data Word	1 =		Gas Generator Speed Difference Fault between NgHMU and NgEng
15	Data Word	1 =		Gas Generator Speed (From HMU) Fault
16	Data Word	1 =		Background Processing Incomplete Fault
17	Data Word	1 =		Gas Generator Speed (From Engine) Fault
18	Data Word	1 =		Water Break Dyno Switch Fault
19	Data Word	1 =		Power Turbine Speed Signal 1 Fault
20	Data Word	1 =		Power Turbine Speed Signal 2 Fault
21	Data Word	1 =		Power Turbine Speed Difference Fault between Np1 and Np2
22	Data Word	1 =		Main Rotor Speed (Nr) Fault
23	Data Word	1 =		Measured Gas Temperature (Including Cold Junction Temperature) Fault
24	Data Word	1 =		Ambient Temperature (T1) Fault
25	Data Word	1 =		Engine Torque Calibration Resistor 1 Fault
26	Data Word	1 =		Engine Torque Calibration Resistor 2 Fault
27	Data Word	1 =		Ambient Pressure (P0) Fault
28	Data Word	1 =		Compressor Discharge Pressure (P3) Fault
29	Data Word (MSB)	1 =		Engine Torque (Q) Fault
		Bit 31	Bit 30	
		0	0	Failure Warning
		0	1	No Computed Data
30	SSM	1	0	Functional Test
31	SSM	1	1	Verified Data/Normal Operation
32	Parity	ODD parity bit computed by the hardware		

Notes:
1. Software variables and constants are shown in italics.
2. Negative values are encoded as the two's complements of positve values with the negative sign bit annunciated in bit 29.
3. Actual maximum value is one least significant bit less than the max
4. Bit Definition for each element of the CFltFlgWrd1 will be provided after BHT release of the ICD

FADEC FAULT WORD #2	FADEC confirmed fault word #2						
FADEC NAME [1]		LABEL (octal)	UNITS	Min. Value [2] (Ref. Only)	Max Value [3] (Ref. Only)	RESOLUTION (Ref. Only)	TRANSMIT RATE (milliseconds)
CFltFlgWrd2		351	n/a	n/a	n/a	n/a	40

BIT	DEFINITION	VALUE		
1	Label (MSB)	11		
2	Label	10		
3	Label	10		
4	Label	01		
5	Label			
6	Label			
7	Label			
8	Label (LSB)			
		Channel A	Channel B	
9	SDI	0	1	
10	SDI	1	0	
11	Data Word (LSB)	Pad (0)		
12	Data Word	Pad (0)		
13	Data Word	Pad (0)		
14	Data Word	1 =		Airframe 28V Fault
15	Data Word	1 =		Alternator Fault
16	Data Word	1 =		28V OR Diode Short Circuit Fault
17	Data Word	1 =		28V OR Diode Open Circuit Fault
18	Data Word	1 =		ECU Switched Power Fault
19	Data Word	1 =		Reserved (Spare Relay Fault)
20	Data Word	1 =		Manual Mode Relay Fault
21	Data Word	1 =		Starter Relay Fault
22	Data Word	1 =		Stepper Motor Tracking Fault
23	Data Word	1 =		Stepper Motor Phase Fault
24	Data Word	1 =		Fuel Flow Feedback RVDT Fault
25	Data Word	1 =		Power Lever Angle (PLA) Fault
26	Data Word	1 =		Frangible Link Fault
27	Data Word	1 =		Frangible Link Shutdown Command
28	Data Word	1 =		Extended Time in a Freeze State Fault
29	Data Word (MSB)	1 =		Test Cell Switch Fault
		Bit 31	Bit 30	
		0	0	Failure Warning
		0	1	No Computed Data
30	SSM	1	0	Functional Test
31	SSM	1	1	Verified Data/Normal Operation
32	Parity	ODD parity bit computed by the hardware		

Notes: 1. Software variables and constants are shown in italics.
2. Negative values are encoded as the two's complements of positve values with the negative sign bit annunciated in bit 29.
3. Actual maximum value is one least significant bit less than the max
4. Bit Definition for each element of the CFltFlgWrd2 will be provided after BHT release of the ICD

FADEC FAULT WORD #3 FADEC confirmed fault word #3

FADEC NAME [(1)]	LABEL (octal)	UNITS	Min. Value [(2)] (Ref. Only)	Max Value [(3)] (Ref. Only)	RESOLUTION (Ref. Only)	TRANSMIT RATE (milliseconds)
CFltFlgWrd3	352	n/a	n/a	n/a	n/a	40

BIT	DEFINITION	VALUE		
1	Label (MSB)	11		
2	Label	10		
3	Label	10		
4	Label	10		
5	Label			
6	Label			
7	Label			
8	Label (LSB)			
		Channel A	Channel B	
9	SDI	0	1	
10	SDI	1	0	
11	Data Word (LSB)	Pad (0)		
12	Data Word	Pad (0)		
13	Data Word	Pad (0)		
14	Data Word	1 =		12-Bit A/D Fault
15	Data Word	1 =		10-Bit QADC A Fault
16	Data Word	1 =		10-Bit QADC B Fault
17	Data Word	1 =		Overspeed Protection System Frequency Power-Up Test Fault
18	Data Word	1 =		Overspeed Protection System Fault
19	Data Word	1 =		Overspeed Protection Inhibit Feedback Fault
20	Data Word	1 =		High Level Gain Fault
21	Data Word	1 =		Low Level Gain Fault
22	Data Word	1 =		Low Level Offset Fault
23	Data Word	1 =		OR 28 Volt Fault
24	Data Word	1 =		EEPROM Fault
25	Data Word	1 =		Min Flow Solenoid IBIT Fault
26	Data Word	1 =		Shutoff Solenoid IBIT Fault
27	Data Word	1 =		Collective Pitch Fault
28	Data Word	1 =		Multiple Channel Switchovers Requested via ECU Health Score Difference
29	Data Word (MSB)	1 =		Overspeed Protection System High Event from the Other Channel Fault
		Bit 31	Bit 30	
		0	0	Failure Warning
		0	1	No Computed Data
30	SSM	1	0	Functional Test
31	SSM	1	1	Verified Data/Normal Operation
32	Parity	ODD parity bit computed by the hardware		

Notes: 1. Software variables and constants are shown in italics.
2. Negative values are encoded as the two's complements of positve values with the negative sign bit annunciated in bit 29.
3. Actual maximum value is one least significant bit less than the max
4. Bit Definition for each element of the CFltFlgWrd3 will be provided after BHT release of the ICD

FADEC FAULT WORD #4		FADEC confirmed fault word #4					
FADEC NAME [1]		LABEL (octal)	UNITS	Min. Value [2] (Ref. Only)	Max Value [3] (Ref. Only)	RESOLUTION (Ref. Only)	TRANSMIT RATE (milliseconds)
CFltFlgWrd4		353	n/a	n/a	n/a	n/a	40

BIT	DEFINITION	VALUE		
1	Label (MSB)	11		
2	Label	10		
3	Label	10		
4	Label	11		
5	Label			
6	Label			
7	Label			
8	Label (LSB)			
		Channel A	Channel B	
9	SDI	0	1	
10	SDI	1	0	
11	Data Word (LSB)	Pad (0)		
12	Data Word	Pad (0)		
13	Data Word	Pad (0)		
14	Data Word	1 =		Shutoff Solenoid Low Side Switch VBIT Fault
15	Data Word	1 =		Shutoff Solenoid High Side Switch VBIT Fault
16	Data Word	1 =		Min Flow Solenoid Low Side Switch VBIT Fault
17	Data Word	1 =		Min Flow Solenoid High Side Switch VBIT Fault
18	Data Word	1 =		OPS Min Flow Solenoid Fault During Shutdown Test
19	Data Word	1 =		OPS Shutoff Solenoid Fault During Shutdown Test
20	Data Word	1 =		Fault Storage Disable Switch Fault
21	Data Word	1 =		Manual Mode Switch Fault
22	Data Word	1 =		Reserved (Analog Output Fault)
23	Data Word	1 =		Channel Identification Fault
24	Data Word	1 =		Channel Switchover Request Switch Fault
25	Data Word	1 =		Channel Active or Channel Health Discrete Fault
26	Data Word	1 =		Other Channel Health Discrete Fault
27	Data Word	1 =		Other Channel is Unhealthy
28	Data Word	1 =		Other Channel Active Discrete Fault
29	Data Word (MSB)	1 =		CSS Commanded Channel Switchover Fault
		Bit 31	Bit 30	
		0	0	Failure Warning
		0	1	No Computed Data
30	SSM	1	0	Functional Test
31	SSM	1	1	Verified Data/Normal Operation
32	Parity	ODD parity bit computed by the hardware		

Notes:
1. Software variables and constants are shown in italics.
2. Negative values are encoded as the two's complements of positve values with the negative sign bit annunciated in bit 29.
3. Actual maximum value is one least significant bit less than the max
4. Bit Definition for each element of the CFltFlgWrd4 will be provided after BHT release of the ICD

FADEC FAULT WORD #5	FADEC confirmed fault word #5					
FADEC NAME [1]	**LABEL** (octal)	**UNITS**	**Min. Value** [2] (Ref. Only)	**Max Value** [3] (Ref. Only)	**RESOLUTION** (Ref. Only)	**TRANSMIT RATE** (milliseconds)
CFltFlgWrd5	354	n/a	n/a	n/a	n/a	40

BIT	DEFINITION	VALUE		
1	Label (MSB)	11		
2	Label	10		
3	Label	11		
4	Label	00		
5	Label			
6	Label			
7	Label			
8	Label (LSB)			
		Channel A	Channel B	
9	SDI	0	1	
10	SDI	1	0	
11	Data Word (LSB)	Pad (0)		
12	Data Word	Pad (0)		
13	Data Word	Pad (0)		
14	Data Word	1 =		Control System Software Identification Fault
15	Data Word	1 =		Operating System Software Identification Fault
16	Data Word	1 =		On-Line Loader Software Identification Fault
17	Data Word	1 =		Np Beeper Up Fault
18	Data Word	1 =		Np Beeper Down Fault
19	Data Word	1 =		Np Beeper State Fault
20	Data Word	1 =		RPM Command Switch Fault
21	Data Word	1 =		Excessive Incomplete Powerup Tests
22	Data Word	1 =		Cross Channel Data Link Fault
23	Data Word	1 =		Excessive Incomplete Shutdown Tests
24	Data Word	1 =		ARINC Fault
25	Data Word	1 =		ARINC Chip Power Up Test Fault
26	Data Word	1 =		Invalid RPM Command from ARINC
27	Data Word	1 =		Fuel Flow Metering Valve Cross-Channel Comparison Confirmed Fault
28	Data Word	1 =		Start Switch Fault
29	Data Word (MSB)	1 =		Development Test Switch Fault
		Bit 31	Bit 30	
		0	0	Failure Warning
		0	1	No Computed Data
30	SSM	1	0	Functional Test
31	SSM	1	1	Verified Data/Normal Operation
32	Parity	ODD parity bit computed by the hardware		

Notes:
1. Software variables and constants are shown in italics.
2. Negative values are encoded as the two's complements of positve values with the negative sign bit annunciated in bit 29.
3. Actual maximum value is one least significant bit less than the max
4. Bit Definition for each element of the CFltFlgWrd5 will be provided after BHT release of the ICD

Selected Control Loop	FADEC selected control loop					
FADEC NAME [1]	LABEL (octal)	UNITS	Min. Value [2] (Ref. Only)	Max Value [3] (Ref. Only)	RESOLUTION (Ref. Only)	TRANSMIT RATE (milliseconds)
Loop	7	n/a	32768	32768	1	40

BIT	DEFINITION	VALUE		
1	Label (MSB)	00		
2	Label	00		
3	Label	01		
4	Label	11		
5	Label			
6	Label			
7	Label			
8	Label (LSB)			
		Channel A	Channel B	
9	SDI	0	1	
10	SDI	1	0	
11	Data Word (LSB)	Pad (0)		
12	Data Word	Pad (0)		
13	Data Word	Pad (0)		
14	Data Word	1		
15	Data Word	2		
16	Data Word	4		
17	Data Word	8		
18	Data Word	16		
19	Data Word	32		
20	Data Word	64		
21	Data Word	128		
22	Data Word	256		
23	Data Word	512		
24	Data Word	1024		
25	Data Word	2048		
26	Data Word	4096		
27	Data Word	8192		
28	Data Word	16384		
29	Data Word (MSB or sign bit)	0 = positive ; 1 = negative		
		Bit 31	Bit 30	
		0	0	Failure Warning
		0	1	No Computed Data
30	SSM	1	0	Functional Test
31	SSM	1	1	Verified Data/Normal Operation
32	Parity	ODD parity bit computed by the hardware		

Notes: 1. Software variables and constants are shown in italics.
2. Negative values are encoded as the two's complements of positive values with the negative sign bit annunciated in bit 29.
3. Actual maximum value is one least significant bit less than the max.

Discrete Word 1		FADEC-Packed Discrete Word 1					
FADEC NAME (1)		LABEL (octal)	UNITS	Min. Value (2) (Ref. Only)	Max Value (3) (Ref. Only)	RESOLUTION (Ref. Only)	TRANSMIT RATE (milliseconds)
DiscreteWrd		270	n/a	n/a	n/a	n/a	40

BIT	DEFINITION	VALUE		
1	Label (MSB)	10		
2	Label	11		
3	Label	10		
4	Label	00		
5	Label			
6	Label			
7	Label			
8	Label (LSB)			
		Channel A	Channel B	
9	SDI	0	1	
10	SDI	1	0	
11	Data Word (LSB)	Pad (0)		
12	Data Word	Pad (0)		
13	Data Word	Pad (0)		
14	Data Word	1 =		Nr/Np Beep Up Switch Discrete
15	Data Word	1 =		Nr/Np Beep Down Switch Discrete
16	Data Word	1 =		RPM Command Switch Discrete (For Quiet Mode ARINC Validation)
17	Data Word	1 =		Incident Detected
18	Data Word	1 =		Manual Select Switch Discrete
19	Data Word	1 =		ECU Hard Fault
20	Data Word	1 =		Develop Test Switch Discrete
21	Data Word	1 =		ECU Degrade Fault
22	Data Word	1 =		Test Cell Switch Discrete
23	Data Word	1 =		Channel Active Discrete
24	Data Word	1 =		Other Channel Active Discrete
25	Data Word	1 =		Channel Health Discrete
26	Data Word	1 =		Other Channel Health Discrete
27	Data Word	1 =		Channel Switchover Request Switch Discrete
28	Data Word	1 =		Channel ID Discrete
29	Data Word (MSB)	1 =		Fault Storage Disable Switch Discrete
		Bit 31	Bit 30	
		0	0	Failure Warning
		0	1	No Computed Data
30	SSM	1	0	Functional Test
31	SSM	1	1	Verified Data/Normal Operation
32	Parity	ODD parity bit computed by the hardware		

Notes: 1. Software variables and constants are shown in italics.
2. Negative values are encoded as the two's complements of positve values with the negative sign bit annunciated in bit 29
3. Actual maximum value is one least significant bit less than the max

Discrete Word 2 FADEC-Packed Discrete Word 2

FADEC NAME (1)		LABEL (octal)		UNITS	Min. Value (2) (Ref. Only)	Max Value (3) (Ref. Only)	RESOLUTION (Ref. Only)	TRANSMIT RATE (milliseconds)
DiscreteWrd2		**271**		n/a	n/a	n/a	n/a	40
BIT	**DEFINITION**	**VALUE**						
1	Label (MSB)	1						
2	Label	0						
3	Label	1						
4	Label	1						
5	Label	1						
6	Label	0						
7	Label	0						
8	Label (LSB)	1						
		Channel A	Channel B					
9	SDI	0	1					
10	SDI	1	0					
11	Data Word (LSB)	Pad (0)						
12	Data Word	Pad (0)						
13	Data Word	Pad (0)						
14	Data Word	1 =		Engine Out				
15	Data Word	1 =		Currently Not Used				
16	Data Word	1 =		Water Brake Dyno Discrete Active				
17	Data Word	1 =		Starter Engaged				
18	Data Word	1 =		Overspeed Event				
19	Data Word	1 =		Start Discrete				
20	Data Word	1 =		Currently Not Used				
21	Data Word	1 =		Overspeed Inhibit Wrap				
22	Data Word	1 =		Overspeed Protection System Enable Shutoff Command				
23	Data Word	1 =		High Side of the Min Flow Solenoid Voltage Built-In Test Circuit Flag				
24	Data Word	1 =		High Side of the Shutoff Solenoid Voltage Built-In Test Circuit Flag				
25	Data Word	1 =		Low Side of the Min Flow Solenoid Voltage Built-In Test Circuit Flag				
26	Data Word	1 =		Low Side of the Shutoff Solenoid Voltage Built-In Test Circuit Flag				
27	Data Word	1 =		Switch Power Monitor Voltage Built-In Test				
28	Data Word	1 =		Switch Power Enabled Flag				
29	Data Word (MSB)	1 =		Manual Relay Voltage Built-In Test Flag				
		Bit 31	Bit 30					
		0	0	Failure Warning				
		0	1	No Computed Data				
30	SSM	1	0	Functional Test				
31	SSM	1	1	Verified Data/Normal Operation				
32	Parity	ODD parity bit computed by the hardware						

Notes: 1. Software variables and constants are shown in italics.
2. Negative values are encoded as the two's complements of positve values with the negative sign bit annunciated in bit 29.
3. Actual maximum value is one least significant bit less than the max

Cumulative Number of Starts FADEC Cumulative Number of Starts for Engine History

FADEC NAME [1]	LABEL (octal)	UNITS	Min. Value [2] (Ref. Only)	Max Value [3] (Ref. Only)	RESOLUTION (Ref. Only)	TRANSMIT RATE (milliseconds)
NumStrt	**155**	%	-32768	32768	1	1000

BIT	DEFINITION	VALUE		
1	Label (MSB)	0		
2	Label	1		
3	Label	1		
4	Label	0		
5	Label	1		
6	Label	1		
7	Label	0		
8	Label (LSB)	1		
		Channel A	Channel B	
9	SDI	0	1	
10	SDI	1	0	
11	Data Word (LSB)	Pad (0)		
12	Data Word	Pad (0)		
13	Data Word	Pad (0)		
14	Data Word	1		
15	Data Word	2		
16	Data Word	4		
17	Data Word	8		
18	Data Word	16		
19	Data Word	32		
20	Data Word	64		
21	Data Word	128		
22	Data Word	256		
23	Data Word	512		
24	Data Word	1024		
25	Data Word	2048		
26	Data Word	4096		
27	Data Word	8192		
28	Data Word	16384		
29	Data Word (MSB or sign bit)	0 = positive ; 1 = negative		
		Bit 31	Bit 30	
		0	0	Failure Warning
		0	1	No Computed Data
30	SSM	1	0	Functional Test
31	SSM	1	1	Verified Data/Normal Operation
32	Parity	ODD parity bit computed by the hardware		

Notes: 1. Software variables and constants are shown in italics.
2. Negative values are encoded as the two's complements of positve values with the negative sign bit annunciated in bit 29.
3. Actual maximum value is one least significant bit less than the max

Total Engine Hours	FADEC Total Engine Hours for Engine History					
FADEC NAME [1]	**LABEL** (octal)	**UNITS**	**Min. Value** [2] (Ref. Only)	**Max Value** [3] (Ref. Only)	**RESOLUTION** (Ref. Only)	**TRANSMIT RATE** (milliseconds)
EngRnTm	**156**	%	-8192	8192	0.25	1000

BIT	DEFINITION	VALUE		
1	Label (MSB)	0		
2	Label	1		
3	Label	1		
4	Label	0		
5	Label	1		
6	Label	1		
7	Label	1		
8	Label (LSB)	0		
		Channel A	Channel B	
9	SDI	0	1	
10	SDI	1	0	
11	Data Word (LSB)	Pad (0)		
12	Data Word	Pad (0)		
13	Data Word	Pad (0)		
14	Data Word	0.25		
15	Data Word	0.5		
16	Data Word	1		
17	Data Word	2		
18	Data Word	4		
19	Data Word	8		
20	Data Word	16		
21	Data Word	32		
22	Data Word	64		
23	Data Word	128		
24	Data Word	256		
25	Data Word	512		
26	Data Word	1024		
27	Data Word	2048		
28	Data Word	4096		
29	Data Word (MSB or sign bit)	0 = positive ; 1 = negative		
		Bit 31	Bit 30	
		0	0	Failure Warning
		0	1	No Computed Data
30	SSM	1	0	Functional Test
31	SSM	1	1	Verified Data/Normal Operation
32	Parity	ODD parity bit computed by the hardware		

Notes: 1. Software variables and constants are shown in italics.
2. Negative values are encoded as the two's complements of positve values with the negative sign bit annunciated in bit 29.
3. Actual maximum value is one least significant bit less than the max

Total Gas Generator Cycles	FADEC Total Gas Generator Cycles for Engine History						
FADEC NAME [(1)]	**LABEL** (octal)	**UNITS**	**Min. Value** [(2)] (Ref. Only)	**Max Value** [(3)] (Ref. Only)	**RESOLUTION** (Ref. Only)	**TRANSMIT RATE** (milliseconds)	
NgCC	**157**	%	-32768	32768	1	1000	

BIT	DEFINITION	VALUE		
1	Label (MSB)	0		
2	Label	1		
3	Label	1		
4	Label	0		
5	Label	1		
6	Label	1		
7	Label	1		
8	Label (LSB)	1		
		Channel A	Channel B	
9	SDI	0	1	
10	SDI	1	0	
11	Data Word (LSB)	Pad (0)		
12	Data Word	Pad (0)		
13	Data Word	Pad (0)		
14	Data Word	1		
15	Data Word	2		
16	Data Word	4		
17	Data Word	8		
18	Data Word	16		
19	Data Word	32		
20	Data Word	64		
21	Data Word	128		
22	Data Word	256		
23	Data Word	512		
24	Data Word	1024		
25	Data Word	2048		
26	Data Word	4096		
27	Data Word	8192		
28	Data Word	16384		
29	Data Word (MSB or sign bit)	0 = positive ; 1 = negative		
		Bit 31	Bit 30	
		0	0	Failure Warning
		0	1	No Computed Data
30	SSM	1	0	Functional Test
31	SSM	1	1	Verified Data/Normal Operation
32	Parity	ODD parity bit computed by the hardware		

Notes: 1. Software variables and constants are shown in italics.
2. Negative values are encoded as the two's complements of positve values with the negative sign bit annunciated in bit 29.
3. Actual maximum value is one least significant bit less than the max

Total Power Turbine Cycles	FADEC Total Power Turbine Cycles for Engine History					
FADEC NAME (1)	**LABEL** (octal)	**UNITS**	**Min. Value** (2) (Ref. Only)	**Max Value** (3) (Ref. Only)	**RESOLUTION** (Ref. Only)	**TRANSMIT RATE** (milliseconds)
NpCC	**160**	%	-32768	32768	1	1000

BIT	DEFINITION	VALUE		
1	Label (MSB)	0		
2	Label	1		
3	Label	1		
4	Label	1		
5	Label	0		
6	Label	0		
7	Label	0		
8	Label (LSB)	0		
		Channel A	Channel B	
9	SDI	0	1	
10	SDI	1	0	
11	Data Word (LSB)	Pad (0)		
12	Data Word	Pad (0)		
13	Data Word	Pad (0)		
14	Data Word	1		
15	Data Word	2		
16	Data Word	4		
17	Data Word	8		
18	Data Word	16		
19	Data Word	32		
20	Data Word	64		
21	Data Word	128		
22	Data Word	256		
23	Data Word	512		
24	Data Word	1024		
25	Data Word	2048		
26	Data Word	4096		
27	Data Word	8192		
28	Data Word	16384		
29	Data Word (MSB or sign bit)	0 = positive ; 1 = negative		
		Bit 31	Bit 30	
		0	0	Failure Warning
		0	1	No Computed Data
30	SSM	1	0	Functional Test
31	SSM	1	1	Verified Data/Normal Operation
32	Parity	ODD parity bit computed by the hardware		

Notes: 1. Software variables and constants are shown in italics.
2. Negative values are encoded as the two's complements of positve values with the negative sign bit annunciated in bit 29.
3. Actual maximum value is one least significant bit less than the max

Last Flight NG Cycles		NG Cycles from the last flight as stored in EEPROM after shutdown					
FADEC NAME (1)		**LABEL** (octal)	**UNITS**	**Min. Value (2)** (Ref. Only)	**Max Value (3)(4)** (Ref. Only)	**RESOLUTION** (Ref. Only)	**TRANSMIT RATE** (milliseconds)
NgCCDltaSel		**161**	Cycles	-256	256	0.0078125	1000
BIT	**DEFINITION**	**VALUE**					
1	Label (MSB)	0					
2	Label	1					
3	Label	1					
4	Label	1					
5	Label	0					
6	Label	0					
7	Label	0					
8	Label (LSB)	1					
		Channel A	Channel B				
9	SDI	0	1				
10	SDI	1	0				
11	Data Word (LSB)	Pad (0)					
12	Data Word	Pad (0)					
13	Data Word	Pad (0)					
14	Data Word	0.0078125					
15	Data Word	0.015625					
16	Data Word	0.03125					
17	Data Word	0.0625					
18	Data Word	0.125					
19	Data Word	0.25					
20	Data Word	0.5					
21	Data Word	1					
22	Data Word	2					
23	Data Word	4					
24	Data Word	8					
25	Data Word	16					
26	Data Word	32					
27	Data Word	64					
28	Data Word	128					
29	Data Word (MSB or sign bit)	0 = positive ; 1 = negative					
		Bit 31	Bit 30				
		0	0	Failure Warning			
		0	1	No Computed Data			
30	SSM	1	0	Functional Test			
31	SSM	1	1	Verified Data/Normal Operation			
32	Parity	ODD parity bit computed by the hardware					

Notes: 1. Software variables and constants are shown in italics.
2. Negative values are encoded as the two's complements of positve values with the negative sign bit annunciated in bit 29.
3. Actual maximum value is one least significant bit less than the max
4. ARINC 429 DITS Mark 33 Specifies Max Value of 256. A max value of 512 is necessary to cover the requirements of this program.
5. ARINC 429 Mark 33 Digital Information Transfer System Specification Part 1 specifies this label be transmitted in °C. Current ECU Software calculates this parameter in °F.

Last Flight NP Cycles	NP Cycles from the last flight as stored in EEPROM after shutdown					
FADEC NAME (1)	LABEL (octal)	UNITS	Min. Value (2) (Ref. Only)	Max Value (3) (Ref. Only)	RESOLUTION (Ref. Only)	TRANSMIT RATE (milliseconds)
NpCCDltaSel	**162**	Cycles	-256	256	0.0078125	1000

BIT	DEFINITION	VALUE		
1	Label (MSB)	0		
2	Label	1		
3	Label	1		
4	Label	1		
5	Label	0		
6	Label	0		
7	Label	1		
8	Label (LSB)	0		
		Channel A	Channel B	
9	SDI	0	1	
10	SDI	1	0	
11	Data Word (LSB)	Pad (0)		
12	Data Word	Pad (0)		
13	Data Word	Pad (0)		
14	Data Word	0.0078125		
15	Data Word	0.015625		
16	Data Word	0.03125		
17	Data Word	0.0625		
18	Data Word	0.125		
19	Data Word	0.25		
20	Data Word	0.5		
21	Data Word	1		
22	Data Word	2		
23	Data Word	4		
24	Data Word	8		
25	Data Word	16		
26	Data Word	32		
27	Data Word	64		
28	Data Word	128		
29	Data Word (MSB or sign bit)	0 = positive ; 1 = negative		
		Bit 31	Bit 30	
		0	0	Failure Warning
		0	1	No Computed Data
30	SSM	1	0	Functional Test
31	SSM	1	1	Verified Data/Normal Operation
32	Parity	ODD parity bit computed by the hardware		

Notes: 1. Software variables and constants are shown in italics.
2. Negative values are encoded as the two's complements of positve values with the negative sign bit annunciated in bit 29.
3. Actual maximum value is one least significant bit less than the max

Table 76-2: Caution, Warning, and Advisory Light Outputs

Nomenclature	Warning / Caution / Advisory	Function
Engine Out	Warning	Indicates when engine N_G drops below idle -3% or an uncommanded deceleration occurs for 0.5 seconds.
Engine Overspeed	Warning	Indicates that the engine control has detected an engine overspeed event.
FADEC Fail	Warning	Indicates a dual-channel ECU hard fault and that the engine has failed to the last commanded fuel flow.
FADEC Degraded	Caution	The active ECU channel indicates a loss of function resulting in degraded operation or performance, based on ARINC 429 data from the ECU channel n control.
FADEC CH Fail	Caution	Indicates that an ECU channel has failed and that control was automatically swapped to the other channel, based on the ARINC 429 data from the ECU channel in control.
A/F Fuel Filter	Caution	Indicates that the airframe fuel filter impending bypass is detected.
Eng Fuel Filter	Caution	Indicates that an engine fuel filter impending bypass is detected.
Eng Chip Detect	Caution	Indicates that metal chip (s) have been sensed by the engine scavenge oil chip detector.

Nomenclature	Warning / Caution / Advisory	Function
Check INSTR	Caution	Indicates that any of the following gauges detected exceedances: Dual Tach – N_P exceeds 105.0% N_G – exceeds 103.6% MGT –exceeds 958°C Torque –exceeds 110.0% Engine Oil Press – below 20 psi and above 120 psi Engine Oil Temp – above 110°C Fuel Quantity – fault detected Fuel Press - below 8 psi and above 25 psi Ammeter – above 180 Amps **NOTE** *Refer to ICA-E407-789 Chapter 95 – Instruments and Chapter 96 for detailed description and operation of Check Instrument Annunciator.*
FADEC Maint	Advisory	Indicates faults or failures in the FADEC related to redundancy or nonperformance-related features, or indicates that the engine incident has been logged by the ECU. This indication is provided after engine shutdown.
Engine Anti-Ice	Advisory	Indicates that the engine anti-ice is ON based upon the anti-ice switch position.
Start	Advisory	Indicates that the engine start is initiated.
Start Fault	Advisory	Indicates that the engine may not start.

76.3.1.2 Fault Reset

Cycling the FADEC RESET switch button instructs the ECU to attempt to clear/reset any faults that might be present in the ECU. FADEC reset can be done on ground and in flight. Stable flight conditions are recommended when attempting to reset/clear ECU faults.

76.3.2 EXCEEDANCES

76.3.2.1 Engine Indicators Exceedance Monitoring

Engine indicators (Torque, N_P/N_R, N_G, and MGT) are equipped with a non-volatile memory that monitor and record engine parameter exceedances. Indicators are programmed with pre-determined limits and time- monitored. Peak values and duration during operations are recorded in the memory. Exceedances are also flagged and activate caution annunciator (CHECK INSTR) when exceed described limits.

To acknowledge an exceedance event, LCD test button can be pressed. The indicator's digital display will play back peak value of the exceedance while the CHECK INSTR annunciator will go off after the LCD test button is released.

NOTE

Refer to Chapter 95 for detailed description and operation of indicator exceedances and system maintenance.

NOTE

Refer to Chapter 96 for detailed description and operation of CHECK INSTR annunciator system.

Data can be retrieved by communication with the indicators through the serial port (RS-485) installed on the left hand side center console. The digital displays play back portions of the data during power-up, or when the indicator check function is activated (LCD test switch).

Duration of indicator exceedances should be recorded in the engine log book. Those exceedances with accumulative time are associated with maintenance requirement.

NOTE

Refer to Honeywell LMM for HTS900-2-1D for detailed Exceedance Maintenance Requirement.

76.3.2.2 Torque Conversion

The interpretation of what represents 100% indicated torque is different from 100% engine torque recorded by the FADEC/ECU. The signal output of torque transducer installed on the engine, is the value recorded and monitored by the FADEC/ECU for control operation. Due to the physical restriction on the main transmission, the indication of 100% torque equates its continuous operational capability. Thus, the ARINC 429 signal transmitted by the FADEC/ECU for indication has been conditioned so that the gauge reads 100% at 560 ft-lbs. To determine the engine (FADEC/ECU) torque, use the factor i.e. (Q × .8903) or (Q ÷1.123). When evaluating an engine overtorque situation (Honeywell Light Maintenance Manual HTS900-2-1D), the following information will be valuable in relating the torque indication system to the relevant engine values. The relationship between the torque indicator system and the FADEC system is shown in Table 76-3.

Table 76-3: Relationship between Torque Indicator and FADEC System

TORQUE INDICATOR (%)	FADEC TORQUE (%)	HORSEPOWER (HP)	FOOT-POUNDS	PSI
121.7	108.40	820	682	59.83
114.2	101.70	769	640	56.06
112.3	100.00	757	629	55.06
100.0	89.00	674	560	48.81
93.5	83.25	630	524	45.55
21.4	19.10	144	120	8.93

76.3.2.3 Downloading Exceedances Recorded by the Indicators

SPECIAL TOOLS REQUIRED

NUMBER	NOMENCLATURE
	M407 Maintenance-Diamond J software

1. Set the battery switch to BATT, or connect the external DC power to the helicopter.
2. Pull the indicator's associated circuit breaker (Torque, N_P/N_R, N_G, or MGT).
3. Establish communication between the Instrument Maintenance Computer and the helicopter by connecting to the serial interface RS-485.
4. Select perform indicator (Torque, N_P/N_R, N_G, or MGT) Memory Read in the maintenance software.
5. Engage the circuit breaker.
6. The maintenance software will show that the indicator memory is being read.
7. Save data to a known folder. After the download, the maintenance software will show that the indicator memory has been completely read.
8. Select perform indicator (Torque, N_P/N_R, N_G, or MGT) Memory Clear in software.
9. The torque indicator will display “EC” for five seconds to indicate that the indicator is ready to clear the memory.
10. The indicator will then display “EC##”, indicating that the memory is being cleared.
11. The indicator will then display “EC--“, indicating the memory has been completely cleared.
12. Pull the circuit breaker.
13. Perform power-up test to confirm indicator memory have been reset.
14. Set the battery switch to OFF, or disconnect the external DC power to the helicopter.
15. Return the helicopter to the standard configuration. Refer to Standard

Practices — After Electrical Maintenance or Repairs (Chapter 96).

76.3.3 CYCLE COUNT

76.3.3.1 Last Flight Power Turbine Cycle Count

Last flight power turbine cycle count is available to the crew on the Measured Gas Temperature (MGT) indicator after engine shutdown when N_G is less than 5%. This information is being transmitted by the ECU via ARINC 429 data bus word label 162 from both ECU channels. The indicator uses the data from the channel in control. After the ECU power is cycled, ARINC 429 resets to 0.0. During this time, the indicator's recorded value for the last flight cycle is available to the crew until the N_G is more than 5% (indicator shows the MGT value). The cycle count resets following a successful engine start with N_G at 55%.

76.3.3.2 Last Flight Gas Producer Cycle Count

Last flight gas producer cycle count is available to the crew on the Gas Producer (N_G) indicator after engine shutdown when N_G less than 5%. This information is being transmitted by the ECU via ARINC 429 data bus word label 161 from both ECU channels. The indicator uses the data from the channel in control. After the ECU power is cycled, ARINC 429 resets to 0.0. During this time, the indictor's recorded value for the last flight cycle is available to the crew until the N_G is more than 5% (indicator shows the N_G value). The cycle count resets following a successful engine start with N_G at 55%

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76.4 GROUND SUPPORT EQUIPMENT

A Honeywell developed HTS900 GSTS software version LTCT32072 provides user-level capabilities in support to FADEC/ ECU and engine operations. This software provides the following capabilities.

- Operating History -Engine history data can be uploaded to a laptop computer for viewing or saving, and downloaded to the ECU if the control is transferred to another engine.
- Torque Calibration – Gain and Offset arguments used by the engine/ECU can be inspected and/or adjusted using this interface.
- Fault Display and Fault Snapshot – The ECU's live mode and stored mode fault words can be displayed, clearly identifying each fault bit with a one-line explanation. Additionally, the ECU's fault snapshot data can be uploaded and saved.
- Incident Recorder Interrogation – Event information associated with the incident recorder ECU capabilities can be uploaded to the laptop computer for viewing or saving.

76.4.1 ENGINE HISTORY RECORDING

The FADEC control system has the capability of recording engine history and protects the last successful recording against power failure during updating. Engine history records listed on Table 76-4 area available for download to the Ground Support Equipment (GSE).

All of the history recordings, with the exception of ECU operating hours, can be overwritten using the GSE.

Table 76-4: Engine History Records

Record Description
Engine Serial Number
Total number of engine starts
Total engine operating hours
N_P exceedance time: Above 104 percent (airframe-specified limit)
Engine Torque exceedance time above limits: Takeoff =682 ft-lbs Maximum permissible = 760 ft-lbs
MGT exceedance time above limits: Maximum continuous = 1652°F (900°C) Takeoff =1757°F (958°C) Transient = 1790°F (977°C)
N_G exceedance time above limits: Maximum continuous =101.1% Takeoff = 103.6% Transient =104.4%
Total ECU operating hours

76.4.2 TORQUE SYSTEM CALIBRATION

76.4.2.1 Torque Transducer Calibration

This procedure applies to in-service replacement of an ECU or engine. The ECU must be programmed with engine-specific torque calibration constants.

SPECIAL TOOLS REQUIRED

NUMBER	NOMENCLATURE
2311F or Equivalent	Barfield Pressure Tester, 0 to 300 PSI
	Honeywell Ground Support Test Set

1. Disconnect the engine oil tube from the torque transducer pressure port.

WARNING

PRESSURE TESTER ACCURACY OF NO MORE THAN ±0.1% OF THE PRESSURE READING IS REQUIRED.

2. Connect a dead weight pressure tester to the transducer pressure port.

3. Set the battery switch to BATT, or connect the external DC power to the helicopter

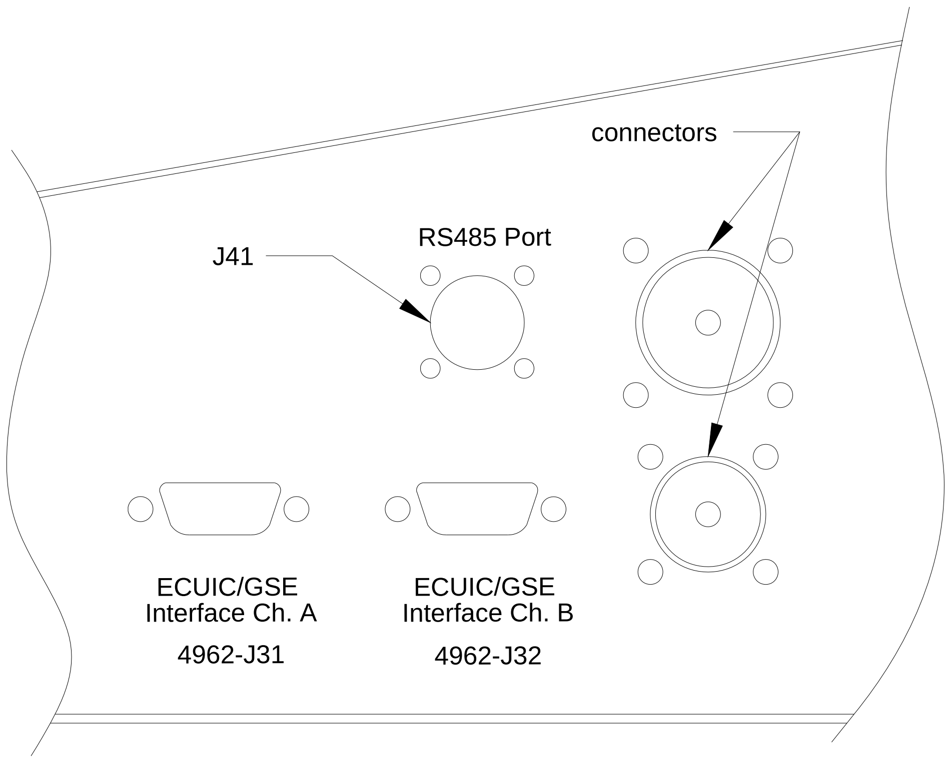


Figure 76- 7: Ground Interface – LH Center Pedestal

4. On the overhead panel, close the FADEC CH A PWR (4962CB1), FADEC CH B PWR (4962CB2) circuit breakers.

5. Establish communication between the aircraft and the FADEC ECU by connecting the GSTS on the ground terminal on the left hand side center console.

WARNING

OPERATING THE GSTS WITH THE PLA _NOT_ IN THE OFF POSITION WILL RESULT IN THE INCORRECT DISPLAY OF DATA.

6. Launch the GSTS application.

7. Open the "User Level" menu from the tool bar and log in.

8. Open Torque Calibration page from the GSTS main toolbar.

9. Select the Channel "A" radio button.

10. Using the pressure tester, apply "$Q_{pressure}$ (LOW)" value from the Engine Log Book. The value is in psig on form DS_1467 for "PTQM at 120 ft-lbs".

11. Press the "Read" button adjacent to "$Q_{pressure}$ (LOW)" in the calibration worksheet. The GSTS will store a 5-

second average of the torque transducer pressure.

NOTE

The GSTS will only save pressures within the valid range: Invalid entries will be flagged and NOT stored. The "$Q_{pressure}$ (LOW)" allowable (valid) range is 7.5 psig to 10.5 psig.

CAUTION

APPLYING A CALIBRATION PRESSURE ABOVE APPROXIMATELY 75 psig WILL CAUSE A TORQUE RANGE FAULT IN THE CONTROL SYSTEM. LIMIT THE CALIBRATION PRESSURE APPLIED TO THE TRANSDUCER DURING THIS PROCEDURE TO 65 psig.

IF A FAULT IS PRESENT, CLEAR THE FAULT AND RESTART THE CALIBRATION PROCESS.

12. Slowly increase the tester's pressure to reach "$Q_{pressure}$ (HIGH)" value recorded in the Engine Log Book. The value is in psig on form DS-1467A for "PTQM at 640 ft-lbs".

13. Press the "Read" button adjacent to "$Q_{pressure}$ (HIGH)" in the calibration worksheet. The GSTS will store a 5-second average of the torque transducer pressure.

NOTE

The GSTS will only save pressures within the valid range: Invalid entries will be flagged and NOT stored. The "$Q_{pressure}$ (HIGH)" allowable (valid) range is 53.6 psig to 56.6 psig.

The GSTS will automatically calculate Torque Gain and Offset per the following formulas:

Gain, ft-lbs/psig = (520)/ ΔQp

and

Offset, ft-lbs = 640 – [Gain* $Q_{pressure}$ (HIGH)]

Where, $\Delta Qp = Q_{pressure}\ (HIGH) - Q_{pressure}\ (LOW)$

NOTE

Calculated Gain and Offset values should appear in the "Proposed" block for gain and offset values on both channels once valid High and Low pressure values are stored.

14. Make sure Gain and Offset values are within the ECU range limits provided below:

10.92 ft-lbs/psig $\leq$ **Gain** $\leq$ 11.64 ft-lbs/psig

1.82 ft-lbs $\leq$ **Offset** $\leq$ 35.00 ft-lbs.

As a reference, the most likely values for gain and offset are 11.28ft-lbs/psig and 18.37 ft-lbs respectively.

15. Download the Gain and Offset values to the ECU by clicking on the "Use Proposed" button.

NOTE

Once download is complete, the GSTS will automatically save a torque calibration data *file for that channel. The file name format is "EngineSN_qcal_Chnl_DateStamp_Time Stamp.xml".*

16. Use the saved file to update the Engine Log Book.

17. Select the channel "B" radio Button.

18. Repeat step (10) through step (16) for Channel "B".

19. Exit the torque calibration screen.

The following procedures are to make sure the new torque calibration proposed values from step 14 are the new "Current" values in use by each ECU channel.

20. Reset helicopter power. During power up, the ECU will read the new calibration numbers from EEPROM into RAM and use the values to calculate the (Q).

21. Wait 10 seconds and repeat step (5) through step (7).

22. Open Torque Calibration page from the GSTS main toolbar.

23. Select the Channel "A" radio button.

24. Verify the "Current" gain and offset values on paper to use in Step (31).

The following steps re-apply the calibaration pressure and verify that the torque reading is within limits.

NOTE

ECU torque reading is different from the torque indicator. Torque conversion should be applied to determine the indicated torque.

25. Using the pressure tester, apply "$Q_{pressure}$ (LOW)" value from the Engine Log Book. The value is in psig on form DS_1467 for "PTQM at 120 ft-lbs". Verify the value displayed in the "Torque (Q)" field is 19.1%Q ±1.0%Q.

NOTE

If the torque value is out of range, repeat the calibration process.

26. Select the Channel "B" radio button.

27. Repeat step (25).

28. Using the pressure tester, apply "$Q_{pressure}$ (HIGH)" value from the Engine Log Book. The value is in psig on form DS_1467 for "PTQM at 640 ft-lbs". Verify the value displayed in the "Torque (Q)" field is 101.7%Q ±1.3%Q.

29. Select the Channel "A" radio button.

30. Repeat step (28).

NOTE

If the torque value is out of range, repeat the calibration process.

31. Calculate ΔOffset and ΔGain.

Where,
Δ Offset = |Offset from Channel A – Offset from Channel B|,

And

Δ **Gain** = |Gain from Channel A – Gain from Channel B|

32. Make sure the Gain and Offset difference between channel A and channel B are within the limits below:

Δ **Offset** $\leq$ **20 ft-lbs**

and

Δ **Gain** $\leq$ **0.4 ft-lbs/psig**

NOTE

If any of the values are out of range, trouble shoot and repair as necessary.

33. Exit the Torque Calibration Screen.

34. Ensure both ECU channels are Fault Free by selecting "Fault" menu from the GSTS toolbar and choose "live Mode Faults".

35. Ensure that "FADEC MAINT" is not annunciated in the cockpit.

36. Close the GSTS application.

37. Return the helicopter to its original configuration.

76.4.2.2 Torque Calibration Constants Re-Load

This procedure is required when experiencing "CalRes1Fault" or "CalRes2Fault". The torque calibration constants (Gain and Offset) need to be checked and re-loaded.

SPECIAL TOOLS REQUIRED

NUMBER	NOMENCLATURE
	Honeywell Ground Support Test Set

1. Set the battery switch to BATT, or connect the external DC power to the helicopter

2. On the overhead panel, close the FADEC CH A PWR (4962CB1), FADEC CH B PWR (4962CB2) circuit breakers.

3. Establish communication between the aircraft and the FADEC ECU by connecting the GSTS on the ground terminal on the left hand side center console.

WARNING

OPERATING THE GSTS WITH THE PLA *NOT* IN THE OFF POSITION WILL RESULT IN THE INCORRECT DISPLAY OF DATA.

4. Launch the GSTS application.

5. Open the "User Level" menu from the tool bar and log in.

6. Open Torque Calibration page from the GSTS main toolbar.

7. Select the Channel "A" radio button.

8. Click on the "Retrieve Constants" button to select the current torque calibration report file for Channel A. When the file's

gain and offset values are displayed, ensure they agree with the Engine Log Book and meet the range and difference requirements discussed on paragraph 76.4.2.1.

OR

Type in the gain and offset values for ECU channel A from the Engine Log Book into the appropriate "Proposed" fields.

9. Download the retrieved Gain and Offset values to the ECU by clicking on the "Use Retrieved" button.

OR

Download the proposed gain and offset values to the ECU by clicking on the "Use Proposed" button.

NOTE

Once download is complete, the GSTS will automatically save a torque calibration data file for that channel. The file name format is "EngineSN_qcal_Chnl_DateStamp_Time Stamp.xml".

10. Use the saved file to update the Engine Log Book.

11. Select the Channel "B" radio button.

12. Repeat step (8) through step (10).

13. Exit the torque calibration screen.

The following steps are to ensure the torque calibration values uploaded in step (9) are the new "Current" values in use by each ECU channel.

14. Reset helicopter power. During power up, the ECU will read the new calibration numbers from EEPROM into RAM and use the values to calculate the (Q).

15. Wait 10 seconds and repeat step (3) through step (5).

16. Open Torque Calibration page from the GSTS main toolbar.

17. Select the Channel "A" radio button.

18. Verify the "Current" gain and offset values are as desired.

19. Exit the Torque Calibration screen.

20. Ensure that "FADEC MAINT" is not annunciated in the cockpit.

21. Close the GSTS application.

22. Return the helicopter to its original configuration.

76.4.3 FAULT DISPLAY

The maintenance terminal has 2 different display modes for ECU fault:

- **Live Mode Faults** – faults that currently exist in the ECU volatile memory
- **Stored Mode Faults** – faults that currently exist in the ECU non-volatile memory in 2 modes:

- Last Engine Run Faults – faults present while running since the last engine run
- System History Faults – all the engine faults since the last fault history clear.

76.4.3.1 FADEC Maintenance

FADEC Maintenance message is displayed only on the ground after engine shutdown with NG less than 5%. The control system will operate normally with no degradation. FADEC Maintenance message is triggered by any Confirmed Fault Word (FADEC ARINC label 350 through 354) Bits 14 through 29 set equal to “1”.

76.4.3.2 FADEC Degraded

The FADEC Degraded light notifies the pilot that the FADEC/ECU has lost some feature of the control system that may cause degradation in performance or general degradation of FADEC capabilities.

76.4.3.3 Fault Isolation

SPECIAL TOOLS REQUIRED

NUMBER	NOMENCLATURE
	Honeywell Ground Support Test Set

1. Set the battery switch to BATT, or connect the external DC power to the helicopter

2. On the overhead panel, close the FADEC CH A PWR (4962CB1), FADEC CH B PWR (4962CB2) circuit breakers.

3. Establish communication between the aircraft and the FADEC ECU by connecting the GSTS on the ground terminal on the left hand side center console.

4. Open “User Level” menu from the GSTS toolbar and log in.

5. Select FADEC faults.

6. Determine the FIM task required. Refer to Honeywell LMM for HTS900-2-1D for complete list of FIM tasks.

7. Close GSTS application. Perform required Maintenance.

76.4.4 ENGINE INCIDENT RECORDING

The control system contains an engine incident recording and reporting system to determine the occurrence of an incident and temporarily store engine and control system data in non-volatile memory for later investigation and evaluation.

The incident recording is designed to provide additional information in support to engine troubleshooting and maintenance. It records data from a period of time prior the incident, the frame of which the incident occur and a period of time following the incident. The pilot has no indication that an incident has been recorded. Incidents that are recorded associated with faults will be notified after engine shutdown.

The control system automatically clears incident data from non-volatile memory on the startup following an incident-free flight.

76.5 ELECTRICAL ENGINE CONTROLS

This section covers removal, inspection, and installation of airframe mounted electrical items that are part of the FADEC system. For information on FADEC related airframe electrical circuits, which integrate with FADEC, refer to Chapter 95, 96, and 98.

For information on FADEC related cockpit switches refer to Chapter 96. For additional information on FADEC Maintenance, refer to Honeywell LMM for HTS900-2-1D.

76.5.1 ELECTRICAL ENGINE CONTROLS – APPLICATION OF CONTACT ENHANCER

MATERIALS REQUIRED
Refer to BHT-ALL-SPM for specifications.

NUMBER	NOMENCLATURE
C-052	Contact Enhancer

Moisture contamination of electrical connectors has been found to be the cause of electrical discrepancies. It has also been found to be the cause of corrosion and premature wear of the contacts. Most of these problems have been reported on helicopters that operate in high relative humidity environment.

To reduce the possibility of these occurrences and downtime due to moisture related problems, Bell has approved the use of contact enhancer (C-052) on the mating surfaces of connectors that are outside of the cabin area, including the top deck, transmission area, lower shell, and tail boom areas.

In specific regards to the FADEC system, it is recommended that operators apply contact enhancer (C-052) in accordance with TB 407-08-81 in the following locations during associated component installation and/or replacement procedures:

REFERENCE DESIGNATOR	NOMENCLATURE
4692-P1	Connector, FADEC/ECU
4962-P2	Connector, FADEC/ECU
4962-P3	Connector, FADEC/ECU
4962-P4	Connector, FADEC/ECU
4962-P5	Connector, FADEC/ECU
4962-P6	Connector, FADEC/ECU
4962-P7/J7	Forward Firewall Disconnect
4962-P8/J8	Engine Bay Disconnect
4962-P8A/J8A	Aft Electrical Roof Disconnect
4962-P9/J9	Forward Firewall Disconnect
4962-P196/J196	Forward Electrical Roof Disconnect
4962-P197/J197	Forward Electrical Roof Disconnect
1B8P1	NR Monopole Sensor

76.5.2 THROTTLE PLA LVDT

PLA is a dual channel linear variable differential transformer (LVDT) that provides power lever position to each ECU channel. PLA LVDT has an input voltage of 4.8Vrms and excitation frequency of 3906 Hz. It has an output voltage of 3.2Vrms Va +Vb±10% as per Figure 76-8.

The FADEC control system uses the power lever reading to allow engine start, modulation of the engine power and shut-off. Detents are defined in Table 76-5.

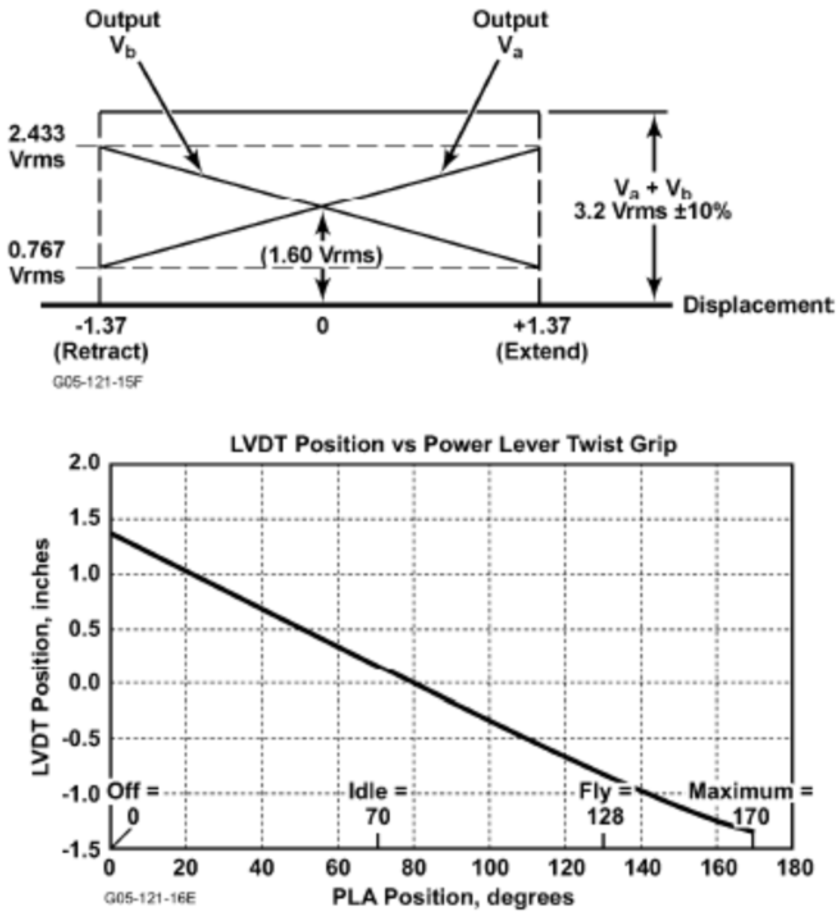


Figure 76-8: PLA LVDT Characteristics

When the power lever is at or above the IDLE detent, the FADEC allows fuel to be introduced in accordance with the start schedule. When the power lever is reduced below the IDLE detent, the FADEC will command fuel cut-off. Hysteresis has applied to prevent inadvertent shutdown during an engine rollback to IDLE as follows:

- Fuel flow is enabled as the LVDT is increased to 55.0 degrees or above.
- Fuel flow is disabled as the LVDT is decreased to below 15.0 degrees.

The relationship between power lever position and allowable N_G is defined on Table 76-6.

76.5.2.1 PLA LVDT Removal

1. Remove component(s) as required to gain access to the PLA assembly under the pilot seat.
2. Disconnect connector P30 from LVDT (4962-A30).
3. Remove fork end from adapter by loosening the nut. See Figure 76-11.
4. Remove attachment from the PLA bracket by removing bolt, washer and nut.

Table 76-5: Power Lever Twist Grip Detents

Detent	PLA Angles, degrees	LVDT position
OFF	0 ±3	1.37
START/IDLE	70 ±5	0.171
FLY	145 ±5	-0.803

Table 76-6: Relationship between Power Lever Position and Allowable Ng

PLA angles, degrees	Ratio Metric Gain	Maximum N_G Command
0	0.5216	Fuel Shutoff
10.5	0.4556	Fuel Shutoff
70	0.06498	Idle N_G
85	0.0	Idle N_G
113	-0.211	Max N_G

76.5.2.2 PLA LVDT Installation

1. Remove component(s) as required to gain access to the PLA assembly under the pilot seat.

2. Install PLA LVDT on the PLA bracket with bolt, washers and nut. See Figure 76-11.

3. Connect the fork end to the adapter. Tighten nut.

4. Set distance from face of the tightened nut to the machined face of threaded shaft to 0.604 inch to assist in rigging.

5. Perform Throttle/FLY Rigging as per paragraph 76.5.2.3.

76.5.2.3 Throttle/Fly Detent Rigging

SPECIAL TOOLS REQUIRED

NUMBER	NOMENCLATURE
	Honeywell Ground Support Test Set

1. Connect connectors P30 and 4962-P40 to the PLA assembly.

2. Set the battery switch to BATT, or connect the external DC power to the helicopter.

3. On the overhead panel, close the FADEC CH A PWR (4962CB1), FADEC CH B PWR (4962CB2) circuit breakers.

4. Pull ENG CONTROLS START (1CB1) and IGNTR (1CB2) circuit breaker

5. Establish communication between the aircraft and the FADEC ECU by connecting the GSTS on the ground terminal on the left hand side center console.

6. Launch the GSTS application.

7. Open the "User Level" menu from the tool bar and log in.

8. Open existing file for standard gauges.

9. Select real time data parameters.

10. Turn the throttle grip to "OFF" position until physical stop is made between throttle idle detent button and end of the channel in throttle twist grip.

11. Monitor the PLA indication. Should read 0° ±3° in both channels. If necessary adjust this position by adjusting the fork end adapter. (Figure 76-11)

12. Confirm that the rod end remains in safety in the adapter, use witness hole to verify.

NOTE

Refer to Figure 76-9, Figure 76-10, and Figure 76-11 for the following procedures.

13. Rotate the throttle grip assembly clockwise until the GSTS shows 145° ±5°in both channels.

14. Loosen the setscrew (3) on the ferrule/bezel (2) and rotate until ball plunger (6) rests in detent (8).

15. Rotate throttle grip assembly (1) until it rests on "FLY" detent (7).

16. Tighten the setscrews (3).

17. Verify rigging per Table 76-5.

18. Close the GSTS application.

19. Perform Check Run Procedure as per paragraph 76.2.7.

20. Return the helicopter to its original configuration.

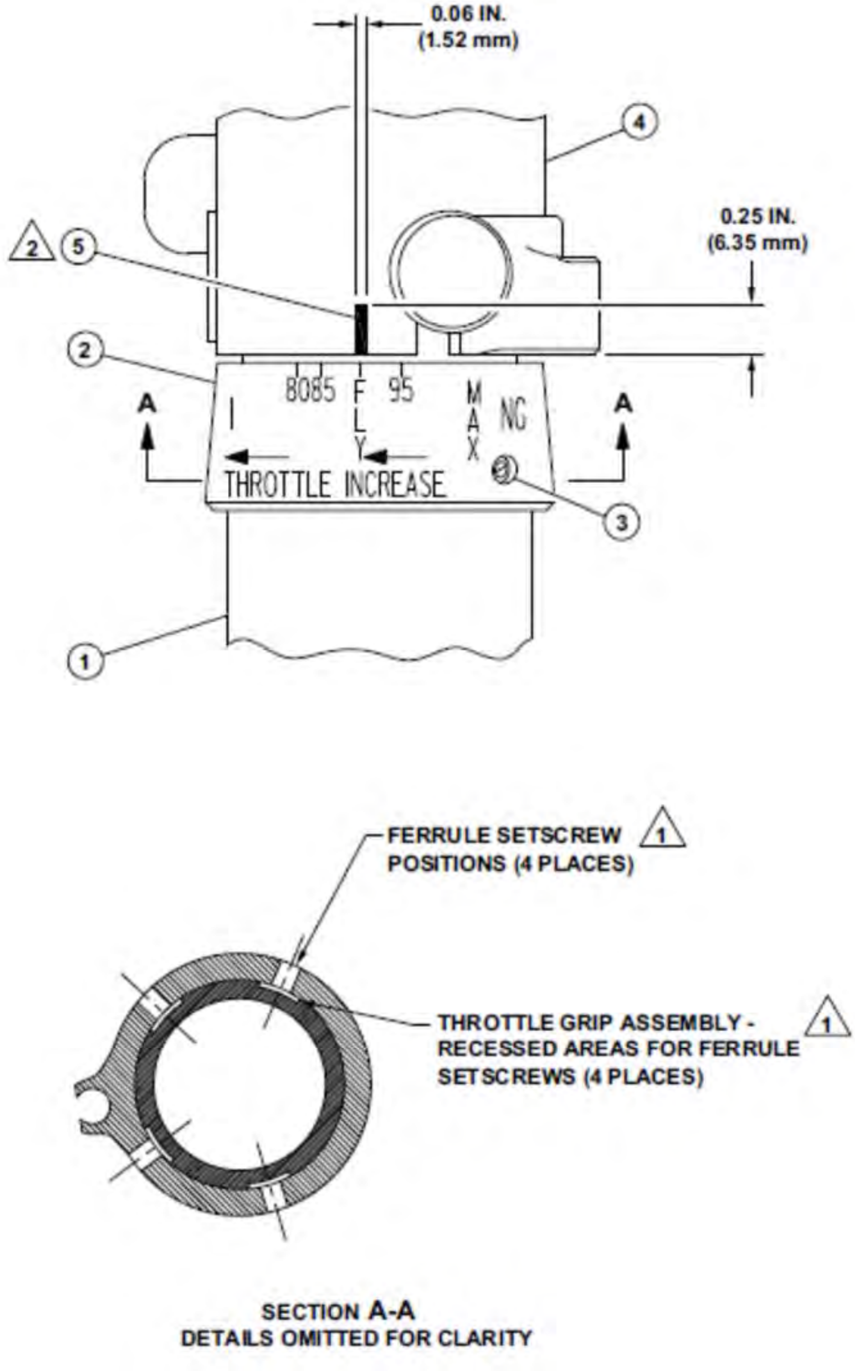
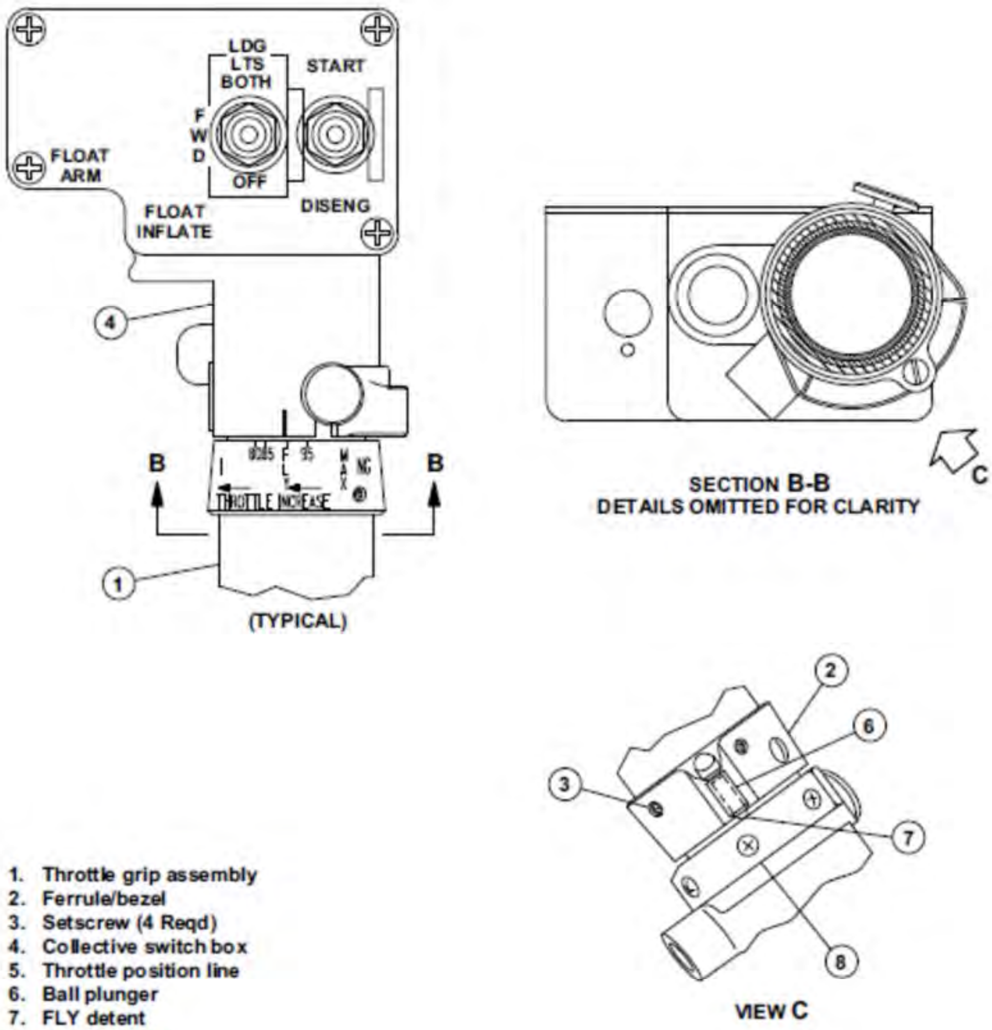


Figure 76-9: Throttle/FLY Rigging



1. Throttle grip assembly
2. Ferrule/bezel
3. Setscrew (4 Reqd)
4. Collective switch box
5. Throttle position line
6. Ball plunger
7. FLY detent
8. Detent block

NOTES

1. There is only one position, between ferrule and throttle grip, where all four setscrews will fully engage.
2. Mark with 299-947-096 epoxy paint, color to be white No. 37925 per FED-STD-595 (C-207).

Figure 76-10: Throttle/Fly Detent Rigging

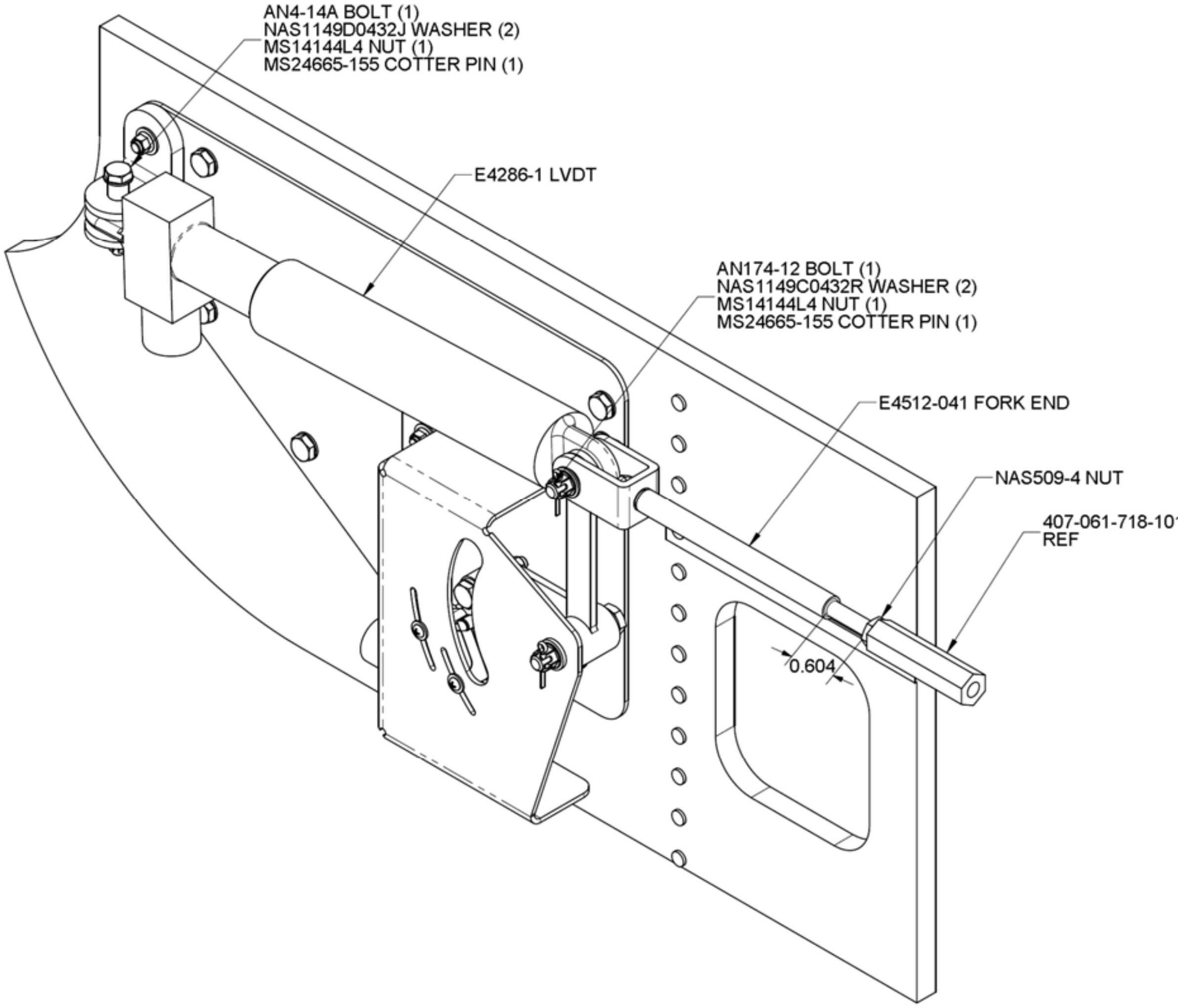


Figure 76-11: PLA Assembly

76.5.2.4 Throttle/Fly Detent Friction Test

MATERIALS REQUIRED
Refer to BHT-ALL-SPM for specifications.

NUMBER	NOMENCLATURE
C-480	Cord

NOTE

Copilot throttle friction will be higher than pilot throttle friction due to gearing in back of pilot collective assembly. With dual controls installed, pilot's throttle friction may be set to a minimum of 7.8 inch-pounds (0.88 Nm) to obtain a maximum resultant copilot throttle friction of 14.9 inch-pounds (1.68 Nm) after break-away torque.

1. Wrap a suitable length of cord (C-480), or equivalent around the pilot's throttle grip and attach a fish scale to the cord.

NOTE

Depress the idle release button during the following step. Friction will increase as ball plunger (6, Figure 76-10) rides on surface of detent block (8).

2. Pull the fish scale to turn the pilot's throttle grip from the OFF position to the FLY detent position. Verify that the fish scale indicates a maximum of 10 ±0.5 pounds (4.5 ±0.23kg) after the initial breakaway force. The operation should be smooth throughout the range.
3. Turn the pilot's throttle to pull the ball plunger (6, Figure 76-10) near the groove of the FLY detent (7). Pull the fish scale to move the ball plunger in and out of the groove. Verify the fish scale value is 14 to 15 ±0.5 pounds (6.3 to 6.8 ±0.23kg) when the plunger is pulled through the detent.
4. If the throttle or FLY detent friction requires adjustment, refer to paragraph 76.5.2.5.

76.5.2.5 Throttle/Fly Detent Friction Adjustment

MATERIALS REQUIRED
Refer to BHT-ALL-SPM for specifications.

NUMBER	NOMENCLATURE
C-480	Cord

NOTE

Copilot throttle friction will be higher than pilot throttle friction due to gearing in back of pilot collective assembly. With dual controls installed, pilot's throttle friction may be set to a minimum of 7.8 inch-pounds (0.88 Nm) to obtain a maximum resultant copilot throttle friction of 14.9 inch-pounds (1.68 Nm) after break-away torque.

1. Adjust the ball plunger (6, Figure 76-10) so that it does not contact face of detent block (8). If ball plunger has lost its thread locking capability, replace with new unit.
2. With the use of a 3/16 inch allen key, remove the throttle friction adjustment setscrews (1, Figure 76-12). Remove spring washers (2) and plug (3). Inspect washers and plug for condition. If washers are flat, cracked, or broken, replace with serviceable washers. Inspect plug for wear. Face of plug is to be flat. If groove is worn into face of plug, replace with serviceable unit.
3. Examine the setscrew (1) to see if there is a Teflon locking element.

NOTE

Do not adjust the setscrew in too far. Damage to the spring washers will occur, which will require removal of spring tension washers to restack or replace them.

4. If the setscrew (1) has a locking element, install the removed components in the reverse order of step 2 and go to step 6.

5. If the setscrew has no locking element, it is recommended to replace the setscrew (1) with a new self-locking setscrew (P/N NAS1081-6B8).

6. Tighten setscrew (1) until you have a slight friction when the throttle grip is turned.

NOTE

If dual controls are installed, pilot throttle friction may be set to a minimum of 7.8 inch-pounds to obtain a maximum resultant copilot throttle friction of 14.9 inch-pounds after break-away torque.

7. To adjust the throttle friction grip setscrew (1) to get a fish scale value of 10 ±0.5 pounds (4.5 ±0.23 kg), after the initial breakaway force, do the procedures that follows:
   a. Wrap a suitable length of cord (C-480), or equivalent around the pilot's throttle grip and attach a fish scale to the cord.
   b. Depress the Idle detent button and pull the fish scale to rotate the throttle from the OFF position to the "FULL OPEN" position.
   c. Adjust setscrew (1) to get the required friction value.

8. Adjust the ball plunger (6, Figure 76-10) to the depth that lets it lightly contact the face of detent block (8).

9. To adjust the ball plunger (6) to get a peak rotational value between 4 to 5 pounds (1.8 to 2.3 kg) in excess of throttle friction adjustment in step 7, when the ball plunger rides through groove of the FLY detent (7), do the procedure that follows:
   a. Turn the throttle grip assembly (1) to put the ball plunger (6) near the groove of the FLY detent (7).
   b. Wrap a suitable length of cord (C-480), or equivalent around the pilot's throttle grip assembly (1) and attach a fish scale to the cord.
   c. Pull the fish scale to move the ball plunger (6) in and out of the groove. Adjust the ball plunger to make sure the fish scale value is 14 to 15±0.5 pounds (6.3 to 6.8±0.23 kg) when the plunger is pulled through groove of the FLY detent (7).

10. Following the throttle and FLY detent friction adjustments, make sure the operation of the throttle is smooth and that a positive indication is felt when the ball plunger (6) is engaged in the FLY detent (7). If applicable, also use the copilot's throttle to confirm a positive indication is felt in the FLY Detent.

11. Perform Check Run Procedure as per paragraph 76.2.7.

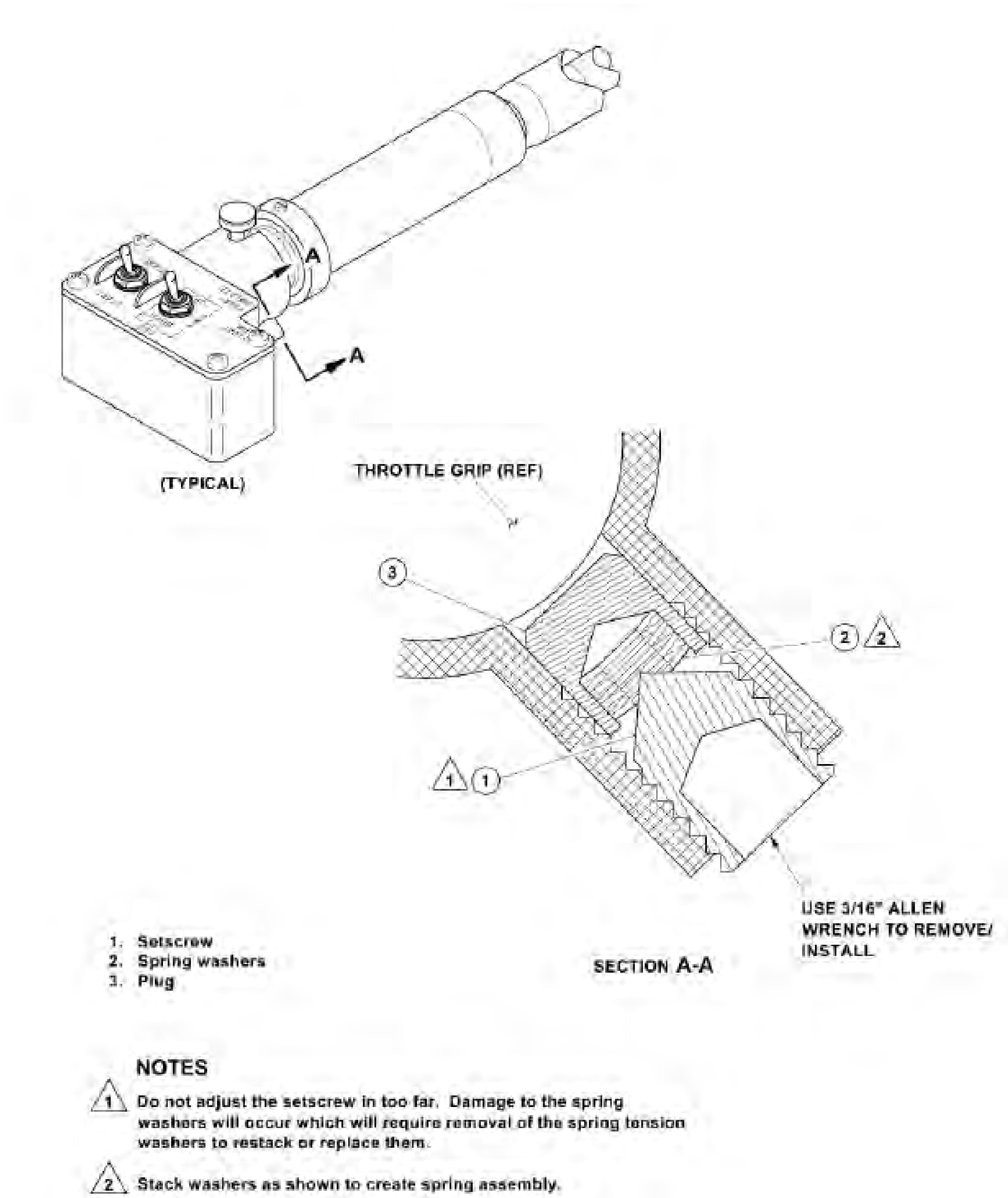


Figure 76-12: Collective Throttle Friction

76.5.3 CP POTENTIOMETER

There are two identical CP potentiometers mounted under the co-pilot seat that provides voltage proportional to collective demand (load) from the pilot, for each ECU channel. They are connected to the airframe at one end and connected to a clamp assembly installed on the collective jackshaft. The signal is used by the control system to minimize rotor droop by anticipating load demand and increasing demanded NG rate of change accordingly. The potentiometers are 5 KΩ with excitation voltage of 5 VDC. The relationship between CP position, ratio, and blade pitch is defined in Table 76-7.

76.5.3.1 CP Transducer Removal

NOTE

Refer to Figure 76-15 for the following procedures.

1. Disconnect helicopter electrical power.
2. Remove the co-pilot seat and seatback (Chapter 25).
3. Remove the metal copilot seat panel assembly.
4. Disconnect the CP transducer electrical connectors 4R1P1 and 4R2P1.
5. Remove the nut and the washer from the upper bolt.
6. Remove the nut and the washer from the lower bolt.
7. Remove the transducer 4962-R1.
8. Remove the two spacers.
9. Remove the bolt and the washer from the transducer 4962-R2 and the clamp.
10. Remove the bolt and washer while holding the transducer 4962-R2 from the support bracket.

76.5.3.2 CP Installation and Rigging

NOTE

Make sure the collective control system is rigged properly per the BHT-407-MM before you install and rig collective transducer.

1. Remove forward transmission cowling.
2. Remove attaching hardware between collective link assembly and collective lever.
3. Remove component(s) as required to gain access to collective jackshaft under co-pilot seat.
4. Adjust rod end on the collective pitch transducers to obtain 5.358 inch dimension between centers of the rod end bearings of the transducer while the transducers is in the retracted position.
5. Verify that support bracket is installed.
6. Ensure that the collective link assembly clears the collective lever.
7. Raise collective stick up until the stop is contacted. Hold in position with collective friction. See Figure 76-13.

8. Confirm clamp assembly is installed on collective jackshaft at LBL 8.05.

9. With the collective full up shown in Figure 76-15, use the rigging tool (Figure 76-14) to confirm dimension between the hole of the support bracket and the clamp.

10. Ensure the dimension is 6.593 inches.

11. Reposition clamp as required and tighten the screws on the clamp maintaining equal gaps between the clamp halves as required.

12. Loosen collective friction.

13. Prior to installing the CP transducers, make sure the CP potentiometer rod end will fit without binding against the clamp. The collective must move thru its entire travel without restriction or damage to the CP potentiometer.

14. Position the CP transducers between the support bracket and the clamp assembly

15. Install bolt (head must point inboard when installed), washers and transducer, on inboard side of the support bracket and the clamp assembly.

16. Install spacers and washers together with transducer through the support bracket and clamp assembly.

17. Complete assembly by installing washers, nut and bolt. Install cotter pin to safety the nut.

18. Install connectors 4R1J1 and 4R2J1 on the bracket. Connect the CP potentiometer electrical connector 4R1P1 and 4R2J1.

19. Set the battery switch to BATT, or connect the external DC power to the helicopter.

20. On the overhead panel, close the FADEC CH A PWR (4962CB1), FADEC CH B PWR (4962CB2) circuit breakers.

21. Establish communication between the aircraft and the FADEC ECU by connecting the GSTS on the ground terminal on the left hand side center console.

22. Launch the GSTS application.

23. Open the “User Level” menu from the tool bar and log in.

24. Open existing file for standard gauges.

25. Select real time data parameters.

26. Using the necessary force push collective full down and maintain against down stop.

27. Monitor the CP parameter. CP position should read 10 +3/-10 on both channels.

28. Adjust rod end on CP potentiometer to obtain proper value. Ensure the rod end remains in safety after making adjustments.

29. Pull collective against physical up stop. CP position should read 90±5.

30. Once rigging is complete, both channels must be within tolerance at both full up and full down position.

31. Reinstall collective link and collective lever.

32. Close the GSTS application.

33. Perform Check Run Procedure as per paragraph 76.2.7.

34. Return the helicopter to its original configuration.

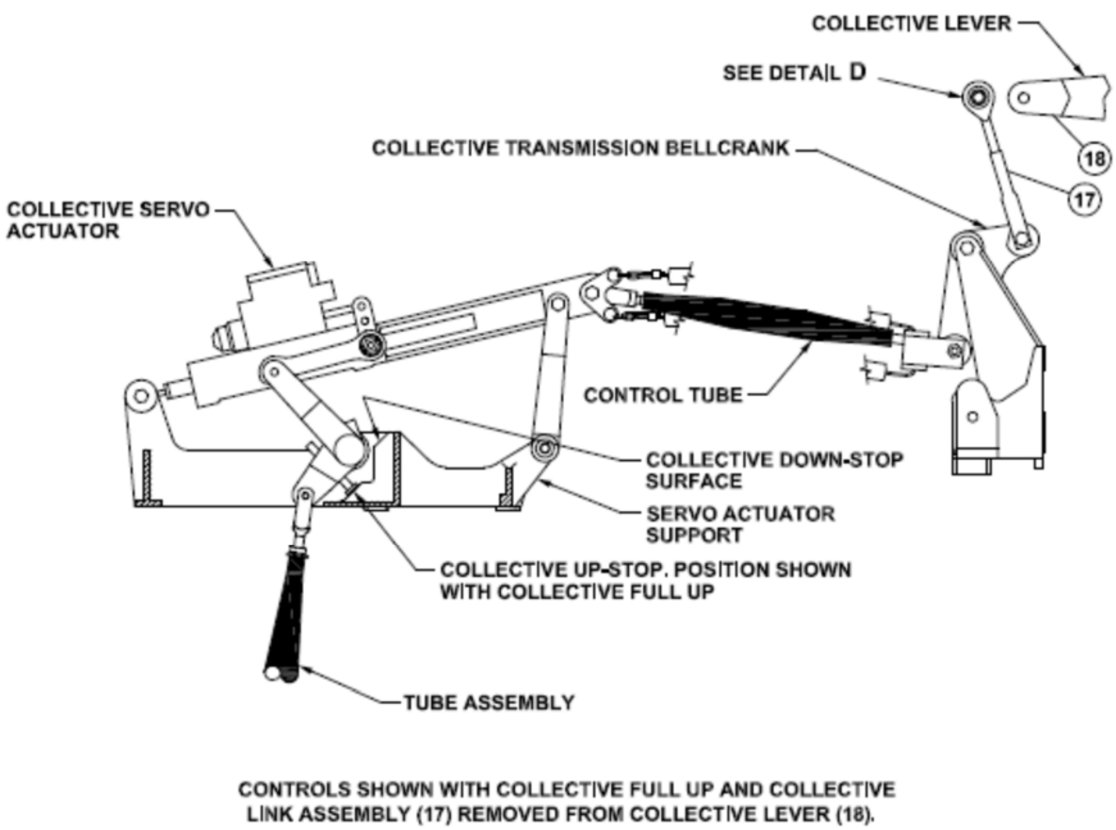


Figure 76-13: Collective Pitch Removal/Installation

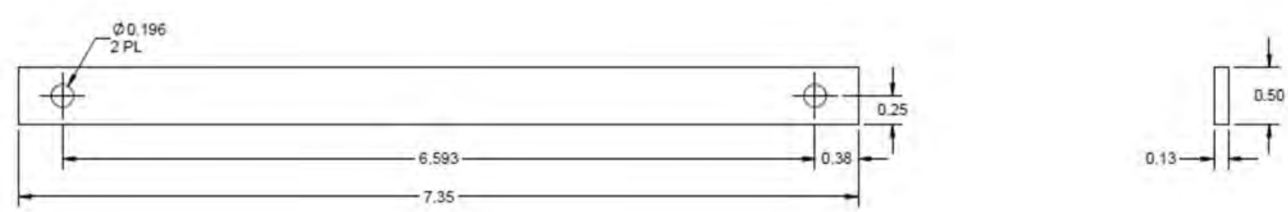


Figure 76-14: CP Transducer Rigging Tool

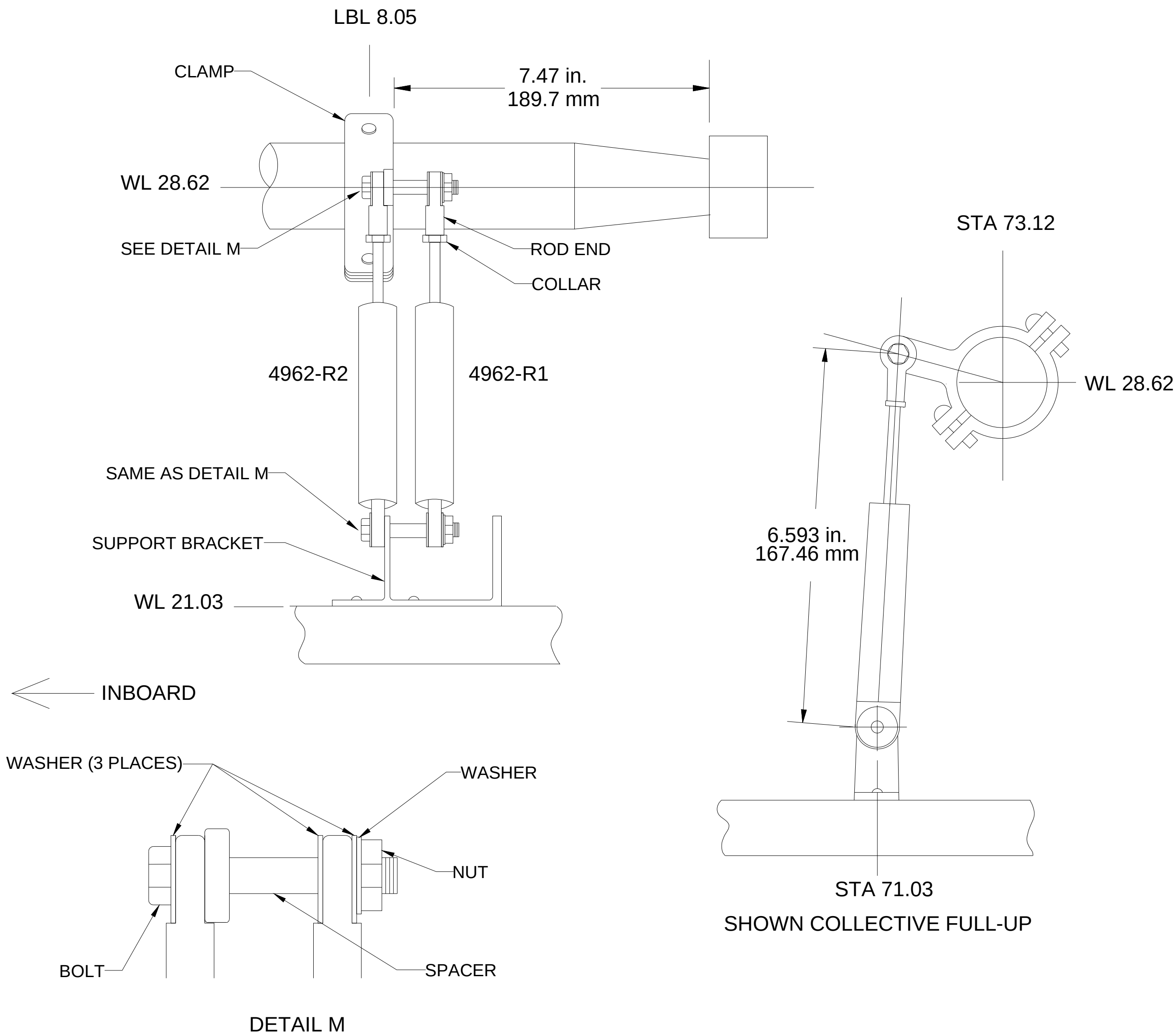


Figure 76-15: Collective Pitch Transducer Installation and Rigging

Table 76-7: CP Position, Ratio, and Blade Pitch Relationship

CP position ,%	Voltage Ratio,%	Main Rotor Blade Angle, degrees
0	10	-0.5
100	90	15.5

76.5.3.3 Collective Pitch Transducer – Inspection

1. Examine the CP transducers for signs of damage, pitting, and corrosion.

2. Examine the CP transducer, mounting support, and clamp assembly for condition, security, and eccentric bolt holes.

3. Examine the electrical leads for signs of chafing and damaged insulations. Examine the electrical connectors for conditions.

4. Examine spherical bearing on CP transducers for condition and security.

5. Visually examine all attaching hardware for wear, damage and corrosion. Replace as required.

76.5.3.4 Collective Pitch Transducer – Functional Test

1. Remove forward transmission cowling.

2. Remove attaching hardware between collective link assembly and collective lever.

3. Set the battery switch to BATT, or connect the external DC power to the helicopter.

4. On the overhead panel, close the FADEC CH A PWR (4962CB1), FADEC CH B PWR (4962CB2) circuit breakers.

5. Establish communication between the aircraft and the FADEC ECU by connecting the GSTS on the ground terminal on the left hand side center console.

6. Launch the GSTS application.

7. Open the “User Level” menu from the tool bar and log in.

8. Open existing file for standard gauges.

9. Select real time data parameters.

10. With the collective full down (down stop contacted), CP reading should be 10% +3/-10%.

11. With collective full up (up-stop contacted), CP reading should be 90% ±5%.

NOTE

If collective pitch is out of limits, confirm rigging per paragraph 76.5.3.2.

12. Disconnect the electrical power from the helicopter.

13. Install the attaching hardware between collective link assembly and collective lever.

14. Return the helicopter to its original configuration.

76.5.4 FADEC ECU

The dual channel ECU is mounted on the roof forward of the transmission assembly.

76.5.4.1 ECU Removal

1. Disconnect helicopter electrical power.

2. Remove the component(s) as required to gain access to the roof, forward of engine transmission.

3. Disconnect electrical connectors 4962-P1, 4962-P2, 4962-P3, 4961-P4, 4962-P5, and 4962-P6.

4. Install connector plugs to ECU and helicopter connectors.

5. Remove bonding jumpers 4962-J2 and 4962-J3 from the ground stud and from each ECU channel.

6. Remove bolts and washers.

7. Remove the ECU from the ECU mounting plate.

76.5.4.2 ECU Installation

1. Remove the component(s) as required to gain access to the roof, forward of engine transmission.

2. Locate the ECU mounting plate.

3. Line up FADEC ECU install hole to the mounting plate with connectors facing forward. Refer to Figure 76-16.

4. Install bolts and washers.

5. Install bonding jumpers 4962-J2 and 4962-J3 from each ECU channel to the ground stud. See Figure 76-17.

6. Install connectors 4962-P1, 4962-P2, 4962-P3, 4962-P4, 4962-P5, and 4962-P6.

7. Set the battery switch to BATT, or connect the external DC power to the helicopter.

8. On the overhead panel, close the FADEC CH A PWR (4962CB1), FADEC CH B PWR (4962CB2) circuit breakers.

9. Verify that there is no FADEC related fault.

10. Perform Torque Transducer Calibration paragraph 76.4.2.1 as required.

11. Perform Check Run Procedure as per paragraph 76.2.7.

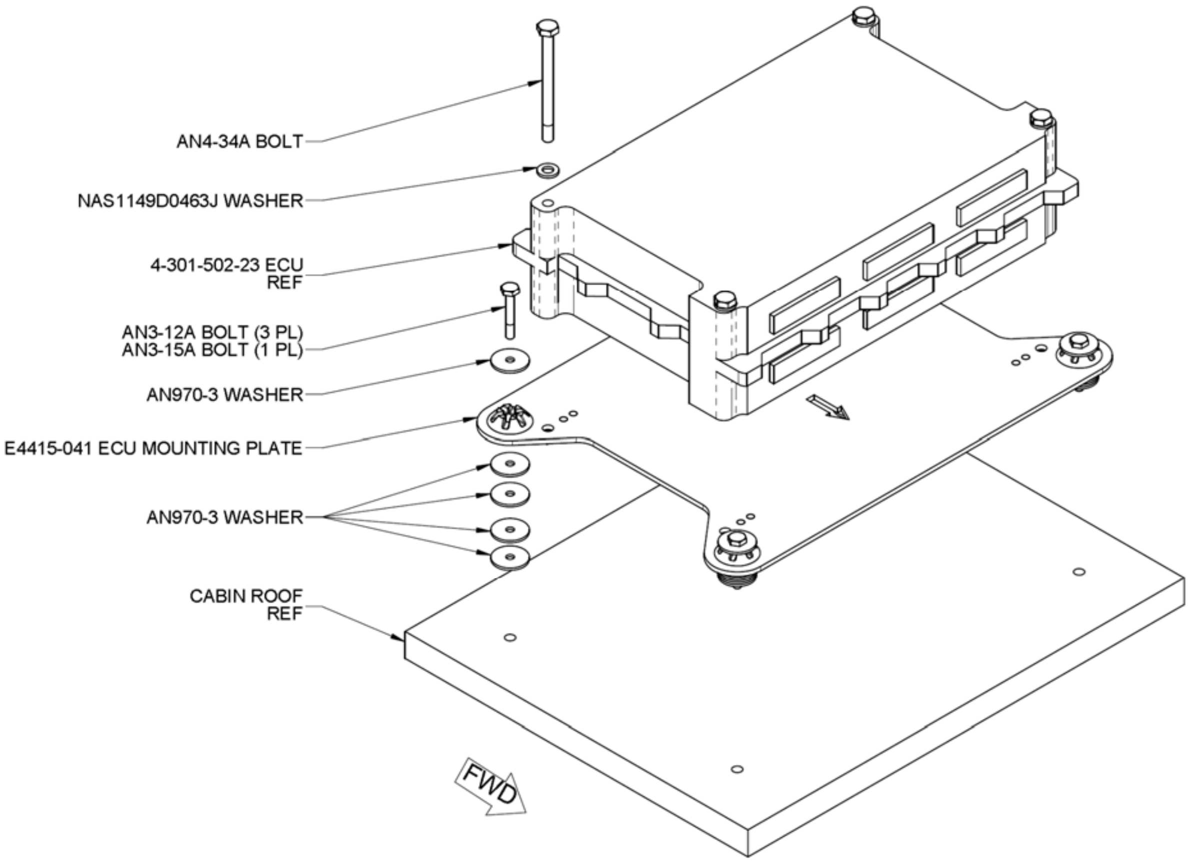


Figure 76-16: ECU Removal/Installation

Figure 76-17: ECU Bonding Jumper Installation.

Chapter 79
ENGINE OIL SYSTEM
(79-00-00)

CHAPTER 79 — ENGINE OIL SYSTEM

Contents

79.1 ENGINE OIL SYSTEM

79.1.1 ENGINE OIL SYSTEM

The engine oil system (Figure 79-1) is a dry sump type lubrication system. The engine oil system includes an externally mounted oil tank (3), a temperature bulb (4), a manually operated drain valve (5), and an oil cooler (9). The oil cooler is installed on top of the fuselage, behind the aft firewall. The lubrication oil is supplied to and from the engine through rigid and flexible tubes.

The oil tank supplies lubricating oil through the Oil Pump Inlet to the Lube Pump. Oil under pressure (Supply Pressure) goes through the oil filter and a pressure regulating valve, through the Temperature Sensor to the Turbine Sump. This oil lubricates the engine. The pressure oil becomes Low Pressure (Scavenge) oil and returns to the two scavenge pumps. The scavenge oil goes through the chip detector and into the Rotorcraft Oil Cooler. The scavenge oil passes through the oil outlet tube to the oil cooler, then from the oil cooler through the oil scavenge tube to the oil tank.

The engine oil pressure indication is supplied by the oil pressure transducer. The engine torque pressure indication is supplied by the engine torque transducer. Both of these components are installed on the engine.
For the engine oil system schematic, refer to Figure 79-2.

For the description and the operation of the engine oil system, refer to the Honeywell, Gas Turbine Engine, Light Maintenance Manual, HTS900-2-1D.

79.1.1.1 ENGINE OIL SYSTEM — TROUBLESHOOTING

For the engine oil system troubleshooting procedures, refer to Honeywell, Gas Turbine Engine, Light Maintenance Manual, HTS900-2-1D.

79.1.1.2 ENGINE OIL SYSTEM TUBE — FLUSHING

MATERIALS REQUIRED
Refer to BHT-ALL-SPM for specifications.

NUMBER	NOMENCLATURE
C-030	Lubricating Oil
C-380	Trichorethane
C-428	Caps and/or Plugs

1. Remove the aft fairing (Chapter 53).

CAUTION

MAKE SURE THAT YOU INSTALL CAPS AND/OR PLUGS (C-428) ON ALL OF THE OPEN PORTS OF THE ENGINE OIL SYSTEM. THIS PREVENTS CONTAMINATION OF THE SYSTEM.

2. For the steps that follow, install caps and/or plugs (C-428) on all of the open ports of the engine oil system.

3. Disconnect and remove the oil scavenge tube (2, Figure 79-1) from the elbow on the oil tank (3) and from the ENG OIL OUT union on the oil cooler (9).

4. Disconnect and remove the oil inlet tube (6) from the elbow on the oil tank (3)

and from the bulkhead union on the aft firewall.

5. Disconnect and remove the oil outlet tube (7) from the union on the oil cooler (9) and from the aft firewall bulkhead union.

6. Disconnect and remove the tubes from the inlet and outlet of the chip detector housing.

7. Disconnect and remove the oil scavenge tube and the oil inlet tube that go between the aft firewall and the engine (Chapter 71).

8. Use trichlorethane (C-380) and flush all of the removed oil tubes.

9. Use dry, filtered compressed air and dry all of the removed oil tubes.

10. Use lubricating oil (C-030). Flush all of the removed oil tubes until the oil comes out clean and free of any remaining cleaning solvent.

11. Connect the oil scavenge tube and the oil inlet tube between (Chapter 71). the engine and the aft firewall

12. Connect the oil outlet tube (7) on the ENG OIL IN union to the oil cooler (9) and to the bulkhead union on the aft firewall.

13. Connect the oil inlet tube (6) to the elbow on the oil tank (3) and to the bulkhead union on the aft firewall.

14. Connect the oil scavenge tube (2) to the ENG OIL OUT union on the oil cooler (9) and to the union on the oil tank (3).

15. Install the aft fairing (Chapter 53).

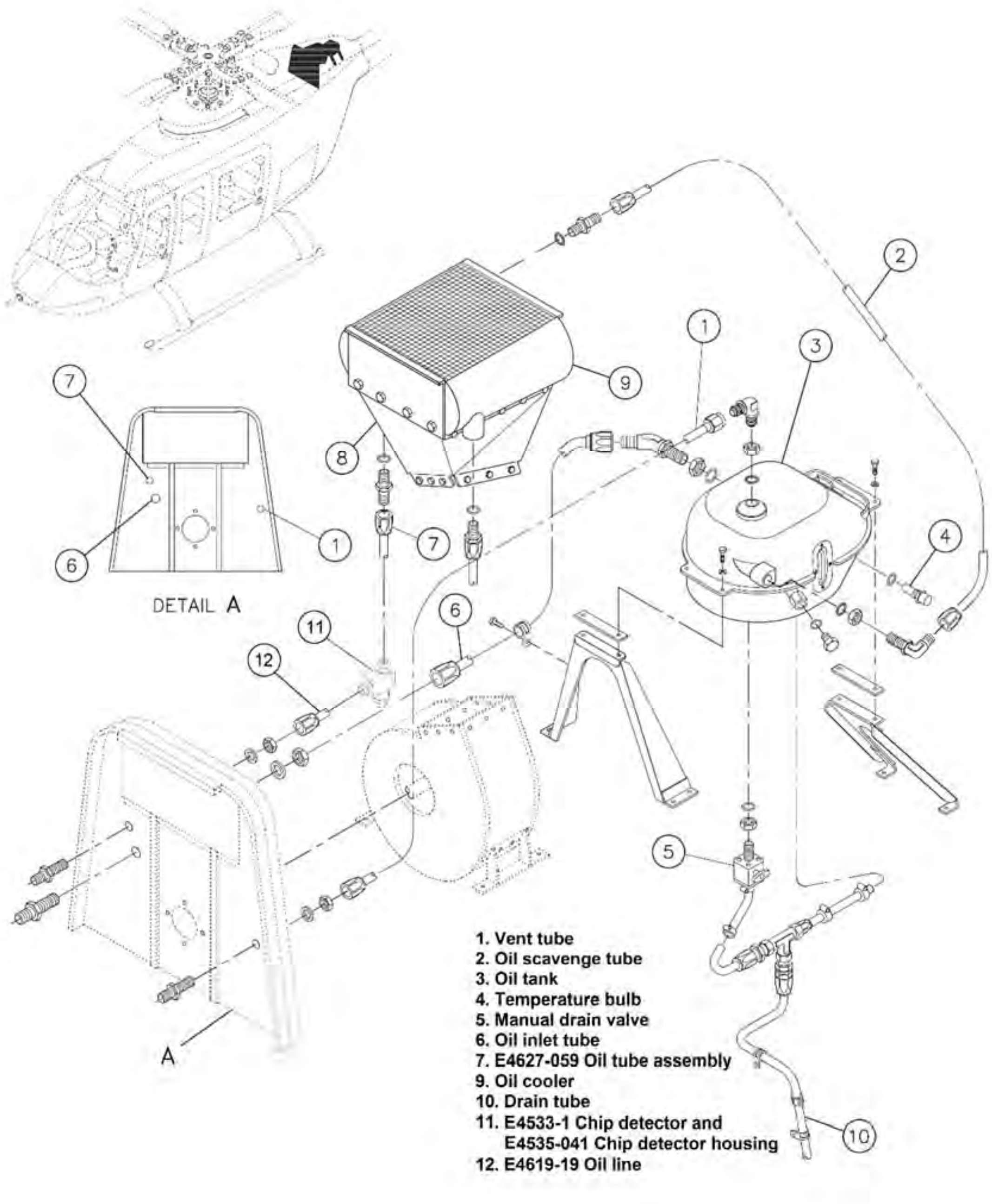


Figure 79- 1 Engine Oil System

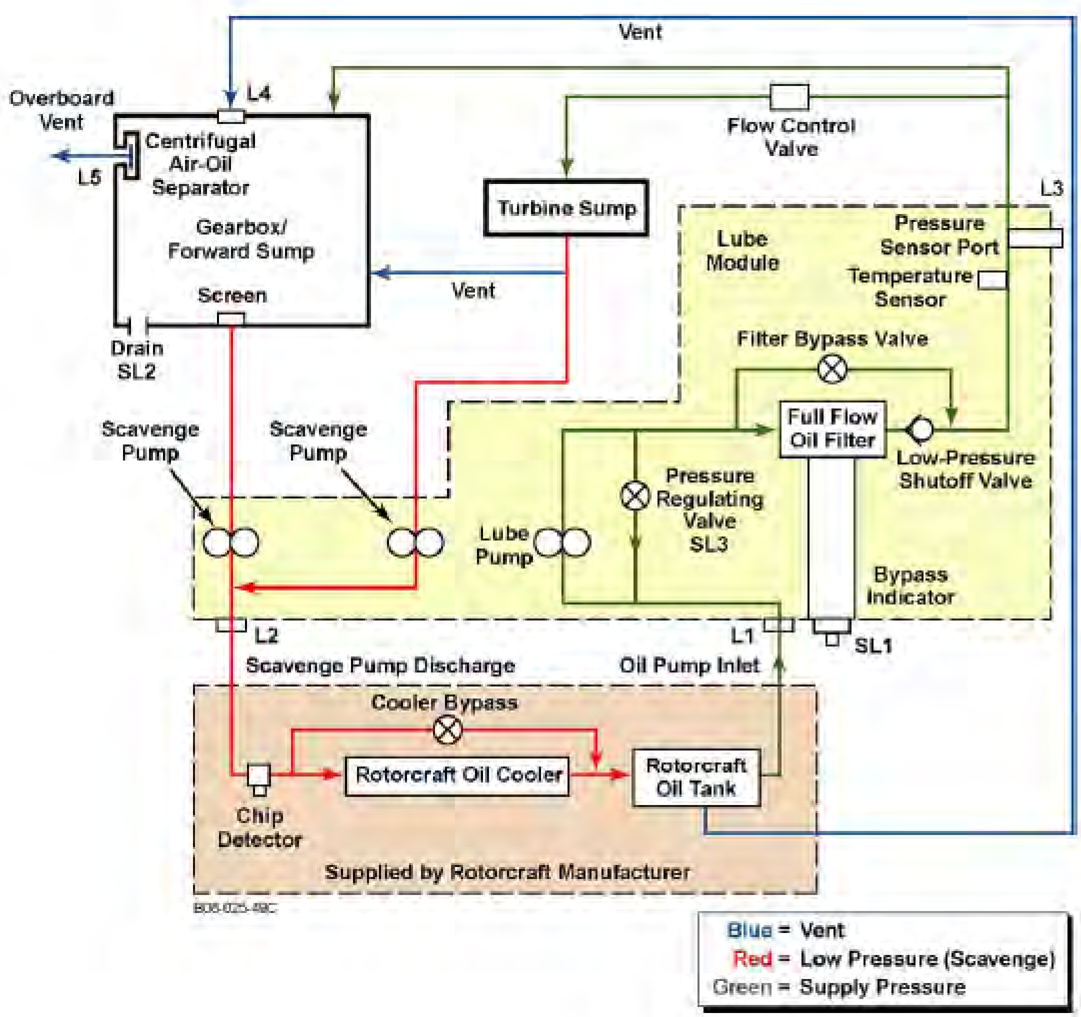


Figure 79- 2 General Lubrication Schematic

79.1.1.3 ENGINE OIL SYSTEM — SERVICING

If the helicopter engine has stopped for more than 15 minutes, dry motor the engine for 30 seconds. This scavenges any oil which could have drained into the gearbox. If you do not do this, a false high engine oil consumption level indication is given, or you will put too much oil in the oil tank when you fill it.

For the servicing procedure for the engine oil system, refer to Chapter 12.

79.1.1.4 ENGINE OIL SYSTEM — PRIME PROCEDURE

MATERIALS REQUIRED
Refer to BHT-ALL-SPM for specifications.

NUMBER	NOMENCLATURE
C-428	Caps and/or Plugs

If you replace an engine, an engine oil system component, or disconnect the oil inlet tube, remove the air in the engine oil system before you start the engine. To remove the air from the engine oil system, do the steps that follow:

CAUTION

DO NOT TRY TO START THE ENGINE BEFORE YOU REMOVE THE AIR FROM THE OIL SYSTEM. IF YOU DO NOT REMOVE THE AIR FROM THE SYSTEM, YOU CAN CAUSE DAMAGE TO THE ENGINE OR TO THE COMPONENTS.

1. If you replace the engine oil filter, fill the engine oil filter cavity with engine oil. Refer to the Honeywell, Gas Turbine Engine, Light Maintenance Manual, HTS900-2-1D, Chapter 72-00-00.

2. If you replace an engine or another major component, do the steps that follow:
   a. Disconnect and remove the oil inlet tube (19, Figure 79-3) from the elbow (20) on the oil tank (27).

CAUTION

MAKE SURE THAT YOU INSTALL CAPS AND/OR PLUGS (C-428) ON ALL OF THE OPEN PORTS OF THE ENGINE OIL SYSTEM. THIS PREVENTS CONTAMINATION OF THE SYSTEM.

   b. Fill (19) the oil inlet tube with engine lubricating oil (Chapter 12).
   c. Remove the cap on the elbow (20) and connect the oil inlet tube (19) to the elbow (20).
   d. Fill the engine oil tank (27) with engine lubricating oil (Chapter 12).

79.2 OIL TANK

79.2.1 OIL TANK

The oil tank (27, Figure 79-3) has a normal fluid capacity of 1.5 gallons (5.7 L). You can see the oil level through the sight gage (29) or measure the oil level with the cap and adapter assembly (28). A dipstick is attached to the cap and adapter assembly. The oil tank includes ports for the vent tube (24), the oil inlet tube (19), the oil scavenge tube (5), the oil temperature bulb (4), and for the oil tank manual drain valve (17).

79.2.1.1 OIL TANK – REMOVAL

1. Remove the aft fairing assembly (Chapter 53).
2. Put a fluid resistant container under the oil tank drain port.
3. Open the oil tank manual drain valve (17, Figure 79-3) and drain the oil tank (27).
4. Disconnect and remove the oil tank vent tube (24) from the elbow (23).
5. Loosen the nut (25). Remove the elbow (23) and the packing (26) from the oil tank (27). Discard the packing.
6. Disconnect and remove the oil scavenge tube (5) from the elbow (6).
7. Loosen the nut (7). Remove the elbow (6) and the packing (8) from the oil tank (27). Discard the packing.
8. Remove the oil temperature bulb (4) and the packing (3) (Chapter 95).
9. Disconnect and remove the engine oil inlet tube (19) from the elbow (20).
10. Loosen the nut (21). Remove the elbow (20) and the packing (22) from the oil tank (27). Discard the packing.
11. Remove the clamp (15) from the oil tank drain tube (16). Remove the drain tube (16) from the oil tank manual drain valve (17).
12. Loosen the nut (14). Remove the oil tank manual drain valve (17) and the packing (18). Discard the packing.
13. Remove the clamp (12) from the scupper drain tube (13). Remove the scupper drain tube.
14. Remove the plug (9) and the packing (10) from the oil tank (27). Discard the packing.
15. Remove the four bolts (1) and the washers (2) from the forward and aft oil tank supports (11).
16. Remove the oil tank (27) from the forward and aft oil tank supports (11).

CAUTION

MAKE SURE THAT YOU INSTALL CAPS AND/OR PLUGS (C-428) ON ALL OF THE OPEN PORTS OF THE OIL TANK. THIS

PREVENTS CONTAMINATION OF THE OIL TANK.

17. Seal all of the open lines and all of the open ports of the oil tank. Install caps and/or plugs (C-428).

79.2.1.2 OIL TANK – INSPECTION

1. Examine the oil tank as follows:
   a. Examine the oil tank for cracks or leaks in the welds.
   b. Examine the oil tank for damage to the threads in the ports and for damage to the threads of the tubes.
   c. Examine the oil tank for loose or missing attaching hardware.
   d. Examine the oil tank for signs of damage to the flanges.
   e. Examine the oil tank sight gage for damage and signs of leaks.
   f. Examine the oil tank filler cap and the scupper for damage and for signs of leaks.

2. Examine the forward and aft supports (11, Figure 79-3) for signs of cracks, for damage to the nutplates, and for security of the rivets.

3. Examine the manual drain valve (17) for proper operation. Examine the drain tubes (13 and 16) for signs of leaks.

4. For the repair procedures for the oil tank and its components, refer to the BHT-407-CR&O manual.

79.2.1.3 OIL TANK – INSTALLATION

1. Put the oil tank (27, Figure 79-3) in position on the forward and aft supports (11). Use the four bolts (1) and the washers (2) and attach the oil tank to the supports.

2. Remove all caps and/or plugs (C-428) from the ports and the tubes of the oil tank.

NOTE

Use turbine oil (C-030) and lubricate the packings before you install them.

3. Install the packing (18) on the manual drain valve (17).

4. Install the manual drain valve (17) in the drain port of the oil tank (27). Attach the nut (14) to the manual drain valve.

5. Connect the drain tube (16) to the manual drain valve (17). Attach the clamp (15).

6. Install the packing (10) on the plug (9). Install the plug in the port of the oil tank (27).

7. Install the oil temperature bulb (4) (Chapter 95).

8. Install the scupper drain tube (13) on the oil tank (27). Attach the clamp (12).

9. Install the packing (22) on the elbow (20).
10. Install the elbow (20) on the port of the oil tank (27). Tighten the nut (21).

11. Install the engine oil inlet tube (19) on the elbow (20).

12. Install the packing (26) on the elbow (23).

13. Install the elbow (23) in the vent port of the oil tank (27). Tighten the nut (25).

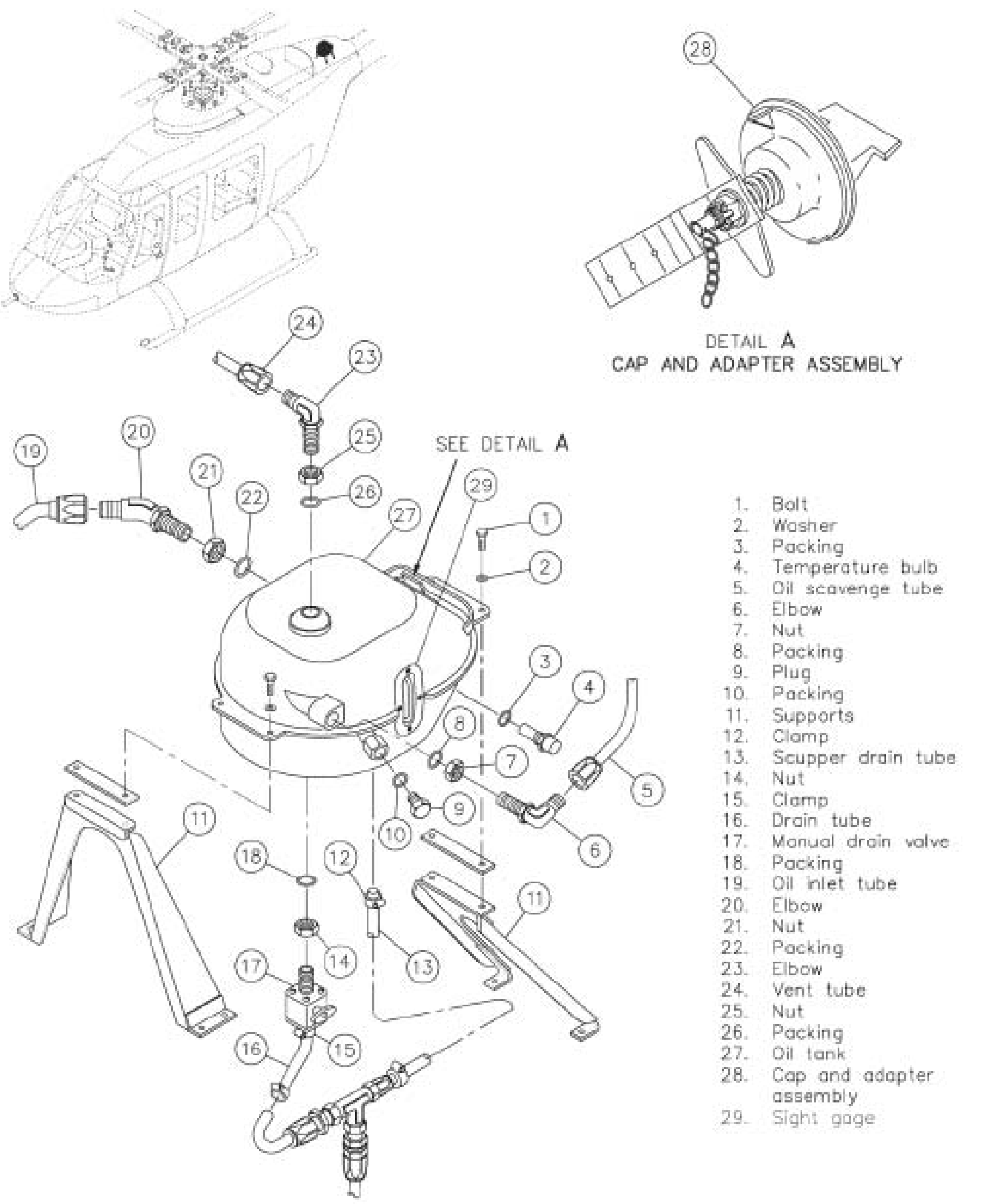


Figure 79- 3 Oil Tank

14. Install the vent tube (24) on the elbow (23).

15. Install the packing (8) on the elbow (6).

16. Install the elbow (6) in the scavenge port of the oil tank (27). Attach the nut (7).

17. Install the oil scavenge tube (5) on the elbow (6).

18. Make sure that the handle of the manual drain valve (17) is in the horizontal position.

19. If the helicopter engine has stopped for more than 15 minutes, dry motor the engine for 30 seconds. This scavenges any oil which could have drained into the gearbox. If you do not do this, a false high engine oil consumption indication is given, or you will put too much oil in the oil tank when you fill it.

20. Fill the engine oil tank with engine lubricating oil (Chapter 12).

21. Install the cap and adapter assembly (28) in the oil tank (27).

22. Make sure that the tubes and the mating surfaces of the oil tank do not have leaks.

79.3 OIL COOLER

79.3.1 OIL COOLER

The oil cooler (16, Figure 79-4) is installed on the duct assembly (15). This duct assembly is installed on the oil cooler blower between the aft firewall and the forward face of the engine oil tank (27, Figure 79-3). The oil cooler is a transmission oil cooler and an engine oil cooler. The tail rotor driveshaft drives the fan that supplies and moves the air through the oil cooler (Chapter 65). The oil cooler is a dual element heat exchanger. One heat exchanger cools the engine oil. The other heat exchanger cools the transmission oil. The oil cooler has a temperature regulating relief valve. This valve regulates the engine oil temperature. This valve starts to close at 160 °F (71 °C) and is fully closed at 178 °F (81 °C). If the system pressure goes above 25 pounds per square inch (PSI) the pressure relief part of the valve opens the valve fully.

79.3.1.1 OIL COOLER DUCT ASSEMBLY – REMOVAL

1. Remove the aft fairing (Chapter 53).

2. Put a fluid resistant container under the oil tank drain port.

3. Open the oil tank manual drain valve (17, Figure 79-3) and drain the oil tank and the oil cooler.

4. Disconnect and remove the tube assembly (1, Figure 79-4) from the union (2).

CAUTION

MAKE SURE THAT YOU INSTALL CAPS AND/OR PLUGS (C-428) ON ALL OF THE OPEN PORTS OF THE ENGINE OIL SYSTEM. THIS PREVENTS CONTAMINATION OF THE SYSTEM.

5. Disconnect and remove the union (2) and the packing (3) from the oil cooler OIL OUT port. Discard the packing.

6. Disconnect and remove the tube assembly (4) from the reducer (5).

7. Remove the reducer (5) and the packing (6) from the OIL IN port. Discard the packing.

8. Disconnect and remove the tube assembly (7) from the reducer (8).

9. Remove the reducer (8) and the packing (9) from the XMSN IN port. Discard the packing.

10. Disconnect and remove the tube assembly (10) from the reducer (11).

11. Remove the reducer (11) and the packing (12) from the XMSN OUT port. Discard the packing.

12. Remove the 12 bolts (13) and the washers (14) from the duct assembly (15).

13. Remove the duct assembly (15) and the oil cooler (16) as one assembly from the oil cooler blower (17).

14. Remove the oil cooler (16) from the duct assembly (15) as follows:
    a. Cut and remove the lockwire from the temperature regulating valve (20).
    b. Remove the temperature regulating valve (20) from the port in the oil cooler (16).
    c. Remove the packing (21) from the temperature regulating valve (20). Discard the packing.
    d. Remove the 18 bolts (18) and washers (19) and remove the oil cooler (16) from the duct assembly (15).

79.3.1.2 OIL COOLER DUCT ASSEMBLY – INSPECTION

1. Examine the oil cooler (16, Figure 79-4) as follows:
    a. Examine the oil cooler cores for signs of damage and for leaks.
    b. Examine the oil cooler for signs of damage to the threads and to the mating surfaces of the ports.
    c. Examine the oil cooler fins for signs of damage. Make sure that the air passages are clean.

2. Examine the duct assembly (15) as follows:
    a. Examine the duct assembly (15) for signs of damage, cracks, or dents.
    b. Examine the duct assembly (15) for loose rivets.
    c. Examine the duct assembly (15) for signs of damage to the mounting holes.

79.3.1.3 OIL COOLER — EXTERNAL CLEANING

1. Examine the exterior surfaces of the oil cooler for signs of blockage.

2. Clean the exterior surface of the oil cooler with solvent (C-304).

3. Dry the exterior surface of the oil cooler with dry filtered air.

79.3.1.4 OIL COOLER — INTERNAL CLEANING

1. Examine the inlet and the outlet ports of the oil cooler for signs of blockage.

2. Flush the oil cooler cores with solvent (C-304).

3. Dry the oil cooler cores with dry filtered compressed air.

79.3.1.5 OIL COOLER — REPAIRS

Repair of the oil cooler is not recommended by the supplier. If the oil cooler is damaged or if the oil cooler has been contaminated, replace the oil cooler.

79.3.1.6 OIL COOLER DUCT ASSEMBLY – INSTALLATION

1. Remove all of the protective covers from the oil cooler ports and from the oil cooler tubes.

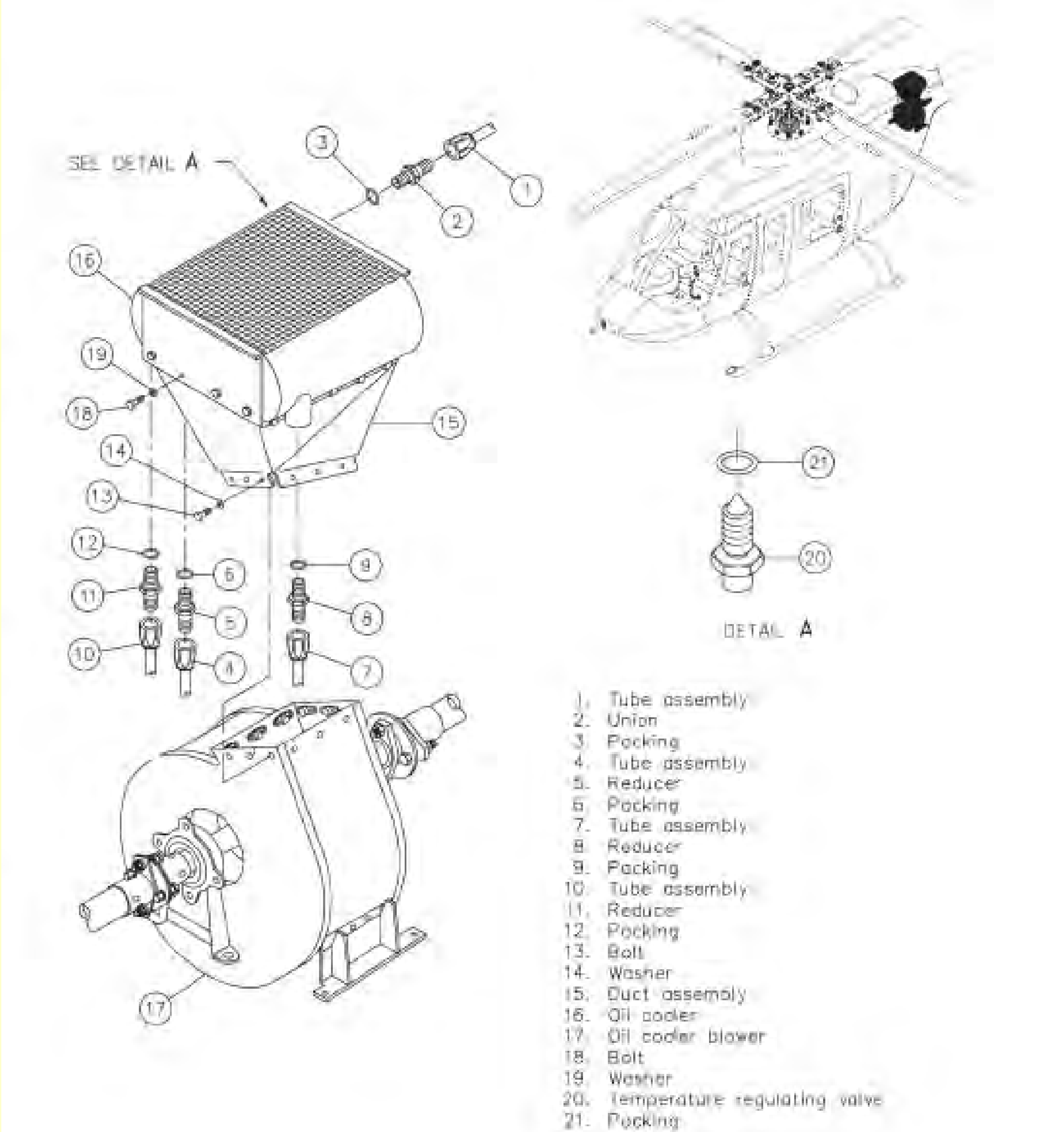


Figure 79- 4 Oil Cooler

2. For the applicable steps that follow, lubricate the packings with the correct oil before you install them. Lubricate the transmission tube packings with transmission lubricating oil. Lubricate the engine oil tube packings with engine lubricating oil.

3. Install the packing (21, Figure 79-4) on the temperature regulating valve (20).

4. Install the temperature regulating valve (20) in the port of the oil cooler (16). Use lockwire (C-405) and safety the temperature regulating valve (20).

5. Put the oil cooler (16) in position on the duct assembly (15). Use the 18 bolts (18) and the washers (19) and install the oil cooler.

6. Put the oil cooler (16) and the duct assembly (15) (as an assembly) in position on the oil cooler blower (17). Use the 12 bolts (13), the washers (14), and install the assembly.

7. Install the packing (12) on the reducer (11).

8. Install the reducer (11) in the XMSN OUT port of the oil cooler (16).

9. Connect the tube assembly (10) to the reducer (11).

10. Install the packing (9) on the reducer (8).

11. Install the reducer (8) in the XMSN IN port of the oil cooler (16).

12. Connect the tube assembly (7) to the reducer (8).

13. Install the packing (6) on the reducer (5).

14. Install the reducer (5) in the OIL IN port of the oil cooler (16).

15. Connect the tube assembly (4) to the reducer (5).

16. Install the packing (3) on the union (2).

17. Install the union (2) in the OIL OUT port of the oil cooler (16).

18. Connect the tube assembly (1) to the union (2).

19. Make sure that the handle of the manual drain valve (17, Figure 79-3) is in the horizontal position.

20. If the helicopter engine has stopped for more than 15 minutes, dry motor the engine for 30 seconds. This scavenges any oil which could have drained into the gearbox. If you do not do this, a false high engine oil consumption indication is given, or you will put too much oil in the oil tank when you fill it.

21. Fill the engine oil tank with engine lubricating oil (Chapter 12).

22. Install the cap and adapter assembly (28) in the oil tank.

23. Make sure that the tubes and the mating surfaces of the oil cooler do not have leaks.

24. Install the aft fairing (Chapter 53).

79.3.1.7 TEMPERATURE REGULATING VALVE — FUNCTIONAL TEST

1. Apply heat to a container of water. Make the temperature reach 160 °F (71 °C).

2. Put the temperature regulating valve into the container for five minutes.

3. Make sure the temperature regulating valve begins to close.

4. Increase the water temperature to 178 °F (81°C). Make sure that the temperature regulating valve closes fully.

5. Remove the temperature regulating valve from the container. Measure the expanded length of the valve. The minimum expansion length of the valve is 0.080 inch (2.03 mm). If the expanded length of the valve is less than 0.080 inch (2.03 mm), the valve is unserviceable. Replace the valve.

79.3.2 OIL COOLER FAN

For the description and the operation of the oil cooler fan, refer to Chapter 65.

79.3.2.1 OIL COOLER FAN — REMOVAL AND INSTALLATION

For the removal and the installation procedures for the oil cooler fan, refer to Chapter 65.

79.3.2.2 OIL COOLER FAN — CLEANING

For the cleaning procedure for the oil cooler fan, refer to Chapter 65.

79.4 ENGINE OIL SYSTEM COMPONENTS

79.4.1 ENGINE OIL FILTER

For the description and the operation of the engine oil filter, refer to Honeywell, Gas Turbine Engine, Light Maintenance Manual, HTS900-2-1D, Chapter 72-00-00.

79.4.1.1 ENGINE OIL FILTER — REMOVAL AND INSTALLATION

For the removal and the installation procedures for the engine oil filter, refer to the Honeywell, Gas Turbine Engine, Light Maintenance Manual, HTS900-2-1D, Chapter 72-00-00.

79.4.1.2 ENGINE OIL FILTER — INSPECTION AND TEST

For the inspection and the test procedures for the engine oil filter, refer to the Honeywell, Gas Turbine Engine, Light Maintenance Manual, HTS900-2-1D, Chapter 72-00-00.

79.4.2 ENGINE OIL CHIP DETECTORS

For the description and the operation of the engine oil chip detectors, refer to the Chapter 96.

79.4.2.1 ENGINE OIL CHIP DETECTORS — REMOVAL AND INSTALLATION

For the removal and the installation procedures for the engine oil chip detectors, refer to Chapter 96.

79.4.2.2 ENGINE OIL CHIP DETECTORS — INSPECTION AND TEST

For the inspection and the test procedures for the engine oil chip detectors, refer to Chapter 96.

79.4.3 OIL TEMPERATURE BULB

For the description and the operation of the oil temperature bulb, refer to Chapter 95.

79.4.3.1 OIL TEMPERATURE BULB — REMOVAL AND INSTALLATION

For the removal and the installation procedures for the oil temperature bulb, refer to Chapter 95.

79.4.3.2 OIL TEMPERATURE BULB — INSPECTION AND TEST

For the inspection and the test procedures for the oil temperature bulb, refer to Chapter 95.

79.4.4 OIL PRESSURE TRANSMITTER

For the description and the operation of the oil pressure transmitter, refer to Chapter 95.

79.4.4.1 OIL PRESSURE TRANSMITTER — REMOVAL AND INSTALLATION

For the removal and the installation procedures for the oil pressure transmitter, refer to Chapter 95.

79.4.4.2 OIL PRESSURE TRANSMITTER — INSPECTION AND TEST

For the inspection and the test procedures for the oil pressure transmitter, refer to Chapter 95.

Chapter 95
INSTRUMENTS
(95-00-00)

CHAPTER 95 — INSTRUMENTS

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95.1 INSTRUMENT SYSTEM AND INTEGRATED AVIONICS SYSTEM

95.1.1 INSTRUMENT SYSTEM AND INTEGRATED AVIONICS SYSTEM — GENERAL DESCRIPTION

This chapter provides the data necessary to understand the operation of the instrument systems and to perform the necessary maintenance steps.

Information is provided for 407HP helicopters modified per TCCA STC SH14-XXXX (Ref FAA STC SRXXXXNE) in conjunction with BHT-MM-10 Chapter 95 Section1.

This chapter describes each system under its own section. It provides the operator with the information necessary to maintain the serviceability of the specific instrument system.

In addition to the information provided in this chapter, refer to Chapter 96 for information on the following:

- Electrical Safety and Hazards
- Safety Practices — General
- Standard Practices — Electrical Maintenance or Repairs
- Standard Practices — Electrical Work in Confined Spaces
- Standard Practices — After Electrical Maintenance or Repairs
- Miscellaneous Electrical Tools
- Operational Checks, Functional Checks, and Troubleshooting Charts
- General Troubleshooting
- Miscellaneous Electrical Components — Maintenance Practices
- Semiconductor Devices
- Control Panels
- Circuit Breakers
- Electrical Load Analysis
- Electrical and Electronic Components, Reference Designator/Description/Location — Reference Table and Location Figure
- Circuit, Wires, and Cable Harness — Designations

Simplified electrical schematics are used throughout the chapter to help clarify system or circuit operation. To make the schematics easier to follow and understand, all wire numbers and certain intermediate connectors are not shown. The schematics are to be used in conjunction with the system operational descriptions. All block diagrams and internal views of the components are simplified and do not show the accurate operation of the components. For detailed wiring diagram information, refer to Chapter 98.

All of the electrical simplified schematics in this chapter show the electrical equipment in the static position. All of the block diagrams and internal views of components are simplified representations and do not necessarily reflect the actual internal workings. The static position is specified as follows:

- No electrical power is applied
- Switches and relays are shown in the off or de-energized position

- The pressure switches are shown with no pressure applied
- The temperature switches are shown at the temperature of 59°F (15°C)

NOTE

If you install Bell Helicopter Textron (BHT) optional equipment for the first time, do this in accordance with the instructions provided in the applicable Installation Instruction (II).

Follow the instructions provided in this chapter for any subsequent installation.

For the specific electrical information and procedures, wiring maintenance refer to the Electrical Standard Practices Manual (BHT-ELEC-SPM), which provides the data necessary to repair and replace the wires, cables, or the electrical components to the standards of performance and quality as specified by Bell Helicopter Textron (BHT).

95.2 SECTION I: INSTRUMENT SYSTEM

95.2.1 INSTRUMENT SYSTEM

The instrument system for 407HP helicopters S/N 53000 through 54299 (Figure 95-1) includes the systems that follow:

1. Flight instrument system. The basic flight instrument system includes a pitot-static system and the instruments that follow:

- Airspeed indicator
- Altimeter
- Instantaneous Vertical Speed Indicator (IVSI)
- Inclinometer

2. The flight instrument system can also include an optional flight instrument kit (BHT-407-II-15). The flight instrument kit includes the additional flight and navigation instruments that follow:

- Directional Gyroscope (DG) indicator
- Attitude indicator/artificial horizon indicator
- Turn and slip indicator (the turn and slip indicator replaces the inclinometer)

3. Optional flight instruments. The optional flight instruments also include an encoding altimeter kit (BHT-407-II-16).
4. Navigation instrument system. The basic navigation instrument system includes a magnetic compass. Additional information on -705 kit navigation instruments is located in Chapter 97.
5. Propulsion instrument system. The propulsion instrument system includes the instrument systems that follow:

- Torque (Q) indication system
- Measured Gas Temperature (MGT) indication system
- Gas producer (NG) indication system
- Dual tachometer (NP/NR) system
- Engine oil temperature and indication system
- Transmission oil temperature and pressure indication system

6. Fuel system instrument system. The fuel system instrument system includes the instrument systems that follow:

- Fuel pressure indication system
- Fuel quantity gauging system

7. Miscellaneous instrument system. The miscellaneous instrument system includes instruments systems that follow:

- Ammeter
- Clock/Outside Air Temperature (OAT)/ volts indication system
- Hourmeter

All of the instruments, except for the magnetic compass and the engine hourmeter, are installed on the instrument panel.

95.2.2 INSTRUMENT PANEL— DESCRIPTION

See BHT-407-MM Chapter 95-3.

95.2.2.1 Instrument Panel — Removal

See BHT-407-MM Chapter 95-4.

95.2.2.2 Instrument Panel — Cleaning

See BHT-407-MM Chapter 95-5.

95.2.2.3 Instrument Panel — Inspection

See BHT-407-MM Chapter 95-6.

95.2.2.4 Instrument Panel — Repair

See BHT-407-MM Chapter 95-7.

95.2.2.5 Instrument Panel — Installation

See BHT-407-MM Chapter 95-8.

95.2.3 SHROUD ASSEMBLY

See BHT-407-MM Chapter 95-9.

95.2.3.1 Shroud Assembly — Removal

See BHT-407-MM Chapter 95-10.

95.2.3.2 Shroud Assembly — Cleaning

See BHT-407-MM Chapter 95-11.

95.2.3.3 Shroud Assembly — Inspection

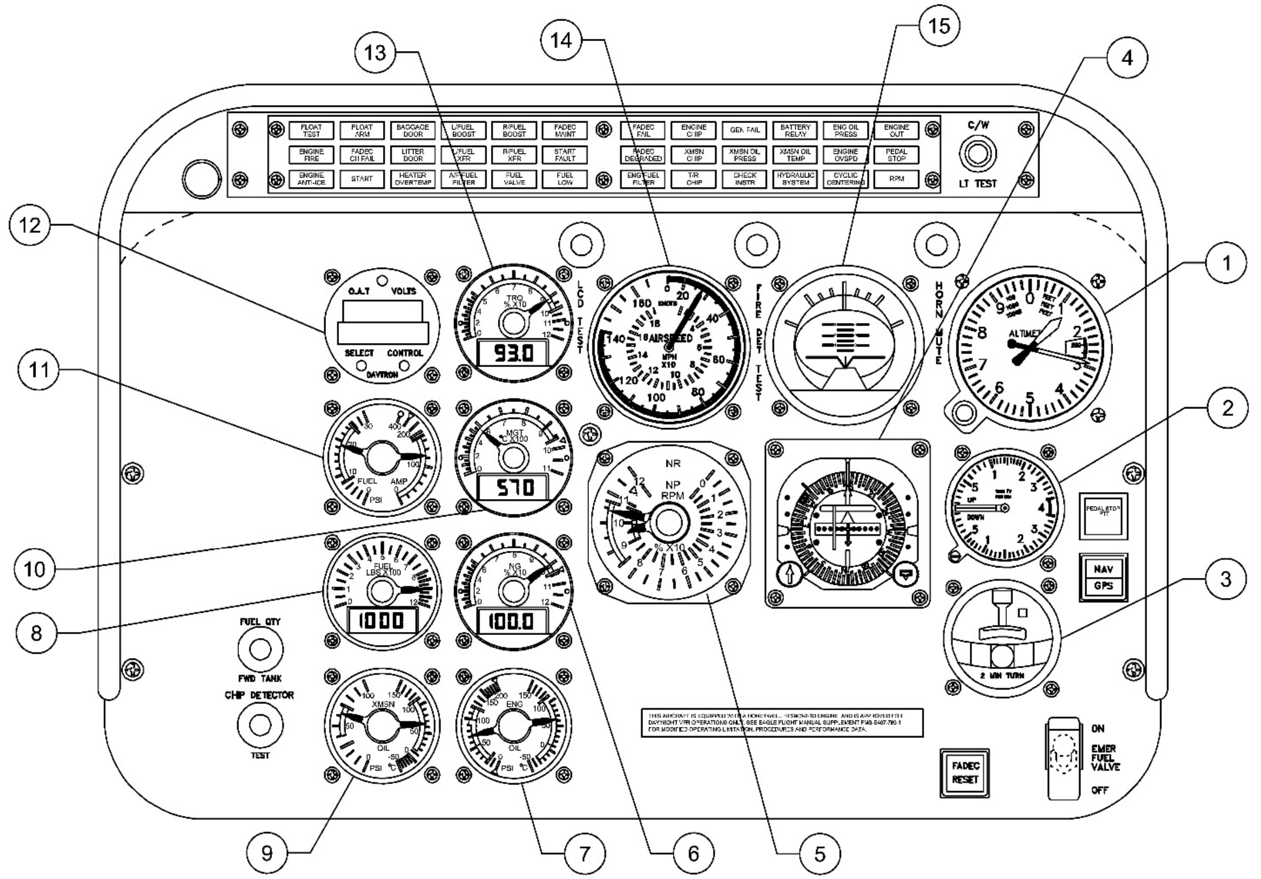
See BHT-407-MM Chapter 95-12.

95.2.3.4 Shroud Assembly — Repair

See BHT-407-MM Chapter 95-13.

95.2.3.5 Shroud Assembly — Installation

See BHT-407-MM Chapter 95-14.



1. Altimeter
2. Vertical Speed Indicator
3. Turn and Bank Indicator (kit)
4. Directional Gyoscope (kit)
5. Dual Tachometer
6. NG Indicator
7. Engine Oil Temperature/Pressure Indicator
8. Fuel Quantity Indicator
9. Transmission Oil Temperature/Pressure Indicator
10. MGT Indicator
11. Fuel Pressure/Ammeter Indicator
12. Clock/OAT/Volts Indicator
13. Engine Torque Indicator
14. Airspeed Indicator
15. Artificial Horizon Indicator (kit)

Figure 95-1: Instrument Panel - Description

95.3 FLIGHT INSTRUMENTS

95.3.1 FLIGHT INSTRUMENT SYSTEM — DESCRIPTION

See BHT-407-MM Chapter 95-15.

95.3.2 PITOT-STATIC SYSTEM — DESCRIPTION

See BHT-407-MM Chapter 95-16.

95.3.2.1 Pitot Tube — Removal

See BHT-407-MM Chapter 95-17.

95.3.2.2 Pitot Tube — Installation

See BHT-407-MM Chapter 95-18.

95.3.2.3 Static Port — Removal

See BHT-407-MM Chapter 95-19.

95.3.2.4 Static Port — Installation

See BHT-407-MM Chapter 95-20.

95.3.2.5 Pitot-static System — Cleaning

See BHT-407-MM Chapter 95-21.

95.3.2.6 Pitot-static System — Inspection

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95.3.2.7 Pitot-static Heating System — Operational Check

See BHT-407-MM Chapter 95-23.

95.3.2.8 Pitot-static System — Leak Check

See BHT-407-MM Chapter 95-24.

95.3.3 FLIGHT INSTRUMENTS— DESCRIPTION

See BHT-407-MM Chapter 95-25.

95.3.3.1 AIRSPEED INDICATOR — DESCRIPTION

See BHT-407-MM Chapter 95-26.

95.3.3.1.1 Airspeed Indicator — Functional Check

See BHT-407-MM Chapter 95-27.

95.3.3.1.2 Airspeed indicator — Removal

See BHT-407-MM Chapter 95-28.

95.3.3.1.3 Airspeed Indicator — Installation

See BHT-407-MM Chapter 95-29.

95.3.3.2 ALTIMETER — DESCRIPTION

See BHT-407-MM Chapter 95-30.

95.3.3.2.1 Altimeter — Functional Check

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95.3.3.2.2 Altimeter Indicator — Removal

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95.3.3.2.3 Altimeter indicator — Installation

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See BHT-407-MM Chapter 95-37.

95.3.3.4.1 Vertical Speed Indicator (VSI) — Functional Check

See BHT-407-MM Chapter 95-38.

95.3.3.4.2 Vertical Speed Indicator (VSI) — Removal

See BHT-407-MM Chapter 95-39.

95.3.3.4.3 Vertical Speed Indicator (VSI) — Installation

See BHT-407-MM Chapter 95-40.

95.4 NAVIGATION INSTRUMENTS

95.4.1 NAVIGATION INSTRUMENTS

See BHT-407-MM Chapter 95-41.

95.4.2 MAGNETIC COMPASS — DESCRIPTION

See BHT-407-MM Chapter 95-42.

95.4.2.1 Magnetic Compass) — Calibration (Compass Rose Method)

See BHT-407-MM Chapter 95-43.

95.4.2.2 Magnetic Compass — Calibration (Sight Compass Method)

See BHT-407-MM Chapter 95-44.

95.4.3 INCLINOMETER — DESCRIPTION

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95.4.4 DIRECTIONAL GYROSCOPE (FLIGHT INSTRUMENTS KIT) — DESCRIPTION

See BHT-407-MM Chapter 95-46.

95.4.4.1 Directional Gyroscope (DG) — Operational Check

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95.4.4.3 Directional Gyroscope (DG) — Installation

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See BHT-407-MM Chapter 95-50.

95.4.5.1 Attitude Indicator — Operational Check

See BHT-407-MM Chapter 95-51.

95.4.5.2 Attitude Indicator — Removal

See BHT-407-MM Chapter 95-52.

95.4.5.3 Attitude Indicator — Installation

See BHT-407-MM Chapter 95-53.

95.4.6 TURN AND SLIP INDICATOR (FLIGHT INSTRUMENTS KIT) — DESCRIPTION

See BHT-407-MM Chapter 95-54.

95.4.6.1 Turn and Slip Indicator — Operational Check

See BHT-407-MM Chapter 95-55.

95.4.6.2 Turn and Slip Indicator — Removal

See BHT-407-MM Chapter 95-56.

95.4.6.3 Turn and Slip Indicator — Installation

See BHT-407-MM Chapter 95-57.

95.5 PROPULSION INSTRUMENTS

95.5.1 PROPULSION INSTRUMENTS

The propulsion instruments provide an indication of the performance of the systems related to the power plant. The propulsion instruments include the instruments that follow:

- Dual tachometer (1M6)
- Engine torque indicator (1M8)
- Measured gas temperature indicator (1M4)
- Gas producer (NG) tachometer (1M5)
- Engine oil pressure and temperature indicator (1M2)
- Transmission oil pressure and temperature indicator (1M3)

95.5.2 PROPULSION INSTRUMENTS — STANDARD PRACTICES

The standard practices that follow are applicable to all of the instruments of the propulsion group.

95.5.2.1 Electrostatic Sensitive Equipment — Standard Practices

Certain components used in the propulsion instruments are sensitive to, and can be damaged by, the discharge of static electricity.

The static damage level for components may not be felt by a person. When damage by static electricity is suspected, do a complete functional check of the instrument.

When sensitive components are handled, protective measures must be taken to prevent damage, which could result in failure or degradation of the function of the component.

When handling a propulsion instrument, take the precautions that follow:

1. Do not touch the electrical pins of the connector.
2. Install an antistatic cover on the connector.
3. Store the indicator in an approved container.

95.5.2.2 Propulsion Instruments — Removal

MATERIALS REQUIRED
Refer to BHT-ALL-SPM for specifications.

NUMBER	NOMENCLATURE
C-156	Caps and/or Plugs

WARNING

OBEY ALL THE SAFETY PRECAUTIONS WHEN DOING MAINTENANCE ON OR NEAR ELECTRICAL/ELECTRONIC EQUIPMENT (CHAPTER 96).

CAUTION

PRIOR TO DISCONNECTING ELECTRICAL CONNECTORS MAKE SURE THAT THE CONNECTORS ARE

PROPERLY LABELLED. CONNECTORS ARE NOT KEYED TO PREVENT CONNECTION TO THE WRONG INDICATOR.

NOTE

This procedure is not used for the removal of dual tachometer indicator.

NOTE

This procedure is also used for removal of the fuel quantity indicator (1M1) and the fuel pressure/ammeter (2M1).

NOTE

Remove components only to the extent necessary to perform the required maintenance.

1. Disconnect the battery and external DC power from the helicopter.
2. On the instrument panel, loosen the indictor clamp screw (larger) adjacent to the indicator. See (Figure 95-2).
3. Carefully slide the instrument (3) out from the instrument panel (5).

CAUTION

HANDLE THE CONNECTORS AND THE RECEPTACLE OF THE INSTRUMENTS IN ACCORDANCE WITH STANDARD PRACTICES FOR ELECTROSTATIC SENSITIVE EQUIPMENT. THESE INSTRUMENTS ARE SENSITIVE TO ELECTROSTATIC. FAILURE TO OBEY THESE PRECAUTIONS MAY RESULT IN DAMAGE TO THE RELATED INSTRUMENT.

4. Disconnect the connector from the propulsion instrument to be removed as shown in Table 95-1. Install caps and/or plugs (C-156) on the electrical receptacle of the instrument and on the electrical connector.

Table 95-1: Propulsion Instruments / Connectors

INSTRUMENT	CONNECTOR
Engine Oil Press/Temp Indicator (1M2)	1M2P1
XMSN Oil Press/Temp Indicator (1M3)	1M3P1
MGT Indicator (1M4)	1M4P1
NG Indicator (1M5)	1M5P1
Dual Tachometer (1M6)	1M6P1, 1M6P2
Engine Torque (1M8)	1M8P1
Fuel Pressure/Ammeter Indicator (2M1)	2M1P1
Fuel Quantity Indicator (1M1)	1M1P1

95.5.2.3 Propulsion Instruments — Installation

WARNING

OBEY ALL THE SAFETY PRECAUTIONS WHEN DOING MAINTENANCE ON OR NEAR ELECTRICAL/ELECTRONIC EQUIPMENT (CHAPTER 96).

CAUTION

CONNECTORS ARE NOT KEYED TO PREVENT CONNECTION TO THE WRONG INDICATOR. VERIFY PROPER CONNECTOR BEFORE CONNECTING TO INDICATOR.

NOTE

This procedure is not used for the removal of dual tachometer indicator.

NOTE

This procedure is also used for installation of the fuel quantity indicator (1M1) and the fuel pressure/ammeter (2M1).

1. Disconnect the battery and external DC power from the helicopter.
2. Check that the connector is through the proper indicator hole on the instrument panel.
3. Remove the caps and/or plugs from the electrical receptacle of the instrument connector to be installed. Connect the related electrical connector to the propulsion instrument as shown in Table 95-1.
4. Slide the indicator into the hole and align the indicator so that the display is properly oriented. (1), (Figure 95-2)
5. Tighten the indicator clamp screw (large) adjacent to the indicator on the instrument panel.
6. Make sure the bond resistance between the instrument (3) and the instrument panel (5) meets Class R-II electrical bonding requirements (BHT-ELEC-SPM, Chapter 8).

NOTE

As applicable to the fuel quantity indicator (1M1), do a fuel quantity gauging system calibration procedure (paragraph 95.6.10.1).

7. Do an operational check of the applicable instrument system after installation.

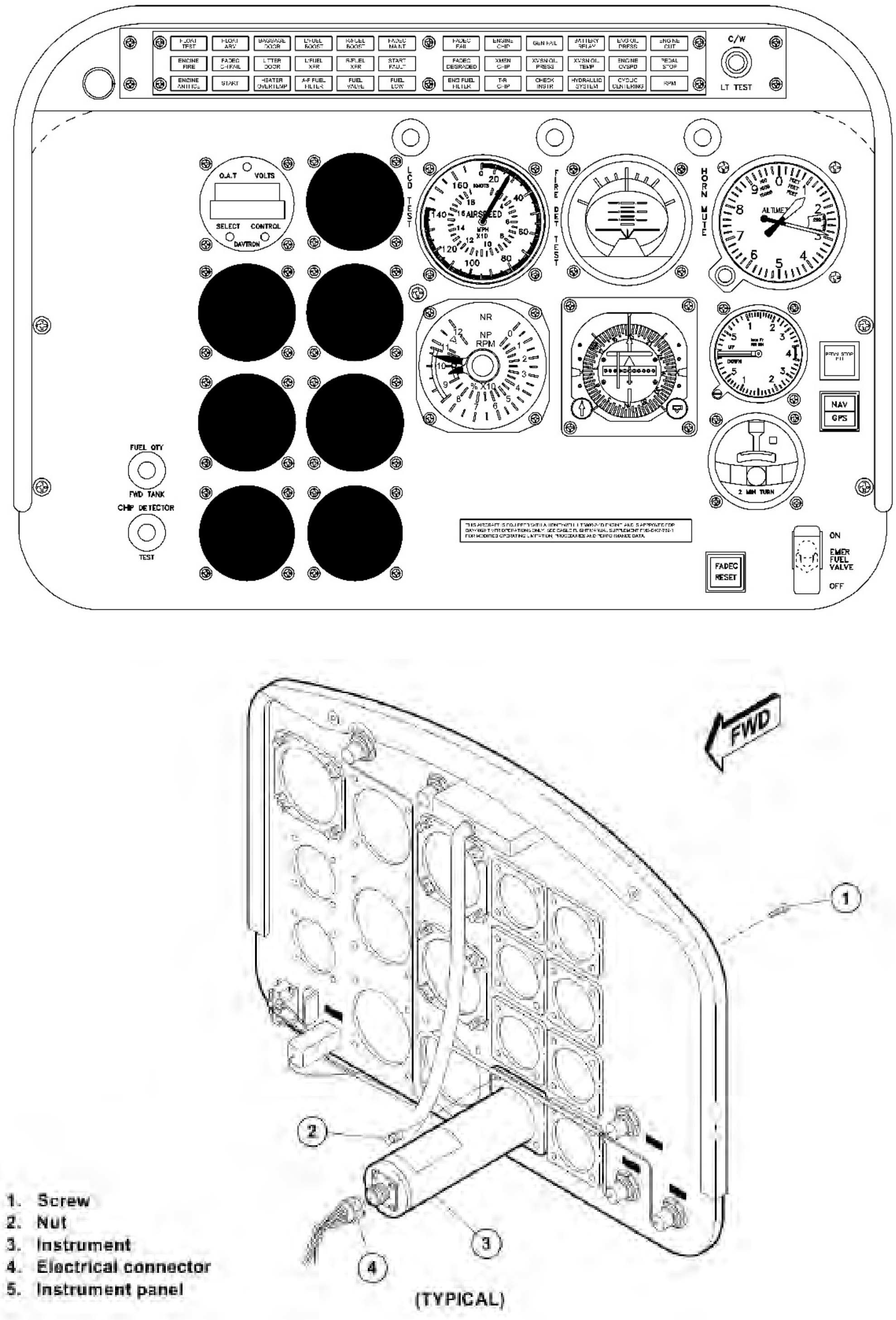


Figure 95-2: Propulsion Instruments - Removal and Installation

95.5.3 ENGINE TORQUE INDICATION SYSTEM — DESCRIPTION

The engine torque system is composed of engine torque indicator (Figure 95-3) and a single dual element engine torque transducer. The torque sensor is mounted on the front of the gearbox and has redundant strain gauges (one output per ECU channel) that measure oil pressure proportional to engine torque. Refer to the Honeywell Light Maintenance Manual HTS900-2-1D for description, operation, and installation/removal of the transducer. The sensor outputs are supplied to the ECU channels for use in torque limiting. The torque value is also provided to the cockpit via ARINC 429. The engine torque indicator (1M8) receives torque information from ARINC 429 data bus word with label 336 (octal) and indicating normal operation from monitored active channel.

The torque indicator is made up of a dial and electronic components in an environmentally sealed case. The dial of the torque indicator has a scale that shows torque in % X 10. The range of the scale is from 0 to 120% torque.

The dial has a single needle/pointer display and a digital display. The needle display moves in a clockwise manner from 0 to 120 %. The digital display shows the TRQ % in a four digit format.

Torque indicator is a digital indicator with analog and digital indication. The 28 VDC bus supplies the power to the torque indicator through the ENGINE INSTR TRQ (1CB25) circuit breaker on the overhead panel. Internal lighting uses dimmable LED backlights. The maximum backlight voltage is 5 VDC. The backlight controller is programmed to simulate incandescent backlight.

Digital displays are LED display that updates a minimum of twice per second. The backlight voltage controls the brightness of the digital display. The digits are full brightness when the voltage is between 0 VDC and approximately 0.25 VDC; normally used for daylight operation. The digits start dimming when the voltage is between 0.25 VDC and 0.5 VDC. The digital display is set to minimum brightness when the backlight voltage is between 0.5 VDC and 1.5 VDC. The brightness of the digital display follows the backlight voltage between 1.5 VDC and 5 VDC; this range is normally used for night operation.

For the simplified schematic of the engine torque indication system, refer to Figure 95-4.

95.5.3.1 Engine Torque Indication System — Range Markings

The range marking for the TRQ scale is shown in Table 95-2.

Table 95-2: Engine Torque (TRQ) Scale — Range Marking

MARKING	RANGE (TRQ)	DEFINITION
Green Arc	0 to 93.5%	Continuous Operation
Yellow Arc	93.5 to 100%	5-minute Takeoff
Red Line	100%	Maximum

The 100% maximum on the torque instrument represents 560 ft-lbs torque. This output is divided on the helicopter between the tail rotor drive system and the main rotor drive system. This division of horsepower is done automatically in flight, depending on the power requirements of the different drivetrain systems.

The 93.5% on the torque instrument represents 524 ft-lbs torque. This is the maximum limit allowed on a continuous basis. The 5-minute limit between 93.5% (524 ft-lbs) and 100% (560 ft-lbs) represents a 5-minute limit in this range of power. The torque recorded by the indicator is different from torque recorded by the ECU.

95.5.3.2 Engine Torque Indication System — Exceedances

The torque indicator microprocessor is pre-programmed with specific torque values, which causes the digital displays to flash. When the indicator flashes once per second, it notifies that the pilot is approaching the end of the 5 minute limit between 93.5% and 100% torque. When the indicator flashes twice per second, it notifies that the torque value exceeds the 100% limit. It will also trigger a switch that provides a ground at pin 21 to turn on the check instrument (CHECK INSTR) annunciator on the caution/warning/advisory panel when the pilot exceeded the 110% limit and actual overtorque is detected.

The peak torque and duration of transient torque events during operation are recorded in the memory. The duration of each event is captured by timers which are started when the torque exceeds the torque limits given in

Table 95-3. The indicator counts over-torque events by maintaining counters in its non-volatile memory. The Operation Exceedance Count (OEC) counts the number of over-torque events that occur during the normal operation.

The torque values have been selected with the intentions that follow:

- There is a torque limitation of 5 minutes between 93.5 and 100%. To give the pilot notice that he is approaching the end of the 5-minute limit, the indicator's digital display begins to flash once per second when 30 seconds remain in the 5-minute time period. The display stops flashing when indicated torque returns below the alert limit, if an over-torque event did not occur.

- There is a red line at 100% representing the maximum torque allowed. When pilot exceeds 100%, the indicator flashes immediately once per second. The display stops flashing when indicated torque returns below the alert limit, if an over-torque event did not occur.

- When pilot exceeds 110.0% the indicator immediately begins to flash twice per second. CHECK INSTR annunciator activates to indicate that exceedance has occurred and has been recorded at the indicator's Non-Volatile Memory. Annunciator is activated until display sequence completed.

The data can be retrieved by communication with the indicator through the serial interface connector installed on the left hand side of the center pedestal. Refer to paragraph 95.5.3.11 for Data acquisition and clearing.

95.5.3.3 Engine Torque Indication System — Relationship between Torque Indicator and FADEC System

The interpretation of what represents 100% indicated torque is different from 100% engine torque recorded by the FADEC/ECU. The signal output of torque transducer installed on the engine, is the value recorded and monitored by the FADEC/ECU for control operation. Due to the physical restriction on the main transmission, the indication of 100% torque equates its continuous operational capability. Thus, the ARINC 429 signal transmitted by the FADEC/ECU for indication has been conditioned to get the gauge reads 100% at 560 ft-lbs. To determine the engine (FADEC/ECU) torque, use the factor i.e. (Q × .8903) or (Q ÷ 1.123). When evaluating an engine overtorque situation (refer to Chapter 76 and Honeywell Light Maintenance Manual HTS900-2-1D), the mentioned information will be valuable in relating the torque indication system to the relevant engine values. The relationship between the torque indicator system and the FADEC system is shown in Table 95-4.

95.5.3.4 Engine Torque Indication System Transducer — Description

The engine torque transducer is mounted on the front of the gearbox and has redundant strain gages that measure oil pressure proportional to engine torque. The sensor outputs are supplied to each FADEC/ECU channel for use in torque limiting. Also torque values from both channels are provided to the cockpit for engine indication via ARINC 429.

95.5.3.5 Engine Torque Indication System — Operation

The engine torquemeter pressure sensing port gives a specific oil pressure output for a specific shaft horsepower. This oil pressure output is fed to each FADEC/ECU channel. The engine transducer data gives input to the FADEC/ECU for the operation of the FADEC system. The strain gauge circuit of the torque transducer receives an excitation voltage from each ECU channel. The signal is transmitted by the FADEC/ECU to the torque indicator via ARINC 429. The torque indicator displays a percentage of torque corresponding to the input signal.

Torque indicator monitors the active ECU channel from ARINC data bus words with label 270 (bit 23- channel active and bit 24- other channel active) and use the data off the channel in control. ARINC data bus transmission is solely dependent on the ECU channel being powered. The indicator receives information from both channels at the same time and monitors the channel in control. In case that label 270 is not present on either channel, indicator have the preference to use channel A over channel B as long as the signal is valid through SSM bit (bit 30 and 31 set to 1). Refer to Chapter 76-00-00 for complete list of ARINC 429 Data Bus Information.

The indicator receives its torque information from ARINC 429 data bus words with label 336 (octal) and indicating normal operation from monitored active channel.

Torque indicator records engine torque data into a non-volatile memory. The data can be retrieved by communication with the indicator through the serial interface connector installed on the left hand side of the center pedestal. The digital display plays back portion of the data during power-up, or when the built-in test is activated by pressing the LCD test switch on the instrument panel.

The peak torque and duration of transient torque events during operation are recorded into the indicator's non-volatile memory. The indicator monitors and captures the peak torque during each event. The duration of each event is captured by timers which are started when the torque exceeds the torque limits given in

Table ***95-3***: (93.5%, 100.0% and 110.0%), and stopped when the torque drops below the respective limits. The event is also flagged as an exceedance if it exceeds the warning limits described in

Table ***95-3***. Zero seconds is stored for the duration if the peak is below the torque limits given in

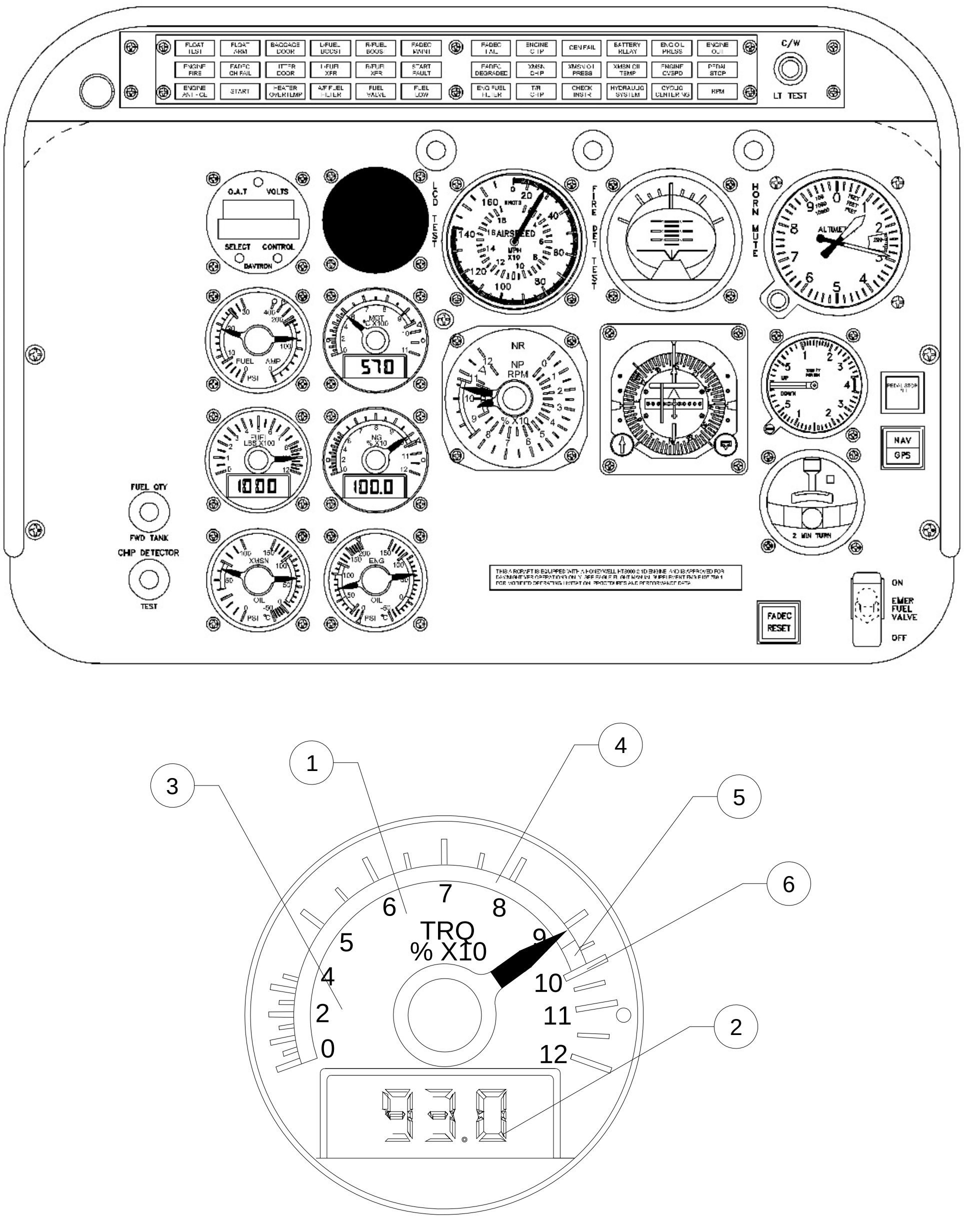
Table ***95-3***. The indicator counts over-torque events by maintaining counters in its non-volatile memory. The Operation Exceedance Count (OEC) counts the number of over-torque events that occur during the normal operation.

On power-up, the digits display the following sequence. During this time the indicator pointer indicates the current engine torque, and the current torque is monitored for over-torque events. During the sequence, each item is displayed for two seconds with the display briefly blanked between items before stepping to the next frame, except when stated otherwise. The data is played back in the following sequence:

- All segments are lit providing an "8.8.8.8" pattern to verify that all display elements are functioning.
- The first three digits and then the last three digits of the software version are displayed for one second each.
- The Operation label "O-" is displayed if no over-torque event has occurred since the last time the indicator memory was reset. Otherwise, the Operation Exceedance label "OE" is displayed.
- If an over-torque event has been recorded, the date of the highest engine torque during operation since the last memory reset is displayed, followed by the time.
- The highest torque during operation since the last memory reset is displayed. If an over-torque event has been recorded, this is followed by the time (in seconds) the torque was above 93.5%, followed by the time (in seconds) the torque was above 100.0%, followed by the time (in seconds) the torque was above 110.0%. If the torque was not over the torque limit, a zero (for zero seconds) is displayed. The maximum time that the indicator can display is 3599 seconds.

If the current gas generator is greater than 5%, the indicator will exit the playback mode and the digital display will start displaying the current engine torque. If the gas generator speed is below this threshold, the indicator will play back the Operation Exceedance Count label "OEC" followed by the number of over-torque events recorded during operation.

After the power-on display sequence, normal operation of the digits begins.



1. TRQ indicator dial
2. Digital display
3. Pointer display
4. Green arc
5. Yellow arc
6. Red line

Figure 95-3: Engine Torque Indicator - Description

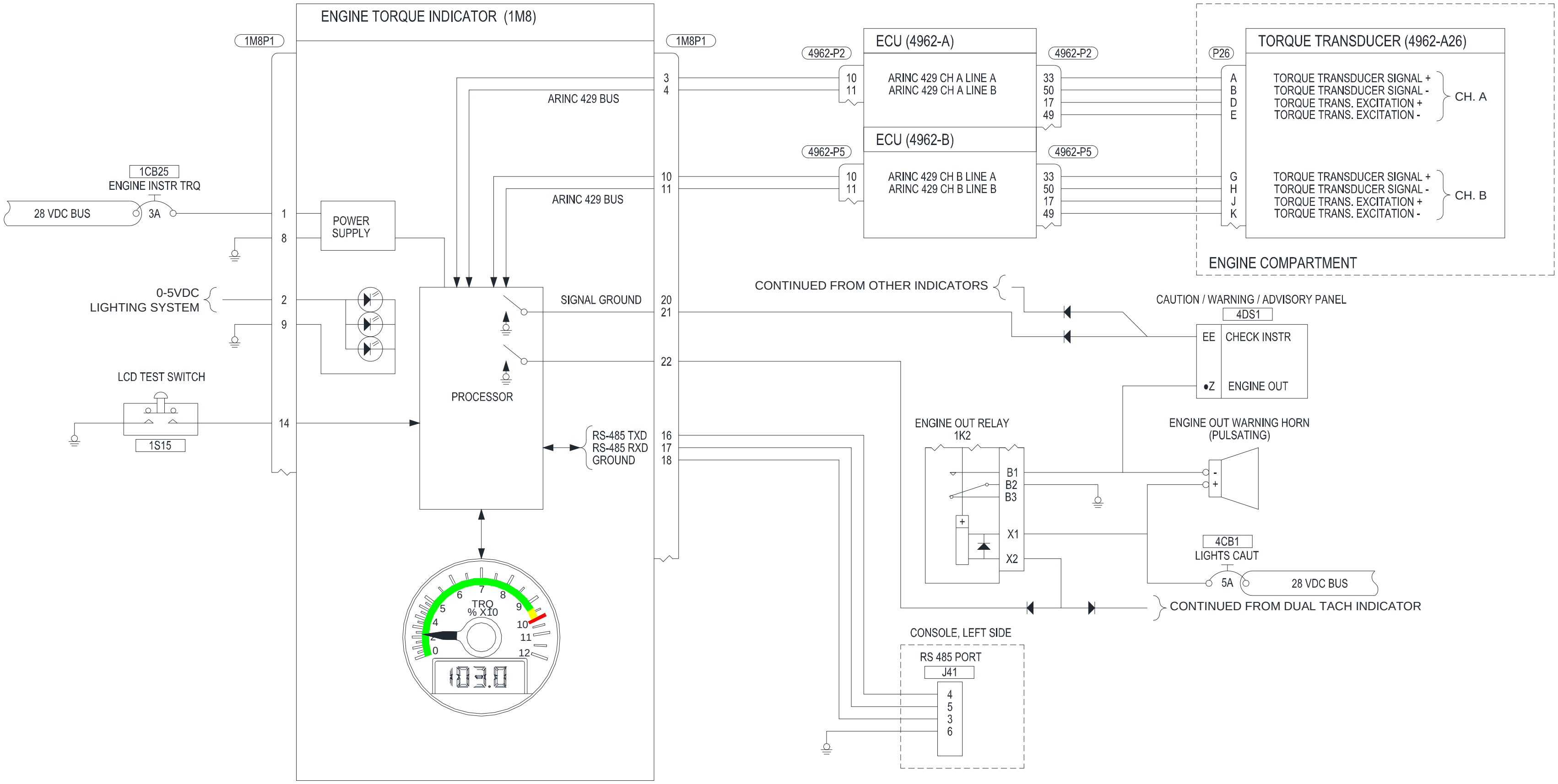


Figure 95-4: Engine Torque Indication System - Simplified Schematic

95.5.3.6 Check Instrument Display Sequence – Torque Indicator

When the built-in test is activated by pushing LCD test on the instrument panel, the digits display the following sequence. During this time the indicator pointer indicates the current engine torque, and the current torque is monitored for over-torque events. During the sequence, each item is displayed for two seconds with the display briefly blanked between items before stepping to the next frame, except when stated otherwise. The data is played back in the following sequence:

- The Operation label “O-” is displayed if no over-torque event has occurred since the last time the indicator memory was reset. Otherwise, the Operation Exceedance label “OE” is displayed.
- If no exceedance has been recorded, the highest engine torque during operation since the last memory reset is displayed. Otherwise the peak during the most recent engine torque operating exceedance event is displayed.

If the current gas generator is greater than 5%, the indicator will exit the playback mode and the digital display will start displaying the current engine torque. If the gas generator speed is below this threshold, the indicator will play back the Operation Exceedance Count label “OEC” followed by the number of over-torque events recorded during operation.

After the power-on display sequence, normal operation of the digits begins.

Table 95-3: Torque Indicator Limits

	OPERATION MODE TRANSIENT LIMITS	DIGITAL DISPLAY	EXCEEDANCE ANNUNCIATOR
Potential Over-Torque Event (Alert)	Greater than 93.5% for more than 270 seconds or Greater than 100.0 %	Flashes once per second (Stops flashing below limit) Flashes once per second (Stops flashing below limit)	
Actual Over-Torque Event (Warning) Recorded	Greater than 110.0% (OEC)	Flashes twice per second	Activated (Remains activated until Check Instrument display sequence completed)

Table 95-4: Relationship between Torque Indicator and FADEC System

TORQUE INDICATOR (%)	FADEC TORQUE (%)	HORSEPOWER (HP)	FOOT-POUNDS	PSI
121.7	108.40	820	682	59.83
114.2	101.70	769	640	56.06
112.3	100.00	757	629	55.06
100.0	89.00	674	560	48.81
93.5	83.25	630	524	45.55
21.4	19.10	144	120	8.93

95.5.3.7 Torque Indicator Fault Indication

Failure	Observations
Indicator Power Failure	Digits extinguish and pointers return to about five angular degrees below 0
Torque Data	Pointer and digits returns to 0 CHECK INSTR caution annunciator activates

95.5.3.8 Engine Out Warning — Torque Indicator

Torque indicator monitors the data bus for words with label 271 (octal) for engine out warning (bit 14). If the active channel indicates engine out, the ENGINE OUT annunciator is activated. Refer to Chapter 96 for Engine Out Warning Annunciator description and operation.

95.5.3.9 Engine Torque Indication System — Operational Check

NOTE

To view exceedances recorded in the NVM with a GSTS, refer to paragraph 95.5.3.11.

1. Set the battery switch to BATT, or connect the external DC power to the helicopter.
2. Close the ENGINE INSTR TRQ (1CB25) circuit breaker.

RESULT:

- Engine out horn will come on.
- Engine out warning annunciator will flash momentarily.
- Indicator pointer indicates the current engine torque.
- All digit segments are lit providing “8.8.8.8” pattern.
- The first three digits and then the last three digits of the software version are displayed for one second each.
- The Operation label “O-” is displayed if no over-torque event has occurred. Otherwise, the Operation Exceedance label “OE” is displayed.
- If an over-torque event has been recorded, the date of the highest engine torque during operation since the last memory reset is displayed, followed by the time.
- The highest torque during operation since the last memory reset is displayed. If an over-torque event has been recorded, this is followed by the time (in seconds) the toque was above 93.5%, followed by the time (in seconds) the torque was above 100.0%, followed by the time (in seconds) the torque was above 110.0%. If the torque was not over the torque limit, a zero (for zero seconds) is displayed. The maximum time that the indicator can display is 3599 seconds.

If the current gas generator speed is greater than 5%, the indicator will exit the playback mode and the digital display will start displaying the current engine torque. If the gas generator speed is below this threshold, the indicator will play back the Operation Exceedance Count label “OEC” followed by the number of over-torque events recorded during operation.

CORRECTIVE ACTION:

- If the digital displays do not come on, refer to Trouble No. 1 (Figure 95-5).

3. Push “HORN MUTE” switch button.

RESULT:

- Warning horn mutes.

4. Push the LCD TEST switch on the instrument panel.

RESULT:

- Engine out horn will come on.
- Engine out warning annunciator will flash momentarily.
- Indicator pointer indicates the current engine torque.

- The Operation label “O-” is displayed if no over-torque event has occurred since the last time the indicator memory was reset. Otherwise, the Operation Exceedance label “OE” is displayed.
- If no exceedance has been recorded, the highest engine torque during operation since the last memory reset is displayed. Otherwise the peak during the most recent engine torque operating exceedance event is displayed.

If the current gas generator speed is greater than 5%, the indicator will exit the playback mode and the digital display will start displaying the current engine torque. If the gas generator speed is below this threshold, the indicator will play back the Operation Exceedance Count label “OEC” followed by the number of over-torque events recorded during operation.

CORRECTIVE ACTION:

- If the digital displays do not perform display sequence, refer to Trouble No. 2 (Figure 95-6).

5. Push “HORN MUTE” switch button.

RESULT:

- Warning horn mutes.

6. Set the battery switch to OFF, or remove the external DC power from the helicopter.
7. Return the helicopter to the standard configuration. Refer to Standard Practices — After Electrical Maintenance or Repairs (Chapter 96).

ENGINE TORQUE INDICATOR - TROUBLE NO. 1

CAUTION

DISCONNECT THE BATTERY AND THE EXTERNAL POWER PRIOR TO PERFORMING A CONTINUITY CHECK OR MAINTENANCE ON THE ENGINE TORQUE INDICATOR.

NOTE

Refer to Chapter 98 for wiring diagram.

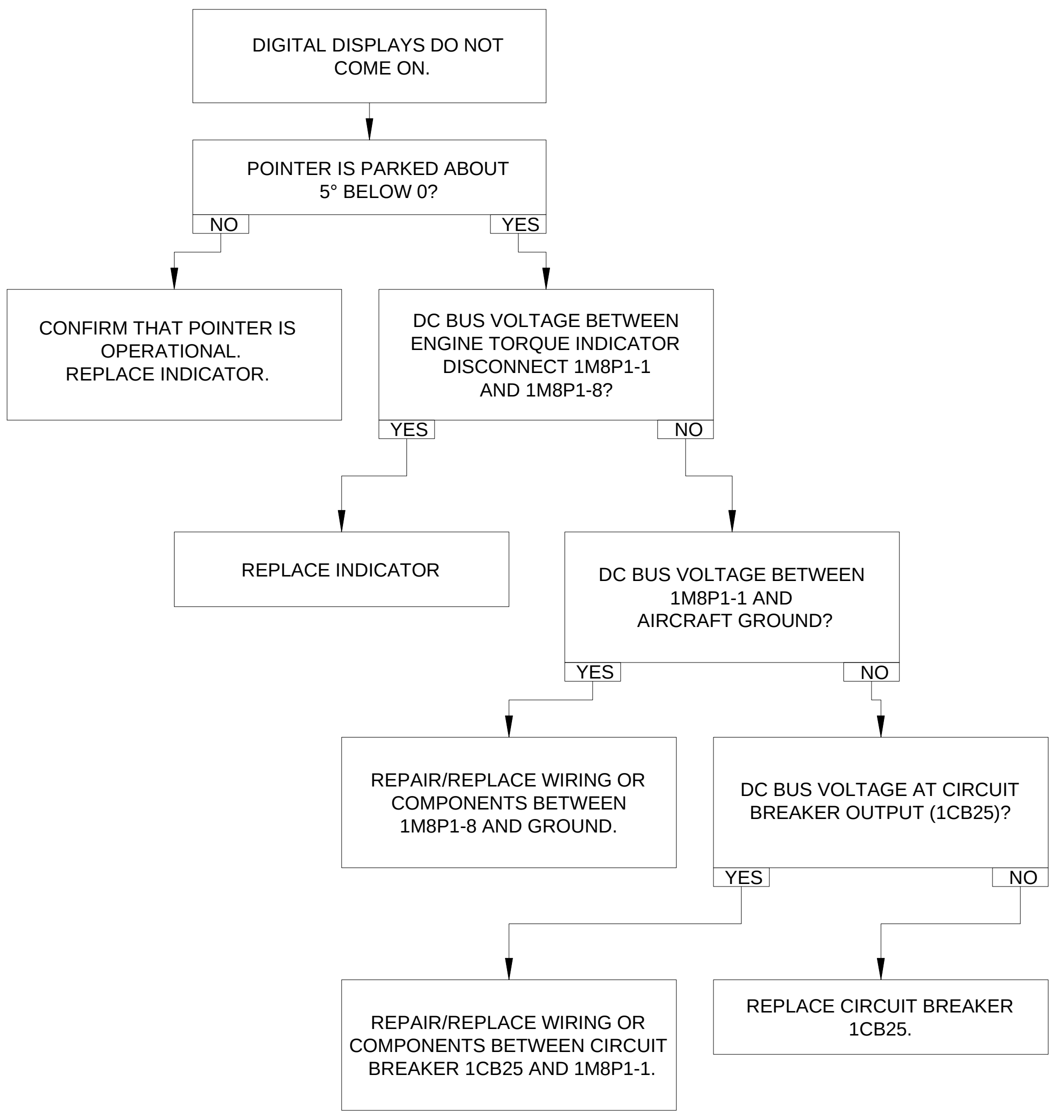


Figure 95-5: Engine Torque Indication System - Trouble No. 1

ENGINE TORQUE INDICATOR - TROUBLE NO. 2

CAUTION

DISCONNECT THE BATTERY AND THE EXTERNAL POWER PRIOR TO PERFORMING A CONTINUITY CHECK OR MAINTENANCE ON THE ENGINE TORQUE INDICATOR.

NOTE
Refer to Chapter 98 for wiring diagram.

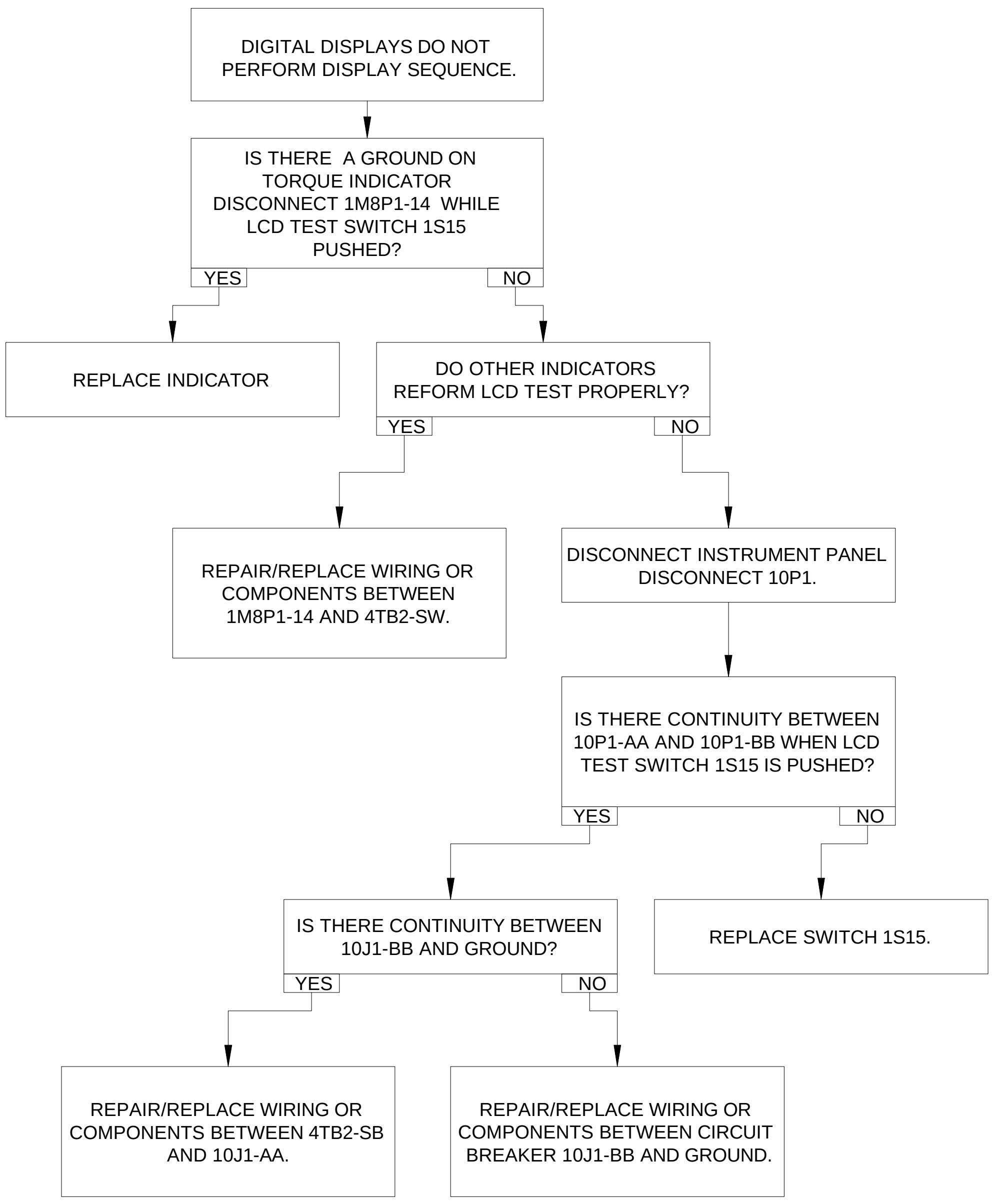


Figure 95-6: Engine Torque Indication System - Trouble No. 2

95.5.3.10 Engine Torque Indication System — Functional Check

SPECIAL TOOLS REQUIRED

NUMBER	NOMENCLATURE
2311F or Equivalent	Barfield Pressure Tester, 0 to 300 PSI
	Ground Support Equipment

The operational check that follows is intended to make sure that the exceedances programmed into the indicator are operating correctly. This check also makes sure that the torque indicator is accurate within the allowable tolerances. For torque transducer calibration procedure refer to Chapter 76 paragraph 76.3.4.2.1.

CAUTION

TO AVOID BATTERY DEPLETION, USE AN EXTERNAL POWER UNIT DURING GROUND MAINTENANCE CHECKS. IF BATTERY POWER IS USED, KEEP ELECTRICAL LOADS AND TEST TIME TO A MINIMUM.

1. Connect 28 VDC external power to the helicopter.
2. On the overhead panel, close the FADEC CH A PWR (4962CB1), FADEC CH B PWR (4962CB2) and ENGINE INSTR TRQ (1CB25) circuit breaker.

CAUTION

MAKE SURE THAT THE OIL IN THE PRESSURE TESTER IS COMPATIBLE WITH THE ENGINE OIL. FAILURE TO OBEY THIS PRECAUTION WILL RESULT IN THE CONTAMINATION OF THE ENGINE OIL SYSTEM.

3. Disconnect the oil pressure line from the engine mounted torque pressure transducer (4962-A26).
4. Attach the pressure tester to the input port of the transducer (4962-A26). Locate the pressure tester as close to the same height (Waterline) as the transducer to minimize any potential errors caused by oil in the line between the tester and the transducer.
5. Establish communication between the ground interface equipment (GSE) and the helicopter.
6. Ensure Ng is set to above 5% in accordance with section 95.5.5.10, steps 1 to 9.
7. Slowly increase the pressure of the pressure tester to 8.93 PSI.
8. On the engine torque indicator, make sure the pointer display and the digital display read 21.4%. Verify that GSE reads 19.1% on both channels.
9. Slowly increase signal to 45.55 PSI.
10. Verify that Torque Indicator reads 93.5% and GSE reads 83.25% on both channels.
11. Keep the torque input for 4.5 minutes (270 seconds).
12. Verify that the digital display starts flashing once per second.
13. Slowly decrease signal below 45.55 PSI (93.5% indicated/83.25% on GSE).
14. Verify that digital display stops flashing.
15. Slowly increase signal above 48.8 PSI (100.0% indicated/89.0% on GSE).

16. Verify that digital display starts flashing once per second.
17. Slowly decrease signal below 48.8 PSI (100.0% indicated/89.0 on GSE).
18. Verify that digital display stops flashing.
19. Slowly increase signal to 55.06 PSI (112.3% indicated/100.0 on GSE).
20. Verify that digital display starts flashing twice per second immediately after 110%.
21. On the caution/warning/advisory panel, make sure the CHECK INSTR annunciator comes on.
22. Verify the exceedances recorded.
23. Slowly decrease signal below 48.8 PSI (100.0% indicated/89.0 on GSE).
24. Press LCD test button.
25. Verify torque indicator initiate CHECK INSTR display sequence as follows:

- Operation Exceedance Label “OE” is displayed.
- The peak value during the recent engine torque operating exceedance event is displayed.
- If the current gas generator speed is greater than 5%, the indicator will exit the playback mode and the digital display will resume displaying the current engine torque. Otherwise, Operation Exceedance Count Label “OEC” is displayed followed by the number of overtorque events recorded during operation.

26. On the overhead panel, open the ENGINE INSTR TRQ circuit breaker. Make sure that the instrument goes blank, indicating that it is no longer powered.

NOTE

Open the circuit breaker for a minimum of 10 seconds to ensure that the delay circuitry within the instrument is exceeded to trigger an instrument reset.

27. Disconnect the pressure tester from the input port of the transducer.
28. Connect the oil pressure line to the airframe mounted torque pressure transducer.
29. On the overhead panel, close the ENGINE INSTR TRQ circuit breaker.
30. After the power-up display cycle, make sure the torque indicator displays “EOC” followed by the number of over-torque event recorded during the operation.
31. Verify the exceedances recorded. After verification, clear any exceedances from the NVM of the indicator (paragraph 95.5.3.11).
32. Remove the external DC power from the helicopter.
33. Return the helicopter to the standard configuration. Refer to Standard Practices — After Electrical Maintenance or Repairs (Chapter 96).

95.5.3.11 Exceedance Acquisition and Clearing — Torque Indicator

SPECIAL TOOLS REQUIRED

NUMBER	NOMENCLATURE
	M407 Maintenance-Diamond J software

1. Set the battery switch to BATT, or connect the external DC power to the helicopter.
2. Pull the ENG INSTR TRQ (1CB25) circuit breaker.
3. Establish communication between the Instrument Maintenance Computer and the helicopter by connecting to the serial interface RS-485.

4. Execute indicator maintenance software on the computer.
5. Select Torque Memory Read Procedure in the maintenance software.
6. Engage ENG INSTR TRQ (1CB25) circuit breaker.
7. Select Perform Torque Memory Read in the maintenance software.
8. The maintenance software will show that the indicator memory is being read.
9. Save data to a known folder. After the download, the maintenance software will show that the indicator memory has been completely read.
10. Select Torque Memory Clear Procedure in the maintenance software.
11. Select Perform Torque Memory Clear in the maintenance software.
12. The torque indicator will display “EC” for five seconds to indicate that the indicator is ready to clear the memory.
13. The indicator will then display “EC##”, indicating that the memory is being cleared.
14. The indicator will then display “EC--“, indicating the memory has been completely cleared.
15. Pull the ENG INSTR TRQ circuit breaker.
16. Perform power-up test to confirm torque indicator memory have been reset.
17. Set the battery switch to OFF, or disconnect the external DC power to the helicopter.
18. Return the helicopter to the standard configuration. Refer to Standard Practices — After Electrical Maintenance or Repairs (Chapter 96).

95.5.3.12 Adjusting Real-Time Clock – Torque Indicator

The real-time clock, used to time stamp recorded data and events, can be adjusted by the user by communication with the indicator through the serial interface.

1. Set the battery switch to BATT, or connect the external DC power to the helicopter.
2. Verify the date and time of the computer is synchronized to NIST.
3. Pull the ENG INSTR TRQ (1CB25) circuit breaker.
4. Establish communication between the Instrument Maintenance Computer and the helicopter by connecting to the serial interface RS-485.
5. Execute indicator maintenance software.
6. Select real time clock adjustment procedure in the maintenance software.
7. Engage ENG INSTR TRQ (1CB25) circuit breaker.
8. Select Perform Real-Time Clock Adjustment in the maintenance software.
9. Pull the ENG INSTR TRQ circuit breaker.
10. Set the battery switch to OFF, or disconnect the external DC power to the helicopter.
11. Return the helicopter to the standard configuration. Refer to Standard Practices — After Electrical Maintenance or Repairs (Chapter 96).

95.5.3.13 Engine Torque Pressure Transducer — Removal

WARNING

OBEY ALL THE SAFETY PRECAUTIONS WHEN DOING MAINTENANCE ON OR NEAR ELECTRICAL/ELECTRONIC EQUIPMENT (CHAPTER 96).

NOTE

Remove components only to the extent necessary to perform the required maintenance.

1. Disconnect the battery and external DC power from the helicopter.
2. Get access to the left side aft of the forward firewall FS 160.00 of the engine compartment.
3. Locate the engine torque pressure transducer (4962-A26), Figure 95-7.
4. Disconnect the electrical connector (P26) from the engine torque pressure (4962-A26) transducer.
5. Remove the engine torque pressure transducer (4962-A26) from the fitting.

95.5.3.14 Engine Torque Pressure Transducer — Installation

MATERIALS REQUIRED

Refer to BHT-ALL-SPM for specifications.

NUMBER	NOMENCLATURE
C-052	Contact Enhancer

WARNING

OBEY ALL THE SAFETY PRECAUTIONS WHEN DOING MAINTENANCE ON OR NEAR ELECTRICAL/ELECTRONIC EQUIPMENT (CHAPTER 96).

1. Disconnect the battery and external DC power from the helicopter.
2. Get access to the left side aft of the forward firewall FS 160.00 of the engine compartment.
3. Install the engine torque pressure transducer (4962-A26) to the fitting.

NOTE

It is recommended to apply contact enhancer (C-052) to the electrical connectors per TB 407-08-81.

4. Connect the electrical connector (P26) to the engine torque pressure transducer (4962-A26).

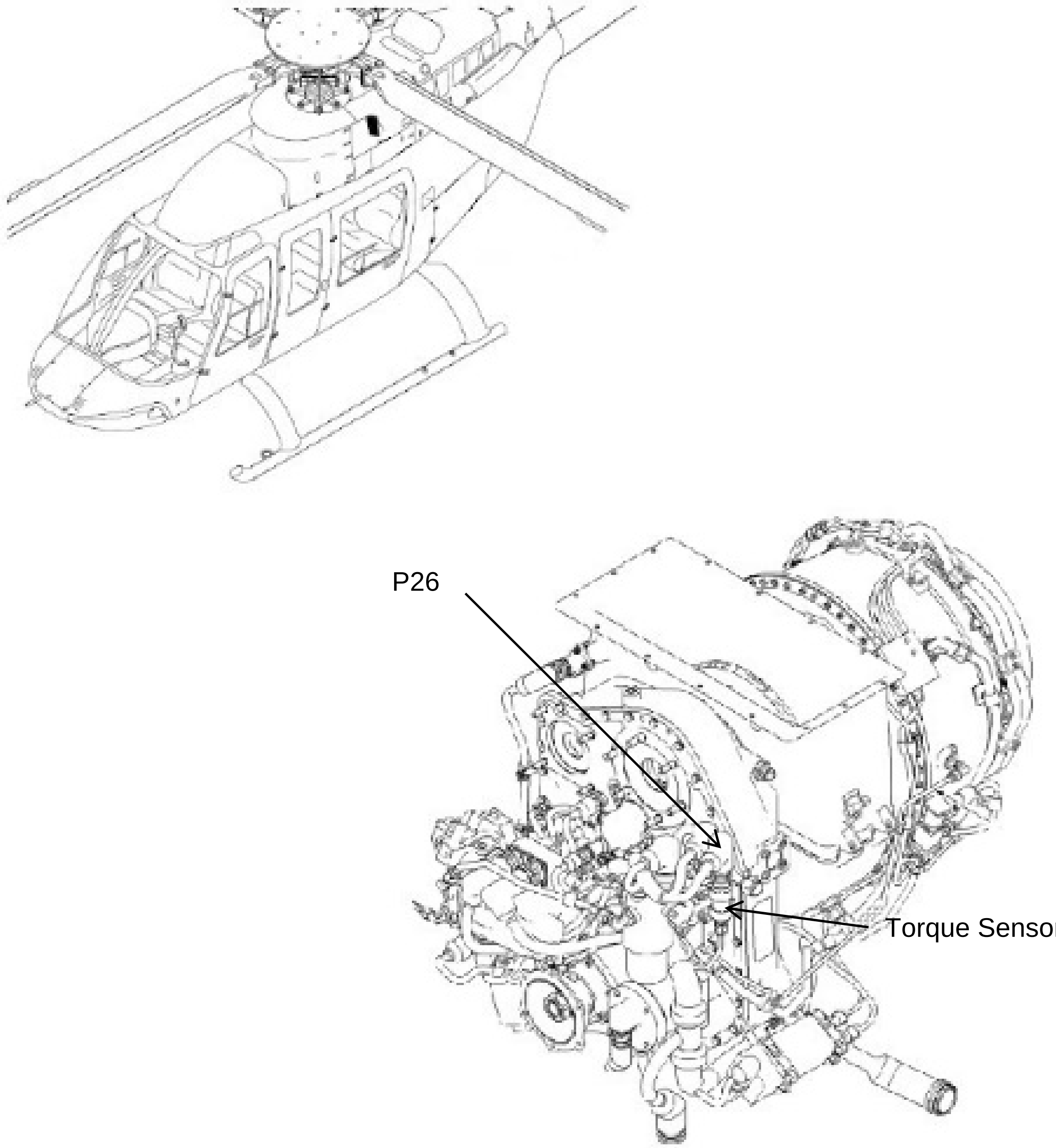


Figure 95-7: Engine Torque Pressure Transducer - Removal and Installation

95.5.3.15 Engine Torque Pressure Transducer — Bleeding

SPECIAL TOOLS REQUIRED	
NUMBER	**NOMENCLATURE**
2311F or Equivalent	Barfield Pressure Tester, 0 to 300 PSI

1. Disconnect the engine oil pressure line at the engine torquemeter pressure sensing port.

CAUTION

MAKE SURE THAT THE PRESSURE TESTER IS FILLED WITH THE SAME TYPE OF OIL THAT IS USED IN THE HELICOPTER ENGINE OIL SYSTEM. IF YOU DO NOT USE THE SAME TYPE OF OIL, YOU WILL CONTAMINATE THE ENGINE OIL SYSTEM.

2. Attach the pressure tester to the engine oil pressure line.
3. Loosen the tee fitting cap installed on the forward firewall before the transducer.
4. Apply pressure slowly so the line will be filled with oil. Continue to force oil into the line until a steady flow without air bubbles is established at the tee fitting cap.
5. When steady flow is established, tighten the tee fitting cap.
6. Release the pressure in the pressure tester. Disconnect the pressure tester from the engine oil pressure line.

NOTE

Keep the engine oil pressure line elevated while attaching to the engine gearbox to minimize the oil loss from the line.

7. Connect the engine oil pressure line to the engine torquemeter pressure sensing port.

95.5.4 MEASURED GAS TEMPERATURE INDICATION SYSTEM — DESCRIPTION

The Measured Gas Temperature (MGT) indication system is an indication of the exhaust gas temperature using thermocouple loop on the engine. (Figure 95-8) The MGT indicator includes a dial and electronic components in a sealed case.

The dial of the MGT indicator has a scale that shows MGT°C X 100. The range of the scale is from 0 to 1100°C.

The dial has a single needle/pointer display and a digital display. The needle display moves in a clockwise manner from 0 to 1100°C. The digital display shows the MGT °C in a four digit format.

Measured Gas Temperature indicator is a digital indicator with analog and digital indication. The 28 VDC bus supplies the power to the MGT indicator through the ENGINE INSTR MGT (1CB10) circuit breaker on the overhead panel. Internal lighting uses dimmable LED backlights. The maximum backlight voltage is 5 VDC. The backlight controller is programmed to simulate incandescent backlight.

Digital displays are LED display that updates a minimum of twice per second. The backlight voltage controls the brightness of the digital display. The digits are full brightness when the voltage is between 0 VDC and approximately 0.25 VDC; normally used for daylight operation. The digits start dimming when the voltage is between 0.25 VDC and 0.5 VDC. The digital display is set to minimum brightness when the backlight voltage is between 0.5 VDC and 1.5 VDC. The brightness of the digital display follows the backlight voltage between 1.5 VDC and 5 VDC; this range is normally used for night operation.

For the simplified schematic of the MGT indication system, refer to Figure 95-9.

95.5.4.1 MGT Indication System — Range Markings

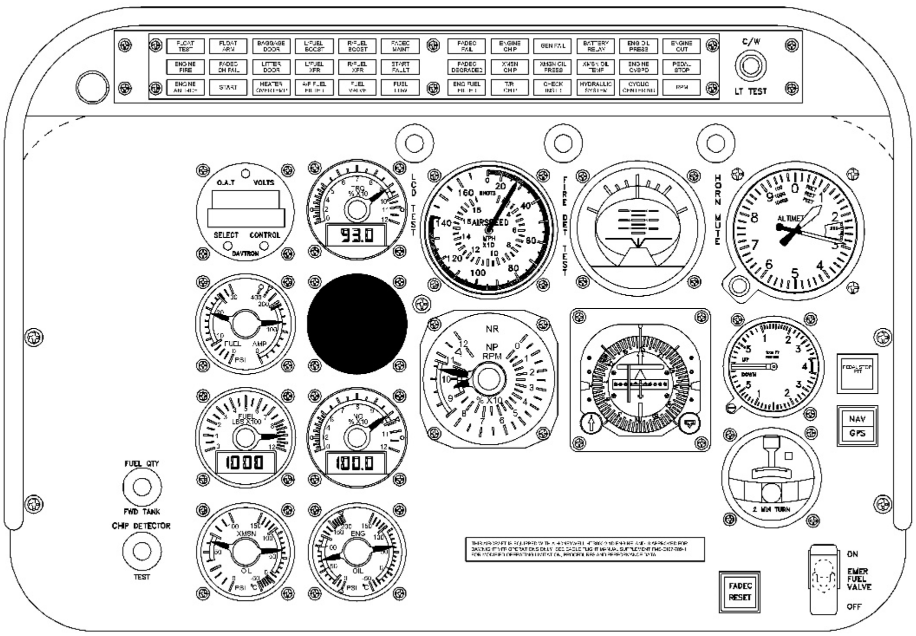
The range marking for the MGT scale is shown in Table 95-5.

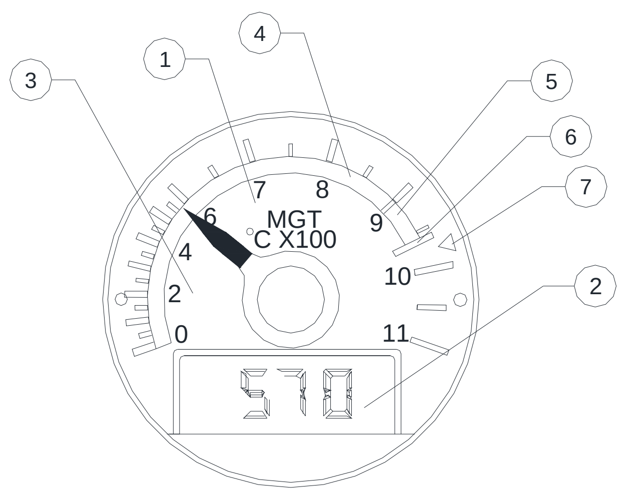
Table 95-5: MGT Scale — Range Marking

MARKING	RANGE (°C)	DEFINITION
Green Arc	0 to 900	Continuous Operation
Yellow Arc	900 to 958	5-minute Take-off Range
Red Line	958	Max for Takeoff
Red Triangle	977	Max for Start

95.5.4.2 MGT Indicator Fault Indication

Failure	Observation
Indicator Power Failure	Digits extinguish and pointers return to about five angular degrees below 0
Temperature Data	Pointer and digits returns to 0 CHECK INSTR caution annunciator activates.





1. MGT indicator dial
2. Digital display
3. Pointer display
4. Green arc
5. Yellow arc
6. Red line
7. Red triangle

Figure 95-8: Measured Gas Temperature (MGT) Indicator - Description

95.5.4.3 MGT Indication System — Exceedances

The MGT indicator microprocessor is pre-programmed with specific temperature values, which causes the digital displays to flash. When the indicator flashes, it will also trigger a switch that provides a ground at pin 21 to turn on the check instrument (CHECK INSTR) annunciator on the caution/warning/advisory panel.

The peak temperature and duration of transient torque events during operation are recorded in the memory. The duration of each event is captured by timers which are started when the temperature exceeds the limits given in Table 95-6. The indicator counts over-temperature events by maintaining counters in its non-volatile memory. The Operation Exceedance Count (OEC) counts the number of over-temperature events that occur during the normal operation.

To warn the pilot when an over-temperature condition exists, the digital display flashes on and off twice per second when the indicated temperature exceeds the red line (958°C). The display stops flashing immediately after the indicated temperature returns to within limits. Exceedances will be recorded by FADEC/ECU and will trigger associated annunciation during flight or after shutdown for maintenance action. Exceedances can be accessed and viewed by using Ground Support Equipment.

95.5.4.4 MGT Indication System Thermocouples — Description

Twelve MGT thermocouples each configured as a closed-bead, Type-K probe, are located between the gas producer turbine and the power turbine, providing a signal that is wire-spliced for use by each ECU channel. If either of the Type-K inputs is severed too an ECU channel, the MGT value can be shared between the two channels via the cross-channel data link.

The temperature measuring system consists of four three-probe Chromel - Alumel thermocouple assemblies and an averaging junction box. Closed and ungrounded sheathed thermocouples are used in the gas flow path. A transition is then made to the high temperature flexible lead, which extends forward on the engine to the junction box. The indicated gas temperature includes an empirically derived bias to account differences between the thermocouple measurement and thermodynamic gas producer turbine temperature.

95.5.4.5 MGT Indication System — Operation

MGT sensing is accomplished through the thermocouples mounted circumferentially in the turbine housing. The electrical harness picks up the signal from the junction box and passes it to the ECU.

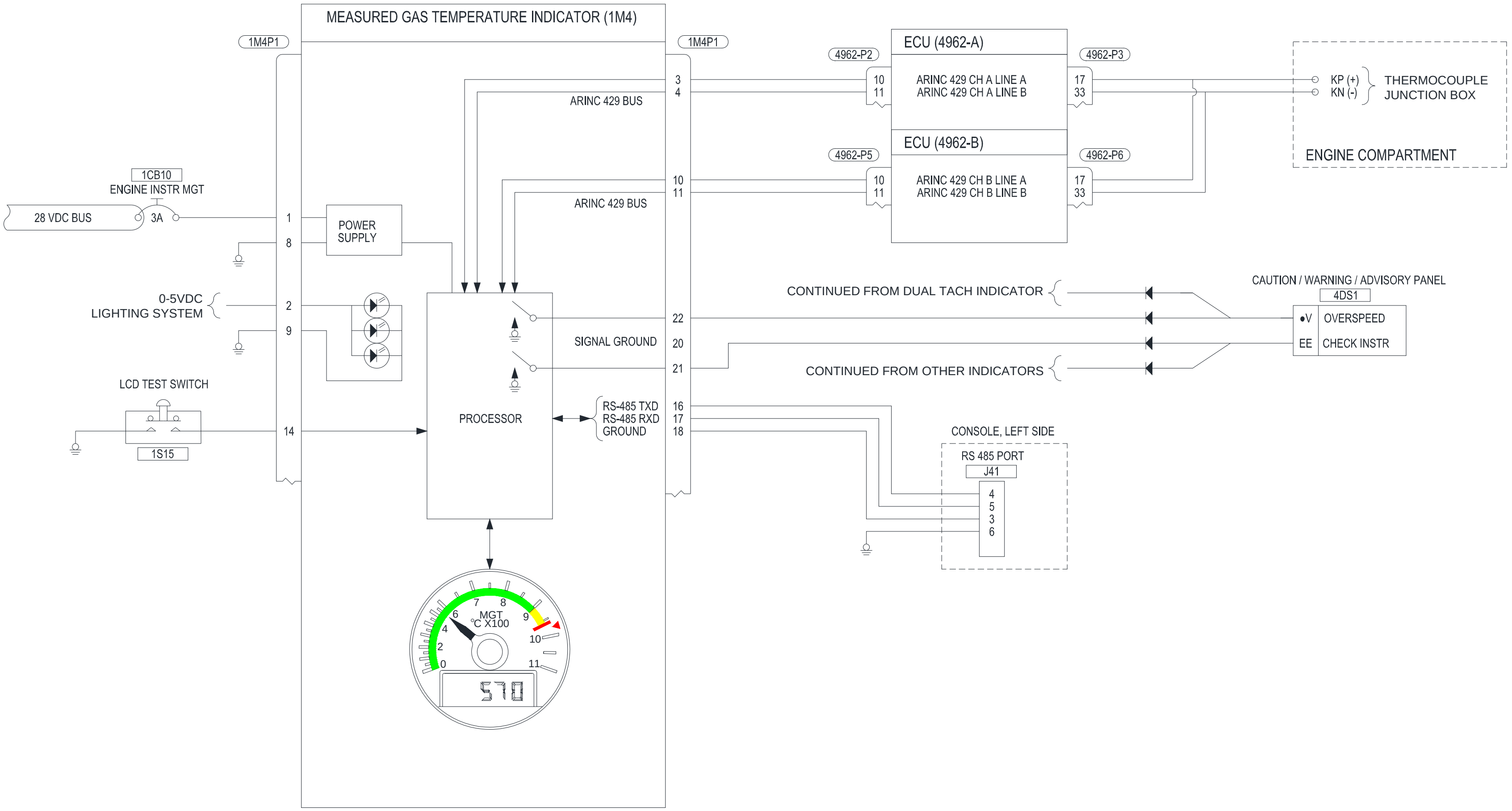


Figure 95-9: MGT Indication System - Simplified Schematic

Table 95-6: MGT Indicator Limits

	OPERATION MODE TRANSIENT LIMITS	DIGITAL DISPLAY	EXCEEDANCE ANNUNCIATOR
Potential Over-temperature Event (Alert)	Greater than 900°C for more than 270 seconds	Flashes once per second (Stops flashing below limit)	
Actual Over-temperature Event (Warning) Recorded	Greater than 958°C OR Greater than 977°C (OEC)	Flashes twice per second (Stops flashing below 958°C)	Activated (Remains activated until Check Instrument display sequence completed)

MGT indicator monitors the active ECU channel from ARINC data bus words with label 270 (bit 23- channel active and bit 24- other channel active) and use the data off the channel in control. ARINC data bus transmission is solely dependent on the ECU channel being powered. The indicator receives information from both channels at the same time and monitors the channel in control. In the case that label 270 is not present on either channel, indicator have the preference to use channel A over channel B as long as the signal is valid through SSM bit (bit 30 and 31 set to 1). Refer to Chapter 76-00-00 for complete list of ARINC 429 Data Bus Information.

The indicator receives its MGT information from ARINC 429 data bus words with label 345 (octal) and indicating normal operation from monitored active channel. The ECU MGT output signal on ground interface equipment and ARINC is biased +22.2°C.

On power-up, the digits display the following sequence. During this time the indicator pointer indicates the current MGT, and the current temperature is monitored for over-temperature events. During the sequence, each item is displayed for two seconds with the display briefly blanked between items before stepping to the next frame, except when stated otherwise. The data is played back in the following sequence:

- All segments are lit providing an “8.8.8.8” pattern to verify that all display elements are functioning.
- The first three digits and then the last three digits of the software version are displayed for one second each.
- The Operation label “O-” is displayed if no over-temperature event has occurred since the last time the indicator memory was reset. Otherwise, the Operation Exceedance label “OE” is displayed.
- If an over-temperature event has been recorded, the date of the highest temperature during operation since the last memory reset is displayed, followed by the time.
- The highest temperature during operation since the last memory reset is displayed. If an over-temperature event has been recorded, this is followed by the time (in seconds) the temperature was above 900°C, followed by the time (in seconds) the temperature was above

958°C, followed by the time (in seconds) the temperature was above 977°C. If the temperature was not over the limit, a zero (for zero seconds) is displayed. The maximum time that the indicator can display is 3599 seconds.

If the current gas generator is greater than 5%, the indicator will exit the playback mode and the digital display will start displaying the current engine temperature. If the gas generator speed is below this threshold, the indicator will play back the Operation Exceedance Count label “OEC” followed by the number of over-temperature events recorded during operation.

After the power-on display sequence, normal operation of the digits begins.

95.5.4.6 Check Instrument Display Sequence – MGT Indicator

When the built-in test is activated by pushing LCD test on the instrument panel, the digits display the following sequence. During this time the indicator pointer indicates the current engine temperature, and the current temperature is monitored for over-temperature events. During the sequence, each item is displayed for two seconds with the display briefly blanked between items before stepping to the next frame, except when stated otherwise. The data is played back in the following sequence:

- The Operation label “O-” is displayed if no over-temperature event has occurred since the last time the indicator memory was reset. Otherwise, the Operation Exceedance label “OE” is displayed.
- If no exceedance has been recorded, the highest temperature during operation since the last memory reset is displayed. Otherwise the peak during the most recent temperature operating exceedance event is displayed.

If the current gas generator is greater than 5%, the indicator will exit the playback mode and the digital display will start displaying the current engine temperature. If the gas generator speed is below this threshold, the indicator will play back the Operation Exceedance Count label “OEC” followed by the number of over-temperature events recorded during operation.

After the power-on display sequence, normal operation of the digits begins.

95.5.4.7 Last Flight Power Turbine Cycle Count — MGT Indicator

The MGT indicator monitors the data bus for words with label 162 (octal) for the last flight power turbine cycles, and words with label 344 (octal) for the gas generator speed. When the gas generator speed is below 5%, the digital displays the recorded last flight power turbine cycles, “C#.##” or “C##.#” instead of the gas temperature. When the gas generator speed is above 55%, the recorded cycle data is updated.

95.5.4.8 Engine Overspeed — MGT Indicator

MGT indicator monitors the data bus for words with label 271 (octal) for over-speed event warning (bit 18). If the active channel indicates over-speed, the ENGINE OVSPD annunciator is activated. Refer to Chapter 96 for Overpeed Warning Annunciator description and operation.

95.5.4.9 MGT Indication System — Operational Check

1. Set the battery switch to BATT, or connect the external DC power to the helicopter.
2. Close the ENGINE INSTR MGT (1CB10) circuit breaker.

RESULT:

- The MGT indicator does a power-on BIT, as follows:
  - o Indicator pointer indicates the current MGT value
  - o All digit segments are lit providing an “8.8.8.8” pattern to verify that all display elements are functioning.
  - o The first three digits and then the last three digits of the software version are displayed for one second each.
  - o If the Gas Generator Speed is below 5%, the digital display shows “C 0.0”.
  - o ENGINE OVSPD annunciator flashes.

CORRECTIVE ACTION:

- If the digital displays do not come on, refer to Trouble No. 1 (Figure 95-10).

3. Push the LCD TEST switch on the instrument panel.

RESULT:

- ENGINE OVSPD annunciator flashes.
- Indicator pointer indicates the current MGT value.
- The Operation label “O-” is displayed if no over-temperature event has occurred since the last time the indicator memory was reset. Otherwise, the Operation Exceedance label “OE” is displayed.
- If no exceedance has been recorded, the highest temperature during operation since the last memory reset is displayed. Otherwise the peak during the most recent temperature operating exceedance event is displayed.
- If the current gas generator is greater than 5%, the indicator will exit the playback mode and the digital display will start displaying the current engine temperature.
- If the gas generator speed is below this threshold, the indicator will play back the Operation Exceedance Count label “OEC” followed by the number of over-temperature events recorded during operation.

CORRECTIVE ACTION:

- If the digital displays do not reform display sequence, refer to Trouble No. 2 (Figure 95-11).

4. Set the battery switch to OFF, or remove the external DC power from the helicopter.
5. Return the helicopter to the standard configuration. Refer to Standard Practices — After Electrical Maintenance or Repairs (Chapter 96).

MEASURED GAS TEMPERATURE INDICATOR - TROUBLE NO. 1

CAUTION

DISCONNECT THE BATTERY AND THE EXTERNAL POWER PRIOR TO PERFORMING A CONTINUITY CHECK OR MAINTENANCE ON THE MEASURED GAS TEMPERATURE INDICATION SYSTEM.

NOTE
Refer to Chapter 98 for wiring diagram.

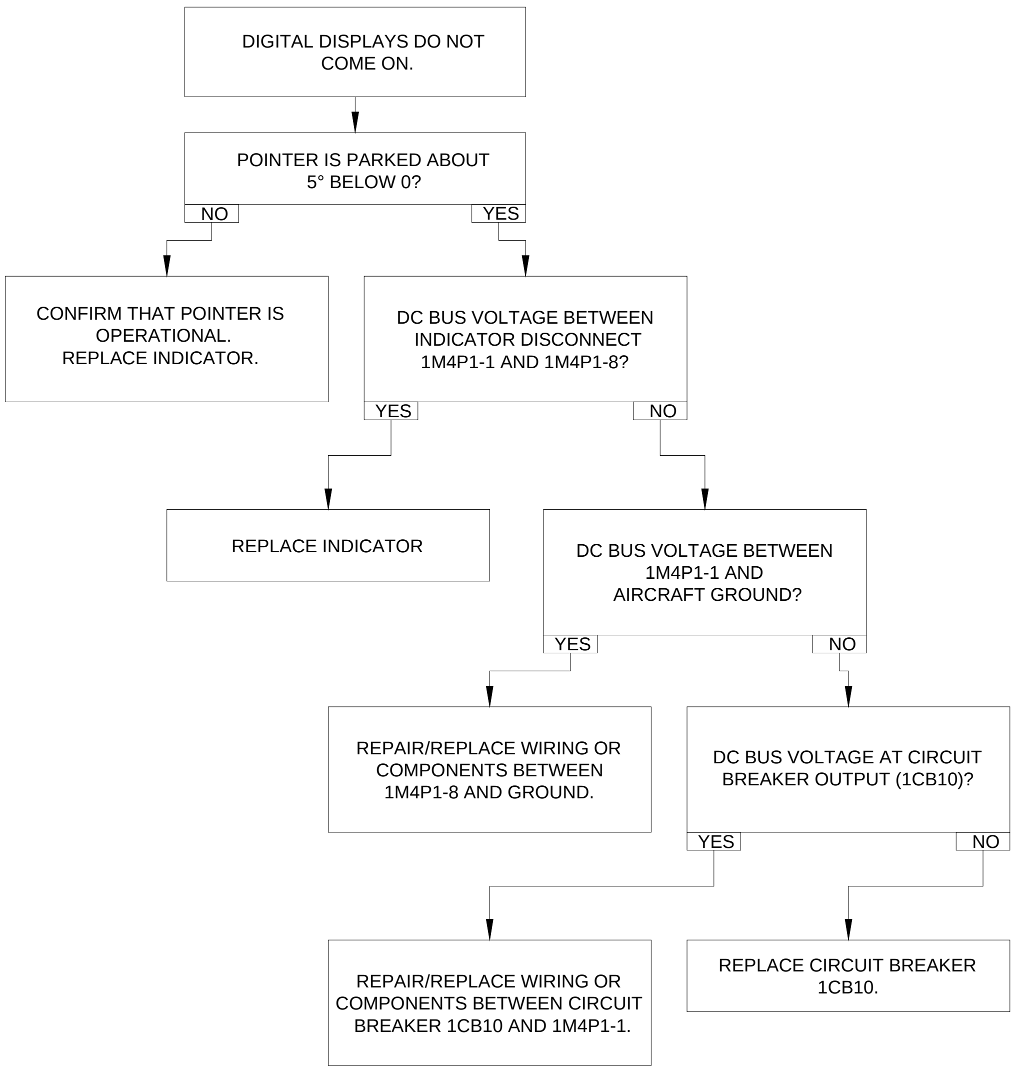


Figure 95-10: MGT Indications System - Trouble No. 1

MEASURED GAS TEMPERATURE INDICATOR - TROUBLE NO. 2

CAUTION

DISCONNECT THE BATTERY AND THE EXTERNAL POWER PRIOR TO PERFORMING A CONTINUITY CHECK OR MAINTENANCE ON THE MEASURED GAS TEMPERATURE INDICATION SYSTEM.

NOTE

Refer to Chapter 98 for wiring diagram.

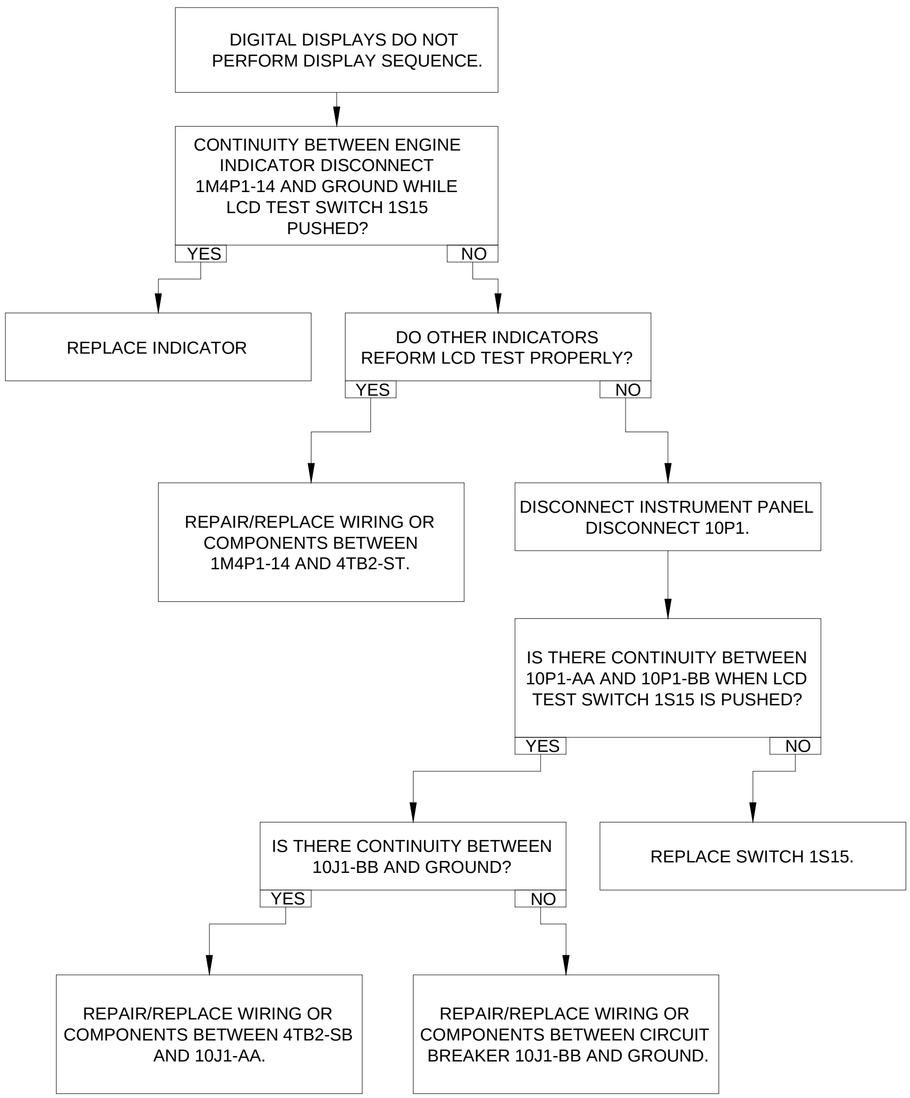


Figure 95-11: MGT Indication System - Trouble No. 2

95.5.4.10 MGT Indicator — Functional Check

SPECIAL TOOLS REQUIRED

NUMBER	NOMENCLATURE
TT-1000A or Equivalent	Turbine Temperature Indicating System Test Set
	Ground Support Equipment

CAUTION

FOLLOW THE MANUFACTURER'S INSTRUCTIONS FOR THE OPERATION OF THE TEST SET. OTHERWISE, DAMAGE TO THE TEST EQUIPMENT OR INDICATOR CAN OCCUR.

CAUTION

TO AVOID BATTERY DEPLETION, USE AN EXTERNAL POWER UNIT DURING GROUND MAINTENANCE CHECKS. IF BATTERY POWER IS USED, KEEP ELECTRICAL LOADS AND TEST TIME TO A MINIMUM.

1. Ensure battery switch is OFF, or external DC power is removed from helicopter.
2. On the overhead panel, open the ENGINE INSTR MGT (1CB10), FADEC CH A PWR (4962CB1) and FADEC CH B PWR (4962CB2) circuit breakers.
3. On the engine compartment, disconnect the engine harness at the MGT junction box.
4. Connect a type K thermocouple signal generator to the MGT engine harness. Observe proper polarity.
5. On the overhead panel, close the ENGINE INSTR MGT (1CB10), FADEC CH A PWR (4962CB1) and FADEC CH B PWR (4962CB2) circuit breakers.
6. Connect 28 VDC external power to the helicopter.

NOTE

The ECU MGT output on Ground Interface Equipment and ARINC is biased +22.2°C.

7. After the power-on BIT is completed by the indicator, make sure that pointer and digital display read ambient engine temperature if more than 5% Ng, otherwise, digital digits display "C 0.0".
8. Ensure that Ng is set to above 5% in accordance with section 9.5.5.10, steps 1 to 9.
9. Ensure no FADEC related fault is activated.
10. On the test set, set the TEMP ADJ knob to a test setting of 350°C.
11. Verify that the indicator needle reads 372.2±5°C.
12. Set the TEMP ADJ knob to a test setting of 400°C.
13. Verify that the indicator needle reads 422.2±5°C.
14. Set the TEMP ADJ knob to a test setting of 600°C.
15. Verify that the indicator needle reads 622.2±5°C.
16. Set the TEMP ADJ knob to a test setting of 800°C.
17. Verify that the indicator needle reads 822.2±5°C.
18. Set the TEMP ADJ knob to a test setting of 900°C for 300 seconds.
19. Verify that the indicator needle reads 922.2±5°C.
20. Verify that digital digits start flashing on and off once per seconds when

temperature exceeds 900°C for more than 270 seconds.

21. Set the TEMP ADJ below 900°C on the indicator.
22. Verify that digital display stops flashing.
23. Set the TEMP ADJ knob to a test setting of 940°C.
24. Verify that the indicator needle reads 962.2±7°C.
25. Verify that digital digits start flashing on and off twice per seconds when temperature exceeds 958°C.
26. On the caution/warning/advisory panel, make sure the CHECK INSTR annunciator comes on
27. Verify the exceedance recorded.
28. Set the TEMP ADJ knob to a test setting below 940°C.
29. Verify that digital display stops flashing.
30. Press LCD test button.
31. Verify MGT indicator initiate CHECK INSTR display sequence as follows:

- Operation Exceedance Label “OE” is displayed.
- The peak value during the recent engine MGT operating exceedance event is displayed.
- If the current gas generator speed is greater than 5%, the indicator will exit the playback mode and the digital display will resume displaying the current engine torque. Otherwise, Operation Exceedance Count Label “OEC” is displayed followed by the number of overspeed events recorded during operation.

32. Set the TEMP ADJ knob to a test setting to 960°C.
33. Verify that the indicator needle reads 982.2 ±5°C.
34. Repeat steps 24 through 30.
35. Verify the exceedances recorded.
36. Set the TEMP ADJ to 0°C.
37. On the overhead panel, open the ENGINE INSTR MGT circuit breaker.
38. Disconnect test set.
39. In the engine compartment, reconnect the engine harness to the thermocouple junction box.
40. On the overhead panel, close the ENGINE INSTR MGT circuit breaker. After the power-up BIT is completed, make sure that “C 0.0” is displayed.
41. Establish communication between the aircraft and the indicator ground support equipment.
42. Verify if any exceedances or faults recorded.
43. Clear any exceedances or faults recorded.
44. Remove the external DC power from the helicopter.
45. Return the helicopter to the standard configuration. Refer to Standard Practices — After Electrical Maintenance or Repairs (Chapter 96).

95.5.4.11 Exceedance Acquisition and Clearing — MGT Indicator

SPECIAL TOOLS REQUIRED

NUMBER	NOMENCLATURE
	M407 Maintenance-Diamond J software

1. Set the battery switch to BATT, or connect the external DC power to the helicopter.
2. Pull the ENG INSTR MGT (1CB10) circuit breaker.
3. Establish communication between the Instrument Maintenance Computer and the helicopter by connecting to the serial interface RS-485.
4. Execute indicator maintenance software on the computer.

5. Select Temperature Memory Read Procedure in the maintenance software.
6. Engage ENG INSTR MGT (1CB10) circuit breaker.
7. Select Perform Temperature Memory Read in the maintenance software.
8. The maintenance software will show that the indicator memory is being read.
9. Save data to a known folder. After the download, the maintenance software will show that the indicator memory has been completely read.
10. Select Temperature Memory Clear Procedure in the maintenance software.
11. Select Perform Temperature Memory Clear in the maintenance software.
12. The MGT indicator will display “EC” for five seconds to indicate that the indicator is ready to clear the memory.
13. The indicator will then display “EC##”, indicating that the memory is being cleared.
14. The indicator will then display “EC--“, indicating the memory has been completely cleared.
15. Pull the ENG INSTR MGT circuit breaker.
16. Perform power-up test to confirm MGT indicator memory have been reset.
17. Set the battery switch to OFF, or disconnect the external DC power to the helicopter.
18. Return the helicopter to the standard configuration. Refer to Standard Practices — After Electrical Maintenance or Repairs (Chapter 96).

95.5.4.12 Adjusting Real-Time Clock – MGT Indicator

The real-time clock, used to time stamp recorded data and events, can be adjusted by the user by communication with the indicator through the serial interface.

1. Set the battery switch to BATT, or connect the external DC power to the helicopter.
2. Verify the date and time of the computer is synchronized to NIST.
3. Pull the ENG INSTR MGT (1CB10) circuit breaker.
4. Establish communication between the Instrument Maintenance Computer and the helicopter by connecting to the serial interface RS-485.
5. Execute indicator maintenance software.
6. Select real time clock adjustment procedure in the maintenance software.
7. Engage ENG INSTR MGT (1CB10) circuit breaker.
8. Select Perform Real-Time Clock Adjustment in the maintenance software.
9. Pull the ENG INSTR MGT(1CB10) circuit breaker.
10. Set the battery switch to OFF, or disconnect the external DC power to the helicopter.
11. Return the helicopter to the standard configuration. Refer to Standard Practices — After Electrical Maintenance or Repairs (Chapter 96).

95.5.4.13 MGT Indicator — Functional Check — Resistance Check of Junction Box

1. Disconnect the battery and external DC power from the helicopter.
2. Tag and disconnect thermocouple harness leads from the junction box.
3. Remove bolts, lock washers and thermocouple junction box bracket.
4. Unscrew junction box screws from thermocouple junction box bracket and remove the junction box.

NOTE

Ensure all wires to junction box are disconnected.

5. Measure resistance between terminals A and B (see Figure 95- 12).

RESULT:

- Resistance is between 160 and 180 ohms.

CORRECTIVE ACTION:

- If the resistance is not between 160 and 180 ohms, replace the junction box.

6. Measure resistance between terminals B and C (see Figure 95- 12).

RESULT:

- Resistance is between 1950 and 2010 ohms.

CORRECTIVE ACTION:

- If the resistance is not between 1950 and 2010 ohms, replace the junction box.

7. Coat threads of bolts with anti-seize compound.
8. Install thermocouple junction box bracket on flange of the gas generator module at approximately 10 o'clock position with lock washers and bolts. Torque bolts to 120 inch-pounds.
9. Connect thermocouple harness leads to the junction box.
10. Install junction box on thermocouple junction box bracket with screws.
11. Return the helicopter to the standard configuration. Refer to Standard Practices — After Electrical Maintenance or Repairs (Chapter 96).

95.5.4.14 MGT Thermocouple Loop — Resistance Check

SPECIAL TOOLS REQUIRED

NUMBER	NOMENCLATURE
TT-1000A or Equivalent	Turbine Temperature Indicating System Test Set

1. Disconnect the battery and external DC power from the helicopter.
2. In the engine compartment, remove thermocouple loop from thermocouple junction box.
3. Separately check resistance between each green and white wire.

RESULT:

- Resistance is between 1.5 and 3.5 ohms at 13° to 29°C (55 to 85°F).

CORRECTIVE ACTION:

- If the resistance is not between 1.5 and 3.5 ohms at 13° to 29°C (55 to 85°F), engine operation may be continued to next 2400 HR inspection with a maximum of two green leads open, otherwise refer to Honeywell Heavy Maintenance Manual HTS900-2-1D.

4. Separately check resistance between three green wires and the shield. Swap leads (positive “+” and negative “-“) and average the two readings.

RESULT:

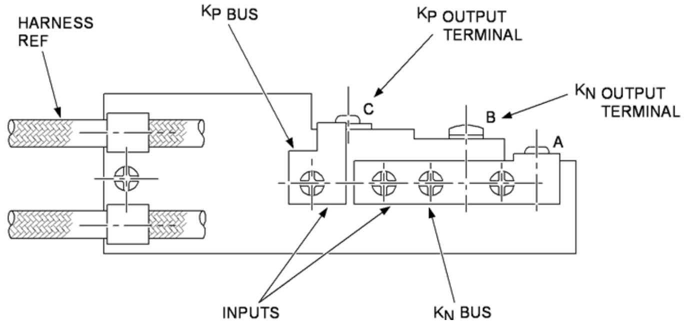
- Resistance shall be more than 500 ohms.

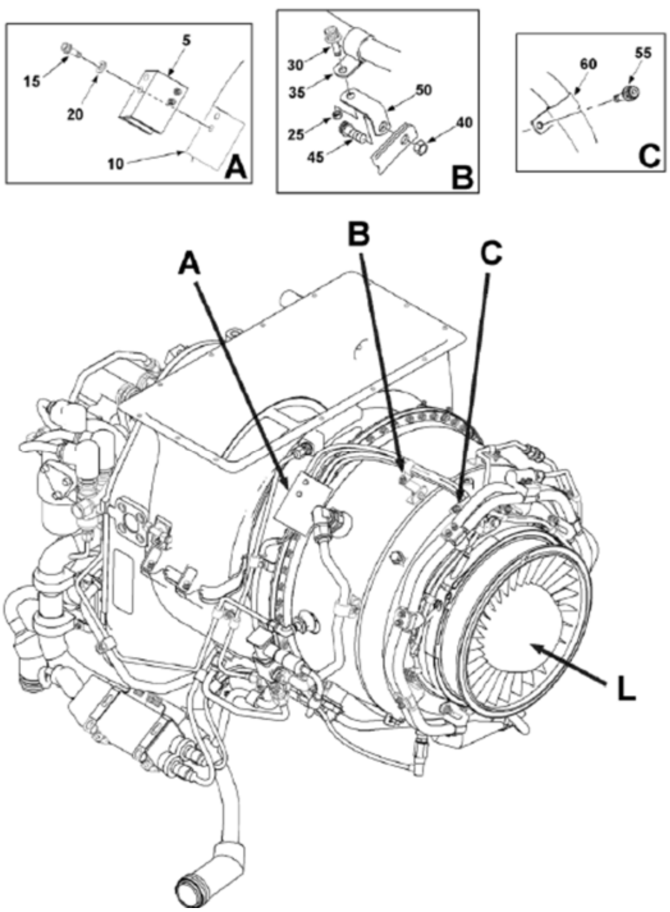
5. Reattach thermocouple loop to the thermocouple junction box.

6. Return the helicopter to the standard configuration. Refer to Standard Practices — After Electrical Maintenance or Repairs (Chapter 96)

95.5.4.15 Thermocouple Harness — Removal/Installation

Refer to the Honeywell Heavy Maintenance Manual for HTS900-2-1D for the removal and installation of the thermocouple harness.





5.	BRACKET
10.	THERMOCOUPLE JUNCTION BOX
15.	BOLT
20.	LOCKWASHER
25.	NUT
30.	BOLT
35.	LOOP CLAMP
40.	NUT
45.	BOLT
50.	BOLT
55.	BOT
60.	LOOP CLAMP

Figure 95- 12: Thermocouple Removal/Installation

95.5.5 GAS PRODUCER TACHOMETER (NG) INDICATION SYSTEM — DESCRIPTION

The NG indicator (Figure 95-13) shows the % Revolutions Per Minute (RPM) of the gas producer. The NG indicator is made of a dial and electronic components in a sealed case.

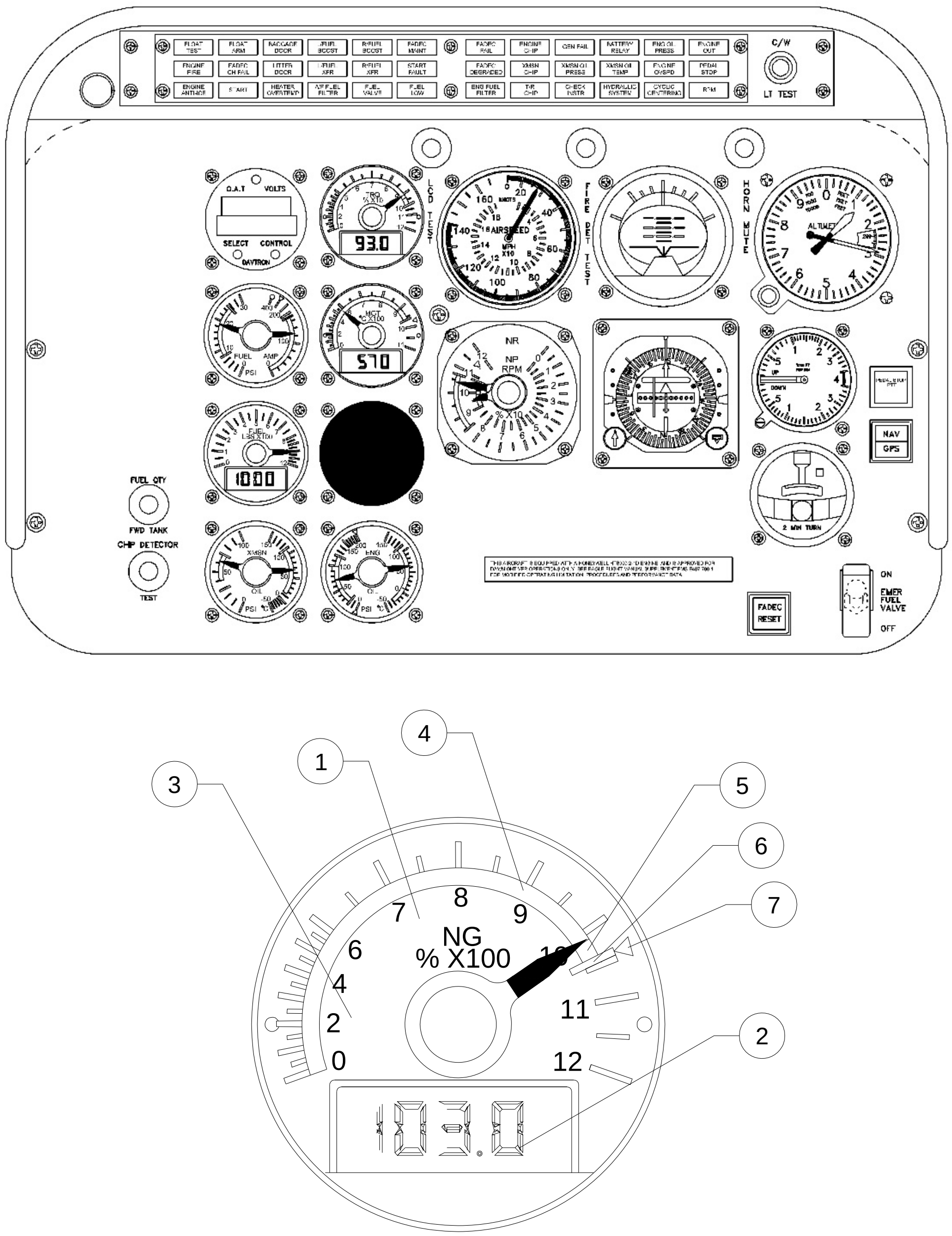
The dial of the NG indicator has a scale that shows RPM% X 10. The range of the scale is from 0 to 120% RPM.

The dial has a single needle/pointer display and a digital display. The needle display moves in a clockwise manner from 0 to 120%. The digital display shows the NG % RPM in a four digit format.

NG indicator is a digital indicator with analog and digital indication. The 28 VDC bus supplies the power to the torque indicator through the ENGINE INSTR NG (1CB22) circuit breaker on the overhead panel. Internal lighting uses dimmable LED backlights. The maximum backlight voltage is 5 VDC. The backlight controller is programmed to simulate incandescent backlight.

Digital displays are LED display that updates a minimum of twice per second. The backlight voltage controls the brightness of the digital display. The digits are full brightness when the voltage is between 0 VDC and approximately 0.25 VDC; normally used for daylight operation. The digits start dimming when the voltage is between 0.25 VDC and 0.5 VDC. The digital display is set to minimum brightness when the backlight voltage is between 0.5 VDC and 1.5 VDC. The brightness of the digital display follows the backlight voltage between 1.5 VDC and 5 VDC; this range is normally used for night operation.

For the simplified schematic of the NG indication system, refer to Figure 95-14.



1. NG indicator dial
2. Digital display
3. Pointer display
4. Green arc
5. Yellow arc
6. Red line
7. Red triangle

Figure 95-13: NG Indicator - Description

95.5.5.1 NG Indication System — Range Markings

The range marking for the NG scale is shown in Table 95-7.

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Table 95-7: NG Indicator Scale — Range Markings

MARKING	RANGE (NG) (%)	DEFINITION
Green Arc	0 to 101.1	Continuous Operation
Yellow Arc	101.1 to 103.6	5 minute Take-off Range
Red Line	103.6	Transient Limit (15 sec)
Red Triangle	104.4	Maximum

95.5.5.2 NG Indication System – Fault Indication

Failure	Observation
Indicator Power Failure	Digits extinguish and pointer returns to about five angular degrees below 0
Rotation Speed Data	Pointer and digits returns to 0

95.5.5.3 NG Indication System — Exceedances

The NG indicator microprocessor is pre-programmed with specific NG speed values, which causes the digital displays to flash. When the indicator flashes, it will also trigger a switch that provides a ground at pin 21 to turn on the check instrument (CHECK INSTR) annunciator on the caution/warning/advisory panel.

The peak and duration of transient %rpm events during operation are recorded in the memory. The duration of each event is captured by timers which are started when the %rpm exceeds the limits given in Table 95-8. The indicator counts exceedances events by maintaining counters in its non-volatile memory. The Operation Exceedance Count (OEC) counts the number of over-speed events that occur during the normal operation

To warn the pilot when an overspeed condition exists, the digital display flashes on and off twice per second when the indicated NG %rpm exceeds the red line (103.6%). The display stops flashing immediately after the indicated speed returns to within limits. Exceedances will be recorded by FADEC/ECU and will trigger associated annunciation during flight or after shutdown for maintenance action. Exceedances can be accessed and viewed by using Ground Support Equipment.

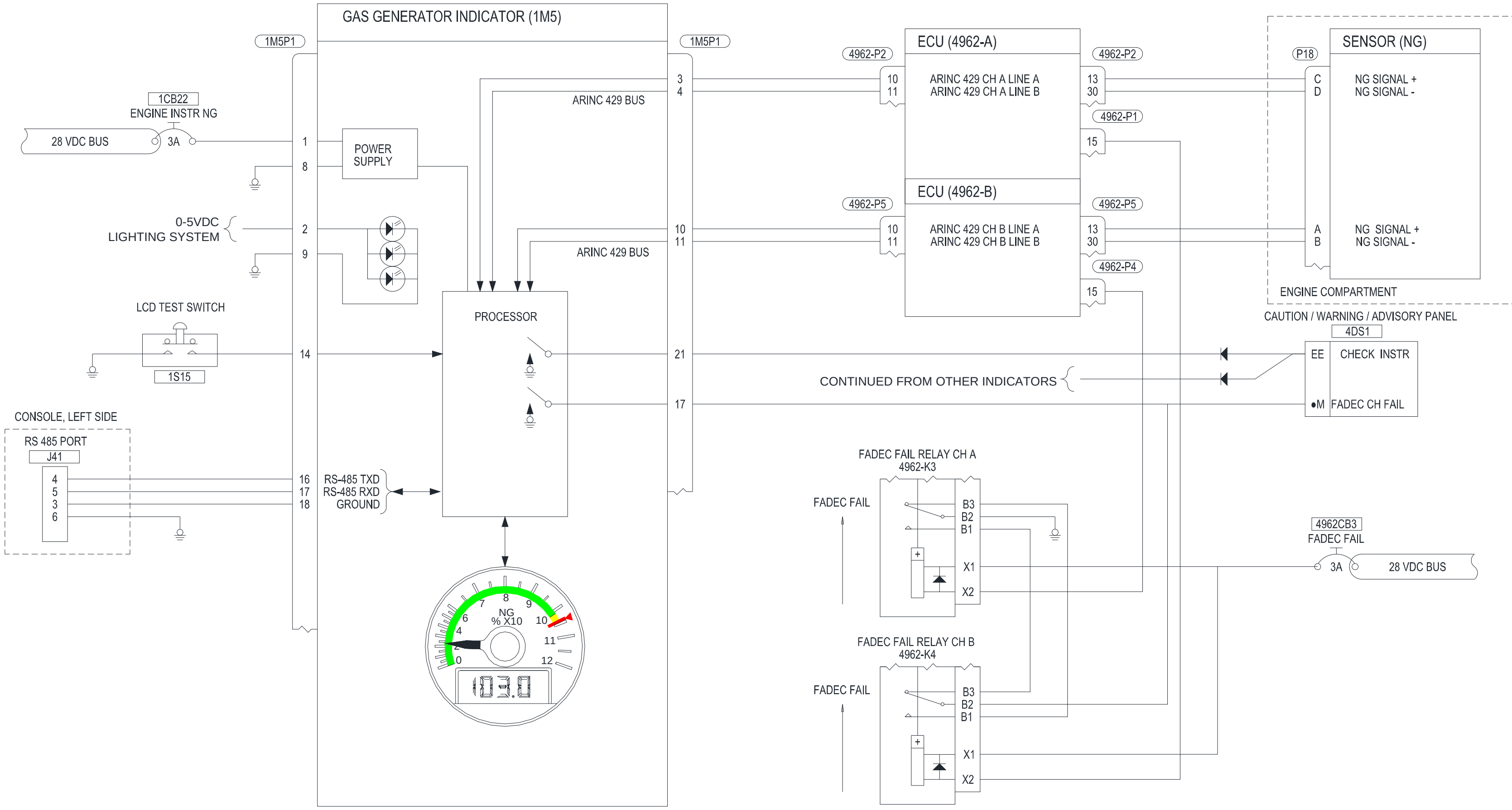


Figure 95-14: NG Indication System - Simplified Schematic

Table 95-8: NG Indicator Limits

	OPERATION MODE TRANSIENT LIMITS	DIGITAL DISPLAY	EXCEEDANCE ANNUNCIATOR
Potential Over-speed Event (Alert)	Greater than 101.1% for more than 270 seconds	Flashes once per second (Stops flashing below limit)	
Actual Over-speed Event (Warning) Recorded	Greater than 103.6% OR Greater than 104.4% (OEC)	Flashes twice per second (Stops flashing below 103.6%)	Activated (Remains activated until Check Instrument display sequence completed)

95.5.5.4 NG Indication System — Ng Sensor Description

The engine includes two independent Ng sensors that are both dual-coil sensors that measure the rotational speed of the gas producer shaft. The primary Ng signals for each ECU channel are obtained from a pickup located on the front of the engine gearbox. The two coils are dedicated for the ECU (one coil per channel). 100 percent Ng from the gearbox monopoles = 47,870 rpm.

Redundant speed signals are obtained from the second monopole mounted on the FMU. With data sharing via the cross-channel data link, each ECU channel has access to both Ng signals.

Each ECU channel determines Ng from one of the two Ng sensor coils by counting the signal pulses resulting from the passage of teeth over a gear revolution. The dual redundant Ng sensors are hermetically sealed LRUs that require no external calibration or adjustment. The Ng output is provided to the cockpit via ARINC 429.

95.5.5.5 NG Indication System — Operation

NG indicator monitors the active ECU channel from ARINC data bus words with label 270 (bit 23- channel active and bit 24- other channel active) and use the data off the channel in control. ARINC data bus transmission is solely dependent on the ECU channel being powered. Thus the indicator is receiving information from both channels at the same time and should monitor the channel in control. In the case that label 270 is not present on either channel, the indicator has the preference to use channel A over channel B as long as the signal is valid through SSM bit (bit 30 and 31 set to 1). Refer to Chapter 76-00-00 for complete list of ARINC 429 Data Bus Information.

The indicator receives its NG information from ARINC 429 data bus words with label 344 (octal) and indicating normal operation from monitored active channel.

On power-up, the digits display the following sequence. During this time the indicator pointer indicates the current NG speed, and the current NG speed is monitored for exceedance events. During the sequence, each item is displayed for two seconds with the display briefly blanked between items before stepping to the next frame, except when stated otherwise. The data is played back in the following sequence:

- All segments are lit providing an "8.8.8.8" pattern to verify that all display elements are functioning.
- The first three digits and then the last three digits of the software version are displayed for one second each.
- The Operation label "O-" is displayed if no exceedance event has occurred since the last time the indicator memory was reset. Otherwise, the Operation Exceedance label "OE" is displayed.
- If an exceedance event has been recorded, the date of the highest % rpm during operation since the last memory reset is displayed, followed by the time.
- The highest % rpm during operation since the last memory reset is displayed. If an exceedance event has been recorded, this is followed by the time (in seconds) the % rpm was above 101.1%, followed by the time (in seconds) the % rpm was above 103.6%, followed by the time (in seconds) the % rpm was above 104.4%. If the % rpm was not over the limit, a zero (for zero seconds) is displayed. The maximum time that the indicator can display is 3599 seconds.

If the current gas generator is greater than 5%, the indicator will exit the playback mode and the digital display will start displaying the current engine NG speed. If the gas generator speed is below this threshold, the indicator will play back the Operation Exceedance Count label "OEC" followed by the number of exceedance events recorded during operation.

After the power-on display sequence, normal operation of the digits begins.

95.5.5.6 Check Instrument Display Sequence – NG Indicator

When the built-in test is activated by pushing LCD test on the instrument panel, the digits display the following sequence. During this time the indicator pointer indicates the current engine NG speed, and the current NG speed is monitored for exceedance events. During the sequence, each item is displayed for two seconds with the display briefly blanked between items before stepping to the next frame, except when stated otherwise. The data is played back in the following sequence:

- The Operation label "O-" is displayed if no exceedance event has occurred since the last time the indicator memory was reset. Otherwise, the Operation Exceedance label "OE" is displayed.
- If no exceedance has been recorded, the highest % rpm during operation since the last memory reset is displayed. Otherwise the peak during the most recent % rpm operating exceedance event is displayed.

If the current gas generator is greater than 5%, the indicator will exit the playback mode and the digital display will start displaying the current engine NG speed. If the gas generator speed is below this threshold, the indicator will play back the Operation Exceedance Count label "OEC" followed by the number of exceedance events recorded during operation.

After the power-on display sequence, normal operation of the digits begins.

95.5.5.7 Last Flight Gas Generator Cycle — NG Indicator

The indicator monitors the data bus for words with label 161 (octal) for the last flight gas generator cycles, and words with label 344 (octal) for the gas generator speed. When the gas generator speed is below 5%, the gauge displays the recorded last flight gas generator cycles, "C#.##" or "C##.#" instead of the gas generator speed. When the gas generator speed is above 55%, the recorded cycle data is updated.

95.5.5.8 FADEC Channel Fail — NG Indicator

The indicator monitors the data bus for words with label 271 (octal) for FADEC channel fail caution (bit 19). If either channel indicates FADEC fail, the FADEC channel fail caution annunciator output is activated. Refer to Chapter 96 for FADEC Channel Fail Annunciator description and operation.

95.5.5.9 NG Indication System — Operational Check

1. Set the battery switch to BATT, or connect the external DC power to the helicopter.
2. Close the ENG INSTR NG (1CB22) circuit breaker.

RESULT:

- Indicator pointer indicates the current NG speed.
- FADEC CH FAIL annunciator flash momentarily.
- All digit segments are lit providing "8.8.8.8" pattern to verify that all display elements are functioning.
- The first three digits and then the last three digits of the software version are displayed for one second each.
- The Operation label "O-" is displayed if no exceedance event has occurred since the last time the indicator memory was reset. Otherwise, the Operation Exceedance label "OE" is displayed.
- If an exceedance event has been recorded, the date of the highest % rpm during operation since the last memory reset is displayed, followed by the time.
- The highest % rpm during operation since the last memory reset is displayed. If an exceedance event has been recorded, this is followed by the time (in seconds) the % rpm was above 101.1%, followed by the time (in seconds) the % rpm was above 103.6%, followed by the time (in seconds) the % rpm was above 104.4%. If the % rpm was not over the limit, a zero (for zero seconds) is displayed. The maximum time that the indicator can display is 3599 seconds.
- If the current gas generator is greater than 5%, the indicator will exit the playback mode and the digital display will start displaying the current engine NG speed.
- If the gas generator speed is below this threshold, the indicator will play back the Operation Exceedance Count label "OEC" followed by the number of exceedance events recorded during operation.
- After the power-on display sequence, normal operation of the digits begins.

CORRECTIVE ACTION:

- If the digital displays do not come on, refer to Trouble No. 1 (Figure 95-15).

3. Push the LCD TEST switch on the instrument panel.

RESULT:

- Indicator pointer indicates the current NG speed.
- The Operation label “O-” is displayed if no exceedance event has occurred since the last time the indicator memory was reset. Otherwise, the Operation Exceedance label “OE” is displayed.
- If no exceedance has been recorded, the highest % rpm during operation since the last memory reset is displayed. Otherwise the peak during the most recent % rpm operating exceedance event is displayed.
- If the current gas generator is greater than 5%, the indicator will exit the playback mode and the digital display will start displaying the current engine NG speed.
- If the gas generator speed is below this threshold, the indicator will play back the Operation Exceedance Count label “OEC” followed by the number of exceedance events recorded during operation.
- After the power-on display sequence, normal operation of the digits begins.

RESULT:

- Warning horn mutes.

CORRECTIVE ACTION:

- If the digital displays do not perform display sequence, refer to Trouble No. 2 (Figure 95-16).

4. Set the battery switch to OFF, or remove the external DC power from the helicopter.
5. Return the helicopter to the standard configuration. Refer to Standard Practices — After Electrical Maintenance or Repairs (Chapter 96).

GAS PRODUCER TACHOMETER INDICATOR - TROUBLE NO. 1

CAUTION

DISCONNECT THE BATTERY AND THE EXTERNAL POWER PRIOR TO PERFORMING A CONTINUITY CHECK OR MAINTENANCE ON THE GAS PRODUCER TACHOMETER INDICATION SYSTEM.

NOTE

Refer to Chapter 98 for wiring diagram.

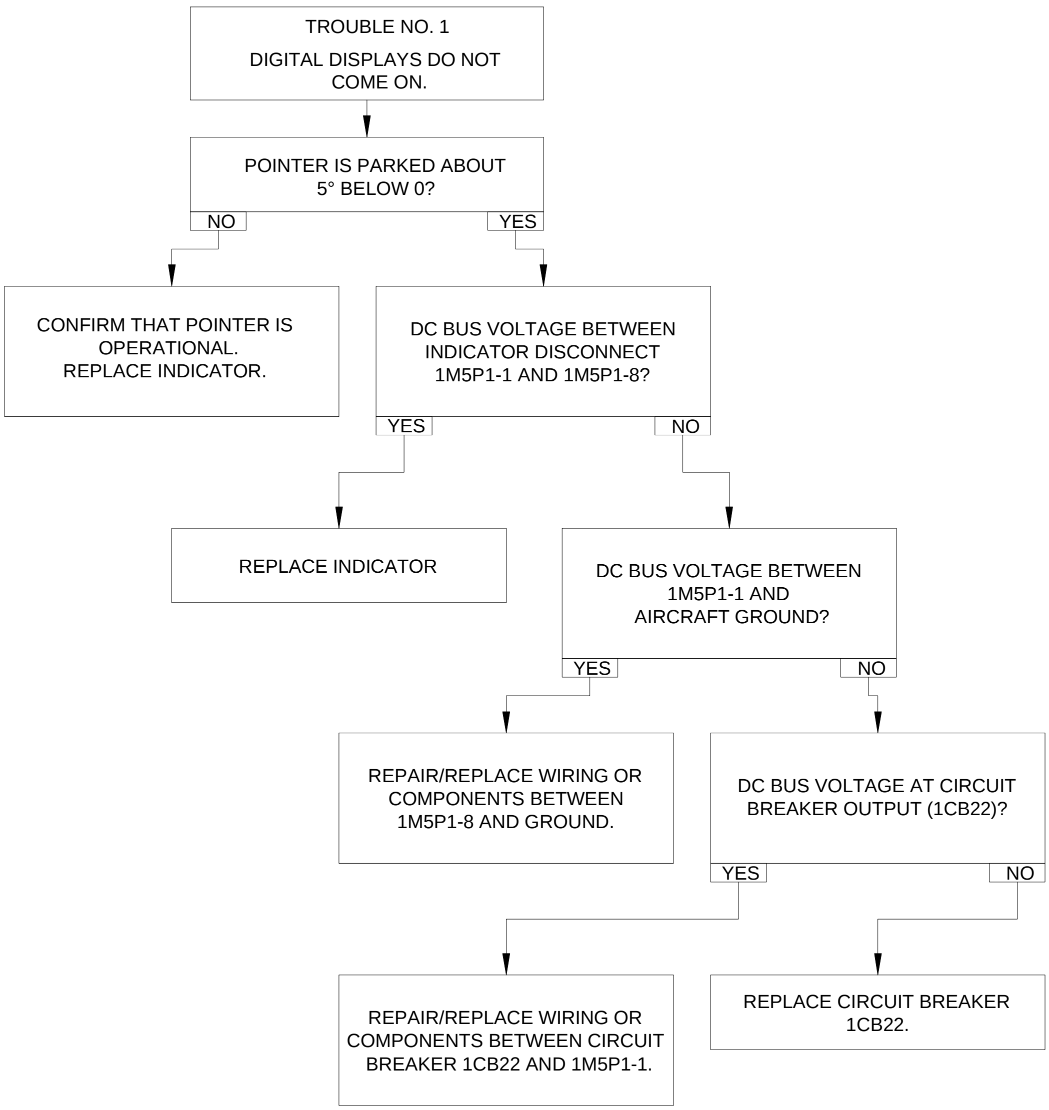


Figure 95-15: NG Indication System - Trouble No. 1

GAS PRODUCER TACHOMETER INDICATOR - TROUBLE NO. 2

CAUTION

DISCONNECT THE BATTERY AND THE EXTERNAL POWER PRIOR TO PERFORMING A CONTINUITY CHECK OR MAINTENANCE ON THE GAS PRODUCER TACHOMETER INDICATION SYSTEM.

NOTE
Refer to Chapter 98 for wiring diagram.

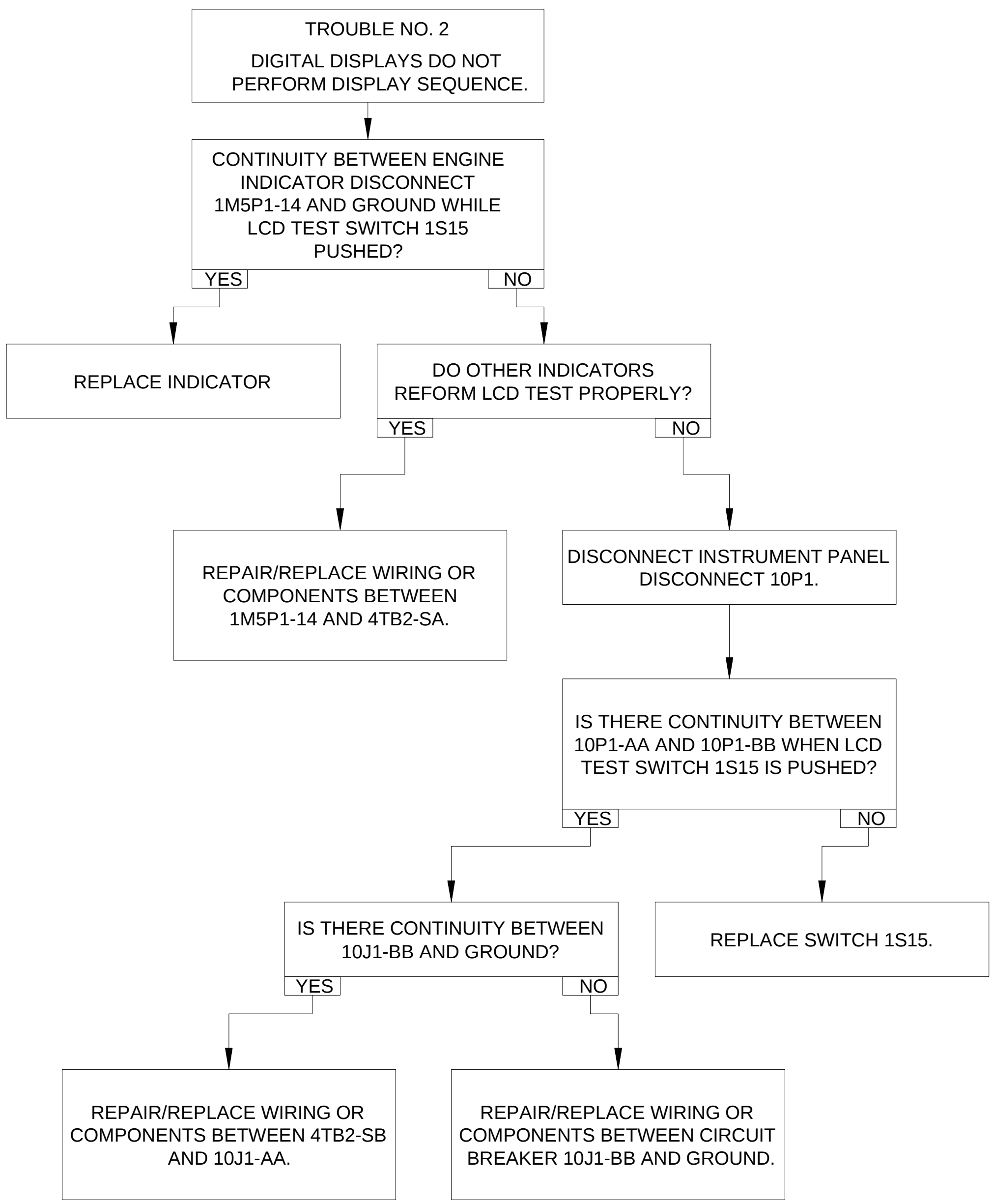


Figure 95-16: NG Indication System - Trouble No. 2

95.5.5.10 NG Indication System — Functional Check

SPECIAL TOOLS REQUIRED

NUMBER	NOMENCLATURE
1110 or Equivalent	Boonton Audio Oscillator (variable frequency generator)
0789-18-002	NG Test fixture

1. Ensure battery switch is OFF, or external DC power is removed from helicopter.
2. On the engine compartment area, locate connector P18.
3. Disconnect connector P18 from the Ng sensor 4962-A18.
4. Install Test fixture, 0789-18-002, to connector P18.
5. Connect a frequency generator (1110 Boonton or equivalent) with the following signal input.

SIGNAL INPUT

Signal HI	Red
Signal LO	Black

NOTE

Disconnecting the Ng monopole sensor will result in a FADEC DEGRADE being displayed on the caution/warning/advisory panel by the FADEC/ECU. The fault will disappear when the Ng monopole sensor is reconnected and the FADEC/ECU is reset by pushing FADEC RESET push button or the power to the FADEC/ECU is turned back on.

INDICATION (% RPM)	INPUT FREQUENCY (HZ)	WAVEFORM
5.1	220	sine
20	863.4	sine
50	2158.5	sine
100	4317.1	sine

6. Set the battery switch to BATT, or connect the external DC power to the helicopter.
7. On the overhead panel, verify that the ENG INSTR NG (1CB22) and FADEC CH A PWR (4962CB1) and FADEC CH B PWR (4962CB2) are closed.
8. Ensure no FADEC related fault is activated.
9. Simulate Ng frequency signal (220 Hz).
10. Verify that the NG pointer and digital display and ground support equipment channel A and B reads above 5%.
11. Increase the signal gradually by 100 Hz every 2 seconds to 863.4 Hz.
12. Verify that the Ng pointer and digital display reads 20±0.1%.
13. Increase the signal gradually by 100 Hz every 2 seconds to 2158.5 Hz.
14. Verify that the Ng pointer and digital display reads 50±0.1%.
15. Increase the signal gradually by 100 Hz every 2 seconds to 4317.1 Hz.

NOTE

FADEC DEGRADED light might come on at about 55% NG. NG indication should not be affected by the fault.

16. Verify that the Ng pointer and digital display reads 100±0.1%.
17. Increase the signal until the indicator reach 103.6%.
18. Verify that the digital digits start flashing on and off twice per second.

19. Decrease the signal below 103.6% but above 101.1.
20. Verify that the digital digits start flashing on and off once per second.
21. Decrease the signal below 101.1.
22. Verify that the digital digits stop flashing.
23. Decrease the signal to 0.
24. Press FADEC RESET switch to reset any existing fault.
25. Set the battery switch to OFF, or disconnect the external DC power to the helicopter.
26. Connect connector P18 to the Ng sensor 4962-A18.
27. Return the helicopter to the standard configuration. Refer to Standard Practices — After Electrical Maintenance or Repairs (Chapter 96).

95.5.5.11 Exceedance Acquisition and Clearing — NG Indicator

SPECIAL TOOLS REQUIRED

NUMBER	NOMENCLATURE
	M407 Maintenance-Diamond J software

1. Set the battery switch to BATT, or connect the external DC power to the helicopter.
2. Pull the ENG INSTR NG (1CB22) circuit breaker.
3. Establish communication between the Instrument Maintenance Computer and the helicopter by connecting to the serial interface RS-485.
4. Execute indicator maintenance software on the computer.
5. Select Gas Generator Speed Memory Read Procedure in the maintenance software.
6. Engage ENG INSTR NG (1CB22) circuit breaker.
7. Select Perform Gas Generator Speed Memory Read in the maintenance software.
8. The maintenance software will show that the indicator memory is being read.
9. Save data to a known folder. After the download, the maintenance software will show that the indicator memory has been completely read.
10. Select Gas Generator Speed Memory Clear Procedure in the maintenance software.
11. Select Perform Gas Generator Speed Memory Clear in the maintenance software.
12. The NG indicator will display “EC” for five seconds to indicate that the indicator is ready to clear the memory.
13. The indicator will then display “EC##”, indicating that the memory is being cleared.
14. The indicator will then display “EC--“, indicating the memory has been completely cleared.
15. Pull the ENG INSTR NG circuit breaker (1CB22).
16. Perform power-up test to confirm NG indicator memory have been reset.
17. Set the battery switch to OFF, or disconnect the external DC power to the helicopter.
18. Return the helicopter to the standard configuration. Refer to Standard Practices — After Electrical Maintenance or Repairs (Chapter 96).

95.5.5.12 Adjusting Real-Time Clock – NG Indicator

The real-time clock, used to time stamp recorded data and events, can be adjusted by the user by communication with the indicator through the serial interface.

1. Set the battery switch to BATT, or connect the external DC power to the helicopter.
2. Verify the date and time of the computer is synchronized to NIST.
3. Pull the ENG INSTR NG (1CB22) circuit breaker.
4. Establish communication between the Instrument Maintenance Computer and the helicopter by connecting to the serial interface RS-485.
5. Execute indicator maintenance software.
6. Select real time clock adjustment procedure in the maintenance software.
7. Engage ENG INSTR NG (1CB22) circuit breaker.
8. Select Perform Real-Time Clock Adjustment in the maintenance software.
9. Pull the ENG INSTR NG (1CB22) circuit breaker.
10. Set the battery switch to OFF, or disconnect the external DC power to the helicopter.
11. Return the helicopter to the standard configuration. Refer to Standard Practices — After Electrical Maintenance or Repairs (Chapter 96).

95.5.5.13 NG Monopole Sensor — Removal/Installation

Refer to the Honeywell Light Maintenance Manual for HTS900-2-1D for the cleaning, inspection and detailed maintenance of the NG monopole sensor.

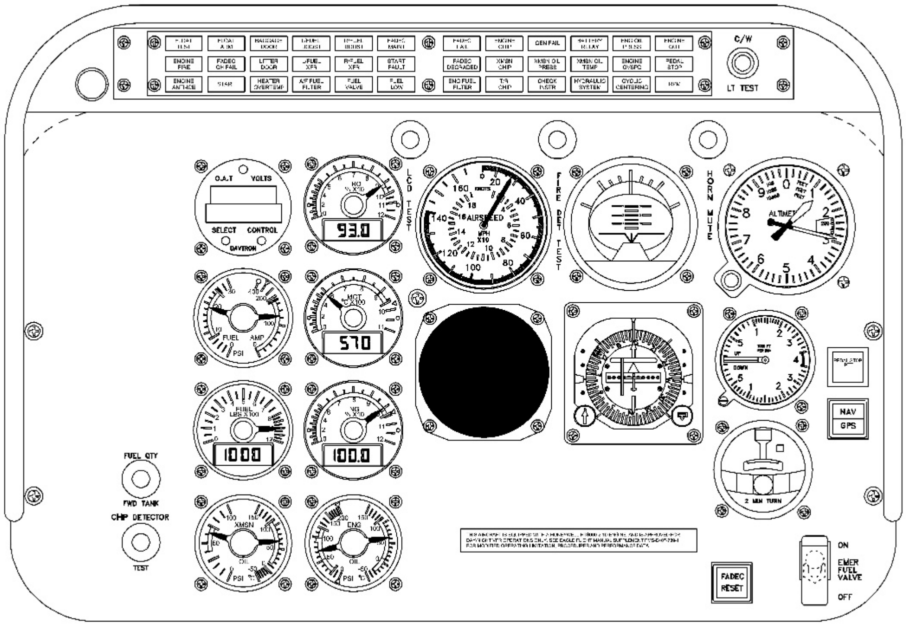
95.5.6 DUAL TACHOMETER INDICATION SYSTEM — DESCRIPTION

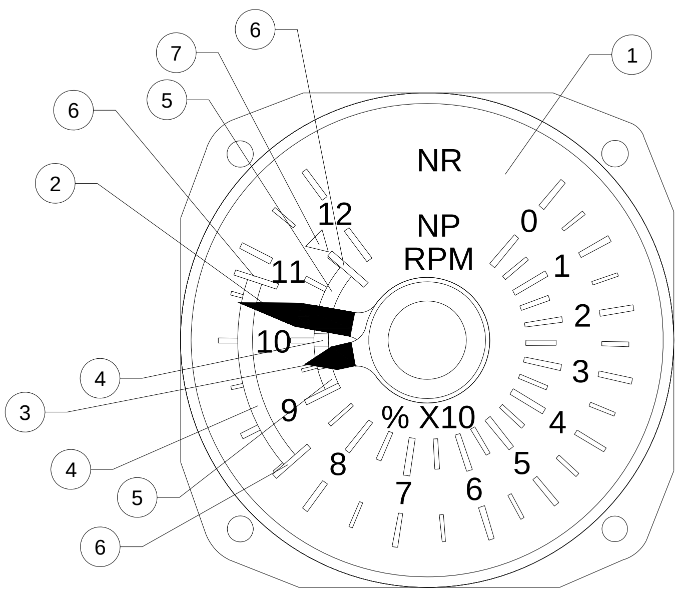
The dual tachometer shows the rotor RPM (NR) and the power turbine RPM (NP). The dual tachometer indicator (Figure 95-17) has a dial, two pointers, and electronic components. Individual power supplies give power to the processing units, which control the drivers that operate the stepper motors. The stepper motors drive their associated pointer.

The dial has two scales that show % RPM. One of the scales is the NR scale and it shows the % RPM X 10 of the main rotor. The NR indication is shown with the rotor pointer. For the range marking of the NR scale, refer to Table 95-9.

The other scale is the NP scale and it shows the % RPM X 10 of the power turbine. The NP indication is shown with the turbine pointer. For the range marking of the NP scale, refer to Table 95-10.

For the simplified schematic of the Dual Tachometer indication system, refer to Figure 95-18.





1. Dual Tachometer indicator dial
2. Rotor pointer
3. Power turbine pointer
4. Green arc
5. Yellow arc
6. Red line
7. Red triangle

Figure 95-17: Dual Tachometer - Description

95.5.6.1 Dual Tachometer Markings System — Range

For the range marking of the NR scale, refer to Table 95-9.

For the range marking of the NP scale, refer to Table 95-10.

Table 95-9: Rotor RPM (NR) Scale — Range Marking

MARKING	RANGE (RPM) (%)	DEFINITION
Red Line	85	Minimum, Power Off
Green Arc	85 to 107	Continuous Operation, Power Off
Red Line	107	Maximum, Power Off

Table 95-10: Power Turbine (NP) Scale — Range Marking

MARKING	RANGE (RPM) (%)	DEFINITION
Yellow Arc	95 to 99	Transient
Green Arc	99 to 101	Continuous Operation
Yellow Arc	101 to 105	Transient
Red Line	115	Maximum
Red Triangle	115	Transient Limit (15 sec)

95.5.6.2 Dual Tachometer — Fault Indication

Failure	Observation
Indicator Power Failure	Pointers return to about five angular degrees above 0
Rotation Speed Data	Corresponding pointer returns to 0 The “CHECK INSTR” caution activates.

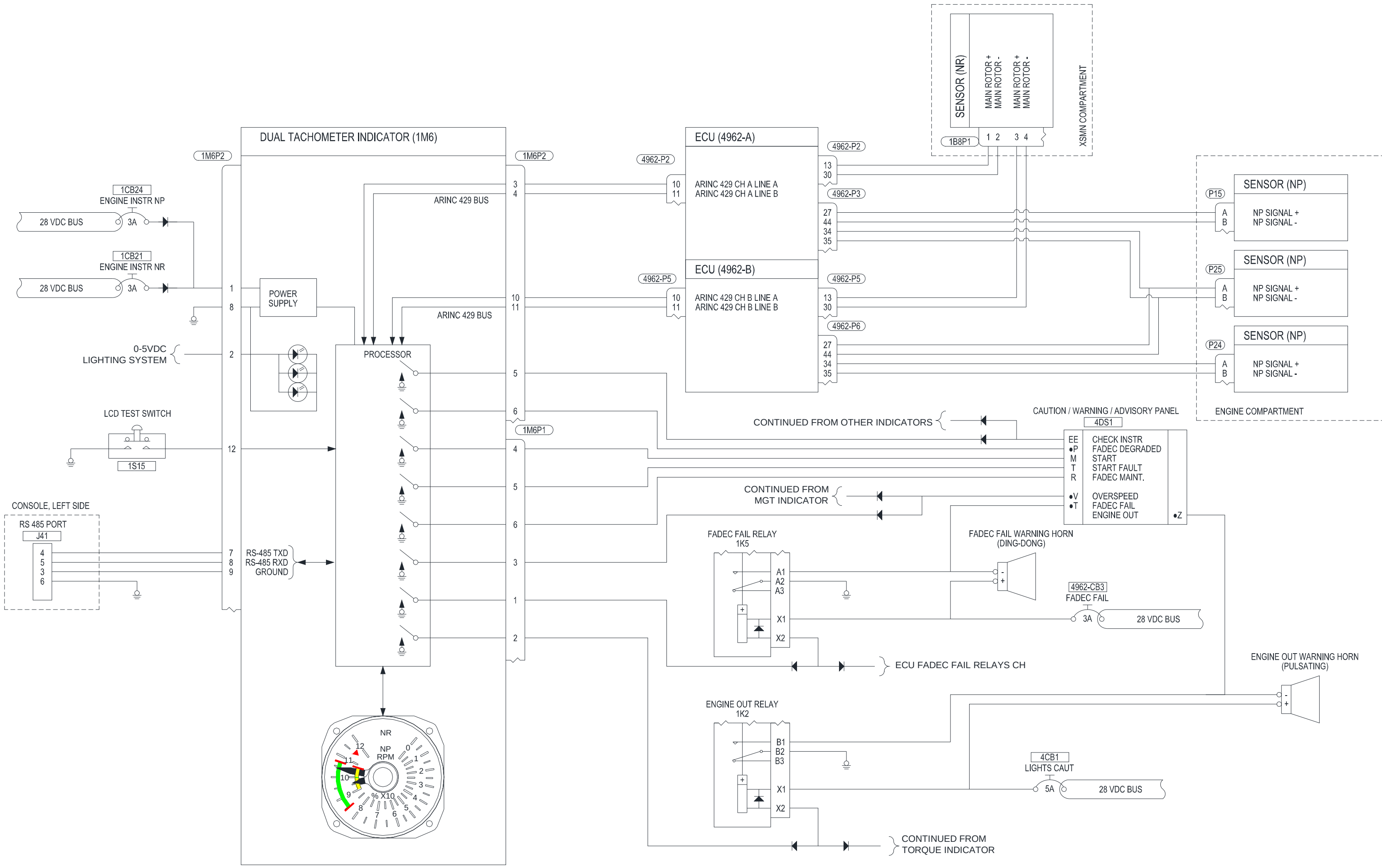


Figure 95-18: Dual Tachometer System - Simplified Schematic

95.5.6.3 NP Indication System — Exceedances

The Dual Tachometer indicator microprocessor is pre-programmed with specific NP values, which triggers a switch that provides a ground at P2 pin 5 to turn on the check instrument (CHECK INSTR) annunciator on the caution/warning/advisory panel.

The peak NP speed and duration of transient speed events during operation are recorded in the memory. The duration of each event is captured by timers which are started when the NP speed exceeds the limits given in Table 95-12. The indicator counts over-overspeed events by maintaining counters in its non-volatile memory. The Operation Exceedance Count (OEC) counts the number of exceedance events that occur during the normal operation.

To warn the pilot when an exceednace condition exists, the indicator will trigger CHECK INSTR annunciator and remain activated until Check Instrument display sequence is completed. Exceedances can be accessed and viewed by using Ground Support Equipment.

95.5.6.4 Dual Tachometer Indication System, NR Monopole Sensor — Description

The NR speed pickup is a magnetic sensor mounted on the transmission lower case. As the gear teeth of the spiral bevel gear pass by the sensor, the change in the magnetic field is converted into alternating voltage. The frequency of the alternating voltage increases as the gear RPM increases.

The pickup has three coils that output the same signal. The coils between pin 1 and pin 2 and between pin 3 and pin 4, provides the input to each FADEC/ECU channel. The coil between pin 5 and pin 6 provides the input to the low rotor sensor.

The signal is sent from the magnetic sensor to the NR circuit of the FADEC/ ECU. The scale indication is in proportion to the frequency input from the speed pickup as shown in Table 95-11.

Table 95-11: NR Scale Indication versus Frequency Input

INDICATION (% RPM)	INPUT FREQUENCY (HZ)	WAVEFORM
20 ± 0.1	400.1	sine
50 ± 0.1	1,000.2	sine
100 ± 0.1	2,000.4	sine

95.5.6.5 Dual Tachometer Indication System, NP Monopole Sensor — Description

Three gearbox-mounted Np sensors are used to measure the rotational speed of the power turbine spool. The Np sensor outputs are used for Np governing and overspeed limiting.

Each ECU channel has a dedicated coil for the Np signal, and one is shared between the channels. With data sharing via the cross-channel data link, each ECU channel has access to all three Np signals. The Np output is provided to the cockpit via ARINC 429. The Np sensors are hermetically sealed LRUs that require no external calibration or adjustment. The ECU defines 100 percent Np = 38,198 rpm.

95.5.6.6 Dual Tachometer Indication System — Operation

Dual Tachometer indicator is a digital indicator with analog indication of % RPM of Main Rotor Speed (NR) and % RPM of Power Turbine Speed (NP). The 28 VDC bus supplies the power to the dual tachometer indicator through the ENGINE INSTR NP (1CB24) and NR (1CB21) circuit breakers on the overhead panel. Circuit breakers are isolated by diode (4962-CR1). Internal lighting uses dimmable LED backlights. The maximum backlight voltage is 5 VDC. The backlight controller is programmed to simulate incandescent backlight.

Dual tachometer indicator monitors the active ECU channel from ARINC data bus words with label 270 (bit 23- channel active and bit 24-other channel active) and use the data off the channel in control. ARINC data bus transmission is solely dependent on the ECU channel being powered. Thus the indicator is receiving information from both channels at the same time and should monitor the channel in control. In the case that label 270 is not present on either channel, indicator have the preference to use channel A over channel B as long as the signal is valid through SSM bit (bit 30 and 31 set to 1). Refer to Chapter 76-00-00 for complete list of ARINC 429 Data Bus Information.

The indicator receives its main rotor rotation speed information from ARINC 429 data bus words with label 40 (octal) and indicating normal operation from monitored active channel.

The indicator receives its power turbine rotation speed information from ARINC 429 data bus words with label 346 (octal) and indicating normal operation from monitored active channel.

The indicator has seven outputs which provide switched grounds. Annunciator outputs activate to provide a ground path when the specified condition is detected in the ARINC 429 data relevant to each output, or when the built-in test is activated. Outputs deactivate when previous conditions are removed. Table 95-13 listed the Np/Nr Indicator discrete outputs.

95.5.6.7 Check Instrument Display Sequence – Dual Tach Indicator

When the built-in test is activated by pushing LCD test on the instrument panel, both needles turns to indicate 100% only when gas generator speed is lower than 5%.

Table 95-12: NP Indicator Limits

	OPERATION MODE TRANSIENT LIMITS	EXCEEDANCE ANNUNCIATOR
Actual Over-speed Event (Warning) **Recorded**	Greater than 105.0% OR Greater than 115.0% (OEC)	Activated (Remains activated until Check Instrument display sequence completed)

Table 95-13: Np/Nr ARINC 429 Discrete Output

ARINC Label	Bit	Channel	Indications Activated		Conditions
270	21	Either	FADEC DEGRADED	Caution	FADEC degraded faults detected per Chapter 76-00-00.
270	19	Both	FADEC FAIL / FADEC fail horn	Warning	Both channel hard faulted
271	18	Active	ENGINE OVSPD /	Warning	Engine control detected Ng or Np oversppeed.
271	17	Active	START	Advisory	Engine start.
271	14	Active	ENGINE OUT/ Engine out horn	Warning	Engine below 55% Ng.
351	21	Both	START FAULT	Advisory	Engine may not start.
350-354	14-29	Either	FADEC MAINT	Advisory	FADEC maintenance fault detected as per Chapter 76-00-00. Will annunciate with Ng below 5%.

95.5.6.8 Dual Tachometer Instrument - Removal

MATERIALS REQUIRED
Refer to BHT-ALL-SPM for specifications.

NUMBER	NOMENCLATURE
C-156	Caps and /or Plugs

NOTE

Remove components only to the extent necessary to perform the required maintenance.

1. Disconnect the battery and external DC power from the helicopter.
2. On the instrument panel, remove the screws and washers that attach the instrument panel (Figure 95-19).
3. Loosen the Dzus fasteners that secure the cover of the shroud assembly to the top of the glareshield.
4. At the instrument panel, remove the bolt and washer that attach the instrument panel.
5. Tilt the instrument panel.

CAUTION

HANDLE THE CONNECTORS AND THE RECEPTACLE OF THE INSTRUMENTS IN ACCORDANCE WITH STANDARD PRACTICES FOR ELECTROSTATIC SENSITIVE EQUIPMENT. THESE INSTRUMENTS ARE SENSITIVE TO ELECTROSTATIC. FAILURE TO OBEY THESE PRECAUTIONS MAY RESULT IN DAMAGE TO THE RELATED INSTRUMENT.

6. Disconnect the electrical connectors (1M6P1 and 1M6P2) (1, Figure 95-19) from the dual tachometer indicator (1M6) (4). Install caps and/or plugs (C-156) on the electrical receptacle of the instrument and on the electrical connector.
7. Hold the dual tachometer indicator.
8. Remove the screws (1), Figure 95-19) and nuts (2) that attach the instrument (3).
9. Carefully remove the instrument (3) from the instrument panel (5).

95.5.6.9 Dual Tachometer Indicator — Installation

WARNING

OBEY ALL THE SAFETY PRECAUTIONS WHEN DOING MAINTENANCE ON OR NEAR ELECTRICAL/ELECTRONIC EQUIPMENT (CHAPTER 96).

1. Disconnect the battery and external DC power from the helicopter.
2. Install the dual tachometer indicator (1M6) (4, Figure 95-19) in its location on the instrument panel (5).
3. Attach the dual tachometer indicator (1M6) (4) to the instrument panel (5) with the screws (2).
4. Connect the electrical connectors (1M6P1 and 1M6P2) (1) to the receptacles of the dual tachometer indicator. Connect the electrical connector (1M6P1) to the indicator receptacle (1M6J1). Connect the electrical connector (1M6P2) to the indicator receptacle (1M6J2).
5. Carefully put the instrument panel (5) in position.
6. Install the bolt and washers that attach the instrument panel.
7. Install the screws and washers that attach the instrument panel.

8. Do an operational check of the dual tachometer indication system (paragraph 95.5.6.10).

95.5.6.10 Dual Tachometer Indication System —Operational Check

CAUTION

USE AN EXTERNAL POWER UNIT DURING GROUND MAINTENANCE CHECKS TO AVOID BATTERY DEPLETION. IF BATTERY POWER IS USED, KEEP ELECTRICAL LOADS AND TEST TIME TO A MINIMUM.

1. Set the battery switch to BATT, or connect the external DC power to the helicopter.
2. Close the ENGINE INSTR NP (1CB24) and NR (1CB21) circuit breakers.

RESULT:

- Both needles move to 0.
- FADEC related annunciator flashes.
- FADEC fail and engine out horn activates.

CORRECTIVE ACTION:

- If both needles do not move to 0 or to the current value, refer to Trouble No. 1 (Figure 95-20).

3. Push HORN MUTE switch button.

RESULT:

- FADEC horn de-activates.

4. Push the LCD TEST switch on the instrument panel.

RESULT:

- Both needles move to 0.
- FADEC related annunciator flashes.
- FADEC fail and engine out horn activates.

CORRECTIVE ACTION:

- If no indicator discrete output activated, refer to Trouble No. 2 (Figure 95-21).

5. Push HORN MUTE switch button.

RESULT:

- FADEC horn de-activates.

6. Set the battery switch to OFF, or remove the external DC power from the helicopter.
7. Return the helicopter to the standard configuration. Refer to Standard Practices — After Electrical Maintenance or Repairs (Chapter 96).

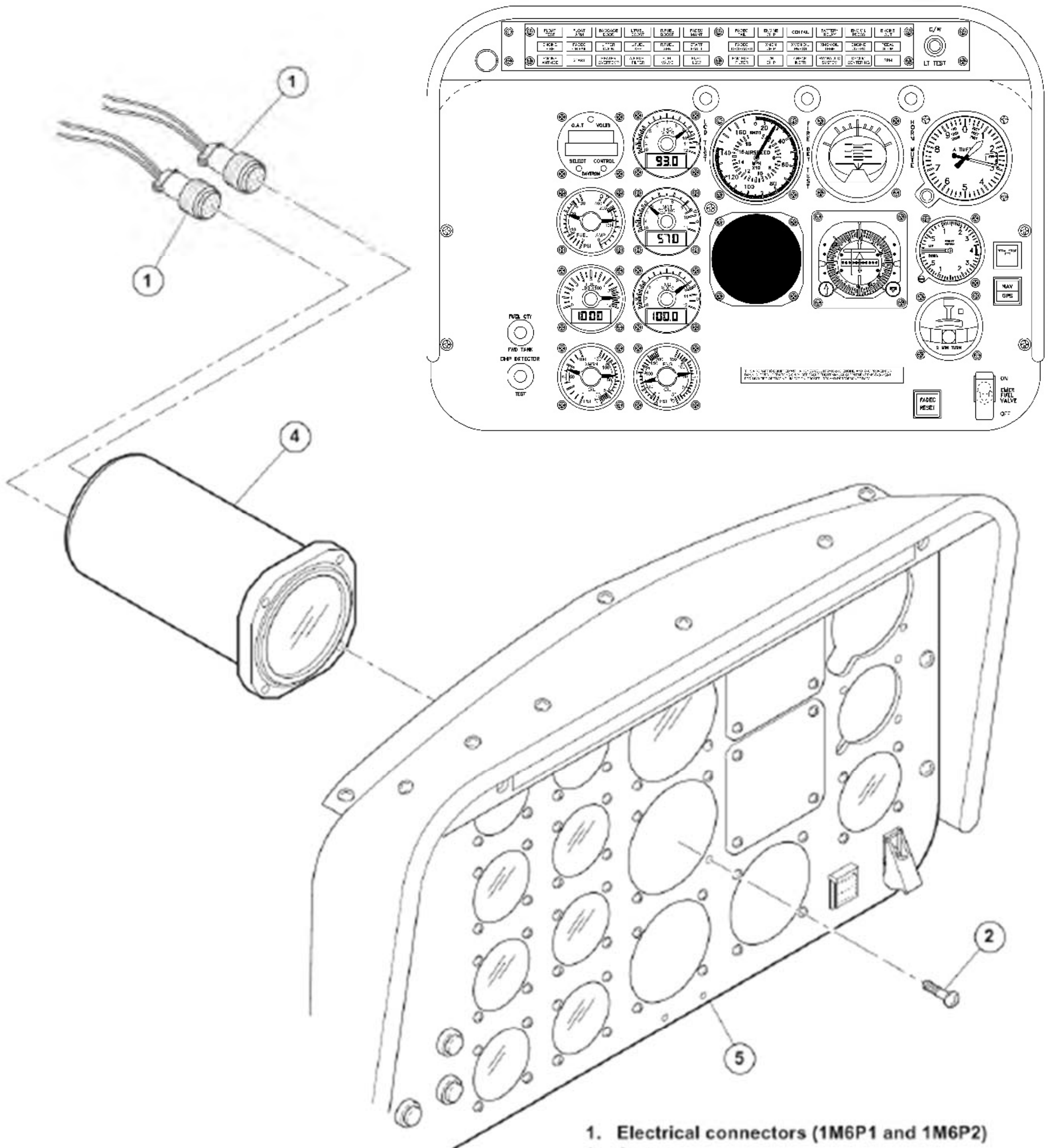


Figure 95-19: Dual Tachometer Indicator - Removal and Installation

DUAL TACHOMETER INDICATOR - TROUBLE NO. 1

CAUTION

DISCONNECT THE BATTERY AND THE EXTERNAL POWER PRIOR TO PERFORMING A CONTINUITY CHECK OR MAINTENANCE ON THE DUAL TACHOMETER INDICATION SYSTEM.

NOTE
Refer to Chapter 98 for wiring diagram.

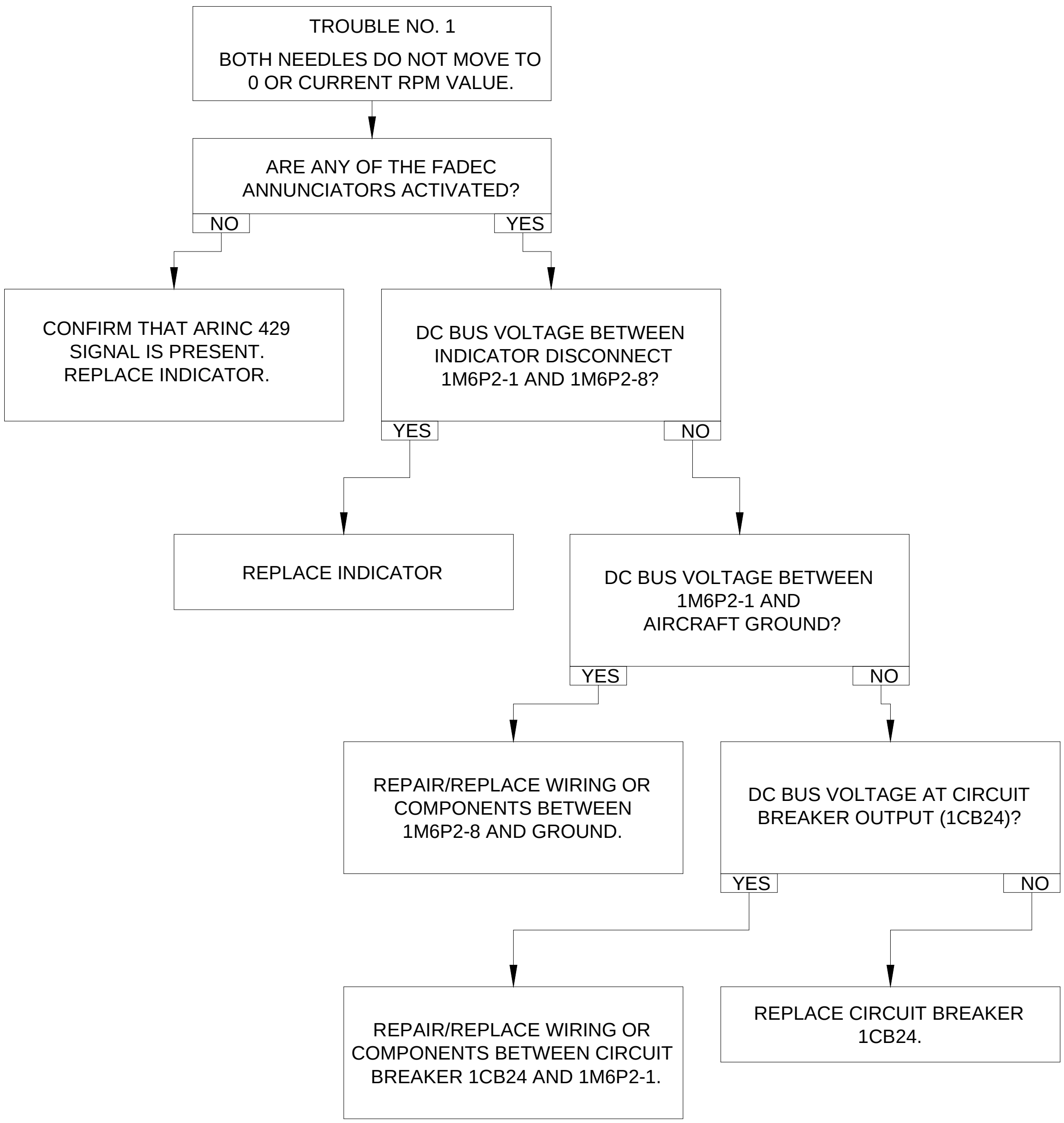


Figure 95-20: Dual Tachometer Indication System - Trouble No. 1

DUAL TACHOMETER INDICATOR - TROUBLE NO. 2

CAUTION

DISCONNECT THE BATTERY AND THE EXTERNAL POWER PRIOR TO PERFORMING A CONTINUITY CHECK OR MAINTENANCE ON THE DUAL TACHOMETER INDICATION SYSTEM.

NOTE

Refer to Chapter 98 for wiring diagram.

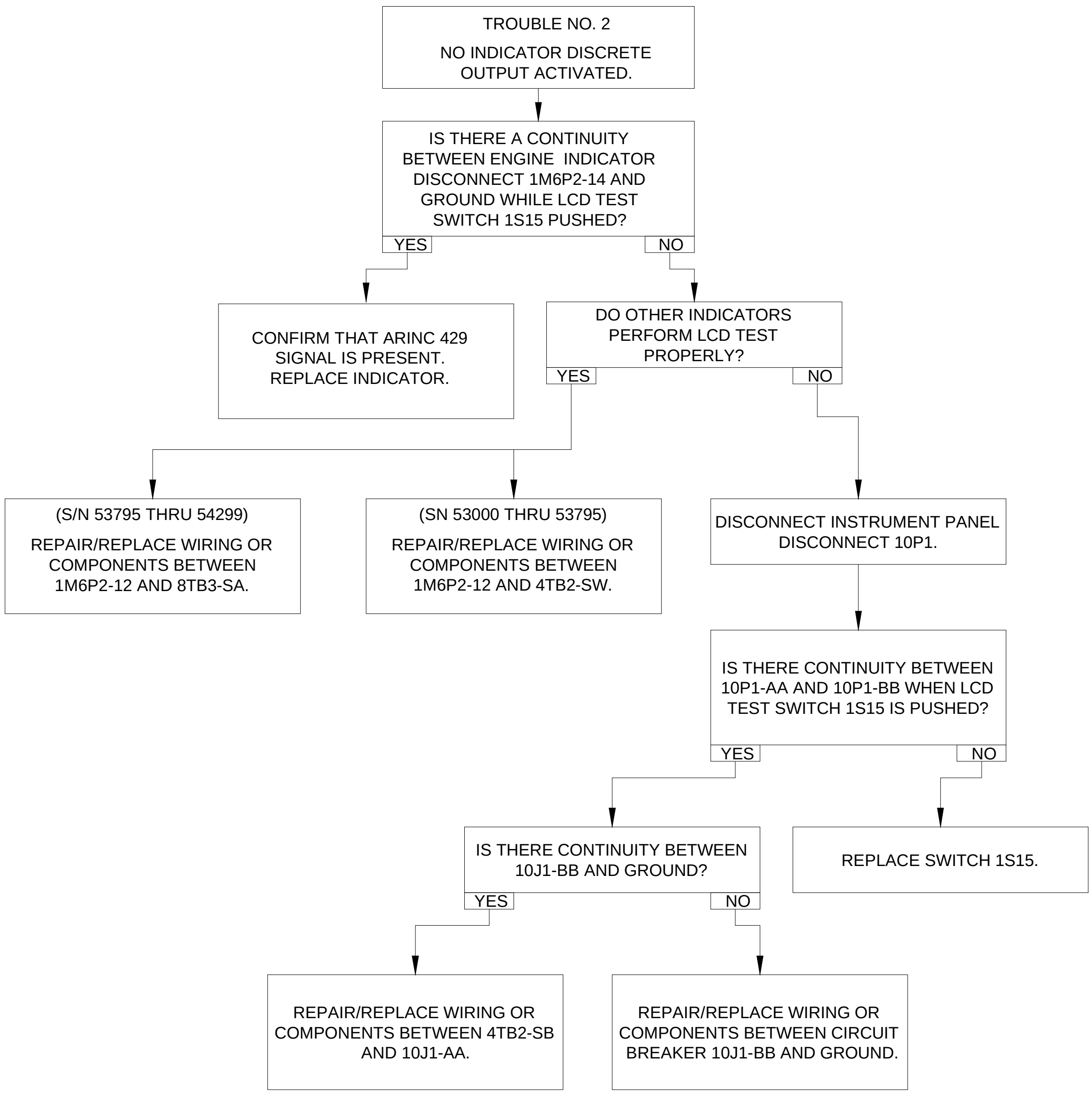


Figure 95-21: Dual Tachometer Indication System - Trouble No. 2

95.5.6.11 Dual Tachometer Indication System — Functional Check

SPECIAL TOOLS REQUIRED

NUMBER	NOMENCLATURE
BK Precision or Equivalent	Function Generator
Bushmaster 2500 or Equivalent	Advanced Databus Analyzer
0789-18-002	NR Test Fixture
0789-18-006	NP Test Fixture

MATERIALS REQUIRED

Refer to BHT-ALL-SPM for specifications.

NUMBER	NOMENCLATURE
C-405	Lockwire

1. Test the indication system of the main rotor RPM (NR) as follows:

   a) Ensure battery switch is OFF, or external DC power is removed from helicopter.
   b) On the transmission compartment, disconnect (1B8P1) NR Monopole Sensor connector.
   c) Connect test fixture, 0789-18-003, between the NR Monopole sensor (1B8) and the connector (1B8P1).
   d) Connect a frequency generator (BK Precision) to the test fixture.

SIGNAL INPUT

Signal HI	Red
Signal LO	Black

NOTE

When the ENGINE NR connector is disconnected, the FADEC/ECU will cause FADEC DEGRADED to be displayed on the caution/warning/advisory panel. This fault will disappear when the ENGINE NR connector is reconnected and the FADEC/ECU is reset by pushing FADEC RESET push button or the power to the FADEC/ECU

   e) Set the battery switch to BATT, or connect the external DC power to the helicopter.
   f) On the overhead panel, verify that the ENG INSTR NP (1CB24), NR (1CB21), FADEC CH A PWR (4962CB1) and FADEC CH B PWR (4962CB2) are closed.
   g) Establish communication between Ground Support Equipment and the helicopter.
   h) Ensure no FADEC related fault is activated.
   i) Simulate NR frequency signal (400.1 Hz sine wave).
   j) Verify that the NR pointer and Ground Support Equipment channel A and B reads 20±0.1 %.
   k) Increase the signal to 1,000.2 Hz.
   l) Verify that the NR pointer and Ground Support Equipment channel A and B reads 50±0.1 %.
   m) Increase the signal to 2,000.4 Hz.
   n) Verify that the NR pointer and Ground Support Equipment channel A and B reads 100±0.1 %.
   o) Set the battery switch to OFF, or disconnect the external DC power to the helicopter.
   p) In the transmission compartment, disconnect the test fixture and frequency generator.
   q) Reconnect Nr sensor connector 1B8P1.
   r) Return the helicopter to the standard configuration. Refer to Standard Practices — After Electrical Maintenance or Repairs (Chapter 96).

2. Test the indication system of the power turbine (NP) as follows:

a) If NP channel A is suspected faulty complete steps b) through j). Otherwise skip ahead to step k).
b) Ensure battery switch is OFF, or external DC power is removed from helicopter.
c) In the engine compartment, disconnect connectors from (4962-A15), and (4962-A25) NP Monopole Sensors.

NOTE

It may be necessary to remove the starter to access the NP monopole sensor connectors.

d) Connect test fixture, 0789-18-006, to the NP Monopole sensor connectors 4962-P15 and 4962-A25.
e) Connect a frequency generator (BK precision or equivalent) to the jack points on the test fixture 0789-18-006.

SIGNAL INPUT

Signal HI	Red
Signal LO	Black
Amplitude	5 Volts P-P
Waveform	Square wave
DC Offset	0 Volts
Frequency	4456 Hz

NOTE

When the ENGINE NP connector is disconnected, the FADEC/ECU may cause FADEC DEGRADED to be displayed on the caution/warning/advisory panel. This fault will disappear when the ENGINE NP connector is reconnected and the FADEC/ECU is reset by pushing FADEC RESET push button or the power to the FADEC/ECU

f) Set the battery switch to BATT, or connect the external DC power to the helicopter.
g) On the overhead panel, verify that the ENG INSTR NP (1CB24), NR (1CB21), FADEC CH A PWR (4962CB1) and FADEC CH B PWR (4962CB2) are closed.
h) FADEC MAINT related fault maybe activated.
i) Simulate NP frequency signal (4456 Hz square wave).
j) Verify that the NP pointer reads 100% ±1.0%.
k) If NP channel B is suspected faulty complete steps l) through s).
l) Ensure battery switch is OFF, or external DC power is removed from helicopter.
m) In the engine compartment, disconnect connectors from (4962-A24), and (4962-A25) NP Monopole Sensors.

NOTE

It may be necessary to remove the starter to access the NP monopole sensor connectors.

n) Connect test fixture, 0789-18-006, to the NP Monopole sensor connectors (4962-P24) and (4962-P25).
o) Connect a frequency generator (BK precision or equivalent) to the jack points on the test fixture 0789-18-006.

SIGNAL INPUT

Signal HI	Red
Signal LO	Black
Amplitude	5 Volts P-P
Waveform	Square wave
DC Offset	0 Volts
Frequency	4456 Hz

NOTE

When the ENGINE NP connector is disconnected, the FADEC/ECU may cause FADEC DEGRADED to be displayed on the caution/warning/advisory panel. This fault will disappear when the ENGINE NP connector is reconnected and the FADEC/ECU is reset by pushing FADEC RESET push button or the power to the FADEC/ECU

p) Set the battery switch to BATT, or connect the external DC power to the helicopter.
q) FADEC MAINT related fault maybe activated.
r) Simulate NP frequency signal (4456 Hz square wave).
s) Verify that the NP pointer reads 100% ±1.0%.
t) Set the battery switch to OFF, or disconnect the external DC power to the helicopter.
u) In the engine compartment, disconnect test fixture 0789-18-006 and the frequency generator.
v) Reconnect all NP sensor connectors.
w) Return the helicopter to the standard configuration. Refer to Standard Practices — After Electrical Maintenance or Repairs (Chapter 96).

3. Test indicator discrete outputs as follows:

a) Ensure battery switch is OFF, or external DC power is removed from helicopter.
b) Make sure that FADEC CH A PWR (4962CB1) and FADEC CH B PWR (4962CB2) circuit breakers are pulled.
c) Make sure that ENG INSTR MGT (1CB10), NG (1CB22), NP (1CB24), and NR (1CB21) indicator circuit breakers are pulled.
d) On the forward transmission area, disconnect 4962-P196.
e) Connect ARINC 429 Transmitter harness, Bushmaster 2500 or Equivalent, to 4962-J196 as follows:

SIGNAL INPUT

	Channel A	**Channel B**
Signal HI	Pin 71	Pin 53
Signal LO	Pin 58	Pin 31

f) Connect a ground to 4962-J196 pin 17.
g) Set the battery switch to BATT, or connect the external DC power to the helicopter.
h) On the overhead panel, push the ENG INSTR NP (1CB24), and NR (1CB21) circuit breakers.
i) Establish communication between the ARINC 429 transmitter and the helicopter.
j) Simulate ARINC 429 words with label 270 on both channels.
   - Set bits 30 and 31 HI
   - Set CHA bit 10 = HI and CHB bit 9 = HI

   Verify SSM bits are valid (HI) and SDI correspond to ECU channel simulated.
k) On the desired active channel, set bit 23 to HI (1) and bit 24 to LO (0). Set the other channel bit 23 to LO (0) and bit 24 to HI (1). Make a note of active channel.
l) On the selected active channel, simulate signal HI on data bus for words with label 270 (octal) for FADEC degrade caution (bit 21) Ensure that the FADEC DEGRADED caution annunciator output is activated.

m) Simulate signal HI on data bus for words with label 271 (octal) for engine overspeed warning (bit 18).
   - Set bits 30 and 31 HI

   Ensure that the ENGINE OVSPD warning annunciator output is activated.
n) Simulate signal HI on data bus for words with label 271 (octal) for engine start advisory (bit 17). Ensure that the START advisory annunciator output is activated.
o) Simulate signal HI on data bus for words with label 271 (octal) for engine out warning (bit 14). Ensure that the ENGINE OUT warning annunciator output and engine out horn are activated.

NOTE

FADEC MAINT annunciator can only be activated after engine shutdown (Ng less than 5%).

p) Simulate signal HI on data bus for words with labels 350, 351, 352, 353, and 354 (octal) on either channel for FADEC maintenance advisory (bits 14 through 29),
   - Set bits 30 and 31 HI

   Ensure that the FADEC MAINT advisory annunciator output is activated.
q) With activated FADEC MAINT annunciator, simulate data words with label 344 (octal) for gas producer (Ng) value greater than 5%.
   - Set bits 24 = 1 (Ng = 8%)

   Verify that FADEC MAINT annunciator deactivate.
r) Simulate signal HI on data bus for words with label 270 (octal) for FADEC fail warning (bit 19) on both channel. Ensure that the FADEC FAIL warning and FADEC FAIL horn annunciator outputs are activated. Verify that warning annunciator do not come on with the condition in one channel only.
s) Simulate signal HI on data bus for words with label 351 (octal) for start fault advisory (bit 21). Ensure that the START FAULT advisory annunciator output is activated. Verify that advisory do not come with the condition on one channel only.
t) Remove the external DC power from the helicopter.
u) Return the helicopter to the standard configuration. Refer to Standard Practices — After Electrical Maintenance or Repairs (Chapter 96).

95.5.6.12 Exceedance Acquisition and Clearing — NP Indicator

SPECIAL TOOLS REQUIRED

NUMBER	NOMENCLATURE
	M407 Maintenance-Diamond J software

1. Set the battery switch to BATT, or connect the external DC power to the helicopter.
2. Pull the ENG INSTR NP and NR (1CB21 and 1CB24) circuit breaker.
3. Establish communication between the Instrument Maintenance Computer and the helicopter by connecting to the serial interface RS-485.
4. Execute indicator maintenance software on the computer.
5. Select Power Turbine Speed Memory Read Procedure in the maintenance software.

6. Engage ENG INSTR NP and NR (1CB21 and 1CB24) circuit breaker.
7. Select Perform Power Turbine Speed Memory Read in the maintenance software.
8. The maintenance software will show that the indicator memory is being read.
9. Save data to a known folder. After the download, the maintenance software will show that the indicator memory has been completely read.
10. Select Power Turbine Speed Memory Clear Procedure in the maintenance software.
11. Select Perform Power Turbine Speed Memory Clear in the maintenance software.
12. Wait for five seconds.
13. Pull the ENG INSTR NP circuit breaker (1CB21).
14. Perform power-up test to confirm NP indicator memory have been reset.
15. Set the battery switch to OFF, or disconnect the external DC power to the helicopter.
16. Return the helicopter to the standard configuration. Refer to Standard Practices — After Electrical Maintenance or Repairs (Chapter 96).

95.5.6.13 Adjusting Real-Time Clock – NP/NR Indicator

The real-time clock, used to time stamp recorded data and events, can be adjusted by the user by communication with the indicator through the serial interface.

1. Set the battery switch to BATT, or connect the external DC power to the helicopter.
2. Verify the date and time of the computer is synchronized to NIST.
3. Pull the ENG INSTR NP and NR (1CB21 and 1CB24) circuit breaker.
4. Establish communication between the Instrument Maintenance Computer and the helicopter by connecting to the serial interface RS-485.
5. Execute indicator maintenance software.
6. Select real time clock adjustment procedure in the maintenance software.
7. Engage ENG INSTR NP and NR (1CB21 and 1CB24) circuit breaker.
8. Select Perform Real-Time Clock Adjustment in the maintenance software.
9. Pull the ENG INSTR NP and NR (1CB21 and 1CB22) circuit breaker.
10. Set the battery switch to OFF, or disconnect the external DC power to the helicopter.
11. Return the helicopter to the standard configuration. Refer to Standard Practices — After Electrical Maintenance or Repairs (Chapter 96).

95.5.6.14 NR Monopole Sensor — Removal

MATERIALS REQUIRED
Refer to BHT-ALL-SPM for specifications.

NUMBER	NOMENCLATURE
C-428	Caps and/or Plugs
C-156	Caps and /or Plugs

WARNING

OBEY ALL THE SAFETY PRECAUTIONS WHEN DOING MAINTENANCE ON OR NEAR ELECTRICAL/ELECTRONIC EQUIPMENT (CHAPTER 96).

NOTE

Remove components only to the extent necessary to perform the required maintenance.

1. Disconnect the battery and external DC power from the helicopter.
2. Remove the fairing to gain access to the NR monopole sensor (1B8) in the transmission compartment.
3. Disconnect the electrical connector (1B8P1) (3, Figure 95-22) from the NR monopole sensor (1B8) (2).
4. Remove the lockwire from the NR monopole sensor (1B8) (2).
5. Remove the NR monopole sensor (1B8) (2) and the packing (1) from the main transmission (4).

CAUTION

INSTALL CAPS AND/OR PLUGS (C-156) ON ELECTRICAL CONNECTOR (1B8P1). AND ON THE NR MONOPOLE SENSOR (1B8).

6. Install caps and/or plugs (C-156) to the electrical connector (1B8P1) (3) and to the NR monopole sensor (1B8) (2).

CAUTION

INSTALL CAPS AND/OR PLUGS (C-428) ON THE OPEN PORT OF THE TRANSMISSION TO PREVENT FOREIGN OBJECT DAMAGE TO THE TRANSMISSION.

7. Install caps and/or plugs (C-428) on the open port of the main transmission (4).

95.5.6.15 NR Monopole Sensor — Installation

WARNING

OBEY ALL THE SAFETY PRECAUTIONS WHEN DOING MAINTENANCE ON OR NEAR ELECTRICAL/ELECTRONIC EQUIPMENT (CHAPTER 96).

MATERIALS REQUIRED

Refer to BHT-ALL-SPM for specifications.

NUMBER	NOMENCLATURE
C-052	Contact Enhancer
C-405	Lockwire

1. Disconnect the battery and external DC power from the helicopter.
2. Gain access to the transmission compartment. On the aft right side of the transmission, locate the transmission port for the NR monopole sensor.
3. Remove the previously installed caps and/or plugs.
4. Install the packing (1, Figure 95-22) on the NR monopole sensor (1B8) (2).
5. Install the NR monopole sensor (1B8) (2) into the transmission port. Torque the NR monopole sensor.
6. Safety the NR monopole sensor with lockwire (C-405).

NOTE

It is recommended to apply contact enhancer (C-052) to the electrical connectors per TB 407-08-81.

7. Connect the electrical connector (1B8P1) (3) to the NR monopole sensor (1B8) (2).

CAUTION

A QUALIFIED PERSON MUST BE AT THE HELICOPTER CONTROLS DURING THE FOLLOWING PROCEDURE.

8. Start the helicopter (BHT-407-FM-1, Section 2) and make sure the NR/NP indication is operational and within limits and that there are no oil leaks.

9. Return the helicopter to the standard configuration. Refer to Standard Practices — After Electrical Maintenance or Repairs (Chapter 96).

95.5.6.16 NP Monopole Sensor — Removal/ Installation

Refer to the Honeywell Light Maintenance Manual for HTS900-2-1D for the cleaning, inspection and detailed maintenance of the NP monopole sensor.

95.5.7 ENGINE OIL TEMPERATURE / PRESSURE INDICATION SYSTEM — DESCRIPTION

The ENG OIL indicator gives an indication of the engine oil temperature in degrees Centigrade (°C) and the engine oil pressure in Pounds per Square Inch (PSI) (Figure 95-23). The ENG OIL indicator is made of a dial and electronic components in a sealed case.

The dial is divided into two scales. The scale on the left side of the dial is the PSI scale and shows the pressure of the engine oil. The scale on the right side of the dial is the °C scale and shows the temperature of the engine oil.

The two scales have needle/pointer displays. Each of the pointers is along their related scale and they operate from bottom up.

For the simplified schematic of the engine oil temperature/pressure indication system, refer to Figure 95-24.

When engine oil pressure drops below 42 PSI and Ng > 80%, the ENG OIL PRESS warning light is turned on.

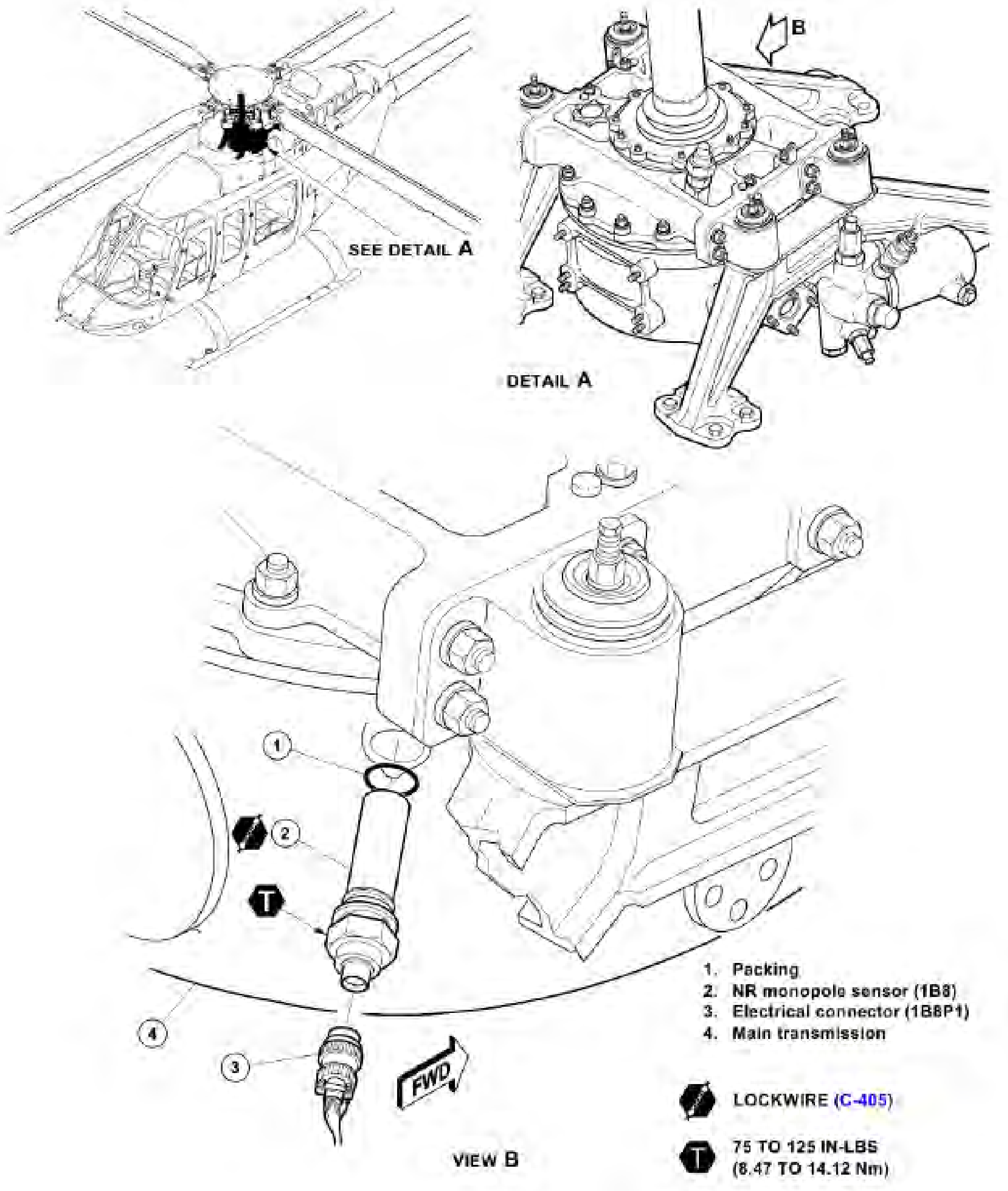
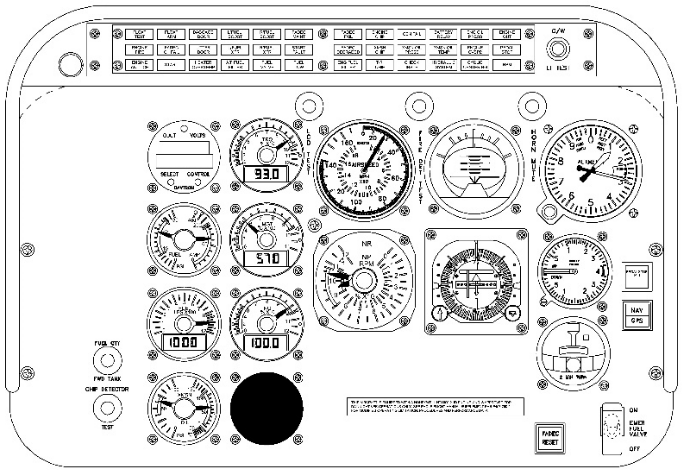
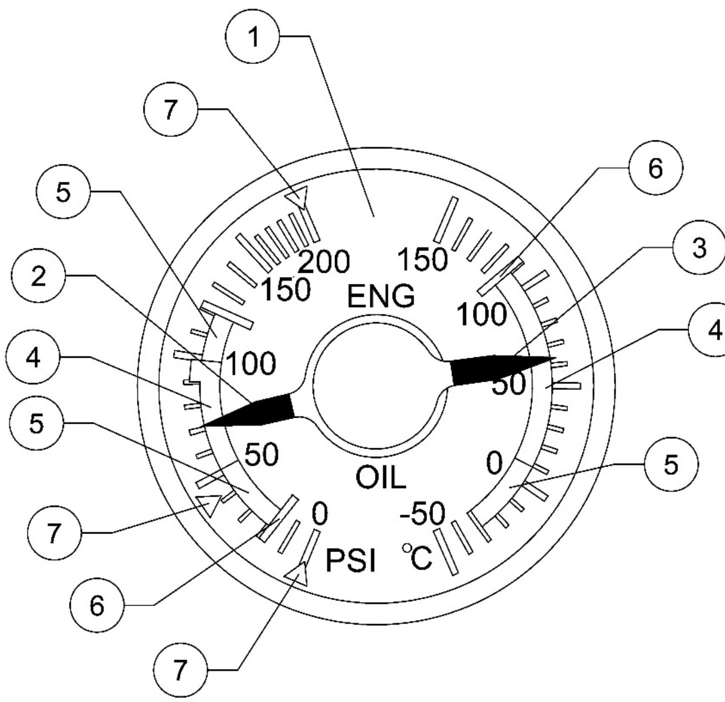


Figure 95-22: NR Monopole Sensor - Removal and Installation





1. Engine oil pressure and temperature indicator dial
2. Pressure pointer display
3. Temperature pointer display
4. Green arc
5. Yellow arc
6. Red line
7. Red triangle

Figure 95-23: Engine Oil Temperature/Pressure Indicator - Description

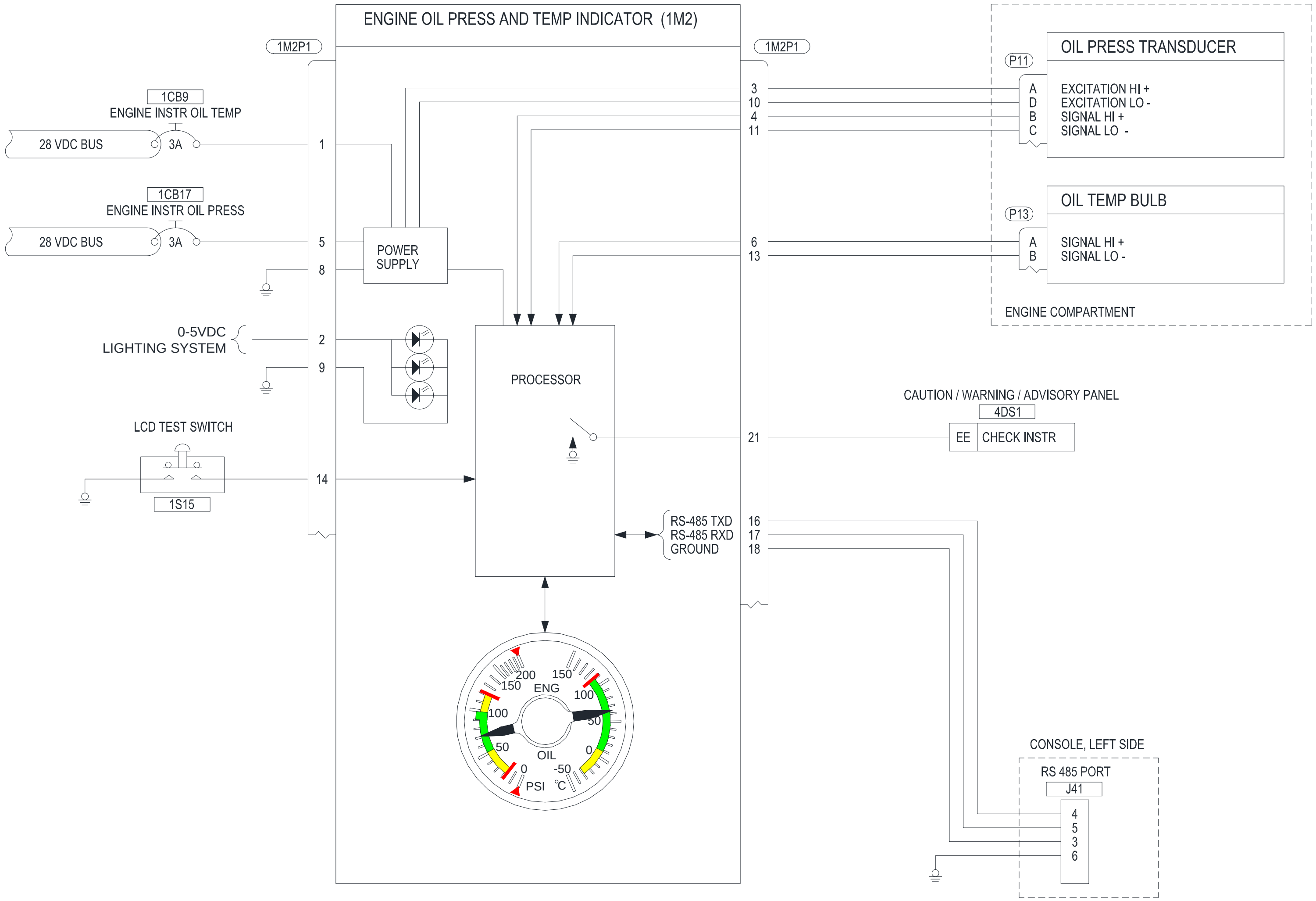


Figure 95-24: Engine Oil Temperature/Pressure Indication System - Simplified Schematic

95.5.7.1 Engine Oil Temperature / Pressure Indication System — Range Markings

The range marking for the PSI scale is shown in Table 95-14. The range marking for the °C scale is shown in Table 95-15.

Table 95-14: Engine Oil Pressure PSI Scale — Range Marking

MARKING	RANGE (PSI)	DEFINITION
Red Triangle	0	Minimum below 45% NG
Red Line	20	Minimum at idle
Yellow Arc	20 to 52	Continuous operation between 45%-80% NG
Red Triangle	42	Minimum above 80% NG
Wide Green Arc	90 to 100	Continuous Operation above 97% NG
Yellow Arc	100 to 120	5 Minute Limit
Red Line	120	Maximum
Red Triangle	200	Maximum Cold Start

Table 95-15: Engine Oil Temperature °C Scale — Range Marking

MARKING	RANGE (°C)	DEFINITION
Yellow Arc	-23 to 10	Minimum
Green Arc	10 to 110	Continuous Operation
Red Line	110	Maximum

95.5.7.2 Engine Oil Temperature / Pressure Indication System — Fault Indication

Failure	Observation
Indicator Power Failure	Pointers return to about five angular degrees below scale
Pressure Transducer Excitation	Pressure pointer returns to 0 psi
Pressure Transducer Signal	Pressure pointer returns to 0 psi
Temperature Signal	Temperature pointer returns to -50°C

95.5.7.3 Engine Oil Pressure Transducer — Description

The engine oil pressure transducer (4962-A11) is mounted in the forward side of the accessory/reduction gearbox secured on to a mounting bracket. The transducer has a pressure diaphragm and a strain gauge bridge.

95.5.7.4 Engine Oil Temperature Bulb — Description

The engine oil temperature bulb (4962-A13) is installed on the output side of the engine oil filter. The temperature bulb is a resistive bulb. The resistance of the bulb changes as the temperature of the engine oil changes.

95.5.7.5 Engine Oil Pressure Indication System — Operation

The strain gauge circuit of the engine oil pressure transducer receives an excitation voltage of 10 VDC from the engine oil pressure indicator. The engine oil pressure port on the engine gearbox outputs a specific oil pressure that changes the strain gauge bridge in the transducer. These changes the signal sent to the engine oil pressure indicator. The engine oil pressure indicator shows the oil pressure in PSI in relation to the input signal from the transducer as shown in Table 95-16.

95.5.7.6 Engine Oil Temperature Indication System — Operation

A resistive type temperature bulb (4692-A13) mounted in the forward side of the accessory gearbox gives a specific resistance value to the indicator. The temperature bulb is the variable resistance part of a Wheatstone bridge. As the temperature of the oil in the oil filter output changes, the resistance of the temperature bulb changes. The engine oil temperature indicator displays the temperature in relation to the resistance value of the temperature bulb, as shown in Table 95-17.

95.5.7.7 Engine Oil Temperature / Pressure Indication System — Power Requirements

The 28 VDC bus supplies the power input to the instrument. The 28 VDC is supplied through the ENGINE INSTR OIL TEMP (1CB9) circuit breaker and ENGINE INSTR OIL PRESS (1CB17) circuit breaker. The two circuit breakers are on the overhead panel. Internal lighting uses dimmable LED backlights. The maximum backlight voltage is 5 VDC. The backlight controller is programmed to simulate incandescent backlight.

95.5.7.8 Engine Oil Temperature / Pressure Indication System — Exceedances

To warn the pilot when over or under pressure or over-temperature conditions exist, the check instrument annunciator activates when the indicated pressure or temperature exceeds a red line. The check instruments annunciator deactivates immediately after the indicated pressure and temperature return to within limits.

95.5.7.9 Engine Oil Temperature Indication System — Functional Check

SPECIAL TOOLS REQUIRED

NUMBER	NOMENCLATURE
Model 726 or Equivalent	Fluke Precision Multifunction Process Calibrator
0789-18-005	Oil Temp test Fixture

CAUTION

TO AVOID BATTERY DEPLETION, USE AN EXTERNAL POWER UNIT DURING GROUND MAINTENANCE CHECKS. IF BATTERY POWER IS USED, KEEP ELECTRICAL LOADS AND TEST TIME TO A MINIMUM.

1. Prepare the functional check setup, as shown in Figure 95-25.
2. Set the battery switch to OFF, or remove the external DC power from the helicopter.
3. On the overhead panel, open the ENGINE INSTR OIL TEMP (1CB9) & PRESS (1CB11) circuit breakers.
4. Disconnect the electrical connector (P13) from the engine oil temperature bulb (4962-A13).
5. Connect the test fixture to the electrical connector (P13), as shown in Figure 95-25.

NOTE

The ability to get the accuracy of the resistance, as shown in Table 95-17, is determined by the type of variable resistor and digital voltmeter used in the functional check setup.

6. Set the battery switch to BATT, or connect the external DC power to the helicopter.
7. On the overhead panel, close the ENGINE INSTR OIL TEMP (1CB9) & PRESS (1CB11) circuit breakers.
8. Adjust the variable resistance to a value, as shown in Table 95-17.
9. On the engine oil temp indicator, make sure the LCD display shows the matching temperature, as that shown on Table 95-17, for the resistance value set.
10. Repeat step 8 through step 9 for other values in Table 95-17.
11. Set the battery switch to OFF, or remove the external DC power from the helicopter.
12. Remove the test fixture.
13. Connect the electrical connector (P13) to the engine oil temperature bulb (4962-A13).
14. Return the helicopter to the standard configuration. Refer to Standard Practices — After Electrical Maintenance or Repairs (Chapter 96).

95.5.7.10 Engine Oil Temperature Bulb — Functional Check

SPECIAL TOOLS REQUIRED

NUMBER	NOMENCLATURE
TK-3531 or Equivalent	Dri-Block Calibrator

1. Remove the oil temperature bulb (paragraph 95.5.7.12).
2. Place the temperature bulb in a Dri-Block calibrator or equivalent.
3. Attach the digital voltmeter to the temperature bulb. Set the voltmeter to read the resistance value in a range as set out in Table 95-17.
4. Adjust the temperature of the Dri-Block calibrator to a value per Table 95-17.
5. Make sure the voltmeter display reads the matching resistance, as shown in Table 95-17, for the temperature value that was set.
6. Repeat step 4 and step 5 for the other values in Table 95-17.
7. Remove the temperature bulb from the Dri-Block calibrator.
8. Install the oil temperature bulb (paragraph 95.5.7.12).

95.5.7.11 Engine Oil Pressure Indication System — Functional Check

SPECIAL TOOLS REQUIRED

NUMBER	NOMENCLATURE
2311F or Equivalent	Barfield Pressure Tester, 0 to 300 PSI

CAUTION

TO AVOID BATTERY DEPLETION, USE AN EXTERNAL POWER UNIT DURING GROUND MAINTENANCE CHECKS. IF BATTERY POWER IS USED, KEEP ELECTRICAL LOADS AND TEST TIME TO A MINIMUM.

1. Set the battery switch to OFF, or remove the external DC power from the helicopter.
2. On the overhead panel, open the ENGINE INSTR OIL TEMP (1CB9) & PRESS (1CB11) circuit breakers.

CAUTION

MAKE SURE THAT THE OIL IN THE PRESSURE TESTER IS THE SAME OIL AS THE ENGINE OIL. FAILURE TO FOLLOW THIS PRECAUTION WILL RESULT IN THE CONTAMINATION OF THE ENGINE OIL SYSTEM.

3. Disconnect the engine oil pressure line from the engine oil pressure transducer (4962-A11).
4. Connect the pressure tester to the input port of the pressure transducer (4962-A11).
5. Set the battery switch to BATT, or connect the external DC power to the helicopter.
6. On the overhead panel, open the ENGINE INSTR OIL TEMP (1CB9) & PRESS (1CB11) circuit breakers.

CAUTION

DO NOT INCREASE THE PRESSURE OF THE PRESSURE TESTER TO MORE THAN 250.0 PSI. IF YOU HAVE PRESSURE ABOVE THE 250.0 PSI LIMIT, YOU CAN CAUSE DAMAGE THE ENGINE OIL PRESSURE TRANSDUCER.

7. Slowly increase the pressure of the pressure tester to 200.0 PSI.
8. On the ENG OIL indicator, make sure the LCD display shows 200.0 ±5 PSI.
9. Decrease the pressure of the pressure tester to 0 PSI.
10. Repeat step 7 and step 8 for each value in Table 95-16. Make sure the indicator is accurate.
11. On the overhead panel, open the ENGINE INSTR OIL TEMP (1CB9) & PRESS (1CB11) circuit breakers.
12. Set the battery switch to OFF, or remove the external DC power from the helicopter.
13. Disconnect the pressure tester from the engine oil pressure transducer.
14. Connect the engine oil pressure line to the engine oil pressure transducer.
15. Return the helicopter to the standard configuration. Refer to Standard Practices — After Electrical Maintenance or Repairs (Chapter 96).

Table 95-16: ENG PSI Scale Indication versus Input Signal

TEST PRESSURE (PSI)	INDICATION (PSI)	INDICATOR TOLERANCE (PSI)
0	0	±12.5
25	25	±5.0
50	50	±5.0
60	60	±5.0
70	70	±5.0
80	80	±5.0
90	90	±5.0
100	100	±5.0
110	110	±5.0
115	115	±5.0
120	120	±5.0
130	130	±5.0
140	140	±5.0
150	150	±5.0
175	175	±5.0
200	200	±5.0

Table 95-17: Engine Oil Temperature versus Resistance

INDICATION (°C)	RESISTANCE (OHMS)	INDICATOR TOLERANCE (°C)
-50	74.24	±3
-25	82.17	±3
0	90.38	±3
25	99.11	±3
50	108.39	±3
75	118.32	±3
100	128.85	±3
125	140.09	±3
150	151.91	±3

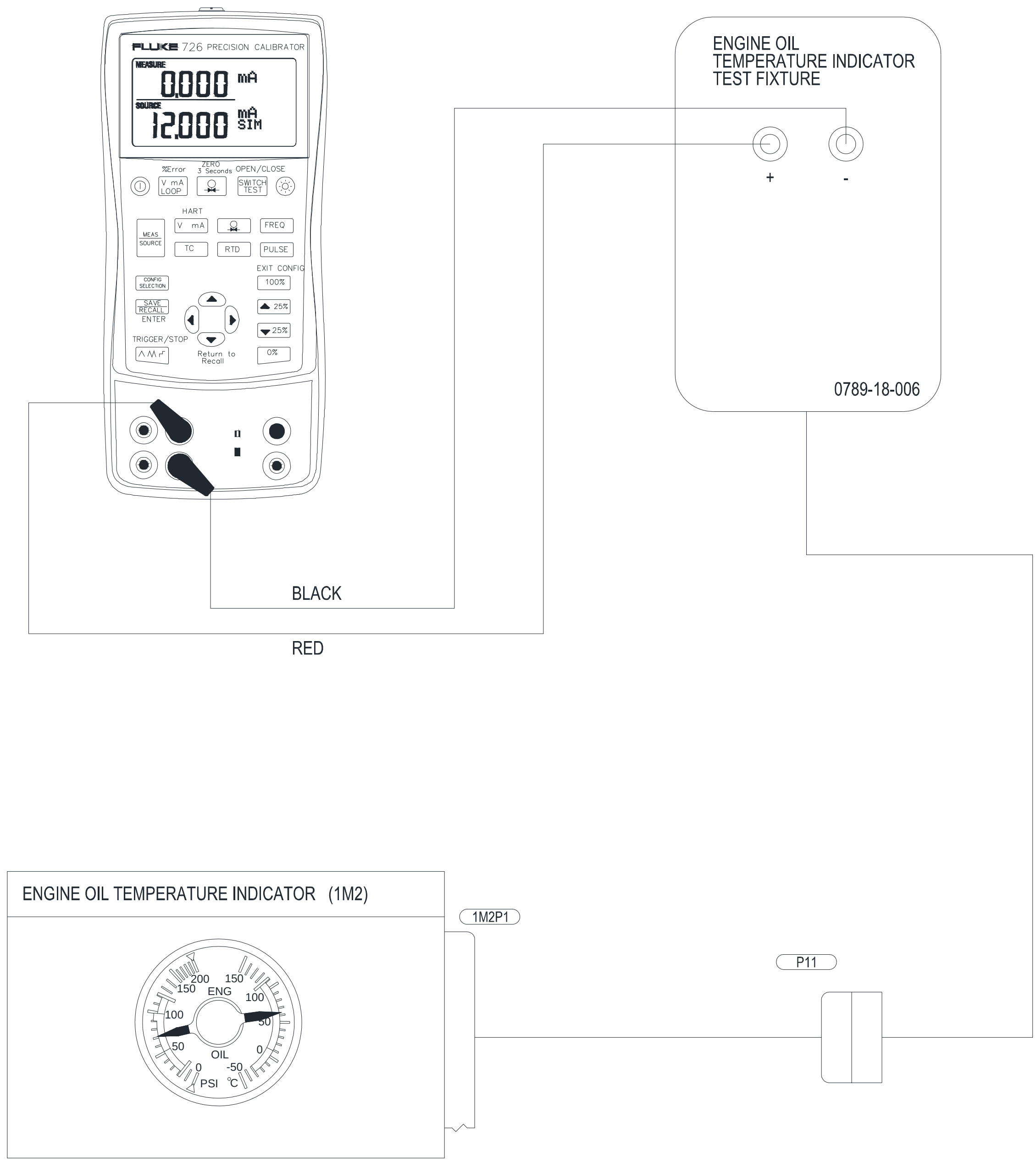


Figure 95-25: Functional Check Setup for the Engine Oil Temperature Indicator

95.5.7.12 Engine Oil Temperature Bulb — Removal/Installation

Refer to the Honeywell Light Maintenance Manual for HTS900-2-1D for the cleaning, inspection and detailed maintenance of the engine oil temperature bulb.

95.5.7.13 Engine Oil Pressure Transducer — Removal

MATERIALS REQUIRED
Refer to BHT-ALL-SPM for specifications.

NUMBER	NOMENCLATURE
C-428	Caps and/or Plugs

WARNING

OBEY ALL THE SAFETY PRECAUTIONS WHEN DOING MAINTENANCE ON OR NEAR ELECTRICAL/ELECTRONIC EQUIPMENT (CHAPTER 96).

NOTE

Remove components only to the extent necessary to perform the required maintenance.

1. Disconnect the battery and external DC power from the helicopter.
2. Gain access to the forward right side of the accessory gearbox at FS 160.00.
3. Disconnect the electrical connector (P11) (1, Figure 95-24) from the engine oil pressure transducer (4962-A11) (2).
4. Remove the lockwire from the engine oil pressure transducer (4962-A11) (2).
5. Remove the oil pressure transducer from the tee fitting (4). (4962-A11) (2)
6. Remove the packing (3) from the oil pressure transducer (4962-A11) (2).

CAUTION

INSTALL CAPS AND/OR PLUGS (C-428) ON THE OPEN PORT OF THE ENGINE OIL PRESSURE TRANSDUCER AND TEE FITTING TO PREVENT FOREIGN OBJECT DAMAGE TO THE ENGINE.

7. Install caps and/or plugs (C-428) on the open fittings of the engine oil pressure transducer (4962-A11) (2) and the tee fitting (4).

95.5.7.14 Engine Oil Pressure Transducer — Installation

MATERIALS REQUIRED
Refer to BHT-ALL-SPM for specifications.

NUMBER	NOMENCLATURE
C-405	Lockwire

WARNING

OBEY ALL THE SAFETY PRECAUTIONS WHEN DOING MAINTENANCE ON OR NEAR ELECTRICAL/ELECTRONIC EQUIPMENT (CHAPTER 96).

1. Disconnect the battery and external DC power from the helicopter.

CAUTION

USE THE SAME OIL AS THE OIL IN THE ENGINE TO LUBRICATE THE PREFORMED PACKING. FAILURE TO FOLLOW THIS PRECAUTION MAY

RESULT IN THE CONTAMINATION OF THE ENGINE OIL SYSTEM.

2. Lubricate the packing (3, Figure 95-26) with engine oil.
3. Remove the previously installed caps and/or plugs.
4. Install the packing (3) on the engine oil pressure transducer (4962-A11) (2).
5. Install the engine oil pressure transducer (4962-A11) (2) on the tee fitting (4). Make sure that the engine oil pressure transducer is correctly installed and tightened.
6. Safety the engine oil pressure transducer (4962-A11) (2) to the tee fitting (4) with lockwire (C-405).
7. Connect the electrical connector (P11) (1) to the engine oil pressure transducer (4962-A11) (2).
8. Bleed the engine oil pressure transducer (paragraph 95.5.7.15).

CAUTION

A QUALIFIED PERSON MUST BE AT THE HELICOPTER CONTROLS DURING THE FOLLOWING PROCEDURE.

9. Start the helicopter (BHT-407-FM-1, Section 2) and make sure the engine oil pressure indication is operational and within limits and that there are no oil leaks.
10. Return the helicopter to the standard configuration. Refer to Standard Practices — After Electrical Maintenance or Repairs (Chapter 96).

95.5.7.15 Engine Oil Pressure Transducer — Bleeding

SPECIAL TOOLS REQUIRED

NUMBER	NOMENCLATURE
2311F or Equivalent	Barfield Pressure Tester, 0 to 300 PSI

1. Disconnect the engine oil pressure line at the engine gearbox.

CAUTION

MAKE SURE THAT THE PRESSURE TESTER IS FILLED WITH THE SAME TYPE OF OIL THAT IS USED IN THE ENGINE OIL SYSTEM. IF YOU DO NOT USE THE SAME TYPE OF OIL, YOU WILL CONTAMINATE THE ENGINE OIL SYSTEM.

2. Attach the pressure tester to the engine oil pressure line.
3. Loosen the tee fitting cap (5, **Error! Reference source not found.**) installed on the forward firewall aft of the engine oil pressure transducer (4962-A11) (2).
4. Apply pressure slowly to fill the line with oil. Continue to force oil into the line until a steady flow without air bubbles comes out the tee fitting (4) cap port.
5. When a steady flow without air bubbles comes out the tee fitting (4) cap port, tighten the tee fitting cap (5).
6. Release the pressure in the pressure tester. Disconnect the pressure tester from the engine oil pressure line.

NOTE

Keep the engine oil pressure line elevated while you attach it to the engine gearbox to minimize the oil loss from the line.

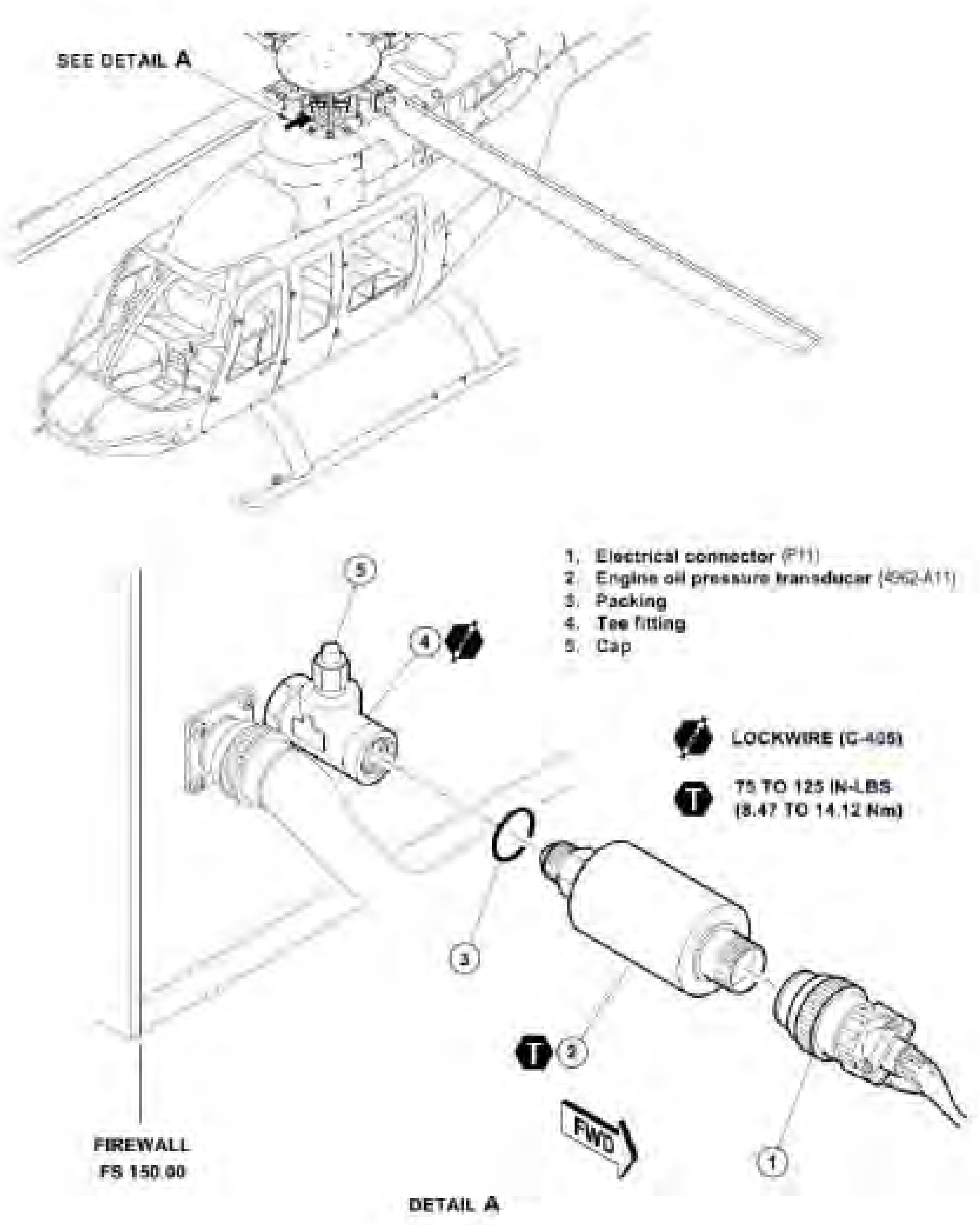


Figure 95-26: Engine Oil Pressure Transducer - Removal and Installation

7. Connect the engine oil pressure line to the engine gearbox. Tighten the oil pressure line at the engine gearbox.

95.5.8 TRANSMISSION OIL TEMPERATURE / PRESSURE INDICATION SYSTEM — DESCRIPTION

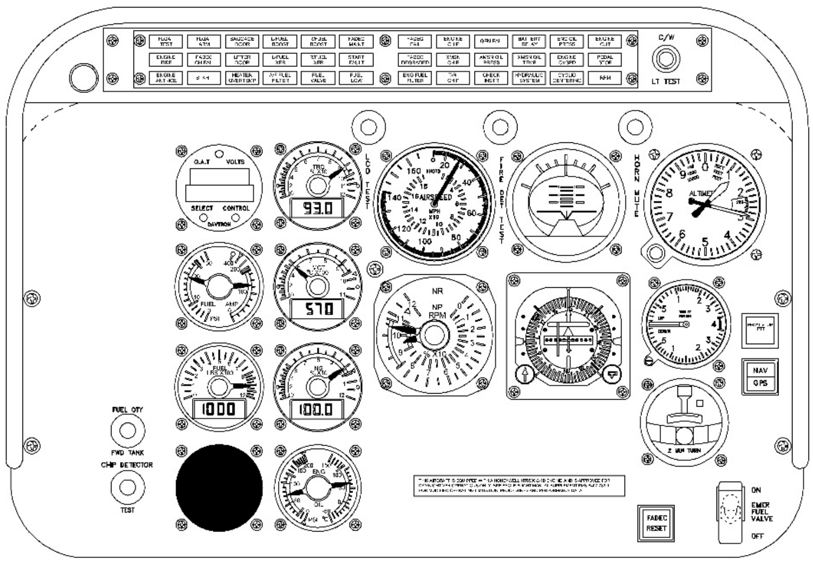
The XMSN OIL indicator provides an indication of the temperature in degrees Centigrade (°C) and the pressure in Pounds per Square Inch (PSI) (Figure 95-27). The XMSN OIL indicator is made up of a dial and electronic components in a sealed case.

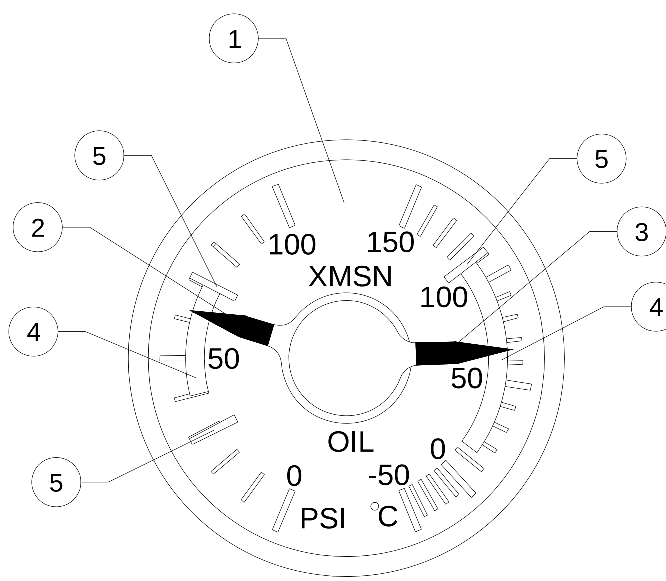
The dial is divided into two scales. The scale on the left side of the dial shows the pressure of the transmission oil. The scale on the right side of the dial is the °C scale and it shows the temperature of the transmission oil.

The two scales have needle/pointer displays. Each of the pointers is along their related scale and they operate from bottom up.

The 28 VDC bus supplies the power input to the power supply of the two electronic circuits. The 28 VDC to the oil temperature circuit is supplied through the XMSN INSTR OIL TEMP (1CB18) circuit breaker. The 28 VDC to the oil pressure circuit is supplied through the XMSN INSTR OIL PRESS (1CB15) circuit breaker. The two circuit breakers are on the overhead panel. Internal lighting uses dimmable LED backlights. The maximum backlight voltage is 5 VDC. The backlight controller is programmed to simulate incandescent backlight.

For the simplified schematic of the transmission oil temperature/pressure indication system, refer to Figure 95-28.





1. Transmission oil pressure and temperature indicator dial
2. Pressure pointer display
3. Temperature pointer display
4. Green arc
5. Red line

Figure 95-27: Transmission Oil Temperature/Pressure Indicator - Description

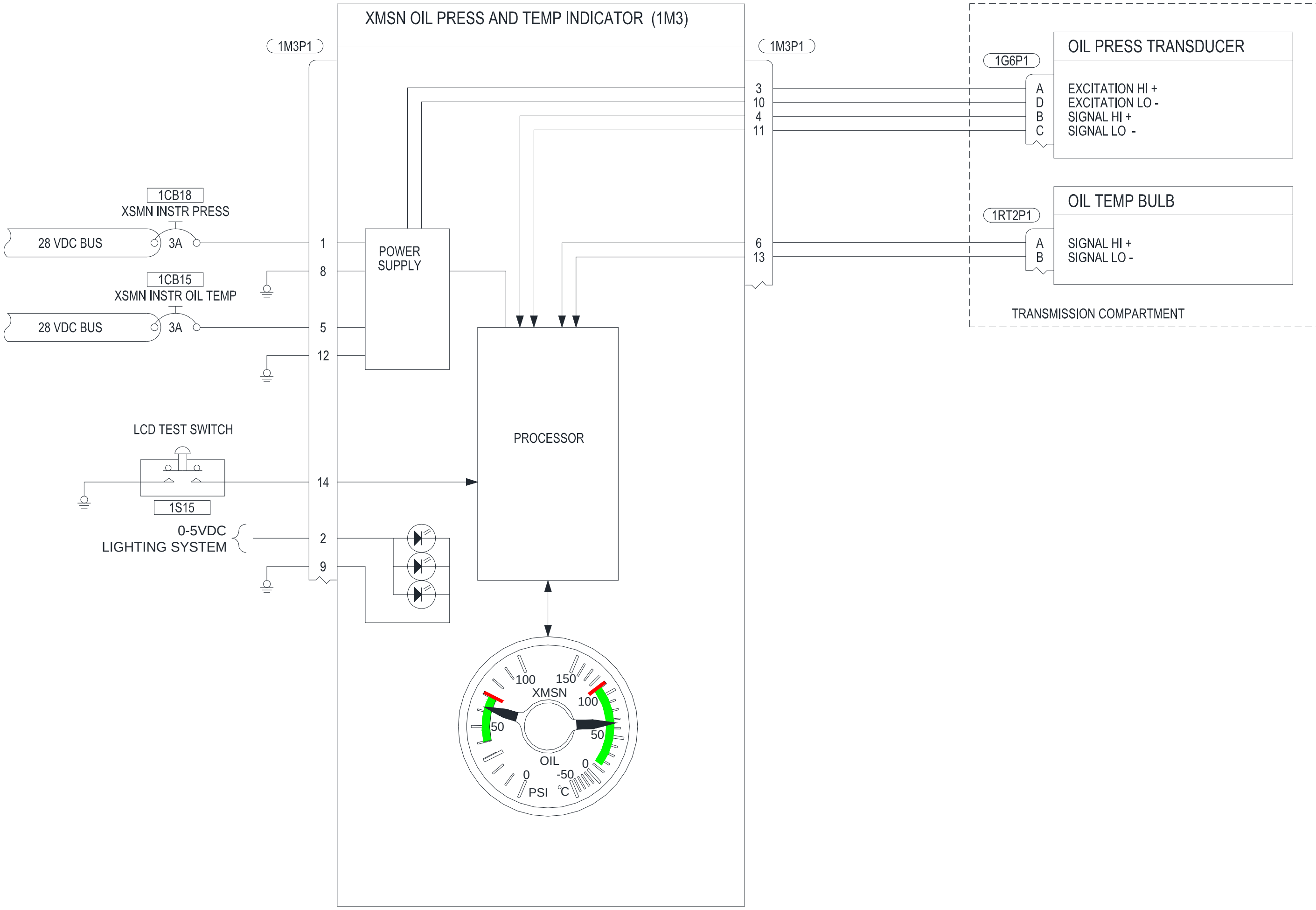


Figure 95-28: Transmission Oil Temperature/Pressure Indication System - Simplified Schematic

95.5.8.1 XMSN Oil Temperature / Pressure Indication System — Range Markings

The range marking for the PSI scale is shown in Table 95-18. The range marking for the °C scale is shown in Table 95-19.

Table 95-18: XMSN Oil Pressure PSI Scale — Range Marking

MARKING	RANGE (PSI)	DEFINITION
Red Line	30	Minimum
Green Arc	40 to 70	Continuous Operation
Red Line	70	Maximum

Table 95-19: XMSN Oil Temperature °C Scale — Range Marking

MARKING	RANGE (°C)	DEFINITION
Green Arc	15 to 110	Continuous Operation
Red Line	110	Maximum

95.5.8.2 Transmission Oil Pressure Indication System — Operation

The strain gauge circuit of the transmission oil pressure transducer receives an excitation voltage of 10 VDC from the transmission oil pressure indicator. The transmission oil pressure port on the transmission oil manifold provides a specific oil pressure output that changes the strain gauge bridge in the transducer. These changes the signal sent to the transmission oil pressure indicator. The transmission oil pressure indicator shows the oil pressure in PSI corresponding to the input signal as shown in Table 95-20.

Table 95-20: Transmission Oil Pressure Indication versus Input Signal

Pressure (PSI)	INPUT SIGNAL FROM TRANSDUCER TO INDICATOR (MV X EXCITATION VOLTAGE)	INDICATOR TOLERANCE (PSI)
0	0.00	±6.0
10	0.80	±2.4
20	1.60	±2.4
30	2.40	±2.4
40	3.20	±2.4
50	4.00	±2.4
60	4.80	±2.4
70	5.60	±2.4
80	6.40	±2.4
90	7.20	±2.4

95.5.8.3 Transmission Oil Pressure Transducer — Description

The transmission oil pressure transducer (1G6) is mounted on the transmission oil manifold. The manifold is on the transmission deck under the main driveshaft. The transducer has a pressure diaphragm and a strain gauge bridge.

95.5.8.4 Transmission Oil Temperature Indication System — Operation

A resistive type temperature bulb (1RT2), mounted in the transmission filter manifold, provides a specific resistance value to the indicator. The temperature bulb is the variable resistance part of a Wheatstone bridge. The balance of the circuit is contained in the indicator itself. As the temperature of the oil in the transmission filter manifold changes, the resistance of the temperature bulb changes. The transmission oil temperature indicator shows the temperature in relation with the resistance value of the temperature bulb as shown in Table 95-21.

Table 95-21: Transmission Oil Temperature Indication Versus Input Signal

INDICATION (°C)	RESISTANCE (OHMS)	INDICATOR TOLERANCE (°C)
0	90.38	±3
10	93.80	±3
20	97.31	±3
30	100.91	±3
40	104.60	±3
50	108.39	±3
60	112.28	±3
70	116.27	±3
80	120.36	±3
90	124.55	±3
100	128.85	±3
107	131.94	±3
110	133.26	±3
120	137.78	±3
130	142.40	±3
140	147.11	±3
150	151.91	±3

95.5.8.5 Transmission Oil Temperature Bulb — Description

The transmission oil temperature bulb (1RT2) is installed on the transmission oil filter manifold. The oil temperature bulb is in contact with the oil of the transmission. The temperature bulb is a resistive bulb. The resistance of the bulb changes as the temperature of the transmission oil changes.

95.5.8.6 Transmission Oil Temperature Indicator — Functional Check

SPECIAL TOOLS REQUIRED

NUMBER	NOMENCLATURE
Model 726 or Equivalent	Fluke Precision Multifunction Process Calibrator
0789-18-007	Oil Temp test Fixture

CAUTION

USE AN EXTERNAL POWER UNIT DURING GROUND MAINTENANCE CHECKS TO AVOID BATTERY DEPLETION. IF BATTERY POWER IS USED, KEEP ELECTRICAL LOADS AND TEST TIME TO A MINIMUM.

1. Prepare the functional check setup, as shown in Figure 95-29.
2. Set the battery switch to OFF, or remove the external DC power from the helicopter.
3. On the overhead panel, open the XMSN OIL TEMP INSTR circuit breaker (1CB18).
4. Disconnect the electrical connector (1RT2P1) from the transmission oil temperature bulb (1RT2).
5. Connect the test fixture to the electrical connector (1RT2P1), as shown in Figure 95-29.

NOTE

The ability to get the accuracy of the resistance, as shown in Table 95-21, is determined by the type of variable resistor and digital voltmeter used in the functional check setup.

6. On the overhead panel, close the XMSN INSTR OIL TEMP (1CB18) circuit breaker.
7. Adjust the variable resistance to a value, as shown in Table 95-21.
8. On the transmission oil temp indicator, make sure the LCD display shows the matching temperature, as shown in Table 95-21, for the resistance value set.
9. Repeat step 7 through step 8 for other values in Table 95-21.
10. Set the battery switch to OFF, or remove the external DC power from the helicopter.
11. Remove the test fixture.
12. Connect the electrical connector (1RT2P1) to the transmission oil temperature bulb (1RT2).
13. Return the helicopter to the standard configuration. Refer to Standard Practices — After Electrical Maintenance or Repairs (Chapter 96).

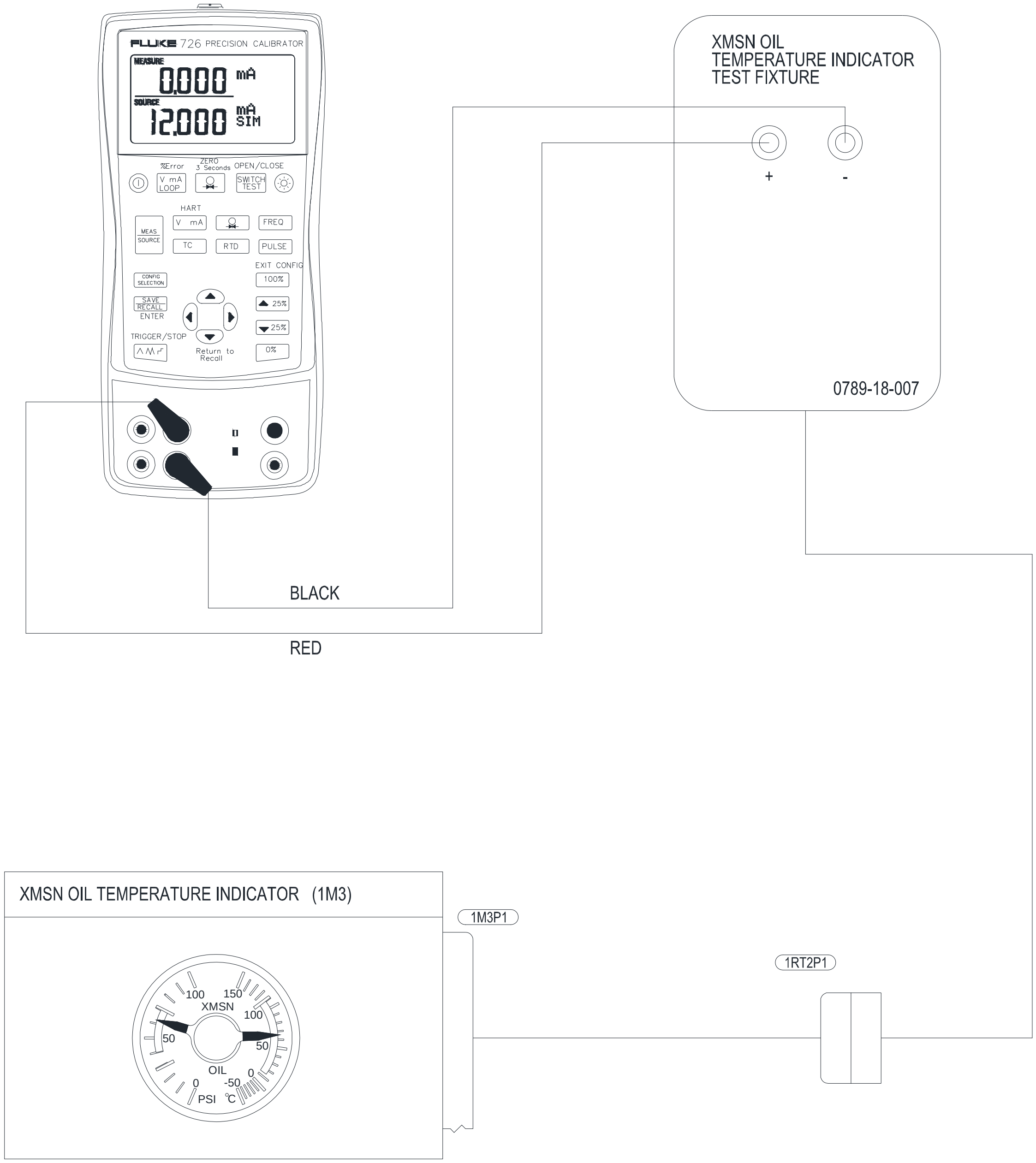


Figure 95-29: Functional Check Setup for Transmission Oil Temperature Indicator

95.5.8.7 Transmission Oil Temperature Probe — Functional Check

SPECIAL TOOLS REQUIRED

NUMBER	NOMENCLATURE
TK-3541 or Equivalent	Dri-Block Calibrator

1. Remove the oil temperature bulb (paragraph 95.5.8.9).
2. Place the temperature bulb in a Dri-Block calibrator or equivalent.
3. Attach the digital voltmeter to the temperature bulb.
4. Set the voltmeter to show the resistance value in a range, as shown in Table 95-21.
5. Adjust the temperature of the Dri-Block calibrator to a value, as shown in Table 95-21.
6. Make sure the voltmeter display shows the matching resistance for the temperature value set.
7. Repeat step 5 and step 6 for the other values in Table 95-21.
8. Remove the oil temperature bulb from the Dri-Block calibrator or equivalent.
9. Install the oil temperature bulb per paragraph 95.5.8.10).

95.5.8.8 Transmission Oil Pressure Indication — Functional Check

SPECIAL TOOLS REQUIRED

NUMBER	NOMENCLATURE
2311F or Equivalent	Barfield Pressure Tester, 0 to 300 PSI

CAUTION

USE AN EXTERNAL POWER UNIT DURING GROUND MAINTENANCE CHECKS TO AVOID BATTERY DEPLETION. IF BATTERY POWER IS USED, KEEP ELECTRICAL LOADS AND TEST TIME TO A MINIMUM.

1. Set the battery switch to OFF, or remove the external DC power from the helicopter.
2. On the overhead panel, open the XMSN INSTR OIL PRESS (1CB15) circuit breaker.
3. Locate the oil pressure line from the transmission oil manifold to the freewheel.
4. Remove the oil pressure line from the firewall.
5. Install a cap on the line that is capable of withstanding at least 100 PSI.
6. Locate the oil pressure line from the transmission to the transmission oil manifold. Disconnect the line from the transmission.

CAUTION

MAKE SURE THAT THE OIL IN THE PRESSURE TESTER IS THE SAME OIL AS THE TRANSMISSION OIL. FAILURE TO FOLLOW THIS PRECAUTION MAY RESULT IN THE CONTAMINATION OF THE TRANSMISSION OIL SYSTEM.

7. Connect the pressure tester at the transmission end of the transmission oil pressure line.

8. Set the battery switch to BATT, or connect the external DC power to the helicopter.
9. On the overhead panel, close the XMSN OIL PRESS INSTR (1CB15) circuit breaker.

CAUTION

DO NOT INCREASE THE PRESSURE OF THE HAND PUMP TO MORE THAN 125.0 PSI. IF YOU HAVE PRESSURE ABOVE THE 125.0 PSI LIMIT, YOU CAN CAUSE DAMAGE TO THE TRANSMISSION OIL PRESSURE TRANSDUCER.

10. Slowly increase the pressure of the pressure tester to 90.0 PSI.
11. On the XMSN OIL indicator, make sure the LCD display shows 90.0 ±2.4 PSI.
12. Decrease the pressure of the pressure tester to 0 PSI.
13. Repeat step 10 and step 11 for each value shown in Table 95-20. Make sure the indication is accurate.
14. Set the battery switch to OFF, or remove the external DC power from the helicopter.
15. Remove the cap on the pressure line to the freewheel.
16. Connect the line to the fitting on the firewall. Tighten the line to the fitting.
17. Disconnect the pressure tester from the oil pressure line.
18. Remove the external power from the helicopter.
19. Disconnect the pressure tester from the oil pressure line to the manifold.

NOTE

Keep the transmission oil pressure line elevated while you attach it to the transmission to minimize the oil loss from the line.

20. Connect the transmission oil pressure line to the transmission. Tighten the oil pressure line at the transmission.
21. Return the helicopter to the standard configuration. Refer to Standard Practices — After Electrical Maintenance or Repairs (Chapter 96).

95.5.8.9 Transmission Oil Temperature Bulb — Removal

MATERIALS REQUIRED
Refer to BHT-ALL-SPM for specifications.

NUMBER	NOMENCLATURE
C-248	Caps and/or Plugs

CAUTION

OBEY ALL THE SAFETY PRECAUTIONS WHEN DOING MAINTENANCE ON OR NEAR ELECTRICAL/ELECTRONIC EQUIPMENT (CHAPTER 96).

NOTE

Remove components only to the extent necessary to perform the required maintenance.

1. Disconnect the battery and external DC power from the helicopter.
2. Gain access to the left side of the transmission compartment. Find the transmission oil temperature bulb (1RT2) that is installed on the transmission oil filter (4).
3. Disconnect the electrical connector (1RT2P1) (3, Figure 95-30) from the transmission oil temperature bulb (1RT2) (2).
4. Remove the lockwire from the transmission oil temperature bulb (1RT2) (2).
5. Remove the transmission oil temperature bulb (1RT2) (2) and the packing (1). Discard the packing.

CAUTION

INSTALL CAPS AND/OR PLUGS (C-428) ON THE OPEN PORT OF THE TRANSMISSION OIL FILTER TO PREVENT FOREIGN OBJECT DAMAGE TO THE TRANSMISSION.

6. Install caps and/or plugs (C-428) on the open port of the transmission oil filter.

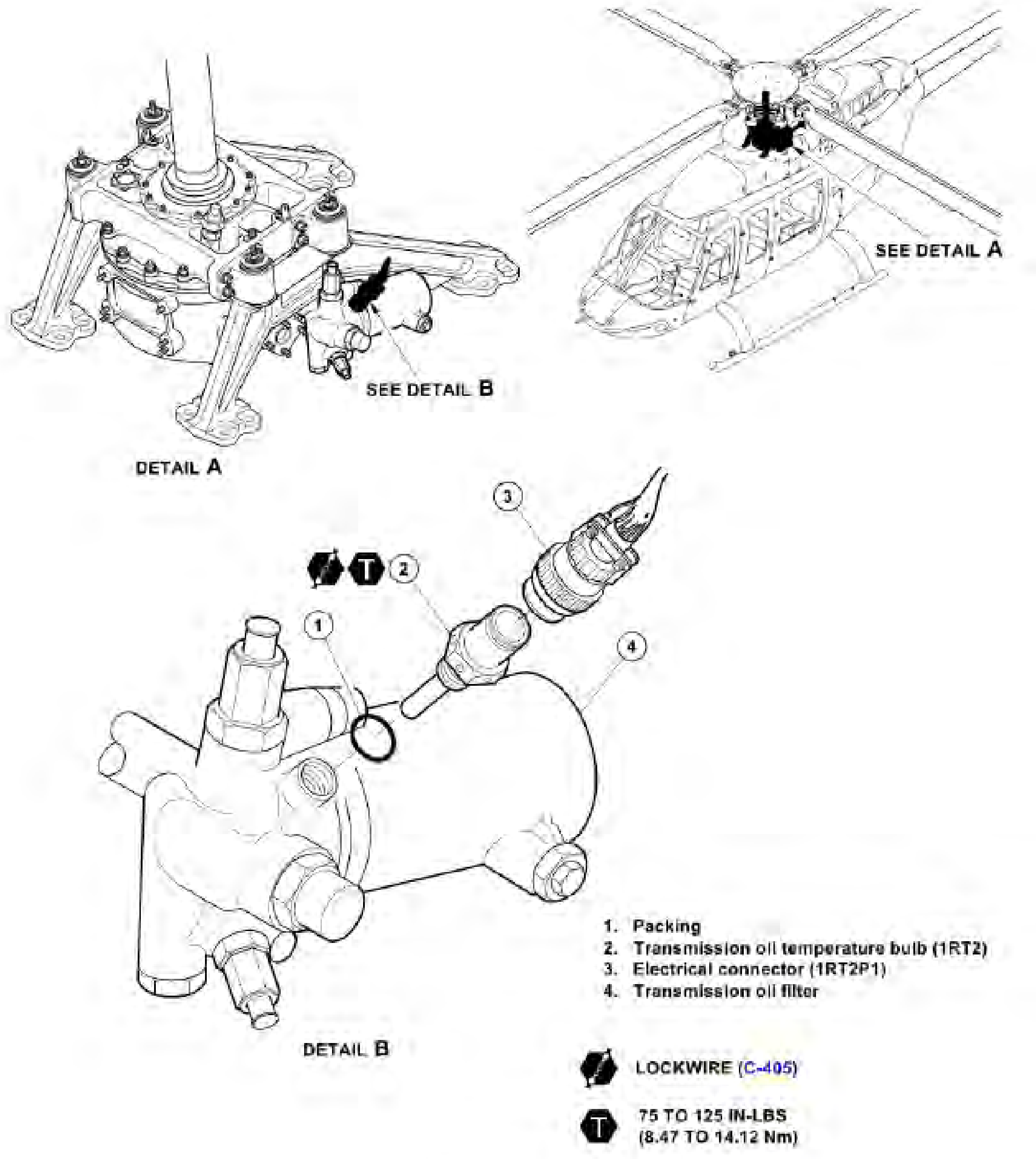


Figure 95-30: Transmission Oil Temperature Bulb - Removal and Installation

95.5.8.10 Transmission Oil Temperature Bulb — Installation

MATERIALS REQUIRED
Refer to BHT-ALL-SPM for specifications.

NUMBER	NOMEMCLATURE
C-405	Lockwire

WARNING

OBEY ALL THE SAFETY PRECAUTIONS WHEN DOING MAINTENANCE ON OR NEAR ELECTRICAL/ELECTRONIC EQUIPMENT (CHAPTER 96).

1. Disconnect the battery and external DC power from the helicopter.

CAUTION

USE THE SAME OIL AS THE OIL IN THE TRANSMISSION TO LUBRICATE THE PREFORMED PACKING. FAILURE TO OBEY THIS PRECAUTION WILL RESULT IN THE CONTAMINATION OF THE ENGINE OIL SYSTEM.

2. Lubricate the packing (1, Figure 95-30) with transmission oil.
3. Remove the previously installed caps and/or plugs.
4. Install the packing (1) on the transmission oil temperature bulb (1RT2) (2).
5. (1RT2) Install the transmission oil temperature bulb (2) in the port on the left side of the transmission. Tighten the transmission oil temperature bulb.
6. Safety the transmission oil temperature bulb (1RT2) (2) with lockwire (C-405).
7. Connect the electrical connector (1RT2P1) (3) to the transmission oil temperature bulb (1RT2) (2).

CAUTION

A QUALIFIED PERSON MUST BE AT THE HELICOPTER CONTROLS DURING THE FOLLOWING PROCEDURE.

8. Start the helicopter (BHT-407-FM-1, Section 2) and make sure the transmission oil temperature indication is operational and within limits and that there are no oil leaks.
9. Return the helicopter to the standard configuration. Refer to Standard Practices — After Electrical Maintenance or Repairs (Chapter 96).

95.5.8.11 Transmission Oil Pressure Transducer — Removal

MATERIALS REQUIRED
Refer to BHT-ALL-SPM for specifications.

NUMBER	NOMEMCLATURE
C-156	Caps and/or Plugs
C-428	Caps and/or Plugs

WARNING

OBEY ALL THE SAFETY PRECAUTIONS WHEN DOING MAINTENANCE ON OR NEAR ELECTRICAL/ELECTRONIC EQUIPMENT (CHAPTER 96).

NOTE

Remove components only to the extent necessary to perform the required maintenance.

1. Disconnect the battery or the external DC power from the helicopter.
2. Remove the engine air inlet cowling (Chapter 53) to access the transmission oil manifold (4, (C-156) Figure 95-31).

CAUTION

HANDLE THE CONNECTORS OF THE TRANSMISSION OIL PRESSURE TRANSDUCER IN ACCORDANCE WITH STANDARD PRACTICES FOR SENSITIVE ELECTROSTATIC EQUIPMENT. THE TRANSMISSION OIL PRESSURE/TEMPERATURE INDICATOR (1M3) IS SENSITIVE TO ELECTROSTATIC. FAILURE TO OBEY THESE STANDARD PRACTICES MAY RESULT IN DAMAGE TO THE XMSN OIL PRESSURE/TEMPERATURE INDICATOR (1M3).

CAUTION

DO NOT TOUCH THE ELECTRICAL PINS ON THE ELECTRICAL CONNECTOR. INSTALL AN ANTISTATIC CONNECTOR COVER ON THE ELECTRICAL CONNECTOR. FAILURE TO OBEY THESE PRECAUTIONS MAY RESULT IN DAMAGE TO THE XMSN OIL PRESSURE/ TEMPERATURE INDICATOR (1M3).

3. Disconnect the electrical connector (1G6P1) (3) from the transmission oil pressure transducer (1G6) (2).
4. Remove the transmission oil pressure transducer (1G6) (2) from the transmission oil manifold (4).

CAUTION

INSTALL CAPS AND/OR PLUGS (C-156) ON THE ELECTRICAL CONNECTOR OF THE TRANSMISSION OIL PRESSURE TRANSDUCER (1G6).

5. Install caps and/or plugs on the electrical connector (1G6P1) (3) and on the transmission oil pressure transducer (1G6) (2).

CAUTION

INSTALL CAPS AND/OR PLUGS (C-428) ON THE OPEN PORT OF THE TRANSMISSION OIL MANIFOLD TO PREVENT FOREIGN OBJECT DAMAGE TO THE TRANSMISSION.

6. Install caps and/or plugs (C-428) in the open port of the transmission oil manifold (4) and on the oil pressure inlet of the transmission oil pressure transducer (1G6) (2).
7. Remove the packing (1) from the transmission oil pressure transducer (1G6) (2). Discard the packing.

95.5.8.12 Transmission Oil Pressure Transducer — Installation

WARNING

OBEY ALL THE SAFETY PRECAUTIONS WHEN DOING MAINTENANCE ON OR NEAR ELECTRICAL/ELECTRONIC EQUIPMENT (CHAPTER 96).

1. Disconnect the battery and external DC power from the helicopter.

CAUTION

USE THE SAME OIL AS THE OIL IN THE TRANSMISSION TO LUBRICATE THE PREFORMED PACKING. FAILURE TO OBEY THIS PRECAUTION WILL RESULT IN THE CONTAMINATION OF THE TRANSMISSION OIL SYSTEM.

2. Lubricate the packing (1, Figure 95-31) with the oil used in the transmission oil system.
3. Remove the previously installed caps and/or plugs.
4. Install the packing (1) on the transmission oil pressure transducer (1G6) (2).
5. Install the transmission oil pressure transducer (1G6) (2) on the transmission oil manifold (4). Torque the transmission oil pressure transducer
6. Connect the electrical connector (1G6P1) (3) to the transmission oil pressure transducer (1G6) (2). Make sure that the electrical connector is tight and secure.
7. Bleed the transmission oil pressure transducer line (paragraph 95.5.8.13).
8. Install the engine air inlet cowling (Chapter 53).

CAUTION

A QUALIFIED PERSON MUST BE AT THE HELICOPTER CONTROLS DURING THE FOLLOWING PROCEDURE.

9. Start the helicopter (BHT-407-FM-1, Section 2) and make sure the transmission oil pressure indication is operational and within limits and that there are no oil leaks.
10. Return the helicopter to the standard configuration. Refer to Standard Practices — After Electrical Maintenance or Repairs (Chapter 96).

95.5.8.13 Transmission Oil Pressure Transducer Line — Bleeding

SPECIAL TOOLS REQUIRED

NUMBER	NOMENCLATURE
2311F or Equivalent	Barfield Pressure Tester, 0 to 300 PSI

1. Locate the oil pressure line that travels from the transmission to the transmission oil manifold (4, Figure 95-31). Disconnect the oil pressure line at the transmission.

CAUTION

MAKE SURE THAT THE OIL IN THE PRESSURE TESTER IS THE SAME OIL AS THE TRANSMISSION OIL. FAILURE TO FOLLOW THIS PRECAUTION MAY RESULT IN THE CONTAMINATION OF THE TRANSMISSION OIL SYSTEM.

2. Attach the oil pressure tester to the line that travels from the transmission to the transmission manifold (4).
3. Loosen the cap (5) on the top of the transmission oil manifold (4).
4. Apply pressure slowly so the line will fill with oil. Continue to force oil into the line until a steady flow without air bubbles comes out at the cap (5).
5. When steady flow comes out at the cap (5), tighten the cap.
6. Release the pressure in the pressure tester. Disconnect the pressure tester from the oil pressure line.

NOTE

Keep the transmission oil pressure line elevated while you attach it to the transmission. This minimizes the oil loss from the line.

7. Connect the transmission oil pressure line to the transmission. Tighten the oil pressure line.

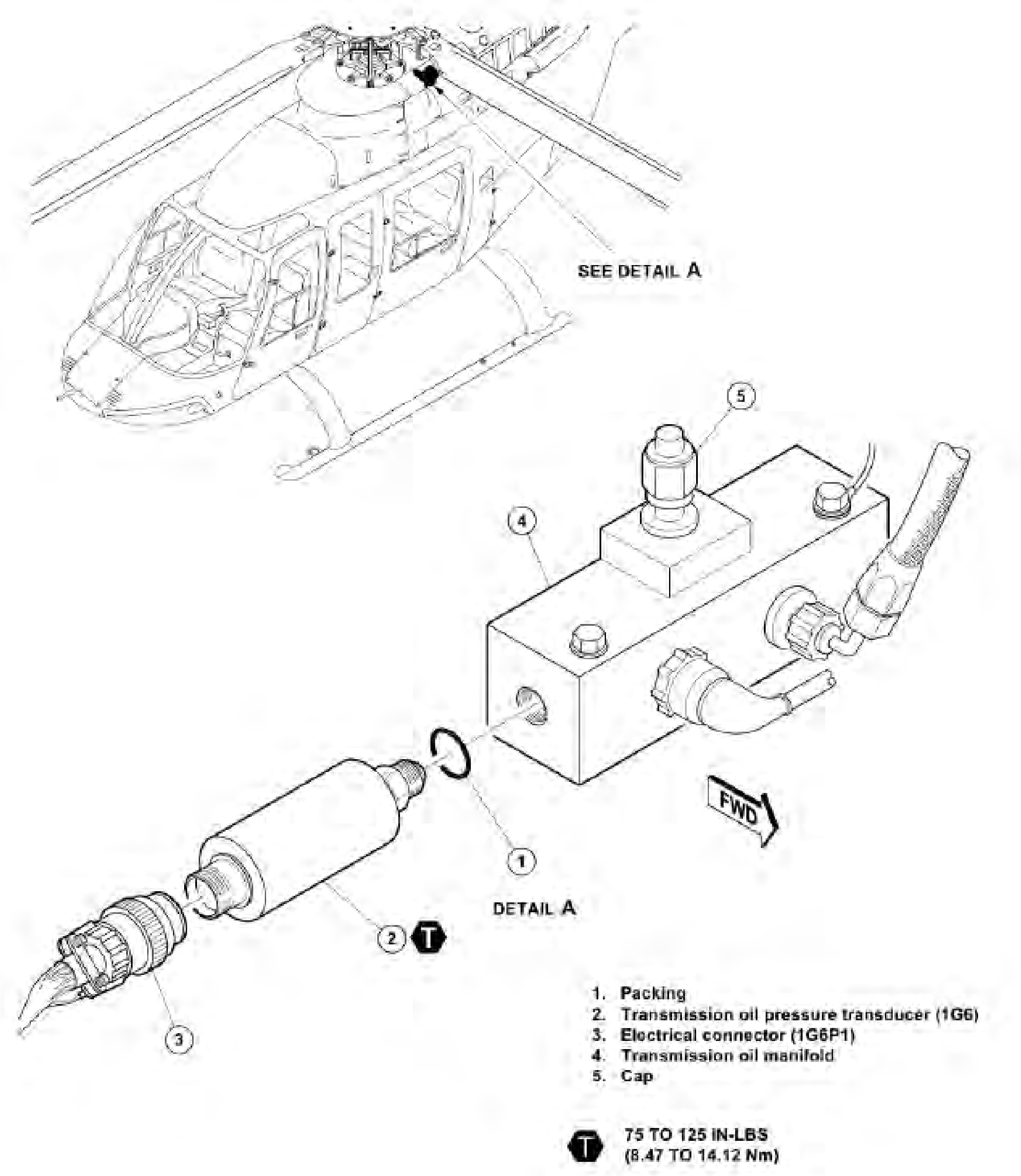


Figure 95-31: Transmission Oil Pressure Transducer - Removal and Installation

95.6 FUEL SYSTEM INSTRUMENTS

95.6.1 FUEL PRESSURE INSTRUMENT SYSTEM

95.6.2 FUEL PRESSURE INDICATION SYSTEM — DESCRIPTION

The fuel pressure indication (Figure 95-32) is part of the fuel pressure/ammeter dual indicator. The indication for the fuel pressure is on the left side of the dual indicator. The fuel pressure indicator gives an indication of the fuel pressure at the fuel shutoff valve. The indicator has a dial and electronic components inside a sealed case.

The dial has a needle/pointer display. The pointer display moves from bottom up starting at 0 PSI.

The 28 VDC is supplied through the FUEL INSTR PRESS (1CB19) and INSTR AMPS (1CB23) on the overhead panel circuit breaker. Internal lighting uses dimmable LED backlights. The maximum backlight voltage is 5 VDC. The backlight controller is programmed to simulate incandescent backlight.

When an over or under pressure condition (exceeds red line) exist, the indicator provides switch ground to activate CHECK INSTR annunciator.

For the simplified schematic of the fuel pressure indication system, refer to Figure 95-33.

95.6.2.1 Fuel Pressure Indication System — Range Markings

The range marking on the PSI scale is shown in Table 95-22.

Table 95-22: Fuel Pressure PSI Scale — Range Marking

MARKING	RANGE (PSI)	DEFINITION
Red Line	8	Minimum
Green Arc	8 to 25	Continuous Operation
Red Line	25	Maximum

95.6.2.2 Fuel Pressure/Ammeter Indicator — Removal and Installation

For the removal and installation of the fuel pressure/ammeter indicator (2M1), refer to paragraph 95.5.2.2 and paragraph 95.5.2.3.

95.6.2.2.1 Fuel Pressure Transducer — Description

The fuel pressure transducer (1B6) is mounted along with the fuel shutoff valve in a compartment on the right side of the aft electrical equipment shelf. The transducer is mounted on a fitting in the pressure line between the aft fuel boost pumps and the fuel shutoff valve. The transducer has a pressure diaphragm and a strain gauge bridge.

95.6.2.3 Fuel Pressure Indication System —Operation

Either one of the two aft fuel boost pumps gives fuel pressure output through a common fuel pressure line to the fuel shutoff valve. The fuel pressure transducer is mounted on the pressure line before the shutoff valve (Chapter 28).

95.6.2.3.1 Fuel Pressure Indication System —Functional Check

SPECIAL TOOLS REQUIRED	
NUMBER	**NOMENCLATURE**
Commercial	Air Pressure Transducer

1. Connect 28 VDC external power to the helicopter.
2. On the overhead panel, open the FUEL INSTR PRESS (1CB19) circuit breaker.

CAUTION

INSTALL A PLUG ON THE OPEN PORT OF THE ADAPTER TO PREVENT UNWANTED MATERIAL CONTAMINATION OF THE FUEL SYSTEM.

3. Remove the transducer (1B6) from the fuel adapter. Put a cap on the opening of the adapter
4. Connect the air pressure regulator to the pressure port of the fuel pressure transducer.
5. On the overhead panel, close the FUEL INSTR PRESS (1CB19) circuit breaker.

CAUTION

DO NOT INCREASE THE PRESSURE OF THE PRESSURE REGULATOR TO MORE THAN 60.0 PSI. YOU MAY CAUSE DAMAGE TO THE FUEL PRESSURE TRANSDUCER.

6. Slowly increase the pressure of the air pressure regulator to 30.0 PSI.
7. On the FUEL PRESS indicator (2M1), make sure the single bar display reads 30.0 PSI.
8. Decrease the pressure of the air pressure regulator to 0 PSI.
9. Repeat step 7 and step 8 for each value shown in
10.
11. Table ***95-23*** and make sure the indication is accurate.
12. On the overhead panel, open the FUEL INSTR PRESS (1CB19) circuit breaker.
13. Disconnect the air pressure regulator from the fuel pressure transducer (1B6).
14. Install the fuel pressure transducer (1B6) on the fuel adapter (paragraph 95.6.2.3.3).
15. Remove external power from the helicopter.
16. Return the helicopter to the standard configuration. Refer to Standard Practices — After Electrical Maintenance or Repairs (Chapter 96).

95.6.2.3.2 Fuel Pressure Transducer — Removal

MATERIALS REQUIRED
Refer to BHT-ALL-SPM for specifications.

NUMBER	NOMEMCLATURE
C-156	Caps and/or Plugs
C-428	Caps and/or Plugs

WARNING

OBEY ALL SAFETY PRECAUTIONS WHEN DOING MAINTENANCE ON OR NEAR ELECTRICAL/ELECTRONIC EQUIPMENT (CHAPTER 96).

NOTE

Remove components only to the extent necessary to perform the required maintenance.

1. Disconnect the battery or the external DC power from the helicopter.
2. Remove the interior and gain access to the panel to get to the fuel pressure transducer (1B6) installed on the right side of the fuselage.
3. Disconnect the electrical connector (1B6P1) from the fuel pressure transducer (1B6) (2).

CAUTION

INSTALL A PLUG ON THE OPEN PORT OF THE ADAPTER TO PREVENT FOREIGN OBJECT DAMAGE TO THE FUEL SYSTEM.

4. Remove the fuel pressure transducer (1B6) (2) from the adapter.
5. Remove the packing (3) from the fuel pressure transducer (1B6) (2).

95.6.2.3.3 Fuel Pressure Transducer — Installation

MATERIALS REQUIRED

Refer to BHT-ALL-SPM for specifications.

NUMBER	NOMEMCLATURE
C-024	Assembly Fluid

WARNING

OBEY ALL SAFETY PRECAUTIONS WHEN DOING MAINTENANCE ON OR NEAR ELECTRICAL/ELECTRONIC EQUIPMENT (CHAPTER 96).

1. Disconnect the battery or remove the external DC power from the helicopter.
2. Lubricate the packing (3, Figure 95-34) with assembly fluid (C-024).
3. Install the packing (3) on the fuel pressure transducer (1B6) (2).
4. Install the fuel pressure transducer (1B6) (2) on the adapter. Tighten the fuel pressure transducer.
5. Connect the electrical connector (1B6P1) (1) to the fuel pressure transducer (1B6) (2).

NOTE

Make sure there is a minimum of 70 pounds or more fuel in the main fuel cell.

6. Set the battery switch to BATT, or connect the external DC power to the helicopter.
7. Set the fuel valve switch to ON.
8. Set the BOOST/XFR switches to LEFT and RIGHT. Make sure that the fuel pressure indication is acceptable and within limits (BHT-407-FM-1, Section 1).
9. Make sure there are no leaks at the fuel pressure transducer (1B6) (2).
10. Set the left and right BOOST/XFR switches to OFF.
11. Set the fuel valve switch to OFF.
12. Set the battery switch to OFF, or remove the external DC power from the helicopter.
13. Install the access cover and the interior.
14. Return the helicopter to the standard configuration. Refer to Standard Practices — After Electrical Maintenance or Repairs (Chapter 96).

Table 95-23: Test Points for Fuel Pressure Indication System

FUEL PRESSURE (PSI)	INPUT SIGNAL FROM TRANSDUCER TO INDICATOR	INDICATOR TOLERANCE (PSI)
0	0.00	±0.6
3	0.50	±0.6
6	1.00	±0.6
9	1.50	±0.6
12	2.00	±0.6
15	2.50	±0.6
18	3.00	±0.6
21	3.50	±0.6
24	4.00	±0.6
27	4.50	±0.6
30	5.00	±0.6

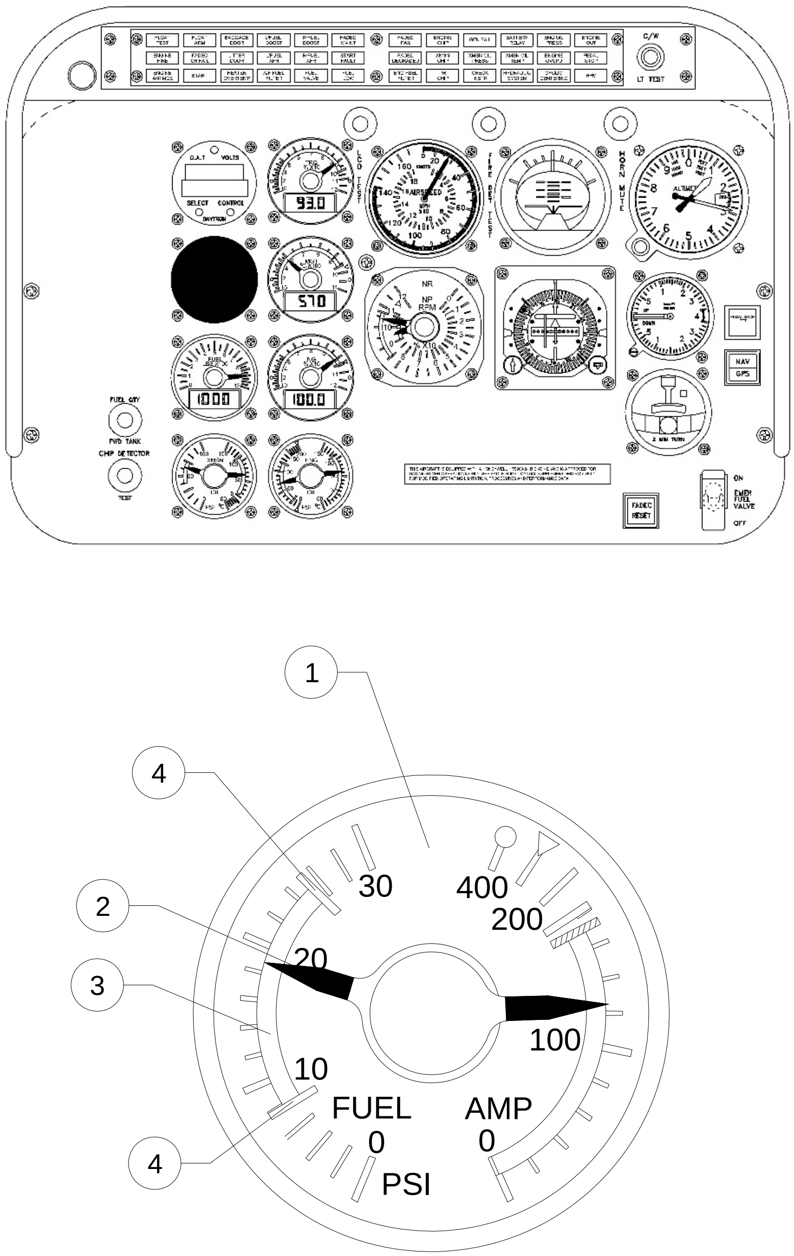
95.6.3 FUEL QUANTITY GAUGING SYSTEM — DESCRIPTION

The Fuel Quantity Gauging System (FQGS) measures the quantity of fuel in the two main fuel tanks. The FQGS also measures the quantity of fuel in the auxiliary fuel tank when it is installed.

The fuel quantity is measured by three capacitance type probes in the fuel tanks. The signals from the probes are used by the fuel signal conditioner to calculate the fuel quantity. The signal conditioner provides a signal to the fuel quantity gauge to display the fuel quantity to the pilot. There is no additional probe installed in the auxiliary fuel tank. On installation of the auxiliary fuel tank in the helicopter, a microswitch is engaged, which tells the signal conditioner to use a different set of values to calculate the fuel quantity.

The components of the FQGS are as follows:

- Three capacitance type probes
- The signal conditioner unit
- The fuel quantity indicator



1. Fuel pressure and ammeter indicator dial
2. Pressure pointer display
3. Green arc
4. Red line

Figure 95-32: Fuel Pressure Indicator - Description

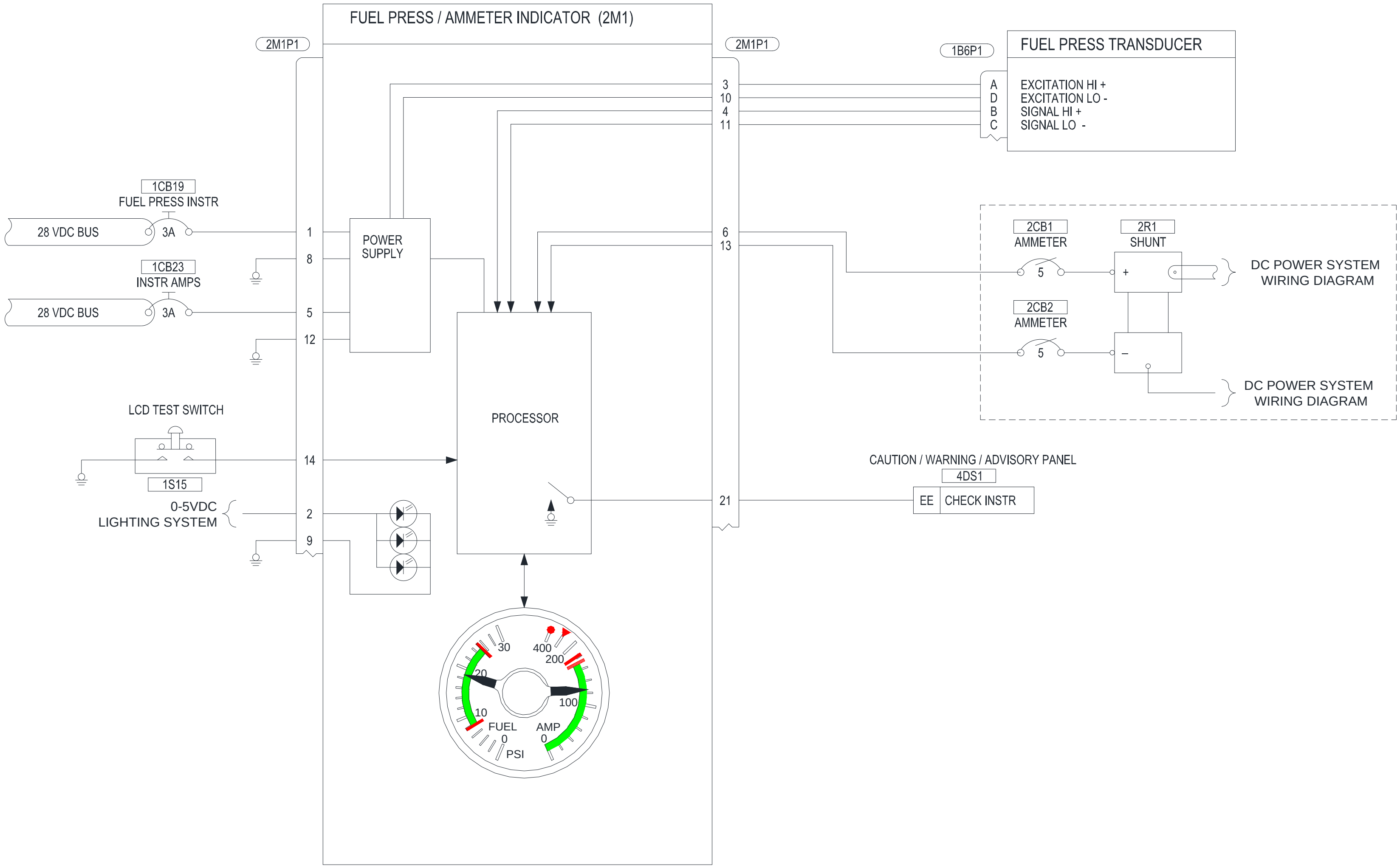


Figure 95-33: Fuel Pressure Indication System - Simplified Schematic

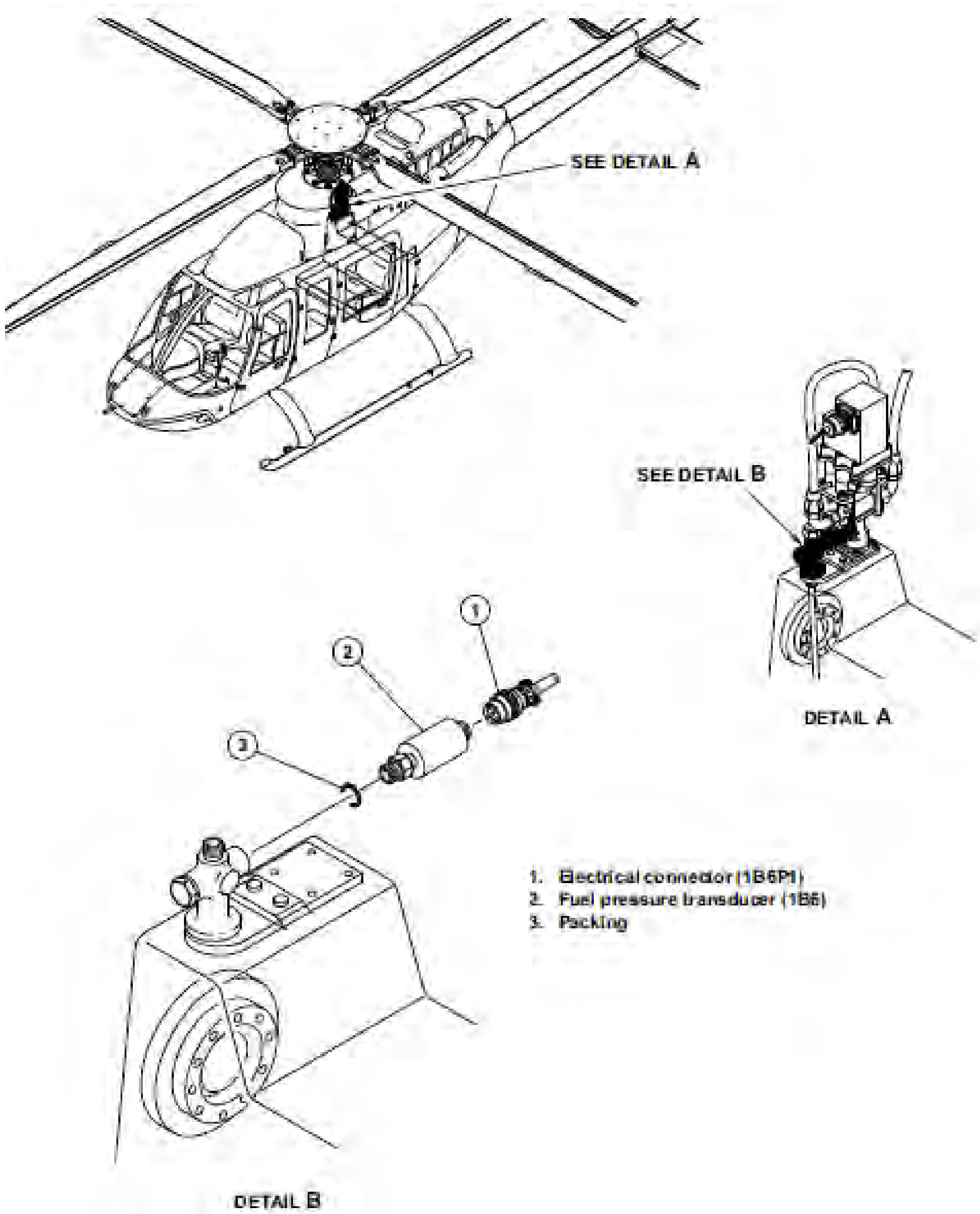


Figure 95-34: Fuel Pressure Transducer –Removal and Installation

95.6.4 FUEL QUANTITY INDICATING SYSTEM — COMPONENT REPLACEMENT

CAUTION

DO A FUEL QUANTITY INDICATING SYSTEM CALIBRATION PROCEDURE ANYTIME AN EXISTING REPAIRED, OR NEW COMPONENT OF THE FUEL QUANTITY INDICATING SYSTEM IS INSTALLED OR IF ASSOCIATED WIRING OR ELECTRICAL CONNECTORS ARE REPAIRED OR REPLACED. IF THIS PROCEDURE IS NOT COMPLETED, THE FUEL QUANTITY INDICATOR MAY NOT BE ACCURATE.

For the removal and installation procedures of fuel quantity indicating system components not provided in this chapter, refer to Chapter 28.

95.6.5 FUEL QUANTITY INDICATOR — DESCRIPTION

The fuel quantity (FUEL QTY) indicator (Figure 95-35) gives an indication of the quantity of fuel in pounds (LBS). The FUEL QTY indicator is made up of a dial and electronic components in an environmentally sealed case.

The dial has a LBS X 100 scale to show the total quantity of fuel. The dial has a single needle/pointer display and a digital display. The pointer display moves on a clockwise direction from 0 to 1200 pounds. The digital display shows the FUEL QTY in pounds in a four digit format.

The indicator receives its input signal from the fuel signal conditioner. The fuel quantity scale indication in relation to the input signal from the signal conditioner is shown in Table 95-24.

The 28 VDC bus supplies the power input to the electronic components of the indicator. The 28 VDC is supplied through the FUEL INSTR QTY (1CB8) circuit breaker on the overhead panel.

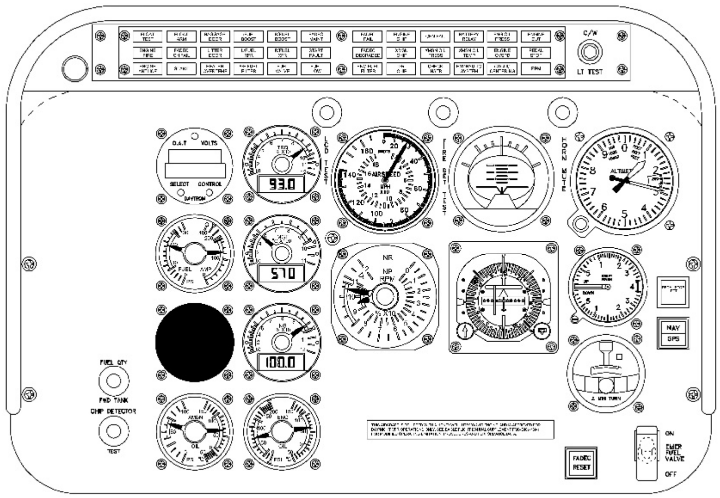
Internal lighting uses dimmable LED backlights. The maximum backlight voltage is 5 VDC. The backlight controller is programmed to simulate incandescent backlight.

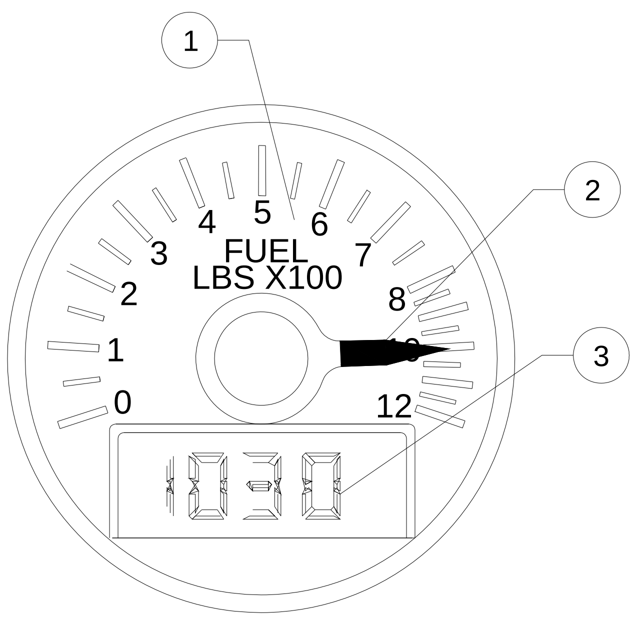
The indicator monitors the fault detected signal from the signal conditioner. If the fault detected signal is grounded, the pointer indicates 0, the display indicates “F 0”, and the check instrument annunciator is activated.

For the simplified schematic of the fuel quantity indication system, refer to Figure 95-36.

95.6.5.1 Fuel Quantity Indicator — Removal and Installation

For the removal and installation of the fuel quantity indicator (1M1), refer to paragraph 95.5.2.2 and paragraph 95.5.2.3.





1. Fuel quantity indicator dial
2. Pointer display
3. Digital display

Figure 95-35: Fuel Quantity Indicator - Description

Table 95-24: Quantity Indication Versus Input Signal From the Signal Conditioner

FUEL QUANTITY (LBS)	INPUT SIGNAL FROM SIGNAL CONDITIONER TO INDICATOR (VDC)	INDICATOR TOLERANCE (LBS)
0	0.50	±6
100	0.92	±6
200	1.33	±6
300	1.75	±6
400	2.17	±6
500	2.58	±6
600	3.00	±6
700	3.42	±6
800	3.83	±6
900	4.25	±6
1000	4.67	±6
1100	5.08	±6
1200	5.50	±6

95.6.5.2 Fuel Quantity Indicator — Fault Indication

Failure	Observation
Indicator Power Failure	Digits extinguish and pointer returns to about five angular degrees below 0
Fuel Quantity Signal	Pointer and digits return to 0 lbs
Activation of fault-detected output	Pointer and digits return to 0 lbs Check instrument annunciator activates

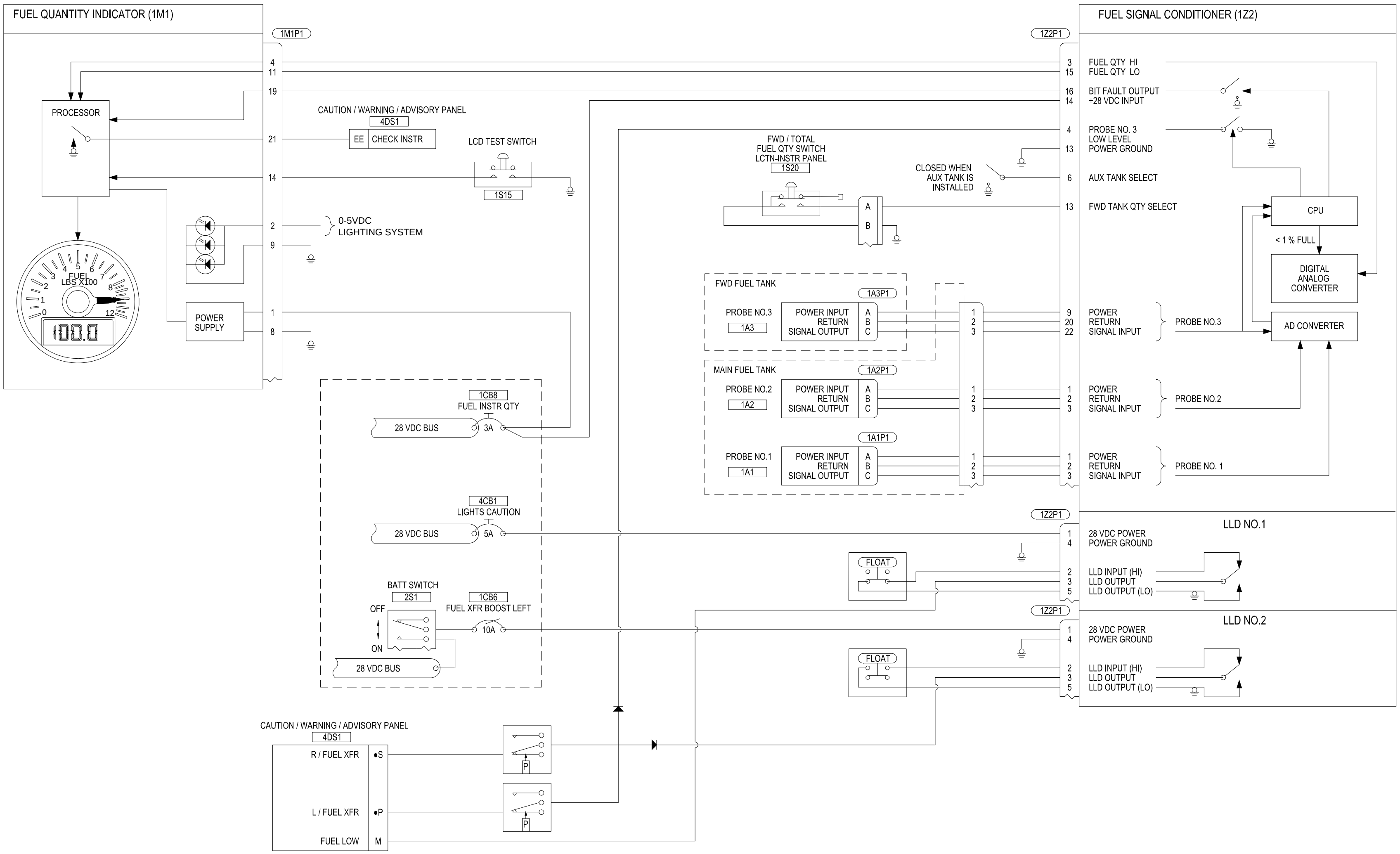


Figure 95-36: Fuel Quantity Indication System - Simplified Schematic

95.6.6 FUEL PROBES — DESCRIPTION

The Fuel Quantity Gauging System (FQGS) has three capacitance-type fuel probes. The fuel probes are identified as follows:

- Main tank aft fuel probe (1A1), probe No. 1
- Main tank forward fuel probe (1A2), probe No. 2
- Forward tank fuel probe (1A3), probe No. 3

The probes are designed to give a signal between 0.5 to 5.0 mA to the signal conditioner. When the probe is dry, the signal is 0.5 mA. When the probe is fully immersed in fuel, the signal is 5.0 mA. The actual probe signal, when immersed in fuel, depends upon the fuel dielectric constant. The fuel signal conditioner makes calculations to adjust for the different dielectric constants.

95.6.7 FUEL SIGNAL CONDITIONER — DESCRIPTION

The fuel signal conditioner is a separate unit that is located on the aft electrical equipment shelf adjacent to the DC controller. The electronic interface circuits for the fuel low level detection system and the fuel gauging system signal conditioner circuits are located in the same unit. Both systems are physically and electrically separate within the unit. In addition, the two low level detection circuits are physically and electrically separate from each other. The fuel probe in the forward tank (probe No. 3) (1A3) also acts as a low level switch.

The signal conditioner is connected to the helicopter electrical harness through three electrical connectors. There are three Light Emitting Diodes (LED) located on the aft side of the unit. They show the FQGS status for troubleshooting purposes.

The descriptions of the fault codes are shown in Table 95-25.

The faults are listed in Table 95-25 in order of decreasing priority. As the table indicates, all internal faults in the fuel signal conditioner have priority over any other fault display status.

If there are multiple faults, the LED will only display the highest priority fault.

Table 95-25: Fuel Signal Conditioner Fault Codes — Description

SYSTEM CONDITION DESCRIPTION	FAULT OUTPUT PROVIDED TO INDICATOR AT PIN 19	LED 0	LED 1	LED 2
No Fault	Open, No Ground	ON	ON	ON
Internal Fault	Ground	OFF	OFF	OFF
Probe No. 1	Ground	ON	OFF	OFF
Probe No. 2	Ground	OFF	ON	OFF
Probe No. 3	Ground	OFF	OFF	ON
Fuel Detect Fault	Open	ON	OFF	ON
NOTE: * A fuel detect fault indicates a fault in the circuitry that outputs the forward tank empty discrete signal (pin 4 on the fuel signal conditioner), which controls the right transfer pump relay.				

95.6.7.1 Fuel Signal Conditioner, Fuel Low Level Circuits — Operation

The fuel signal conditioner contains the Low Level Detector (LLD) electronic circuitry that operates with two fuel low level switches mounted in the fuel tanks (LLD No. 1 in the main fuel tank and LLD No. 2 in the forward fuel tank). The only functions of these circuits is to provide timing for the circuits and to remove any erratic switch activation and corresponding light flickering that may be caused as the switches move from one position to another. Software is not used in these circuits.

Power input to the low level circuits is from separate circuit breakers. The power for the LLD No. 1 circuit comes from the LIGHTS CAUT (4CB1) circuit breaker. When no power is supplied to the LLD No. 1 circuit, the low level circuit will be open between pin 3 and pin 5. When power is supplied to the LLD No. 1 circuit, the low level circuit will be set to open or closed within 2 seconds, to agree with the LLD No. 1 position at the time of power-up. The power for the LLD No. 2 circuit comes from the FUEL BOOST/XFR LEFT (1CB6) circuit breaker. When no power is supplied to the LLD No. 2 circuit, the low level circuit will be open between pin 3 and pin 5. When power is supplied to LLD No. 2 circuit, the low level circuit will be set to open or closed within 2 seconds, to agree with the LLD No. 2 position at the time of power-up.

For a description of the operation of the low level switches, refer to Chapter 96. For a complete description of the operation of the fuel low level switches and the fuel system, refer to Chapter 28.

95.6.7.2 Low Level Detection Power-up Built-in Test (BIT)

The low level circuit does not have a Built-in Test (BIT) feature to check the system for the integrity of the components of the system.

95.6.7.3 Low Level Detection Forward Fuel Probe (1A3) — Operation

When the signal conditioner calculates that the fuel level sensed by probe No. 3 is less than 1% of the total reading for this probe, a timing circuit is activated. After 155 ±2 seconds, the signal conditioner will break the ground through pin 4 on the signal conditioner, which will remove the electrical power from the XFR pump relay and disable the XFR pump. Similarly when the signal conditioner calculates that the fuel level sensed by probe No. 3 is greater than 1% of the total reading for this probe, the same timing circuit is activated. After 155 ±2 seconds, the signal conditioner will provide a ground connection through pin 4 on the signal conditioner that energizes the XFR pump relay and enables the pump.

Power to the signal conditioner is provided by the FUEL INSTR QTY (1CB8) circuit breaker. When no power is supplied to the signal conditioner, pin 4 will not be grounded. When power is supplied to the signal conditioner, pin 4 will be set open or closed to agree with the results of the calculation of probe No. 3 at the time of power-up. The setting of pin 4 may only be delayed by the completion of the power-up BIT.

Refer to Chapter 96 for a description of the use of the low level feature of probe No. 3. Refer to Chapter 28 for a complete description of the operation of the low level feature of probe No. 3 in the operation of the fuel system.

95.6.7.4 Fuel Signal Conditioner Quantity Circuits, Built-in Test (BIT) — Operation

The fuel signal conditioner does a power-up Built-in Test (BIT) when the unit is first given power by the FUEL INSTR QTY (1CB8) circuit breaker. The power-up BIT must be completed before the fuel signal conditioner can take any readings of fuel quantity. The fuel signal conditioner should complete a power-up BIT check within approximately 4 seconds after application of power. There is no connection between the BIT feature of the fuel quantity indicator and the fuel signal conditioner.

The power-up BIT examines the following:

- Microprocessor operation
- Validity of each probe signal received
- Power source for probe input
- Indicator output

If a failure is detected during the power-up BIT, the fuel signal conditioner will provide a ground to pin 19 of the fuel quantity indicator. The ground at pin 19 causes the indicator display to go blank. If an error is found in the probe signal received or in the power source for the probe input, the indicator output will be set to zero for that probe or probes. In addition, the failures detected will be displayed on three LEDs on the back of the fuel signal conditioner (Table 95-25).

The continuous BIT examines the following:

- Microprocessor operation
- Validity of each probe signal received
- Power source for probe input
- Indicator output

If a failure is detected during the continuous BIT, the fuel signal conditioner will provide a ground to pin 19 of the fuel quantity indicator. The ground at pin 19 causes the indicator display to go blank. If an error is found in the probe signal received or in the power source for the probe input, the indicator output will be set to zero for that probe or probes. In addition, the failures detected will be displayed on three LEDs on the back of the fuel signal conditioner.

95.6.7.5 Fuel Signal Conditioner Unit — Removal

MATERIALS REQUIRED
Refer to BHT-ALL-SPM for specifications.

NUMBER	NOMEMCLATURE
C-156	Caps and/or Plugs

WARNING

OBEY ALL THE SAFETY PRECAUTIONS WHEN DOING MAINTENANCE ON OR NEAR ELECTRICAL/ELECTRONIC EQUIPMENT (CHAPTER 96).

NOTE

Remove components only to the extent necessary to perform the required maintenance.

1. Disconnect the battery or the external DC power from the helicopter.
2. Get access to the aft electrical equipment shelf.

CAUTION

HANDLE THE CONNECTORS OF THE FUEL SIGNAL CONDITIONER IN ACCORDANCE WITH STANDARD PRACTICES FOR ELECTROSTATIC SENSITIVE EQUIPMENT. THE FUEL SIGNAL CONDITIONER AND THE FUEL QUANTITY INDICATOR ARE SENSITIVE TO ELECTROSTATIC. FAILURE TO OBEY THESE STANDARD PRACTICES MAY RESULT IN DAMAGE TO THESE COMPONENTS.

CAUTION

DO NOT TOUCH THE ELECTRICAL PINS ON THE ELECTRICAL CONNECTORS. INSTALL AN ANTISTATIC CONNECTOR COVER ON THE ELECTRICAL CONNECTOR. FAILURE TO OBEY THESE STANDARD PRACTICES MAY RESULT IN DAMAGE TO THESE ELECTROSTATIC SENSITIVE COMPONENTS.

3. Disconnect the electrical connectors (1Z2P1, 1Z2P2, 1Z2P3) (1, Figure 95-37) from the fuel quantity signal conditioner (1Z2) (4).
4. Remove the screws (2) and the washers (3).
5. Remove the fuel quantity signal conditioner (1Z2) (4).
6. Install caps and/or plugs (C-156) on the electrical connectors (1Z2P1, 1Z2P2, 1Z2P3) (1) and on the fuel quantity signal conditioner (1Z2) (4).

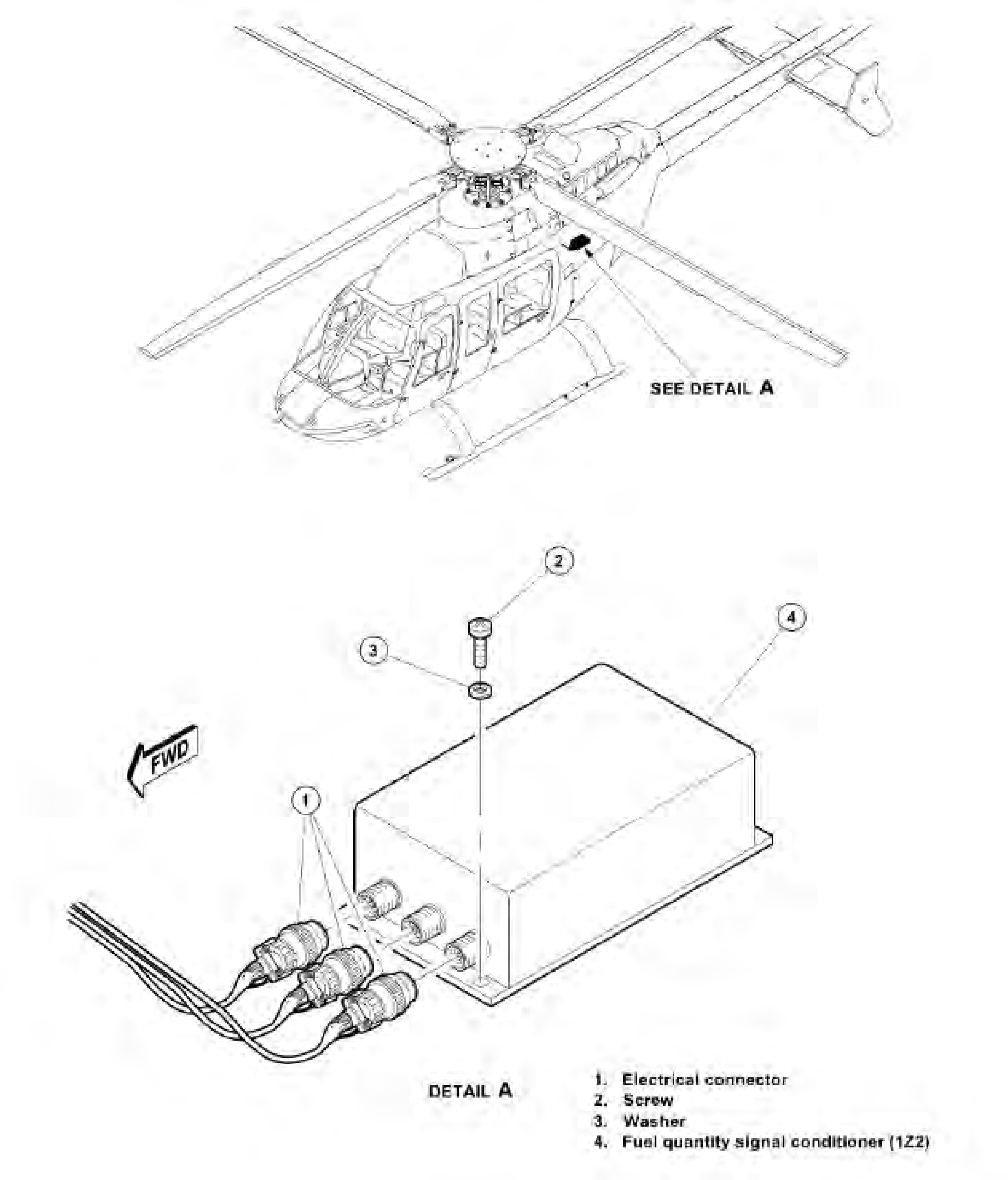


Figure 95-37: Fuel Signal Conditioner - Removal and Installation

95.6.7.6 Fuel Signal Conditioner — Installation

WARNING

OBEY ALL THE SAFETY PRECAUTIONS WHEN DOING MAINTENANCE ON OR NEAR ELECTRICAL/ELECTRONIC EQUIPMENT (CHAPTER 96).

1. Disconnect the battery or remove the external DC power from the helicopter.
2. Get access to the aft electrical equipment shelf.
3. Install the fuel quantity signal conditioner (1Z2) (4, Figure 95-37). Make sure that the electrical receptacles point forward of the helicopter.
4. Install the screws (2) and the washers (3).

CAUTION

HANDLE THE CONNECTORS OF THE FUEL SIGNAL CONDITIONER IN ACCORDANCE WITH STANDARD PRACTICES FOR ELECTROSTATIC SENSITIVE EQUIPMENT. THE FUEL SIGNAL CONDITIONER AND THE FUEL QUANTITY INDICATOR ARE SENSITIVE TO ELECTROSTATIC. FAILURE TO OBEY THESE STANDARD PRACTICES MAY RESULT IN DAMAGE TO THESE COMPONENTS.

CAUTION

DO NOT TOUCH THE ELECTRICAL PINS ON THE ELECTRICAL CONNECTORS. INSTALL AN ANTISTATIC CONNECTOR COVER ON THE ELECTRICAL CONNECTOR. FAILURE TO OBEY THESE STANDARD PRACTICES MAY RESULT IN DAMAGE TO THESE ELECTROSTATIC SENSITIVE COMPONENTS.

5. Connect the electrical connectors (1Z2P1, 1Z2P2, 1Z2P3) (1) to the fuel quantity signal conditioner (1Z2) (4).
6. Do a calibration check of the fuel quantity gauging system (paragraph 95.6.10.1).

95.6.8 FUEL QUANTITY GAUGING SYSTEM — OPERATION

95.6.8.1 Fuel Probes — Operation

The fuel probes in the Fuel Quantity Gauging System (FQGS) are capacitance-type probes. Capacitance probes vary the current returned to the signal conditioner as the capacitance of the probe varies. The capacitance of the probe increases as it is covered with fuel, since the dielectric constant of fuel is greater than that of air. Therefore, as the probe is covered with fuel, the current output will increase. The probes in this system are designed to provide 0.5 mA of current when dry and increase the current linearly to 5.0 mA when the probe is completely covered in fuel. All three probe input signals are continuously sampled by the signal conditioner.

95.6.8.2 Fuel Signal Conditioner — Operation

The Analog to Digital (A/D) converter changes the milliampere input current from the three probes to digital format. The microprocessor uses the digital data to compute the weight of the fuel as described in the steps that follow:

1. The microprocessor finds if the main tank forward fuel probe (1A2), probe No. 2, input signal is a valid signal or if a default value should be used for the reference signal. It chooses either probe No. 2 value or a default value. It uses the value of probe No. 2 to calculate the density of the fuel or use the default density value of 6.6594 pounds per gallon.
2. The microprocessor calculates the height of the fuel for each of the three probes. The calculation uses the value from the step above to correct for different densities of fuel.
3. The calculated height on each probe is used to look up a volume of fuel in gallons in a database contained in the Non-Volatile Memory (NVM) of the signal conditioner.
4. The weight of the fuel is then calculated by multiplying the volume by the density. A calculation is done for all three probes to calculate the total system weight of fuel. A calculation is also done for only the forward tank fuel probe (1A3), probe No. 3. The digital data on the weight of fuel data is changed to analog data by an A/D converter. The analog signal is transmitted from the signal conditioner to the fuel quantity indicator in the form of millivolts. The fuel quantity indicator shows the fuel quantity, in pounds, in agreement with the input signal shown in Table 95-24.

95.6.8.3 Fuel Density Compensation — Operation

The dielectric value of the fuel changes as a result of the type of fuel and the temperature of the fuel. The Fuel Quantity Gauging System (FQGS) calculates the change in dielectric value with the use of a reference input signal from the main tank forward fuel probe (1A2), probe No. 2. In most conditions, the main tank forward fuel probe (1A2) is completely immersed in fuel (when there is a significant amount of fuel in the tank). With the probe completely immersed in a standard density fuel, the reference input signal from the probe is known precisely.

The FQGS also receives a signal from the completely immersed main tank aft fuel probe (1A1). It compares this signal with the reference input signal from the main tank forward fuel probe (1A2) (dielectric value signal when the probe No. 2 is completely immersed in a standard density fuel). The microprocessor then calculates the actual density of the fuel currently being used. This density value is used to correct all probe data for density, when calculating the height of the fuel on the probe.

95.6.8.4 Forward Fuel Tank Quantity — Operation

When the FWD FUEL QTY button is pushed, a ground signal is provided to pin 17 of the fuel signal conditioner. When the microprocessor receives the ground signal, it is programmed to only output the weight of the forward tank fuel probe (1A3), probe No. 3, to the indicator.

95.6.8.5 Auxiliary Fuel Tank Quantity — Operation

When the auxiliary fuel tank is installed, a ground signal is provided to pin 5 on the signal conditioner. When the microprocessor receives the ground signal, it is programmed to use a different table to get the volume versus the calculated height on the main tank aft fuel probe (1A1), probe No. 1. The volume is used to calculate the weight as previously described. The microprocessor sends the signal to the indicator.

95.6.9 FUEL QUANTITY INDICATOR — OPERATIONAL CHECK

1. Connect 28 VDC external power to the helicopter.
2. Close the FUEL INSTR QTY (1CB8) breaker.

RESULT:
- Pointer shows the current fuel quantity.
- All digit segments are lit providing “8.8.8.8” pattern to verify that all display elements are functioning.
- The first three digits and then the last three digits of the software version are displayed for one second each.

CORRECTIVE ACTION:
- If the digital displays do not come on, refer to Trouble No. 1 (Figure 95-38).

3. Push the LCD TEST switch on the instrument panel.

RESULT:
- Pointer shows the current fuel quantity.
- All digit segments are lit providing “8.8.8.8” pattern to verify that all display elements are functioning.
- The first three digits and then the last three digits of the software version are displayed for one second each.

CORRECTIVE ACTION:
- If the digital displays do not perform display sequence, refer to Trouble No. 2 (Figure 95-39).

FUEL QUANTITY INDICATOR - TROUBLE NO. 1

CAUTION

DISCONNECT THE BATTERY AND THE EXTERNAL POWER PRIOR TO PERFORMING A CONTINUITY CHECK OR MAINTENANCE ON THE FUEL QUANTITY INDICATION SYSTEM.

NOTE
Refer to Chapter 98 for wiring diagram.

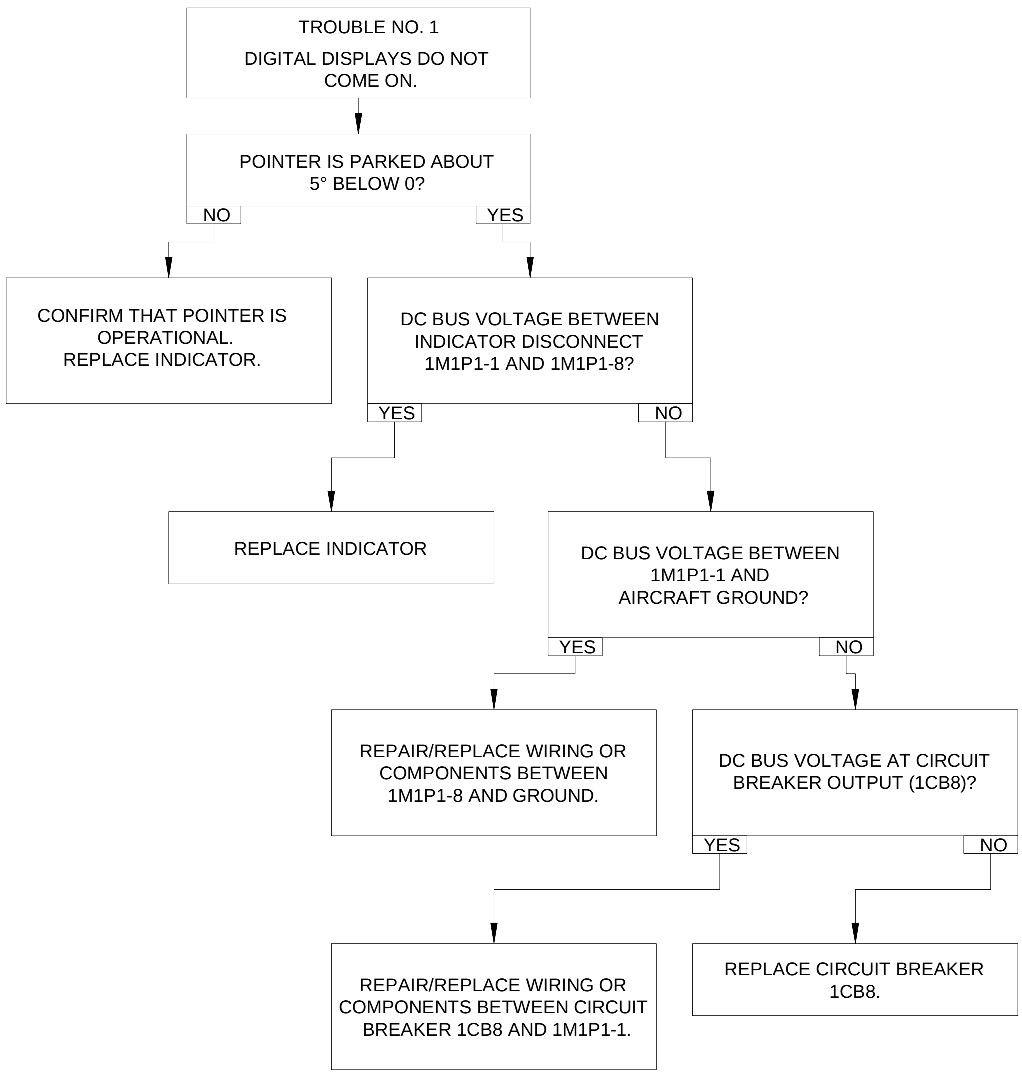


Figure 95-38: Fuel Quantity Indicator - Trouble No. 1

FUEL QUANTITY INDICATOR - TROUBLE NO. 2

CAUTION

DISCONNECT THE BATTERY AND THE EXTERNAL POWER PRIOR TO PERFORMING A CONTINUITY CHECK OR MAINTENANCE ON THE FUEL QUANTITY INDICATION SYSTEM.

NOTE
Refer to Chapter 98 for wiring diagram.

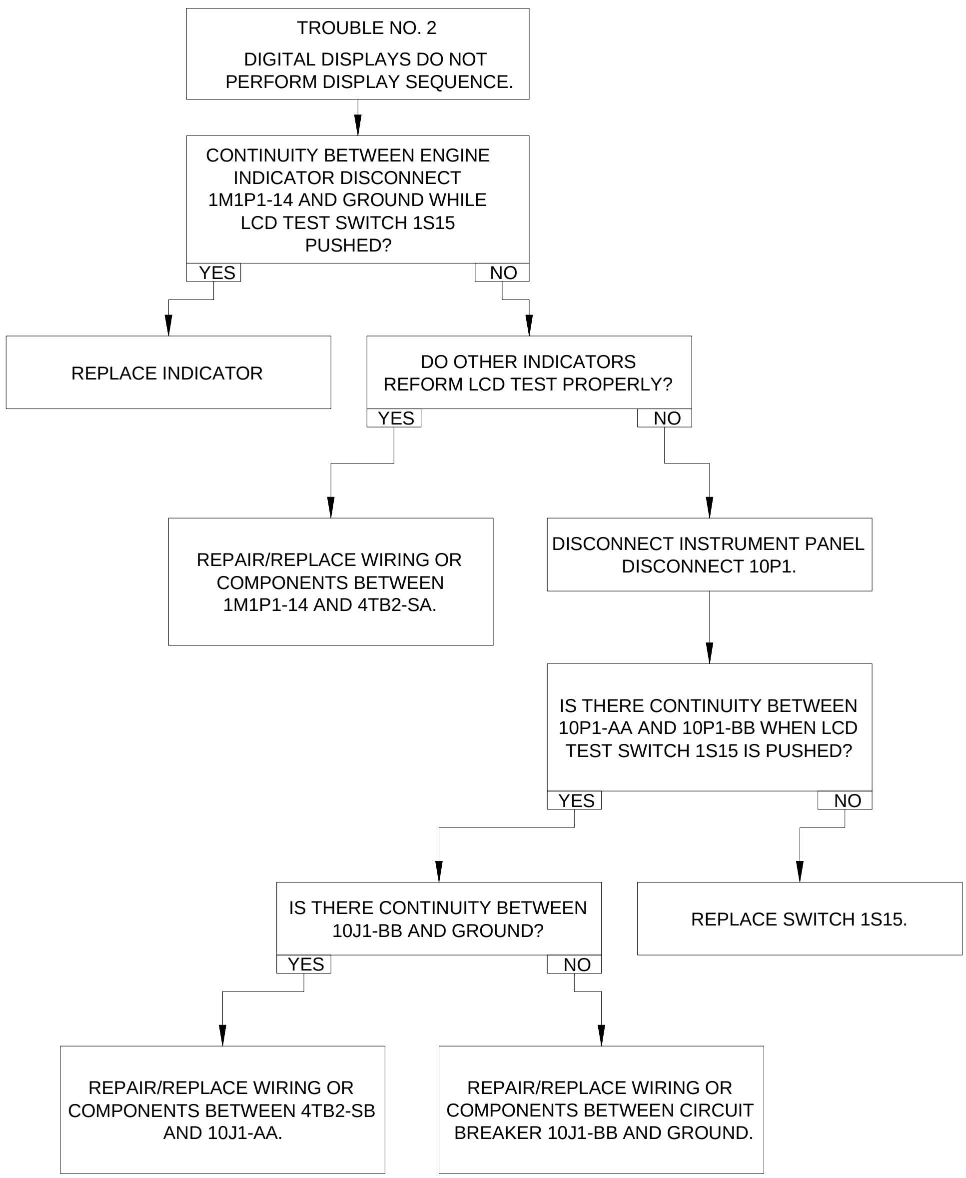


Figure 95-39: Fuel Quantity Indicator - Trouble No. 2

95.6.10 FUEL QUANTITY GAUGING SYSTEM — OPERATIONAL CHECK

NOTE

If there are multiple faults, the fuel signal conditioner LEDs show the highest priority failure first, as shown in Table 95-25. If multiple faults are present in the system, it may be necessary to examine signal conditioner LEDs after some corrective action has already been carried out.

NOTE

The faults that are shown by the signal conditioner are not reset unless the power to the signal conditioner is turned off and then back on. After any corrective action is taken, the power to the signal conditioner must be reset in order for the LEDs to show the current fault status.

1. Connect 28 VDC external power to the helicopter.
2. Close the FUEL INSTR QTY (1CB8) circuit breaker.

RESULT:

- After the instrument power-up BIT is complete, the indicator shows the weight of fuel in the helicopter.

CORRECTIVE ACTION:

- If the instrument does not complete power-up BIT, refer to paragraph 95.6.9
- If the indicator does not show the weight of fuel in the helicopter, refer to Trouble No. 1 (Figure 95-40).
- If the indicator goes blank, refer to Trouble No. 2 (Figure 95-41).

95.6.10.1 Fuel Quantity Gauging System — Calibration Procedure

CAUTION

OBSERVE STANDARD PRECAUTIONS WHEN FUELING OR DEFUELING THE HELICOPTER (CHAPTER 12).

CAUTION

DO A FUEL QUANTITY GAUGING SYSTEM CALIBRATION PROCEDURE ANYTIME AN EXISTING, REPAIRED, OR NEW COMPONENT OF THE FUEL QUANTITY GAUGING SYSTEM IS INSTALLED OR IF ASSOCIATED WIRING OR ELECTRICAL CONNECTORS ARE REPAIRED OR REPLACED. IF THIS PROCEDURE IS NOT COMPLETED, THE FUEL QUANTITY GAUGING INDICATION MAY NOT BE ACCURATE.

1. Place the helicopter at a safe distance from fire hazards (Chapter 12).
2. Set the BATT ON OFF switch to the OFF position.
3. Ground the helicopter.
4. Position helicopter 0.5° nose up.
5. Defuel the fuel cells (Chapter 12).
6. Add 18 pounds (approximately 2.8 U.S. gallons) of fuel to the aft fuel tank.

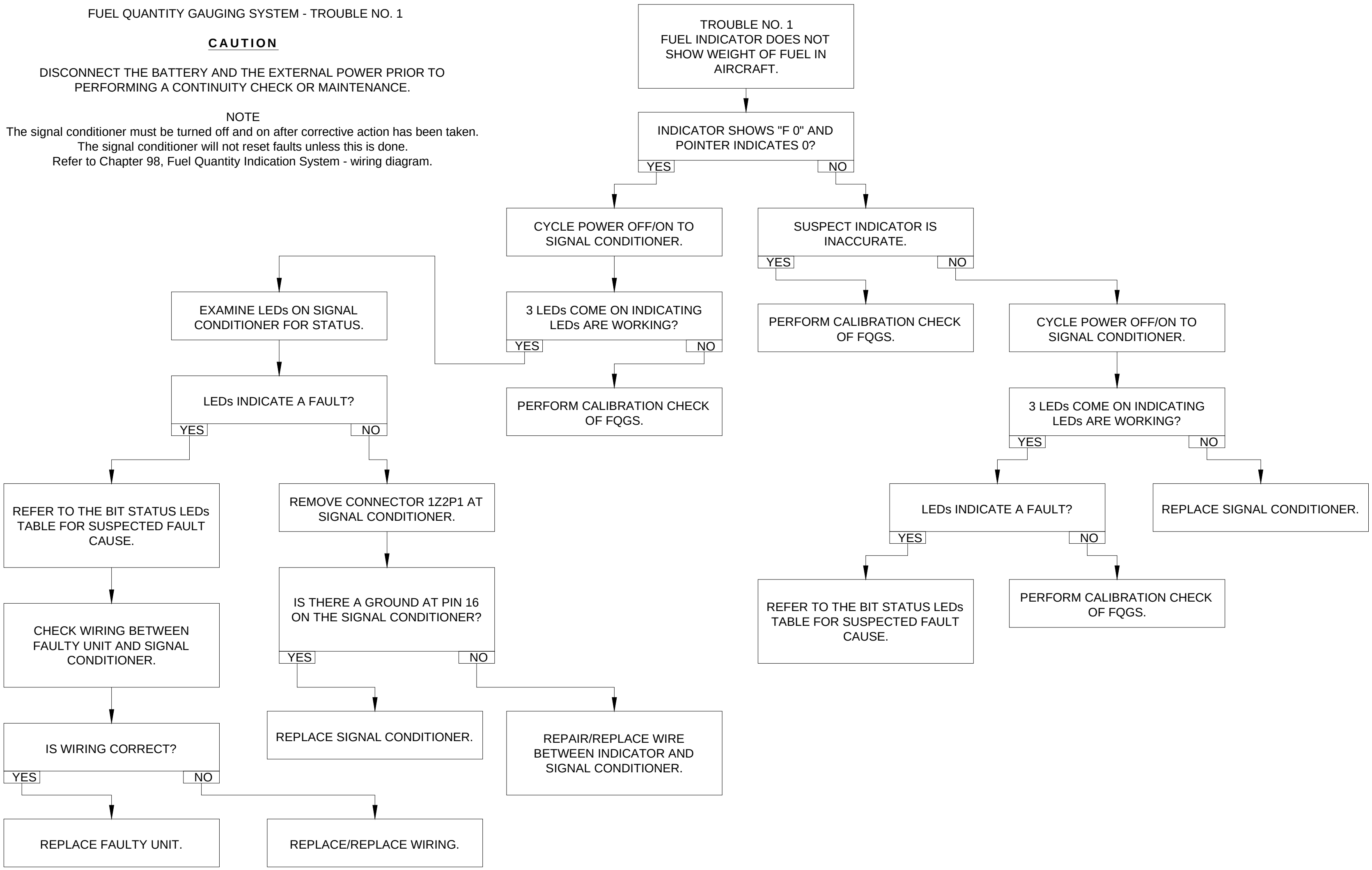


Figure 95-40: Fuel Quantity Gauging System - Trouble No. 1

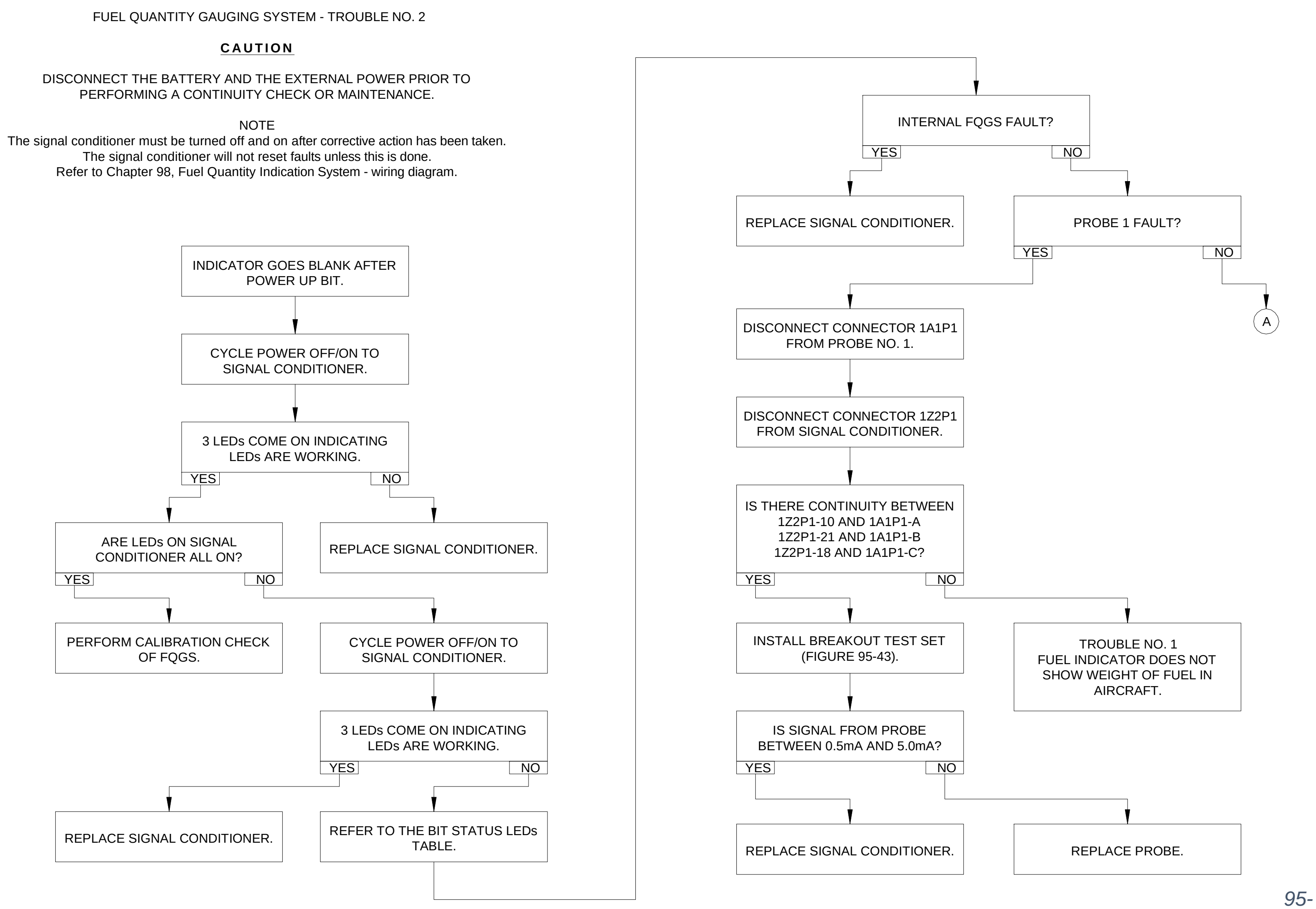


Figure 95-41: Fuel Quantity Gauging System - Trouble No. 2

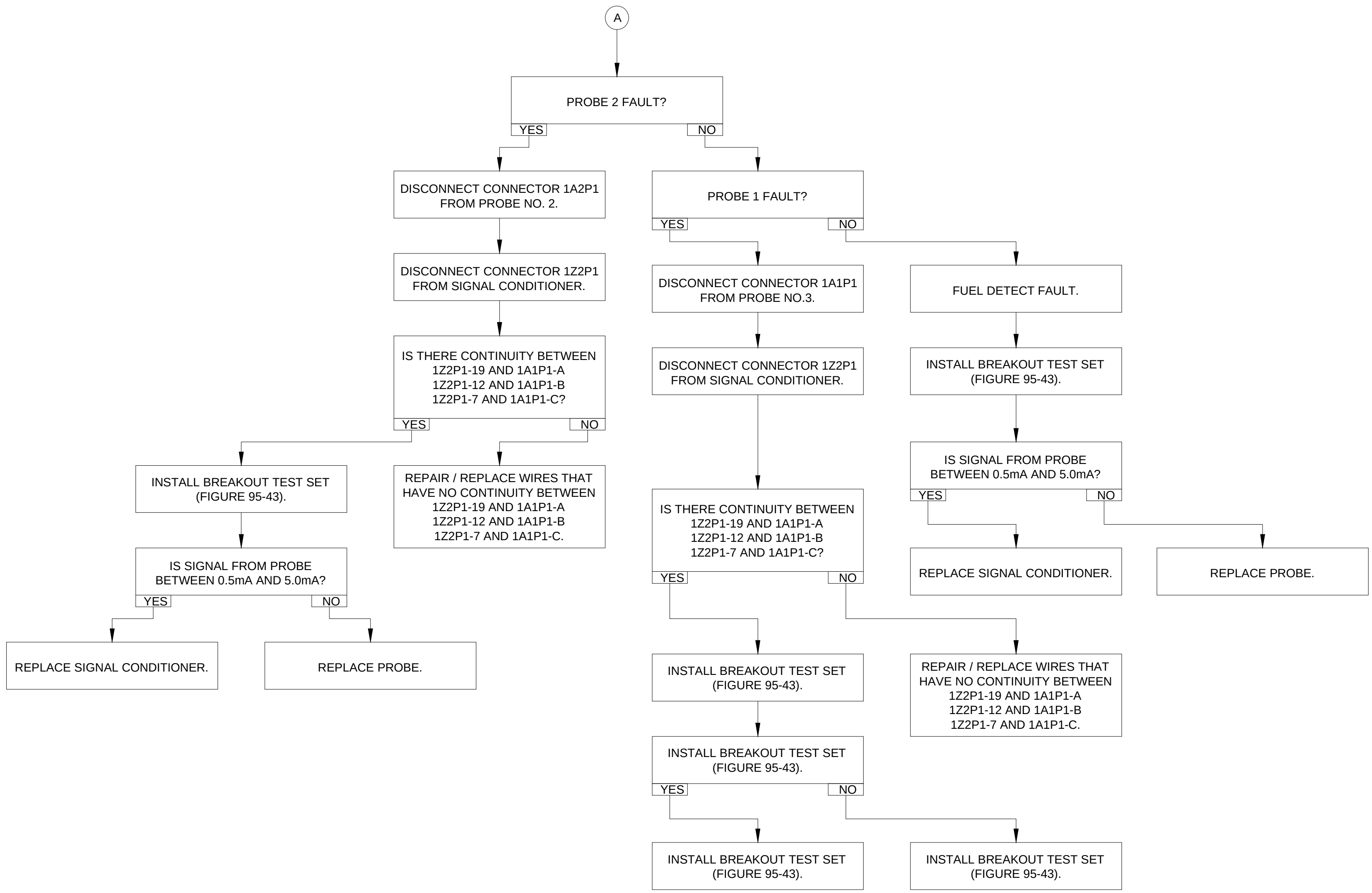


Figure 95-42: Fuel Quantity Gauging System - Trouble No.2

7. Connect 28 VDC external power to the helicopter.
8. On the overhead panel, close the FUEL INSTR QTY (1CB8) circuit breaker.
9. On the fuel quantity indicator, make sure the needle and digital display reads between 0 and 6 pounds. If necessary, adjust the EMPTY ADJUST nut located on the back side of the signal conditioner until the indicator shows 5 LBS.
10. On the instrument panel, push and hold the FUEL QTY FWD TANK switch.
11. On the fuel quantity indicator, make sure that the needle and digital display shows between 0 and 6 pounds.
12. Close the LIGHTS CAUT (1CB4) circuit breaker.
13. Add 110 ±15 pounds (approximately 16 U.S. gallons) of fuel to the aft fuel tank.
14. On the caution/warning/advisory panel, make sure that the FUEL LOW annunciator goes off. If the annunciator does not go off, refer to Fuel Low Annunciator Circuit (Chapter 96).
15. Add fuel until the fuel cell is full. The fuel level should be at the bottom of the filler port.

CAUTION

DO NOT ADJUST THE FULL FUEL QTY ADJUSTMENT. THE FULL FUEL QUANTITY IS DETERMINED BY THE SOFTWARE IN THE FUEL SIGNAL CONDITIONER.

16. On the fuel quantity indicator, make sure that the needle and digital display read as shown in Table 95-26 or Table 95-27 if an auxiliary tank is installed.
17. Push and hold the FUEL QTY FWD TANK switch on the instrument panel.
18. On the fuel quantity indicator, make sure that the needle and digital display reads as per Table 95-26.
19. On the overhead panel, open the FUEL INSTR QTY (1CB8) circuit breaker.
20. Remove the external power from the helicopter.
21. Return the helicopter to the standard configuration. Refer to Standard Practices — After Electrical Maintenance or Repairs (Chapter 96).

Table 95-26: Fuel Temperature Versus Fuel Weight-pounds

FUEL TEMPERATURE		FULL FUEL WEIGHT-POUNDS (125.5 U.S. GAL/475 L)			
		JP4, JET B FUEL		JET A, JET A1, JP5, JP8 FUEL	
°F	°C	TOTAL	FORWARD	TOTAL	FORWARD
-40	-40.0	844 ±25	259 ±8	898 ±27	276 ±8
-20	-28.9	836 ±25	256 ±8	889 ±27	273 ±8
0	-17.8	826 ±25	253 ±8	881 ±26	270 ±8
20	-6.7	818 ±25	251 ±8	874 ±26	268 ±8
40	4.4	809 ±24	248 ±7	864 ±26	265 ±8
60	15.6	799 ±24	245 ±7	857 ±26	263 ±8
80	26.7	791 ±24	243 ±7	848 ±25	260 ±8
100	37.8	781 ±23	239 ±7	840 ±25	258 ±8
120	48.9	773 ±23	237 ±7	833 ±25	256 ±8

Table 95-27: Fuel Temperature Versus Fuel Weight-pounds (Including Auxiliary Fuel Tank)

TEMPERATURE		FULL FUEL WEIGHT-POUNDS (146.9 U.S. GAL/556.1 L)	
°F	°C	JP4, JET B FUEL	JET A, JET A1, JP5, JP8 FUEL
-40	-40.0	976 ±29	1037 ±31
-20	-28.9	966 ±29	1028 ±31
0	-17.8	955 ±29	1018 ±31
20	-6.7	945 ±28	1010 ±30
40	4.4	935 ±28	999 ±30
60	15.6	924 ±28	990 ±30
80	26.7	914 ±27	981 ±29
100	37.8	903 ±27	971 ±29
120	48.9	893 ±27	962 ±29

95.6.11 LOW LEVEL FUNCTION OF FORWARD FUEL CELL PROBE NO. 3 OPERATIONAL CHECK

For the operational check of the left and right fuel transfer pump annunciator circuit, refer to Chapter 96. The purpose of this section is to describe the specific functions of the fuel probe No. 3 as a fuel low level switch.

1. Connect 28 VDC external power to the helicopter.
2. Close the FUEL INST QTY (1CB8) breaker.

RESULT:

- Signal conditioner LEDs are all on.

CORRECTIVE ACTION:

- If the LEDs on the signal conditioner are not all on, refer to Trouble No.1 (Figure 95-44).

3. Return the helicopter to the standard configuration. Refer to Standard Practices — After Electrical Maintenance or Repairs (Chapter 96).

95.6.12 FUEL QUANTITY GAUGING SYSTEM — TEST SET

SPECIAL TOOLS REQUIRED

NUMBER	NOMEMCLATURE
Model 77 or Equivalent	Fluke Digital Multimeter

NOTE

The information provided in Figure 95-43 may use by operators to build the fuel quantity gauging system test set. The test set may be built using standard electrical/ electronic supplies.

The fuel quantity gauging system test set (Figure 95-43) may use as an aid for troubleshooting problems associated with the fuel quantity gauging system.

Specifically, the fuel quantity gauging system test set may be used to measure any of the three fuel quantity probe (1A1, 1A2 and 1A3) input signals to the fuel signal conditioner (1Z2) as well as the output signals from the fuel signal conditioner to the fuel quantity indicator (1M1).

Unless the actual quantity of fuel in the fuel cells is known, it is recommended that the fuel be drained from the fuel cells and a measured amount added prior to taking readings from the probes (1A1, 1A2 and 1A3) and from the fuel signal conditioner (1Z2). For initial troubleshooting, measurements of the three fuel quantity probe (1A1, 1A2 and 1A3) input signals to the fuel signal conditioner (1Z2) as well as the output signals from the fuel signal conditioner (1Z2) to the fuel quantity indicator (1M1) should be recorded at empty, low fuel and full fuel conditions to coincide with the fuel quantity gauging system calibration procedure (paragraph 95.6.10.1).

WARNING

OBEY ALL THE SAFETY PRECAUTIONS WHEN DOING MAINTENANCE ON OR NEAR ELECTRICAL/ELECTRONIC EQUIPMENT (CHAPTER 96).

CAUTION

OBSERVE STANDARD PRECAUTIONS WHEN FUELING OR DEFUELING THE HELICOPTER (CHAPTER 12).

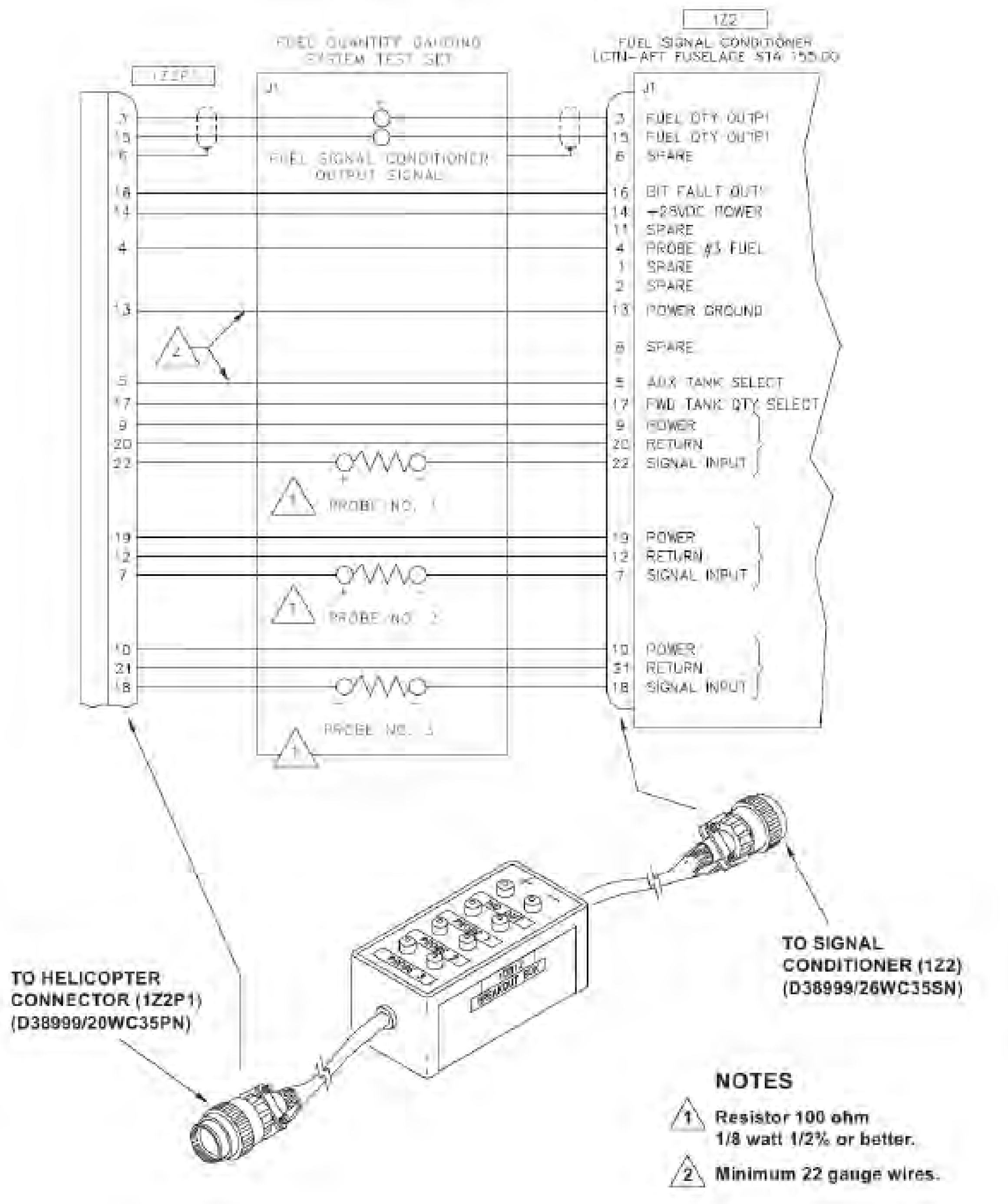


Figure 95-43: Fuel Quality Gauging System Test Set

LOW LEVEL FUNCTION OF FORWARD FUEL CELL PROBE NO. 3 - TROUBLE NO. 1

CAUTION

DISCONNECT THE BATTERY AND THE EXTERNAL POWER PRIOR TO PERFORMING A CONTINUITY CHECK OR MAINTENANCE.

NOTE
The signal conditioner must be turned off and on after corrective action has been taken.
The signal conditioner will not reset faults unless this is done.
Refer to Chapter 98, Fuel Quantity Indication System - wiring diagram.

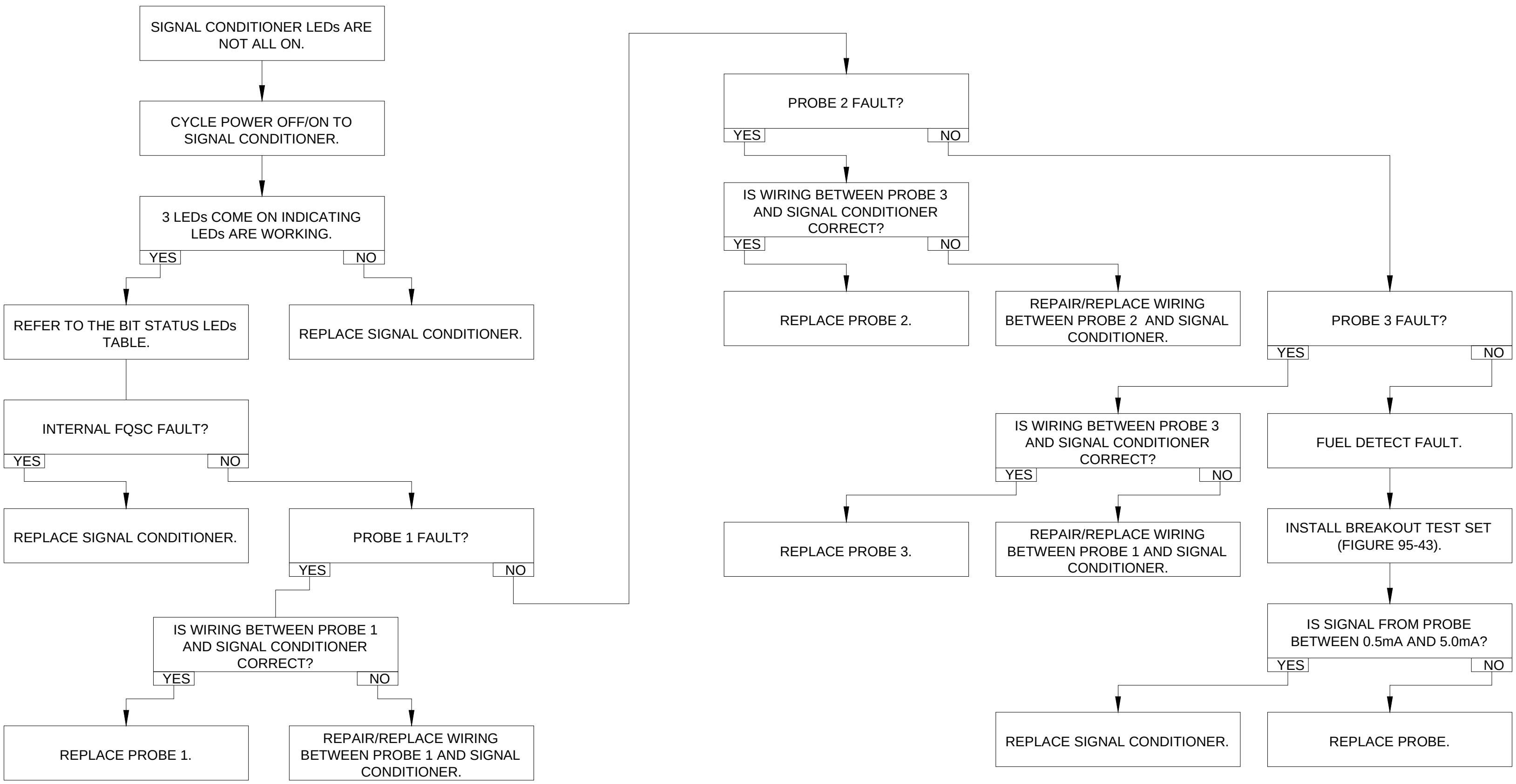


Figure 95-44: Low Level Function of Forward Fuel Cell Probe No. 3 - Trouble No.1

1. Drain the fuel system (Chapter 12).

NOTE

Refer to paragraph 95.6.10.1 for the procedures to drain and fill the fuel cells to reflect empty, low fuel, and full fuel conditions.

2. Add a measured amount of fuel to the fuel cells. Record the specification and amount of measured fuel that has been added to the fuel cells from an initial drained condition.
3. Install the fuel quantity gauging system test set as follows;
   a. Set the battery switch to OFF, or remove the external DC power from the helicopter.
   b. Gain access to the fuel signal conditioner (1Z2) and disconnect the electrical connector (1Z2P1).
   c. Connect the test set connector D38999/ 20WC35PN to electrical connector (1Z2P1) and connect test set connector D38999/26WC35SN to the fuel signal conditioner (1Z2).
4. Take readings of the fuel quantity probe (1A1, 1A2 and 1A3) input signals to the fuel signal conditioner (1Z2) as follows;

NOTE

Make sure the electrical connectors at the fuel quantity probes are connected.

   a. Set the multimeter selector to read millivolts.
   b. Place the positive and negative multimeter probes into the applicable ports of the test set for probe No. 1 (1A1).

CAUTION

USE AN EXTERNAL POWER UNIT DURING GROUND MAINTENANCE CHECKS TO AVOID BATTERY DEPLETION. IF BATTERY POWER IS USED, KEEP ELECTRICAL LOADS AND TEST TIME TO A MINIMUM.

   c. Set the battery switch to BATT, or connect the external DC power to the helicopter.
   d. Close the FUEL INSTR QTY circuit breaker.

NOTE

Divide the millivolt reading by 100 to obtain milliamps.

   e. Record the millivolt reading for probe No. 1 (1A1).
   f. Place the positive and negative multimeter probes into the applicable ports of the test set for probe No. 2 (1A2).

<u>NOTE</u>

Divide the millivolt reading by 100 to obtain milliamps.

   g. Record the millivolt reading for probe No. 2 (1A2).
   h. Place the positive and negative multimeter probes into the applicable ports of the test set for probe No. 3 (1A3).

NOTE

Divide the millivolt reading by 100 to obtain milliamps.

i. Record the millivolt reading for probe No. 3 (1A3).
j. Remove the positive and negative multimeter probes from the test set.
k. Divide the millivolt readings recorded for probe No.1 (1A1), probe No. 2 (1A2) and probe No. 3 (1A3) by 100 to obtain millivolt values.

5. Record the voltage reading of the fuel signal conditioner (1Z2) output signal to the fuel quantity indicator (1M1) as follows;

NOTE

Set the multimeter selector to volts prior to taking the reading of the fuel signal conditioner (1Z2) output signal to the fuel quantity indicator (1M1).

a. Set the multimeter selector to volts.
b. Place the positive and negative multimeter probes into the applicable ports of the test set for the fuel signal conditioner (1Z2) output signal.
c. Record the voltage reading of the fuel signal (1Z2) output signal to the fuel quantity indicator (1M1).

6. Refer to Table 95-25 to compare the voltage value recorded in step c, against the fuel quantity indication on the fuel quantity indicator (1M1) and the actual amount of fuel in the fuel cells.
7. Repeat step 2 through step 6 for conditions of low fuel and full fuel as specified in paragraph 95.6.10.1 or other fuel quantities as required.
8. Remove the fuel quantity gauging system test set as follows;
   a. Set the battery switch to OFF, or remove the external DC power from the helicopter.
   b. Gain access to the fuel signal conditioner (1Z2) and disconnect the test set connectors.
   c. Connect electrical connector (1Z2P1) to the fuel signal conditioner (1Z2).
9. Set the battery switch to BATT, or connect the external DC power to the helicopter and make sure the fuel quantity indication reflects the amount of fuel in the fuel cells.
10. Set the battery switch to OFF, or remove external DC power from the helicopter.
11. Contact the Product Support Engineering for assistance with interpretation of the fuel quantity probe (1A1, 1A2, and 1A3) and fuel signal conditioner (1Z2) recorded readings as required.
8. Return the helicopter to the standard configuration. Refer to Standard Practices — After Electrical Maintenance or Repairs (Chapter 96).

95.7 MISCELLANEOUS INSTRUMENTS

95.7.1 MISCELLANEOUS INSTRUMENTS

The miscellaneous instruments are as follows:

- Ammeter
- Clock/Outside Air Temperature (OAT)/volts indicator
- Hourmeter

95.7.2 AMMETER — DESCRIPTION

The ammeter is part of the fuel pressure/ammeter dual indicator (2M1). The ammeter gives an indication of the total current load on the generator. The ammeter has a dial and electronic components inside a sealed case (Figure 95-45).

The range of the scale is from 0 to 400 amps. The range marking on the scale has a red line at 180 amps.

The scale is a single needle/pointer display. The pointer display moves counter-clockwise from the zero position on the scale.

To warn the pilot when over-current conditions exist, the check instrument annunciator activates when the indicated current exceeds a red line (180 Amps). The check instruments annunciator deactivates immediately after the indicated pressure or current return to within limits.

95.7.2.1 Shunt Resistor — Description

The shunt resistor has a very low resistance. It is connected in series between the output of the starter generator and the helicopter 28 VDC bus. The voltage drop across the shunt is calibrated so that it gives a specific millivolt drop for a given current. The voltage supplied to the ammeter flow is designed to indicate a specific amperage as shown in Table 95-28, given a difference between the HI input from the shunt and the LO input. Circuit breakers are installed on both outputs from the shunt to the instrument because they are positive and wiring from the shunt to the indicator must be protected.

Table 95-28: Ammeter Indication Versus Input Voltage

INDICATION (AMPS)	INPUT VOLTAGE (MV)
0	0
20	10
40	20
60	30
80	40
100	50
120	60
140	70
160	80
180	90
200	100
300	150
400	200

95.7.2.2 Ammeter Indication System — Operation

The ammeter indicator receives its input signal from the shunt resistor installed in line with the output of the generator (Figure 95-45). The load current is measured across the shunt resistor. The ammeter indicator is protected against a current overload from the input signal by two circuit breakers. The circuit breakers are installed in line with the two wires from the shunt resistor. The ammeter shows the amps in agreement with the input signal.

The 28 VDC is supplied through the FUEL INSTR PRESS (1CB19) and INSTR AMPS (1CB23) on the overhead panel circuit breaker. Internal lighting uses dimmable LED backlights. The maximum backlight voltage is 5 VDC. The backlight controller is programmed to simulate incandescent backlight.

For the simplified schematic of the ammeter indication system, refer to Figure 95-46.

95.7.2.3 Ammeter Indicator — Removal and Installation

For the removal and installation of the fuel pressure/ ammeter indicator (2M1), refer to paragraph 95.5.2.2 and paragraph 95.5.2.3.

95.7.2.4 Ammeter Indication System — Operational Check

1. Connect 28 VDC external power to the helicopter.
2. Open and then close the AMPS INSTR (1CB23) circuit breaker.

RESULT:

- The needle/pointer reads the corresponding value.

3. Do ground runs of the helicopter (BHT-407-FM-1).
4. With the engine operating at an appropriate RPM (BHT-407-FM-1), set the generator switch to the ON position.

RESULT:

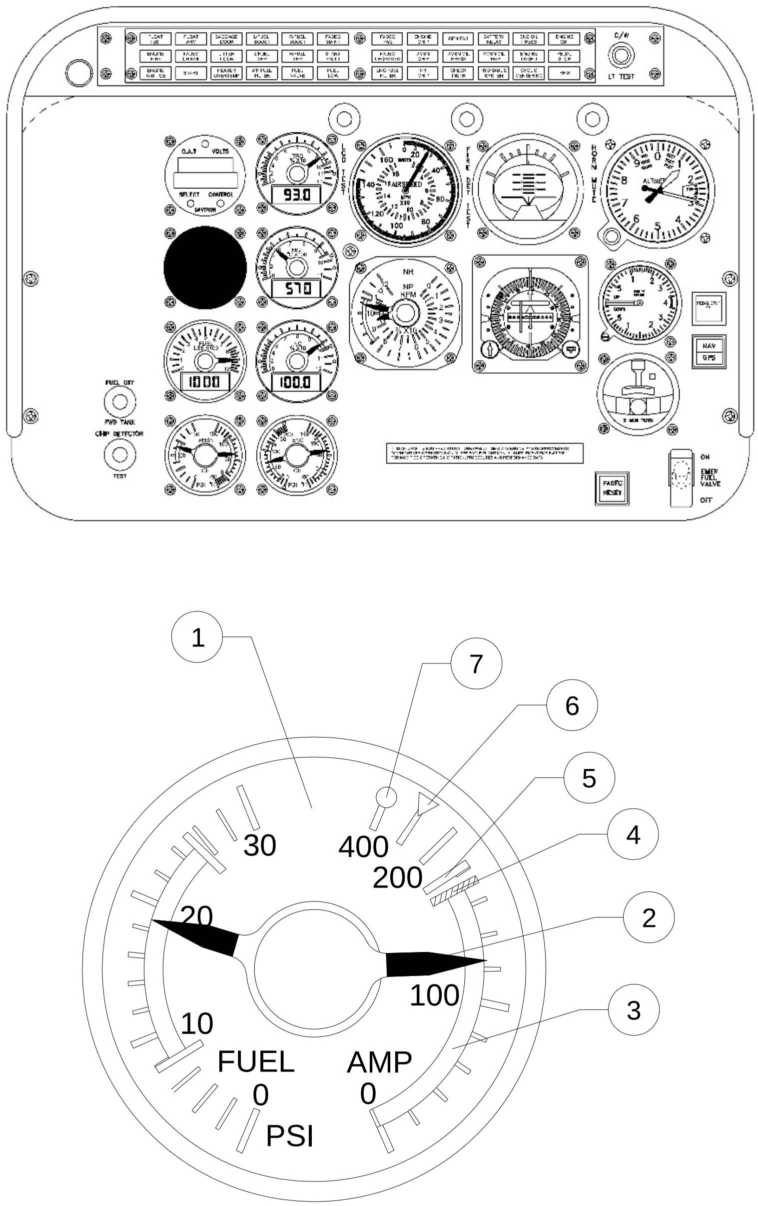
- The ammeter indicates maximum amps. The maximum amp indication will vary in agreement with the condition of the charge on the battery and what equipment is connected on the helicopter bus.

5. Wait until the ammeter shows a constant amp indication. Make a note of the ammeter indication.
6. Turn on both landing lights.

RESULT:

- The ammeter indicates an increase of load of approximately 18 amps.

7. Turn off both landing lights.
8. Return the helicopter to the standard configuration. Refer to Standard Practices — After Electrical Maintenance or Repairs (Chapter 96).



1. Fuel pressure and ammeter indicator dial
2. Ammeter pointer display
3. Green arc
4. Red hatch
5. Red line
6. Red triangle
7. Red circle

Figure 95-45: Ammeter Indicator - Description

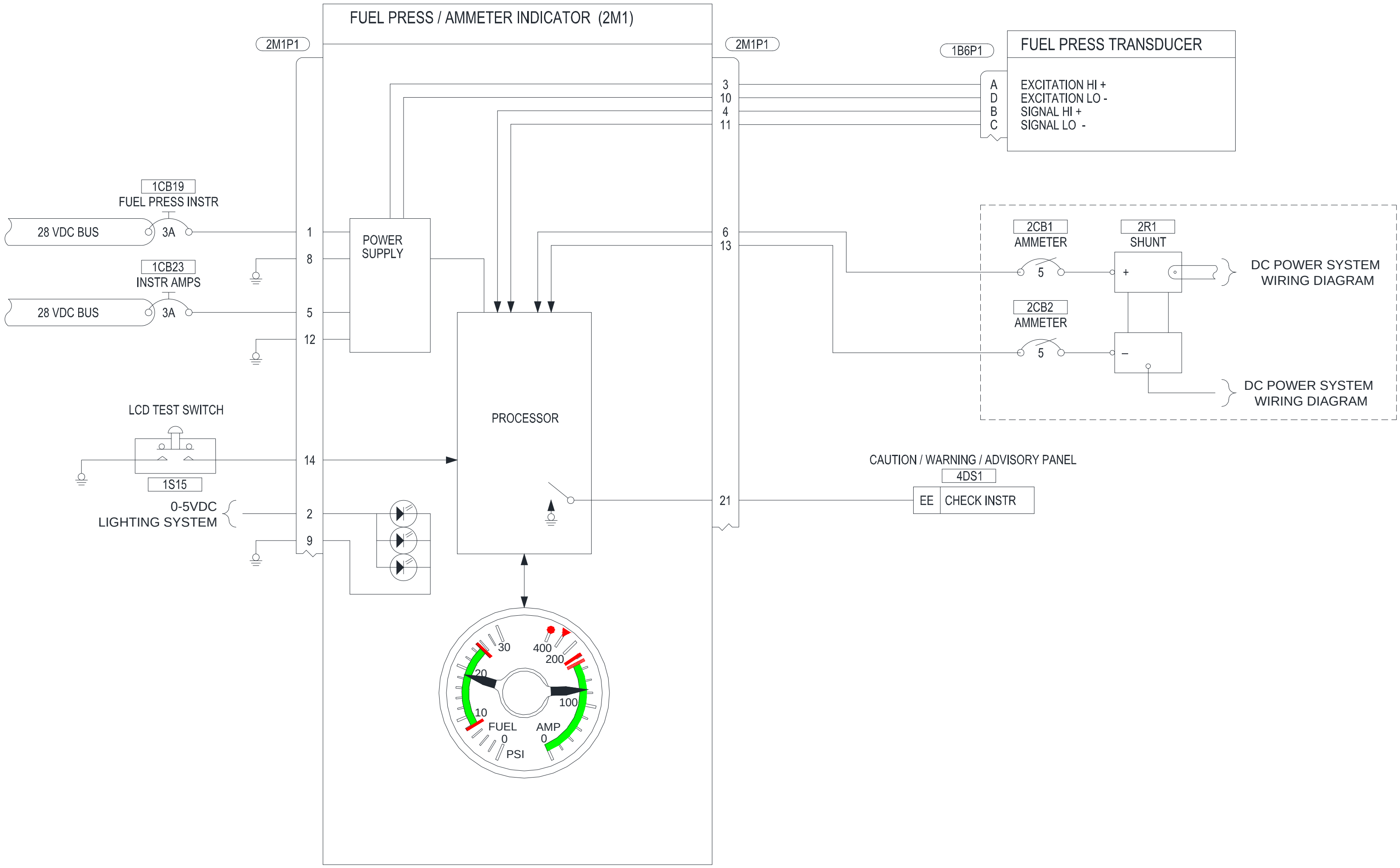


Figure 95-46: Ammeter Indication System - Simplified Schematic

95.7.2.5 Shunt Resistor — Removal

WARNING

OBEY ALL THE SAFETY PRECAUTIONS WHEN DOING MAINTENANCE ON OR NEAR ELECTRICAL/ELECTRONIC EQUIPMENT (CHAPTER 96).

NOTE

Remove components only to the extent necessary perform the required maintenance.

1. Disconnect the battery and external DC power from the helicopter.
2. Get access to the DC equipment panel at FS 155.00.
3. Remove the screws (1, Figure 95-47) and the washers (2 and 3).
4. Remove the cover (4) from the DC equipment panel.
5. Remove the bolts (9 and 12), screw (16), washers (10, 13, 15, and 18), and lugs (14 and 17) from the shunt (2R1) (19).
6. Remove the nut (7) and washer (8) from the bus bar (11).
7. Remove the bus bar (11) from the terminal of the shunt (2R1) (19).
8. Remove the screws (5 and 16) and washers (6 and 18) from the shunt (2R1) (19).
9. Remove the shunt (2R1) (19) from the DC equipment panel.

95.7.2.6 Shunt Resistor — Installation

WARNING

OBEY ALL THE SAFETY PRECAUTIONS WHEN DOING MAINTENANCE ON OR NEAR ELECTRICAL/ELECTRONIC EQUIPMENT (CHAPTER 96).

1. Disconnect the battery and external DC power from the helicopter.
2. Get access to the DC equipment panel at FS 155.00.
3. Install the shunt resistor (2R1) (19, Figure 95-47) on the DC equipment panel.
4. Install the screws (5) and washers (6) that attach the shunt (2R1) (19) to the DC equipment panel.
5. Install the lug (14) on the shunt (2R1) (19) with the bolt (12) and washers (13 and 15).
6. Install the lug (17) on the shunt (2R1) (19) with the screw (16) and washer (18).
7. Install the bus bar (11) to the terminal on the shunt (2R1) (19) with the bolt (9) and washer (10).
8. Attach the bus bar (11) to the DC power panel with the nut (7) and washer (8).
9. Install the cover (4) on the DC equipment panel.

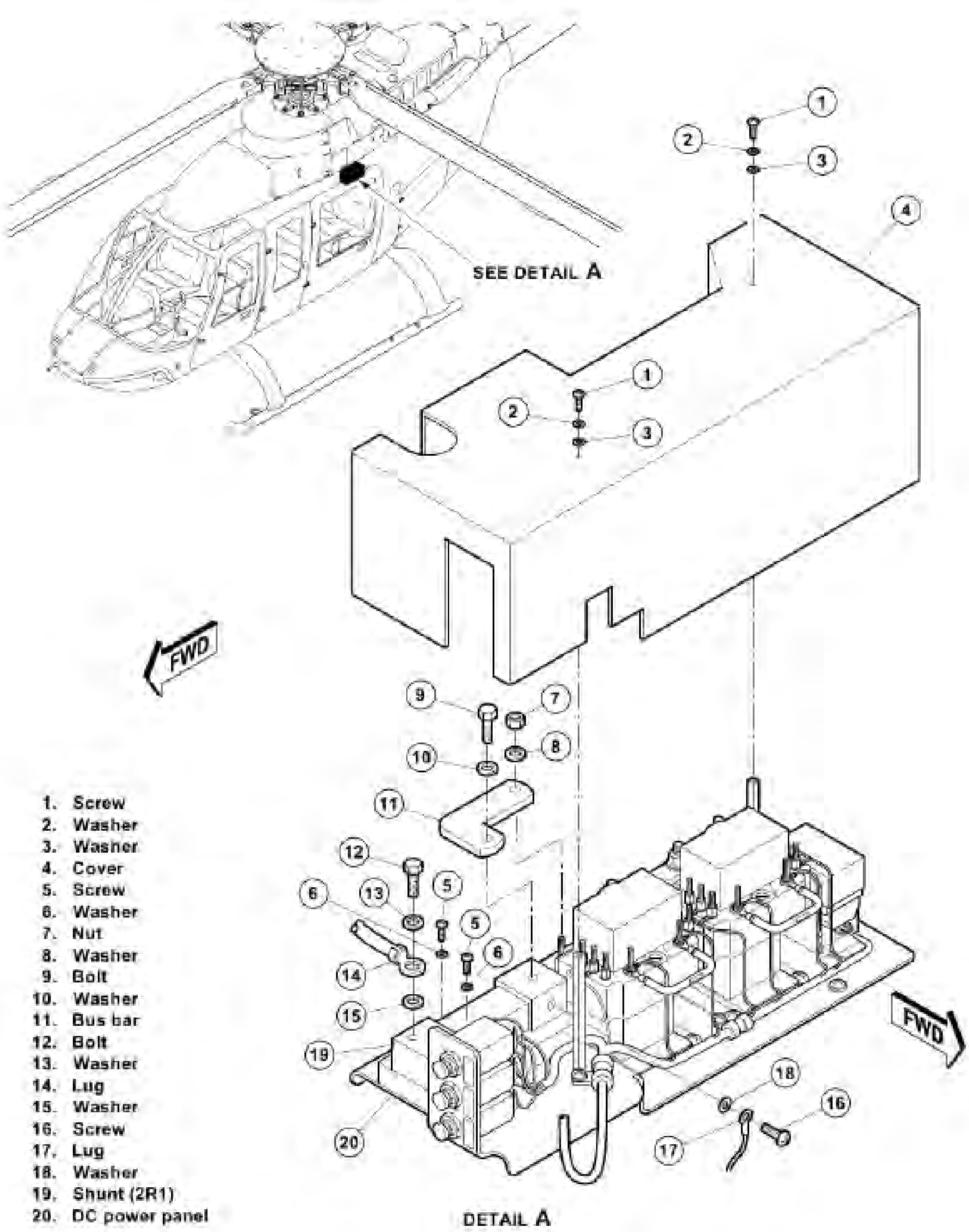


Figure 95-47: Shunt Resistor - Removal and Installation

95.7.3 CLOCK/OAT/VOLTS INDICATOR — DESCRIPTION

See BHT-407-MM Chapter 95-181.

95.7.3.1 CLOCK — DESCRIPTION

See BHT-407-MM Chapter 95-182.

95.7.3.1.1 Clock Battery Replacement

See BHT-407-MM Chapter 95-183.

95.7.3.1.2 Clock Test Mode

See BHT-407-MM Chapter 95-184.

95.7.3.1.3 Clock Universal Time (UT) Set

See BHT-407-MM Chapter 95-185.

95.7.3.1.4 Clock Local Time (LT) Set

See BHT-407-MM Chapter 95-186.

95.7.3.1.5 Clock Flight Time (FT) Alarm Set

See BHT-407-MM Chapter 95-187.

95.7.3.1.6 Clock Flight Time Alarm Display

See BHT-407-MM Chapter 95-188.

95.7.3.2 CLOCK DISPLAY SELECTION

See BHT-407-MM Chapter 95-189.

95.7.3.3 OUTSIDE AIR TEMPERATURE (OAT) DISPLAY — DESCRIPTION

See BHT-407-MM Chapter 95-190.

95.7.3.4 VOLTS DISPLAY — DESCRIPTION

See BHT-407-MM Chapter 95-191.

95.7.3.5 CLOCK/OAT/VOLTS INDICATOR — OPERATIONAL CHECK

See BHT-407-MM Chapter 95-192.

95.7.3.5.1 Clock/OAT/Volts Indicator — Removal

See BHT-407-MM Chapter 95-193.

95.7.3.5.2 Clock/OAT/Volts Indicator — Installation

See BHT-407-MM Chapter 95-194.

95.7.3.6 HOURMETER — DESCRIPTION

See BHT-407-MM Chapter 95-195.

95.7.3.6.1 Hourmeter — Removal

See BHT-407-MM Chapter 95-196.

95.7.3.6.2 Hourmeter — Installation

See BHT-407-MM Chapter 95-197.

95.7.3.6.3 Hourmeter — Operational Check See BHT-407-MM Chapter 95-198.

Chapter 96
ELECTRICAL SYSTEMS
(96-00-00)

CHAPTER 96 — ELECTRICAL SYSTEMS

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96.1. ELECTRICAL SYSTEMS

96.1.1 GENERAL DESCRIPTION

This chapter provides the data necessary to understand the operation of the electrical systems and to perform the necessary maintenance actions. Information is provided for 407HP helicopters S/N 53000 through 54299 modified per TCCA STC XXX (Ref. FAA STC SRXXXXXNE). This includes the data that follows:

- Electrical safety and hazard procedures
- The location of all the electrical components
- The inspection procedures for the electrical components
- The operational checks, functional checks, and troubleshooting charts for the electrical systems and the components
- The removal and installation procedures for the electrical components

This chapter describes each system under its own section. It provides the operator with the information necessary to maintain the serviceability of the specific electrical system.

Refer to the electrical and electronic components, reference designator/description/location — reference table (Table 96-6) and location figure (Figure 96-1 to Figure 96-12) to find the installed location of components.

Simplified electrical schematics are used throughout the chapter to help clarify system or circuit operation. To make the schematics easier to follow and understand, all wire numbers and certain intermediate connectors are not shown. The schematics are to be used in conjunction with the system operational descriptions. For detailed wiring diagram information, refer to Chapter 98.

All of the electrical simplified schematics in this chapter show the electrical equipment in the static position. All of the block diagrams and internal views of components are simplified representations and do not necessarily reflect the actual internal workings. The static position is specified as follows:

- No electrical power is applied
- Switches and relays are shown in the off or de-energized position
- The pressure switches are shown with no pressure applied
- The temperature switches are shown at the temperature of 59°F (15°C)

For the specific electrical information and procedures, wiring maintenance refer to the Electrical Standard Practices Manual (BHT-ELEC-SPM), which provides the data necessary for you to repair and replace the wires, cables, or the electrical components to the standards of performance and quality as specified by the manufacturer.

CAUTION

DO ONLY APPROVED REPAIRS ON THE ELECTRICAL SYSTEM OF THE FADEC/ ECU. BEFORE YOU DO REPAIRS TO THIS ELECTRICAL SYSTEM, REFER TO THE APPROPRIATE SECTIONS OF THIS MANUAL FOR APPROVAL. FIELD MAINTENANCE OR REPAIR TO THE MAIN FADEC HARNESSES IS NOT AUTHORIZED. FAILURE TO OBEY THIS PRECAUTION CAN CAUSE THE FADEC/ ECU TO NOT OPERATE WITHIN THE PARAMETERS CRITICAL TO FLIGHT SAFETY.

NOTE

If you install Bell Helicopter Textron (BHT) optional equipment for the first time, do this in accordance with the instructions provided in the applicable Installation Instruction (II). Follow the instructions provided in this chapter for any subsequent installation.

96.1.1.1. ELECTRICAL SAFETY AND HAZARDS

See BHT-407-MM Chapter 96-2.

96.1.1.1.1 Safety Practices — General

See BHT-407-MM Chapter 96-3.

96.1.1.1.2 Standard Practices — Electrical Maintenance or Repairs

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96.1.1.1.3 Standard Practices — Electrical Work In Confined Spaces

See BHT-407-MM Chapter 96-5.

96.1.1.1.4 Standard Practices — After Electrical Maintenance or Repairs

See BHT-407-MM Chapter 96-6.

96.1.2 MISCELLANEOUS ELECTRICAL TOOLS

See BHT-407-MM Chapter 96-7.

96.1.3 ELECTRICAL SYSTEMS

See BHT-407-MM Chapter 96-8.

96.1.4 OPERATIONAL CHECKS, FUNCTIONAL CHECKS, AND TROUBLESHOOTING CHARTS

See BHT-407-MM Chapter 96-9.

96.1.5 GENERAL TROUBLESHOOTING

The following troubleshooting procedures are general in nature and may be used as a guide to find a malfunction in an electrical system. Refer to the applicable system operational check or functional check and troubleshooting chart(s) for a specific fault. Make sure the system and component operation is understood prior to proceeding with any troubleshooting. Do the easiest or the most obvious step first.

1. Make sure electrical power is supplied to the electrical components you think are defective. Make sure ground connections are tight and properly installed. Refer to the applicable wiring diagram (Chapter 98) for the system.
2. Make sure the switches, relays, diodes, and the other miscellaneous electrical components are serviceable.
3. Examine the wires, connectors, and terminal junctions. Make sure they are in good condition. Make sure the connections are properly connected and are tight.
4. Make sure each component of a system operates correctly.

96.1.6 MISCELLANEOUS ELECTRICAL COMPONENTS— MAINTENANCE PRACTICES

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96.1.6.3. MISCELLANEOUS ELECTRICAL COMPONENTS — INSPECTION

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96.1.6.4. MISCELLANEOUS ELECTRICAL COMPONENTS — INSTALLATION

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96.1.7.2. STANDARD AND ZENER DIODES — FUNCTIONAL CHECK

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96.1.7.3. TRANSIENT SUPPRESSION DIODE ASSEMBLIES — DESCRIPTION

See BHT-407-MM Chapter 96-19.

96.1.7.4. TRANSIENT SUPPRESSION DIODE ASSEMBLIES — FUNCTIONAL CHECK

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96.1.7.5. TRANSISTOR NEGATIVE POSITIVE NEGATIVE (NPN) — DESCRIPTION

See BHT-407-MM Chapter 96-21.

96.1.7.6. TRANSISTOR (NPN) — FUNCTIONAL CHECK

See BHT-407-MM Chapter 96-22.

96.1.7.6.1 Semiconductor Devices — Maintenance Practices

See BHT-407-MM Chapter 96-23.

96.1.8 CONTROL PANELS — ELECTRICAL

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96.1.8.1. Control Panels — Removal

See BHT-407-MM Chapter 96-25.

96.1.8.2. Control Panels — Inspection

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96.1.8.3. Control Panels — Repair

See BHT-407-MM Chapter 96-27.

96.1.8.4. Control Panels — Installation

See BHT-407-MM Chapter 96-28.

96.1.9 CIRCUIT BREAKERS

See BHT-407-MM Chapter 96-29.

96.1.9.1. Circuit Breaker — Removal

See BHT-407-MM Chapter 96-30.

96.1.9.2. Circuit Breaker — Inspection

See BHT-407-MM Chapter 96-31.

96.1.9.3. Circuit Breaker — Installation

See BHT-407-MM Chapter 96-32.

96.1.10ELECTRICAL LOAD ANALYSIS

The following DC electrical load analysis information covers the net electrical loads associated with the installation of HTS900-2-1D engine on Model 407 helicopters S/N 53000 through 54299 modified per TCCA STC SH14-XX (Ref, FAA STC SRXXXXXNE). The electrical load analysis is used to make sure the demand on the DC generation system will not exceed its designed capacity during all in-flight conditions.

To ensure the DC generation system is capable of handling the maximum power requirements under all probable in-flight operating conditions, the available excess capacity of the electrical system may be determined from the electrical load data provided using the maximum usage during take-off, cruise, and landing phases of the flight profile. Refer to Table 96-1 to Table 96-3.

If additional electrical/avionics items not listed in this manual are installed on the helicopter, the operator can obtain electrical load data from the appropriate manufacturer. Electrical load and weight and balance calculations should be determined prior to installation of equipment to ensure limitations will not be exceeded.

For basic helicopter electrical load please refer to BHT-407-MM-10 Chapter 96-33.

96.1.10.1. DC GENERATOR OUTPUT LOAD CAPACITY

The primary power source is an engine driven 30 volt, 200 amps, starter generator de- rated to 180 amps for continuous operation to ensure adequate cooling. In addition, the generator has a transient 2-minute rating from 180 to 300 amps and a transient 5-second rating from 300 to 400 amps.

Table 96-1: Modification Net Electrical Loads

Installation	AMPS	Op Time	Start-up			Take-off			Cruise			Landing			Emergency		
		(Min)	5 Sec	2 Min	15 Min	5 Sec	2 Min	15 Min	5 Sec	2 Min	15 Min	5 Sec	2 Min	15 Min	5 Sec	2 Min	15 Min
Instruments																	
Engine Oil Press/Temp	0.16	CONT	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16
Torque	0.16	CONT	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16
Dual % RPM	0.16	CONT	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16
MGT	0.16	CONT	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16
NG	0.16	CONT	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16
XMSN Oil Press/Temp	0.16	CONT	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16
Fuel Quantity	0.16	CONT	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16
Fuel Press/Ammeter	0.16	CONT	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16
Engine Start/Ignition [1]																	
Igniter	3.00	0															
Start Relay A and B	1.00	0															
Engine Controls																	
FADEC ECU [2]	5.53	1	5.53	2.27	0.37												
Warning/Emergency																	
FADEC Fail Relay [3]	0.065	0															
FADEC Reset Light	0.31	CONT	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31
Voltage Regulator	0.50	CONT	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Emer. Shutdown Solenoid [3]	2.06	0															
Fire Detect [3]	0.20	0															
Total E407-789-011 Kit			**7.62**	**4.86**	**2.46**	**2.09**	**2.09**	**2.09**	**2.09**	**2.09**	**2.09**	**2.09**	**2.09**	**2.09**	**2.09**	**2.09**	**2.09**

[1] These equipment are starting load only.

[2] Above 55% NP, the FADEC ECU power is supplied by a dedicated engine-mounted permanent magnet alternator (PMA)

[3] These equipment are normally de-energized.

Table 96-2: Removed Load

Installation	AMPS	Op Time	Start-up			Take-off			Cruise			Landing			Emergency		
		(Min)	5 Sec	2 Min	15 Min	5 Sec	2 Min	15 Min	5 Sec	2 Min	15 Min	5 Sec	2 Min	15 Min	5 Sec	2 Min	15 Min
Removed from Basic Helicopter																	
Ind – Transmission P/T	0.393	CONT	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39
Ind – Fuel Quantity	0.286	CONT	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29
Ind – Fuel Press/Temp	0.393	CONT	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39
Ind – NR	0.121	CONT	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12
Ind – MGT	0.286	CONT	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29
Ind – NG	0.286	CONT	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29
Ind – Eng Torque	0.286	CONT	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29
Ind – Engine P/T	0.393	CONT	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39
Ind – NP	0.121	CONT	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12
407 Engine																	
Ignitor	1.75	CONT															
Ignitor Relay	0.065	CONT															
FADEC/ECU	5.4	CONT	5.4	2.7	0.36												
FADEC A/B Relay	0.065	CONT	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
ECU Fail Relay	0.065	CONT	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
FADEC/Start Relay	0.065	CONT															
Removed from Kit (if installed)																	
Quiet Mode Kit																	
Quiet Mode Kit SW Light	0.096	CONT	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Quiet Mode Kit Relay	0.076	CONT	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
Quiet Mode RPM Sensor	0.071	CONT	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
Total Removed [1]																	

[1] Customer to fill-in.

Table 96-3: Summary

Installation	AMPS	Op Time	Start-up			Take-off			Cruise			Landing			Emergency		
		(Min)	5 Sec	2 Min	15 Min	5 Sec	2 Min	15 Min	5 Sec	2 Min	15 Min	5 Sec	2 Min	15 Min	5 Sec	2 Min	15 Min
Existing Aircraft configuration [1]																	
Total Removed [3] [1]																	
E407-789-011 Kit [2]			7.62	4.86	2.46	2.09	2.09	2.09	2.09	2.09	2.09	2.09	2.09	2.09	2.09	2.09	2.09
Total [1]																	

[1] Customer to fill-in.

[2] From Table 96-1.

[3] From Table 96-2.

96.1.11 ELECTRICAL AND ELECTRONIC COMPONENTS — DESIGNATOR REFERENCE

96.1.11.1. ELECTRICAL COMPONENTS AND ASSEMBLIES — REFERENCE DESIGNATOR ASSIGNMENT

Each electrical component and assembly is assigned an alphanumeric code on the wiring diagrams and schematics called a reference designator. The reference designator consists of a system number as shown in Table 96-4 and unit number as shown in Table 96-5 for identification. Item numbers are also used at the end of the reference designator to identify an item such as a connector that connects to the particular reference designator. Components are identified by their reference designator on the electrical schematics, and by a decal or label adjacent to their installation location in the helicopter.

Table 96-4: Reference Designator, System Number, and Description

SYSTEM NUMBER	SYSTEM DESCRIPTION
1	Propulsion and fuel system
2	DC power system, start and ignition system
4	Instrument panels and console
6	Flight controls
8	Light systems
9	Flight controls hydraulic system
10	Environmental controls system
24	Float, cargo hook and miscellaneous kits
2301	Audio control and intercom systems
2303	VHF navigation and communication systems
2321	Emergency locator transmitter (ELT) system
3400	NAV indicator system
3406	Automatic direction finder (ADF) system
3407	Directional gyroscope (DG) system
3410	ATC transponder system
3415	Global positioning system (GPS)
3427	Encoder altimeter
9700	Video camera system
4962	FADEC system (HTS900-2-1D)

Table 96-5: Reference Designator, Unit Number, and Item Number Letter Codes

SYSTEM NUMBER	SYSTEM DESCRIPTION
A	Electronic or electrical assembly, control panel, fuel probe
B	Electrically driven pump, blower, fan
BT	Battery, battery cell
C	Capacitor
CB	Circuit breaker
CP	Control panel (avionic); Connector, adapter (electrical)
CR	Diode, diode assembly
D	Light
DS	Light assembly (electrical), indicator (avionic), alarm, annunciator
E	Chip detector (electrical); antenna (avionic)
F	Fuse
G	Pressure transducer
J	Electrical receptacle
K	Relay
L	Solenoid
LS	Speaker, warning horn
M	Indicator, clock
MG	Starter generator
MP	Directional gyroscope
ND	Ground assembly
P	Electrical connector
Q	Transistor
R	Resistor, shunt
RE	Receiver (avionic)
RT	Resistive temperature bulb
S	Switch
TB	Terminal block
TC	Thermocouple
TR	Transceiver (avionic)
TX	Transmitter (avionic)
VR	Voltage regulator, generator control unit
WTB	Junction module
WTD	Ground module
XK	Relay mount socket
Z	Fuel signal conditioner

96.1.11.2. ELECTRICAL AND ELECTRONIC COMPONENTS, REFERENCE DESIGNATOR / DESCRIPTION / LOCATION — REFERENCE TABLE AND LOCATION FIGURE

All electrical reference designated components used on the Model 407 helicopter are listed in alphanumerical order in Table 96-6. To locate the installed location of a specific reference designated component, find the reference designator callout in the table. In addition to providing the reference designator, the listing provides the full name description, and the approximate installed location of the component as shown in Figure 96-1 to Figure 96-12. Refer to the figure number provided to view the installed location of the component.

Table 96-6: Electrical and Electronic Components, Reference Designator/Description - Reference Table

REFERENCE DESIGNATOR	COMPONENT DESCRIPTION	LOCATION	FIGURE NO.
J41	RS-485 Interface	LH SIDE CENTER CONSOLE	Figure 96-4
ND456	Ground Stud	COPILOT SEAT, STA 70.70 LBL18.66,OUTBOARD SIDE	Figure 96-5
ND4962-1	Ground Stud		
ND4962-2	Ground Stud		
ND4962-3	Ground Stud		
ND4962-4	Ground Stud		
ND4962-5	Ground Stud		
ND4962-6	Ground Stud		
ND4962-7	Ground Stud		
ND852	Ground Stud	XMSN COMPARTMENT, FS 134.0 LBL 6.25	
P10	Fuel Filter Switch Connector	ENGINE COMPARTMENT	LMM-HTS900-2-1D
P11	Oil Pressure Transducer Connector	ENGINE COMPARTMENT	LMM-HTS900-2-1D
P12	Ignition Unit Connector	ENGINE COMPARTMENT	LMM-HTS900-2-1D
P13	Oil Temp. Bulb Connector	ENGINE COMPARTMENT	LMM-HTS900-2-1D
P14	Anti-Ice Valve Connector	ENGINE COMPARTMENT	LMM-HTS900-2-1D
P15	NP Monopole Sensor Connector	ENGINE COMPARTMENT	LMM-HTS900-2-1D
P16	Fuel Metering Unit Connector	ENGINE COMPARTMENT	LMM-HTS900-2-1D
P17	Fuel Metering Unit Connector	ENGINE COMPARTMENT	LMM-HTS900-2-1D
P18	NG Monopole Sensor Connector	ENGINE COMPARTMENT	LMM-HTS900-2-1D
P19	Minflow Sensor Connector	ENGINE COMPARTMENT	LMM-HTS900-2-1D
P20	Permanent Magnet Alternator Connector	ENGINE COMPARTMENT	LMM-HTS900-2-1D
P23	T1 Sensor Connector	ENGINE COMPARTMENT	LMM-HTS900-2-1D
P24	NP Monopole Sensor Connector	ENGINE COMPARTMENT	LMM-HTS900-2-1D
P25	NP Monopole Sensor Connector	ENGINE COMPARTMENT	LMM-HTS900-2-1D
P26	Torque Transducer Connector	ENGINE COMPARTMENT	LMM-HTS900-2-1D

REFERENCE DESIGNATOR	COMPONENT DESCRIPTION	LOCATION	FIGURE NO.
P27	P3 Pressure Transducer Connector	ENGINE COMPARTMENT	LMM-HTS900-2-1D
P28	Shaft Detector Connector	ENGINE COMPARTMENT	LMM-HTS900-2-1D
P30	PLA LVDT Connector		Figure 96-5
P35	Anti-Ice Pressure Switch Connector	ENGINE COMPARTMENT	LMM-HTS900-2-1D
P42	Emergency Battery Connector	HAT RACK AREA	LMM-HTS900-2-1D
WTB150	Ground Terminal Block	STA 24.0	Figure 96-3
WTD250	Ground Terminal Block	STA 28.0	Figure 96-3
WTD251	Ground Terminal Block	STA 28.0	Figure 96-3
WTD252	Ground Terminal Block	STA 28.0	Figure 96-3
WTD450	Ground Terminal Block	STA 58.0	Figure 96-5
WTD451	Ground Terminal Block	STA 155.0	Figure 96-10
1CB1	ENGINE CONTROLS START Circuit Breaker (5 amps)	OVERHEAD CONSOLE	Figure 96-8
1CB2	ENGINE CONTROLS IGNTR Circuit Breaker (5 amps)	OVERHEAD CONSOLE	Figure 96-8
1CB4	ENGINE CONTROLS ANTI-ICE Circuit Breaker (5 amps)	OVERHEAD CONSOLE	Figure 96-8
1CB8	FUEL INSTR QTY Circuit Breaker (3 amps)	OVERHEAD CONSOLE	Figure 96-8
1CB9	ENGINE INSTR OIL TEMP Circuit Breaker (3 amps)	OVERHEAD CONSOLE	Figure 96-8
1CB10	ENGINE INSTR MGT Circuit Breaker (3 amps)	OVERHEAD CONSOLE	Figure 96-8
1CB15	XMSN INSTR OIL PRESS Circuit Breaker (3 amps)	OVERHEAD CONSOLE	Figure 96-8
1CB17	ENGINE INSTR OIL PRESS Circuit Breaker (3 amps)	OVERHEAD CONSOLE	Figure 96-8
1CB18	XMSN INSTR OIL TEMP Circuit Breaker (3 amps)	OVERHEAD CONSOLE	Figure 96-8
1CB19	FUEL INSTR PRESS Circuit Breaker (3 amps)	OVERHEAD CONSOLE	Figure 96-8
1CB21	ENGINE INSTR NR Circuit Breaker (3 amps)	OVERHEAD CONSOLE	Figure 96-8
1CB22	ENGINE INSTR NG	OVERHEAD CONSOLE	Figure 96-8

REFERENCE DESIGNATOR	COMPONENT DESCRIPTION	LOCATION	FIGURE NO.
	Circuit Breaker (3 amps)		
1CB23	INSTR AMPS Circuit Breaker (3 amps)	OVERHEAD CONSOLE	Figure 96-8
1CB24	ENGINE INSTR NP Circuit Breaker (3 amps)	OVERHEAD CONSOLE	Figure 96-8
1CB25	ENGINE INSTR TRQ Circuit Breaker (3 amps)	OVERHEAD CONSOLE	Figure 96-8
1B8	NR Monopole Sensor	TRANSMISSION COMPARTMENT	Figure 96-11
1B8P1	NR Monopole Sensor Connector	TRANSMISSION COMPARTMENT	Figure 96-11
1J1	Engine Compartment Disconnect Connector	ENGINE COMPARTMENT, RH	Figure 96-10
1J8	Transmission Compartment Disconnect Connector	UPPER DECK TRANSMISSION COMPARTMENT	Figure 96-11
1P1	Engine Compartment Disconnect Receptacle	ENGINE COMPARTMENT, RH	Figure 96-10
1P8	At Roof Receptacle	STA 144.6 RBL 11.60	Figure 96-11
1M1	Fuel Quantity Indicator	INSTRUMENT PANEL	Figure 96-6
1M1P1	Fuel Quantity Indicator Connector	INSTRUMENT PANEL	Figure 96-7
1M2	Engine Oil Temperature and Pressure Indicator	INSTRUMENT PANEL	Figure 96-6
1M2P1	Engine Oil Temperature and Pressure Indication Connector	INSTRUMENT PANEL	Figure 96-7
1M3	Transmission Oil Temperature and Pressure	INSTRUMENT PANEL	Figure 96-6
1M3P1	Transmission Oil Temperature and Pressure Connector	INSTRUMENT PANEL	Figure 96-7
1M4	Measured Gas Temperature Indicator	INSTRUMENT PANEL	Figure 96-6
1M4P1	Measured Gas Temperature Indicator Connector	INSTRUMENT PANEL	Figure 96-7
1M5	Gas Producer Tachometer Indicator	INSTRUMENT PANEL	Figure 96-6
1M5P1	Gas Producer Tachometer Indicator Connector	INSTRUMENT PANEL	Figure 96-7
1M6	Dual Tachometer Indicator	INSTRUMENT PANEL	Figure 96-6
1M6P1	Dual Tachometer Indicator Connector	INSTRUMENT PANEL	Figure 96-7
1M6P2	Dual Tachometer Indicator Connector	INSTRUMENT PANEL	Figure 96-7

REFERENCE DESIGNATOR	COMPONENT DESCRIPTION	LOCATION	FIGURE NO.
1M8	Engine Torque Indicator	INSTRUMENT PANEL	Figure 96-6
1M8P1	Engine Torque Indicator Connector	INSTRUMENT PANEL	Figure 96-7
2BT1	Battery	BATTERY COMPARTMENT	Figure 96-1
2M1	Fuel Pressure/Ammeter	INSTRUMENT PANEL	Figure 96-6
2M1P1	Fuel Pressure/Ammeter Connector	INSTRUMENT PANEL	Figure 96-7
4A1S3	Engine Anti-Ice Switch	OVERHEAD CONSOLE	Figure 96-8
4CB1	LIGHTS CAUT Circuit Breaker (5 amps)	OVERHEAD CONSOLE	Figure 96-8
4DS1	Caution/Warning /Advisory Panel	INSTRUMENT PANEL	Figure 96-6
4DS1P1	Caution/Warning /Advisory Panel Connector	INSTRUMENT PANEL	Figure 96-6
4LS1	Engine Out Warning Horn	OVERHEAD CONSOLE	Figure 96-8
4LS2	Low Rotor RPM Warning Horn	OVERHEAD CONSOLE	Figure 96-9
4LS3	FADEC Fail Horn	OVERHEAD CONSOLE	Figure 96-8
4R1J1	Collective Pitch Transducer Receptacle	UNDER COPILOT SEAT	Figure 96-5
4R1P1	Collective Pitch Transducer Connector	UNDER COPILOT SEAT	Figure 96-5
4R2J1	Collective Pitch Transducer Receptacle	UNDER COPILOT SEAT	Figure 96-5
4R2P1	Collective Pitch Transducer Connector	UNDER COPILOT SEAT	Figure 96-5
4TB2	Terminal Block		Figure 96-2
8TB1	Terminal Block		Figure 96-2
8TB3	Terminal Block		Figure 96-2
10P1	Instrument Panel Disconnect Connector	BEHIND INSTRUMENT PANEL	Figure 96-5
10J1	Instrument Panel Disconnect Receptacle	BEHIND INSTRUMENT PANEL	Figure 96-5
22P1	Instrument Panel Disconnect Connector	BEHIND INSTRUMENT PANEL	Figure 96-5
22J1	Instrument Panel Disconnect Receptacle	BEHIND INSTRUMENT PANEL	Figure 96-5
4962-A	ECU	TRANSMISSION COMPARTMENT	Figure 96-11
4962-A2	Gearbox Chip Detector	ENGINE COMPARTMENT	LMM-HTS900-2-1D
4962-A10	Fuel Filter Switch	ENGINE COMPARTMENT	LMM-HTS900-2-1D

REFERENCE DESIGNATOR	COMPONENT DESCRIPTION	LOCATION	FIGURE NO.
4962-A11	Oil Pressure Transducer	ENGINE COMPARTMENT	LMM-HTS900-2-1D
4962-A12	Ignition Unit	ENGINE COMPARTMENT	LMM-HTS900-2-1D
4962-A13	Oil Temp. Bulb	ENGINE COMPARTMENT	LMM-HTS900-2-1D
4962-A14	Anti-Ice Valve	ENGINE COMPARTMENT	LMM-HTS900-2-1D
4962-A15	NP Monopole Sensor	ENGINE COMPARTMENT	LMM-HTS900-2-1D
4962-A16	Fuel Metering Unit	ENGINE COMPARTMENT	LMM-HTS900-2-1D
4962-A17	Fuel Metering Unit	ENGINE COMPARTMENT	LMM-HTS900-2-1D
4962-A18	NG Monopole Sensor	ENGINE COMPARTMENT	LMM-HTS900-2-1D
4962-A19	Minflow Sensor	ENGINE COMPARTMENT	LMM-HTS900-2-1D
4962-A20	Permanent Magnet Alternator	ENGINE COMPARTMENT	LMM-HTS900-2-1D
4962-A23	T1 Sensor	ENGINE COMPARTMENT	LMM-HTS900-2-1D
4962-A24	NP Monopole Sensor	ENGINE COMPARTMENT	LMM-HTS900-2-1D
4962-A25	NP Monopole Sensor	ENGINE COMPARTMENT	LMM-HTS900-2-1D
4962-A26	Torque Transducer	ENGINE COMPARTMENT	LMM-HTS900-2-1D
4962-A27	P3 Pressure Transducer	ENGINE COMPARTMENT	LMM-HTS900-2-1D
4962-A28	Shaft Detector	ENGINE COMPARTMENT	LMM-HTS900-2-1D
4962-A30	PLA LVDT		
4962-A35	Anti-Ice Pressure Switch	ENGINE COMPARTMENT	
4962CB1	FADEC PWR CH A Circuit Breaker (7.5 amps)	OVERHEAD CONSOLE	Figure 96-8
4962CB2	FADEC PWR CH B Circuit Breaker (7.5 amps)	OVERHEAD CONSOLE	Figure 96-8
4962CB3	FADEC FAIL Circuit Breaker (3 amps)	OVERHEAD CONSOLE	Figure 96-8
4962CB3	EMER SHUTOFF for Voltage Regulator Circuit Breaker (3 amps)	OVERHEAD CONSOLE	Figure 96-8
4962-CR1	Diode Assembly	DUAL TACH INDICATOR	
4962-CR2	Diode		

REFERENCE DESIGNATOR	COMPONENT DESCRIPTION	LOCATION	FIGURE NO.
4962-J7	Engine Interface Connector	FORWARD ENGINE FIREWALL (LH SIDE0	Figure 96-11
4962-J8	Engine Interface Connector	LH SIDE ENGINE OILPAN	
4962-J8A	Engine Interface connector	AFT CABIN ROOF	Figure 96-11
4962-J9	Engine Interface Connector	FORWARD ENGINE FIREWALL (RH SIDE)	Figure 96-11
4962-J31	ECUIC/GSE Interface Connector CH A	LH SIDE CENTER CONSOLE	Figure 96-4
4962-J32	ECUIC/GSE Interface Connector CH B	LH SIDE CENTER CONSOLE	Figure 96-4
4962-J196	Cockpit Interface Connector	FWD CABIN ROOF	Figure 96-9
4962-J197	Cockpit Interface Connector	FWD CABIN ROOF	Figure 96-9
4962-K1	Start Relay Channel A		
4962-K2	Start Relay Channel B		
4962-K3	FADEC Fail Relay CH A	FWD LH SIDE CENTER PEDESTAL STA 26.0 BL0.0 WL 35.0	Figure 96-2
4962-K4	FADEC Fail Relay CH B	FWD LH SIDE CENTER PEDESTAL	Figure 96-2
4962-K5	FADEC Mode Relay CH A	FWD LH SIDE CENTER PEDESTAL	Figure 96-2
4962-K6	FADEC Mode Relay CH B	FWD LH SIDE CENTER PEDESTAL	Figure 96-2
4962-P1	ECU Connector	TRANSMISSION COMPARTMENT	Figure 96-11
4962-P2	ECU Connector	TRANSMISSION COMPARTMENT	Figure 96-11
4962-P3	ECU Connector	TRANSMISSION COMPARTMENT	Figure 96-11
4964-P4	ECU Connector	TRANSMISSION COMPARTMENT	Figure 96-11
4962-P5	ECU Connector	TRANSMISSION COMPARTMENT	Figure 96-11
4962-P6	ECU Connector	TRANSMISSION COMPARTMENT	Figure 96-11
4962-P7	Engine Compartment Disconnect Connector	ENGINE COMPARTMENT	LMM-HTS900-2-1D
4962-P8	Engine Compartment Disconnect Connector	ENGINE COMPARTMENT	LMM-HTS900-2-1D
4962-P8A	Transmission Compartment Disconnect Connector	TRANSMISSION COMPARTMENT	LMM-HTS900-2-1D
4962-P9	Engine Compartment Disconnect Connector	ENGINE COMPARTMENT	LMM-HTS900-2-1D

REFERENCE DESIGNATOR	COMPONENT DESCRIPTION	LOCATION	FIGURE NO.
4962-P196	Cabin Compartment Disconnect Connector	FWD CABIN ROOF	Figure 96-11
4962-P197	Cabin Compartment Disconnect Connector	FWD CABIN ROOF	Figure 96-11
4962-R1	Collective Pitch Transducer	UNDER COPILOT SEAT	Figure 96-5
4962-R2	Collective Pitch Transducer	UNDER COPILOT SEAT	Figure 96-5
4962-S5	Throttle Detent Switch	PLA ASSEMBLY, UNDER PILOT SEAT	Figure 96-5
4962-S6	Start Switch	COLLECTIVE SWITCH BOX	Figure 96-5
4962-S7	FADEC Reset Switch	INSTRUMENT PANEL	Figure 96-6
4962-S9	Emergency Fuel Valve Switch	INSTRUMENT PANEL	Figure 96-6
4962-S10	Chip Detector Test Switch	INSTRUMENT PANEL	Figure 96-6
4962-TB1	FADEC Terminal Block Assembly	FWD LH CENTER PEDESTAL	
4962-VR1	Voltage Regulator	UNDER PILOT SEAT	

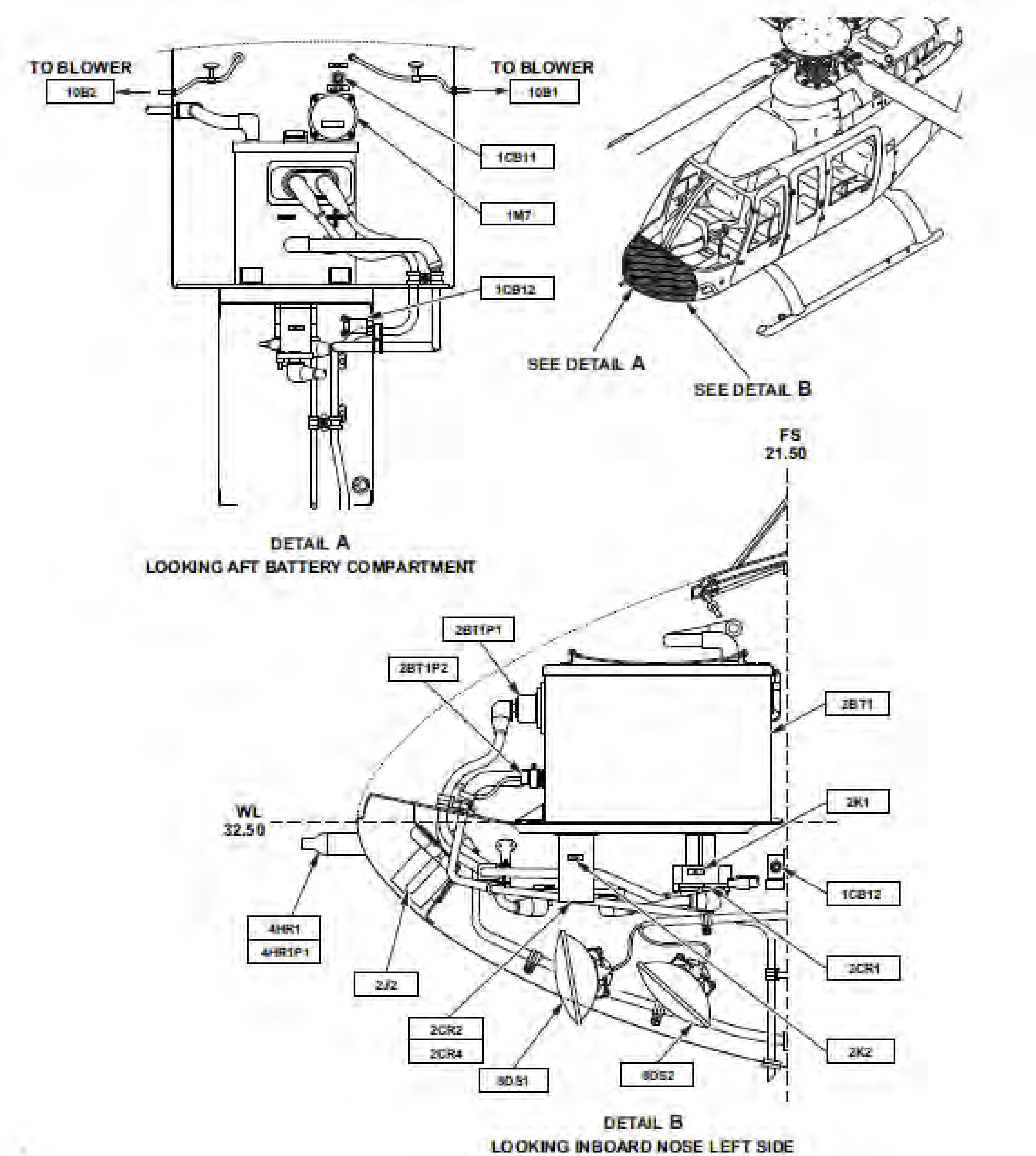


Figure 96-1: Electrical and Electronic Components - Location

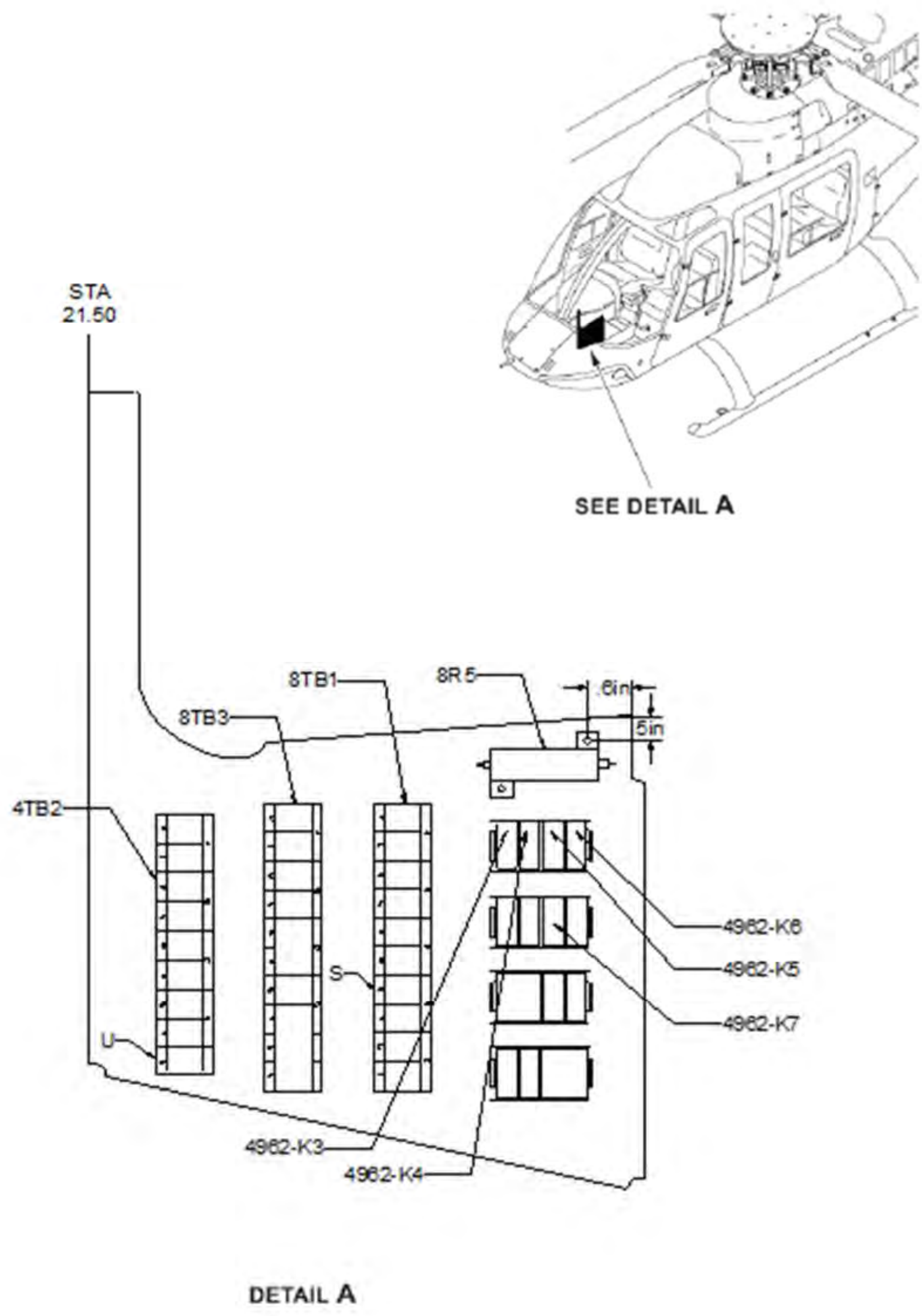


Figure 96-2: Electrical and Electronic Components - Location

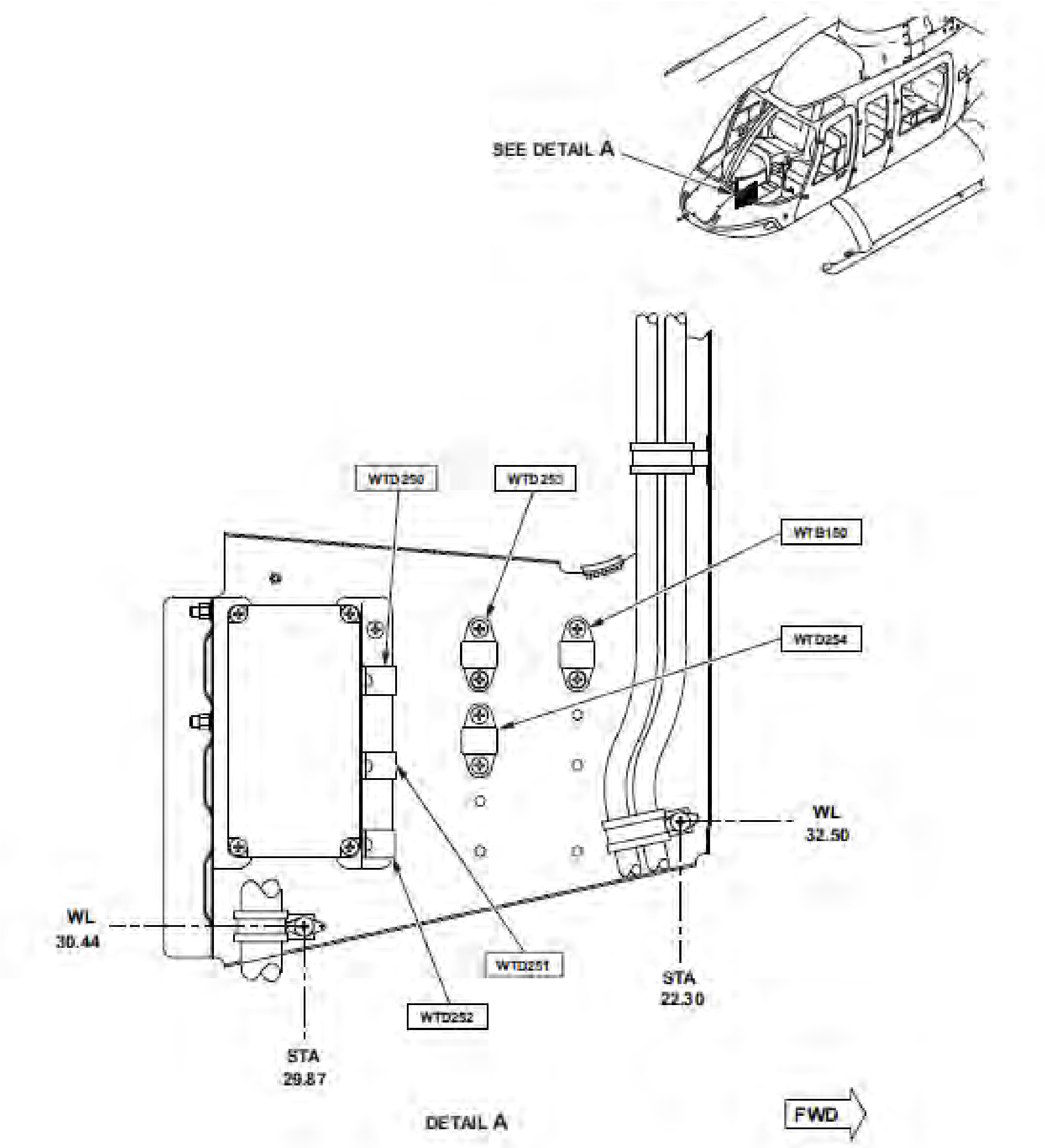


Figure 96-3: Electrical and Electronic Components - Location

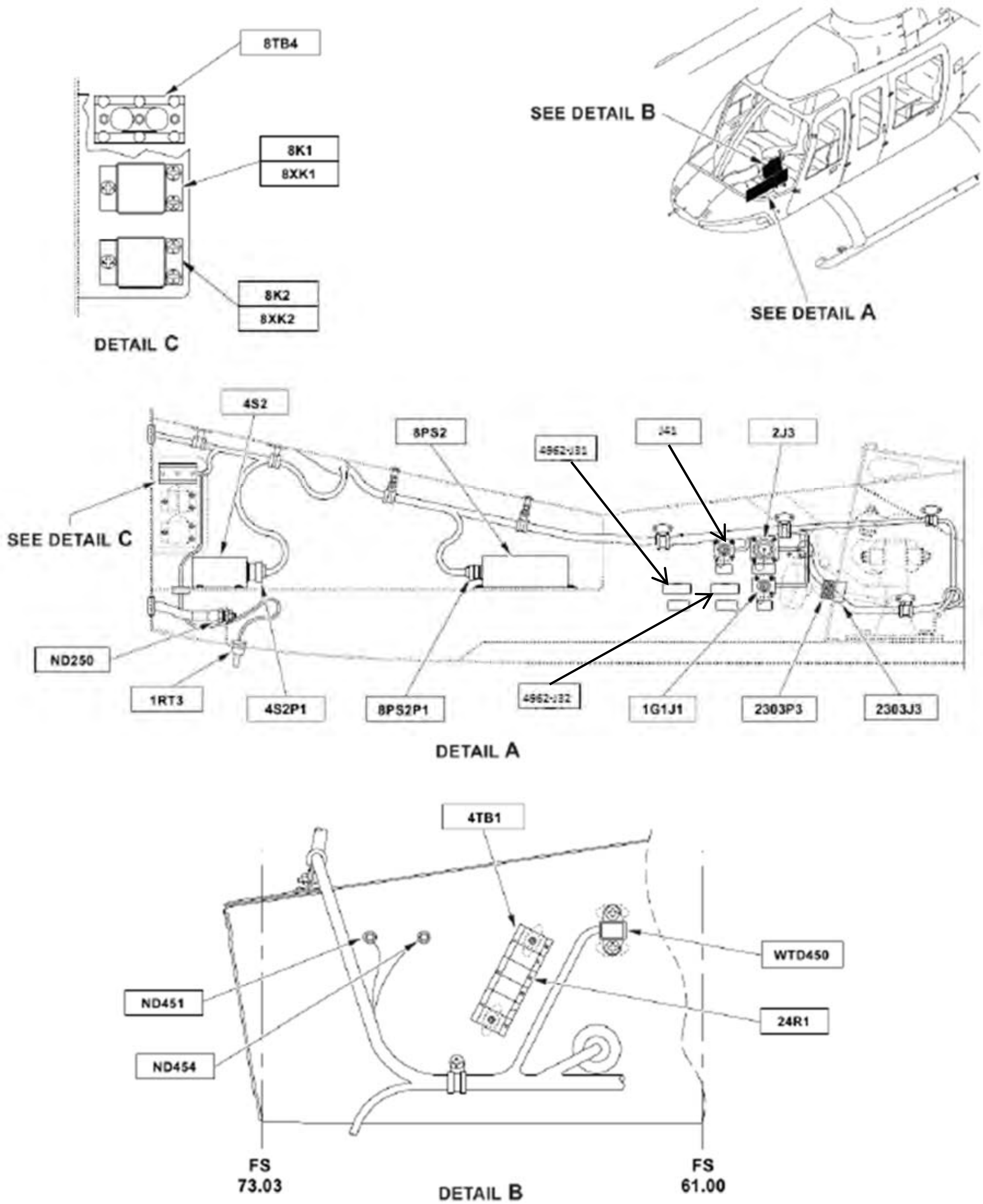


Figure 96-4: Electrical and Electronic Components - Location

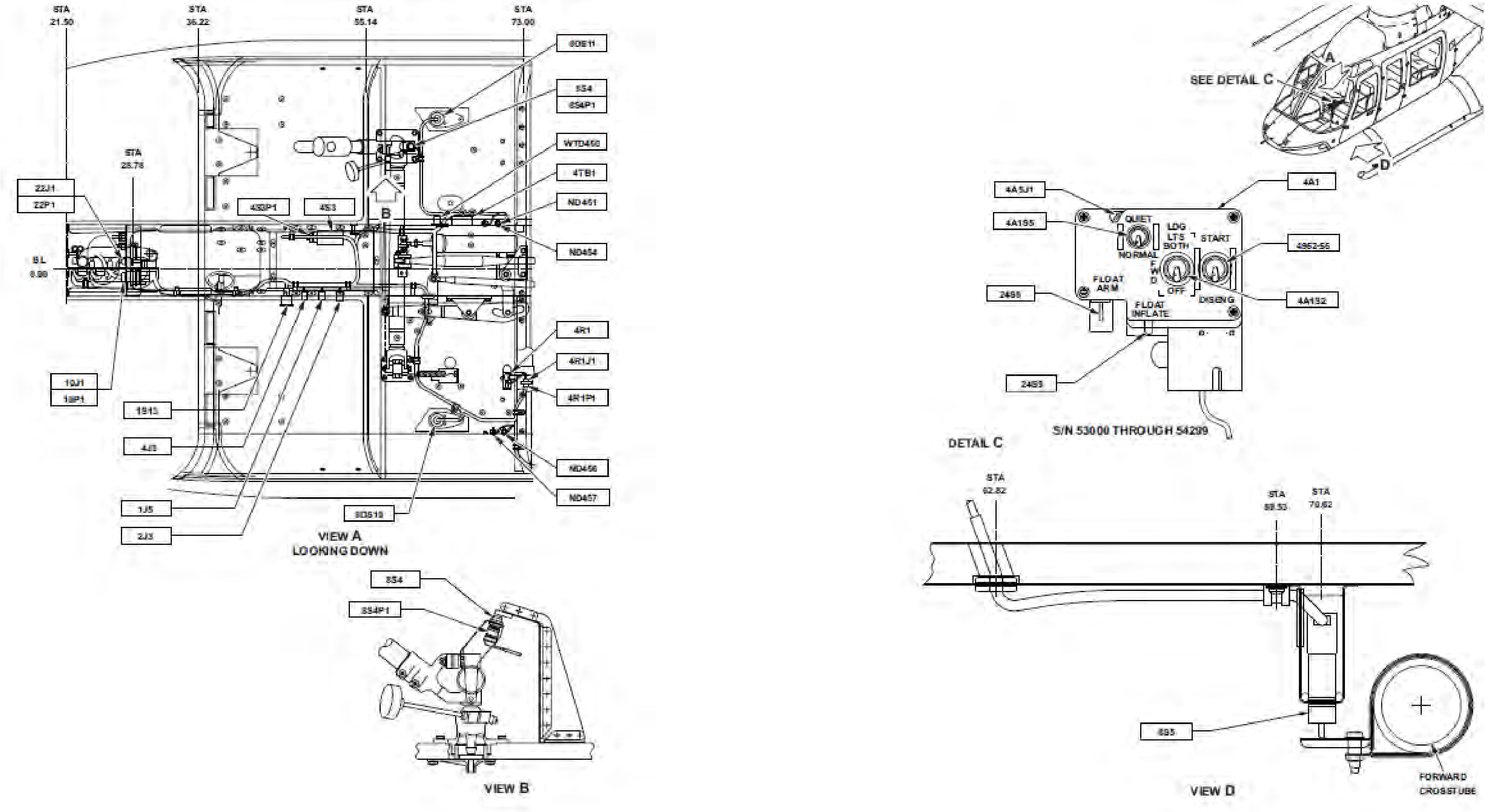


Figure 96-5: Electrical and Electronic Components - Location

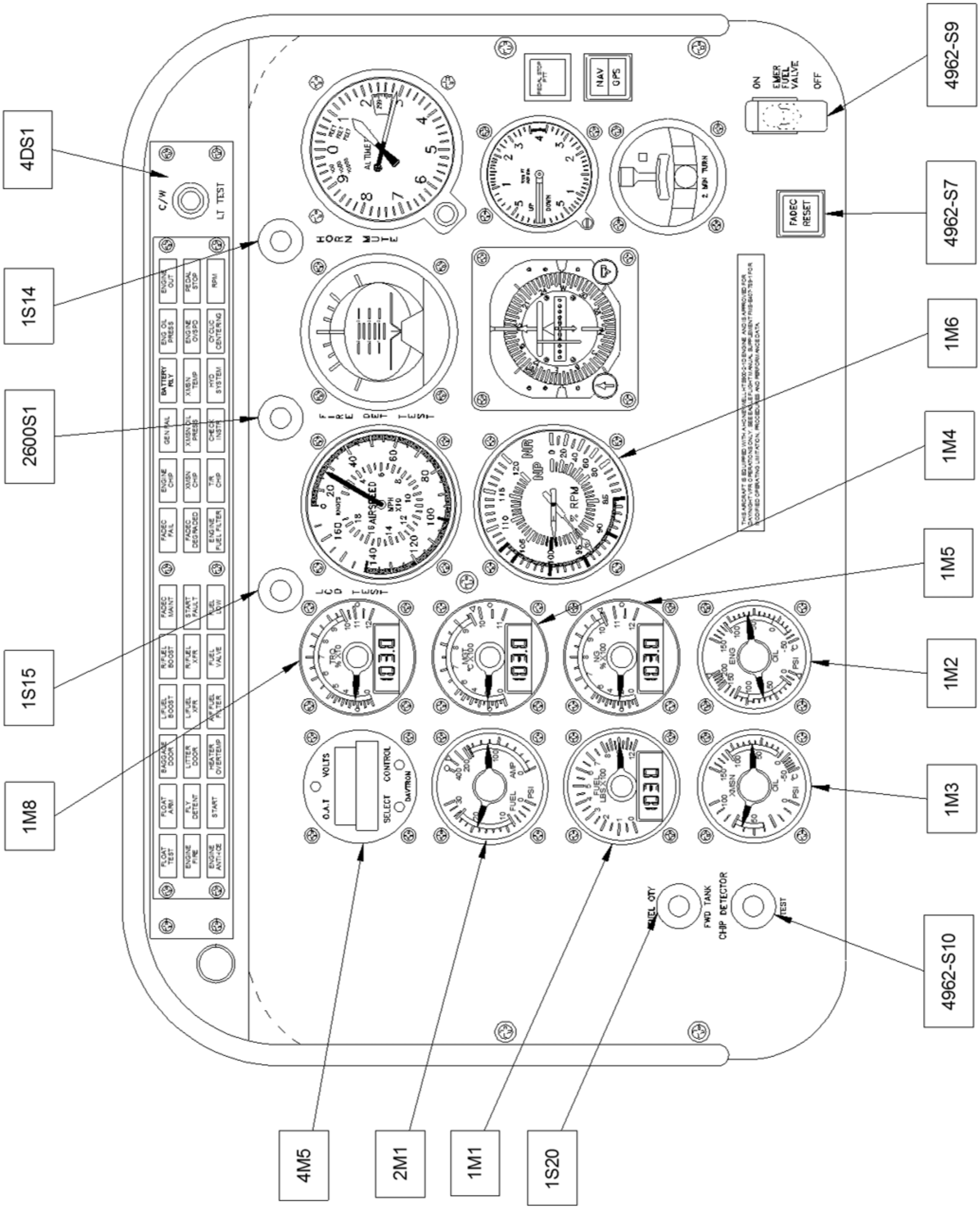


Figure 96-6: Electrical and Electronic Components - Location

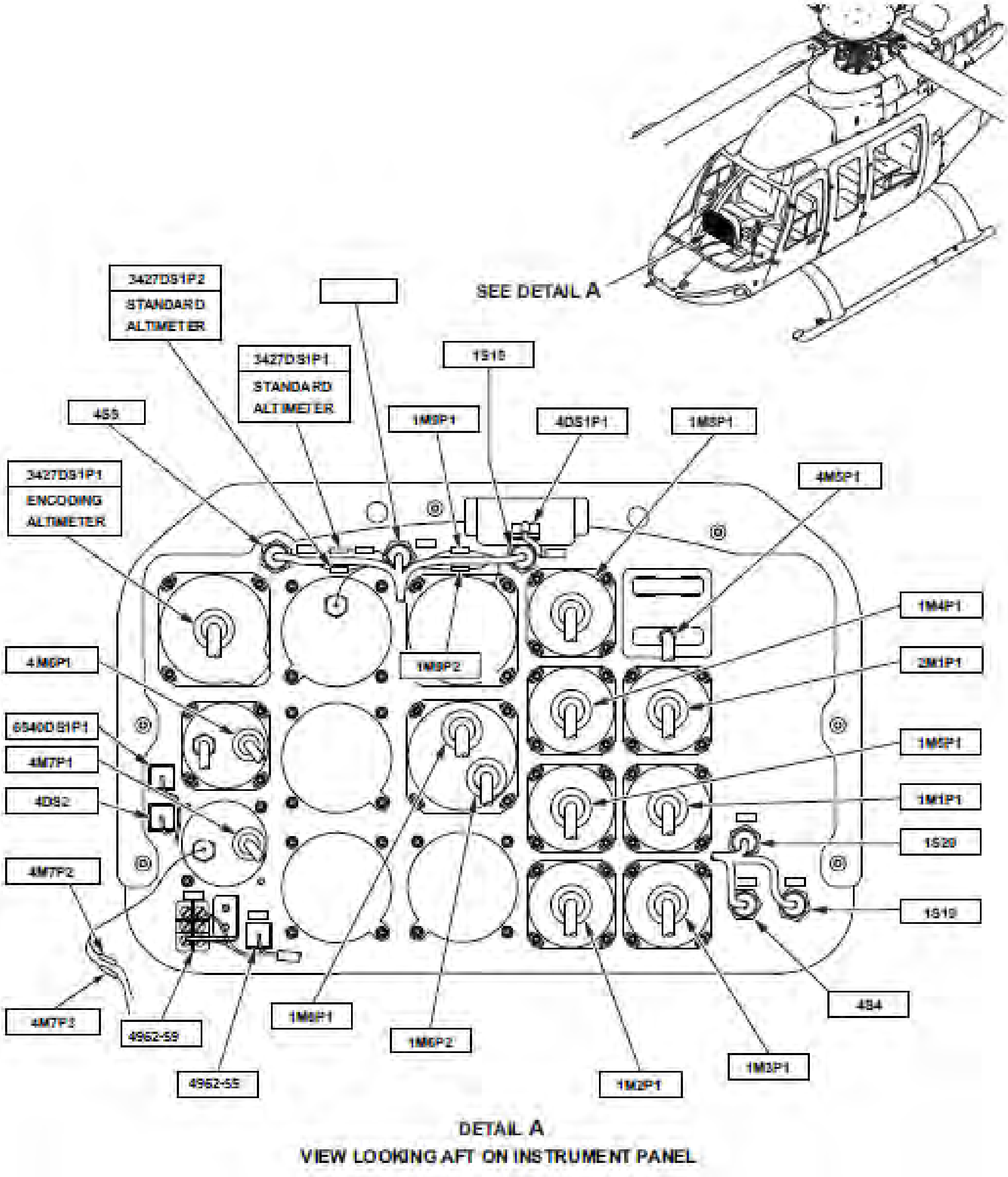
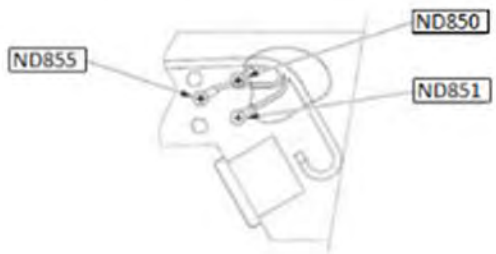


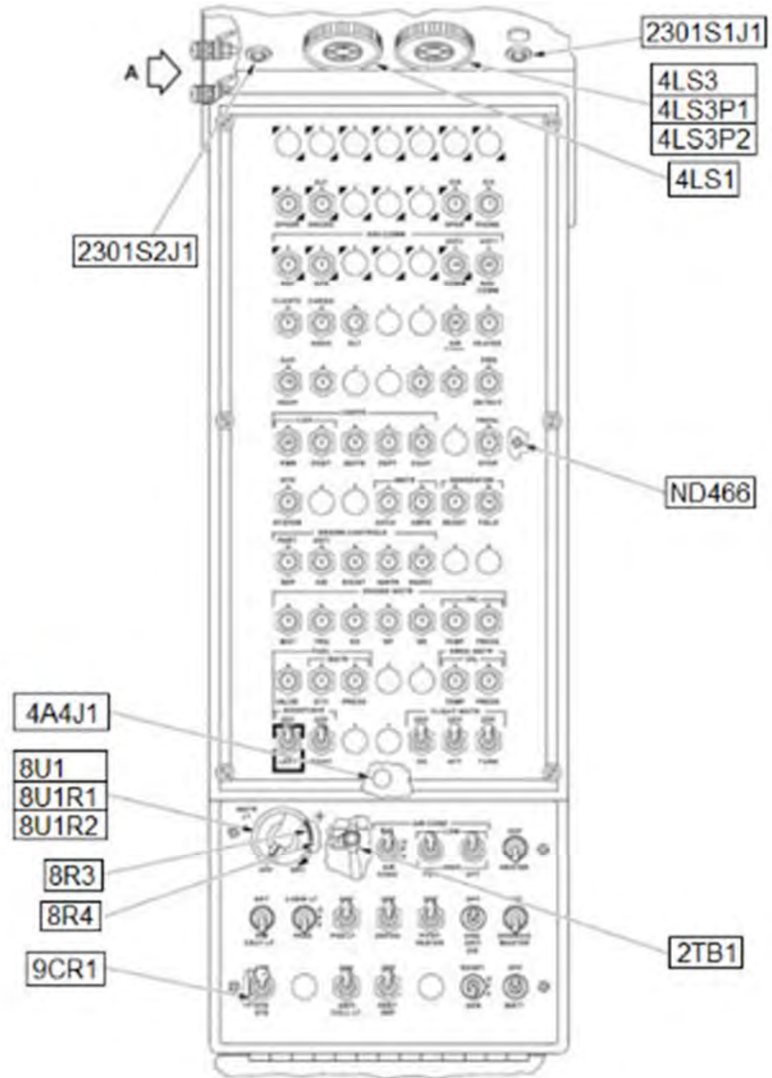
Figure 96-7: Electrical and Electronic Components - Location



VIEW A
(LOOKING INBOARD FROM LEFT SIDE)

CIRCUIT BREAKER PLACEMENT CHART						
SPARE	SPARE	SPARE	SPARE	SPARE	SPARE	SPARE
3410CB1	3427CB1	SPARE	SPARE	SPARE	2301CB1	2301CB1
3406CB1	3415CB1	SPARE	SPARE	SPARE	2303CB2	2303CB2
24CB1	4CB5	2321CB1	SPARE	SPARE	10CB3	10CB2
2CB5	SPARE	4962CB4	4962CB3	4962CB2	4962CB1	2600CB1
8CB2	8CB6	8CB1	8CB5	4CB1	SPARE	6540CB1
9CB1	SPARE	SPARE	1CB20	1CB23	2CB4	2CB3
1CB14	1CB4	1CB1	1CB2	1CB16	SPARE	SPARE
1CB10	1CB25	1CB22	1CB24	1CB21	1CB9	1CB17
1CB7	1CB8	1CB9	SPARE	SPARE	1CB15	1CB18
1CB6	1CB5	SPARE	SPARE	4CB6	4CB3	4CB4

SWITCH/CIRCUIT BREAKER PLACEMENT CHART						
8U1		SPARE	10S2	10S3	10S3	10S1
4A2S3	8S6	8CB4	10CB1	4CB2	4A2S1	3CB1
4A2S2	SPARE	8CB3	4CR6 4A2S4	SPARE	2S2	2S1



OVERHEAD PANEL
VIEW LOOKING UP

Figure 96-8: Electrical and Electronic Components - Location

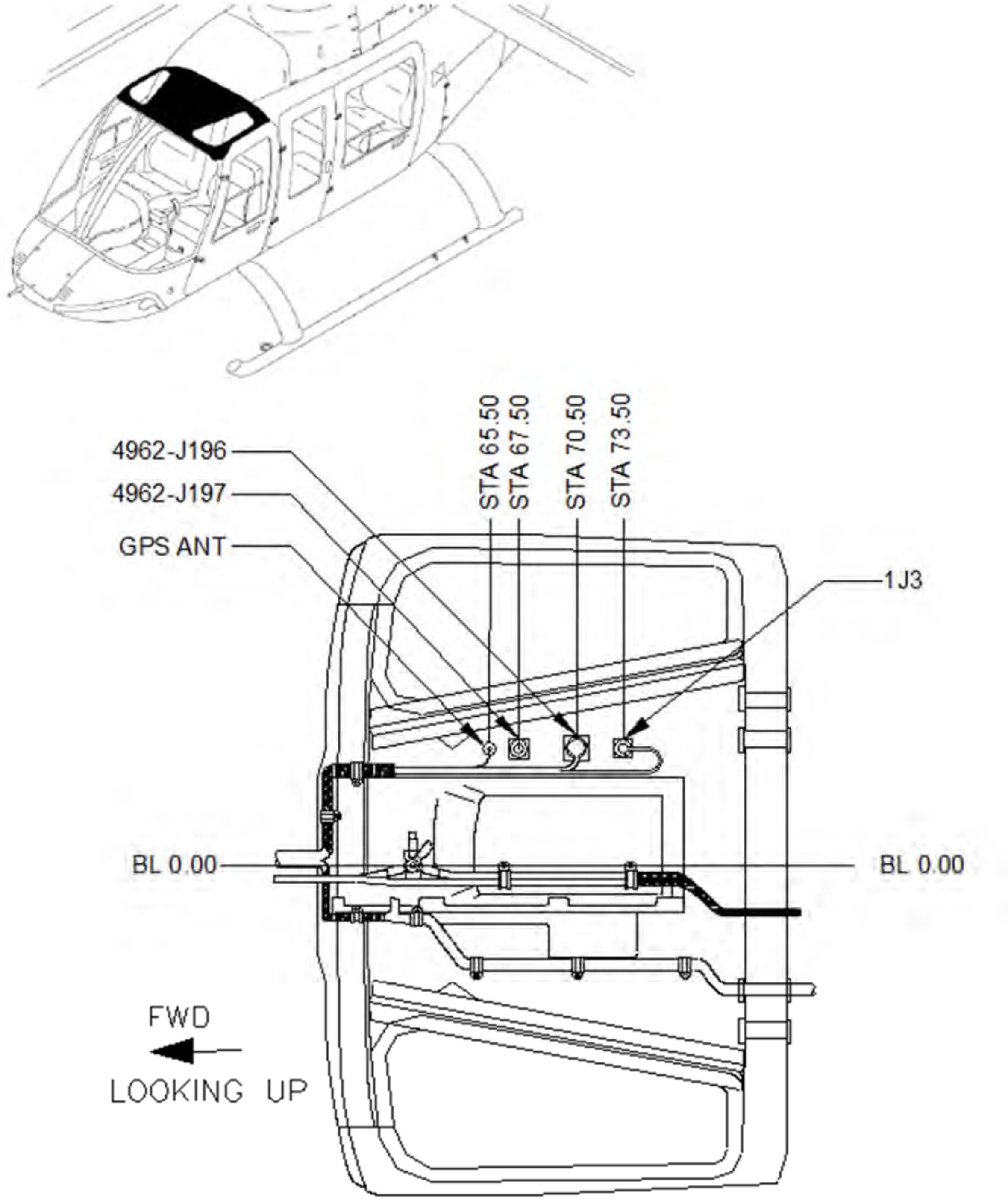


Figure 96-9: Electrical and Electronic Components - Location

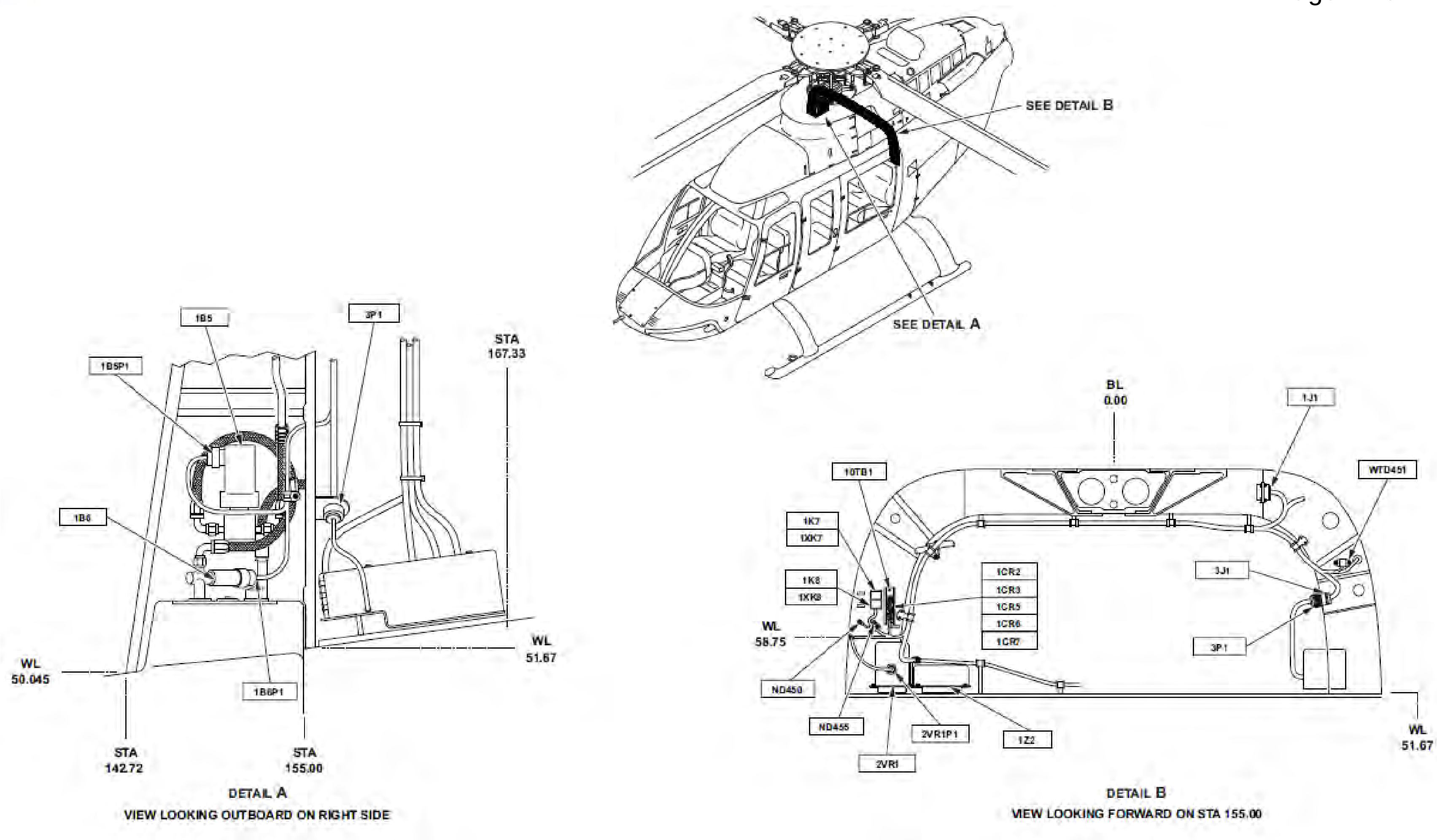
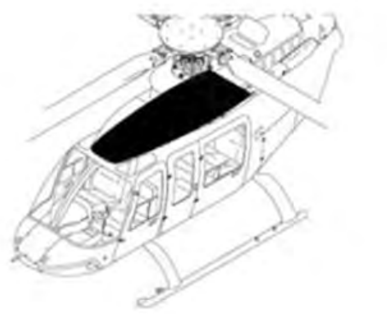


Figure 96-10: Electrical and Electronic Components - Location



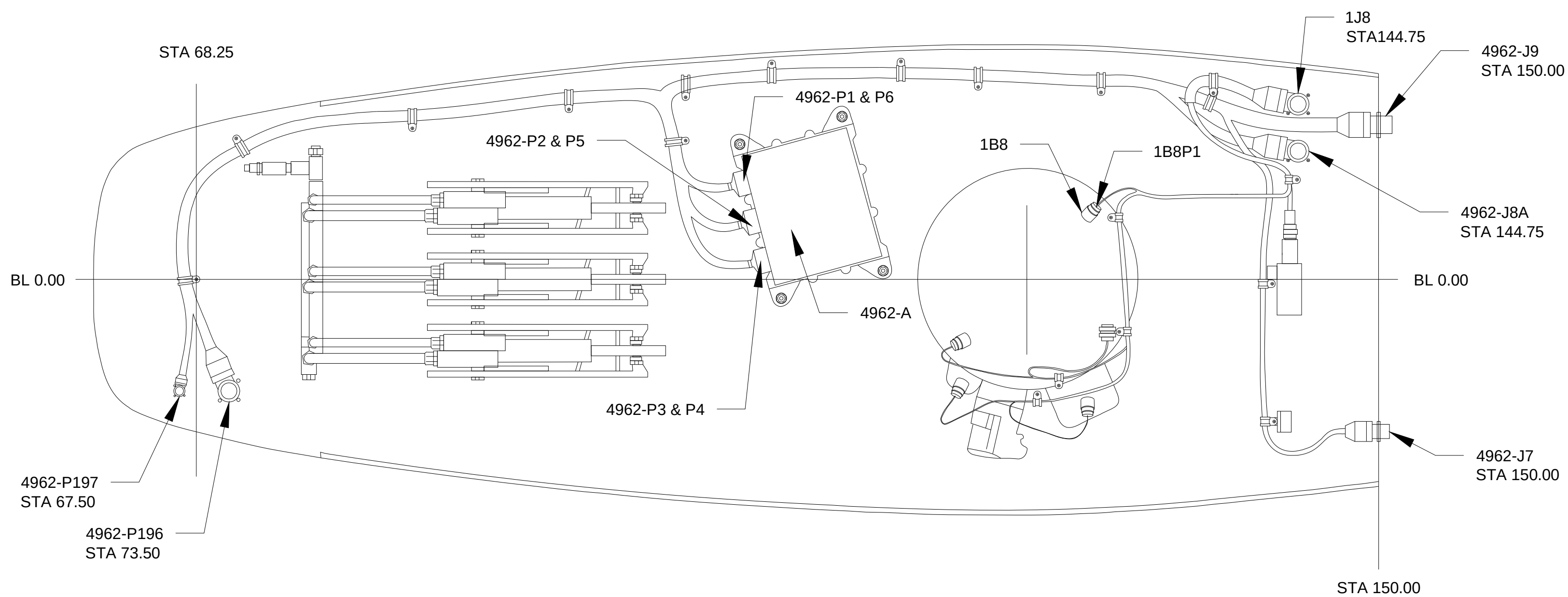


Figure 96-11: Electrical and Electronic Components - Location

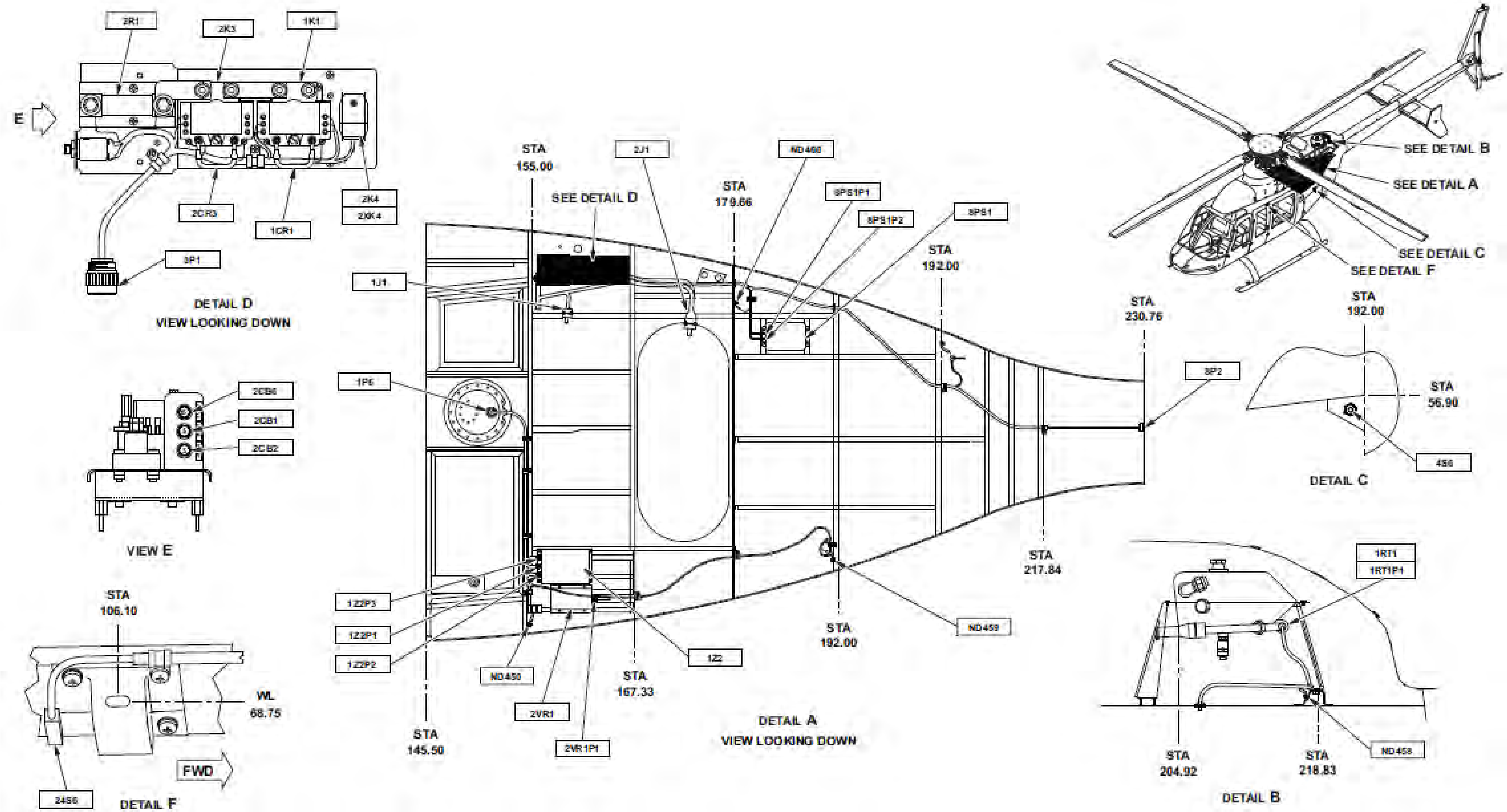


Figure 96-12: Electrical and Electronic Components - Location

96.1.12CIRCUIT, WIRES, AND CABLE HARNESS — DESIGNATIONS

The information that follows is necessary to troubleshoot and maintain the helicopter electrical circuits for Eagle 407HP. Each wire, cable, and cable harness is physically marked for identification on wiring diagrams. All of the wires installed in the helicopter are identified with an identification code. The identification code is stamped on the wire. The identification code identifies the electrical system, wire number, wire segment, wire size, and the circuit function. The identification of wires can be accomplished with the use of the identification codes as specified in the related wiring diagram.

96.1.12.1. WIRE IDENTIFICATION CODE — DESCRIPTION

Each wire is stamped with an identification code approximately every 6 inches along its entire length. The identification code shows the circuit function, wire number for that circuit, the segment of a specific wire number, the wire size, and if applicable, ground. Refer to Figure 96-13.

NOTE

Some customized installation may use additional codes not listed in Figure 96-13. The circuit function is the first letter, or letters, of the identification code. In the event there is more than one circuit of that type, there is a number that precedes the letter to identify the individual circuit.

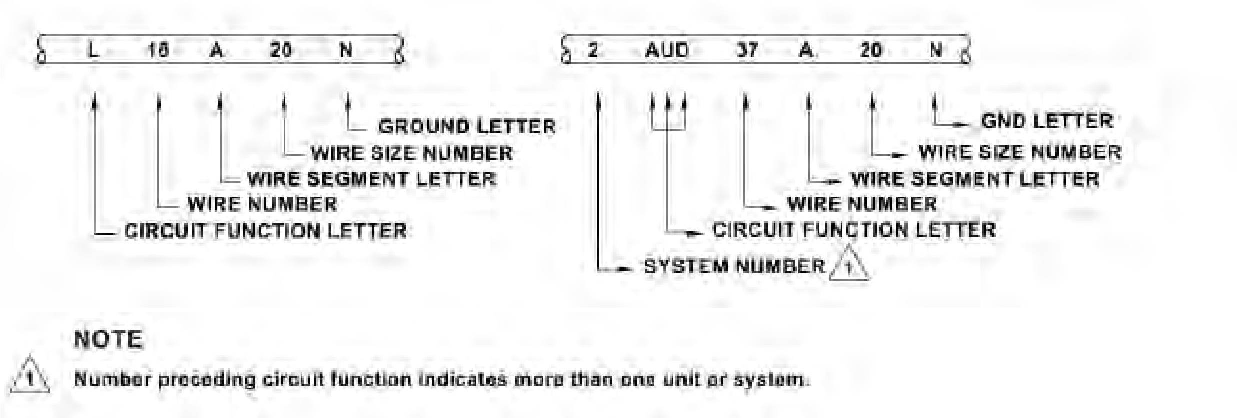
The next designation is the wire number for a particular circuit. This number identifies the complete wire run between two components. Typically it is from a power source or bus to the control component or a wire from the control component to an actuator, motor, or indicator. Refer to the example shown in Figure 96-14.

Each segment of a wire number is marked at the start with a letter A at the power or control source. Each time the wire number is interrupted by a terminal board, connector, etc., the wire segment is changed to the next available letter in the alphabetical sequence. Refer to the example shown Figure 96-14.

The wire size number denotes the wire size to American Wire Gauge (AWG) standards. The letter N designates a wire as part of a ground circuit if it is present.

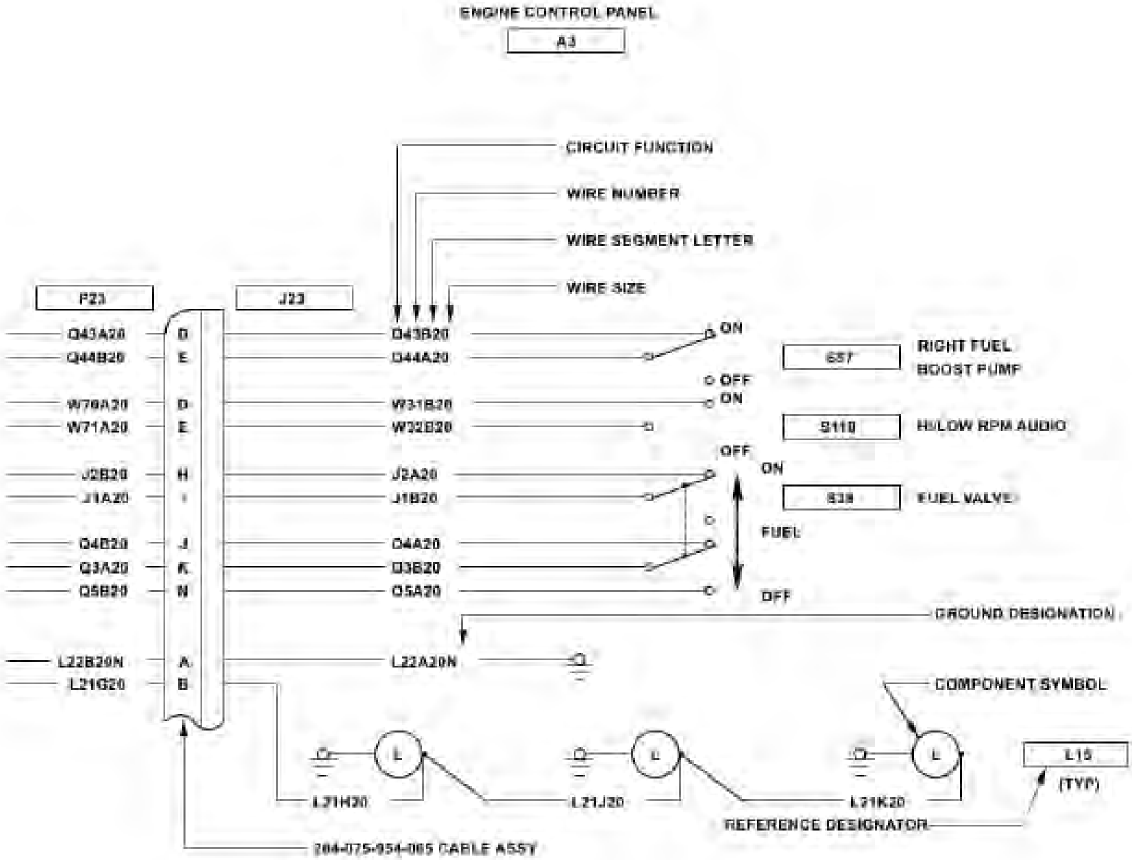
96.1.12.2. WIRE HARNESS AND CABLE DESIGNATION

Wire harnesses and cable assemblies are marked by part number on a white teflon sleeve or label placed within 3 inches of the termination connector. Refer to Figure 96-14.



Code	Nomenclature	Code	Nomenclature
ADF	Automatic Direction Finder	Q	Fuel and Oil
ALT	Encoding Altimeter	R	Radio (Navigation and communication)
ARC	UHF Communication	RD	Direction Finder
AUD	Audio Intercommunication (ICS)	RF	VHF Liaison
C	Control Surfaces	RL	HF Communication
CMPS	Compass	RM	Marker Beacon
D	Instruments (Other Than Flight or Engine)	RN	Navigation/Artificial Horizon
E	Engine Instruments	RU	UHF Command
ELT	Emergency Locator Transmitter	RV	VHF Command
F	Flight Instruments	RZ	Interphone and Headphone
FL	Electrical Filter	V	DC Power and DC Control Cables For AC System.
GS	Glide Slope	VHF	VHF Communication
GPS	Global Positioning System	W	Warning and Emergency
GYRO	Gyromagnetic Compass	X	AC Power
H	Heating, Ventilating and Deicing	XPDR	Transponder
J	Ignition	ECU	Engine Control Unit
K	Engine Control	FMU	Fuel Metering Unit
L	Lighting		
M	Miscellaneous Electric		
N	Ground		
NAV	Navigation VOR/LOC		
P	DC Power		

Figure 96-13: Electrical Wires Identification Code – Description



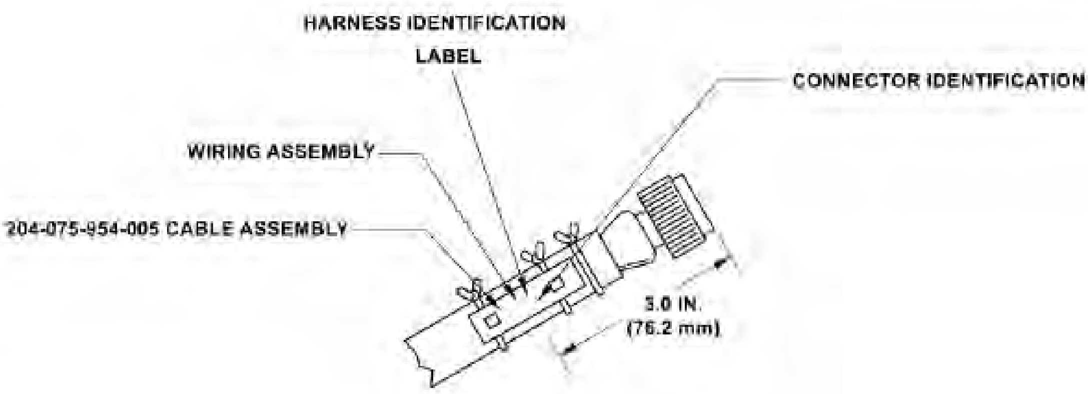


Figure 96-14: Circuit Identification – Example

96.2. DC POWER SYSTEM

96.2.1 DC POWER SYSTEM

The DC power system includes the battery system, external power system, starting-ignition system, and DC generator system. The primary electrical system is a 28 volt direct current (VDC), single conductor system (Figure 96-15). The primary power source is a 30 volt, 200 ampere starter generator.

A single DC bus arrangement that can be supplied from the generator, battery, or external power source, distributes the DC power. The DC bus distributes voltage to the overhead circuit breakers. The circuit breakers supply the DC voltage to their associated electrical components that use DC power. Under normal operation conditions, the generator supplies regulated power to the 28 VDC bus. A solid-state voltage regulator regulates the output voltage of the generator. A circuit breaker switch distributes the power from the 28 VDC bus to the avionics bus.

In the event the generator does not operate, the helicopter battery supplies emergency electrical power. The 24 volt, 28 amp/hour battery also supplies power for an engine start. The helicopter may also be powered or started from an external DC power source.

96.2.2 BATTERY SYSTEM

The function of the battery system is to supply power from the battery to the DC power system. Control of the circuit is obtained through the use of the battery relay (2K1) and the battery switch. During normal flight operations, the battery will be charged through the battery relay (2K1) by the generator.

The battery system includes the components that follow:

- Battery (2BT1)
- Battery power connector (2BT1P1)
- Battery relay (2K1)
- Battery switch (2S1)

A battery vent installation is connected to the battery to ventilate the gas fumes and the heat generated by the battery.

96.2.2.1. BATTERY

NOTE

Information pertaining to specific battery maintenance should be obtained from the battery manufacturer maintenance manual.

The battery (2BT1) is installed in the battery compartment of the nose section. The battery is a source of power for engine start and it also supplies emergency DC power if required. The battery is a 24 VDC valve regulated lead-acid (VRLA) battery with a rated capacity of 34 Amp/hours.

The pressure relief valve is designed to open when the internal pressure of a cell is approximately 1.5 psi above the external pressure. This valve prevents excessive pressure buildup when the battery is being charged, and automatically reseals once the pressure is released. A slight bulge in the battery container may occur when the internal pressure increases slightly, but not enough to open the valve. Alternatively, if the valves open and the external pressure can be greater than the internal pressure, it may result in a concave battery container. Both of these conditions are normal and do not affect the battery's operation.

96.2.2.2. BATTERY — GENERAL WARNINGS

WARNING

FOLLOW THE WARNINGS THAT FOLLOW WHEN YOU HANDLE AND WORK ON A LEAD - ACID BATTERY. FAILURE TO OBEY THESE INSTRUCTIONS CAN CAUSE SERIOUS INJURY TO PERSONNEL.

DO NOT WEAR JEWELRY WHEN YOU WORK ON OR HANDLE A LEAD-ACID BATTERY. ACCIDENTAL CONTACT OF JEWELRY WITH A BATTERY PART THAT CARRIES CURRENT CAN CAUSE A SHORT THAT COULD CAUSE SERIOUS BURNS.

USE ONLY TOOLS THAT ARE COVERED WITH A NON-CONDUCTIVE INSULATION MATERIAL. IF YOU DROP A METAL TOOL IN THE BATTERY, A SHORT-CIRCUIT BETWEEN THE CELL CONNECTION BARS COULD RESULT. THE SHORT-CIRCUIT COULD CAUSE ARCS THAT COULD DAMAGE THE BATTERY AND CAUSE SERIOUS INJURY TO PERSONNEL.

WEAR SAFETY GLASSES TO AVOID CONTACT OF THE ELECTROLYTE WITH THE EYES. IF THE ELECTROLYTE GETS IN CONTACT WITH THE EYES, IMMEDIATELY WASH THE EYES WITH A LARGE QUANTITY OF WATER. GET IMMEDIATE MEDICAL ATTENTION.

TO PREVENT DAMAGE TO THE CONNECTOR, ARC BURNS, OR EXPLOSION, BATTERIES SHOULD NEVER BE CONNECTED OR DISCONNECTED WHILE BEING CHARGED OR DISCHARGED. ENSURE THE AIRCRAFT BATTERY SWITCH, EXTERNAL POWER SOURCE IS IN THE "OFF" POSITION BEFORE CONNECTING OR DISCONNETING THE BATTERY. BATTERY TERMINAL PROTECTORS SHOULD BE INSTALLED WHENEVER THE BATTERY IS NOT CONNECTED IN THE AIRCRAFT OR TO THE TEST EQUIPMENT.

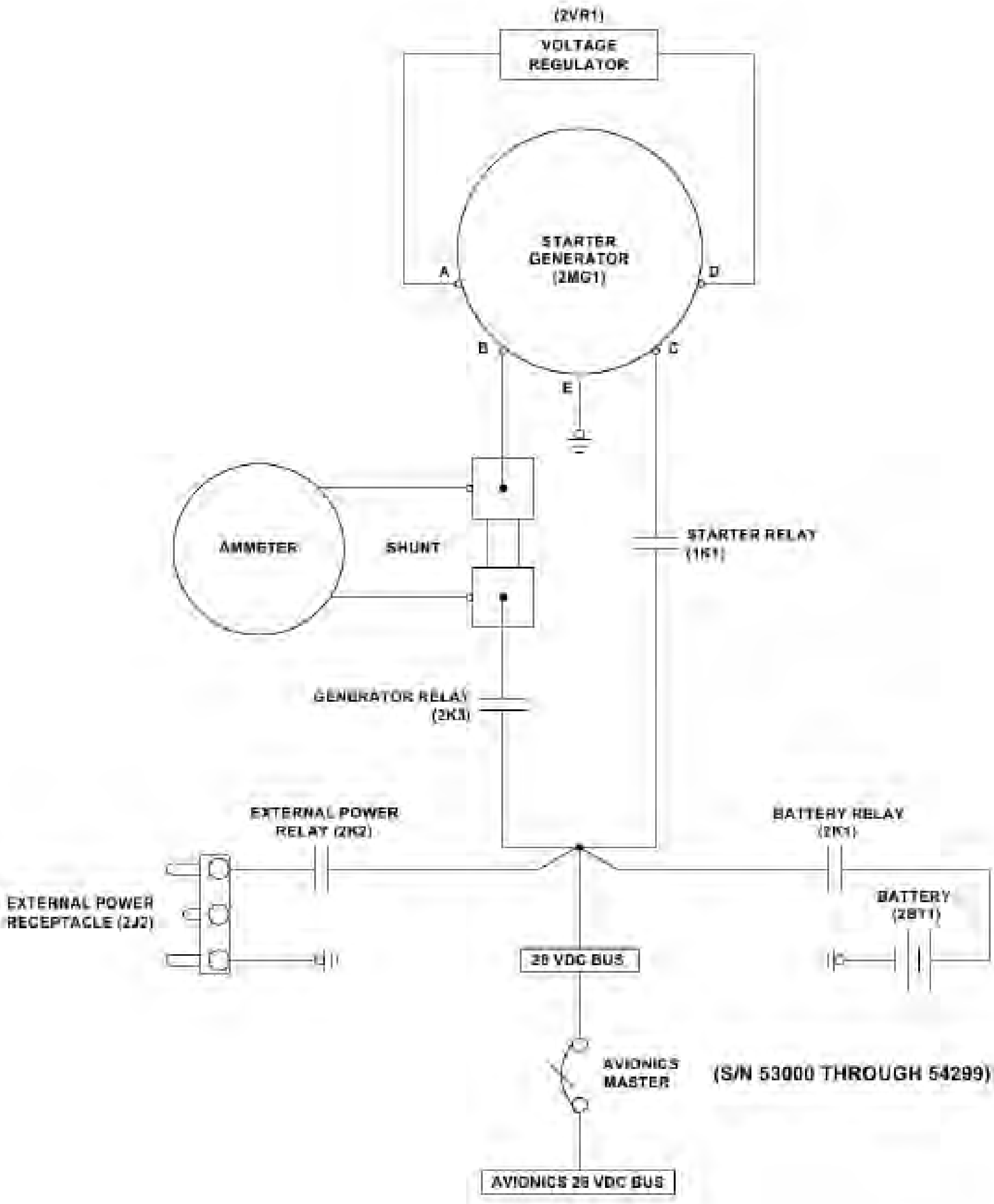


Figure 96-15: DC Power System - Simplified Schematic

96.2.2.3. BATTERY VENT

The battery vent installation connected between a ram air inlet and the battery case. An exhaust tube connects the opposite side of the battery case to an outlet installed on the lower fuselage. In flight, the ram air inlet collects the ram air and distributes it to the inside of the battery case. The ram air exits the battery case through the vent tube and is evacuated overboard.

96.2.2.4. BATTERY RELAY (2K1)

The battery relay (2K1) is installed under the shelf of the battery compartment. The battery relay connects the battery to the 28 VDC bus and to the start/ignitor and generator systems. The battery relay has one main contact and two individual auxiliary contacts. The main contact, A1 to A2, supplies battery power to the DC bus when it is closed. One of the two auxiliary contacts, 21 to 22, supplies a ground path to the caution/warning/advisory panel. The auxiliary contact supplies the ground path if the battery relay fails in the closed position with the BATT SWITCH set to OFF. The ground causes the BATTERY RLY caution annunciator of the caution/warning/advisory panel caution message to come on. The second set of auxiliary contacts is not used.

A suppression diode assembly (2CR1) is installed between terminals X1 and X2 of the relay coil. The function of the suppression diode is to decrease the back EMF when the relay is de-energized. When power is removed from the battery relay, it generates a reverse high voltage. The zener diode of the suppression diode assembly quickly decreases the reverse high voltage to zero. When the battery relay energizes, the diode of the suppression diode assembly stops the flow of current to ground.

96.2.2.5. BATTERY SWITCH (2S1)

The battery switch (2S1) is installed on the overhead console. The battery switch has two internal sets of contacts, and does the functions that follow:

- Controls the activation of the battery relay (2K1)
- Supplies a ground path to the circuit of the BATTERY RLY caution annunciator on the caution/warning/advisory
- Configures the DC power feed for the left boost and transfer pumps between the helicopter battery and the 28 VDC bus

96.2.2.6. BATTERY SYSTEM — OPERATION

With the battery connected to the battery power connector (2BT1P1), DC power will be supplied to terminals A2 and X1 of the battery relay (2K1), and terminal 5 of the fuel valve switch. With the battery switch set to ON, a ground path is provided through the switch to terminal X2 of the relay coil, which allows the battery relay to energize and close the contacts of the relay. The closed main contact, A2 to A1, will then supply battery voltage to the 28 VDC bus through the terminal junction (2TB1). Battery voltage is supplied also to the starter relay (1K1). Refer to Figure 96-16.

When the battery switch (2S1) is set to OFF, the ground path to the coil of the relay is opened, which de-energizes the relay and opens the contacts. In the event the main contact, A2 to A1, does not open, a ground path is provided through the battery switch and one set of the relay auxiliary contacts to the BATTERY RLY caution annunciator of the caution/warning/ advisory panel (4DS1). This will illuminate the BATTERY RLY caution annunciator.

In addition, a DC power path is provided from the 28 VDC bus for operation of the left fuel boost pump and left fuel transfer pump when the battery switch is set to the ON position.

In the event the battery switch has to be set to the OFF position during flight, the DC power feed to the left fuel boost pump and the left fuel transfer pump is re-directed, through the battery 28 VDC bus to the helicopter switch, from the battery. In this configuration, the DC power supply from the battery to the left fuel boost pump and the left fuel transfer pump is fed through the fuel valve switch, when set to the ON position, and through the battery switch.

96.2.2.6.1 Battery System — Operational Check

NOTE

For this operational check, external DC power must be disconnected. This operational check uses the voltmeter, low rotor RPM and engine out horns activation to detect the presence, or absence, of power on the 28 VDC bus.

1. Disconnect the battery power connector (2BT1P1) from the battery.
2. Close all circuit breakers in the overhead circuit breaker panel.
3. Make sure the throttle is in the CUT-OFF position.
4. Set the battery switch to OFF.
5. Connect the battery power connector (2BT1P1) to the battery.

RESULT:
- The voltmeter and warning horns do not operate.

CORRECTIVE ACTION:
- If the voltmeter and warning horns operate (the battery output voltage is supplied to the 28 VDC bus), refer to Trouble No. 1 (Figure 96-17).

NOTE

The low rotor horn and engine out horn operates continuously.

6. Set the battery switch to ON.

RESULT:
- The warning horns operate.
- The voltmeter indicates battery voltage.

CORRECTIVE ACTION:
- If the voltmeter and warning horns do not operate (the battery output voltage is not supplied to the 28 VDC bus), refer to Trouble No. 2 (Figure 96-18).

7. On the overhead console, set the battery switch to OFF.

RESULT:
- The voltmeter and warning horns do not operate.

CORRECTIVE ACTION:
- If the voltmeter and warning horns operate (the battery output voltage is supplied to the 28 VDC bus), refer to the troubleshooting chart for Trouble No. 1 (Figure 96-17).

8. Return the helicopter to the standard configuration. Refer to Standard Practices — After Electrical Maintenance or Repairs (paragraph 96.1.1.1.4).

96.2.2.6.2 Battery — Removal

WARNING

OBEY ALL OF THE SAFETY PRECAUTIONS WHEN MAINTENANCE DOING ON OR NEAR ELECTRICAL/ELECTRONIC EQUIPMENT (PARAGRAPH 96.1.1.1.).

1. Remove external power.
2. Unlatch and open the battery access door.
3. Disconnect the battery power connector (2BT1P1) (6) and connector (2BT1P2) (5) (if installed) from the battery (15). Install caps and/or plugs (C-428) on the battery receptacle. Refer to Figure 96-20 and Figure 96-21.
4. On the sides of the battery (15), remove the clamps (1 and 3) and the vent tube assemblies (2 and 4).
5. Remove the bolts (7) and the washers (8) from the front of the battery (15).
6. Remove the lockwire (9), wing nuts (10), lockwashers (11), washers (12), and bushings (13) from the hold down rods (14). Reposition the hold down rods clear of the battery cover hold down arms.

WARNING

HANDLE THE BATTERY WITH CARE. SERIOUS INJURY TO PERSONNEL CAN OCCUR IF THE CORRECT TECHNIQUES TO LIFT AND HANDLE THE BATTERY ARE NOT FOLLOWED. THE WEIGHT OF THE 34 AMP/HOUR LEAD-ACID BATTERY IS APPROXIMATELY 62 POUNDS (28.2 KG).

7. Remove the battery (15) from the battery compartment.

96.2.2.6.3 Battery — Maintenance Practices

NOTE

Batteries shall not be serviced while installed in the helicopter. The battery shall be serviced by authorized battery shop personnel only.

NOTE

The procedure that follows is intended to provide a quick means to determine the state of charge of the battery. It cannot be used to measure the capacity of the battery. Measure the capacity of the battery as per the battery manufacturer maintenance manual.

To find the state of charge of the battery, set the battery switch from BATT to OFF, with the generator online, and monitor the indication on the ammeter. If the indication change between the BATT and OFF position of the battery switch is less than 8 amps, the battery is charged.

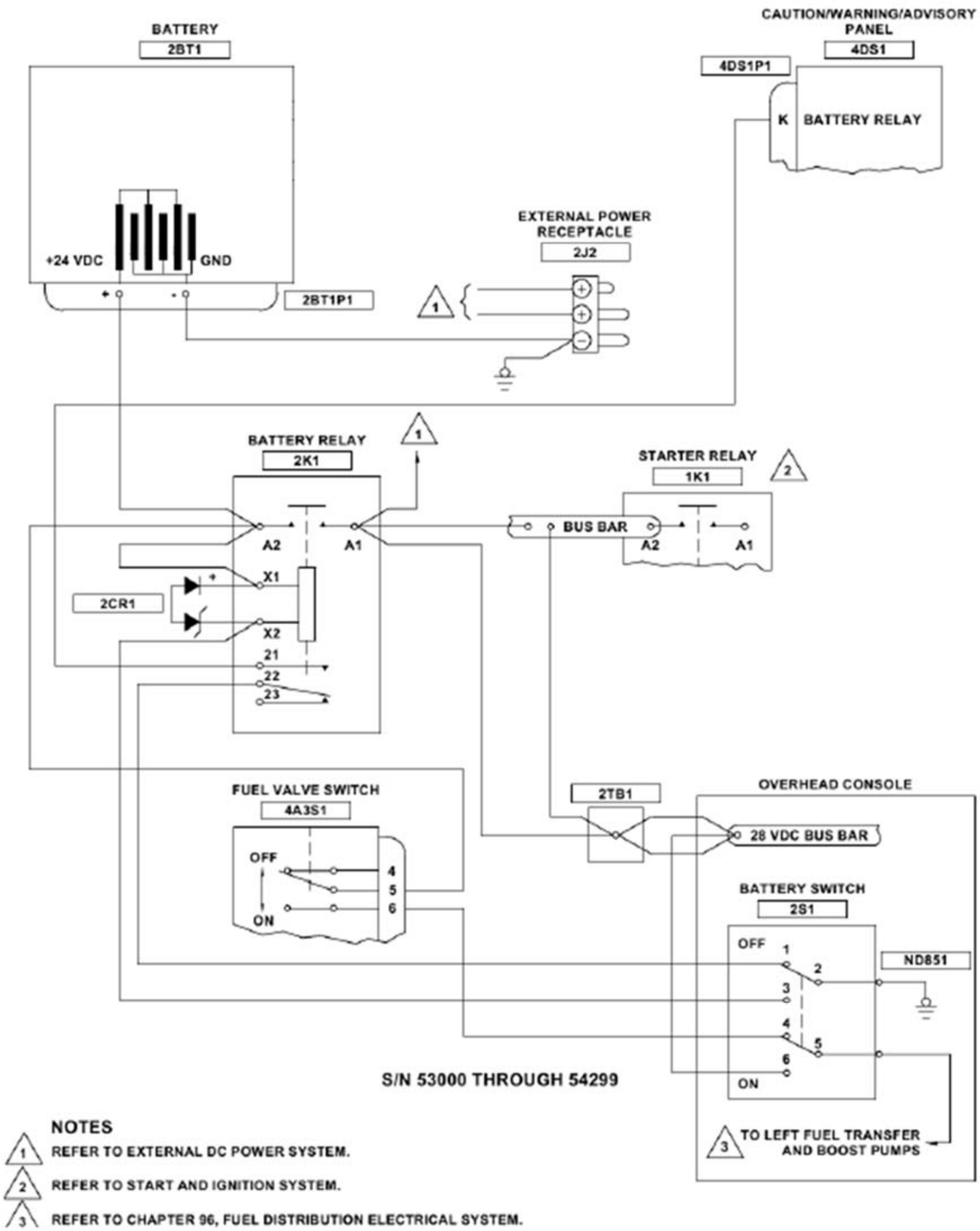


Figure 96-16: Lead-Acid Battery System - Simplified Schematic

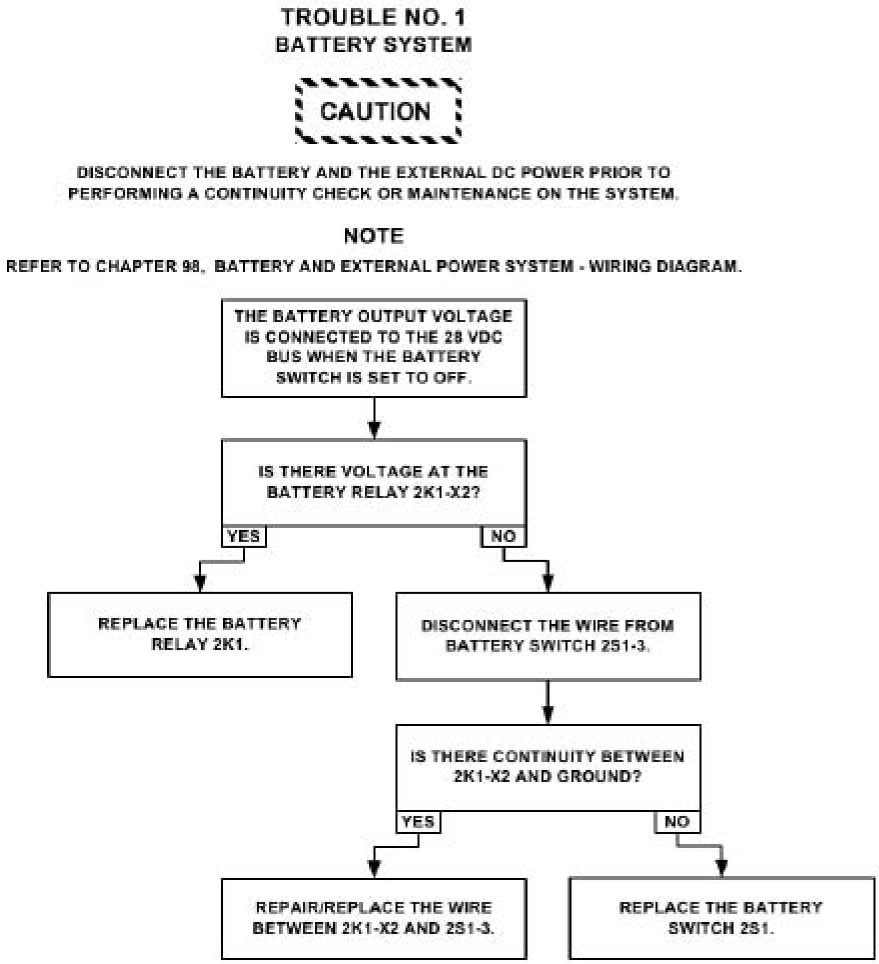


Figure 96-17: Battery System - Trouble No. 1

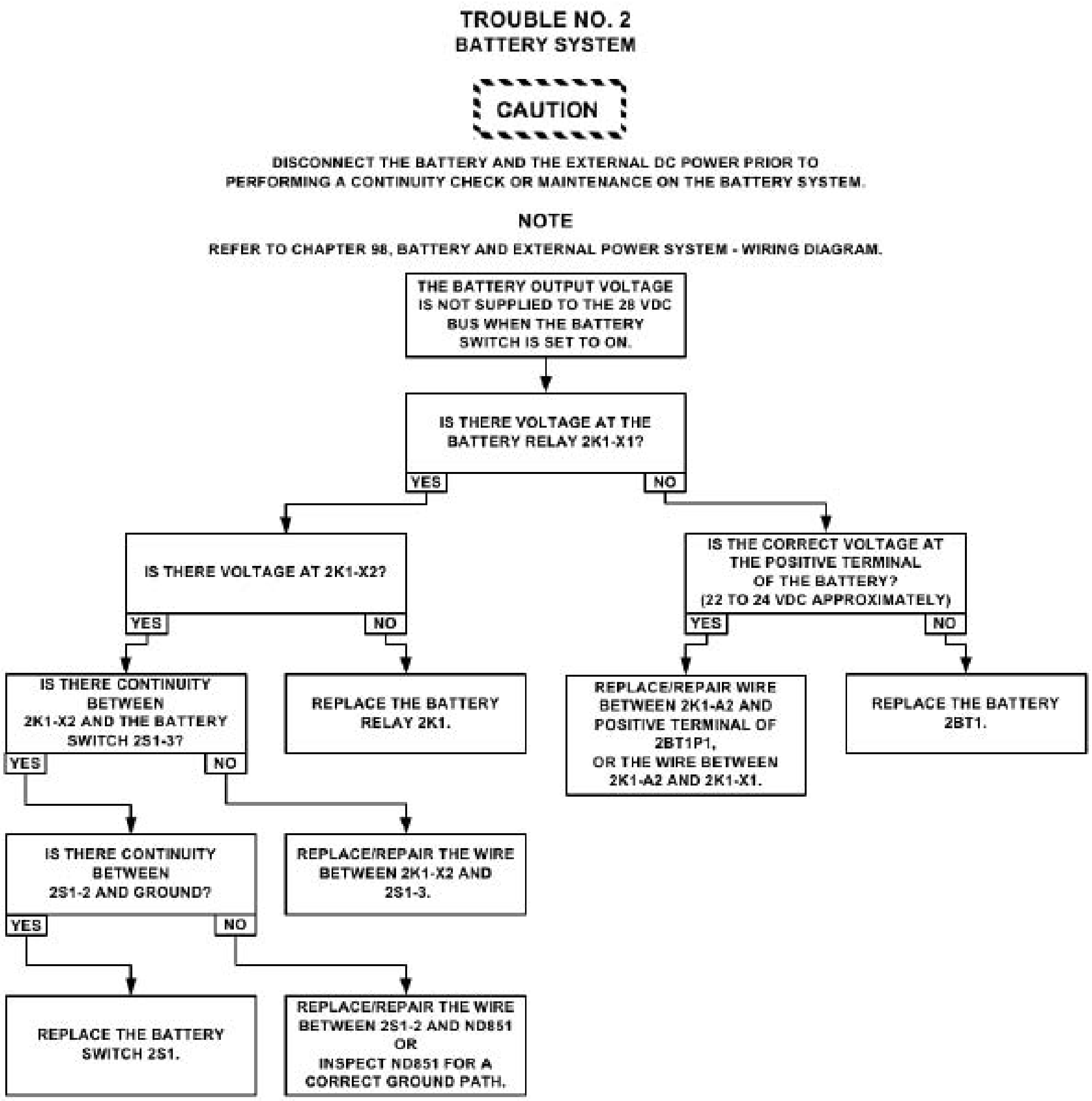
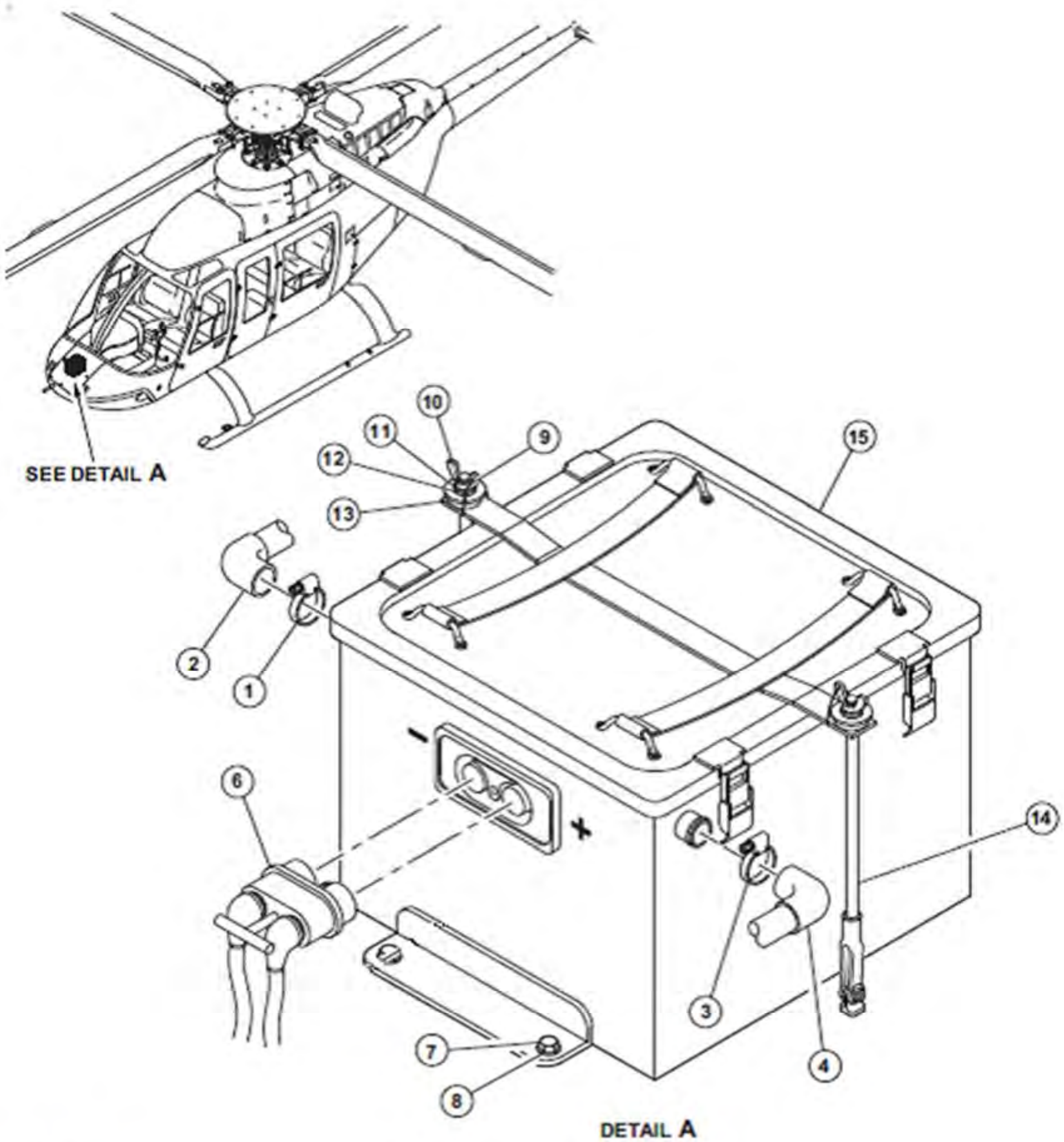


Figure 96-18: Battery System - Trouble No. 2



1. Clamp
2. Vent tube assembly
3. Clamp
4. Vent tube assembly
6. Battery power connector (2BT1P1)
7. Bolt
8. Washer
9. Lockwire
10. Wing nut
11. Lock washer
12. Washer
13. Bushing
14. Hold down rod
15. Battery (2BT1)

Figure 96-19: 34 Amp/Hour Lead-Acid Battery - Removal and Installation

96.2.2.6.4 Battery Charging Procedure

This procedure provides operators with the ability to charge the battery, while installed in the helicopter, due to minor depletion. Battery charging may be accomplished with a Ground Power Unit (GPU) that has a good quality constant voltage regulator, a variable voltage selector, and an amperage indicator.

NOTE

It is recommended the charging procedure not exceed 45 minutes in duration. Frequent use of this procedure may cause loss of electrolyte due to gassing through electrolysis. Reduced levels of electrolyte can cause cell imbalances and lower overall battery capacity. This procedure is not intended to take the place of scheduled battery maintenance requirements (Chapter 5).

Battery switch may be set to ON after GPU power is applied and voltage adjusted to 28.5 VDC (do not exceed 28.5 volts). Battery charging is supplied by the GPU and must be monitored. Charging will be completed when GPU output indicates approximately 8 amps.

96.2.2.6.5 Lead-Acid Battery – External Inspection

1. Check the outside surfaces of the battery and electrical connector (2BT1P1) for deterioration or corrosion that may affect the battery's operation.
2. Check the battery for loose or missing fastener.
3. Check the identification and information labels to ensure they are legible and securely attached.
4. If the above checks reveal items that need attention, repair or replace battery as appropriate.

96.2.2.6.6 Battery Case and Battery Compartment — Cleaning

MATERIALS REQUIRED

Refer to BHT-ALL-SPM for specifications.

NUMBER	NOMENCLATURE
C-237	Varnish
C-428	Caps and/or Plugs

WARNING

ONLY AUTHORIZED PERSONNEL INSTRUCTED IN THE MAINTENANCE PRECAUTIONS AND ASSOCIATED HAZARDS RELATED TO THE HANDLING OF LEAD-ACID BATTERIES SHOULD DO THIS PROCEDURE. SERIOUS INJURY TO PERSONNEL MAY OCCUR IF THE PROPER PRECAUTIONS ARE NOT TAKEN.

DO NOT USE A WIRE BRUSH OR STEEL WOOL TO CLEAN THE BATTERY TERMINALS. THIS COULD RESULT IN SERIOUS INJURY TO PERSONNEL AND/OR DAMAGE TO THE BATTERY IF AN ELECTRICAL SHORT OCCURS. USE ONLY A STIFF FIBER BRUSH. MAKE SURE THE FIBER BRUSH IS CLEAN AND HAS NOT BEEN USED ON A NI-CAD BATTERY.

CAUTION

MAKE SURE THE BATTERY VENTS ARE NOT OPEN TO AVOID CONTAMINATION INSIDE THE BATTERY CASE DURING CLEANING. CLOSE THE BATTERY

VENTS WITH CAPS AND/OR PLUGS (C-428).

MAKE SURE THE EXTERIOR OF THE BATTERY CASE IS DRY BEFORE IT IS INSTALLED IN THE BATTERY COMPARTMENT. FAILURE TO OBEY THIS PRECAUTION CAN RESULT IN CORROSION IN THE BATTERY COMPARTMENT.

DO NOT USE THE SAME TOOLS THAT WERE USED ON NICKLE-CADMIUM BATTERIES TO CLEAN LEAD-ACID BATTERIES. THIS INCLUDES GLOVES, GLASSES, AND PROTECTIVE CLOTHING. A STRONG CHEMICAL REACTION WILL RESULT IF THE TWO ELECTROLYTES COME INTO CONTACT WITH EACH OTHER.

1. Clean the outside surfaces of the battery with a lint-free shop cloth that is clean, dry, and free of oil.
2. If the battery has caked-on dirt or grime, use a cloth dampened with tap water, then wipe dry.

96.2.2.6.7 Battery — Installation

MATERIALS REQUIRED

Refer to BHT-ALL-SPM for specifications.

NUMBER	NOMENCLATURE
C-018	Lubricant
C-405	Lockwire
C-428	Caps and/or Plugs

WARNING

OBEY ALL OF THE SAFETY PRECAUTIONS WHEN DOING MAINTENANCE ON OR NEAR ELECTRICAL/ELECTRONIC EQUIPMENT (PARAGRAPH 96.1.1.1.).

WARNING

HANDLE THE BATTERY WITH CARE. SERIOUS INJURY TO PERSONNEL COULD OCCUR IF THE CORRECT TECHNIQUES TO LIFT AND HANDLE THE BATTERY ARE NOT FOLLOWED. THE WEIGHT OF THE 34 AMP/HOUR LEAD-ACID BATTERY IS APPROXIMATELY 62 POUNDS (28.2 KG).

1. Remove external power.
2. Make sure the battery being installed is fully charged and caps and/or plugs (C-428) are installed on the main power receptacle.
3. Install the battery (15, Figure 96-20, Figure 96-21) in the battery compartment.
4. On the sides of the battery (15), install the vent tube assemblies (2 and 4) and clamps (1 and 3).
5. Install the bracket, bolts (7), and washers (8) at the front of the battery (15).

WARNING

CUTTING LOCKWIRE CAN PRODUCE AIRBORNE PARTICLES OF WIRE THAT CAN BE HARMFUL TO EYES. WEAR EYE PROTECTION WHEN REMOVING OR INSTALLING LOCKWIRE.

6. Reposition the hold down rods (14) into the slots of the battery cover hold-down arms. Install the bushing (13), washer (12), lockwasher (11), and wing nut (10) onto each of the hold down rods. Hand tighten the wing nuts and safety with lockwire (C-405) (9).

7. Remove the caps and/or plugs from the main power receptacle.

WARNING

LUBRICANT MAY CAUSE EYE AND SKIN IRRITATION. AVOID CONTACT WITH EYES, SKIN, AND CLOTHING. WASH THOROUGHLY AFTER HANDLING.

8. Apply a light coat of lubricant (C-018) on the pins of the main power receptacle.
9. Connect the battery power connectors (2BT1P1) and (2BT1P2 if installed) (6) to the battery (15).
10. Do an operational check of the battery system (paragraph 96.2.2.6.1).
11. Close and latch the battery compartment access door.

96.2.2.6.8 Battery Relay (2K1) — Removal

SPECIAL TOOLS REQUIRED

NUMBER	NOMENCLATURE
M81969/14-02 or M81969/14-11	Insertion/Extraction Tool

WARNING

OBEY ALL OF THE SAFETY PRECAUTIONS WHEN DOING MAINTENANCE ON OR NEAR ELECTRICAL/ELECTRONIC EQUIPMENT (PARAGRAPH 96.1.1.1.).

1. Disconnect battery and external DC power from the helicopter.
2. Gain access to the battery relay (2K1) (12, Figure 96-20) through the landing lights cover.
3. Pull the nipples (1). Remove the nuts (2), lockwashers (3), and washers (4). Remove the wires.
4. Pull the nipples (5). Remove the nuts (6), lockwashers (7), washers (8), wires, and suppression diode assembly (2CR1) (9).

NOTE

Refer to the start and ignition system wiring diagram (Chapter 98) for the correct installation of the suppression diode assembly (2CR1) and wires.

5. With the insertion/extraction tool (M81969/14-11 or M81969/14-02), remove the wires at positions 21 and 22 on the suppression diode assembly (2CR1) (9).
6. Remove the screws (10) and washers (11).
7. Remove the battery relay (2K1) (12).

96.2.2.6.9 Battery Relay (2K1) — Installation

SPECIAL TOOLS REQUIRED

NUMBER	NOMENCLATURE
M81969/14-02 or M81969/14-11	Insertion/Extraction Tool

WARNING

OBEY ALL OF THE SAFETY PRECAUTIONS WHEN DOING MAINTENANCE ON OR NEAR ELECTRICAL/ELECTRONIC EQUIPMENT (PARAGRAPH 96.1.1.1.).

1. Install the battery relay (2K1) (12, Figure 96-20) on its mounting base at FS 155.00, DC equipment panel. Install the washers (11) and the screws (10).

NOTE

Refer to the start and ignition system wiring diagram (Chapter 98) for the correct installation of the suppression diode assembly (2CR1) and wires.

2. Install the wires on terminals A1 and A2 of the battery relay (2K1) (12). Install the washers (4), lockwashers (3), nuts (2), and nipples (1).
3. Install the suppression diode assembly (2CR1) (9) on terminal X1 and X2 of the battery relay (2K1) (12). Make sure the orientation of the suppression diode assembly (2CR1) (9) is correct (positive (+) end of the diode assembly (2CR1) to X1 of battery relay (2K1)). Install the washers (8), lockwashers (7), and nuts (6) to attach the suppression diode assembly (2CR1) (9). Install the nipples (5) on terminals X1and X2.
4. With the insertion/extraction tool (M81969/14-11or M81969/14-02), install the correct wire at positions 21 and 22 of the battery relay (2K1) (12).
5. Do an operational check of the battery system (paragraph 96.2.2.6.1).

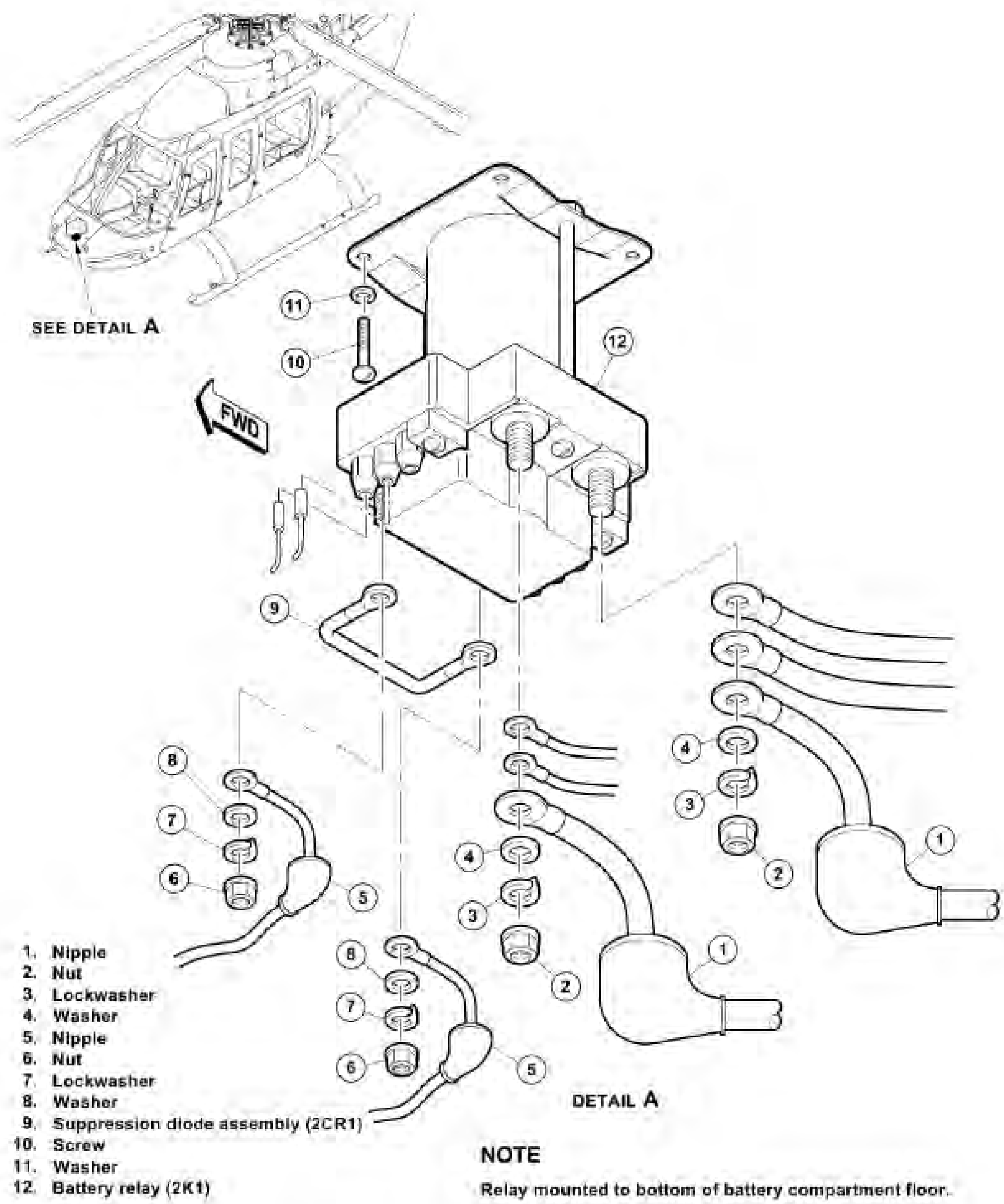


Figure 96-20: Battery Relay (2K1) - Removal and Installation

96.2.3 EXTERNAL DC POWER SYSTEM — DESCRIPTION

CAUTION

28 VDC GPU SHALL BE 500 AMPS OR LESS TO REDUCE RISK OF STARTER DAMAGE FROM OVERHEATING.

The function of the external power circuit is to receive DC power from an external power source (Ground Power Unit (GPU)) and connect it to the helicopter DC power system. The external power system includes an external power connector (2J2) and an external power relay (2K2) (Figure 96-21).

96.2.3.1. EXTERNAL POWER RECEPTACLE

The external power receptacle is located at the center line of the nose section, at WL 29.90, below the pitot tube. The receptacle has three pins: one small positive (+) external power relay control pin, one large positive (+) main power supply pin, and one large negative (–) ground pin.
The two positive (+) pins of the receptacle are of different lengths to reduce the possibility of arcing during the installation and removal of the Ground Power Unit (GPU) connector.

96.2.3.2. EXTERNAL POWER RELAY (2K2)

The external power relay (2K2) is installed on the underside of the battery compartment shelf, in the landing lights compartment. The external power relay (2K2) has one set of contacts and a coil. The external power relay (2K2) operates as a switch between the external power receptacle and the 28 VDC bus.

A suppression diode assembly (2CR2) is installed between terminals X1 and X2 of the external power relay (2K2). The suppression diode assembly (2CR2) is installed to decrease back EMF when the power is removed from the relay. When the power is removed from the external power relay (2K2), it generates a reverse high voltage. The zener diode of the suppression diode assembly (2CR2) quickly decreases the reverse high voltage to zero. When the external power relay (2K2) is energized, the diode of the suppression diode assembly (2CR2) stops the flow of current to ground.

96.2.3.3. EXTERNAL DC POWER — OPERATION

With an external power source connected to the external power receptacle (2J2), DC power will be supplied to terminals A1 and X1 of the external power relay (2K2). As terminal X2 of the external power relay (2K2) is connected to a continuous ground source, the relay coil will automatically energize and close the main contact, A1 to A2. The closed main contact, A1 to A2, will then supply external DC power to the 28 VDC bus through the terminal junction (2TB1). External DC power relay is also supplied to the starter (1K1).

To protect against reverse polarity, a diode (2CR4) is installed in the ground lead of the relay coil. The diode (2CR4) will prevent the external power relay (2K2) from energizing in the event a reverse polarity connection is made to the external power receptacle (2J2).

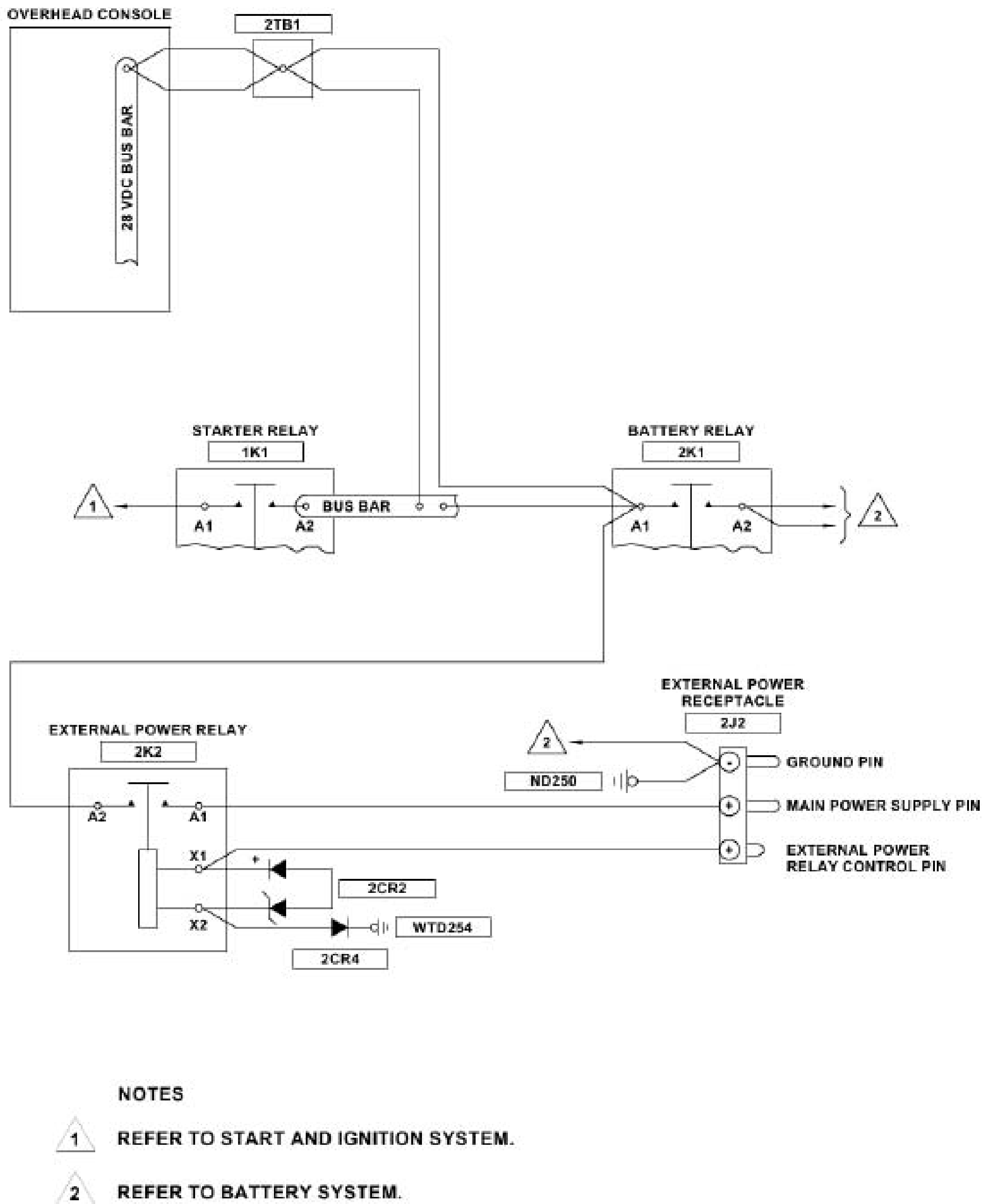


Figure 96-21: External DC Power System - Simplified Schematic

96.2.3.3.1 External DC Power — Operational Check

NOTE

This operational check uses the voltmeter, low rotor RPM, and engine out horns activation to detect the presence, or absence, of power on the 28 VDC bus.

1. Disconnect the battery power connector (2BT1P1) from the battery.
2. Close all circuit breakers in the overhead circuit breaker panel.
3. Make sure the throttle is in the CUT-OFF position.

CAUTION

MAKE SURE THE OUTPUT OF THE GROUND POWER UNIT (GPU) IS 28 ±0.5 VDC BEFORE YOU CONNECT IT TO THE HELICOPTER ELECTRICAL SYSTEM.

4. Connect the GPU to the external DC power connector (2J2).

NOTE

The low rotor horn and engine out horn will sound continuously.

5. Turn on the GPU.

RESULT:

- The warning horns operate.
- The voltmeter indicates 28 ±0.5 VDC.

CORRECTIVE ACTION:

- If the voltmeter and warning horns do not operate (external DC power is not connected to the 28 VDC bus), refer to Trouble No. 1 (Figure 96-22).

6. Turn off the GPU.
7. Disconnect the GPU connector from the external DC power receptacle (2J2).
8. Connect the battery power connector (2BT1P1) to the battery.
9. Set the battery switch (2S1) to ON.
10. With a multimeter, measure the voltage between the large positive (+) main power supply pin of the external power receptacle (2J2) and ground.

RESULT:

- The multimeter measures 0 VDC (the battery output voltage is not supplied to the large positive (+) main power supply pin through the external power relay (2K2).

CORRECTIVE ACTION:

- If the multimeter measures battery voltage at the large positive (+) main power supply pin, replace the external power relay (2K2).

11. Set the battery switch to OFF.
12. Return the helicopter to the standard configuration. Refer to Standard Practices — After Electrical Maintenance or Repairs (paragraph 96.1.1.1.4).

96.2.3.3.2 External Power Relay (2K2) — Removal

WARNING

OBEY ALL OF THE SAFETY PRECAUTIONS WHEN DOING MAINTENANCE ON OR NEAR ELECTRICAL/ELECTRONIC EQUIPMENT (PARAGRAPH 96.1.1.1.).

1. Disconnect battery and external power from the helicopter.
2. On the overhead console, set the BATT SWITCH (2S1) to OFF.
3. Remove the access panel of the landing lights compartment.
4. Pull away the nipples (11, Figure 96-23) from terminals A1 and A2.
5. Remove the nuts (5), washers (3), and lockwashers (4) from terminals A1 and A2.
6. Remove the nuts (8), washers (6), and lockwashers (7) from terminals X1 and X2.
7. Tag and remove the wires from the terminals of the relay (2K2) (10).
8. Remove the suppression diode assembly (2CR2) (9) from terminals X1 and X2.
9. Remove the bolts (2) and washers (1).
10. Remove the external power relay (2K2) (10).

TROUBLE NO. 1
EXTERNAL DC POWER

CAUTION

DISCONNECT THE BATTERY AND THE EXTERNAL DC POWER PRIOR TO PERFORMING A CONTINUITY CHECK OR MAINTENANCE ON THE EXTERNAL POWER SYSTEM.

NOTE

1. REFER TO THE WIRING DIAGRAM OF THE BATTERY AND EXTERNAL POWER SYSTEM (CHAPTER 96).
2. DO THE FUNCTIONAL CHECK OF THE DIODE WITH A MULTIMETER AS PER THE METHOD DESCRIBED IN "STANDARD AND ZENER DIODES - FUNCTIONAL CHECK". CONNECT THE POSITIVE LEAD OF THE MULTIMETER TO 2K2-X2.

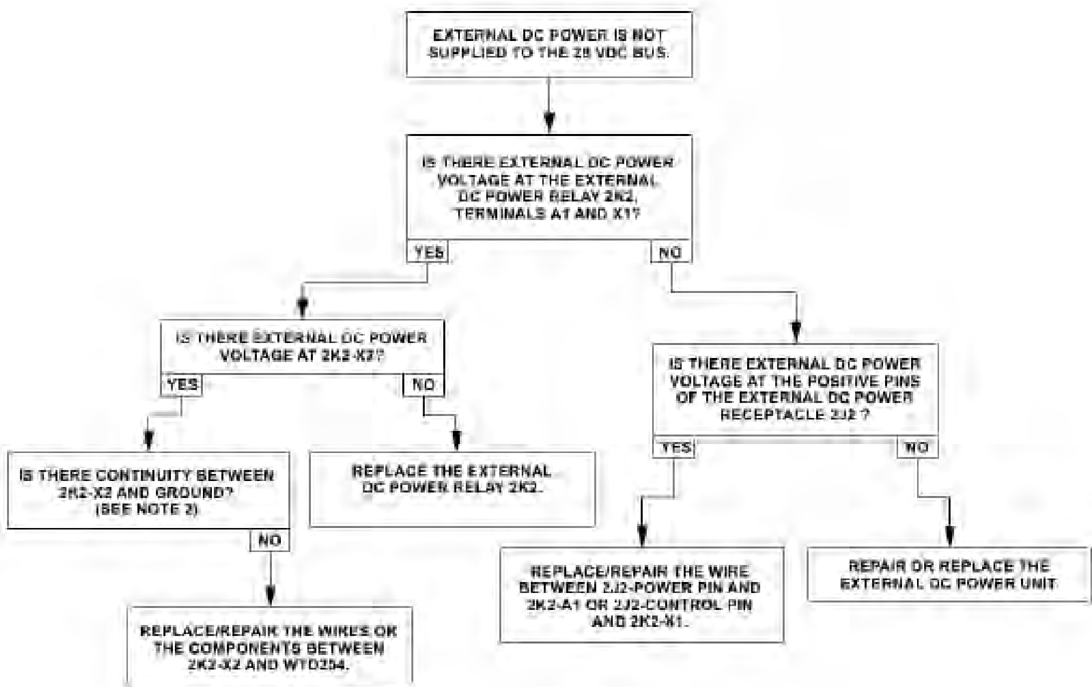


Figure 96-22: External DC Power - Trouble No. 1

96.2.3.3.3 External Power Relay (2K2) — Installation

WARNING

OBEY ALL OF THE SAFETY PRECAUTIONS WHEN DOING MAINTENANCE ON OR NEAR ELECTRICAL/ELECTRONIC EQUIPMENT (PARAGRAPH 96.1.1.1.).

1. Install the external power relay (2K2) (10, Figure 96-23) on the under side of the battery compartment shelf.
2. Install the washers (1) and the bolts (2) that attach the external power relay (2K2) (10).

NOTE

Refer to the external DC power wiring diagram (Chapter 98) for the correct installation of the wires on the relay. Make sure of the correct orientation of the suppression diode assembly (2CR2).

3. Install the suppression diode assembly (2CR2) (9) to terminals X1 and X2. Make sure the positive end of the suppression diode assembly (2CR2) (9) is installed on terminal X1.
4. Install the wires on the terminals of the external power relay (2K2) (10).
5. Install the washers (6), lockwashers (7), and nuts (8) on terminals X1 and X2.
6. Install the washers (3), lockwashers (4), and nuts (5) on terminals A1 and A2.
7. Install the nipples (11) on terminals A1 and A2.
8. Install the access cover of the landing lights.
9. Do an operational check of the external DC power system (paragraph 96.2.3.3.1) and the landing lights system (paragraph 96.4.6.4.1).

96.2.3.3.4 External Power Receptacle — Replacement

To replace the external power connector, refer to the Miscellaneous Electrical Components — Maintenance Practices (paragraph 96.1.6).

96.2.4 START AND IGNITION SYSTEM

The function of the start and ignition system is to correctly sequence and control the different components in the system during the start procedure. The start and ignition system can be initiated with the use of battery or external power. The components in the system include the following:

- Start switch (4962-S6)
- FADEC/START relays (4962-K1 and 4962-K2)
- FADEC/ECU (4962-A)
- Starter relay (1K1)
- Voltage regulator (2VR1)
- Ignitor relay (2K4)
- Starter generator (2MG1)
- Ignitor exciter box, lead, and spark ignitor (supplied with the engine)
- Engine start (ENG CONTROLS START) circuit breaker (1CB1)
- Engine ignitor (ENG CONTROLS IGNTR) circuit breaker (1CB2)

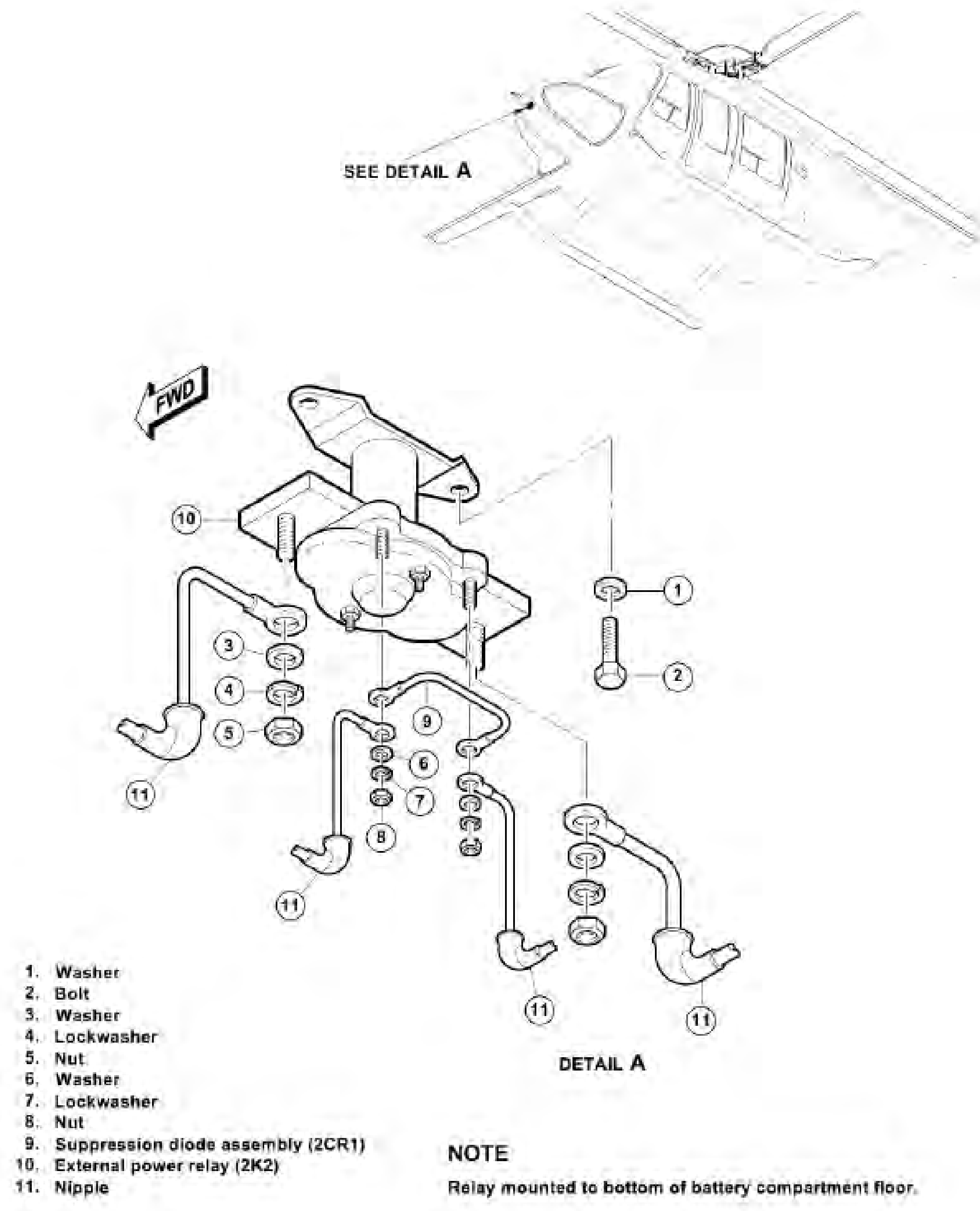


Figure 96-23: External Power Relay (2K2) - Removal and Installation

96.2.4.1. START SWITCH (4962-S6) — DESCRIPTION

The start switch (4962-S6) is installed on the collective switch box. The switch contains four spring loaded poles that provide momentary contact to START position (Figure 96-24).

Refer to the start and ignition system simplified schematic (Figure 96-25) to help understand the description of the system.

The start switch (4962-S6) activation sends signal to the FADEC/ECU to initiate start sequence and ignition control when energized for 0.5 seconds within 60 seconds of PLA at or above IDLE detent.

There are two start relay (4962-K1 and 4962-K2) designated for each FADEC/ECU channel. Activation of the start relay by the FADEC/ECU channel in control, supplies aircraft supplied 28 VDC to both the ignition relay and the starter contactor. During the start sequence, FADEC/ECU features automatic engine limiting, monitoring and control. Cockpit display during start is provided through ARINC 429 data bus transmitted to the Dual Tachometer Indicator (1M6) to trigger advisory “START” on the Caution/Warning Advisory Panel (4DS1).

Once a start sequence has been initiated, it can be manually stopped at any time by rotating the throttle to CUT-OFF or by activating emergency fuel shutoff switch. FADEC/ECU automatically aborts start sequence when MGT reached the limit of 977°C.

96.2.4.2. FADEC/START RELAY (4962-K1 and 4962-K2) — DESCRIPTION

The FADEC/START relay (4962-K1 and 4962-K2) are installed on the emergency battery tray at the aft avionics shelf. Only the relay of the active FADEC/ECU channel is held energized when start sequence is initiated.

When energized, the FADEC/START relay (4962-K1 and/or 4962-K2) does the following:

- Supplies a 28 VDC power path to energize the starter relay (1K1)
- Supplies 28 VDC bus power to the START input of the voltage regulator (2VR1)
- Provides ground path to energize the ignitor relay 2K4 that supplies power to the ignition unit

The FADEC/START relays (4962-K1 and 4962-K2) have an internal suppression diode assembly. The suppression diode assembly is installed to decrease back EMF when the relay is de-energized. When the relay is de-energized, the reverse high voltage that results is rapidly reduced to zero by the zener diode of the suppression diode assembly. When the relay is energized, the diode of the suppression diode assembly stops the flow of current to ground through the suppression diode assembly.

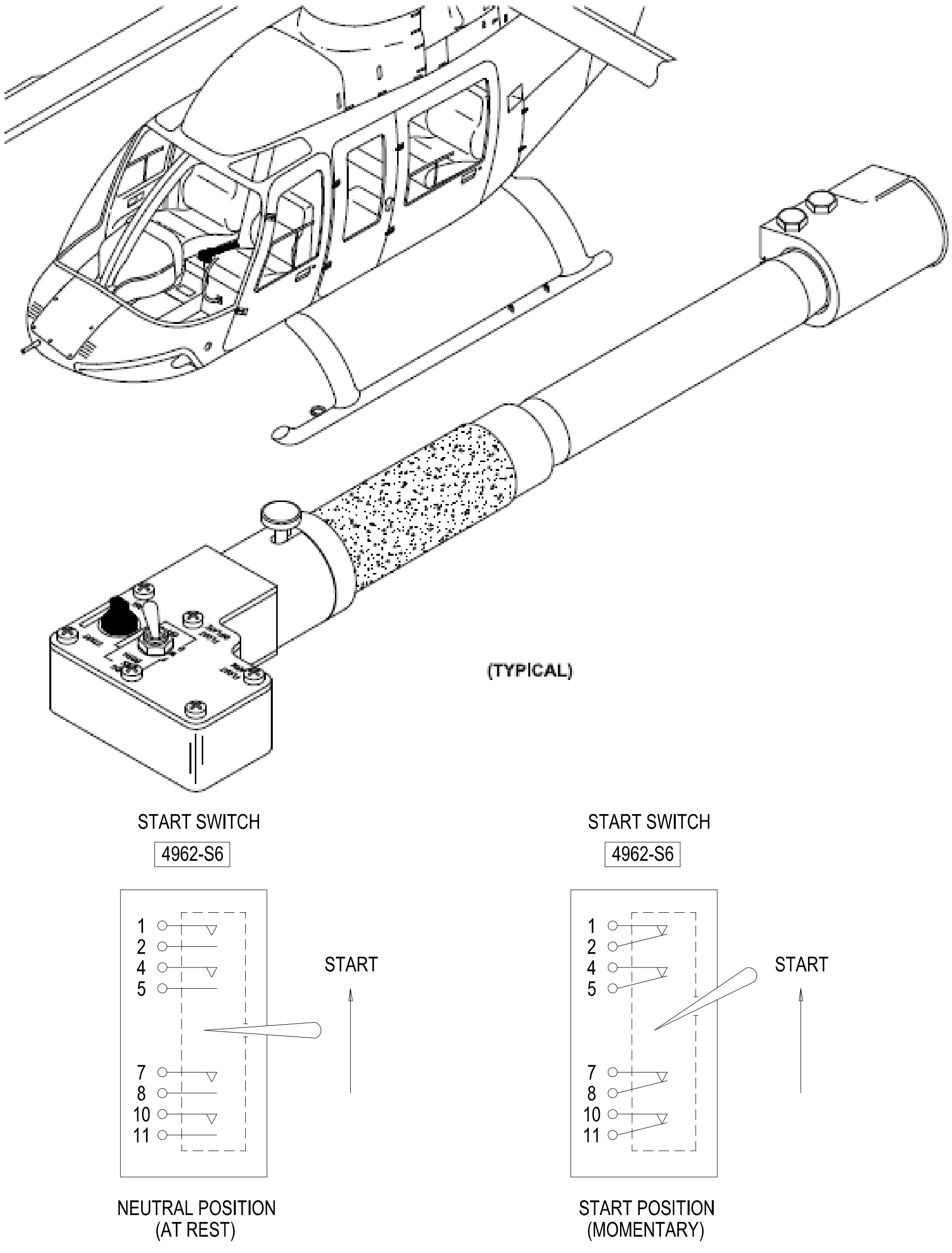


Figure 96-24: Start Switch (4962-S6) - Contact Arm Positions

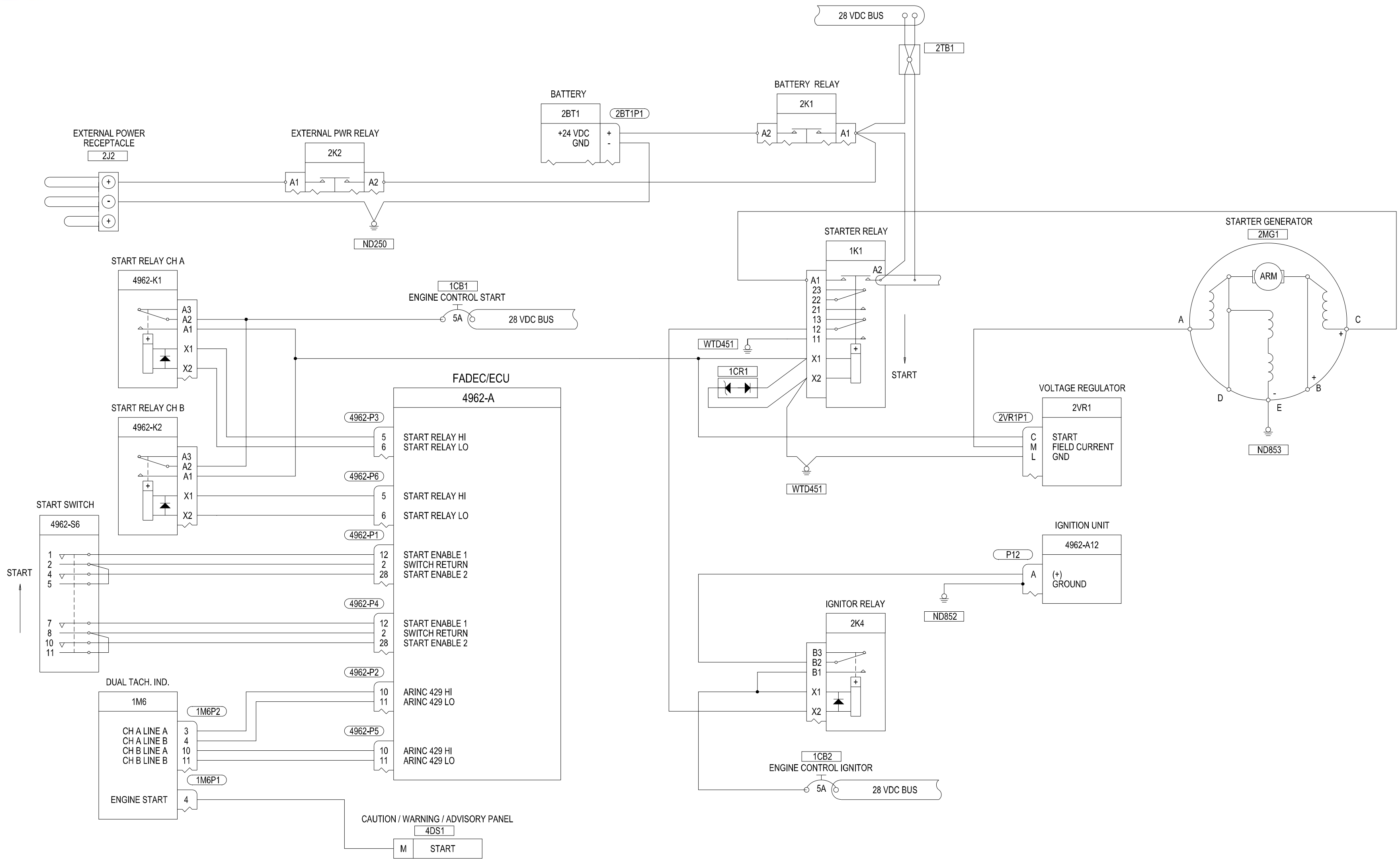


Figure 96-25: Start Ignition System - Simplified Schematic

96.2.4.3. FADEC/ECU (4962-A) — DESCRIPTION

NOTE

For more information on the FADEC/ECU (4962-A), refer to Chapter 76.

The FADEC/ECU (4962-A) is installed on the roof right side of the transmission compartment. During the start procedure, the main function of the FADEC/ECU (4962-A) is to control and monitor all of the engine parameters to provide efficient automatic start and engine-limiting that includes measured gas temperature, fuel flow and engine acceleration.

Once the throttle has been set to idle, the FADEC/ECU (4962-A) allows 60 seconds for the start switch (4962-S6) to be set to START. If the 60 second time frame has exceeded, the latching feature of the FADEC/START relay (4962-K1 and/or 4962-K2) will be inhibited by the FADEC/ECU (4962-A). To reset the timing circuit within the FADEC/ECU (4962-A), the throttle must be set to CUT-OFF and then back to IDLE.

NOTE

The timing circuit is a safety feature to prevent accidental initiation of a start sequence.

After the start sequence has been initiated with the start switch (4962-S6), FADEC/ECU (4962-A) channel in control will latch the FADEC/START relay (4962-K1 or 4962-K2) until the gas producer speed (NG) reaches 50%. This enables the starter relay (1K1) to energize, which in turn supplies power to the starter portion of the starter generator (2MG1) (terminal C) and to the ignitor relay (2K4). Once the gas producer speed (NG) is 50% RPM, an open circuit will be provided which will unlatch the FADEC/START relay (4962-K1 and/or 4962-K2) and terminate the start sequence.

During the start, FADEC/ECU provides cockpit display through ARINC 429 data bus transmitted to the Dual Tachometer Indicator (1M6) to trigger advisory “START” on the Caution/Warning Advisory Panel (4DS1).

In addition to the functions mentioned above, the FADEC/ECU (4962-A) also controls the fuel scheduling and it monitors the engine parameters for an efficient start sequence. It automatically abort start when measured gas temperature reaches the limit of 977°C.

96.2.4.4. STARTER RELAY (1K1) — DESCRIPTION

The starter relay (1K1) is installed on the DC equipment panel at FS 162. The primary function of the starter relay (1K1) is to supply a path for the DC power from the 28 VDC bus to terminal C of the starter generator (2MG1) during the start sequence. It also supplies a ground path to energize the ignitor relay (2K4).

A suppression diode assembly (1CR1) is installed between terminals X1 and X2 of the starter relay (1K1). The suppression diode assembly is installed to decrease back EMF when the starter relay is de-energized. When the starter relay is de-energized, the reverse high voltage that results is rapidly reduced to zero by the zener diode of the suppression diode assembly. When the starter relay is energized, the diode of the suppression diode assembly stops the flow of current to ground through the suppression diode assembly.

96.2.5 IGNITOR RELAY (2K4) — DESCRIPTION

The ignitor relay (2K4) is installed on the DC equipment panel at FS 160. The primary function of the ignitor relay is to provide a DC power path from the engine ignitor circuit breaker (1CB2) to the engine exciter box during start.

During a start, the ignitor relay (2K4) is energized via the engine ignitor circuit breaker (1CB2) and a ground path supplied through the starter relay (1K1) until the gas producer (NG) speed reaches 50 ±1%. FADEC/ECU (4962-A) de-energizes the FADEC/START relay (4962-K1 and/or 4962-K2) discrete when NG exceeds 50 percent.

The ignitor relay (2K4) has an internal suppression diode assembly. The suppression diode assembly includes a standard diode and a zener diode. The suppression diode assembly decreases back EMF when the ignitor relay is de-energized. When the ignitor relay is de-energized, the reverse high voltage that results is rapidly reduced to zero by the zener diode of the suppression diode assembly. When the ignitor relay is energized, the standard diode stops the flow of current to ground through the suppression diode assembly.

96.2.6 VOLTAGE REGULATOR (2VR1)

NOTE

Refer to the generator system in this chapter for additional information on the voltage regulator.

The voltage regulator (2VR1) is installed behind the hat rack on the left side at FS 160.00. During a start, the main function of the voltage regulator (2VR1) is to prevent generator output by inhibiting field control. Upon activation of the FADEC/START relay (1K3) during a start, DC power is supplied from the engine controls start circuit breaker (1CB1) through the FADEC/START relay (1K3) to pin C (start) of the voltage regulator (2VR1). This inhibits field control to prevent current output from the generator.

Additionally, approximately 1 VDC from pin M (field current) of the voltage regulator (2VR1) is supplied to terminal A (shunt field) of the generator during the operation of the starter. This flashes the shunt field and causes the generator voltage to increase in a positive direction. It also prevents the shunt field from acting as a brake during a start.

96.2.7 STARTER GENERATOR (2MG1)

NOTE

Refer to the generator system in this chapter for starter generator inspection and maintenance data.

The starter generator (2MG1) is installed on the forward side of the engine gearbox. During a start, it provides rotation of the entire drivetrain of the engine gas producer (NG) through the accessory drive gearbox.

The starter generator (2MG1) operates with power supplied from the 28 VDC bus through the main contacts, A2 to A1, of the starter relay (1K1). With the FADEC/ECU (4962-A), the starter generator stays automatically engaged when the start switch (4962-S6) is momentarily set to START, until the engine gas producer speed (NG) reaches 50%.

96.2.8 IGNITOR EXCITER BOX, IGNITOR LEAD, AND SPARK IGNITOR — DESCRIPTION

NOTE

Refer to the Honeywell Light Maintenance Manual for HTS900-2-1D for data, maintenance instructions, and safety precautions.

96.2.9 START AND IGNITOR SYSTEM OPERATION

NOTE

Refer to Chapter 76 and to Honeywell Light Maintenance Manual for HTS900-2-1D for a full operational description and maintenance procedures of the FADEC/ ECU.

The operation of the start and ignition system is described below. The descriptions are written with the 28 VDC bus powered and all of the applicable circuit breakers closed (Figure 96-25).

CAUTION

THIS PROCEDURE IS WRITTEN TO GIVE A DESCRIPTION OF THE OPERATION OF THE START AND IGNITION SYSTEM. REFER TO THE FMS-E407-789-1 FOR THE SPECIFIC START PROCEDURES.

1. Set the throttle to the idle position.

NOTE

After the throttle is set to the idle position, the start switch (4962-S6) must be momentarily positioned to START within 60 seconds or the start sequence will be disabled by the FADEC/ECU (4962-A). To reset the system, the throttle must be repositioned to CUT-OFF and back to IDLE.

2. Momentarily set the start switch (4962-S6) to START.

When the start switch (4962-S6) is momentarily set to START, FADEC/ECU (4962-A) senses start signal through pin 12, 2 and 28 of 4962-P1(Channel A) and 4962-P4 (Channel B), cause to energize FADEC/START relay (4962-K1 and/or 4962-K2) of the channel in control.

FADEC/ECU relay (4962-K1 and/or 4962-K2) is then latched for the entire start sequence. The conditions that follow occur in the system.

1. Power is supplied from the engine controls start circuit breaker (1CB1) through the closed contacts A2 to A1 of either FADEC/START relay (4962-K1 or 4962-K2) to terminal X1 of the starter relay (1K1) and terminal C (START) of the voltage regulator (2VR1).
2. The application of 28 VDC bus power to terminal C of the voltage regulator (2VR1) inhibits the generator output during the start sequence. Approximately 1 VDC is also supplied from terminal M of the voltage regulator (2VR1) to terminal A of the starter generator (2MG1) to flash the shunt field.
3. This supplies the ground to terminal X2 of the FADEC/START relay (4962-K1 and/or 4962-K2). This causes the FADEC/ START relay (4962-K1 and/or 4962-K2) to latch for the start sequence.
4. FADEC/ECU provides cockpit display through ARINC 429 data bus transmitted to the Dual Tachometer Indicator (1M6) to trigger advisory

"START" on the Caution/Warning Advisory Panel (4DS1).

With 28 VDC bus power supplied to terminal X1 of the starter relay (1K1), the starter relay (1K1) is energized. With the starter relay (1K1) energized, the conditions that follow occur in the system:

1. The closed main contacts, A2 to A1, of the starter relay (1K1) provide 28 VDC bus power to terminal C of the starter generator (2MG1). This causes the starter to operate.
2. A ground path is also completed through the closed contacts 11 to 12 of the starter relay (1K1) to terminal X2 of the ignitor relay (2K4).

With a ground at terminal X2 of the ignitor relay (2K4) and 28 VDC power applied to terminal X1 of the ignitor relay (2K4) from the engine controls ignitor circuit breaker (1CB2), the relay energizes. With the ignitor relay energized, the conditions that follow occur in the system:

1. Power is supplied from the 28 VDC bus through the engine controls ignitor circuit breaker (1CB2) through the closed contacts B1 to B2 of the ignitor relay (2K4) to the engine exciter box. This causes the engine exciter box to come on and activate the engine spark ignitor.

The starter will stay engaged until the gas producer speed (NG) is at 50%. When the FADEC/ECU (4962-A) senses the (NG) is at 50%, a temporarily open ground circuit is provided from the START terminal of the FADEC/ECU (4962-A). This temporarily open ground circuit unlatches the FADEC/START relay (4962-K1 and/or 4962-K2) and stops the operation of the start system.

During the activation of the start and ignition system, the FADEC/ECU (4962-A) monitors the engine parameters and controls the fuel scheduling to make sure of an efficient start. Upon reaching an engine gas producer speed (NG) of 50% RPM, the FADEC/ECU (4962-A) unlatches the FADEC/START relay (4962-K1 and/or 4962-K2) to stop the entire start sequence. The engine continues to accelerate until reaching a stabilized idle of 63 ±1% NG.

NOTE

For more information on the FADEC/ECU (4962-A), refer to Chapter 76.

96.2.9.1. START AND IGNITION SYSTEM — OPERATIONAL CHECK

CAUTION

OBSERVE THE ENGINE STARTER MOTORING LIMITATIONS IN THE FMS-E407-789-1 AND MAKE SURE THE ROTORS ARE CLEAR.

1. Remove and secure fuel line from fuel nozzle. Make sure fuel expelled from fuel line is collected properly (BHT-407-MM-2, Chapter 12).
2. Open the BOOST/XFR RIGHT (1CB5) and BOOST/XFR LEFT (1CB6) circuit breakers.
3. Connect the external power to the helicopter.
4. Open the FUEL VALVE circuit breaker (1CB7).
5. Verify that no FADEC/ECU related caution/warning annunciated.
6. Position the throttle out of the CUT-OFF position to IDLE.

NOTE

Once the throttle is placed to IDLE, the start latching circuit will be armed for seconds. After 60 seconds have elapsed, the start circuit is disabled. To re-arm the start circuit, the throttle must be repositioned to CUT-OFF and back to IDLE.

8. Press and hold the start switch (4962-S6) to START for 0.5 seconds.

RESULT:
- The START advisory annunciator of the caution/warning/advisory panel (4DS1) comes on and stays on.
- The starter is engaged (motoring).
- The ignitor is activated.

CORRECTIVE ACTION:
- If the START annunciator does not come on and the starter is engaged, refer to the START annunciator circuit operational check (paragraph 96.3.9.1.).
- If the starter is not engaged, the START annunciator come on, refer to Trouble No. 1 (Figure 96-26).
- If the ignitor is not activated, but the START come on with the starter engaged, refer to Trouble No. 2 (Figure 96-27).
- If the starter does not engage, and ignitor is activated refer to Trouble No. 3 (Figure 96-28).

9. Verify that START annunciator extinguished at 50% NG.
10. Return the helicopter to the standard configuration. Refer to Standard Practices — After Electrical Maintenance or Repairs (paragraph 96.1.1.1.4).

TROUBLE NO. 1
START AND IGNITION SYSTEM

CAUTION

DISCONNECT THE BATTERY AND THE EXTERNAL POWER PRIOR TO PERFORMING A CONTINUITY CHECK OR MAINTENANCE ON THE START AND IGNITION SYSTEM.

NOTE
Refer to Chapter 98 for wiring diagram.

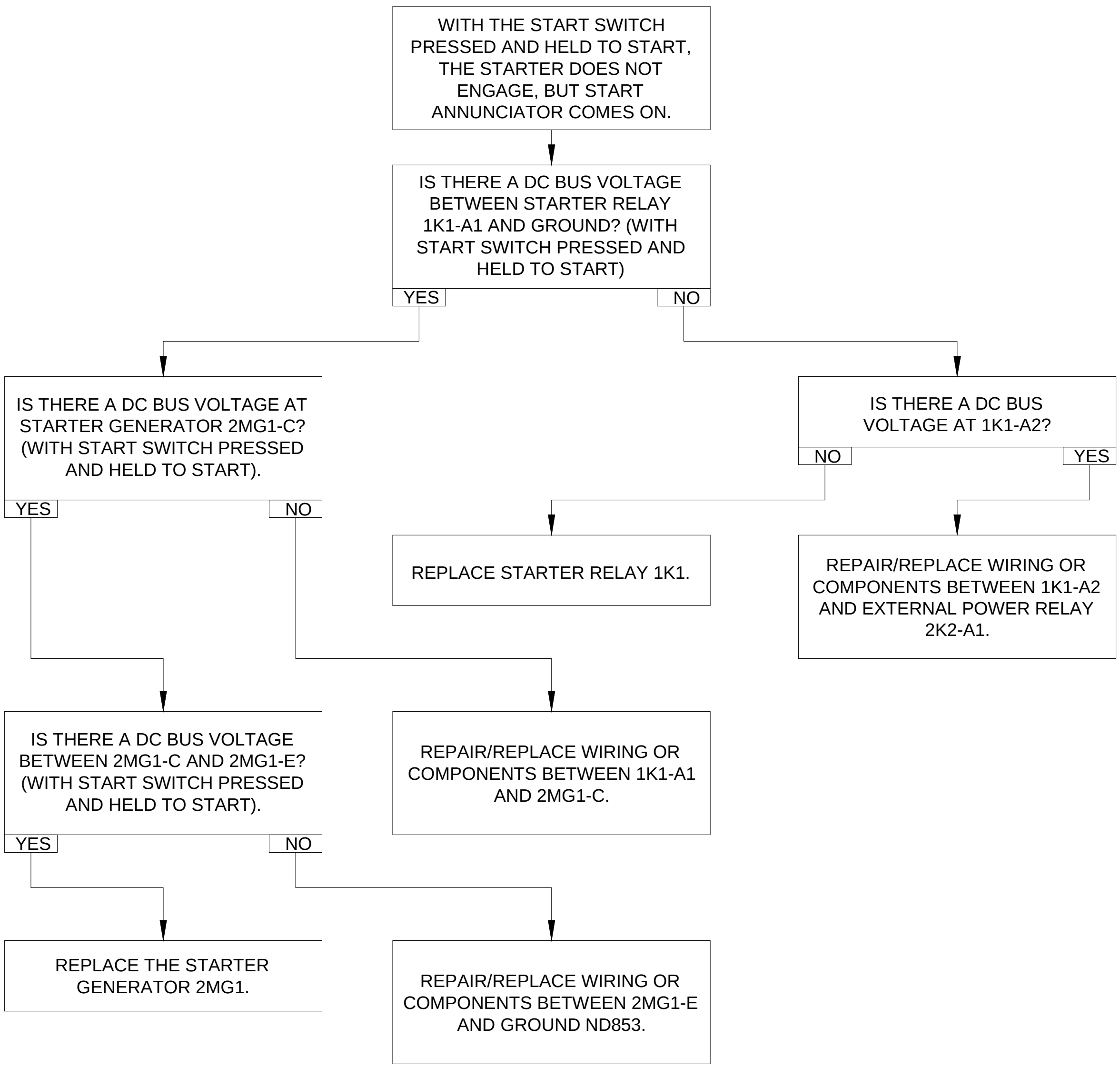


Figure 96-26: Start and Ignition System - Trouble No. 1

TROUBLE NO. 2
START AND IGNITION SYSTEM

CAUTION

DISCONNECT THE BATTERY AND THE EXTERNAL POWER PRIOR TO PERFORMING A CONTINUITY CHECK OR MAINTENANCE ON THE START AND IGNITION SYSTEM.

NOTE
Refer to Chapter 98 for wiring diagram.

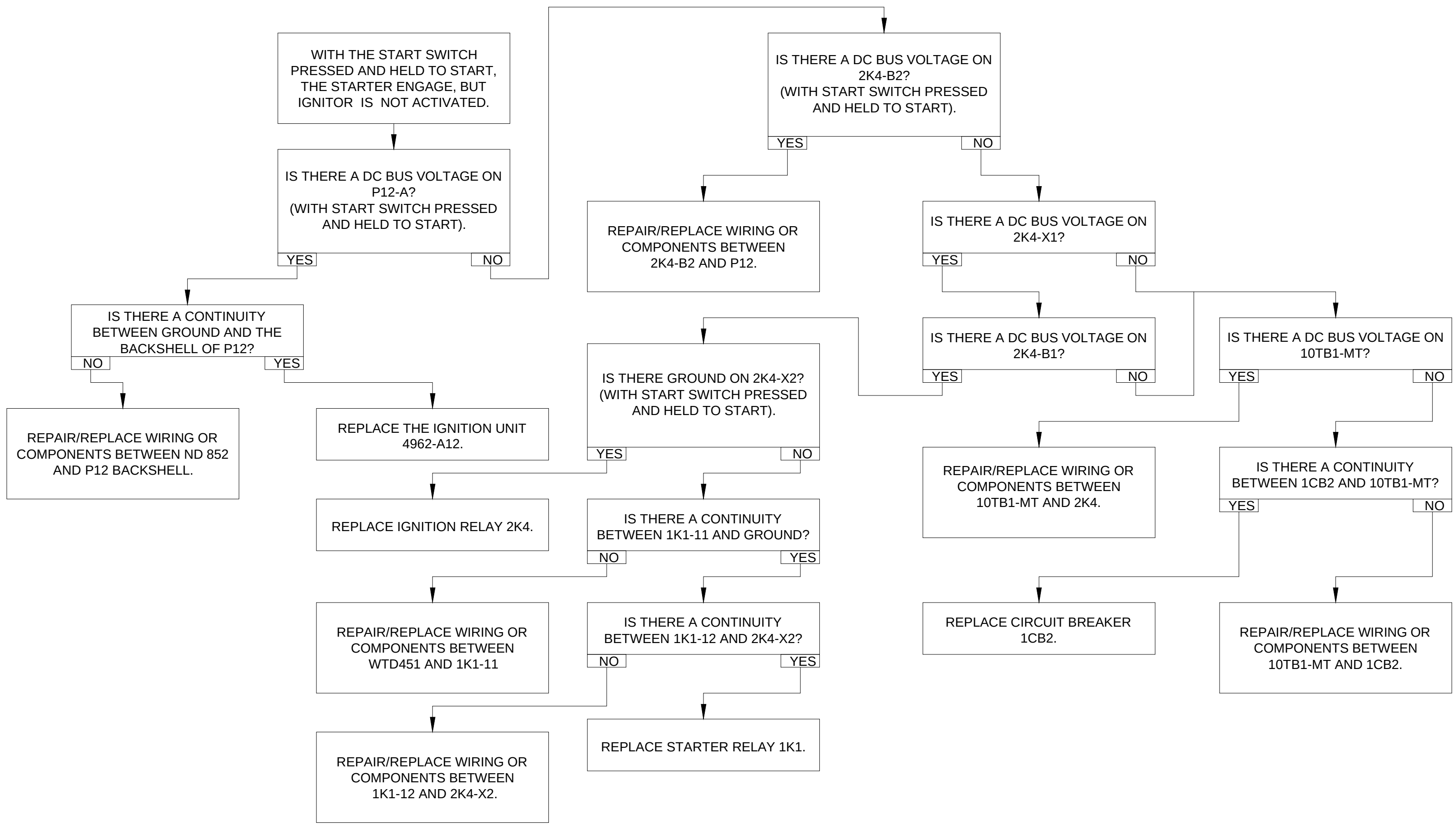


Figure 96-27: Start and Ignition System - Trouble No. 2

TROUBLE NO. 3
START AND IGNITION SYSTEM

CAUTION

DISCONNECT THE BATTERY AND THE EXTERNAL POWER PRIOR TO PERFORMING A CONTINUITY CHECK OR MAINTENANCE ON THE START AND IGNITION SYSTEM.

NOTE
Refer to Chapter 98 for wiring diagram.

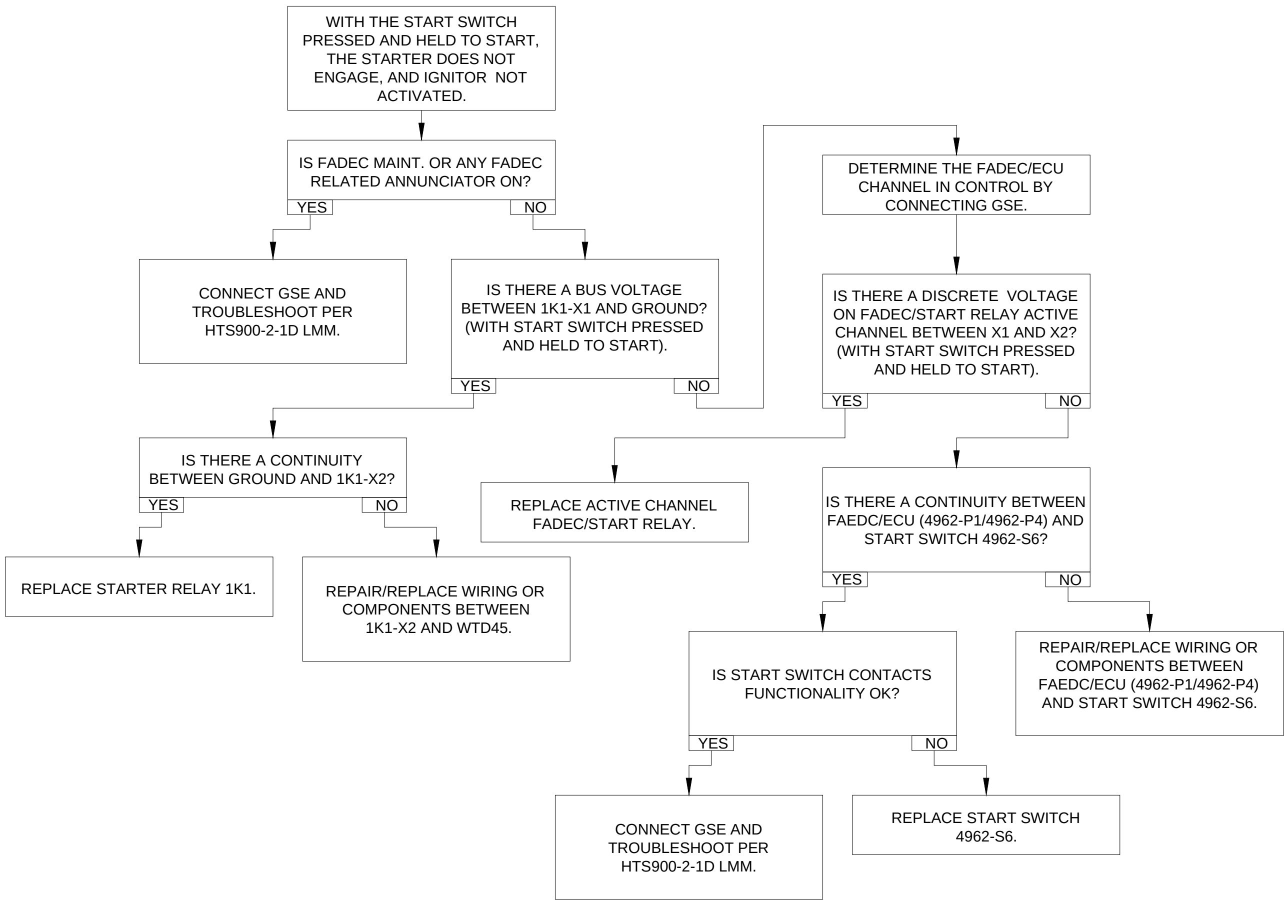


Figure 96-28: Start and Ignition System - Trouble No. 3

96.2.9.2. IGNITOR CIRCUIT — FUNCTIONAL CHECK

NOTE

Prior to checking the ignition system, make sure there is no fuel in the combustion section of the engine.

1. Perform the following:
    - Disconnect 2P1 (generator).
    - Throttle (PLA) to OFF.
    - Collective pitch to minimum.
    - Close ECU CH A (4962CB1) and ECU CH B (4962CB2) circuit breakers.
    - Close IGNTR (1CB2) circuit breaker.
    - Close START (1CB1) circuit breaker.
2. Ensure the following switches are OFF:
    - Anti-Ice
    - Bleed Air
    - Fuel Boost/XFR

3. Toggle start switch to START.

RESULT:

- Engine ignition system creates popping sound indicating ignitor is firing.

CORRECTIVE ACTION:

- If engine ignition is not firing, refer to Start and Ignition System Trouble No. 2 (Figure 96-27).

4. Return the helicopter to the standard configuration. Refer to Standard Practices — After Electrical Maintenance or Repairs (paragraph 96.1.1.1.4

96.2.9.3. STARTER GENERATOR (2MG1) — MAINTENANCE PRACTICES

For the removal, mechanical inspection, and installation of the starter generator (2MG1), refer to Chapter 71. For an inspection of the brushes and the terminal block of the starter generator, refer to paragraph 96.1.6.4.

96.2.9.4. VOLTAGE REGULATOR (2VR1) — REMOVAL AND INSTALLATION

For the removal and installation of the voltage regulator (2VR1), refer to paragraph 96.2.10.6.7 and paragraph 96.2.10.6.8

96.2.9.5. FADEC/ECU (1A50) — REMOVAL AND INSTALLATION

For the removal and installation of the FADEC/ECU (4962-A), refer to the Chapter 76 and to the Honeywell Light Maintenance Manual for HTS900-1-2D.

96.2.9.6. IGNITOR EXCITER BOX AND SPARK IGNITOR—REMOVAL AND INSTALLATION

For the removal and installation of the ignitor exciter box and spark ignitor, refer to the Honeywell Light Maintenance Manual for HTS900-1-2D.

96.2.9.7. BASE MOUNTED RELAYS, ENGINE OUT RELAY (1K2), AND IGNITOR RELAY (2K4) — REMOVAL

SPECIAL TOOLS REQUIRED

NUMBER	NOMENCLATURE
M6106/31-001	Relay Removal Tool
M6106/32-001	Relay Base Removal Tool
M81969/14-10	Insertion/Extraction Tool

WARNING

OBEY ALL OF THE SAFETY PRECAUTIONS WHEN DOING MAINTENANCE ON OR NEAR ELECTRICAL/ELECTRONIC EQUIPMENT (PARAGRAPH 96.1.1.1).

NOTE

This removal procedure is for the removal of the relays that follow: engine out relay (1K2) and ignitor relay (2K4).

1. Disconnect battery and external power from the helicopter.
2. Remove the engine out relay (1K2) as follows:
   a. To gain access to the engine out relay (1K2) remove the panel from the left side of the instrument console at FS 26.00.
   b. Push the relay removal tool (M6106/31-001) (1, Figure 96-29) over the relay (2). This will grasp and unlatch it from its relay base (3).

   NOTE

   Refer to the BHT-ELEC-SPM for the removal procedures of the electrical contacts of the relay base (3). Use the insertion/extraction tool (M81969/14-10).

   c. If required, remove the relay base (3) with the relay base removal tool (M6106/32-01) (5) as follows:
      i. Insert the relay base removal tool (M6106/32-01) (5) under the relay base (3) and extend the rail (4).
      ii. Push the relay base (3) out of the rail (4).
3. Remove the ignitor relay (2K4) (2, Figure 96-30) as follows:
   a. Gain access to the ignitor relay (2K4) (2) through the hat rack or upper access panel of the baggage compartment; remove the cover of the DC power panel at FS 160.00.
   b. Push the relay removal tool (M6106/31-001) (1) over the ignitor relay (2K4) (2). This will grasp and unlatch it from its relay base (3).

   NOTE

   Refer to the BHT-ELEC-SPM for the removal procedures of the electrical contacts of the relay base (3). Use the insertion/extraction tool (M81969/14-10).

   c. If required, remove the relay base (3) with the relay base removal tool (M6106/32-001) (5) as follows:
      i. Insert the relay base removal tool (M6106/32-01) (5) under the relay base (3) and extend the rail (4).
      ii. Push the relay base (3) out of the rail (4).

96.2.9.8. BASE MOUNTED RELAYS, ENGINE OUT RELAY (1K2), AND IGNITOR RELAY (2K4) — INSTALLATION

WARNING

OBEY ALL OF THE SAFETY PRECAUTIONS WHEN DOING MAINTENANCE ON OR NEAR ELECTRICAL/ELECTRONIC EQUIPMENT (PARAGRAPH 96.1.1.1.).

NOTE

This installation procedure is for the installation of the relays that follow: engine out relay (1K2) and ignitor relay (2K4).

1. Install the engine out relay (1K2) as follows (Figure 96-29):

NOTE

Refer to the BHT-ELEC-SPM for the installation procedures of the electrical contacts of the relay base (3). Refer to the related wiring diagrams in Chapter 98 for the correct wire installation to the relay base. Use the insertion/extraction tool (M81969/14-10).

   a. If it is necessary to install the relay base (3), correctly position it on the rail (4). Then apply finger pressure to lock it in the rail.
   b. Correctly position the relay (2) on the relay base (3) and apply finger pressure until it latches into place.
   c. After the installation of the engine out relay (1K2), do an operational check of the ENGINE OUT annunciator and warning horn circuit (paragraph 96.3.38.1.).
   d. Install the panel on the left side of the console at FS 26.00.

2. Install the ignitor relay (2K4) (12, Figure 96-30) as follows:

NOTE

Refer to the BHT-ELEC-SPM for the installation procedures of the electrical contacts of the relay base (3). Refer to the related wiring diagrams in Chapter 98 for the correct wire installation to the relay base. Use the insertion/extraction tool (M81969/14-10).

   a. If it is necessary to install the relay base (3), correctly position it on the rail (4), then apply finger pressure to lock it in the rail.
   b. Correctly position the ignition relay (2) on the relay base (3) and apply finger pressure until it latches into place.
   c. After the installation of the ignitor relay (2K4) (2), do an operational check of the start and ignition system (paragraph 96.2.9.1.).
   d. Install the cover on the DC power panel at FS 160.00.

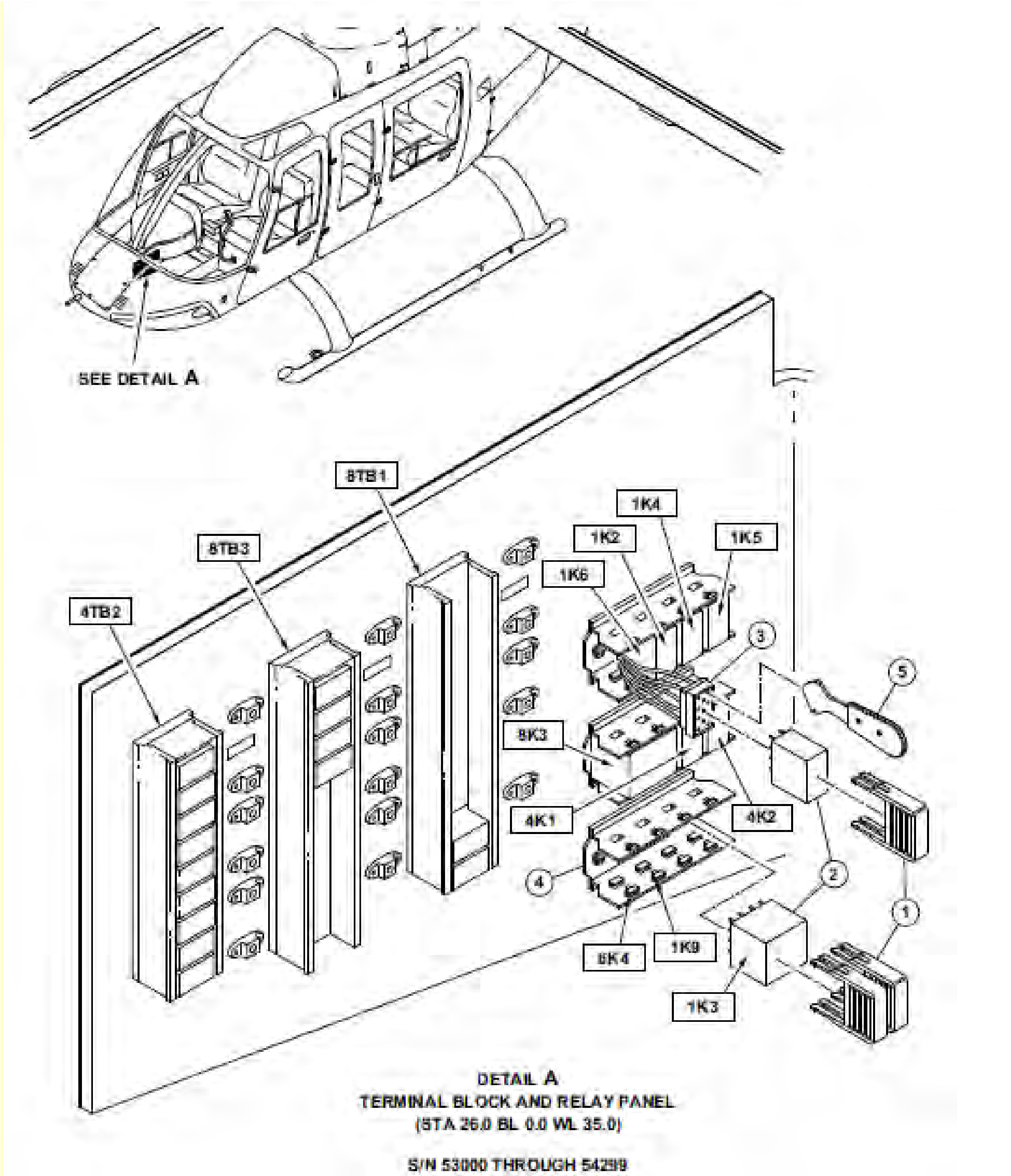


Figure 96-29: Engine Out Relay (1K2) - Removal and Installation

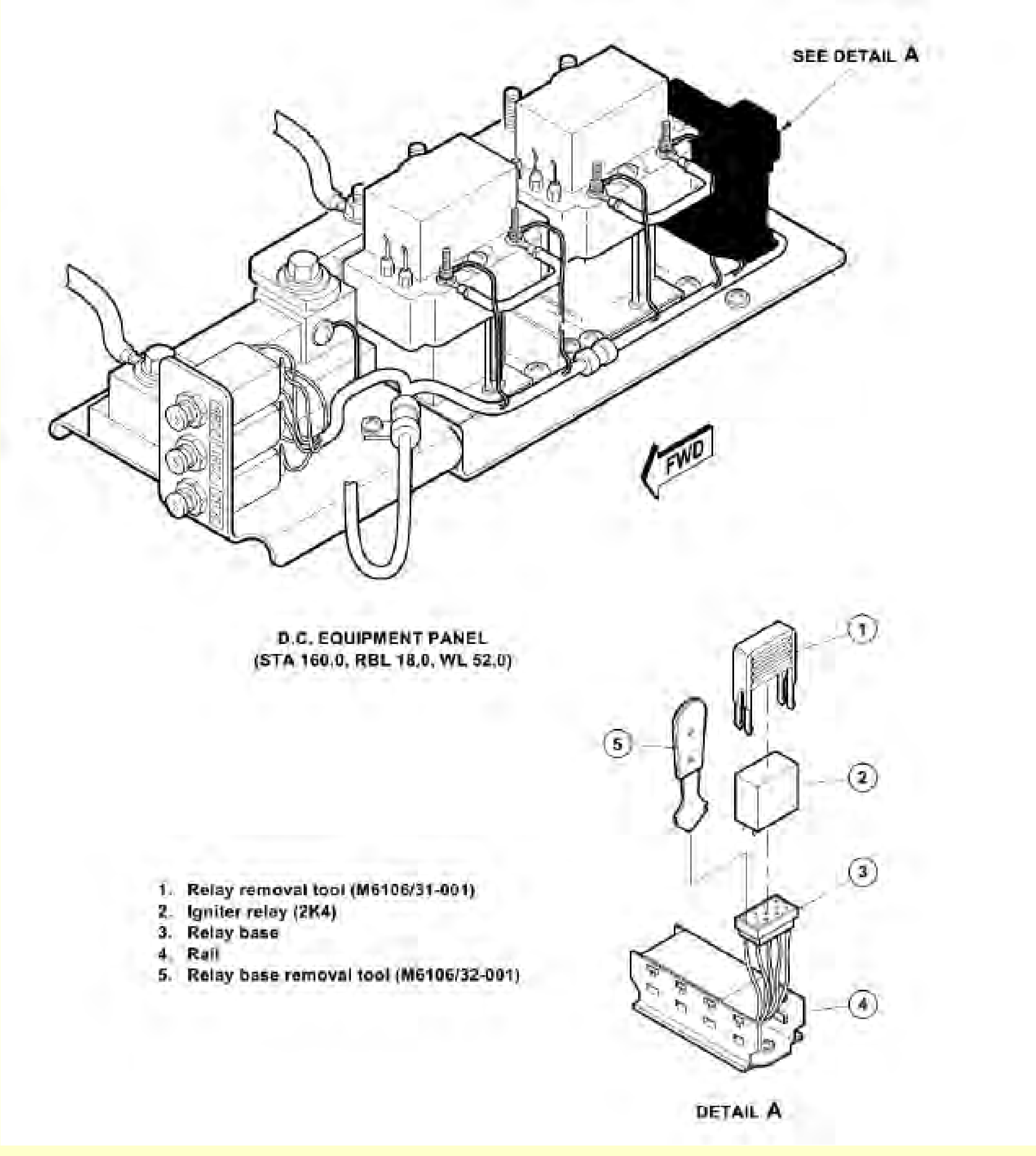


Figure 96-30: Ignitor Relay (2K4) - Removal and Installation

96.2.9.9. STARTER RELAY (1K1) — REMOVAL

SPECIAL TOOLS REQUIRED

NUMBER	NOMENCLATURE
M81969/14-02 or M81969/14-11	Insertion/Extraction Tool

WARNING

OBEY ALL OF THE SAFETY PRECAUTIONS WHEN DOING MAINTENANCE ON OR NEAR ELECTRICAL/ELECTRONIC EQUIPMENT (PARAGRAPH 96.1.1.1.).

1. Disconnect battery and external DC power from the helicopter.
2. Gain access to the starter relay (1K1) (9, Figure 96-31) through the aft hat rack or through the upper access panel of the baggage compartment.
3. Remove the cover from the DC power panel.
4. Remove the nuts (1), lockwashers (2), and washers (3). Remove the wires and the bus bar (10).
5. Remove the nuts (4), washers (5), and suppression diode assembly (1CR1) (6).
6. With the insertion/extraction tool (M81969/14-02 or M81969/14-11), remove the wires at the positions 11, 12, 13, 21, and 22.
7. Remove the screws (7) and the washers (8).
8. Remove the starter relay (1K1) (9).

96.2.9.10. STARTER RELAY (1K1) — INSTALLATION

SPECIAL TOOLS REQUIRED

NUMBER	NOMENCLATURE
M81969/14-02 or M81969/14-11	Insertion/Extraction Tool

1. Install the starter relay (1K1) (9, Figure 96-31) at DC equipment panel. Install the screws (7) and the washers (8).
2. Install the bus bar (10).

NOTE

Refer to the start and ignition system wiring diagram (Chapter 98) for the correct installation of the suppression diode assembly (1CR1) (6) and wires.

3. Install the wires on the terminals of the generator relay (2K3) (11) and starter relay (1K1) (9).
4. Install the lockwashers (2), washers (3), and nuts (1).
5. Install the suppression diode assembly (1CR1) (6) and wires to terminal X1 of the starter relay (1K1) (9). Make sure the orientation of the suppression diode assembly (1CR1) (6) is correct (positive (+) end of 1CR1 to X1 of the starter relay (1K1)). Install the washers (5) and nuts (4) to attach the suppression diode assembly (1CR1).
6. With the insertion/extraction tool (M81969/14-02 or M81969/14-11), install the correct wire to terminals 11, 12, 13, 21, and 22.
7. Do an operational check of the start and ignition system (paragraph 96.2.9.1.).
8. Install the cover on the DC power panel.

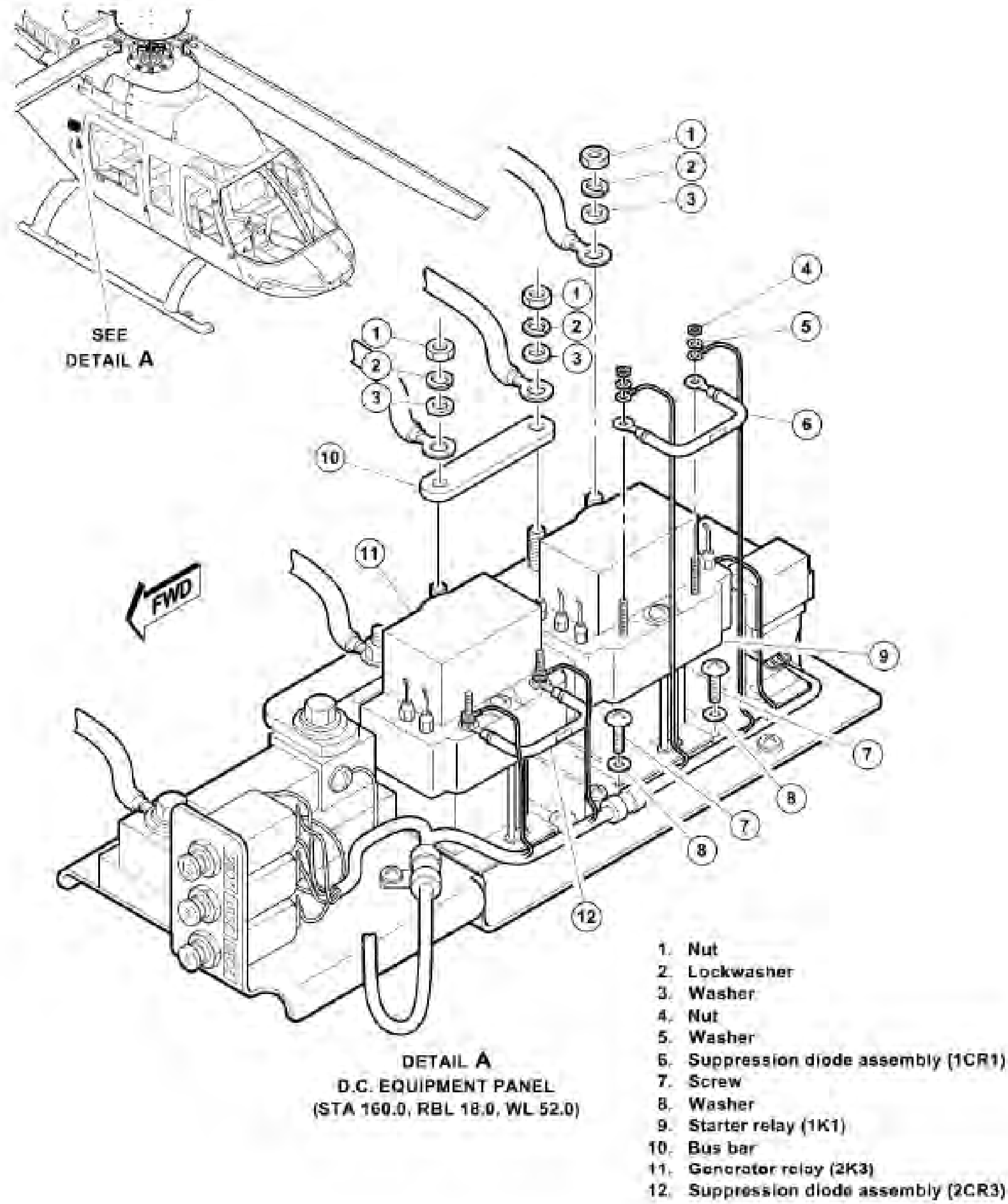


Figure 96-31: Starter Relay (1K1) - Removal and Installation

96.2.10GENERATOR SYSTEM

The function of the generator system is to generate, regulate, and supply DC power to the helicopter electrical systems. The DC generation includes the components that follow:

- Starter generator (2MG1)
- Voltage regulator (2VR1)
- Generator relay (2K3)
- Generator ON/OFF/RESET switch (2S2)
- Shunt (2R1)
- Generator reset (GEN RESET) circuit breaker (2CB4)
- Generator field (GEN FIELD) circuit breakers (2CB3 and 2CB6)

96.2.10.1. GENERATOR RESET SWITCH (2S2)

The generator reset switch (2S2) is installed on the overhead console and it does multiple functions. The generator reset switch is a double pole, double throw, spring loaded switch, with only a momentary contact in the RESET position. The switch has three positions: ON, OFF, and RESET.

With the generator reset switch (2S2) set to ON, its function is to complete the generator field circuit between terminal B of the starter generator (2MG1) and terminal J-INPUT of the voltage regulator (2VR1). During normal operational conditions, this permits the voltage regulator to monitor and control the output voltage of the starter generator and in turn connect the output of the generator to the 28 VDC bus through the generator relay (2K3).

With the generator reset switch (2S2) set to OFF, it opens the generator field circuit, which removes control of the voltage regulator (2VR1) from the starter generator (2MG1) and the generator relay (2K3). This causes the generator output voltage to decrease to a residual voltage of 0.5 to 4 VDC. The relay opens and removes the generator output voltage from the 28 VDC bus.

In the event that an overvoltage condition is detected by the voltage regulator (2VR1), its internal regulator trip relay circuit is activated. When the generator reset switch (2S2) is set to RESET, it supplies a 28 VDC power path to terminal D of the voltage regulator, which resets the internal regulator trip relay circuit.

96.2.10.2. VOLTAGE REGULATOR (2VR1)

The voltage regulator (2VR1) is installed in the equipment compartment at FS 160, WL 52, LBL 20. The main function of the voltage regulator (2VR1) is to monitor and control the output voltage of the starter generator (2MG1).

NOTE

Refer to the voltage regulator (2VR1) simplified schematic (Figure 96-32) for the description that follows.

The voltage regulator (2VR1) maintains a constant output voltage of the starter generator (2MG1) through the application of a control voltage to the shunt field of the starter generator. The control voltage is a duty cycle modulated, pulsating DC voltage, with a repetition rate of 1150 Hz. The output voltage of the starter generator can be adjusted with an adjustment screw located on the aft end of the voltage regulator.

VOLTAGE REGULATOR (2VR1)

SIMPLIFIED FUNCTIONAL DESCRIPTION OF 2VR1 INPUTS AND OUTPUTS.

G-REVERSE CURRENT

- MONITORS REVERSE CURRENT THROUGH STARTER GENERATOR (GENERATOR TERMINALS D TO E).
- IF REVERSE CURRENT OF 0.08 TO 0.150 VDC (APPROX 8 TO 15 AMPS) IS DETECTED FOR 350 MILLISECONDS, GENERATOR RELAY (2K3) CONTROL DRIVE NETWORK WILL BE DEACTIVATED. THIS WILL REMOVE THE STARTER GENERATOR FROM THE 28 VDC BUS.

J-POWER INPUT

- CONTROLS: ACTIVATION OF 2VR1 UNDERVOLTAGE DETECTOR.
  ACTIVATION OF 2VR1 OVERVOLTAGE DETECTOR.
  ACTIVATION OF 2VR1 GENERATOR RELAY (2K3) CONTROL DRIVE NETWORK.
  ACTIVATION OF REGULATOR TRIP RELAY.

C-START

- DURING START 28 VDC BUS POWER APPLIED TO TERMINAL C START INPUT OF 2VR1.
- CONTROLS: FLASHING OF GENERATOR SHUNT FIELD.
  INHIBITING OF GENERATOR RELAY (2K3) CONTROL DRIVE NETWORK THROUGH THE UNDER VOLTAGE DETECTOR.

D-RESET

- CONTROLS RESETING OF 2VR1 AFTER OVERVOLTAGE TRIP.
- 18 TO 28 VDC REQUIRED FOR RESET.

H-GENERATOR RELAY (2K3)

- CONTROLS ACTIVATION OF GENERATOR RELAY (2K3).
- NORMAL OPERATION: RELAY ACTIVATED AT GENERATOR OUTPUT VOLTAGE OF 24 +/-2.4 VDC.
- UNDERVOLTAGE RELAY DEACTIVATED AT GENERATOR OUTPUT VOLTAGE OF 18 +/-1.8 VDC.
- OVERVOLTAGE RELAY DEACTIVATED AT GENERATOR OUTPUT VOLTAGE OF 32 +/-0.5 VDC.
- REVERSE CURRENT: RELAY DEACTIVATED WHEN REVERSE CURRENT OF 0.08 TO 0.150 VDC (APPROX. 8 TO 15 AMPS) DETECTED FOR 350 MILLISECONDS.

M-FIELD

- CONTROLS GENERATOR SHUNT FIELD.
- DURING START, 1 VDC APPLIED TO FLASH GENERATOR SHUNT FIELD.
- DURING NORMAL OPERATION, VOLTAGE TO GENERATOR SHUNT FIELD REGULATED TO MAINTAIN REQUIRED GENERATOR OUTPUT VOLTAGE.
- DURING OVERVOLTAGE CONDITION, VOLTAGE FEED TO SHUNT FIELD IS DEACTIVATED.

L-GROUND

- PROVIDES INTERNAL GROUND FOR OPERATION OF 2VR1.
- ALLOWS 2VR1 TO MONITOR AND COMPARE REFERENCE VOLTAGE BETWEEN ITSELF AND STARTER GENERATOR.

K-VOLTAGE SENSING

- INPUT TO 2VR1 NOISE FILTER.

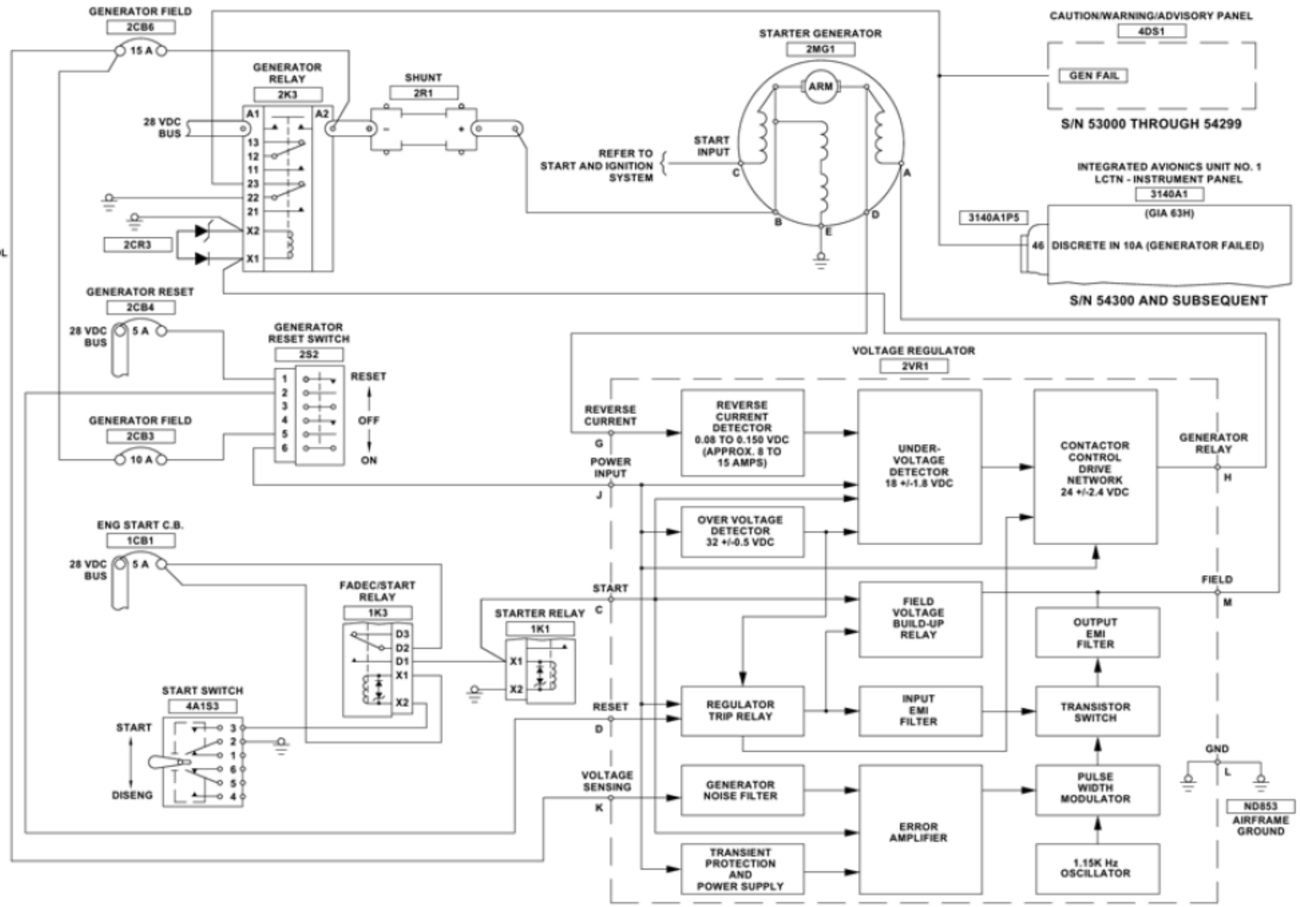


Figure 96-32: Voltage Regulator (2VR1)- Simplified Schematic

96.2.10.2.1 Start and Regulation

With the start switch momentarily set to START (start sequence latched), 28 VDC bus voltage is applied to pin C of the voltage regulator (2VR1). This voltage inhibits the voltage regulator field control voltage, which in turn inhibits the starter generator (2MG1) output voltage. The generator relay (2K3) control drive network is also inhibited during a start to make sure the starter generator is not connected to the 28 VDC bus.

Additionally, the voltage regulator (2VR1) also applies a voltage of 1 VDC (approximately) to the shunt field, terminal A, of the starter generator (2MG1) during the start to maintain proper polarization of the starter generator residual magnetism or flash the field.

Once the start procedure is complete, the 28 VDC input to pin C of the voltage regulator (2VR1) is removed. With the generator reset switch (2S2) set to ON, the output voltage of the starter generator (2MG1) is then connected to the generator field through the field voltage build-up relay of the voltage regulator. This causes a re-generative build-up of the generator voltage.

As the generator output voltage increases to approximately 16 VDC, the voltage regulator (2VR1) takes control of the generator output and allows it to increase to the set value. As the generator output goes through the threshold of 24 ±2.4 VDC, the generator relay (2K3) control drive network supplies a DC power output from pin H that activates the contactor and connects the generator output voltage to the 28 VDC bus.

Overall regulation of the generator output voltage is achieved by comparing the generator output voltage from terminal B (of 2MG1) at pin J of the voltage regulator adjusting the strength of the shunt field as required. If the generator output voltage either (2VR1) with a reference voltage increases or decreases, the error amplifier in the voltage regulator modifies the duty cycle of the field control voltage. For example, if the generator output voltage increases due to a reduced electrical system demand or an increased speed of the generator drive, the error amplifier will sense the voltage change and automatically adjust the pulse width modulator to correctly decrease the duty cycle of the pulsating DC voltage. This will decrease the strength of the generator shunt field to maintain the required generator output.

The voltage regulator (2VR1) also has three circuits that detect and protect against overvoltage, undervoltage, and generator reverse current conditions.

96.2.10.2.2 Overvoltage

The voltage regulator (2VR1) continuously monitors the generator output to detect the presence of an overvoltage condition. An overvoltage condition is undesirable and must be eliminated to prevent damage to the electrically operated equipment in the helicopter. With an overvoltage condition, the increased current flow will cause an increase in the rotation speed of the motors, overheating of components, and in the case of the battery, an overcharge that could result in a thermal runaway condition.

Overvoltage is detected by the overvoltage detector of the voltage regulator (2VR1) when the generator output voltage is at 32 ±0.5 VDC. When an overvoltage condition occurs, the regulator trip relay will trip and cause the generator relay (2K3) control drive network to de-activate, which in turn de-activates the generator relay (2K3) and removes the generator output voltage from the 28 VDC bus. The generator field control circuit is also de-activated in the voltage regulator to decrease the high generator output voltage.

After an overvoltage condition, the voltage regulator (2VR1) must be reset with the generator switch (2S2) set to the RESET position. This applies 28 VDC bus power to pin D of the voltage regulator and resets the regulator trip relay. The generator reset switch can then be set to ON to allow the normal operation of the generator system.

96.2.10.2.3 Undervoltage

The voltage regulator (2VR1) continuously monitors the generator output to detect an undervoltage condition. As the majority of the electrical equipment and components can operate with an undervoltage condition, it is not as critical as the overvoltage condition. However, to make sure of adequate operation of the systems and components, a minimum undervoltage limit has been determined.

Undervoltage is detected by the undervoltage detector of the voltage regulator (2VR1) when the generator output voltage is at 18 ±1.8 VDC. When an undervoltage condition occurs, the undervoltage detector causes the generator relay (2K3) control drive network to de-activate, which in turn de-activates the generator relay and removes the generator output voltage from the 28 VDC bus.

96.2.10.2.4 Generator Reverse Current

If a reverse current of approximately 8 to 15 amps (0.08 to 0.150 VDC) flows through the starter generator relay (2MG1) for a period that exceeds 350 milliseconds, it will be detected by the reverse current detector of the voltage regulator (2VR1). The reverse current detector de-activates the generator control drive network, which in turn de-activates the generator relay (2K3) and removes the generator output voltage from the 28 VDC bus. Generator reverse current occurs when the helicopter battery (2BT1) is connected to the 28 VDC bus and the output voltage of the starter generator decreases below the output voltage of the battery.

This condition is undesirable, as the available power of the battery (2BT1) would rapidly decrease as it tries to drive the starter generator (2MG1).

96.2.10.3. STARTER GENERATOR (2MG1)

The starter generator (2MG1) is installed on the upper right side of the engine gearbox. During generator operation, the primary function of the generator portion of the starter generator is to provide the helicopter electrical system with a continuous supply of DC power for the operation of all the electrical equipment and to charge the battery. The 200-amp starter generator is approved for a continuous operation at 180 amps. In addition, the starter generator has a transient 2-minute rating from 180 to 300 amps and a transient 5-second rating from 300 to 400 amps.

The starter generator (2MG1) has a stator and an armature. The compound-wound type stator has series and shunt coils. In the generator mode, the series and shunt coils of the generator stator are used to make a magnetic field (Figure 96-33). The armature of the generator is driven from the starter generator mounting pad of the engine gearbox through a splined shaft.

As the armature turns in the magnetic field, it causes an induction of current in the armature coil. The generator brush assemblies supply the induced current to terminal B+ on the generator terminal block. The brush assemblies are spring loaded to keep the brushes seated directly on the armature.

The voltage regulator (2VR1) controls the output voltage of the starter generator (2MG1). The output voltage of the starter generator changes with the strength of the shunt field. The amount of current flow (pulsating DC voltage) through the stator field windings controls the strength of the shunt field.

The starter generator (2MG1) is internally cooled by a fan and cooling duct installation. The fan is an integral part of the starter generator and it is installed at the aft end of the starter generator. The fan is driven by the armature. A cooling duct installed between the right engine cowl door and the aft end of the starter generator supplies the cool air to the fan of the starter generator.

96.2.10.4. GENERATOR RELAY (2K3)

The generator relay (2K3) is installed on the DC equipment panel at FS 155.00, RBL 20.0, in the aft equipment compartment. The primary function of the generator relay is to connect the generator DC output voltage to the 28 VDC bus. The generator relay has one main contact and two auxiliary contacts. During normal operation, the generator relay is energized by DC power supplied from the voltage regulator (2VR1). The voltage regulator supplies the DC power when the generator output voltage is at 24 ±2.4 VDC. The DC power that controls the contactor is removed in the event of an overvoltage, undervoltage, reverse current condition, or by positioning the generator reset switch (2S2) to OFF.

The main contact, A2 to A1, supplies the generator power to the 28 VDC bus. The auxiliary contact, 22 to 23, supplies a ground path to the GENERATOR FAIL caution annunciator on the caution/warning/advisory panel (4DS1), when the generator relay (2K3) is not energized.

A suppression diode assembly (2CR3) is installed between terminals X1 and X2 of the relay coil. The suppression diode assembly decreases back EMF when the power is removed from the generator relay (2K3). When the power is removed from the generator relay, it generates a reverse high voltage. The zener diode of the suppression diode assembly quickly decreases the reverse high voltage to zero. When the generator relay is energized, the diode of the suppression diode assembly stops the flow of current to ground through the suppression diode assembly.

96.2.10.5. SHUNT (2R1) AND AMMETER INDICATION

The shunt (2R1) is installed in the DC equipment panel at FS 155.0, RBL 20.0, in the aft equipment compartment. The primary function of the shunt (2R1) is to provide a voltage drop proportional to the load on the starter generator (2MG1). The ammeter indicator (2M1) measures the current flow through the shunt to give an indication of the total amount of current used by the electrical systems of the helicopter. Refer to Chapter 95 for more data on the ammeter indication.

The rating of the shunt (2R1) is specified at 300 amps for 150 millivolts (mV). For any mV value measured across terminals (+) and (–) of the shunt, the value of the amps indication on the fuel pressure/ammeter indicator (2M1) is two times the value of mV. For example, if 10 mV is measured across the shunt, the ammeter gives an indication of 20 amps. If 75 mV is measured across the shunt, the ammeter gives an indication of 150 amps.

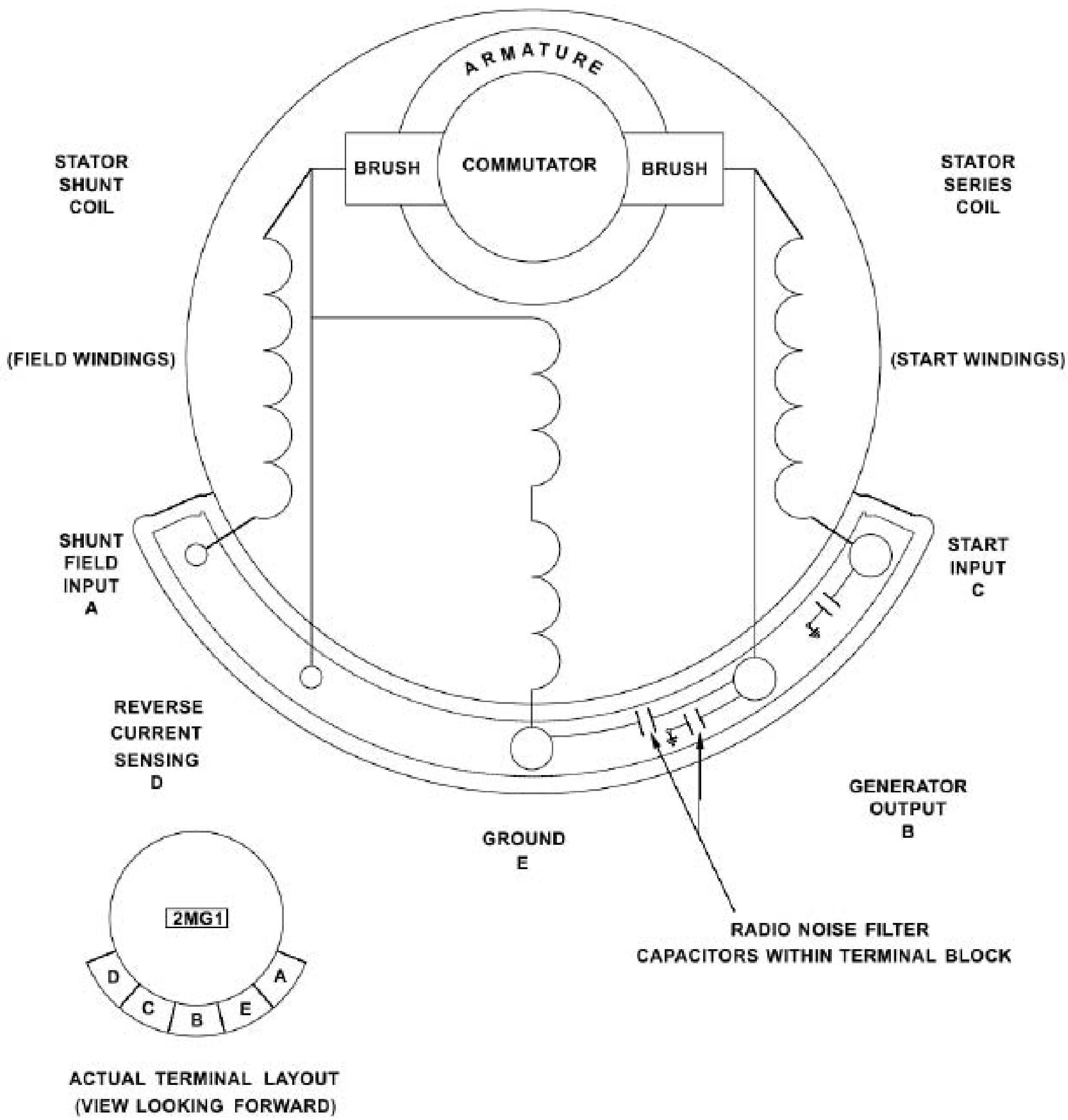


Figure 96-33: Starter Generator (2MG1) - Simplified Schematic

96.2.10.6. GENERATOR SYSTEM — OPERATION

NOTE

Refer to the generator system simplified schematic (Figure 96-34) for the description that follows.

After an engine start, with the generator reset switch (2S2) set to the OFF position, the output voltage of the starter generator (2MG1) becomes stable at approximately 0.5 to 4 VDC due to residual generator field magnetism. The GEN FAIL caution annunciator on the caution/warning/advisory panel (4DS1) will be on.

With the generator reset switch (2S2) set to ON, the contact 5 to 6 closes and allows the residual output voltage from terminal B of the starter generator (2MG1) to flow through the shunt (2R1), the generator field circuit breakers (2CB6 and 2CB3), and the generator reset switch to pin J of the voltage regulator (2VR1). Generator field circuit breaker (2CB6) also provides an input to pin K of the voltage regulator to filter generator noise.

The generator residual output voltage is then directed back to terminal A of the generator shunt field through terminal M of the voltage regulator (2VR1). This permits the regenerative build-up of the generator output voltage.

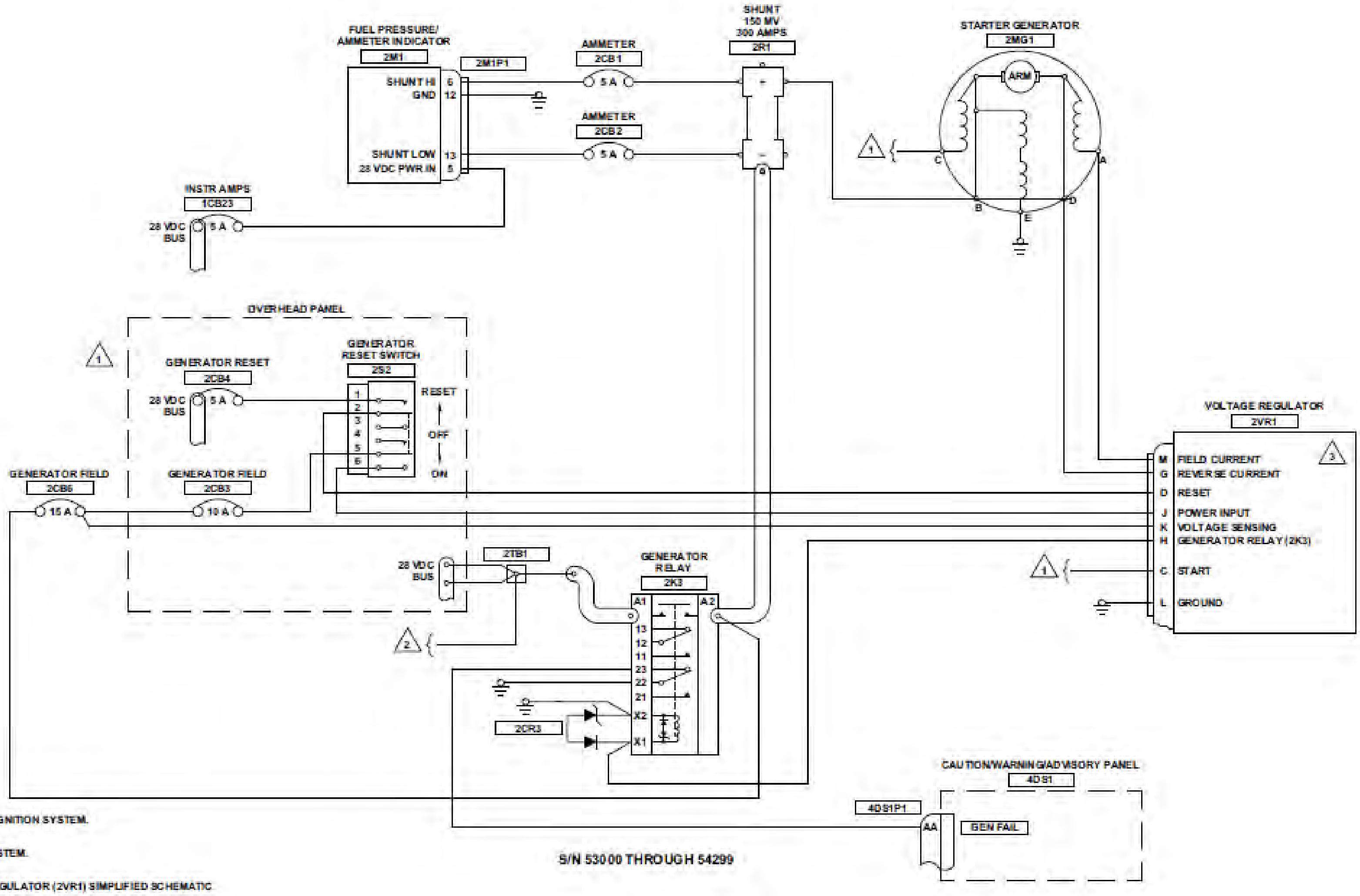
As the generator output voltage increases to approximately 16 VDC, the voltage regulator (2VR1) takes control of the generator output and allows the generator output voltage to increase to the set value. When the output of the generator goes through the threshold of 24 ±2.4 VDC, a DC power output is provided from pin H of the voltage regulator (2VR1) to terminal X1 of the generator relay (2K3).

This activates the generator relay (2K3), which in turn connects the generator output voltage to the 28 VDC bus. The contact, 22 to 23, of the energized contactor will now be open and remove the ground path to the GEN FAIL caution annunciator.

With the generator output voltage connected to the 28 VDC bus, the voltage regulator (2VR1) maintains the required system voltage.

In the event the voltage regulator (2VR1) detects an overvoltage, undervoltage, or reverse current condition, it removes the DC power output from its pin H to terminal X1 of the generator relay (2K3). This removes the generator output voltage from the 28 VDC bus and it also causes the GEN FAIL caution annunciator to come on.

During an overvoltage condition, the voltage regulator (2VR1) activates an internal trip relay and removes the pulsating field control voltage from its pin M to terminal A of the starter generator (2MG1). This decreases the high generator output voltage to a residual voltage of approximately 0.5 to 4 VDC.



NOTES

1. REFER TO START AND IGNITION SYSTEM.
2. REFER TO BATTERY SYSTEM.
3. REFER TO VOLTAGE REGULATOR (2VR1) SIMPLIFIED SCHEMATIC

Figure 96-34: Generator System - Simplified Schematic

To re-activate the voltage regulator (2VR1) after an overvoltage, the generator reset switch (2S2) must be momentarily set to the RESET position with the battery or external power connected to the 28 VDC bus. This allows the 28 VDC bus voltage to flow through the generator reset circuit breaker (2CB4), contact 1 to 2 of the generator reset switch, to pin D (RESET INPUT) of the voltage regulator. This unlatches the regulator trip relay in the voltage regulator. The generator system may be re-activated by positioning the generator reset switch to ON.

96.2.10.6.1 Generator System — Operational Check

CAUTION

A QUALIFIED PERSON MUST BE AT THE HELICOPTER CONTROLS DURING THE GROUND RUN PROCEDURE. REFER TO THE BHT-407-FM-1 OR BHT-407-FM-2.

1. Prepare the helicopter for a ground run.
2. Start the engine and let it warm up.
3. Set the generator reset switch (2S2) to ON per the procedures given in the FMS-E407-789-1.

RESULT:

- On the caution/warning/advisory panel (4DS1), the GEN FAIL caution annunciator goes off.
- On the instrument panel, the clock/OAT/volts indicator shows the generator output voltage. The generator output voltage should be at 29 ±0.1 VDC if the ambient temperature is below 59°F (15°C). The generator output voltage should be at 28.5 ±0.1 VDC if the ambient temperature is above 59°F (15°C).
- On the instrument panel, the fuel pressure/ ammeter indicator (2M1) shows the current drawn from the starter generator (2MG1).

CORRECTIVE ACTION:

- If the GEN FAIL annunciator stays on, refer to Trouble No. 1 (Figure 96-35).
- If the generator output voltage is not displayed on the clock/OAT/volts indicator, refer to Trouble No. 2 (Figure 96-36).
- If the generator output voltage is not in the limits, do adjustments of the generator output voltage (paragraph 96.2.10.6.2).
- If the fuel pressure/ammeter indicator (2M1) does not show an indication, reset the circuit breakers (2CB1 and 2CB2). If the fuel pressure/ammeter indicator does not show an indication, refer to Trouble No. 3 (Figure 96-37).

4. On the overhead console, set the generator reset switch (2S2) to OFF.

RESULT:

- On the caution/warning/advisory panel (4DS1), the GEN FAIL caution annunciator comes on.
- On the instrument panel, the clock/OAT/volts indicator shows the battery voltage. The voltage indication should decrease from the voltage regulator (2VR1) set value to approximately 24 VDC in accordance to the condition of the battery charge.

CORRECTIVE ACTION:

- If the GEN FAIL caution annunciator does not come on, refer to Trouble No. 4 (Figure 96-38).
- If the clock/OAT/volts indicator does not show the battery voltage, refer to Trouble No. 5 (Figure 96-39).

5. Shut down the engine per the FMS-E407-789-1.
6. On the overhead console, set the battery switch (2S1) to OFF.
7. Return the helicopter to the standard configuration. Refer to Standard Practices — After Electrical Maintenance or Repairs (paragraph 96.1.1.1.4).

96.2.10.6.2 Voltage Regulator (2VR1) — Adjustment

SPECIAL TOOLS REQUIRED

NUMBER	NOMENCLATURE
Model 79 Fluke or Equivalent	Multimeter

1. Set the multimeter to an applicable scale to measure 28 VDC.
2. Gain access to the DC equipment panel in the equipment compartment (Figure 96-40). Remove the protective cover.
3. Connect the positive lead of the multimeter to the 28 VDC bus side of the DC equipment panel.
4. Connect the negative lead of the multimeter to the airframe ground.
5. On the voltage regulator (2VR1), loosen the locknut on the adjustment screw.

NOTE

During operations in extremely hot environments, the voltage setting may be lowered to reduce the possibility of internal battery overheating and the depletion of the cell electrolyte. Refer to the manufacturer of the battery for additional information.

6. Adjust the output voltage as follows (to increase the generator output voltage, turn the adjustment screw clockwise. To decrease the generator output voltage, turn the adjustment screw counterclockwise):
   a. Winter seasonal temperature: Average maximum daily ambient temperature does not exceed 59°F (15°C). Set the output voltage to 29.0 ±0.1 VDC.
   b. Summer seasonal temperature: Average maximum daily ambient temperature exceeds 59°F (15°C). Set the output voltage to 28.5 ±0.1 VDC.
7. Tighten the locknut and make sure the generator output voltage has not changed from the set value.
8. On the clock/OAT/volts indicator, make sure the set generator output voltage shown is within ±0.2 VDC.
9. Reinstall the protective cover on the DC equipment panel.

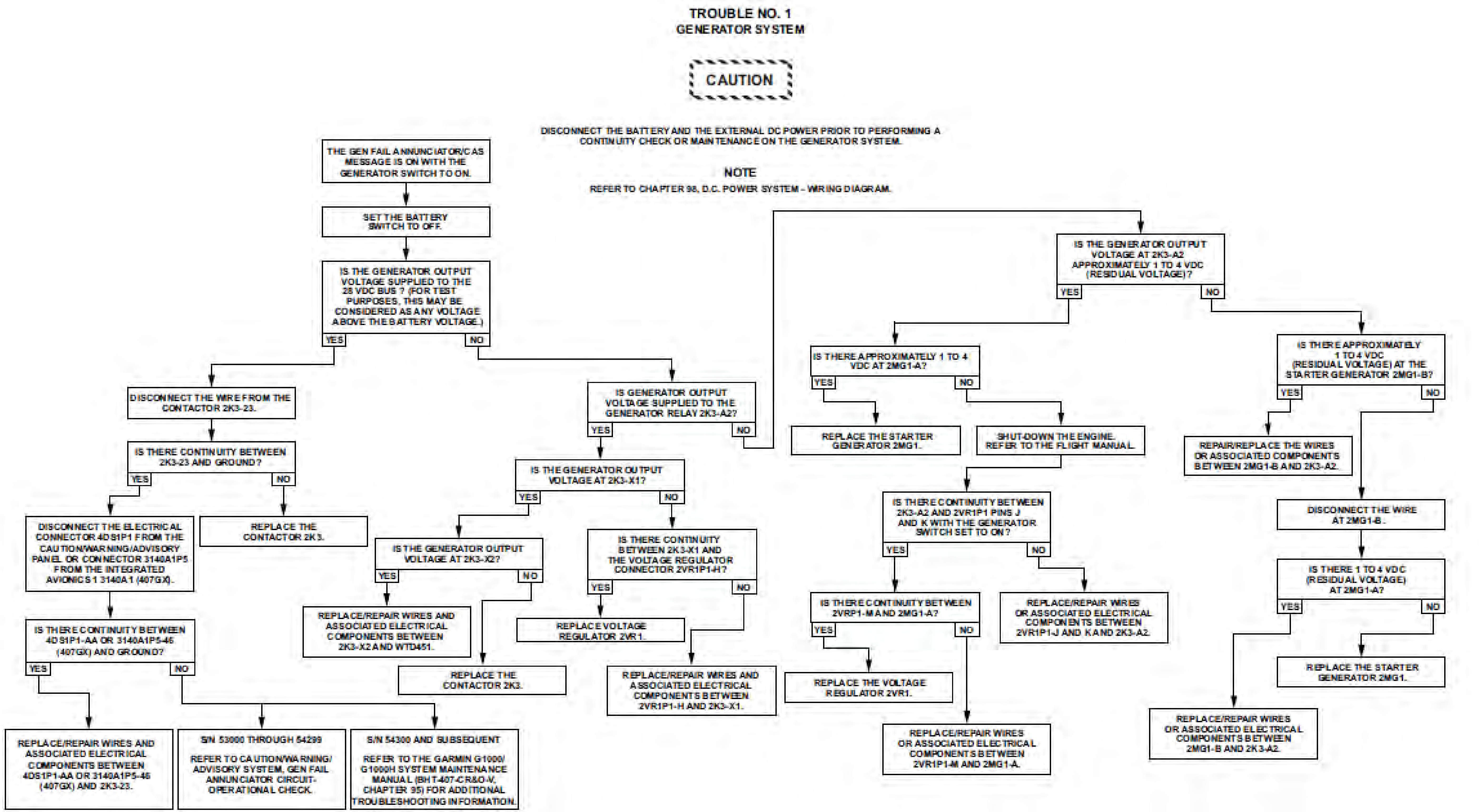


Figure 96-35: Generator System - Trouble No. 1

TROUBLE NO. 2
GENERATOR SYSTEM

CAUTION

DISCONNECT THE BATTERY AND EXTERNAL DC POWER PRIOR TO PERFORMING A CONTINUITY CHECK OR MAINTENANCE ON THE GENERATOR SYSTEM.

NOTE

REFER TO CHAPTER 98, D.C. POWER SYSTEM - WIRING DIAGRAM.

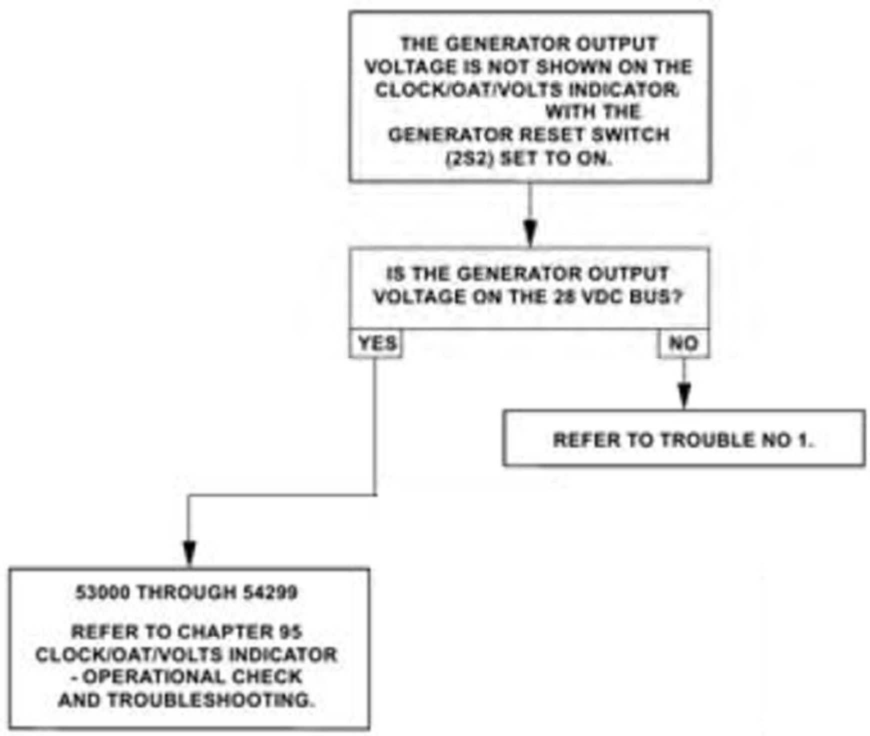


Figure 96-36: Generator System - Trouble No. 2

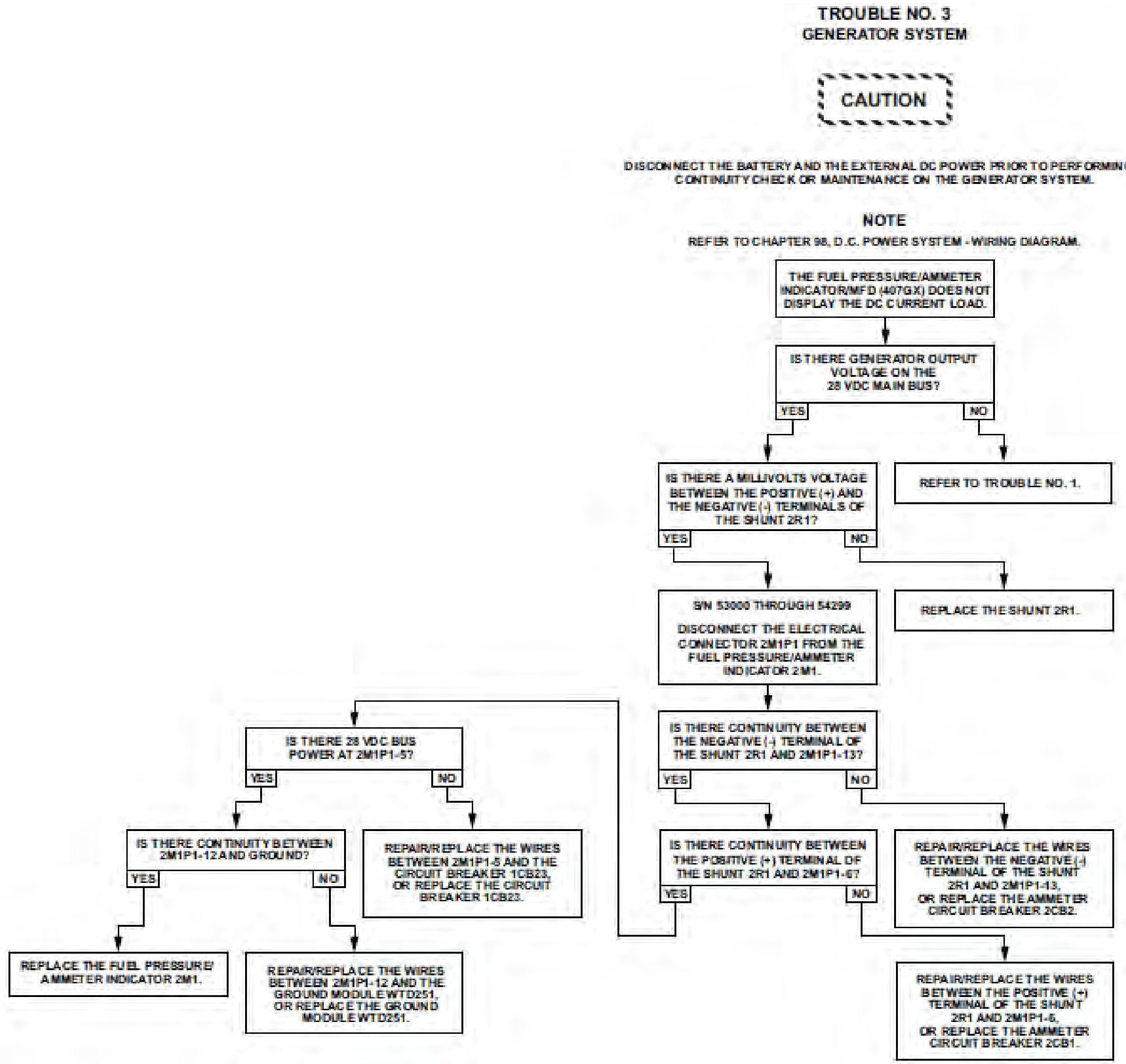


Figure 96-37: Generator System - Trouble No. 3

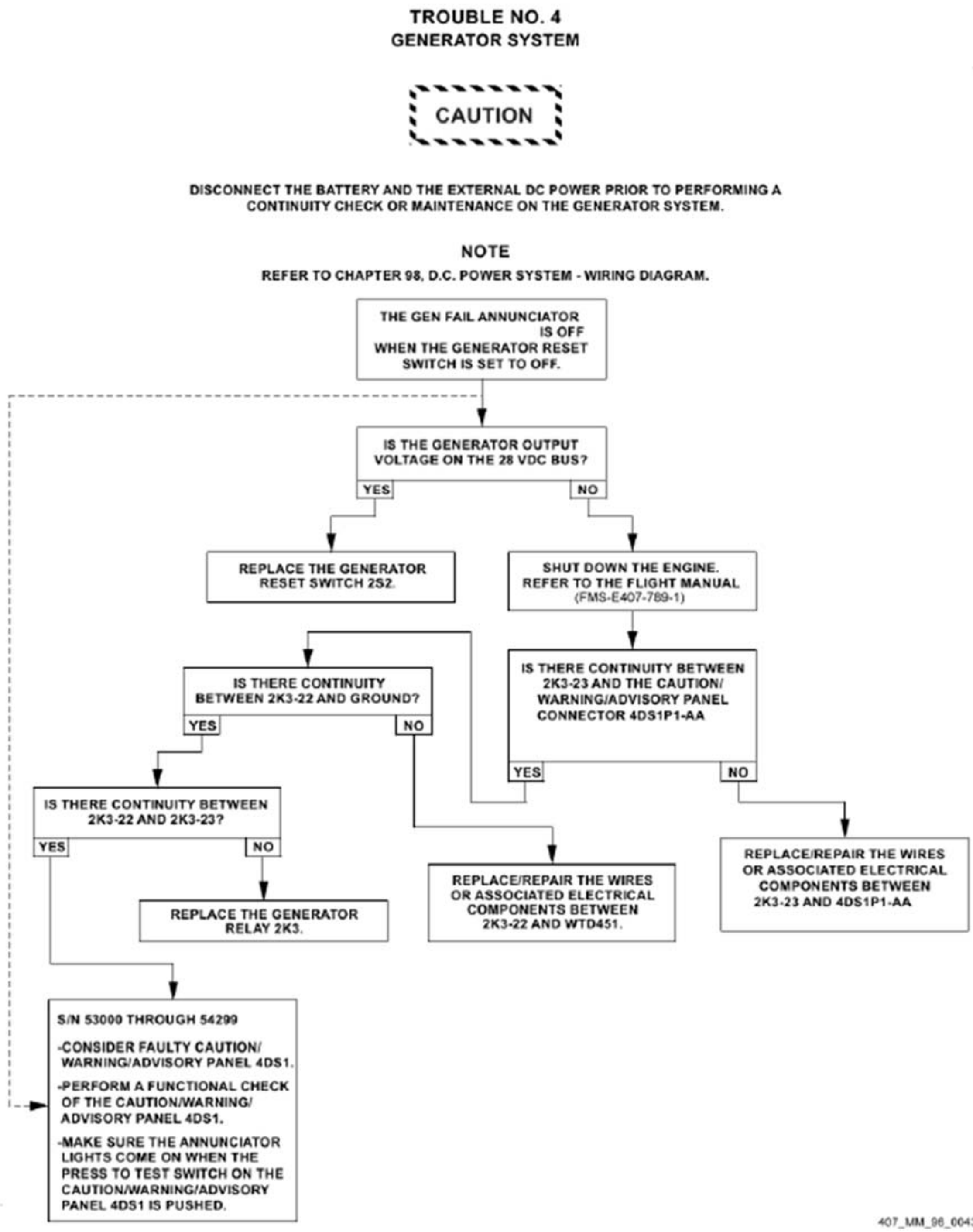


Figure 96-38: Generator System - Trouble No. 4

TROUBLE NO. 5
GENERATOR SYSTEM

CAUTION

DISCONNECT THE BATTERY AND THE EXTERNAL DC POWER PRIOR TO PERFORMING A CONTINUITY CHECK OR MAINTENANCE ON THE GENERATOR SYSTEM.

NOTE

REFER TO CHAPTER 98, D.C. POWER SYSTEM - WIRING DIAGRAM.

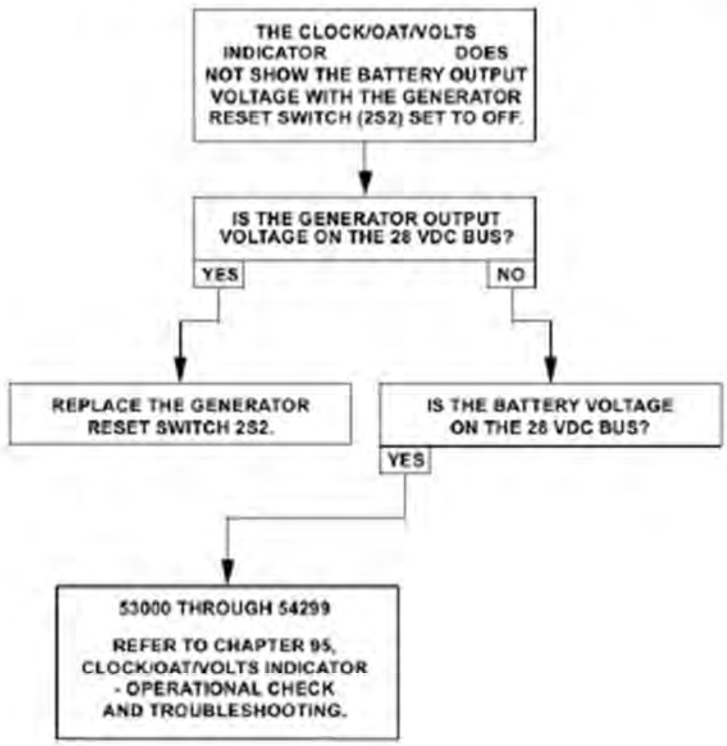
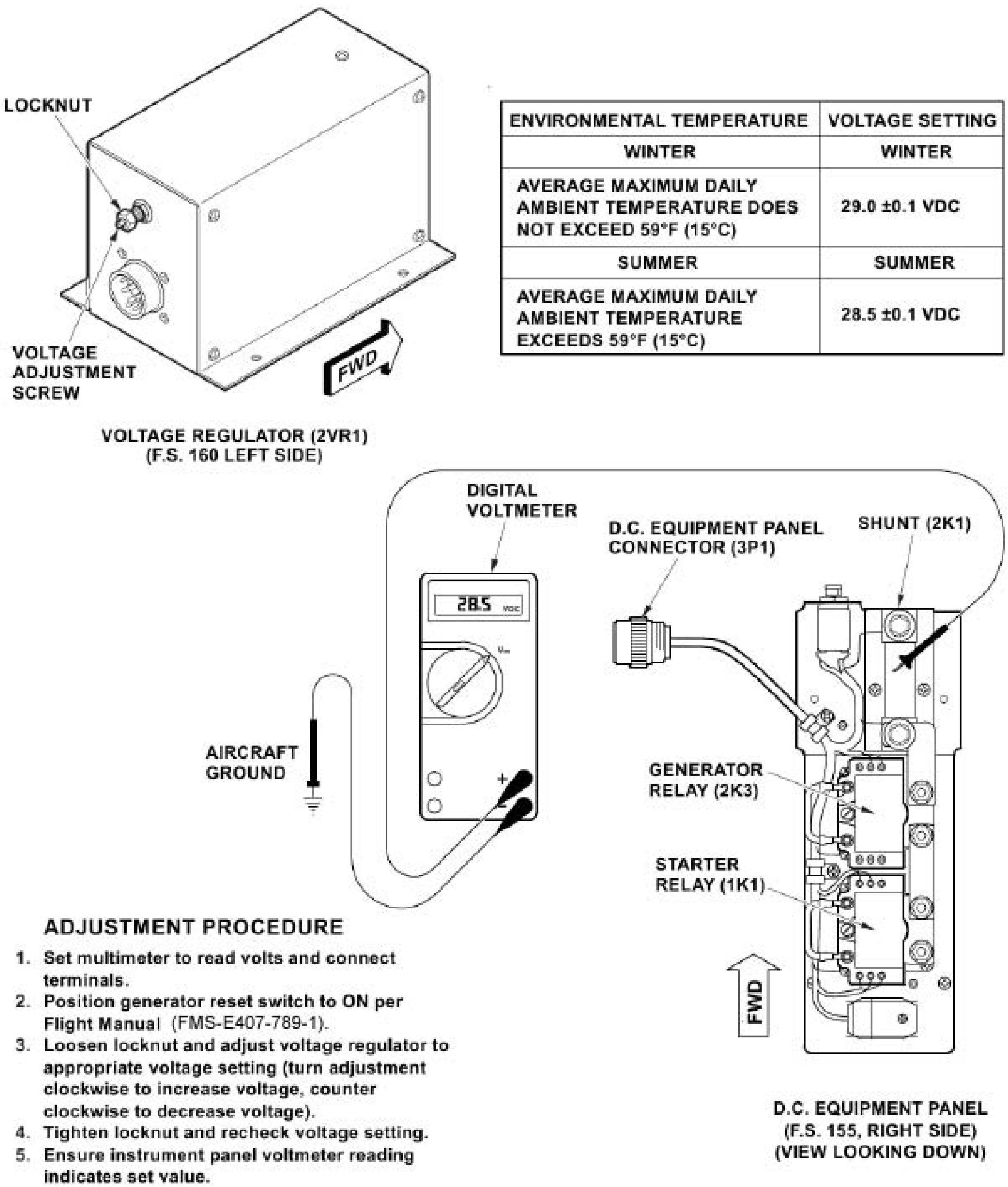


Figure 96-39: Generator System - Trouble No. 5



ENVIRONMENTAL TEMPERATURE	VOLTAGE SETTING
WINTER	WINTER
AVERAGE MAXIMUM DAILY AMBIENT TEMPERATURE DOES NOT EXCEED 59°F (15°C)	29.0 ±0.1 VDC
SUMMER	SUMMER
AVERAGE MAXIMUM DAILY AMBIENT TEMPERATURE EXCEEDS 59°F (15°C)	28.5 ±0.1 VDC

ADJUSTMENT PROCEDURE

1. Set multimeter to read volts and connect terminals.
2. Position generator reset switch to ON per Flight Manual (FMS-E407-789-1).
3. Loosen locknut and adjust voltage regulator to appropriate voltage setting (turn adjustment clockwise to increase voltage, counter clockwise to decrease voltage).
4. Tighten locknut and recheck voltage setting.
5. Ensure instrument panel voltmeter reading indicates set value.

Figure 96-40: Voltage Regulator (2VR1) - Adjustment

96.2.10.6.3 Voltage Regulator (2VR1) — Inspection

Do a visual inspection of the voltage regulator (2VR1) for damage to the case. Make sure it is correctly secured. Inspect the electrical connector (2VR1P1) and the voltage regulator receptacle to make sure the contacts are clean.

96.2.10.6.4 Starter Generator (2MG1) — Inspection

MATERIALS REQUIRED

Refer to BHT-ALL-SPM for specifications.

NUMBER	NOMENCLATURE
C-304	Drycleaning Solvent

NOTE

Refer to Chapter 71 for starter generator removal and installation instructions.

1. Do a visual check of the terminal block to make sure that there are no cracks, and it is not warped or loose. Make sure the terminals are not loose or damaged.
2. Do a visual check of the brush end cover for dents and loose or damaged air inlet screen.
3. With a clean cloth moist with drycleaning solvent (C-304), clean the exterior of the starter generator (2MG1) and wipe dry.
4. Rotate the splined shaft to check for fan rub and bearing condition.

CAUTION

USE DRY FILTERED AIR (LOW PRESSURE) TO CLEAN THE INTERIOR OF THE STARTER GENERATOR.

5. Remove the brush end cover and do an inspection for oil, dirt, and other foreign material. Do an air vacuum to remove any foreign material.
6. Do an inspection of the commutator for a smooth bright appearance with light filming.
7. Do an inspection of the brushes as follows. Take care when removing the brushes to ensure the leads are not damaged and excessive force is not applied.
   a. Make sure the brush leads are flexible with no broken or frayed strands.
   b. Make sure the brushes have more than 1/4 life remaining (Figure 96-41).
   c. Make sure the brushes are seated correctly (Figure 96-42). A 100% seat in the direction of the rotation and a minimum of 85% axially is mandatory.

CAUTION

MAKE SURE THE BRUSH LEADS ARE SECURED AND THEY DO NOT RUB OR HANG ON THE BRUSH HOLDER.

NOTE

If the brushes pass the inspection, they must be carefully installed in their original position in the starter generator. If any of the brushes need to be replaced before the next scheduled inspection or overhaul (every 1000 hours), remove the starter generator. Send the starter generator to an approved repair facility.

8. Install the brushes and make sure their position is correct (Figure 96-43).

96.2.10.6.5 Starter Generator (2MG1) — Repair

If the starter generator (2MG1) does not meet the inspection requirements, replace with a serviceable unit. Send the starter generator to an approved repair facility for overhaul.

96.2.10.6.6 Generator Reset Switch (2S2) — Removal and Installation

For the removal and installation procedures to replace the generator reset switch (2S2), refer to the Miscellaneous Electrical Components — Maintenance Practices (paragraph 96.1.6).

96.2.10.6.7 Voltage Regulator (2VR1) — Removal

WARNING

OBEY ALL OF THE SAFETY PRECAUTIONS WHEN DOING MAINTENANCE ON OR NEAR ELECTRICAL/ELECTRONIC EQUIPMENT (PARAGRAPH 96.1.1.1.).

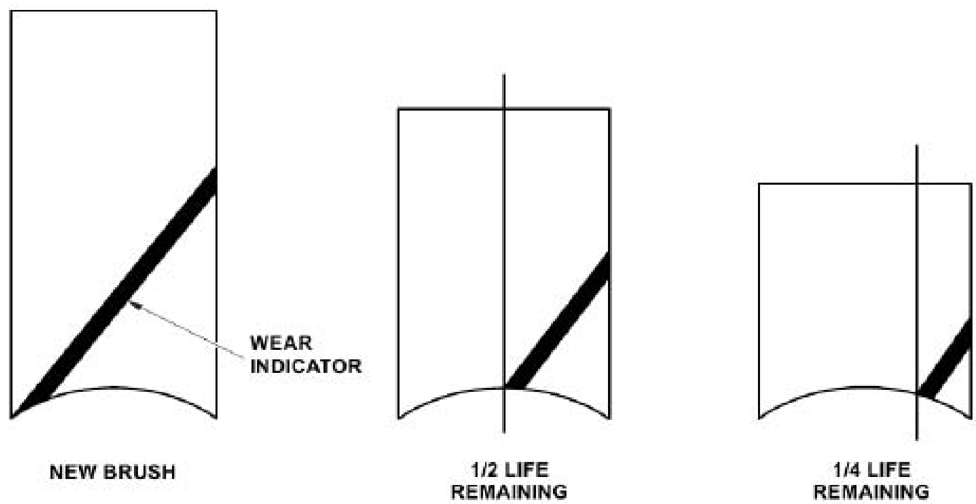
1. Disconnect battery and external DC power source from the helicopter.
2. Gain access to the voltage regulator (2VR1) (3, Figure 96-44) from the hat rack or from the upper access panel in the baggage compartment.
3. Disconnect the electrical connector (2VR1P1) (4) from the voltage regulator (2VR1) (3).
4. Remove the screws (1) and washers (2).
5. Remove the voltage regulator (2VR1) (3).

96.2.10.6.8 Voltage Regulator (2VR1) — Installation

WARNING

OBEY ALL OF THE SAFETY PRECAUTIONS WHEN DOING MAINTENANCE ON OR NEAR ELECTRICAL/ELECTRONIC EQUIPMENT (PARAGRAPH 96.1.1.1.).

1. Install the voltage regulator (2VR1) (3, Figure 96-44) onto its mounting bracket located between FS 155.1 and FS 167.3, LBL 18.5. Make sure the electrical receptacle of the voltage regulator (2VR1) (3) is installed towards the aft of the helicopter.



NOTE

Starter generator brushes should be replaced when the brush wear indicates near or at 1/4 life remaining.

Figure 96-41: Wear Limits of the Starter Generator Brushes – Inspection

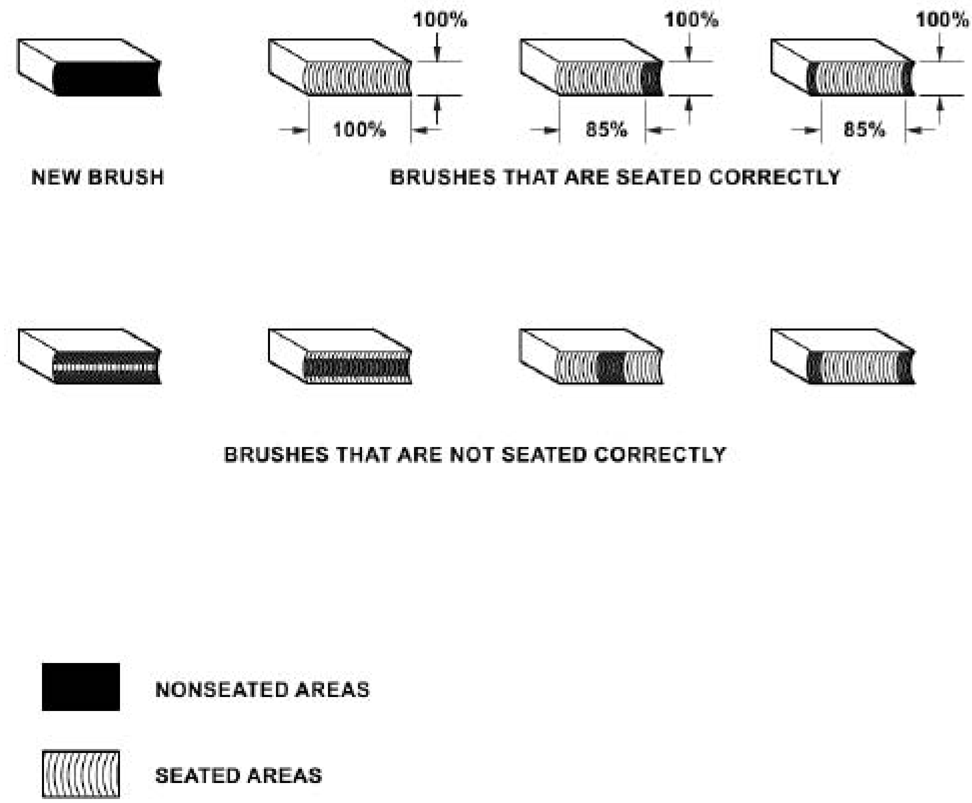


Figure 96-42: Seating of the Starter Generator Brushes – Inspection

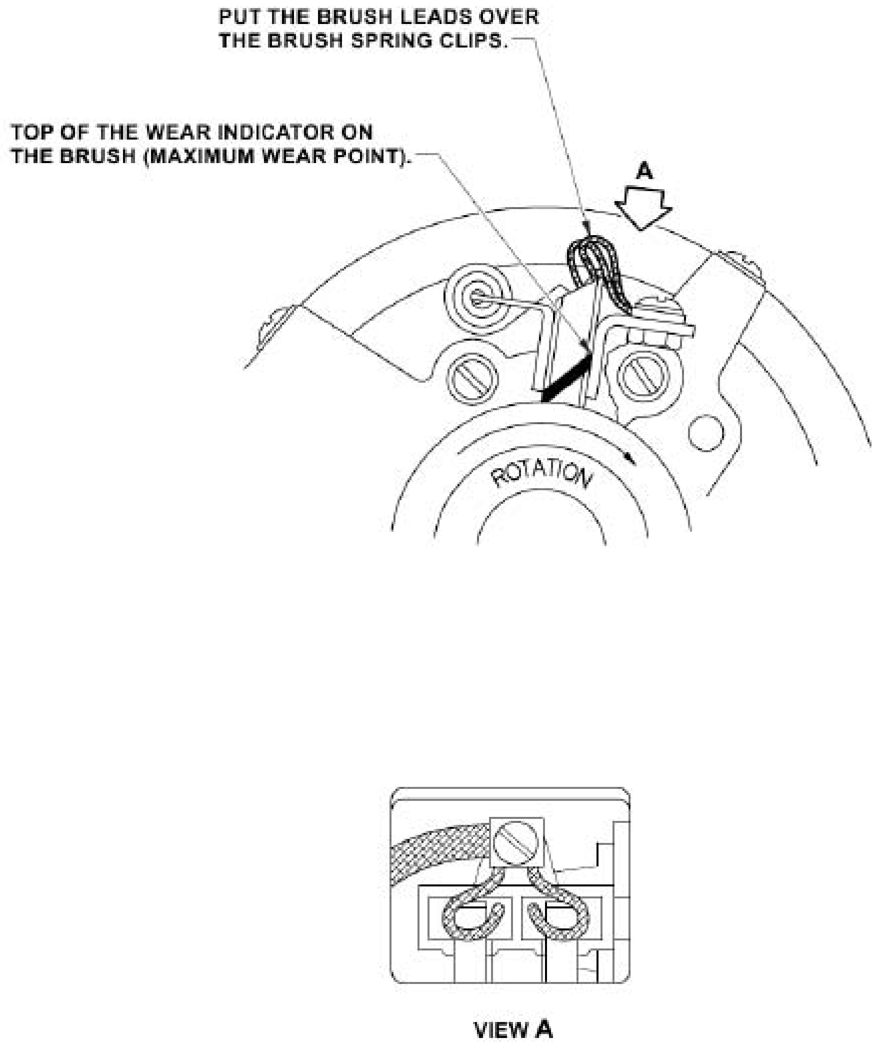


Figure 96-43: Correct Position of the Starter Generator Brushes and Springs – Inspection

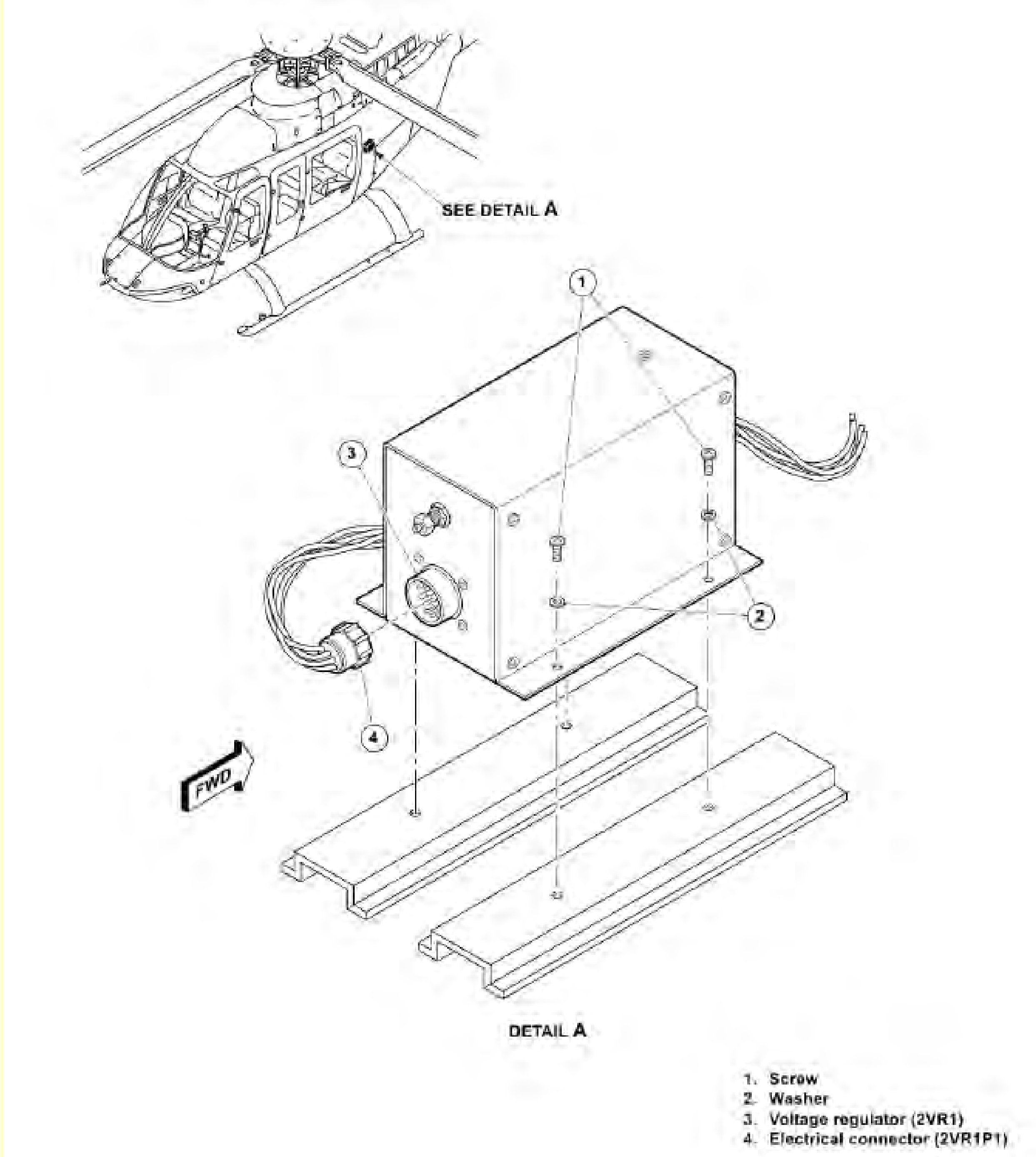


Figure 96-44: Voltage Regulator (2VR1) - Remove and Installation

2. Attach the voltage regulator (2VR1) (3) with the screws (1) and washers (2).
3. Connect the electrical connector (2VR1P1) (4) to the voltage regulator (2VR1) (3). Make sure the electrical connector (2VR1P1) (4) is correctly installed and secured.
4. Do an operational check (paragraph 96.2.10.6.1) of the generator system and do an adjustment (paragraph 96.2.10.6.2) of the voltage regulator.
5. Install the access panels.

96.2.10.6.9 Generator Relay (2K3) — Removal

SPECIAL TOOLS REQUIRED

NUMBER	NOMENCLATURE
M81969/14-02 or M81969/14-11	Insertion/Extraction Tool

WARNING

OBEY ALL OF THE SAFETY PRECAUTIONS WHEN DOING MAINTENANCE ON OR NEAR ELECTRICAL/ELECTRONIC EQUIPMENT (PARAGRAPH 96.1.1.1.).

1. Disconnect battery and external DC power from the helicopter.
2. Gain access to the DC equipment panel at FS 155.00.
3. Remove the cover from the DC equipment panel.
4. Remove the nuts (1, Figure 96-45), lockwashers (2), and washers (3). Remove the wires and the bus bar (4).
5. Remove the nuts (1), lockwashers (2), washers (3), bolt (10), lockwashers (2), washers (3), and the bus bar (11).
6. Remove the nuts (7) and washers (8). Remove the wires and the suppression diode assembly (2CR3) (9) from the generator relay (2K3) (12).
7. With the insertion/extraction tool (M81969/14-02 or M81969/14-11), remove the wires from terminals 22 and 23.
8. Remove the screws (5) and washers (6).
9. Remove the generator relay (2K3) (12).

96.2.10.6.10 Generator Relay (2K3) — Installation

SPECIAL TOOLS REQUIRED

NUMBER	NOMENCLATURE
M81969/14-02 or M81969/14-11	Insertion/Extraction Tool

WARNING

OBEY ALL OF THE SAFETY PRECAUTIONS WHEN DOING MAINTENANCE ON OR NEAR ELECTRICAL/ELECTRONIC EQUIPMENT (PARAGRAPH 96.1.1.1.).

1. Install the generator relay (2K3) (12, on its mounting base in the DC (Figure 96-45) equipment panel, at FS 155.00.
2. Install the screws (5) and washers (6) to attach the generator relay (2K3) (12).

NOTE

Refer to the generator system wiring diagram (Chapter 98) for the correct wire installation on the generator relay (2K3) (12) and for the correct orientation of the suppression diode assembly (1CR3) (9).

3. With the insertion/extraction tool (M81969/14-11), install the wires to terminals 22 and 23.
4. Install the suppression diode assembly (2CR3) (9) (positive (+) end of 2CR3 to X1 of generator relay (2K3)) and the wires on the generator relay (2K3) (12). Install the washers (8) and nuts (7) to secure the wires and the suppression diode assembly (2CR3).
5. Install the bus bar (11) on the generator relay (2K3) (12) and the shunt. Install the lockwashers (2), washers (3), and bolt (10) to attach the bus bar to the shunt. Install the lockwashers, washers, and nuts (1) to attach the bus bar to the relay terminal (2K3).
6. Install the bus bar (4) and the wires. Install the lockwashers (2), washers (3), and nuts (1) to attach the bus bar to the terminals of the generator relay (2K3) (12) and starter relay (1K1) (13).
7. Install the cover on the DC equipment panel.
8. Do an operational check of the generator system (paragraph 96.2.10.6.1).

96.2.10.6.11 Starter Generator (2MG1) — Removal

Refer to the Chapter 71 for the removal procedure of the starter generator (2MG1).

96.2.10.6.12 Starter Generator (2MG1) — Installation

Refer to the Chapter 71 for the installation procedure of the starter generator (2MG1).

96.2.10.6.13 Shunt Resistor (2R1) — Removal and Installation

For the removal and installation procedures for the shunt resistor (2R1), refer to the Miscellaneous Electrical Components — Maintenance Practices (paragraph 96.1.6).

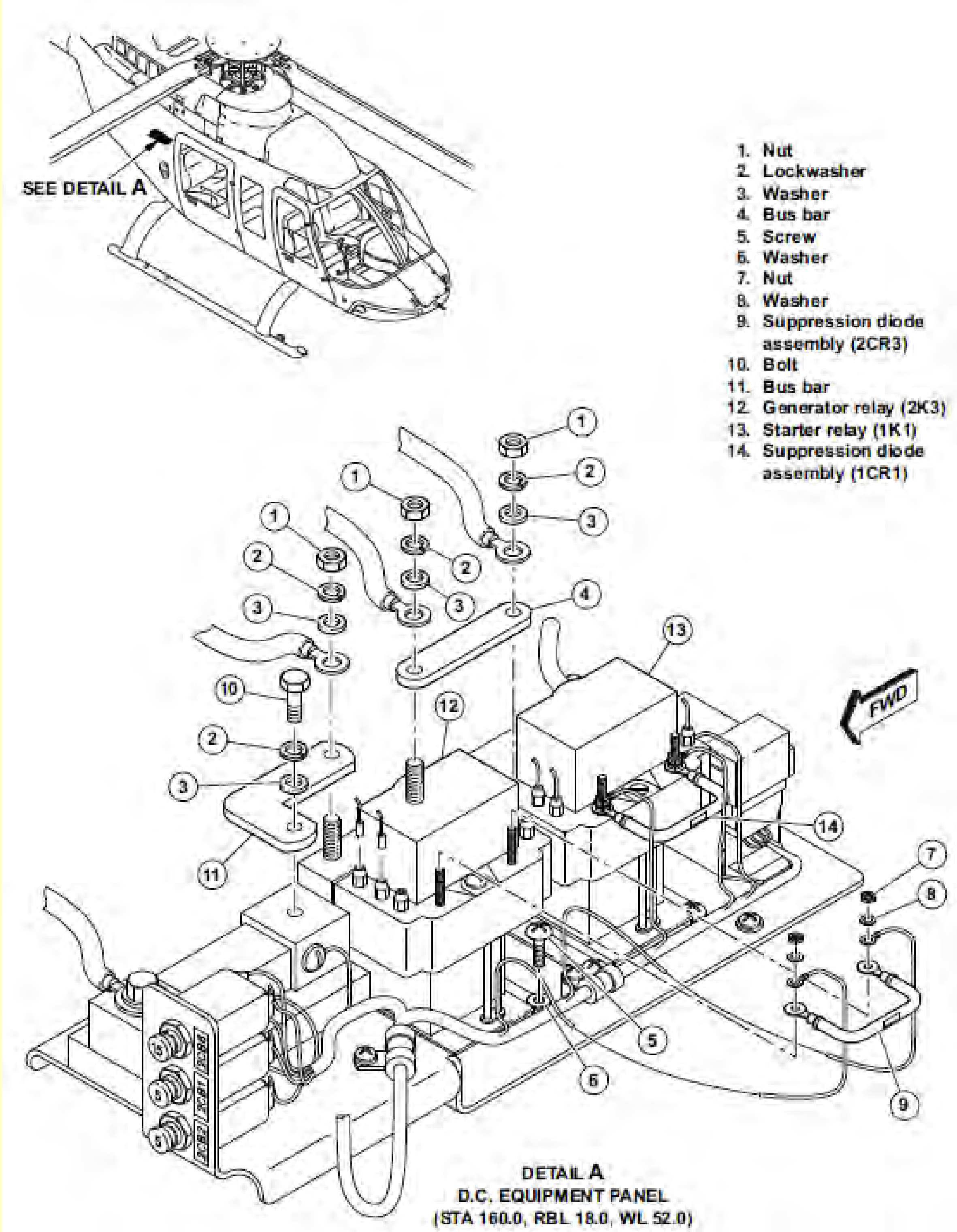


Figure 96-45: Generator Relay (2K3) - Removal and Installation

96.3. CAUTION/WARNING/ADVISORY

96.3.1 CAUTION/WARNING/ ADVISORY

The main function of the caution / warning / advisory system is to detect specific system conditions and provide a visual or visual/audio indication to the pilot. Detection is accomplished with the use of various sensors, switches, and relays. Visual indications are provided through a caution/warning/advisory panel.

As applicable to helicopters 407HP, audio indications are provided through three separate warning horns.

In conjunction with the information provided in this section, the electrical and electronic components, reference designator / description reference table (Table 96-6) can be used to find the installation location of specific items. The BHT-ELEC-SPM can be used for wiring repair information. The wiring diagrams in Chapter 98 can be used for complete information on the actual electrical circuits.

96.3.2 CAUTION/WARNING/ ADVISORY PANEL (4DS1)

The caution/warning/advisory panel (4DS1) is installed in the glareshield of the instrument panel assembly. The caution/warning/advisory panel is comprised of 36 individual annunciator positions that provide a visual indication of cautions (amber annunciators), warnings (red annunciators), and advisory annunciators (green or white conditions) (Table 96-7). Each annunciator contains three lamps. The lamps are wired in parallel to allow individual operation in the event that one or more of the lamps burns out (Figure 96-47).

Of the 36 annunciators, 32 are illuminated with a ground input (ground seeking), three are illuminated with a 28 VDC bus input (positive seeking), and one is illuminated with a combination ground and 28 VDC bus input (ground/positive seeking).

Additionally, all but five of the annunciators (FLOAT TEST, FADEC FAIL, ENGINE OVERSPEED, ENGINE OUT, and RPM) can come on in either the fixed bright mode or the fixed dim mode.

With the instrument light potentiometer (8U1) in the OFF position, all annunciators will be illuminated in the fixed bright mode. With the instrument light potentiometer set to the ON position, the caution light brt/dim switch (4A2S3) may be used to select either the dim or bright mode (refer to the lighting system section of this chapter for additional information). In the dim mode, all annunciators with the exception of those mentioned above will be illuminated at a fixed dim value. An internal dimming resistor is used in each annunciator, which can be dimmed to ensure an equal intensity of illumination. Isolation diodes are also used in the annunciators to ensure appropriate power and ground paths during different modes of annunciator operation (i.e., dim, bright, and test) (Figure 96-47).

All of the annunciator lamps can be tested by pressing the test switch. This completes a required ground or 28 VDC input to each annunciator to check the operation of the lamps. The press to test C/W LT TEST (4DS1S1) switch will also confirm operation of the lamps in the FADEC reset switch

(4962-S7) and the NAV/GPS switch (3415S2), if installed.

Warning (red) — Immediate crew awareness and immediate crew action required; accompanied by one or more audio alert tones

Caution (yellow) — Immediate crew awareness and subsequent corrective action required; accompanied by one or more audio alert tones

Advisory (white) — Crew awareness required and subsequent action may be required.

Safe Operating Advisory (green) — Crew awareness required.

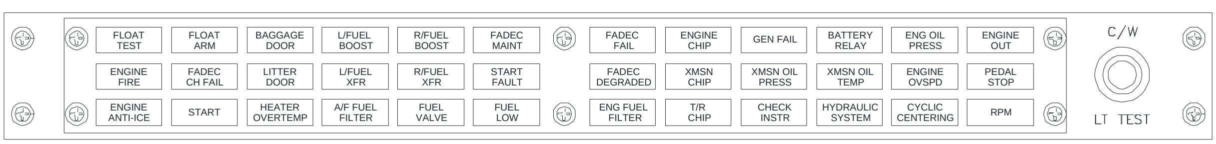


Figure 96-46: Caution/Warning/Advisory annunciator Panel

Table 96-7: Annunciator Matrix

POSITION	ANNUNCIATOR NEW	COLOR	DIM	PIN	ACTIVATION POLARITY
1	FLOAT TEST	Green	No	FF	28 VDC
1	FLOAT TEST	Green	No	A	GND
2	ENGINE FIRE	Red	No	C	28 VDC
3	ENGINE ANTI-ICE	Amber	Yes	E	GND
4	FLOAT ARM	Amber	Yes	H	28 VDC
5	FADEC CH FAIL	Amber	Yes	K	GND
6	START	White	Yes	M	GND
7	BAGGAGE DOOR	Amber	Yes	P	GND
8	LITTER DOOR	Amber	Yes	S	GND
9	HEATER OVERTEMP	Amber	Yes	U	28 VDC
10	L/FUEL BOOST	Amber	Yes	B	GND
11	L/FUEL XFR	Amber	Yes	D	GND
12	A/F FUEL FILTER	Amber	Yes	F	GND
13	R/FUEL BOOST	Amber	Yes	J	GND
14	R/FUEL XFR	Amber	Yes	L	GND
15	FUEL VALVE	Amber	Yes	N	GND
16	FADEC MAINT	White	Yes	R	GND
17	START FAULT	White	Yes	T	GND
18	FUEL LOW	Amber	Yes	V	GND
19	FADEC FAIL	Red	Yes	m	GND
20	FADEC DEGRADED	Amber	Yes	p	GND
21	ENG FUEL FILTER	Amber	Yes	s	GND
22	ENGINE CHIP	Amber	Yes	u	GND
23	XMSN CHIP	Amber	Yes	w	GND
24	T/R CHIP	Amber	Yes	y	GND
25	GEN FAIL	Amber	Yes	AA	GND
26	XMSN OIL PRESS	Red	Yes	CC	GND
27	CHECK INSTR	Amber	Yes	EE	GND
28	BATTERY RELAY	Amber	Yes	k	GND
29	XMSN OIL TEMP	Red	Yes	n	GND
30	HYDRAULIC SYSTEM	Amber	Yes	r	GND
31	ENG OIL PRESS	Red	No	t	GND
32	ENGINE OVSPD	Red	No	v	GND
33	CYCLIC CENTERING	Amber	Yes	x	GND
34	ENGINE OUT	Red	No	z	GND
35	PEDAL STOP	Amber	Yes	BB	GND
36	RPM	Red	No	DD	GND

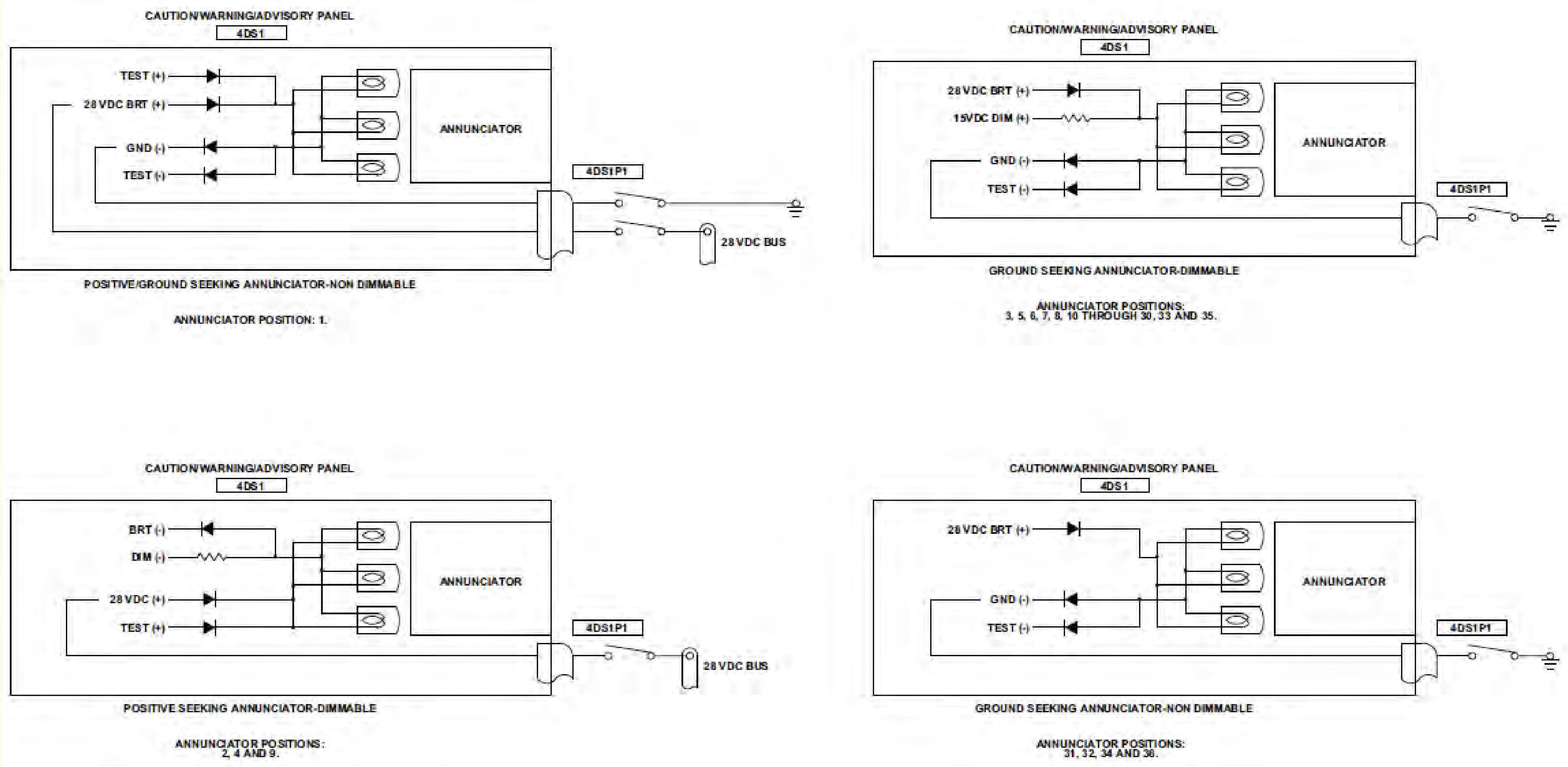


Figure 96-47: Caution/Warning/Advisory Panel Annunciators - Internal Simplified Schematic

Table 96-8: Audio Alerts

NAME	AUDIO TYPE	ACTIVATION LOGIC	ALERT DESCRIPTION
Low Rotor RPM Alert	Continuous	RPM audio alert warning logic (paragraph 96.3.41).	Continuous solid Tone at 2900 Hz ±500 Hz.
Engine Out	Continuous	Engine out audio alert warning logic (paragraph 96.3.38).	Fast-pulsing tone at a rate of maximum 8 pulses per second at 2900 Hz ±500 Hz.
FADEC Fail	Continuous	FADEC fail audio alert warning logic (FADEC fail discrete input = active) (paragraph 96.3.23).	Repeating DING-DONG tone at frequency 750 to 912 Hz.

96.3.3 CAUTION/WARNING/ ADVISORY PANEL (4DS1) — FUNCTIONAL CHECK

SPECIAL TOOLS REQUIRED

NUMBER	NOMENCLATURE
100-1020S	Contacts (Qty 50)
Fluke Model 79 or Equivalent	Multimeter
MRAC50SG7HVL2	Connector
MS22759/41-22-9	Wire (Qty as required)
Commercial Unit	0 to 28 Volt Variable DC Power Supply

NOTE

To manufacture a test harness, label and insert the test wires into the harness connector advisory as per the panel caution/warning/ annunciators (Table 96-7).

1. Remove caution/warning/advisory panel per paragraph 96.3.4.1. and connect the test connector and harness to the caution/warning/advisory panel.
2. Apply a ground path to the following input pins: a, c, b, and HH.
3. Apply 28 VDC to the following input pins: X, Z, f, and d.
4. Press the C/W LT TEST (4DS1S1) switch.

RESULT:
- All of the annunciators come on bright.
- Continuity exists between pins e and j.

CORRECTIVE ACTION:
- If all of the annunciators do not come on bright, replace faulty lamps or return the caution / warning / advisory panel to an approved repair center.

5. With C/W LT TEST (4DS1S1) switch released, apply the proper inputs required for each annunciator to come on as per the activation polarity information contained in Table 96-7.

RESULT:
- Each of the annunciators comes on bright.

CORRECTIVE ACTION:
- If any of the annunciators do not come on bright, send the caution/warning/advisory panel to an approved repair center.

6. Remove 28 VDC from inputs X and Z, while maintaining 28 VDC on inputs f and d.
7. Apply 15 VDC to input W and apply ground to input Y.
8. Press the C/W LT TEST (4DS1S1) switch.

RESULT:

- All of the annunciators come on dim with the exception of positions 1, 31, 32, 34, and 36, which will come on bright.

CORRECTIVE ACTION:

- If all of the annunciators do not come on dim (except the positions 1, 31, 32, 34, and 36), send the caution/warning/advisory panel (4DS1) to an approved repair center.

9. Apply proper inputs required for each annunciator to come on as per activation polarity information contained in Table 96-7.

RESULT:

- Each of the annunciators comes on dim except for positions 1, 31, 32, 34, and 36, which will come on bright.

CORRECTIVE ACTION:

- If any of the annunciators do not come on dim (except for positions 1, 31, 32, 34, and 36), send the caution/warning/advisory panel (4DS1) to an authorized repair center.

10. Remove all input voltages and grounds from the connector test harness.
11. Disconnect the test connector and harness from the caution/warning/advisory panel (4DS1).
12. Return the helicopter to the standard configuration. Refer to Standard Practices — After Electrical Maintenance or Repairs (paragraph 96.1.1.1.4).

96.3.4 CAUTION / WARNING / ADVISORY PANEL (4DS1) LAMPS — REPLACEMENT

WARNING

OBEY ALL OF THE SAFETY PRECAUTIONS WHEN MAINTENANCE DOING ON OR NEAR ELECTRICAL/ELECTRONIC EQUIPMENT (PARAGRAPH 96.1.1.1.).

1. Disconnect battery and external DC power from the helicopter.
2. Loosen the screws that secure the bezel assembly (1, Figure 96-48) to the case of the caution/ warning/advisory panel (4DS1).
3. Pull the bezel assembly (1) out of the case of the panel.
4. Remove the lamp(s) (2) that are not serviceable. Install a serviceable lamp to replace the lamps removed.

NOTE

Make sure the letters of the annunciators have the correct orientation when the bezel assembly is put into position in the case.

5. Correctly position the bezel assembly (1) into the case of the caution/warning/advisory panel (4DS1).

CAUTION

DO NOT FORCE THE BEZEL ASSEMBLY INTO THE CASE OF THE CAUTION/ WARNING/ADVISORY PANEL. THE LAMPS CAN BE DAMAGED IF THE BEZEL ASSEMBLY IS FORCED INTO THE CASE.

6. Carefully push the bezel assembly (1) into the case of the panel.
7. Tighten the screws to secure the bezel assembly (1) to the caution/warning/advisory panel (4DS1).
8. Apply the battery or external DC power. Press and hold the C/W LT TEST (4DS1S1) switch on the caution/warning/advisory panel (4DS1). Make sure all of the annunciators come on. Release the C/W LT TEST switch.

96.3.4.1. Caution/Warning/Advisory Panel (4DS1) — Removal

WARNING

OBEY ALL OF THE SAFETY PRECAUTIONS WHEN MAINTENANCE DOING ON OR NEAR ELECTRICAL/ELECTRONIC EQUIPMENT (PARAGRAPH 96.1.1.1.).

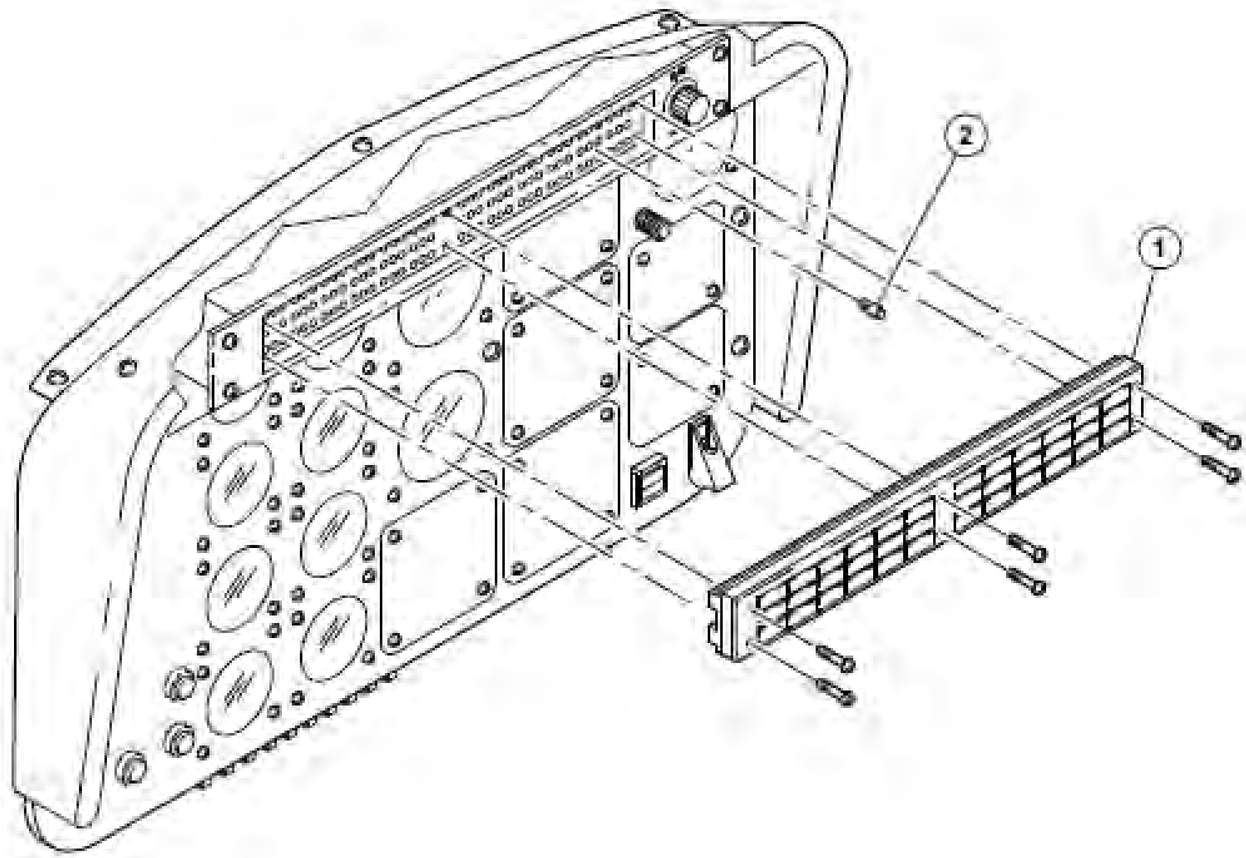
1. Disconnect battery and external power from the helicopter.
2. On the circuit breaker panel, open the LIGHTS CAUT circuit breaker (4CB1).
3. Remove the upper instrument console cover.
4. Disconnect the electrical connector (4DS1P1) (3, Figure 96-50) from the caution/warning/advisory panel (4DS1) (2).
5. Remove the screws (1) that attach the caution/ warning/advisory panel (4DS1) (2) to the glareshield.
6. Remove the caution/warning/advisory panel (4DS1) (2).

96.3.4.2. Caution/Warning/Advisory Panel (4DS1) — Installation

WARNING

OBEY ALL OF THE SAFETY PRECAUTIONS WHEN MAINTENANCE DOING ON OR NEAR ELECTRICAL/ELECTRONIC EQUIPMENT (PARAGRAPH 96.1.1.1.).

1. Install the caution/warning/advisory panel (4DS1) (2, Figure 96-50) into its position in the glareshield.
2. Install the screws (1) to secure the caution/ warning/advisory panel (4DS1) (2) to the glareshield.
3. Connect the electrical connector (4DS1P1) (3) to the connector of the caution/warning/advisory panel (4DS1) (2).
4. Apply battery or external DC power. Close the LIGHTS CAUT circuit breaker (4CB1) and press C/W LT TEST (4DS1S1) switch and make sure all of the annunciators come on.
5. Install the instrument console cover.



1. Bezel assembly
2. Lamp (924-91792-007)

Figure 96-48: Caution/Warning/Advisory Panel Lamps - Removal and Installation

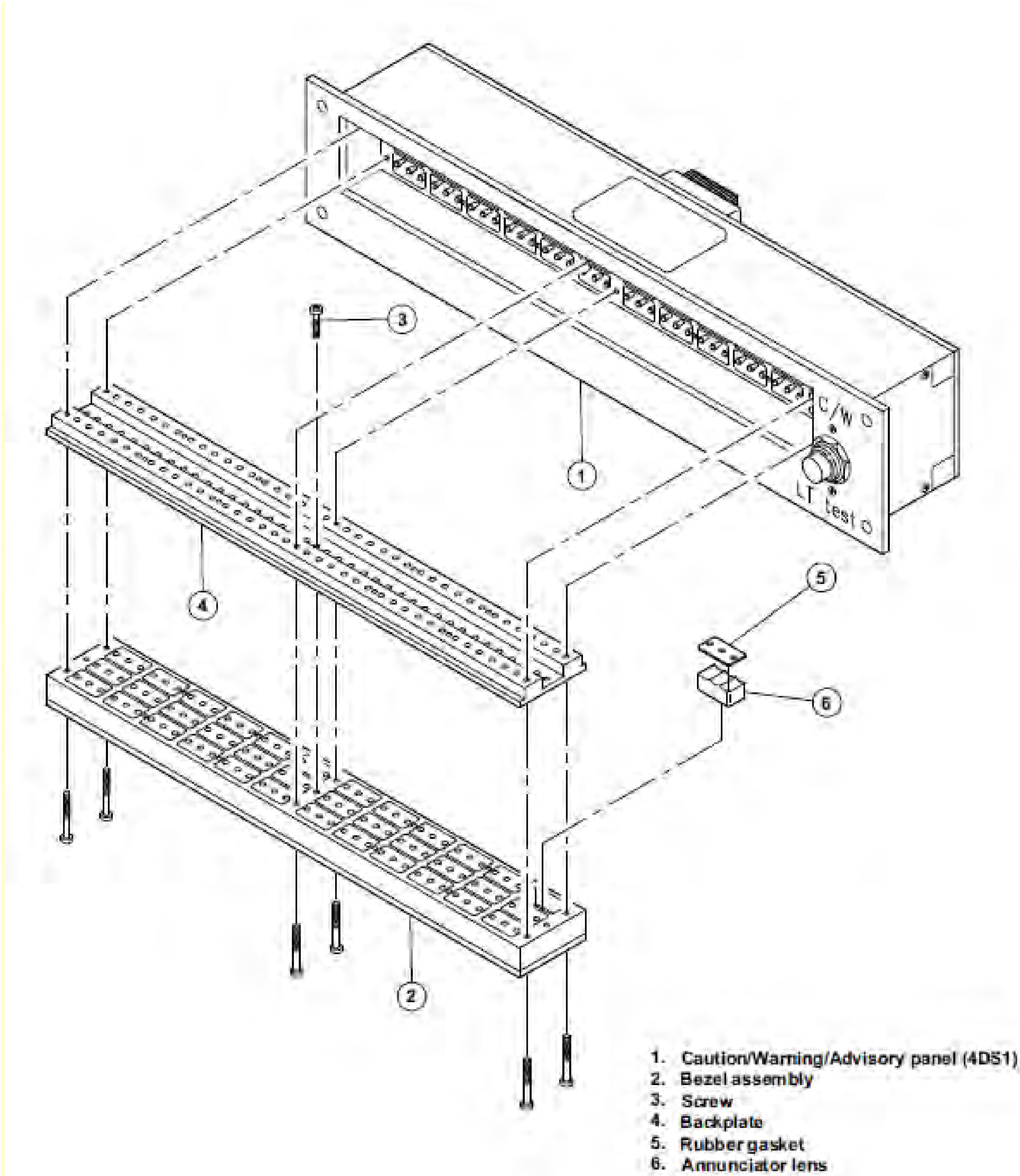


Figure 96-49: Annunciator Lens - Replacement

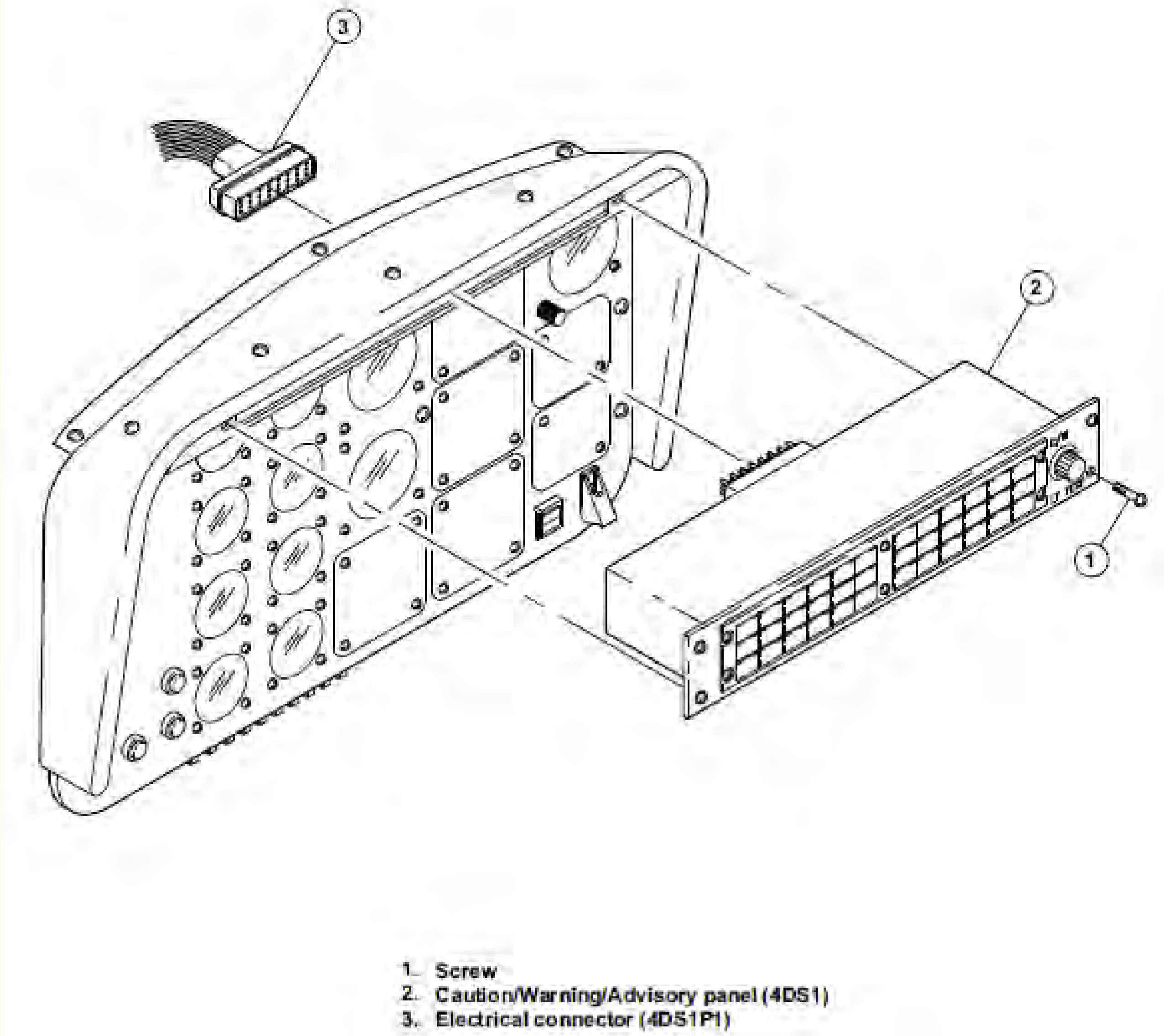


Figure 96-50: Caution/Warning/Advisory Panel (4DS1) - Removal and Installation

96.3.5 FLOAT TEST ANNUNCIATOR CIRCUIT — OPERATION

See BHT-407-MM Chapter 96-137.

96.3.5.1. FLOAT TEST Annunciator Circuit — Operational Check

See BHT-407-MM Chapter 96-138.

96.3.5.2. FLOAT TEST Annunciator Circuit— Component Replacement

See BHT-407-MM Chapter 96-139.

96.3.6 FLOAT ARM ANNUNCIATOR CIRCUIT — OPERATION

See BHT-407-MM Chapter 96-140.

96.3.6.1. FLOAT ARM Annunciator Circuit — Operational Check

See BHT-407-MM Chapter 96-141.

96.3.6.2. FLOAT ARM Annunciator Circuit— Component Replacement

See BHT-407-MM Chapter 96-142.

96.3.7 ENGINE FIRE ANNUNCIATOR CIRCUIT — OPERATION

The engine fire warning annunciator circuit is designed to notify the pilot when an excessive temperature or fire develops in the engine compartment. This circuit is installed in conjunction with the HTS900-2-1D engine installation in accordance with BHT-407-II-19. The ENGINE FIRE annunciator requires a 28 VDC input to come on. Refer to the engine fire annunciator circuit simplified schematic (Figure 96-51).

The ENGINE FIRE annunciator comes on when the fire overheat detector element senses a temperature of 338°F (170°C) over its entire length or 842°F (450°C) over a 12 inch (30.4 cm) section. There is a ±6% tolerance on the activation/deactivation temperatures. When this temperature range is reached, the contacts in the fire overheat detector (2600A1) close. This provides 28 VDC bus power from the FIRE DET circuit breaker (2600CB1) to illuminate the ENGINE FIRE annunciator. When the temperature drops below the previously mentioned temperatures (±6%), the contacts in the fire overheat detector (2600A1) open and break the circuit. The 28 VDC is no longer supplied and the annunciator extinguishes.

The ENGINE FIRE annunciator warning also illuminates when the FIRE DET TEST switch (2600S1) is depressed. This push-type switch is mounted on the instrument panel to enable testing of the fire detection system circuit. When the FIRE DET TEST switch is depressed, 28 VDC is supplied throughout the system and the ENGINE FIRE annunciator comes on. When the switch is released, the circuit is broken and the ENGINE FIRE annunciator warning extinguishes.

96.3.7.1. ENGINE FIRE Annunciator Circuit — Operational Check

1. Make sure the FIRE DET (2600CB1) circuit breaker is closed.
2. Connect external DC power to the helicopter.
3. Press and hold the FIRE DET TEST switch (2600S1).

RESULT:

- The ENGINE FIRE annunciator comes on.

CORRECTIVE ACTION:

- If the ENGINE FIRE annunciator does not come on, refer to Trouble No. 1 (Figure 96-52).

4. Release the FIRE DET TEST switch (2600S1).

RESULT:

- The ENGINE FIRE annunciator/ extinguishes.

CORRECTIVE ACTION:

- If the ENGINE FIRE annunciator does not extinguish, replace the FIRE DET TEST switch (2600S1).

5. Disconnect external DC power.

6. Return the helicopter to the standard configuration. Refer to Standard Practices — After Electrical Maintenance or Repairs (paragraph 96.1.1.1.).

96.3.7.2. ENGINE FIRE Annunciator Circuit — Functional Check

Refer to BHT-407-II-19 for functional check procedures.

96.3.7.3. ENGINE FIRE Annunciator Circuit — Component Replacement

Refer to Caution/warning/advisory panel (4DS1) (paragraph 96.3.2, and paragraph 96.3.3 through paragraph 96.3.4.2.), or the BHT-ELEC-SPM for wiring to maintenance procedures as required. For the removal and installation of engine fire annunciator circuit components, refer to BHT-407-II-19.

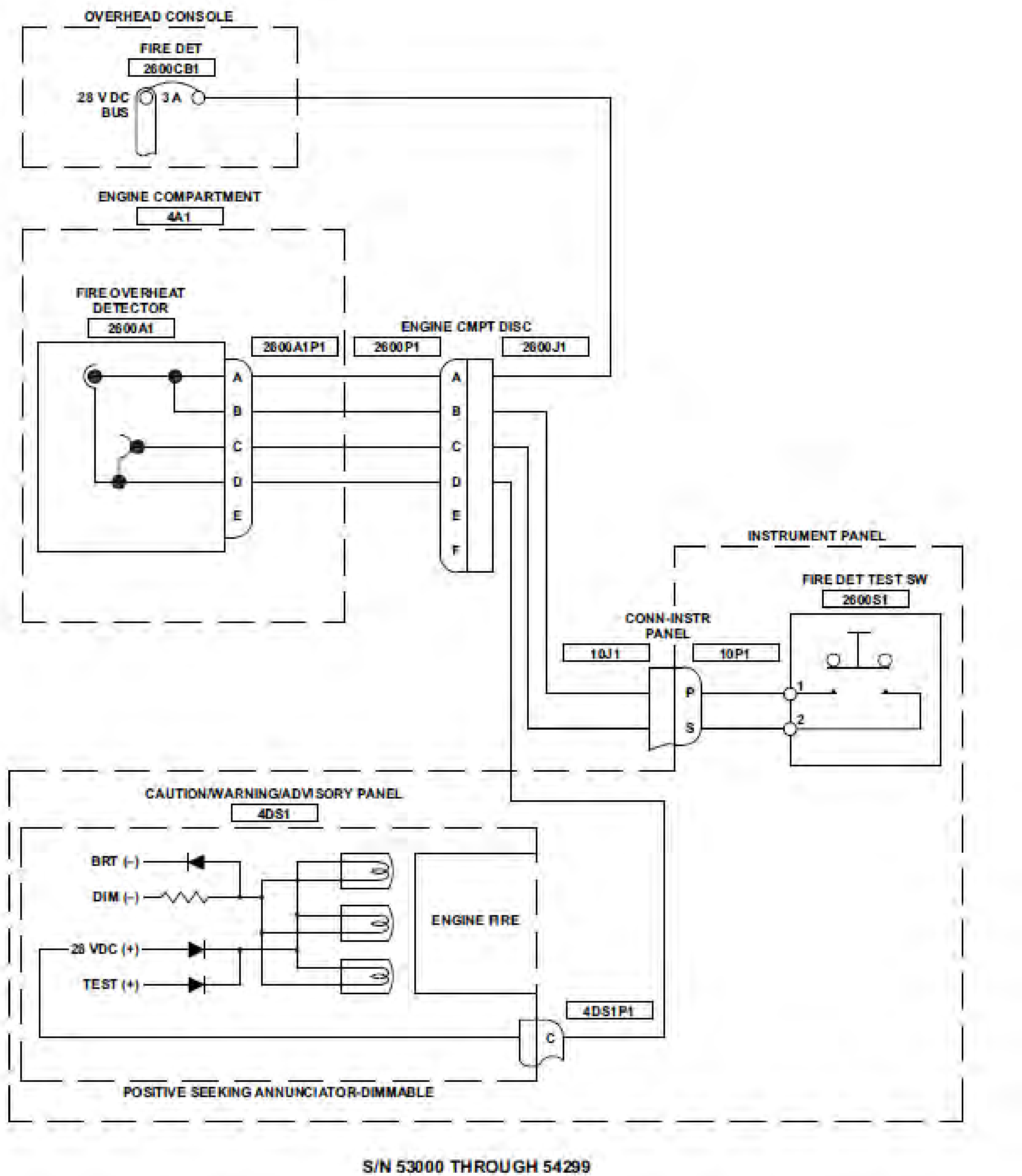


Figure 96-51: ENGINE FIRE Annunciator Circuit - Simplified Schematic

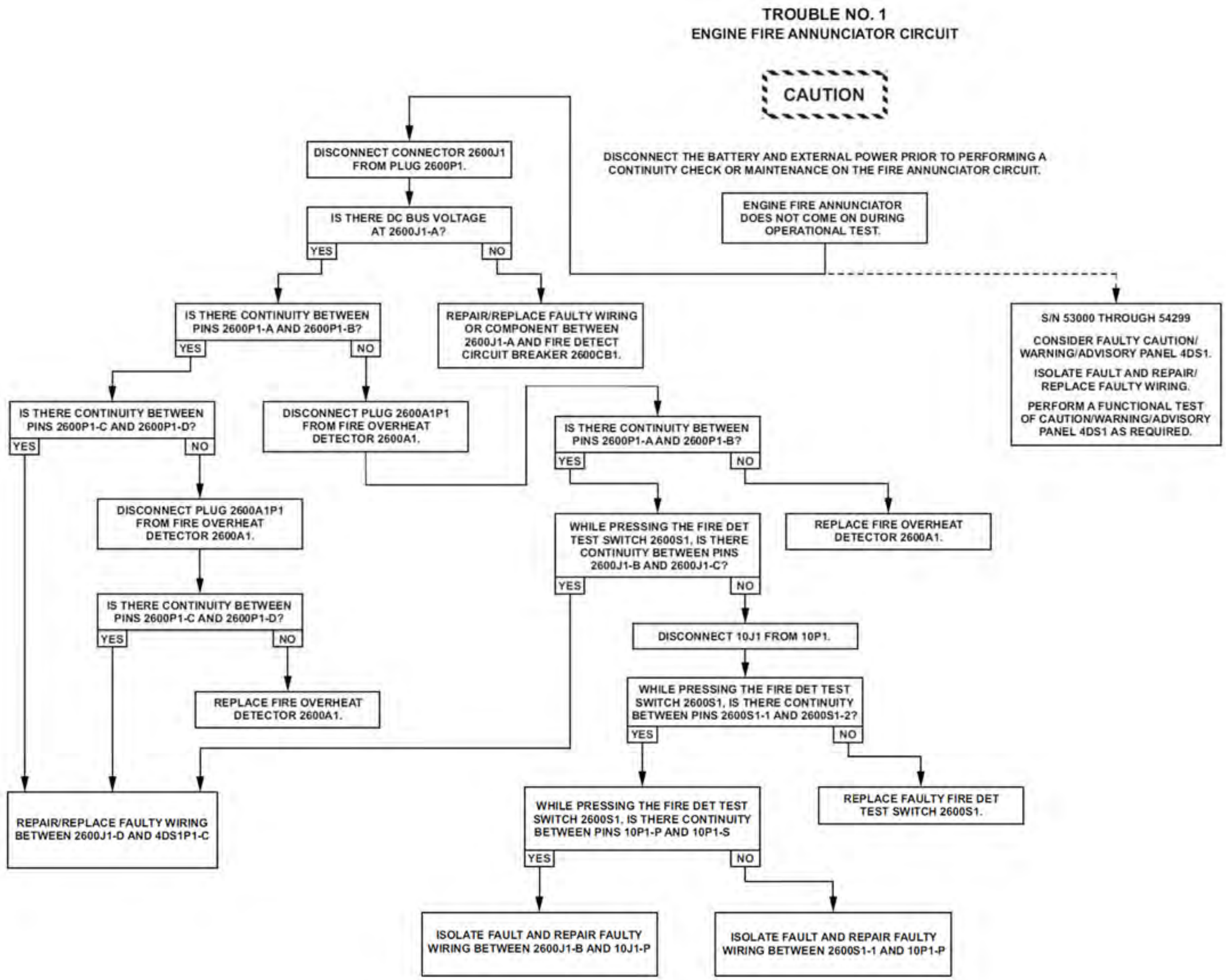


Figure 96-52: ENGINE FIRE Annunciator Circuit - Trouble No. 1

96.3.8 ENGINE ANTI-ICE ANNUNCIATOR CIRCUIT — OPERATION

The ENGINE ANTI-ICE annunciator circuit is designed to notify the pilot when the engine anti-ice system is on. The white ENGINE ANTI-ICE annunciator requires a ground to come on. Refer to the engine anti-ice annunciator circuit simplified schematic (Figure 96-53).

The ENGINE ANTI-ICE annunciator comes on when the engine anti-ice pressure switch (4962-A35) is activated. The engine anti-ice pressure switch will be activated by hot air when the engine anti-ice switch (4A2S1) is set to ON. This de-energizes (opens) the engine anti-ice solenoid –valve delivering compressor bleed air to the associated anti-ice air tubes and internal passages within the engine inlet; discharging to the engine compartment and anti-ice pressure port for the switch. Engine anti-ice pressure switch activation occurs on increasing pressure at 5.5 ±0.5 PSI (37.9 ±3.4 kPa), which closes contacts B to C and completes the circuit to ground to turn on the ENGINE ANTI-ICE annunciator.

When the engine anti-ice switch (4A2S1) is set to OFF, the flow of hot air to the engine inlet housing and to the engine anti-ice pressure switch (4962-A35) is cut off. Engine anti-ice pressure switch deactivation occurs on decreasing pressure prior to 3.0 PSI (20.68 kPa), which opens contacts B to C and opens the circuit to ground to turn off the ENGINE ANTI-ICE annunciator.

96.3.8.1. ENGINE ANTI-ICE Annunciator Circuit — Operational Check

WARNING

A QUALIFIED PERSON MUST BE AT THE HELICOPTER CONTROLS DURING THE GROUND RUN PROCEDURE. REFER TO THE BHT-407-FM-1 OR BHT-407-FM-2. FAILURE TO COMPLY MAY RESULT IN INJURY TO PERSONNEL.

1. Make sure the LIGHTS CAUT (4CB1) circuit breaker is closed and the engine anti-ice switch (4A2S1) is set to OFF.
2. Connect external DC power to the helicopter.

RESULT:

- The ENGINE ANTI-ICE annunciator is off.

CORRECTIVE ACTION:

- If the ENGINE ANTI-ICE annunciator is on (ground is supplied to the annunciator), refer to Trouble No. 1 (Figure 96-54).

3. Prepare the helicopter for a ground run.
4. Start the helicopter per the BHT-407-FM-1 or BHT-407-FM-2. Following required warm-up period increase throttle to 100% and set engine anti-ice switch (4A2S1) to ON.

RESULT:

- The ENGINE ANTI-ICE annunciator.
- Engine MGT indicator (1M4) shows temperature rise.

CORRECTIVE ACTION:

- If the ENGINE ANTI-ICE annunciator does not come on, refer to Trouble No. 2 (Figure 96-55).

5. Set engine anti-ice switch (4A2S1) to OFF.

RESULT:

- The ENGINE ANTI-ICE annunciator is off.
- Engine MGT indicator (1M4) shows temperature decrease.

CORRECTIVE ACTION:

- If the ENGINE ANTI-ICE annunciator does not go off, refer to Trouble No. 1 (Figure 96-54).

6. Shut down helicopter per the FMS-E407-789-1.
7. Return the helicopter to the standard configuration. Refer to Standard Practices — After Electrical Maintenance or Repairs (paragraph 96.1.1.1.4).

96.3.8.2. Engine Anti-ice Pressure Switch (4962-A35) — Removal

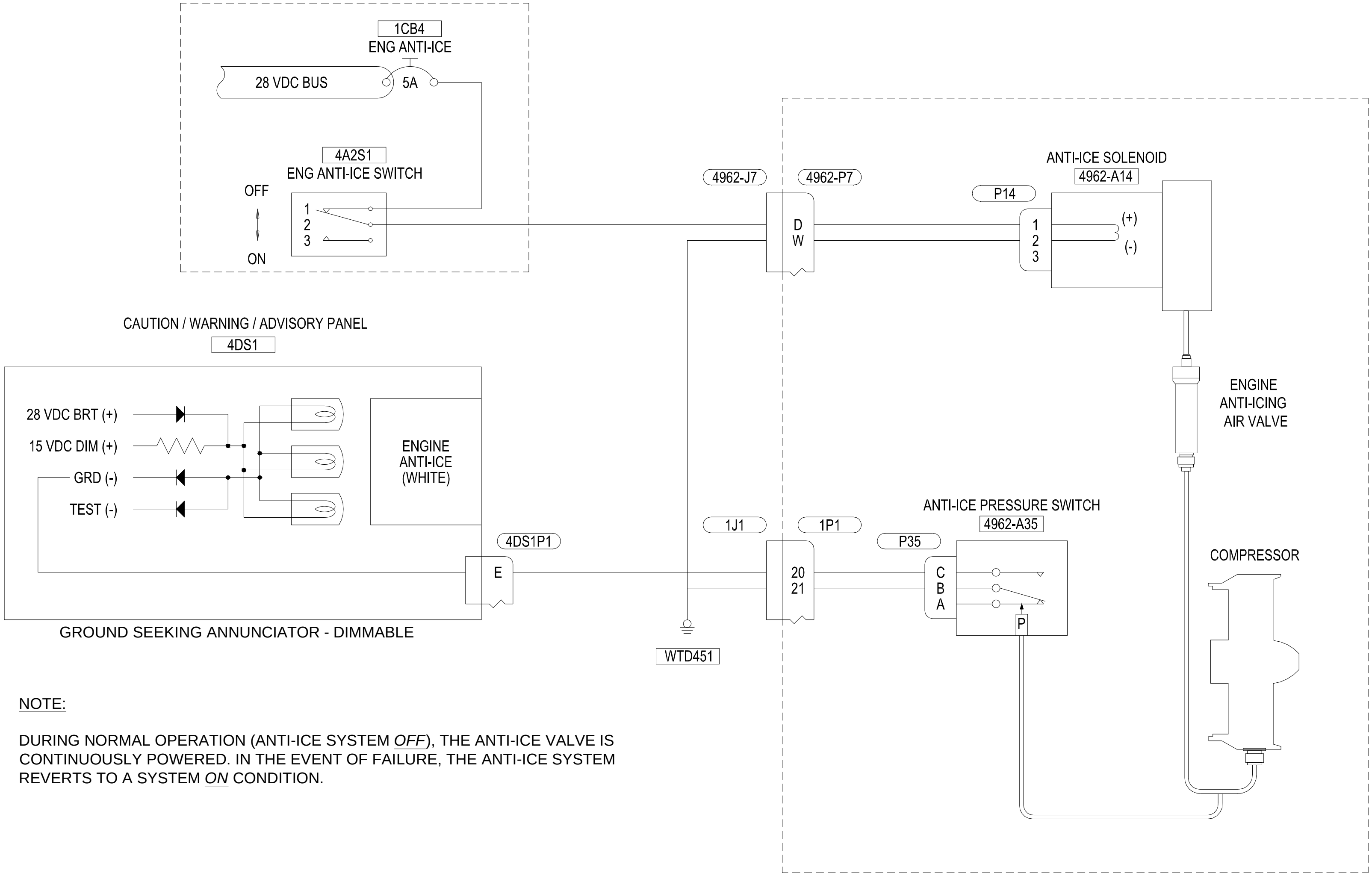
MATERIALS REQUIRED

NUMBER	NOMENCLATURE
C-428	Caps and/or Plugs

WARNING

OBEY ALL OF THE SAFETY PRECAUTIONS WHEN DOING MAINTENANCE ON OR NEAR ELECTRICAL/ELECTRONIC EQUIPMENT (PARAGRAPH 96.1.1.1.).

1. Disconnect battery and external DC power from the helicopter.
2. Gain access to the engine anti-ice pressure switch (4962-A35) (1, Figure 96-56).
3. Remove the connector (7) and hose assembly (6). Close the open pressure port and electrical receptacle of the switch with caps and/or plugs (C-428).
4. Remove attaching hardware (2, 3, 4, and 5) and remove the engine anti-ice pressure switch (4962-A35) (1).



NOTE:

DURING NORMAL OPERATION (ANTI-ICE SYSTEM *OFF*), THE ANTI-ICE VALVE IS CONTINUOUSLY POWERED. IN THE EVENT OF FAILURE, THE ANTI-ICE SYSTEM REVERTS TO A SYSTEM *ON* CONDITION.

Figure 96-53: ENGINE ANTI-ICE Annunciator Circuit - Simplified Schematic

TROUBLE NO. 1
ENGINE ANTI-ICE ANNUNCIATOR CIRCUIT

CAUTION

DISCONNECT THE BATTERY AND EXTERNAL DC POWER PRIOR TO PERFORMING A CONTINUITY CHECK OR MAINTENANCE ON THE ENGINE ANTI-ICE ANNUNCIATOR CIRCUIT.

NOTE

REFER TO CHAPTER 98, CAUTION/WARNING/ADVISORY SYSTEM WIRING DIAGRAM AND ENGINE ANTI-ICE SYSTEM - WIRING DIAGRAM.

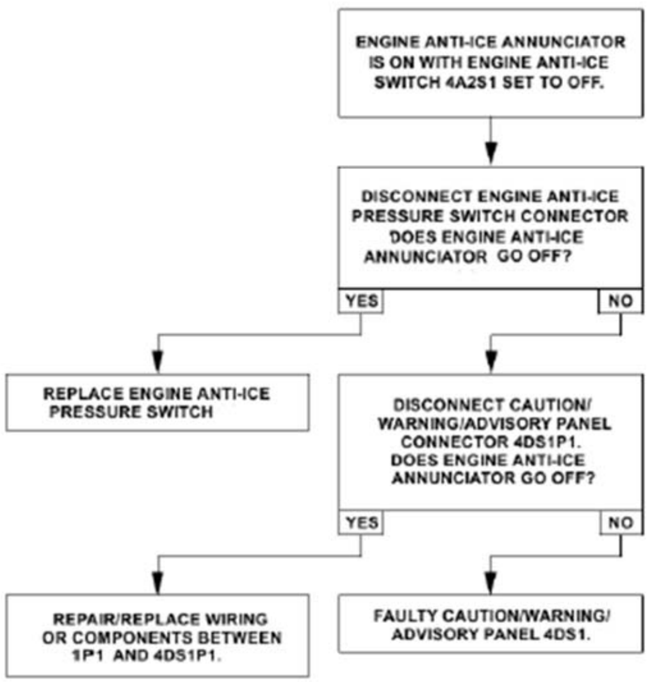


Figure 96-54: ENGINE ANTI-ICE Annunciator Circuit - Trouble No. 1

TROUBLE NO. 2
ENGINE ANTI-ICE ANNUNCIATOR CIRCUIT

CAUTION

DISCONNECT THE BATTERY AND THE EXTERNAL DC POWER PRIOR TO PERFORMING A CONTINUITY CHECK OR MAINTENANCE ON THE ENGINE ANTI-ICE ANNUNCIATOR CIRCUIT.

NOTE

REFER TO CHAPTER 98, CAUTION/WARNING/ADVISORY SYSTEM - WIRING DIAGRAM AND ENGINE ANTI-ICE SYSTEM - WIRING DIAGRAM

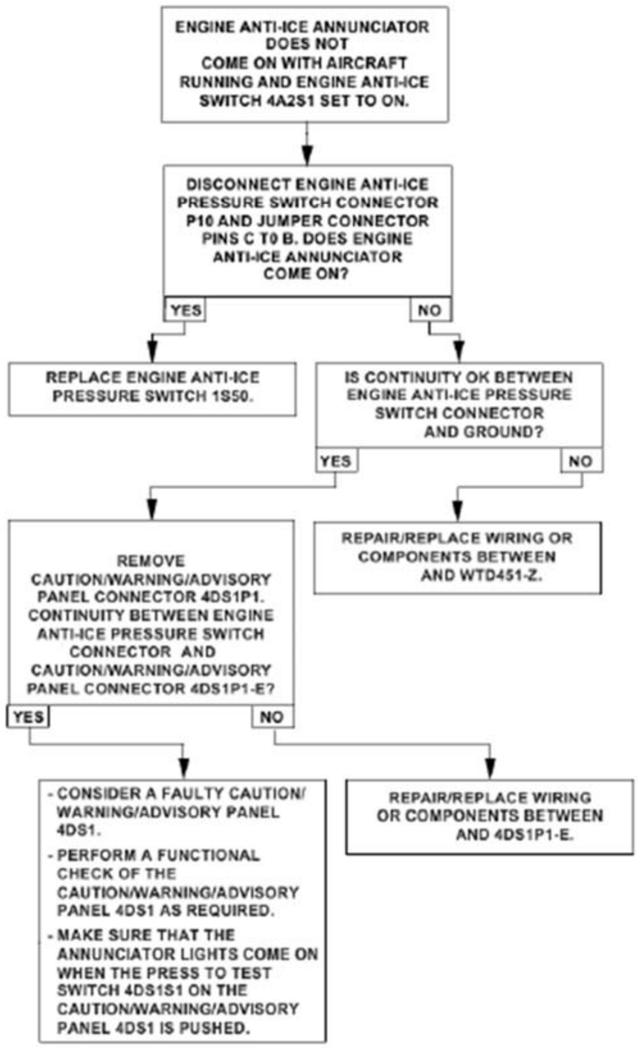


Figure 96-55: ENGINE ANTI-ICE Annunciator Circuit - Trouble No. 2

96.3.8.3. Engine Anti-ice Pressure Switch (4962-A35) — Functional Check

SPECIAL TOOLS REQUIRED

NUMBER	NOMENCLATURE
Fluke Model 79 or Equivalent	Multimeter

NOTE

The engine anti-ice pressure switch (4962-A35) is preset by the manufacturer and cannot be adjusted. If the pressure switch fails the functional check, replace the pressure switch.

1. Remove the engine anti-ice pressure switch (4962-A35) (paragraph 96.3.8.2.).
2. Connect controlled calibrated low air pressure source to switch pressure port.
3. Set the multimeter to read resistance or continuity. Connect the multimeter leads to the engine anti-ice pressure switch pins B and C.
4. Slowly increase air pressure. Contact B to C should close on increasing pressure at 5.5 ±0.5 PSI (37.9 ±3.4 kPa).

RESULT:
- The multimeter reads continuity.

CORRECTIVE ACTION:
- If the multimeter did not read continuity, replace the pressure switch.

5. Slowly decrease air pressure. Contact B to C should open on decreasing pressure prior to 3.0 PSI (20.68 kPa).

RESULT:
- The multimeter reads open.

CORRECTIVE ACTION:
- If the multimeter did not read open, replace the pressure switch.

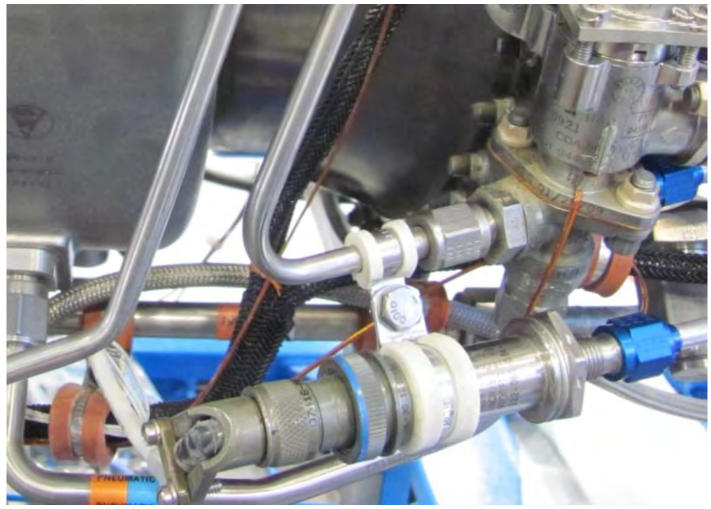
6. Disconnect the pressure switch and multimeter.
7. Return the helicopter to the standard configuration. Refer to Standard Practices — After Electrical Maintenance or Repairs (paragraph 96.1.1.1.4).

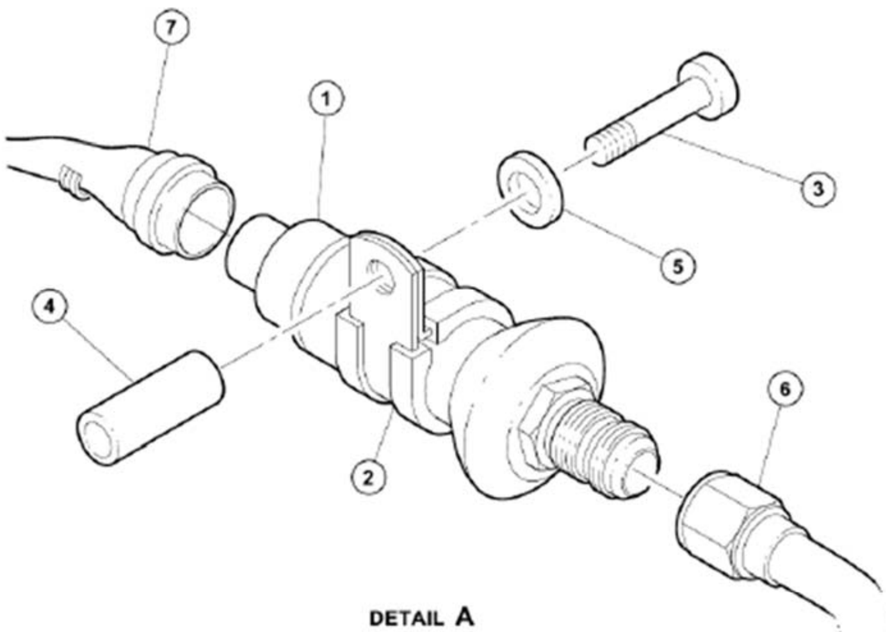
96.3.8.4. Engine Anti-ice Pressure Switch (4962-A35) — Installation

WARNING

OBEY ALL OF THE SAFETY PRECAUTIONS WHEN MAINTENANCE DOING ON OR NEAR ELECTRICAL/ELECTRONIC EQUIPMENT (PARAGRAPH 96.1.1.1.).

1. Mount the engine anti-ice pressure switch (4962-A35) (1, Figure 96-56) with attaching hardware (2, 3, 4, and 5).
2. Remove the connector and pressure port caps and/or plugs and install the hose assembly (6) and the connector (7).
3. Do an operational check of the ENGINE ANTI-ICE annunciator circuit (paragraph 96.3.8.3.).





1. Switch, engine anti-ice pressure
2. Clamp
3. Screw
4. Spacer
5. Washer
6. Hose assembly
7. Connector

Figure 96-56: Engine Anti-Ice Pressure Switch (4962-A35) - Removal and Installation

96.3.9 START ANNUNCIATOR CIRCUIT — OPERATION

The START annunciator circuit is designed to notify the pilot when the engine start circuit is activated. The white START annunciator requires a ground input to come on. As applicable to helicopters S/N 53000 through 54299, this annunciator can be dimmed. Refer to the START annunciator circuit simplified schematic (Figure 96-57).

The START annunciator comes on when the FADEC/ECU transmit ARINC 429 data bus word label 271 bit 17 set to switch discrete ground on the Dual Tachometer Indicator (1M6). This provides a ground path to input M of the START annunciator on caution/warning/advisory panel (4DS1).

96.3.9.1. START Annunciator Circuit — Operational Check

Perform Start and Ignition Operational Test paragraph 96.2.9

96.3.9.2. START Annunciator Circuit — Functional Check

Perform FADEC/ECU Annunciator Circuit Functional Check per paragraph 96.3.43

96.3.9.3. START Annunciator Circuit — Component Replacement

Refer to the caution/warning/advisory panel (4DS1) (paragraph 96.3.2, and paragraph 96.3.3 through paragraph 96.3.4.2.), the start and ignition system section for the replacement of the starter relay (1K1), or to the Electrical Standard Practices Manual (BHT-ELEC-SPM) for wiring maintenance procedures as required.

96.3.10 BAGGAGE DOOR ANNUNCIATOR CIRCUIT — OPERATION

See BHT-407-MM Chapter 96-158.

96.3.10.1. BAGGAGE DOOR Annunciator Circuit — Operational Check

See BHT-407-MM Chapter 96-159.

96.3.10.2. Baggage Door Switch (4S6) — Removal

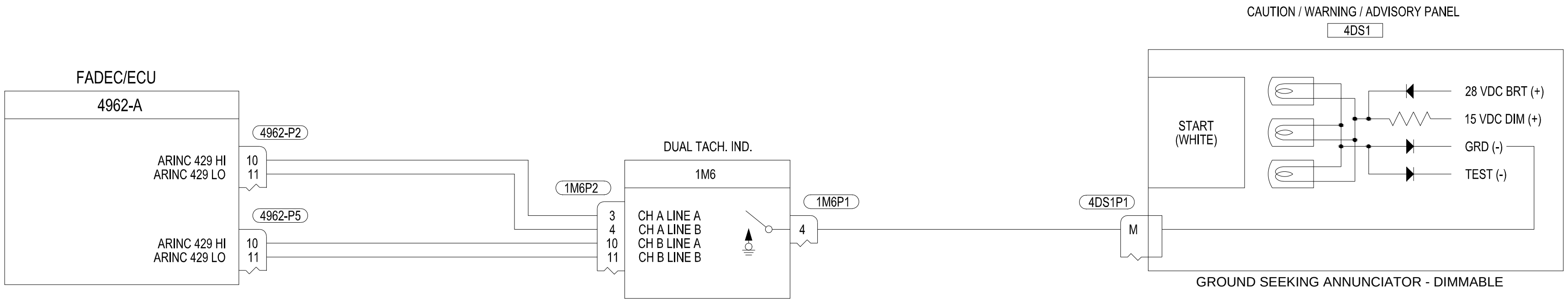
See BHT-407-MM Chapter 96-160.

96.3.10.3. Baggage Door Switch (4S6) — Installation

See BHT-407-MM Chapter 96-161.

96.3.10.4. Baggage Door Switch (4S6) — Adjustment

See BHT-407-MM Chapter 96-162.



NOTE:

START ANNUNCIATOR ACTIVATES WHEN THE FADEC/ECU ACTIVE CHANNEL TRANSMIT ARINC 429 DATA BUS WORDS WITH LABEL 270 BIT 17 SET TO SWITCH DISCRETE GROUND ON THE DUAL TACHOMETER INDICATOR.

Figure 96-57: START Annunciator Circuit - Simplified Schematic

96.3.12 LITTER DOOR OPEN (LITTER DOOR) ANNUNCIATOR CIRCUIT — OPERATION

See BHT-407-MM Chapter 96-163.

96.3.12.1. LITTER DOOR Annunciator Circuit — Operational Check

See BHT-407-MM Chapter 96-164.

96.3.12.2. Litter Door Switch (24S6) — Removal and Installation

See BHT-407-MM Chapter 96-165.

96.3.13 HEATER OVERTEMP ANNUNCIATOR CIRCUIT — OPERATION

See BHT-407-MM Chapter 96-166.

96.3.13.1. HEATER OVERTEMP Annunciator Circuit — Operational Check and Troubleshooting

See BHT-407-MM Chapter 96-167.

96.3.13.2. HEATER OVERTEMP Annunciator Circuit — Component Replacement

See BHT-407-MM Chapter 96-168.

96.3.14 L/FUEL BOOST ANNUNCIATOR CIRCUIT — OPERATION

See BHT-407-MM Chapter 96-169.

96.3.14.1. L/FUEL BOOST Annunciator Circuit — Operational Check

See BHT-407-MM Chapter 96-170.

96.3.14.2. Left Boost Pump Fuel Pressure Switch (1S22) — Functional Check

See BHT-407-MM Chapter 96-171.

96.3.14.3. Left Boost Pump Fuel Pressure Switch (1S22) — Remove

See BHT-407-MM Chapter 96-172.

96.3.14.4. Left Boost Pump Fuel Pressure Switch (1S22) — Installation

See BHT-407-MM Chapter 96-173.

96.3.14.5. L/FUEL BOOST Annunciator Circuit — Component Replacement

See BHT-407-MM Chapter 96-174.

96.3.15 LEFT AND RIGHT FUEL TRANSFER PUMP (L/FUEL XFR, R/FUEL XFR) ANNUNCIATORS — CIRCUIT OPERATION (S/N 53000 THROUGH 53174)

See BHT-407-MM Chapter 96-175.

96.3.16 LEFT AND RIGHT FUEL TRANSFER PUMP (L/FUEL XFR, R/FUEL XFR) ANNUNCIATORS — CIRCUIT OPERATION (S/N 53175 THROUGH 54299)

See BHT-407-MM Chapter 96-176.

96.3.16.1. Left and Right Fuel Transfer Pump (L/ FUEL XFR, R/FUEL XFR) Annunciators — Operational Check (S/N 53000 Through 53174 Pre TB 407-08-85)

See BHT-407-MM Chapter 96-178.

96.3.16.2. Left and Right Fuel Transfer Pump (L/FUEL XFR, R/FUEL XFR) Annunciators — Operational Check (S/N 53000 Through 53799 Post TB 407-08-85 and S/N 53800 Through 54299)

See BHT-407-MM Chapter 96-179.

96.3.16.3. Left and Right Fuel Transfer Pump (L/FUEL XFR, R/FUEL XFR) Annunciators — Operational Check (S/N 54300 and Subsequent)

See BHT-407-MM Chapter 96-180.

96.3.16.4. Left and Right Transfer Pump Fuel Pressure Switches (1S24 and 1S23) — Functional Check

See BHT-407-MM Chapter 96-181.

96.3.16.5. Left Transfer Pump Fuel Pressure Switch (1S24) — Removal

See BHT-407-MM Chapter 96-182.

96.3.16.6. Left Transfer Pump Fuel Pressure Switch (1S24) — Installation

See BHT-407-MM Chapter 96-183.

96.3.16.7. Right Transfer Pump Fuel Pressure Switch (1S23) — Removal

See BHT-407-MM Chapter 96-184.

96.3.16.8. Right Transfer Pump Fuel Pressure Switch (1S23) — Installation

See BHT-407-MM Chapter 96-185.

96.3.16.9. Left and Right Transfer Pump Annunciators—Component Replacement

See BHT-407-MM Chapter 96-186.

96.3.17 A/F FUEL FILTER ANNUNCIATOR CIRCUIT — OPERATION

The A/F FUEL FILTER annunciator circuit is designed to notify the pilot the airframe fuel filter is in an impending bypass condition. The amber A/F FUEL FILTER requires a ground input to come on. As applicable to helicopters S/N 53000 through 54299, this annunciator can be dimmed. Refer to the fuel filter annunciator circuit simplified schematic (Figure 96-58).

The A/F FUEL FILTER annunciator comes on when the airframe fuel filter differential pressure switch closes. As applicable to helicopters S/N 53000 through 54299, this provides a ground to input F on the caution/warning/advisory panel connector (4DS1P1). The switch closes when a differential pressure of 0.875 ±0.125 PSI (6.03 ±0.86 kPa) is present between the input and the output ports of the fuel filter. The airframe fuel filter will go into bypass at 3.75 ±0.25 PSI (25.8 ±1.7 kPa).

96.3.17.1. A/F FUEL FILTER Annunciator Circuit — Operational Check

1. Make sure the LIGHTS CAUT (4CB1) circuit breaker is closed.
2. Make sure the emergency fuel valve switch (4962-S9) is set to OFF.
3. Connect external DC power to the helicopter.

RESULT:

- The A/F FUEL FILTER annunciator is off.

CORRECTIVE ACTION:

- If the A/F FUEL FILTER annunciator comes on, refer to Trouble No. 1 (Figure 96-59).

4. On the airframe fuel filter, push and hold the red PRESS TO TEST switch.

RESULT:

- The A/F FUEL FILTER annunciator comes on.

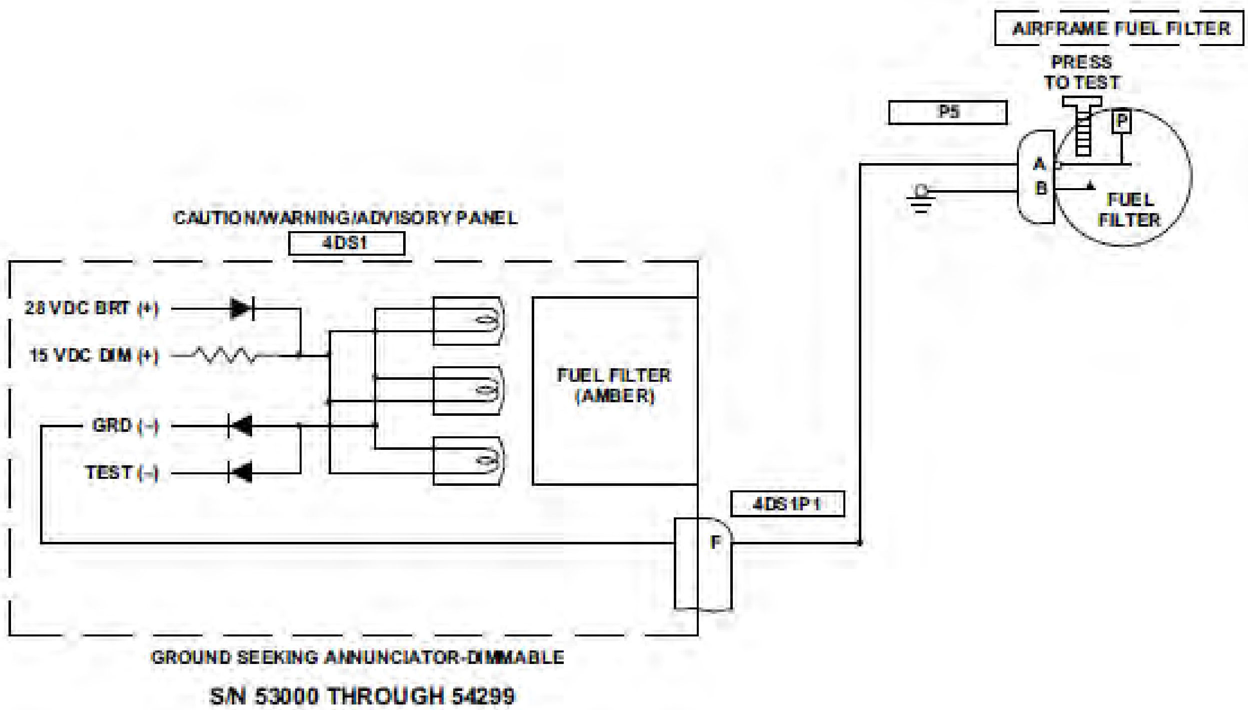
CORRECTIVE ACTION:

- If the FUEL FILTER annunciator does not come on, refer to Trouble No. 2 (Figure 96-60).

5. Release the PRESS TO TEST switch on the fuel filter.
6. Remove the external power from the helicopter.
7. Return the helicopter to the standard configuration. Refer to Standard Practices — After Electrical Maintenance or Repairs (paragraph 96.1.1.1.4).

96.3.17.2. A/F FUEL FILTER Annunciator — Component Replacement

Refer to the caution/warning/advisory panel (4DS1) (paragraph 96.3.2, and paragraph 96.3.3 through paragraph 96.3.4.2.), or to the BHT-ELEC-SPM for wiring maintenance procedures as required.



NOTE

THE PRESSURE SWITCH CLOSES WHEN THE DIFFERENTIAL PRESSURE IS 0.875 ± 0.125 PSI (6.03 ± 0.86 kPa).

Figure 96-58: A/F FUEL FILTER Annunciator Circuit – Simplified Schematic

TROUBLE NO. 1
FUEL FILTER ANNUNCIATOR CIRCUIT

CAUTION

DISCONNECT THE BATTERY AND THE EXTERNAL DC POWER PRIOR TO PERFORMING A CONTINUITY CHECK OR MAINTENANCE ON THE FUEL FILTER ANNUNCIATOR CIRCUIT.

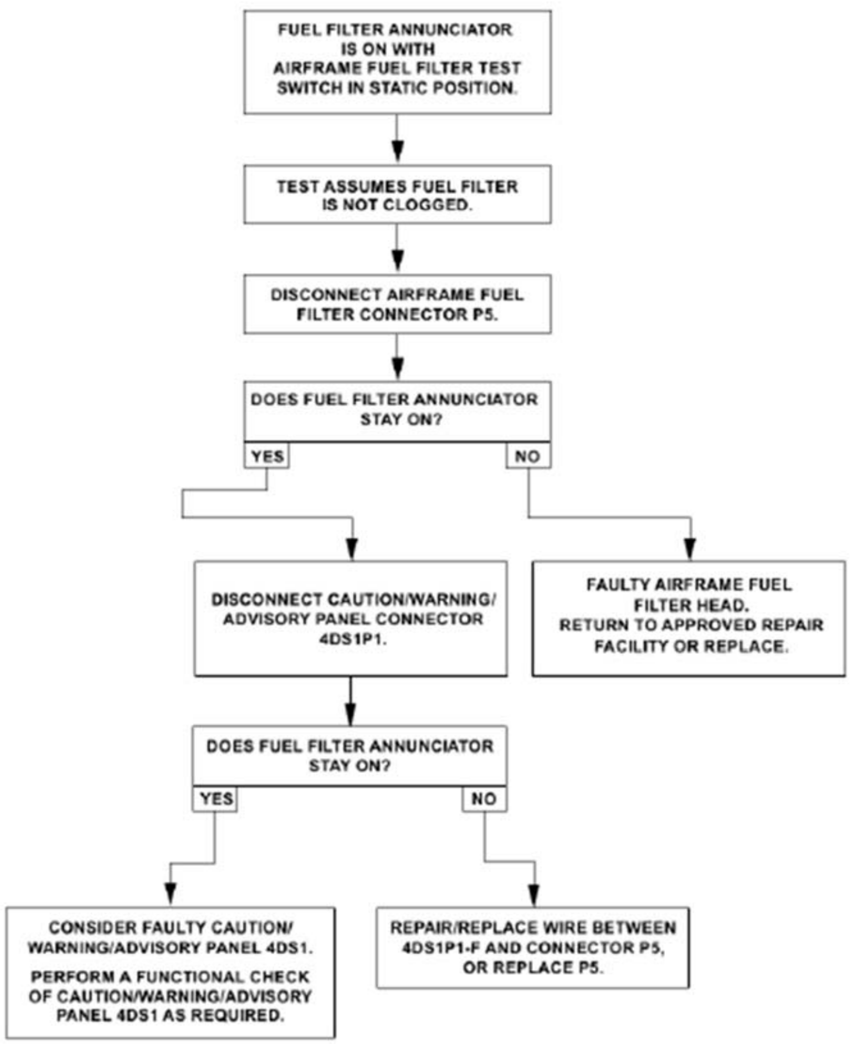


Figure 96-59: A/F FUEL FILTER Annunciator Circuit – Trouble No. 1

TROUBLE NO. 2
FUEL FILTER ANNUNCIATOR CIRCUIT

CAUTION

DISCONNECT THE BATTERY AND EXTERNAL DC POWER PRIOR TO PERFORMING A CONTINUITY CHECK OR MAINTENANCE ON THE FUEL FILTER ANNUNCIATOR CIRCUIT.

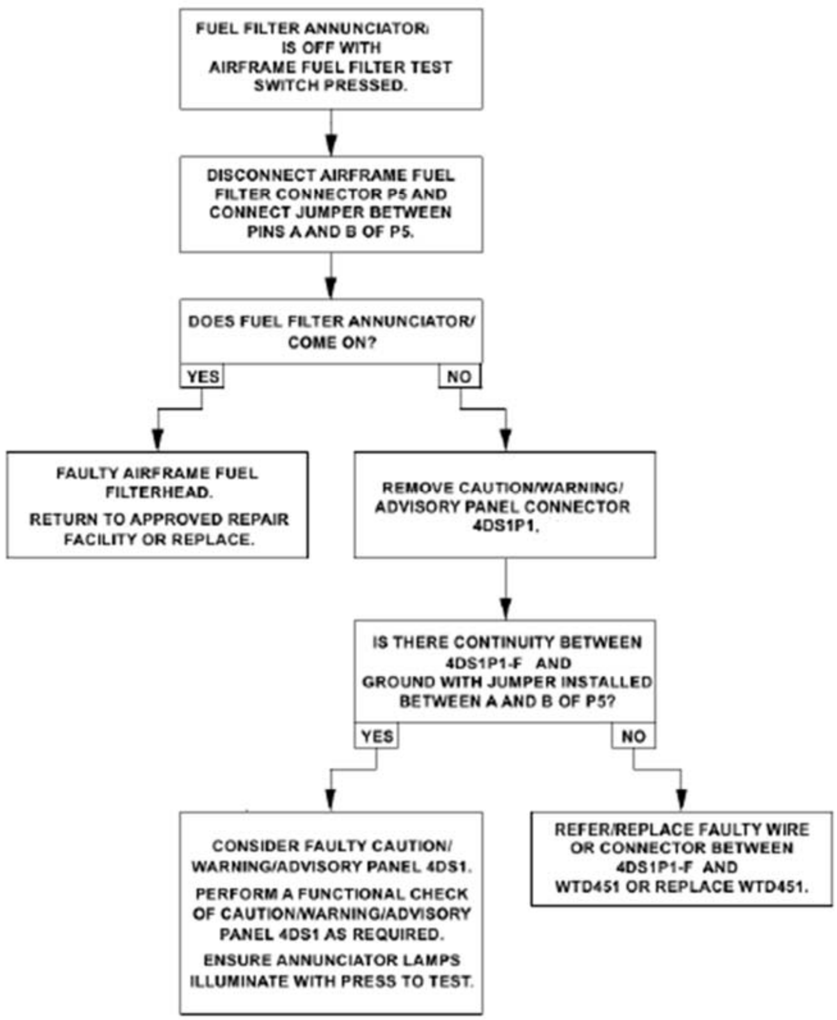


Figure 96-60: A/F FUEL FILTER Annunciator Circuit – Trouble No. 2

96.3.18 R/FUEL BOOST ANNUNCIATOR CIRCUIT — OPERATION

See BHT-407-MM Chapter 96-190.

96.3.18.1. R/FUEL BOOST Annunciator Circuit — Operational Check

See BHT-407-MM Chapter 96-191.

96.3.18.2. Right Boost Pump Fuel Pressure Switch (1S21) — Functional Check

See BHT-407-MM Chapter 96-192.

96.3.18.3. Right Boost Pump Fuel Pressure Switch (1S21) — Removal

See BHT-407-MM Chapter 96-193.

96.3.18.4. Right Boost Pump Fuel Pressure Switch (1S21) — Installation

See BHT-407-MM Chapter 96-194.

96.3.18.5. Right Boost Pump Annunciator Circuit — Component Replacement

See BHT-407-MM Chapter 96-195.

96.3.19 FUEL VALVE ANNUNCIATOR CIRCUIT — OPERATION

The fuel valve annunciator circuit is designed to notify the pilot the fuel shutoff valve (1B5) is in transit or has stopped somewhere between the fully open or fully closed position. Refer to the fuel valve annunciator circuit simplified schematic (Figure 96-61).

The amber fuel valve annunciator requires a ground input to come on. This annunciator can be dimmed. With power on the 28 VDC bus and the emergency fuel valve switch (4962-S9) set to OFF or ON, the fuel valve shutoff relay (1K6) will be energized if the fuel shutoff valve (1B5) is fully opened or fully closed. Under these conditions, the contact A2 to A3 of the fuel valve shutoff relay is opened and it removes the ground path from WTD250 to input N of the fuel valve annunciator.

When the emergency fuel valve switch (4962-S9) is set from OFF to ON, or ON to OFF, the 28 VDC bus power circuit that allows the fuel valve shutoff relay (1K6) to energize is opened while the fuel shutoff valve (1B5) is in transit. During this time, the fuel valve shutoff relay is de-energized, which completes the ground circuit through the contacts A2 to A3 and causes the FUEL VALVE annunciator to come on.

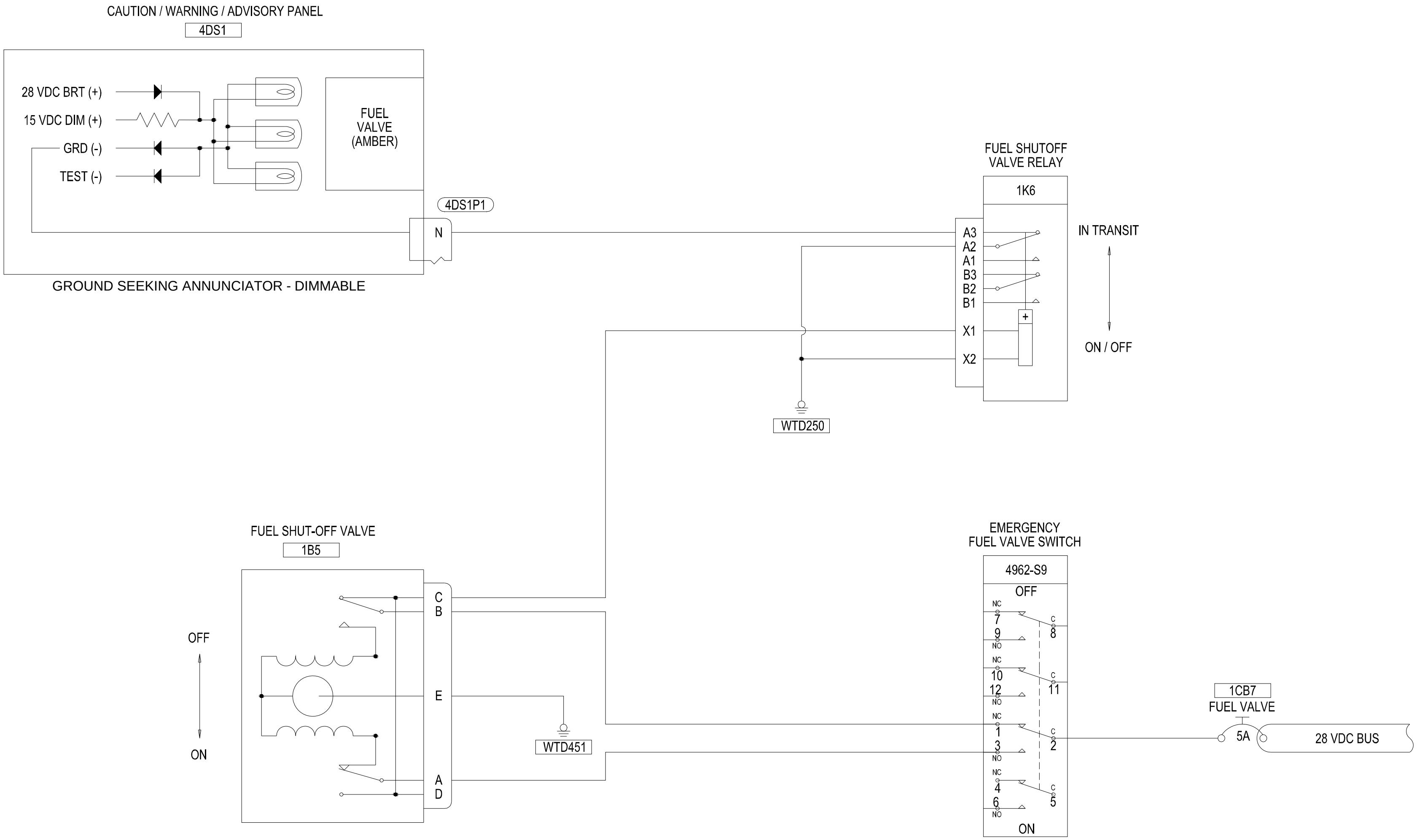


Figure 96-61: FUEL VALVE Annunciator Circuit – Simplified Schematic

96.3.19.1. FUEL VALVE Annunciator Circuit — Operational Check

See BHT-407-MM Chapter 96-197.

96.3.19.2. Fuel Shutoff Valve Relay (1K6) Removal (S/N 53000 Through 54299)

See BHT-407-MM Chapter 96-198.

96.3.19.3. Fuel Shutoff Valve Relay (1K6) — Installation (S/N 53000 Through 54299)

See BHT-407-MM Chapter 96-199.

96.3.19.4. FUEL VALVE Annunciator Circuit — Component Replacement

See BHT-407-MM Chapter 96-200.

96.3.20 FADEC MAINT ANNUNCIATOR CIRCUIT — OPERATION

The FADEC MAINT annunciator circuit is designed to notify the pilot that a loss of redundant features, which should not cause degradation in performance, has occurred in the FADEC system. Refer to the FADEC FAULT annunciator circuit simplified schematic (Figure 96-62).

The FADEC MAINT annunciator comes on when either FADEC/ECU channel transmit ARINC 429 data bus word label 350,351,352,353 and 354 bit 14 through 29 set to switch discrete ground on the Dual Tachometer Indicator (1M6). This indication is only provided after engine shutdown (Ng less than 5%). These complete the ground required at input R of the amber FADEC FAULT annunciator to cause the annunciator to come on. This annunciator can be dimmed.

96.3.20.1. FADEC MAINT ANNUNCIATOR CIRCUIT — Functional Check

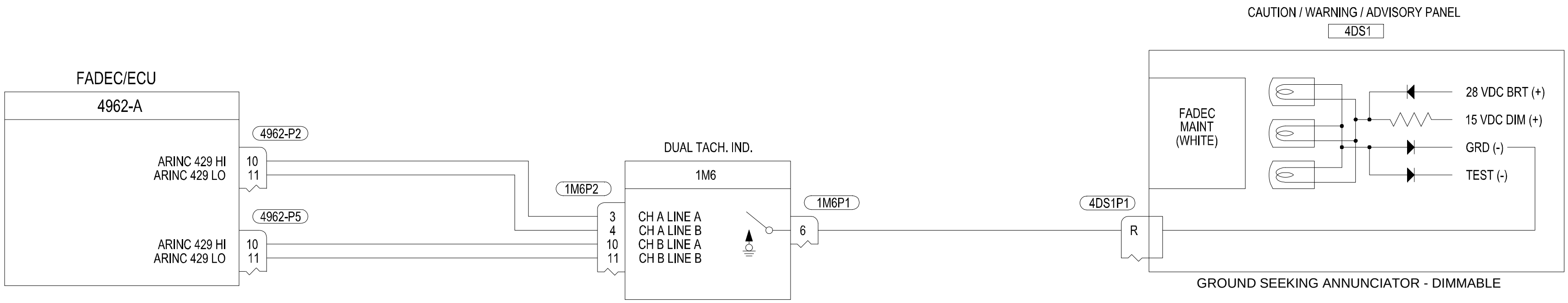
Perform FADEC/ECU Annunciator Circuit Functional Check per paragraph 96.3.43

96.3.20.2. FADEC MAINT – Confirmed Faults

Refer to Chapter 76 for engine and control system operating conditions for confirmed faults that trigger the FADEC MAINT advisory light through the ARINC 429.

96.3.20.3. FADEC MAINT Annunciator Circuit — Component Replacement

Refer to the caution/warning/advisory panel (4DS1) (paragraph 96.3.2 and paragraph 96.3.3 through paragraph 96.3.4.2.), or to the BHT-ELEC-SPM for wiring maintenance procedures as required. For data on the FADEC/ECU, refer to Chapter 76 or to the Honeywell Light Maintenance Manual for HTS900-2-1D.



NOTE:

FADEC MAINT ANNUNCIATOR ACTIVATES WHEN EITHER FADEC/ECU CHANNEL TRANSMIT ARINC 429 DATA BUS WORDS WITH LABEL 350, 351,352,353 AND 354 BIT 14 THROUGH 29 SET TO SWITCH DISCRETE GROUND ON THE DUAL TACHOMETER INDICATOR ONLY WHEN Ng IS LESS THAN 5%.

Figure 96-62: FADEC MAINT Annunciator – Simplified Schematic

96.3.21 START FAULT ANNUNCIATOR CIRCUIT — OPERATION

The START FAULT annunciator circuit is designed to notify the pilot that a fault has been detected by the FADEC/ECU (4962-A) that should not affect performance of the helicopter, but may inhibit a normal start sequence. Refer to the START FAULT annunciator circuit simplified schematic (Figure 96-63).

The START FAULT annunciator comes on when both FADEC/ECU channel transmit ARINC 429 data bus word label 351bit 21 set to switch discrete ground on the Dual Tachometer Indicator (1M6). This complete the ground required at input T of the white START FAULT annunciator to cause the annunciator to come on. This annunciator can be dimmed.

96.3.21.1. START FAULT Annunciator Circuit — Component Replacement

Refer to the caution/warning/advisory panel (4DS1) (paragraph 96.3.2 and paragraph 96.3.6 through paragraph 96.3.8.1), or to the BHT-ELEC-SPM for wiring maintenance procedures as required. For data on the FADEC/ECU, refer to Chapter 76 or to the Honeywell Light Maintenance Manual for HTS900-2-1D.

96.3.22 FUEL LOW ANNUNCIATOR CIRCUIT — OPERATION

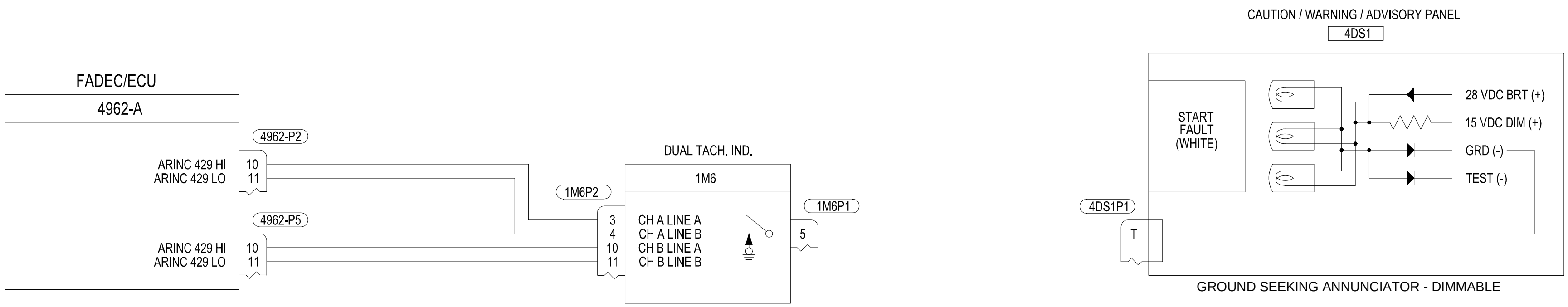
See BHT-407-MM Chapter 96-209.

96.3.22.1. FUEL LOW Annunciator Circuit — Operational Check

See BHT-407-MM Chapter 96-210.

96.3.22.2. FUEL LOW Annunciator Circuit — Component Replacement

See BHT-407-MM Chapter 96-211.



NOTE:

START FAULT ANNUNCIATOR ACTIVATES WHEN BOTH FADEC/ECU CHANNEL TRANSMIT ARINC 429 DATA BUS WORDS LABEL 351 BIT 21 SET TO SWITCH DISCRETE ON THE DUAL TACHOMETER INDICATOR.

Figure 96-63: START FAULT Annunciator Circuit – Simplified Schematic

96.3.23 FADEC FAIL ANNUNCIATOR AND FAIL HORN CIRCUIT — OPERATION

The FADEC FAIL annunciator and fail horn circuit is designed to notify the pilot that a dual-channel FADEC/ECU hard fault has occurred and that the engine has failed to the last commanded fuel flow. Refer to Figure 96-64 for the FADEC FAIL annunciator and fail horn circuit simplified schematic.

The FADEC FAIL annunciator comes on when both FADEC/ECU channel transmit ARINC 429 data bus word label 270 bit 19 set to switch discrete ground on the Dual Tachometer Indicator (Np/Nr) (1M6). This provides a ground path to input X2 of the FADEC fail relay 1K5 to activate. This cause the A2 and A1 contacts of 1K5 to close providing ground path to input (m) of the red FADEC FAIL annunciator and the (-) terminal of the FADEC fail horn (4LS3) to cause them to come on. This annunciator can be dimmed.

Parallel to the ARINC 429 signal, when FADEC/ECU channel are both healthy, pin 15 of 4962-P1 and 4962-P4 are held to ground, keeping FADEC relays 4962-K3 and 4962-K4 activated. During both channel hard fault, both relays will return to its relax configuration, providing ground to closed contact of 4962-K3 A3 and A2 through 4962-K4 A3 and A2 and providing completing ground to 1K5 activating the horn and the red warning light.

96.3.23.1. FADEC FAIL Annunciator and Horn — Operational Check

1. On the overhead circuit breaker panel, pull (open) FADEC PWR CH A (4962CB1) and FADEC PWR CH B (4962CB2).
2. Connect external DC power to the helicopter.
3. Push FADEC FAIL circuit breaker (4962CB3).

RESULT:
- The FADEC FAIL annunciator and horn come on.

CORRECTIVE ACTION:
- If the FADEC FAIL annunciator and horn do not come on, refer to Trouble No. 1 (Figure 96-65).

4. On the overhead circuit breaker panel, push (close) either FADEC PWR CH A (4962CB1) or CH B (4962CB2).

RESULT:
- The FADEC FAIL annunciator and horn should not come on.

CORRECTIVE ACTION:
- If the FADEC FAIL annunciator and horn does come on, refer to Trouble No. 2 (Figure 96-66).

5. Remove the external power from the helicopter.
6. Return the helicopter to the standard configuration. Refer to Standard Practices — After Electrical Maintenance or Repairs (paragraph 96.1.1.1.4)

96.3.23.2. FADEC FAIL Annunciator Circuit, FADEC Fail Relay (1K5), (4962K3) and (4962K4) — Removal

SPECIAL TOOLS REQUIRED

NUMBER	NOMENCLATURE
M106/31-001	Relay Removal Tool
M6106/32-001	Relay Base Removal Tool
M81969/14-10	Insertion/Extraction Tool

WARNING

OBEY ALL OF THE SAFETY PRECAUTIONS WHEN DOING MAINTENANCE ON OR NEAR ELECTRICAL/ELECTRONIC EQUIPMENT (PARAGRAPH 96.1.1.1.).

1. Disconnect battery and external DC power from the helicopter.
2. To gain access to the FADEC fail relays (1K5), (4962-K3) and (4962-K4) (2, Figure 96-67); remove the left forward instrument console access cover.
3. Push the relay removal tool (M6106/31-001) (1) over the FADEC fail relay (1K5) (2). This will unlatch and grasp the relay.
4. Pull the FADEC fail relay (2) out of the relay base (3) with the relay removal tool (M6106/31-001) (1).
5. If required, remove the relay base (3) with the relay base removal tool (M6106/32-001) (5) as follows:
   a. Insert the relay base removal tool (M6106/ 32-001) (5) under the relay base (3) and extend the rail (4).
   b. Push the relay base (3) out of the rail (4).

NOTE

Refer to the BHT-ELEC-SPM for the removal procedures of the electrical contacts of the relay base and data on the relay base contacts.

   c. With the contact insertion/extraction tool (M81969/14-10), remove the wires from the base if the base needs to be replaced.

NOTE:

FADEC FAIL ANNUNCIATOR AND HORN ACTIVATES WHEN BOTH FADEC/ECU CHANNEL TRANSMIT ARINC 429 DATA BUS WORDS LABEL 270 BIT 19, SET TO SWITCH DISCRETE GROUND ON DUAL TACHOMETER INDICATOR.

FADEC FAIL ANNUNCIATOR AND HORN ALSO ACTIVATES WHEN BOTH FADEC/ECU CHANNEL HARD FAIL OCCUR DUE TO POWER LOSS.

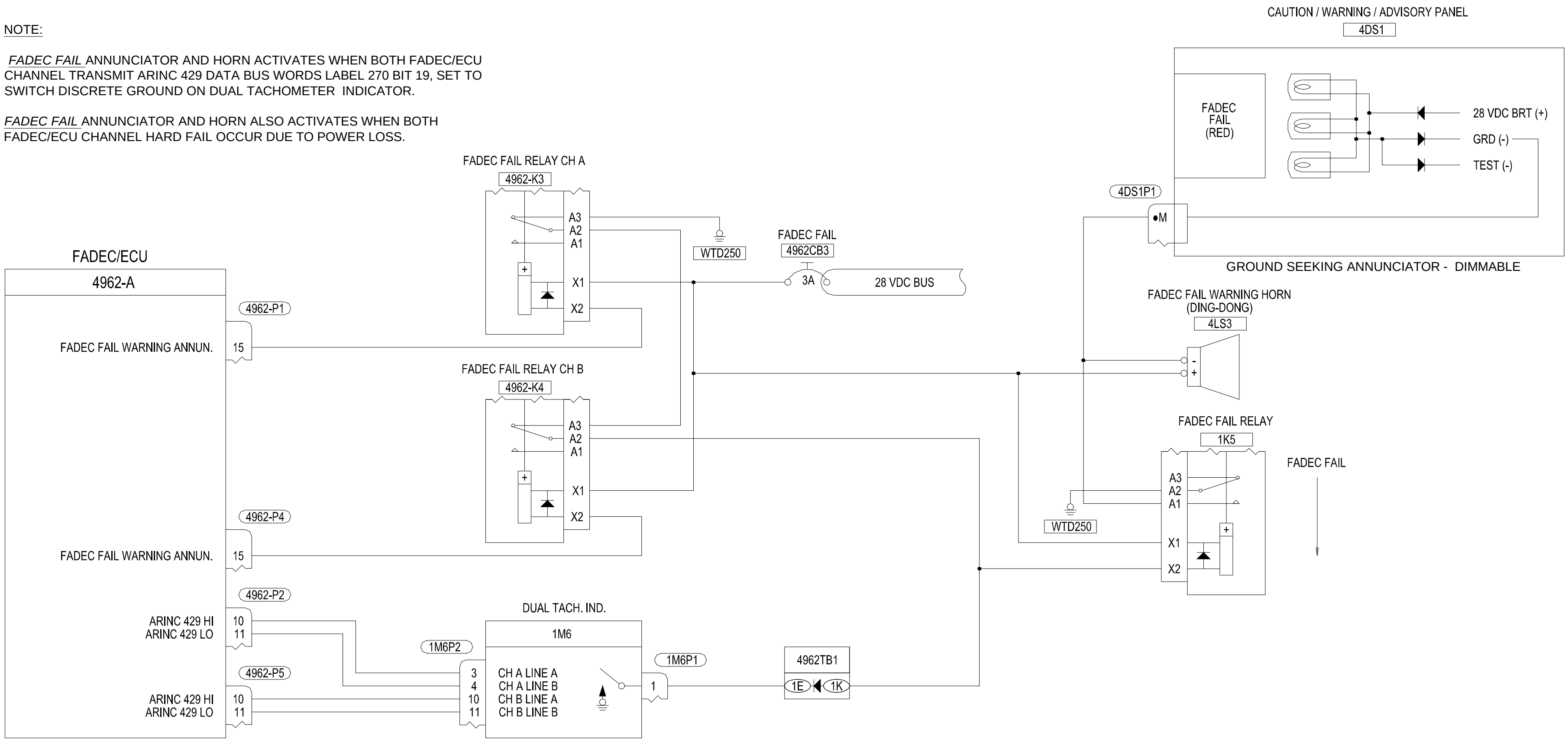


Figure 96-64: FADEC FAIL Annunciator and Fail Horn Circuit – Simplified Schematic

TROUBLE NO.1
FADEC FAIL ANNUNCIATOR AND HORN CIRCUIT

CAUTION

DISCONNECT THE BATTERY AND THE EXTERNAL POWER PRIOR TO PERFORMING A CONTINUITY CHECK OR MAINTENANCE ON THE FADEC FAIL ANNUNCIATOR AND HORN CIRCUIT.

NOTE
Refer to Chapter 98 for wiring diagram.

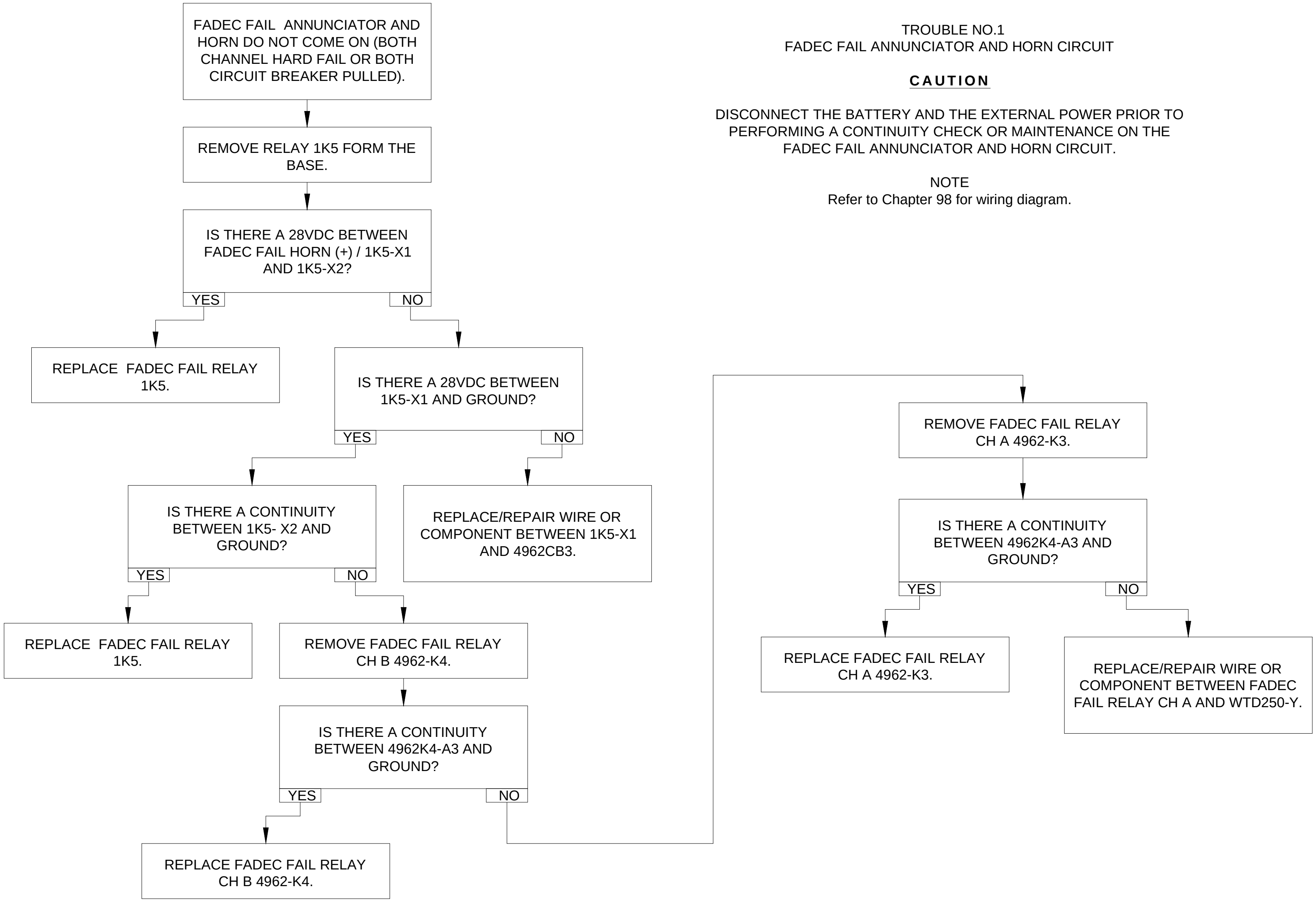


Figure 96-65: FADEC FAIL Annunciator and Horn Circuit – Trouble No. 1

TROUBLE NO.2
FADEC FAIL ANNUNCIATOR AND HORN CIRCUIT

CAUTION

DISCONNECT THE BATTERY AND THE EXTERNAL POWER PRIOR TO PERFORMING A CONTINUITY CHECK OR MAINTENANCE ON THE FADEC FAIL ANNUNCIATOR AND HORN CIRCUIT.

NOTE
Refer to Chapter 98 for wiring diagram.

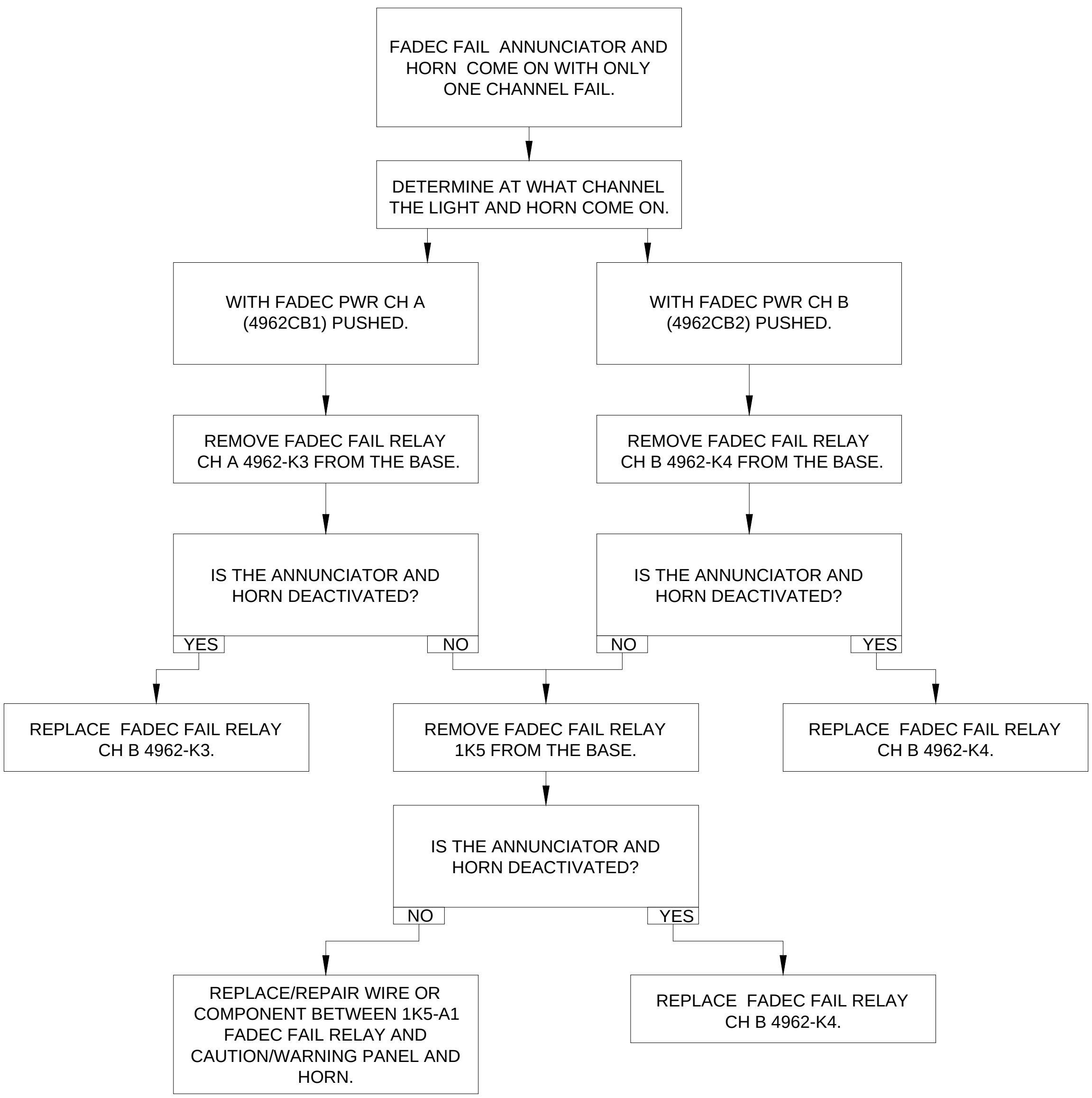


Figure 96-66: FADEC FAIL Annunciator and Horn Circuit – Trouble No. 2

96.3.23.3. FADEC FAIL Annunciator Circuit, FADEC Fail Relay (1K5), (4962K3) and (4962K4) — Installation

SPECIAL TOOLS REQUIRED

NUMBER	NOMENCLATURE
M81969/14-10	Insertion/Extraction Tool

WARNING

OBEY ALL OF THE SAFETY PRECAUTIONS WHEN DOING MAINTENANCE ON OR NEAR ELECTRICAL/ELECTRONIC EQUIPMENT (PARAGRAPH 96.1.1.1.).

NOTE

If the wires and contacts have been removed from the relay base, refer to the BHT-ELEC-SPM for the installation procedures of the electrical contacts of the relay base. Refer to the system wiring diagram (Chapter 98) for the correct wire installation to the base. Install the wires in the base with the insertion/extraction tool (M81969/14-10)

1. Correctly position the relay base (3, Figure 96-67) on the rail pressure until it locks into place. (4) and apply finger
2. Correctly position the FADEC fail relay (1K5) (2) on the relay base (3) and apply finger pressure until it latches into place.
3. Do an operational check of the FADEC FAIL annunciator circuit (paragraph 96.3.23.1.).
4. Install the panel on the left side of the instrument console.

96.3.23.4. FADEC FAIL Annunciator Circuit — Component Replacement

SPECIAL TOOLS REQUIRED

NUMBER	NOMENCLATURE
M81969/14-10	Insertion/Extraction Tool

Refer to the caution/warning/advisory panel (4DS1) (paragraph 96.3.2 and paragraph 96.3.3 through paragraph 96.3.4.2.), or to the BHT-ELEC-SPM for wiring maintenance procedures as required. For data on the FADEC/ECU, refer to Chapter 76 or to the Honeywell Light Maintenance Manual for HTS900-2-1D.

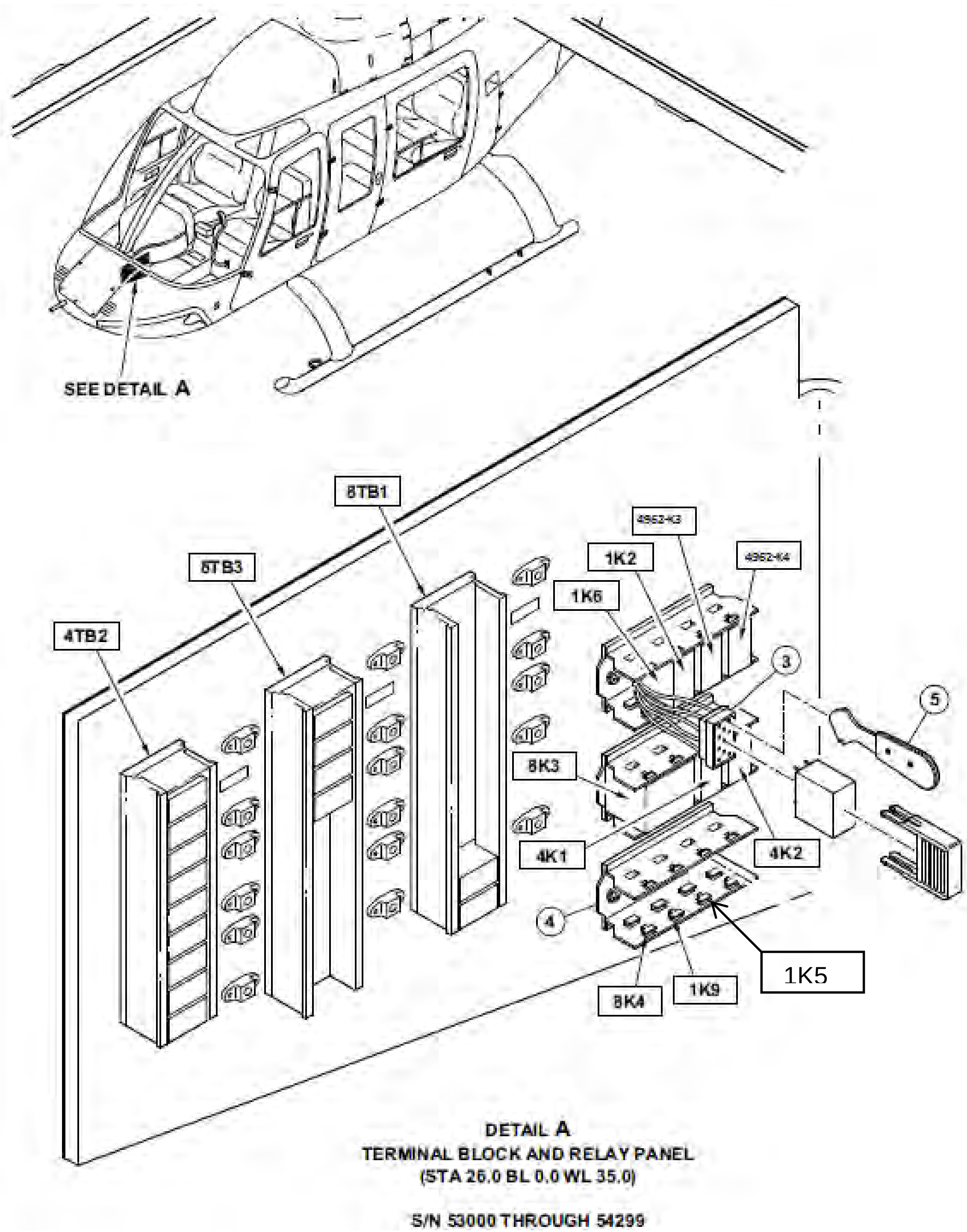


Figure 96-67: FADEC FAIL Relay (1K5), (4962K3) and (4962K4) – Removal and Installation

96.3.24 FADEC CHANNEL FAILANNUNCIATOR CIRCUIT—OPERATION

The FADEC CHANNEL FAIL annunciator circuit is designed to notify the pilot that a FADEC/ECU channel has failed and that control was automatically swapped to the other channel. Refer to the FADEC CHANNEL FAIL annunciator circuit simplified schematic (Figure 96-68).The FADEC CH FAIL annunciator comes on when either of the FADEC/ECU channels transmits ARINC 429 data bus word label 270 bit 19 set to switch discrete ground on the Gas Producer Indicator (1M5). This complete the ground required at input (K) of the amber FADEC CH FAIL annunciator to cause the annunciator to come on. This annunciator can be dimmed

Parallel to the ARINC 429 signal, when FADEC/ECU channel are both healthy, pin 15 of 4962-P1 and 4962-P4 are held to ground, keeping FADEC relays 4962-K3 and 4962-K4 activated. During one channel failed, relay of failed channel will return to it's relax configuration, providing ground to closed contact of 4962-K3 through 4962-K4 and providing completing ground to activate the FADEC CH FAIL caution light.

96.3.24.1. FADEC CH FAIL ANNUNCIATOR CIRCUIT – Operational Check

1. On the overhead circuit breaker panel, pull (open) FADEC PWR CH A (4962CB1) and FADEC PWR CH B (4962CB2).
2. Connect external DC power to the helicopter.
3. Push FADEC FAIL circuit breaker (4962CB3).

RESULT:
- The FADEC CH FAIL annunciator should not come on.(FADEC FAIL should come on)

CORRECTIVE ACTION:
- If the FADEC CH FAIL annunciator does come on, refer to Trouble No.1. (Figure 96- 69)

4. On the overhead circuit breaker panel, push (close) either FADEC PWR CH A (4962CB1) or CH B (4962CB2).

RESULT:
- FADEC CH FAIL should come on. (FADEC FAIL is extinguished)

CORRECTIVE ACTION:
- If the FADEC CH FAIL does not come on, refer to Trouble No. 2. (Figure 96-70).

5. Remove the external power from the helicopter.
6. Return the helicopter to the standard configuration. Refer to Standard Practices — After Electrical Maintenance or Repairs (paragraph 96.1.1.1.4)

96.3.24.2. FADEC CH FAIL ANNUNCIATOR CIRCUIT — Functional Check

Perform FADEC/ECU Annunciator Circuit Functional Check per paragraph 96.3.44.

96.3.24.3. FADEC CH FAIL Annunciator Circuit — Component Replacement

Refer to the caution/warning/advisory panel (4DS1) (paragraph 96.3.2, and paragraph 96.3.3 through paragraph 96.3.4.2.), or to the BHT-ELEC-SPM for wiring maintenance procedures as required. For data on the FADEC/ECU, refer to Chapter 76 or to the Honeywell Light Maintenance Manual for HTS900-2-1D.

96.3.25 FADEC DEGRADED ANNUNCIATOR CIRCUIT — OPERATION

The FADEC DEGRADED annunciator circuit is designed to notify the pilot that a fault has been detected by the FADEC/ECU (4962-A) that represents a loss of some features of the FADEC system that may cause degradation in performance or general degradation of FADEC capabilities. Refer to the FADEC DEGRADED annunciator circuit simplified schematic (Figure 96-71).

A ground is required at input (p) of the amber FADEC DEGRADED annunciator to cause the annunciator to come on. This annunciator can be dimmed.

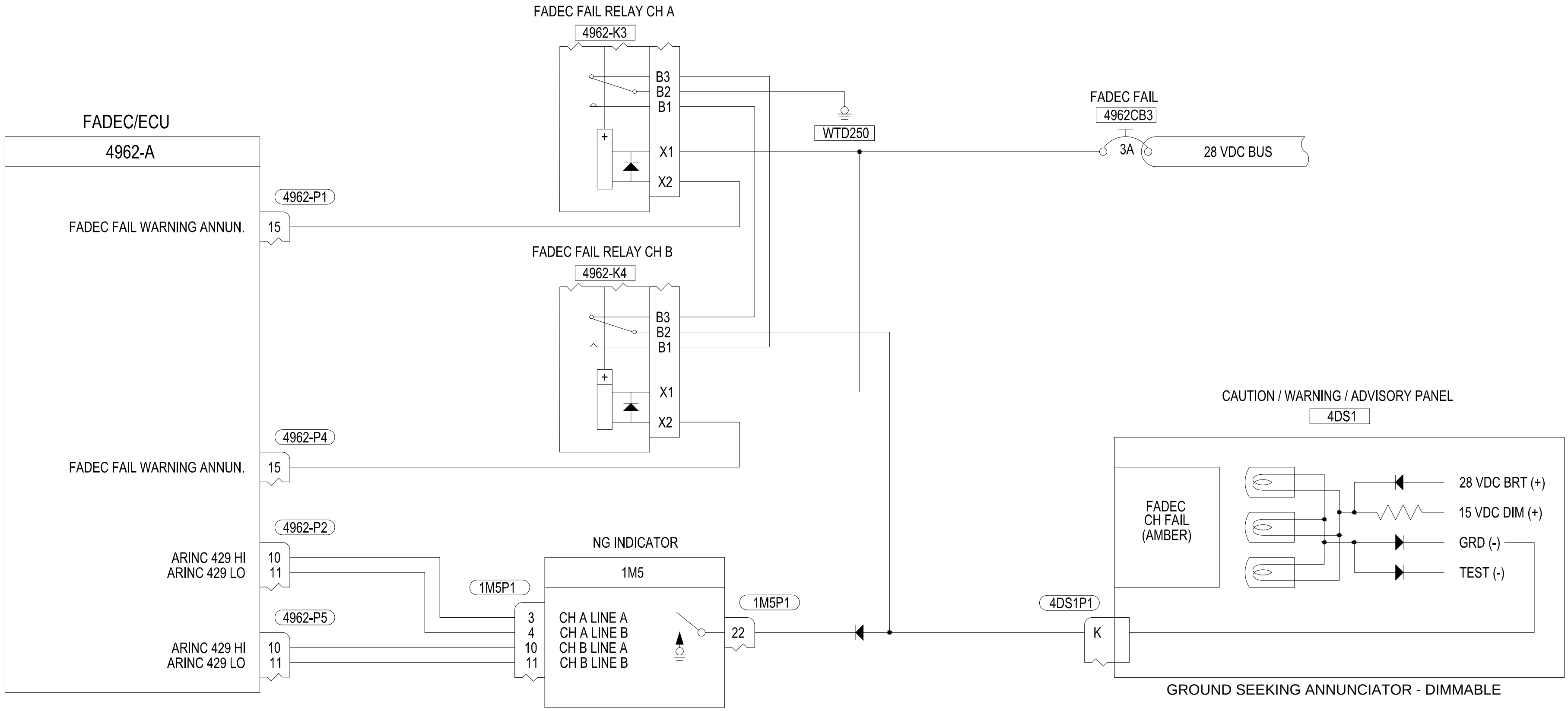
The FADEC DEGRADED annunciator comes on when either of the FADEC/ECU channels transmits ARINC 429 data bus word label 270 bit 21 set to switch discrete ground on the Dual Tachometer Indicator (1M6).

96.3.25.1. FADEC DEGRADED ANNUNCIATOR CIRCUIT — Functional Check

Perform FADEC/ECU Annunciator Circuit Functional Check per paragraph 96.3.44.

96.3.25.2. FADEC DEGRADED Annunciator Circuit — Component Replacement

Refer to the caution/warning/advisory panel (4DS1) (paragraph 96.3.2, and paragraph 96.3.3 through paragraph 96.3.4.2), or to the BHT-ELEC-SPM for wiring maintenance procedures as required. For data on the FADEC/ECU, refer to Chapter 76 or to the Honeywell Light Maintenance Manual for HTS900-2-1D.



NOTE:

FADEC CH FAIL ANNUNCIATOR ACTIVATES WHEN EITHER FADEC/ECU CHANNEL TRANSMIT ARINC 429 DATA BUS WORDS WITH LABEL 270 BIT 19, SET TO SWITCH DISCRETE GROUND ON THE Ng INDICATOR.

Figure 96-68: FADEC CHANNEL FAIL Annunciator Circuit – Simplified Schematic

TROUBLE NO.1
FADEC CHANNEL FAIL ANNUNCIATOR AND HORN CIRCUIT

CAUTION

DISCONNECT THE BATTERY AND THE EXTERNAL POWER PRIOR TO PERFORMING A CONTINUITY CHECK OR MAINTENANCE ON THE FADEC CHANNEL FAIL ANNUNCIATOR.

NOTE
Refer to Chapter 98 for wiring diagram.

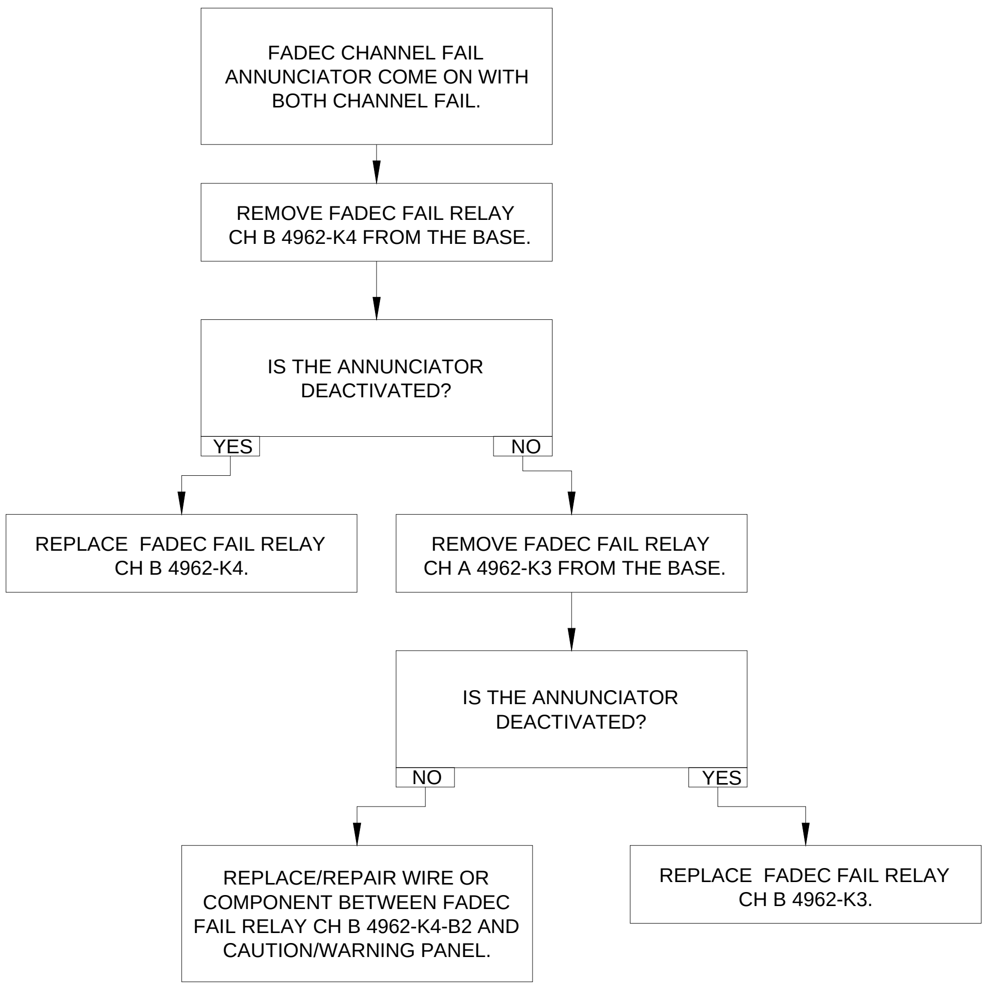


Figure 96- 69: FADEC CHANNEL FAIL Annunciator – Trouble No. 1

TROUBLE NO.2
FADEC CHANNEL FAIL ANNUNCIATOR CIRCUIT

CAUTION

DISCONNECT THE BATTERY AND THE EXTERNAL POWER PRIOR TO PERFORMING A CONTINUITY CHECK OR MAINTENANCE ON THE FADEC CHANNEL FAIL ANNUNCIATOR.

NOTE
Refer to Chapter 98 for wiring diagram.

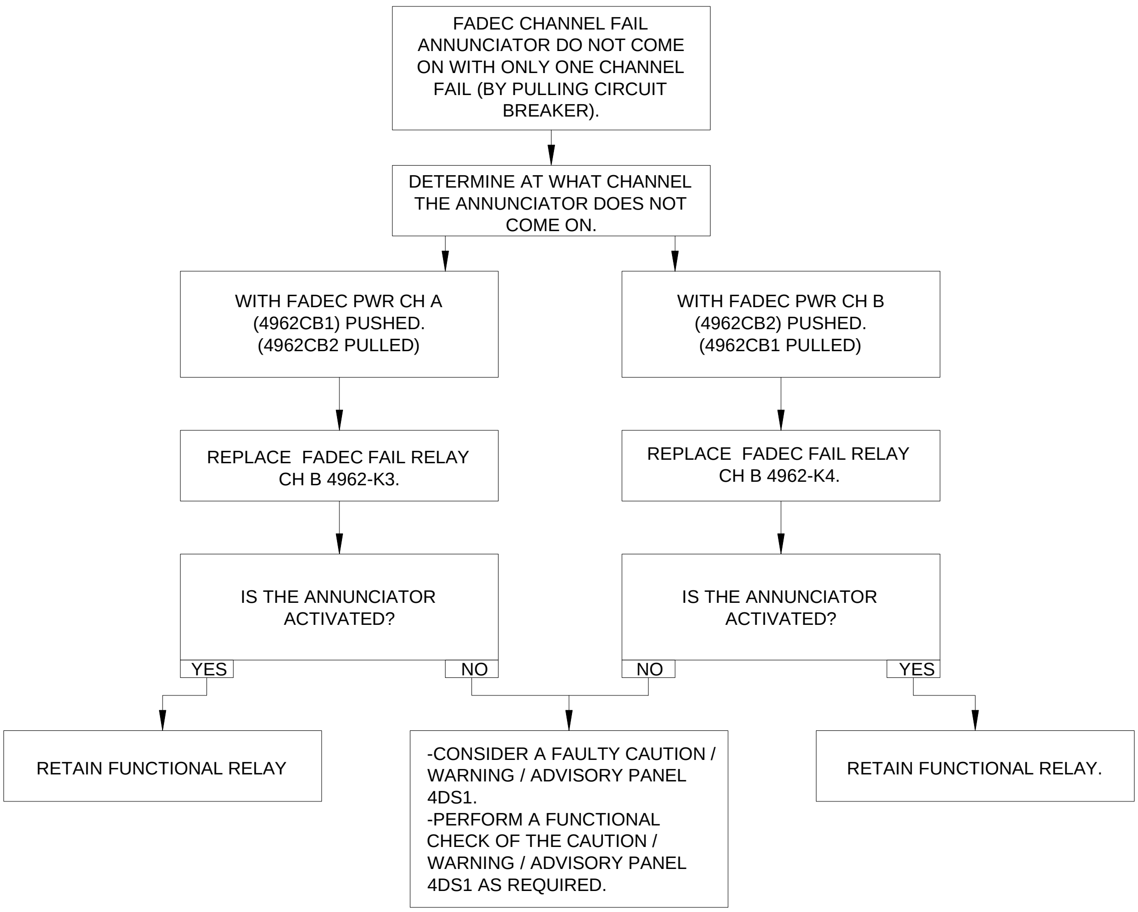
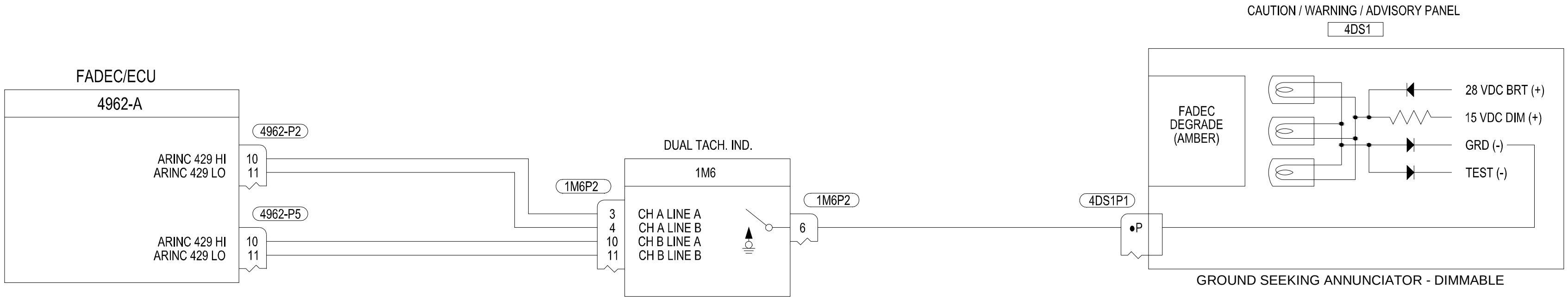


Figure 96- 70: FADEC CHANNEL FAIL Annunciator – Trouble No. 2



NOTE:

FADEC DEGRADED ANNUNCIATOR ACTIVATES WHEN EITHER FADEC/ECU CHANNEL TRANSMIT ARINC 429 DATA BUS WORDS WITH LABEL 270 BIT 21, SET TO SWITCH DISCRETE GROUND ON THE DUAL TACHOMETER INDICATOR.

Figure 96-71: FADEC DEGRADED Annunciator Circuit – Simplified Schematic

96.3.26 ENGINE FUEL FILTER ANNUNCIATOR CIRCUIT — OPERATION

The ENG FUEL FILTER annunciator circuit is designed to notify the pilot that the engine fuel filter is in an impending bypass condition. A ground is required at input (s) of the amber ENG FUEL FILTER annunciator to cause the annunciator to come on. This annunciator can be dimmed. Refer to the engine fuel filter annunciator circuit simplified schematic, Figure 96-72.

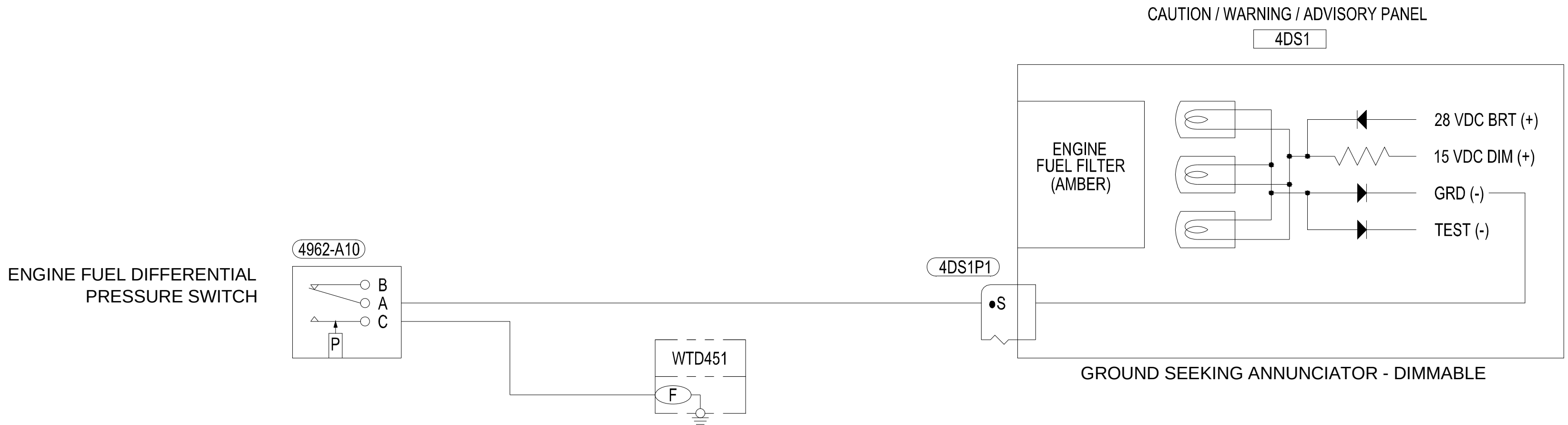
The ENG FUEL FILTER annunciator comes on when the engine fuel filter differential pressure switch (4962-A10) closes. This provides a ground to input (s) on the caution / warning / advisory panel connector (4DS1P1). The switch closes when a differential pressure of 16 +/-3 psi is present between the fuel pump discharge pressure and the filtered fuel pressure. When exposed to further contamination, the engine fuel filter will go into bypass at 35 +/-4 psi, sending fuel around the filter directly to the FMU inlet.

96.3.26.1. ENGINE FUEL FILTER Annunciator Circuit — Operational Check

Perform operational check of fuel filter assembly by-pass indicator per Honeywell Light Maintenance Manual for HTS900-2-1D Chapter 73-10-05 Section 4.C.

96.3.26.2. ENGINE FUEL FILTER Annunciator — Component Replacement

Refer to the caution/warning/advisory panel (4DS1) (paragraph 96.3.2, and paragraph 96.3.3 through paragraph 96.3.4.2.), or to the BHT-ELEC-SPM for wiring maintenance procedures as required.



NOTE:

ENGINE FUEL FILTER ANNUNCIATOR ACTIVATES WHEN A DIFFERENTIAL PRESSURE OF 16 +/-3 PSI IS PRESENT BETWEEN THE FUEL PUMP DISCHARGE PRESSURE A ND THE FILTERED FUEL PRESSURE.

Figure 96-72: ENGINE FUEL FILTER Annunciator Circuit – Simplified Schematic

96.3.27 ENGINE CHIP ANNUNCIATOR CIRCUIT — OPERATION

The ENGINE CHIP annunciator circuit is designed to notify the pilot of metallic particles in the engine oil system. Magnetic chip detector (4962-A2) is mounted on the engine chip detector housing downstream of the scavenge pump discharge port ahead of the oil cooler to collect the metallic particles on the lubrication system. The ENGINE CHIP annunciator will be illuminated when metallic particles bridge the gap of the chip detector element. This completes the ground circuit to annunciator. Refer to the ENGINE CHIP annunciator circuit simplified schematic (Figure 96-73).

A ground is required at input (u) of the amber ENGINE CHIP annunciator to cause the annunciator to come on. This annunciator can be dimmed.

A chip detector test switch (4962-S10) is available for continuity testing of the chip detector wiring every flight. The ENGINE CHIP annunciator will come on when the chip detector test switch (4962-S10) is pushed. These complete the ground circuit to the annunciator.

96.3.27.1. ENGINE CHIP Annunciator Circuit — Operational Check

1. Make sure the LIGHTS CAUT (4CB1) circuit breaker is closed.
2. Connect external DC power to the helicopter.

RESULT:
- The ENGINE CHIP annunciator is off.

CORRECTIVE ACTION:
- If the ENGINE CHIP annunciator is on (a ground signal is supplied to the annunciator), refer to Trouble No.1 (Figure 96-74).

3. Push chip detect test switch (4962-S10) on the instrument panel.

RESULT:
- The ENGINE CHIP annunciator is on.

CORRECTIVE ACTION:
- If the ENGINE CHIP annunciator does not come on, (a ground signal is not supplied to the annunciator), refer to Trouble No. 2 (Figure 96-75).

4. Remove the external power from the helicopter.
5. Return the helicopter to the standard configuration. Refer to Standard Practices — After Electrical Maintenance or Repairs (paragraph 96.1.1.1.4).

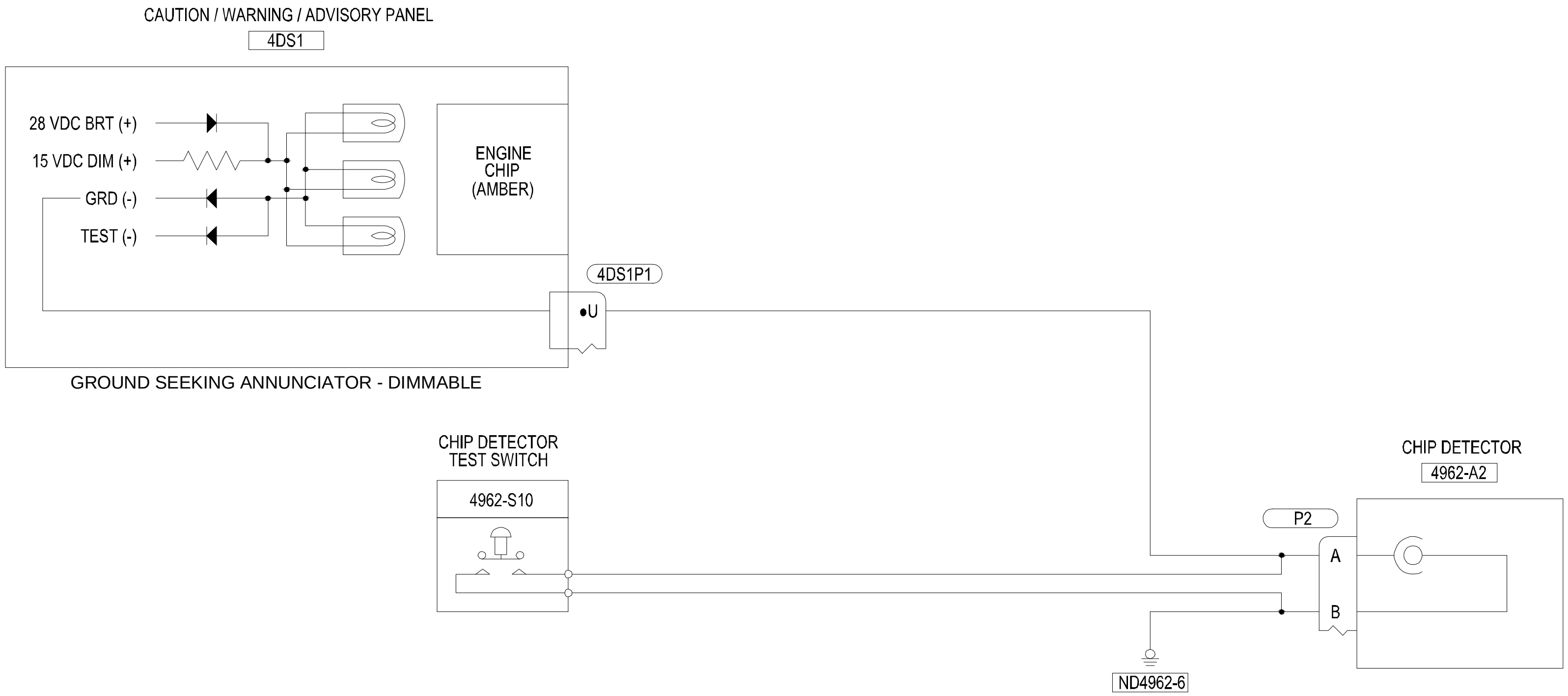


Figure 96-73: ENGINE CHIP Annunciator Circuit – Simplified Schematic

96.3.27.2. ENGINE CHIP Annunciator Circuit — Functional Check

1. Remove the chip detectors from the housing. Keep the associated electrical connector connected to the chip detectors. Make sure the chip detectors are isolated from the airframe ground.
2. Make sure the LIGHTS CAUT (4CB1) circuit breaker is closed.
3. Connect external DC power to the helicopter.

RESULT:
- The ENGINE CHIP annunciator is off.

CORRECTIVE ACTION:
- If the ENGINE CHIP annunciator is on (a ground signal is supplied to the annunciator), refer to Trouble No. 1 (Figure 96-74).

4. Temporarily complete the ground path between the two poles of the engine scavenge oil chip detector (4962-A2) with a conductive metal object.

RESULT:
- The ENGINE CHIP annunciator comes on.

CORRECTIVE ACTION:
- If the ENGINE CHIP annunciator does not come on (a ground signal is not supplied to the annunciator), refer to Trouble No. 2 (Figure 96-75).

5. Install the chip detectors (4962-A2) on the chip detector housing. Make sure the ENGINE CHIP annunciator is off.
6. Remove external DC power from the helicopter.
7. Return the helicopter to the standard configuration. Refer to Standard Practices — After Electrical Maintenance or Repairs (paragraph 96.1.1.1.4).

96.3.27.3. Engine Scavenge Oil Chip Detector (4962-A2) — Removal and Installation

NOTE

The following procedures do not require draining of oil from lubrication system. Instead, expect to collect all the oil that may drain from the oil cooler assembly.

1. Remove fairing aft of the aft engine firewall.
2. Locate and disconnect the engine chip detector connector P2 from the chip detector.
3. Remove the chip detector from the housing.

96.3.27.4. ENGINE CHIP Annunciator Circuit — Component Replacement

Refer to the caution/warning/advisory panel (4DS1) (paragraph 96.3.2, and paragraph 96.3.3 through paragraph 96.3.4.2.), or to the BHT-ELEC-SPM for wiring maintenance procedures as required.

TROUBLE NO.1
ENGINE CHIP ANNUNCIATOR CIRCUIT
CAUTION

DISCONNECT THE BATTERY AND THE EXTERNAL POWER PRIOR TO PERFORMING A CONTINUITY CHECK OR MAINTENANCE ON THE ENGINE CHIP ANNUNCIATOR CIRCUIT.

NOTE
Refer to Chapter 98 for wiring diagram.

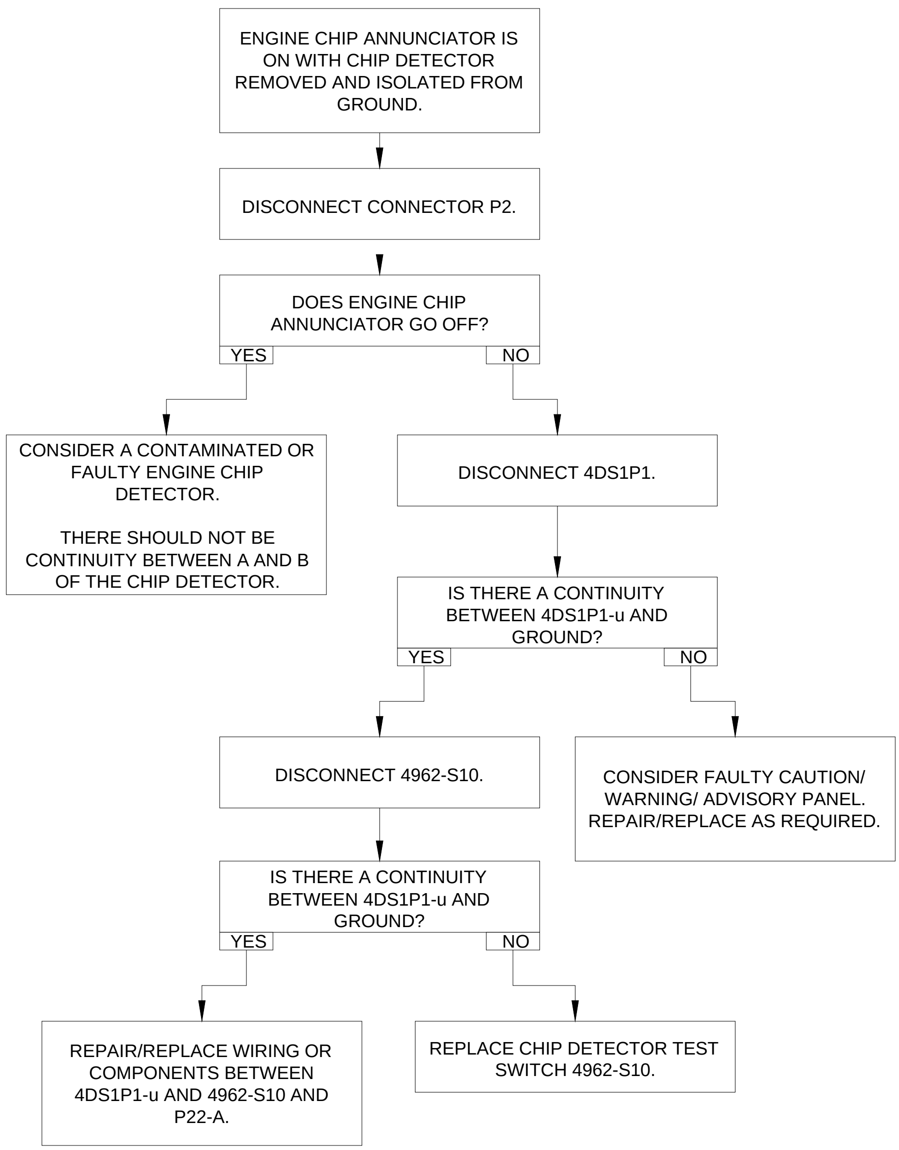


Figure 96-74: ENGINE CHIP Annunciator Circuit – Trouble No. 1

TROUBLE NO.2
ENGINE CHIP ANNUNCIATOR CIRCUIT

CAUTION

DISCONNECT THE BATTERY AND THE EXTERNAL POWER PRIOR TO PERFORMING A CONTINUITY CHECK OR MAINTENANCE ON THE ENGINE CHIP ANNUNCIATOR CIRCUIT.

NOTE
Refer to Chapter 98 for wiring diagram.

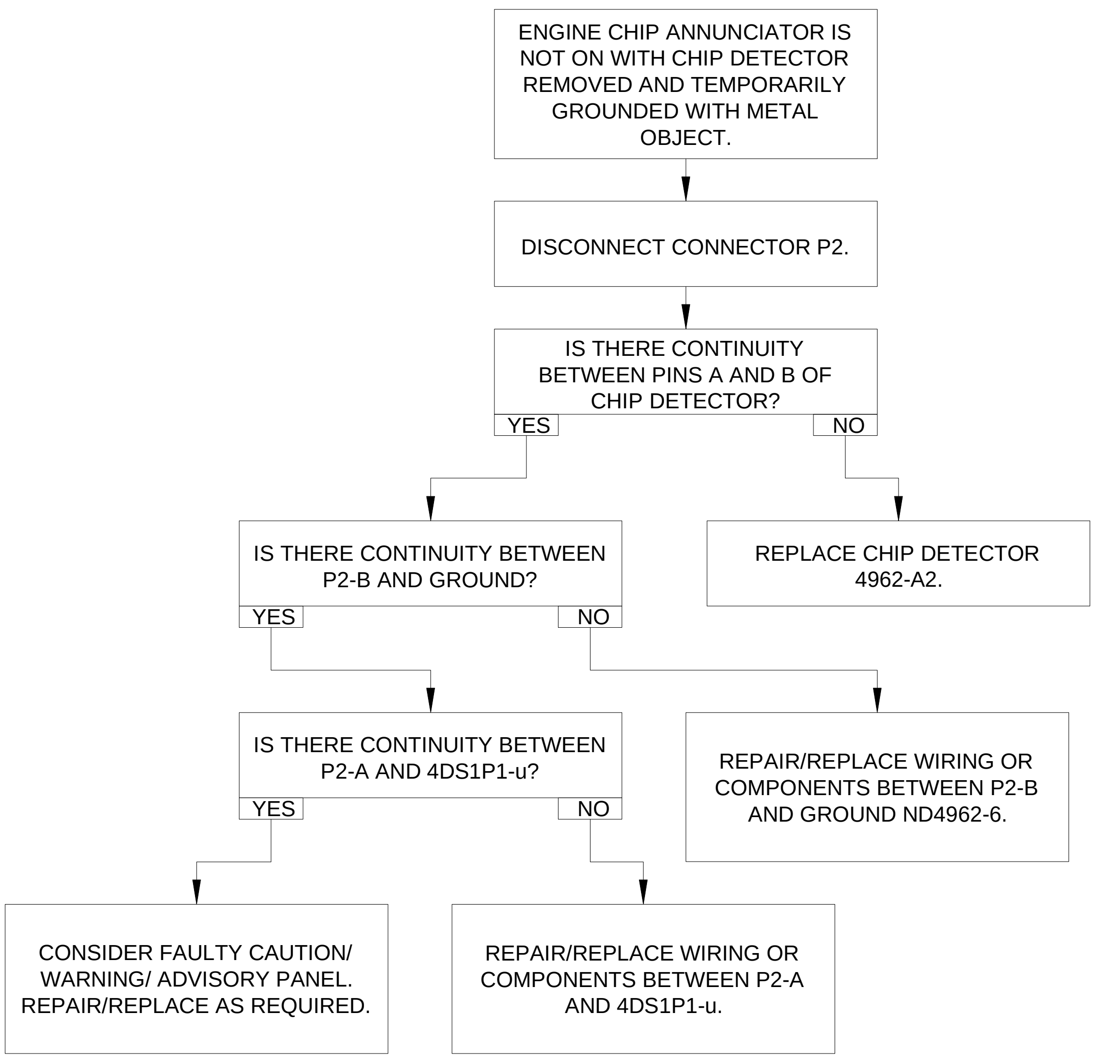


Figure 96-75: ENGINE CHIP Annunciator Circuit – Trouble No. 2

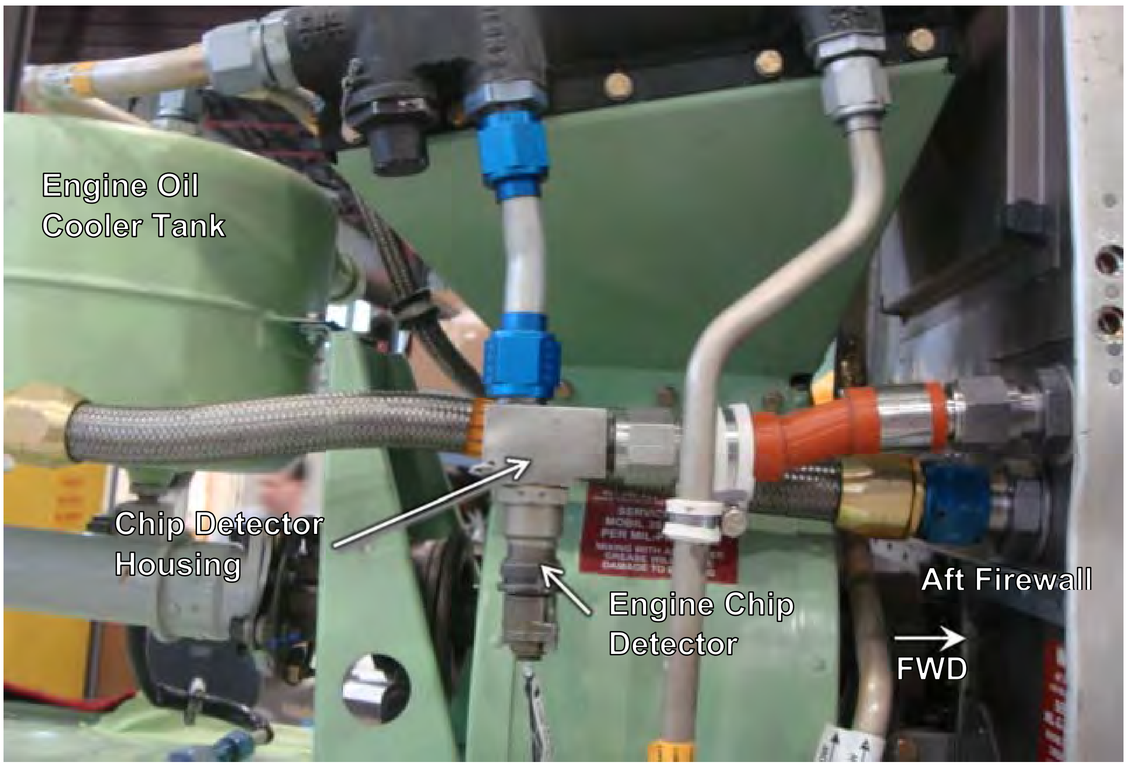


Figure 96- 76: Engine Chip Detector – Removal /Installation

96.3.28 TRANSMISSION CHIP (XMSN CHIP) ANNUNCIATOR CIRCUIT — OPERATION

See BHT-407-MM Chapter 96-232.

96.3.28.1. Transmission Chip (XMSN CHIP) Annunciator Circuit — Operational Check

See BHT-407-MM Chapter 96-233.

96.3.28.2. XMSN CHIP Annunciator Circuit — Functional Check

See BHT-407-MM Chapter 96-234.

96.3.28.3. Transmission Chip Detectors 1E3, 1E5, and Freewheel Chip Detector — Removal and Installation

See BHT-407-MM Chapter 96-235.

96.3.28.4. Transmission Chip (XMSN CHIP) Annunciator Replacement Circuit — Component

See BHT-407-MM Chapter 96-236.

96.3.29 TAIL ROTOR GEARBOX CHIP (T/R CHIP) ANNUNCIATOR CIRCUIT — OPERATION

See BHT-407-MM Chapter 96-237.

96.3.29.1. Tail Rotor Gearbox Chip (T/R CHIP) Annunciator Circuit — Operational Check

See BHT-407-MM Chapter 96-238.

96.3.29.2. Tail Rotor Gearbox Chip (T/R CHIP) Annunciator Circuit — Functional Check

See BHT-407-MM Chapter 96-239.

96.3.29.3. Tail Rotor Gearbox Chip Detector (1E4) — Removal and Installation

See BHT-407-MM Chapter 96-240.

96.3.29.4. Tail Rotor Gearbox Chip Annunciator Replacement (T/R CHIP) Circuit — Component

See BHT-407-MM Chapter 96-241.

96.3.30 GENERATOR FAIL (GEN FAIL) ANNUNCIATOR CIRCUIT — OPERATION

See BHT-407-MM Chapter 96-242.

96.3.30.1. Generator Fail (GEN FAIL) Annunciator Circuit — Operational Check

See BHT-407-MM Chapter 96-243.

96.3.30.2. Generator Fail (GEN FAIL) Annunciator Circuit — Component Replacement

See BHT-407-MM Chapter 96-244.

96.3.31 TRANSMISSION OIL PRESSURE (XMSN OIL PRESS) ANNUNCIATOR CIRCUIT — OPERATION

See BHT-407-MM Chapter 96-245.

96.3.31.1. Transmission Oil Pressure (XMSN OIL PRESS) Annunciator Circuit — Operational Check

See BHT-407-MM Chapter 96-246.

96.3.31.2. Transmission Oil Pressure Switch (1S4) — Removal

See BHT-407-MM Chapter 96-247.

96.3.31.3. Transmission Oil Pressure Switch (1S4) — Functional Check

See BHT-407-MM Chapter 96-248.

96.3.31.4. Transmission Oil Pressure Switch (1S4) — Installation

See BHT-407-MM Chapter 96-249.

96.3.31.5. Transmission Oil Pressure (XMSN OIL PRESS) Annunciator Circuit — Component Replacement

See BHT-407-MM Chapter 96-250.

96.3.32 CHECK INSTRUMENTS (CHECK INSTR) ANNUNCIATOR CIRCUIT — OPERATION

The check instrument (CHECK INSTR) annunciator circuit is designed to notify the pilot that either the Torque, Dual Tach, NG, or MGT indicator has detected an exceedance. A ground is required at input EE of the amber CHECK INSTR annunciator to cause the annunciator to come on. This annunciator can be dimmed. Refer to the check instrument (CHECK INSTR) annunciator circuit simplified schematic (Figure 96-77).

TORQUE INDICATOR

When the Engine Torque Indicator detects and records an exceedance (greater than 110% indicated Q), the CHECK INSTR annunciator comes on by a ground, which is provided from the inside of the indicator, through pin No. 21. The indicator digital display will flash prior to an exceedance.

Following the exceedance, the Torque indicator needle and digital display will continue to provide the pilot with accurate readings. The CHECK INSTR annunciator will remain illuminated until the pilot acknowledges the exceedance by pressing the LCD test switch (1S15) on the instrument panel.

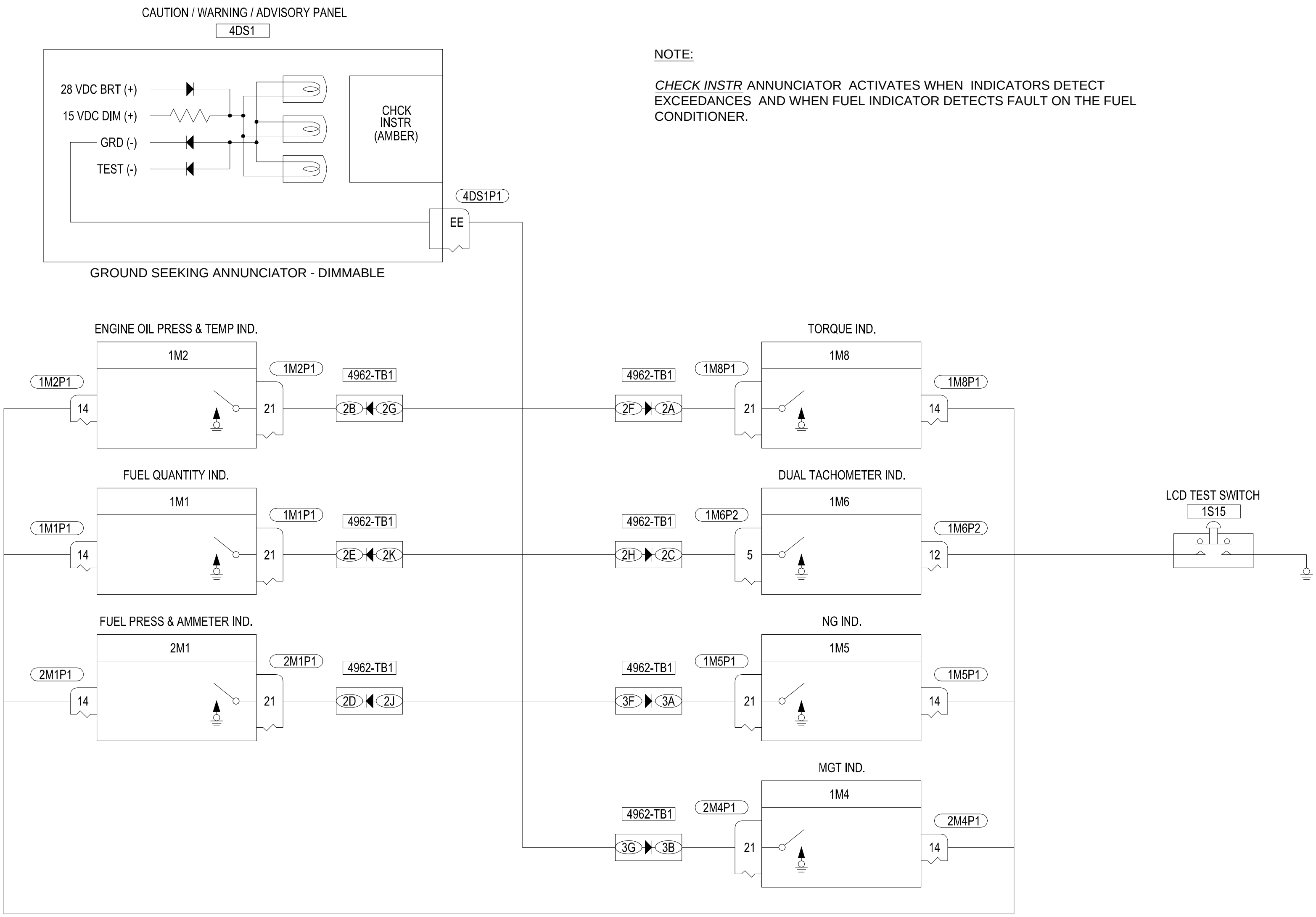


Figure 96-77: Check Instruments (CHECK INSTR) Annunciator Circuit – Simplified Schematic

When the LCD test switch (1S15) is pressed following an Overtorque exceedance, the ENGINE TORQUE indicator digital display will show the peak value of the exceedance while the CHECK INSTR annunciator will go off when the LCD test switch is released. During the LCD test, all other engine instruments built-in test is activated. Please refer Chapter 95 for individual indicators built-in test properties.

The CHECK INSTR will come on again following any subsequent torque exceedance. “OEC” followed by a number during LCD test after an event notifies the torque events recorded during the operation.

Exceedances can be downloaded for analysis and be erased from the Torque indicator memory. Refer to Chapter 95 for information on indicator exceedance data downloading and erasing.

DUAL TACHOMETER INDICATOR (NP/NR)

When the Dual Tachometer Indicator detect exceedance on NP % RPM (greater than 105%), the CHECK INSTR annunciator comes on by a ground, which is provided from the inside of the indicator, through pin No. 5.

Following the exceedance, the Dual Tach indicator needles will continue to provide the pilot with accurate readings. The CHECK INSTR annunciator will remain illuminated until the pilot acknowledges the exceedance by pressing the LCD test switch (1S15) on the instrument panel.

When the LCD test switch (1S15) is pressed following an NP exceedance, the CHECK INSTR annunciator will go off when the LCD test switch is released. During the LCD test, all other engine instruments built-in test is activated. Please refer Chapter 95 for individual indicators built-in test properties.

The CHECK INSTR will come on again following any subsequent NP exceedance. Exceedances can be downloaded for analysis and be erased from the Dual Tach indicator memory. Refer to Chapter 95 for information on indicator exceedance data downloading and erasing.

GAS GENERATOR INDICATOR

When the Gas Generator Indicator detects and records an exceedance (greater than 103.6% RPM), the CHECK INSTR annunciator comes on by a ground, which is provided from the inside of the indicator, through pin No. 21. The indicator digital display will flash prior to an exceedance.

Following the exceedance, the Gas Generator Indicator needle and digital display will continue to provide the pilot with accurate readings. The CHECK INSTR annunciator will remain illuminated until the pilot acknowledges the exceedance by pressing the LCD test switch (1S15) on the instrument panel.

When the LCD test switch (1S15) is pressed following an exceedance, the Gas Generator indicator digital display will show the peak value of the exceedance while the CHECK INSTR annunciator will go off when the LCD test switch is released. During the LCD test, all other engine instruments built-in test is activated. Please refer Chapter 95 for individual indicators built-in test properties.

The CHECK INSTR will come on again following any subsequent exceedance. “OEC” followed by a number during LCD test after an event notifies the exceedance events recorded during the operation.

Exceedances can be downloaded for analysis and be erased from the Gas Generator indicator memory. Refer to Chapter 95 for information on indicator exceedance data downloading and erasing.

MEASURED GAS TEMPERATURE INDICATOR

When the Measured Gas Temperature Indicator detects and records an exceedance (greater than 958°C), the CHECK INSTR annunciator comes on by a ground, which is provided from the inside of the indicator, through pin No. 21. The indicator digital display will flash prior to an exceedance.

Following the exceedance, the Measured Gas Temperature Indicator needle and digital display will continue to provide the pilot with accurate readings. The CHECK INSTR annunciator will remain illuminated until the pilot acknowledges the exceedance by pressing the LCD test switch (1S15) on the instrument panel.

When the LCD test switch (1S15) is pressed following an exceedance, the Measured Gas Temperature indicator digital display will show the peak value of the exceedance while the CHECK INSTR annunciator will go off when the LCD test switch is released. During the LCD test, all other engine instruments built-in test is activated. Please refer Chapter 95 for individual indicators built-in test properties.

The CHECK INSTR will come on again following any subsequent over temperature exceedance. “OEC” followed by a number during LCD test after an event notifies the exceedance events recorded during the operation.

Exceedances can be downloaded for analysis and be erased from the Measured Gas Temperature indicator memory. Refer to Chapter 95 for information on indicator exceedance data downloading and erasing.

96.3.32.1. Check Instruments (CHECK INSTR) Annunciator Circuit — Operational Check

1. Disconnect battery and external DC power from the helicopter.
2. On the overhead console open the circuit breakers that follow:

- ENGINE INSTR TRQ (1CB25)
- ENGINE INSTR NG (1CB22)

CAUTION

HANDLE THE CONNECTORS AND THE RECEPTACLES OF THE INSTRUMENTS IN ACCORDANCE WITH STANDARD PRACTICES FOR ELECTROSTATIC SENSITIVE EQUIPMENT. THESE INSTRUMENTS ARE SENSITIVE TO STATIC ELECTRICITY. FAILURE TO OBEY THESE PRECAUTIONS MAY RESULT IN DAMAGE TO THE INSTRUMENTS.

3. Gain access to NG indicator and disconnect 1M5P1 connector.
4. Close the LIGHTS CAUT (4CB1) circuit breaker.

5. Connect external DC power to the helicopter.

RESULT:
- The CHECK INSTR annunciator is off.

CORRECTIVE ACTION:
- If the CHECK INSTR annunciator is on (a ground is supplied to the annunciator), refer to Trouble No. 1 (Figure 96-78)

6. Connect temporary jumper between 1M5P1 pin 21 and ground.

RESULT:
- The CHECK INSTR annunciator comes on.

CORRECTIVE ACTION:
- If the CHECK INSTR annunciator does not come on, refer to Trouble No. 2 (Figure 96-79).

7. Remove the temporary jumper between 1M5P1 pin 21 and ground.
8. Remove external DC power from the helicopter.
9. Return the helicopter to the standard configuration. Refer to Standard Practices — After Electrical Maintenance or Repairs (paragraph 96.1.1.1.4)

96.3.32.2. Check Instruments (CHECK INSTR) Annunciator Circuit — Component Replacement

Refer to the caution/warning/advisory panel (4DS1) (paragraph 96.3.2, and paragraph 96.3.3 through paragraph 96.3.4.2.), or to the BHT-ELEC-SPM for wiring maintenance procedures as required. For the removal and installation procedures for the LCD test switch (1S15), refer to the Miscellaneous Electrical Components — Maintenance Practices (paragraph 96.1.6).

TROUBLE NO.1
CHECK INSTRUMENT ANNUNCIATOR CIRCUIT

CAUTION

DISCONNECT THE BATTERY AND THE EXTERNAL POWER PRIOR TO PERFORMING A CONTINUITY CHECK OR MAINTENANCE ON THE CHECK INSTRUMENT ANNUNCIATOR CIRCUIT.

NOTE
Refer to Chapter 98 for wiring diagram.

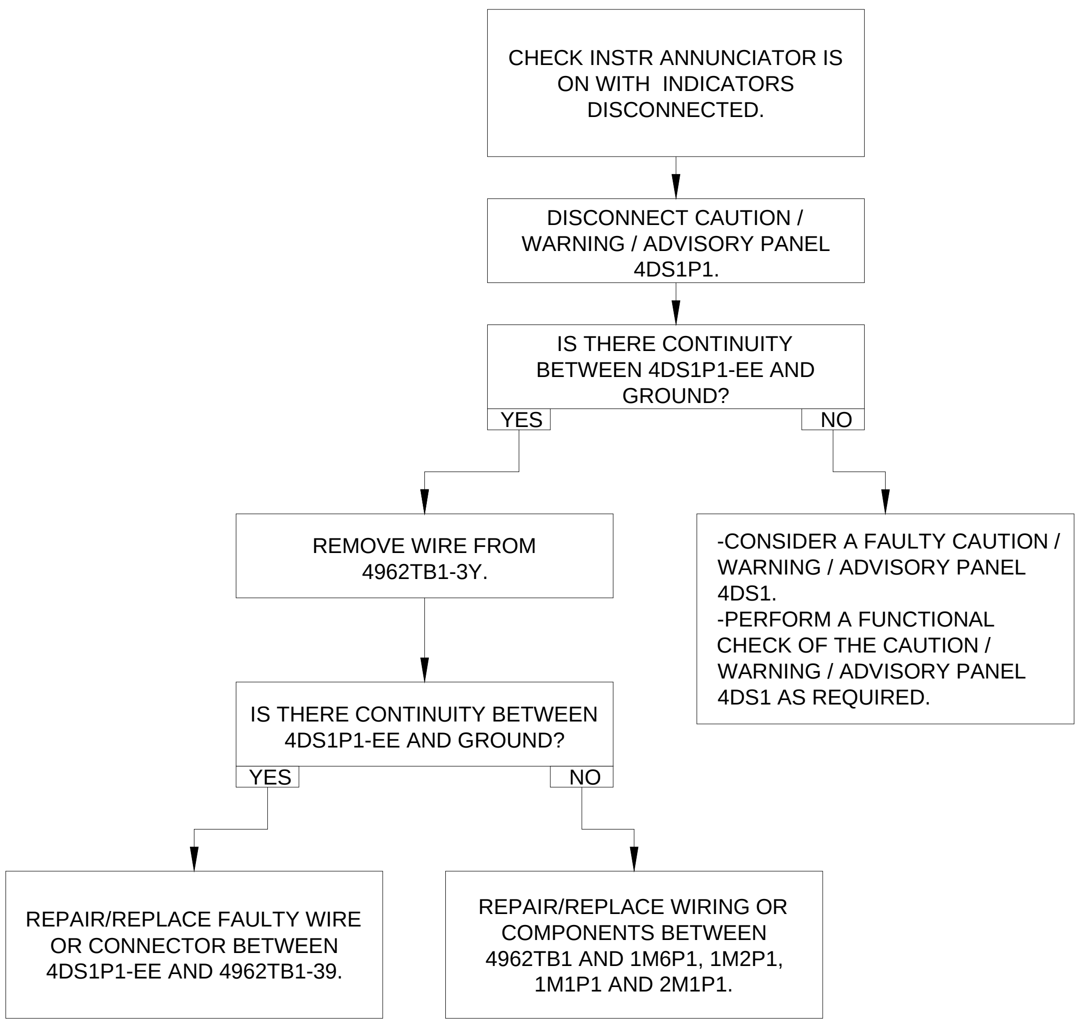


Figure 96-78: Check Instruments (CHECK INSTR) Annunciator Circuit – Trouble No. 1

TROUBLE NO.2
CHECK INSTRUMENT ANNUNCIATOR CIRCUIT

CAUTION

DISCONNECT THE BATTERY AND THE EXTERNAL POWER PRIOR TO PERFORMING A CONTINUITY CHECK OR MAINTENANCE ON THE CHECK INSTRUMENT ANNUNCIATOR CIRCUIT.

NOTE
Refer to Chapter 98 for wiring diagram.

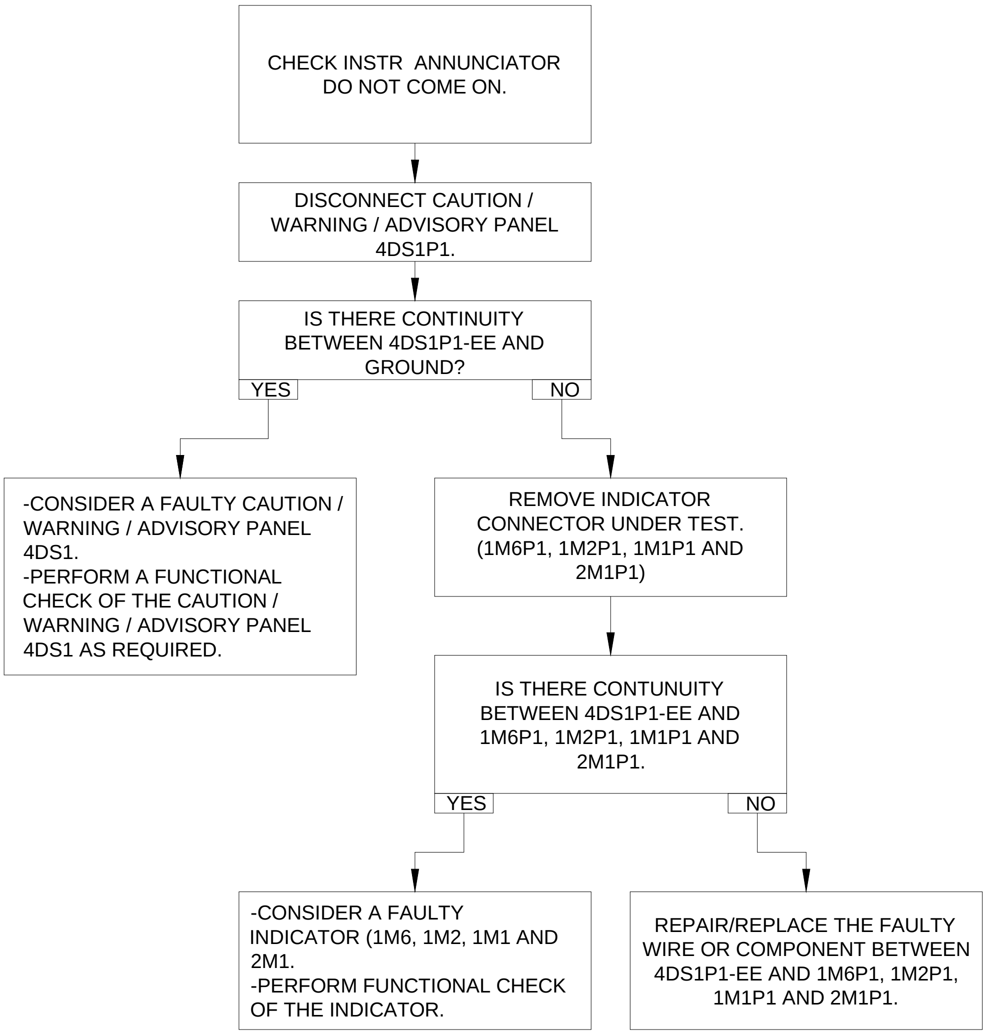


Figure 96-79: Check Instruments (CHECK INSTR) Annunciator Circuit – Trouble No. 2

96.3.33 BATTERY RELAY ANNUNCIATOR CIRCUIT — OPERATION

See BHT-407-MM Chapter 96-254.

96.3.33.1. BATTERY RELAY Annunciator Circuit — Functional Check

See BHT-407-MM Chapter 96-255.

96.3.33.2. BATTERY RELAY Annunciator Circuit — Component Replacement

See BHT-407-MM Chapter 96-256.

96.3.34 TRANSMISSION OIL TEMPERATURE (XMSN OIL TEMP) ANNUNCIATOR CIRCUIT — OPERATION

See BHT-407-MM Chapter 96-257.

96.3.34.1. Transmission Oil Temperature (XMSN OIL TEMP) Annunciator Circuit — Operational Check

See BHT-407-MM Chapter 96-258.

96.3.34.2. Transmission Oil Temperature Switch (1S3) — Removal

See BHT-407-MM Chapter 96-259.

96.3.34.3. Transmission Oil Temperature Switch (1S3) — Functional Check

See BHT-407-MM Chapter 96-260.

96.3.34.4. Transmission Oil Temperature Switch (1S3) — Installation

See BHT-407-MM Chapter 96-261.

96.3.34.5. Transmission Oil Temperature XMSN OIL TEMP) Annunciator Circuit — Component Replacement

See BHT-407-MM Chapter 96-262.

96.3.35 HYDRAULIC SYSTEM CIRCUIT — OPERATION ANNUNCIATOR

See BHT-407-MM Chapter 96-263.

96.3.35.1. HYDRAULIC SYSTEM Annunciator Circuit — Operational Check

See BHT-407-MM Chapter 96-264.

96.3.35.2. Hydraulic Pressure Switch (9S1) — Removal

See BHT-407-MM Chapter 96-265.

96.3.35.3. Hydraulic Pressure Switch (9S1) — Functional Check

See BHT-407-MM Chapter 96-266.

96.3.35.4. Hydraulic Pressure Switch (9S1) — Installation

See BHT-407-MM Chapter 96-267.

96.3.35.5. HYDRAULIC SYSTEM Annunciator Circuit — Component Replacement

See BHT-407-MM Chapter 96-268.

96.3.36 ENGINE OVERSPEED (ENGINE OVSPD) ANNUNCIATOR CIRCUIT — OPERATION

The engine overspeed (ENGINE OVSPD) annunciator circuit is designed to notify the pilot the engine power turbine (NP) speed or the gas producer (NG) speed exceeds limit settings. Refer to the engine overspeed (ENGINE OVSPD) annunciator circuit simplified schematic (Figure 96-81).

The ENGINE OVERSPEED annunciator comes on when FADEC/ECU channel in control transmit ARINC 429 data bus word label 271 bit 18 set to switch discrete ground on the Dual Tachometer Indicator (Np/Nr) (1M6) or the Measured Gas Temperature Indicator MGT (1M4). These complete the ground required at input (v) of the red ENGINE OVSP annunciator to cause illumination. This annunciator is not dimmable.

FADEC/ECU detects overspeed on gas producer turbine (Ng) when exceeds 110.4% rpm. Once the overspeed event is no longer present, the annunciator will extinguish and the incident will be recorded on the ECU.

FADEC/ECU Np overspeed has two conditions to meet in order to declare overspeed event. (1) When Np exceeds 105.4% rpm and (2) % rpm is higher than the set speed for specific rate of change. This is defined by a linear relationship between the Np speed and the rate of change; where the Np speed is 116.8% - rate of change is zero and when the Np speed is 105.4% - rate of change is 142.5 % per second. See Figure 96- 80. Once the overspeed event is no longer present, the annunciator will extinguish and the incident will be recorded on the ECU.

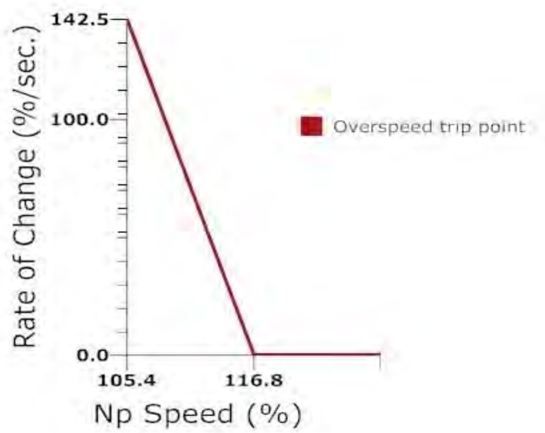


Figure 96- 80: Np Overspeed Trip Point

CAUTION

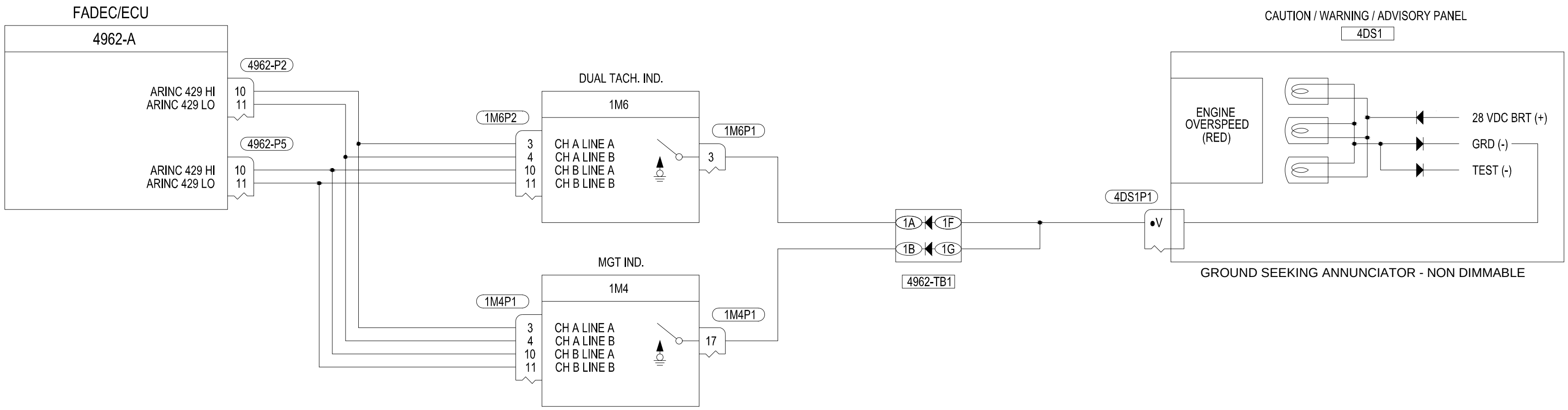
REFER TO CHAPTER 76 FOR OVERSPEED OPERATION.

96.3.36.1. Engine Overspeed (ENGINE OVSPD) ANNUNCIATOR CIRCUIT — Functional Check

Perform FADEC/ECU Annunciator Circuit Functional Check per paragraph 96.3.44.

96.3.36.2. Engine Overspeed (ENGINE OVSPD) Annunciator Circuit — Component Replacement

Refer to the caution/warning/advisory panel (4DS1) (paragraph 96.3.2 and paragraph



NOTE:

ENGINE OVERSPEED ANNUNCIATOR ACTIVATES WHEN FADEC/ECU ACTIVE CHANNEL TRANSMIT ARINC 429 DATA BUS WORDS WITH LABEL 271 BIT 18, SET TO SWITCH DISCRETE GROUND ON EITHER DUAL TACHOMETER OR MGT INDICATOR.

Figure 96-81: Engine Overspeed (ENGINE OVSPD) Annunciator Circuit – Simplified Schematic

96.3.3 through paragraph 96.3.4.2.), or to the BHT-ELEC-SPM for wiring maintenance procedures as required. For data on the FADEC/ECU, refer to Chapter 76 or to the Honeywell Light Maintenance Manual for HTS900-2-1D.

96.3.37 WEIGHT-ON-GEAR AND CYCLIC CENTERING ANNUNCIATOR CIRCUIT— OPERATION

See BHT-407-MM Chapter 96-277.

96.3.37.1. CYCLIC CENTERING Annunciator Circuit — Functional Check

See BHT-407-MM Chapter 96-278.

96.3.37.2. CYCLIC CENTERING Annunciator Circuit — Troubleshooting

See BHT-407-MM Chapter 96-279.

96.3.37.3. Weight On Gear Switch (8S5) Removal

See BHT-407-MM Chapter 96-280.

96.3.37.4. Weight On Gear Switch (8S5) Installation

See BHT-407-MM Chapter 96-.281

96.3.37.5. Weight On Gear Switch (8S5) Rigging

See BHT-407-MM Chapter 96-282.

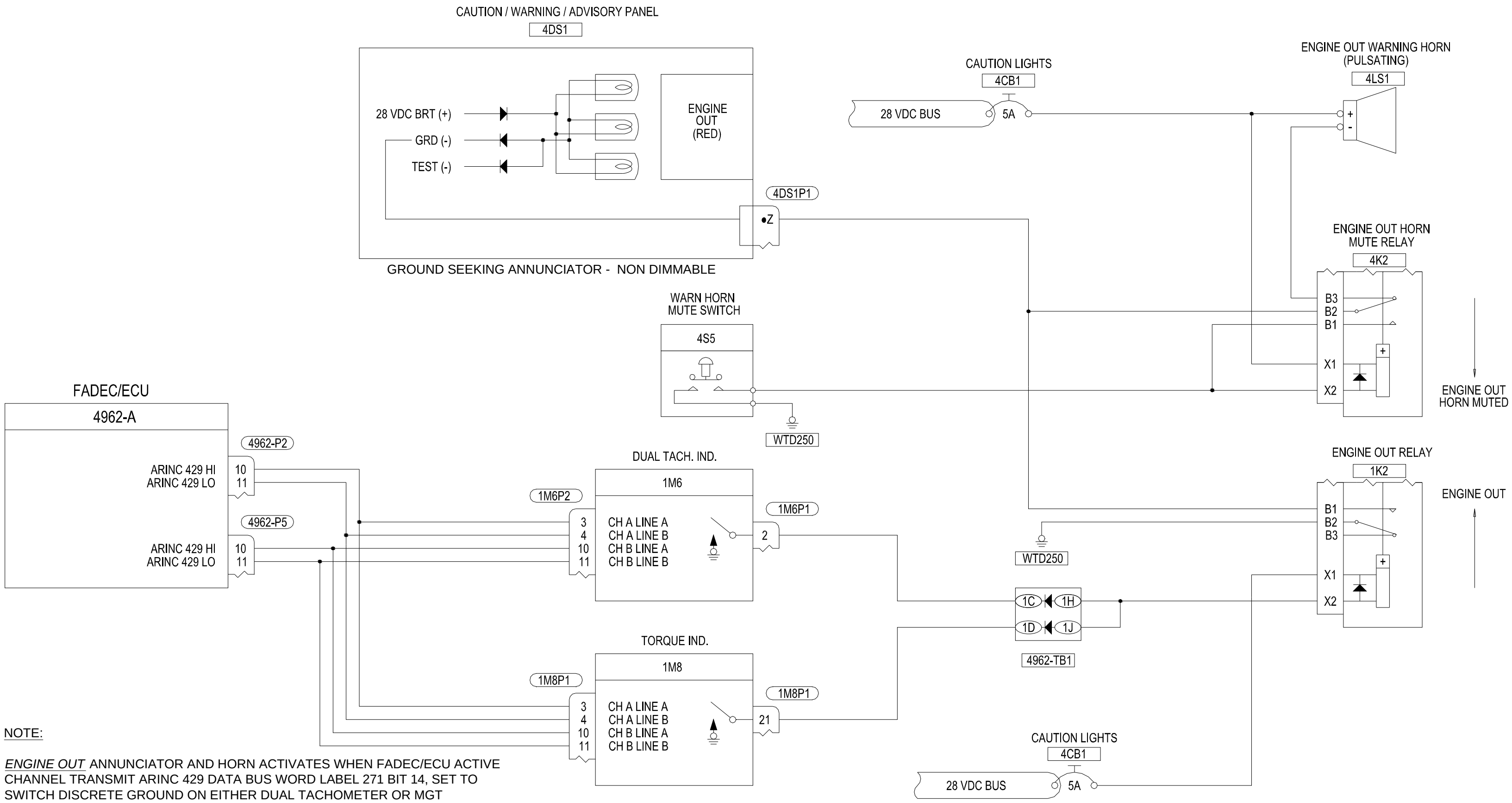
96.3.37.6. CYCLIC CENTERING Annunciator Circuit — Component Replacement

See BHT-407-MM Chapter 96-283.

96.3.38 ENGINE OUT ANNUNCIATOR AND WARNING HORN CIRCUIT — OPERATION

The ENGINE OUT annunciator and warning horn circuit is designed to notify the pilot that the engine has had a flameout or the gas generator (NG) speed is below 55 ±3%. Refer to the ENGINE OUT annunciator and warning horn circuit (Figure 96-82).

The ENGINE OUT annunciator comes on when either FADEC/ECU channel transmit ARINC 429 data bus word label 271 bit 14 set to switch discrete ground on the Dual Tachometer Indicator (Np/Nr) (1M6) or the Torque Indicator MGT (1M8). These complete the ground required at X2 of the engine out relay 1K2 causing the contact B2 and B1 to close. These provide ground to input (z) of the red ENGINE OUT annunciator to cause illumination. This annunciator is not dimmable. Also, the ground from B1 of 1K2 will be provided to the (-) of the engine out warning horn through closed contact B2 and B3 of 4K2 engine out horn mute relay.



NOTE:

ENGINE OUT ANNUNCIATOR AND HORN ACTIVATES WHEN FADEC/ECU ACTIVE CHANNEL TRANSMIT ARINC 429 DATA BUS WORD LABEL 271 BIT 14, SET TO SWITCH DISCRETE GROUND ON EITHER DUAL TACHOMETER OR MGT INDICATOR.

THE WARNING HORN MUTE SWITCH (4S5) IS USED FOR ENGINE OUT AND LOW ROTOR RPM HORN MUTE.

Figure 96-82: ENGINE OUT Annunciator and Warning Horn Circuit – Simplified Schematic

The engine out warning horn (4LS1) can be muted by pressing the warning horn mute switch (4S5). When the warning horn mute switch (4S5) is pressed, a ground is provided to terminals X2 and B1 of the engine out horn mute relay (4K2), which allows the relay to energize. With the engine out horn mute relay (4K2) energized, the contact B2 to B3 is opened, which deactivates the engine out warning horn (4LS1). As the contact B2 to B1 is closed, a continuous ground path is provided to terminal X2 of the engine out horn mute relay (4K2) to keep it latched after the warning horn mute switch (4S5) is released. As the warning horn mute switch (4S5) is also used to mute the low rotor RPM warning horn (4LS2), the engine FADEC system diode assemblies (4CR4 and 4CR5) are used to isolate the engine out warning system from the low rotor RPM system.

96.3.38.1. ENGINE OUT Annunciator and Warning Horn Circuit — Operational Check

1. On the overhead console, close the LIGHTS CAUT (4CB1), FADEC CH A PWR (4962CB1), FADEC CH B PWR (4962CB2), ENGINE INSTR TRQ (1CB25), NR (1CB21) and NP (1CB24) circuit breakers.
2. Apply electrical power to the helicopter. DO NOT PRESS THE MUTE SWITCH.

RESULT:

- At completion of the NP/NR and/or MGT power-up self-test, the ENGINE OUT annunciator and the engine out warning horn (4LS1) stay on.

CORRECTIVE ACTION:

- If the ENGINE OUT annunciator and the engine out warning horn (4LS1) do not stay on, refer to Trouble No. 1 (Figure 96-83).
- If the ENGINE OUT annunciator stays off and the engine out warning horn (4LS1) come on, refer to Trouble No. 2 (Figure 96-84).
- If the ENGINE OUT annunciator is on and the engine out warning horn (4LS1) stay off, refer to Trouble No. 3 (Figure 96-85).

3. Push the WARN HORN MUTE switch (4S5) on the instrument panel.

RESULT:

- The engine out warning horn (4LS1) mutes.

CORRECTIVE ACTION:

- If the engine out warning horn (4LS1) does not mute, refer to Trouble No. 4 (Figure 96-86).

WARNING

A QUALIFIED PERSON MUST BE AT THE HELICOPTER CONTROLS DURING THE GROUND RUN PROCEDURE. REFER TO THE BHT-407-FM-1.

4. Start the engine. Keep the helicopter at idle (63 ±1% NG).

RESULT:

- The ENGINE OUT annunciator and the engine out warning horn (4LS1) are off.

5. Shutdown the engine.
6. Return the helicopter to the standard configuration. Refer to Standard Practices — After Electrical Maintenance or Repairs (paragraph 96.1.1.1.4).

96.3.38.2. ENGINE OUT ANNUNCIATOR CIRCUIT — Functional Check

Perform FADEC/ECU Annunciator Circuit Functional Check per paragraph 96.3.44.

96.3.38.3. ENGINE OUT Annunciator and Warning Horn Circuit, Engine Out Relay (1K2), Engine Out Horn Mute Relay (4K2) — Removal

SPECIAL TOOLS REQUIRED

NUMBER	NOMENCLATURE
M6106/31-001	Relay Removal Tool
M6106/32-001	Relay Base Removal Tool
M81969/14-10	Insertion/Extraction Tool

WARNING

OBEY ALL OF THE SAFETY PRECAUTIONS WHEN DOING MAINTENANCE ON OR NEAR ELECTRICAL/ELECTRONIC EQUIPMENT (PARAGRAPH 96.1.1.1.).

1. Disconnect battery and external DC power from the helicopter.
2. To gain access to the relays, remove the left side access cover of the instrument panel console.
3. Push the relay removal tool (M6106/31-001) (1, Figure 96-87) over the relay (2). This will unlatch and grasp the relay.
4. Pull the relay removal tool (M6106/31-001) (1) to remove the engine out relay (1K2) from its base.
5. If required, remove the relay base (3) with the relay base removal tool (M6106/32-001) (5) as follows:
   a. Insert the relay base removal tool (M6106/ 32-001) (5) under the relay base (3) and extend the rail (4).
   b. Push the relay base (3) out of the rail (4).

NOTE

Refer to the BHT-ELEC-SPM for the removal procedures of the electrical contacts of the relay base and data on the relay base contacts.

With the contact insertion/extraction tool (M81969/14-10), remove the wires from the relay base (3) if the base needs to be replaced

TROUBLE NO.1
ENGINE OUT ANNUNCIATOR AND HORN CIRCUIT

CAUTION

DISCONNECT THE BATTERY AND THE EXTERNAL POWER PRIOR TO PERFORMING A CONTINUITY CHECK OR MAINTENANCE ON THE ENGINE OUT ANNUNCIATOR AND HORN CIRCUIT.

NOTE
Refer to Chapter 98 for wiring diagram.

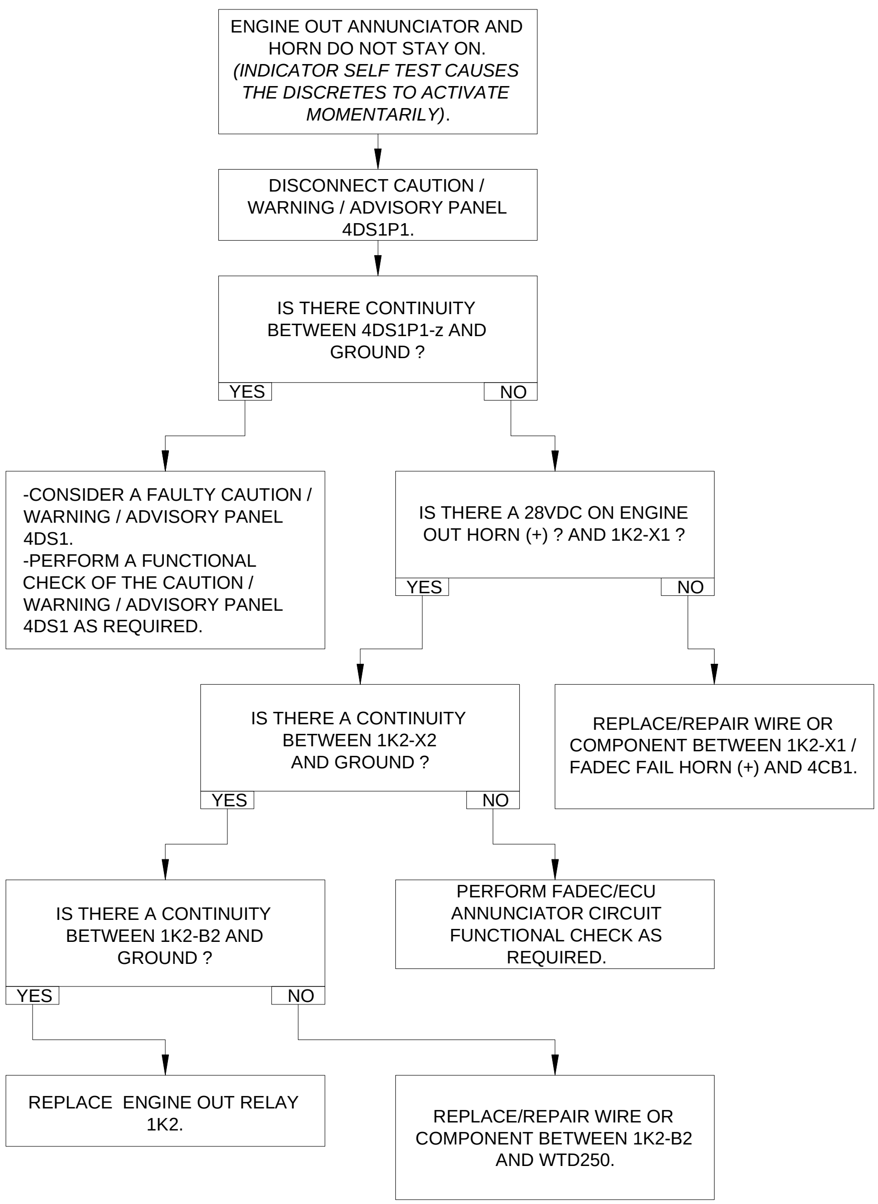


Figure 96-83: ENGINE OUT Annunciator and Warning Horn Circuit – Trouble No. 1

TROUBLE NO.2
ENGINE OUT ANNUNCIATOR AND HORN CIRCUIT

CAUTION

DISCONNECT THE BATTERY AND THE EXTERNAL POWER PRIOR TO PERFORMING A CONTINUITY CHECK OR MAINTENANCE ON THE ENGINE OUT ANNUNCIATOR AND HORN CIRCUIT.

NOTE
Refer to Chapter 98 for wiring diagram.

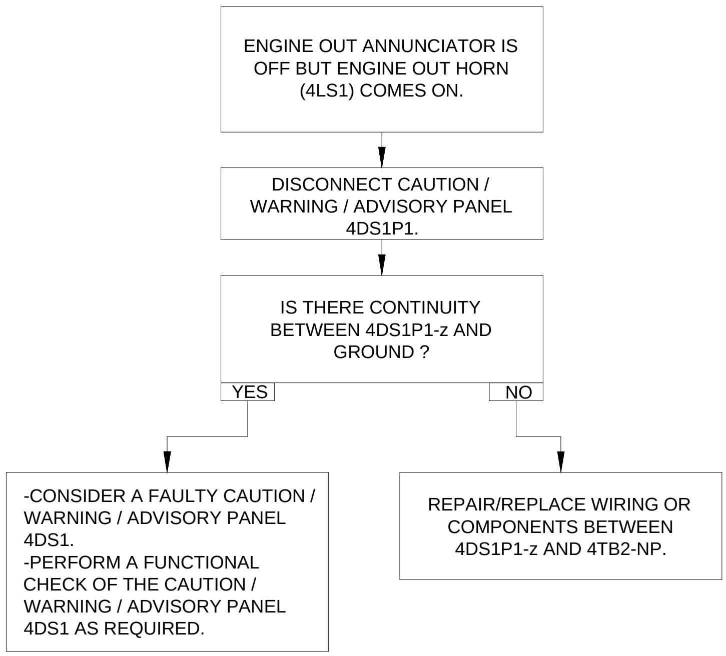


Figure 96-84: ENGINE OUT Annunciator and Warning Horn Circuit – Trouble No. 2

TROUBLE NO.3
ENGINE OUT ANNUNCIATOR AND HORN CIRCUIT

CAUTION

DISCONNECT THE BATTERY AND THE EXTERNAL POWER PRIOR TO PERFORMING A CONTINUITY CHECK OR MAINTENANCE ON THE ENGINE OUT ANNUNCIATOR AND HORN CIRCUIT.

NOTE
Refer to Chapter 98 for wiring diagram.

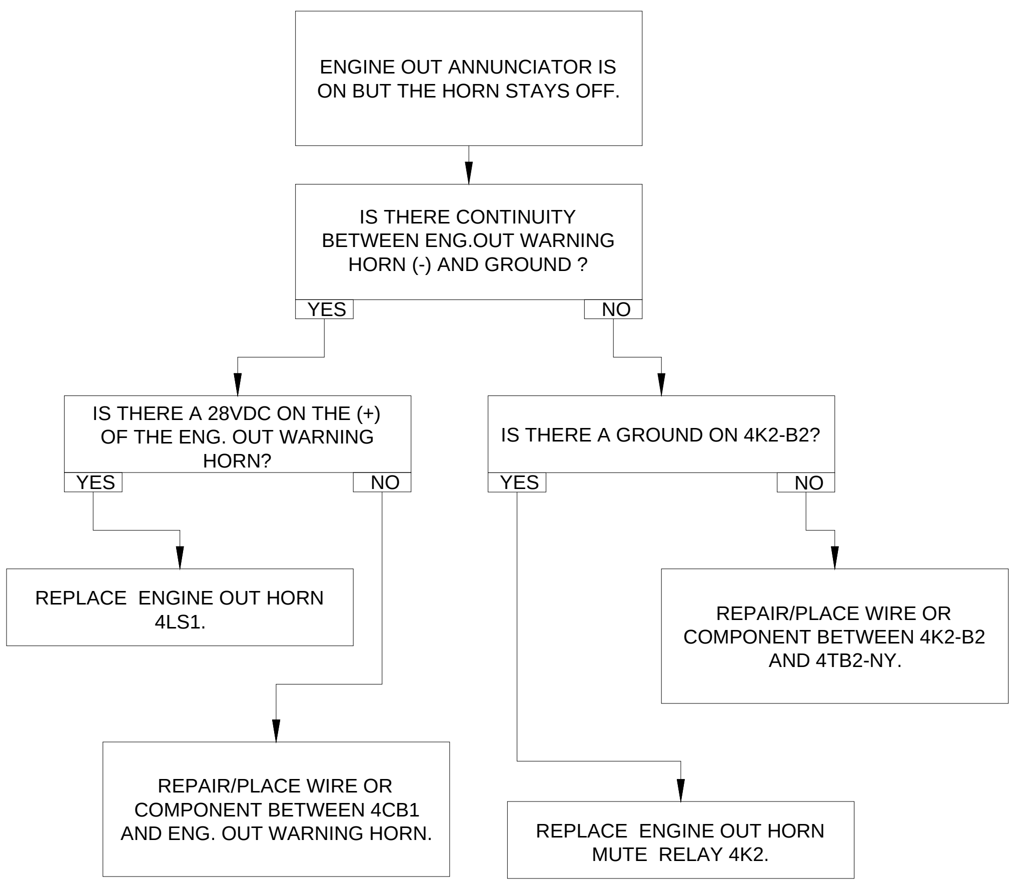


Figure 96-85: ENGINE OUT Annunciator and Warning Horn Circuit – Trouble No. 3

TROUBLE NO.4
ENGINE OUT ANNUNCIATOR AND HORN CIRCUIT

CAUTION

DISCONNECT THE BATTERY AND THE EXTERNAL POWER PRIOR TO PERFORMING A CONTINUITY CHECK OR MAINTENANCE ON THE ENGINE OUT ANNUNCIATOR AND HORN CIRCUIT.

NOTE
Refer to Chapter 98 for wiring diagram.

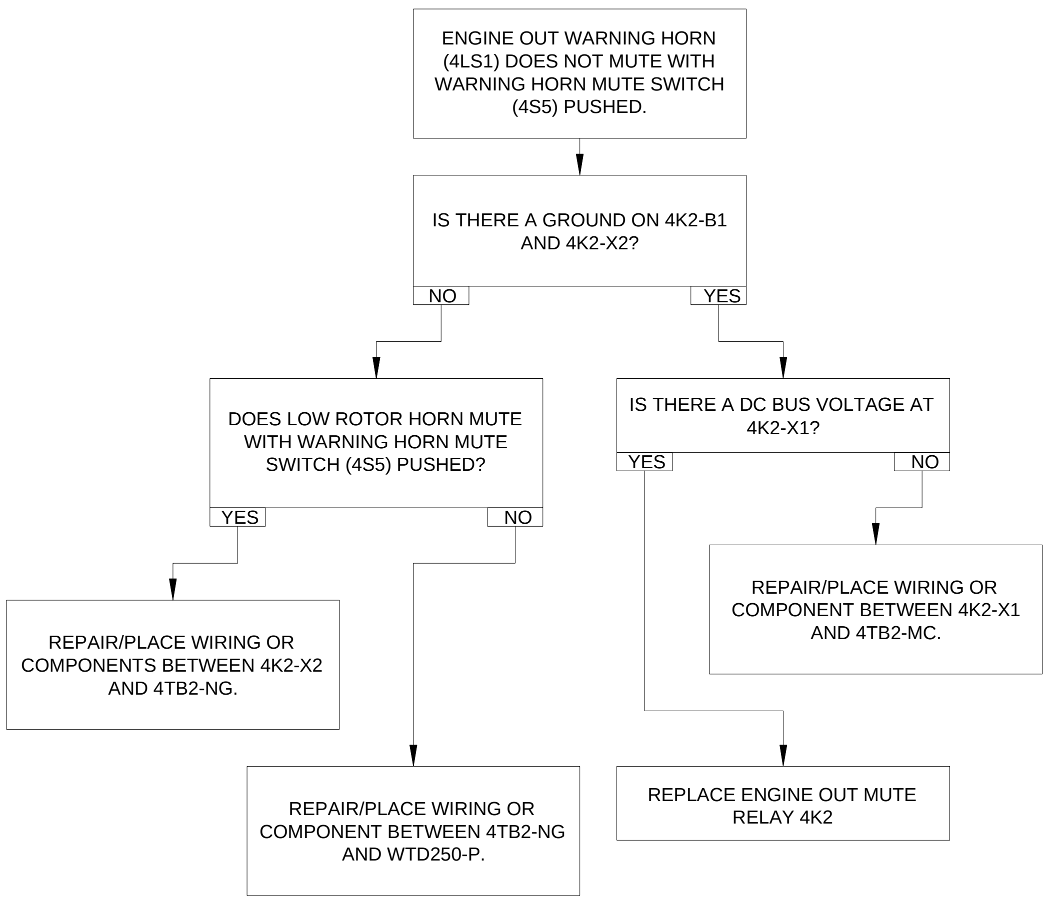


Figure 96-86: ENGINE OUT Annunciator and Warning Horn Circuit – Trouble No. 4

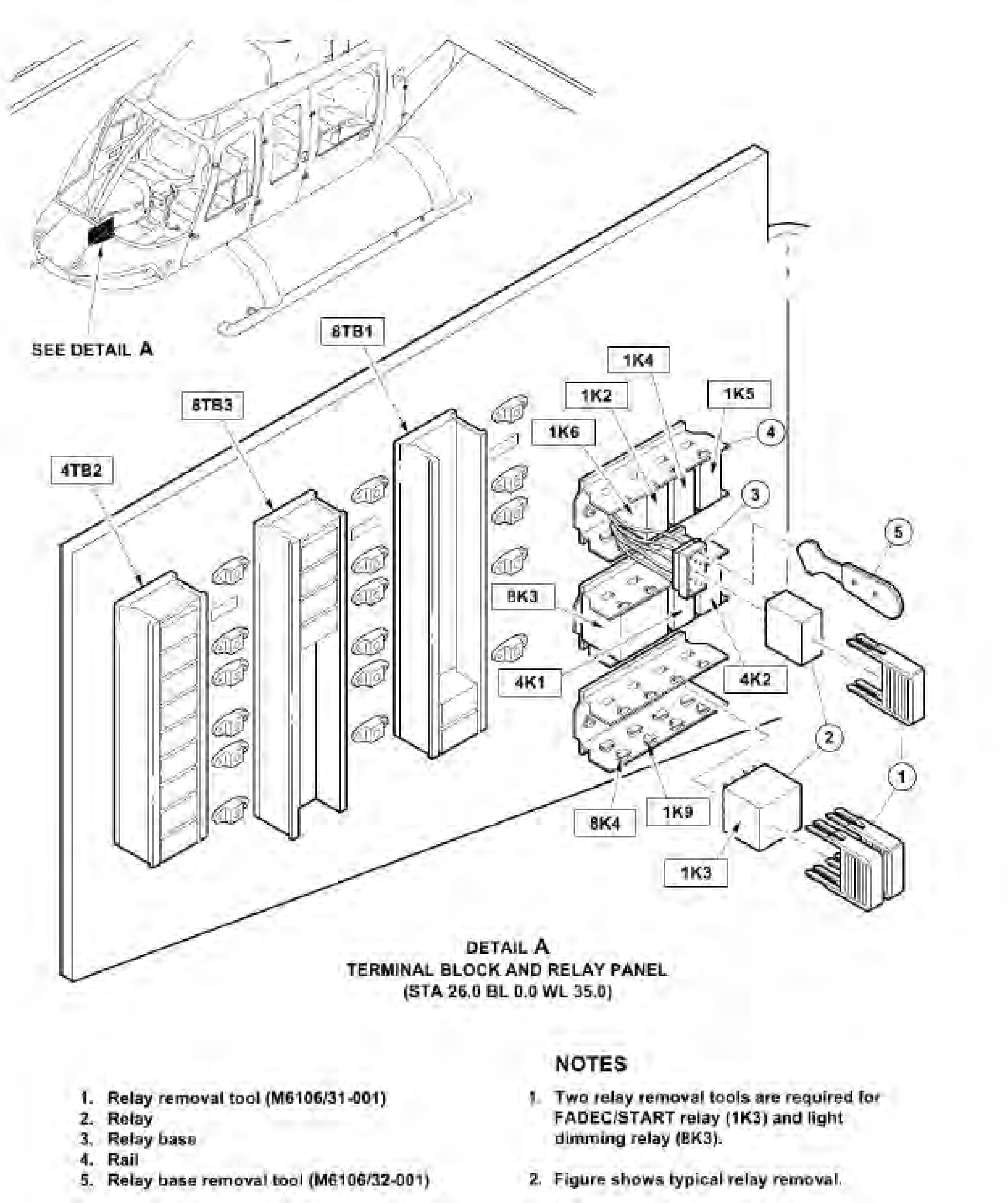


Figure 96-87: Engine Out Relay (1K2) and Engine Out Horn Mute Relay (4K2) – Removal and Installation

96.3.38.4. ENGINE OUT Annunciator and Warning Horn Circuit, Engine Out Relay (1K2), Engine Out Horn Mute Relay (4K2) — Installation

SPECIAL TOOLS REQUIRED

NUMBER	NOMENCLATURE
M81969/14-10	Insertion/Extraction Tool

WARNING

OBEY ALL OF THE SAFETY PRECAUTIONS WHEN DOING MAINTENANCE ON OR NEAR ELECTRICAL/ELECTRONIC EQUIPMENT (PARAGRAPH 96.1.1.1.).

NOTE

If the wires and contacts have been removed from the relay base, refer to the BHT-ELEC-SPM for the installation procedures of the electrical contacts of the relay base. Refer to the FADEC/ECU system wiring diagram (Chapter 98) for the correct wire installation to the base. Install the wires in the base with the insertion/ extraction tool (M81969/14-10).

1. Correctly position the relay base (3, Figure 96-87) on the rail (4) and apply finger pressure until it locks into place.
2. Correctly position the relay (2) on the relay base (3) and apply finger pressure until it latches into place.
3. Do an operational check of the ENGINE OUT annunciator and warning horn circuit (paragraph 96.3.43.1).
4. Install the panel on the left side of the instrument panel console.

96.3.38.5. ENGINE OUT Annunciator and Warning Horn Circuit — Component Replacement

Refer to the caution/warning/advisory panel (4DS1) (paragraph 96.3.2, and paragraph 96.3.6 through paragraph 96.3.8.1), or to the BHT-ELEC-SPM for wiring maintenance procedures as required. For the removal and installation procedures for the warning horn mute switch (4S5) and engine out warning horn (4LS1), refer to the Miscellaneous Electrical Components — Maintenance Practices (paragraph 96.1.6).

96.3.39 PEDAL STOP ANNUNCIATOR CIRCUIT — OPERATION (S/N 53000 THROUGH 54299)

See BHT-407-MM Chapter 96-292.

96.3.40 PEDAL STOP CAUTION MESSAGE CIRCUIT — OPERATION (S/N 54300 AND SUBSEQUENT)

See BHT-407-MM Chapter 96-293.

96.3.40.1. PEDAL STOP Annunciator Circuit — Operational Check

See BHT-407-MM Chapter 96-294.

96.3.40.2. PEDAL STOP Annunciator Circuit — Functional Check (S/N 53000 Through 54299)

See BHT-407-MM Chapter 96-295.

96.3.40.3. PEDAL STOP Annunciator Circuit — Component Replacement

See BHT-407-MM Chapter 96-296.

96.3.41 RPM ANNUNCIATOR AND WARNING HORN CIRCUIT — OPERATION

See BHT-407-MM Chapter 96-297.

96.3.42 RPM WARNING LIGHT AND AUDIO ALERT CIRCUIT — OPERATION (S/N 54300 AND SUBSEQUENT)

See BHT-407-MM Chapter 96-298.

96.3.42.1. RPM Annunciator and Warning Horn Circuit — Operational Check (S/N 53000 Through 54299)

See BHT-407-MM Chapter 96-299.

96.3.42.2. RPM Warning Light and Audio Alert Circuit — Operational Check (S/N 54300 and Subsequent)

See BHT-407-MM Chapter 96-300.

96.3.42.3. RPM Annunciator and Warning Horn Circuit, Low RPM Horn Mute Relay (4K1) — Removal (S/N 53000 Through 54299)

See BHT-407-MM Chapter 96-301.

96.3.42.4. RPM Annunciator and Warning Horn Circuit, Low Rotor RPM Horn Mute Relay (4K1) — Installation (S/N 53000 Through 54299)

See BHT-407-MM Chapter 96-302.

96.3.42.5. RPM Annunciator and Rotor RPM Warning Horn/Audio Alert Circuit — Component Replacement

See BHT-407-MM Chapter 96-303.

96.3.43 FADEC/ECU ANNUNCIATOR CIRCUIT — Functional Check

SPECIAL TOOLS REQUIRED

NUMBER	NOMENCLATURE
	ARINC 429 Data Transmitter

1. Disconnect battery and external DC power from the helicopter.
2. On the overhead console open the circuit breakers that follow:

- FADEC PWR CH A (4962CB1)
- FADEC PWR CH B (4962CB2)
- ENG INSTR MGT (1CB10)
- ENG INSTR NG (1CB22)

3. On the overhead console, make sure the following circuit breakers are closed:

- ENG INSTR Nr (1CB21)
- ENG INSTR Np (1CB24)

4. On the forward roof area, disconnect connector 4962-P196.
5. Connect an ARINC 429 Data Transmitter to 4962-J196 as follows:

SIGNAL INPUT

	Channel A	Channel B
Signal HI	Pin 71	Pin 53
Signal LO	Pin 58	Pin 31

6. Set the battery switch to BATT, or connect the external DC power to the helicopter.
7. Establish communication between the ARINC 429 transmitter and the helicopter.
8. Simulate ARINC 429 words with label 270 on both channels. Verify SSM bit are valid (HI) and SDI correspond to ECU channel simulated.
9. On the desired active channel, set bit 23 to HI (1) and bit 24 to LO (0). Set the other channel bit 23 to LO (0) and bit 24 to HI (1). Make a note of active channel.
10. On the selected active channel, simulate signal HI on data bus for words with label 270 (octal) for FADEC degrade caution (bit 21) Ensure that the FADEC DEGRADED caution annunciator output is activated. Deactivate signal before next step.
11. Simulate signal HI on data bus for words with label 271 (octal) for engine overspeed warning (bit 18). Ensure that the ENGINE OVSPD warning annunciator output is activated. Deactivate signal before next step.
12. Simulate signal HI on data bus for words with label 271 (octal) for engine start advisory (bit 17). Ensure that the START advisory annunciator output is activated Deactivate signal before next step.
13. Simulate signal HI on data bus for words with label 271 (octal) for engine out warning (bit 14). Ensure that the ENGINE OUT warning annunciator output and engine out horn are activated. Deactivate signal before next step.

NOTE

FADEC MAINT annunciator can only be activated after engine shutdown (Ng less than 5%).

14. Simulate signal HI on data bus for words with labels 350, 351, 352, 353, and 354 (octal) on either channel for FADEC maintenance advisory (bits 14 through 29), Ensure that the FADEC MAINT advisory annunciator output is activated. Deactivate signal for every bit.
15. With activated FADEC MAINT annunciator, simulate data words with label 344 (octal) for gas producer (Ng) value greater than 5%. Verify that FADEC MAINT annunciator deactivate. Deactivate signal before next step.
16. Simulate signal HI on data bus for words with label 270 (octal) for FADEC fail warning (bit 19) on both channel. Ensure that the FADEC FAIL warning and FADEC FAIL horn annunciator outputs are activated. Verify that warning annunciator do not come on with the condition in one channel only. Deactivate signal before next step.
17. Simulate signal HI on data bus for words with label 351 (octal) for start fault advisory (bit 21). Ensure that the START FAULT advisory annunciator output is activated. Verify that advisory do not come with the condition on one channel only. Deactivate signal before next step.
18. On the overhead console panel, open ENG INSTR Np/Nr (1CB24) and push in ENG INSTR NG (1CB22) circuit breaker:
19. Repeat step 7.to 9.
20. Simulate signal HI on data bus for words with label 270 (octal) for FADEC fail warning (bit 19) on both channel. Ensure that the FADEC FAIL warning and FADEC FAIL horn annunciator outputs are activated. Verify that FADEC CH FAIL comes on with the condition in one channel only. Deactivate signal before next step.
21. On the overhead console panel, open ENG INSTR NG (1CB22) and push in

ENG INSTR MGT (1CB10) circuit breaker:

22. Repeat step 7.to 9.
23. Simulate signal HI on data bus for words with label 271 (octal) for engine overspeed warning (bit 18). Ensure that the ENGINE OVSPD warning annunciator output is activated. Deactivate signal before next step.
24. Simulate signal HI on data bus for words with label 271 (octal) for engine out warning (bit 14). Ensure that the ENGINE OUT warning annunciator output and engine out horn are activated. Deactivate signal before next step.
25. Remove connections from 4962-J196.
26. Set the battery switch to OFF, or disconnect the external DC power to the helicopter.
27. Return the helicopter to the standard configuration. Refer to Standard Practices — After Electrical Maintenance or Repairs (paragraph 96.1.1.1.4).

96.4. LIGHTING SYSTEMS

96.4.1 LIGHTING SYSTEMS

See BHT-407-MM Chapter 96-309.

96.4.2 INTERIOR LIGHTING SYSTEM — DESCRIPTION

See BHT-407-MM Chapter 96-310.

96.4.3 MAP/UTILITY LIGHT (8DS7) — DESCRIPTION

See BHT-407-MM Chapter 96-311.

96.4.3.1. Map/Utility Light Circuit — Operational Check

See BHT-407-MM Chapter 96-312.

96.4.3.2. Map/Utility Light (8DS7) — Removal

See BHT-407-MM Chapter 96-313.

96.4.3.3. Map/Utility Light (8DS7) — Installation

See BHT-407-MM Chapter 96-314.

96.4.4 5VDC AND 28 VDC LIGHTING CIRCUIT — INSTRUMENT PANEL, CAUTION/ WARNING/ADVISORY PANEL, AND CONTROL PANEL LIGHTING (S/N 53000 THROUGH 54299)

See BHT-407-MM Chapter 96-315.

96.4.4.1. 5 VDC Instrument Lighting Circuit — Operation (S/N 53000 Through 54299)

See BHT-407-MM Chapter 96-316.

96.4.4.2. 28 VDC Instrument/Control Panel Lighting Circuit — Operation (S/N 53000 Through 54299)

See BHT-407-MM Chapter 96-317.

96.4.4.3. Instrument and Panel Lighting System — Operation (S/N 54300 and Subsequent)

See BHT-407-MM Chapter 96-318.

96.4.4.4. Caution/Warning/Advisory Panel Lighting and Dimming — Operation

The caution/warning/advisory panel lighting and dimming circuit provides fixed 28 VDC bright or fixed 15 VDC dim lighting. Variable lighting between 15 and 28 VDC is not possible. The circuit includes an instrument lights circuit breaker LIGHTS INSTR (8CB1), a caution lights circuit breaker LIGHTS CAUT (4CB1), an instrument light potentiometer INST LT POTENTIOMETER (8U1), a caution light dim switch BRT DIM CAUT LT (4A2S3), a light dimming relay (8K3), a 10 ohm resistor (8R5), and a 15 volt zener diode (8CR2). Refer to the caution/warning/advisory panel lighting and dimming simplified schematic (Figure 96-88)

All but five of the caution/warning/advisory panel annunciators (FLOAT TEST, FADEC FAIL, ENGINE OVSPD, ENGINE OUT, and

RPM) can come on in either the fixed bright mode or the fixed dim mode. Refer to the caution/warning/advisory section of this chapter for additional information on the individual annunciators and their circuits.

Additionally, the zener diode (8CR4) is used to dim the FADEC RESET switch (4962-S7) PEDAL STOP switch (6540DS1), and the GPS NAV switch (3415S2), if installed.

28 VDC FIXED BRIGHT MODE

With the instrument light potentiometer (8U1) in the OFF position, all ground seeking annunciators will be illuminated in the fixed bright mode via 28 VDC bus voltage supplied to the caution/warning/advisory panel (4DS1) through the caution lights circuit breaker (4CB1). The 28 VDC bus voltage is provided to the caution/warning/advisory panel (4DS1) from the LIGHTS CAUT circuit breaker (4CB1) directly through the terminal block (4TB2) and the closed contact C2 to C3 of the light dimming relay (8K3). The FADEC RESET switch (4962-S7), PEDAL STOP switch (6540DS1), and GPS NAV switch (3415S2) (if installed) will also be supplied with 28 VDC bus power through the closed contact C2 to C3 of the light dimming relay (8K3). All positive seeking annunciators will be illuminated in the fixed bright mode via a ground path through the closed contact D3 to D2 of the light dimming relay (8K3).

With the instrument light potentiometer (8U1) control knob positioned anywhere between dim and bright, the contact 2 to 1 of the instrument light potentiometer (8U1) will be closed. This allows bus voltage to be provided through the instrument lights circuit breaker (8CB1) to terminal 3 of the BRT DIM CAUT LT switch (4A2S3) and to terminal A1 of the light dimming relay (8K3). Provided the BRT DIM CAUT LT switch (4A2S3) is not momentarily positioned to DIM, the annunciators, FADEC RESET switch (4962-S7), PEDAL STOP switch (6540DS1), and GPS NAV switch (3415S2) (if installed) will be illuminated in the fixed bright mode.

15 VDC FIXED DIM MODE

To select the fixed dim mode, the instrument light potentiometer (8U1) control knob must be positioned anywhere between dim and bright. As mentioned previously, this will close the contact 2 to 1 of the instrument light potentiometer (8U1). This allows bus voltage to be provided through the instrument lights circuit breaker (8CB1) to terminal 3 of the BRT DIM CAUT LT switch (4A2S3) and to terminal A1 of the light dimming relay (8K3).

Momentarily positioning the BRT DIM CAUT LT switch (4A2S3) to DIM closes its contact 2 to 3, which allows bus voltage to terminal X1 of the light dimming relay (8K3). This energizes the light dimming relay (8K3). After the BRT DIM CAUT LT switch (4A2S3) is released from the dim position, the light dimming relay (8K3) is kept energized by a latching circuit completed through the closed contact A1 to A2 of the light dimming relay (8K3) and the closed contact 5 to 6 of the BRT DIM CAUT LT switch (4A2S3).

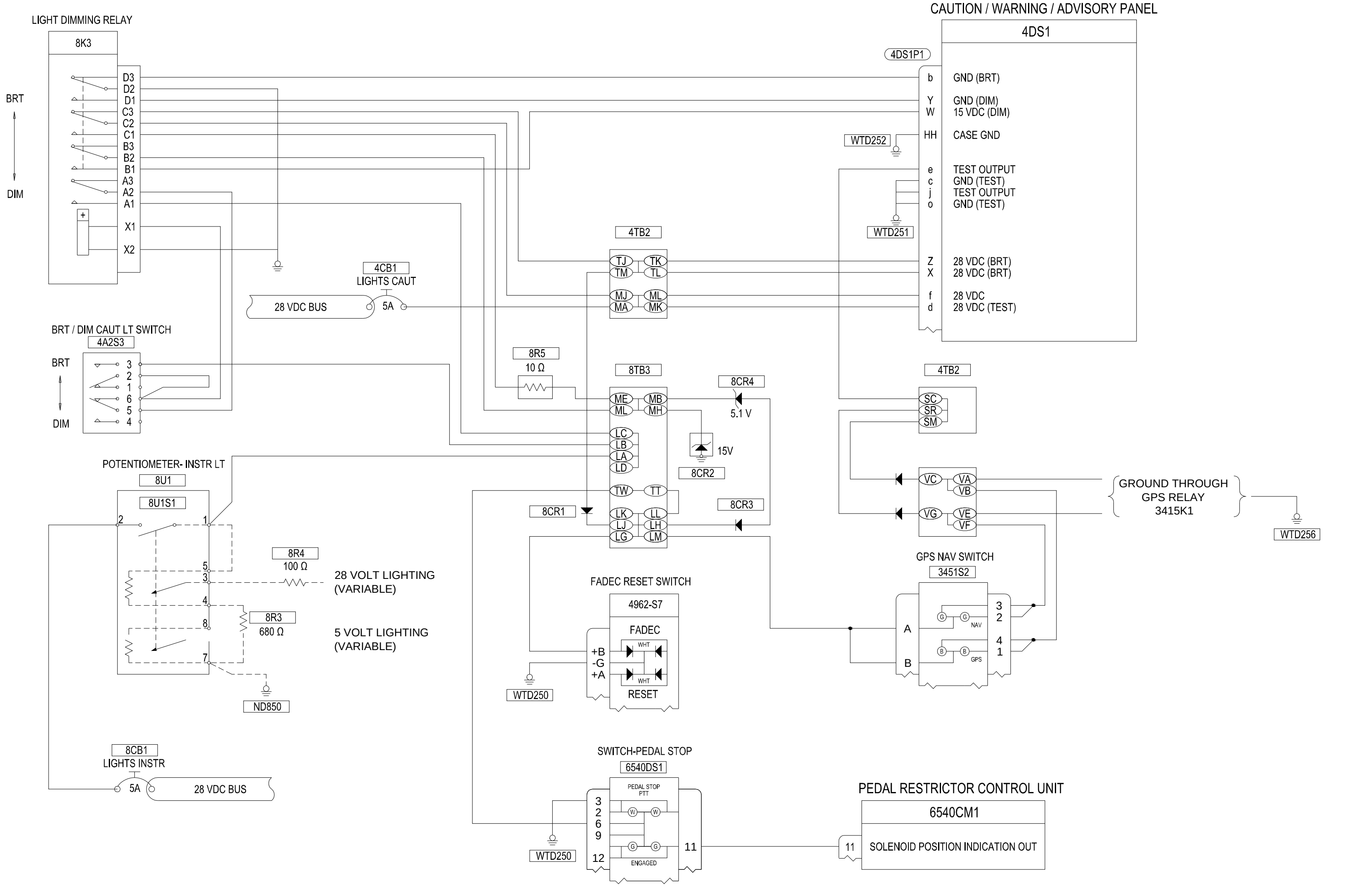


Figure 96-88: Caution/Warning/Advisory Panel Lighting and Dimming – Simplified Schematic

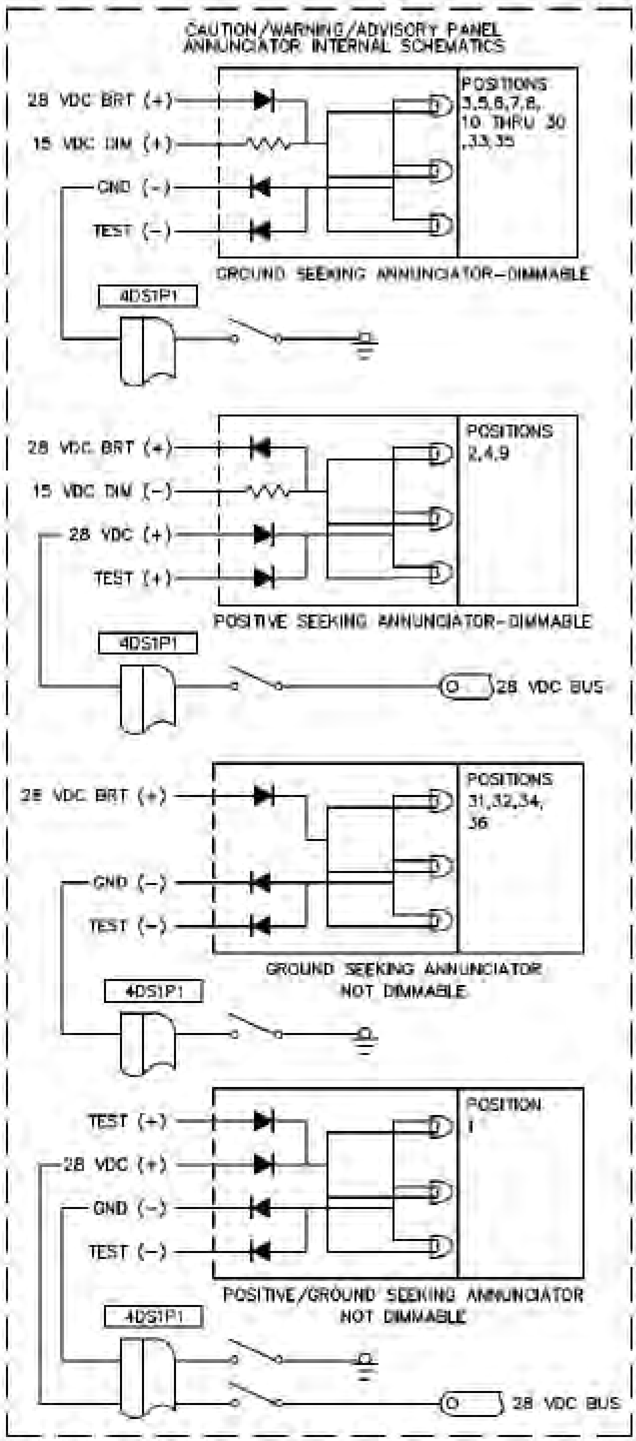


Figure 96-89: Caution/Warning/Advisory Panel Lighting and Dimming – Simplified Schematic

With the light dimming relay (8K3) energized and latched, the contact C2 to C1 is closed. This provides voltage to the 10 ohm resistor (8R5) and to the 15 volt zener diode (8CR2). The zener diode (8CR2) acts like a voltage regulator by varying the current through the resistor (8R5) to maintain a fixed 15 volt power supply for the caution/warning/advisory panel lighting. The fixed 15 volt power supply is provided to the ground seeking annunciators, which are dimmable, through the closed contact B2 to B1 of the light dimming relay (8K3) and input W of the caution/warning/advisory panel (4DS1). The FADEC RESET switch (4962-S7), PEDAL STOP switch (6540DS1), and GPS NAV switch (3415S2) (if installed), are dimmed through the zener diode (8CR4). The diodes (8CR1 and 8CR3) are used to isolate the 28 VDC bright lighting circuit and the dimming circuit.

The positive seeking dimmable annunciators are dimmed through an internal resistor. The ground path for these annunciators is provided through the closed contact D2 to D1 of the light dimming relay (8K3) in the dim mode.

Momentarily positioning the BRT DIM CAUT LT switch (4A2S3) to BRIGHT opens the contact 5 to 6 of the switch and opens the light dimming relay (8K3) latching circuit. This de-energizes the light dimming relay (8K3) and returns the caution/warning/advisory panel (4DS1), FADEC RESET switch (4962-S7), PEDAL STOP switch (6540DS1), and GPS NAV switch (3415S2) (if installed), lighting to the fixed 28 VDC bright mode.

BRIGHT/DIM (FADEC MODE, PEDAL STOP, AND GPS NAV SWITCHES)

When testing the lamps in the PEDAL STOP switch (6540DS1), the upper (white) PEDAL STOP lamps should always be illuminated with helicopter electrical power applied. The lower (green) ENGAGED lamps will only illuminate when the PEDAL STOP switch (6540DS1) is depressed. The ENGAGED lamps will illuminate for approximately 5 seconds as part of the PEDAL STOP system self-test. Bright or dim voltage to both the (white) PEDAL STOP lamps and (green) ENGAGED lamps is provided to pin 6 of the PEDAL STOP switch (6540DS1). In the bright mode (paragraph 96.4.4.4), 28 VDC is supplied to pin 6 from the LIGHTS CAUT circuit breaker (4CB1) through the terminal block (4TB2), the closed contact C2 to C3 of the light dimming relay (8K3), and back through terminal blocks (4TB2 and 8TB3). In dim mode (paragraph 96.4.4.4), voltage is supplied to pin 6 from the zener diode (8CR4) through the terminal block (8TB3). The ground side of the circuit for the (white) PEDAL STOP lamps is provided through WTD253. The ground side of the circuit for the (green) ENGAGED lamps is provided from pin 11 of the Pedal Restrictor Control Unit (PRCU) (6540CM1).

When testing the lamps in the GPS NAV switch (3415S2), if installed, in the bright or dim mode, the circuit ground is provided from WTD251 through the caution/warning/advisory panel (4DS1) C/W LT TEST switch (4DS1S1-j and e) and 4TB2-SC-SR-SM. Diodes (3415CR4 and 341CR5) are installed as part of the GPS NAV switch (3415S2) circuit and are used to isolate the GPS NAV switch circuit from the FADEC RESET switch circuit.

96.4.4.5. 5 VDC and 28 VDC Instrument/Control Panel Lighting Circuit — Operational Check

1. Connect external DC power to the helicopter.
2. Make sure the LIGHTS INSTR (8CB1) is closed.
3. Turn the INSTR LT potentiometer (8U1) from OFF to the full dimmed position.

RESULT:

- The 5 VDC lights (engine instruments) are on and dimmed.
- The 28 VDC lights (edge lit panels/compass/ avionics) are on and dimmed.

CORRECTIVE ACTION:

- If the 5 VDC lights (engine instruments) do not come on dimmed, refer to Trouble No. 1 (Figure 96-90).
- If the 28 VDC lights (edge lit panels/compass/ avionics) do not come on dimmed, refer to Trouble No. 2 (Figure 96-91).
- If the 5 VDC lights (engine instruments) and the 28 VDC lights (edge lit panels/compass/ avionics) do not come on dimmed, refer to Trouble No. 3 (Figure 96-92).

4. Turn the INSTR LT potentiometer (8U1) to full BRT.

RESULT:

- The 5 VDC lights (engine instruments) are on bright.
- The 28 VDC lights (edge lit panels/compass/ avionics) are on bright.

CORRECTIVE ACTION:

- If the 5 VDC lights (engine instruments) do not come on bright, refer to Trouble No. 4 (Figure 96-93).
- If the 28 VDC lights (edge lit panels/compass/ avionics) do not come on bright, refer to Trouble No. 5 (Figure 96-94).

5. Turn the INSTR LT potentiometer (8U1) to OFF. Make sure the lights of the engine instruments (5 VDC lighting) and the edge lit panels/compass/avionics (28 VDC lighting) go off.
6. Return the helicopter to the standard configuration. Refer to Standard Practices — After Electrical Maintenance or Repairs (paragraph 96.1.1.1.4).

TROUBLE NO. 1
5/28 VDC INSTRUMENT LIGHTING SYSTEM

CAUTION

DISCONNECT THE BATTERY AND THE EXTERNAL DC POWER PRIOR TO PERFORMING A CONTINUITY CHECK OR MAINTENANCE ON THE 5/28 VDC INSTRUMENT LIGHTING SYSTEM.

NOTE

REFER TO CHAPTER 98, INSTRUMENT AND PANEL LIGHT SYSTEM - WIRING DIAGRAM.

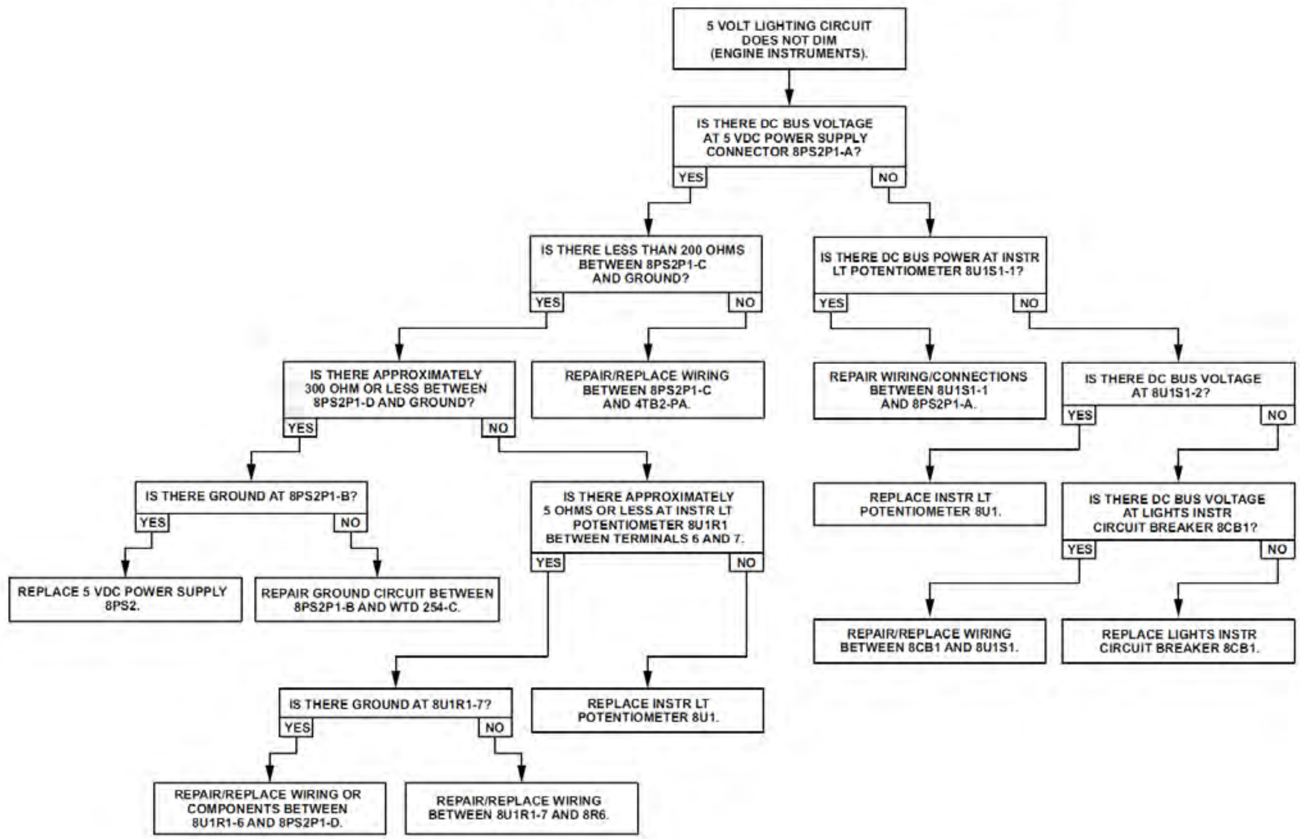


Figure 96-90: 5 VDC and 28 VDC Instrument/Control Panel Lighting Circuit – Trouble No. 1

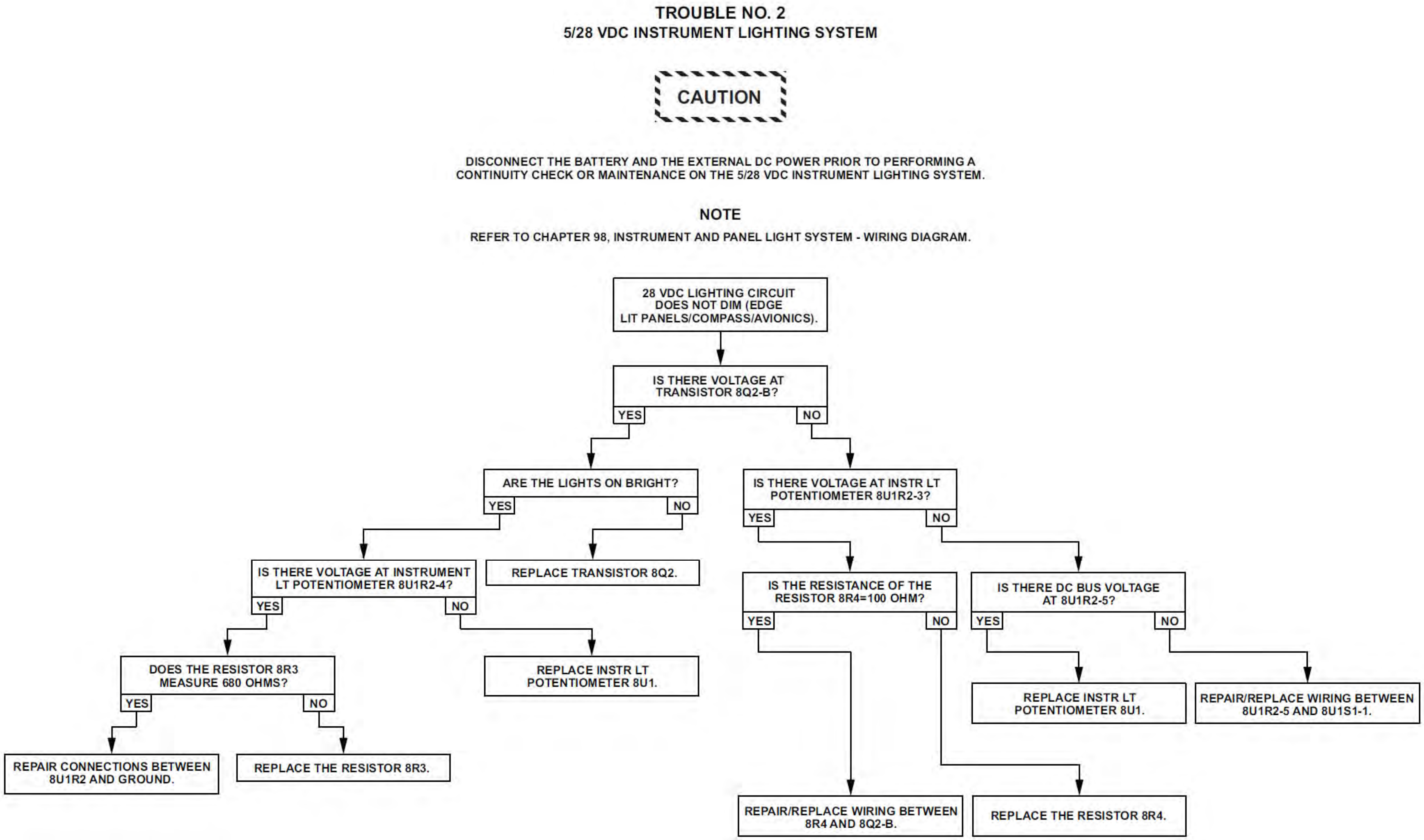


Figure 96-91: 5 VDC and 28 VDC Instrument/Control Panel Lighting Circuit – Trouble No. 2

TROUBLE NO. 3

5/28 VDC INSTRUMENT LIGHTING SYSTEM

CAUTION

DISCONNECT THE BATTERY AND THE EXTERNAL DC POWER PRIOR TO PERFORMING A CONTINUITY CHECK OR MAINTENANCE ON THE 5/28 VDC INSTRUMENT LIGHTING SYSTEM.

NOTE

REFER TO CHAPTER 98, INSTRUMENT AND PANEL LIGHT SYSTEM - WIRING DIAGRAM.

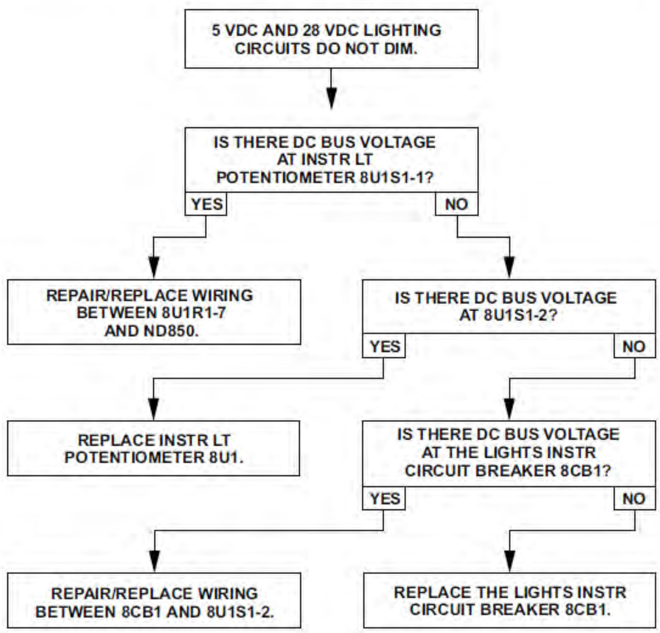


Figure 96-92: 5 VDC and 28 VDC Instrument/*Control Panel Lighting Circuit – Trouble No. 3*

TROUBLE NO. 4
5/28 VDC INSTRUMENT LIGHTING SYSTEM

CAUTION

DISCONNECT THE BATTERY AND THE EXTERNAL DC POWER PRIOR TO PERFORMING A CONTINUITY CHECK OR MAINTENANCE ON THE 5/28 VDC INSTRUMENT LIGHTING SYSTEM.

NOTE

REFER TO CHAPTER 98, INSTRUMENT AND PANEL LIGHT SYSTEM - WIRING DIAGRAM.

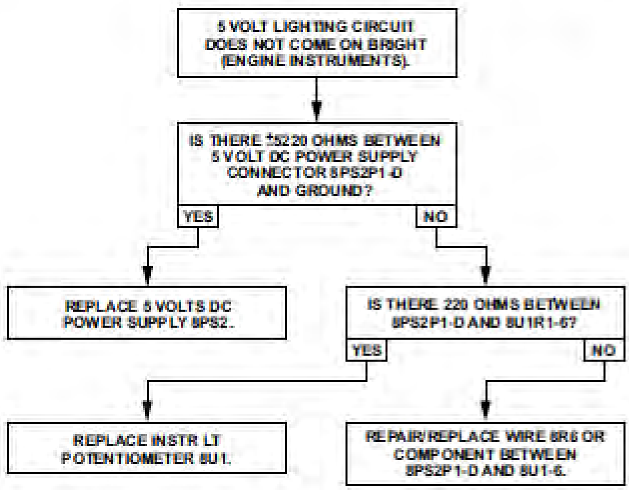


Figure 96-93: 5 VDC and 28 VDC Instrument/Control Panel Lighting Circuit – Trouble No. 4

TROUBLE NO. 5
5/28 VDC INSTRUMENT LIGHTING SYSTEM

CAUTION

DISCONNECT THE BATTERY AND THE EXTERNAL DC POWER PRIOR TO PERFORMING A CONTINUITY CHECK OR MAINTENANCE ON THE 5/28 VDC INSTRUMENT LIGHTING SYSTEM.

NOTE

REFER TO CHAPTER 98, INSTRUMENT AND PANEL LIGHT SYSTEM - WIRING DIAGRAM.

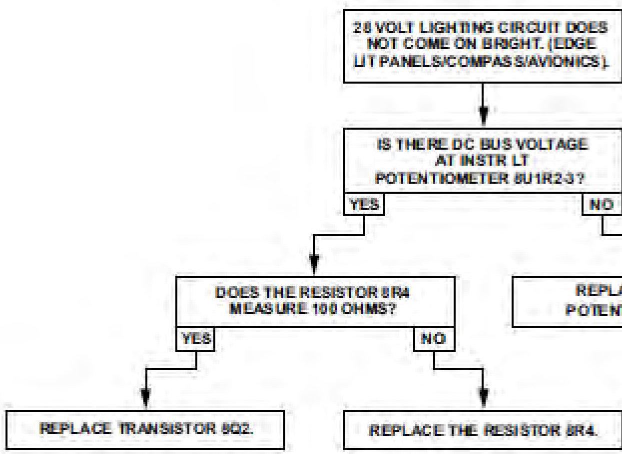


Figure 96-94: 5 VDC and 28 VDC Instrument/Control Panel Lighting Circuit – Trouble No. 5

96.4.4.6. Caution/Warning/Advisory Panel Lighting and Dimming — Operational Check

1. Connect external DC power to the helicopter.
2. Make sure the LIGHTS CAUT (4CB1) and the INSTR LIGHTS (8CB1) circuit breakers are closed.
3. Position the BRT DIM CAUT LT switch (4A2S3) to BRIGHT.
4. Turn the INSTR LT potentiometer (8U1) to OFF. Push the C/W LT TEST switch (4DS1S1) on the caution/warning/advisory panel.

RESULT:

- All of the annunciators and the FADEC RESET switch (4962-S7) and the GPS NAV switch (3415S2), if installed, are on bright.

CORRECTIVE ACTION:

- If none of the dimmable annunciators (positions 2 to 30, 33, and 35) come on bright, refer to Trouble No. 1 (Figure 96-95).
- If all of the annunciators (except for the positions 1, 31, 32, 34, and 36) come on dim, refer to Trouble No. 2 (Figure 96-96).
- If FADEC RESET switch (4962-S7) and GPS NAV switch (3415S2) results are not proper, refer to general troubleshooting (paragraph 96.1.5).

5. Turn the INSTR LT potentiometer (8U1) out of the OFF position. Set the BRT DIM CAUT LT switch (4A2S3) to DIM. Push the C/W LT TEST switch (4DS1S1) to open the caution/warning/advisory panel.

RESULT:

- All of the dimmable annunciators (positions 2 to 30, 33 and 35) and the FADEC RESET switch (4962-S7) and GPS NAV switch (3415S2) if installed come on dimmed.

CORRECTIVE ACTION:

- If none of the dimmable annunciators (positions 2 to 30, 33, and 35) come on dimmed, refer to Trouble No. 3 (Figure 96-97).

TROUBLE NO. 1

CAUTION/WARNING/ADVISORY PANEL LIGHTING AND DIMMING

CAUTION

DISCONNECT THE BATTERY AND THE EXTERNAL DC POWER PRIOR TO PERFORMING A CONTINUITY CHECK OR MAINTENANCE ON THE CAUTION/WARNING/ADVISORY PANEL LIGHTING AND DIMMING CIRCUIT.

NOTE

REFER TO CHAPTER 98, INSTRUMENTS AND PANEL LIGHT SYSTEM - WIRING DIAGRAM.

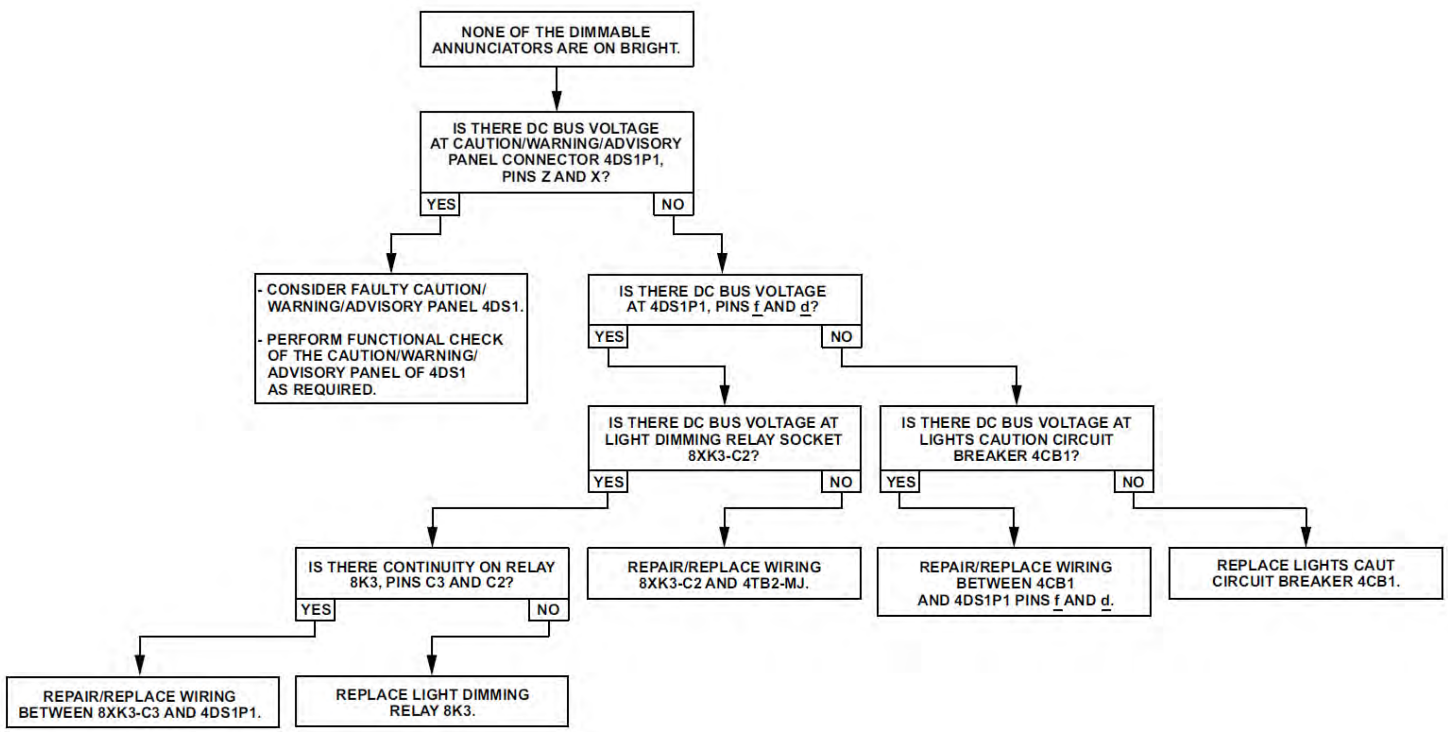


Figure 96-95: Caution/Warning/Advisory Panel Lighting and Dimming – Trouble No. 1

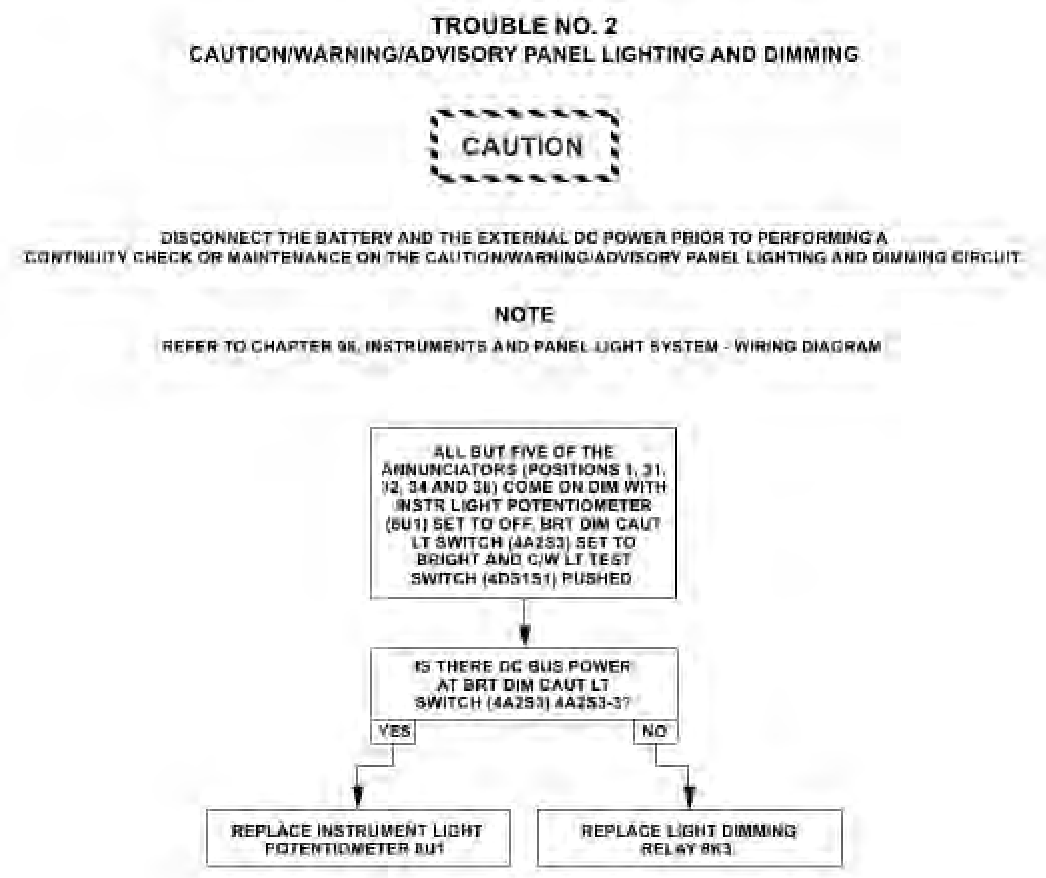


Figure 96-96: Caution/Warning/Advisory Panel Lighting and Dimming – Trouble No. 2

TROUBLE NO. 3
CAUTION/WARNING/ADVISORY PANEL LIGHTING AND DIMMING

CAUTION

DISCONNECT THE BATTERY AND THE EXTERNAL DC POWER PRIOR TO PERFORMING A CONTINUITY CHECK OR MAINTENANCE ON THE CAUTION/WARNING/ADVISORY PANEL LIGHTING AND DIMMING CIRCUIT.

NOTE

REFER TO CHAPTER 96, INSTRUMENTS AND PANEL LIGHT SYSTEM - WIRING DIAGRAM.

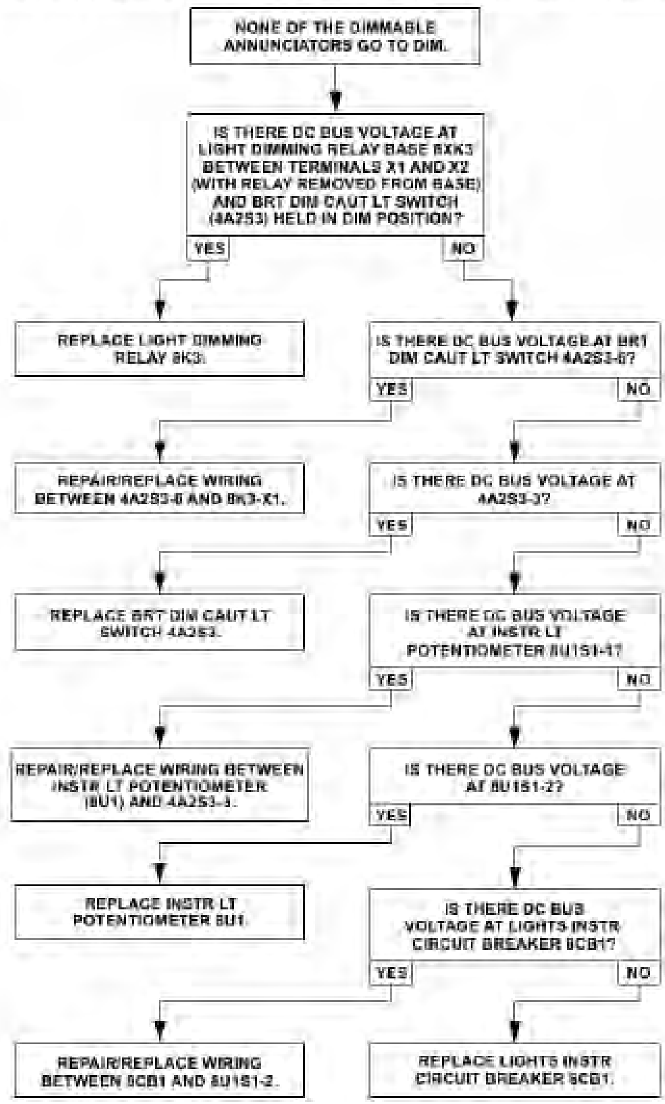


Figure 96-97: Caution/Warning/Advisory Panel Lighting and Dimming – Trouble No. 3

- If only the annunciators at positions No. 4 (FLOAT ARM), No. 9 (HEATER OVERTEMP), and the spare position No. 2 do not come on dimmed, refer to Trouble No. 4 (Figure 96-98).
- If only the annunciators at positions No. 4 (FLOAT ARM), No. 9 (HEATER OVERTEMP), and the spare position No. 2 come on dimmed, refer to Trouble No. 5 (Figure 96-99).
- If FADEC mode switch (1S18) and GPS NAV switch (3415S2) results are not proper, refer to general troubleshooting (paragraph 96.1.5).

6. Return the helicopter to the standard configuration. Refer to Standard Practices — After Electrical Maintenance or Repairs (paragraph 96.1.1.1.4).

96.4.4.7. Transistor (8Q2) — Removal

See BHT-407-MM Chapter 96-323.

96.4.4.8. Transistor (8Q2) — Installation

See BHT-407-MM Chapter 96-324.

96.4.4.9. Zener Diode (8CR2) — Removal (S/N 53000 Through 54299)

See BHT-407-MM Chapter 96-325.

96.4.4.10. Zener Diode (8CR2) — Installation (S/N 53000 Through 54299)

See BHT-407-MM Chapter 96-326.

96.4.4.11. Light Dimming Relay (8K3) — Removal

See BHT-407-MM Chapter 96-327.

96.4.4.12. Light Dimming Relay (8K3) — Installation

See BHT-407-MM Chapter 96-328.

96.4.4.13. 5 VDC and 28 VDC Lighting Circuits, Instrument Panel, Control Panel, Caution/Warning/Advisory Panel — Component Replacement

To replace an electrical component, refer to the miscellaneous electrical components maintenance practices (paragraph 96.1.6). For wiring maintenance procedures, refer to the BHT-ELEC-SPM. To replace an annunciator lamp, refer to the caution/ warning/advisory panel (4DS1) (paragraph 96.3.2, and paragraph 96.3.3 through paragraph 96.3.4.2.).

TROUBLE NO. 4
CAUTION/WARNING/ADVISORY PANEL LIGHTING AND DIMMING

CAUTION

DISCONNECT THE BATTERY AND THE EXTERNAL DC POWER PRIOR TO PERFORMING A CONTINUITY CHECK OR MAINTENANCE ON THE CAUTION/WARNING/ADVISORY PANEL LIGHTING AND DIMMING CIRCUIT.

NOTE

REFER TO CHAPTER 98, INSTRUMENTS AND PANEL LIGHT SYSTEM - WIRING DIAGRAM.

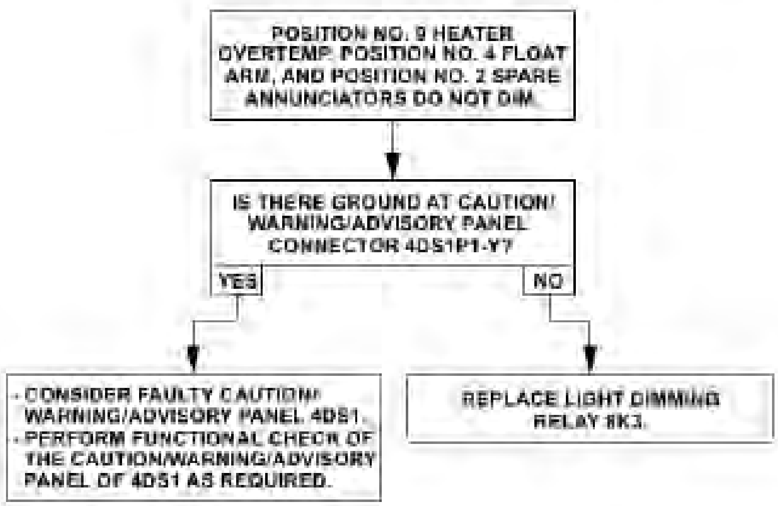


Figure 96-98: Caution/Warning/Advisory Panel Lighting and Dimming – Trouble No. 4

TROUBLE NO. 5
CAUTION/WARNING/ADVISORY PANEL LIGHTING AND DIMMING

CAUTION

DISCONNECT THE BATTERY AND THE EXTERNAL DC POWER PRIOR TO PERFORMING A CONTINUITY CHECK OR MAINTENANCE ON THE CAUTION/WARNING/ADVISORY PANEL LIGHTING AND DIMMING CIRCUIT.

NOTE

REFER TO CHAPTER 98, INSTRUMENTS AND PANEL LIGHT SYSTEM - WIRING DIAGRAM.

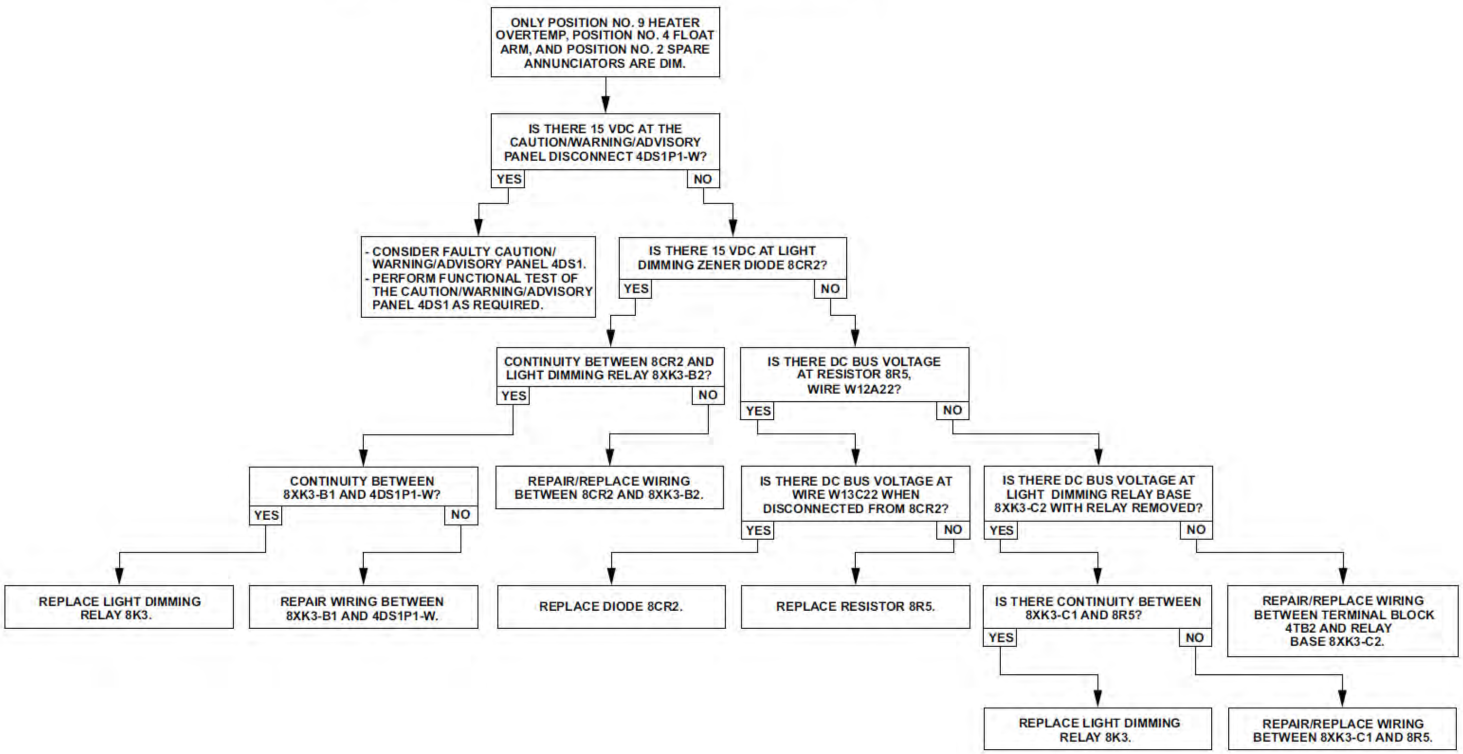


Figure 96-99: Caution/Warning/Advisory Panel Lighting and Dimming – Trouble No. 5

96.4.5 CABIN/PASSENGER LIGHTING SYSTEM — DESCRIPTION

See BHT-407-MM Chapter 96-330.

96.4.6 EXTERIOR LIGHTING SYSTEMS

See BHT-407-MM Chapter 96-334.

96.4.6.1. POSITION LIGHTS SYSTEM — OPERATION

See BHT-407-MM Chapter 96-335.

96.4.6.1.1 Position Lights System — Operational Check

See BHT-407-MM Chapter 96-336.

96.4.6.1.2 Position (Navigation) Lights — Removal (S/N 53000 Through 54299)

See BHT-407-MM Chapter 96-337.

96.4.6.1.3 Forward Position Lights — Removal (S/N 54300 and Subsequent)

See BHT-407-MM Chapter 96-338.

96.4.6.1.4 Aft Position Lights — Removal (S/N 54300 and Subsequent)

See BHT-407-MM Chapter 96-339.

96.4.6.1.5 Tail Light (8DS4) — Removal (S/N 53000 Through 54299)

See BHT-407-MM Chapter 96-340.

96.4.6.1.6 Tail Light (8DS4) — Removal (S/N 54300 and Subsequent)

See BHT-407-MM Chapter 96-341.

96.4.6.1.7 Position Lights — Cleaning

See BHT-407-MM Chapter 96-342.

96.4.6.1.8 Position Lights — Inspection

See BHT-407-MM Chapter 96-343.

96.4.6.1.9 Position (Navigation) Lights — Installation (S/N 53000 Through 54299)

See BHT-407-MM Chapter 96-344.

96.4.6.1.10 Forward Position Lights — Installation (S/N 54300 and Subsequent)

See BHT-407-MM Chapter 96-345.

96.4.6.1.11 Aft Position Lights — Installation (S/N 54300 and Subsequent)

See BHT-407-MM Chapter 96-346.

96.4.6.1.12 Tail Light (8DS4) — Installation (S/N 54300 and Subsequent)

See BHT-407-MM Chapter 96-347.

96.4.6.2. ANTI-COLLISION (STROBE) LIGHT SYSTEM — OPERATION (S/N53000 THROUGH 54299)

See BHT-407-MM Chapter 96-348.

96.4.6.2.1 Anti-collision (Strobe) Light System — Operational Check (S/N 53000 Through 54299)

See BHT-407-MM Chapter 96-349.

96.4.6.2.2 Anti-collision (Strobe) Light System — Troubleshooting (S/N53000 Through 54299)

See BHT-407-MM Chapter 96-350.

96.4.6.2.3 Anti-collision Light (8DS3) — Removal (S/N 53000 Through 54299)

See BHT-407-MM Chapter 96-351.

96.4.6.2.4 Anti-collision Light (8DS3) — Installation (S/N 53000 Through 54299)

See BHT-407-MM Chapter 96-352.

96.4.6.2.5 Strobe Light Power Supply (8PS1) — Removal (S/N 53000 Through 54299)

See BHT-407-MM Chapter 96-353.

96.4.6.2.6 Strobe Light Power Supply (8PS1) — Installation (S/N 53000 Through 54299)

See BHT-407-MM Chapter 96-354.

96.4.6.3. ANTI-COLLISION LIGHT SYSTEM — OPERATION (S/N 54300 AND SUBSEQUNT)

See BHT-407-MM Chapter 96-355.

96.4.6.3.1 Anti-collision Light System — Operational Check (S/N 54300 and Subsequent)

See BHT-407-MM Chapter 96-356.

96.4.6.3.2 Anti-collision Light (8DS3) — Removal (S/N 54300 and Subsequent)

See BHT-407-MM Chapter 96-357.

96.4.6.3.3 Anti-collision Light — Cleaning

See BHT-407-MM Chapter 96-358.

96.4.6.3.4 Anti-collision Light — Inspection

See BHT-407-MM Chapter 96-359.

96.4.6.3.5 Anti-collision Light — Installation (S/N 54300 and Subsequent)

See BHT-407-MM Chapter 96-360.

96.4.6.4. LANDING LIGHT SYSTEM — OPERATION

See BHT-407-MM Chapter 96-361.

96.4.6.4.1 Landing Light System — Operational Check (S/N 53000 Through 54299)

See BHT-407-MM Chapter 96-362.

96.4.6.4.2 Landing Light System — Operational Check (S/N 54300 and Subsequent)

See BHT-407-MM Chapter 96-363.

96.4.6.4.3 Landing Lights (8DS1/8DS2) — Removal

See BHT-407-MM Chapter 96-364.

96.4.6.4.4 Landing Lights (8DS1/8DS2) — Installation

See BHT-407-MM Chapter 96-365.

96.4.6.4.5 Landing Light Relays (8K1 and 8K2) — Removal (S/N 53000 Through 54299)

See BHT-407-MM Chapter 96-366.

96.4.6.4.6 Landing Light Relays (8K1 and 8K2) — Installation (S/N 53000 Through 54299)

See BHT-407-MM Chapter 96-367.

96.4.6.4.7 Landing Light Switch (4A1S2) — Removal

See BHT-407-MM Chapter 96-368.

96.4.6.4.8 Landing Light Switch (4A1S2) — Installation

See BHT-407-MM Chapter 96-369.

96.5. ENGINE ELECTRICAL SYSTEMS

96.5.1 ENGINE ELECTRICAL SYSTEM

Refer to Chapter 76 and to the Light Maintenance Manual for HTS900-2-1D for information on the FADEC/ECU system operation, troubleshooting, and maintenance procedures.

In conjunction with the information provided in this section, the electrical and electronic components, reference designator/description/location reference table (Table 96-6) can be used to locate the installed position of specific items. The BHT-ELEC-SPM can be used for wiring repair information, and the Chapter 98 wiring diagrams can be used for complete information on the actual electrical circuits.

96.5.2 ENGINE ANTI-ICING CIRCUIT — DESCRIPTION

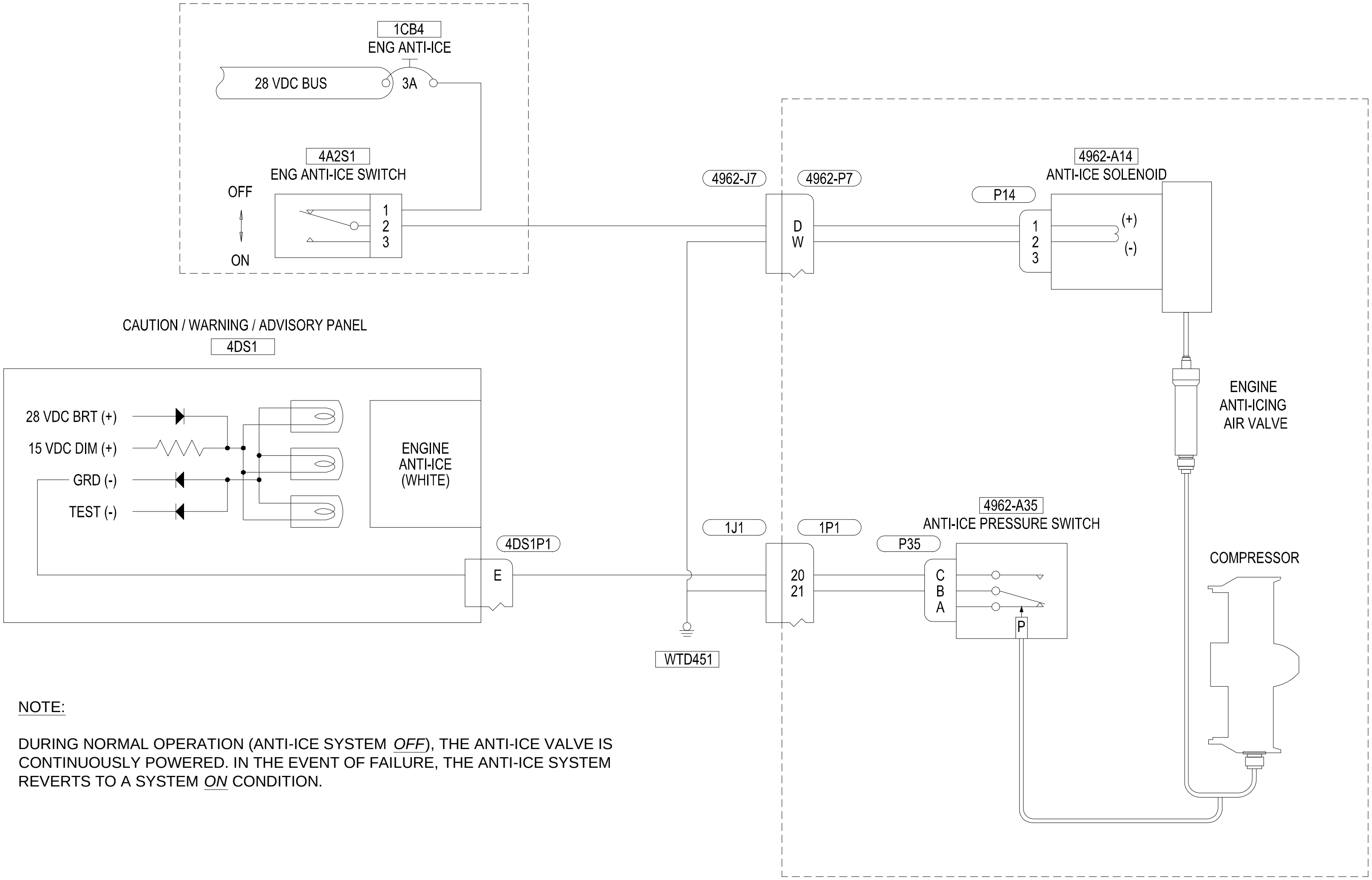
The anti-ice solenoid (4962-A14) (installed on the engine) is powered from the 28 VDC bus through the ENGINE CONTROLS ANTI-ICE circuit breaker (1CB4) and ENG ANTI-ICE switch (4A2S1). Refer to the Engine anti-icing circuit simplified schematic (Figure 96-100).

The engine anti-ice system will be activated when the ENG ANTI-ICE switch (4A2S1) is set to ON. This de-energizes (opens) the engine anti-ice solenoid –valve delivering compressor bleed air to the associated anti-ice air tubes and internal passages within the engine inlet; discharging to the engine compartment and anti-ice pressure port for the switch. The system is a failsafe to on.

Engine anti-ice pressure switch (4962-A35) activation occurs on increasing pressure at 5.5 ±0.5 PSI (37.9 ±3.4 kPa), which closes contacts B to C and completes the circuit to ground to turn on the ENGINE ANTI-ICE annunciator.

When the ENG ANTI-ICE switch (4A2S1) is set to OFF, bus voltage is provided to the engine anti-ice solenoid (1L3) from the ENGINE CONTROLS ANTI-ICE circuit breaker (1CB4). This energizes the engine anti-ice solenoid (4962-A14) and prevents the flow of hot air from the engine anti-icing air valve to the engine compressor front support guide vanes.

The anti-ice pressure switch (4962-A35) deactivation occurs on decreasing pressure prior to 3.0 PSI (20.68 kPa), which opens the circuit to ground to turn off the ENGINE ANTI-ICE annunciator.



NOTE:

DURING NORMAL OPERATION (ANTI-ICE SYSTEM *OFF*), THE ANTI-ICE VALVE IS CONTINUOUSLY POWERED. IN THE EVENT OF FAILURE, THE ANTI-ICE SYSTEM REVERTS TO A SYSTEM *ON* CONDITION.

Figure 96-100: Engine Anti-icing Circuit – Simplified Schematic

96.5.2.1. Engine Anti-ice Circuit — Operational Check

1. Make sure the LIGHTS CAUT circuit breaker (4CB1) is closed and the ENG ANTI-ICE switch (4A2S1) is set to OFF.
2. Connect external DC power to the helicopter.

RESULT:

- The ENGINE ANTI-ICE annunciator is off.

CORRECTIVE ACTION:

- If the ENGINE ANTI-ICE annunciator is on (ground is supplied to the annunciator), refer to the ENGINE ANTI-ICE annunciator circuit operation (paragraph 96.3.8).

WARNING

A QUALIFIED PERSON MUST BE AT THE HELICOPTER CONTROLS DURING THE GROUND RUN PROCEDURE. REFER TO THE BHT-407-FM-1 OR BHT-407-FM-2.

3. Prepare the helicopter for a ground run.
4. Start the helicopter per the FMS-E407-789-1. Following required warm-up period increase throttle to 100% and set ENG ANTI-ICE switch (4A2S1) to ON.

RESULT:

- The ENGINE ANTI-ICE annunciator is on.
- Engine MGT indicator (1M4) shows a temperature increase.

CORRECTIVE ACTION:

- If the ENGINE ANTI-ICE annunciator does not come on, refer to the ENGINE ANTI-ICE annunciator circuit operation (paragraph 96.3.8).
- If the MGT indication does not show a temperature increase, make sure the bus voltage is not being supplied to the engine anti-ice solenoid (4962-A14) with the ENG ANTI-ICE switch (4A2S1) set to ON. If bus voltage is not supplied to the engine anti-ice solenoid (4962-A14), refer to the Light Maintenance Manual for HTS-900-2-1D for troubleshooting.

5. Set the ENG ANTI-ICE switch (4A2S1) to OFF.

RESULT:

- The ENGINE ANTI-ICE annunciator is off.
- The MGT indication shows a temperature decrease.

CORRECTIVE ACTION:

- If the ENGINE ANTI-ICE annunciator does not go off, refer to the ENGINE ANTI-ICE annunciator circuit operation (paragraph 96.3.8).
- If the MGT indication does not show a temperature decrease, make sure the bus voltage is being supplied to the engine anti-ice solenoid (4962-A14) with the ENG ANTI-ICE switch (4A2S1) set to OFF. If bus voltage is supplied to the engine anti-ice solenoid (4962-A14), refer to the Light Maintenance Manual for HTS-900-2-1D for troubleshooting.

6. Shut down the helicopter per the FMS-E407-789-1.
7. Return the helicopter to the standard configuration. Refer to Standard Practices — After Electrical Maintenance or Repairs (paragraph 96.1.1.1.4).

96.5.2.2. Engine Anti-icing Circuit — Functional Check

1. Connect external DC power to the helicopter.

NOTE

During this functional check, it is recommended that a person stands by the engine anti-ice solenoid (4962-A14), in the engine compartment, to listen to the engine anti-ice solenoid (4962-A14) audible click when the engine anti-ice solenoid (4962-A14) becomes energized and de-energized.

2. Close the ENGINE CONTROLS ANTI-ICE circuit breaker (1CB4).

RESULT:

- The engine anti-ice solenoid (4962-A14) becomes energized (an audible click can be heard).

3. Set the ENG ANTI-ICE switch (4A2S1) to ENG ANTI-ICE.

RESULT:

- The engine anti-ice solenoid (4962-A14) becomes de-energized (an audible click can be heard).

4. Set the ENG ANTI-ICE switch (4A2S1) to OFF.

RESULT:

- The engine anti-ice solenoid (4962-A14) becomes energized (an audible click can be heard).

5. Open the ENGINE CONTROLS ANTI-ICE circuit breaker (1CB4).
6. Disconnect external DC power from the helicopter.

96.5.2.3. Engine Anti-icing Circuit — Troubleshooting

Refer to the electrical systems general troubleshooting (paragraph 96.1.5) and to the Light Maintenance Manual for HTS900-2-1D.

96.5.2.4. ENG ANTI-ICE Switch (4A2S1) — Removal

WARNING

OBEY ALL OF THE SAFETY PRECAUTIONS WHEN DOING MAINTENANCE ON OR NEAR ELECTRICAL/ELECTRONIC EQUIPMENT (PARAGRAPH 96.1.1.1.).

1. Disconnect external DC power from the helicopter.
2. Open the ENGINE CONTROLS ANTI-ICE circuit breaker (1CB4).
3. Gain access (remove edge lit panel), and remove the nut (3, Figure 96-101) and the washer (4) from the ENG ANTI-ICE switch (4A2S1) (1). Remove the ENG ANTI-ICE switch (4A2S1) from the overhead panel (2).
4. Remove the wires from the ENG ANTI-ICE switch (4A2S1) (1). Protect the ends of the wires with tape.

96.5.2.5. ENG ANTI-ICE Switch (4A2S1) — Installation

WARNING

OBEY ALL OF THE SAFETY PRECAUTIONS WHEN DOING MAINTENANCE ON OR NEAR

ELECTRICAL/ELECTRONIC EQUIPMENT (PARAGRAPH 96.1.1.1.).

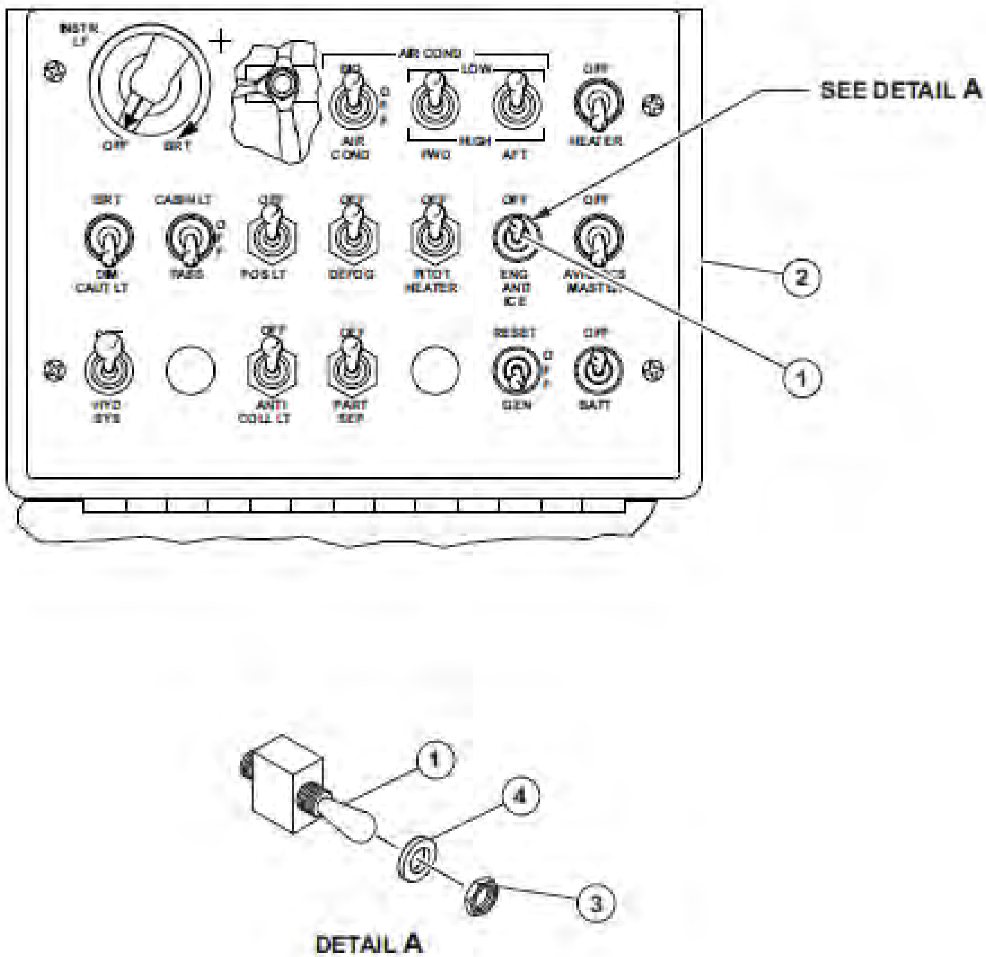
NOTE

Refer to the engine anti-icing system wiring diagram (Chapter 98) for the correct wire installation to the engine anti-icing switch (4A2S1).

1. Remove the tape from the ends of the wires. Install the wires on the ENG ANTI-ICE switch (4A2S1).
2. Install the ENG ANTI-ICE switch (4A2S1) (1, Figure 96-101) into its position on the overhead panel (2). Install the washer (4) and the nut (3) that attach the ENG ANTI-ICE switch (4A2S1) to the overhead panel. Install the edge lit panel.
3. Do a functional check of the engine anti-icing system (paragraph 96.5.2.2.).

96.5.2.6. Engine Anti-icing Circuit — Component Replacement

Refer to the Light Maintenance Manual for HTS900-2-1D for the replacement of the ENG ANTI-ICE solenoid (4962-A14). For the removal and installation of the anti-ice pressure switch (4962-A35), refer to paragraph 96.3.8.2. and paragraph 96.3.8.4.



1. Eng anti-ice switch (4A2S1)
2. Overhead panel
3. Nut
4. Washer

Figure 96-101: Engine Anti-ice Switch (4A2S1) – Removal and Installation

96.6. FUEL DISTRIBUTION ELECTRICAL SYSTEMS

96.6.1 FUEL DISTRIBUTION ELECTRICAL SYSTEMS

The electrical systems for fuel distribution consist of the following:

- The emergency fuel shutoff valve electrical system
- The fuel cells drain valve electrical system
- The right fuel transfer/boost pumps electrical system
- The left fuel transfer/boost pumps electrical system

96.6.2 EMERGENCY FUEL SHUTOFF VALVE SYSTEM — OPERATION ELECTRICAL

In conjunction with the information provided in this section, the electrical and electronic components, reference designator / description / location reference table (Table 96-6) can be used to locate the installed position of specific items. The BHT-ELEC-SPM can be used for wiring repair information, and the fuel distribution wiring diagram (Chapter 98) can be used for complete information on the actual electrical circuits.

The emergency fuel shutoff valve electrical system provides a means of shutting off the flow of fuel to the engine. In addition, the system also controls the activation of the FUEL VALVE annunciator circuit and the fuel cell drain valve circuits. The emergency fuel shutoff valve electrical system includes a fuel shutoff valve (1B5), an emergency fuel valve switch (4962-S9), a fuel valve circuit breaker (1CB7), emergency shutoff circuit breaker (4962-CB4), and voltage regulator (4962-VR1). Refer to the fuel shutoff valve electrical system simplified schematics (Figure 96-102).

The fuel shutoff valve (1B5) is a motorized gate valve that must be driven to either the open or closed position. The motor of the shutoff valve includes an armature, two coils, and two contacts. Terminal A of the fuel shutoff valve (1B5) controls the open control coil and terminal B controls the close control coil. Each of the coils generates a magnetic field of opposite direction when an electric current flows through them. This allows the armature to rotate in either the open or closed direction. The armature drives the gate valve, which also controls the position of the contacts.

When the emergency fuel valve switch (4962-S9) is set from OFF to ON, 28 VDC bus power is provided to terminal A of the fuel shutoff valve (1B5) through the fuel valve circuit breaker (1CB7) and the closed contact 2 to 3 of the emergency fuel valve switch (4962-S9). This allows the fuel shutoff valve (1B5) to motor from the CLOSED to the OPEN position.
When the emergency fuel valve switch (4962-S9) is set from ON to OFF, 28 VDC bus power is provided to terminal B of the fuel shutoff valve (1B5) through the fuel valve circuit breaker (1CB7) and the closed contact 2 to 1 of the emergency fuel valve switch (4962-S9). This allows the fuel shutoff valve (1B5) to motor from the OPEN to the CLOSED position.

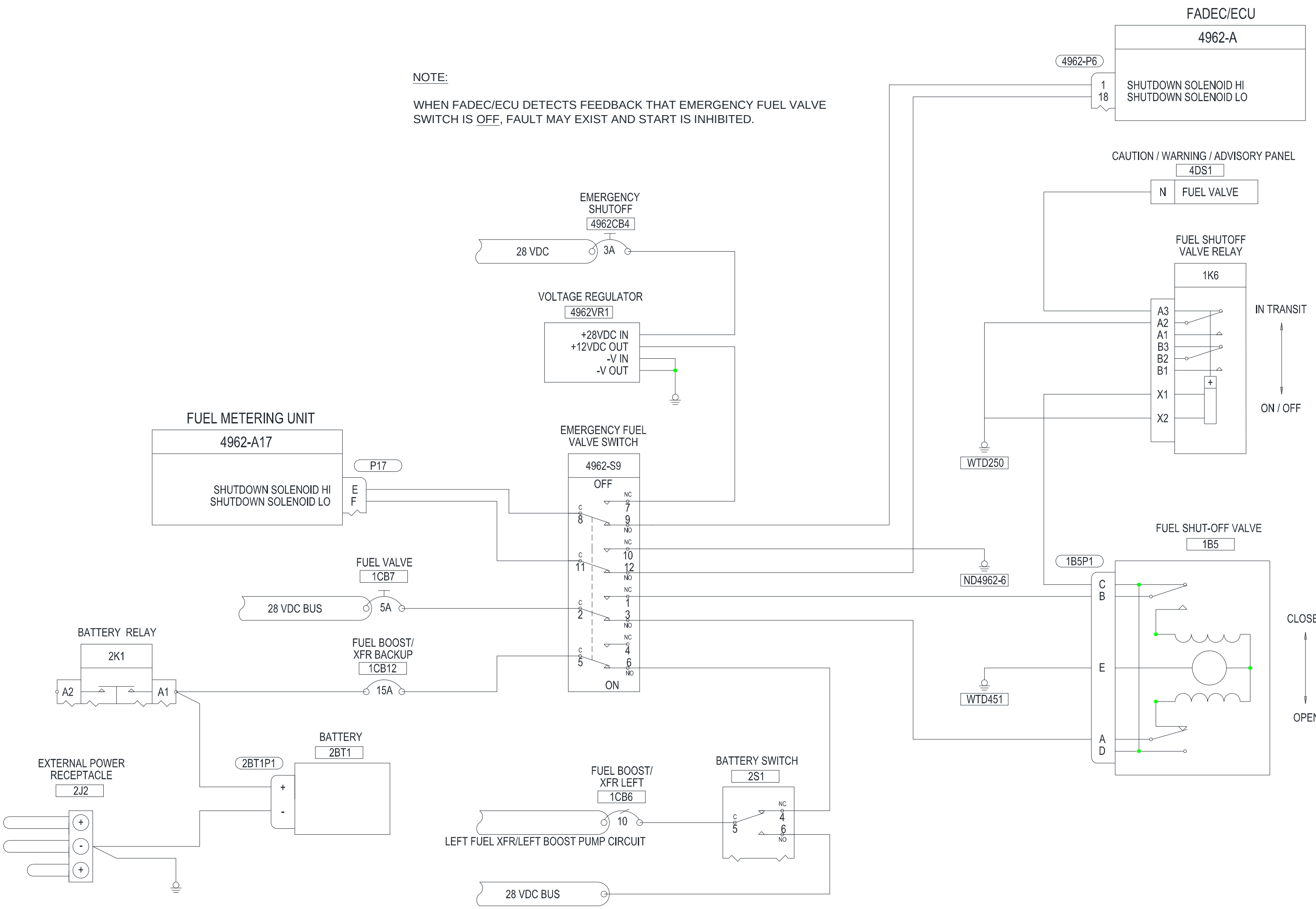


Figure 96-102: Emergency Fuel Shutoff Valve Electrical System – Simplified Schematic

When the emergency fuel valve switch (4962-S9) is set from OFF to ON, or ON to OFF, the circuit that controls the activation of the fuel valve shutoff relay (1K6) is opened while the fuel shutoff valve (1B5) is in transit. During this time, the fuel valve shutoff relay (1K6) is de-energized, which completes the ground circuit to cause the FUEL VALVE annunciator to come on.

With power on the 28 VDC bus, and the emergency fuel valve switch (4962-S9) set to OFF or ON, the fuel valve shutoff relay (1K6) will be energized provided the fuel shutoff valve (1B5) is fully opened or fully closed. Under these conditions, the contact A2 to A3 of the fuel valve shutoff relay (1K6) is opened, removing the ground path from WTD250 to input N of annunciator. These will the fuel valve cause the FUEL VALVE annunciator to go off.

If the battery switch (2S1) is set to OFF during helicopter operations, an alternate circuit is provided to allow operation of the left fuel transfer and left fuel boost pumps. During this condition, with the fuel valve switch set to ON, battery voltage is supplied through the fuel boost/transfer backup circuit breaker (1CB12), the closed contact 5 to 6 of the emergency fuel valve switch (4962-S9), the closed contact 4 to 5 of the battery switch (2S1), and the left fuel boost/XFR circuit breaker switch (1CB6) to the left fuel transfer and left fuel boost pumps.

During normal engine shutdown, the FADEC/ECU (4961-A) provides power to the fuel shutoff solenoid in the engine mounted Fuel Metering Unit (4962-A17). With emergency fuel valve switch (4962-S9) on the ON position, power from ECU channel B is provided through contact 8 and 9 of the emergency fuel valve switch. Also, LO signal is provided to the FMU through contact 11 and 12 of the emergency fuel valve switch. During this time, the fuel valve (1B5) remains open.

When the emergency fuel valve switch (4962-S9) is set from ON to OFF, the 12VDC from voltage regulator (4962-VR1) to the fuel solenoid in the engine mounted Fuel Metering Unit (4962-A17) through contact 7 and 8. Ground from WTD250 is also provided to the FMU (4962-A17) through contact 10 and 11. During this time FADEC/ECU (4962-A) receives feedback confirmation of a pilot-commanded emergency shutdown. While the emergency fuel valve switch is activated, no engine starts can be initiated and fuel valve (1B5) is also activated closed.

Voltage regulator (4962-VR1) is provided to have the aircraft supply of 28VDC stepped down to 12 VDC required by the solenoid installed on the FMU.

96.6.2.1. Emergency Fuel Shutoff Valve Electrical System, Fuel Cell Drain Valve Circuit — Operational Check

1. Close the FUEL VALVE circuit breaker (1CB7).
2. Close the EMER SHUTOFF circuit breaker (4962-CB4).
3. Close the FADEC CH A PWR (4962-CB1) and FADEC CH B PWR (4962-CB2) circuit breakers.
4. Set the EMERGENCY FUEL VALVE switch (4962-S9) to ON.
5. Connect external DC power to the helicopter.
6. Verify that no FADEC related annunciator is on.

RESULT:
- The fuel shutoff valve (1B5) opens.
- The FUEL VALVE annunciator comes on momentarily and then goes off.

CORRECTIVE ACTION:
- If the fuel shutoff valve is not open, refer to Trouble No. 1 (Figure 96-103).
- If the FUEL VALVE annunciator does not come on momentarily and then go off, refer to the FUEL VALVE annunciator circuit operational check (paragraph 96.3.19.1.).

7. Push and hold the forward cell fuel drain switch (1S1).

RESULT:
- The fuel drain solenoid valve (1L1) does not open.

CORRECTIVE ACTION:
- If the fuel drain solenoid valve (1L1) opens, refer to Trouble No. 2 (Figure 96-104).

8. Push and hold the main cell fuel drain switch (1S2).

RESULT:
- The drain valve solenoid (1L2) does not open.

CORRECTIVE ACTION:
- If the drain valve solenoid (1L2) opens, refer to Trouble No. 3 (Figure 96-105).

9. Set the FUEL VALVE switch (4962-S9) to OFF.

RESULT:
- The fuel shutoff valve (1B5) closes.
- The FUEL VALVE annunciator comes on momentarily and then goes off.
- FADEC MAINT and FADEC DEGRADED annunciator are on.

CORRECTIVE ACTION:
- If the fuel shutoff valve (1B5) does not close, refer to Trouble No. 4 (Figure 96-106).
- If the FUEL VALVE annunciator does not come on momentarily and then go off, refer to the FUEL VALVE annunciator circuit operational check (paragraph 96.3.19.1.).
- If FADEC MAINT and FADEC DEGRADED annunciator do not come on.

10. Push and hold the forward cell fuel drain switch (1S1).

RESULT:
- The fuel drain solenoid valve (1L1) opens.

96.6.2.2. Voltage Regulator – Functional Check

1. Close the EMER SHUTOFF circuit breaker (4962-CB4).
2. Connect external DC power to the helicopter.
3. Set the FUEL VALVE switch (4962-S9) to OFF.
4. Measure voltage output of the voltage regulator.

RESULT:
- Voltage should be 12VDC.

CORRECTIVE ACTION:
- If no voltage measured, replace the voltage regulator.

96.6.2.3. Emergency Fuel Shutoff Valve System, — Functional Check

1. Prepare the helicopter for a ground run.
2. Close the EMER SHUTOFF circuit breaker (4962CB4).
3. Close the FUEL VALVE circuit breaker (1CB7).
4. Close the FADEC CH A PWR (4962CB1) and FADEC CH B PWR (4962-CB2) circuit breakers.
5. Set the EMERGENCY FUEL VALVE switch (4962-S9) to ON.
6. Connect external DC power to the helicopter.
7. Verify that no FADEC related annunciator is on.
8. Preform starts procedure per FMS-407-789-01.

CORRECTIVE ACTION:
- If the fuel drain solenoid valve (1L1) does not open, refer to Trouble No. 5 (Figure 96-107).

9. Release the forward cell fuel drain switch (1S1).

RESULT:
- The fuel drain solenoid valve (1L1) closes.

CORRECTIVE ACTION:
- If the fuel drain solenoid valve (1L1) does not close, clean/replace the forward cell fuel drain switch (1S1).

10. Push and hold the main cell fuel drain switch (1S2).

RESULT:
- The fuel drain solenoid valve (1L2) opens.

CORRECTIVE ACTION:
- If the fuel drain solenoid valve (1L2) does not open, refer to Trouble No. 6. (Figure 96-108).

11. Release the main cell fuel drain switch (1S2).

RESULT:
- The fuel drain solenoid valve (1L2) closes.

CORRECTIVE ACTION:
- If the fuel drain solenoid valve (1L2) does not close, clean/replace the main cell fuel drain switch (1S2).

12. Remove external DC power from the helicopter.
13. Return the helicopter to the standard configuration. Refer to Standard Practices — After Electrical Maintenance or Repairs (paragraph 96.1.1.1.4).

TROUBLE NO.1
EMERGENCY FUEL VALVE ELECTRICAL SYSTEM / FUEL CELL DRAIN VALVE CIRCUIT

CAUTION

DISCONNECT THE BATTERY AND THE EXTERNAL POWER PRIOR TO PERFORMING A CONTINUITY CHECK OR MAINTENANCE ON THE EMERGENCY FUEL VALVE ELECTRICAL SYSTEM / FUEL CELL DRAIN VALVE CIRCUIT CIRCUIT.

NOTE
Refer to Chapter 98 for wiring diagram.

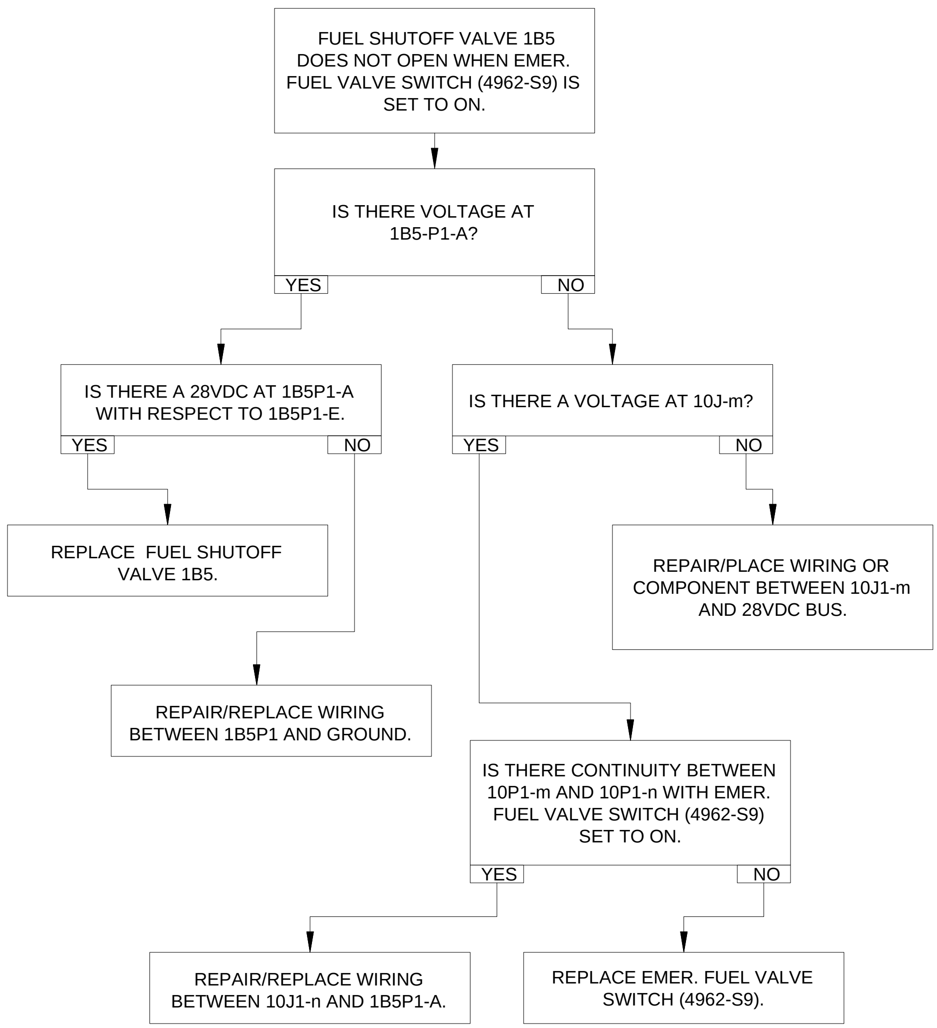


Figure 96-103: Fuel Shutoff Valve Electrical System, Fuel Cells Drain Valve Circuit – Trouble No. 1

96.6.2.4. Voltage Regulator (4962VR1) – Removal

1. Remove LH Crew seat per BHT-407MM-3, Section 25-8.
2. Remove access panel under crew seat (Ref. BHT-407-MM-5, Figure 53-2, Item 5).
3. Disconnect qty 4 wires from Voltage Regulator 4962-VR1.
4. Remove Bracket P/N 0789-03-117-1 by removing qty 2 screws.
5. Flip Bracket upside down to gain access to the fasteners that mount the Voltage Regulator to the bracket.
6. Remove qty 2 screws to remove Voltage Regulator from bracket.

96.6.2.5. Voltage Regulator (4962VR1) – Installation

1. Install Voltage regulator to Bracket P/N 0789-03-117-1 using qty 2 M3x5 screws and M3 washers.
2. Flip Bracket upside down and position in place, locating the 2 attachment holes.
3. Install Bracket P/N 0789-03-117-1 using qty 2 screws MS35215-55 and qty 2 washer NAS1149F0332P.
4. Reconnect the qty 4 wires.
5. Connect power to the voltage regulator and verify that the output voltage is 12 VDC ±1V
6. Reinstall access panel (Ref. BHT-407-MM-5, Figure 53-2, Item 5).
7. Reinstall LH Crew seat per BHT-407MM-3, Section 25-10.

96.6.2.6. Fuel Shutoff Valve (1B5) — Removal and Installation

Refer to Chapter 28 for the removal and installation procedures of the fuel shutoff valve.

96.6.2.7. Emergency Fuel Valve Switch (4962-S9) — Removal

WARNING

OBEY ALL OF PRECAUTIONS WHEN THE SAFETY DOING MAINTENANCE ON OR NEAR ELECTRICAL/ELECTRONIC EQUIPMENT (PARAGRAPH 96.1.1.1.).

1. Disconnect battery and external DC power from the helicopter.
2. Disconnect the wires from the emergency fuel valve switch (4962-S9). Protect the ends of the wires with tape.
3. Remove the attaching hardware from the emergency fuel valve switch (4962-S9). Remove the switch guard.
4. Remove the emergency fuel valve switch (4962-S9).

TROUBLE NO. 2

FUEL SHUTOFF VALVE ELECTRICAL SYSTEM/FUEL CELL DRAIN VALVE CIRCUIT

CAUTION

DISCONNECT THE BATTERY AND EXTERNAL DC POWER PRIOR TO PERFORMING A CONTINUITY CHECK OR MAINTENANCE ON THE FUEL SHUTOFF VALVE ELECTRICAL SYSTEM AND FUEL CELL DRAIN VALVE CIRCUIT.

NOTE

REFER TO CHAPTER 96, FUEL DISTRIBUTION SYSTEM - WIRING DIAGRAM.

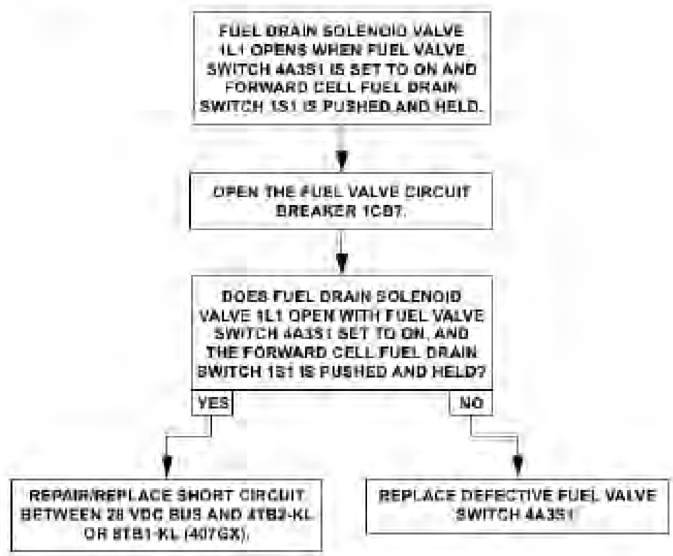


Figure 96-104: Fuel Shutoff Valve Electrical System, Fuel Cells Drain Valve Circuit – Trouble No. 2

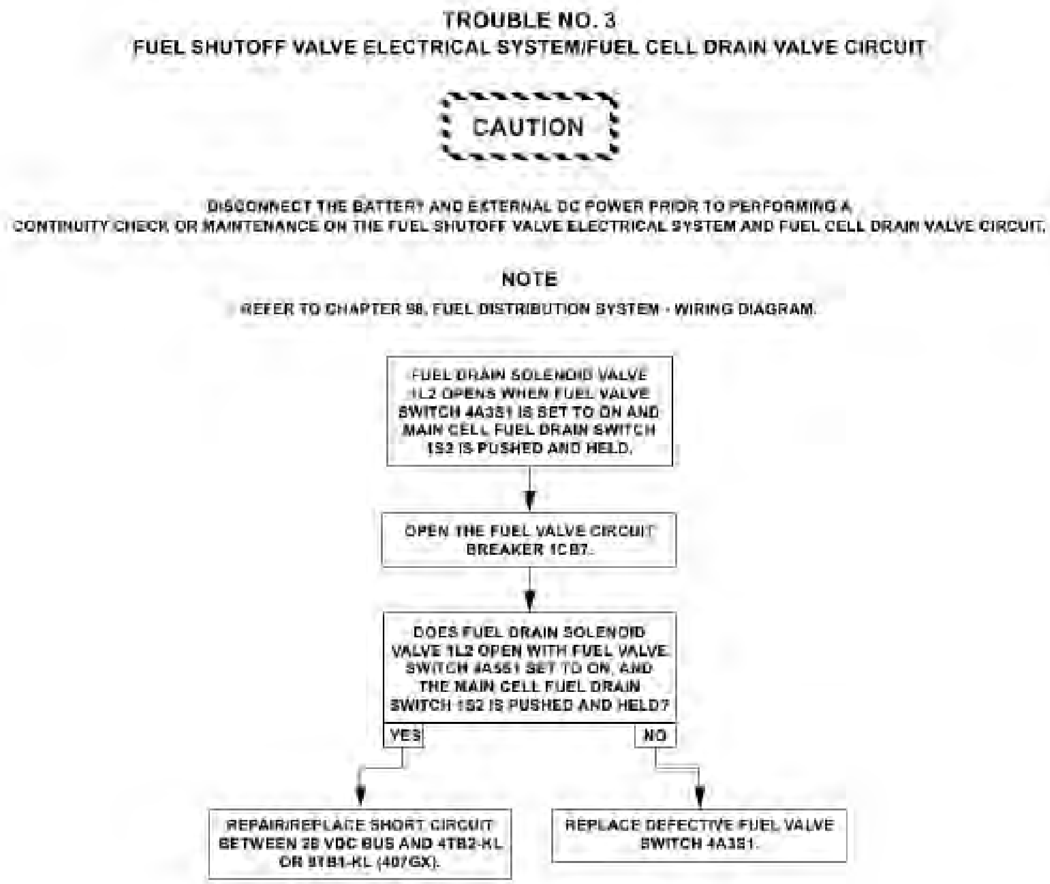


Figure 96-105: Fuel Shutoff Valve Electrical System, Fuel Cells Drain Valve Circuit – Trouble No. 3

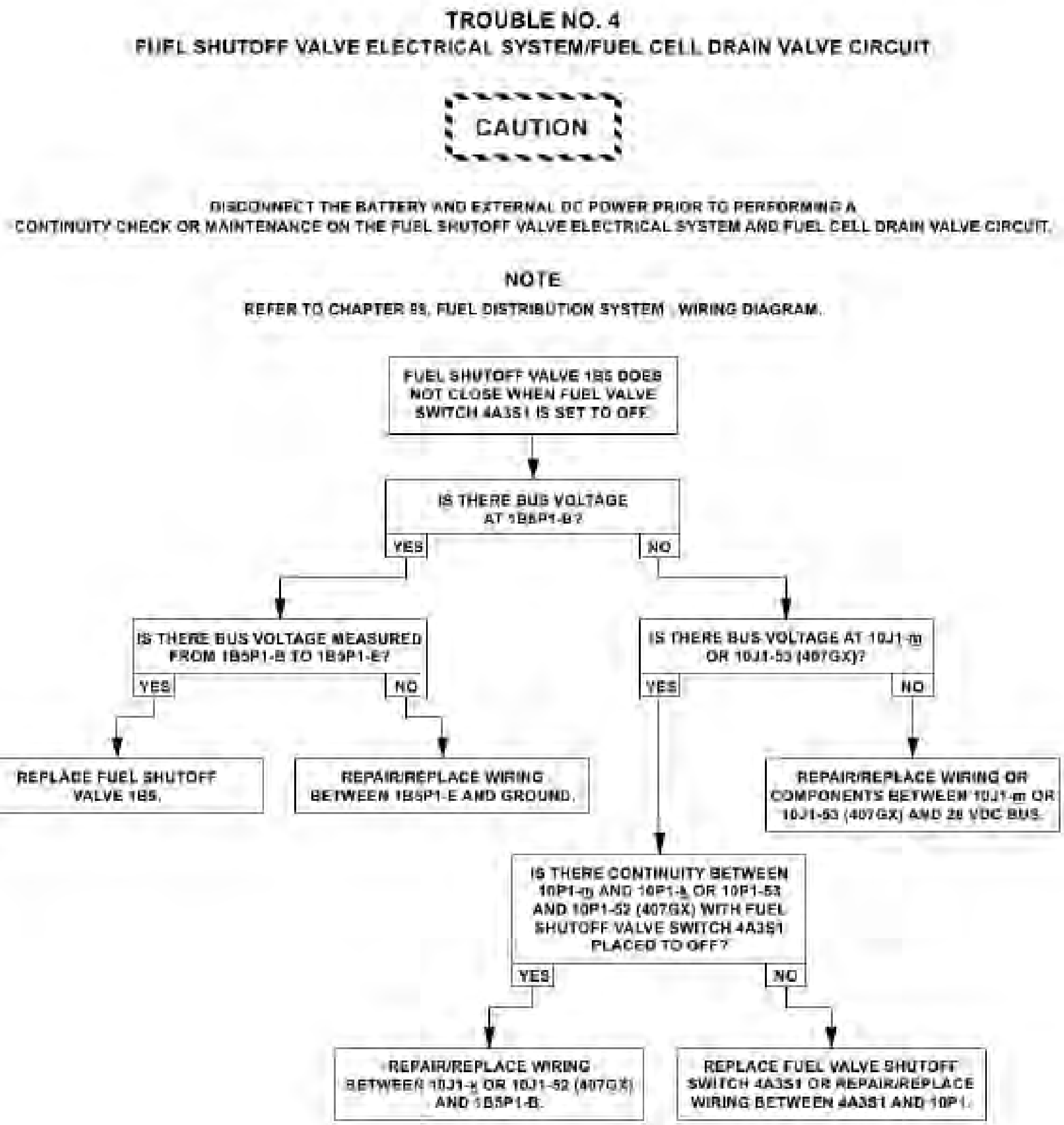


Figure 96-106: Fuel Shutoff Valve Electrical System, Fuel Cells Drain Valve Circuit – Trouble No. 4

TROUBLE NO. 5

FUEL SHUTOFF VALVE ELECTRICAL SYSTEM/FUEL CELL DRAIN VALVE CIRCUIT

CAUTION

DISCONNECT THE BATTERY AND EXTERNAL DC POWER PRIOR TO PERFORMING A CONTINUITY CHECK OR MAINTENANCE ON THE FUEL SHUTOFF VALVE ELECTRICAL SYSTEM AND FUEL CELL DRAIN VALVE CIRCUIT.

NOTE

REFER TO CHAPTER 98, FUEL DISTRIBUTION SYSTEM - WIRING DIAGRAM.

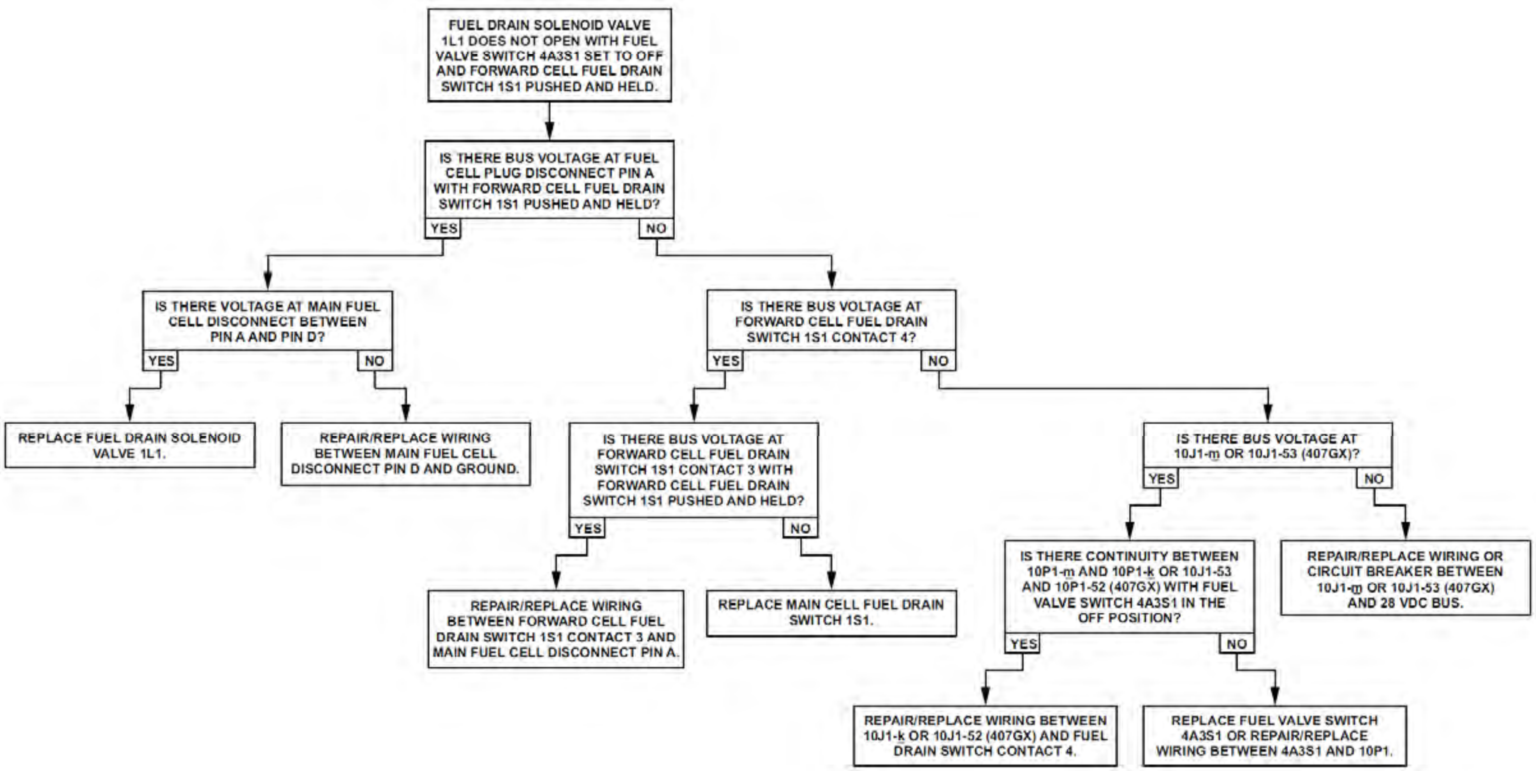


Figure 96-107: Fuel Shutoff Valve Electrical System, Fuel Cells Drain Valve Circuit – Trouble No. 5

TROUBLE NO. 6
FUEL SHUTOFF VALVE ELECTRICAL SYSTEM/FUEL CELL DRAIN VALVE CIRCUIT

CAUTION

DISCONNECT THE BATTERY AND EXTERNAL DC POWER PRIOR TO PERFORMING A CONTINUITY CHECK OR MAINTENANCE ON THE FUEL SHUTOFF VALVE ELECTRICAL SYSTEM AND FUEL CELL DRAIN VALVE CIRCUIT.

NOTE

REFER TO CHAPTER 98, FUEL DISTRIBUTION SYSTEM - WIRING DIAGRAM.

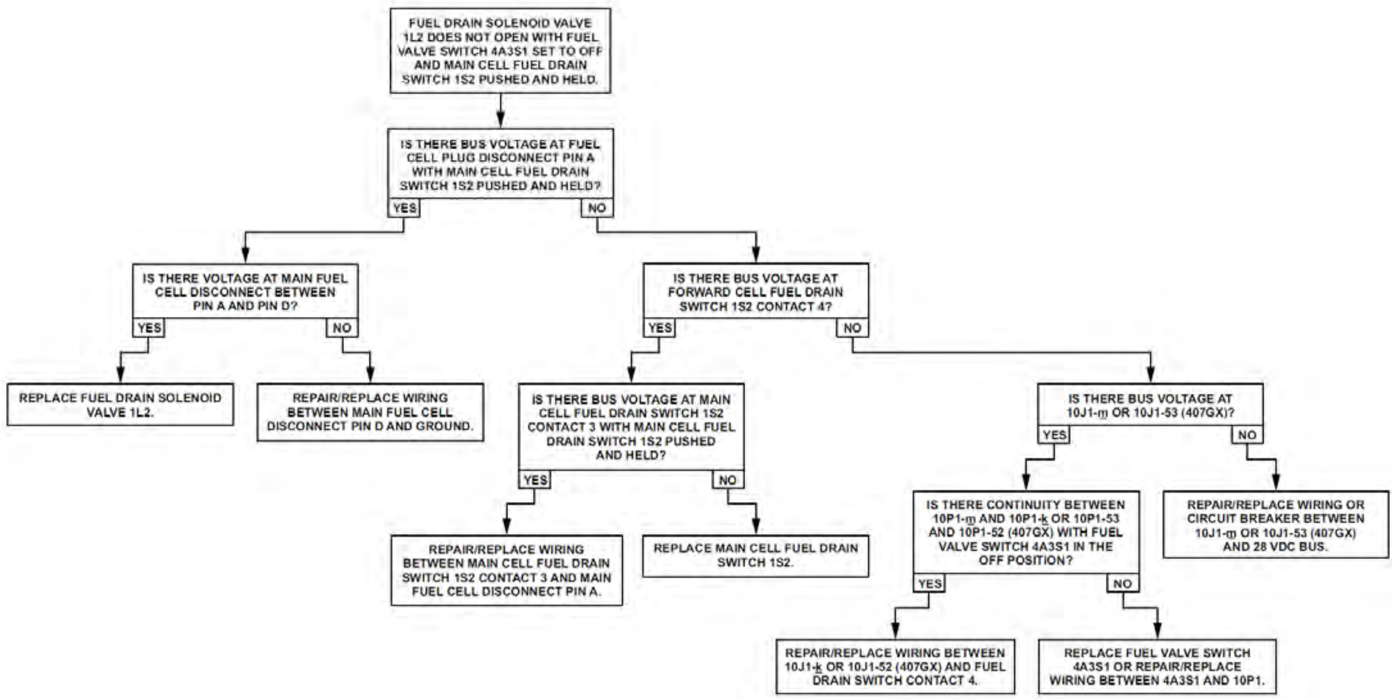


Figure 96-108: Fuel Shutoff Valve Electrical System, Fuel Cells Drain Valve Circuit – Trouble No. 6

96.6.2.8. Emergency Fuel Valve Switch (4962-S9) — Installation

WARNING

OBEY ALL OF PRECAUTIONS WHEN THE SAFETY DOING MAINTENANCE ON OR NEAR ELECTRICAL/ELECTRONIC EQUIPMENT (PARAGRAPH 96.1.1.1.).

NOTE

Refer to the fuel distribution system wiring diagram (Chapter 98) for the correct wire installation to the emergency fuel valve switch (4962-S9).

1. Remove the tape from the ends of the wires. Install the wires on the emergency fuel valve switch (4962-S9).
2. Install the emergency fuel valve switch (4962-S9) into its position on the instrument panel with the attaching hardware.
3. Position the switch guard and install with the attaching hardware.
4. Do an operational check of the fuel shutoff valve electrical system, fuel cell drain valve circuits (paragraph 96.6.2.1).

96.6.2.9. Fuel Shutoff Valve Electrical System, Fuel Cell Drain Valve Circuit — Component Replacement

To replace an electrical miscellaneous electrical component, refer to the components maintenance practices (paragraph 96.1.6). For wiring maintenance procedures, refer to the BHT-ELEC-SPM.

96.6.3 FUEL CELL DRAIN VALVE CIRCUIT — OPERATION

See BHT-407-MM Chapter 96-385.

96.6.3.1. Fuel Cell Drain Valves Circuit — Operational Check

See BHT-407-MM Chapter 96-386.

96.6.3.2. Forward/Main Fuel Drain Switches (1S1) and (1S2) — Removal

See BHT-407-MM Chapter 96-387.

96.6.3.3. Forward/Main Fuel Drain Switches (1S1) and (1S2) — Installation

See BHT-407-MM Chapter 96-388.

96.6.3.4. Fuel Drain Solenoid Valves (1L1 and 1L2) — Removal and Installation

See BHT-407-MM Chapter 96-389.

96.6.4 RIGHT FUEL TRANSFER PUMP/RIGHT FUEL BOOST PUMP CIRCUIT — OPERATION

See BHT-407-MM Chapter 96-390.

96.6.4.1. Right Fuel Transfer Pump Circuit (S/N 53000 Through 53174)

See BHT-407-MM Chapter 96-391.

96.6.4.2. Right Fuel Transfer Pump Circuit (S/N 53175 Through 54299)

See BHT-407-MM Chapter 96-392.

96.6.4.3. Right Fuel Transfer Pump Circuit (S/N 54300 and Subsequent)

See BHT-407-MM Chapter 96-393.

96.6.4.4. Right Fuel Boost Pump Circuit

See BHT-407-MM Chapter 96-394.

96.6.4.4.1 Right Fuel Transfer Pump/Right Fuel Boost Pump Circuit — Operational Check

See BHT-407-MM Chapter 96-395.

96.6.4.5. Right Fuel Transfer Pump Relay (1K8) — Removal

See BHT-407-MM Chapter 96-396.

96.6.4.6. Right Fuel Transfer Pump Relay (1K8) — Installation

See BHT-407-MM Chapter 96-397.

96.6.4.7. Right Fuel Transfer Pump/Right Fuel Boost Pump Circuit — Component Replacement

See BHT-407-MM Chapter 96-398.

96.6.5 LEFT FUEL TRANSFER PUMP/LEFT BOOST PUMP CIRCUIT — OPERATION

See BHT-407-MM Chapter 96-399.

96.6.5.1. Left Fuel Transfer Pump Circuit (S/N 53000 Through 53174)

See BHT-407-MM Chapter 96-400.

96.6.5.2. Left Fuel Transfer Pump Circuit (S/N 53175 Through 54299)

See BHT-407-MM Chapter 96-401.

96.6.5.3. Left Fuel Transfer Pump Circuit (S/N 54300 and Subsequent)

See BHT-407-MM Chapter 96-402.

96.6.5.4. Left Fuel Boost Pump Circuit

See BHT-407-MM Chapter 96-403.

96.6.5.5. Left Fuel Transfer Pump/Left Fuel Boost Pump Circuit — Operational Check

See BHT-407-MM Chapter 96-404.

96.6.5.6. Left Fuel Transfer Pump Relay (1K7) — Removal

See BHT-407-MM Chapter 96-405.

96.6.5.7. Left Fuel Transfer Pump Relay (1K7) — Installation

See BHT-407-MM Chapter 96-406.

96.6.5.8. Left Fuel Transfer Pump/Left Fuel Boost Pump Circuit — Component Replacement

See BHT-407-MM Chapter 96-407.

96.7. HYDRAULIC ELECTRICAL CONTROL SYSTEM

96.7.1 HYDRAULIC ELECTRICAL CONTROL SYSTEM

See BHT-407-MM Chapter 96-408.

96.7.1.1. Hydraulic Electrical Control System — Operational Check

See BHT-407-MM Chapter 96-409.

96.7.1.2. Off Hyd Sys Switch (4A2S2) — Removal

See BHT-407-MM Chapter 96-410.

96.7.1.3. Off Hyd Sys Switch (4A2S2) — Installation

See BHT-407-MM Chapter 96-411.

96.7.1.4. Hydraulic Bypass Solenoid (9L1) — Replacement

See BHT-407-MM Chapter 96-412.

96.8. FLIGHT CONTROL ELECTRICAL SYSTEM

96.8.1 AIRSPEED ACTUATED TAIL ROTOR PEDAL RESTRICTOR CONTROL SYSTEM — OPERATION (S/N 53000 THROUGH 54299)

See BHT-407-MM Chapter 96-413.

96.8.2 AIRSPEED ACTUATED TAIL ROTOR PEDAL RESTRICTOR CONTROL SYSTEM — OPERATION (S/N 54300 AND SUBSEQUENT)

See BHT-407-MM Chapter 96-414.

96.8.2.1. Airspeed Actuated Tail Rotor Pedal Restrictor Control System — Operational Check (S/N 53000 Through 54299)

See BHT-407-MM Chapter 96-415.

96.8.2.2. Airspeed Actuated Tail Rotor Pedal Restrictor Control System — Operational Check (S/N 54300 and Subsequent)

See BHT-407-MM Chapter 96-416.

96.8.2.3. Airspeed Actuated Tail Rotor Pedal Restrictor Control System — Functional Check (S/N 53000 Through 54299)

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96.8.2.4. Airspeed Actuated Tail Rotor Pedal Restrictor Control System — Functional Check (S/N 54300 and Subsequent)

See BHT-407-MM Chapter 96-418.

96.8.2.5. Pedal Restrictor Control Unit (PRCU) (6540CM1) — Removal (S/N 53000 Through 54299)

See BHT-407-MM Chapter 96-419.

96.8.2.6. Pedal Restrictor Control Unit (PRCU) (6540CM1) — Inspection (S/N 53000 Through 54299)

See BHT-407-MM Chapter 96-420.

96.8.2.7. Pedal Restrictor Control Unit (PRCU) (6540CM1) — Installation (S/N Through 54299)

See BHT-407-MM Chapter 96-421.

96.8.2.8. Pedal Stop Switch (6540DS1) — Removal (S/N 53000 Through 54299)

See BHT-407-MM Chapter 96-422.

96.8.2.9. Pedal Stop Switch (6540DS1) — Installation (S/N 53000 Through 54299)

See BHT-407-MM Chapter 96-423.

96.8.2.10. Pedal Stop Switch (6540DS1) — Lamp Replacement (S/N 53000 Through 54299)

See BHT-407-MM Chapter 96-424.

96.8.2.11. Airspeed Actuated Tail Rotor Pedal Restrictor Control Electrical System — Component Replacement

See BHT-407-MM Chapter 96-425.

96.8.2.12. Pedal Restrictor Control System Relay (6540K1) — Removal (S/N 54300 and Subsequent)

See BHT-407-MM Chapter 96-426.

96.8.2.13. Pedal Restrictor Control System Relay (6540K1) — Installation (S/N 54300 and Subsequent

See BHT-407-MM Chapter 96-427.

96.8.3 MISCELLANEOUS ELECTRICAL SYSTEM

See BHT-407-MM Chapter 96-428.

96.8.3.1. PARTICLE SEPARATOR ELECTRICAL SYSTEM — OPERATION

See BHT-407-MM Chapter 96-429.

96.8.3.1.1 Particle Separator Electrical System — Operational Check

See BHT-407-MM Chapter 96-430.

96.8.3.2. AUXILIARY 28 VDC POWER CONNECTOR

See BHT-407-MM Chapter 96-431.

96.8.3.3. WINDSHIELD DEFOGGING BLOWER SYSTEM

See BHT-407-MM Chapter 96-432.

96.8.3.3.1 Windshield Defogging Blower System — Operational Check

See BHT-407-MM Chapter 96-433.

96.8.3.3.2 Windshield Defogging Blower System — Troubleshooting

See BHT-407-MM Chapter 96-434.

96.8.3.3.3 Windshield Defog Blowers (10B1 and 10B2) — Replacement

See BHT-407-MM Chapter 96-435.

96.8.3.4. AIR CONDITIONING ELECTRICAL SYSTEM (AIR COMM STC)

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96.8.3.5. CABIN HEATER ELECTRICAL SYSTEM (AIR COMM STC)

See BHT-407-MM Chapter 96-437.

96.8.3.6. TAIL ROTOR CAMERA (9700A1) (S/N 54300 AND SUBSEQUENT)

See BHT-407-MM Chapter 96-438.

96.8.3.7. TAIL ROTOR CAMERA (9700A1) — OPERATION (S/N 54300 AND SUBSEQUENT)

See BHT-407-MM Chapter 96-439.

96.8.3.7.1 Tail Rotor Camera (9700A1) — Operational Check (S/N 54300 and Subsequent)

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96.8.3.7.2 Tail Rotor Camera (9700A1) — Removal (S/N 54300 and Subsequent)

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96.8.3.7.3 Tail Rotor Camera (9700A1) — Cleaning (S/N 54300 and Subsequent)

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96.8.3.7.4 Tail Rotor Camera (9700A1) — Inspection (S/N 54300 and Subsequent)

See BHT-407-MM Chapter 96-443.

96.8.3.7.5 Tail Rotor Camera (9700A1) — Installation (S/N 54300 and Subsequent)

See BHT-407-MM Chapter 96-444.

96.8.3.7.6 Tail Rotor Camera Transistor (9700Q1) — Removal

See BHT-407-MM Chapter 96-445.

96.8.3.7.7 Tail Rotor Camera Transistor (9700Q1) — Installation

See BHT-407-MM Chapter 96-446.

96.8.3.7.8 Tail Rotor Camera Relay (9700K1) — Removal

See BHT-407-MM Chapter 96-447.

96.8.3.7.9 Tail Rotor Camera Relay (9700K1) — Installation

See BHT-407-MM Chapter 96-448.